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Notes regarding this deck:

- This deck is a study guide to accompany the Linux Basics course at KodeKloud - https://kodekloud.com/p/linux-basics-course
- Do not copy and paste commands from this directly as it might copy hidden characters too
- Lookup the options for the commands using man or help pages from the Linux terminal.
- All lab and hands-on activities are done best in the course at KodeKloud.

The Linux Basics Course

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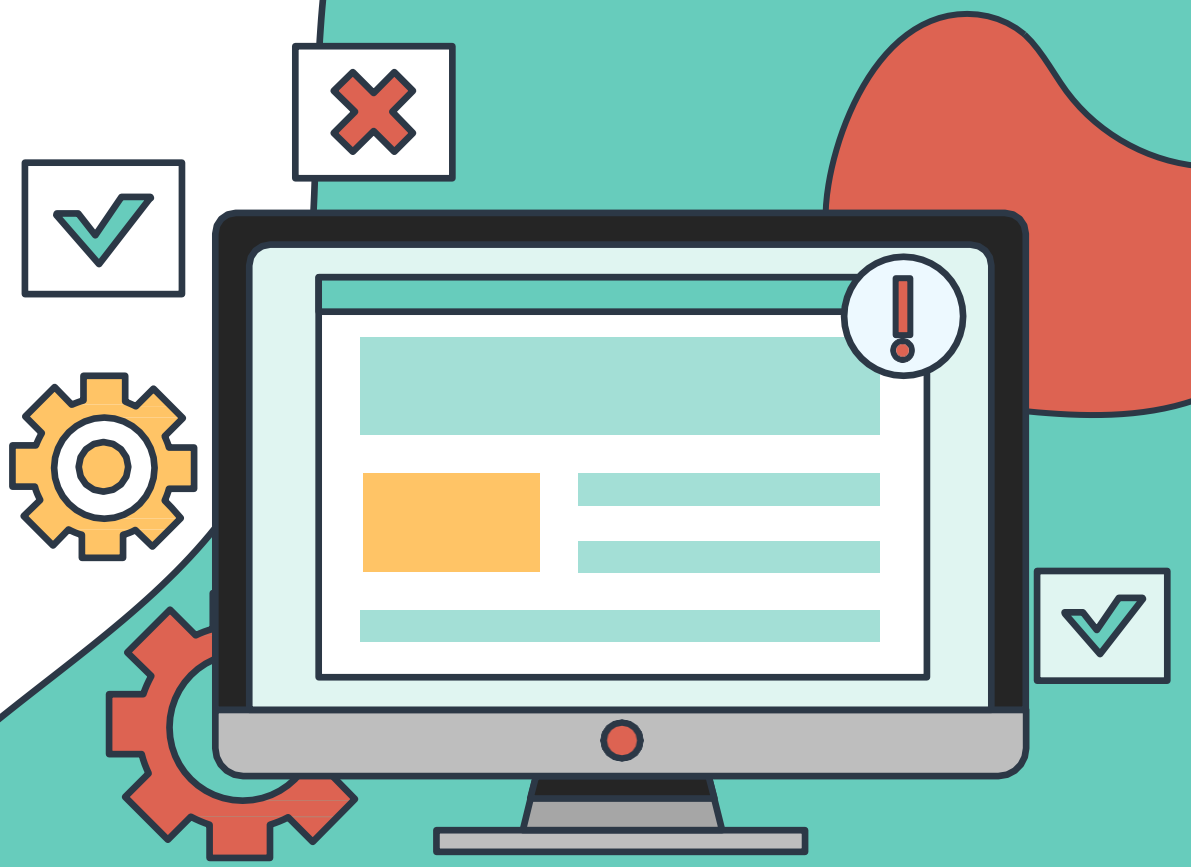

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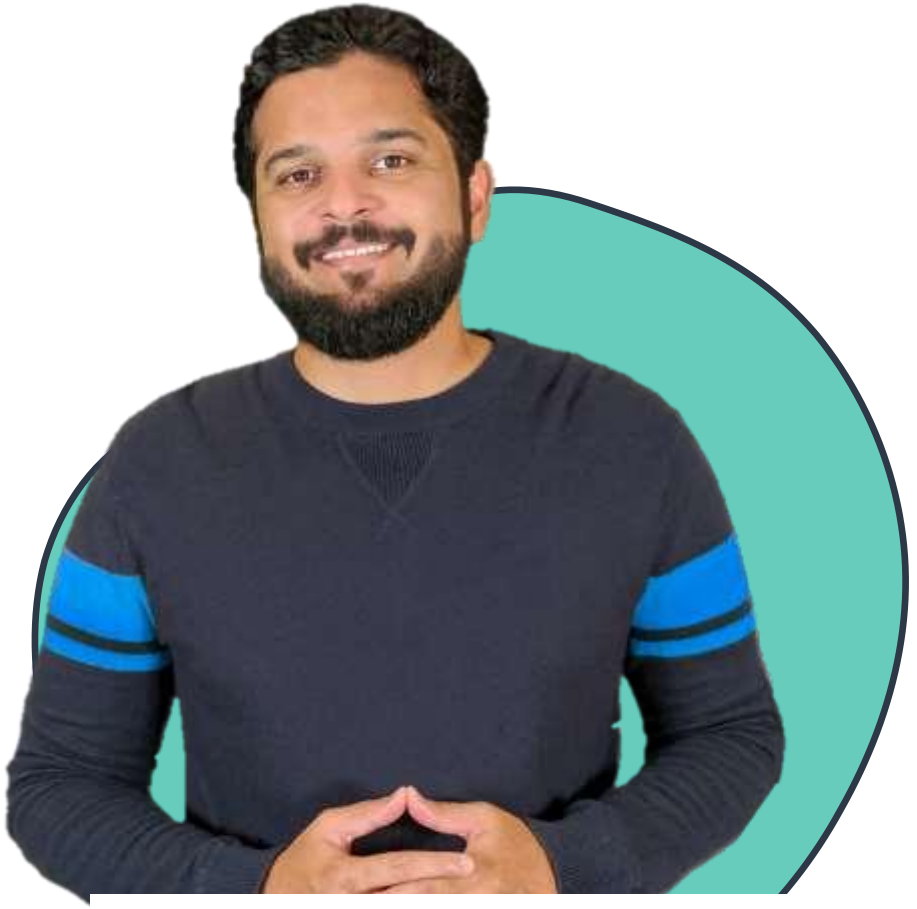

Vijin Palazhi

Mumshad Mannambeth

...

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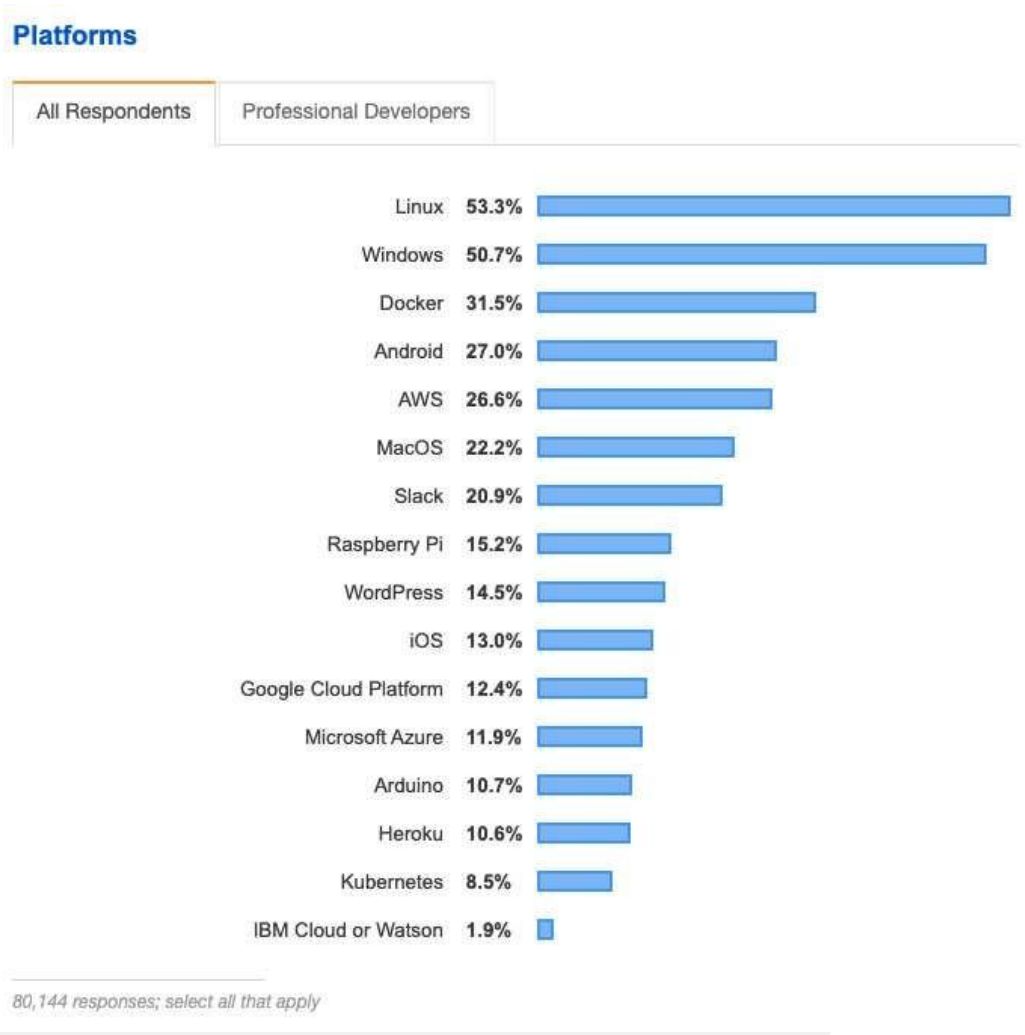
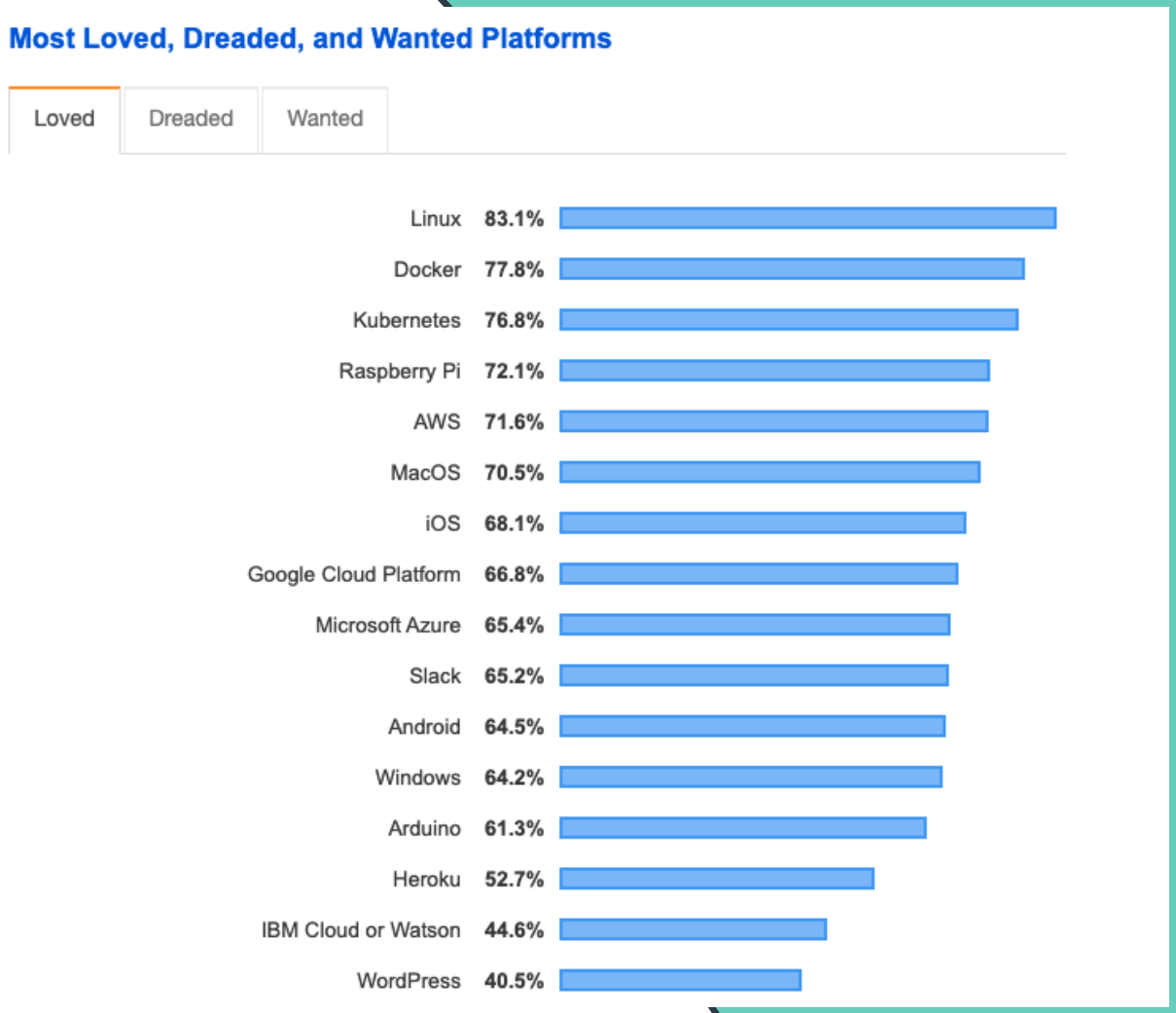
Why Linux?





https://insights.stackoverflow.com/survey/2019

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Why Linux?

As per the latest report from Top 500, Linux now runs on all of the fastest 500 supercomputers in the world. The previous number was 498 as remaining two supercomputers ran Unix.

Top500 is an independent project that was launched in 1993 to benchmark supercomputers. It publishes the details about the top 500 fastest supercomputers known to them, twice a year. You can go the website and filter out the list based on various criteria such as country, OS type, vendors etc.

https://itsfoss.com/linux-runs-top-supercomputers/

Looking deeper, Linux's importance to the Web is even more extreme. By W3Cook's analysis of Alexa's data, 96.3 percent of the top 1 million web servers are running Linux. The remainder is split between Windows, 1.9 percent, and FreeBSD, 1.8 percent.

https://www.zdnet.com/article/can-the-internet-exist-without-linux/

No, I didn't use a misleading blog title. Smartphones powered by Linux are in fact dominating the smartphone market. A few of you may be scratching your heads at this point (stop that, you'll go bald) while others are filled with that *Sound of Music – "The Hills are Alive!"* kind of Linux pride! Read on and I'll provide some pudding, filled with proof that ~~81%~~ 86% of all Smartphones are powered by Linux.

https://haydenjames.io/81-percent-smartphones-powered-by-linux/

https://hostingtribunal.com/blog/linux-statistics

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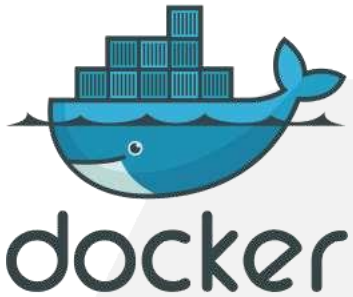
Linux & DevOps



2013 - Docker was born
2016- Docker for Windows was born

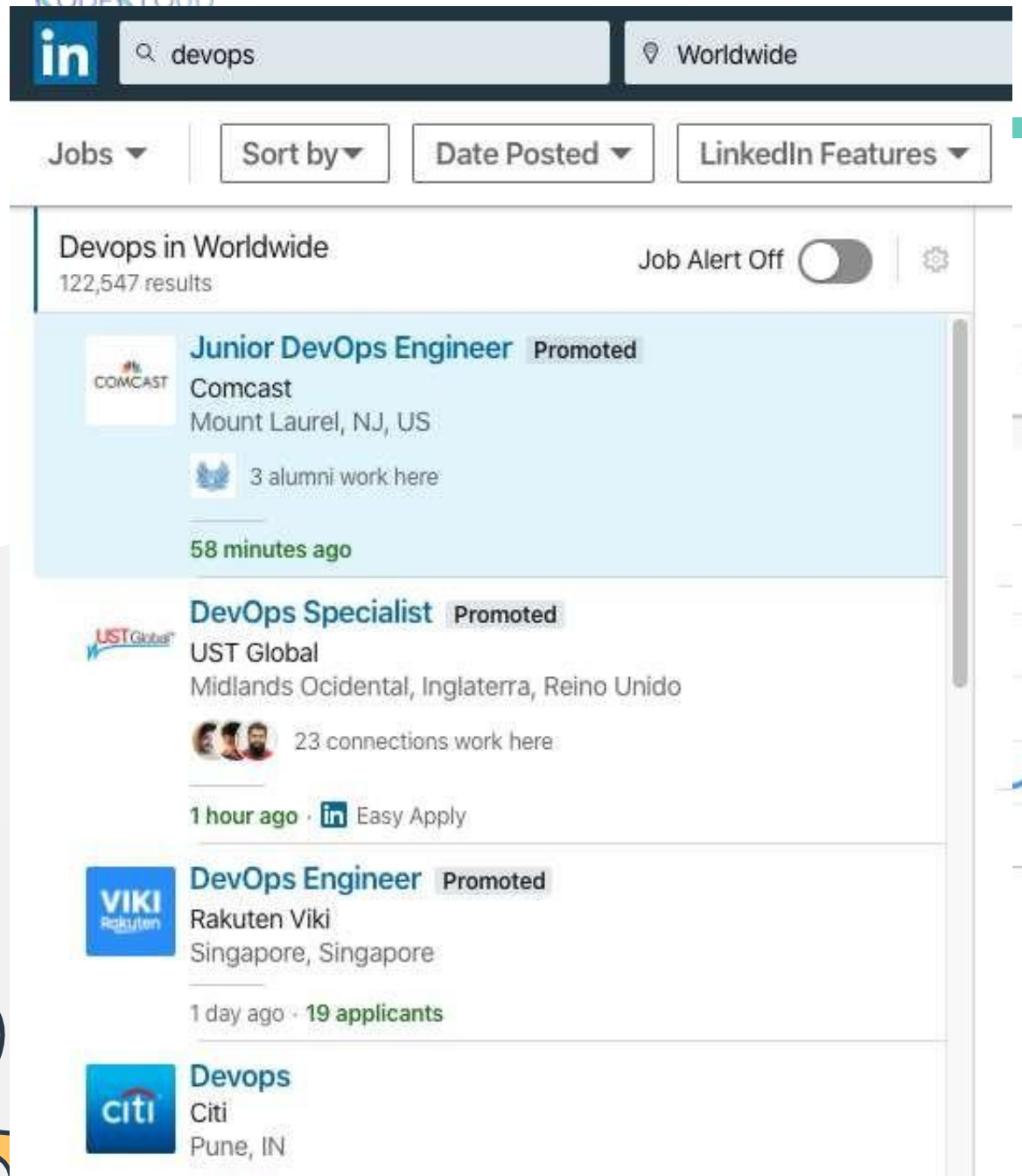
Can Ansible run on Windows?

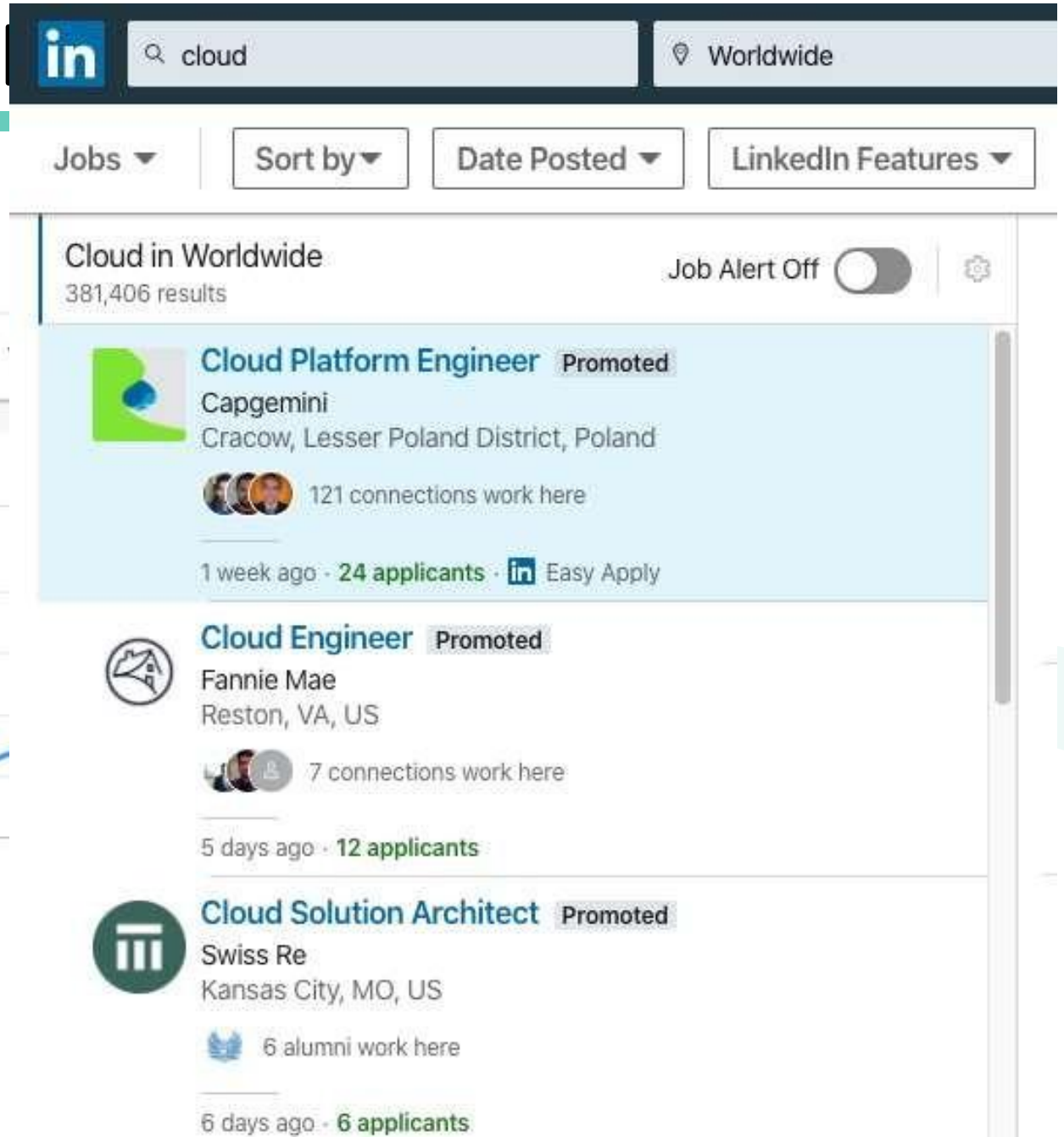
No, Ansible can only manage Windows hosts. Ansible cannot run on a Windows host natively, though it can run under the Windows Subsystem for Linux (WSL).

https://docs.ansible.com/ansible/latest/user_guide/windows_faq.html

> **Note:** The Kubernetes control plane, including the master components, continues to run on Linux. There are no plans to have a Windows-only Kubernetes cluster.

Kubernetes Documentation


devops
Worldwide
Jobs
Sort by
Date Posted
LinkedIn Features
Devops in Worldwide
122,547 results
Job Alert Off
Junior DevOps Engineer
Promoted
Comcast
Mount Laurel, NJ, US
3 alumni work here
58 minutes ago
DevOps Specialist
Promoted
UST Global
Midlands Ocidental, Inglaterra, Reino Unido
23 connections work here
1 hour ago · Easy Apply
DevOps Engineer
Promoted
Rakuten Viki
Singapore, Singapore
1 day ago · 19 applicants
Devops
Citi
Pune, IN


cloud
Worldwide
Jobs
Sort by
Date Posted
LinkedIn Features
Cloud in Worldwide
381,406 results
Job Alert Off
Cloud Platform Engineer
Promoted
Capgemini
Cracow, Lesser Poland District, Poland
121 connections work here
1 week ago · 24 applicants · Easy Apply
Cloud Engineer
Promoted
Fannie Mae
Reston, VA, US
7 connections work here
5 days ago · 12 applicants
Cloud Solution Architect
Promoted
Swiss Re
Kansas City, MO, US
6 alumni work here
6 days ago · 6 applicants

3 alumni work here

58 minutes ago

DevOps Specialist Promoted

UST Global

Midlands Ocidental, Inglaterra, Reino Unido

23 connections work here

1 hour ago · Easy Apply

DevOps Engineer Promoted

Rakuten Viki

Singapore, Singapore

1 day ago · 19 applicants

Devops

Citi

Pune, IN

60 connections work here

1 day ago · 18 applicants

Devops

KWAN

Porto, PT

6 days ago · 1 applicant

DevOps Specialist

Amdocs

Toronto, Ontario, Canada

33 connections work here

121 connections work here

1 week ago · 24 applicants · Easy Apply

Cloud Engineer Promoted

Fannie Mae

Reston, VA, US

7 connections work here

5 days ago · 12 applicants

Cloud Solution Architect Promoted

Swiss Re

Kansas City, MO, US

6 alumni work here

6 days ago · 6 applicants

Cloud Architect

Anonymous

Dublin, IE

15 hours ago

Cloud Engineer

National Australia Bank

Melbourne, Victoria, Australia

6 connections work here

6 hours ago

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Common Challenges...

- Trouble with navigating Linux CLI
- Navigating directory structures and files
- No experience working with text editors- VI editor
- Different flavors of Linux
- Errors during installation of applications and /dependencies
  - rpm, dpkg, apt and yum
- Issues with networking between VMs
- Trouble with permissions and security in Linux
- Lack of hands-on practice

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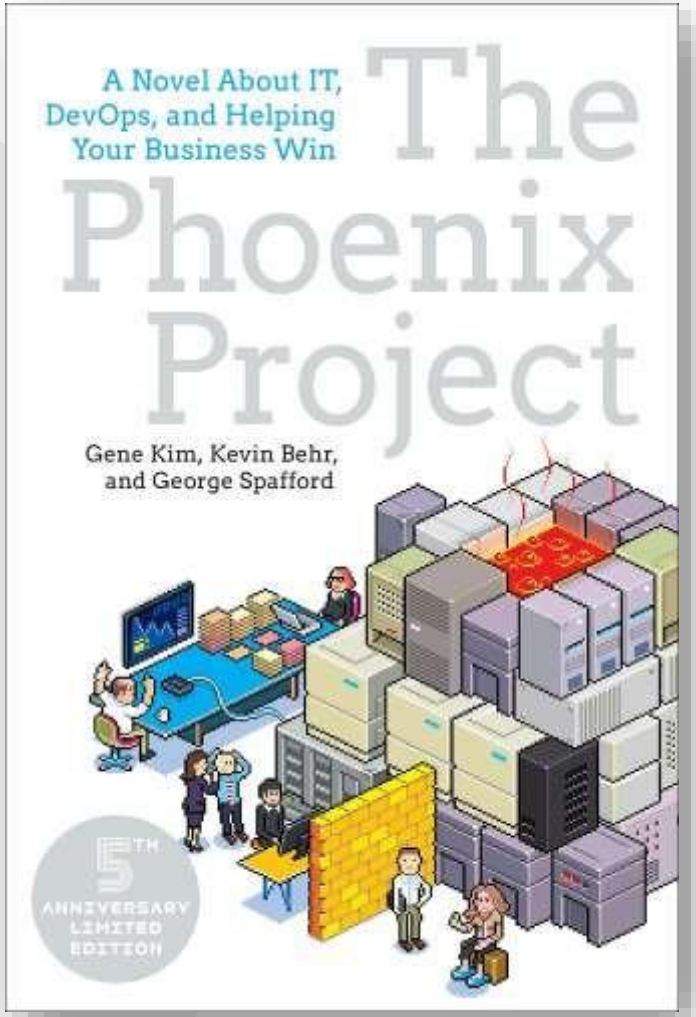
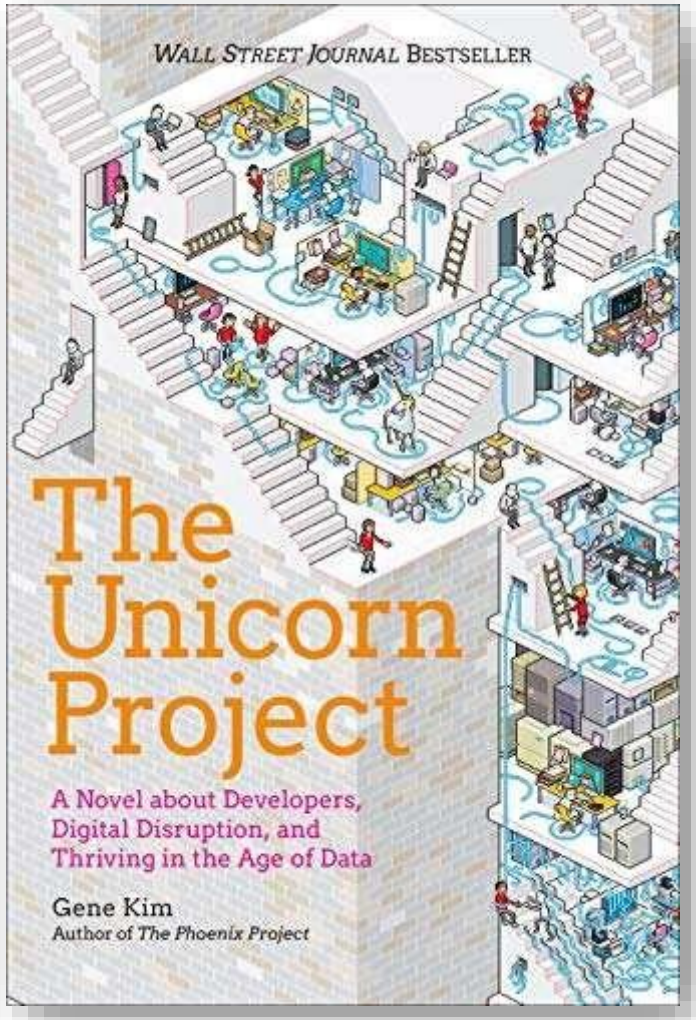
Inspiration...





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About

this ~~comic~~ course...

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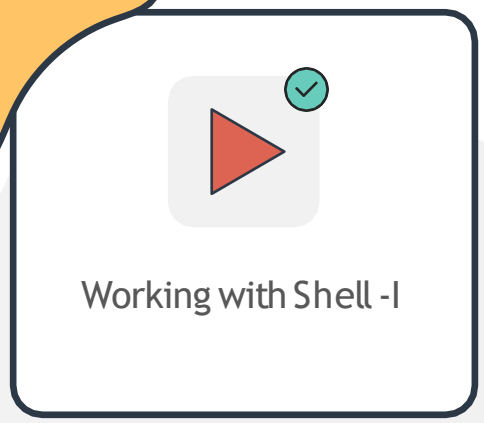
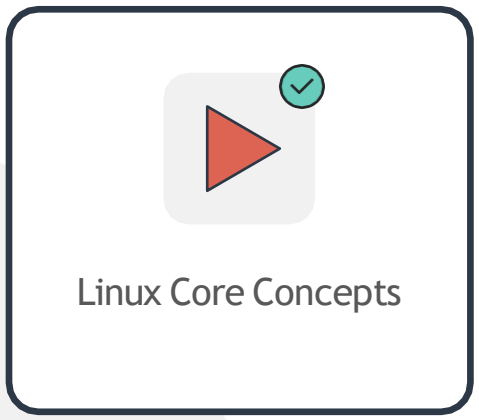
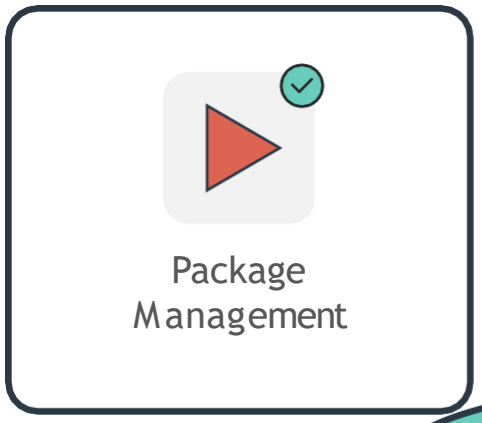
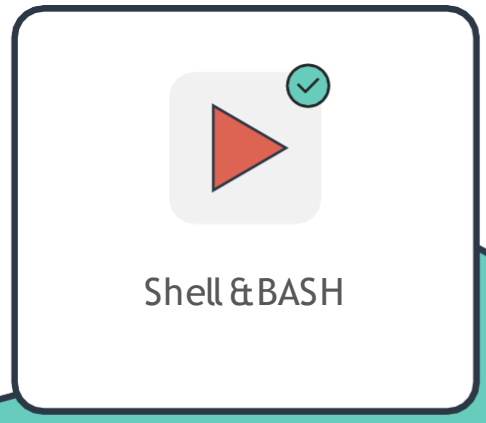
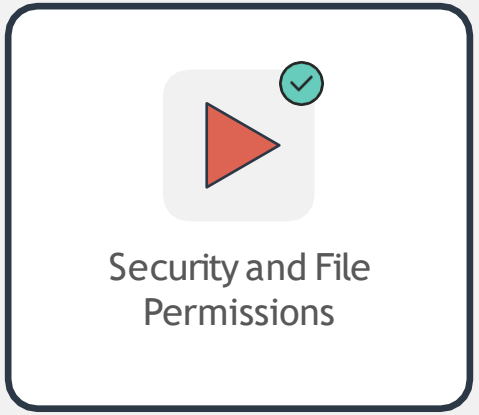
Objectives

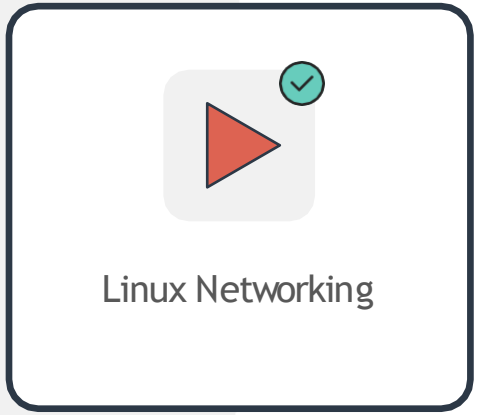


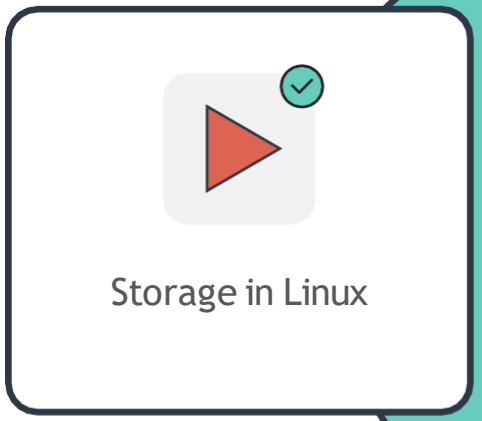


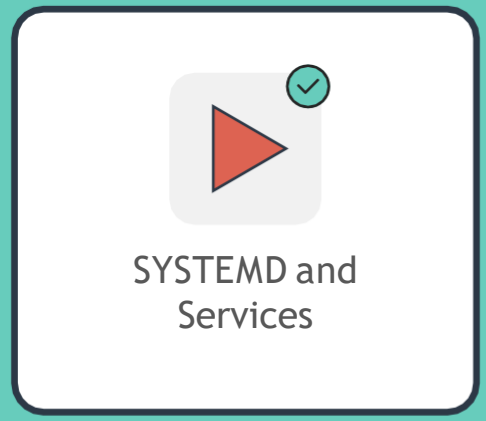












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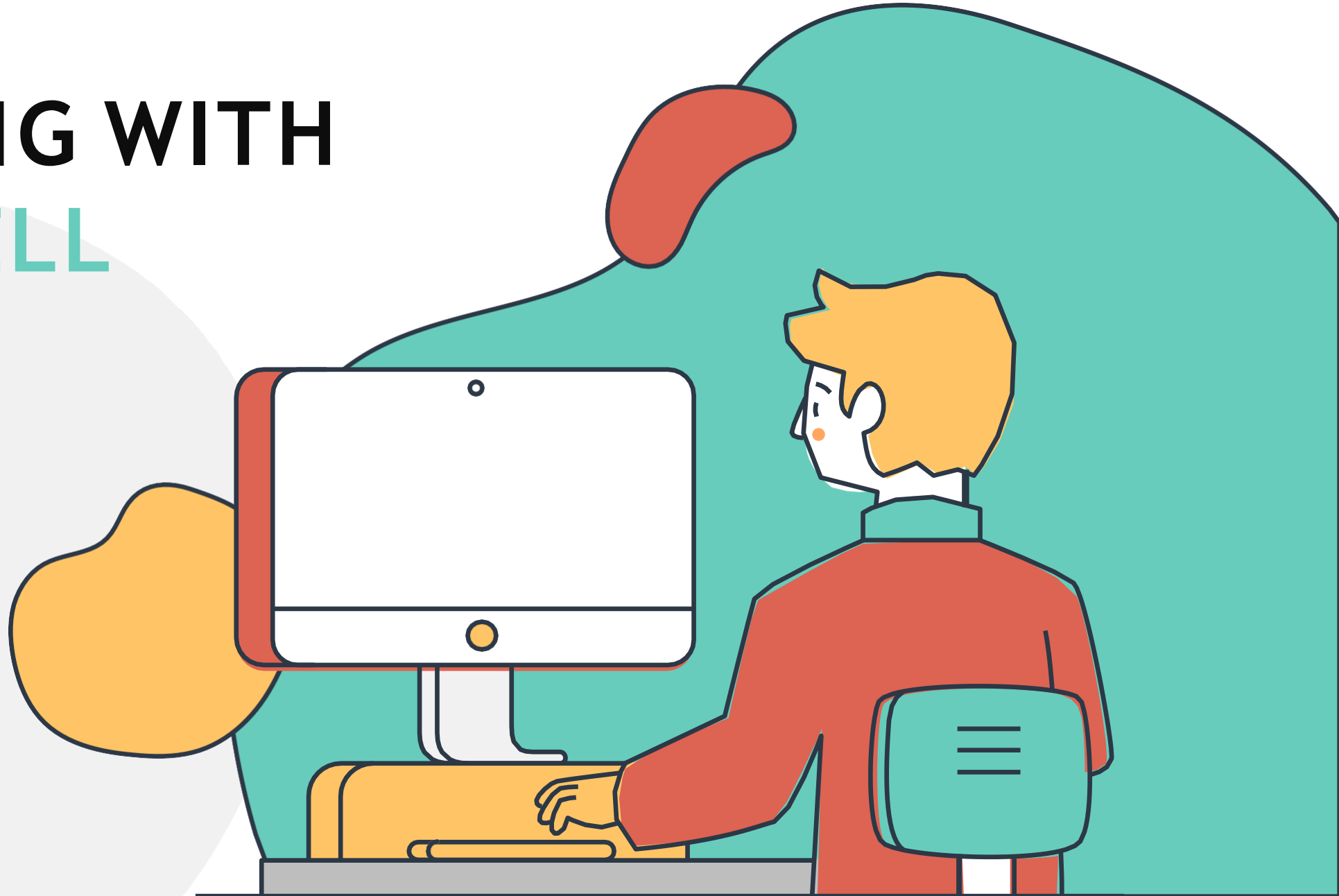
WORKING WITH
THE SHELL



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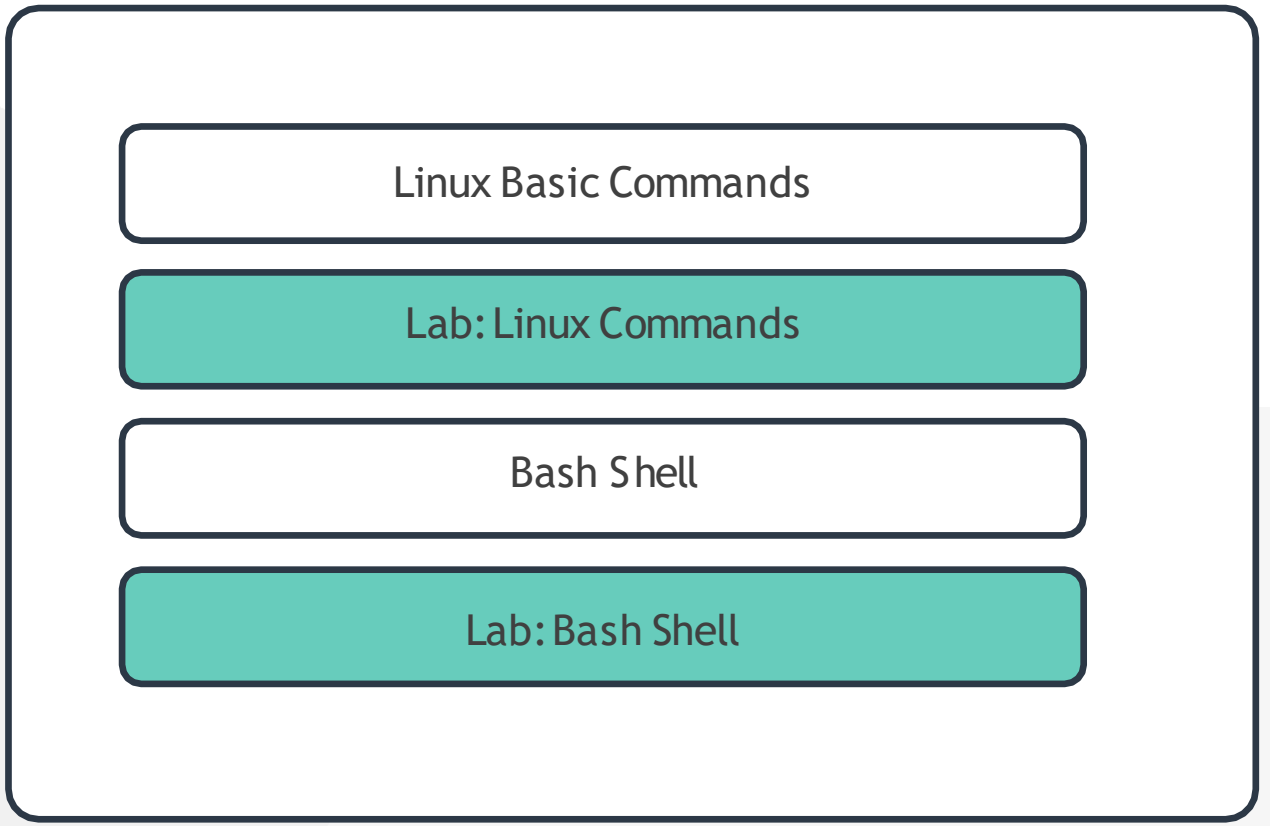
Working with the Shell - I



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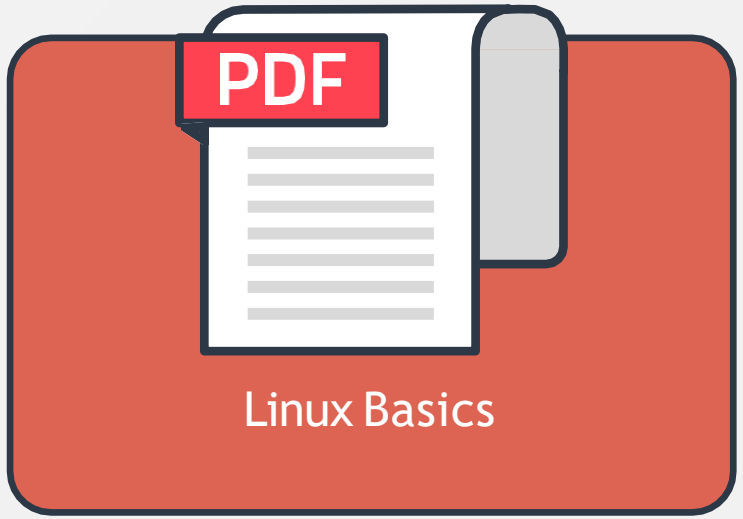
Shell



Ubuntu Desktop
/ Graphical View

Linux Shell

```
$ echo  Hello
Hello
$
```

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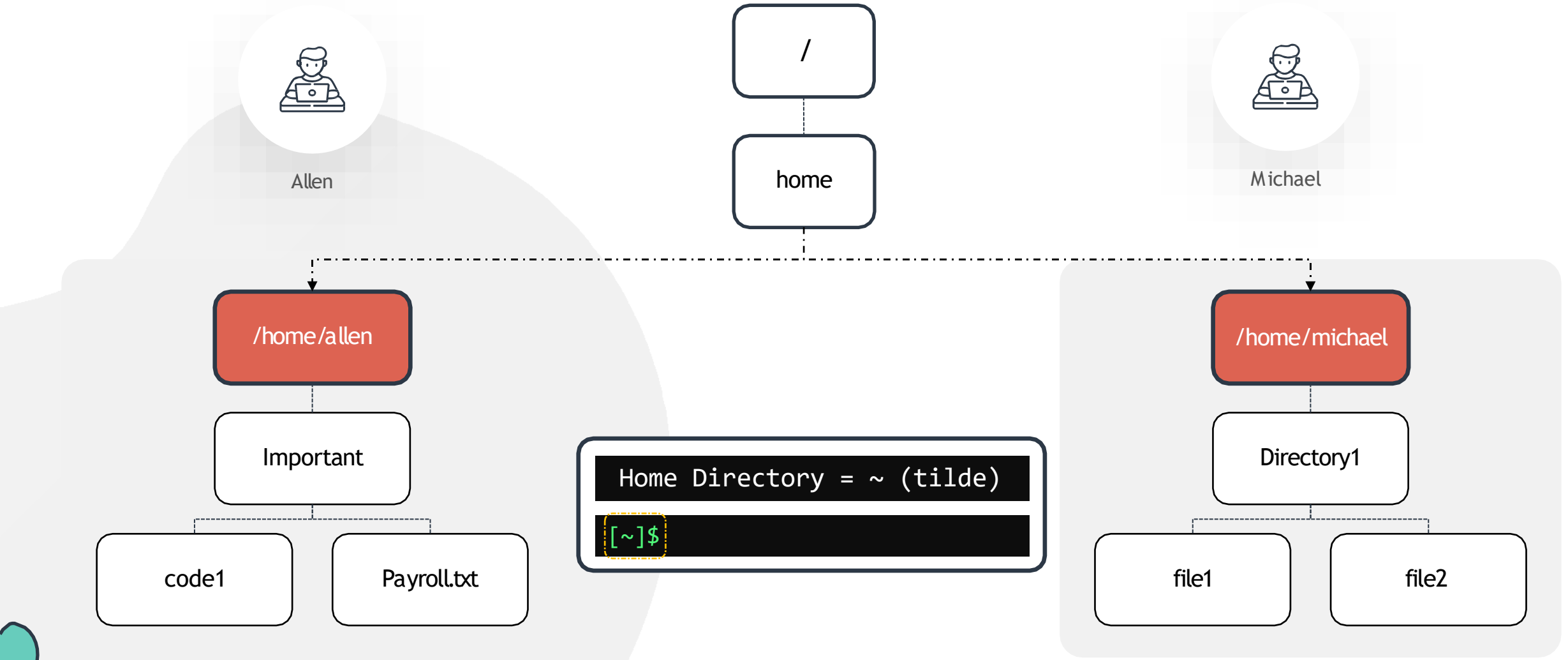
The Home Directory



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Command and Arguments

```
[~]$ echo
[~]$
```

```
[~]$ uptime
19:18:51 up 19:48,  2 users,  load average:
1.18, 0.49, 0.36
```

```
[~]$ echo  Hello
Hello
[~]$
```

```
[~]$ echo -n Hello
Hello[~]$
```

```
command <options> <arguments>
echo = command
option = -n
Hello = argument
```

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Command Types

Internal or Built-in Commands
echo, cd, pwd, set e.t.c

```
[~]$ type echo
echo is a shell built-in
[~]$
```

External Commands
mv, date, uptime, cp, uptime e.t.c

```
[~]$ type mv
mv is hashed (/bin/mv)
[~]$
```

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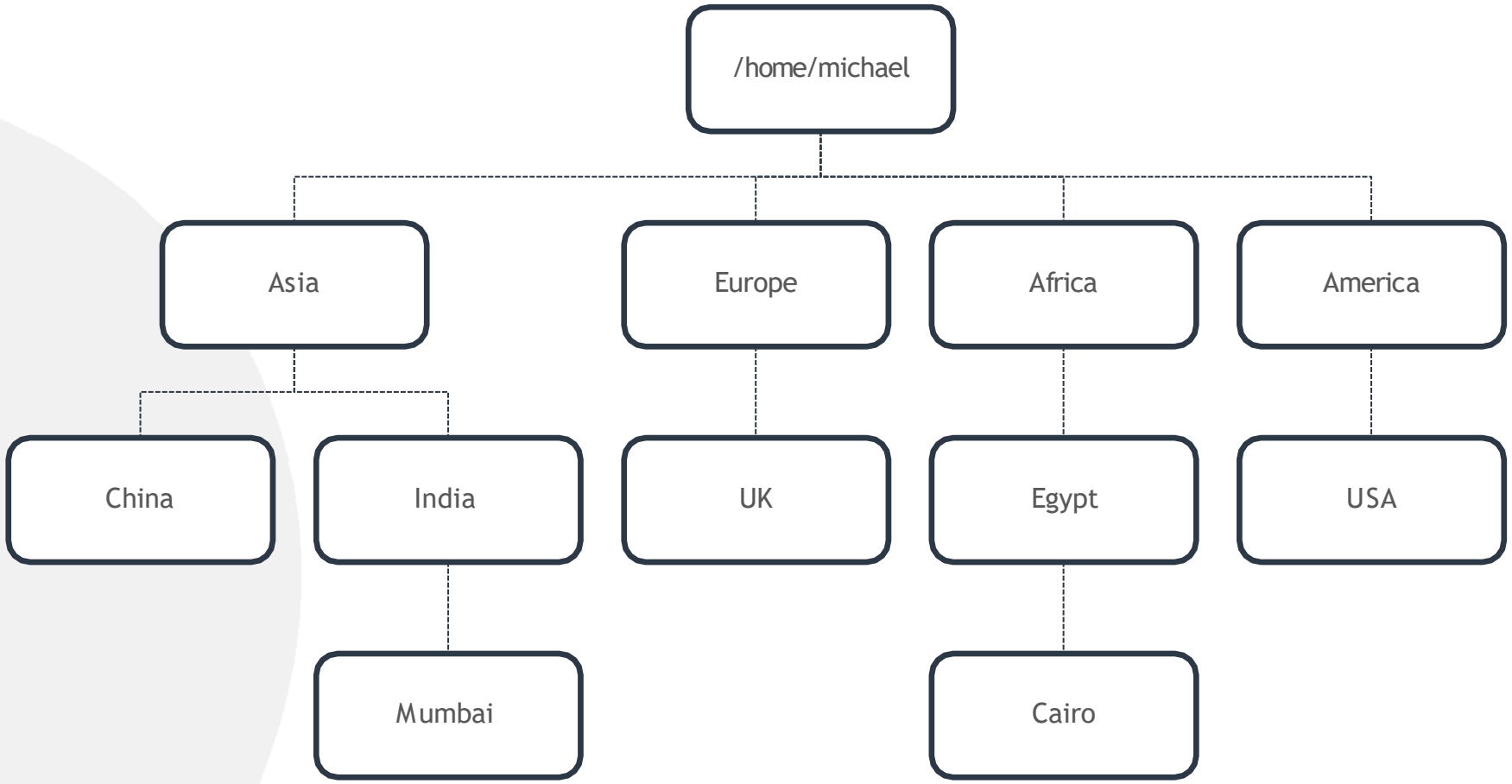
Basic Linux Commands



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Basic Linux Commands

pwd (present working directory)

```
[~]$ pwd
/home/michael
```

Ls (List contents)

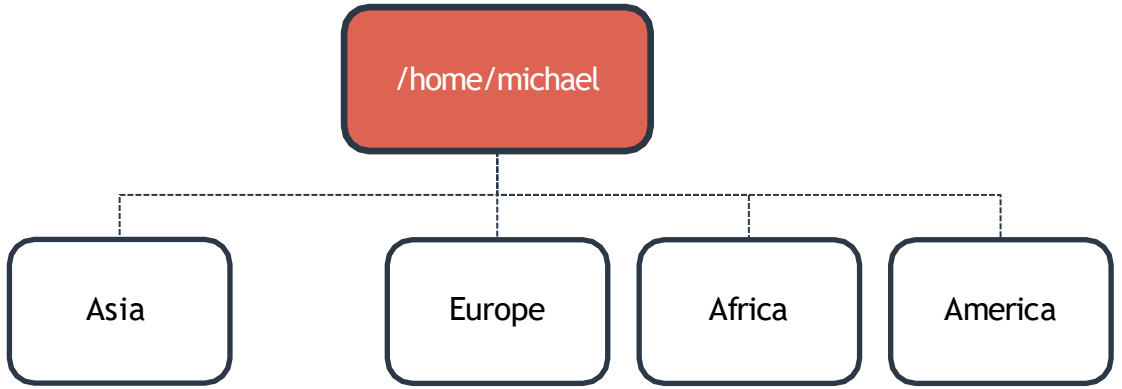
```
[~]$ ls
```

mkdir (make a new directory)

```
[~]$ mkdir Asia
```

mkdir (multiple directories)

```
[~]$ mkdir Europe Africa America
```



Ls (List contents)

```
[~]$ ls
Asia Europe Africa America
```

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Basic Linux Commands

cd (change directory)

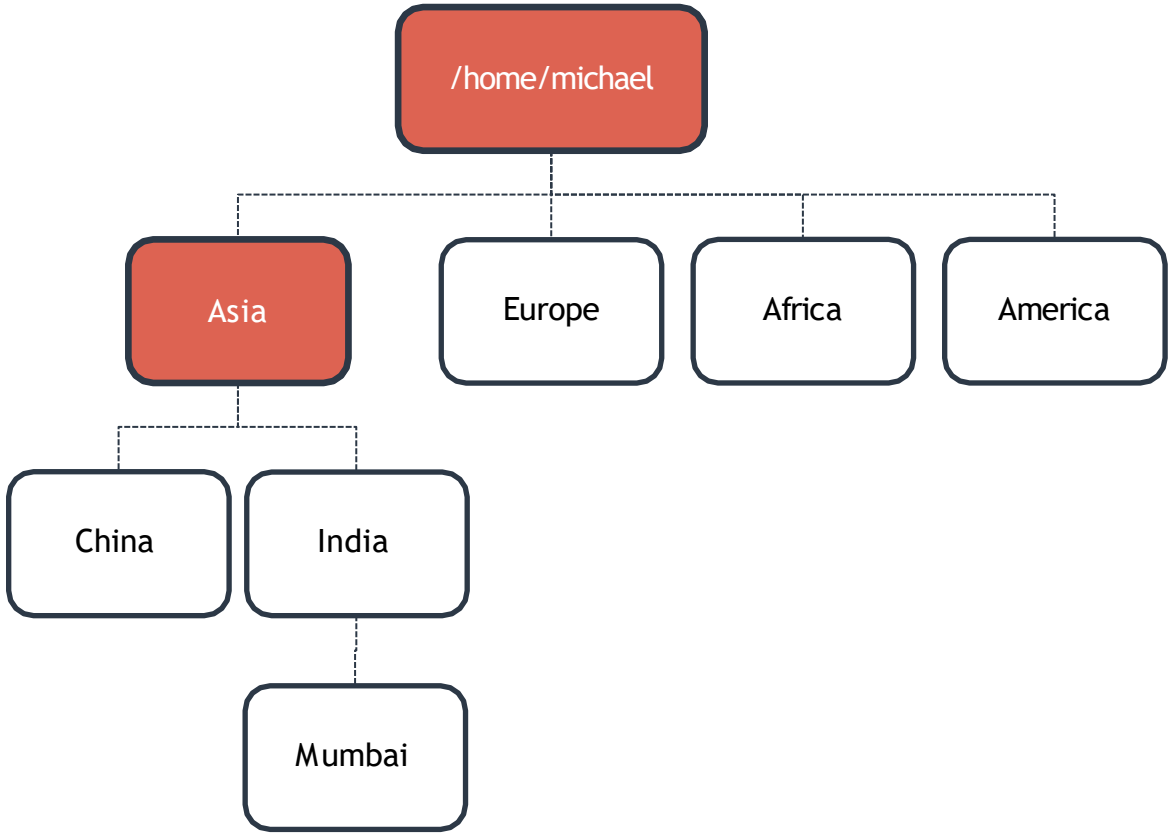
```
[~]$ cd Asia
[~/Asia]$
```

```
[~/Asia]$ pwd
/home/Michael/Asia
```

```
[~/Asia]$ mkdir China India
```

```
[~/Asia]$ mkdir India/Mumbai
```

```
[~/Asia]$ mkdir -p India/Mumbai
```



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Basic Linux Commands

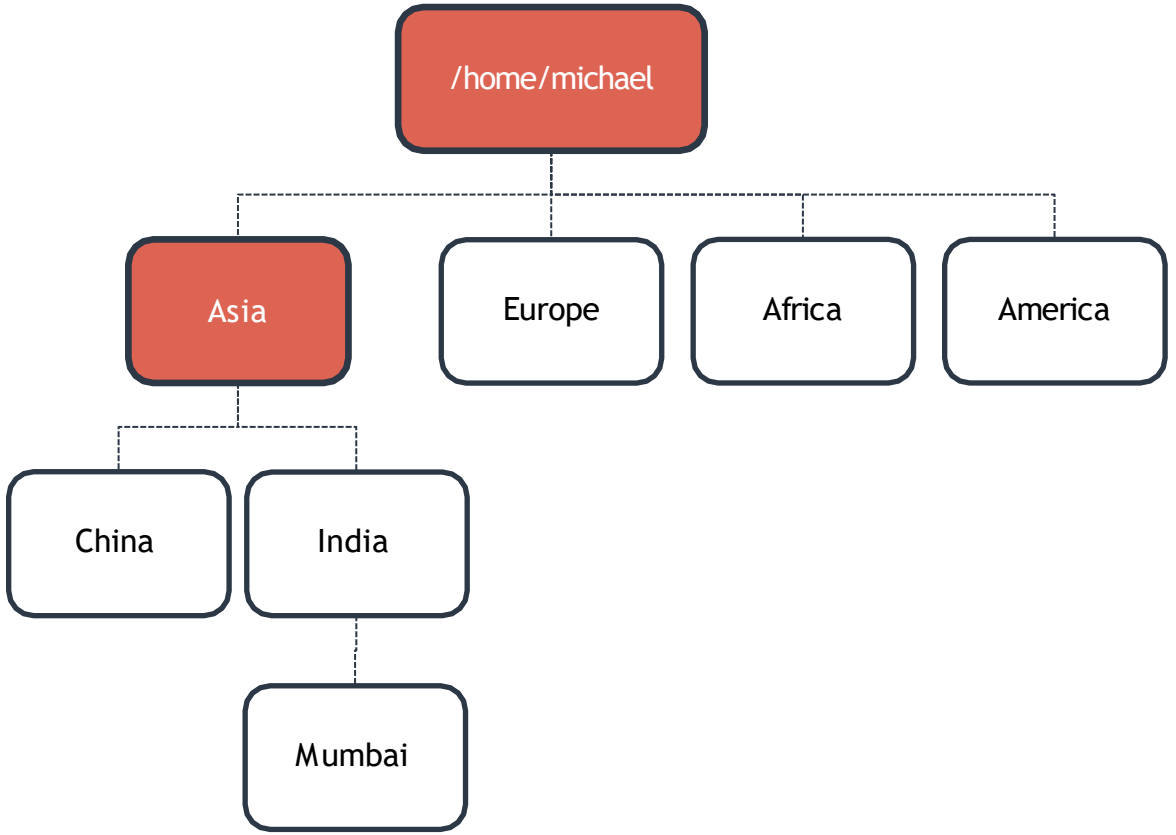
```
[ ~/Asia]$ cd ..
[ ~]$
```

OR

```
[ ~/Asia]$ cd
[ ~]$
```

OR

```
[ ~/Asia]$ cd /home/michael
[ ~]$
```



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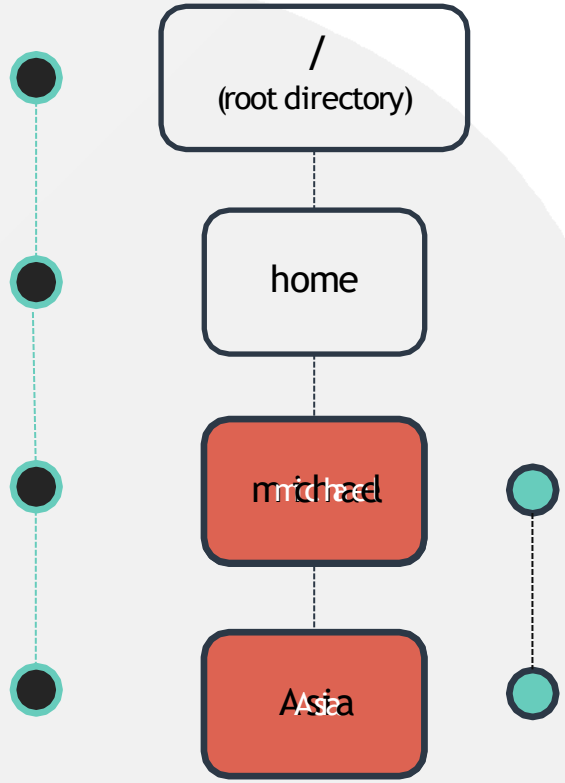
Absolute and Relative Path




```
[~] pwd
/home/michael
```

Absolute Path

```
[~]$ cd /home/michael/Asia
```

Relative Path

```
[~] cd Asia
```

`cd = change directory`

`pwd = print present working directory`

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Pro Tip - pushd/popd

Push

Pop

```
[~] pushd /etc
/etc ~
```

```
[/etc] cd /var
```

```
[/var] cd /tmp
```

```
[/tmp] popd
[~]
```

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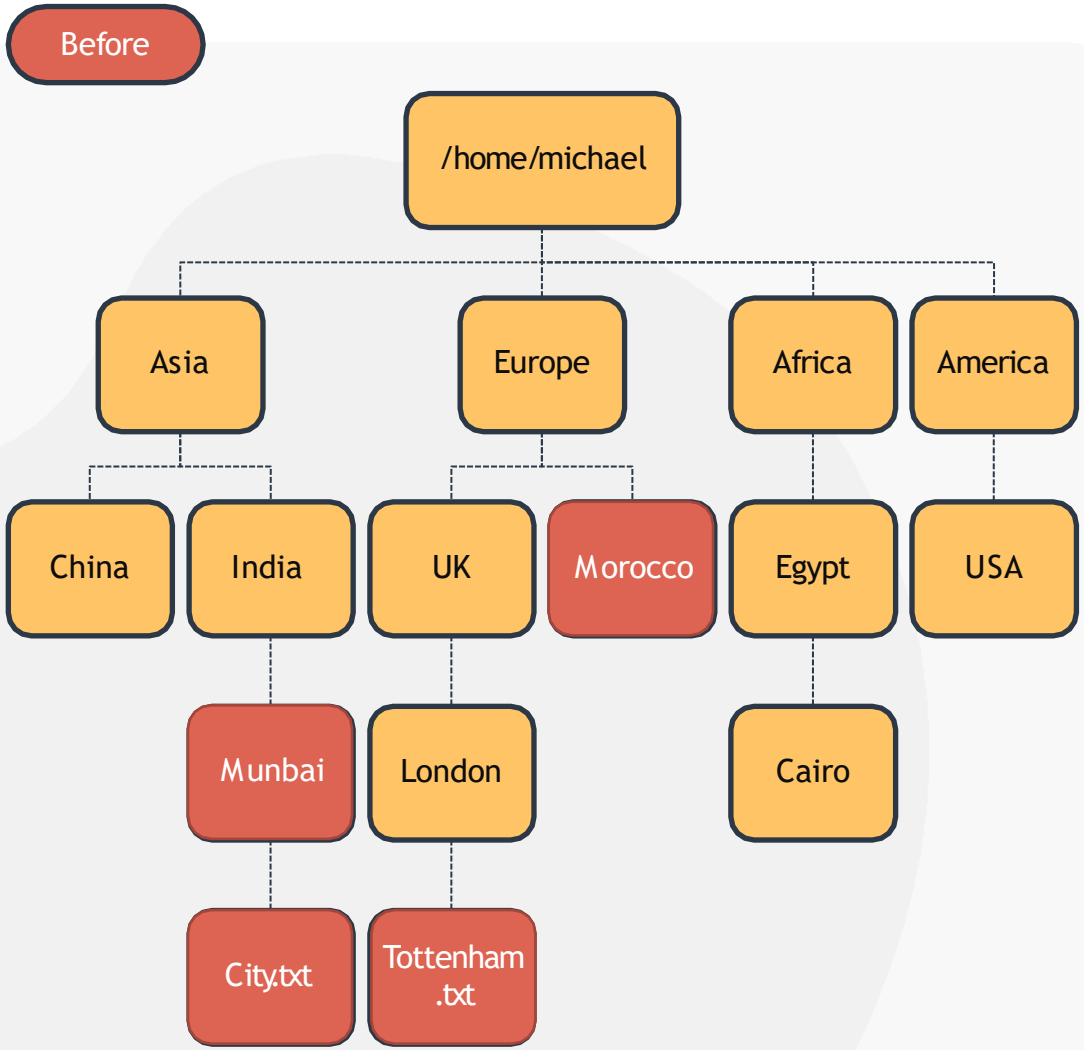
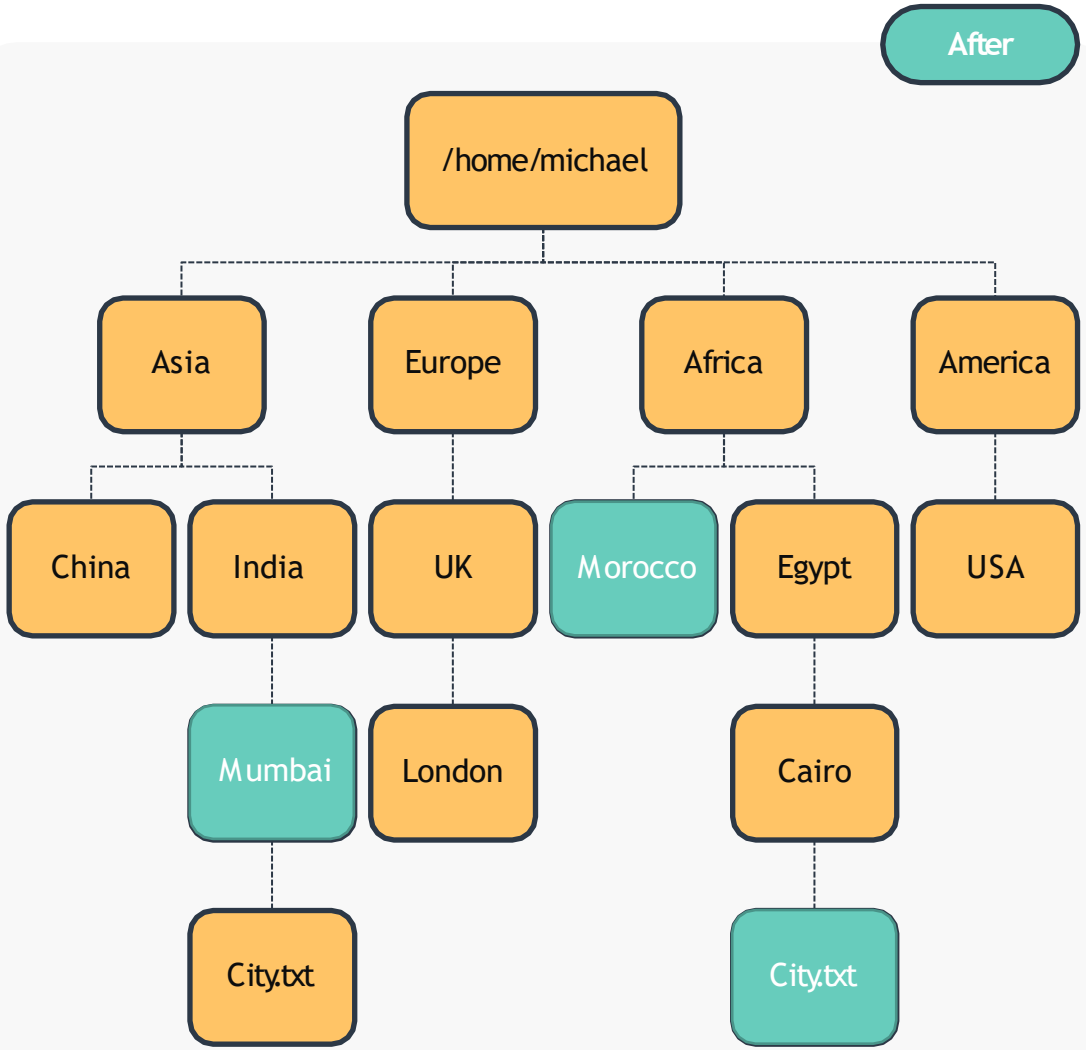
Basic Linux Commands





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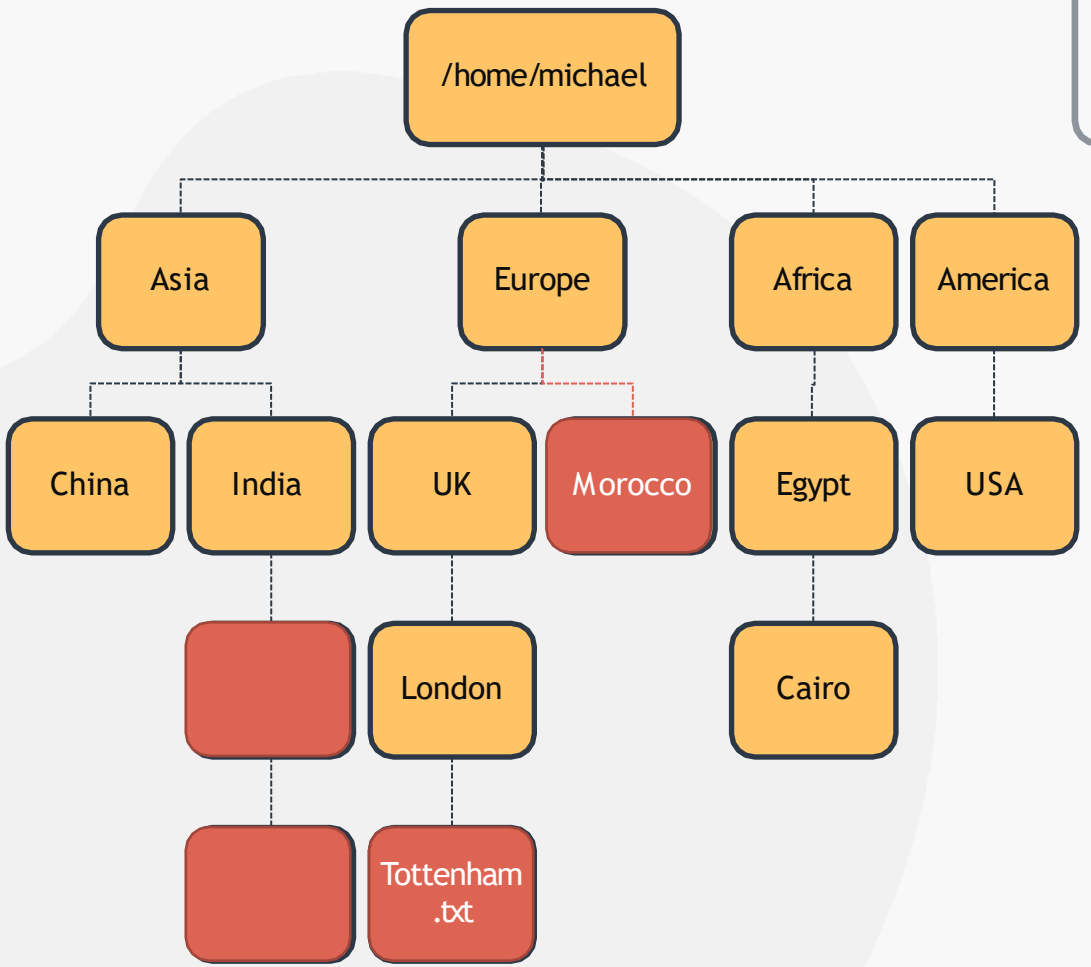
Basic Linux Commands



mv (Move file or directory)

```
[~]$ mv /home/michael/Europe/Morocco /home/michael/Africa/
```

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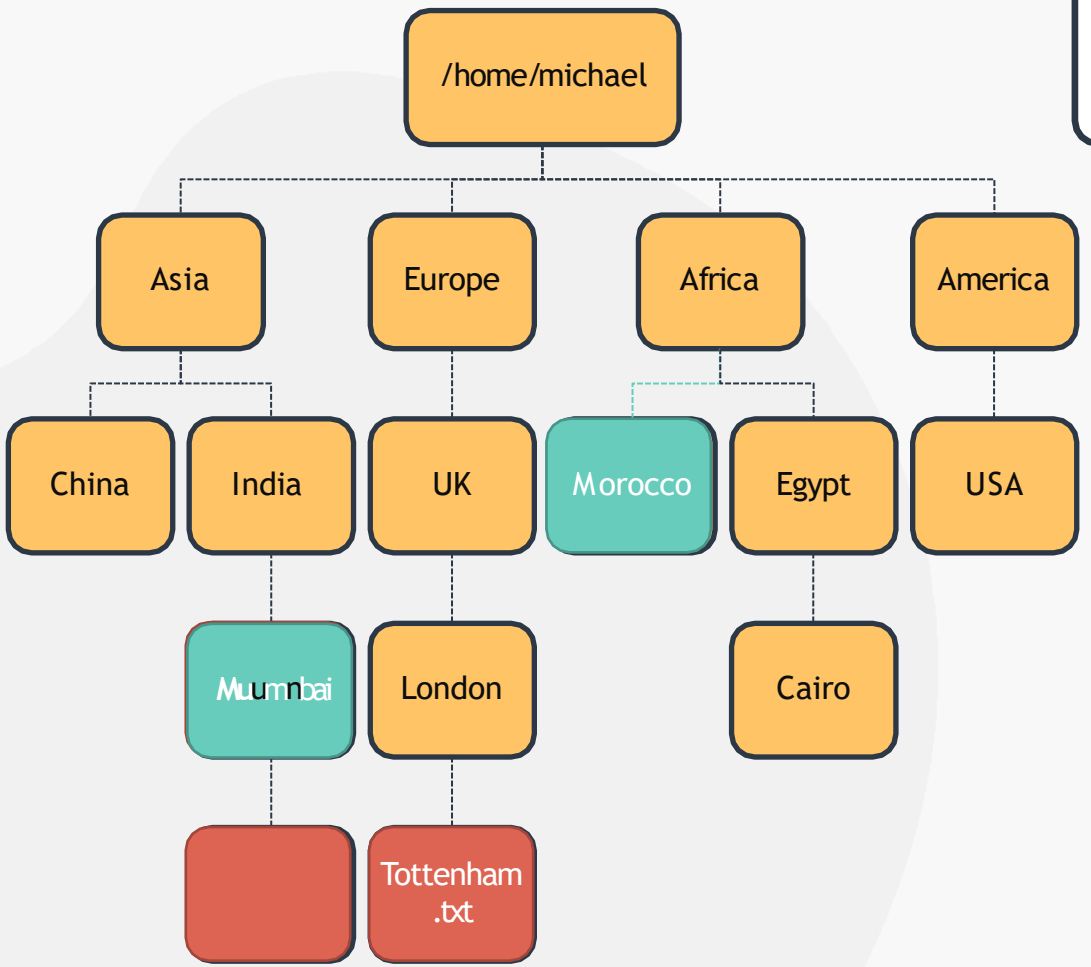
Basic Linux Commands



mv (Move file or directory)

```
[~]$ mv /home/michael/Europe/Morocco /home/michael/Africa/
```

OR

```
[~]$ mv Europe/Morocco Africa/
[~]$
```

```
[~]$ mv Asia/India/Munbai Asia/India/Mumbai
```

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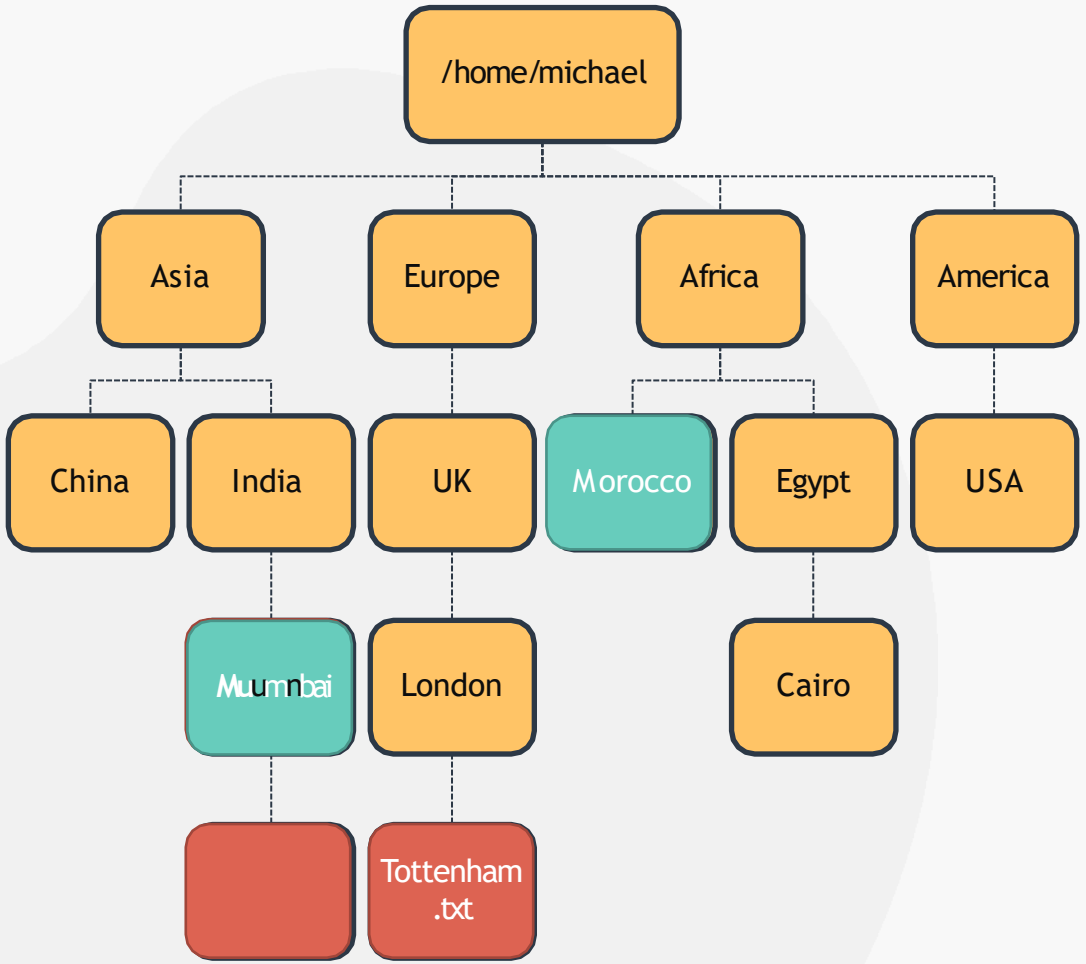
Basic Linux Commands



cp (Copy file)

```
[~]$ cp Asia/India/Mumbai/City.txt Africa/Egypt/Cairo
```

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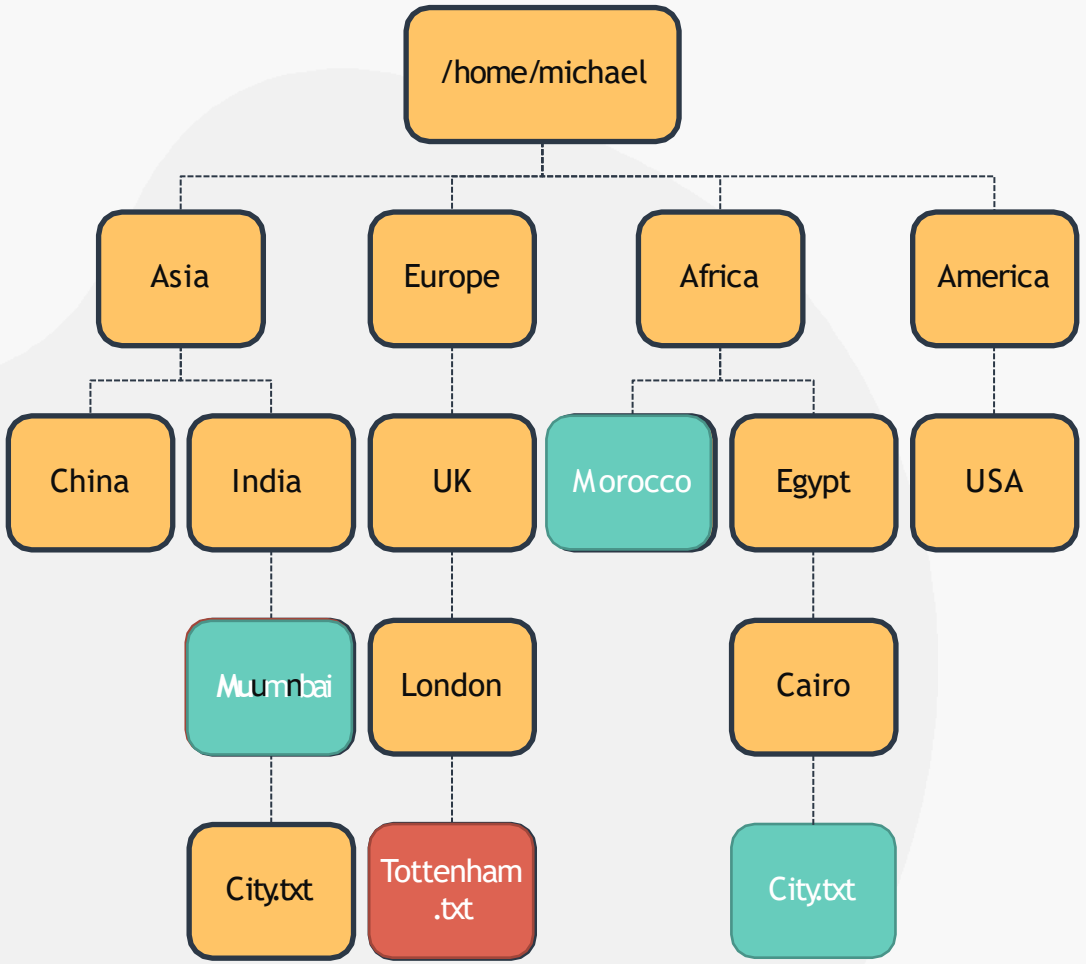
Basic Linux Commands



cp (Copy file)

```
[~]$ cp Asia/India/Mumbai/City.txt Africa/Egypt/Cairo
```

rm (Remove file or directory)

```
[~]$ rm Europe/UK/London/Tottenham.txt
```

cp -r (Copy directory)

```
[~]$ cp -r Europe/UK Europe/UnitedKingdom
```

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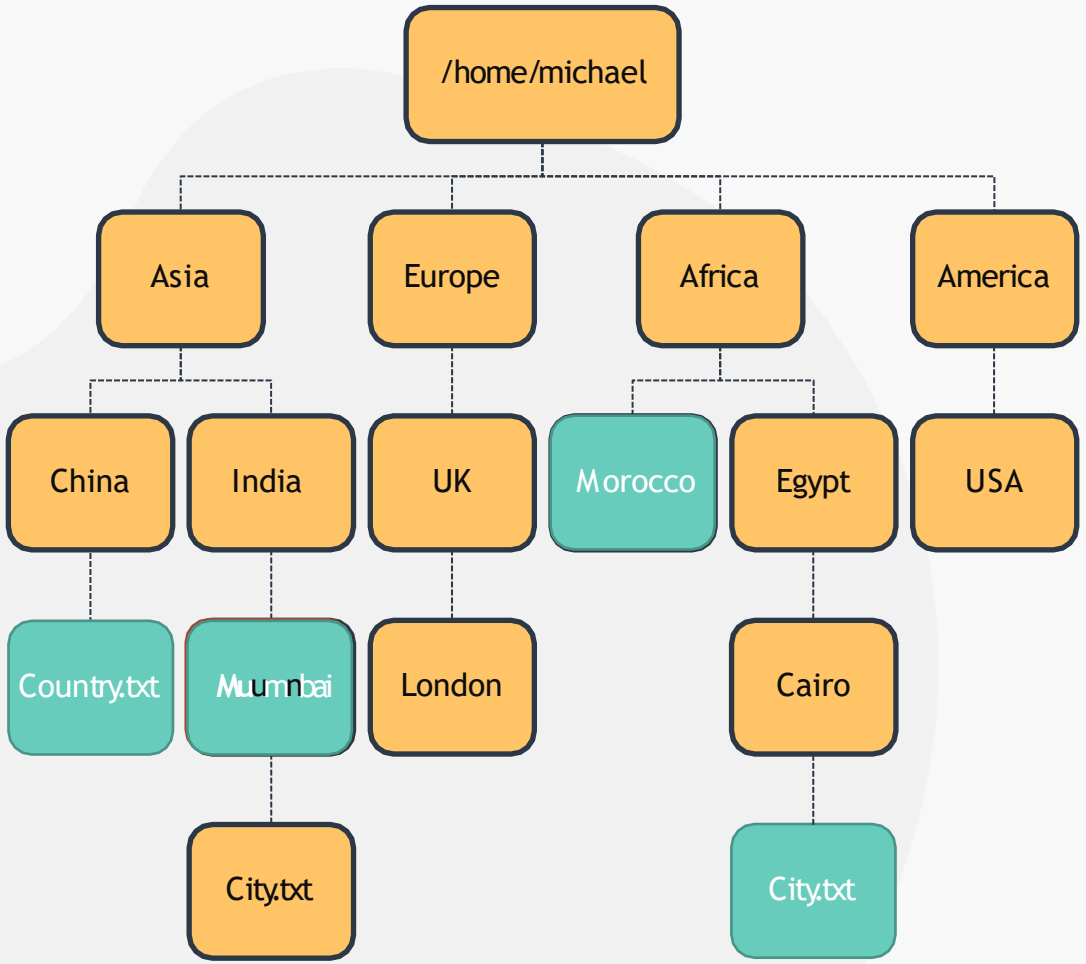
Working with Files and Directories




```
[~]$ cat Asia/India/Mumbai/City.txt
Mumbai

[~]$
```

cat (redirect)

```
[~]$ cat >
Africa/Egypt/Cairo/City.txt Cairo
ctrl  d
```

touch (create a new file)

```
[~]$ touch /home/michael/Asia/China/Country.txt
```

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Pagers


```
[~]$ more new_file.txt
```

[Space] - scrolls the display, one screenful of data at a time

[Enter] - scrolls the display one line

[b] - scrolls the display backwards one screenful of data

[/] - search text

```
[~]$ less new_file.txt
```

[Up Arrow] - scrolls up the display one line

[Down Arrow] - scrolls down the display one line

[/] - search text

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LS (Long List)

ls - l (long list)

```
[~]$ ls -l
total 0
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 File.txt
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 index.html
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 caleston
```

ls - lt (long list files in order created)

```
[~]$ ls -lt
total 0
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 File.txt
-rw-rw-r-- 1 bob bob 0 Mar 13 11:28 index.html
-rw-rw-r-- 1 bob bob 0 Mar 13 11:27 caleston
```

ls -a (list all files including hidden)

```
[~]$ ls -a
.  ..  File.txt  index.html  caleston  .test
```

ls -ltr (long list files in the reverse order created)

```
 [~]$ ls -ltr
total 0
-rw-rw-r-- 1 bob bob 0 Mar 13 11:27 caleston
-rw-rw-r-- 1 bob bob 0 Mar 13 11:28 index.html
-rw-rw-r-- 1 bob bob 0 Mar 13 11:30 File.txt
```


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GETTING HELP IN COMMAND LINE

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Using Command Line to Get Help

```
[~]$ whatis date
date (1)              - print or set the system date and time2
```

```
[~]$ man date
DATE(1)                          User Commands
DATE(1)

NAME
       date - print or set the system date and time

SYNOPSIS
       date [OPTION]... [+FORMAT]
       date [-u|--utc|--universal] [MMDDhhmm[[CC]YY][.ss]]

DESCRIPTION
       Display the current time in the given FORMAT, or set the system date.
```

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Using Command Line to Get Help

```
[~]$ date --help
Usage: date [OPTION]... [+FORMAT]
  or:  date [-u|--utc|--universal] [MMDDhhmm[[CC]YY][.ss]]
Display the current time in the given FORMAT, or set the system date.
```

```
[~]$ apropos modpr
modprobe (8)         - Add and remove modules from the Linux Kernel
modprobe.d (5)       - Configuration directory for modprobe.
```


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SHELL TYPES

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Shell Types

- Bourne Shell (sh)
- C Shell (csh or tcsh)
- Korn Shell (ksh)
- Z Shell (zsh)
- Bourne again Shell (bash)

```
[~]$ echo $SHELL
/bin/bash
```

```
[~]$ chsh
Password:
Changing the login shell for michael
Enter the new value, or press ENTER for the default
        Login Shell [/bin/bash]: /bin/sh
```

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Bash Shell Features

Bash Auto-Completion

```
[~]$ ls Documents                    tab
File1.txt file2.txt some_directory
```

Alias

```
[~]$ alias dt=date
```

```
[~]$ dt
Tue Mar  3 12:00:00 EST 2020
```

Command History

```
[~]$ history
1 ls Documents
2 alias dt=date
3 dt
```

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```
[~]$ echo $SHELL
/bin/bash
```

```
[~]$ env
LANG=en_CA.UTF-8
GDM_LANG=en_CA
DISPLAY=:0
GTK_OVERLAY_SCROLLING=
1
COLORTERM=truecolor
XDG_VTNR=7
USER=bob
PWD=/home/bob
HOME=/home/bob
SSH_AGENT_PID=2023
QT_ACCESSIBILITY=1
XDG_SESSION_TYPE=x11
GJS_DEBUG_OUTPUT=stderr
GTK_MODULES=gail:atk-bridge
TERM=xterm-256color
SHELL=/bin/bash
VTE_VERSION=5202
XDG_SEAT_PATH=/org/freedesktop/DisplayManager/Seat0
LANGUAGE=en_CA:en
LOGNAME=bob
PATH=/home/bob/bin:/home/bob/.local/bin:/home/bob/bin:/
usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:
/bin:/usr/games:/usr/local/games:/snap/bin
```

Bash Environment Variables

```
[~]$ echo $LOGNAME
bob
```

```
[~]$ export OFFICE=caleston
```

```
[~]$ OFFICE=caleston
```

~/.profile or ~/.pam_environment

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Path Variable

```
[~]$ echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
```

```
[~]$ which obs-studio
```

```
[~]$ obs-studio
obs-studio: command not found
```

```
[~]$ export PATH=$PATH:/opt/obs/bin
```

```
[~]$ which obs-studio
/opt/obs/bin/obs-studio
```

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Bash Prompt

```
[~]$
```

~ = Present Working Directory
$ = User Prompt Symbol

```
[michael@prod-server]$
```

```
[~]$ echo $PS1
[\W]$
```

\W = Present Working Directory =~
$ = Prompt Symbol

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Bash Prompt

```
[~]$ PS1=“ubuntu-server:”
ubuntu-server:
```

```
ubuntu-server: echo $PS1
ubuntu-server:
```

```
ubuntu-server: PS1="[\d \t \u@\h:\w ] $ "
[Thu Mar 12 22:12:54 bob@caleston:~ ] $
```

\d : the date in “Weekday Month Date” format (e.g., “Tue May 26”)
\e : an ASCII escape character (033)
\h : the hostname HQDN
\H : the complete hostname
\n : newline
\r : carriage return
\s : the name of the shell
\t : the current time in 24-hour HH:MM:SS format
\T : the current time in 12-hour HH:MM:SS format
\@ : the current time in 12-hour am/pm format
\A : the current time in 24-hour HH:MM format
\u : the username of the current user
\w : the current working directory, with $HOME abbreviated with a tilde
\W : the basename of the current working directory, with $HOME abbreviated with a tilde
\$: if the effective UID is 0, a #, otherwise a $

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HANDS-ON LABS


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Core Concepts

The Linux Basics Course

KODEKLOUD

Linux Core Concepts

- Introduction to the Linux Kernel
- Linux Boot Sequence
- Kernel Space and User Space
- SYSTEMD TARGETS (RUNLEVELS)
- Working with Hardware
- Filesystems and Hierarchy
- Labs: Linux Core Concepts

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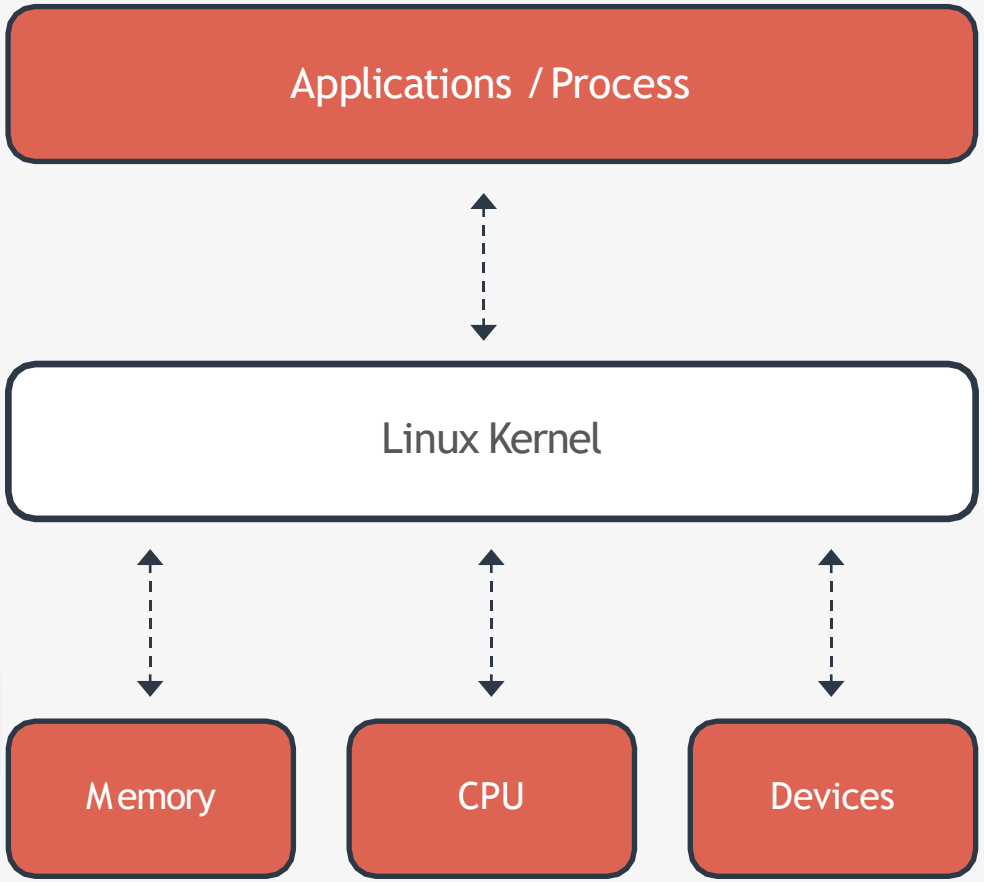
Linux Kernel



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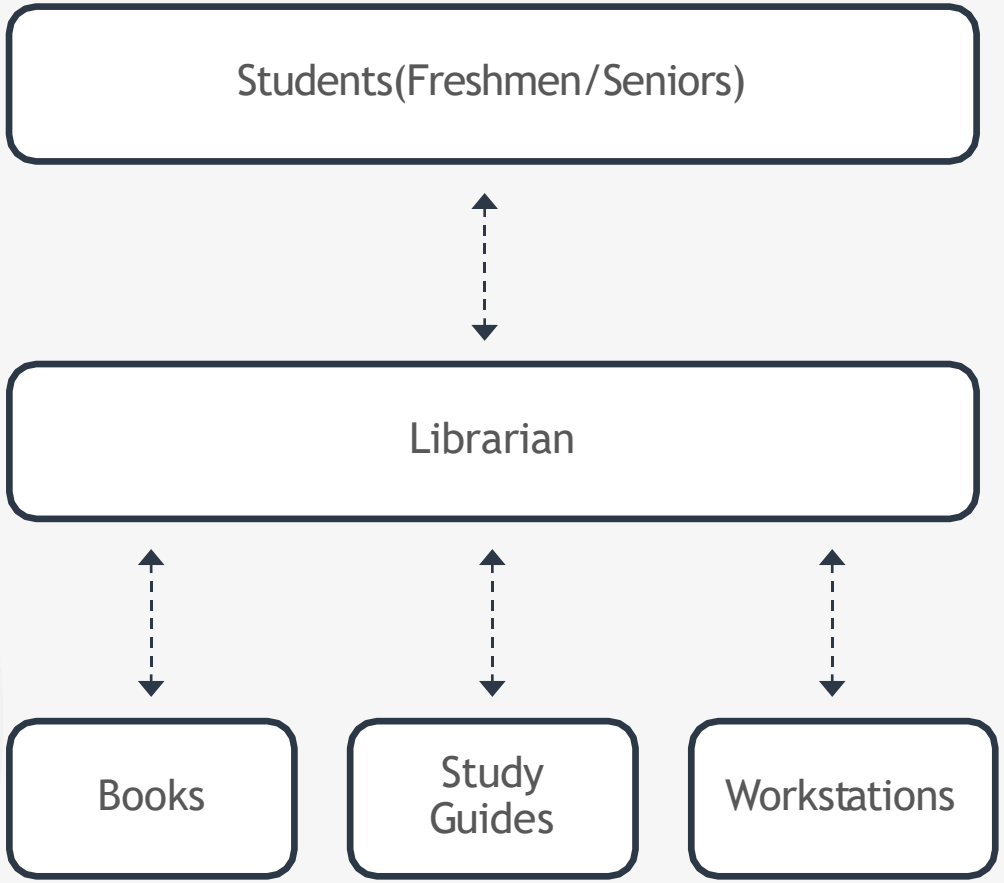
Linux Kernel



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Linux Kernel

01 Memory Management

02 Process Management

03 Device Drivers

04 System Calls and Security

Monolithic

Modular

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Kernel Versions

```
[~]$ uname
Linux
```

```
[~]$ uname -r
4.15.0-72-generic
```

4 = Kernel Version

15 = Major version

0 = Minor Version

72 = patch release

Generic = Distro Specific Info

https://kernel.org

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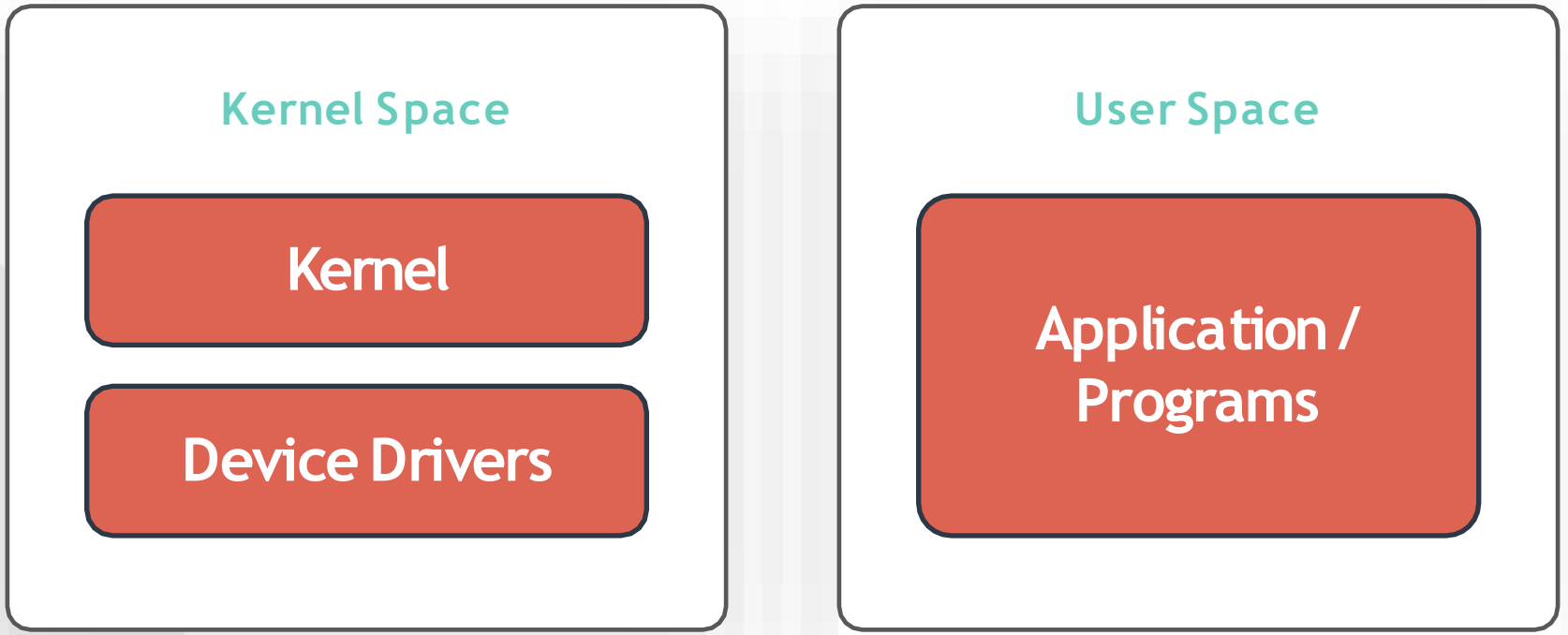
Kernel And User Space



- Kernel Code
- Kernel Extensions
- Device Drivers

- C
- Java
- Python
- Ruby
- Docker Containers

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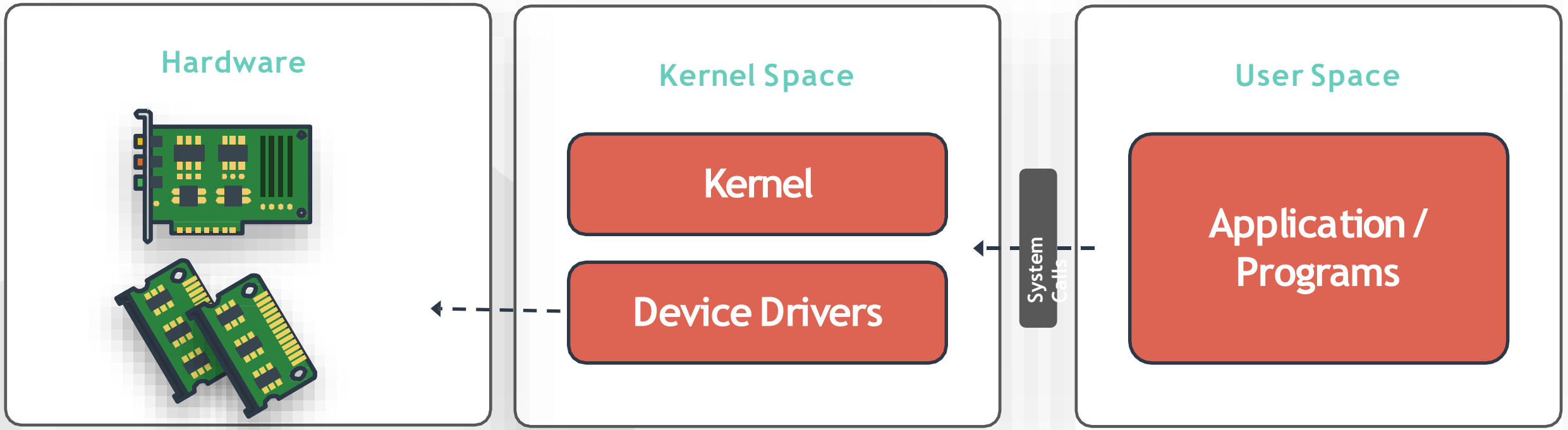
Kernel And User Space



- Open a File
- Write to a file
- List Processes
- Defining a variable

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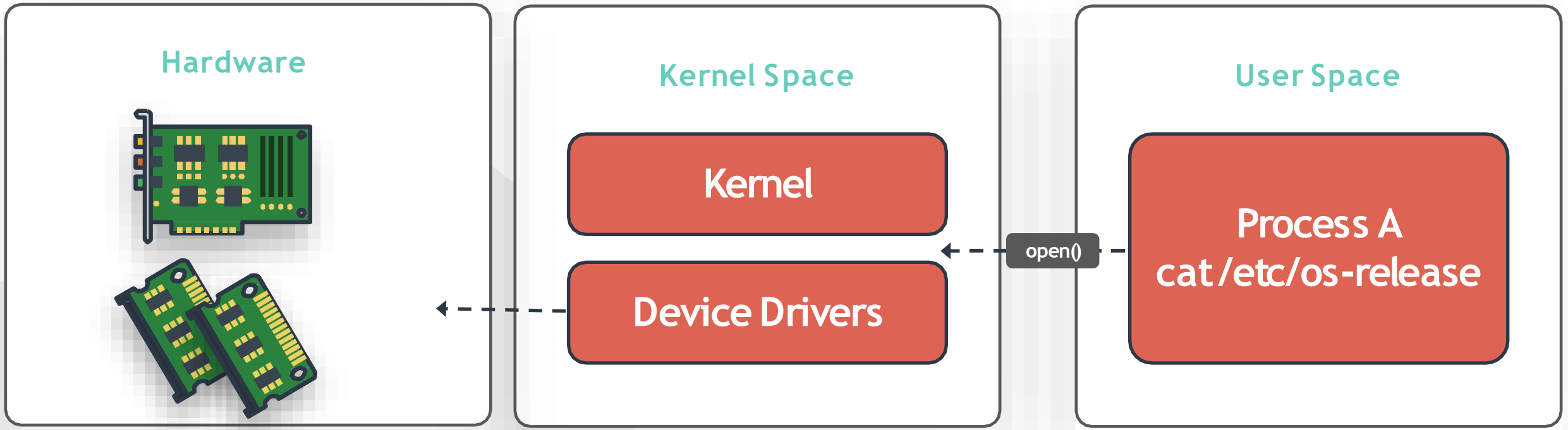
Kernel And User Space



- open()
- close()
- readdir()
- strlen()
- closedir()

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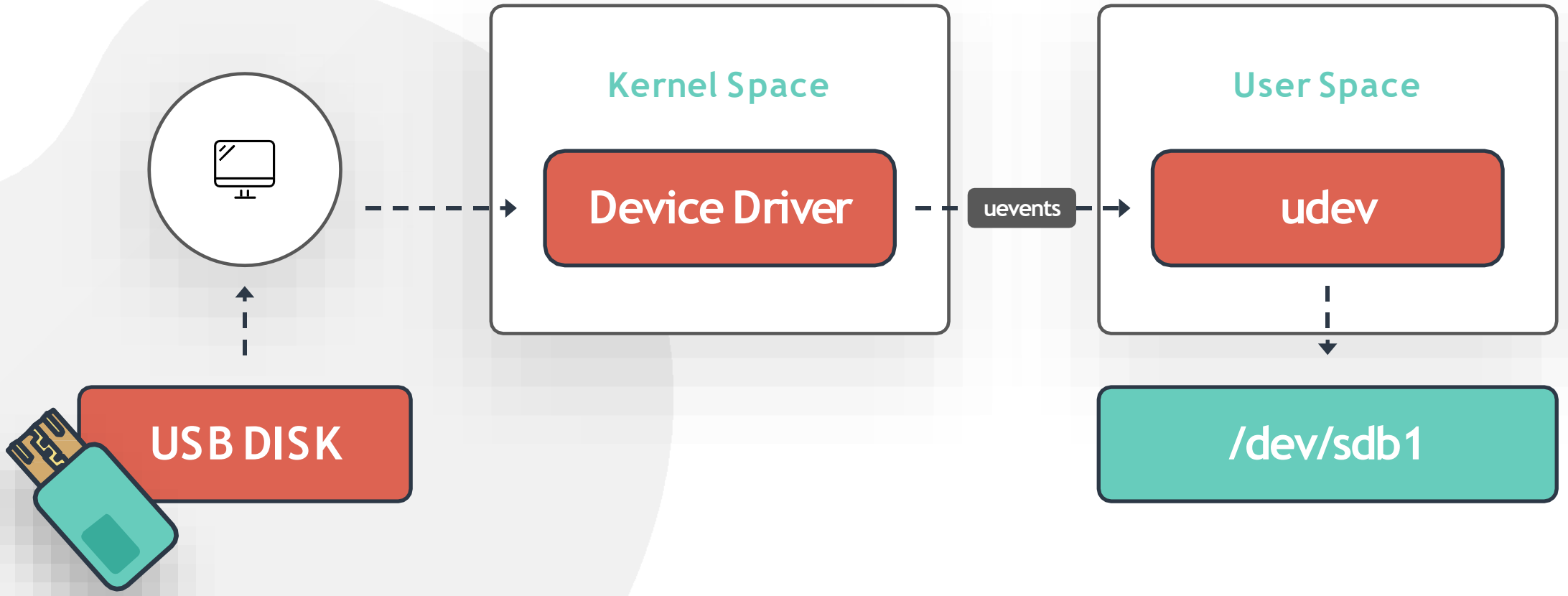
Working with Hardware



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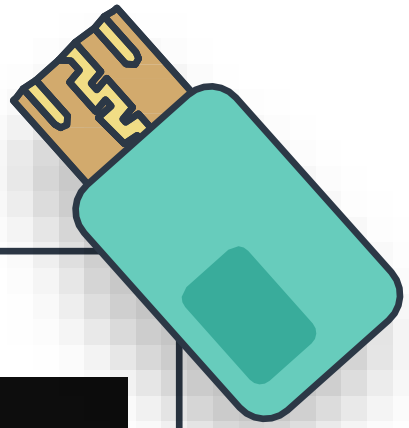
Working with Hardware



```
[~]$ dmesg
```

```
[~]$ dmesg | grep -i usb
[    0.082019] ACPI: Power Resource [USBC]
[    (on) 0.132167] ACPI: bus type USB
[    registered
[    0.132167] usbcore: registered new interface driver
[    usbfs 0.132167] usbcore: registered new interface
[    driver hub  0.132167] usbcore: registered new device
[    driver usb
[    0.840295] ehci_hcd: USB 2.0 'Enhanced' Host Controller (EHCI)
[    Driver 0.840306] ohci_hcd: USB 1.1 'Open' Host Controller (OHCI)
[    Driver  0.840315] uhci_hcd: USB Universal Host Controller Interface
[    driver
[    0.840446] xhci_hcd 0000:00:14.0: new USB bus registered, assigned bus number
[    1 0.841764] usb usb1: New USB device found, idVendor=1d6b, idProduct=0002
[    0.841765] usb usb1: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[    0.841765] usb usb1: Product: xHCI Host Controller
     0.841766] usb usb1: Manufacturer: Linux 4.15.0-72-generic xhci-
     hcd 0.841767] usb usb1: SerialNumber: 0000:00:14.0
     0.841905] hub 1-0:1.0: USB hub found
```

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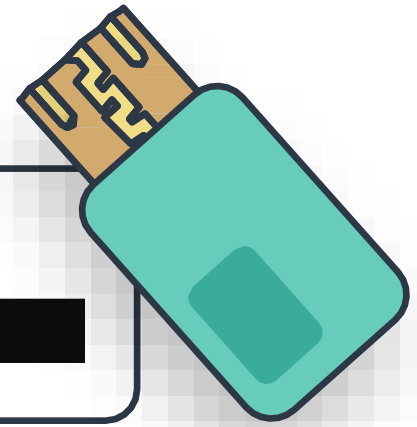
Working with Hardware



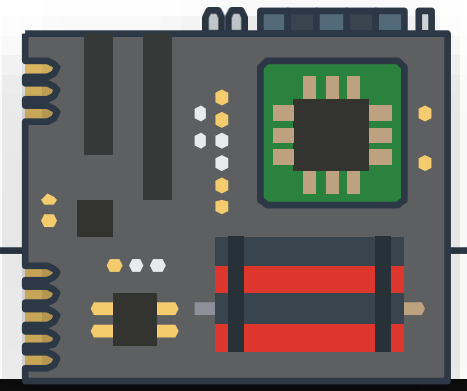
```
[~]$ udevadm info --query=path --name=/dev/sda5
/devices/pci0000:00/0000:00:17.0/ata3/host2/target2:0:0/2:0:0:0/block/sda/sda5
```

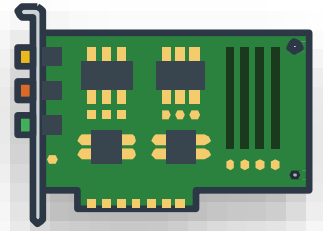
```
[~]$ udevadm monitor
monitor will print the received events for:
UDEV - the event which udev sends out after rule processing
KERNEL - the kernel uevent

KERNEL[6532.487876] remove   /devices/pci0000:00/0000:00:14.0/usb1/1-4/1-4:1.0/0003:03F0:094A.0001/input/input6/mouse0
UDEV  [6532.492641] remove   (input)
KERNEL[6532.500425] remove   /devices/pci0000:00/0000:00:14.0/usb1/1-4/1-4:1.0/0003:03F0:094A.0001/input/input6/mouse0 (input)
UDEV  [6532.502180] remove   /devices/pci0000:00/0000:00:14.0/usb1/1-4/1-4:1.0/0003:03F0:094A.0001/input/input6/event6
KERNEL[6532.532441] remove   (input)
/devices/pci0000:00/0000:00:14.0/usb1/1-4/1-4:1.0/0003:03F0:094A.0001/input/input6/event6
(input)
/devices/pci0000:00/0000:00:14.0/usb1/1-4/1-4:1.0/0003:03F0:094A.0001/input/input6 (input)
```

KODEKLOUD

Working with Hardware





```
[~]$ lspci
00:00.0 Host bridge: Intel Corporation Device 3e34 (rev 0c)
00:02.0 VGA compatible controller: Intel Corporation Device 3ea0 (rev 02)
00:08.0 System peripheral: Intel Corporation Xeon E3-1200 v5/v6 / E3-1500 v5 / 6th/7th Gen Core Processor Gaussian
Mixture Model
00:12.0 Signal processing controller: Intel Corporation Device 9df9 (rev
30) 00:14.0 USB controller: Intel Corporation Device 9ded (rev 30)
00:14.2 RAM memory: Intel Corporation Device 9def (rev 30)
00:14.3 Network controller: Intel Corporation Device 9df0 (rev 30)
00:15.0 Serial bus controller [0c80]: Intel Corporation Device 9de8 (rev 30)
00:15.1 Serial bus controller [0c80]: Intel Corporation Device 9de9 (rev 30)
00:16.0 Communication controller: Intel Corporation Device 9de0 (rev 30)
00:17.0 RAID bus controller: Intel Corporation 82801 Mobile SATA Controller [RAID mode] (rev
30) 00:1d.0 PCI bridge: Intel Corporation Device 9db0 (rev f0)
00:1f.0 ISA bridge: Intel Corporation Device 9d84 (rev 30)
00:1f.3 Audio device: Intel Corporation Device 9dc8 (rev 30)
00:1f.4 SMBus: Intel Corporation Device 9da3 (rev 30)
00:1f.5 Serial bus controller [0c80]: Intel Corporation Device 9da4 (rev 30)
01:00.0 Unassigned class [ff00]: Realtek Semiconductor Co., Ltd. RTL8411B PCI Express Card Reader (rev 01)
01:00.1 Ethernet controller: Realtek Semiconductor Co., Ltd. RTL8111/8168/8411 PCI Express Gigabit Ethernet Controller (rev
12) (linux-mint) ~ #
```

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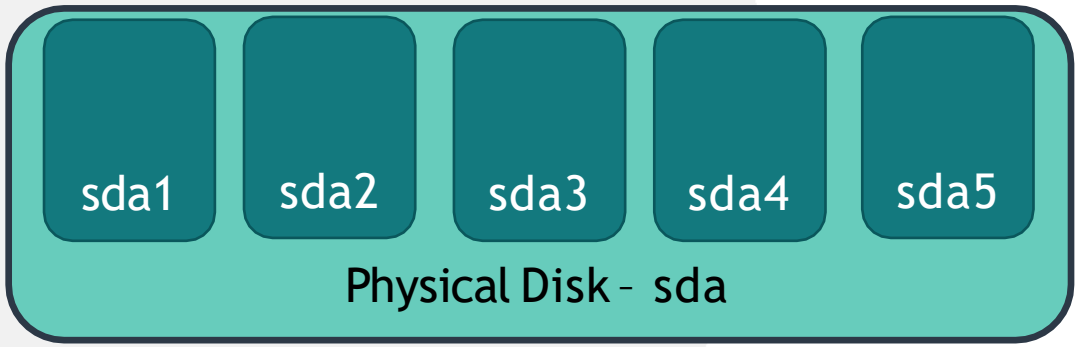
Working with Hardware

```
[~]$ lsblk
NAME                      MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
sda                         8:0    0 119.2G  0 disk
├─sda1                      8:1    0   100M  0 part /boot/efi
├─sda2                      8:2    0    16M  0 part
├─sda3                      8:3    0  71.5G  0 part
├─sda4                      8:4    0     1G  0 part
└─sda5                      8:5    0  46.6G  0 part /
```

Major Number	Device Type
1	RAM
3	HARD DISK or CD ROM
6	PARALLEL PRINTERS
8	SCSI DISK



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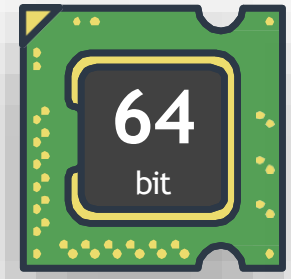
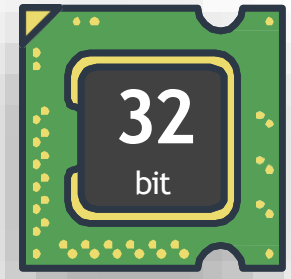
Working with Hardware

```
[~]$ lscpu
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:            Little Endian
CPU(s):                8
On-line CPU(s) list:   0-7
Thread(s) per core:    2
Core(s) per socket:    4
Socket(s):             1
NUMA node(s):          1
Vendor ID:             GenuineIntel
CPU family:            6
Model:                 142
Model name:            Intel(R) Core(TM) i5-8265U CPU @ 1.60GHz
Stepping:              12
CPU MHz:               700.060
CPU max MHz:           3900.0000
CPU min MHz:           400.0000
BogoMIPS:              3600.00
Virtualization:        VT-x
L1d cache:             32K
L1i cache:             32K
L2 cache:              256K
L3 cache:              6144K
NUMA node0 CPU(s):     0-7
```

2^{64}
18 EB

2^{32}
4 GB





KODEKLOUD

Working with Hardware

```
[~]$ lscpu
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:            Little Endian
CPU(s):                8
On-line CPU(s) list:   0-7
Thread(s) per core:    2
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Socket(s):             1
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Vendor ID:             GenuineIntel
CPU family:            6
Model:                 142
Model name:            Intel(R) Core(TM) i5-8265U CPU @ 1.60GHz
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BogoMIPS:              3600.00
Virtualization:        VT-x
L1d cache:             32K
L1i cache:             32K
L2 cache:              256K
L3 cache:              6144K
NUMA node0 CPU(s):     0-7
```
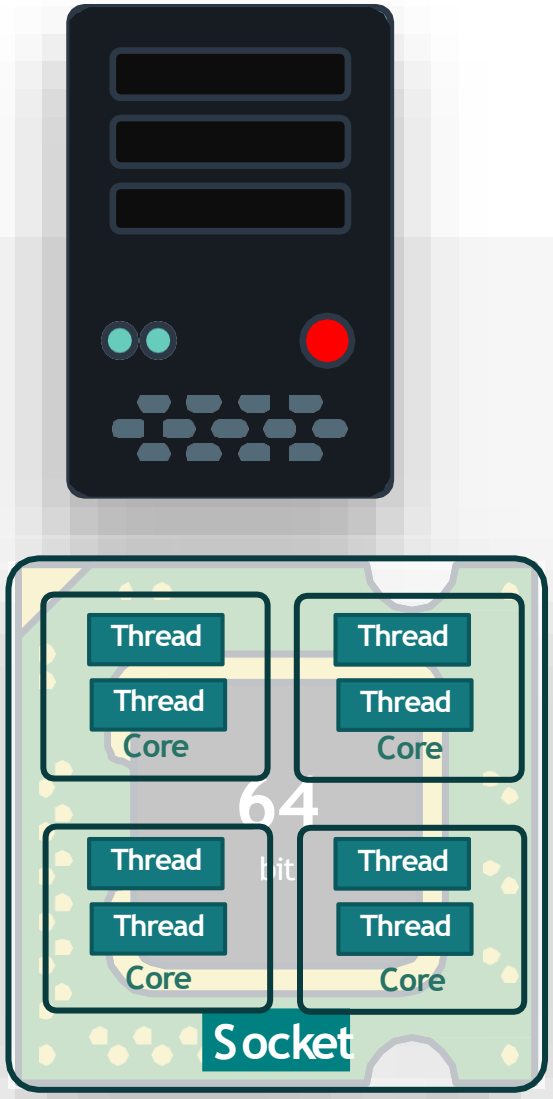

Sockets x Cores x Threads = CPUs



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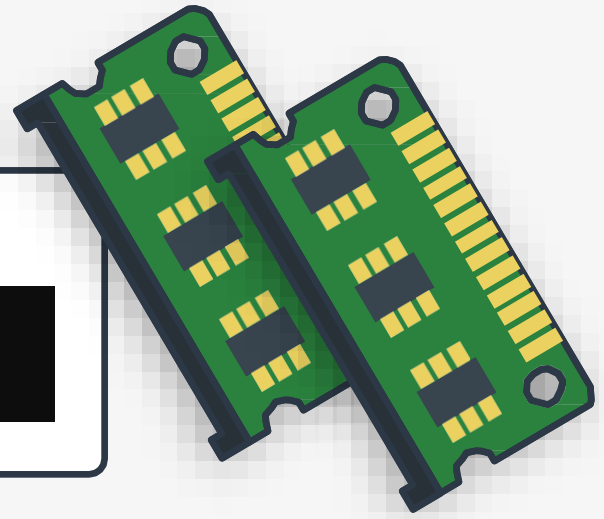
Working with Hardware

```
[~]$ lsmem  --summary
Memory block size:       128M
Total online memory:       8G
Total offline memory:      0B
```

```
[~]$ free -m
               total        used        free      shared  buff/cache   available
Mem:            7824        2518         541         525        4764        4481
Swap:           2047           0        2047
```



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Working with Hardware

```
[~]$ lshw
 description: Notebook
    product: Aspire A515-52 (0000000000000000)
    vendor: Acer
    version: V1.12
    serial: NXH89AA0026262680A13400
    width: 64 bits
capabilities: smbios-3.0 dmi-3.0 smp vsyscall32
    configuration: chassis=notebook family=Aspire 5 sku=0000000000000000 uuid=D74676912-9EFF-ABCDE-8192-085643E554D
  *-core
       description: Motherboard
       product: Raticate_WL
       vendor: WL
       physical id: 0
       version: V1.12
       serial: LAC12110069561AB521500
       slot: Type2 - Board Chassis Location
     *-firmware
          description: BIOS
          vendor: Insyde Corp.
          physical id: 0
          version: V1.12
          date: 04/26/2019
          size: 128KiB
          capacity: 15MiB
```

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SUDO

```
[~]$ lshw
WARNING: output may be incomplete or
inaccurate, you should run this
program as super-user.
```

```
[~]$ sudo lshw
[sudo] password for bob:
 description: Notebook
    product: Aspire A515-52 (0000000000000000)
    vendor: Acer
    version: V1.12
    serial: NXH89AA0026262680A13400
    width: 64 bits
capabilities: smbios-3.0 dmi-3.0 smp vsyscall32
    configuration: chassis=notebook family=Aspire 5
sku=0000000000000000 uuid=D74676912-9EFF-ABCDE-8192-085643E554D
  *-core
       description: Motherboard
       product: Raticate_WL
       vendor: WL
       physical id: 0
       version: V1.12
       serial: LAC12110069561AB521500
       slot: Type2 - Board Chassis Location
     *-firmware
          description: BIOS
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          version: V1.12
          date: 04/26/2019
          size: 128KiB
          capacity: 15MiB
```

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HANDS-ON LABS


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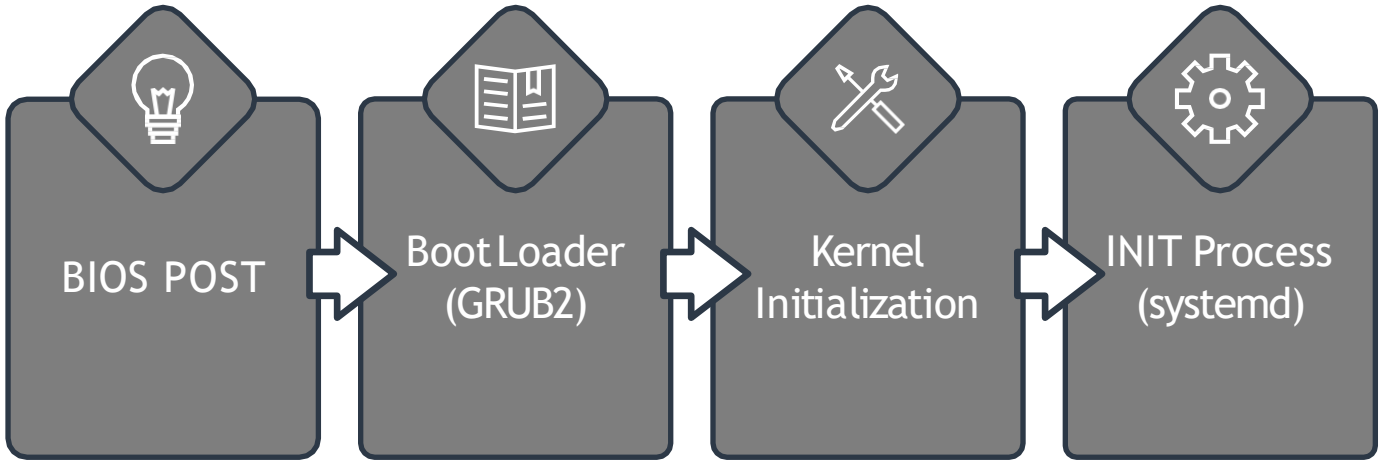
Linux Boot
Sequence Overview



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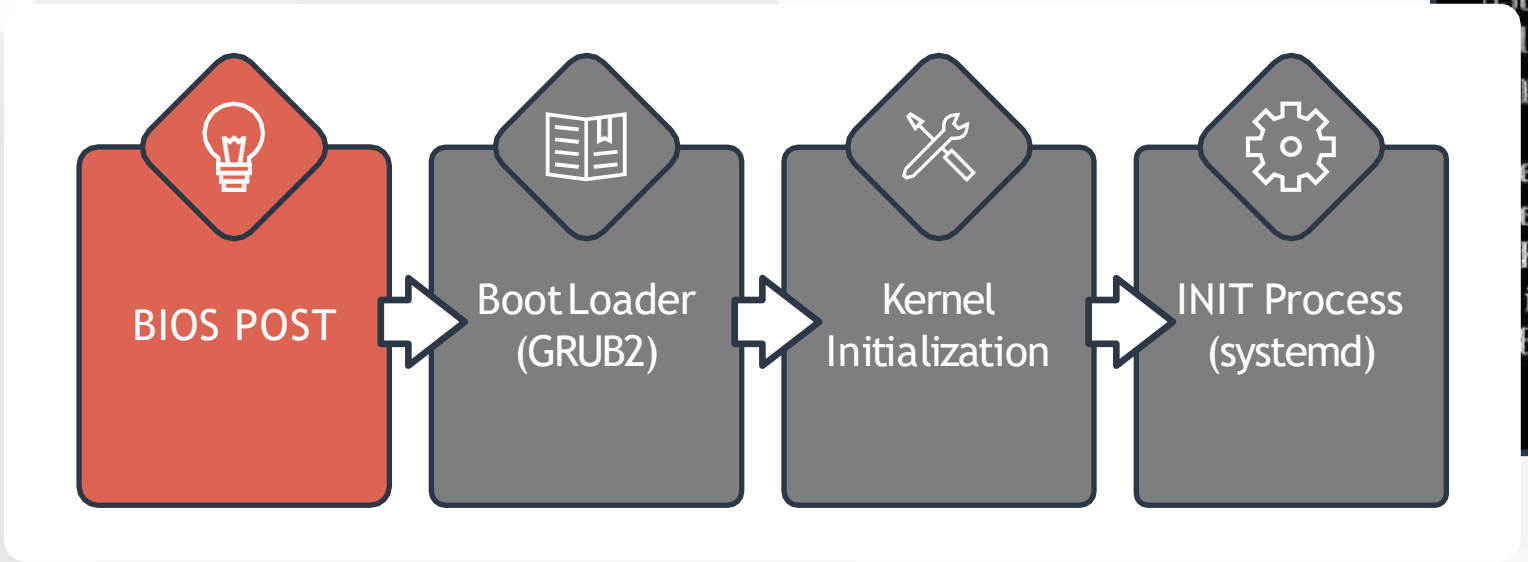
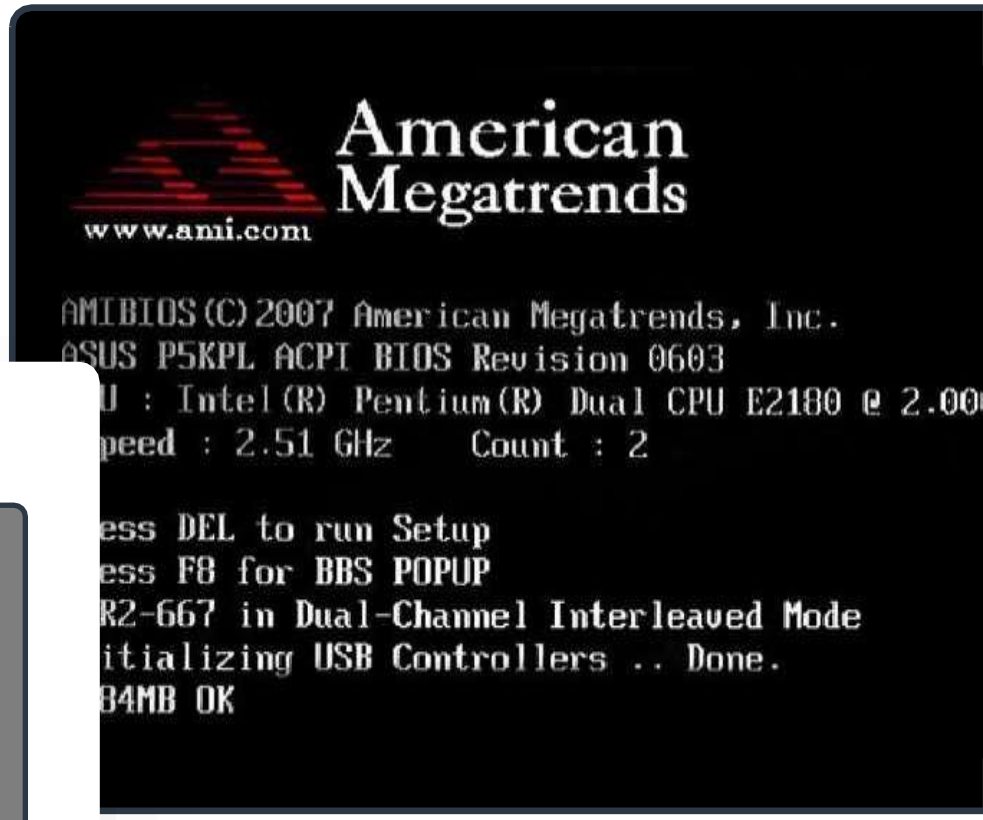
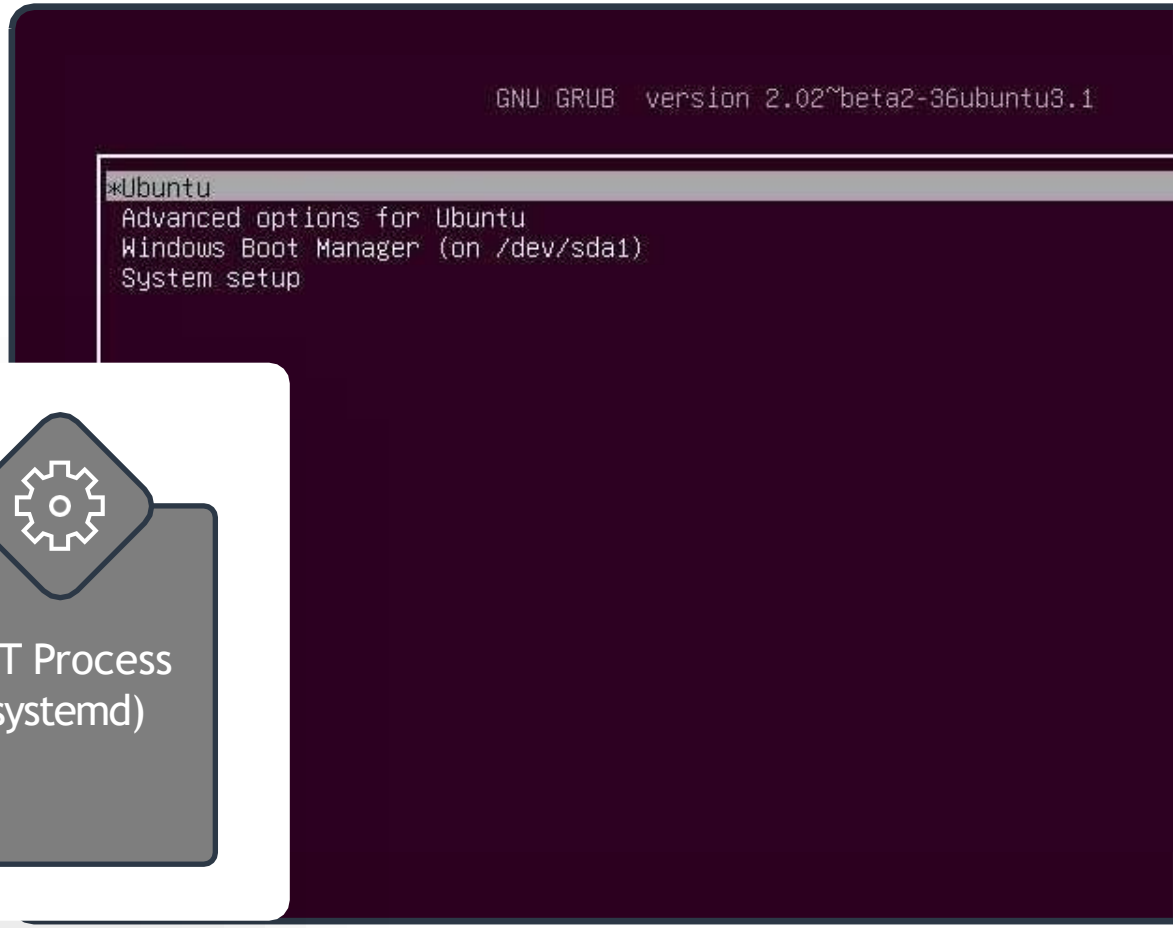
Linux Boot
Sequence Overview

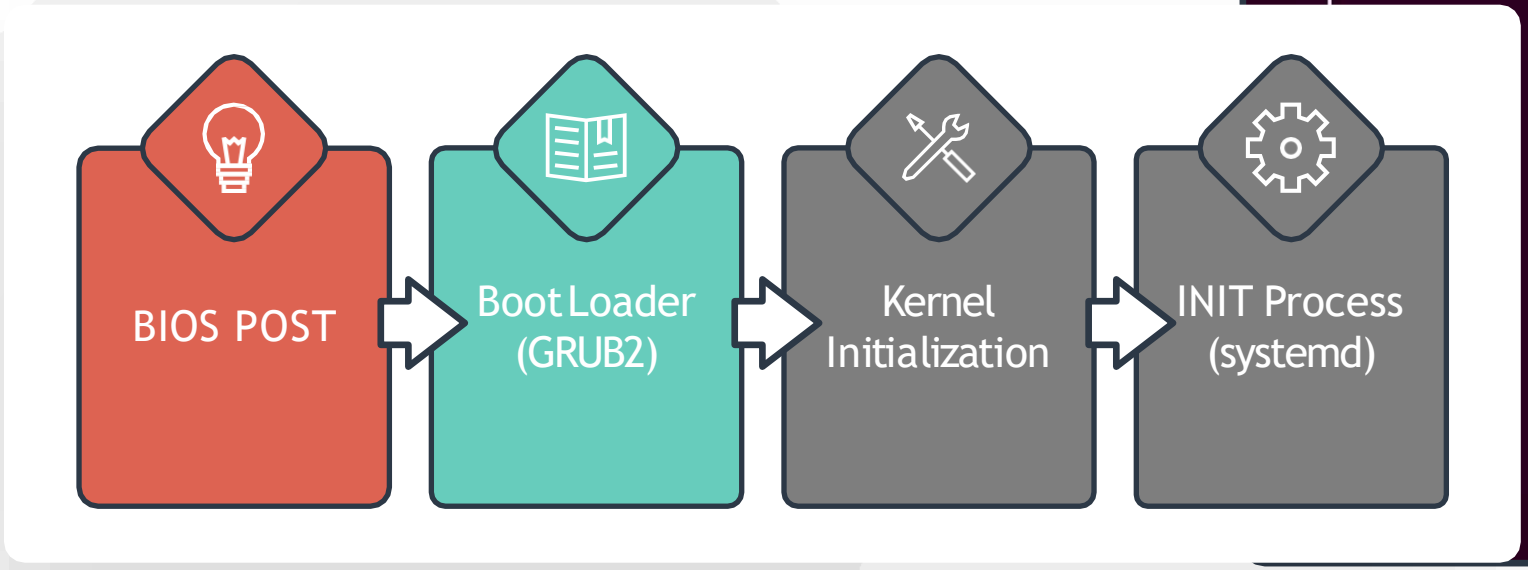




KODEKLOUD

Linux Boot
Sequence Overview





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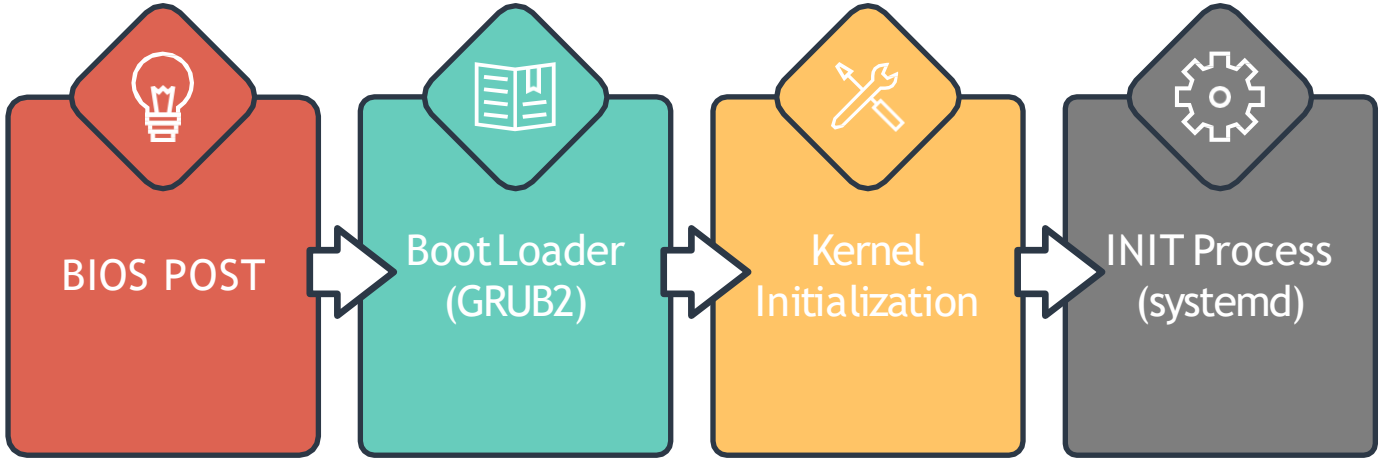
Linux Boot
Sequence Overview




```
    0.553626] evm: HMAC attrs: 0x1
    0.554274]   Magic number: 0:465:215
    0.557297] event_source software: hash matches
    0.557984] rtc_cmos rtc_cmos: setting system clock to 2020-04-09
(1586412850)
    0.559123] BIOS EDD facility v0.16 2004-Jun-25, 0 devices found
    0.559857] EDD information not available.
    0.697079] Freeing unused kernel image memory: 2432K
    0.709461] Write protecting the kernel read-only data: 20480k
    0.7     ] Freeing unused kernel image memory: 2008K
    0.7     ] reeing unused kernel image memory: 1880K
    0.7     ] 86/mm: Checked W+X mappings: passed, no W+X pages fou
    0.7     ] 1000: Intel(R) PRO/1000 Network Driver - version 7.3
    0.7     ] 1000: Copyright (c) 1999-2006 Intel Corporation.
    0.7     ] usion MPT base driver 3.04.20
    0.7     ] opyright (c) 1999-2008 LSI Corporation
    0.7     ] usion MPT SPI Host driver 3.04.20
    0.7     ] VX2 version of gcm_enc/dec engaged.
    0.7     ] ES CTR mode by8 optimization enabled
    0.7     ] nput: ImExPS/2 Generic Explorer Mouse as /devices/pla
    0.7     ] put4
    0.7     ] 1000 0000:00:03.0 eth0: (PCI:33MHz:32-bit) 02:12:4b:
    0.7     ] 1000 0000:00:03.0 eth0: Intel(R) PRO/1000 Network Co
    0.7     ] ptbase: ioc0: Initiating bringup
```

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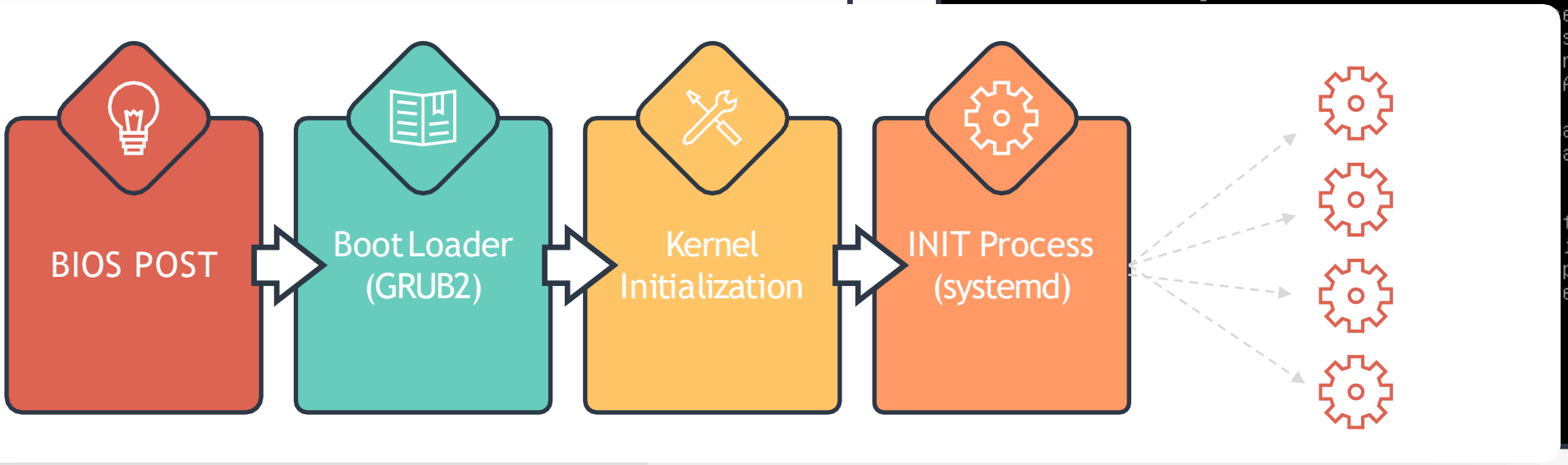
Linux Boot
Sequence Overview

```
[~]$ ls -l /sbin/init
 lrwxrwxrwx /sbin/init -> /lib/systemd/systemd
```




```
[    5.574670] EXT4-fs (sda1): mounted filesystem with ordered data mod
(null)
[    5.720090] ip_tables: (C) 2000-2006 Netfilter Core Team
[    5.730446] systemd[1]: systemd 237 running in system mode. (+PAM +A
INUX +IMA +APPARMOR +SMACK +SYSVINIT +UTMP +LIBCRYPTSETUP +GCRYPT +GNUT
XZ +LZ4 +SECCOMP +BLKID +ELFUTILS +KMOD -IDN2 +IDN -PCRE2 default-hiera
id)
[    5.732961] systemd[1]: Detected virtualization oracle.
[    5.733587] systemd[1]: Detected architecture x86-64.
[    5.748912] systemd[1]: Set hostname to <kubemaster>.
er and Group Name Lookups.
stem Time Synchronized.
r and Session Slice.
Arbitrary Executable File F

ap.
assword Requests to Wall Di

 v2.0-870.
tcp)
iser)
pts: (null)
ed request to flush runtime
```

KODEKLOUD

Systemd Targets

Bob's Laptop

```
Ubuntu 18.04.4 LTS caleston-lp03 tty1

caleston-lp03 login:
```

Dave's Laptop

```
[~]$ runlevel
N   5
```

```
[~]$ runlevel
N   3
```

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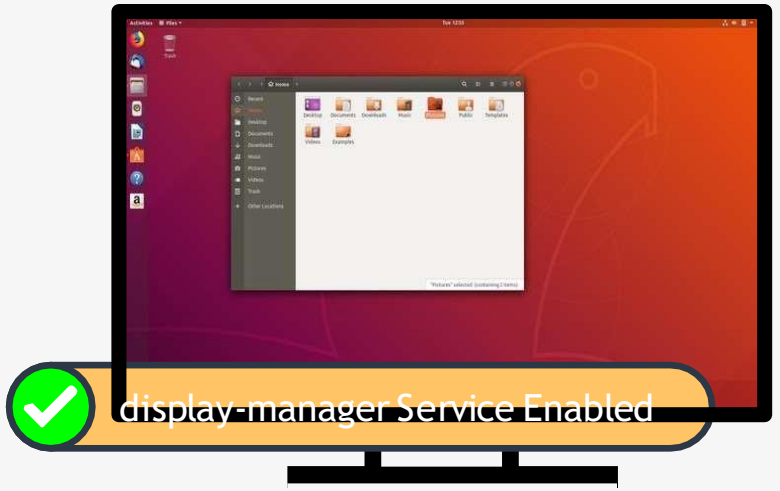
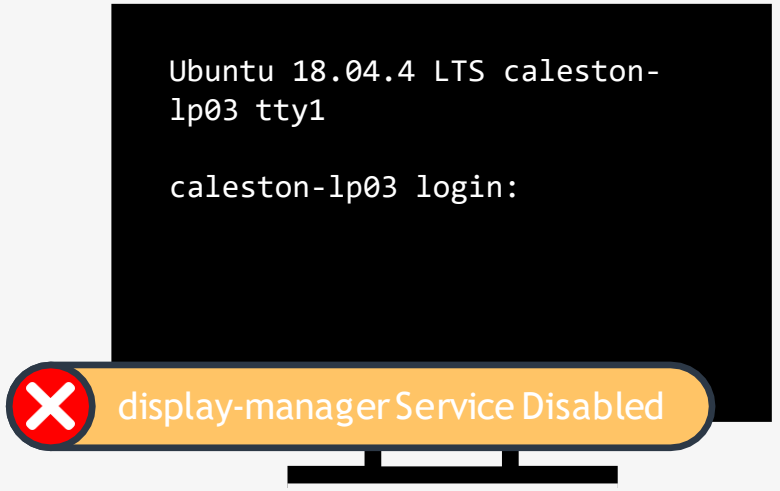
Systemd Target (Runlevels)

Runlevel	Function
5	Boots into a Graphical Interface
3	Boots into a Command Line Interface





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Systemd Target (Runlevels)

Runlevel	Systemd Targets	Function
5	graphical.target	Boots into a Graphical Interface
3	multiuser.target	Boots into a Command Line Interface

RHEL 6 / Ubuntu 14.04

Runlevels

RHEL 7 / Ubuntu 18.04

Systemd Targets

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Viewing and Changing Systemd Target

```
[~]$ systemctl get-default
 graphical.target
```

```
[~]$ ls -ltr /etc/systemd/system/default.target
/etc/systemd/system/default.target ->
/lib/systemd/system/graphical.target
```

```
[~]$ systemctl set-default multi-user.target
 Created symlink /etc/systemd/system/default.target → /lib/systemd/system/multi-
  user.target
```

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Questions?

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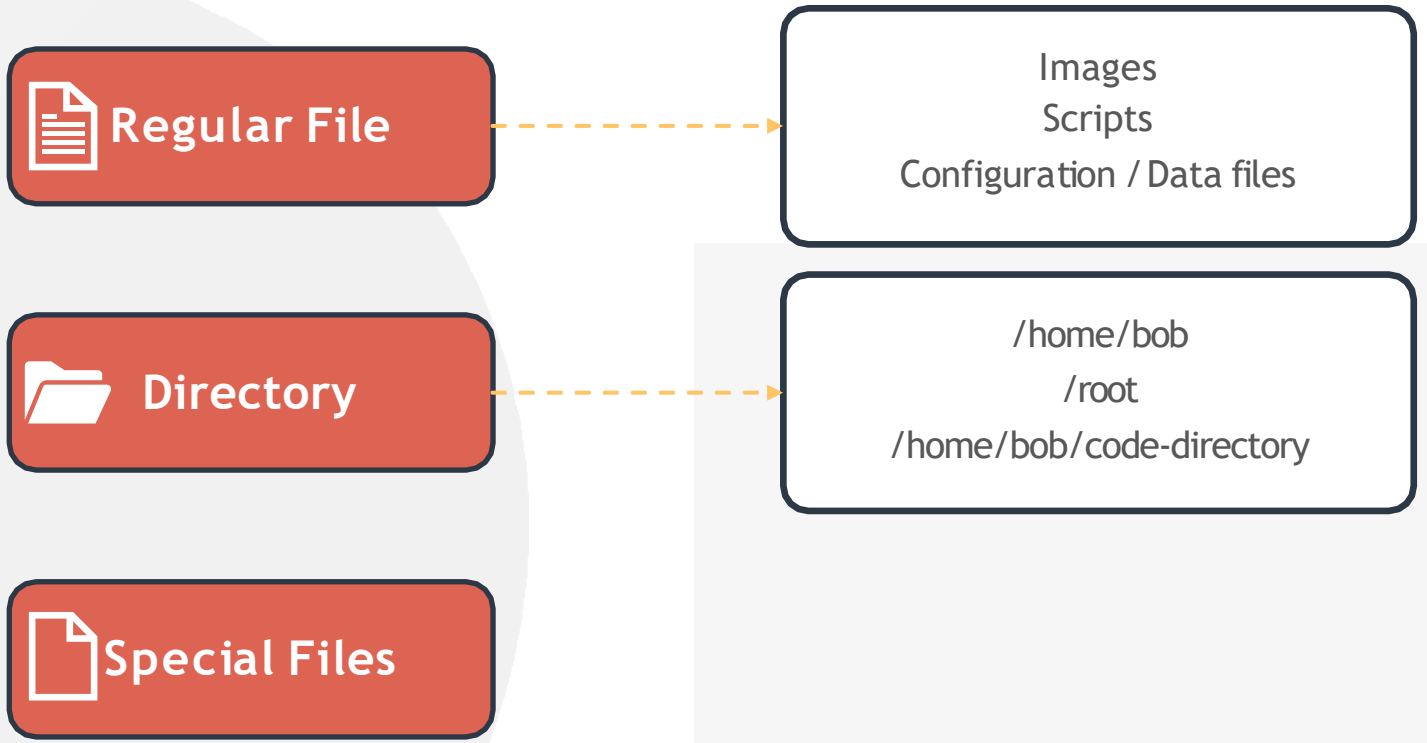
File Types
in Linux



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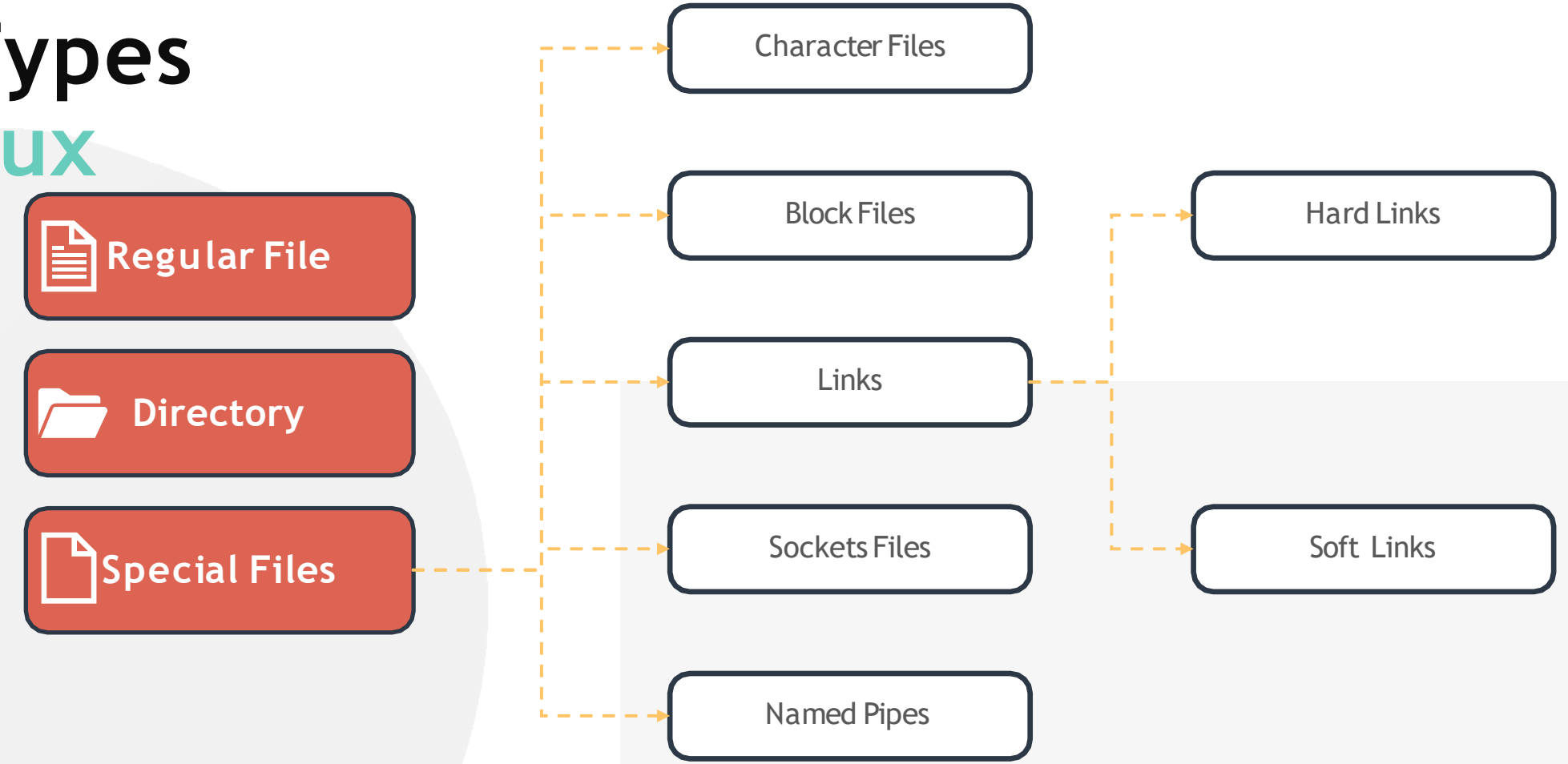
File Types in Linux



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File Types in Linux

```
[~]$ file /home/michael/
/home/michael/: directory
```

```
[~]$ file bash-script.sh
bash-script.sh: Bourne-Again shell script, UTF-8 Unicode text executable
```

```
[~]$ file insync1000.sock
insync1000.sock: socket
```

```
[~]$ file /home/michael/bash-script
/home/michael/bash-script: symbolic link to /home/sara/bash-script.sh
```

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File Types in Linux

```
[~]$ ls -ld /home/michael/
drwxr-xr-x 3 root root 4096 Mar 18 17:20 /home/michael/
```

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

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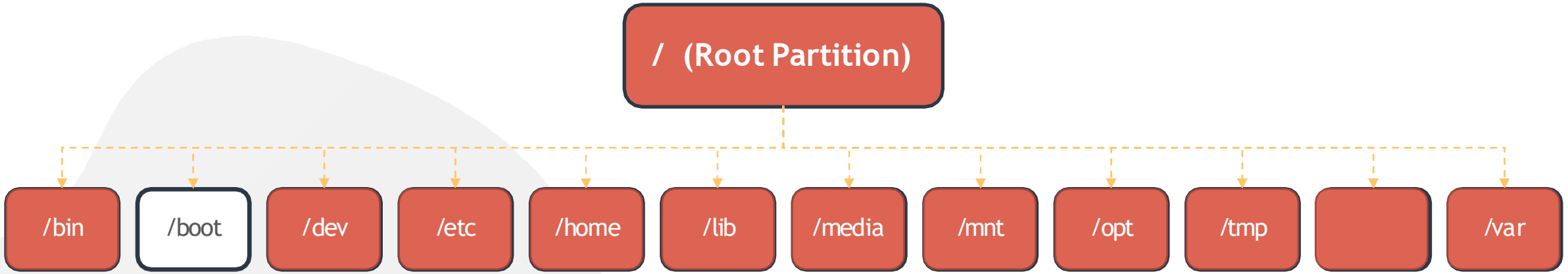
Filesystem Hierarchy



[redacted]

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HANDS-ON LABS


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Linux Package Management

The Linux Basics Course

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Linux Package Management

Introduction to Package Management

RPM and YUM

APT and DPKG

Labs: Package Management

KODEKLOUD

Introduction to Package Managers

DPKG / APT

debian

RPM

Red Hat

CentOS

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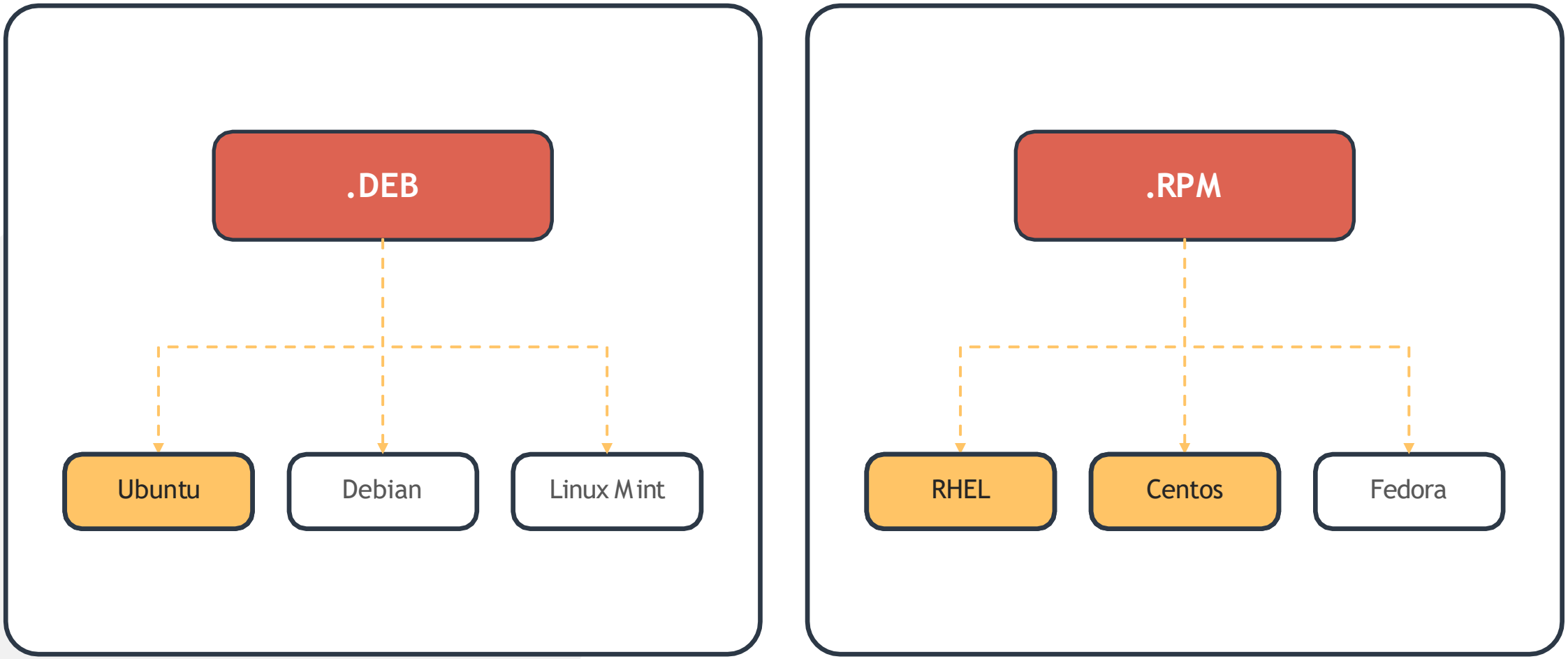
Introduction to Package Managers



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Introduction to Package Managers

Enterprise Offering
Paid version
Technical Support

Community Version
Free version
Community Support

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Introduction to Package Managers

Software Package

Ubuntu 18.04 System

gimp.deb package

- Software Binaries
- METADATA
- Configuration Files

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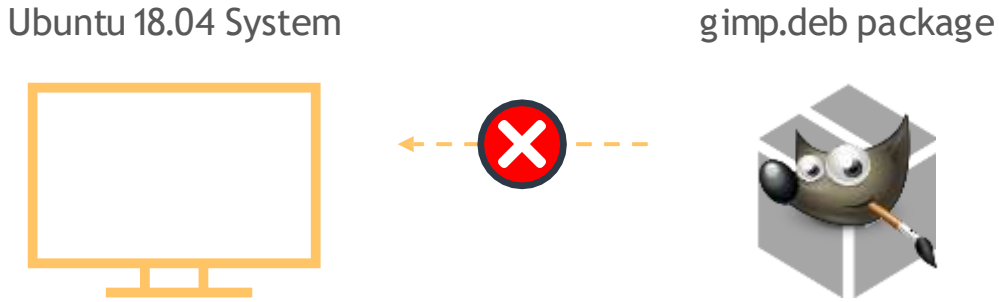
Introduction to Package Managers




```
[~]$ dpkg -i gimp.deb
(Reading database ... 419857 files and directories
currently installed.)
Preparing to unpack gimp.deb ...
Unpacking gimp (2.10.8-2) over (2.10.8-2) ...
dpkg: dependency problems prevent configuration of
gimp:
 gimp depends on libgimp2.0 (>= 2.10.8); however:
  Version of libgimp2.0 on system is 2.8.22-1.
dpkg: error processing package gimp (--install):
dependency problems - leaving unconfigured
Processing triggers for gnome-menus (3.13.3-
11ubuntu1.1) ...
Processing triggers for desktop-file-utils
(0.23+linuxmint6) ...
Processing triggers for mime-support (3.60ubuntu1)
...
Processing triggers for man-db (2.8.3-2ubuntu0.1)
...
Errors were encountered while processing:
 gimp
```

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Introduction to Package Managers

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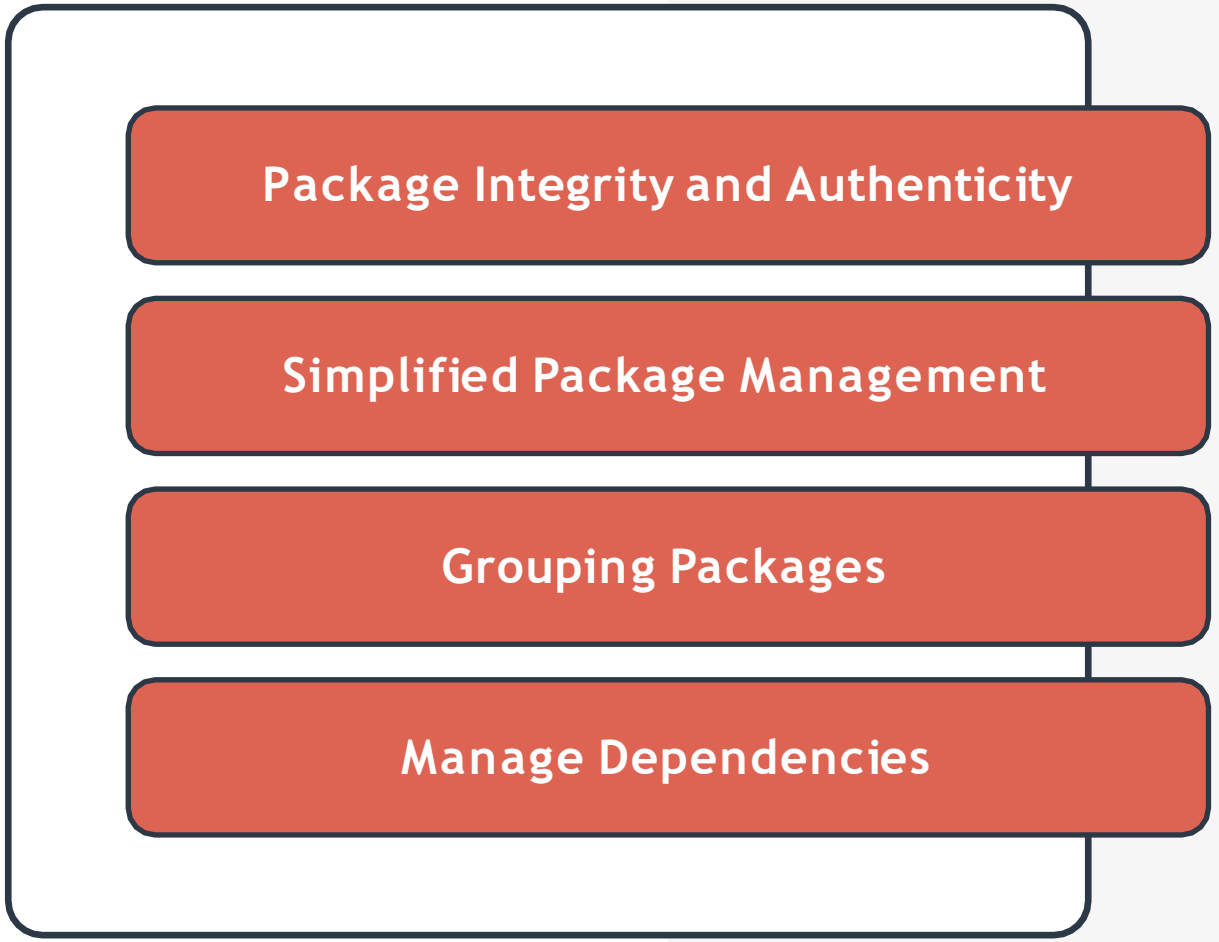
Functions of Package Managers



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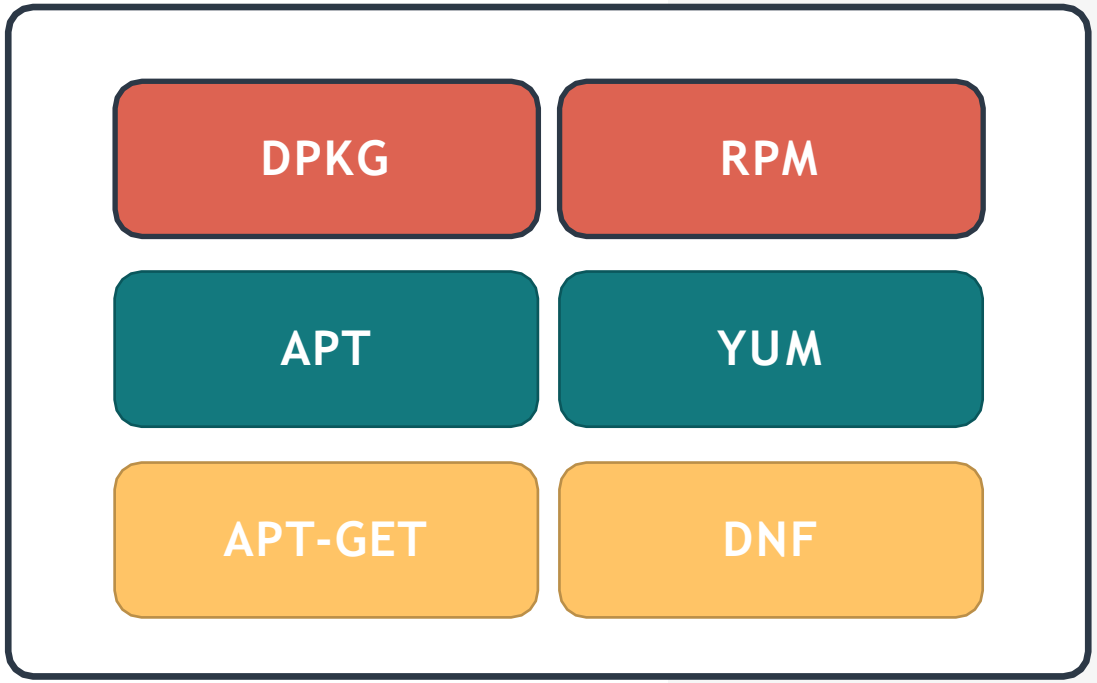
Types of Package Managers



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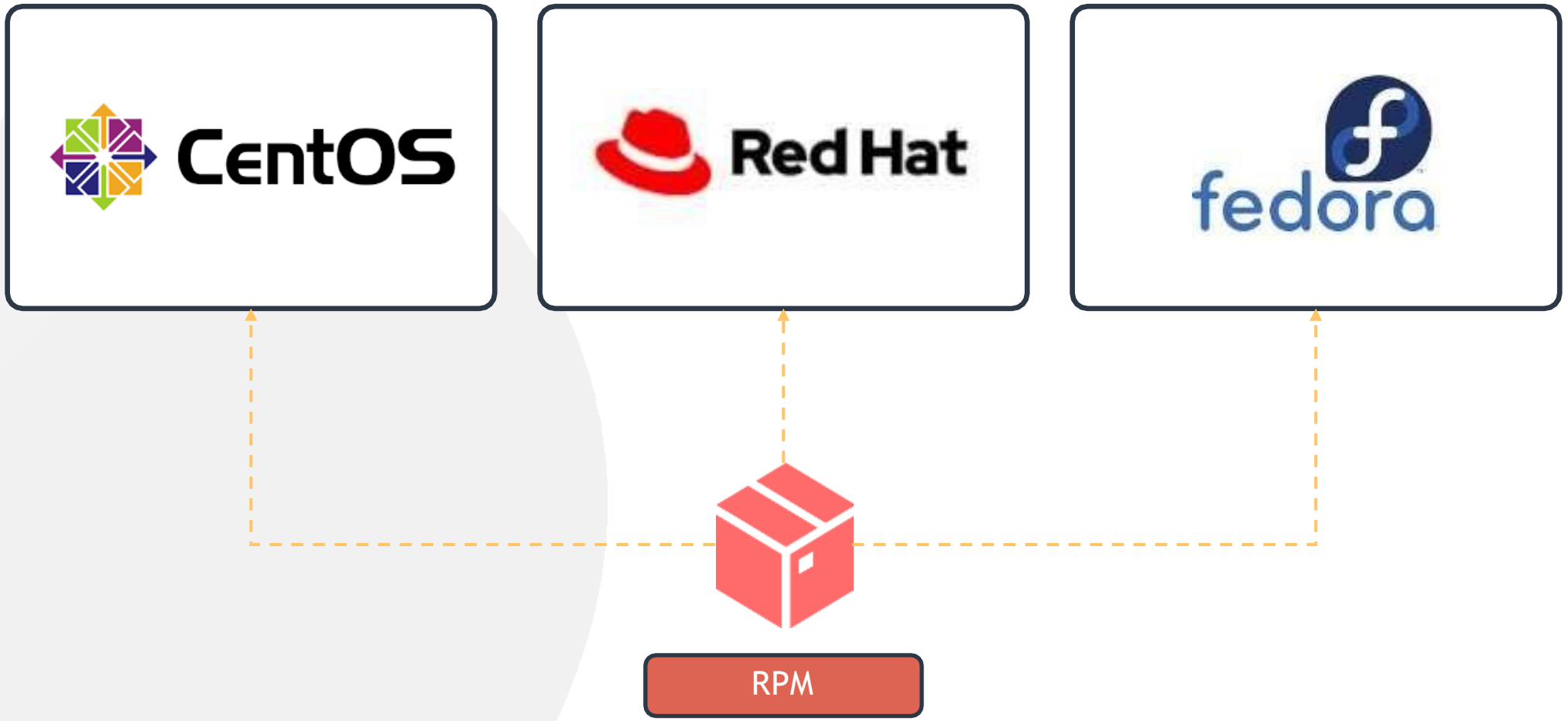
RPM



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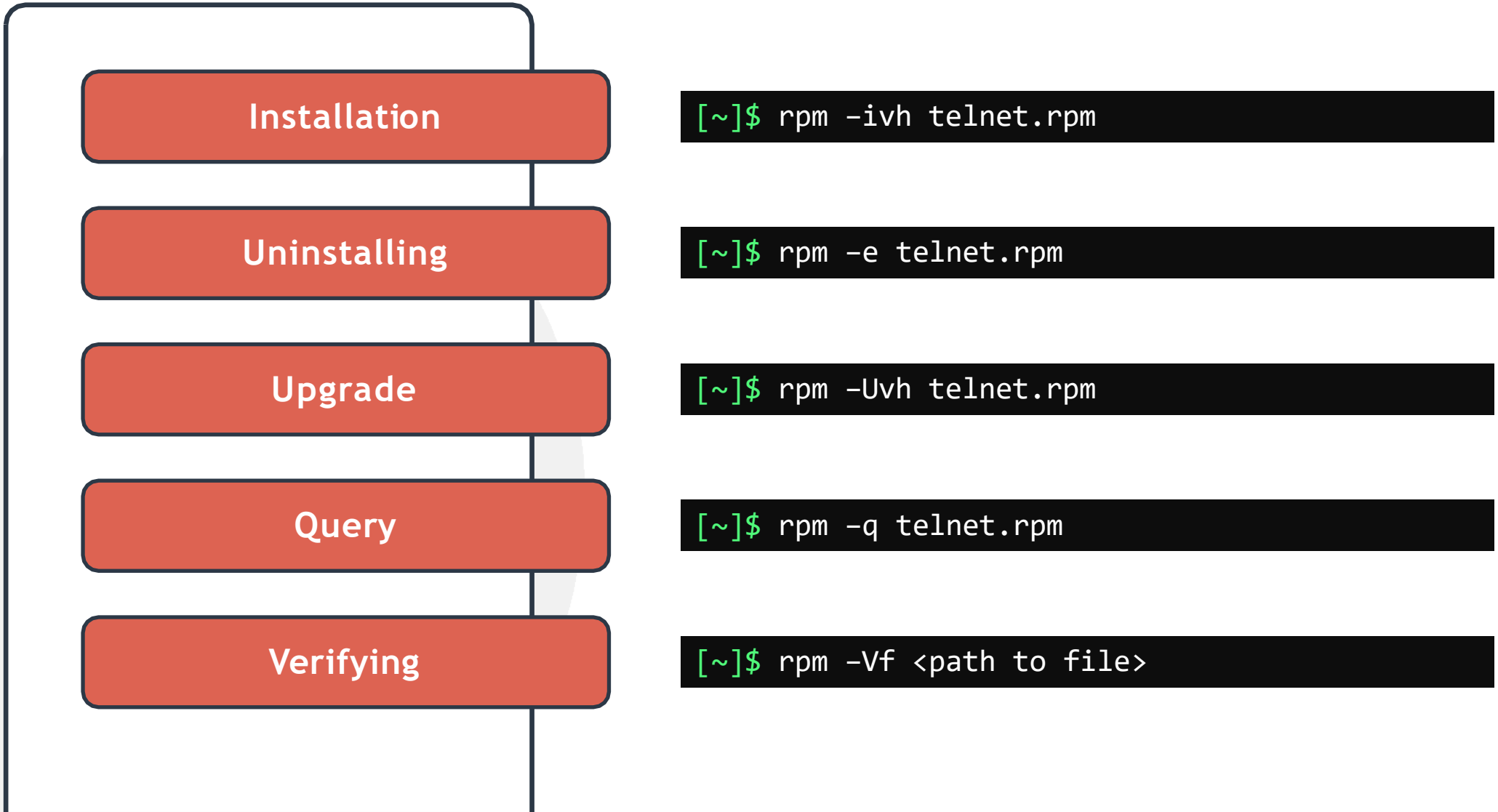
Working with RPM



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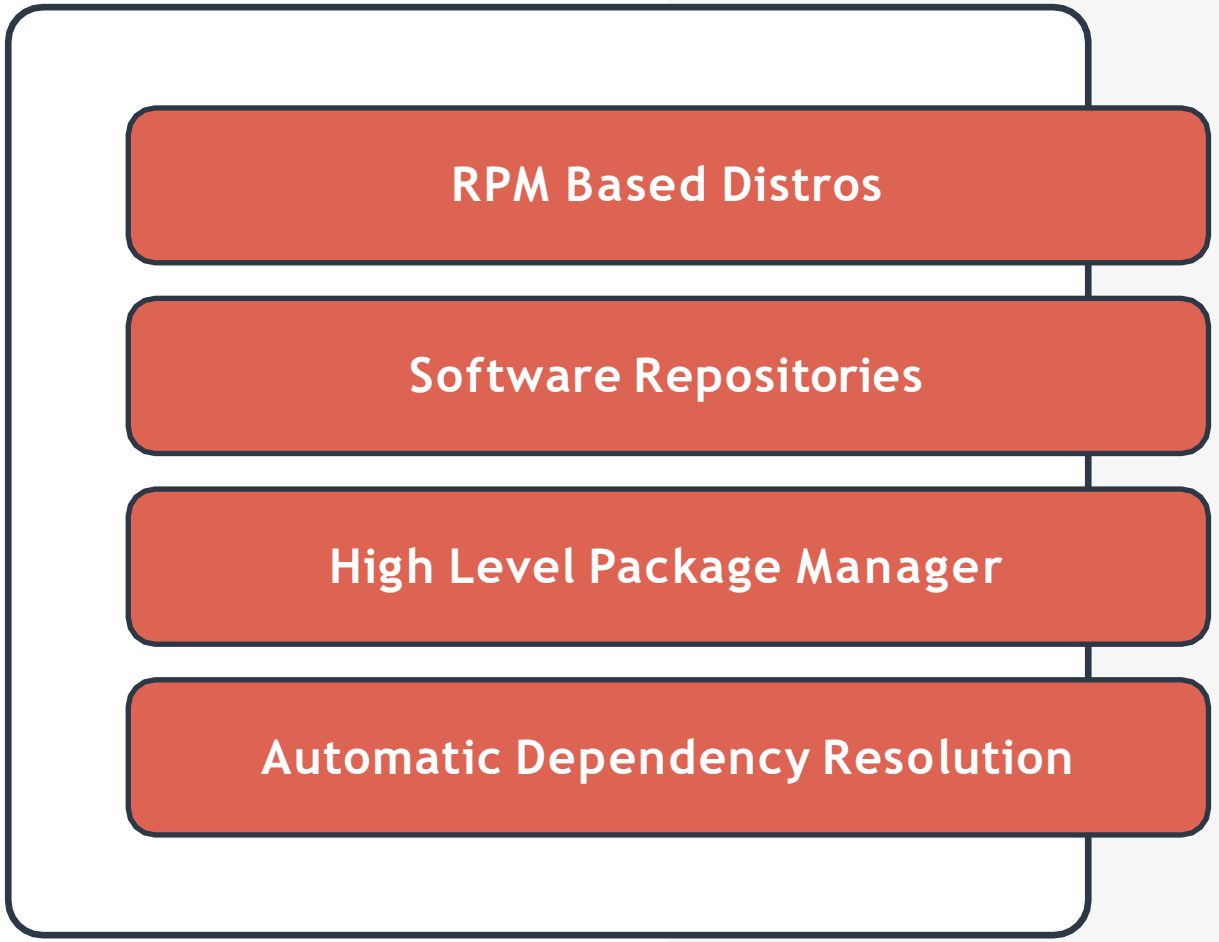
YUM Package Manager



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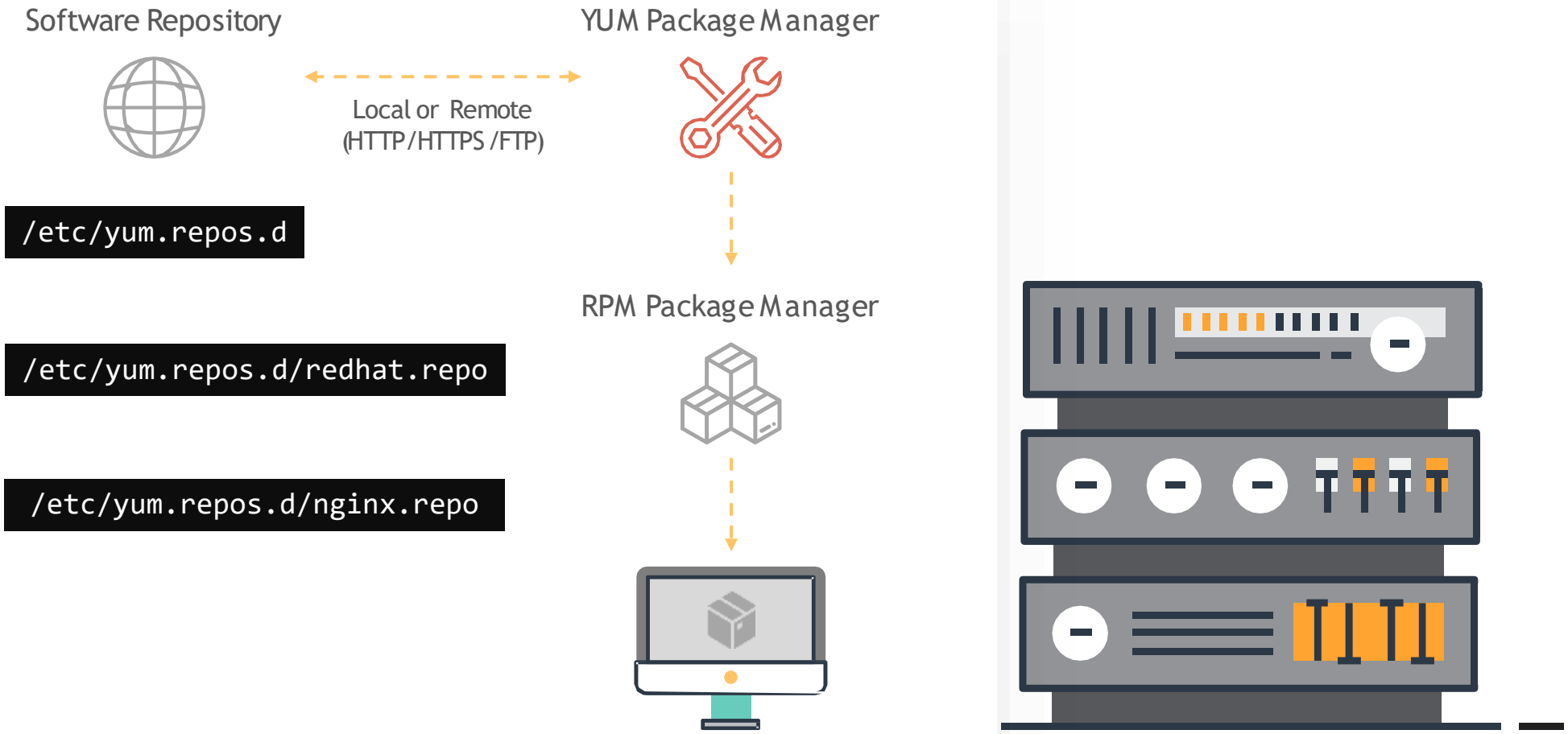
YUM Package Manager



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YUM Package Manager

```
[~]$ yum install httpd
Loading mirror speeds from cached hostfile
 * base: centos.mirror.net-d-sign.de
 * epel: mirror.nl.leaseweb.net
 * extras: mirror.softaculous.com
 * remi-php72: mir01.syntis.net
 * remi-safe: mir01.syntis.net
 * updates: linux.darMMenguin.net
Resolving Dependencies
--> Running transaction check
---> Package httpd.x86_64 0:2.4.6-90.el7.centos will be installed

--> Finished Dependency Resolution

Dependencies Resolved

==============================================================================================
 Package                    Arch                       Version                        Repository          Size
==============================================================================================
Installing:
 httpd                      x86_64                     2.4.6-90.el7.centos            base                2.7 M

Transaction Summary
==============================================================================================
Install  1 Package
```

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YUM Package Manager

```
Transaction Summary
================================================================================================================================
Install  1 Package

Total download size: 2.7 M
Installed size: 9.4 M
Is this ok [y/d/N]: y
Downloading packages:
httpd-2.4.6-                                                                                   | 2.7 MB  00:00:00
90.el7.centos.x86_64.rpm  Running
transaction check
Running transaction test
Transaction test succeeded
Running transaction                                                                                          1/1
  Verifying  : httpd-2.4.6-90.el7.centos.x86_64                                                              1/1

Installed:
  httpd.x86_64 0:2.4.6-90.el7.centos

Complete!
```

YUM Package Manager

```
[~]$ yum repolist
Repo id                       repo name                                              status
base/7/x86_64                 CentOS-7 - Base                                        10,097
epel/x86_64                   Extra Packages for Enterprise Linux 7 - x86_64         13,229
extras/7/x86_64               CentOS-7 - Extras                                         341
```

```
[~]$ yum provides scp
openssh-clients-7.4p1-21.el7.x86_64 : An open source SSH client
applications Repo     : base
Matched from:
Filename     : /usr/bin/scp
```

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YUM Package Manager

```
[~]$ yum remove httpd
```

```
[~]$ yum update telnet
Loaded plugins: fastestmirror, ovl
Loading mirror speeds from cached hostfile
 * base: centos.mirror.net-d-sign.de
 * epel: mirror.nl.leaseweb.net
*extras: mirror.softaculous.com
No packages marked for update
```

```
[~]$ yum update
Transaction Summary
================================================================================================================================
Install              ( 4 Dependent packages)
Upgrade  78 Packages

Total download size: 64 M
Is this ok [y/d/N]:
```

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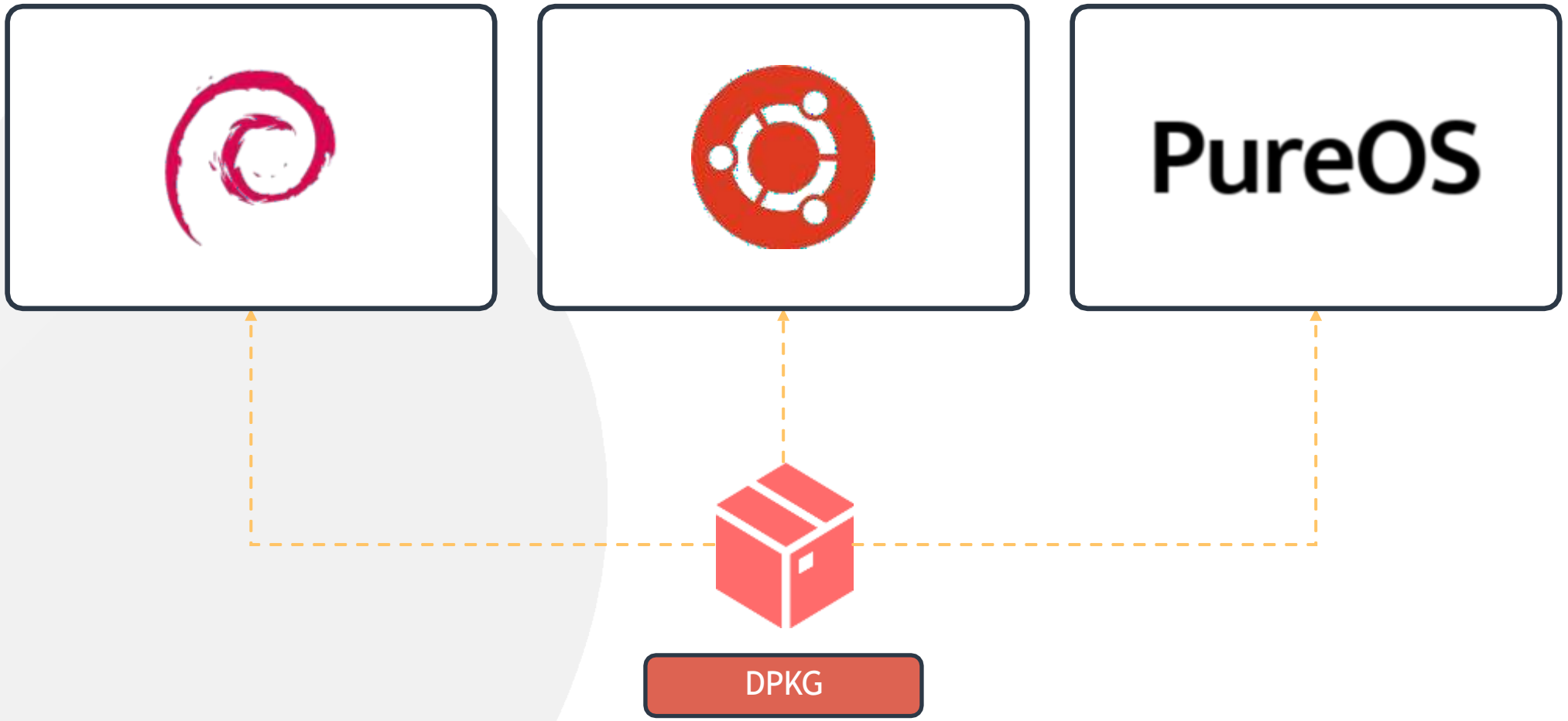
DPKG UTILITY



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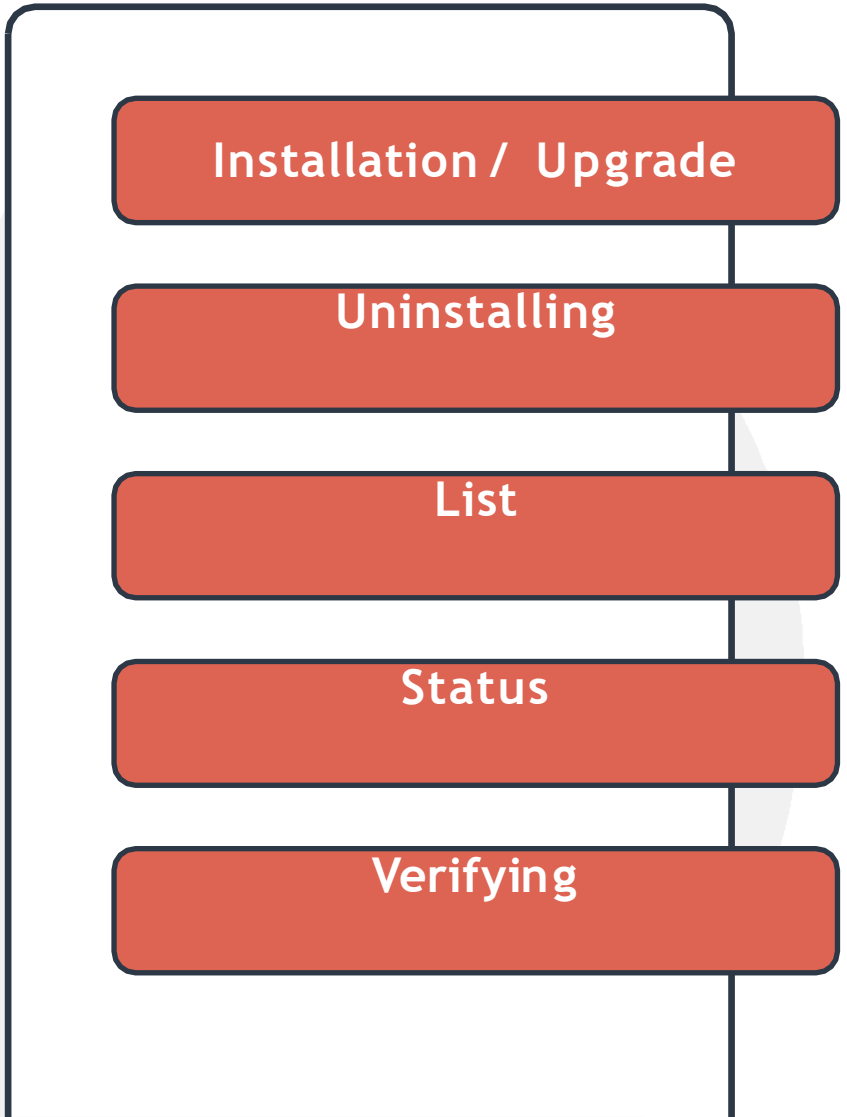
Working with DPKG




```
[~]$ dpkg -i telnet.deb
```

```
[~]$ dpkg -r telnet.deb
```

```
[~]$ dpkg -l telnet
```

```
[~]$ dpkg -s telnet
```

```
[~]$ dpkg -p <path to file>
```

KODEKLOUD

APT / APT-GET

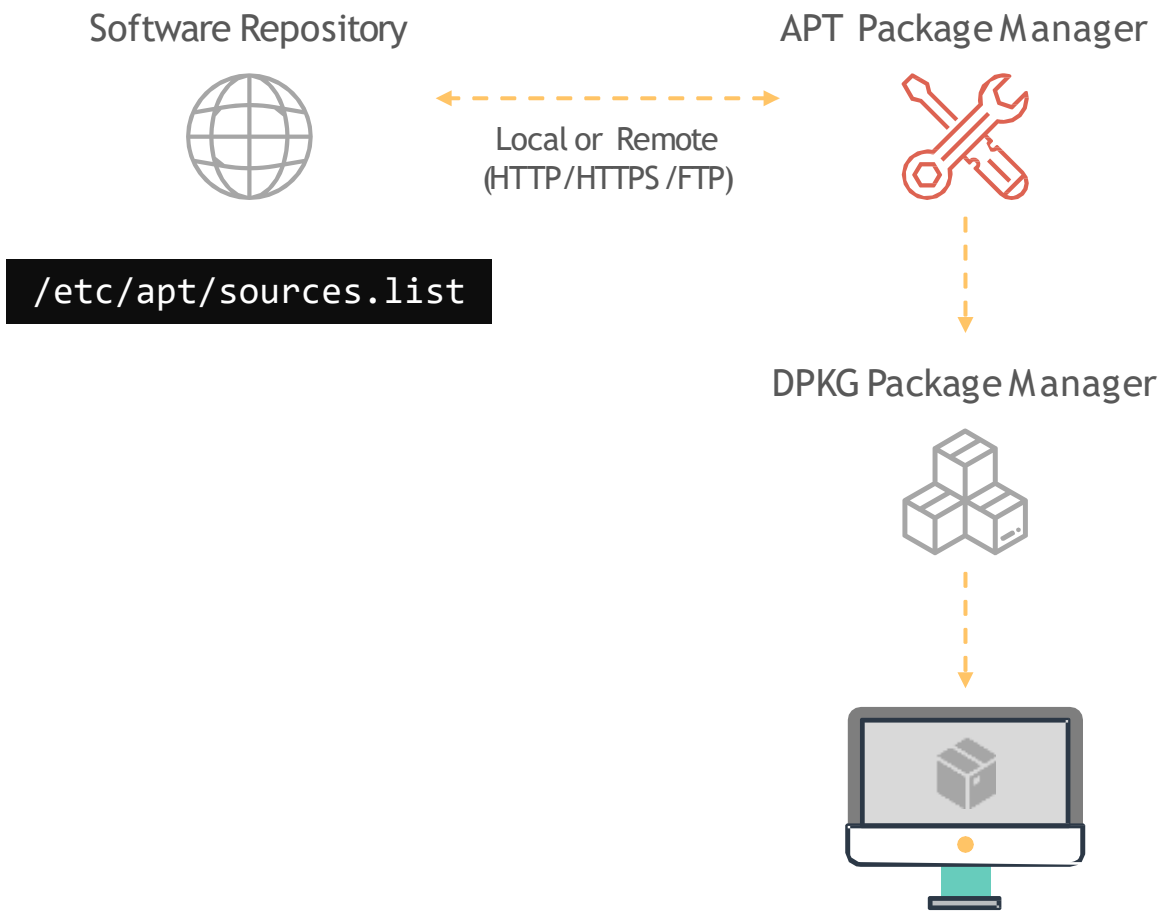
```
[~]$ dpkg –i gimp.deb
(Reading database ... 419857 files and
directories currently installed.)
Preparing to unpack gimp.deb ...
Unpacking gimp (2.10.8-2) over (2.10.8-2) ...
dpkg: dependency problems prevent configuration
of
gimp:
 gimp depends on libgimp2.0 (>= 2.10.8);
  however: Version of libgimp2.0 on system is
  2.8.22-1.
dpkg: error processing package gimp (--
install): dependency problems - leaving
unconfigured  Processing triggers for gnome-
menus (3.13.3-  11ubuntu1.1) ...
Processing triggers for desktop-file-utils
(0.23+linuxmint6) ...
Processing triggers for mime-support
(3.60ubuntu1)
...
Processing triggers for man-db (2.8.3-2ubuntu0.1)
 gimp
Errors were encountered while
 processing: gimp
```

```
apt install gimp
```

```
apt-get install gimp
```

KODEKLOUD

APT



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APT

```
[~]$ apt update
```

```
[~]$ apt upgrade
```

```
[~]$ apt edit-sources
```

KODEKLOUD

APT

```
[~]$ apt install telnet
```

```
[~]$ apt remove telnet
```

```
[~]$ apt search telnet
```

```
[~]$ apt list | grep telnet
```

KODEKLOUD

APT VS APT-GET

```
[~]$ apt install firefox
Recommended packages:
  xul-ext-ubufox
The following NEW packages will be installed:
  firefox
0 upgraded, 1 newly installed, 0 to remove and 36 not
upgraded.
Need to get 0 B/52.0 MB of archives.
After this operation, 202 MB of additional disk space will
be used.
Selecting previously unselected package firefox.
(Reading database ... 416280 files and directories currently
installed.)
Preparing to unpack
.../firefox_74.0+linuxmint2+tricia_amd64.deb ...
Unpacking firefox (74.0+linuxmint2+tricia) ...

Progress: [ 17%]
[##########.....................................................
......]
```

```
[~]$ apt-get install firefox
The following NEW packages will be installed:
  firefox
0 upgraded, 1 newly installed, 0 to remove and 36 not
upgraded.
Need to get 0 B/52.0 MB of archives.
After this operation, 202 MB of additional disk space will
be used.
Selecting previously unselected package firefox.
(Reading database ... 416280 files and directories currently
installed.)
Preparing to unpack
.../firefox_74.0+linuxmint2+tricia_amd64.deb ...
Unpacking firefox (74.0+linuxmint2+tricia) ...
Setting up firefox (74.0+linuxmint2+tricia) ...
Please restart all running instances of firefox, or you will
experience problems.
Processing triggers for gnome-menus (3.13.3-11ubuntu1.1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for mime-support (3.60ubuntu1) ...
Processing triggers for desktop-file-utils (0.23+linuxmint8)
...
Processing triggers for mintsystem (8.4.6) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
```

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APT VS APT-GET

```
[~]$ apt search telnet
p   dcap-tunnel-telnet                - telnet tunnel for dCache
p   dcap-tunnel-telnet:i386           - telnet tunnel for dCache
p   inetutils-telnet                  - telnet client
p   inetutils-telnet:i386             - telnet client
p   inetutils-telnetd                 - telnet server
p   inetutils-telnetd:i386            - telnet server
i   telnet                            - basic telnet client
p   telnet:i386                       - basic telnet client
```

```
[~]$ apt-cache search telnet
curl - command line tool for transferring data with URL syntax
libcurl3-gnutls - easy-to-use client-side URL transfer library (GnuTLS flavour)
libcurl3-nss - easy-to-use client-side URL transfer library (NSS flavour)
libcurl4-doc - documentation for libcurl
libcurl4-gnutls-dev - development files and documentation for libcurl (GnuTLS flavour)
libcurl4-nss-dev - development files and documentation for libcurl (NSS flavour)
libcurl4-openssl-dev - development files and documentation for libcurl (OpenSSL flavour)
redir - Redirect TCP connections
ser2net - Serial port to network proxy
socks4-clients - Socks4 enabled clients as rtelnet and rftp
sredird - RFC 2217 compliant Telnet serial port redirector
swaks - SMTP command-line test tool
telnet-ssl - telnet client with SSL encryption support
telnetd - basic telnet server
telnetd-ssl - telnet server with SSL encryption support
```

KODEKLOUD

Viewing File Sizes

```
[~]$ du -sk test.img
 100000
```

```
[~]$ du -sh test.img
 98M     test.img
```

```
[~]$ ls -lh test.img
 -rw-rw-r-- 1 99M Mar 13 15:48 test.img
```

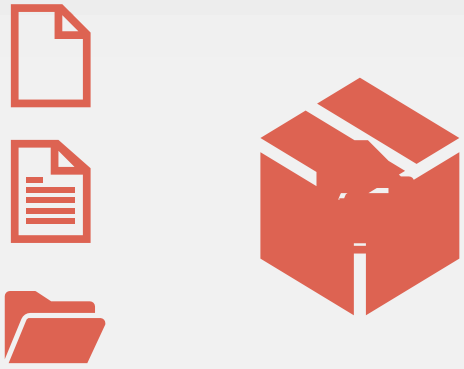
KODEKLOUD

Archiving Files

tar -cf

```
[~]$ tar -cf  test.tar file1 file2 file3
```

```
[~]$ ls -ltr test.tar
 -rw-rw-r-- 1281054720 Mar 13 19:48 test.tar
```



tar -tf

```
[~]$ tar -tf test.tar
./file1
./file2
./file3
```

tar -xf

```
[~]$ tar -xf test.tar
```

tar -zcf

```
[~]$ tar -zcf  test.tar file1 file2 file3
```

KODEKLOUD

Compressing

bzip2

```
[~]$ bzip2 test.img
```

```
[~]$ du -sh test.img.bz2
 4.0K    test.img.bz2
```

gzip

```
[~]$ gzip test1.img
```

```
[~]$ du -sh test1.img.gz
 100K    test1.img.gz
```

xz

```
[~]$ xz test2.img
```

```
[~]$ du -sh test2.img.xz
 16K     test2.img.xz
```

Uncompressing

bunzip2

```
[~]$ bunzip2 test.img.bz2
```

```
[~]$ du -sh test.img
 99M     test.img
```

gunzip

```
[~]$ gunzip test1.img
```

```
[~]$ du -sh test2.img.gz
 99M     test1.img
```

unxz

```
[~]$ unxz test2.img
```

```
[~]$ du -sh test2.img.xz
 99M     test2.img
```

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Compressing Files

zcat / bzcat / xzcat

```
[~]$ zcat hostfile.txt.bz2
127.0.0.1       localhost
127.0.1.1       Minty-Bionic

# The following lines are desirable for
IPv6 capable hosts
::1     ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
```

KODEKLOUD

Searching for Files and Directories

locate

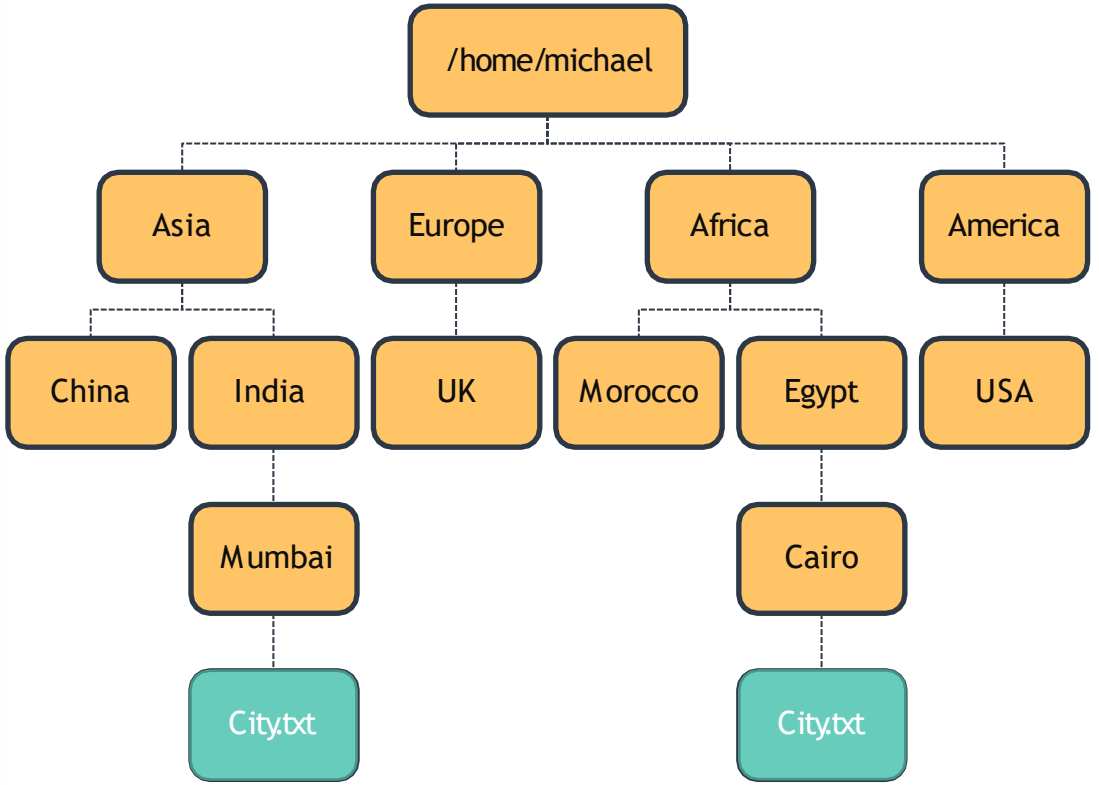
```
[~]$ locate City.txt
/home/michael/Africa/Egypt/Cairo/City.txt
/home/michael/Asia/India/Mumbai/City.txt
```

updatedb

```
[~]$ updatedb
```

find

```
[~]$ find /home/michael -name City.txt
/home/michael/Africa/Egypt/Cairo/City.txt
/home/michael/Asia/India/Mumbai/City.txt
```



KODEKLOUD

GREP

grep

```
[~]$ grep second sample.txt
Followed by the second line.
```

```
[~]$ grep capital sample.txt
```

grep -i

```
[~]$ grep -i capital sample.txt
The fourth line has CAPITAL LETTERS
```

grep - r

```
[~]$ grep -r ”third line" /home/michael
./sample.txt:And then the third line.
```

```
[~]$ cat sample.txt
This is the first line.
Followed by the second line.
And then the third line.
The fourth line has CAPITAL LETTERS
The fifth line does not want to be printed
```

grep - v

```
[~]$ grep -v “printed" sample.txt
This is the first line.
Followed by the second line.
And then the third line.
The fourth line has CAPITAL LETTERS
```

KODEKLOUD

GREP

```
[~]$ cat examples.txt
grep examples
linux exam on 19th
```

```
[~]$ grep exam examples.txt
grep examples
linux exam on 19th
```

grep -w

```
[~]$ grep -w  exam examples.txt
linux exam on 19th
```

grep - w & -v

```
[~]$ grep -vw exam examples.txt
grep examples
```

```
[~]$ cat premier-league-table.txt
1 Arsenal
2 Liverpool
3 Chelsea
4 Manchester City
```

grep - A

```
[~]$ grep -A1 Arsenal premier-league-table.txt
1  Arsenal
2  Liverpool
```

grep - B

```
[~]$ grep -B1 4 premier-league-table.txt
3  Chelsea
4  Manchester City
```

KODEKLOUD

GREP

```
[~]$ cat premier-league-table.txt
1 Arsenal
2 Liverpool
3 Chelsea
4 Manchester City
```

grep -A and grep -B

```
[~]$ grep -A1 -B1 Chelsea premier-league-table.txt
2 Liverpool
3 Chelsea
4 Manchester City
```

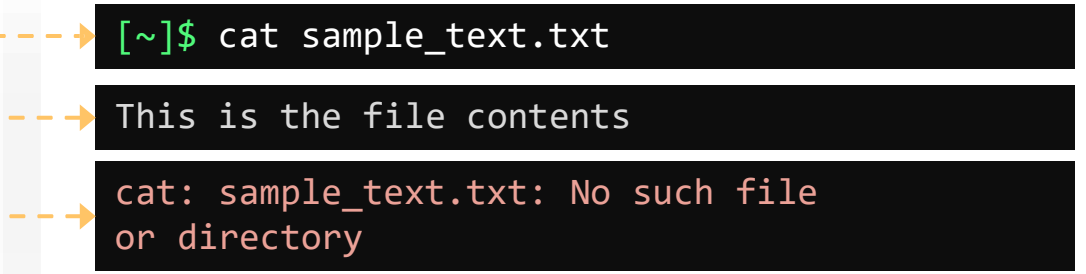
KODEKLOUD

IO REDIRECTION

STANDARD INPUT

STANDARD OUTPUT

STANDARD ERROR



KODEKLOUD

```
[~]$ echo $SHELL > shell.txt
```

```
[~]$ cat shell.txt
 /bin/bash
```

```
[~]$ echo “This is the Bash shell” >> shell.txt
```

```
[~]$ cat shell.txt
 /bin/bash
  This is the Bash shell
```

REDIRECT STDOUT

KODEKLOUD

REDIRECT STDERR

```
[~]$ cat missing_file 2> error.txt
```

```
[~]$ cat error.txt
cat: missing_file: No such file or directory
```

```
[~]$ cat missing_file 2>> shell.txt
```

```
[~]$ cat shell.txt
 /bin/bash
 This is the Bash shell
 cat: missing_file: No such file or directory
```

```
[~]$ cat missing_file 2> /dev/null
```

KODEKLOUD

COMMAND LINE PIPES

```
[~]$ cat sample.txt
 hello there!
  Nice to see you here!
```

```
[~]$  grep Hello sample.txt > file.txt
```

```
[~]$ less file.txt
```

command 1 | command 2

```
[~]$ grep Hello sample.txt  | less
 Hello There!
  (END)
```

```
[~]$  less sample.txt
 hello there!
  Nice to see you here!
  sample.txt (END)
```

KODEKLOUD

COMMAND LINE PIPES

```
[~]$ echo $SHELL | tee shell.txt
 /bin/bash
```

```
[~]$ cat shell.txt
 /bin/bash
```

```
[~]$ echo “This is the bash shell”| tee -a
shell.txt
 This is the bash shell
```

```
[~]$ cat shell.txt
 /bin/bash
This is the Bash shell
```

KODEKLOUD

HANDS-ON LABS


KODEKLOUD

KODEKLOUD

TEXT EDITORS

```
[~]$ cat Asia/India/Mumbai/City.txt
Mumbai
```

```
[~]$
```

```
[~]$ cat >
Africa/Egypt/Cairo/City.txt Cairo
```

ctrl d

VI EDITOR

KODEKLOUD

VI EDITOR

```
[~]$ vi/home/michael/sample.txt
```

COMMAND MODE

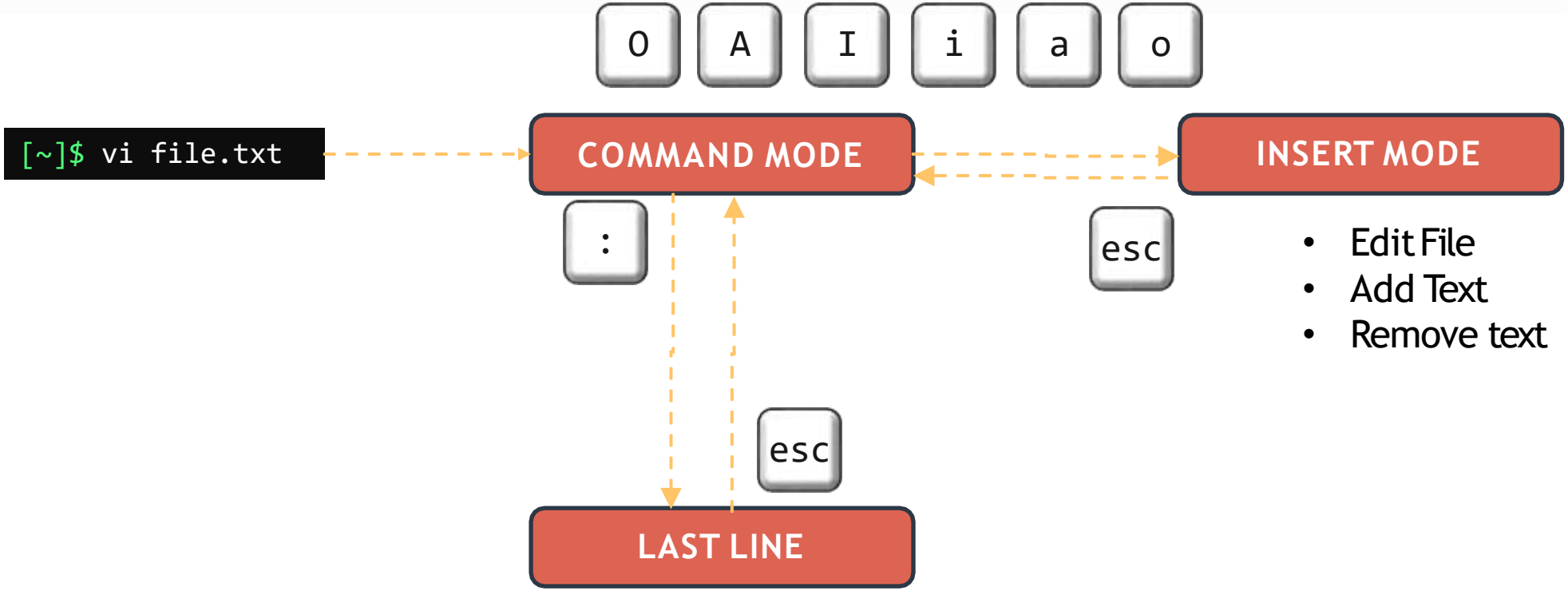
INSERT MODE

LAST LINE

```
This is the first line.
Followed by the second line.
Third line is very long compared to the previous two
lines. Hello there!
hello there!
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
"sample.txt" 5L, 139C                                  1,1           All
```

KODEKLOUD

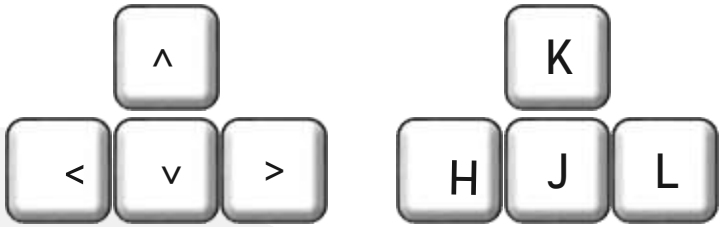
VI EDITOR MODES



KODEKLOUD

COMMAND MODE

Move Around



Copy a Line

Paste

Delete a letter


```
This is the first line.
Followed by the second line.
Third line is very long compared to the previous two lines.
Hello there!
hello there!
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
"sample.txt" 5L, 139C                         1,1           All
```

KODEKLOUD

COMMAND MODE

Delete a line — d d

Delete 3 lines — d 3 d

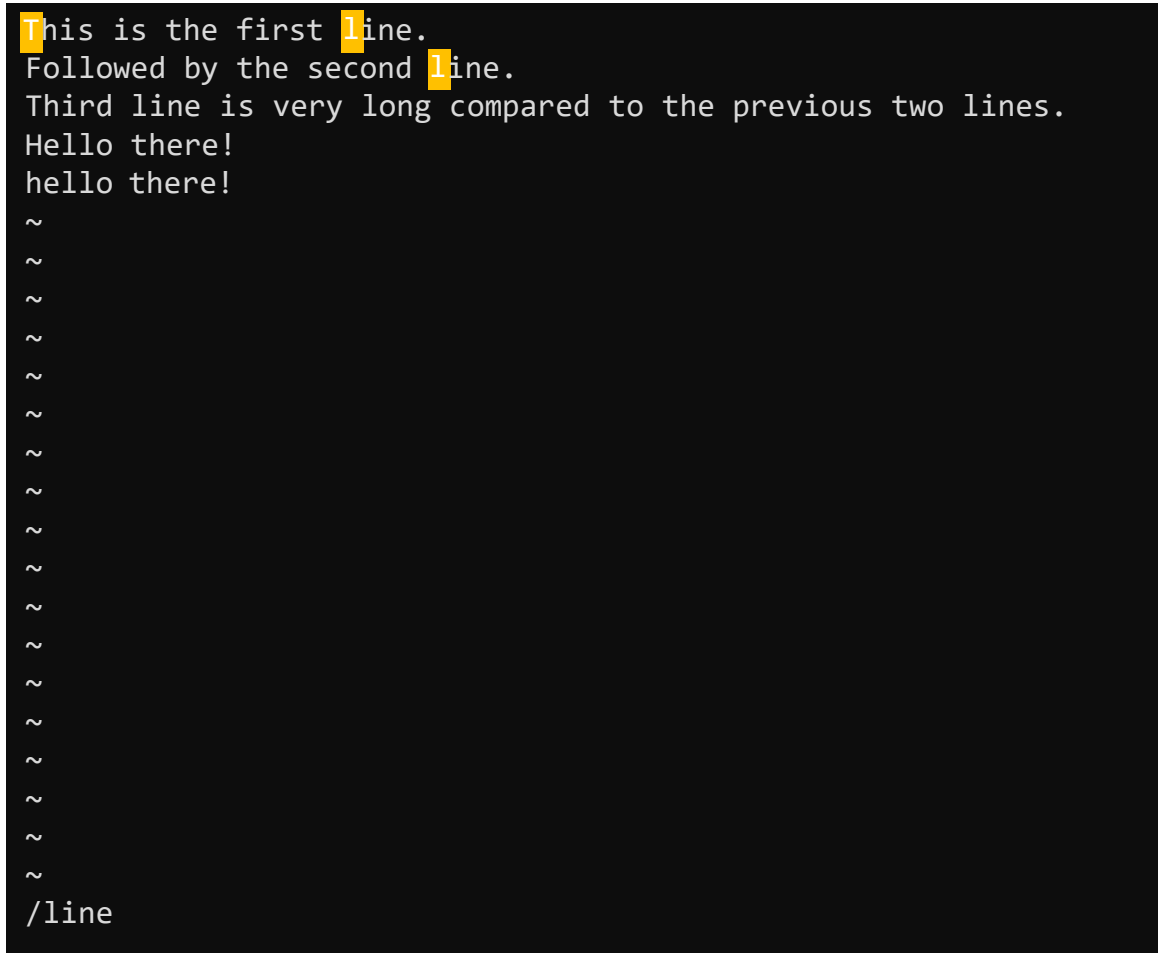
Undo — u

Redo — r

KODEKLOUD

COMMAND MODE

Find	/line	?line
Find Next	n	
Find Previous	N	



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INSERT MODE

Insert Mode

i,o,a I,O,A

Command Mode

esc

KODEKLOUD

LASTLINE MODE

Save	:w
Quit	:q
Save & Quit	:wq
Quit Without Confirmation	:q!

```
This is the first line.
Followed by the second line.
Third line is very long compared to the previous two lines.
Hello there!
hello there!
I made some changes to this file.
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
:w                                          1,1           All
```

KODEKLOUD

VIM

VIM = VI IMPROVED

COMPLETION	PLUGINS
SPELL CHECK	SYNTAX
COMPARISON	HIGHLIGHTING
MERGING	...and many more
GUI	

```
[~]$ which vi
/usr/bin/vi

[~]$ ls -ltr /usr/bin/vi
lrwxrwxrwx 1 root root 20 Apr 10 08:31 /usr/bin/vi -> /etc/alternatives/vi

[~]$ ls -ltr /etc/alternatives/vi
lrwxrwxrwx 1 root root 18 Apr 24 02:06 /etc/alternatives/vi -> /usr/bin/vim.basic
```

```
Differences between Vim and Vi                          vi-differences

1. Simulated command                    simulated-command
2. Missing options                      missing-options
3. Limits                               limits
4. The most interesting additions       vim-additions
5. Other vim features                   other-features
6. Supported Vi features                vi-features
7. Command-line arguments               cmdline-arguments
8. POSIX compliance                     posix-compliance

==============================================================================
1. Simulated command                                    simulated-command
vi_diff.txt [Help][RO]
7,35-57         0%
This is the first line.
sample.txt                                                              1,1
Top
"vi_diff.txt" [readonly] 1370L, 57621C
```

KODEKLOUD

HANDS-ON LABS


KODEKLOUD

KODEKLOUD

Security and File Permissions

The Linux Basics Course

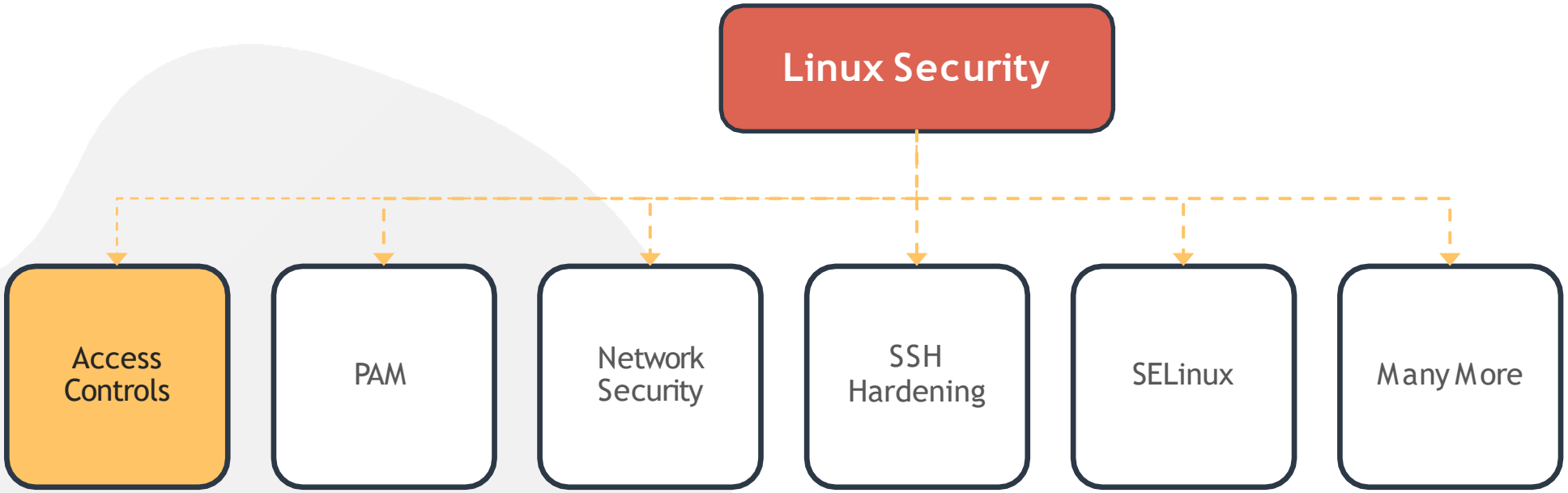
KODEKLOUD

Security and File Permissions

- Basic Security and Identifying File Types
- Creating Users and Groups
- Labs: Users and Groups
- Managing file permission and ownership
- Labs: File Permissions
- Special Directories and Files
- Labs: Special Directories and Files

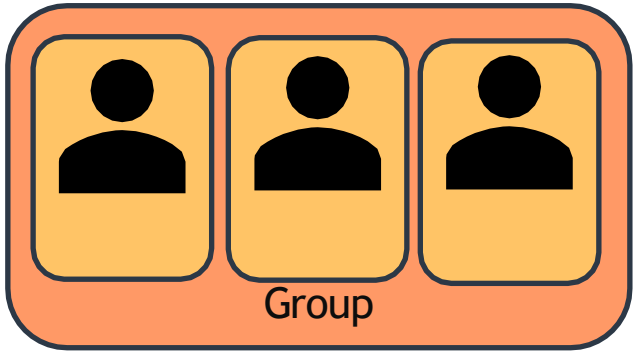
KODEKLOUD

Linux Accounts



KODEKLOUD

Linux Accounts

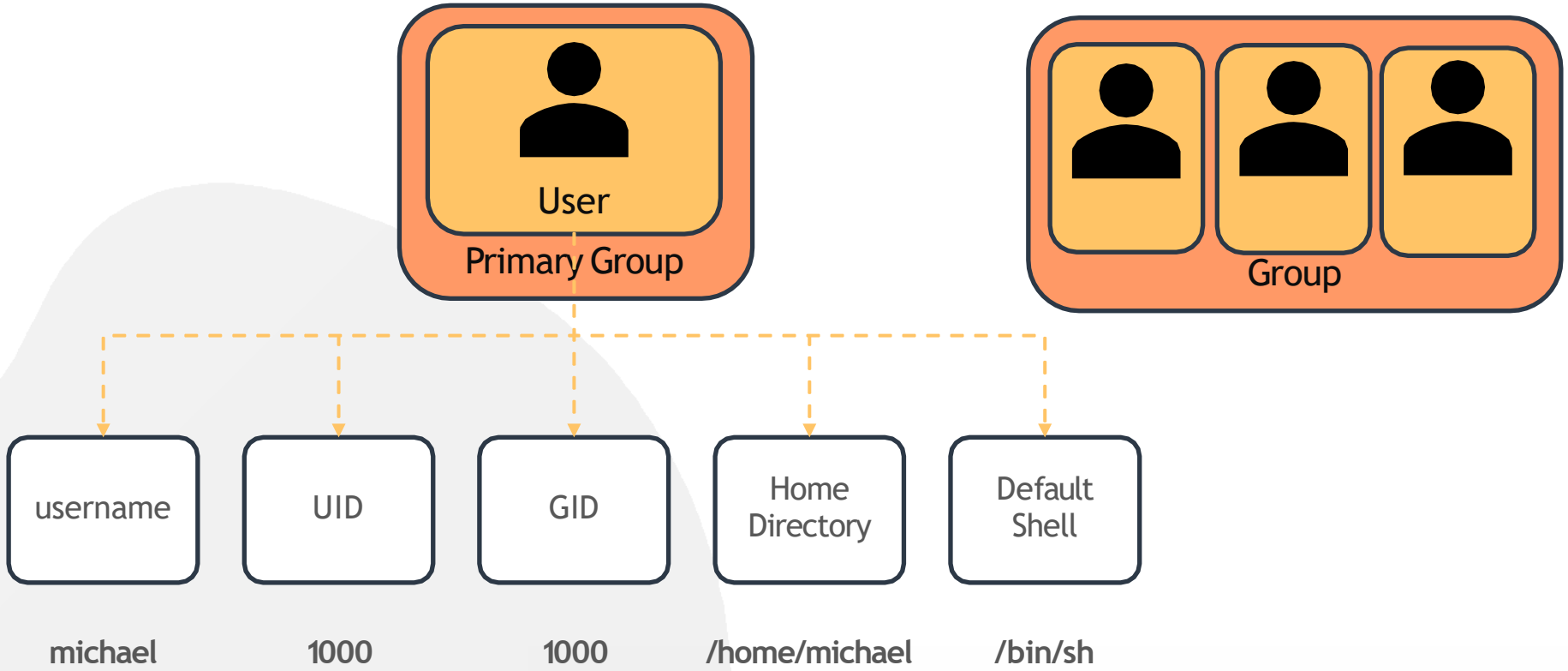



```
[~]$ cat /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
www-data:x:33:33:www-
data:/var/www:/usr/sbin/nologin
bob:1000:1000:Bob Kingsley,,,:/home/bob:/bin/bash
```

```
[~]$ cat /etc/group
ssh:x:118:
lpadmin:x:119:
scanner:x:120:saned
avahi:x:121:
saned:x:122:
colord:x:123:
geoclue:x:124:
pulse:x:125:
pulse-access:x:126:
gdm:x:127:
systemd-coredump:x:999:
bob:x:1000:
developers:x:1003:bob,michael
```

KODEKLOUD

Linux Accounts




```
[~]$ id michael
uid=1001(michael) gid=1001(michael)groups=1001(michael),1003(developers)
```

```
[~]$ grep -i michael /etc/passwd
michael:x:1001:1001::/home/michael:/bin/s
h
```

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Account Types

- Bob
- michael
- dave

01 User Account

02 Superuser Account

UID = 0

- root

- ssh
- mail

03 System Accounts

UID < 100 OR between 500 - 100

04 Service Accounts

- nginx
- mercury

KODEKLOUD

COMMAND

```
[~]$ id
uid=1000(michael) gid=1000(michael)
groups=1000(michael)
```

```
[~]$ who
bob      pts/2        Apr 28 06:48 (172.16.238.187)
```

```
[~]$ last
michael   :1     :1                   Tue May 12 20:00  still logged in
sarah     :1     :1                   Tue May 12 12:00  still running
reboot    system boot 5.3.0-758-gen   Mon May 11 13:00  - 19:00 (06:00)
```

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Switching Users

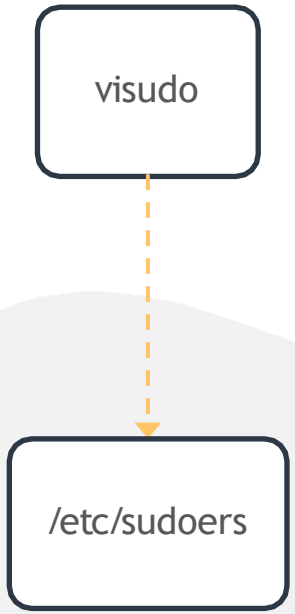
```
[~]$ su -
  Password:
root ~#
```

```
[michael@ubuntu-server ~]$ su -c "whoami"
  Password:
root
```

```
[michael@ubuntu-server ~]$ sudo apt-get install
  nginx [sudo] password for michael:
```

KODEKLOUD

SUDO




```
[michael@ubuntu-server ~]$ sudo apt-get install
nginx [sudo] password for michael:
```

```
[~]$ cat /etc/sudoers

User privilege specification
root    ALL=(ALL:ALL) ALL
# Members of the admin group may gain root privileges
%admin ALL=(ALL) ALL
# Allow members of group sudo to execute any command
%sudo    ALL=(ALL:ALL) ALL
# Allow Bob to run any command
bob ALL=(ALL:ALL) ALL
# Allow Sarah to reboot the system
sarah localhost=/usr/bin/shutdown -r now
# See sudoers(5) for more information on
"#include" directives:
#includedir /etc/sudoers.d
```

```
[~]$ grep -i  ^root /etc/passwd
/root:x:0:0:root:/root:/usr/sbin/nologin
```

KODEKLOUD

SUDO

```
[~]$ cat /etc/sudoers

User privilege specification
root    ALL=(ALL:ALL) ALL
# Members of the admin group may gain
root privileges
%admin ALL=(ALL) ALL
# Allow members of group sudo to execute
any command
%sudo    ALL=(ALL:ALL) ALL
# Allow Bob to run any command
bob ALL=(ALL:ALL) ALL
# Allow Sarah to reboot the system
sarah localhost=/usr/bin/shutdown -r now
# See sudoers(5) for more information on
"#include" directives:
#includedir /etc/sudoers.d
```

Field	Description	Example
1	User or Group	bob, %sudo (group)
2	Hosts	localhost,ALL(default)
3	User	ALL(default)
4	Command	/bin/ls, ALL(unrestricted)

KODEKLOUD

Access Control Files

/etc/passwd

```
[~]$ grep -i  ^bob /etc/passwd
/bob:x:1001:1001::/home/bob:/bin/bash
```

/ etc/shadow

```
[~]$ grep -i  ^bob /etc/shadow
/bob:$6$0h0utOtO$5JcuRxR7y72LLQk4Kdog7u09LsNFS0yZPkIC8pV9tgD0wXCHut
YcWF/7.eJ3TfGfG0lj4JF63PyuPwKC18tJS.:18188:0:99999:7:::
```

/ etc/ g roup

```
[~]$ grep -i  ^bob /etc/group
developer:x:1001:bob,michael
```

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Access Control Files

/etc/passwd

```
[~]$ grep -i  ^bob /etc/passwd
bob:x:1001:1001::/home/bob:/bin/bash
```

```
USERNAME:PASSWORD:UID:GID:GECOS:HOMEDIR:SHELL
```

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Access Control Files

/ etc/shadow

```
[~]$ grep -i  ^bob /etc/shadow
bob:$6$0h0utOtO$5JcuRxR7y72LLQk4Kdog7u09LsNFS0yZPkIC8pV9tgD0wXCHutY
cWF/7.eJ3TfGfG0lj4JF63PyuPwKC18tJS.:18188:0:99999:7:::
```

```
USERNAME:PASSWORD:LASTCHANGE:MINAGE:MAXAGE:WARN:INACTIVE:EXPDATE
```

KODEKLOUD

Access Control Files

/ etc/group

```
[~]$ grep -i  ^bob /etc/group
developer:x:1001:bob,sara
```

```
NAME:PASSWORD:GID:MEMBERS
```

KODEKLOUD

Managing Users

```
[~]$ useradd bob
```

```
[~]$ grep -i  bob /etc/passwd
bob:x:1002:1002::/home/bob:/bin/sh
```

```
[~]$ grep -i  bob /etc/shadow
bob:!:18341:0:99999:7:::
```

```
[~]$ passwd bob
Changing password for user bob.
New UNIX password:
Retype new UNIX password:
passwd: all authentication tokens updated
successfully.
```

```
[~]$ whoami
bob
```

```
[~]$ passwd
Changing password for bob.
(current) UNIX password:
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
```

KODEKLOUD

Managing Users

```
[~]$ useradd -u 1009 -g 1009 -d /home/robert -s /bin/bash -c ”Mercury Project member" bob
```

```
[~]$ id bob
uid=1009(bob) gid=1009(avenger) groups=1009(avenger)
```

```
[~]$ grep -i bob /etc/passwd
bob:x:1009:1009:Robert Downey Jr,Avenger:/home/bob:/bin/bash
```

- -c Custom Comments
- -d custom home directory
- -e Expiry date
- -g specific GID

- -G create user with multiple secondary groups
- -s specify login shells
- -u specific UID

KODEKLOUD

Managing Users

```
[~]$ userdel bob
```

```
[~]$ groupadd -g 1011 developer
```

```
[~]$ groupdel developer
```

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HANDS-ON LABS


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Linux File Permissions

```
[~]$ ls -l bash-script.sh
-rwxrwxr-x 1 bob bob 89 Mar 17 01:35 bash-script.sh
```

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

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Linux File Permissions

Bit	Purpose	Octal Value
r	Read	4
w	Write	2
x	Execute	1

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Directory Permissions

Bit	Purpose	Octal Value
r	Read	4
w	Write	2
x	Execute	1
-	No permission	0

```
[~]$ ls -ld /home/bob/random_dir
 d--xrwxrwx 1 bob bob 89 Mar 17 01:35 .
```

```
[~]$ whoami
bob
```

```
[~]$ ls /home/bob/random_dir
ls: cannot open directory 'random_dir/': Permission denied
```

```
[~]$ cd /home/bob/random_dir
[bob@ubuntu-server random_dir]$
```

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Linux File Permissions

r w x	r w -	- w x	r - x
4 + 2 + 1	4 + 2 + 0	0 + 2 + 1	4 + 0 + 1
7	6	3	5

Bit	Purpose	Octal Value
r	Read	4
w	Write	2
x	Execute	1
-	No permission	0

KODEKLOUD

Modifying File Permissions

```
chmod <permissions> file
```

```
[~]$ chmod u+rwx test-file
```

Provide full access to Owners

```
[~]$ chmod ugo+r-x test-file
```

Provide Read access to Owners, groups and others, Remove execute access

```
[~]$ chmod o-rwx test-file
```

Remove all access for others

```
[~]$ chmod u+rwx,g+r-x,o-rwx test-file
```

Full access for Owner, add read , remove execute for group and no access for others

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Modifying File Permissions

```
chmod <permissions> file
```

```
[~]$ chmod 777 test-file
```

Provide full access to Owners, group and others

```
[~]$ chmod 555 test-file
```

Provide Read and execute access to Owners, groups and others

```
[~]$ chmod 660 test-file
```

Read and Write access for Owner and Group, No access for others

```
[~]$ chmod 750 test-file
```

Full access for Owner, read and execute for group and no access for others

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Modifying File Permissions

```
chown owner:group file
```

```
[~]$ chown bob:developer test-file
```

Changes owner to bob and group to developer

```
[~]$ chown bob andoid.apk
```

Changes just the owner of the file to bob. Group unchanged.

```
[~]$ chgrp android test-file
```

Change the group for the test-file to the group called android.

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HANDS-ON LABS


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SSH

```
ssh <hostname OR IP Address>
```

```
ssh <user>@<hostname OR IP Address>
```

```
ssh -l <user> <hostname OR IP Address>
```

```
[bob@caleston-lp10 ~]$ ssh devapp01
bob@devapp01's password:
Last login: Tue Apr  7 20:08:58 2020
from 192.168.1.109
[bob@devapp01 ~]$
```

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PASSWORD-LESS SSH

```
Key Pair = Private Key +Public Key
```

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PASSWORD-LESS SSH

Client

```
[bob@caleston-lp10 ~]$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/bob/.ssh/id_rsa):
/home/bob/.ssh/id_rsa already exists.
Overwrite (y/n)? y
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/bob/.ssh/id_rsa.
Your public key has been saved in /home/bob/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:PCRTdbxxzffzmi8uunjn5V/1LZCG0BvhVJYXBr9gYsE bob@caleston-lp10
The key's randomart image is:
+---[RSA 2048]----+
|        .o=o=oo+ |
|       . +E=+oo +|
|      o o * o=. o|
|       = o *.o o.|
|        S o + . +|
|         . . .  =|
|              oo+|
|         .. oo+..|
|        ..o=.oo+o|
+----[SHA256]-----+
```

Public Key: /home/bob/.ssh/id_rsa.pub

Private Key: /home/bob/.ssh/id_rsa

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PASSWORD-LESS SSH

Client

```
[bob@caleston-lp10 ~]$ ssh-copy-id bob@devapp01
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/bob/.ssh/id_rsa.pub"
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that
are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is
to install the new keys
bob@devapp01's password:

Number of key(s) added: 1

Now try logging into the machine, with:   "ssh 'bob@devapp01'"
and check to make sure that only the key(s) you wanted were added.
```

```
[bob@caleston-lp10 ~]$ ssh devapp01
Last login: Tue Apr  7 20:10:58 2020 from 192.168.1.109
[bob@devapp01 ~]$
```

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PASSWORD-LESS SSH

Remote Server

```
[bob@caleston-lp10 ~]$ cat /home/bob/.ssh/authorized_keys
ssh-rsa
AAAAB3NzaC1yc2EAAAADAQABAAABAQCgVV5wgH37kNwjnEIxgeX4j6LASNckjKi4bRpjPGecyxEiEeJhIU4x31XPEFzUFp/1xX2rj
eiM2Ko3oPmTGCCTEQMpQogerR7NS+bA9eXs34jWIg+xoSQjeQu1+lXgrRippJn2YhWYVAY3sKWIiiklowuMXmxjmBBr48L52di1J+
8EASwnM4ILX/YL72Czq3uFFhVW1fNUKBPUbW58h4QSAd2r9abzZfrHH48ThPJW4/5i8LOHEo3W0BXl3foEV0c6pk3TgxcjTuZQOim
d48mM2pxWJh9WxA0xcXwbD3+JrcnZeMJq4TbrKjaXQ0pBGenglxurxnRT2og9DeTIqGN3 bob@caleston-lp10
```

KODEKLOUD

SCP


```
[bob@caleston-lp10 ~]$ scp  /home/bob/caleston-code.tar.gz devapp01:/home/bob

bob@devapp01's password:
caleston-code.tar.gz                                          100% 2498KB   51MB/s 00.00
```

```
[bob@caleston-lp10 ~]$ scp  /home/bob/caleston-code.tar.gz devapp01:/root

bob@devapp01's password:
Scp /root/caleston-code.tar.gz: Permission denied
```

```
[bob@caleston-lp10 ~]$ scp -pr  /home/bob/media/ devapp01:/home/bob

bob@devapp01's password:
Caleston.jpg                                          100% 3124KB   51.1MB/s   00.00
Random.png                                            100% 2122KB   29.2MB/s   00.00
```

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HANDS-ON LABS


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LINUX
NETWORKING BASICS

KODEKLOUD

Networking Basics

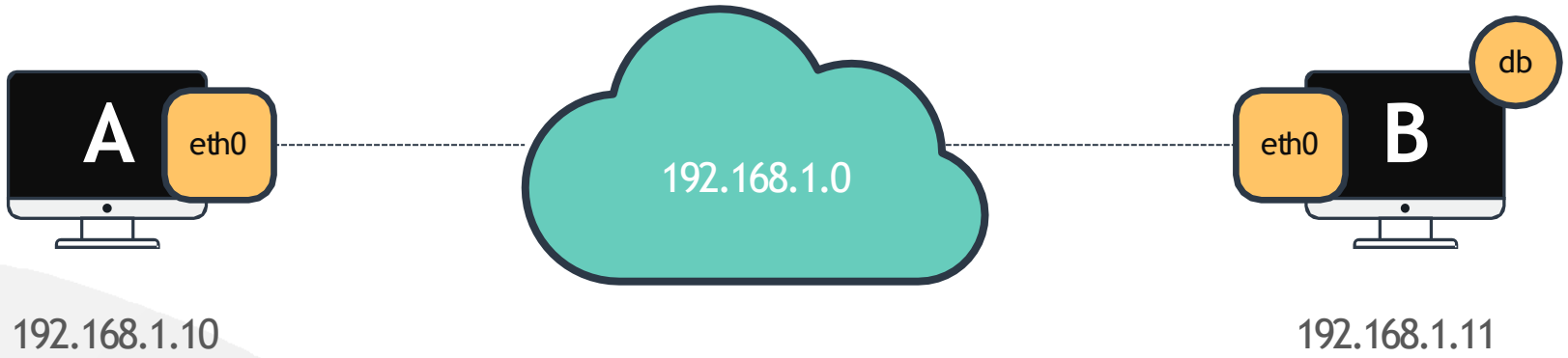
DNS

Labs: DNS

Networking Basics

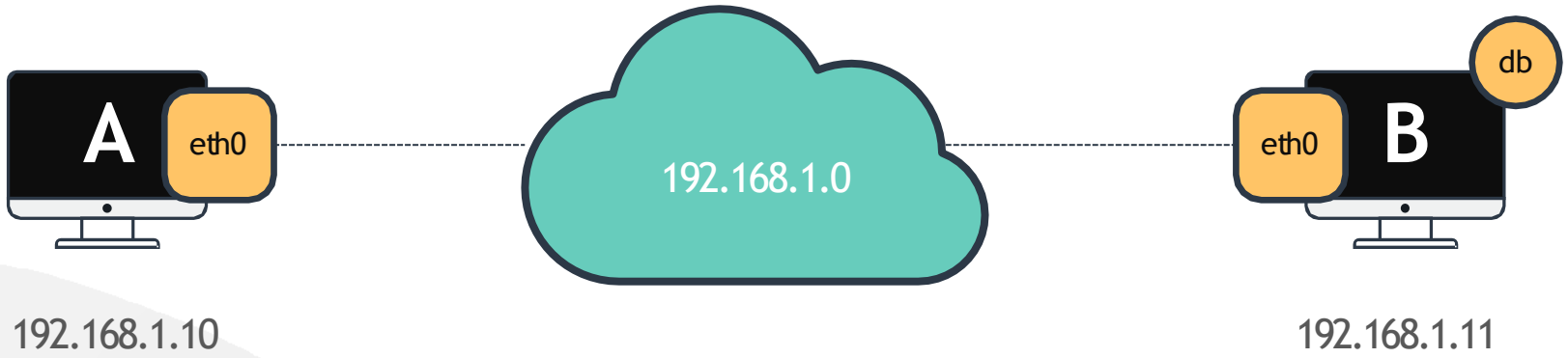
Labs: Networking Basics

Troubleshooting




```
[~]$ ping 192.168.1.11
Reply from 192.168.1.11: bytes=32 time=4ms TTL=117
Reply from 192.168.1.11: bytes=32 time=4ms TTL=117
```

```
[~]$ ping db
ping: unknown host db
```

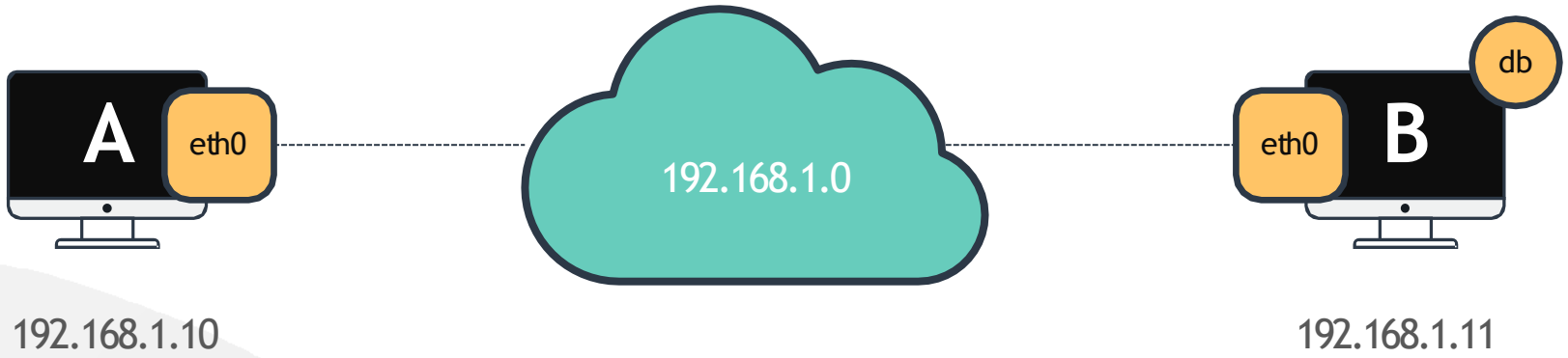



```
[~]$ ping db
ping: unknown host db
```

```
[~]$ cat >> /etc/hosts
192.168.1.11        db
```

```
[~]$ ping db
PING db (192.168.1.11) 56(84) bytes of data.
64 bytes from db (192.168.1.11): icmp_seq=1 ttl=64 time=0.052 ms
64 bytes from db (192.168.1.11): icmp_seq=2 ttl=64 time=0.079 ms
```

```
[~]$ hostname
host-2
```




```
[~]$ cat >> /etc/hosts
192.168.1.11        db
192.168.1.11        www.google.com
```

```
[~]$ ping db
PING db (192.168.1.11) 56(84) bytes of data.
64 bytes from db (192.168.1.11): icmp_seq=1 ttl=64 time=0.052 ms
64 bytes from db (192.168.1.11): icmp_seq=2 ttl=64 time=0.079 ms
```

```
[~]$ hostname
host-2
```

```
[~]$ ping www.google.com
PING www.google.com (192.168.1.11) 56(84) bytes of data.
64 bytes from www.google.com (192.168.1.11): icmp_seq=1 ttl=64 time=0.052 ms
64 bytes from www.google.com (192.168.1.11): icmp_seq=2 ttl=64 time=0.079 ms
```

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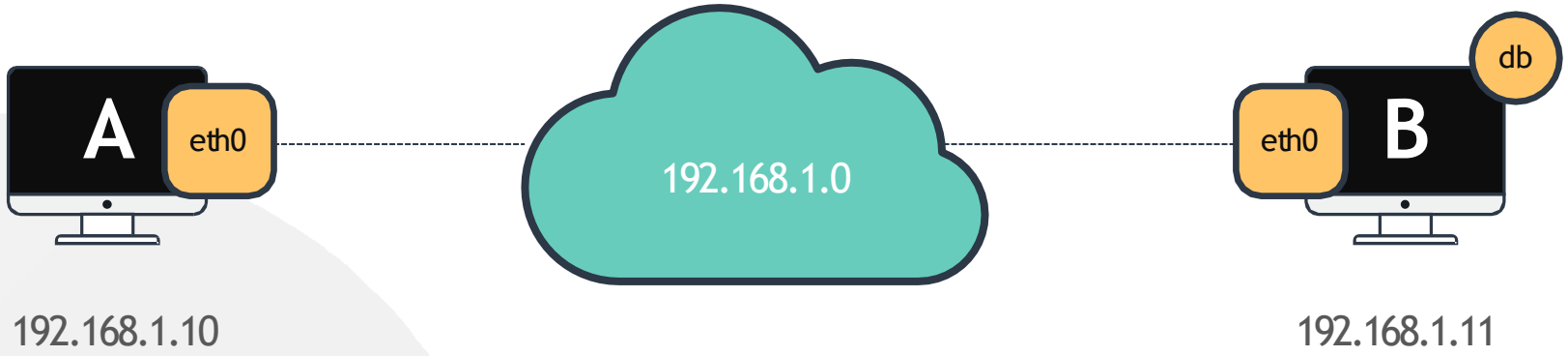
Name Resolution




```
[~]$ cat >> /etc/hosts
192.168.1.11        db
192.168.1.11        www.google.com
```

```
[~]$ ping db
```

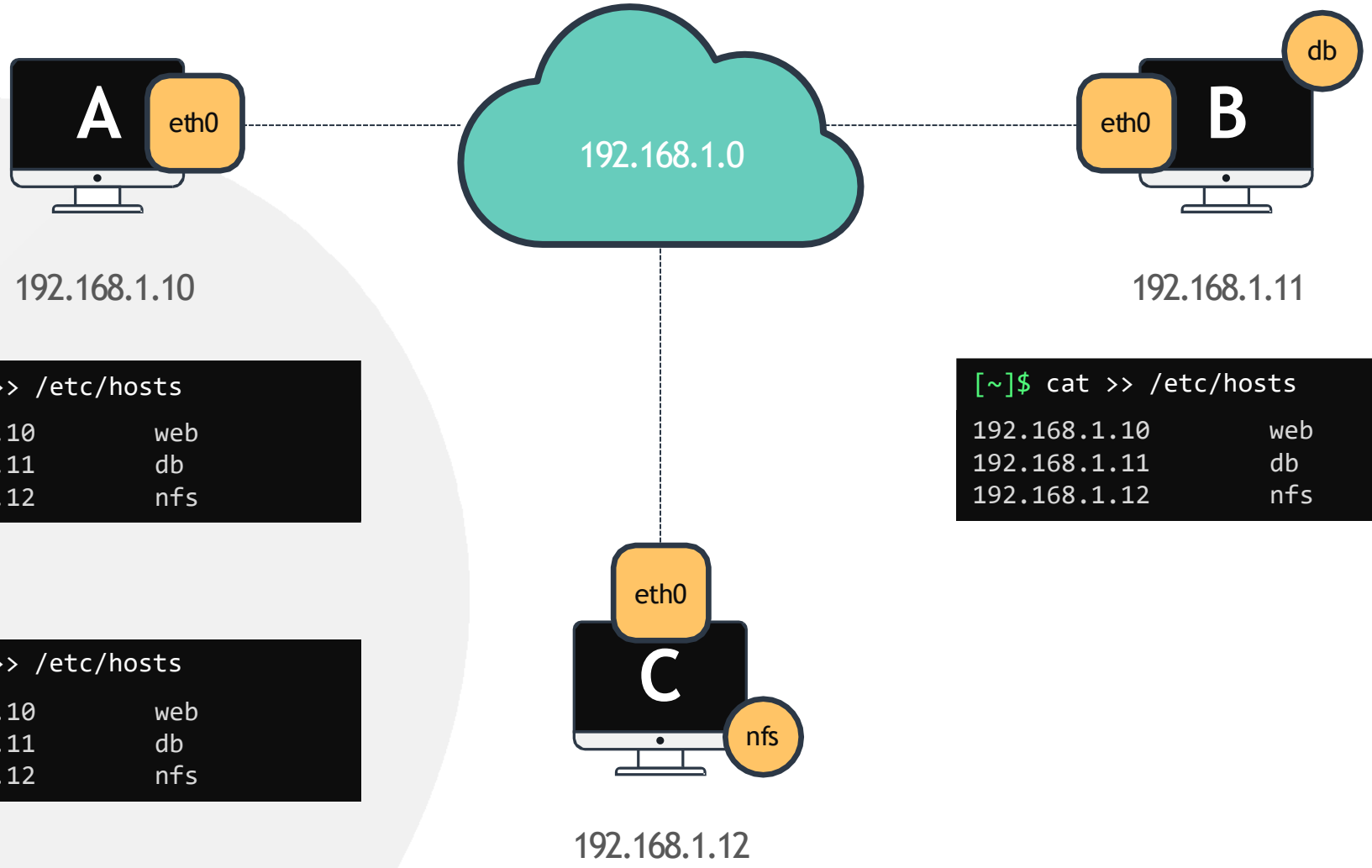
```
[~]$ ssh db
```

```
[~]$ curl http://www.google.com
```

```
[~]$ hostname
host-2
```

KODEKLOUD

Name Resolution




```
[~]$ cat >> /etc/hosts
192.168.1.10        web
192.168.1.11        db
192.168.1.12        nfs
```

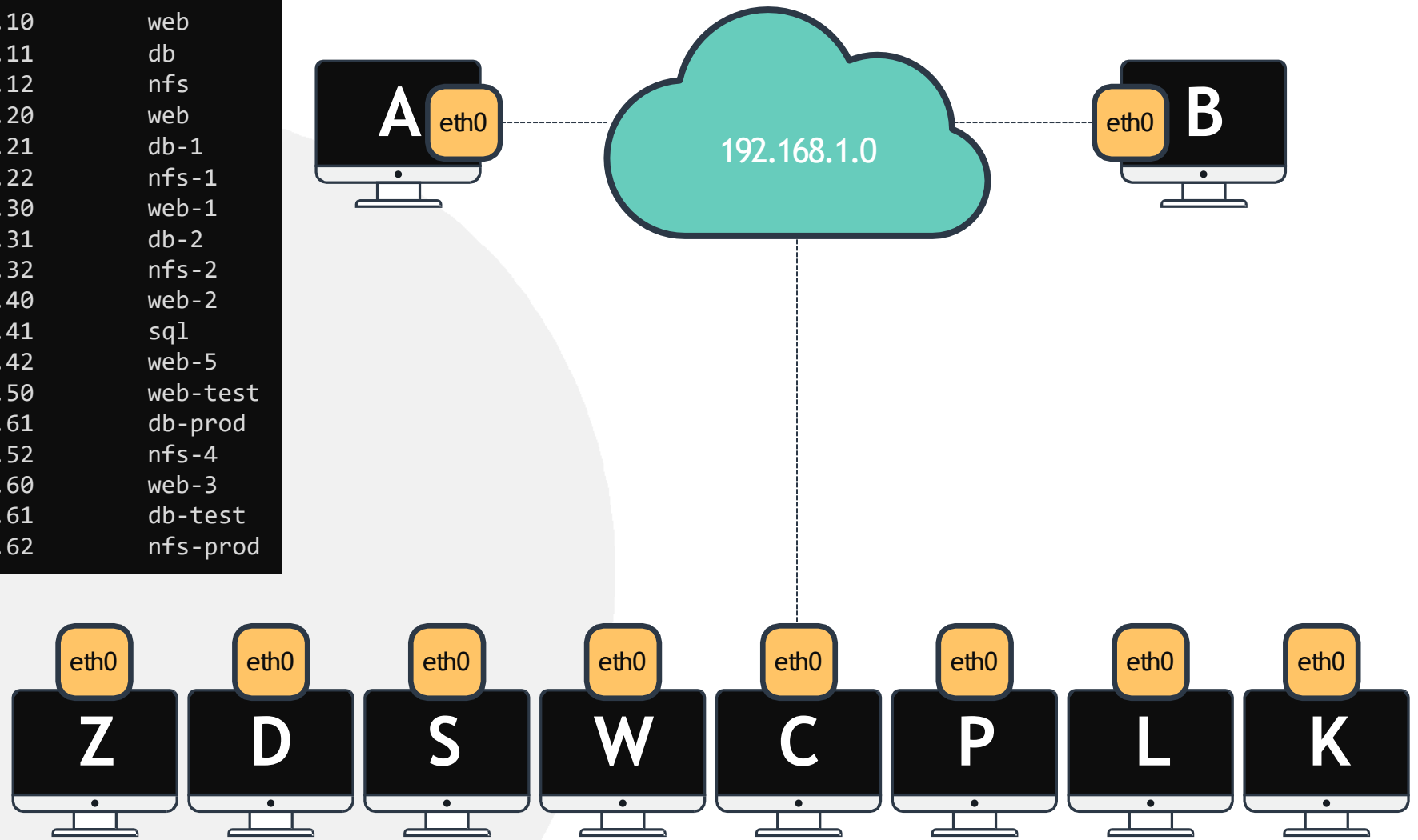
```
[~]$ cat >> /etc/hosts
192.168.1.10        web
192.168.1.11        db
192.168.1.12        nfs
```

```
[~]$ cat >> /etc/hosts
192.168.1.10        web
192.168.1.11        db
192.168.1.12        nfs
```

KODEKLOUD

Name Resolution

```
[~]$ cat >> /etc/hosts
192.168.1.10        web
192.168.1.11        db
192.168.1.12        nfs
192.168.1.20        web
192.168.1.21        db-1
192.168.1.22        nfs-1
192.168.1.30        web-1
192.168.1.31        db-2
192.168.1.32        nfs-2
192.168.1.40        web-2
192.168.1.41        sql
192.168.1.42        web-5
192.168.1.50        web-test
192.168.1.61        db-prod
192.168.1.52        nfs-4
192.168.1.60        web-3
192.168.1.61        db-test
192.168.1.62        nfs-prod
```



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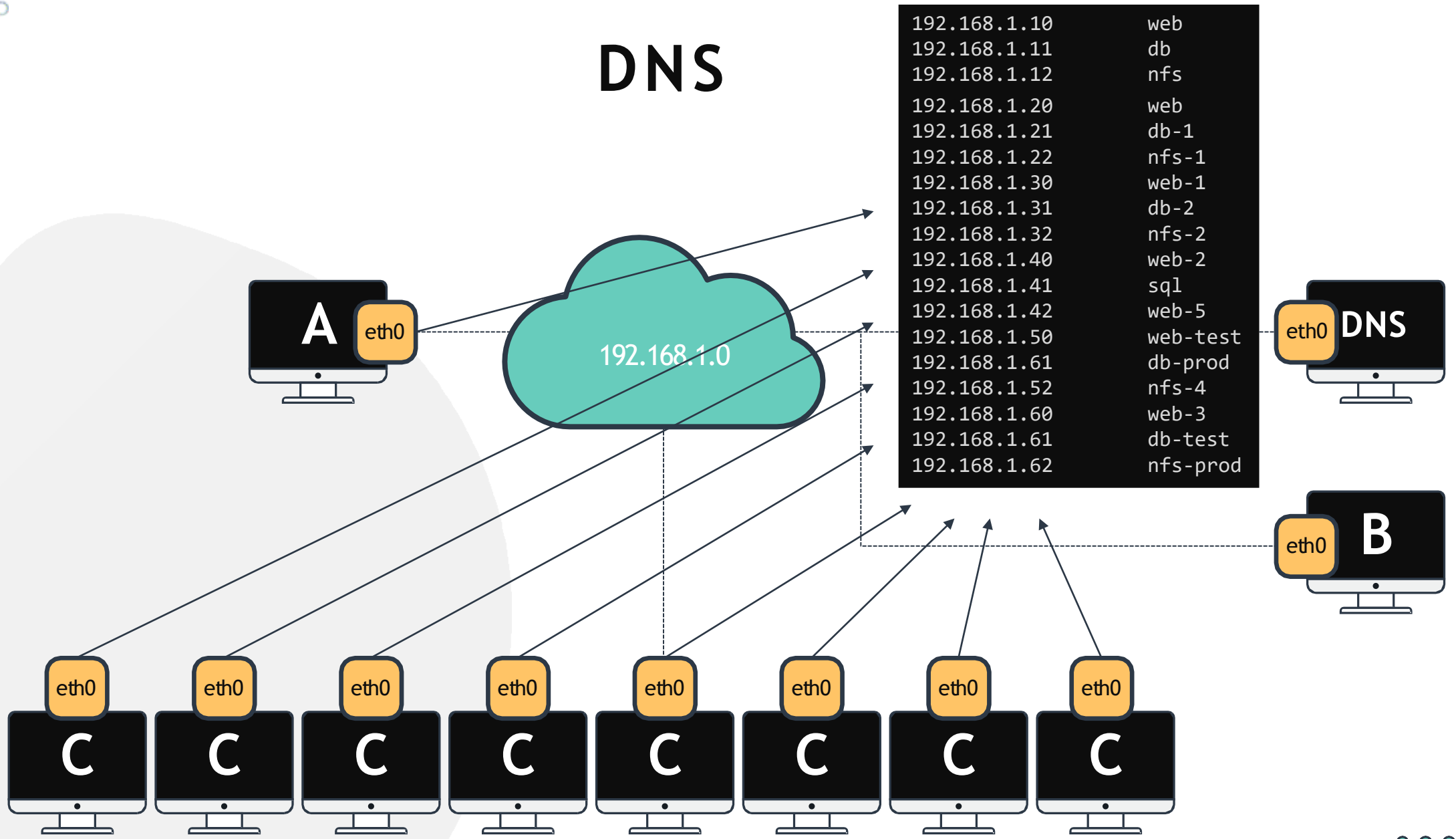
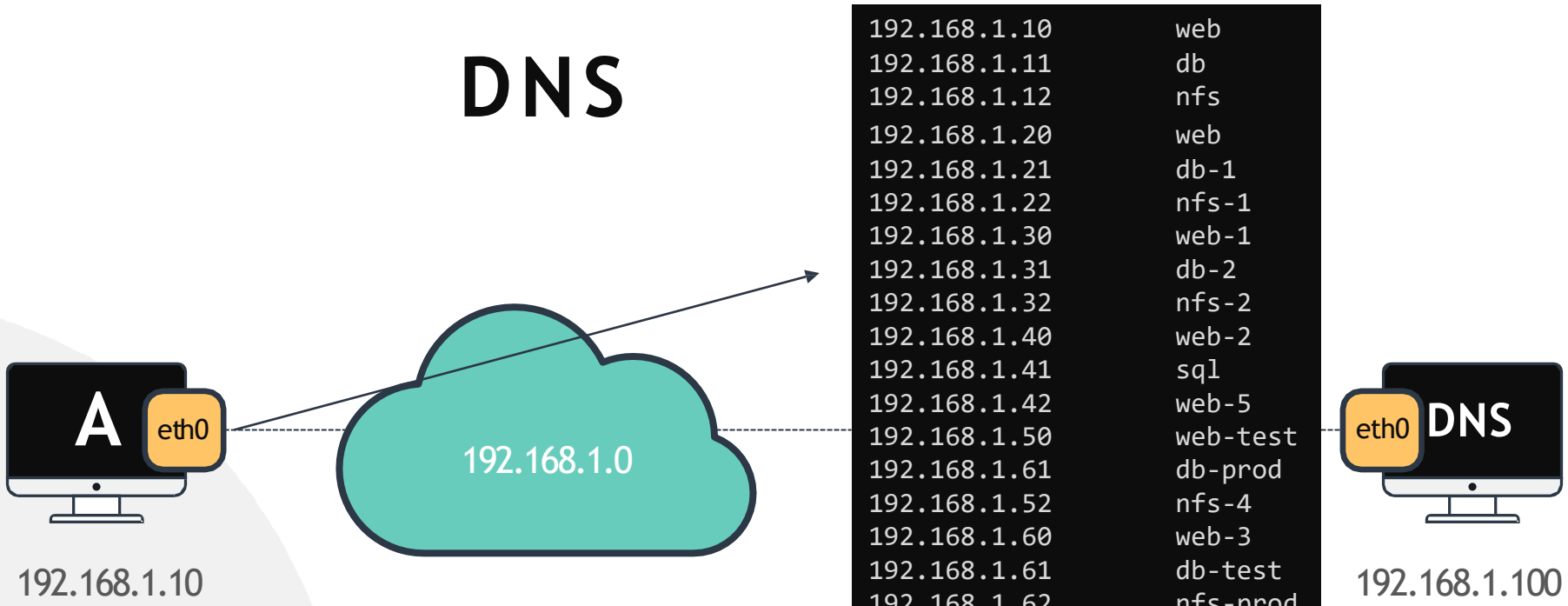
DNS



KODEKLOUD

DNS




```
[~]$ cat /etc/resolv.conf
nameserver        192.168.1.100
```

```
[~]$ ping db
PING db (192.168.1.11) 56(84) bytes of data.
64 bytes from db (192.168.1.11): icmp_seq=1 ttl=64 time=0.052 ms
64 bytes from db (192.168.1.11): icmp_seq=2 ttl=64 time=0.079 ms
```

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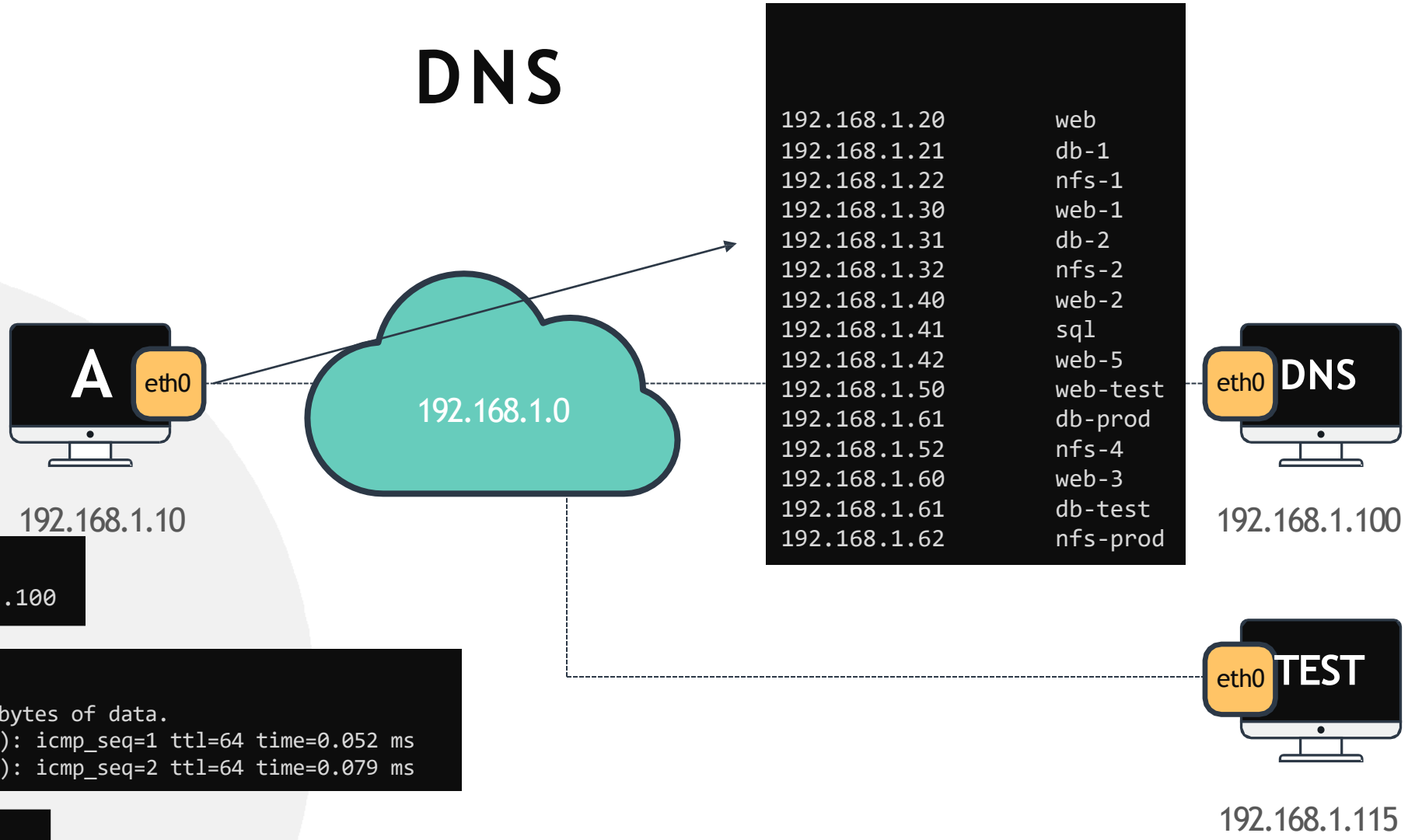
DNS




```
[~]$ cat /etc/resolv.conf
nameserver        192.168.1.100
```

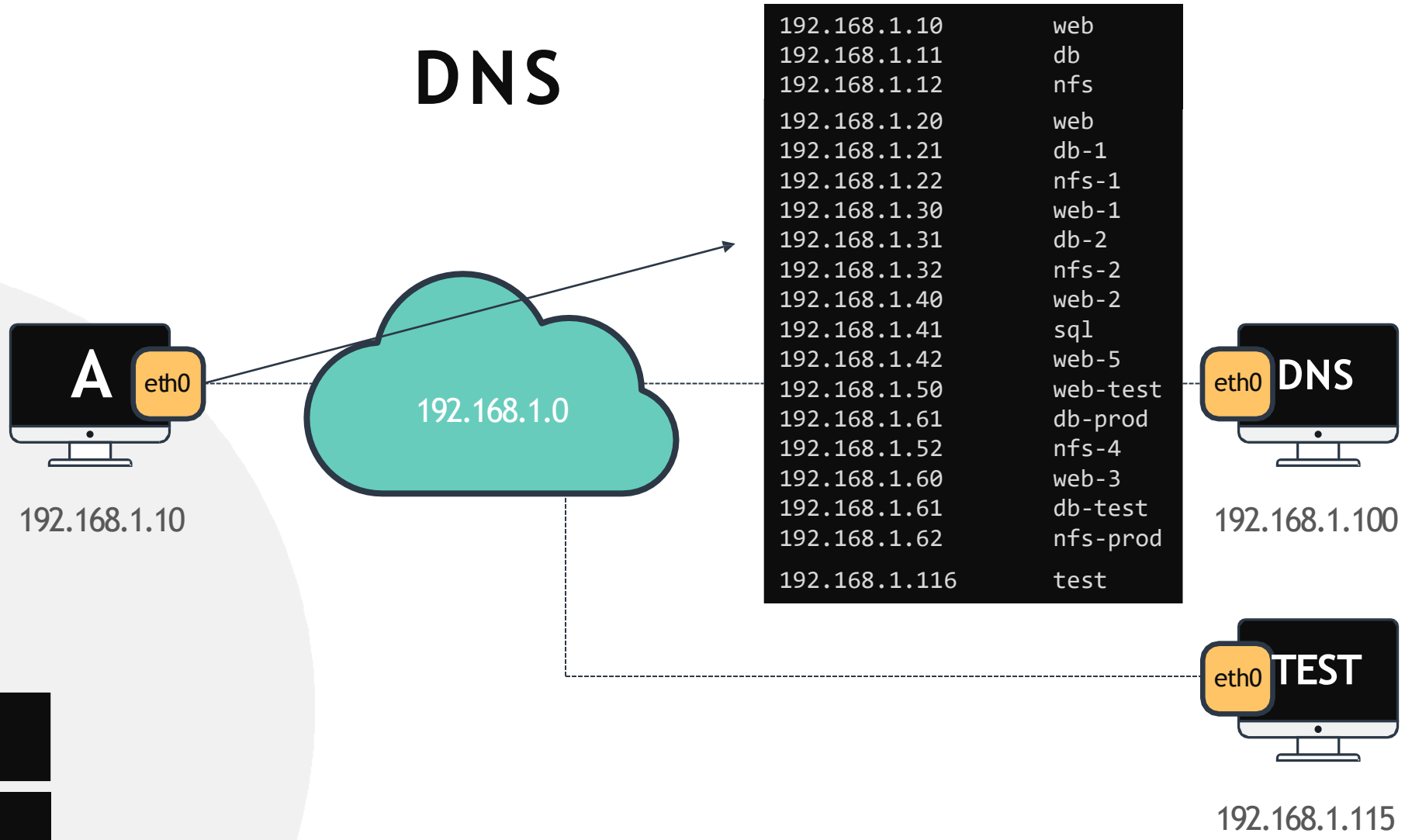
```
[~]$ ping db
PING db (192.168.1.11) 56(84) bytes of data.
64 bytes from db (192.168.1.11): icmp_seq=1 ttl=64 time=0.052 ms
64 bytes from db (192.168.1.11): icmp_seq=2 ttl=64 time=0.079 ms
```

```
[~]$ cat >> /etc/hosts
192.168.1.115        test
```

```
[~]$  ping test
PING test (192.168.1.115) 56(84) bytes of data.
64 bytes from test (192.168.1.115): icmp_seq=1 ttl=64 time=0.052 ms
64 bytes from test (192.168.1.115): icmp_seq=2 ttl=64 time=0.079 ms
```

KODEKLOUD

DNS

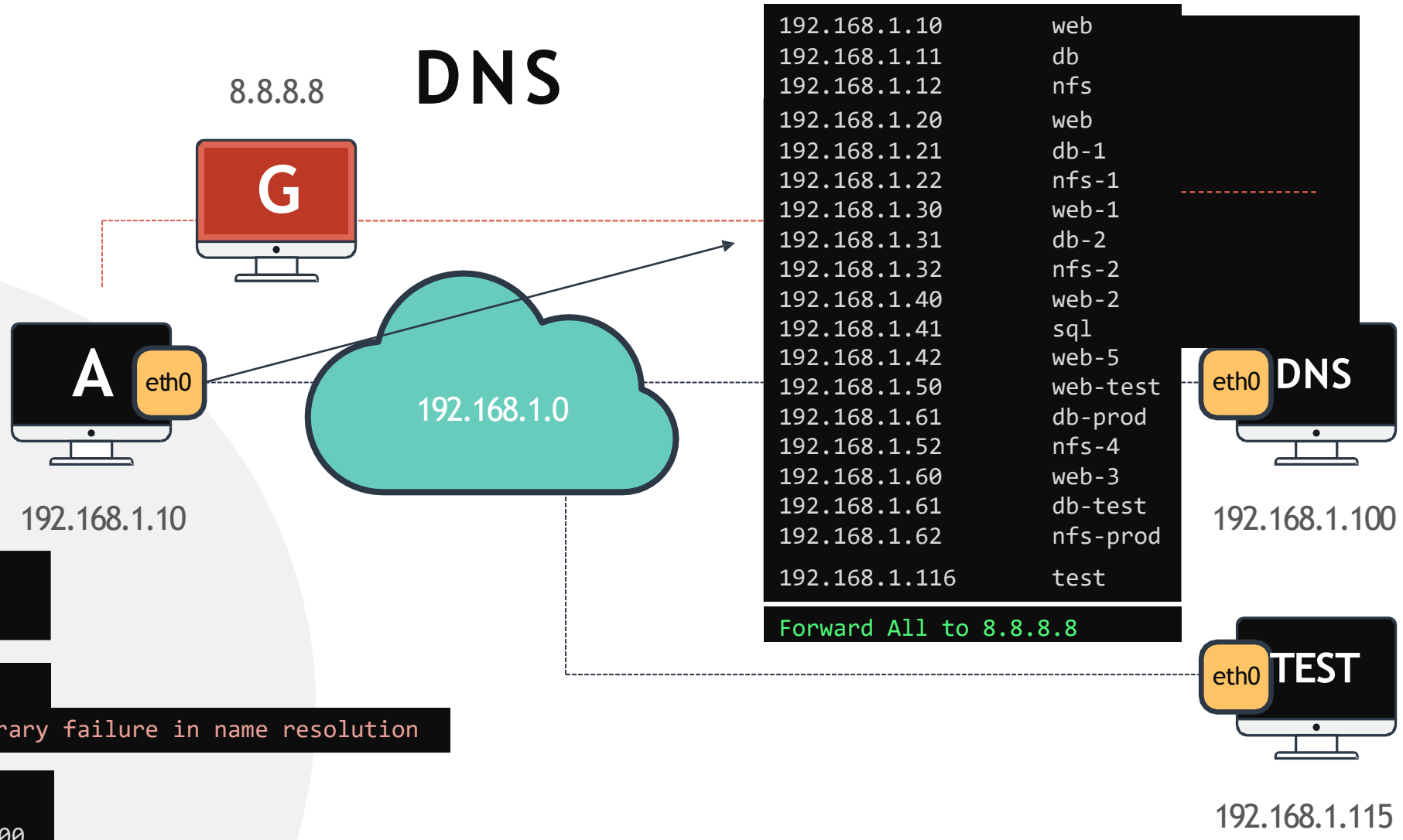



```
[~]$ cat >> /etc/hosts
192.168.1.115        test
```

```
[~]$ cat /etc/nsswitch.conf
…
hosts:          files dns
…
```

KODEKLOUD

DNS




```
[~]$ cat >> /etc/hosts
192.168.1.115        test
```

```
[~]$ ping www.facebook.com
ping: www.facebook.com: Temporary failure in name resolution
```

```
[~]$ cat >> /etc/resolv.conf
nameserver        192.168.1.100
nameserver        8.8.8.8
```

```
[~]$ ping www.facebook.com
PING star-mini.c10r.facebook.com (157.240.13.35) 56(84) bytes of data.
64 bytes from edge-star-mini-shv-02-sin6.facebook.com (157.240.13.35): icmp_seq=1 ttl=50 time=5.70 ms
```

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Domain Names

www.kubernetes.io

www.codepen.io

www.un.org

www.facebook.com

www.mit.edu

www.behance.net

www.google.com

www.speedtest.net

www.stanford.edu

www.care.org

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Domain Names

.com	.net	.edu	.org	.io
www.google	www.behance	www.stanford	www.care	www.kubernetes
www.facebook	www.speedtest	www.mit	www.un	www.codepen

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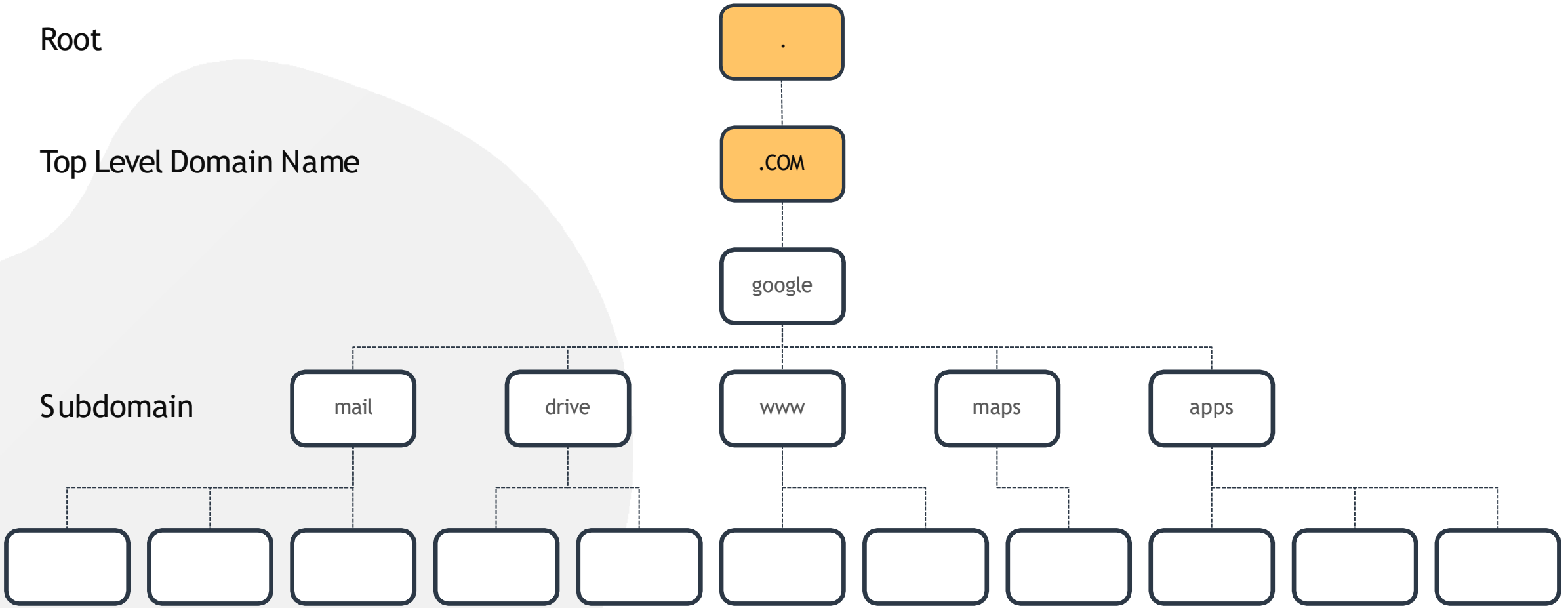
Domain Names

Root

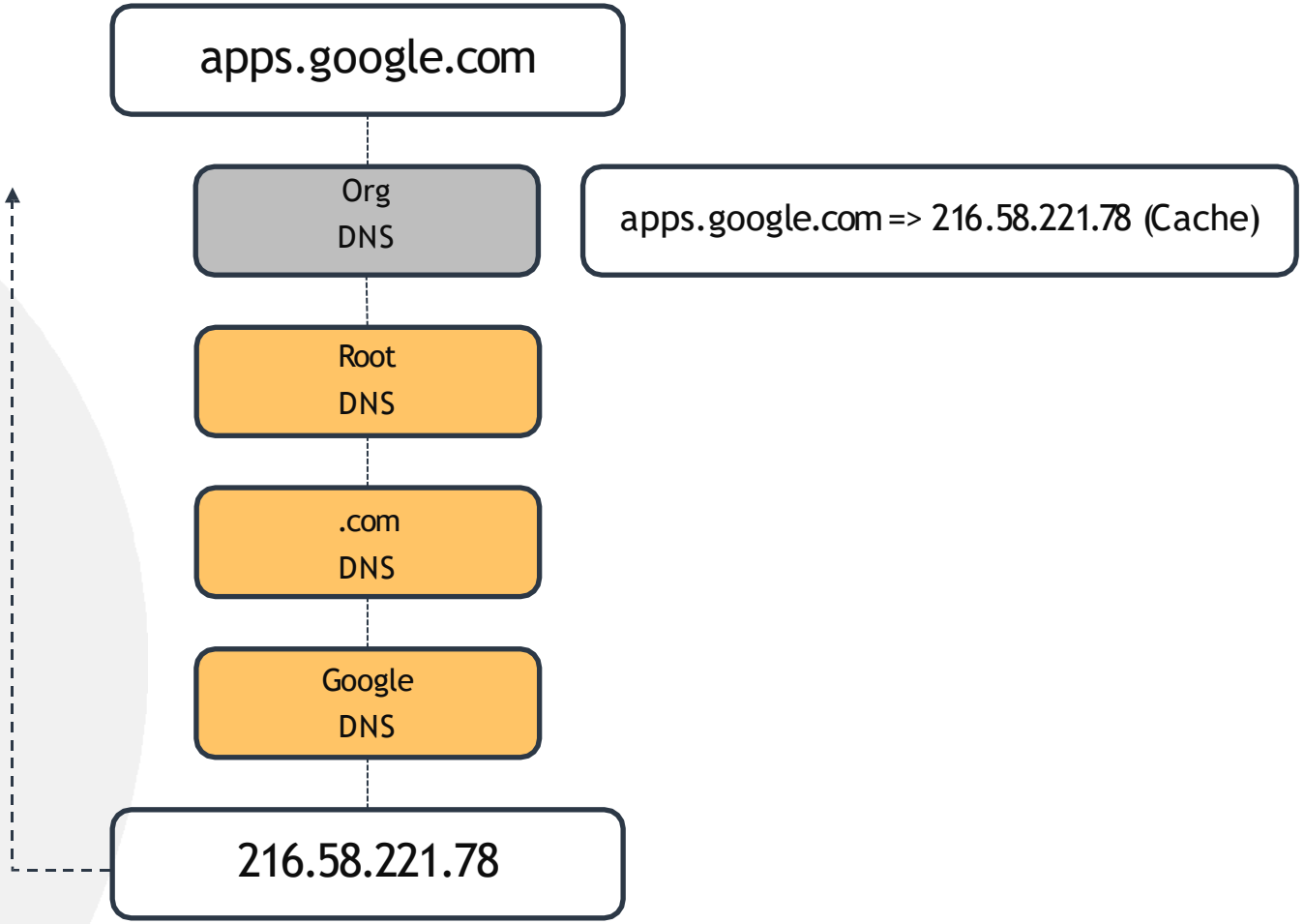
Top Level Domain Name

Subdomain



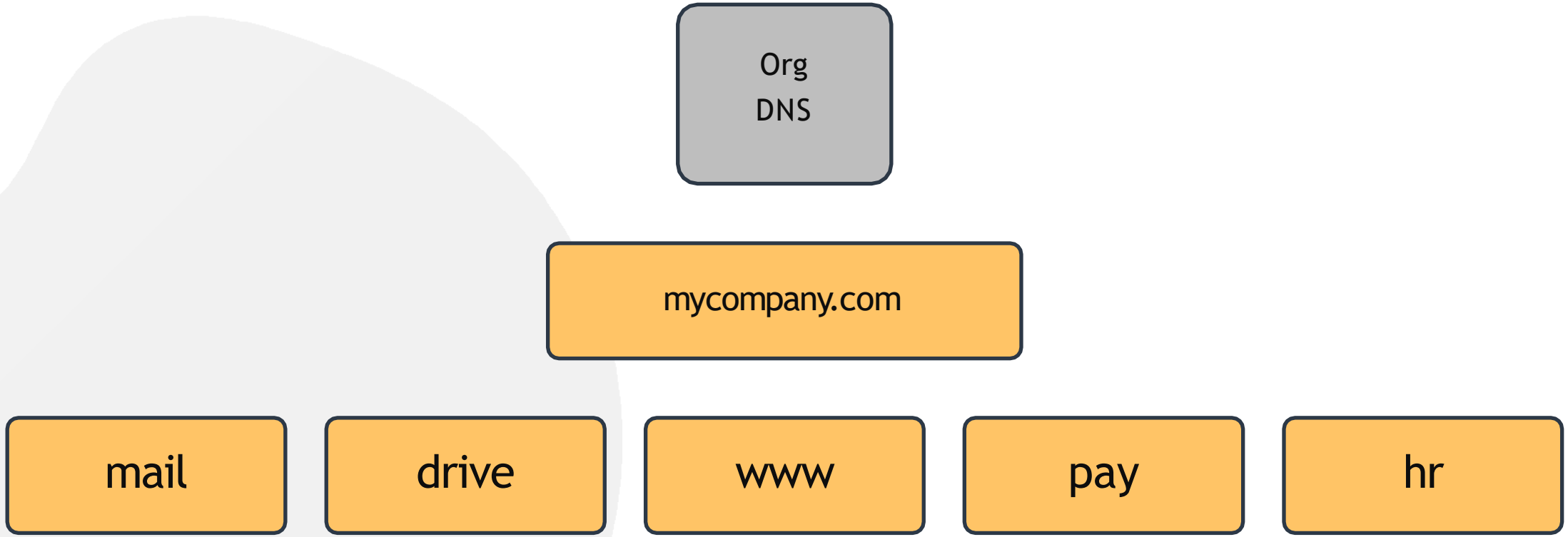
KODEKLOUD

Domain Names



KODEKLOUD

Domain Names



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Search Domain

Org
DNS

mycompany.com

```
192.168.1.10        web.mycompany.com
192.168.1.11        db.mycompany.com
192.168.1.12        nfs.mycompany.com
192.168.1.13        web-1.mycompany.com
192.168.1.14        sql.mycompany.com
```

nfs | web | mail | drive | www | pay | hr | sql

```
[~]$ cat >> /etc/resolv.conf
nameserver          192.168.1.100
search              mycompany.com    prod.mycompany.com
```

```
[~]$ ping web
PING web.mycompany.com (192.168.1.10) 56(84) bytes of data.
64 bytes from web.mycompany.com (192.168.1.10): … time=0.052 ms
64 bytes from web.mycompany.com (192.168.1.10): … time=0.079 ms
```

```
[~]$ ping web.mycompany.com
PING web.mycompany.com (192.168.1.10) 56(84) bytes of data.
64 bytes from web.mycompany.com (192.168.1.10): ttl=64 time=0.052 ms
```

```
[~]$ ping web
PING web (192.168.1.10) 56(84) bytes of data.
64 bytes from web (192.168.1.10): icmp_seq=1 ttl=64 time=0.052 ms
64 bytes from web (192.168.1.10): icmp_seq=2 ttl=64 time=0.079 ms
```

```
[~]$ ping web
ping: web: Temporary failure in name resolution
```

```
[~]$ ping web.mycompany.com
PING web.mycompany.com (192.168.1.10) 56(84) bytes of data.
64 bytes from web.mycompany.com (192.168.1.10): ttl=64 time=0.052 ms
```

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Record Types

A	web-server	192.168.1.1
AAAA	web-server	2001:0db8:85a3:0000:0000:8a2e:0370:7334
CNAME	food.web-server	eat.web-server, hungry.web-server

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nslookup

```
[~]$ nslookup www.google.com
Server:         8.8.8.8
Address:        8.8.8.8#53

Non-authoritative answer:
Name:   www.google.com
Address: 172.217.0.132
```

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DIG

```
[~]$ dig www.google.com

; <<>> DiG 9.10.3-P4-Ubuntu <<>> www.google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 28065
;; flags: qr rd ra; QUERY: 1, ANSWER: 6, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;www.google.com.                        IN      A

;; ANSWER SECTION:
www.google.com.         245     IN      A       64.233.177.103
www.google.com.         245     IN      A       64.233.177.105
www.google.com.         245     IN      A       64.233.177.147
www.google.com.         245     IN      A       64.233.177.106
www.google.com.         245     IN      A       64.233.177.104
www.google.com.         245     IN      A       64.233.177.99

;; Query time: 5 msec
;; SERVER: 8.8.8.8#53(8.8.8.8)
;; WHEN: Sun Mar 24 04:34:33 UTC 2019
;; MSG SIZE  rcvd: 139
```


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Switching & Routing

The Linux Basics Course

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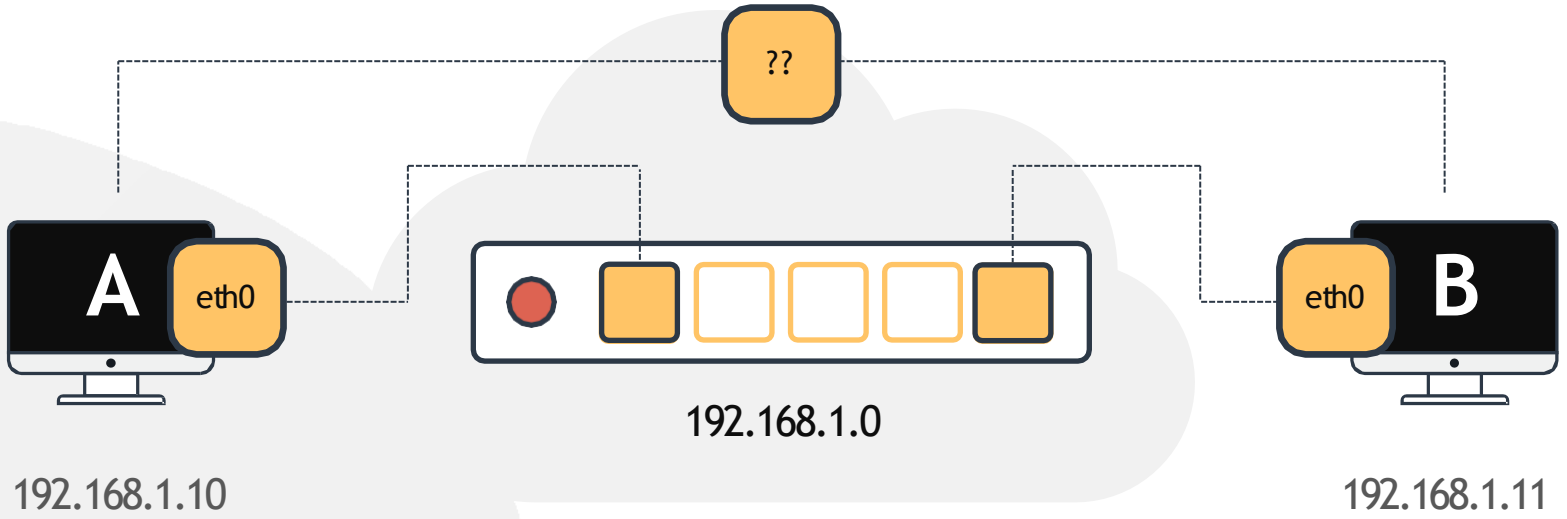
Switching




```
[~]$ ip link
eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP mode
DEFAULT group default qlen 1000
```

```
[~]$ ip addr add 192.168.1.10/24 dev eth0
```

```
[~]$ ip link
eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP mode
DEFAULT group default qlen 1000
```

```
[~]$ ip addr add 192.168.1.11/24 dev eth0
```

```
[~]$ ping 192.168.1.11
Reply from 192.168.1.11: bytes=32 time=4ms TTL=117
Reply from 192.168.1.11: bytes=32 time=4ms TTL=117
```

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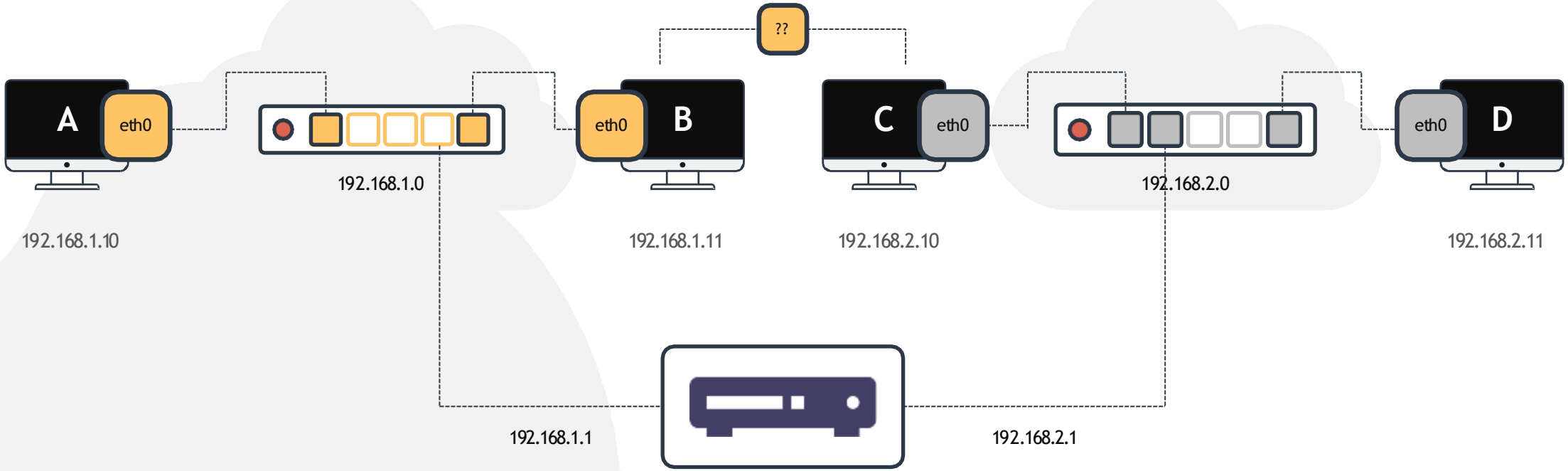
Routing



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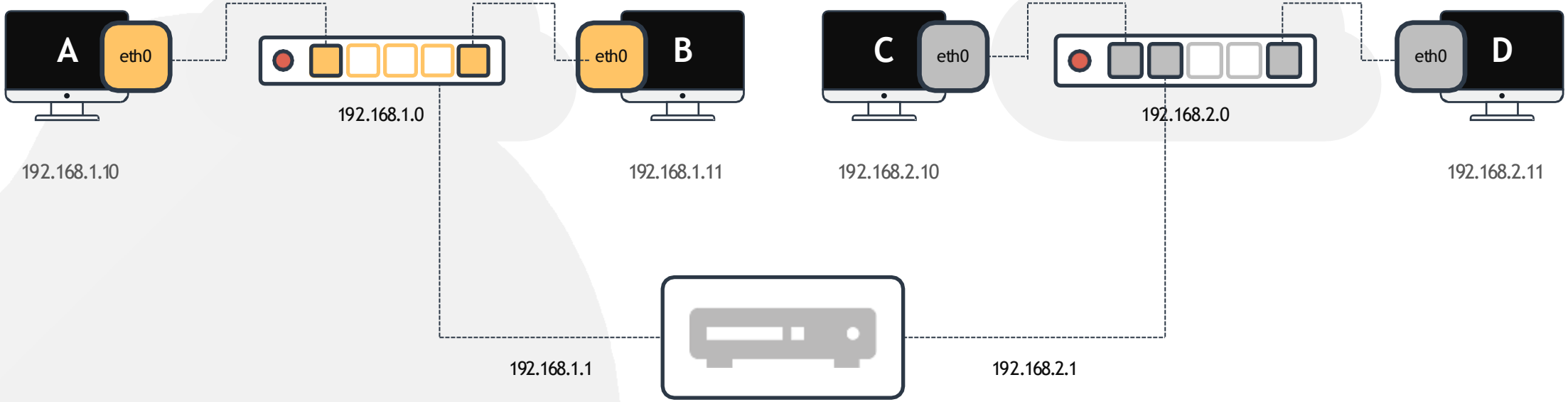
Gateway




```
[~]$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
```

```
[~]$ ip route add 192.168.2.0/24 via 192.168.1.1
```

```
[~]$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.2.0     192.168.1.1     255.255.255.0   UG    0      0        0 eth0
```

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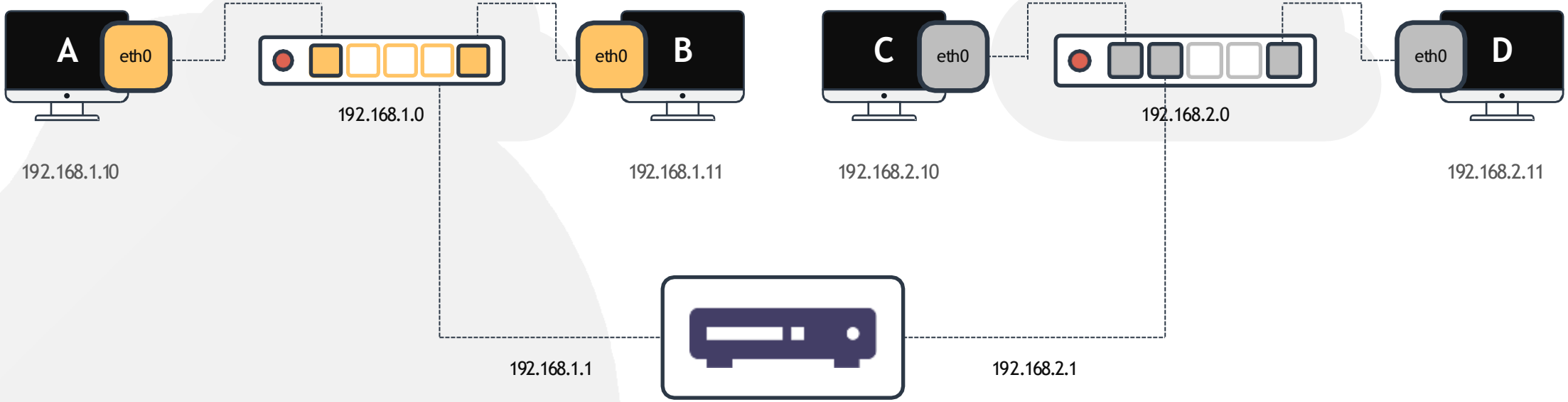
Gateway

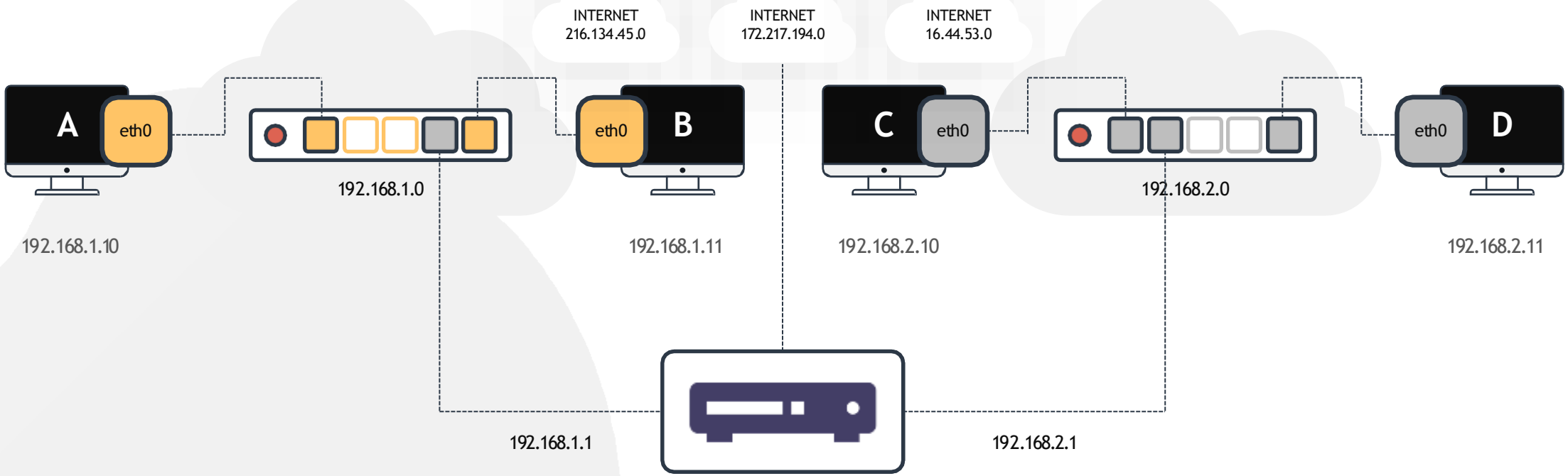



```
[~]$ ip route add 192.168.1.0/24 via 192.168.2.1
```

```
[~]$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.1.0     192.168.2.1     255.255.255.0   UG    0      0        0 eth0
```

KODEKLOUD

Default Gateway



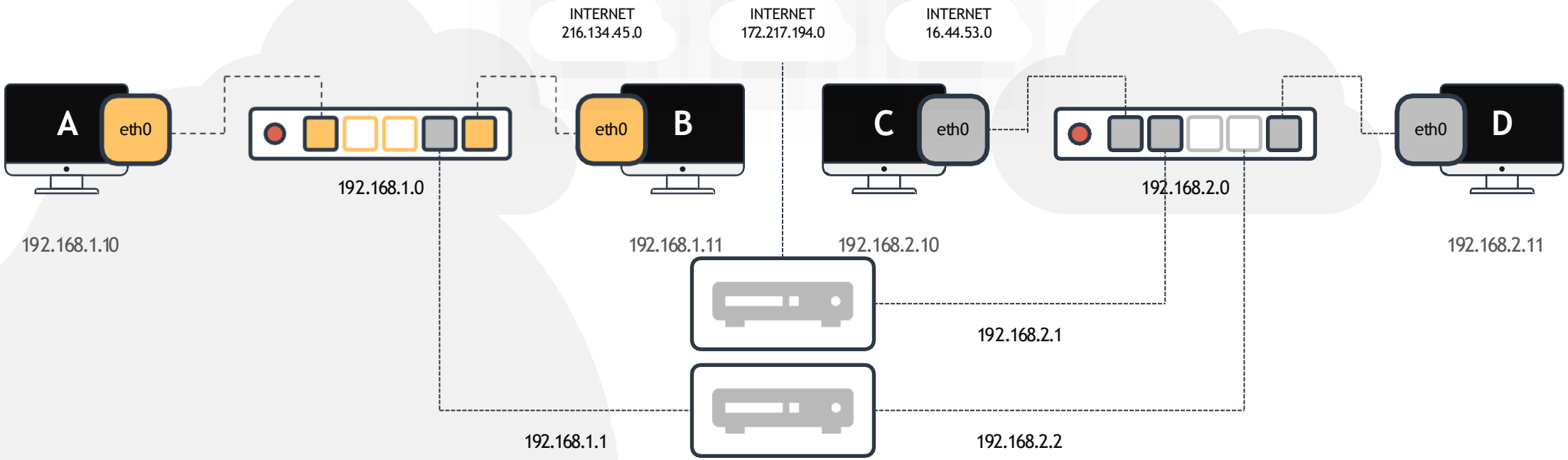

```
[~]$ ip route add default via 192.168.2.1
```

```
[~]$ ip route add 192.168.1.0/24 via 192.168.2.1
```

```
[~]$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.1.0     192.168.2.1     255.255.255.0   UG    0      0        0 eth0
192.168.2.0     0.0.0.0         255.255.255.0   UG    0      0        0 eth0
```

KODEKLOUD

Default Gateway




```
[~]$ ip route add 192.168.1.0/24 via 192.168.2.2
```

```
[~]$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         192.168.2.1     255.255.255.0   UG    0      0        0 eth0
192.168.1.0     192.168.2.2     255.255.255.0   UG    0      0        0 eth0
```

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Take Aways

```
[~]$ ip link
```

```
[~]$ ip addr
```

```
[~]$ ip addr add 192.168.1.10/24 dev eth0
```

```
[~]$ route
```

```
[~]$ ip route add 192.168.1.0/24 via 192.168.2.1
```

```
[~]$ ip route
```


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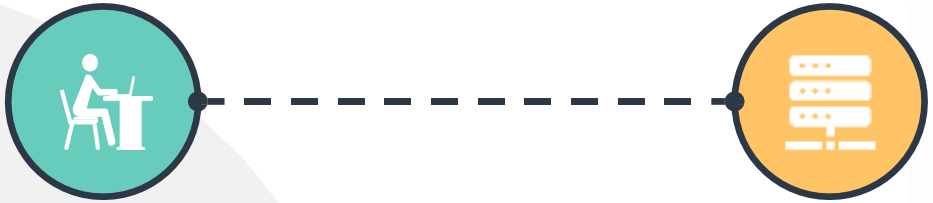
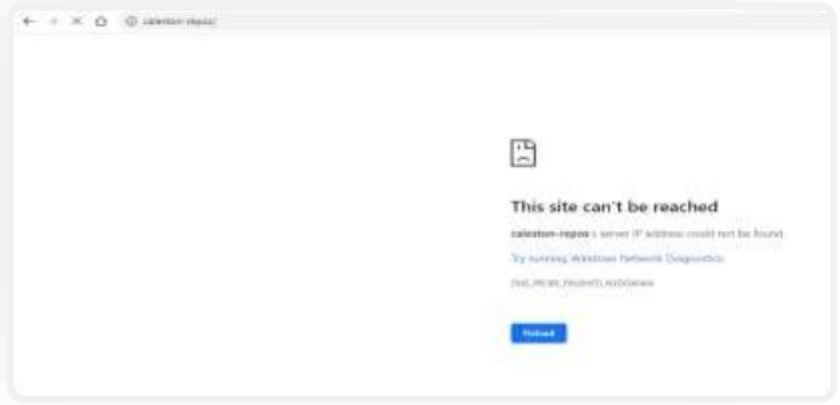
Troubleshooting Network

The Linux Basics Course



http://caleston-repo-01

Repository Server



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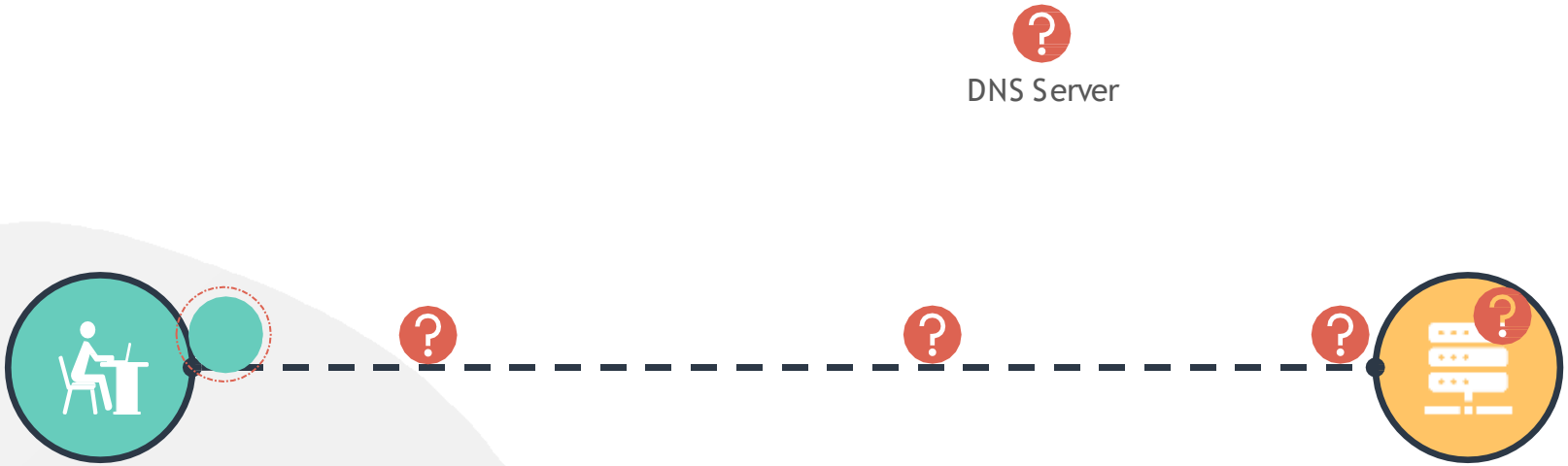
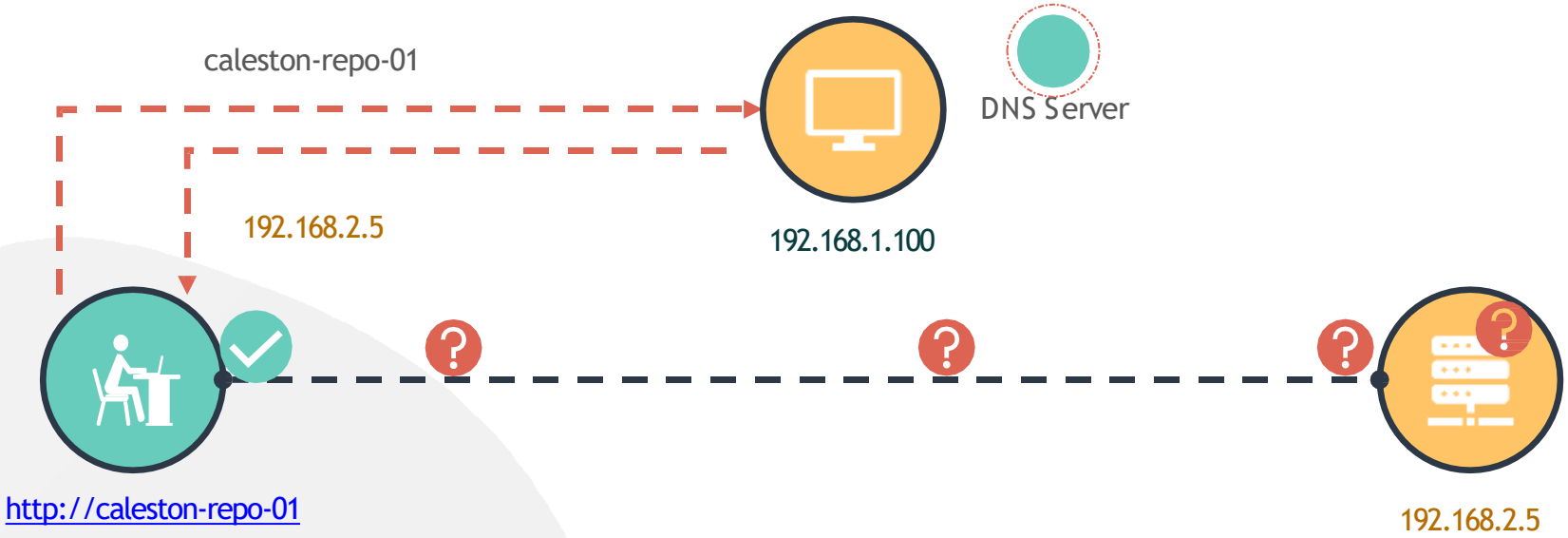



```
[~]$ ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc
    noqueue state UNKNOWN mode DEFAULT group default qlen
    1000 link/loopback 00:00:00:00:00:00 brd
    00:00:00:00:00:00
2: enp1s0f1: <BROADCAST,BROADCAST,MULTICAST,UP> mtu 1500 qdisc
    fq_codel state UP mode DEFAULT group default qlen 1000
    link/ether 08:97:98:6e:55:4d brd ff:ff:ff:ff:ff:ff
```

Check Interfaces

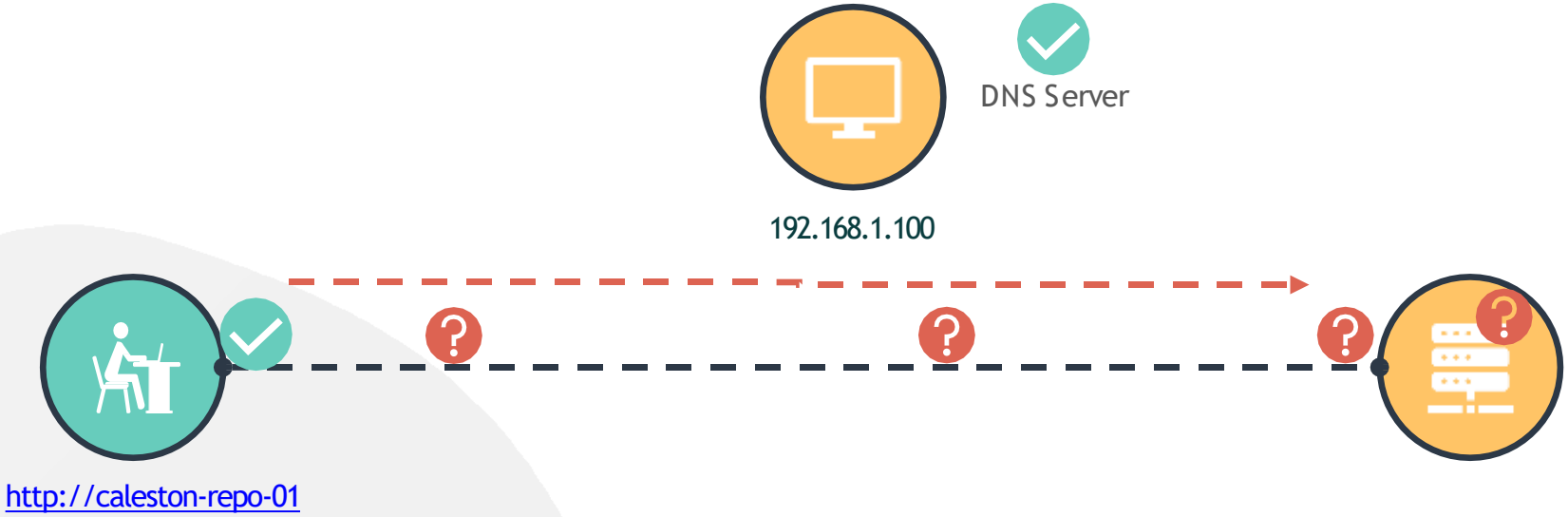
KODEKLOUD




```
[~]$ nslookup caleston-repo-01
Server:         192.168.1.100
Address:        192.168.1.100 #53

Non-authoritative answer:
Name:   caleston-repo-01
Address: 192.168.2.5
```

Check DNS Resolution




```
[~]$ ping caleston-repo-01
PING caleston-repo-01 (192.168.2.5) 56(84) bytes of data.
^C
--- localhost ping statistics ---
3 packets transmitted, 0 received, 100% packet loss, time 2034ms
```

Check Connectivity

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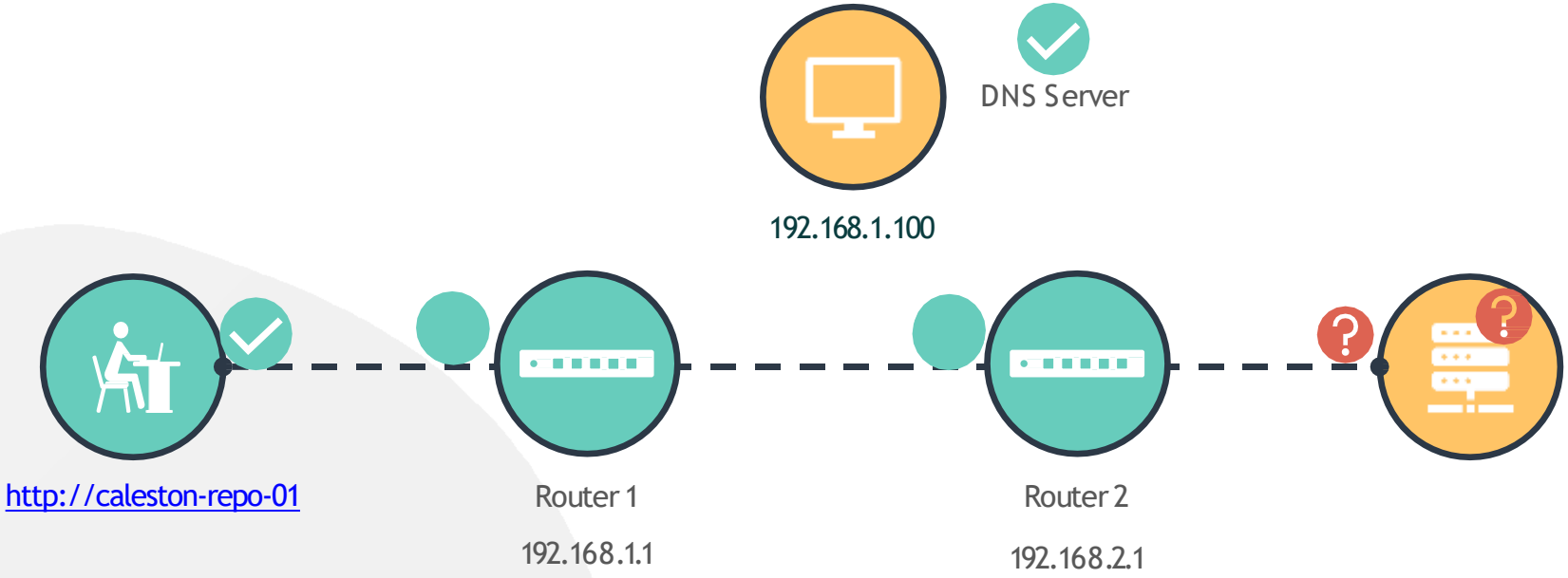


```
[~]$ traceroute 192.168.2.5
Tracing route to example.com [192.168.2.5]
over a maximum of 30 hops:
1    <1 ms    <1 ms    <1 ms  192.168.1.1
2    <2 ms    <1 ms    <1 ms  192.168.2.1
3      *        *        *    Request timed out.
```

Check Route

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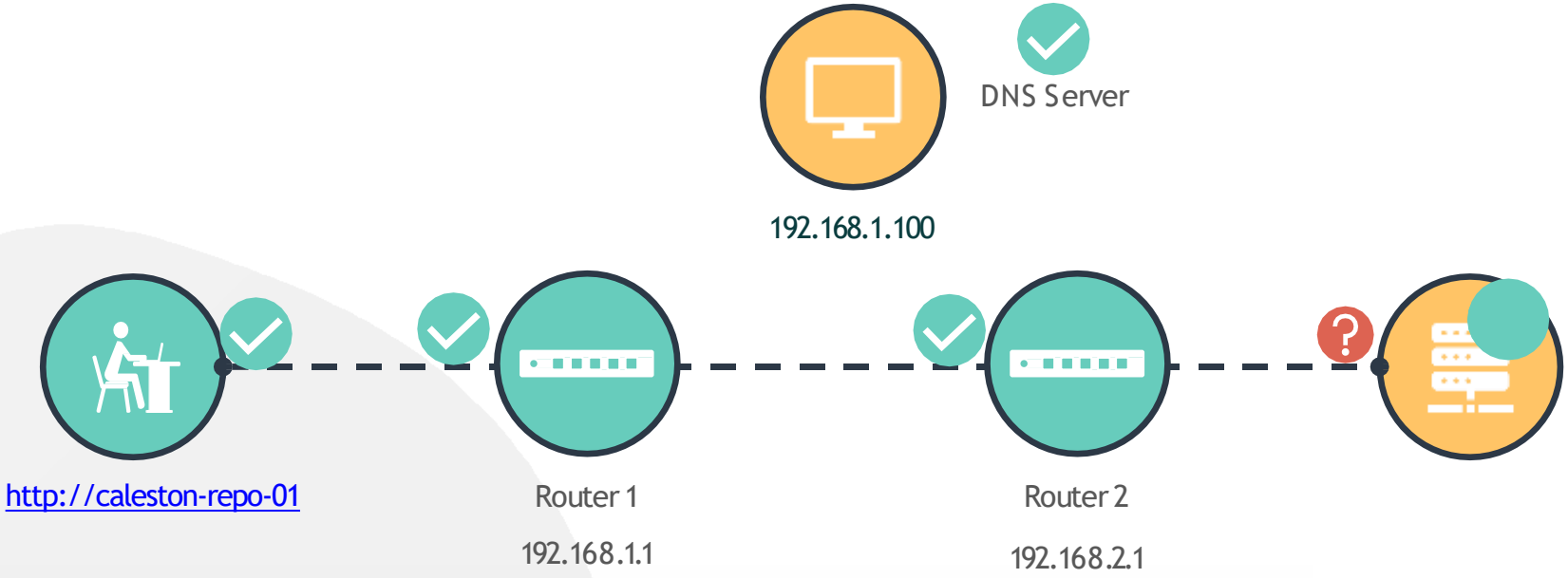
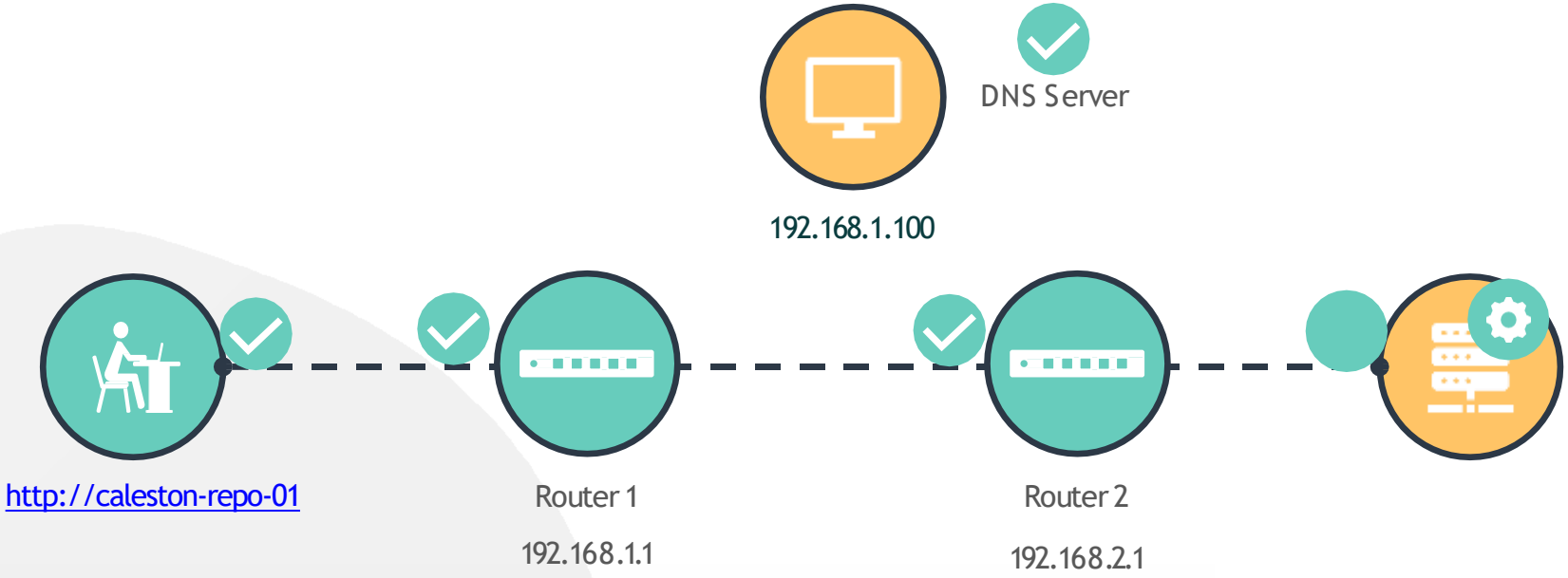


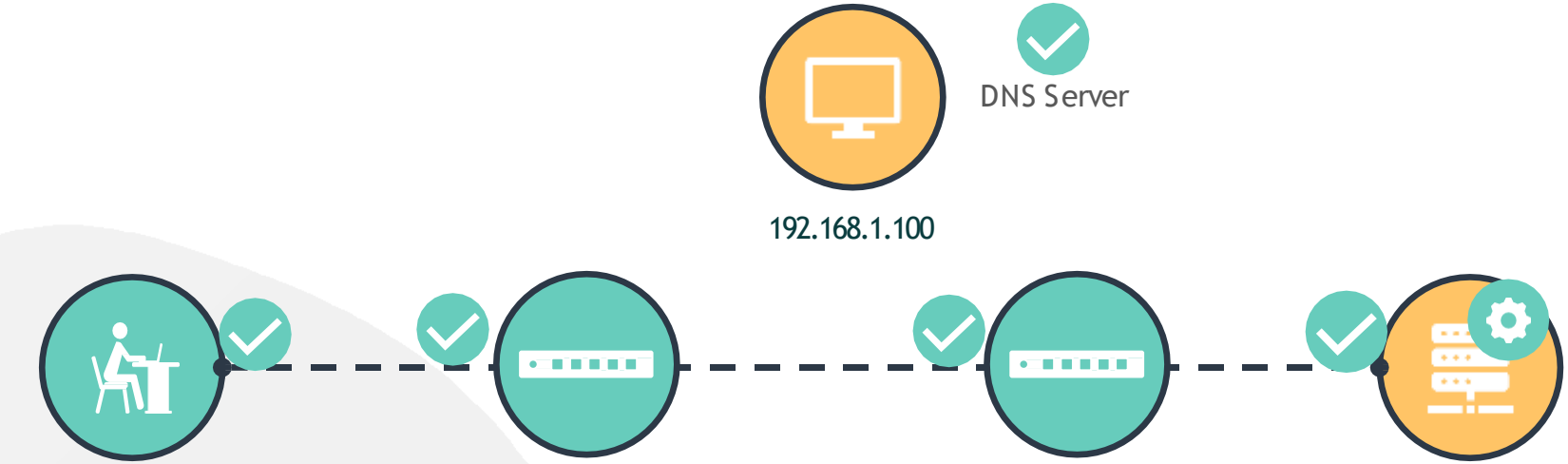

```
[caleston-repo-01: ~]$ netstat -an | grep     | grep -i  LISTEN
80 tcp6    0      0 :::80                   :::*                    LISTEN
```

Check Services




```
[caleston-repo-01: ~]$ ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc
    noqueue state UNKNOWN mode DEFAULT group default qlen
    1000 link/loopback 00:00:00:00:00:00 brd
    00:00:00:00:00:00
2: enp1s0f1: <BROADCAST,BROADCAST,MULTICAST,UP> mtu 1500 qdisc
    fq_codel state DOWN mode DEFAULT group default qlen
    1000 link/ether 08:97:98:34:52:12 brd ff:ff:ff:ff:ff:ff
[caleston-repo-01: ~]$ ip link set dev enp1s0f1 up
```

Check Interfaces



Index of /packages

Name	Last modified	Size	Description
Parent Directory		-	
Debian/	2020-03-30 20:41	-	
RedHat/	2020-03-30 20:41	-	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Storage Basics

The Linux Basics Course

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Storage Basics

- Disk Partitions
- External Storage Devices (DAS/NAS/SAN)
- Linux Filesystems (EXT2-EXT4)
- Logical Volume Manager
- Labs: Partitions and Filesystems
- Labs: LVM
- NFS

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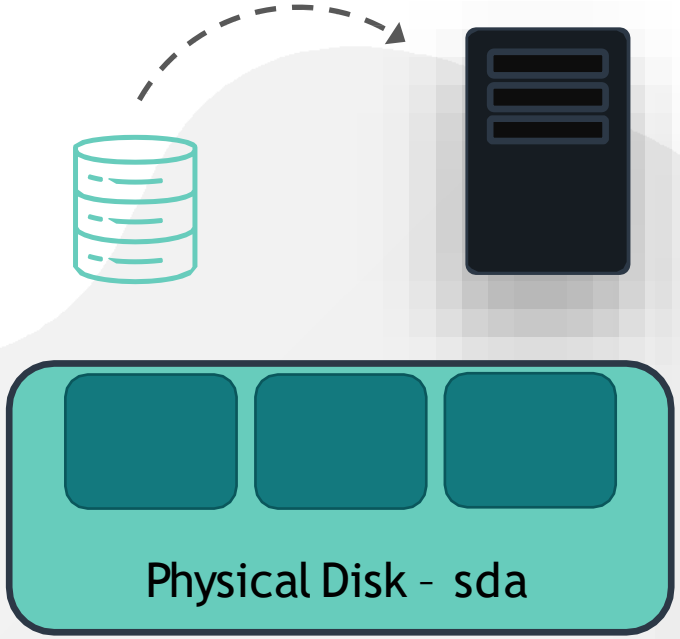
INTRODUCTION TO STORAGE BASICS

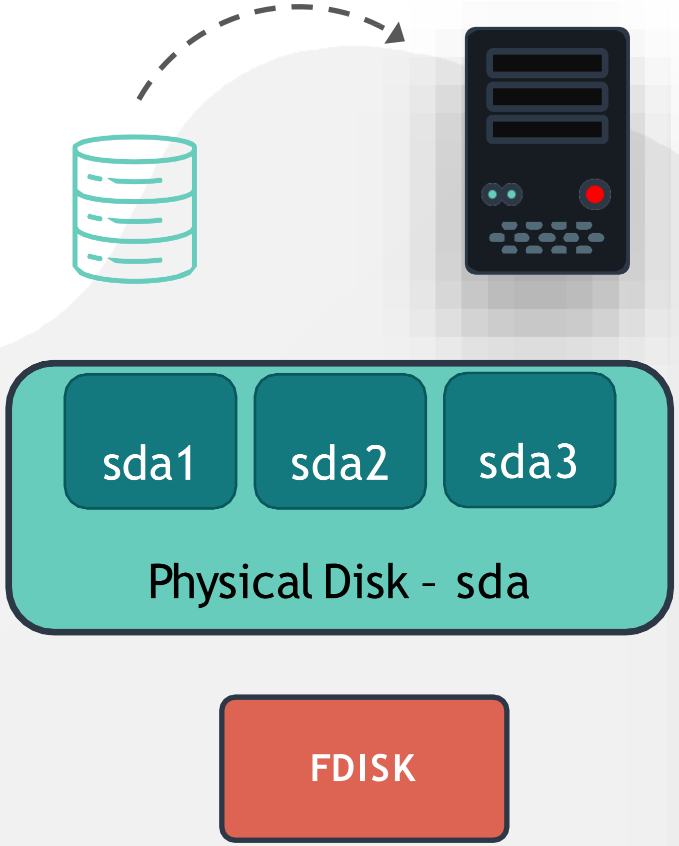


Major Number	Device Type
1	RAM
3	HARD DISK or CD ROM
6	PARALLEL PRINTERS
8	SCSI DISK

```
[~]$ lsblk
NAME                    MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
sda                       8:0    0 119.2G  0 disk
├─sda1                    8:1    0   100M  0 part /boot/efi
├─sda2                    8:2    0  72.5G  0 part /media/MM/Data
└─sda3                    8:3    0  46.6G  0 part /
```

```
[~]$ ls -l /dev/ | grep "^b"
brw-rw----  1 root disk      8,     0 Mar 19 17:43 sda
brw-rw----  1 root disk      8,     1 Mar 19 17:43 sda1
brw-rw----  1 root disk      8,     2 Mar 19 17:43 sda2
brw-rw----  1 root disk      8,     3 Mar 19 17:43 sda3
```

DISK PARTITIONS




```
[~]$ lsblk
NAME                     MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
sda                        8:0    0 119.2G  0 disk
├─sda1                     8:1    0   100M  0 part /boot/efi
├─sda2                     8:2    0  72.5G  0 part /media/MM/Data
└─sda3                     8:3    0  46.6G  0 part /
```

```
[~]$ sudo fdisk -l /dev/sda
Disk /dev/sda: 119.2 GiB, 128035676160 bytes, 250069680
sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512
bytes I/O size (minimum/optimal): 512 bytes / 512
bytes
Disklabel type: gpt
Disk identifier: 7CABF26E-9E23-4496-75A1-C2B9B6270A23
Device           Start       End   Sectors  Size Type
/dev/sda1         2048    206847    204800  100M EFI System
/dev/sda2       239616 150194175 149954560 71.5G Linux filesystem
/dev/sda3    150194176 247955455  97761280 46.6G Linux filesystem
```

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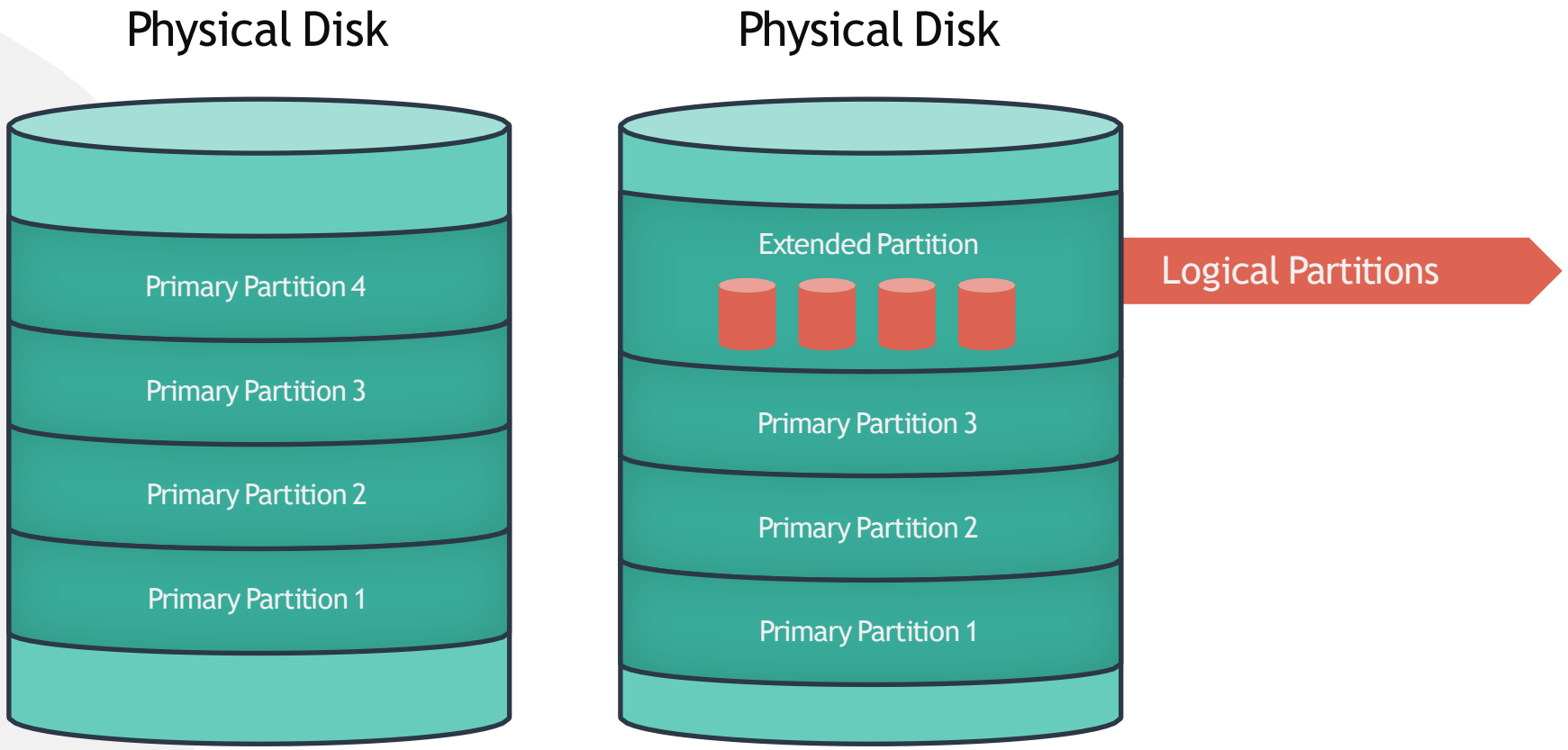
PARTITION TYPES -
PRIMARY, EXTENDED AND LOGICAL

Primary Partition

Extended Partition

Logical Partition



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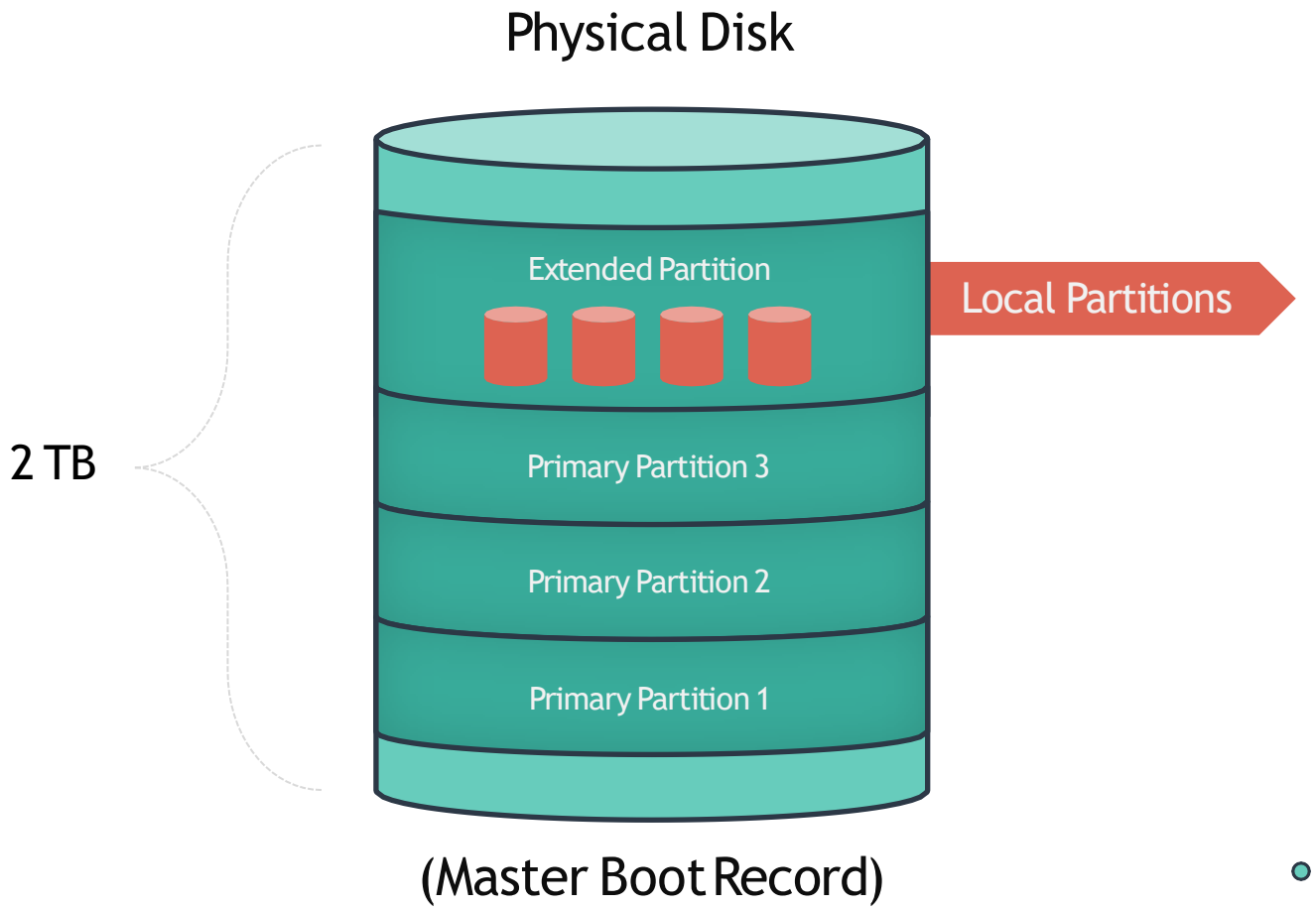
PARTITION SCHEME - MBR



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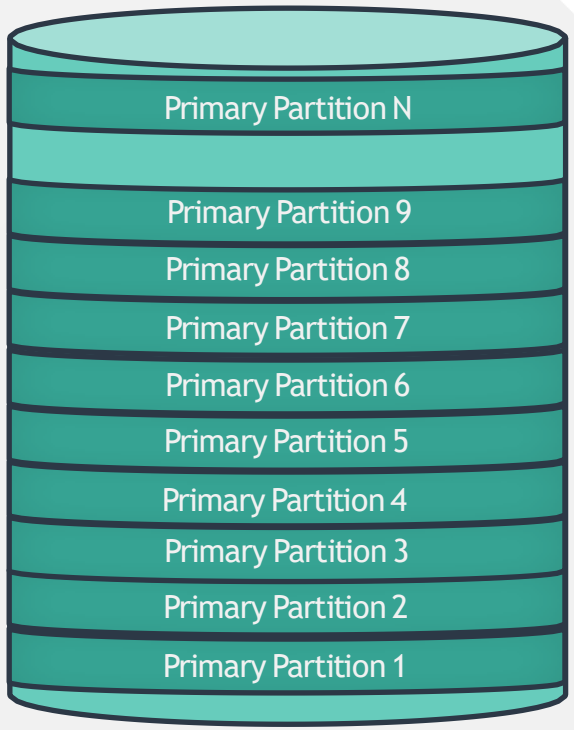
PARTITION SCHEME - GPT



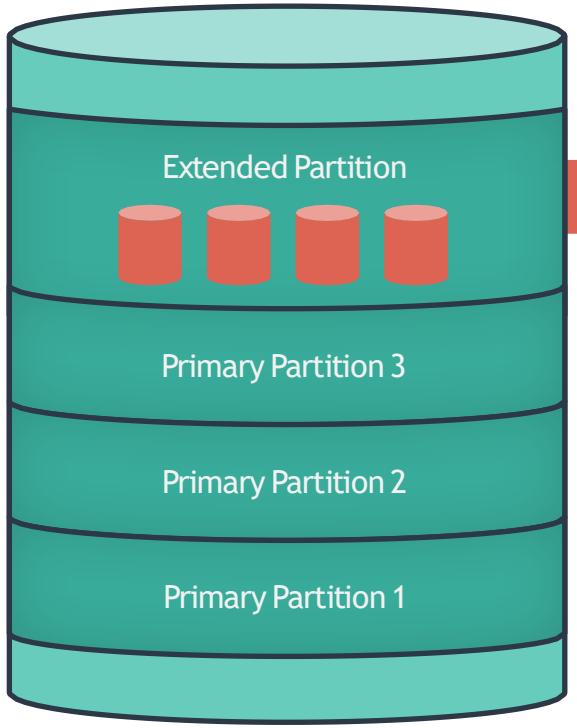
(GUID Partition Table)

2 TB

No max Size per partition

Unlimited partitions

Physical Disk



Local Partitions

(Master Boot Record)

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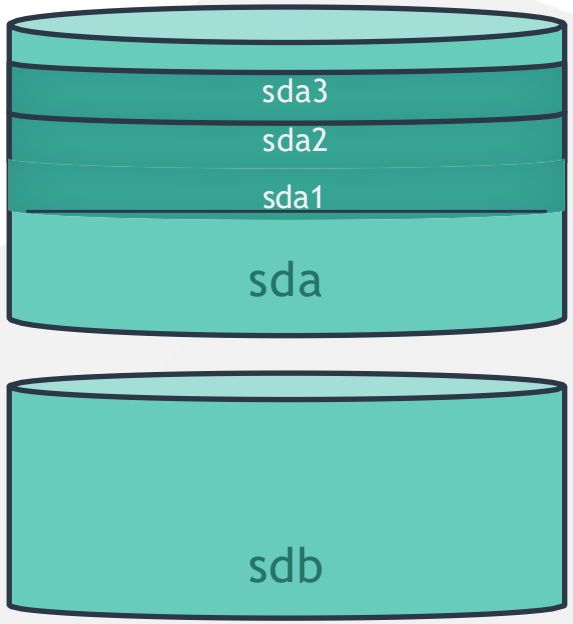
CREATING PARTITIONS




```
[~]$ lsblk
fd0      2:0    1    4K  0 disk
sr0     11:0    1 1024M  0 rom
sda      8:0    0 97.7G  0 disk
|-sda1   8:1    0 93.7G  0 part /
|-sda2   8:2    0    1K  0 part
|-sda5   8:5    0  3.9G  0 part
sdb      8:16   0   20G  0 disk
```

```
[~]$ gdisk /dev/sdb
GPT fdisk (gdisk) version 1.0.1

Partition table scan:
  MBR: protective
  BSD: not present
  APM: not present
  GPT: present

Found valid GPT with protective MBR; using

GPT. Command (? for help):
```

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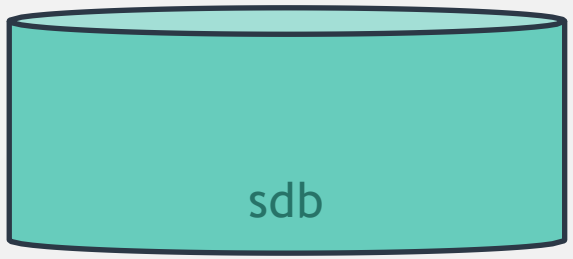
CREATING PARTITIONS




```
[~]$ gdisk /dev/sdb
GPT fdisk (gdisk) version 1.0.1

Partition table scan:
  MBR: protective
  BSD: not present
  APM: not present
  GPT: present

Found valid GPT with protective MBR; using
GPT.

b       back up GPT data to a file
c       change a partition's name
d       delete a partition
i       show detailed information on a partition
l       list known partition types
n       add a new partition
o       create a new empty GUID partition table (GPT)
p       print the partition table
q       quit without saving changes
r       recovery and transformation options (experts only)
s       sort partitions
t       change a partition's type code
v       verify disk
w       write table to disk and exit
x       extra functionality (experts only)
Command (? for help):
```

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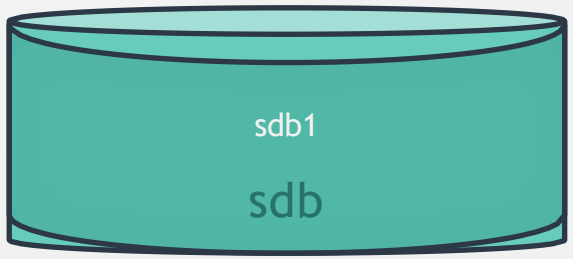
CREATING PARTITIONS




```
Command (? for help): ?

b       back up GPT data to a file
c       change a partition's name
d       delete a partition
i       show detailed information on a partition
l       list known partition types
n       add a new partition
o       create a new empty GUID partition table (GPT)
p       print the partition table
q       quit without saving changes
r       recovery and transformation options (experts only)
s       sort partitions
t       change a partition's type code
v       verify disk
w       write table to disk and exit
x       extra functionality (experts only)
?       print this menu

Command (? for help):  n

Partition number (1-128, default 1): 1
First sector (34-41943006, default = 2048) or {+-}size{KMGTP}: 2048
Information: Moved requested sector from 34 to 2048 in
order to align on 2048-sector boundaries.
Use 'l' on the experts' menu to adjust alignment
Last sector (2048-41943006, default = 41943006) or {+-}size{KMGTP}: 41943006
Current type is 'Linux filesystem'
Hex code or GUID (L to show codes, Enter = 8300):
Changed type of partition to 'Linux filesystem'

Command (? for help):  w

Final checks complete. About to write GPT data. THIS WILL OVERWRITE EXISTING
PARTITIONS!!

Do you want to proceed? (Y/N): Y
OK; writing new GUID partition table (GPT) to /dev/vdb.
The operation has completed successfully.
```

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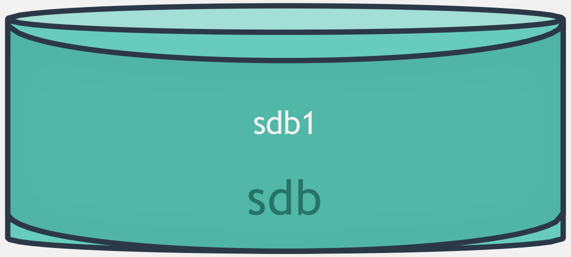
CREATING PARTITIONS




```
Command (? for help):
Partition number (1-128, default 1): 1
First sector (34-41943006, default = 2048) or {+-}size{KMGTP}: 2048
Information: Moved requested sector from 34 to 2048 in
order to align on 2048-sector boundaries.
Use 'l' on the experts' menu to adjust alignment
Last sector (2048-41943006, default = 41943006) or {+-}size{KMGTP}: 41943006
Current type is 'Linux filesystem'
Hex code or GUID (L to show codes, Enter = 8300):
Changed type of partition to 'Linux filesystem'
Command (? for help):  w

Final checks complete. About to write GPT data. THIS WILL OVERWRITE EXISTING
PARTITIONS!!

Do you want to proceed? (Y/N): Y
OK; writing new GUID partition table (GPT) to /dev/vdb.
The operation has completed successfully.
```

```
[~]$ sudo fdisk -l /dev/sdb
Disk /dev/sdb: 20 GiB, 128035676160 bytes, 250069680
sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512
bytes I/O size (minimum/optimal): 512 bytes / 512
bytes
Disklabel type: gpt
Disk identifier: 7CABF26E-9E23-4496-B5A1-C2B2B6270A23
Device       Start     End       Sectors   Size Type
/dev/sdb1       2048    41943006 204800   20GB Linux filesystem
```

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Linux Filesystems

The Linux Basics Course

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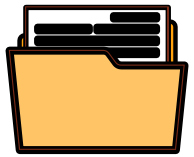
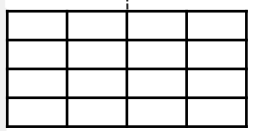
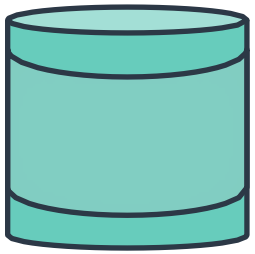
/my-disk







Mount Filesystem

Create Filesystem

Partition Disk

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Linux Filesystem

EXT2
2 TB File size
4 TB volume size
Supports Compression
Supports Linux Permissions
Long Crash Recovery

EXT3
2 TB File size
4 TB volume size
Uses Journal
Backwards Compatible

EXT4
16 TB File size
Uses Journal
Backwards Compatible

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Working with EXT4

```
[~]$ mkfs.ext4 /dev/sdb1
Allocating group tables: done
Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done
```

```
[~]$ mkdir /mnt/ext4;
```

```
[~]$ mount /dev/sdb1 /mnt/ext4
```

```
[~]$ mount | grep /dev/sdb1
/dev/sdb1 on /mnt/ext4 type ext4 (rw,relatime,data=ordered)
```

```
[~]$ df -hP | grep /dev/sdb1
/dev/sdb1       20G       52K     20G       0%       /mnt/ext4
```

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FSTAB

/etc/fstab

```
# /etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name
devices # that works even if disks are added and removed. See fstab(5).
#
# <file system> <mount point>   <type>          <options>                       <dump>  <pass>
/dev/sda1       /               ext4    defaults,relatime,errors=panic      0       1 ~
```

```
echo "/dev/sdb1  /mnt/ext4  ext4  rw 0 0" >> /etc/fstab
```

FIELD	Purpose
Mountpoint	Directory to be mounted on
Options	Such as RW = Read-write, RO = Read Only
Dump	0 = Ignore, 1 = take backup

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Network Filesystem

The Linux Basics Course

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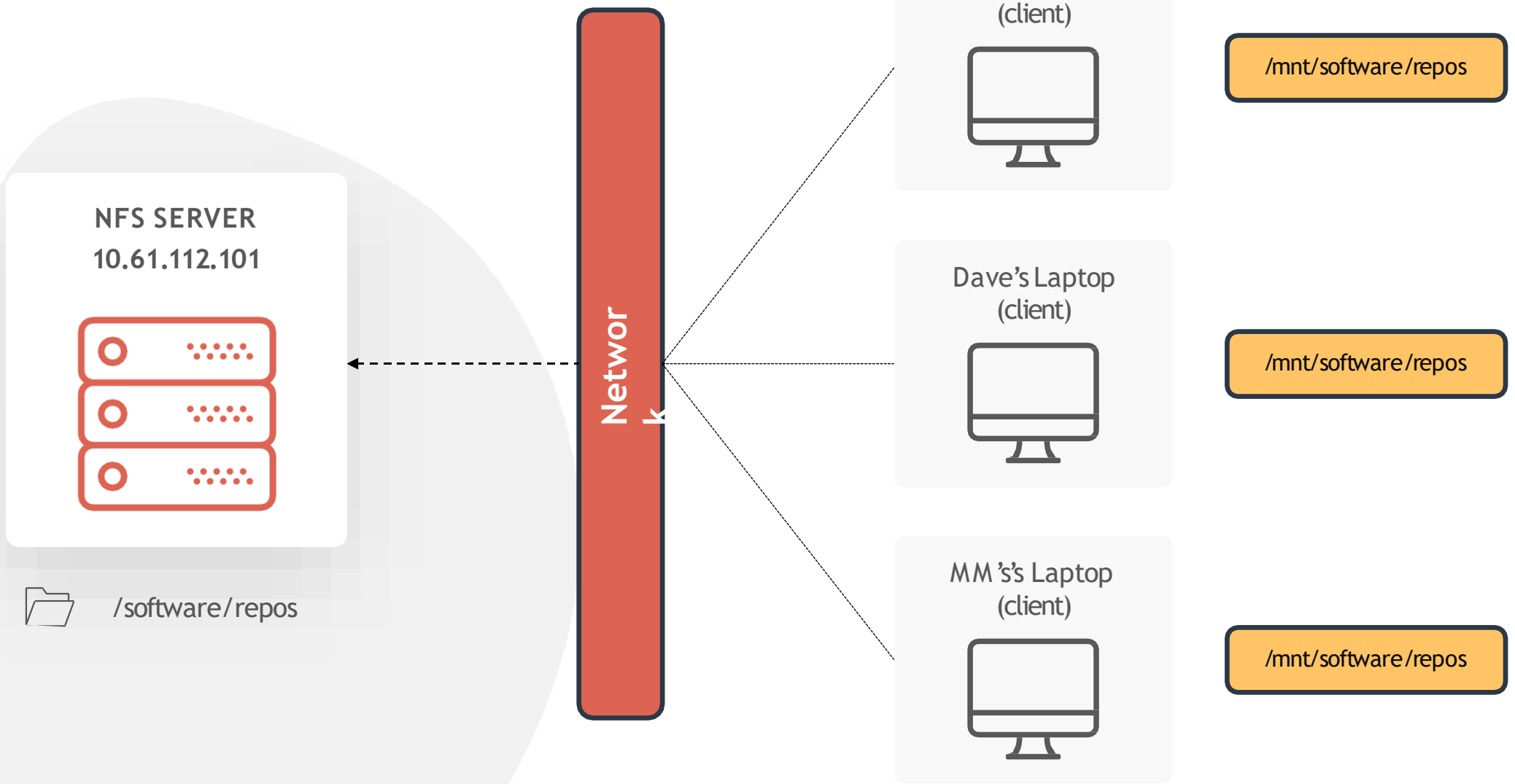
NFS



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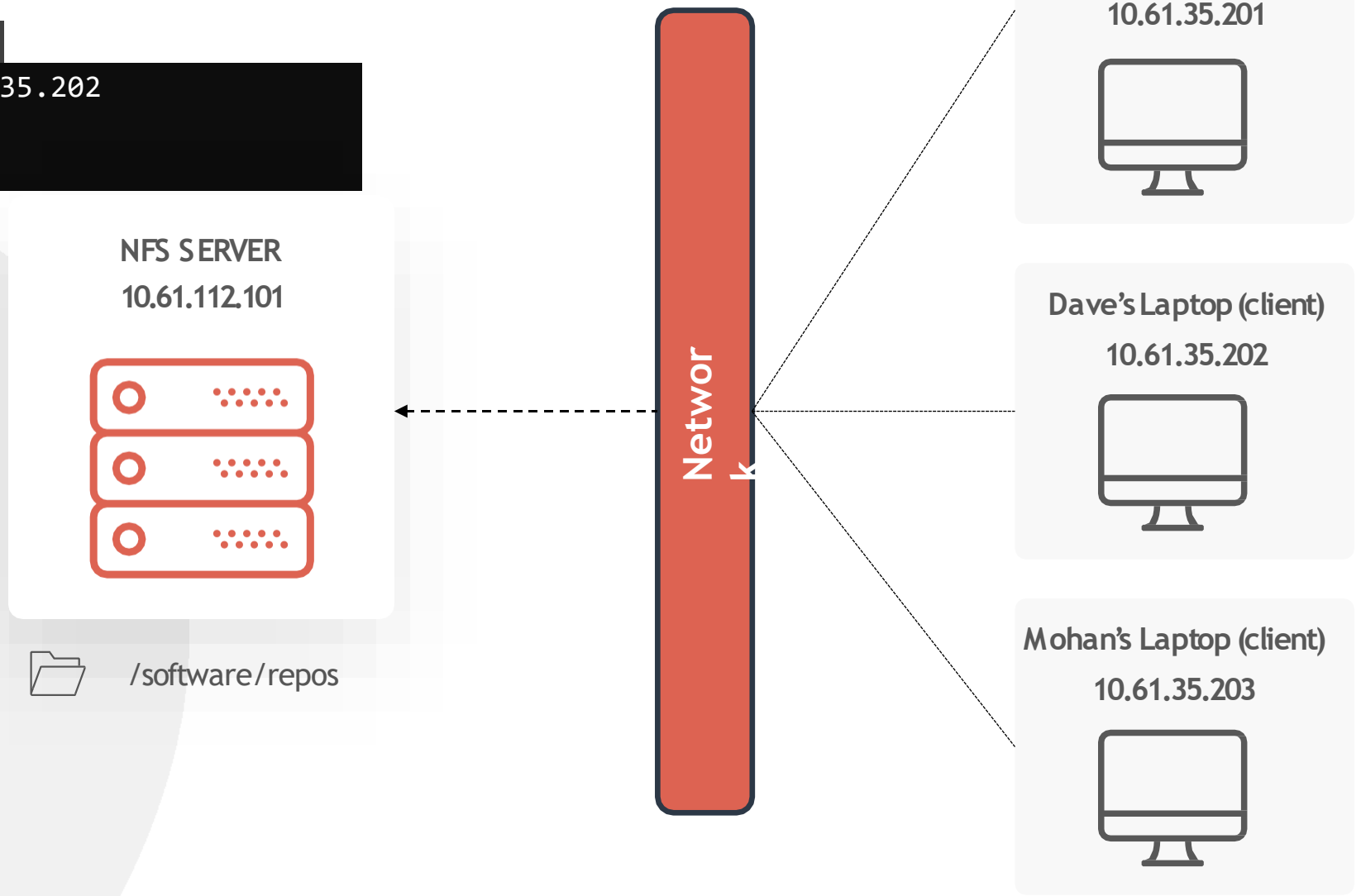
NFS

```
[~]$ /etc/exports
/software/repos 10.61.35.201 10.61.35.202
10.61.35.203
```



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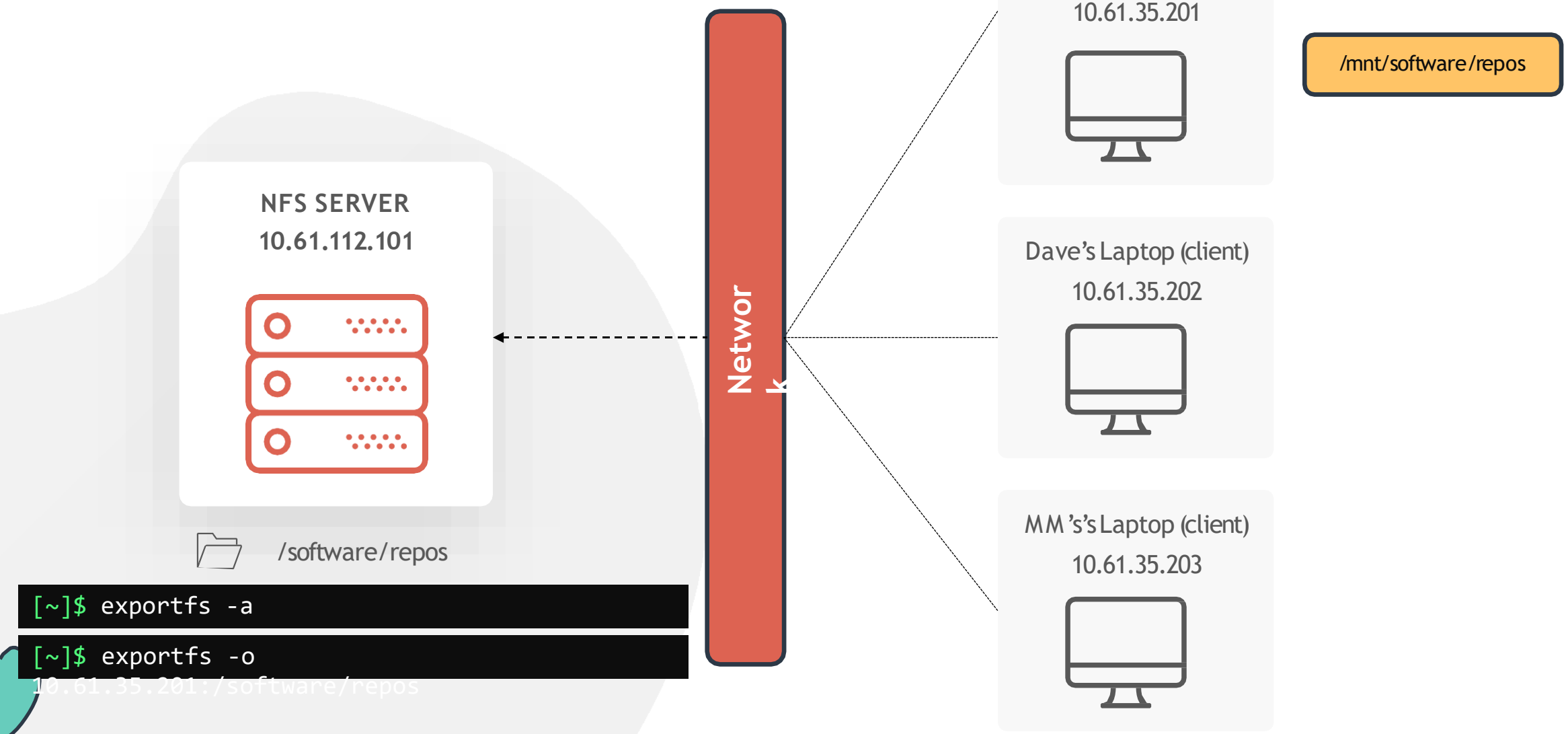
NFS

```
[~]$ mount 10.61.112.101:/software/repos /mnt/software/repos
```




```
[~]$ exportfs -a
[~]$ exportfs -o
10.61.35.201:/software/repos
```

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DAS, NAS & SAN

The Linux Basics Course

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DAS, NAS and SAN

DAS = Direct Attached Storage

NAS = Network Attached Storage

SAN = Storage Area Network

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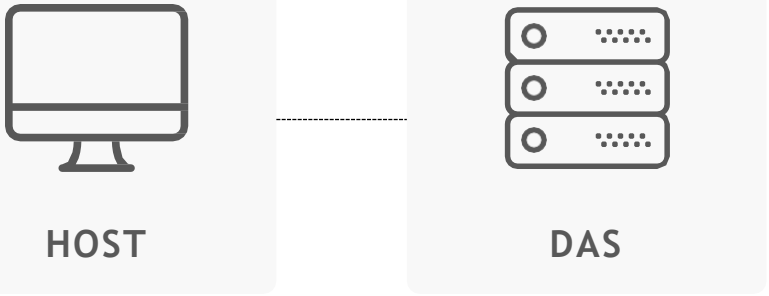
DAS

DAS = Direct Attached Storage

DAS

Fast and Reliable

Dedicated to single host



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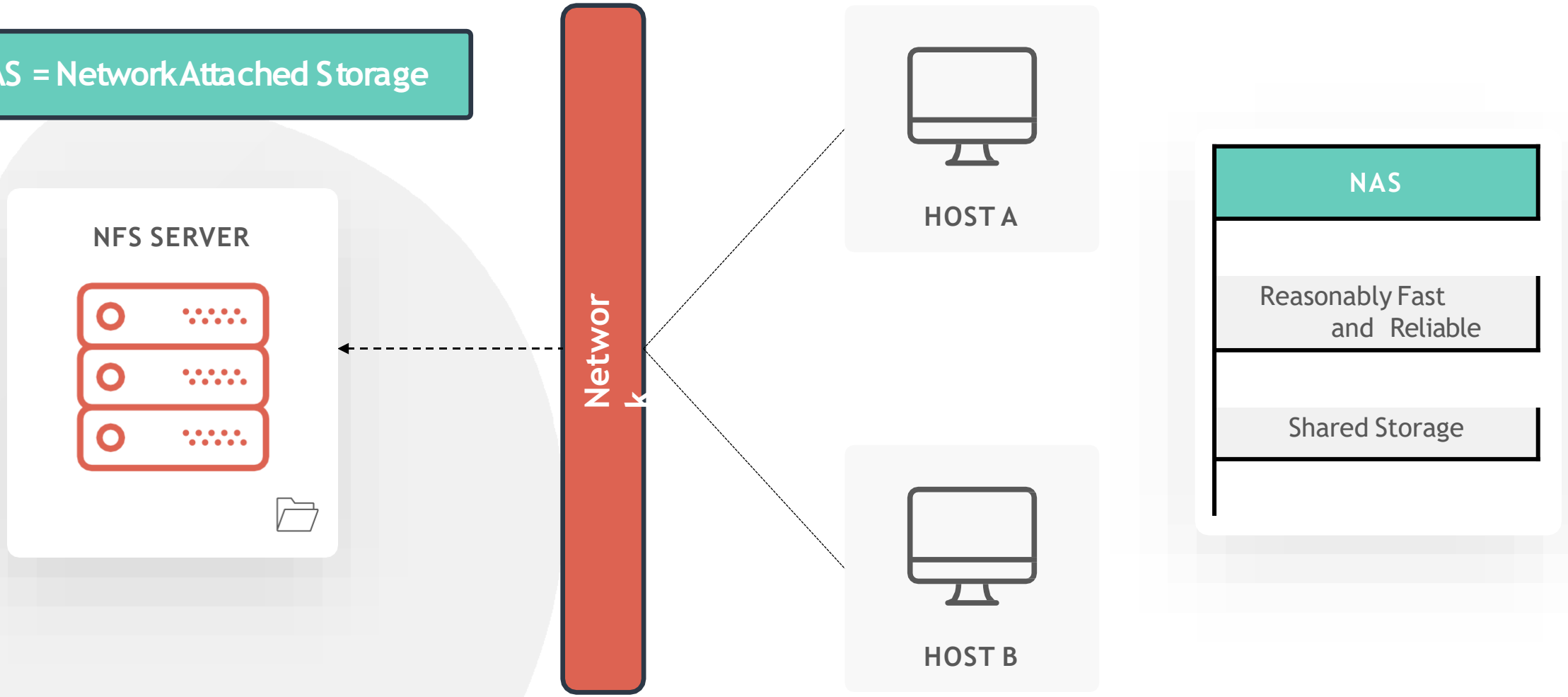
NAS

NAS = Network Attached Storage



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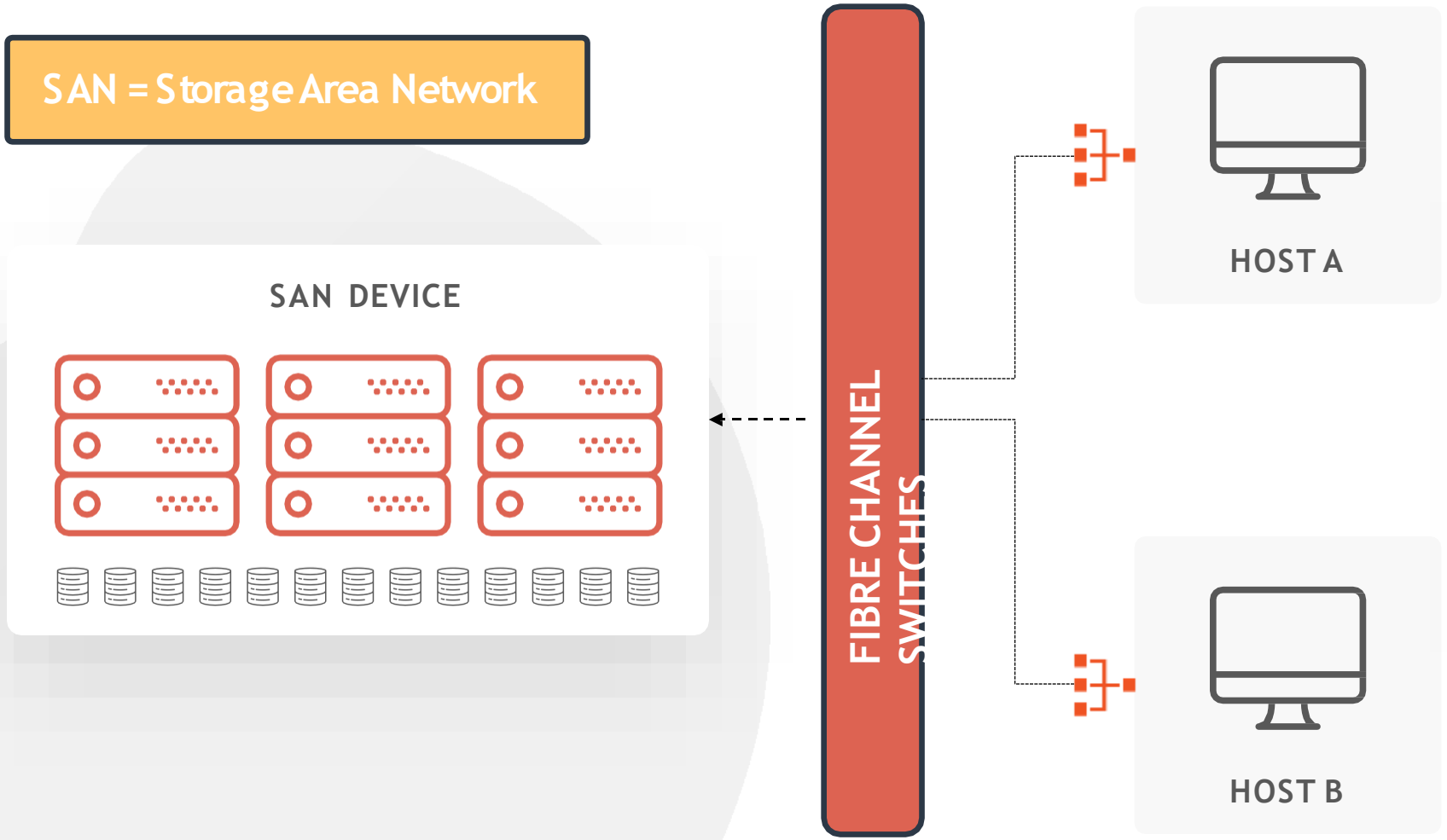
SAN

SAN = Storage Area Network

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Logical Volume Manager

The Linux Basics Course

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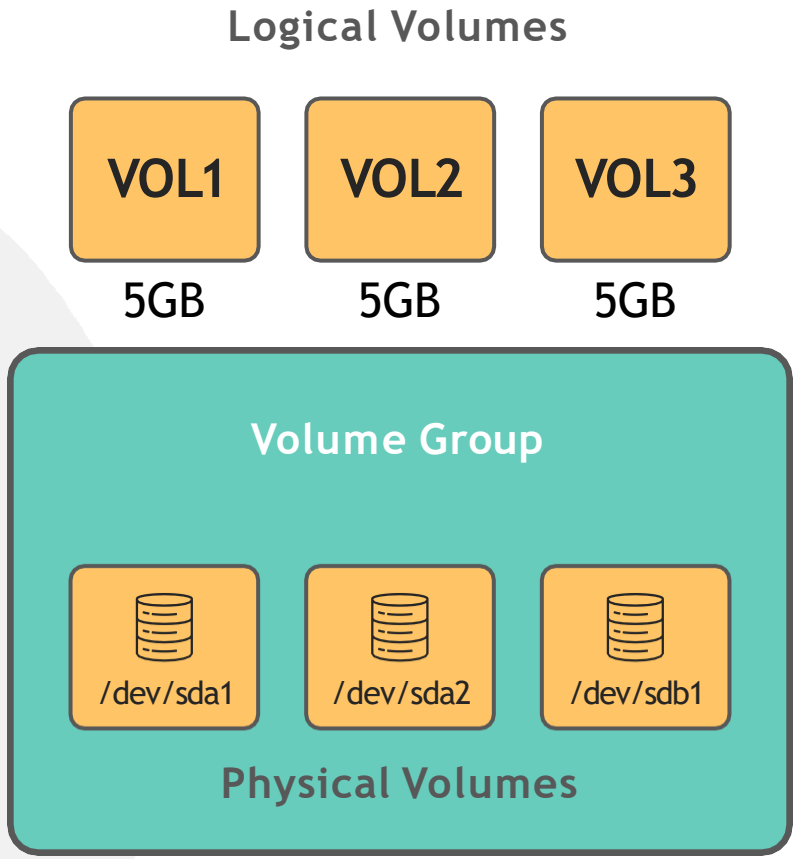
LVM



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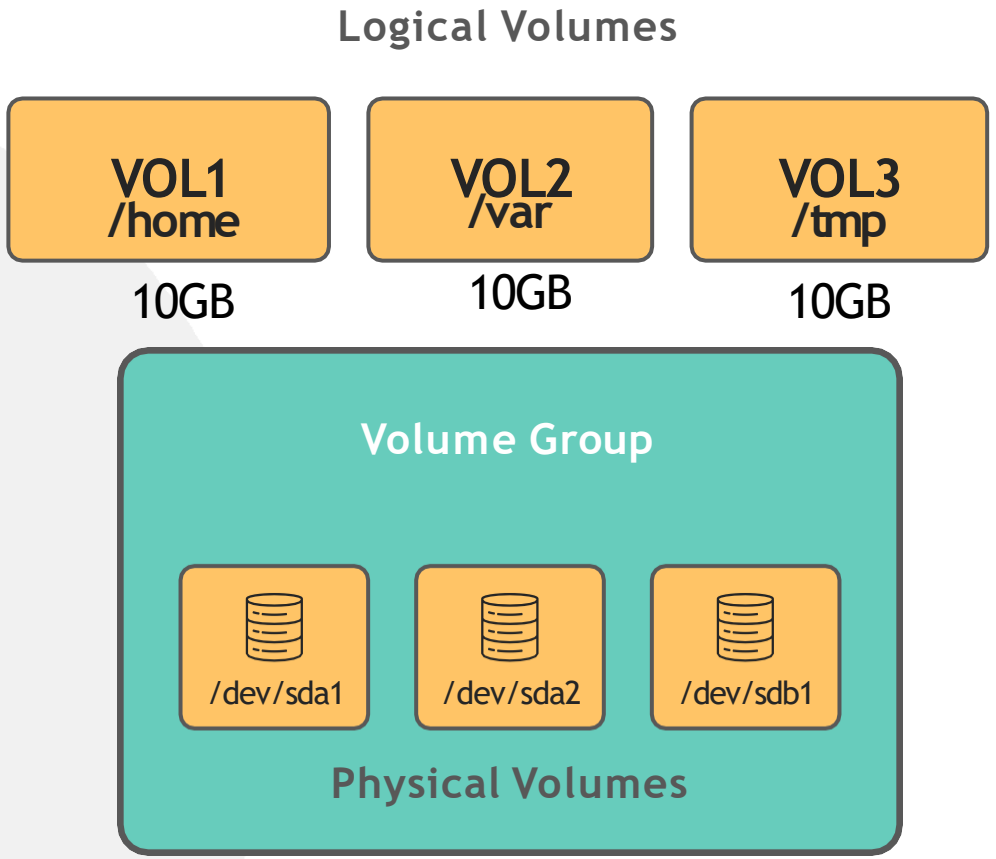
LVM



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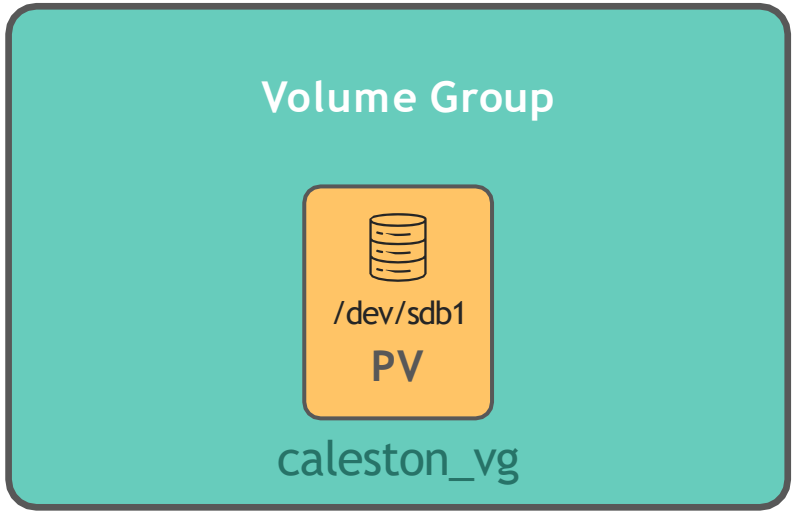
LVM

```
[~]$ apt-get install lvm2
```

```
[~]$ pvcreate /dev/sdb
Physical volume "/dev/sdb" successfully created
```

```
[~]$ vgcreate  caleston_vg /dev/sdb
Volume group "caleston_vg" successfully created
```

```
[~]$ pvdisplay
--- Physical volume ---
  PV Name               /dev/sdb
  VG Name               caleston_vg
  PV Size               20.00 GiB / not usable 3.00 MiB
  Allocatable           yes
  PE Size               4.00 MiB
  Total PE              5119
  Free PE               5119
  Allocated PE          0
  PV UUID               iDCXIN-En2h-5ilJ-Yjqv-GcsR-gDfV-zaf66E
```



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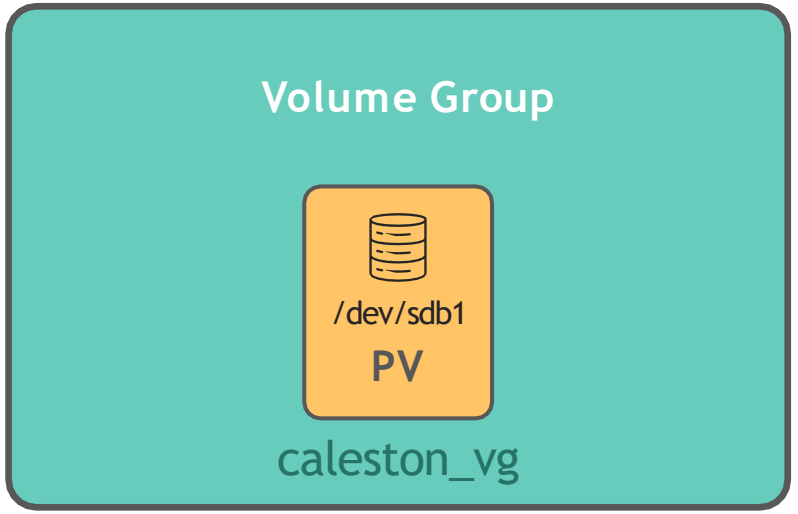
```
[~]$  vgdisplay
--- Volume group ---
  VG Name               caleston_vg
  System ID
  Format                lvm2
  Metadata Areas        1
  Metadata Sequence No  1
  VG Access             read/write
  VG Status             resizable
  MAX LV                0
  Cur LV                0
  Open LV               0
  Max PV                0
  Cur PV                1
  Act PV                1
  VG Size               20.00 GiB
  PE Size               4.00 MiB
  Total PE              5119
  Alloc PE / Size       0 / 0
  Free  PE / Size       5119 / 20.00 GiB
  VG UUID               VzmIAn-9cEl5bA-lVtm-wHKX-KQaObR
```



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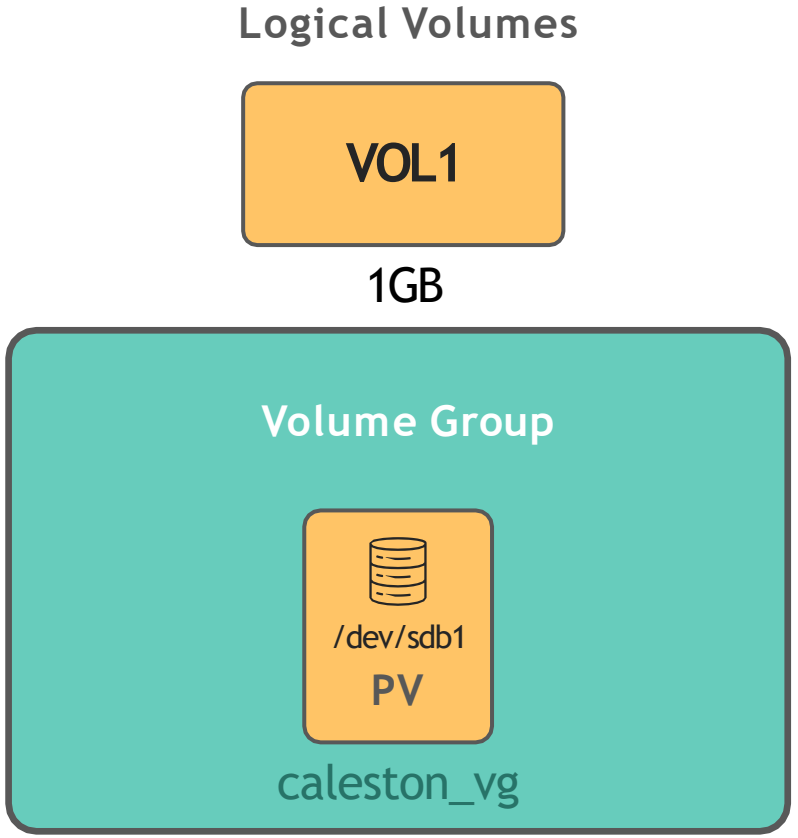
LVM

```
[~]$ lvcreate -L 1G -n vol1 caleston_vg
Logical volume "vol1" created.
```

```
[~]$ lvdisplay
--- Logical volume ---
  LV Path                /dev/caleston_vg/vol1
  LV Name                vol1
  VG Name                caleston_vg
  LV UUID                LueYC3-VWpE31-UaYk-wjIR-FjAOyL
  LV Write Access        read/write
  LV Creation host, time master, 2020-03-31 06:26:14
  LV Status              available
  # open                 0
  LV Size                1.00 GiB
  Current LE             256
  Segments               1
  Allocation             inherit
  Read ahead sectors     auto
  - currently set to     256
  Block device           252:0
```

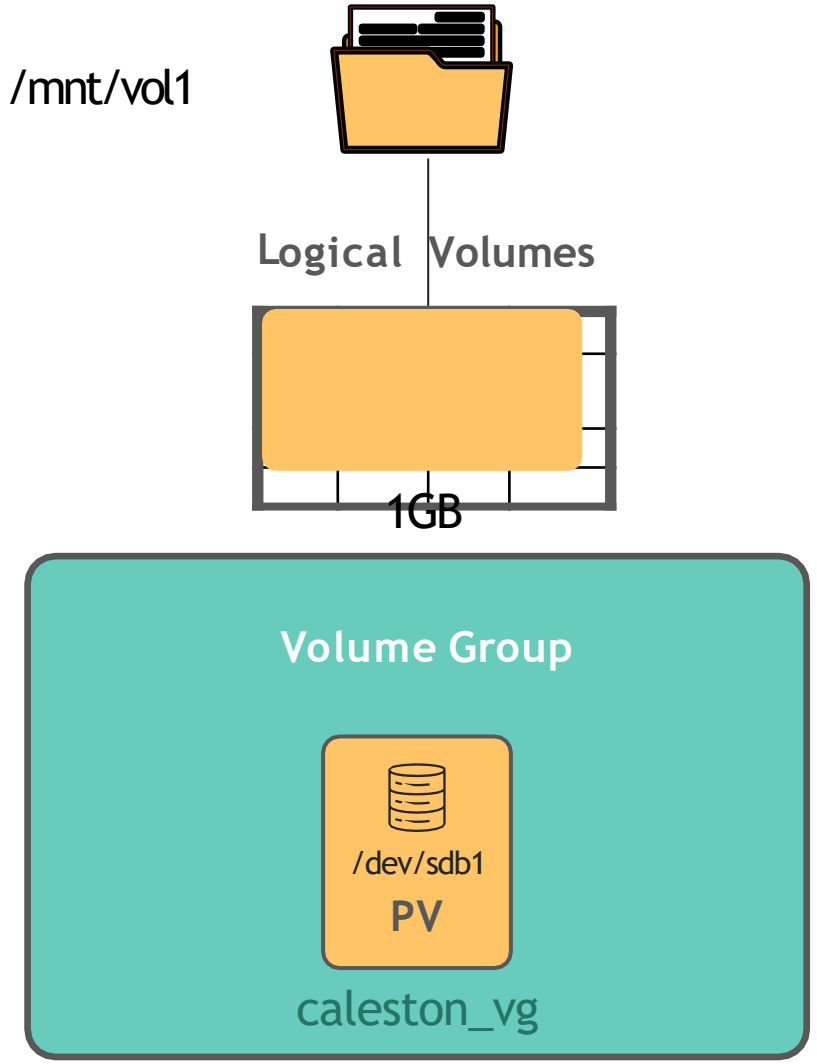


```
[~]$ lvs
 LV   VG          Attr       LSize Pool
 vol1 caleston_vg -wi-a----- 1.00g
```

```
[~]$ mkfs.ext4 /dev/caleston_vg/vol1
 mke2fs 1.42.13 (17-May-2015)
Creating filesystem with 262144 4k blocks and 65536 inodes
Filesystem UUID: 3ba95aaa-5f1a-417e-8baf-91b1233999b5
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376

Allocating group tables: done
Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information:
done
```

```
[~]$ mount -t ext4 /dev/caleston_vg/vol1 /mnt/vol1
```



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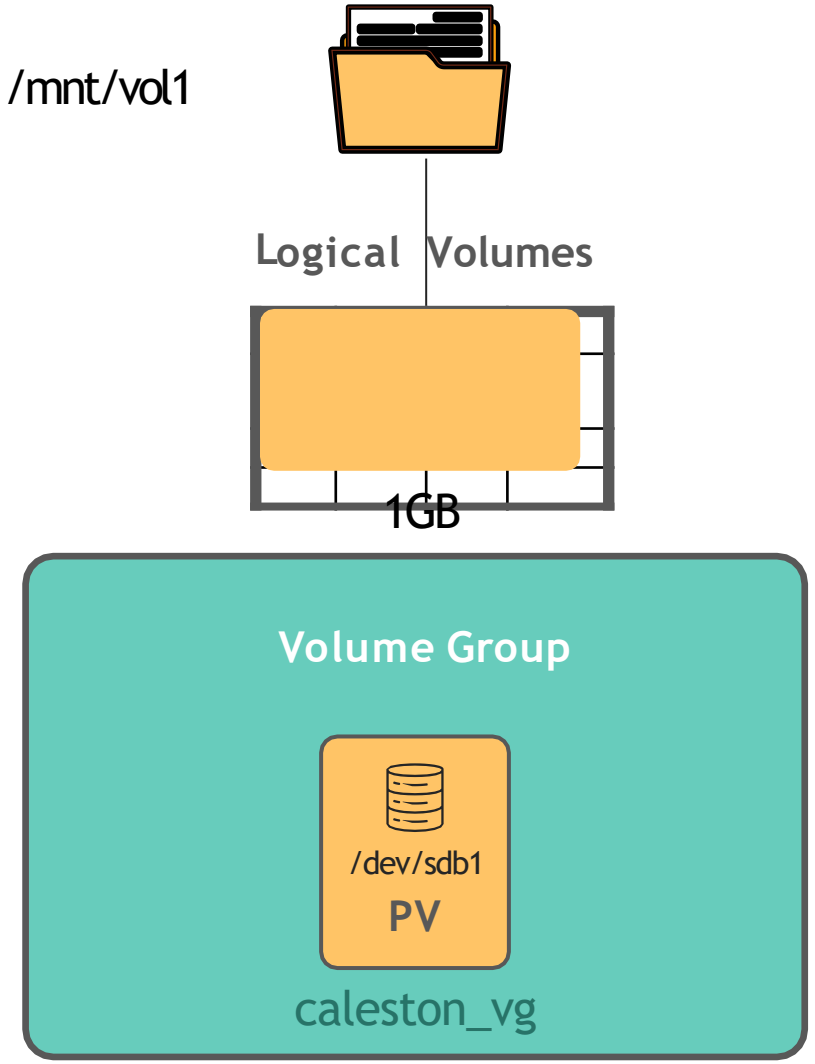
LVM

```
[~]$ vgs
VG          #PV #LV #SN Attr   VSize  VFree
caleston_vg   1   1   0 wz--n- 20.00g 19.00g
```

```
[~]$ lvresize -L +1G -n /dev/caleston_vg/vol1
Logical volume vol1 successfully resized.
```

```
[~]$ df -hP /mnt/vol1
Filesystem                  Size  Used Avail Use% Mounted on
/dev/mapper/caleston_vg-vol1  976M  1.3M  908M   1% /mnt/vol1
```



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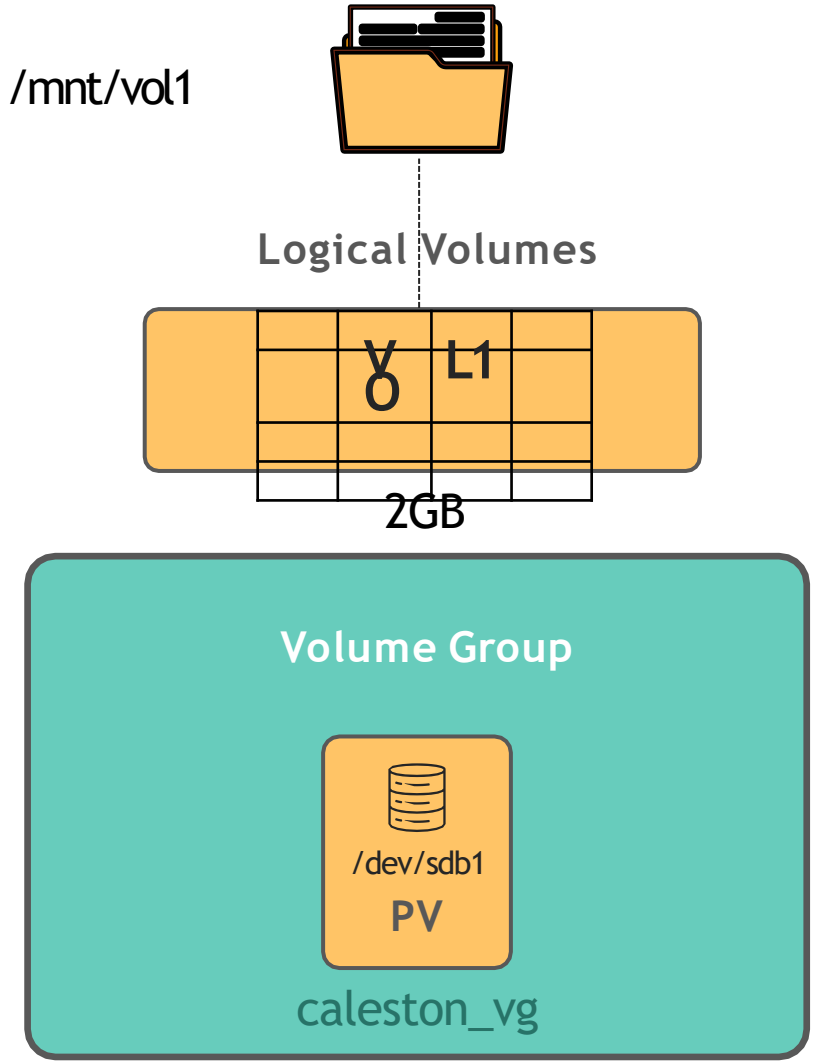
```
[~]$ resize2fs /dev/caleston_vg/vol1
resize2fs 1.42.13 (17-May-2015)
Filesystem at /dev/mapper/caleston_vg-vol1 is mounted on
/mnt/vol1; on-line resizing required
old_desc_blocks = 1, new_desc_blocks = 1
The filesystem on /dev/mapper/caleston_vg-vol1 is now 524288
(4k) blocks long.
```



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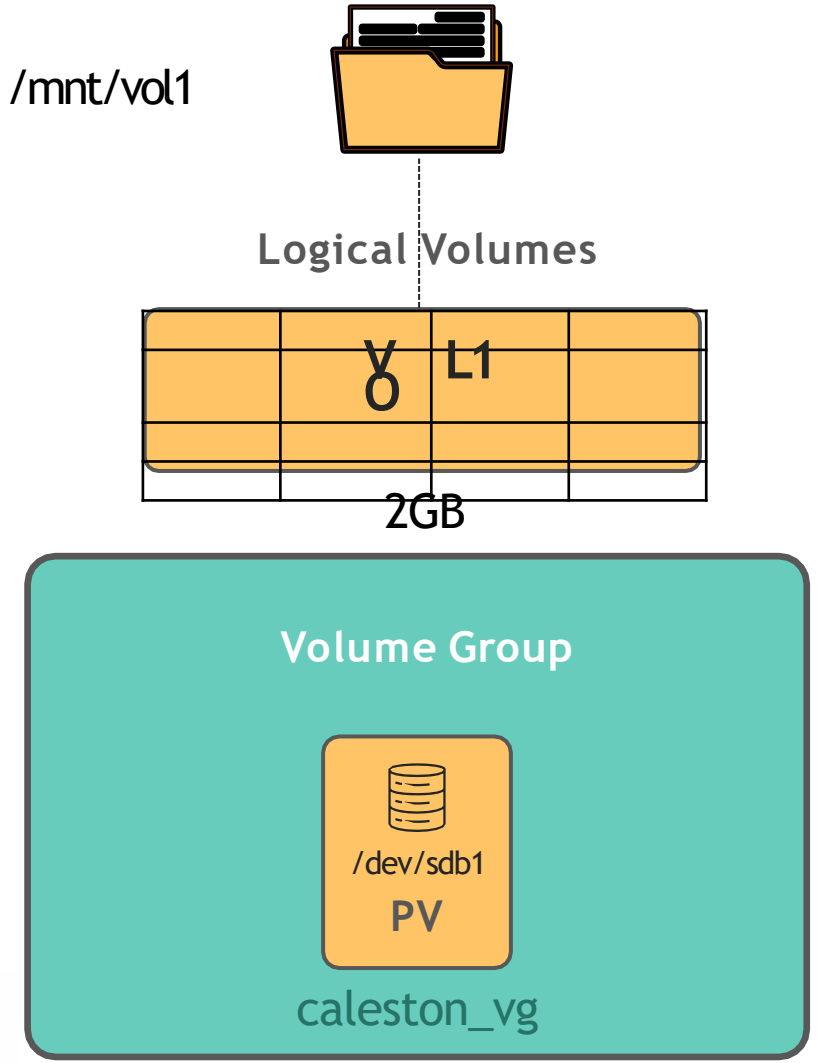
```
[~]$ resize2fs /dev/caleston_vg/vol1
resize2fs 1.42.13 (17-May-2015)
Filesystem at /dev/mapper/caleston_vg-vol1 is mounted on
/mnt/vol1; on-line resizing required
old_desc_blocks = 1, new_desc_blocks = 1
The filesystem on /dev/mapper/caleston_vg-vol1 is now 524288
(4k) blocks long.
```

```
[~]$ df -hP /mnt/vol1
Filesystem                      Size  Used Avail Use% Mounted on
/dev/mapper/caleston_vg-vol1    2.0G  1.6M  1.9G   1% /mnt/vol1
```

Logical Volume	Filesystem Path
vol1	/dev/caleston_vg/vol1



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SYSTEMD and Service Management

The Linux Basics Course

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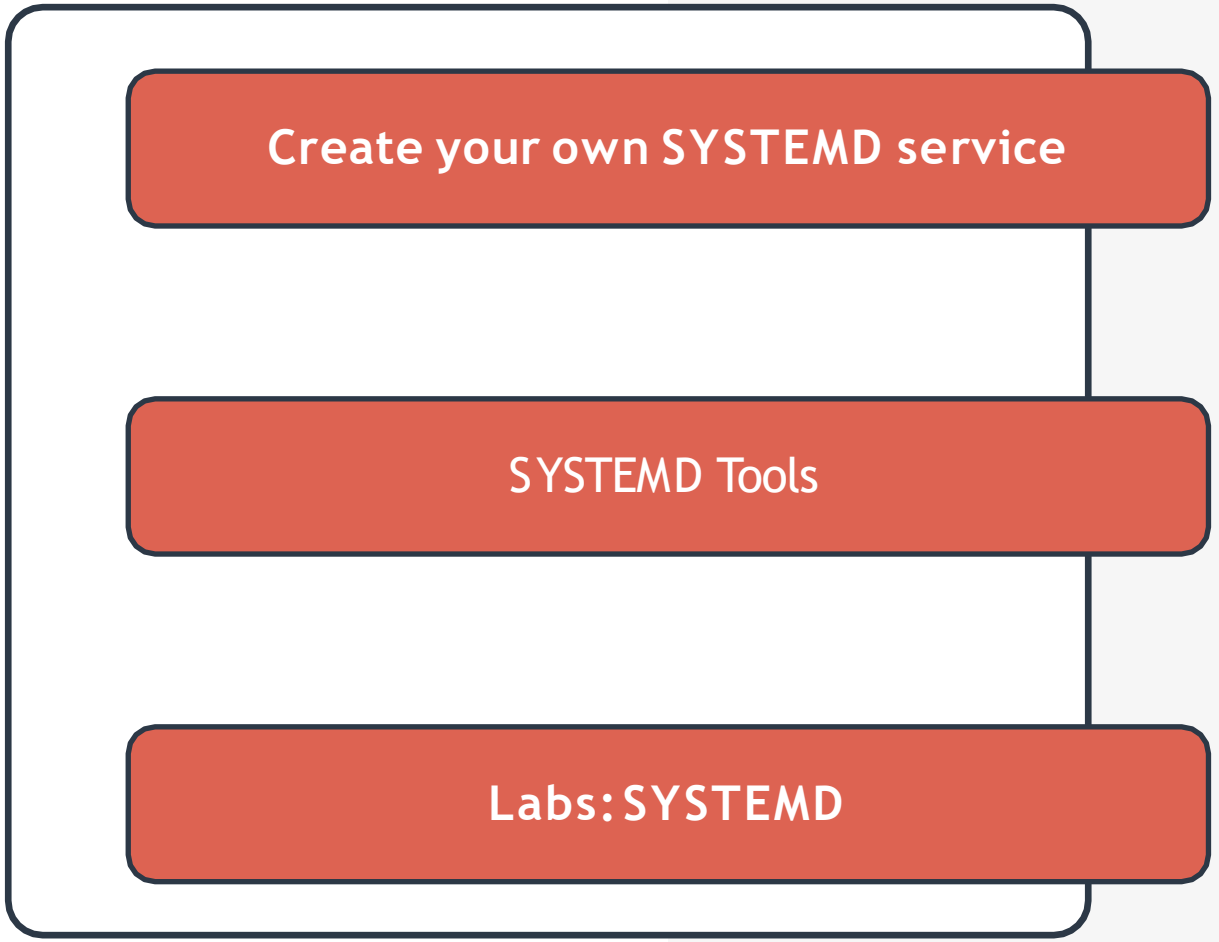
SYSTEMD
and Services



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Introduction to SYSTEMD

Program - /usr/bin/project-mercury.sh

Start Python Application after Postgres DB

Use Service Account project_mercury

Auto Restart on Failure

Restart Interval 10 seconds

Log Service Events

Load when booting into Graphical Mode

KODEKLOUD

Introduction to SYSTEMD

```
[~]$ /usr/bin/project-mercury.sh
```

Program - /usr/bin/project-mercury.sh

Start Python Application after Postgres DB

Use Service Account project_mercury

Auto Restart on Failure

Restart Interval 10 seconds

Log Service Events

Load when booting into Graphical Mode

/etc/systemd/system/project-mercury.service

```
[Service]
ExecStart=
```

```
[~]$ systemctl start project-mercury.service
```

```
[~]$ systemctl status project-mercury.service
● project-mercury.service
   Loaded: loaded (/etc/systemd/system/ report-manager;
static; vendor preset: enabled)
   Active: active (running) Fri 2020-04-10 00:52:16 EDT; 6min
 ago Main PID: 25041 (project-mercury.sh)
    Tasks: 2 (limit: 4915)
   CGroup: /system.slice/ project-mercury.service
           ├─ 6494 sleep 60
           └─25041 /bin/bash /usr/bin/project-mercury.sh
```

```
[~]$ systemctl stop project-mercury.service
```

KODEKLOUD

Introduction to SYSTEMD

- Program - /usr/bin/project-mercury.sh
- Start Python Application after Postgres DB
- Use Service Account project_mercury
- Auto Restart on Failure
- Restart Interval 10 seconds
- Log Service Events
- Load when booting into Graphical Mode

/etc/systemd/system/project-mercury.service

```
[Service]
ExecStart=/usr/bin/project-
mercury.sh
[Install]
WantedBy=graphical.target
```

KODEKLOUD

Introduction to SYSTEMD

- Program - /usr/bin/project-mercury.sh
- Start Python Application after Postgres DB
- Use Service Account project_mercury
- Auto Restart on Failure
- Restart Interval 10 seconds
- Log Service Events
- Load when booting into Graphical Mode

/etc/systemd/system/project-mercury.service

```
[Service]
ExecStart=/usr/bin/project-
mercury.sh
User=project_mercury
Restart=on-failure
RestartSec=10

[Install]
WantedBy=graphical.target
```

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Introduction to SYSTEMD

- Program - /usr/bin/project-mercury.sh
- Start Python Application after Postgres DB
- Use Service Account project_mercury
- Auto Restart on Failure
- Restart Interval 10 seconds
- Log Service Events
- Load when booting into Graphical Mode

/etc/systemd/system/project-mercury.service

```
[Unit]
Description=Python Django for Project Mercury
Documentation=http://wiki.caleston-dev.ca/mercury
After=postgresql.service

[Service]
ExecStart=/usr/bin/project-mercury.sh
User=project_mercury
Restart=on-failure
RestartSec=10

[Install]
WantedBy=graphical.target
```

```
[~]$ systemctl daemon-reload
```

```
[~]$ systemctl start project-mercury.service
```

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Introduction to SYSTEMD

- Program - /usr/bin/project-mercury.sh
- Start Python Application after Postgres DB
- Use Service Account project_mercury
- Auto Restart on Failure
- Restart Interval 10 seconds
- Log Service Events
- Load when booting into Graphical Mode

/etc/systemd/system/project-mercury.service

```
[Unit]
Description=Python Django for Project Mercury
Documentation=http://wiki.caleston-dev.ca/reported

After=postgresql.service
[Service]
ExecStart=/usr/bin/project-mercury.sh
User=project_mercury


Restart=on-failure


RestartSec=10









[Install]
WantedBy=graphical.target
```


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SYSTEMD Tools

The Linux Basics Course

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SYSTEMD TOOLS

SYSTEMCTL

- MANAGE SYSTEM STATE
- START/STOP/RESTART/RELOAD
- ENABLE/DISABLE
- LIST AND MANAGE UNITS
- LIST AND UPDATE TARGETS

JOURNALCTL

- QUERY SYSTEMD JOURNAL

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Service Management with SYSTEMD

```
[~]$ systemctl start docker
```

```
[~]$ systemctl stop docker
```

```
[~]$ systemctl restart docker
```

```
[~]$ systemctl reload docker
```

```
[~]$ systemctl enable docker
```

```
[~]$ systemctl disable docker
```

```
[~]$ systemctl status docker
● docker.service - Docker Application Container Engine
   Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled)
   Active: active (running) since Sat 2020-03-21 00:45:22 EDT; 43s ago
     Docs: https://docs.docker.com
 Main PID: 23340 (dockerd)
    Tasks: 18
   CGroup: /system.slice/docker.service
           └─23340 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock

Mar 21 00:45:21 bob-Bionic dockerd[23340]: time="2020-03-21T00:45:21.628503806-04:00" level=warning msg="Your kernel does not
Mar 21 00:45:21 bob-Bionic dockerd[23340]: time="2020-03-21T00:45:21.628577159-04:00" level=warning msg="Your kernel does not
Mar 21 00:45:21 bob-Bionic dockerd[23340]: time="2020-03-21T00:45:21.628602304-04:00" level=warning msg="Your kernel does not
Mar 21 00:45:21 bob-Bionic dockerd[23340]: time="2020-03-21T00:45:21.629107909-04:00" level=info msg="Loading containers: sta
Mar 21 00:45:21 bob-Bionic dockerd[23340]: time="2020-03-21T00:45:21.827189816-04:00" level=info msg="Default bridge (docker0
Mar 21 00:45:22 bob-Bionic dockerd[23340]: time="2020-03-21T00:45:22.032716885-04:00" level=info msg="Loading containers: don
Mar 21 00:45:22 bob-Bionic dockerd[23340]: time="2020-03-21T00:45:22.134167743-04:00" level=info msg="Docker daemon" commit=6
Mar 21 00:45:22 bob-Bionic dockerd[23340]: time="2020-03-21T00:45:22.140093558-04:00" level=info msg="Daemon has completed in
Mar 21 00:45:22 bob-Bionic dockerd[23340]: time="2020-03-21T00:45:22.188345103-04:00" level=info msg="API listen on /var/run/
Mar 21 00:45:22 bob-Bionic systemd[1]: Started Docker Application Container Engine.
```

STATE	Meaning
Active	Service Running
Inactive	Service Stopped
Failed	Crashed/Error/Timeout e.t.c

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SERVICE MANAGEMENT WITH SYSTEMD

```
[~]$ systemctl daemon-reload
```

```
[~]$ systemctl edit project-mercury.service --full
```

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SYSTEMCTL TO MANAGE STATE

```
[~]$ systemctl get-default
```

```
[~]$ systemctl set-default multi-user.target
```

```
[~]$ systemctl list-units --all
```

```
UNIT                                                    LOAD      ACTIVE   SUB       JOB   DESCRIPTION

  network.target                                        loaded    active   active          Network
  nss-lookup.target                                     loaded    active   active          Host and Network Name Look
  nss-user-lookup.target                                loaded    active   active          User and Group Name Lookup
  paths.target                                          loaded    active   active          Paths
  remote-fs-pre.target                                  loaded    inactive dead            Remote File Systems (Pre)
  remote-fs.target                                      loaded    active   active          Remote File Systems
  rescue.target                                         loaded    inactive dead            Rescue Mode
  shutdown.target                                       loaded    inactive dead            Shutdown
```

```
[~]$ systemctl list-units
```

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JOURNALCTL

```
[~]$ journalctl
```

```
[~]$ journalctl -b
```

```
[~]$ journalctl -u UNIT
```

```
[~]$ journalctl -u docker.service
-- Logs begin at Fri 2020-03-13 19:47:52 EDT, end at Sat 2020-03-21 02:29:48 EDT. --
Mar 19 17:43:21  systemd[1]: Starting Docker Application Container Engine...
Mar 19 17:43:22  dockerd[2590]: level=info msg="Starting up"
Mar 19 17:43:22 dockerd[2590]: level=info msg="ClientConn switching bal
Mar 19 17:43:22 dockerd[2590]: level=warning msg="[graphdriver] WARNING
Mar 19 17:43:22 dockerd[2590]: level=warning msg="Usage of loopback dev
Mar 19 17:43:22 dockerd[2590]: level=warning msg="Base device already e
Mar 19 17:43:23 dockerd[2590]: level=info msg="Default bridge (docker0)
Mar 19 17:43:23 dockerd[2590]: level=info msg="Loading containers: done
Mar 19 17:43:23 dockerd[2590]: level=info msg="Docker daemon" commit=63
Mar 19 17:43:23 dockerd[2590]: level=info msg="Daemon has completed ini
Mar 19 17:43:23 dockerd[2590]: level=info msg="API listen on /var/run/d
Mar 19 17:43:23 systemd[1]: Started Docker Application Container Engine.
```

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HANDS-ON LABS


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