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Academic Year: 2024-25 Semester: V Class /

Branch: TE IT

Subject: DevOPs Lab (DL)

Subject Lab In-charge: Prof. Sujata Oak

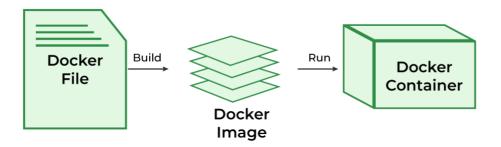
EXPERIMENT NO. 09

Aim: To build an image for a sample web application from a docker file using various docker file instructions

Theory: The Dockerfile uses DSL (Domain Specific Language) and contains instructions for generating a Docker image. Dockerfile will define the processes to quickly produce an image. While creating your application, you should create a Dockerfile in order since the Docker daemon runs all of the instructions from top to bottom.

An artifact with several layers and a lightweight, compact stand-alone executable package that contains all of the components required to run a piece of software, including the code, a runtime, libraries, environment variables, and configuration files is called a <u>Docker image</u>.

A container is a runtime instance of an image. Containers make development and deployment more efficient since they contain all the dependencies and parameters needed for the application it runs completely isolated from the host environment.



Dockerfile commands/Instructions

1. FROM

• Represents the base image(OS), which is the command that is executed first before any other commands.

Syntax

FROM < ImageName>

2. COPY

• The copy command is used to copy the file/folders to the image while building the image.



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Syntax:

COPY <Source> < Destination>

3] RUN

• Scripts and commands are run with the RUN instruction. The execution of RUN commands or instructions will take place while you create an image on top of the prior layers (Image).

Syntax

RUN < Command + ARGS>

4] CMD

• The main purpose of the CMD command is to start the process inside the container and it can be overridden.

Syntax

CMD [command + args]

Stages of Creating Docker Image from Dockerfile

The following are the stages of creating docker image form Dockerfile:

- 1. Create a file named Dockerfile.
- 2. Add instructions in Dockerfile.
- 3. Build Dockerfile to create an image.
- 4. Run the image to create a container.

IMPLEMENTATION:

PART I: Containerize an application using docker CLI Commands:

Let's create an nginx webserver, it is a web server platform which helps to host your web applications.

STEP1: Download nginx official image and then containerized your web application in it.

#docker images

devasc@labvm:~/Desktop/DOCKER_LAB\$ docker images						
REPOSITORY	TAG	IMAGE ID	CREATED	SIZE		
mysql	latest	a82a8f162e18	5 weeks ago	586MB		
hello-world	latest	d2c94e258dcb	16 months ago	13.3kB		



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#docker pull nginx

```
devasc@labvm:~/Desktop/DOCKER_LAB$ docker pull nginx
Using default tag: latest
latest: Pulling from library/nginx
e4fff0779e6d: Pull complete
2a0cb278fd9f: Pull complete
7045d6c32ae2: Pull complete
03de31afb035: Pull complete
0f17be8dcff2: Pull complete
14b7e5e8f394: Pull complete
23fa5a7b99a6: Pull complete
Digest: sha256:447a8665cc1dab95b1ca778e162215839ccbb9189104c79d7ec3a81e1457
Status: Downloaded newer image for nginx:latest
docker.io/library/nginx:latest
```

```
devasc@labvm:~/Desktop/DOCKER_LAB$ docker images
REPOSITORY
              TAG
                         IMAGE ID
                                        CREATED
                                                         SIZE
nginx
                         5ef79149e0ec
              latest
                                        2 weeks ago
                                                         188MB
mysql
              latest
                        a82a8f162e18
                                        5 weeks ago
                                                         586MB
hello-world
              latest
                      d2c94e258dcb 16 months ago
                                                         13.3kB
```

STEP2: Run the container from nginx image

root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker run --name webserver1 5ef

```
root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker run --name webserver1 5ef
 /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: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh /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 2024/08/31 18:32:00 [notice] 1#1: using the "epoll" event method 2024/08/31 18:32:00 [notice] 1#1: nginx/1.27.1 2024/08/31 18:32:00 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14) 2024/08/31 18:32:00 [notice] 1#1: OS: Linux 5.4.0-37-generic 2024/08/31 18:32:00 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576 2024/08/31 18:32:00 [notice] 1#1: start worker processes 2024/08/31 18:32:00 [notice] 1#1: start worker process 30
 docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh/
```

In another terminal

#docker ps -a



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devasc@labvm:~/Desktop/DOCKER_LAB\$ sudo su root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker ps -a CONTAINER ID IMAGE COMMAND CREATED STATU NAMES PORTS 5ef 34816ce8fdab "/docker-entrypoint..." About a minute ago Up Ab out a minute bc8a1f0b194f 80/tcp webserver1 "/hello" hello-world 6 days ago Exite d (0) 6 days ago peaceful_aryabhata fbd148039aee hello-world "/hello" Exite 6 days ago (0) 6 days infallible_cerf ago

In previous terminal: ctrl+C ie; exit from container

In another terminal

#docker ps -a

root@labvm:/ho	me/devasc/Des	ktop/DOCKER LAB# docker ps	- a	
CONTAINER ID	IMAGE PORTS	COMMAND	CREATED	STATUS
34816ce8fdab 10 seconds ag	5ef o	"/docker-entrypoint" webserver1	3 minutes ago	Exited (0)
bc8a1f0b194f 6 days ago	hello-world	"/hello" peaceful arvabhata	6 days ago	Exited (0)
fbd148039aee 6 days ago	hello-world	"/hello" infallible_cerf	6 days ago	Exited (0)

Remove the container:

```
root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker rm 348
348
root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker ps -a
CONTAINER ID
               IMAGE
                             COMMAND
                                        CREATED
                                                     STATUS
TS
      NAMES
                             "/hello"
bc8a1f0b194f
               hello-world
                                                     Exited (0) 6 days ago
                                        6 days ago
      peaceful_aryabhata
               helio-world
fbd148039aee
                             "/hello"
                                                     Exited (0) 6 days ago
                                        6 days ago
      infallible cerf
```

In terminal 1:

root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker run -it -p 3031:80 --name server1 nginx:latest bash

root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker run -it -p 3031:80 --name nse rver1 nginx:latest bash

In Another Terminal:

#docker ps -a





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root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker ps -a IMAGE CONTAINER ID COMMAND CREATED **STATUS** PORTS NAMES "/docker-entrypoint... 595c2fa10371 nginx:latest 8 minutes ago Up 8 minu 0.0.0.0:3031->80/tcp, :::3031->80/tcp hello-world "/hello" nserver1 tes bc8a1f0b194f hello-world 6 days ago Exited (6 peaceful_aryabhata) 6 days ago 6 days ago fbd148039aee hello-world "/hello" Exited (6 infallible 6 days ago

Lets create a static website inside container. I need to go to the location where my index.html file is:

cd /usr/share/nginx/html/

root@595c2fa10371:/# cd /usr/share/nginx/html/

#1s

root@595c2fa10371:/usr/share/nginx/html# 50x.html index.html

Rename the default index.html to index.html_backup

#mv index.html index.html_backup

root@595c2fa10371:/usr/share/nginx/html# mv index.html index.html backup

#nano index.html

root@595c2fa10371:/usr/share/nginx/html# nano index.html

Nano not found: Because the container that I am running inside the shell says that nano application is not available inside the container. So first install nano: apt install nano

root@595c2fa10371:/usr/share/nginx/html# nano index.html bash: nano: command not found

root@595c2fa10371:/usr/share/nginx/html# apt install nano Reading package lists... Done Building dependency tree... Done Reading state information... Done Package nano is not available, but is referred to by another package. This may mean that the package is missing, has been obsoleted, or is only available from another source Package 'nano' has no installation candidate





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```
root@595c2fa10371:/usr/share/nginx/html# apt update
Get:1 http://deb.debian.org/debian bookworm InRelease [151 kB]
Get:2 http://deb.debian.org/debian bookworm-updates InRelease [55.4 kB]
Get:3 http://deb.debian.org/debian-security bookworm-security InRelease [48.0 kB
Get:4 http://deb.debian.org/debian bookworm/main amd64 Packages [8787 kB]
Get:5 http://deb.debian.org/debian bookworm-updates/main amd64 Packages [13.8 kB
Get:6 http://deb.debian.org/debian-security bookworm-security/main amd64 Package
s [179 kB]
Fetched 9234 kB in 1s (6581 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
10 packages can be upgraded. Run 'apt list --upgradable' to see them.
root@595c2fa10371:/usr/share/nginx/html# apt install nano
Reading package lists... Done
```

root@595c2fa10371:/usr/share/nginx/html# nano index.html

```
<!DOCTYPE html>
<html>
<head>
<meta name="viewport" content="width=device-width, initial-scale=1">
<title> Login Page </title>
<style>
Body {
 font-family: Calibri, Helvetica, sans-serif;
 background-color: pink;
button {
    background-color: #4CAF50;
    width: 100%;
    color: orange;
    padding: 15px;
     margin: 10px 0px;
    border: none;
     cursor: pointer;
form {
     border: 3px solid #f1f1f1;
input[type=text], input[type=password] {
     width: 100%;
     margin: 8px 0;
    padding: 12px 20px;
     display: inline-block;
     border: 2px solid green;
     box-sizing: border-box;
  }
button:hover {
     opacity: 0.7;
```





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```
.cancelbtn {
    width: auto;
    padding: 10px 18px;
    margin: 10px 5px;
.container {
    padding: 25px;
    background-color: lightblue;
</style>
</head>
<body>
  <center> <h1> <b>Student Login Form Designed by Sujata Oak</b> </h1> </center>
  <form>
    <div class="container">
      <label>Username : </label>
      <input type="text" placeholder="Enter Username" name="username" required>
      <label>Password : </label>
      <input type="password" placeholder="Enter Password" name="password" required>
      <button type="submit">Login</button>
      <input type="checkbox" checked="checked"> Remember me
      <button type="button" class="cancelbtn"> Cancel</button>
      Forgot <a href="#"> password? </a>
    </div>
  </form>
</body>
</html>
```

To check nginx service status:

root@595c2fa10371:/usr/share/nginx/html# service nginx status nginx is not running .





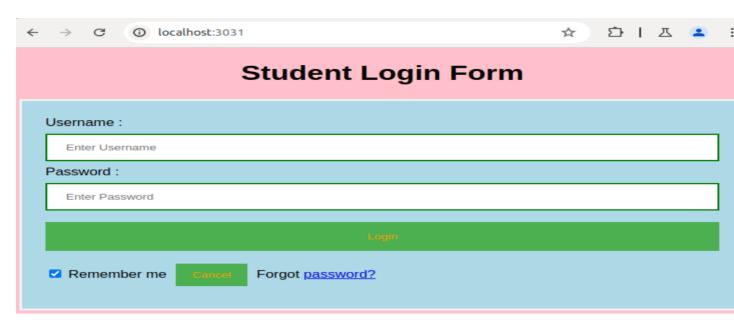
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```
root@595c2fa10371:/usr/share/nginx/html# service nginx start
2024/08/31 19:57:58 [notice] 170#170: using the "epoll" event method
2024/08/31 19:57:58 [notice] 170#170: nginx/1.27.1
2024/08/31 19:57:58 [notice] 170#170: built by gcc 12.2.0 (Debian 12.2.0-14)
2024/08/31 19:57:58 [notice] 170#170: OS: Linux 5.4.0-37-generic
2024/08/31 19:57:58 [notice] 170#170: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2024/08/31 19:57:58 [notice] 171#171: start worker processes
 root@595c2fa10371:/usr/share/nginx/html# 2024/08/31 19:57:58 [notice] 171#171: s
tart worker process 172
2024/08/31 19:57:58 [notice] 171#171: start worker process 173
172.17.0.1 - [31/Aug/2024:19:58:36 +0000] "GET / HTTP/1.1" 200 1727 "-" "Mozil
la/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/126.0.0
.0 Safari/537.36" "-"
```

STEP 3:

GOTO BROWSER: localhost:3031



root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker stop 595

Goto browser→ Refresh page . Your Container is stopped now





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① localhost:3031



This site can't be reached

localhost refused to connect.

Try:

- · Checking the connection
- · Checking the proxy and the firewall

ERR_CONNECTION_REFUSED

root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker start 595 595

Goto browser→ Refresh page . Your Container is not started

root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker restart 595 595

Goto browser→ Refresh page . Your Container is not restarted



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① localhost:3031



This site can't be reached

localhost refused to connect.

Try:

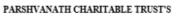
- Checking the connection
- Checking the proxy and the firewall

ERR_CONNECTION_REFUSED

docker exec 595 service nginx start

```
root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker exec 595 service nginx start
2024/08/31 20:20:56 [notice] 18#18: using the "epoll" event method 2024/08/31 20:20:56 [notice] 18#18: using the "epoll" event method 2024/08/31 20:20:56 [notice] 18#18: nginx/1.27.1 2024/08/31 20:20:56 [notice] 18#18: built by gcc 12.2.0 (Debian 12.2.0-14) 2024/08/31 20:20:56 [notice] 18#18: OS: Linux 5.4.0-37-generic 2024/08/31 20:20:56 [notice] 18#18: getrlimit(RLIMIT_NOFILE): 1048576:1048576
                                                            19#19: start worker processes
2024/08/31 20:20:56
2024/08/31 20:20:56
2024/08/31 20:20:56
                                                             19#19: start worker process 20
                                           [notice]
                                           [notice]
                                                             19#19:
                                                                            start worker process 21
```

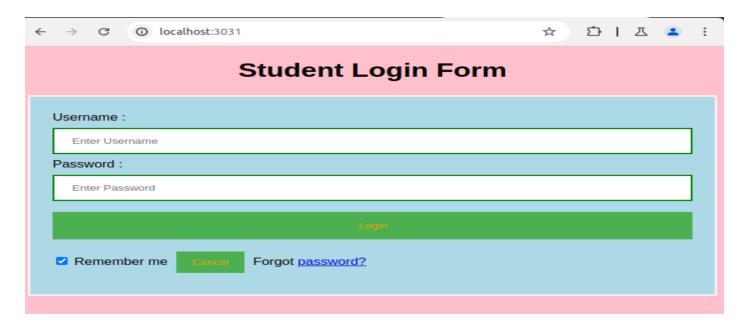
Goto Browser and refresh it:





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Firstly stop the container:

root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker stop 595 595

#docker pause 595

#docker unpause 595

Then, Remove the Container

root@labvm:/home/devasc/Desktop/DOCKER LAB# docker 595

To Verify container is removed or not:

```
root@labvm:/home/devasc/Desktop/DOCKER_LAB# docker ps -a
CONTAINER ID
               IMAGE
                             COMMAND
                                        CREATED
                                                      STATUS
                                                                               POR
      NAMES
TS
                             "/hello"
bc8a1f0b194f
               hello-world
                                        6 days ago
                                                      Exited (0) 6 days ago
       peaceful_aryabhata
               hello-world
                             "/hello"
fbd148039aee
                                        6 days ago
                                                      Exited (0) 6 days ago
```



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PART II: DOCKERFILE

Creating a Docker Image for your Application:

This is the recommended workflow for creating your own Docker image for your application:

- 1. Write a Dockerfile for your application.
- 2. Build the image with docker build command.
- 3. Host your Docker image on a registry.
- 4. Pull and run the image on the target machine.

Docker builds images automatically by reading the instructions from a Dockerfile. It is a text file that contains all commands needed to build a given image.

STEP 1:

```
devasc@labvm:~$ cd Desktop/
devasc@labvm:~/Desktop$ cd DOCKER_LAB/
devasc@labvm:~/Desktop/DOCKER_LAB$ ls
docker-java docker-nginx get-docker.sh
devasc@labvm:~/Desktop/DOCKER_LAB$ cd docker-nginx/
devasc@labvm:~/Desktop/DOCKER_LAB/docker-nginx$ ls
Dockerfile index.html style.css
```

Step 2:

devasc@labvm:~/Desktop/DOCKER_LAB/docker-nginx\$ nano Dockerfile



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```
devasc@labvm: ~/Desktop/DOCKER_LAB/docker-nginx
File Edit View Search Terminal
                              Help
                                       Dockerfile
  GNU nano 4.8
FROM ubuntu
LABEL author="Sujata Oak"
RUN apt-get update
RUN apt-get install nginx -y
COPY . /var/www/html/
EXPOSE 80
CMD ["nginx","-g","daemon off;"]
```

#docker build -t sujatadocker2024/websitetest.

```
devasc@labvm:~/Desktop/DOCKER_LAB/docker-nginx$ docker build -t sujatadocker2024/websit
[+] Building 1.2s (9/9) FINISHED
      transferring dockerfile: 190B
                                                           docker:default
```

```
devasc@labvm:~/Desktop/DOCKER_LAB/docker-nginx$ docker images
REPOSITORY
                                                   IMAGE ID
                                                                     CREATED
                                      TAG
                                                  da519d43aaa4 14 seconds ago
5c8d66732fa0 3 minutes ago
96e1fc59d3fa 8 minutes ago
                                                                                           SIZE
                                      latest
sujatadocker2024/websitetest
                                                                                           126MB
<none>
                                      <none>
                                                                                           126MB
<none>
                                      <none>
                                                                                           126MB
                                                                    2 weeks ago
5 weeks ago
nginx
                                      latest
                                                  5ef79149e0ec
                                                                                           188MB
                                                   a82a8f162e18
mysql
                                      latest
                                                                                           586MB
hello-world
                                                   d2c94e2<u>5</u>8dcb
                                      latest
                                                                     16 months ago
                                                                                           13.3kB
```

Step 3: Run the container now:





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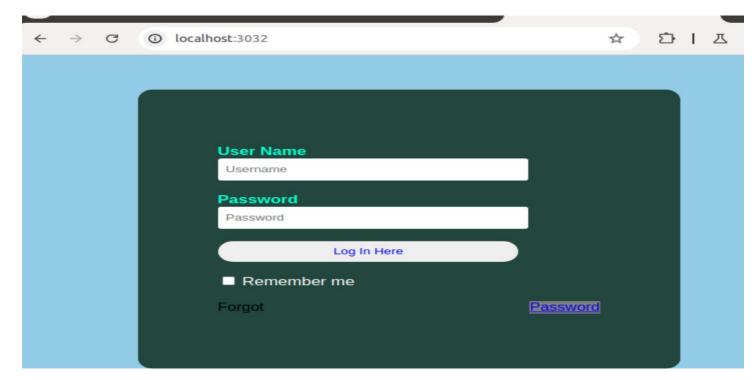
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```
devasc@labvm:~/Desktop/DOCKER LAB/docker-nginx$ sudo su
root@labvm:/home/devasc/Desktop/DOCKER_LAB/docker-nginx# docker run -d -p 3032:80 --nam
e sujata website da5
ff0cc2e19a4fc46780008104cbe41de8332724e133d4be93363b2c72a0dd9451
oot@labvm:/home/devasc/Desktop/DOCKER_LAB/docker-nginx# docker ps
CONTAINER ID
               IMAGE
                         COMMAND
                                                   CREATED
                                                                     STATUS
                                                                                     PORT
                                    NAMES
ff0cc2e19a4f
                         "nginx -g
                                    'daemon of..."
                                                   46 seconds ago
                                                                     Up 46 seconds
                                                                                     0.0
```

sujata_website

Step 4: Goto Browser: localhost:3032

0.0:3032->80/tcp, :::3032->80/tcp



STEP 5: How to push this image to your dockerhub:

7ddbe83467ff: Preparing d17b9906ed77: Preparing f36fd4bb7334: Preparing

```
devasc@labvm:~/Desktop/DOCKER_LAB/docker-nginx$ docker
REPOSITORY
                                 TAG
                                            IMAGE ID
                                                            CREATED
                                                                               SIZE
                                                            14 seconds ago
sujatadocker2024/websitetest
                                 latest
                                            da519d43aaa4
                                                                               126MB
                                            5c8d66732fa0
                                                            3 minutes ago
                                                                               126MB
<none>
                                 <none>
<none>
                                 <none>
                                            96e1fc59d3fa
                                                            8 minutes ago
                                                                               126MB
nginx
                                 latest
                                            5ef79149e0ec
                                                              weeks ago
                                                              weeks ago
mysql
                                 latest
                                            a82a8f162e18
                                                                               586MB
hello-world
                                 latest
                                            d2c94e258dcb
                                                            16 months ago
                                                                               13.3kB
oot@labvm:/home/devasc/Desktop/DOCKER_LAB/docker-nginx# docker push sujatadocker2024/w
ebsitetest
Using default tag: latest
The push refers to repository [docker.io/sujatadocker2024/websitetest]
b4de1b3782f3: Preparing
```

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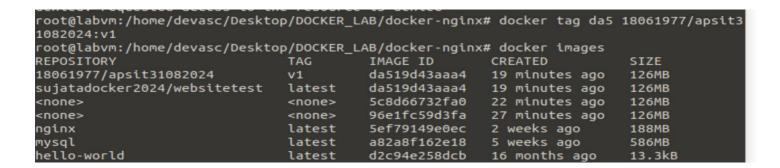
denied: requested access to the resource is denied





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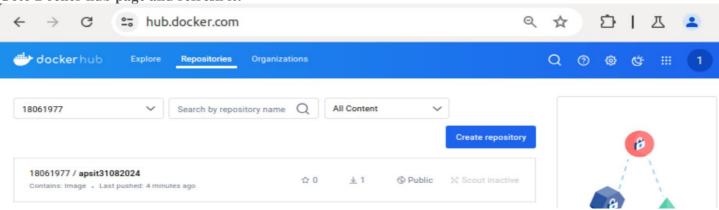
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root@labvm:/home/devasc/Desktop/DOCKER_LAB/docker-nginx# docker login Authenticating with existing credentials... WARNING! Your password will be stored unencrypted in /root/.docker/config.json. Configure a credential helper to remove this warning. See https://docs.docker.com/engine/reference/commandline/login/#credential-stores Login Succeeded

root@labvm:/home/devasc/Desktop/DOCKER_LAB/docker-nginx# docker push 18061977/apsit3108 2024: v1 The push refers to repository [docker.io/18061977/apsit31082024] b4de1b3782f3: Pushed 7ddbe83467ff: Pushed d17b9906ed77: Pushed f36fd4bb7334: Pushed v1: digest: sha256:754b62bd4141cff7bb3701128e61aa564e3544e66c8538bfc6e1e3e13ca1f9ae siz e: 1161

Goto Docker hub page and refresh it:

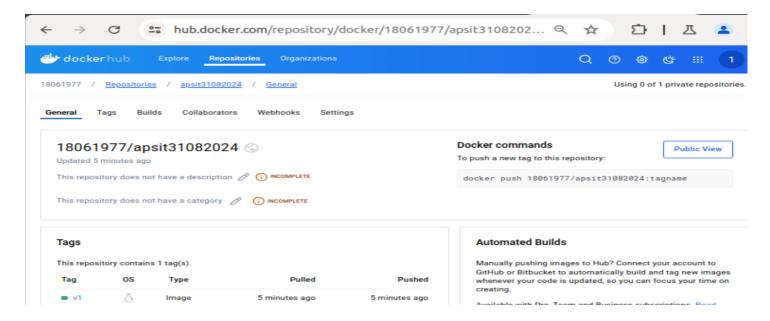




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Conclusion: In the experiment, we used various docker commands to pull images that were already built, also we created our own images by using docker file instructions for a sample web application and atlast we have pushed the image to docker hub account for others to use the repository.