Docker and Kubernates – The Complete Guide

By

Stephen Grider

Couse Link

https://www.udemy.com/course/docker-and-kubernetes-the-complete-guide/

Notes By

Naveen Kumar M

https://www.linkedin.com/in/naveen-kumar-m-5a6960119/

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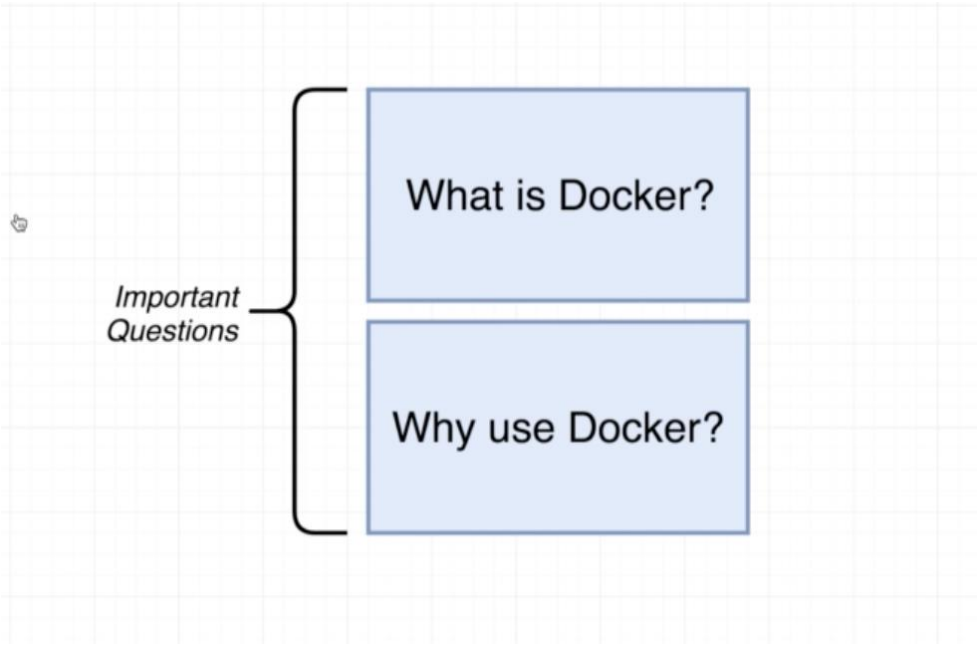
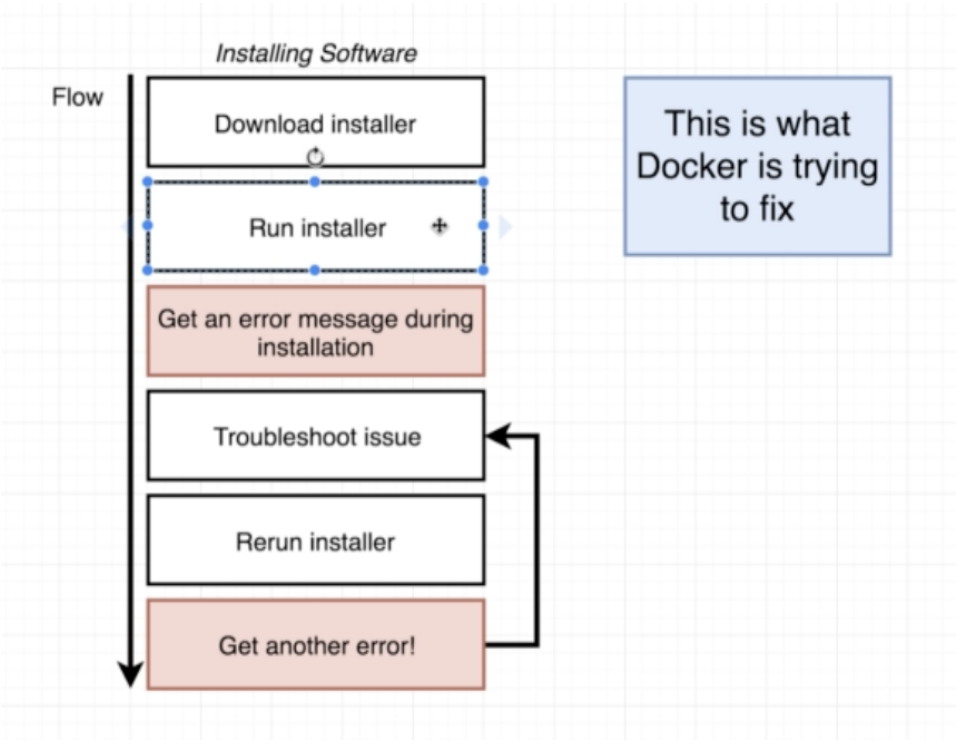
Dive Into Docker !

Why use Docker?



Installing Software



Docker wants to make it easy and straightforward for you to install and run software on computer (Web servers and cloud-based computing platform).

Example installing redis using docker

Redis is in-memory data store.

Below is the installation step.

Installation

Download, extract and compile Redis with:

```
$ wget http://download.redis.io/releases/redis-4.0.11.tar.gz
$ tar xzf redis-4.0.11.tar.gz
$ cd redis-4.0.11
$ make
```

The binaries that are now compiled are available in the `src` directory. Run Redis with:

```
$ src/redis-server
```

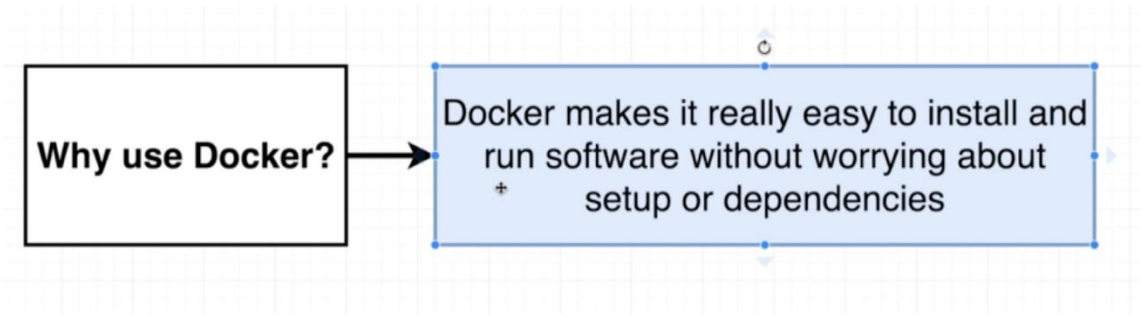
You can interact with Redis using the built-in client:

```
$ src/redis-cli
redis> set foo bar
OK
redis> get foo
"bar"
```

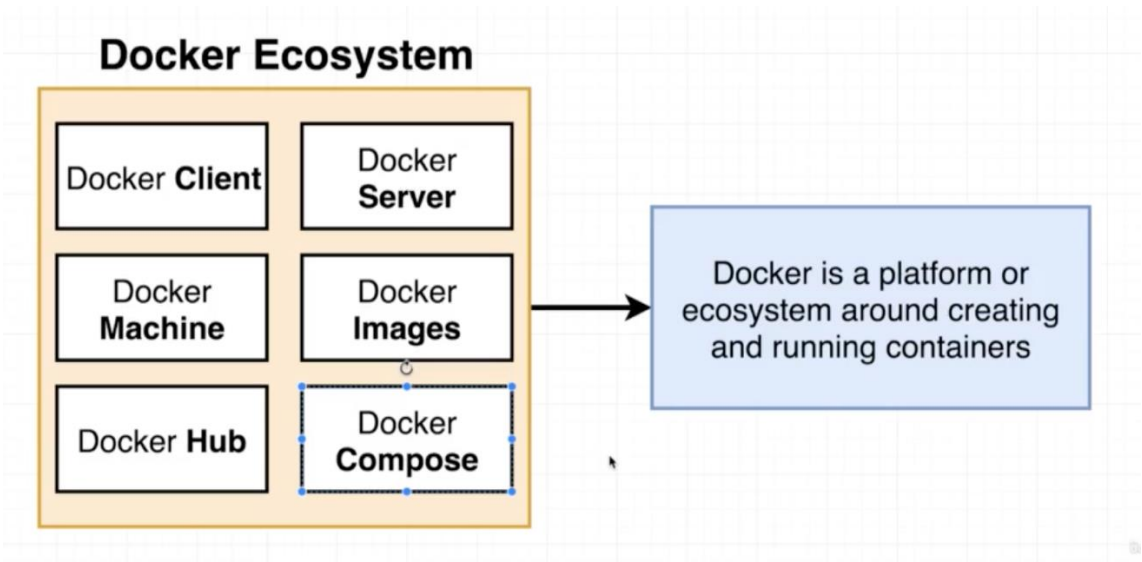
Got an error while downloading the package. We need to fix this before moving forward. This is the problem docker wants to solve.

But using a docker, application is installed and up and running, with a single command.

Summary



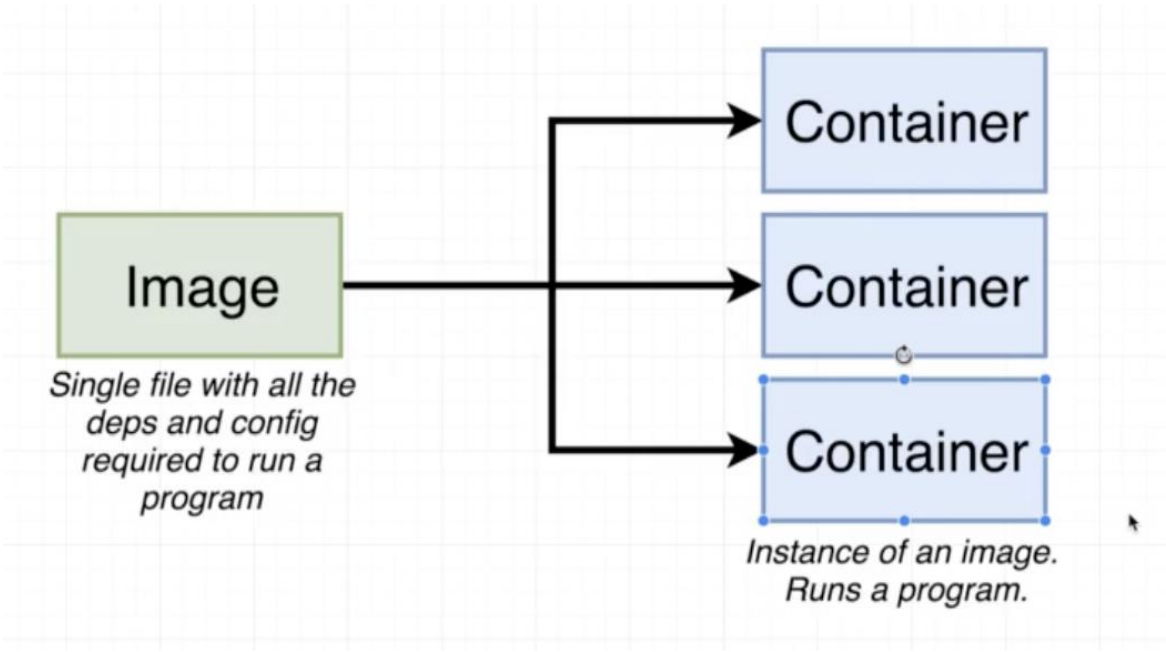
What is Docker?



What is Image?

When running the docker command, docker cli reaches to docker hub and download the single file called image.

Here image refers to,



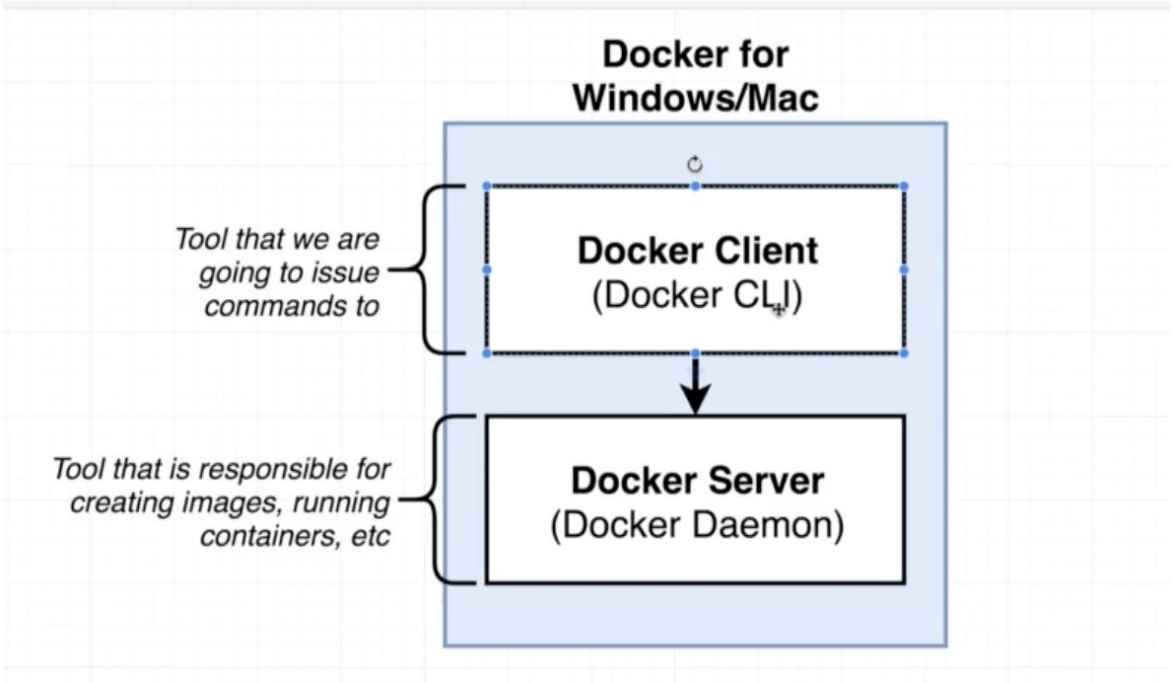
What is container?

We can use an image to create a container.

Container is running programs and has its own isolated set of hardware resources (memory, networking technology and hard drive).

Docker for Mac/Windows

Docker for Mac/Windows Architecture

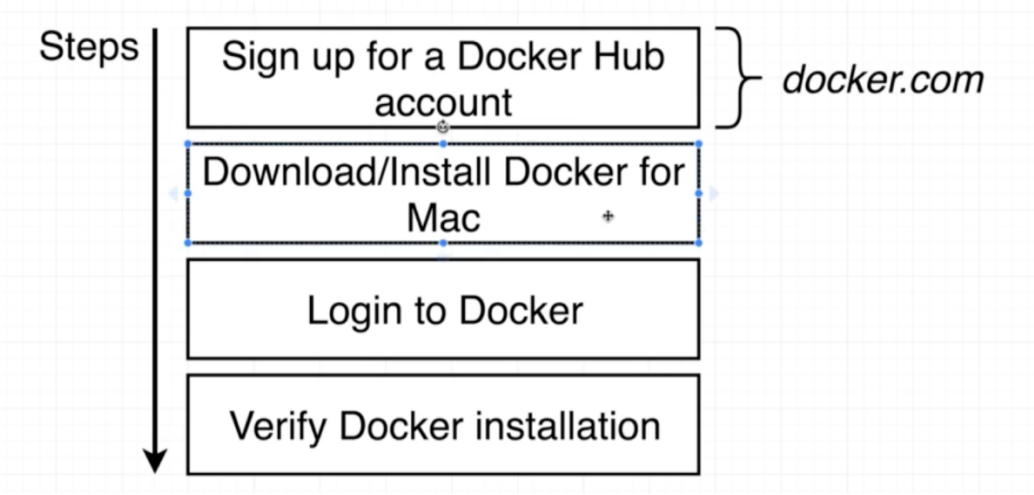


Docker client used to interact with Docker Server.

Docker Server is running behind the scenes.

Installing Docker for Mac

Steps for Installing Docker



Verifying Installation

```
➜  ~ docker version
Client:
 Cloud integration: 1.0.17
 Version:           20.10.8
 API version:       1.41
 Go version:        go1.16.6
 Git commit:        3967b7d
 Built:             Fri Jul 30 19:55:20 2021
 OS/Arch:           darwin/amd64
 Context:           default
 Experimental:      true

Server: Docker Engine - Community
 Engine:
  Version:          20.10.8
  API version:      1.41 (minimum version 1.12)
  Go version:       go1.16.6
  Git commit:       75249d8
  Built:            Fri Jul 30 19:52:10 2021
  OS/Arch:          linux/amd64
  Experimental:     false
 containerd:
  Version:          1.4.9
  GitCommit:        e25210fe30a0a703442421b0f60afac609f950a3
 runc:
  Version:          1.0.1
  GitCommit:        v1.0.1-0-g4144b63
 docker-init:
  Version:          0.19.0
  GitCommit:        de40ad0
➜  ~
```

Installing Docker with WSL2 on Windows 10 Home and Pro

Installing Docker with WSL2 on Windows 10 Home and Pro

updated 2-19-2021

WSL2

Windows 10 Pro and some Windows 10 Home users will be able to install Docker Desktop if their computer supports the Windows Subsystem for Linux (WSL2).

Please see this guide first which includes all of the steps to install and enable WSL2:

https://docs.microsoft.com/en-us/windows/wsl/install-win10

Once you have successfully installed and enabled WSL2 and then installed the Linux OS of your choice, continue to the Docker Desktop installation docs here:

https://docs.docker.com/docker-for-windows/wsl/

With Docker Desktop installed using WSL2 as a backend, you will now be able to follow along with the course. You will access the applications at localhost just like we do in the video lectures.

Important - A significant difference when using WSL2 is that you will need to create and run your project files from within the Linux filesystem, not the Windows filesystem. This will be very important in later lectures when we cover volumes.

You can access your Linux system by running `wsl` in the Windows Search Bar. Going forward, all Docker commands should be run within WSL2 and not on the Windows file system.

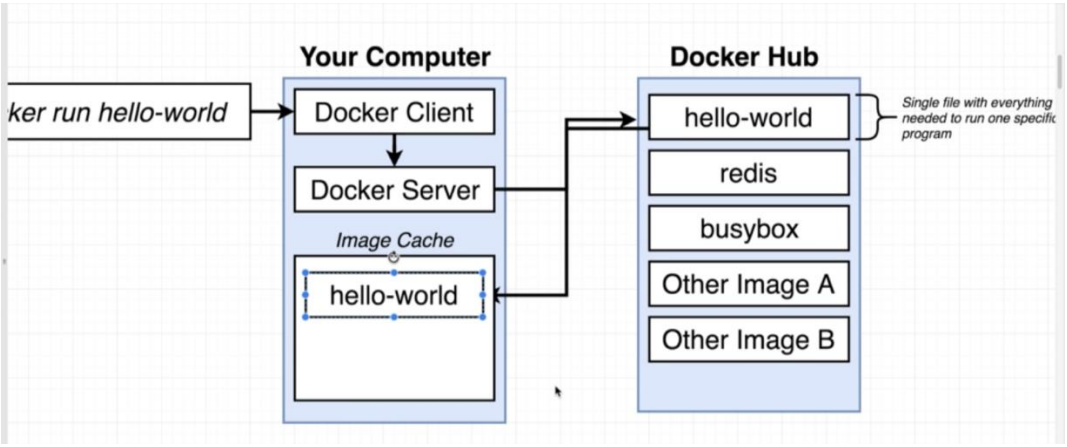
Using the Docker Client

Running docker run hello-world command

```
➜  ~ docker run hello-world
docker: Cannot connect to the Docker daemon at unix:///var/run/docker.sock. Is the docker daemon runn
ing?.
See 'docker run --help'.
➜  ~ docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
2db29710123e: Pull complete
Digest: sha256:97a379f4f88575512824f3b352bc03cd75e239179eea0fecc38e597b2209f49a
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
    (amd64)
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
    to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
 $ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
 https://hub.docker.com/

For more examples and ideas, visit:
 https://docs.docker.com/get-started/
```

What's happing in the background?

1. "docker run hello-world" – docker commend for running "hello-world" image.
2. When we run "docker run hello-world" command in terminal, it start up the Docker Client.
3. Docker Client then communicate with Docker Server (also known as Docker daemon).
4. Docker server checks in local image cache that "hello-world" image already exist or not.
5. If the local image does not exist, docker server will communicate to docker hub to fetch the image.
6. Once received image from docker hub, it will be store in image cache.
7. Next, container is created from the image and runs the problem.
8. So, we are seeing the "Hello from Docker!" message in terminal as result program run.



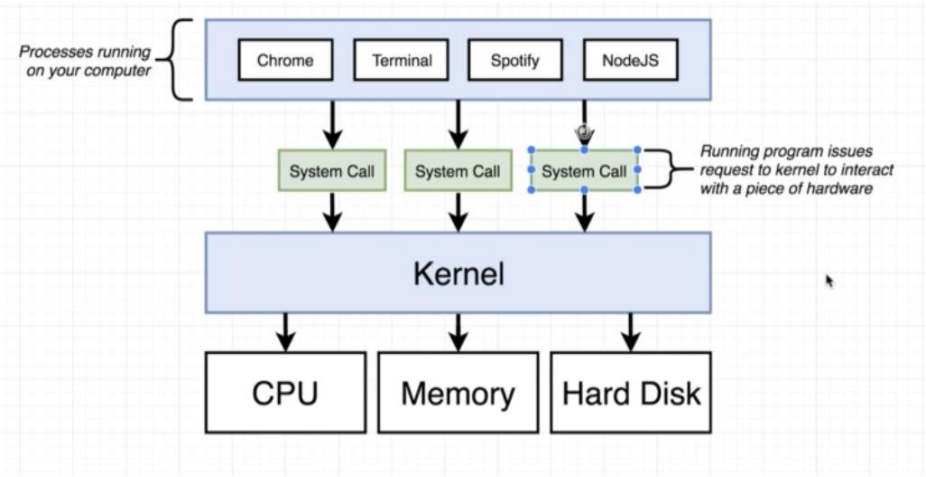
What is Container?

To understand the container, we need to understand how operating system works.

How Operating System Works?

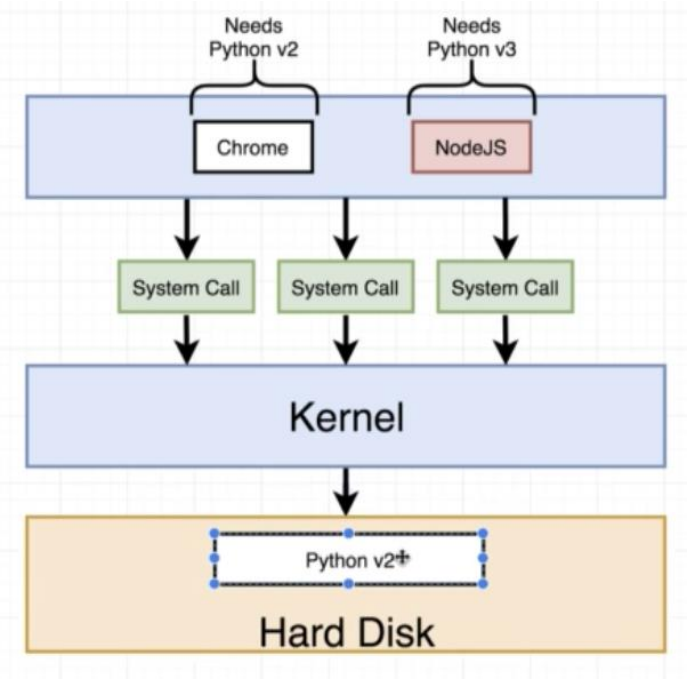
Kernel

- Running software process.
- Governs access between the programs running on computer and hardware connected to the computer.



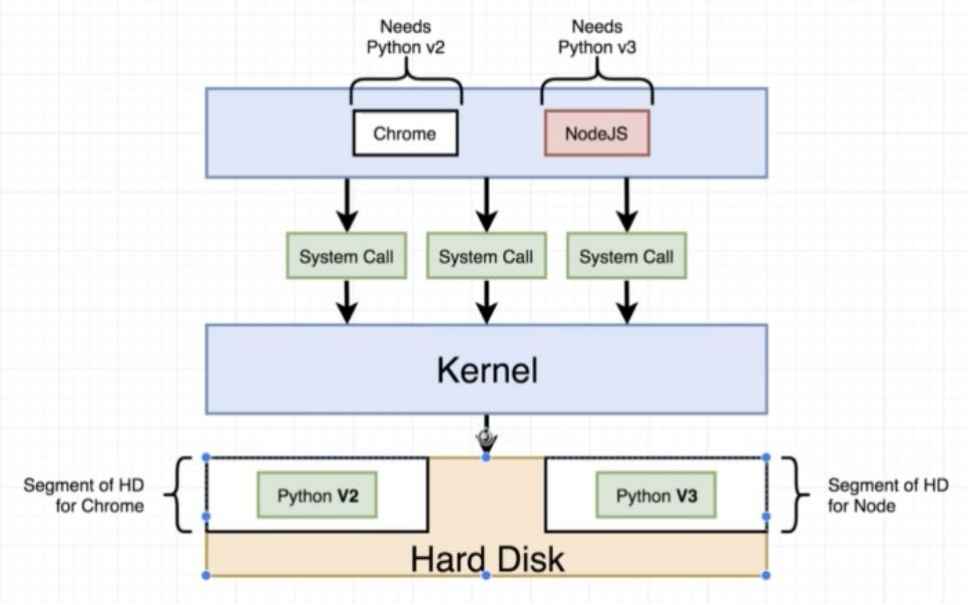
Imagine a scenario

- Two program is running on a computer one is chrome and other is NodeJS.
- Chrome require Python v2 and NodeJS require a Python V3 to be installed in the computer.
- But our computer is installed only with Python v2.

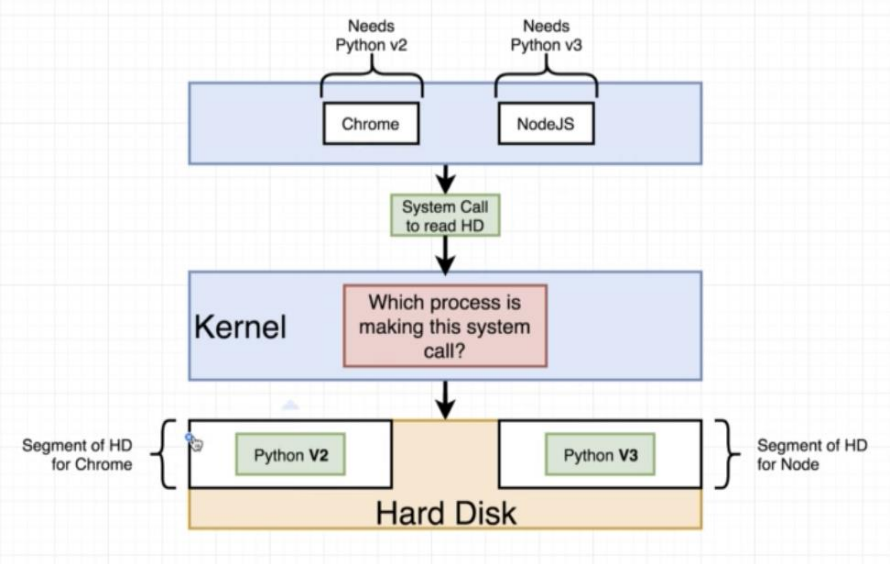


How can we solve this issue?

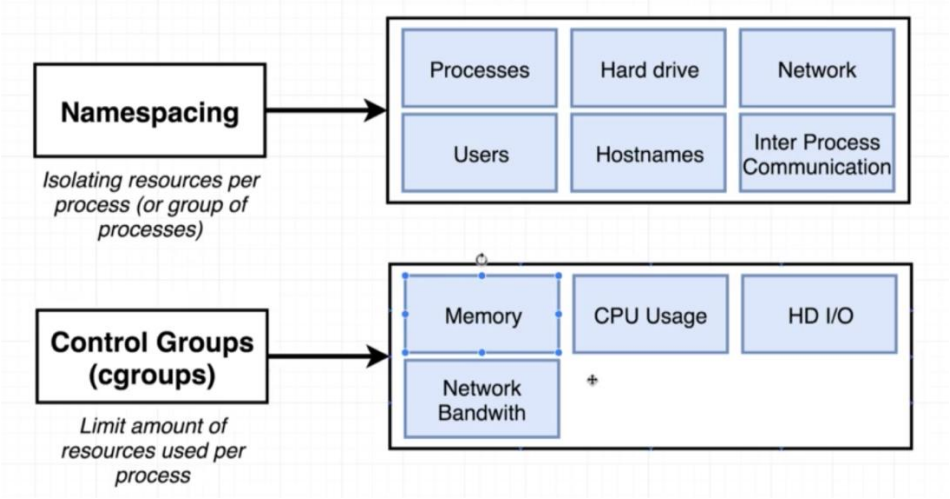
we can make use of the OS feature called name spacing.



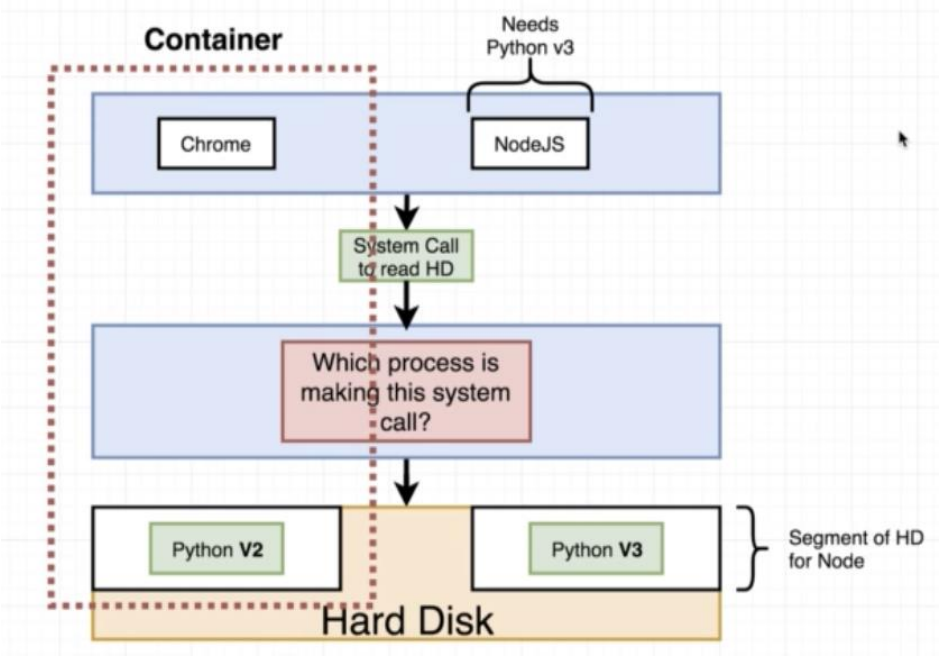
Based on the system call, kernel can able to assign right segment to the program.



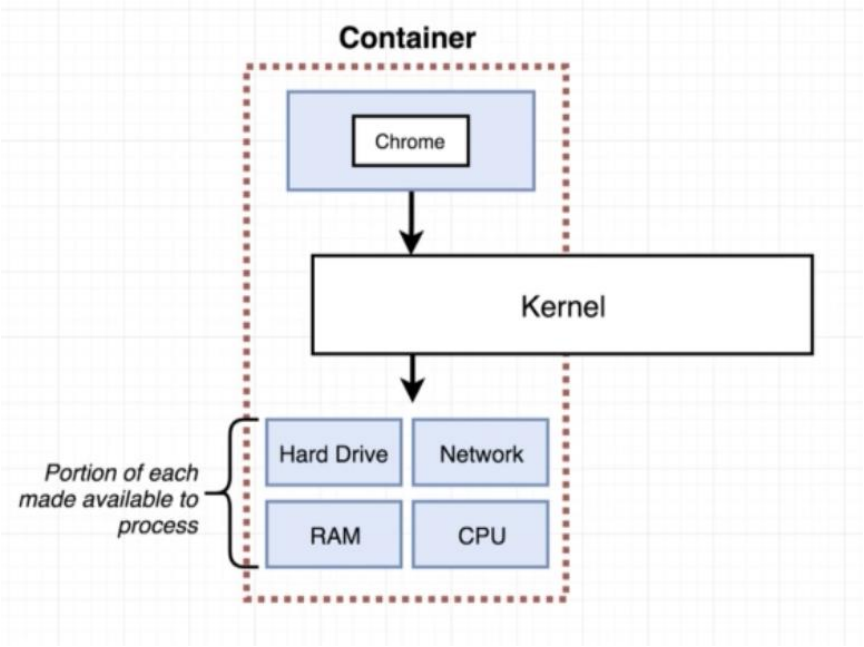
Name spacing and Control Groups



Container in getting a picture



Here, Container represent program with separate allocated resource.
Process or set of processes that have a grouping of resources specifically assigned to it.



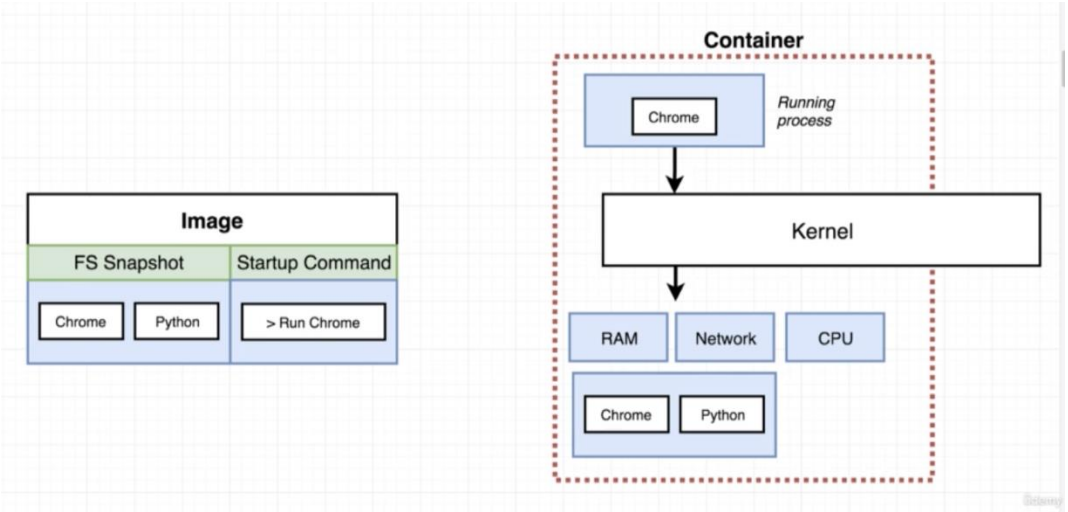
How is the Image eventually creating a Container?

Image contains,

- File System Snapshot - A copy case of directory and files. (Installable directories)
- Startup command - For running the program.

Container Creation Process

- Initially kernel assign an isolated set of resource specific to the container.
- File Snapshot from the images are placed inside the allocated segment of the hard drive.
- Then, startup command is executed and that creates instance of the process like example in Chrome, Python.

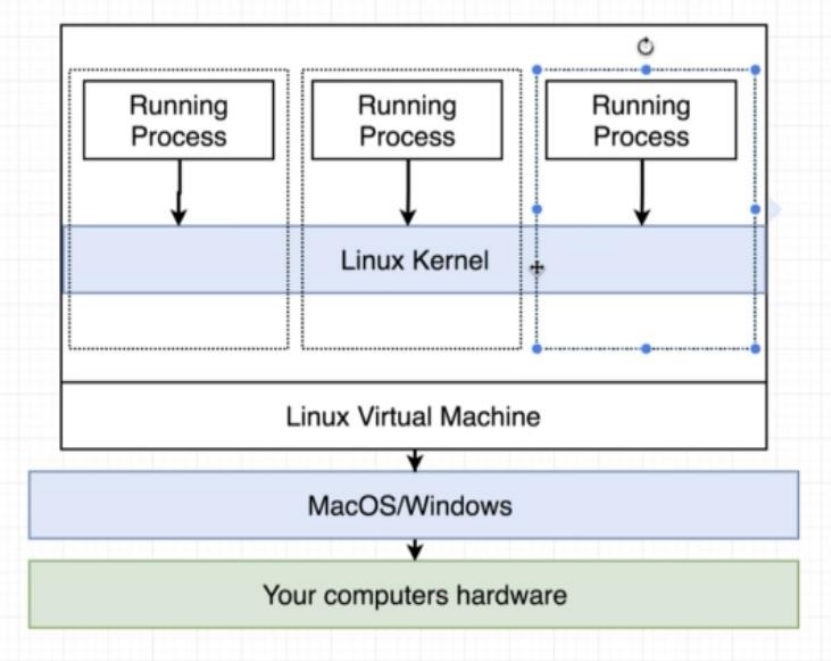


How is Docker running on your computer?

Linux Virtual Machine

Namespacing and Control Groups are specific to Linux operating system.

When we installed docker, we installed Linux virtual machine.



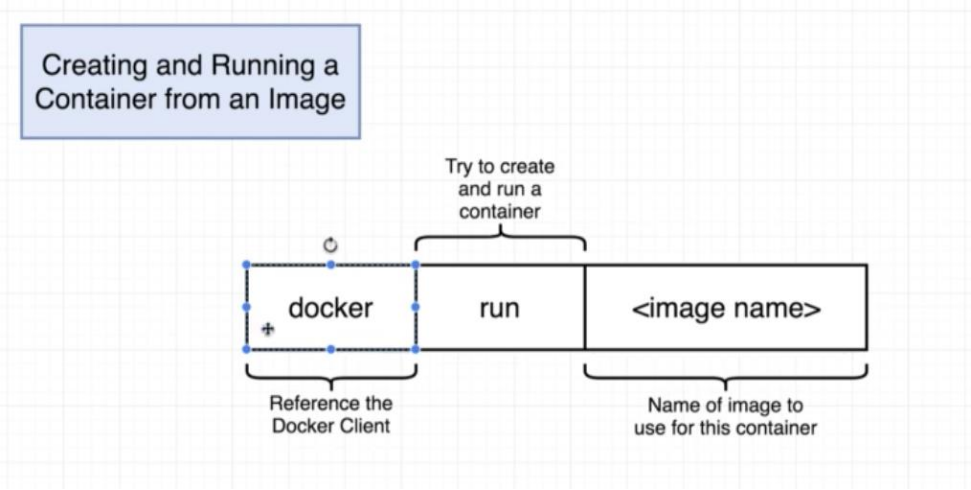
Checking OS Architecture

```
➜  ~ docker version
Client:
 Cloud integration: v1.0.22
 Version:           20.10.12
 API version:       1.41
 Go version:        go1.16.12
 Git commit:        e91ed57
 Built:             Mon Dec 13 11:46:56 2021
 OS/Arch:           darwin/amd64
 Context:           default
 Experimental:      true

Server: Docker Desktop 4.5.0 (74594)
 Engine:
  Version:          20.10.12
  API version:      1.41 (minimum version 1.12)
  Go version:       go1.16.12
  Git commit:       459d0df
  Built:            Mon Dec 13 11:43:56 2021
  OS/Arch:          linux/amd64
  Experimental:     false
 containerd:
  Version:          1.4.12
  GitCommit:        7b11cfaabd73bb80907dd23182b9347b4245eb5d
 runc:
  Version:          1.0.2
  GitCommit:        v1.0.2-0-g52b36a2
 docker-init:
  Version:          0.19.0
  GitCommit:        de40ad0
```

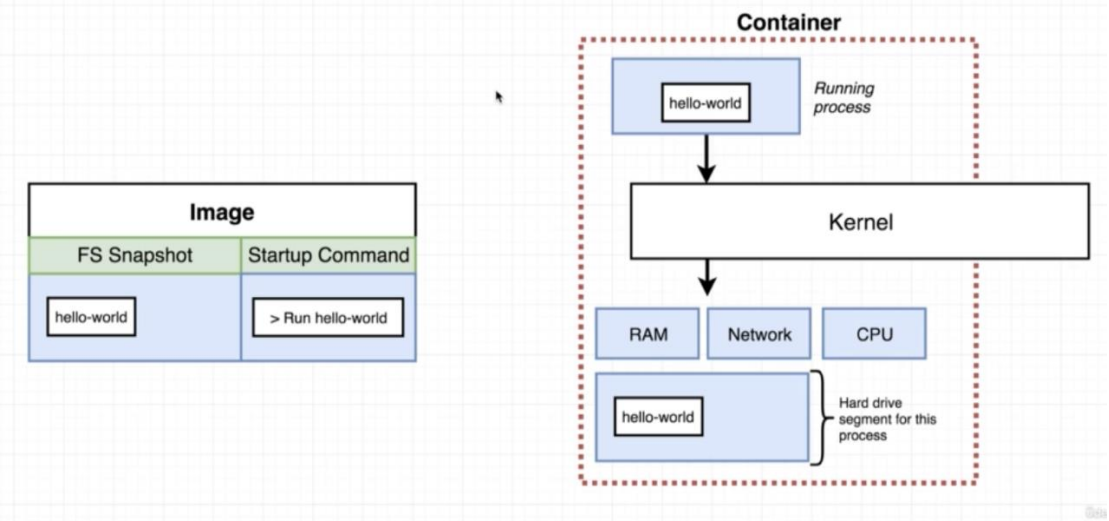
Manipulating Containers with the Docker Client

Docker Run in Detail

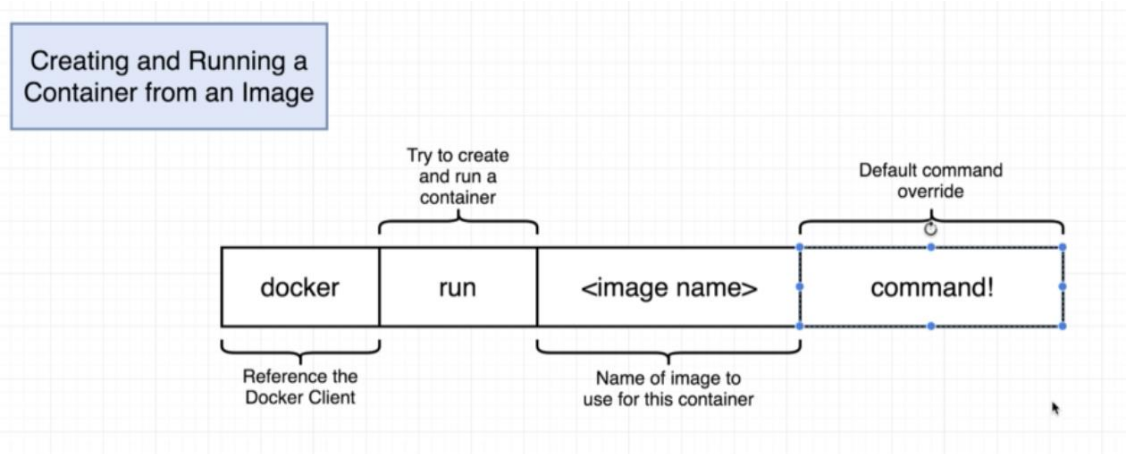
Creating and Running a Container from an Image



What is happening behind the scenes?



Overriding Default Commands

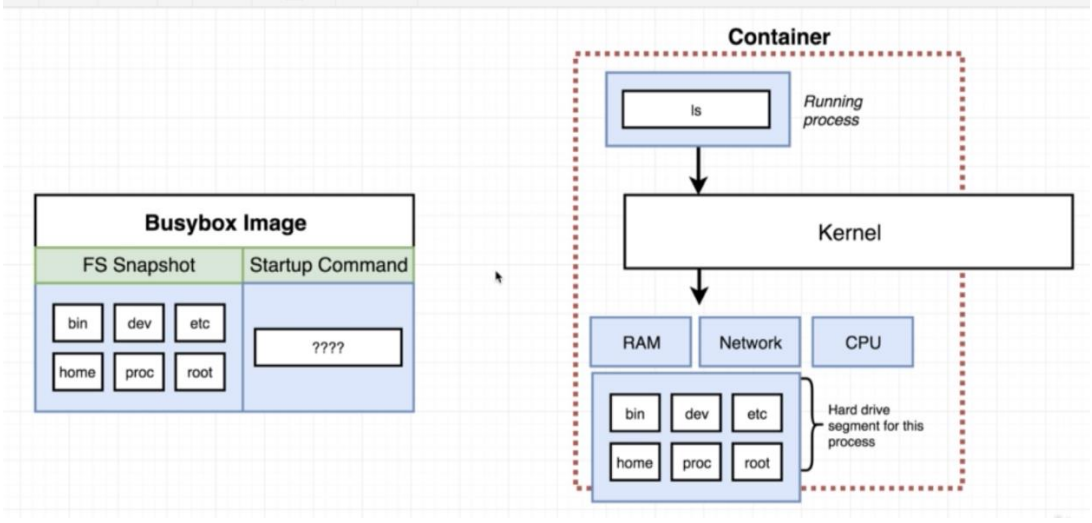


Alternate command to be executed after the container starts up. This alternate command overrides the existing start up command inside the image.

```
➜ prod git:(master) docker run busybox echo hi there
hi there
➜ prod git:(master) docker run busybox echo bye there
bye there
➜ prod git:(master) docker run busybox echo how are you
how are you
```

```
➜ prod git:(master) docker run busybox ls
bin
dev
etc
home
proc
root
sys
tmp
usr
var
```

What happens behind the scenes?



Busybox image has a FS Snapshot is mentioned above. That is the reason why we are getting a list of same file system.

Command “ls” and “echo” executables are available in FS Snapshot. That’s the reason why we are to see the output of those command.

If we don’t have a FS for a given command, we will be getting an error like below.

```
➜ prod git:(master) docker run hello-world ls
docker: Error response from daemon: OCI runtime create failed: container_li
nux.go:348: starting container process caused "exec: \"ls\": executable fil
e not found in $PATH": unknown.
➜ prod git:(master) docker run hello-world echo hi there
docker: Error response from daemon: OCI runtime create failed: container_li
nux.go:348: starting container process caused "exec: \"echo\": executable f
ile not found in $PATH": unknown.
```

Listing Running Containers

docker ps

Shows running container.

```
➜ prod git:(master) docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED             STAT
US                  PORTS               NAMES
➜ prod git:(master)
```

```
round-trip min/avg/max = 45.922/73.735/292.132 ms
➜  ~ docker run busybox ping google.com
PING google.com (216.58.200.142): 56 data bytes
64 bytes from 216.58.200.142: seq=0 ttl=37 time=56.886 ms
64 bytes from 216.58.200.142: seq=1 ttl=37 time=57.832 ms
64 bytes from 216.58.200.142: seq=2 ttl=37 time=48.046 ms
64 bytes from 216.58.200.142: seq=3 ttl=37 time=54.966 ms
64 bytes from 216.58.200.142: seq=4 ttl=37 time=56.016 ms
64 bytes from 216.58.200.142: seq=5 ttl=37 time=46.098 ms
64 bytes from 216.58.200.142: seq=6 ttl=37 time=62.768 ms
64 bytes from 216.58.200.142: seq=7 ttl=37 time=63.596 ms
64 bytes from 216.58.200.142: seq=8 ttl=37 time=41.999 ms
```

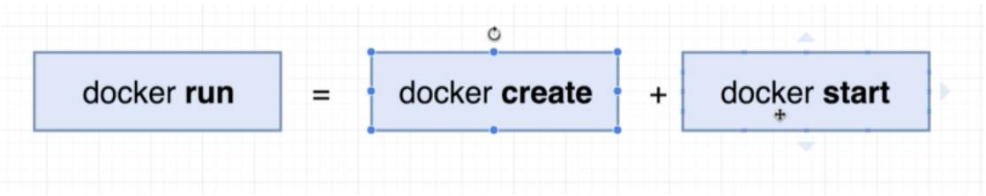
```
➜  ~ docker ps
CONTAINER ID   IMAGE     COMMAND             CREATED         STATUS         PORTS     NAMES
d31ad06d36c8   busybox   "ping google.com"   7 seconds ago   Up 7 seconds             sleepy_johnson
➜  ~
```

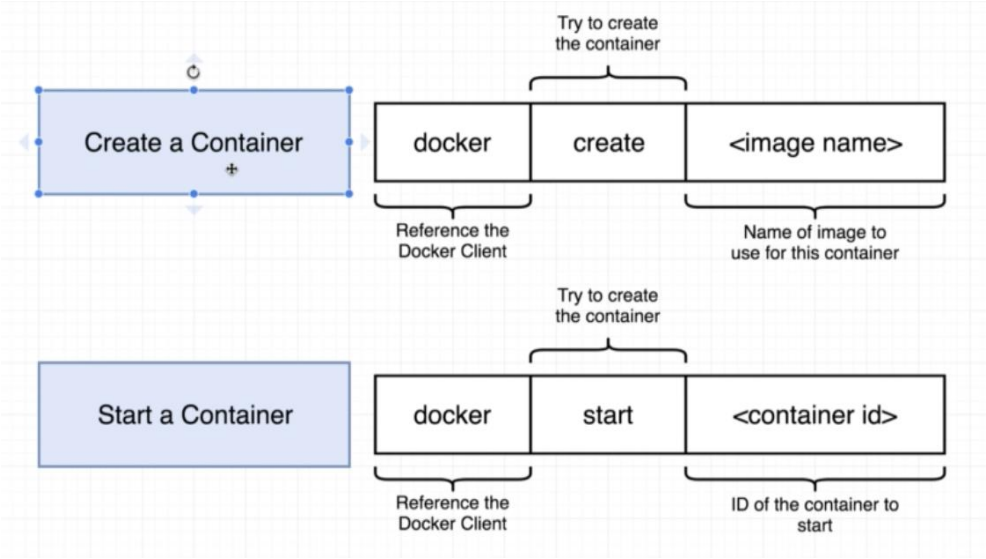
docker ps --all

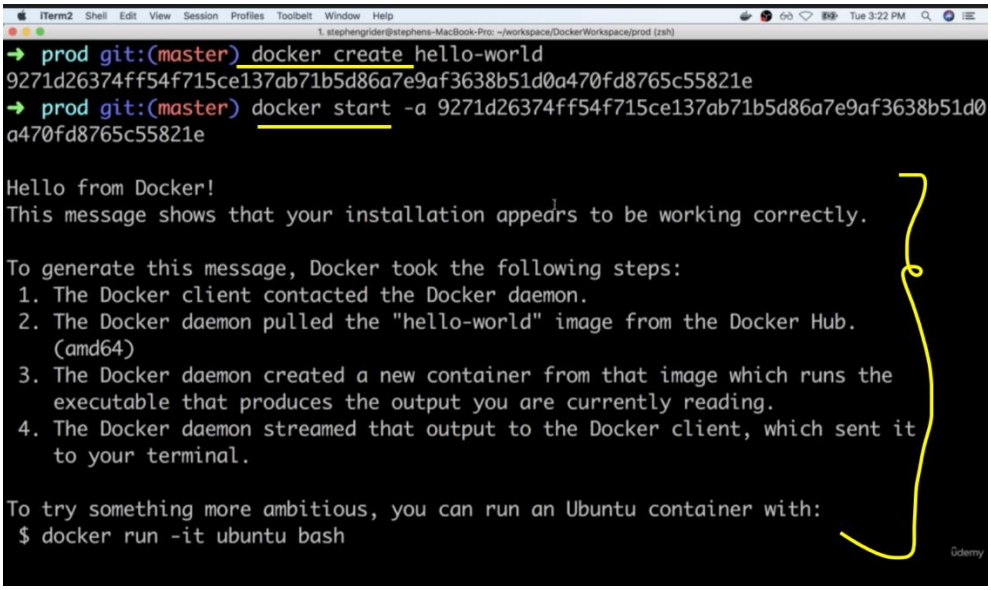
Shows all the container ever created.

```
➜  ~ docker ps --all
CONTAINER ID   IMAGE         COMMAND             CREATED         STATUS                     PORTS     NAMES
f72a680a4002   busybox       "ping google.com"   3 minutes ago   Up 3 minutes                         nervous_black
d31ad06d36c8   busybox       "ping google.com"   4 minutes ago   Exited (0) 3 minutes ago             sleepy_johnson
85a2afd89457   hello-world   "/hello"            3 hours ago     Exited (0) 3 hours ago               epic_tesla
➜  ~
```

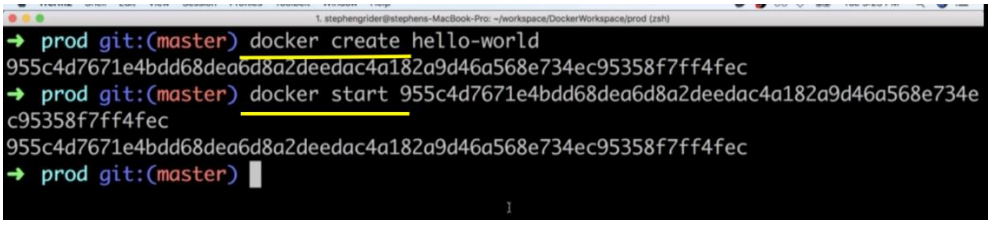
Container Lifecycle







-a => Watch for the output from the container and print it to the terminal.



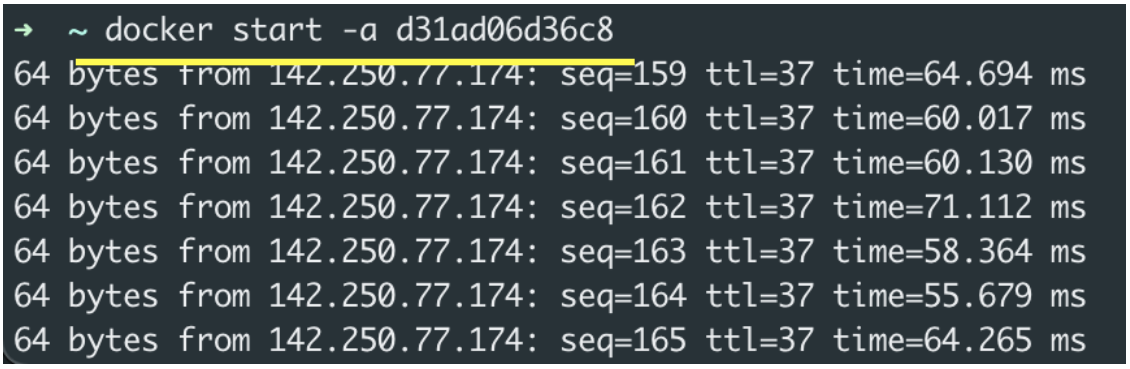
Restarting Stopped Containers

Listing All Container

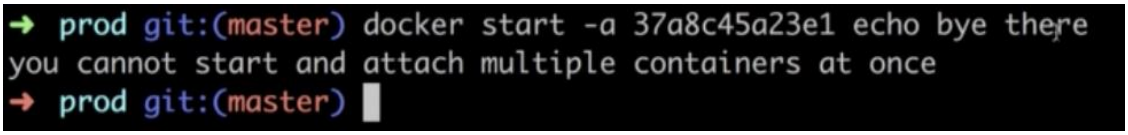
We can start the container which status is Exited (0).

Starting the Container without Logging

Starting the Container with Logging



Once the container created, we cannot override the default command.



Removing the stopped container

docker system prune

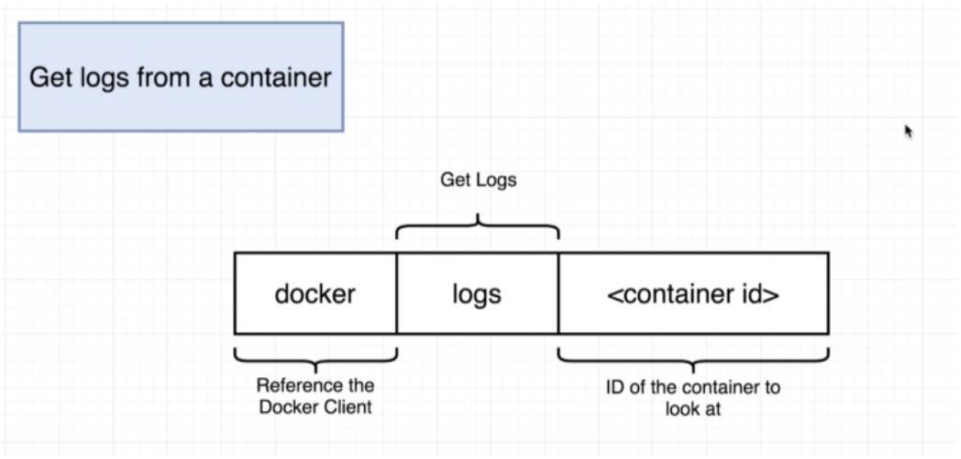
“docker system prune” command

- Remove all containers.
- Remove all image build cache.

```
➜  ~ docker ps --all
CONTAINER ID   IMAGE         COMMAND             CREATED        STATUS                     PORTS     NAMES
f72a680a4002   busybox       "ping google.com"   13 hours ago   Exited (0) 13 hours ago              nervous_black
d31ad06d36c8   busybox       "ping google.com"   13 hours ago   Exited (0) 6 seconds ago             sleepy_johnson
85a2afd89457   hello-world   "/hello"            16 hours ago   Exited (0) 16 hours ago              epic_tesla
➜  ~ docker system prune
WARNING! This will remove:
  - all stopped containers
  - all networks not used by at least one container
  - all dangling images
  - all dangling build cache

Are you sure you want to continue? [y/N] y
Deleted Containers:
f72a680a4002eb74e690a14270e59a430567a04400b6000c74fe3827d5c2ddd0
d31ad06d36c84074fca4aa5761472299dd05bd40d0cf2a7df70b713cc91a7cfd
85a2afd8945757a558cc82a3d3b7bc01c7ba7004e60bbdc5b203cc713ed8b1be

Total reclaimed space: 0B
➜  ~ docker ps --all
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
➜  ~
```

Retrieving Log Outputs

Command Explanation



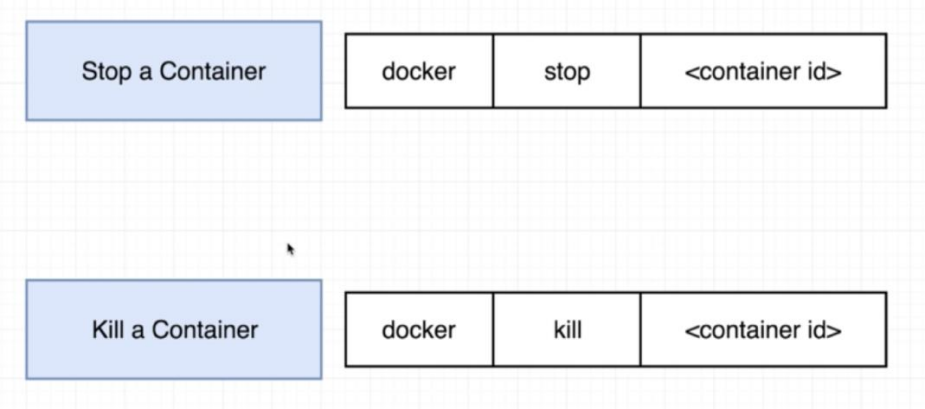
Retrieve the logs emitted from the container.

Command Execution

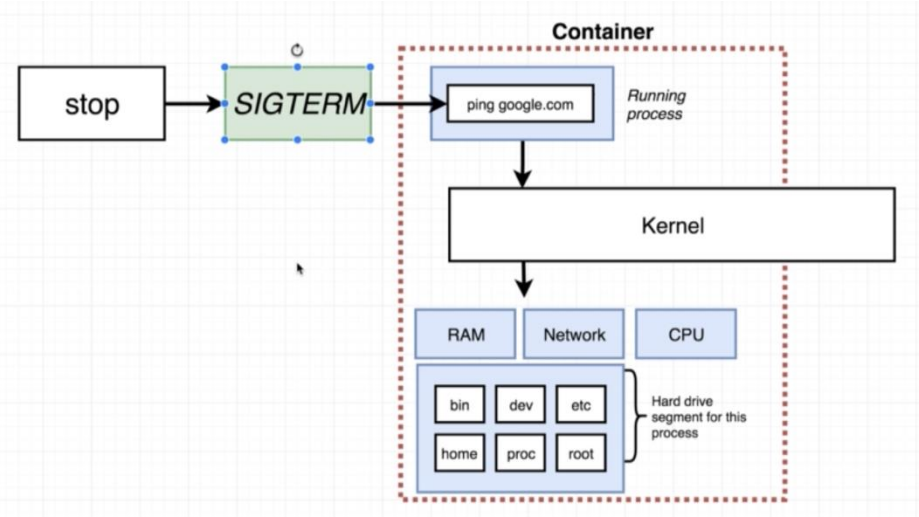
```
➜  ~ docker create busybox echo hi there
0e30728dda9aedbb545e0d67c9b386385048b139d996b1ce94b777c9667b6445
➜  ~ docker start 0e30728dda9aedbb545e0d67c9b386385048b139d996b1ce94b777c9667b6445
0e30728dda9aedbb545e0d67c9b386385048b139d996b1ce94b777c9667b6445
➜  ~ docker log 0e30728dda9aedbb545e0d67c9b386385048b139d996b1ce94b777c9667b6445
docker: 'log' is not a docker command.
See 'docker --help'
➜  ~ docker logs 0e30728dda9aedbb545e0d67c9b386385048b139d996b1ce94b777c9667b6445
hi there
➜  ~
```

Stopping the container

We have two options

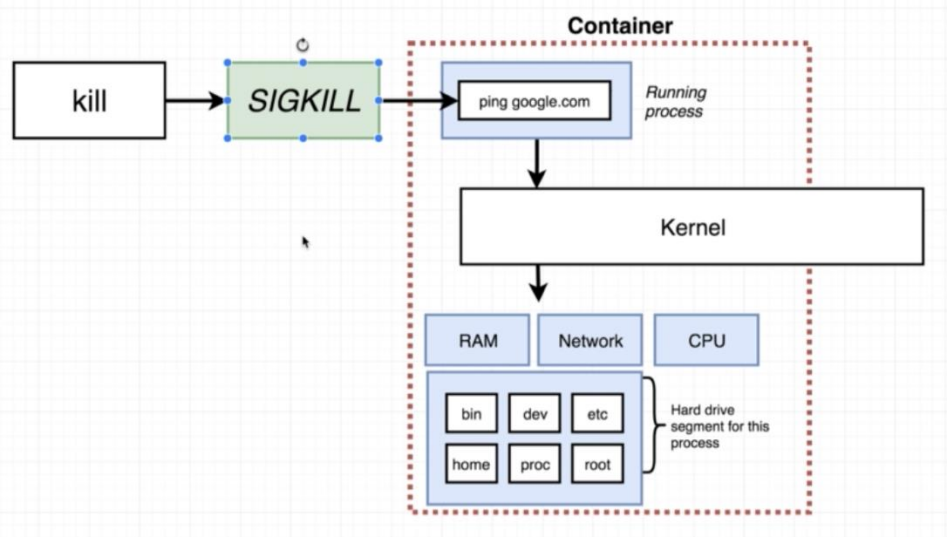


Docker stop



- Docker stop command send “SIGTERM” message to primary process in the container.
- SIGTERM – provides the process a time to shutdown process and do the necessary clean up activity.

Docker kill



- Docker kill command issue a SIGKILL message.
- It tells container process to shut down immediately.
- No relaxing time given for clean-up and so on.

Some Facts

Ideally, we will be stopping the container using stop command. If the container is locked up and not responding to the docker stop command, then we will be issuing the docker kill.

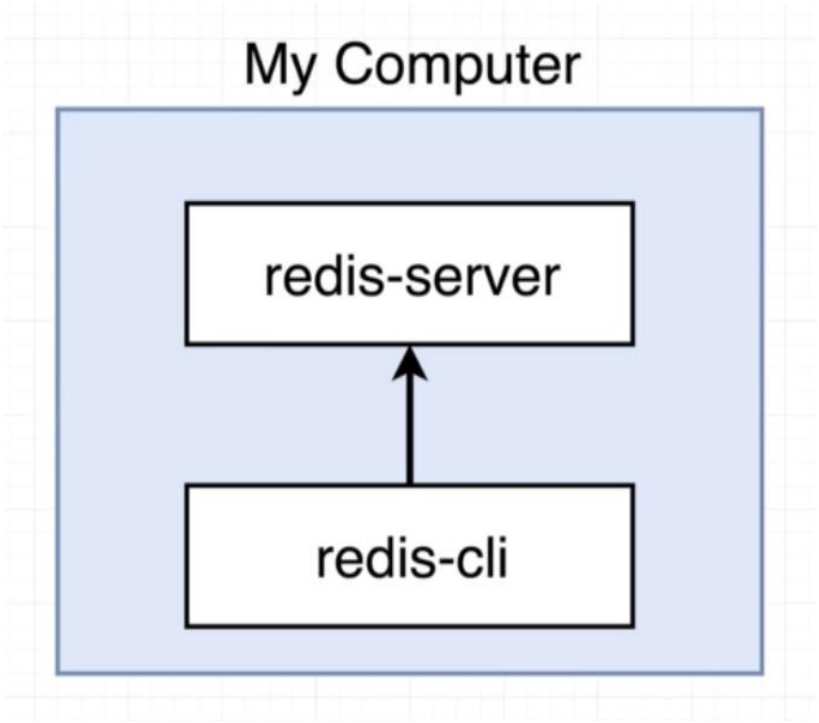
After issuing a docker stop command, if the docker did not stops docker automatically in 10 seconds, docker fallback to the docker kill command and executing the same.

Demo

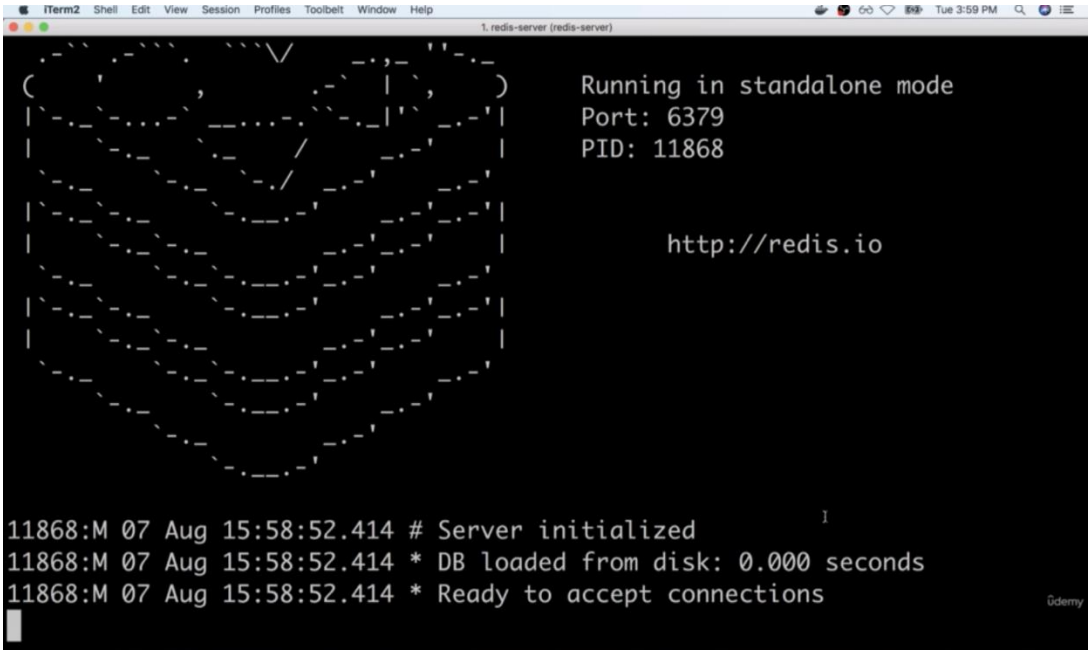
```
➜  ~ docker create busybox ping google.com
da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
➜  ~ docker start da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
➜  ~ docker logs da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
PING google.com (142.250.77.174): 56 data bytes
64 bytes from 142.250.77.174: seq=0 ttl=37 time=51.610 ms
64 bytes from 142.250.77.174: seq=1 ttl=37 time=51.901 ms
64 bytes from 142.250.77.174: seq=2 ttl=37 time=52.139 ms
64 bytes from 142.250.77.174: seq=3 ttl=37 time=72.741 ms
64 bytes from 142.250.77.174: seq=4 ttl=37 time=73.879 ms
64 bytes from 142.250.77.174: seq=5 ttl=37 time=53.557 ms
64 bytes from 142.250.77.174: seq=6 ttl=37 time=64.142 ms
64 bytes from 142.250.77.174: seq=7 ttl=37 time=61.993 ms
64 bytes from 142.250.77.174: seq=8 ttl=37 time=50.674 ms
64 bytes from 142.250.77.174: seq=9 ttl=37 time=60.838 ms
➜  ~ docker stop da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
```

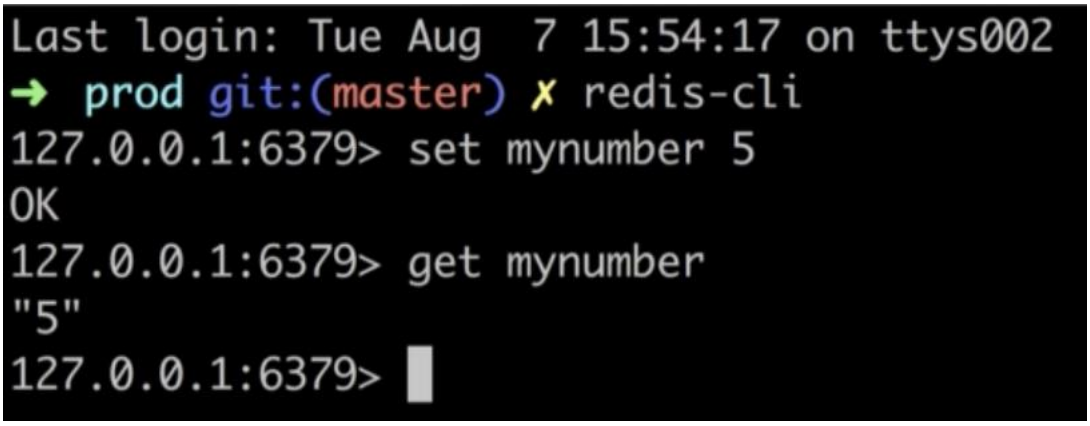
```
➜  ~ docker start da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
➜  ~ docker kill da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
da5c8008d8cef73ca5c263dd054e4e45dab5ce67377490d8c56d10ea85473adc
➜  ~
```

Multi-Command Containers



Redis is an in-memory data store.





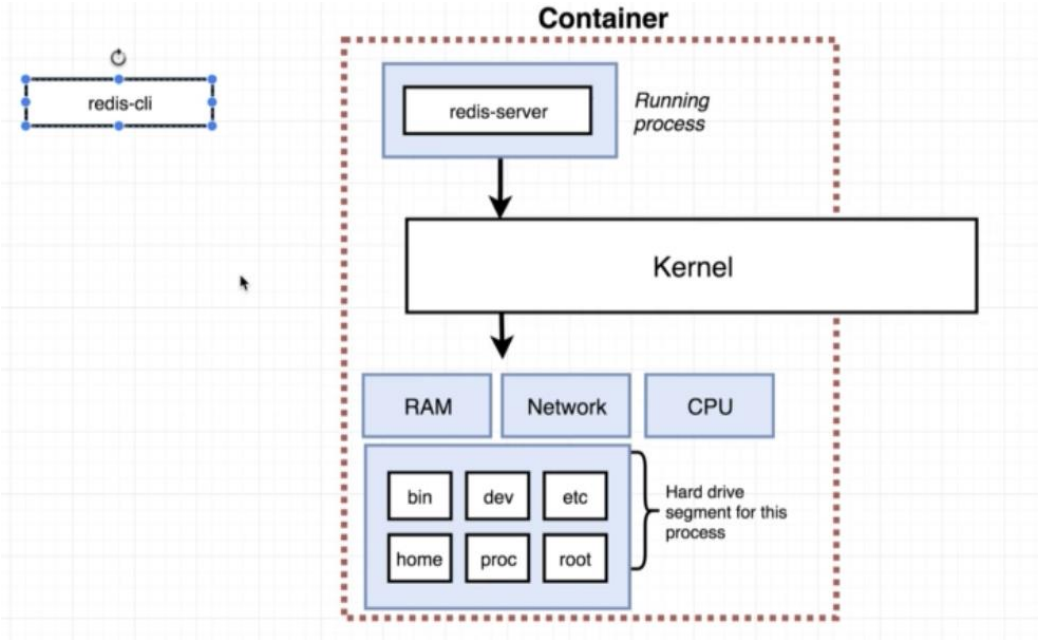
Running a Redis using Docker

Redis server

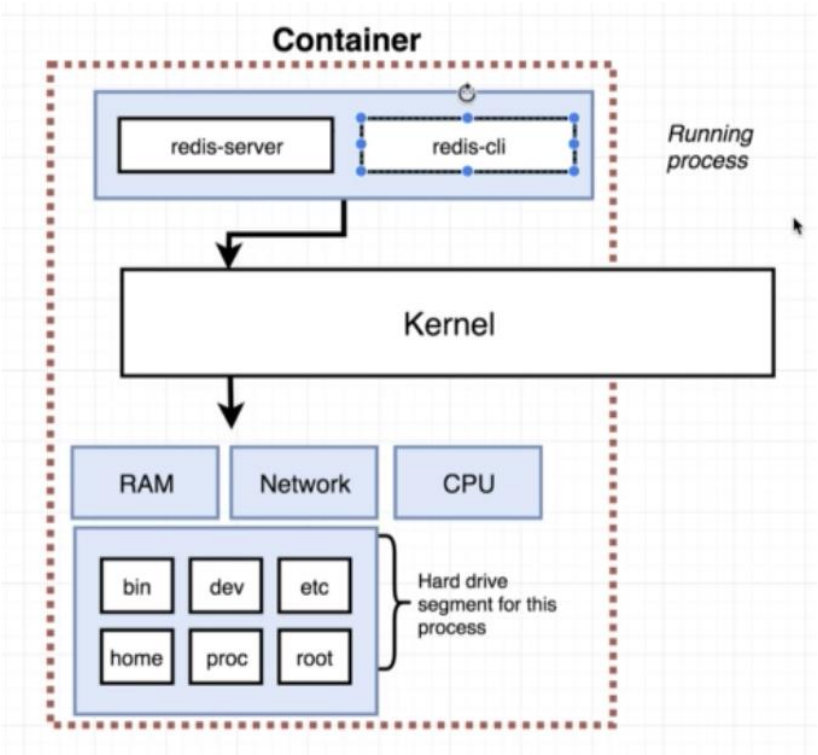
```
➜  ~ docker run redis
Unable to find image 'redis:latest' locally
latest: Pulling from library/redis
5eb5b503b376: Pull complete
6530a7ea3479: Pull complete
91f5202c6d9b: Pull complete
9f1ac212e389: Pull complete
82c311187b72: Pull complete
da84aa65ce64: Pull complete
Digest: sha256:0d9c9aed1eb385336db0bc9b976b6b49774aee3d2b9c2788a0d0d9e239986cb3
Status: Downloaded newer image for redis:latest
1:C 27 Feb 2022 14:19:12.305 # oO0OoO0OoO0Oo Redis is starting oO0OoO0OoO0Oo
1:C 27 Feb 2022 14:19:12.305 # Redis version=6.2.6, bits=64, commit=00000000, modified=0, pid=1, just started
1:C 27 Feb 2022 14:19:12.305 # Warning: no config file specified, using the default config. In order to specif
y a config file use redis-server /path/to/redis.conf
1:M 27 Feb 2022 14:19:12.306 * monotonic clock: POSIX clock_gettime
1:M 27 Feb 2022 14:19:12.307 * Running mode=standalone, port=6379.
1:M 27 Feb 2022 14:19:12.307 # Server initialized
1:M 27 Feb 2022 14:19:12.308 * Ready to accept connections
```

```
➜  ~ redis-cli
zsh: command not found: redis-cli
➜  ~
```

We are trying to run the redis-cli command outside the container.

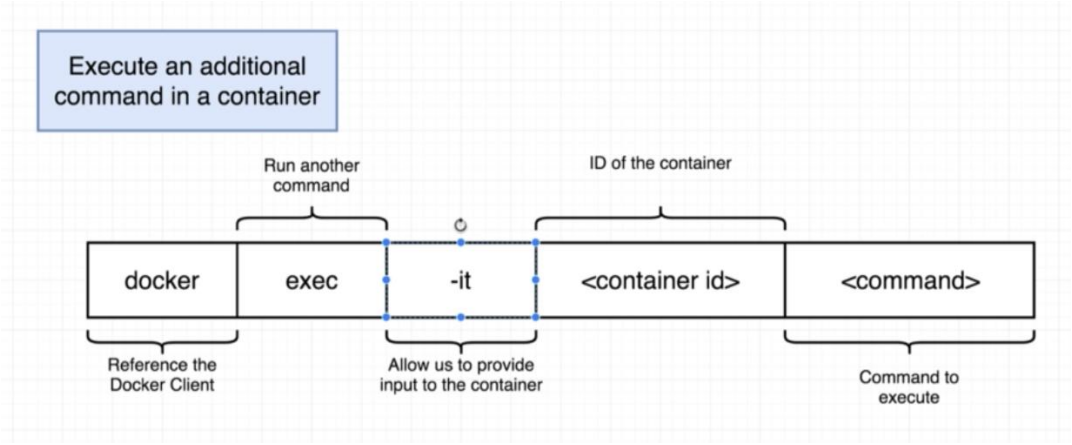


Redis-cli will work we are trying to run int same container.



Executing Command in Running Container

Docker exec Command




```
➜  ~ docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED          STATUS          PORTS      NAMES
c3cc7e3c8642   redis     "docker-entrypoint.s…"   12 minutes ago   Up 12 minutes   6379/tcp   elated_
cori
➜  ~ docker exec -it c3cc7e3c8642 redis-cli
127.0.0.1:6379> set a 5
OK
127.0.0.1:6379> get a
"5"
127.0.0.1:6379>
```

Purpose of the “-it” flag

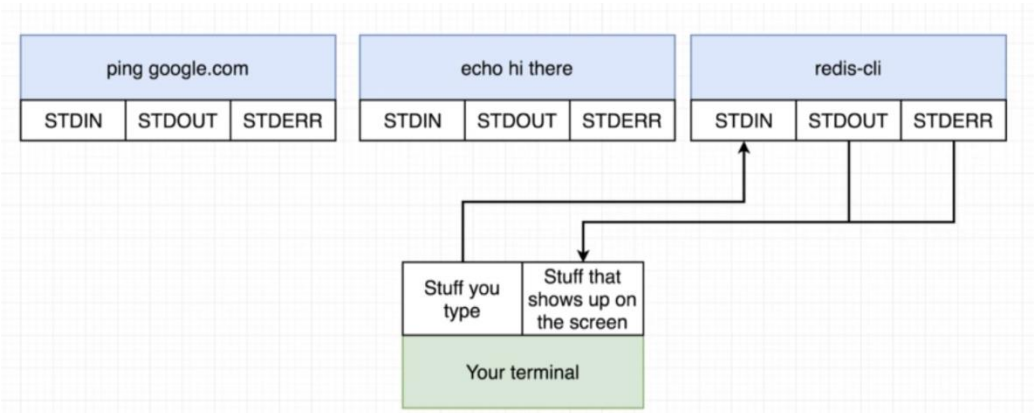
```
→  ~ docker exec -it c3cc7e3c8642 redis-cli
127.0.0.1:6379> set a 5
OK
127.0.0.1:6379> get a
"5"
127.0.0.1:6379>
→  ~ docker exec c3cc7e3c8642 redis-cli
→  ~
```

Running command without “-it” flag, could not enter redis-cli, so it just moved out.

How processes run in Linux environment

Every container will run in Linux virtual machine. So, all the processes in container are runs in Linux environment.

Every process we create in a Linux environment, three communication channels attached to it. That is STDIN, STDOUT and STDERR.



How does it relate to “-it” flag?

Command “-it” flag

We can split the “-it” flag into two parts.

-it = -i -t

-i ➔ Stuff we type will be sent to the process’s STDIN communication channel.
-t ➔ This flag responsible for make the content nicely formatted on screen.

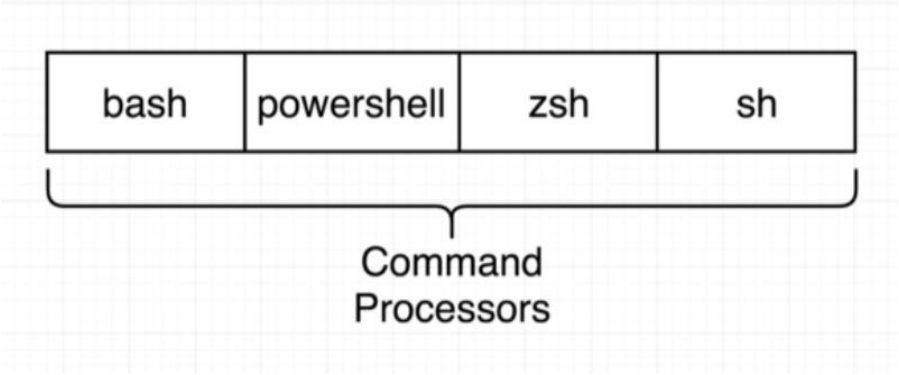
Without -t flag

```
→ prod git:(master) ✗ docker exec -i 093b6e72ff2b redis-cli
set myvalue 5
OK
get myvalue
5
```

Getting a Command Prompt in Container

Command Processors

We can enable the command processors for our container.



Enable Command Prompt

Enable the command prompt for container

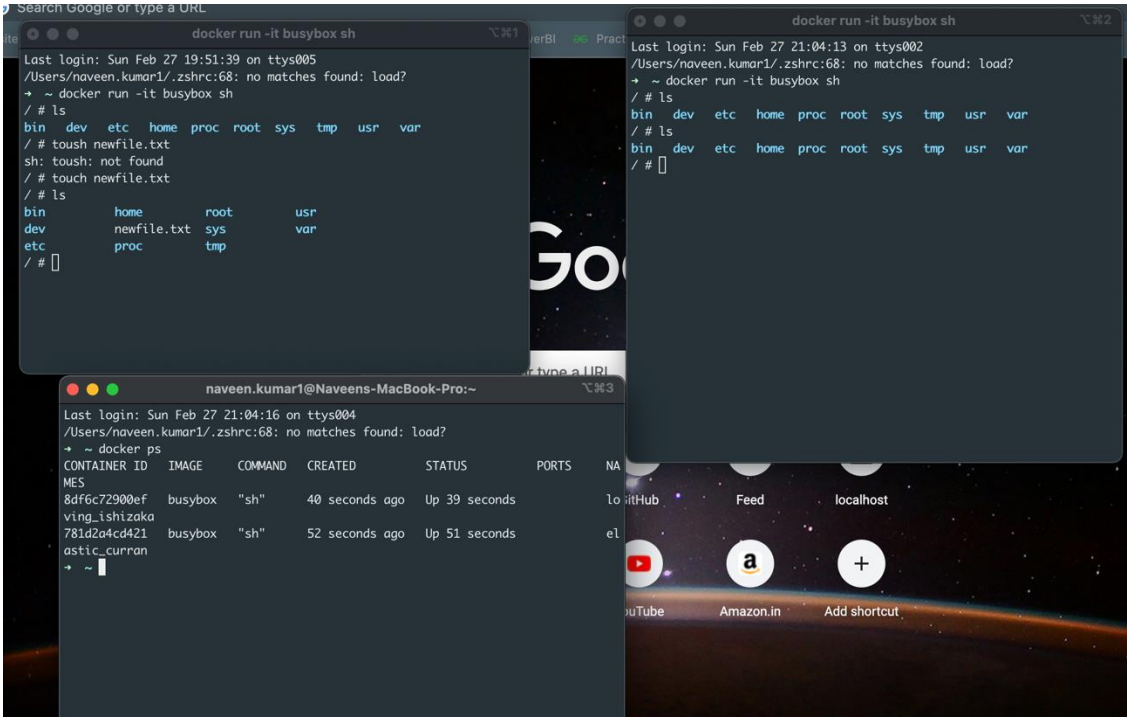
```
→  ~ docker exec -it c3cc7e3c8642 sh
# redis-cli
127.0.0.1:6379> set b 2
OK
127.0.0.1:6379> get b
"2"
127.0.0.1:6379>
# export a=5
# echo $a
5
# ls
# cd ~/
# ls
# cd /
# ls
bin   data  etc   lib    media  opt   root  sbin  sys  usr
boot  dev   home  lib64  mnt    proc  run   srv   tmp  var
#
```

Starting with a Shell

```
➜  ~ docker run -it busybox sh
/ # ping google.com
PING google.com (142.250.67.46): 56 data bytes
64 bytes from 142.250.67.46: seq=0 ttl=37 time=50.944 ms
64 bytes from 142.250.67.46: seq=1 ttl=37 time=48.368 ms
64 bytes from 142.250.67.46: seq=2 ttl=37 time=37.944 ms
^C
--- google.com ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 37.944/45.752/50.944 ms
/ # echo hi there
hi there
/ # echo bye!!
bye!!
/ # ls
bin   dev   etc   home  proc  root  sys   tmp   usr   var
/ #
```

Container Isolation

Demo and Explanation



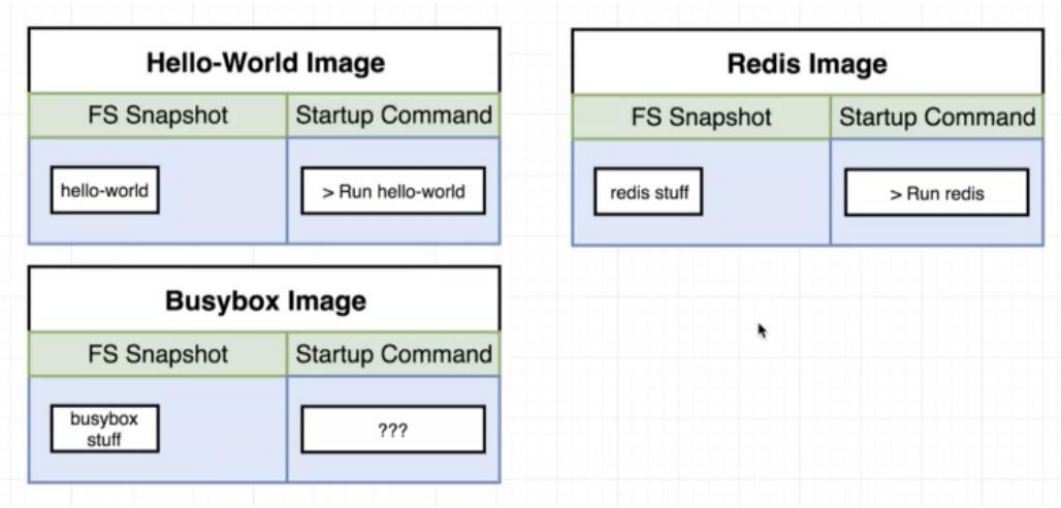
- We have created a two different container for the same image “busybox”.
- Created a new file called “newfile.txt” in the first container’s file systems.
- We tried to list all the files in second container’s file systems. We could see that “newfile.txt” file is not listed over there.

From this, we can conclude, each container having its own resources. Resources are not being shared among the containers.

Building Custom Images Through Docker Server

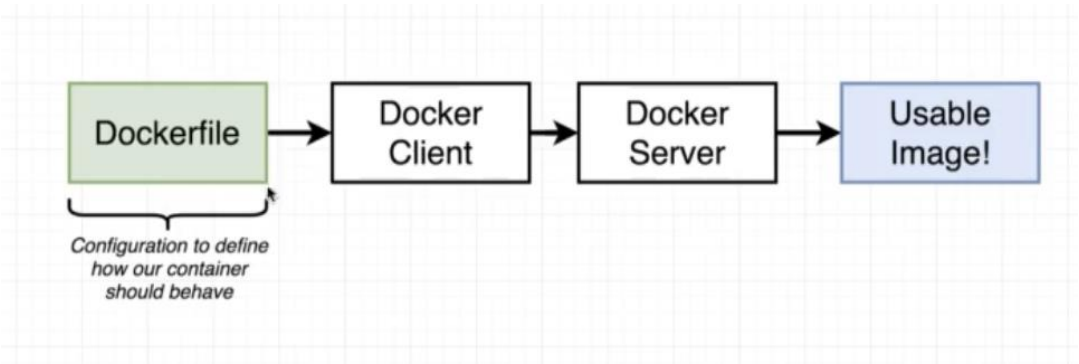
Creating Docker Images

Before we have been using an image created by other engineers.



Now, we are going to figure out how can we build own custom images.

Introducing Docker File



Docker File contains,

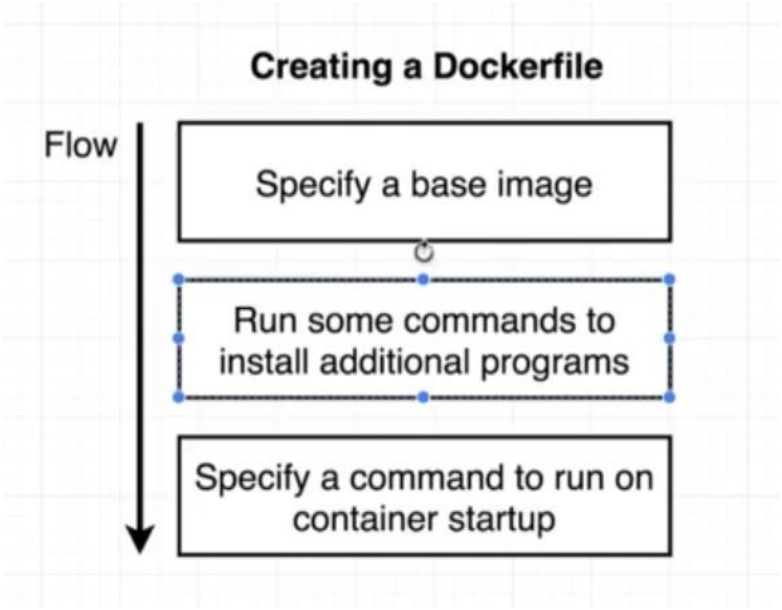
- What are the programs to run?
- What images does when starting a container?
- Configurations and dependencies required for program to run.

We will be passing the docker file to docker client (docker cli), that in turn pass it to docker server.

Docker server is what is doing the heavy lifting for us. It takes the docker file and look at all the lines of configurations and then build a usable image.

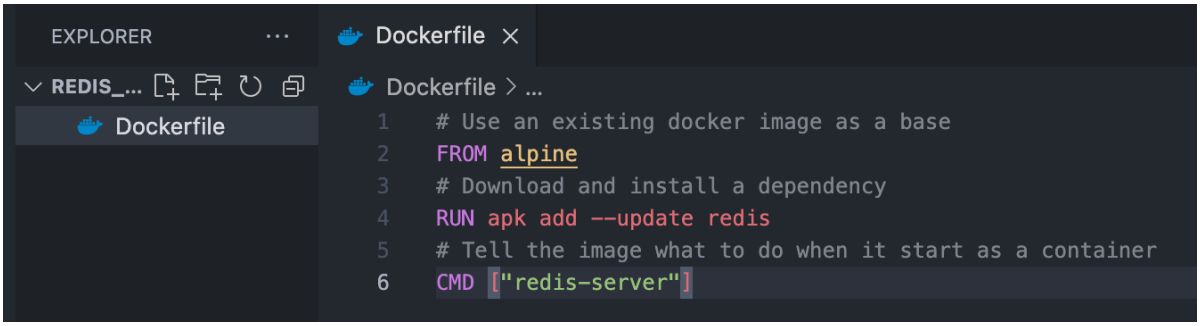
Then, that image is used for creating a container.

Docker File Creation Flow

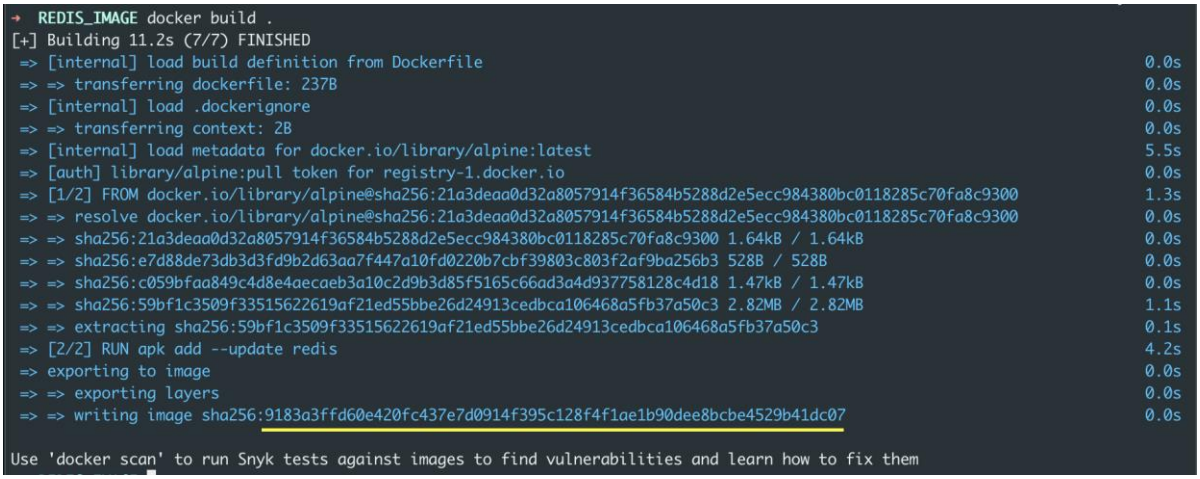


Building a Docker Image

Creating a Docker File



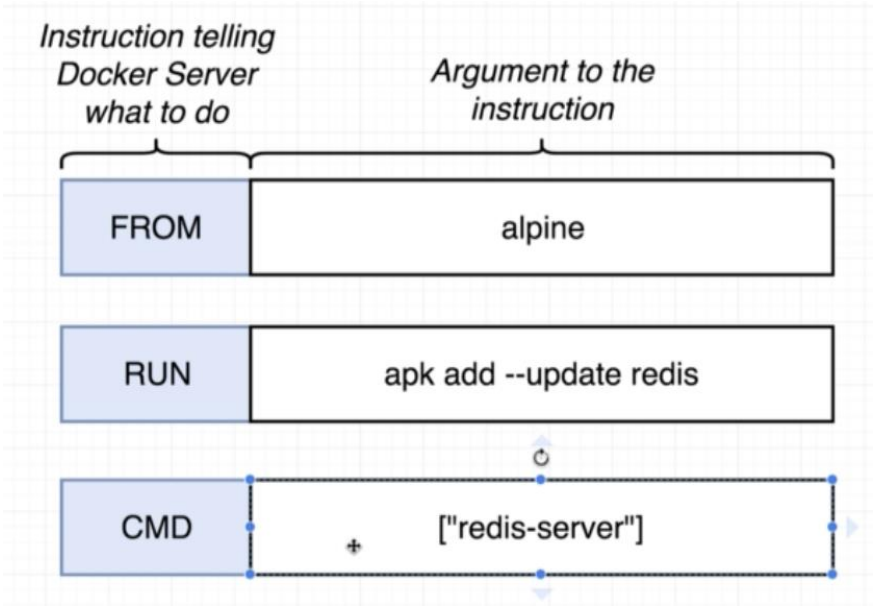
Docker Build



Running an Image

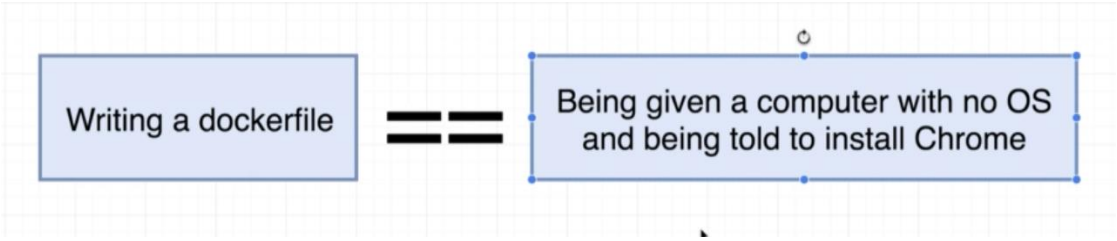
```
 => exporting to image
 => => exporting layers
 => => writing image sha256:9183a3ffd60e420fc437e7d0914f395c128f4f1ae1b90dee8bcbe4529b41dc07

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them
➜  REDIS_IMAGE docker run 9183a3ffd60e420fc437e7d0914f395c128f4f1ae1b90dee8bcbe4529b41dc07
1:C 28 Feb 2022 19:57:15.736 # oooOoooOoooOo Redis is starting oooOoooOoooOo
1:C 28 Feb 2022 19:57:15.736 # Redis version=6.2.6, bits=64, commit=b39e1241, modified=0, pid=1, just
1:C 28 Feb 2022 19:57:15.736 # Warning: no config file specified, using the default config. In order
redis-server /path/to/redis.conf
1:M 28 Feb 2022 19:57:15.737 * monotonic clock: POSIX clock_gettime
1:M 28 Feb 2022 19:57:15.738 * Running mode=standalone, port=6379.
1:M 28 Feb 2022 19:57:15.738 # Server initialized
1:M 28 Feb 2022 19:57:15.739 * Ready to accept connections
```

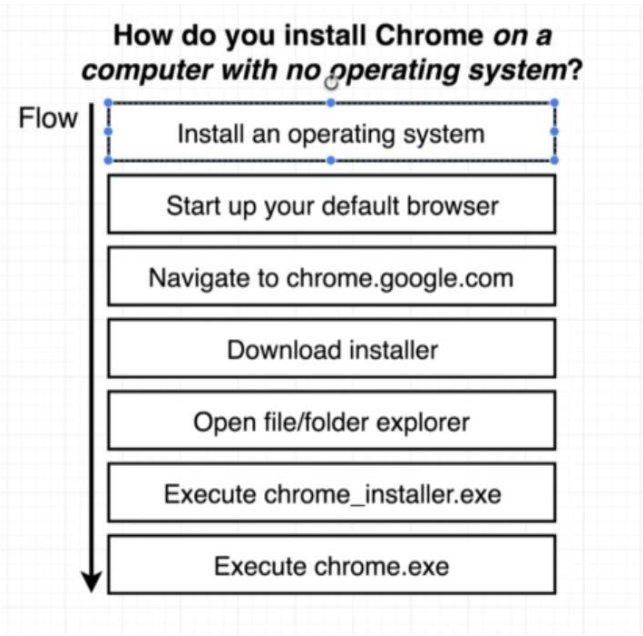
Dockerfile Teardown



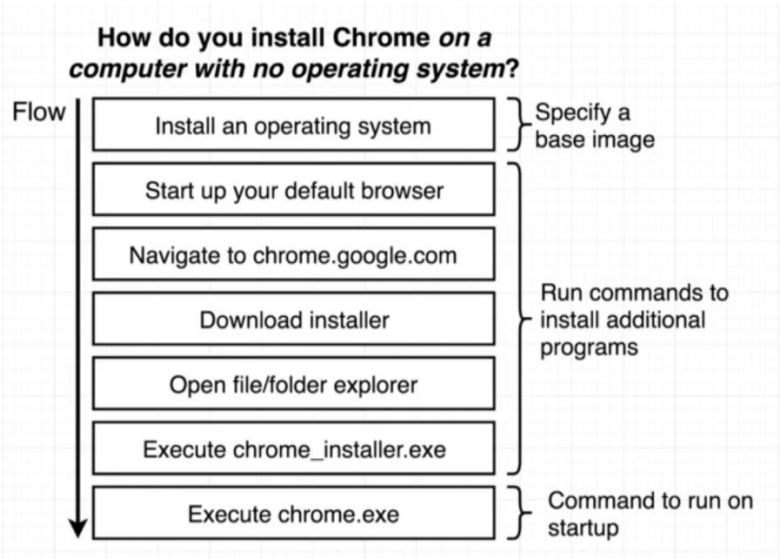
What is Base Image?

Analogy

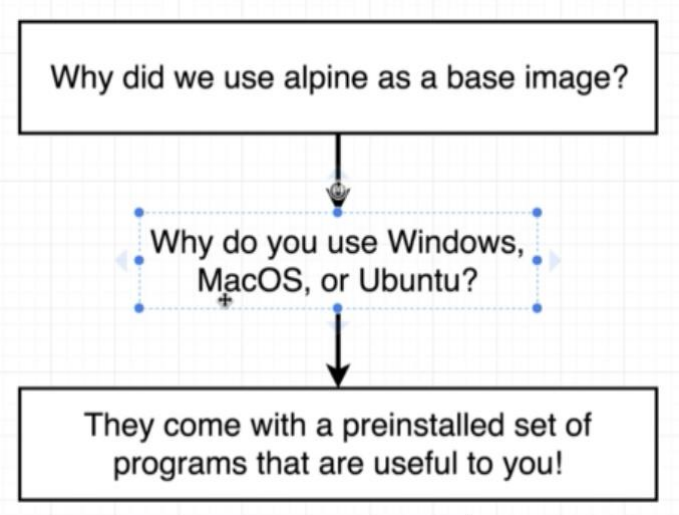




Base Image



Purpose of giving a base image is initial starting point or initial set of programs used for configuring an image further.



Base image contains all set of necessary programs to run, run commands.

The Build Process in Detail

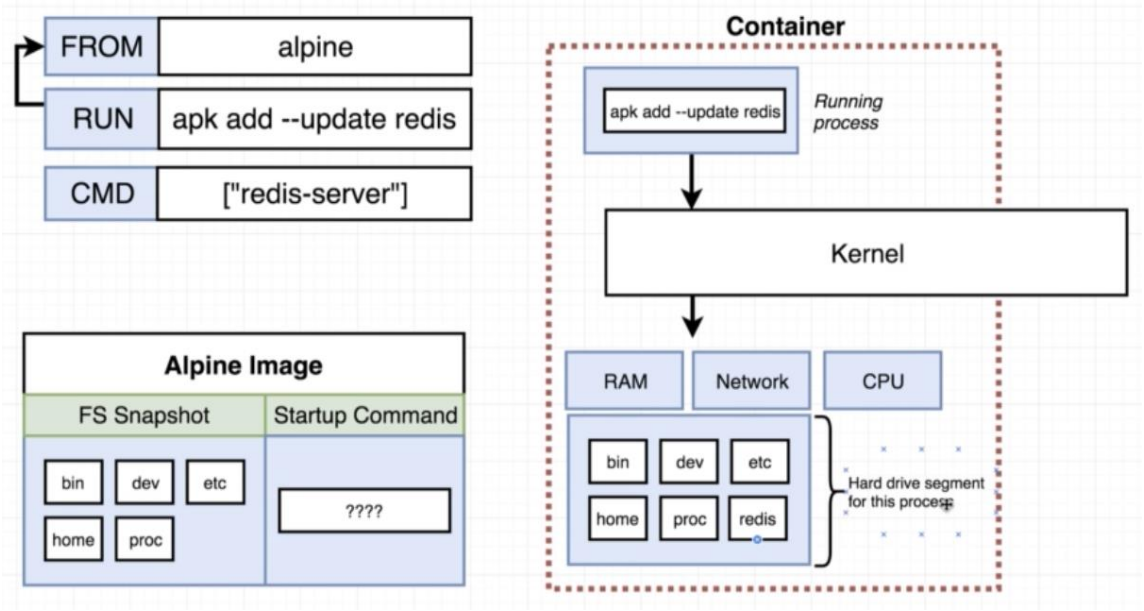
```
→  REDIS_IMAGE docker build .
[+] Building 11.2s (7/7) FINISHED
 => [internal] load build definition from Dockerfile                                                                0.0s
 => => transferring dockerfile: 237B                                                                                0.0s
 => [internal] load .dockerignore                                                                                   0.0s
 => => transferring context: 2B                                                                                     0.0s
 => [internal] load metadata for docker.io/library/alpine:latest                                                    5.5s
 => [auth] library/alpine:pull token for registry-1.docker.io                                                       0.0s
 => [1/2] FROM docker.io/library/alpine@sha256:21a3deaa0d32a8057914f36584b5288d2e5ecc984380bc0118285c70fa8c9300     1.3s
 => => resolve docker.io/library/alpine@sha256:21a3deaa0d32a8057914f36584b5288d2e5ecc984380bc0118285c70fa8c9300     0.0s
 => => sha256:21a3deaa0d32a8057914f36584b5288d2e5ecc984380bc0118285c70fa8c9300 1.64kB / 1.64kB                      0.0s
 => => sha256:e7d88de73db3d3fd9b2d63aa7f447a10fd0220b7cbf39803c803f2af9ba256b3 528B / 528B                          0.0s
 => => sha256:c059bfaa849c4d8e4aecaeb3a10c2d9b3d85f5165c66ad3a4d937758128c4d18 1.47kB / 1.47kB                      0.0s
 => => sha256:59bf1c3509f33515622619af21ed55bbe26d24913cedbca106468a5fb37a50c3 2.82MB / 2.82MB                      1.1s
 => => extracting sha256:59bf1c3509f33515622619af21ed55bbe26d24913cedbca106468a5fb37a50c3                           0.1s
 => [2/2] RUN apk add --update redis                                                                                4.2s
 => exporting to image                                                                                              0.0s
 => => exporting layers                                                                                             0.0s
 => => writing image sha256:9183a3ffd60e420fc437e7d0914f395c128f4f1ae1b90dee8bcbe4529b41dc07                        0.0s

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them
```

What “docker build .” command is doing?

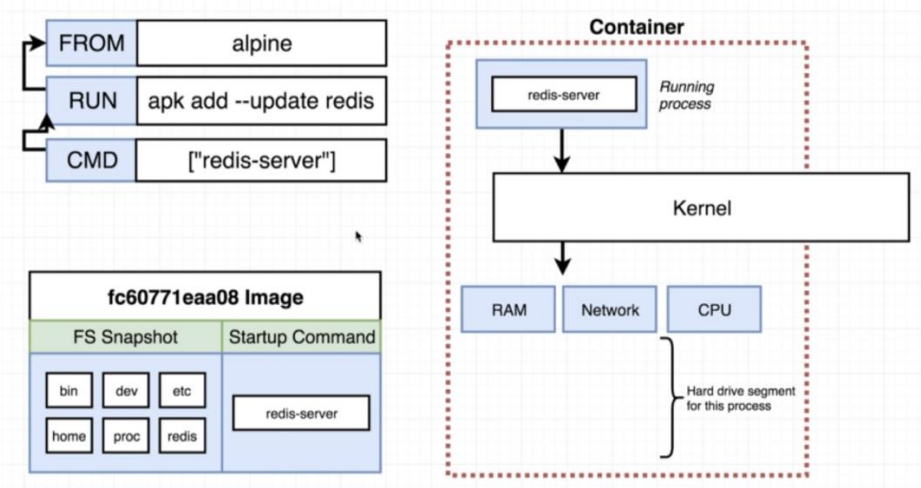
- Giving Dockerfile to docker cli.
- Build command takes the docker file and creates an image out of it.
- “.” in command specify the build context. Set of file and folders, that we want wrap and bring it into the container.

Building Process

- Checks local cache, whether base image is available or not.
- If it is not available, image will be download from the docker hub.
- Next step is running the run commands.
- For, running the num command, docker make use of the base image and creates temporary container out of it.

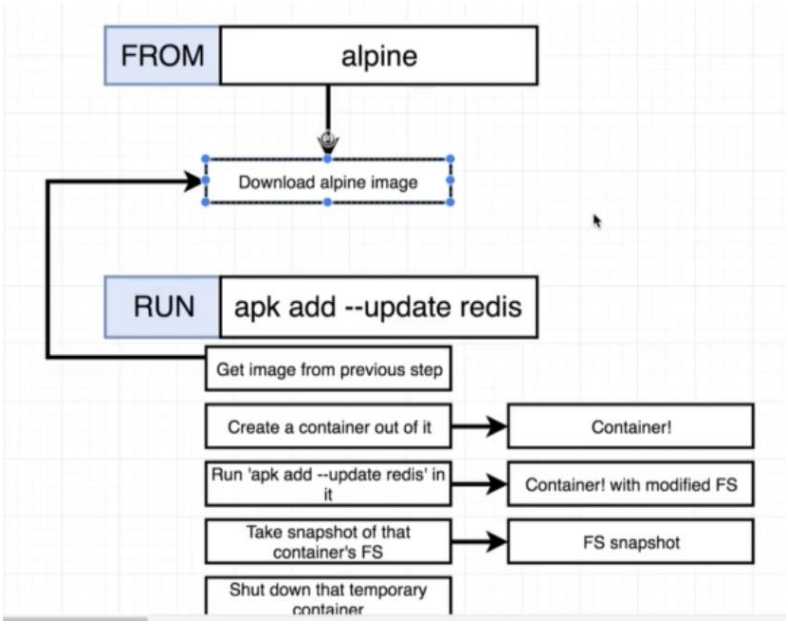


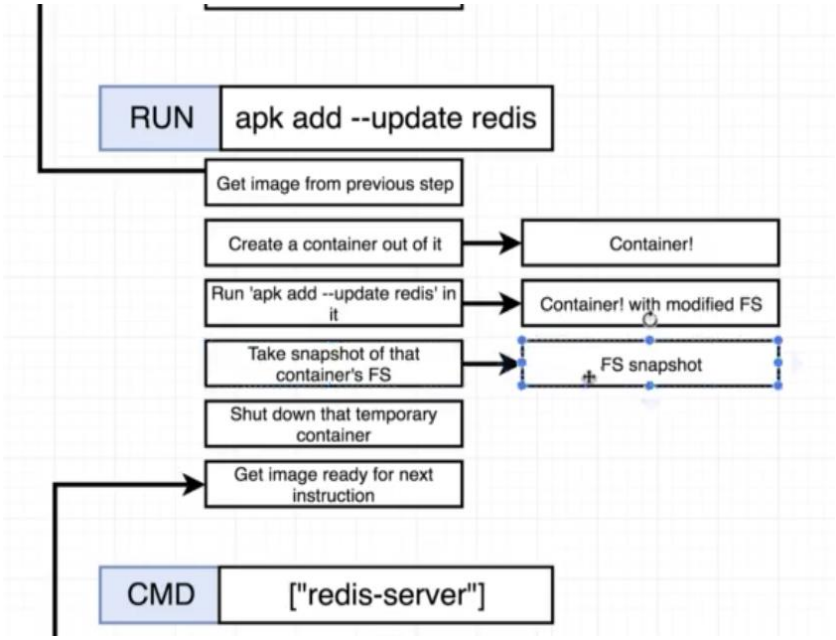
- Once the running command is installed, we are taking all the file system back from the container and stopping it.
- Run command installed file system is saved in temporary image.
- CMD command is updated as startup command in saved temporary image, that in turn creates a new image and gives the result as image id.

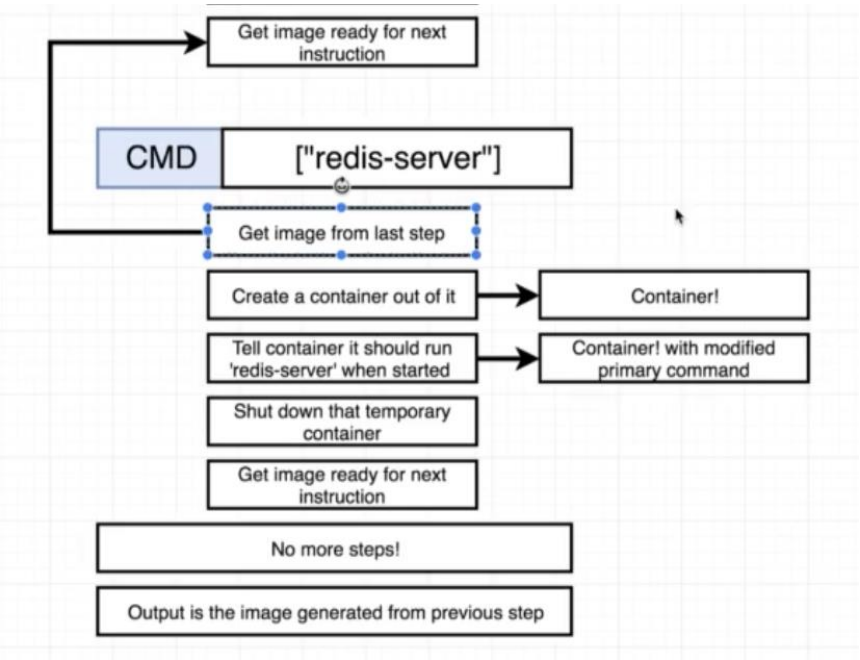


Brief Recap

Recap



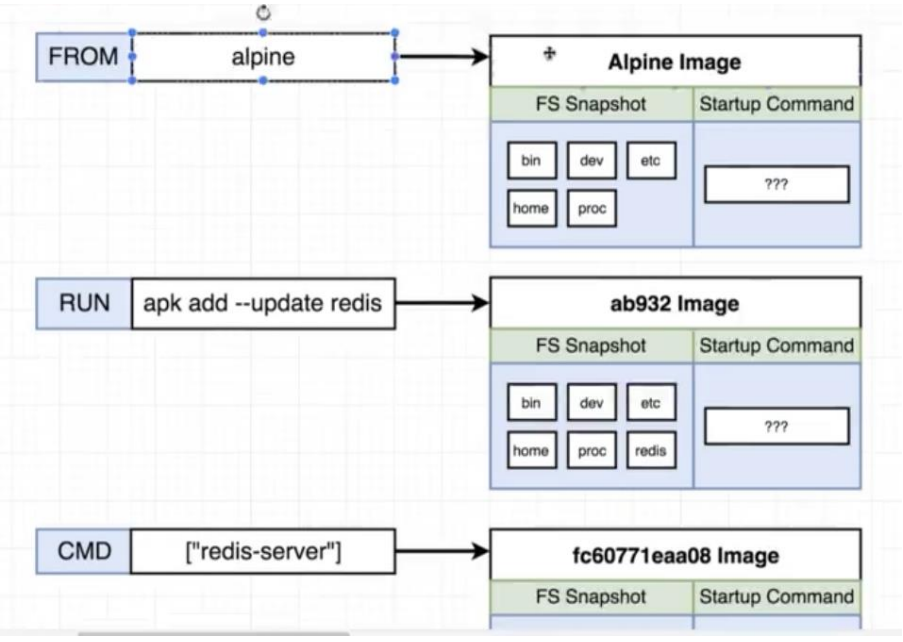




Rebuild with Cache

```
# Use an existing docker image as a base
FROM alpine

# Download and install a dependency
RUN apk add --update redis

# Tell the image what to do when it starts
# as a container
CMD ["redis-server"]
```

We have three instructions, for each instruction we will be getting the new image.



```
1  # Use an existing docker image as a base
2  FROM alpine
3
4  # Download and install a dependency
5  RUN apk add --update redis
6  RUN apk add --update gcc
7
8  # Tell the image what to do when it starts
9  # as a container
10 CMD ["redis-server"]
```

We updated the Dockerfile with one more RUN instruction.

For running the instruction, we are using the image. If the image is already created and stored in cache, we are reusing the same.

```
➜  redis-image git:(master) ✗ docker build .
Sending build context to Docker daemon  2.048kB
Step 1/4 : FROM alpine
 ---> 11cd0b38bc3c
Step 2/4 : RUN apk add --update redis
 ---> Using cache
 ---> 38ec9aea7e10
Step 3/4 : RUN apk add --update gcc
 ---> Using cache
 ---> a6d5a254e65b
Step 4/4 : CMD ["redis-server"]
 ---> Using cache
 ---> b90e9fb1e7e0
Successfully built b90e9fb1e7e0
```

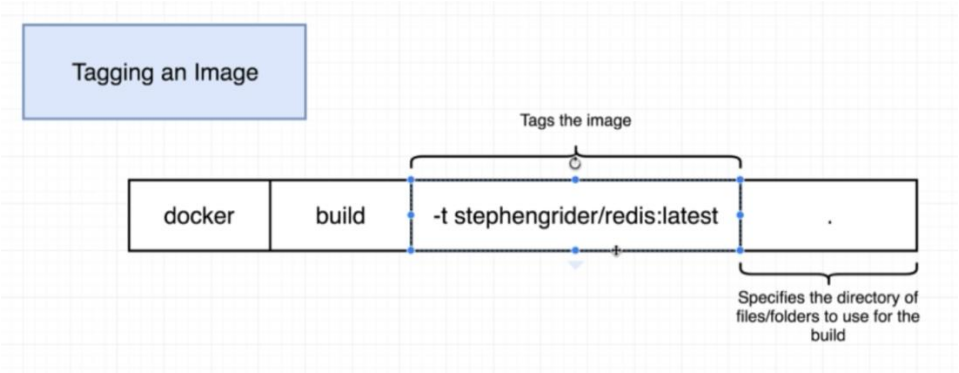
If the series of the steps from the Dockerfile is same as before while building, we are reusing the image from cache.

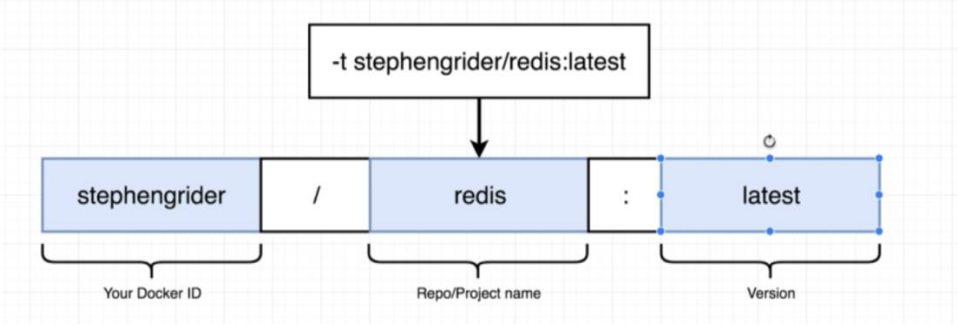
Tagging an Image

Explanations

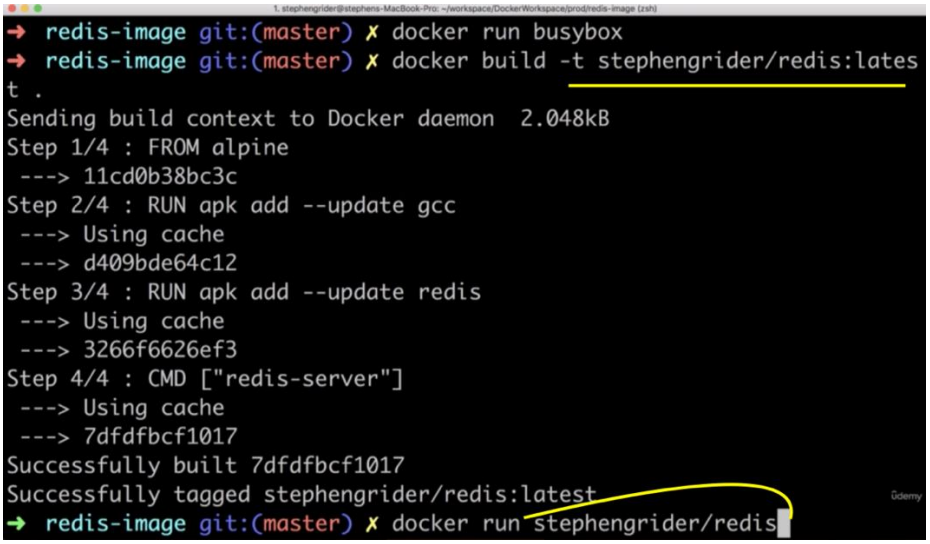
Tagging an image name while building the Dockerfile.

Docker run hello-world
Docker run redis
Docker run busybox



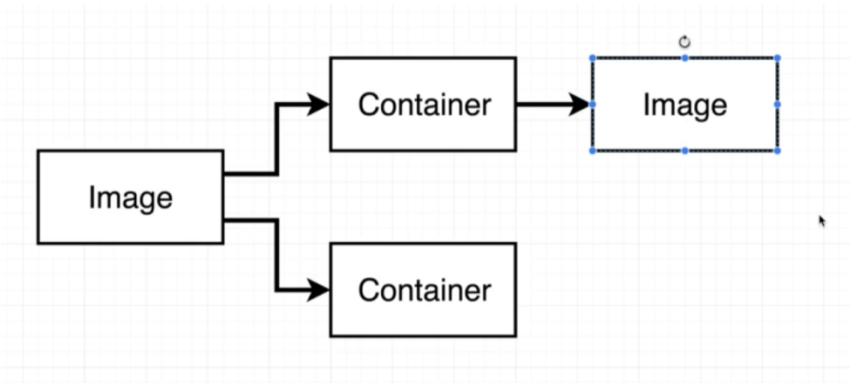


Executions



Manual Image Generation with Docker Commit

Explanations



We could create an Image from container. This approach is equivalent to building an image from docker file.

Note: Do not recommended to do it in projects.

Demo

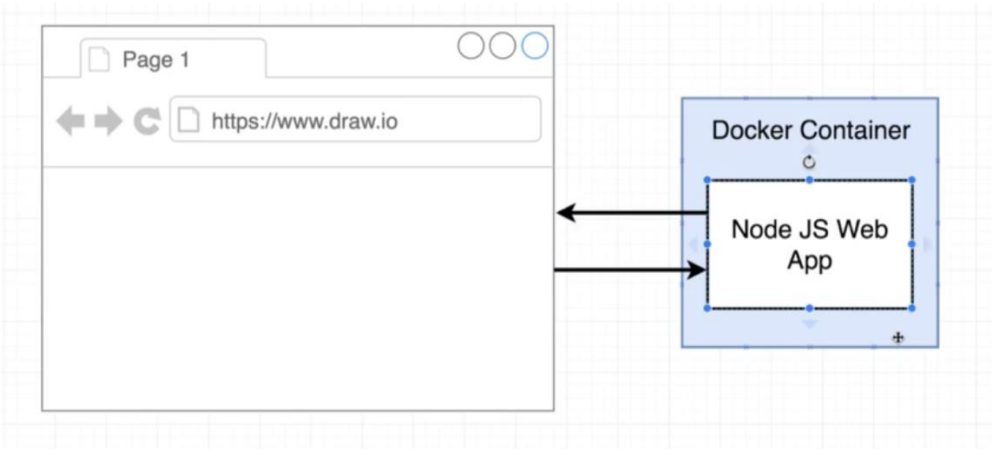
```
→ redis-image git:(master) ✗ docker run -it alpine sh
/ # apk add --update redis
fetch http://dl-cdn.alpinelinux.org/alpine/v3.8/main/x86_64/APKINDEX.tar.gz
fetch http://dl-cdn.alpinelinux.org/alpine/v3.8/community/x86_64/APKINDEX.tar.gz
(1/1) Installing redis (4.0.10-r1)
Executing redis-4.0.10-r1.pre-install
Executing redis-4.0.10-r1.post-install
Executing busybox-1.28.4-r0.trigger
OK: 6 MiB in 14 packages
/ #
```

```
Last login: Wed Aug  8 13:07:25 on ttys002
→ redis-image git:(master) ✗ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED
     STATUS              PORTS               NAMES
39075447a383        alpine              "sh"                48 seconds ago
     Up 47 seconds                           friendly_brown
→ redis-image git:(master) ✗ docker commit -c 'CMD ["redis-server"]' 39075447a383
sha256:0835898662afae4b5a9d9e9961a0e89c2cbe55d895a0c0fbe6b7664f980d272b
→ redis-image git:(master) ✗ docker run 0835898662af
```

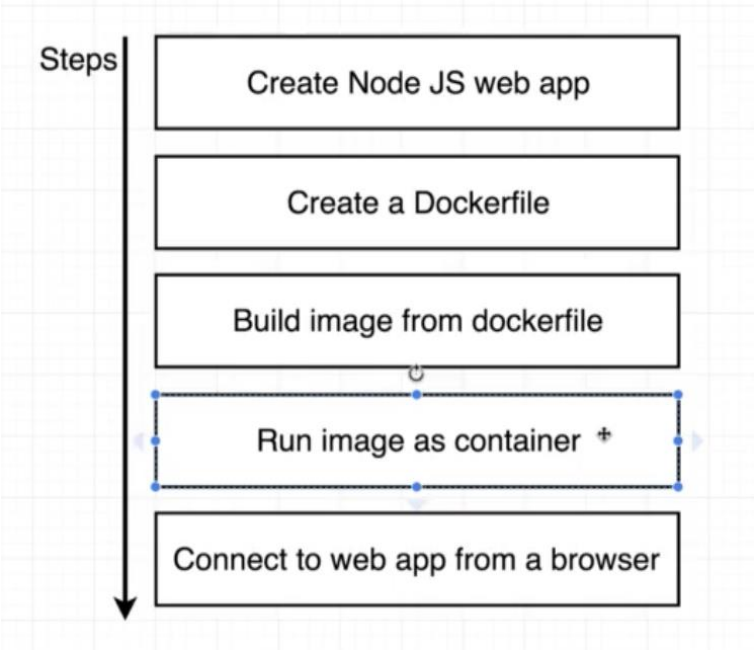
Making Real Projects with Docker

Creating a Sample Project

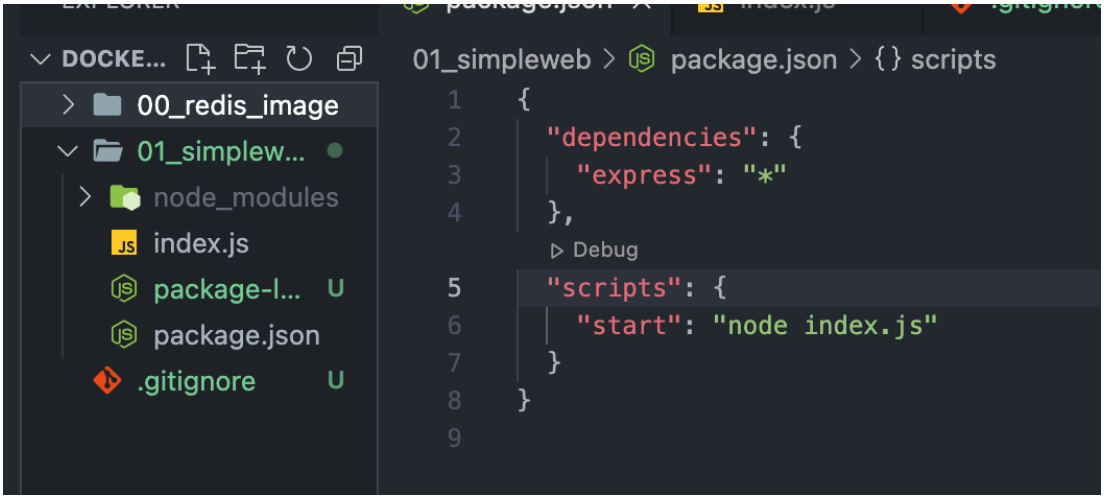
Project Outline

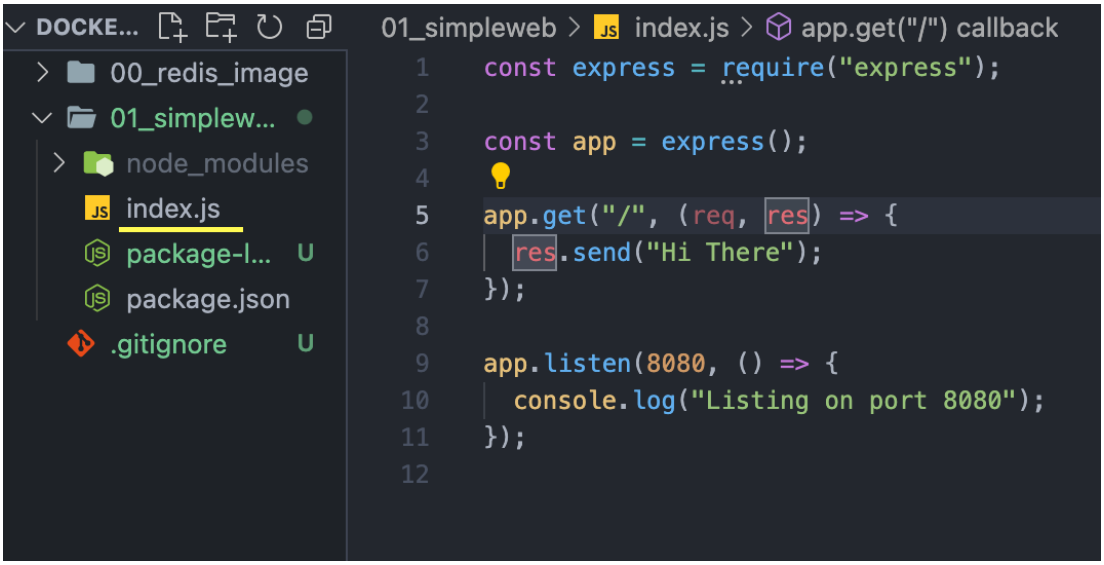


Project Plan



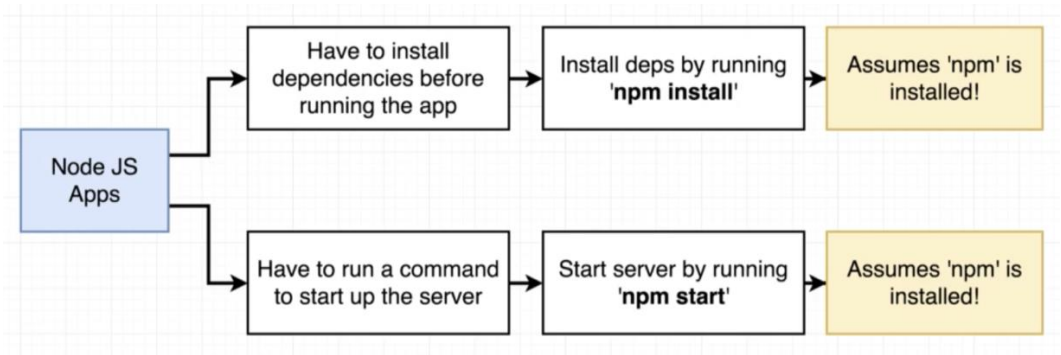
Node Server Setup



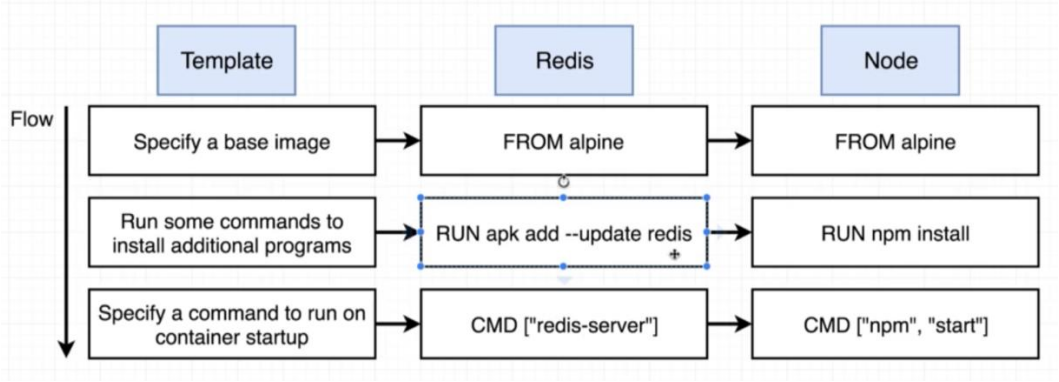


Buidling a Docker Image for Our Project

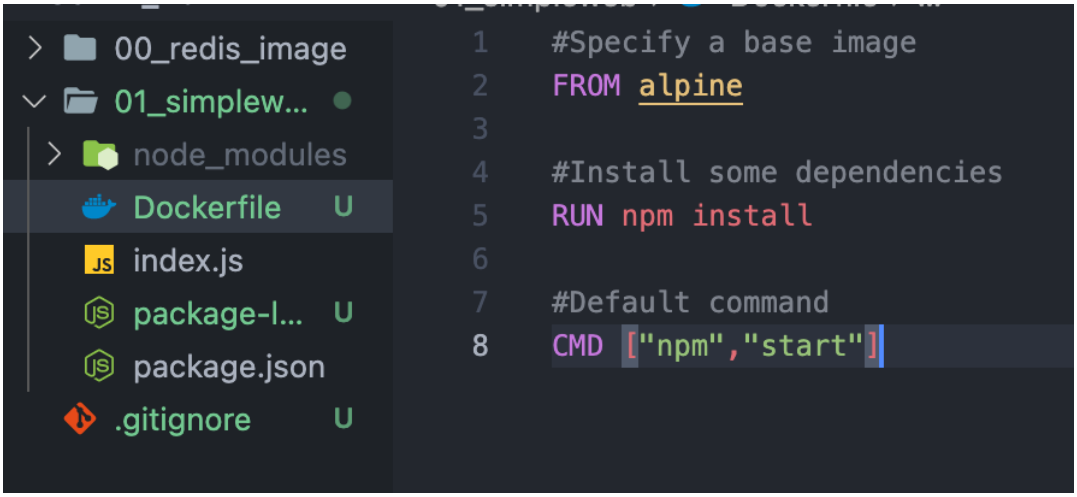
npm Setup



Step for Building Docker Image for Our Node Application



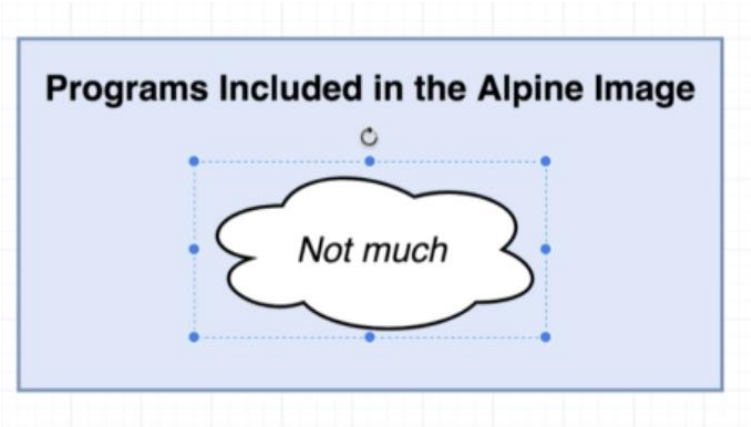
Creating a Docker File



Building a Docker File

```
➜  01_simpleweb git:(main) ✗ docker build .
[+] Building 3.6s (6/6) FINISHED
 => [internal] load build definition from Dockerfile           0.0s
 => => transferring dockerfile: 157B                           0.0s
 => [internal] load .dockerignore                              0.0s
 => => transferring context: 2B                                0.0s
 => [internal] load metadata for docker.io/library/alpine:lat  3.3s
 => [auth] library/alpine:pull token for registry-1.docker.io  0.0s
 => CACHED [1/2] FROM docker.io/library/alpine@sha256:21a3dea  0.0s
 => ERROR [2/2] RUN npm install                                0.2s
------
 > [2/2] RUN npm install:
#6 0.206 /bin/sh: npm: not found
------
executor failed running [/bin/sh -c npm install]: exit code: 127
➜  01_simpleweb git:(main) ✗
```

Here we are getting npm not fount error. Because our base image “alpine” file system does not have npm installed.



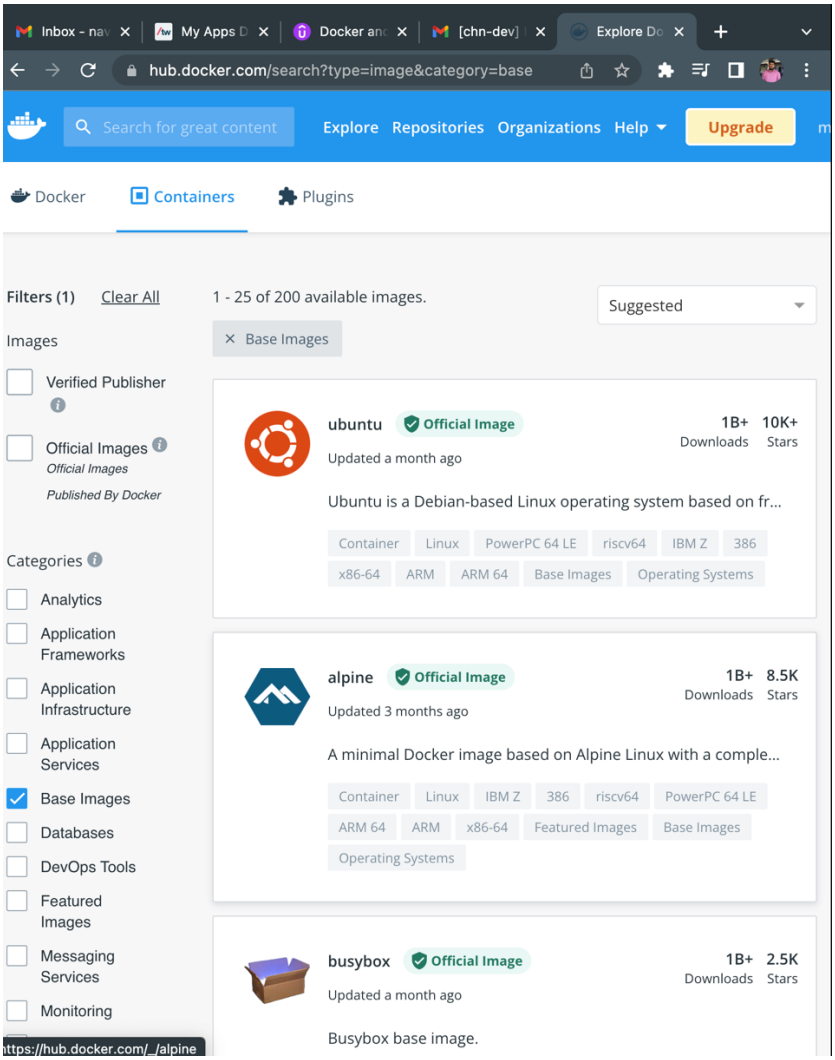
To solve this issue, we have two options. That is,

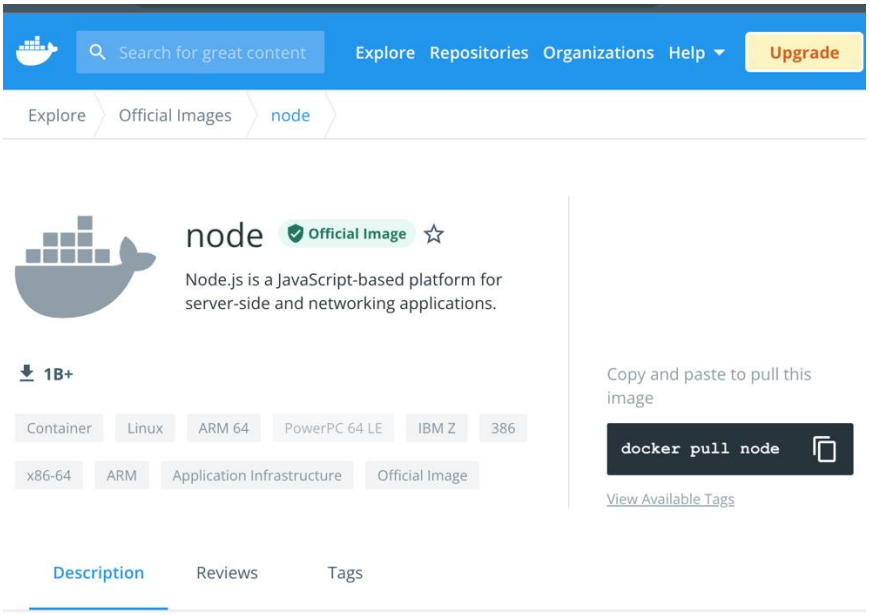
1. Find a different base image where npm pre-installed.
2. We can continue keeping “alpine” base image, install npm as dependency.

For this example, we are going with first option. For that, we need to find a base image which have a npm pre-installed.

Exploring Public Images from Docker Hub

https://hub.docker.com/search?type=image





Versions available for node image

Supported tags and respective `Dockerfile` links

- `17-alpine3.14`, `17.6-alpine3.14`, `17.6.0-alpine3.14`, `alpine3.14`, `current-alpine3.14`
- `17-alpine`, `17-alpine3.15`, `17.6-alpine`, `17.6-alpine3.15`, `17.6.0-alpine`, `17.6.0-alpine3.15`, `alpine`, `alpine3.15`, `current-alpine`, `current-alpine3.15`
- `17`, `17-bullseye`, `17.6`, `17.6-bullseye`, `17.6.0`, `17.6.0-bullseye`, `bullseye`, `current`, `current-bullseye`, `latest`
- `17-bullseye-slim`, `17-slim`, `17.6-bullseye-slim`, `17.6-slim`, `17.6.0-bullseye-slim`, `17.6.0-slim`, `bullseye-slim`, `current-bullseye-slim`, `current-slim`, `slim`
- `17-buster`, `17.6-buster`, `17.6.0-buster`, `buster`, `current-buster`
- `17-buster-slim`, `17.6-buster-slim`, `17.6.0-buster-slim`, `buster-slim`, `current-buster-slim`
- `17-stretch`, `17.6-stretch`, `17.6.0-stretch`, `current-stretch`, `stretch`

Example of Defining Version Along with Image

```
# Specify a base image
FROM node:alpine

# Install some depenendencies
RUN npm install

# Default command
CMD ["npm", "start"]
```

Updating the Dockerfile

```
01_simpleweb > Dockerfile > ...
1   #Specify a base image
2   FROM node:alpine
3
4   #Install some dependencies
5   RUN npm install
6
7   #Default command
8   CMD ["npm","start"]
```

Building Dockerfile Again

```
[+] Building 26.3s (6/6) FINISHED
 => [internal] load build definition from Dockerfile                0.0s
 => => transferring dockerfile: 162B                                0.0s
 => [internal] load .dockerignore                                   0.0s
 => => transferring context: 2B                                     0.0s
 => [internal] load metadata for docker.io/library/node:alpine      4.7s
 => [auth] library/node:pull token for registry-1.docker.io         0.0s
 => [1/2] FROM docker.io/library/node:alpine@sha256:250e9a093b86   20.5s
 => => resolve docker.io/library/node:alpine@sha256:250e9a093b861   0.0s
 => => sha256:e4e269ec1fe432faa79436b86ac6a194f9bc19d 449B / 449B   1.4s
 => => sha256:250e9a093b861c330be2f4d1d224712d4e4 1.43kB / 1.43kB   0.0s
 => => sha256:13961fc7673e7a62de914c5978336408703 1.16kB / 1.16kB   0.0s
 => => sha256:eb56d56623e54e8819e79c9ee3c5cd5d4db 6.53kB / 6.53kB   0.0s
 => => sha256:13f72b2a902f68ec36db45f4738973f7 45.84MB / 45.84MB   17.9s
 => => sha256:3bd6b5da901231b85e31594a95a26439b24 2.34MB / 2.34MB   3.0s
 => => extracting sha256:13f72b2a902f68ec36db45f4738973f76e70a2e5   2.2s
 => => extracting sha256:3bd6b5da901231b85e31594a95a26439b2466fa0   0.1s
 => => extracting sha256:e4e269ec1fe432faa79436b86ac6a194f9bc19d6   0.0s
 => ERROR [2/2] RUN npm install                                     1.0s
------
 > [2/2] RUN npm install:
#6 0.808 npm ERR! Tracker "idealTree" already exists
#6 0.810
#6 0.810 npm ERR! A complete log of this run can be found in:
#6 0.811 npm ERR!     /root/.npm/_logs/2022-03-03T08_04_31_026Z-debug-0.
log
------
executor failed running [/bin/sh -c npm install]: exit code: 1
```

To solve this error,

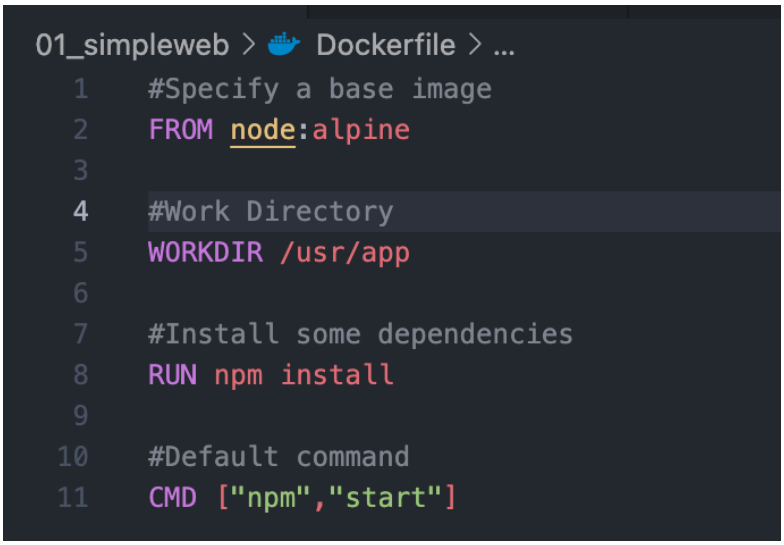
npm ERR! idealTree already exists

To resolve this, add a WORKDIR right after the FROM instruction: (we will be adding this very soon anyway)

```
FROM node:alpine

WORKDIR /usr/app
```

Also, you will no longer get the error regarding the missing

Updating the Dockerfile,

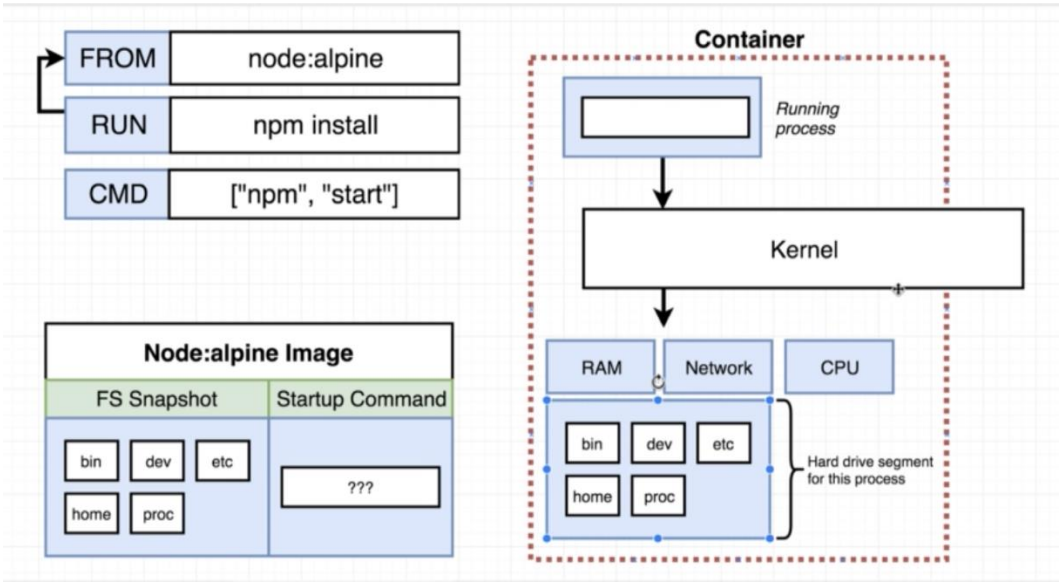


Running a docker build again,

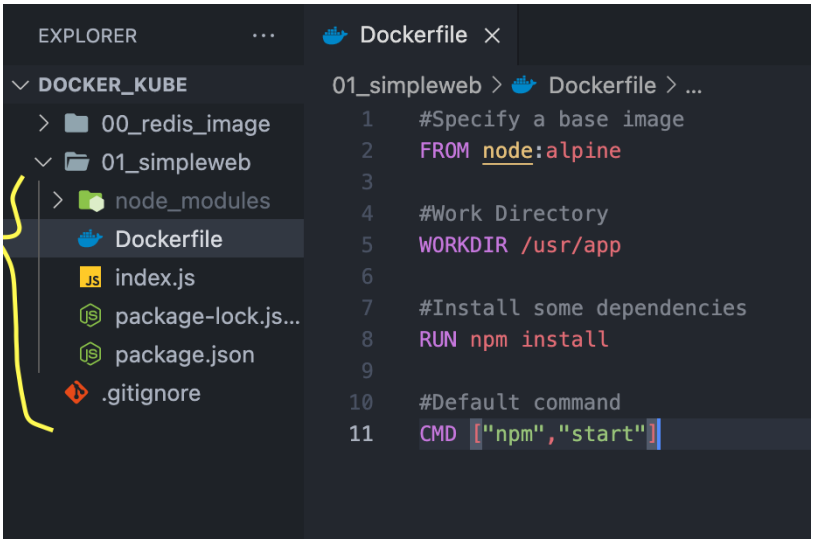
```
→  01_simpleweb git:(main) ✗ docker build .
[+] Building 5.4s (7/7) FINISHED
 => [internal] load build definition from Dockerfile               0.0s
 => => transferring dockerfile: 198B                               0.0s
 => [internal] load .dockerignore                                  0.0s
 => => transferring context: 2B                                    0.0s
 => [internal] load metadata for docker.io/library/node:alpine     4.5s
 => [auth] library/node:pull token for registry-1.docker.io        0.0s
 => CACHED [1/3] FROM docker.io/library/node:alpine@sha256:250e9a  0.0s
 => [2/3] WORKDIR /usr/app                                         0.0s
 => ERROR [3/3] RUN npm install                                    0.8s
------
 > [3/3] RUN npm install:
#7 0.799 npm ERR! code ENOENT
#7 0.800 npm ERR! syscall open
#7 0.800 npm ERR! path /usr/app/package.json
#7 0.801 npm ERR! errno -2
#7 0.803 npm ERR! enoent ENOENT: no such file or directory, open '/usr/a
pp/package.json'
#7 0.803 npm ERR! enoent This is related to npm not being able to find a
 file.
#7 0.804 npm ERR! enoent
#7 0.805
#7 0.805 npm ERR! A complete log of this run can be found in:
#7 0.805 npm ERR!     /root/.npm/_logs/2022-03-03T08_09_51_956Z-debug-0.
log
------
executor failed running [/bin/sh -c npm install]: exit code: 254
→  01_simpleweb git:(main) ✗
```

Why “no such file or directory, open '/usr/app/package.json'” ?

Because there is no, package.json file inside the container file system. We are using only the segment of the hard drive where container filesystem lies in. We are still have the rest of the hard drive part where package.json exist. So container is not communicating with rest of the hard drive part.

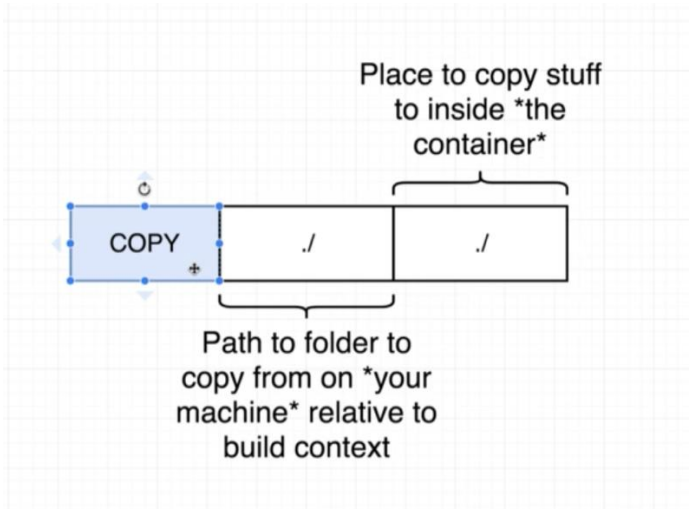


Our project files won’t come into container by default. We need to explicitly specify in Dockerfile.



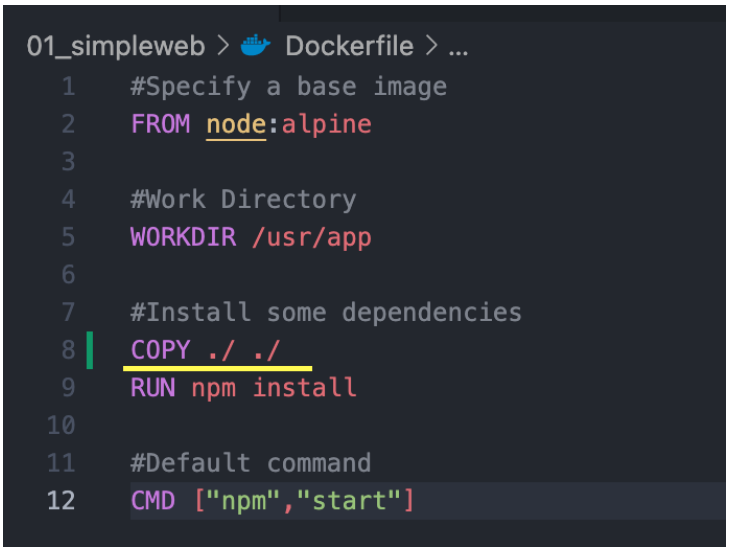
Copying Build Files

Explanations



./ is a build context.

Updating the docker file



Building the Docker Image

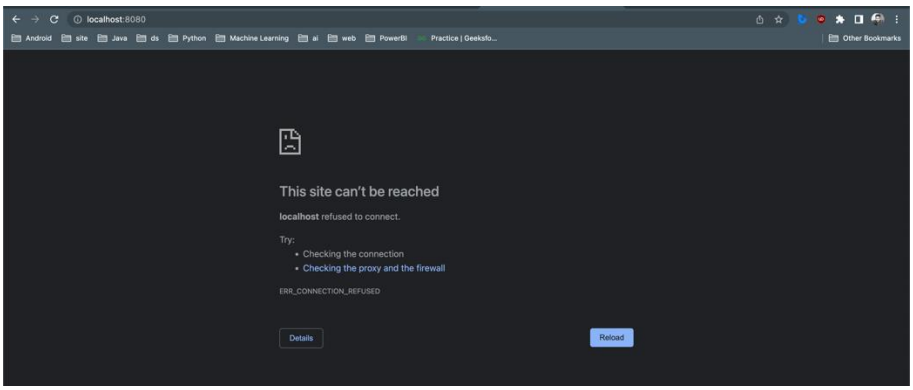
```
➜  01_simpleweb git:(main) ✗ docker build .
[+] Building 6.7s (10/10) FINISHED
 => [internal] load build definition from Dockerfile           0.0s
 => => transferring dockerfile: 209B                           0.0s
 => [internal] load .dockerignore                              0.0s
 => => transferring context: 2B                                0.0s
 => [internal] load metadata for docker.io/library/node:alpine  4.2s
 => [auth] library/node:pull token for registry-1.docker.io    0.0s
 => [1/4] FROM docker.io/library/node:alpine@sha256:250e9a093b  0.0s
 => [internal] load build context                              0.1s
 => => transferring context: 1.76MB                            0.1s
 => CACHED [2/4] WORKDIR /usr/app                              0.0s
 => [3/4] COPY ./ ./                                           0.0s
 => [4/4] RUN npm install                                      2.1s
 => exporting to image                                         0.1s
 => => exporting layers                                        0.1s
 => => writing image sha256:f95c2b702af5a79c1f0648f4a4421d9a9f  0.0s

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to f
ix them
➜  01_simpleweb git:(main) ✗
```

Building Docker Image with Tagging an Image Name

```
➜  01_simpleweb git:(main) ✗ docker build -t mnaveensmn/simpleweb .
[+] Building 1.5s (9/9) FINISHED
 => [internal] load build definition from Dockerfile                                0.0s
 => => transferring dockerfile: 37B                                                 0.0s
 => [internal] load .dockerignore                                                   0.0s
 => => transferring context: 2B                                                     0.0s
 => [internal] load metadata for docker.io/library/node:alpine                      1.3s
 => [internal] load build context                                                   0.0s
 => => transferring context: 20.96kB                                                0.0s
 => [1/4] FROM docker.io/library/node:alpine@sha256:250e9a093b861c330be2f4d1d224712d4e  0.0s
 => CACHED [2/4] WORKDIR /usr/app                                                   0.0s
 => CACHED [3/4] COPY ./ ./                                                         0.0s
 => CACHED [4/4] RUN npm install                                                    0.0s
 => exporting to image                                                              0.0s
 => => exporting layers                                                             0.0s
 => => writing image sha256:f95c2b702af5a79c1f0648f4a4421d9a9fa08a0b31cc437d2ee5f282fd  0.0s
 => => naming to docker.io/mnaveensmn/simpleweb                                     0.0s

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to f
ix them
➜  01_simpleweb git:(main) ✗
```

Running a Docker Image

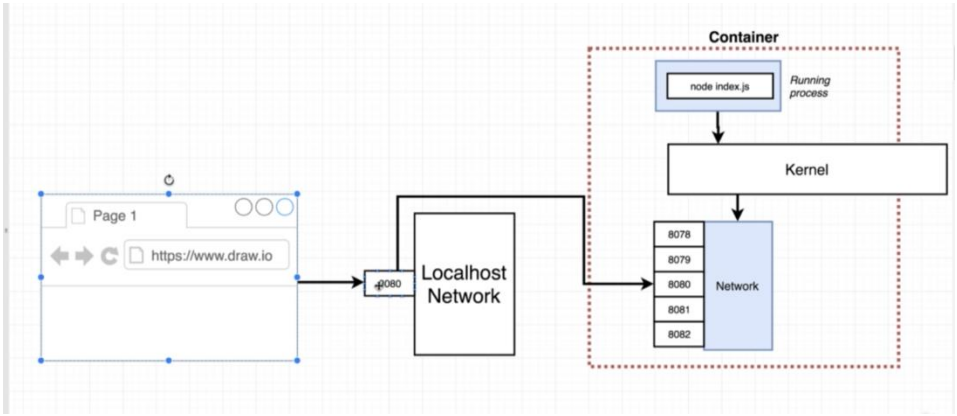
```
➜  01_simpleweb git:(main) ✗ docker run mnaveensmn/simpleweb

> start
> node index.js

Listing on port 8080
```



But localhost:8080 is not running.

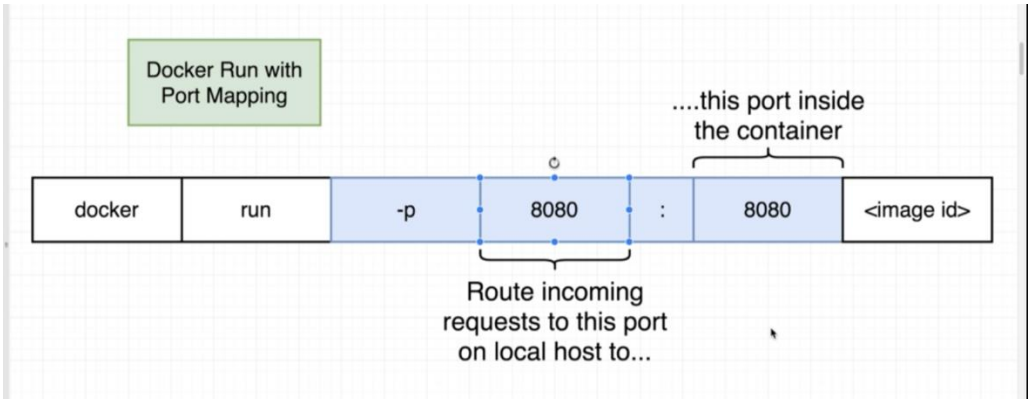
Container Port Mapping

Why we cannot be able to access the API?



Because container having an own isolated set of network ports. When we access the network in our machine, network traffic is not routed to container network port by default. We need to explicitly specify the mapping between machine port to container network port.

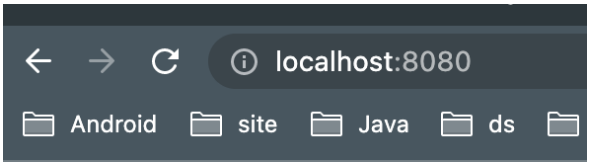
Port Mapping Command



Port on localhost and port inside the container does not have to be the same. It can be different.
If we are changing the port inside the container, we need to make sure our app listen to the port.

Running the Command

```
→  01_simpleweb git:(main) ✗ docker run -p 8080:8080 mnaveensmn/simpl
eweb

> start
> node index.js

Listing on port 8080
```



Hi There

Specifying the Working Directory

Opening the Shell Inside Container

```
→  01_simpleweb git:(main) ✗ docker run -it mnaveensmn/simpleweb sh
/usr/app # ls
Dockerfile          node_modules        package.json
index.js            package-lock.json
/usr/app #
```

If we don't specify the working directory, all the files will be pasted into root directory of the container like below,

```
/ # ls
Dockerfile          mnt                 sbin
bin                 node_modules        srv
dev                 opt                 sys
etc                 package-lock.json   tmp
home                package.json        usr
index.js            proc                var
lib                 root
media               run
/ #
```

Since specified the working directory, all the project files are pasted in /usr/app folder inside the container.

Specifying the Working Directory in Dockerfile

```
_simpleweb > Dockerfile > ...
1   #Specify a base image
2   FROM node:alpine
3
4   #Work Directory
5   WORKDIR /usr/app
6
7   #Install some dependencies
8   COPY ./ ./
9   RUN npm install
10
11  #Default command
12  CMD ["npm","start"]
```

```
→  DOCKER_KUBE git:(main) ✗ docker ps
CONTAINER ID   IMAGE                  COMMAND
 CREATED          STATUS          PORTS     NAMES
836d19f7a5c1   mnaveensmn/simpleweb   "docker-entrypoint.s…"
 22 minutes ago   Up 22 minutes             vigorous_wilson
→  DOCKER_KUBE git:(main) ✗ docker exec -it 836d19f7a5c1 sh
/usr/app # ls
Dockerfile         node_modules       package.json
index.js           package-lock.json
/usr/app # cd ..
/usr # s
sh: s: not found
/usr # ls
app    bin    lib    local  sbin   share
/usr # cd ..
/ # ls
bin    home   mnt    root   srv    usr
dev    lib    opt    run    sys    var
etc    media  proc   sbin   tmp
/ # 
```

Unnecessary Rebuilds

What happens we change the project files?

- If we are modifying the project file while container running, our changes won't reflect.
- To make the changes reflect, we need to rebuild the image.
- Example, if changed one of the project files, then we are rebuilding the image, docker also executes instructions which does not required for the changes to be reflected along with required instruction.
- We need to find a way to solve this problem.

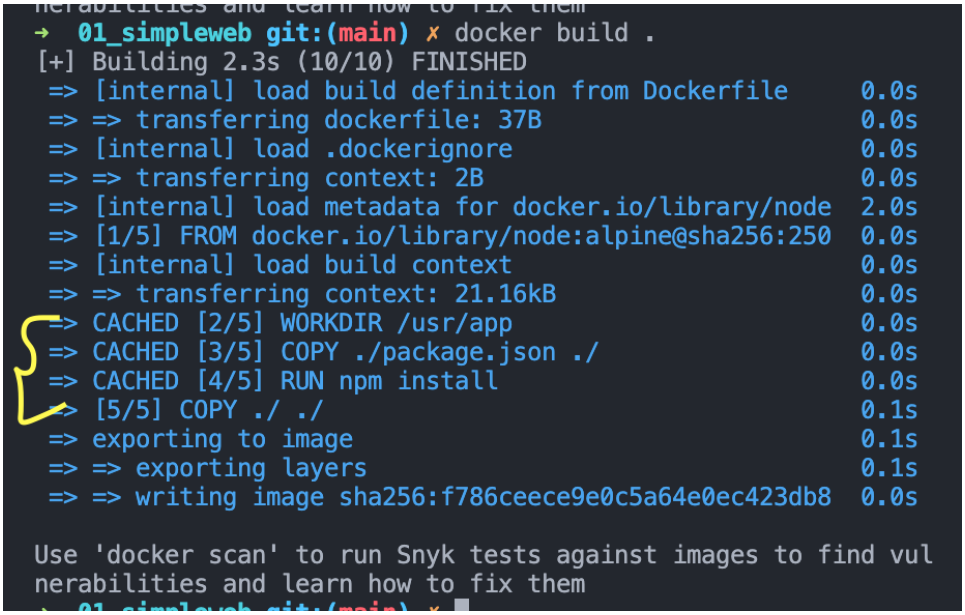
Controlling unnecessary rebuild

01_simpleweb > Dockerfile > ...

```
1   #Specify a base image
2   FROM node:alpine
3
4   #Work Directory
5   WORKDIR /usr/app
6
7   #Install some dependencies
8   COPY ./package.json ./
9   RUN npm install
10  COPY ./ ./
11
12  #Default command
13  CMD ["npm","start"]
```

By specifying the COPY command for package.json, we will be running the npm install only when above instruction files get changed, in other word, package.json get changed. "npm install" won't get executed if we changed any other files.

After doing the changes, when we want to rebuild the image, as highlighted in the image, docker using it from the cache.

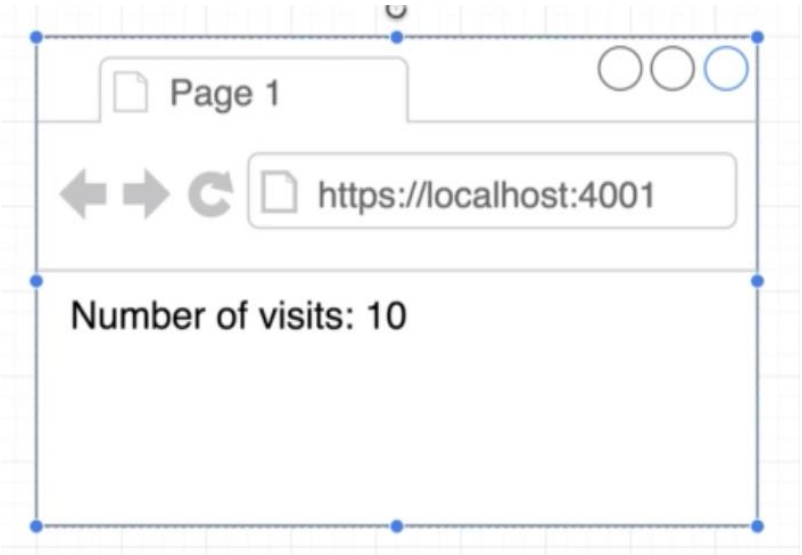


It’s best practice to segment out the COPY operation.

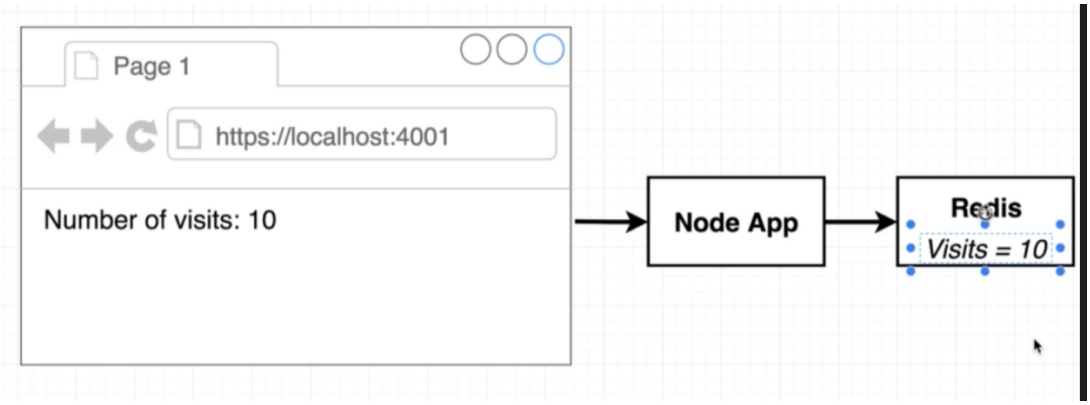
Docker Compose with Multiple Local Container

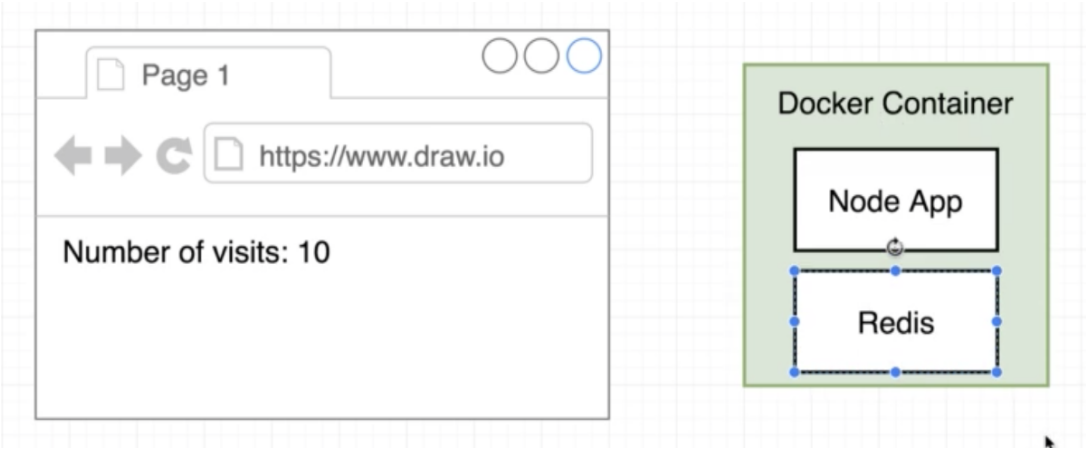
App Overview

Overview



Architecture

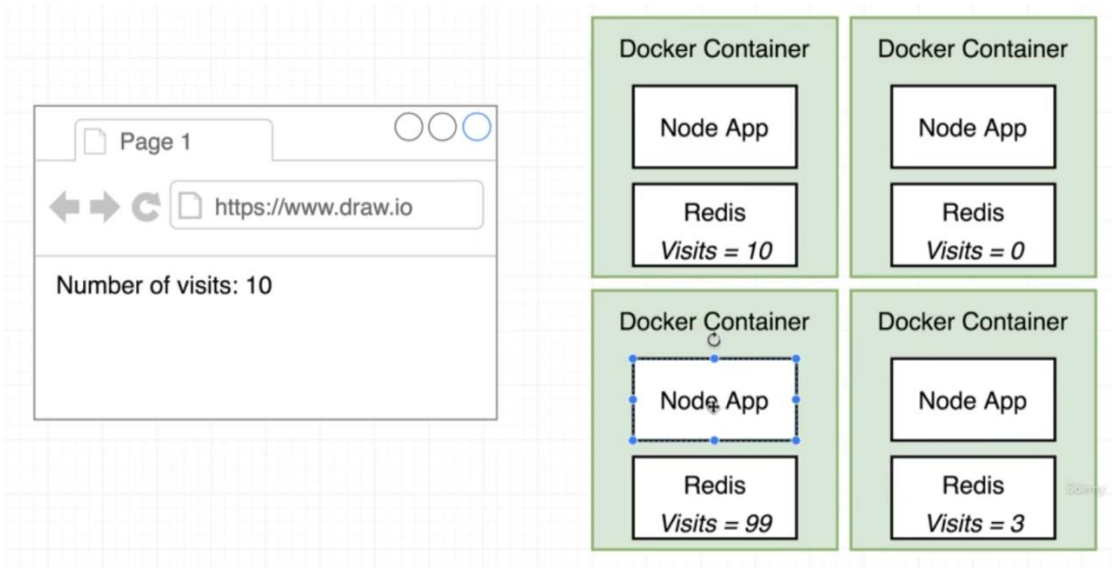




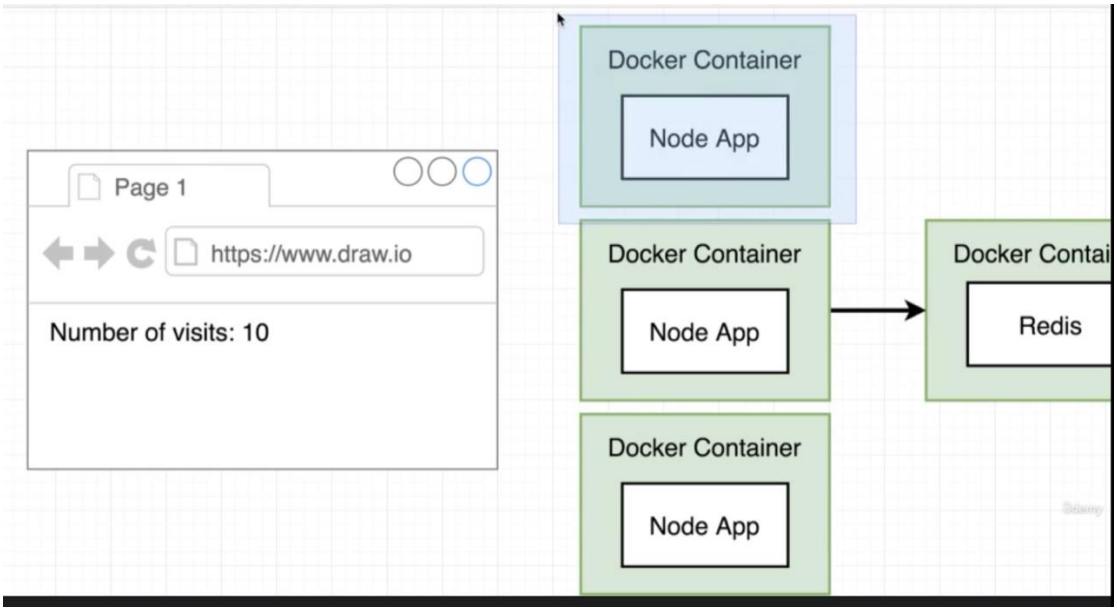
We can keep the Node App and Redis in single container.

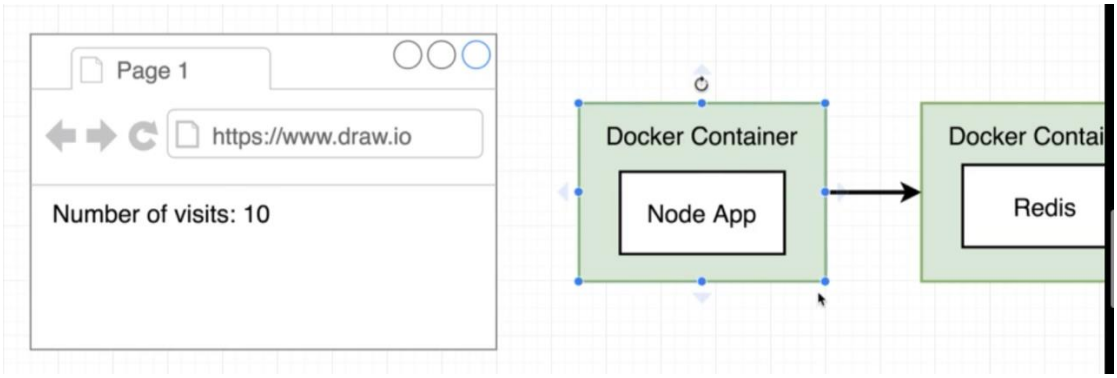
Problem with single container approach

When traffic of our webpage increase, we will be creating multiple docker container instances. So, each docker container having it's ow redis server and disconnected from each other. Because of this, each container having its own visit count instead of having a cumulative one.



Sperate container for redis





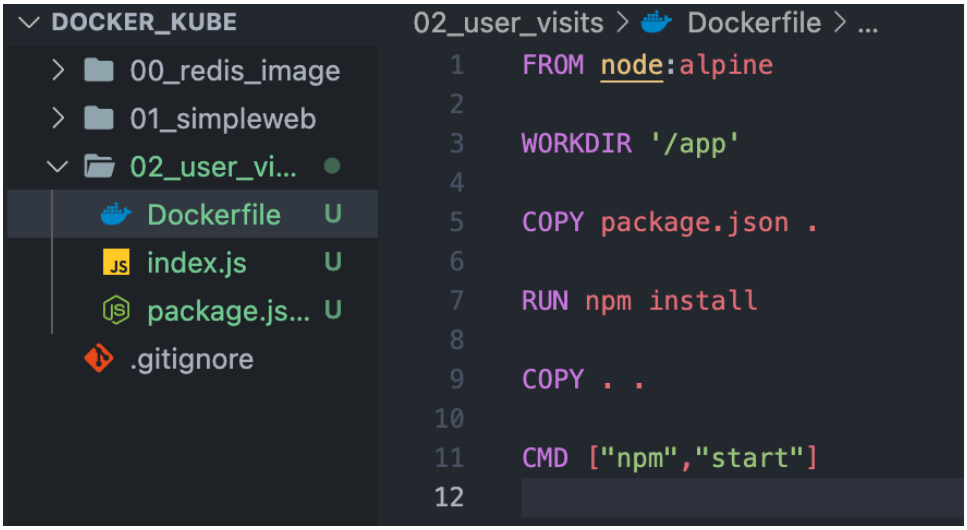
Now, we are having a single docker container for redis and container for node app is connected to it. When the network traffic increase, we will be creating a instances of only node app container and still all the instance is connected single redis container.

App Server Started Code

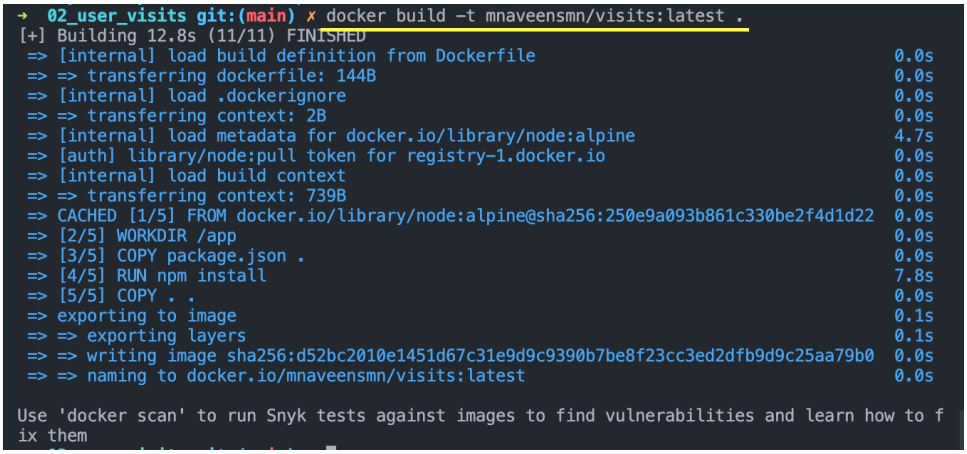
Code

Assembling a Docker File

Creating a docker file

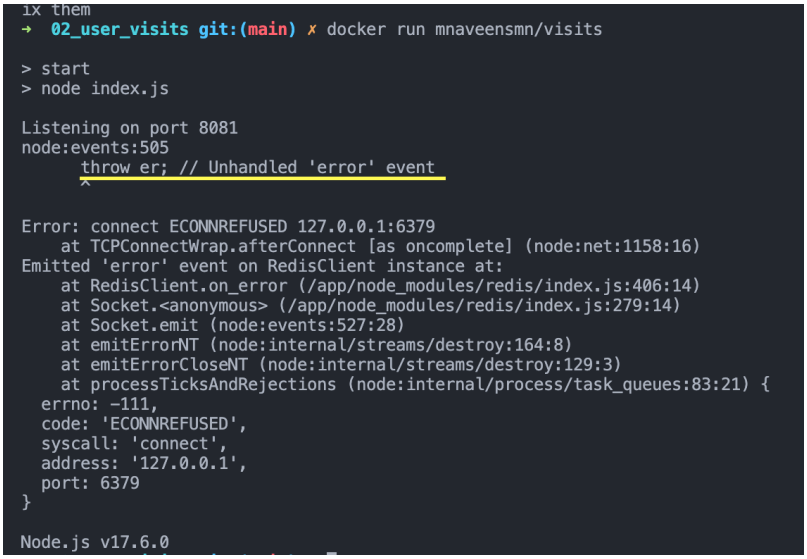


Building an image



Introducing a Docker Compose

Running a docker image



Error due to there is no redis running in the container.

Starting the redis server

```
→  DOCKER_KUBE git:(main) ✗ docker run redis
1:C 07 Mar 2022 04:03:38.487 # oO0OoO0OoO0Oo Redis is starting oO0OoO0OoO0Oo
1:C 07 Mar 2022 04:03:38.487 # Redis version=6.2.6, bits=64, commit=00000000, modified
=0, pid=1, just started
1:C 07 Mar 2022 04:03:38.487 # Warning: no config file specified, using the default co
nfig. In order to specify a config file use redis-server /path/to/redis.conf
1:M 07 Mar 2022 04:03:38.488 * monotonic clock: POSIX clock_gettime
1:M 07 Mar 2022 04:03:38.489 * Running mode=standalone, port=6379.
1:M 07 Mar 2022 04:03:38.489 # Server initialized
1:M 07 Mar 2022 04:03:38.490 * Ready to accept connections
```

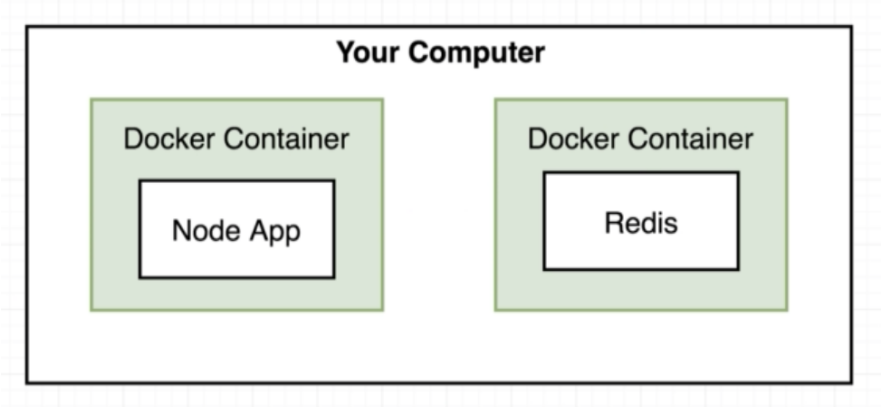
We just started the redis server.

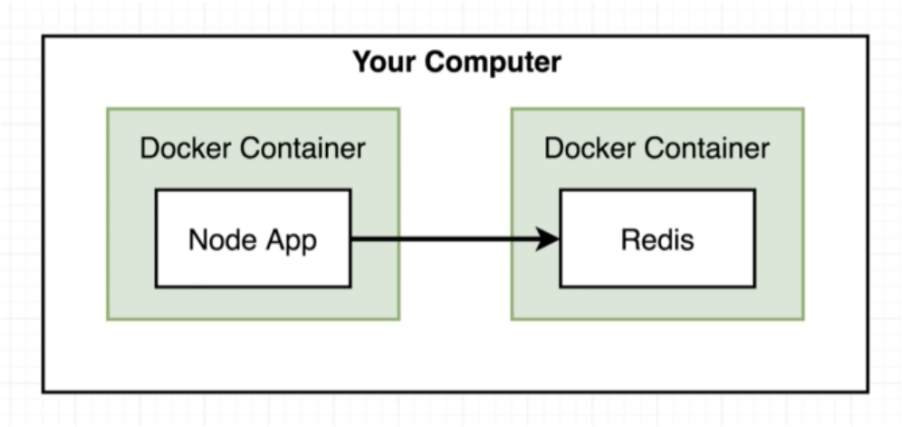
```
→  02_user_visits git:(main) ✗ docker run mnaveensmn/visits

> start
> node index.js

Listening on port 8081
node:events:505
      throw er; // Unhandled 'error' event
      ^

Error: connect ECONNREFUSED 127.0.0.1:6379
    at TCPConnectWrap.afterConnect [as oncomplete] (node:net:1158:16)
Emitted 'error' event on RedisClient instance at:
    at RedisClient.on_error (/app/node_modules/redis/index.js:406:14)
    at Socket.<anonymous> (/app/node_modules/redis/index.js:279:14)
    at Socket.emit (node:events:527:28)
    at emitErrorNT (node:internal/streams/destroy:164:8)
    at emitErrorCloseNT (node:internal/streams/destroy:129:3)
    at processTicksAndRejections (node:internal/process/task_queues:83:21) {
  errno: -111,
  code: 'ECONNREFUSED',
  syscall: 'connect',
  address: '127.0.0.1',
  port: 6379
}

Node.js v17.6.0
```

Even though we have a redis server running our app still fails.

Analyzing the issue

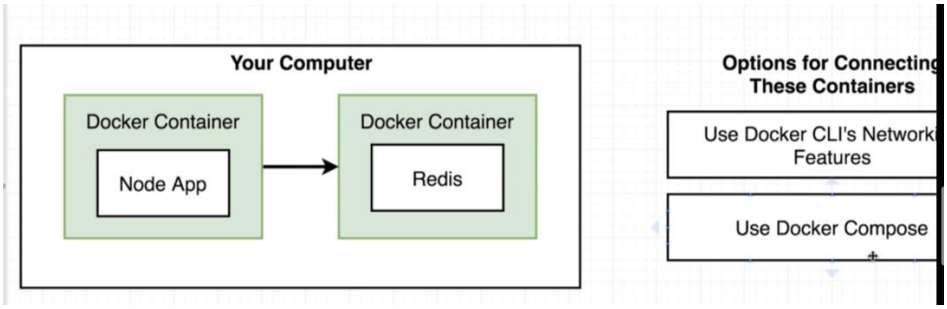
Node and redis server are running in separate container and not connected each other.





We need to find a way to establish the networking infrastructure between these two containers.

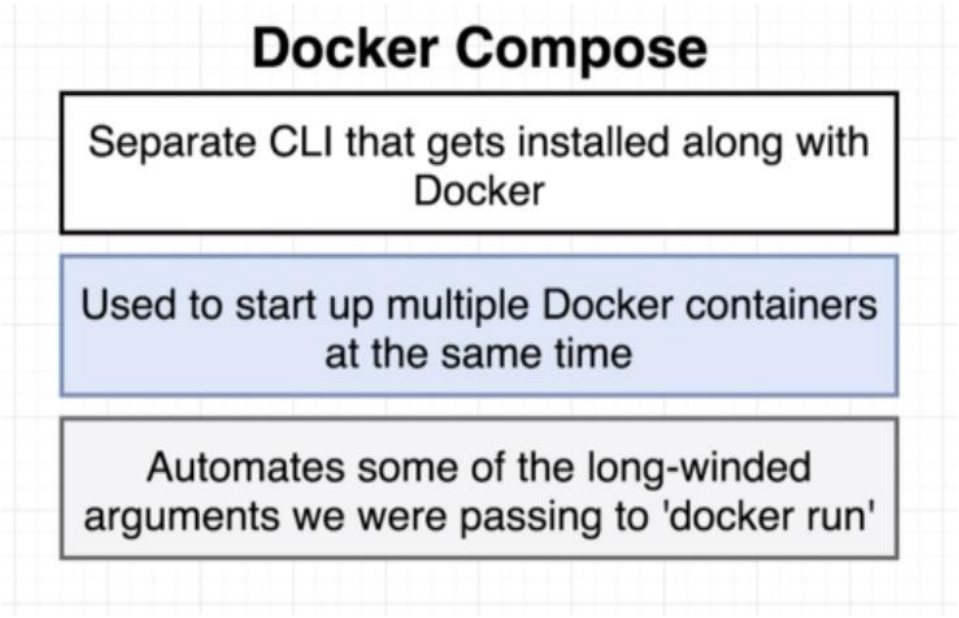
Options for establishing the network infrastructure



We have two options to look at.

Establishing the network infrastructure using Docker CLI's network feature required to do a hand full of job every time when start the docker cli.

Docker Compose

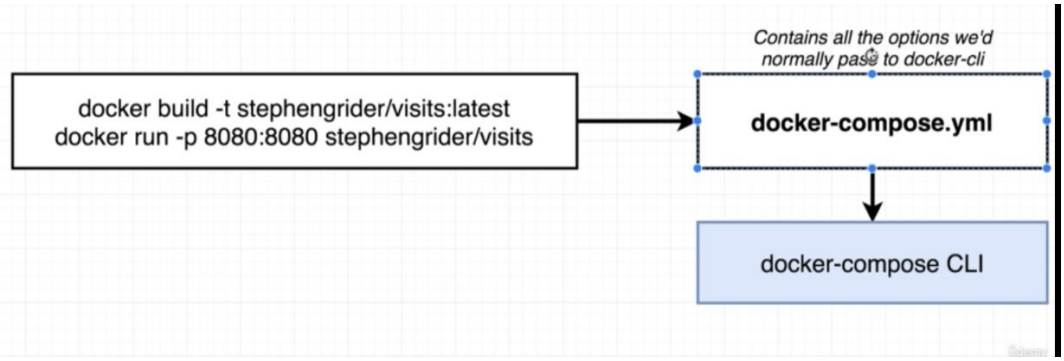


```
→  02_user_visits git:(main) ✗ docker-compose

Usage:  docker compose [OPTIONS] COMMAND

Docker Compose

Options:
      --ansi string                Control when to print ANSI control
                                   characters ("never"|"always"|"auto")
                                   (default "auto")
      --compatibility              Run compose in backward compatibility mode
      --env-file string            Specify an alternate environment file.
  -f, --file stringArray           Compose configuration files
      --profile stringArray        Specify a profile to enable
      --project-directory string   Specify an alternate working directory
                                   (default: the path of the Compose file)
  -p, --project-name string        Project name

Commands:
  build       Build or rebuild services
  convert     Converts the compose file to platform's canonical format
  cp          Copy files/folders between a service container and the local filesystem
  create      Creates containers for a service.
  down        Stop and remove containers, networks
  events      Receive real time events from containers.
  exec        Execute a command in a running container.
  images      List images used by the created containers
  kill        Force stop service containers.
  logs        View output from containers
  ls          List running compose projects
  pause       Pause services
  port        Print the public port for a port binding.
  ps          List containers
```

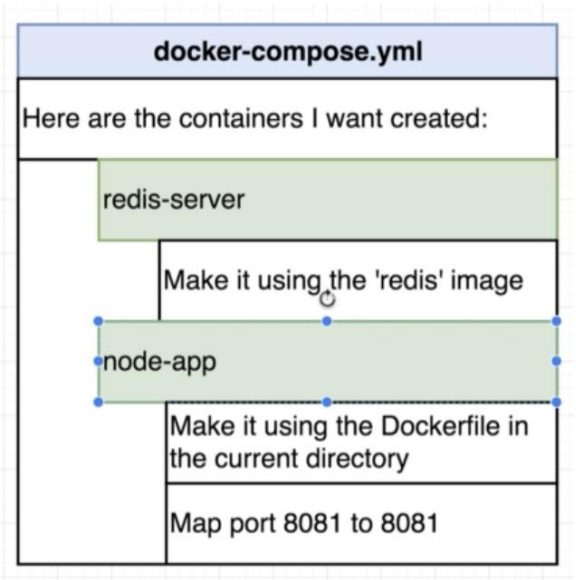
Docker compose avoids running the repetitive commands.

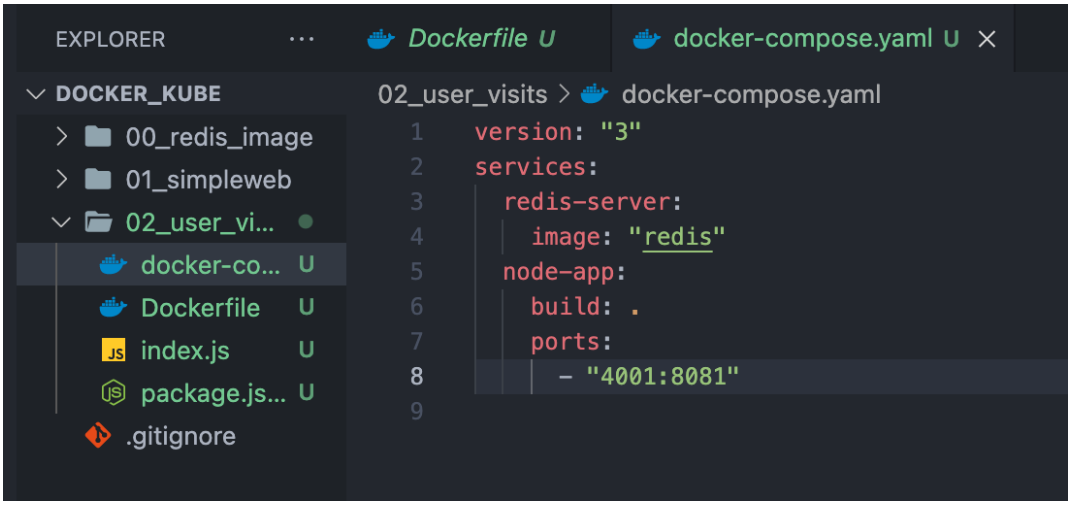
Docker Compose File

What is YAML File



Creating a YAML File

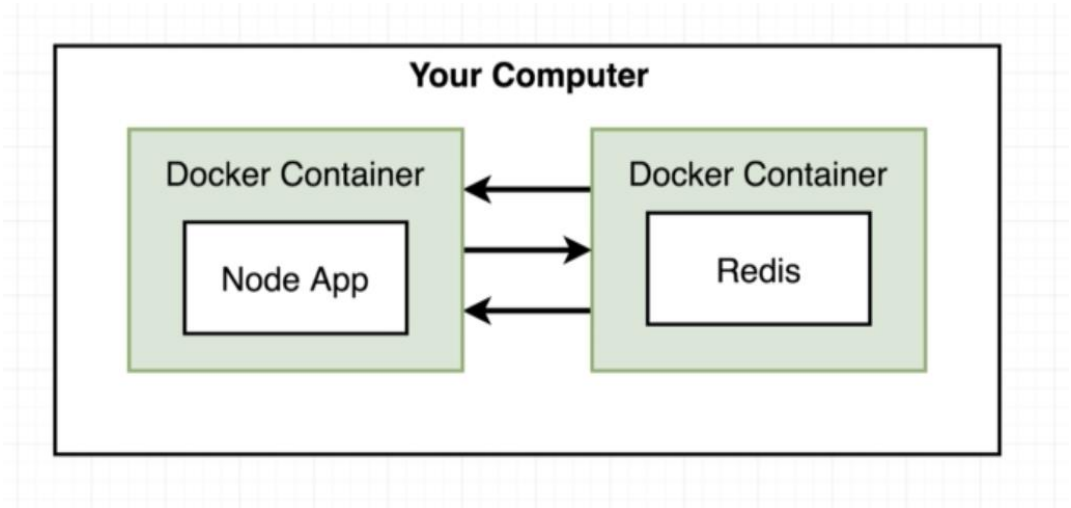




In the first service, we are using the image from docker hub. In the second service, we are building the image from Dockerfile.

Networking with Docker Compose

With the docker compose containers are free to share data with each other.



Establishing connection

Now, we have a docker container for Node App and Redis running, it's a time to establish the connection between Node App and Redis.

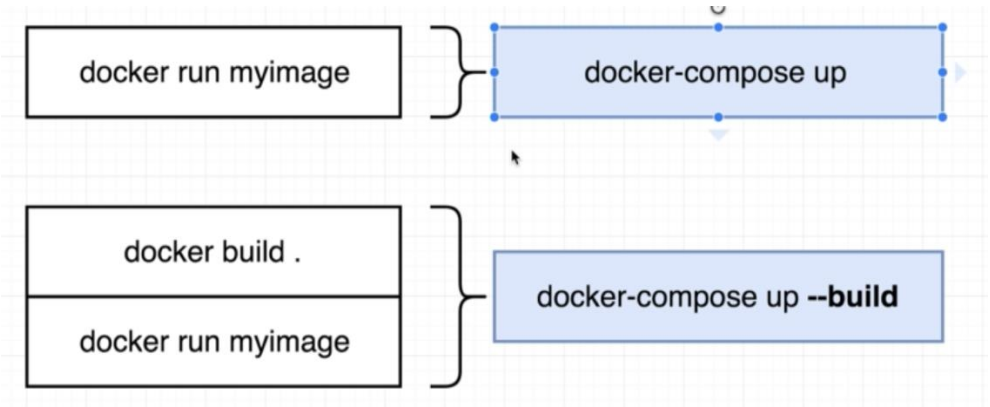
To establishing the connection between redis server and node app by specifying the redis service name (from the docker compose yaml file) and port while creating the redis client at the node app.

```
const express = require("express");
const redis = require("redis");

const app = express();
const client = redis.createClient({
  host: "redis-server",
  port: 6379,
});
client.set("visits", 0);

app.get("/", (req, res) => {
  client.get("visits", (err, visits) => {
    res.send("Number of visits is " + visits);
    client.set("visits", parseInt(visits) + 1);
  });
});

app.listen(8081, () => {
  console.log("Listening on port 8081");
});
```

Docker Compose Commands

One of the purposes of docker compose is to make easier to run the docker commands.

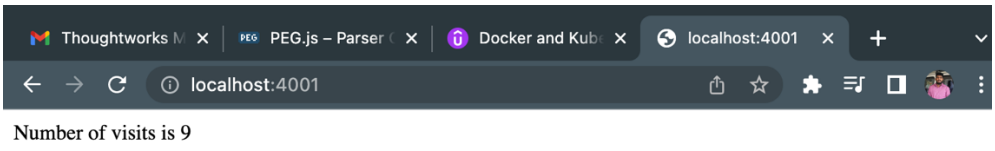
Commands



Execution

```
docker-compose.yaml  package.json
➜  02_user_visits git:(main) docker-compose up
[+] Building 4.2s (11/11) FINISHED
 => [internal] load build definition from Dockerfile     0.0s
 => => transferring dockerfile: 139B                     0.0s
 => [internal] load .dockerignore                        0.0s
 => => transferring context: 2B                          0.0s
 => [internal] load metadata for docker.io/library/node  4.0s
 => [auth] library/node:pull token for registry-1.docke  0.0s
 => [internal] load build context                        0.0s
 => => transferring context: 942B                        0.0s
 => [1/5] FROM docker.io/library/node:alpine@sha256:250  0.0s
 => CACHED [2/5] WORKDIR /app                            0.0s
 => CACHED [3/5] COPY package.json .                     0.0s
 => CACHED [4/5] RUN npm install                         0.0s
 => [5/5] COPY . .                                       0.0s
 => exporting to image                                   0.0s
 => => exporting layers                                  0.0s
 => => writing image sha256:5fb572190352a673b3f67911f75  0.0s
 => => naming to docker.io/library/02_user_visits_node-  0.0s

Use 'docker scan' to run Snyk tests against images to find vul
nerabilities and learn how to fix them
[+] Running 3/3
 ⠿ Network 02_user_visits_default           Created      0.0s
 ⠿ Container 02_user_visits-node-app-1      Created      0.1s
 ⠿ Container 02_user_visits-redis-server-1  Created      0.1s
Attaching to 02_user_visits-node-app-1, 02_user_visits-redis-s
erver-1
02_user_visits-redis-server-1  | 1:C 08 Mar 2022 07:30:15.246
# oO0OoO0OoO0Oo Redis is starting oO0OoO0OoO0Oo
02_user_visits-redis-server-1  | 1:C 08 Mar 2022 07:30:15.246
# Redis version=6.2.6, bits=64, commit=00000000, modified=0, p
id=1, just started
02_user_visits-redis-server-1  | 1:C 08 Mar 2022 07:30:15.246
# Warning: no config file specified, using the default config.
 In order to specify a config file use redis-server /path/to/r
edis.conf
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 07:30:15.246
```

By using the docker compose, now two containers able to communicate.



Stopping docker compose containers

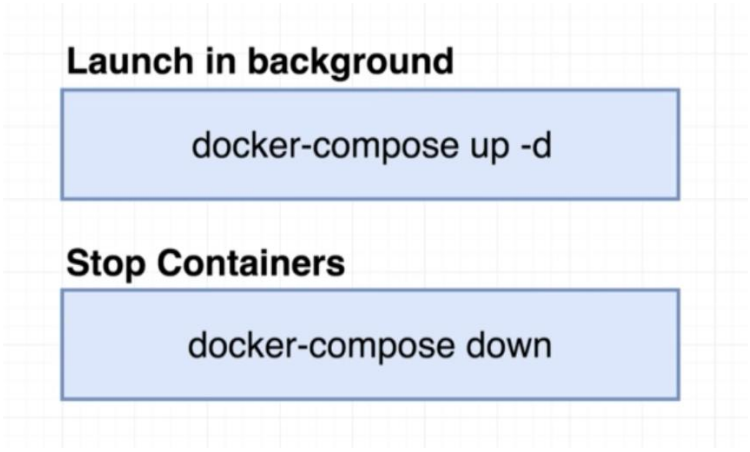
Using the docker compose we are working with multiple containers at the same time. So, we can start or stop all the containers at once.

Typical docker commands to run and stop the containers.

```
→ visits git:(066-stats) docker run -d redis
ba1220ea9edc743504aeaa5f198ae40fd7651558ab23b1746a45b1264f4c9acf
→ visits git:(066-stats) docker ps
CONTAINER ID        IMAGE               COMMAND                  CREATED
         STATUS              PORTS               NAMES
ba1220ea9edc        redis               "docker-entrypoint.s…"   13 seconds
 ago       Up 12 seconds       6379/tcp            quizzical_fermat
→ visits git:(066-stats) docker stop ba1220ea9edc
ba1220ea9edc
→ visits git:(066-stats)
```

`--cpus`	API 1.25+ Number of CPUs
`--cpuset-cpus`	CPUs in which to allow execution (0-3, 0,1)
`--cpuset-mems`	MEMs in which to allow execution (0-3, 0,1)
`--detach` , `-d`	Run container in background and print container ID
`--detach-keys`	Override the key sequence for detaching a container
`--device`	Add a host device to the container
`--device-cgroup-rule`	Add a rule to the cgroup allowed devices list

Stopping the containers




```
→ DOCKER_KUBE git:(main) docker ps
CONTAINER ID   IMAGE                      COMMAND                  CREATED          STATUS
     PORTS                    NAMES
e9fc15ac9e1e   02_user_visits_node-app   "docker-entrypoint.s…"   22 minutes ago   Up 22 minut
es   0.0.0.0:4001->8081/tcp   02_user_visits-node-app-1
ea5396be2e61   redis                      "docker-entrypoint.s…"   22 minutes ago   Up 22 minut
es   6379/tcp                 02_user_visits-redis-server-1
→ DOCKER_KUBE git:(main) docker-compose down
no configuration file provided: not found
→ DOCKER_KUBE git:(main) cd 02_user_visits
→ 02_user_visits git:(main) docker-compose down
[+] Running 3/3
 ⠿ Container 02_user_visits-redis-server-1  Removed                                0.2s
 ⠿ Container 02_user_visits-node-app-1      Rem...                                 0.7s
 ⠿ Network 02_user_visits_default           Removed                                0.1s
→ 02_user_visits git:(main) docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
→ 02_user_visits git:(main)
```

Container Maintenance with Docker Compose

What if container crash

Making the server to crash for learning purpose

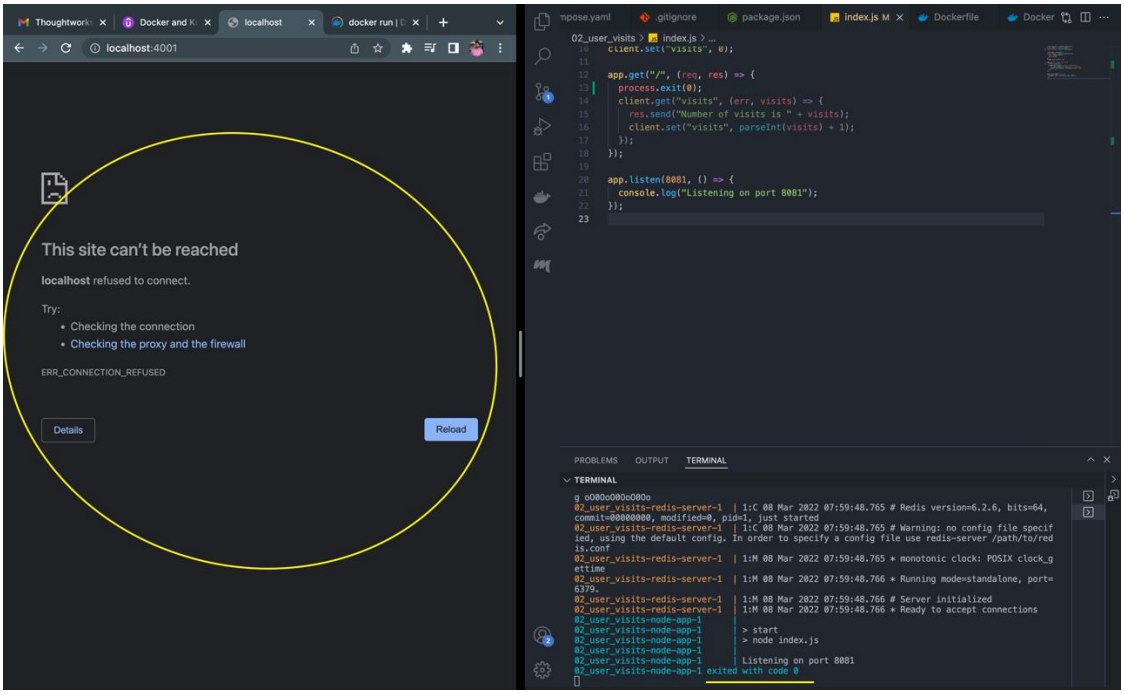
Making the changes in the code.

```
user_visits > JS index.js > app.get("/") callback
const express = require("express");
const redis = require("redis");
const process = require("process");

const app = express();
const client = redis.createClient({
  host: "redis-server",
  port: 6379,
});
client.set("visits", 0);

app.get("/", (req, res) => {
  process.exit(0);
  client.get("visits", (err, visits) => {
    res.send("Number of visits is " + visits);
    client.set("visits", parseInt(visits) + 1);
  });
});

app.listen(8081, () => {
  console.log("Listening on port 8081");
});
```

Building the image and starting the container

```
➜  02_user_visits git:(main) ✗ docker-compose up --build
[+] Building 4.0s (11/11) FINISHED
 => [internal] load build definition from Dockerfile                                0.0s
 => => transferring dockerfile: 31B                                                 0.0s
 => [internal] load .dockerignore                                                   0.0s
 => => transferring context: 2B                                                     0.0s
 => [internal] load metadata for docker.io/library/node:alpine                      3.9s
 => [auth] library/node:pull token for registry-1.docker.io                         0.0s
 => [internal] load build context                                                   0.0s
 => => transferring context: 637B                                                   0.0s
 => [1/5] FROM docker.io/library/node:alpine@sha256:250e9a093b861c330be2f4d1d224712d4e4  0.0s
 => CACHED [2/5] WORKDIR /app                                                       0.0s
 => CACHED [3/5] COPY package.json .                                                0.0s
 => CACHED [4/5] RUN npm install                                                    0.0s
 => [5/5] COPY . .                                                                  0.0s
 => exporting to image                                                              0.0s
 => => exporting layers                                                             0.0s
```

Application crashes when access the link



As we can see, only Redis container is running. Node app container got crashed.

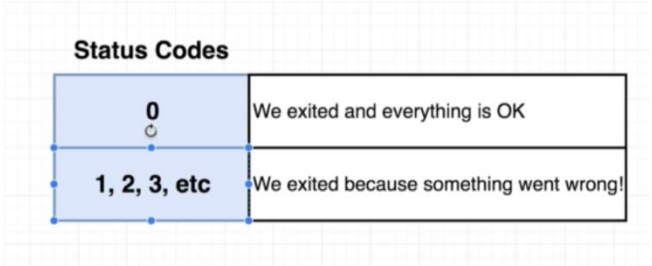
```
➜  DOCKER_KUBE git:(main) ✗ docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED         STATUS         PORTS      NA
MES
00a3e3afdf31   redis     "docker-entrypoint.s…"   5 minutes ago   Up 5 minutes   6379/tcp   02
_user_visits-redis-server-1
➜  DOCKER_KUBE git:(main) ✗
```

Automatic Container Restart

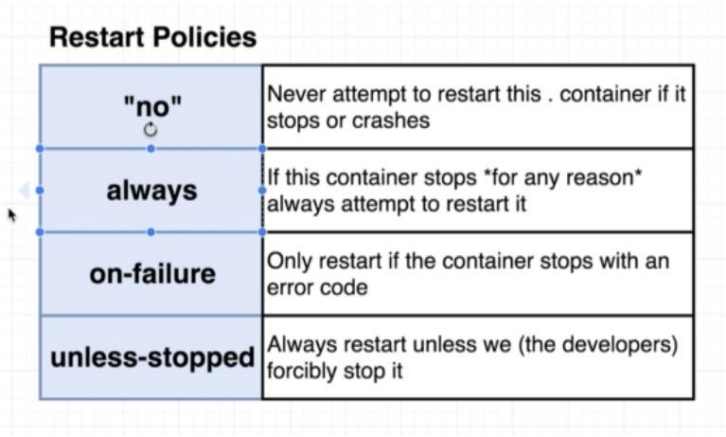
How to auto restart the container when it crashes.

Status codes

Docker can decide whether to restart or not based on the status from exit status codes.



Restart Policies



In yaml file “no” interpreted as a false. So, when specifying the “no” as a policy, we need to have a double or single quote.

Updating the docker-compose.yaml

We are specifying the restart policies for specific containers.

02_user_visits > docker-compose.yaml

```yaml
version: "3"
services:
  redis-server:
    image: "redis"
  node-app:
    restart: always
    build: .
    ports:
      - "4001:8081"
```

Running the container

```
→  02_user_visits git:(main) ✗ docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
→  02_user_visits git:(main) ✗ docker-compose up
[+] Running 3/3
 ⠿ Network 02_user_visits_default          Created                    0.0s
 ⠿ Container 02_user_visits-redis-server-1  Created                    0.1s
 ⠿ Container 02_user_visits-node-app-1      Created                    0.0s
Attaching to 02_user_visits-node-app-1, 02_user_visits-redis-server-1
02_user_visits-redis-server-1  | 1:C 08 Mar 2022 08:22:58.101 # oO0OoO0OoO0
Oo Redis is starting oO0OoO0OoO0Oo
02_user_visits-redis-server-1  | 1:C 08 Mar 2022 08:22:58.101 # Redis versi
on=6.2.6, bits=64, commit=00000000, modified=0, pid=1, just started
02_user_visits-redis-server-1  | 1:C 08 Mar 2022 08:22:58.101 # Warning: no
 config file specified, using the default config. In order to specify a con
fig file use redis-server /path/to/redis.conf
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 08:22:58.102 * monotonic c
lock: POSIX clock_gettime
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 08:22:58.103 * Running mod
e=standalone, port=6379.
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 08:22:58.103 # Server init
ialized
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 08:22:58.103 * Ready to ac
```

As we can see in the run log that, every time application exited with status code 0, it’s start the container once again.

```
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 08:22:58.103 * Ready
cept connections
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | > start
02_user_visits-node-app-1      | > node index.js
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | Listening on port 8081
02_user_visits-node-app-1 exited with code 0
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | > start
02_user_visits-node-app-1      | > node index.js
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | Listening on port 8081
02_user_visits-node-app-1 exited with code 0
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | > start
02_user_visits-node-app-1      | > node index.js
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | Listening on port 8081
02_user_visits-node-app-1 exited with code 0
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | > start
02_user_visits-node-app-1      | > node index.js
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | Listening on port 8081
```

When docker restarting the container, it is using the already created container.

Container status with Docker

Starting the container

```
→ 02_user_visits git:(main) docker-compose up
[+] Running 3/3
 ⠿ Network 02_user_visits_default           Created     0.0s
 ⠿ Container 02_user_visits-node-app-1      Created     0.0s
 ⠿ Container 02_user_visits-redis-server-1  Created     0.1s
Attaching to 02_user_visits-node-app-1, 02_user_visits-redis-server-1
02_user_visits-redis-server-1  | 1:C 08 Mar 2022 08:43:47.807 # oO0OoO0OoO0
Oo Redis is starting oO0OoO0OoO0Oo
02_user_visits-redis-server-1  | 1:C 08 Mar 2022 08:43:47.807 # Redis versi
on=6.2.6, bits=64, commit=00000000, modified=0, pid=1, just started
02_user_visits-redis-server-1  | 1:C 08 Mar 2022 08:43:47.807 # Warning: no
 config file specified, using the default config. In order to specify a con
fig file use redis-server /path/to/redis.conf
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 08:43:47.807 * monotonic c
lock: POSIX clock_gettime
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 08:43:47.808 * Running mod
e=standalone, port=6379.
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 08:43:47.808 # Server init
ialized
02_user_visits-redis-server-1  | 1:M 08 Mar 2022 08:43:47.808 * Ready to ac
cept connections
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | > start
02_user_visits-node-app-1      | > node index.js
02_user_visits-node-app-1      |
02_user_visits-node-app-1      | Listening on port 8081
```

Container status

```
→ 02_user_visits git:(main) docker-compose ps
NAME                           COMMAND                  SERVICE          STATUS
   PORTS
02_user_visits-node-app-1      "docker-entrypoint.s…"   node-app         running
   0.0.0.0:4001->8081/tcp
02_user_visits-redis-server-1  "docker-entrypoint.s…"   redis-server     running
   6379/tcp
→ 02_user_visits git:(main)
```

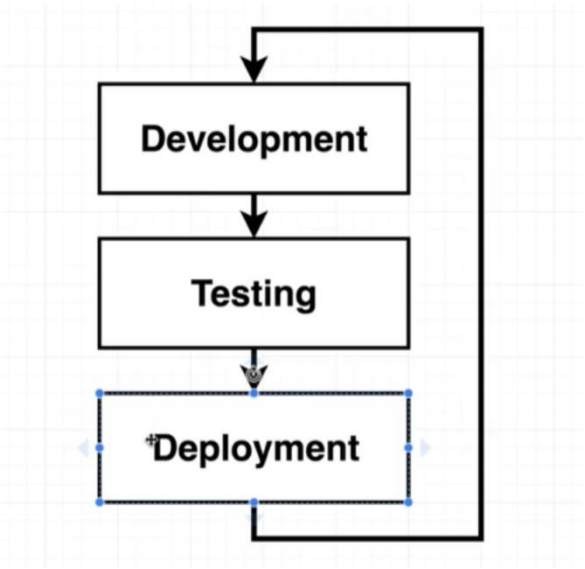
Docker-compose ps command require a yaml file. So, we cannot run this command outside the yaml file's directory.


6379/tcp
➜ 02_user_visits git:(main) cd ..
➜ DOCKER_KUBE git:(main) docker-compose ps
no configuration file provided: not found
➜ DOCKER_KUBE git:(main)

Creating a Production Grade Workflow

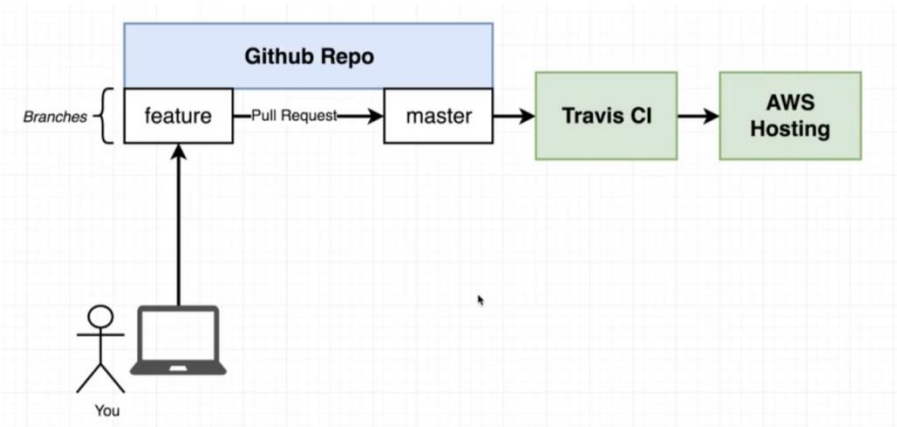
Workflow

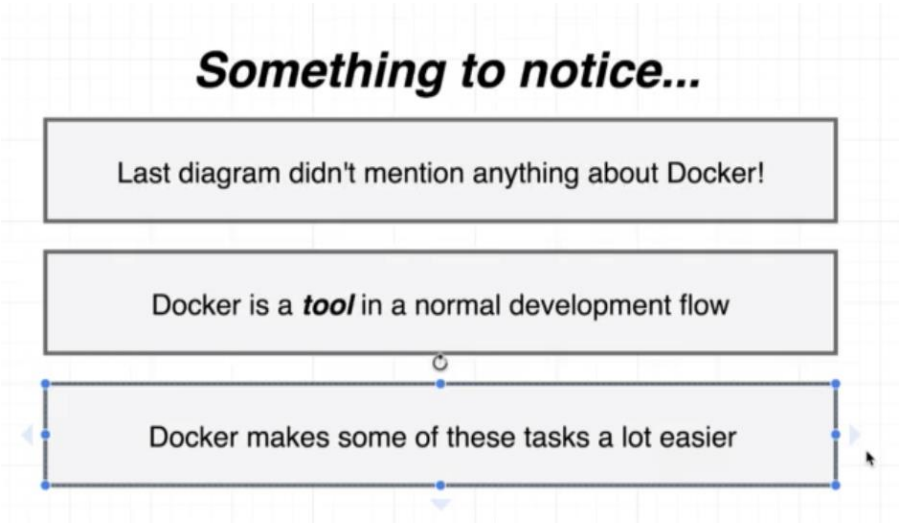
Development Workflow



As our software expands with multiple features and functionalities, we have to do multiple deployments.

Flow Specifics





Project Creation

735902

Creating react app

```
→  DOCKER_KUBE git:(main) npx create-react-app 03_frontend-react-app

Creating a new React app in /Users/naveen.kumar1/Workspace/DOCKER_KUBE/03_frontend-react-app.

Installing packages. This might take a couple of minutes.
Installing react, react-dom, and react-scripts with cra-template...

(                    ) ⠸ idealTree:03_frontend-react-app: sill idealTr
(                    ) ⠸ idealTree:03_frontend-react-app: sill idealTr
(                    ) ⠸ idealTree:03_frontend-react-app: sill idealTr
(                    ) ⠸ idealTree:babel-jest: timing idealTree:node_modules/babel-jest Comple
```

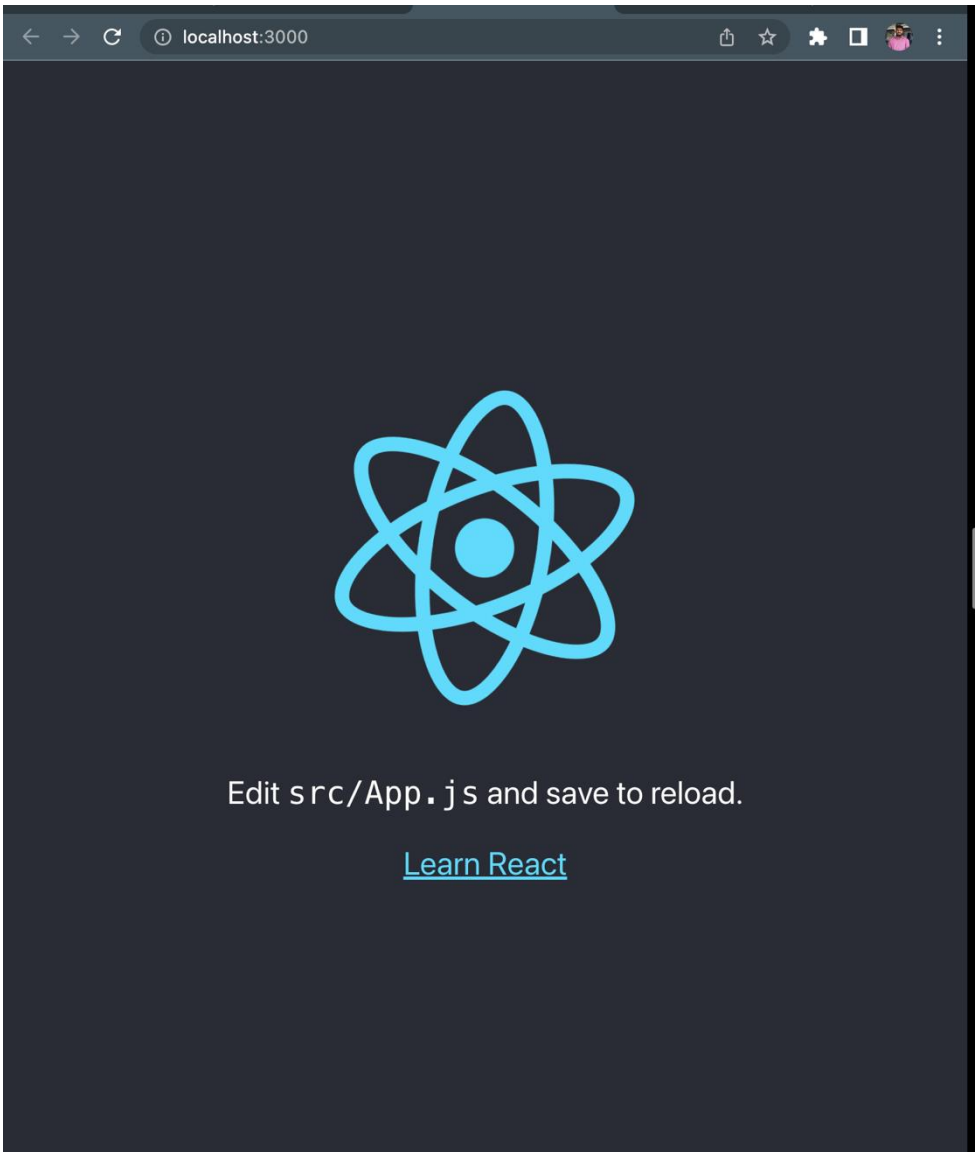
```
Success! Created 03_frontend-react-app at /Users/naveen.kumar1/Workspace/DOCKER_KUBE/03_front
end-react-app
Inside that directory, you can run several commands:

  npm start
    Starts the development server.

  npm run build
    Bundles the app into static files for production.

  npm test
    Starts the test runner.

  npm run eject
    Removes this tool and copies build dependencies, configuration files
    and scripts into the app directory. If you do this, you can't go back!

We suggest that you begin by typing:

  cd 03_frontend-react-app
  npm start

Happy hacking!
```

Necessary Commands

npm run start	Starts up a development server. *For development use only*
npm run test	Runs tests associated with the project
npm run build	Builds a **production** version of the application

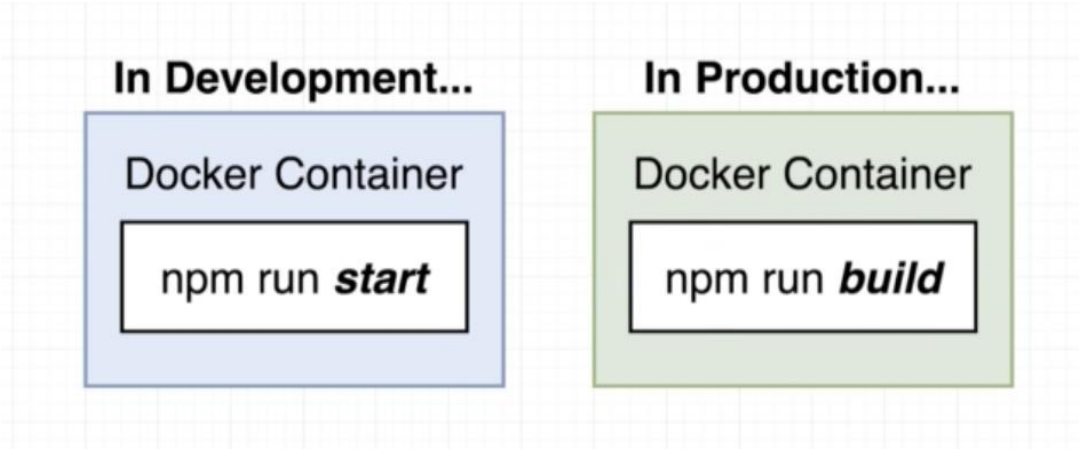
```
PASS src/App.test.js
  ✓ renders learn react link (30 ms)

Test Suites: 1 passed, 1 total
Tests:       1 passed, 1 total
Snapshots:   0 total
Time:        5.139 s
Ran all test suites related to changed files.

Watch Usage
 › Press a to run all tests.
 › Press f to run only failed tests.
 › Press q to quit watch mode.
 › Press p to filter by a filename regex pattern.
 › Press t to filter by a test name regex pattern.
 › Press Enter to trigger a test run.


➜  03_frontend-react-app git:(main) ✗ npm run build

> 03_frontend-react-app@0.1.0 build
> react-scripts build

Creating an optimized production build...
Compiled successfully.
```

Npm start



Creating a Dev Dockerfile

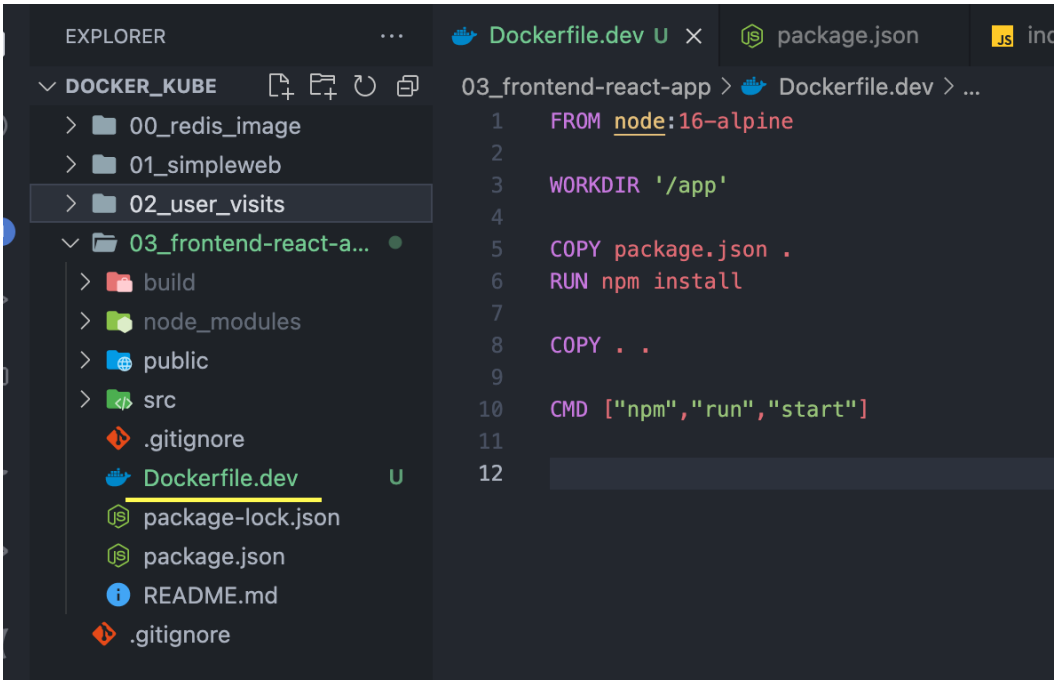
Type of dockerfile



We can have a dockerfile for development and production.

Creating a dockerfile

Now, we are proceeding with creating a dockerfile for development environment. We named the file as “Dockerfie.dev” instead of “Dockerfile”. It’s a custom file name. With the custom docker file name, we need to specify the file name explicitly in docker build command.



Building dockerfile

```
→  03_frontend-react-app git:(main) ✗ docker build -f Dockerfile.dev .
Sending build context to Docker daemon  289.7MB
Step 1/6 : FROM node:16-alpine
16-alpine: Pulling from library/node
59bf1c3509f3: Already exists
683dd8c3cc08: Pull complete
ae5b2724f19b: Pull complete
39190df3f477: Pull complete
Digest: sha256:2c6c59cf4d34d4f937ddfcf33bab9d8bbad8658d1b9de7b97622566a52167f2b
Status: Downloaded newer image for node:16-alpine
 ---> 0e1547c0f4a4
Step 2/6 : WORKDIR '/app'
 ---> Running in 07b57c81335c
Removing intermediate container 07b57c81335c
 ---> 7a3f59dd43d4
Step 3/6 : COPY package.json .
 ---> f3682d8b6bba
Step 4/6 : RUN npm install
 ---> Running in d4b85933c1c8
npm WARN deprecated svgo@1.3.2: This SVGO version is no longer supported. Upgrade to v2.x.x.
npm WARN deprecated source-map-resolve@0.6.0: See https://github.com/lydell/source-map-resolve
#deprecated

added 1237 packages, and audited 1238 packages in 2m

169 packages are looking for funding
  run `npm fund` for details

6 moderate severity vulnerabilities
```

When we build for second time, it ran really fast.

```
→  03_frontend-react-app git:(main) ✗ docker build -t mnaveensmn/react-app:latest  -f
Dockerfile.dev .
[+] Building 2.3s (10/10) FINISHED
 => [internal] load build definition from Dockerfile.dev                       0.0s
 => => transferring dockerfile: 40B                                            0.0s
 => [internal] load .dockerignore                                              0.0s
 => => transferring context: 2B                                                0.0s
 => [internal] load metadata for docker.io/library/node:16-alpine              0.0s
 => [1/5] FROM docker.io/library/node:16-alpine                                0.0s
 => [internal] load build context                                              2.2s
 => => transferring context: 2.85MB                                            2.1s
 => CACHED [2/5] WORKDIR /app                                                  0.0s
 => CACHED [3/5] COPY package.json .                                           0.0s
 => CACHED [4/5] RUN npm install                                               0.0s
 => CACHED [5/5] COPY . .                                                      0.0s
 => exporting to image                                                         0.0s
 => => exporting layers                                                        0.0s
 => => writing image sha256:9280fae1d175b76ea685bedba0a8b73e88ad92cc6b57af61f5e  0.0s
 => => naming to docker.io/mnaveensmn/react-app:latest                         0.0s

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn h
ow to fix them
```

Starting the Container

Command

docker run -it -p 3000:3000 IMAGE_ID

```
Compiled successfully!

You can now view 03_frontend-react-app in the browser.

  Local:            http://localhost:3000
  On Your Network:  http://172.17.0.2:3000

Note that the development build is not optimized.
To create a production build, use npm run build.

assets by status 9.52 KiB [cached] 2 assets
assets by status 1.48 MiB [emitted]
  assets by chunk 1.48 MiB (name: main)
    asset static/js/bundle.js 1.48 MiB [emitted] (name: main) 1 related asset
    asset main.9fe084b7c6ee7d8087a3.hot-update.js 373 bytes [emitted] [immutable] [hmr
] (name: main) 1 related asset
  assets by path *.json 699 bytes
    asset asset-manifest.json 671 bytes [emitted]
    asset main.9fe084b7c6ee7d8087a3.hot-update.json 28 bytes [emitted] [immutable] [hm
r]
  asset index.html 1.67 KiB [emitted]
Entrypoint main 1.48 MiB (1.5 MiB) = static/js/bundle.js 1.48 MiB main.9fe084b7c6ee7d8
087a3.hot-update.js 373 bytes 3 auxiliary assets
cached modules 1.37 MiB [cached] 107 modules
runtime modules 31.4 KiB 15 modules
webpack 5.70.0 compiled successfully in 213 ms
```

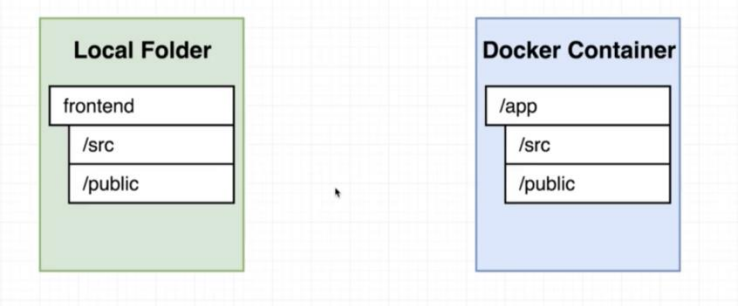
We made a following changes to App.js file. But our changes not reflected in UI as container using the file system snapshot when the time image was built.

```
import logo from "./logo.svg";
import "./App.css";

Complexity is 4 Everything is cool!
function App() {
  return (
    <div className="App">
      <h1>Hello Docker !!</h1>
    </div>
  );
}

export default App;
```

How to make to the changes reflected immediately in the UI ?

Docker Volume

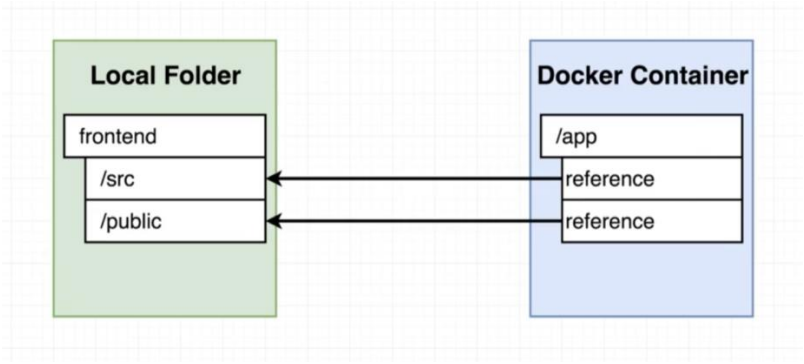
Current Scenario



In the current scenario, we are copying the file from local folder to docker container.

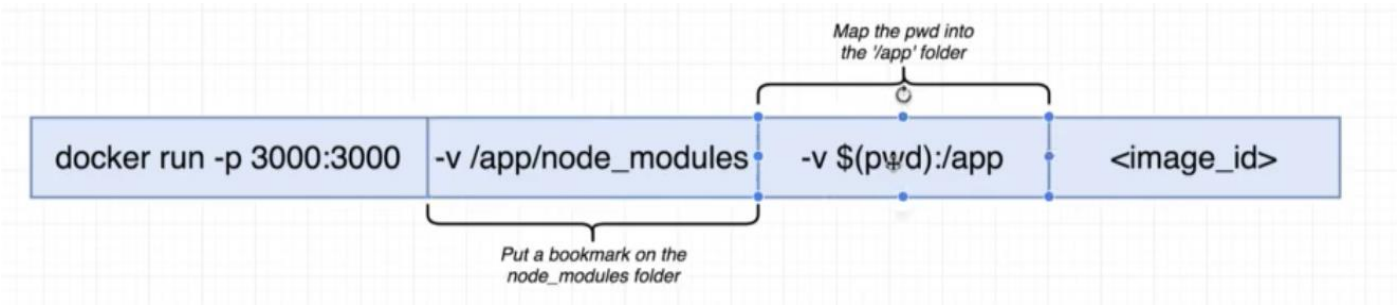
How to make the changes we make in the local folder get updated in the docker container?

- We can achieve this by using the docker volume. It's an out of the box feature in docker.
- With the docker volume, we have a placeholder in the container which has reference files in local folders.

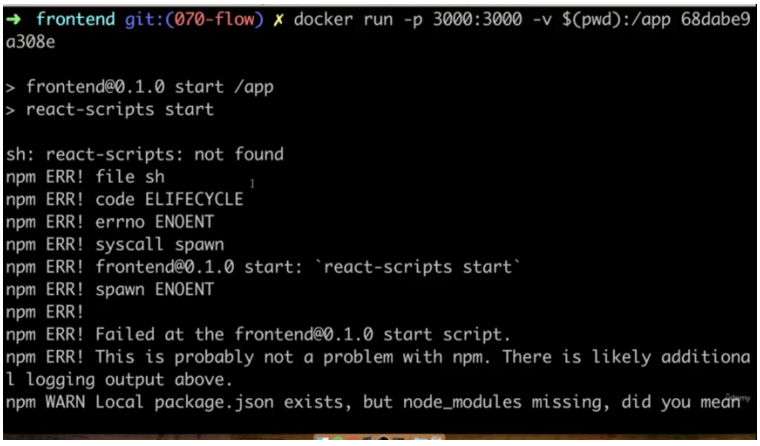


- It is like mapping between folders insider and outside the container.

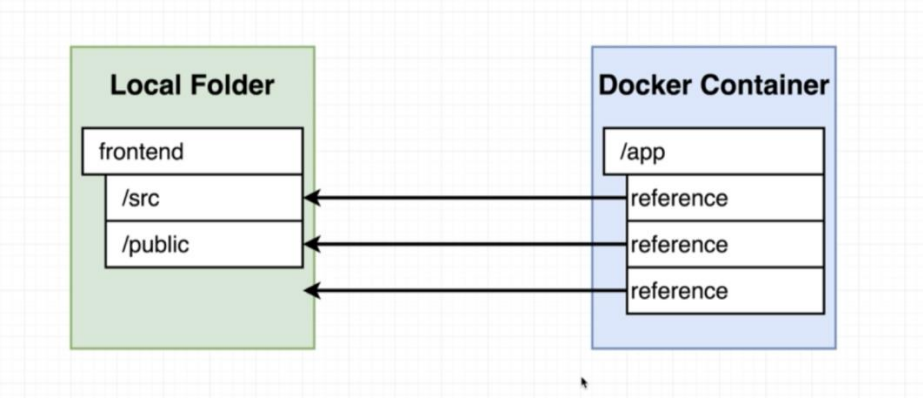
Syntax for setting up the volume



Running the commands



"-v $(pwd):/app" command tells the docker that map the current directory to app folder inside the container.



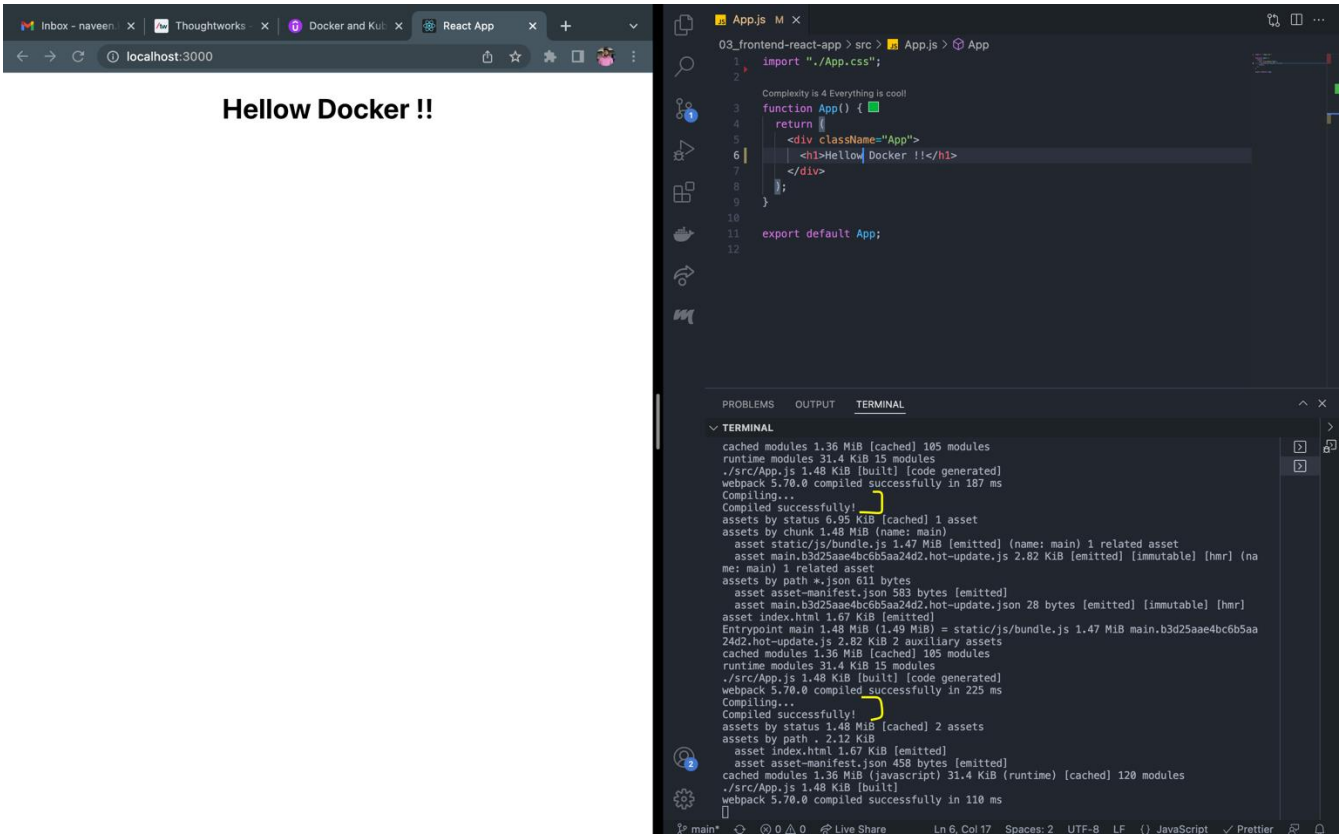
When we initially run the docker run command there is no “node_module” folder. So, docker container pointing to empty reference. That’s the cause of the above issue.

```
See 'docker run --help'.
➜  03_frontend-react-app git:(main) ✗ docker run -p 3000:3000 -v $(pwd):/app mnaveensmn/
react-app

> 03_frontend-react-app@0.1.0 start
> react-scripts start

sh: react-scripts: not found
➜  03_frontend-react-app git:(main) ✗ docker run -p 3000:3000 -v /app/node_modules  -v $
(pwd):/app mnaveensmn/react-app

> 03_frontend-react-app@0.1.0 start
> react-scripts start

(node:26) [DEP_WEBPACK_DEV_SERVER_ON_AFTER_SETUP_MIDDLEWARE] DeprecationWarning: 'onAfte
rSetupMiddleware' option is deprecated. Please use the 'setupMiddlewares' option.
(Use `node --trace-deprecation ...` to show where the warning was created)
(node:26) [DEP_WEBPACK_DEV_SERVER_ON_BEFORE_SETUP_MIDDLEWARE] DeprecationWarning: 'onBef
oreSetupMiddleware' option is deprecated. Please use the 'setupMiddlewares' option.
Starting the development server...

Compiled successfully!

You can now view 03_frontend-react-app in the browser.

  Local:            http://localhost:3000
  On Your Network:  http://172.17.0.2:3000

Note that the development build is not optimized.
To create a production build, use npm run build.
```

In the above image, we deleted the node_modules folder inside local folder and ran the first command. It given an error as react-scripts not found.

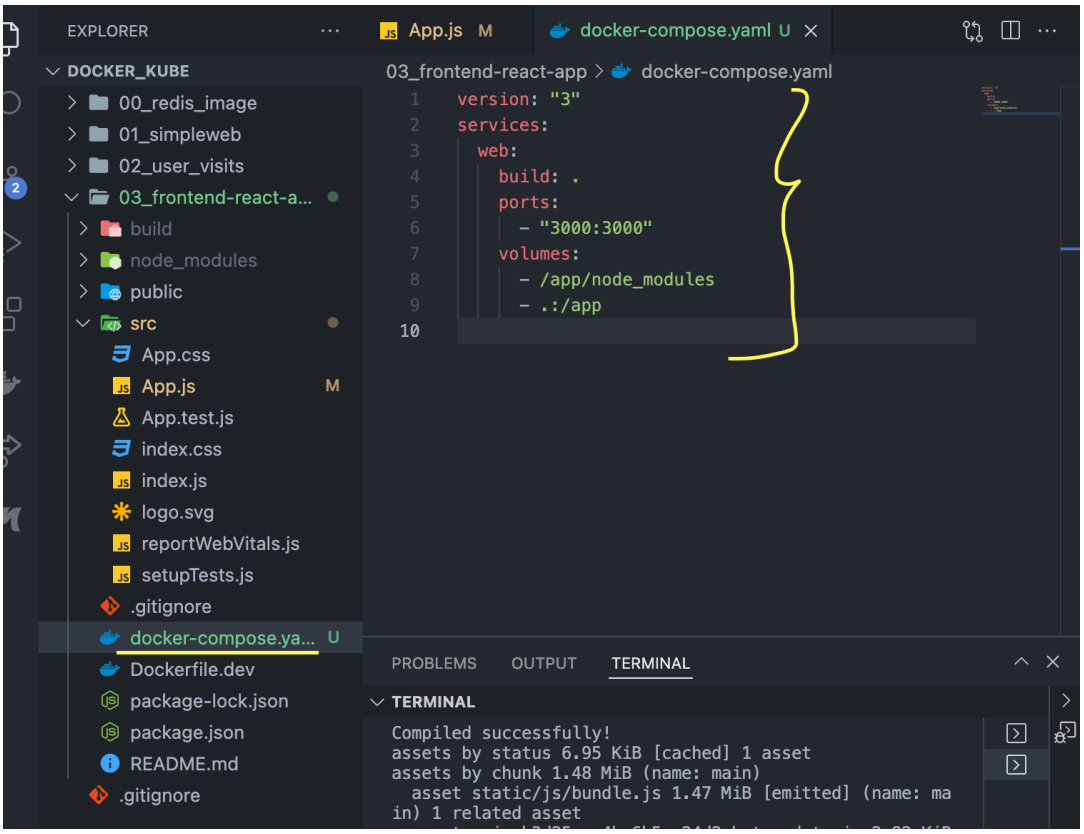
In the second command in the above image, we have given the “-v /app/node_modules” along with existing command. It’s telling the docker to not to look for any reference in the local folder. Because, by the time when we run image, we would already have the node_module folder inside the container.

Now, we can see that docker accepting the running changes from the local folder. This set up is called volumn mounting system.



Shorthand with Docker Compose

Creating docker compose yaml file

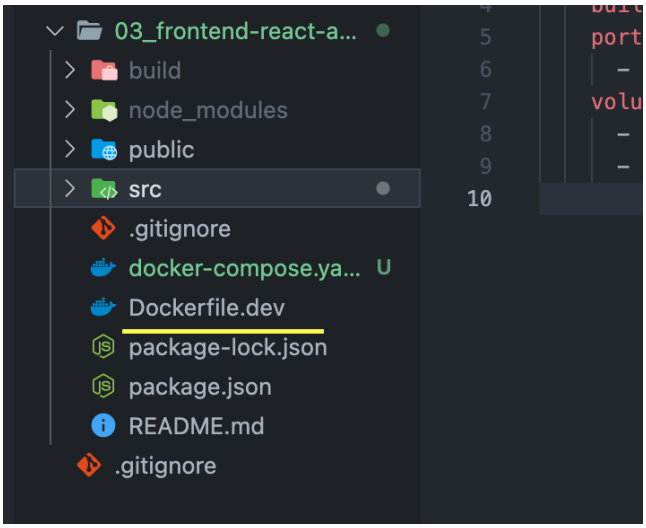


We are doing the volume mapping in the docker compose file.

Running the docker compose file

```
→  03_frontend-react-app git:(main) ✗ docker-compose up
[+] Building 0.0s (1/2)
 => [internal] load build definition from Dockerfile                       0.0s
 => => transferring dockerfile: 2B                                         0.0s
failed to solve: rpc error: code = Unknown desc = failed to solve with frontend dockerfi
le.v0: failed to read dockerfile: open /var/lib/docker/tmp/buildkit-mount870413150/Docke
rfile: no such file or directory
→  03_frontend-react-app git:(main) ✗
```

When run the docker-compose, we are getting the error as failed to read docker.



Because, we are having the dockerfile with different name. (Instead of Dockerfile, it is Dockerfile.dev)

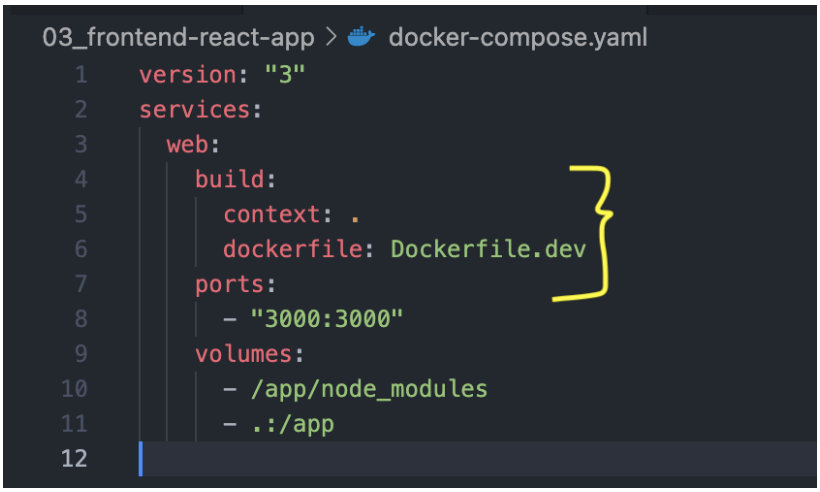
Overriding the Dockerfile Selection

Updating the docker compose yaml file

We are updating context and docker file required for building the image.

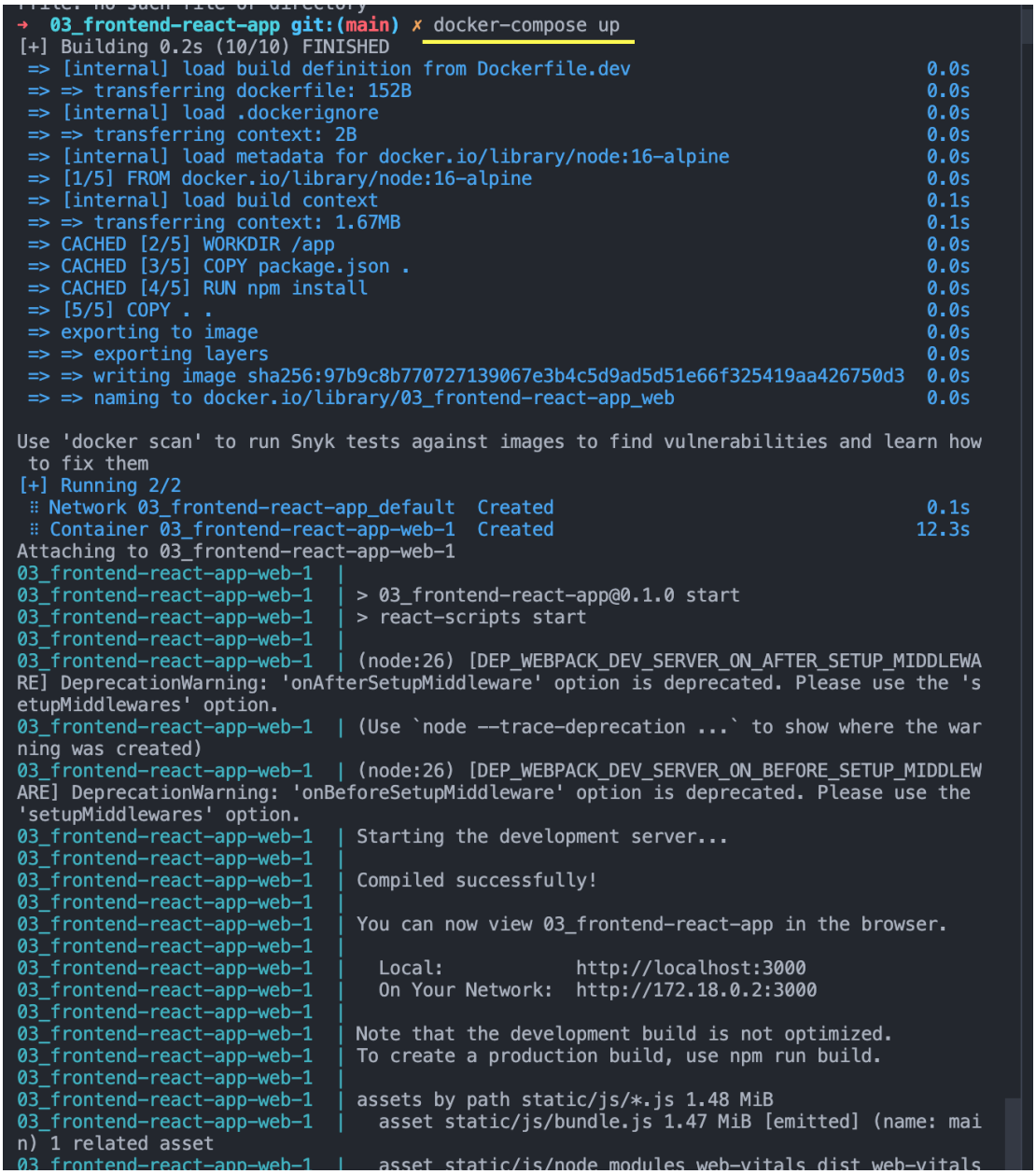
context => Path of the files system required for building the image.

dockerfile => Name of docker file inside the given context.



“context: .” represent the current directory.

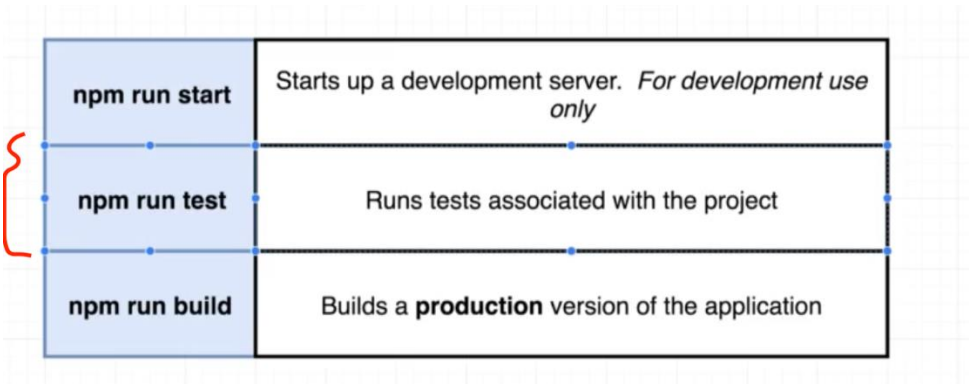
Running the image using docker-compose command



Do we need a copy?

Even though we are specifying the volume mounting in the docker compose, we are still keeping the “COPY . .” instruction in the docker file. If we don’t want to use the docker compose in the future, this copy instruction in the docker file, gives hand.

Executing Tests



npm run start	Starts up a development server. *For development use only*
npm run test	Runs tests associated with the project
npm run build	Builds a **production** version of the application

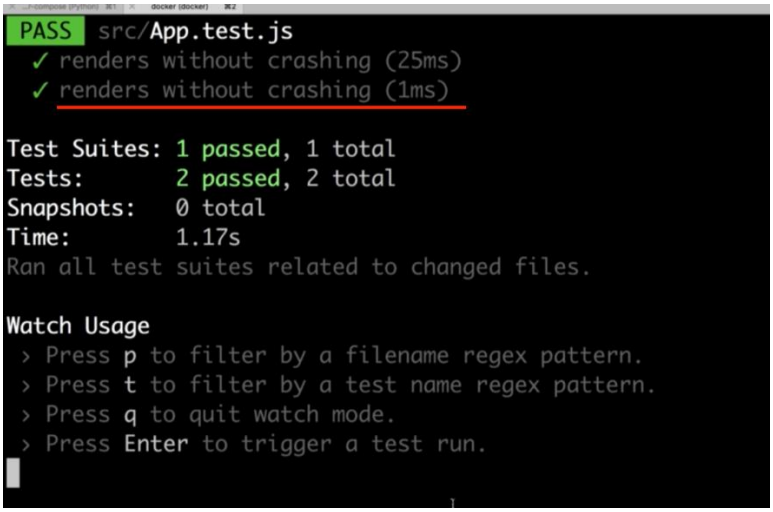
```
➜ frontend git:(081-t) docker run -it 3debad3faf7e npm run test
```

```
PASS src/App.test.js
  ✓ renders without crashing (26ms)

Test Suites: 1 passed, 1 total
Tests:       1 passed, 1 total
Snapshots:   0 total
Time:        1.116s
Ran all test suites related to changed files.

Watch Usage
 › Press p to filter by a filename regex pattern.
 › Press t to filter by a test name regex pattern.
 › Press q to quit watch mode.
 › Press Enter to trigger a test run.
```

Live updating tests

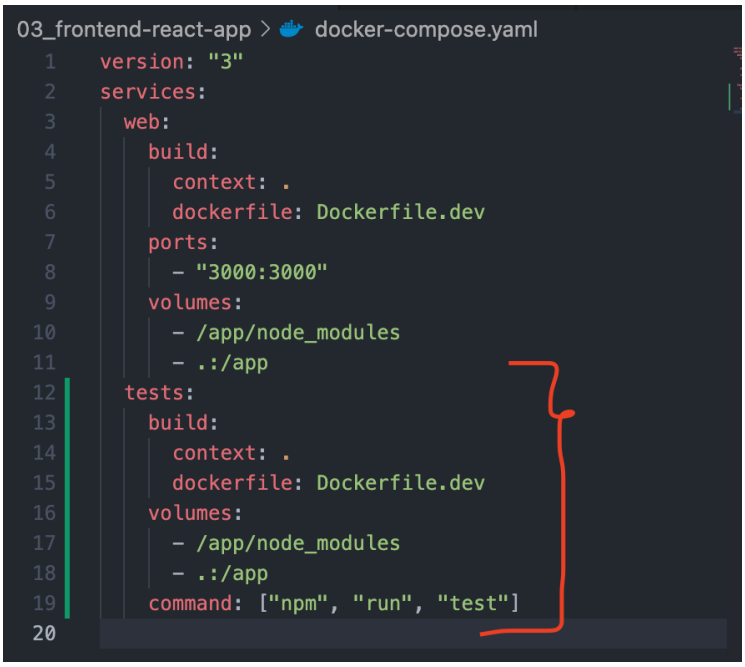
```
Last login: Tue Jul 31 10:47:37 on ttys003
➜ frontend git:(081-t) ✗ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED
     STATUS              PORTS                    NAMES
0fe01eef2915        frontend_web        "npm run start"     36 minutes ago
     Up 43 seconds       0.0.0.0:3000->3000/tcp   frontend_web_1
➜ frontend git:(081-t) ✗ docker exec -it 0fe01eef2915 npm run test
```

We can reuse the existing container to run the test. The running container is, ran from docker compose where we have a volume mounting. So, updating the test will be reflected in command prompt.

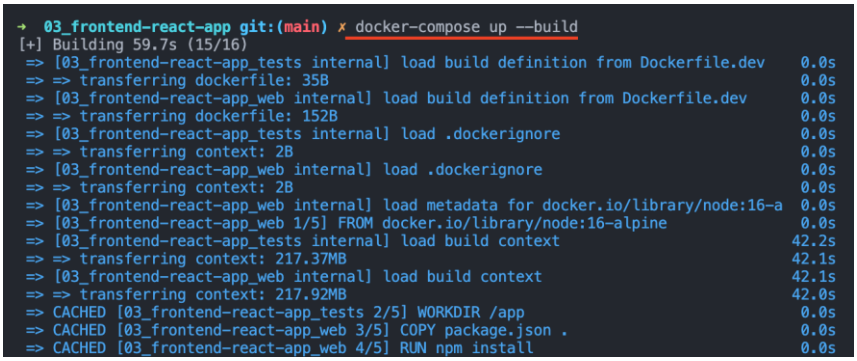


Docker Compose for Running the Tests

Updating the docker file



Running the docker compose



As we can see in the below image, that test is running as part of the docker compose.

```
tewares' option.
03_frontend-react-app-web-1    | (Use `node --trace-deprecation ...` to show where the warnin
g was created)
03_frontend-react-app-web-1    | (node:25) [DEP_WEBPACK_DEV_SERVER_ON_BEFORE_SETUP_MIDDLEWARE
] DeprecationWarning: 'onBeforeSetupMiddleware' option is deprecated. Please use the 'setupMi
ddlewares' option.
03_frontend-react-app-tests-1  | PASS src/App.test.js
03_frontend-react-app-tests-1  |   ✓ should render the App component (63 ms)
03_frontend-react-app-tests-1  |
03_frontend-react-app-tests-1  | Test Suites: 1 passed, 1 total
03_frontend-react-app-tests-1  | Tests:       1 passed, 1 total
03_frontend-react-app-tests-1  | Snapshots:   0 total
03_frontend-react-app-tests-1  | Time:        2.254 s
03_frontend-react-app-tests-1  | Ran all test suites.
03_frontend-react-app-tests-1  |
03_frontend-react-app-web-1    | Starting the development server...
03_frontend-react-app-web-1    |
03_frontend-react-app-web-1    | Compiled successfully!
```

Modifying the test file

03_frontend-react-app > src > App.test.js > ...

```
1  import { render, screen } from "@testing-library/react";
2  import App from "./App";
3
4  test("should render the App component", () => {
5    render(<App />);
6    const paragraphElement = screen.getByText(/Hello Docker/i);
7    expect(paragraphElement).toBeInTheDocument();
8  });
9
10 test("should render the App component", () => {
11   render(<App />);
12   const paragraphElement = screen.getByText(/Docker/i);
13   expect(paragraphElement).toBeInTheDocument();
14 });
15
```

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```
03_frontend-react-app-web-1    | assets by path static/js/*.js 1.48 MiB
03_frontend-react-app-web-1    |   asset static/js/bundle.js 1.47 MiB [emitted] (name: main)
1 related asset
03_frontend-react-app-web-1    |   asset static/js/node_modules_web-vitals_dist_web-vitals_js
.chunk.js 6.95 KiB [emitted] 1 related asset
03_frontend-react-app-web-1    | asset index.html 1.67 KiB [emitted]
03_frontend-react-app-web-1    | asset asset-manifest.json 458 bytes [emitted]
03_frontend-react-app-web-1    | runtime modules 31.4 KiB 15 modules
03_frontend-react-app-web-1    | modules by path ./node_modules/ 1.35 MiB 99 modules
03_frontend-react-app-web-1    | modules by path ./src/ 13.4 KiB
03_frontend-react-app-web-1    |   modules by path ./src/*.css 8.82 KiB
03_frontend-react-app-web-1    |     ./src/index.css 2.72 KiB [built] [code generated]
03_frontend-react-app-web-1    |     ./node_modules/css-loader/dist/cjs.js??ruleSet[1].rules[
1].oneOf[5].use[1]!./node_modules/postcss-loader/dist/cjs.js??ruleSet[1].rules[1].oneOf[5].us
e[2]!./node_modules/source-map-loader/dist/cjs.js!./src/index.css 1.37 KiB [built] [code gene
rated]
03_frontend-react-app-web-1    |     ./src/App.css 2.72 KiB [built] [code generated]
03_frontend-react-app-web-1    |     ./node_modules/css-loader/dist/cjs.js??ruleSet[1].rules[
1].oneOf[5].use[1]!./node_modules/postcss-loader/dist/cjs.js??ruleSet[1].rules[1].oneOf[5].us
e[2]!./node_modules/source-map-loader/dist/cjs.js!./src/App.css 2 KiB [built] [code generated
]
03_frontend-react-app-web-1    |   modules by path ./src/*.js 4.56 KiB
03_frontend-react-app-web-1    |     ./src/index.js 1.73 KiB [built] [code generated]
03_frontend-react-app-web-1    |     ./src/App.js 1.48 KiB [built] [code generated]
03_frontend-react-app-web-1    |     ./src/reportWebVitals.js 1.36 KiB [built] [code generate
d]
03_frontend-react-app-web-1    | webpack 5.70.0 compiled successfully in 11436 ms
03_frontend-react-app-tests-1  | PASS src/App.test.js
03_frontend-react-app-tests-1  |   ✓ should render the App component (61 ms)
03_frontend-react-app-tests-1  |   ✓ should render the App component (6 ms)
03_frontend-react-app-tests-1  |
03_frontend-react-app-tests-1  | Test Suites: 1 passed, 1 total
03_frontend-react-app-tests-1  | Tests:       2 passed, 2 total
03_frontend-react-app-tests-1  | Snapshots:   0 total
03_frontend-react-app-tests-1  | Time:        2.821 s
03_frontend-react-app-tests-1  | Ran all test suites.
03_frontend-react-app-tests-1  |
```

Updating the new test is directly reflected in the container run.

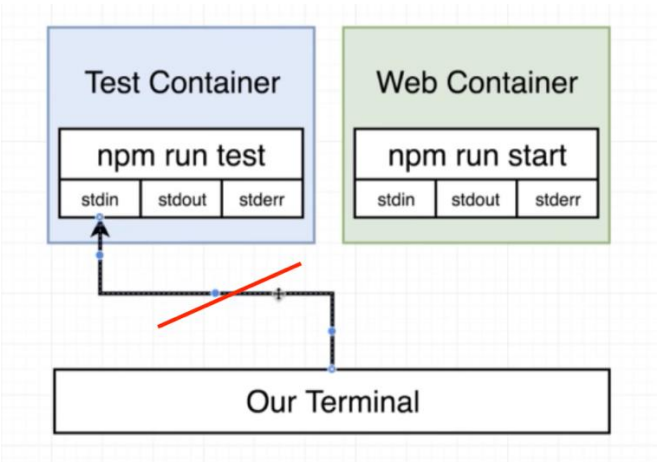
There is one drawback of this approach. Since it is part of the docker compose, we cannot execute any additional test command while container is running.

```
Test Suites: 1 passed, 1 total
Tests:       1 passed, 1 total
Snapshots:   0 total
Time:        0.627s, estimated 1s
Ran all test suites related to changed files.

Watch Usage
 › Press p to filter by a filename regex pattern.
 › Press t to filter by a test name regex pattern.
 › Press q to quit watch mode.
 › Press Enter to trigger a test run.
Compiled successfully!
```

```
web_1    |
web_1    | Note that the development build is not optimized.
web_1    | To create a production build, use npm run build.
web_1    |


pp
q
t
w
```

Shortcomings on Testing

Why are test commands not accepted while container is running?



- We are typing the additional test command in out terminal, here we don't have the default setup to pass the command to Test Container's stdin.

- stdin, stdout and stderr are process specific. Every process inside the container has its own stdin, stdout and stderr.

Docker attach

Docker attach command used to attach terminal to stdin, stdout and stderr of primary process of the container.

After we ran the "docker-compose up", we will be getting the container ID using "docker ps". Then, we will be passing the container ID to docker attach command.

```
/Users/naveen.kumar1/.zshrc:68: no matches found: load?
➜  DOCKER_KUBE git:(main) docker ps
CONTAINER ID   IMAGE                          COMMAND                  C
REATED       STATUS          PORTS                    NAMES
a33da6e988b5   03_frontend-react-app_tests   "docker-entrypoint.s…"   2
 days ago    Up 24 seconds                            03_frontend-react-
app-tests-1
42da8371ea3d   03_frontend-react-app_web     "docker-entrypoint.s…"   2
 days ago    Up 24 seconds   0.0.0.0:3000->3000/tcp   03_frontend-react-
app-web-1
➜  DOCKER_KUBE git:(main) docker attach a33da6e988b5
p
q
q
```

If we are trying to run the test commands, it is not working. Let's analyze why.

```
➜  DOCKER_KUBE git:(main) docker ps
CONTAINER ID   IMAGE                          COMMAND                  C
REATED       STATUS          PORTS                    NAMES
a33da6e988b5   03_frontend-react-app_tests   "docker-entrypoint.s…"   2
 days ago    Up 5 seconds                             03_frontend-react-a
pp-tests-1
42da8371ea3d   03_frontend-react-app_web     "docker-entrypoint.s…"   2
 days ago    Up 5 seconds    0.0.0.0:3000->3000/tcp   03_frontend-react-a
pp-web-1
➜  DOCKER_KUBE git:(main) docker exec -it a33da6e988b5 sh
/app # ps
PID   USER     TIME  COMMAND
    1 root      0:00 npm run test
   19 root      0:00 node /app/node_modules/.bin/react-scripts test
   26 root      0:01 /usr/local/bin/node /app/node_modules/react-scrip
   78 root      0:00 sh
   84 root      0:00 ps
/app #
```

There multiple process running in the container. When do the docker attach, terminal always attached to the primary process in the container.

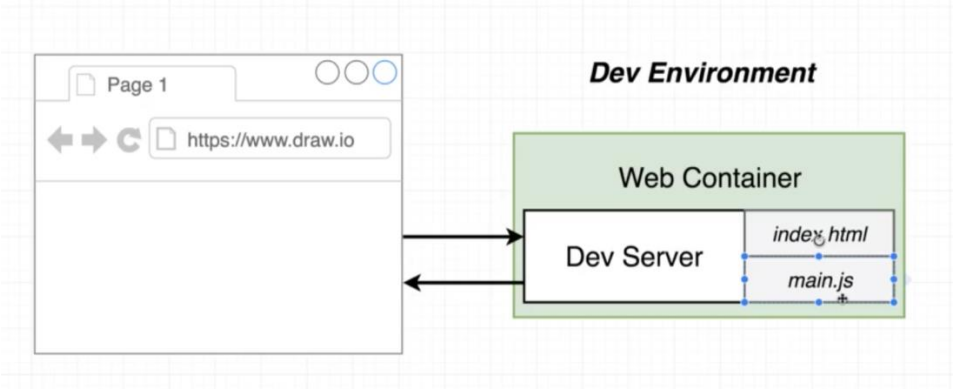
So, unfortunately, we cannot handle the test commands while container is running.

Need for Ngix

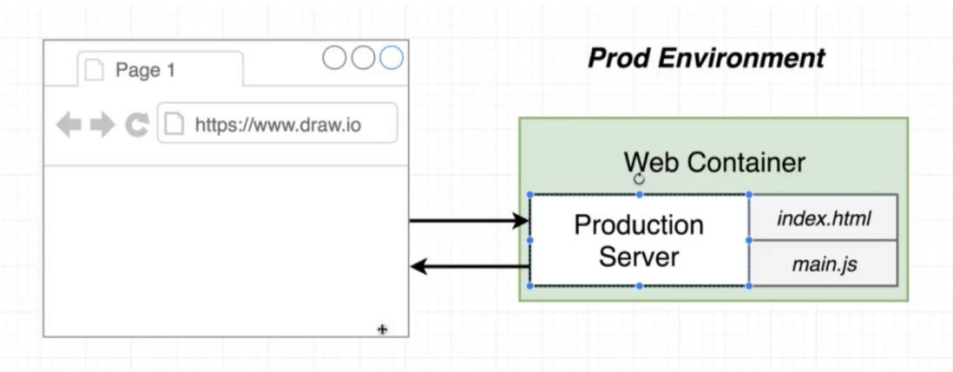
Npm run build

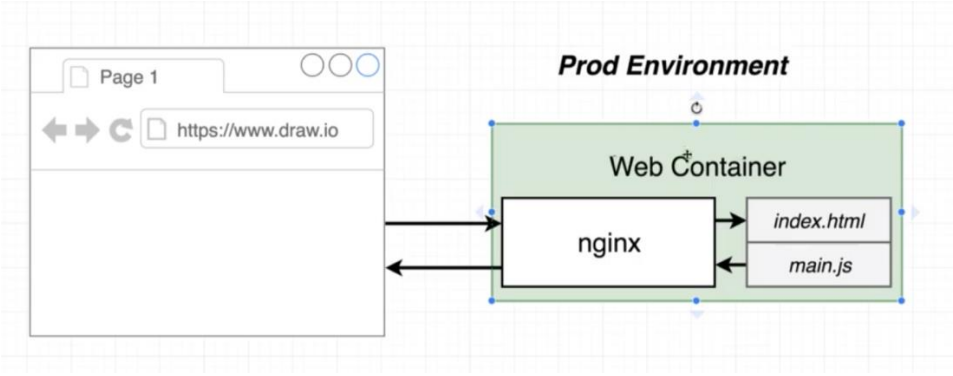
npm run start	Starts up a development server. *For development use only*
npm run test	Runs tests associated with the project
npm run build	Builds a **production** version of the application

Development Environment



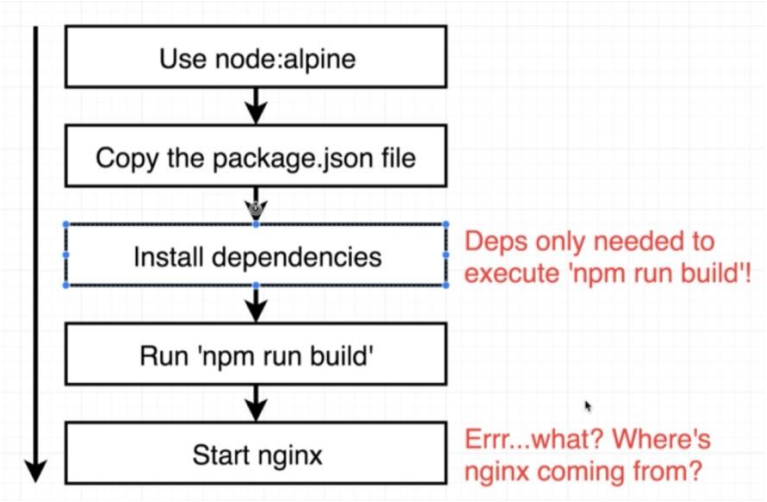
Production Environment





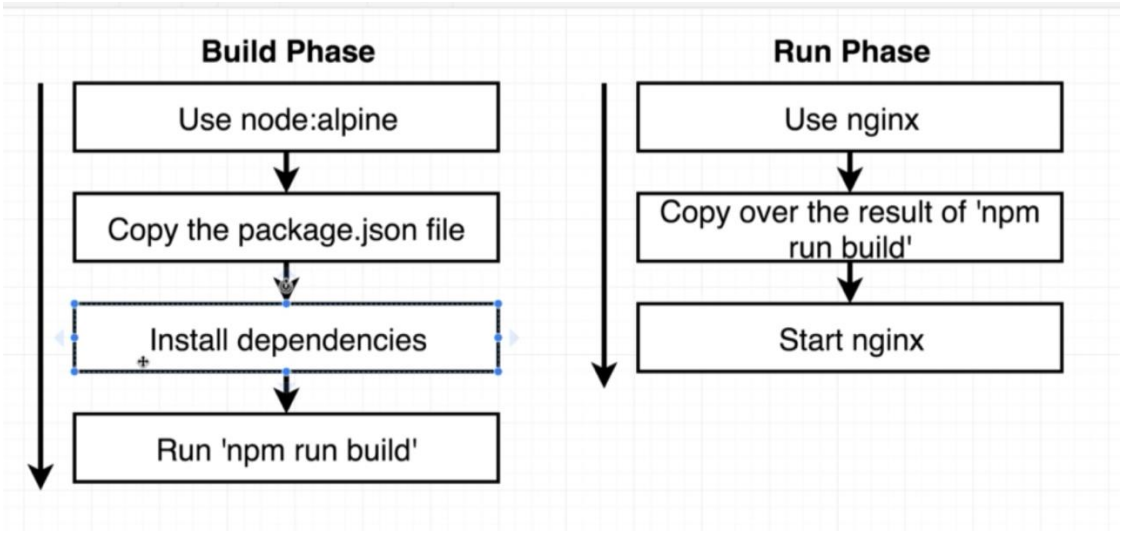
We are going to use the Engine X as a production server.

Multi-Step Docker Build



Once we build the application, dependencies are no longer required. We are using the ngnix for production server.

Multi Step Docker File



We are going to have two base images. One is for build phase and another one is for run phase.

Implementing Multi Step Builds

```
03_frontend-react-app > Dockerfile > ...
1   FROM node:16-alpine as builder
2   WORKDIR '/app'
3   COPY package.json .
4   RUN npm install
5   COPY . .
6   RUN npm run build
7
8   FROM nginx
9   COPY --from=builder /app/build /usr/share/nginx/html
10
```

/usr/share/nginx/html => This the folder where nginx, look for the files to run.

Running Nginx

Building the Image

Dockerfile 03_frontend-react-app U | Dockerfile 01_simpleweb

03_frontend-react-app > Dockerfile > ...

```
1   FROM node:16-alpine as builder
2   WORKDIR '/app'
3   COPY package.json .
4   RUN npm install
5   COPY . .
6   RUN npm run build
7
8   FROM nginx
9   COPY --from=builder /app/build /usr/share/nginx/html
10
```

PROBLEMS OUTPUT TERMINAL

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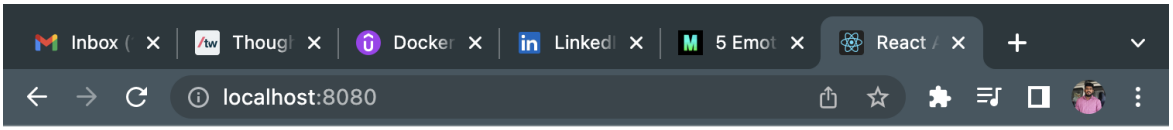
```
→  03_frontend-react-app git:(main) ✗ docker build .
[+] Building 21.2s (6/14)
 => [internal] load build definition from Dockerfile                          0.0s
 => => transferring dockerfile: 218B                                          0.0s
 => [internal] load .dockerignore                                             0.0s
 => => transferring context: 2B                                               0.0s
 => [internal] load metadata for docker.io/library/nginx:latest               4.9s
 => [internal] load metadata for docker.io/library/node:16-alpine             0.0s
 => [auth] library/nginx:pull token for registry-1.docker.io                  0.0s
 => [internal] load build context                                            16.2s
 => => transferring context: 48.57MB                                         15.9s
 => [stage-1 1/2] FROM docker.io/library/nginx@sha256:1c13bc6de5dfca749c3779741  16.2s
 => => resolve docker.io/library/nginx@sha256:1c13bc6de5dfca749c377974146ac05256  0.0s
 => => sha256:c919045c4c2b0b0007c606e763ed2c830c7b1d038ce878a3c0 7.66kB / 7.66kB  0.0s
 => => sha256:4d3e1d15534ccf8091e19bd74215f6512abadfb5b341122 24.12MB / 25.35MB  16.2s
 => => sha256:9ebb164bd1d87b4b3da53bdda045dff49cf370c803b023c9b9ec2a 601B / 601B  3.0s
 => => sha256:1c13bc6de5dfca749c377974146ac05256791ca2fe1979fc8e 1.86kB / 1.86kB  0.0s
 => => sha256:f7a1c6dad28192bd417b78079d6ddc03cbca6d5ea46bba1 11.53MB / 31.37MB  16.2s
 => => sha256:2468d48e476b6a079eb646e87620f96ce1818ac0c5b3a84505 1.57kB / 1.57kB  0.0s
 => => sha256:59baa8b00c3c90731a08416338a21d113876a624553d34fbc717e6 893B / 893B  3.9s
 => => sha256:a41ae70ab6b499f58a869b3323ec69d8ecb47745aa811c5ee2ed58 664B / 664B  4.9s
 => => sha256:e3908122b958943f7ebb162d6d710262b8a5d50c203f7897d5 1.40kB / 1.40kB  5.8s
 => [builder 1/6] FROM docker.io/library/node:16-alpine                       0.0s
```

```
TERMINAL
 => [internal] load build definition from Dockerfile                                0.0s
 => => transferring dockerfile: 218B                                                0.0s
 => [internal] load .dockerignore                                                   0.0s
 => => transferring context: 2B                                                     0.0s
 => [internal] load metadata for docker.io/library/nginx:latest                     4.9s
 => [internal] load metadata for docker.io/library/node:16-alpine                   0.0s
 => [auth] library/nginx:pull token for registry-1.docker.io                        0.0s
 => [internal] load build context                                                  39.0s
 => => transferring context: 217.37MB                                              38.5s
 => [stage-1 1/2] FROM docker.io/library/nginx@sha256:1c13bc6de5dfca749c3779741    30.6s
 => => resolve docker.io/library/nginx@sha256:1c13bc6de5dfca749c377974146ac05256    0.0s
 => => sha256:c919045c4c2b0b0007c606e763ed2c830c7b1d038ce878a3c0 7.66kB / 7.66kB    0.0s
 => => sha256:4d3e1d15534ccf8091e19bd74215f6512abadfb5b341122 25.35MB / 25.35MB    16.6s
 => => sha256:9ebb164bd1d87b4b3da53bdda045dff49cf370c803b023c9b9ec2a 601B / 601B    3.0s
 => => sha256:1c13bc6de5dfca749c377974146ac05256791ca2fe1979fc8e 1.86kB / 1.86kB    0.0s
 => => sha256:f7a1c6dad28192bd417b78079d6ddc03cbca6d5ea46bba1 31.37MB / 31.37MB    26.0s
 => => sha256:2468d48e476b6a079eb646e87620f96ce1818ac0c5b3a84505 1.57kB / 1.57kB    0.0s
 => => sha256:59baa8b00c3c90731a08416338a21d113876a624553d34fbc717e6 893B / 893B    3.9s
 => => sha256:a41ae70ab6b499f58a869b3323ec69d8ecb47745aa811c5ee2ed58 664B / 664B    4.9s
 => => sha256:e3908122b958943f7ebb162d6d710262b8a5d50c203f7897d5 1.40kB / 1.40kB    5.8s
 => => extracting sha256:f7a1c6dad28192bd417b78079d6ddc03cbca6d5ea46bba12769b235    2.2s
 => => extracting sha256:4d3e1d15534ccf8091e19bd74215f6512abadfb5b341122e91c1254    1.4s
 => => extracting sha256:9ebb164bd1d87b4b3da53bdda045dff49cf370c803b023c9b9ec2a4    0.0s
 => => extracting sha256:59baa8b00c3c90731a08416338a21d113876a624553d34fbc717e6c    0.0s
 => => extracting sha256:a41ae70ab6b499f58a869b3323ec69d8ecb47745aa811c5ee2ed58c    0.0s
 => => extracting sha256:e3908122b958943f7ebb162d6d710262b8a5d50c203f7897d5afa60    0.0s
 => [builder 1/6] FROM docker.io/library/node:16-alpine                             0.0s
 => CACHED [builder 2/6] WORKDIR /app                                               0.0s
 => CACHED [builder 3/6] COPY package.json .                                        0.0s
 => CACHED [builder 4/6] RUN npm install                                            0.0s
 => [builder 5/6] COPY . .                                                         12.9s
 => [builder 6/6] RUN npm run build                                                18.1s
 => [stage-1 2/2] COPY --from=builder /app/build /usr/share/nginx/html              0.1s
 => exporting to image                                                              0.0s
 => => exporting layers                                                             0.0s
 => => writing image sha256:6966026fc67d8aeb7874f61d13d51575645e1fabc8007a8748cb    0.0s

  Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn ho
  w to fix them
```

Running the Image

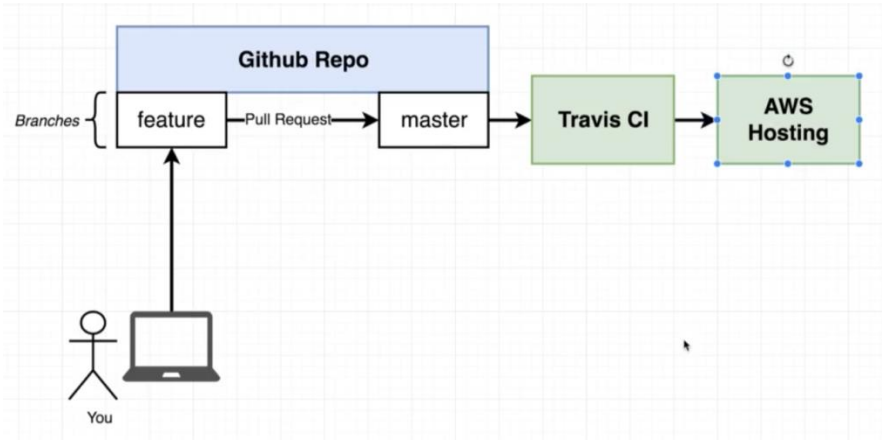
```
➜  03_frontend-react-app git:(main) ✗ docker run -p 8080:80 6966026fc67d8aeb7874f61d13d
51575645e1fabc8007a8748cb
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform conf
iguration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/defaul
t.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/defa
ult.conf
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2022/03/14 08:19:24 [notice] 1#1: using the "epoll" event method
2022/03/14 08:19:24 [notice] 1#1: nginx/1.21.6
2022/03/14 08:19:24 [notice] 1#1: built by gcc 10.2.1 20210110 (Debian 10.2.1-6)
2022/03/14 08:19:24 [notice] 1#1: OS: Linux 5.10.76-linuxkit
2022/03/14 08:19:24 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2022/03/14 08:19:24 [notice] 1#1: start worker processes
2022/03/14 08:19:24 [notice] 1#1: start worker process 31
2022/03/14 08:19:24 [notice] 1#1: start worker process 32
2022/03/14 08:19:24 [notice] 1#1: start worker process 33
2022/03/14 08:19:24 [notice] 1#1: start worker process 34
2022/03/14 08:19:24 [notice] 1#1: start worker process 35
2022/03/14 08:19:24 [notice] 1#1: start worker process 36
```



Hello Docker !!

Continuous Integration and Deployment with AWS

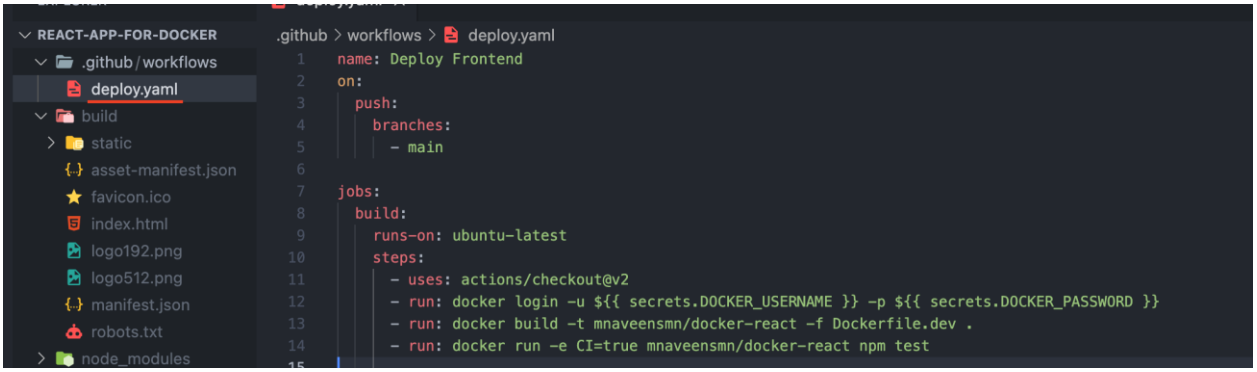
Services Overview



We will be using the Github Actions platform in the place of Travis CI.

Continuous Integration with Github Actions

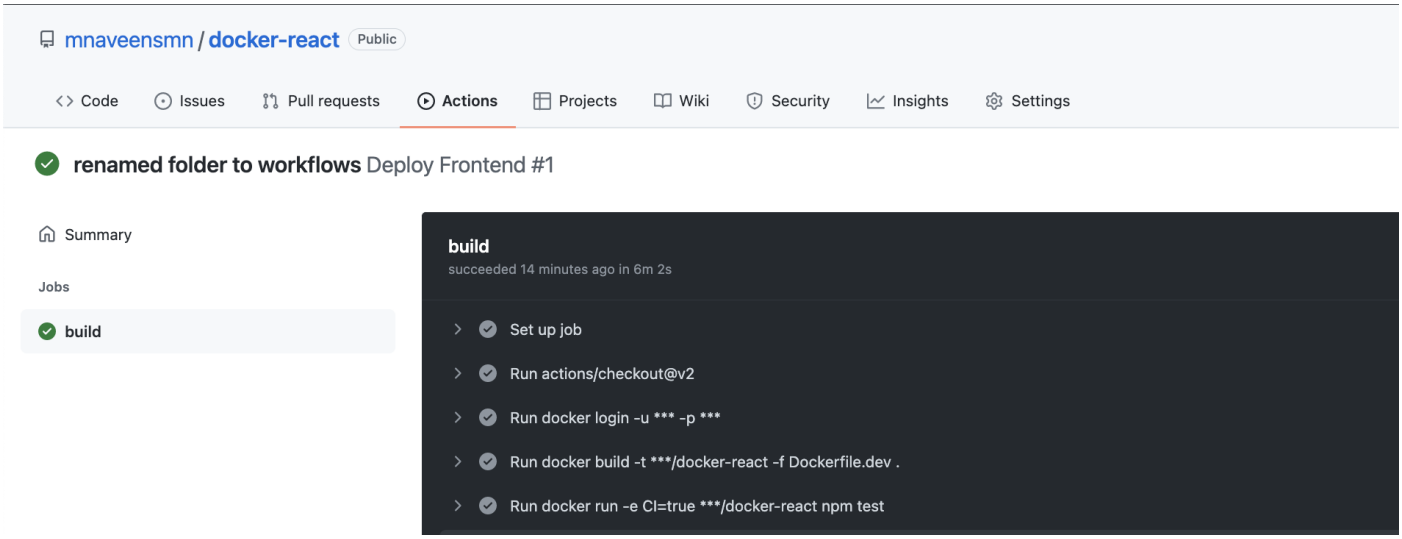
Creating a Github Actions configuration file



In this config, we are,

- Building the docker image “mnaveensmn/docker-react” using the Dockerfile.dev file.
- Running the build image with initial command as npm run test.

Checking the build



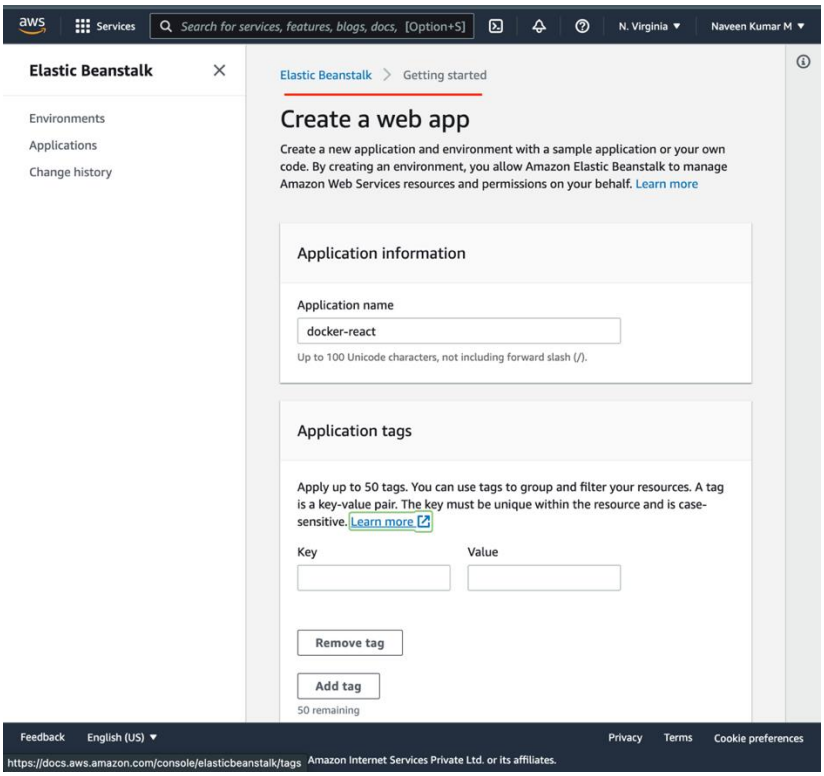
Build output.

AWS Elastic Beanstalk

What is it?

- Easiest way to get started with production docker instances.
- It must be appropriate when running a one container at a time.
- It automatically scales the application using load balancer (By creating multiple instances as required)

Creating an application in elastic beanstalk



Platform

Platform

Docker

Platform branch

Docker running on 64bit Amazon Linux 2

Platform version

3.4.12 (Recommended)

Application code

- (•) Sample application
  Get started right away with sample code.
- ( ) Upload your code
  Upload a source bundle from your computer or copy one from Amazon S3.

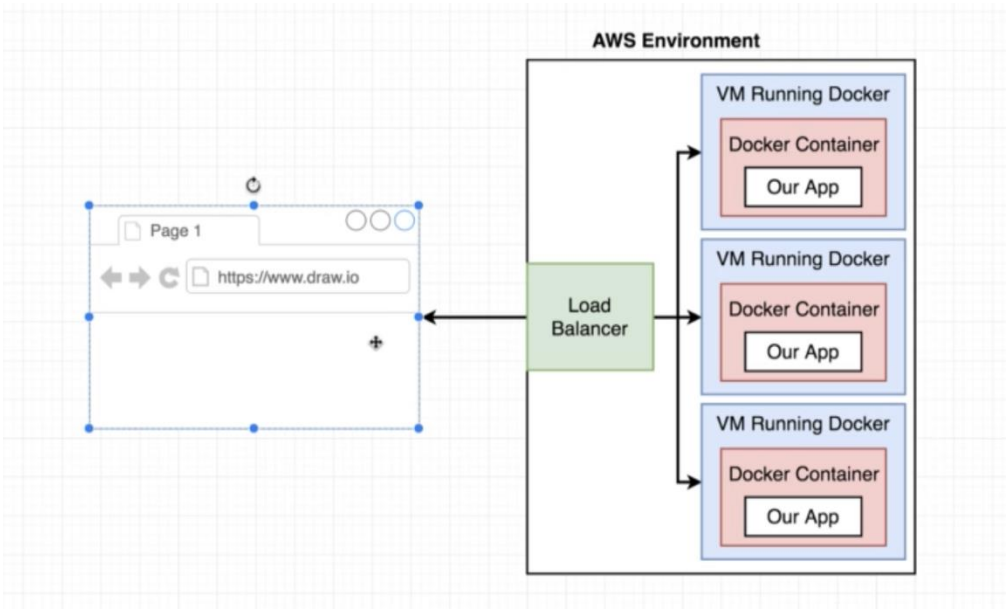
Cancel | Configure more options | Create application

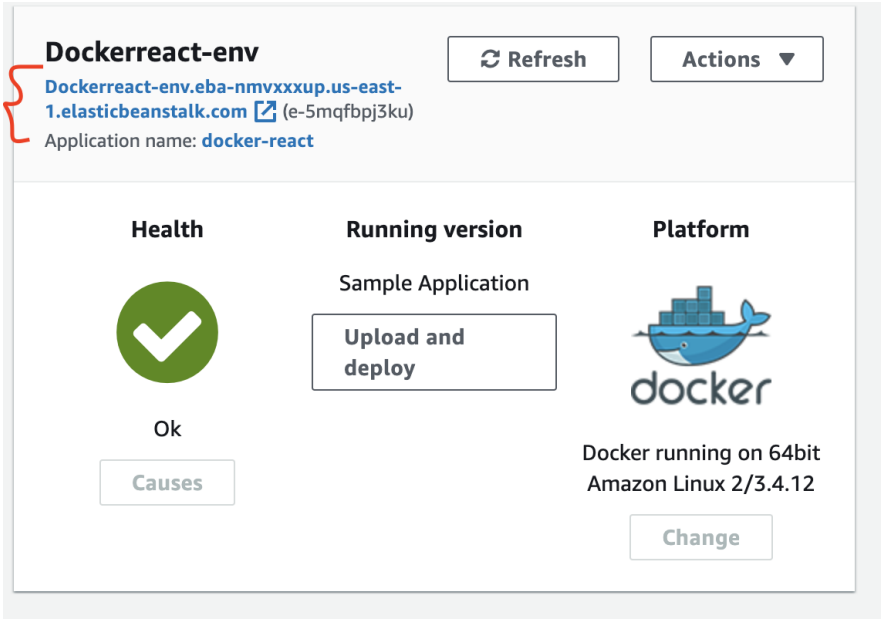
Elastic Beanstalk > Environments > Dockerreact-env

Creating Dockerreact-env
This will take a few minutes. .

2:22pm Using elasticbeanstalk-us-east-1-218788053233 as Amazon S3 storage bucket for environment data.

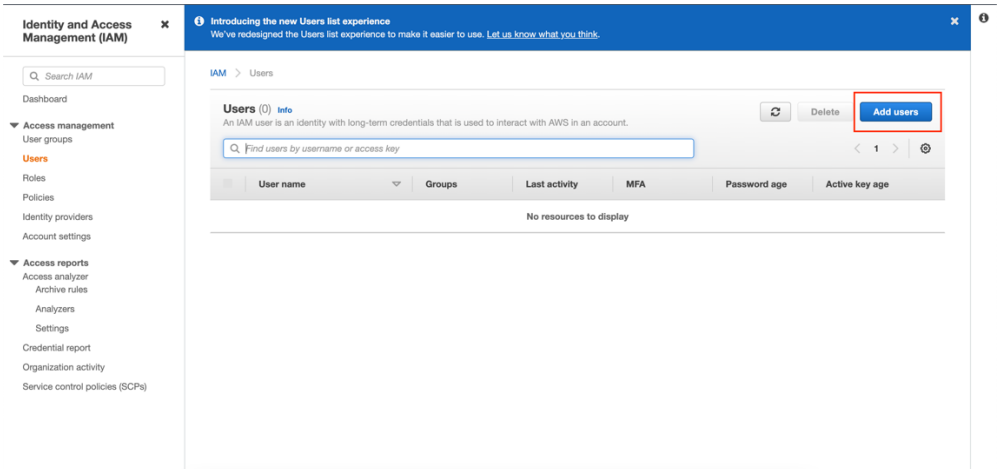
2:22pm createEnvironment is starting.

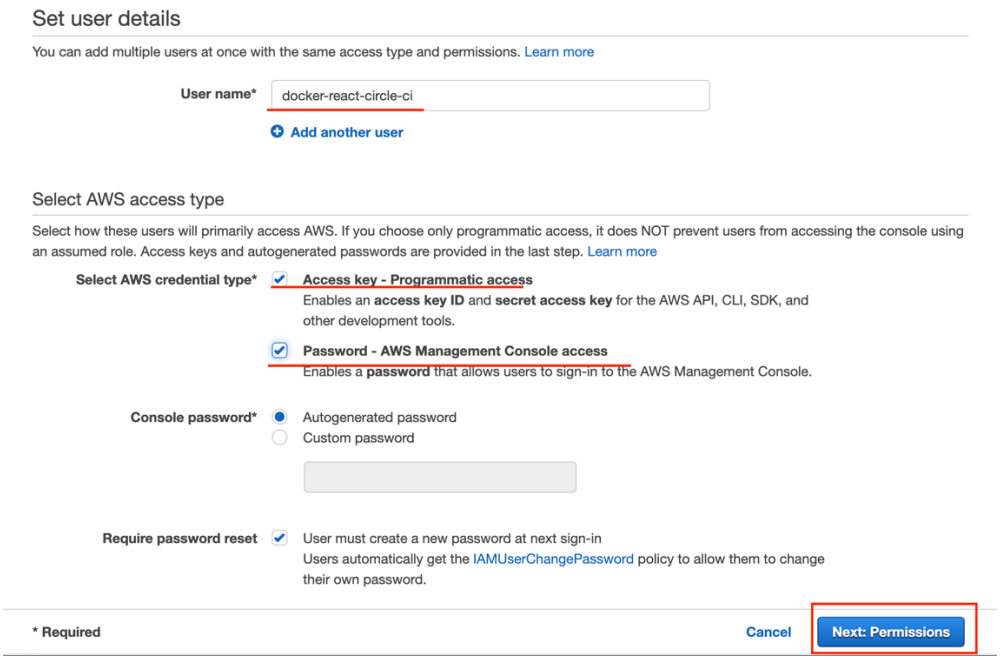


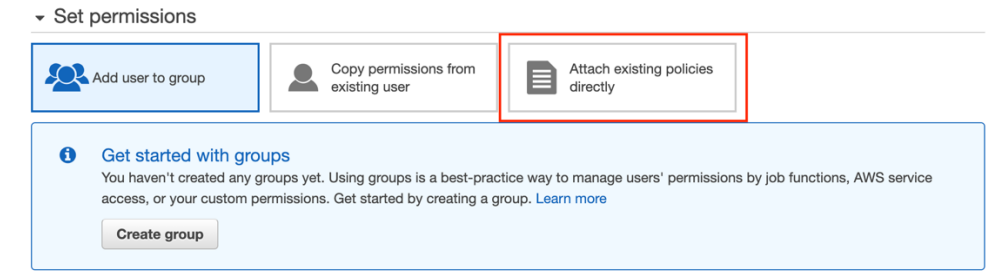


Github Actions Configurations for Deployment

Creating a user for access in AWS IAM Service

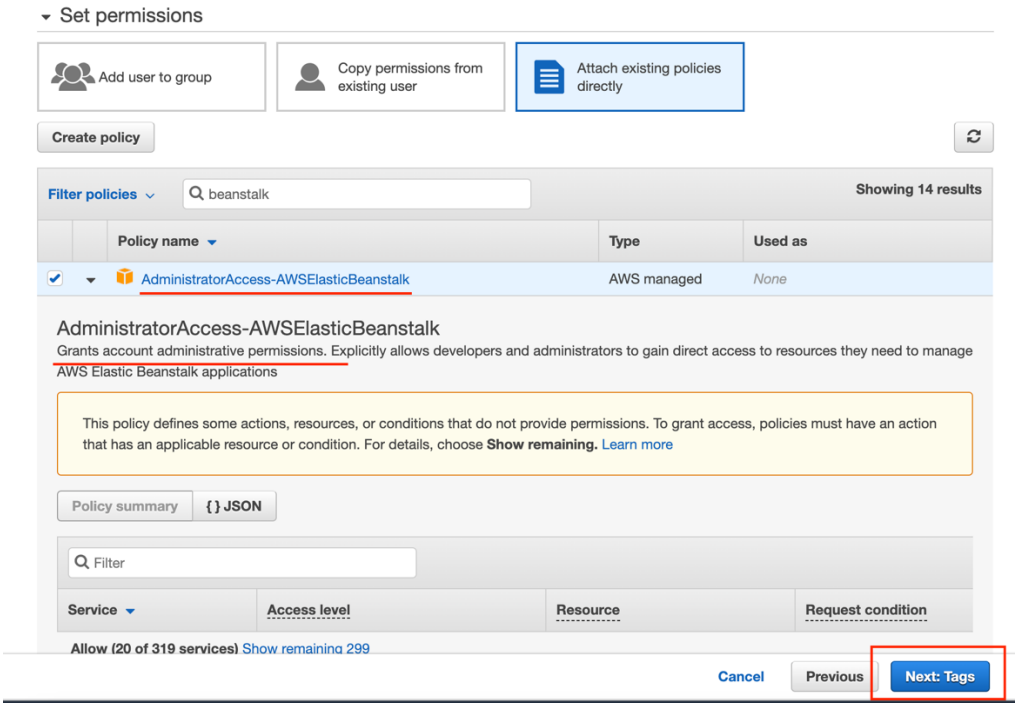


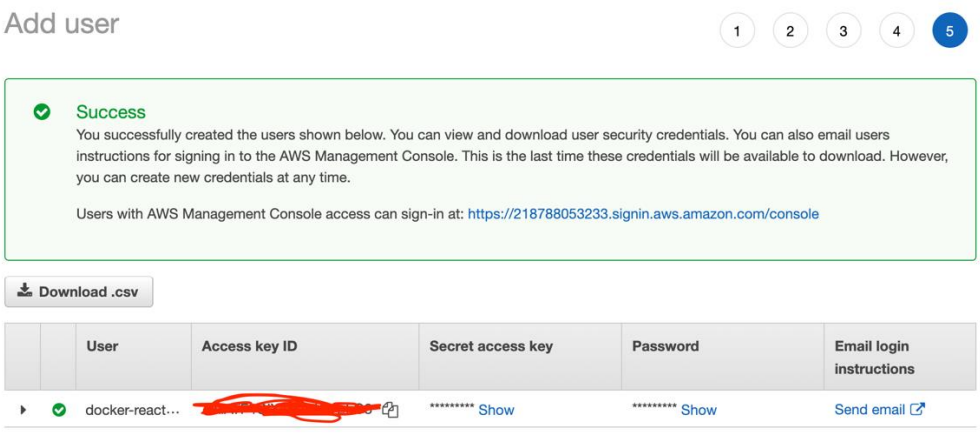



Set permissions
Add user to group
Copy permissions from existing user
Attach existing policies directly
Get started with groups
You haven't created any groups yet. Using groups is a best-practice way to manage users' permissions by job functions, AWS service access, or your custom permissions. Get started by creating a group. Learn more
Create group

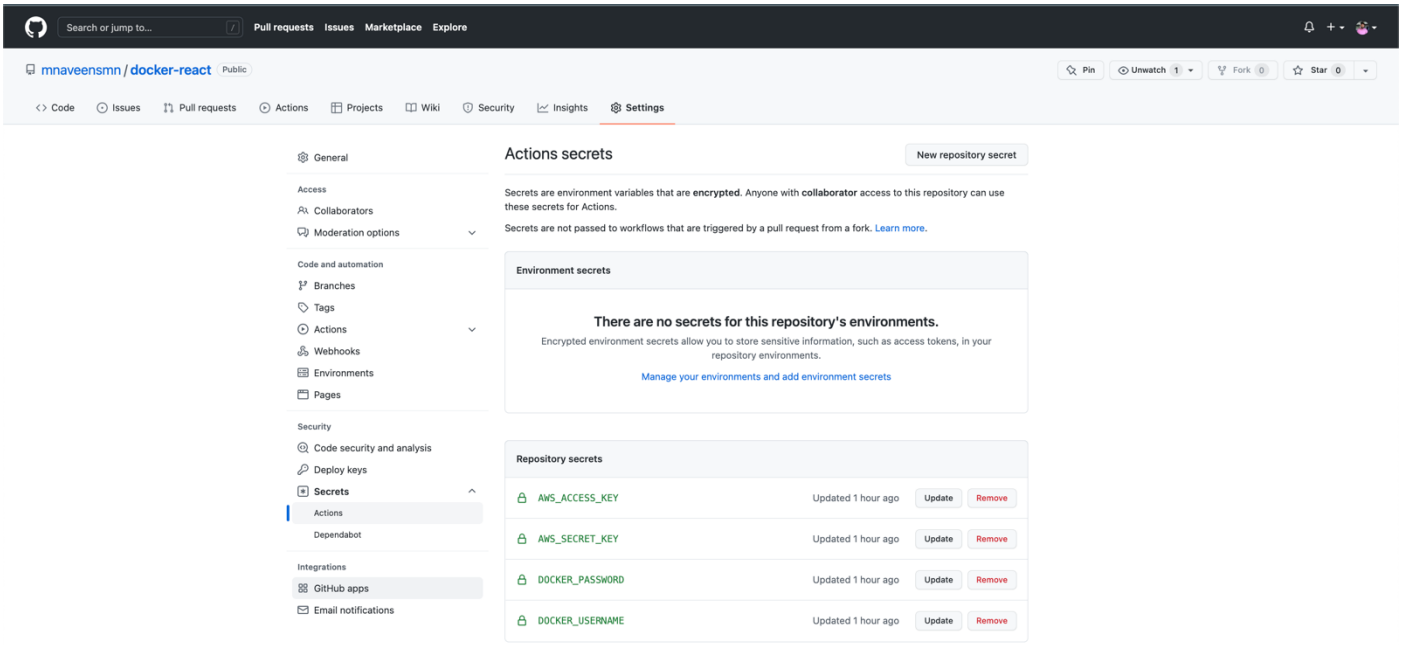

Set permissions boundary


Cancel
Previous
Next: Tags

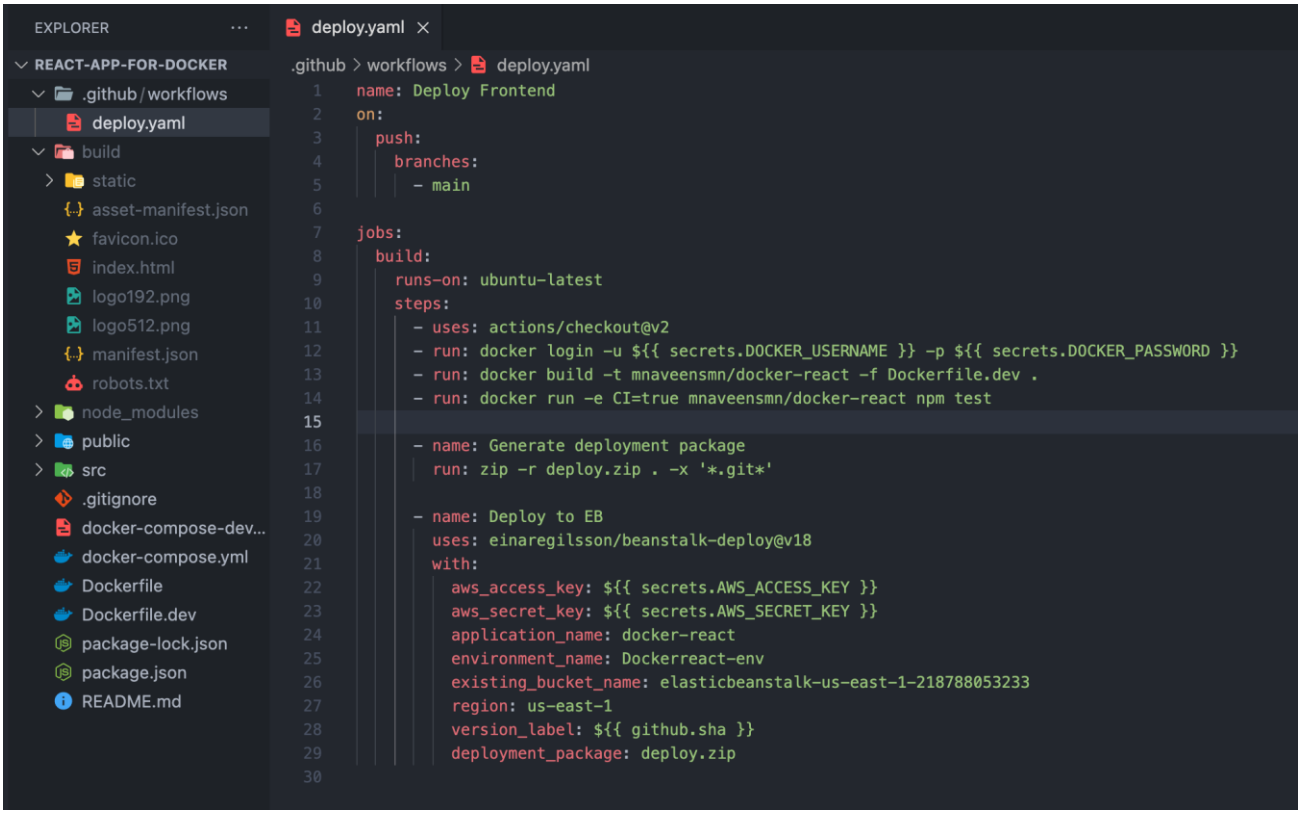

Set permissions
Add user to group
Copy permissions from existing user
Attach existing policies directly
Create policy
Filter policies
beanstalk
Showing 14 results
Policy name
Type
Used as
AdministratorAccess-AWSElasticBeanstalk
AWS managed
None
AdministratorAccess-AWSElasticBeanstalk
Grants account administrative permissions. Explicitly allows developers and administrators to gain direct access to resources they need to manage AWS Elastic Beanstalk applications
This policy defines some actions, resources, or conditions that do not provide permissions. To grant access, policies must have an action that has an applicable resource or condition. For details, choose Show remaining. Learn more
Policy summary
{ } JSON
Filter
Service
Access level
Resource
Request condition
Allow (20 of 319 services) Show remaining 299
Cancel
Previous
Next: Tags


Add user
1
2
3
4
5
Success
You successfully created the users shown below. You can view and download user security credentials. You can also email users instructions for signing in to the AWS Management Console. This is the last time these credentials will be available to download. However, you can create new credentials at any time.
Users with AWS Management Console access can sign-in at: https://218788053233.signin.aws.amazon.com/console
Download .csv
User
Access key ID
Secret access key
Password
Email login instructions
docker-react…
********** Show
********** Show
Send email

Setting the secrets for repository

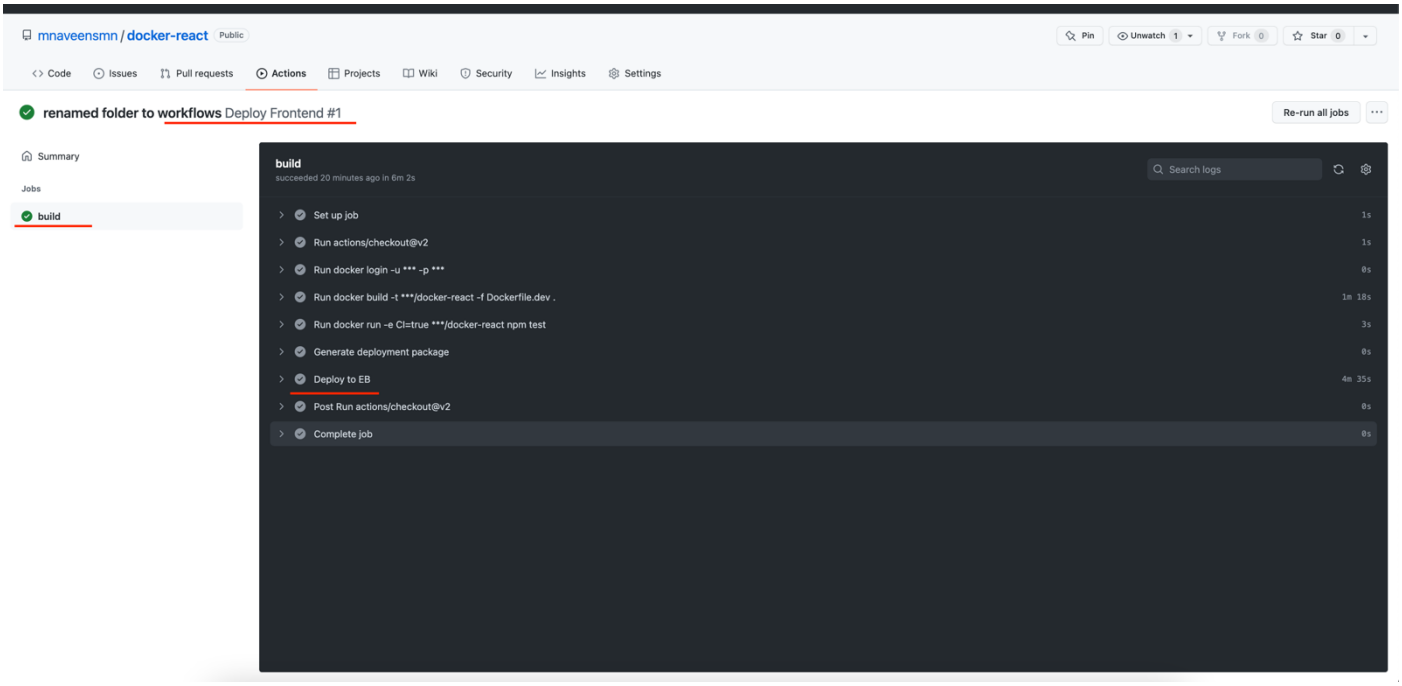


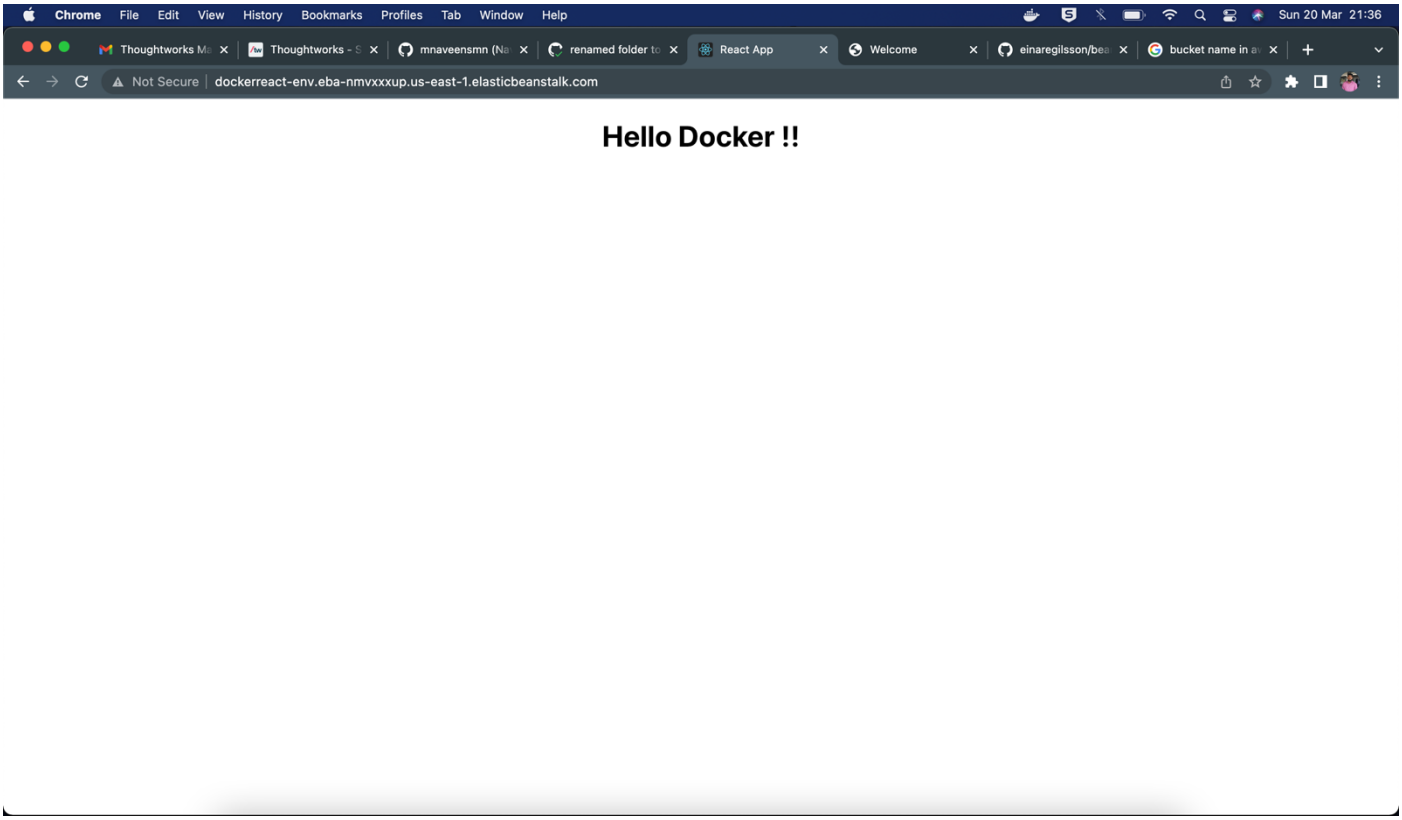
Updating the Github Actions deploy.yml file



Commit and Push

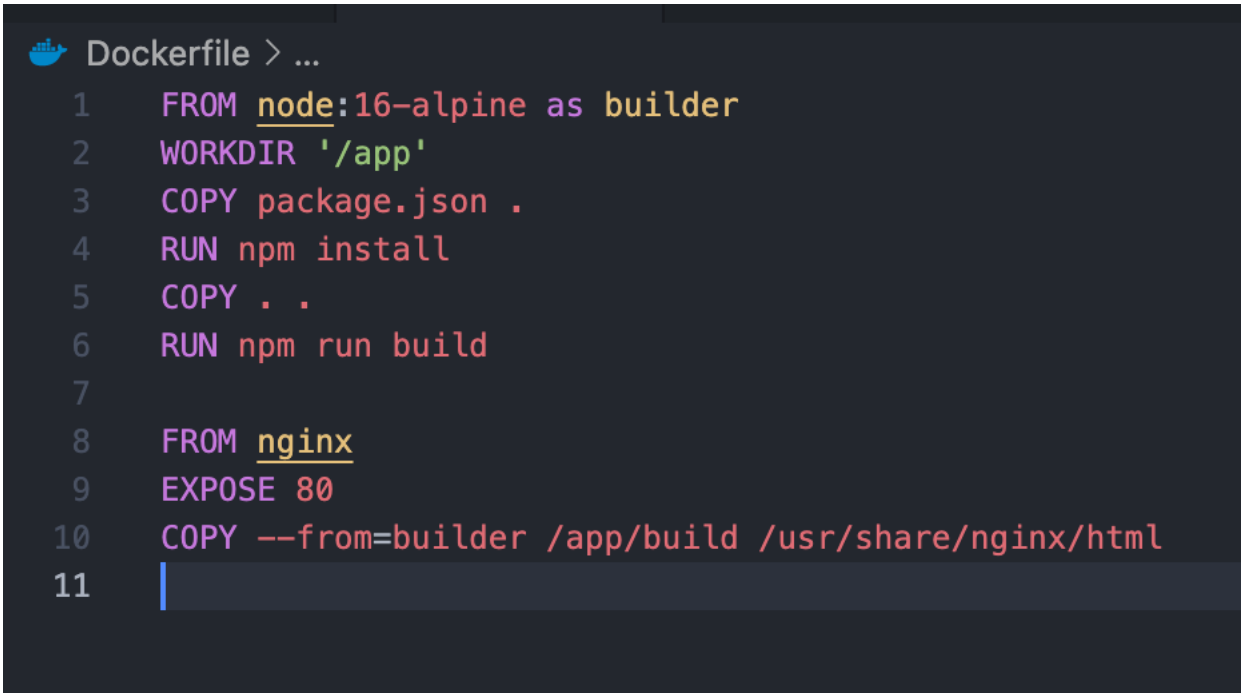
Once we commit and push, we can see the workflow running in github actions.





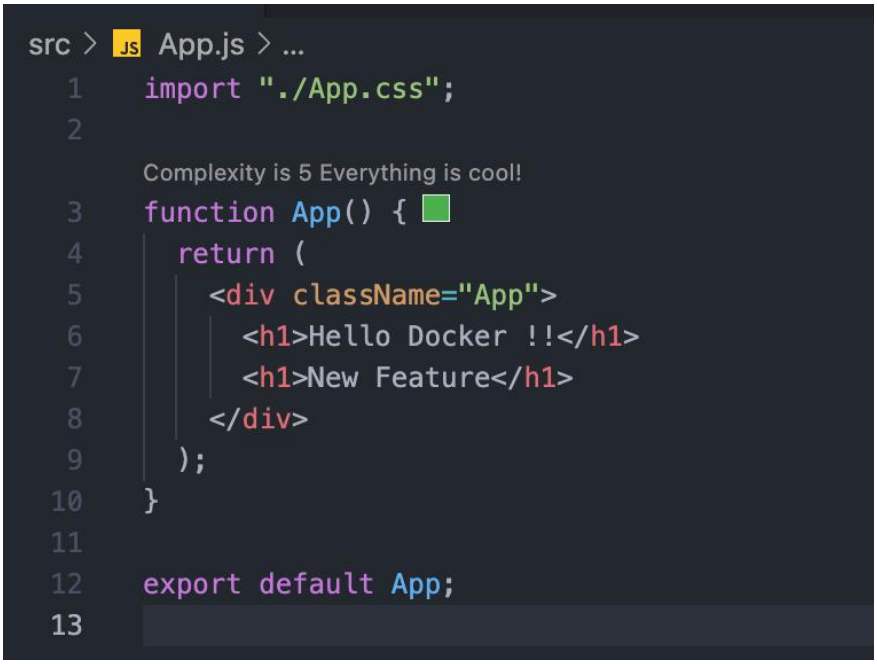
Exposing ports through docker file

There is no port in the container expose by default. We must expose manually in the docker file.



Workflow with Github

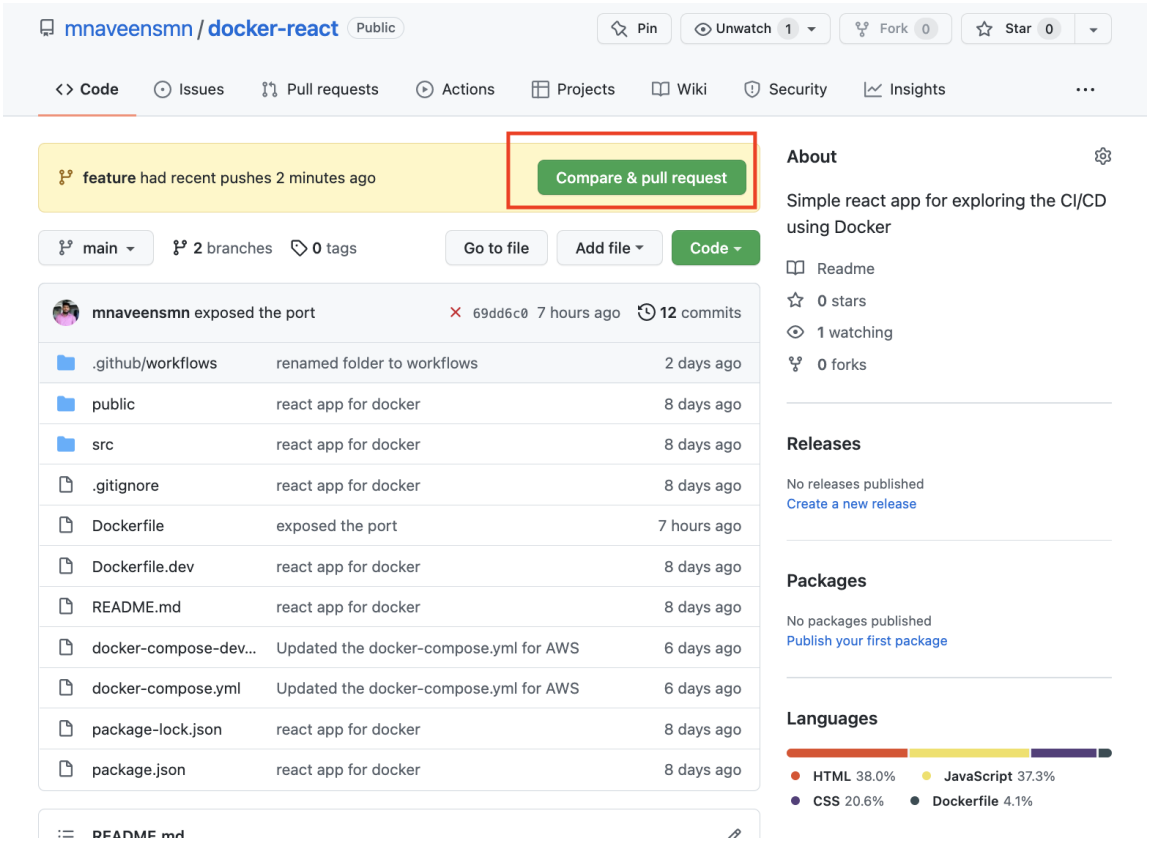
Adding a new feature



New git branch

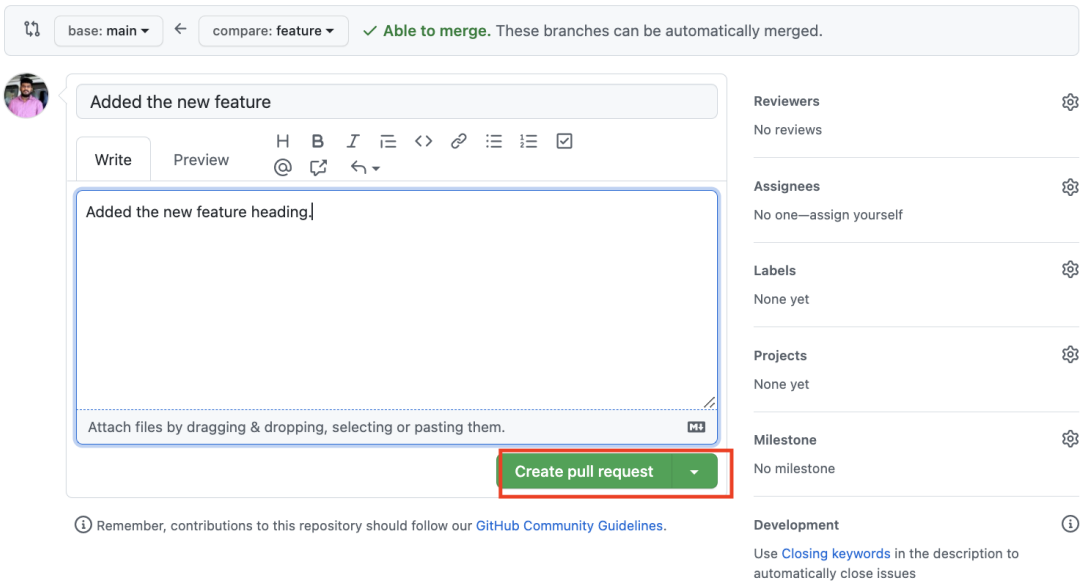
```
checkout
➜  react-app-for-docker git:(main) git checkout -b feature
Switched to a new branch 'feature'
➜  react-app-for-docker git:(feature) ✗ git add .
➜  react-app-for-docker git:(feature) ✗ git commit -m 'Added the new feature'
[feature cc257bd] Added the new feature
 1 file changed, 1 insertion(+)
➜  react-app-for-docker git:(feature) git push origin feature
Enumerating objects: 7, done.
Counting objects: 100% (7/7), done.
Delta compression using up to 12 threads
Compressing objects: 100% (4/4), done.
Writing objects: 100% (4/4), 372 bytes | 372.00 KiB/s, done.
Total 4 (delta 3), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (3/3), completed with 3 local objects.
remote:
remote: Create a pull request for 'feature' on GitHub by visiting:
remote:      https://github.com/mnaveensmn/docker-react/pull/new/feature
remote:
To github.com:mnaveensmn/docker-react.git
 * [new branch]      feature -> feature
➜  react-app-for-docker git:(feature)
```

Compare and pull request

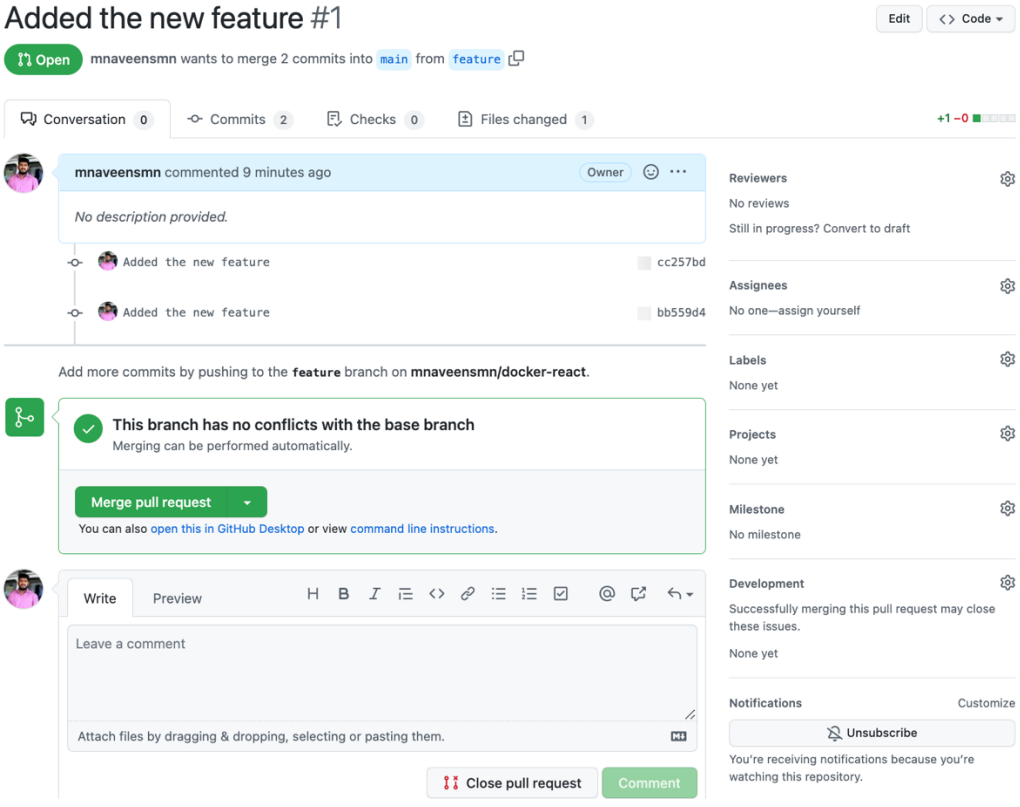


Open a pull request

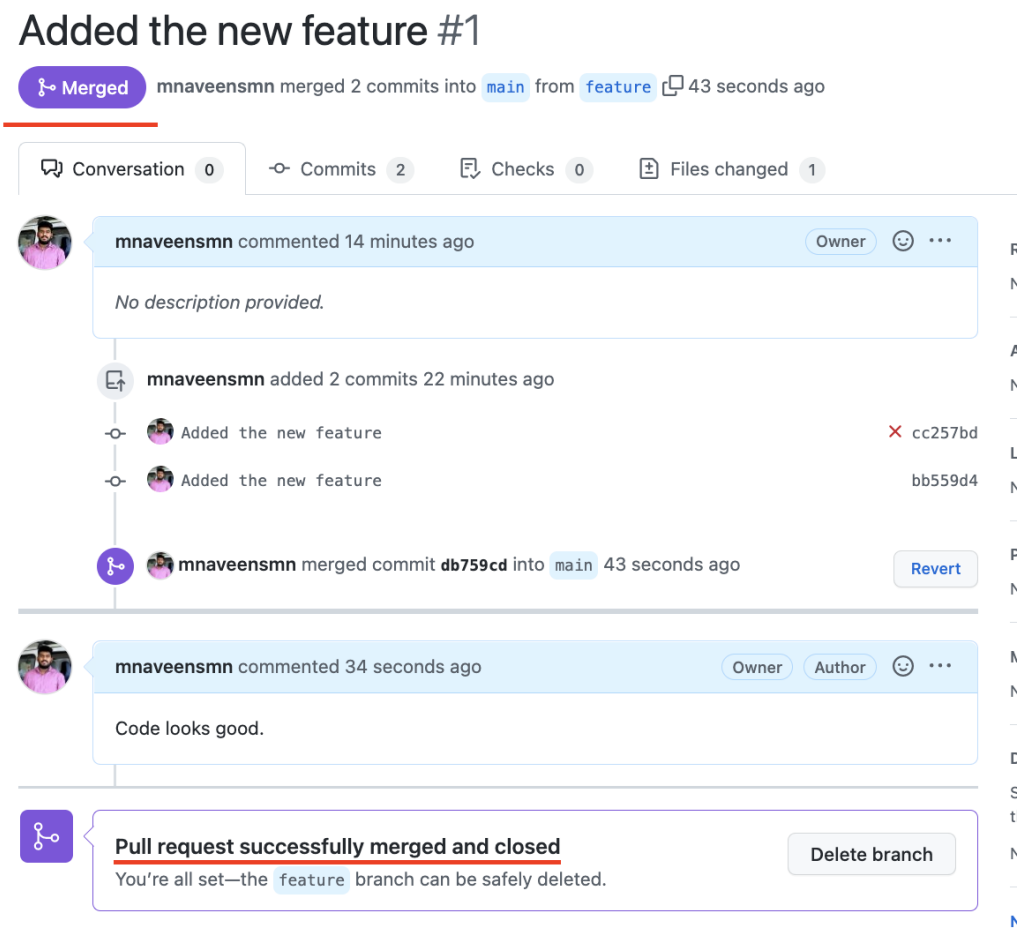
Create a new pull request by comparing changes across two branches. If you need to, you can also compare across forks.



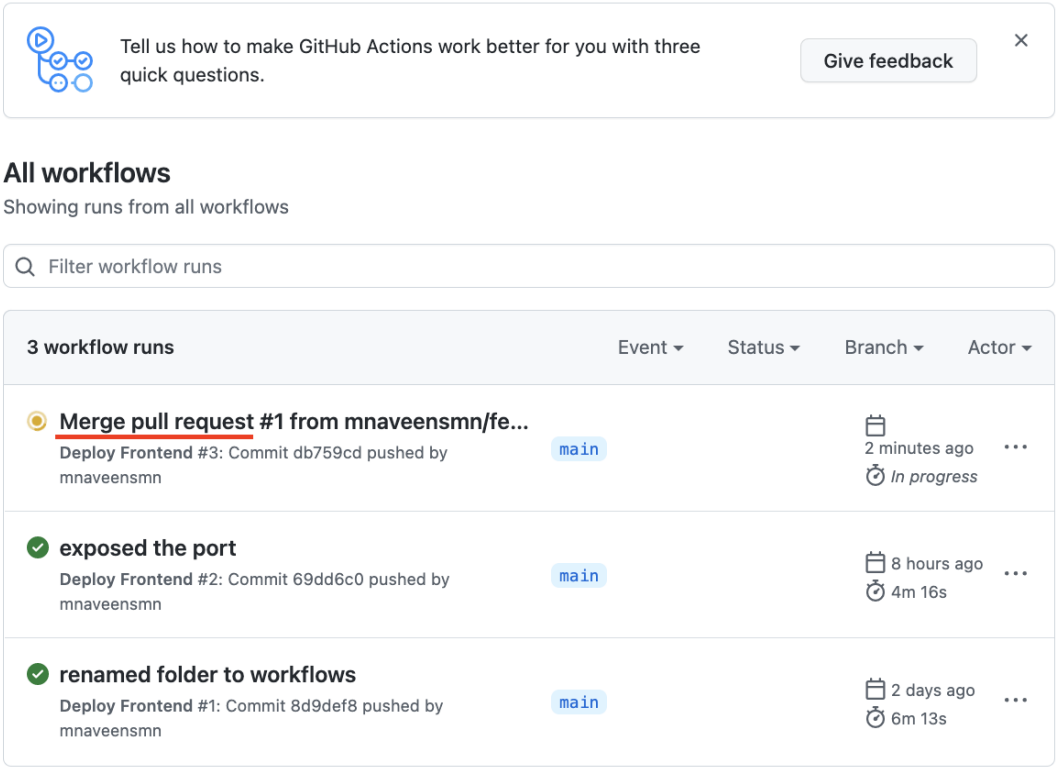
Added the new feature #1

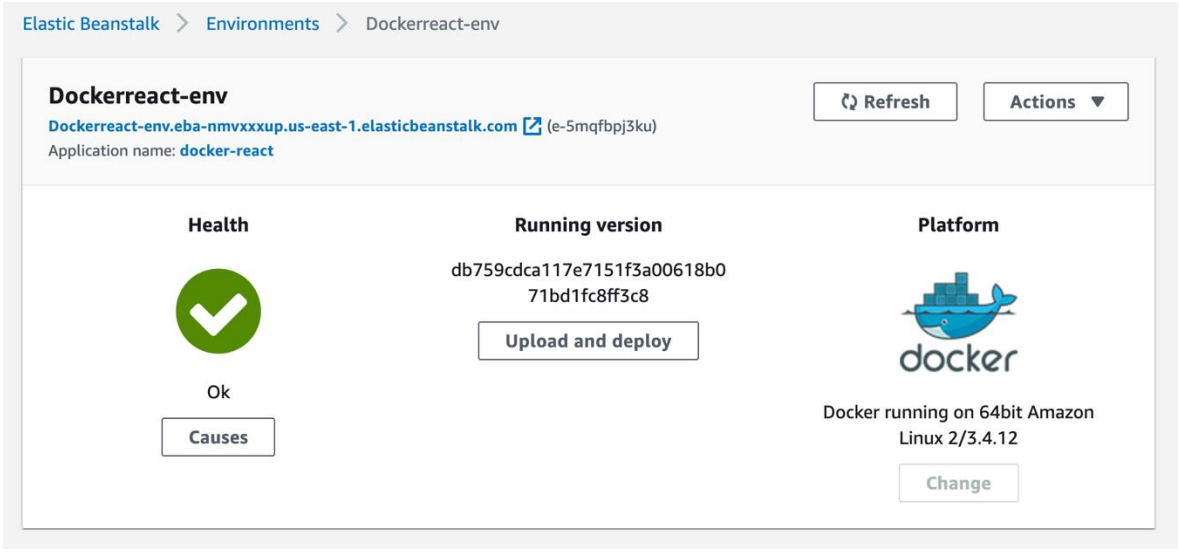


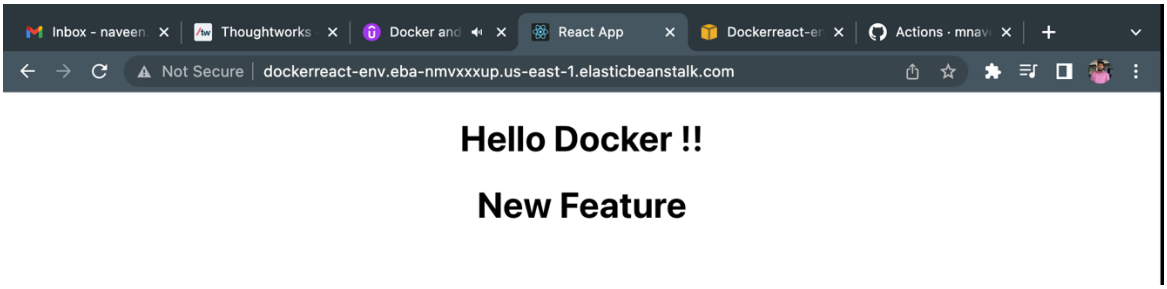
Merging the pull request



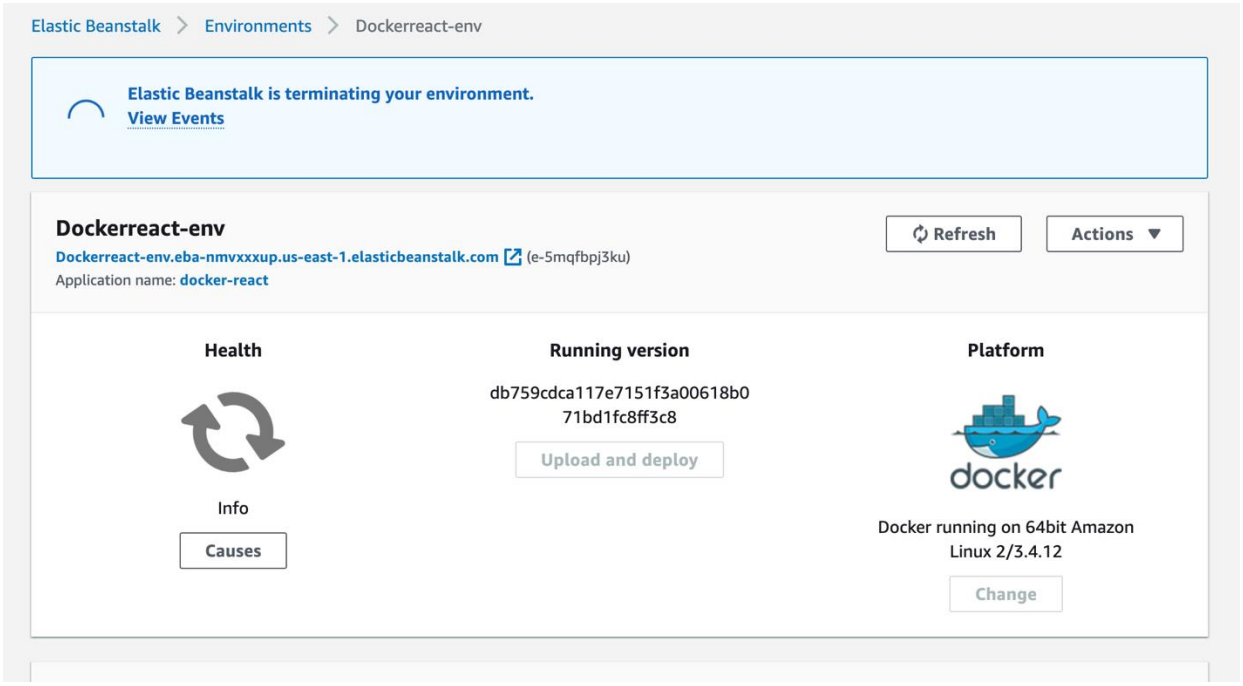
Our pipeline automatically deploying the merged code





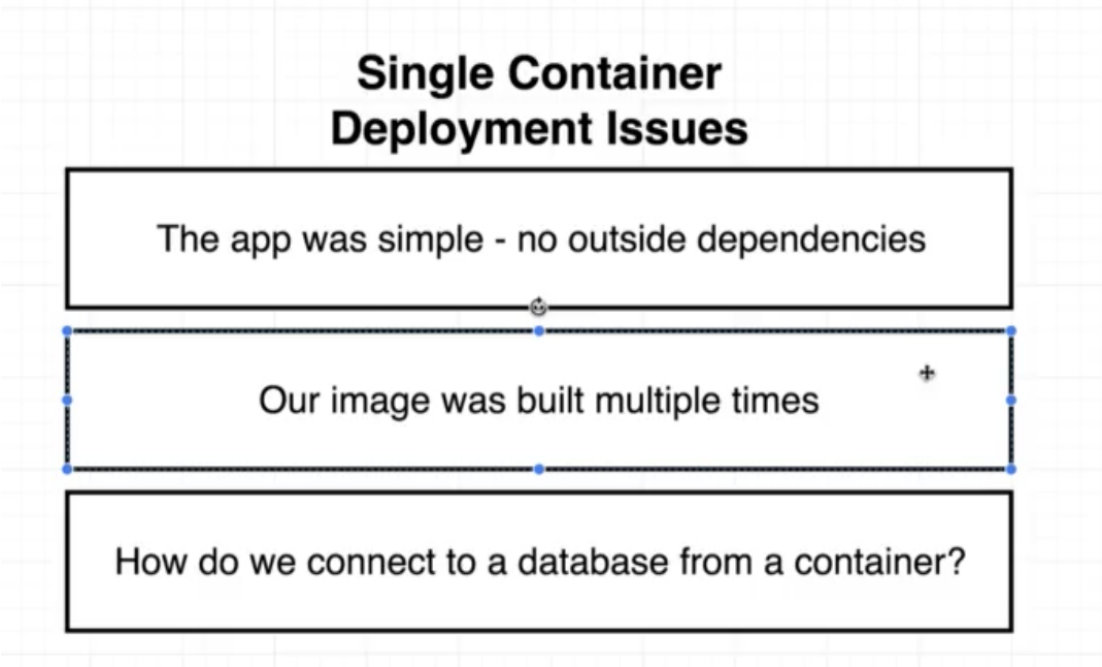


Terminating AWS Elastic beanstalk Environment



Building Multi Container Application

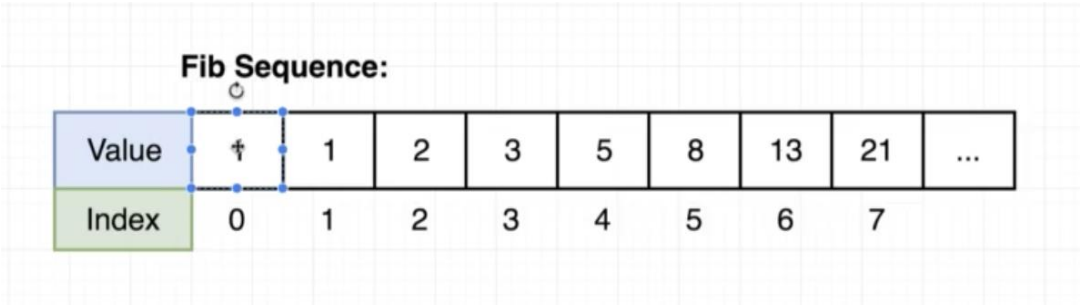
Single Container Deployment Issue



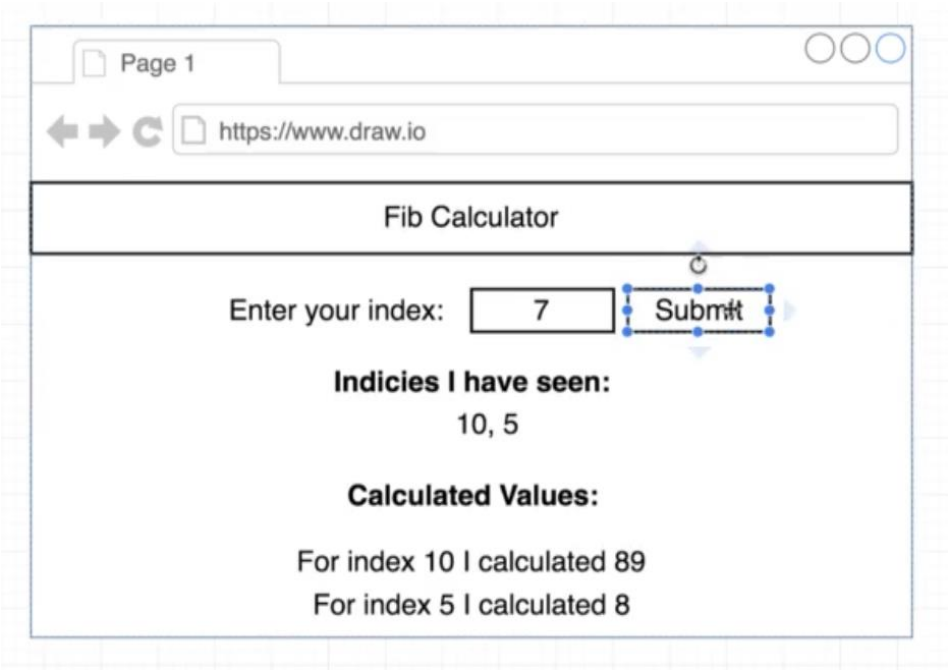
Fibonacci Sequence Generator

Application Overview

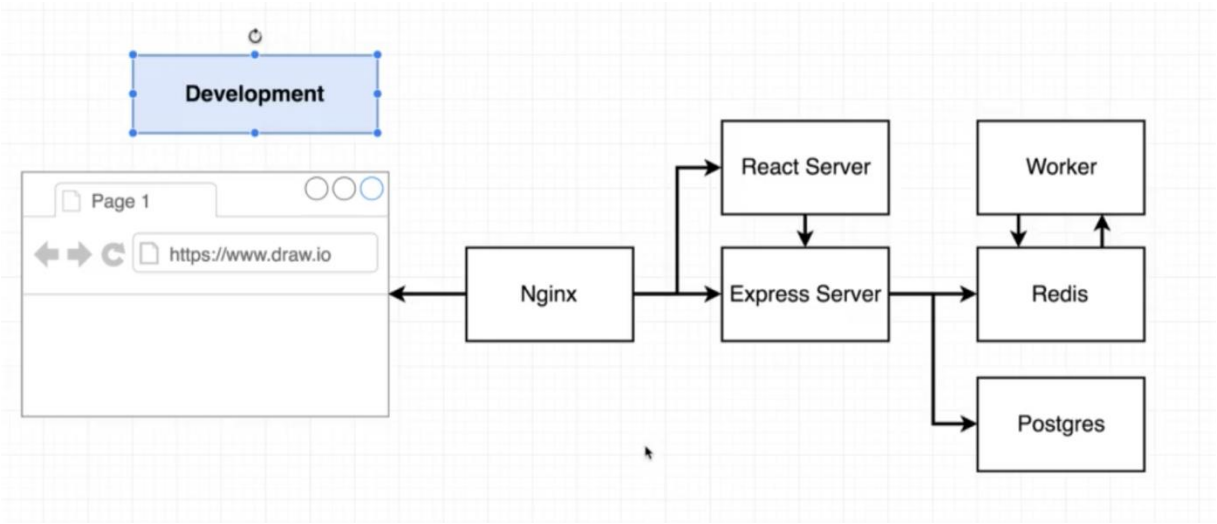
Fibonacci Series

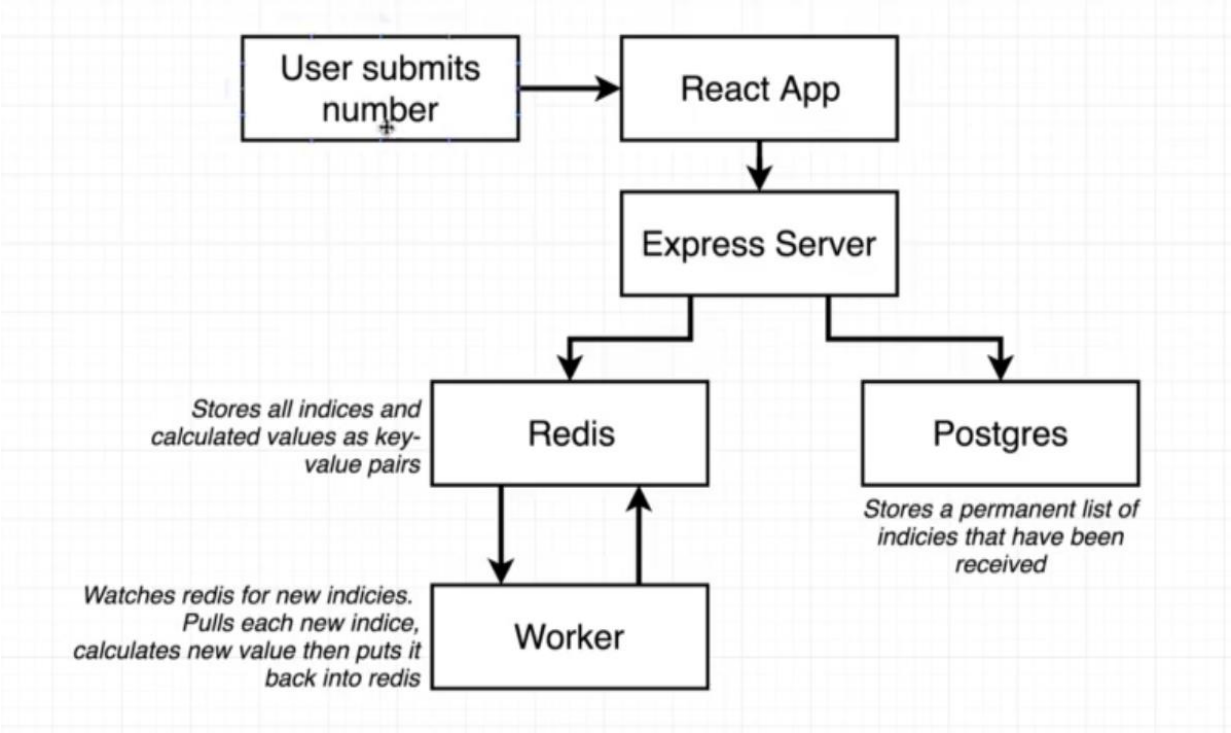


Returns the fib sequence value for given index.



Application Architecture

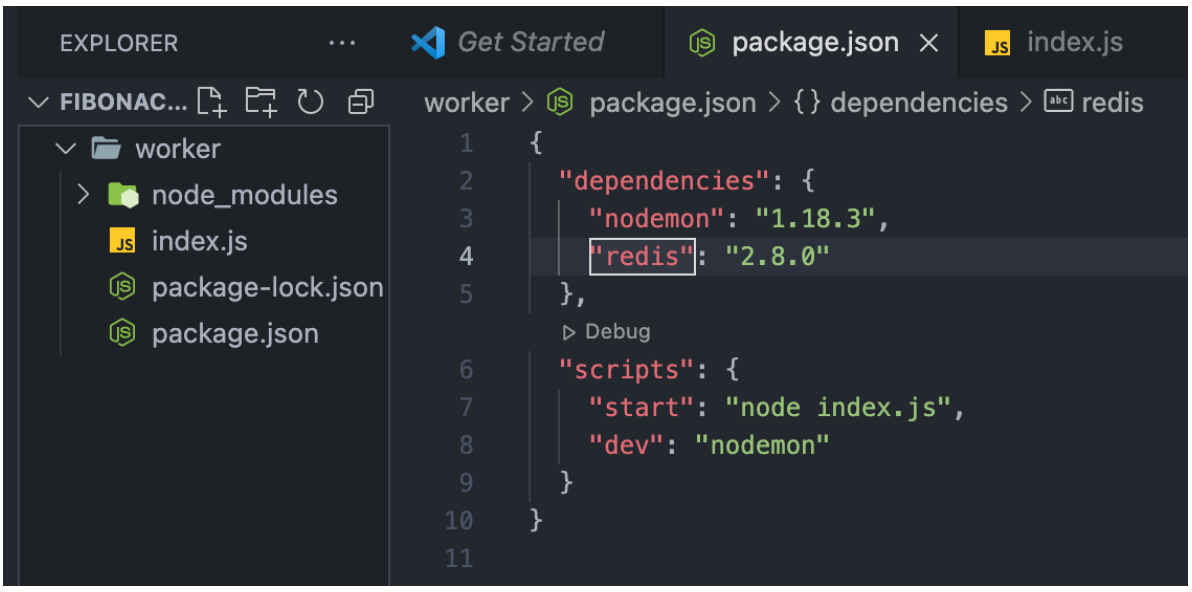




Application Development

Worker

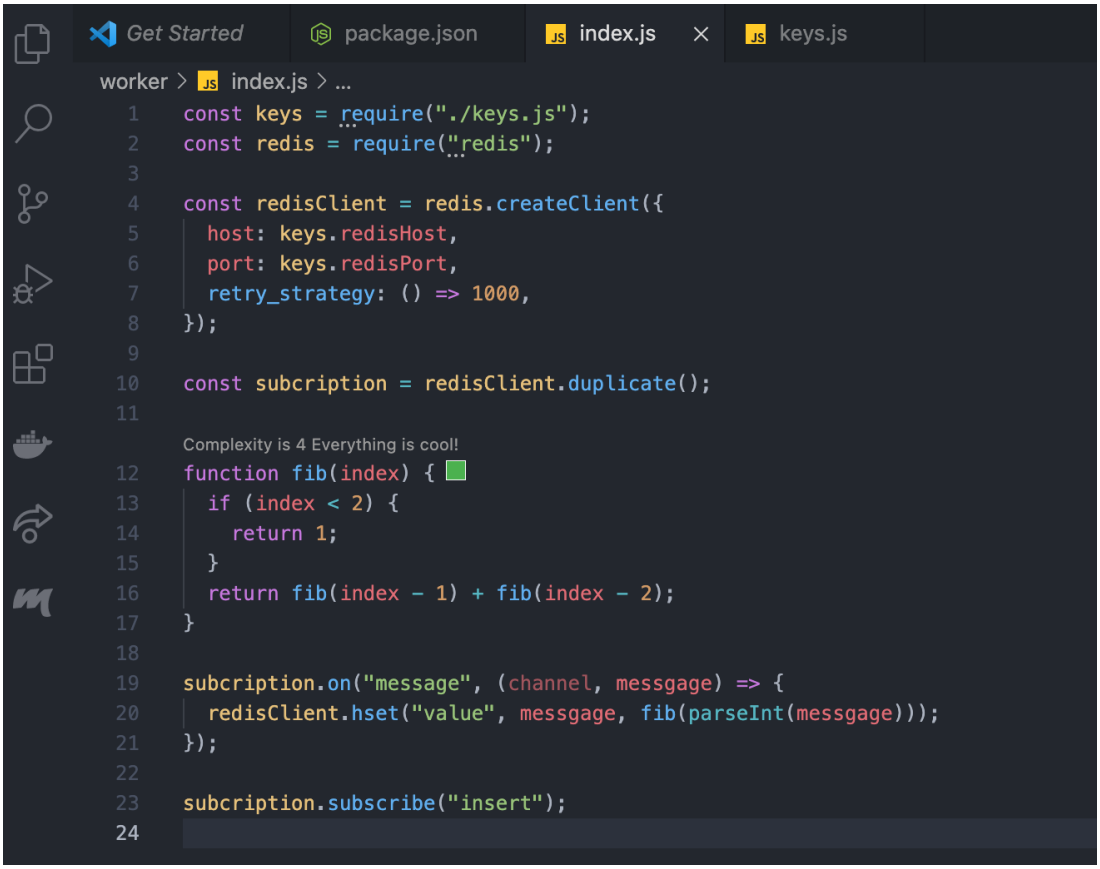
Adding the package.json file.



Configuring Redis and adding the Fibonacci series algorithm

worker > keys.js > <unknown>

```
1  module.exports = {
2    redisHost: process.env.REDIS_HOST,
3    redisPort: process.env.REDIS_PORT,
4  };
5
```



Server

Express and Postgres setup

server > index.js > ...

```
const keys = require("./keys");

// Express App Setup
const express = require("express");
const bodyParser = require("body-parser");
const cors = require("cors");

//cors - cross version resource sharing
const app = express();
app.use(cors());
app.use(bodyParser.json());

//Postgress Client Set
const { Pool } = require("pg");
const pgClient = new Pool({
  user: keys.pgUser,
  host: keys.pgHost,
  database: keys.pgDatabase,
  password: keys.pgPassword,
  port: keys.pgPort,
});

pgClient.on("connect", (client) => {
  client
    .query("CREATE TABLE IF NOT EXISTS values (number INT)")
    .catch((err) => console.error(err));
});

```

server > keys.js > ...

```
module.exports = {
  redisHost: process.env.REDIS_HOST,
  redisPort: process.env.REDIS_PORT,
  pgUser: process.env.PGUSER,
  pgHost: process.env.PGHOST,
  pgDatabase: process.env.PGDATABASE,
  pgPassword: process.env.PGPASSWORD,
  pgPort: process.env.PGPORT,
};

```

Redis client setup and Express handler

```
// Redis Client Setup
const redis = require("redis");
const redisClient = redis.createClient({
  host: keys.redisHost,
  port: keys.redisPort,
  retry_strategy: () => 1000,
});
const redisPublisher = redisClient.duplicate();

// Express route handlers
app.get("/", (req, res) => {
  res.send("Hi");
});

app.get("/values/all", async (req, res) => {
  const values = await pgClient.query("SELECT * from values");
  res.send(values.rows);
});

app.get("/values/current", async (req, res) => {
  redisClient.hgetall("values", (err, values) => {
    res.send(values);
  });
});

Complexity is 3 Everything is cool!
app.post("/values", async (req, res) => {
  const index = req.body.index;
  if (parseInt(index) > 40) {
    return res.status(422).send("Index too high");
  }
  redisClient.hset("values", index, "Nothing yet!");
  redisPublisher.publish("insert", index);
  pgClient.query("INSERT INTO values(number) VALUES($1)", [index]);
  res.send({ working: true });
});

app.listen(5000, (err) => {
  console.log("Listening");
});
```

Client

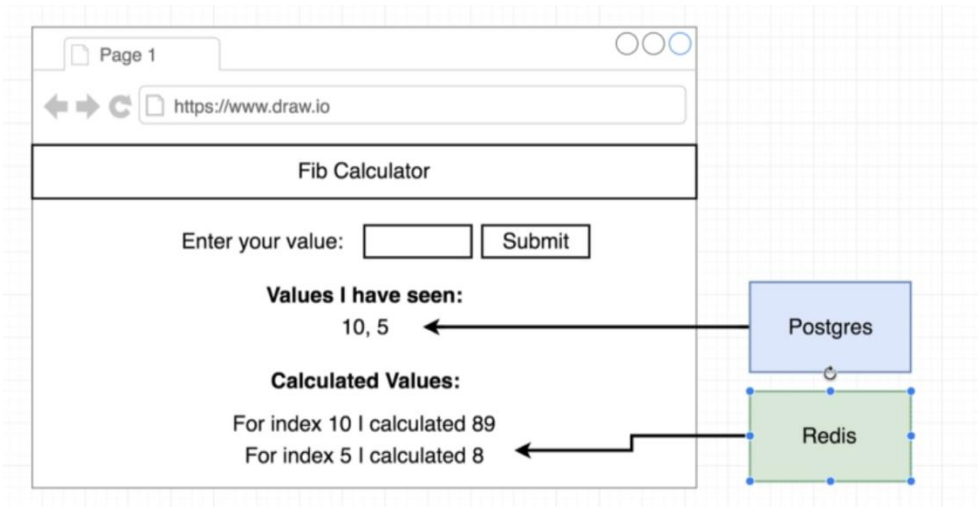
Creating a react app

```
→  fibonacci-generator-web npx create-react-app client

Creating a new React app in /Users/naveen.kumar1/Workspace/WEB/fibonacci-generator-w
eb/client.

Installing packages. This might take a couple of minutes.
Installing react, react-dom, and react-scripts with cra-template...


added 1372 packages in 3m

169 packages are looking for funding
  run `npm fund` for details

Initialized a git repository.

Installing template dependencies using npm...
npm WARN deprecated source-map-resolve@0.6.0: See https://github.com/lydell/source-m
ap-resolve#deprecated

added 38 packages in 9s

169 packages are looking for funding
  run `npm fund` for details
Removing template package using npm...
```

Fetching the data in react app

```
Complexity is 7 It's time to do something...
class Fib extends Component {
  state = {
    seenIndexes: [],
    values: {},
    index: "",
  };

  componentDidMount() {
    this.fetchValues();
    this.fetchIndexes();
  }

  async fetchValues() {
    const values = await axios.get("/api/values/current");
    this.setState({ values: values.data });
  }

  async fetchIndexes() {
    const seenIndexes = await axios.get("/api/values/current");
    this.setState({
      seenIndexes: seenIndexes.data,
    });
  }

  Complexity is 7 It's time to do something...
  render() {
    return (
      <div>
        <form>
          <label>Enter your index:</label>
          <input />
          <button>Submit</button>
        </form>
      </div>
    );
  }
}
```

Rendering logic

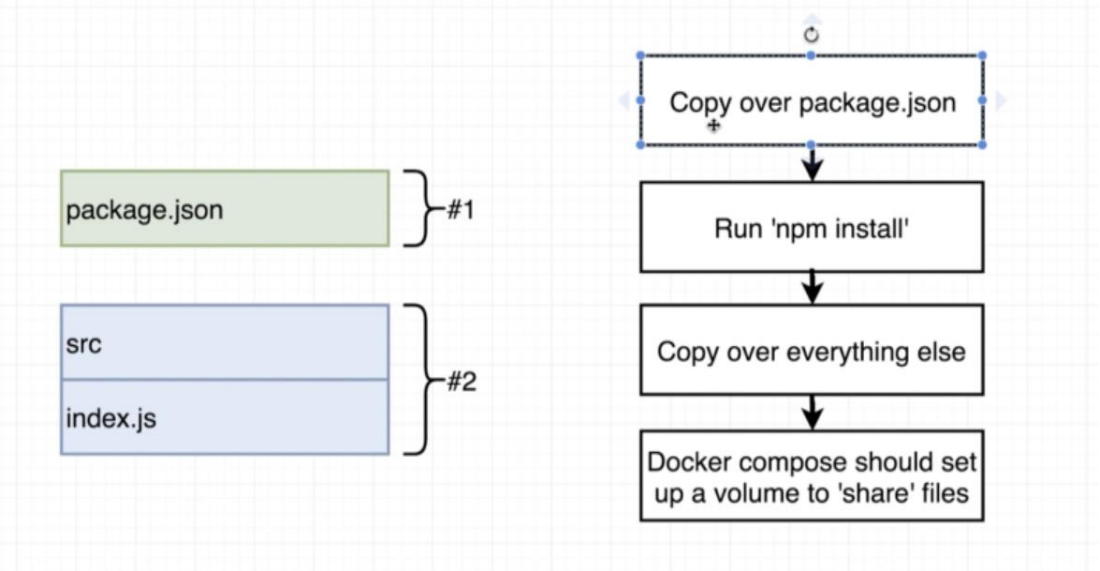


Routing in react app

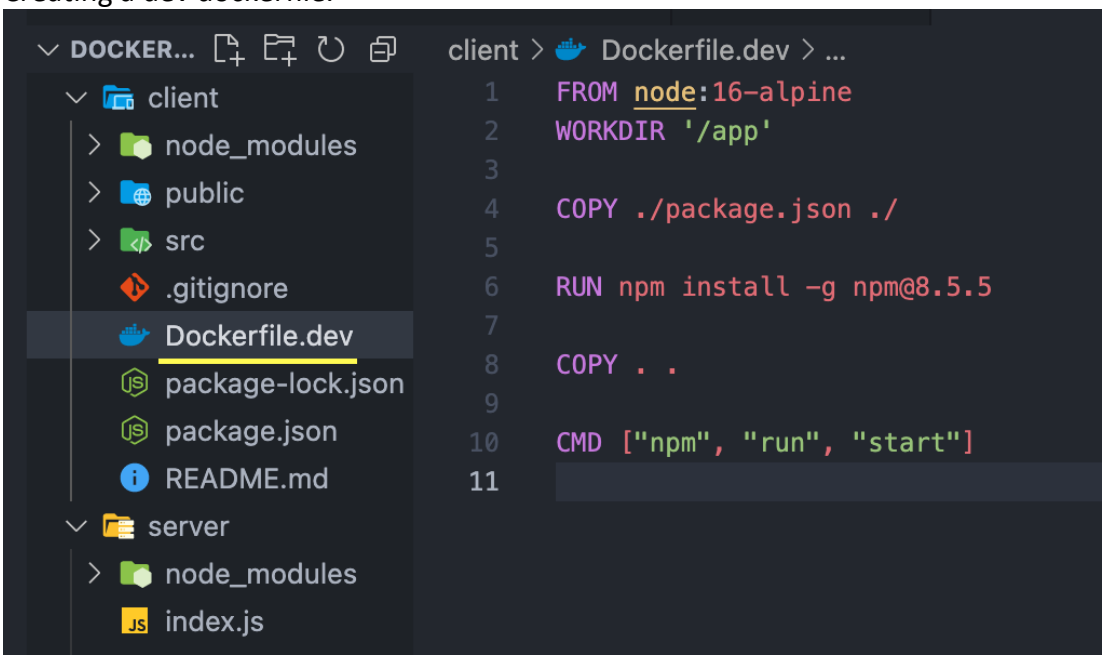
```
src > App.js > ...
import "./App.css";
import { BrowserRouter as Router, Route, Link } from "react-router-dom";
import OtherPage from "./OtherPage";
import Fib from "./Fib";

Complexity is 8 It's time to do something...
function App() {
  return (
    <Router>
      <div className="App">
        <Link to="/">Home</Link>
        <Link to="/otherpage">Other Page</Link>

        <Route exact path="/" component={Fib} />
        <Route exact path="/otherpage" component={OtherPage} />
      </div>
    </Router>
  );
}

export default App;
```

Dockerizing the Multi Services

Dockerizing the React App



Creating a dev dockerfile.



Building a dev docker file.

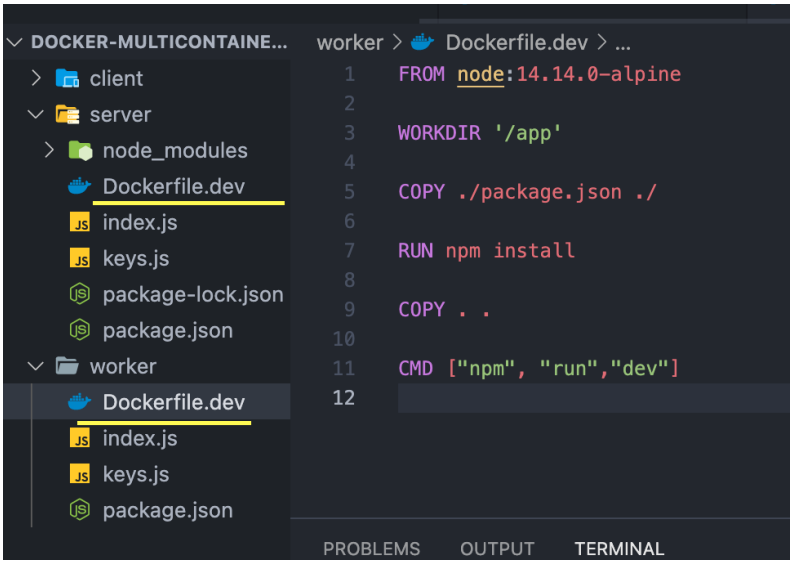
```
→  client docker build -f Dockerfile.dev .
[+] Building 25.5s (10/10) FINISHED
 => [internal] load build definition from Dockerfile.dev      0.0s
 => => transferring dockerfile: 176B                          0.0s
 => [internal] load .dockerignore                             0.0s
 => => transferring context: 2B                               0.0s
 => [internal] load metadata for docker.io/library/node:16-a  0.0s
 => [internal] load build context                             1.8s
 => => transferring context: 3.06MB                           1.8s
 => [1/5] FROM docker.io/library/node:16-alpine               0.0s
 => CACHED [2/5] WORKDIR /app                                 0.0s
 => CACHED [3/5] COPY ./package.json ./                       0.0s
 => [4/5] RUN npm install -g npm@8.5.5                       10.2s
 => [5/5] COPY . .                                            7.0s
 => exporting to image                                        6.3s
 => => exporting layers                                       6.3s
 => => writing image sha256:5fd5f07f816a9960517b03f777ab8ad0  0.0s
```

Running the docker image.

```
→  client docker run 5fd5f07f816a9960517b03f777ab8ad0

> client@0.1.0 start
> react-scripts start

ℹ ｢wds｣: Project is running at http://172.17.0.2/
ℹ ｢wds｣: webpack output is served from
ℹ ｢wds｣: Content not from webpack is served from /app/public
ℹ ｢wds｣: 404s will fallback to /
Starting the development server...

→  client
```

Dockerizing the generic node app

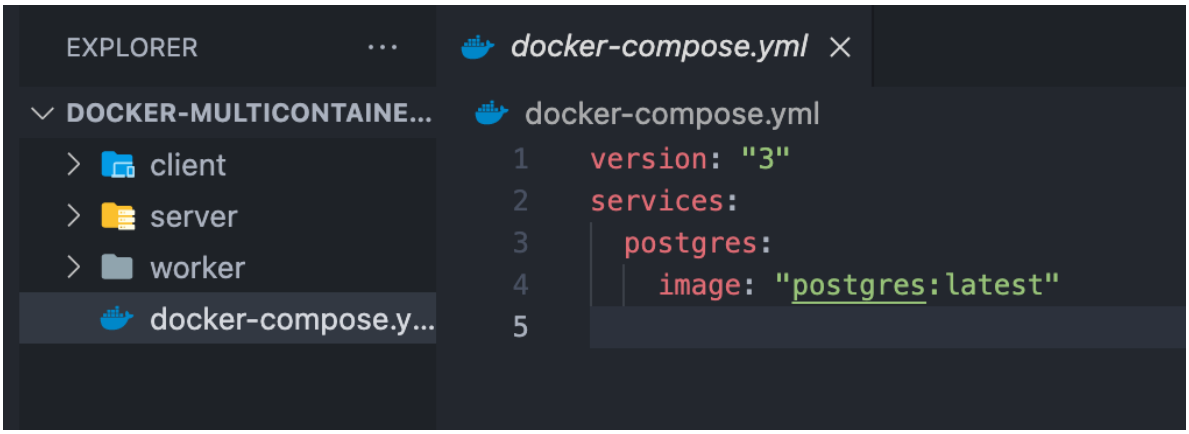
Adding a docker file for server and worker project. It is a same command for both the dockerfiles.



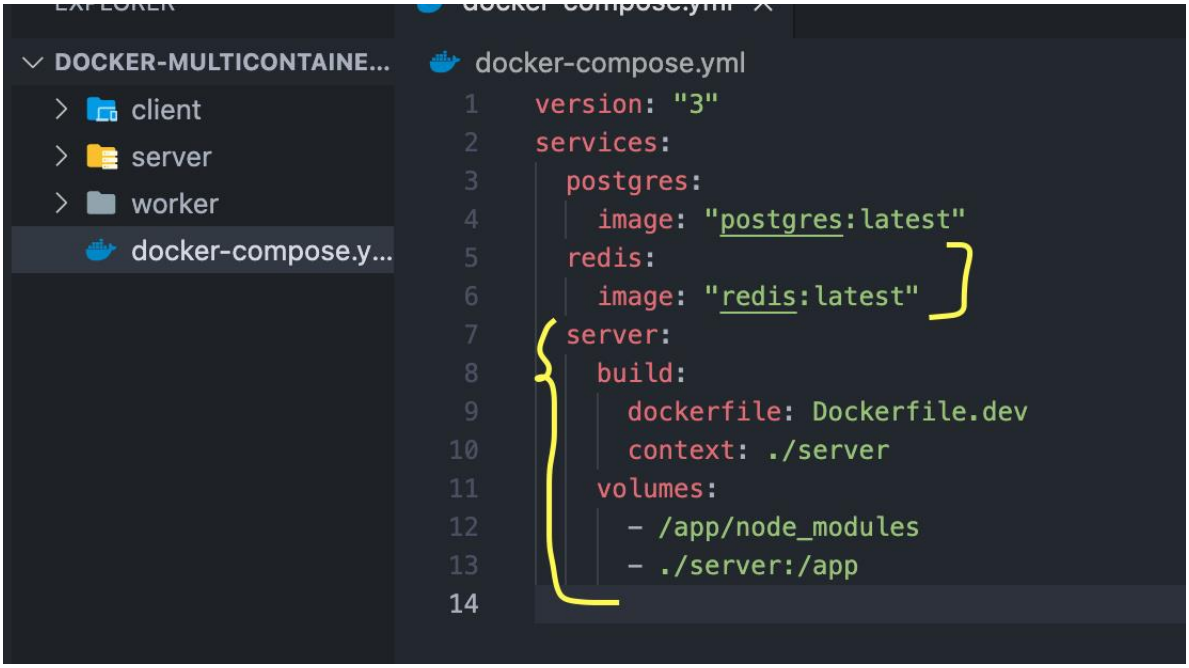
Building a docker image

```
 => => extracting sha256:378c9540b231b522ab12144ad767b0abb1c  1.6s
 => => extracting sha256:fd5173d1722049170dadc1ec1e8a0653b8c  0.1s
 => => extracting sha256:72f138d46980234e4f5b2469131de318f07  0.0s
 => [internal] load build context                            3.4s
 => => transferring context: 8.25MB                          3.4s
 => [2/5] WORKDIR /app                                       0.1s
 => [3/5] COPY ./package.json ./                             0.0s
 => [4/5] RUN npm install                                   18.8s
 => [5/5] COPY . .                                           0.2s
 => exporting to image                                       0.5s
 => => exporting layers                                      0.5s
 => => writing image sha256:7e99c3a97a32f10f6e764a20eae11eb8  0.0s

Use 'docker scan' to run Snyk tests against images to find vulnerab
ilities and learn how to fix them
➜  server cd ..
➜  DOCKER-MULTICONTAINER-APP cd worker
➜  worker docker build -f Dockerfile.dev .
[+] Building 13.2s (10/10) FINISHED
 => [internal] load build definition from Dockerfile.dev     0.0s
 => => transferring dockerfile: 164B                         0.0s
 => [internal] load .dockerignore                            0.0s
 => => transferring context: 2B                              0.0s
 => [internal] load metadata for docker.io/library/node:14.1  1.6s
 => [1/5] FROM docker.io/library/node:14.14.0-alpine@sha256:  0.0s
 => [internal] load build context                            0.1s
 => => transferring context: 1.22kB                          0.1s
 => CACHED [2/5] WORKDIR /app                                0.0s
 => [3/5] COPY ./package.json ./                             0.0s
 => [4/5] RUN npm install                                   11.0s
 => [5/5] COPY . .                                           0.0s
 => exporting to image                                       0.4s
 => => exporting layers                                      0.4s
 => => writing image sha256:16395da1d2c8e4f1ff5a48b4cebfa808  0.0s

Use 'docker scan' to run Snyk tests against images to find vulnerab
ilities and learn how to fix them
➜  worker
```

Adding a postgres as a service

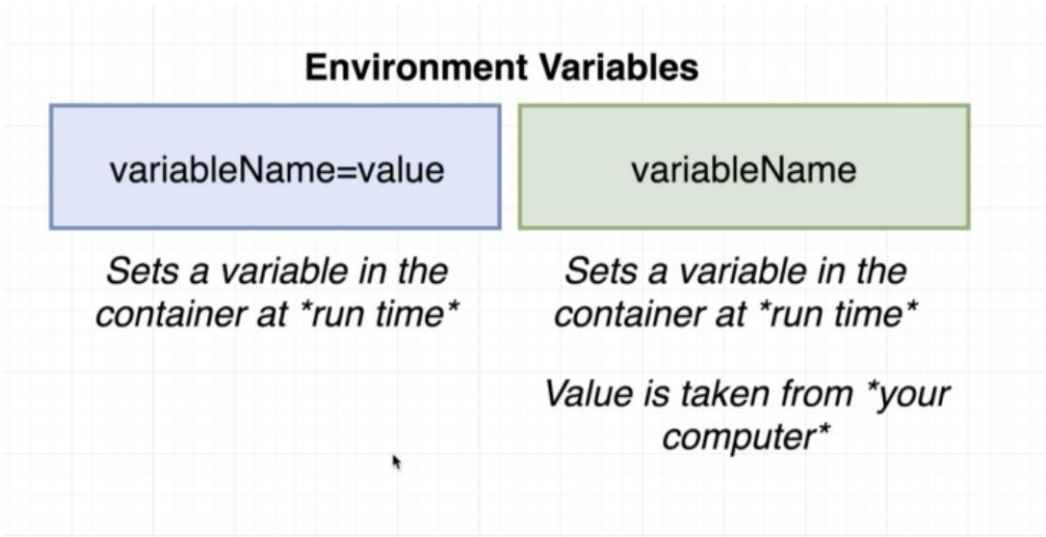


Docker compose config



Adding a redis service and server to docker compose.

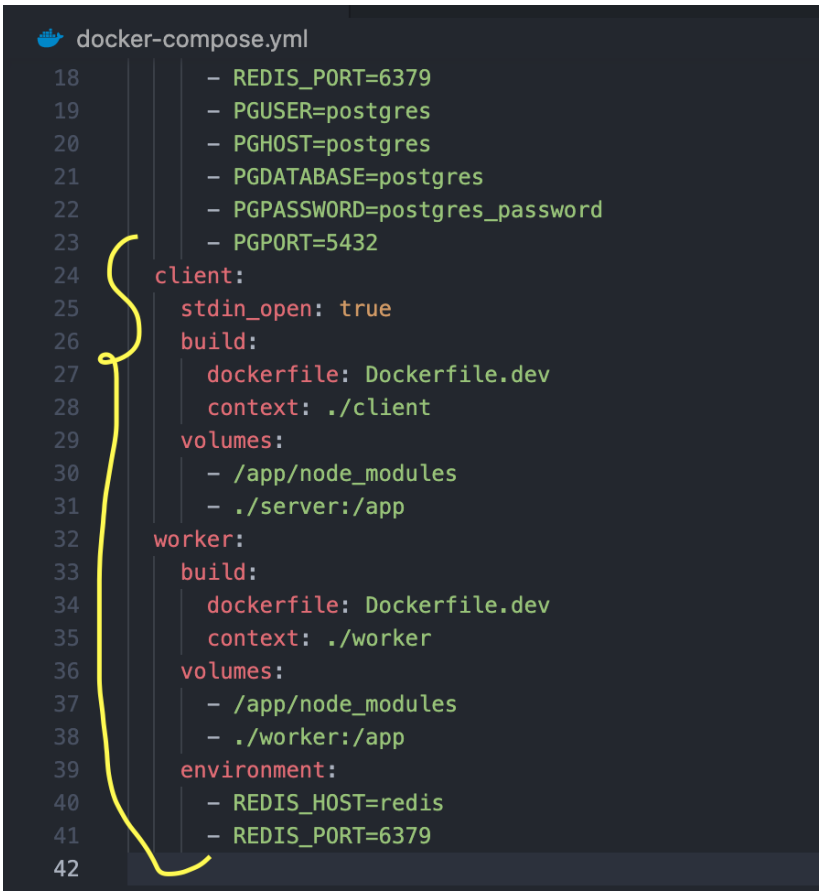
Environment variable with docker compose



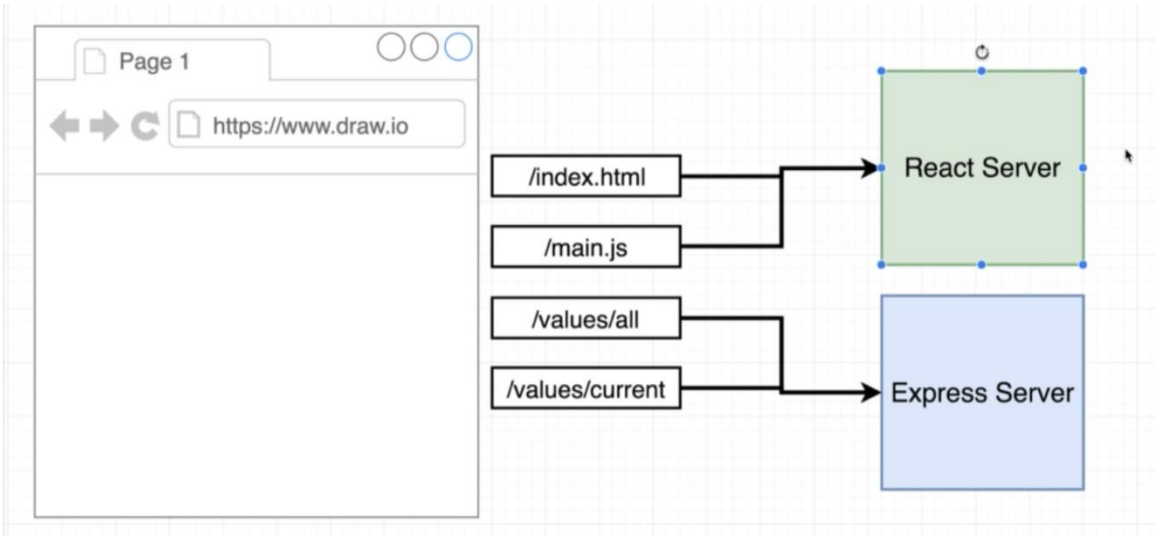
docker-compose.yml

```yaml
version: "3"
services:
  postgres:
    image: "postgres:latest"
    environment:
      - POSTGRES_PASSWORD=postgres_password
  redis:
    image: "redis:latest"
  server:
    build:
      dockerfile: Dockerfile.dev
      context: ./server
    volumes:
      - /app/node_modules
      - ./server:/app
    environment:
      - REDIS_HOST=redis
      - REDIS_PORT=6379
      - PGUSER=postgres
      - PGHOST=postgres
      - PGDATABASE=postgres
      - PGPASSWORD=postgres_password
      - PGPORT=5432

```

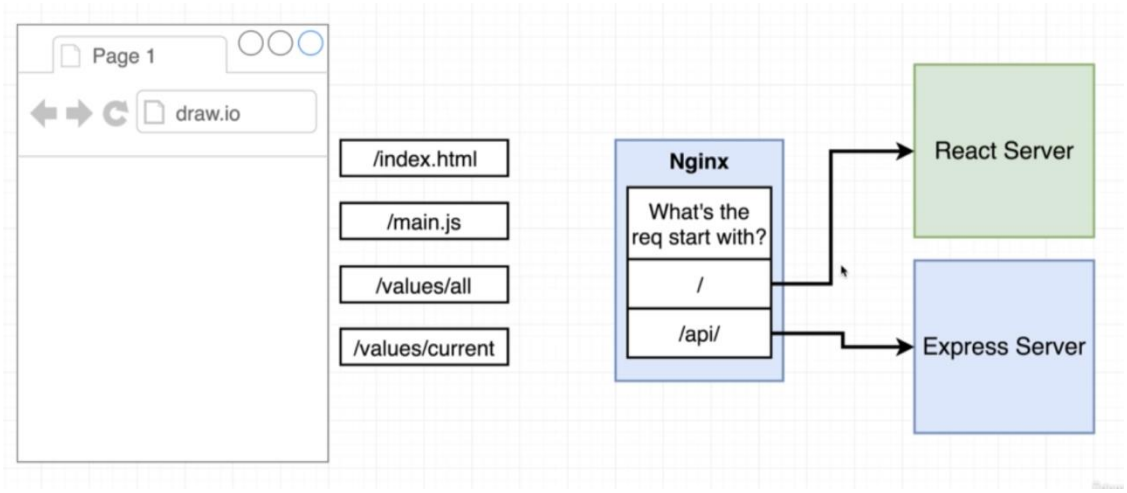
The worker and client services

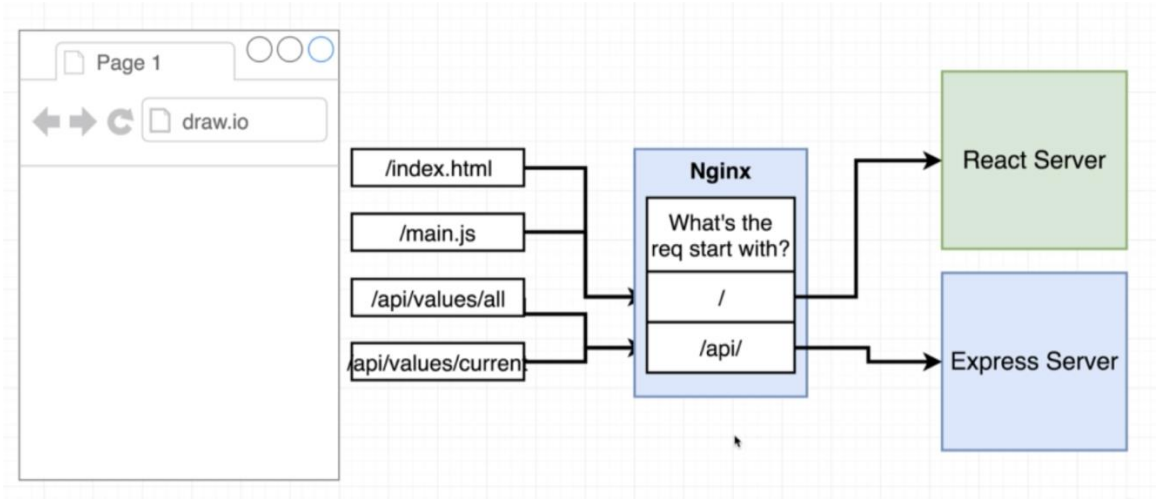


Nginx Path Routing

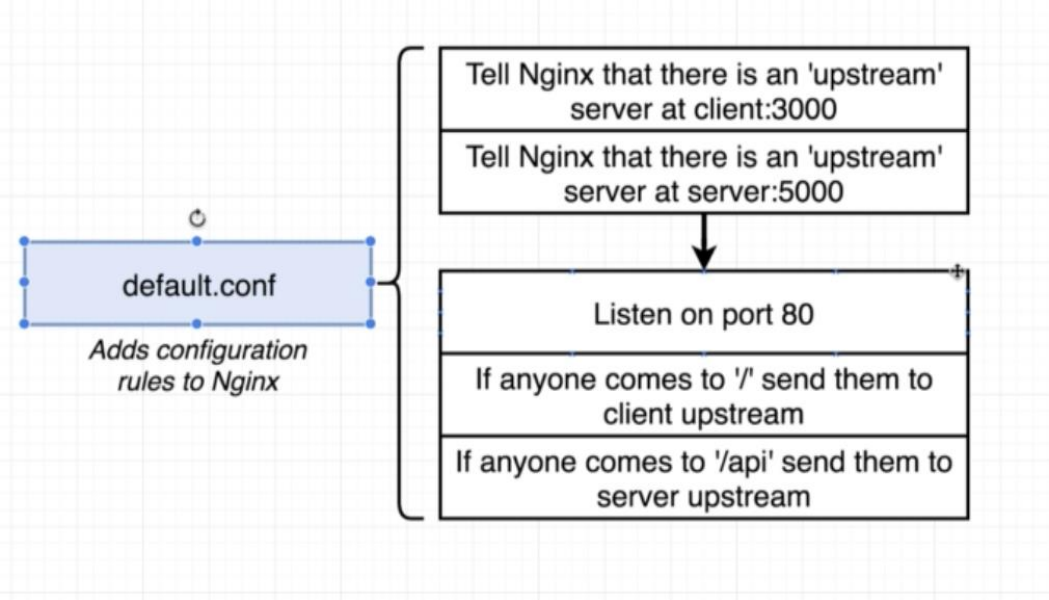


Ngix helps to route the request to right server.

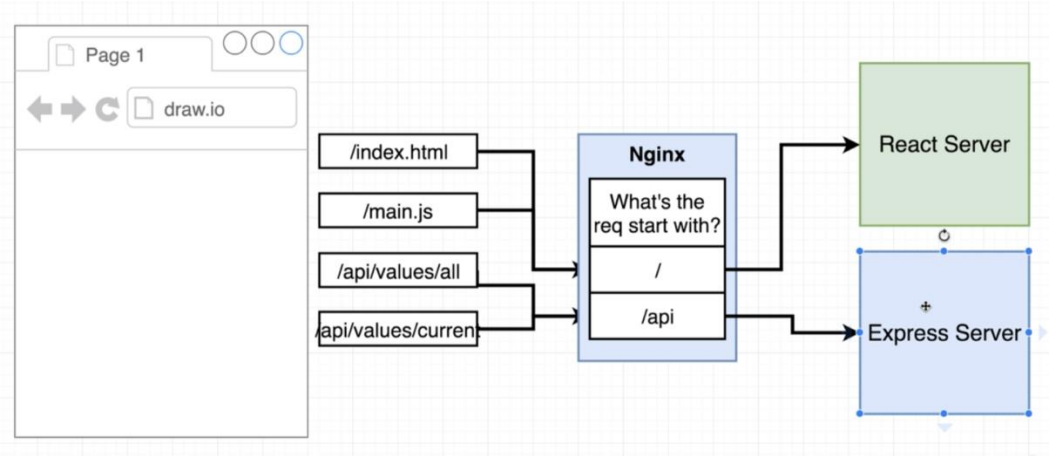




If the request contains the api in url, request goes to express server. Otherwise, it goes to react server.



Adding a configuration file for nginx routing.

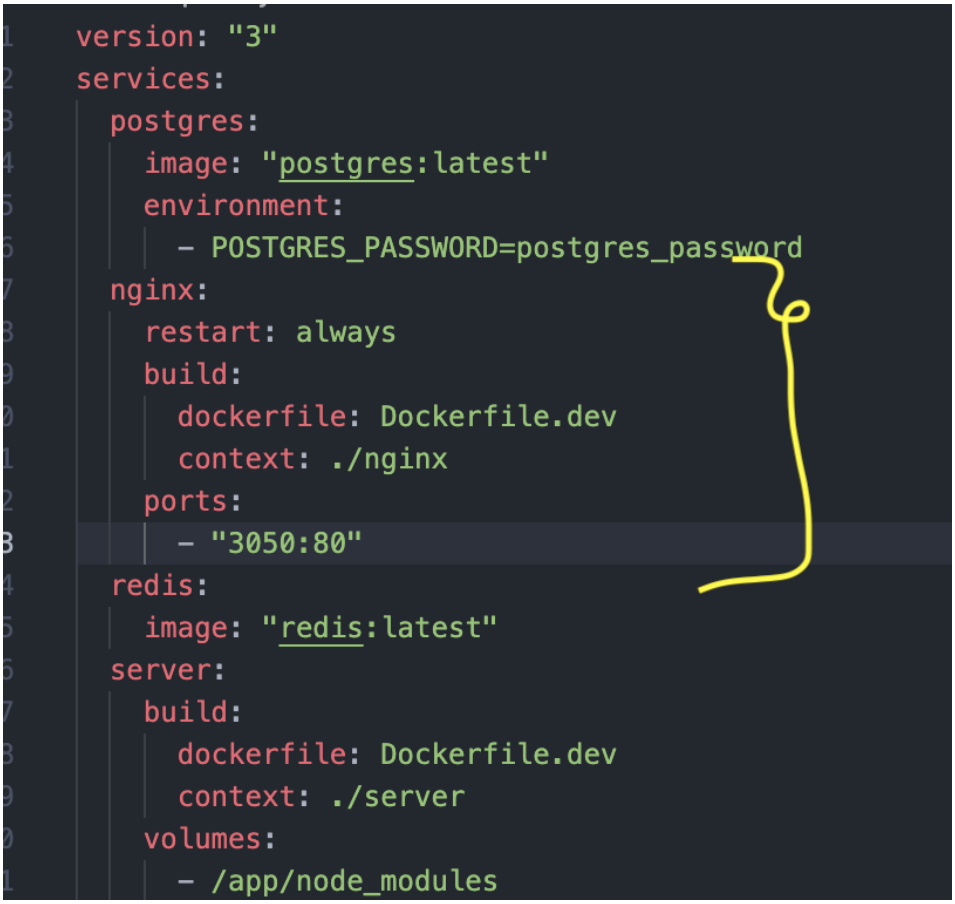


Nginx route the request to appropriate server.

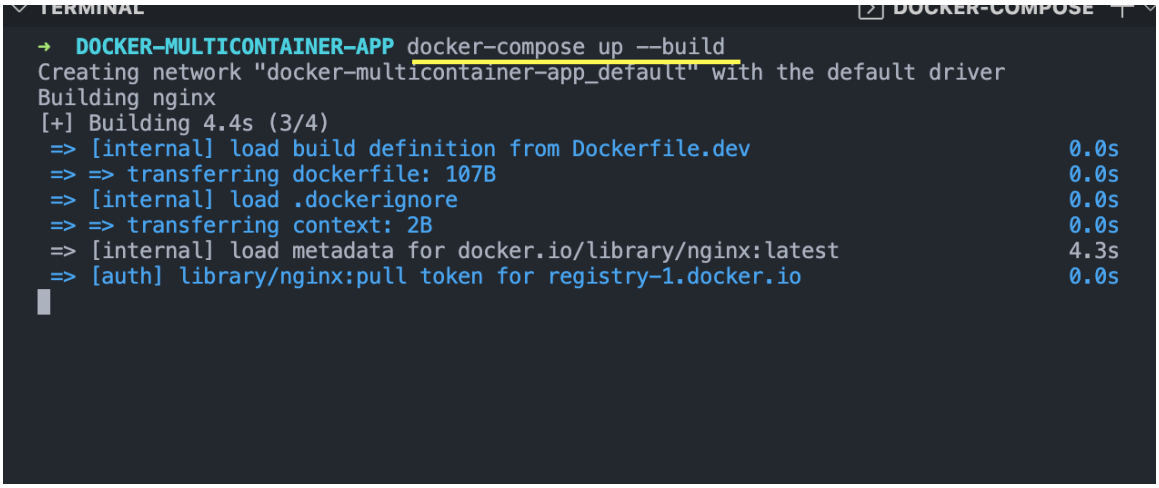
nginx > default.conf

```
upstream client {
    server client:3000;
}

upstream server {
    server server:5000;
}

server {
    listen 80;

    location / {
        proxy_pass http://client;
    }

    location /api {
        rewrite /api/(.*) /$1 break;
        proxy_pass http://api;
    }
}
```

Building a custom Nginx image

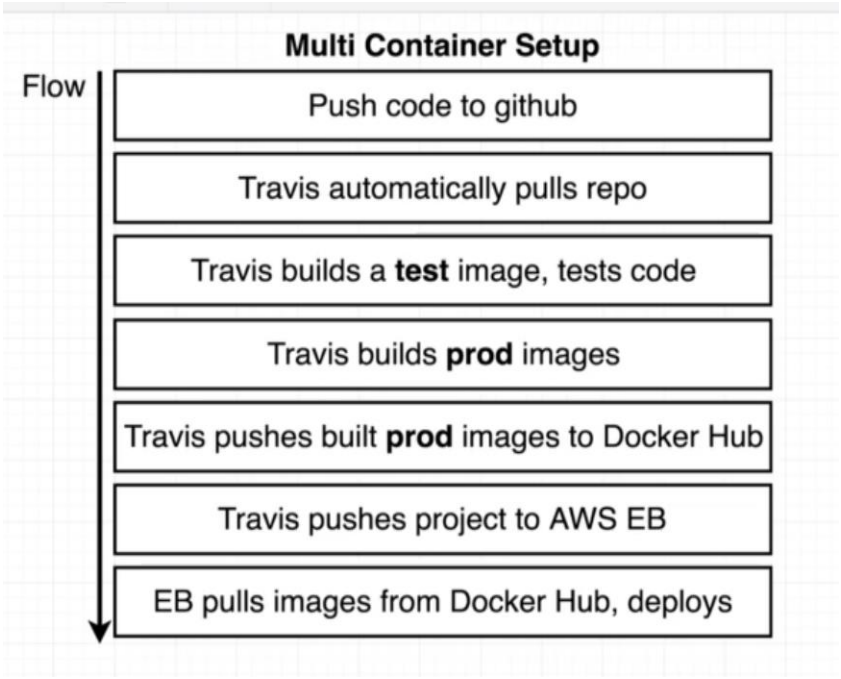


Starting up docker compose



A Continuous Integration Workflow for Multiple Images

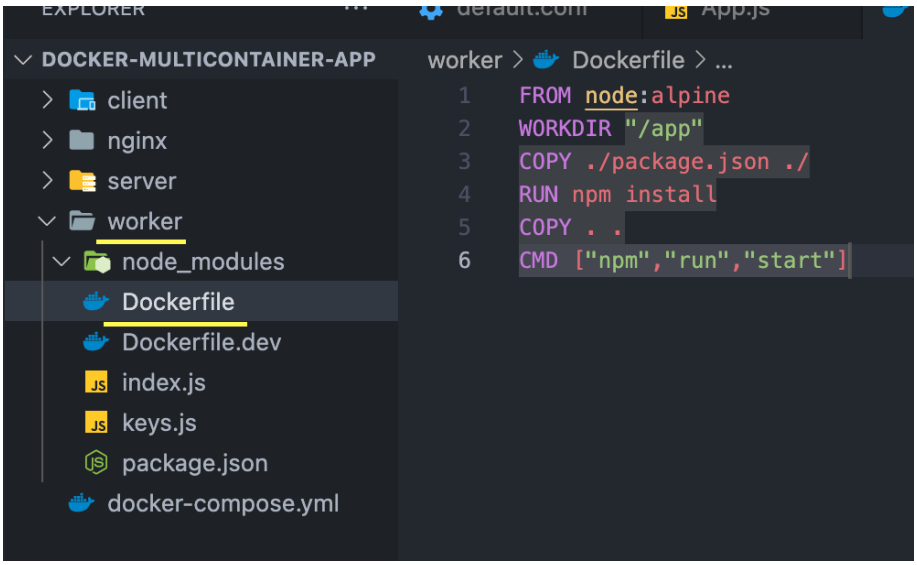
Production Multi Container Deployment



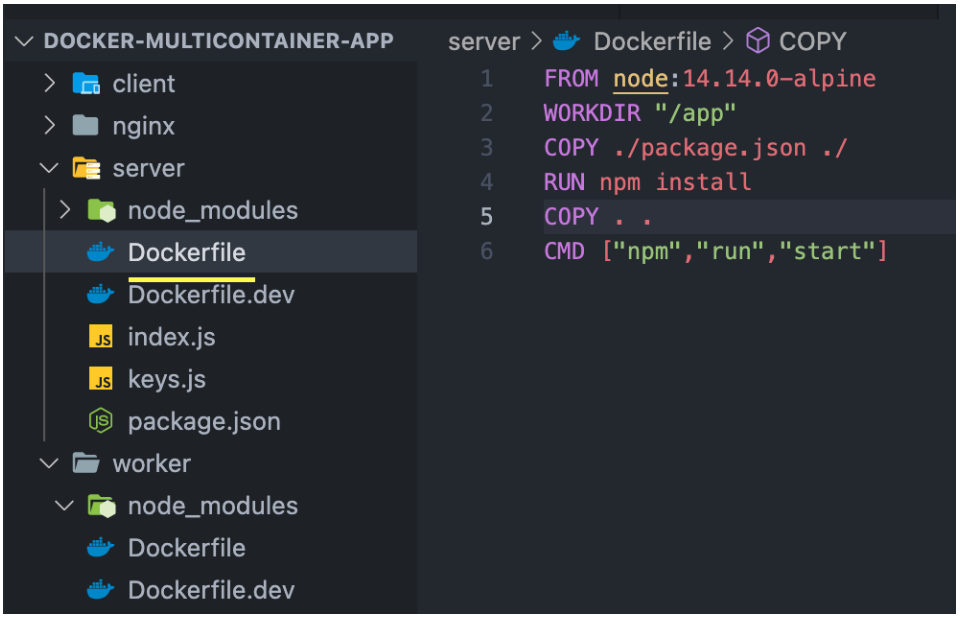
We will be using the GitHub Actions in place of Travis.

Production Dockerfile

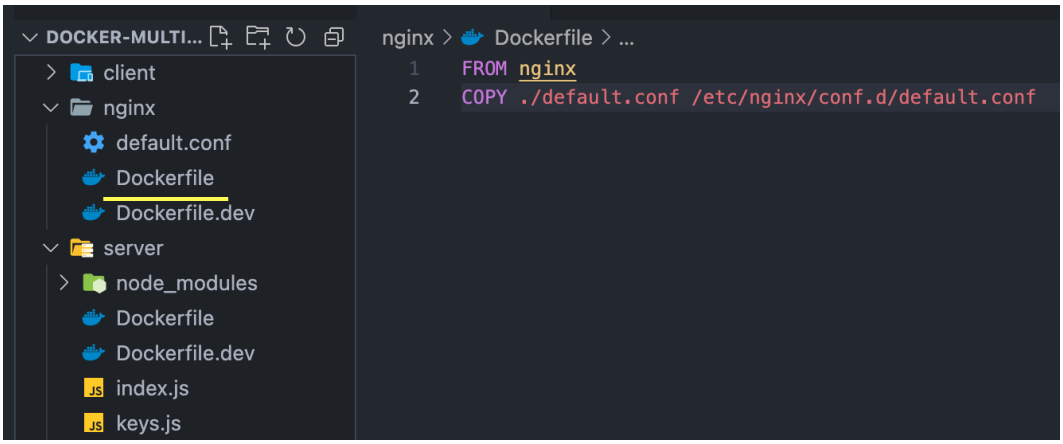
Worker dockerfile



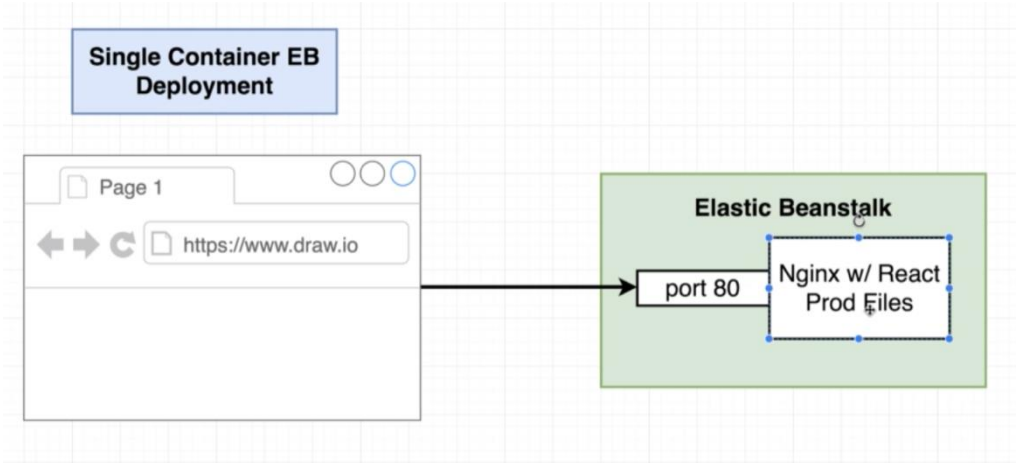
Server Dockerfile

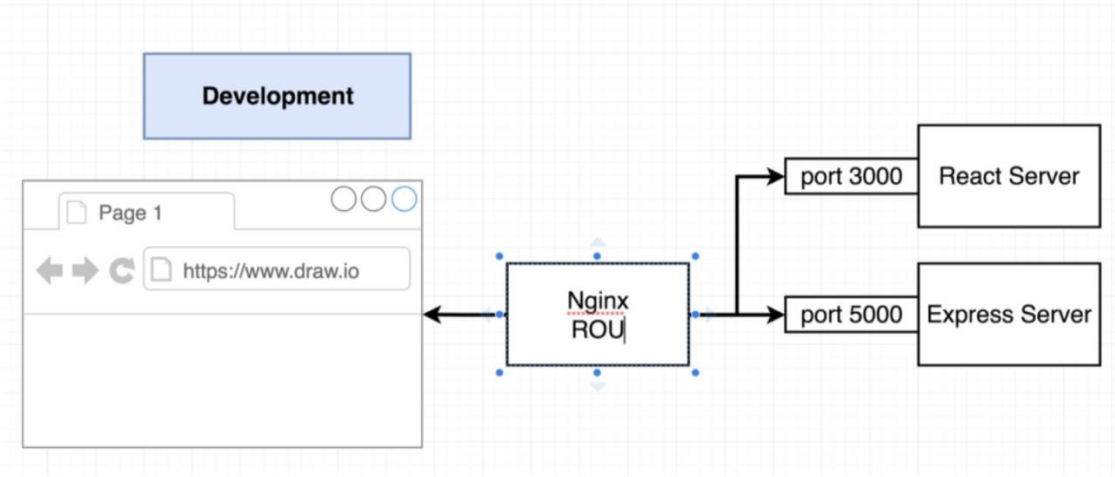


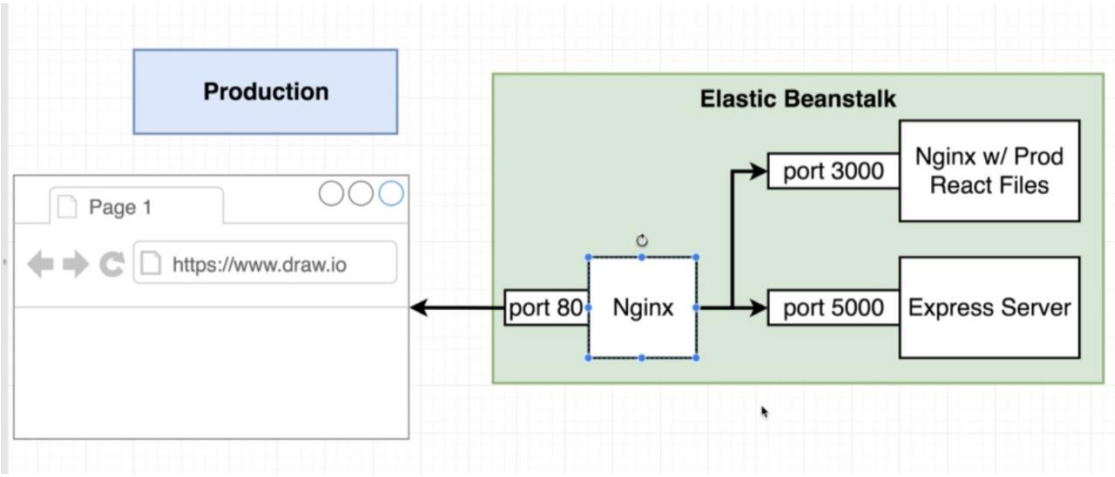
Nginx Dockerfile



Mutliple Nginx Instances







Client Production Dockerfile

client > Dockerfile > ...

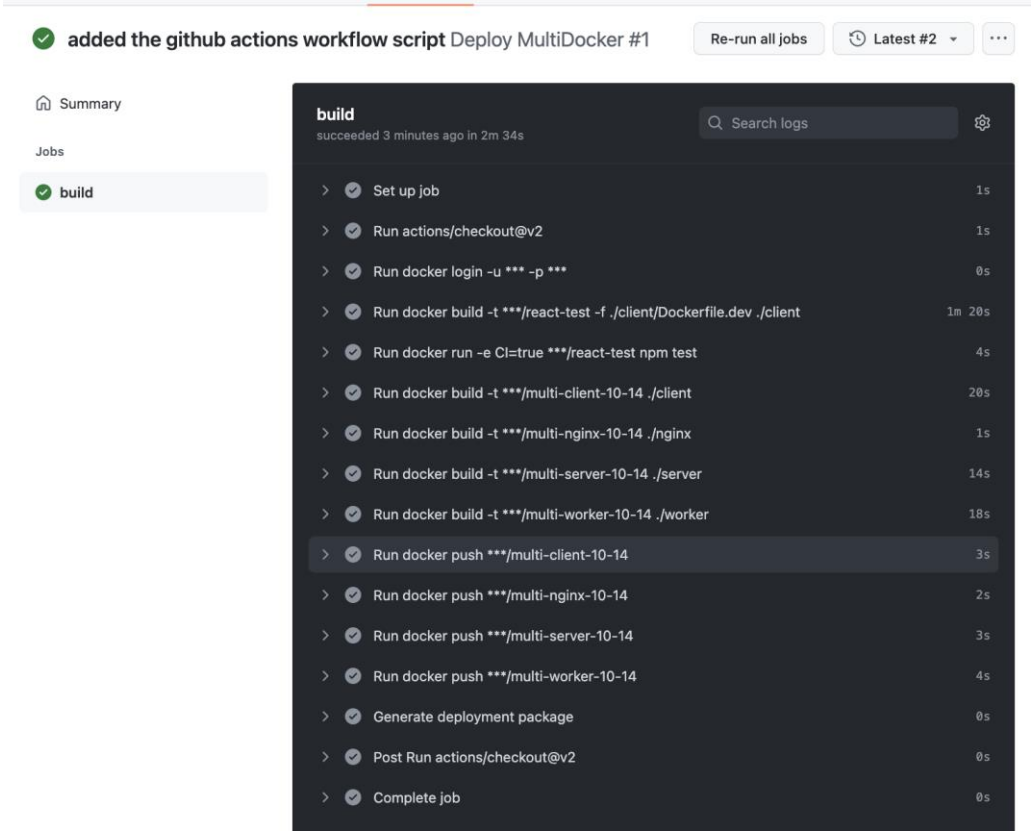
```
1   FROM node:16-alpine as builder
2   WORKDIR '/app'
3   COPY ./package.json ./
4   RUN npm install
5   COPY . .
6   RUN npm run build
7
8   FROM nginx
9   EXPOSE 3000
10  COPY ./nginx/default.conf /etc/nginx/conf.d/default.conf
11  COPY --from=builder /app/build /use/share/nginx/html
12
```

Continuous Integration with Github Actions

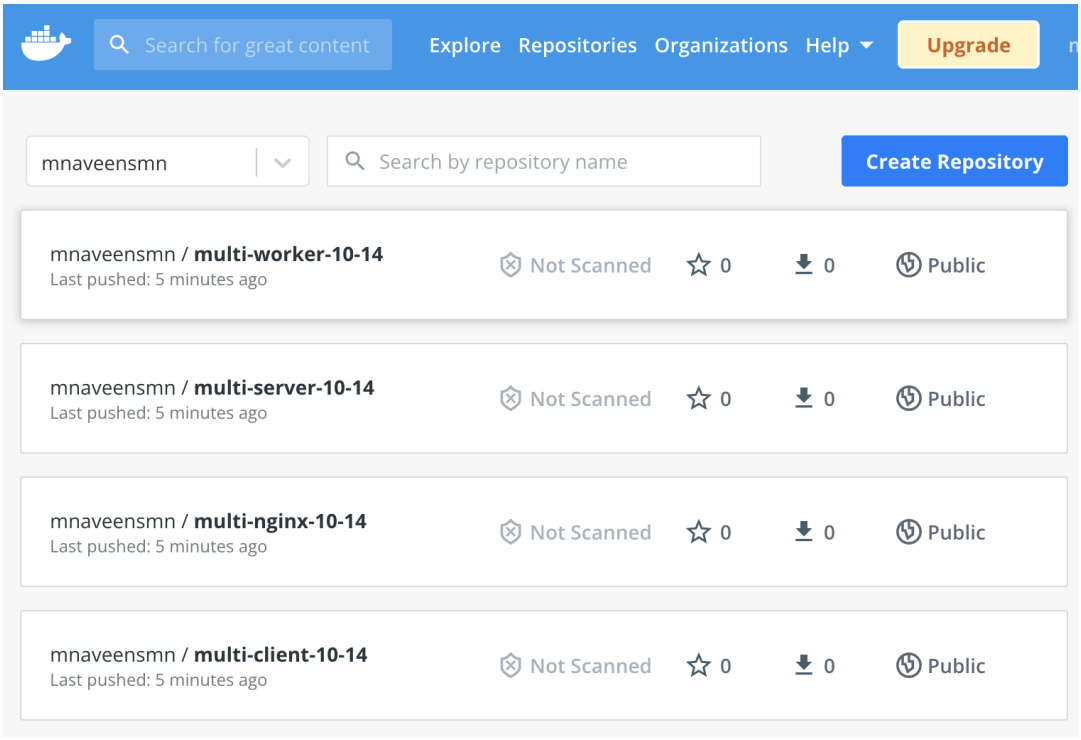
.github > workflows > deploy.yaml

```yaml
name: Deploy MultiDocker
on:
  push:
    branches:
      - main

jobs:
  build:
    runs-on: ubuntu-latest
    steps:
      - uses: actions/checkout@v2
      - run: docker login -u ${{ secrets.DOCKER_USERNAME }} -p ${{ secrets.D
      - run: docker build -t mnaveensmn/react-test -f ./client/Dockerfile.de
      - run: docker run -e CI=true mnaveensmn/react-test npm test

      - run: docker build -t mnaveensmn/multi-client-10-14 ./client
      - run: docker build -t mnaveensmn/multi-nginx-10-14 ./nginx
      - run: docker build -t mnaveensmn/multi-server-10-14 ./server
      - run: docker build -t mnaveensmn/multi-worker-10-14 ./worker

      - run: docker push mnaveensmn/multi-client-10-14
      - run: docker push mnaveensmn/multi-nginx-10-14
      - run: docker push mnaveensmn/multi-server-10-14
      - run: docker push mnaveensmn/multi-worker-10-14

      - name: Generate deployment package
        run: zip -r deploy.zip . -x '*.git*'
```

Successful Image Building



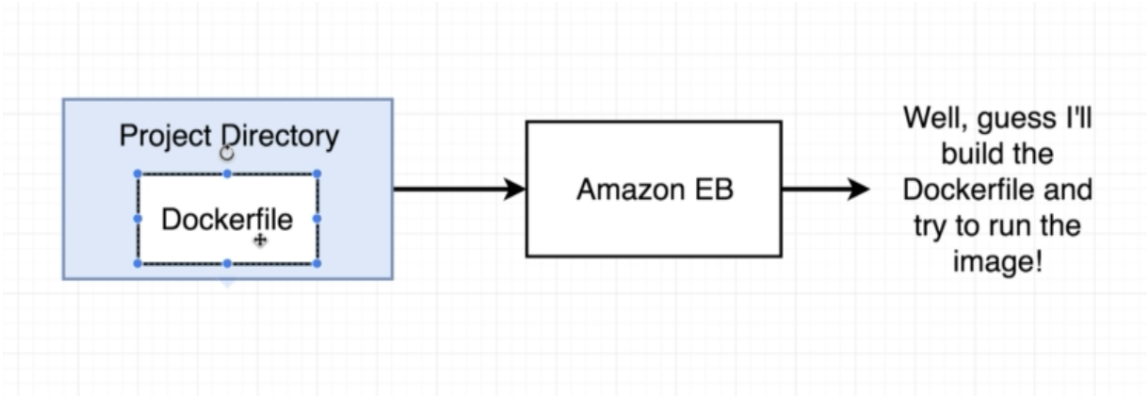
Build image has been pushed to docker repository



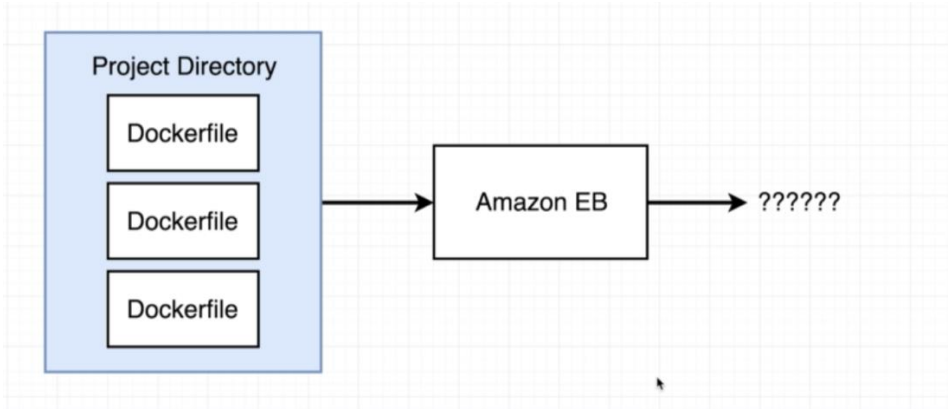
Multi Container Deployment to AWS

Multi container Definition Files

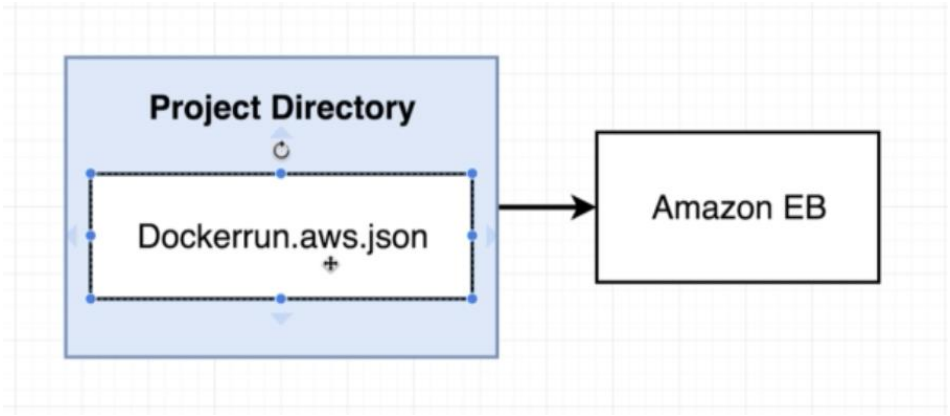
Single container scenario.



This time around we have a multi container.



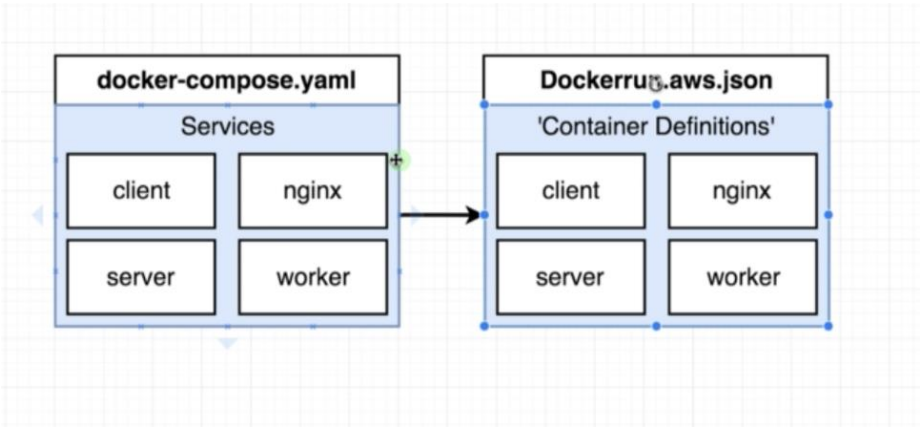
We are going to create a special file inside the project directory.



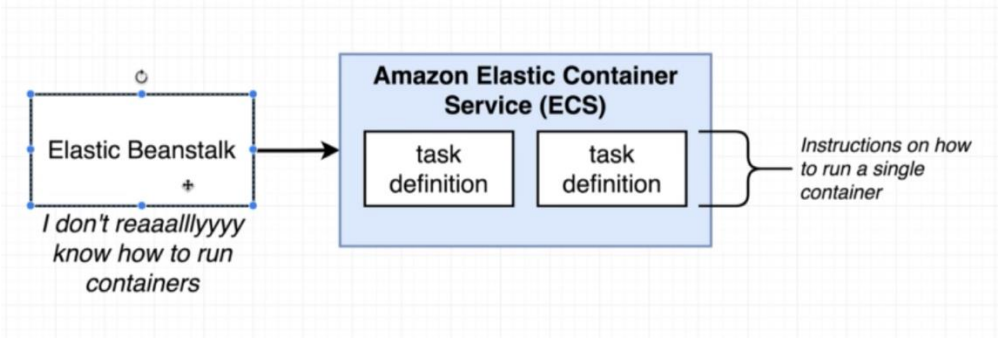
Dockerrun.aws.json file going to tell Amazon EB that how to work with multiple containers by specifying the information below.

1. Where to pull the image from?
2. What resource to allocate to each image?
3. How to set up a port mapping?
4. And some associated information.

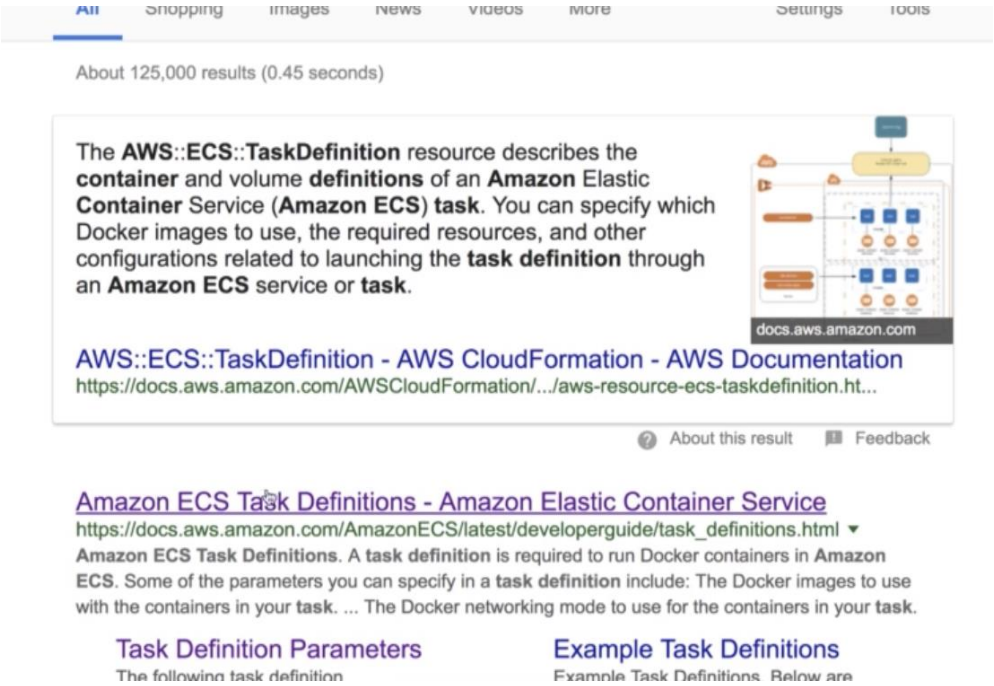
It is like docker compose yaml file. The difference is, in docker compose file, we are giving the instruction to build the image from dockerfile. In dockerrun.aws.json file we are giving the instruction to where to pull the image from.



Elastic Beanstalk by default does not know the how to work with multiple containers.



ECS has definition file that contains instruction to run a single container.

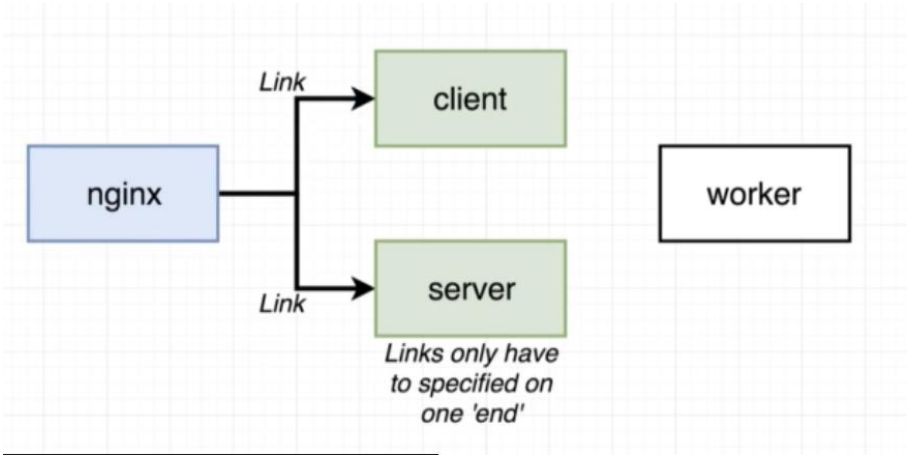


https://docs.aws.amazon.com/AmazonECS/latest/developerguide/task_definition_parameters.html

If essential container crashes, all other containers will be shut down.

At least one container marker as essential true.

Forming Container Links



Dockerrun.aws.json > [ ] containerDefinitions > {} 3

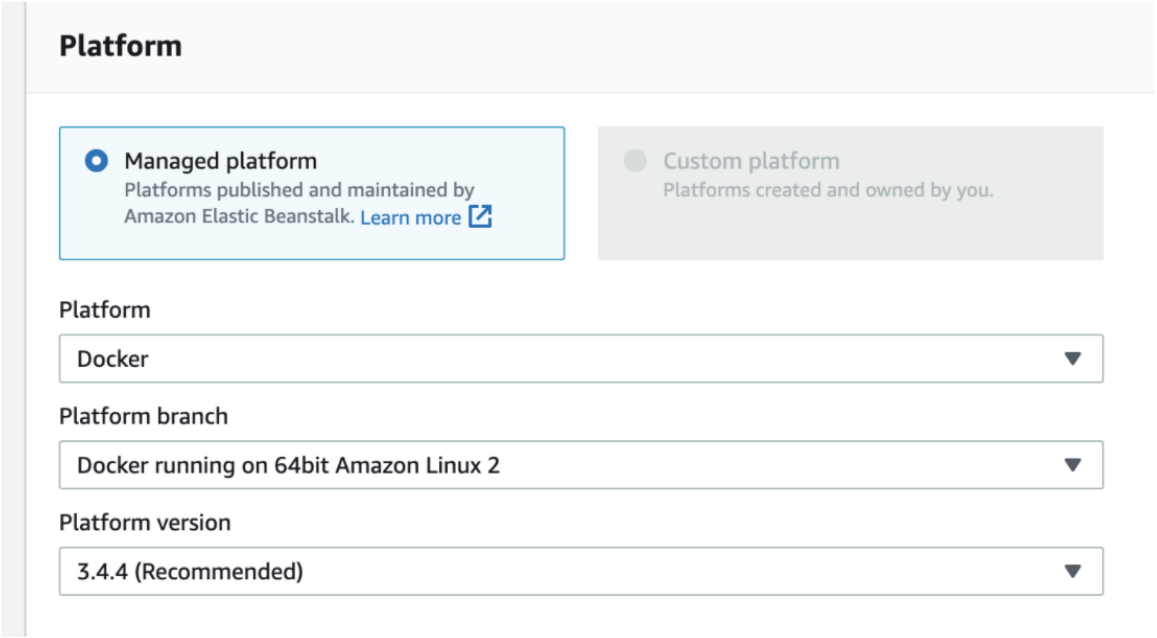
```
{
  "AWSEBDockerrunVersion": 2,
  "containerDefinitions": [
    {
      "name": "client",
      "image": "mnaveensmn/multi-client",
      "hostname": "client",
      "essential": false
    },
    {
      "name": "server",
      "image": "mnaveensmn/multi-server",
      "hostname": "api",
      "essential": false
    },
    {
      "name": "worker",
      "image": "mnaveensmn/multi-worker",
      "hostname": "worker",
      "essential": false
    },
    {
      "name": "ngix",
      "image": "mnaveensmn/multi-nginx",
      "hostname": "nginx",
      "essential": true,
      "portMappings": [
        {…
        }
      ],
      "links": ["client", "server"]
    }
  ]
}
```

Using Amazon Linux 2 Platform

Create environment using the new platform

1. Create environment using the new platform

When creating our Elastic Beanstalk environment we need to select **Docker running on 64bit Amazon Linux 2**



Rename the current docker-compose file

2. Rename the current docker-compose file

Rename the **docker-compose.yml** file to **docker-compose-dev.yml**. Going forward you will need to pass a flag to specify which compose file you want to build and run from:

```
docker-compose -f docker-compose-dev.yml up
docker-compose -f docker-compose-dev.yml up --build
docker-compose -f docker-compose-dev.yml down
```

3. Create a production only docker-compose.yml file

The production compose file will follow closely what was written in the Dockerrun.aws.json. There are two major differences:

No Container Links: In the "Forming Container Links" lecture we add the client and server services to the links array of the nginx service. Docker Compose will handle this container communication automatically for us.

Environment Variables: When using a compose file we will need to explicitly specify the environment variables each service will need access to. The value for each variable must match the corresponding variable names you have specified in the Elastic Beanstalk environment. The AWS variables are created in the "Setting Environment Variables" lecture.

Note - You must not have a Dockerrun.aws.json file in your project directory. If AWS EBS sees this file the deployment will fail. If you have previously followed this course and deployed to the old Multi-container platform **you will need to delete this file before moving to the new platform!!!**

Complete docker-compose.yml file:

```
version: "3"
services:
  client:
    image: "cygnetops/multi-client-10-14"
    mem_limit: 128m
    hostname: client
  server:
    image: "cygnetops/multi-server-10-14"
    mem_limit: 128m
    hostname: api
    environment:
      - REDIS_HOST=$REDIS_HOST
      - REDIS_PORT=$REDIS_PORT
      - PGUSER=$PGUSER
      - PGHOST=$PGHOST
      - PGDATABASE=$PGDATABASE
      - PGPASSWORD=$PGPASSWORD
      - PGPORT=$PGPORT
  worker:
    image: "cygnetops/multi-worker-10-14"
    mem_limit: 128m
    hostname: worker
    environment:
      - REDIS_HOST=$REDIS_HOST
      - REDIS_PORT=$REDIS_PORT
  nginx:
    image: "cygnetops/multi-nginx-10-14"
    mem_limit: 128m
    hostname: nginx
    ports:
      - "80:80"
```

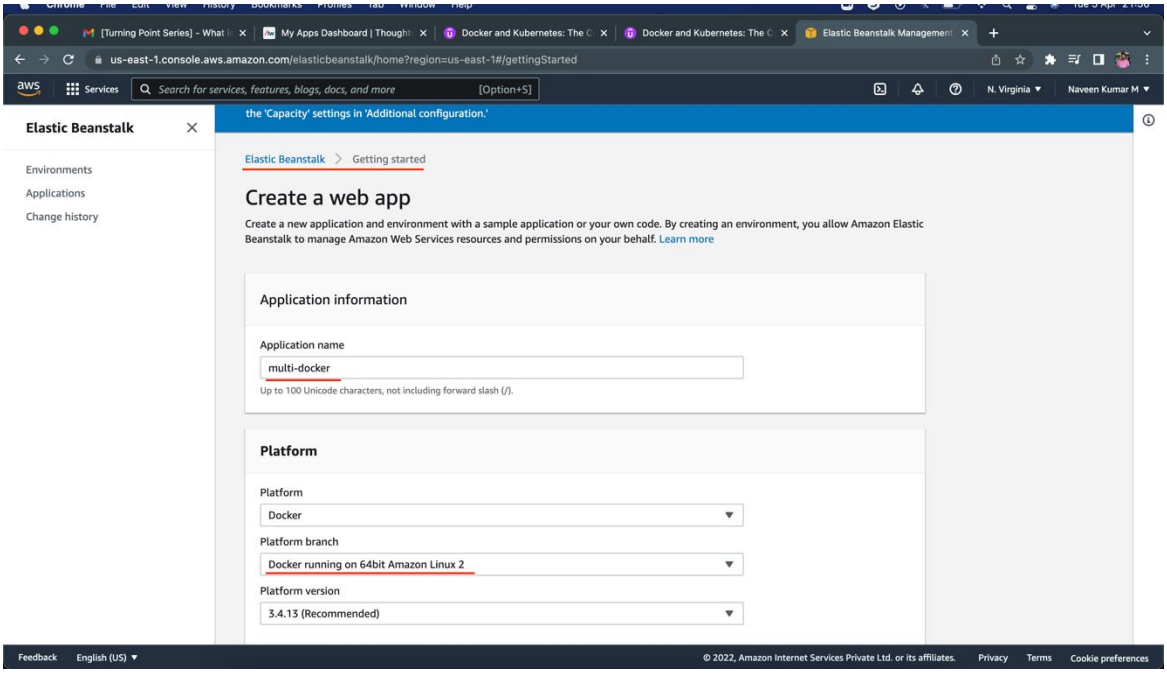
Creating the EB Environment

Steps

EBS Application Creation (If using Amazon Linux 2 Platform Platform)

1. Make sure you have followed the guidance in this note.
2. Go to AWS Management Console and use Find Services to search for Elastic Beanstalk
3. Click “Create Application”
4. Set Application Name to 'multi-docker'
5. **Scroll down to Platform and select Docker**
6. The Platform Branch should be automatically set to **Docker Running on 64bit Amazon Linux 2**.
7. Click Create Application
8. You may need to refresh, but eventually, you should see a green checkmark underneath Health.

Screenshots



Platform

Platform

Docker

Platform branch

Docker running on 64bit Amazon Linux 2

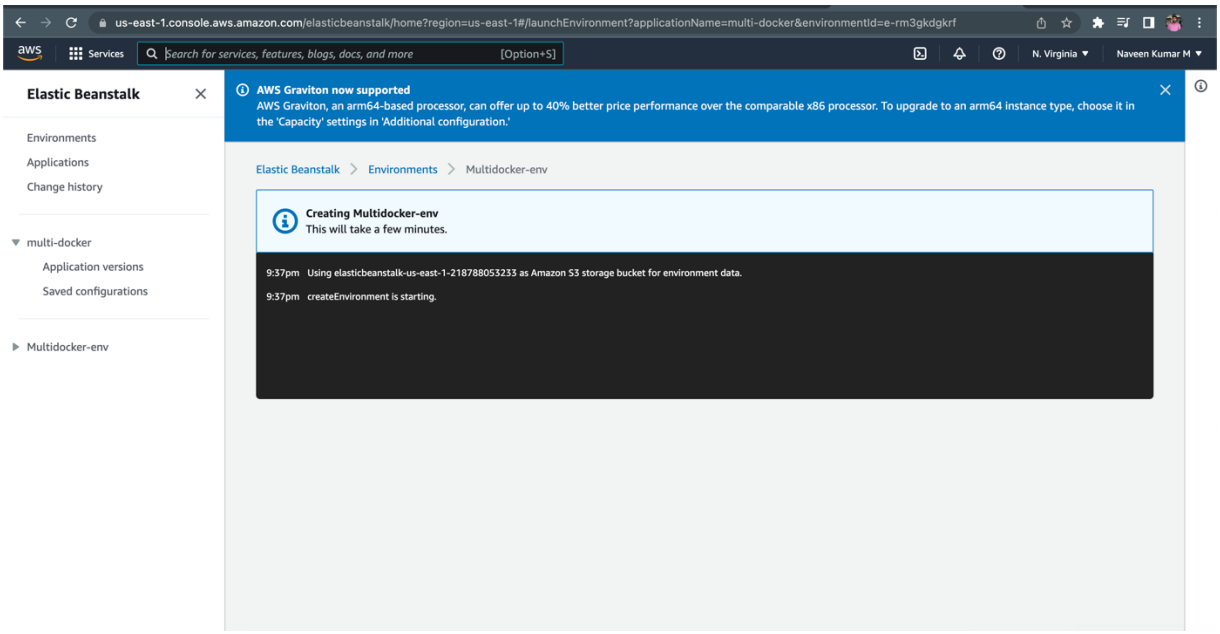
Platform version

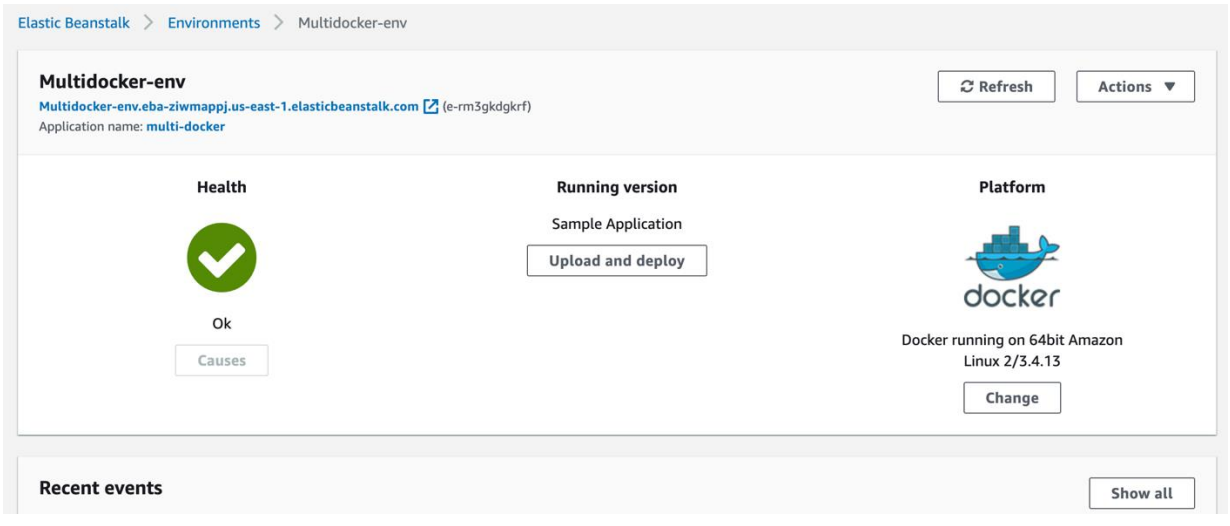
3.4.13 (Recommended)

Application code

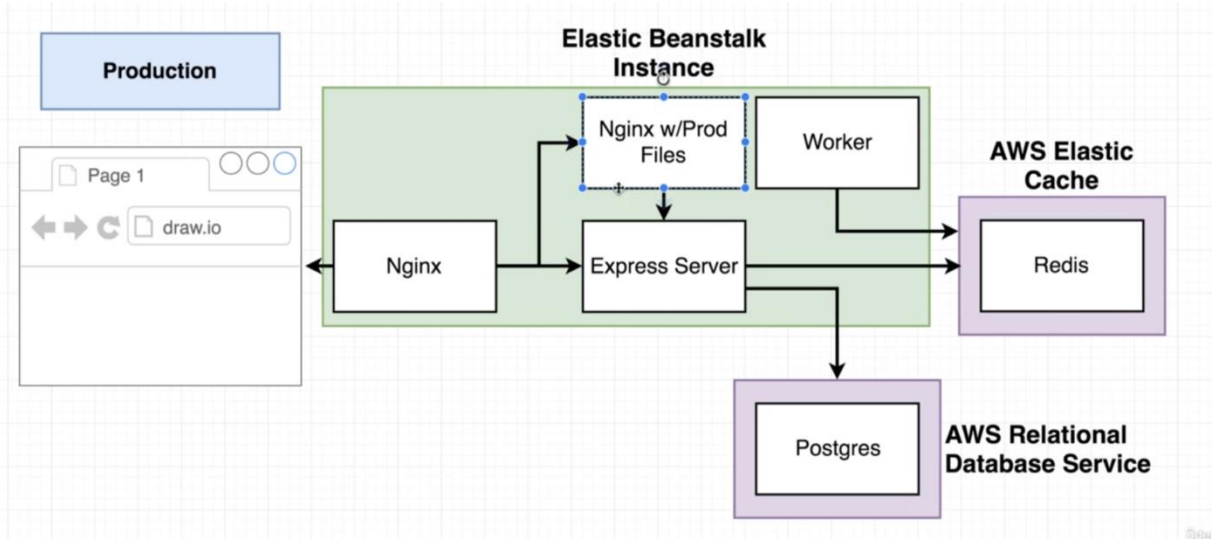
- (•) Sample application
  Get started right away with sample code.
- ( ) Upload your code
  Upload a source bundle from your computer or copy one from Amazon S3.

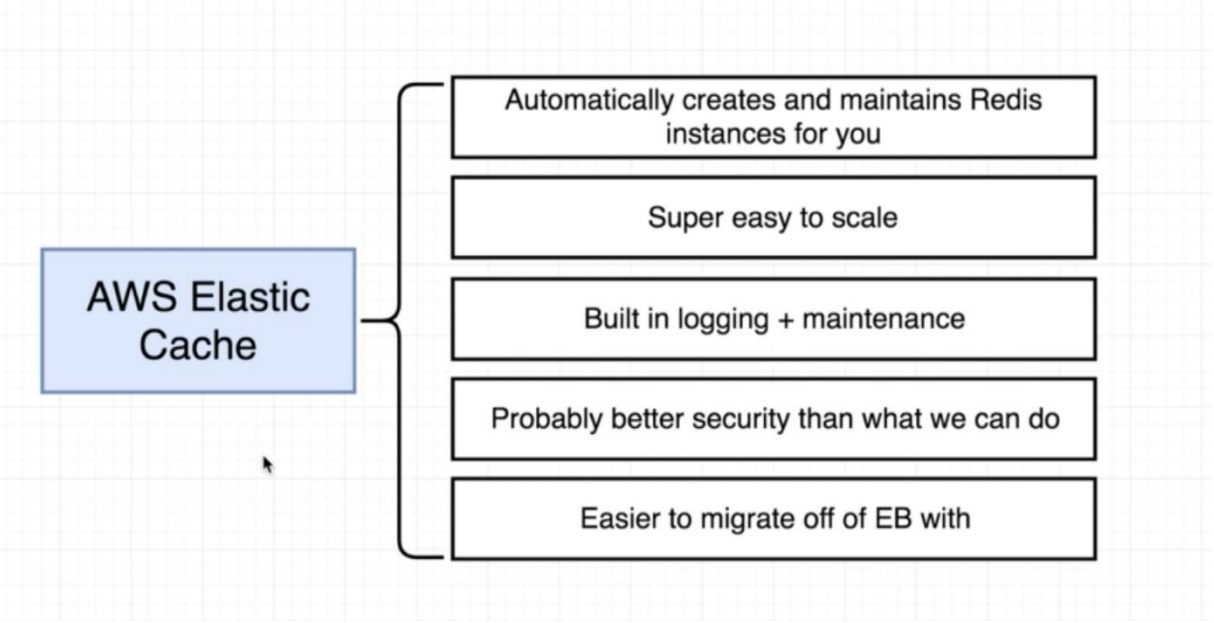
Cancel | Configure more options | Create application

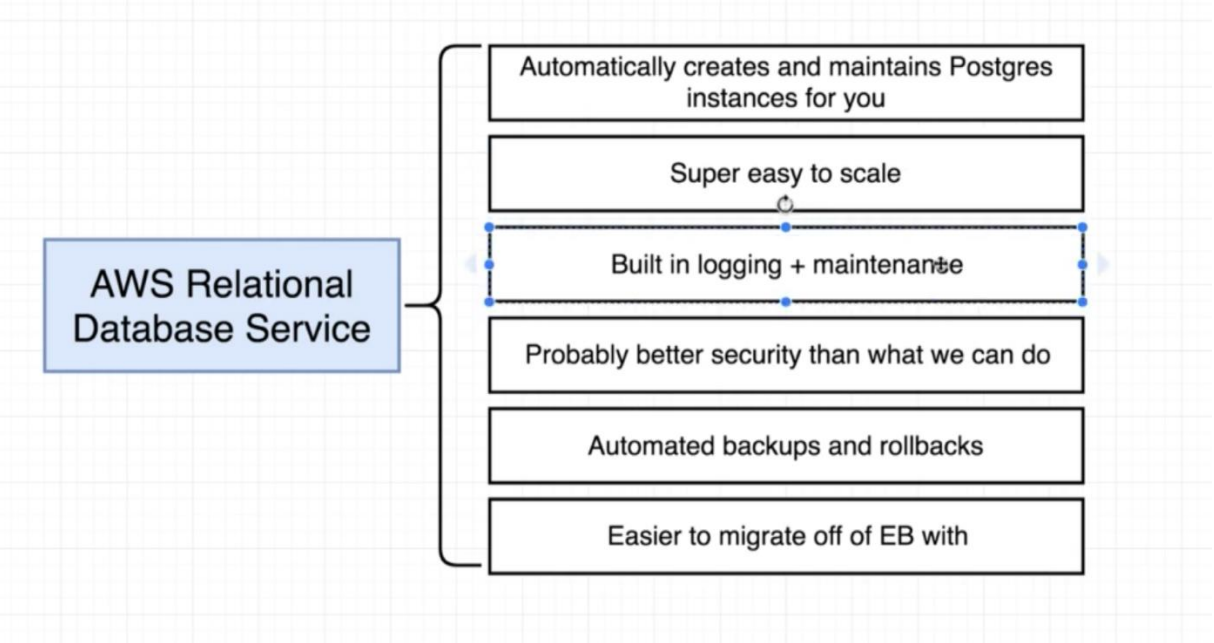




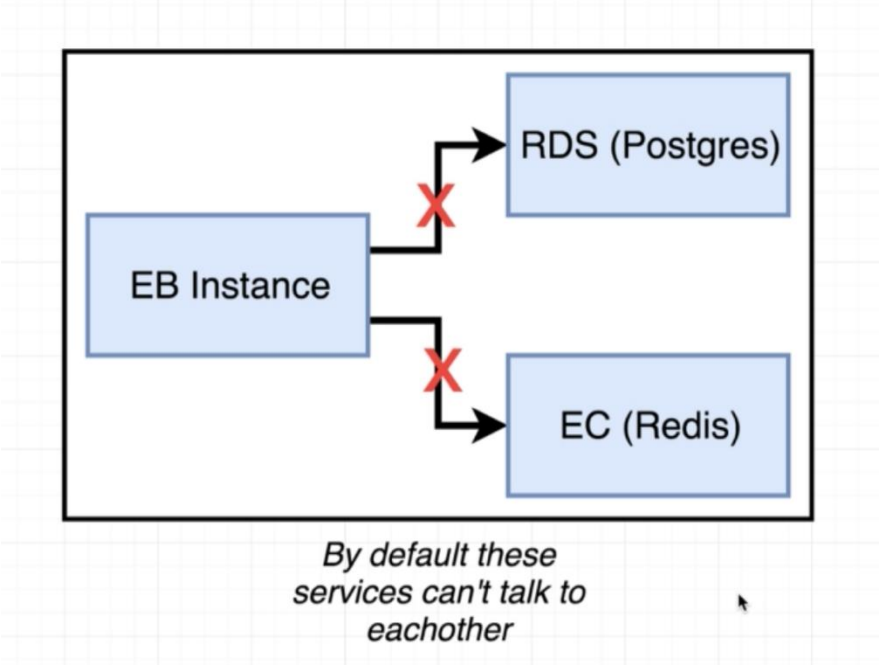
Architecture in Production Environment



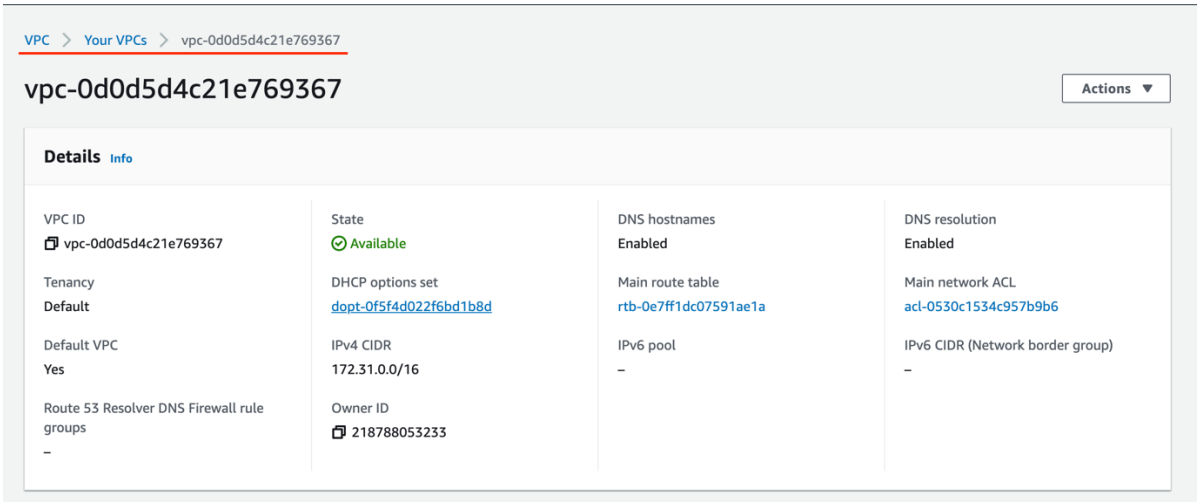


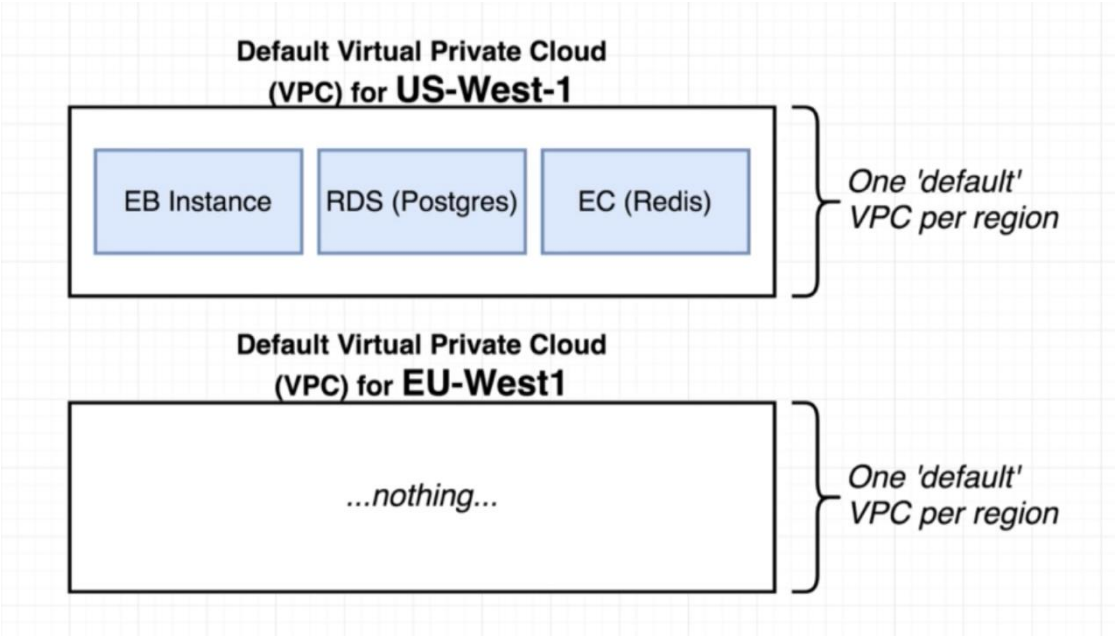


Overview of AWS VPC's and Security Group



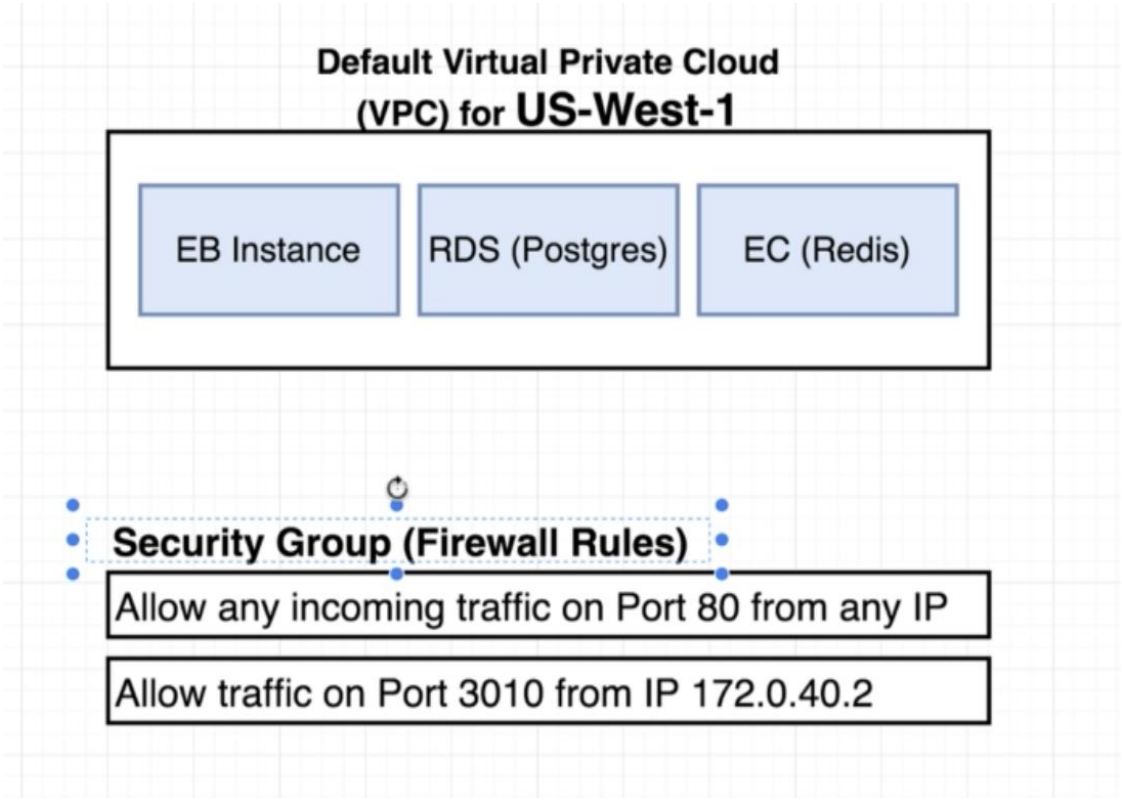
VPC

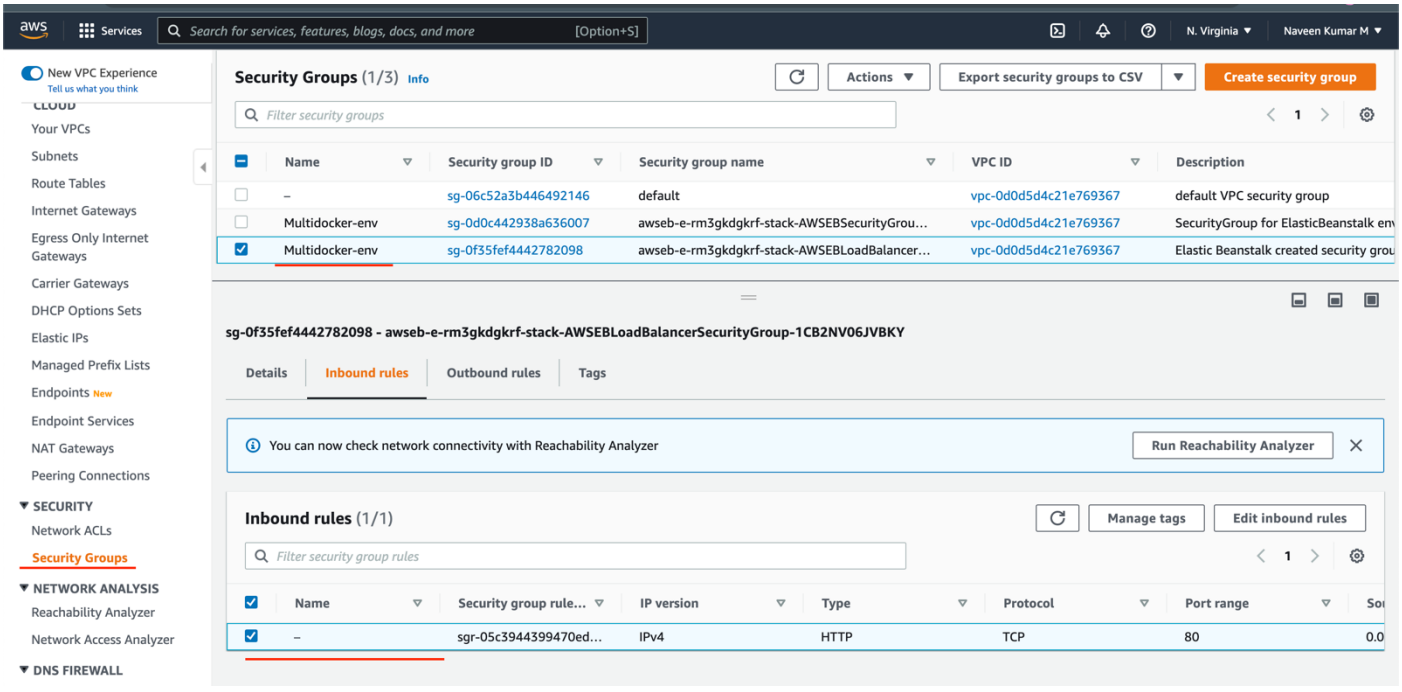


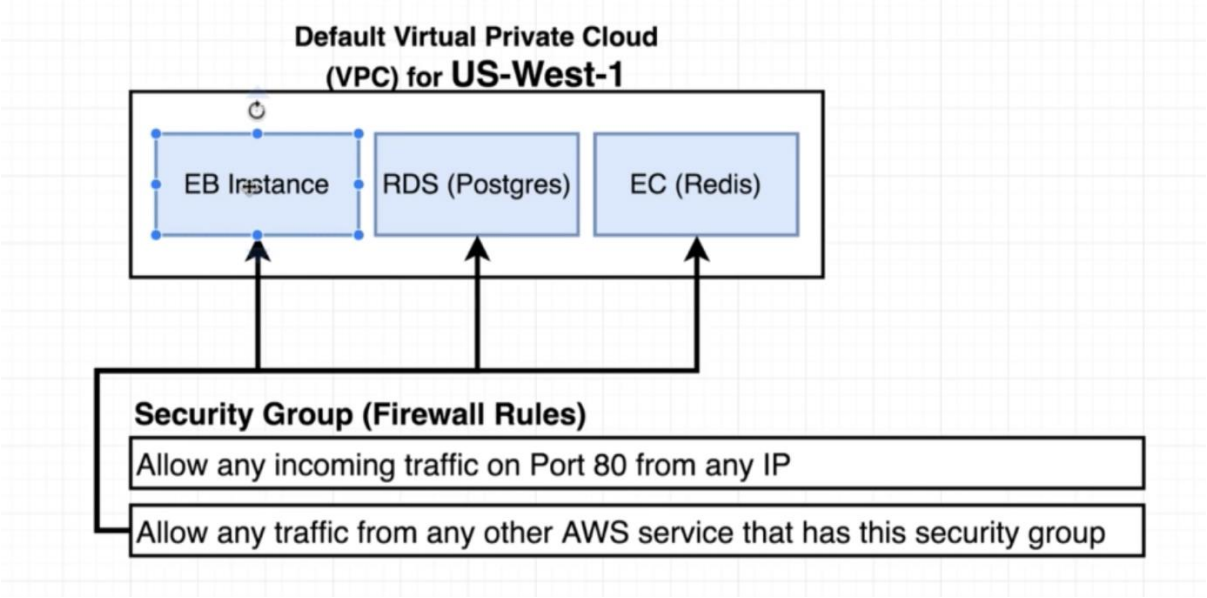


Security group

To get the different service to connect to each other, we need to create the Security group.







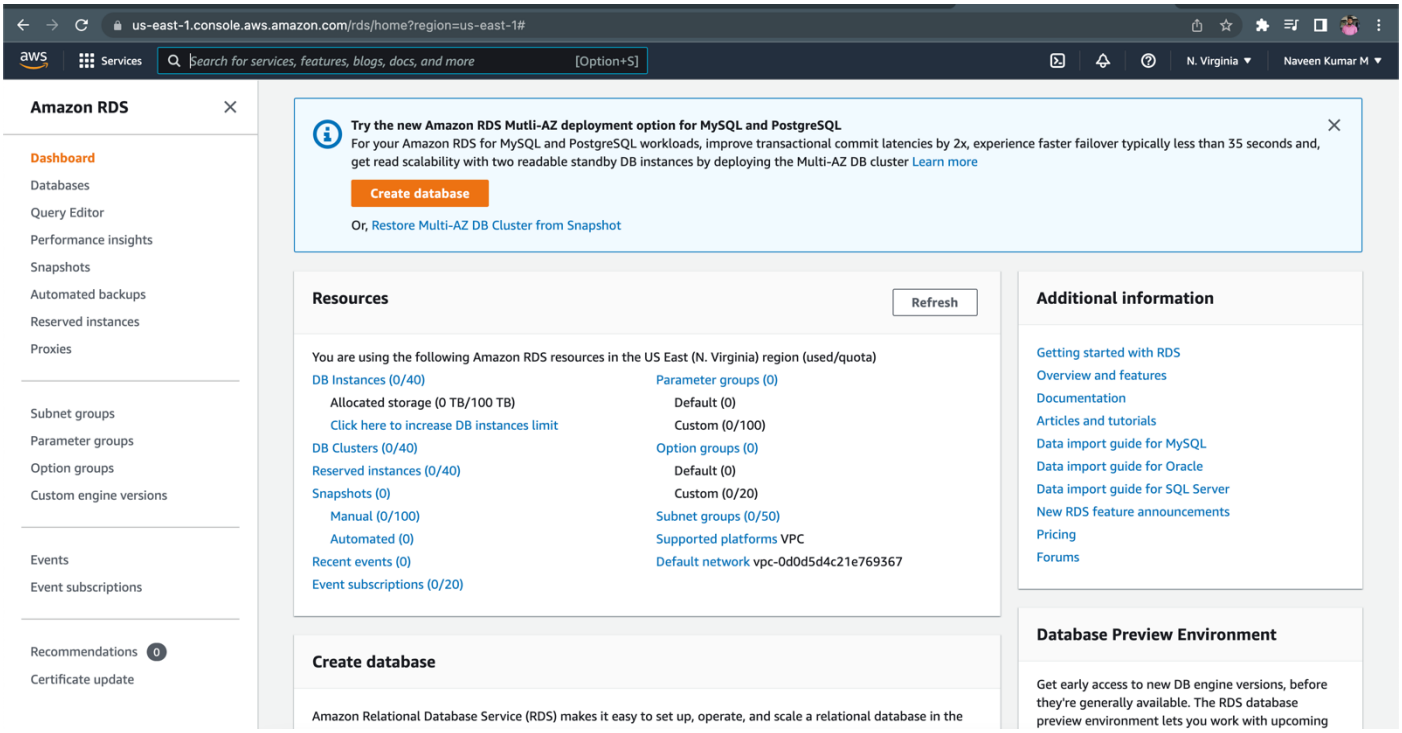
RDS Database Creation

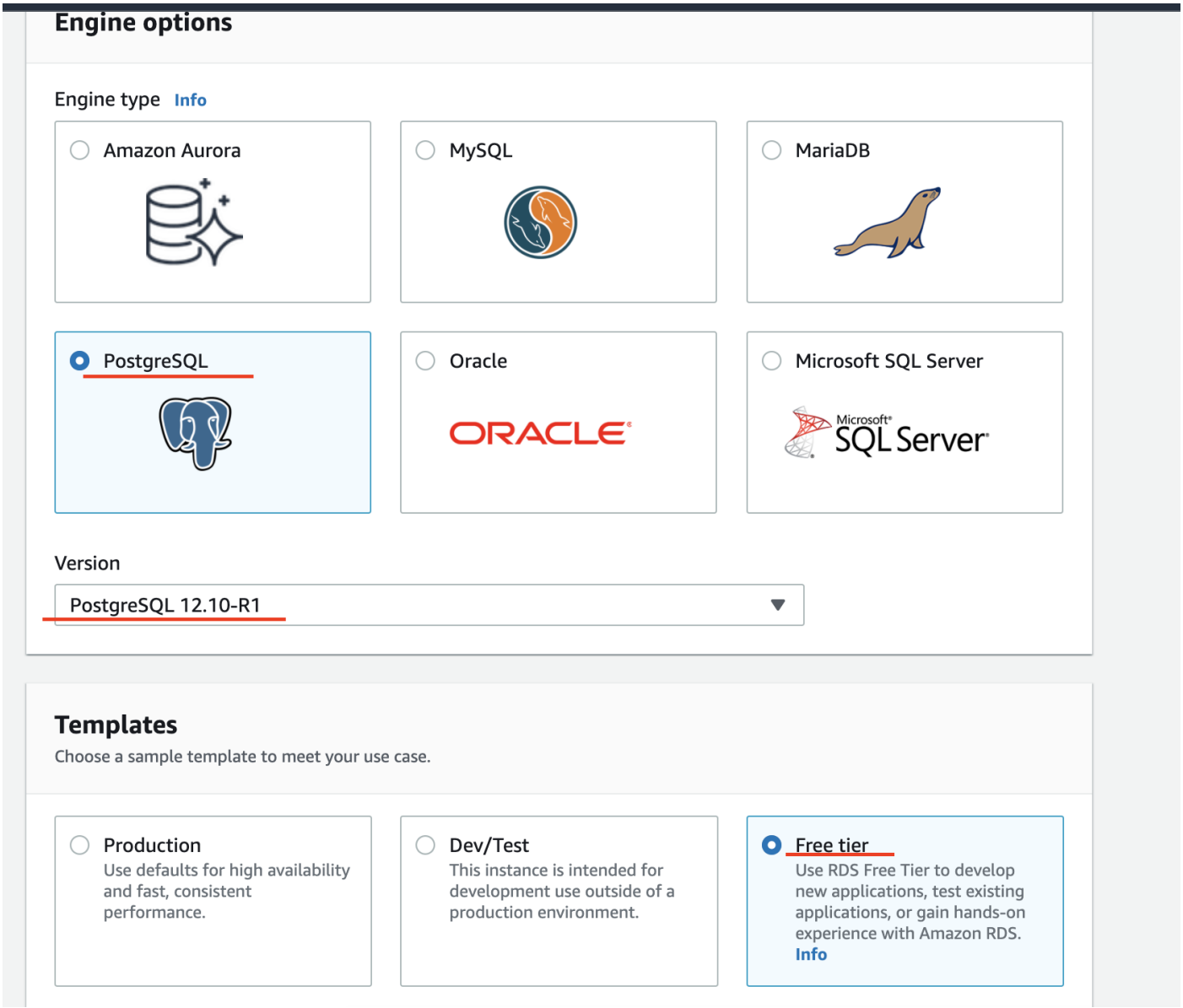
Steps

RDS Database Creation

1. Go to AWS Management Console and use Find Services to search for RDS
2. Click Create database button
3. Select PostgreSQL
4. Change Version to the newest available v12 version (The free tier is currently not available for Postgres v13)
5. In Templates, check the Free tier box.
6. Scroll down to Settings.
7. Set DB Instance identifier to **multi-docker-postgres**
8. Set Master Username to **postgres**
9. Set Master Password to **postgrespassword** and confirm.
10. Scroll down to Connectivity. Make sure VPC is set to Default VPC
11. Scroll down to Additional Configuration and click to unhide.
12. Set Initial database name to **fibvalues**
13. Scroll down and click Create Database button

Screenshots





Settings

DB instance identifier Info

Type a name for your DB instance. The name must be unique across all DB instances owned by your AWS account in the current AWS Region.

multi-docker-postgres

The DB instance identifier is case-insensitive, but is stored as all lowercase (as in "mydbinstance"). Constraints: 1 to 60 alphanumeric characters or hyphens. First character must be a letter. Can't contain two consecutive hyphens. Can't end with a hyphen.

▼ Credentials Settings

Master username Info

Type a login ID for the master user of your DB instance.

postgres

1 to 16 alphanumeric characters. First character must be a letter.

☐ Auto generate a password

Amazon RDS can generate a password for you, or you can specify your own password.

Master password Info

••••••••••••••••

Constraints: At least 8 printable ASCII characters. Can't contain any of the following: / (slash), '(single quote), "(double quote) and @ (at sign).

Confirm password Info

••••••••••••••••

Connectivity

Virtual private cloud (VPC) Info

VPC that defines the virtual networking environment for this DB instance.

Default VPC (vpc-0d0d5d4c21e769367)

Only VPCs with a corresponding DB subnet group are listed.

ⓘ After a database is created, you can't change its VPC.

Subnet group Info

DB subnet group that defines which subnets and IP ranges the DB instance can use in the VPC you selected.

default

Public access Info

○ Yes

Amazon EC2 instances and devices outside the VPC can connect to your database. Choose one or more VPC security groups that specify which EC2 instances and devices inside the VPC can connect to the database.

◉ No

RDS will not assign a public IP address to the database. Only Amazon EC2 instances and devices inside the VPC can connect to your database.

VPC security group

Choose a VPC security group to allow access to your database. Ensure that the security group rules allow the appropriate incoming traffic.

◉ Choose existing
Choose existing VPC security groups

○ Create new
Create new VPC security group

Additional configuration

Database options, encryption enabled, backup enabled, backtrack disabled, Performance Insights enabled, Enhanced Monitoring disabled, maintenance, CloudWatch Logs, delete protection disabled.

Database options

Initial database name Info

fibvalues

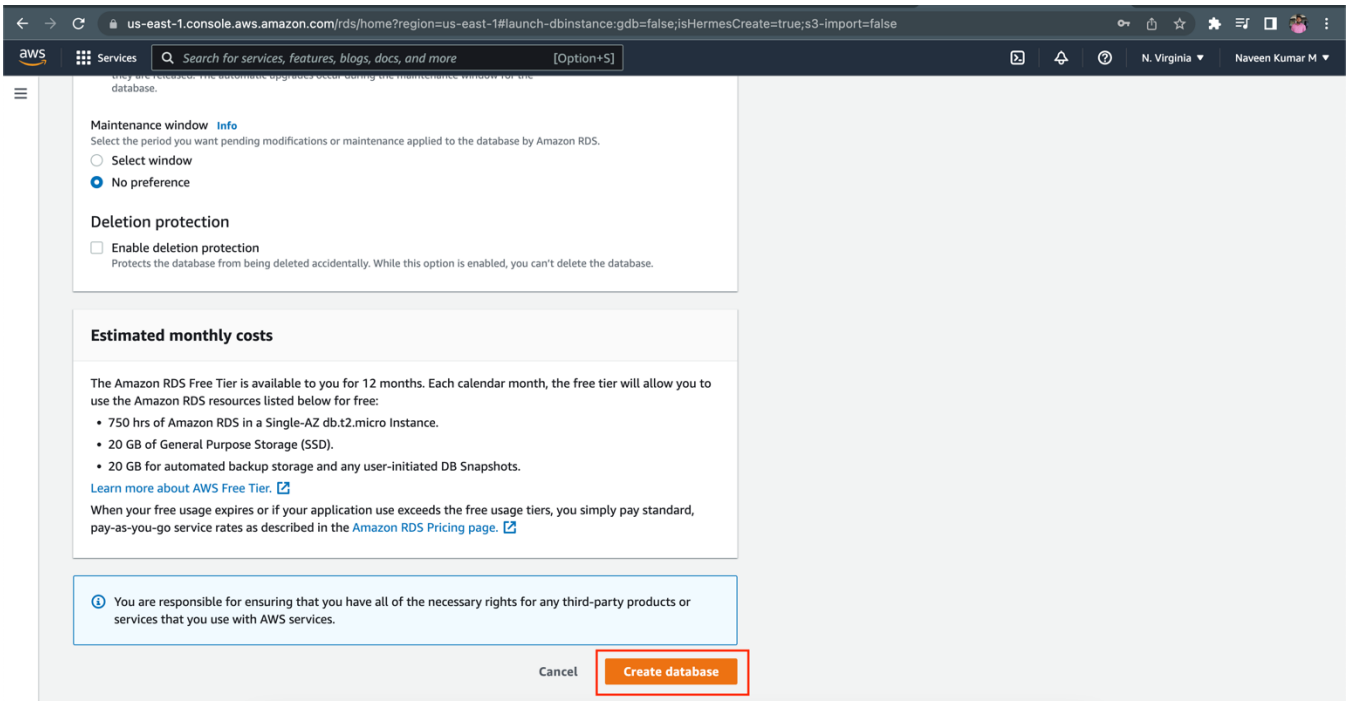
If you do not specify a database name, Amazon RDS does not create a database.

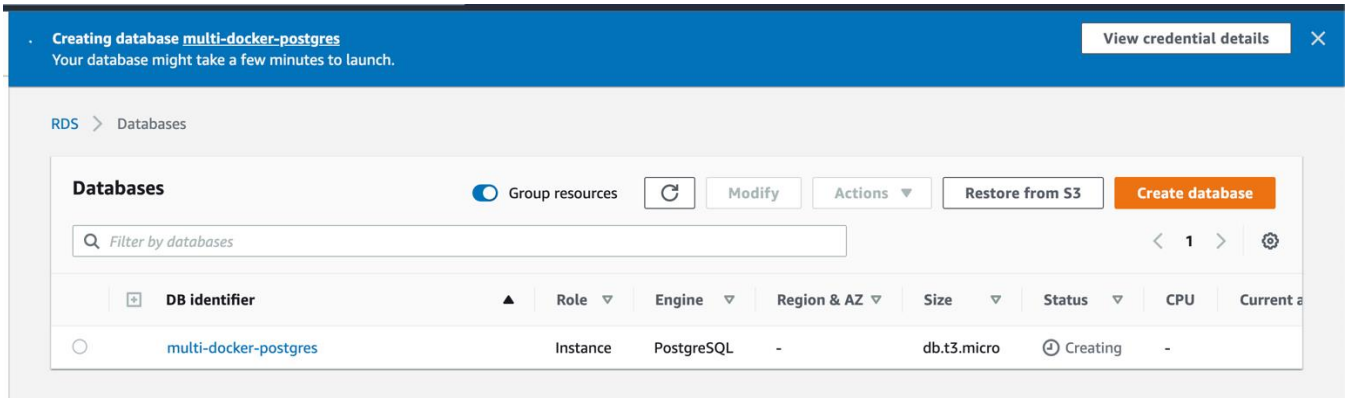
DB parameter group Info

default.postgres12

Option group Info

default:postgres-12





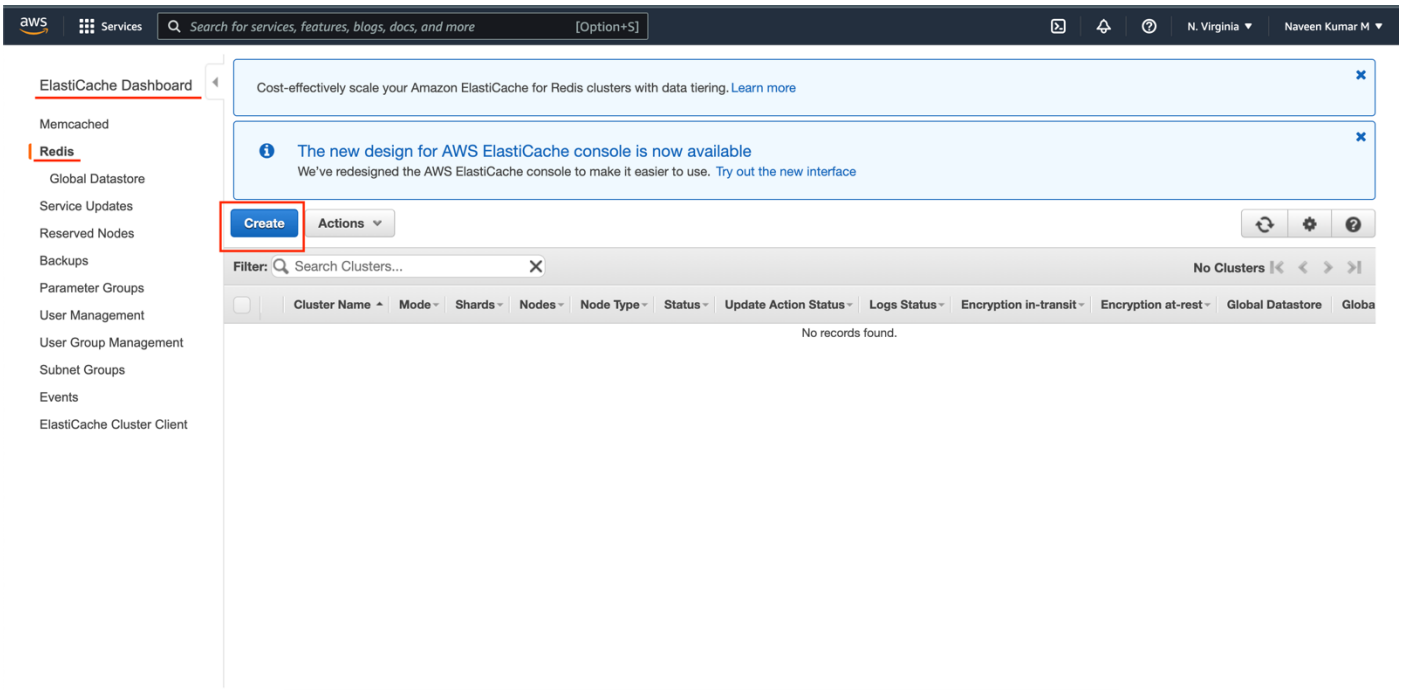
ElastiCache Redis Creation

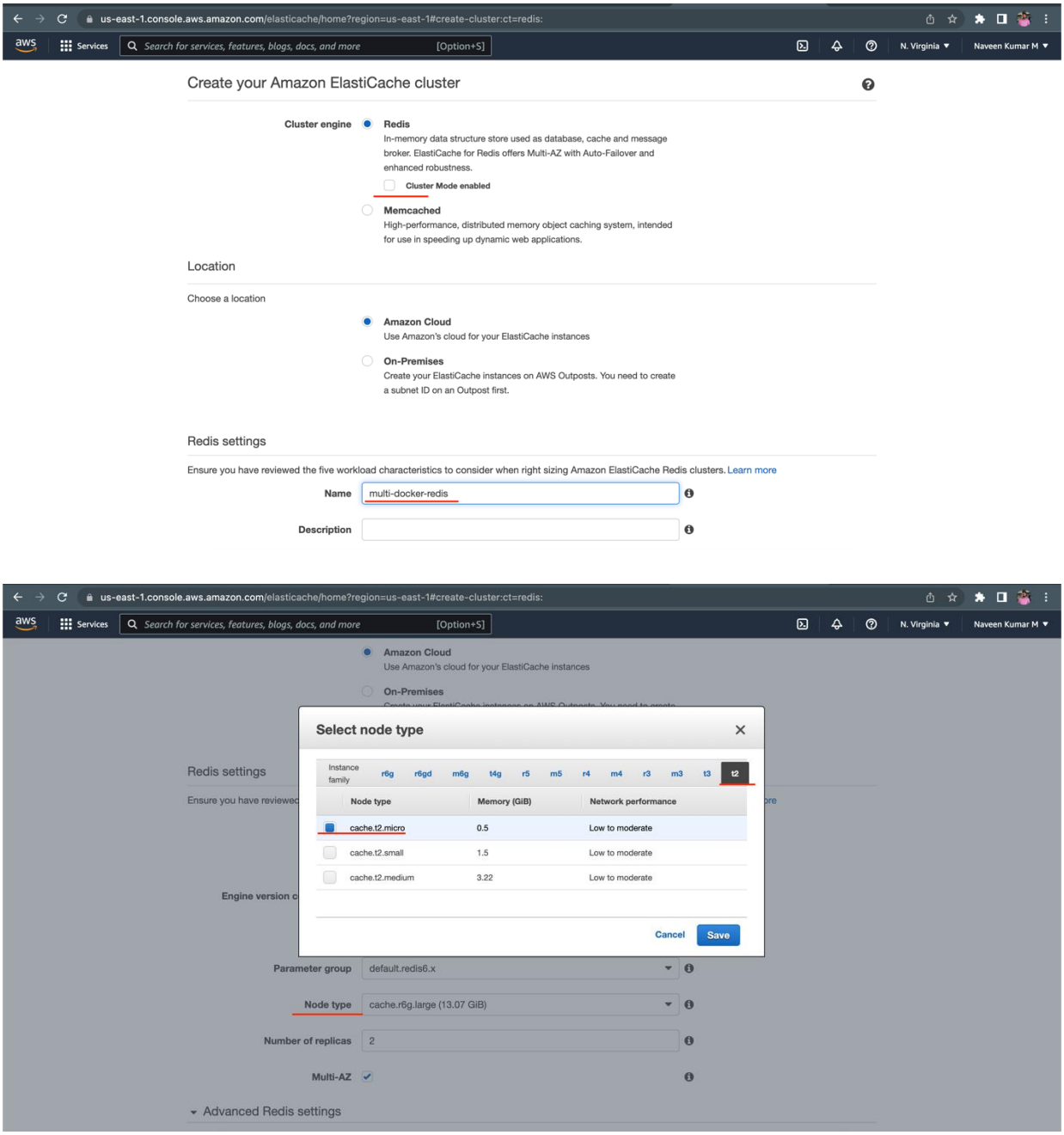
Steps

ElastiCache Redis Creation

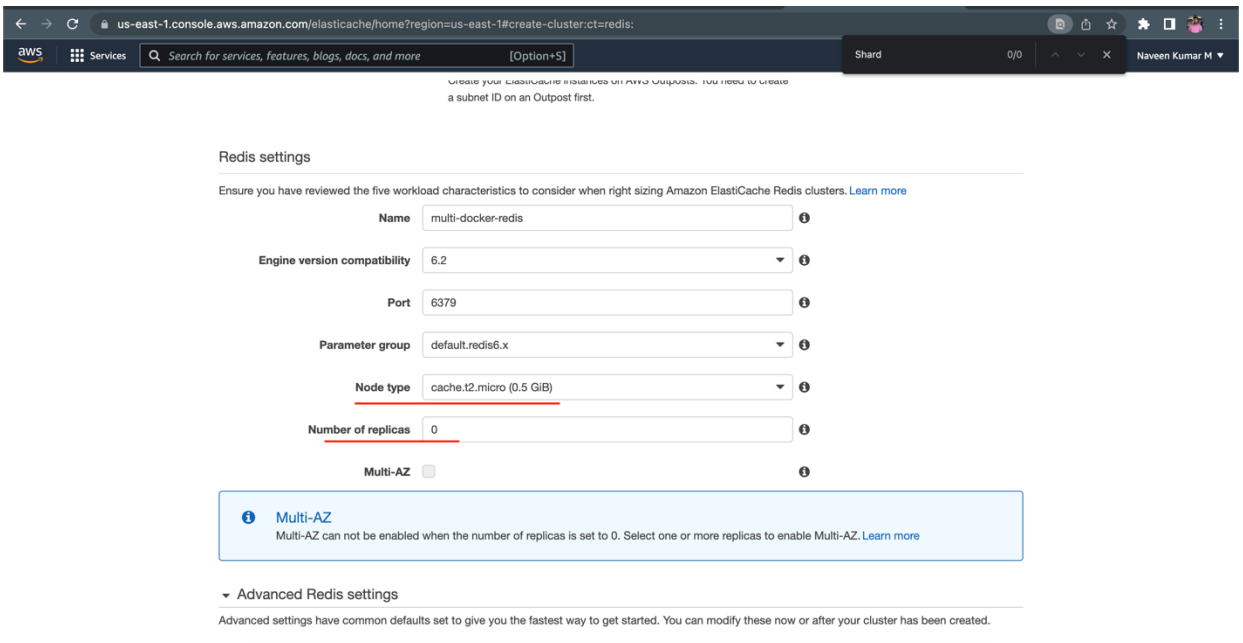
1. Go to AWS Management Console and use Find Services to search for ElastiCache
2. Click Redis in sidebar
3. Click the Create button
4. **Make sure Cluster Mode Enabled is NOT ticked**
5. In Redis Settings form, set Name to multi-docker-redis
6. Change Node type to 'cache.t2.micro'
7. Change Replicas per Shard to 0
8. Scroll down and click Create button

Screenshots

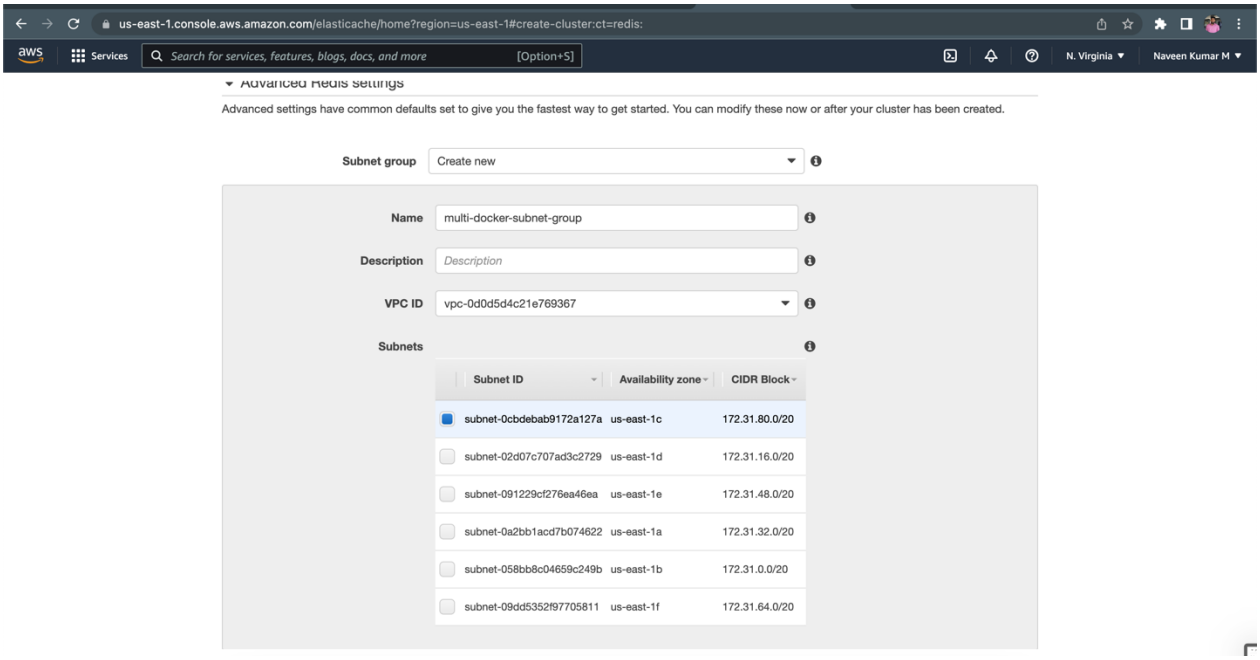


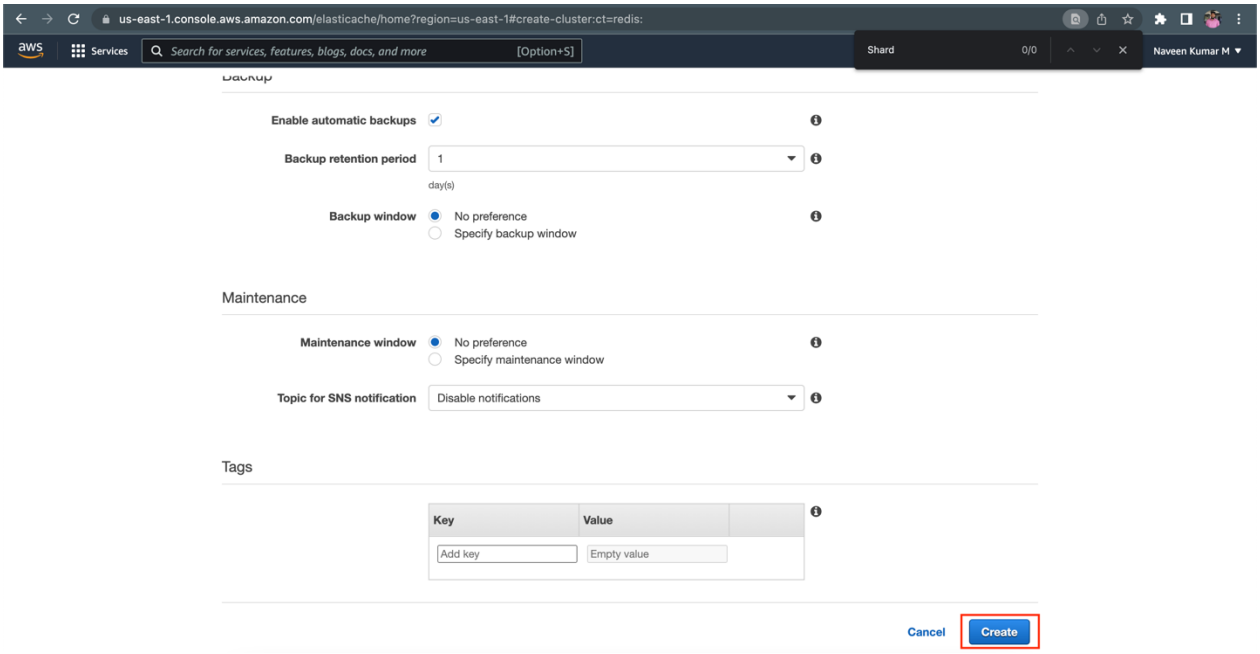

us-east-1.console.aws.amazon.com/elasticache/home?region=us-east-1#create-cluster:ct=redis:
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
Naveen Kumar M
Create your Amazon ElastiCache cluster
Cluster engine
Redis
In-memory data structure store used as database, cache and message broker. ElastiCache for Redis offers Multi-AZ with Auto-Failover and enhanced robustness.
Cluster Mode enabled
Memcached
High-performance, distributed memory object caching system, intended for use in speeding up dynamic web applications.
Location
Choose a location
Amazon Cloud
Use Amazon's cloud for your ElastiCache instances
On-Premises
Create your ElastiCache instances on AWS Outposts. You need to create a subnet ID on an Outpost first.
Redis settings
Ensure you have reviewed the five workload characteristics to consider when right sizing Amazon ElastiCache Redis clusters. Learn more
Name
multi-docker-redis
Description

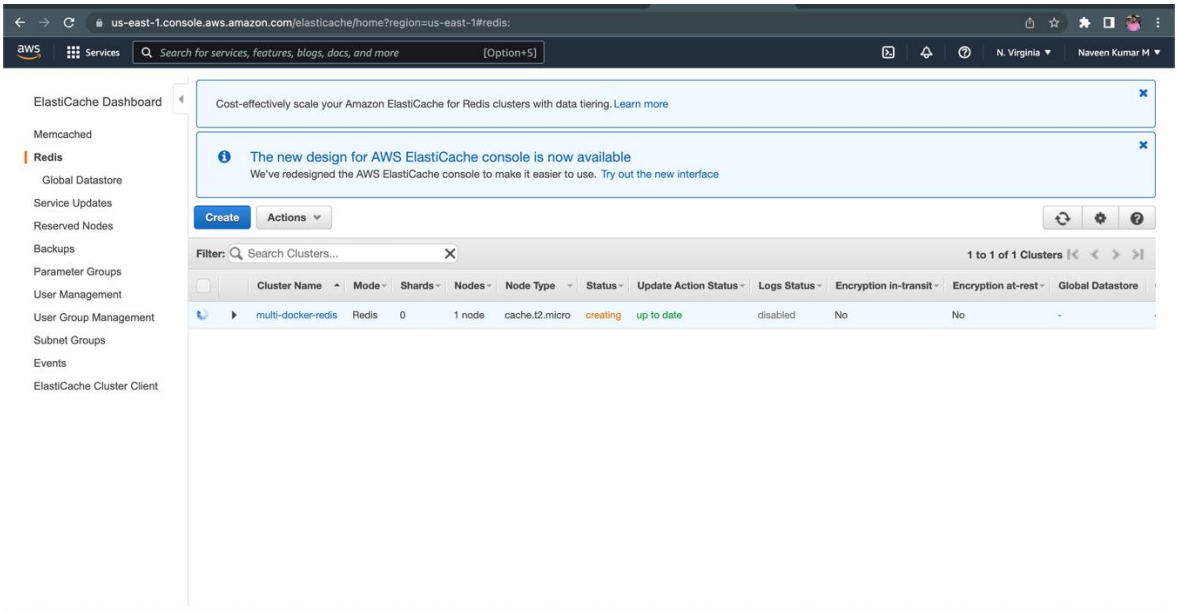
us-east-1.console.aws.amazon.com/elasticache/home?region=us-east-1#create-cluster:ct=redis:
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
Naveen Kumar M
Amazon Cloud
Use Amazon's cloud for your ElastiCache instances
On-Premises
Select node type
Instance family
r6g
r6gd
m6g
t4g
r5
m5
r4
m4
r3
m3
t3
t2
Node type
Memory (GiB)
Network performance
cache.t2.micro
0.5
Low to moderate
cache.t2.small
1.5
Low to moderate
cache.t2.medium
3.22
Low to moderate
Cancel
Save
Redis settings
Engine version c
Parameter group
default.redis6.x
Node type
cache.r6g.large (13.07 GiB)
Number of replicas
2
Multi-AZ
Advanced Redis settings


us-east-1.console.aws.amazon.com/elasticache/home?region=us-east-1#create-cluster:ct=redis:
Services
Search for services, features, blogs, docs, and more
[Option+S]
Shard
0/0
Naveen Kumar M
a subnet ID on an Outpost first.
Redis settings
Ensure you have reviewed the five workload characteristics to consider when right sizing Amazon ElastiCache Redis clusters. Learn more
Name
multi-docker-redis
Engine version compatibility
6.2
Port
6379
Parameter group
default.redis6.x
Node type
cache.t2.micro (0.5 GiB)
Number of replicas
0
Multi-AZ
Multi-AZ
Multi-AZ can not be enabled when the number of replicas is set to 0. Select one or more replicas to enable Multi-AZ. Learn more
Advanced Redis settings
Advanced settings have common defaults set to give you the fastest way to get started. You can modify these now or after your cluster has been created.

Subnet group is mandatory setting.







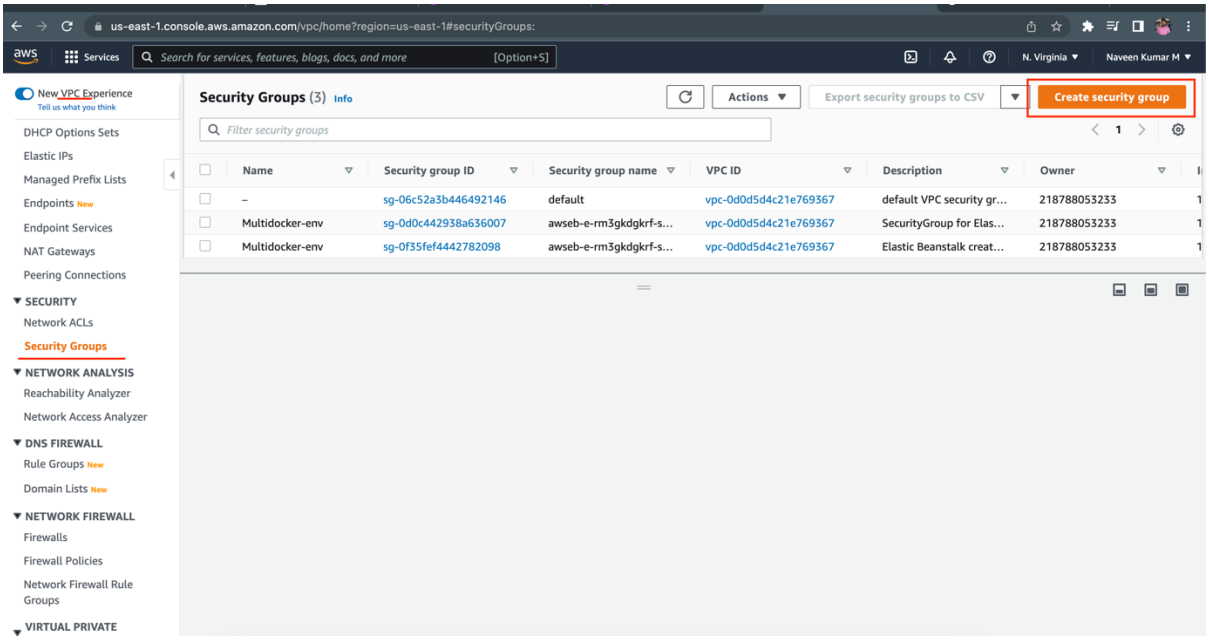
Creating a Custom Security Group

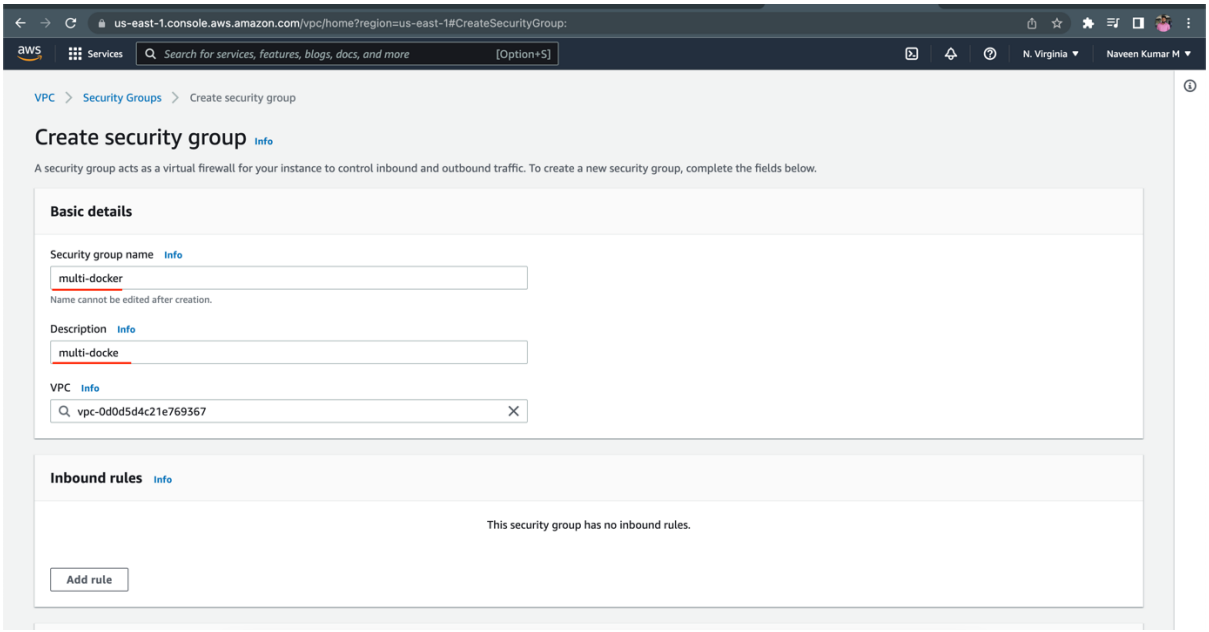
Steps

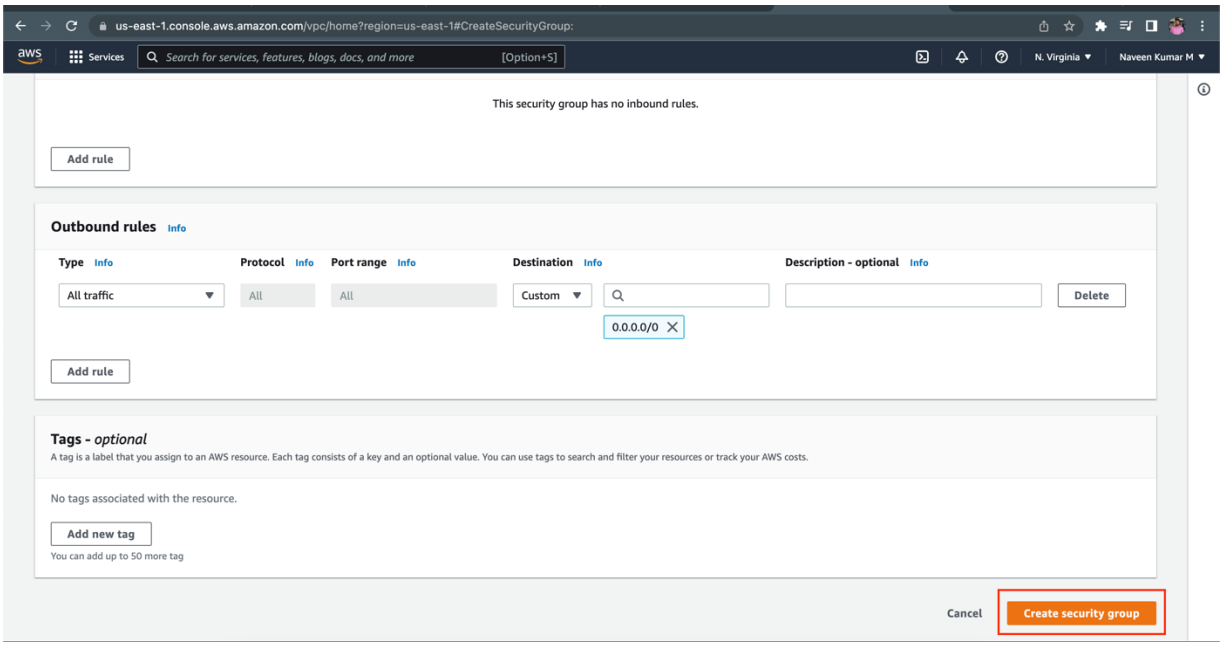
Creating a Custom Security Group

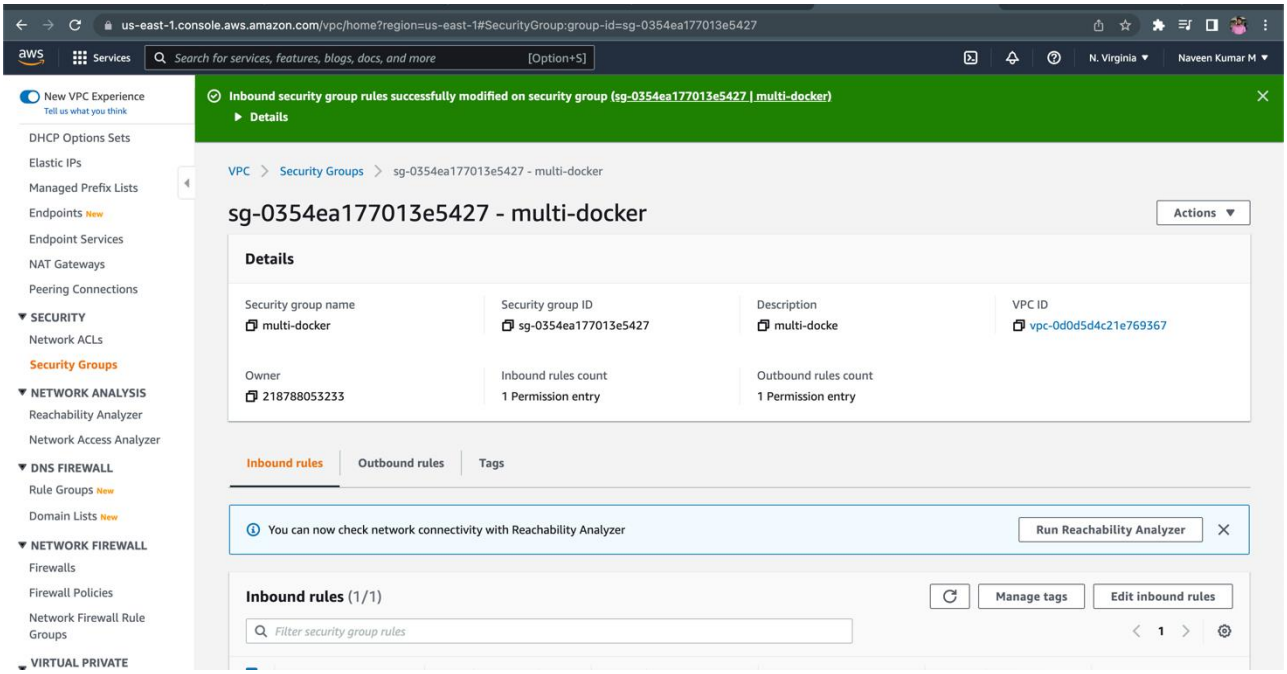
1. Go to AWS Management Console and use Find Services to search for VPC
2. Find the Security section in the left sidebar and click Security Groups
3. Click Create Security Group button
4. Set Security group name to multi-docker
5. Set Description to multi-docker
6. Make sure VPC is set to default VPC
7. Scroll down and click the Create Security Group button.
8. After the security group has been created, find the Edit inbound rules button.
9. Click Add Rule
10. Set Port Range to 5432-6379
11. Click in the box next to Source and start typing 'sg' into the box. Select the Security Group you just created.
12. Click the Save rules button

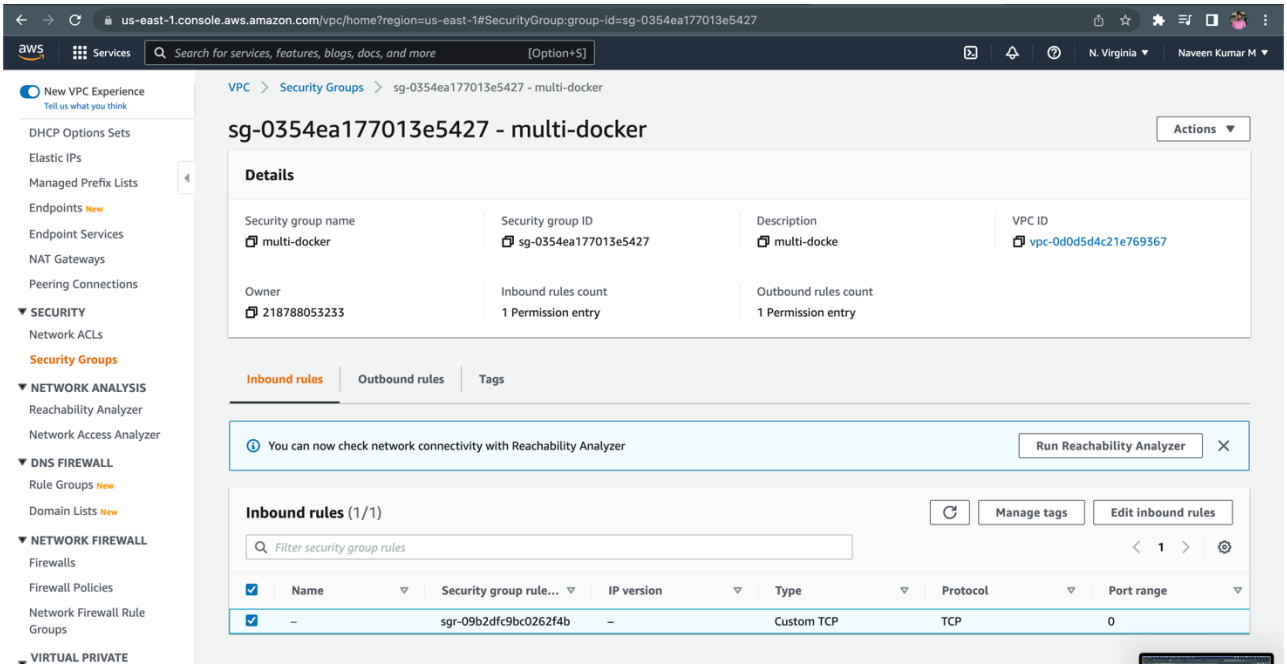
Screenshots








us-east-1.console.aws.amazon.com/vpc/home?region=us-east-1#SecurityGroup:group-id=sg-0354ea177013e5427
Services
Search for services, features, blogs, docs, and more [Option+S]
N. Virginia
Naveen Kumar M
New VPC Experience
Tell us what you think
DHCP Options Sets
Elastic IPs
Managed Prefix Lists
Endpoints New
Endpoint Services
NAT Gateways
Peering Connections
SECURITY
Network ACLs
Security Groups
NETWORK ANALYSIS
Reachability Analyzer
Network Access Analyzer
DNS FIREWALL
Rule Groups New
Domain Lists New
NETWORK FIREWALL
Firewalls
Firewall Policies
Network Firewall Rule Groups
VIRTUAL PRIVATE
Inbound security group rules successfully modified on security group (sg-0354ea177013e5427 | multi-docker)
Details
VPC > Security Groups > sg-0354ea177013e5427 - multi-docker
sg-0354ea177013e5427 - multi-docker
Actions
Details
Security group name
multi-docker
Security group ID
sg-0354ea177013e5427
Description
multi-docke
VPC ID
vpc-0d0d5d4c21e769367
Owner
218788053233
Inbound rules count
1 Permission entry
Outbound rules count
1 Permission entry
Inbound rules
Outbound rules
Tags
You can now check network connectivity with Reachability Analyzer
Run Reachability Analyzer
Inbound rules (1/1)
Manage tags
Edit inbound rules
Filter security group rules
1


us-east-1.console.aws.amazon.com/vpc/home?region=us-east-1#SecurityGroup:group-id=sg-0354ea177013e5427
Services
Search for services, features, blogs, docs, and more [Option+S]
N. Virginia
Naveen Kumar M
New VPC Experience
Tell us what you think
DHCP Options Sets
Elastic IPs
Managed Prefix Lists
Endpoints New
Endpoint Services
NAT Gateways
Peering Connections
SECURITY
Network ACLs
Security Groups
NETWORK ANALYSIS
Reachability Analyzer
Network Access Analyzer
DNS FIREWALL
Rule Groups New
Domain Lists New
NETWORK FIREWALL
Firewalls
Firewall Policies
Network Firewall Rule Groups
VIRTUAL PRIVATE
VPC > Security Groups > sg-0354ea177013e5427 - multi-docker
sg-0354ea177013e5427 - multi-docker
Actions
Details
Security group name
multi-docker
Security group ID
sg-0354ea177013e5427
Description
multi-docke
VPC ID
vpc-0d0d5d4c21e769367
Owner
218788053233
Inbound rules count
1 Permission entry
Outbound rules count
1 Permission entry
Inbound rules
Outbound rules
Tags
You can now check network connectivity with Reachability Analyzer
Run Reachability Analyzer
Inbound rules (1/1)
Manage tags
Edit inbound rules
Filter security group rules
1
Name
Security group rule...
IP version
Type
Protocol
Port range
–
sgr-09b2dfc9bc0262f4b
–
Custom TCP
TCP
0

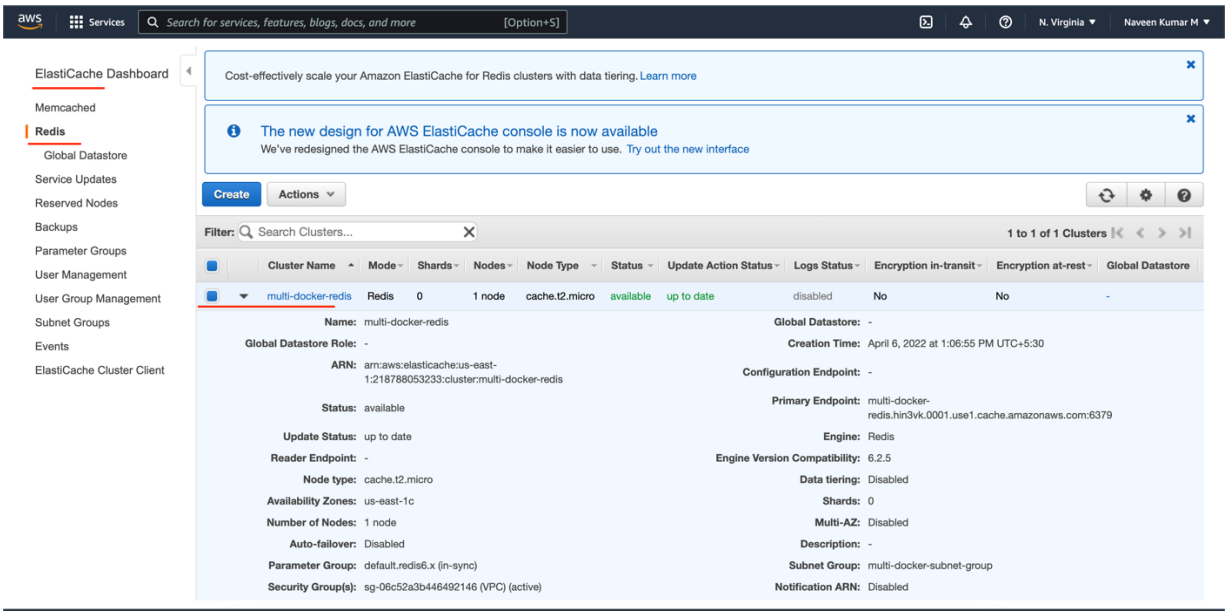
Applying Security Groups to ElastiCache

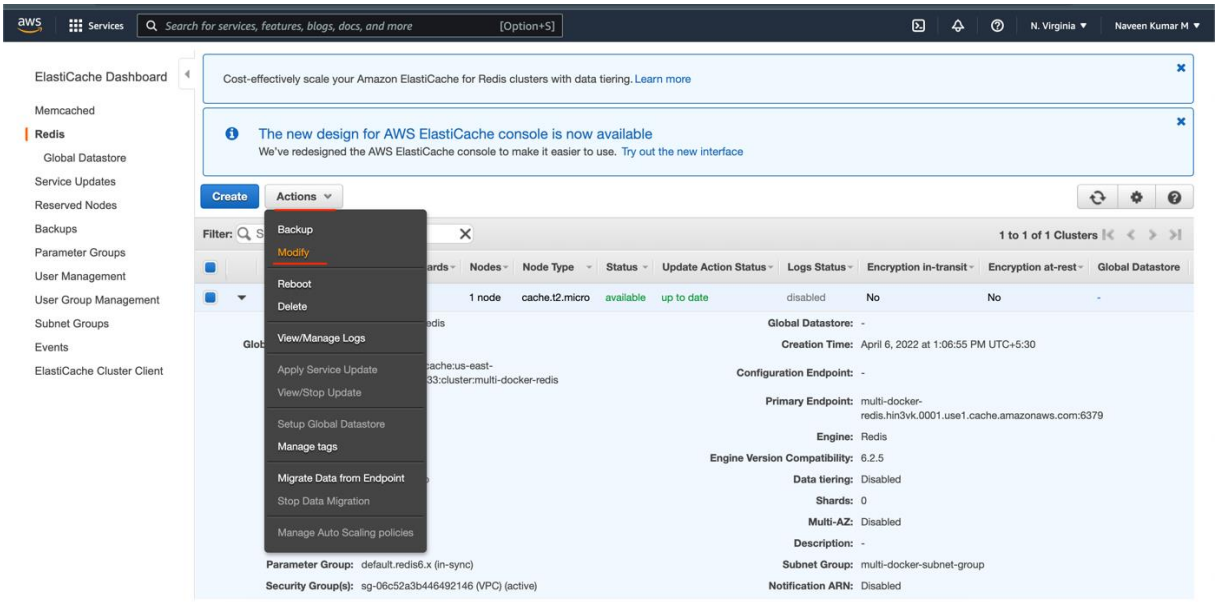
Steps

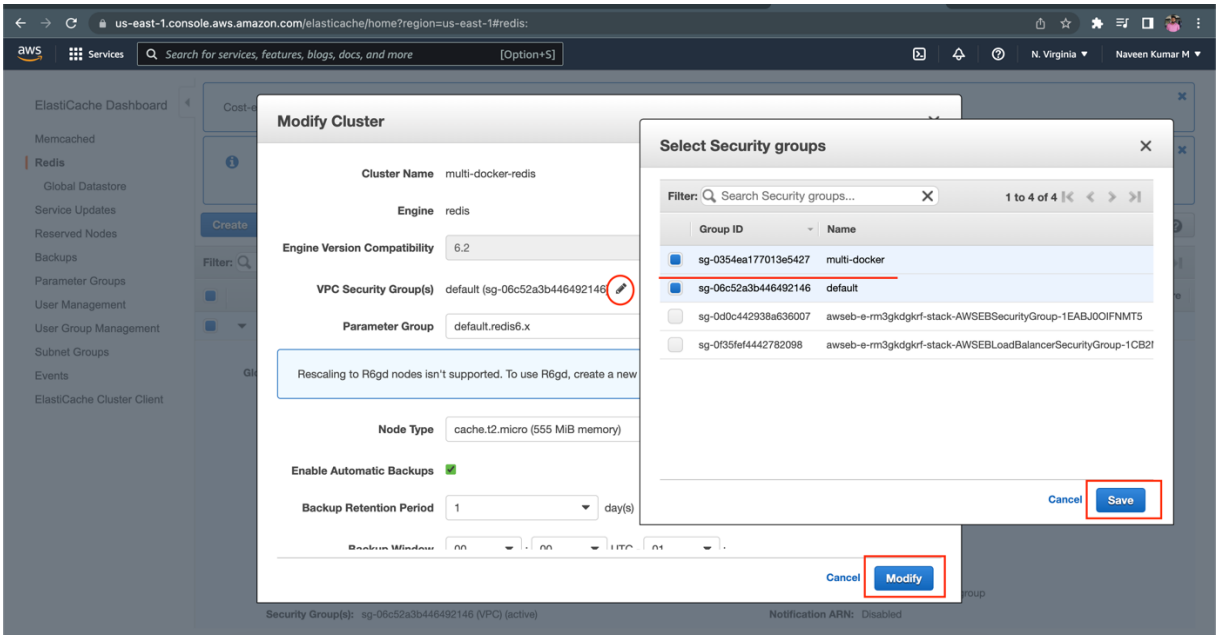
Applying Security Groups to ElastiCache

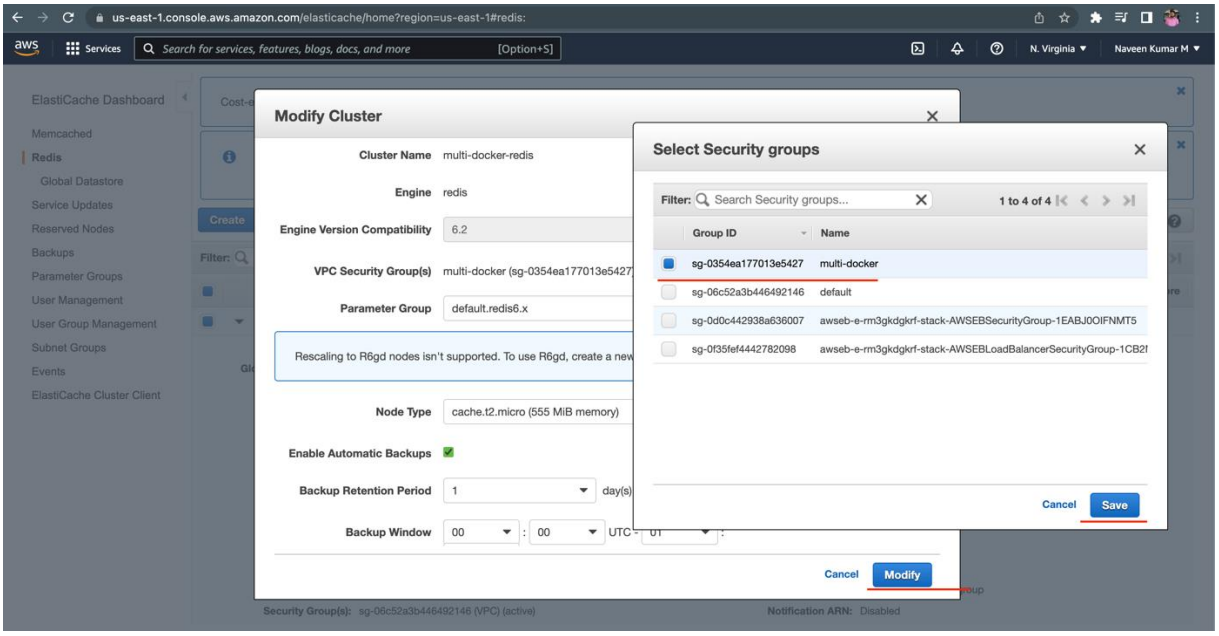
1. Go to AWS Management Console and use Find Services to search for ElastiCache
2. Click Redis in Sidebar
3. Check the box next to Redis cluster
4. Click Actions and click Modify
5. Click the pencil icon to edit the VPC Security group. Tick the box next to the new multi-docker group and click Save
6. Click Modify

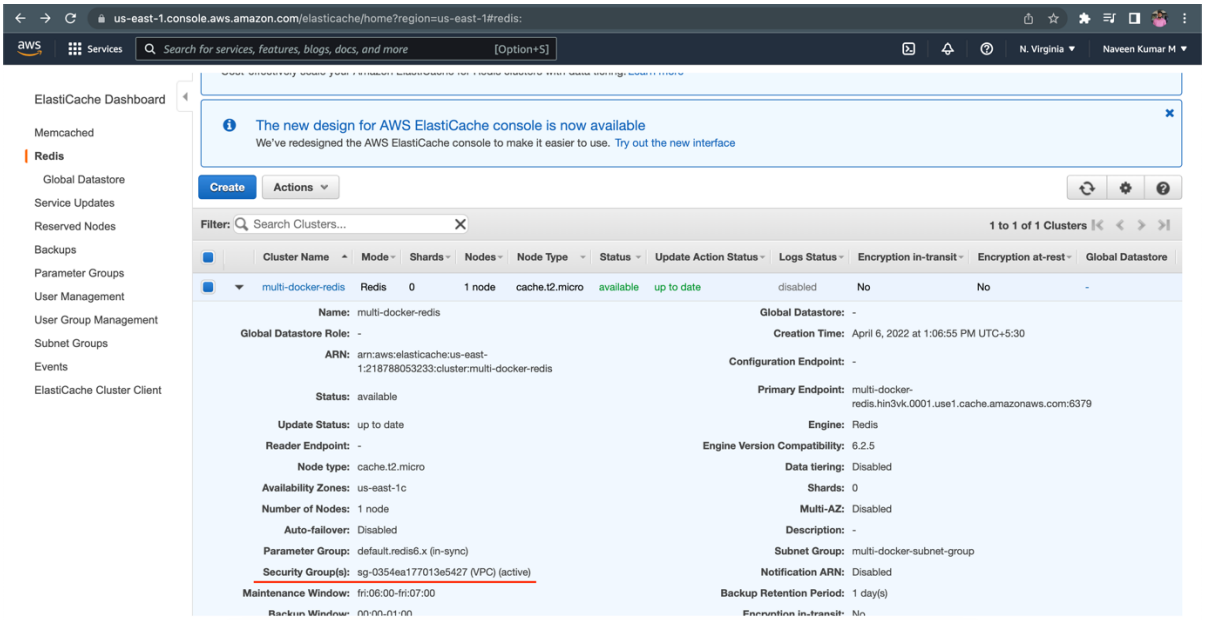
Screenshots




Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
Naveen Kumar M
ElastiCache Dashboard
Memcached
Redis
Global Datastore
Service Updates
Reserved Nodes
Backups
Parameter Groups
User Management
User Group Management
Subnet Groups
Events
ElastiCache Cluster Client
Cost-effectively scale your Amazon ElastiCache for Redis clusters with data tiering. Learn more
The new design for AWS ElastiCache console is now available
We've redesigned the AWS ElastiCache console to make it easier to use. Try out the new interface
Create
Actions
Backup
Modify
Reboot
Delete
View/Manage Logs
Apply Service Update
View/Stop Update
Setup Global Datastore
Manage tags
Migrate Data from Endpoint
Stop Data Migration
Manage Auto Scaling policies
Filter:
1 to 1 of 1 Clusters
Nodes
Node Type
Status
Update Action Status
Logs Status
Encryption in-transit
Encryption at-rest
Global Datastore
1 node
cache.t2.micro
available
up to date
disabled
No
No
Global Datastore:
Creation Time: April 6, 2022 at 1:06:55 PM UTC+5:30
Configuration Endpoint:
Primary Endpoint: multi-docker-redis.hin3vk.0001.use1.cache.amazonaws.com:6379
Engine: Redis
Engine Version Compatibility: 6.2.5
Data tiering: Disabled
Shards: 0
Multi-AZ: Disabled
Description:
Parameter Group: default.redis6.x (in-sync)
Subnet Group: multi-docker-subnet-group
Security Group(s): sg-06c52a3b446492146 (VPC) (active)
Notification ARN: Disabled


us-east-1.console.aws.amazon.com/elasticache/home?region=us-east-1#redis:
Modify Cluster
Cluster Name multi-docker-redis
Engine redis
Engine Version Compatibility 6.2
VPC Security Group(s) default (sg-06c52a3b446492146)
Parameter Group default.redis6.x
Rescaling to R6gd nodes isn't supported. To use R6gd, create a new
Node Type cache.t2.micro (555 MiB memory)
Enable Automatic Backups
Backup Retention Period 1 day(s)
Cancel
Modify
Select Security groups
Filter: Search Security groups...
1 to 4 of 4
Group ID
Name
sg-0354ea177013e5427 multi-docker
sg-06c52a3b446492146 default
sg-0d0c442938a636007 awseb-e-rm3gkdgkrf-stack-AWSEBSecurityGroup-1EABJ0OIFNMT5
sg-0f35fef4442782098 awseb-e-rm3gkdgkrf-stack-AWSEBLoadBalancerSecurityGroup-1CB2I
Cancel
Save


us-east-1.console.aws.amazon.com/elasticache/home?region=us-east-1#redis:
Modify Cluster
Cluster Name multi-docker-redis
Engine redis
Engine Version Compatibility 6.2
VPC Security Group(s) multi-docker (sg-0354ea177013e5427
Parameter Group default.redis6.x
Rescaling to R6gd nodes isn't supported. To use R6gd, create a new
Node Type cache.t2.micro (555 MiB memory)
Enable Automatic Backups
Backup Retention Period 1 day(s)
Backup Window 00 : 00 UTC
Cancel
Modify
Select Security groups
Filter: Search Security groups...
1 to 4 of 4
Group ID
Name
sg-0354ea177013e5427 multi-docker
sg-06c52a3b446492146 default
sg-0d0c442938a636007 awseb-e-rm3gkdgkrf-stack-AWSEBSecurityGroup-1EABJ0OIFNMT5
sg-0f35fef4442782098 awseb-e-rm3gkdgkrf-stack-AWSEBLoadBalancerSecurityGroup-1CB2I
Cancel
Save



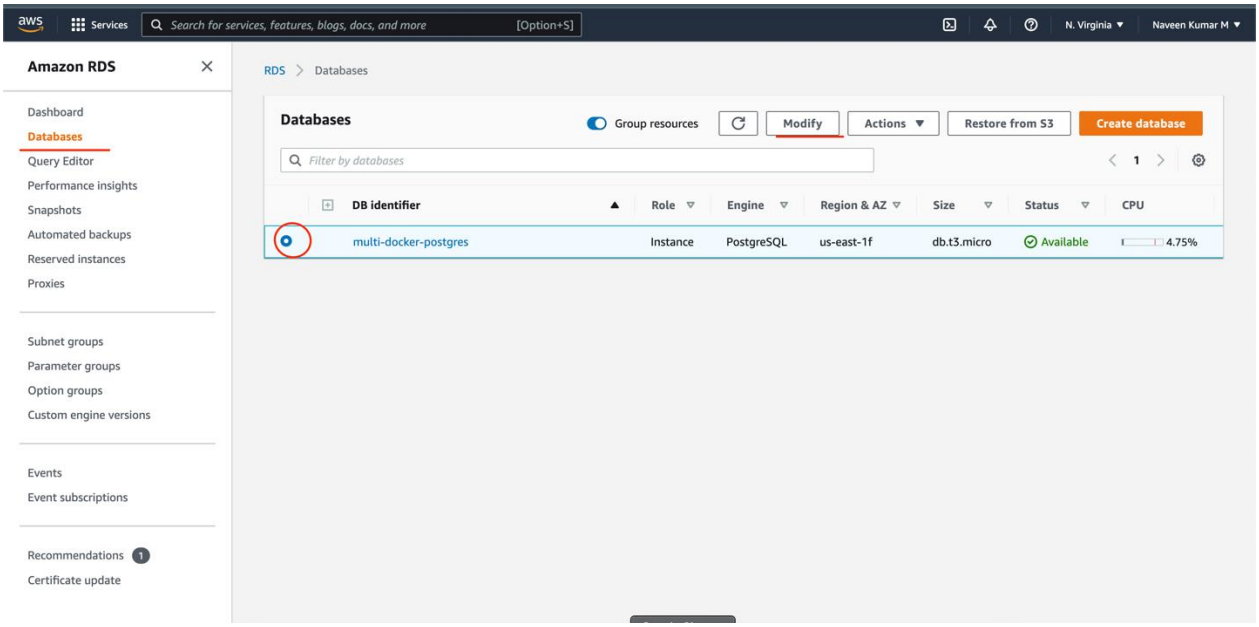
Applying Security Groups to RDS

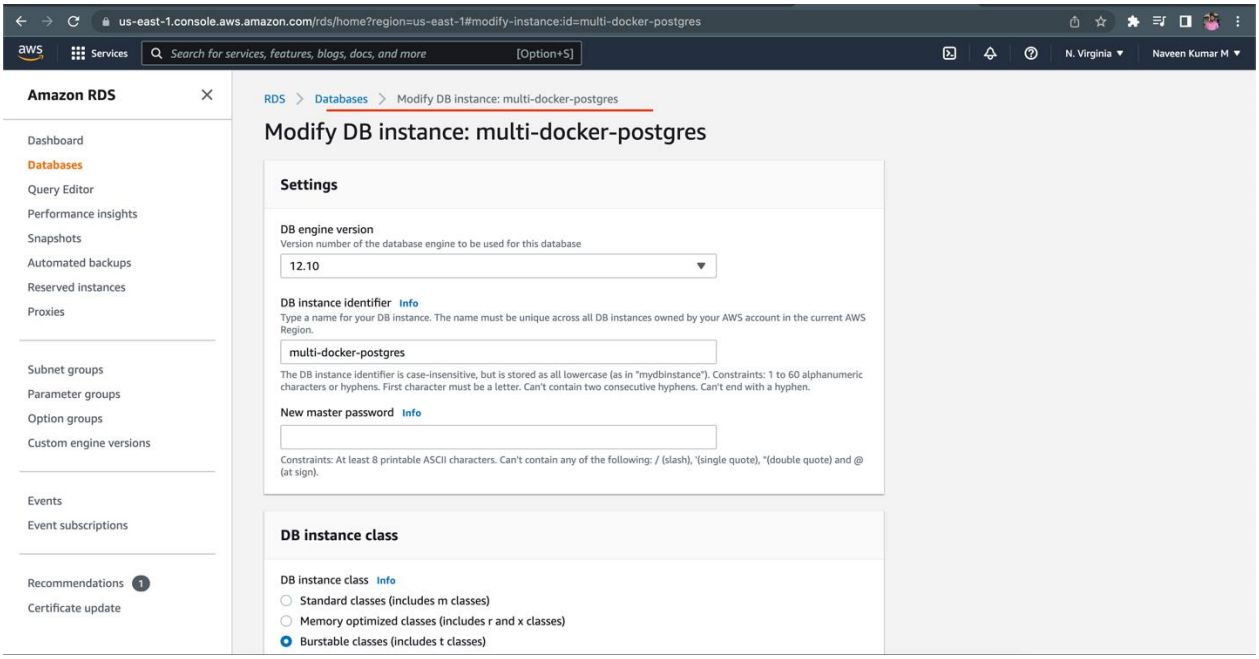
Steps

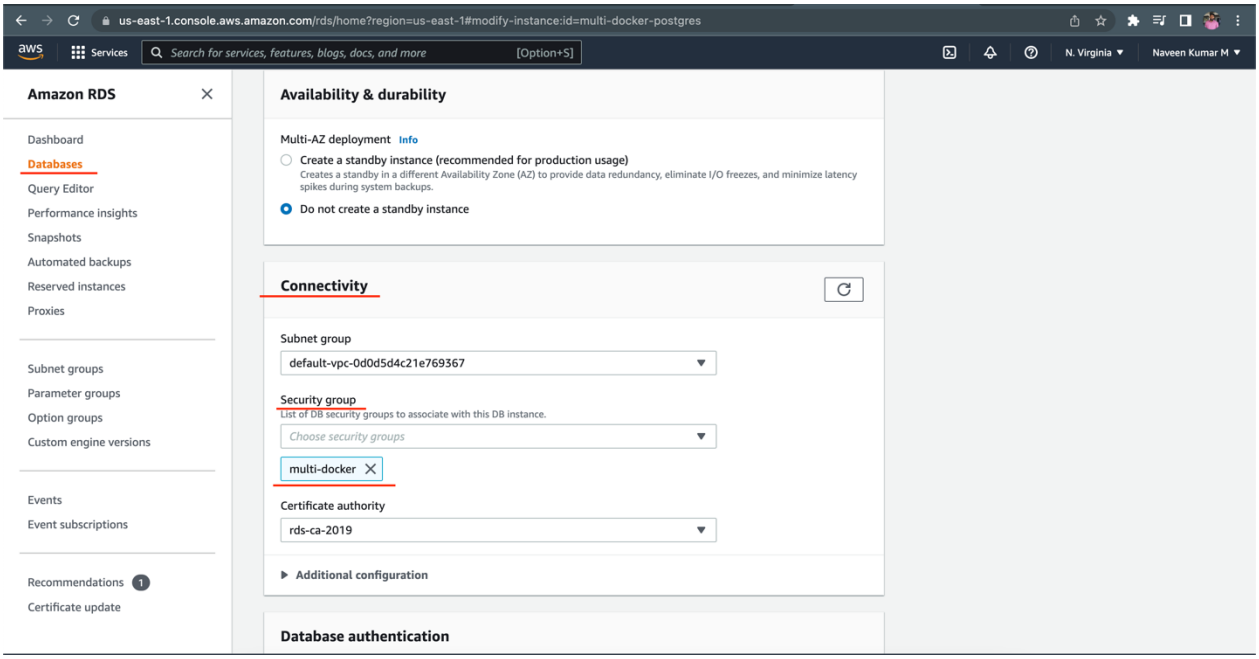
Applying Security Groups to RDS

1. Go to AWS Management Console and use Find Services to search for RDS
2. Click Databases in Sidebar and check the box next to your instance
3. Click Modify button
4. Scroll down to Connectivity and add the new multi-docker security group
5. Scroll down and click the Continue button
6. Click Modify DB instance button

Screenshots






us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#modify-instance:id=multi-docker-postgres
aws
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
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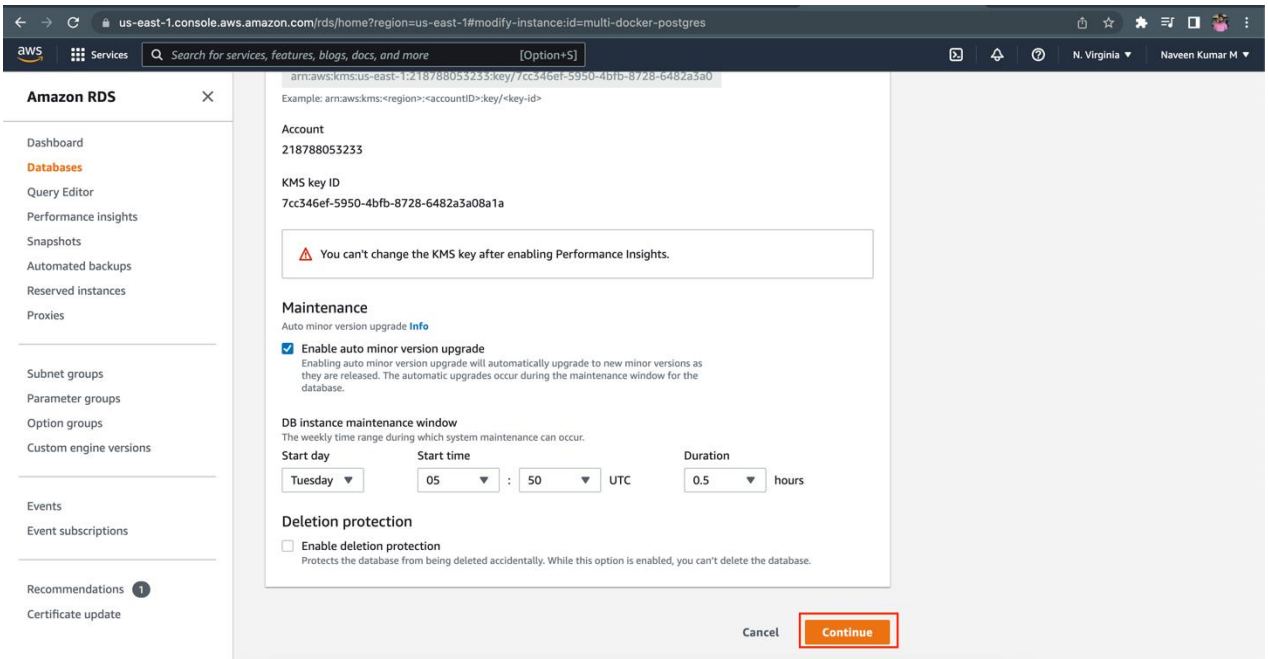
Amazon RDS
Dashboard
Databases
Query Editor
Performance insights
Snapshots
Automated backups
Reserved instances
Proxies
Subnet groups
Parameter groups
Option groups
Custom engine versions
Events
Event subscriptions
Recommendations 1
Certificate update
Availability & durability
Multi-AZ deployment Info
Create a standby instance (recommended for production usage)
Creates a standby in a different Availability Zone (AZ) to provide data redundancy, eliminate I/O freezes, and minimize latency spikes during system backups.
Do not create a standby instance
Connectivity
Subnet group
default-vpc-0d0d5d4c21e769367
Security group
List of DB security groups to associate with this DB instance.
Choose security groups
multi-docker
Certificate authority
rds-ca-2019
Additional configuration
Database authentication


us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#modify-instance:id=multi-docker-postgres
aws
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
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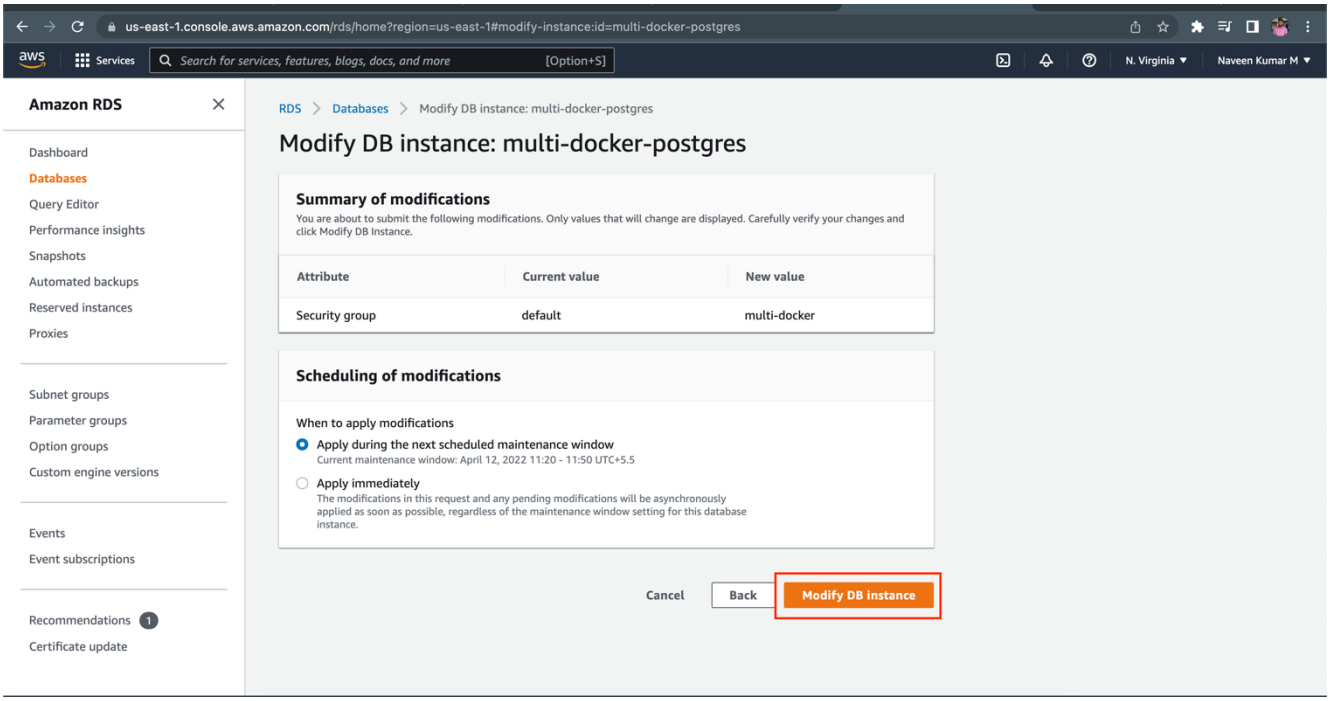
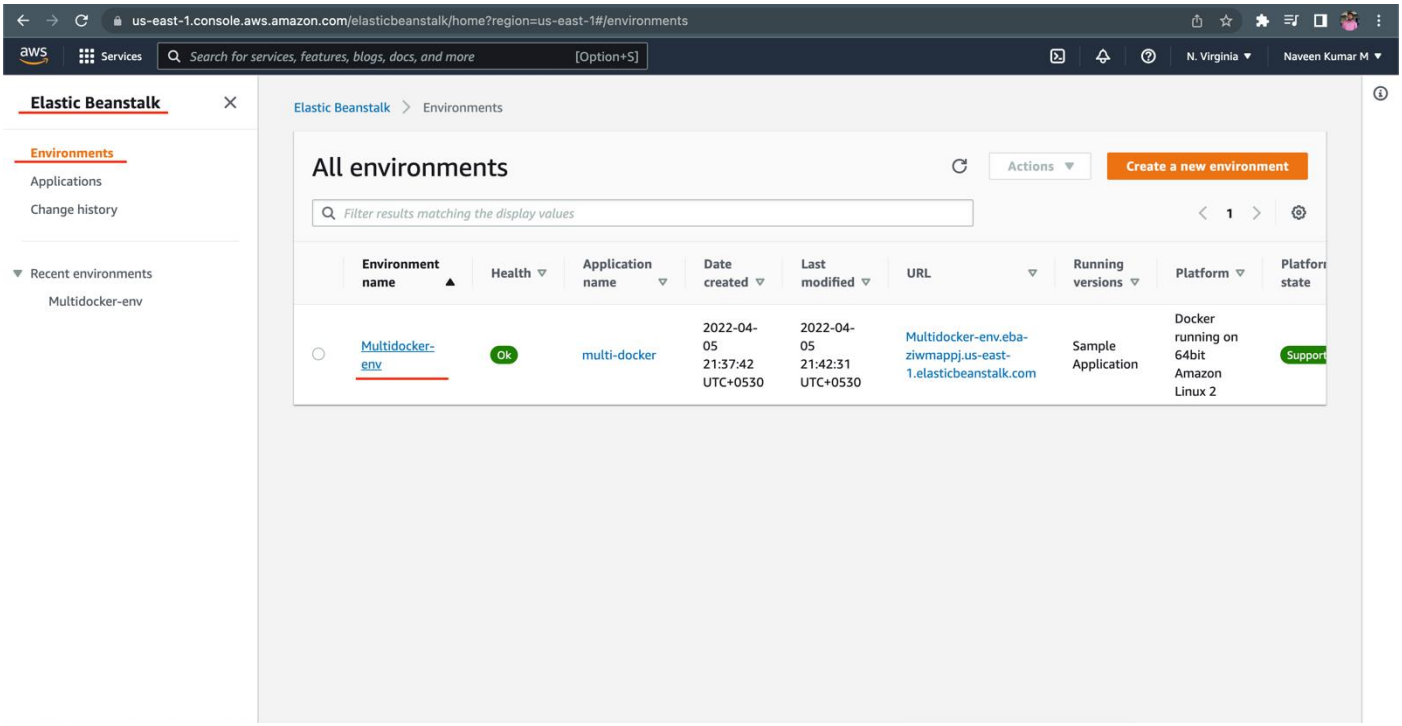
Amazon RDS
Dashboard
Databases
Query Editor
Performance insights
Snapshots
Automated backups
Reserved instances
Proxies
Subnet groups
Parameter groups
Option groups
Custom engine versions
Events
Event subscriptions
Recommendations 1
Certificate update
arn:aws:kms:us-east-1:218788053233:key/7cc346ef-5950-4bfb-8728-6482a3a0
Example: arn:aws:kms:<region>:<accountID>:key/<key-id>
Account
218788053233
KMS key ID
7cc346ef-5950-4bfb-8728-6482a3a08a1a
You can't change the KMS key after enabling Performance Insights.
Maintenance
Auto minor version upgrade Info
Enable auto minor version upgrade
Enabling auto minor version upgrade will automatically upgrade to new minor versions as they are released. The automatic upgrades occur during the maintenance window for the database.
DB instance maintenance window
The weekly time range during which system maintenance can occur.
Start day
Tuesday
Start time
05
50
UTC
Duration
0.5
hours
Deletion protection
Enable deletion protection
Protects the database from being deleted accidentally. While this option is enabled, you can't delete the database.
Cancel
Continue

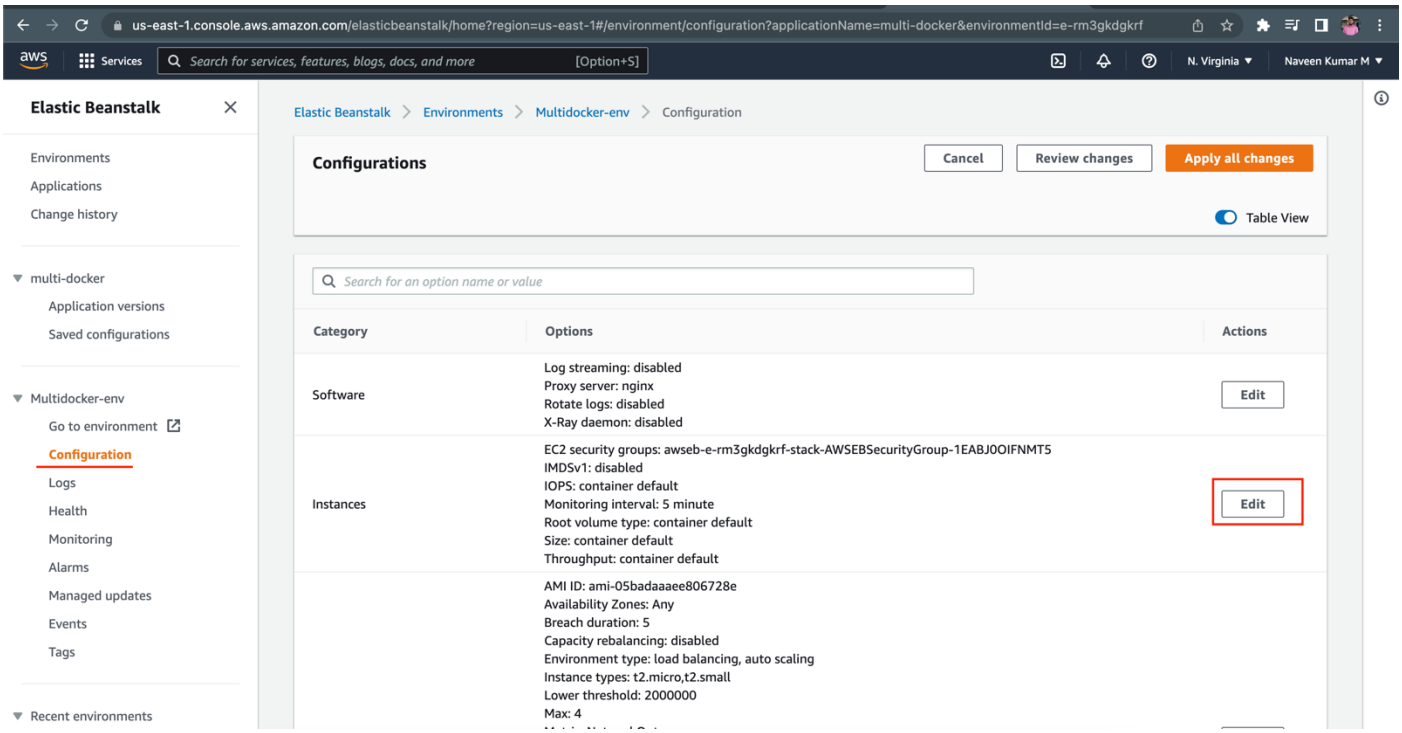


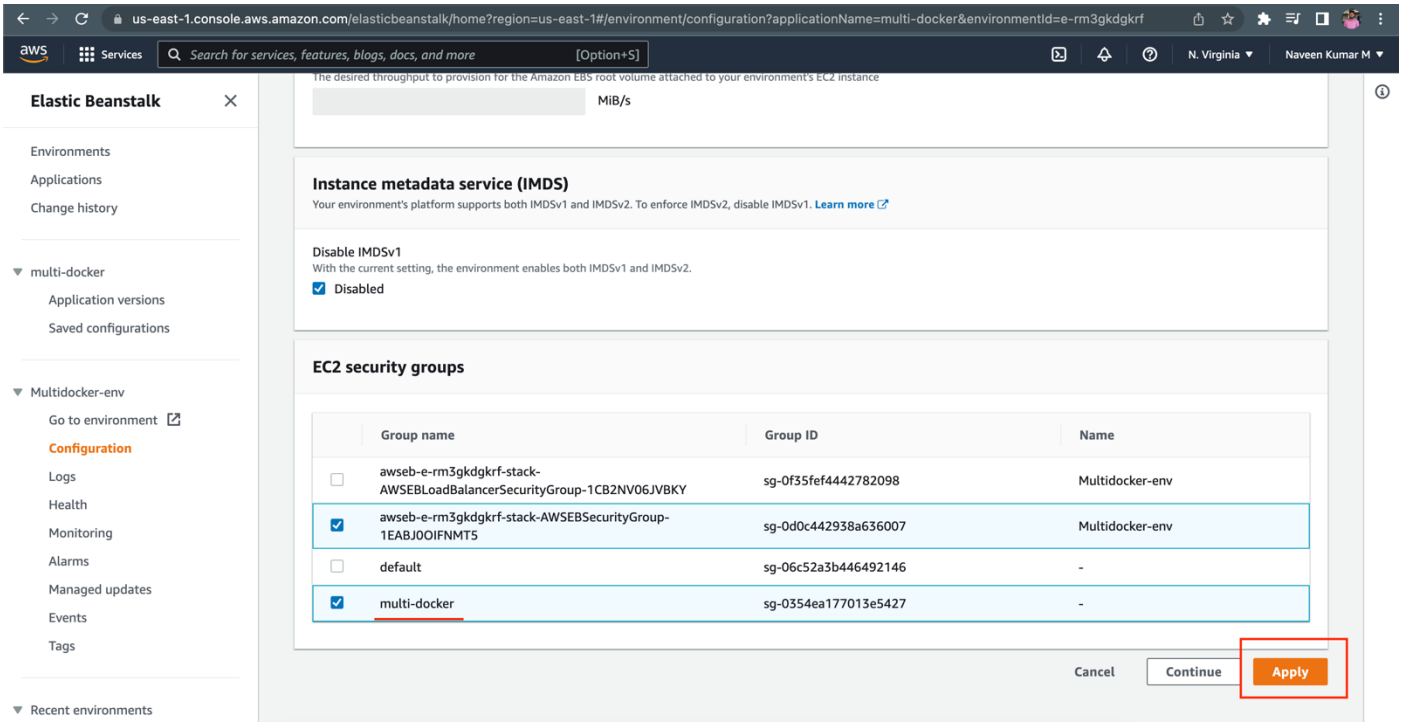
Applying Security Groups to Elastic Beanstalk

Applying Security Groups to Elastic Beanstalk

1. Go to AWS Management Console and use Find Services to search for Elastic Beanstalk
2. Click Environments in the left sidebar.
3. Click MultiDocker-env
4. Click Configuration
5. In the Instances row, click the Edit button.
6. Scroll down to EC2 Security Groups and tick box next to multi-docker
7. Click Apply and Click Confirm
8. After all the instances restart and go from No Data to Severe, you should see a green checkmark under Health.


us-east-1.console.aws.amazon.com/elasticbeanstalk/home?region=us-east-1#/environments
aws
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
Naveen Kumar M
Elastic Beanstalk
Environments
Applications
Change history
Recent environments
Multidocker-env
Elastic Beanstalk > Environments
All environments
Actions
Create a new environment
Filter results matching the display values
1
Environment name
Health
Application name
Date created
Last modified
URL
Running versions
Platform
Platform state
Multidocker-env
Ok
multi-docker
2022-04-05 21:37:42 UTC+0530
2022-04-05 21:42:31 UTC+0530
Multidocker-env.eba-ziwmappj.us-east-1.elasticbeanstalk.com
Sample Application
Docker running on 64bit Amazon Linux 2


us-east-1.console.aws.amazon.com/elasticbeanstalk/home?region=us-east-1#/environment/configuration?applicationName=multi-docker&environmentId=e-rm3gkdgkrf
aws
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
Naveen Kumar M
Elastic Beanstalk
Environments
Applications
Change history
multi-docker
Application versions
Saved configurations
Multidocker-env
Go to environment
Configuration
Logs
Health
Monitoring
Alarms
Managed updates
Events
Tags
Recent environments
Elastic Beanstalk > Environments > Multidocker-env > Configuration
Configurations
Cancel
Review changes
Apply all changes
Table View
Search for an option name or value
Category
Options
Actions
Software
Log streaming: disabled
Proxy server: nginx
Rotate logs: disabled
X-Ray daemon: disabled
Edit
Instances
EC2 security groups: awseb-e-rm3gkdgkrf-stack-AWSEBSecurityGroup-1EABJ0OIFNMT5
IMDSv1: disabled
IOPS: container default
Monitoring interval: 5 minute
Root volume type: container default
Size: container default
Throughput: container default
Edit
AMI ID: ami-05badaaaee806728e
Availability Zones: Any
Breach duration: 5
Capacity rebalancing: disabled
Environment type: load balancing, auto scaling
Instance types: t2.micro,t2.small
Lower threshold: 2000000
Max: 4


us-east-1.console.aws.amazon.com/elasticbeanstalk/home?region=us-east-1#/environment/configuration?applicationName=multi-docker&environmentId=e-rm3gkdgkrf
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
Naveen Kumar M
Elastic Beanstalk
Environments
Applications
Change history
multi-docker
Application versions
Saved configurations
Multidocker-env
Go to environment
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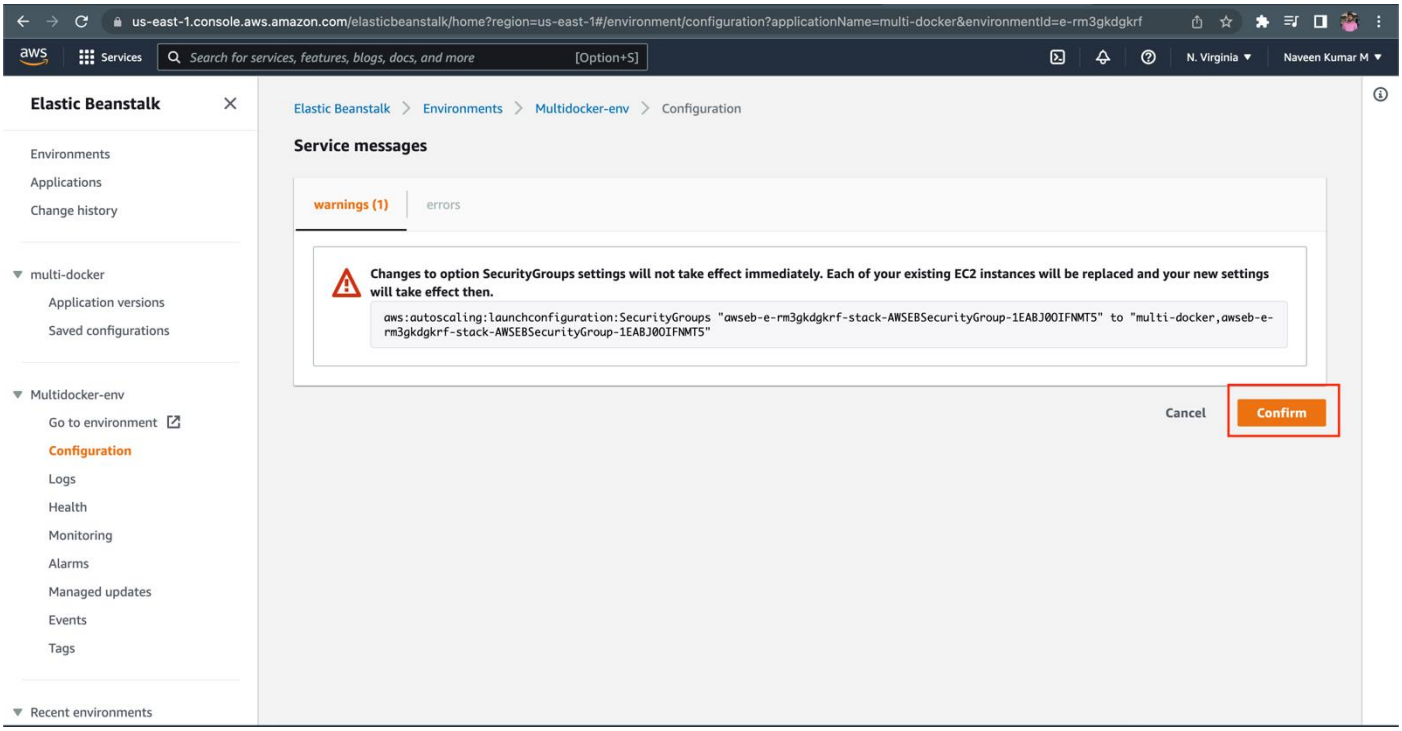
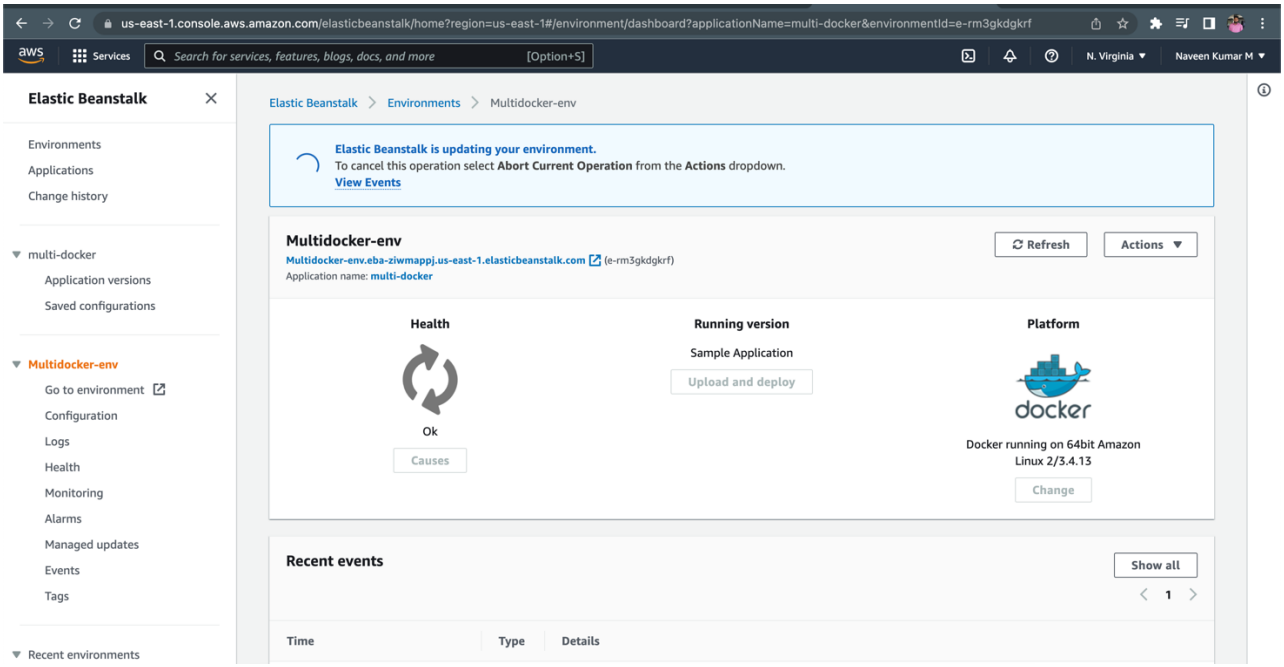
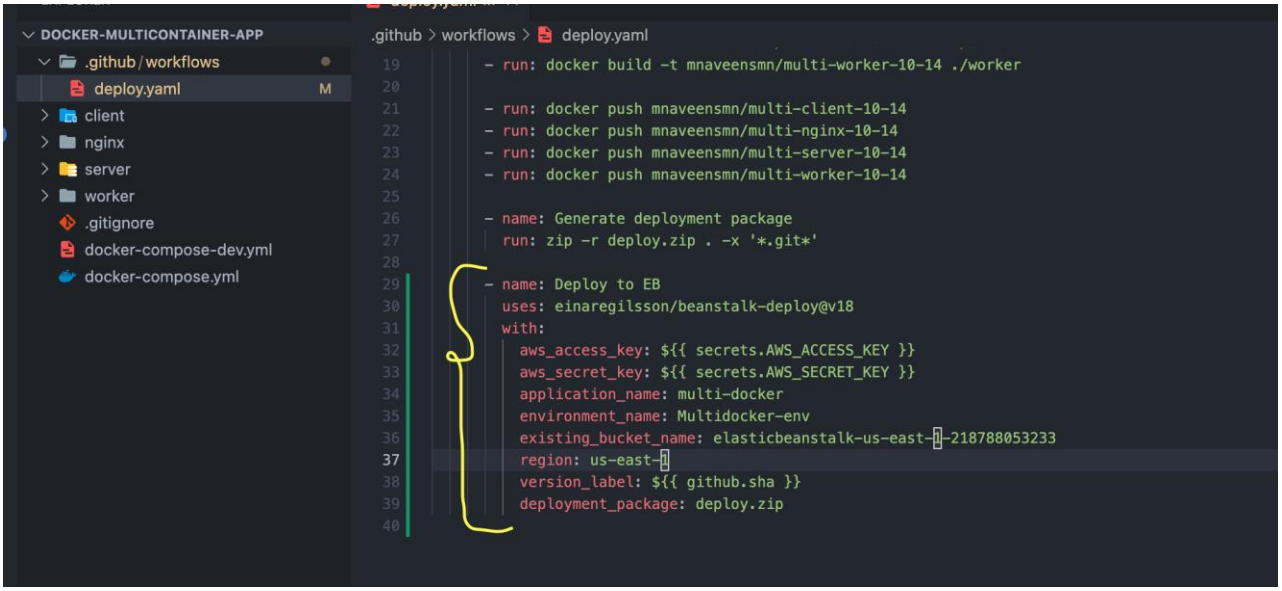
Logs
Health
Monitoring
Alarms
Managed updates
Events
Tags
Recent environments
The desired throughput to provision for the Amazon EBS root volume attached to your environment's EC2 instance
MiB/s
Instance metadata service (IMDS)
Your environment's platform supports both IMDSv1 and IMDSv2. To enforce IMDSv2, disable IMDSv1. Learn more
Disable IMDSv1
With the current setting, the environment enables both IMDSv1 and IMDSv2.
Disabled
EC2 security groups
Group name
Group ID
Name
awseb-e-rm3gkdgkrf-stack-AWSEBLoadBalancerSecurityGroup-1CB2NV06JVBKY
sg-0f35fef4442782098
Multidocker-env
awseb-e-rm3gkdgkrf-stack-AWSEBSecurityGroup-1EABJ0OIFNMT5
sg-0d0c442938a636007
Multidocker-env
default
sg-06c52a3b446492146
-
multi-docker
sg-0354ea177013e5427
-
Cancel
Continue
Apply


us-east-1.console.aws.amazon.com/elasticbeanstalk/home?region=us-east-1#/environment/configuration?applicationName=multi-docker&environmentId=e-rm3gkdgkrf
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
Naveen Kumar M
Elastic Beanstalk
Environments
Applications
Change history
multi-docker
Application versions
Saved configurations
Multidocker-env
Go to environment
Configuration
Logs
Health
Monitoring
Alarms
Managed updates
Events
Tags
Recent environments
Elastic Beanstalk > Environments > Multidocker-env > Configuration
Service messages
warnings (1)
errors
Changes to option SecurityGroups settings will not take effect immediately. Each of your existing EC2 instances will be replaced and your new settings will take effect then.
aws:autoscaling:launchconfiguration:SecurityGroups "awseb-e-rm3gkdgkrf-stack-AWSEBSecurityGroup-1EABJ0OIFNMT5" to "multi-docker,awseb-e-rm3gkdgkrf-stack-AWSEBSecurityGroup-1EABJ0OIFNMT5"
Cancel
Confirm



Add AWS configuration details to Github Actions deploy.yml file's deploy script

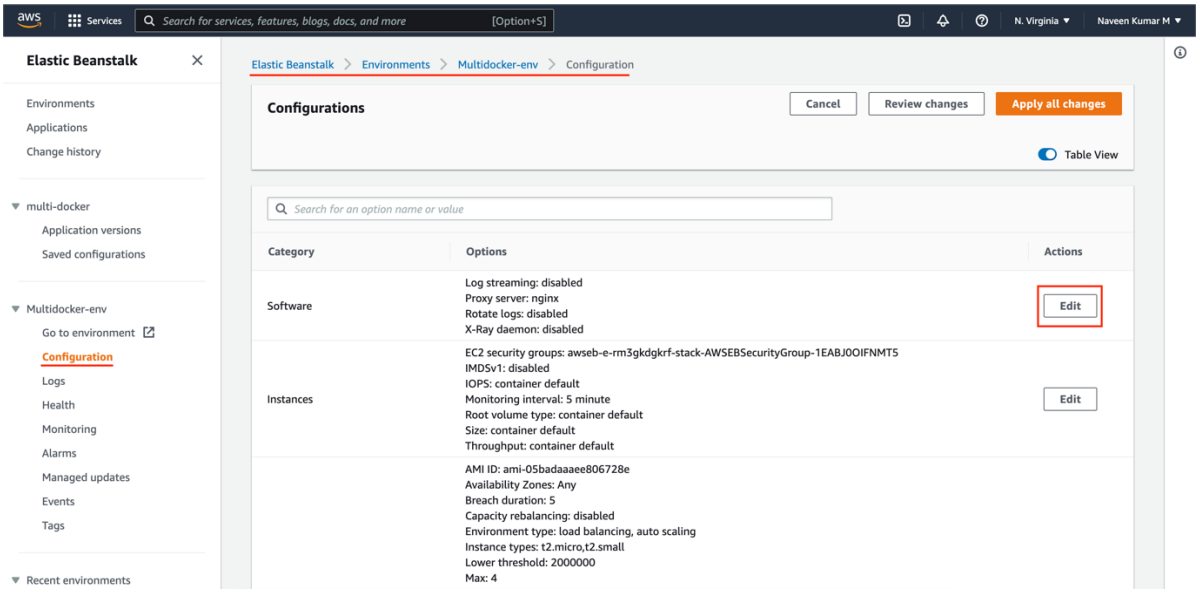


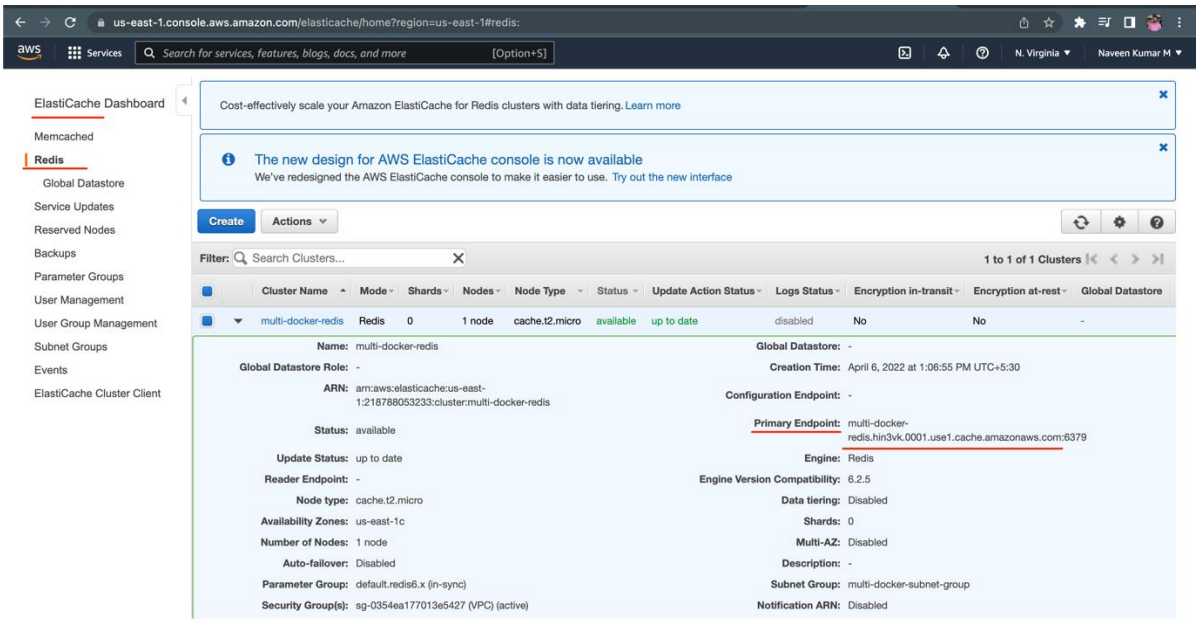
Setting Environment Variables

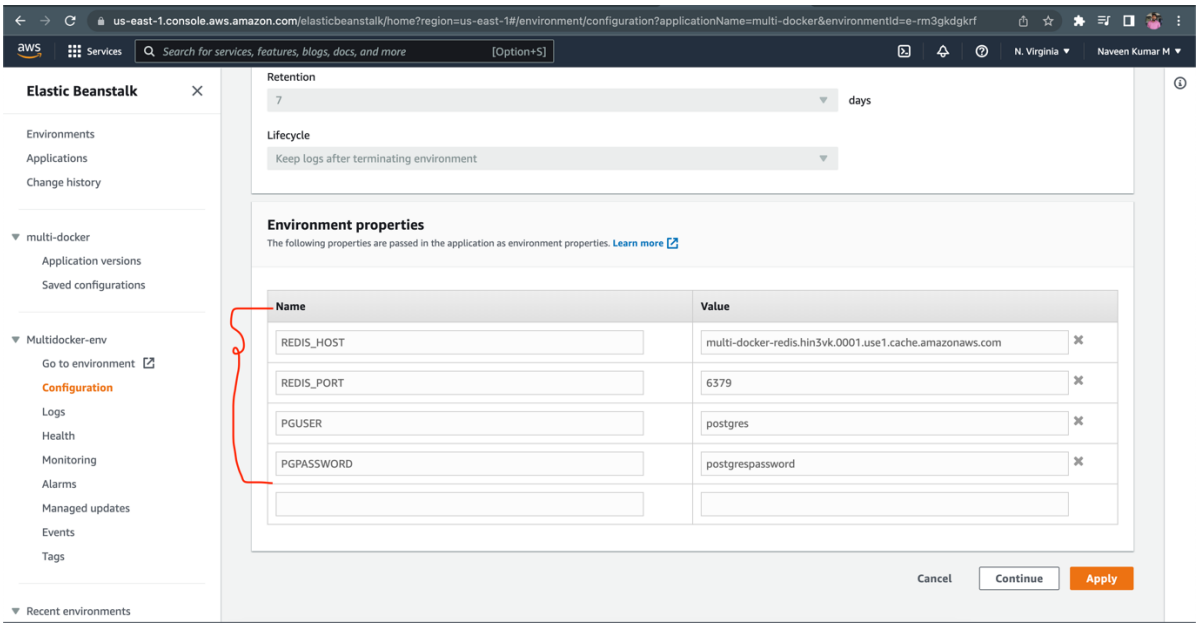
Steps

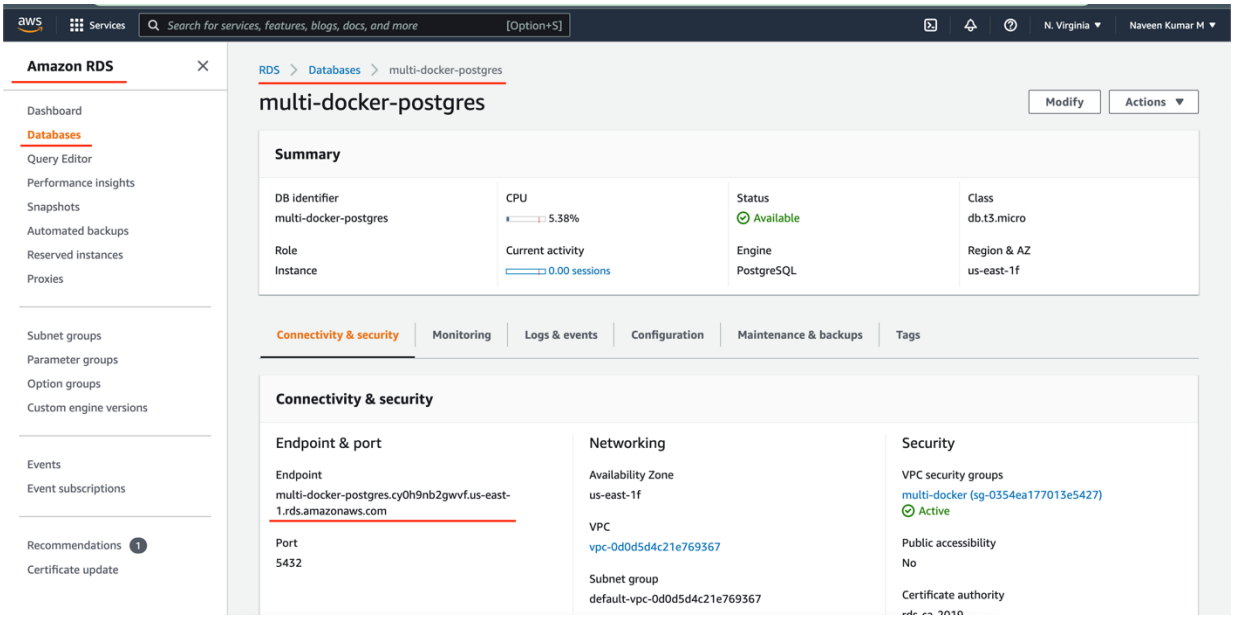
1. Go to AWS Management Console and use Find Services to search for Elastic Beanstalk
2. Click Environments in the left sidebar.
3. Click MultiDocker-env
4. Click Configuration
5. In the Software row, click the Edit button
6. Scroll down to Environment properties
7. In another tab Open up ElastiCache, click Redis and check the box next to your cluster. Find the Primary Endpoint and copy that value but omit the :6379
8. Set REDIS_HOST key to the primary endpoint listed above, remember to omit :6379
9. Set REDIS_PORT to 6379
10. Set PGUSER to postgres
11. Set PGPASSWORD to postgrespassword
12. In another tab, open up the RDS dashboard, click databases in the sidebar, click your instance and scroll to Connectivity and Security. Copy the endpoint.
13. Set the PGHOST key to the endpoint value listed above.
14. Set PGDATABASE to fibvalues
15. Set PGPORT to 5432
16. Click Apply button
17. After all instances restart and go from No Data, to Severe, you should see a green checkmark under Health.

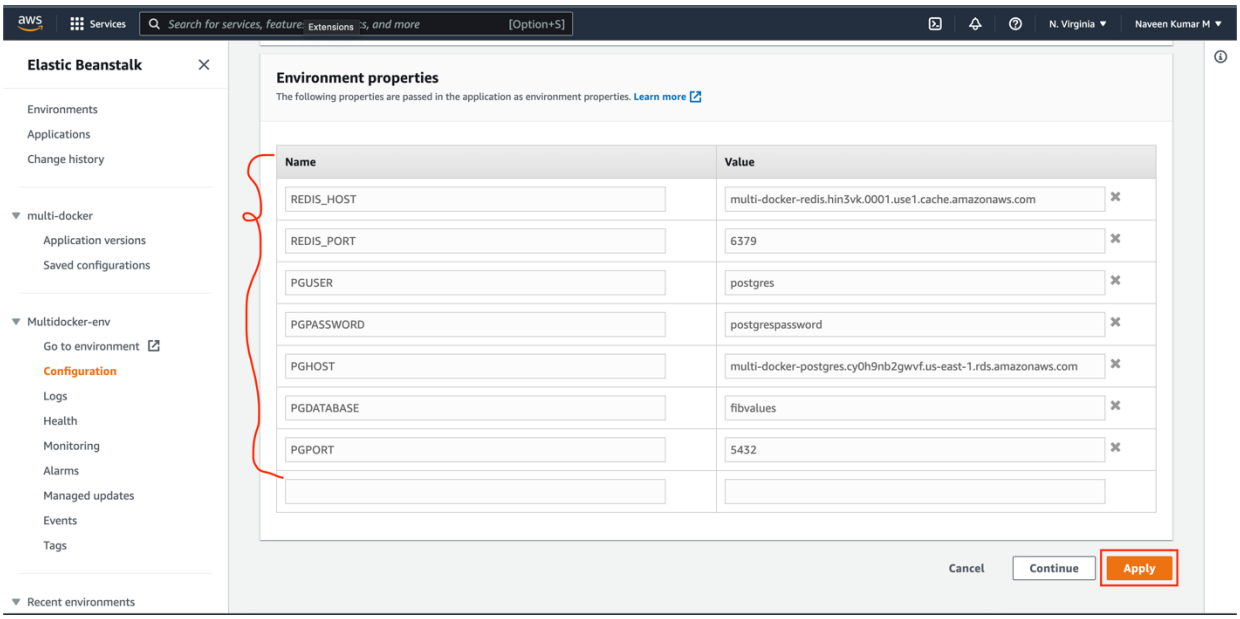
Screenshots

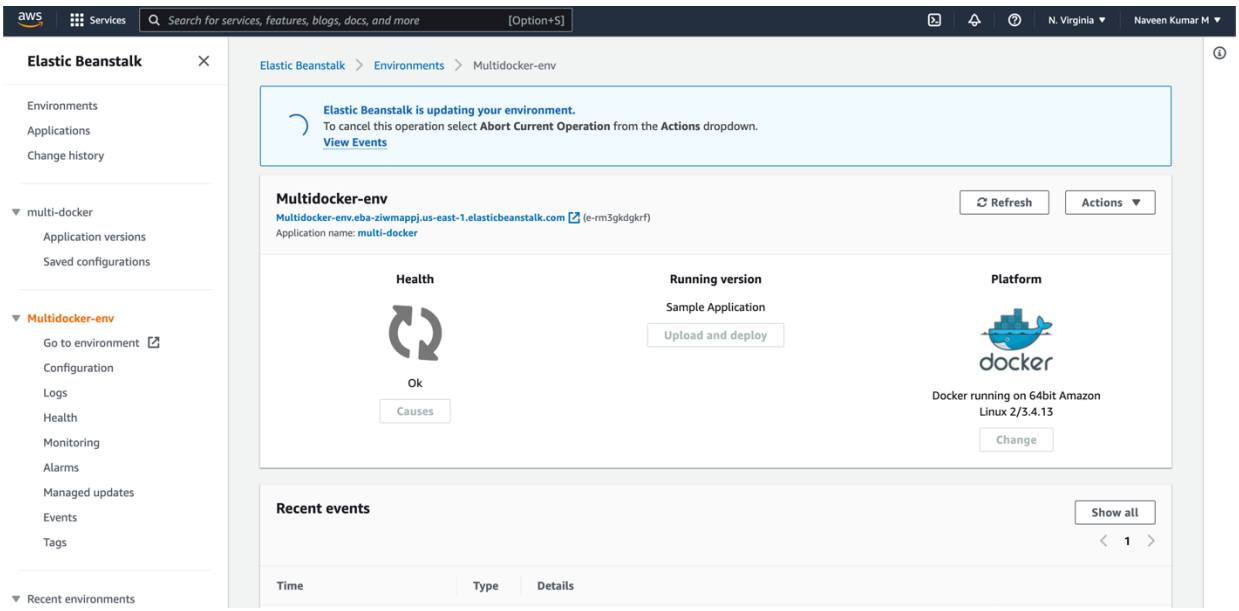







Amazon RDS
Dashboard
Databases
Query Editor
Performance insights
Snapshots
Automated backups
Reserved instances
Proxies
Subnet groups
Parameter groups
Option groups
Custom engine versions
Events
Event subscriptions
Recommendations 1
Certificate update
RDS > Databases > multi-docker-postgres
multi-docker-postgres
Modify
Actions
Summary
DB identifier
multi-docker-postgres
CPU
5.38%
Status
Available
Class
db.t3.micro
Role
Instance
Current activity
0.00 sessions
Engine
PostgreSQL
Region & AZ
us-east-1f
Connectivity & security
Monitoring
Logs & events
Configuration
Maintenance & backups
Tags
Connectivity & security
Endpoint & port
Endpoint
multi-docker-postgres.cy0h9nb2gwvf.us-east-1.rds.amazonaws.com
Port
5432
Networking
Availability Zone
us-east-1f
VPC
vpc-0d0d5d4c21e769367
Subnet group
default-vpc-0d0d5d4c21e769367
Security
VPC security groups
multi-docker (sg-0354ea177013e5427)
Active
Public accessibility
No
Certificate authority


Elastic Beanstalk
Environments
Applications
Change history
multi-docker
Application versions
Saved configurations
Multidocker-env
Go to environment
Configuration
Logs
Health
Monitoring
Alarms
Managed updates
Events
Tags
Recent environments
Environment properties
The following properties are passed in the application as environment properties. Learn more
Name
Value
REDIS_HOST
multi-docker-redis.hin3vk.0001.use1.cache.amazonaws.com
REDIS_PORT
6379
PGUSER
postgres
PGPASSWORD
postgrespassword
PGHOST
multi-docker-postgres.cy0h9nb2gwvf.us-east-1.rds.amazonaws.com
PGDATABASE
fibvalues
PGPORT
5432
Cancel
Continue
Apply


Elastic Beanstalk
Environments
Applications
Change history
multi-docker
Application versions
Saved configurations
Multidocker-env
Go to environment
Configuration
Logs
Health
Monitoring
Alarms
Managed updates
Events
Tags
Recent environments
Elastic Beanstalk > Environments > Multidocker-env
Elastic Beanstalk is updating your environment.
To cancel this operation select Abort Current Operation from the Actions dropdown.
View Events
Multidocker-env
Multidocker-env.eba-ziwmappj.us-east-1.elasticbeanstalk.com (e-rm3gkdgkrf)
Application name: multi-docker
Refresh
Actions
Health
Ok
Causes
Running version
Sample Application
Upload and deploy
Platform
docker
Docker running on 64bit Amazon Linux 2/3.4.13
Change
Recent events
Show all
1
Time
Type
Details

IAM Keys for Deployment

Steps

IAM Keys for Deployment

You can use the same IAM User's access and secret keys from the single container app we created earlier, or, you can create a new IAM user for this application:

1. Search for the "IAM Security, Identity & Compliance Service"

2. Click "Create Individual IAM Users" and click "Manage Users"

3. Click "Add User"

4. Enter any name you'd like in the "User Name" field.

eg: docker-multi-travis-ci

5. Tick the "Programmatic Access" checkbox

6. Click "Next:Permissions"

7. Click "Attach Existing Policies Directly"

8. Search for "beanstalk"

9. Tick the box next to "AdministratorAccess-AWSElasticBeanstalk"

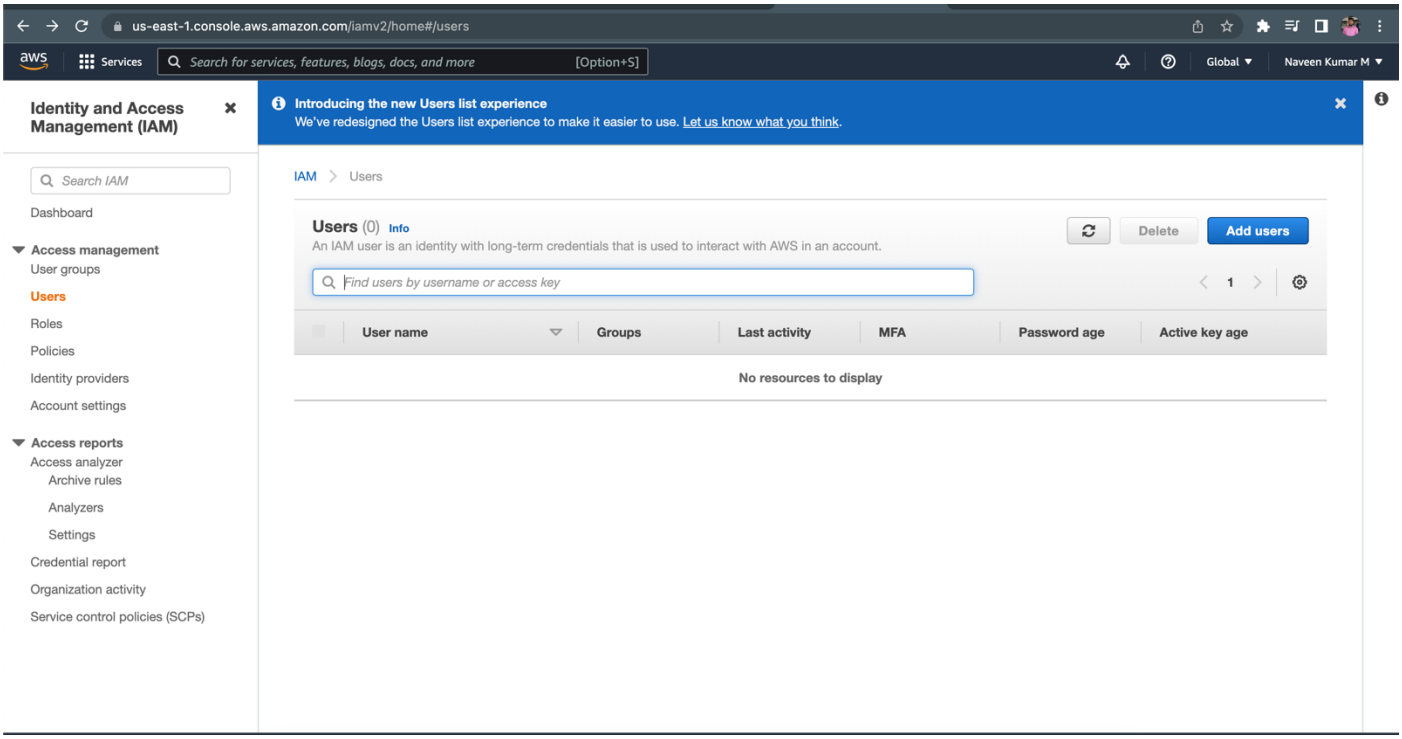
10. Click "Next:Tags"

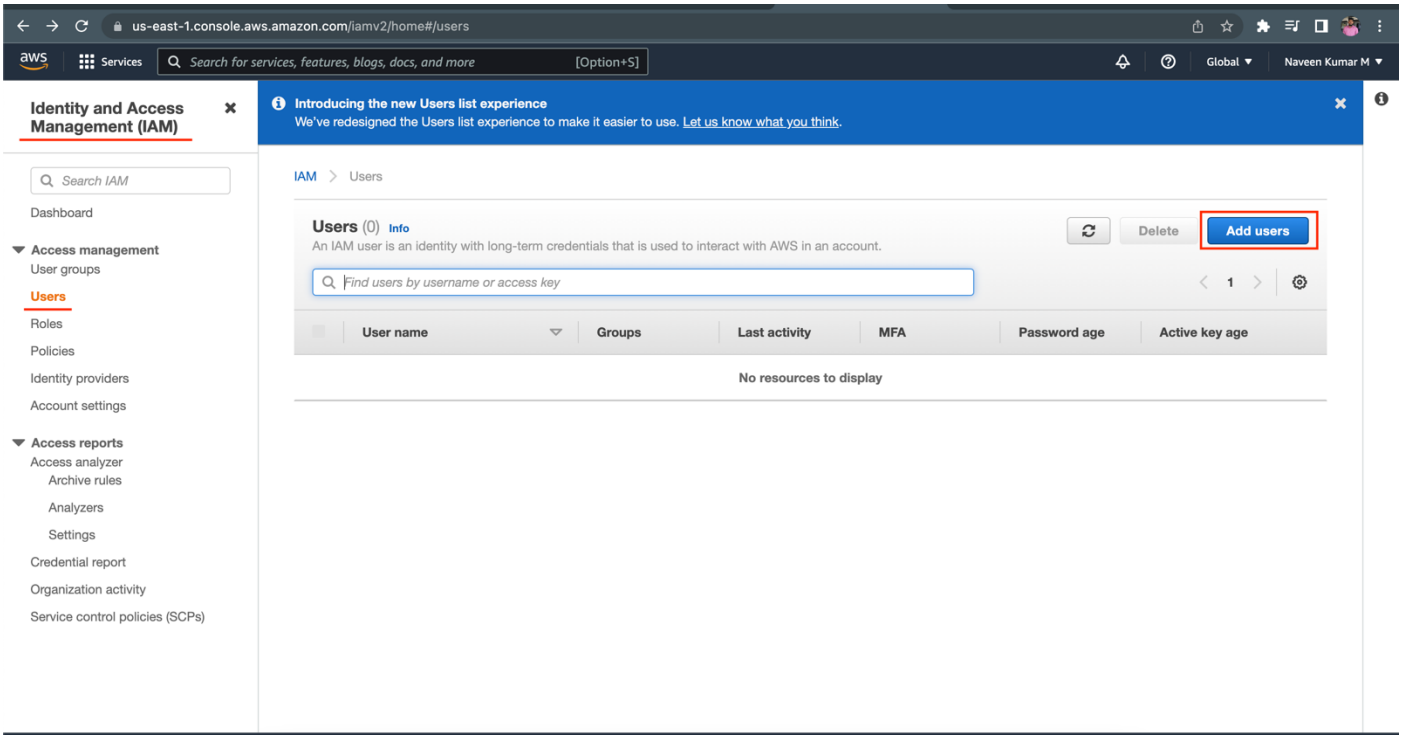
11. Click "Next:Review"

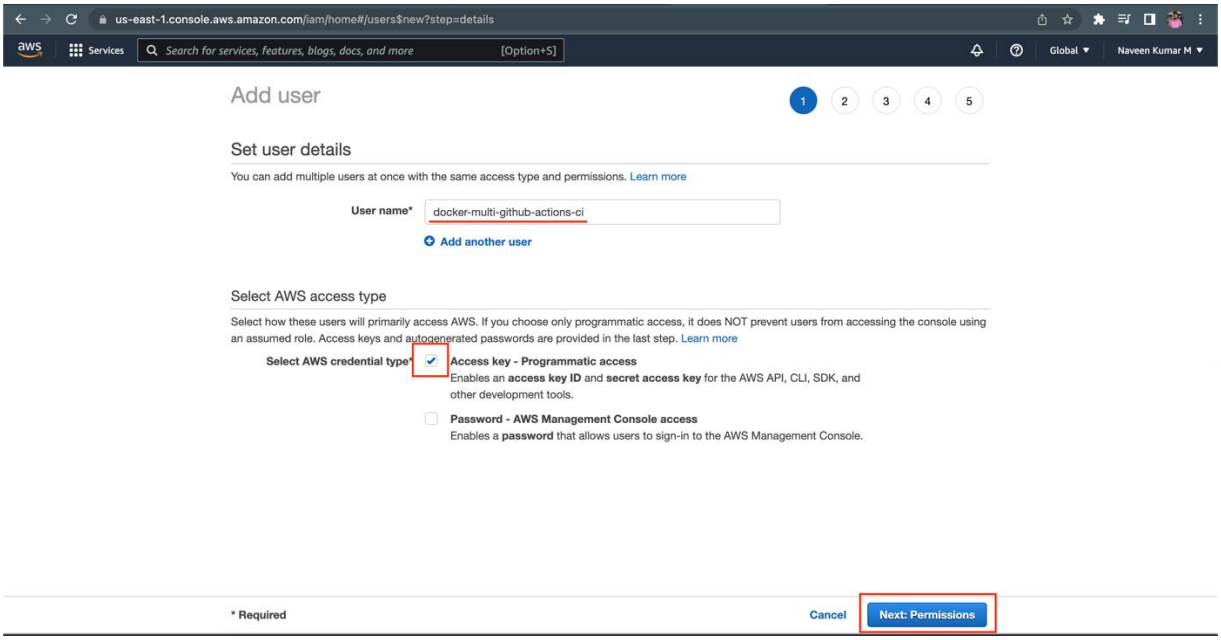
12. Click "Create user"

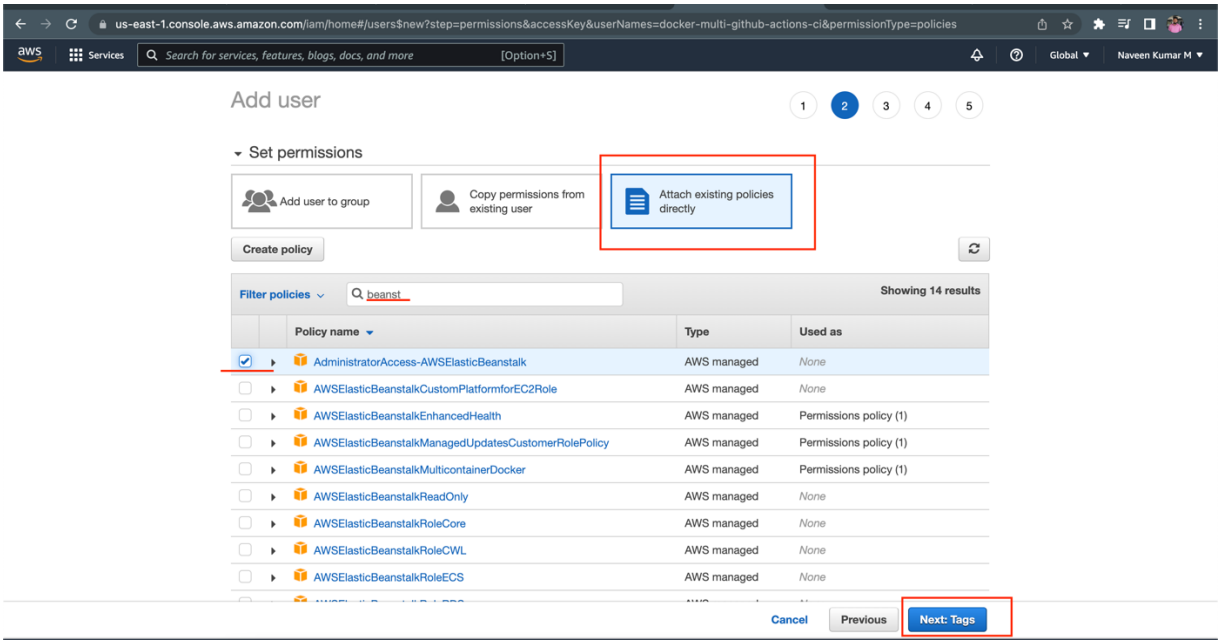
13. Copy and / or download the *Access Key ID* and *Secret Access Key* to use in the Travis Variable Setup.

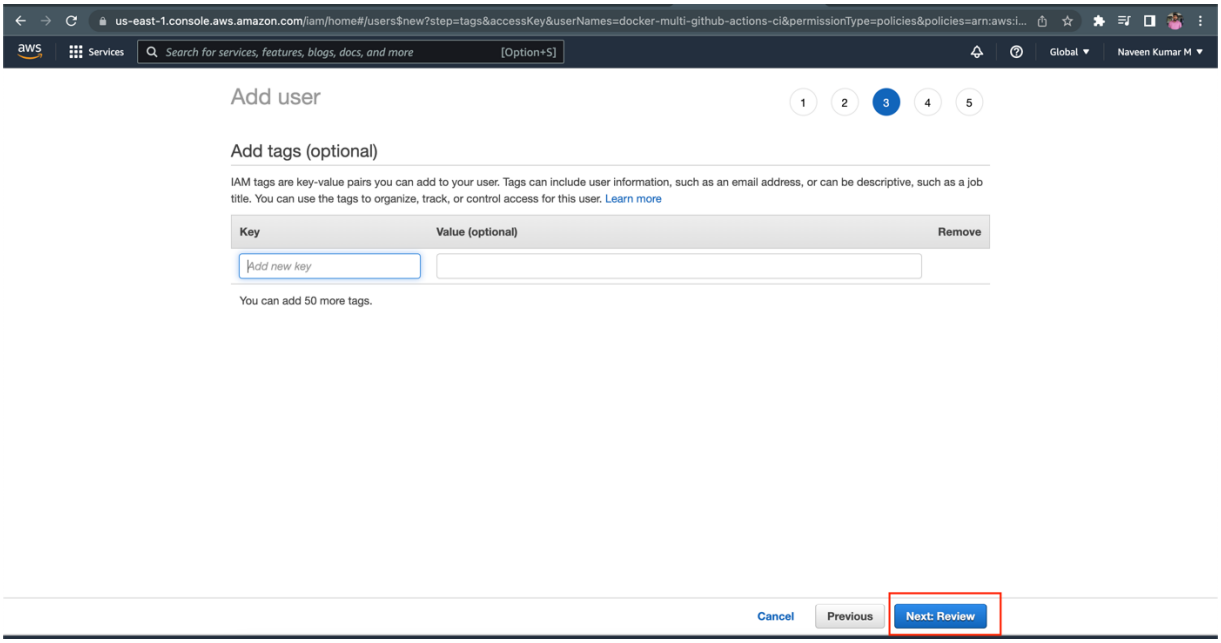
Screenshots

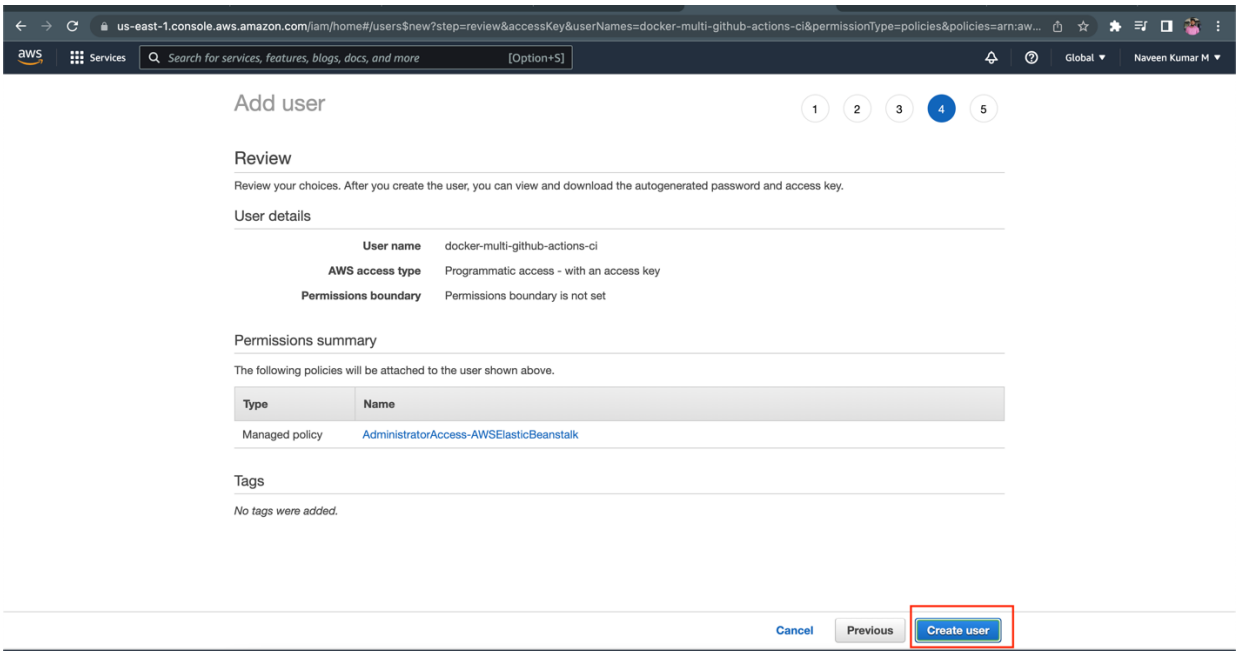


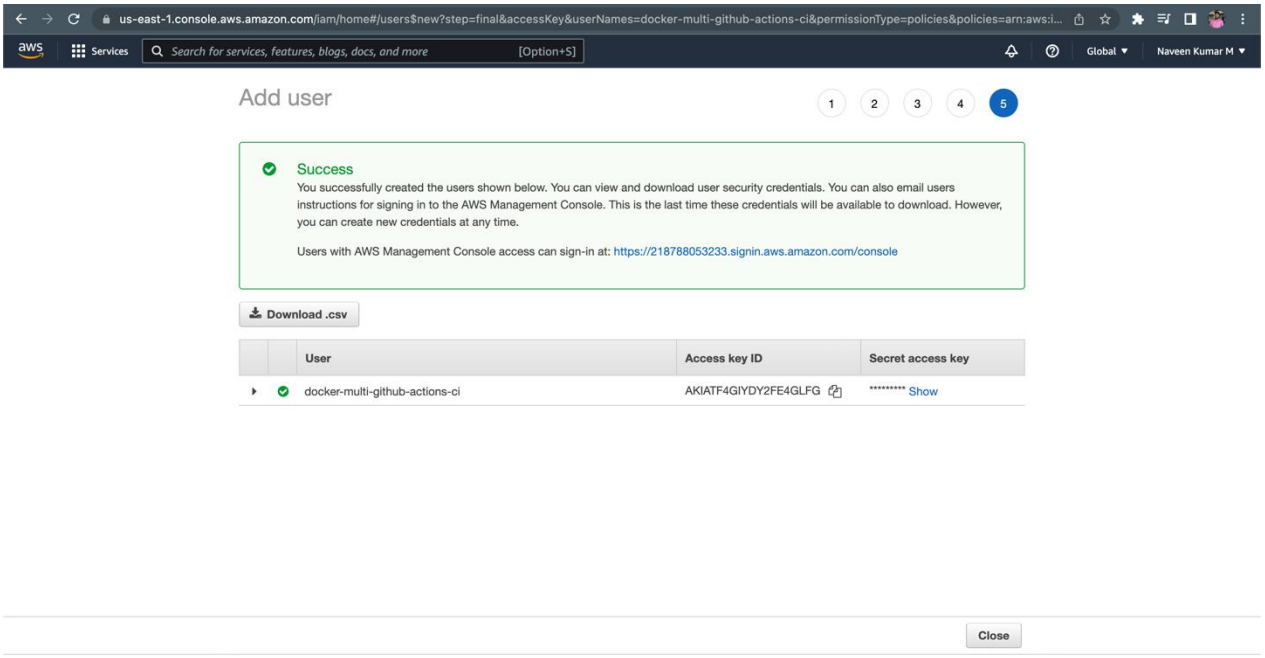



us-east-1.console.aws.amazon.com/iam/home#/users$new?step=details
Services
Search for services, features, blogs, docs, and more
[Option+S]
Global
Naveen Kumar M
Add user
1 2 3 4 5
Set user details
You can add multiple users at once with the same access type and permissions. Learn more
User name*
docker-multi-github-actions-ci
Add another user
Select AWS access type
Select how these users will primarily access AWS. If you choose only programmatic access, it does NOT prevent users from accessing the console using an assumed role. Access keys and autogenerated passwords are provided in the last step. Learn more
Select AWS credential type*
Access key - Programmatic access
Enables an access key ID and secret access key for the AWS API, CLI, SDK, and other development tools.
Password - AWS Management Console access
Enables a password that allows users to sign-in to the AWS Management Console.
* Required
Cancel
Next: Permissions

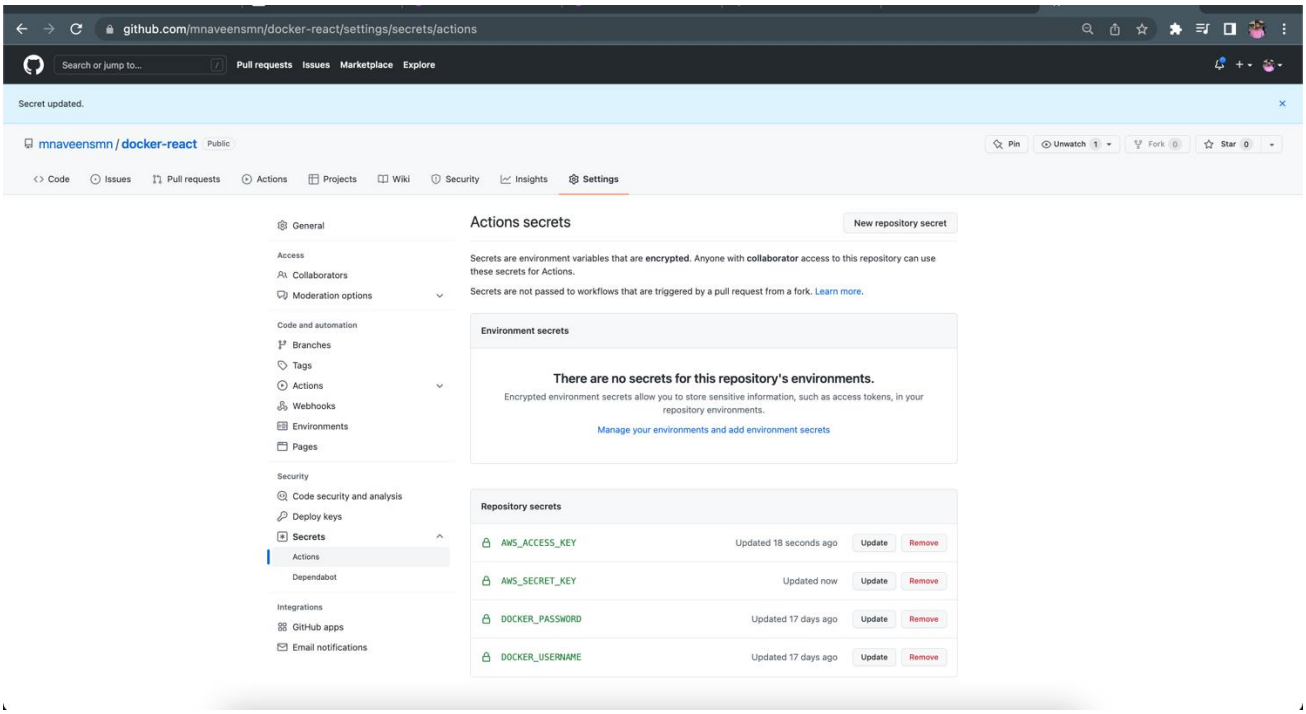

us-east-1.console.aws.amazon.com/iam/home#/users$new?step=permissions&accessKey&userNames=docker-multi-github-actions-ci&permissionType=policies
Services
Search for services, features, blogs, docs, and more
[Option+S]
Global
Naveen Kumar M
Add user
1 2 3 4 5
Set permissions
Add user to group
Copy permissions from existing user
Attach existing policies directly
Create policy
Filter policies
beanst
Showing 14 results
Policy name
Type
Used as
AdministratorAccess-AWSElasticBeanstalk AWS managed None
AWSElasticBeanstalkCustomPlatformforEC2Role AWS managed None
AWSElasticBeanstalkEnhancedHealth AWS managed Permissions policy (1)
AWSElasticBeanstalkManagedUpdatesCustomerRolePolicy AWS managed Permissions policy (1)
AWSElasticBeanstalkMulticontainerDocker AWS managed Permissions policy (1)
AWSElasticBeanstalkReadOnly AWS managed None
AWSElasticBeanstalkRoleCore AWS managed None
AWSElasticBeanstalkRoleCWL AWS managed None
AWSElasticBeanstalkRoleECS AWS managed None
Cancel
Previous
Next: Tags


us-east-1.console.aws.amazon.com/iam/home#/users$new?step=tags&accessKey&userNames=docker-multi-github-actions-ci&permissionType=policies&policies=arn:aws:i...
Services
Search for services, features, blogs, docs, and more
[Option+S]
Global
Naveen Kumar M
Add user
1 2 3 4 5
Add tags (optional)
IAM tags are key-value pairs you can add to your user. Tags can include user information, such as an email address, or can be descriptive, such as a job title. You can use the tags to organize, track, or control access for this user. Learn more
Key
Value (optional)
Remove
Add new key
You can add 50 more tags.
Cancel
Previous
Next: Review

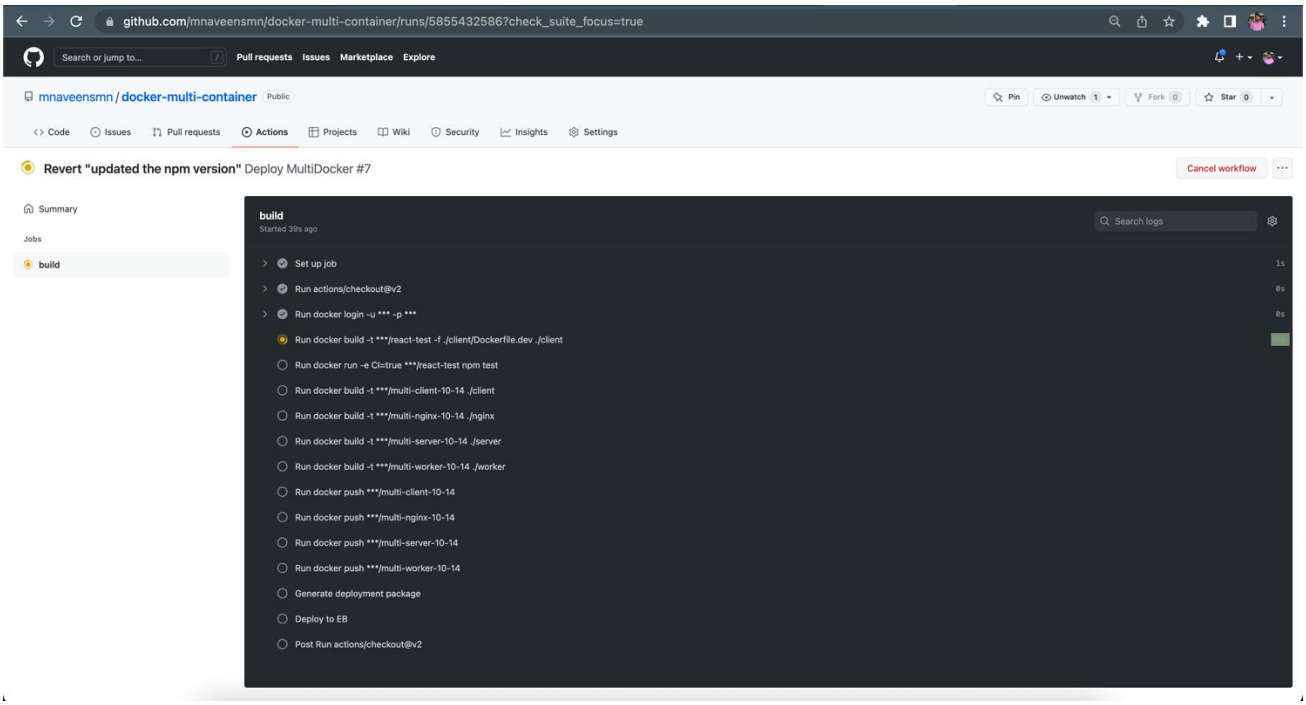

us-east-1.console.aws.amazon.com/iam/home#/users$new?step=review&accessKey&userNames=docker-multi-github-actions-ci&permissionType=policies&policies=arn:aw...
Services
Search for services, features, blogs, docs, and more
[Option+S]
Global
Naveen Kumar M
Add user
1 2 3 4 5
Review
Review your choices. After you create the user, you can view and download the autogenerated password and access key.
User details
User name
docker-multi-github-actions-ci
AWS access type
Programmatic access - with an access key
Permissions boundary
Permissions boundary is not set
Permissions summary
The following policies will be attached to the user shown above.
Type
Name
Managed policy
AdministratorAccess-AWSElasticBeanstalk
Tags
No tags were added.
Cancel
Previous
Create user

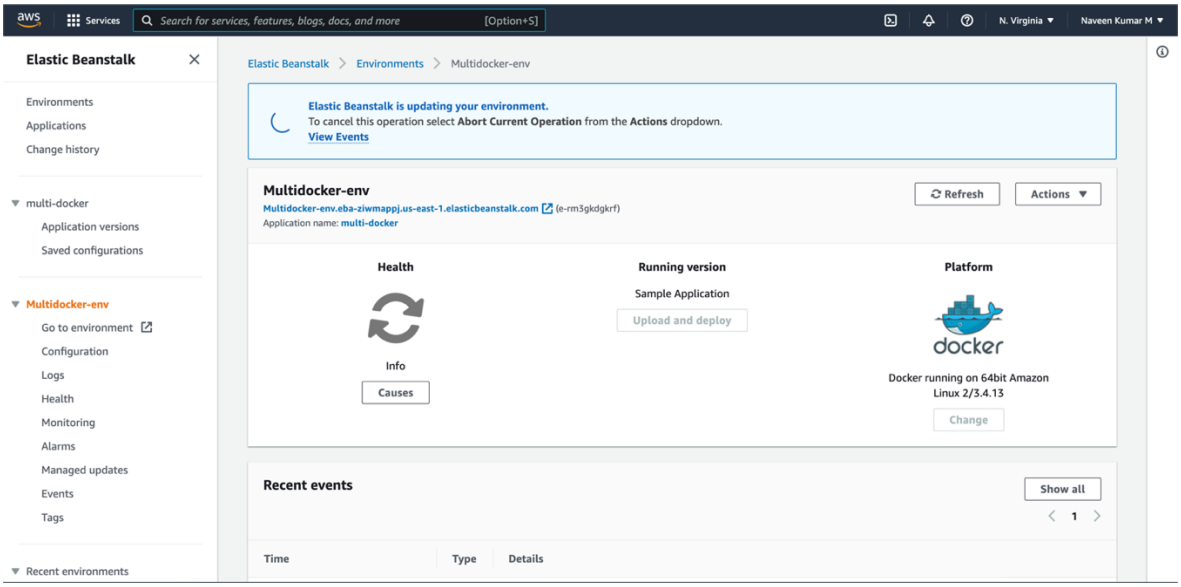

us-east-1.console.aws.amazon.com/iam/home#/users$new?step=final&accessKey&userNames=docker-multi-github-actions-ci&permissionType=policies&policies=arn:aws:i...
Services
Search for services, features, blogs, docs, and more
[Option+S]
Global
Naveen Kumar M
Add user
1 2 3 4 5
Success
You successfully created the users shown below. You can view and download user security credentials. You can also email users instructions for signing in to the AWS Management Console. This is the last time these credentials will be available to download. However, you can create new credentials at any time.
Users with AWS Management Console access can sign-in at: https://218788053233.signin.aws.amazon.com/console
Download .csv
User
Access key ID
Secret access key
docker-multi-github-actions-ci
AKIATF4GIYDY2FE4GLFG
******** Show
Close

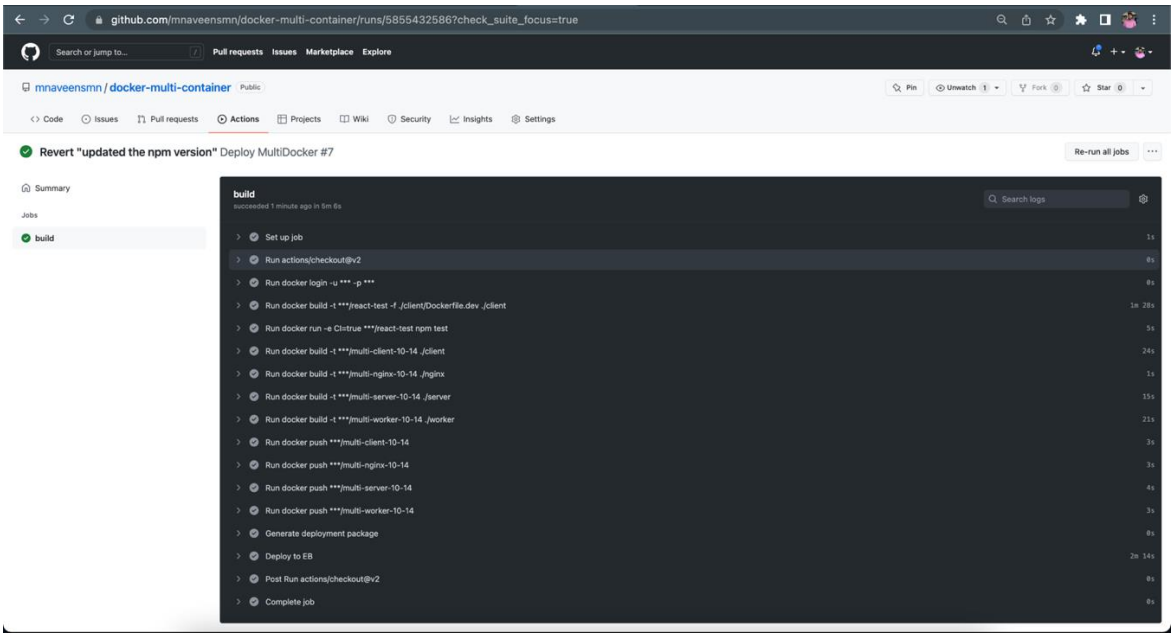
AWS Keys in Github Actions

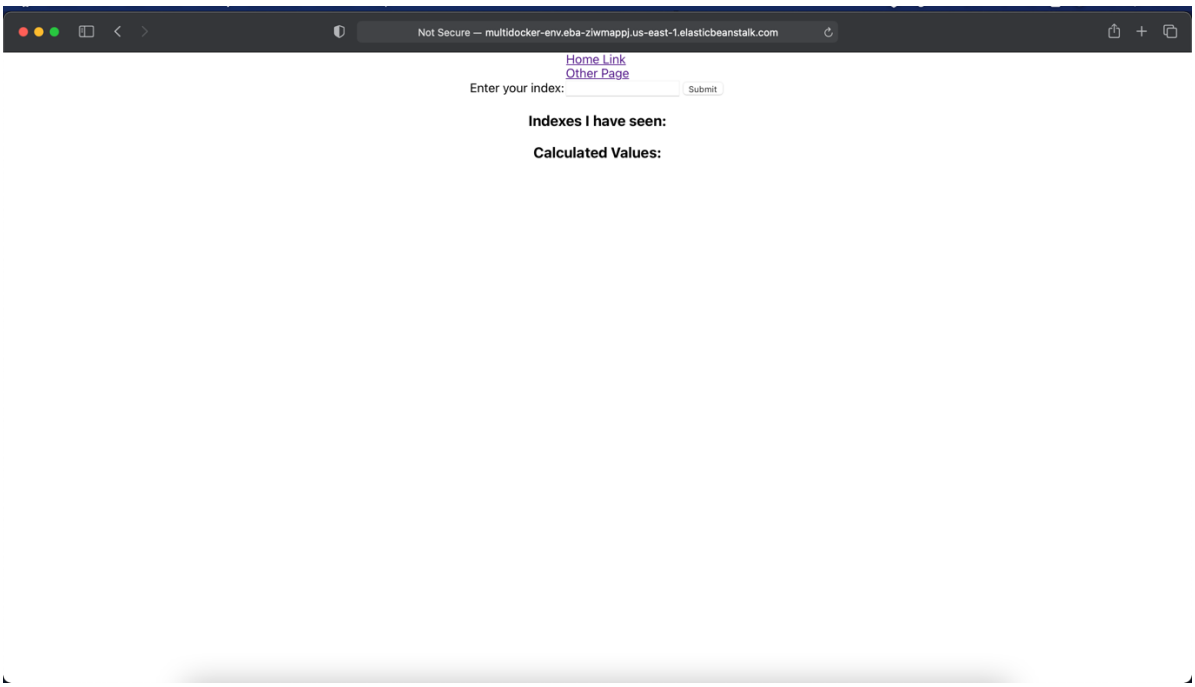


Deploying the App




aws
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
Naveen Kumar M
Elastic Beanstalk
Environments
Applications
Change history
multi-docker
Application versions
Saved configurations
Multidocker-env
Go to environment
Configuration
Logs
Health
Monitoring
Alarms
Managed updates
Events
Tags
Recent environments
Elastic Beanstalk > Environments > Multidocker-env
Elastic Beanstalk is updating your environment.
To cancel this operation select Abort Current Operation from the Actions dropdown.
View Events
Multidocker-env
Multidocker-env.eba-ziwmappj.us-east-1.elasticbeanstalk.com (e-rm3gkdgkrf)
Application name: multi-docker
Refresh
Actions
Health
Info
Causes
Running version
Sample Application
Upload and deploy
Platform
docker
Docker running on 64bit Amazon Linux 2/3.4.13
Change
Recent events
Show all
1
Time
Type
Details

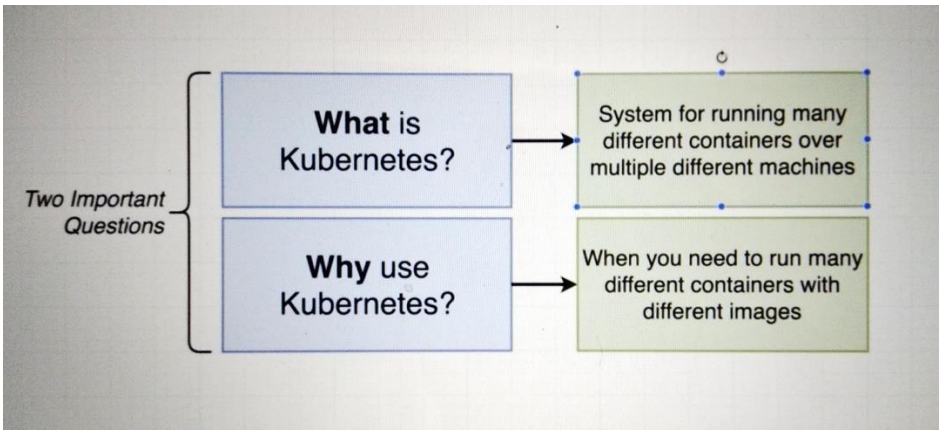

github.com/mnaveensmn/docker-multi-container/runs/5855432586?check_suite_focus=true
Search or jump to...
Pull requests
Issues
Marketplace
Explore
mnaveensmn / docker-multi-container
Public
Pin
Unwatch 1
Fork 0
Star 0
Code
Issues
Pull requests
Actions
Projects
Wiki
Security
Insights
Settings
Revert "updated the npm version" Deploy MultiDocker #7
Re-run all jobs
Summary
Jobs
build
build
succeeded 1 minute ago in 6m 6s
Search logs
Set up job
Run actions/checkout@v2
Run docker login -u *** -p ***
Run docker build -t ***/react-test -f ./client/Dockerfile.dev ./client
Run docker run -e CI=true ***/react-test npm test
Run docker build -t ***/multi-client-10-14 ./client
Run docker build -t ***/multi-nginx-10-14 ./nginx
Run docker build -t ***/multi-server-10-14 ./server
Run docker build -t ***/multi-worker-10-14 ./worker
Run docker push ***/multi-client-10-14
Run docker push ***/multi-nginx-10-14
Run docker push ***/multi-server-10-14
Run docker push ***/multi-worker-10-14
Generate deployment package
Deploy to EB
Post Run actions/checkout@v2
Complete job


Not Secure — multidocker-env.eba-ziwmappj.us-east-1.elasticbeanstalk.com
Home Link
Other Page
Enter your index:
Submit
Indexes I have seen:
Calculated Values:

Onwards to Kubernates

The Why's and What's of Kubernates

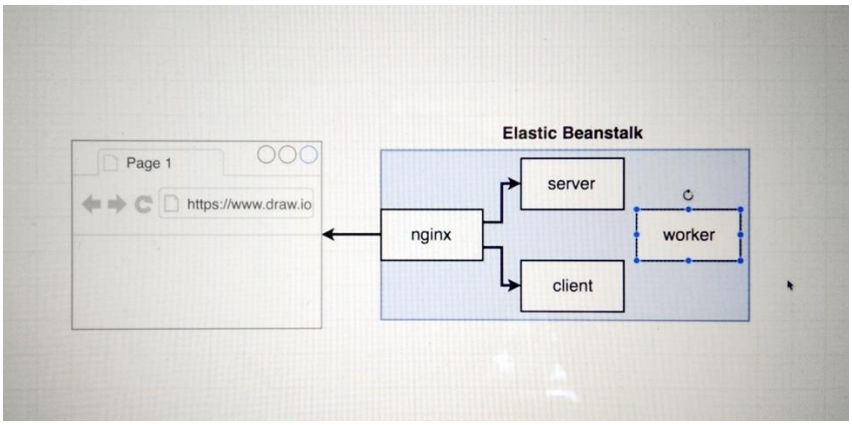
Why Kubernates?

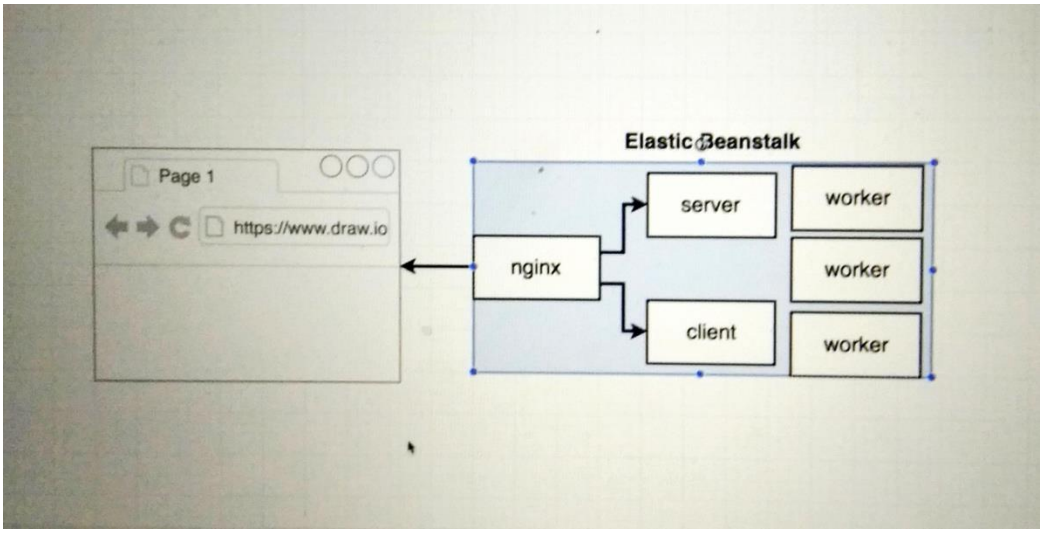


How do we scale our elastic beanstalk application?

How do we manage the large traffic request for Fibonacci number?

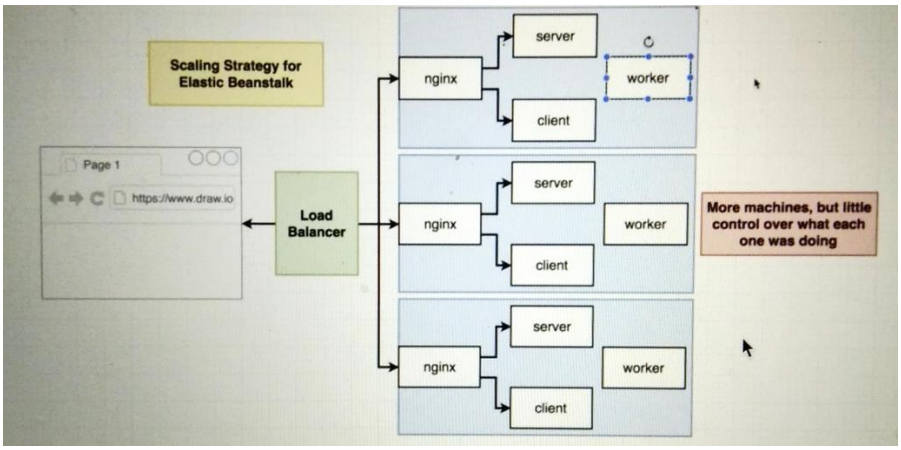
The worker container doing the actual job of finding the Fibonacci number. If worker container does the replica, it would be easy for us to manage the traffic.



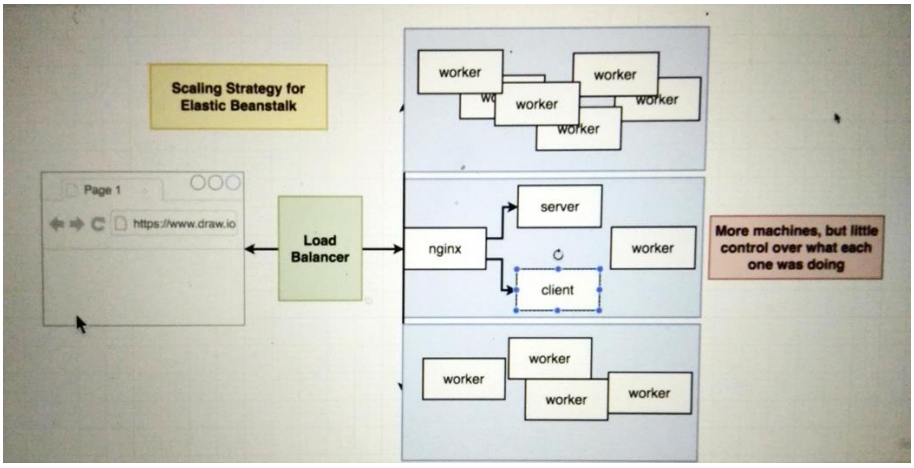


Scaling Challenge

Elastic beanstalk spins up additional copies of entire set of containers.



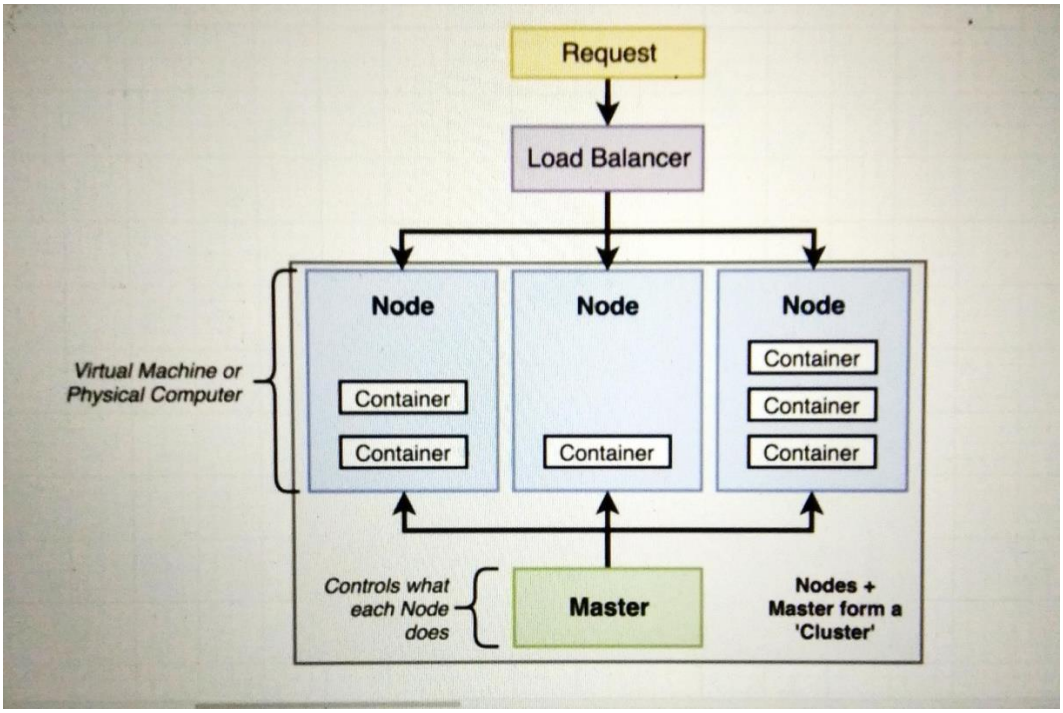
It will be useful when we have an additional copies of worker container instead of others.



Tons of additional copies worker container makes application efficient when we have a large traffic.

By using the Kubernetes, we can have an additional container and determine what these additional containers should be doing. Used to solve the scaling issue.

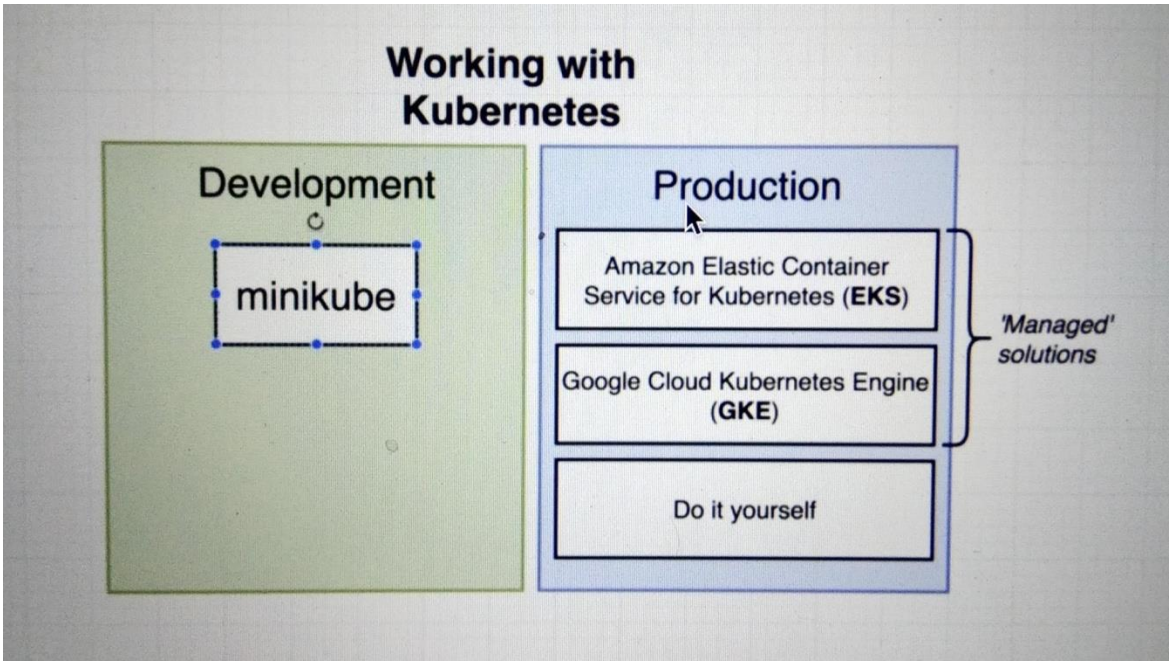
Kubernetes cluster

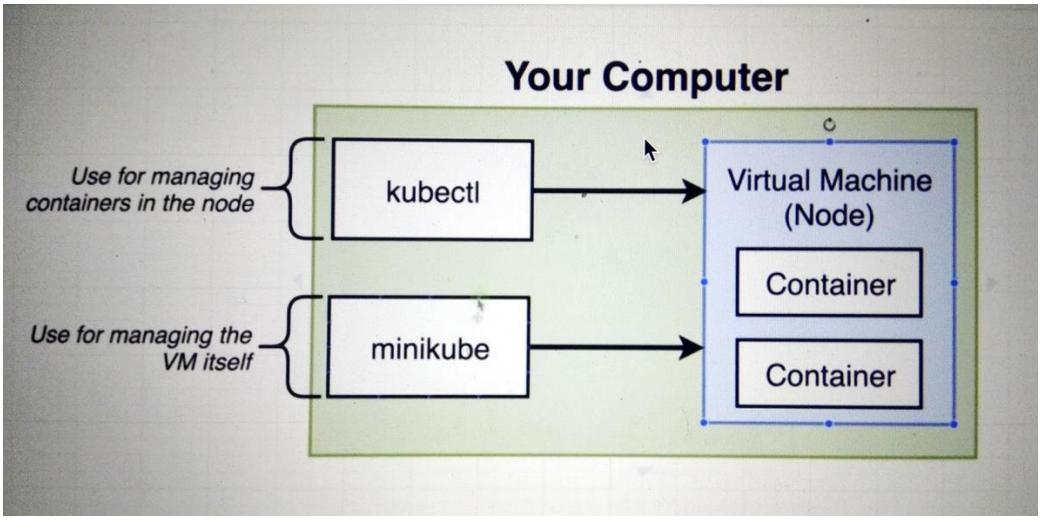


Kubernates cluster is the assembly of master and one or more nodes. Each node will run different set of containers. Inside the node, containers can be of different types. These nodes are created and managed by master. We can send the docker commands to master. Then, master will take care of running the commands in different nodes.

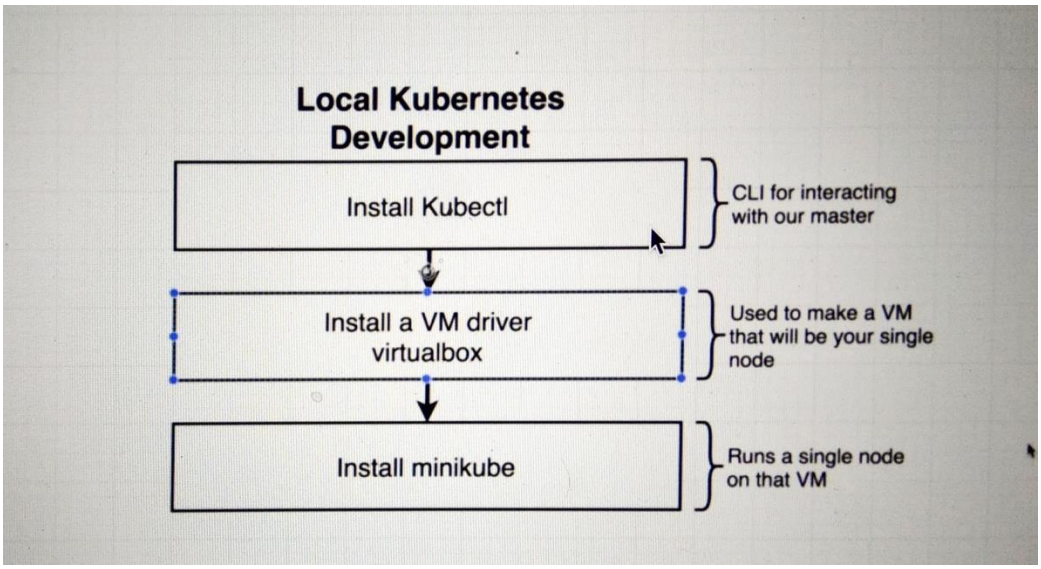
Getting Started with Kubernates

Kubernates in Development and Production





Minikube is only used in local.



Minikube Setup

Install Minikube with Homebrew

First, make sure you have Homebrew installed. If not, follow the instructions here:

https://brew.sh/

Then, in your terminal, run:

```
brew install minikube
```

Your output should look something like this (it will be ok if it is not exact)

Starting Minikube and Testing Installation

After you have successfully installed Minikube we need to start and test the cluster to make sure everything is working correctly.

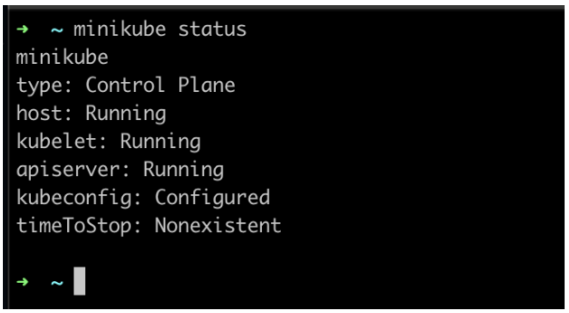
1. Start with VM driver:

In your terminal, run:

`minikube start --driver=hyperkit`

2. Check Minikube Status

After you see a **Done!** message in your terminal, run `minikube status` to make sure the cluster is healthy. Pay particular attention that the **apiserver** is in a "**Running**" state.



3. Check kubectl

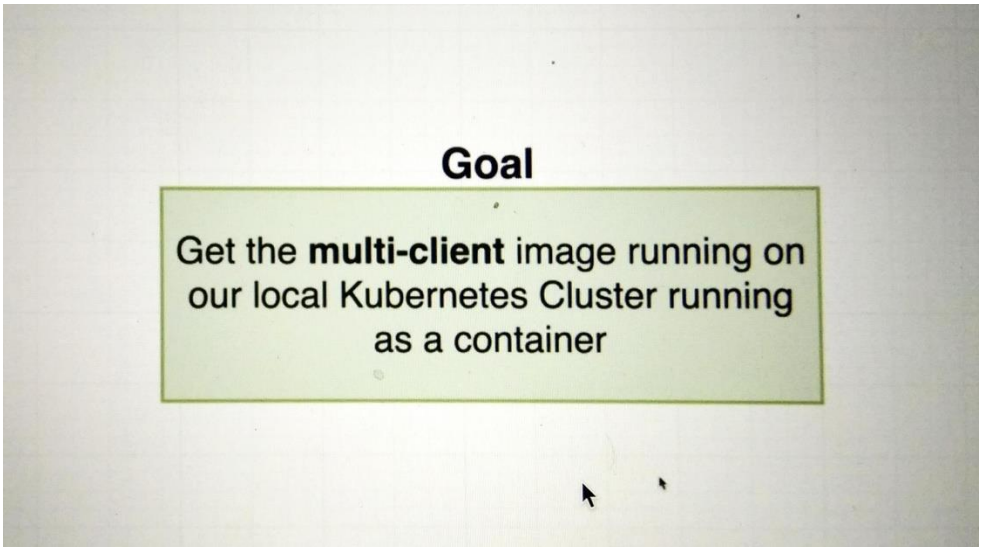
3. Check kubectl

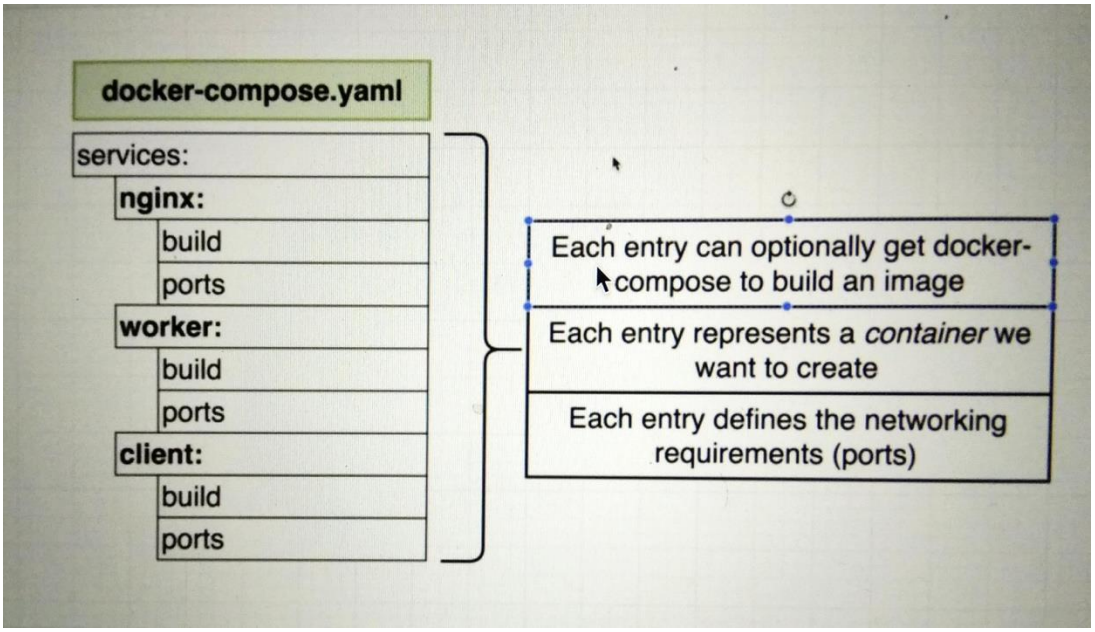
Lastly, open up your terminal and make sure that you can run `kubectl version`

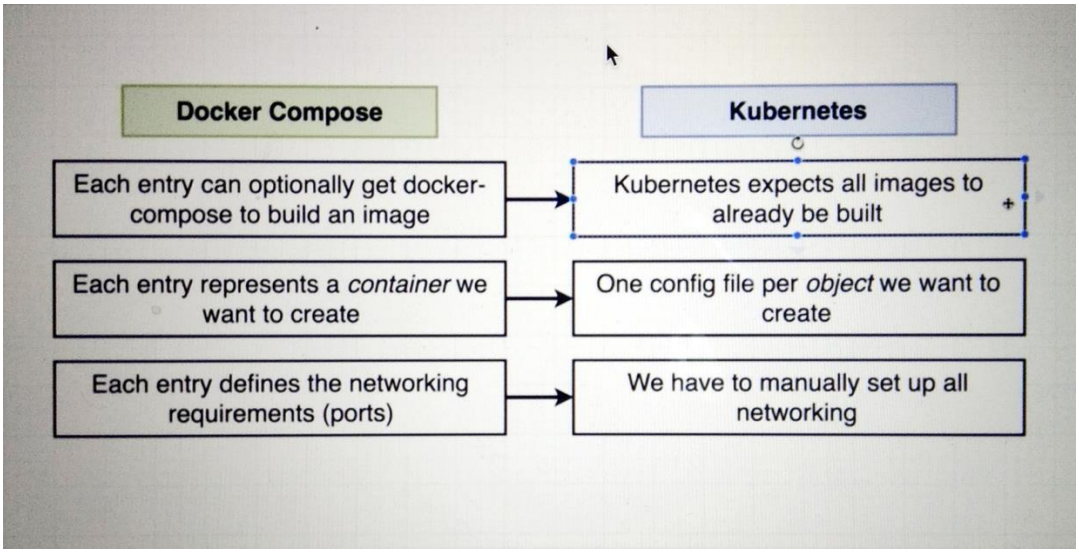
Note - the client and server can be off by one minor version without error or issue.

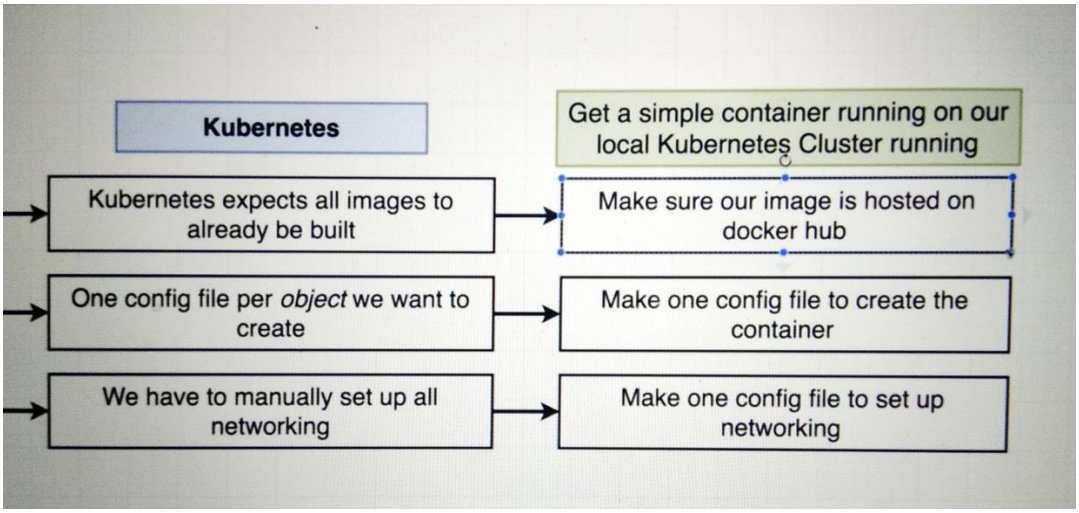
Mapping Existing Knowledge

```
→  ~ kubectl cluster-info
Kubernetes control plane is running at https://kubernetes.docker.internal:6443
CoreDNS is running at https://kubernetes.docker.internal:6443/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
→  ~
```





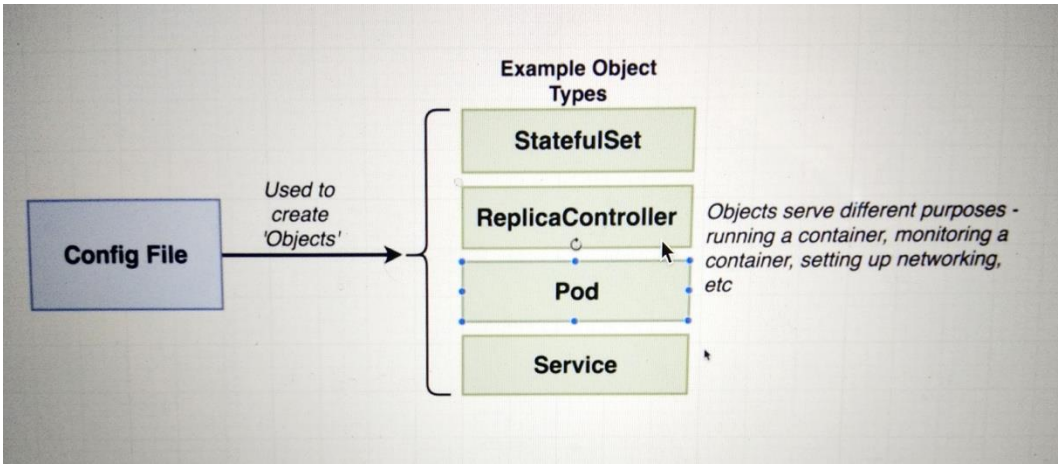




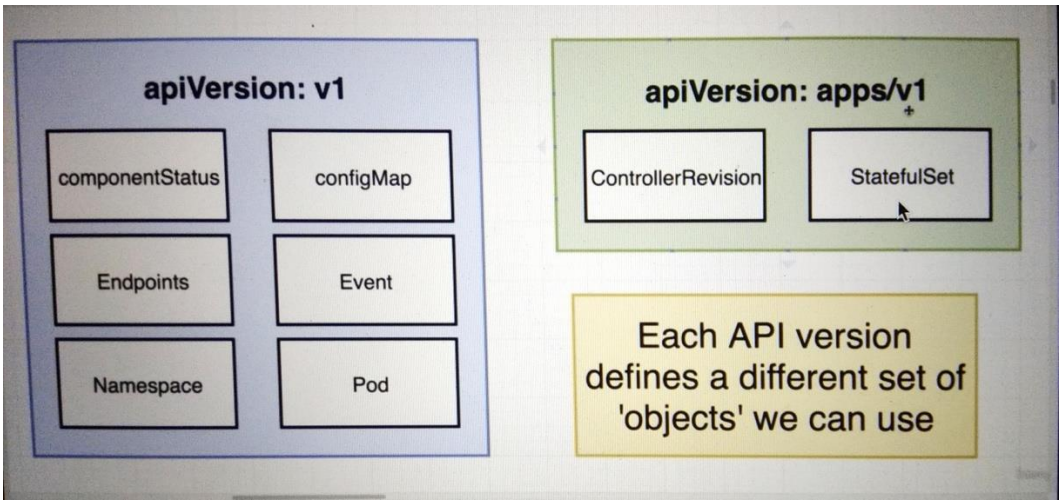
Adding Configuration File

Configuration file to create a container

In terms of kubernates, container is a object.



“Kind” property represents the object type. Pod object type is used to run a container.



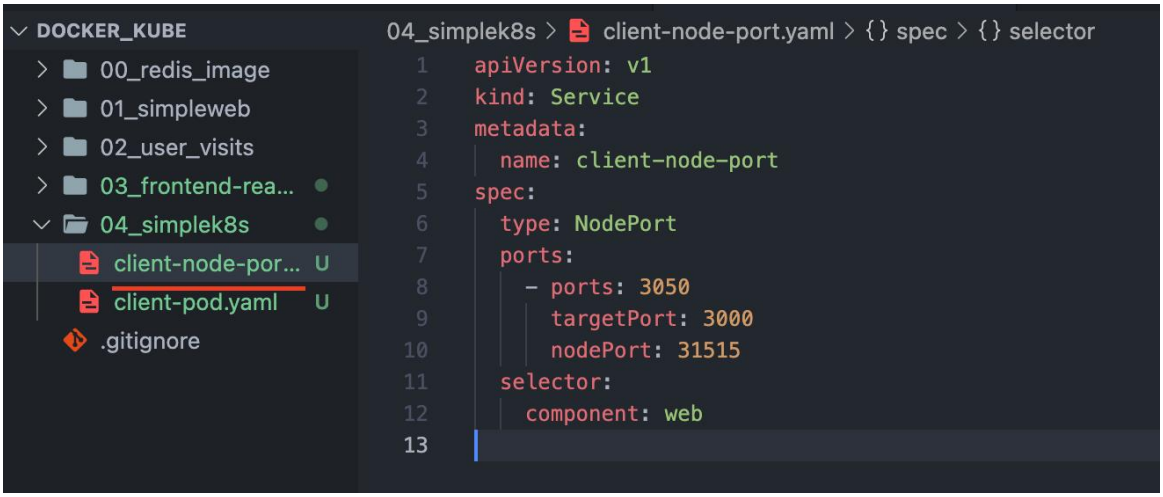
“apiVersion” defines a different set of objects we can use.

Spec – container property represents a name of the container and image repository and port we want to expose.

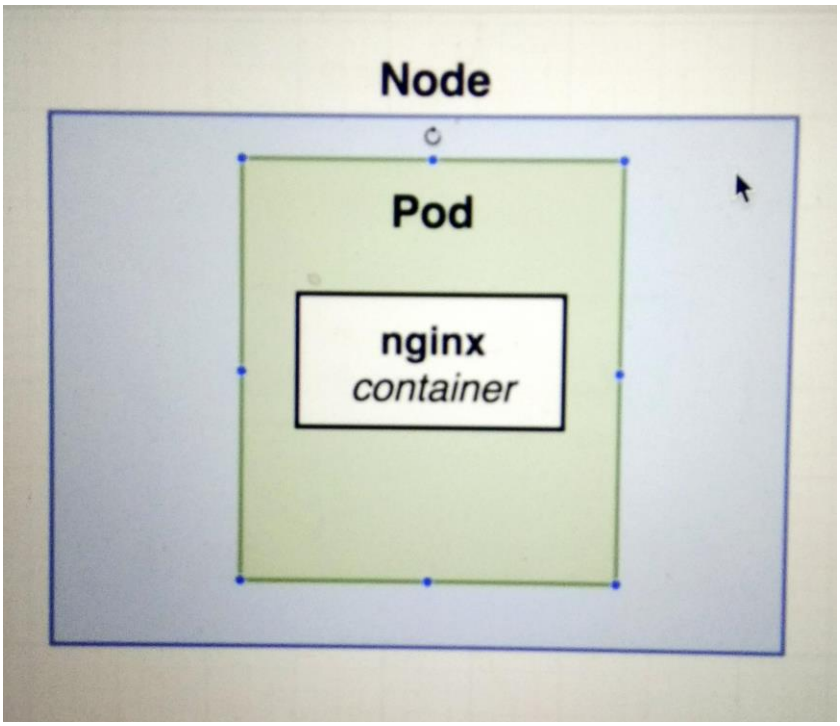
Meta-data – name property represent a name of the pod.

Labels-component property used to connect another config file (object). Here we specified the values as “web” that’s is used by network config file.

Configuration file to set up networking

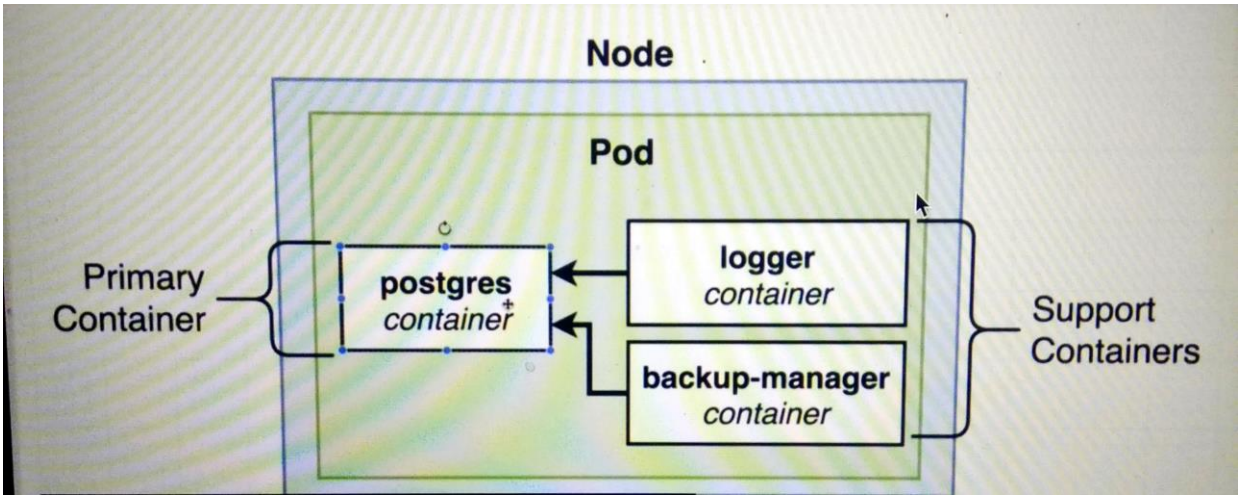


Running a container in Pod



Minikube creates a virtual machine in our machine, that is called Node. This node will be later used by kubernates to run some number of objects. The object is called Pod.

Pod is a grouping of container with a common purpose. Tightly coupled containers with close relations. If either of container crashes application will break.

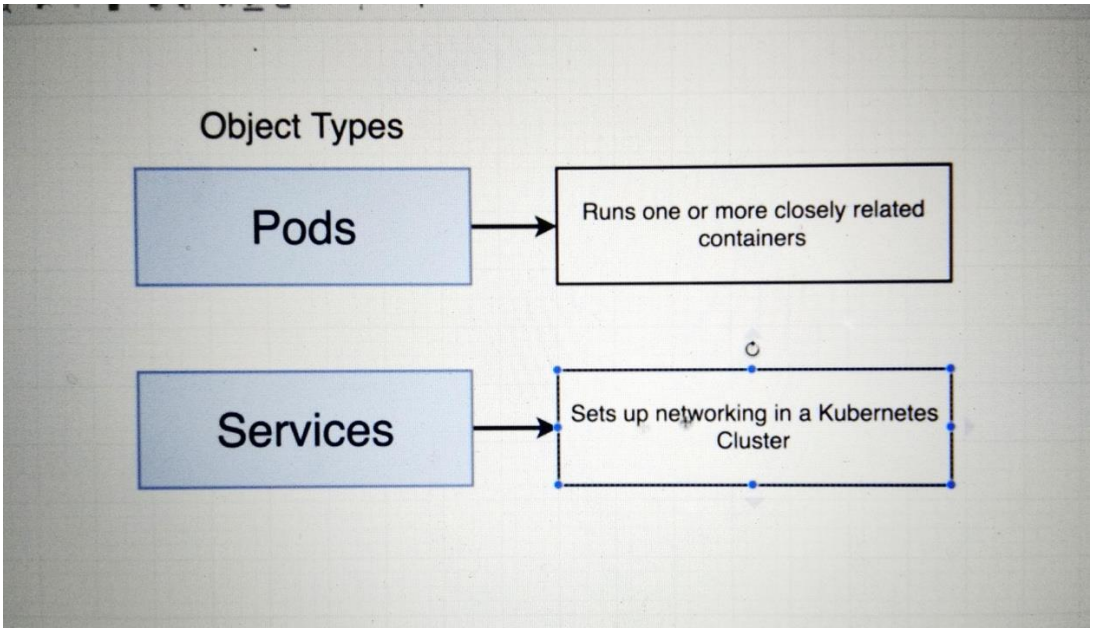


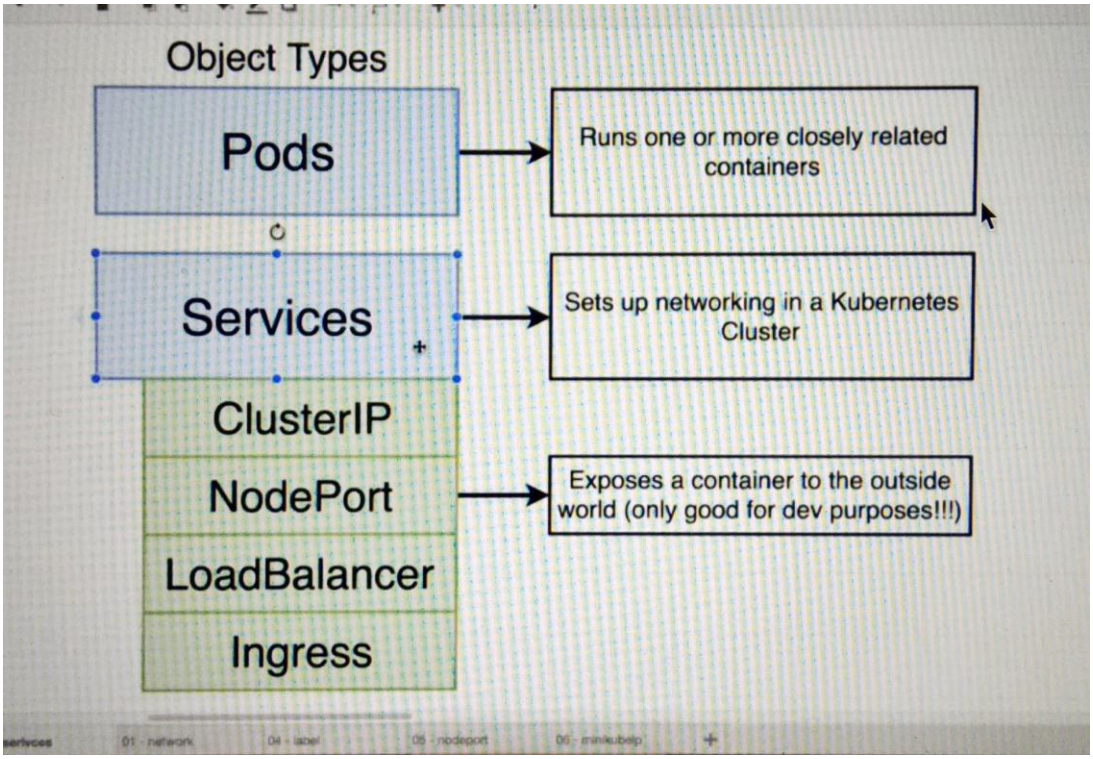
In the above application, if primary containers go away, support container won't work. So, this is the tightly coupled scenario.

In Kubernates, we cannot deploy individual container by themselves. Anytime when we want to deploy container in the world of kubernates, we need to make use pod.

Pod can run one or more container inside of it. These containers in the Pod are close relation with each other.

Service Config File in Depth



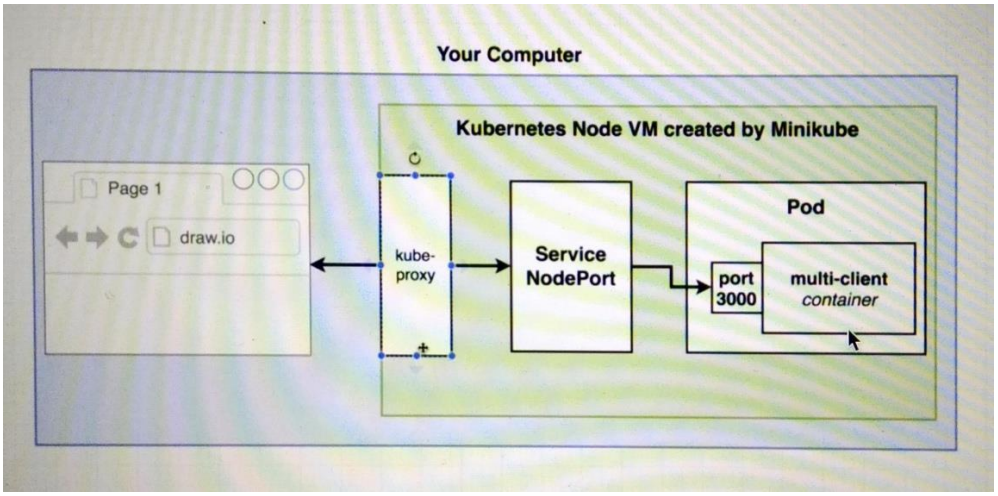


Service has a four sub type.

04_simplek8s > client-node-port.yaml

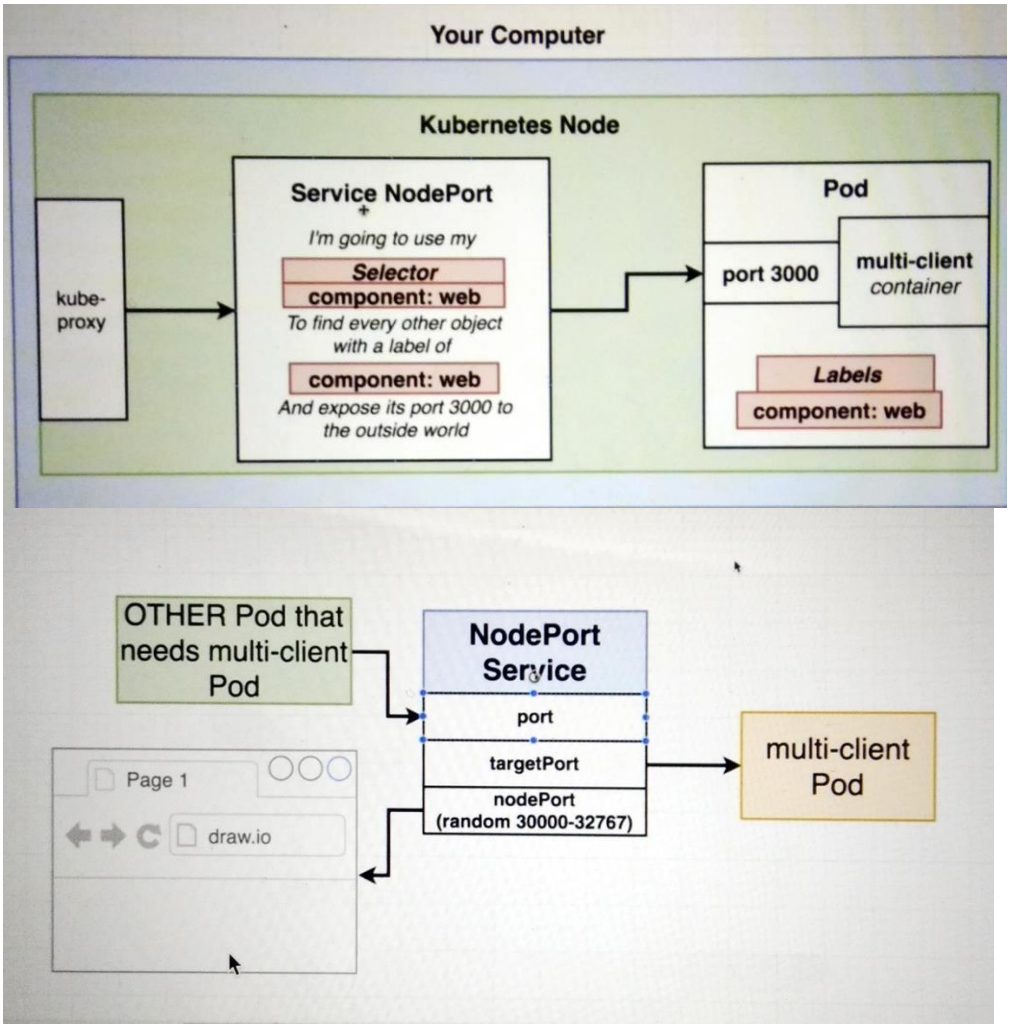
```yaml
apiVersion: v1
kind: Service
metadata:
  name: client-node-port
spec:
  type: NodePort
  ports:
    - ports: 3050
      targetPort: 3000
      nodePort: 31515
  selector:
    component: web
```

For our example we used the NodePort type. It exposes the contain to outside world which means accessing through web browser. NodePort is only suitable for development purpose.



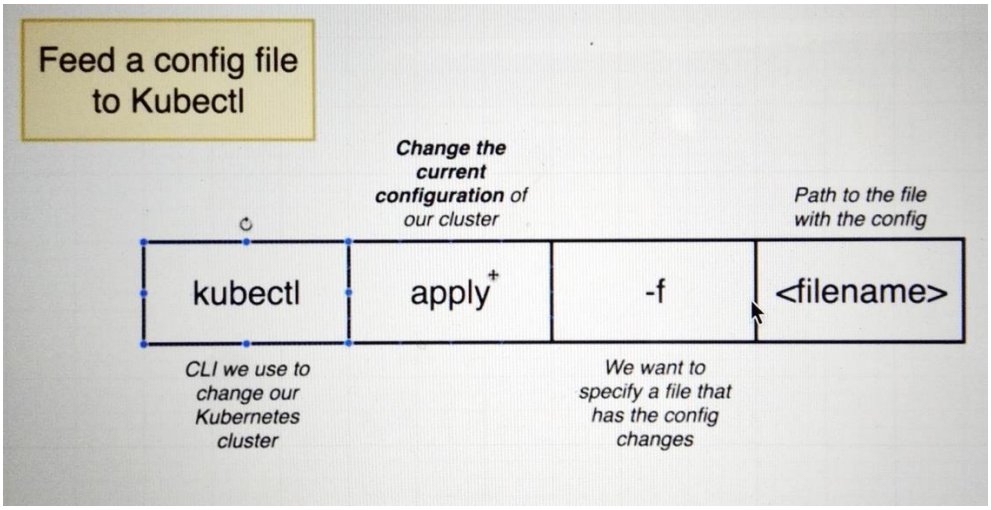
Intial request goes to the kube-proxy. Next it navigated to Service NodePort. From there, request will be mapped to the container running inside the Pod.

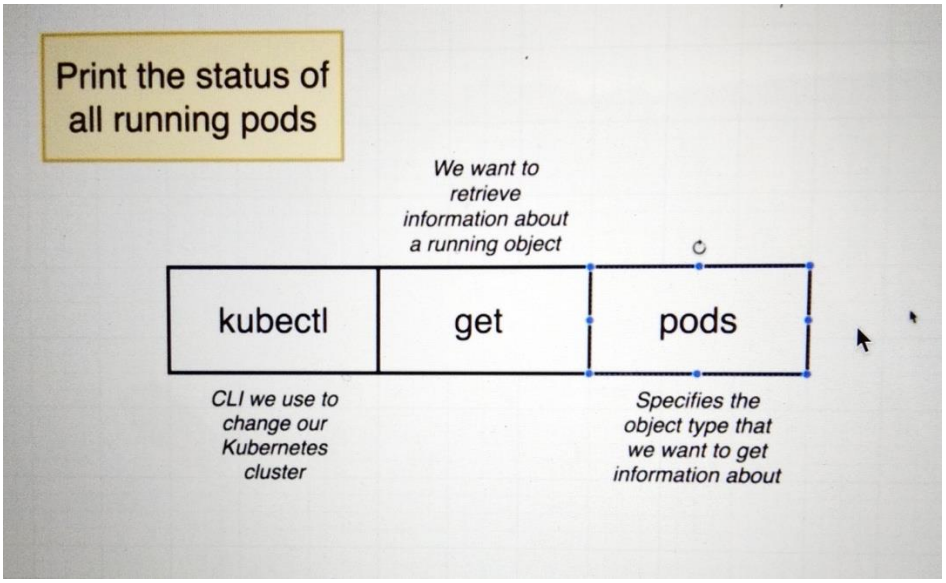
Let's look at inside of the node more detail.

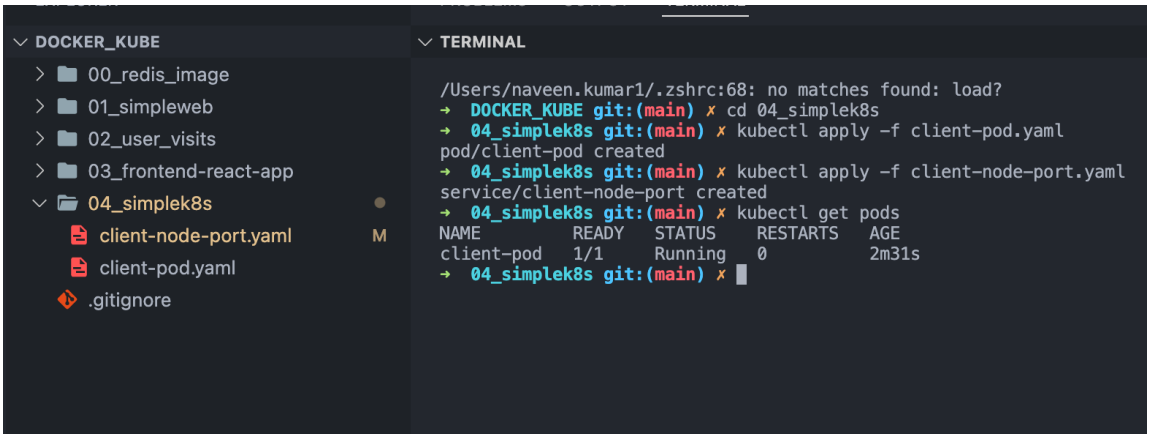


Port – used for communication between Pods.
targetPort – tells in which port request should be navigated to.
nodePort – used for sending request to Pod from browser.

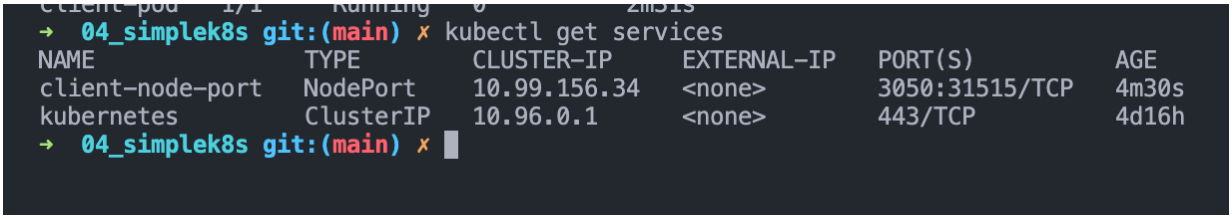
Connecting to Running Container



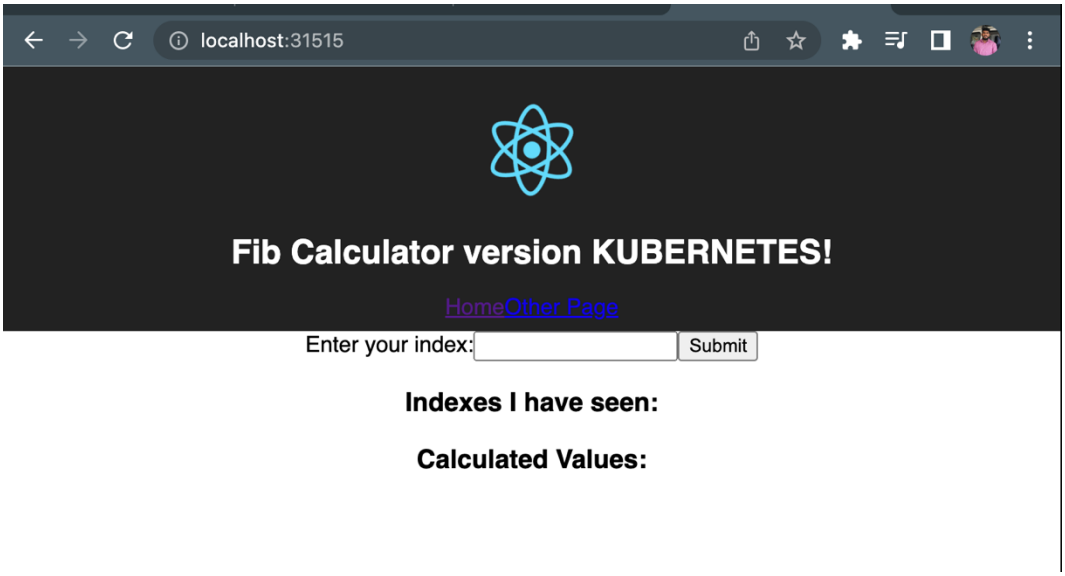




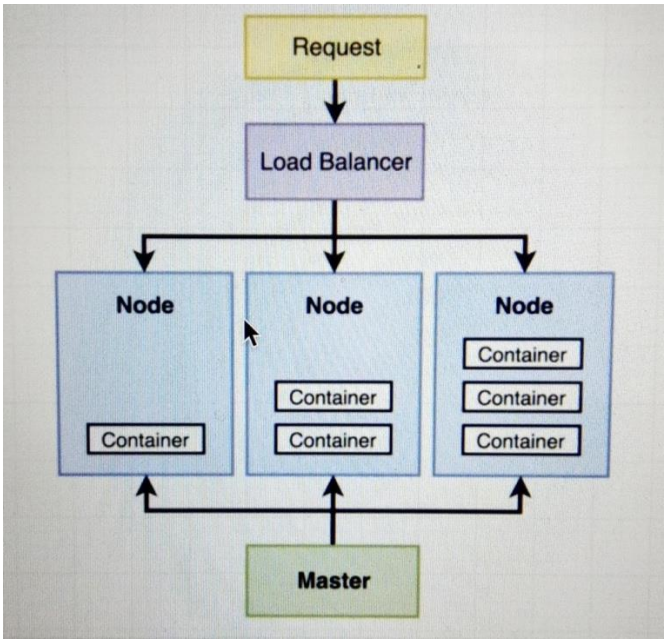
Kubectl get services



Output of running kubernates cluster

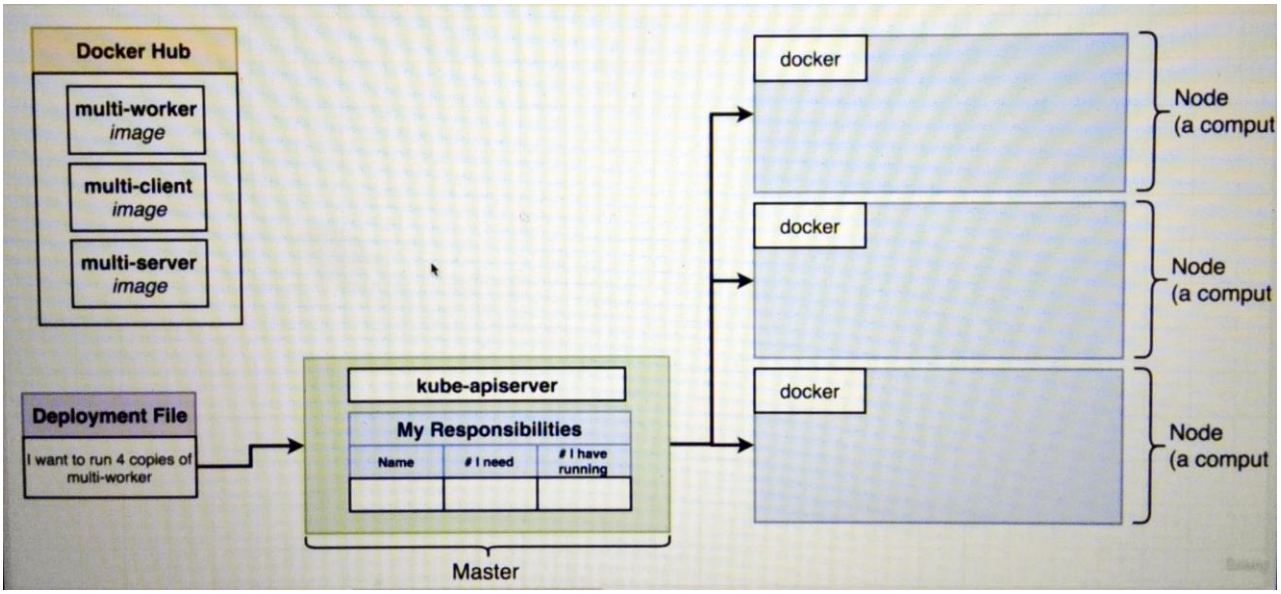


The Entire Deployment Flow




```
→  04_simplek8s git:(main) ✗ docker ps
CONTAINER ID   IMAGE                          COMMAND                  CREATED          STATUS          PORTS     NAMES
e8880b2d3e85   stephengrider/multi-client   "nginx -g 'daemon of…"   12 minutes ago   Up 12 minutes             k8s_client_client-pod_default_5945b3b0-6f3d-4bbd-8de
f-0f615c6792fe_0
→  04_simplek8s git:(main) ✗ docker kill e8880b2d3e85
e8880b2d3e85
→  04_simplek8s git:(main) ✗ docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME         READY   STATUS    RESTARTS      AGE
client-pod   1/1     Running   1 (18s ago)   19m
→  04_simplek8s git:(main) ✗ docker ps
CONTAINER ID   IMAGE                          COMMAND                  CREATED         STATUS         PORTS     NAMES
d6bff6793ab5   stephengrider/multi-client   "nginx -g 'daemon of…"   3 minutes ago   Up 3 minutes             k8s_client_client-pod_default_5945b3b0-6f3d-4bbd-8def-
0f615c6792fe_1
→  04_simplek8s git:(main) ✗
```

Even though we are killing the docker container, container getting restarted automatically in kubernates cluster.



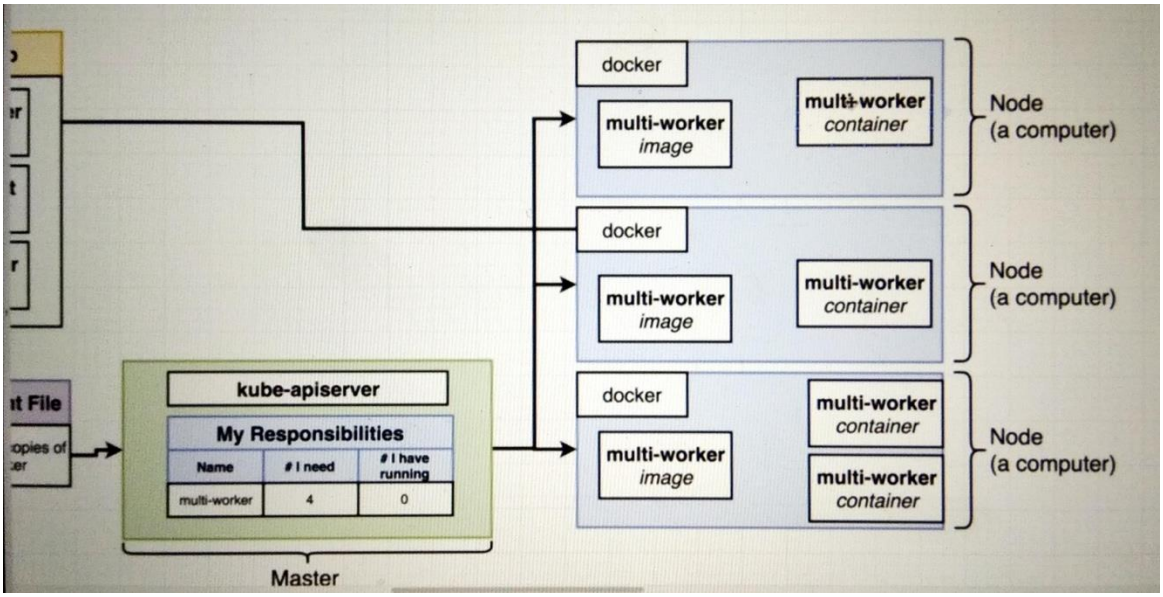
Here, Node represent virtual machine or computer that going to run some number of objects that we create inside the kubernates cluster.

When we give “kubectl apply” command, configuration file passed on to master. On the master there is variety of different program that controls the entire kubernates cluster. For an example, we are going to consider only kube-apiserver.

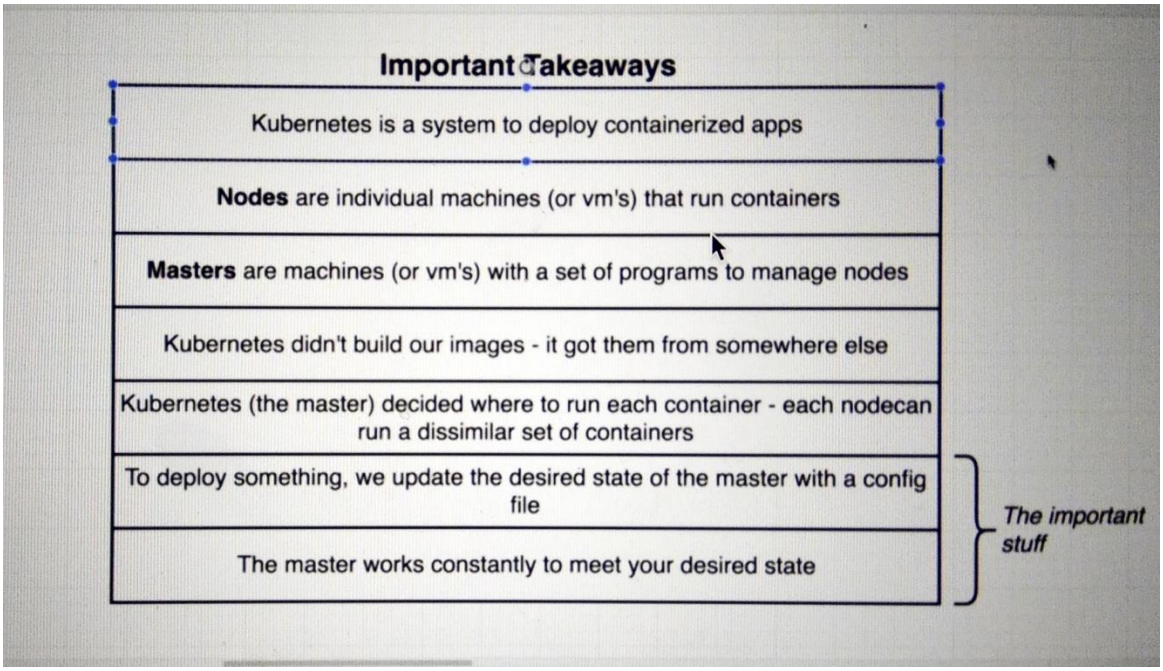
kube-apiserver responsible for monitoring entire nodes in kubernates cluster. Master makes the list of responsibilities of all the commands that we give through config file.

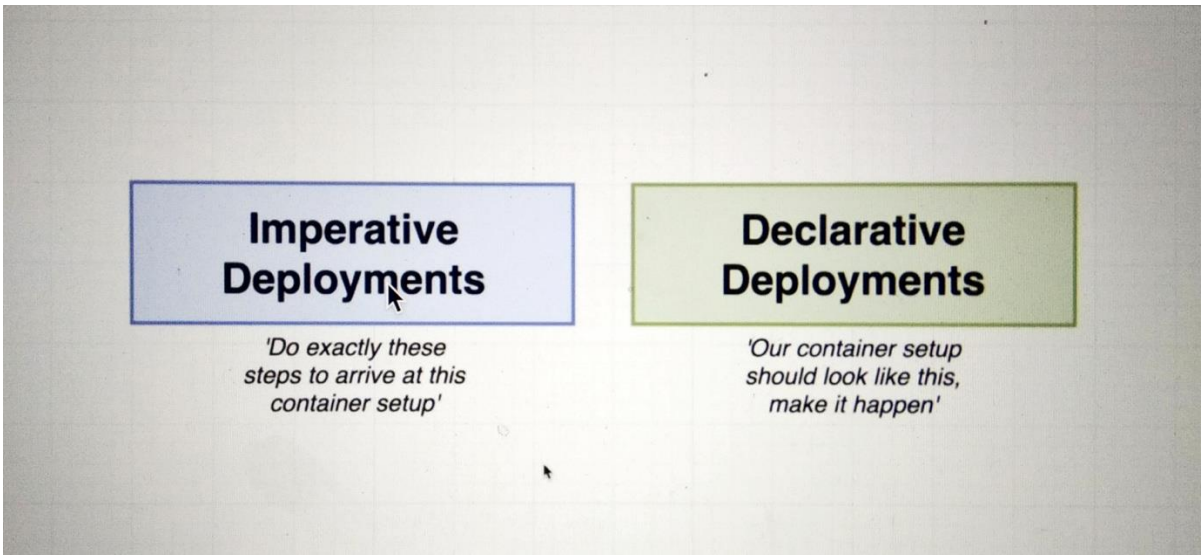
Master will check the responsibilities list, if it finds any mismatch between “# I need” and “# I have running”, it will run the respective command to match the same count. This is the reason why container recreated after we did the docker kill.

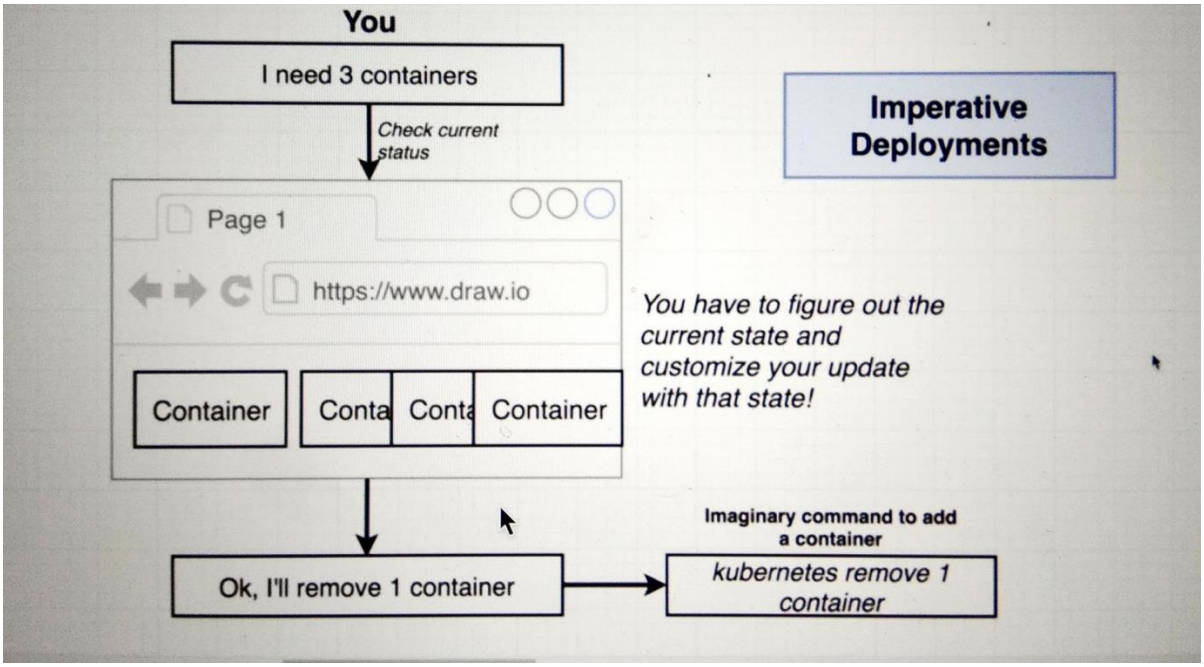
Docker inside the node will reach out docker hub and pull the image and run the docker.

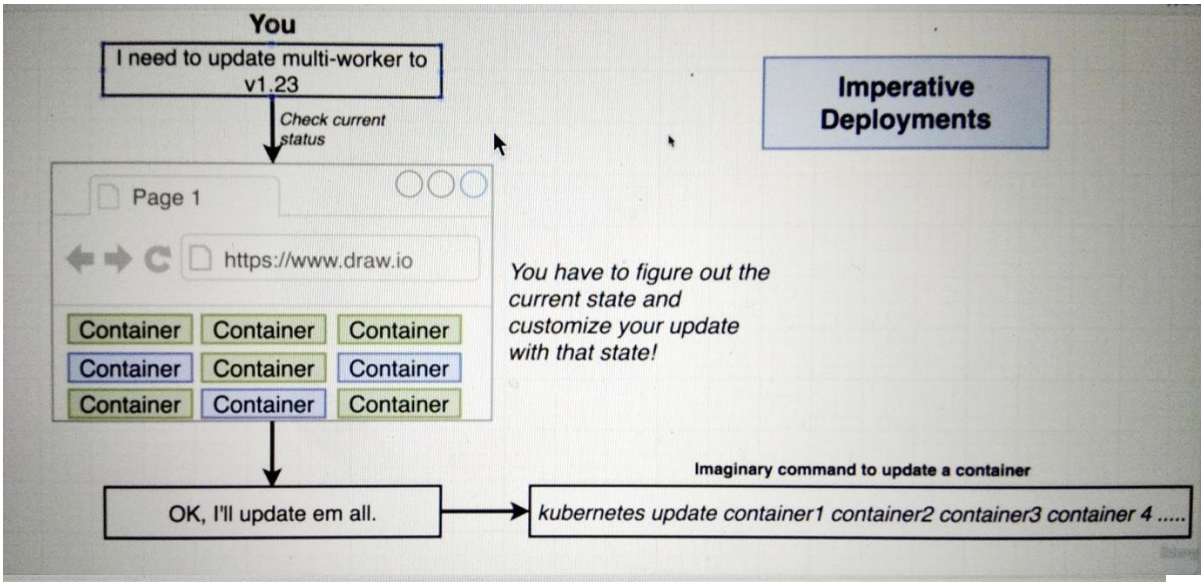


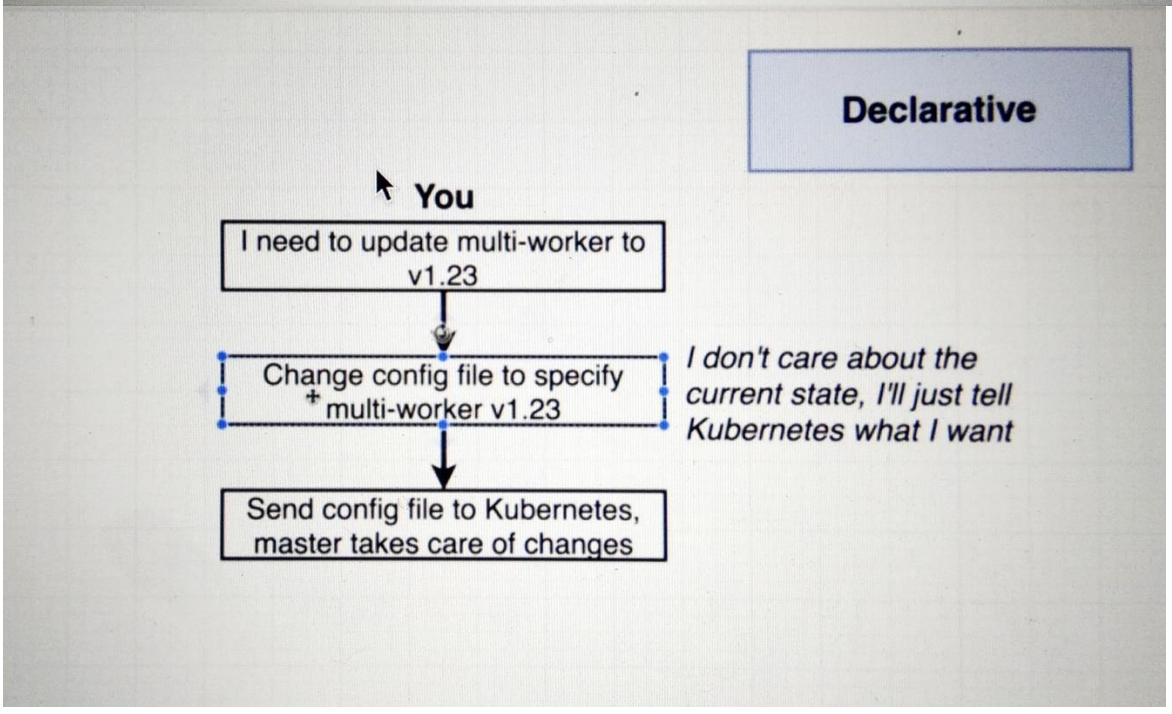
Imperative and Declarative Deployments



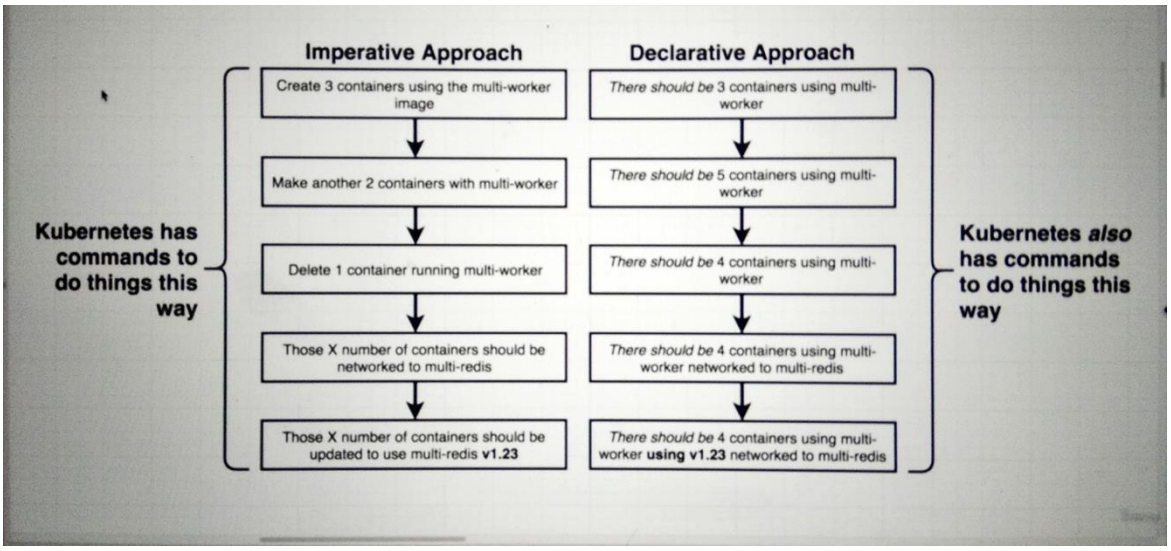








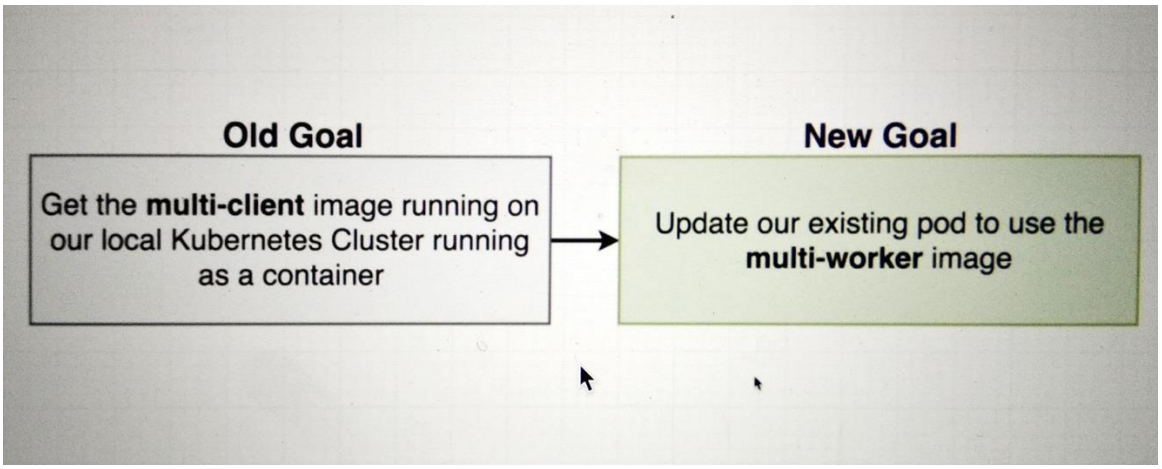
Comparatively declarative approach is an easy one.

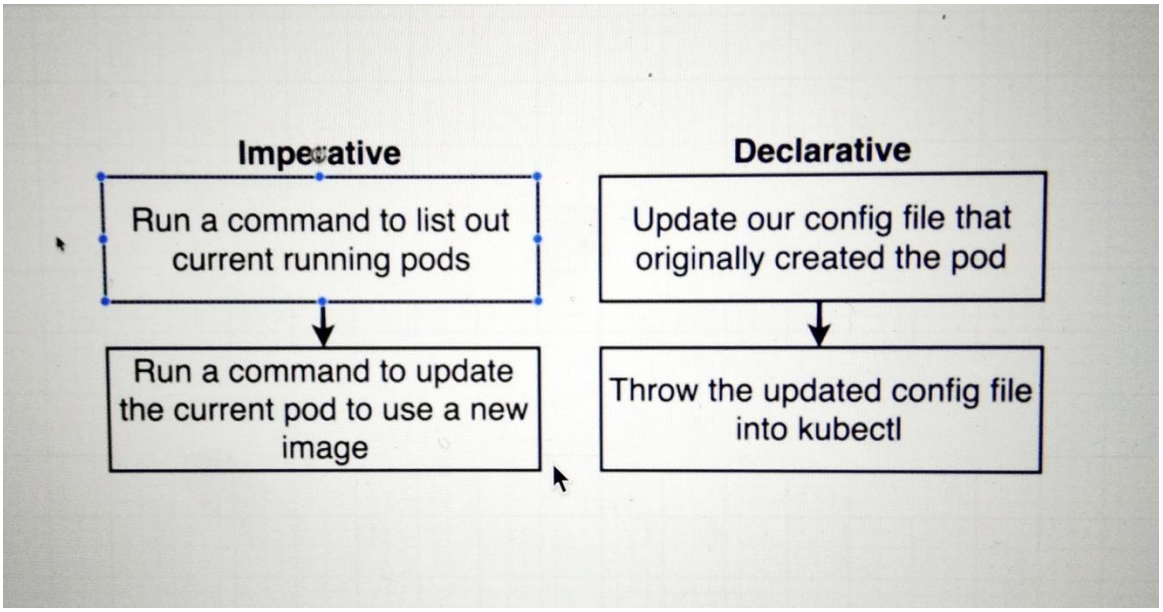

Imperative Approach
Declarative Approach
Create 3 containers using the multi-worker image
There should be 3 containers using multi-worker
Make another 2 containers with multi-worker
There should be 5 containers using multi-worker
Delete 1 container running multi-worker
There should be 4 containers using multi-worker
Those X number of containers should be networked to multi-redis
There should be 4 containers using multi-worker networked to multi-redis
Those X number of containers should be updated to use multi-redis v1.23
There should be 4 containers using multi-worker using v1.23 networked to multi-redis
Kubernetes has commands to do things this way
Kubernetes also has commands to do things this way

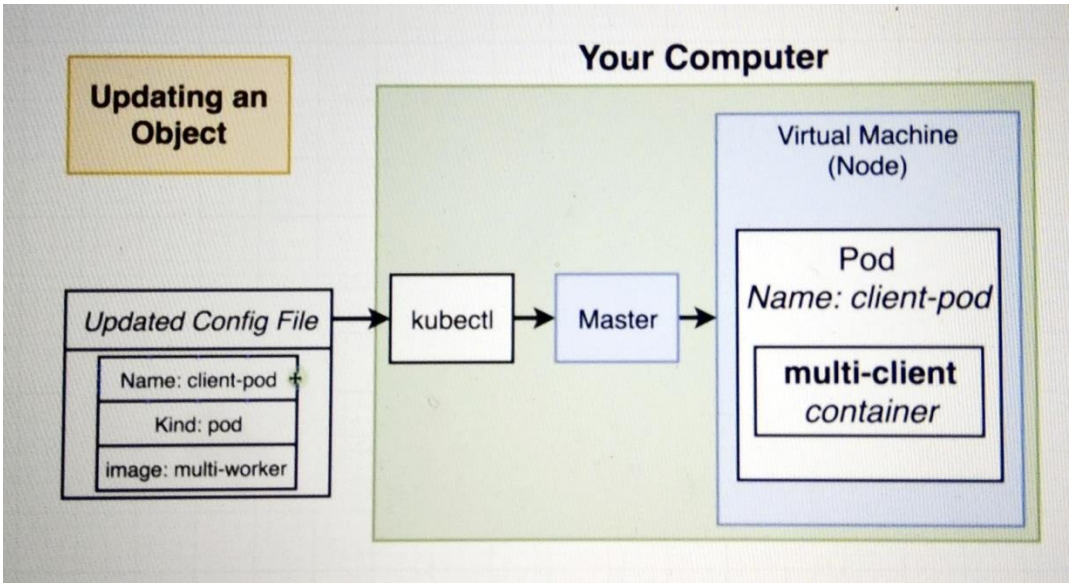
Maintaining Set of Containers with Deployments

Updating Existing Object

Approach







Changing the config file

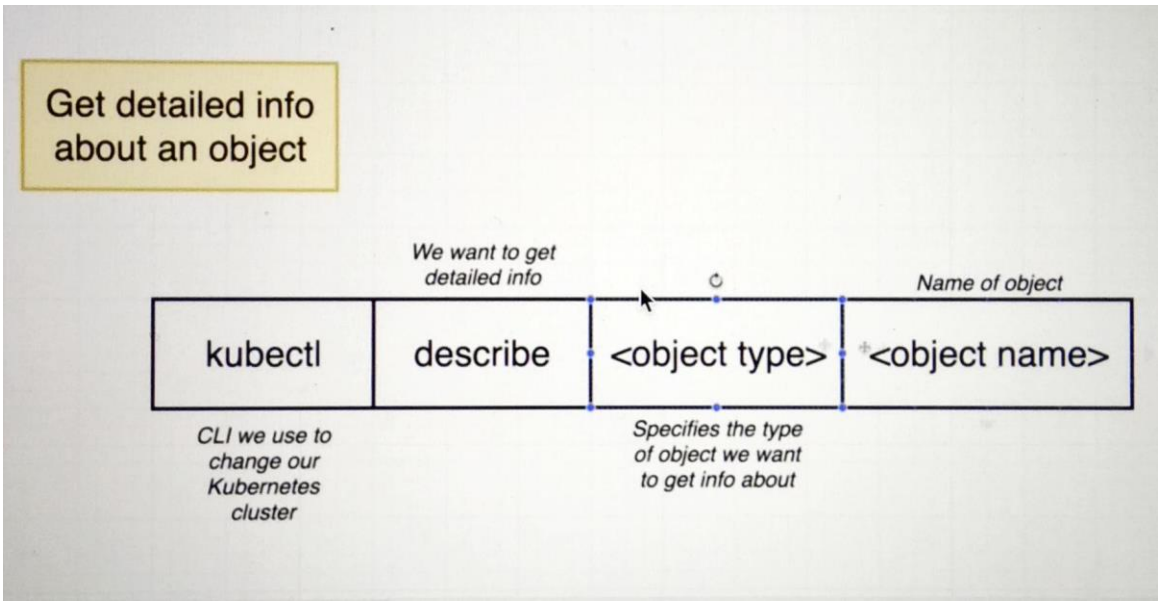
04_simplek8s > client-pod.yaml

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: client-pod
  labels:
    component: web
spec:
  containers:
    - name: client
      image: stephengrider/multi-worker
      ports:
        - containerPort: 3000

```

Applying the config file

```
→ 04_simplek8s git:(main) ✗ kubectl apply client-pod.yaml
error: must specify one of -f and -k
→ 04_simplek8s git:(main) ✗ kubectl apply -f client-pod.yaml
pod/client-pod configured
→ 04_simplek8s git:(main) ✗ kubectl apply -f client-node-port.yaml
service/client-node-port unchanged
→ 04_simplek8s git:(main) ✗ kubectl get pods
NAME         READY   STATUS    RESTARTS      AGE
client-pod   1/1     Running   3 (2m28s ago)   46h
→ 04_simplek8s git:(main) ✗ kubectl get services
NAME              TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)          AGE
client-node-port  NodePort    10.99.156.34   <none>        3050:31515/TCP   46h
kubernetes        ClusterIP   10.96.0.1      <none>        443/TCP          6d15h
→ 04_simplek8s git:(main) ✗ docker ps
CONTAINER ID   IMAGE                      COMMAND           CREATED          STATUS          PORTS     NAMES
5d2fdcee2c13   stephengrider/multi-worker   "npm run start"   14 seconds ago   Up 14 seconds             k8s_client_client-pod_default_5945b3b0-6f3d-4bbd-8def-0f615
c6792fe_4
→ 04_simplek8s git:(main) ✗
```

Inspecting the specific pod



```
→  04_simplek8s git:(main) ✗ kubectl describe pod client-pod
Name:         client-pod
Namespace:    default
Priority:     0
Node:         docker-desktop/192.168.65.4
Start Time:   Sun, 17 Apr 2022 14:24:21 +0530
Labels:       component=web
Annotations:  <none>
Status:       Running
IP:           10.1.0.26
IPs:
  IP:  10.1.0.26
Containers:
  client:
    Container ID:   docker://5d2fdcee2c13159e681055a0757b79753c75445b8ceb141a9329599c7f076c3b
    Image:          stephengrider/multi-worker
    Image ID:       docker-pullable://stephengrider/multi-worker@sha256:5fbab5f86e6a4d499926349a5f0ec032c42e7f7450acc98b053791df26dc4d2b
    Port:           3000/TCP
    Host Port:      0/TCP
    State:          Running
      Started:      Tue, 19 Apr 2022 13:19:51 +0530
    Last State:     Terminated
      Reason:       Completed
      Exit Code:    0
      Started:      Tue, 19 Apr 2022 13:17:41 +0530
      Finished:     Tue, 19 Apr 2022 13:19:19 +0530
    Ready:          True
    Restart Count:  4
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-jfhgt (ro)
Conditions:
  Type              Status
  Initialized       True
  Ready             True
  ContainersReady   True
  PodScheduled      True
Volumes:
  kube-api-access-jfhgt:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    ConfigMapOptional:       <nil>
    DownwardAPI:             true
QoS Class:                   BestEffort
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s

Events:
  Type    Reason          Age                    From     Message
  ----    ------          ----                   ----     -------
  Normal  SandboxChanged  13h                    kubelet  Pod sandbox changed, it will be killed and re-created.
  Normal  Pulling         13h                    kubelet  Pulling image "stephengrider/multi-client"
  Normal  Pulled          13h                    kubelet  Successfully pulled image "stephengrider/multi-client" in 5.800051077s
  Normal  Created         13h                    kubelet  Created container client
  Normal  Started         13h                    kubelet  Started container client
  Normal  SandboxChanged  7m45s                  kubelet  Pod sandbox changed, it will be killed and re-created.
  Normal  Pulling         7m44s                  kubelet  Pulling image "stephengrider/multi-client"
  Normal  Pulled          7m40s                  kubelet  Successfully pulled image "stephengrider/multi-client" in 4.16683186s
  Normal  Killing         6m2s                   kubelet  Container client definition changed, will be restarted
  Normal  Pulling         6m2s                   kubelet  Pulling image "stephengrider/multi-worker"
  Normal  Created         5m30s (x2 over 7m40s)  kubelet  Created container client
  Normal  Started         5m30s (x2 over 7m40s)  kubelet  Started container client
  Normal  Pulled          5m30s                  kubelet  Successfully pulled image "stephengrider/multi-worker" in 31.712919588s
→  04_simplek8s git:(main) ✗
```

Limitation in config update

We are trying to update the container port in client-pod.yaml file.

04_simplek8s > client-pod.yaml

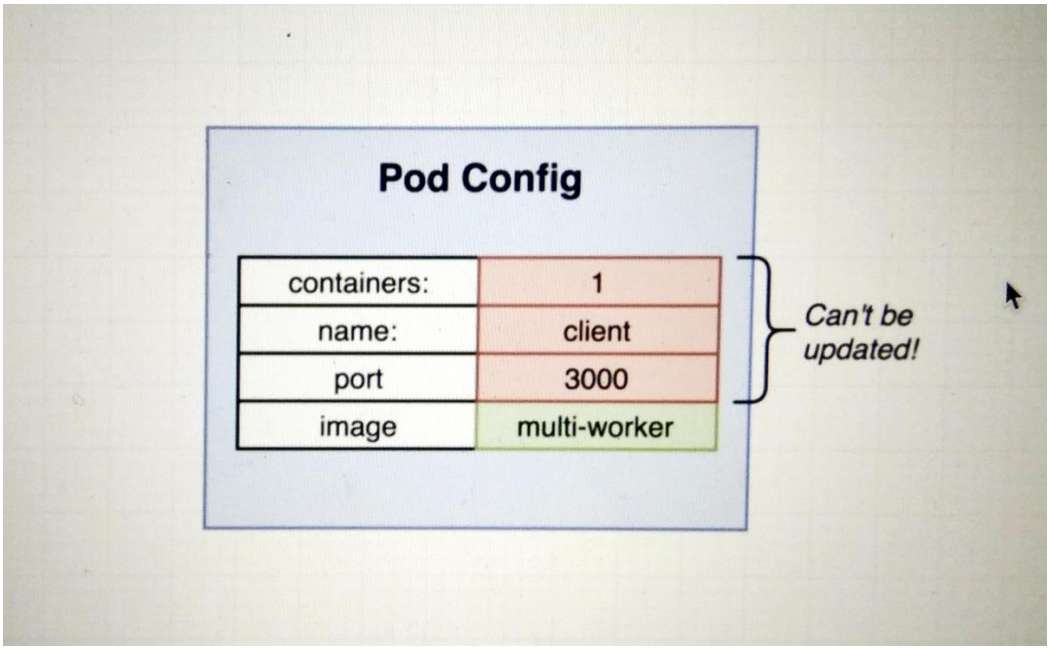
```yaml
apiVersion: v1
kind: Pod
metadata:
  name: client-pod
  labels:
    component: web
spec:
  containers:
    - name: client
      image: stephengrider/multi-worker
      ports:
        - containerPort: 9999

```

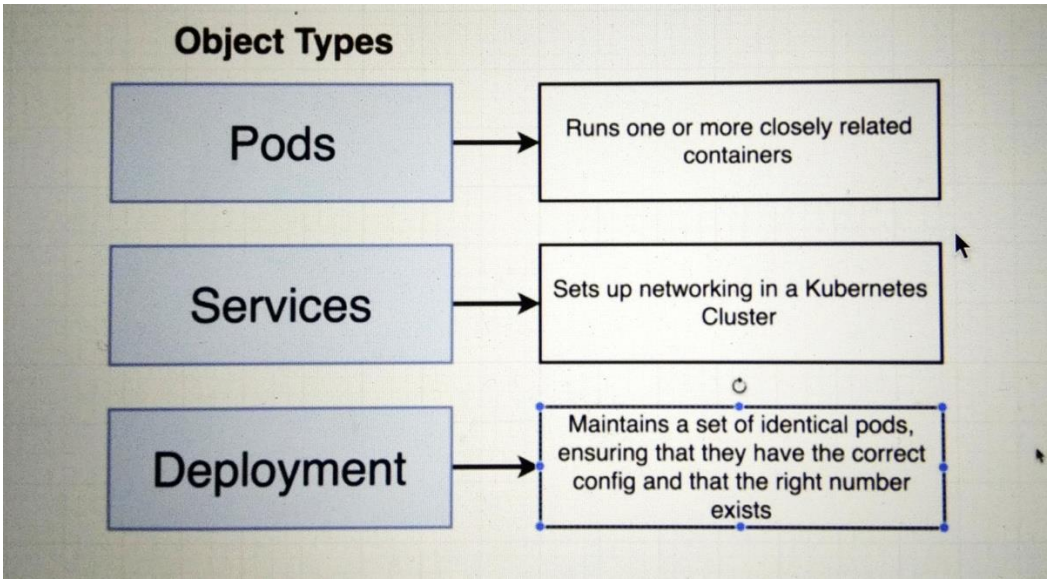
```
→  04_simplek8s git:(main) ✗ kubectl apply -f client-pod.yaml
The Pod "client-pod" is invalid: spec: Forbidden: pod updates may not change fields other than `spec.containers[*].image`, `spec.initContainers[*].image`, `spec.act
iveDeadlineSeconds`, `spec.tolerations` (only additions to existing tolerations) or `spec.terminationGracePeriodSeconds` (allow it to be set to 1 if it was previous
ly negative)
  core.PodSpec{
        Volumes:        {{Name: "kube-api-access-jfhgt", VolumeSource: {Projected: &{Sources: {{ServiceAccountToken: &{ExpirationSeconds: 3607, Path: "token"}}, {Co
nfigMap: &{LocalObjectReference: {Name: "kube-root-ca.crt"}, Items: {{Key: "ca.crt", Path: "ca.crt"}}}}, {DownwardAPI: &{Items: {{Path: "namespace", FieldRef: &{API
Version: "v1", FieldPath: "metadata.namespace"}}}}}, DefaultMode: &420}}},
        InitContainers: nil,
        Containers: []core.Container{
                {
                        ... // 3 identical fields
                        Args:       nil,
                        WorkingDir: "",
                        Ports: []core.ContainerPort{
                                {
                                        Name:          "",
                                        HostPort:      0,
-                                       ContainerPort: 9999,
```

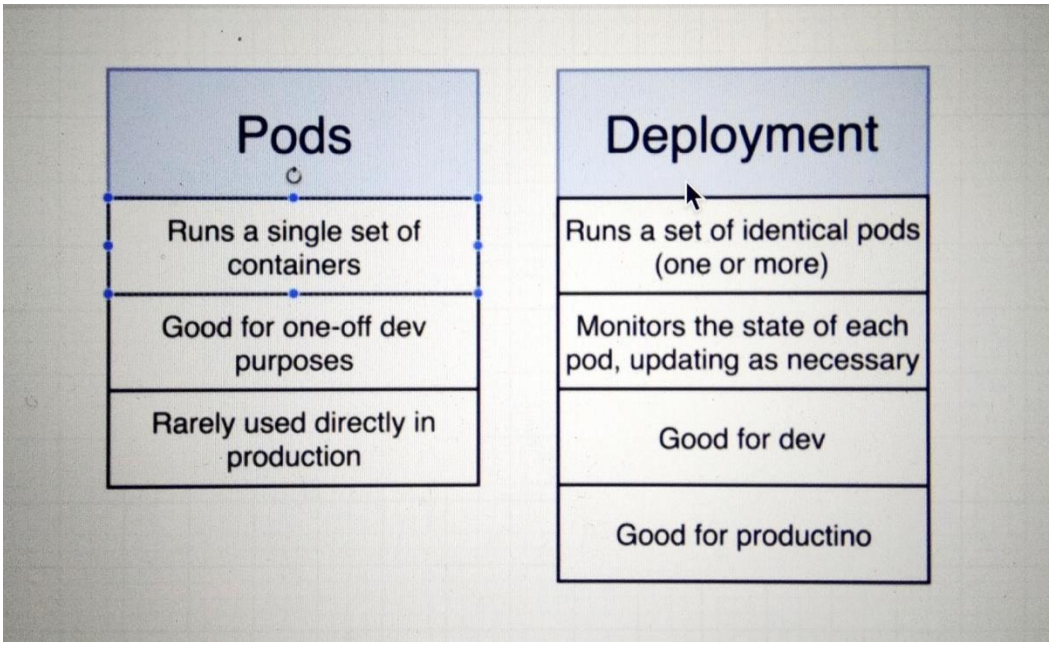
When we tried to apply the config file to kubernates we get above error. Only specified property can be updated in config file and applied to kubernates.

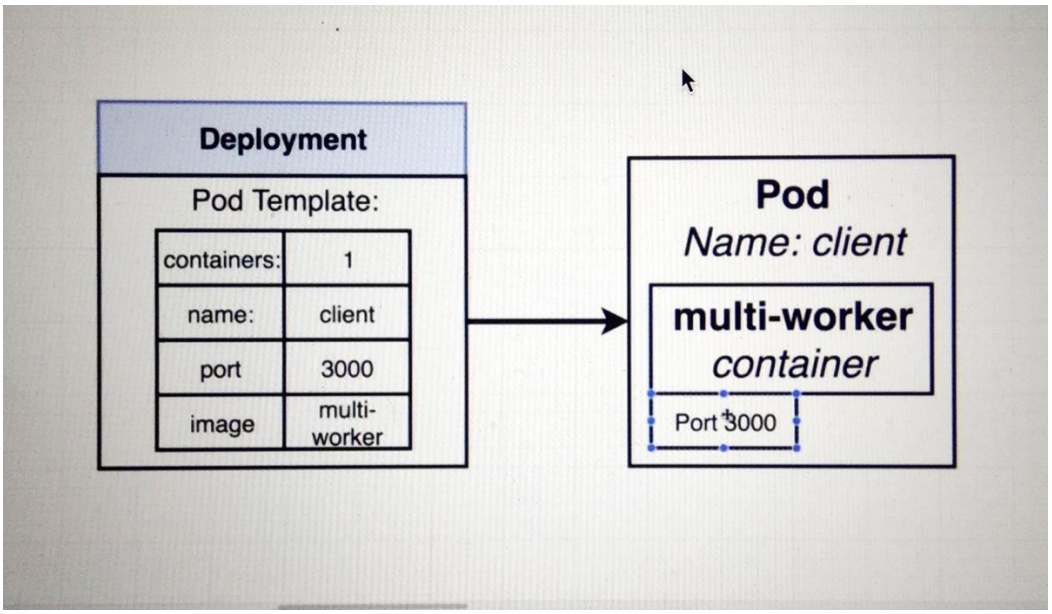
Deployment Object

Running containers with deployment









Deployment has a pod template which has all the configuration info. When this configuration gets deployed to kubernates cluster, container will be created as per the configuration.

When there is a change in configuration, existing container will be killed and created again as per the configuration.

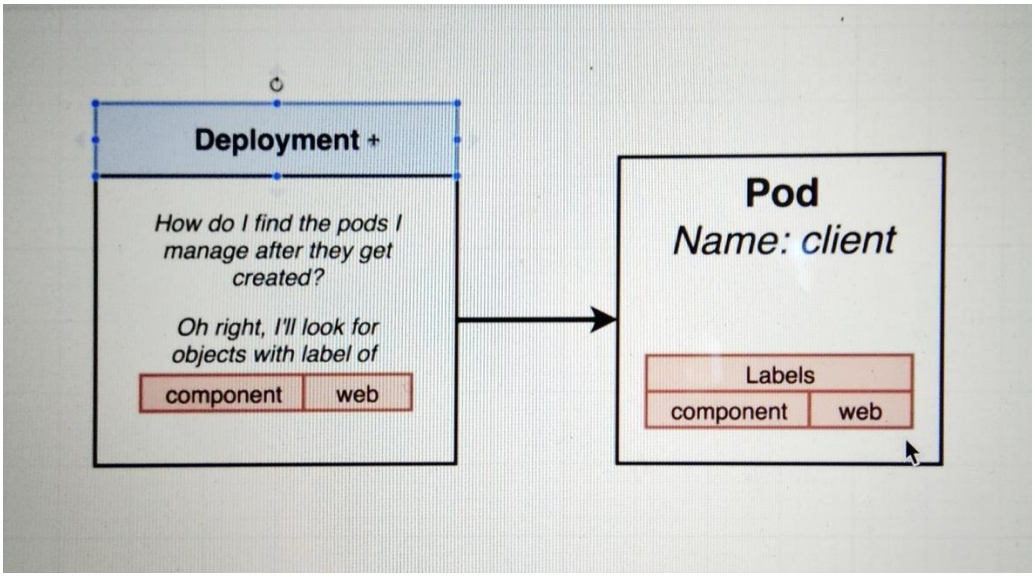
Deployment object constantly watching all the pods and make sure everything maintains a correct state.

Deployment Config File

04_simplek8s > client-deployment.yaml

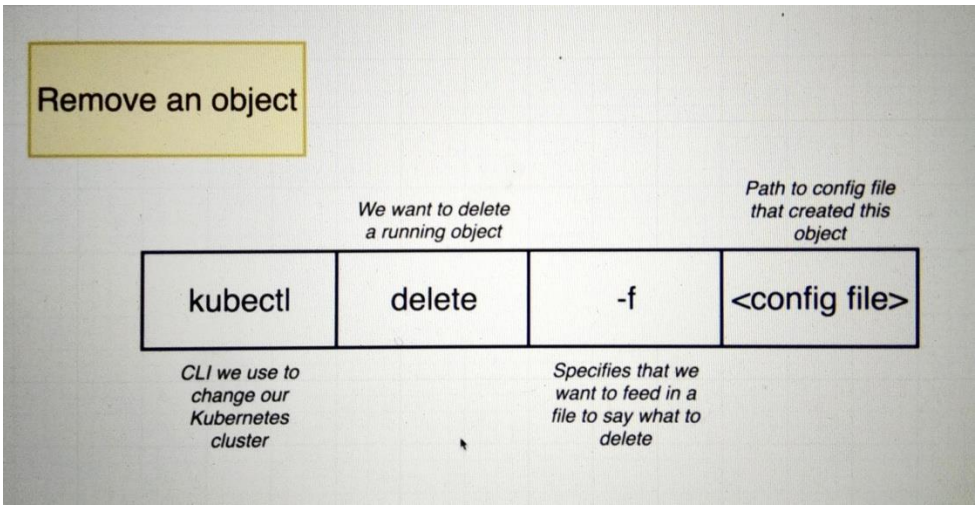
```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: client-deployment
spec:
  replicas: 1
  selector:
    matchLabels:
      component: web
  template:
    metadata:
      labels:
        component: web
    spec:
      containers:
        - name: client
          image: stephengrider/multi-client
          ports:
            - containerPort: 3000

```

appVersion: app/v1 => Avail object type
kind => type of object. Here it is Deployment
metadata: name: client-deployment => Name of the object.
Template => defines configuration for every pod that's get created.
Replicas => represent a number of pods to create.
Selector work like below,



Applying Deployment

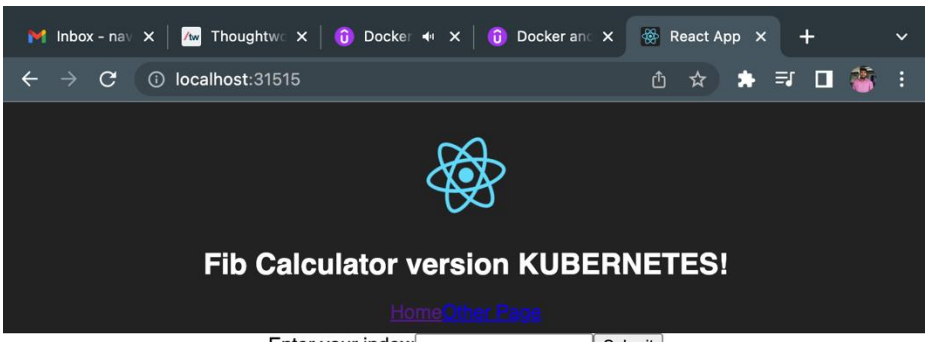
Removing existing object.




```
→  DOCKER_KUBE git:(main) ✗ kubectl get pods
NAME         READY   STATUS    RESTARTS       AGE
client-pod   1/1     Running   22 (37s ago)   8d
→  DOCKER_KUBE git:(main) ✗ cd 04_simplek8s
→  04_simplek8s git:(main) ✗ kubectl delete -f client-pod.yaml
pod "client-pod" deleted
→  04_simplek8s git:(main) ✗
```

Applying deployment config file.

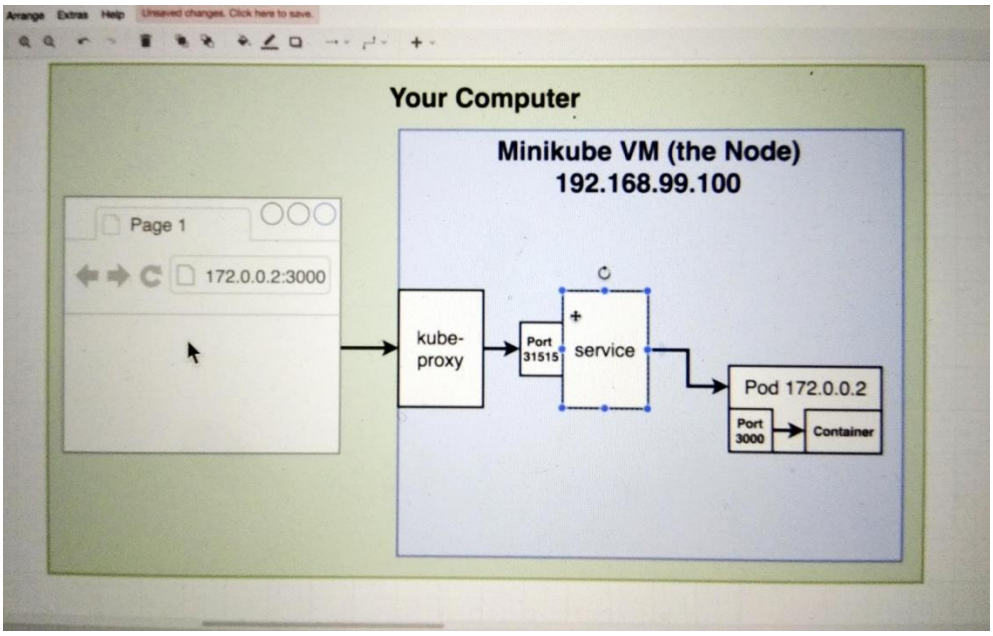
```
→  04_simplek8s git:(main) ✗ kubectl apply -f client-deployment.yaml
deployment.apps/client-deployment created
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME                                 READY   STATUS    RESTARTS   AGE
client-deployment-7cb6c958f7-6nq7h   1/1     Running   0          11s
→  04_simplek8s git:(main) ✗ kubectl get deployments
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   1/1     1            1           96s
→  04_simplek8s git:(main) ✗
```



```
→  04_simplek8s git:(main) ✗ kubectl get pods -o wide
NAME                                 READY   STATUS    RESTARTS   AGE     IP          NODE             NOMINATED NODE   READINESS
GATES
client-deployment-7cb6c958f7-6nq7h   1/1     Running   0          6m49s   10.1.0.39   docker-desktop   <none>           <none>
→  04_simplek8s git:(main) ✗
```

Every pod assigned with IP Address.

Use of service object



If try to access the pod directly using the pod IP address, on time of pod crash, pod will be deleted and created again. Newly created pod will be assigned with new IP address. In client side we must change the URL. This is the problem we face when every time pod gets created.

By using the service object, based on the selector, request will be navigated to right pod.

Scaling and changing the deployments

```yaml
  template:
    metadata:
      labels:
        component: web
    spec:
      containers:
        - name: client
          image: stephengrider/multi-client
          ports:
            - containerPort: 9999
```

Changed the container port to 9999.

```
→  04_simplek8s git:(main) ✗ kubectl apply -f client-deployment.yaml
deployment.apps/client-deployment configured
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME                                 READY   STATUS    RESTARTS   AGE
client-deployment-cb665f48d-pw4w9    1/1     Running   0          35s
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME                                 READY   STATUS    RESTARTS   AGE
client-deployment-cb665f48d-pw4w9    1/1     Running   0          47s
→  04_simplek8s git:(main) ✗
```

We just applied the deployment config file to kubernates. Pod is recreated again as we can see from AGE.

Scaling up pods

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: client-deployment
spec:
  replicas: 5
  selector:
    matchLabels:
      component: web
  template:
    metadata:
      labels:
        component: web
    spec:
      containers:
        - name: client
          image: stephengrider/multi-client
          ports:
            - containerPort: 9999
```

```
→  04_simplek8s git:(main) ✗ kubectl apply -f client-deployment.yaml
deployment.apps/client-deployment configured
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME                                 READY   STATUS              RESTARTS   AGE
client-deployment-cb665f48d-486v5    0/1     ContainerCreating   0          2s
client-deployment-cb665f48d-7s4z5    0/1     ContainerCreating   0          2s
client-deployment-cb665f48d-hp8zd    0/1     ContainerCreating   0          2s
client-deployment-cb665f48d-pv8ng    0/1     ContainerCreating   0          2s
client-deployment-cb665f48d-pw4w9    1/1     Running             0          9m9s
→  04_simplek8s git:(main) ✗ kubectl get deployment
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   5/5     5            5           40m
→  04_simplek8s git:(main) ✗
```

Updating the image in deployment config file.

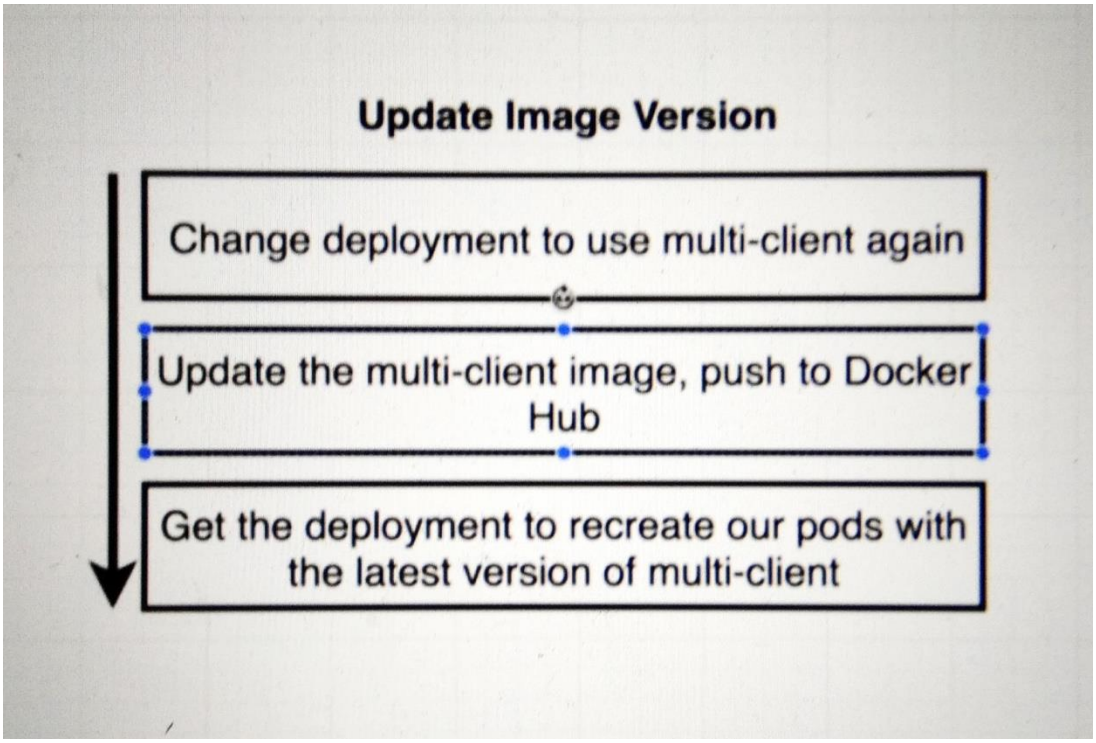
```yaml
  template:
    metadata:
      labels:
        component: web
    spec:
      containers:
        - name: client
          image: stephengrider/multi-worker
          ports:
            - containerPort: 9999
```

```
→  04_simplek8s git:(main) ✗ kubectl apply -f client-deployment.yaml
deployment.apps/client-deployment configured
→  04_simplek8s git:(main) ✗ kubectl get pods
→  04_simplek8s git:(main) ✗ kubectl apply -f client-deployment.yaml
deployment.apps/client-deployment configured
→  04_simplek8s git:(main) ✗ kubectl get deployment
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   4/5     3            4           60m
→  04_simplek8s git:(main) ✗ kubectl get deployment
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   4/5     4            4           60m
→  04_simplek8s git:(main) ✗ kubectl get deployment
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   4/5     4            4           60m
```

```
client-deployment   4/5     5            4           60m
→  04_simplek8s git:(main) ✗ kubectl get deployment
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   5/5     5            5           61m
→  04_simplek8s git:(main) ✗
```

Once changed the image in deployment. Not all the pods recreated immediately. Initially, 3 pods recreated followed by 4 and 5.

Updating Deployment Image



Updating the latest version of the image.

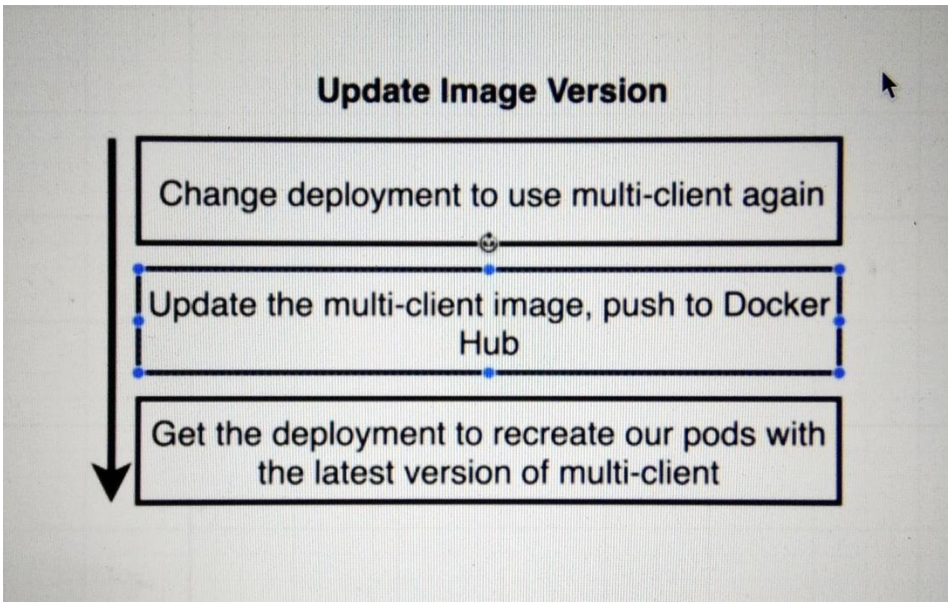
We made the following changes to deployment config file.

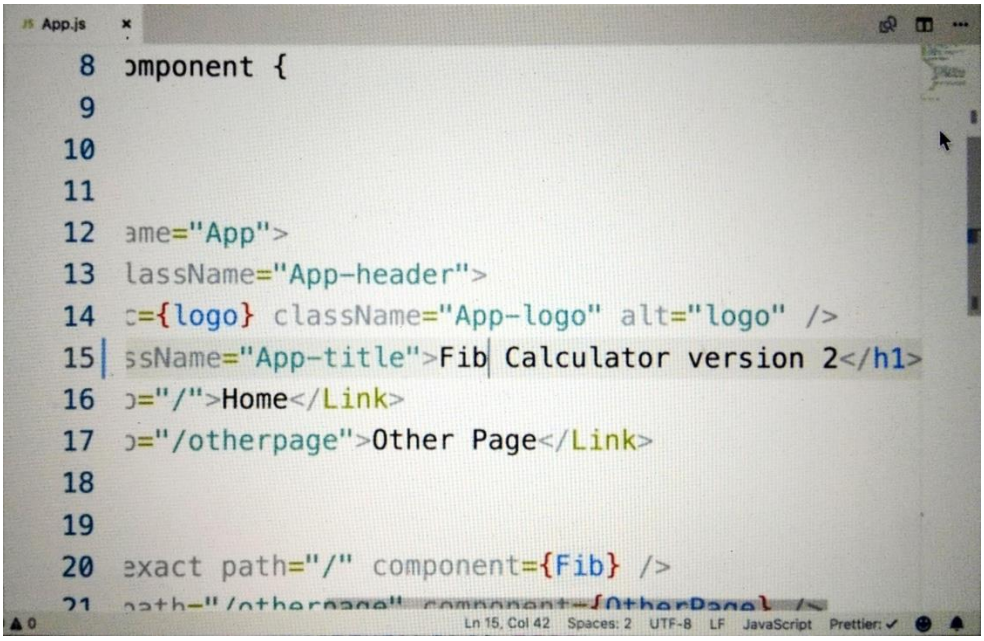
```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: client-deployment
spec:
  replicas: 1
  selector:
    matchLabels:
      component: web
  template:
    metadata:
      labels:
        component: web
    spec:
      containers:
        - name: client
          image: stephengrider/multi-client
          ports:
            - containerPort: 3000
```

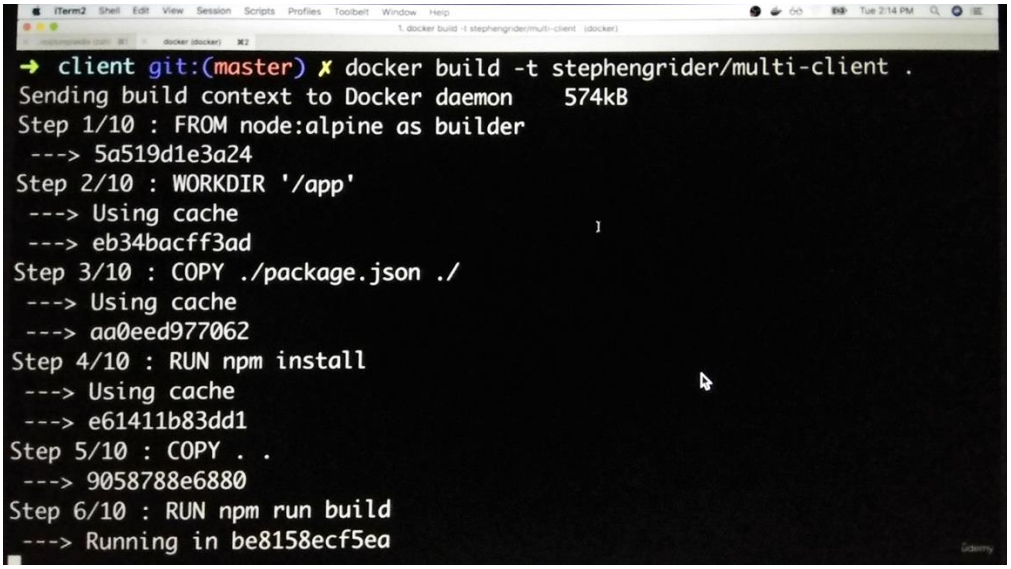
Applying the latest config file to kubernates cluster and checking the result.

```
→  DOCKER_KUBE git:(main) ✗ cd 04_simplek8s
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME                                READY   STATUS    RESTARTS      AGE
client-deployment-57f4f5b4c7-bf99m   1/1     Running   1 (20m ago)   46h
client-deployment-57f4f5b4c7-k9m4z   1/1     Running   1 (20m ago)   46h
client-deployment-57f4f5b4c7-mr8rf   1/1     Running   1 (20m ago)   46h
client-deployment-57f4f5b4c7-r7k8g   1/1     Running   1 (20m ago)   46h
client-deployment-57f4f5b4c7-snr4r   1/1     Running   1 (20m ago)   46h
→  04_simplek8s git:(main) ✗ kubectl apply -f client-deployment.yaml
deployment.apps/client-deployment configured
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME                                READY   STATUS              RESTARTS      AGE
client-deployment-57f4f5b4c7-k9m4z   1/1     Running             1 (21m ago)   46h
client-deployment-7cb6c958f7-kc52d   0/1     ContainerCreating   0             4s
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME                                READY   STATUS              RESTARTS      AGE
client-deployment-57f4f5b4c7-k9m4z   1/1     Running             1 (21m ago)   46h
client-deployment-7cb6c958f7-kc52d   0/1     ContainerCreating   0             9s
→  04_simplek8s git:(main) ✗
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME                                READY   STATUS              RESTARTS      AGE
client-deployment-57f4f5b4c7-k9m4z   1/1     Running             1 (21m ago)   46h
client-deployment-7cb6c958f7-kc52d   0/1     ContainerCreating   0             11s
→  04_simplek8s git:(main) ✗ kubectl get services
NAME              TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)          AGE
client-node-port  NodePort    10.99.156.34   <none>        3050:31515/TCP   10d
kubernetes        ClusterIP   10.96.0.1      <none>        443/TCP          14d
→  04_simplek8s git:(main) ✗ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
client-deployment-7cb6c958f7-kc52d   1/1     Running   0          28s
→  04_simplek8s git:(main) ✗
```

Rebuilding the Client Image





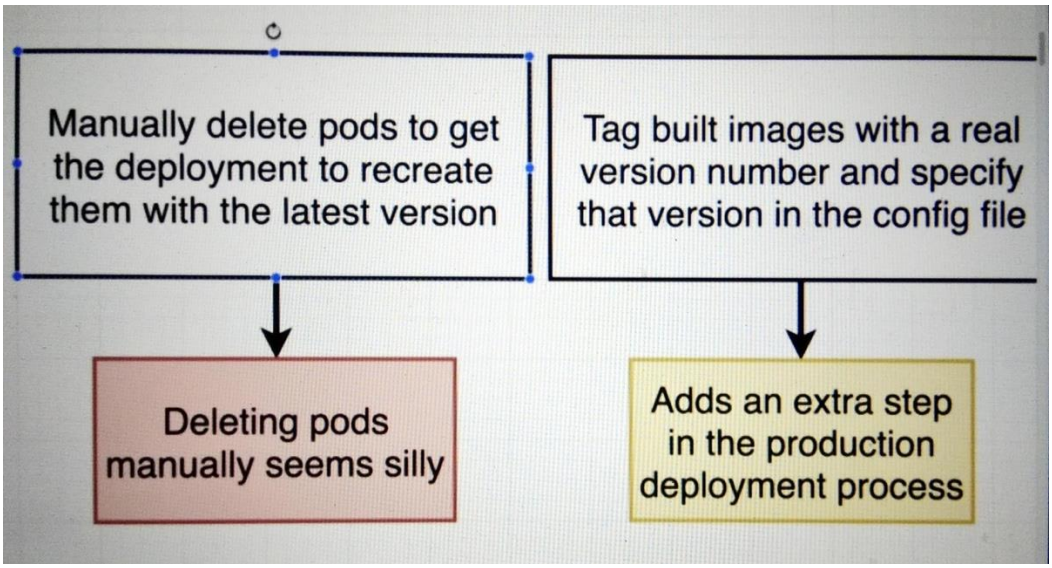


```
Step 8/10 : EXPOSE 3000
 ---> Using cache
 ---> edf8c36f5171
Step 9/10 : COPY ./nginx/default.conf /etc/nginx/conf.d/default.conf
 ---> Using cache
 ---> 63fea4bcfe12
Step 10/10 : COPY --from=builder /app/build /usr/share/nginx/html
 ---> 96aae3282fff
Successfully built 96aae3282fff
Successfully tagged stephengrider/multi-client:latest
➜  client git:(master) ✗ docker push stephengrider/multi-client
The push refers to repository [docker.io/stephengrider/multi-client]
51bfb905f2b3: Pushed
694a6abf5f0d: Layer already exists
08d25fa0442e: Layer already exists
a8c4aeeaa045: Layer already exists
cdb3f9544e4c: Layer already exists
```

```
➜  simplek8s git:(master) ✗ kubectl apply -f client-deployment.yaml
deployment.apps/client-deployment unchanged
➜  simplek8s git:(master) ✗
```

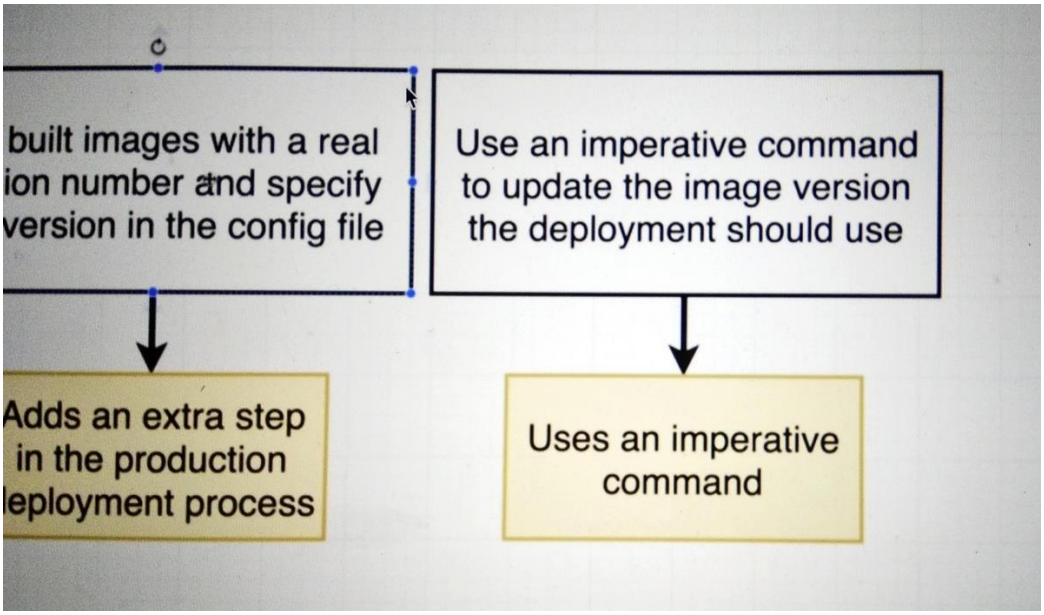
When we try to apply the config file, it says configuration file is unchanged. Our kubernates cluster does not know, we have published new changes to our image.

There are three ways to overcome this problem.

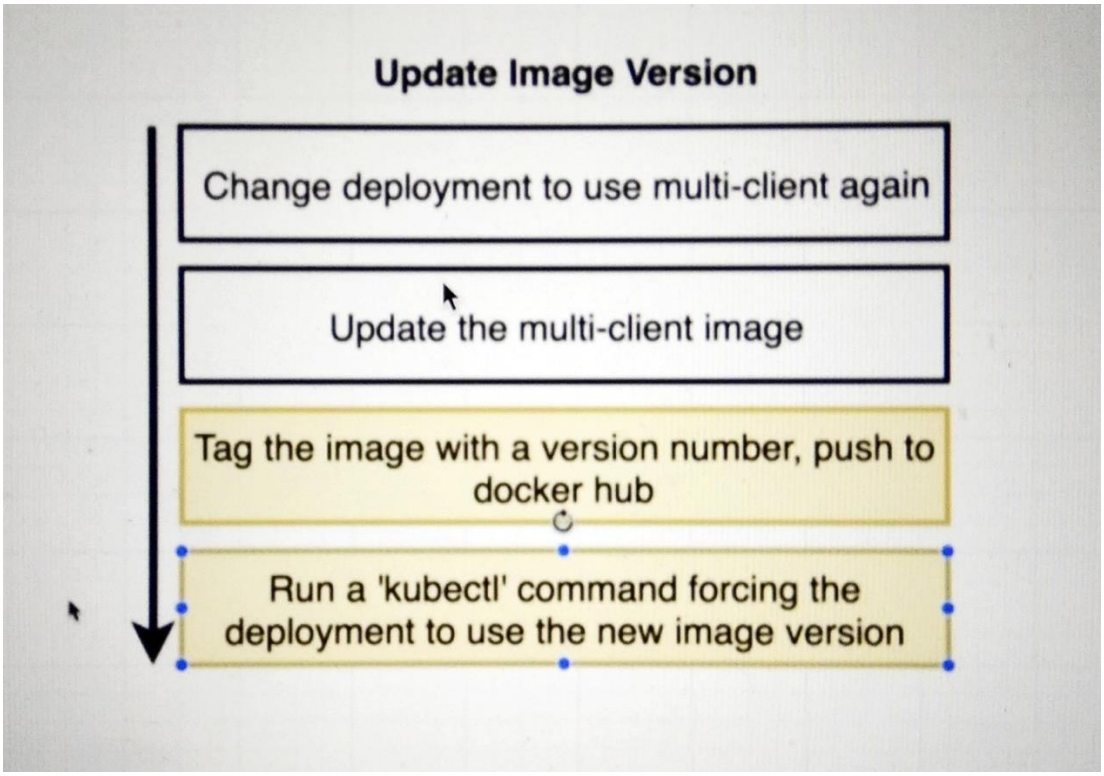


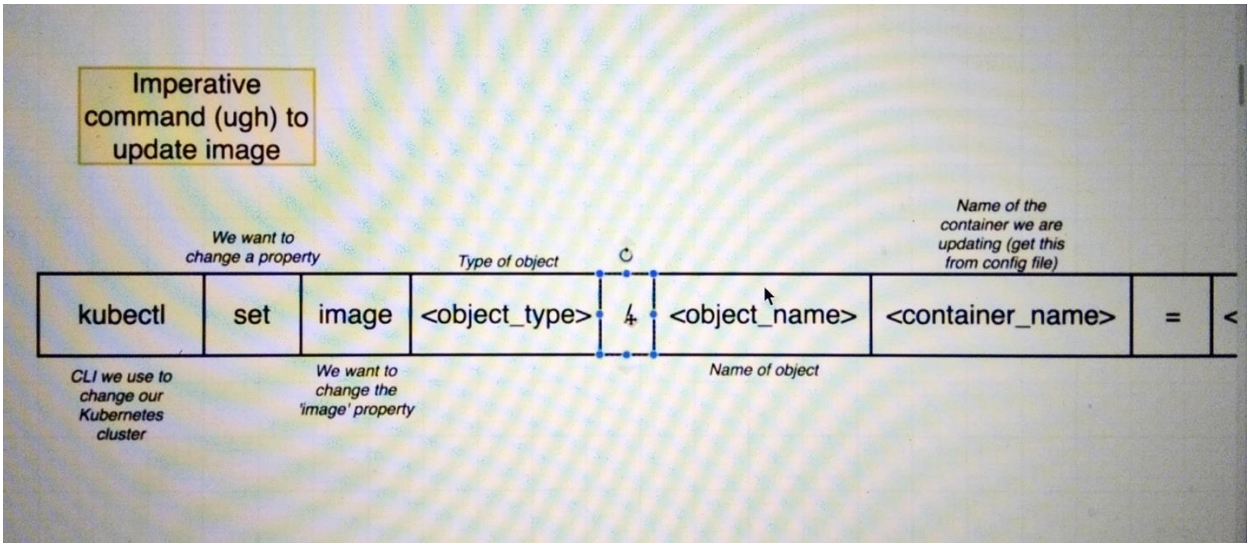
```yaml
template:
  metadata:
    labels:
      component: web
  spec:
    containers:
      - name: client
        image: stephengrider/multi-client:v4
        ports:
          - containerPort: 3000
```

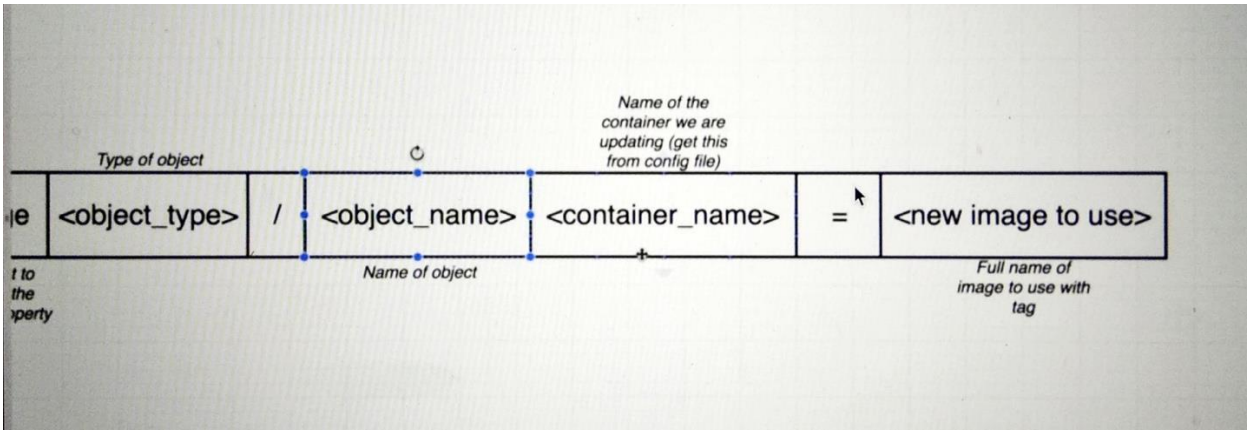
In the second approach, we must update the version number in config file whenever we build the image.



Imperatively updating a deployment image

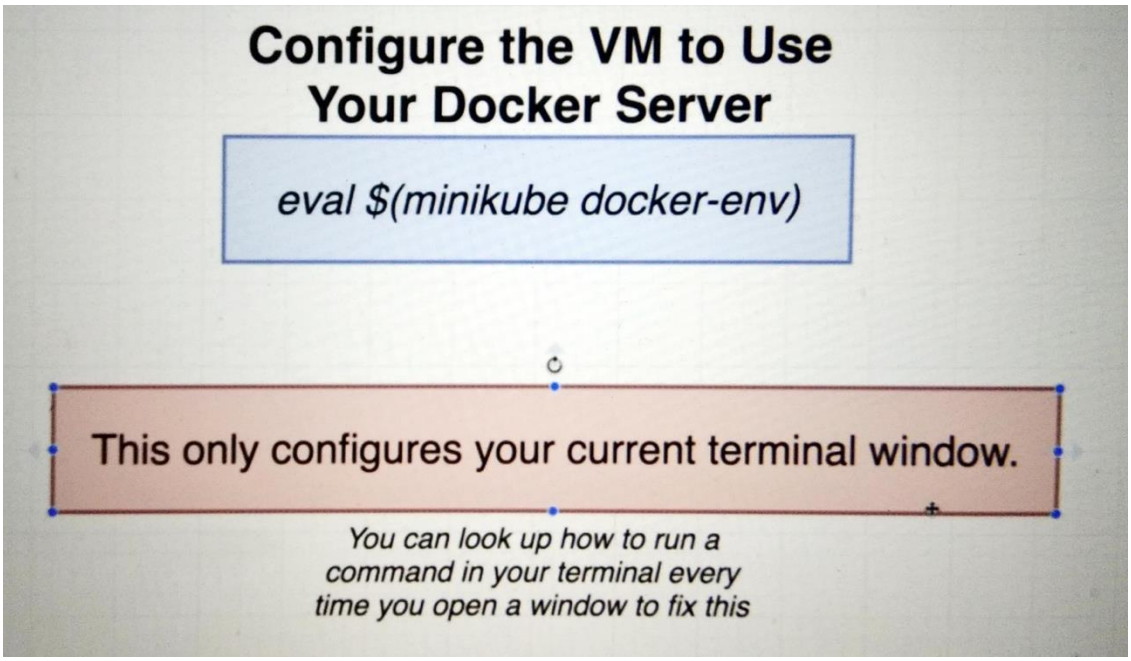


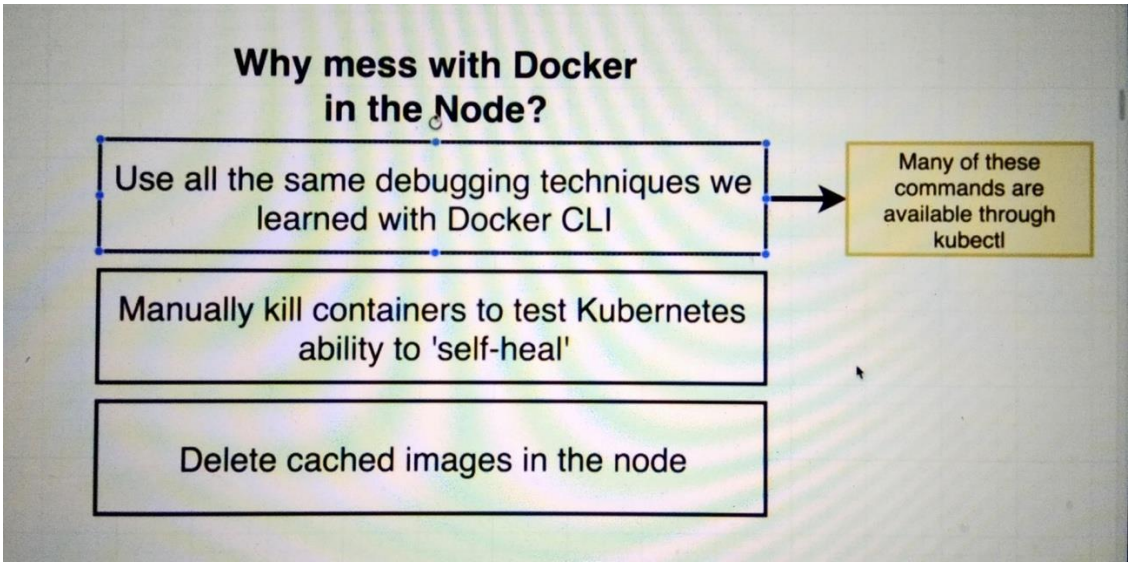




```
➜ simplek8s git:(master) ✗ kubectl set image deployment/client-deployment
client=stephengrider/multi-client:v5
deployment.extensions/client-deployment image updated
➜ simplek8s git:(master) ✗
```

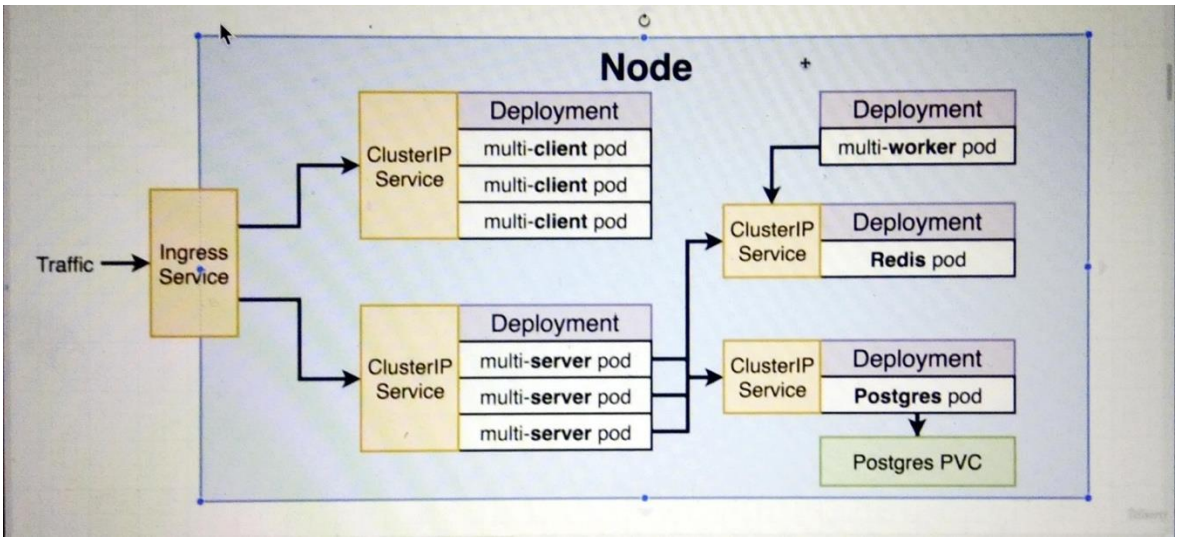
Configure VM to Use Docker Server



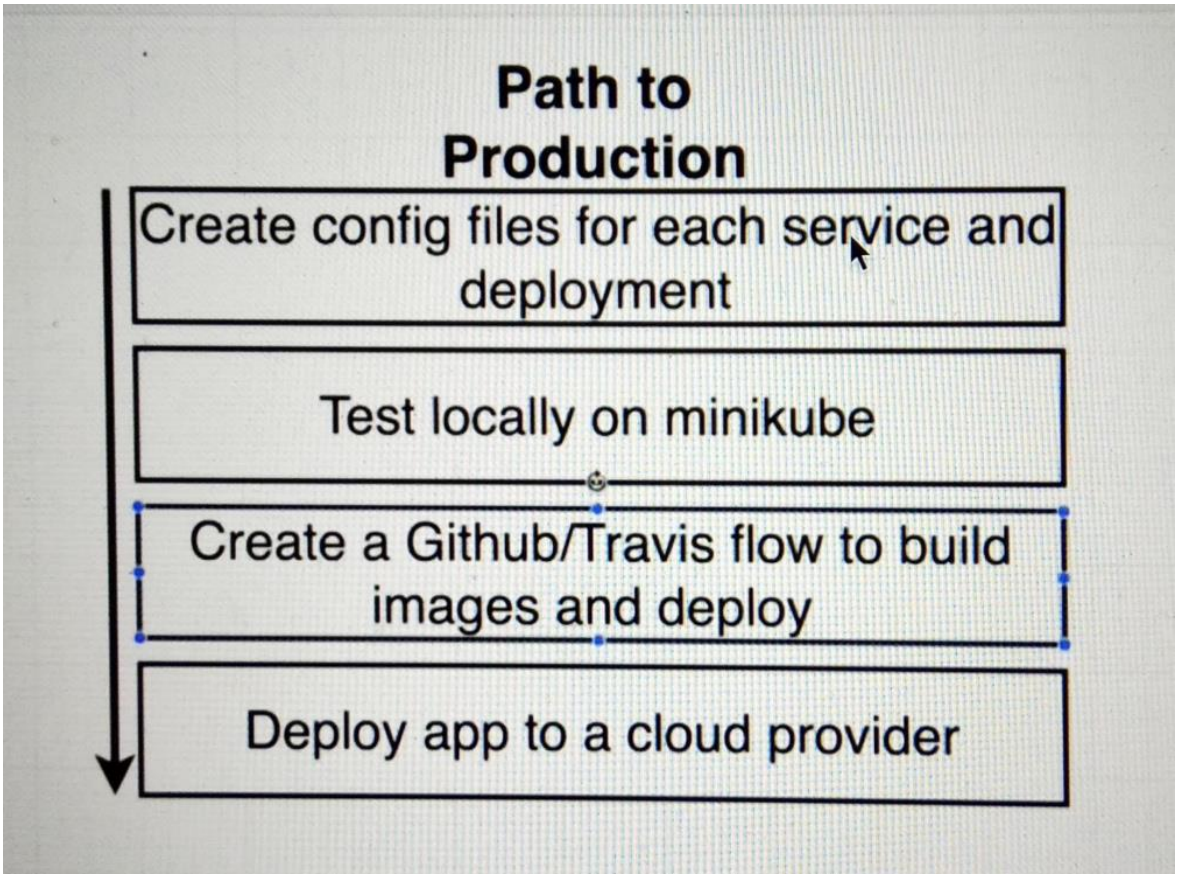


A Multi Container App with Kubernates

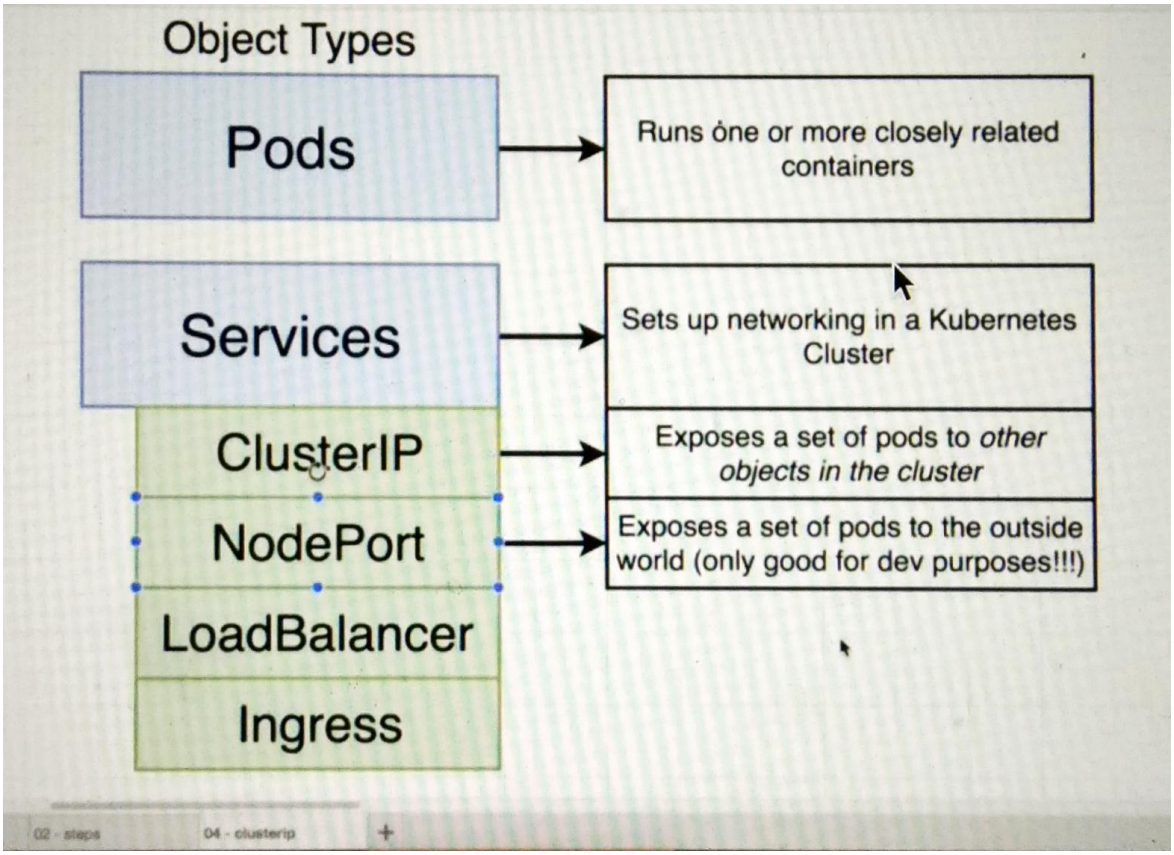
The Path to Production



Postgres PVC, Here PVC stands for Persistent Volume Claim.

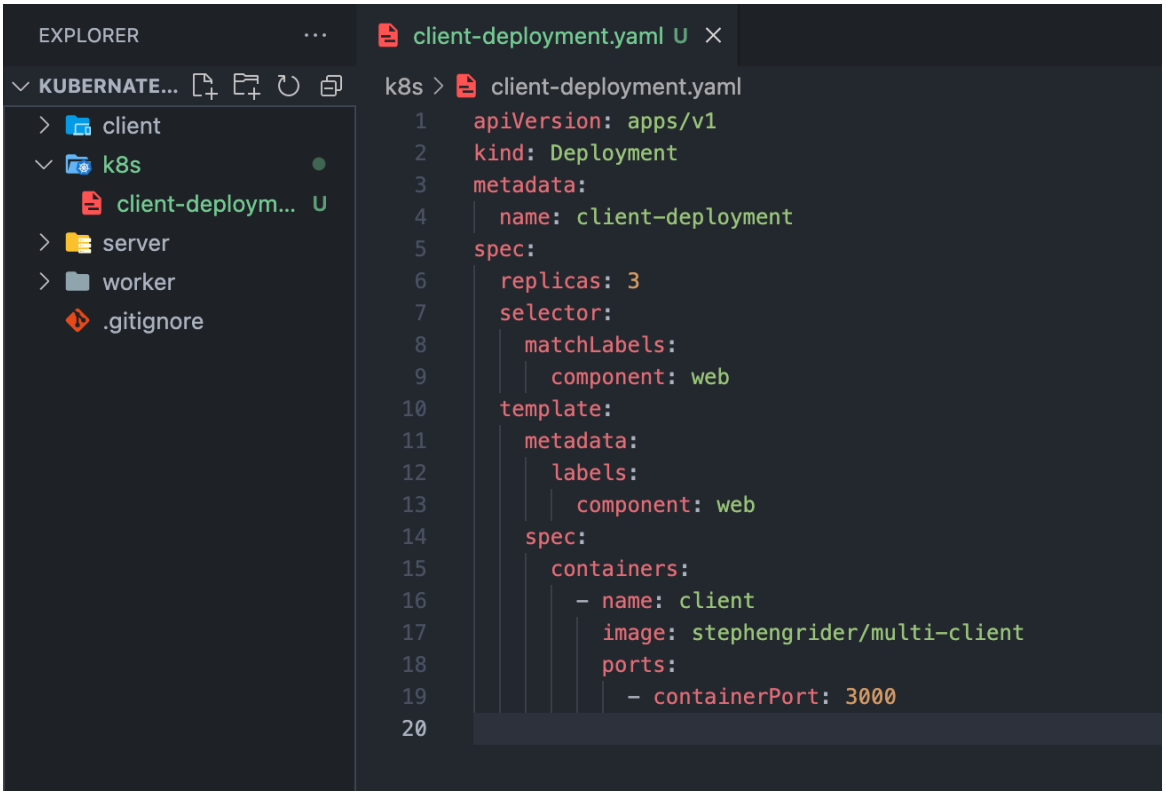


Cluster IP vs Node Port

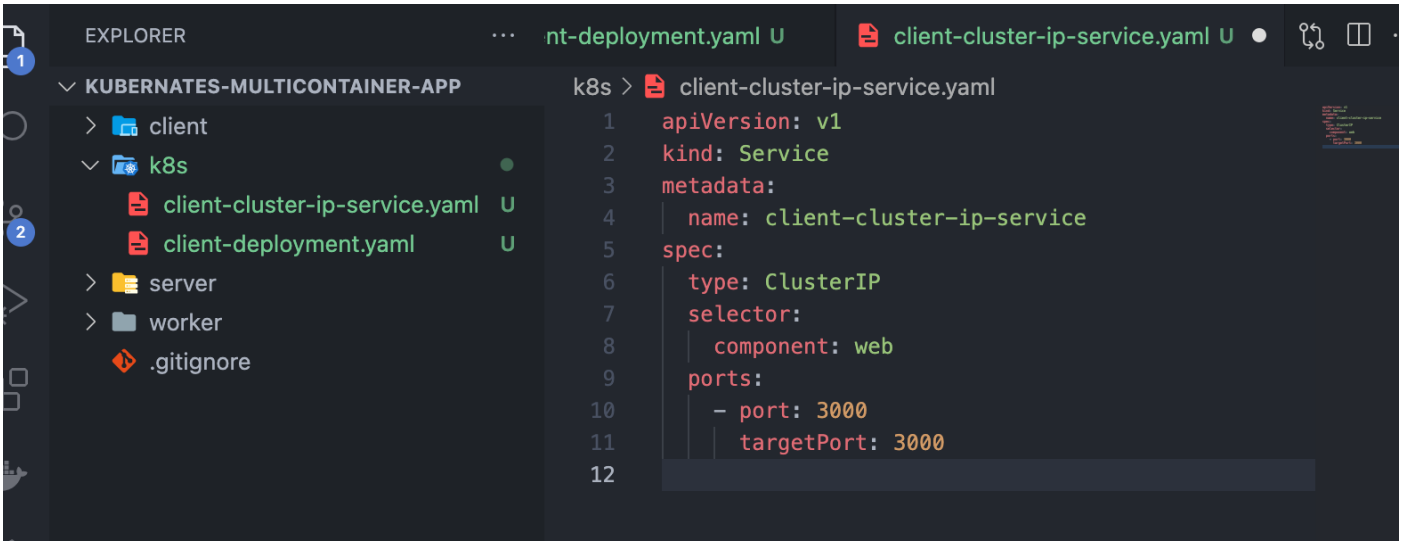


Kubernates multi container application

Client deployment config file.



Client cluster IP service



Deploying the kubernates configuration

Deleting Existing Deployment

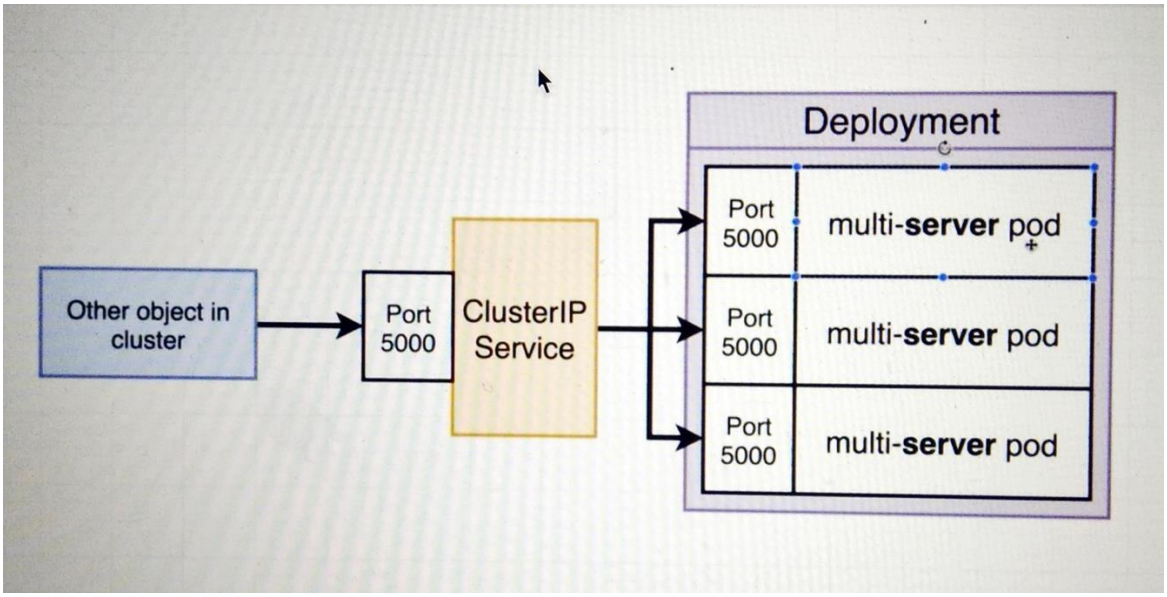
```
/Users/naveen.kumar1/.zshrc:68: no matches found: load?
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get deployments
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   1/1     1            1           9d
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl delete deployment client-deployment
deployment.apps "client-deployment" deleted
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get deployments
No resources found in default namespace.
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗
```

Deleting the node port services

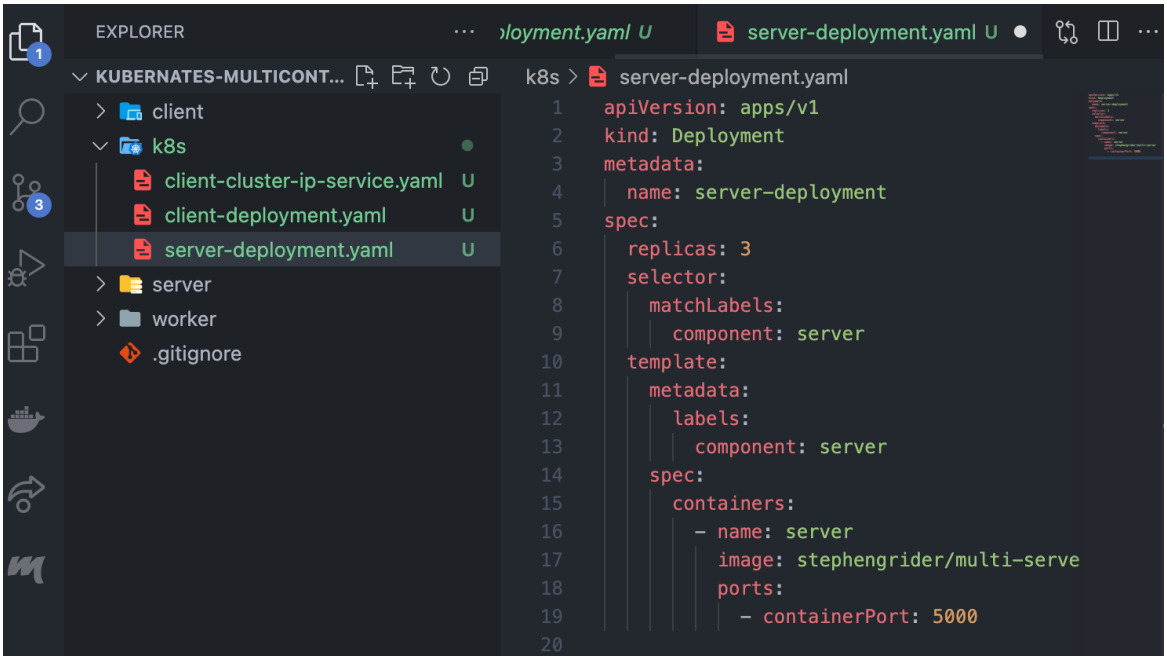
```
No resources found in default namespace.
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get services
NAME                TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)          AGE
client-node-port    NodePort    10.99.156.34    <none>        3050:31515/TCP   17d
kubernetes          ClusterIP   10.96.0.1       <none>        443/TCP          22d
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl delete services client-node-port
service "client-node-port" deleted
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get services
NAME         TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP   22d
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗
```

Deploying kubernates configuration

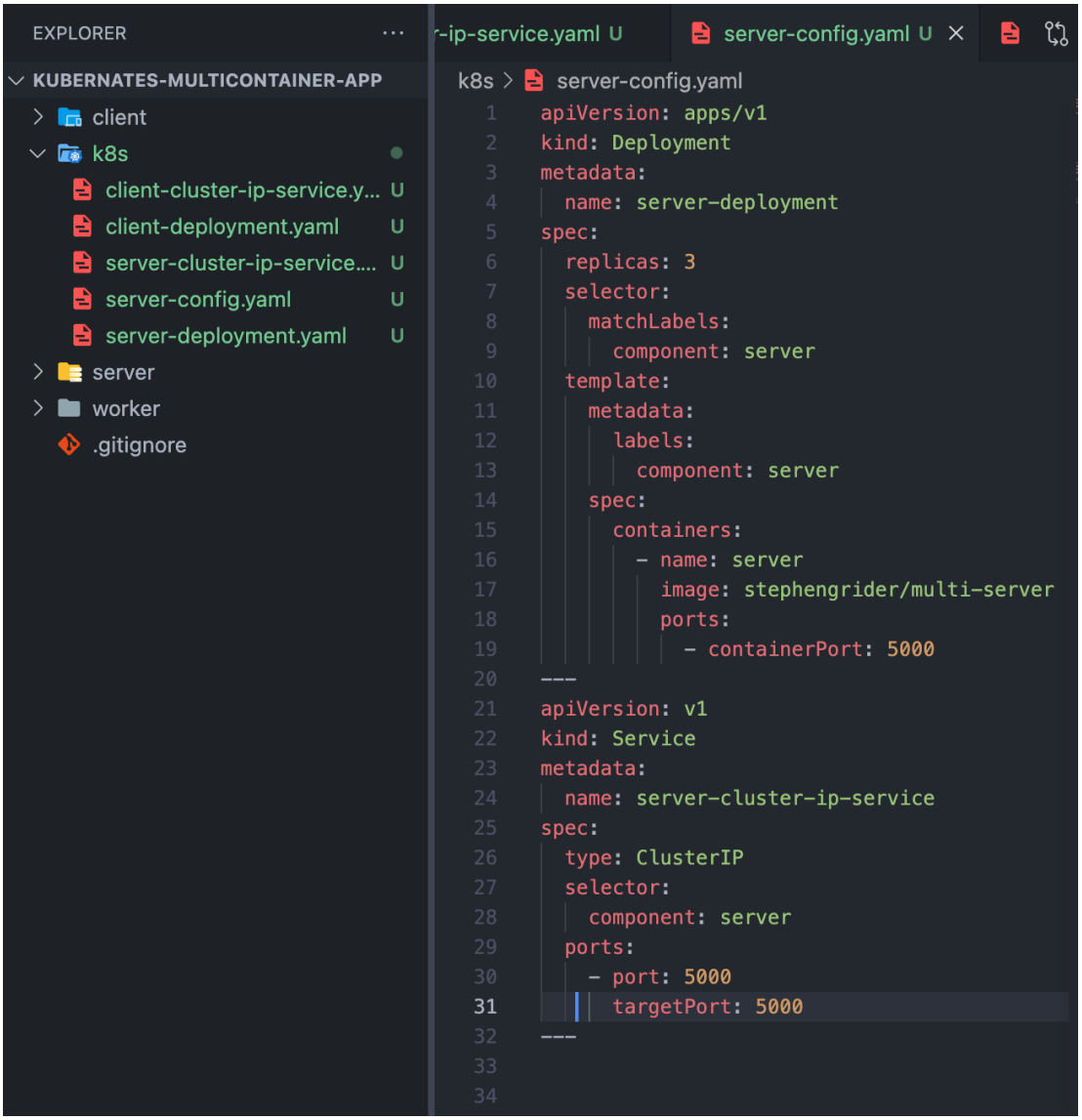
```
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl apply -f k8s
service/client-cluster-ip-service created
deployment.apps/client-deployment unchanged
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get deployments
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   3/3     3            3           27s
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get pods
NAME                                 READY   STATUS    RESTARTS   AGE
client-deployment-7cb6c958f7-mqf6c   1/1     Running   0          40s
client-deployment-7cb6c958f7-shgmv   1/1     Running   0          40s
client-deployment-7cb6c958f7-xpcgk   1/1     Running   0          40s
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get services
NAME                        TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)    AGE
client-cluster-ip-service   ClusterIP   10.98.174.100   <none>        3000/TCP   40s
kubernetes                  ClusterIP   10.96.0.1       <none>        443/TCP    23d
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗
```



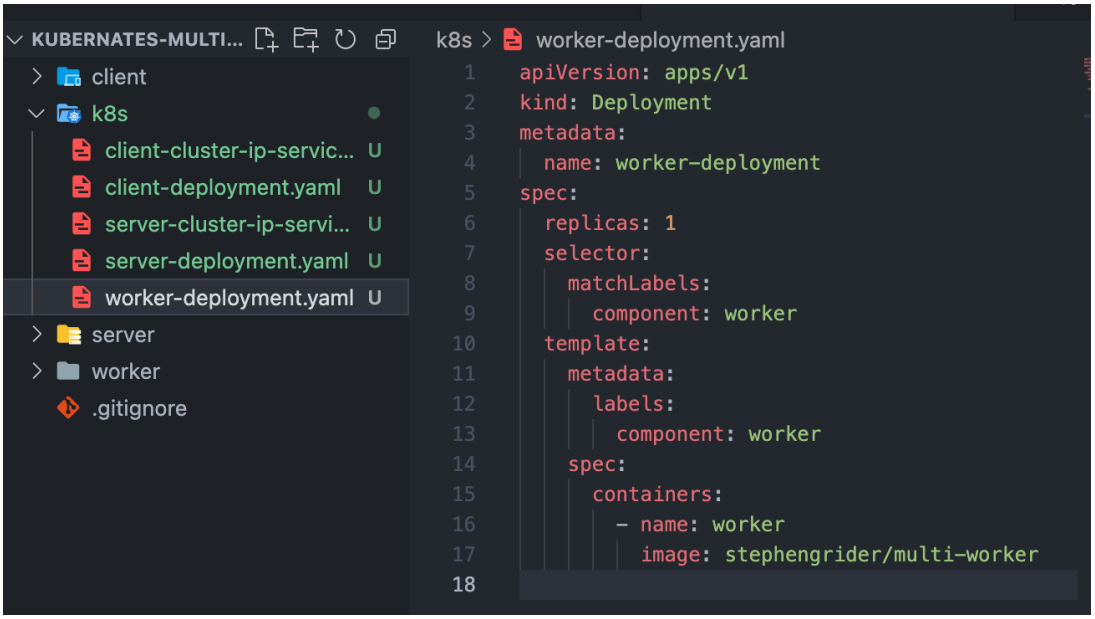
Express API Configuration



We can combine config file into a single file.



The Worker Deployment



```
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get deployment
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   3/3     3            3           51m
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl apply -f k8s
service/client-cluster-ip-service unchanged
deployment.apps/client-deployment unchanged
service/server-cluster-ip-service created
deployment.apps/server-deployment created
deployment.apps/worker-deployment created
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get deployment
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
client-deployment   3/3     3            3           51m
server-deployment   0/3     3            0           3s
worker-deployment   0/1     1            0           3s
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get pods
NAME                                 READY   STATUS    RESTARTS   AGE
client-deployment-7cb6c958f7-mqf6c   1/1     Running   0          52m
client-deployment-7cb6c958f7-shgmv   1/1     Running   0          52m
client-deployment-7cb6c958f7-xpcgk   1/1     Running   0          52m
server-deployment-9bff8dfb-chc4b     1/1     Running   0          88s
server-deployment-9bff8dfb-rmvwq     1/1     Running   0          88s
server-deployment-9bff8dfb-s46s6     1/1     Running   0          88s
worker-deployment-666c96ffc5-tkdbj   1/1     Running   0          88s
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗
```

Creating and applying redis config file

k8s > redis-deployment.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: redis-deployment
spec:
  replicas: 1
  selector:
    matchLabels:
      component: redis
  template:
    metadata:
      labels:
        component: redis
    spec:
      containers:
        - name: redis
          image: redis
          ports:
            - containerPort: 6379

```

```
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl apply -f k8s
service/client-cluster-ip-service unchanged
deployment.apps/client-deployment unchanged
service/redis-cluster-ip-service unchanged
deployment.apps/redis-deployment created
service/server-cluster-ip-service unchanged
deployment.apps/server-deployment unchanged
deployment.apps/worker-deployment unchanged
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗
```

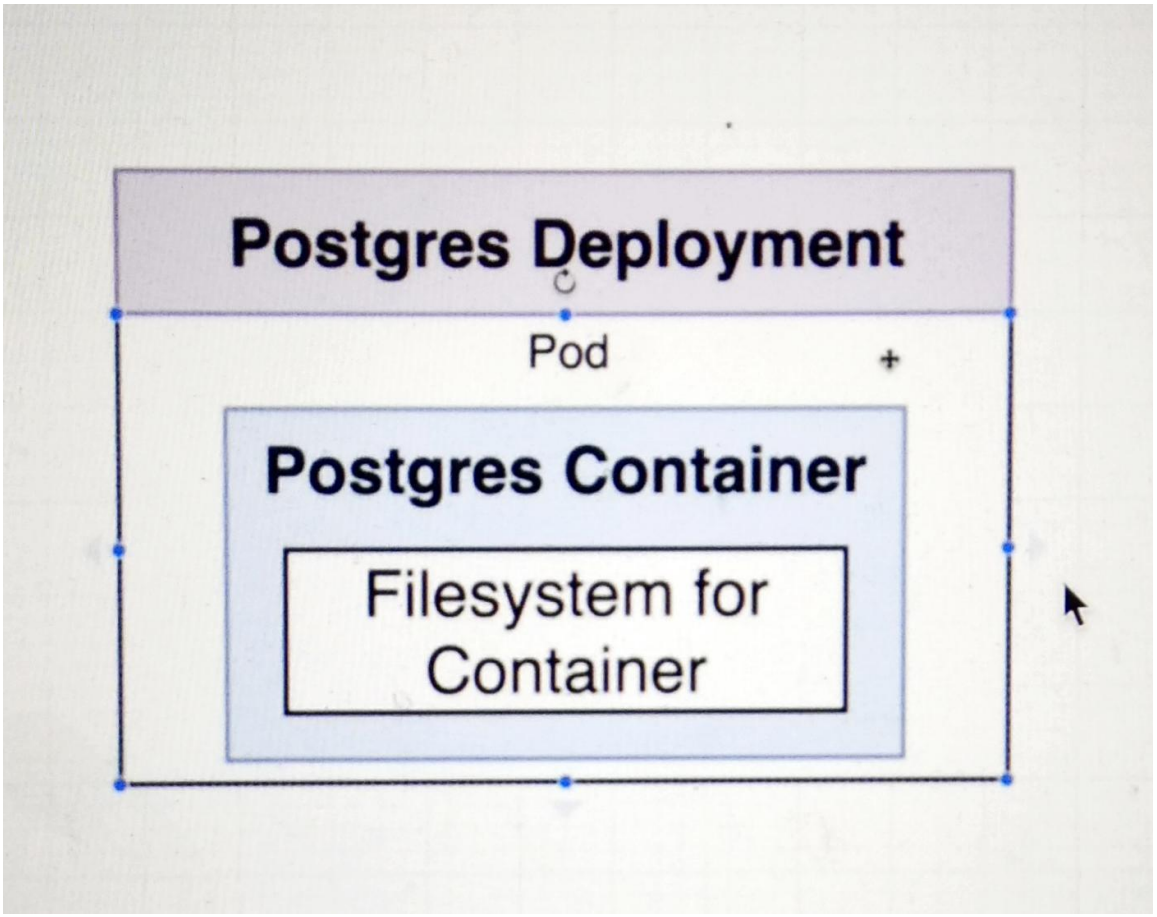
Creating and applying postgres config file

k8s > postgres-deployment.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: postgres-deployment
spec:
  replicas: 1
  selector:
    matchLabels:
      component: postgres
  template:
    metadata:
      labels:
        component: postgres
    spec:
      containers:
        - name: postgres
          image: postgres
          ports:
            - containerPort: 5432

```

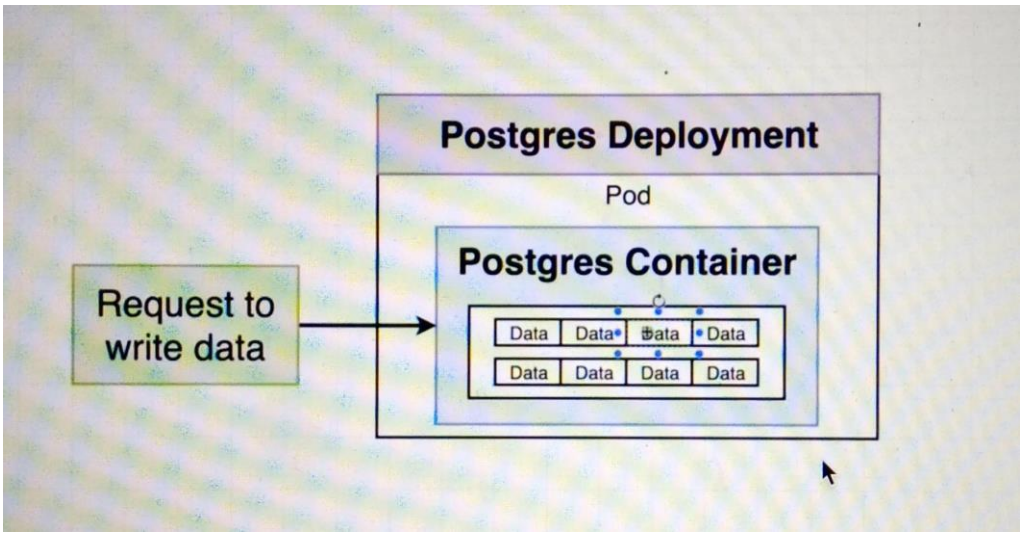
```
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl apply -f k8s
service/client-cluster-ip-service unchanged
deployment.apps/client-deployment unchanged
service/postgres-cluster-ip-service unchanged
deployment.apps/postgres-deployment created
service/redis-cluster-ip-service unchanged
deployment.apps/redis-deployment unchanged
service/server-cluster-ip-service unchanged
deployment.apps/server-deployment unchanged
deployment.apps/worker-deployment unchanged
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗
```

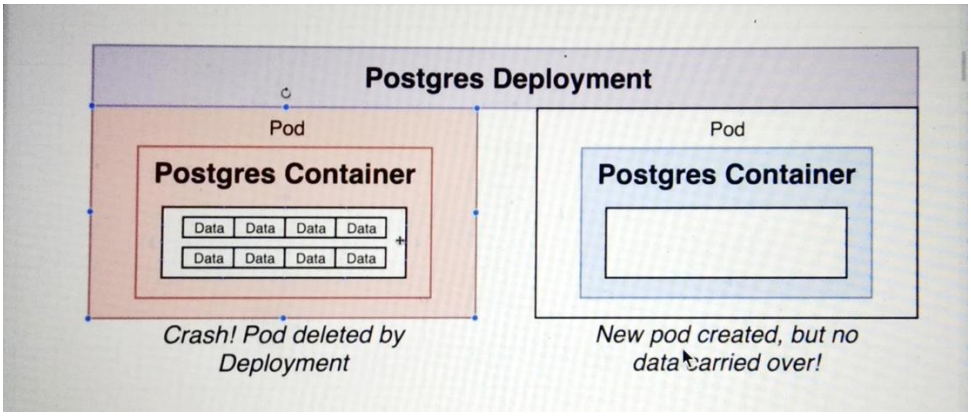
The Need for Volume with Database

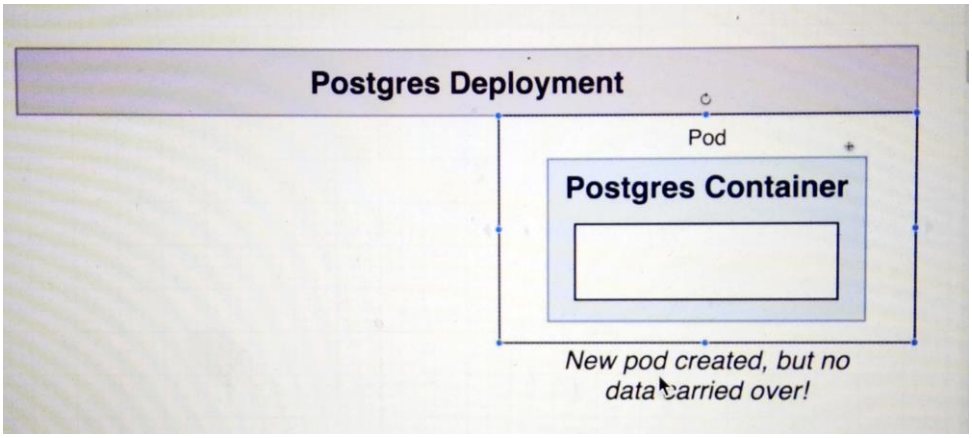


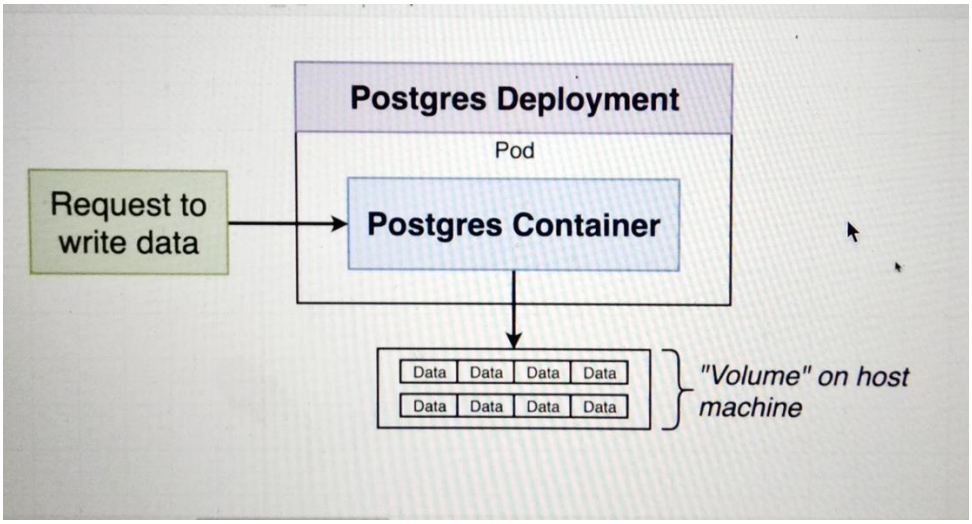
Volume is a consistent file system. Even if the pod crashes we have the data.

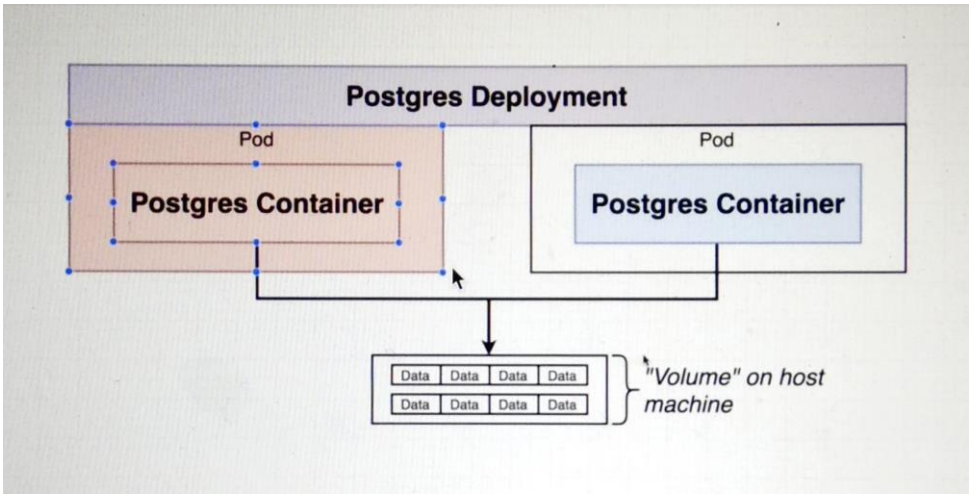
Running a multiple copies of postgres replicas, will access the same filesystem. It is the recipe for disaster. When we have replicas for database, we need to have a multiple configurations.

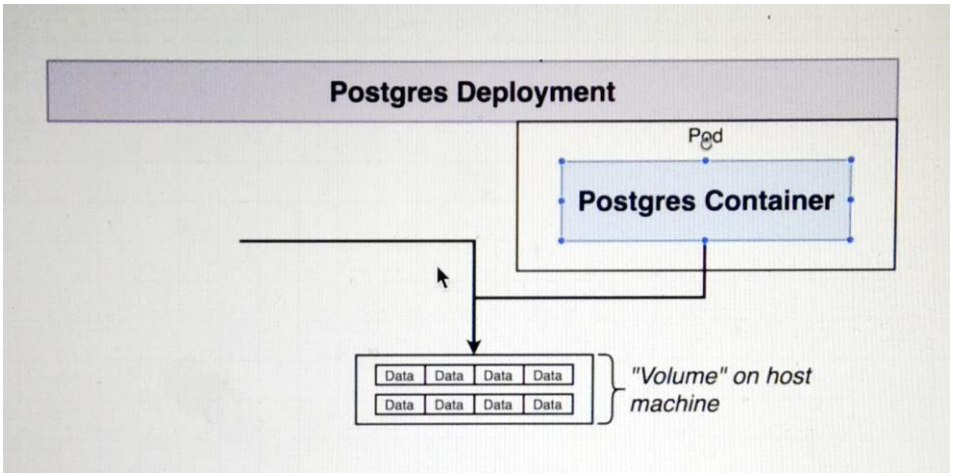



Postgres Deployment
Pod
Postgres Container
Data Data Data Data
Data Data Data Data
Pod
Postgres Container
Crash! Pod deleted by Deployment
New pod created, but no data carried over!


Postgres Deployment
Pod
Postgres Container
New pod created, but no data carried over!


Postgres Deployment
Pod
Request to write data
Postgres Container
Data Data Data Data
Data Data Data Data
"Volume" on host machine


Postgres Deployment
Pod
Postgres Container
Pod
Postgres Container
Data Data Data Data
Data Data Data Data
"Volume" on host machine



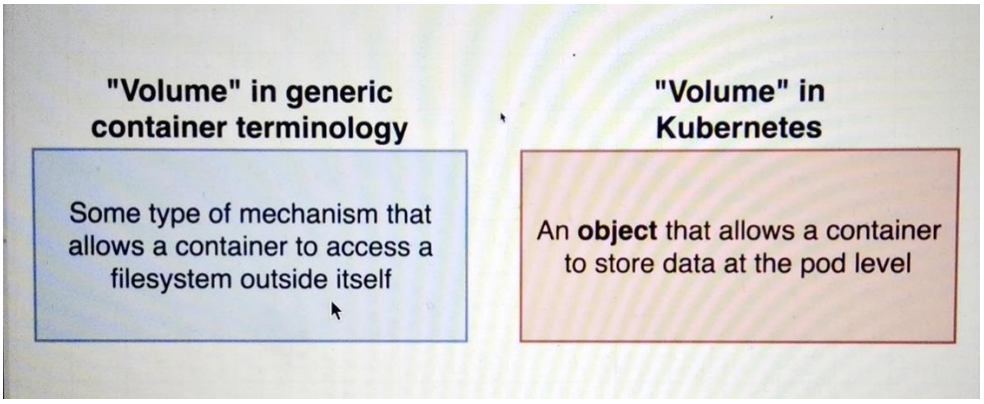
Kubernates Volume

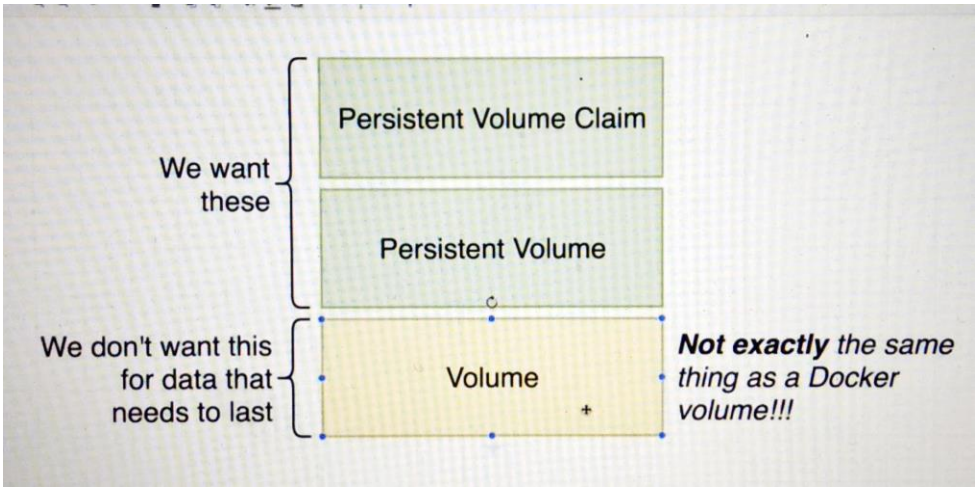
Storage tied directly to the specific pod.

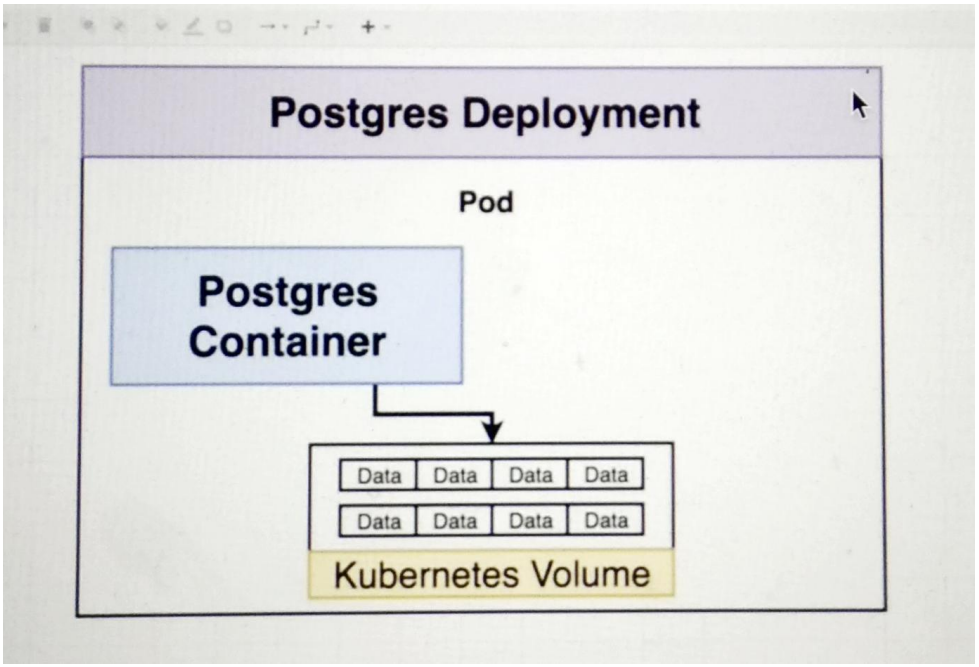
If any container crashes inside the pods, new container makes use of the existing data.

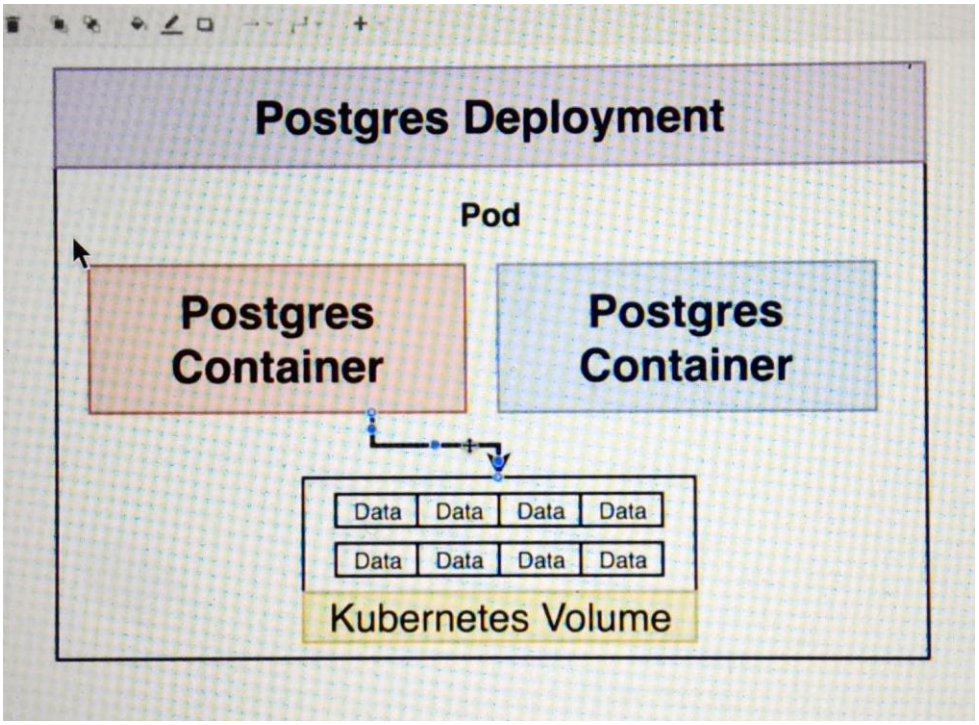
If the pod itself crashes, kubernates volume will be lost.

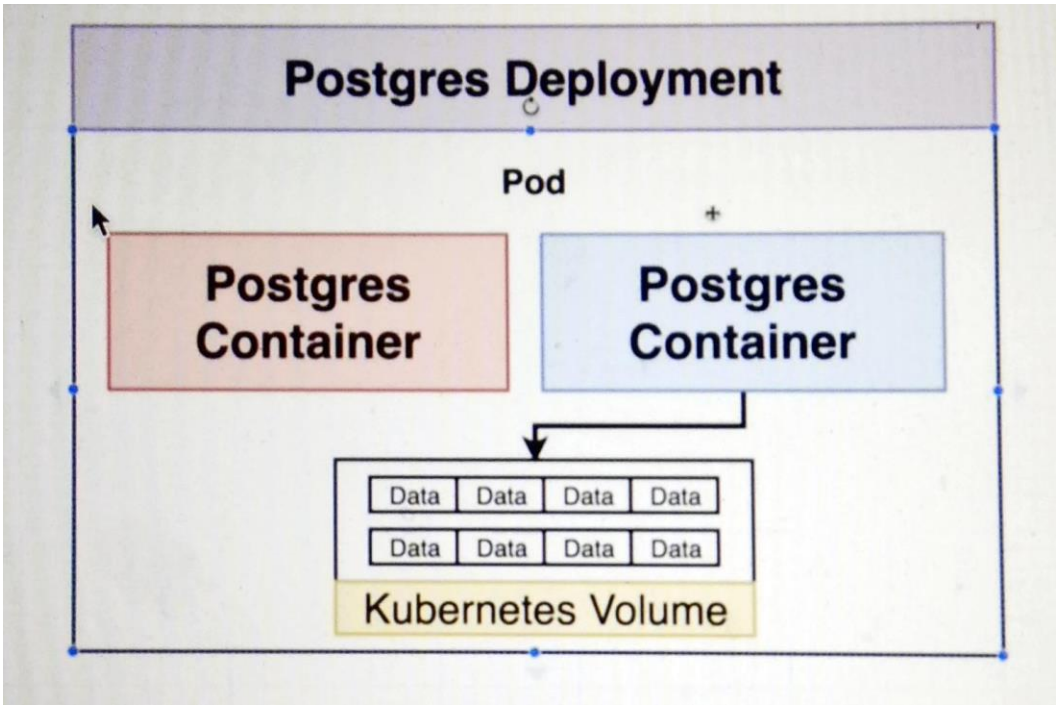
That is the reason we are going with Persistent volume claim.



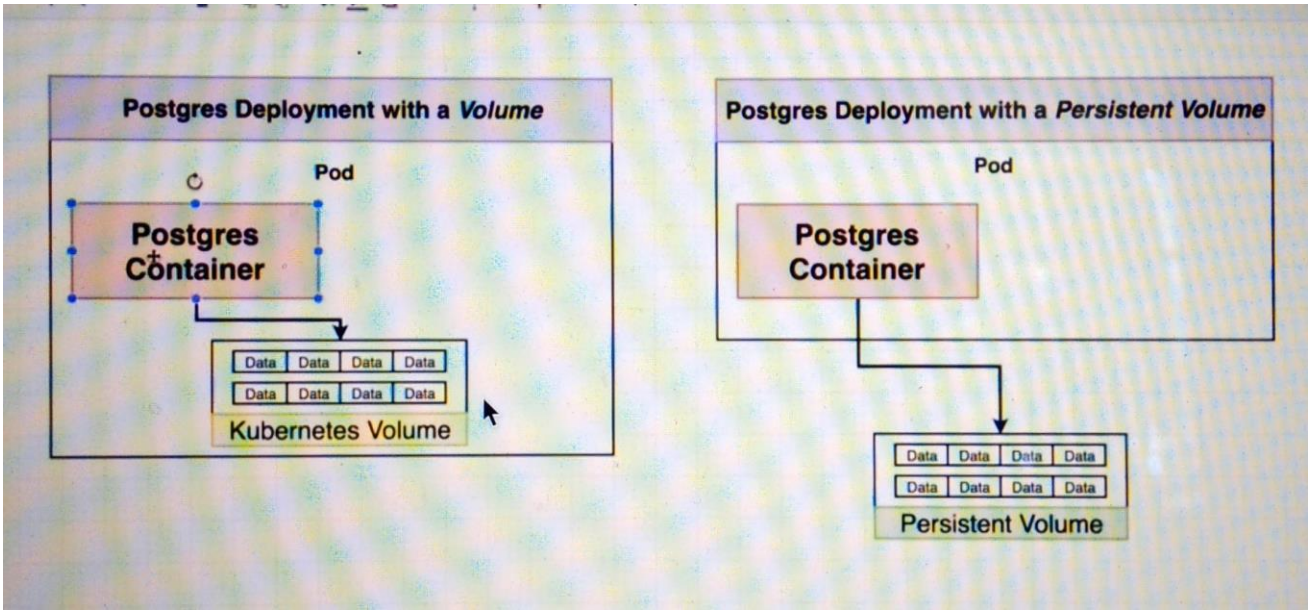



Postgres Deployment
Pod
Postgres Container
Data Data Data Data
Data Data Data Data
Kubernetes Volume


Postgres Deployment
Pod
Postgres Container
Postgres Container
Data Data Data Data
Data Data Data Data
Kubernetes Volume



Volume vs Persistent Volume

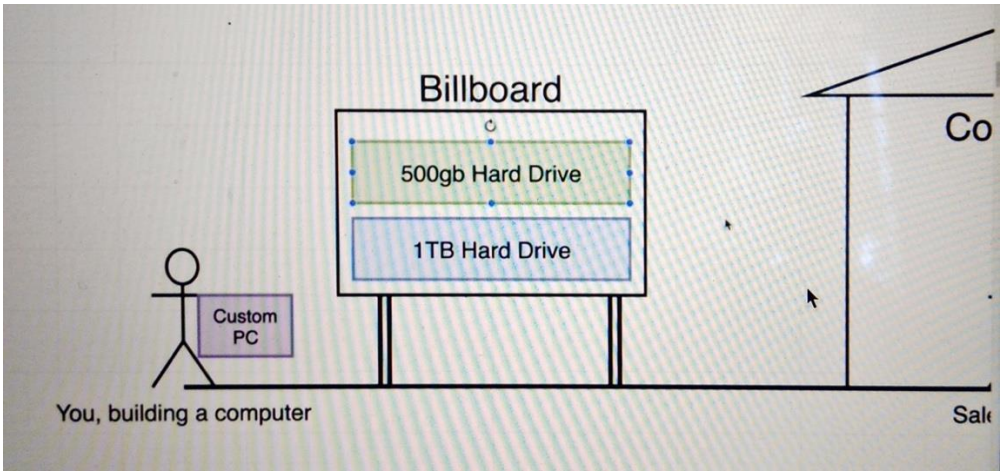


In case of persistent volume, even if the pod deleted or recreated, persistent volume stick around.

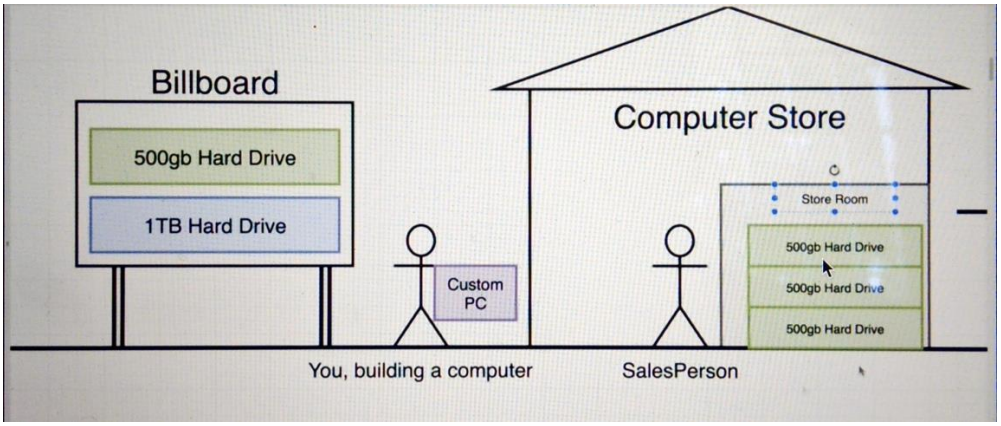
Persistent volume will last if the pod crashes.

Persistent Volume vs Persistent Volume Claim

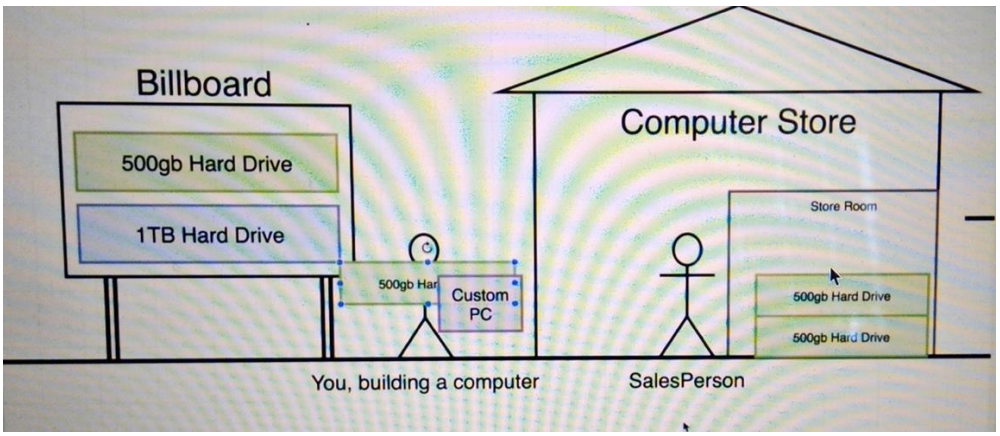
Customer sales person analogy for understanding persistent volume claim.



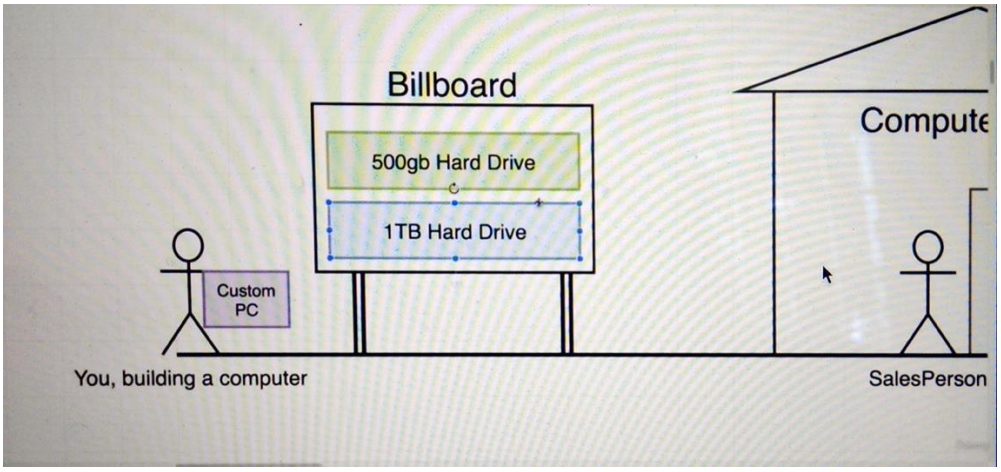
Asking for a 500gb hard drive.

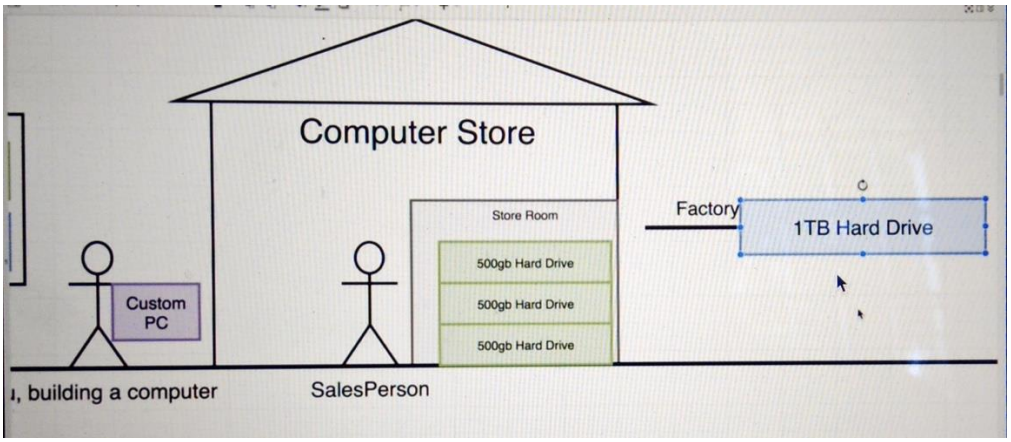


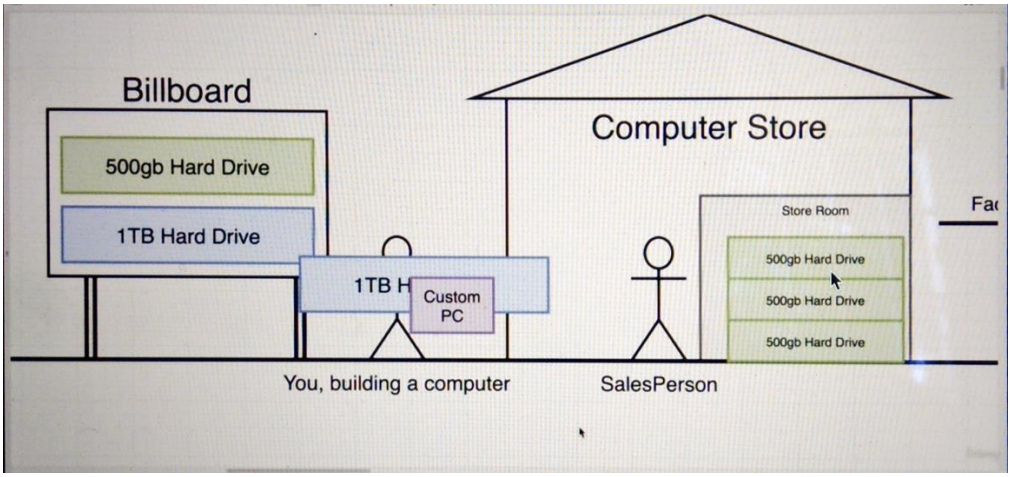
Available in the store. So purchased.



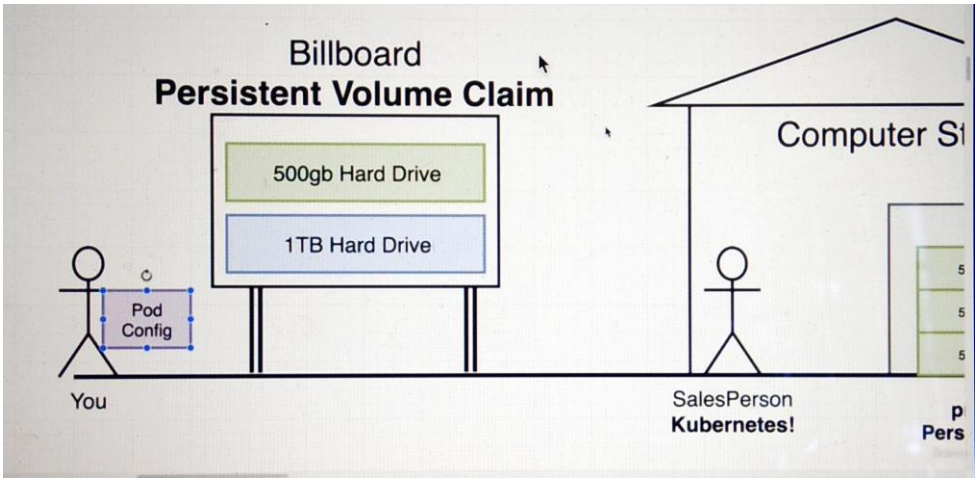
Coming to the store again. Now, we are asking for 1TB hard disk. But 1TB hard disk is not available in stock. So sales person immediate going to factory and manufacture it on sport. And Salesperson bring it back and handover to customer.

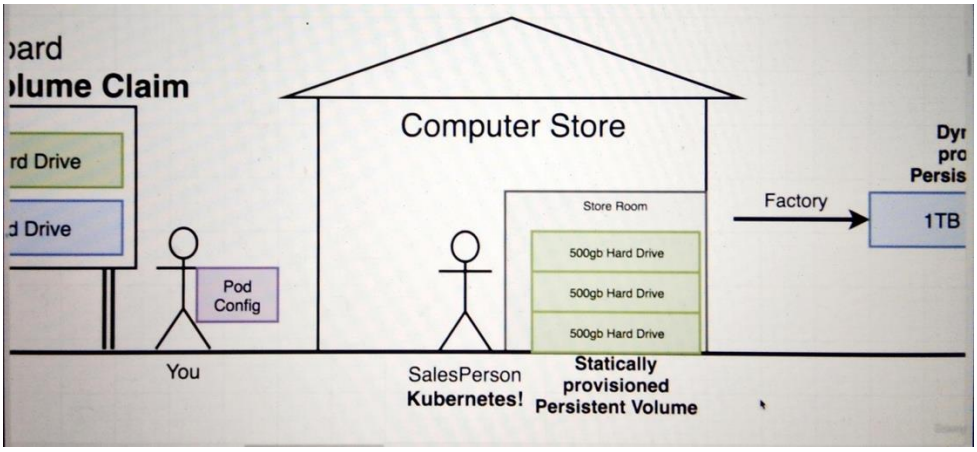


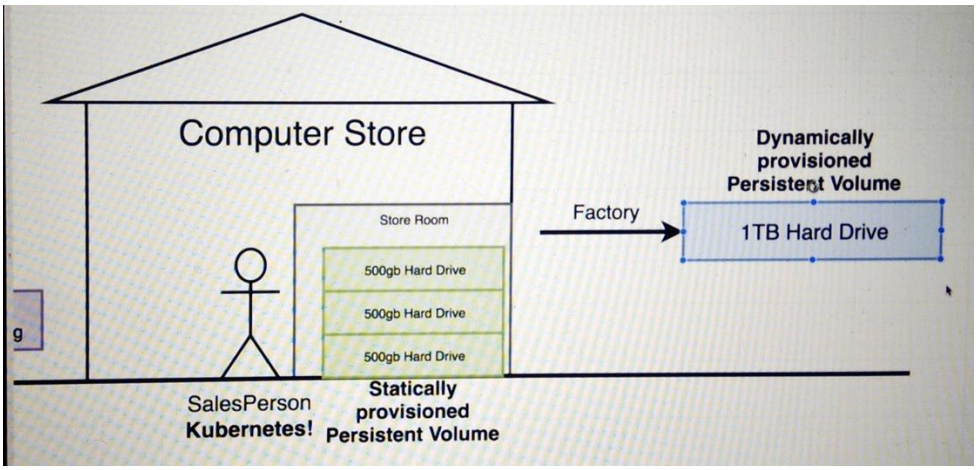




Kubernates version of the same story with different terms





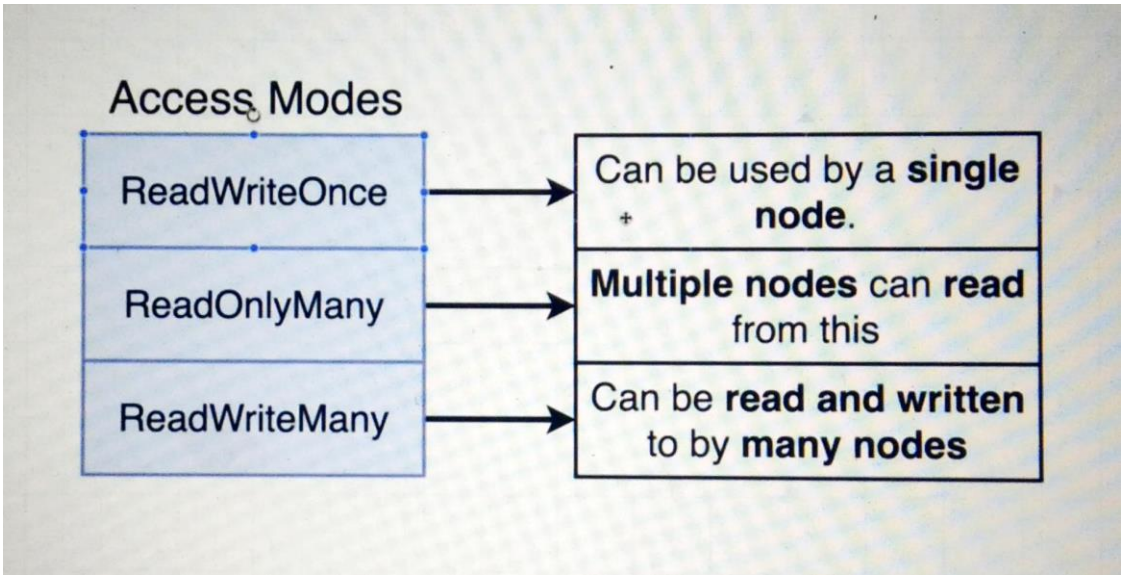


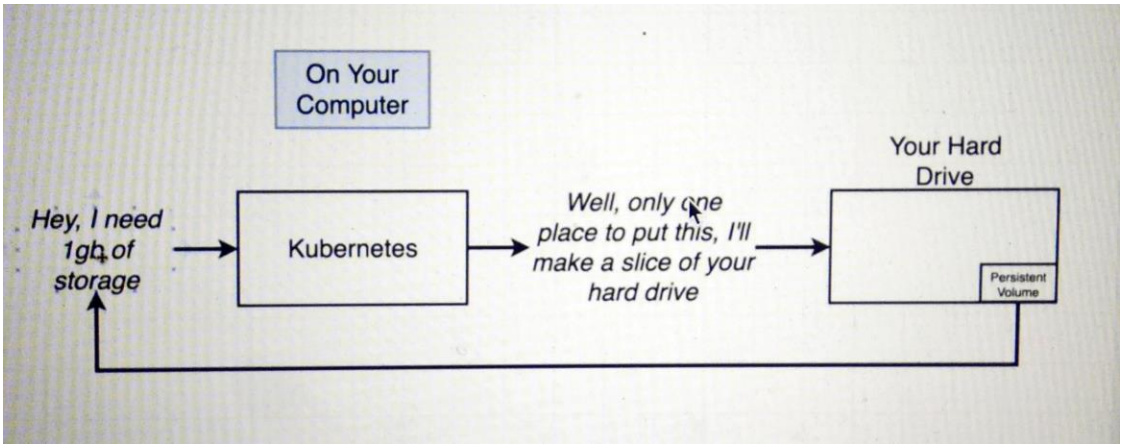
Persistent volume claim is an advertisement.

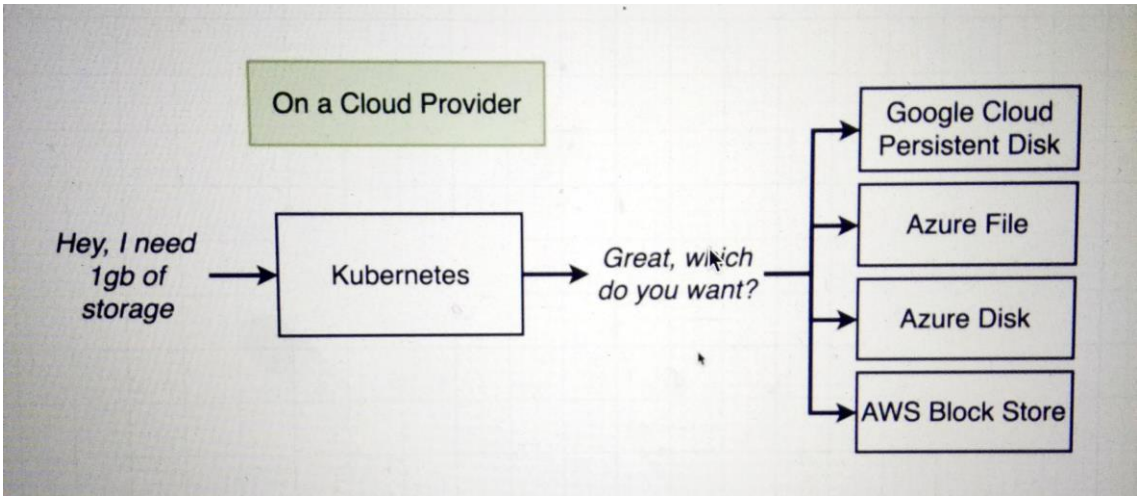
Claim Config Files

k8s > database-persistent-volume-claim.yaml

```yaml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: database-persistent-volume-claim
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 2Gi

```







Designating PVC in Pod Template

k8s > postgres-deployment.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: postgres-deployment
spec:
  replicas: 1
  selector:
    matchLabels:
      component: postgres
  template:
    metadata:
      labels:
        component: postgres
    spec:
      volumes:
        - name: postgres-storage
          persistentVolumeClaim:
            claimName: database-persistent-volume-claim
      containers:
        - name: postgres
          image: postgres
          ports:
            - containerPort: 5432
          volumeMounts:
            - name: postgres-storage
              mountPath: /var/lib/postgressql/data
              subPath: postgres

```

Applying a PVC

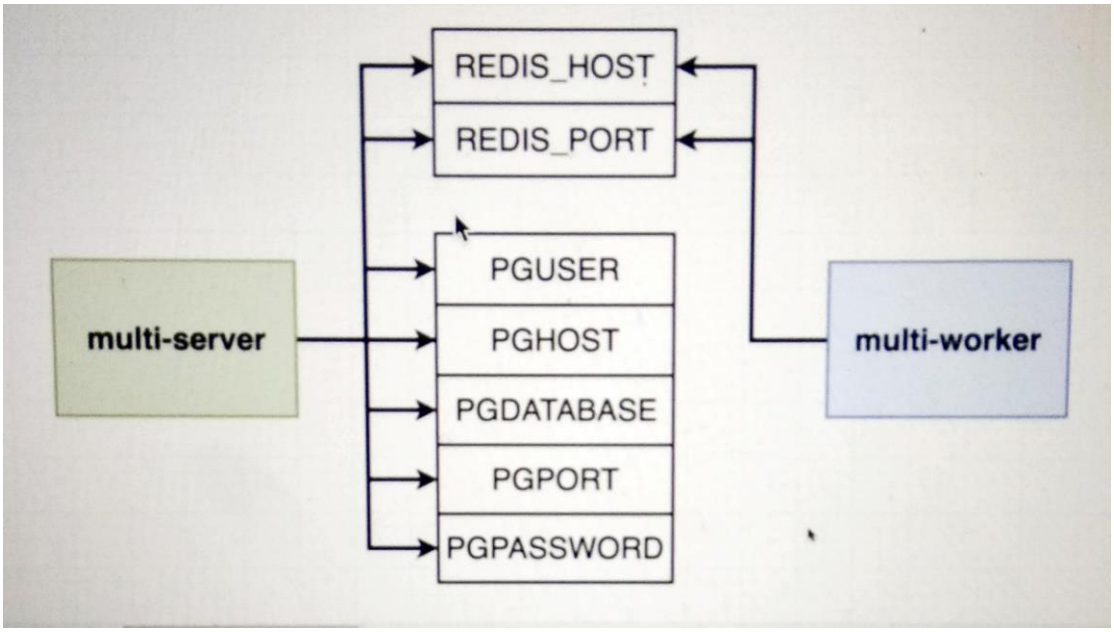
```
/Users/naveen.kumar17/.zshrc:68: no matches found: load?
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl apply -f k8s
service/client-cluster-ip-service unchanged
deployment.apps/client-deployment unchanged
persistentvolumeclaim/database-persistent-volume-claim created
service/postgres-cluster-ip-service unchanged
deployment.apps/postgres-deployment configured
service/redis-cluster-ip-service unchanged
deployment.apps/redis-deployment unchanged
service/server-cluster-ip-service unchanged
deployment.apps/server-deployment unchanged
deployment.apps/worker-deployment unchanged
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗
```

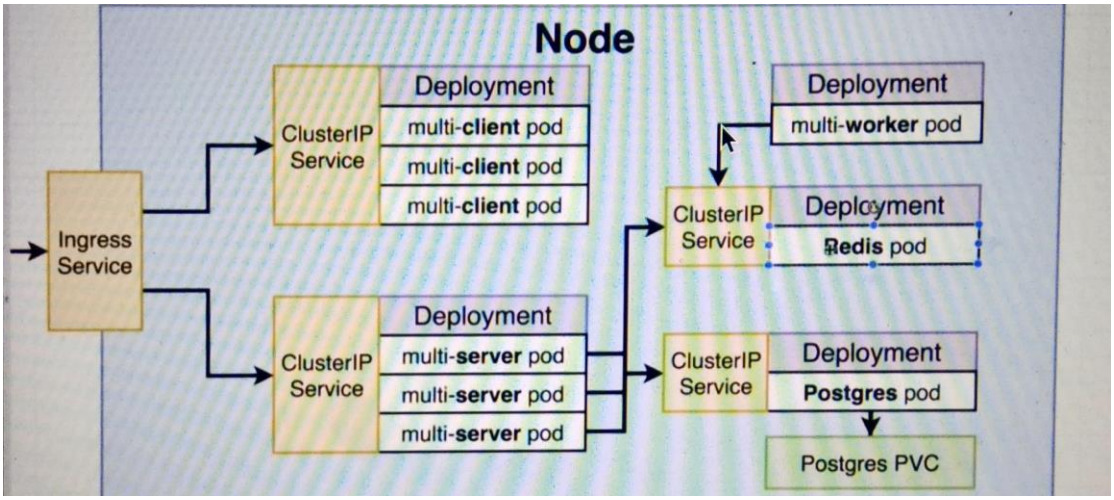
Get persistent volume in kubernates cluster

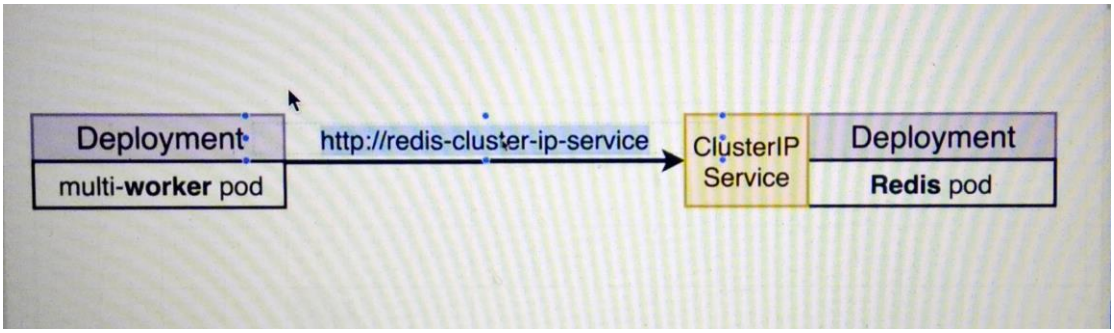
```
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get pv
NAME                                       CAPACITY   ACCESS MODES   RECLAIM POLICY   STATUS   CLAI
M                                    STORAGECLASS   REASON   AGE
pvc-d2b9d88c-743c-455b-9277-daed76e6caf2   2Gi        RWO            Delete           Bound    defa
ult/database-persistent-volume-claim   hostpath                21s
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗
```

Defining Environment Variable

Environment Variables







Updating the config file

k8s > worker-deployment.yaml

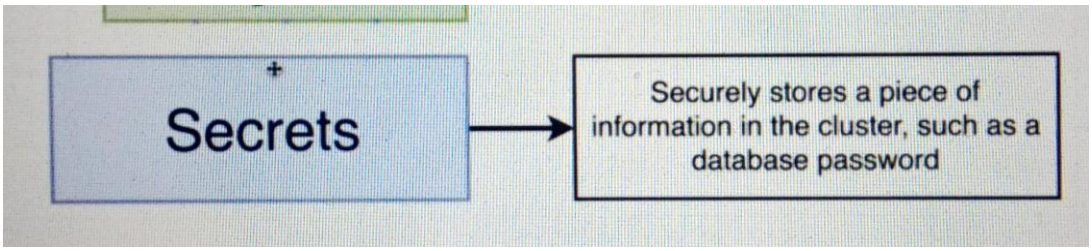
```yaml
  replicas: 1
  selector:
    matchLabels:
      component: worker
  template:
    metadata:
      labels:
        component: worker
    spec:
      containers:
        - name: worker
          image: stephengrider/multi-worker
          env:
            - name: REDIS_HOST
              value: redis-cluster-ip-service
            - name: REDIS_PORT
              value: 6379

```

k8s > server-deployment.yaml

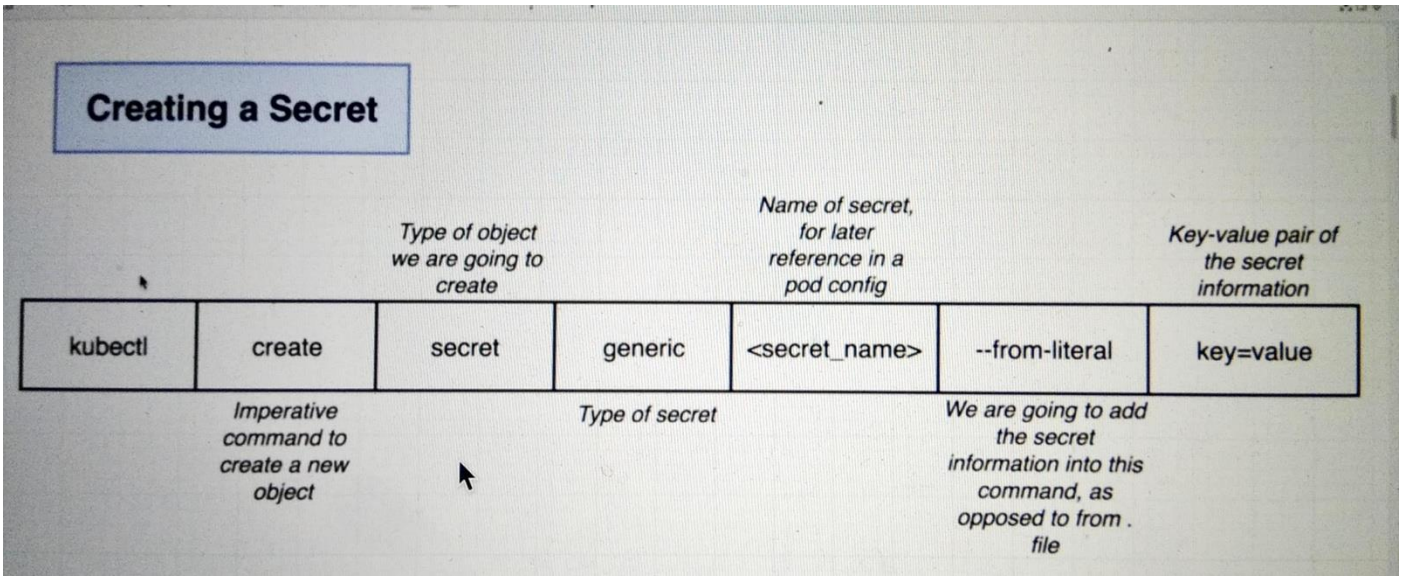
```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: server-deployment
spec:
  replicas: 3
  selector:
    matchLabels:
      component: server
  template:
    metadata:
      labels:
        component: server
    spec:
      containers:
        - name: server
          image: stephengrider/multi-server
          ports:
            - containerPort: 5000
          env:
            - name: REDIS_HOST
              value: redis_cluster_ip_service
            - name: REDIS_PORT
              value: 6379
            - name: PGUSER
              value: postgres
            - name: PGHOST
              value: postgres-cluster-ip-service
            - name: PGDATABASE
              value: postgres

```

Creating an encoded secret

Kubernates secret object



Kubernates command for creating a secret

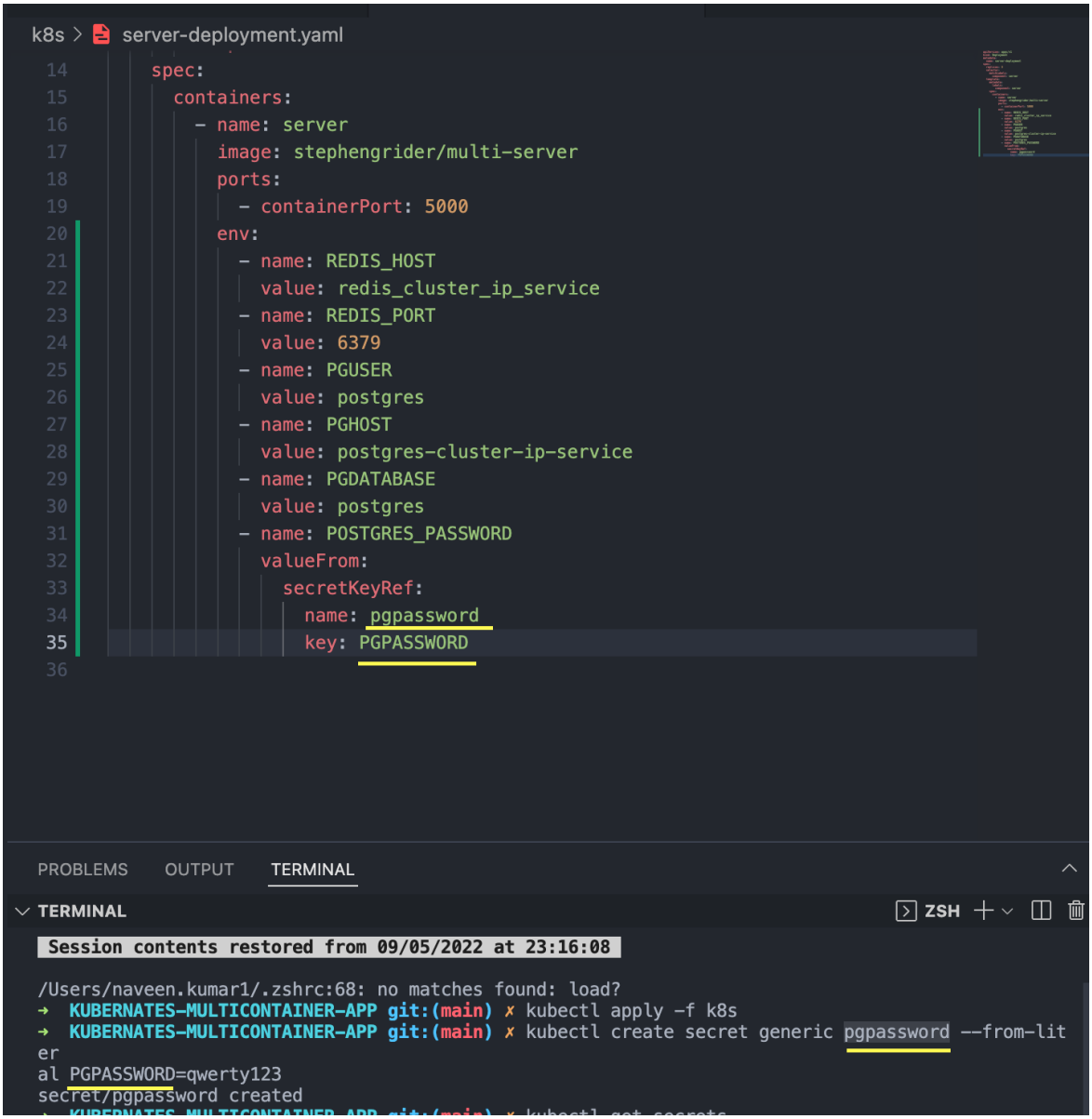


Type of secret

- Tls
- Docker-registry
- Generic

```
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl create secret generic pgpassword --from-liter
al PGPASSWORD=qwerty123
secret/pgpassword created
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get secrets
NAME                  TYPE                                  DATA   AGE
default-token-d549x   kubernetes.io/service-account-token   3      30d
pgpassword            Opaque                                1      18s
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗
```

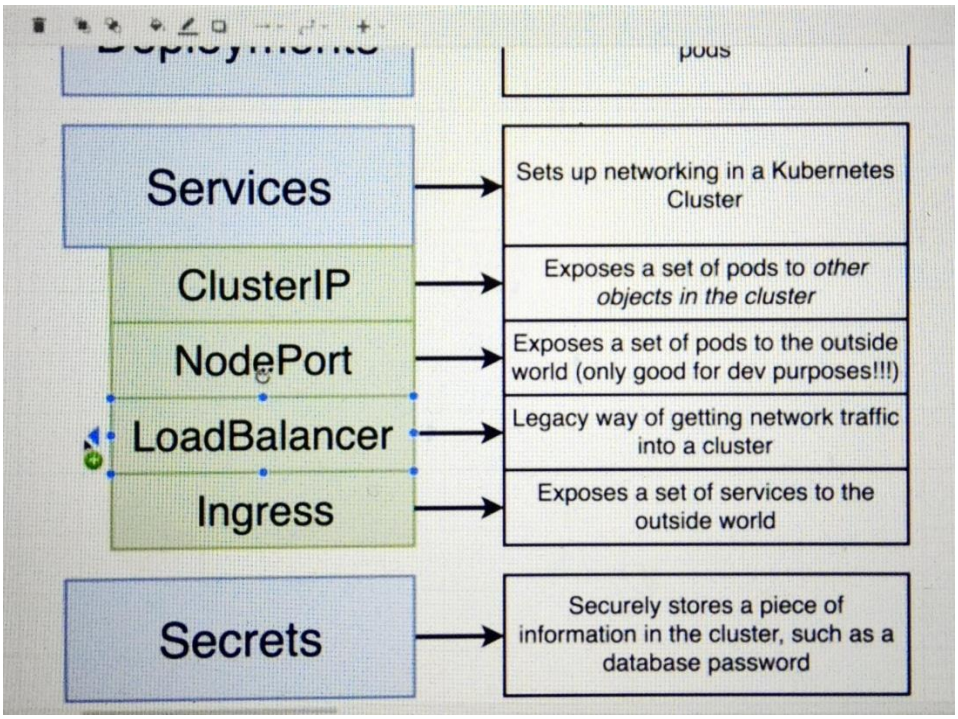
Updating the config file

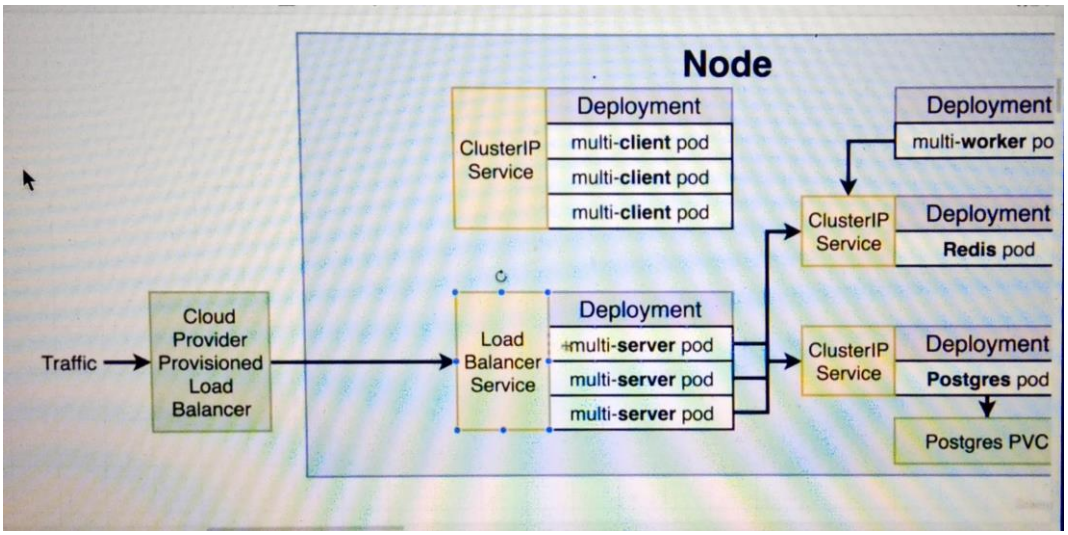


Applying config file.

Handling the traffic with Ingress Controller

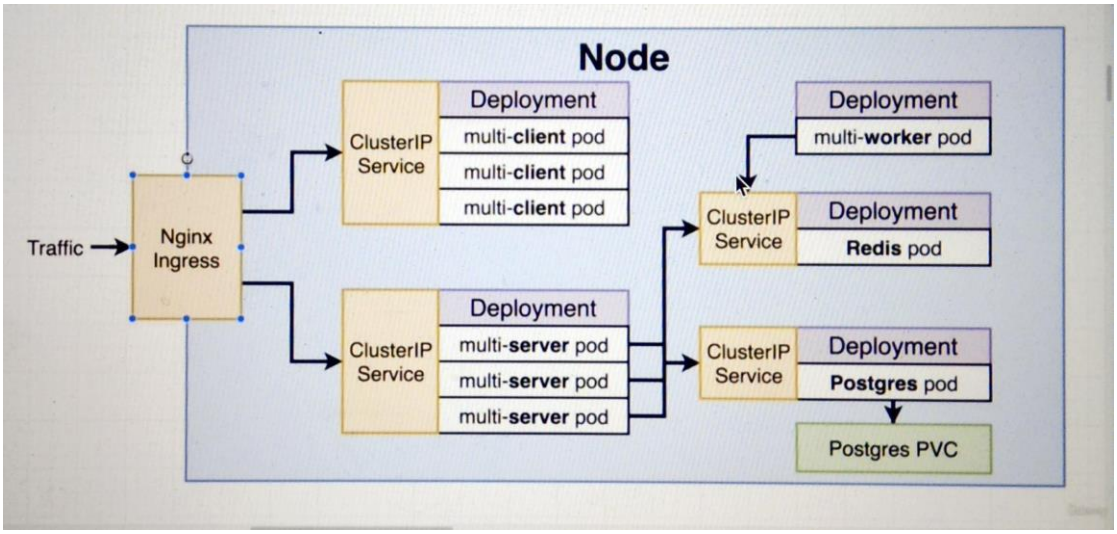
Load Balancer Services

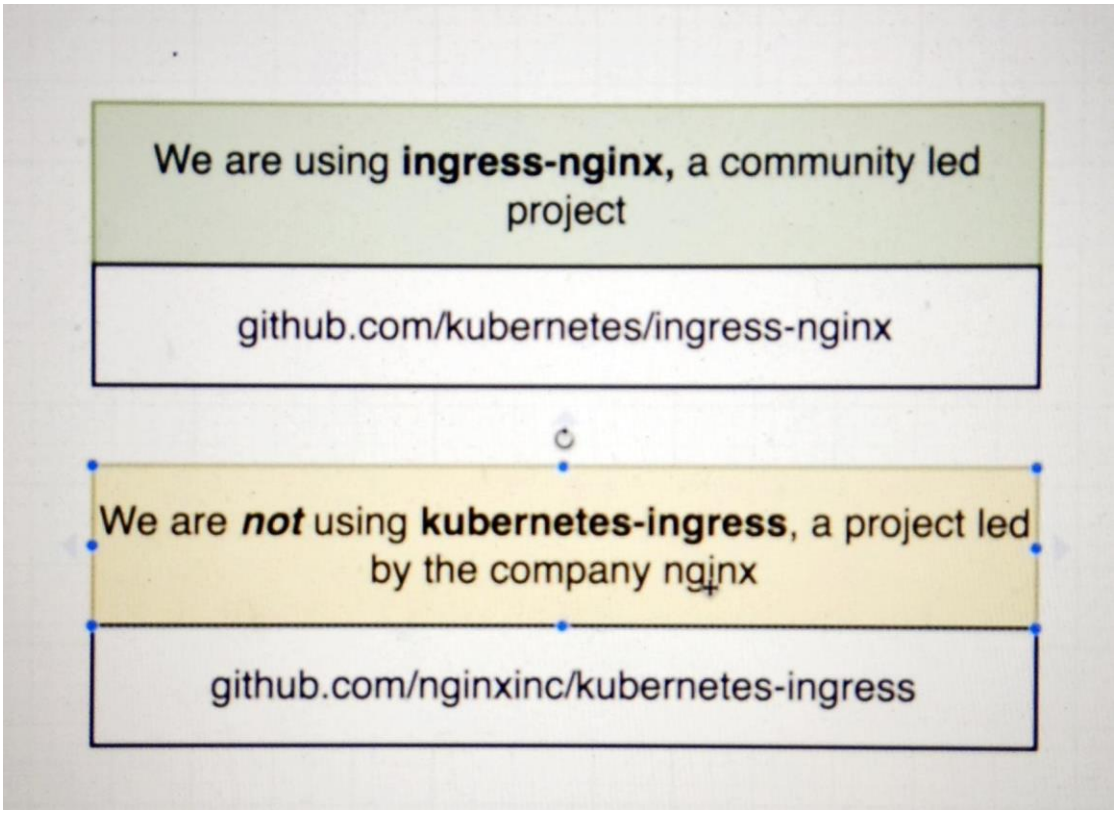




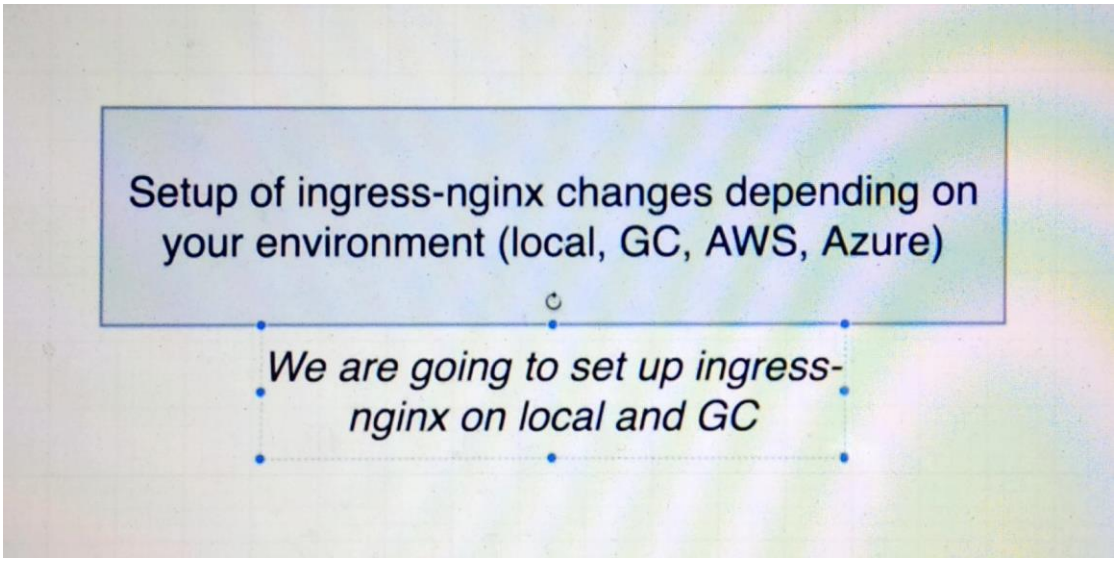
Load balancer is specific to pods.

Quick notes in Ingress

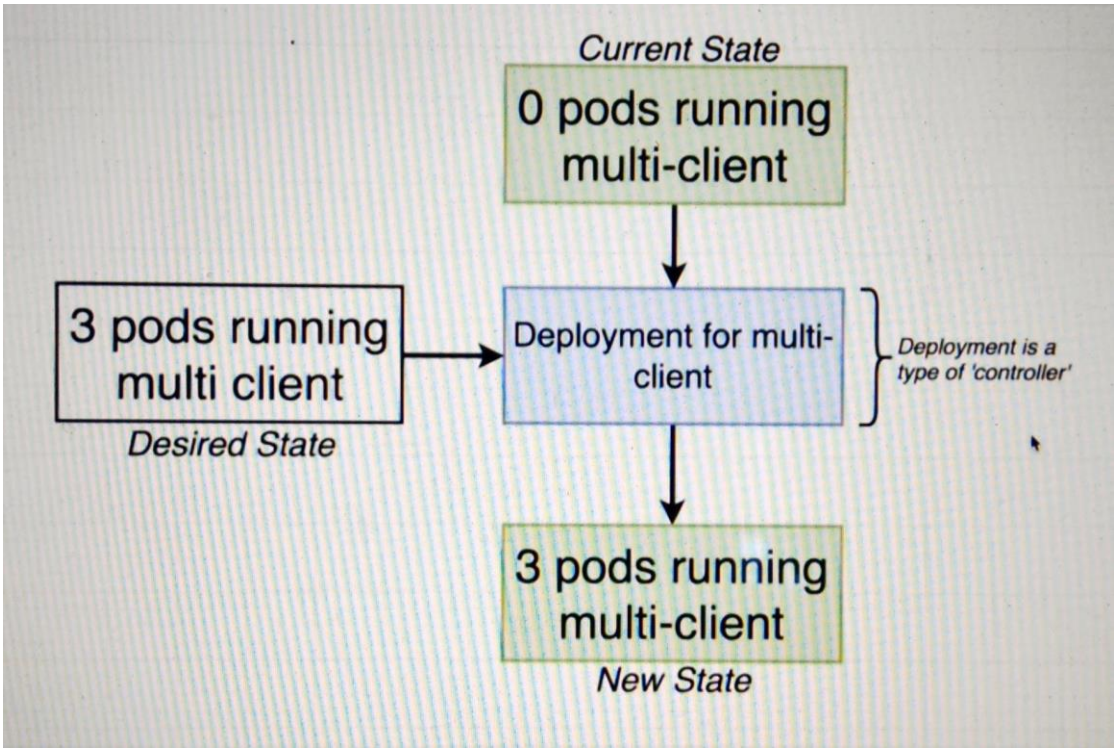




We are going to use ingress-nginx.

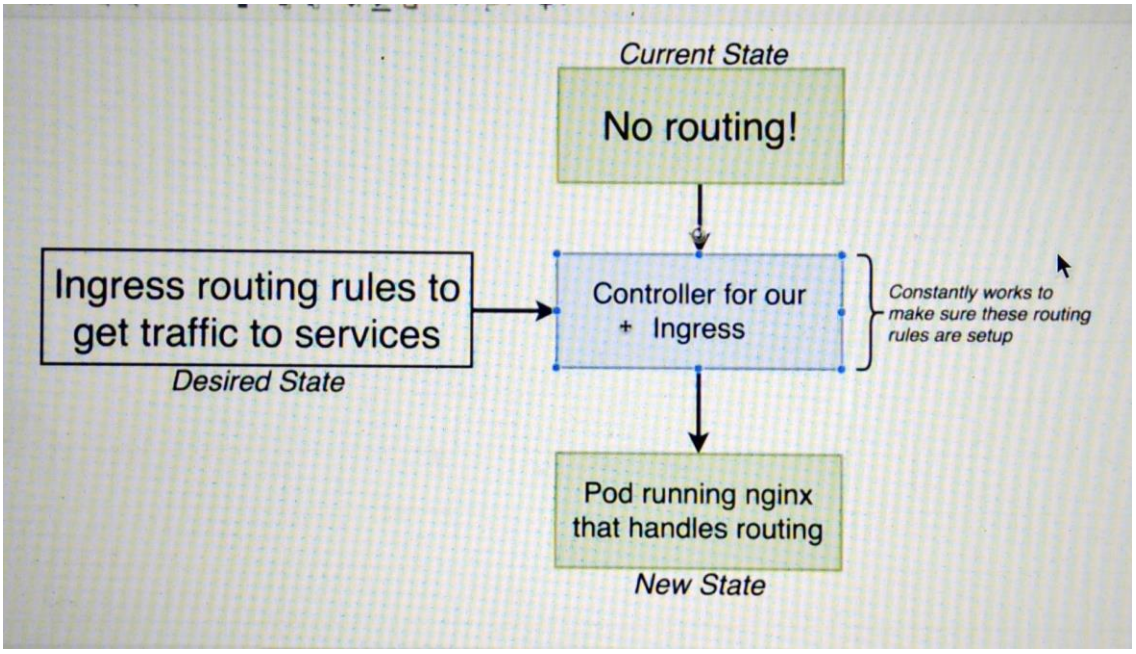


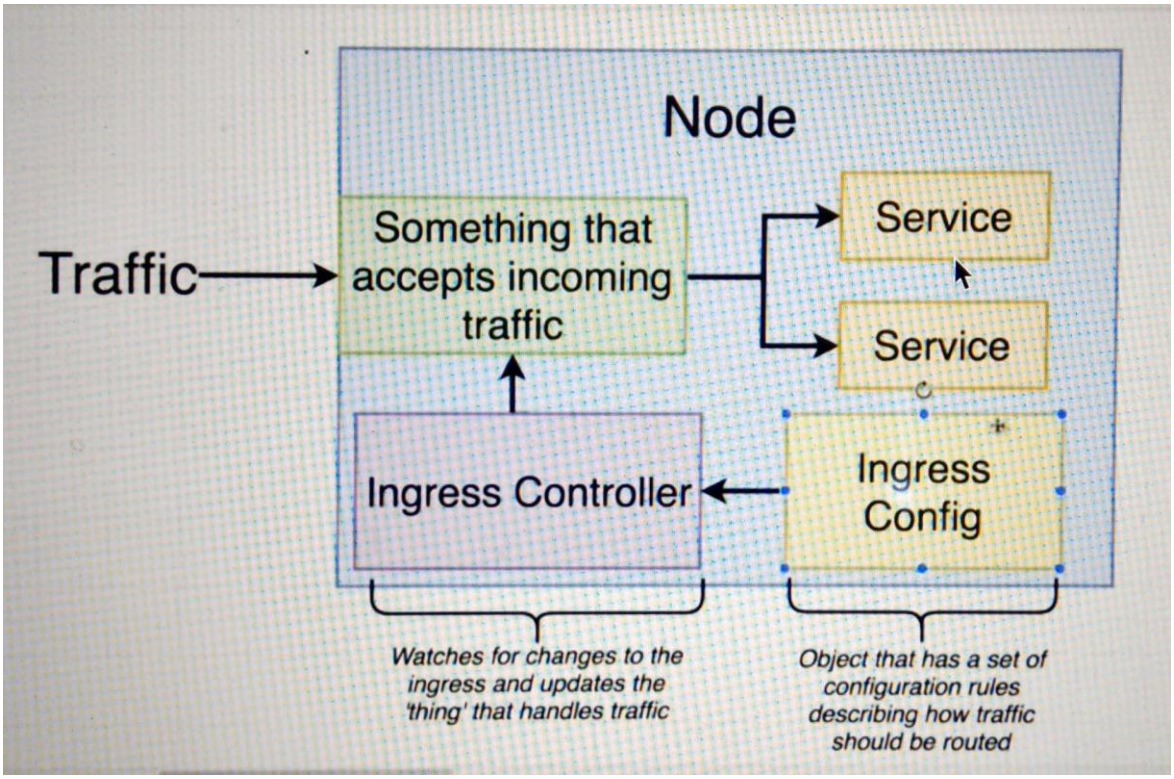
Behind the Scenes of Ingress

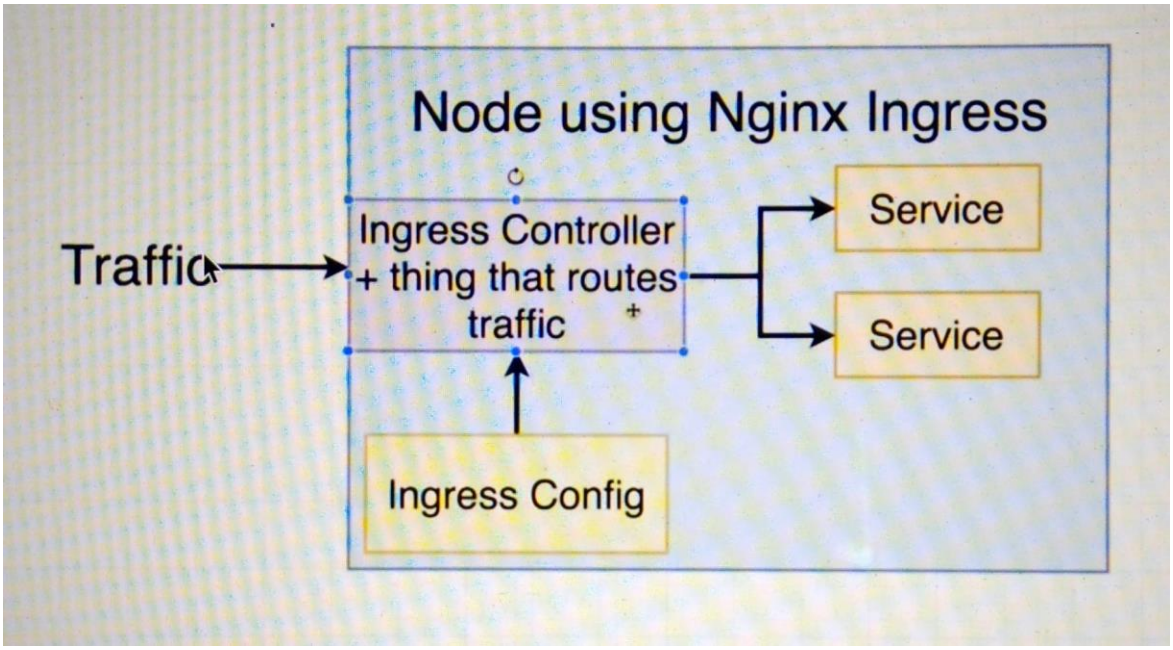


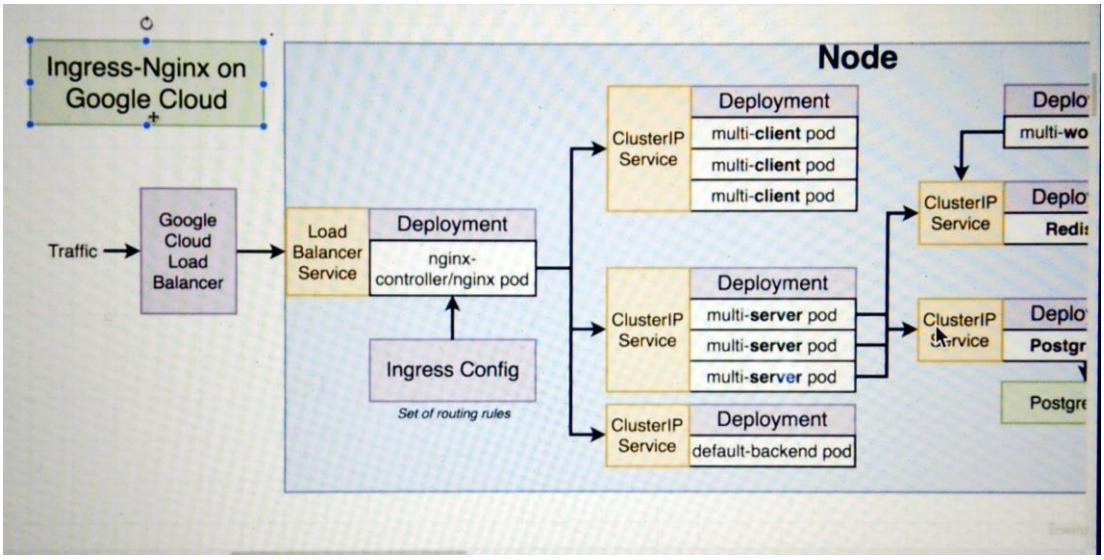
In kubernates, controller means any type of object constantly runs in background to make the desired state.

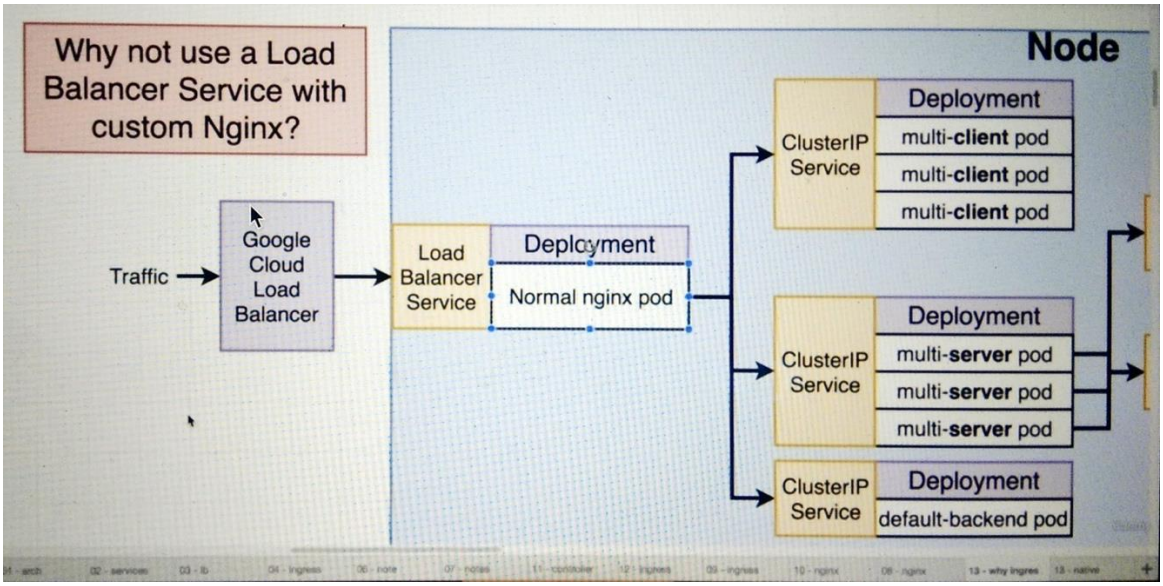
Same thing applies to ingress also.


Current State
No routing!
Ingress routing rules to get traffic to services
Desired State
Controller for our + Ingress
Constantly works to make sure these routing rules are setup
Pod running nginx that handles routing
New State


Node
Traffic
Something that accepts incoming traffic
Service
Service
Ingress Controller
Ingress Config
Watches for changes to the ingress and updates the 'thing' that handles traffic
Object that has a set of configuration rules describing how traffic should be routed







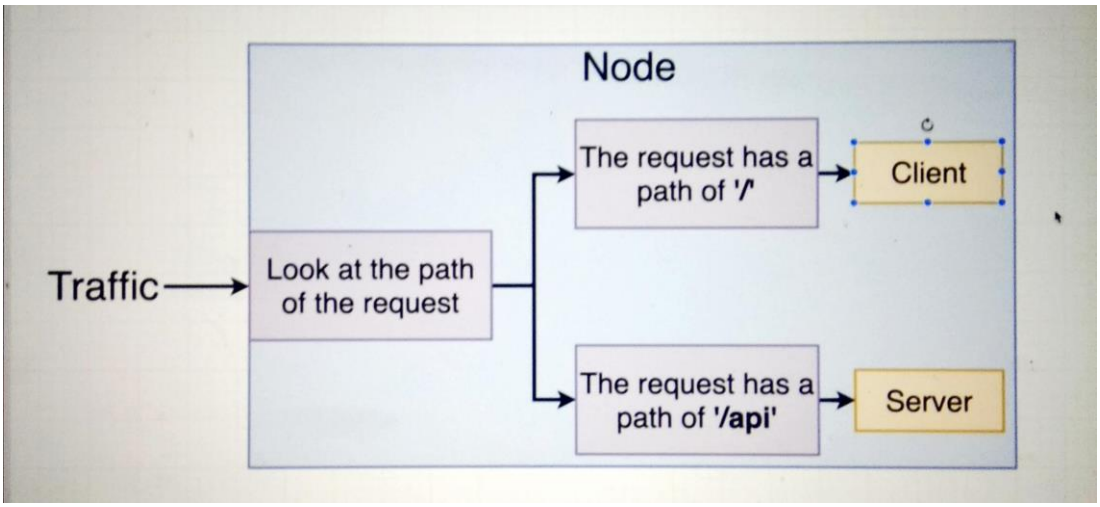
Nginx helps to route the request directly to pod, ability to bypass the multi-client pod.

https://www.joyfulbikeshedding.com/blog/2018-03-26-studying-the-kubernetes-ingress-system.html

Setting up Ingress Locally with Minikube

```
→  DOCKER_KUBE git:(main) ✗ kubectl apply -f https://raw.githubusercontent.com/kubernetes/ingress-nginx/controller-v1.2.0/deploy/static/provider/cloud/deploy.yaml
namespace/ingress-nginx created
serviceaccount/ingress-nginx created
serviceaccount/ingress-nginx-admission created
role.rbac.authorization.k8s.io/ingress-nginx created
role.rbac.authorization.k8s.io/ingress-nginx-admission created
clusterrole.rbac.authorization.k8s.io/ingress-nginx created
clusterrole.rbac.authorization.k8s.io/ingress-nginx-admission created
rolebinding.rbac.authorization.k8s.io/ingress-nginx created
rolebinding.rbac.authorization.k8s.io/ingress-nginx-admission created
clusterrolebinding.rbac.authorization.k8s.io/ingress-nginx created
clusterrolebinding.rbac.authorization.k8s.io/ingress-nginx-admission created
configmap/ingress-nginx-controller created
service/ingress-nginx-controller created
service/ingress-nginx-controller-admission created
deployment.apps/ingress-nginx-controller created
job.batch/ingress-nginx-admission-create created
job.batch/ingress-nginx-admission-patch created
ingressclass.networking.k8s.io/nginx created
validatingwebhookconfiguration.admissionregistration.k8s.io/ingress-nginx-admission created
```

kubectl apply -f https://raw.githubusercontent.com/kubernetes/ingress-nginx/controller-v1.2.0/deploy/static/provider/cloud/deploy.yaml



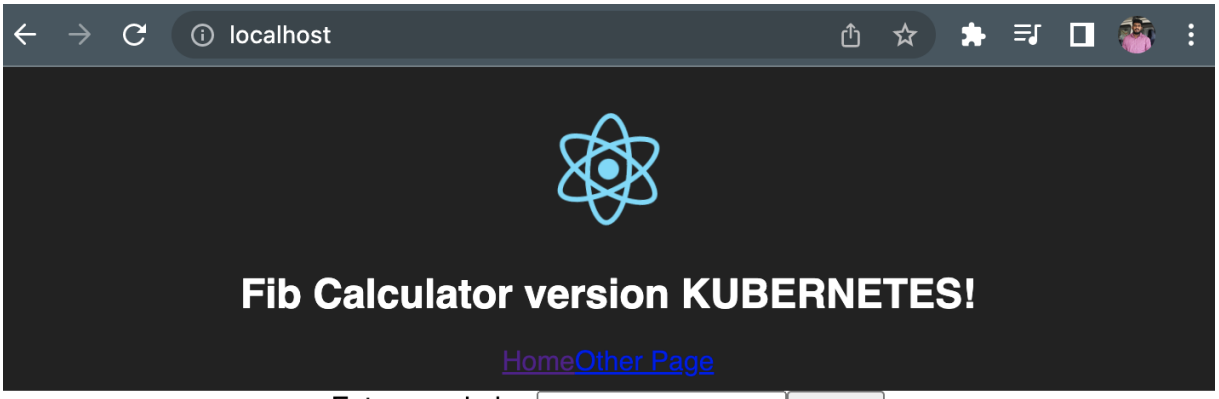
Ingress Config File

k8s > ingress-service.yaml

```yaml
apiVersion: networking.k8s.io/v1
# UPDATE API
kind: Ingress
metadata:
  name: ingress-service
  annotations:
    kubernetes.io/ingress.class: "nginx"
    nginx.ingress.kubernetes.io/use-regex: "true"
    # ADD ANNOTATION
    nginx.ingress.kubernetes.io/rewrite-target: /$1
    # UPDATE ANNOTATION
spec:
  rules:
    - http:
        paths:
          - path: /?(.*)
            # UPDATE PATH
            pathType: Prefix
            # ADD PATHTYPE
            backend:
              service:
                # UPDATE SERVICE FIELDS
                name: client-cluster-ip-service
                port:
                  number: 3000
          - path: /api/?(.*)
            # UPDATE PATH
            pathType: Prefix
            # ADD PATHTYPE
            backend:
              service:
                # UPDATE SERVICE FIELDS
                name: server-cluster-ip-service
                port:
                  number: 5000
```

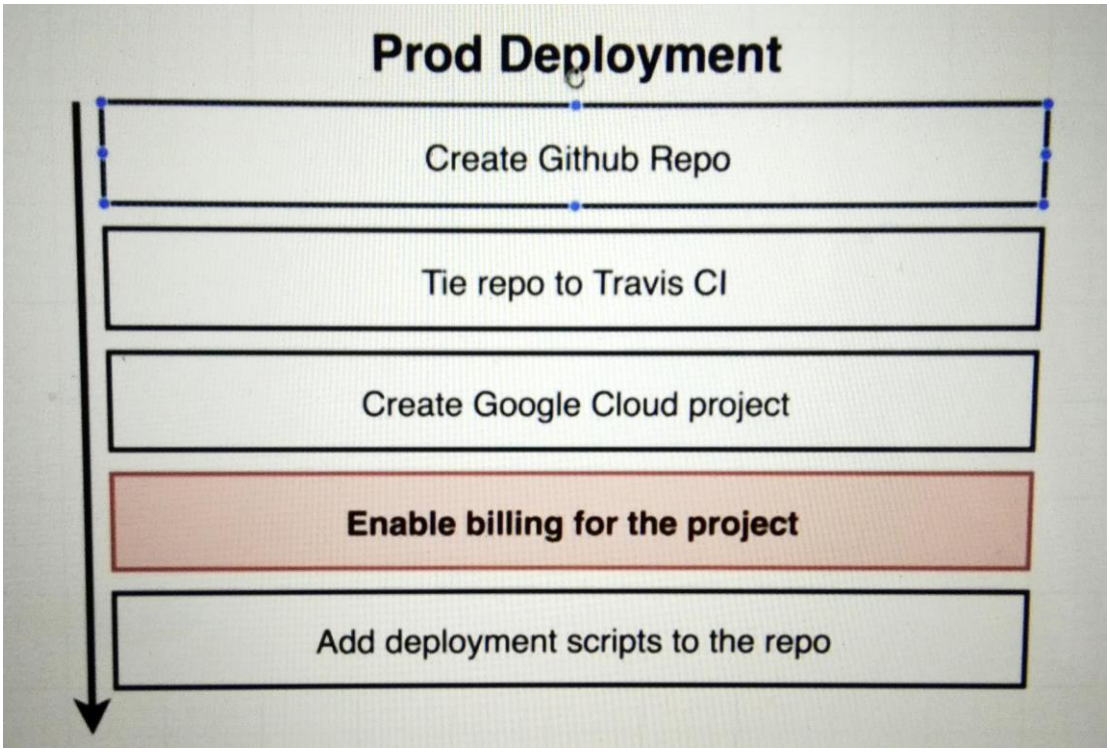
Applying the config file.

```
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl apply -f k8s
service/client-cluster-ip-service unchanged
deployment.apps/client-deployment unchanged
persistentvolumeclaim/database-persistent-volume-claim unchanged
ingress.networking.k8s.io/ingress-service created
service/postgres-cluster-ip-service unchanged
deployment.apps/postgres-deployment unchanged
service/redis-cluster-ip-service unchanged
deployment.apps/redis-deployment unchanged
service/server-cluster-ip-service unchanged
deployment.apps/server-deployment unchanged
deployment.apps/worker-deployment unchanged
```


localhost
Fib Calculator version KUBERNETES!
HomeOther Page
Enter your index:
Submit
Indexes I have seen:
Calculated Values:

Kubernates Production Deployment

Deployment Steps



We have a option to avail free google cloud credits.

Free Google Cloud Credits

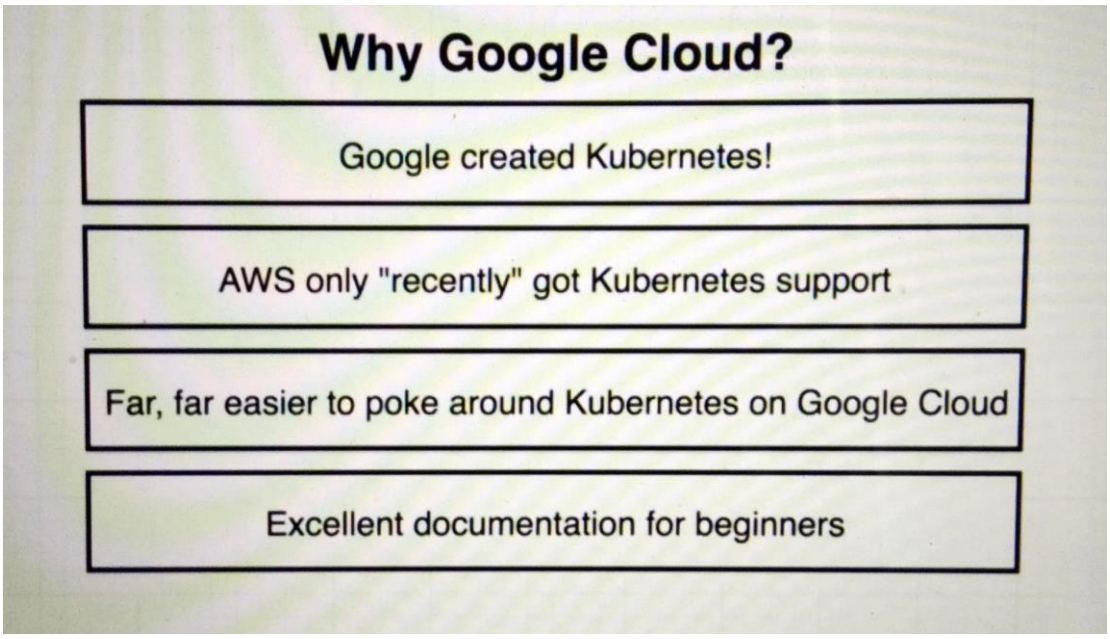
In the next section, we are going to start creating our project on Google Cloud.

Remember, creating Kubernetes clusters on Google Cloud costs real money! If you are sensitive to spending money, you can try getting some free Google Cloud credits using this link:

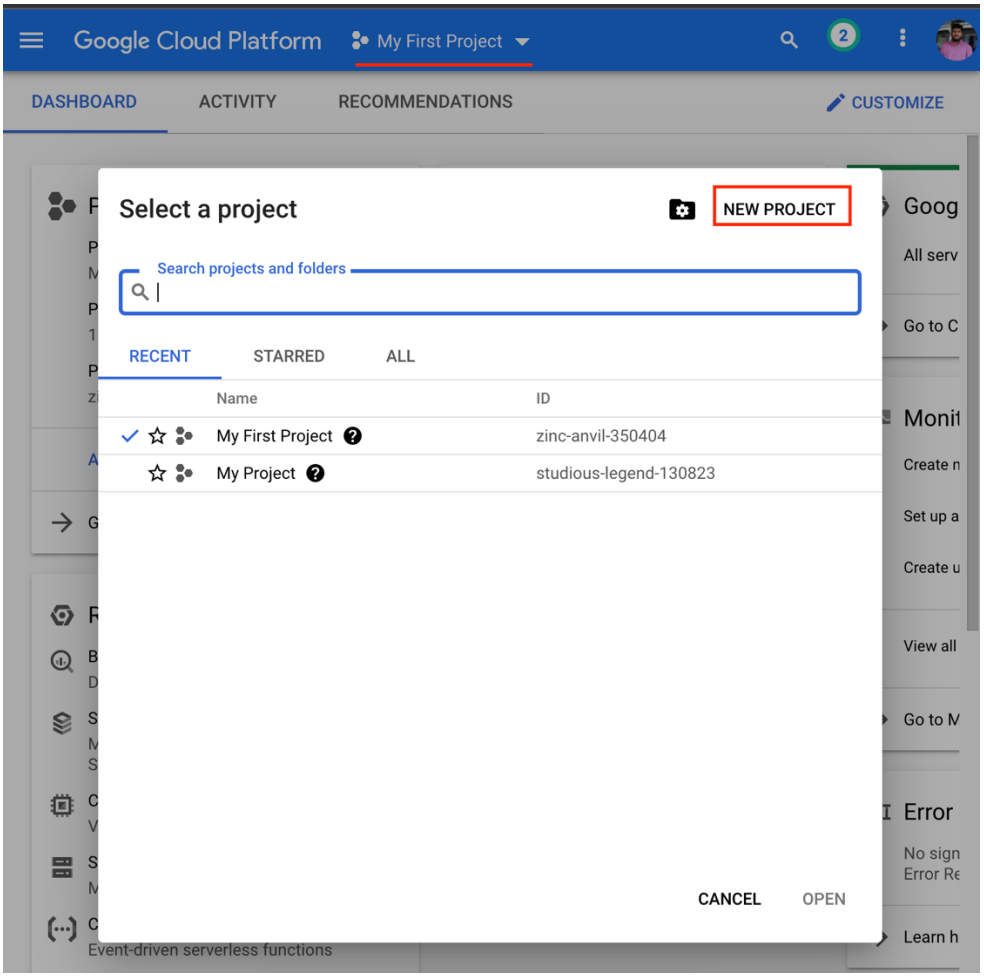
https://cloud.google.com/free

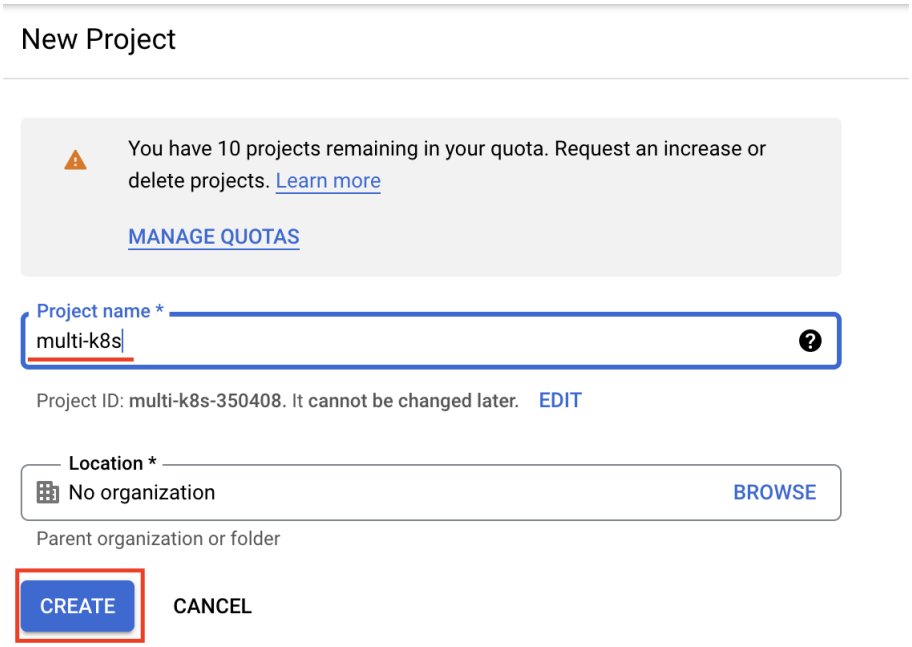
Important! If you already have a Google Cloud account you will have to sign out of it and create a new account in order to get those free credits!

Google Cloud



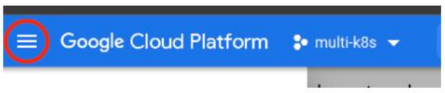
Creating a project in Google Cloud



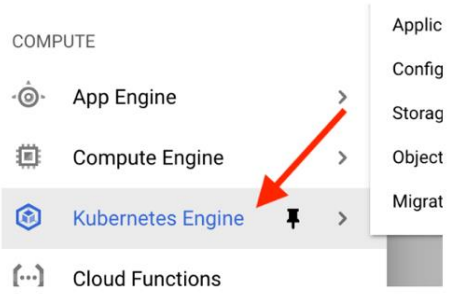


Creating Kubernates Engine and starting the cluster in GCP

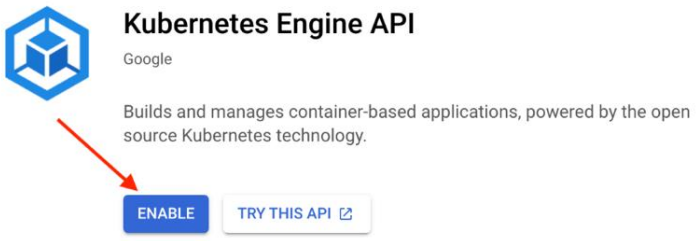
1. Click the Hamburger menu on the top left-hand side of the dashboard.



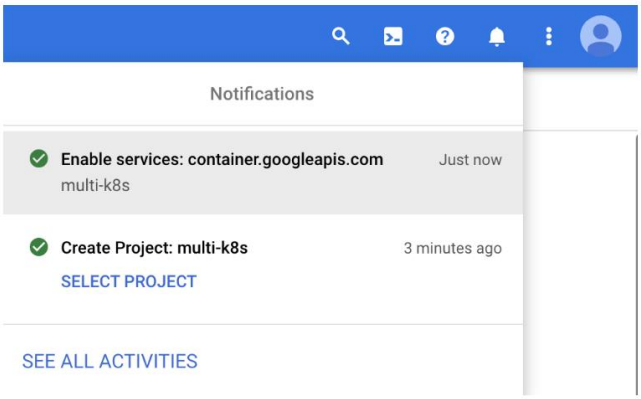
2. Click **Kubernetes Engine**



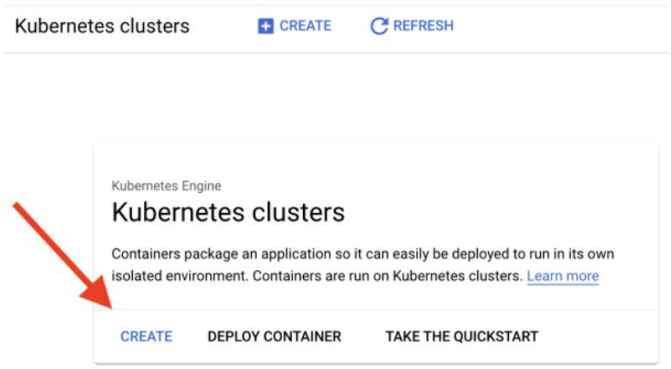
3. Click the **ENABLE** button to enable the Kubernetes API for this project.



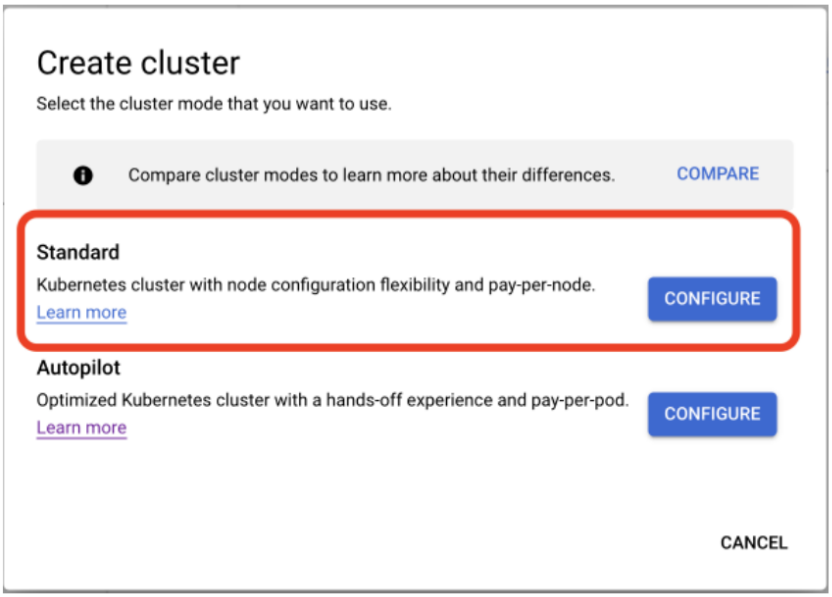
4. After a few minutes of waiting, clicking the **bell** icon in the top right part of the menu should show a **green** checkmark for **Enable services: container.googleapis.com**



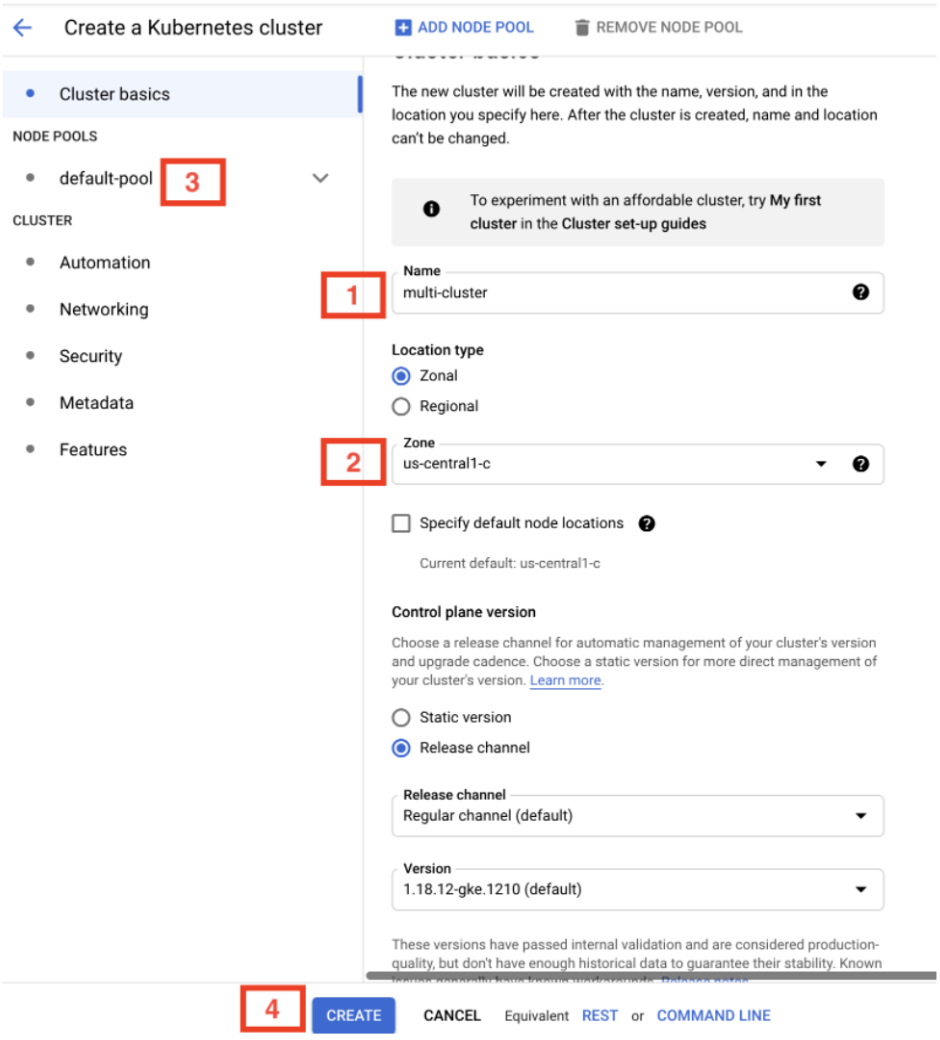
5. If you refresh the page it should show a screen to create your first cluster. If not, click the hamburger menu and select **Kubernetes Engine** and then **Clusters**.
Once you see the screen below, click the **CREATE** button.



6. A **Create Cluster** dialog will open and provide two choices. Standard and Autopilot. Click the **CONFIGURE** button within the **Standard** cluster option

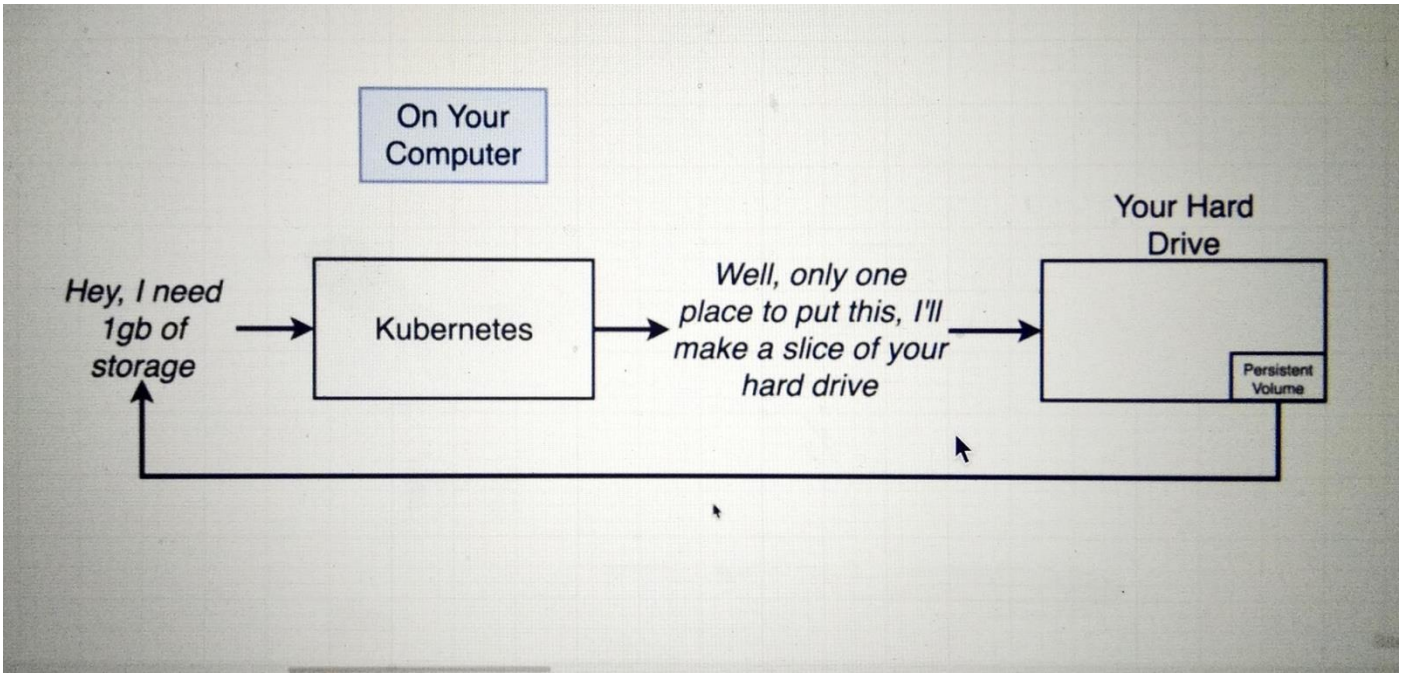


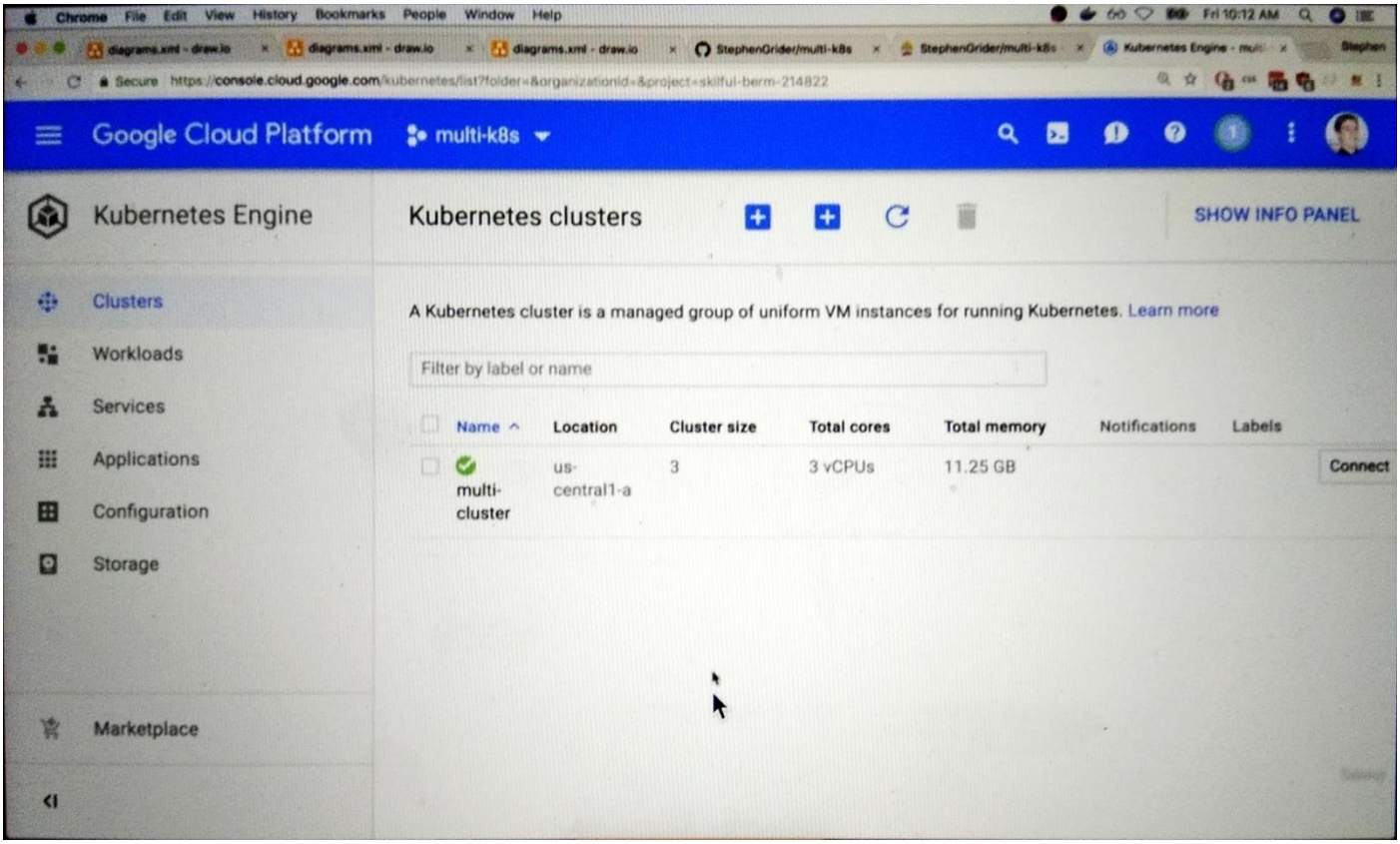
7. A form similar to the one shown in the video will be presented. Set the **Name** to **multi-cluster** (step 1). Confirm that the **Zone** set is actually near your location (step 2). The Node Pool that is discussed in the video is now found in a separate dropdown on the left sidebar. Click the downward-facing arrow to view the settings. No changes are needed here (step 3). Finally, click the **CREATE** button at the bottom of the form (step 4).

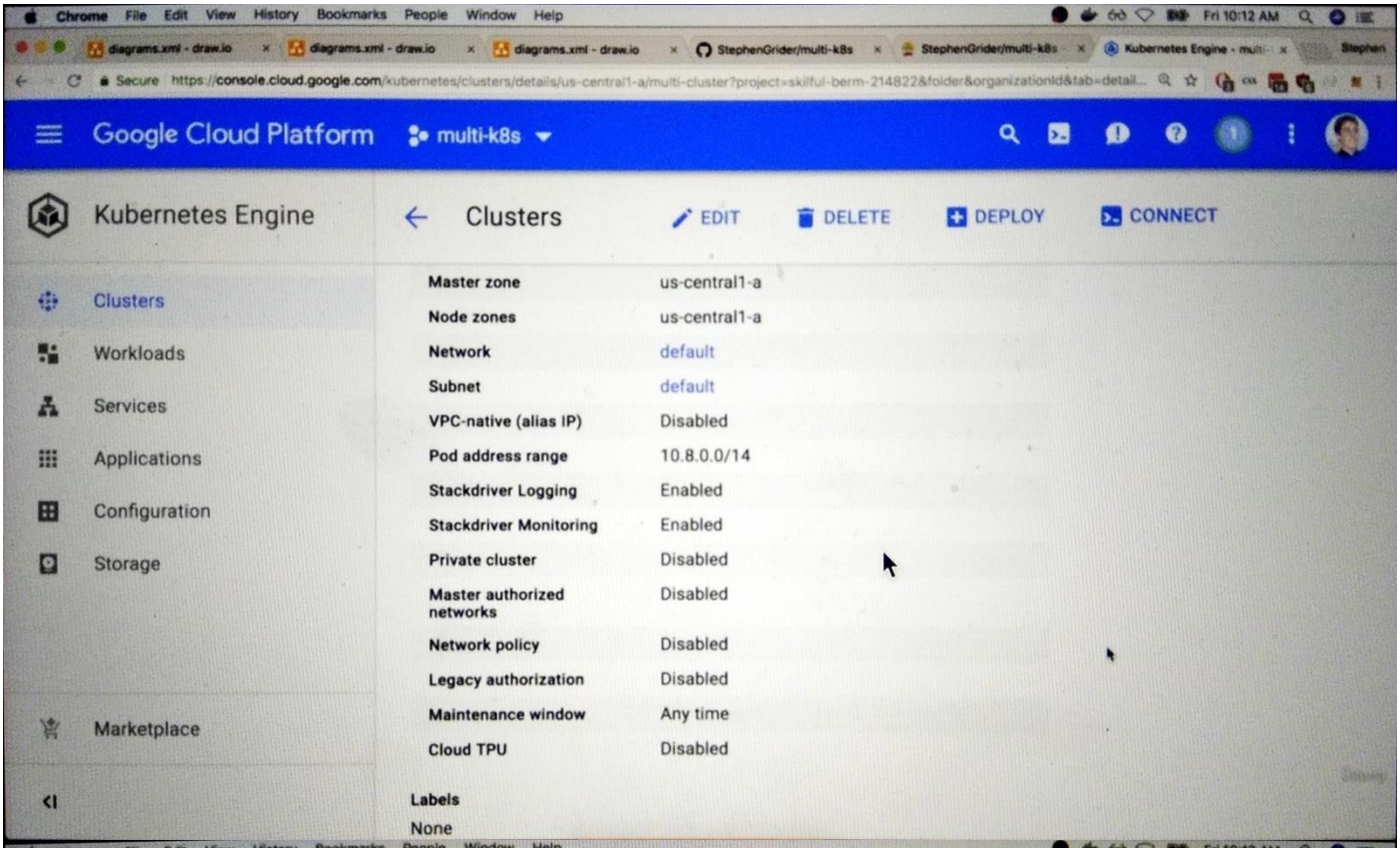


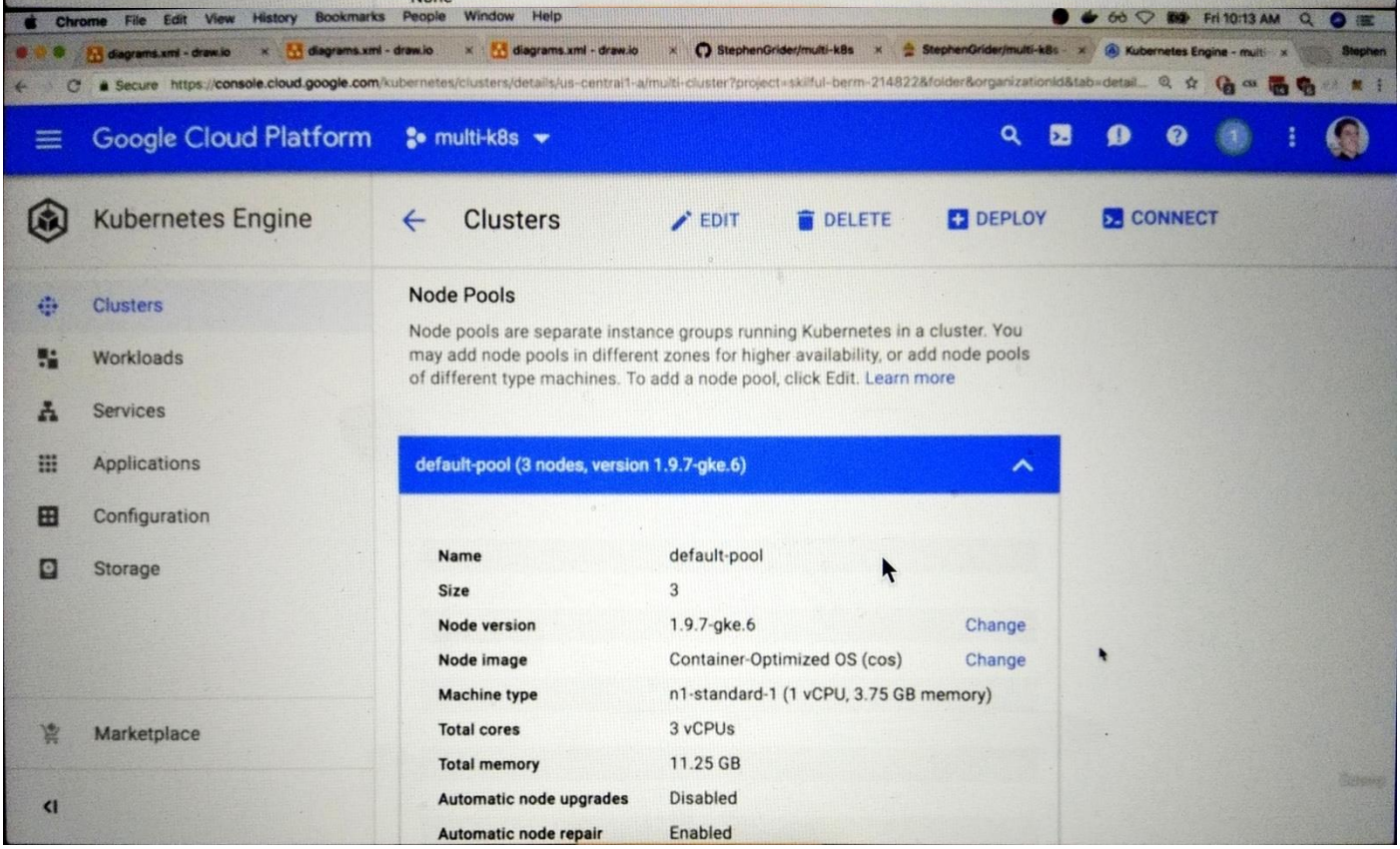
8. After a few minutes, the cluster dashboard should load and your multi-cluster should have a **green** checkmark in the table.

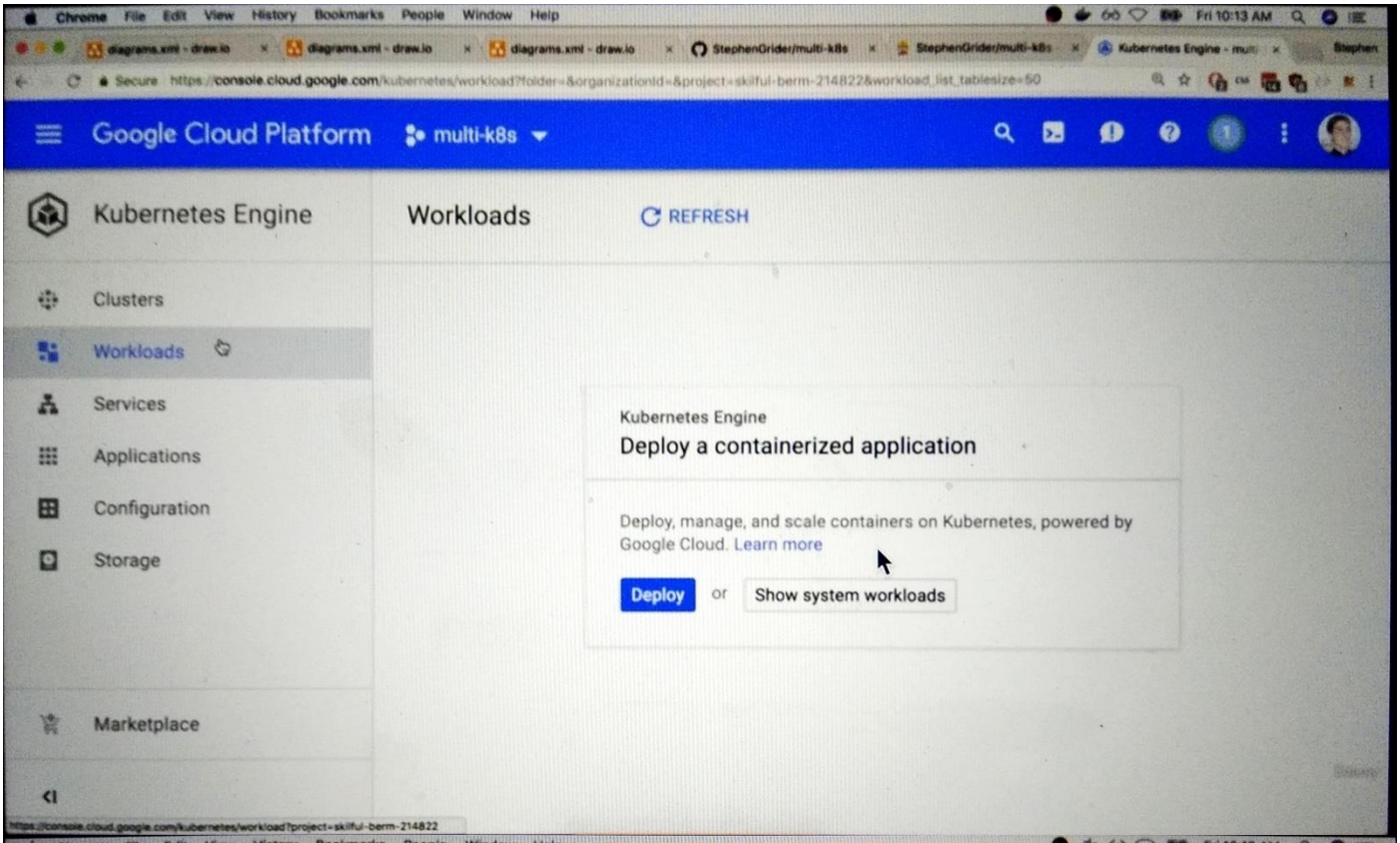
Kubernates Dashboard on Google Cloud

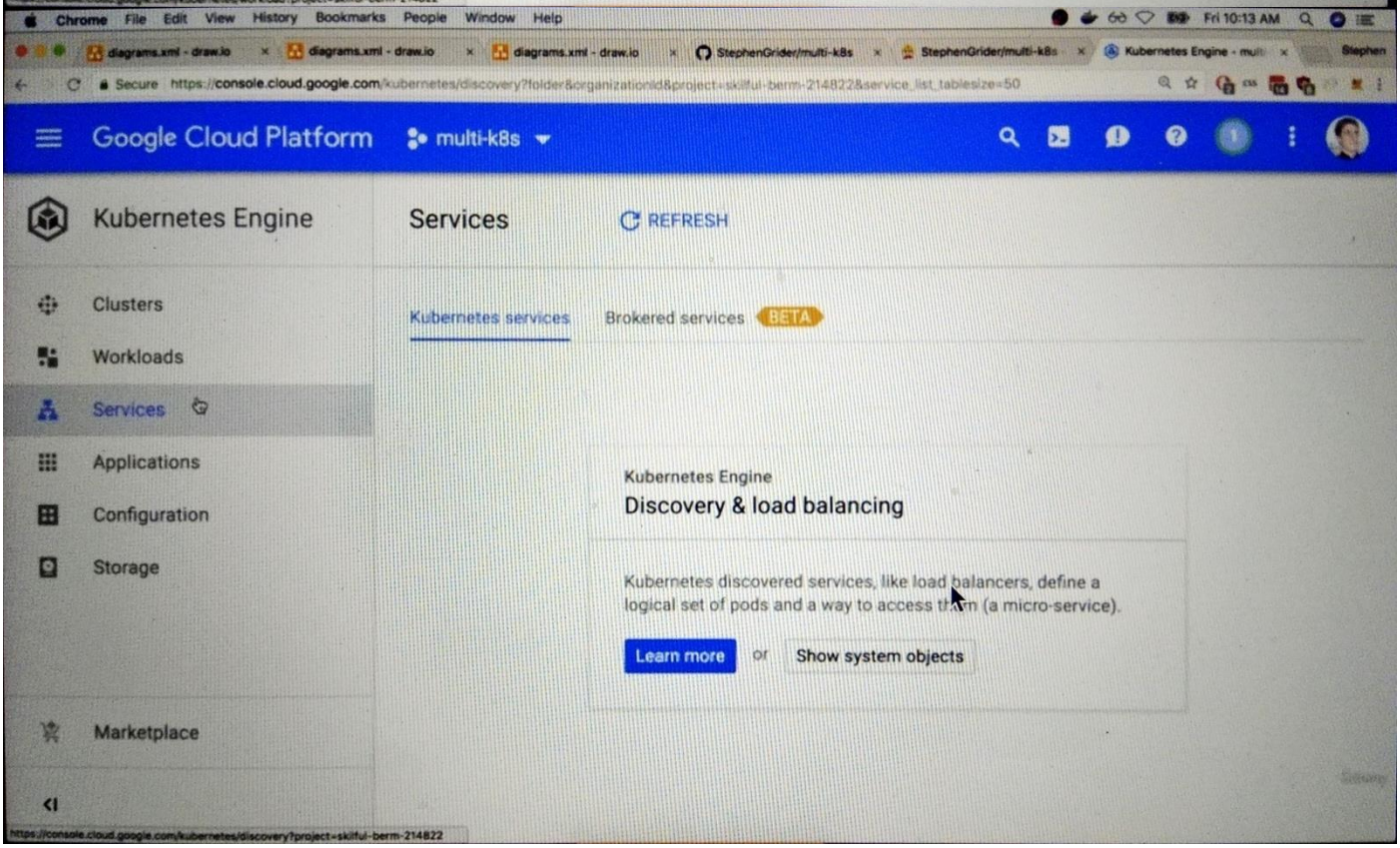


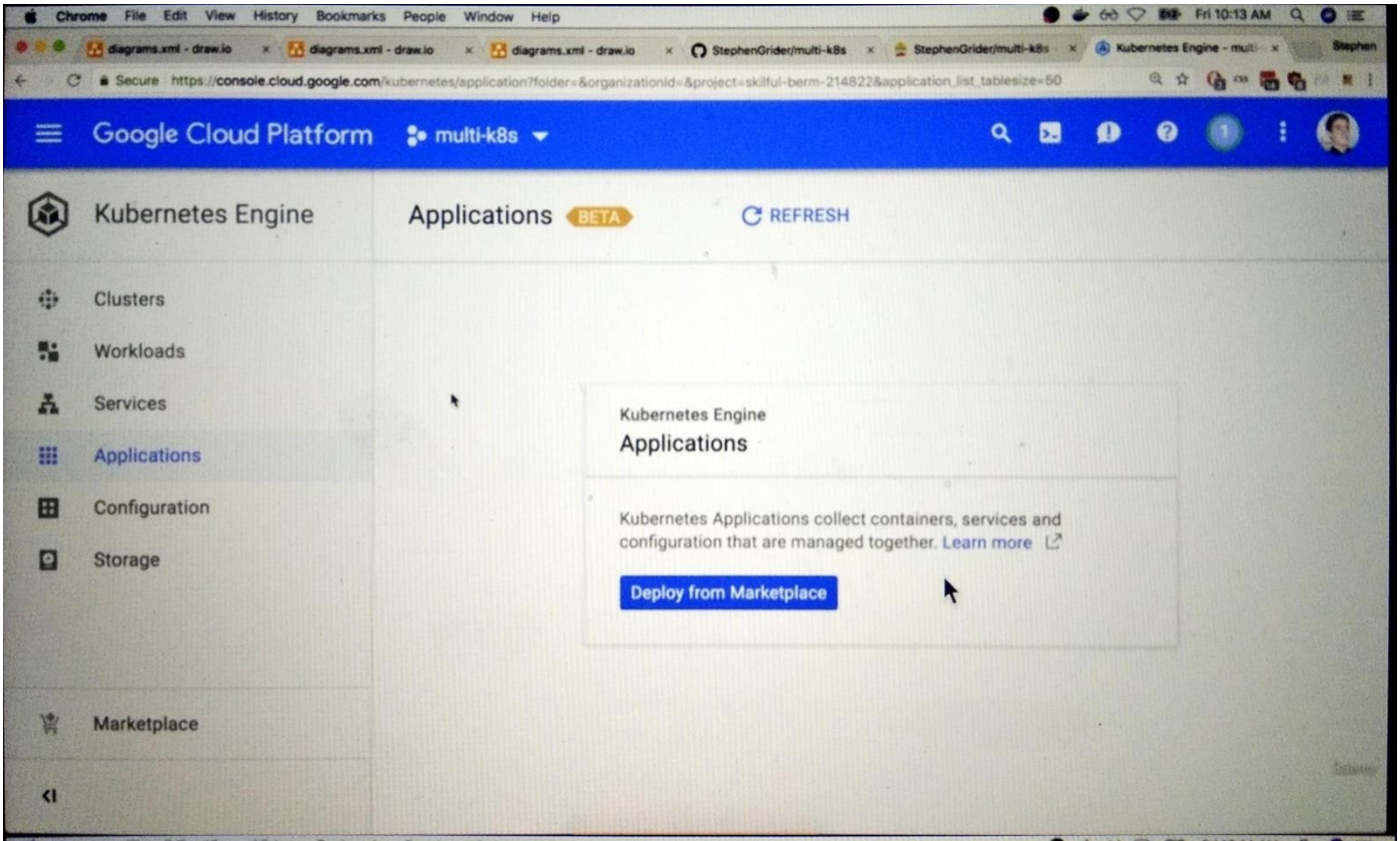


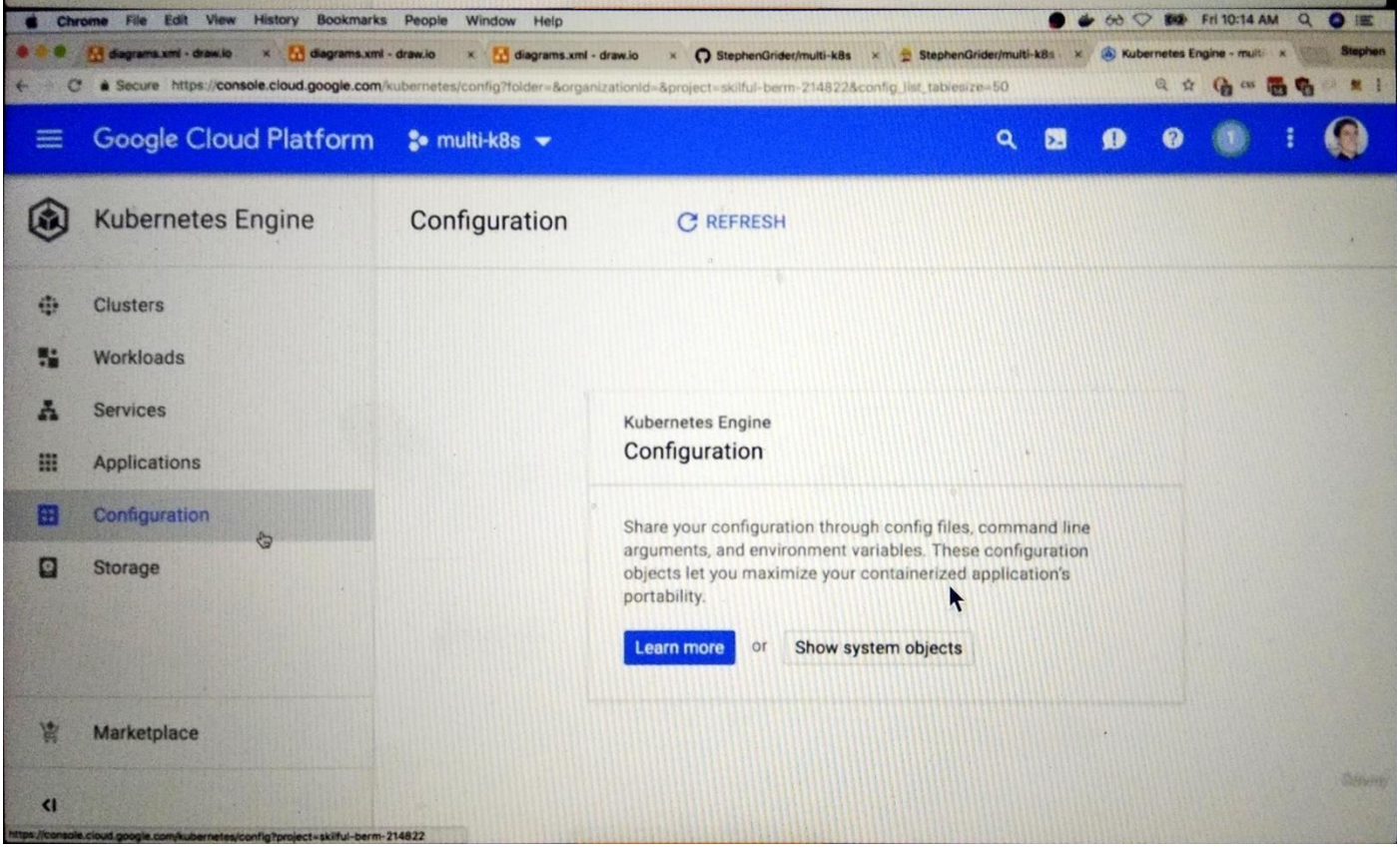

Google Cloud Platform
multi-k8s
Kubernetes Engine
Clusters
EDIT
DELETE
DEPLOY
CONNECT
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Master zone us-central1-a
Node zones us-central1-a
Network default
Subnet default
VPC-native (alias IP) Disabled
Pod address range 10.8.0.0/14
Stackdriver Logging Enabled
Stackdriver Monitoring Enabled
Private cluster Disabled
Master authorized networks Disabled
Network policy Disabled
Legacy authorization Disabled
Maintenance window Any time
Cloud TPU Disabled
Labels
None

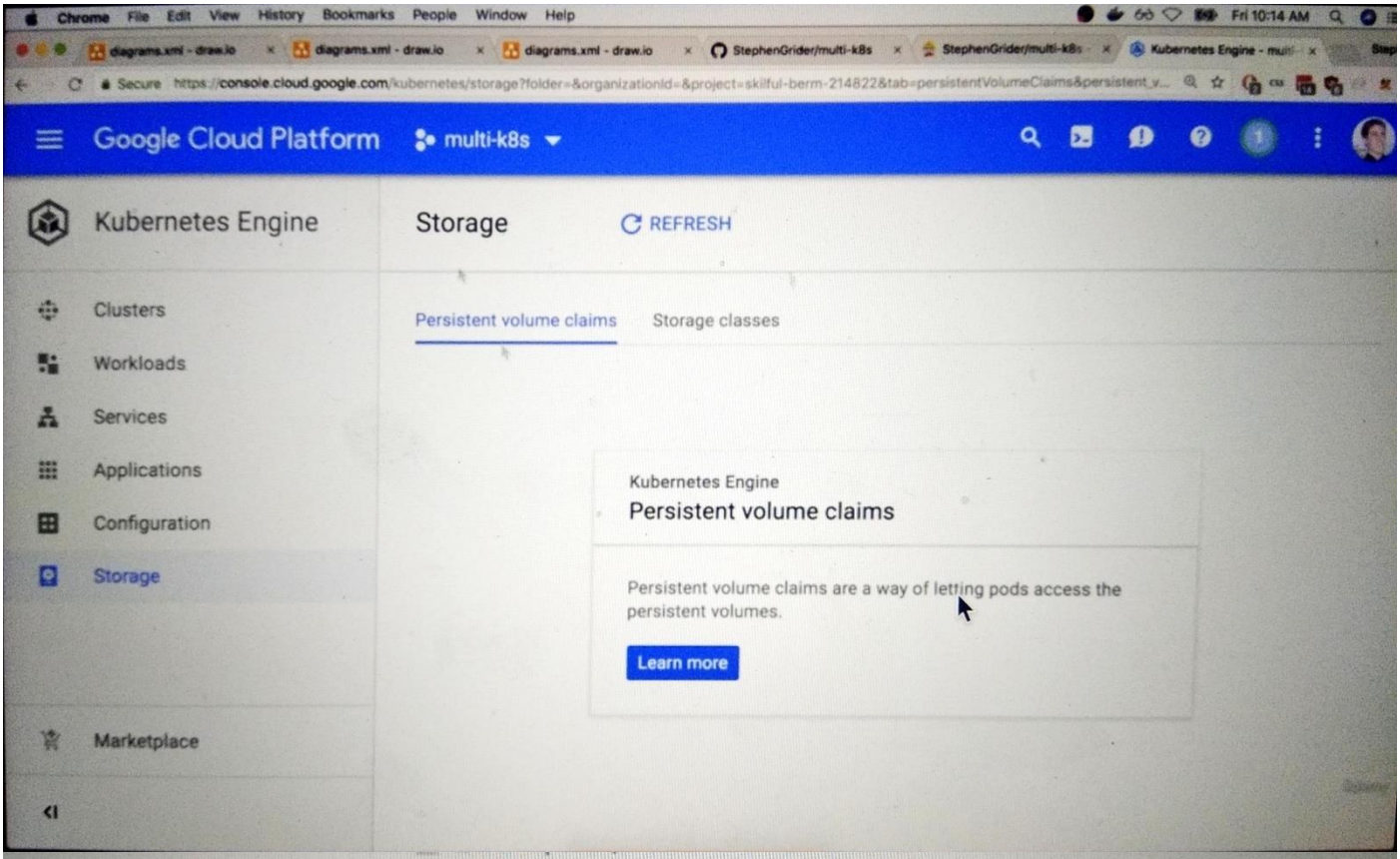

Google Cloud Platform
multi-k8s
Kubernetes Engine
Clusters
EDIT
DELETE
DEPLOY
CONNECT
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Node Pools
Node pools are separate instance groups running Kubernetes in a cluster. You may add node pools in different zones for higher availability, or add node pools of different type machines. To add a node pool, click Edit. Learn more
default-pool (3 nodes, version 1.9.7-gke.6)
Name default-pool
Size 3
Node version 1.9.7-gke.6 Change
Node image Container-Optimized OS (cos) Change
Machine type n1-standard-1 (1 vCPU, 3.75 GB memory)
Total cores 3 vCPUs
Total memory 11.25 GB
Automatic node upgrades Disabled
Automatic node repair Enabled

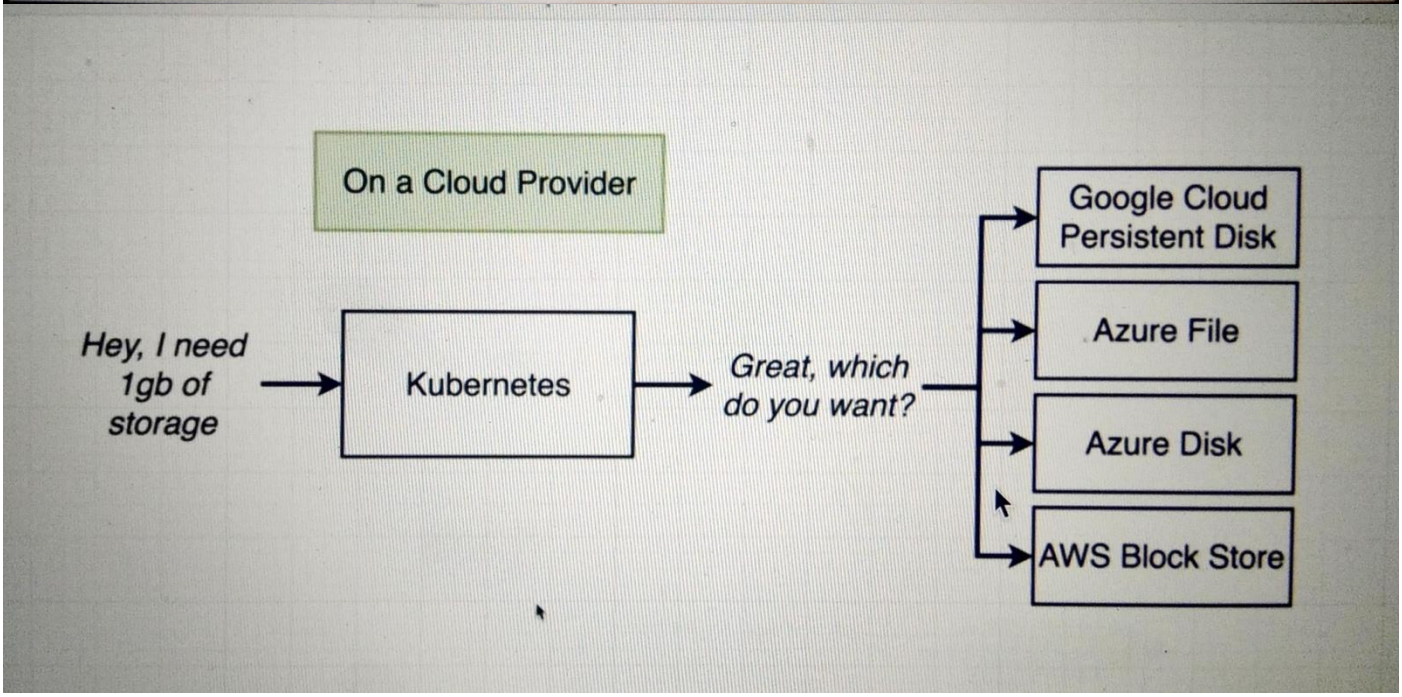

Google Cloud Platform
multi-k8s
Kubernetes Engine
Workloads
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes Engine
Deploy a containerized application
Deploy, manage, and scale containers on Kubernetes, powered by Google Cloud. Learn more
Deploy
or
Show system workloads

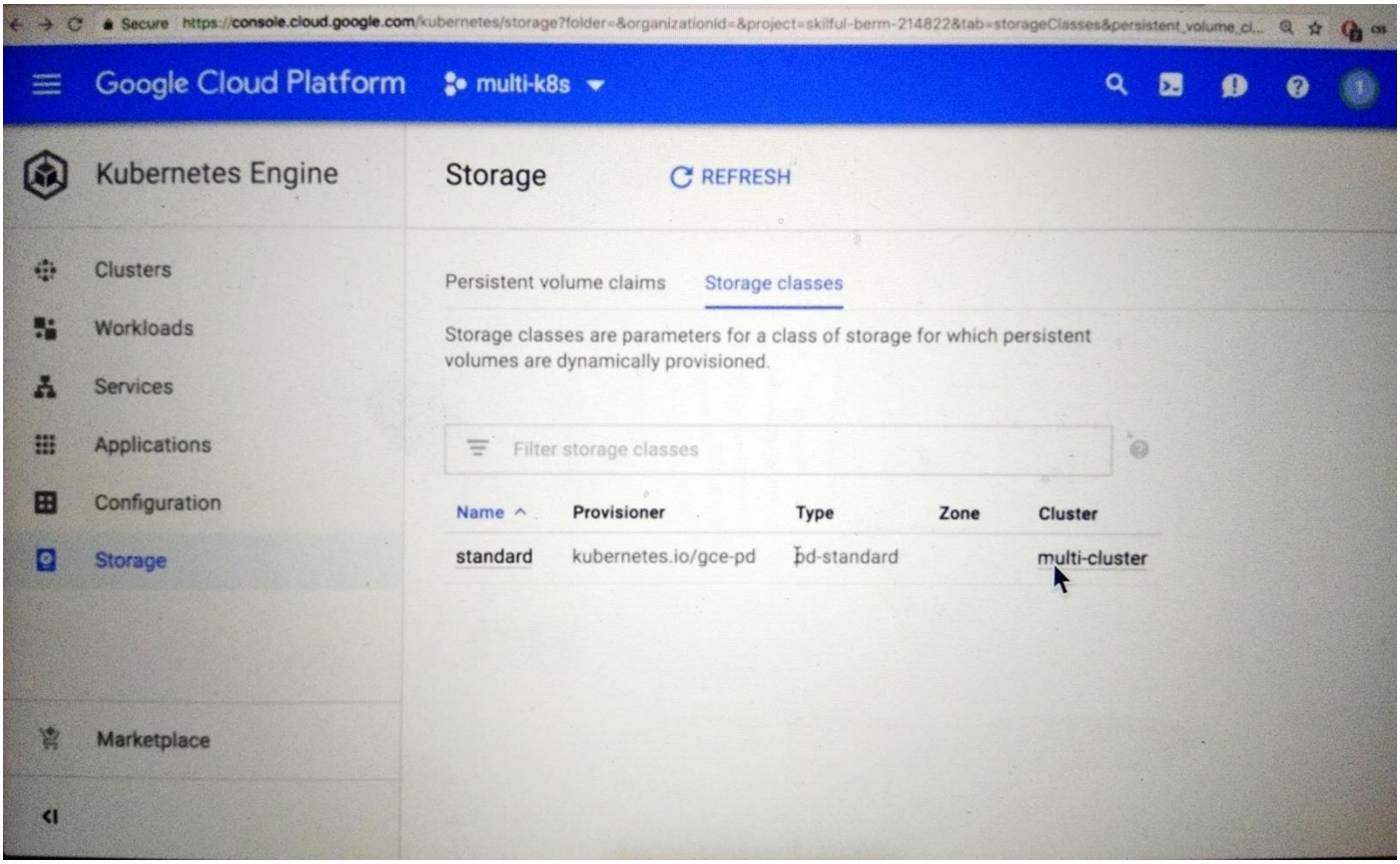

Google Cloud Platform
multi-k8s
Kubernetes Engine
Services
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes services
Brokered services
BETA
Kubernetes Engine
Discovery & load balancing
Kubernetes discovered services, like load balancers, define a
Learn more
or
Show system objects

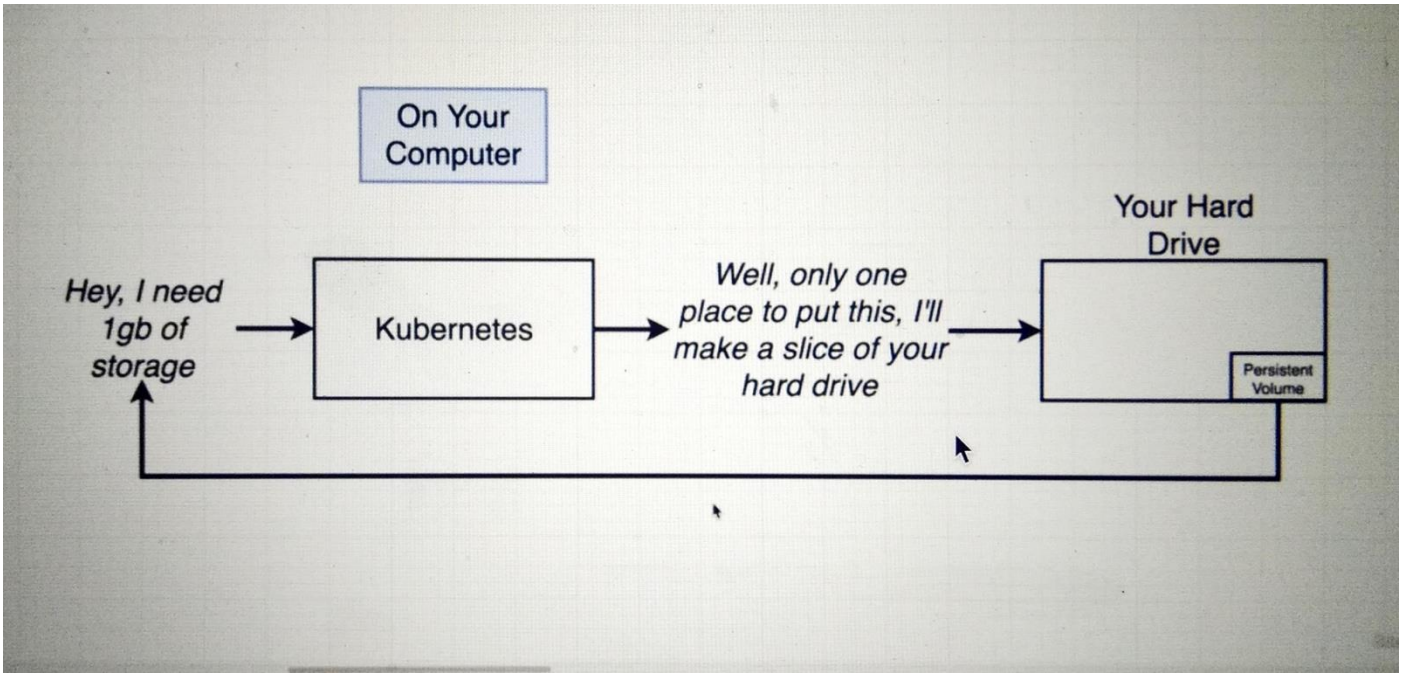

Google Cloud Platform
multi-k8s
Kubernetes Engine
Applications
BETA
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes Engine
Applications
Kubernetes Applications collect containers, services and configuration that are managed together. Learn more
Deploy from Marketplace

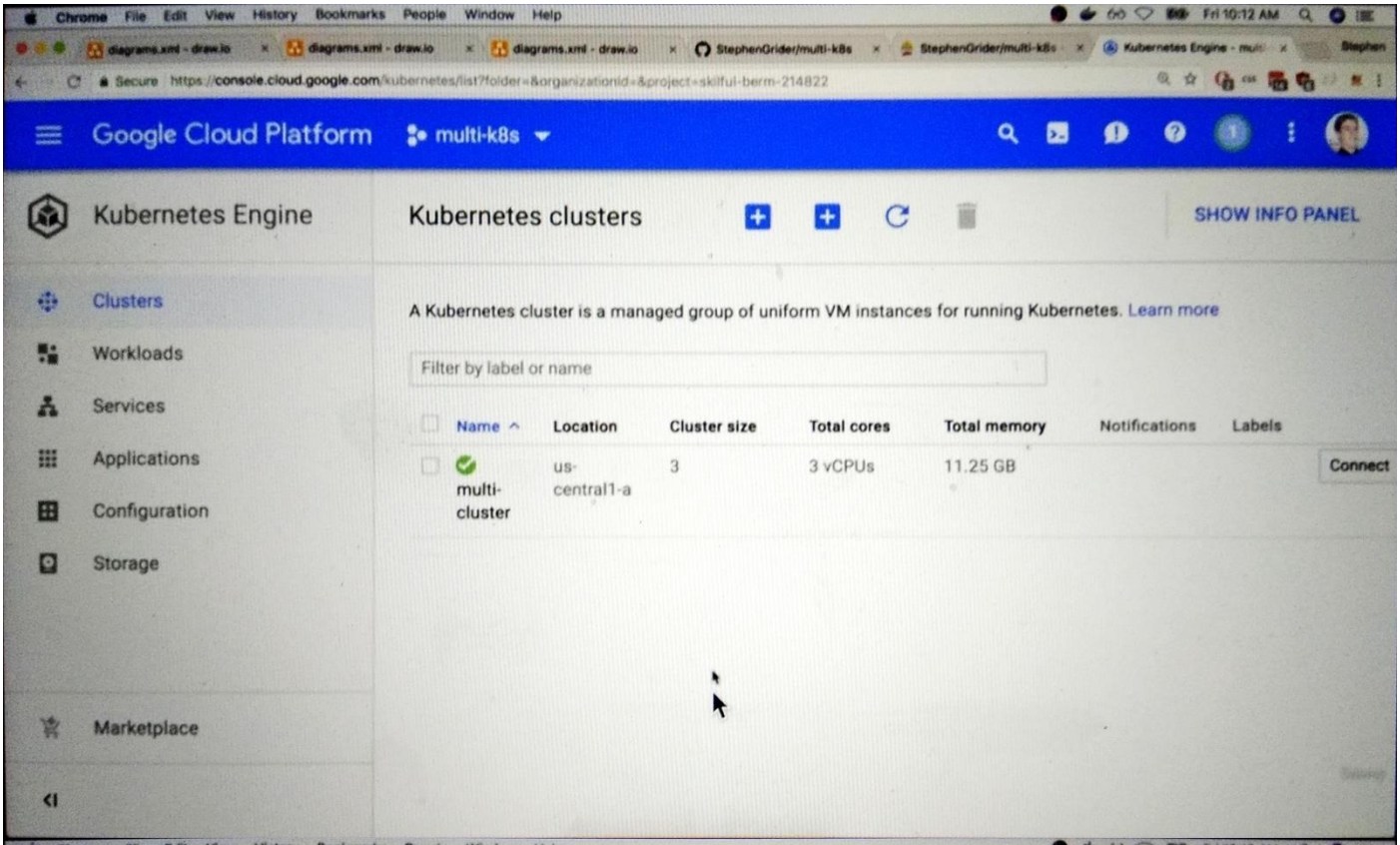

Google Cloud Platform
multi-k8s
Kubernetes Engine
Configuration
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes Engine
Configuration
Share your configuration through config files, command line arguments, and environment variables. These configuration objects let you maximize your containerized application's portability.
Learn more
or
Show system objects

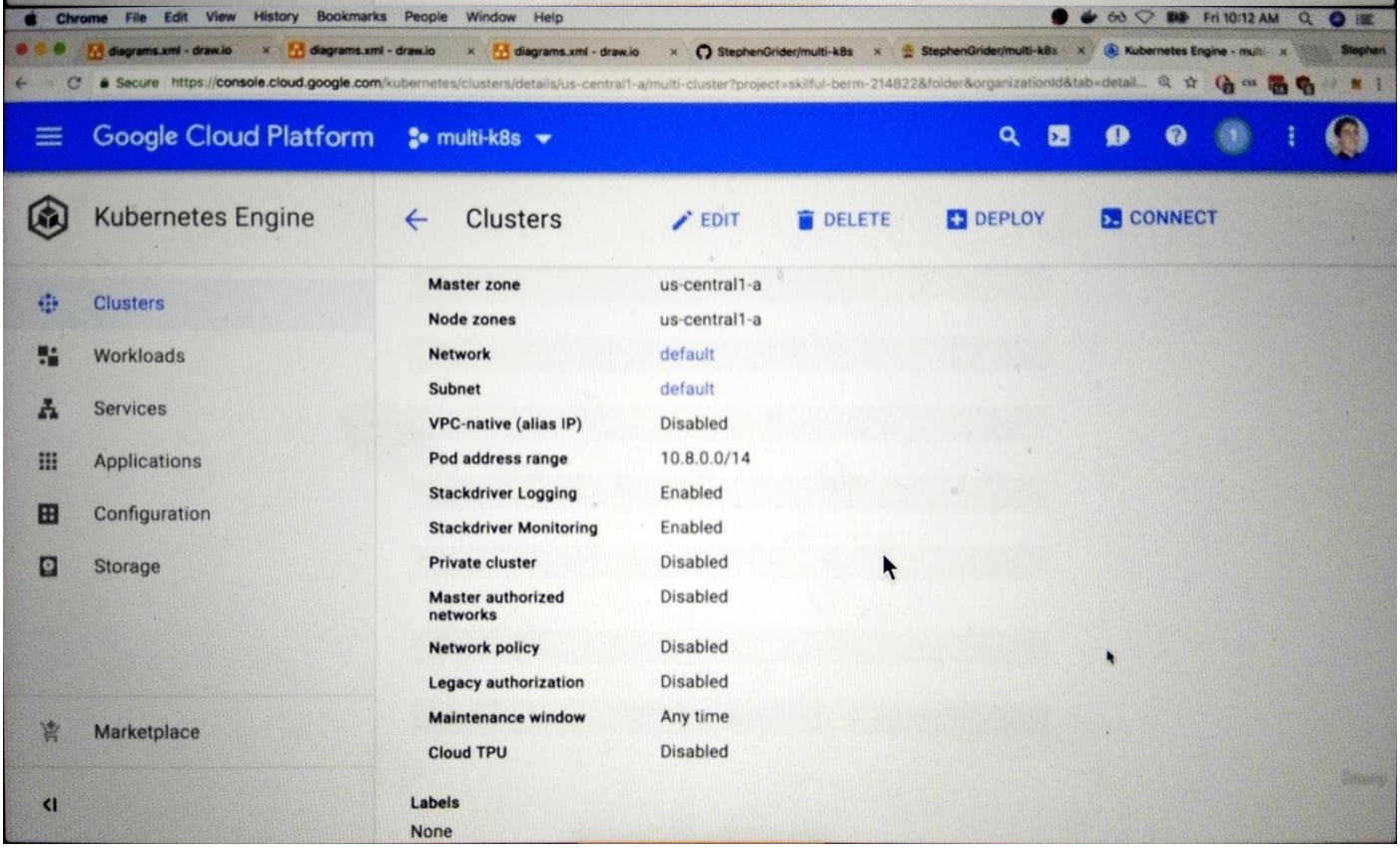

Chrome File Edit View History Bookmarks People Window Help
Fri 10:14 AM
diagrams.xml - draw.io
diagrams.xml - draw.io
diagrams.xml - draw.io
StephenGrider/multi-k8s
StephenGrider/multi-k8s
Kubernetes Engine - multi
Secure https://console.cloud.google.com/kubernetes/storage?folder=&organizationId=&project=skilful-berm-214822&tab=persistentVolumeClaims&persistent_v...
Google Cloud Platform
multi-k8s
Kubernetes Engine
Storage
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Persistent volume claims
Storage classes
Kubernetes Engine
Persistent volume claims
Persistent volume claims are a way of letting pods access the persistent volumes.
Learn more


On a Cloud Provider
Hey, I need 1gb of storage
Kubernetes
Great, which do you want?
Google Cloud Persistent Disk
Azure File
Azure Disk
AWS Block Store


Secure https://console.cloud.google.com/kubernetes/storage?folder=&organizationId=&project=skilful-berm-214822&tab=storageClasses&persistent_volume_cl...
Google Cloud Platform
multi-k8s
Kubernetes Engine
Storage
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Persistent volume claims
Storage classes
Storage classes are parameters for a class of storage for which persistent volumes are dynamically provisioned.
Filter storage classes
Name
Provisioner
Type
Zone
Cluster
standard
kubernetes.io/gce-pd
pd-standard
multi-cluster


On Your Computer
Hey, I need 1gb of storage
Kubernetes
Well, only one place to put this, I'll make a slice of your hard drive
Your Hard Drive
Persistent Volume


Google Cloud Platform
multi-k8s
Kubernetes Engine
Kubernetes clusters
SHOW INFO PANEL
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
A Kubernetes cluster is a managed group of uniform VM instances for running Kubernetes. Learn more
Filter by label or name
Name
Location
Cluster size
Total cores
Total memory
Notifications
Labels
multi-cluster
us-central1-a
3
3 vCPUs
11.25 GB
Connect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Kubernetes Engine
Clusters
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Clusters
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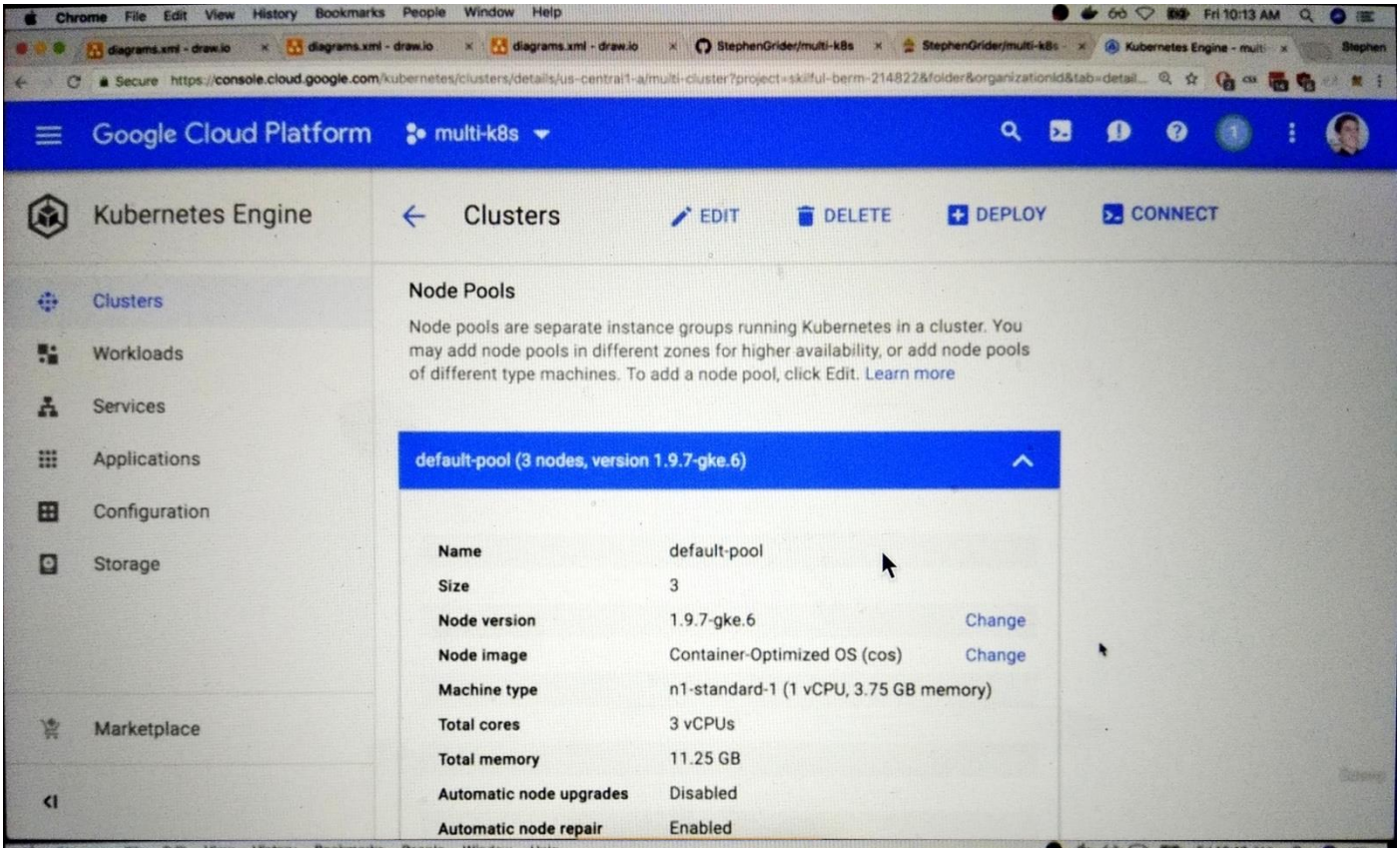
Applications
Configuration
Storage
Marketplace
Master zone
us-central1-a
Node zones
us-central1-a
Network
default
Subnet
default
VPC-native (alias IP)
Disabled
Pod address range
10.8.0.0/14
Stackdriver Logging
Enabled
Stackdriver Monitoring
Enabled
Private cluster
Disabled
Master authorized networks
Disabled
Network policy
Disabled
Legacy authorization
Disabled
Maintenance window
Any time
Cloud TPU
Disabled
Labels
None


Google Cloud Platform
multi-k8s
Kubernetes Engine
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Name default-pool
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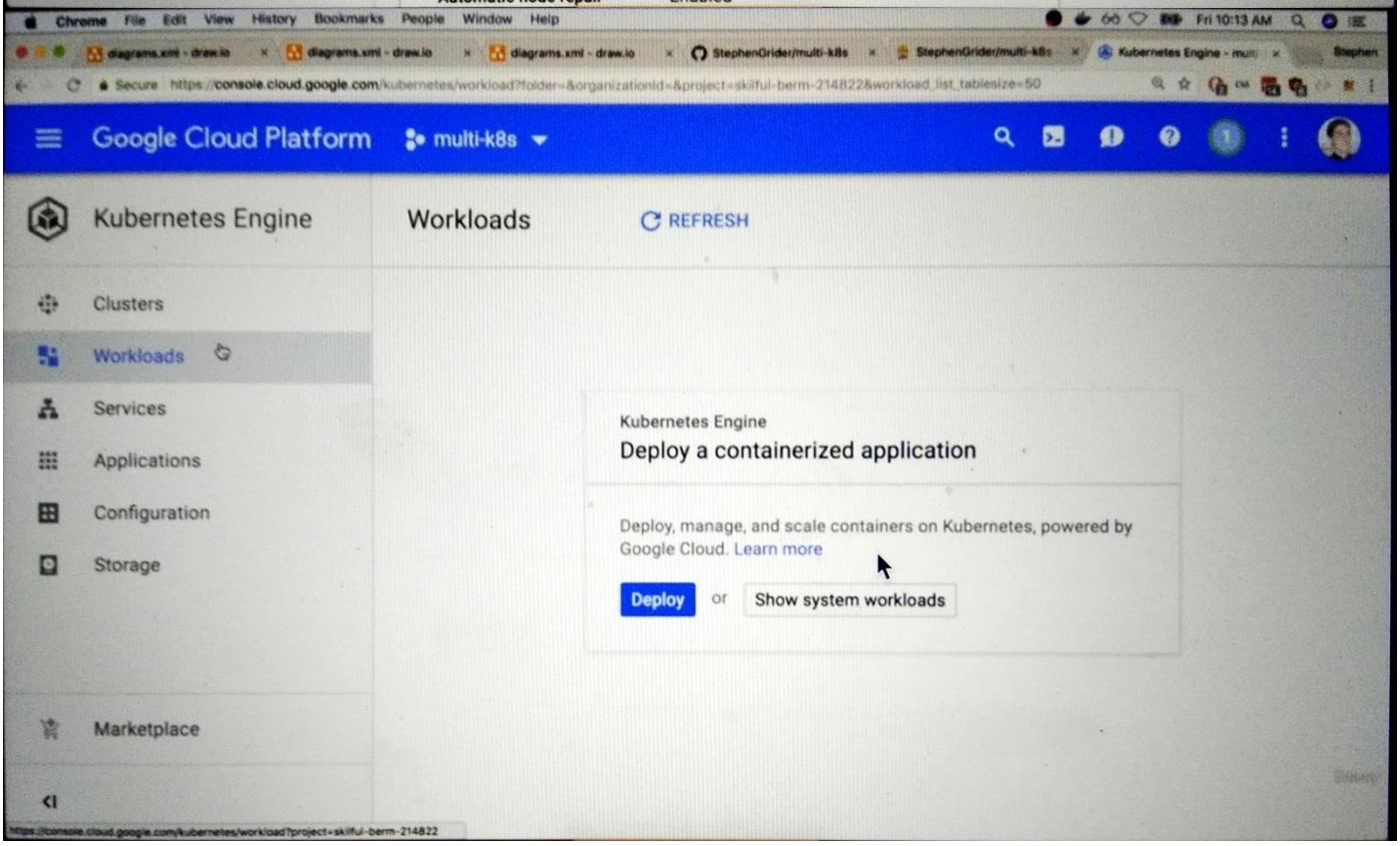
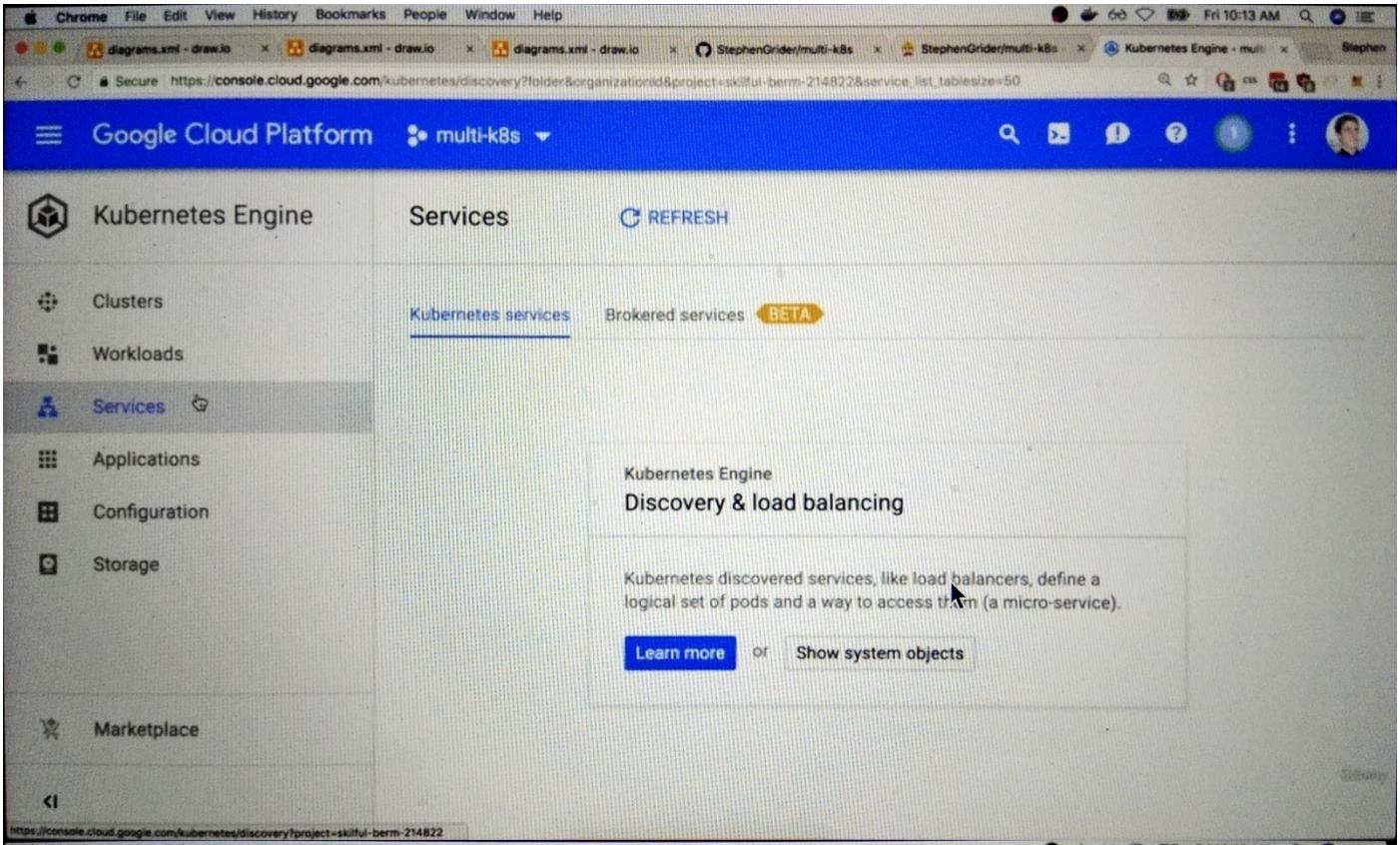
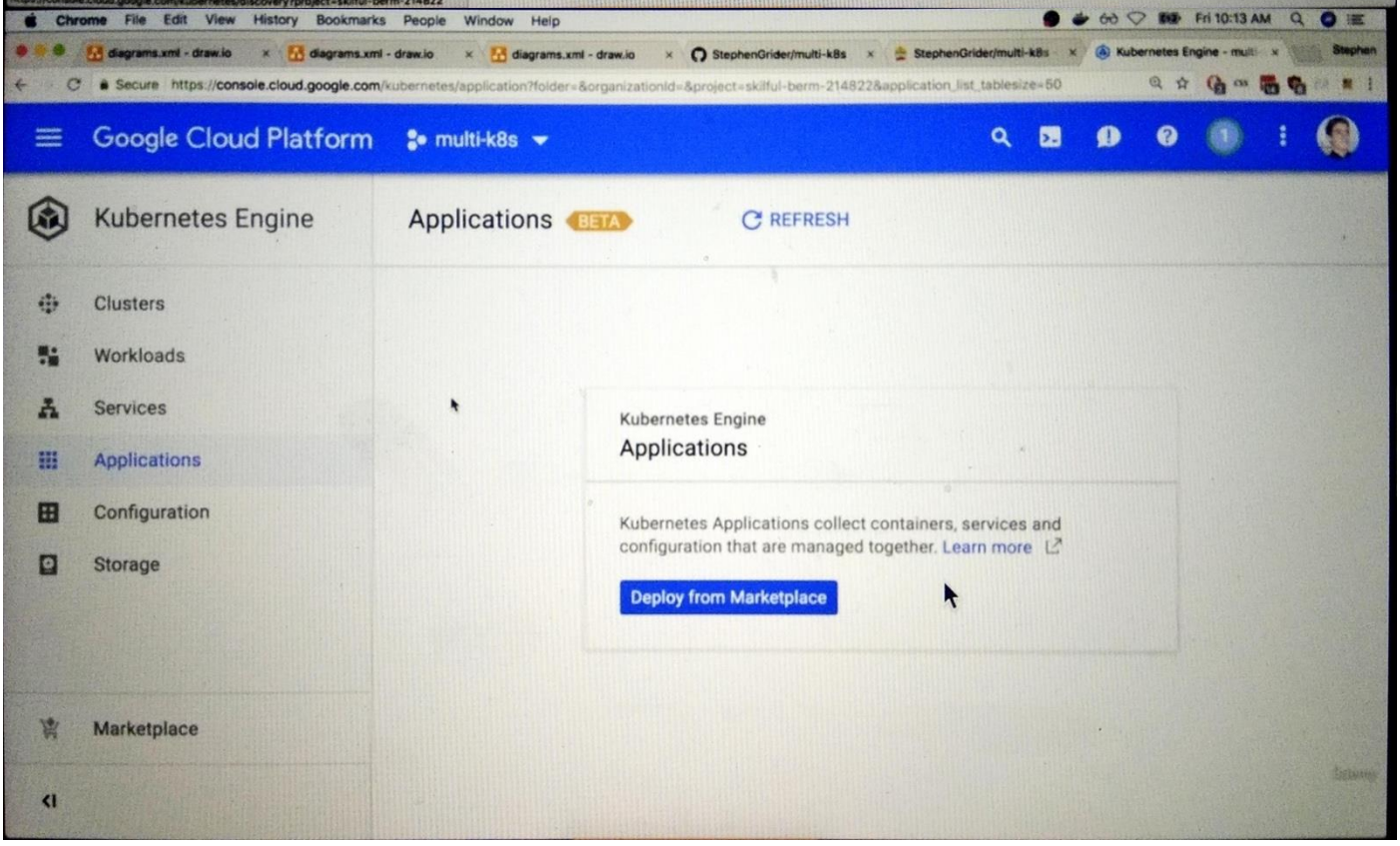
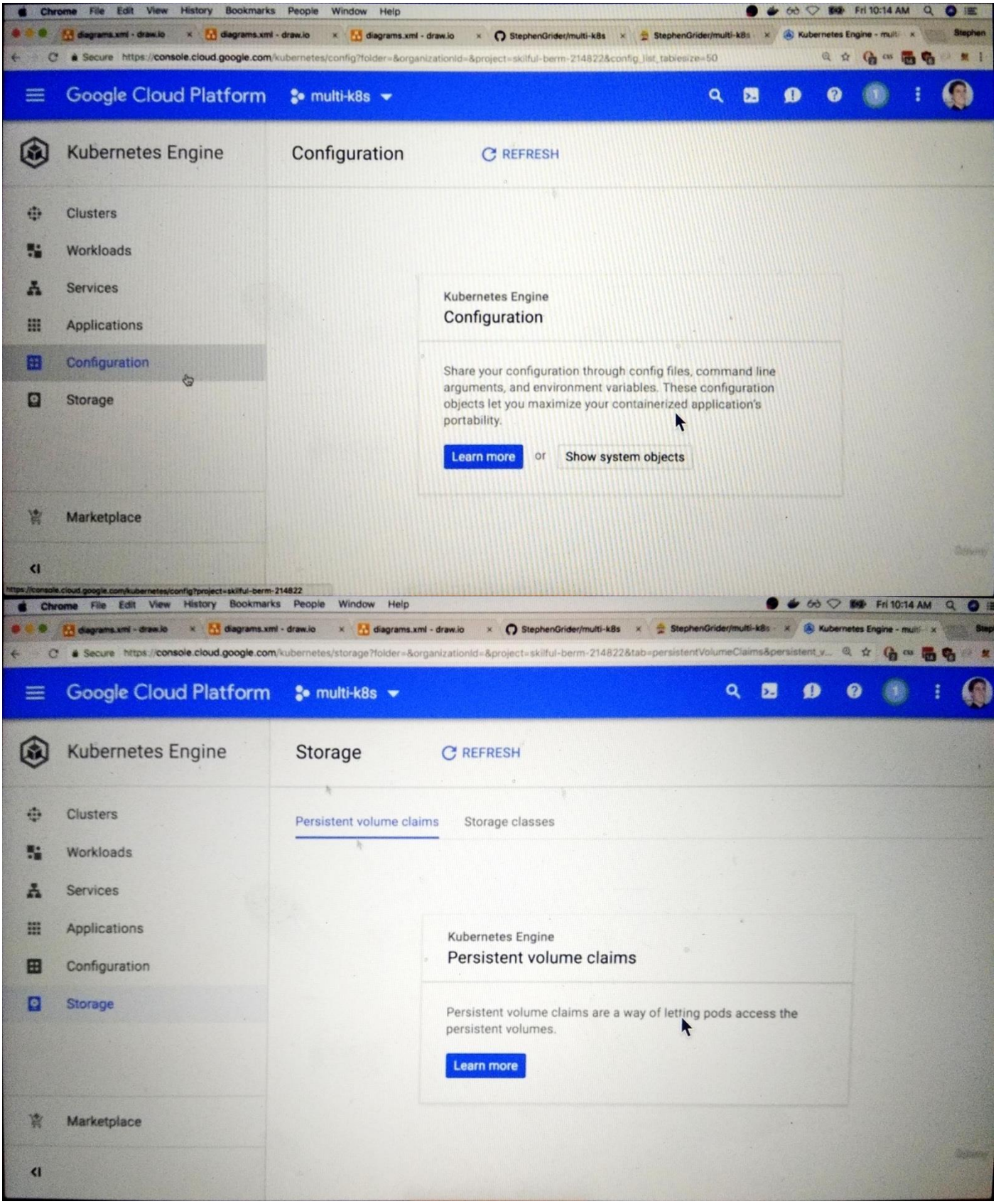
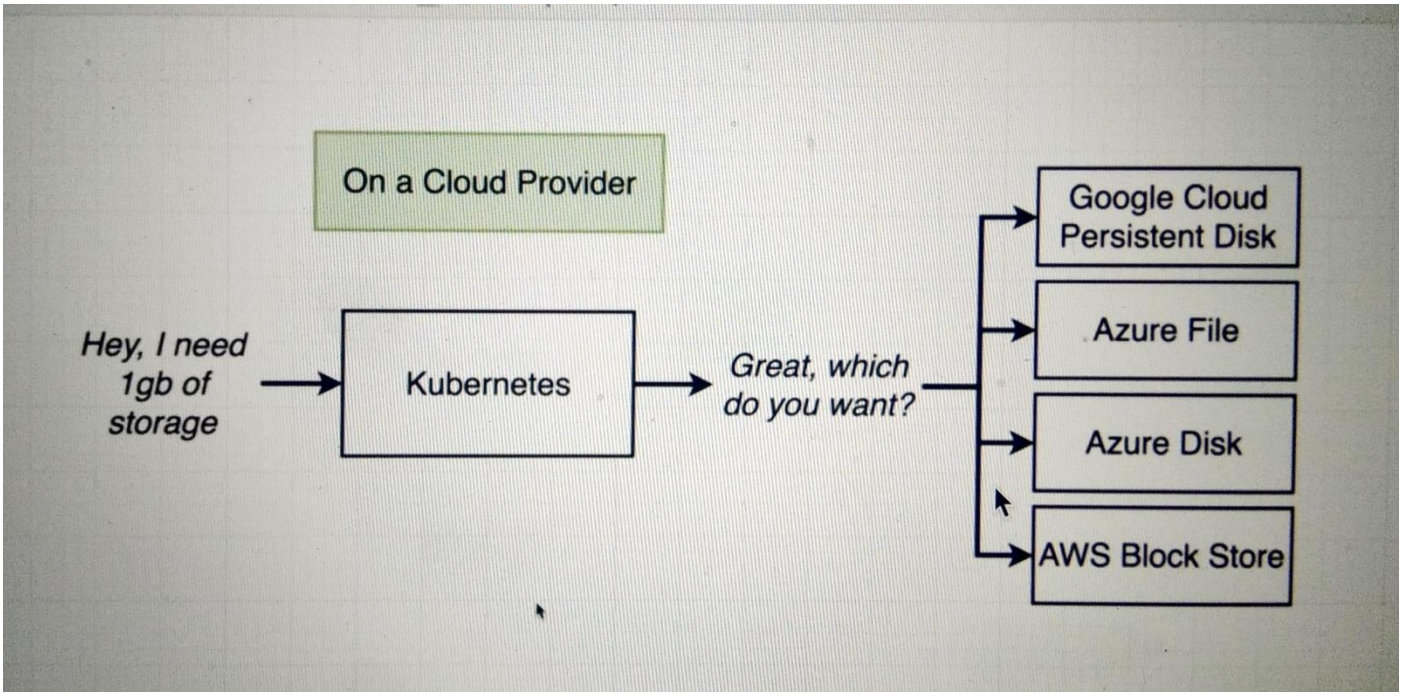
Node version 1.9.7-gke.6 Change
Node image Container-Optimized OS (cos) Change
Machine type n1-standard-1 (1 vCPU, 3.75 GB memory)
Total cores 3 vCPUs
Total memory 11.25 GB
Automatic node upgrades Disabled
Automatic node repair Enabled

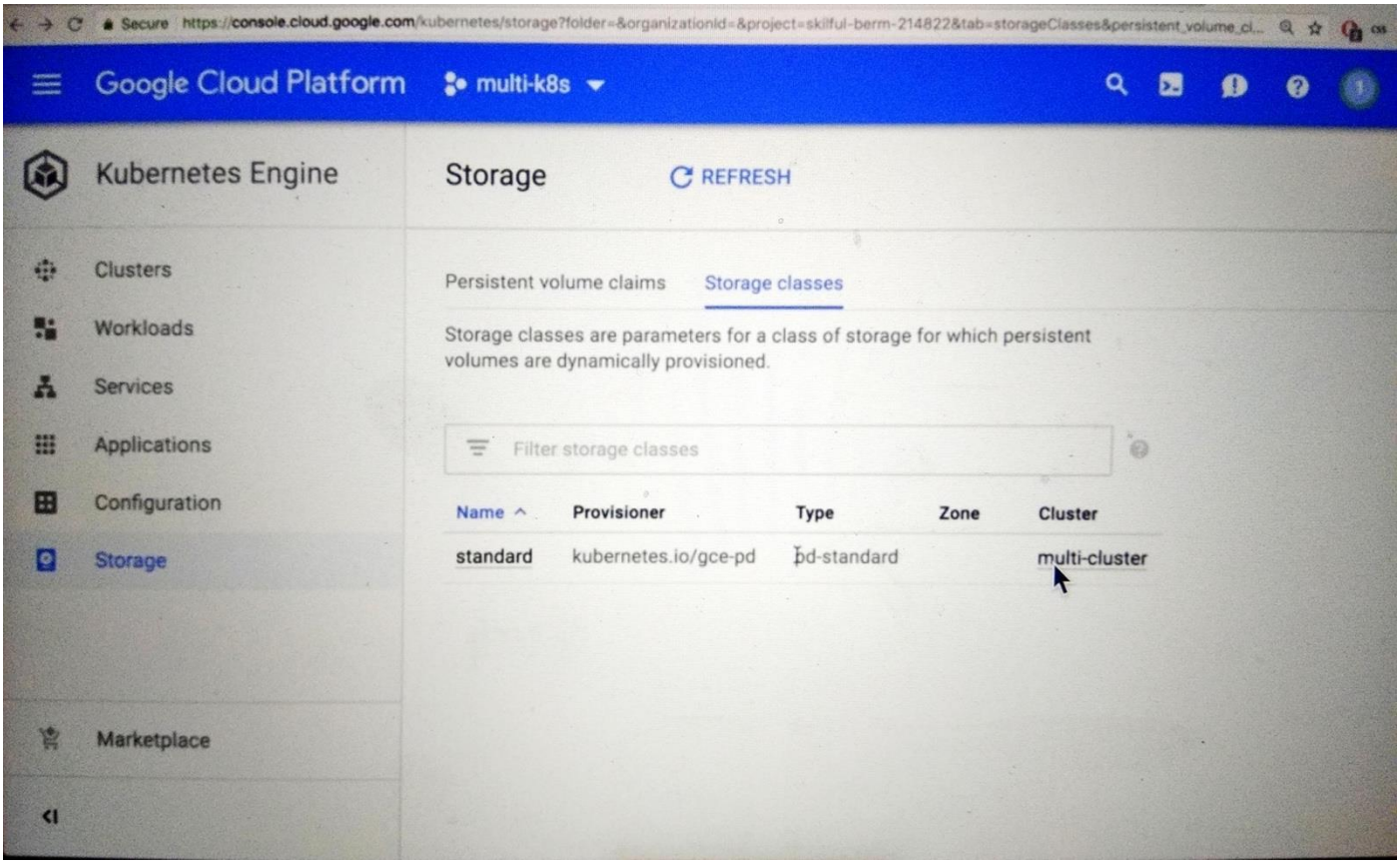

Google Cloud Platform
multi-k8s
Kubernetes Engine
Workloads
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes Engine
Deploy a containerized application
Deploy, manage, and scale containers on Kubernetes, powered by Google Cloud. Learn more
Deploy
or
Show system workloads


Google Cloud Platform
multi-k8s
Kubernetes Engine
Services
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes services
Brokered services
BETA
Kubernetes Engine
Discovery & load balancing
Kubernetes discovered services, like load balancers, define a logical set of pods and a way to access them (a micro-service).
Learn more
or
Show system objects


Google Cloud Platform
multi-k8s
Kubernetes Engine
Applications
BETA
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes Engine
Applications
Kubernetes Applications collect containers, services and configuration that are managed together. Learn more
Deploy from Marketplace


Google Cloud Platform
multi-k8s
Kubernetes Engine
Configuration
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes Engine
Configuration
Share your configuration through config files, command line arguments, and environment variables. These configuration objects let you maximize your containerized application's portability.
Learn more
or
Show system objects
Google Cloud Platform
multi-k8s
Kubernetes Engine
Storage
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Persistent volume claims
Storage classes
Kubernetes Engine
Persistent volume claims
Persistent volume claims are a way of letting pods access the persistent volumes.
Learn more





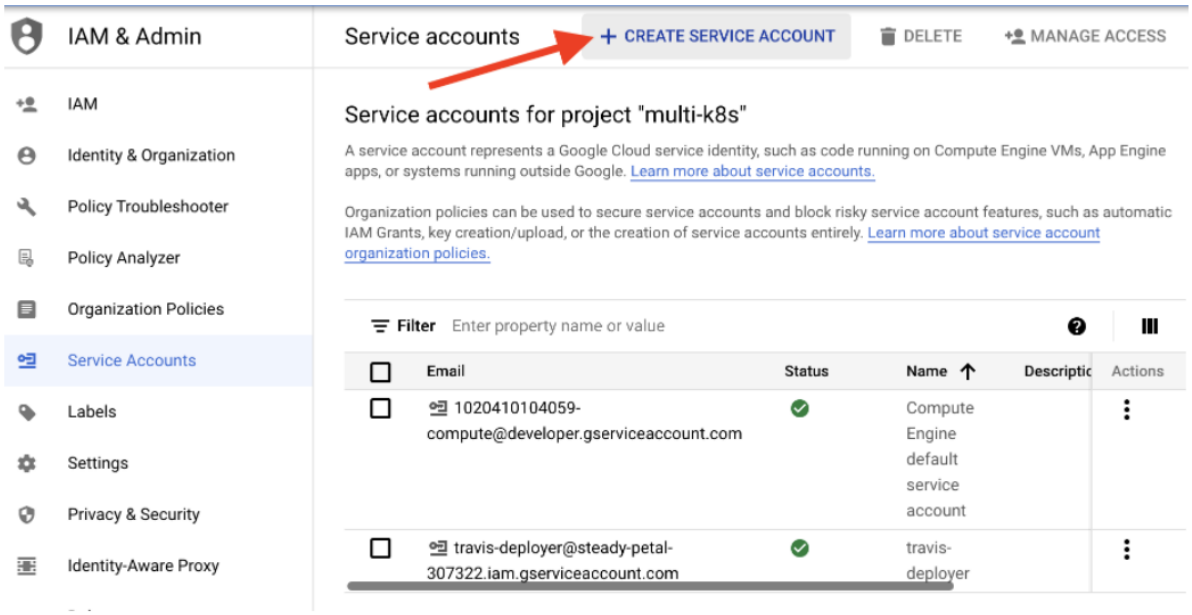
Github Actions

.github > workflows > deployment.yaml

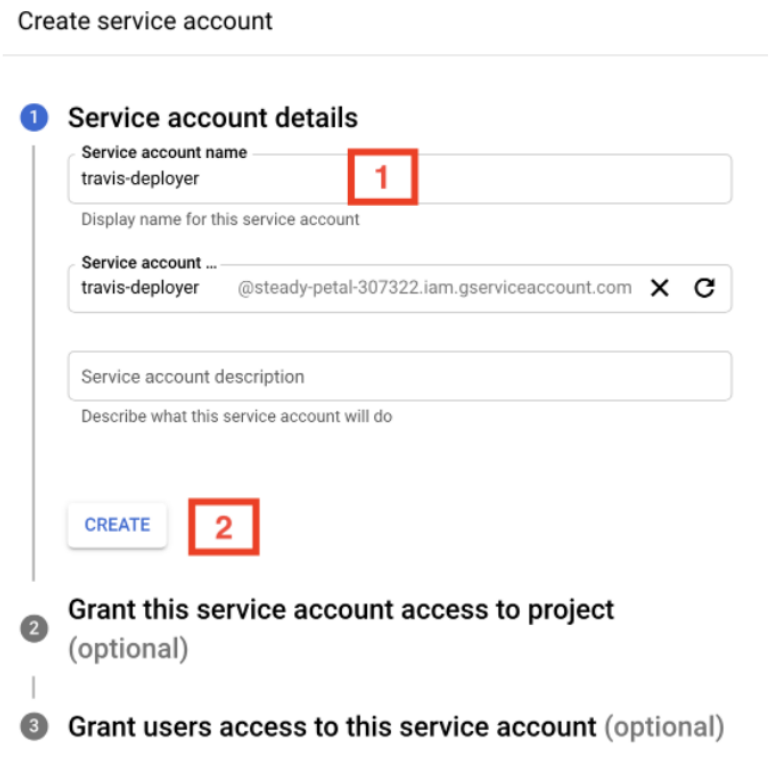
```yaml
name: Deploy MultiK8s
on:
  push:
    branches:
      - main

env:
  SHA: $(git rev-parse HEAD)

jobs:
  build:
    runs-on: ubuntu-latest
    steps:
      - uses: actions/checkout@v3

      - name: Test
        run: |-
          docker login -u ${{ secrets.DOCKER_USERNAME }} -p ${{ secrets.DOCKER_PASSWORD }}
          docker build -t cygnetops/react-test -f ./client/Dockerfile.dev ./client
          docker run -e CI=true cygnetops/react-test npm test

      - name: Set Service Key
        uses: "google-github-actions/auth@v0"
        with:
          credentials_json: "${{ secrets.GKE_SA_KEY }}"

      - name: Set Project
        uses: google-github-actions/setup-gcloud@v0
        with:
          project_id: multi-338920

      - name: Auth
        run: |-
          gcloud --quiet auth configure-docker

      - name: Get Credentials
        uses: google-github-actions/get-gke-credentials@v0
        with:
          cluster_name: multi-cluster
          location: us-central1-c
```

```yaml
    - name: Build
      run: |-
        docker build -t cygnetops/multi-client-k8s-gh:latest -t cygnetops/multi-client-k8s-gh:${{ env.SHA }} -f ./client/Dockerfile ./client
        docker build -t cygnetops/multi-server-k8s-pgfix-gh:latest -t cygnetops/multi-server-k8s-pgfix-gh:${{ env.SHA }} -f ./server/Dockerfile
        docker build -t cygnetops/multi-worker-k8s-gh:latest -t cygnetops/multi-worker-k8s-gh:${{ env.SHA }} -f ./worker/Dockerfile ./worker

    - name: Push
      run: |-
        docker push cygnetops/multi-client-k8s-gh:latest
        docker push cygnetops/multi-server-k8s-pgfix-gh:latest
        docker push cygnetops/multi-worker-k8s-gh:latest

        docker push cygnetops/multi-client-k8s-gh:${{ env.SHA }}
        docker push cygnetops/multi-server-k8s-pgfix-gh:${{ env.SHA }}
        docker push cygnetops/multi-worker-k8s-gh:${{ env.SHA }}

    - name: Apply
      run: |-
        kubectl apply -f k8s
        kubectl set image deployments/server-deployment server=cygnetops/multi-server-k8s-pgfix-gh:${{ env.SHA }}
        kubectl set image deployments/client-deployment client=cygnetops/multi-client-k8s-gh:${{ env.SHA }}
        kubectl set image deployments/worker-deployment worker=cygnetops/multi-worker-k8s-gh:${{ env.SHA }}
```

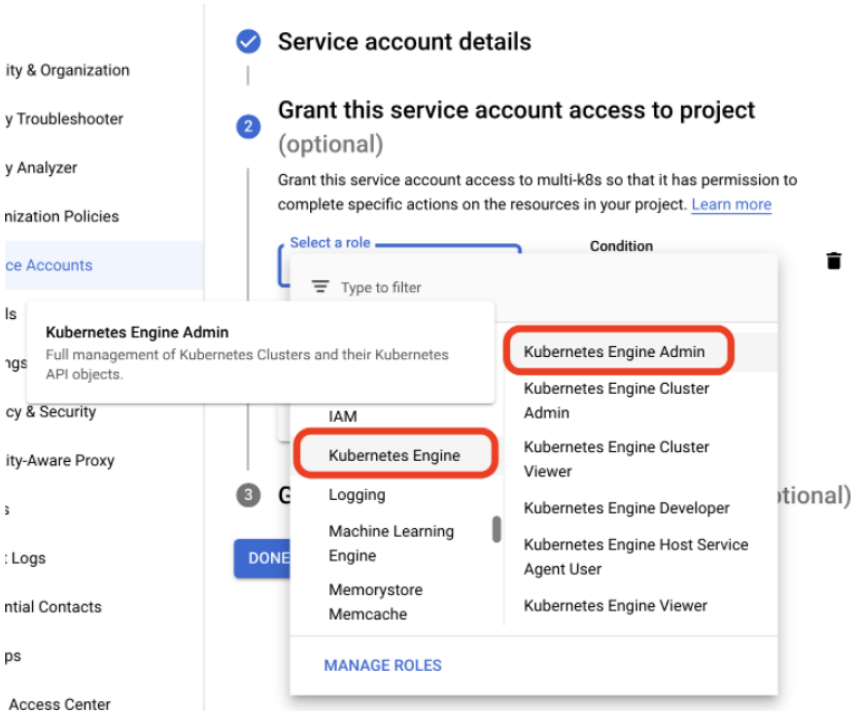
1. Click the Hamburger menu on the top left-hand side of the dashboard, find **IAM & Admin**, and select **Service Accounts**. Then click the **CREATE SERVICE ACCOUNT** button.



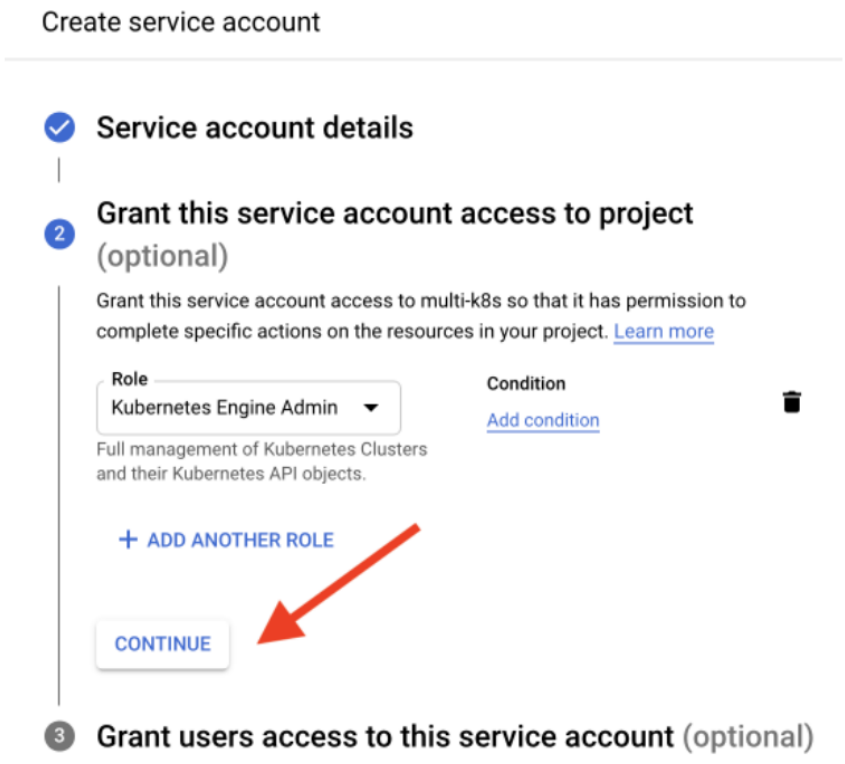
2. In the form that is displayed, set the **Service account name** to **travis-deployer** (step 1), then click the **CREATE** button (step 2).



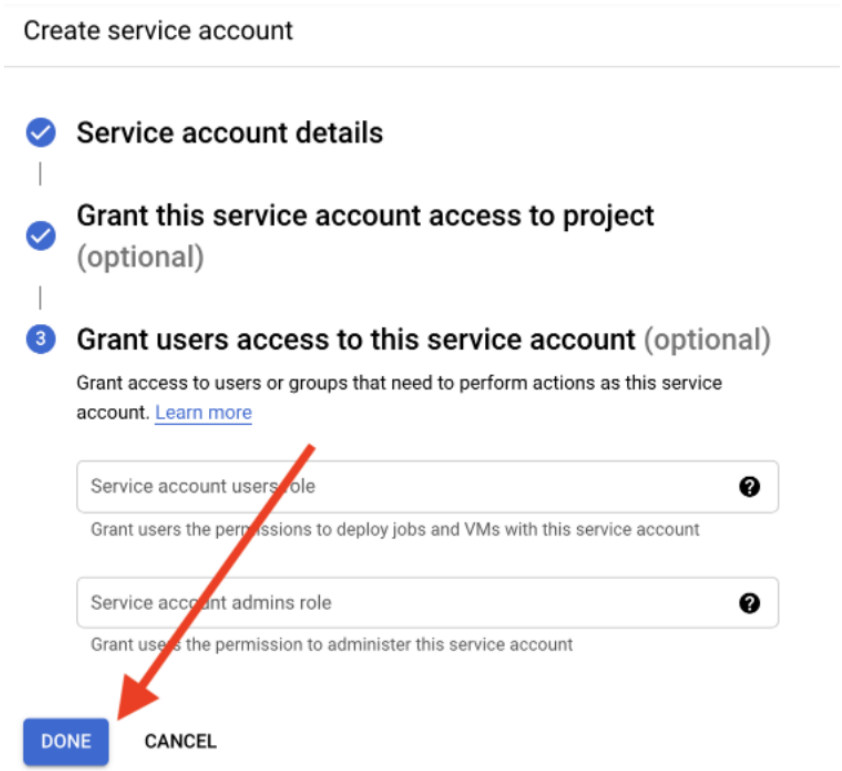
3. Click in the **Select a role** filter and scroll down to select **Kubernetes Engine** and then **Kubernetes Engine Admin**.



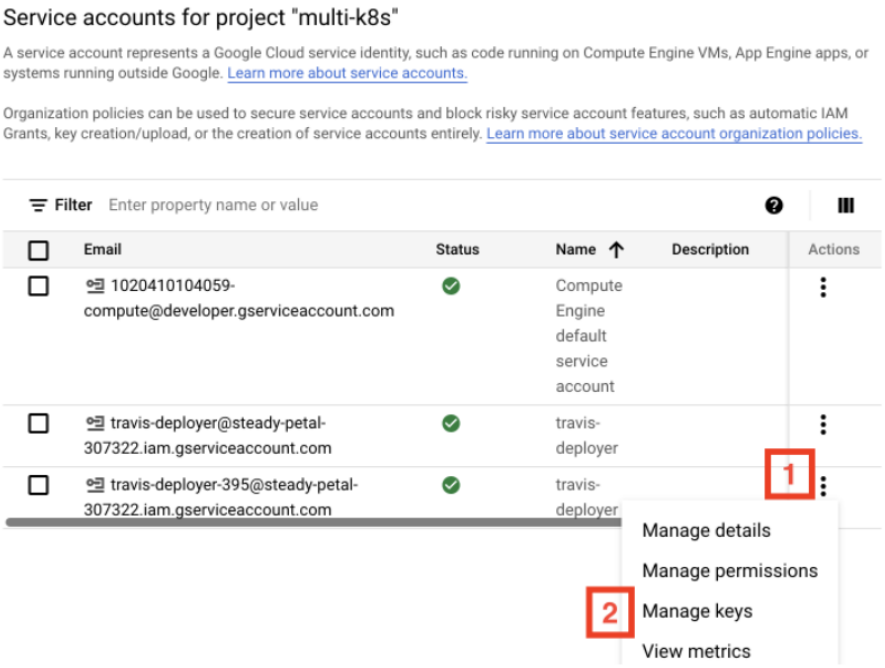
4. Make sure the filter now shows **Kubernetes Engine Admin** and then click **CONTINUE**



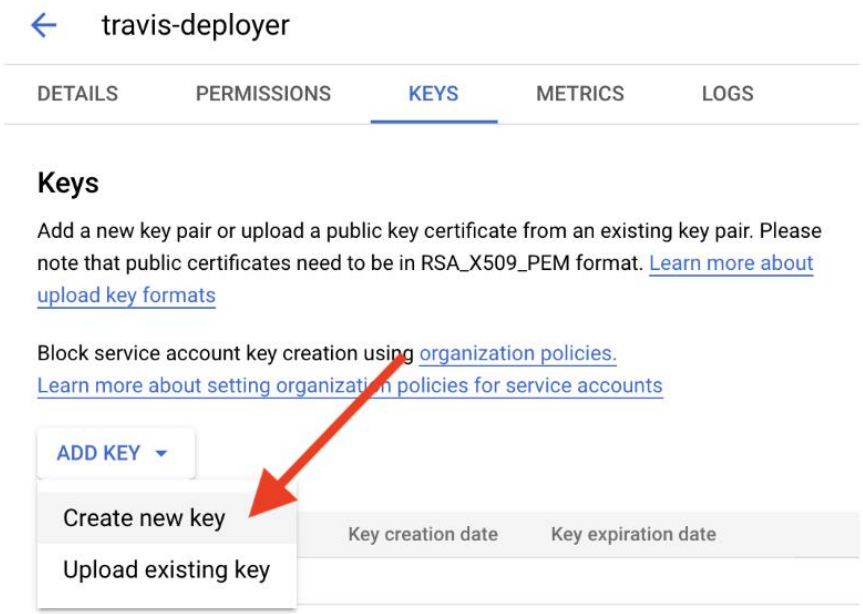
5. The Grant users access form is optional and should be skipped. Click the **DONE** button.



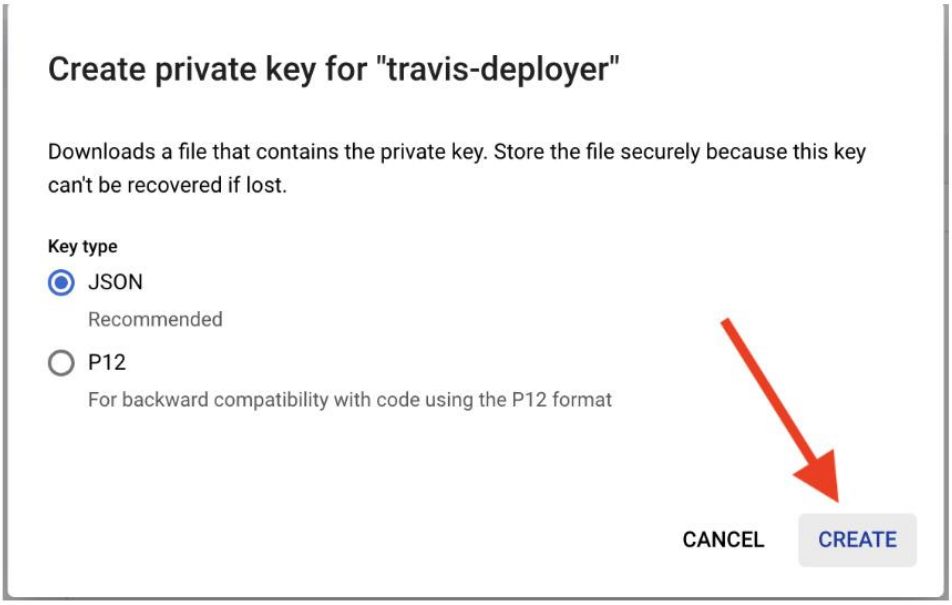
6. You should now see a table listing all of the service accounts including the one that was just created. Click the **three dots** to the right of the service account you just created. Then select **Manage Keys** in the dropdown.



7. In the **Keys** dashboard, click **ADD KEY** and then select **Create new key**.

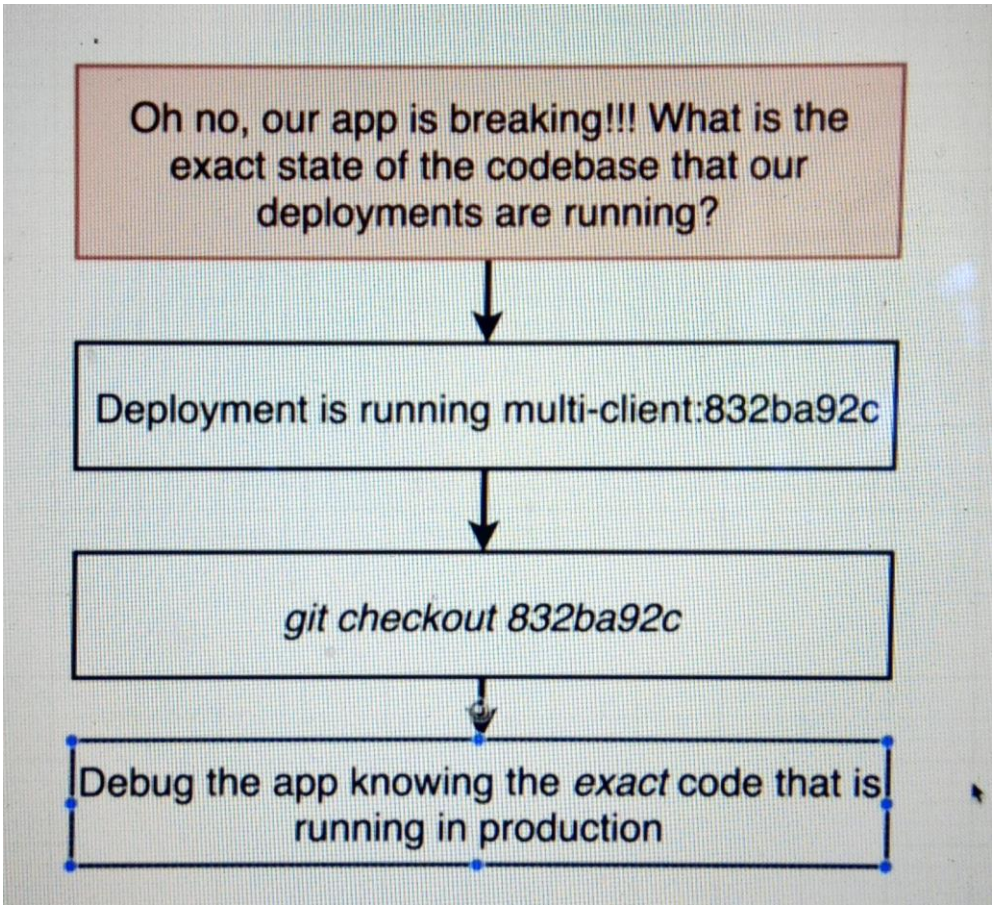


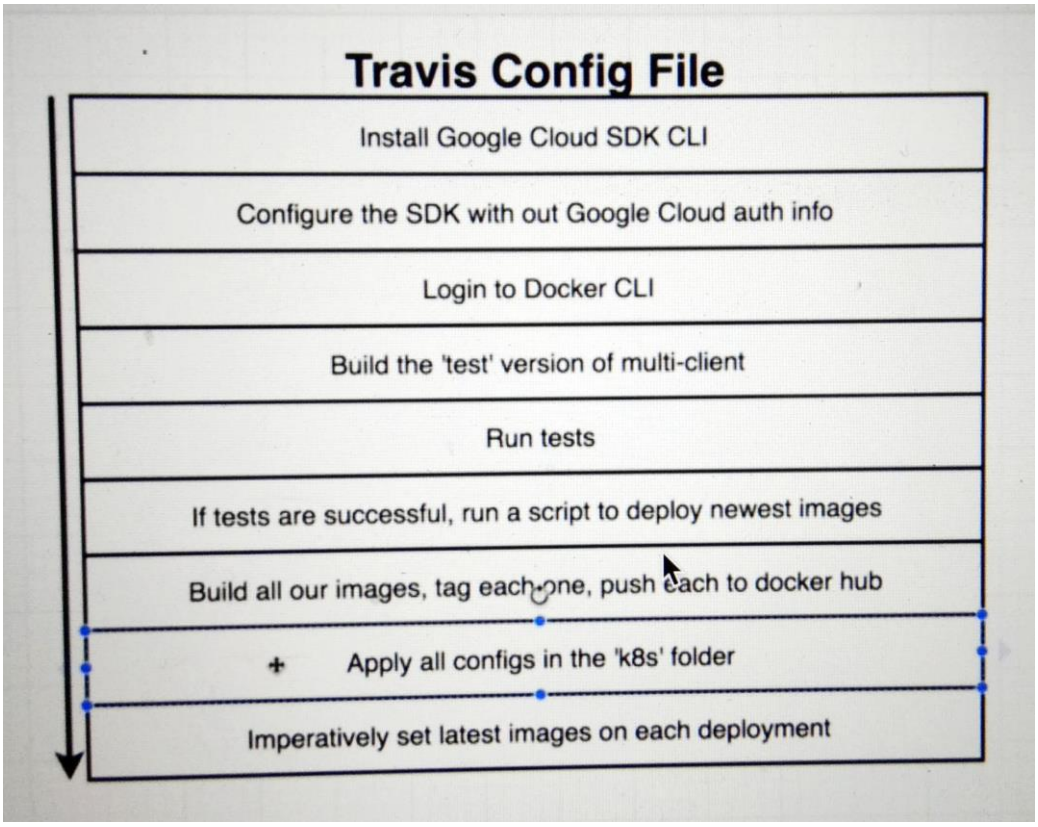
8. In the **Create private key** dialog box, make sure **Key type** is set to **JSON,** and then click the **CREATE** button.

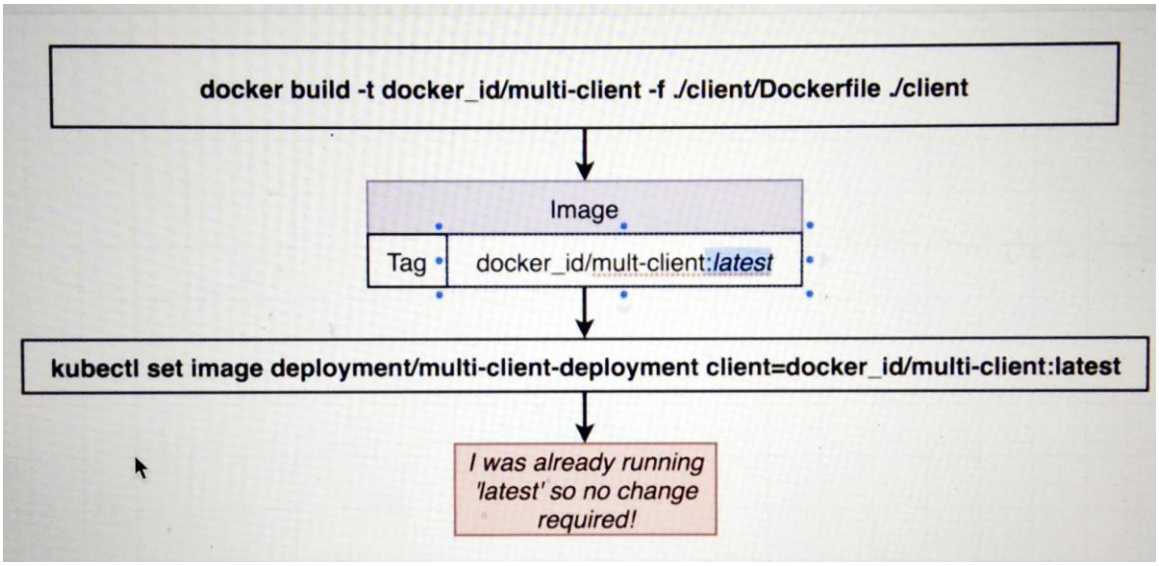


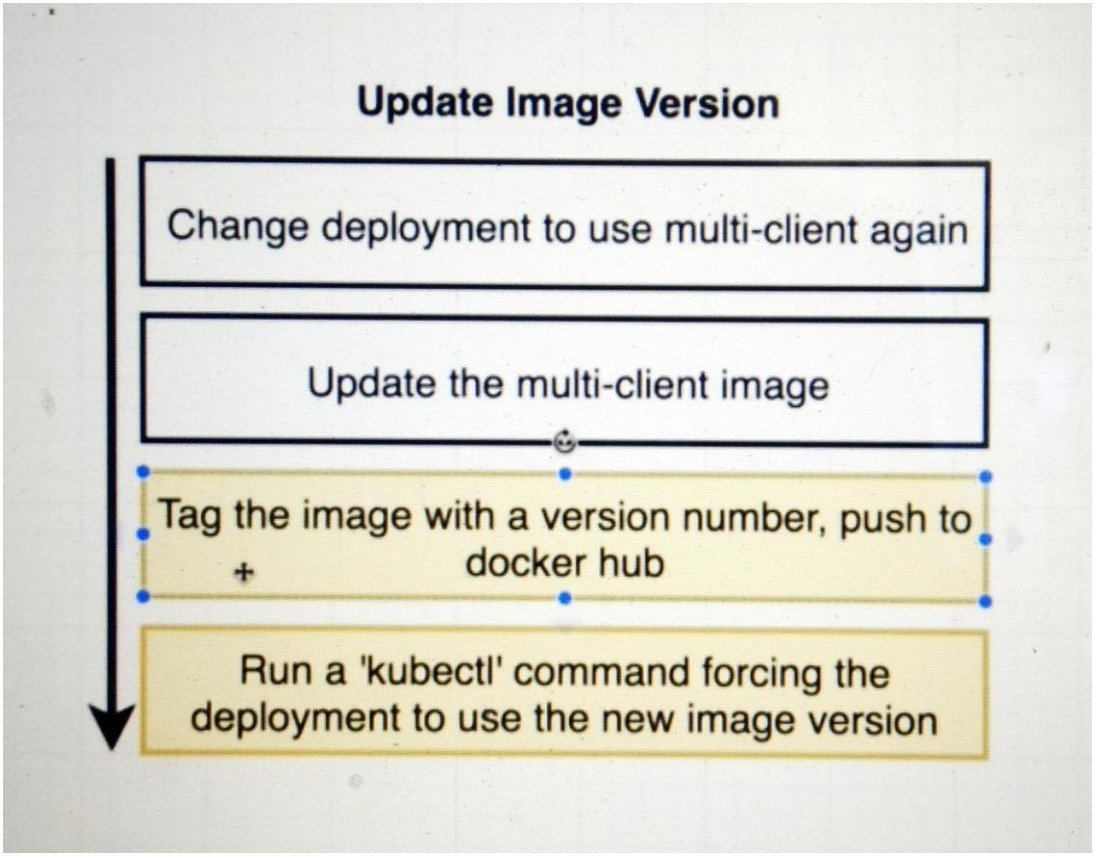
9. The JSON key file should now download to your computer.

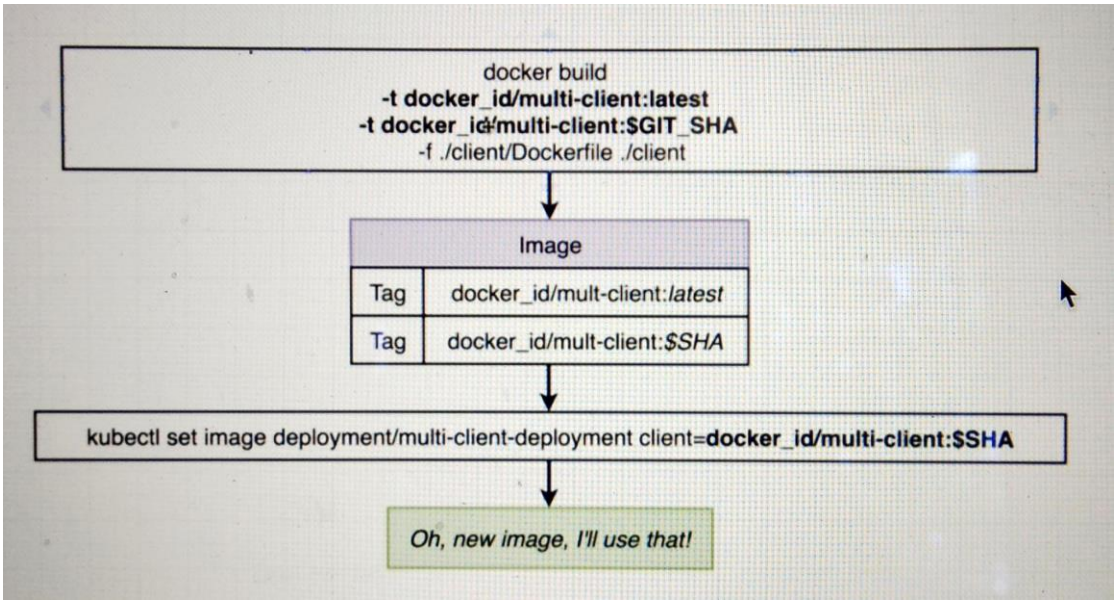
Unique Tag for Build Image

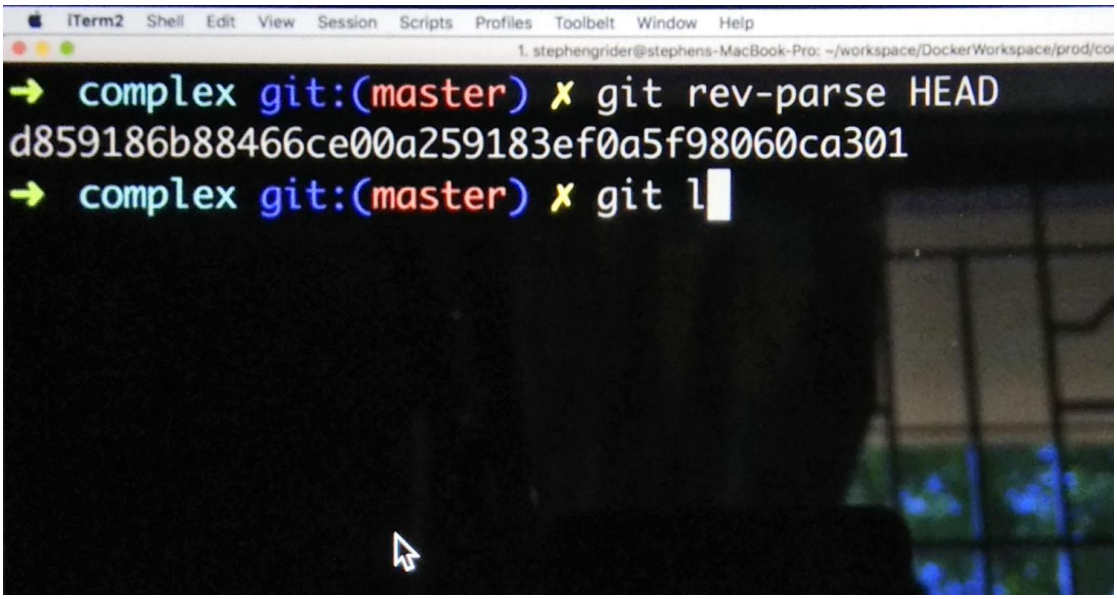


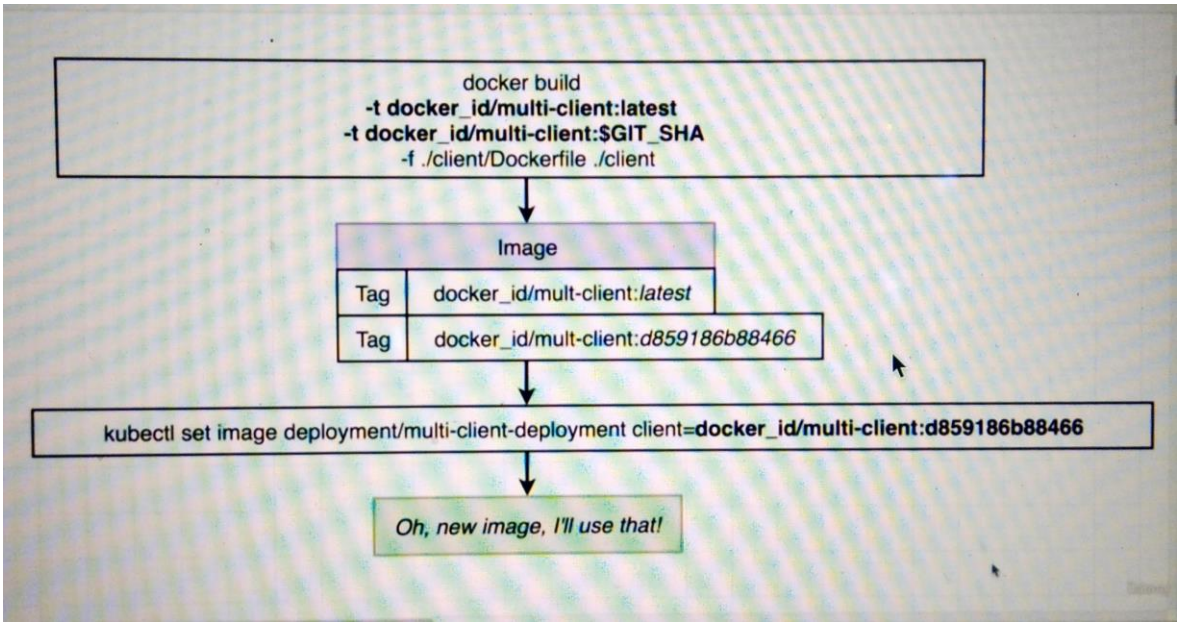


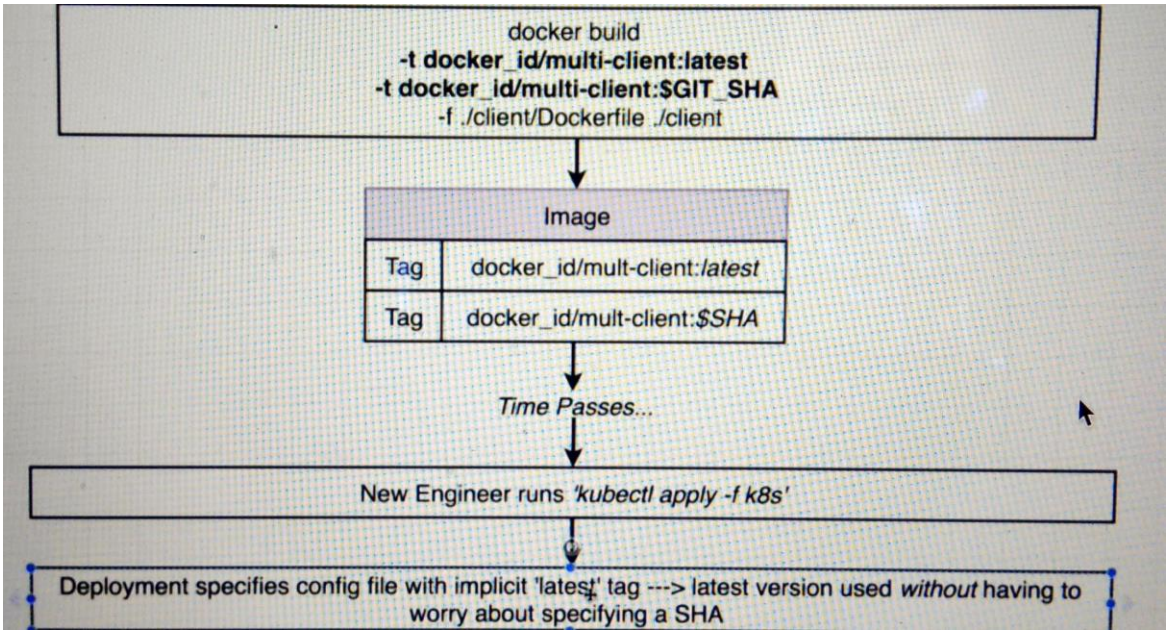

docker build -t docker_id/multi-client -f ./client/Dockerfile ./client
Image
Tag
docker_id/mult-client:latest
kubectl set image deployment/multi-client-deployment client=docker_id/multi-client:latest
I was already running 'latest' so no change required!


Update Image Version
Change deployment to use multi-client again
Update the multi-client image
Tag the image with a version number, push to docker hub
Run a 'kubectl' command forcing the deployment to use the new image version

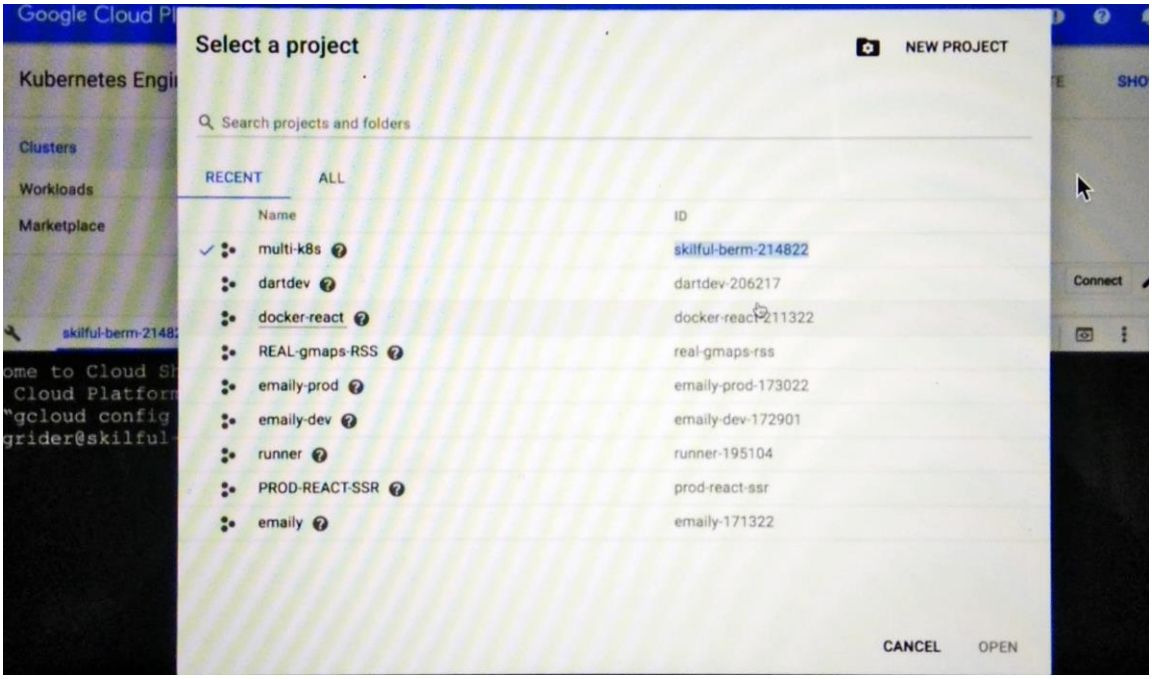

docker build
-t docker_id/multi-client:latest
-t docker_id/multi-client:$GIT_SHA
-f ./client/Dockerfile ./client
Image
Tag
docker_id/mult-client:latest
Tag
docker_id/mult-client:$SHA
kubectl set image deployment/multi-client-deployment client=docker_id/multi-client:$SHA
Oh, new image, I'll use that!

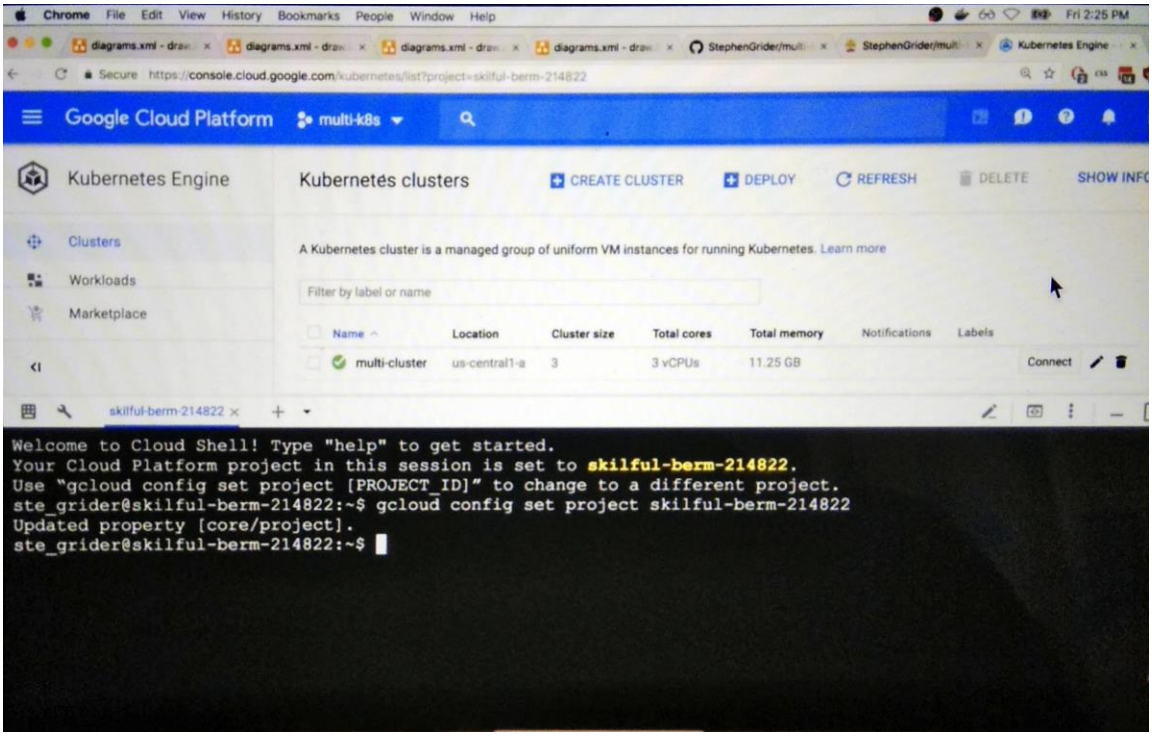

iTerm2 Shell Edit View Session Scripts Profiles Toolbelt Window Help
1. stephengrider@stephens-MacBook-Pro: ~/workspace/DockerWorkspace/prod/co
➜ complex git:(master) ✗ git rev-parse HEAD
d859186b88466ce00a259183ef0a5f98060ca301
➜ complex git:(master) ✗ git l

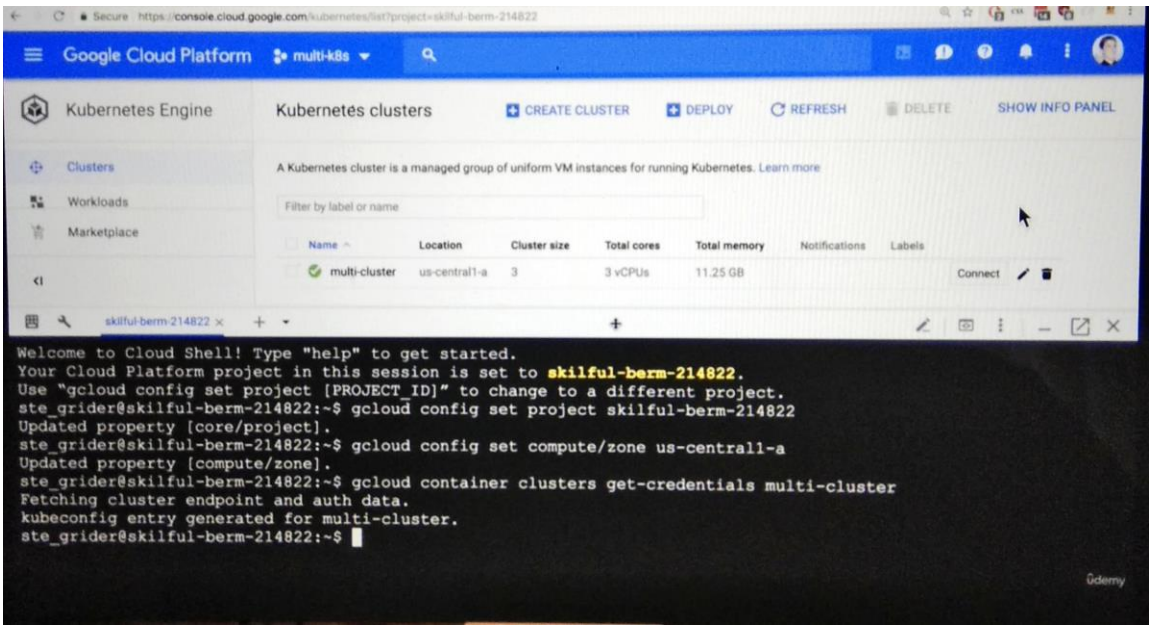

docker build
-t docker_id/multi-client:latest
-t docker_id/multi-client:$GIT_SHA
-f ./client/Dockerfile ./client
Image
Tag
docker_id/mult-client:latest
Tag
docker_id/mult-client:d859186b88466
kubectl set image deployment/multi-client-deployment client=docker_id/multi-client:d859186b88466
Oh, new image, I'll use that!



Configuring the GCloud CLI on Cloud Console




Chrome File Edit View History Bookmarks People Window Help
Fri 2:25 PM
Secure https://console.cloud.google.com/kubernetes/list?project=skilful-berm-214822
Google Cloud Platform
multi-k8s
Kubernetes Engine
Kubernetes clusters
CREATE CLUSTER
DEPLOY
REFRESH
DELETE
SHOW INFO
Clusters
Workloads
Marketplace
A Kubernetes cluster is a managed group of uniform VM instances for running Kubernetes. Learn more
Filter by label or name
Name
Location
Cluster size
Total cores
Total memory
Notifications
Labels
multi-cluster
us-central1-a
3
3 vCPUs
11.25 GB
Connect
skilful-berm-214822
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to skilful-berm-214822.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
ste_grider@skilful-berm-214822:~$ gcloud config set project skilful-berm-214822
Updated property [core/project].
ste_grider@skilful-berm-214822:~$


Secure https://console.cloud.google.com/kubernetes/list?project=skilful-berm-214822
Google Cloud Platform
multi-k8s
Kubernetes Engine
Kubernetes clusters
CREATE CLUSTER
DEPLOY
REFRESH
DELETE
SHOW INFO PANEL
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A Kubernetes cluster is a managed group of uniform VM instances for running Kubernetes. Learn more
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Cluster size
Total cores
Total memory
Notifications
Labels
multi-cluster
us-central1-a
3
3 vCPUs
11.25 GB
Connect
skilful-berm-214822
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to skilful-berm-214822.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
ste_grider@skilful-berm-214822:~$ gcloud config set project skilful-berm-214822
Updated property [core/project].
ste_grider@skilful-berm-214822:~$ gcloud config set compute/zone us-central1-a
Updated property [compute/zone].
ste_grider@skilful-berm-214822:~$ gcloud container clusters get-credentials multi-cluster
Fetching cluster endpoint and auth data.
kubeconfig entry generated for multi-cluster.
ste_grider@skilful-berm-214822:~$
Udemy

In the next lecture, we will be installing Helm. Helm v3 has since been released which is a major update, as it removes the use of Tiller. Please follow the updated instructions for this version below:

1. Install Helm v3:

In your Google Cloud Console run the following:

```
curl -fsSL -o get_helm.sh https://raw.githubusercontent.com/helm/helm/master/scripts/get-helm-3
chmod 700 get_helm.sh
./get_helm.sh
```

link to the docs:

https://helm.sh/docs/intro/install/#from-script

2. Skip the commands run in the following lectures:

Helm Setup, Kubernetes Security with RBAC, Assigning Tiller a Service Account, and Ingress-Nginx with Helm. You should still watch these lectures and they contain otherwise useful info.

3. Install Ingress-Nginx:

In your Google Cloud Console run the following:

```
helm repo add ingress-nginx https://kubernetes.github.io/ingress-nginx
helm install my-release ingress-nginx/ingress-nginx
```

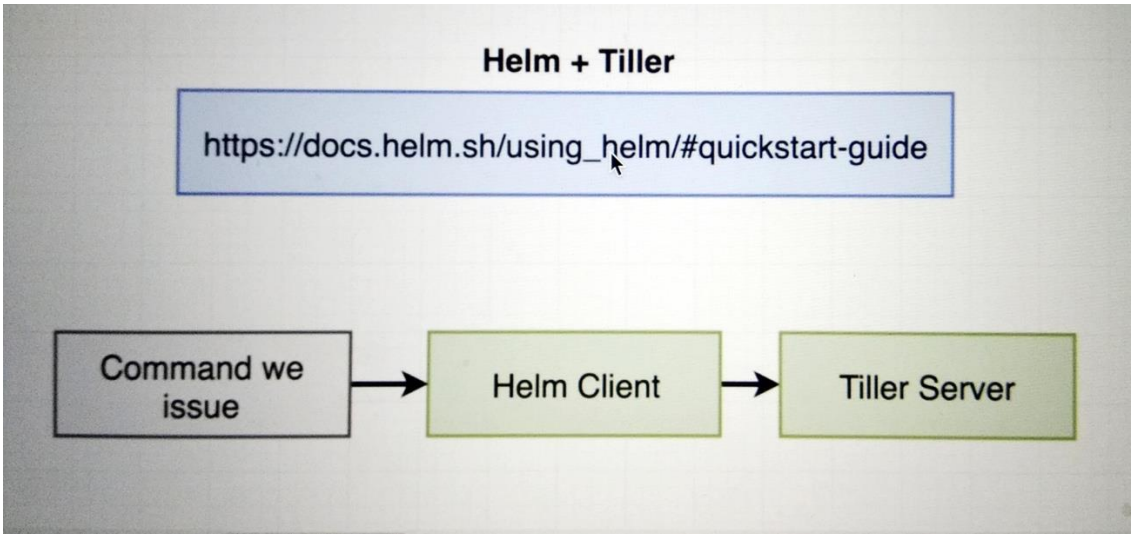
IMPORTANT: If you get an error such as *chart requires kubeVersion: >=1.16.0-0.....*

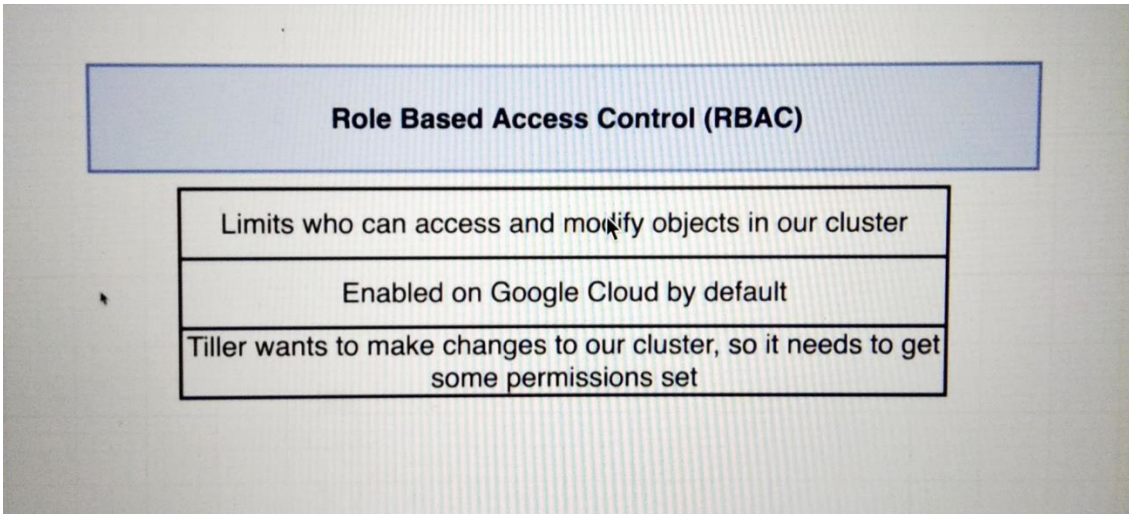
You may need to manually upgrade your cluster to at least the version specified:

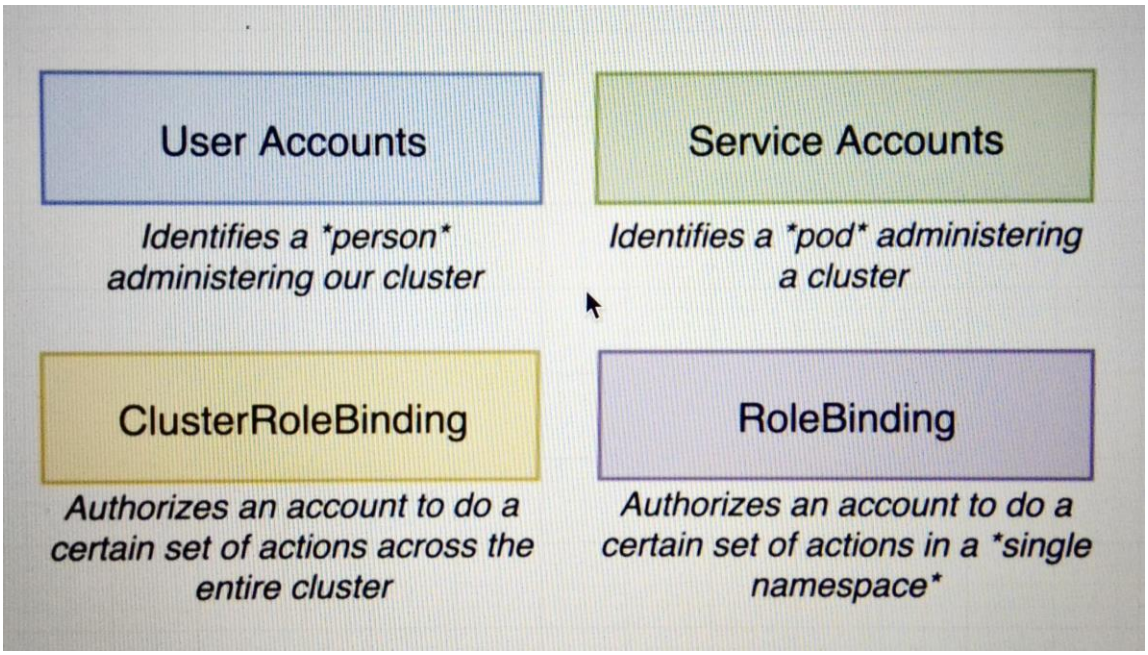
`gcloud container clusters upgrade  YOUR_CLUSTER_NAME --master --cluster-version 1.16`

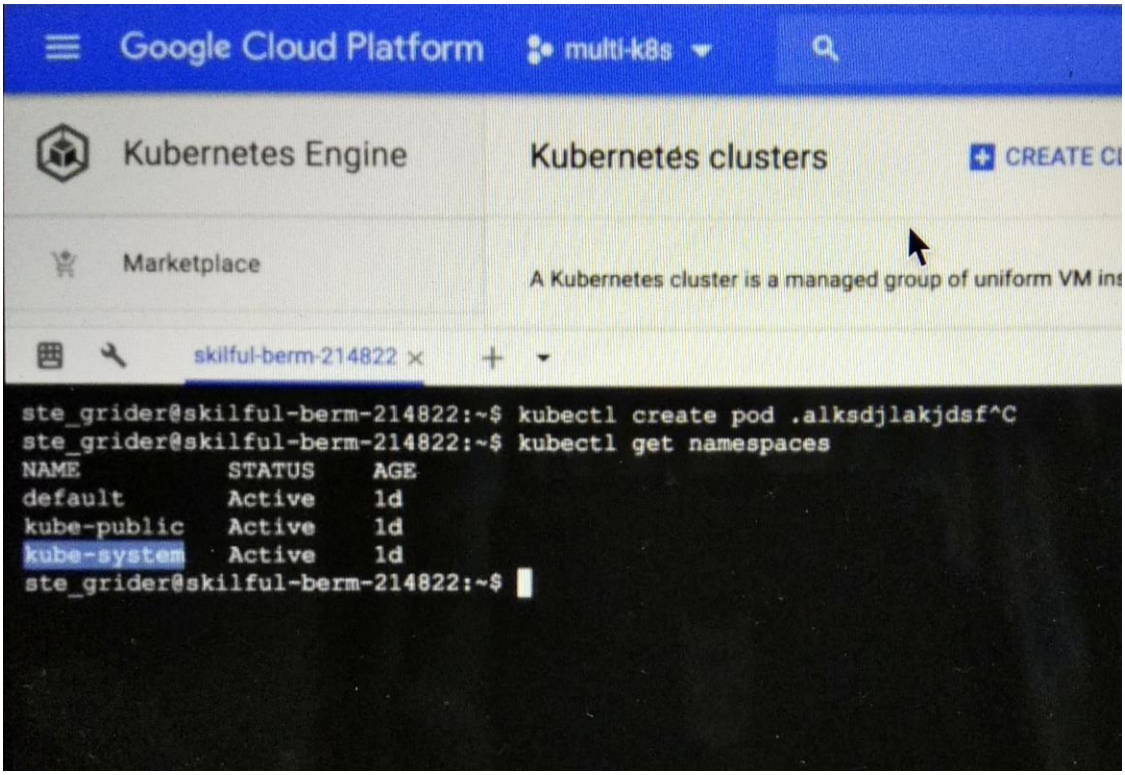
This should not be a long term issue since Google Cloud should handle this automatically:

https://cloud.google.com/kubernetes-engine/docs/how-to/upgrading-a-cluster

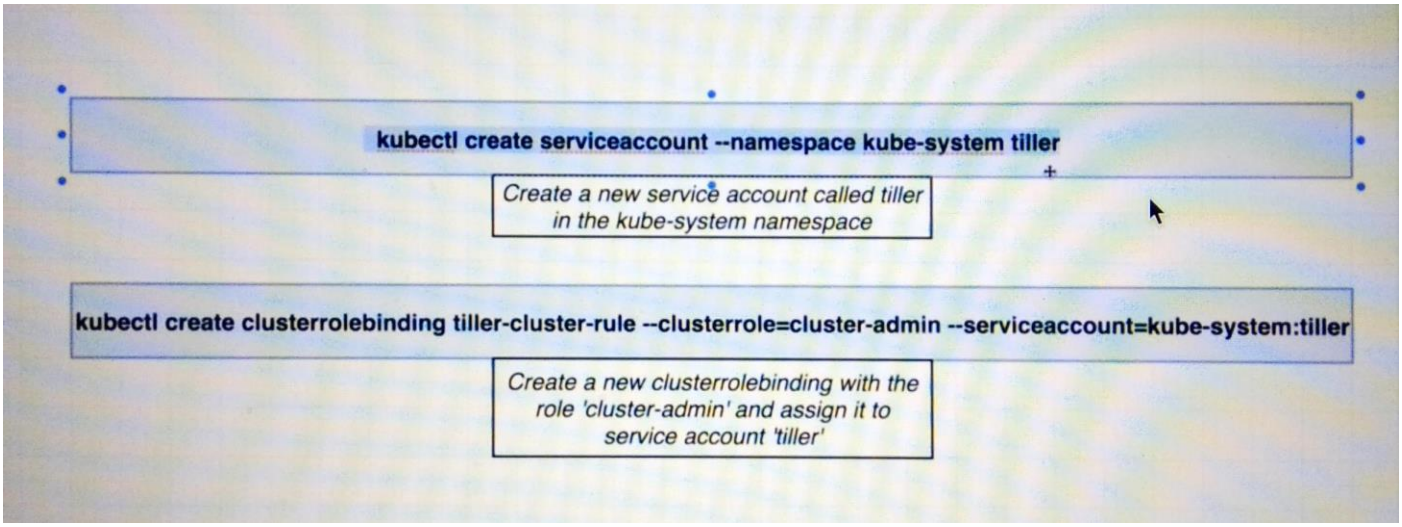

Helm + Tiller
https://docs.helm.sh/using_helm/#quickstart-guide
Command we issue
Helm Client
Tiller Server

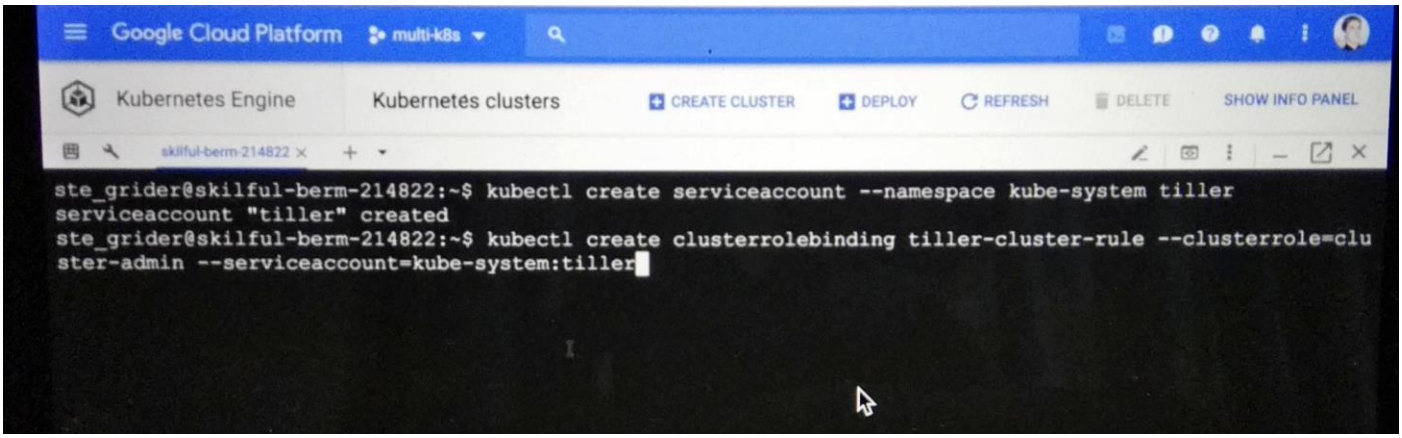

Role Based Access Control (RBAC)
Limits who can access and modify objects in our cluster
Enabled on Google Cloud by default
Tiller wants to make changes to our cluster, so it needs to get some permissions set

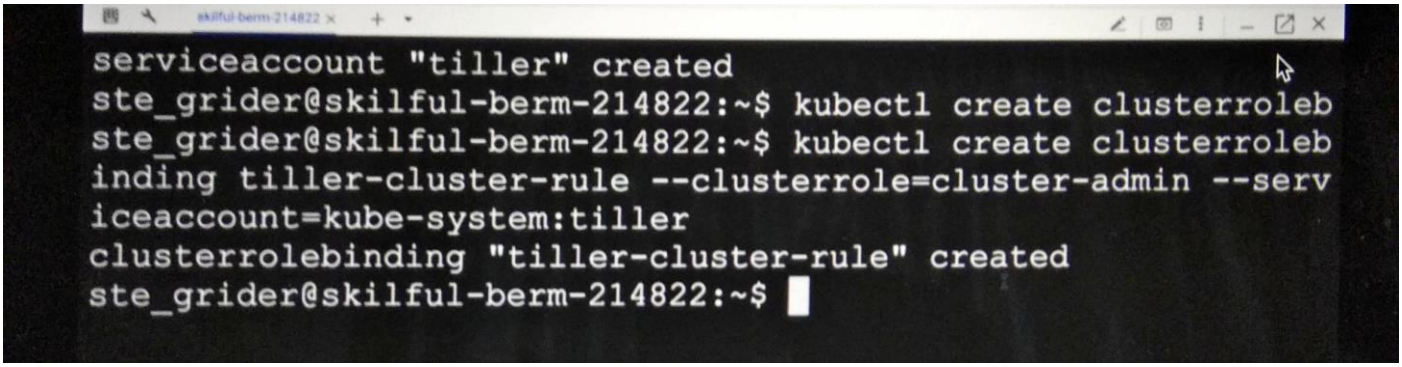

User Accounts
Identifies a *person* administering our cluster
Service Accounts
Identifies a *pod* administering a cluster
ClusterRoleBinding
Authorizes an account to do a certain set of actions across the entire cluster
RoleBinding
Authorizes an account to do a certain set of actions in a *single namespace*

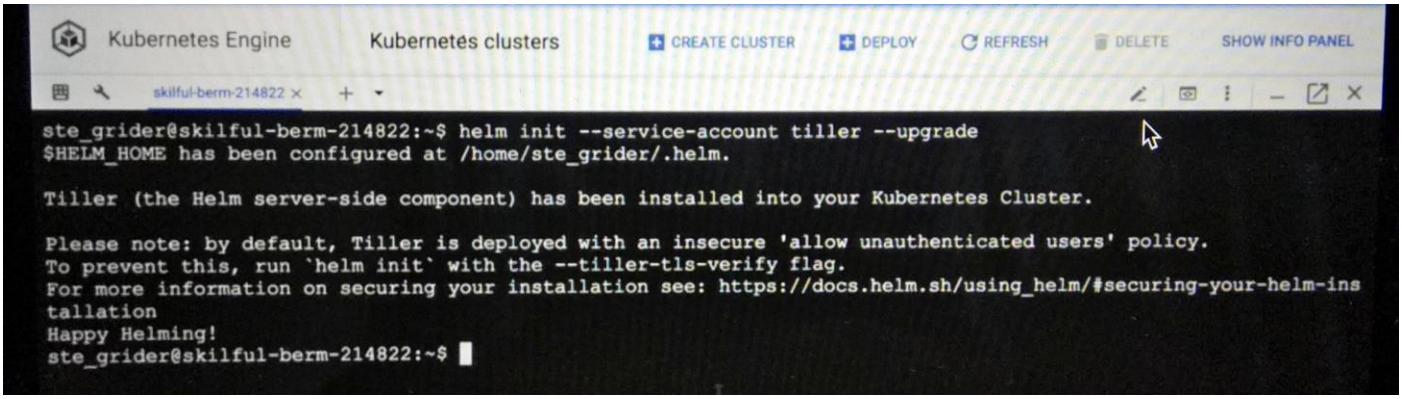


Assigning Tiller a Service Account







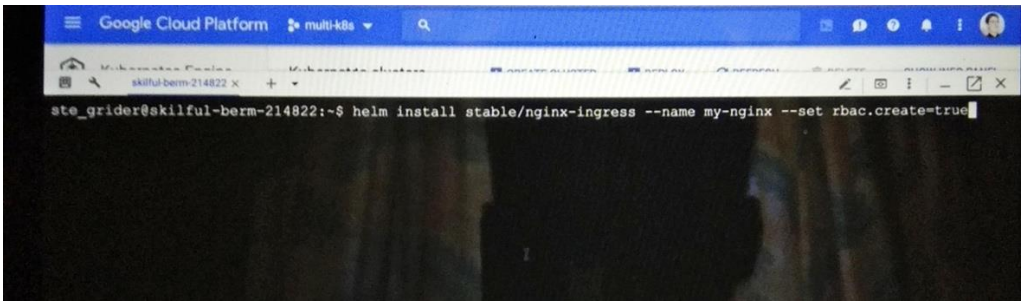


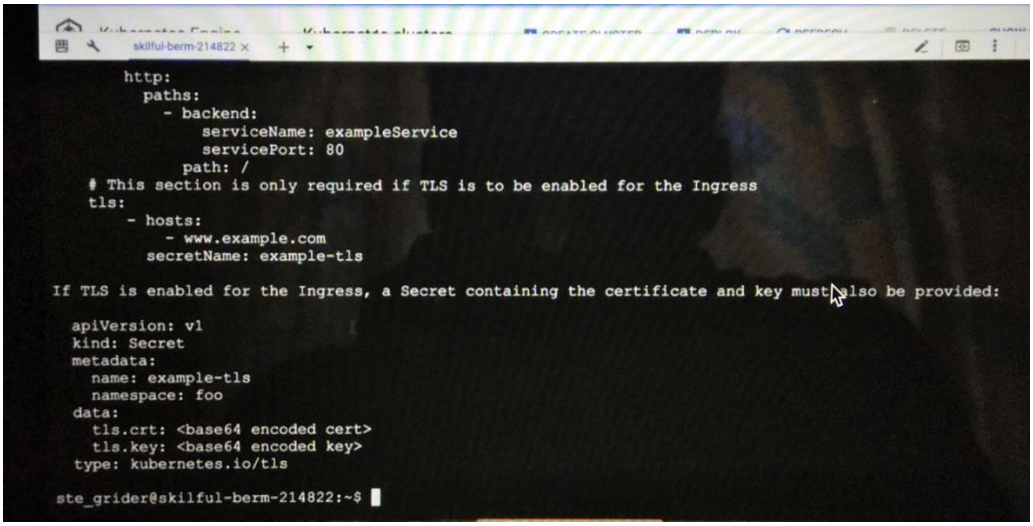
Ingress-Ngnix with Helm

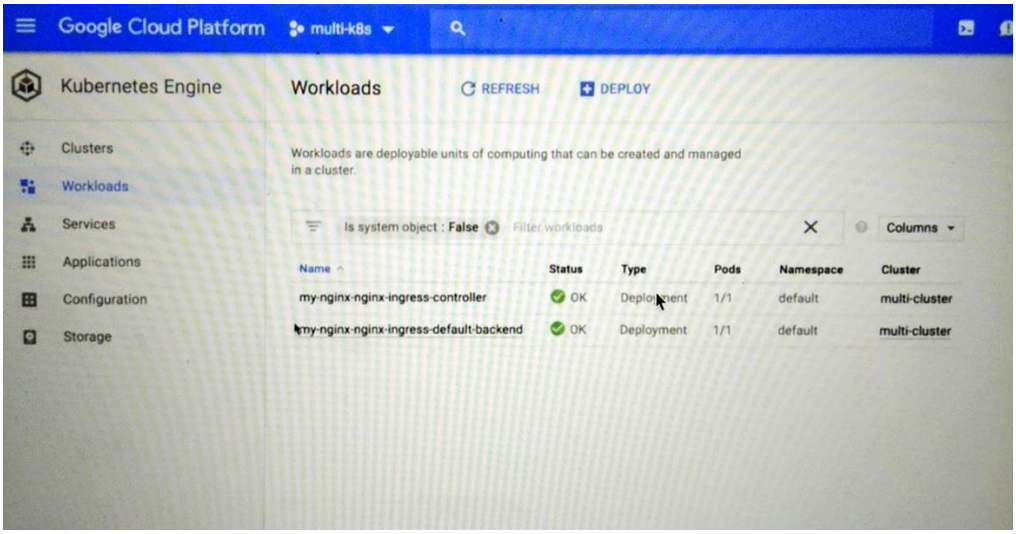
Quick Note about the Default Backend

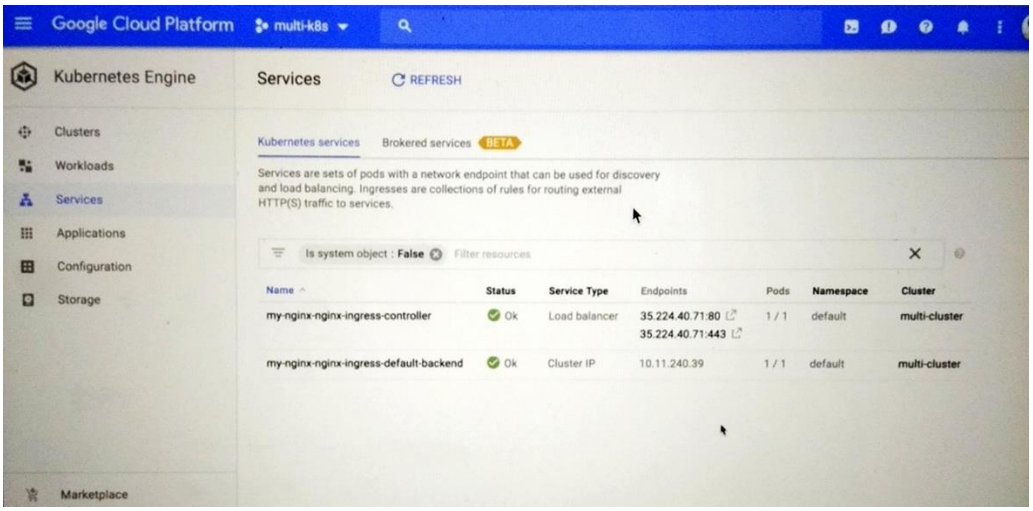
In the next lecture, you will see the **Services** dashboard showing an ingress controller and default backend. A default backend no longer ships with ingress-nginx, so, if you only see a controller and you get a **404 Not Found** when visiting the IP address, this is perfectly expected.

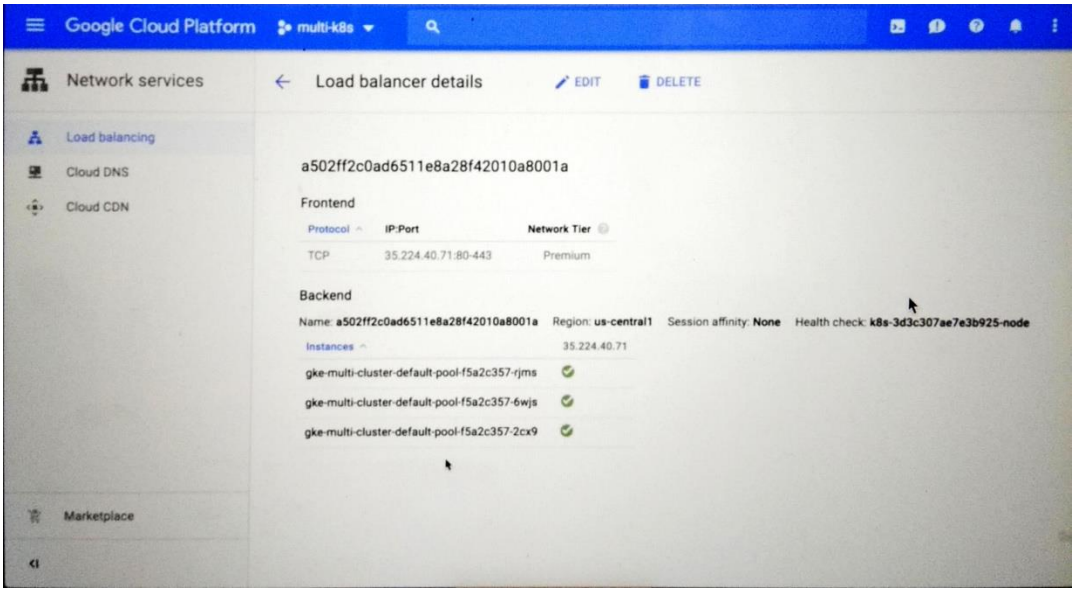
The Result of Ingress Nginx



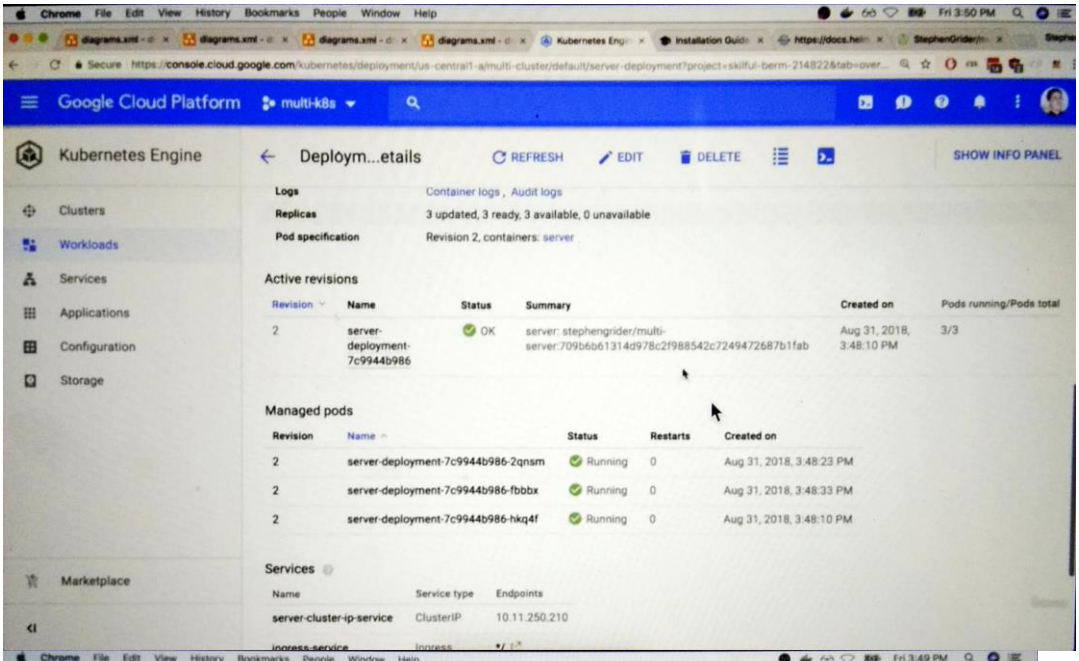

skilful-berm-214822
http:
paths:
- backend:
serviceName: exampleService
servicePort: 80
path: /
This section is only required if TLS is to be enabled for the Ingress
tls:
- hosts:
- www.example.com
secretName: example-tls
If TLS is enabled for the Ingress, a Secret containing the certificate and key must also be provided:
apiVersion: v1
kind: Secret
metadata:
name: example-tls
namespace: foo
data:
tls.crt: <base64 encoded cert>
tls.key: <base64 encoded key>
type: kubernetes.io/tls
ste_grider@skilful-berm-214822:~$

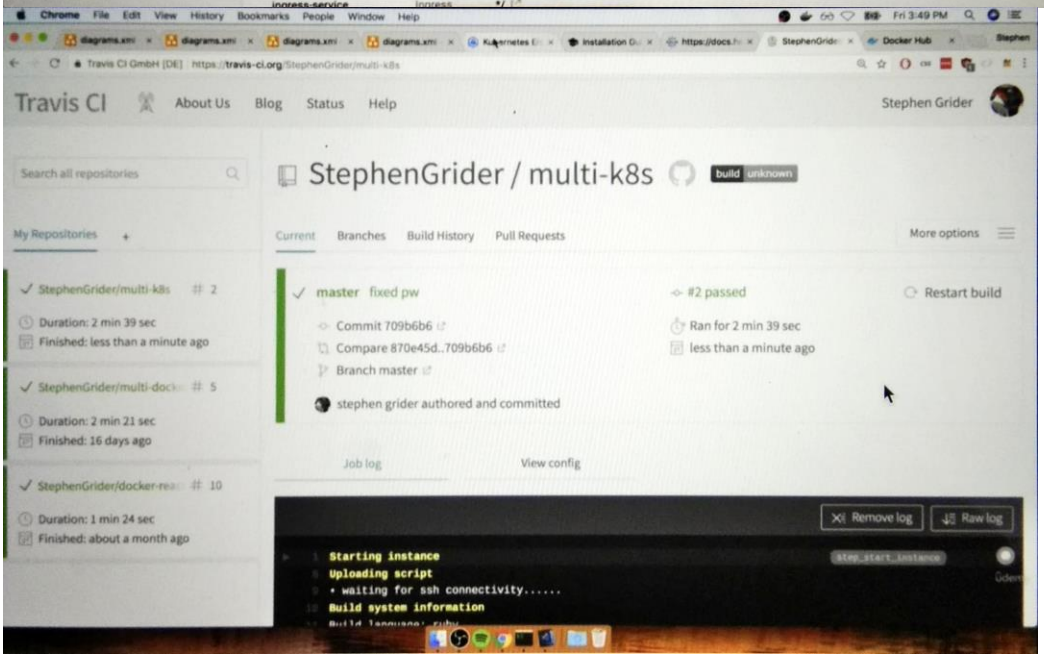

Google Cloud Platform
multi-k8s
Kubernetes Engine
Workloads
REFRESH
DEPLOY
Clusters
Workloads
Services
Applications
Configuration
Storage
Workloads are deployable units of computing that can be created and managed in a cluster.
Is system object : False
Filter workloads
Columns
Name
Status
Type
Pods
Namespace
Cluster
my-nginx-nginx-ingress-controller
OK
Deployment
1/1
default
multi-cluster
my-nginx-nginx-ingress-default-backend
OK
Deployment
1/1
default
multi-cluster

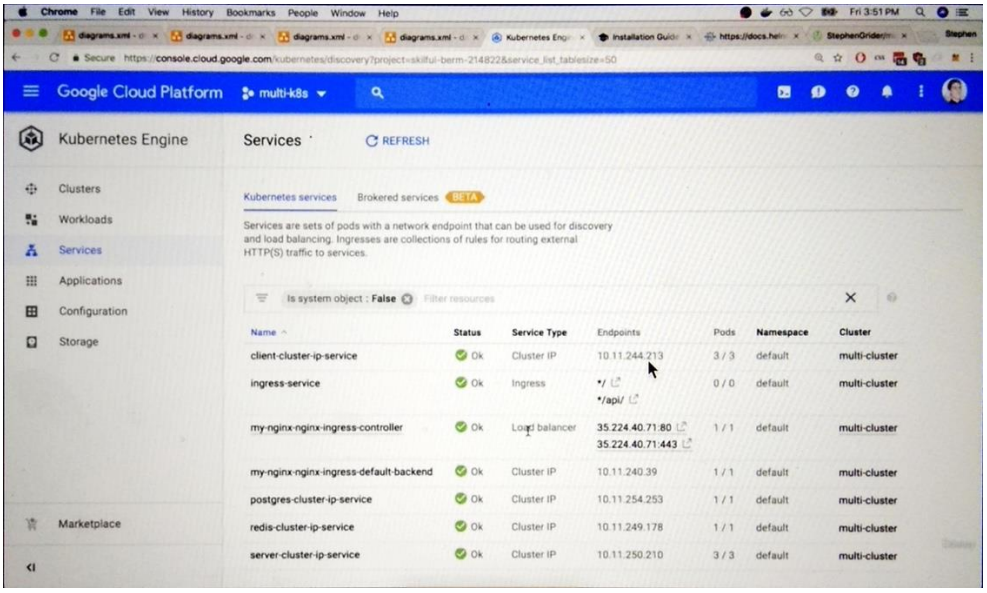

Google Cloud Platform
multi-k8s
Kubernetes Engine
Services
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes services
Brokered services
BETA
Services are sets of pods with a network endpoint that can be used for discovery and load balancing. Ingresses are collections of rules for routing external HTTP(S) traffic to services.
Is system object : False
Filter resources
Name
Status
Service Type
Endpoints
Pods
Namespace
Cluster
my-nginx-nginx-ingress-controller
Ok
Load balancer
35.224.40.71:80
35.224.40.71:443
1 / 1
default
multi-cluster
my-nginx-nginx-ingress-default-backend
Ok
Cluster IP
10.11.240.39
1 / 1
default
multi-cluster

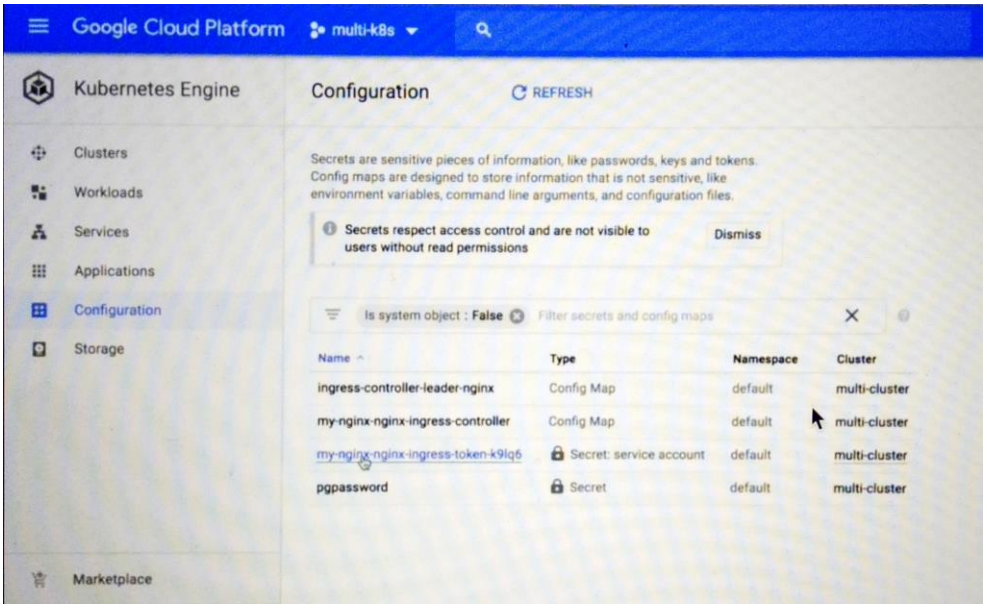


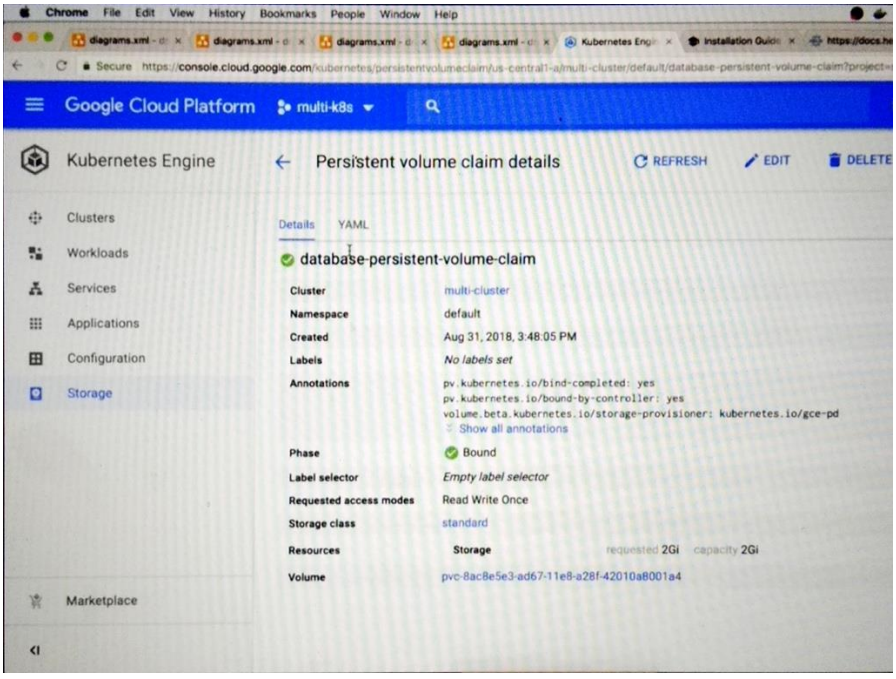
Verifying Deployment

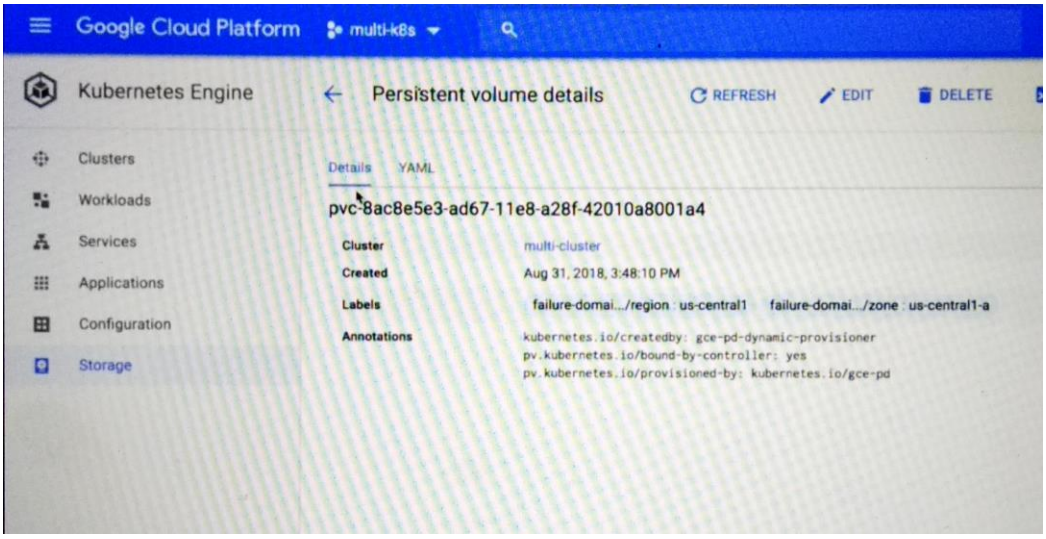


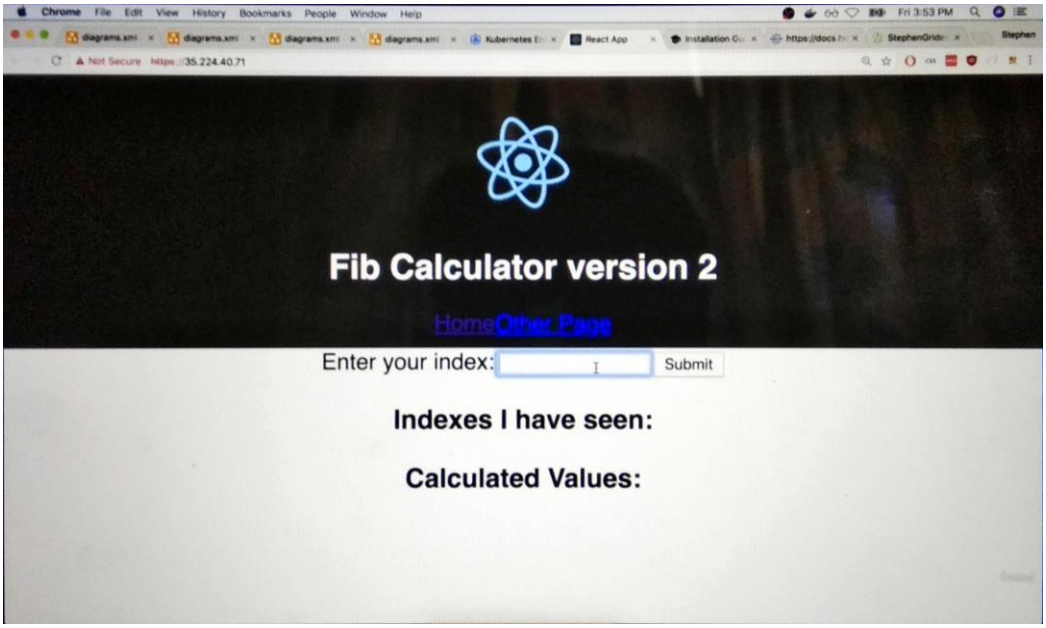



Google Cloud Platform
multi-k8s
Kubernetes Engine
Services
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Kubernetes services
Brokered services
BETA
Services are sets of pods with a network endpoint that can be used for discovery and load balancing. Ingresses are collections of rules for routing external HTTP(S) traffic to services.
Is system object : False
Filter resources
Name
Status
Service Type
Endpoints
Pods
Namespace
Cluster
client-cluster-ip-service
Ok
Cluster IP
10.11.244.213
3 / 3
default
multi-cluster
ingress-service
Ok
Ingress
*/
*/api/
0 / 0
default
multi-cluster
my-nginx-nginx-ingress-controller
Ok
Load balancer
35.224.40.71:80
35.224.40.71:443
1 / 1
default
multi-cluster
my-nginx-nginx-ingress-default-backend
Ok
Cluster IP
10.11.240.39
1 / 1
default
multi-cluster
postgres-cluster-ip-service
Ok
Cluster IP
10.11.254.253
1 / 1
default
multi-cluster
redis-cluster-ip-service
Ok
Cluster IP
10.11.249.178
1 / 1
default
multi-cluster
server-cluster-ip-service
Ok
Cluster IP
10.11.250.210
3 / 3
default
multi-cluster

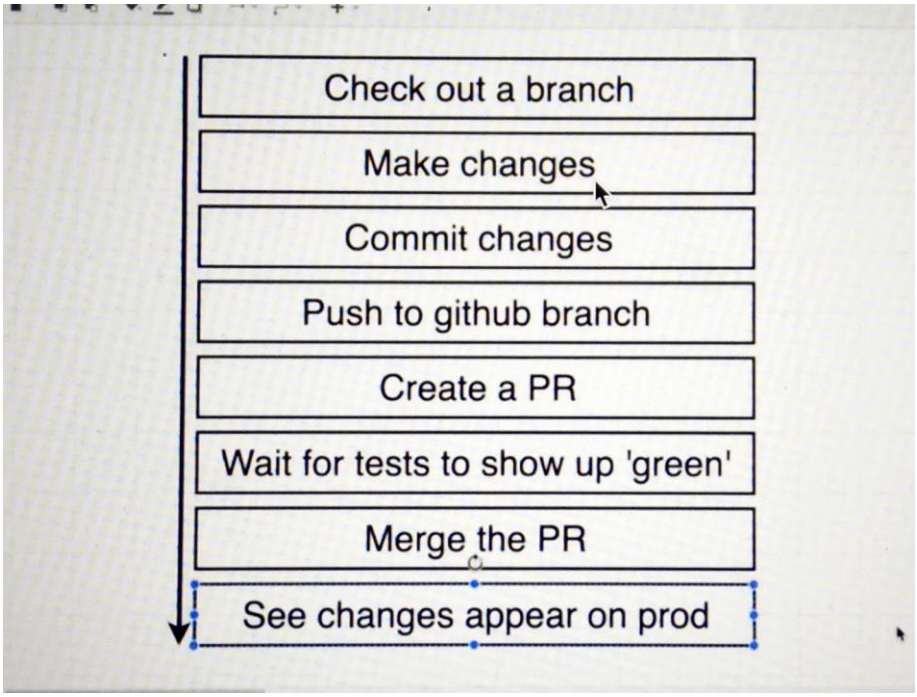

Google Cloud Platform
multi-k8s
Kubernetes Engine
Configuration
REFRESH
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Secrets are sensitive pieces of information, like passwords, keys and tokens. Config maps are designed to store information that is not sensitive, like environment variables, command line arguments, and configuration files.
Secrets respect access control and are not visible to users without read permissions
Dismiss
Is system object : False
Filter secrets and config maps
Name
Type
Namespace
Cluster
ingress-controller-leader-nginx
Config Map
default
multi-cluster
my-nginx-nginx-ingress-controller
Config Map
default
multi-cluster
my-nginx-nginx-ingress-token-k9lq6
Secret: service account
default
multi-cluster
pgpassword
Secret
default
multi-cluster

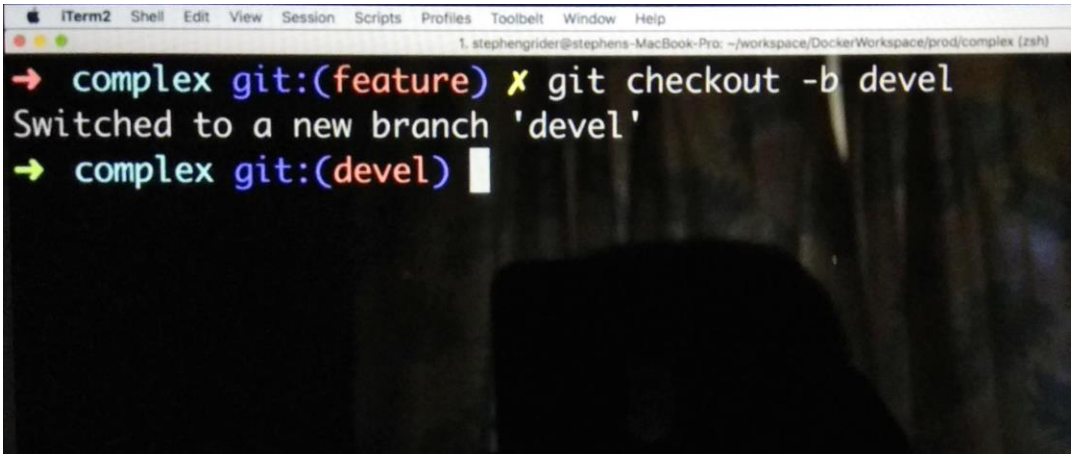

Google Cloud Platform
multi-k8s
Kubernetes Engine
Persistent volume claim details
REFRESH
EDIT
DELETE
Clusters
Workloads
Services
Applications
Configuration
Storage
Marketplace
Details
YAML
database-persistent-volume-claim
Cluster
multi-cluster
Namespace
default
Created
Aug 31, 2018, 3:48:05 PM
Labels
No labels set
Annotations
pv.kubernetes.io/bind-completed: yes
pv.kubernetes.io/bound-by-controller: yes
volume.beta.kubernetes.io/storage-provisioner: kubernetes.io/gce-pd
Show all annotations
Phase
Bound
Label selector
Empty label selector
Requested access modes
Read Write Once
Storage class
standard
Resources
Storage
requested 2Gi
capacity 2Gi
Volume
pvc-8ac8e5e3-ad67-11e8-a28f-42010a8001a4

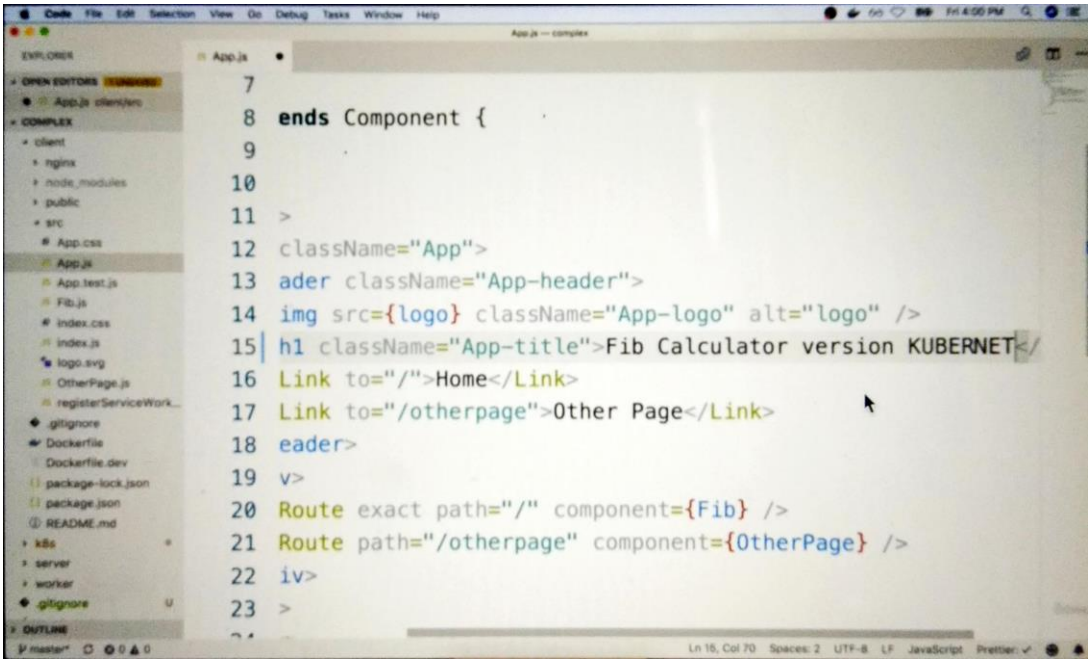


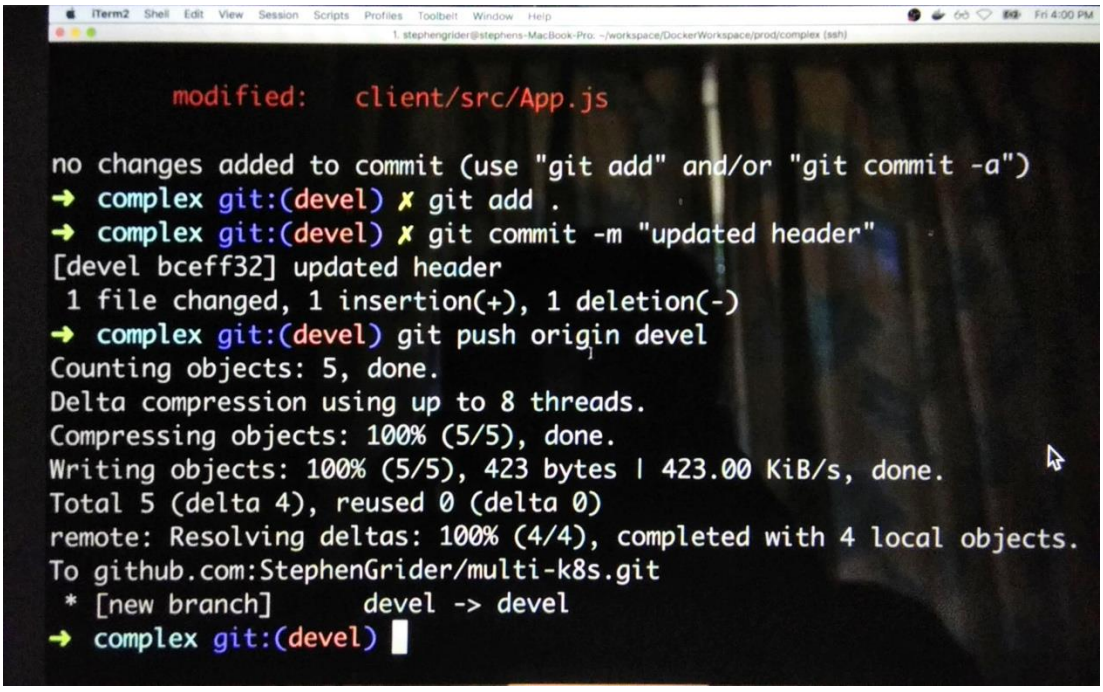


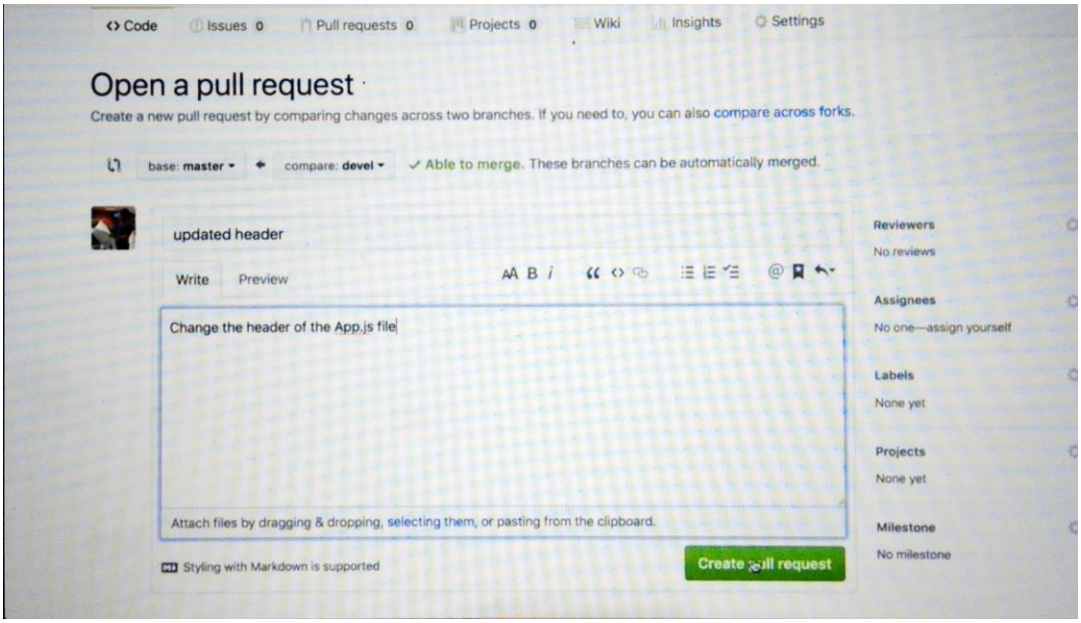
A Workflow for Changing in Pods

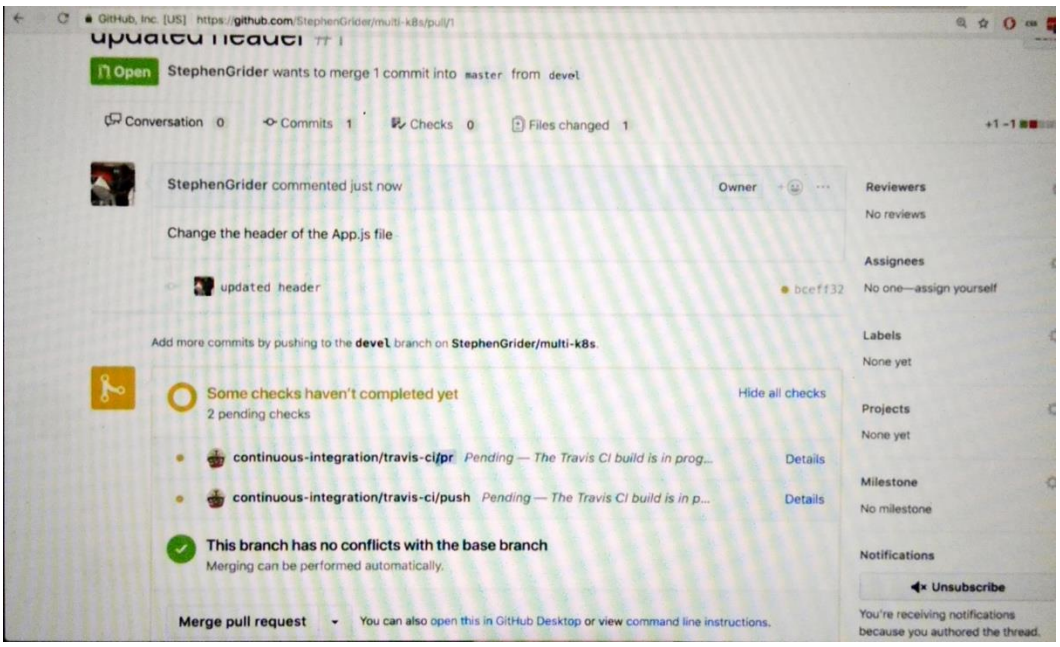


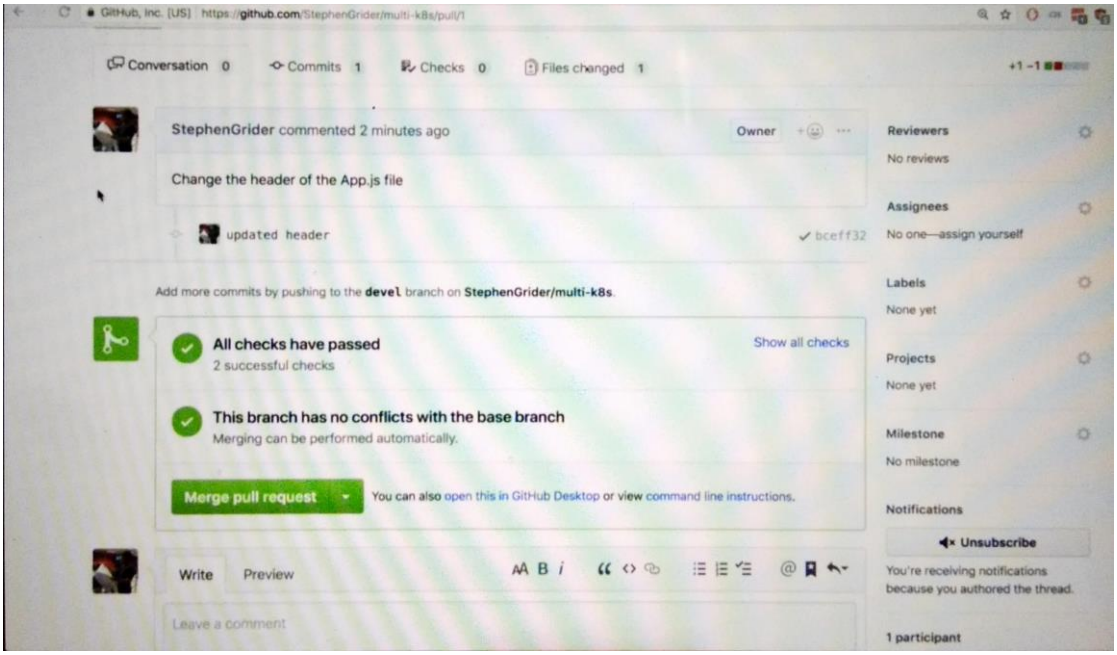

iTerm2 Shell Edit View Session Scripts Profiles Toolbelt Window Help
1. stephengrider@stephens-MacBook-Pro: ~/workspace/DockerWorkspace/prod/complex (zsh)
➜ complex git:(feature) ✗ git checkout -b devel
Switched to a new branch 'devel'
➜ complex git:(devel)

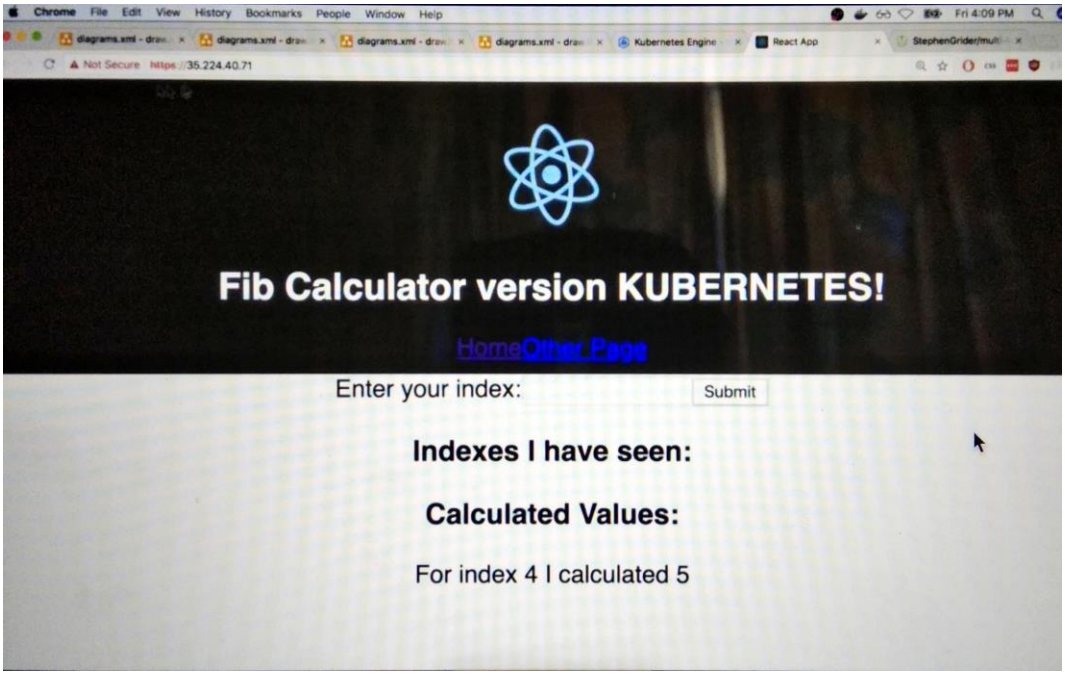

ends Component {
>
className="App">
ader className="App-header">
img src={logo} className="App-logo" alt="logo" />
h1 className="App-title">Fib Calculator version KUBERNET</
Link to="/">Home</Link>
Link to="/otherpage">Other Page</Link>
eader>
v>
Route exact path="/" component={Fib} />
Route path="/otherpage" component={OtherPage} />
iv>
>


iTerm2 Shell Edit View Session Scripts Profiles Toolbelt Window Help
1. stephengrider@stephens-MacBook-Pro: ~/workspace/DockerWorkspace/prod/complex (ssh)
modified: client/src/App.js
no changes added to commit (use "git add" and/or "git commit -a")
➜ complex git:(devel) ✗ git add .
➜ complex git:(devel) ✗ git commit -m "updated header"
[devel bceff32] updated header
1 file changed, 1 insertion(+), 1 deletion(-)
➜ complex git:(devel) git push origin devel
Counting objects: 5, done.
Delta compression using up to 8 threads.
Compressing objects: 100% (5/5), done.
Writing objects: 100% (5/5), 423 bytes | 423.00 KiB/s, done.
Total 5 (delta 4), reused 0 (delta 0)
remote: Resolving deltas: 100% (4/4), completed with 4 local objects.
To github.com:StephenGrider/multi-k8s.git
* [new branch] devel -> devel
➜ complex git:(devel)


Code
Issues 0
Pull requests 0
Projects 0
Wiki
Insights
Settings
Open a pull request
Create a new pull request by comparing changes across two branches. If you need to, you can also compare across forks.
base: master
compare: devel
Able to merge. These branches can be automatically merged.
updated header
Write
Preview
Change the header of the App.js file
Attach files by dragging & dropping, selecting them, or pasting from the clipboard.
Styling with Markdown is supported
Create pull request
Reviewers
No reviews
Assignees
No one—assign yourself
Labels
None yet
Projects
None yet
Milestone
No milestone


GitHub, Inc. [US] https://github.com/StephenGrider/multi-k8s/pull/1
Open
StephenGrider wants to merge 1 commit into master from devel
Conversation 0
Commits 1
Checks 0
Files changed 1
+1 −1
StephenGrider commented just now
Owner
Change the header of the App.js file
updated header
bceff32
Add more commits by pushing to the devel branch on StephenGrider/multi-k8s.
Some checks haven't completed yet
2 pending checks
Hide all checks
continuous-integration/travis-ci/pr Pending — The Travis CI build is in prog...
Details
continuous-integration/travis-ci/push Pending — The Travis CI build is in p...
Details
This branch has no conflicts with the base branch
Merging can be performed automatically.
Merge pull request
You can also open this in GitHub Desktop or view command line instructions.
Reviewers
No reviews
Assignees
No one—assign yourself
Labels
None yet
Projects
None yet
Milestone
No milestone
Notifications
Unsubscribe
You're receiving notifications because you authored the thread.

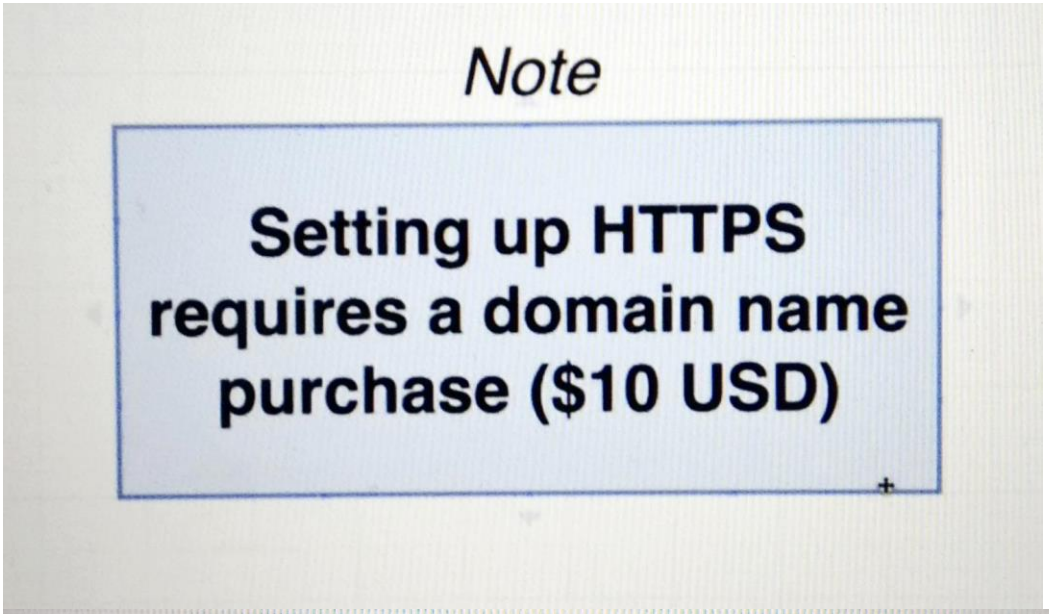

GitHub, Inc. [US] https://github.com/StephenGrider/multi-k8s/pull/1
Conversation 0
Commits 1
Checks 0
Files changed 1
+1 −1
StephenGrider commented 2 minutes ago
Owner
Change the header of the App.js file
updated header
bceff32
Add more commits by pushing to the devel branch on StephenGrider/multi-k8s.
All checks have passed
2 successful checks
Show all checks
This branch has no conflicts with the base branch
Merging can be performed automatically.
Merge pull request
You can also open this in GitHub Desktop or view command line instructions.
Write
Preview
Leave a comment
Reviewers
No reviews
Assignees
No one—assign yourself
Labels
None yet
Projects
None yet
Milestone
No milestone
Notifications
Unsubscribe
You're receiving notifications because you authored the thread.
1 participant

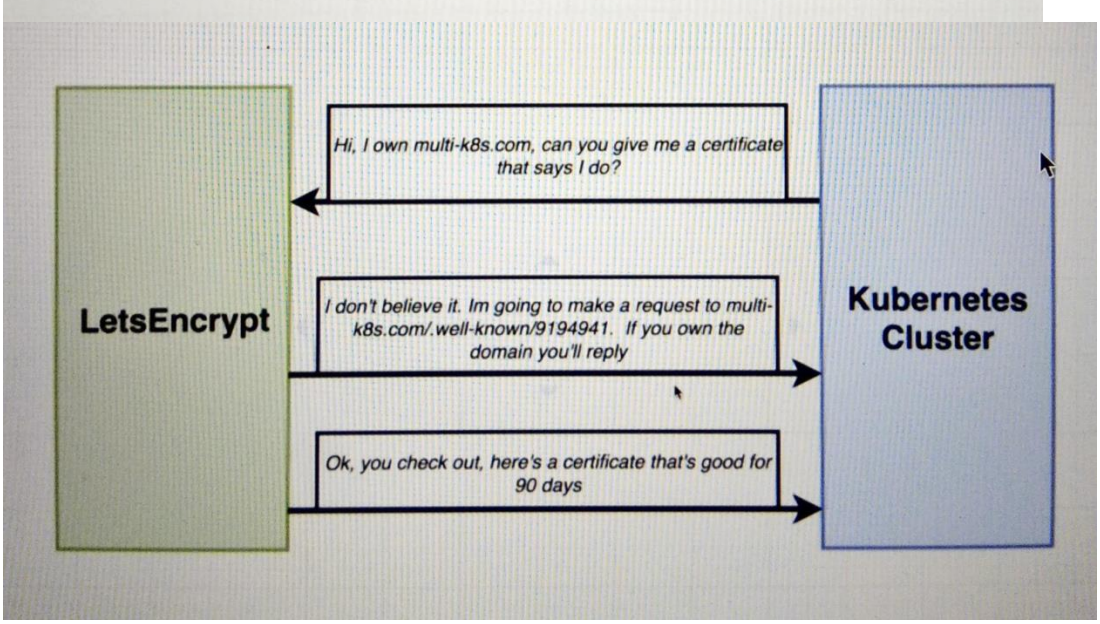

Chrome File Edit View History Bookmarks People Window Help
Fri 4:09 PM
Not Secure https://35.224.40.71
Fib Calculator version KUBERNETES!
HomeOther Page
Enter your index:
Submit
Indexes I have seen:
Calculated Values:
For index 4 I calculated 5

HTTPS Setup with Kubernates

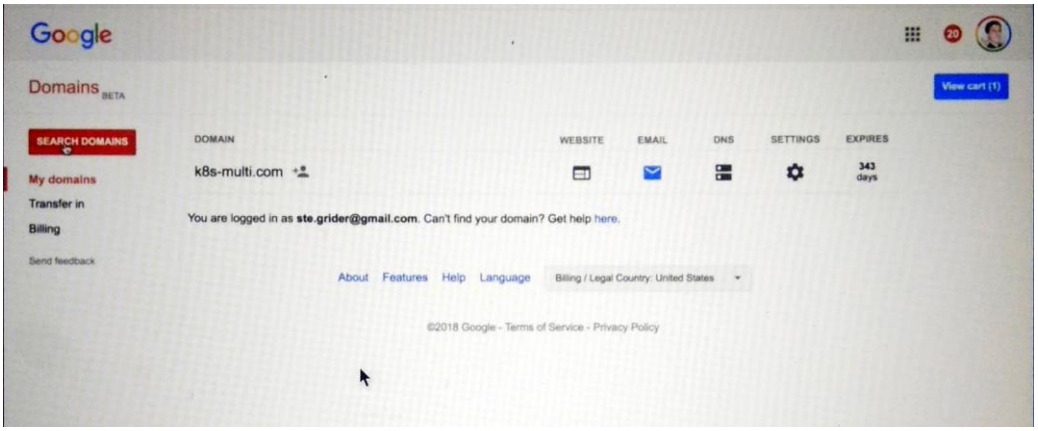
Overview

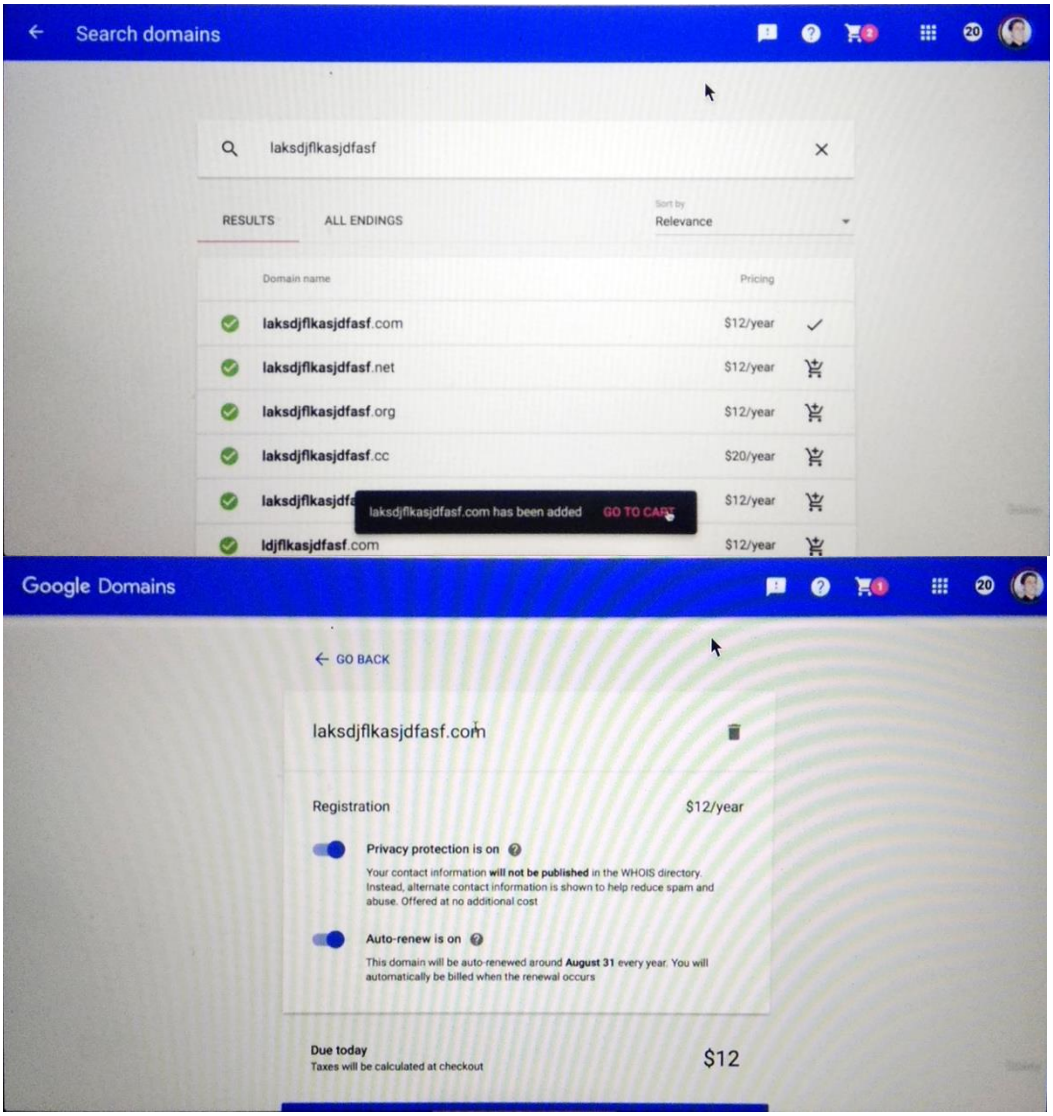
HTTP Set Overview



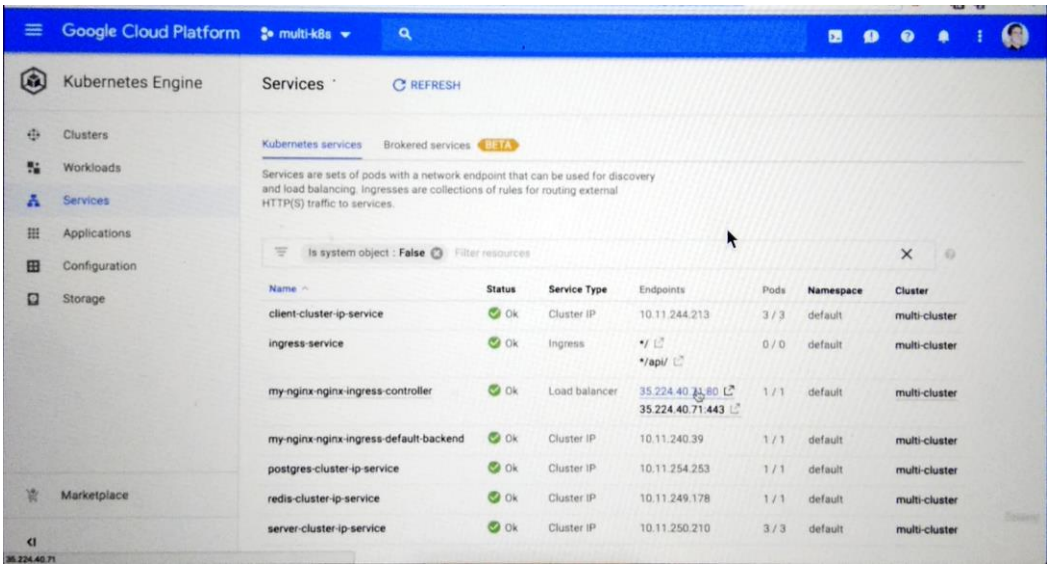


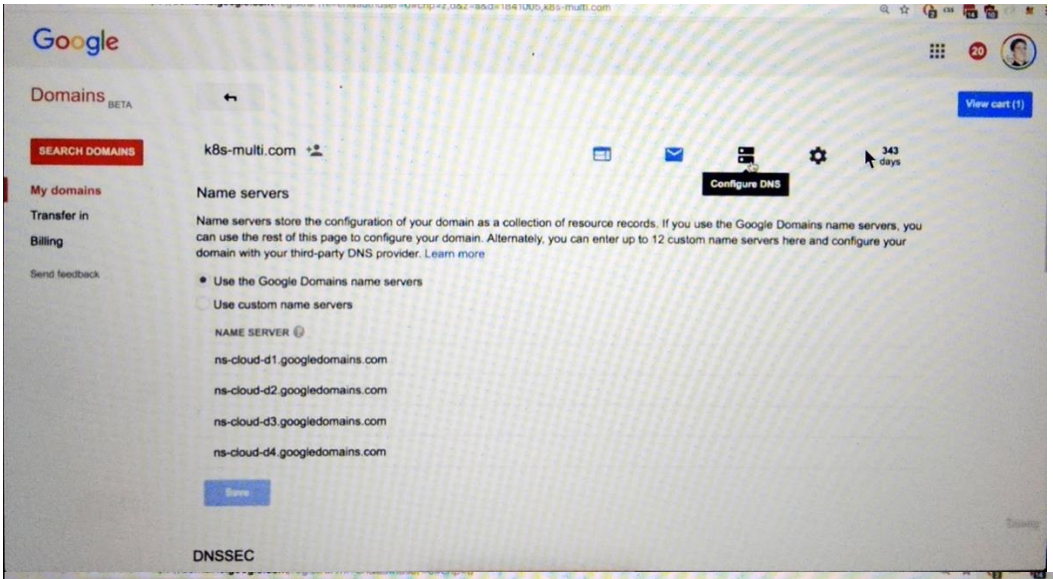
Domain Purchase

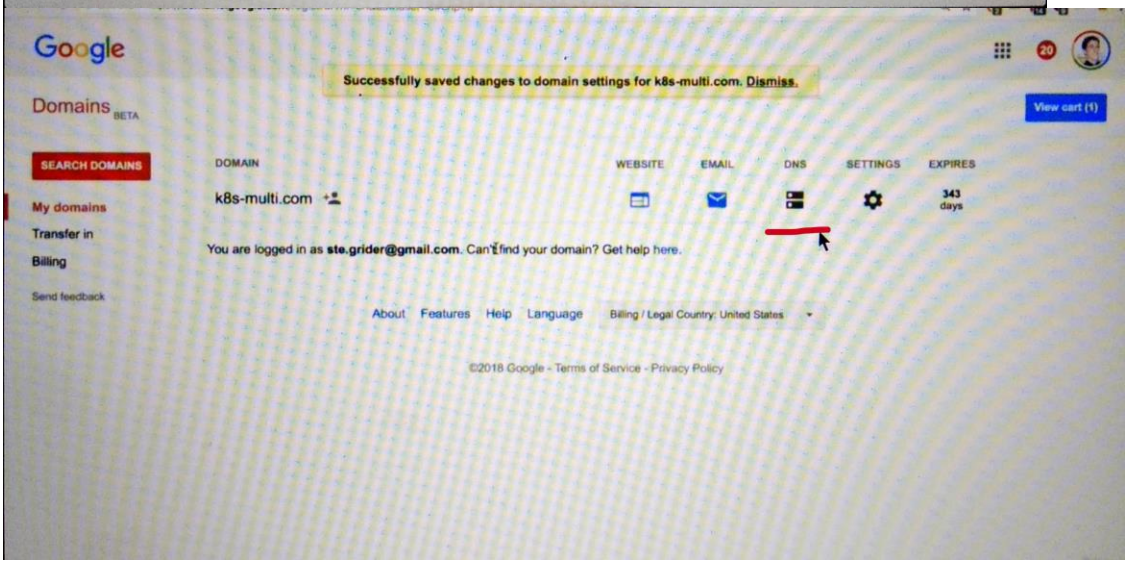


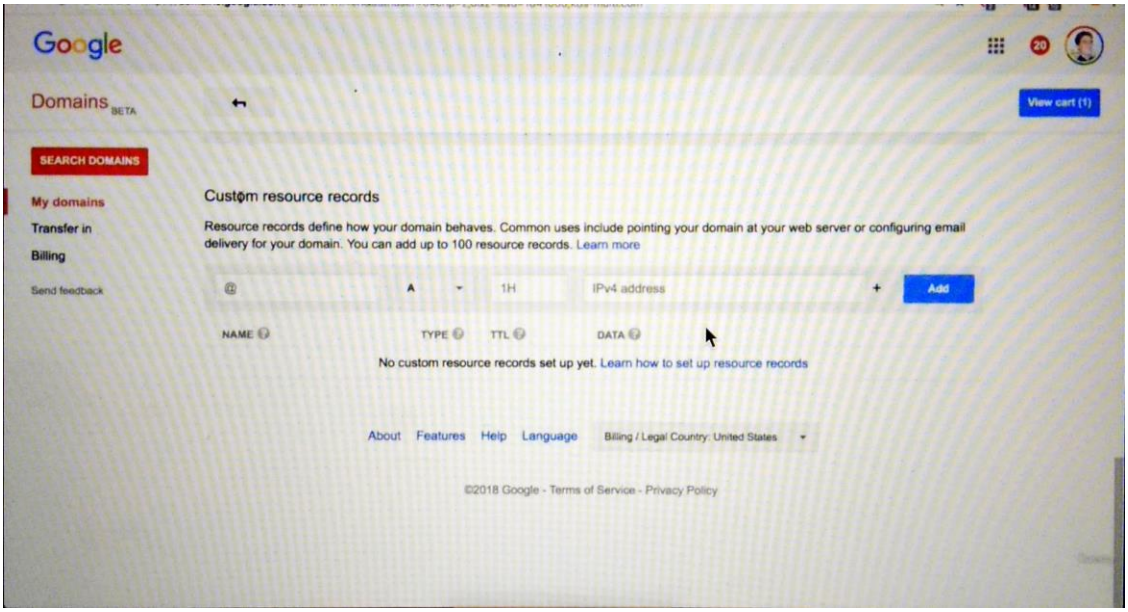


Domain Name Setup




Google
Domains BETA
View cart (1)
SEARCH DOMAINS
My domains
Transfer in
Billing
Send feedback
k8s-multi.com
343 days
Configure DNS
Name servers
Name servers store the configuration of your domain as a collection of resource records. If you use the Google Domains name servers, you can use the rest of this page to configure your domain. Alternately, you can enter up to 12 custom name servers here and configure your domain with your third-party DNS provider. Learn more
Use the Google Domains name servers
Use custom name servers
NAME SERVER
ns-cloud-d1.googledomains.com
ns-cloud-d2.googledomains.com
ns-cloud-d3.googledomains.com
ns-cloud-d4.googledomains.com
Save
DNSSEC


Google
Successfully saved changes to domain settings for k8s-multi.com. Dismiss.
Domains BETA
View cart (1)
SEARCH DOMAINS
My domains
Transfer in
Billing
Send feedback
DOMAIN
WEBSITE
EMAIL
DNS
SETTINGS
EXPIRES
k8s-multi.com
343 days
You are logged in as ste.grider@gmail.com. Can't find your domain? Get help here.
About Features Help Language
Billing / Legal Country: United States
©2018 Google - Terms of Service - Privacy Policy


Google
Domains BETA
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Custom resource records
Resource records define how your domain behaves. Common uses include pointing your domain at your web server or configuring email delivery for your domain. You can add up to 100 resource records. Learn more
@
A
1H
IPv4 address
Add
NAME
TYPE
TTL
DATA
No custom resource records set up yet. Learn how to set up resource records
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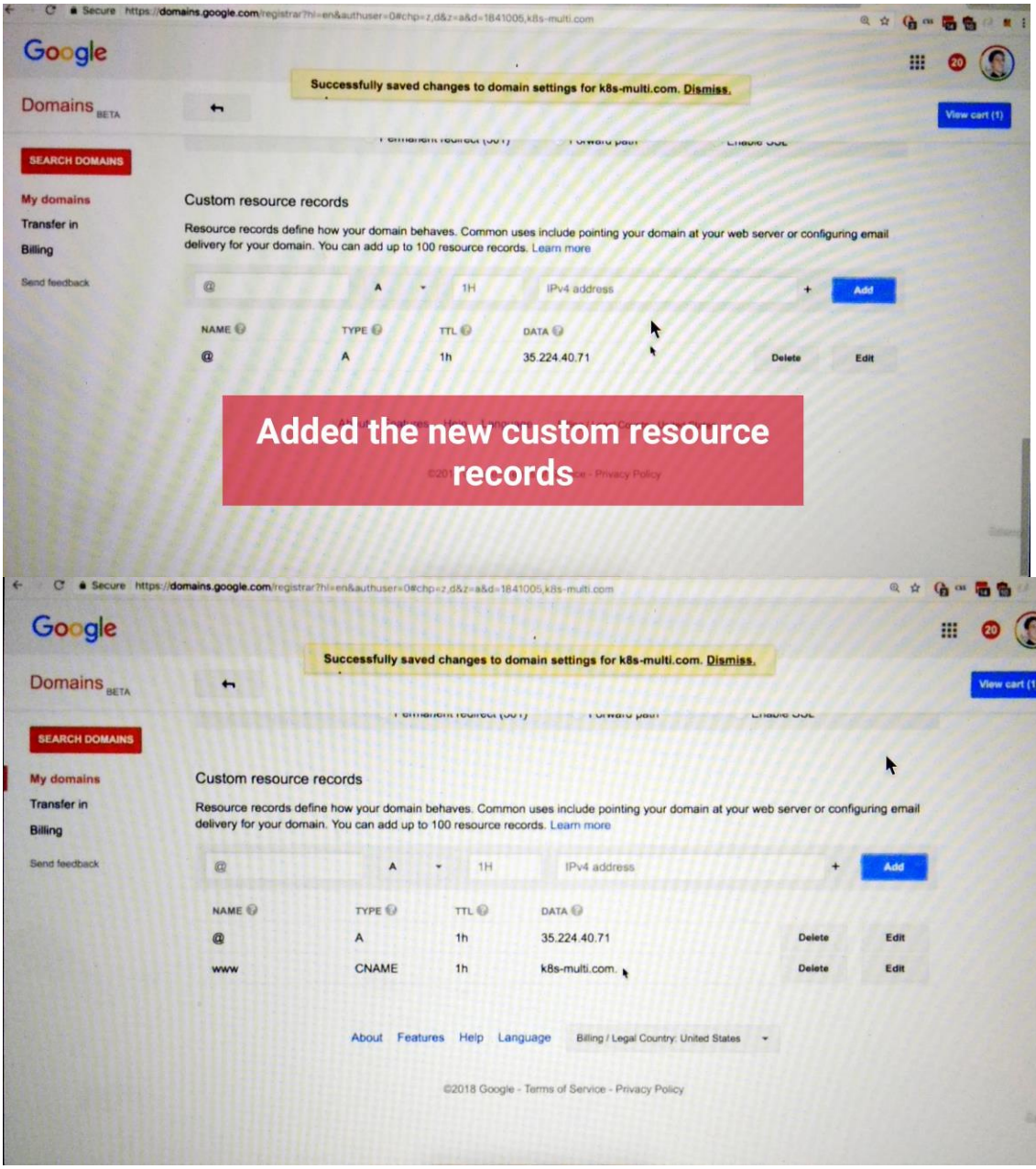


Cert Manager Install

1. Add the Jetstack Helm repository

   ```
   helm repo add jetstack https://charts.jetstack.io
   ```

2. Update your local Helm chart repository cache:

   ```
   helm repo update
   ```

3. Install the cert-manager Helm chart:

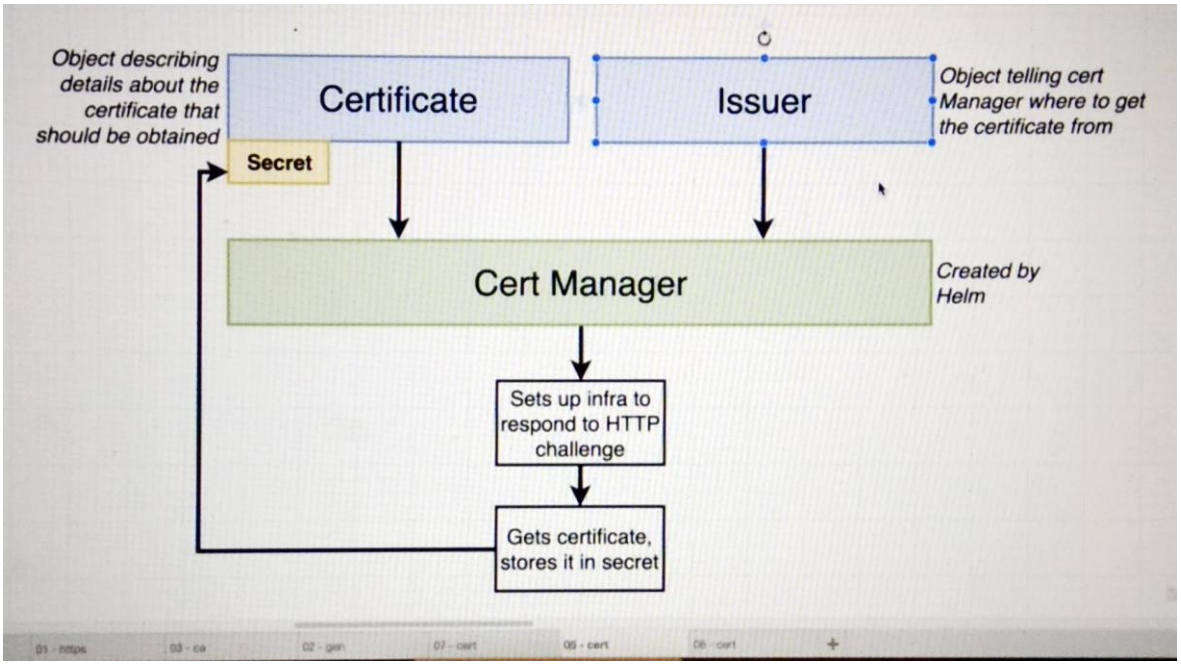
   ```
   helm install \
     cert-manager jetstack/cert-manager \
     --namespace cert-manager \
     --create-namespace \
     --version v1.8.0 \
   ```

--set installCRDs=true

Official docs for reference:

https://cert-manager.io/docs/installation/helm/#steps

How to write up Cert Manager



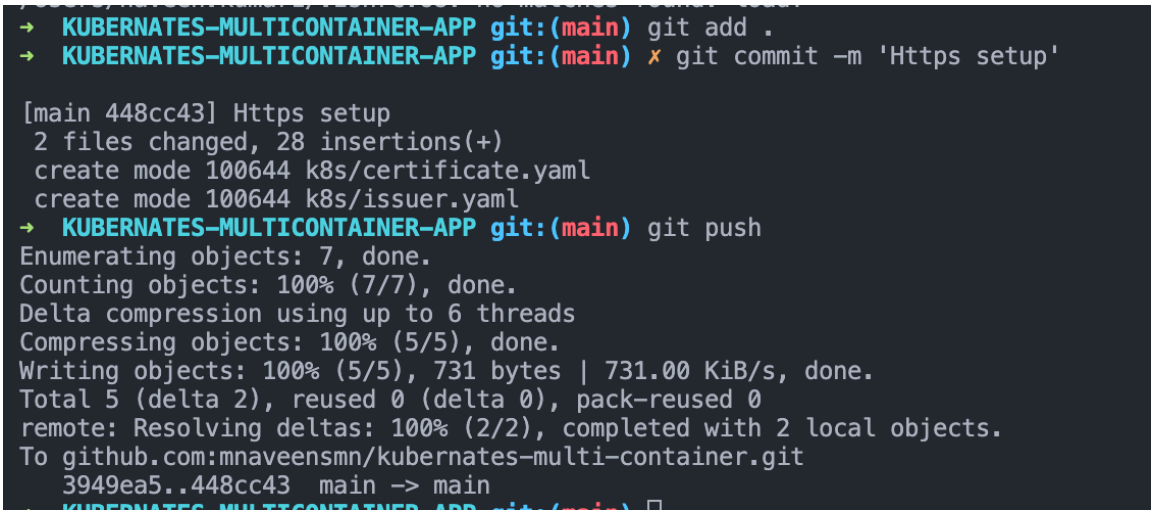
Issuer Config File

```yaml
apiVersion: cert-manager.io/v1
kind: ClusterIssuer
metadata:
  name: letsencrypt-prod
spec:
  acme:
    server: https://acme-v02.api.letsencrypt.org/directory
    email: "test@test.com"
    privateKeySecretRef:
      name: letsencrypt-prod
    solvers:
      - http01:
          ingress:
            class: nginx
```

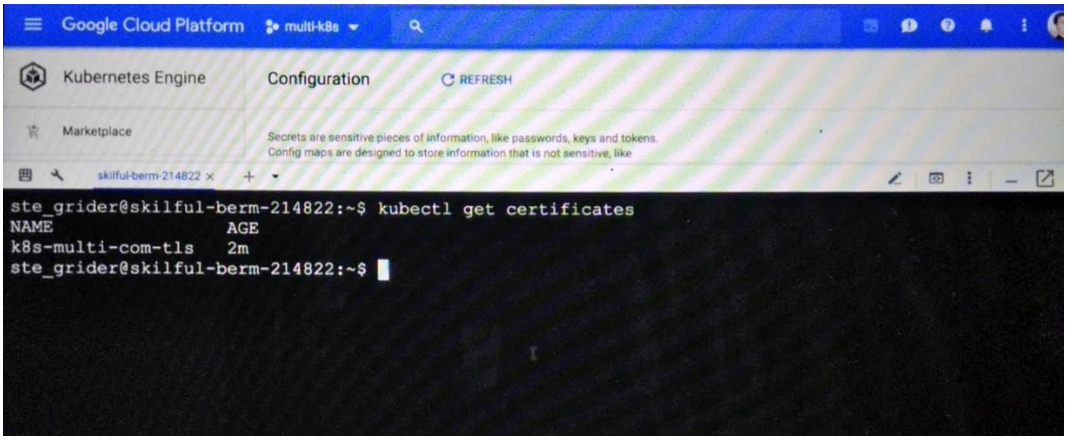
Certificate Config File

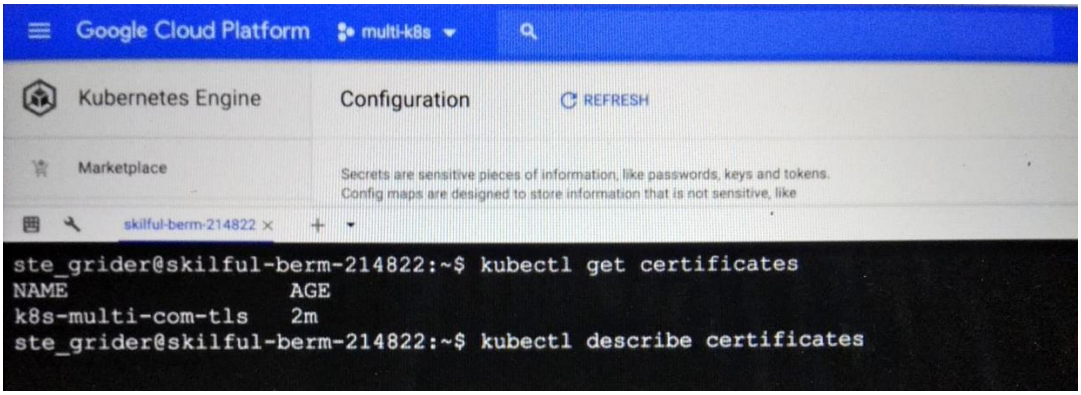
```yaml
apiVersion: cert-manager.io/v1

kind: Certificate
metadata:
  name: yourdomain-com-tls
spec:
  secretName: yourdomain-com
  issuerRef:
    name: letsencrypt-prod
    kind: ClusterIssuer
  commonName: yourdomain.com
  dnsNames:
    - yourdomain.com
    - www.yourdomain.com
```

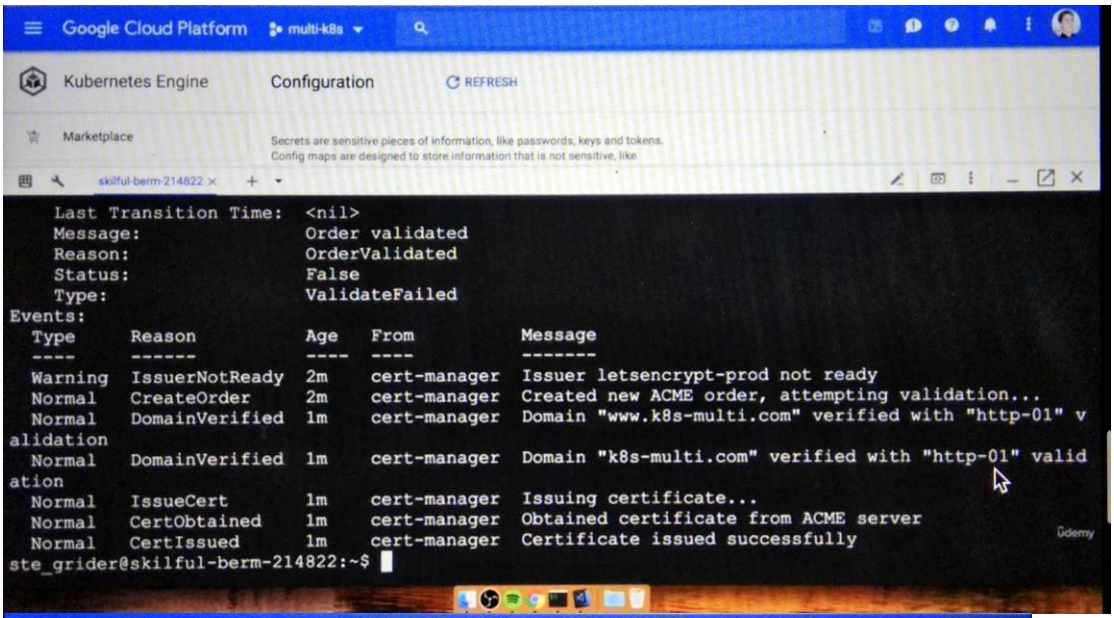
Deployment

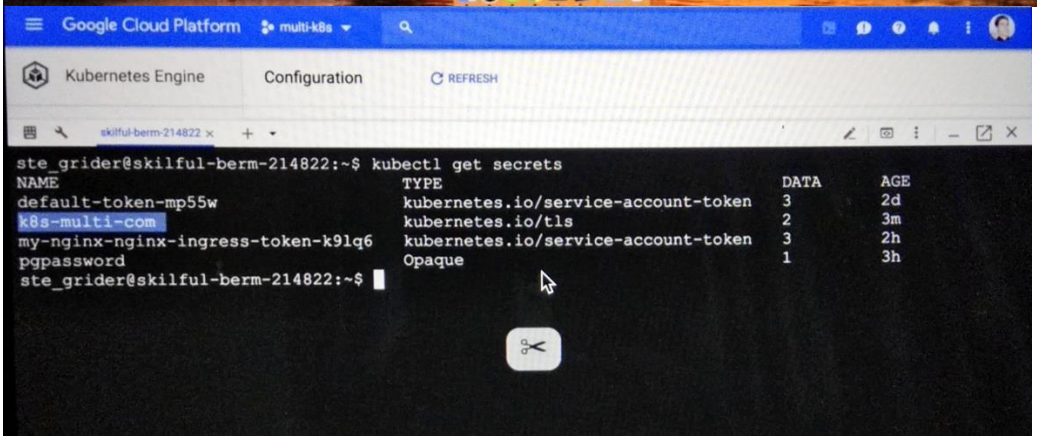


Ingress Config for HTTPS









thoughtworks.udemy.com/course/docker-and-kubernetes-t...

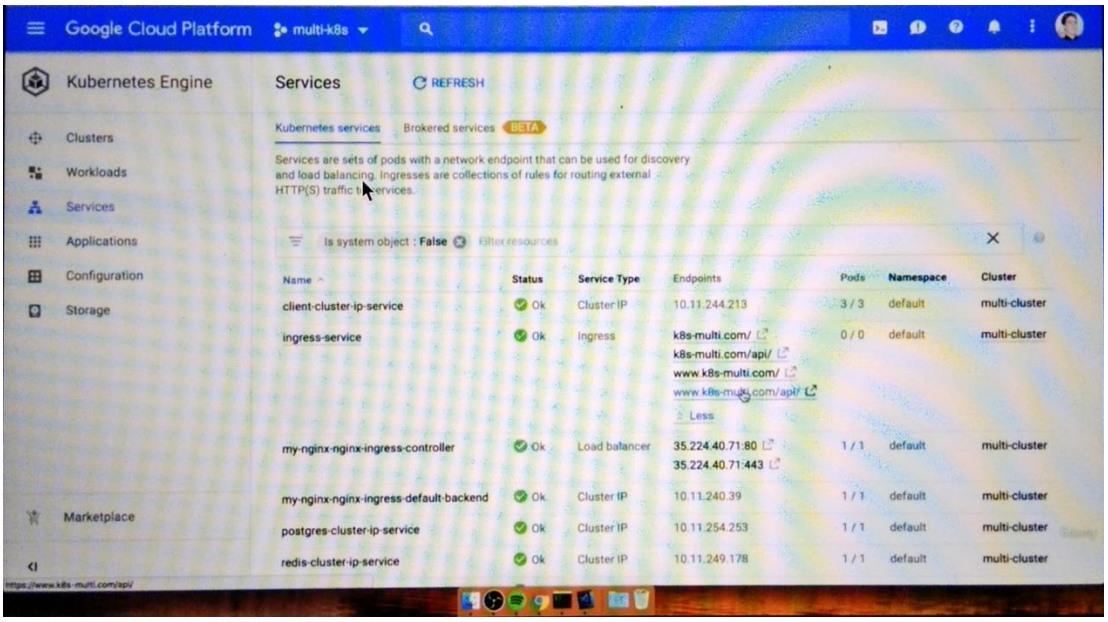
Required Update for the HTTPS Ingress

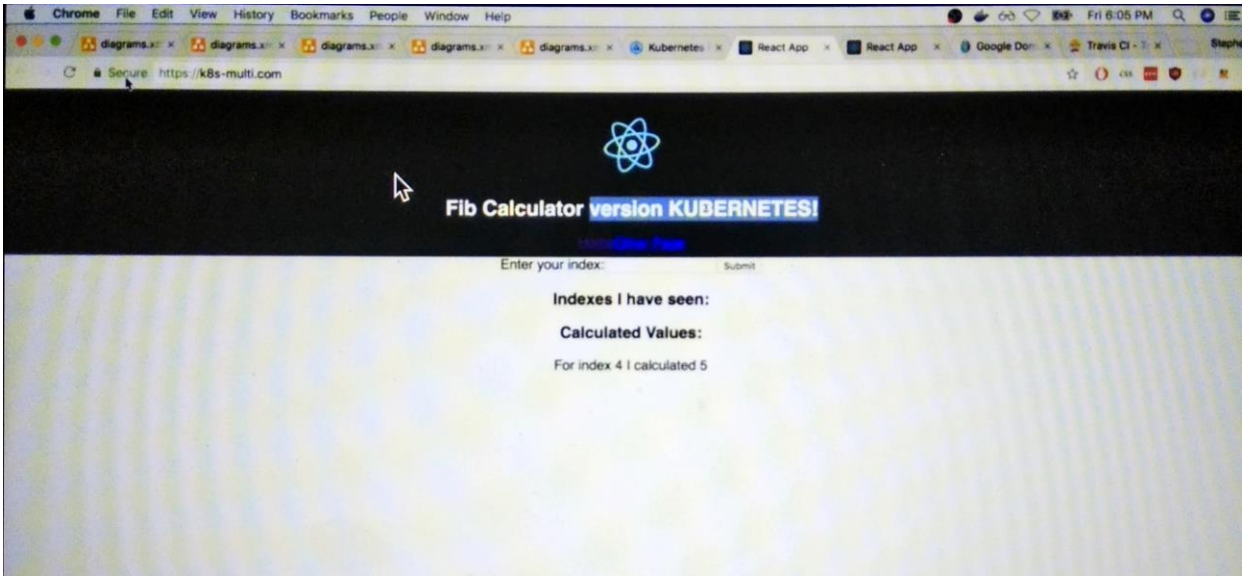
In the upcoming lecture, we need to make one small change to one of the annotations:

```
certmanager.k8s.io/cluster-issuer: "letsencrypt-prod"
```

change to:

```
cert-manager.io/cluster-issuer: "letsencrypt-prod"
```





deployment.yaml | issuer.yaml | certificate.yaml | ingress-service.yaml M

k8s > ingress-service.yaml > { } spec > [ ] rules > { } 0 > { } http > [ ] paths > { } 1 > { } backend > { } s

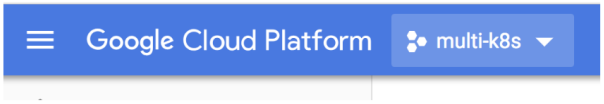
```yaml
apiVersion: networking.k8s.io/v1
# UPDATE API
kind: Ingress
metadata:
  name: ingress-service
  annotations:
    kubernetes.io/ingress.class: "nginx"
    nginx.ingress.kubernetes.io/use-regex: "true"
    # ADD ANNOTATION
    nginx.ingress.kubernetes.io/rewrite-target: /$1
    # UPDATE ANNOTATION
    cert-manager.io/cluster-issuer: "letsencrypt-prod"
    nginx.ingress.kubernetes.io/ssl-redirect: "true"
spec:
  tls:
    - host:
      - k8s-multi.com
      - www.k8s-multi.com
      secretName: k8s-multi-com
  rules:
    - host: k8s-multi.com
      http:
        paths:
          - path: /?(.*)
            # UPDATE PATH
            pathType: Prefix
            # ADD PATHTYPE
            backend:
              service:
                # UPDATE SERVICE FIELDS
                name: client-cluster-ip-service
                port:
                  number: 3000
          - path: /api/?(.*)
            # UPDATE PATH
            pathType: Prefix
            # ADD PATHTYPE
            backend:
              service:
                # UPDATE SERVICE FIELDS
                name: server-cluster-ip-service
                port:
                  number: 5000
    - host: www.k8s-multi.com
      http:
        paths:
          - path: /?(.*)
            # UPDATE PATH
```

Google Cloud Cleanup

Time for some cleanup! **If you want to close down the Kubernetes cluster running on Google Cloud, do the following. Remember, you are paying for the running cluster!**

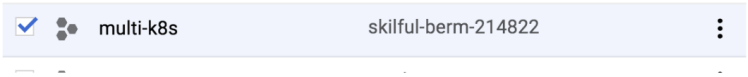
Steps to clean up:

1) Click the project selector on the top left of the page

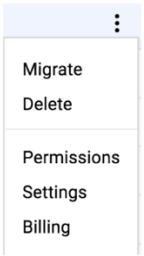


2) Click the 'gear' icon on the top right

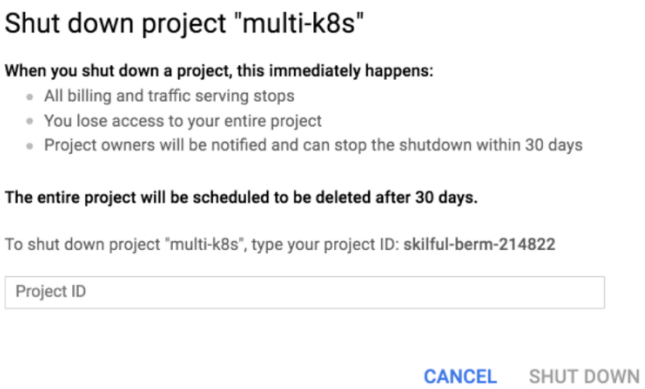
3) Find your project in the list of projects that is presented, then click the three dots on the far right hand side



4) Click 'Delete'



5) Enter your project ID and click 'Shut Down'



Local Environment Cleanup

You might want to also clean up some of the work you did on your local machine. Remember, we have a running Kubernetes cluster, and we have also built a ton of images.

Deleting Pods, Deployments, Services from the Multi K8's project

In the root project directory, run `kubectl delete -f k8s/`

Stopping Minikube

To stop Minikube, and the VM that it runs, run `minikube stop`. You can bring your local cluster back online at any time by running `minikube start`

To fully delete the cluster, run `minikube delete`

Stopping Running Containers

You might still have some containers running on your machine. Try a `docker ps`. You can then run `docker stop <container_id>` to clean up any running containers

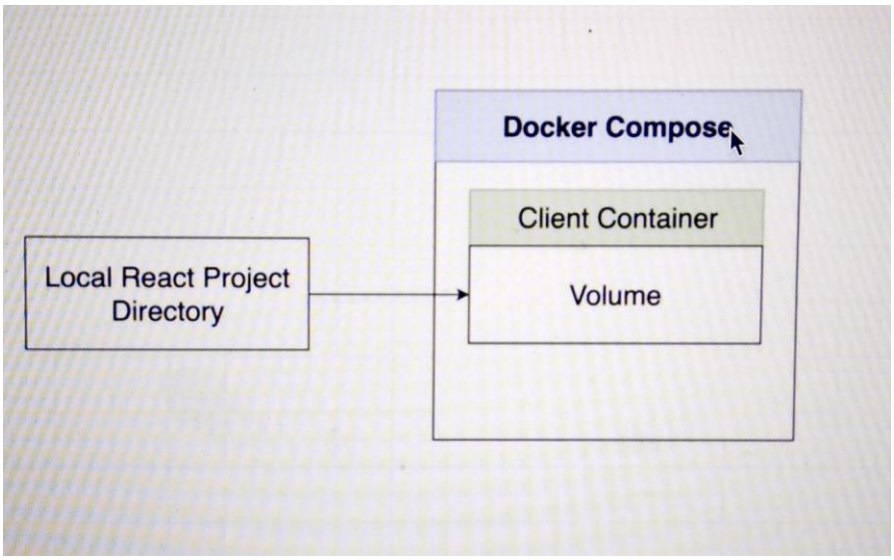
Clearing the Build Cache

All the images that we built and ran during the course are cached on your local machine - they might be taking up to around 1GB of space. You can clean these up by running `docker system prune`

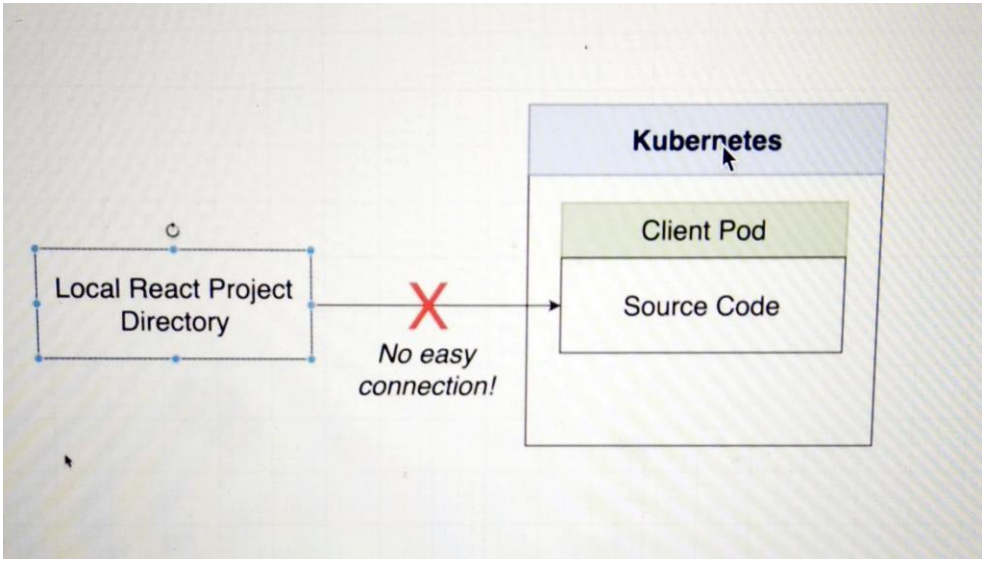
```
/Users/naveen.kumar1/.zshrc:68: no matches found: load?
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl delete -f k8s/
service "client-cluster-ip-service" deleted
deployment.apps "client-deployment" deleted
persistentvolumeclaim "database-persistent-volume-claim" deleted
ingress.networking.k8s.io "ingress-service" deleted
service "postgres-cluster-ip-service" deleted
deployment.apps "postgres-deployment" deleted
service "redis-cluster-ip-service" deleted
deployment.apps "redis-deployment" deleted
service "server-cluster-ip-service" deleted
deployment.apps "server-deployment" deleted
deployment.apps "worker-deployment" deleted
unable to recognize "k8s/certificate.yaml": no matches for kind "Certificate" in versi
on "cert-manager.io/v1"
unable to recognize "k8s/issuer.yaml": no matches for kind "ClusterIssuer" in version
"cert-manager.io/v1"
➜  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ docker system prune
WARNING! This will remove:
  - all stopped containers
  - all networks not used by at least one container
  - all dangling images
  - all dangling build cache

Are you sure you want to continue? [y/N] y
Deleted Containers:
503f30532c3fbc1adb01aaeea4062d3be01cfcbcb413e14b44c3757dd25e6e38
adfc18b8e12cfd56e89e9f44af322df5c862e125777c1a89c2524f9953b6c5aa
5fba0ac5035ad6ef00e105e58d5a7fb853137dd3f074446a72ff2e0f1ee1b272
854e0a8f351a6023bd6de187ee4e0d4cb8415d2f62be999327aaa454a8597d38
daa1b2f934430af6cd3c40baf63f3ade73ac0f1c36b2c35d1a32a703774e5c4b
f6021788dfb373c465b1ad01987549e9ce28c7e9e9a72eac9a97be439189b7f8
25003ed1cfb5afe75f7950435aecb9fe03cd501340541914380577ecf7bc91bc
c248a8af4be576b68cef1162fc308d9f4284a1dbbdd2367da783393536f472da
4e7acae273c9fe7af9efa9b12868a9894aeb2f83aaacf82ecdee3d311d94ff03
fe48a45fc7b8f85f0c3deef15345adec23636983992329727725dccddb34a7
113b026b3df082c49b11c3d54341e0810ab969425b9503faa6ec8451e50e6987
ea8c71d5fe7107ed47eb5b33d14995545c5e078c5a50e2163d96bff094a9a3e7
430c1d8568c4d2af61171dcddd2638d5b6c7bcea87b16fc19ed078950ebbb850
f9f1b41a9bcfa1f07adfb554d6e7ec0fcf1b04b7708716d70ebbe4c763e233bc
ea041bf784a259c8319baa127bfcae2a9f321a916e8c2622e4b7418089365544
ddacf7d192e8cdb044213c216f35f0918acfecb53c3be19cbf80ba93ef5a0a79
c5d3c6ed1e2036ce7bcce81f0aec0039c347f36b711ed665d8a683dd1dcaf523
586909d422134ea883b7786ad4792d59311ffc0208548f95c8118605e5e8573d
509c88be88215f14b05bfa9ab292cf2bf1386219928a3fe6e52994a5a0277a74
78db62e76109a39d4e380411a16510dfbcedab860e5aa27e08d114b3884d204f

Deleted Images:
deleted: sha256:8618b223fb37f964ed78d2fa29a044b404d9d6009d17387634147445125b799e
deleted: sha256:b87800a6d0d1d07ced7d11f90a82a234cdb5715392404b8bb61e325e153a06d8
deleted: sha256:07b5158828ba0f137f0344e23cc1a7565df43164f4ec853db0298da0ee817df3
deleted: sha256:d852c578c64a1ac74c66c7e1159acb1a43aef0e94a5595fb20cc8b5ce1921232
deleted: sha256:f4576edb4e31506b600e94d5f6ba5495b7b29a91abd82ce58cd5072da111df41
deleted: sha256:f3682d8b6bba3b83e6c8ef3ecdf286f38dc73b67f17191318f977e1f0c3de374
deleted: sha256:a425ab92770316f1f83826993e3130319a84a4c90792f03344552d4a6c65fceb
deleted: sha256:7a3f59dd43d40d2592fb5d6469ab4819bfdb5cc324a558fea5b0cc1fe2db6436
deleted: sha256:7bb989c513ca0e3029dd767fb10198261a2b4a4c114c5a3b0a2e68fd0cfad0d1
deleted: sha256:9dadae6f286e2295c5062383c7f4246d320f92dd44c533a97ff74522f3435fae
untagged: k8s.gcr.io/ingress-nginx/kube-webhook-certgen@sha256:64d8c73dca984af206adf9d
6d7e46aa550362b1d7a01f3a0a91b20cc67868660
deleted: sha256:c41e9fcadf5a291120de706b7dfa1af598b9f2ed5138b6dcb9f79a68aad0ef4c
```

Local Development with Skaffold

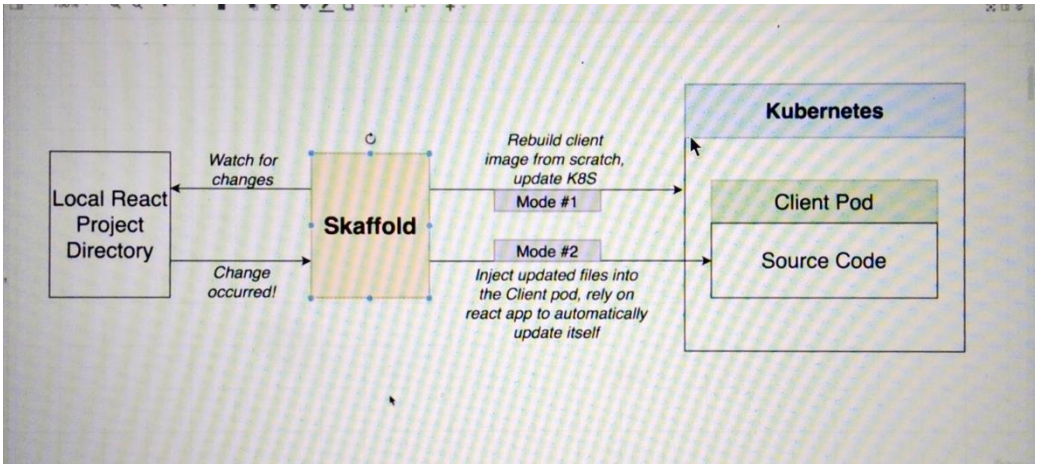
Local Development



With docker compose we have an option to see our local changes instantly in deployment output.

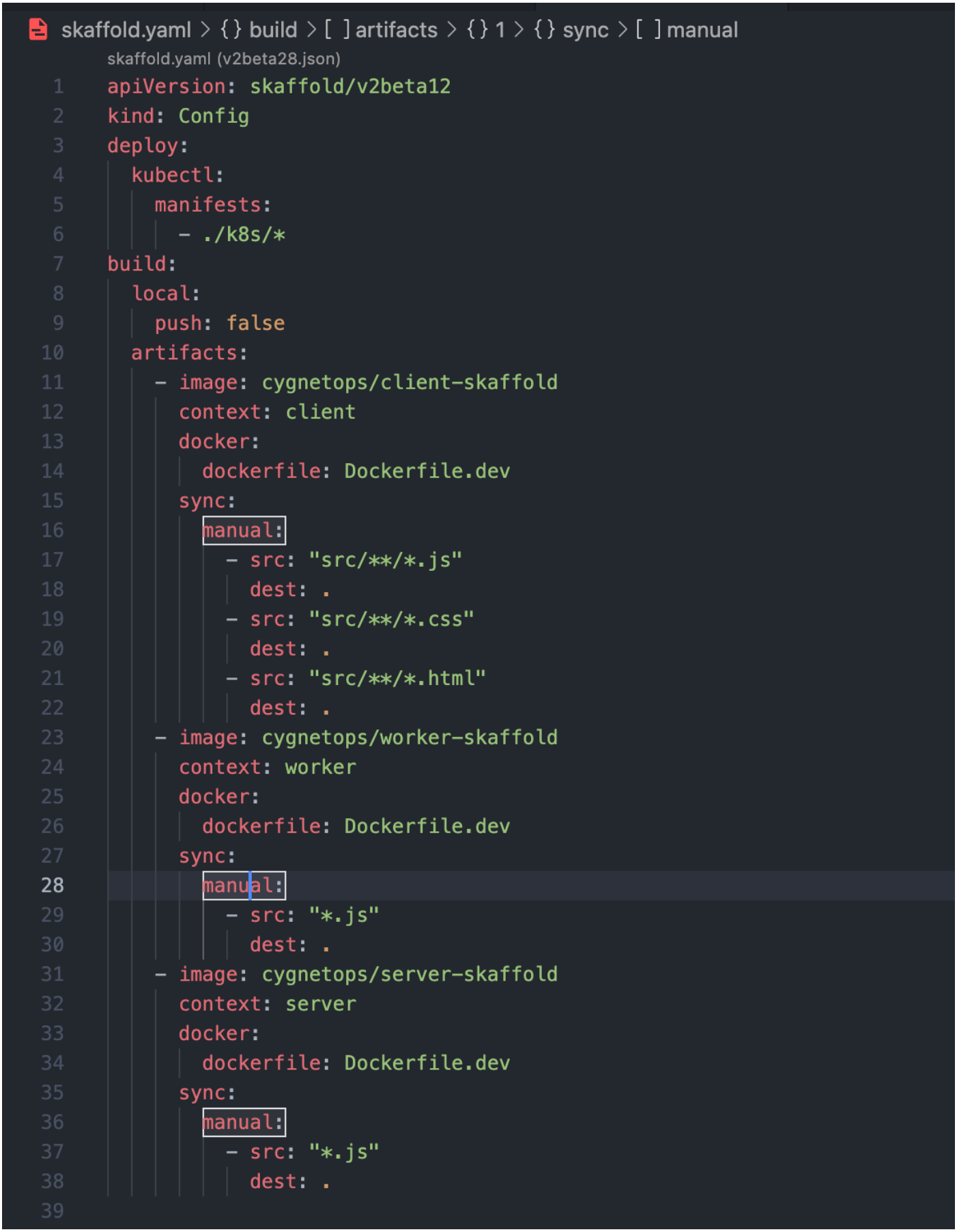


But with Kubernates, we don't have the direct option. That's where Skaffold comes into play.



Installing Skaffold

Skaffold Config File


skaffold.yaml > {} build > [ ] artifacts > {} 1 > {} sync > [ ] manual
skaffold.yaml (v2beta28.json)
apiVersion: skaffold/v2beta12
kind: Config
deploy:
kubectl:
manifests:
- ./k8s/*
build:
local:
push: false
artifacts:
- image: cygnetops/client-skaffold
context: client
docker:
dockerfile: Dockerfile.dev
sync:
manual:
- src: "src/**/*.js"
dest: .
- src: "src/**/*.css"
dest: .
- src: "src/**/*.html"
dest: .
- image: cygnetops/worker-skaffold
context: worker
docker:
dockerfile: Dockerfile.dev
sync:
manual:
- src: "*.js"
dest: .
- image: cygnetops/server-skaffold
context: server
docker:
dockerfile: Dockerfile.dev
sync:
manual:
- src: "*.js"
dest: .

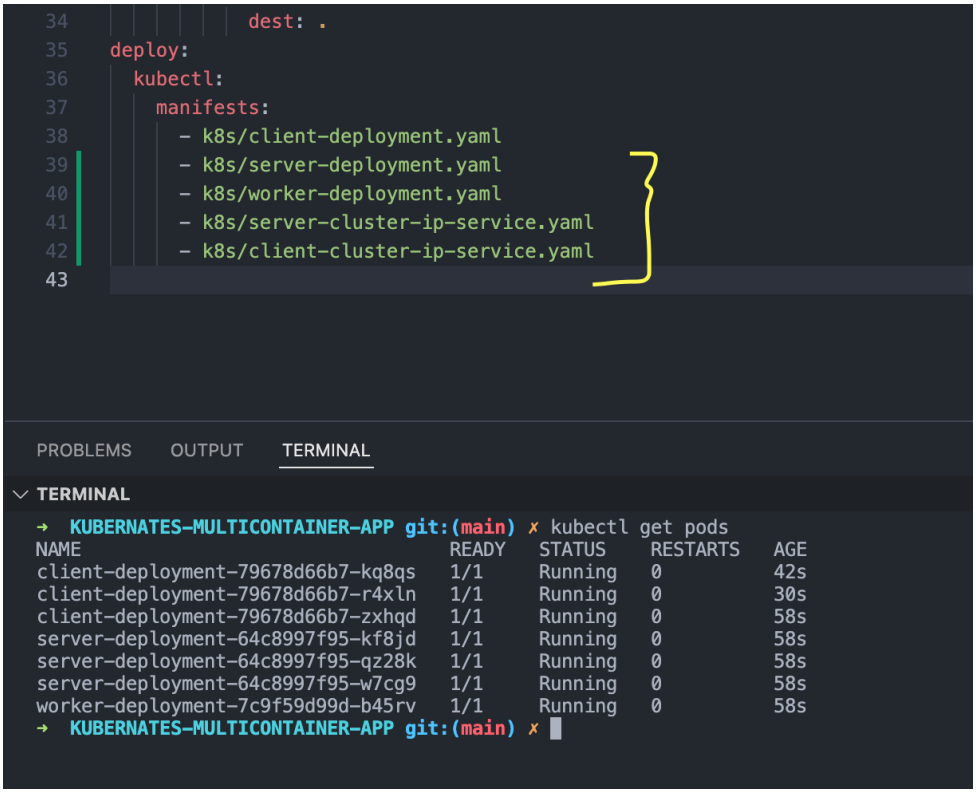
Running the Skaffold

```
→  KUBERNATES-MULTICONTAINER-APP git:(main) ✗ skaffold d
ev
Listing files to watch...
 - cygnetops/client-skaffold
 - cygnetops/worker-skaffold
 - cygnetops/server-skaffold
Generating tags...
 - cygnetops/client-skaffold -> cygnetops/client-skaffold:448cc43-dirty
 - cygnetops/worker-skaffold -> cygnetops/worker-skaffold:448cc43
 - cygnetops/server-skaffold -> cygnetops/server-skaffold:448cc43
Checking cache...
 - cygnetops/client-skaffold: Not found. Building
 - cygnetops/worker-skaffold: Not found. Building
 - cygnetops/server-skaffold: Not found. Building
Starting build...
Found [docker-desktop] context, using local docker daemon.
Building [cygnetops/server-skaffold]...
Target platforms: [linux/amd64]
[+] Building 6.3s (8/10)
 => [internal] load build definition from Dockerfile.dev                    0.0s
 => => transferring dockerfile: 242B                                        0.0s
 => [internal] load .dockerignore                                           0.0s
 => => transferring context: 2B                                             0.0s
 => [internal] load metadata for docker.io/library/node:14.14.0-alpine      3.5s
 => [auth] library/node:pull token for registry-1.docker.io                 0.0s
 => [1/5] FROM docker.io/library/node:14.14.0-alpine@sha256:97c4cddbbf97299f5eda09  0.0s
[+] Building 6.4s (8/10)
 => => transferring context: 3.05kB                                         0.0s
 => CACHED [2/5] WORKDIR /app                                               0.0s
 => [3/5] COPY ./package.json ./                                            0.0s
 => [4/5] RUN npm install                                                   2.8s
```

Live Sync Changes

skaffold.yaml > {} build > [ ] artifacts > {} 0 > {} sync > [ ] manual > {} 2

```
14                  dest: .
15                - src: "src/**/*.css"
16                  dest: .
17                - src: "src/**/*.html"
18                  dest: .
19          - image: cygnetops/worker-skaffold
20            context: worker
21            docker:
22              dockerfile: Dockerfile.dev
23            sync:
24              manual:
25                - src: "*.js"
26                  dest: .
27          - image: cygnetops/server-skaffold
28            context: server
29            docker:
30              dockerfile: Dockerfile.dev
31            sync:
32              manual:
33                - src: "*.js"
34                  dest: .
35    deploy:
36      kubectl:
37        manifests:
38          - k8s/client-deployment.yaml
39
```


34 dest: .
35 deploy:
36 kubectl:
37 manifests:
38 - k8s/client-deployment.yaml
39 - k8s/server-deployment.yaml
40 - k8s/worker-deployment.yaml
41 - k8s/server-cluster-ip-service.yaml
42 - k8s/client-cluster-ip-service.yaml
43
PROBLEMS
OUTPUT
TERMINAL
TERMINAL
→ KUBERNATES-MULTICONTAINER-APP git:(main) ✗ kubectl get pods
NAME READY STATUS RESTARTS AGE
client-deployment-79678d66b7-kq8qs 1/1 Running 0 42s
client-deployment-79678d66b7-r4xln 1/1 Running 0 30s
client-deployment-79678d66b7-zxhqd 1/1 Running 0 58s
server-deployment-64c8997f95-kf8jd 1/1 Running 0 58s
server-deployment-64c8997f95-qz28k 1/1 Running 0 58s
server-deployment-64c8997f95-w7cg9 1/1 Running 0 58s
worker-deployment-7c9f59d99d-b45rv 1/1 Running 0 58s
→ KUBERNATES-MULTICONTAINER-APP git:(main) ✗