

Getting Started



{KODE} {LOUD}

www.kodekloud.com

The DevOps Pre-Requisite Course

2 ЭТАП

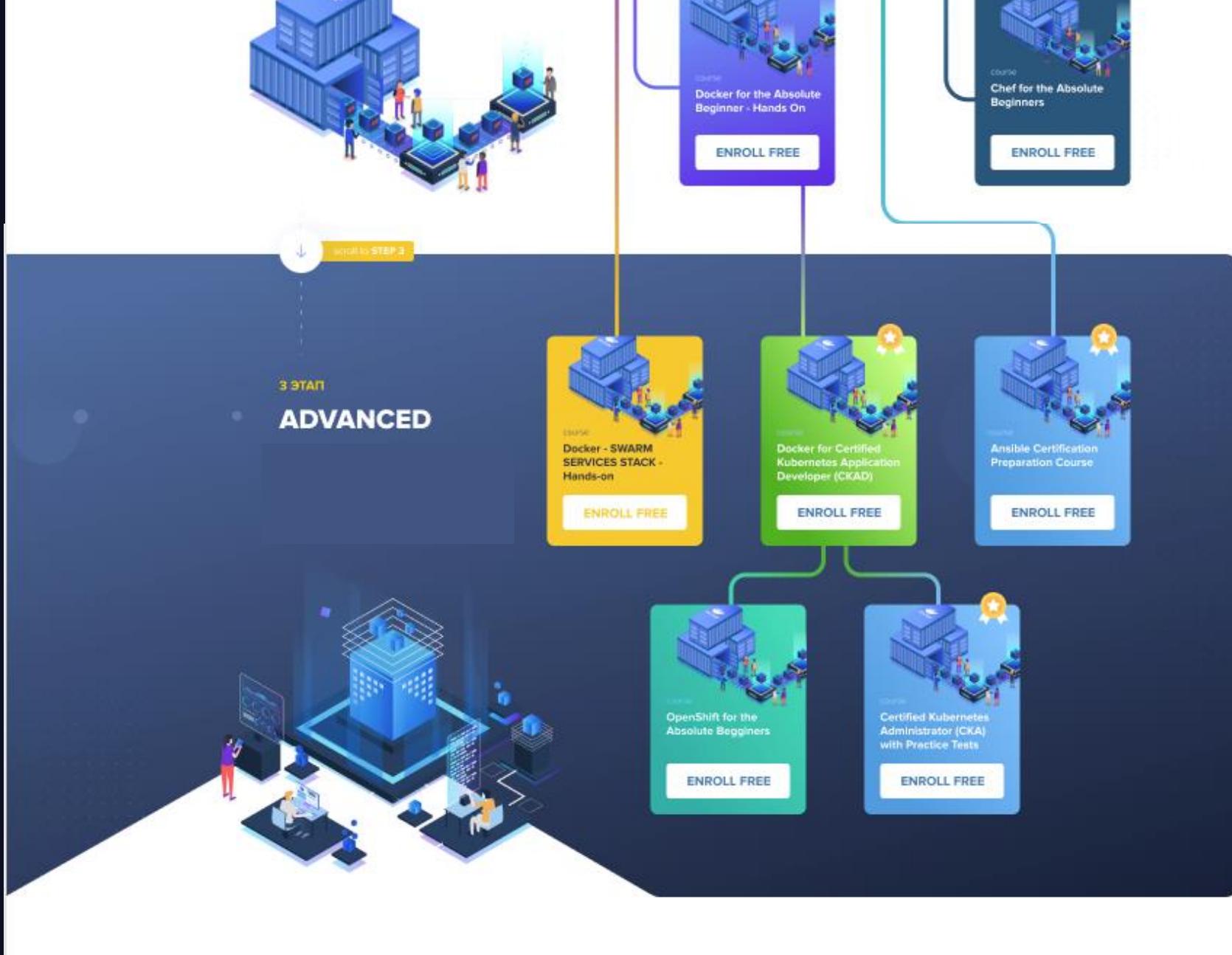
BEGINNERS



3 ЭТАП

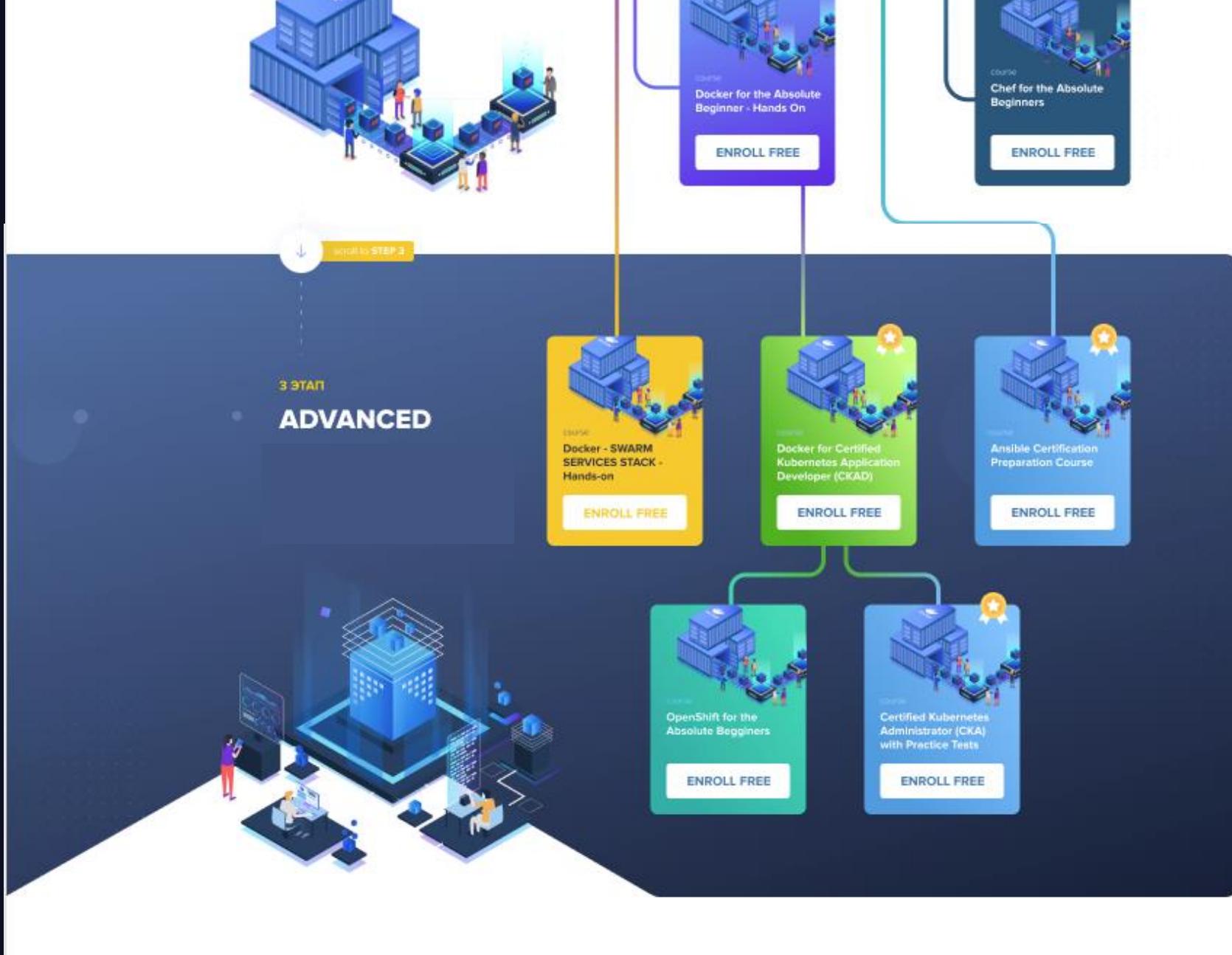
ADVANCED





Common Challenges

- Issues with setting up a basic lab
- Issues with connecting to VMs
- Trouble with navigating Linux CLI
- No experience working with text editors
- Errors during installation of application/dependencies
 - Applications – Java, Python, NodeJS
 - Web Servers – Apache, NGINX
 - Databases – MySQL, MongoDB
- Issues with networking between VMs
- Trouble navigating JSON or YAML files



DevOps Pre-Requisite

The screenshot shows the KodeKloud website interface. At the top, there is a navigation bar with the KodeKloud logo, Pricing, Tech Support, Contact Us, Blog, and Login options. Below the navigation bar, the main content area features a large banner with the text "1 ЭТАП" and "GET YOUR BASICS RIGHT". A purple downward arrow points to the next section. The text "2 ЭТАП" and "BEGINNERS" is displayed above three course cards. Each card has a title, a small icon, and an "ENROLL FREE" button. The courses are categorized under "CONTAINERS" and "AUTOMATION (IAC)".

1 ЭТАП

**GET YOUR
BASICS RIGHT**

2 ЭТАП

BEGINNERS

CONTAINERS

Docker for the Absolute Beginner - Hands On

ENROLL FREE

AUTOMATION (IAC)

Ansible for the Absolute Beginners

ENROLL FREE

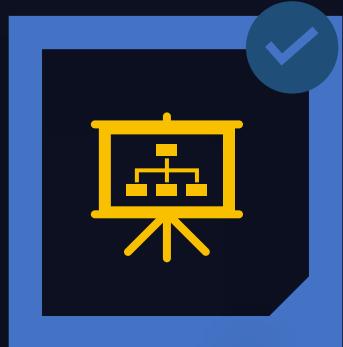
Puppet for the Absolute Beginners - Hands-on - DevOps

ENROLL FREE

Who is this course for?

- ANYONE who wants to start DevOps or Cloud Journey
- Non-IT Background or No Computer Science Degree
- College Students
- Developers trying to learn the basics of Operations
- Operations trying to learn the basics of Development
- Working in IT without a CS Degree

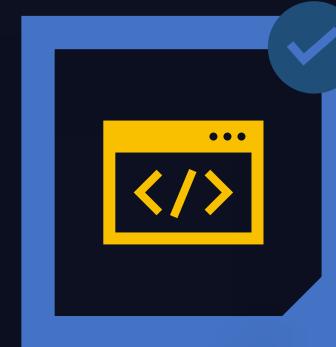
Course Features



VISUAL LEARNING



DEMOS



HANDS-ON LABS



COMMUNITY SUPPORT



Terminal

localhost:80...

localhost:90...

localhost:80

localhost:30...

localhost:50...

+

thor@host01 /\$

01 02 03 04 05

10:22

Which java version is installed on host01 server?

1.8.0_24

13.0.1

13.0.2

11.0.0

1.7

i Hint

logs

[All Courses](#) [Home](#) [Pricing](#)[all categories ▶](#)[Categories](#)[Latest](#)[New \(10\)](#)[Unread \(17\)](#)[Top](#)[+ New Topic](#)

Category

Topics

Latest

Uncategorized

Topics that don't need a category, or don't fit into any other existing category.

67 / month

1 unread

1 new

KodeKloud Engineer



Welcome to the
[KodeKloud Engineer](#)
Community!

168 / month

9 unread

9 new

Docker for Beginners



Welcome to the Docker for Beginners Category. Feel free to post your queries on the Docker for the Absolute Beginners course here.

8 / month

2 unread



Deploy WebApplication : Not able to copy files from jumphost to other servers

1

2h



Bonus points bug

1

[KodeKloud Engineer](#)

20

3h



No Task Assigned Till Now Today

2

16

4h



Linux Resource Limits II task failed

8

[KodeKloud Engineer](#)

5h



BonusPonitsRemoved

4

7h



Task failed Firewalld

•

1

8h



Install / configure mariadb

5

in Worldwide

Jobs ▾ Sort by ▾ Date Posted ▾ LinkedIn Features ▾

Devops in Worldwide
122,547 results

 **Junior DevOps Engineer** Promoted
Comcast
Mount Laurel, NJ, US
 3 alumni work here
58 minutes ago

 **DevOps Specialist** Promoted
UST Global
Midlands Occidental, 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

in Worldwide

Jobs ▾ Sort by ▾ Date Posted ▾ LinkedIn Features ▾

Cloud in Worldwide
381,406 results

 **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 Occidental, Inglaterra, Reino Unido



23 connections work here

1 hour ago · [in](#) 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** · [in](#) 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

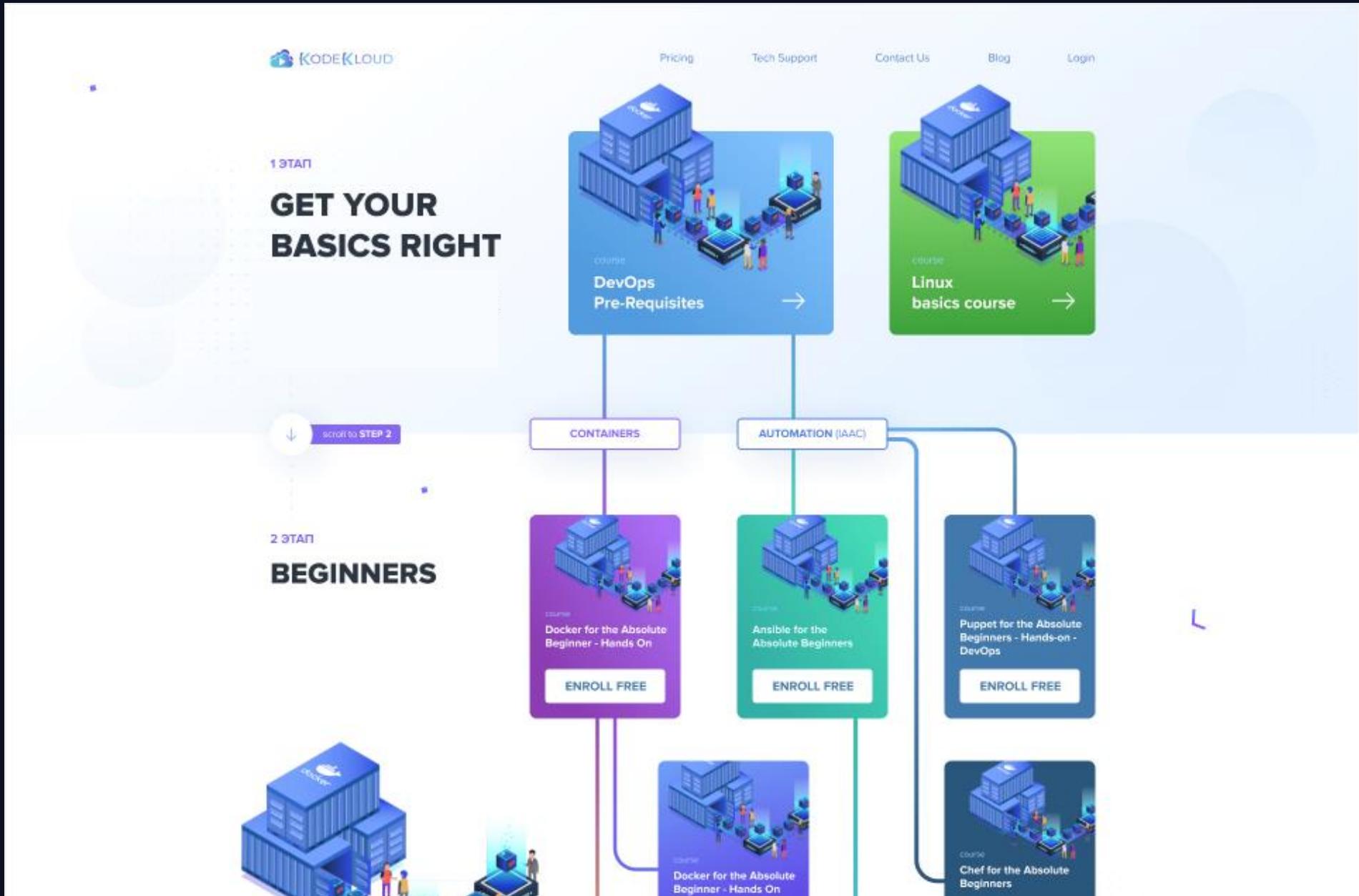
National Australia Bank

Melbourne, Victoria, Australia



6 connections work here

6 hours ago



Curriculum



CURRICULUM



LINUX BASICS

SETUP LAB ENVIRONMENT

LINUX NETWORKING BASICS

SCM BASICS (GIT)

APPLICATION BASICS

WEB SERVERS

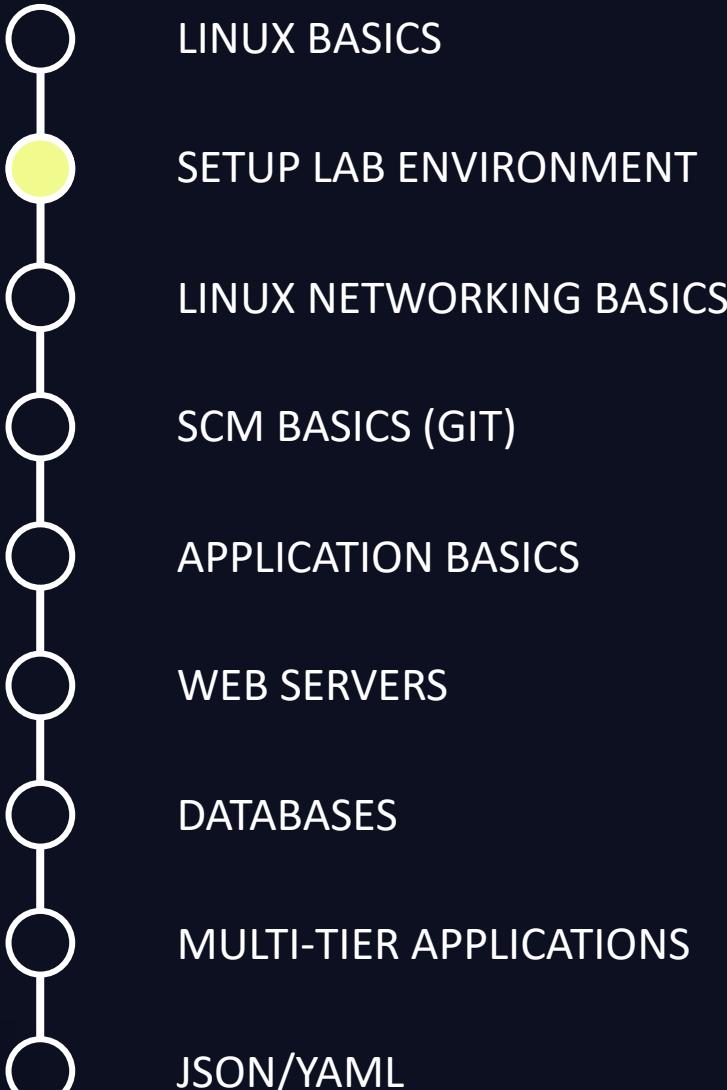
DATABASES

MULTI-TIER APPLICATIONS

JSON/YAML

- Linux CLI
- VI Editor
- Package Management
- Service Management

CURRICULUM



- Setup Labs – Laptop or Cloud
- VirtualBox
 - Deploying VMs
 - Multiple VMs
 - Networking and Troubleshooting Network
 - Snapshots and Restore VMs
- Vagrant Basics

CURRICULUM



LINUX BASICS

SETUP LAB ENVIRONMENT

LINUX NETWORKING BASICS

SCM BASICS (GIT)

APPLICATION BASICS

WEB SERVERS

DATABASES

MULTI-TIER APPLICATIONS

JSON/YAML

- Interfaces
- IP Addresses
- Routing
- DNS

CURRICULUM



LINUX BASICS

SETUP LAB ENVIRONMENT

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SCM BASICS (GIT)

APPLICATION BASICS

WEB SERVERS

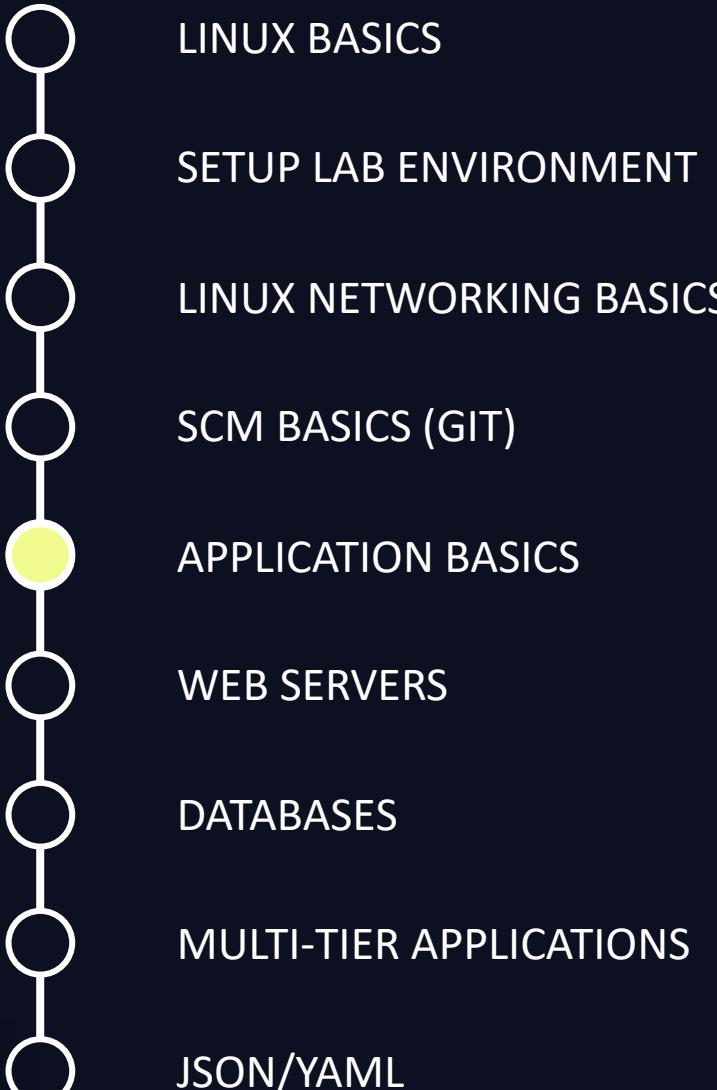
DATABASES

MULTI-TIER APPLICATIONS

JSON/YAML

- Install GIT
- GIT Repositories
- Clone source code with GIT
- Make and commit changes
- Push source code

CURRICULUM



- Who is this for?
 - Non-Developers
- Different types of applications
 - Python
 - NodeJS
 - Java
- Building and Deploying them
- Troubleshooting Applications
- Labs

CURRICULUM



LINUX BASICS

SETUP LAB ENVIRONMENT

LINUX NETWORKING BASICS

SCM BASICS (GIT)

APPLICATION BASICS

WEB SERVERS

DATABASES

MULTI-TIER APPLICATIONS

JSON/YAML

- Web Frameworks
- Web Servers
- Apache HTTPD
- NGINX
- Python - Gunicorn
- NodeJS – PM2
- IPs and Ports
- SSL and TLS Security

CURRICULUM



LINUX BASICS

SETUP LAB ENVIRONMENT

LINUX NETWORKING BASICS

SCM BASICS (GIT)

APPLICATION BASICS

WEB SERVERS

DATABASES

MULTI-TIER APPLICATIONS

JSON/YAML

- Who is this for?
 - Non-Developers
- Different types of databases
 - MySQL
 - MongoDB
- Web Server connectivity

CURRICULUM



LINUX BASICS

SETUP LAB ENVIRONMENT

LINUX NETWORKING BASICS

SCM BASICS (GIT)

APPLICATION BASICS

WEB SERVERS

DATABASES

MULTI-TIER APPLICATIONS

JSON/YAML

KODEKLOUD

Laptops Drones Gadgets Phones VR Contact us

Product List



Macbook Pro
Purchase MB at the lowest price 100\$



Drone
Purchase Multifunctional drones 200\$



VR
Explore our VR Devices



Macbook air
Purchase MB at the lowest price 500\$



CURRICULUM

- LINUX BASICS
- SETUP LAB ENVIRONMENT
- LINUX NETWORKING BASICS
- SCM BASICS (GIT)
- APPLICATION BASICS
- WEB SERVERS
- DATABASES
- MULTI-TIER APPLICATIONS
- JSON/YAML

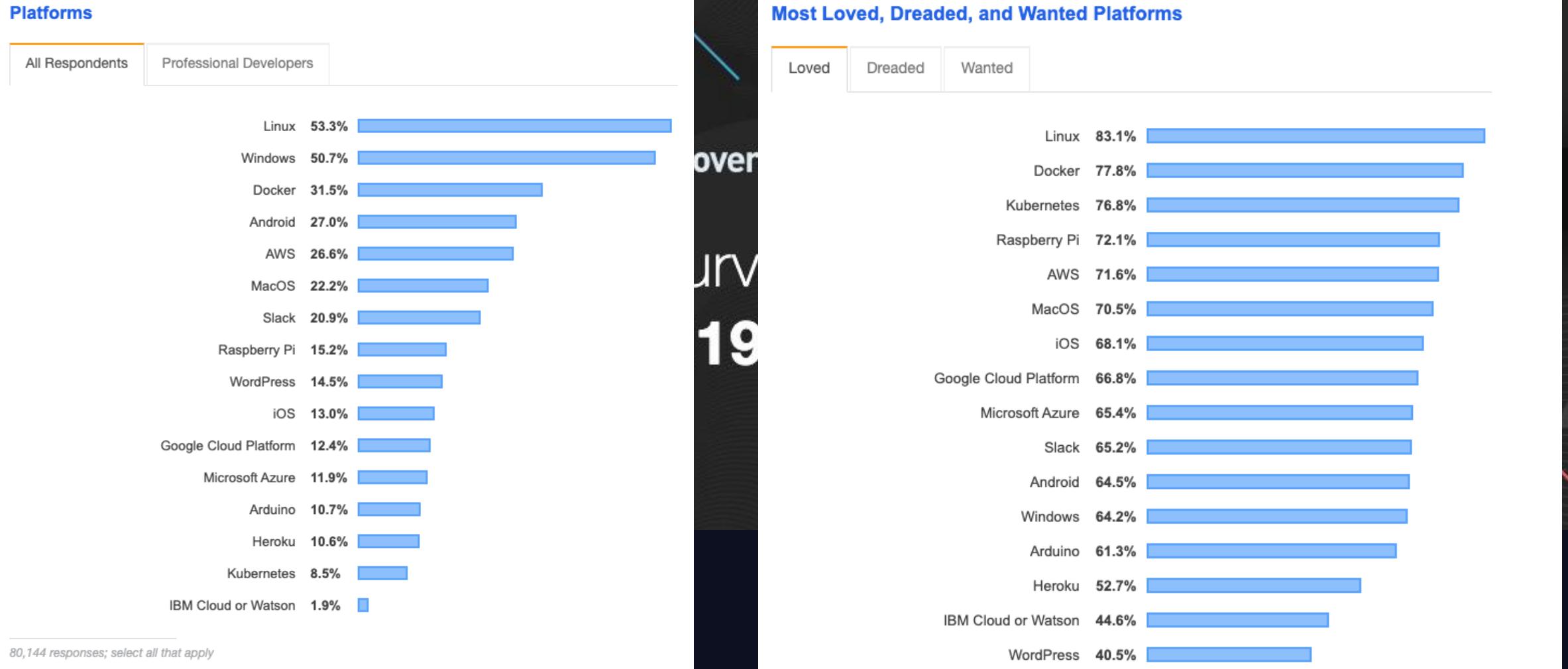


just enough

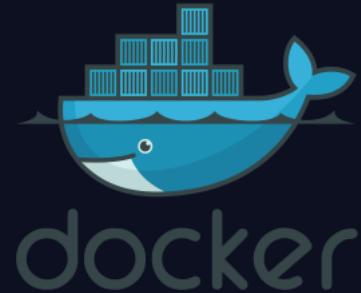


LINUX

Why Linux?



Why Linux?



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



Can Ansible run on Windows? Ansible 2.0 documentation

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

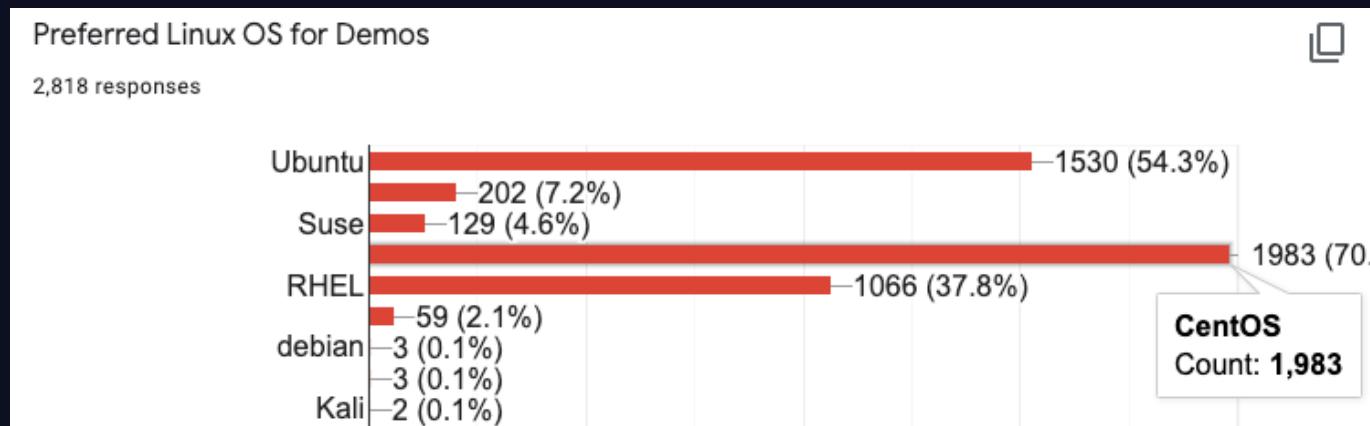


Note: The Kubernetes control plane, including the [master components](#), continues to run on Linux. There are no plans to have a Windows-only Kubernetes cluster.

[Kubernetes Documentation](#)

Linux Basics

- Linux CLI
- VI Editor
- Package Management
- Service Management



*Allowed multiple selections

Linux Basics Course

www.kodekloud.com



just enough



LINUX

Shell Types

```
▶ echo $SHELL  
/bin/bash
```

Bourne Shell (Sh Shell)

C Shell (csh or tcsh)

Z Shell (zsh)

Bourne again Shell (bash)

Basic Commands

```
▶ echo Hi
```

```
Hi
```

Print to screen

```
▶ ls
```

```
File.txt my_dir1 file2.conf
```

List files & folders

```
▶ cd my_dir1
```

Change directory

```
▶ pwd
```

```
/home/my_dir1
```

Present Working Directory

```
▶ mkdir new_directory
```

Make Directory

```
▶ cd new_directory; mkdir www; pwd
```

```
/home/my_dir1/new_directory
```

Multiple commands

Commands - Directories

```
/tmp/asia/india/bangalore
```

```
▶ mkdir /tmp/asia  
▶ mkdir /tmp/asia/india  
▶ mkdir /tmp/asia/india/bangalore
```



```
▶ mkdir -p /tmp/asia/india/bangalore
```

Make Directory Hierarchy

```
▶ rm -r /tmp/my_dir1
```

Remove Directory

```
▶ cp -r my_dir1 /tmp/my_dir1
```

Copy Directory

Commands - Files

```
▶ touch new_file.txt
```

Hi

Create a new file (no contents)

```
▶ cat > new_file.txt
```

This is some sample contents

CTRL + D

Add contents to file

```
▶ cat new_file.txt
```

This is some sample contents

View contents of file

```
▶ cp new_file.txt copy_file.txt
```

Copy File

```
▶ mv new_file.txt sample_file.txt
```

Move (Rename) File

```
▶ rm new_file.txt
```

Remove (Delete) File

Labs

just a bit more



LINUX

User Accounts

```
▶ whoami
```

```
matthew
```



matthew

```
▶ id
```

```
uid=1001(matthew) gid=1001(matthew) groups=1001(matthew)
```

```
▶ su aparna
```

```
Password:
```

```
▶ ssh aparna@192.168.1.2
```

User Accounts

```
▶ ls /root
```

```
ls: cannot open directory /root: Permission denied
```

```
▶ sudo ls /root
```

```
anaconda-ks.cfg initial-setup-ks.cfg
```



matthew



root

SUDO
/etc/sudoers

Download Files

```
▶ curl http://www.some-site.com/some-file.txt -O  
some-file.txt
```

```
▶ wget http://www.some-site.com/some-file.txt -O some-file.txt  
some-file.txt
```

Check OS Version

```
▶ ls /etc/*release*
```

```
/etc/centos-release      /etc/os-release   /etc/system-release  
/etc/centos-release-upstream /etc/redhat-release /etc/system-release-cpe
```

```
▶ cat /etc/*release*
```

```
CentOS Linux release 7.7.1908 (Core)  
Derived from Red Hat Enterprise Linux 7.7 (Source)  
NAME="CentOS Linux"  
VERSION="7 (Core)"  
ID="centos"  
ID_LIKE="rhel fedora"  
VERSION_ID="7"  
PRETTY_NAME="CentOS Linux 7 (Core)"  
ANSI_COLOR="0;31"  
CPE_NAME="cpe:/o:centos:centos:7"  
HOME_URL="https://www.centos.org/"  
BUG_REPORT_URL="https://bugs.centos.org/"
```

- Wget
- Curl
- Cat /etc/*release*

Package Managers

RPM (Red Hat Package Manager)

```
▶ rpm -i telnet.rpm
```

Install Package

```
▶ rpm -e telnet.rpm
```

Uninstall Package

```
▶ rpm -q telnet.rpm
```

Query Package

?
?
?
?



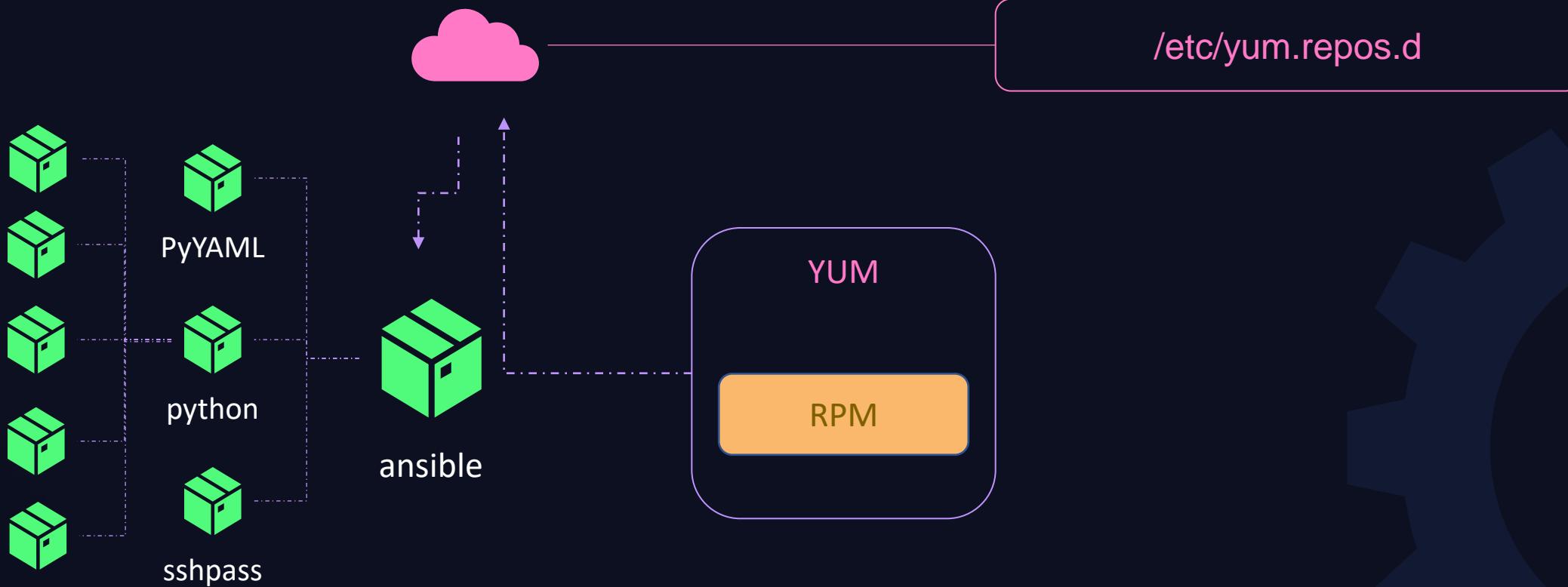
telnet.rpm
ansible

RPM

YUM

▶ `yum install ansible`

Install Package



YUM Repos

The screenshot shows a web browser window with the URL <https://fedoraproject.org/wiki/EPEL>. The page title is "Extra Packages for Enterprise Linux (EPEL)".

Left Sidebar (YUM History):

- repo id: base/7
- extras/mongo
- mysql-*
- mysql-*
- mysql8
- update

Content Area:

Extra Packages for Enterprise Linux (EPEL)

Welcome to the home of the EPEL Special Interest Group.

Quickstart

- epel-release-latest-6
- epel-release-latest-7
- epel-release-latest-8

You may retrieve signed binary configuration files from one the above two links (varying by the major release number) automatically installed by root thus:

- RHEL/CentOS 6:

```
# yum install https://dl.fedoraproject.org/pub/epel/epel-release-latest-6.noarch.rpm
```
- RHEL/CentOS 7:

```
# yum install https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
```

YUM

```
▶ yum list ansible
```

Installed Packages

ansible.noarch 2.9.6-1.el7 @epel

```
▶ yum remove ansible
```

```
▶ yum --showduplicates list ansible
```

Available Packages

| | | |
|----------------|---------------|--------|
| ansible.noarch | 2.4.2.0-2.el7 | extras |
| ansible.noarch | 2.9.6-1.el7 | epel |

```
▶ yum install ansible-2.4.2.0
```

Labs

Services

Services

```
▶ service httpd start
```

Or

```
▶ systemctl start httpd
```

Start HTTPD service

```
▶ systemctl stop httpd
```

Stop HTTPD service

```
▶ systemctl status httpd
```

Check HTTPD service Status

```
▶ systemctl enable httpd
```

Configure HTTPD to start at startup

```
▶ systemctl disable httpd
```

Configure HTTPD to not start at startup

Services

▶ /usr/bin/python3 /opt/code/my_app.py

```
* Serving Flask app "my_app" (lazy loading)
* Environment: production
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

▶ systemctl start my_app

▶ systemctl stop my_app

/etc/systemd/system

▶ curl http://localhost:5000

```
Hello, World!
```

Services

/etc/systemd/system

▶ /usr/bin/python3.8 opt/prototype/app/app.py

```
* Serving Flask app "my_app" (lazy loading)
* Environment: production
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

my_app.service

[Service]

ExecStart=

▶ curl http://localhost:5000

Hello, World!

▶ systemctl daemon-reload

▶ systemctl start my_app

Services

/etc/systemd/system

▶ `systemctl status my_app`

```
● my_app.service
  Loaded: loaded (/etc/systemd/system/my_app.service; static; vendor preset: disabled)
  Active: active (running) since Tue 2020-04-07 09:01:39 UTC; 2s ago
    Main PID: 5038 (python3)
   CGroup: /system.slice/my_app.service
           └─5038 /usr/bin/python3 /tmp/app/my_app.py
```

```
Apr 07 09:01:39 systemd[1]: Started my_app.service.
Apr 07 09:01:39 python3[5038]: * Serving Flask app "my_app" (lazy loading)
Apr 07 09:01:39 python3[5038]: * Environment: production
Apr 07 09:01:39 python3[5038]: WARNING: This is a development server. Do not use it in a produ...ent.
Apr 07 09:01:39 python3[5038]: Use a production WSGI server instead.
Apr 07 09:01:39 python3[5038]: * Debug mode: off
Apr 07 09:01:39 python3[5038]: * Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
Hint: Some lines were ellipsized, use -l to show in full.
```

my_app.service

[Service]

`ExecStart= /usr/bin/python3 /opt/code/my_app.py`

▶ `systemctl daemon-reload`

▶ `systemctl start my_app`

▶ `systemctl stop my_app`

▶ `curl http://localhost:5000`

Hello, World!

Services

/etc/systemd/system

▶ `systemctl status my_app`

```
● my_app.service
  Loaded: loaded (/etc/systemd/system/my_app.service; static; vendor preset: disabled)
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Apr 07 09:01:39 python3[5038]: * Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
Hint: Some lines were ellipsized, use -l to show in full.
```

my_app.service

[Service]

`ExecStart= /usr/bin/python3 /opt/code/my_app.py`

[Install]

`WantedBy=multi-user.target`

▶ `systemctl daemon-reload`

▶ `systemctl start my_app`

▶ `systemctl stop my_app`

▶ `systemctl enable my_app`

▶ `curl http://localhost:5000`

Hello, World!

Services

/etc/systemd/system

▶ `systemctl status my_app`

```
● my_app.service
  Loaded: loaded (/etc/systemd/system/my_app.service; static; vendor preset: disabled)
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Hint: Some lines were ellipsized, use -l to show in full.
```

my_app.service

[Unit]

Description=My python web application

[Service]

ExecStart= /usr/bin/python3 /opt/code/my_app.py

ExecStartPre=/opt/code/configure_db.sh

ExecStartPost=/opt/code/email_status.sh

[Install]

WantedBy=multi-user.target

▶ `curl http://localhost:5000`

Hello, World!

▶ `systemctl daemon-reload`

▶ `systemctl start my_app`

Services

/etc/systemd/system

▶ `systemctl status my_app`

```
● my_app.service
  Loaded: loaded (/etc/systemd/system/my_app.service; static; vendor preset: disabled)
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Apr 07 09:01:39 python3[5038]: * Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
Hint: Some lines were ellipsized, use -l to show in full.
```

my_app.service

[Unit]

Description=My python web application

[Service]

ExecStart= /usr/bin/python3 /opt/code/my_app.py

ExecStartPre=/opt/code/configure_db.sh

ExecStartPost=/opt/code/email_status.sh

Restart=always

[Install]

WantedBy=multi-user.target

▶ `curl http://localhost:5000`

Hello, World!

▶ `systemctl daemon-reload`

▶ `systemctl start my_app`

Service Unit File - Docker

```
/lib/systemd/system/docker.service
```

```
[Unit]
Description=Docker Application Container Engine
Documentation=https://docs.docker.com
BindsTo=containerd.service
After=network-online.target firewalld.service containerd.service
Wants=network-online.target
Requires=docker.socket

[Service]
Type=notify
ExecStart=/usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock
ExecReload=/bin/kill -s HUP $MAINPID
Restart=always
StartLimitBurst=3
StartLimitInterval=60s
LimitNOFILE=infinity
LimitNPROC=infinity
LimitCORE=infinity

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

Labs

VI Editor

Working with Files

► cat > index.html

```
<!DOCTYPE html>
<html>
<body>

<h1>The VIM Poem</h1>

<p>The wise man said just walk this way</p>
<p>To the dawn of the light</p>
<p>The wind will blow into your face</p>
<p>As the years pass you by</p>
<p>Hear this voice from deep inside</p>
<p>It's the call of your heart</p>
<p>Close your eyes and your will find</p>
<p>The passage out of the dark</p>
<p>V-I-M</p>
<p>Will you send me an angel</p>
<p>V-I-M</p>
</body>
</html>
```

CTRL + D

VI Editor

► vi index.html

COMMAND
MODE

INSERT
MODE

esc

i

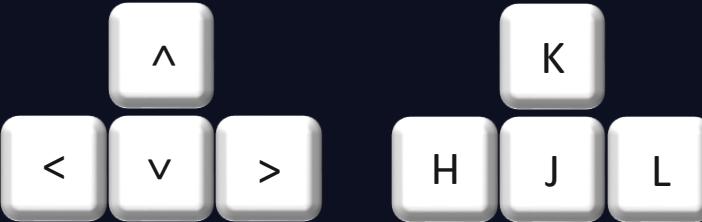
```
<!DOCTYPE html>
<html>
<body>

<h1>The VIM Poem</h1>

<p>The wise man said just walk this way</p>
<p>To the dawn of the light</p>
<p>The wind will blow into your face</p>
<p>As the years pass you by</p>
<p>Hear this voice from deep inside</p>
<p>It's the call of your heart</p>
<p>Close your eyes and your will find</p>
<p>The passage out of the dark</p>
<p>V-I-M</p>
<p>Will you send me an angel</p>
<p>V-I-M</p>
</body>
</html>
~
```

VI Editor - Command Mode

Move Around



Delete



Copy & Paste



Scroll Up/Down

CTRL +u

CTRL +d

```
<!DOCTYPE html>
<html>
<body>

<h1>The VIM Poem</h1>

<p>The wise man said just walk this way</p>
<p>To the dawn of the light</p>
<p>The wind will blow into your face</p>
<p>As the years pass you by</p>
<p>Hear this voice from deep inside</p>
<p>It's the call of your heart</p>
<p>Close your eyes and your will find</p>
<p>The passage out of the dark</p>
<p>V-I-M</p>
<p>Will you send me an angel</p>
<p>V-I-M</p>
</body>
</html>
```

VI Editor - Command Mode

Command

:

Save

:w

:w filename

Quit (Discard)

:q

Save + Quit

:wq

```
<!DOCTYPE html>
<html>
<body>

<h1>The VIM Poem</h1>

<p>The wise man said just walk this way</p>
<p>To the dawn of the light</p>
<p>The wind will blow into your face</p>
<p>As the years pass you by</p>
<p>Hear this voice from deep inside</p>
<p>It's the call of your heart</p>
<p>Close your eyes and your will find</p>
<p>The passage out of the dark</p>
<p>V-I-M</p>
<p>Will you send me an angel</p>
<p>V-I-M</p>
|
</body>
</html>
```

~

~

~

~

~

~

:

VI Editor - Command Mode

Find

/of

n

```
<!DOCTYPE html>
<html>
<body>

<h1>The VIM Poem</h1>

<p>The wise man said just walk this way</p>
<p>To the dawn of the light</p>
<p>The wind will blow into your face</p>
<p>As the years pass you by</p>
<p>Hear this voice from deep inside</p>
<p>It's the call of your heart</p>
<p>Close your eyes and your will find</p>
<p>The passage out of the dark</p>
<p>V-I-M</p>
<p>Will you send me an angel</p>
<p>V-I-M</p>

</body>
</html>
~
```

/of

8,16

All



Lab Setup

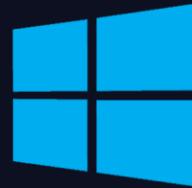
Labs

Virtualization S/W

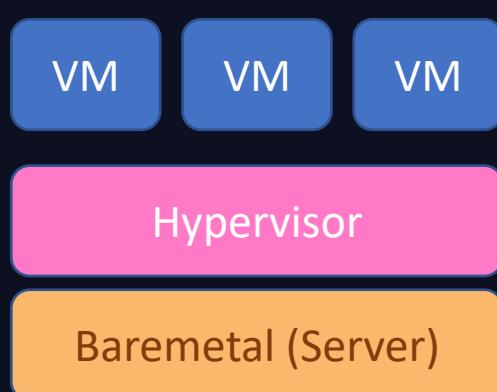
Type 1



vmware
ESXi



Microsoft
Hyper-v



Virtualization S/W

Type 1



Microsoft
Hyper-v

VM

VM

VM

Hypervisor

Baremetal (Server)

Type 2



VM

VM

VM

Hypervisor

Host

Operating System

Baremetal (Server)

Virtualization S/W

- FREE
- OpenSource
- Install Anywhere – Windows, Linux, MAC
- Snapshots & Clones
- Run Multiple VMs
- Networking



Oracle VirtualBox



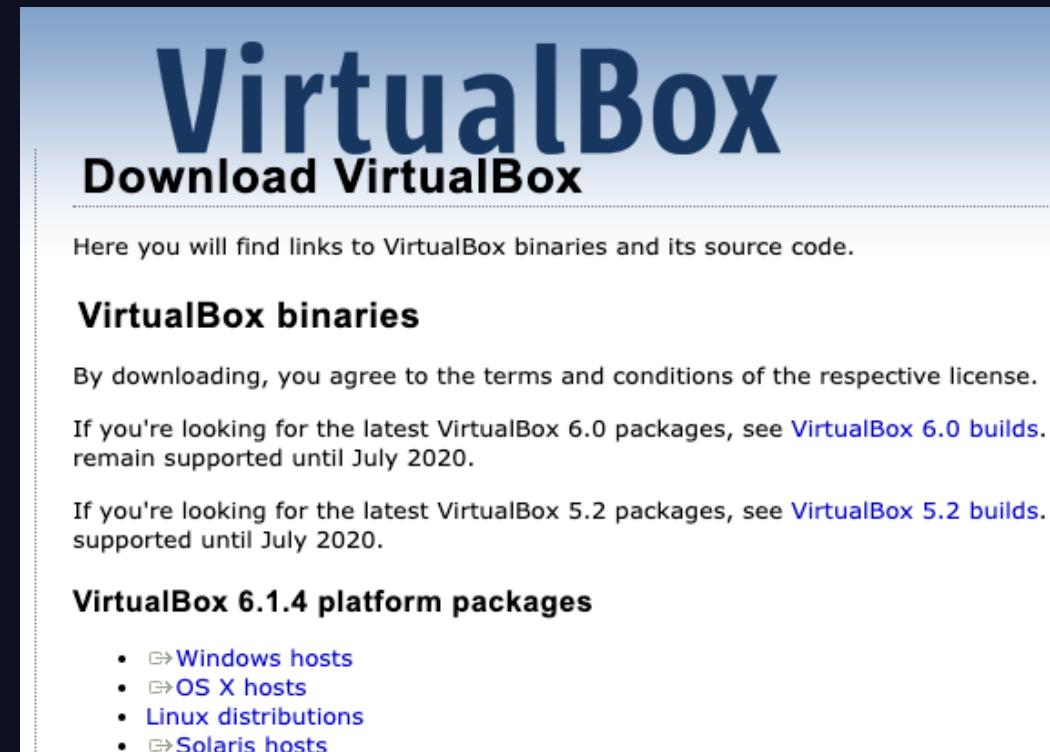
VMWare Workstation

- Commercial
- Install Anywhere – Windows, Linux
- Snapshots & Clones
- VMWare Player:
 - Free
 - Windows/Linux
 - One VM at a time
 - No Snapshots
- VMWare Fusion:
 - Free
 - Mac
 - One VM at a time
 - No Snapshots

Oracle VirtualBox

- Support:
 - Windows, MAC OS X, Linux, Solaris
<https://www.virtualbox.org/manual/ch01.html#hostossupport>
- Resource Requirements:
 - CPU: x86 Intel or AMD
 - Memory: 512 MB
 - Disk space: 30 MB
- Recommended Resources:
 - CPU: Dual or Quadcore
 - Memory: 4 GB
 - Disk Space: 100 GB

The more the better



The screenshot shows the official Oracle VirtualBox download page. The header features the "VirtualBox" logo in large blue letters, followed by the text "Download VirtualBox". Below this, a sub-section titled "VirtualBox binaries" is visible, along with a note about license terms and links to the latest builds. A separate section for "VirtualBox 6.1.4 platform packages" lists links for Windows, OS X, Linux, and Solaris hosts.

VirtualBox
Download VirtualBox

Here you will find links to VirtualBox binaries and its source code.

VirtualBox binaries

By downloading, you agree to the terms and conditions of the respective license.

If you're looking for the latest VirtualBox 6.0 packages, see [VirtualBox 6.0 builds](#).
remain supported until July 2020.

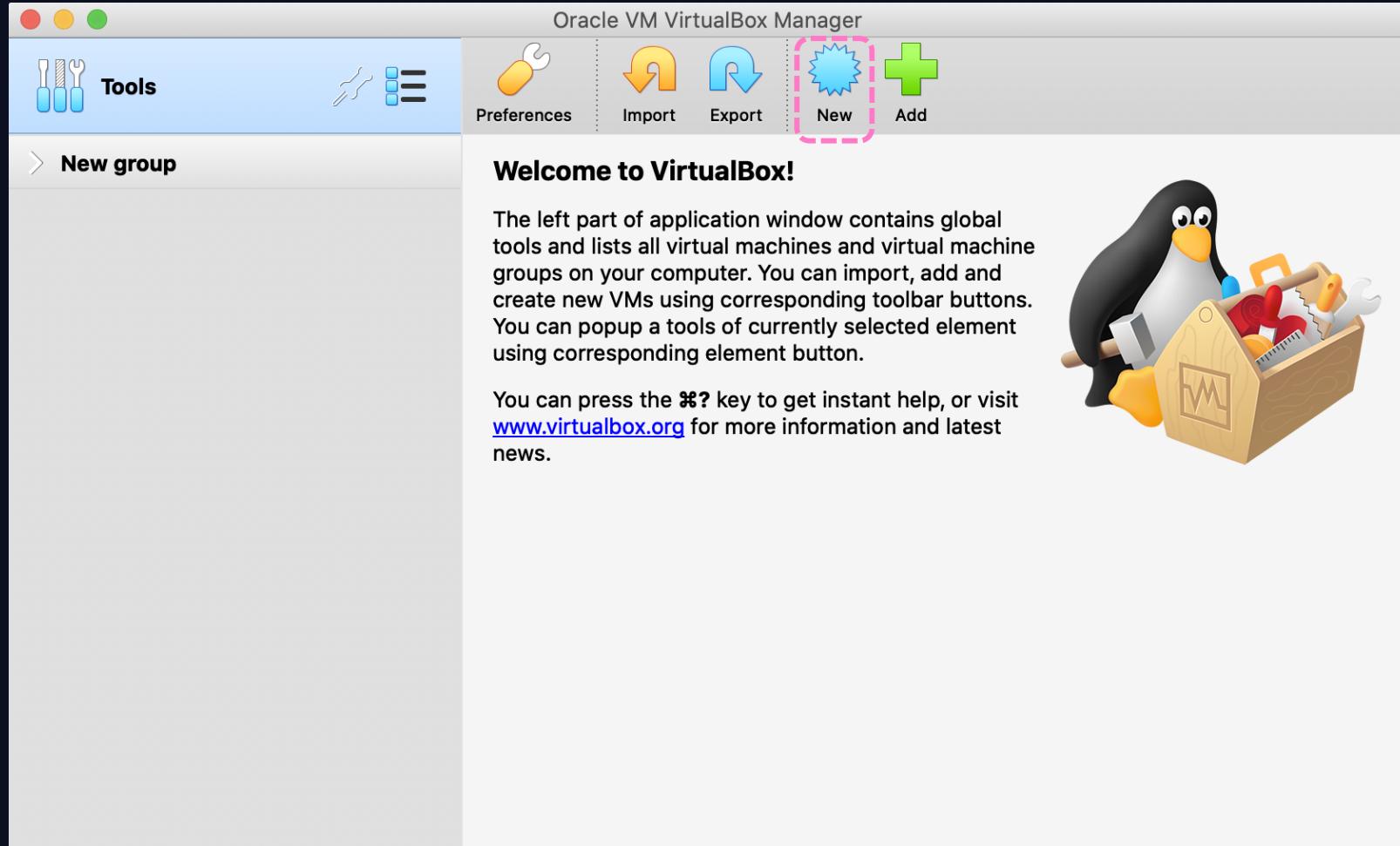
If you're looking for the latest VirtualBox 5.2 packages, see [VirtualBox 5.2 builds](#).
supported until July 2020.

VirtualBox 6.1.4 platform packages

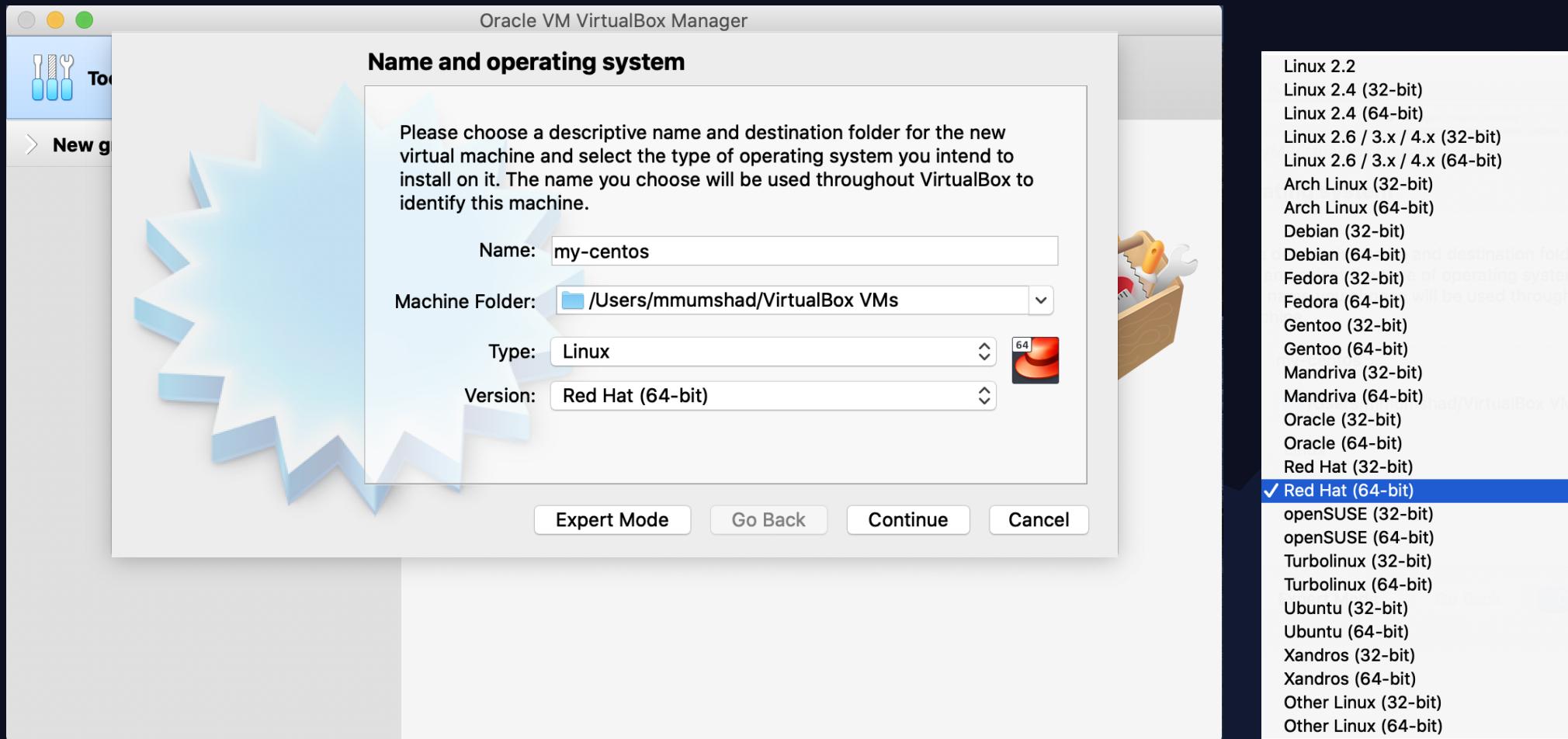
- [Windows hosts](#)
- [OS X hosts](#)
- [Linux distributions](#)
- [Solaris hosts](#)

<https://www.virtualbox.org/wiki/Downloads>

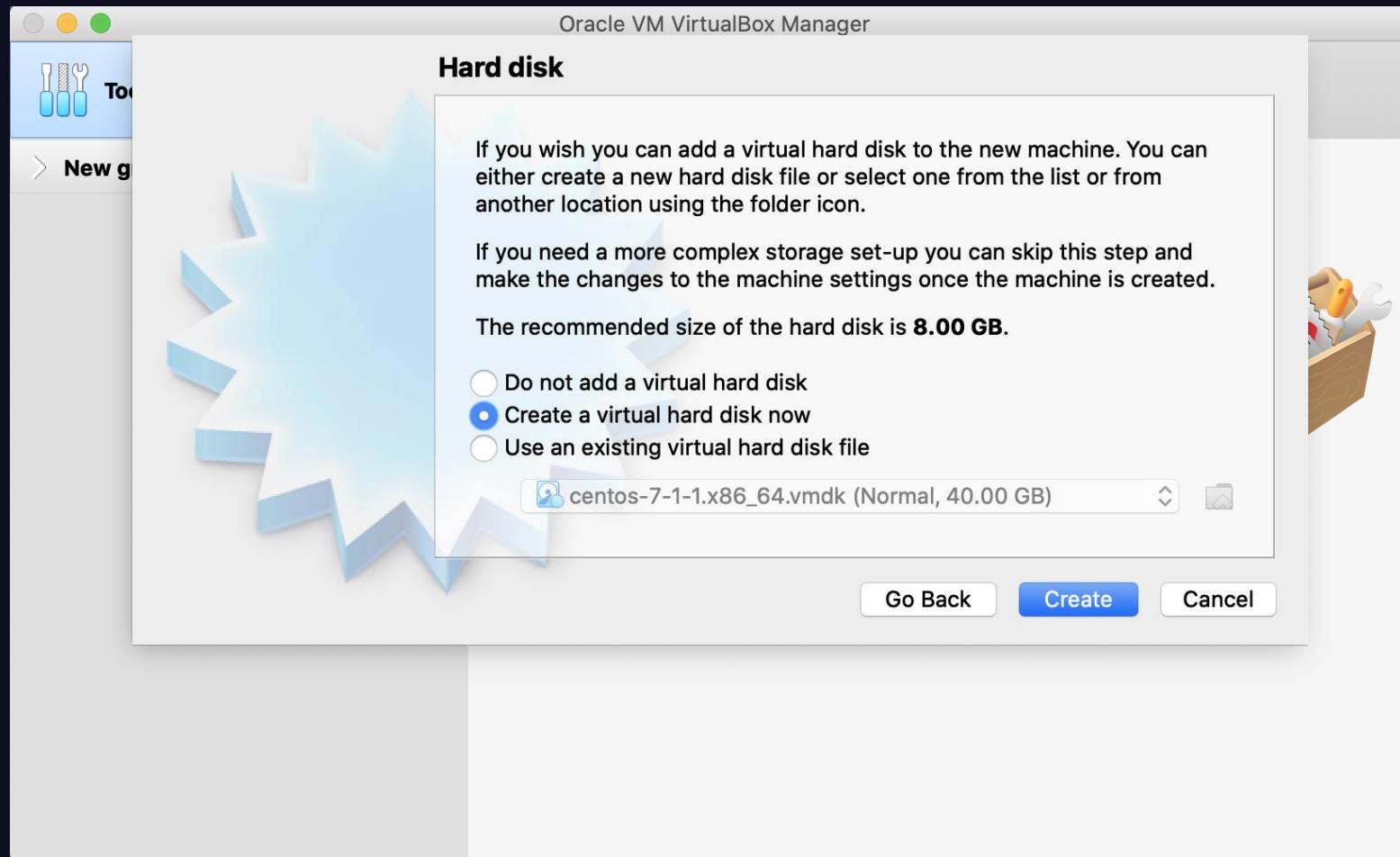
Oracle VirtualBox



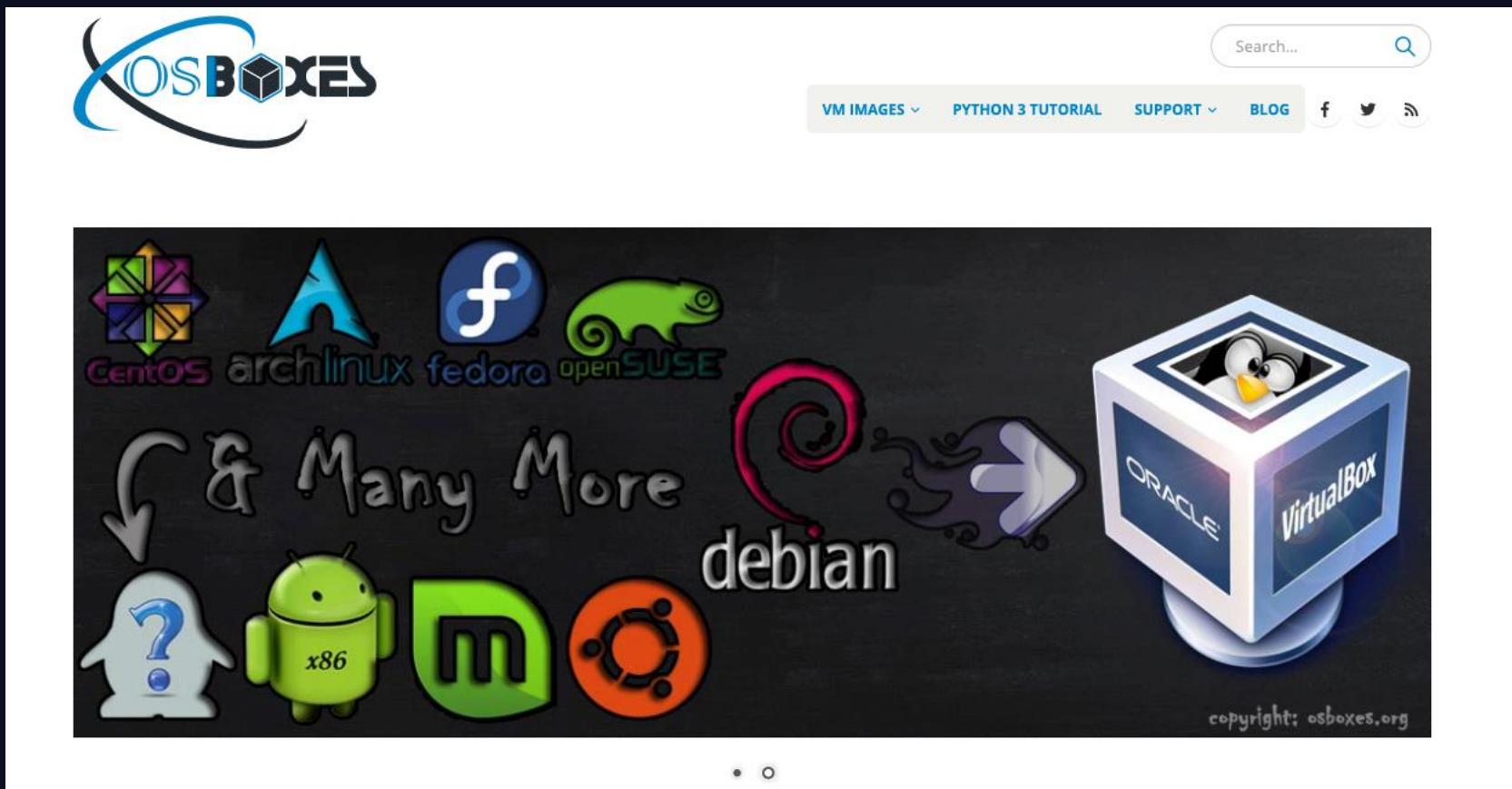
Oracle VirtualBox



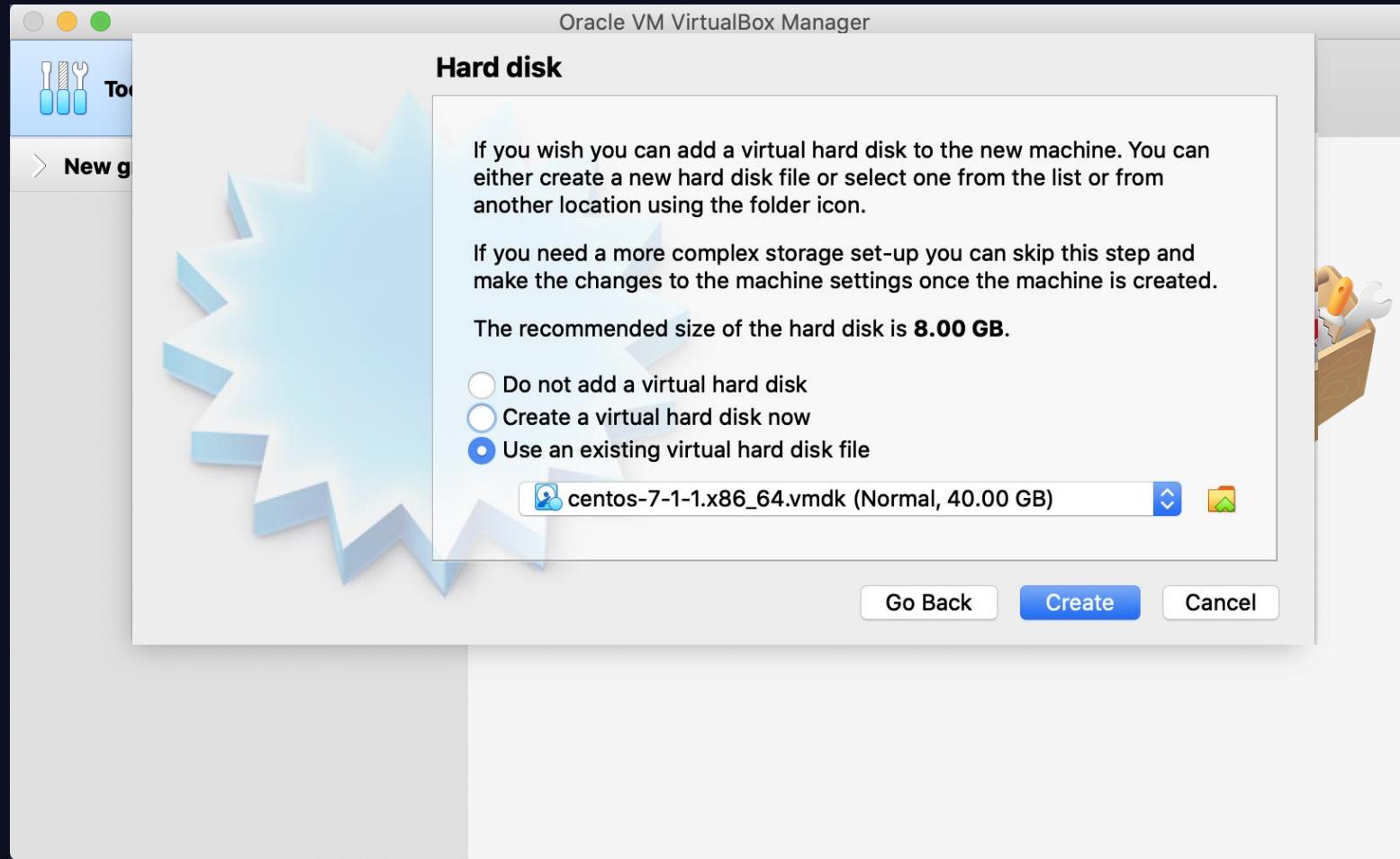
Oracle VirtualBox



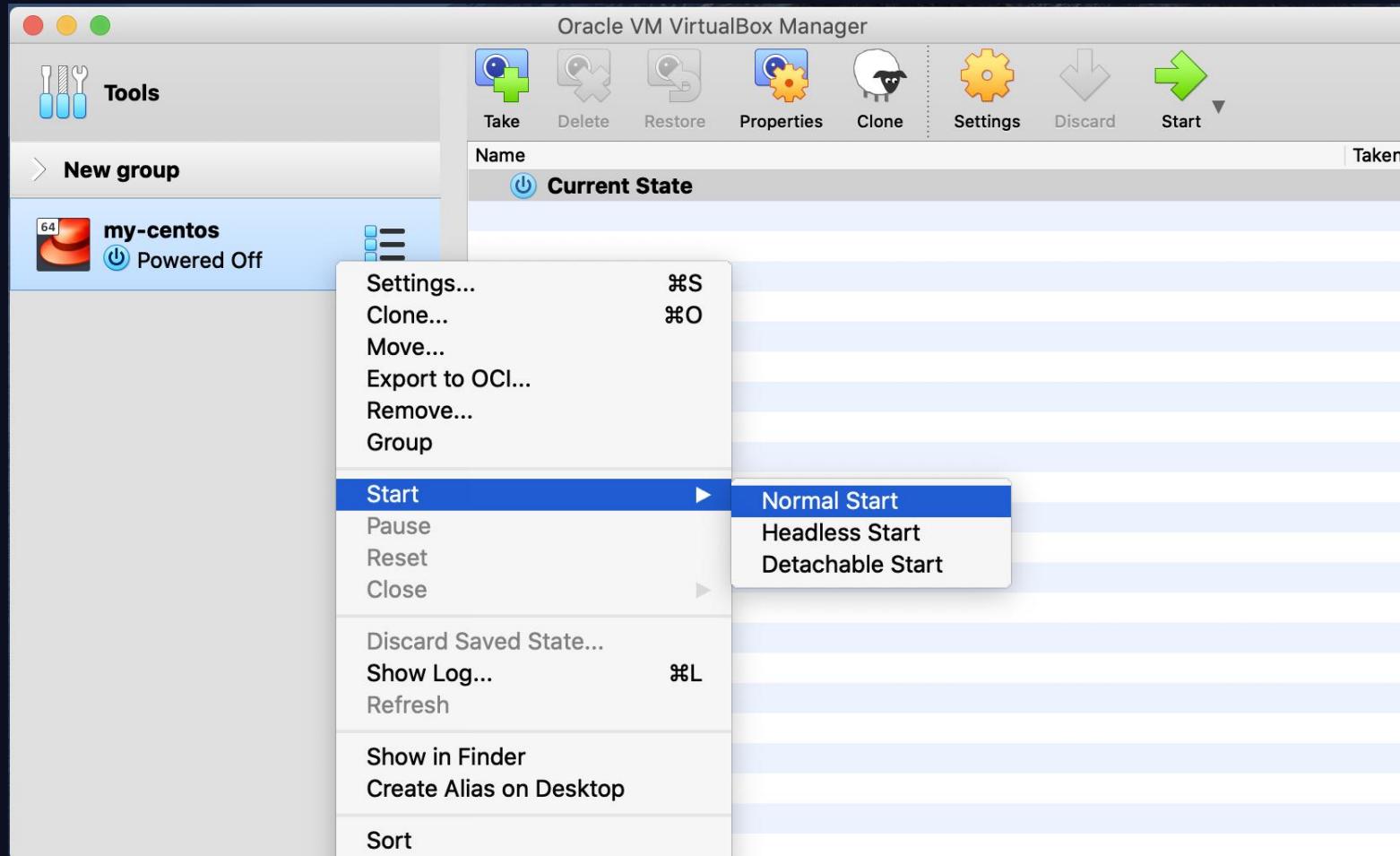
Images



Oracle VirtualBox



Start



References

- <https://communities.vmware.com/thread/579385>
- <https://www.vmware.com/products/workstation-player.html#compare>

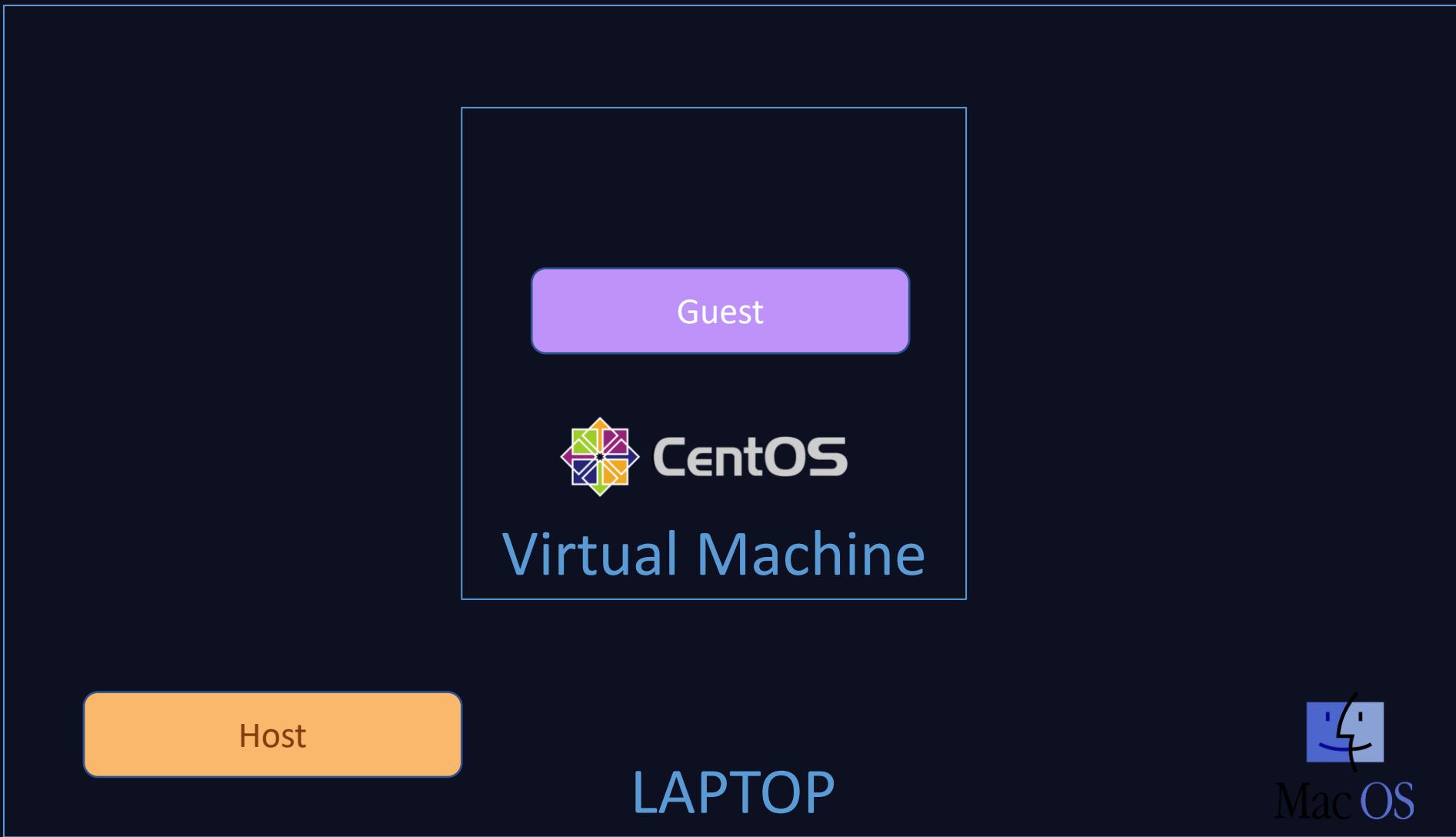
Labs

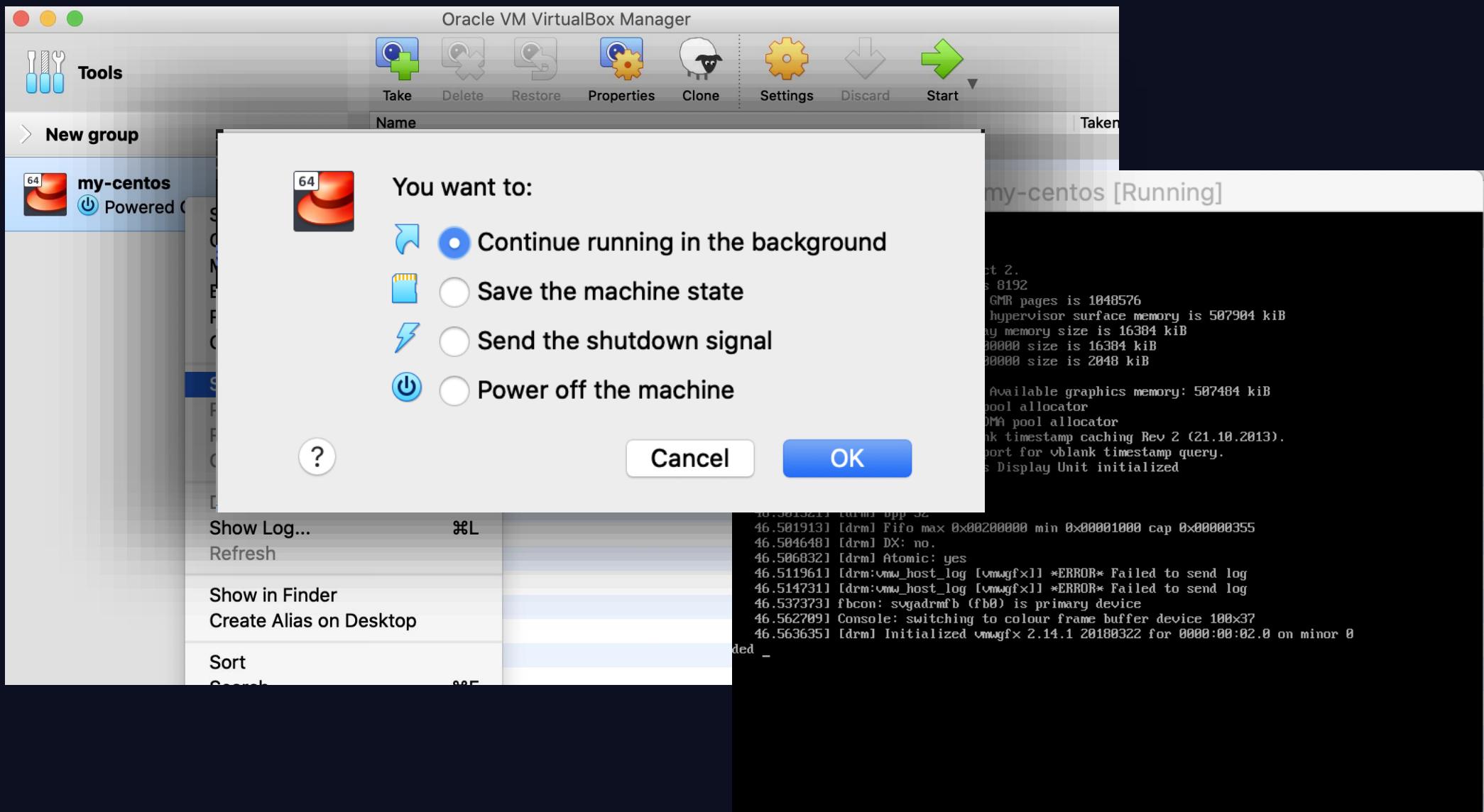


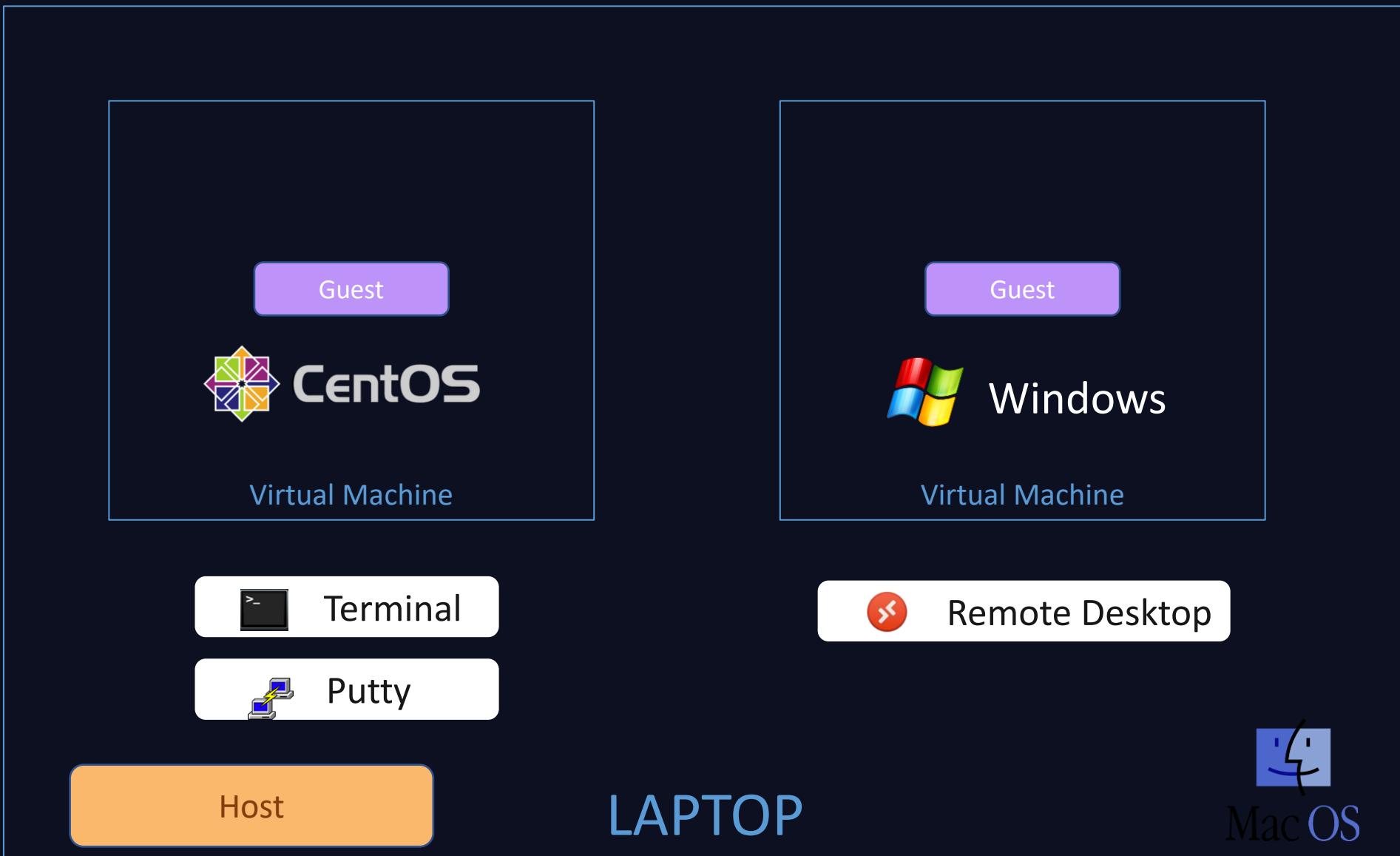
Connectivity

Frequently Asked Questions

- How do I connect to the VM?
- How do I SSH into my VM?
- Why can't I access the server on my VM?
- What's Port mapping?







► guest> service sshd status

```
Redirecting to /bin/systemctl status sshd.service
● sshd.service - OpenSSH server daemon
   Loaded: loaded (/usr/lib/systemd/system/sshd.service; enabled; vendor preset: enabled)
   Active: active (running) since Sun 2020-03-22 11:57:47 UTC; 1 day 18h ago
     Docs: man:sshd(8)
           man:sshd_config(5)
  Main PID: 2406 (sshd)
    CGroup: /system.slice/sshd.service
            └─2406 /usr/sbin/sshd -D -u0
```



Terminal

► host> ssh 192.168.1.10

Host

LAPTOP

Services

File Action View Help



Services (Local)

Name

Description

| | |
|--|-----------------|
| ● Remote Access Connection Manager | Manages di... |
| ● Remote Desktop Configuration | Remote Des... |
| ● Remote Desktop Services | Allows user... |
| ● Remote Desktop Services UserMode Port R... | Allows the r... |
| ● Remote Procedure Call (RPC) | The RPCSS i... |
| ● Remote Procedure Call (RPC) Locator | In Windows... |
| ● Remote Registry | Enables remo... |
| ● Routing and Remote Access | Offers routi... |
| ● RPC Endpoint Mapper | Resolves RP... |

III

Extended Standard



Remote Desktop



Mac OS

IP Address

► guest> ip addr show

```
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 52:54:00:8a:fe:e6 brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.10/24 brd 192.168.1.255 scope global noprefixroute dynamic eth0
        valid_lft 86387sec preferred_lft 86387sec
```

► guest> ip addr add 192.168.1.10/24 dev eth0

Start SSH service

```
► guest> service sshd status
```

```
Redirecting to /bin/systemctl status sshd.service
● sshd.service - OpenSSH server daemon
   Loaded: loaded (/usr/lib/systemd/system/sshd.service; enabled; vendor preset: enabled)
   Active: active (running) since Wed 2020-03-25 09:29:51 UTC; 3h 53min ago
     Docs: man:sshd(8)
           man:sshd_config(5)
```

```
► guest> service sshd start
```

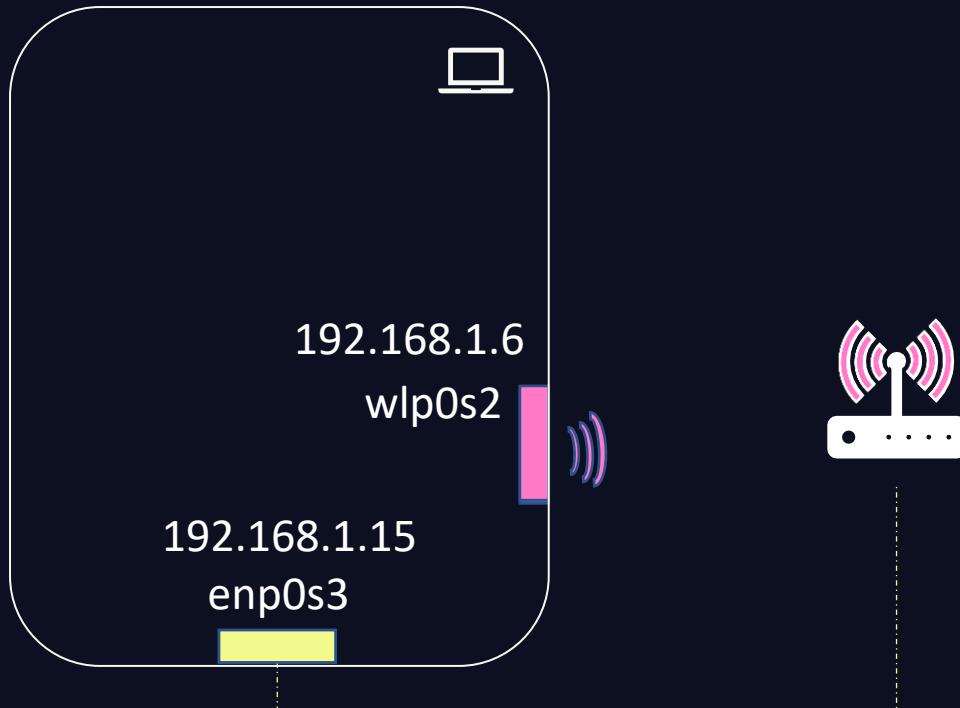


Networking

Objectives

- Networking in VirtualBox
- Networking Adapters
- NAT
- Bridge
- Host Only
- Internet Connectivity

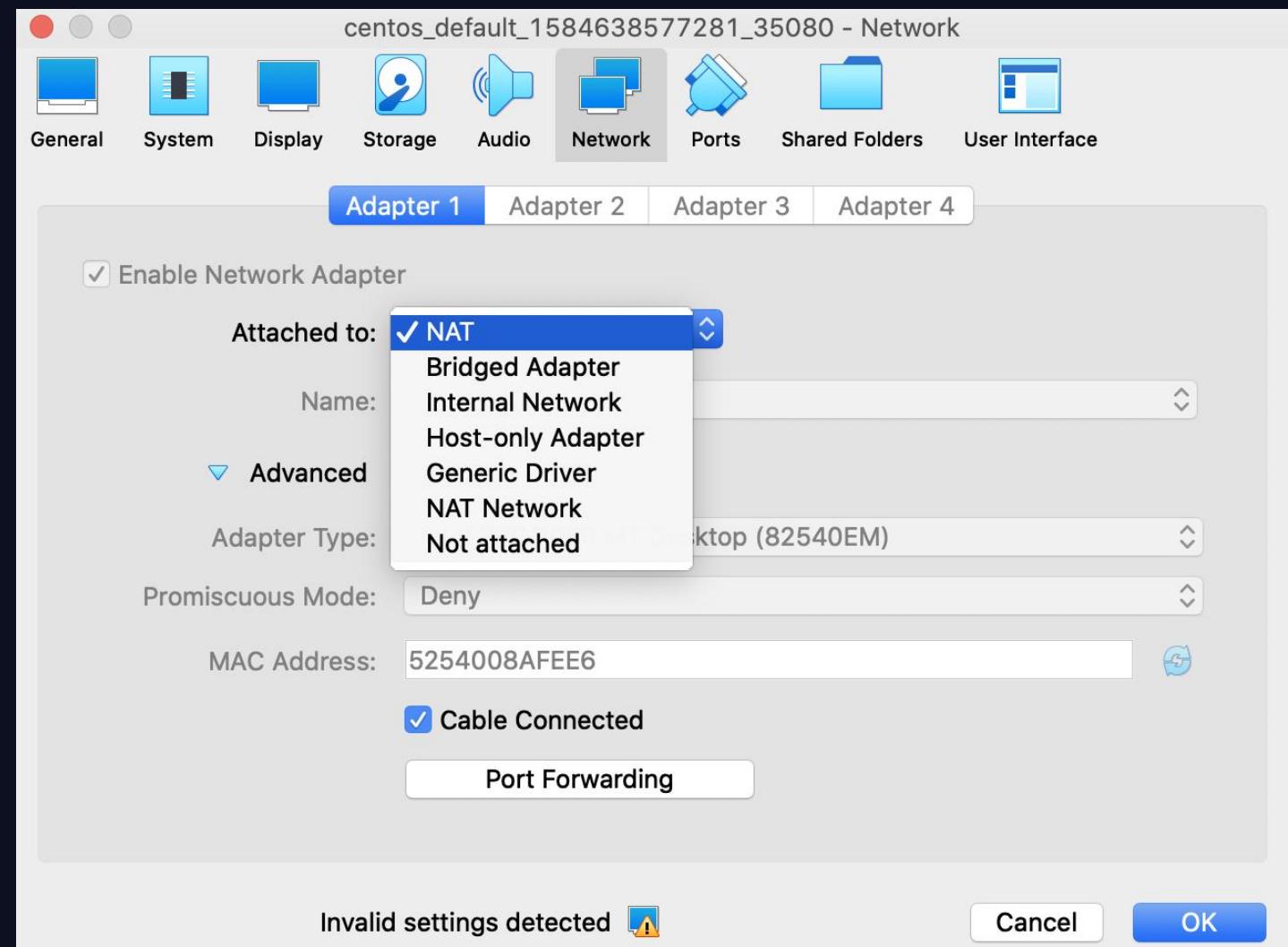
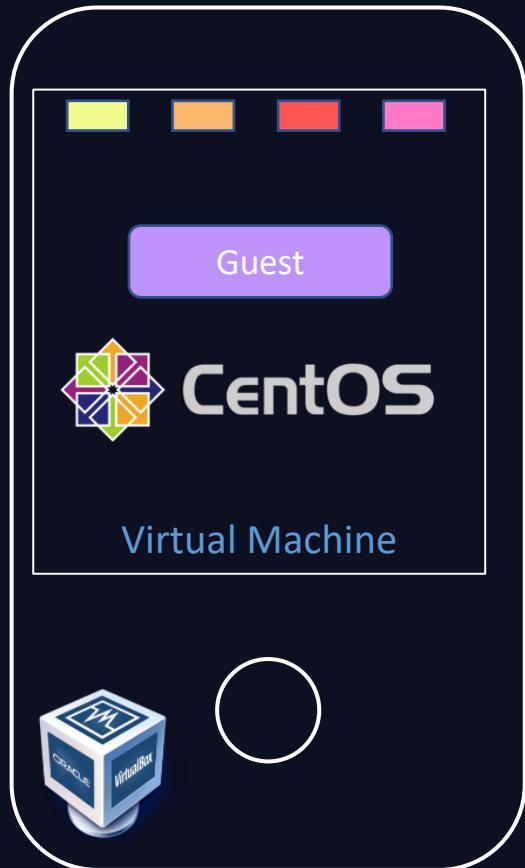
IP Address

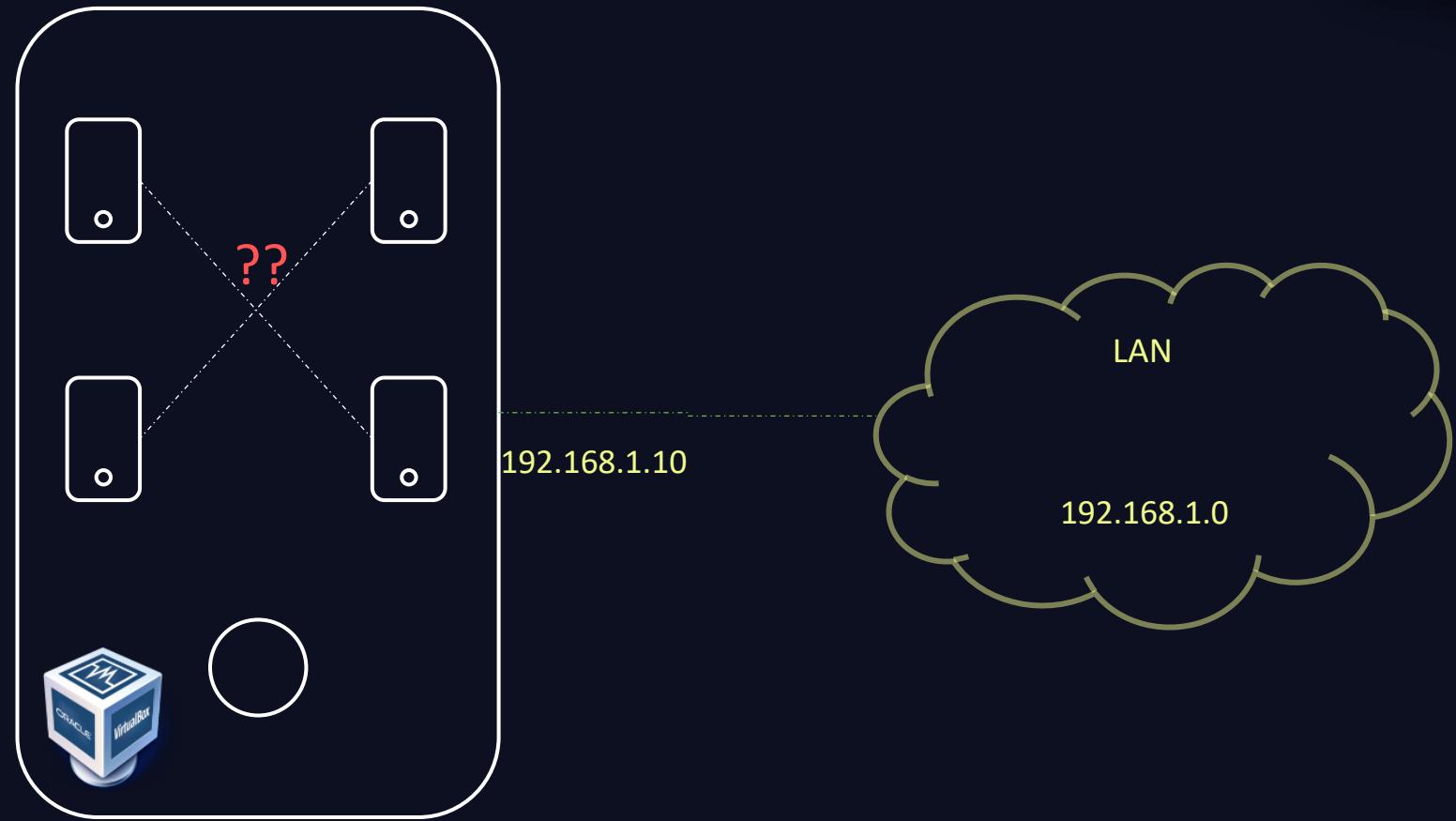


► `ip addr show`

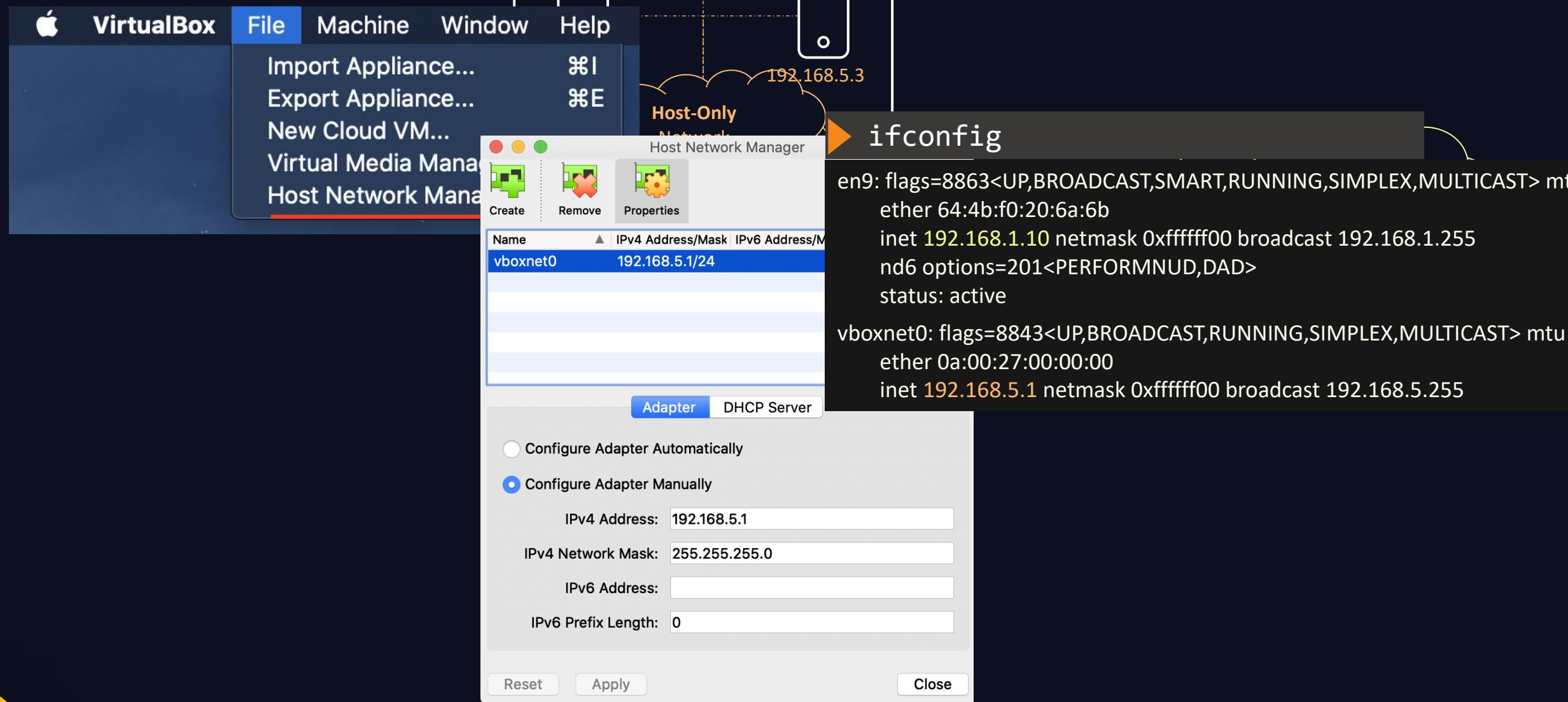
```
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast  
    link/ether 02:0e:0c:9a:00:f0 brd ff:ff:ff:ff:ff:ff  
    inet 192.168.1.5/24 brd 192.168.1.255 scope global enp0s3  
  
3: wlp0s2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast  
    link/ether dc:fb:48:dd:4b:4f brd ff:ff:ff:ff:ff:ff  
    inet 192.168.1.6/24 brd 192.168.1.255 scope global enp0s3
```

VirtualBox Networking



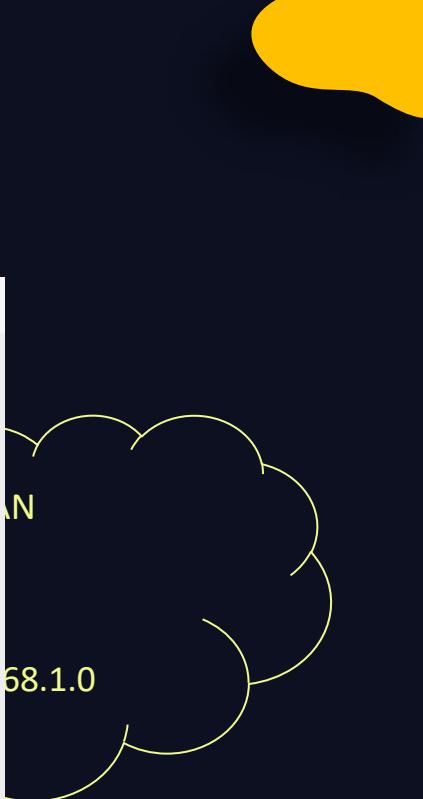
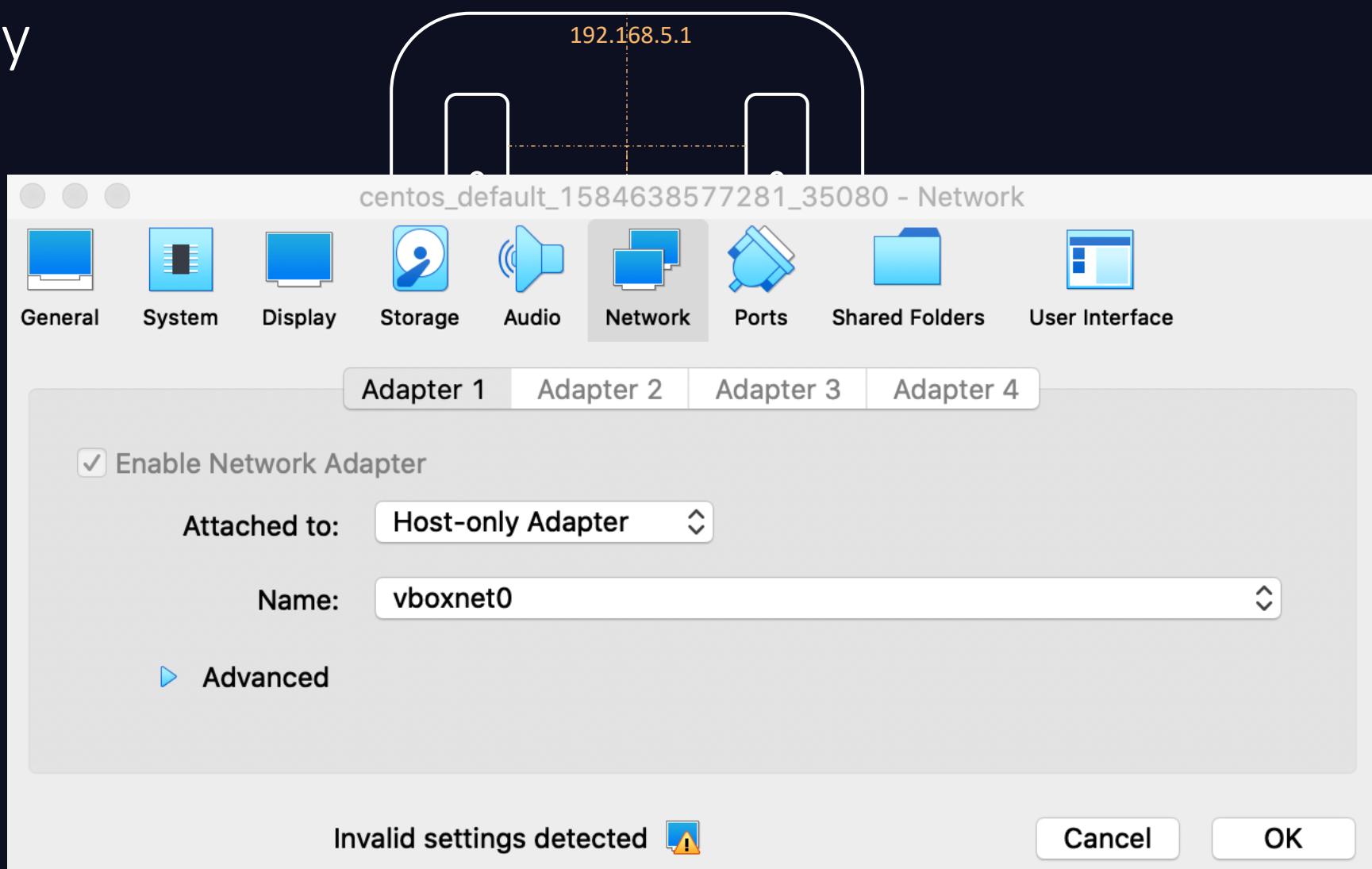


+ Host Only

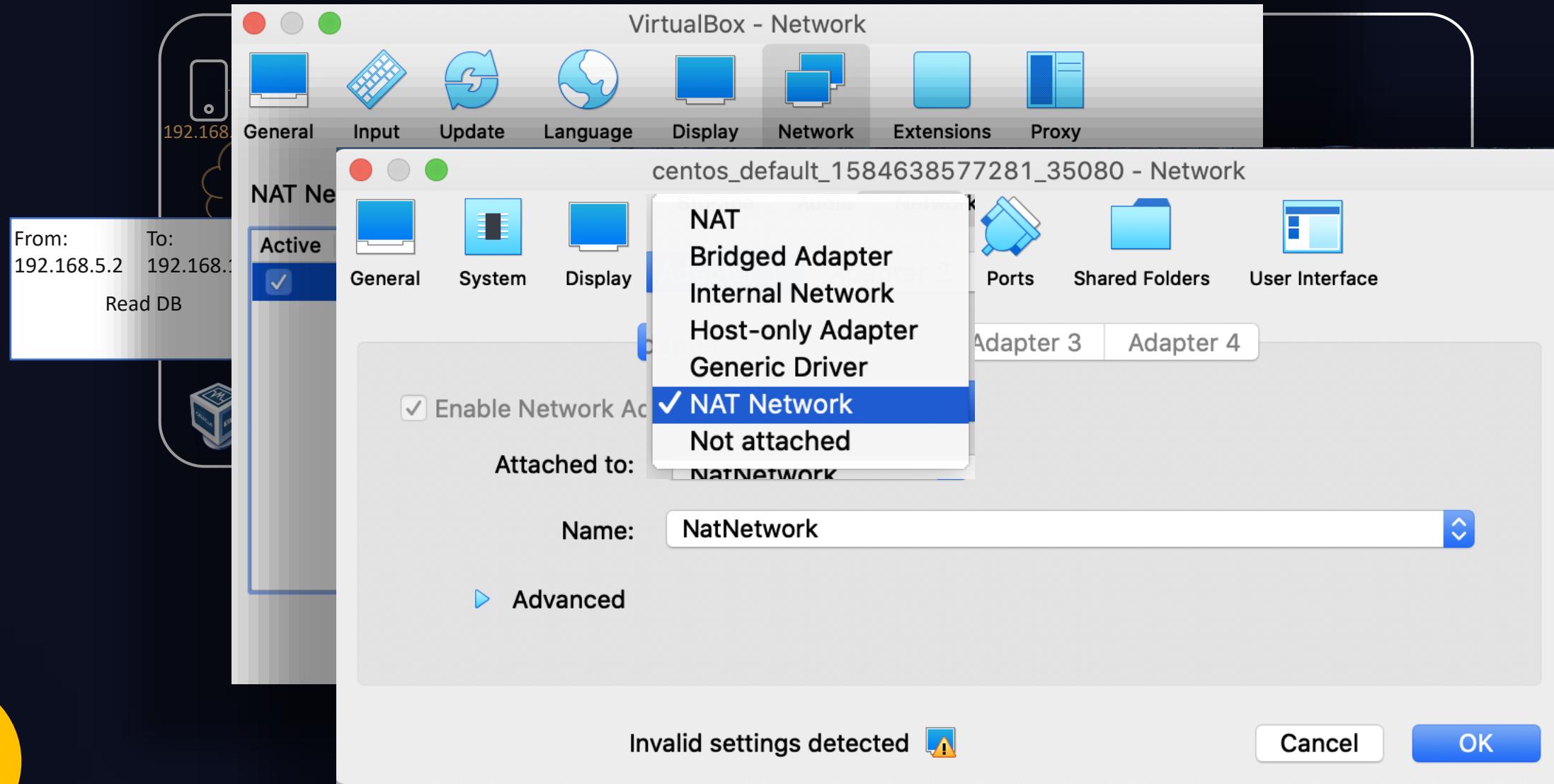




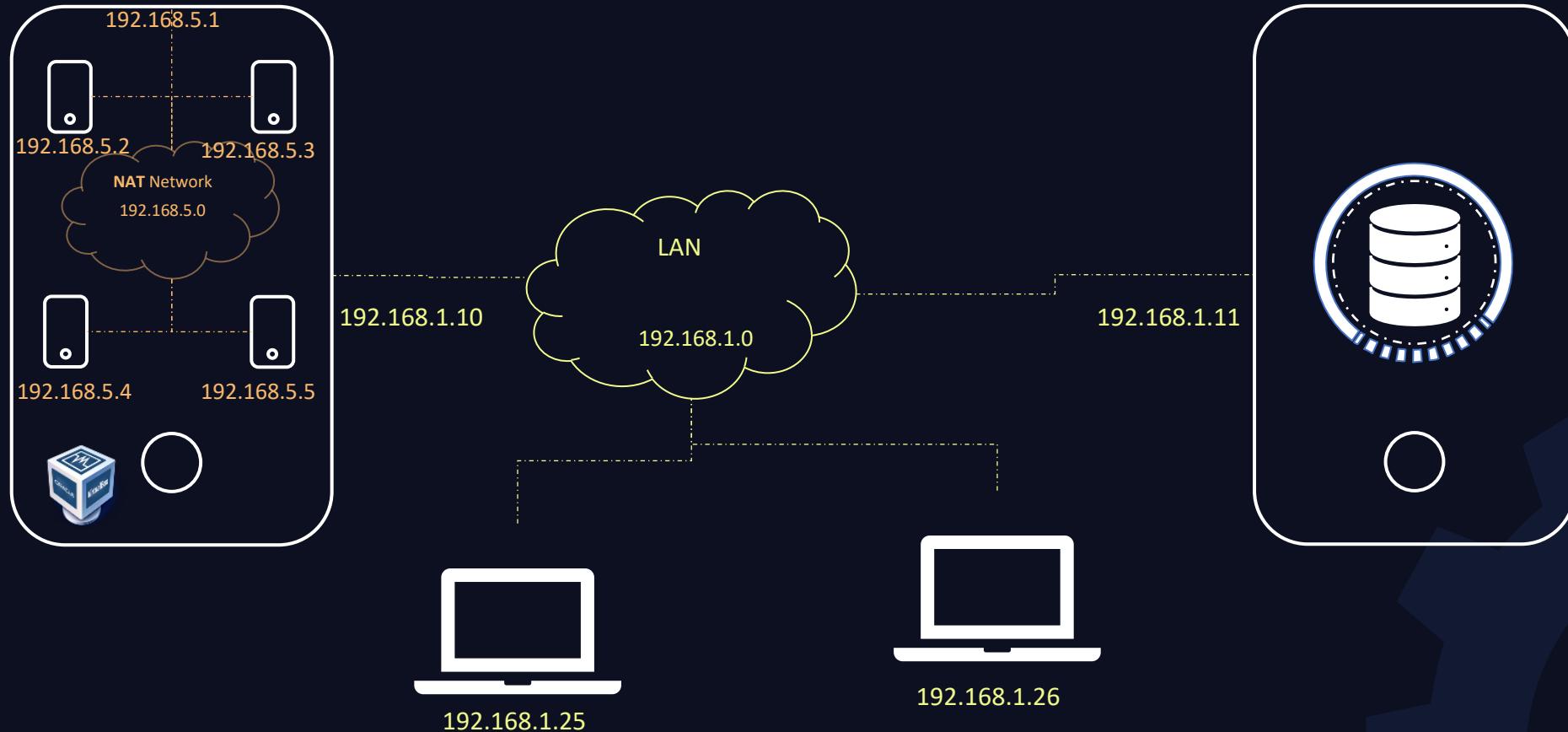
+ Host Only



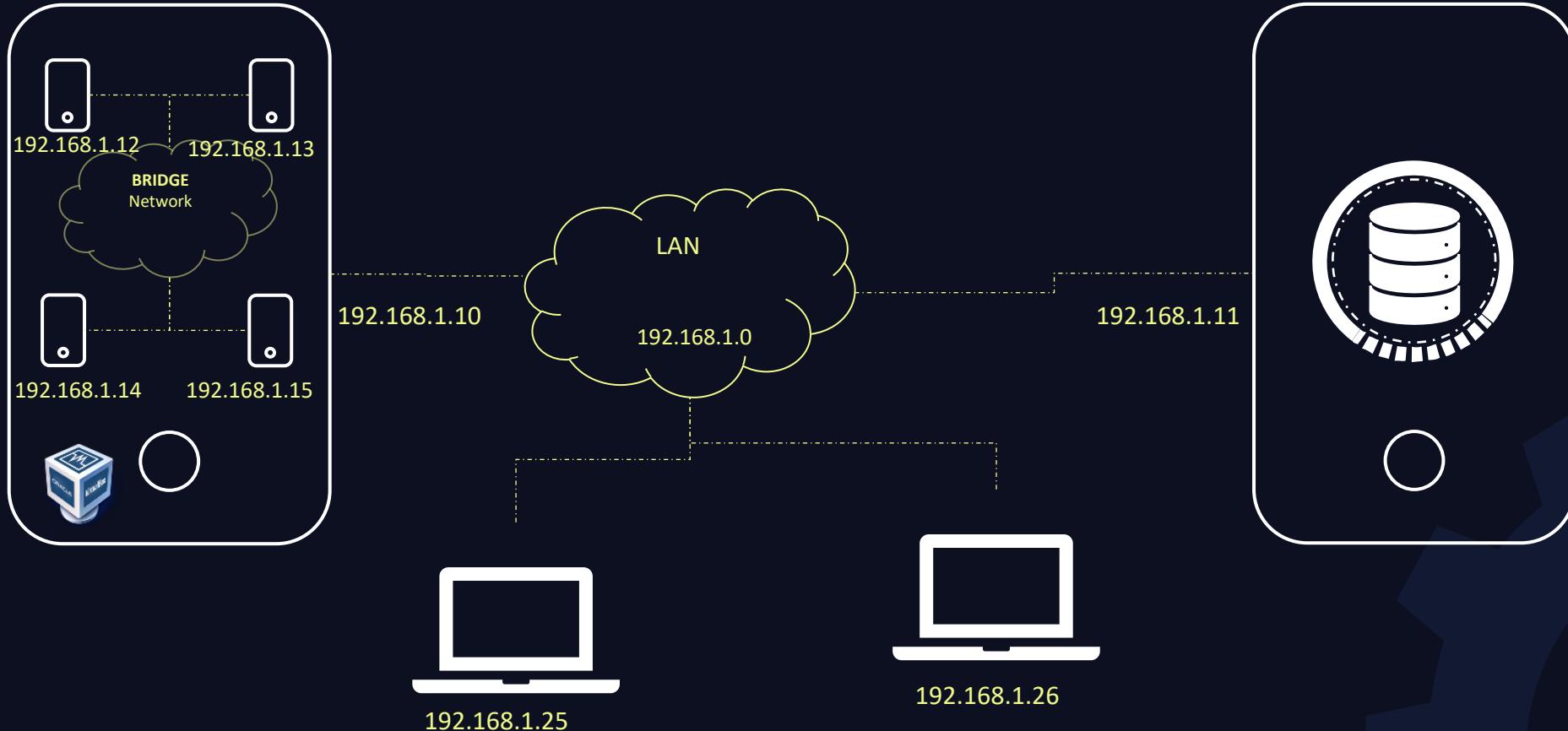
Network Address Translation (NAT) Network



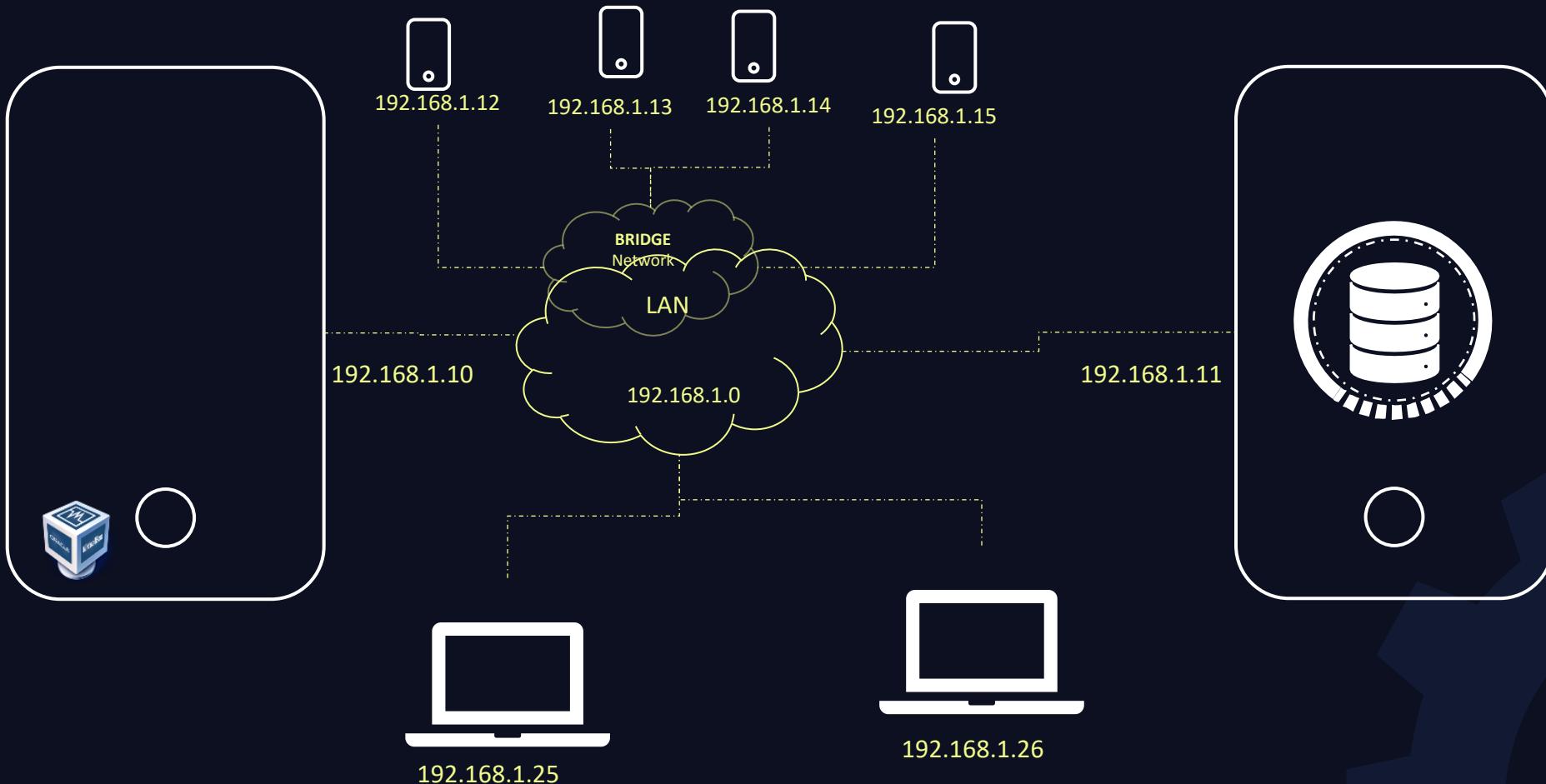
Network Address Translation (NAT)



Bridge Network

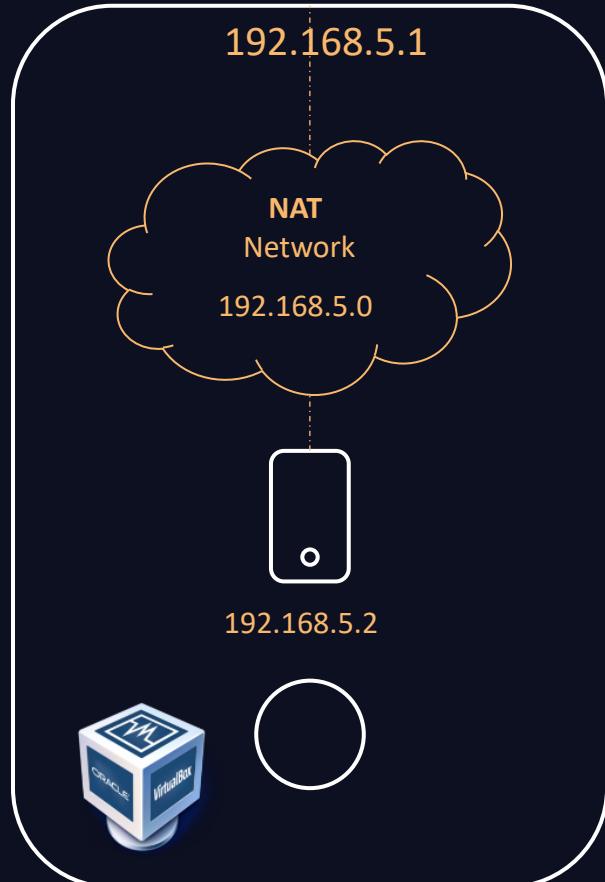


Bridge Network



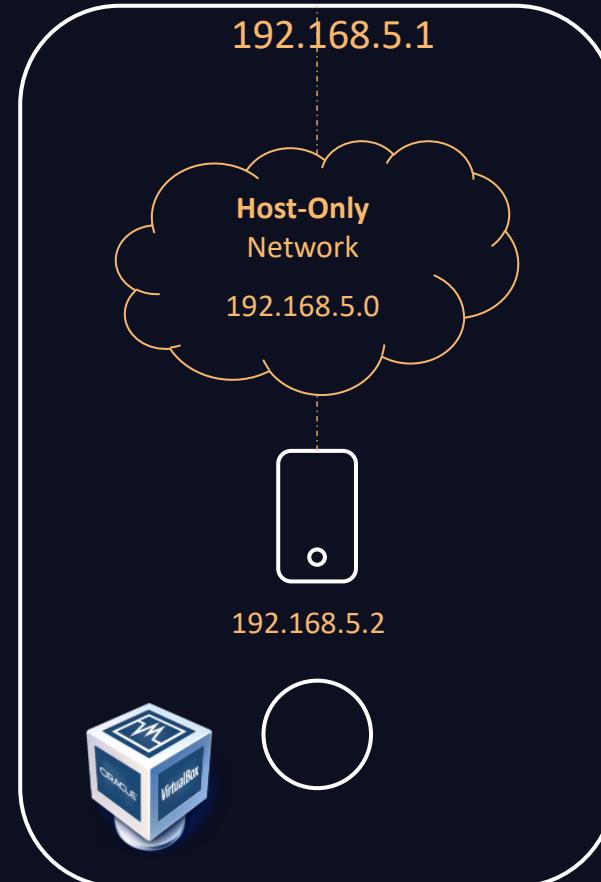
Internet Connectivity

Network Address Translation (NAT)



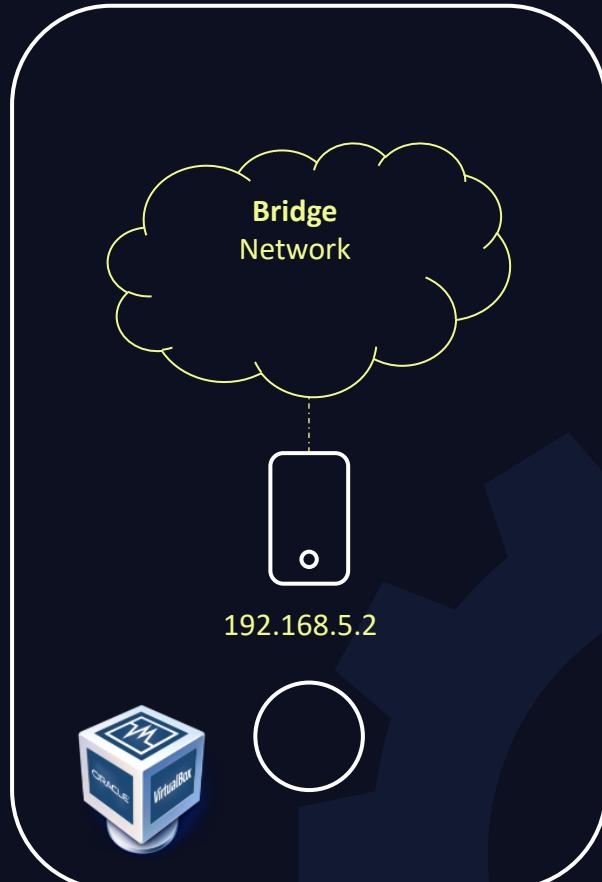
Possible

Host-Only Network



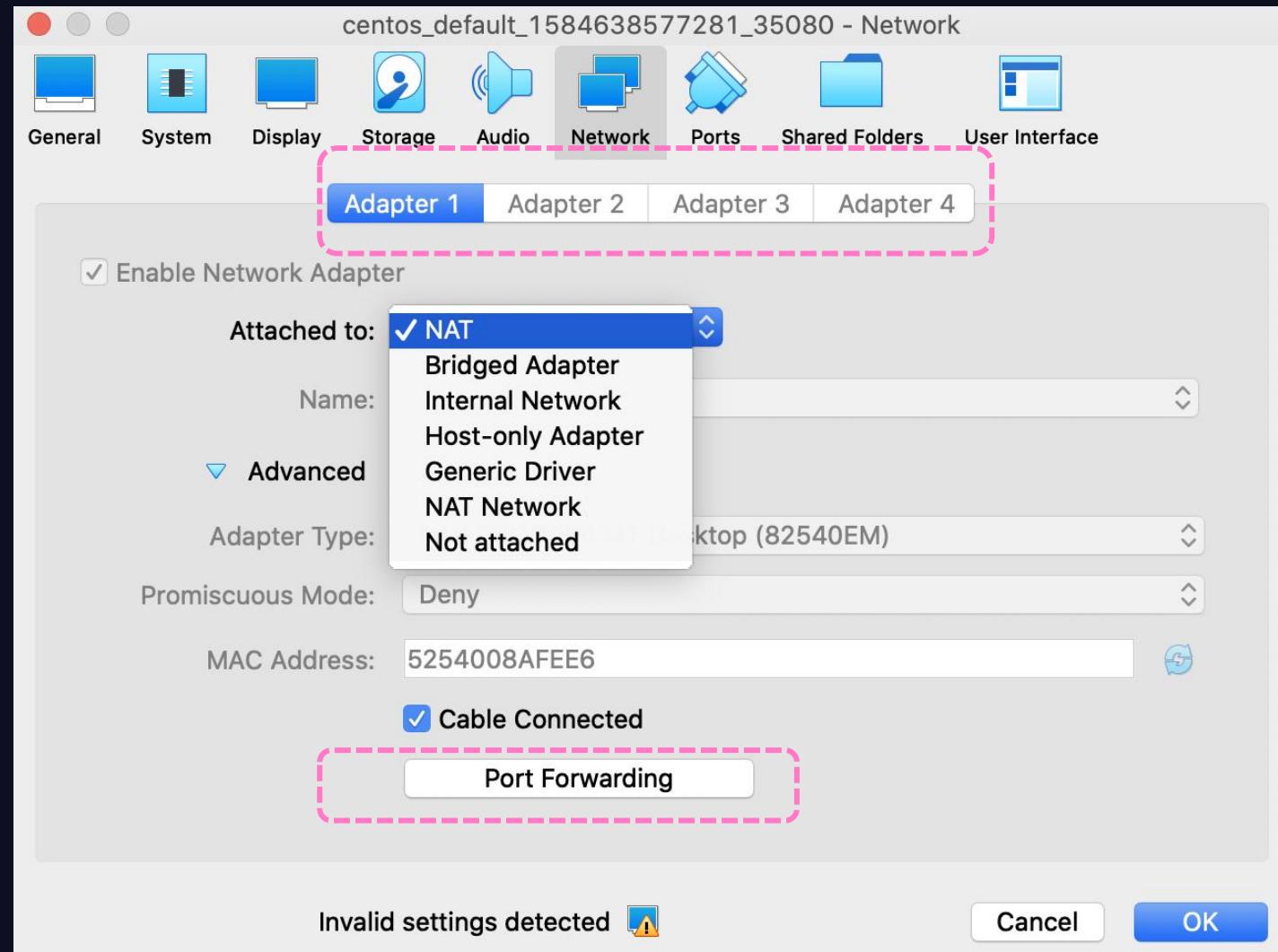
Possible with IP Forwarding

Bridged



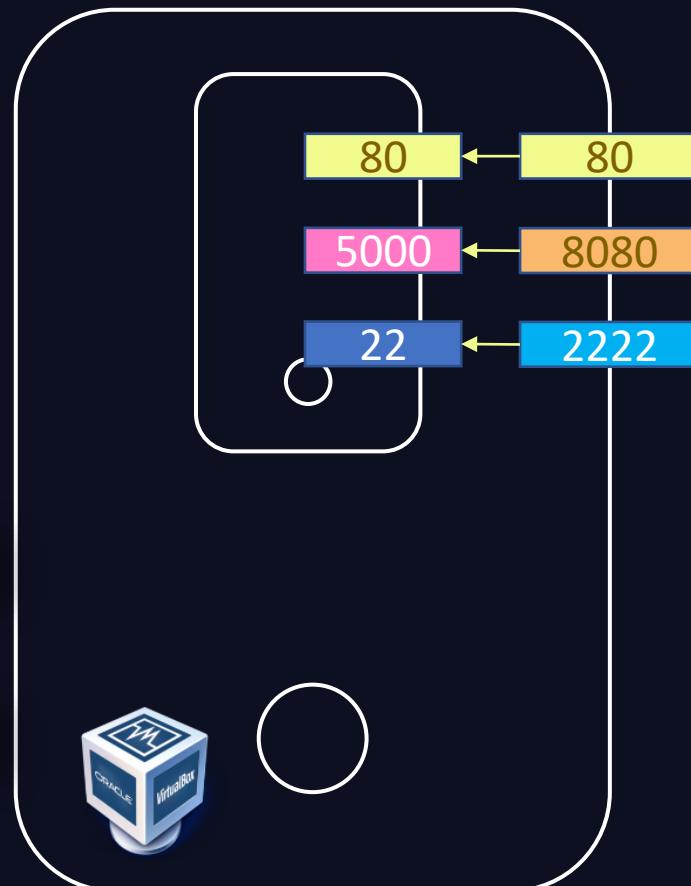
Possible

Internet Connectivity



Port Forwarding

Network Address
Translation (NAT)



```
host> ssh 192.168.1.10
```

```
host> ssh 127.0.0.1 -p 2222
```

Port Forwarding

centos_default_1584638577281_35080 - Network

General System Display Storage Audio Network Ports Shared Folders User Interface

| Name | Protocol | Host IP | Host Port | Guest IP | Guest Port |
|--------|----------|-----------|-----------|----------|------------|
| Rule 1 | TCP | | 80 | | 80 |
| ssh | TCP | 127.0.0.1 | 2222 | | 22 |
| Rule 2 | TCP | | 8080 | | 5000 |

Cancel OK

VirtualBox Networking

| Requirement | Solution |
|---|-----------------------------------|
| VMs must be able to reach the internet/other systems in the network | NAT |
| VMs must be visible in the external network | Bridged |
| VMs must NOT be visible in the external network and VMs must NOT be able to reach internet/other systems in the network | Host Network |
| VMs must be able to reach each other | Host Network |
| VMs must be able to reach each other and the internet but NOT visible in the external network | Host Network + NAT NAT Network |

VirtualBox Networking

| VM can reach internet/other systems in the network | VMs can reach each other | Host can reach VM (Without Port forwarding) | Other systems in network can reach VM | Solution |
|--|--------------------------|---|---------------------------------------|--------------------|
| Yes | No | No | No | NAT |
| Yes | Yes | No | No | NAT Network |
| No | Yes | Yes | No | Host Network |
| Yes | Yes | Yes | No | Host Network + NAT |
| Yes | Yes | Yes | Yes | Bridged |



HashiCorp

Vagrant

Vagrant

1. Download
2. Create VM
3. Create Networks
4. Configure Networking
5. Configure Port Forwarding
6. Boot up VM

▶ vagrant up

```
Bringing machine 'default' up with 'virtualbox' provider...
==> default: Importing base box 'centos/7'...
==> default: Matching MAC address for NAT networking...
==> default: Checking if box 'centos/7' version '1905.1' is up to date...
==> default: Setting the name of the VM: centos2_default_1586895892002_53453
==> default: Preparing network interfaces based on configuration...
      default: Adapter 1: nat
==> default: Forwarding ports...
      default: 22 (guest) => 2200 (host) (adapter 1)
==> default: Booting VM...
==> default: Waiting for machine to boot. This may take a few minutes...
==> default: Machine booted and ready!
```

Getting started



HashiCorp

Vagrant

Development Environments Made Easy

[Get Started](#)

[Download 2.2.7](#)

[Find Boxes](#)



Debian

32-bit | 64-bit



Windows

32-bit | 64-bit



Centos

32-bit | 64-bit



Linux

64-bit



macOS

64-bit

<https://www.vagrantup.com/>

Discover Vagrant Boxes

Search for boxes by operating system, included software, architecture and more



Provider

Sort by

| | | | |
|---|--|-------------------------|-------------------------------|
|  ubuntu/trusty64 20190514.0.0 | <input type="button" value="virtualbox"/> | Downloads 30,495,172 | Released 5 months ago |
| Official Ubuntu Server 14.04 LTS (Trusty Tahr) builds (End of standard support) | | | |
|  laravel/homestead 9.4.0 | <input type="button" value="hyperv"/> <input type="button" value="parallels"/> <input type="button" value="virtualbox"/> <input type="button" value="vmware_desktop"/> | Downloads 13,927,187 | Released 22 days ago |
| Official Laravel local development box. | | | |
|  hashicorp/precise64 1.1.0 | <input type="button" value="hyperv"/> <input type="button" value="virtualbox"/> <input type="button" value="vmware_fusion"/> | Downloads 6,769,100 | Released about 6 years ago |
| A standard Ubuntu 12.04 LTS 64-bit box. | | | |
|  centos/7 1905.1 | <input type="button" value="hyperv"/> <input type="button" value="libvirt"/> <input type="button" value="virtualbox"/> <input type="button" value="vmware"/> and 3 more providers | Downloads 5,154,991 | Released 9 months ago |
| CentOS Linux 7 x86_64 Vagrant Box | | | |

==> default: Booting VM...

==> default: Waiting for machine to boot. This may take a few minutes...

<https://app.vagrantup.com/boxes>

Vagrant Commands

► vagrant

Usage: vagrant [options] <command> [<args>]

-v, --version Print the version and exit.

-h, --help Print this help.

Common commands:

init initializes a new Vagrant environment by creating a Vagrantfile

up starts and provisions the vagrant environment

suspend suspends the machine

resume resume a suspended vagrant machine

halt stops the vagrant machine

destroy stops and deletes all traces of the vagrant machine

status outputs status of the vagrant machine

reload restarts vagrant machine, loads new Vagrantfile configuration

snapshot manages snapshots: saving, restoring, etc.

► vagrant ssh

[vagrant@localhost ~]\$

Vagrantfile

```
Vagrant.configure("2") do |config|  
  
  config.vm.box = "centos/7"  
  
  config.vm.network "forwarded_port", guest: 80, host: 8080  
  config.vm.synced_folder "../data", "/vagrant_data"  
  
  config.vm.provider "virtualbox" do |vb|  
  
    vb.memory = "1024"  
  
  end  
  
  config.vm.provision "shell", inline: <<-SHELL  
    apt-get update  
    apt-get install -y apache2  
  SHELL  
  
end
```

Vagrant Providers

- VirtualBox
- VMware
- Hyper-V
- Docker
- Custom

Review

Lab

Linux

Applications

DB

Security

Networking

Storage

DevOps Pre-Requisites

Docker

Ansible

CI/CD

Kubernetes

Chef

Jenkins

CKA

Puppet

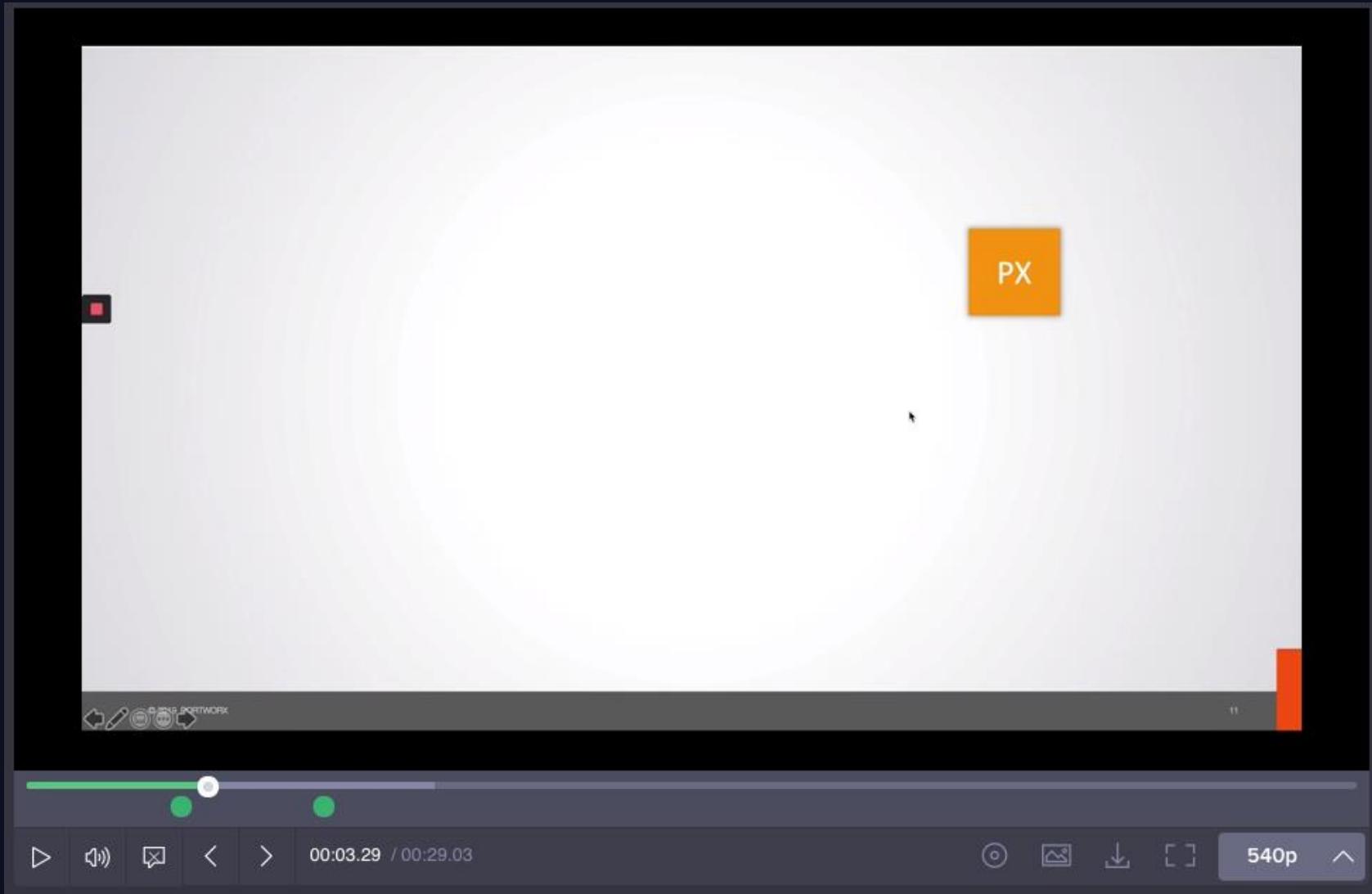
CKAD

DevOps

What to test

| Check | Ignore |
|--------------------|----------------|
| Facts | Delivery/Speed |
| Explanation | Noise |
| Code/Typos | Pauses/Stops |
| Analogies/Examples | Animation |
| Student/Expert | |
| | |
| | |

How to Review



just enough

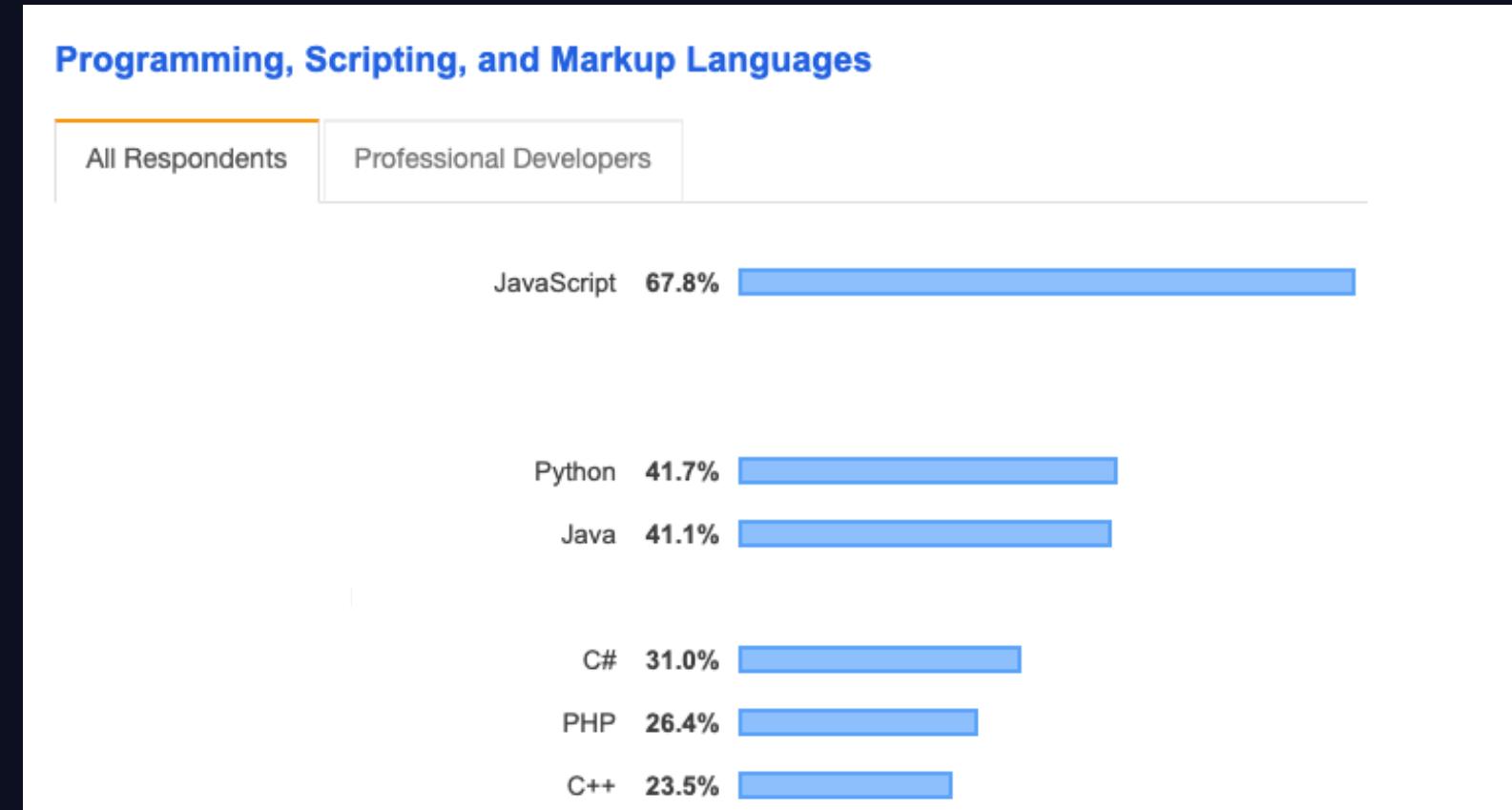
Applications

Introduction

- Who is this for?
 - Non-Developers
- Different types of programming languages
 - Python
 - NodeJS
 - Java
- Building and Deploying them
- Troubleshooting Applications
- Labs

Programming Languages

- JavaScript – NodeJS
- Python
- Java



Types

Compiled

Interpreted



C

C++



python



Ruby



Compiled

1. Develop Source Code

MyClass.java

```
public class MyClass {  
    public static void main(String[] args) {  
        System.out.println("Hello World");  
    }  
}
```

2. Compile

► javac MyClass.java

MyClass.class

3. Run

► java MyClass

Hello World

Interpreted

1. Develop Source Code

main.py

```
def print_message():
    print("Hello World")

if __name__ == '__main__':
    print_message()
```

2. Run

▶ python main.py
Hello World

Code

main.py

```
def print_message():
    print("Hello World")

if __name__ == '__main__':
    print_message()
```

Human Readable
Source Code



Machine Code

```
01101000 10111100 10000001
01100100 01011100 00010111
00001010 00001110 11111010
10110001 01101000 10111100
10000001 01100100 01011100
00010111 00001010 00001110
11111010 10110001 10110001
```

Machine Readable
Machine Code

Code

main.py

```
def print_message():
    print("Hello World")

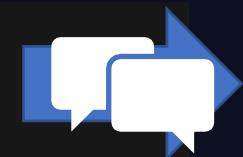
if __name__ == '__main__':
    print_message()
```



Compiler

main.pyc

```
Hello World
 1  0 LOAD_NAME      0 (dig)
 3  0 LOAD_NAME      1 (print)
 6  0 LOAD_CONST     0 ('Hello World')
--> 12 CALL_FUNCTION 1 (1 positional,0 keyword)
 15 PRINT_EXPR
 16 LOAD_CONST        1 (None)
 19 RETURN_VALUE
```



Interpreter

Machine Code

```
01101000 10111100 10000001
01100100 01011100 00010111
00001010 00001110 11111010
10110001 01101000 10111100
10000001 01100100 01011100
00010111 00001010 00001110
11111010 10110001 10110001
```

Human Readable
Source Code

Intermediary
Byte Code

Machine Readable
Machine Code

Virtual Machine

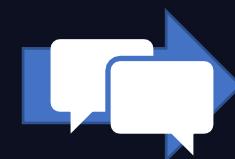


Compiler

main.py

```
Hello World
 1  0 LOAD_NAME      0 (dig)
 3  LOAD_NAME      1 (print)
 6  LOAD_CONST     0 ('Hello World')
--> 12 CALL_FUNCTION 1 (1 positional,0 keyword)
15  PRINT_EXPR
16  LOAD_CONST      1 (None)
19  RETURN_VALUE
```

Intermediary
Byte Code



Interpreter



Python VM

Machine Code

```
01101000 10111100 10000001
01100100 01011100 00010111
00001010 00001110 11111010
10110001 01101000 10111100
10000001 01100100 01011100
00010111 00001010 00001110
11111010 10110001 10110001
```

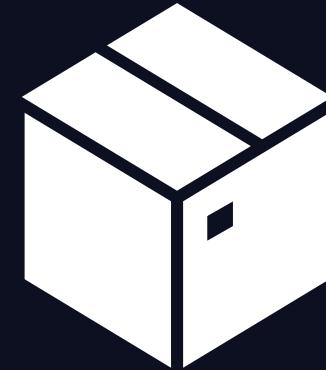
Machine Readable
Machine Code

▶ python main.py

Hello World

Packages/Modules/Libraries

- Filesystems
- Math
- Operating system
- HTTP
- Security
- Networking



Build

- Compile
- Run Tests
- Package
- Delivery
- Check build procedure for different types of applications:
 - Python
 - Java
 - NodeJS

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NETWORKING

Networking Pre-Requisites

- Switching
- Routing
- Default Gateway
- DNS Configurations on Linux

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DNS

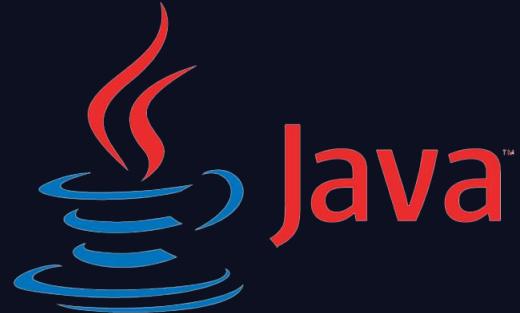
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Introduction

About Java

- Free
- Open-source
- Huge Community



| Version | Date |
|---------|------|
| 13 | 2019 |
| 12 | 2019 |
| 11 | 2018 |
| 10 | 2018 |
| 9 | 2017 |
| 8 | 2014 |
| 7 | 2011 |
| 6 | 2006 |
| 5 | 2004 |

Install Java

```
▶ wget https://download.java.net....  
openjdk-13.0.2_linux-x64_bin.tar.gz
```

```
▶ tar -xvf openjdk-13.0.2_linux-x64_bin.tar.gz  
/opt/jdk-13/bin/java -version
```

```
▶ jdk-13.0.2/bin/java -version  
openjdk version "13.0.2" 2020-01-14  
OpenJDK Runtime Environment (build 13.0.2+8)  
OpenJDK 64-Bit Server VM (build 13.0.2+8, mixed mode, sharing)
```

```
▶ java -version  
openjdk version "1.8.0_242"  
OpenJDK Runtime Environment (build 1.8.0_242-b08)  
OpenJDK 64-Bit Server VM (build 25.242-b08, mixed mode)
```



JDK 13.0.2 General-Availability Release

Schedule, status, & features (OpenJDK)

Documentation

- Release notes
- API Javadoc

Build 8 (2019/12/11): General Availability

- Changes in th
- Issues addres

| | Version | Name | Public License, |
|--|---------|------|-----------------------------------|
| These open-sourc version 2, with th | 13 | 13 | Public License, |
| Linux/ macOS/ Windows/ | 12 | 12 | Public License, |
| Commercial buil wider range of pla | 11 | 11 | Source license, for a Network. |
| Notes | 10 | 10 | |
| | 9 | 9 | |
| | 8 | 1.8 | |
| | 7 | 1.7 | |
| | 6 | 1.6 | |
| | 5 | 1.5 | |



Java Development Kit (JDK)

Develop



Build



Run



(Java Runtime Environment)



```
▶ ls jdk-13.0.2/bin
```

```
jaotc javadoc jdeprscan jinfo jps jstath rmiregistry  
jar javap jdeps jjs jrungscript keytool serialver  
jarsigner jcmsg jfr jlink jshell pack200 unpack200  
java jconsole jhsdb jmap jstack rmic  
javac jdb jimage jmod jstat rmid
```

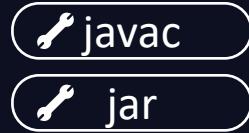
Before v9

Java Development Kit (JDK)

Develop



Build



Run



JRE

(Java Runtime Environment)

[Download JDK](#)

.tar.gz - 106 MB

[Checksum](#)

[Download JRE](#)

.tar.gz - 39 MB

[Checksum](#)

After v9



Java Development Kit (JDK)

Develop



jdb



javadoc

Build



javac



jar

Run



JRE

(Java Runtime Environment)



java

Labs

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Build

Compile

1. Develop Source Code

MyClass.java

```
public class MyClass {  
    public static void main(String[] args) {  
        System.out.println("Hello World");  
    }  
}
```

2. Compile

► javac MyClass.java

MyClass.class

3. Run

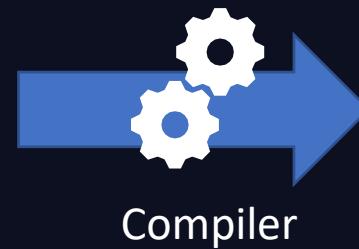
► java MyClass

Hello World

Compile

MyClass.java

```
public class MyClass {  
    public static void main(String[] args) {  
        System.out.println("Hello World");  
    }  
}
```



Machine Code

```
01101000 10111100 10000001  
01100100 01011100 00010111  
00001010 00001110 11111010  
10110001 01101000 10111100  
10000001 01100100 01011100  
00010111 00001010 00001110  
11111010 10110001 10110001
```

Human Readable
Source Code

Machine Readable
Machine Code

Java Virtual Machine

MyClass.java

```
public class MyClass {  
    public static void main(String[] args) {  
        System.out.println("Hello World");  
    }  
}
```



Compiler

MyClass.class

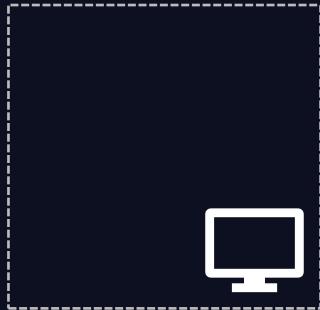
```
0:  iconst_2  
1:  istore_1  
2:  iload_1  
3:  sipush 1000  
6:  if_icmpge 44  
9:  iconst_2  
10:  istore_2  
11:  iload_2  
12:  iload_1  
13:  if_icmpge 31
```

Human Readable
Source Code

Intermediary
Byte Code

Machine Code

```
01101000 10111100 10000001  
01100100 01011100 00010111  
00001010 00001110 11111010  
10110001 01101000 10111100  
10000001 01100100 01011100  
00010111 00001010 00001110  
11111010 10110001 10110001
```



JVM

Machine Readable
Machine Code

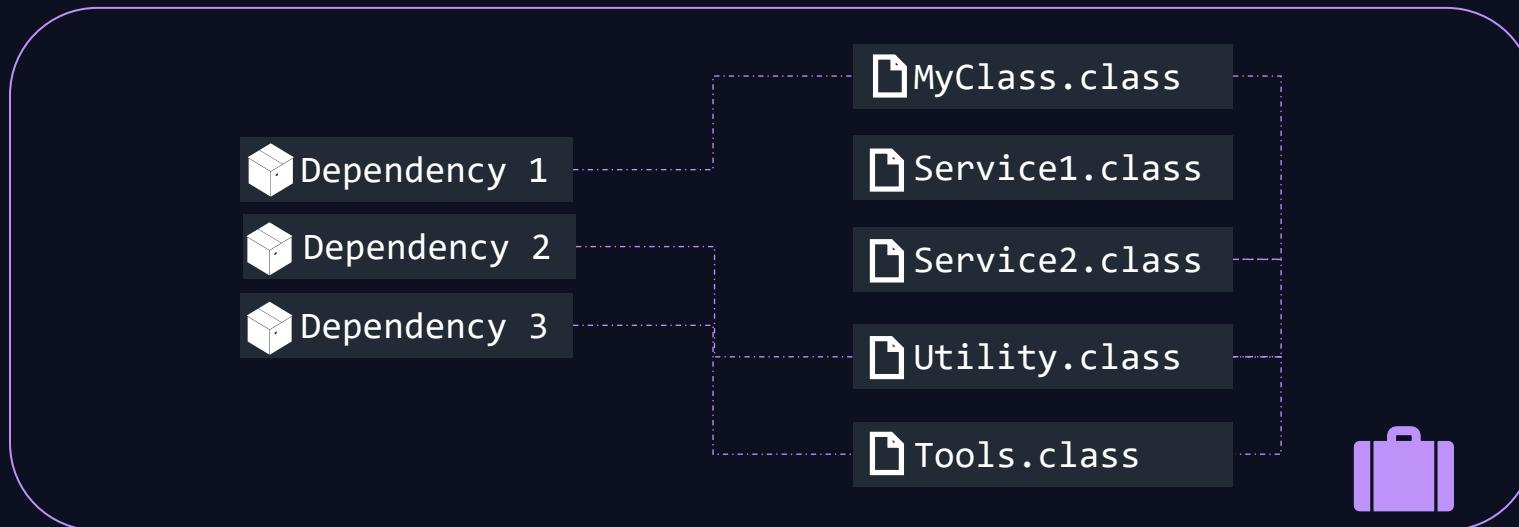
▶ javac MyClass.java

MyClass.class

▶ java MyClass

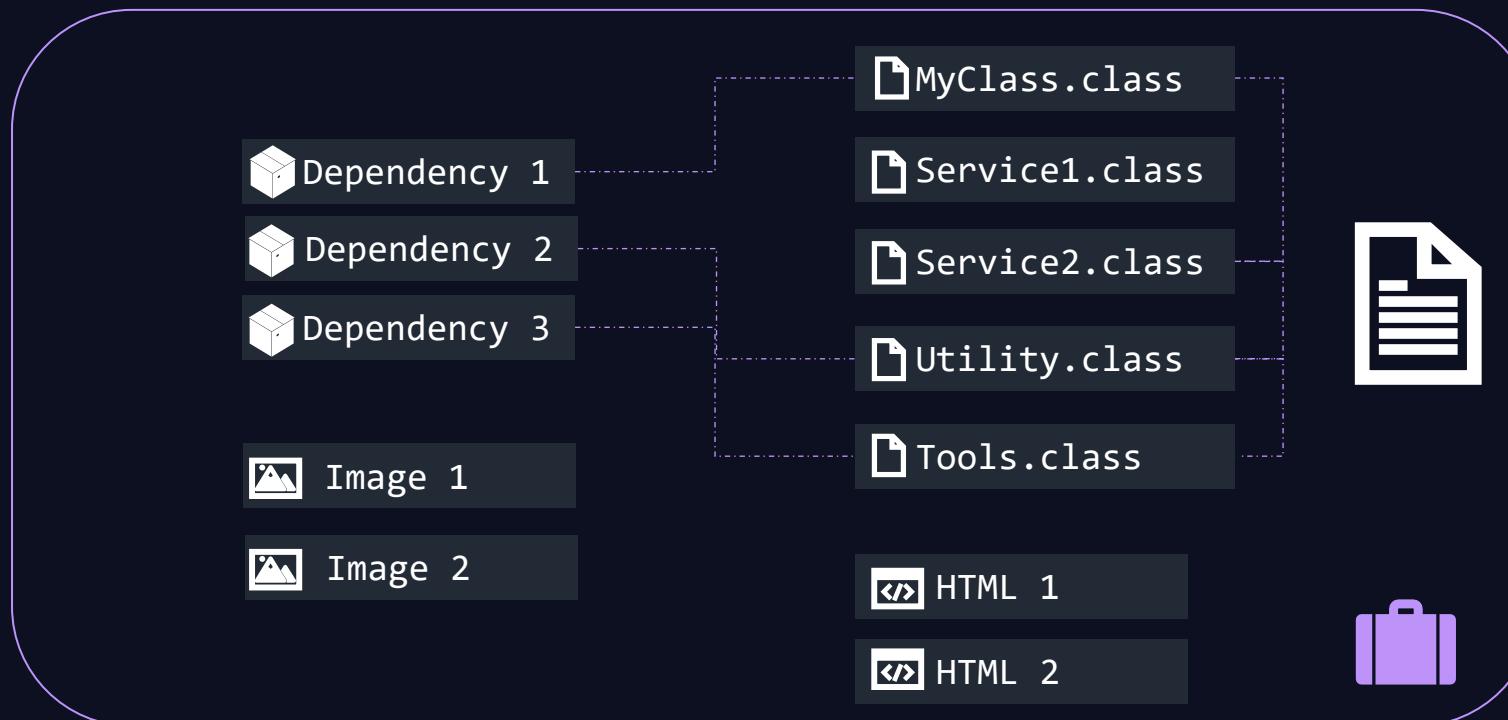
Hello World

Package



Java Archive
(JAR)

Package



META-INF/MANIFEST.MF

```
Manifest-Version: 1.0  
Created-By: 1.8.0_242 (Private Build)  
Main-Class: MyClass
```

Java Archive Web Archive
(JAR) (WAR)

```
▶ jar cf MyApp.jar MyClass.class Service1.class Service2.class ...
```

MyApp.jar

```
▶ java -jar MyApp.jar
```

Hello World

Document

```
▶ javadoc -d doc MyClass.java
```

PACKAGE CLASS TREE DEPRECATED INDEX HELP

PREV CLASS NEXT CLASS FRAMES NO FRAMES

SUMMARY: NESTED | FIELD | CONSTR | METHOD DETAIL: FIELD | CONSTR | METHOD

Class MyClass

java.lang.Object
MyClass

```
public class MyClass
extends java.lang.Object
```

Prints Hello World Message

Constructor Summary

Constructors

Constructor and Description

`MyClass()`

Build Process



Develop



Compile



Package



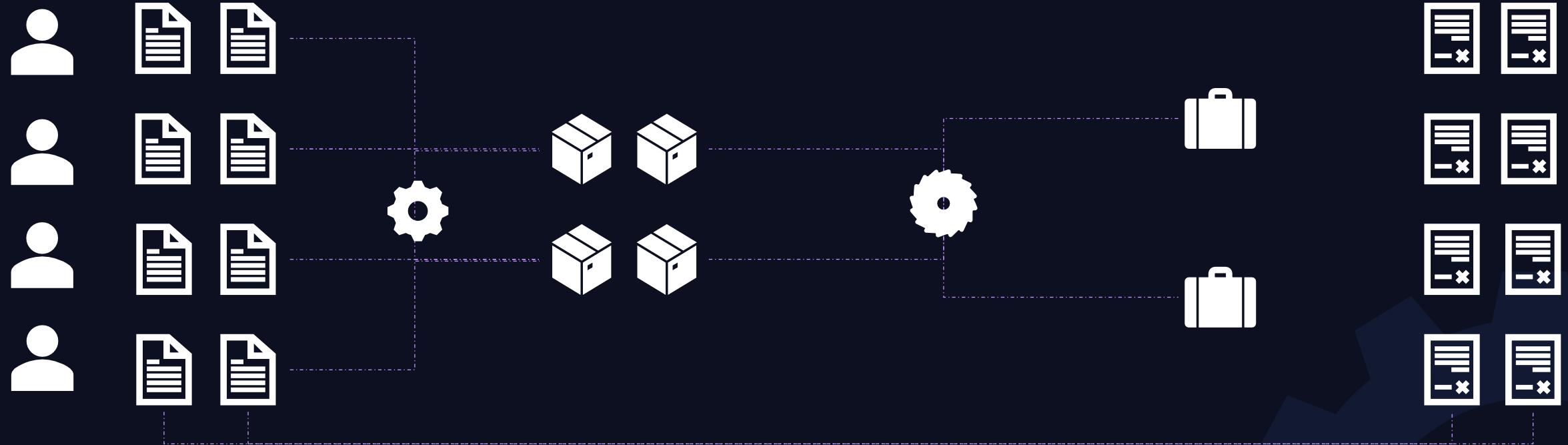
Document

```
▶ javac MyClass.java
```

```
▶ jar cf MyClass.jar ..
```

```
▶ javadoc MyClass.java
```

Build Process



Build Tools

- Maven
- Gradle
- ANT

```
# Build Steps
```

```
1.Compile
```

```
2.Package
```

```
3.Document
```

Gradle

Branch: master ▾ docker-java-sample / build.gradle

 arun-gupta upgrading the version to 3.0.6

2 contributors  

45 lines (35 sloc) | 961 Bytes

```
1 buildscript {  
2     repositories {  
3         jcenter()  
4     }  
5  
6     dependencies {  
7         classpath 'com.bmuschko:gradle-docker-plugin:3.0.6'  
8     }  
9 }  
10  
11 apply plugin: 'java'  
12 apply plugin: 'application'  
13 apply plugin: 'com.bmuschko.docker-java-application'  
14  
15 import com.bmuschko.gradle.docker.tasks.container.*  
16 import com.bmuschko.gradle.docker.tasks.image.*  
17
```

Gradle

Classical

1. Build app: `./gradlew build`

2. Run app: `./gradlew run`

Summary

- Java
- Java Runtime Environment
- Java Development Kit
- Compiling a Java application
- Packaging a given application to JARs
- What are Build Tools?

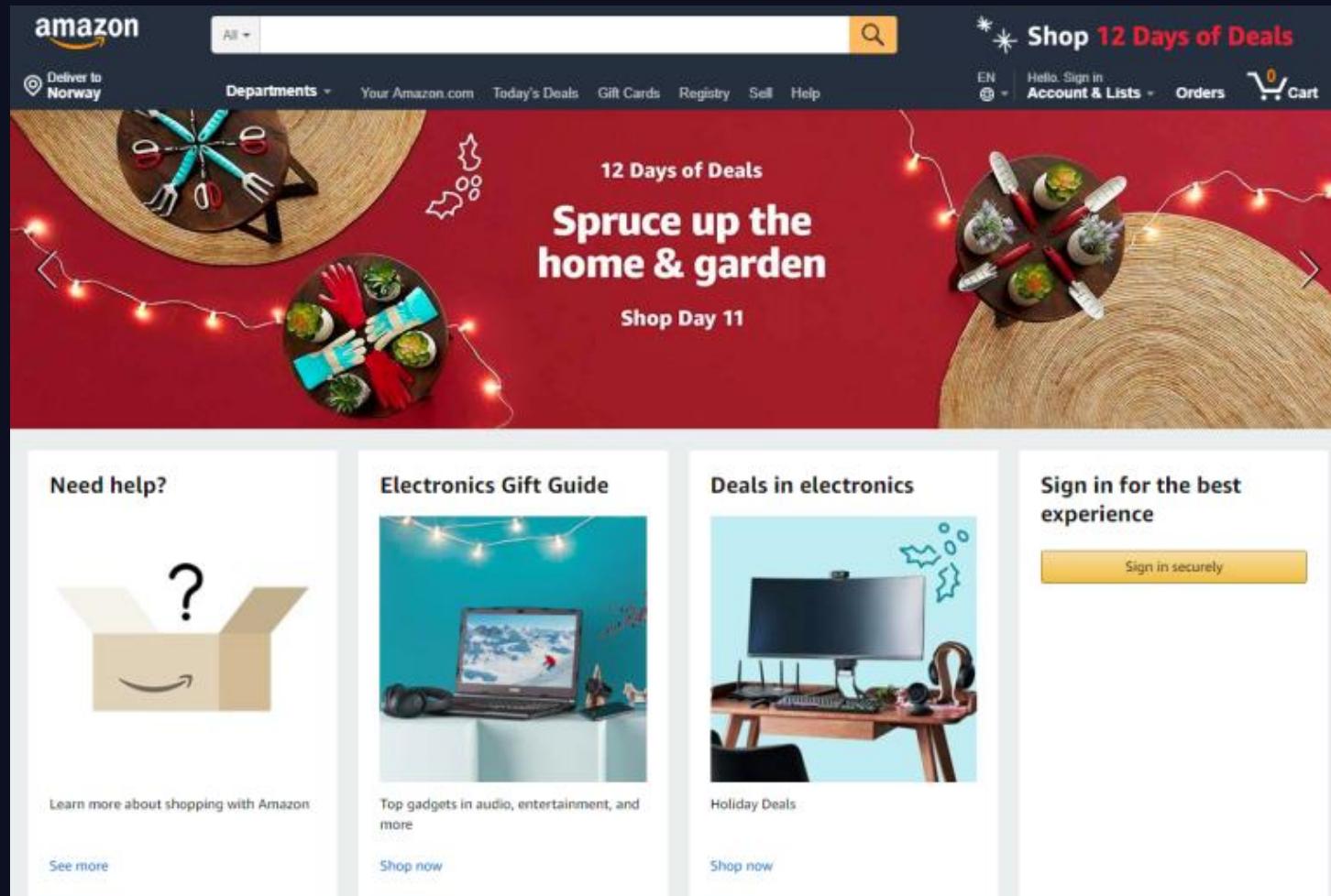
DevOps Course

Labs

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JavaScript



jQuery

A

Atom

V

ember

NodeJS

- Free
- Open source
- Cross Platform Compatible



[Node.js 13.x](#)

[Node.js 12.x](#)

[Node.js 11.x](#)

[Node.js 10.x](#)

[Node.js 9.x](#)

[Node.js 8.x](#)

[Node.js 7.x](#)

[Node.js 6.x](#)

[Node.js 5.x](#)

[Node.js 4.x](#)

[Node.js 0.12.x](#)

[Node.js 0.10.x](#)

Install NodeJS

NodeSource Node.js Binary Distributions



ubuntu®



centOS

fedora^f

```
▶ curl -sL https://rpm.nodesource.com/setup_13.x | bash -
```

```
▶ yum install nodejs
```

NodeJS Commands

```
▶ node -v
```

```
v13.10.1
```

```
▶ node add.js
```

```
Addition : 15
```

add.js

```
// Returns addition of two numbers
let add = function (a, b) {
    return a+b;
};

const a = 10, b = 5;

console.log("Addition : "+ add(a,b));
```

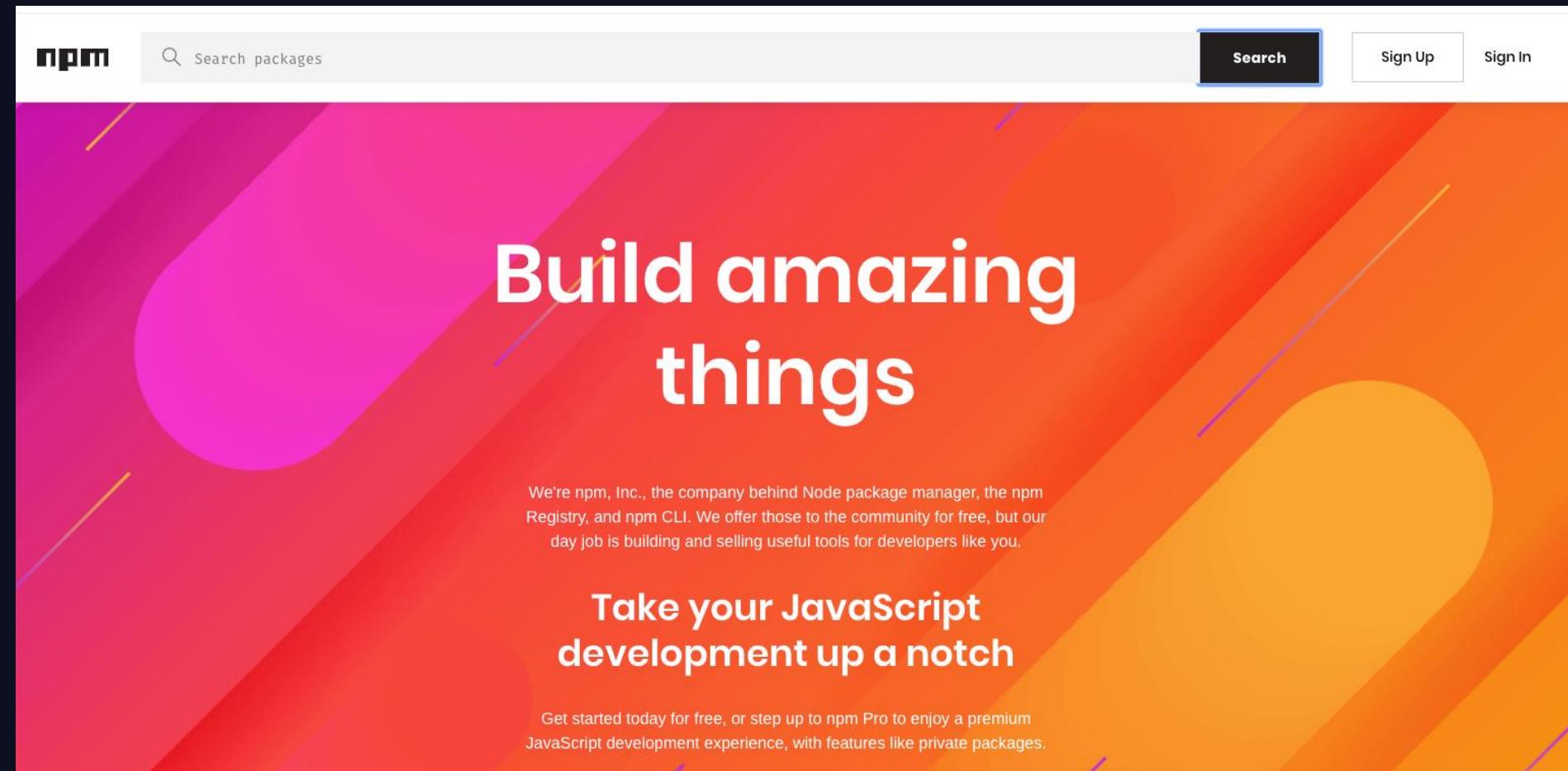
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Node Package Manager (NPM)

- Files
- Web Servers
- Databases
- Security
- Many More



<https://www.npmjs.com/>

NPM Commands

```
▶ npm -v
```

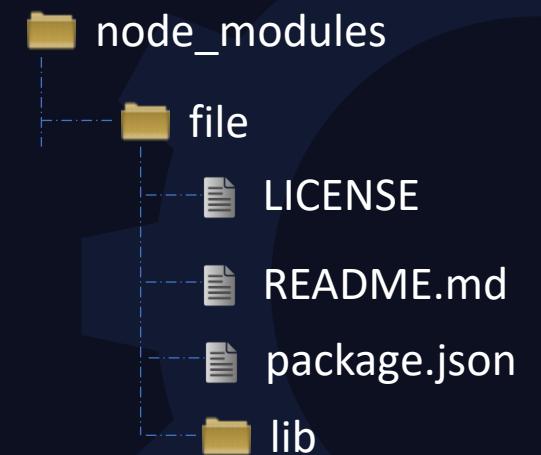
```
6.13.7
```

```
▶ npm search file
```

| NAME | DESCRIPTION | AUTHOR | DATE |
|-------------|----------------------|------------------|------------|
| file | Higher level path... | =aconbere | 2014-02-21 |
| File | HTML5 FileAPI... | =coolaj86 =narf | 2014-10-24 |
| dotenv | Loads environment... | =~jcblw... | 2019-10-16 |
| fs-extra | fs-extra contains... | =jprichardson... | 2019-06-28 |
| file-loader | A file loader... | =d3viant0ne... | 2020-02-19 |

```
▶ npm install file
```

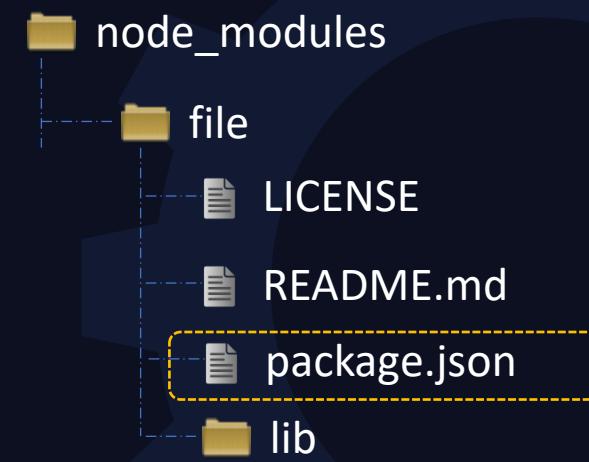
```
+ file@0.2.2  
added 1 package from 1 contributor and audited 1 package in 1.072s  
found 0 vulnerabilities
```



NPM Commands

package.json

```
{  
  "author": {  
    "name": "Anders Conbere",  
    "email": "aconbere@gmail.com"  
  },  
  "bundleDependencies": false,  
  "devDependencies": {  
    "mocha": "1.9.x"  
  },  
  "directories": {  
    "lib": "lib"  
  },  
  "homepage": "https://github.com/aconbere/node-file-utils#readme",  
  "license": "MIT",  
  "main": "./lib/file",  
  "name": "file",  
  "repository": {  
    "type": "git",  
    "url": "git+ssh://git@github.com/aconbere/node-file-utils.git"  
  },  
  "tags": [  
    "file",  
    "path",  
    "fs",  
    "walk"  
  ],  
  "version": "0.2.2"  
}
```



NPM Commands

```
▶ npm install file
```

```
+ file@0.2.2  
added 1 package from 1 contributor and audited 1 package in 1.072s  
found 0 vulnerabilities
```

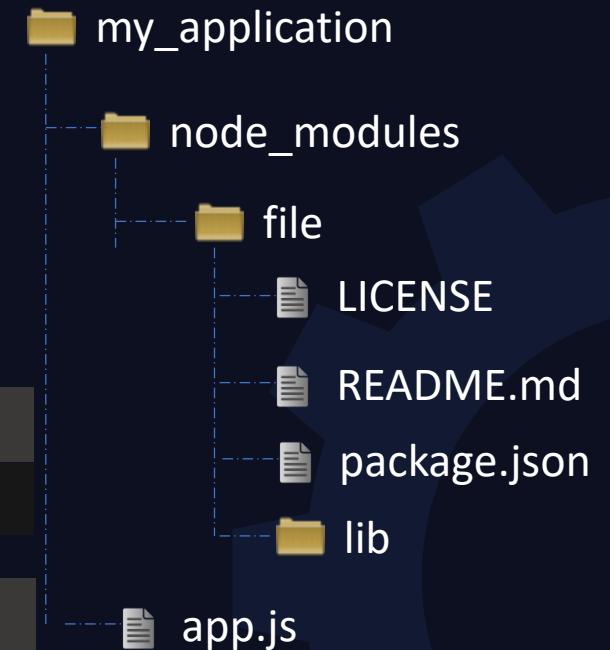
```
app.js
```

```
var file = require("file");  
  
file.mkdirs("/tmp/dir1")
```

```
▶ node -e "console.log(module.paths)"
```

```
[ '/app/node_modules', '/node_modules' ]
```

```
▶ npm install file -g
```



Common Modules

| Built-In Modules | | External Modules | |
|------------------|-----------------------------------|------------------|---|
| fs | To handle filesystem | express | Fast, unopinionated, minimalist web framework |
| http | To host an HTTP server | react | To create user interfaces |
| os | To work with the Operating System | debug | To debug applications |
| events | To handle events | async | To work with asynchronous JS |
| tls | To implement TLS and SSL | lodash | To work with arrays, objects, strings etc |
| url | To Parse URL Strings | | |

```
▶ ls /usr/lib/node_modules/npm/node_modules/
```

```
▶ ls /usr/lib/node_modules/
```

Application Dependencies

package.json

```
{  
  "name": "example-contentful-theExampleApp-js",  
  "version": "0.0.0",  
  "private": true,  
  "dependencies": {  
    "body-parser": "^1.18.2",  
    "contentful": "^6.0.0",  
    "cookie-parser": "~1.4.3",  
    "dotenv": "^5.0.0",  
    "execa": "^0.9.0",  
    "express": "^4.16.2",  
    "helmet": "^3.11.0",  
    "lodash": "^4.17.5",  
    "marked": "^0.3.16",  
    "morgan": "^1.9.1",  
    "pug": "~2.0.0-beta6"  
  }  
}
```

Labs

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Python

- Free
- Open source
- Cross Platform Compatible



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 python™

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[Download Python 3.8.2](#)

Looking for Python with a different OS? Python for [Windows](#), [Linux/UNIX](#), [Mac OS X](#), [Other](#)

Want to help test development versions of Python? [Prereleases](#), [Docker images](#)

Looking for Python 2.7? See below for specific releases



<https://www.python.org/downloads/>

Versions

- Python2 – (2000 – 2010)
- Python3 – (2008 to Present)

Install

```
▶ yum install python2
```

```
▶ python2
```

```
Python 2.7.16 (default, Nov 17 2019, 00:07:27)
[GCC 8.3.1 20190507 (Red Hat 8.3.1-4)] on linux2
Type "help", "copyright", "credits" or "license"
for more information.

>>> exit()
```

```
▶ yum install python36
```

```
▶ python3
```

```
Python 3.6.8 (default, Nov 21 2019, 19:31:34)
[GCC 8.3.1 20190507 (Red Hat 8.3.1-4)] on linux
Type "help", "copyright", "credits" or "license"
for more information.

>>> exit()
```

```
▶ python2 -V
```

```
Python 2.7.16
```

```
▶ python3 -V
```

```
Python 3.6.8
```

Python Commands

```
▶ python2 main.py  
Hello World
```

```
main.py  
  
def print_message():  
    print("Hello World")  
  
if __name__ == '__main__':  
    print_message()
```

Labs

just enough



Python Package Manager (pip)

```
▶ python2 -V
```

```
Python 2.7.16
```

```
▶ pip2 -V
```

```
pip 9.0.3 from /usr/lib/python2.7/site-packages  
(python 2.7)
```

```
▶ python3 -V
```

```
Python 3.6.8
```

```
▶ pip3 -V
```

```
pip 9.0.3 from /usr/lib/python3.6/site-packages  
(python 3.6)
```

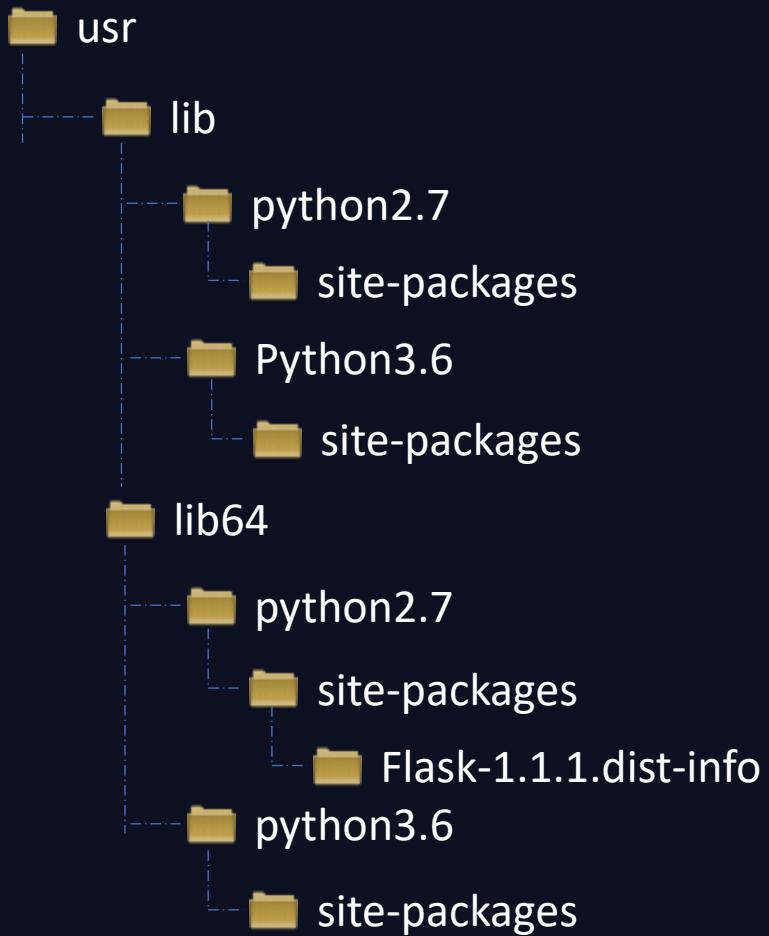
```
▶ pip -V
```

```
pip 9.0.3 from /usr/lib/python2.7/site-packages (python 2.7)
```

```
▶ pip install flask
```

Python Package Manager (pip)

```
▶ pip install flask
```



Python Package Manager (pip)

```
▶ pip install flask
```

```
▶ pip show flask
```

```
Name: Flask
Version: 1.1.1
Summary: A simple framework for building complex
web applications.
Home-page: https://palletsprojects.com/p/flask/
Author: Armin Ronacher
Author-email: armin.ronacher@active-4.com
License: BSD-3-Clause
Location: /usr/lib64/python2.7/site-packages
Requires: Werkzeug, click, Jinja2, itsdangerous
```

```
▶ python2 -c "import sys; print(sys.path)"
```

```
'/usr/lib/python27.zip', '/usr/lib64/python2.7',
'/usr/lib64/python2.7/plat-linux2',
'/usr/lib64/python2.7/lib-tk',
'/usr/lib64/python2.7/lib-old',
'/usr/lib64/python2.7/lib-dynload',
'/usr/lib64/python2.7/site-packages',
'/usr/lib/python2.7/site-packages'
```

```
main.py
from flask import Flask, request
app = Flask(__name__)
@app.route('/')
def hello():
    return 'Hello, World'
```

```
python2.7
└── site-packages
    └── Flask-1.1.1.dist-info
python3.6
└── site-packages
```

Requirements

```
▶ pip install flask
```

```
▶ pip install jinja2
```

```
▶ pip install markupsafe
```

```
▶ pip install Werkzeug
```

```
▶ pip install requests
```

```
▶ pip install gunicorn
```

```
▶ pip install flask jinja2 markupsafe
```

```
requirements.txt
```

```
Flask==0.10.1
```

```
Jinja2==2.7.3
```

```
MarkupSafe==0.23
```

```
Werkzeug==0.9.6
```

```
requests==2.3.0
```

```
gunicorn==18.0
```

```
▶ pip install -r requirements.txt
```

Upgrade/Uninstall Package

```
▶ pip install flask --upgrade
Installing collected packages: click, flask
  Attempting uninstall: flask
    Found existing installation: Flask 0.10.1
    Uninstalling Flask-0.10.1:
      Successfully uninstalled Flask-0.10.1
Successfully installed click-7.1.1 flask-1.1.1
```

```
▶ pip uninstall flask
Found existing installation: Flask 1.1.1
Uninstalling Flask-1.1.1:
  Would remove:
    /home/vagrant/.local/bin/flask
    /home/vagrant/.local/lib/python3.5/site-
packages/Flask-1.1.1.dist-info/*
    /home/vagrant/.local/lib/python3.5/site-
packages/flask/*
Proceed (y/n)? y
  Successfully uninstalled Flask-1.1.1
```

Other Package Managers

- easy_install

► easy_install install app



app.py



✖️ setuptools



app.egg

- wheels

► pip install app.whl



app.py



✖️ setuptools



app.whl

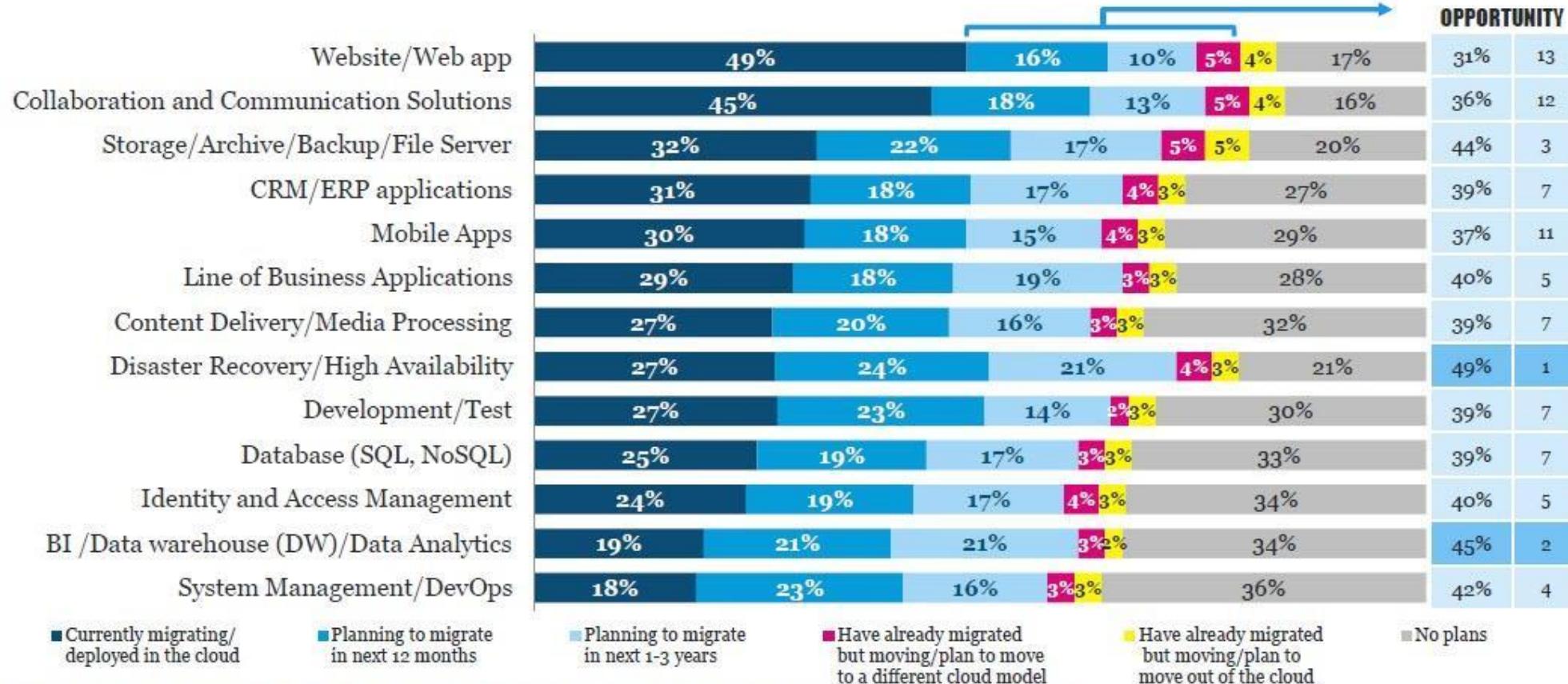
Labs

Servers



Why?

Q. Please use the scale below to describe your organization's plans for moving each of the following types of applications to the cloud



Q. Please use the scale below to describe your organization's plans for moving each of the following types of applications to the cloud.

Application Types



Desktop



Mobile



Web

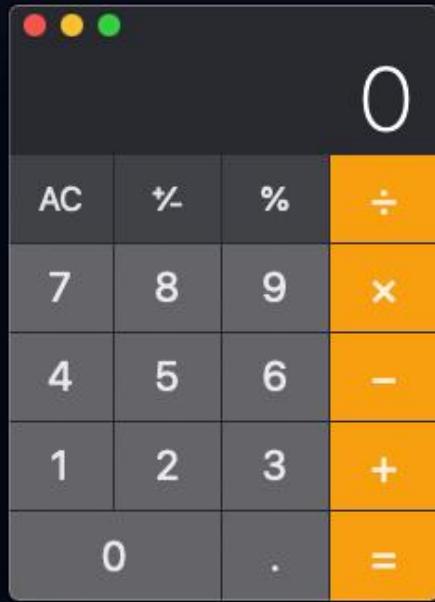


Analytics

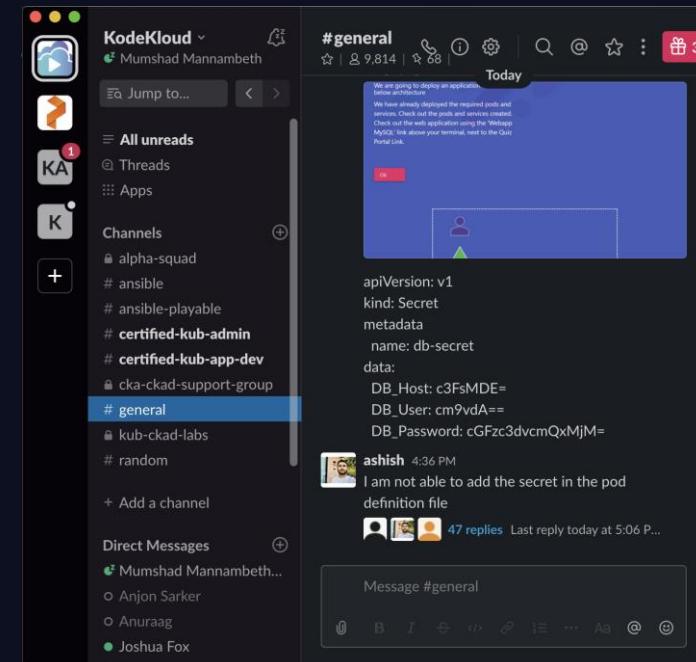


Problem Solving

Standalone vs Client-Server



Standalone Desktop

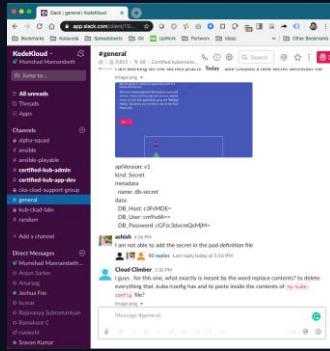


Desktop Client

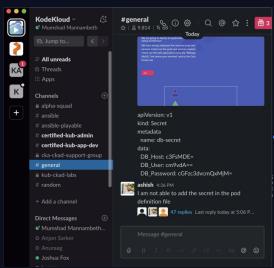


Server

Client-Server



Web Client



Desktop Client



Mobile Client



Chat
Server

Servers



Servers



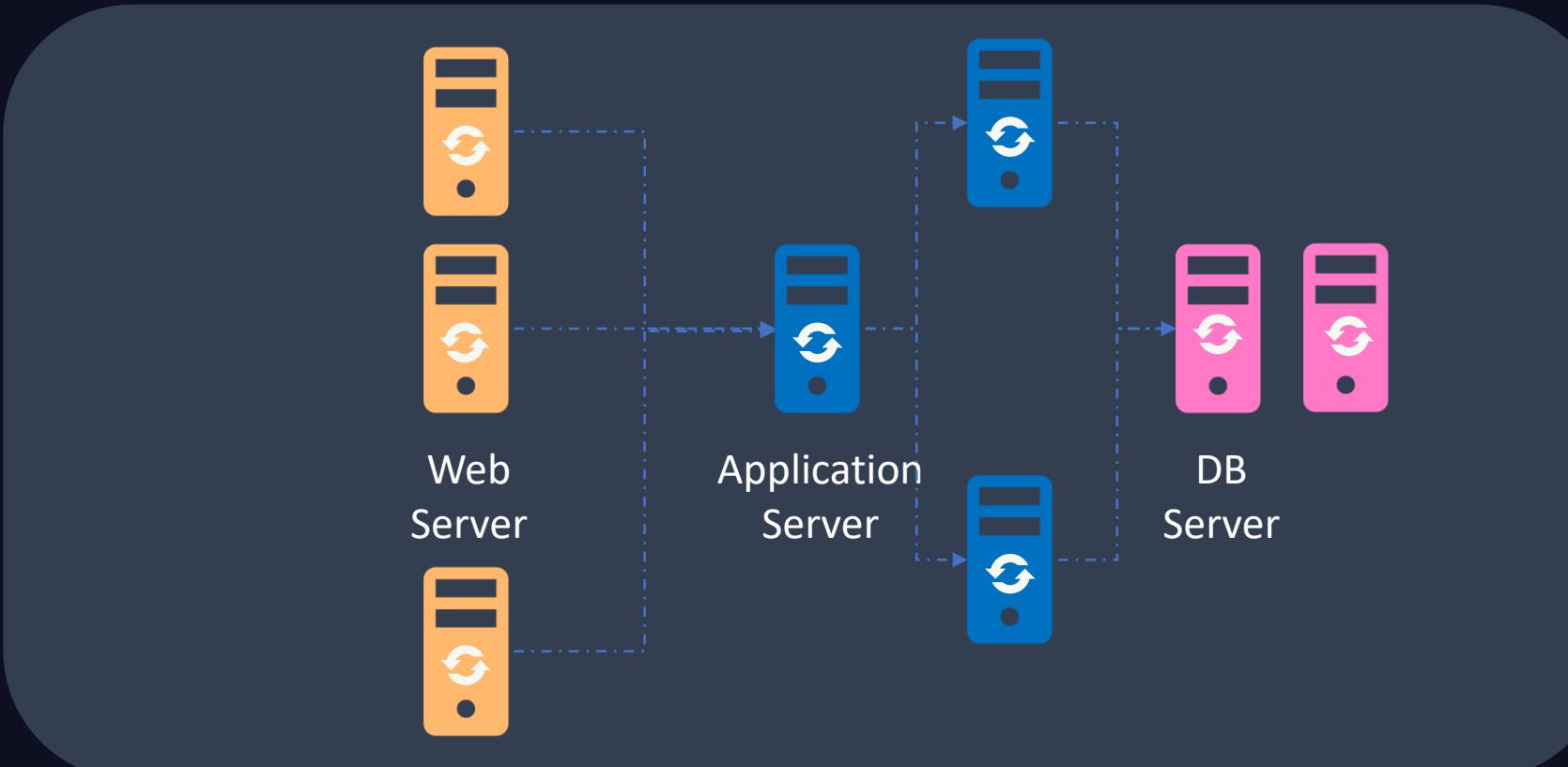
Web Application
Server Server

Servers



AppWebion
Server

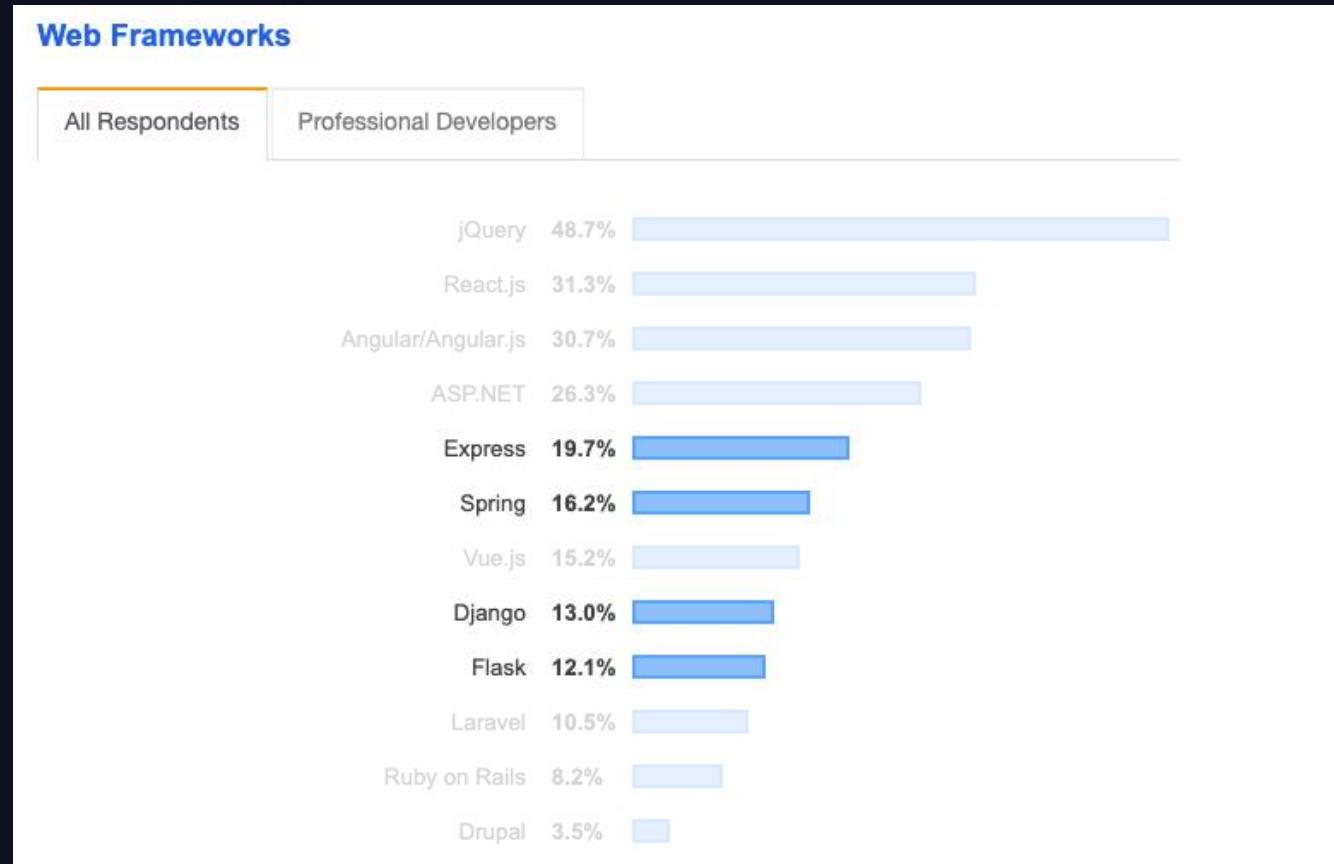
Servers



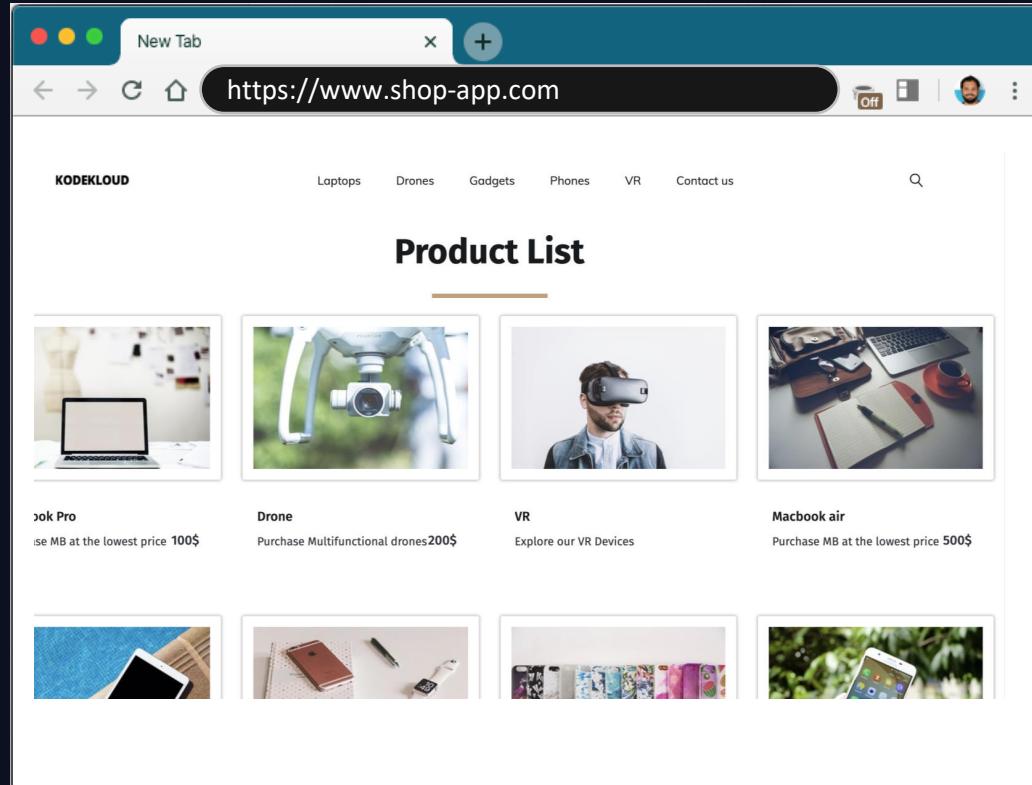
just enough

Web Frameworks & Web Servers

Web Frameworks



Web Frameworks



REQUEST



HTML

CSS

JavaScript

RESPONSE

Python

NodeJS

Web Frameworks

app.js

```
$(document).ready(function() {
    $.get("/products", function (data, status) {
        displayProducts( data )
    });
});
```

DemoApplication.java

```
package com.example.demo;

// <code hidden>

@SpringBootApplication
@RestController
public class DemoApplication {

    public static void main(String[] args) {
        SpringApplication.run(DemoApplication.class, args);
    }

    @GetMapping("/products")
    public String[] getProducts() {
        return getProductList();
    }
}
```

HTML

CSS

JavaScript

JAVA

Python

NodeJS

Application Code

Web Frameworks

DemoApplication.java

```
package com.example.demo;

// <code hidden>

@SpringBootApplication
@RestController
public class DemoApplication {

    public static void main(String[] args) {
        SpringApplication.run(DemoApplication.class, args);
    }

    @GetMapping("/products")
    public String[] getProducts() {
        return get productList();
    }
}
```

demo.py

```
from flask import Flask

app = Flask(__name__)

@app.route('/products')
def hello():
    return get productList()

if __name__ == '__main__':
    app.run()
```

demo.js

```
const express = require('express')
const app = express()

app.get('/products', (req, res) =>
  res.send(getProductList()))
```

HTML

CSS

JavaScript

JAVA

Python

NodeJS

Application Code

Web Server

DemoApplication.java

```
package com.example.demo;

// <code hidden>

@SpringBootApplication
@RestController
public class DemoApplication {

    public static void main(String[] args) {
        SpringApplication.run(DemoApplication.class, args);
    }

    @GetMapping("/products")
    public String[] getProducts() {
        return getProductList();
    }
}
```



Web
Server

HTML

CSS

JavaScript

JAVA

Python

NodeJS

Application Code

Web Server

DemoApplication.java

```
package com.example.demo;

// <code hidden>

@SpringBootApplication
@RestController
public class DemoApplication {

    public static void main(String[] args) {
        SpringApplication.run(DemoApplication.class, args);
    }

    @GetMapping("/products")
    public String[] getProducts() {
        return getProductList();
    }
}
```



Apache Tomcat

8080

NGINX



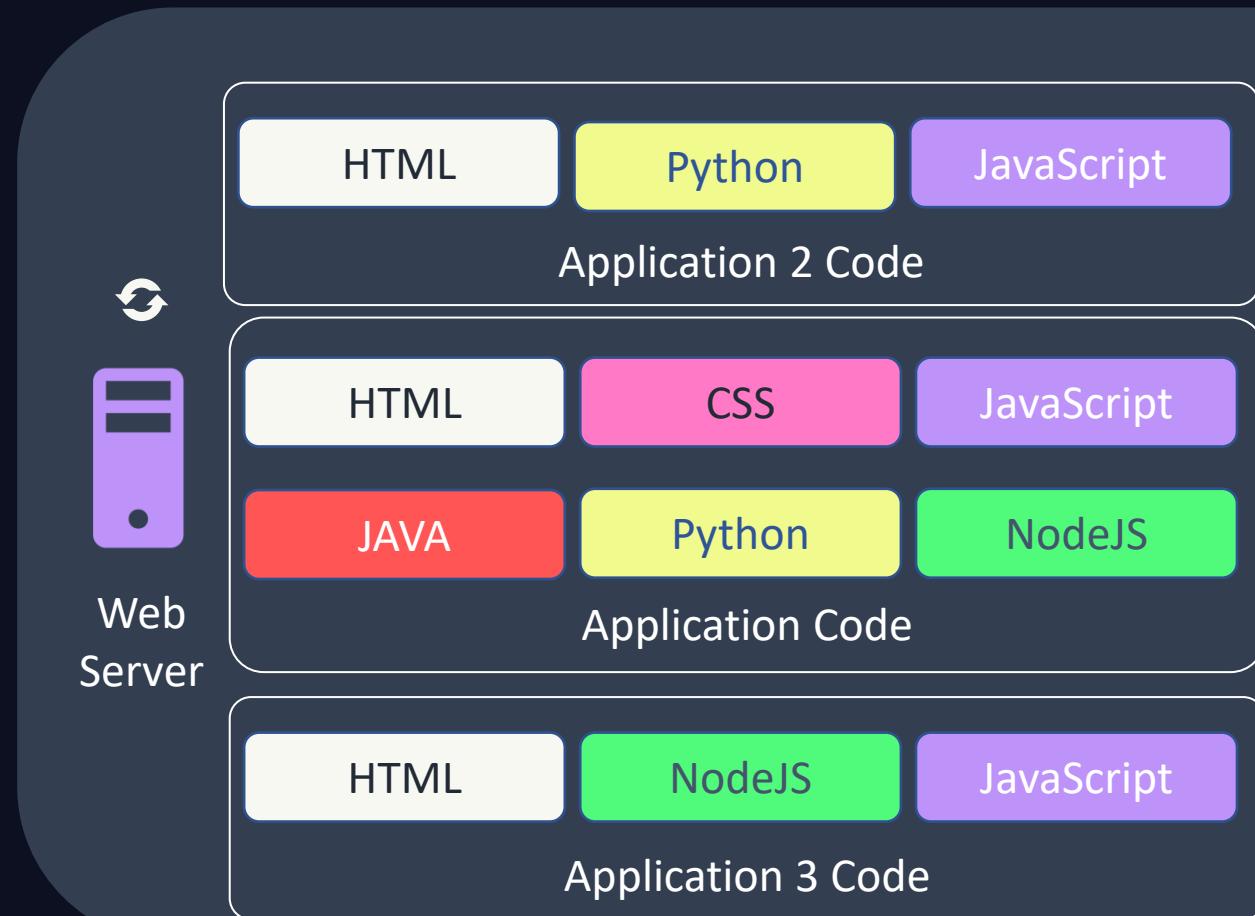
80

8000

Web Server

DemoApplication.java

```
package com.example.demo;  
  
// <code hidden>  
  
@SpringBootApplication  
@RestController  
public class DemoApplication {  
  
    public static void main(String[] args) {  
        SpringApplication.run(DemoApplication.class, args);  
    }  
  
    @GetMapping("/products")  
    public String[] getProducts() {  
        return getProductList();  
    }  
}
```

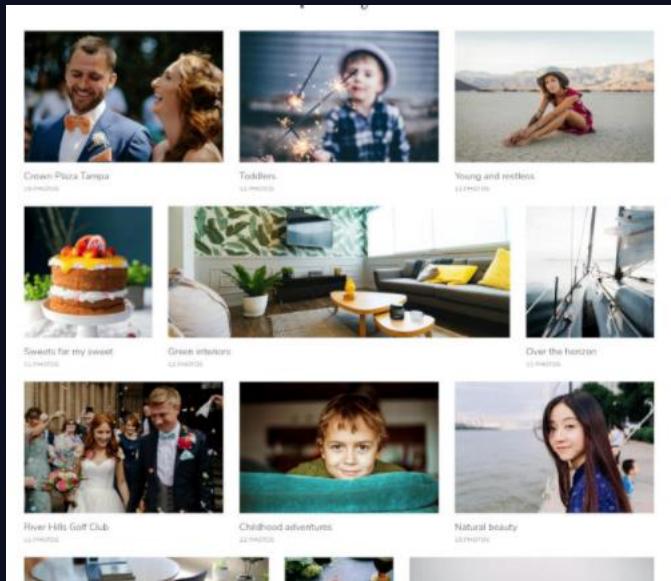


Apache Tomcat

NGINX



Static vs Dynamic Websites



KODEKLOUD

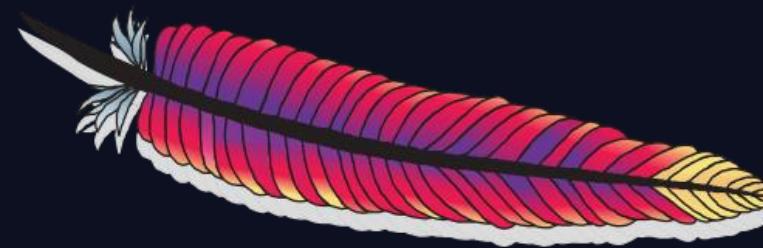
Laptops Drones Gadgets Phones VR Contact us

Product List

| Product | Description |
|-------------|---------------------------------------|
| MacBook Pro | Purchase MB at the lowest price 100\$ |
| Drone | Purchase Multifunctional drones 200\$ |
| VR | Explore our VR Devices |
| Macbook air | Purchase MB at the lowest price 500\$ |



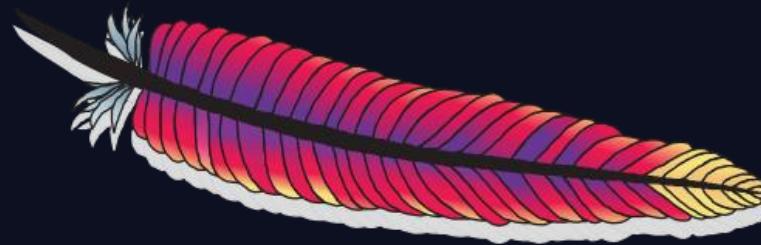
just enough



APACHE WEB SERVER

Apache Web Server

- Open source
- Web Server



Install Apache Web Server

```
▶ yum install httpd
```

```
▶ service httpd start
```

```
▶ service httpd status
```

```
Redirecting to /bin/systemctl status httpd.service
● httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; disabled; vendor preset: disabled)
   Active: active (running) since Sun 2020-03-22 12:01:42 UTC; 56s ago
     Docs: man:httpd(8)
           man:apachectl(8)
   Main PID: 4253 (httpd)
      Status: "Total requests: 0; Current requests/sec: 0; Current traffic: 0 B/sec"
```

```
▶ firewall-cmd --permanent --add-service=http
```



Web
Server

View Logs

```
▶ cat /var/log/httpd/access_log
```

```
::1 - - [22/Mar/2020:13:00:38 +0000] "GET / HTTP/1.1" 403 4897 "-" "curl/7.29.0"
```



```
▶ cat /var/log/httpd/error_log
```

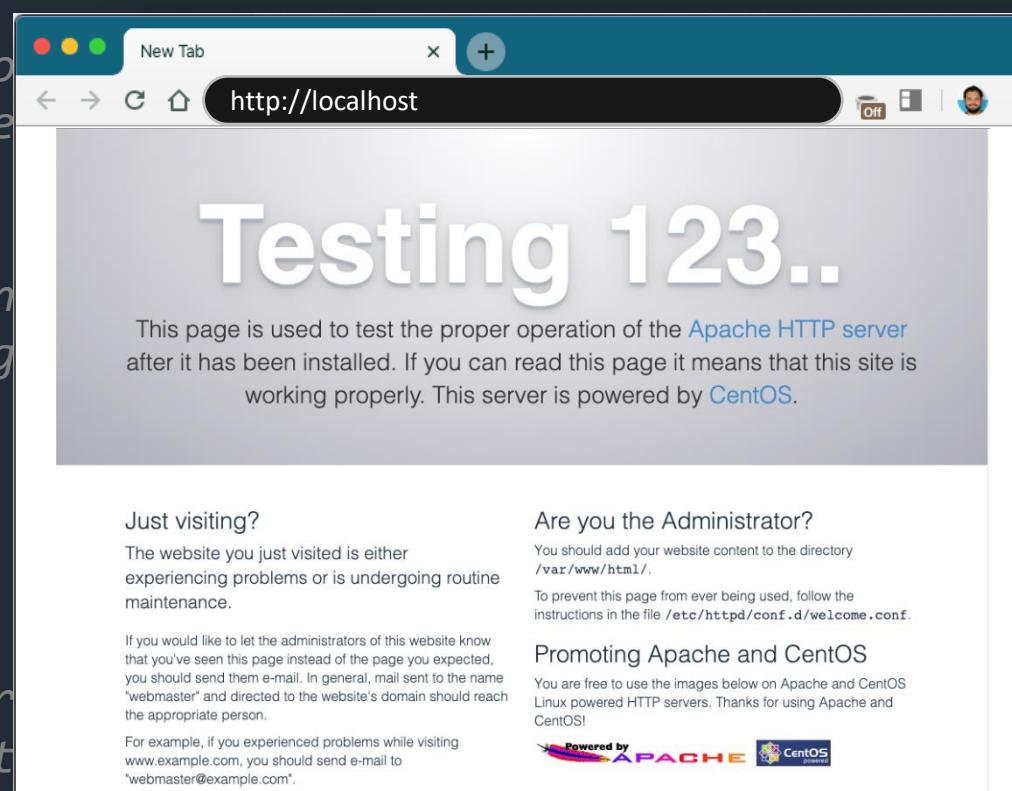
```
[Sun Mar 22 12:01:42.409565 2020] [core:notice] [pid 4253] SELinux policy enabled; httpd running as context system_u:system_r:httpd_t:s0
[Sun Mar 22 12:01:42.411052 2020] [suexec:notice] [pid 4253] AH01232: suEXEC mechanism enabled (wrapper: /usr/sbin/suexec)
AH00558: httpd: Could not reliably determine the server's fully qualified domain name, using localhost.localdomain. Set the 'ServerName' directive globally to suppress this message
[Sun Mar 22 12:01:42.418732 2020] [lbmethod_heartbeat:notice] [pid 4253] AH02282: No slotmem from mod_heartmonitor
[Sun Mar 22 12:01:42.420272 2020] [mpm_prefork:notice] [pid 4253] AH00163: Apache/2.4.6 (CentOS) configured -- resuming normal operations
[Sun Mar 22 12:01:42.420283 2020] [core:notice] [pid 4253] AH00094: Command line: '/usr/sbin/httpd -D FOREGROUND'
[Sun Mar 22 13:00:38.040460 2020] [autoindex:error] [pid 4257] [client ::1:41654] AH01276: Cannot serve directory /var/www/html/: No matching DirectoryIndex (index.html) found, and
server-generated directory index forbidden by Options directive
[Sun Mar 22 13:16:36.345183 2020] [autoindex:error] [pid 4258] [client 10.0.2.2:54103] AH01276: Cannot serve directory /var/www/html/: No matching DirectoryIndex (index.html) found,
and server-generated directory index forbidden by Options directive
[Mon Mar 23 01:17:39.060209 2020] [autoindex:error] [pid 4256] [client 10.0.2.2:61535] AH01276: Cannot serve directory /var/www/html/: No matching DirectoryIndex (index.html) found,
and server-generated directory index forbidden by Options directive
[Mon Mar 23 01:20:14.131909 2020] [autoindex:error] [pid 4619] [client 10.0.2.2:61553] AH01276: Cannot serve directory /var/www/html/: No matching DirectoryIndex (index.html) found,
and server-generated directory index forbidden by Options directive
[Mon Mar 23 01:20:15.074959 2020] [autoindex:error] [pid 4255] [client 10.0.2.2:61558] AH01276: Cannot serve directory /var/www/html/: No matching DirectoryIndex (index.html) found,
and server-generated directory index forbidden by Options directive
```

Web
Server

Config File

/etc/httpd/conf/httpd.conf

```
#  
# Listen: Allows you to  
# ports, instead of the  
# directive.  
#  
# Change this to Listen  
# prevent Apache from g  
#  
#Listen 12.34.56.78:80  
Listen 80  
  
#  
# DocumentRoot: The dir  
# documents. By default  
# symbolic links and aliases may be used to point to other locations.  
#  
DocumentRoot "/var/www/html"
```



Web
Server

80

Default HTTP Port - 80

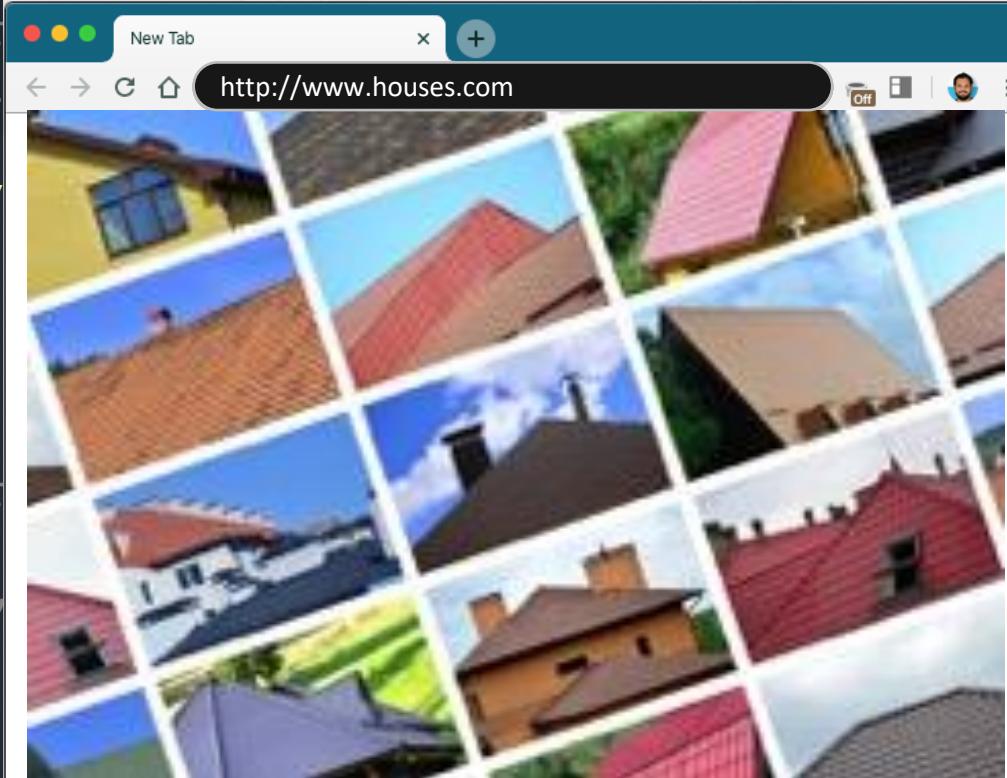
Document Root
/var/www/html

prevent Apache from geometry onto all bound IP addresses.

| DNS Name | IP Address |
|----------------|--------------|
| www.houses.com | 192.168.1.10 |
| | |

```
#  
/etc/hosts  
  
# Host Database  
127.0.0.1      localhost  
127.0.0.1      www.houses.com  
  
#  
DocumentRoot "/var/www/  
  
#  
# ServerName gives the  
itself.  
# This can often be det  
specify  
# it explicitly to prev  
#  
# If your host doesn't  
here.  
#  
#ServerName www.example.com:80  
ServerName www.houses.com:80
```

The directory out of which you will serve your



ctory, but
ations.

dentify

you

Default HTTP Port - 80

HTML

CSS

JavaScript

Document Root
/var/www/html



Web
Server

80

```
# prevent Apache from geomitting onto all bound IP addresses.  
#  
#Listen 12.34.56.78:80
```

```
Listen 80
```

```
#  
# DocumentRoot: The directory out of which you will serve your  
# documents. By default, all re  
# symbolic links and aliases ma
```

```
#  
DocumentRoot "/var/www/html"
```

```
#  
# ServerName gives the name and  
itself.
```

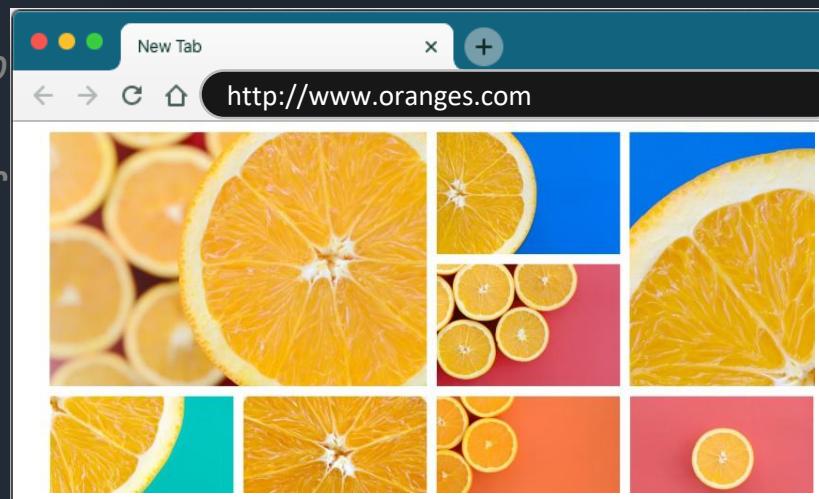
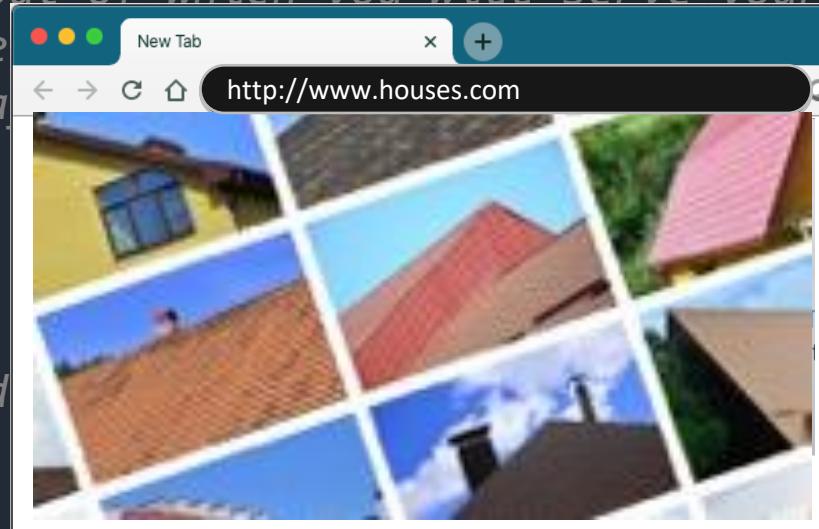
```
# This can often be determined  
specify
```

```
# it explicitly to prevent prob  
#
```

```
# If your host doesn't have a r  
here.
```

```
#  
#ServerName www.example.com:80  
ServerName www.houses.com:80
```

Config File



Web
Server

HTML

CSS

JavaScript

Server: www.houses.com
Document Root: /var/www/houses
VirtualHost

HTML

CSS

JavaScript

Server: www.oranges.com
Document Root: /var/www/oranges
VirtualHost

Document Root
/var/www/html

DNS Name

IP Address

| DNS Name | IP Address |
|-----------------|--------------|
| www.houses.com | 192.168.1.10 |
| www.oranges.com | 192.168.1.10 |

/etc/hosts

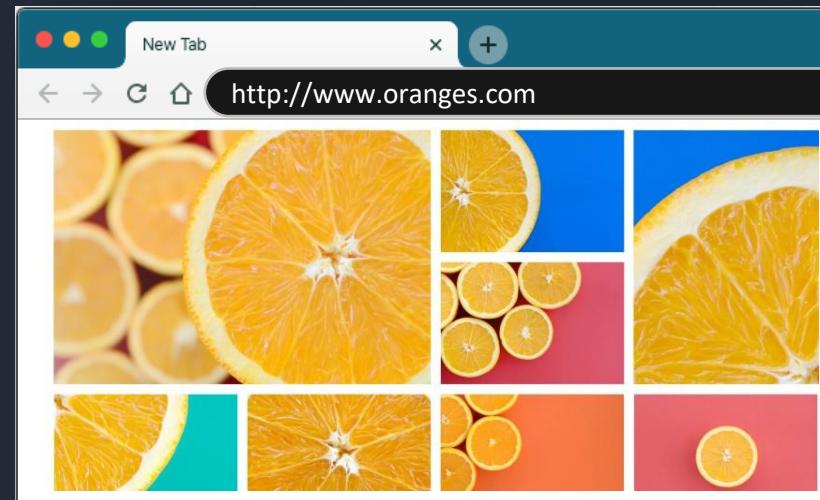
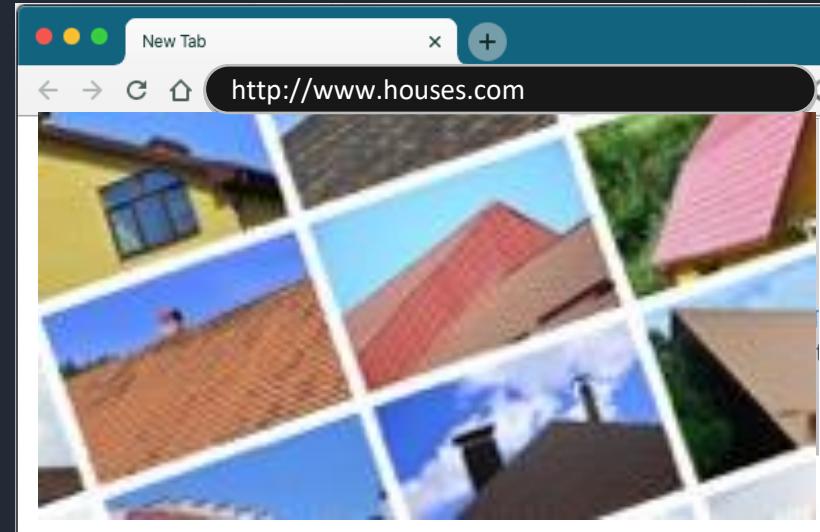
```
# Host Database
127.0.0.1      localhost
127.0.0.1      www.houses.com
127.0.0.1      www.oranges.com
```

```
</VirtualHost>
```

```
<VirtualHost *:80>
  ServerName www.oranges.com
  DocumentRoot /var/www/oranges
</VirtualHost>
```

► service httpd restart

Config File



Web
Server

HTML
CSS
JavaScript

Server: www.houses.com
Document Root: /var/www/houses
VirtualHost

HTML
CSS
JavaScript

Server: www.oranges.com
Document Root: /var/www/oranges
VirtualHost

Document Root
/var/www/html

```
#  
#ServerName www.example.com:80  
ServerName www.houses.com:80
```

Config File

```
Include conf/houses.conf  
Include conf/oranges.conf
```

```
/etc/httpd/conf/houses.conf
```

```
<VirtualHost *:80>  
    ServerName www.houses.com  
    DocumentRoot /var/www/houses  
</VirtualHost>
```

```
/etc/httpd/conf/oranges.conf
```

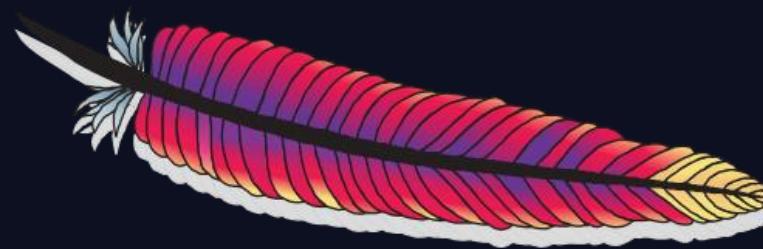
```
<VirtualHost *:80>  
    ServerName www.oranges.com  
    DocumentRoot /var/www/oranges  
</VirtualHost>
```

Labs

References

- <https://www.digitalocean.com/community/tutorials/how-to-install-the-apache-web-server-on-centos-7>

just enough



NGINX

just enough



APACHE TOMCAT

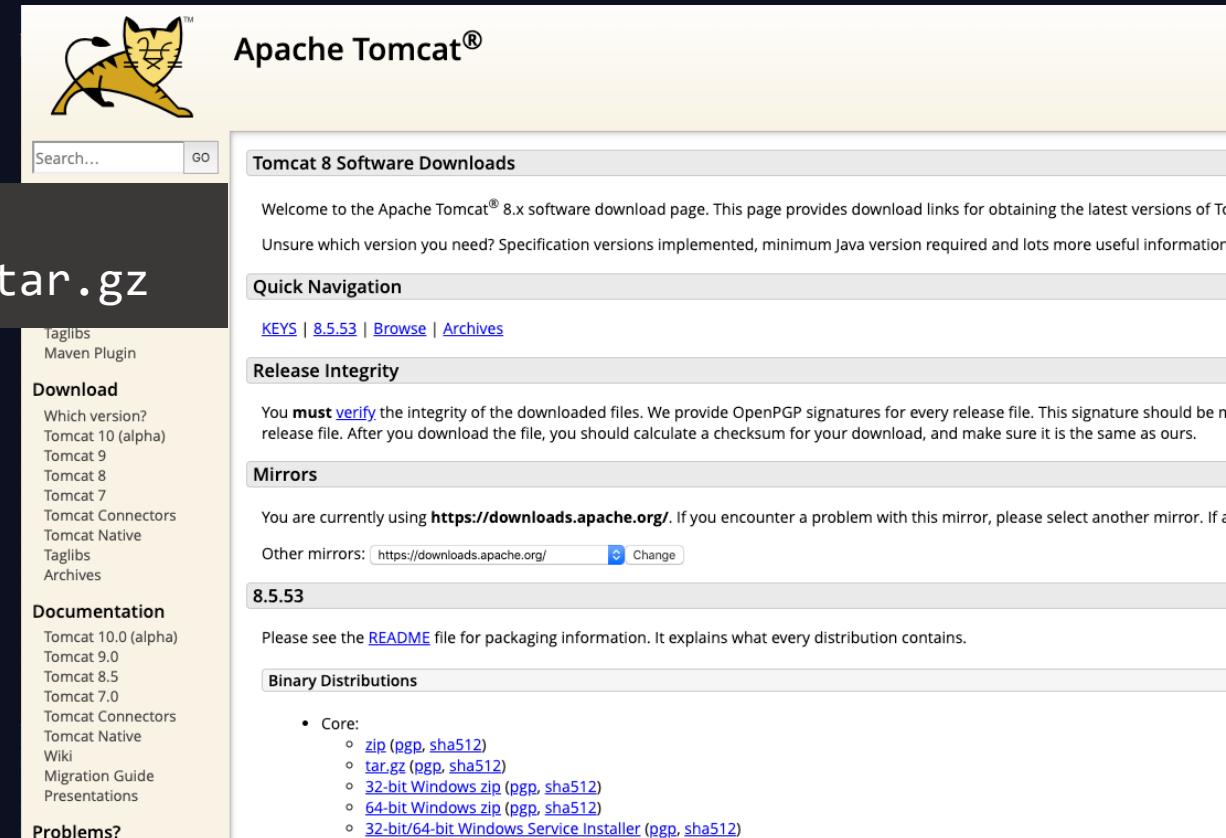
Install Apache Tomcat

```
▶ yum install java-1.8.0-openjdk-devel
```

```
▶ wget https://downloads.apache.org/tomcat/tomcat-8/v8.5.53/bin/apache-tomcat-8.5.53.tar.gz
```

```
▶ tar xvf apache-tomcat-8.5.53.tar.gz
```

```
▶ ./apache-tomcat-8.5.53/bin/startup.sh
```



The screenshot shows the Apache Tomcat Software Downloads page. At the top is the Apache logo, a yellow cartoon cat. Below it is a search bar with a 'GO' button. The main header reads 'Apache Tomcat®'. To the left, there's a sidebar with links for 'Taglibs', 'Maven Plugin', 'Download' (with options for Tomcat 10, 9, 8, 7, Connectors, Native, Taglibs, Archives), 'Documentation' (with links for Tomcat 10.0, 9.0, 8.5, 7.0, Connectors, Native, Wiki, Migration Guide, Presentations), and 'Problems?'. The main content area is titled 'Tomcat 8 Software Downloads' and contains sections for 'Quick Navigation' (links to KEYS, 8.5.53, Browse, Archives), 'Release Integrity' (instructions to verify files using OpenPGP signatures), 'Mirrors' (a note about using https://downloads.apache.org/), and '8.5.53' (a section for the specific release). Under '8.5.53', there's a link to the 'README' file and a 'Binary Distributions' section listing various download formats like zip, tar.gz, and Windows zip files, each with PGP and SHA512 signatures.

<http://tomcat.apache.org/download-80.cgi>

View Server

https://localhost:8080

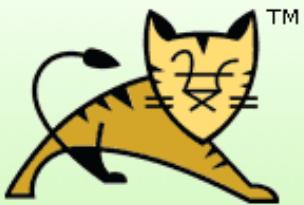
Home Documentation Configuration Examples Wiki Mailing Lists

Find Help

Apache Tomcat/8.5.53



If you're seeing this, you've successfully installed Tomcat. Congratulations!



Recommended Reading:

[Security Considerations How-To](#)

[Manager Application How-To](#)

[Clustering/Session Replication How-To](#)

[Server Status](#)

[Manager App](#)

[Host Manager](#)

Developer Quick Start

[Tomcat Setup](#)

[First Web Application](#)

[Realms & AAA](#)

[JDBC DataSources](#)

[Examples](#)

[Servlet Specifications](#)

[Tomcat Versions](#)

Apache Tomcat Directory

```
▶ ls -l apache-tomcat-8.5.53
```

```
-rw-r---- 1 19318 Mar 11 10:06 BUILDING.txt
-rw-r---- 1 5408 Mar 11 10:06 CONTRIBUTING.md
-rw-r---- 1 57011 Mar 11 10:06 LICENSE
-rw-r---- 1 1726 Mar 11 10:06 NOTICE
-rw-r---- 1 3255 Mar 11 10:06 README.md
-rw-r---- 1 7136 Mar 11 10:06 RELEASE-NOTES
-rw-r---- 1 16262 Mar 11 10:06 RUNNING.txt
drwxr-x--- 2 4096 Mar 18 10:17 bin
drwx----- 2 4096 Mar 11 10:06 conf
drwxr-x--- 2 4096 Mar 18 10:17 lib
drwxr-x--- 2 4096 Mar 11 10:03 logs
drwxr-x--- 2 4096 Mar 18 10:17 temp
drwxr-x--- 7 4096 Mar 11 10:04 webapps
drwxr-x--- 2 4096 Mar 11 10:03 work
```

```
catalina-tasks.xml
catalina.bat
catalina.sh
ciphers.bat
ciphers.sh
configtest.bat
configtest.sh
daemon.sh
digest.bat
digest.sh
setclasspath.bat
setclasspath.sh
shutdown.bat
shutdown.sh
startup.bat
startup.sh
tool-wrapper.bat
tool-wrapper.sh
version.bat
version.sh
```

Apache Tomcat Directory

```
▶ ls -l apache-tomcat-8.5.53
```

```
-rw-r---- 1 19318 Mar 11 10:06 BUILDING.txt
-rw-r---- 1 5408 Mar 11 10:06 CONTRIBUTING.md
-rw-r---- 1 57011 Mar 11 10:06 LICENSE
-rw-r---- 1 1726 Mar 11 10:06 NOTICE
-rw-r---- 1 3255 Mar 11 10:06 README.md
-rw-r---- 1 7136 Mar 11 10:06 RELEASE-NOTES
-rw-r---- 1 16262 Mar 11 10:06 RUNNING.txt
drwxr-x--- 2 4096 Mar 18 10:17 bin
drwx----- 2 4096 Mar 11 10:06 conf
drwxr-x--- 2 4096 Mar 18 10:17 lib
drwxr-x--- 2 4096 Mar 11 10:03 logs
drwxr-x--- 2 4096 Mar 18 10:17 temp
drwxr-x--- 7 4096 Mar 11 10:04 webapps
drwxr-x--- 2 4096 Mar 11 10:03 work
```

```
catalina.policy
catalina.properties
context.xml
jaspic-providers.xml
jaspic-providers.xsd
logging.properties
server.xml
tomcat-users.xml
tomcat-users.xsd
web.xml
```

<!-- A "Connector" represents an endpoint by which requests are received and responses are returned. Documentation at : Java HTTP Connector: /docs/config/http.html Java AJP Connector: /docs/config/ajp.html APR (HTTP/AJP) Connector: /docs/apr.html -->

```
<Connector port="8080" protocol="HTTP/1.1"
           connectionTimeout="20000"
           redirectPort="8443" />
<!-- A "Connector" using the shared thread pool-->
<!--
<Connector executor="tomcatThreadPool"
           port="8080" protocol="HTTP/1.1"
           connectionTimeout="20000"
           redirectPort="8443" />
```

Apache Tomcat Directory

```
▶ ls -l apache-tomcat-8.5.53
```

```
-rw-r---- 1 19318 Mar 11 10:06 BUILDING.txt
-rw-r---- 1 5408 Mar 11 10:06 CONTRIBUTING.md
-rw-r---- 1 57011 Mar 11 10:06 LICENSE
-rw-r---- 1 1726 Mar 11 10:06 NOTICE
-rw-r---- 1 3255 Mar 11 10:06 README.md
-rw-r---- 1 7136 Mar 11 10:06 RELEASE-NOTES
-rw-r---- 1 16262 Mar 11 10:06 RUNNING.txt
drwxr-x--- 2 4096 Mar 18 10:17 bin
drwx----- 2 4096 Mar 11 10:06 conf
drwxr-x--- 2 4096 Mar 18 10:17 lib
drwxr-x--- 2 4096 Mar 11 10:03 logs
drwxr-x--- 2 4096 Mar 18 10:17 temp
drwxr-x--- 7 4096 Mar 11 10:04 webapps
drwxr-x--- 2 4096 Mar 11 10:03 work
```

```
catalina.2020-03-18.log
catalina.out
host-manager.2020-03-18.log
localhost.2020-03-18.log
localhost_access_log.2020-03-18.txt
manager.2020-03-18.log
```

Apache Tomcat Directory

► ls -l apache-tomcat-8.5.53

```
-rw-r---- 1 19318 Mar 11 10:06 BUILDING.txt
-rw-r---- 1 5408 Mar 11 10:06 CONTRIBUTING.md
-rw-r---- 1 57011 Mar 11 10:06 LICENSE
-rw-r---- 1 1726 Mar 11 10:06 NOTICE
-rw-r---- 1 3255 Mar 11 10:06 README.md
-rw-r---- 1 7136 Mar 11 10:06 RELEASE-NOTES
-rw-r---- 1 16262 Mar 11 10:06 RUNNING.txt
drwxr-x--- 2 4096 Mar 18 10:17 bin
drwx----- 2 4096 Mar 11 10:06 conf
drwxr-x--- 2 4096 Mar 18 10:17 lib
drwxr-x--- 2 4096 Mar 11 10:03 logs
drwxr-x--- 2 4096 Mar 18 10:17 temp
drwxr-x--- 7 4096 Mar 11 10:04 webapps
drwxr-x--- 2 4096 Mar 11 10:03 work
```

► jar -cvf app.war *

► mvn package

► gradle build



app.war

HTML

CSS

JavaScript

JAVA

Application Code

Web Frameworks

```
▶ ls -l apache-tomcat-8.5.53
```

```
-rw-r---- 1 19318 Mar 11 10:06 BUILDING.txt  
-rw-r---- 1 5408 Mar 11 10:06 CONTRIBUTING.md  
-rw-r---- 1 57011 Mar 11 10:06 LICENSE  
-rw-r---- 1 1726 Mar 11 10:06 NOTICE  
-rw-r---- 1 3255 Mar 11 10:06 README.md  
-rw-r---- 1 7136 Mar 11 10:06 RELEASE-NOTES  
-rw-r---- 1 16262 Mar 11 10:06 RUNNING.txt  
drwxr-x--- 2 4096 Mar 18 10:17 bin  
drwx----- 2 4096 Mar 11 10:06 conf  
drwxr-x--- 2 4096 Mar 18 10:17 lib  
drwxr-x--- 2 4096 Mar 11 10:03 logs  
drwxr-x--- 2 4096 Mar 18 10:17 temp  
drwxr-x--- 7 4096 Mar 11 10:04 webapps  
drwxr-x--- 2 4096 Mar 11 10:03 work
```

```
▶ jar -cvf app.war *
```

```
▶ mvn package
```

```
▶ gradle build
```



HTML

CSS

JavaScript

JAVA

Application Code

Verify

```
▶ cat ~/apache-tomcat-8.5.53/logs/catalina.out
```

```
18-Mar-2020 10:43:32.769 INFO [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Deployment of web application directory [/home/vagrant/apache-tomcat-8.5.53/webapps/ROOT] has finished in [13] ms
18-Mar-2020 10:43:32.769 INFO [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Deploying web application directory [/home/vagrant/apache-tomcat-8.5.53/webapps/manager]
18-Mar-2020 10:43:32.783 INFO [localhost-startStop-1] org.apache.catalina.startup.HostConfig.deployDirectory Deployment of web application directory [/home/vagrant/apache-tomcat-8.5.53/webapps/manager] has finished in [14] ms
18-Mar-2020 10:43:32.784 INFO [main] org.apache.coyote.AbstractProtocol.start Starting ProtocolHandler ["http-nio-8080"]
18-Mar-2020 10:43:32.789 INFO [main] org.apache.catalina.startup.Catalina.start Server startup in 407 ms
18-Mar-2020 11:21:23.503 INFO [localhost-startStop-2] org.apache.catalina.startup.HostConfig.deployWAR Deploying web application archive [/home/vagrant/apache-tomcat-8.5.53/webapps/app.war]
18-Mar-2020 11:21:23.560 INFO [localhost-startStop-2] org.apache.catalina.startup.HostConfig.deployWAR Deployment of web application archive [/home/vagrant/apache-tomcat-8.5.53/webapps/app.war] has finished in [57] ms
```

View Sample Application

<https://localhost:8080/app>



Sample "Hello, World" Application

This is the home page for a sample application used to illustrate the source directory organization of a web application utilizing the principles outlined in the Application Developer's Guide.

To prove that they work, you can execute either of the following links:

- To a [JSP page](#).
- To a [servlet](#).

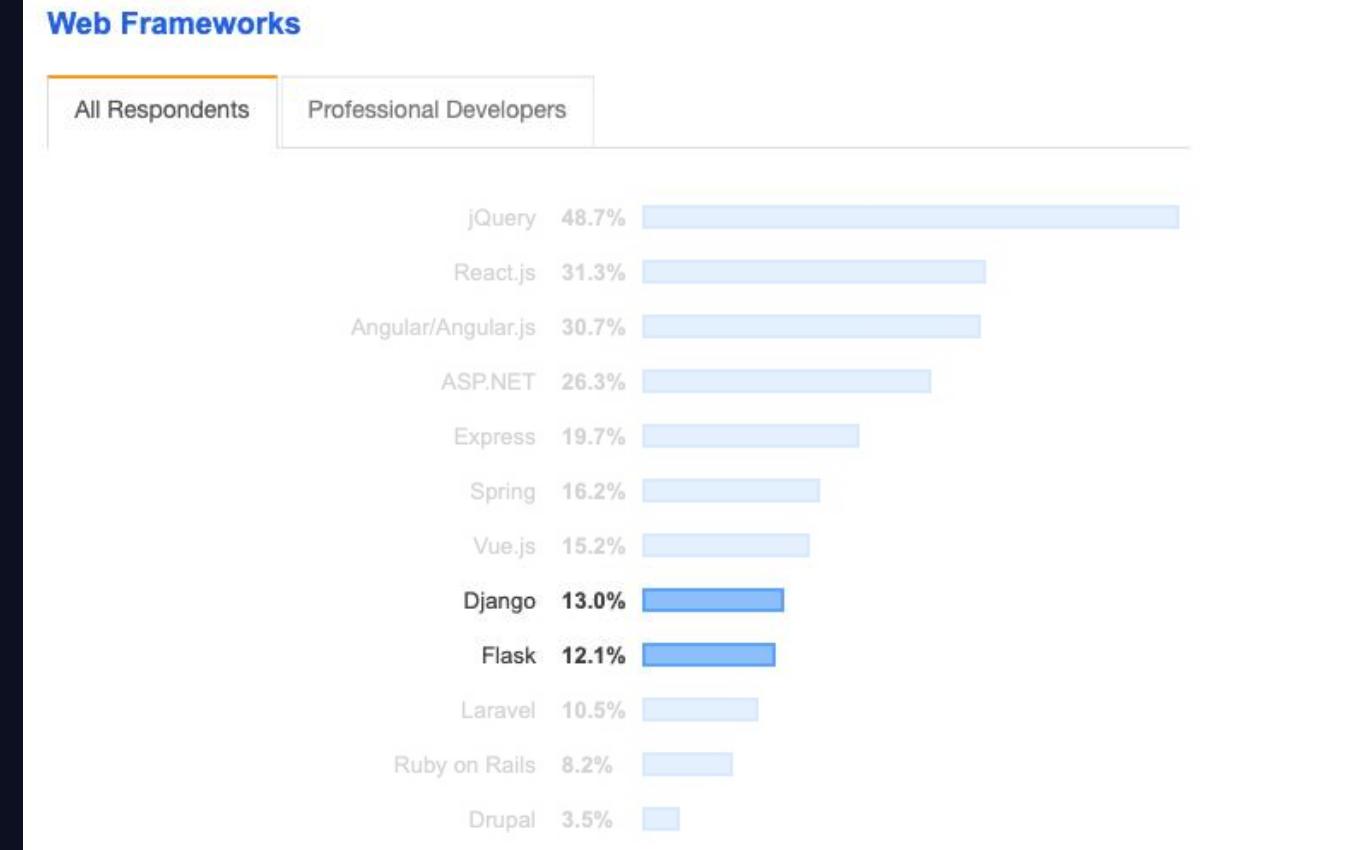
Labs

just enough



Web Frameworks

django



Project Structure

```
my-application
  LICENSE
  README.md
  requirements.txt
  main.py
  utils
  tests
  config
  routes
  services
  db
  core
```

```
▶ pip install -r requirements.txt
```

```
▶ python main.py
```

```
* Serving Flask app "main" (lazy loading)
* Environment: production
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

```
main.py
from flask import Flask

app = Flask(__name__)

@app.route('/')
def hello():
    return 'Hello, World!'

if __name__=='__main__':
    app.run()
```

Production Deployment

- Gunicorn
- uWSGI
- Gevent
- Twisted Web

```
▶ gunicorn main:app -w 2
```

```
[2020-03-10 09:53:29 +0000] [2916] [INFO] Starting gunicorn 20.0.4
[2020-03-10 09:53:29 +0000] [2916] [INFO] Listening at: http://127.0.0.1:8000 (2916)
[2020-03-10 09:53:29 +0000] [2916] [INFO] Using worker: sync
[2020-03-10 09:53:29 +0000] [2919] [INFO] Booting worker with pid: 2919

[2020-03-10 09:53:29 +0000] [2921] [INFO] Booting worker with pid: 2921
```

```
main.py
from flask import Flask

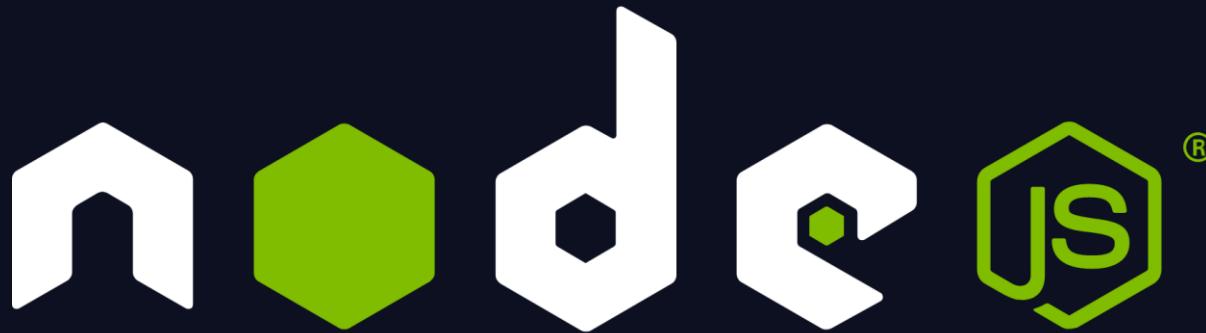
app = Flask(__name__)

@app.route('/')
def hello():
    return 'Hello, World!'

if __name__ == '__main__':
    app.run()
```

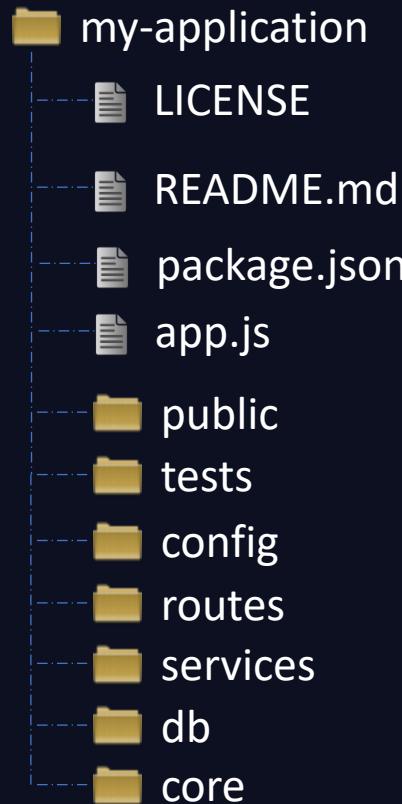
Labs

just enough



Express.js

Project Structure



app.js

```
const express = require('express')
const app = express()

app.get('/products', (req, res) =>
  res.send(getProductList()))

app.use(express.static(path.join(__dirname, 'public')))

app.listen(3000);
```

Project Structure

```
my-application
  LICENSE
  README.md
  package.json
  app.js
  public
  tests
  config
  routes
  services
  db
  core
```

```
▶ npm install
▶ node app.js
▶ npm run start:dev
```

package.json

```
{
  "name": "my-application",
  "version": "0.0.0",
  "private": true,
  "dependencies": {
    "dotenv": "^5.0.0",
    "execa": "^0.9.0",
    "express": "^4.16.2"
  },
  "scripts": {
    "debug": "node debug app.js",
    "start": "NODE_ENV=production node app.js",
    "start:dev": "NODE_ENV=dev node app.js",
    "test:e2e": "node tests/run-e2e-test.js",
    "test:unit": "jest tests/unit",
    "test:unit:watch": "jest tests/unit --watch"
  }
}
```

Project Structure

```
my-application
  LICENSE
  README.md
  package.json
  app.js
  public
  tests
  config
  routes
  services
  db
  core
```

► npm install

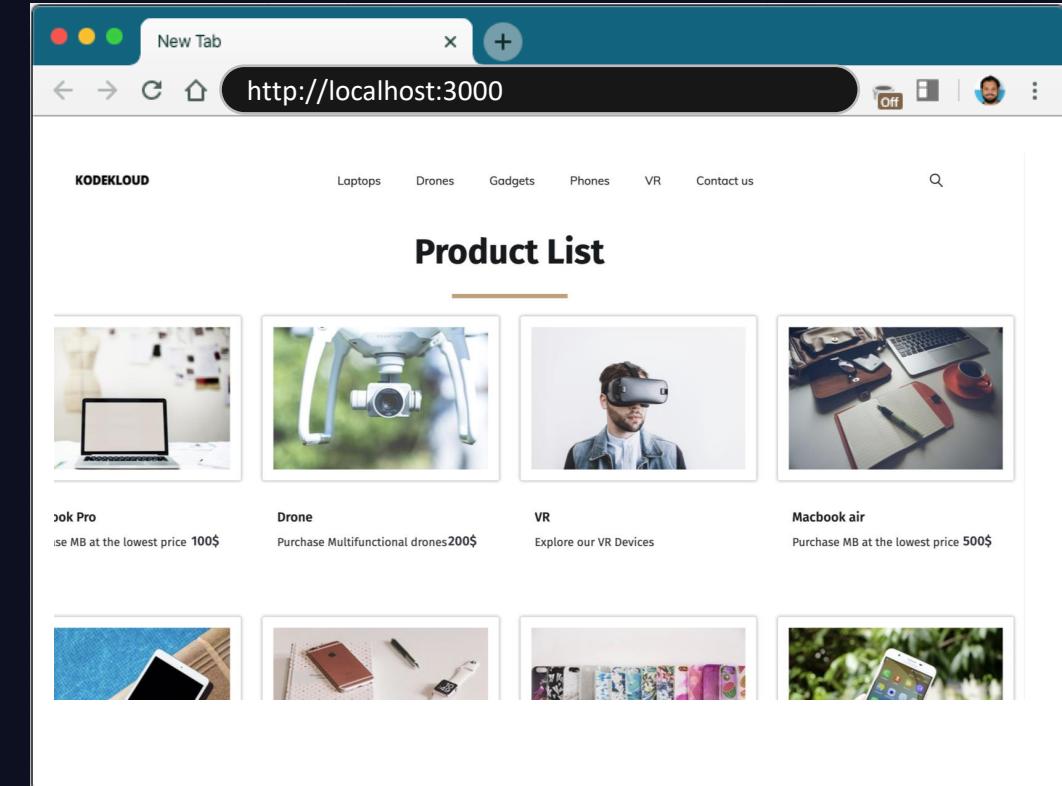
► node app.js

► npm run start :dev

supervisord

forever

pm2



pm2



PM2

P(rocess) M(anager) 2
Runtime Edition

npm package 4.2.3 node >=8.10.0 build passing

PM2 is a production process manager for Node.js applications with a built-in load balancer. It allows you to keep applications alive forever, to reload them without downtime and to facilitate common system admin tasks.

▶ pm2 start app.js

▶ pm2 start app.js -i 4

<https://github.com/Unitech/pm2>

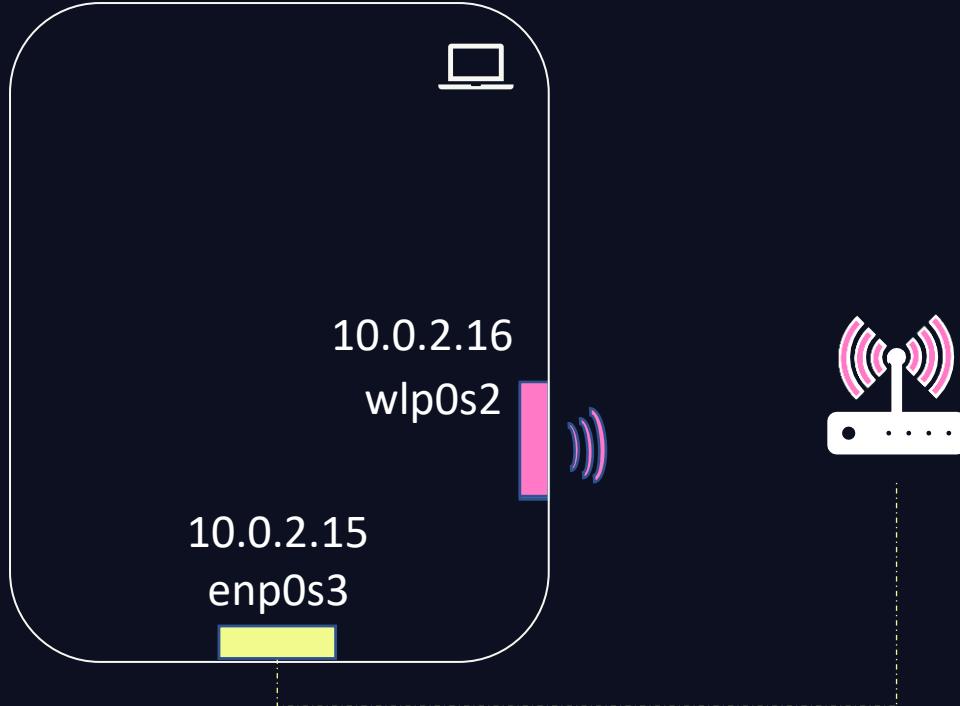
Labs

IP Addresses and Ports From a Web Application Perspective

FAQ

- What IP Address and Port should I use?
- localhost vs 127.0.0.1 vs IP Address
- Why can't I connect to my server?
- HTTP or HTTPS?

IP Address

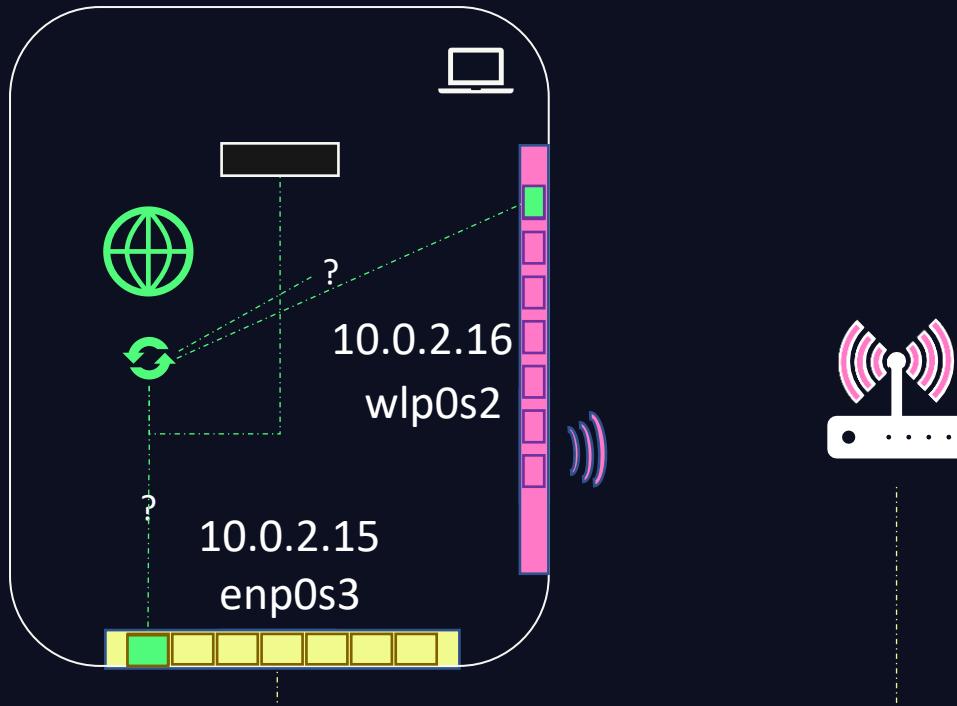


► `ip addr show`

```
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast  
    link/ether 02:0e:0c:9a:00:f0 brd ff:ff:ff:ff:ff:ff  
    inet 10.0.2.15/24 brd 10.0.2.255 scope global enp0s3
```

```
3: wlp0s2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast  
    link/ether dc:fb:48:dd:4b:4f brd ff:ff:ff:ff:ff:ff  
    inet 10.0.2.16/24 brd 10.0.2.255 scope global enp0s3
```

Ports



main.py

```
from flask import Flask  
  
app = Flask(__name__)  
  
@app.route('/')  
def hello():  
    return 'Hello, World!'  
  
if __name__=='__main__':  
    app.run(port=8000 , host='127.0.0.1')
```

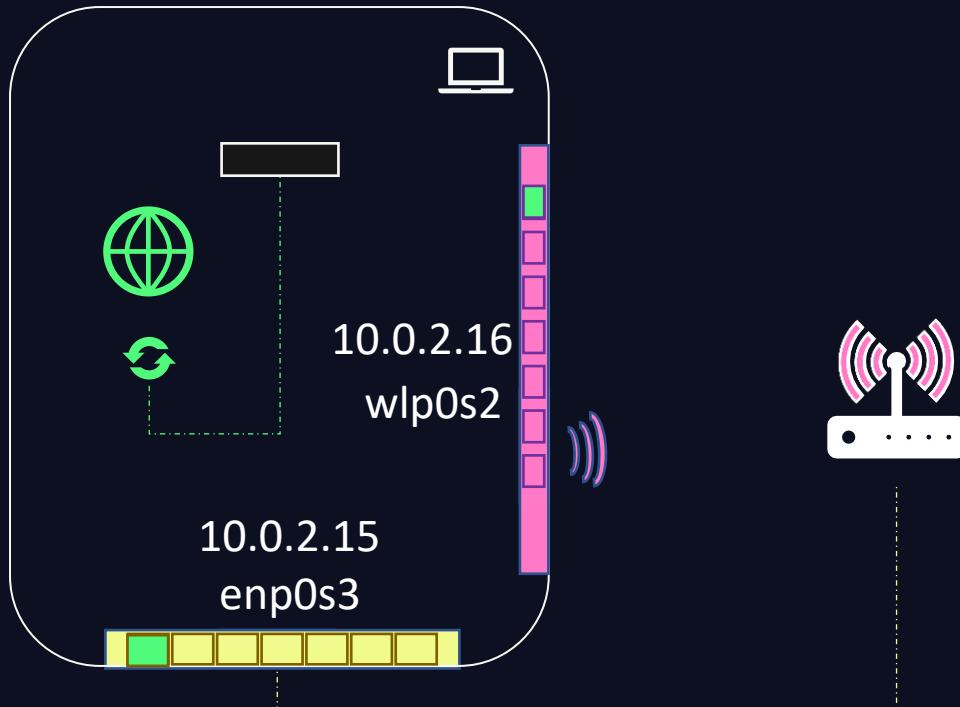
http://10.0.2.15:8000



http://10.0.2.16:8000



Ports

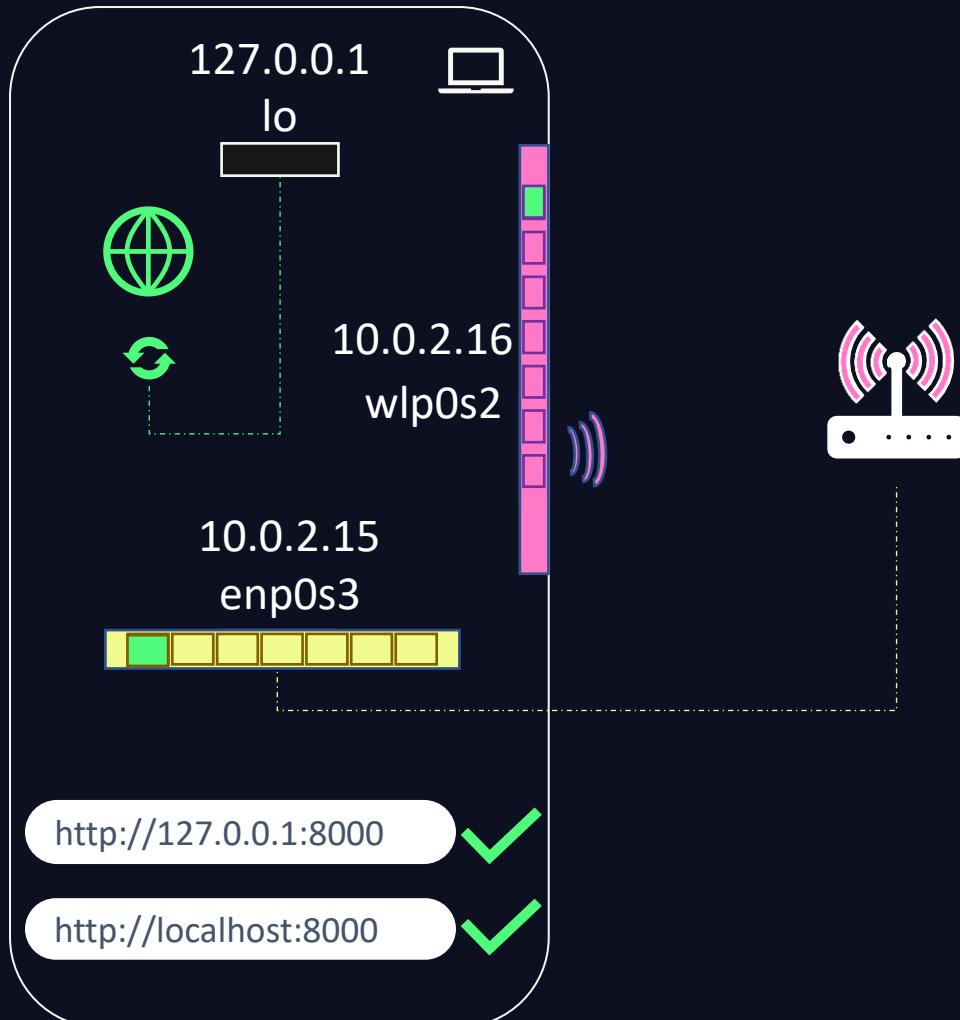


► **ip addr show**

```
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc 1000
    link/ether 02:0e:0c:9a:00:f0 brd ff:ff:ff:ff:ff:ff
    inet 10.0.2.15/24 brd 10.0.2.255 scope global enp0s3

3: wlp0s2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc 1000
    link/ether dc:fb:48:dd:4b:4f brd ff:ff:ff:ff:ff:ff
    inet 10.0.2.16/24 brd 10.0.2.255 scope global enp0s3
```

Ports



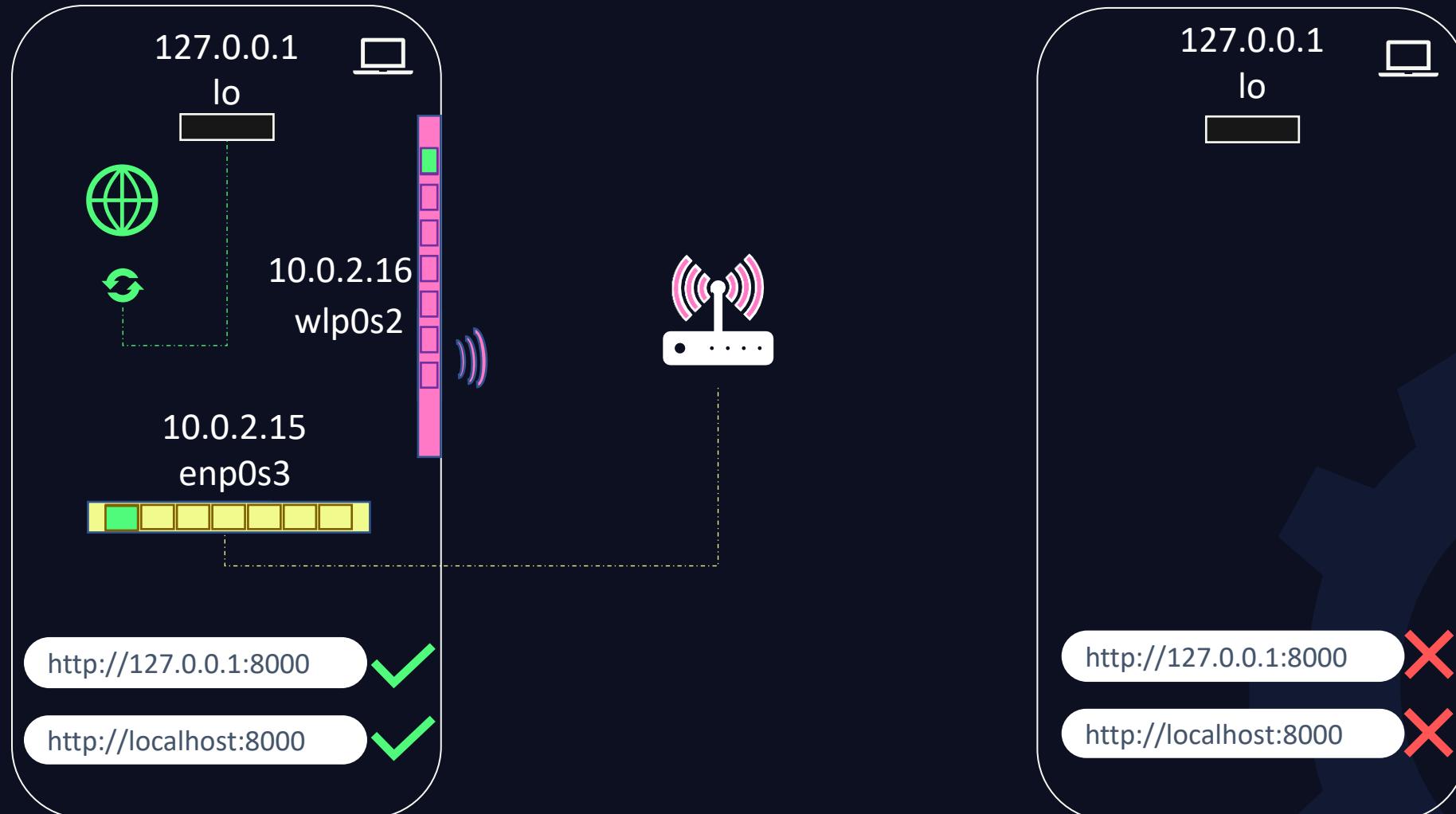
► ip addr show

```
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UP  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever

2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc 1000  
    link/ether 02:0e:0c:9a:00:f0 brd ff:ff:ff:ff:ff:ff  
    inet 10.0.2.15/24 brd 10.0.2.255 scope global enp0s3

3: wlp0s2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc 1000  
    link/ether dc:fb:48:dd:4b:4f brd ff:ff:ff:ff:ff:ff  
    inet 10.0.2.16/24 brd 10.0.2.255 scope global enp0s3
```

Ports



Labs

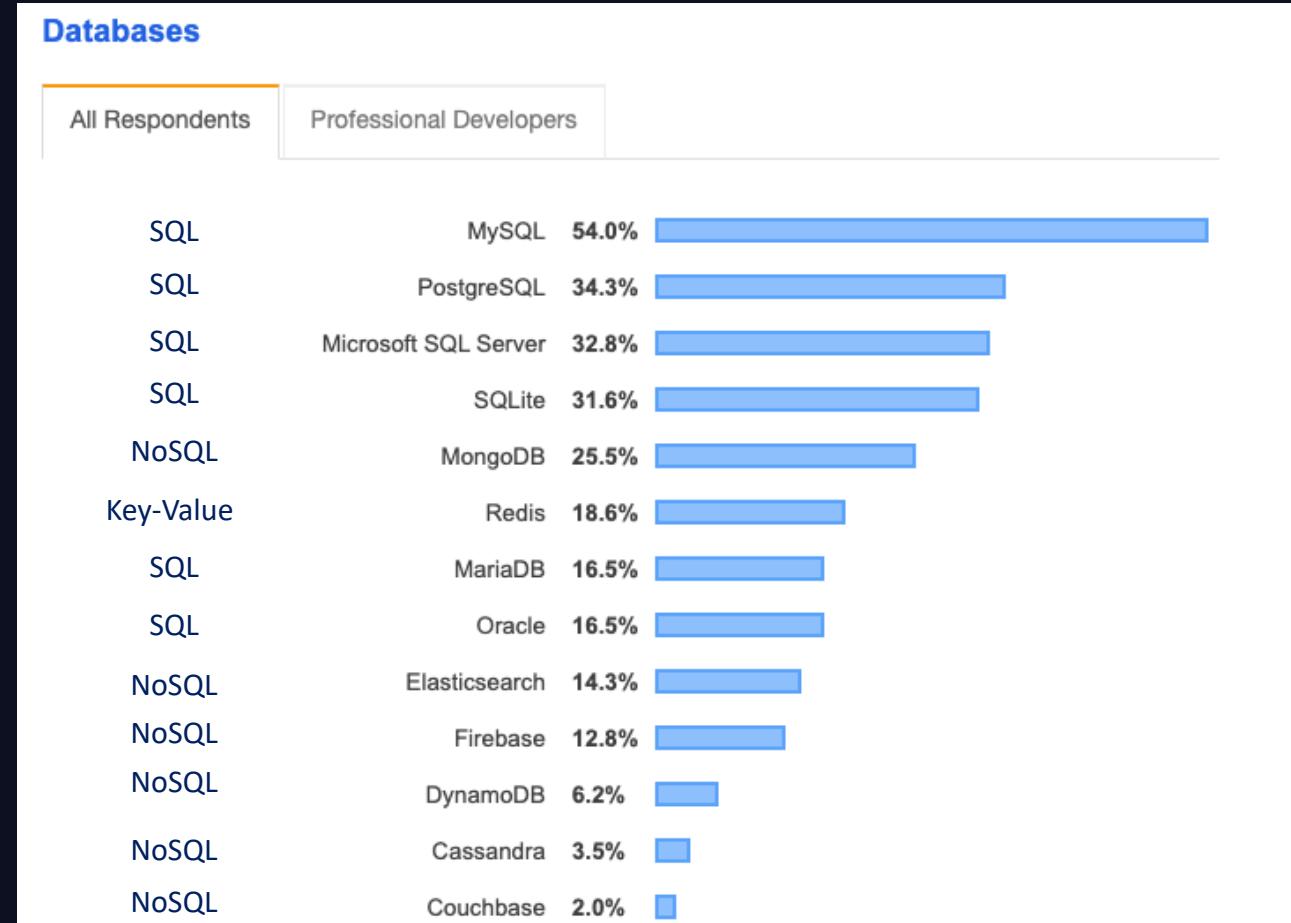
Databases



Why?

Databases

- MySQL
- MongoDB
- Redis



SQL

Tabular/Relational Databases

| Name | Age | Location | Salary | Grade |
|-------------|-----|-----------|--------|-------|
| John Doe | 45 | New York | 5000 | |
| Dave Smith | 34 | New York | 4000 | |
| Aryan Kumar | 10 | New York | | A |
| Lauren Rob | 13 | Bangalore | | C |
| Lily Oliver | 15 | Bangalore | | B |

NoSQL

| Key | Value |
|----------|----------|
| Name | John Doe |
| Age | 45 |
| Location | New York |
| Salary | 5000 |

| Key | Value |
|----------|------------|
| Name | Dave Smith |
| Age | 34 |
| Location | New York |
| Salary | 4000 |

| Key | Value |
|----------|-------------|
| Name | Aryan Kumar |
| Age | 10 |
| Location | New York |
| Grade | A |

| Key | Value |
|----------|------------|
| Name | Lauren Rob |
| Age | 13 |
| Location | Bangalore |
| Grade | C |

| Key | Value |
|----------|-------------|
| Name | Lily Oliver |
| Age | 15 |
| Location | Bangalore |
| Grade | B |

NoSQL

| Key | Value |
|----------|----------|
| Name | John Doe |
| Age | 45 |
| Location | New York |
| Salary | 5000 |

| Key | Value |
|--------------|------------|
| Name | Dave Smith |
| Age | 34 |
| Location | New York |
| Salary | 4000 |
| Organization | ACME |

| Key | Value |
|----------|-------------|
| Name | Aryan Kumar |
| Age | 10 |
| Location | New York |
| Grade | A |

| Key | Value |
|----------|------------|
| Name | Lauren Rob |
| Age | 13 |
| Location | Bangalore |
| Grade | C |

| Key | Value |
|----------|-------------|
| Name | Lily Oliver |
| Age | 15 |
| Location | Bangalore |
| Grade | B |

NoSQL

```
{  
  "name": "John Doe",  
  "age": 45,  
  "location": "New York",  
  "salary": 5000  
}
```

```
{  
  "name": "Dave Smith",  
  "age": 34,  
  "location": "New York",  
  "salary": 4000,  
  "organization": "ACME"  
}
```

```
{  
  "name": "Aryan Kumar",  
  "age": 10,  
  "location": "New York",  
  "Grade": "A"  
}
```

```
{  
  "name": "Lily Oliver",  
  "age": 15,  
  "location": "Bangalore",  
  "Grade": "B"  
}
```

```
{  
  "name": "Lauren Rob",  
  "age": 13,  
  "location": "Bangalore",  
  "Grade": "C"  
}
```

SQL vs NoSQL

```
SELECT * from persons where AGE > 10
```

Table

| Name | Age | Location | Salary | Grade |
|-------------|-----|-----------|--------|-------|
| John Doe | 45 | New York | 5000 | |
| Dave Smith | 34 | New York | 4000 | |
| Lauren Rob | 13 | Bangalore | | C |
| Lily Oliver | 15 | Bangalore | Row | B |

```
db.persons.find( { age: { $gt: 10 } } )
```

```
{  
  "name": "John Doe",  
  "age": 45,  
  "location": "New York",  
  "salary": 5000  
}
```

```
{  
  "name": "Dave Smith",  
  "age": 34,  
  "location": "New York",  
  "salary": 4000,  
  "organization": "ACME"  
}
```

```
{  
  "name": "Aryan Kumar",  
  "age": 10,  
  "location": "New York",  
  "Grade": "A"  
}
```

```
{  
  "name": "Lauren Rob",  
  "age": 13,  
  "location": "Bangalore",  
  "Grade": "C"  
}
```

```
{  
  "name": "Lily Oliver",  
  "age": 15,  
  "location": "Bangalore",  
  "Grade": "B"  
}
```

Document

SQL vs NoSQL

```
SELECT * from persons where age > 10
```

```
db.persons.find( { age: { $gt: 10 } } )
```

| Name | Age | Location | Salary | Grade |
|-------------|-----|-----------|--------|-------|
| John Doe | 45 | New York | 5000 | |
| Dave Smith | 34 | New York | 4000 | |
| | | | | |
| Lauren Rob | 13 | Bangalore | | C |
| Lily Oliver | 15 | Bangalore | | B |

```
{  
  "name": "John Doe",  
  "age": 45,  
  "location": "New York",  
  "salary": 5000  
}
```

```
{  
  "name": "Dave Smith",  
  "age": 34,  
  "location": "New York",  
  "salary": 4000,  
  "organization": "ACME"  
}
```

```
{  
  "name": "Lily Oliver",  
  "age": 15,  
  "location": "Bangalore",  
  "Grade": "B"  
}
```

```
{  
  "name": "Lauren Rob",  
  "age": 13,  
  "location": "Bangalore",  
  "Grade": "C"  
}
```

SQL vs NoSQL



just enough



- Open source
- Fast
- Reliable
- SQL

MySQL

- MySQL Editions
 - MySQL Enterprise Edition
 - MySQL Standard Edition
 - MySQL Classic Edition
 - MySQL Cluster CGE
 - MySQL Embedded (OEM/ISV)
 - MySQL Community Edition



MySQL Editions

MySQL is the world's most popular open source database. Whether you are a fast growing web p...
deliver high performance, scalable database applications.

[Learn more about Oracle MySQL Cloud Service »](#)

MySQL Community Edition is the freely downloadable version of the world's most popular open...

- [Learn more about the MySQL Community Edition](#)
- [Download the MySQL Community Edition](#)

Commercial customers have the flexibility of choosing from multiple editions to meet specific bu...

- [MySQL Standard Edition](#)
- [MySQL Enterprise Edition](#)
- [MySQL Cluster Carrier Grade Edition](#)

ISVs, OEMs and VARs can learn more about [MySQL as an Embedded Database](#)

Community

Commercial

Install

```
▶ wget https://dev.mysql.com/get/mysql80-community-release-el7-3.noarch.rpm
```

```
▶ rpm -ivh mysql80-community-release-el7-3.noarch.rpm
```

```
▶ yum install mysql-server
```

```
▶ service mysqld start
```

```
▶ service mysqld status
```

Redirecting to /bin/systemctl status mysqld.service

- mysqld.service - MySQL Server
 Loaded: loaded (/usr/lib/systemd/system/mysqld.service; enabled; vendor preset: disabled)
 Active: active (running) since Thu 2020-03-19 17:57:44 UTC; 1min 12s ago

Docs: man:mysqld(8)

<http://dev.mysql.com/doc/refman/en/using-systemd.html>

Process: 4135 ExecStartPre=/usr/bin/mysqld_pre_systemd (code=exited, status=0/SUCCESS)

Main PID: 4211 (mysqld)

Status: "Server is operational"

CGroup: /system.slice/mysqld.service

└─4211 /usr/sbin/mysqld

Validate

```
▶ cat /var/log/mysqld.log
```

```
2020-03-19T17:57:37.375709Z 0 [System] [MY-013169] [Server] /usr/sbin/mysqld (mysqld 8.0.19) initializing of server in progress as process 4162
2020-03-19T17:57:39.467035Z 5 [Note] A temporary password is generated for root@localhost: g/io%pF1E77m
2020-03-19T17:57:41.582829Z 0 [System] [MY-010116] [Server] /usr/sbin/mysqld (mysqld 8.0.19) starting as process 4162
2020-03-19T17:57:43.812826Z 0 [Warning] [MY-010068] [Server] CA certificate ca.pem is self signed.
2020-03-19T17:57:44.021160Z 0 [System] [MY-010931] [Server] /usr/sbin/mysqld: ready for connections. Version: '8.0.19' socket: '/var/lib/mysql/mysql.sock' port: 3306 MySQL Community Server - GPL.
2020-03-19T17:57:44.245102Z 0 [System] [MY-011323] [Server] X Plugin ready for connections. Socket: '/var/run/mysqld/mysqlx.sock' bind-address: '::' port: 33060
2020-03-19T18:04:21.190127Z 8 [Warning] [MY-013360] [Server] Plugin sha256_password reported: "sha256_password" is deprecated and will be removed in a future release.
Please use caching_sha2_password instead'
```

```
▶ mysql -u root -pg/io%pF1E77m
```

```
mysql: [Warning] Using a password on the command line interface can be insecure.
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 11
Server version: 8.0.19

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
```

```
mysql>
```

Validate

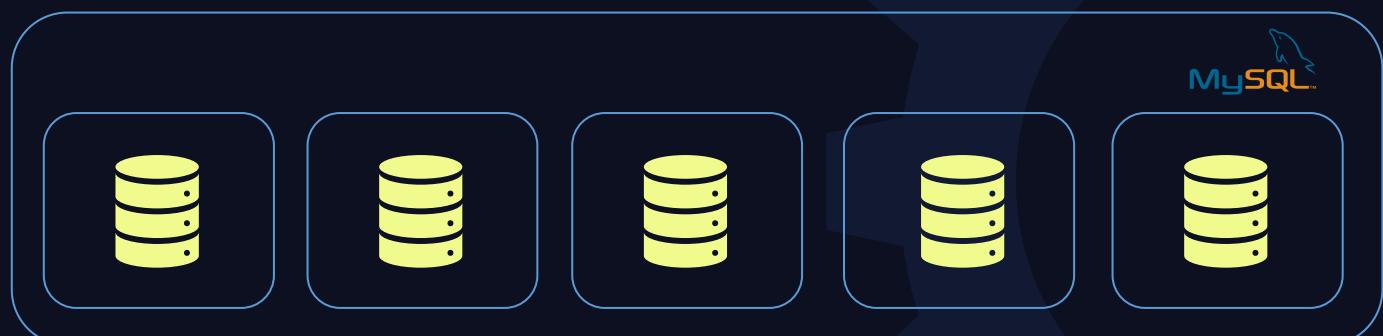
```
▶ mysql> ALTER USER 'root'@'localhost' IDENTIFIED BY 'MyNewPass4!';
```

```
▶ mysql_secure_installation
```

```
▶ mysql> SHOW DATABASES;
```

```
+-----+  
| Database      |  
+-----+  
| information_schema |  
| mysql          |  
| performance_schema |  
| sys            |  
+-----+  
4 rows in set (0.00 sec)
```

```
▶ mysql> CREATE DATABASE school;
```



Validate

```
▶mysql> USE school;
```

```
▶mysql> CREATE TABLE persons  
(  
    Name varchar(255),  
    Age int,  
    Location varchar(255)  
);
```

```
▶mysql> SHOW TABLES;
```

| |
|------------------|
| Tables_in school |
| persons |

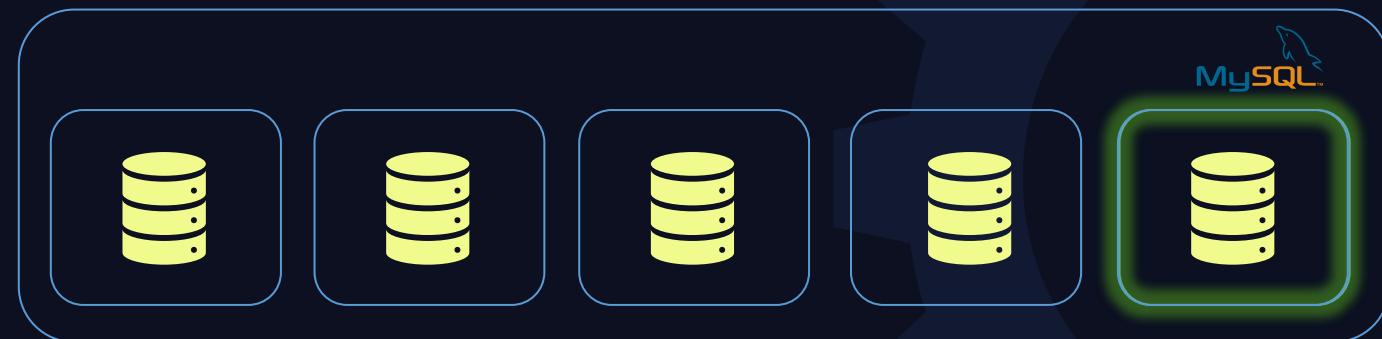
1 row in set (0.00 sec)

```
▶mysql> INSERT INTO persons values  
        ( "John Doe", 45, "New York");
```

```
▶mysql> SELECT * FROM persons;
```

| name | age | location |
|----------|-----|----------|
| John Doe | 45 | New York |

1 row in set (0.00 sec)



Create User

```
▶ mysql -u root -pg/io%pF1E77m
```

```
▶ mysql> CREATE USER 'john'@'localhost' IDENTIFIED BY 'MyNewPass4!';
```

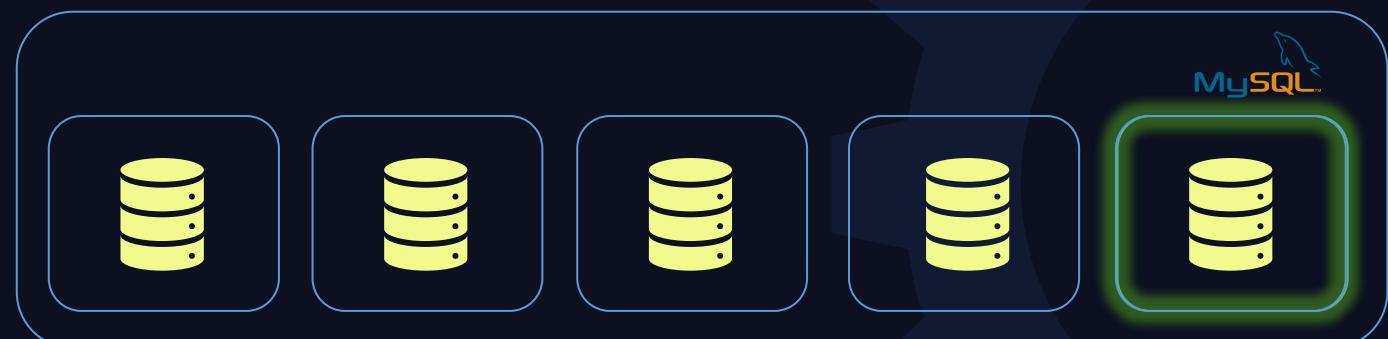


user



password

'username' @ 'host'



Create User

```
▶ mysql -u root -pg/io%pF1E77m
```

```
▶ mysql> CREATE USER 'john'@'localhost' IDENTIFIED BY 'MyNewPass4!';
```

```
▶ mysql> CREATE USER 'john'@'192.168.1.10' IDENTIFIED BY 'MyNewPass4!';
```

'username'@'host'

```
▶ mysql -u john -pMyNewPass4! ✗
```

192.168.1.10



```
▶ mysql -u john -pMyNewPass4! ✓
```



Create User

```
▶ mysql -u root -pg/io%pF1E77m
```

```
▶ mysql> CREATE USER 'john'@'localhost' IDENTIFIED BY 'MyNewPass4!';
```

```
▶ mysql> CREATE USER 'john'@'192.168.1.10' IDENTIFIED BY 'MyNewPass4!';
```

```
▶ mysql> CREATE USER 'john'@'%' IDENTIFIED BY 'MyNewPass4!';
```

```
▶ mysql -u john -pMyNewPass4! ✗
```

192.168.1.10



```
▶ mysql -u john -pMyNewPass4! ✓
```



Privileges

```
▶ mysql> GRANT <PERMISSION> ON <DB.TABLE> TO 'john'@'%';
```

```
▶ mysql> GRANT SELECT ON school.persons TO 'john'@'%';
```

```
▶ mysql> GRANT SELECT, UPDATE ON school.persons TO 'john'@'%';
```

```
▶ mysql> GRANT SELECT, UPDATE ON school.* TO 'john'@'%';
```

```
▶ mysql> GRANT ALL PRIVILEGES ON *.* TO 'john'@'%';
```

```
▶ mysql> SHOW GRANTS FOR 'john'@'localhost';
```

```
+-----+  
| Grants for john@localhost |  
+-----+  
| GRANT USAGE ON *.* TO `john`@`localhost` |  
| GRANT SELECT ON `school`.`persons` TO `john`@`localhost` |  
+-----+  
2 rows in set (0.00 sec)
```

| Privileges | |
|----------------|------------------------|
| ALL PRIVILEGES | Grant all access |
| CREATE | Create databases |
| DROP | Delete databases |
| DELETE | Delete rows from table |
| INSERT | Insert rows into table |
| SELECT | Read/Query tables |
| UPDATE | Update rows in table |

Labs

just enough



MySQL

- Open source
- NoSQL
- Scalable
- High Performance

What Is MongoDB?

MongoDB is a document database with the scalability and flexibility that you want with the querying and indexing that you need

Available how you want it

Cloud

| | |
|--------------------|------------------------|
| Shared | Dedicated |
| Up to 8 GB Storage | Consistent performance |
| Shared RAM | Advanced security |
| | Unlimited scaling |

Sandbox
Free, forever. Ideal for learning, developing, and prototyping.

Server

MongoDB offers both an Enterprise and Community version of its powerful distributed document database.

| | |
|-----------------|-------------------|
| Community | Enterprise |
| Feature Rich | Advanced Features |
| Developer Ready | Performance Grade |

Community

Enterprise

MongoDB

```
{  
  "name": "John Doe",  
  "age": 45,  
  "location": "New York",  
  "salary": 5000  
}
```

Document

```
{  
  "name": "Dave Smith",  
  "age": 34,  
  "location": "New York",  
  "salary": 4000,  
  "organization": "ACME"  
}
```

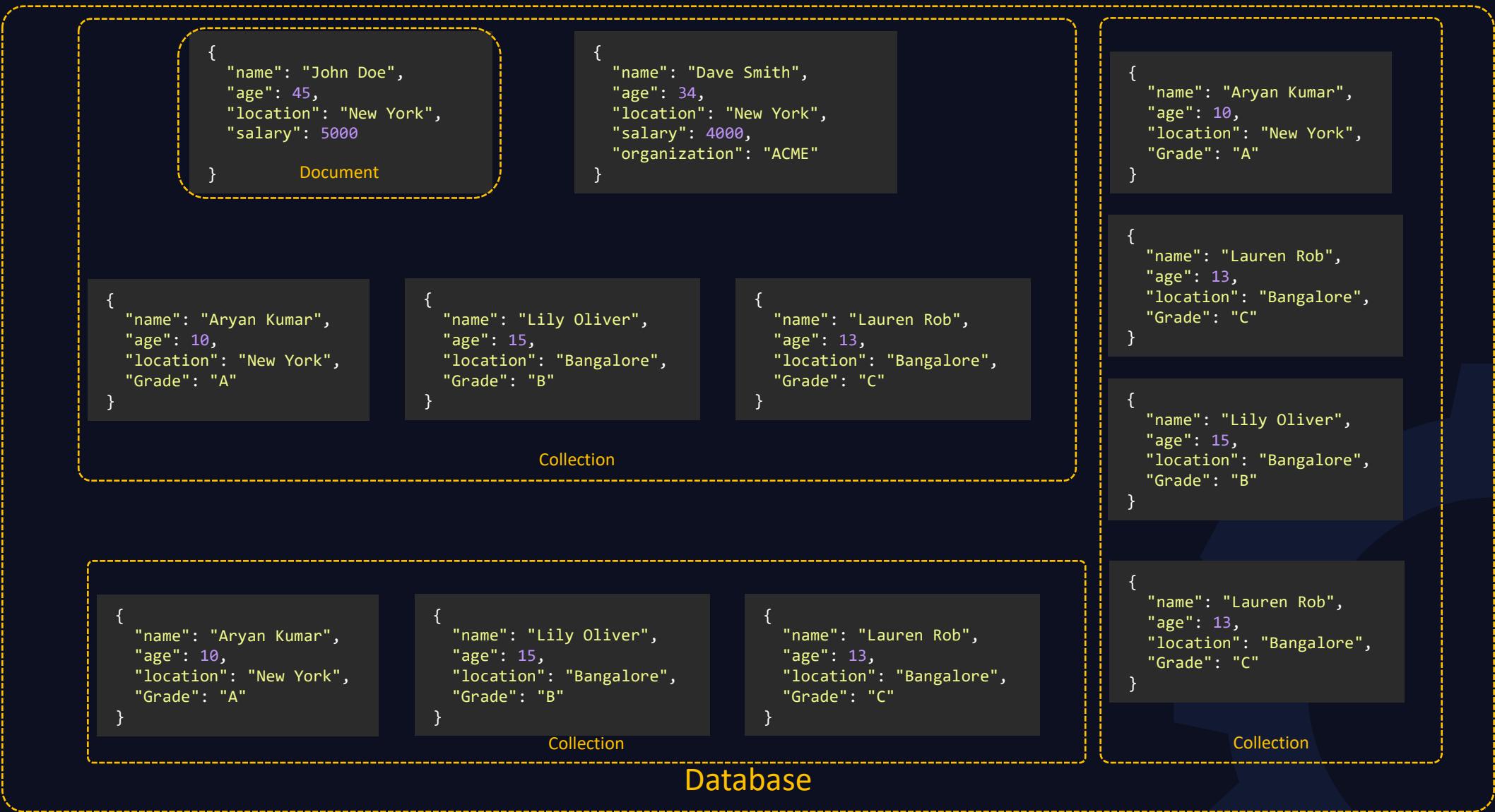
```
{  
  "name": "Aryan Kumar",  
  "age": 10,  
  "location": "New York",  
  "Grade": "A"  
}
```

```
{  
  "name": "Lily Oliver",  
  "age": 15,  
  "location": "Bangalore",  
  "Grade": "B"  
}
```

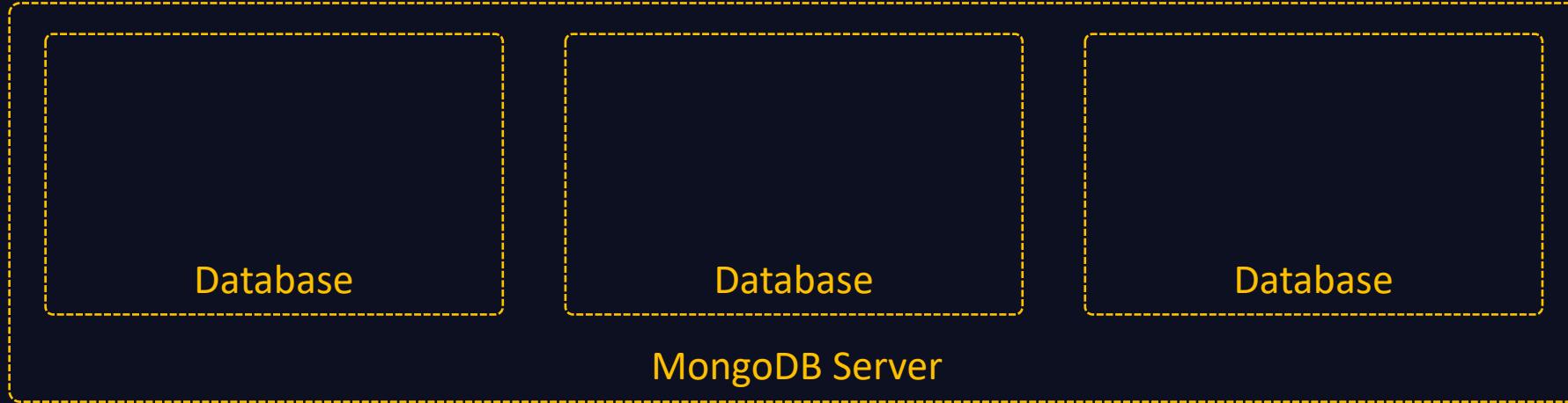
```
{  
  "name": "Lauren Rob",  
  "age": 13,  
  "location": "Bangalore",  
  "Grade": "C"  
}
```

Collection

MongoDB



MongoDB



Install

What Is MongoDB?

MongoDB is a document database with the scalability and flexibility that you want with the querying and indexing that you need

Available how you want it

Cloud

| | |
|--------------------|------------------------|
| Shared | Dedicated |
| Up to 8 GB Storage | Consistent performance |
| Shared RAM | Advanced security |
| | Unlimited scaling |

Sandbox
Free, forever. Ideal for learning, developing, and prototyping.

Server

MongoDB offers both an Enterprise and Community version of its powerful distributed document database.

Community
Feature Rich
Developer Ready Enterprise
Advanced Features
Performance Grade

Install

Select the server you would like to run:

MongoDB Community Server

FEATURE RICH. DEVELOPER READY.

MongoDB Enterprise Server

ADVANCED FEATURES. PERFORMANCE GRADE.

Version

4.2.3 (current release)

OS

Select OS

Package

Download

- Release notes
- Changelog
- Download source (tgz)
- Download source (zip)

Install

1 Configure the package management system (yum).

Create a `/etc/yum.repos.d/mongodb-org-4.2.repo` file so that you can install MongoDB directly using yum:

```
[mongodb-org-4.2]
name=MongoDB Repository
baseurl=https://repo.mongodb.org/yum/redhat/$releasever/mongodb-org/4.2/x86_64/
gpgcheck=1
enabled=1
gpgkey=https://www.mongodb.org/static/pgp/server-4.2.asc
```

copy

▶ `yum install mongodb-org`

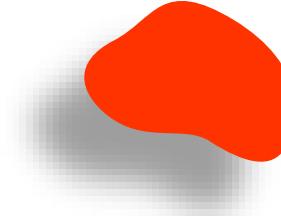
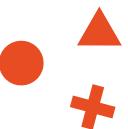
<https://docs.mongodb.com/manual/tutorial/install-mongodb-on-red-hat/>

Start DB Service

```
▶ systemctl start mongod
```

```
▶ systemctl status mongod
```

- mongod.service - MongoDB Database Server
 Loaded: loaded (/usr/lib/systemd/system/mongod.service; enabled; vendor preset: disabled)
 Active: active (running) since Sat 2020-03-21 18:43:53 UTC; 1min 46s ago
 Docs: <https://docs.mongodb.org/manual>
 Process: 4224 ExecStart=/usr/bin/mongod \$OPTIONS (code=exited, status=0/SUCCESS)
 Process: 4222 ExecStartPre=/usr/bin/chmod 0755 /var/run/mongodb (code=exited, status=0/SUCCESS)
 Process: 4220 ExecStartPre=/usr/bin/chown mongod:mongod /var/run/mongodb (code=exited, status=0/SUCCESS)
 Process: 4219 ExecStartPre=/usr/bin/mkdir -p /var/run/mongodb (code=exited, status=0/SUCCESS)
 Main PID: 4227 (mongod)
 CGroup: /system.slice/mongod.service
 └─4227 /usr/bin/mongod -f /etc/mongod.conf



Getting Started



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