Describe what is the difference between containerization and virtualization

What are docker image, container, and registry?

Docker Image:

- A read-only file containing set of instructions for creating a container that can run on the Docker platform
- Such as installations, application code, and dependencies
- Docker image provides a convenient way to package up applications and preconfigured server environments

Docker Container:

- An executable package of software
- Includes everything needed to run an application: code, runtime, system tools, system libraries and settings
- Lightweight, standalone

Docker Registry:

- A storage and content delivery system
- Holds named Docker images
- Available in different tagged versions

List the Docker commands used in the video with a brief description for each command and option.

docker build -t: The command “build” builds a docker image. Command “-t” specifies the image name, tag and version

docker images: This command list all images, along with image ID

docker run -d: This command runs the container. Command “-d” runs it in the background

docker ps: This command lists all the (currently) running containers

docker ps -a: The “-a” command lists all containers, whether running or not

docker logs: This command prints logs of the containers that ran in the background

At the end of the video, there are two running containers, what commands can be used to stop and delete those two containers?

docker stop (container ID): stops a running container docker rm -f (container ID): deletes the container; “-f” forcefully removes it.

Prepare a video showing the container(s) created on your machine, displaying their logs, stopping them, and then deleting them. (Note: the JDK version must match that installed in your machine and used to compile the java code. If you have a problem compiled it can download it from the repository from the path: “/v1/out/production/HelloWorldDocker/Main.class” and use OpenJDK:14 in your Dockerfile).

***See individual folder

Build a multi-container Docker application
What’s a multi-container Docker application?

A multi container docker application is an application that contains multiple running containers. Each container simultaneously communicates with each other on the docker application.

How are these containers communicated together?

Docker creates virtual networks which lets the containers communicate with each other. In a network, a container has an IP address, and optionally a hostname.

What command can be used to stop the Docker application and delete its images?

docker stop: stops the docker application

docker rmi -q (image ID): deletes image; “-q” deletes multiple images

List the new docker commands used in the video with a brief description for each command and option.

- docker pull mysql: pulls mysql images
- docker build -t: builds an image with image name, tag and version
- docker run --name app -d -p 8080:8080 --network=app-network mywebapp:1.0: runs the docker application on port 8080
- docker run --name app-db -d -e MYSQL_ROOT_PASSWORD=password MYSQL_DATABASE=myDB mysql: sets root password and database name; locally runs sql database
- docker network create app-network: creates network
- docker network connect app-network app-db: connects docker app container with the database container on app-network.

Prepare a video showing the created application, run the webapp, stop the application and delete the application containers. (Note: if you have a problem generating the war file, you can download it from the repository from the path: “/v2/target/MyWebApp.war”).

***See individual folder

Create a free Google Cloud Account. The first two videos in the following playlist may be helpful

Follow the following video to deploy dockers containers (valid until the shell session is expired) on GCP or by using Kubernetes (until you change it)

Prepare a video showing how the container is deployed using Docker and Kubernetes in GCP.

***See individual folder

List all used GCP shell commands and their description in your report.

- gcloud config set project projectmil1: sets the project with project ID
- gcloud config set compute/zone us-central1-a: sets current directory's timezone
- gcloud services enable container.googleapis.com: enables google apis
- gcloud container clusters create gk-cluster --num-nodes=1: creates a cluster with the name "gk-cluster" and specified number of nodes
- gcloud container clusters get-credentials gk-cluster: gets credentials for deployment
- kubectl create deployment web-server --image=us.gcr.io/projectmil1/cad-site:version1: creates deployment
- kubectl expose deployment web-server --type LoadBalancer --port 80 --target-port 80: exposes web server to port 80
- kubectl get pods: shows a list of active pods
- kubectl get service web-server: displays external IP address to access the web server

Prepare a Kubernetes YML (or YAML) file to load the webApp used in steps 6:8 and deploy it using the Kubernetes engine on GCP. The file is a little different than that used by docker-compose.

- The hostname of all containers is the same and can be accessed by localhost, the address of the MySQL should be changed to localhost and recompiled. (Note: if you have a problem generating the war file, you can download it from the repository from the path "/KGS/target/MyWebApp.war").
- Create a new image using the new war file and push it to Google Container Registry.
- Follow the comments and fill the missing lines in the "/webApp.yml" file.
- Apply the YML file into Kubernetes and run the server (what is the appropriate Cloud shell command?).

Prepare another video describing the YML file and showing how it's deployed on GCP.

What is Kubernetes' pod, service, node, and deployment?

Kubernetes' pod: Pods are the smallest, most basic deployable objects in Kubernetes. A Pod represents a single instance of a running process in your cluster. Pods contain one or more containers, such as Docker containers.

Kubernetes service: Service is a logical abstraction for a deployed group of pods in a cluster (which all perform the same function). Since pods are ephemeral, a service enables a group of pods, which provide specific functions (web services, image processing, etc.) to be assigned a name and unique IP address (clusterIP).

Kubernetes node: Node is a worker machine in Kubernetes and may be either a virtual or a physical machine, depending on the cluster. Each node is managed by the control plane and can have multiple pods.

Kubernetes deployment: Deployment is used to tell Kubernetes how to create or modify instances of the pods that hold a containerized application.

What's meant by replicas?

- A process that keeps a specified number of pod instances.

What are the types of Kubernetes' services? What is the purpose of each?

There are four types of Kubernetes services:

ClusterIP: Exposes the Service on a cluster-internal IP. This is the default ServiceType and choosing this value makes the Service only reachable from within the cluster.

NodePort: Exposes the Service on each Node's IP at a static port (the NodePort).

LoadBalancer: This type of service involves a client submitting a request to a network load balancer's Ip address.

ExternalName: A special case of service that does not have selectors. It does not define any ports or endpoints. Rather, it serves as a way to return an alias to an external service residing outside the cluster.

Video 1

Commands:

```
docker version
docker build -t hello-world:1.0 .
docker images
docker run hello-world:1.0
```

docker ps

docker ps -a

docker build -t hello-world:2.0 .

docker images

docker run -d hello-world:2.0

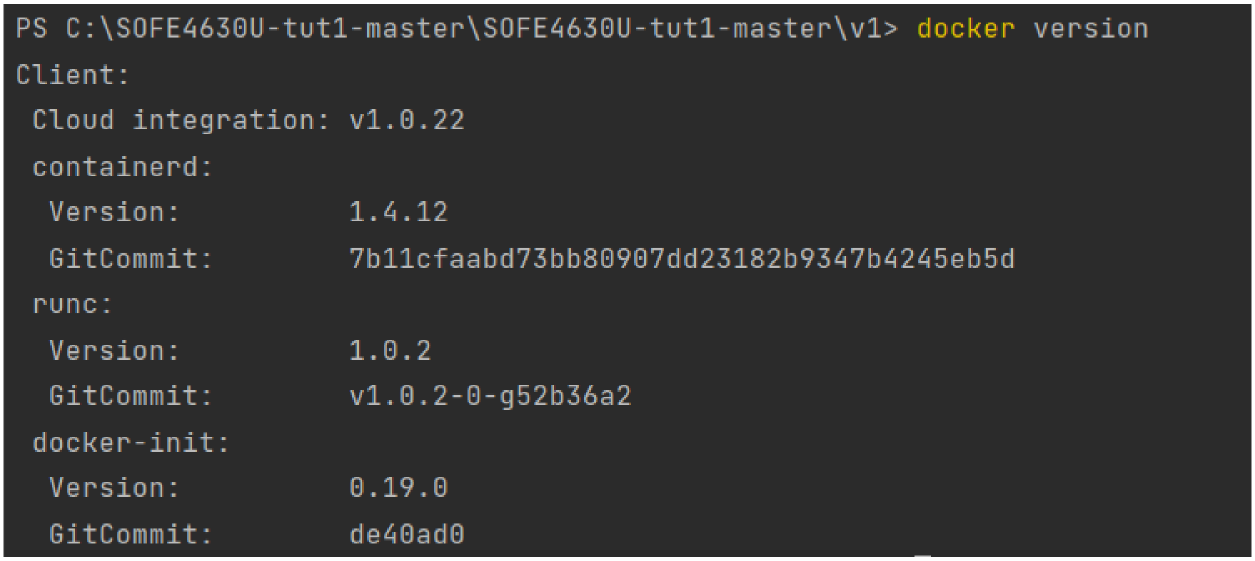
docker ps

docker logs (container id)

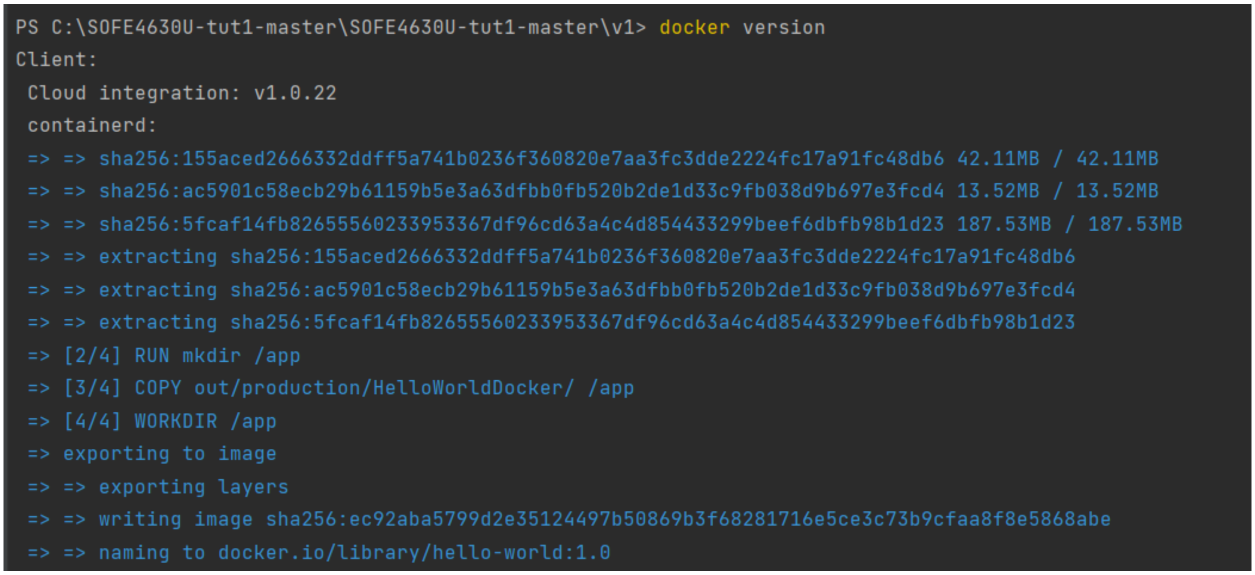
docker stop 29b3f1160d28

docker rm -f 29b3f1160d28

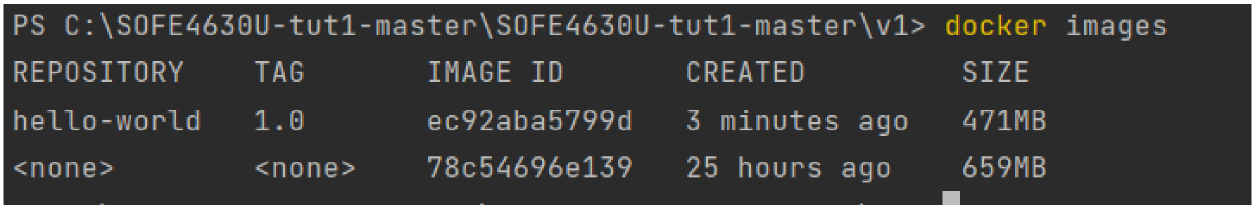
Screenshots:



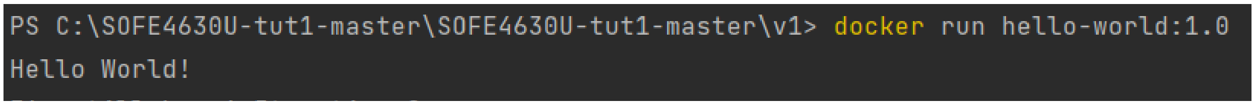
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker version
Client:
 Cloud integration: v1.0.22
 containerd:
  Version:          1.4.12
  GitCommit:        7b11cfaabd73bb80907dd23182b9347b4245eb5d
 runc:
  Version:          1.0.2
  GitCommit:        v1.0.2-0-g52b36a2
 docker-init:
  Version:          0.19.0
  GitCommit:        de40ad0
```



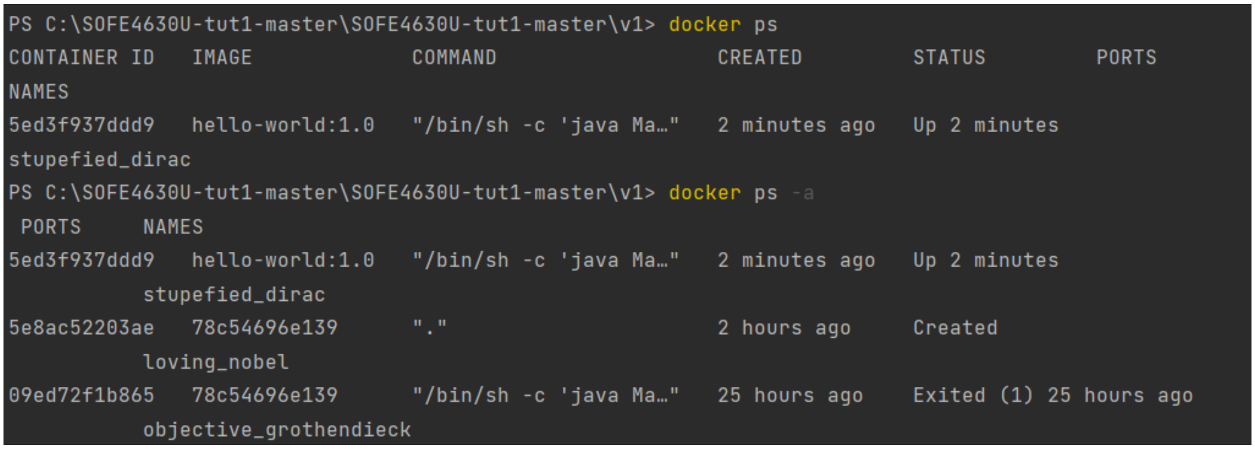
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker version
Client:
 Cloud integration: v1.0.22
 containerd:
 => => sha256:155aced2666332ddff5a741b0236f360820e7aa3fc3dde2224fc17a91fc48db6 42.11MB / 42.11MB
 => => sha256:ac5901c58ecb29b61159b5e3a63dfbb0fb520b2de1d33c9fb038d9b697e3fcd4 13.52MB / 13.52MB
 => => sha256:5fcaf14fb82655560233953367df96cd63a4c4d854433299beef6dbfb98b1d23 187.53MB / 187.53MB
 => => extracting sha256:155aced2666332ddff5a741b0236f360820e7aa3fc3dde2224fc17a91fc48db6
 => => extracting sha256:ac5901c58ecb29b61159b5e3a63dfbb0fb520b2de1d33c9fb038d9b697e3fcd4
 => => extracting sha256:5fcaf14fb82655560233953367df96cd63a4c4d854433299beef6dbfb98b1d23
 => [2/4] RUN mkdir /app
 => [3/4] COPY out/production/HelloWorldDocker/ /app
 => [4/4] WORKDIR /app
 => exporting to image
 => => exporting layers
 => => writing image sha256:ec92aba5799d2e35124497b50869b3f68281716e5ce3c73b9cfaa8f8e5868abe
 => => naming to docker.io/library/hello-world:1.0
```



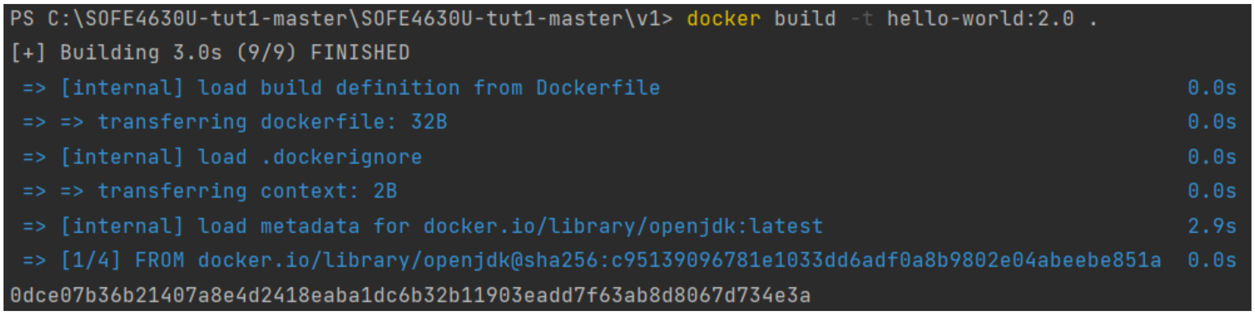
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker images
REPOSITORY    TAG       IMAGE ID       CREATED          SIZE
hello-world   1.0       ec92aba5799d   3 minutes ago    471MB
<none>        <none>    78c54696e139   25 hours ago     659MB
```



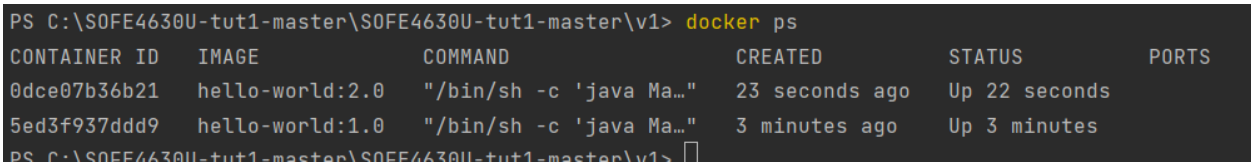
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker run hello-world:1.0
Hello World!
```



```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker ps
CONTAINER ID   IMAGE             COMMAND                  CREATED          STATUS          PORTS
NAMES
5ed3f937ddd9   hello-world:1.0   "/bin/sh -c 'java Ma…"   2 minutes ago    Up 2 minutes
stupefied_dirac
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker ps -a
 PORTS     NAMES
5ed3f937ddd9   hello-world:1.0   "/bin/sh -c 'java Ma…"   2 minutes ago    Up 2 minutes
           stupefied_dirac
5e8ac52203ae   78c54696e139      "."                      2 hours ago      Created
           loving_nobel
09ed72f1b865   78c54696e139      "/bin/sh -c 'java Ma…"   25 hours ago     Exited (1) 25 hours ago
           objective_grothendieck
```



```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker build -t hello-world:2.0 .
[+] Building 3.0s (9/9) FINISHED
 => [internal] load build definition from Dockerfile                                           0.0s
 => => transferring dockerfile: 32B                                                            0.0s
 => [internal] load .dockerignore                                                              0.0s
 => => transferring context: 2B                                                                0.0s
 => [internal] load metadata for docker.io/library/openjdk:latest                              2.9s
 => [1/4] FROM docker.io/library/openjdk@sha256:c95139096781e1033dd6adf0a8b9802e04abeebe851a  0.0s
0dce07b36b21407a8e4d2418eaba1dc6b32b11903eadd7f63ab8d8067d734e3a
```



```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker ps
CONTAINER ID   IMAGE             COMMAND                  CREATED          STATUS          PORTS
0dce07b36b21   hello-world:2.0   "/bin/sh -c 'java Ma…"   23 seconds ago   Up 22 seconds
5ed3f937ddd9   hello-world:1.0   "/bin/sh -c 'java Ma…"   3 minutes ago    Up 3 minutes
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1>
```

Video 2

Commands:

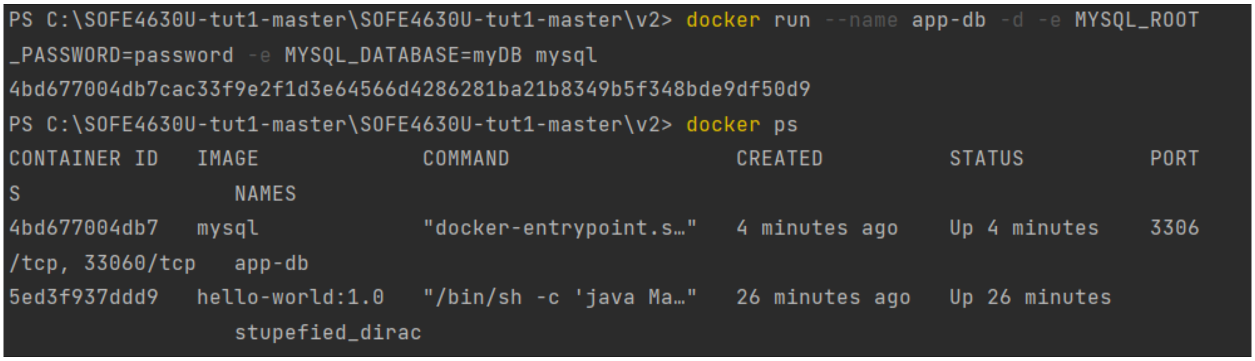
```
docker version
docker pull mysql
docker run --name app-db -d -e MYSQL_ROOT_PASSWORD=password -e MYSQL_DATABASE=myDB mysql
docker ps
docker logs app-db
```

For the application:

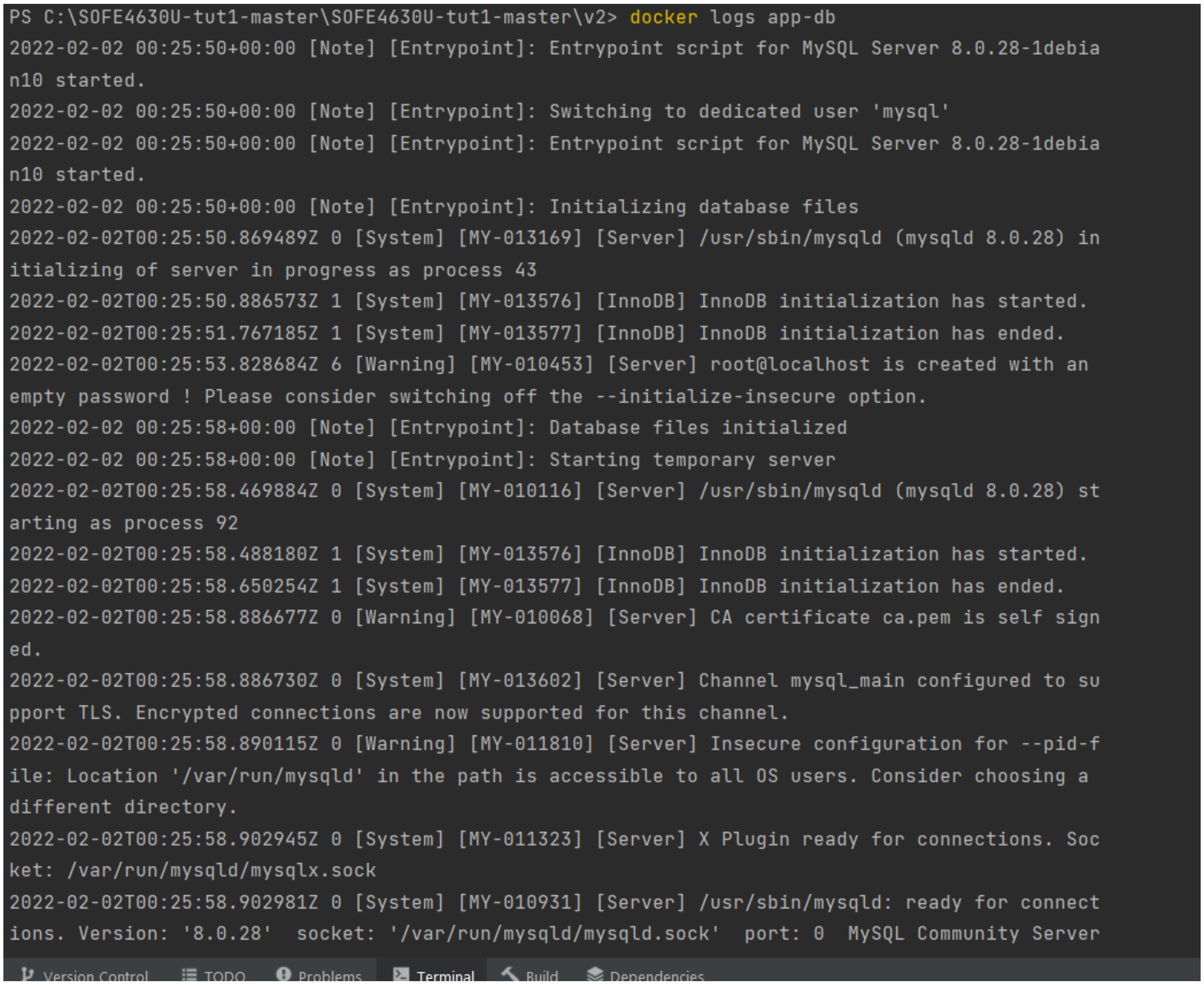
```
docker build -t my-web-app:1.0 .
docker images
docker run --name app -d my-web-app:1.0 //build application container
docker ps
docker logs app
docker build -t my-web-app:1.0 . //rebuild image after expose 8080
docker rm -f app
docker run --name app -d -p 8080:8080 my-web-app:1.0
docker run -d -p 8081:8080 my-web-app:1.0 //connecting container on other port
docker ps
docker rm -f 1244e706371e //removing the container
docker ps
docker network create (app-network) //creating own network
docker network ls
docker network connect app-network app-db //connects app container with db container on same network
mvn clean install //clean and rebuild
docker build -t my-web-app:1.0 .
docker rm -f app
docker run  --name app -d -p 8080:8080 --network=app-network my-web-app:1.0
//docker compose (automatically creates a bridge network and attaches containers to it so no need to create a network manually)
docker rm -f app
docker rm -f app-db
docker ps
```

docker-compose up -d

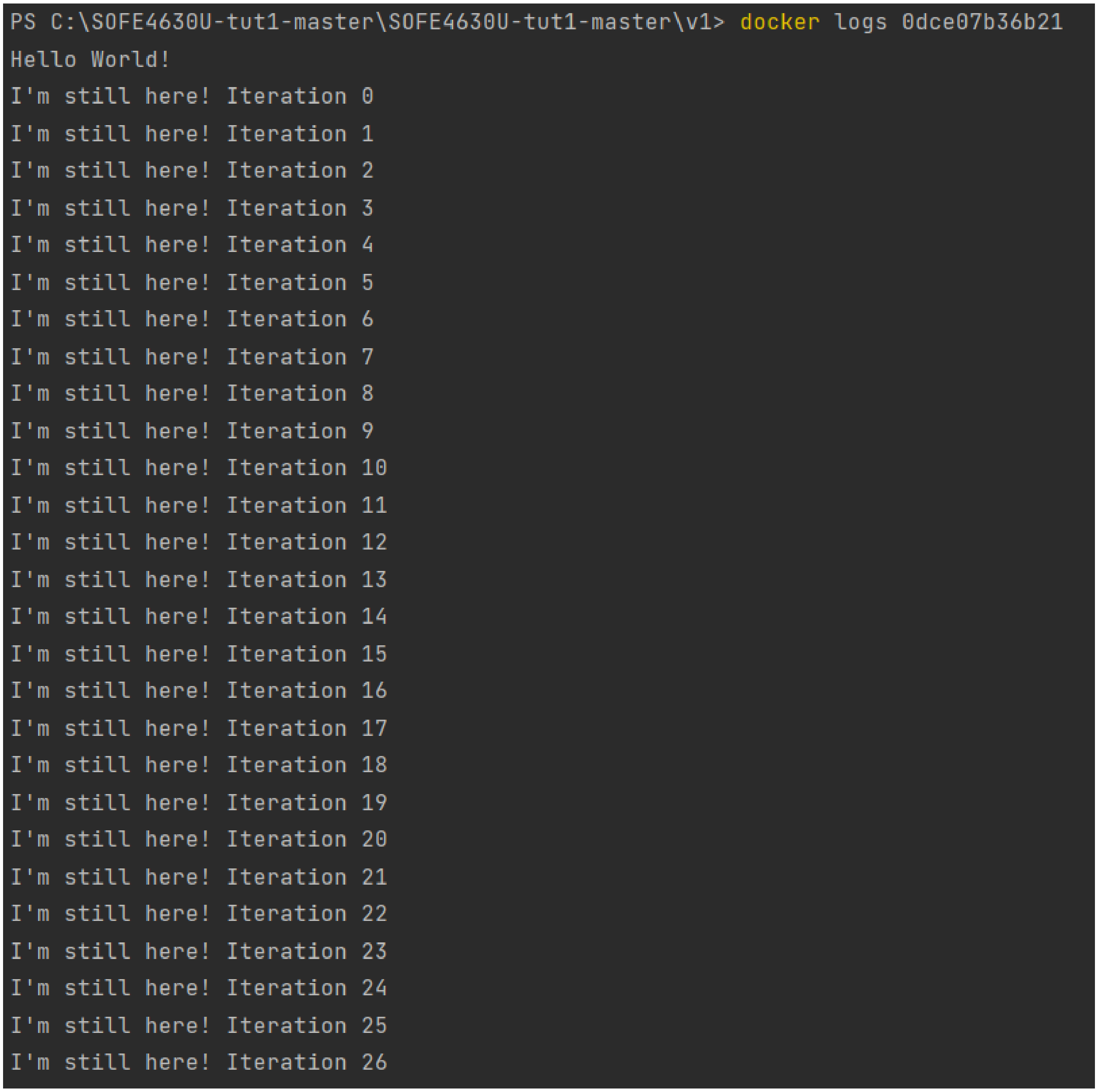
Screenshots:



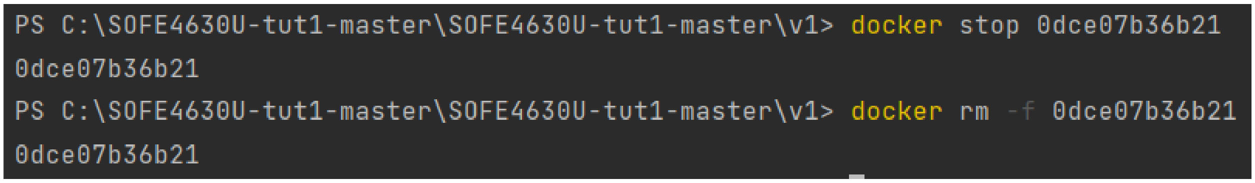
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker run --name app-db -d -e MYSQL_ROOT
_PASSWORD=password -e MYSQL_DATABASE=myDB mysql
4bd677004db7cac33f9e2f1d3e64566d4286281ba21b8349b5f348bde9df50d9
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker ps
CONTAINER ID   IMAGE             COMMAND                  CREATED          STATUS          PORT
S                 NAMES
4bd677004db7   mysql             "docker-entrypoint.s…"   4 minutes ago    Up 4 minutes    3306
/tcp, 33060/tcp   app-db
5ed3f937ddd9   hello-world:1.0   "/bin/sh -c 'java Ma…"   26 minutes ago   Up 26 minutes
                  stupefied_dirac
```



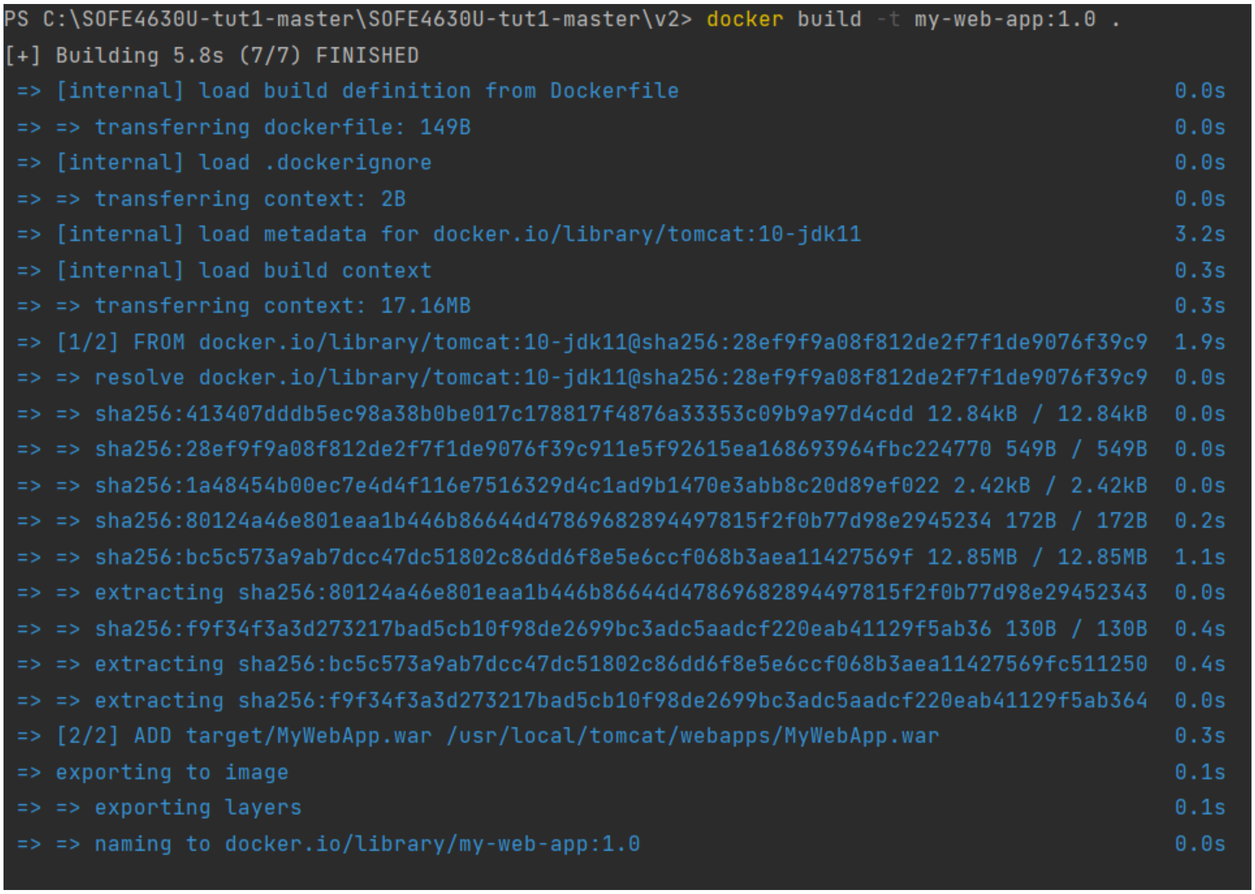
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker logs app-db
2022-02-02 00:25:50+00:00 [Note] [Entrypoint]: Entrypoint script for MySQL Server 8.0.28-1debia
n10 started.
2022-02-02 00:25:50+00:00 [Note] [Entrypoint]: Switching to dedicated user 'mysql'
2022-02-02 00:25:50+00:00 [Note] [Entrypoint]: Entrypoint script for MySQL Server 8.0.28-1debia
n10 started.
2022-02-02 00:25:50+00:00 [Note] [Entrypoint]: Initializing database files
2022-02-02T00:25:50.869489Z 0 [System] [MY-013169] [Server] /usr/sbin/mysqld (mysqld 8.0.28) in
itializing of server in progress as process 43
2022-02-02T00:25:50.886573Z 1 [System] [MY-013576] [InnoDB] InnoDB initialization has started.
2022-02-02T00:25:51.767185Z 1 [System] [MY-013577] [InnoDB] InnoDB initialization has ended.
2022-02-02T00:25:53.828684Z 6 [Warning] [MY-010453] [Server] root@localhost is created with an
empty password ! Please consider switching off the --initialize-insecure option.
2022-02-02 00:25:58+00:00 [Note] [Entrypoint]: Database files initialized
2022-02-02 00:25:58+00:00 [Note] [Entrypoint]: Starting temporary server
2022-02-02T00:25:58.469884Z 0 [System] [MY-010116] [Server] /usr/sbin/mysqld (mysqld 8.0.28) st
arting as process 92
2022-02-02T00:25:58.488180Z 1 [System] [MY-013576] [InnoDB] InnoDB initialization has started.
2022-02-02T00:25:58.650254Z 1 [System] [MY-013577] [InnoDB] InnoDB initialization has ended.
2022-02-02T00:25:58.886677Z 0 [Warning] [MY-010068] [Server] CA certificate ca.pem is self sign
ed.
2022-02-02T00:25:58.886730Z 0 [System] [MY-013602] [Server] Channel mysql_main configured to su
pport TLS. Encrypted connections are now supported for this channel.
2022-02-02T00:25:58.890115Z 0 [Warning] [MY-011810] [Server] Insecure configuration for --pid-f
ile: Location '/var/run/mysqld' in the path is accessible to all OS users. Consider choosing a
different directory.
2022-02-02T00:25:58.902945Z 0 [System] [MY-011323] [Server] X Plugin ready for connections. Soc
ket: /var/run/mysqld/mysqlx.sock
2022-02-02T00:25:58.902981Z 0 [System] [MY-010931] [Server] /usr/sbin/mysqld: ready for connect
ions. Version: '8.0.28'  socket: '/var/run/mysqld/mysqld.sock'  port: 0  MySQL Community Server
```



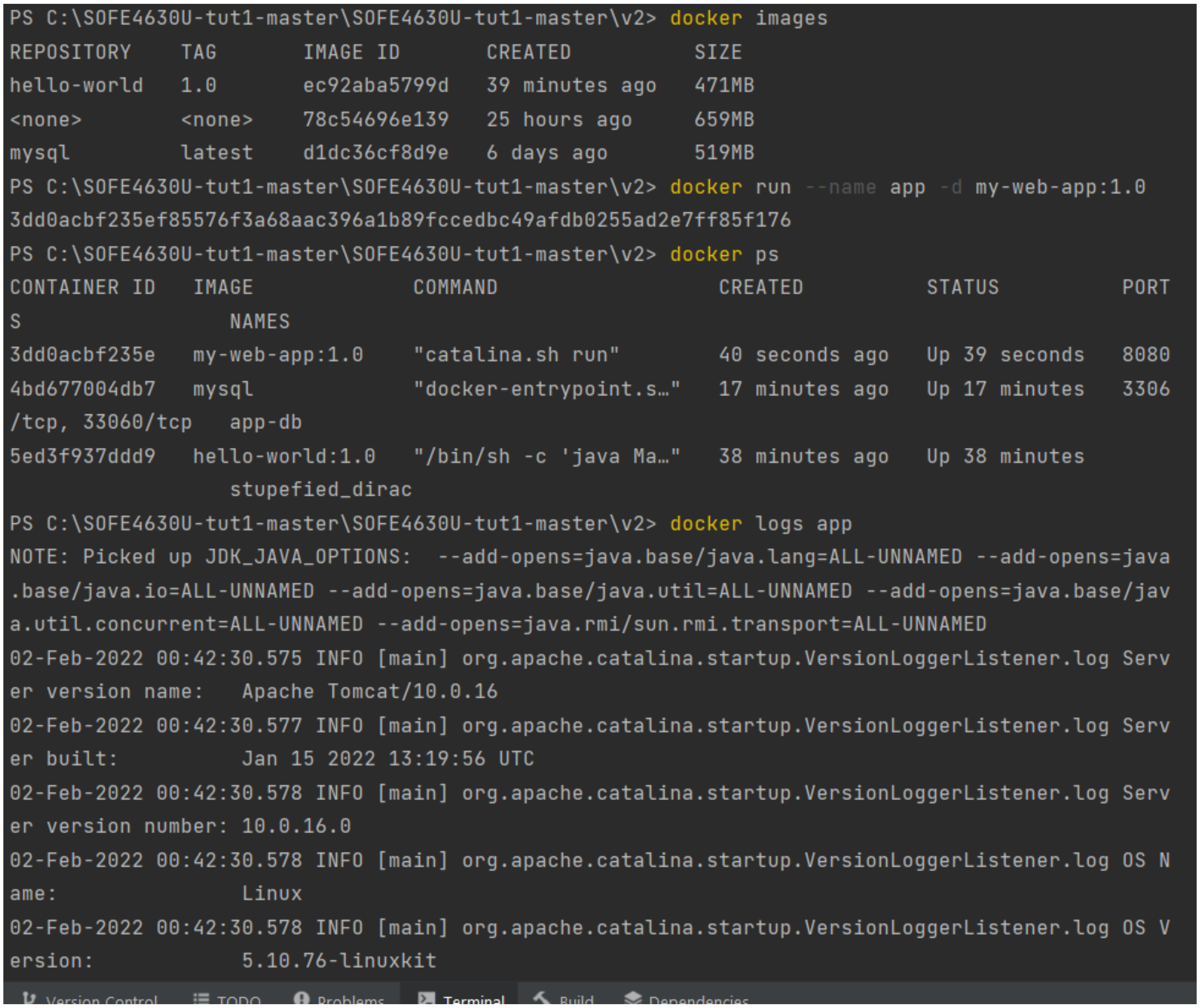
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker logs 0dce07b36b21
Hello World!
I'm still here! Iteration 0
I'm still here! Iteration 1
I'm still here! Iteration 2
I'm still here! Iteration 3
I'm still here! Iteration 4
I'm still here! Iteration 5
I'm still here! Iteration 6
I'm still here! Iteration 7
I'm still here! Iteration 8
I'm still here! Iteration 9
I'm still here! Iteration 10
I'm still here! Iteration 11
I'm still here! Iteration 12
I'm still here! Iteration 13
I'm still here! Iteration 14
I'm still here! Iteration 15
I'm still here! Iteration 16
I'm still here! Iteration 17
I'm still here! Iteration 18
I'm still here! Iteration 19
I'm still here! Iteration 20
I'm still here! Iteration 21
I'm still here! Iteration 22
I'm still here! Iteration 23
I'm still here! Iteration 24
I'm still here! Iteration 25
I'm still here! Iteration 26
```



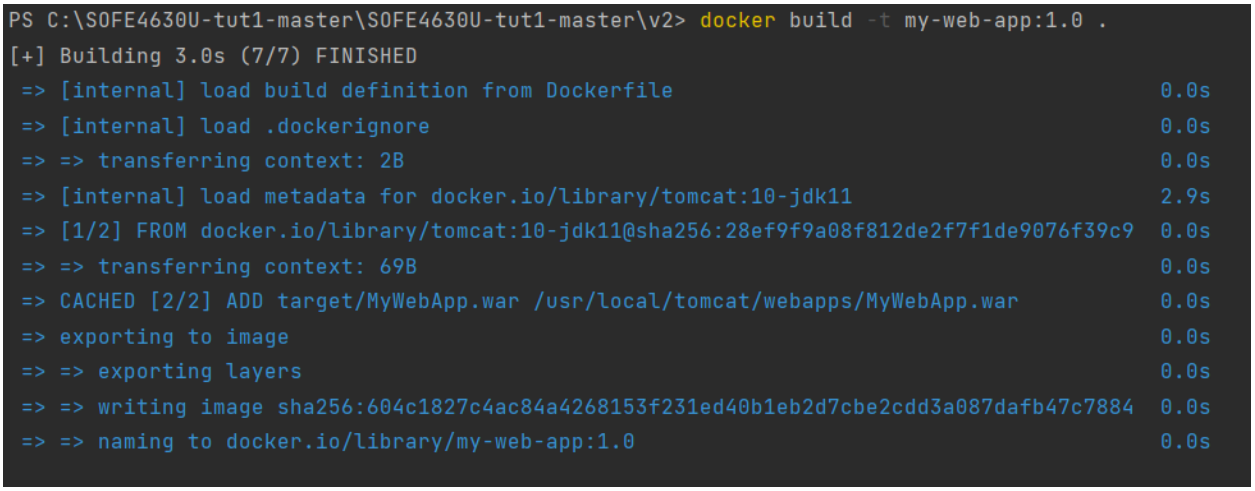
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker stop 0dce07b36b21
0dce07b36b21
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v1> docker rm -f 0dce07b36b21
0dce07b36b21
```



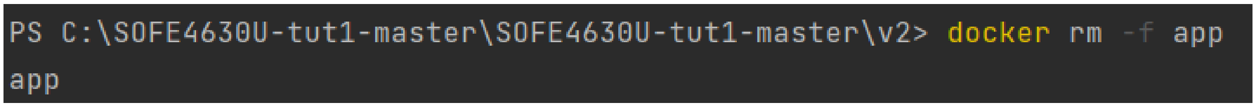
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker build -t my-web-app:1.0 .
[+] Building 5.8s (7/7) FINISHED
 => [internal] load build definition from Dockerfile                                      0.0s
 => => transferring dockerfile: 149B                                                      0.0s
 => [internal] load .dockerignore                                                         0.0s
 => => transferring context: 2B                                                           0.0s
 => [internal] load metadata for docker.io/library/tomcat:10-jdk11                        3.2s
 => [internal] load build context                                                         0.3s
 => => transferring context: 17.16MB                                                      0.3s
 => [1/2] FROM docker.io/library/tomcat:10-jdk11@sha256:28ef9f9a08f812de2f7f1de9076f39c9  1.9s
 => => resolve docker.io/library/tomcat:10-jdk11@sha256:28ef9f9a08f812de2f7f1de9076f39c9  0.0s
 => => sha256:413407dddb5ec98a38b0be017c178817f4876a33353c09b9a97d4cdd 12.84kB / 12.84kB  0.0s
 => => sha256:28ef9f9a08f812de2f7f1de9076f39c911e5f92615ea168693964fbc224770 549B / 549B  0.0s
 => => sha256:1a48454b00ec7e4d4f116e7516329d4c1ad9b1470e3abb8c20d89ef022 2.42kB / 2.42kB  0.0s
 => => sha256:80124a46e801eaa1b446b86644d47869682894497815f2f0b77d98e2945234 172B / 172B  0.2s
 => => sha256:bc5c573a9ab7dcc47dc51802c86dd6f8e5e6ccf068b3aea11427569f 12.85MB / 12.85MB  1.1s
 => => extracting sha256:80124a46e801eaa1b446b86644d47869682894497815f2f0b77d98e29452343  0.0s
 => => sha256:f9f34f3a3d273217bad5cb10f98de2699bc3adc5aadcf220eab41129f5ab36 130B / 130B  0.4s
 => => extracting sha256:bc5c573a9ab7dcc47dc51802c86dd6f8e5e6ccf068b3aea11427569fc511250  0.4s
 => => extracting sha256:f9f34f3a3d273217bad5cb10f98de2699bc3adc5aadcf220eab41129f5ab364  0.0s
 => [2/2] ADD target/MyWebApp.war /usr/local/tomcat/webapps/MyWebApp.war                  0.3s
 => exporting to image                                                                    0.1s
 => => exporting layers                                                                   0.1s
 => => naming to docker.io/library/my-web-app:1.0                                         0.0s
```



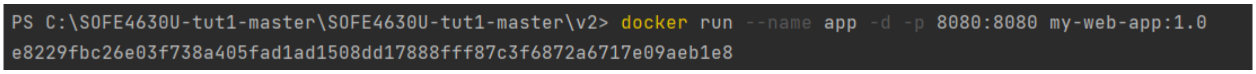
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker images
REPOSITORY    TAG       IMAGE ID       CREATED          SIZE
hello-world   1.0       ec92aba5799d   39 minutes ago   471MB
<none>        <none>    78c54696e139   25 hours ago     659MB
mysql         latest    d1dc36cf8d9e   6 days ago       519MB
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker run --name app -d my-web-app:1.0
3dd0acbf235ef85576f3a68aac396a1b89fccedbc49afdb0255ad2e7ff85f176
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker ps
CONTAINER ID   IMAGE            COMMAND                  CREATED          STATUS          PORT
S                 NAMES
3dd0acbf235e   my-web-app:1.0   "catalina.sh run"        40 seconds ago   Up 39 seconds   8080
4bd677004db7   mysql            "docker-entrypoint.s…"   17 minutes ago   Up 17 minutes   3306
/tcp, 33060/tcp   app-db
5ed3f937ddd9   hello-world:1.0  "/bin/sh -c 'java Ma…"   38 minutes ago   Up 38 minutes
                  stupefied_dirac
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker logs app
NOTE: Picked up JDK_JAVA_OPTIONS:  --add-opens=java.base/java.lang=ALL-UNNAMED --add-opens=java
.base/java.io=ALL-UNNAMED --add-opens=java.base/java.util=ALL-UNNAMED --add-opens=java.base/jav
a.util.concurrent=ALL-UNNAMED --add-opens=java.rmi/sun.rmi.transport=ALL-UNNAMED
02-Feb-2022 00:42:30.575 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Serv
er version name:   Apache Tomcat/10.0.16
02-Feb-2022 00:42:30.577 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Serv
er built:          Jan 15 2022 13:19:56 UTC
02-Feb-2022 00:42:30.578 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log Serv
er version number: 10.0.16.0
02-Feb-2022 00:42:30.578 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log OS N
ame:               Linux
02-Feb-2022 00:42:30.578 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log OS V
ersion:            5.10.76-linuxkit
```



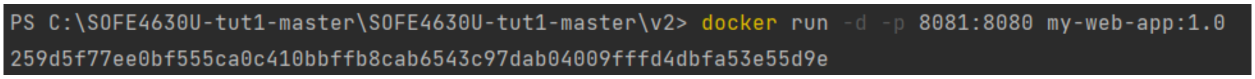
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker build -t my-web-app:1.0 .
[+] Building 3.0s (7/7) FINISHED
 => [internal] load build definition from Dockerfile                                     0.0s
 => [internal] load .dockerignore                                                        0.0s
 => => transferring context: 2B                                                          0.0s
 => [internal] load metadata for docker.io/library/tomcat:10-jdk11                       2.9s
 => [1/2] FROM docker.io/library/tomcat:10-jdk11@sha256:28ef9f9a08f812de2f7f1de9076f39c9  0.0s
 => => transferring context: 69B                                                         0.0s
 => CACHED [2/2] ADD target/MyWebApp.war /usr/local/tomcat/webapps/MyWebApp.war           0.0s
 => exporting to image                                                                   0.0s
 => => exporting layers                                                                  0.0s
 => => writing image sha256:604c1827c4ac84a4268153f231ed40b1eb2d7cbe2cdd3a087dafb47c7884  0.0s
 => => naming to docker.io/library/my-web-app:1.0                                        0.0s
```



```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker rm -f app
app
```

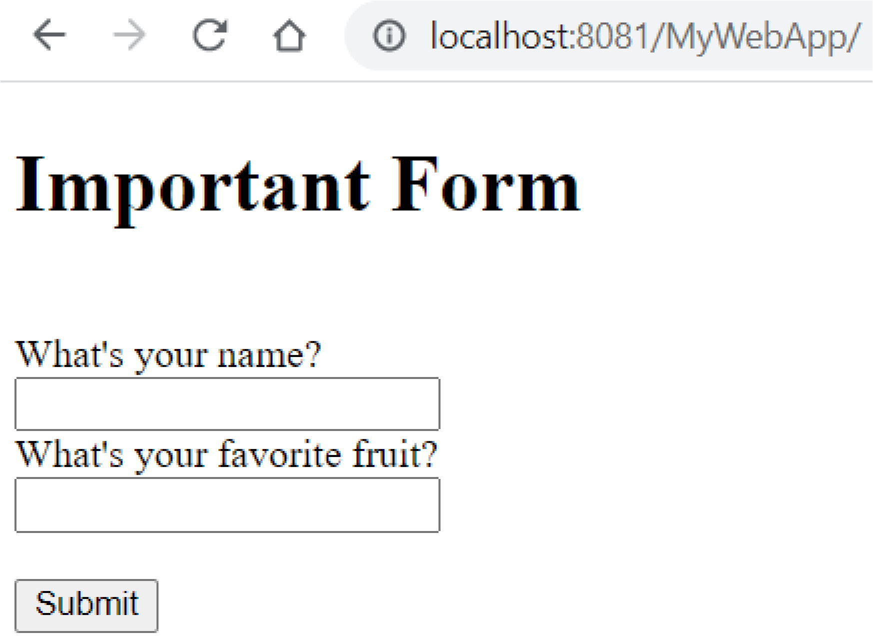


```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker run --name app -d -p 8080:8080 my-web-app:1.0
e8229fbc26e03f738a405fad1ad1508dd17888fff87c3f6872a6717e09aeb1e8
```



```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker run -d -p 8081:8080 my-web-app:1.0
259d5f77ee0bf555ca0c410bbffb8cab6543c97dab04009fffd4dbfa53e55d9e
```

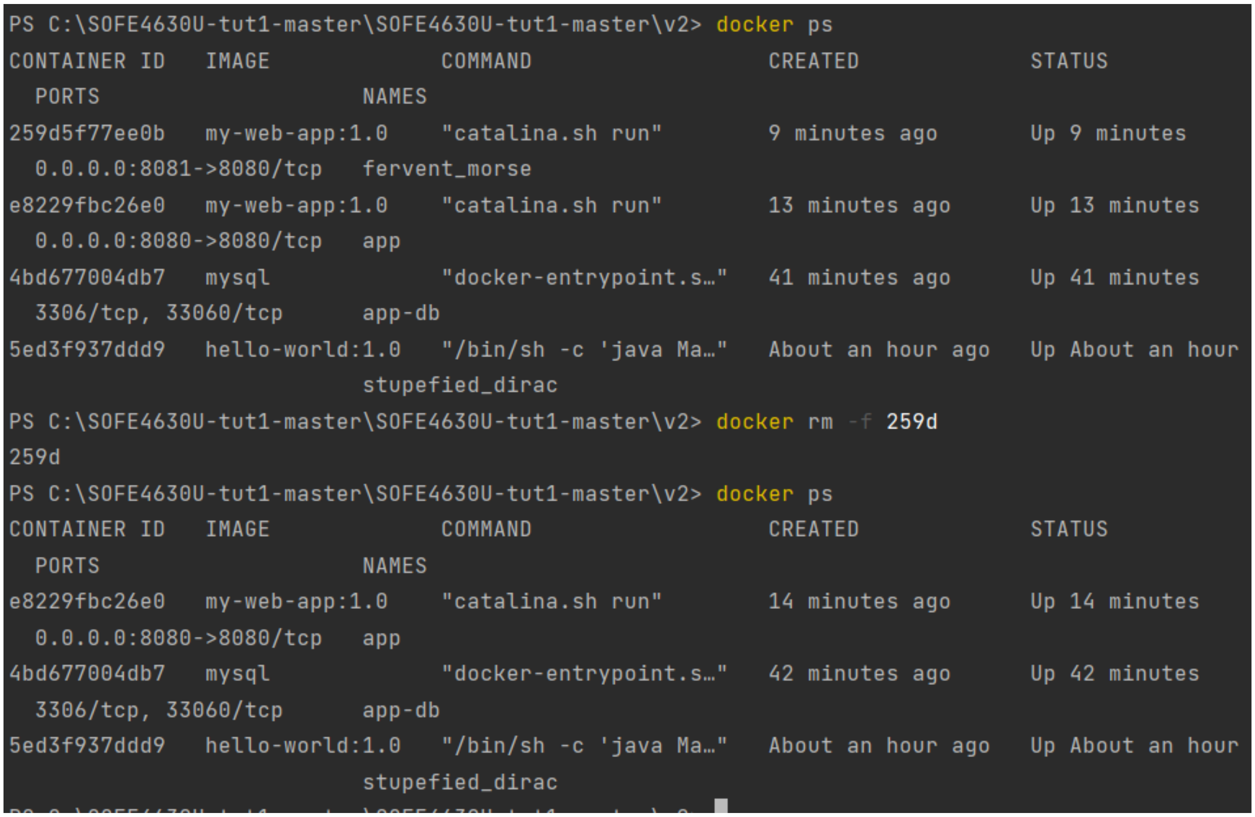
https://localhost:8080/MyWebApp/



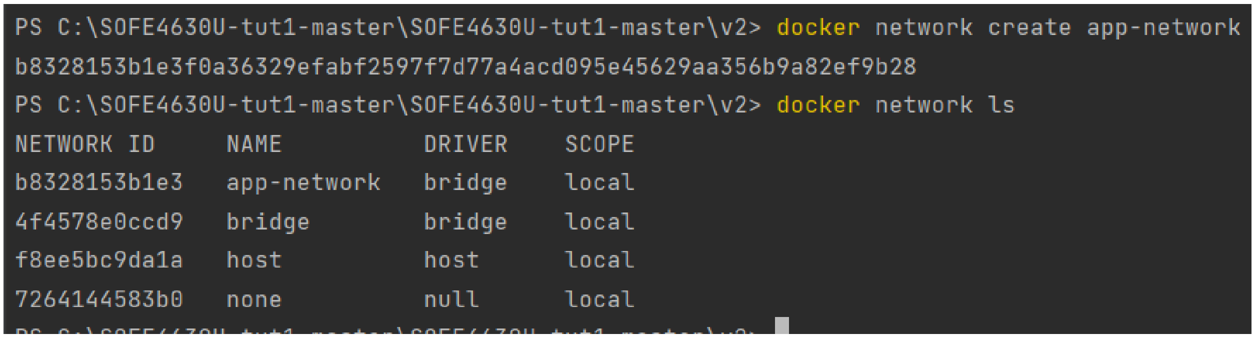
Important Form

What's your name?

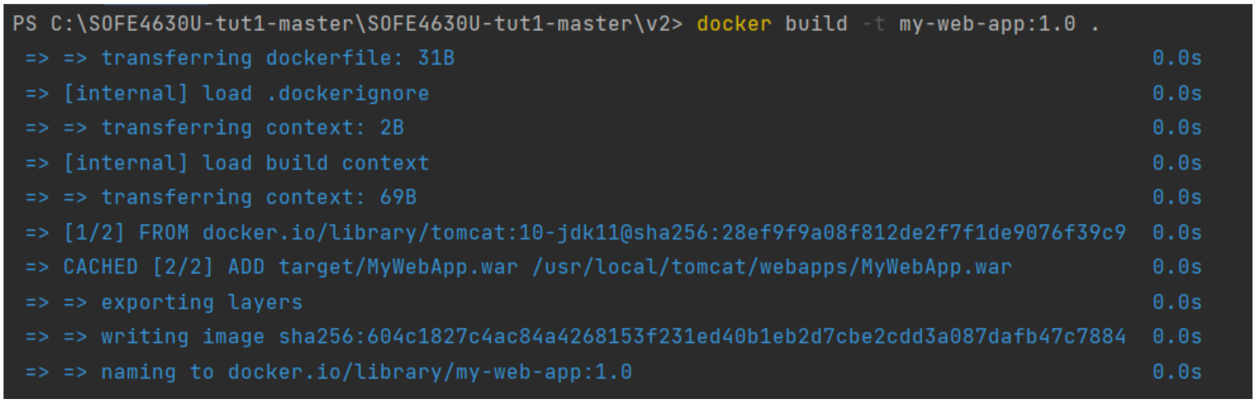
What's your favorite fruit?



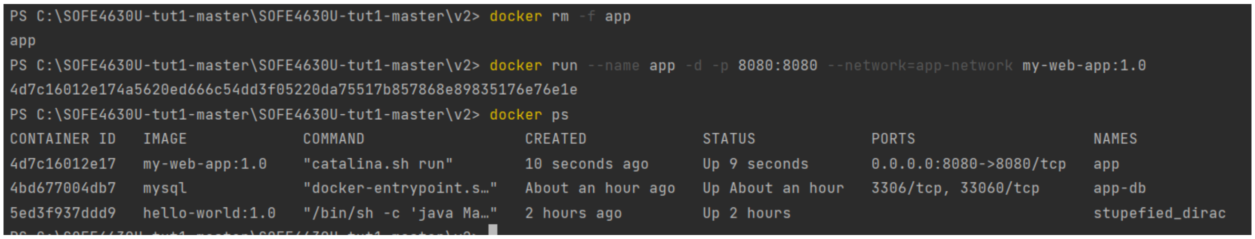
```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker ps
CONTAINER ID   IMAGE            COMMAND                  CREATED              STATUS
  PORTS                    NAMES
259d5f77ee0b   my-web-app:1.0   "catalina.sh run"        9 minutes ago        Up 9 minutes
  0.0.0.0:8081->8080/tcp   fervent_morse
e8229fbc26e0   my-web-app:1.0   "catalina.sh run"        13 minutes ago       Up 13 minutes
  0.0.0.0:8080->8080/tcp   app
4bd677004db7   mysql            "docker-entrypoint.s…"   41 minutes ago       Up 41 minutes
  3306/tcp, 33060/tcp      app-db
5ed3f937ddd9   hello-world:1.0  "/bin/sh -c 'java Ma…"   About an hour ago    Up About an hour
                           stupefied_dirac
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker rm -f 259d
259d
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker ps
CONTAINER ID   IMAGE            COMMAND                  CREATED              STATUS
  PORTS                    NAMES
e8229fbc26e0   my-web-app:1.0   "catalina.sh run"        14 minutes ago       Up 14 minutes
  0.0.0.0:8080->8080/tcp   app
4bd677004db7   mysql            "docker-entrypoint.s…"   42 minutes ago       Up 42 minutes
  3306/tcp, 33060/tcp      app-db
5ed3f937ddd9   hello-world:1.0  "/bin/sh -c 'java Ma…"   About an hour ago    Up About an hour
                           stupefied_dirac
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2>
```



```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker network create app-network
b8328153b1e3f0a36329efabf2597f7d77a4acd095e45629aa356b9a82ef9b28
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker network ls
NETWORK ID     NAME          DRIVER    SCOPE
b8328153b1e3   app-network   bridge    local
4f4578e0ccd9   bridge        bridge    local
f8ee5bc9da1a   host          host      local
7264144583b0   none          null      local
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2>
```

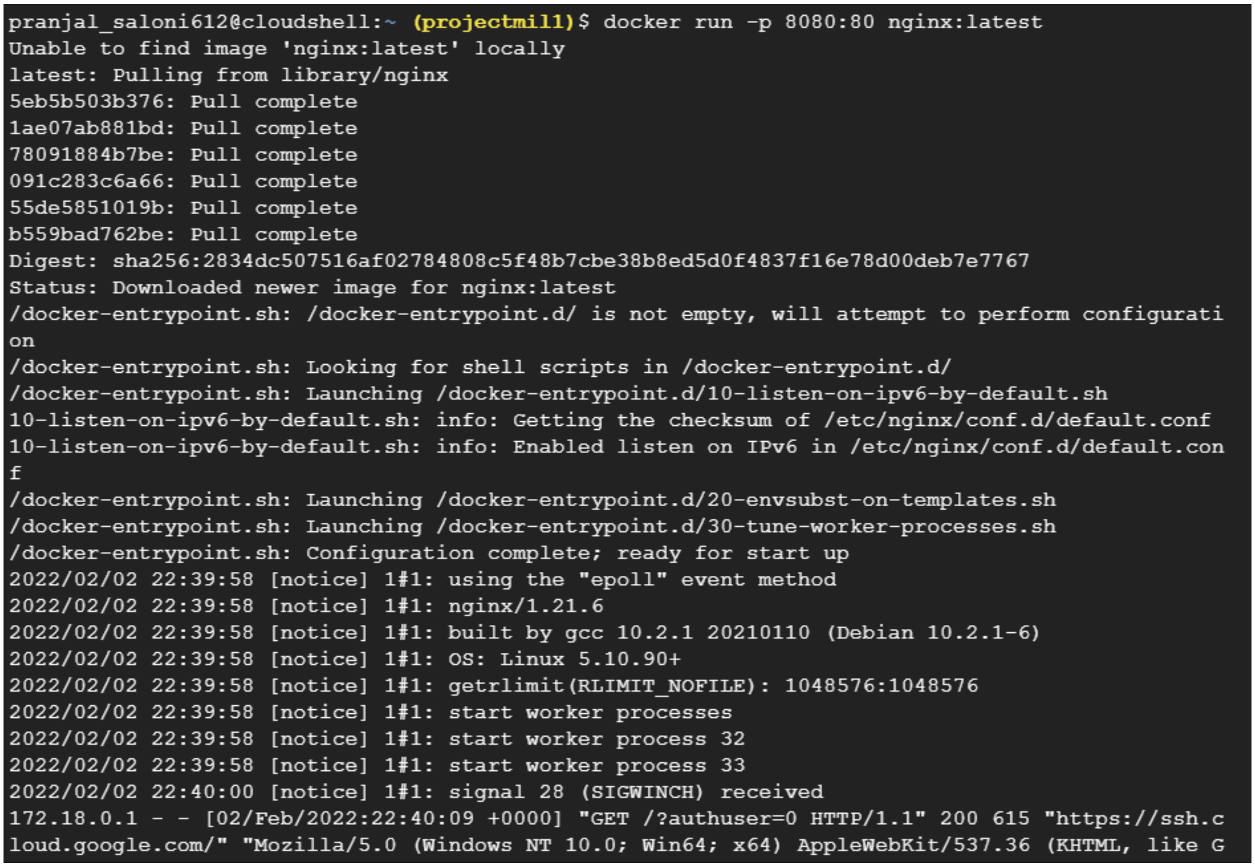


```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker build -t my-web-app:1.0 .
 => => transferring dockerfile: 31B                                                       0.0s
 => [internal] load .dockerignore                                                         0.0s
 => => transferring context: 2B                                                           0.0s
 => [internal] load build context                                                         0.0s
 => => transferring context: 69B                                                          0.0s
 => [1/2] FROM docker.io/library/tomcat:10-jdk11@sha256:28ef9f9a08f812de2f7f1de9076f39c9  0.0s
 => CACHED [2/2] ADD target/MyWebApp.war /usr/local/tomcat/webapps/MyWebApp.war           0.0s
 => => exporting layers                                                                   0.0s
 => => writing image sha256:604c1827c4ac84a4268153f231ed40b1eb2d7cbe2cdd3a087dafb47c7884  0.0s
 => => naming to docker.io/library/my-web-app:1.0                                         0.0s
```

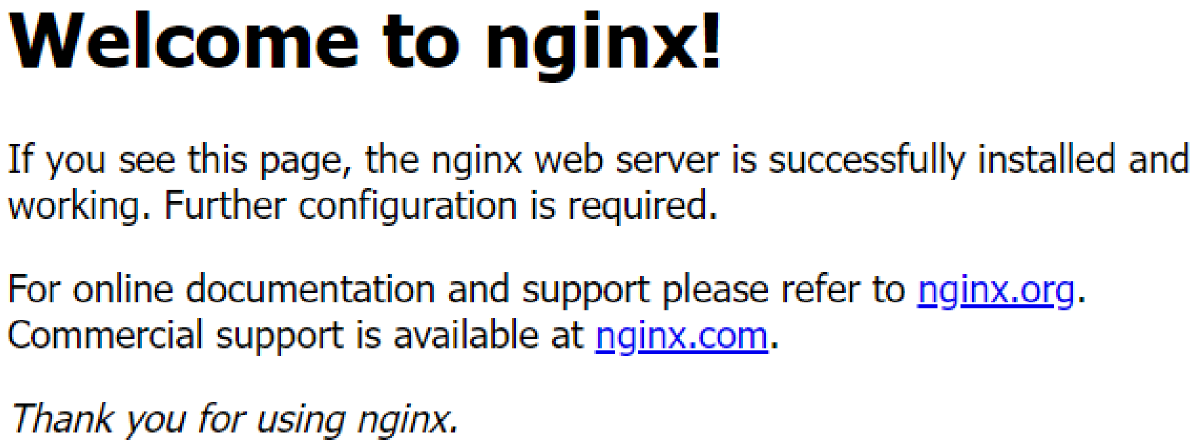


```
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker rm -f app
app
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker run --name app -d -p 8080:8080 --network=app-network my-web-app:1.0
4d7c16012e174a5620ed666c54dd3f05220da75517b857868e89835176e76e1e
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2> docker ps
CONTAINER ID   IMAGE            COMMAND                  CREATED              STATUS              PORTS                    NAMES
4d7c16012e17   my-web-app:1.0   "catalina.sh run"        10 seconds ago       Up 9 seconds        0.0.0.0:8080->8080/tcp   app
4bd677004db7   mysql            "docker-entrypoint.s…"   About an hour ago    Up About an hour    3306/tcp, 33060/tcp      app-db
5ed3f937ddd9   hello-world:1.0  "/bin/sh -c 'java Ma…"   2 hours ago          Up 2 hours                                   stupefied_dirac
PS C:\SOFE4630U-tut1-master\SOFE4630U-tut1-master\v2>
```

Video 3



```
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker run -p 8080:80 nginx:latest
Unable to find image 'nginx:latest' locally
latest: Pulling from library/nginx
5eb5b503b376: Pull complete
1ae07ab881bd: Pull complete
78091884b7be: Pull complete
091c283c6a66: Pull complete
55de5851019b: Pull complete
b559bad762be: Pull complete
Digest: sha256:2834dc507516af02784808c5f48b7cbe38b8ed5d0f4837f16e78d00deb7e7767
Status: Downloaded newer image for nginx:latest
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configurati
on
/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/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.con
f
/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
2022/02/02 22:39:58 [notice] 1#1: using the "epoll" event method
2022/02/02 22:39:58 [notice] 1#1: nginx/1.21.6
2022/02/02 22:39:58 [notice] 1#1: built by gcc 10.2.1 20210110 (Debian 10.2.1-6)
2022/02/02 22:39:58 [notice] 1#1: OS: Linux 5.10.90+
2022/02/02 22:39:58 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2022/02/02 22:39:58 [notice] 1#1: start worker processes
2022/02/02 22:39:58 [notice] 1#1: start worker process 32
2022/02/02 22:39:58 [notice] 1#1: start worker process 33
2022/02/02 22:40:00 [notice] 1#1: signal 28 (SIGWINCH) received
172.18.0.1 - - [02/Feb/2022:22:40:09 +0000] "GET /?authuser=0 HTTP/1.1" 200 615 "https://ssh.c
loud.google.com/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like G
```

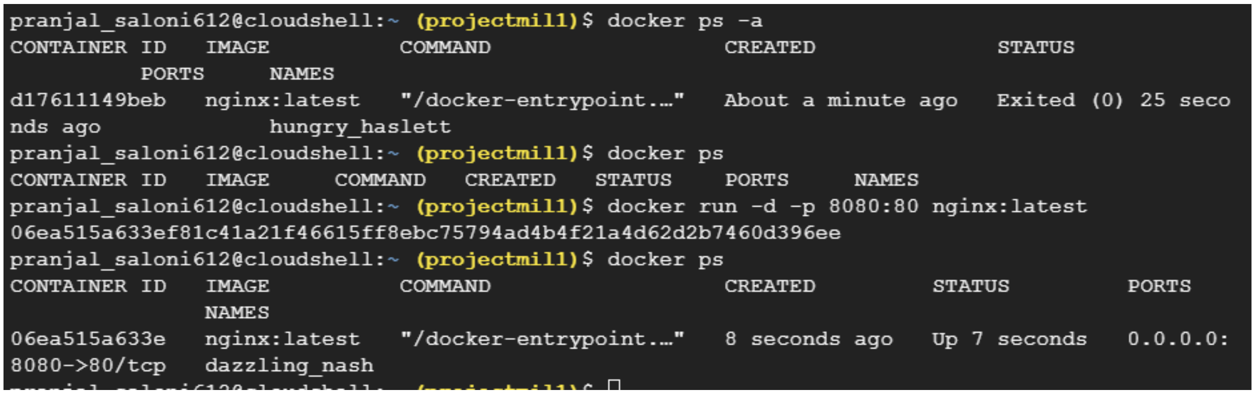


Welcome to nginx!

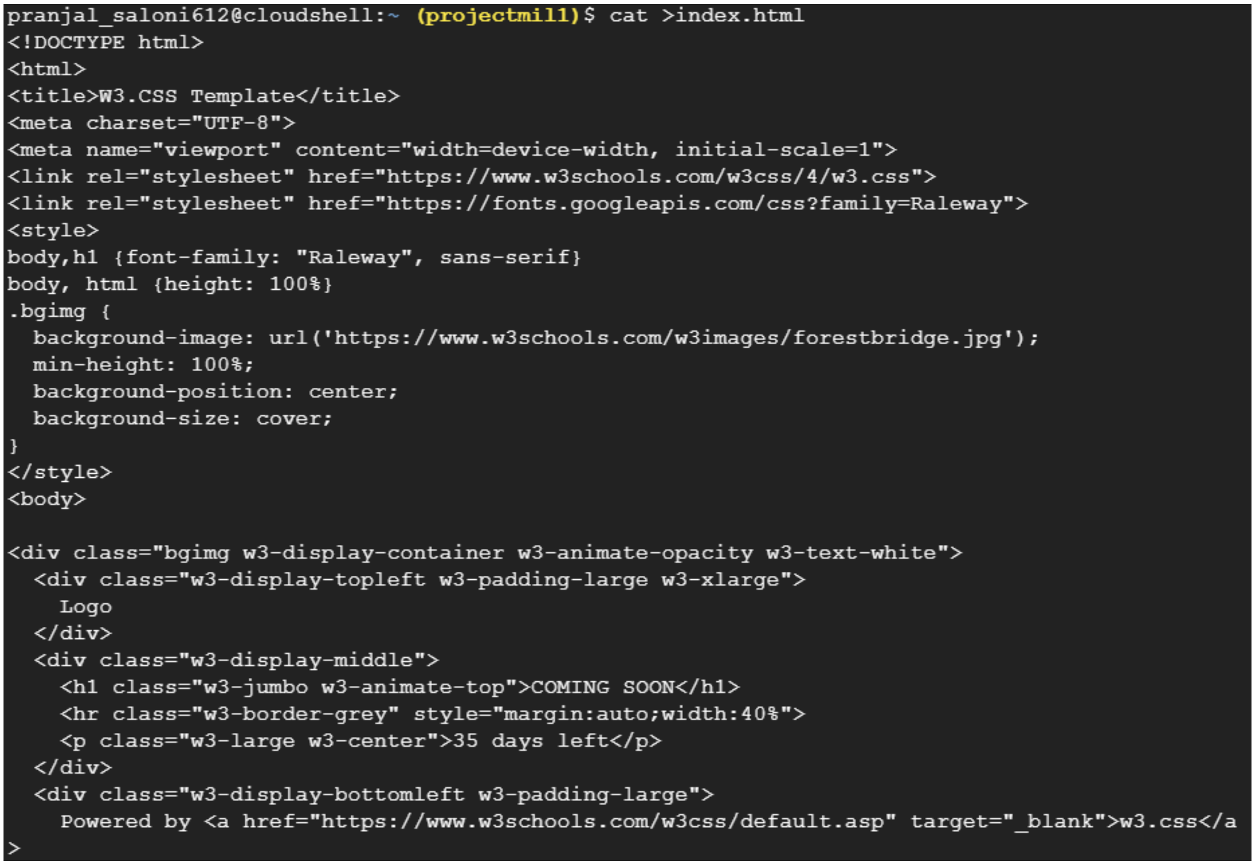
If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

For online documentation and support please refer to nginx.org.
Commercial support is available at nginx.com.

Thank you for using nginx.

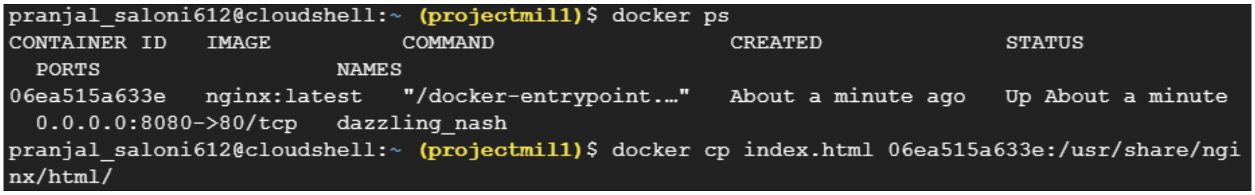


```
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker ps -a
CONTAINER ID   IMAGE          COMMAND                  CREATED              STATUS
          PORTS     NAMES
d17611149beb   nginx:latest   "/docker-entrypoint.…"   About a minute ago   Exited (0) 25 seco
nds ago             hungry_haslett
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker run -d -p 8080:80 nginx:latest
06ea515a633ef81c41a21f46615ff8ebc75794ad4b4f21a4d62d2b7460d396ee
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED         STATUS         PORTS
               NAMES
06ea515a633e   nginx:latest   "/docker-entrypoint.…"   8 seconds ago   Up 7 seconds   0.0.0.0:
8080->80/tcp   dazzling_nash
pranjal_saloni612@cloudshell:~ (projectmil1)$ 
```

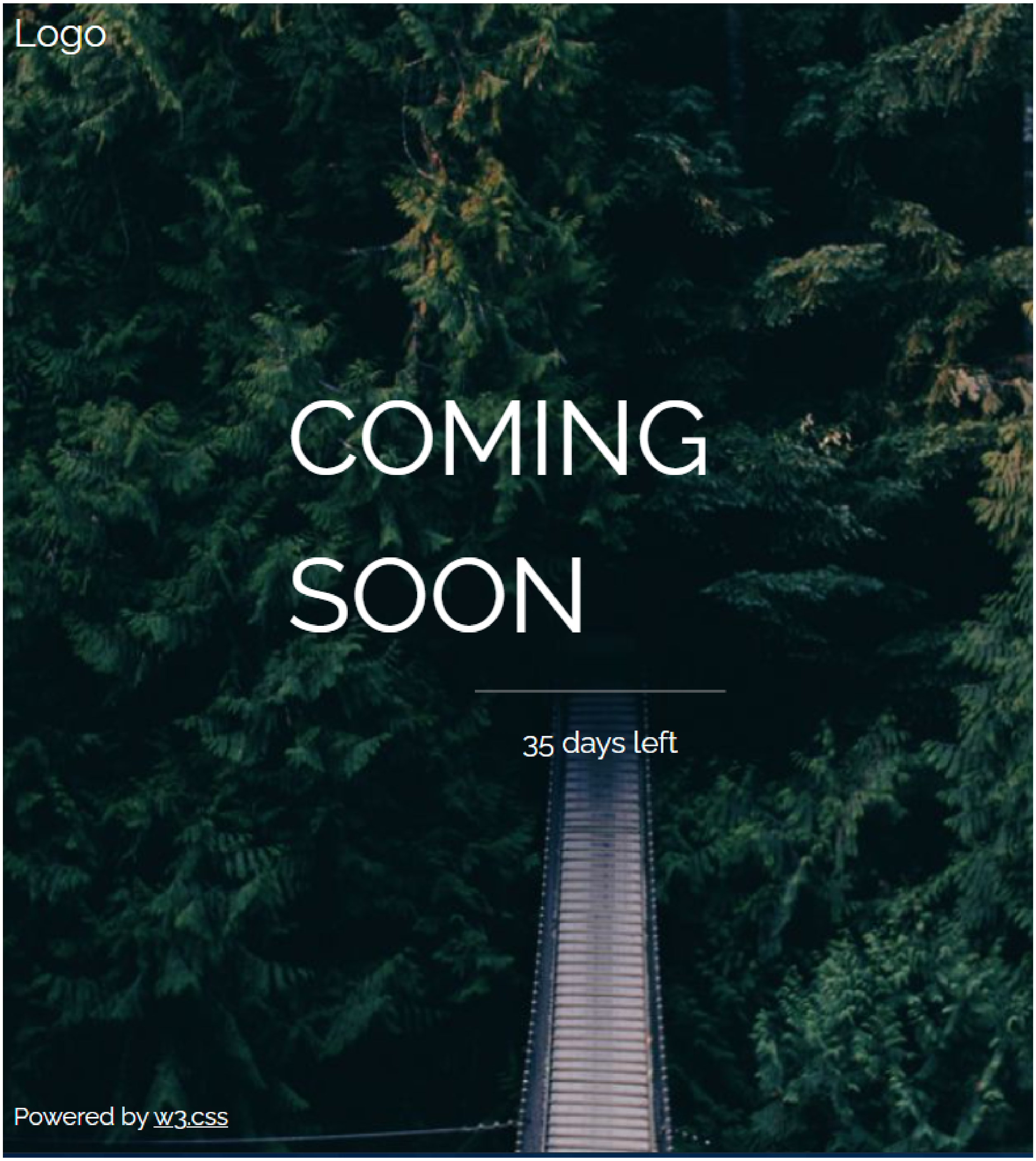


```
pranjal_saloni612@cloudshell:~ (projectmil1)$ cat >index.html
<!DOCTYPE html>
<html>
<title>W3.CSS Template</title>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
<link rel="stylesheet" href="https://www.w3schools.com/w3css/4/w3.css">
<link rel="stylesheet" href="https://fonts.googleapis.com/css?family=Raleway">
<style>
body,h1 {font-family: "Raleway", sans-serif}
body, html {height: 100%}
.bgimg {
  background-image: url('https://www.w3schools.com/w3images/forestbridge.jpg');
  min-height: 100%;
  background-position: center;
  background-size: cover;
}
</style>
<body>

<div class="bgimg w3-display-container w3-animate-opacity w3-text-white">
  <div class="w3-display-topleft w3-padding-large w3-xlarge">
    Logo
  </div>
  <div class="w3-display-middle">
    <h1 class="w3-jumbo w3-animate-top">COMING SOON</h1>
    <hr class="w3-border-grey" style="margin:auto;width:40%">
    <p class="w3-large w3-center">35 days left</p>
  </div>
  <div class="w3-display-bottomleft w3-padding-large">
    Powered by <a href="https://www.w3schools.com/w3css/default.asp" target="_blank">w3.css</a
>
```



```
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED              STATUS
  PORTS                  NAMES
06ea515a633e   nginx:latest   "/docker-entrypoint.…"   About a minute ago   Up About a minute
  0.0.0.0:8080->80/tcp   dazzling_nash
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker cp index.html 06ea515a633e:/usr/share/ngi
nx/html/
```

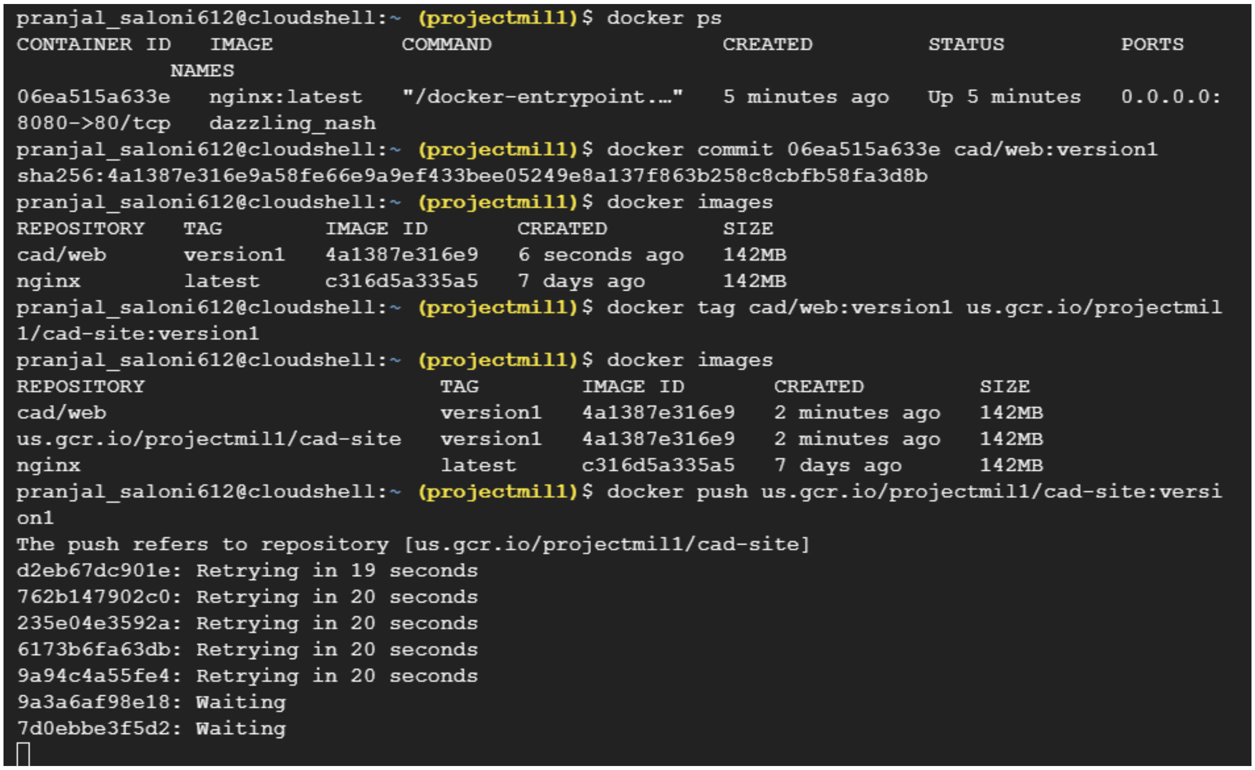


Logo

COMING SOON

35 days left

Powered by w3.css



```
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED         STATUS         PORTS
            NAMES
06ea515a633e   nginx:latest   "/docker-entrypoint.…"   5 minutes ago   Up 5 minutes   0.0.0.0:
8080->80/tcp   dazzling_nash
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker commit 06ea515a633e cad/web:version1
sha256:4a1387e316e9a58fe66e9a9ef433bee05249e8a137f863b258c8cbfb58fa3d8b
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker images
REPOSITORY   TAG        IMAGE ID       CREATED         SIZE
cad/web      version1   4a1387e316e9   6 seconds ago   142MB
nginx        latest     c316d5a335a5   7 days ago      142MB
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker tag cad/web:version1 us.gcr.io/projectmil
1/cad-site:version1
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker images
REPOSITORY                        TAG        IMAGE ID       CREATED         SIZE
cad/web                           version1   4a1387e316e9   2 minutes ago   142MB
us.gcr.io/projectmil1/cad-site    version1   4a1387e316e9   2 minutes ago   142MB
nginx                             latest     c316d5a335a5   7 days ago      142MB
pranjal_saloni612@cloudshell:~ (projectmil1)$ docker push us.gcr.io/projectmil1/cad-site:versi
on1
The push refers to repository [us.gcr.io/projectmil1/cad-site]
d2eb67dc901e: Retrying in 19 seconds
762b147902c0: Retrying in 20 seconds
235e04e3592a: Retrying in 20 seconds
6173b6fa63db: Retrying in 20 seconds
9a94c4a55fe4: Retrying in 20 seconds
9a3a6af98e18: Waiting
7d0ebbe3f5d2: Waiting
```

Command:

gcloud config set project projectmil1

gcloud config set compute/zone us-central1-a

gcloud services enable container.googleapis.com

gcloud container clusters create gk-cluster --num-nodes=1

gcloud container clusters get-credentials gk-cluster

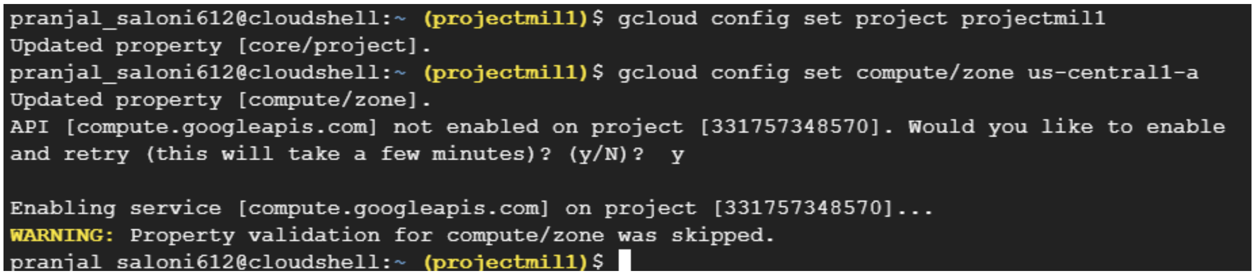
kubectl create deployment web-server --image=us.gcr.io/projectmil1/cad-site:version1

kubectl expose deployment web-server --type LoadBalancer --port 80 --target-port 80

kubectl get pods

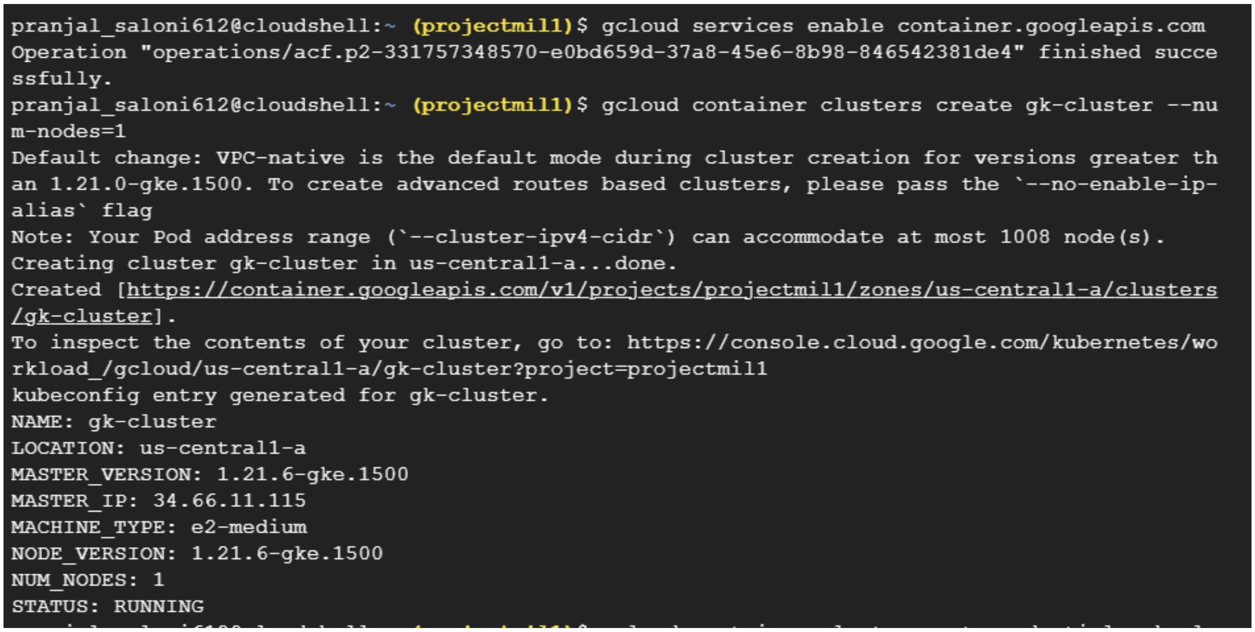
kubectl get service gk-cluster

kubectl get service web-server

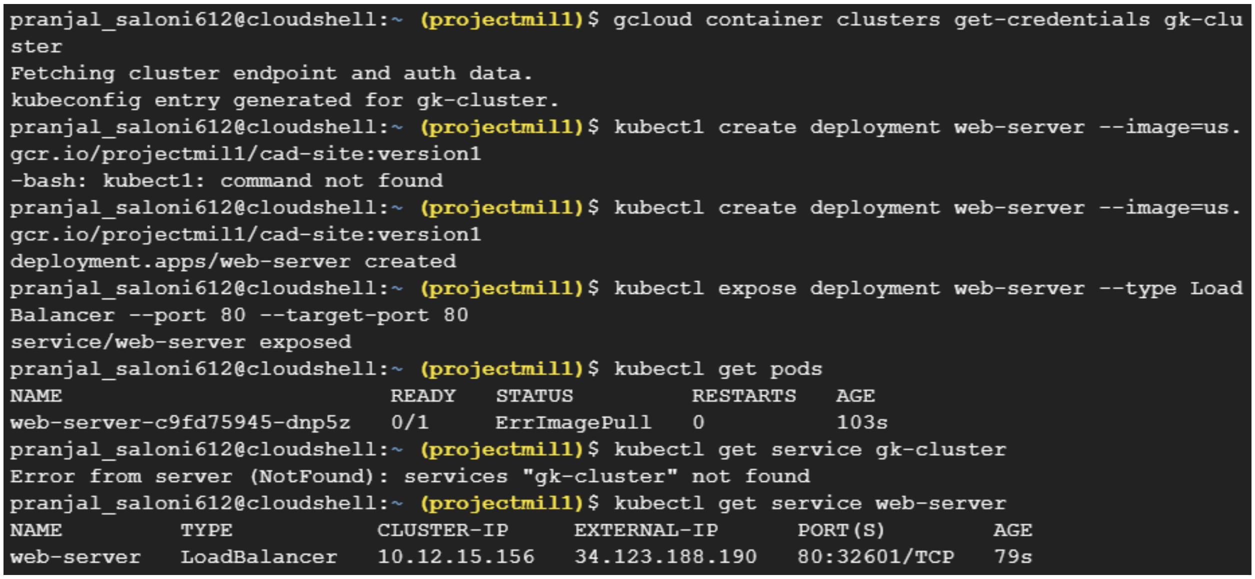


```
pranjal_saloni612@cloudshell:~ (projectmil1)$ gcloud config set project projectmil1
Updated property [core/project].
pranjal_saloni612@cloudshell:~ (projectmil1)$ gcloud config set compute/zone us-central1-a
Updated property [compute/zone].
API [compute.googleapis.com] not enabled on project [331757348570]. Would you like to enable
and retry (this will take a few minutes)? (y/N)?  y

Enabling service [compute.googleapis.com] on project [331757348570]...
WARNING: Property validation for compute/zone was skipped.
pranjal_saloni612@cloudshell:~ (projectmil1)$
```

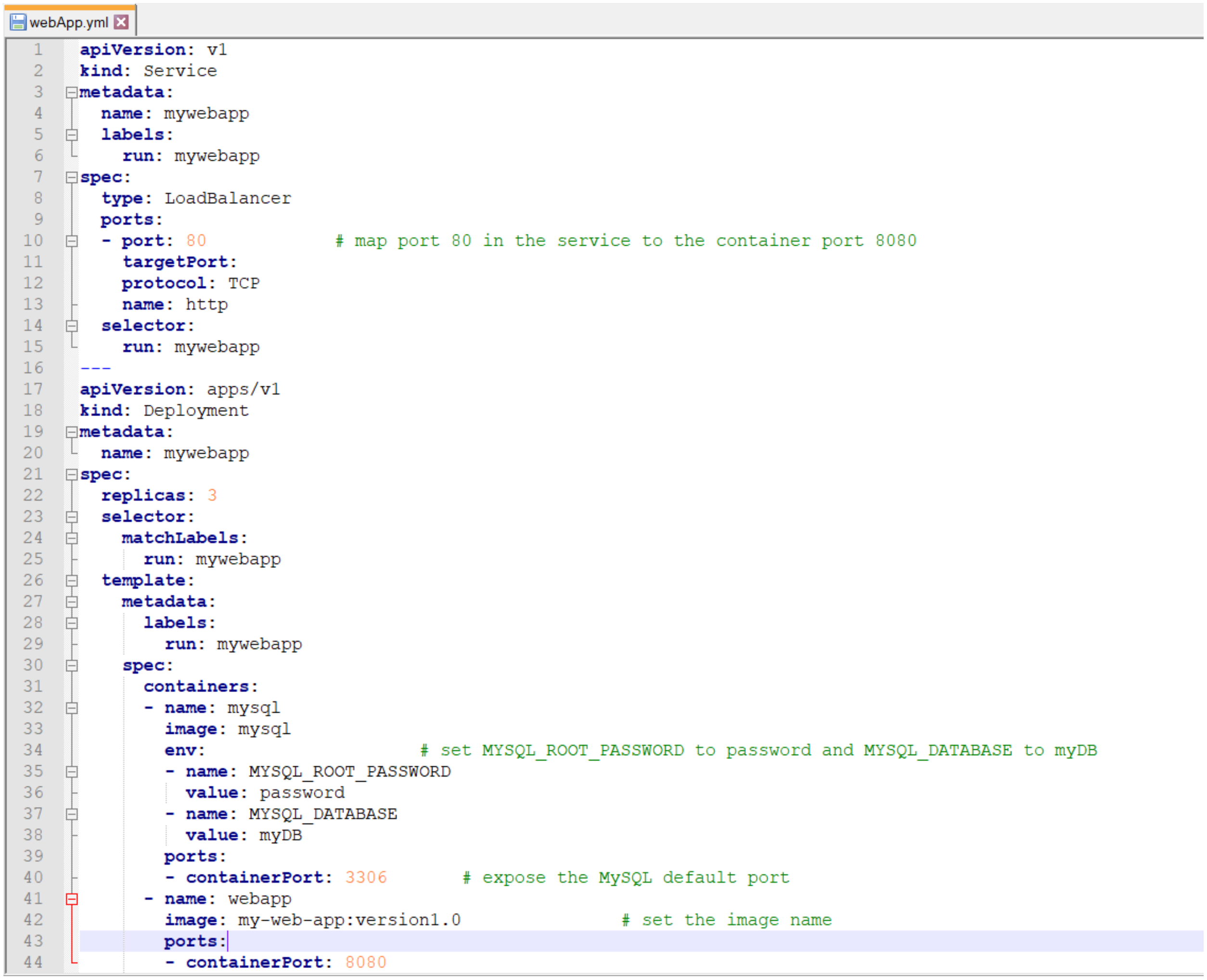


```
pranjal_saloni612@cloudshell:~ (projectmil1)$ gcloud services enable container.googleapis.com
Operation "operations/acf.p2-331757348570-e0bd659d-37a8-45e6-8b98-846542381de4" finished succe
ssfully.
pranjal_saloni612@cloudshell:~ (projectmil1)$ gcloud container clusters create gk-cluster --nu
m-nodes=1
Default change: VPC-native is the default mode during cluster creation for versions greater th
an 1.21.0-gke.1500. To create advanced routes based clusters, please pass the `--no-enable-ip-
alias` flag
Note: Your Pod address range (`--cluster-ipv4-cidr`) can accommodate at most 1008 node(s).
Creating cluster gk-cluster in us-central1-a...done.
Created [https://container.googleapis.com/v1/projects/projectmil1/zones/us-central1-a/clusters
/gk-cluster].
To inspect the contents of your cluster, go to: https://console.cloud.google.com/kubernetes/wo
rkload_/gcloud/us-central1-a/gk-cluster?project=projectmil1
kubeconfig entry generated for gk-cluster.
NAME: gk-cluster
LOCATION: us-central1-a
MASTER_VERSION: 1.21.6-gke.1500
MASTER_IP: 34.66.11.115
MACHINE_TYPE: e2-medium
NODE_VERSION: 1.21.6-gke.1500
NUM_NODES: 1
STATUS: RUNNING
```



```
pranjal_saloni612@cloudshell:~ (projectmil1)$ gcloud container clusters get-credentials gk-clu
ster
Fetching cluster endpoint and auth data.
kubeconfig entry generated for gk-cluster.
pranjal_saloni612@cloudshell:~ (projectmil1)$ kubect1 create deployment web-server --image=us.
gcr.io/projectmil1/cad-site:version1
-bash: kubect1: command not found
pranjal_saloni612@cloudshell:~ (projectmil1)$ kubectl create deployment web-server --image=us.
gcr.io/projectmil1/cad-site:version1
deployment.apps/web-server created
pranjal_saloni612@cloudshell:~ (projectmil1)$ kubectl expose deployment web-server --type Load
Balancer --port 80 --target-port 80
service/web-server exposed
pranjal_saloni612@cloudshell:~ (projectmil1)$ kubectl get pods
NAME                          READY   STATUS         RESTARTS   AGE
web-server-c9fd75945-dnp5z    0/1     ErrImagePull   0          103s
pranjal_saloni612@cloudshell:~ (projectmil1)$ kubectl get service gk-cluster
Error from server (NotFound): services "gk-cluster" not found
pranjal_saloni612@cloudshell:~ (projectmil1)$ kubectl get service web-server
NAME         TYPE           CLUSTER-IP     EXTERNAL-IP      PORT(S)        AGE
web-server   LoadBalancer   10.12.15.156   34.123.188.190   80:32601/TCP   79s
```

Video 4



```
apiVersion: v1
kind: Service
metadata:
  name: mywebapp
  labels:
    run: mywebapp
spec:
  type: LoadBalancer
  ports:
  - port: 80            # map port 80 in the service to the container port 8080
    targetPort:
    protocol: TCP
    name: http
  selector:
    run: mywebapp
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: mywebapp
spec:
  replicas: 3
  selector:
    matchLabels:
      run: mywebapp
  template:
    metadata:
      labels:
        run: mywebapp
    spec:
      containers:
      - name: mysql
        image: mysql
        env:                    # set MYSQL_ROOT_PASSWORD to password and MYSQL_DATABASE to myDB
        - name: MYSQL_ROOT_PASSWORD
          value: password
        - name: MYSQL_DATABASE
          value: myDB
        ports:
        - containerPort: 3306       # expose the MySQL default port
      - name: webapp
        image: my-web-app:version1.0               # set the image name
        ports:
        - containerPort: 8080
```