Devops Commands Guide

Linux Intro and Commands

Deployable package management

- packages
- application code or executable
- dependencies (libraries or other packages)
- types
- red hat
- rpm format (red hat package manager)
- package manager
- rpm: offline package manager
- yum or dnf: online package manager

```
# update the yum sources
> sudo yum update

# install apache2
> sudo yum install httpd
```

- debian
- deb format
- package manager
- dpkg: offline package manager
- apt or apt-get or snap: online package manager

```
# update the apt sources
> sudo apt-get update

# install required application
> sudo apt-get install htop apache2

# purge or remove the package
> sudo apt-get purge apache2
```

service management

- service
- application which runs in the background
- does not have any GUI
- uses daemons to provide the functionality
- controled by systemd (system daemon)
- systemd is the first process which starts after the computer boots

```
# syntax
# > sudo systemctl <operation> <daemon or service>
# get the status of the service
> sudo systemctl status apache2

# start the service
> sudo systemctl start apache2

# restart the service
> sudo systemctl restart apache2

# stop the service
> sudo systemctl stop apache2


# start the service at the time of system boot
> sudo systemctl enable apache2


# disable the service from running at the system boot
> sudo systemctl disable apache2

# check if the apache2 is working
> curl http://locahost

> curl http://127.0.0.1
```

```
# add http service in firewall
> sudo firewall-cmd --add-service http --permanent

# reload the firewall settings
> sudo firewall-cmd --reload
```

```
# get the list of allowed services
> sudo firewall-cmd --list-services
```

vim: text editor

```

# install vim

> sudo apt-get install vim

> sudo yum install vim

> sudo dnf install vim

```

- mode
- view mode
- read only mode
- default mode
- escape yy - yank (copy) the current line
- escape 2y - yank two lines
- escape dd - delete the current line (cut the line -> keep the contents in memory)
- escape 2dd - delete two lines (current and the next one)
- escape p - paste the yanked (copied) line(s)
- escape u - undo the last step
- control + r - redo the step
- escape o - insert a new line below
- escape G - goto the last line of the document
- escape gg - goto the first line of the document
- escape { - goto the previous page
- escape } - goto the next page
- escape :set number - show the line numbers
- escape / - search a text in the current document

- escape n - search forward
- escape N - search backward
- escape w - move to next word
- escape b - move to the previous word
- escape $ - goto the last character of the current line
- escape ^ - goto the first character of the current line
- insert mode
- used to write the contents in the file
- escape + i - to start the insert mode
- escape :w - write the contents to the disk (save)
- escape :q - quit from the editor
- escape :wq - save the contents and quit
- escape :q! - forcelly quit without saving the contents
- visual mode
- escape v: start the visual mode
- select the portion to copy using left and right arrows and press y
- escape p - paste the yanked contents
- to open multiple files
- vim -O : open the files vertically
- vim -o : open the files horizontally
- control ww: used to switch between the files
- to configure vim with global settings
- save the settings in ~/.vimrc file
- ~: home directory of currently logged in use
- file/directory which starts with . is a hidden file/directory
- set number -> enable line numbers
- set tabstop -> set the tab size
- set expandtab -> convert the tab to space

bash scriptings

- script which contains the list of commands which can be executed by bash

common commands

- hostnamectl: get information about the host
- curl: console url (browsing website on console)
- ifconfig: to get the ip related information
- ip: used to get the ip related information
- ip address show
- firewall-cmd: used to deal with firewall settings

Git

Installation

```
# update the apt repo

> sudo apt-get update


# install git

> sudo apt-get install git

# on windows

# https://git-scm.com/downloads/win
```

First time configuration

```
# set the user name

> git config --global user.name "Amit"


# set the email for the user

> git config --global user.email "pythoncpp@gmail.com"
```

Basic workflow

```
# initialize a repository

> git init


# get the status of working directory

> git status


# get the status of working directory in one line (short status)

> git status -s
```

```
# statuses

# first letter: status of a file with respect to the staging area

# second letter: status of a file with respect to the working directory

# ??: the file is not yet committed in the repository

# A : the file is present in the staging area and will be added to the repository
when committed

# M: the file is modified and is present in the working directory

# M : the file is modified and is added to the staging area

# UU: the file has got at least one conflict


# conflict

# the file is modified by both the branches on the same line

# in which scenario, git can not handle merging the changes


# add the changes to the staging area

# git add <file(s) with changes>

# git add . : add all the files which are changed in the current directory

# > git ady myfile

> git add .


# commit the changes

# > git commit -m <message>

> git commit -m "first commit"



# get the logs

> git log

# get the logs

# --oneline: shows only one line log info

# --graph: render the commit graph
# --color: enable color while rendering the commit graph

> git log --oneline --graph --color



# get the difference between the current and previous version of all updated files

# +: the line is added to the file

# -: the file is deleted from the file

> git diff



# get the difference between the current and previous version of selected file

# > git diff <file name>

> git diff myfile


# replace the last version with current version

# > git checkout <filename>

> git checkout myfile

# remove all the changes from staging area and move them to the working directory

# this command will not remove the changes, but only move from staging to working
directory

> git reset

# hard reset

# - all the changes (from working directory and staging area) will be removed

# - once removed there is no way to get them back

# note: please execute this command on your own risk

> git reset --hard
```

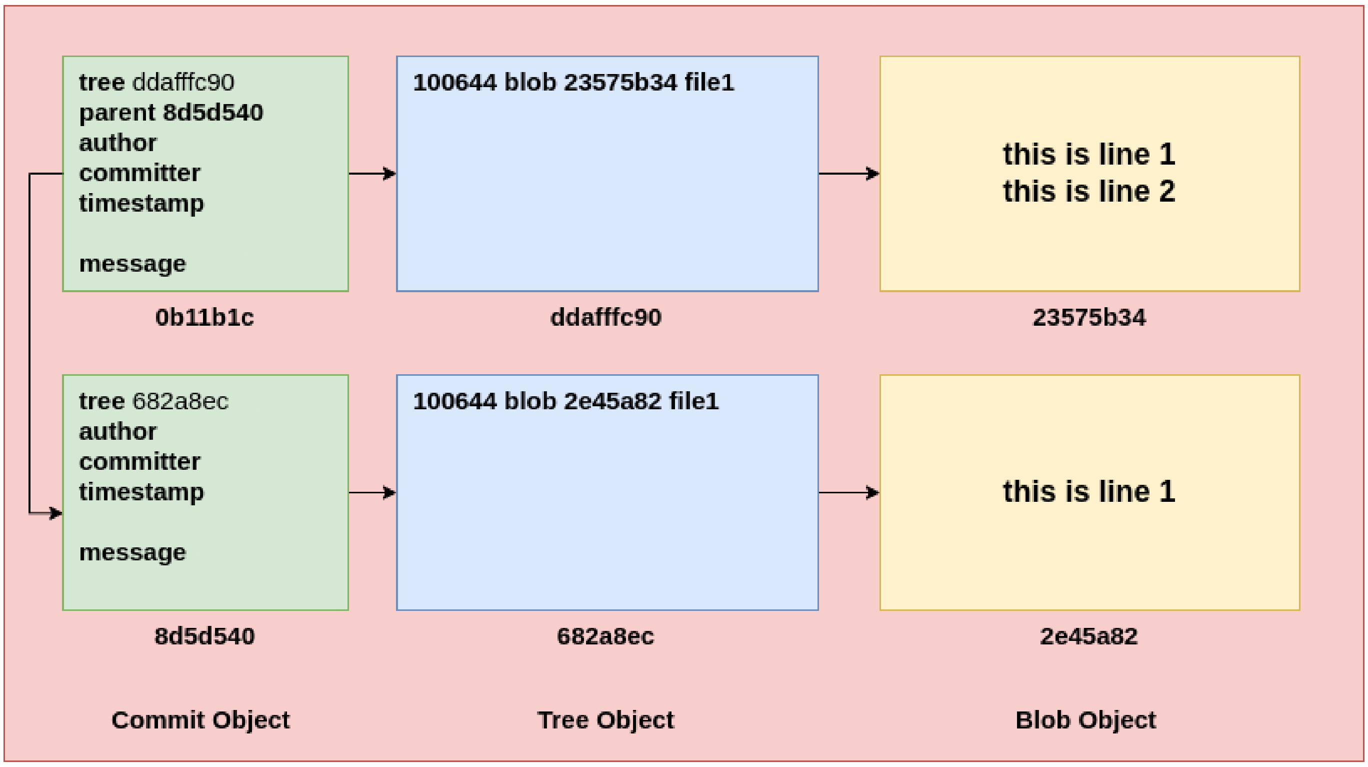
Git internals

- git init command creates a repository (directory named .git)

- .git directory contains
- HEAD
- file which has an entry of current branch
- branches
- config
- file contains the local repository configuration
- the configuration here is restricted only for the current repository
- description
- description about the repository
- hooks
- contains the scripts to be executed on different events
- the scripts can be written in any language or even shell scripts
- info
- objects
- object file stores the encrypted metadata (file contents or commit info etc)
- every object (file) has a unique identifier (40 bytes)
- out of 40 bytes
- first 2 bytes are used to create a directory
- remaining 38 bytes are used to create a file to store the contents of a file
- git used SHA algorithm to get the hash of the object
- types
- blob
- object file which stores the contents of a file in encrypted format
- gets created per file
- tree
- object file which contains the mappings of blob object files with their respective file names
- object gets create per directory
- commit

- object file which stores the commit information
- contains
- author details
- committer details
- unix timestamp
- commit message
- parent object id
- root commit object
- this type of commit object will get created only once (first time)
- this commit object does not contain the parent object id
- refs

GIT INTERNALS WORKING



```
# find the type of the object

# -t: type of an object

# > git cat-file -t <object id>

# get the readable contents of an object
# -p: pretty print the contents

# > git cat-file -p <object id>

# delete all unwanted objects and create pack files
# gc: garbage collection
> git gc

# watch the progress

> cd .git
> rm hooks/*
> watch -n 1 tree .
```

Branches

- is simply reference to a latest commit object

```
# get the list of branches
> git branch

# create a new branch
# the new branch will have same commit id as that of the current branch

# > git branch <branch name>
> git branch branch1

# switch to other branch
# > git checkout <branch name>
> git checkout branch1


# create a new branch and checkout immediately
# > git checkout -b <branch name>
> git checkout -b branch2

# merge the changes from one branch to another branch
# note: first checkout the branch in which you want to merge another branch
> git checkout master

# > git merge <branch name>
> git merge branch1

# squash merge
# - collect all the commit objects of second branch and turn them into a single
object

# - then the single commit object gets merged in the source branch
# - this will help git to reduce the commit history/tree/graph
# delete a branch
# > git branch -d <branch name>
> git branch -d branch1

# rename a branch
# the current branch will be renamed
# > git branch -M <new branch>
> git branch -M main
```

Stash

```
# get the list of changes parked in the stash area
> git stash list

# stash the changes
# move the changes from working directory to stash area
# > git stash
# > git stash save <message>
> git stash save "algo1"

# get the details of a stash entry
# > git stash show <stash id>
> git stash show stash@{0}

# apply the changes from stash area to working directory
# > git stash apply <stash id>
> git stash apply stash@{1}

# delete the stash object
# > git stash drop <stash id>
> git stash drop stash@{0}

# apply and drop the last commit from the stash area
# git stash pop = git stash apply + git stash drop
> git stash pop
```

git remote

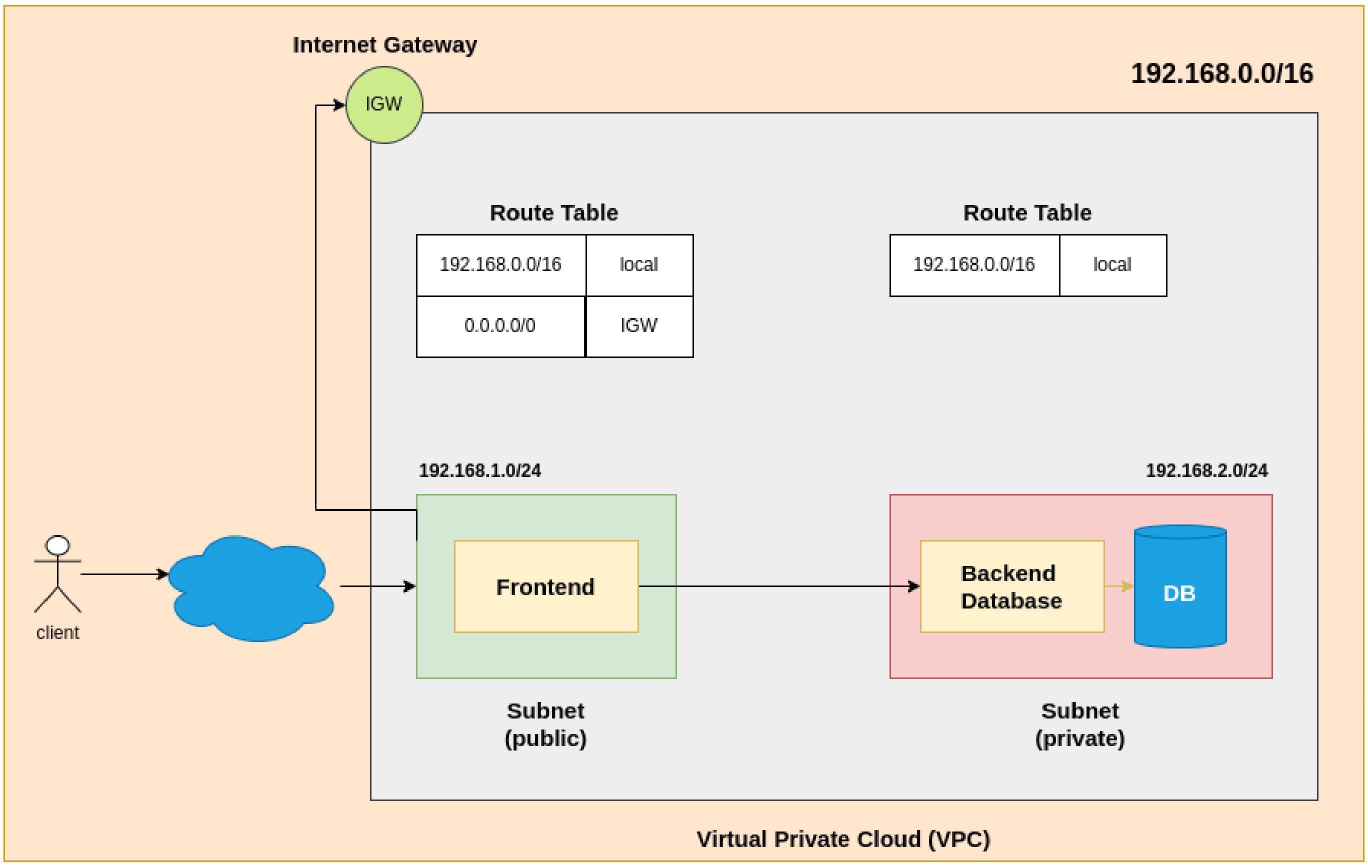
```
# get the remote repo details
> git remote -v

# connect the local repo to the remote one
# > git remote add <alias> <remote repo url>

# remove the remote from repository
# > git remote remove <alias>
> git remote remove origin
```

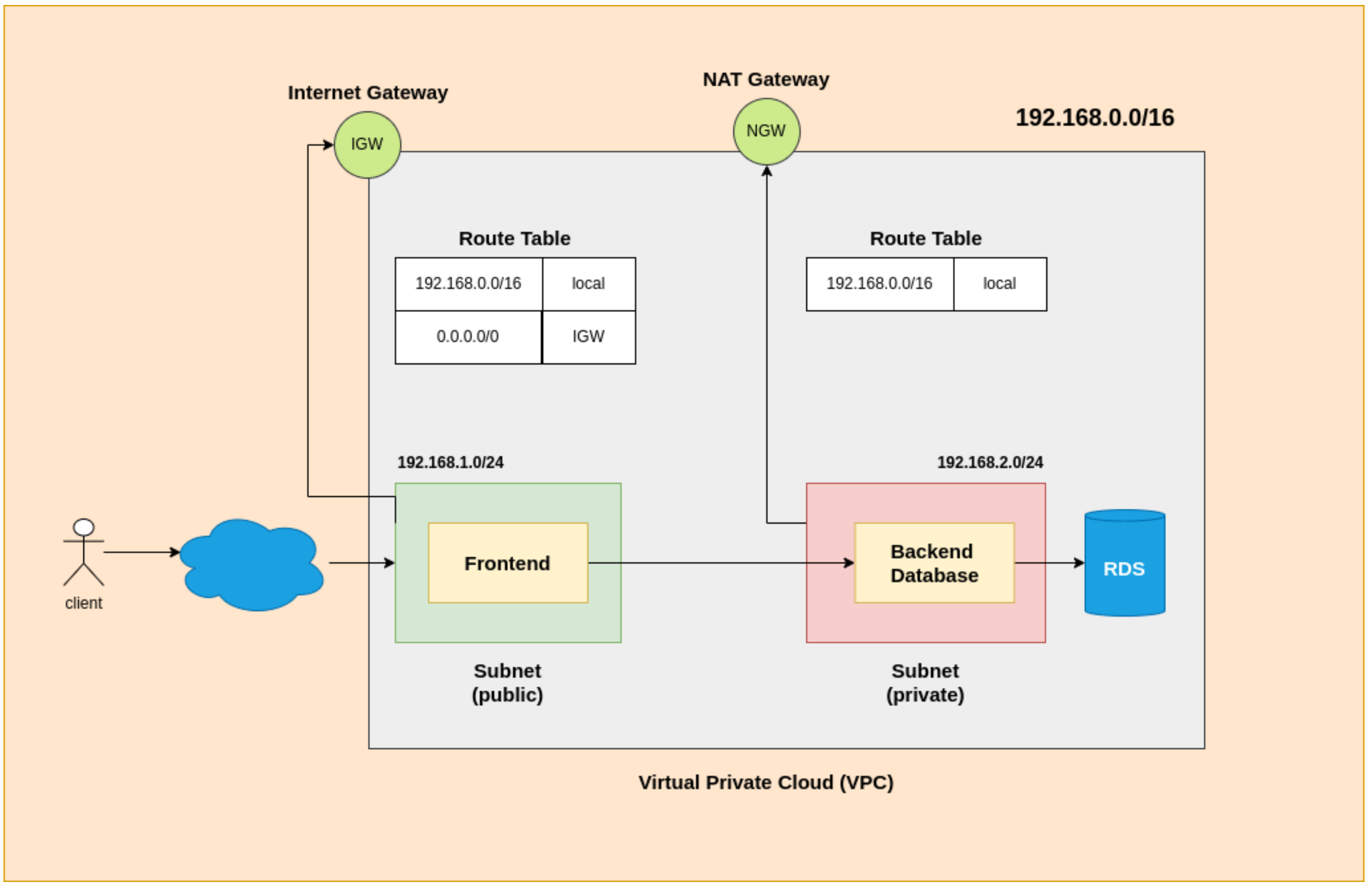
```
# get the repository contents for the first time
# > git clone <git repository url>
> git clone https://github.com/pythoncpp/application1.git

# generate ssh keys (private and public)
# public key: used for encryption
# private key: used for decryption
# this command will create keys under ~/.ssh directory
> ssh-keygen
```

AWS EC2 : Install apache

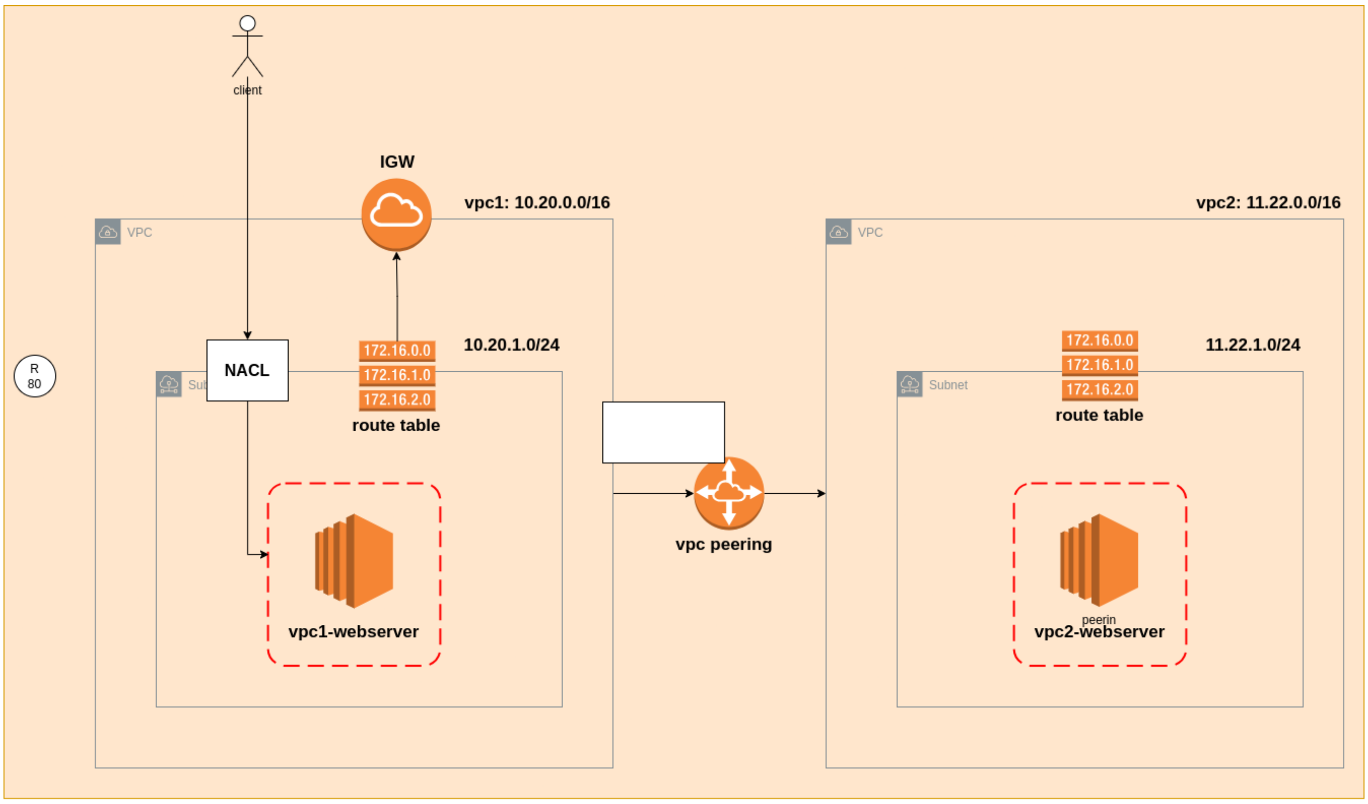
```
# connect to the ec2 instance

# usernames

# - ubuntu: ubuntu server AMI
# - ec2-user: Amazon Linux (Centos based image)
# - Administrator: Windows
# > ssh -i <pem file path> <username>@<public ip of ec2 instance>


# update the apt cache
> sudo apt-get update


# install apache
> sudo apt-get install apache2


# check the status of the apache2 service
> sudo systemctl status apache2


# start the apache service
> sudo systemctl start apache2

# enable the service to run after reboot automatically
> sudo systemctl enable apache2


# upload the file(s) from your machine to the ec2 instance
# > scp -i <pem file path> <source file> <user>@<public ip address>:<destination
path>
> scp -i ~/Downloads/key-demops.pem index.html ubuntu@18.206.171.237:/tmp/

# copy the file to the apache's web root directory

> sudo mv /tmp/index.html /var/www/html/
```

AWS VPC ARCHITECTURE

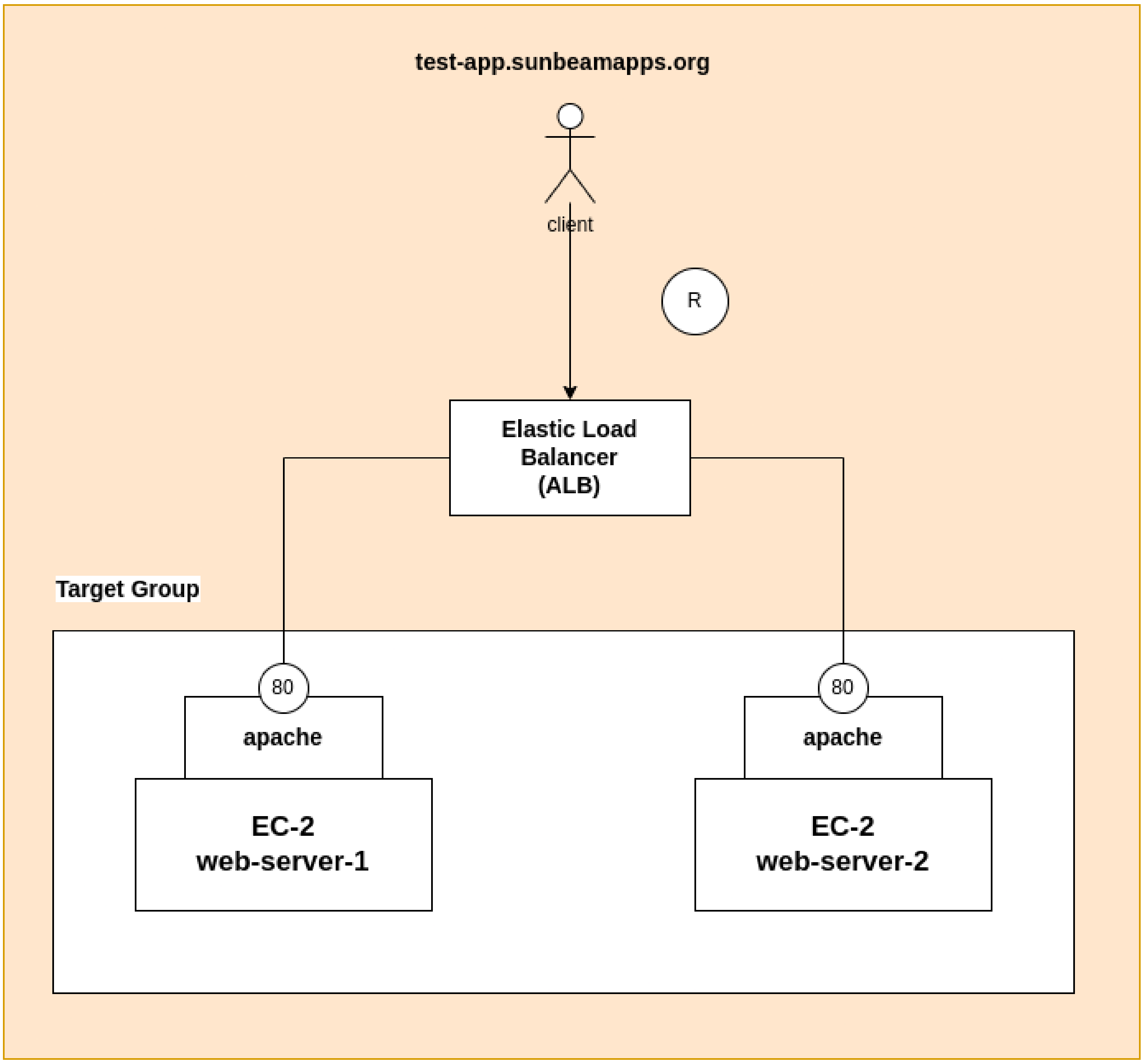




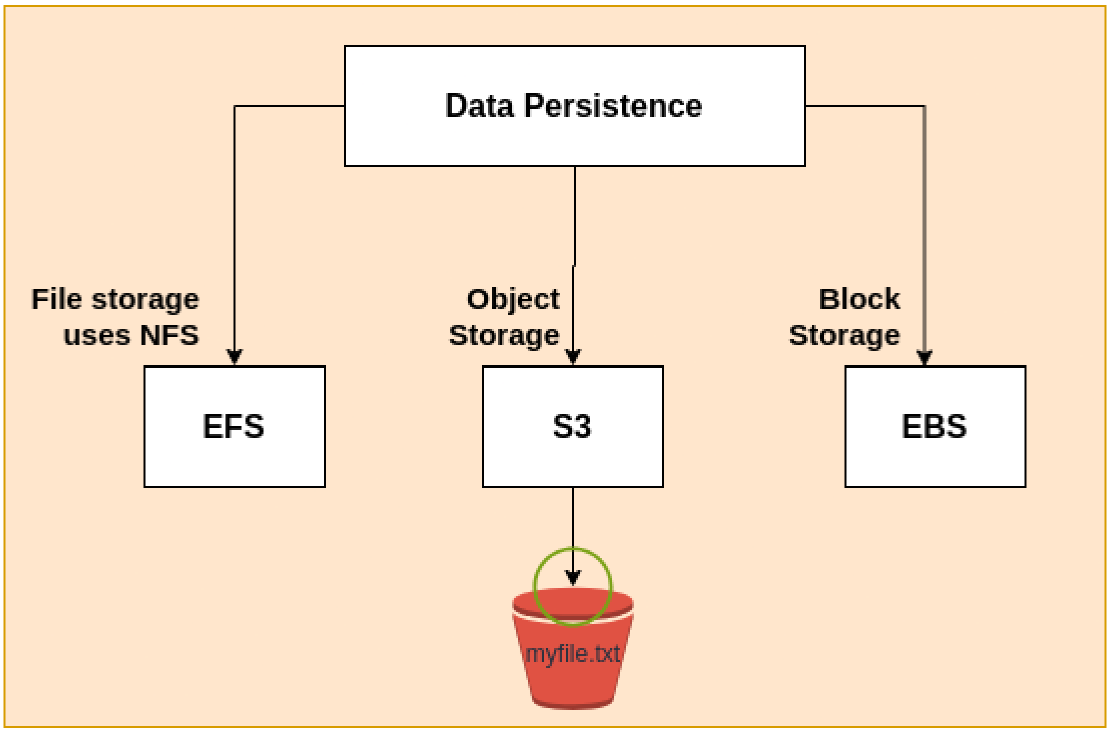
AWS VPC PEERING



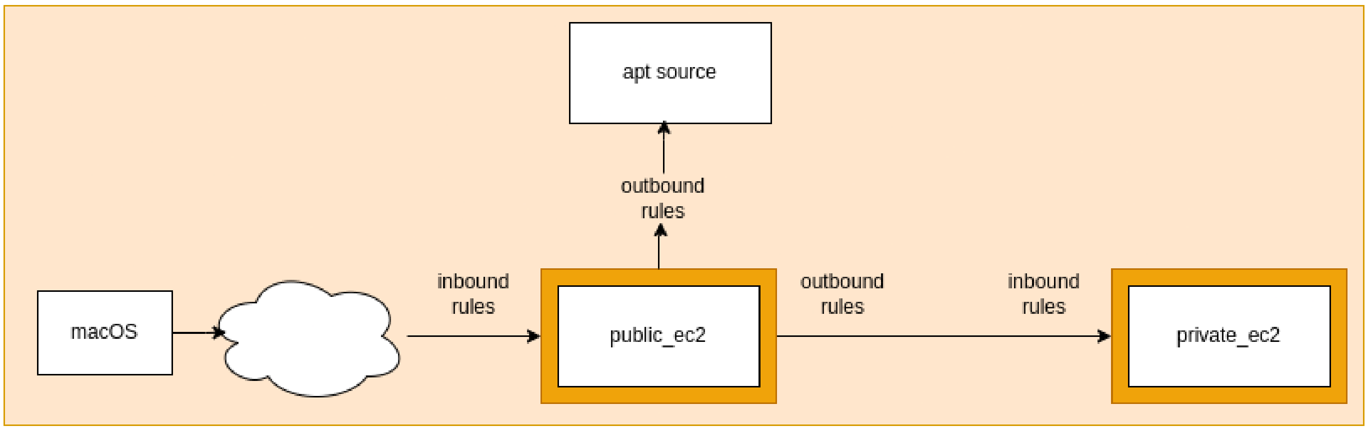
AWS ELASTIC LOAD BALANCER


test-app.sunbeamapps.org
client
R
Elastic Load Balancer (ALB)
Target Group
80
apache
EC-2 web-server-1
80
apache
EC-2 web-server-2

AWS S3



JUMPBOX ARCHITECTURE



Terraform

Installation on Ubuntu

```
# download the key to access hashicorp apt source

> wget -O - https://apt.releases.hashicorp.com/gpg |  sudo  gpg  --dearmor  -o
/usr/share/keyrings/hashicorp-archive-keyring.gpg


# add the hashicorp apt source
> echo "deb [arch=$(dpkg  --print-architecture) signed-
by=/usr/share/keyrings/hashicorp-archive-keyring.gpg]
https://apt.releases.hashicorp.com $(lsb_release  -cs) main"  |  sudo  tee
/etc/apt/sources.list.d/hashicorp.list

# update the apt cache
> sudo apt update

# install terraform
> sudo apt install terraform

# check if terraform is installed
> terraform version
```

installation on macOS

```
# add brew source
> brew tap hashicorp/tap

# install terraform
> brew install hashicorp/tap/terraform
```

Configure AWS CLI

```
# open the bashrc file
> vim ~/.bashrc

# add the following configuration
>  export  AWS_ACCESS_KEY_ID=
>  export  AWS_SECRET_ACCESS_KEY=
>  export  AWS_DEFAULT_REGION=

# North Virginia - us-east-1
# Mumbai - ap-south-1
# load the settings in the same terminal
> source ~/.bashrc

# confirm if the access key is properly configured
> echo $AWS_ACCESS_KEY_ID
> echo $AWS_SECRET_ACCESS_KEY
```

Configure the VS

```
https://marketplace.visualstudio.com/items?itemName=HashiCorp.terraform
```

Test the settings

```
terraform {

    required_version = ">= 1.0.0"

    required_providers {

        aws={

            source = "hashicorp/aws"

            version = "5.82.2"

        }

    }

}



provider "aws" {

    region = "us-east-1"

}



resource "aws_instance" "web-server" {

    ami = "ami-0e2c8caa4b6378d8c"

    instance_type = "t2.micro"

    key_name = "key-demops"
    tags = {

    Name = "Web Server"

    }

}
```

perform the operations

```
# download required providers
> terraform init

# check if the configuration is valid
> terraform validate

# get the plan of execution
> terraform plan


# create the infra using terraform

> terraform apply

# refresh the state of resources

> terraform refresh
```

Ansible

vagrant setup

```
# configure vagrant machine
> vagrant init <box name>

# create the machine
> vagrant up

# check the status
> vagrant status

# get the global status
> vagrant global-status

# shut down the machine
> vagrant halt
```

```
Vagrant.configure("2") do |config|
    config.vm.box  =  "ubuntu"
    config.vm.provider  "vmware_desktop"  do |v|
    v.linked_clone  =  false
end

# define the controller node
    config.vm.define  "controller"  do |controller|
        # change the hostname
        controller.vm.hostname  =  "controller"
    end

# define the manged node
    config.vm.define  "m1"  do |m1|
        # change the hostname
        m1.vm.hostname  =  "node"
    end
end
```

installing ansible

- note: please make sure that you are inside the controller node

> vagrant ssh controller

```
# update the apt cache
> sudo apt-get update
```

```
# install the pre-requisites
> sudo apt install software-properties-common

# add the ansible apt source
> sudo add-apt-repository --yes --update ppa:ansible/ansible


# install ansible
> sudo apt install ansible

# check if ansible is installed
> ansible --version
```

configure the managed node

- note: make sure that you are connected to the managed node

```
> vagrant ssh m1

# change the hostname to controller
> sudo vim /etc/hostname

# restart the machine
> sudo reboot
```

configure the vim

```
# configure the vim using ~/.vimrc
> vim ~/.vimrc

# convert the tab into spaces
set  expandtab

# one tab will be converted to two spaces
set  tabstop=2

# enable the line numbers
set  number
```

create the inventory

```
# create a directory to hold the inventory
> mkdir myplaybooks

# create an inventory file for listing all the nodes
```

```
> vim inventory.ini

# [hosts] <- group name
# 172.16.140.145 <- managed node ip address
# 172.16.140.145 ansible_ssh_user=vagrant ansible_ssh_pass=vagrant <- managed node
ip address

# check the connectivity with the nodes
# hosts: group name
# ping: module (command which will check the connectivity)
# inventory.ini: inventory file
> ansible hosts -m ping -i inventory.ini
```

playbooks

```
# execute a playbook
> ansible-playbook playbook.yaml -i inventory.ini
```

Docker

installation

```
# update the apt cache

> sudo apt-get update

# install pre-requisites
> sudo apt-get install ca-certificates curl

# create keyrings
> sudo install -m 0755 -d /etc/apt/keyrings

# download the gpg key for downloading the docker tool
> sudo curl -fsSL https://download.docker.com/linux/ubuntu/gpg -o
/etc/apt/keyrings/docker.asc
> sudo chmod a+r /etc/apt/keyrings/docker.asc

# Add the repository to Apt sources:

> echo \

"deb [arch=$(dpkg --print-architecture) signed-by=/etc/apt/keyrings/docker.asc]
https://download.docker.com/linux/ubuntu \

$(.  /etc/os-release  &&  echo  "$VERSION_CODENAME") stable"  |  \

sudo  tee  /etc/apt/sources.list.d/docker.list  >  /dev/null


# update the apt cache
> sudo apt-get update


# install docker
> sudo apt-get install docker-ce docker-ce-cli containerd.io docker-buildx-plugin
docker-compose-plugin


# check if the docker service is installed
> sudo systemctl status docker


# start the docker server
> sudo systemctl start docker

# enable the docker server
> sudo systemctl enable docker
```

```
# add the current user to the docker group
> sudo usermod -aG docker $USER

# restart the machine
# check if docker is installed
> docker version
```

image commands

```
# get the list of images available on the machine
> docker image ls

# download or pull the image on the machine
# > docker image pull <image name>
# the image gets stored in /var/lib/docker/images directory
> docker image pull hello-world


# remove image from machine
# > docker image rm <image name>
> docker image rm hello-world

# get information about an image
> docker image inspect hello-world
```

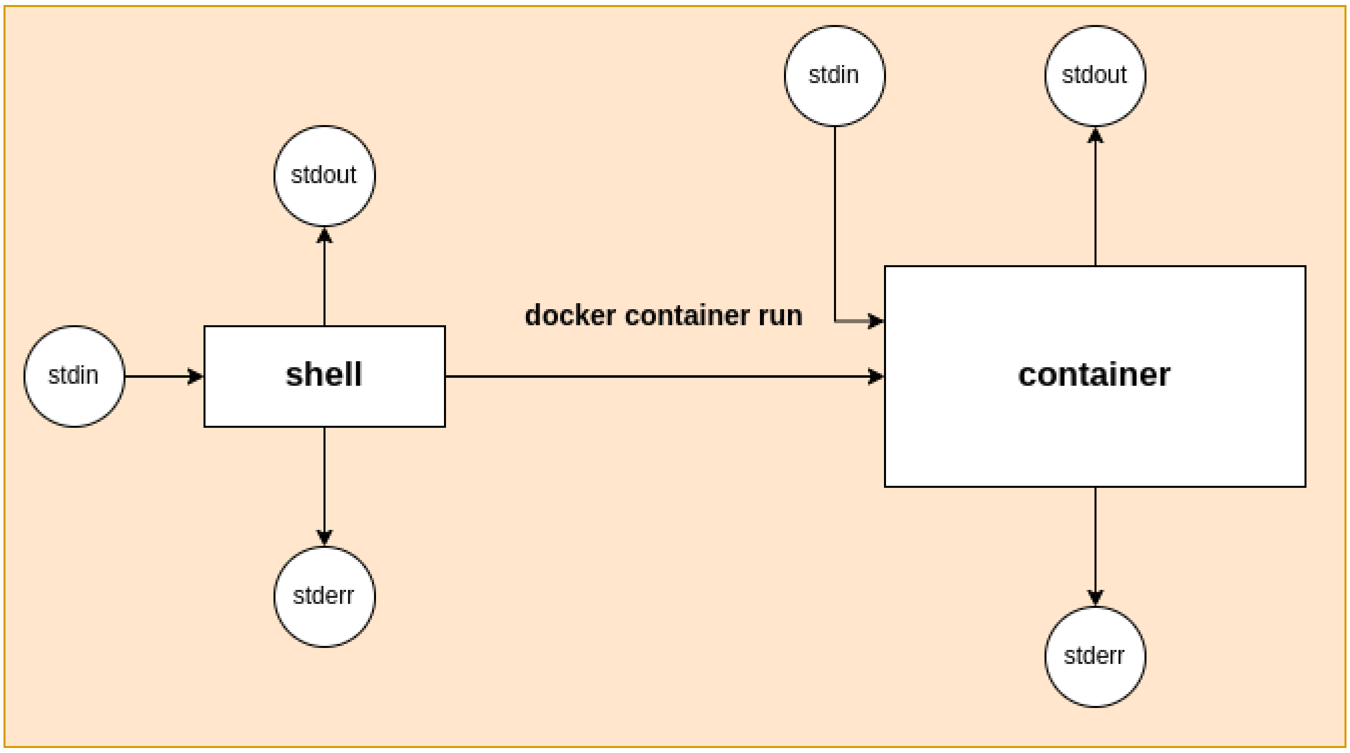
container commands

```
# get the list of running containers
> docker container ls


# get the list of containers in all states (created, updated)
> docker container ls -a

# create a container
> docker container create hello-world

# get the details of selected container
# > docker container inspect <container name or container id>
> docker container inspect c1c


# start already created container
> docker container start <container id or name>


# stop a running container
> docker container stop <container id or name>
```

```
# remove a stopped container
> docker container rm <container id or name>


# remove a running container
> docker container rm --force <container id or name>
```

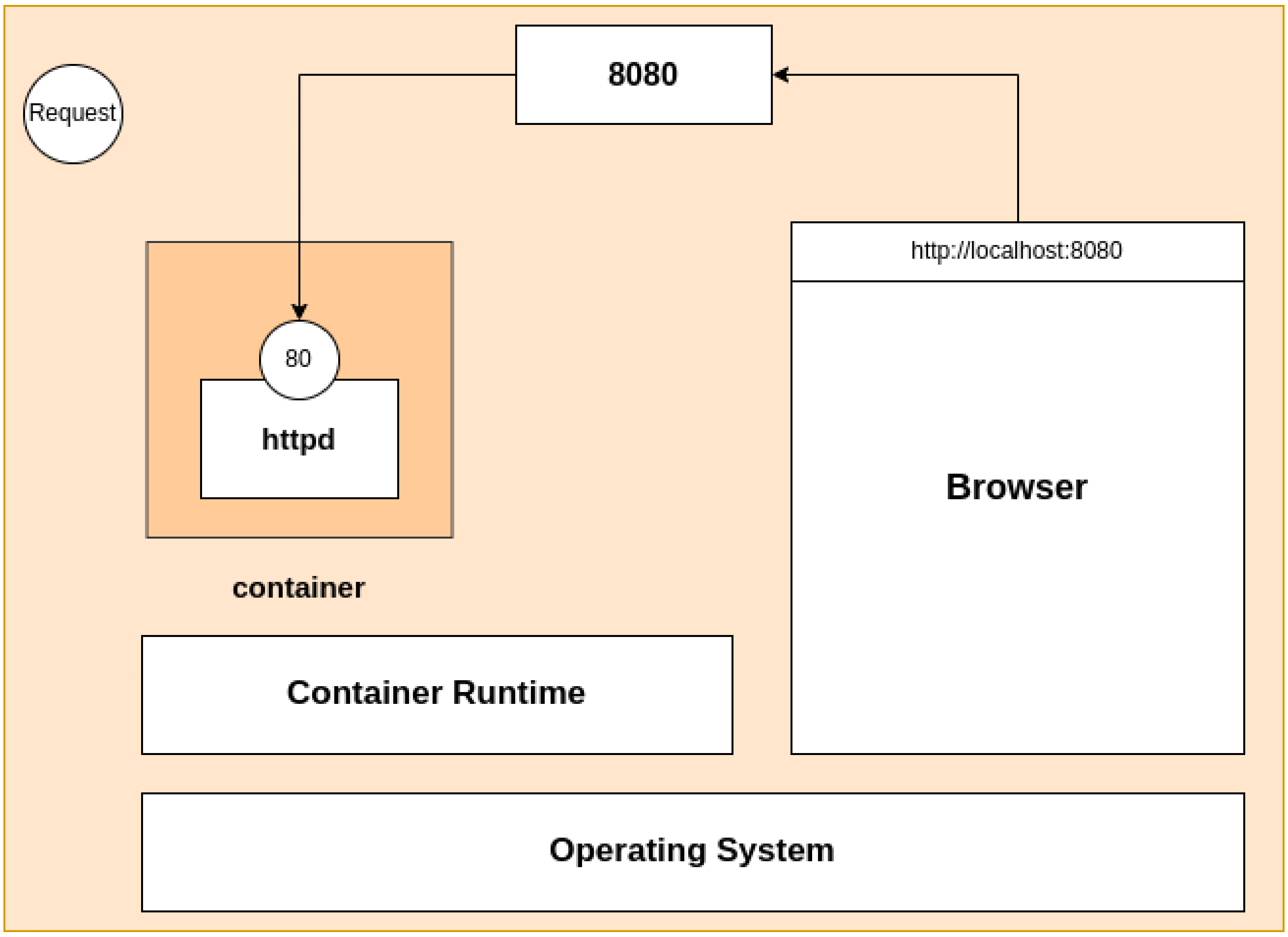
```

# run the container
# create and start the container

# this command will run a new container every time
> docker container run <image name or id>

# set the name while running the application
# this container will run by default in attached mode
> docker container run --name <name>  <image name or id>

```

Attached Mode Architecture



```

# run the container in detached mode (background)
# -d: detached mode
# -i: enable the docker interactive mode
# -t: enable the teletype terminal for the docker
> docker container run --name <name> -itd <image name or id>

# enable port forwarding for a container
# source port
# - port allocated on OS
# - can be any available port
# container port
# - port exposed by the container
# > docker container run --name <name> -itd -p <source port>:<container port>
<image name or id>
> docker container run --name myhttpd -itd -p 8080:80 httpd
```

Port forwarding Architecture

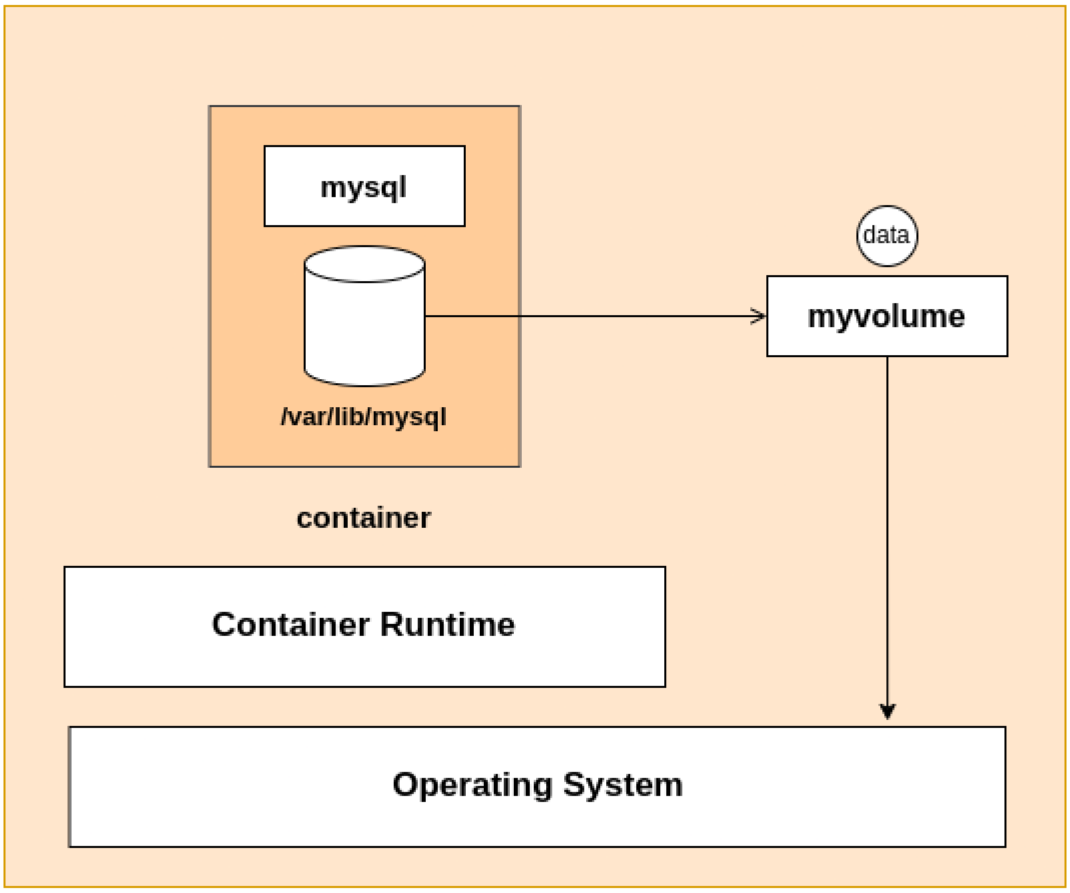


```
# run mysql in a container
> docker container run --name mysql -itd -p 3306:3306 -e MYSQL_ROOT_PASSWORD=root
mysql

# execute a command inside the container
# > docker container exec <container name or id> <command>
> docker container exec myhttpd date

# get the terminal from the container
# > docker container exec -it <container name or id> <shell>
> docker container exec -it myhttpd bash

# get the logs generated by the container
# > docker container logs <container name or id>
> docker container logs mysql
```

volume

```
# get the list of volumes
> docker volume ls

# remove the unused volumes
> docker volume prune

# create a volume
# - this will create a new directory name myvolume under /var/lib/docker/volumes
> docker volume create myvolume

# find more information about a volume
> docker volume inspect <volume name>

# remove a volume
> docker volume rm <volume name>


# attach volume to a container
# > docker container run --name <name> -itd -p <source port>:<container port> -v <volume name>:<mount point inside the container> <image name>
> docker container run --name mysql -itd -p 3306:3306 -v myvolume:/var/lib/mysql -e MYSQL_ROOT_PASSWORD=root  mysql
```

Volume Architecture



images

- customize the docker image to run your application by using Dockerfile
- Dockerfile contains instructions/commands to create an image
- commands
- FROM
- used to select the base image
- COPY
- used to copy file/directory from local machine to the image
- syntax: COPY
- e.g. COPY index.html /usr/local/apache2/htdocs/ will copy the index.html from local machine to the /usr/local/apache2/htdocs/ of image
- WORKDIR
- used to set the working directory
- if the directory does not exist, the image creates this new directory
- RUN
- used to run a command while building an image

- installing dependencies while building an image
- CMD
- used to run the command when container starts
- this must be the last command of your Dockerfile
- EXPOSE
- used to expose a port for consumer to access the application running inside the container

```

# build a custom image
# > docker image build -t <image name>:<image tag> <context>
> docker image build -t myimage .

# login with docker credentials
> docker login -u <user name>

# create a new tag for your image to push to the docker hub
# > docker image tag <existing image> <docker username>/<image name>
> docker image tag myserver amitksunbeam/myserver

# push the image to the docker hub
# > docker image push <image name>
> docker image push amitksunbeam/myserver

# to build the image for other CPU architecture use buildx command
> docker buildx build --platform <platform>  .
```

swarm

```
# check if the node is a part of any swarm
> docker system info |  grep  Swarm

# start initializing the swarm
> docker swarm init

# remove the current node from the cluster
> docker swarm leave --force

# generate a token to add a worker
> docker swarm join-token worker
```

node

```
```

```
# get the list of nodes
> docker node ls

# get the details of selected node
> docker node inspect <node id>

# remove a node from cluster
> docker node rm <node id>

# promote a worker to work as manager
> docker node promote <worker node id>


# demote a manager to work as worker
> docker node demote <manager node id>
```

service

```
# get the list of services
> docker service ls

# create a service

# > docker service create --name <service name> <image name>
> docker service create --name myservice httpd

# create a service with required desired count
# > docker service create --replicas <desired count> --name myservice httpd
> docker service create --replicas 5 --name httpd -p 8080:80 httpd

# get the list of containers created by the service
> docker service ps <service name>

# remove a service
> docker service rm <service name>

# to watch the current state of service
> watch -n 1 docker container ls

# horizontally scale the service
# > docker service scale <service name>=<new desired count>
> docker service scale myservice=10
```

docker compose

- used in development to deal with multiple microservices at a time
- in-built in the docker engine

- can be done using yaml configuration
- does not support Swarm

```
# get the list of services managed by docker compose
> docker compose ls

# create images for all the services mentioned in the docker-compose file
> docker compose build

# create containers for all the services
> docker compose up -d

# delete all the containers for the services
> docker compose down

# delete all the images along with the containers for the services
> docker compose down --rmi all
```

docker stack

- used to deal with multiple service with swarm

```
# get the list of stacks
> docker stack ls

# deploy or create a new stack
# > docker stack deploy --compose-file <stack yaml file> --detached=true <stack
name>
> docker stack deploy --compose-file docker-stack.yaml --detached=true  myapp

# remove a running stack
# > docker stack rm <stack name>
> docker stack rm myapp
```

---

minikube

download and configure docker

```
# install pre-requisites

> sudo apt-get update

> sudo apt-get install ca-certificates curl

> sudo install -m 0755 -d /etc/apt/keyrings

> sudo curl -fsSL https://download.docker.com/linux/ubuntu/gpg -o
/etc/apt/keyrings/docker.asc

> sudo chmod a+r /etc/apt/keyrings/docker.asc


# Add the repository to Apt sources:

> echo \

"deb [arch=$(dpkg --print-architecture) signed-by=/etc/apt/keyrings/docker.asc]
https://download.docker.com/linux/ubuntu \

$(.  /etc/os-release  &&  echo  "${UBUNTU_CODENAME:-$VERSION_CODENAME}") stable"
|  \

sudo  tee  /etc/apt/sources.list.d/docker.list  >  /dev/null
> sudo apt-get update

# install docker
> sudo apt-get install docker-ce docker-ce-cli containerd.io docker-buildx-plugin
docker-compose-plugin

# add current user to the docker group
> sudo usermod -aG docker $USER
# restart or logout
```

download minikube

```
# download
> curl -LO
https://github.com/kubernetes/minikube/releases/latest/download/minikube-linux-
arm64

# install minikube on arm-64
```

```
> sudo install minikube-linux-arm64 /usr/local/bin/minikube && rm  minikube-linux-
arm64
```

minikube commands

```
# start the cluster
> minikube start

# stop the cluster
> minikube stop

# delete the cluster
> minikube delete

# get the cluster status
> minikube status

# add the following entry in your ~/.bashrc
> alias  kubectl="minikube kubectl --"
> source ~/.bashrc

# ssh into the minikube virtual machine
> minikube ssh

# get the dashboard
> minikube dashboard

# get the ip address of the minikube node
> minikube ip
```

Kubernetes

Installation

> These commands to be fired on Master as well as all Nodes

```
set -euxo pipefail

# declare variables
KUBERNETES_VERSION="v1.31"
CRIO_VERSION="v1.30"

# disable swap
sudo swapoff -a

# Create the .conf file to load the modules at boot time
cat <<EOF | sudo tee /etc/modules-load.d/k8s.conf
overlay
br_netfilter
EOF

sudo modprobe overlay
sudo modprobe br_netfilter

# Sysctl params required by setup, params persist across reboots
cat <<EOF | sudo tee /etc/sysctl.d/k8s.conf
net.bridge.bridge-nf-call-iptables  = 1
net.bridge.bridge-nf-call-ip6tables = 1
net.ipv4.ip_forward                 = 1
EOF

# Apply sysctl params without reboot
sudo sysctl --system

# Install CRI-O Runtime
sudo apt-get update -y
sudo apt-get install -y apt-transport-https ca-certificates curl gpg software-
properties-common

# add CRI-O key and repository
curl -fsSL https://pkgs.k8s.io/addons:/cri-
o:/stable:/$CRIO_VERSION/deb/Release.key |
    sudo gpg --dearmor -o /etc/apt/keyrings/cri-o-apt-keyring.gpg
echo "deb [signed-by=/etc/apt/keyrings/cri-o-apt-keyring.gpg]
https://pkgs.k8s.io/addons:/cri-o:/stable:/$CRIO_VERSION/deb/ /" |
    sudo tee /etc/apt/sources.list.d/cri-o.list

# update the cache and install CRI-O
sudo apt-get update -y
sudo apt-get install -y cri-o
```

```
# start the CRI-O service
sudo systemctl daemon-reload
sudo systemctl enable crio --now
sudo systemctl start crio.service

# add the kubernetes key and repository
curl -fsSL https://pkgs.k8s.io/core:/stable:/$KUBERNETES_VERSION/deb/Release.key |
    sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg

echo "deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg]
https://pkgs.k8s.io/core:/stable:/$KUBERNETES_VERSION/deb/ /" |
    sudo tee /etc/apt/sources.list.d/kubernetes.list

# install kubelet, kubeadm, and kubectl latest version
sudo apt-get update -y
sudo apt-get install -y kubelet kubectl kubeadm

# Prevent automatic updates for kubelet, kubeadm, and kubectl
sudo apt-mark hold kubelet kubeadm kubectl
sudo apt-get update -y
```

> After that these commands to be fired on master

```
# Setup for Control Plane (Master) servers

NODENAME=$(hostname -s)
POD_CIDR="192.168.0.0/16"

# Pull required images
sudo kubeadm config images pull

# get the private IP of the master node
MASTER_PRIVATE_IP=$(ip addr show eth1 | awk '/inet / {print $2}' | cut -d/ -f1)
sudo kubeadm init --apiserver-advertise-address="$MASTER_PRIVATE_IP" --apiserver-
cert-extra-sans="$MASTER_PRIVATE_IP" --pod-network-cidr="$POD_CIDR" --node-name
"$NODENAME" --ignore-preflight-errors Swap

# if this doesn't work set the ip of MASTER IP manually

# MASTER_PRIVATE_IP=192.x.x.x


# Configure kubeconfig
mkdir -p "$HOME"/.kube
sudo cp -i /etc/kubernetes/admin.conf "$HOME"/.kube/config
sudo chown "$(id -u)":"$(id -g)" "$HOME"/.kube/config

# Install Calico Network Plugin Network
kubectl apply -f https://docs.projectcalico.org/manifests/calico.yaml
```

vim configuration

```
# add the following lines in ~/.vimrc

> set expandtab

> set number

> set tabstop=2
```

nodes

```
# get the list of nodes
> kubectl get nodes

# get details of a selected node
> kubectl describe node <node name>

# delete a node
> kubectl delete node <node name>
```

namespace

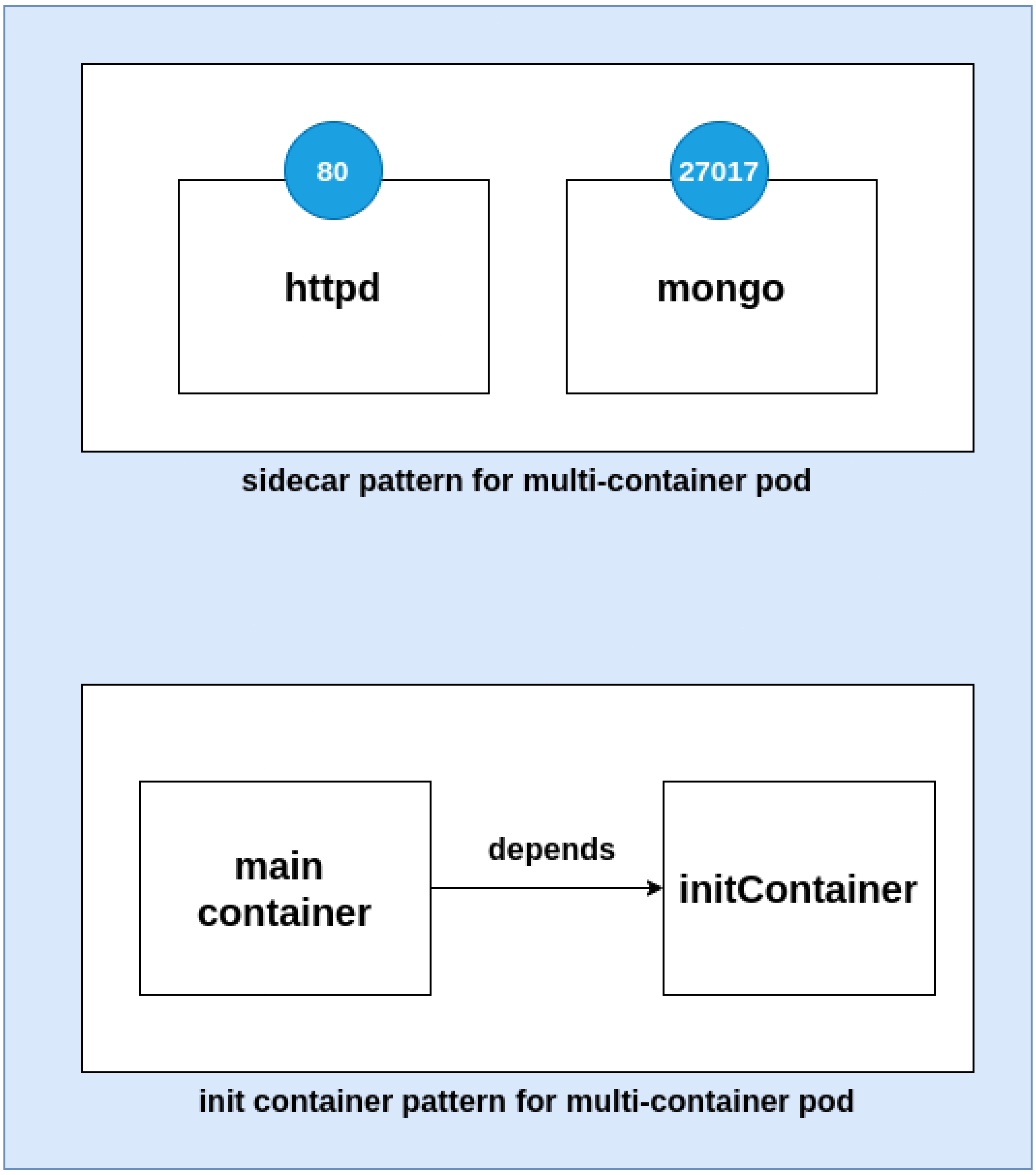
```
# get the list of namespaces

> kubectl get namespaces
> kubectl get namespaces
> kubectl get ns

# create a new namespace
# > kubectl create namespace <namespace name>
> kubectl create namespace ns1

# delete a namespace
# this command will also delete all the objects under the namespace
# > kubectl delete namespace <namespace name>
> kubectl delete namespace ns1
```

pod

```
# get the list of pods running in default namespace
> kubectl get pods

# get the list of pods running in requirement namespace
> kubectl get pods -n <ns name>
```

```
# get the list of pods with wide/more options
> kubectl get pods -n <ns name> -o wide

# create a pod using pod1.yaml file
> kubectl create -f pod1.yaml

# get the details of selected pod
> kubectl describe pod <pod name>

# delete the pod from default namespace
> kubectl delete pod <pod name>

# delete the pod from required namespace
> kubectl delete pod <pod name> -n <ns name>

# get the logs of a selected pod
> kubectl logs <pod name>

# get the logs continuously of a selected pod
> kubectl logs -f <pod name>

# execute a command inside a pod
> kubectl exec -it <pod name> -- <command>

# get the terminal of a selected pod
> kubectl exec -it <pod name> -- bash

# get the terminal of a selected pod from a selected containers
# if -c is not given, the first container will execute the command
> kubectl exec -it <pod name> -c <container name> -- bash
```

Sidecar Pattern vs Init-container pattern


80
27017
httpd
mongo
sidecar pattern for multi-container pod
main container
depends
initContainer
init container pattern for multi-container pod

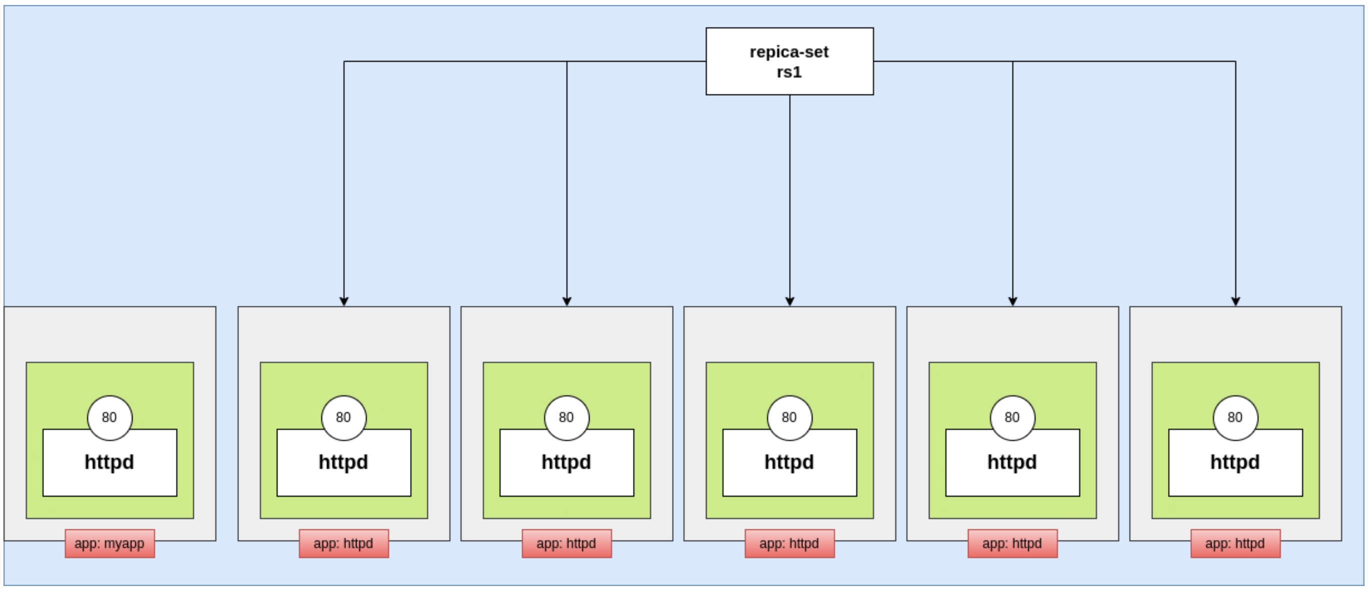
---

replica sets

- used to create multiple replicas of selected pod

```
# get list of replica-set
> kubectl get replicasets
> kubectl get replicaset
> kubectl get rs

# get details of selected replica-set
> kubectl describe rs <rs name>


# to scale out or in, update the replicas in yaml file
> kubectl apply -f <rs yaml file>

# delete a replica-set
> kubectl delete replicaset <rs name>
```

Replicaset Architecture



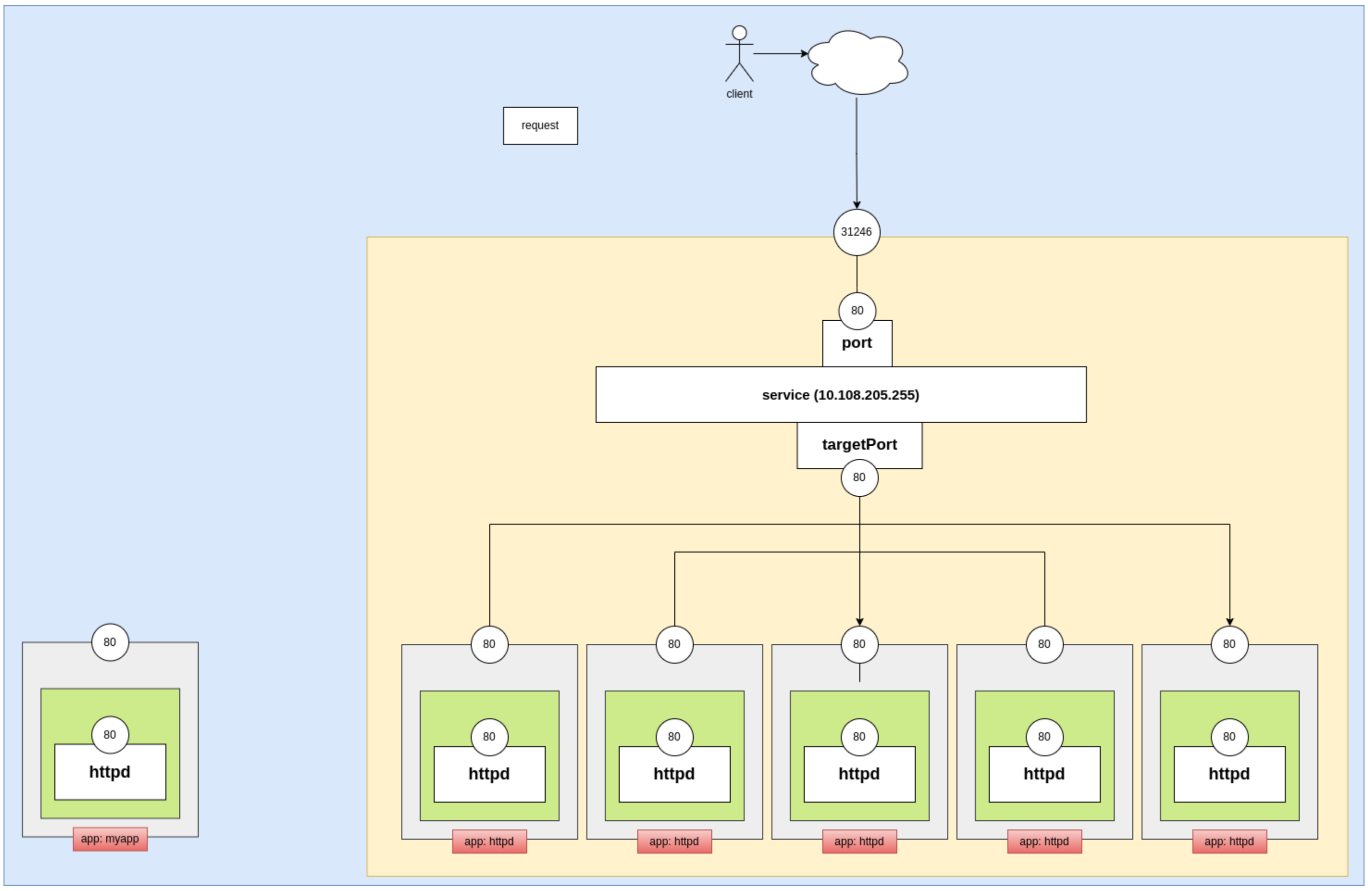
service

- used to balance the load amongst multiple pods
- these multiple pods can be created using replica-set or deployment
- types
- ClusterIP
- service which will be accessible only within the cluster
- service can not be accessed outside the cluster
- can be used to access an application inside the cluster by other pods
- e.g. frontend pod is accessing backend service which is load balancing the backend pods
- ports
- port
- the internal client will send the request to service on this port
- you are free to choose this port as per your requirement
- targetPort
- service will forward the request to pod(s) on this port
- this port number must be same as the port on which the pod is listening on
- NodePort
- service will make the application accessible outside the cluster

- it internally will create a clusterIP service
- ports
- port
- the internal client will send the request to service on this port
- you are free to choose this port as per your requirement
- targetPort
- service will forward the request to pod(s) on this port
- this port number must be same as the port on which the pod is listening on
- nodePort
- the port assigned to the node on which external client will send the request
- if needed you can specify the nodePort within the range of 30000-32767
- if not specified, the kubernetes will assign a random nodePort to the service
- LoadBalancer
- used to create a load balancer in cloud (for AWS it will create ALB)

```
# get the list of services
> kubectl get services

# get the service details
> kubectl describe service <service name>
```

Service architecture



config map

- collection of key-value pairs (configuration)
- used for storing non-sensitive application configurations
- e.g. port number, backend url
- all the configurations stored in config map are exposed to the application

via environment variables

- all values must be in string format (wrapped in double quotes)

```
# get the list of config maps
> kubectl get configmap
> kubectl get cm

# get details of selected config map
> kubectl describe cm <cm name>

# delete selected config map
> kubectl delete cm <cm name>
```

secrets

- collection of key-value pairs (configuration)

- used for storing sensitive application configurations
- e.g. password, secret, access token
- all the configurations stored in secrets are exposed to the application

via environment variables

- all values must be in bas64 encoded string format (wrapped in double quotes)

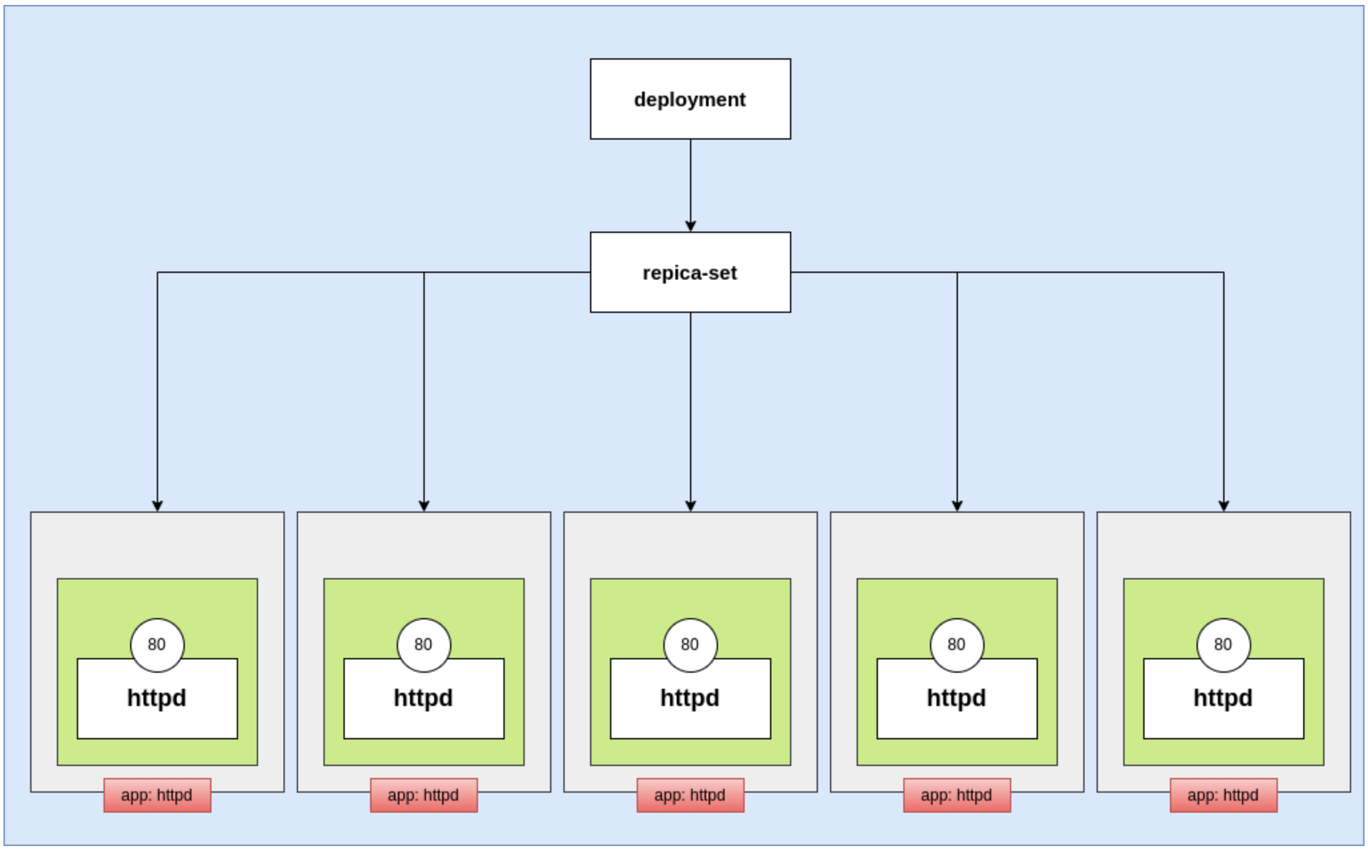
```
# get the list of secrets
> kubectl get secrets

# get details of a selected secret
> kubectl describe secret <secret name>

# delete selected secret
> kubectl delete secret <secret name>
```

deployment

- represents logical deployment of an application
- internally it uses replica set to replicate the pods
- can be updated or rollbacked using rollout commands

```


# get the list of deployments
> kubectl get deployments
> kubectl get deploy

# get details of selected deployment
> kubectl describe deploy <deploy name>

# delete deployment
> kubectl delete deploy <deploy name>
```

Deployment architecture



rollout

```
# restart the deployment using rollout
# this will force deployment to load the new version from docker hub
> kubectl rollout restart deployment <deployment-name>

# get the history of rollout
> kubectl rollout history deployment <deployment-name>

# rollback to the older version (previous version)
> kubectl rollout undo deployment <deployment-name>

# rollback to the specific older version
> kubectl rollout undo deployment <deployment-name>  --to-revision=<version-
number>

# update the image tag (version)
> kubectl set image deployment <deployment-name>  <container-name>=<newer version>

# get the current status of rollout
> kubectl rollout status deployment <deployment-name>
```

persistent volumes

```
# get the list of persistent volumes
> kubectl get persistentvolumes
> kubectl get pv
```

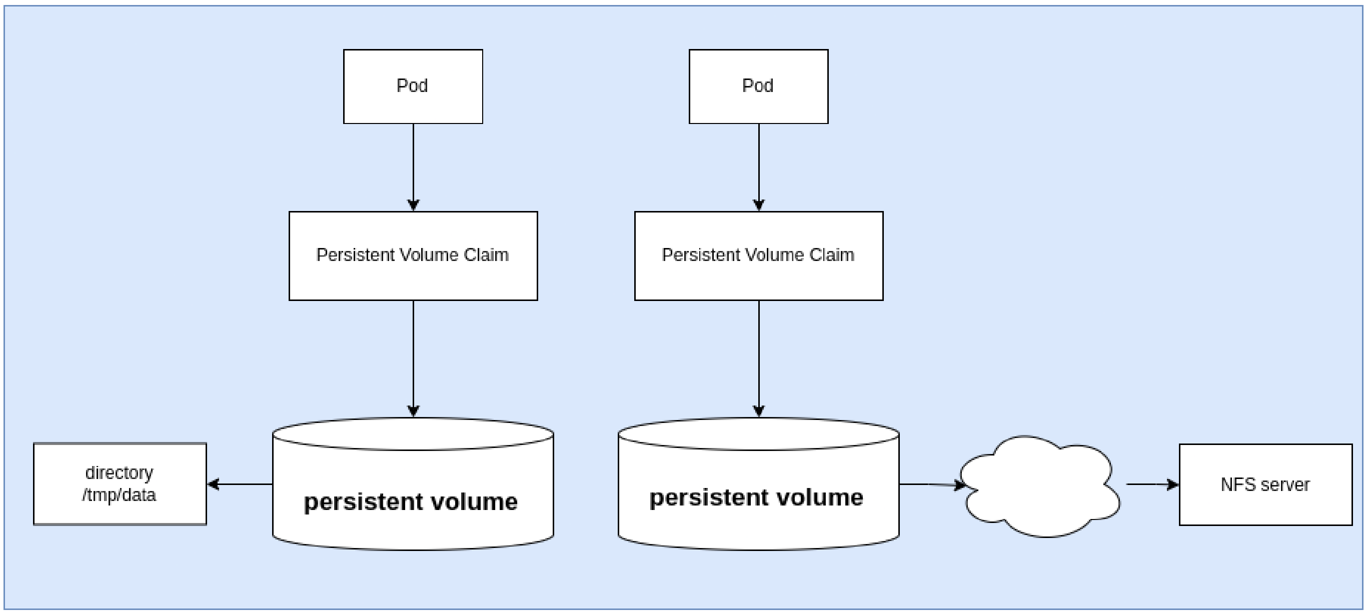
```
# create a pv
> kubectl apply -f pv.yaml

# get details of selected pv
> kubectl describe pv <pv name>

# delete a pv
> kubectl delete pv <pv name>
```

persistent volume claim

```
# get the list of pvc
> kubectl get pvc

# get details of a selected pvc
> kubectl describe pvc <pvc name>

# delete a pvc
> kubectl delete pvc <pvc name>
```

---

persistent volume claim architecture



---

metrics service

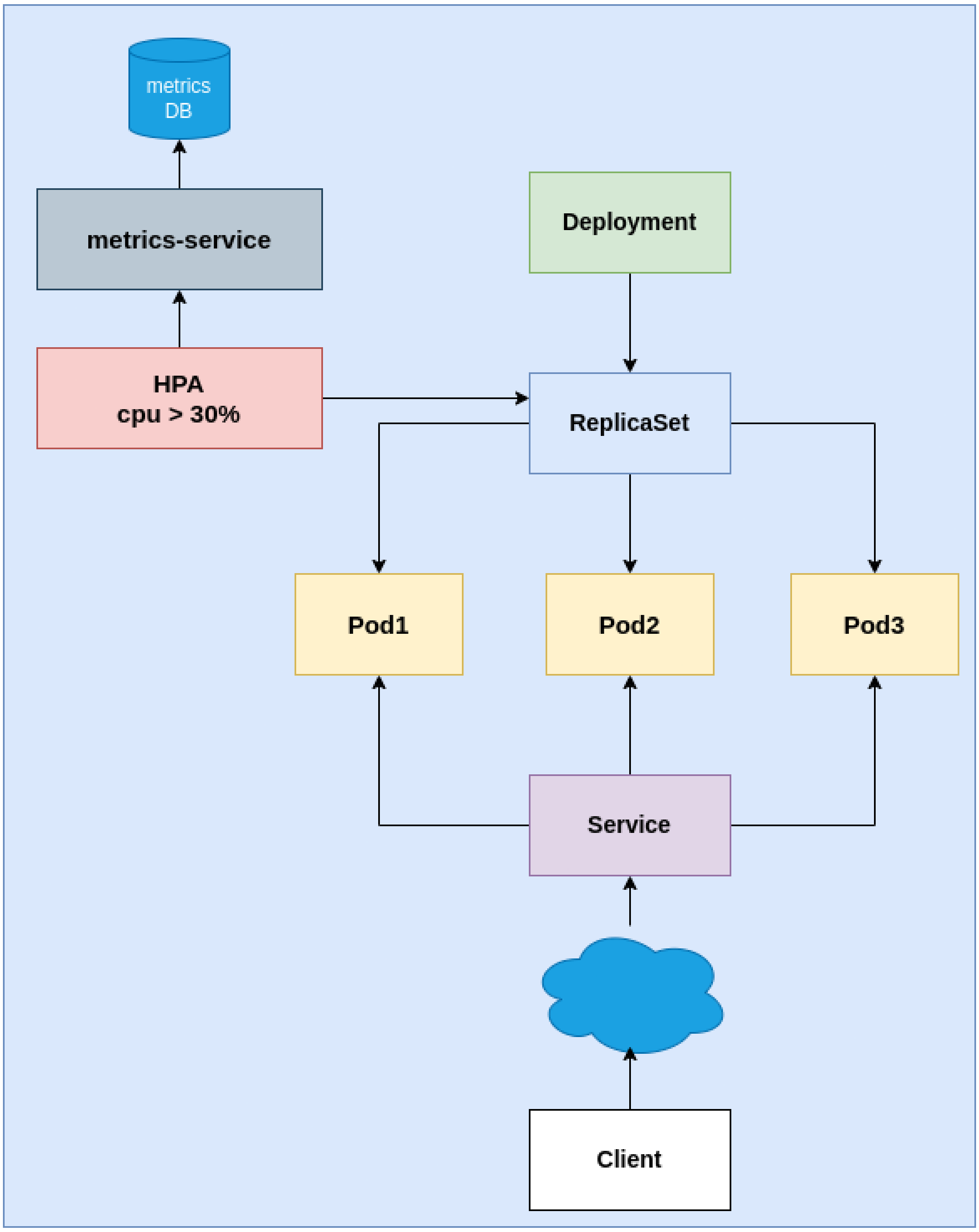
```
# apply the metrics server yaml
> kubectl apply -f https://github.com/kubernetes-sigs/metrics-
server/releases/latest/download/components.yaml
```

```
# the above url will deploy the metrics server in kube-system namespace
# by default, this will not work
# to fix the problem
> kubectl edit deployment metrics-server -n kube-system

# add the following line on line number 45
>  --kubelet-insecure-tls=true

# save and exit => esc :wq

# get the top node usage
> kubectl top nodes

# get the top pods usage
> kubectl top pods

# get all the resources created in the kube-system namespace
> kubectl get all -n kube-system
```

horizontal pod autoscaling

```
# get the list of hpa
> kubectl get hpa

# get details of selected hpa
> kubectl describe hpa <hpa name>

# delete a selected hpa
> kubectl delete hpa <hpa name>
```

Metrics service and HPA architecture



job

```
# get the list of jobs
> kubectl get jobs

# get details of selected job
> kubectl describe job <job name>

# delete a selected job
> kubectl delete job <job name>
```

cron job

```
# get the list of cronjobs
> kubectl get cronjobs

# get details of selected cronjob
> kubectl describe cronjob <cronjob name>

# delete a selected cronjob
> kubectl delete cronjob <cronjob name>
```

Helm

- package manager for managing the applications inside K8s

installation

```
# download the script file to install the helm
> curl -fsSL -o get_helm.sh
https://raw.githubusercontent.com/helm/helm/main/scripts/get-helm-3

# change the permission to execute the file
> chmod 700 get_helm.sh

# run the bash script to install helm
> ./get_helm.sh

# check if helm is installed
> helm version
```

charts

- chart as a package which contains all the yaml files for running the application in k8s cluster along with its all dependencies

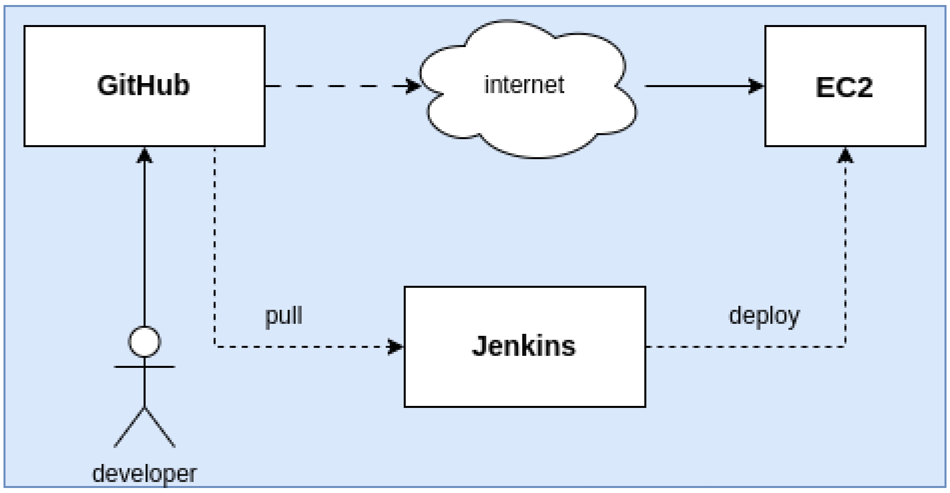
```
# get the list of charts created or installed
> helm list

# create a new chart

# > helm create <chart name>
> helm create website

# once the chart get created, simply delete everything from templates directory
# copy your yaml files inside the templates directory

# install the chart
# > helm install <chart name> <chart location>
> helm install website ./website

# uninstall the chart
# > helm uninstall <chart name>
> helm uninstall website
```

helm repositories

```
# get the list of installed repos
> helm repo list

# add a repo

# > helm repo add <name> <repo url>
> helm repo add prometheus-community https://prometheus-community.github.io/helm-
charts

> helm repo add grafana https://grafana.github.io/helm-charts

# download the charts from repo
> helm repo update

# install prometheus
> helm install prometheus prometheus-community/prometheus

# install grafana
> helm install grafana grafana/grafana
```

Jenkins

Architecture



installation

```
# update the apt cache
> sudo apt-get update

# install jre
> sudo apt-get install openjdk-17-jdk

# download the apt key for jenkins repo
> sudo wget -O /usr/share/keyrings/jenkins-keyring.asc \
https://pkg.jenkins.io/debian-stable/jenkins.io-2023.key

# install the key
echo  "deb [signed-by=/usr/share/keyrings/jenkins-keyring.asc]"  \
https://pkg.jenkins.io/debian-stable binary/ | sudo tee \
/etc/apt/sources.list.d/jenkins.list  >  /dev/null


# update the apt cache
> sudo apt-get update

# install jenkins
> sudo apt-get install jenkins

# check the status of jenkins service
> sudo systemctl status jenkins

# enable and start the jenkins service
> sudo systemctl enable --now jenkins
```

configure the jenkins

```
# visit the url: http://<ip>:8080
# enter the initial password from /var/lib/jenkins/secrets/initialAdminPassword
file
> sudo cat /var/lib/jenkins/secrets/initialAdminPassword
```

automating the passwordless authentication with EC2 instance

- execute these instructions on your machine

```
# login as root

> sudo su

# login as jenkins

> su jenkins

# generate a ssh key

> ssh-keygen

# do not set any passphrase

# this will create a private key named id_ed25519 and public key with name
id_ed25519.pub

# copy the contents of id_ed25519.pub and paste them to the EC2's

# - /home/ubuntu/.ssh/authorized_keys file

# test passwordless auth by login to the ec2 instance

> ssh ubuntu@<public ip of ec2>
```

install and configure the ssh plugin

```
# install the ssh and publish over ssh plugins from manage jenkins screen

# go to the system configuration from manage jenkins

# configure the ssh servers (SSH remote hosts)

# - name: alias for ec2 instance

# - hostname: public ip address of ec2 instance
# - username: ubuntu

# - remote directory: /home/ubuntu

# - key: contents of pem file
```

job configuration

```
# execute shell commands
> echo $SERVER_IP
# upload the file named index.html to the ec2 instance
> scp index.html ubuntu@$SERVER_IP:~/
```

```
# execute commands over ssh
> sudo mv ~/index.html /var/www/html
```

configure email notification

- settings for Extended E-mail Notification

```
# SMTP server: smtp.gmail.com
# SMTP port: 465
# User SSL: true
# create app password
> https://myaccount.google.com/u/1/apppasswords
# remove the space and copy the password
```

using docker

```
# add jenkins to the docker group
> sudo usermod -aG docker jenkins

# restart the jenkins service
> sudo systemctl restart jenkins

# create Dockerfile
# include docker in the system path
>  export  PATH=$PATH:/usr/bin/

# create image
> docker image build -t <dockerhub username>/python-server .

# login to the docker hub
```

```
> echo <docker hub token>  |  docker  login  -u  <docker  hub  username>  --
password-stdin


# push the image to docker hub
docker  image  push  <dockerhub  username>/python-server

# remove the service
docker service  rm  python-server

# create the service again
docker  service  create  --name  python-server  --replicas  2  -p  5000:5000
<dockerhub  username>/python-server
```

ArgoCD

installation

```
# create a namespace for argocd
> kubectl create namespace argocd

# install argoCD using yaml file

> kubectl apply -n argocd -f https://raw.githubusercontent.com/argoproj/argo-
cd/stable/manifests/install.yaml

# once installed and all components are running in argocd namespace,

# edit the argocd-server service to change the type to NodePort
> kubectl edit service argocd-server -n argocd

# expose the service for argocd (only for minikube)
> minikube service argocd-server -n argocd

# get the initial admin password
> kubectl edit secret argocd-initial-admin-secret -n argocd

# get the password from secret decoded
> echo <base64 encoded password>  |  base64  -d
```

create ArgoCD application

```
# application name: website-app

# project name: default

# sync policy: automatic

# self heal: checked

# repository url: github repo url

# path: ./ (this is the path where the deployment.yaml file is located)

# k8s cluster: https://kubernetes.default.svc

# namespace: default
```

SonarQube

installation

```
# install unzip
> sudo apt-get install unzip

# download the sonarqube
> wget https://binaries.sonarsource.com/Distribution/sonarqube/sonarqube-
9.9.8.100196.zip

# unzip the zip file
> unzip sonarqube-9.9.8.100196.zip

# start the sonarqube server
> cd sonarqube-9.9.8.100196/bin/linux-x86-64
> bash sonar.sh start

# check the sonarqube installation
> visit http://<vm ip address>:9000
```

install sonar-scanner

```
# download the respective version from
> https://docs.sonarsource.com/sonarqube-server/9.9/analyzing-source-
code/scanners/sonarscanner/

# download the file for linux
> wget https://binaries.sonarsource.com/Distribution/sonar-scanner-cli/sonar-
scanner-cli-6.2.1.4610-linux-x64.zip

# unzip the file
> unzip sonar-scanner-cli-6.2.1.4610-linux-x64.zip

# rename the directory
> mv sonar-scanner-cli-6.2.1.4610-linux-x64 sonar-scanner

# move the directory to /var/lib/
> sudo mv sonar-scanner /var/lib
```

Installing Chef Server Workstation on Ubuntu 18.04

Chef is a Ruby based configuration management tool used to define infrastructure as code. This enables users to automate the management of many *nodes* and maintain consistency across those nodes. *Recipes* declare the desired state for managed nodes and are created on a user's *workstation* using the *Chef Workstation* package. Your recipes are distributed across nodes via a *Chef server*. **A *Chef client*, installed on each node**, is in charge of applying the recipe to its corresponding node.

This guide will show you how to create and configure a Chef server and workstation on Ubuntu 18.04. You'll also learn how to bootstrap a node to manage with Chef. This will involve setting up three machines (Chef Server, Chef Workstation, and Node).

alt text

Prerequisites

1. **Chef Server**

The **Chef Server** is the central hub where all your infrastructure configurations are stored. It holds the recipes and cookbooks that define how machines should be configured, and it communicates with Chef Clients to apply these configurations to nodes.

2. **Chef Workstation**

The **Chef Workstation** is where you create and manage the code (recipes and cookbooks) that will be applied to nodes. It's the machine where you write, test, and upload configurations to the Chef Server for deployment.

3. **Chef-client**

The **Chef-client** runs on each node (machine) that Chef manages. It pulls configuration data from the Chef Server and ensures that the node is in the desired state, applying any necessary changes to match the defined recipes.

Ensure Workstation and Server are running **Ubuntu 18.04** and that they are up-to-date:

```
sudo apt update && sudo apt upgrade
```

Chef Server Installation

Install Chef Server

1. Download the latest Chef Server core package for Ubuntu 18.04:

```
wget https://packages.chef.io/files/stable/chef-server/13.0.17/ubuntu/18.04/chef-server-core_13.0.17-1_amd64.deb
```

2. Install Chef Server:

```
sudo dpkg -i chef-server-core_*.deb
```

3. Clean up the downloaded package: (Optional)

```
rm chef-server-core_*.deb
```

4. Reconfigure Chef Server to start the services:

```
sudo chef-server-ctl reconfigure
```

Create Chef User and Organization

Create a user and an organization that will be associated with the Chef Server.

1. Create a `.chef` directory to store keys:

```
mkdir ~/.chef
```

2. Create an administrator user for Chef:

```
sudo chef-server-ctl user-create USER_NAME FIRST_NAME LAST_NAME EMAIL 'PASSWORD' --filename ~/.chef/USER_NAME.pem
```

Eg >

```
chef-server-ctl user-create harry "Harry" "Potter" harry.potter@hogwarts.com "Harry@123" -f /root/admin.pem
```

3. Create an organization and associate the user with it:

`ORG_NAME` must be in all lower case.

```
sudo chef-server-ctl org-create ORG_NAME "Full Organization Name" --association_user USER_NAME --filename ~/.chef/ORG_NAME.pem
```

> Replace `USER_NAME`, `ORG_NAME`, `FIRST_NAME`, `LAST_NAME`, `EMAIL`, and `PASSWORD` with your own details.

Eg>

```
chef-server-ctl org-create hogswarts "Hogwarts" --association_user harry -f
/root/myorg-validator.pem
```

When you create user and organization, it will generate two .pem files under .chef folder, which is present in the home directory, to view the folder type command (ls -a) under the home directory.

When using the `user-list` or `org-list` commands, errors can occur if the Chef server is not properly configured or there are issues with connectivity, permissions, or server configuration. Here's how you can handle potential errors:

1. Error Handling for `user-list` and `org-list` Commands

- **Error Logs**: When running `user-list` or `org-list`, if you encounter an error, you should check the Chef server logs for more details. The logs can be found in the following location:
  - `/var/log/chef-server/` (Chef server logs).
  - `/var/log/opscode/` (This directory holds the Chef server log files for different components).

  Use commands like `tail -f` or `cat` to view logs, such as:

  ```
  tail -f /var/log/chef-server/chef-server.log
  ```

- **Permissions**: Ensure you have the correct permissions to access the Chef server. Sometimes, a failure occurs because of insufficient privileges or a lack of proper authentication.

- **Authentication Issues**: If you have problems with authentication or access to the Chef server, make sure your `.pem` files are valid and properly configured. Verify that the `USER_NAME.pem` file exists in the `~/.chef/` directory, which is needed for proper authentication.

2. .chef Folder and the .pem Files

- **Location of .chef Folder**: The `.chef` folder is typically located in the home directory of the user running the Chef commands. You can check its existence by running:

  ```
  ls -a ~/
  ```

- **.pem Files**: When you create a Chef user or an organization, the system generates `.pem` files for authentication purposes. These files are typically stored in the `.chef` directory. If you see files like `USER_NAME.pem` and `ORG_NAME.pem`, it means the user and organization were successfully created.

Verify Users and Organizations

You can list the users and organizations on your Chef server using:

```
sudo chef-server-ctl user-list
sudo chef-server-ctl org-list
```

You should see in output you created user and pivotal user

```
harry
pivotal
```

and in org list you should see your created organization

```
hogwarts
```

Chef Workstation Setup

Install Chef Workstation

1. Download the Chef Workstation package:

```
wget https://packages.chef.io/files/stable/chef-workstation/0.2.43/ubuntu/18.04/chef-workstation_0.2.43-1_amd64.deb
```

2. Install Chef Workstation:

```
sudo dpkg -i chef-workstation_*.deb
```

3. Clean up the downloaded package:

```
rm chef-workstation_*.deb
```

Create Chef Repository

1. Generate a Chef repository:

```
chef generate repo chef-repo
```

2. Move into the repository directory:

```
cd ~/chef-repo
```

3. When you create user and organization ON SERVER, it will generate two .pem files under `.chef` folder, which is present in the home directory, to view the folder type command (`ls -a`) under the home directory.
4. Send these two files to the chef-workstation in folder (`~/chef-repo/.chef/`)
5. How to send file: `scp /source/path/ username@ip:~/chef-repo/.chef/` .

Configure Knife

Knife is a command-line tool used to manage your Chef infrastructure. To configure Knife:

1. Create the `.chef` directory:

```
mkdir ~/chef-repo/.chef
```

2. Create the Knife configuration file (`knife.rb`) in the `.chef` directory:

```
nano ~/chef-repo/.chef/knife.rb
```

Add the following configuration:

```
chef_server_url 'https://SERVER_IP/organizations/ORG_NAME'
node_name 'USER_NAME' #use username that was created ON SERVER
client_key '/root/chef-repo/.chef/admin.pem' #created on Server
ssl_verify_mode :verify_none
cache_type               'BasicFile'
cache_options( :path => "#{ENV['HOME']}/.chef/checksums" )
cookbook_path            ["#{current_dir}/../cookbooks"]
```

Test Knife Configuration

Test if the configuration is working by listing the Chef clients:

```
knife client list
```

In Output you must see your org validator `hogwarts-validator` this means server and workstation are connected.

CREATE A COOKBOOK

1. Go to Chef-Workstation, go to chef-repo/cookbooks/ run command

```
chef generate cookbook cookbook_name
```

This creates a cookbook template in `chef-repo` directory with a `cookbooks/cookbook_name/recipes/default.rb` recipe in it

It is written in ruby language

By default, Chef generates a `default.rb` recipe, but you can have as many recipes as needed within the same cookbook. The name `default.rb` is a convention, but it's not mandatory. You can create additional recipes for specific tasks, and you can name them whatever you want (e.g., `install.rb`, `configure.rb`, etc.).

Is `default.rb` the only recipe we can create?

No, you are not restricted to just a `default.rb` recipe. The `default.rb` file is just a convention that Chef looks for when no specific recipe is specified. You can create multiple recipes and reference them as needed, for example:

- `install.rb` for installation-related tasks
- `configure.rb` for configuration tasks
- `patch_installation.rb` for patching tasks
-

2. **Modify the `default.rb` content:**

The `default.rb` recipe is written in Ruby language, and you can edit it using editors like `vim` or `nano`.

To upload the cookbook to the Chef server after making changes, use the following command:

```
knife cookbook upload cookbook_name
```

This will upload the cookbook to the Chef server, making it available for clients to pull.

If the command fails:

1. **Check for authentication issues**: Ensure your `knife.rb` configuration file is correct and you have the necessary permissions. If there are authentication errors, you might need to reauthenticate or check your Chef server credentials.

2. **Check network connectivity**: Ensure your workstation can communicate with the Chef server. Network issues could cause a failure to upload the cookbook.

3. **Check for missing dependencies**: Ensure all dependencies for the cookbook are available and properly configured. In your `knife.rb` file, make sure the `cookbook_path` is correctly set to point to the location of your cookbooks. The following line should be included in your `knife.rb`:

   ```
   cookbook_path ["#{current_dir}/../cookbooks"]
   ```

This ensures that Chef is aware of the correct path to your cookbooks and can find and upload them without issues.

4. **Check cookbook name**: Ensure you enter correct cookbook name

   - If the upload fails, you will see an error message with details on what went wrong. Look for clues like:
     - "Permission denied" (authentication issues)
     - "Could not connect" (network or server issues)
     - "Cookbook validation failed" (cookbook-related issues)

If you encounter a failure, review the error message to diagnose and resolve the issue.

Bootstrap a Node (Works only if you have SSH)

Bootstrapping a node installs the Chef client on the node and validates the node. This allows the node to read from the Chef server and pull down and apply any needed configuration updates detected by the chef-client.

> If you encounter any `401 Unauthorized` errors ensure that your `ORGANIZATION.pem` file has `700` permissions. See Chef's troubleshooting guide for further information on diagnosing authentication errors.

1. From your *workstation*, navigate to your `~/chef-repo/.chef` directory:

   ```
   cd ~/chef-repo/.chef
   ```

2. Bootstrap the client node either using the client node's root user, or a user with elevated privileges:

   - **As the node's root user**, change `password` to your root password and `nodename` to the desired name for your client node. You can leave this off if you would like the name to default to your node's hostname:

     ```
     knife bootstrap 192.0.2.0 -x root -P password --node-name nodename
     ```

   - **As a user with sudo privileges**, change `username` to a node user, `password` to the user's password and `nodename` to the desired name for the client node. You can leave this off if you would like the name to default to your node's hostname:

     ```
      knife bootstrap 192.0.2.0 -x username -P password --use-sudo-password
     --node-name nodename
     ```

   - **As a user with key-pair authentication**, change `username` to a node user, and `nodename` to the desired name for the client node. You can leave this off if you would like the name to default to your client node's hostname:

```
knife bootstrap 192.0.2.0 --ssh-user username --sudo --identity-file
~/.ssh/id_rsa.pub --node-name hostname
```

3. Confirm that the node has been bootstrapped by listing the client nodes:

   ```
   knife client list
   ```

   Your new client node should be included in the list.

   ```
   workstation@workstation:~/chef-repo$ knife client list
   Test-0001
   Test-0002
   hogswarts-validator
   ```

Add the cookbook to the node's run-list:

1. Go to Chef-Workstation run command

```
knife node run_list add NODE_NAME recipe[COOKBOOK_NAME]
```

(ex. knife node run_list add Test-001 recipe[example_cookbook]).

2. We have also created a script to add cookbook to run-list for number of nodes based on pattern

Use the bash script provided to you move it to workstation `chef-repo` folder

and then use this command

```
./upload_cookbook <NODE_PATTERN> <COOKBOOK_NAME>
```

eg . > ./upload_cookbook Test-00 example_cookbook

Script to do this

```
#!/bin/bash

if [ "$#" -ne 2 ]; then
        echo "command like ./upload_cookbook <NODE_PATTERN> <COOKBOOK_NAME>"
        exit
fi

# Variables
```

```
COOKBOOK_NAME=$2   # Replace with your cookbook name
PATTERN=$1     # Replace with your desired pattern (e.g., "test-")
LOG_FILE="/var/log/chef_node_update.log"

# Upload cookbook to server
knife cookbook upload $COOKBOOK_NAME

# Fetch all nodes from the Chef server
echo "Fetching node list from Chef server..."
NODE_LIST=$(knife node list)

# Loop through each node
for NODE in $NODE_LIST; do
    if [[ "$NODE" == *"$PATTERN"* ]]; then
        echo "Adding cookbook '$COOKBOOK_NAME' to run list of node: $NODE"

        # Add the cookbook to the node's run list
        knife node run_list add "$NODE" "recipe[$COOKBOOK_NAME]" >> "$LOG_FILE"
2>&1

        if [ $? -eq 0 ]; then
            echo "Successfully added '$COOKBOOK_NAME' to $NODE"
        else
            echo "Failed to add cookbook to $NODE. Check $LOG_FILE for details."
        fi
    fi
done

echo "Script execution completed."
```

The command `sudo chef-client` fetches the required package, which is added to the run-list.

To view the status of the last pull, run the command `knife status` on the workstation. This will list all nodes and their last pull times.

Output of `knife-status` should look like this

```
3 minutes ago, Test-001, ubuntu 22.04
3 minutes ago, Test-002, ubuntu 22.04
3 minutes ago, Test-003, ubuntu 22.04
```

To Setup Chef-Client in Goldmaster VM if SSH is disabled

1. This settings are for you to create a fresh client setup without using Bootstrap command because it uses SSH so now client and server will talk with HTTP (443)

CHEF CLIENT SETUP:

1. Install Chef client from the chef website.

2. This is a link to download Chef-Client (https://downloads.chef.io/chef) OR https://community.chef.io/downloads/tools/infra-client?os=ubuntu

select prefered OS and version

> You can install Ubuntu 20.04 version chef-client in 22.04 We have tested with this and it is working fine

3. Install it using command `dpkg -i *c`
4. After that go to `/etc` folder `cd /etc`, make directory `mkdir chef`, under chef folder make a file `client.rb`.

Add the following configuration:

```
chef_server_url "[https://CHEF-SERVER-IP/organizations/ORGNAME"]
validation_client_name "ORGNAME-validator"
log_location "/var/log/chef-exec.log"
ssl_verify_mode :verify_none
validation_key '/etc/chef/myorg-validator.pem'
interval 120 # pulls changes every 2 minutes
splay 20 # random delay to help server not overload
```

All activity is logged to `/var/log/chef-exec.log`. You can view the log file to check the output of `chef-client` execution:

```
tail -f /var/log/chef-exec.log
```

5. When you create user and organization ON SERVER, it will generate two .pem files under `.chef` folder, which is present in the home directory, to view the folder type command (`ls -a`) under the home directory.
6. Send these two files to the chef client in folder (`~/etc/chef/`)
7. How to send file: `scp /source/path/ username@ip:~/etc/chef/`.

Create a cronjob to connect node automatically on reboot

To add a cronjob to `/etc/crontab` for running `chef-client` on system startup follow these steps:

1. Open `/etc/crontab` using a text editor:

   ```
   sudo vim /etc/crontab
   ```

2. Add the following lines:

   At first boot (delays `chef-client` by 180 seconds to allow the system to stabilize):

   ```
   @reboot (sleep 180; chef-client)
   ```

3. Save the file and exit the editor.

- On the **first boot**, the cronjob triggers the `chef-client` with a 180-second delay to allow the system to stabilize. This process will authenticate the node, create `client.pem`, and connect to the Chef server for the initial setup.

Create a cronjob to pull changes if you have not used interval and splay in client.rb

1. Open `/etc/crontab` using a text editor:

```
sudo nano /etc/crontab
```

2. **Every 30 minutes** (executes `chef-client` to pull configuration changes from the Chef server):

```
`*/30 * * * * chef-client
```

3. Save the file and exit the editor.

What happens:

- Every **30 minutes** thereafter, the cronjob triggers `chef-client` to check for configuration changes and apply them.

This setup ensures that chef-client runs on startup (with a delay) and periodically every 30 minutes, keeping the system synchronized with the Chef server.