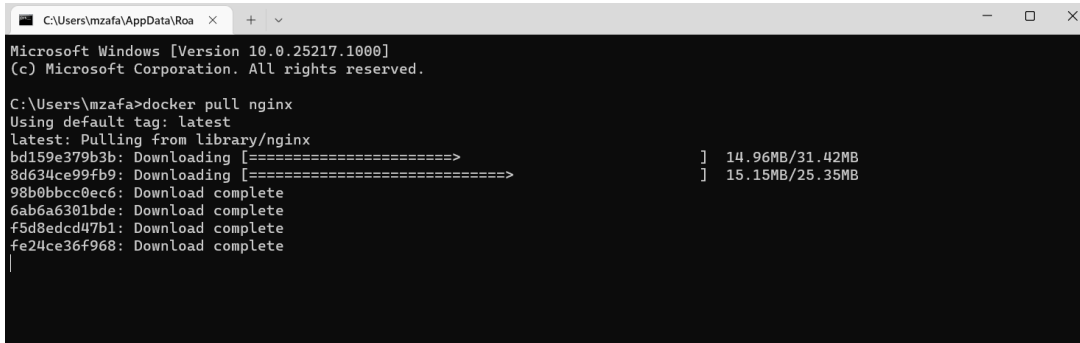## Lab 7: Docker Commands and custom images

Objectives: In this lab, students will learn how to use various Docker commands, customize Docker images, build custom images and deploy it. Student will learn famous lightweight webserver Nginx and will learn famous Unix editor Vi/Vim.

1. Start Docker, double click on Docker icon to run the docker, on the docker dashboard, all the images you have downloaded to your local system will be listed. Right side shows username, below username, size of docker images collectively is shown against the total size. Bottom shows the status of connection to the Docker Hub.
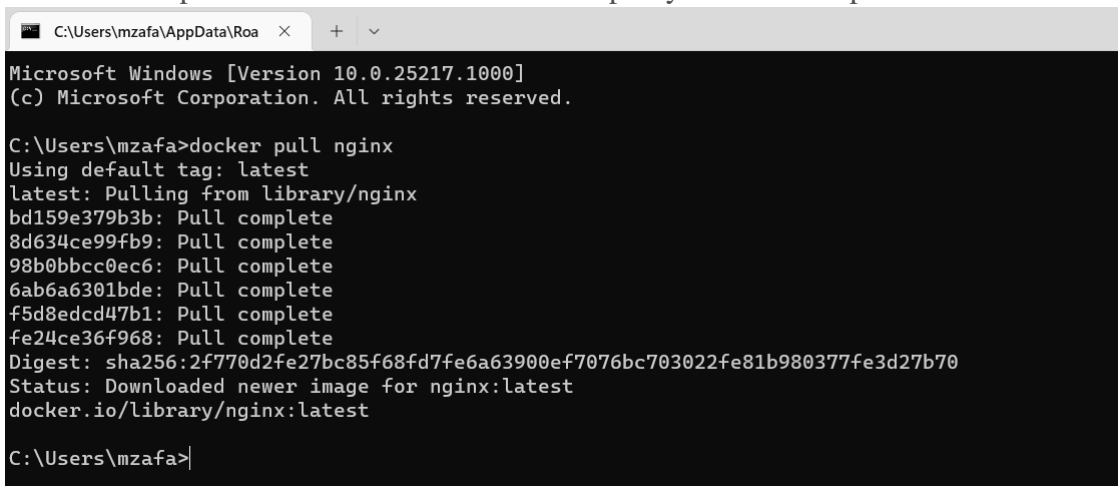
2. Let's pull nginx*** server from the docker hub and run it.

it should complete with in few minutes based upon your internet speed
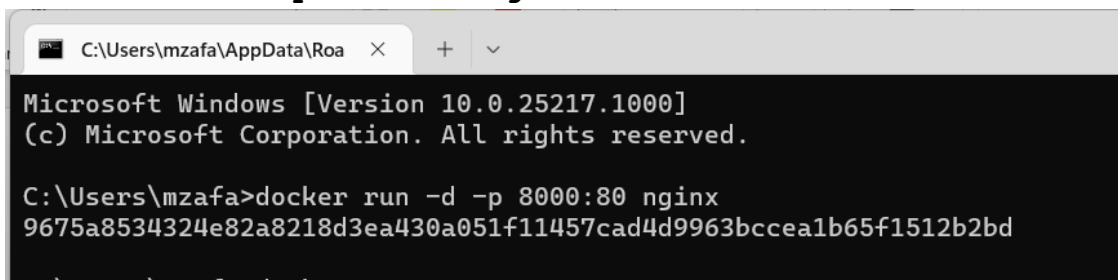
3. Now start the nginx, with following command
   docker run -d -p 8000:80 nginx

-p 8000:80 is used to map the tcp port 80 to the Nginx port of 8000

-d is used to detach the command window from the nginx daemon process

The long hash in the next line is the process id attached to the nginx container by the docker.

Verify these parameters by issuing following command

docker ps

4. Open any web browser of your choice, in the address bar write 127.0.0.1:8000, it will now show homepage of the Nginx server
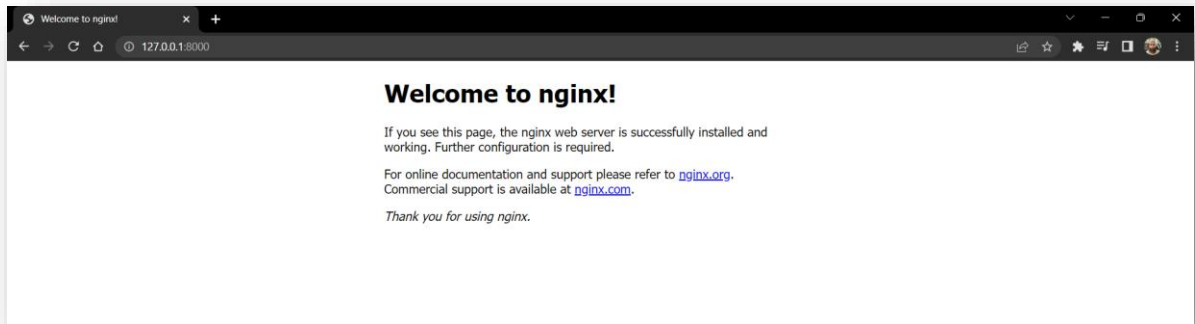
5. To stop this container, run following command from the command prompt, and then again run the ps command to show the running containers
docker stop <container id>
docker ps

*it is not necessary to write complete container ID, only few characters which may identify container uniquely will suffice.

6. To list all the containers created in the system, use -a switch with docker ps command

docker ps -a

```
C:\Users\mzafa>docker ps -a
CONTAINER ID   IMAGE                     COMMAND                 CREATED            STATUS                        PORTS     NAMES
9675a8534324   2d389e545974             "/docker-entrypoint..."  56 minutes ago     Exited (0) 6 minutes ago                determined_archimedes
e09891b7c526   2d389e545974             "/docker-entrypoint..."  58 minutes ago     Exited (0) 56 minutes ago               elated_jang
285df801660c   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (0) 58 minutes ago               beautiful_ride
538c2954778c   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (0) About an hour ago            naughty_dubinsky
63d268fdbb78   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (127) About an hour ago          awesome_wiles
a7a99c9845a7   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (0) About an hour ago            nice_bouman
5abf47cc0cb7   ubuntu                   "bash"                   2 hours ago        Exited (0) 2 hours ago                  goofy_feistel
48e4a68aabda   ubuntu                   "bash"                   2 hours ago        Exited (0) 2 hours ago                  ecstatic_rhodes
eb6737851897   ubuntu                   "bash"                   5 days ago         Exited (0) 2 hours ago                  thirsty_visvesvaraya
c04bf752ae27   hello-world              "/hello"                 12 days ago        Exited (0) 2 hours ago                  bold_pasteur
59cd40a60a28   docker/getting-started   "/docker-entrypoint..."  12 days ago        Exited (0) 11 days ago                  objective_wescoff

C:\Users\mzafa>
```

7. To remove a container reference, run following command

docker rm <container id>

and then again list all the containers with

docker ps

e.g. let's remove the *hello-world* container, starting with c04b

```
C:\Users\mzafa>docker rm c04b
c04b

C:\Users\mzafa>docker ps -a
CONTAINER ID   IMAGE                     COMMAND                 CREATED            STATUS                        PORTS     NAMES
9675a8534324   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (0) 17 minutes ago               determined_archimedes
e09891b7c526   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (0) About an hour ago            elated_jang
285df801660c   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (0) About an hour ago            beautiful_ride
538c2954778c   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (0) About an hour ago            naughty_dubinsky
63d268fdbb78   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (127) About an hour ago          awesome_wiles
a7a99c9845a7   2d389e545974             "/docker-entrypoint..."  About an hour ago  Exited (0) About an hour ago            nice_bouman
5abf47cc0cb7   ubuntu                   "bash"                   2 hours ago        Exited (0) 2 hours ago                  goofy_feistel
48e4a68aabda   ubuntu                   "bash"                   2 hours ago        Exited (0) 2 hours ago                  ecstatic_rhodes
eb6737851897   ubuntu                   "bash"                   5 days ago         Exited (0) 2 hours ago                  thirsty_visvesvaraya
59cd40a60a28   docker/getting-started   "/docker-entrypoint..."  12 days ago        Exited (0) 11 days ago                  objective_wescoff

C:\Users\mzafa>
```

8. To remove all these containers, use **docker system prune** command

```
C:\Users\mzafa>docker system prune
WARNING! This will remove:
  - all stopped containers
  - all networks not used by at least one container
  - all dangling images
  - all dangling build cache

Are you sure you want to continue? [y/N] y
Deleted Containers:
9675a8534324e82a8218d3ea430a051f11457cad4d9963bccea1b65f1512b2bd
e09891b7c5264e91f739f7a68c9676b175ce82cf4dcff2114156dda9f4ba1bbe
285df801660cc2c343676bdc9dbff9077596b2dced53acc064db5907e03c42d6
538c2954778cc72e34fdd8397d9de437dc78ceb15b08dd23072fe44235606ab2
63d268fdbb78ac9586995dc205ca8c55b6b6c29c4d5ea33ab77c9d590867d74a
a7a99c9845a73c3af81fe32023ed75eeb2d636b8adbf1c48aca67cf36ade0e95
5abf47cc0cb7160216fca7e1077ddba0a8c2ccee74beac9a4be1f4522a728617
48e4a68aabdaadfee0edba320a0ad3472882e2bbc7fb7e1f14dc94ed6a3b197f
eb67378518971c8779c825989648d7ff299ae658c81a9ba7f5bf3e8f6b2e13f6
59cd40a60a28d2aca96de55b4cdaa082353288e87641ae1a4149a6ccc376aaa7

Deleted Images:
untagged: nginx@sha256:bc3dcfdab9454ec5eae4991ed5c979d0240d273b00929ce682790f3085ca80d5
deleted: sha256:2d389e545974d4a93ebdef09b650753a55f72d1ab4518d17a30c0e1b3e297444
deleted: sha256:363202476290a0db2316a59ad55a204a29c38a3911e3446667cb701cc4198dc7
deleted: sha256:2206f0339ff8e4bea401bd90d6dc4e7e709bc22428c1ae5f68f38c67386c7e7f
deleted: sha256:d70edfab07872218e08147095350ca0ae6e2b6cc21c38468b95d00e9ae8325cc
deleted: sha256:7b46b6757c9a5142df79b3310962da6c7dd41a49a5a51c938d44fdf574b5f8e3
deleted: sha256:39a76abc4386c54429c626f7bc0e378eddf566dad18f6b8a2281e480a5cae071
deleted: sha256:b45078e74ec97c5e600f6d5de8ce6254094fb3cb4dc5e1cc8335fb31664af66e

Deleted build cache objects:
vywympj120slqddnrwzkbzxkh
po9ix04xzzjaj1v5dnqinfsqd
r4clo0ik8oujgjuzrtiykv9ap
yyraovucat6snsnfh18b4tb30

Total reclaimed space: 192MB

C:\Users\mzafa>
```

Now check again with **docker ps -a** command

```
C:\Users\mzafa>docker ps -a
CONTAINER ID    IMAGE      COMMAND     CREATED     STATUS     PORTS      NAMES

C:\Users\mzafa>
```

9. Now let's again, start the nginx server with docker run command

10. Let's enter into the nginx shell, with following command

clearly now we are in nginx shell, now lets make some changes into this

11. Run the apt update command to update the packages in the nginx

*cf41 is the container id, copied from the command output just above the apt update

```
C:\Users\mzafa>docker run -d -p 8000:80 nginx
cf4155b89fc1805291bacab9b05104eb96cf6f5f62abff571f6ff9e9dbd7e04a

C:\Users\mzafa>docker exec -it cf41 /bin/bash
root@cf4155b89fc1:/# apt update
Get:1 http://deb.debian.org/debian bullseye InRelease [116 kB]
Get:2 http://deb.debian.org/debian-security bullseye-security InRelease [48.4 kB]
Get:3 http://deb.debian.org/debian bullseye-updates InRelease [44.1 kB]
Get:4 http://deb.debian.org/debian bullseye/main amd64 Packages [8184 kB]
Get:5 http://deb.debian.org/debian-security bullseye-security/main amd64 Packages [1
89 kB]
Get:6 http://deb.debian.org/debian bullseye-updates/main amd64 Packages [6344 B]
Fetched 8587 kB in 4s (1975 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
root@cf4155b89fc1:/#
```

12. Let's install vim editor in this with apt install vim command

```
root@cf4155b89fc1:~# pwd
/root
root@cf4155b89fc1:~# apt install vim
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libgpm2 vim-common vim-runtime xxd
Suggested packages:
update-alternatives: warning: skip creation of /usr/share/man/fr/man1/editor.1.gz be
cause associated file /usr/share/man/fr/man1/vim.1.gz (of link group editor) doesn't
 exist
update-alternatives: warning: skip creation of /usr/share/man/it/man1/editor.1.gz be
cause associated file /usr/share/man/it/man1/vim.1.gz (of link group editor) doesn't
 exist
update-alternatives: warning: skip creation of /usr/share/man/ja/man1/editor.1.gz be
cause associated file /usr/share/man/ja/man1/vim.1.gz (of link group editor) doesn't
 exist
update-alternatives: warning: skip creation of /usr/share/man/pl/man1/editor.1.gz be
cause associated file /usr/share/man/pl/man1/vim.1.gz (of link group editor) doesn't
 exist
```

After successful installation bash prompt will return on the terminal

13. By default "index.html" file exist in **/usr/share/nginx/html** directory of nginx, let's browse to this directory and check it's presence with **ls** command

```
root@cf4155b89fc1:~# cd /usr/share/nginx/html
root@cf4155b89fc1:/usr/share/nginx/html# ls
50x.html  index.html
root@cf4155b89fc1:/usr/share/nginx/html#
```

14. Use Vim editor to edit this file,

```
root@cf4155b89fc1:/usr/share/nginx/html# vim index.html
```

a new vim window will open, to make changes into the file, press i to start insert (edit) mode of the vim editor

15. Make few simple changes in the index.html file, press **Esc** to exit from the insert mode, press **:wq** to save and exit from

```
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial, sans-serif; }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<br>
<h1>Welcome to SE489</h1>
<h2>DevOps are Amazing</h2>
<p>If you see this page, the nginx web server is successfully
installed and
working. Further configuration is required.</p>

<p>For online documentation and support please refer to
:wq
```

16. Now open browser of your choice and, on address bar enter url http://localhost:8000 , a customized index.html page is displayed, meaning we have successfully edited and configured index.html file on nginx server on docker.
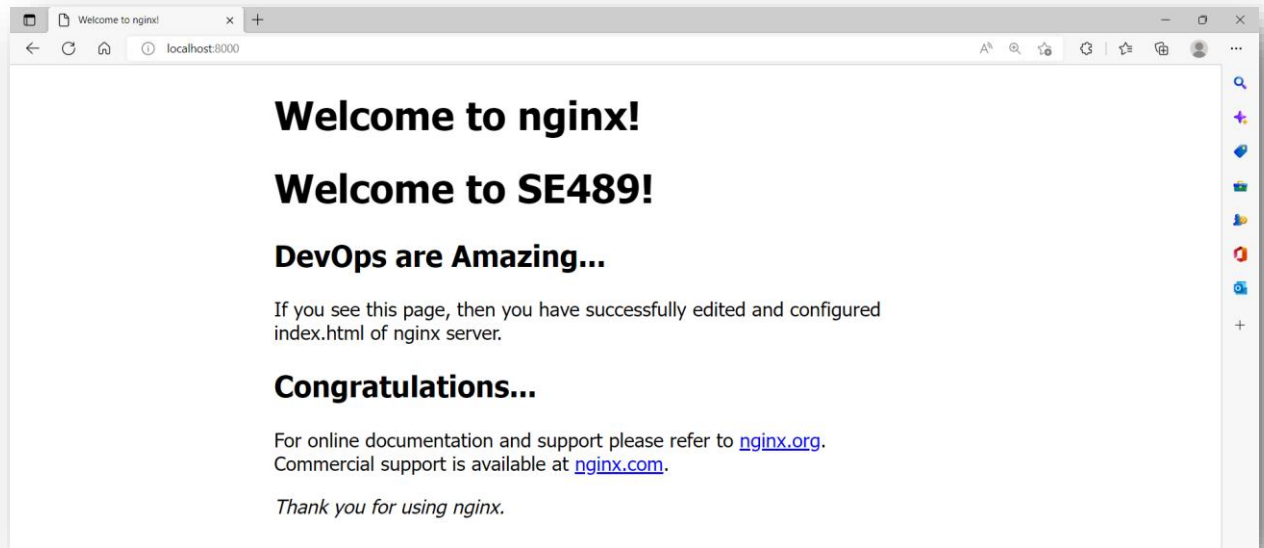
17. Now if we want to pack this customized nginx container into an image that can be shared, posted etc, do following, first commit this container to an image
    docker commit <container id> <author> <tag>

   to know the container id, we can use **docker ps command
   7d53 is first 4 characters from the container hash
   zafar is the Author name
   100 is the tag assigned to this image
   docker has assign a sha256 hash for our customized image of nginx

18. Now run **docker images** command to verify the parameters

```
C:\Users\mzafa\AppData\Roa    ×    +    ∨                                                  —    □    ×

Microsoft Windows [Version 10.0.25217.1000]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mzafa>docker images
REPOSITORY                TAG        IMAGE ID        CREATED         SIZE
zafar/nginx               100        0aa45a30b734    5 minutes ago   196MB
nginx                     latest     51086ed63d8c    5 days ago      142MB
ubuntu                    latest     216c552ea5ba    5 days ago      77.8MB
alpine                    latest     9c6f07244728    2 months ago    5.54MB
docker/getting-started    latest     cb90f98fd791    6 months ago    28.8MB
hello-world               latest     feb5d9fea6a5    12 months ago   13.3kB

C:\Users\mzafa>
```

docker has created a customized nginx image for us with size 196 MB
this extra-large size is partially due to the fact that we have updated the nginx with **apt update command and mainly due to installation of **VIM package** into it.

19. Let's run this customized image on port 5000

```
C:\Users\mzafa\AppData\Roa    ×    +    ∨                                                  —    □    ×

Microsoft Windows [Version 10.0.25217.1000]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mzafa>docker images
REPOSITORY                TAG        IMAGE ID        CREATED         SIZE
zafar/nginx               100        0aa45a30b734    5 minutes ago   196MB
nginx                     latest     51086ed63d8c    5 days ago      142MB
ubuntu                    latest     216c552ea5ba    5 days ago      77.8MB
alpine                    latest     9c6f07244728    2 months ago    5.54MB
docker/getting-started    latest     cb90f98fd791    6 months ago    28.8MB
hello-world               latest     feb5d9fea6a5    12 months ago   13.3kB

C:\Users\mzafa>docker run -d -p 5000:80 0aa45
f4ea11b7bcffc3df305ea761679944a9040d8957df82a0a041a421c752d5d304

C:\Users\mzafa>
```

20. Open any web browser of your choice and enter url http://localhost:5000
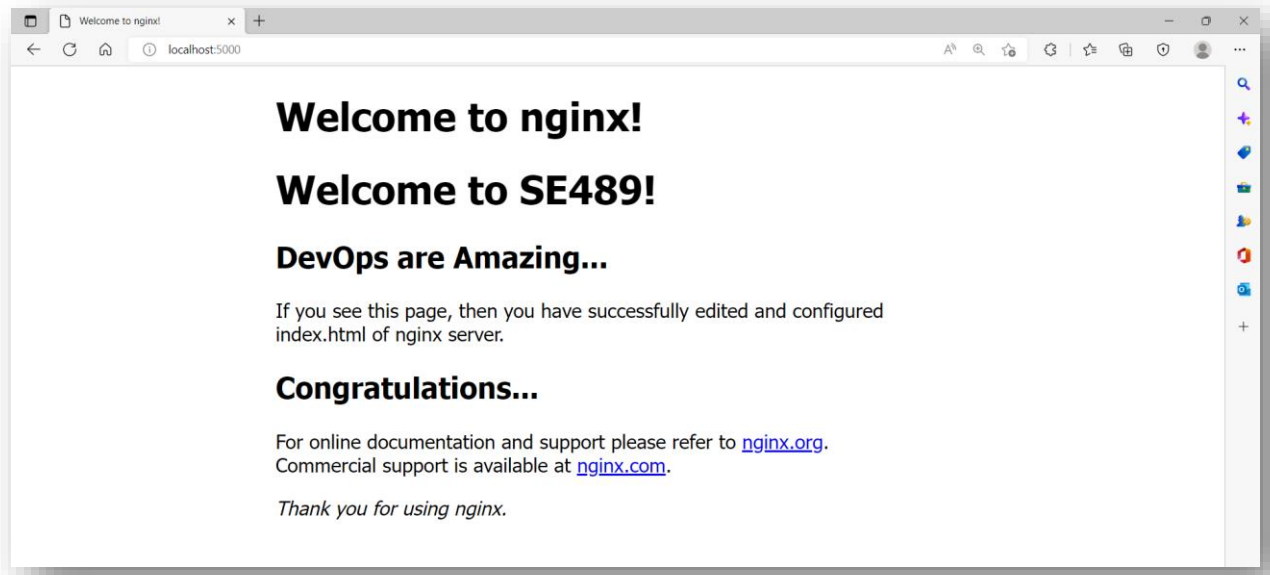
Our customized home page appears, Congratulations!!
This customized image can be uploaded to docker hub, shared among desired user group.