INFORMATION
TECHNOLOGY
UNIVERSITY

Software Development & Construction

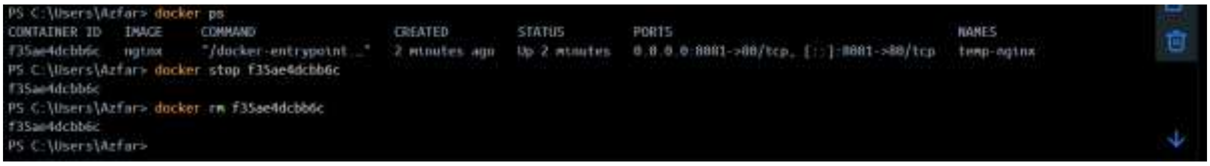
Quiz 2

Docker & Kubernetes Challenge

Muhammad Hamza	BSSE23001
Muhammad Sarmad	BSSE23013
Hafiz Azfar Umar Sheikh	BSSE23064

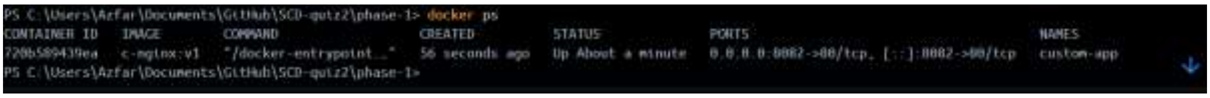
PHASE 1: Container Bootcamp

Nginx image container:

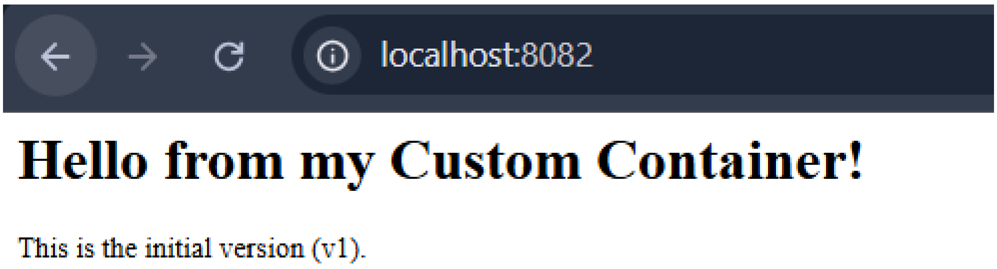


```
PS C:\Users\Azfar> docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED         STATUS         PORTS                                   NAMES
f35ae4dcbb6c   nginx     "/docker-entrypoint.…"   2 minutes ago   Up 2 minutes   0.0.0.0:8081->80/tcp, [::]:8081->80/tcp   temp-nginx
PS C:\Users\Azfar> docker stop f35ae4dcbb6c
f35ae4dcbb6c
PS C:\Users\Azfar> docker rm f35ae4dcbb6c
f35ae4dcbb6c
PS C:\Users\Azfar>
```

V1 of custom nginx:



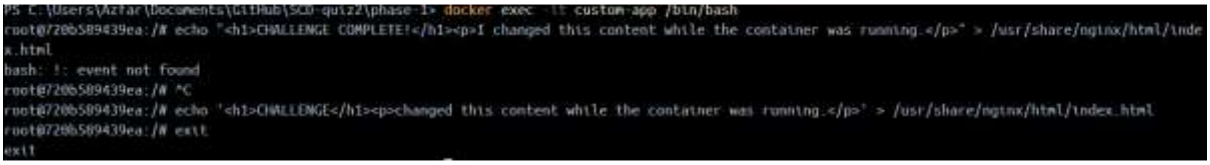
```
PS C:\Users\Azfar\Documents\GitHub\SCD-quiz2\phase-1> docker ps
CONTAINER ID   IMAGE         COMMAND                  CREATED          STATUS              PORTS                                   NAMES
720b589439ea   c-nginx:v1    "/docker-entrypoint.…"   56 seconds ago   Up About a minute   0.0.0.0:8082->80/tcp, [::]:8082->80/tcp   custom-app
PS C:\Users\Azfar\Documents\GitHub\SCD-quiz2\phase-1>
```



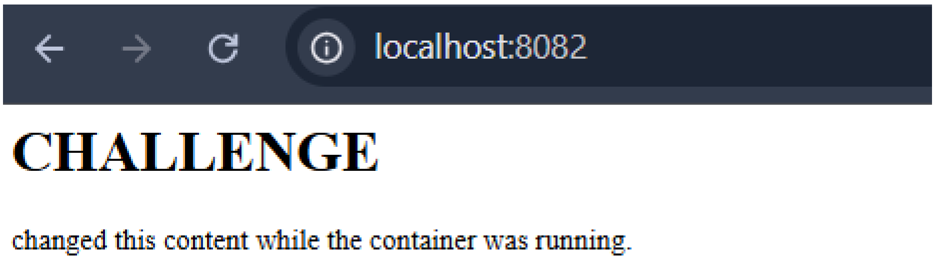
Hello from my Custom Container!

This is the initial version (v1).

Changing content while container is running:



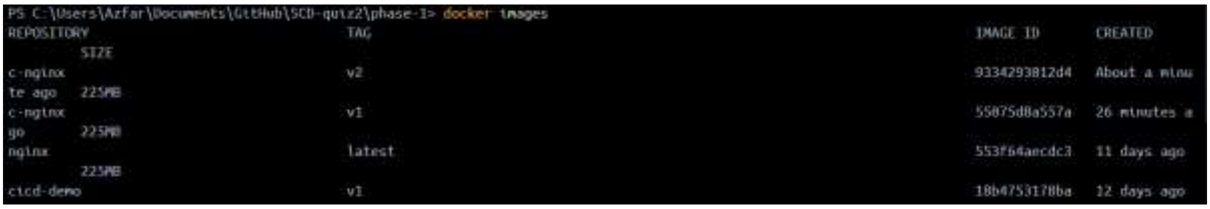
```
PS C:\Users\Azfar\Documents\GitHub\SCD-quiz2\phase-1> docker exec -it custom-app /bin/bash
root@720b589439ea:/# echo "<h1>CHALLENGE COMPLETE!</h1><p>I changed this content while the container was running.</p>" > /usr/share/nginx/html/inde
x.html
bash: !: event not found
root@720b589439ea:/# ^C
root@720b589439ea:/# echo '<h1>CHALLENGE</h1><p>changed this content while the container was running.</p>' > /usr/share/nginx/html/index.html
root@720b589439ea:/# exit
exit
```



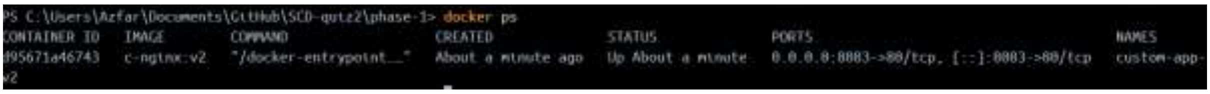
CHALLENGE

changed this content while the container was running.

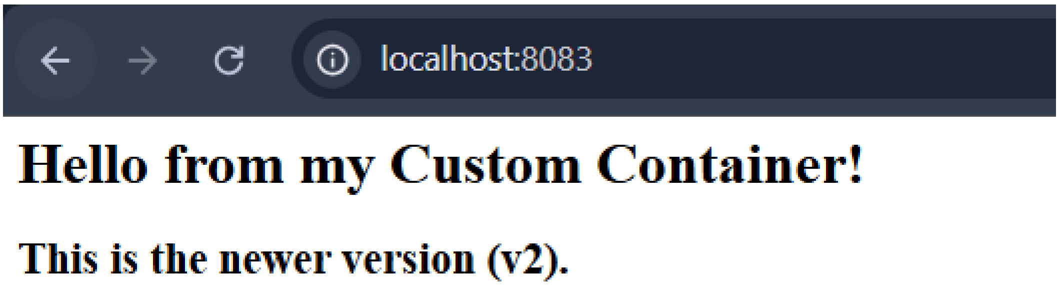
Rebuilt v2 image:



```
PS C:\Users\Azfar\Documents\GitHub\SCD-quiz2\phase-1> docker images
REPOSITORY                                        TAG                                                          IMAGE ID       CREATED
          SIZE
c-nginx                                           v2                                                           9334293812d4   About a minu
te ago    225MB
c-nginx                                           v1                                                           55075d8a557a   26 minutes a
go        225MB
nginx                                             latest                                                       553f64aecdc3   11 days ago
          225MB
cicd-demo                                         v1                                                           18b4753178ba   12 days ago
```



```
PS C:\Users\Azfar\Documents\GitHub\SCD-quiz2\phase-1> docker ps
CONTAINER ID   IMAGE        COMMAND                  CREATED              STATUS              PORTS                                     NAMES
d95671a46743   c-nginx:v2   "/docker-entrypoint.…"   About a minute ago   Up About a minute   0.0.0.0:8083->80/tcp, [::]:8083->80/tcp   custom-app-
v2
```

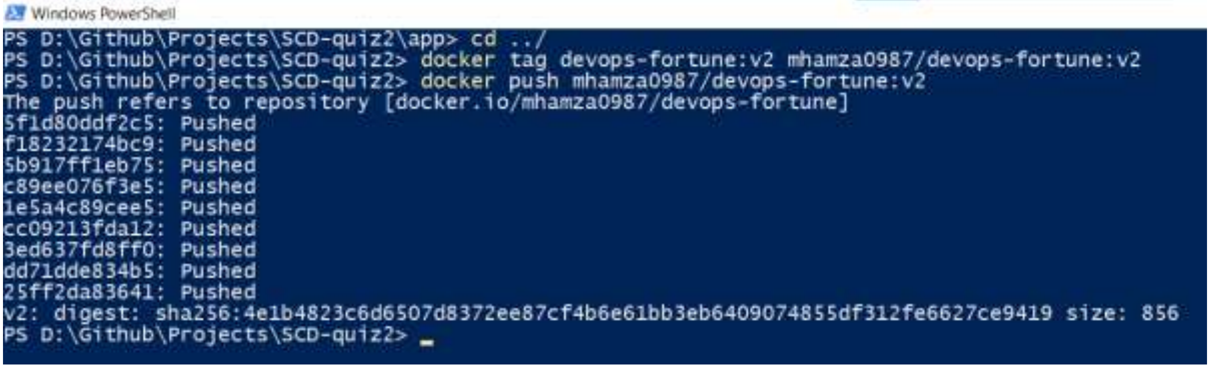


Hello from my Custom Container!

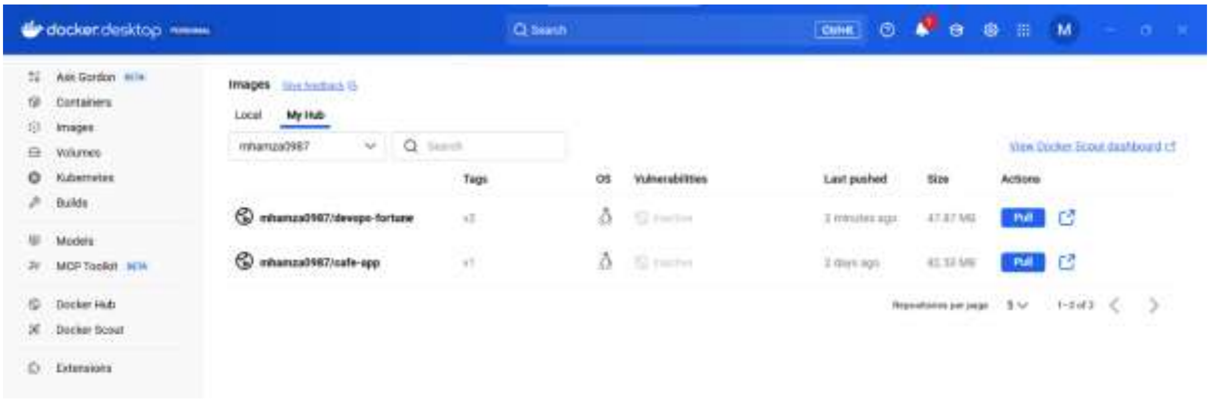
This is the newer version (v2).

Phase 2: App to Containers

Pushing image:

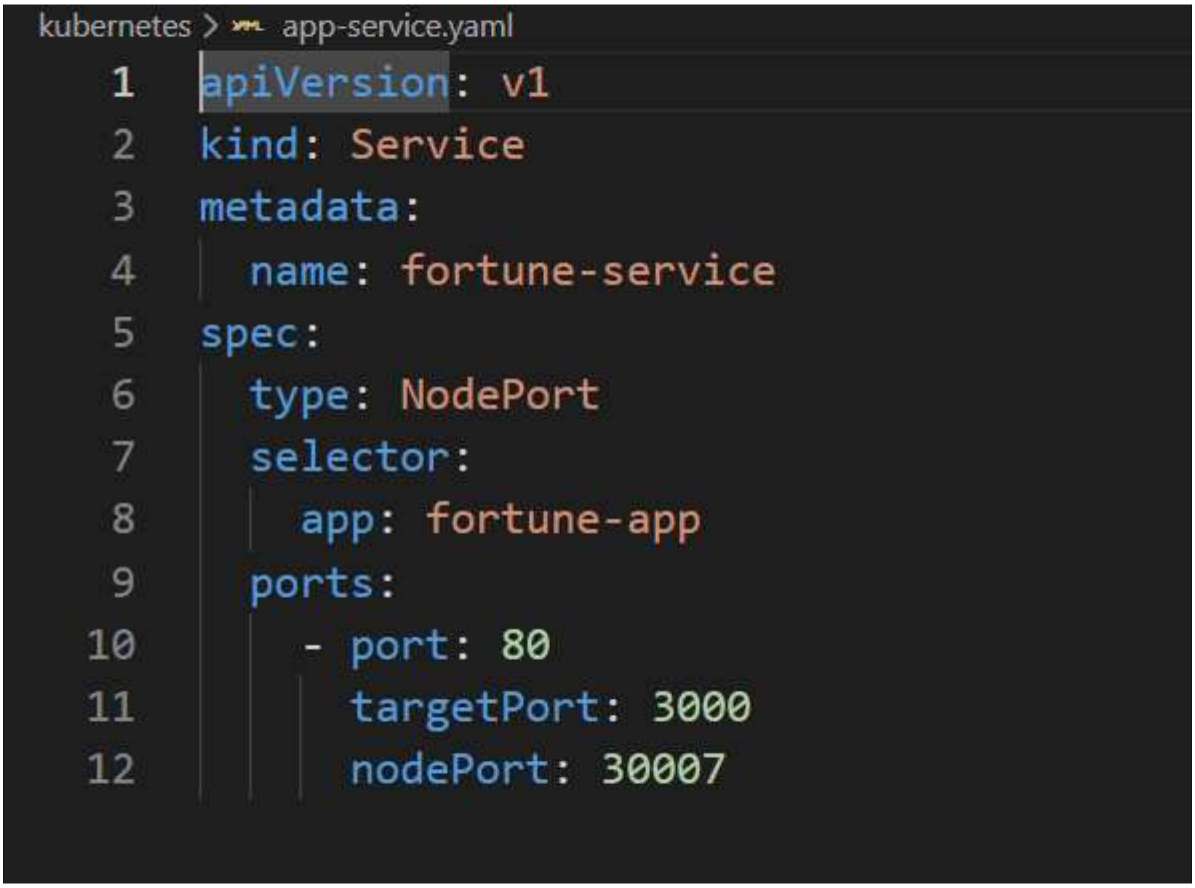


```
PS D:\Github\Projects\SCD-quiz2\app> cd ../
PS D:\Github\Projects\SCD-quiz2> docker tag devops-fortune:v2 mhamza0987/devops-fortune:v2
PS D:\Github\Projects\SCD-quiz2> docker push mhamza0987/devops-fortune:v2
The push refers to repository [docker.io/mhamza0987/devops-fortune]
5f1d80ddf2c5: Pushed
f18232174bc9: Pushed
5b917ff1eb75: Pushed
c89ee076f3e5: Pushed
1e5a4c89cee5: Pushed
cc09213fda12: Pushed
3ed637fd8ff0: Pushed
dd71dde834b5: Pushed
25ff2da83641: Pushed
v2: digest: sha256:4e1b4823c6d6507d8372ee87cf4b6e61bb3eb6409074855df312fe6627ce9419 size: 856
PS D:\Github\Projects\SCD-quiz2> _
```

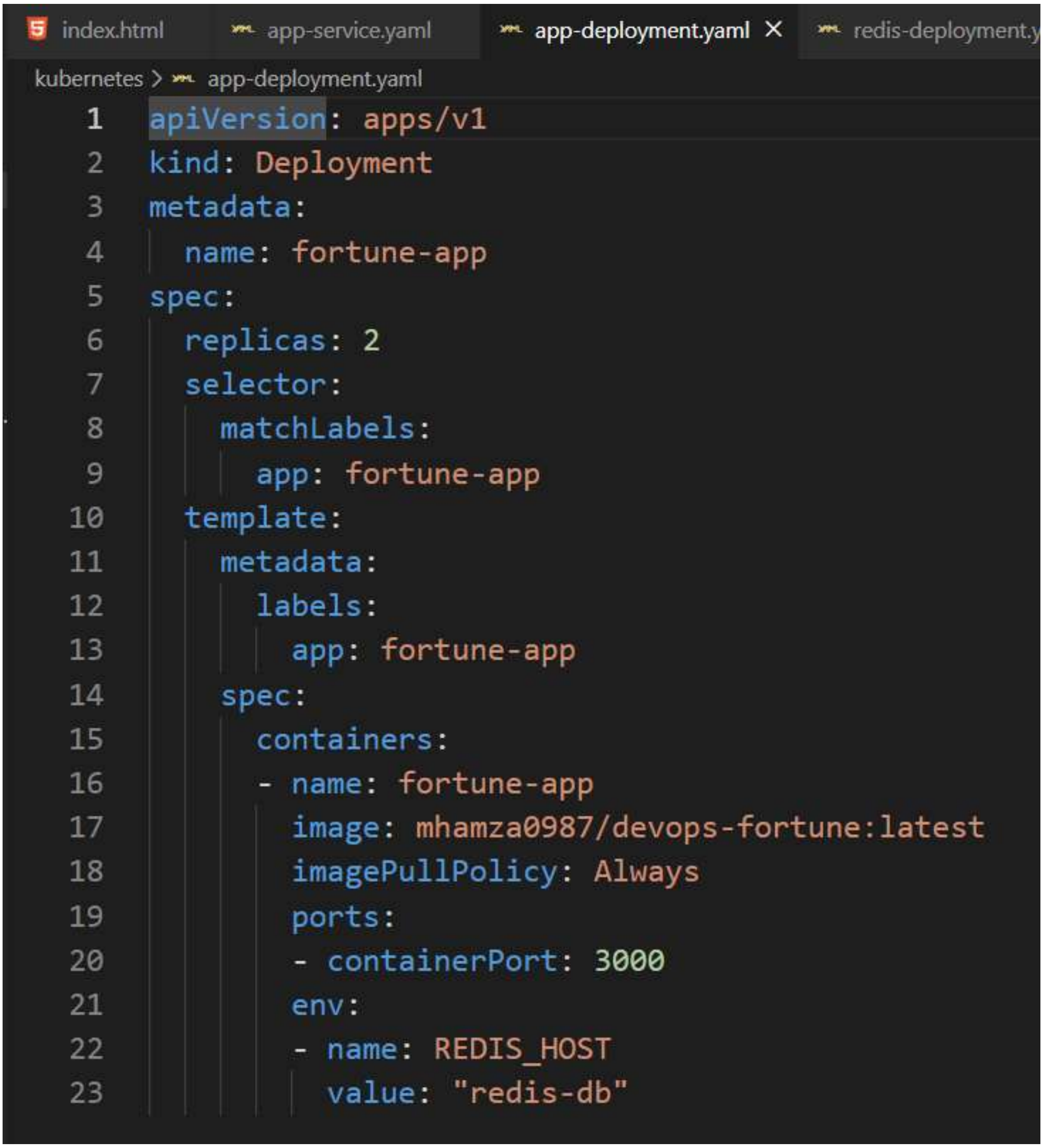


	Tags	OS	Vulnerabilities	Last pushed	Size	Actions
mhamza0987/devops-fortune	+2		Inactive	3 minutes ago	47.87 MB	Pull
mhamza0987/cafe-app	+1		Inactive	2 days ago	82.32 MB	Pull

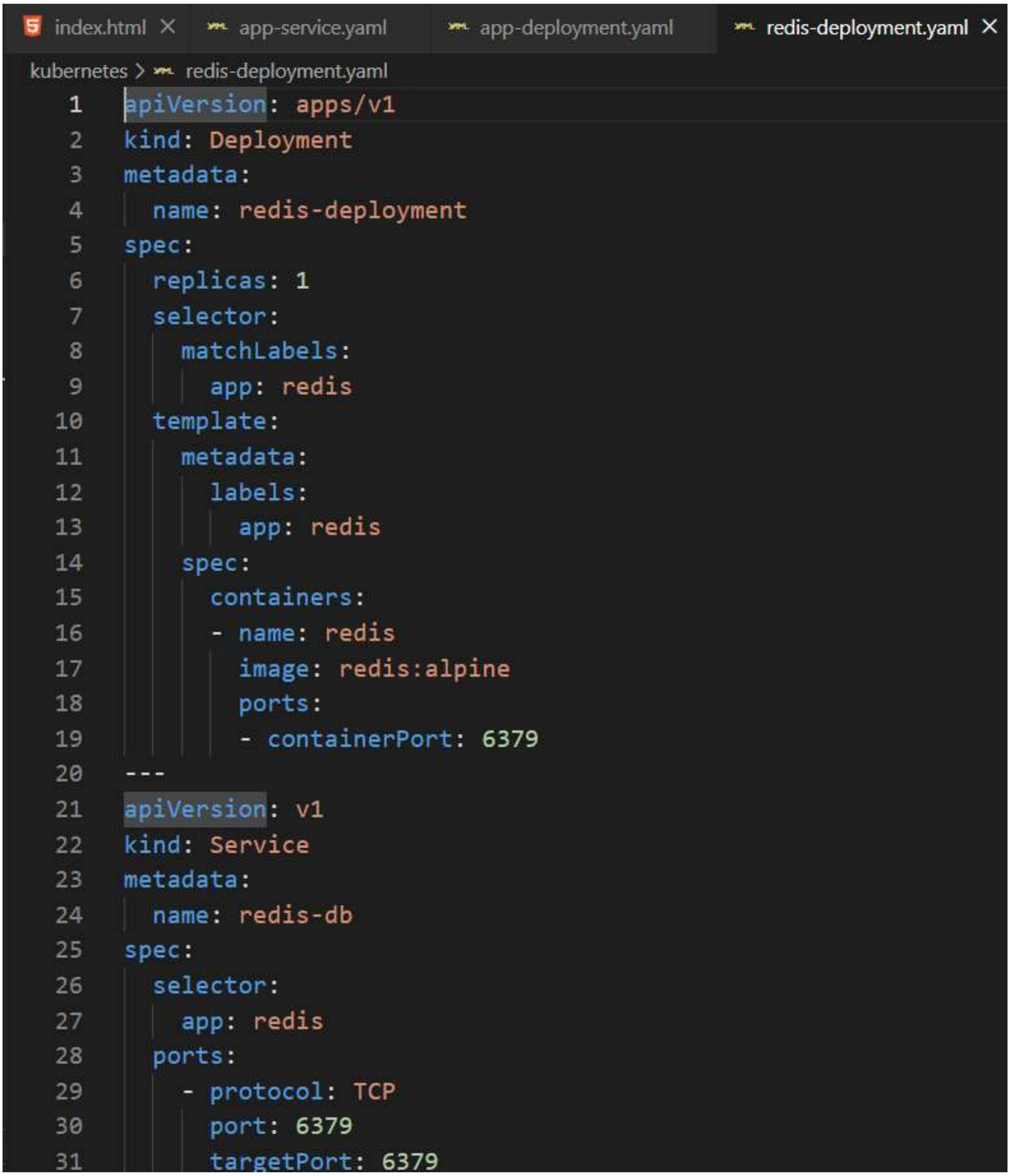
Yaml files:


kubernetes > app-service.yaml

```yaml
apiVersion: v1
kind: Service
metadata:
  name: fortune-service
spec:
  type: NodePort
  selector:
    app: fortune-app
  ports:
    - port: 80
      targetPort: 3000
      nodePort: 30007
```

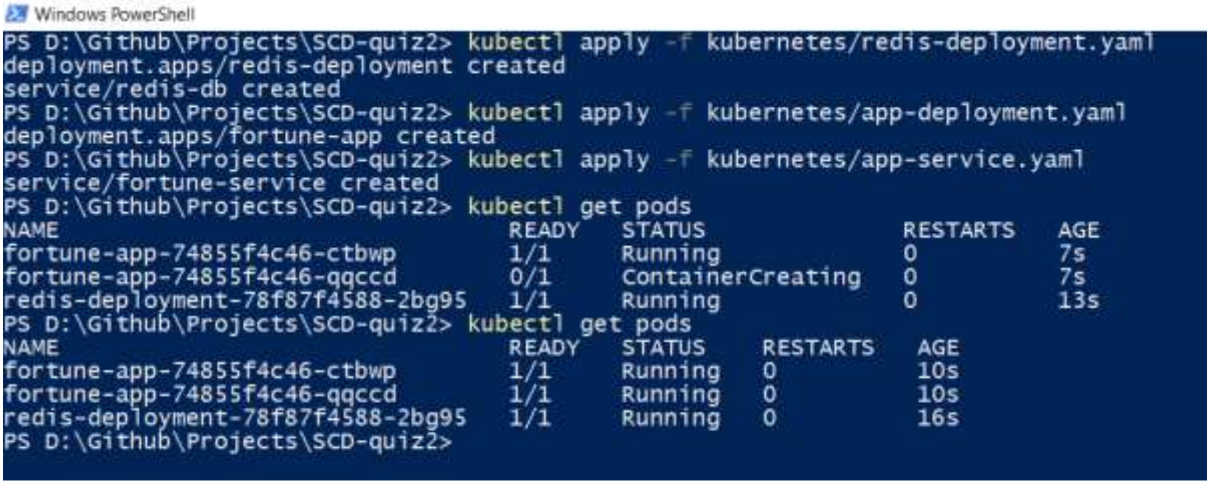


```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: fortune-app
spec:
  replicas: 2
  selector:
    matchLabels:
      app: fortune-app
  template:
    metadata:
      labels:
        app: fortune-app
    spec:
      containers:
      - name: fortune-app
        image: mhamza0987/devops-fortune:latest
        imagePullPolicy: Always
        ports:
        - containerPort: 3000
        env:
        - name: REDIS_HOST
          value: "redis-db"
```

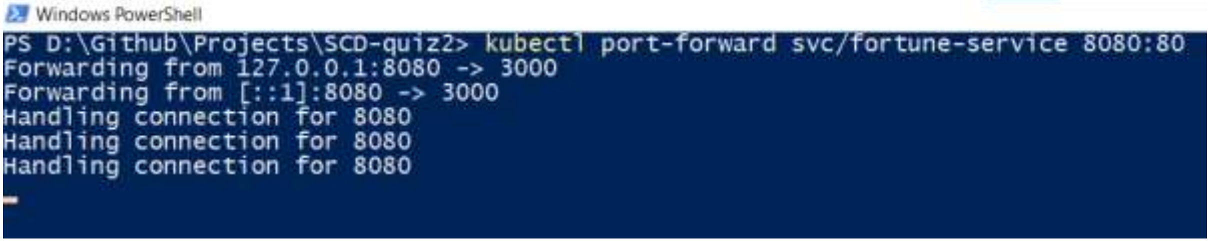


```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: redis-deployment
spec:
  replicas: 1
  selector:
    matchLabels:
      app: redis
  template:
    metadata:
      labels:
        app: redis
    spec:
      containers:
      - name: redis
        image: redis:alpine
        ports:
        - containerPort: 6379
---
apiVersion: v1
kind: Service
metadata:
  name: redis-db
spec:
  selector:
    app: redis
  ports:
    - protocol: TCP
      port: 6379
      targetPort: 6379
```

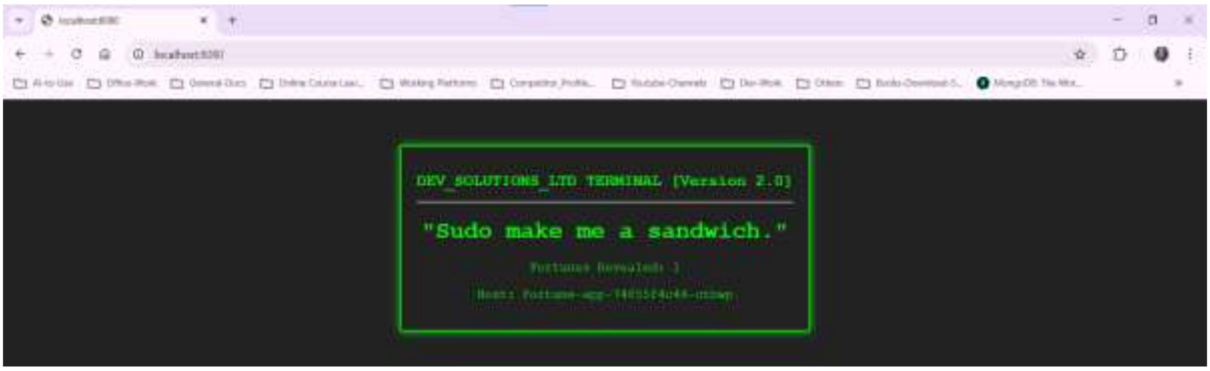
Pods:



```
PS D:\Github\Projects\SCD-quiz2> kubectl apply -f kubernetes/redis-deployment.yaml
deployment.apps/redis-deployment created
service/redis-db created
PS D:\Github\Projects\SCD-quiz2> kubectl apply -f kubernetes/app-deployment.yaml
deployment.apps/fortune-app created
PS D:\Github\Projects\SCD-quiz2> kubectl apply -f kubernetes/app-service.yaml
service/fortune-service created
PS D:\Github\Projects\SCD-quiz2> kubectl get pods
NAME                                READY   STATUS              RESTARTS   AGE
fortune-app-74855f4c46-ctbwp        1/1     Running             0          7s
fortune-app-74855f4c46-qqccd        0/1     ContainerCreating   0          7s
redis-deployment-78f87f4588-2bg95   1/1     Running             0          13s
PS D:\Github\Projects\SCD-quiz2> kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
fortune-app-74855f4c46-ctbwp        1/1     Running   0          10s
fortune-app-74855f4c46-qqccd        1/1     Running   0          10s
redis-deployment-78f87f4588-2bg95   1/1     Running   0          16s
PS D:\Github\Projects\SCD-quiz2>
```



```
PS D:\Github\Projects\SCD-quiz2> kubectl port-forward svc/fortune-service 8080:80
Forwarding from 127.0.0.1:8080 -> 3000
Forwarding from [::1]:8080 -> 3000
Handling connection for 8080
Handling connection for 8080
Handling connection for 8080
_
```



DEV_SOLUTIONS_LTD TERMINAL [Version 2.0]

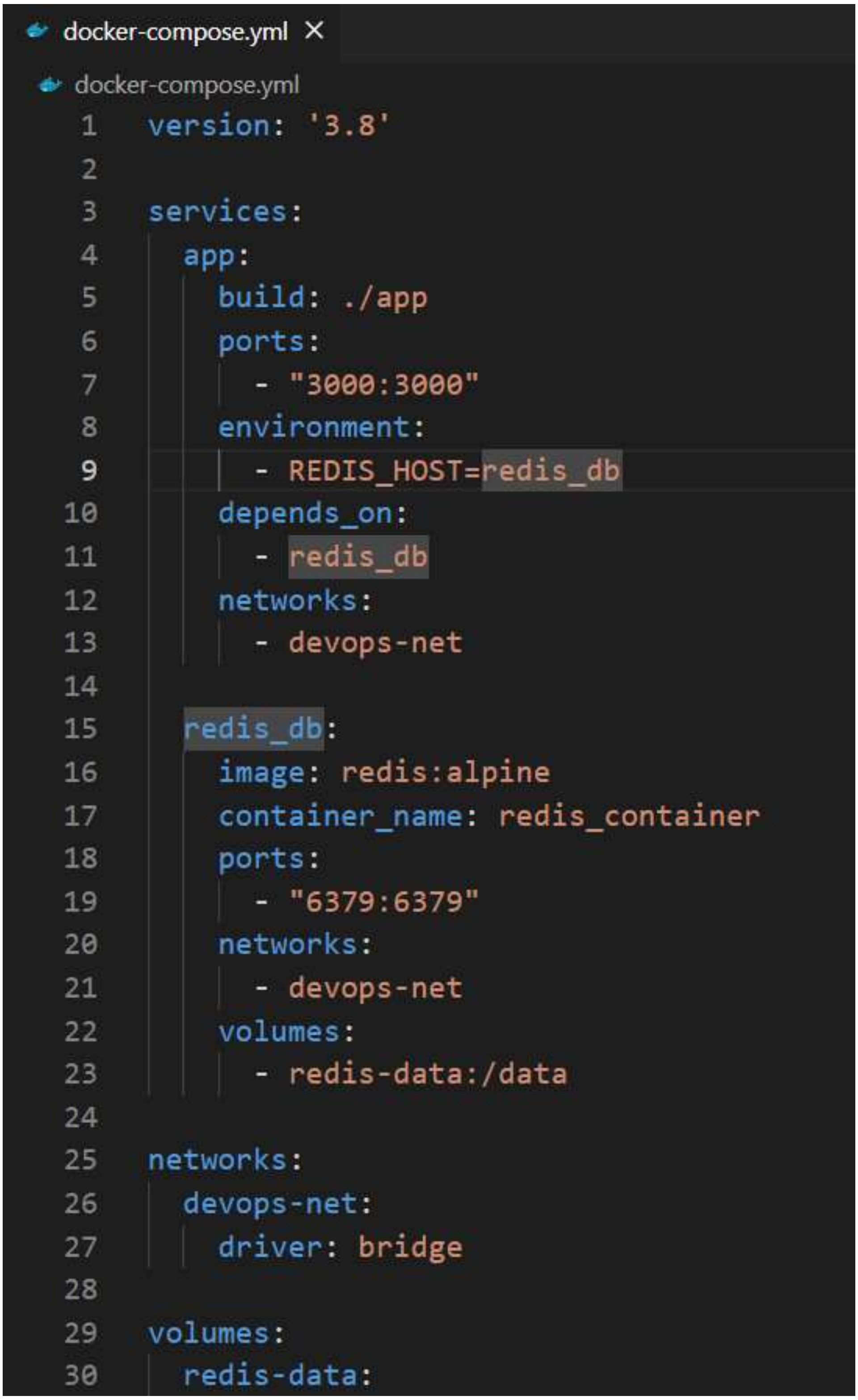
"Sudo make me a sandwich."

Fortunes Revealed: 1

Host: fortune-app-74855f4c46-ctbwp

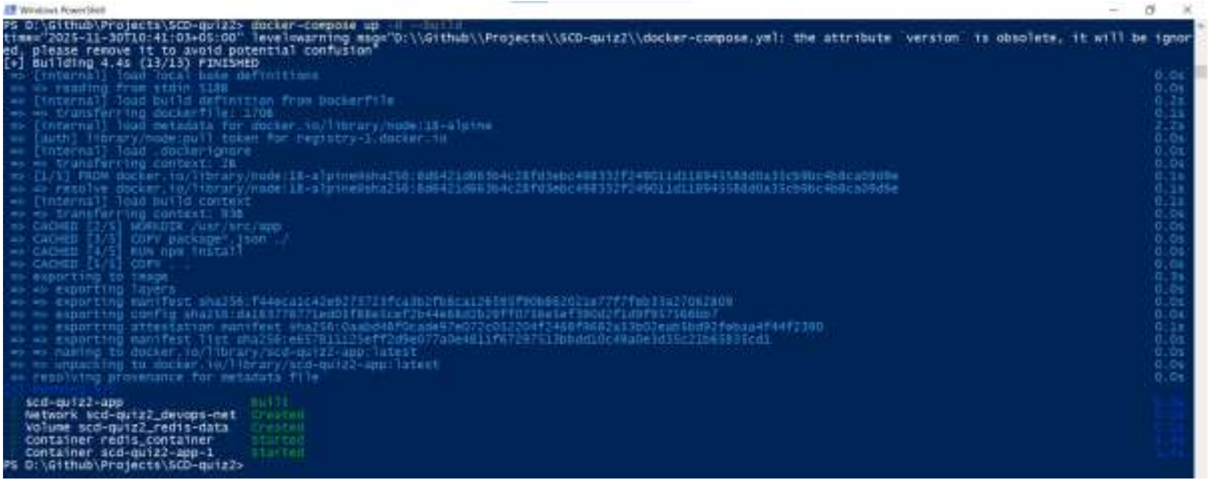
Phase 3 Multi-Service App

Docker-compose.yml:

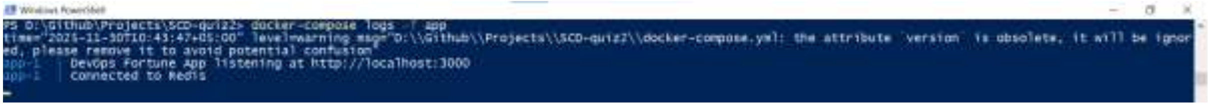


```yaml
version: '3.8'

services:
  app:
    build: ./app
    ports:
      - "3000:3000"
    environment:
      - REDIS_HOST=redis_db
    depends_on:
      - redis_db
    networks:
      - devops-net

  redis_db:
    image: redis:alpine
    container_name: redis_container
    ports:
      - "6379:6379"
    networks:
      - devops-net
    volumes:
      - redis-data:/data

networks:
  devops-net:
    driver: bridge

volumes:
  redis-data:
```

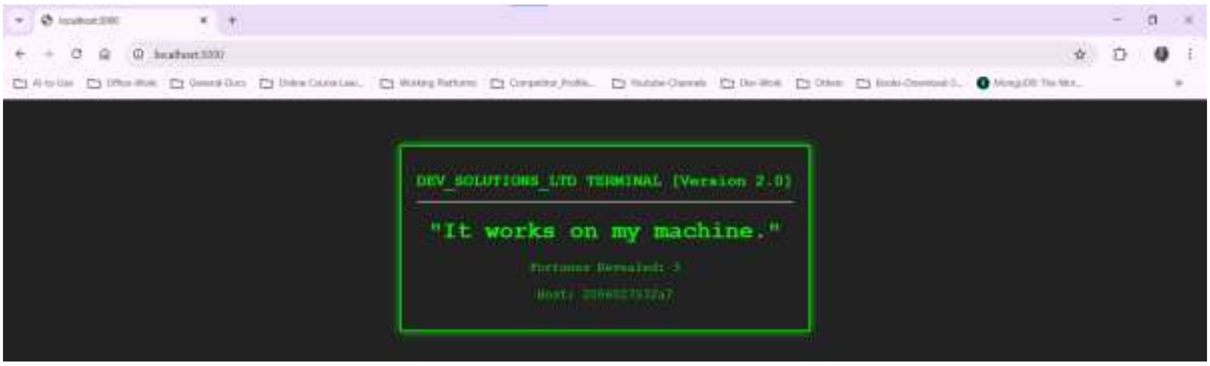
Building docker-compose up:



```
PS D:\Github\Projects\SCD-quiz2> docker-compose up -d --build
time="2025-11-30T10:41:03+05:00" level=warning msg="D:\\Github\\Projects\\SCD-quiz2\\docker-compose.yml: the attribute `version` is obsolete, it will be ignor
ed, please remove it to avoid potential confusion"
[+] Building 4.4s (13/13) FINISHED
 => [internal] load local bake definitions                                                                                              0.0s
 => => reading from stdin 518B                                                                                                          0.0s
 => [internal] load build definition from Dockerfile                                                                                    0.2s
 => => transferring dockerfile: 170B                                                                                                    0.1s
 => [internal] load metadata for docker.io/library/node:18-alpine                                                                       2.2s
 => [auth] library/node:pull token for registry-1.docker.io                                                                             0.0s
 => [internal] load .dockerignore                                                                                                       0.0s
 => => transferring context: 2B                                                                                                         0.0s
 => [1/5] FROM docker.io/library/node:18-alpine@sha256:8d6421d663b4c28fd3ebc498332f249011d118945588d0a33cb9bc4b8ca09d8e                  0.1s
 => => resolve docker.io/library/node:18-alpine@sha256:8d6421d663b4c28fd3ebc498332f249011d118945588d0a33cb9bc4b8ca09d8e                  0.1s
 => [internal] load build context                                                                                                       0.2s
 => => transferring context: 93B                                                                                                        0.0s
 => CACHED [2/5] WORKDIR /usr/src/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                                                                                                                  0.3s
 => => exporting layers                                                                                                                 0.0s
 => => exporting manifest sha256:f44eca1c42e6273723fca3b2fb8ca12658f90b6862d1a77f7fab33a27062808                                        0.0s
 => => exporting config sha256:da16377877 1ed01f88e1caf2b44e68d2b29ff0718e1af390d2f1d9f957566b7                                         0.0s
 => => exporting attestation manifest sha256:0aabd48f0cade67e072c012204f2468f9682a13b02eab1bd92feba4f44f2380                            0.1s
 => => exporting manifest list sha256:e6578112 5eff2d9e077a0e4811f67297513bbdd10c49a0e1d35c21b65835cd1                                  0.0s
 => => naming to docker.io/library/scd-quiz2-app:latest                                                                                 0.0s
 => => unpacking to docker.io/library/scd-quiz2-app:latest                                                                              0.0s
 => resolving provenance for metadata file                                                                                              0.0s
   scd-quiz2-app                      Built
   Network scd-quiz2_devops-net       Created
   Volume scd-quiz2_redis-data        Created
   Container redis_container          Started
   Container scd-quiz2-app-1          Started
PS D:\Github\Projects\SCD-quiz2>
```



```
PS D:\Github\Projects\SCD-quiz2> docker-compose logs -f app
time="2025-11-30T10:43:47+05:00" level=warning msg="D:\\Github\\Projects\\SCD-quiz2\\docker-compose.yml: the attribute `version` is obsolete, it will be ignor
ed, please remove it to avoid potential confusion"
app-1  | DevOps Fortune App listening at http://localhost:3000
app-1  | Connected to Redis
```



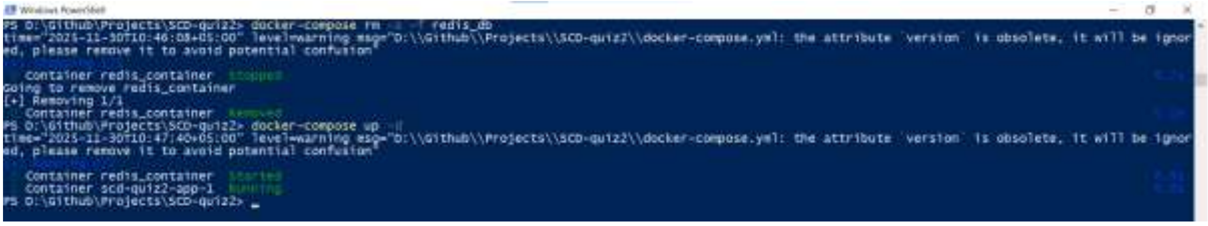
DEV_SOLUTIONS_LTD TERMINAL (Version 2.0)

"It works on my machine."

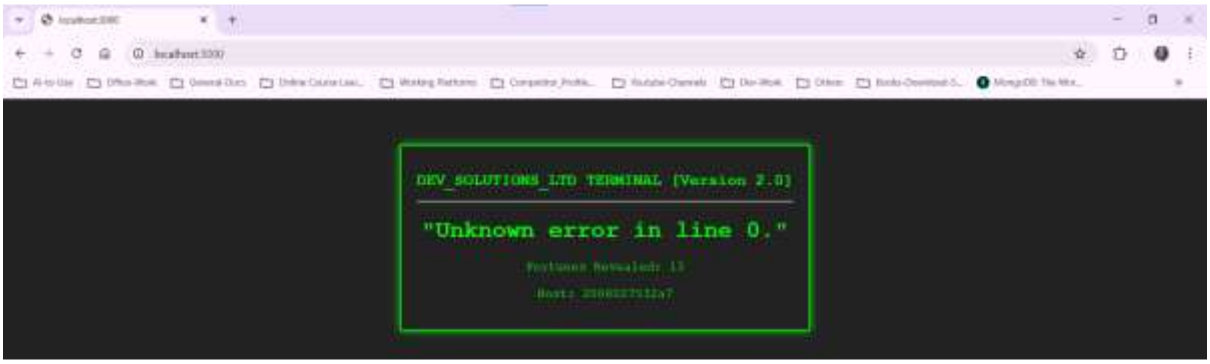
Fortunes Revealed: 3

Host: 2896027532a7

Removing and restarting service:



```
PS D:\Github\Projects\SCD-quiz2> docker-compose rm -s -f redis_db
time="2025-11-30T10:46:08+05:00" level=warning msg="D:\\Github\\Projects\\SCD-quiz2\\docker-compose.yml: the attribute `version` is obsolete, it will be ignor
ed, please remove it to avoid potential confusion"

   Container redis_container  Stopped
Going to remove redis_container
[+] Removing 1/1
   Container redis_container  Removed
PS D:\Github\Projects\SCD-quiz2> docker-compose up -d
time="2025-11-30T10:47:40+05:00" level=warning msg="D:\\Github\\Projects\\SCD-quiz2\\docker-compose.yml: the attribute `version` is obsolete, it will be ignor
ed, please remove it to avoid potential confusion"

   Container redis_container  Started
   Container scd-quiz2-app-1  Running
PS D:\Github\Projects\SCD-quiz2> _
```



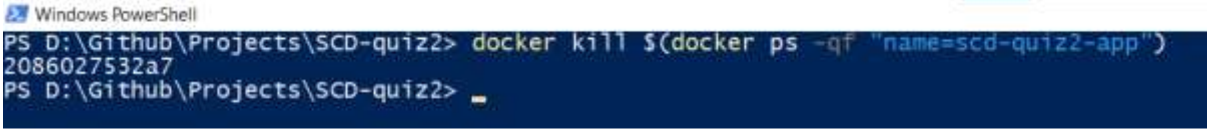
DEV_SOLUTIONS_LTD TERMINAL (Version 2.0)

"Unknown error in line 0."

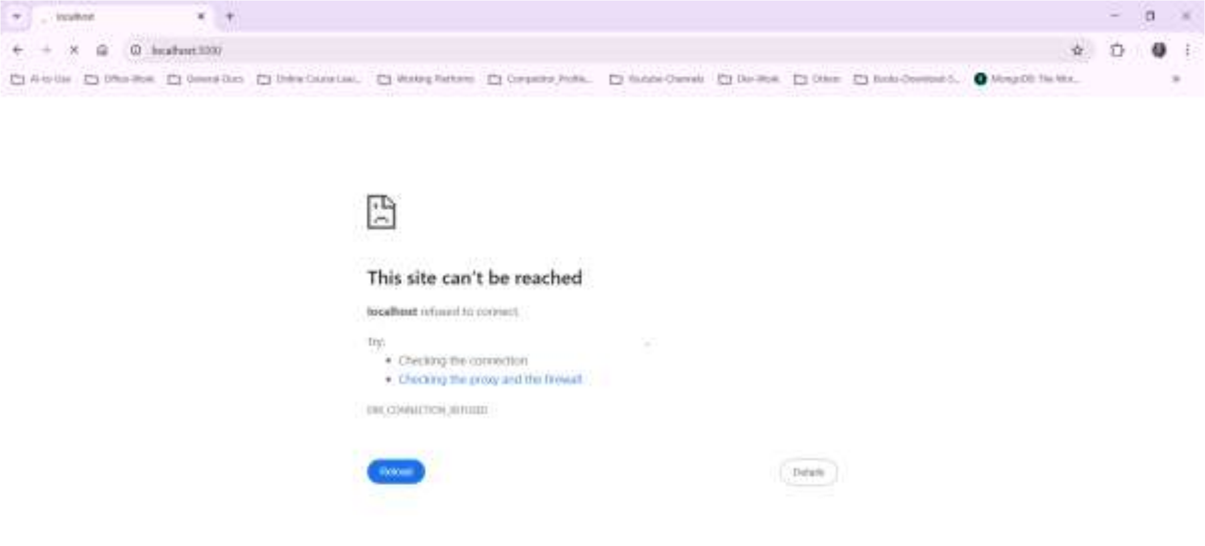
Fortunes Revealed: 13

Host: 2896027532a7

Killing backend and recovery:



```
PS D:\Github\Projects\SCD-quiz2> docker kill $(docker ps -qf "name=scd-quiz2-app")
2086027532a7
PS D:\Github\Projects\SCD-quiz2> _
```



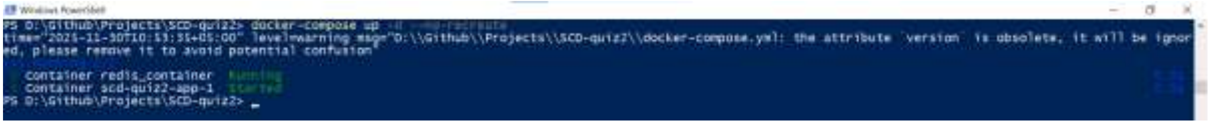
This site can't be reached

localhost refused to connect.

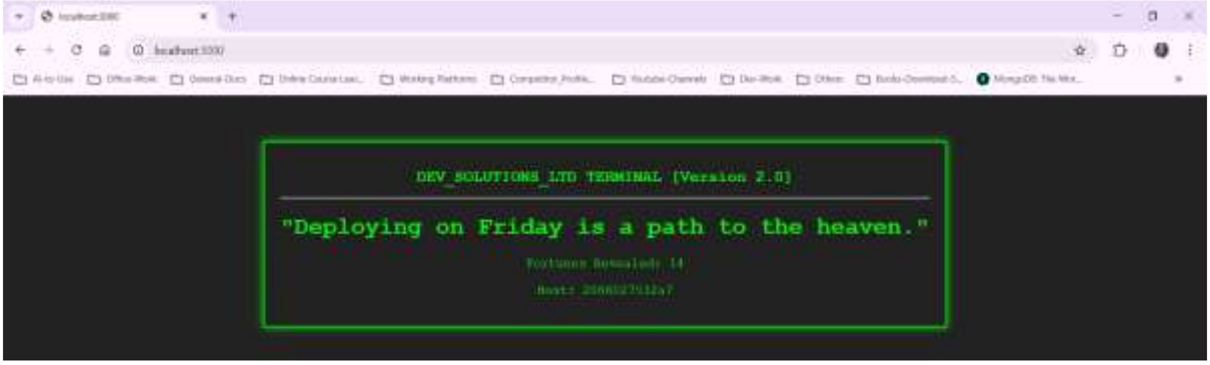
Try:

- Checking the connection
- Checking the proxy and the firewall

ERR_CONNECTION_REFUSED



```
PS D:\Github\Projects\SCD-quiz2> docker-compose up -d --no-recreate
time="2025-11-30T10:53:35+05:00" level=warning msg="D:\\Github\\Projects\\SCD-quiz2\\docker-compose.yml: the attribute `version` is obsolete, it will be ignor
ed, please remove it to avoid potential confusion"
 ✔ Container redis_container  Running
 ✔ Container scd-quiz2-app-1  Started
PS D:\Github\Projects\SCD-quiz2> _
```



DEV_SOLUTIONS_LTD TERMINAL [Version 2.0]

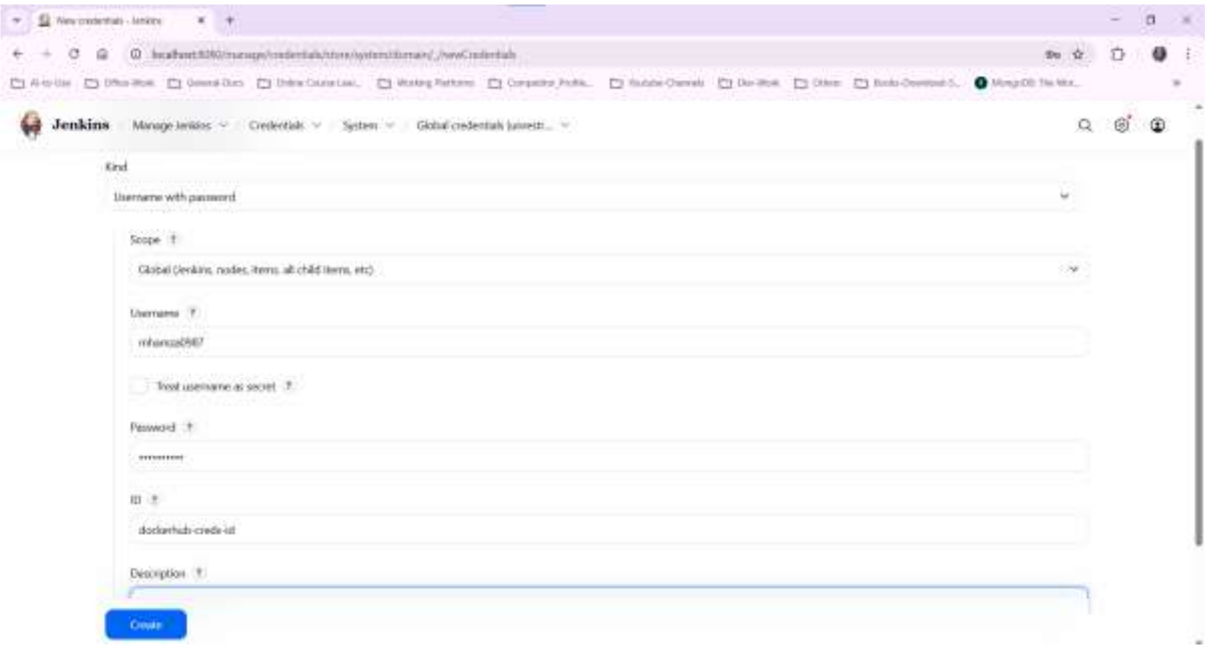
"Deploying on Friday is a path to the heaven."

Fortunes Revealed: 14

Host: 2086027532a7

Phase 4: CI/CD War Zone

Initializing:


New credentials - Jenkins
localhost:8080/manage/credentials/store/system/domain/_/newCredentials
Jenkins
Manage Jenkins
Credentials
System
Global credentials (unrestr...
Create

Kind

Username with password

Scope

Global (Jenkins, nodes, items, all child items, etc)

Username

mhamza0987

□ Treat username as secret

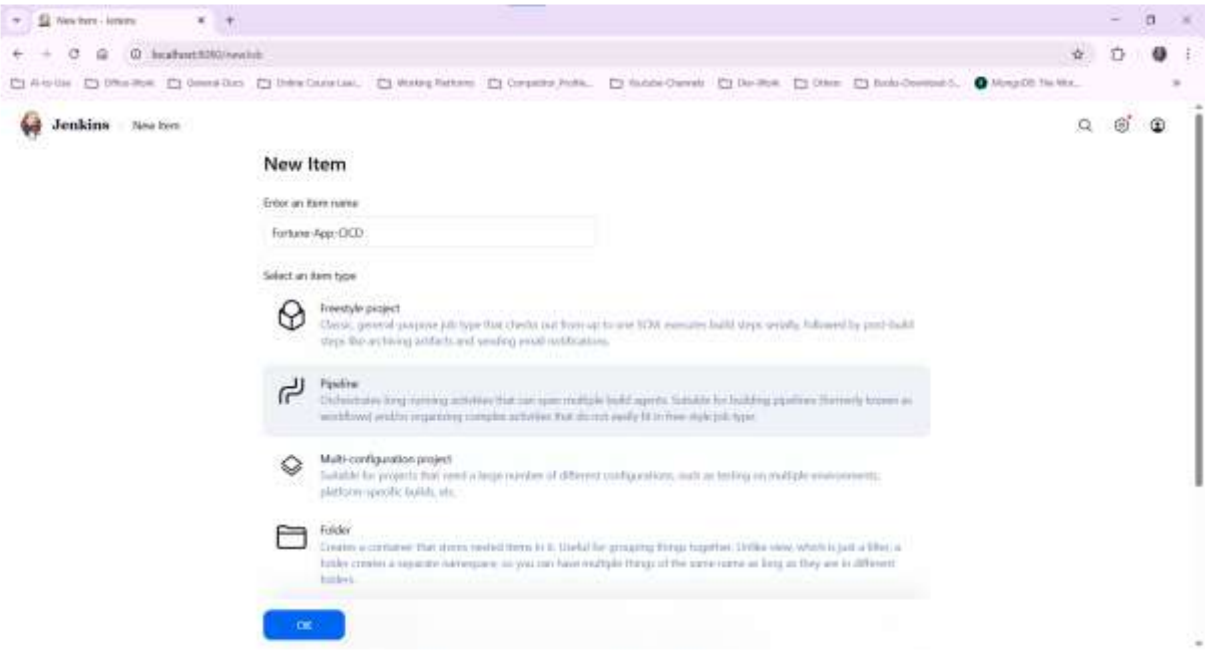
Password

****

ID

dockerhub-creds-id

Description



New Item

Enter an item name

Fortune-App-CICD

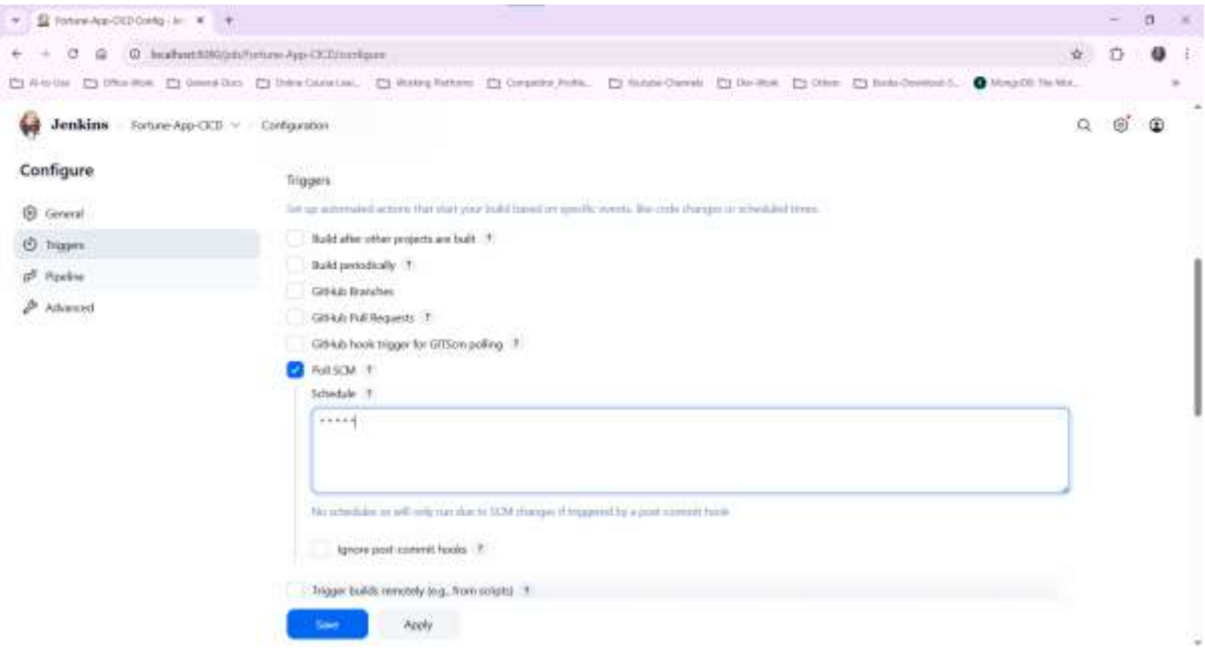
Select an item type

Freestyle project
Classic, general-purpose job type that checks out from up to one SCM, executes build steps serially, followed by post-build steps like archiving artifacts and sending email notifications.

Pipeline
Orchestrates long-running activities that can span multiple build agents. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

Multi-configuration project
Suitable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

Folder
Creates a container that stores nested items in it. Useful for grouping things together. Unlike view, which is just a filter, a folder creates a separate namespace, so you can have multiple things of the same name as long as they are in different folders.



Triggers

Set up automated actions that start your build based on specific events, like code changes or scheduled times.

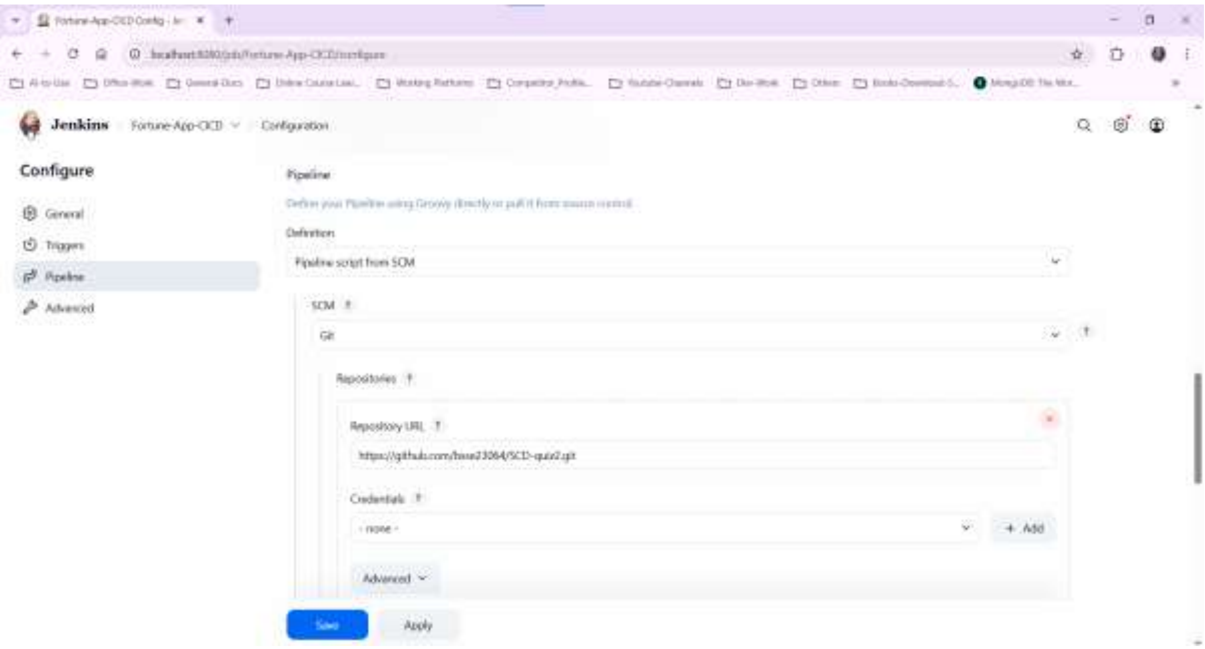
- □ Build after other projects are built ?
- □ Build periodically ?
- □ GitHub Branches
- □ GitHub Pull Requests ?
- □ GitHub hook trigger for GITScm polling ?
- ☑ Poll SCM ?

Schedule ?

```
* * * * *
```

No schedules so will only run due to SCM changes if triggered by a post-commit hook

- □ Ignore post-commit hooks ?
- □ Trigger builds remotely (e.g., from scripts) ?



Pipeline

Define your Pipeline using Groovy directly or pull it from source control.

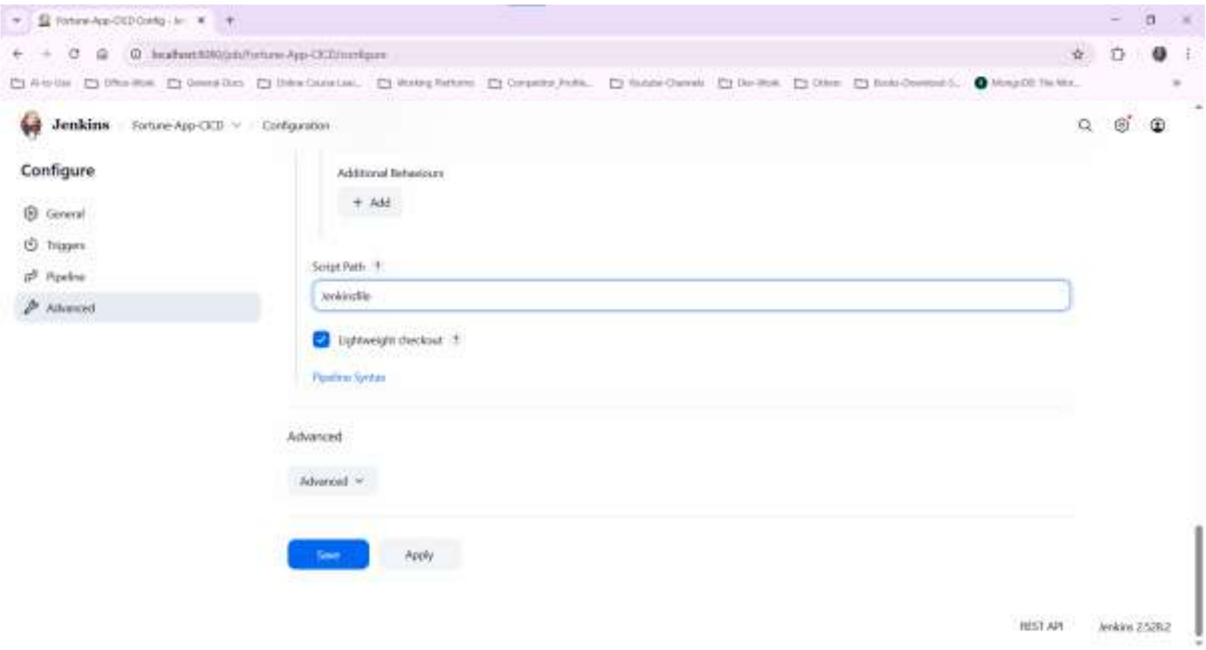
Definition: Pipeline script from SCM

SCM ?: Git

Repositories ?

Repository URL ?: https://github.com/bsse23064/SCD-quiz2.git

Credentials ?: - none -



Additional Behaviours

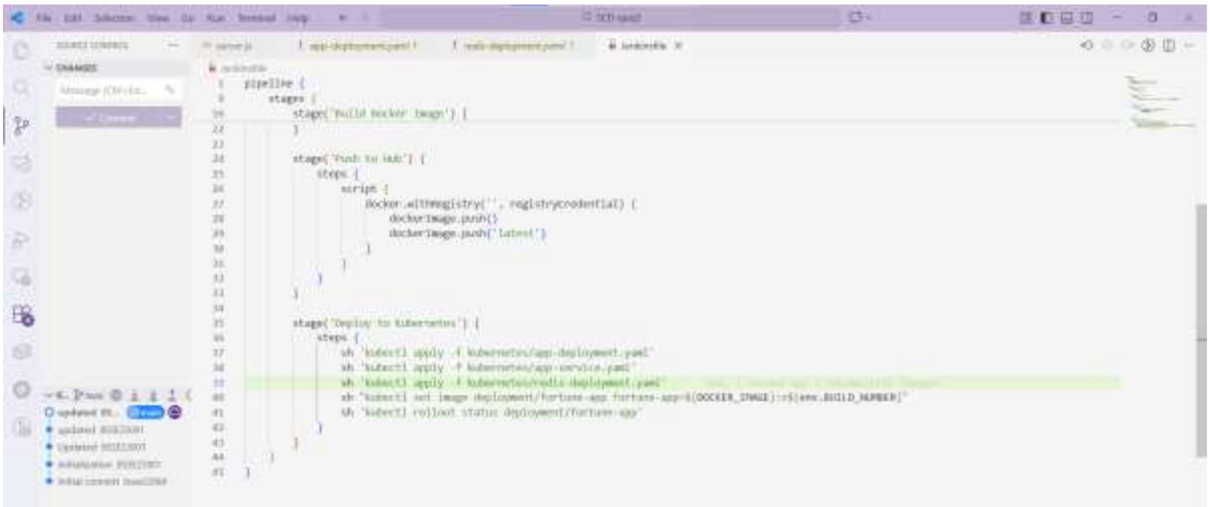
Script Path: Jenkinsfile

☑ Lightweight checkout

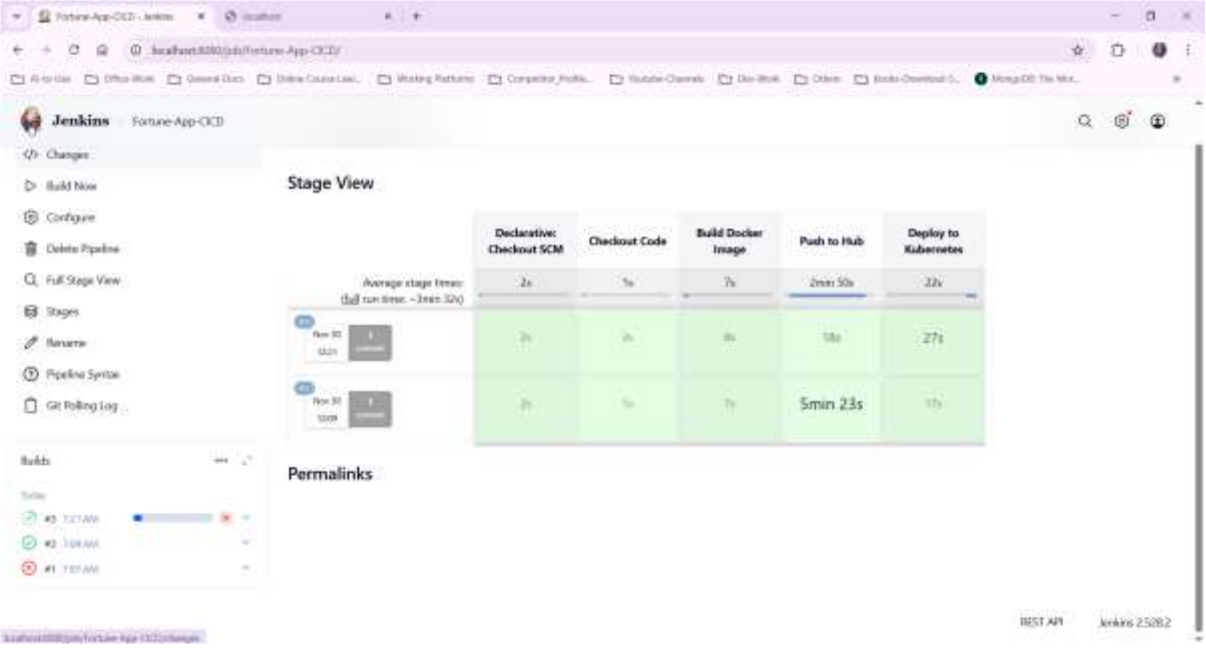
Advanced: Advanced

Note: The pipeline checks the repo after every min and if there is a commit then it triggers the ci/cd

Jenkinsfile:



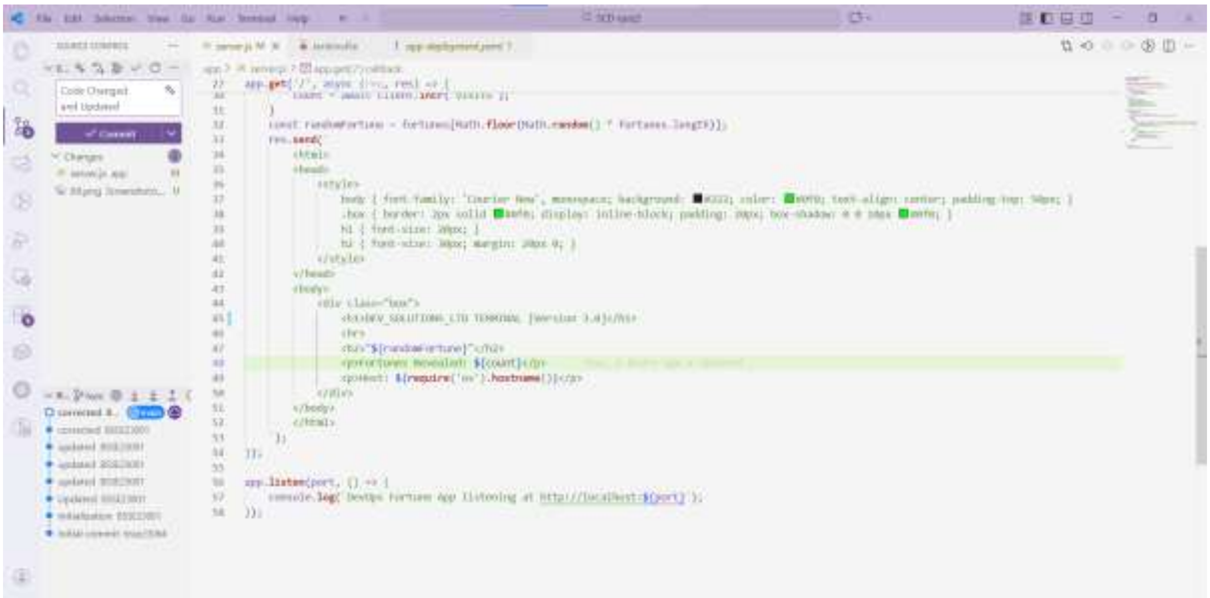
```
pipeline {
    stages {
        stage('Build Docker Image') {
        }

        stage('Push to Hub') {
            steps {
                script {
                    docker.withRegistry('', registryCredential) {
                        dockerImage.push()
                        dockerImage.push('latest')
                    }
                }
            }
        }

        stage('Deploy to Kubernetes') {
            steps {
                sh 'kubectl apply -f kubernetes/app-deployment.yaml'
                sh 'kubectl apply -f kubernetes/app-service.yaml'
                sh 'kubectl apply -f kubernetes/redis-deployment.yaml'
                sh "kubectl set image deployment/fortune-app fortune-app=${DOCKER_IMAGE}:${env.BUILD_NUMBER}"
                sh 'kubectl rollout status deployment/fortune-app'
            }
        }
    }
}
```



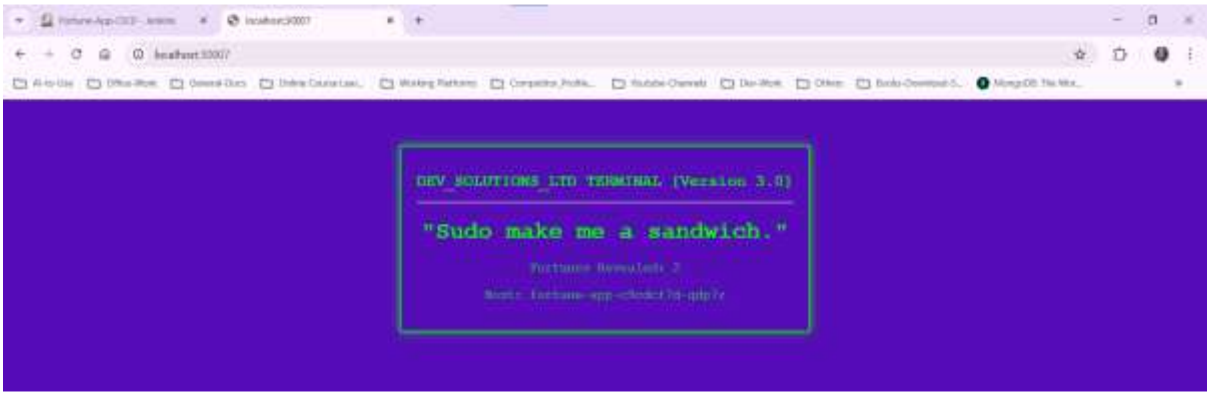
Stage View

	Declarative: Checkout SCM	Checkout Code	Build Docker Image	Push to Hub	Deploy to Kubernetes
Average stage times: (full run time: ~3min 32s)	2s	1s	7s	2min 50s	22s
Nov 30 12:21	2s	2s	8s	18s	27s
Nov 30 12:09	2s	1s	7s	5min 23s	17s

Making a commit:



```
app.get('/', async (req, res) => {
    count = await client.incr('visits');
  }
  const randomFortune = fortunes[Math.floor(Math.random() * fortunes.length)];
  res.send(`
    <html>
    <head>
      <style>
        body { font-family: 'Courier New', monospace; background: #222; color: #0f0; text-align: center; padding-top: 50px; }
        .box { border: 2px solid #0f0; display: inline-block; padding: 20px; box-shadow: 0 0 10px #0f0; }
        h1 { font-size: 20px; }
        h2 { font-size: 30px; margin: 20px 0; }
      </style>
    </head>
    <body>
      <div class="box">
        <h1>DEV_SOLUTIONS_LTD TERMINAL [Version 3.0]</h1>
        <hr>
        <h2>"${randomFortune}"</h2>
        <p>Fortunes Revealed: ${count}</p>
        <p>Host: ${require('os').hostname()}</p>
      </div>
    </body>
    </html>
  `);
});

app.listen(port, () => {
  console.log(`DevOps Fortune App listening at http://localhost:${port}`);
});
```



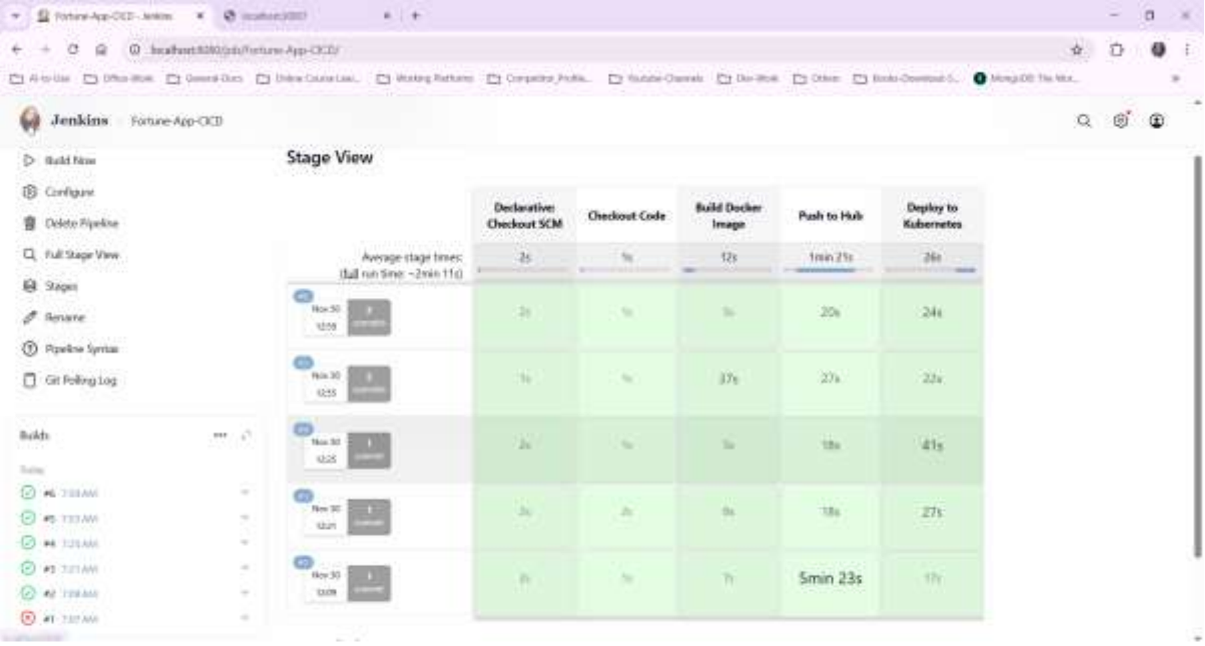
DEV_SOLUTIONS_LTD TERMINAL [Version 3.0]

"Sudo make me a sandwich."

Fortunes Revealed: 2

Host: fortune-app-c5bdcf7d-qdp7v

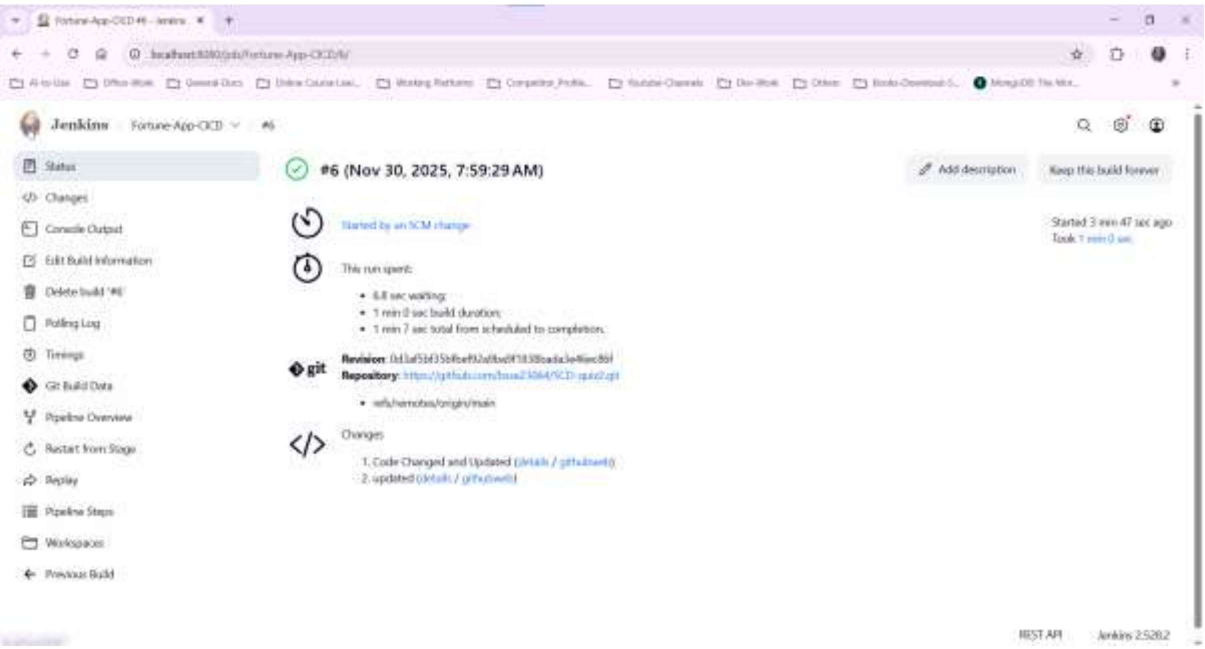
Pipeline trigger:



- #6 7:59 AM
- #5 7:55 AM
- #4 7:25 AM
- #3 7:21 AM
- #2 7:09 AM
- #1 7:07 AM

Stage View

	Declarative: Checkout SCM	Checkout Code	Build Docker Image	Push to Hub	Deploy to Kubernetes
Average stage times: (full run time: ~2min 11s)	2s	1s	12s	1min 21s	26s
Nov 30 12:59	2s	1s	5s	20s	24s
Nov 30 12:55	1s	1s	37s	27s	22s
Nov 30 12:25	2s	1s	5s	18s	41s
Nov 30 12:21	2s	2s	8s	18s	27s
Nov 30 12:09	2s	1s	7s	5min 23s	17s



#6 (Nov 30, 2025, 7:59:29 AM)

Started by an SCM change

Started 3 min 47 sec ago
Took 1 min 0 sec

This run spent:

- 6.8 sec waiting;
- 1 min 0 sec build duration;
- 1 min 7 sec total from scheduled to completion.

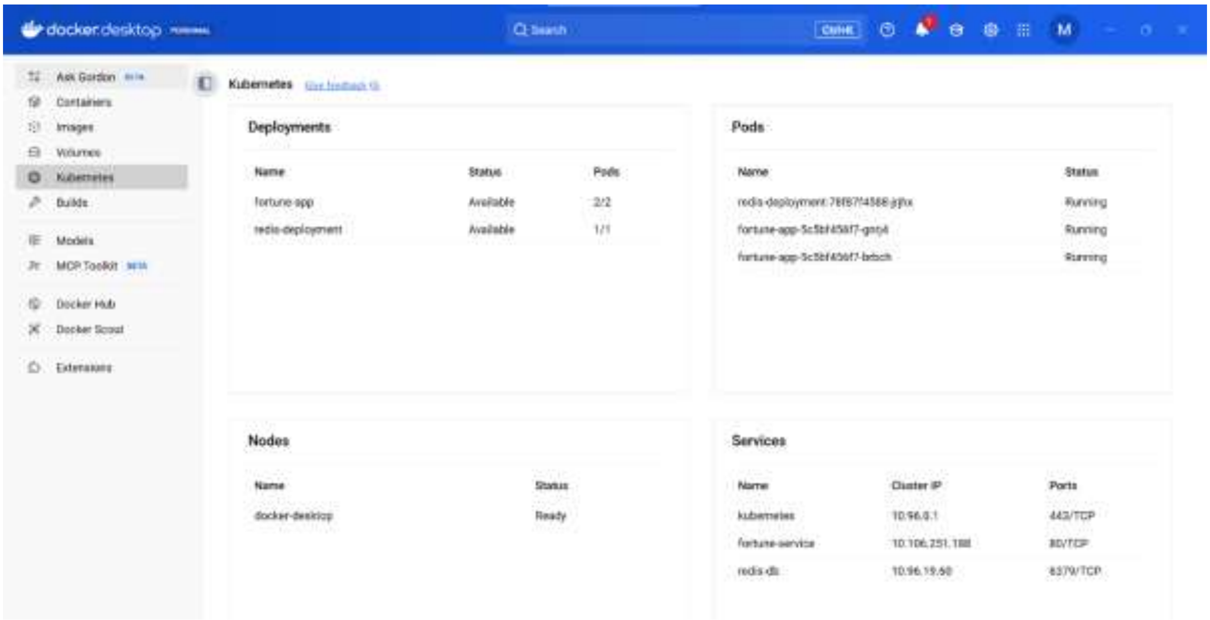
Revision: 0d3af5bf35bfbef92af6bd9f1838bada3e4fiec86f
Repository: https://github.com/bosa23064/SCD-quiz2.git

- refs/remotes/origin/main

Changes

1. Code Changed and Updated (details / githubweb)
2. updated (details / githubweb)

Pods and deployments:



Deployments

Name	Status	Pods
fortune-app	Available	2/2
redis-deployment	Available	1/1

Pods

Name	Status
redis-deployment-78f87f4588-jqhx	Running
fortune-app-5c5bf458f7-gnrj4	Running
fortune-app-5c5bf458f7-bdsch	Running

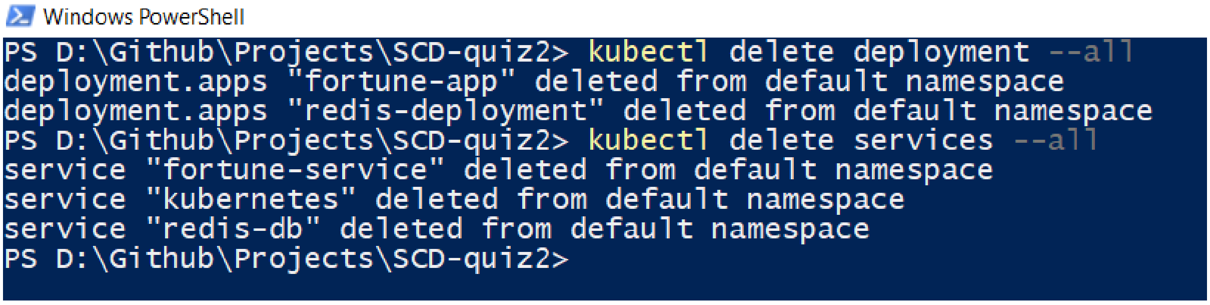
Nodes

Name	Status
docker-desktop	Ready

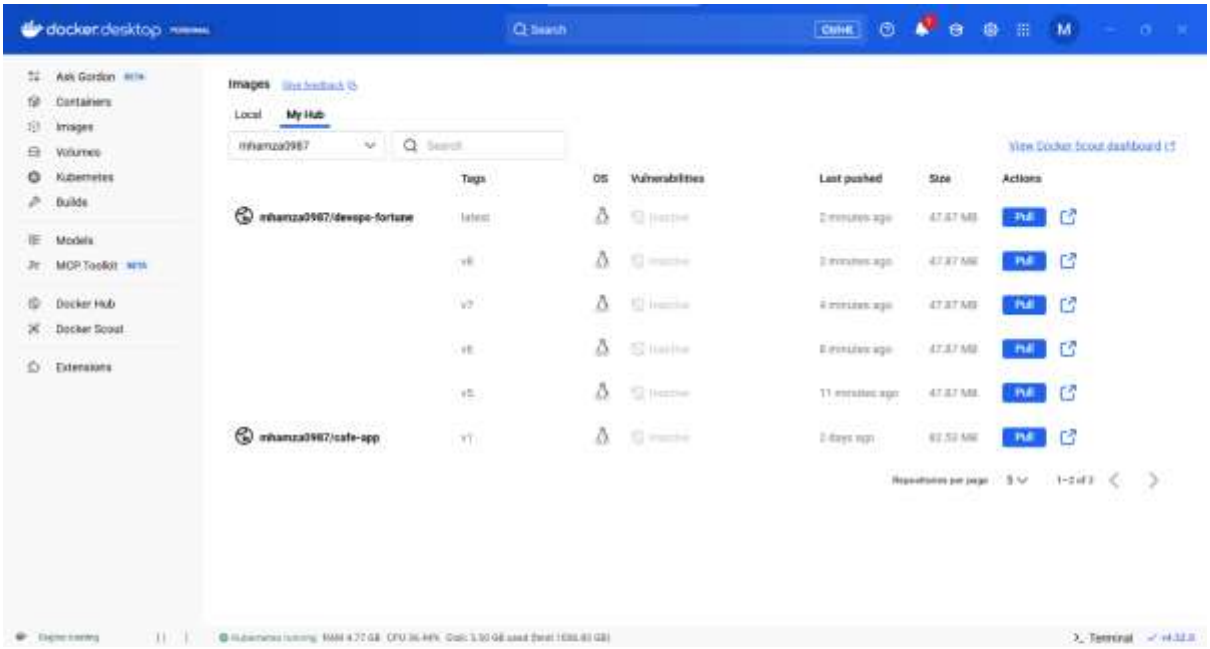
Services

Name	Cluster IP	Ports
kubernetes	10.96.0.1	443/TCP
fortune-service	10.106.251.188	80/TCP
redis-db	10.96.19.60	6379/TCP

Cleanup:



```
PS D:\Github\Projects\SCD-quiz2> kubectl delete deployment --all
deployment.apps "fortune-app" deleted from default namespace
deployment.apps "redis-deployment" deleted from default namespace
PS D:\Github\Projects\SCD-quiz2> kubectl delete services --all
service "fortune-service" deleted from default namespace
service "kubernetes" deleted from default namespace
service "redis-db" deleted from default namespace
PS D:\Github\Projects\SCD-quiz2>
```



	Tags	OS	Vulnerabilities	Last pushed	Size	Actions
mhamza0987/devops-fortune	latest		Inactive	2 minutes ago	47.87 MB	Pull
	v8		Inactive	3 minutes ago	47.87 MB	Pull
	v7		Inactive	4 minutes ago	47.87 MB	Pull
	v6		Inactive	8 minutes ago	47.87 MB	Pull
	v5		Inactive	11 minutes ago	47.87 MB	Pull
mhamza0987/cafe-app	v1		Inactive	2 days ago	62.53 MB	Pull

GITHUB LINK: https://github.com/bsse23064/SCD-quiz2