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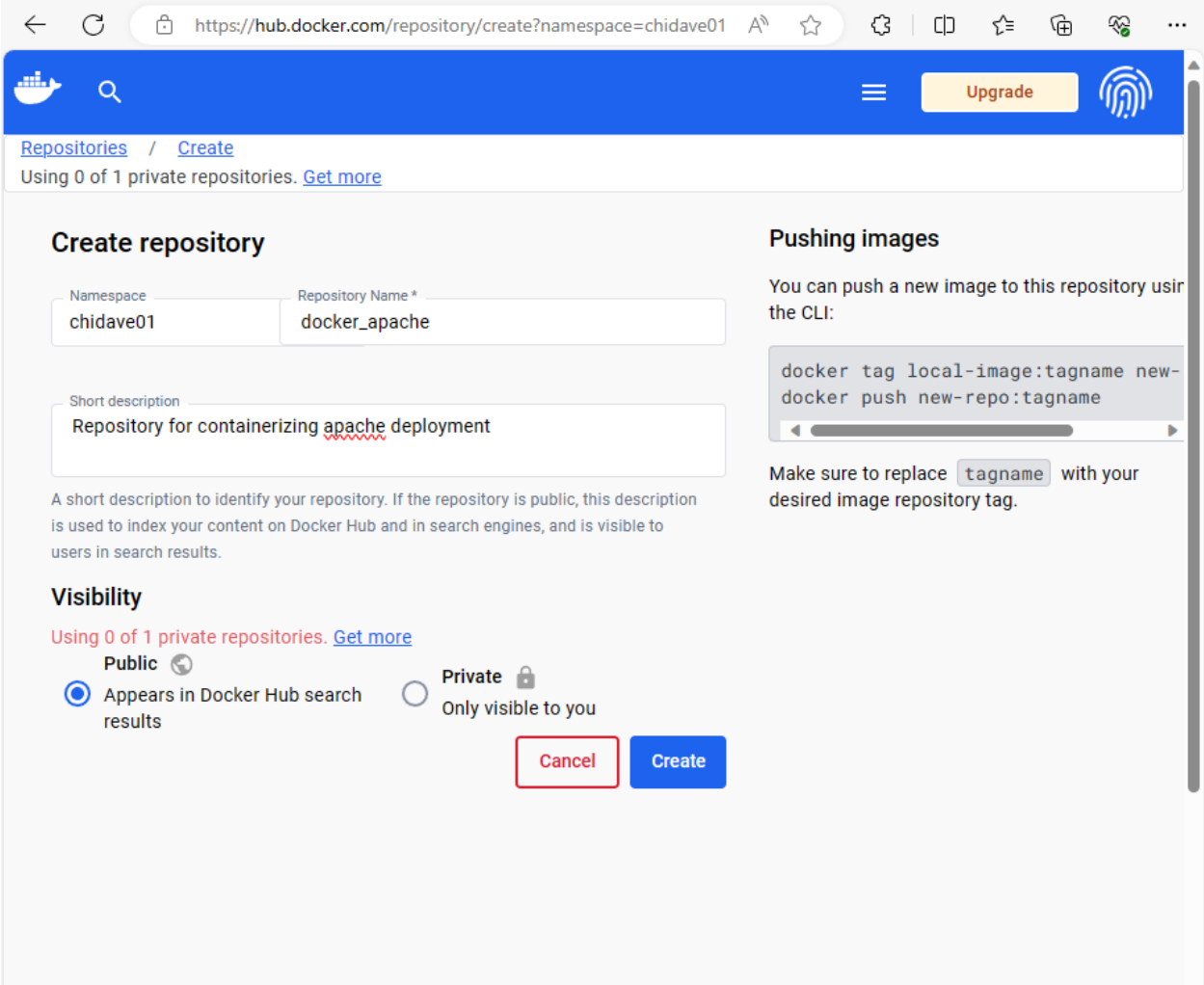
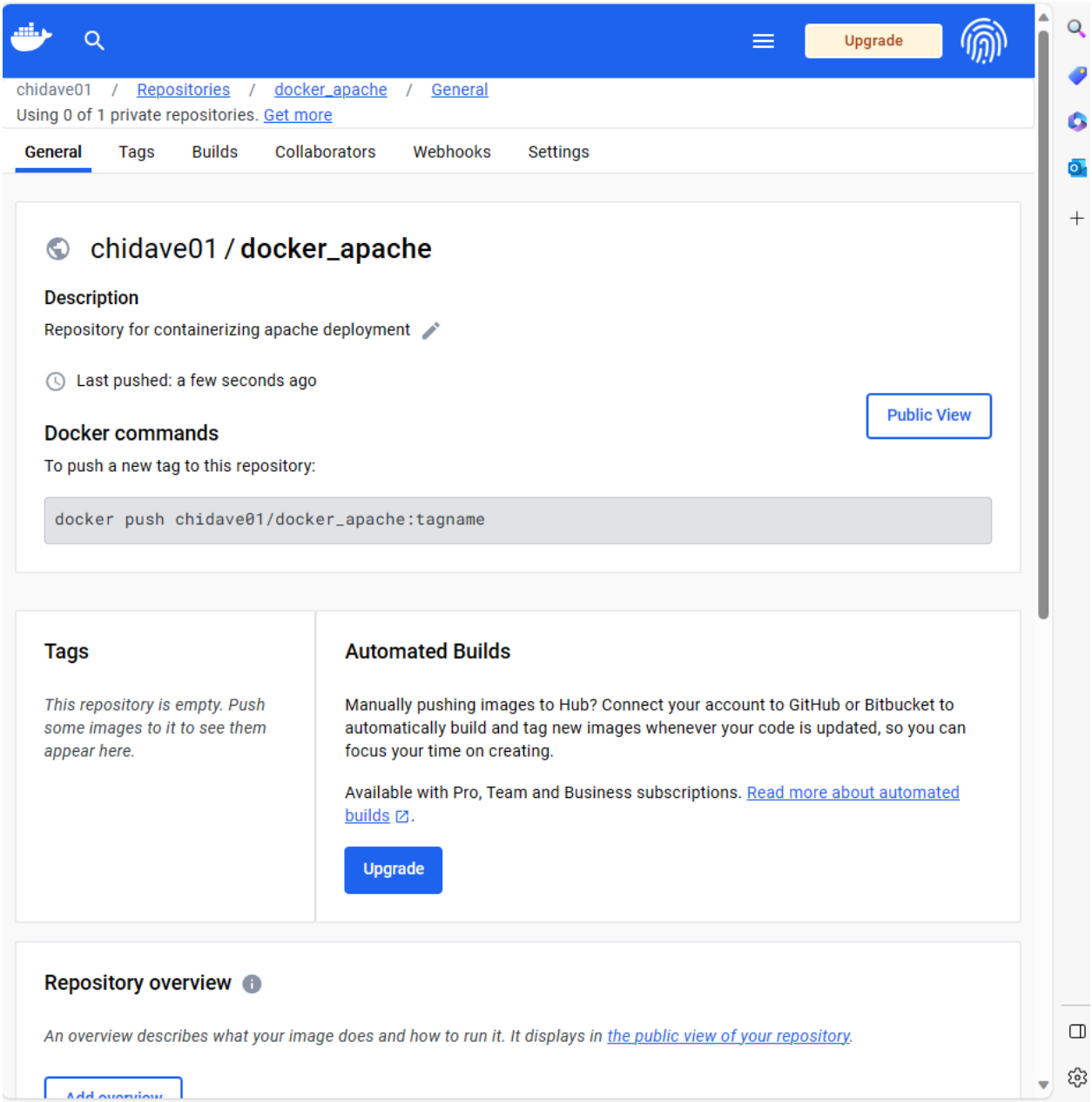
Project- *Containerizing webserver using Docker*

- Create a Docker hub public repository
- Containerize our Apache webserver
- Upload image to your docker hub
- Have a friend from your cluster to pull your image and build it.
- Share screenshot of app in browser, and image uploaded
- Upload it in a repo on your github

- **Create a Dockerhub Public Repository**



First, I signed up on dockerhub and created a repository titled “docker_apache”. Note that only lowercase is accepted in creating the docker hub repository name.

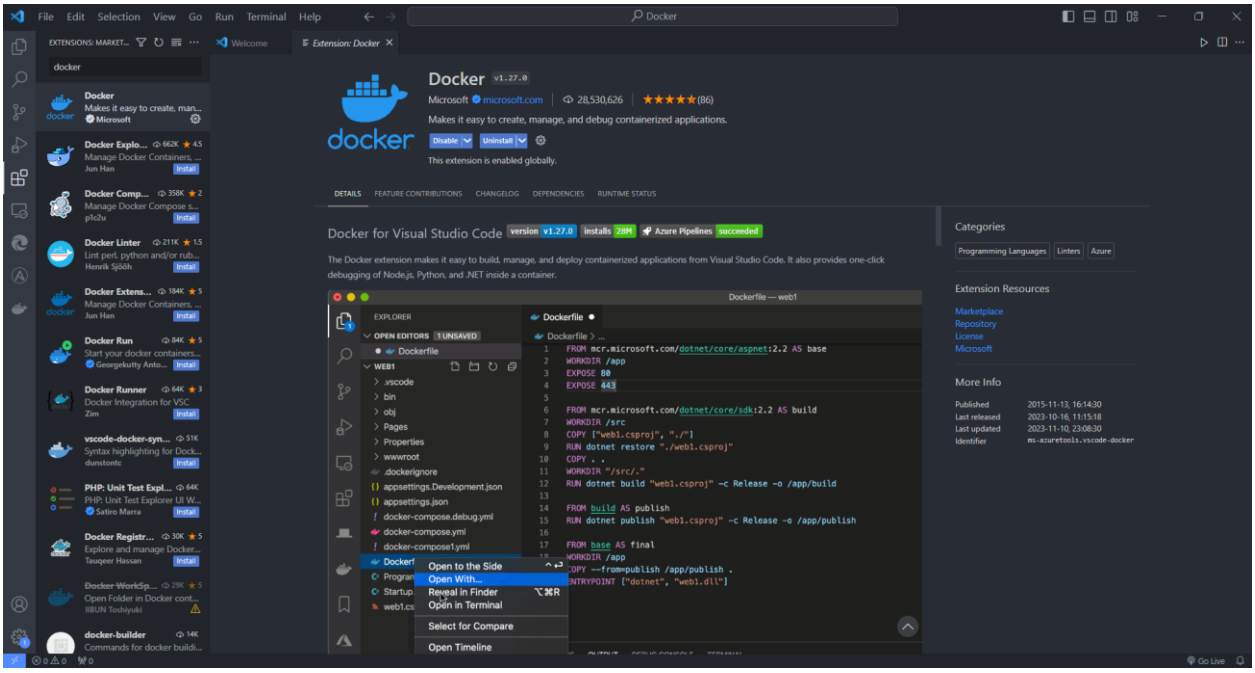


- ## Containerize the apache webserver

  In order to achieve this, I need a dockerfile to create a docker image. It will save you a lot of time to download the docker extension on Vscode.

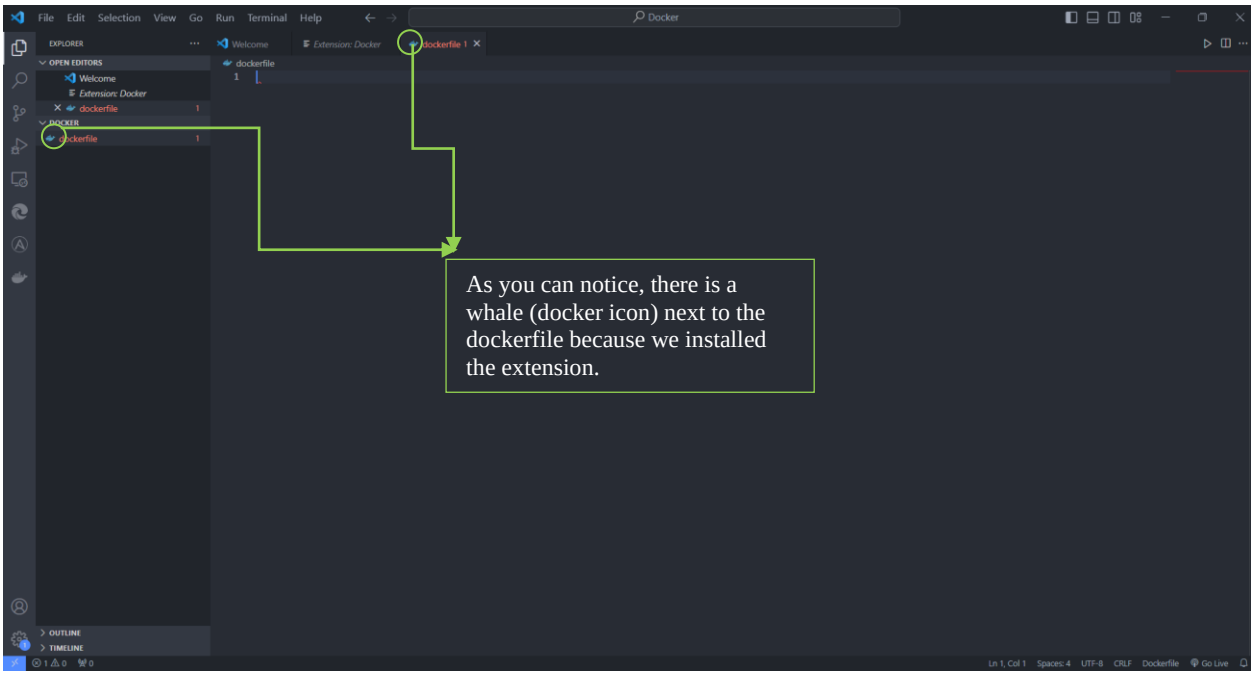
  A docker file always start with a base image (something similar to an operating system for the container. You can choose centos, linux, ubuntu, etc…)

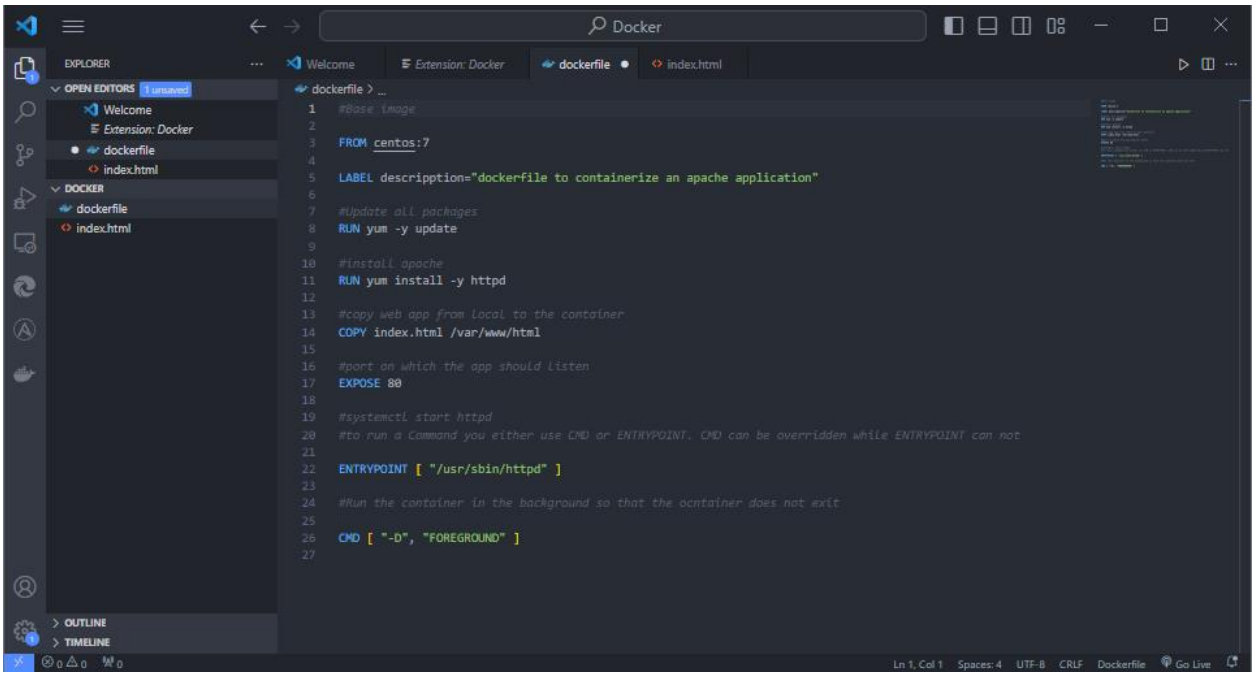
  Always reference the documentation as a guide in order not to make any mistakes.



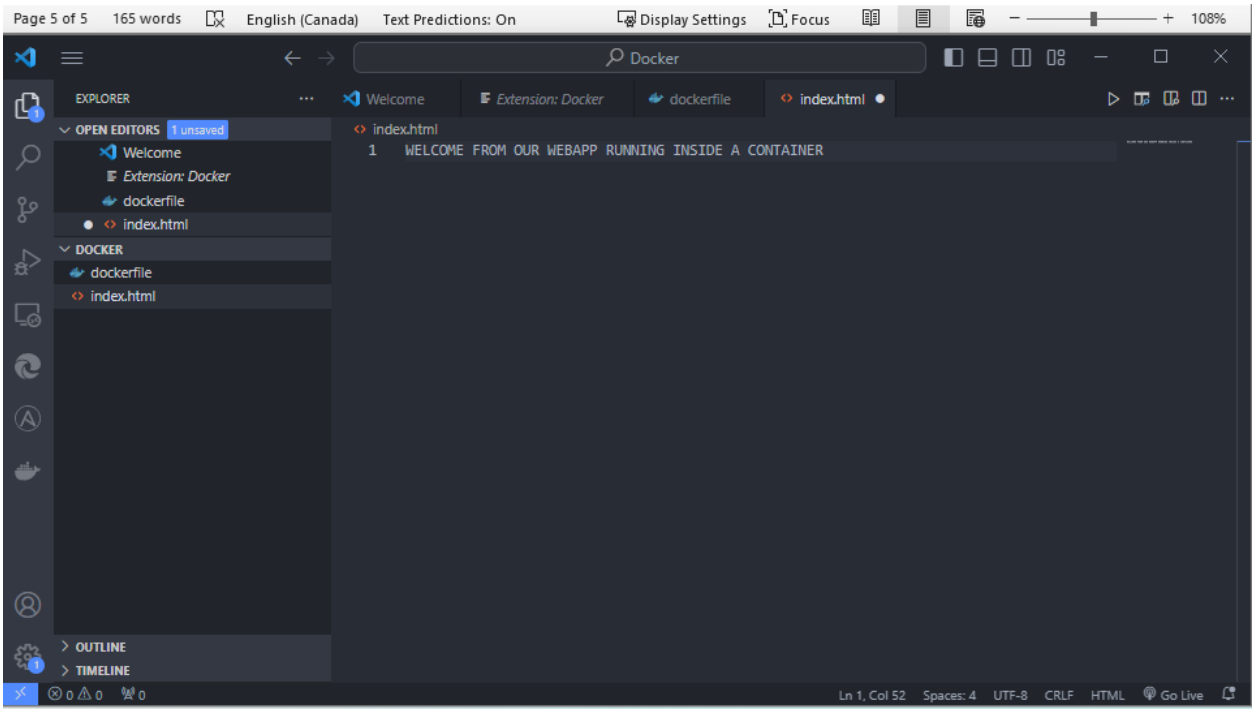
I downloaded the Docker Extension to my VsCode.

Next, I created a dockerfile…





Since we referenced the index.html file in the dockerfile, we need to create an index.html file in the same folder as the dockerfile.



- ## Building and uploading image to dockerhub repository

  To achieve this, we need to use an ec2, install docker in it, run the centos image (base image) and build the apache image on it.

  - Installing docker on linux instance:

  In order to achieve this, I referenced the Amazon documentation to install docker docker. Note that Amazon Linux instance is Fedora operating system based. Hence, we will use the documentation for fedora.
  Documentation reference: https://docs.aws.amazon.com/serverless-application-model/latest/developerguide/install-docker.html

Session ID: admin-008b72aee75030f12 Instance ID: i-00455a6458fff6f6d **Terminate**

```
sh-5.2$ sudo yum update -y
Last metadata expiration check: 0:04:09 ago on Sat Nov 11 17:15:20 2023.
Dependencies resolved.
Nothing to do.
Complete!
sh-5.2$ sudo amazon-linux-extras install docker
sudo: amazon-linux-extras: command not found
sh-5.2$ sudo yum install -y docker
Last metadata expiration check: 0:04:35 ago on Sat Nov 11 17:15:20 2023.
Dependencies resolved.
================================================================================
 Package                    Architecture Version                      Repository        Size
================================================================================
Installing:
 docker                     x86_64       24.0.5-1.amzn2023.0.2        amazonlinux       42 M
Installing dependencies:
 containerd                 x86_64       1.7.2-1.amzn2023.0.4         amazonlinux       34 M
 iptables-libs              x86_64       1.8.8-3.amzn2023.0.2         amazonlinux      401 k
 iptables-nft               x86_64       1.8.8-3.amzn2023.0.2         amazonlinux      183 k
 libcgroup                  x86_64       3.0-1.amzn2023.0.1           amazonlinux       75 k
 libnetfilter_conntrack     x86_64       1.0.8-2.amzn2023.0.2         amazonlinux       58 k
 libnfnetlink               x86_64       1.0.1-19.amzn2023.0.2        amazonlinux       30 k
 libnftnl                   x86_64       1.2.2-2.amzn2023.0.2         amazonlinux       84 k
 pigz                       x86_64       2.5-1.amzn2023.0.3           amazonlinux       83 k
 runc                       x86_64       1.1.7-1.amzn2023.0.3         amazonlinux      3.0 M

Transaction Summary
================================================================================
Install  10 Packages

Total download size: 80 M
Installed size: 306 M
Downloading Packages:
(1/10): iptables-libs-1.8.8-3.amzn2023.0.2.x86_64.rpm          5.2 MB/s | 401 kB     00:00
(2/10): runc-1.1.7-1.amzn2023.0.3.x86_64.rpm                    28 MB/s | 3.0 MB     00:00
(3/10): pigz-2.5-1.amzn2023.0.3.x86_64.rpm                     2.3 MB/s |  83 kB     00:00
(4/10): libnftnl-1.2.2-2.amzn2023.0.2.x86_64.rpm               720 kB/s |  84 kB     00:00
(5/10): libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64.rpm          1.9 MB/s |  30 kB     00:00
(6/10): libcgroup-3.0-1.amzn2023.0.1.x86_64.rpm                1.4 MB/s |  75 kB     00:00
(7/10): libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64.rpm 3.6 MB/s |  58 kB     00:00
(8/10): iptables-nft-1.8.8-3.amzn2023.0.2.x86_64.rpm           7.9 MB/s | 183 kB     00:00
(9/10): containerd-1.7.2-1.amzn2023.0.4.x86_64.rpm              46 MB/s |  34 MB     00:00
(10/10): docker-24.0.5-1.amzn2023.0.2.x86_64.rpm                42 MB/s |  42 MB     00:00
--------------------------------------------------------------------------------
Total                                                           68 MB/s |  80 MB     00:01
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
  Preparing        :                                                            1/1
```

We need to start docker after installing docker in the instance:

Session ID: admin-008b72aee75030f12 Instance ID: i-00455a6458fff6f6d Terminate

```
(7/10): libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64.rpm    3.6 MB/s |  58 kB     00:00
(8/10): iptables-nft-1.8.8-3.amzn2023.0.2.x86_64.rpm              7.9 MB/s | 183 kB     00:00
(9/10): containerd-1.7.2-1.amzn2023.0.4.x86_64.rpm                 46 MB/s |  34 MB     00:00
(10/10): docker-24.0.5-1.amzn2023.0.2.x86_64.rpm                   42 MB/s |  42 MB     00:00
--------------------------------------------------------------------------------------------------
Total                                                              68 MB/s |  80 MB     00:01
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
  Preparing        :                                                                          1/1
  Installing       : runc-1.1.7-1.amzn2023.0.3.x86_64                                        1/10
  Installing       : containerd-1.7.2-1.amzn2023.0.4.x86_64                                  2/10
  Running scriptlet: containerd-1.7.2-1.amzn2023.0.4.x86_64                                  2/10
  Installing       : libcgroup-3.0-1.amzn2023.0.1.x86_64                                     3/10
  Installing       : libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64                               4/10
  Installing       : libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64                      5/10
  Installing       : iptables-libs-1.8.8-3.amzn2023.0.2.x86_64                               6/10
  Installing       : pigz-2.5-1.amzn2023.0.3.x86_64                                          7/10
  Installing       : libnftnl-1.2.2-2.amzn2023.0.2.x86_64                                    8/10
  Installing       : iptables-nft-1.8.8-3.amzn2023.0.2.x86_64                                9/10
  Running scriptlet: iptables-nft-1.8.8-3.amzn2023.0.2.x86_64                                9/10
  Running scriptlet: docker-24.0.5-1.amzn2023.0.2.x86_64                                     10/10
  Installing       : docker-24.0.5-1.amzn2023.0.2.x86_64                                     10/10
  Running scriptlet: docker-24.0.5-1.amzn2023.0.2.x86_64                                     10/10
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /usr/lib/systemd/system/d
ocker.socket.

  Verifying        : libnftnl-1.2.2-2.amzn2023.0.2.x86_64                                    1/10
  Verifying        : iptables-libs-1.8.8-3.amzn2023.0.2.x86_64                               2/10
  Verifying        : runc-1.1.7-1.amzn2023.0.3.x86_64                                        3/10
  Verifying        : pigz-2.5-1.amzn2023.0.3.x86_64                                          4/10
  Verifying        : libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64                               5/10
  Verifying        : libcgroup-3.0-1.amzn2023.0.1.x86_64                                     6/10
  Verifying        : docker-24.0.5-1.amzn2023.0.2.x86_64                                     7/10
  Verifying        : containerd-1.7.2-1.amzn2023.0.4.x86_64                                  8/10
  Verifying        : libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64                      9/10
  Verifying        : iptables-nft-1.8.8-3.amzn2023.0.2.x86_64                               10/10

Installed:
  containerd-1.7.2-1.amzn2023.0.4.x86_64      docker-24.0.5-1.amzn2023.0.2.x86_64
  iptables-libs-1.8.8-3.amzn2023.0.2.x86_64   iptables-nft-1.8.8-3.amzn2023.0.2.x86_64
  libcgroup-3.0-1.amzn2023.0.1.x86_64         libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64
  libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64   libnftnl-1.2.2-2.amzn2023.0.2.x86_64
  pigz-2.5-1.amzn2023.0.3.x86_64              runc-1.1.7-1.amzn2023.0.3.x86_64

Complete!
sh-5.2$ sudo service docker start
Redirecting to /bin/systemctl start docker.service
sh-5.2$
```

We also have to add the ec2-user in the permission group. After we do this, we need to exit the instance and re-login to make the changes to wor

```
sh-5.2$ sudo usermod -a -G docker ec2-user
sh-5.2$
```

- Saving the dockerfile and the index file in the instance:

To generate an image using the dockerfile, e need to have them saved locally in the instance.

We use the command “vim dockerfile” to create a dockerfile and then paste the dockerfile script and save. We have to do the same for the index file.

Session ID: admin-0498d7ff26744b469 Instance ID: i-00455a6458fff6f6d Terminate

```
#Base image

FROM centos:7

LABEL description="dockerfile to containerize an apache application"

#Update all packages
RUN yum -y update

#install apache
RUN yum install -y httpd

#copy web app from local to the container
COPY index.html /var/www/html

#port on which the app should listen
EXPOSE 80

#systemctl start httpd
#to run a Command you either use CMD or ENTRYPOINT. CMD can be overridden while ENTRYPOINT can not

ENTRYPOINT [ "/usr/sbin/httpd" ]

#Run the container in the background so that the ocntainer does not exit

CMD [ "-D", "FOREGROUND" ]
~
~
~
```

We also need to create and save the index file in the instance;

```
sh-5.2$ sudo su - ec2-user
Last login: Sat Nov 11 17:26:46 UTC 2023 on pts/0
[ec2-user@ip-10-0-3-121 ~]$ ls -l
total 0
[ec2-user@ip-10-0-3-121 ~]$ vim dockerfile
[ec2-user@ip-10-0-3-121 ~]$ vim index.html
[ec2-user@ip-10-0-3-121 ~]$
```

Session ID: admin-069df29cf92fa5e95 Instance ID: i-00455a6458fff6f6d Terminate

```
[ec2-user@ip-10-0-3-121 bin]$ docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
[ec2-user@ip-10-0-3-121 bin]$
```

- Next, we need to build the image using the dockerfile and the index file.

We use the command: “docker build -t apacheimage:v1 .” where the “apacheimage” is the name of the docker image we want to build while “v1” is a tag. The “.” Signifies the location where the dockerfile is saved in the local computer. Alternatively if the dockerfile was located in another location, you need to state the path of the directory where the docker file is saved.

```
[ec2-user@ip-10-0-9-10 ~]$ docker build --ulimit nofile=1024 -t apacheimage:v1 .
[+] Building 39.2s (9/9) FINISHED                                                                                    docker:default
 => [internal] load build definition from dockerfile                                                                          0.0s
 => => transferring dockerfile: 656B                                                                                          0.0s
 => [internal] load .dockerignore                                                                                             0.0s
 => => transferring context: 2B                                                                                               0.0s
 => [internal] load metadata for docker.io/library/centos:7                                                                   0.1s
 => CACHED [1/4] FROM docker.io/library/centos:7@sha256:be65f488b7764ad3638f236b7b515b3678369a5124c47b8d32916d6487418ea4       0.0s
 => [internal] load build context                                                                                             0.0s
 => => transferring context: 86B                                                                                              0.0s
 => [2/4] RUN yum -y update                                                                                                  26.5s
 => [3/4] RUN yum install -y httpd                                                                                            5.0s
 => [4/4] COPY index.html /var/www/html                                                                                       0.1s
 => exporting to image                                                                                                        7.3s
 => => exporting layers                                                                                                       7.3s
 => => writing image sha256:8c3323a18bb20931a1d6c867e91df893122df3de337fad3fb7113828f0ff0cc9                                  0.0s
 => => naming to docker.io/library/apacheimage:v1                                                                             0.0s
[ec2-user@ip-10-0-9-10 ~]$
```

Note: My build process was taking too long so I used an additional command to execute the build process faster. The command is; “docker build –ulimit nofile=1024 -t apacheimage:v1 .” and everything ran smoothly and faster.

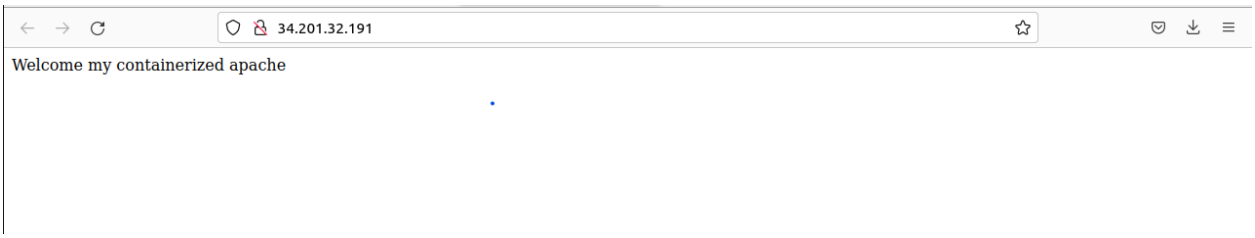
To verify that the image was built, I used the “docker images” command

```
[ec2-user@ip-10-0-9-10 ~]$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED          SIZE
apacheimage   v1        8c3323a18bb2   5 minutes ago    802MB
ubuntu        latest    e4c58958181a   7 weeks ago      77.8MB
hello-world   latest    9c7a54a9a43c   6 months ago     13.3kB
ubuntu        16.04     b6f507652425   2 years ago      135MB
[ec2-user@ip-10-0-9-10 ~]$
```

To run the image, I used the command “docker run -t -d -p 80:80 apacheimage:v1” . The “-d” will allow the apache run in the background

```
[ec2-user@ip-10-0-9-10 ~]$ docker run -t -d -p 80:80 apacheimage:v1
54c030f28a8054a31ecb6b9b9f1231301396c26aa698b91bc862c4bec2c1c2f9
[ec2-user@ip-10-0-9-10 ~]$ docker ps
CONTAINER ID   IMAGE            COMMAND                  CREATED         STATUS         PORTS                                   NAMES
54c030f28a80   apacheimage:v1   "/usr/sbin/httpd -D …"   6 seconds ago   Up 5 seconds   0.0.0.0:80->80/tcp, :::80->80/tcp   zealous_newton
[ec2-user@ip-10-0-9-10 ~]$
```

To verify that the image is running, I’ll try to access the public IP of the instance used in creating the image.



It works! :)

- ## Uploading image to dockerhub repository

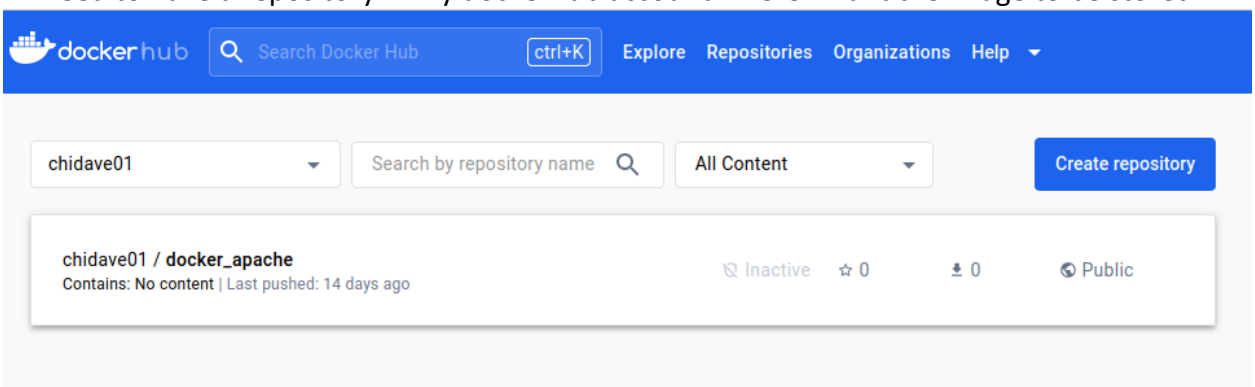
```
[ec2-user@ip-10-0-9-10 ~]$ docker login
Login with your Docker ID to push and pull images from Docker Hub. If you don't have a Docker ID, head over to https://hub.docker.com to cr
eate one.
Username: chidave01
Password:
WARNING! Your password will be stored unencrypted in /home/ec2-user/.docker/config.json.
Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
[ec2-user@ip-10-0-9-10 ~]$
```

First, I need to login to docker hub using the “docker login” command

Next, I’ll reference the docker documentation to guide me to tag the image properly for docker upload.

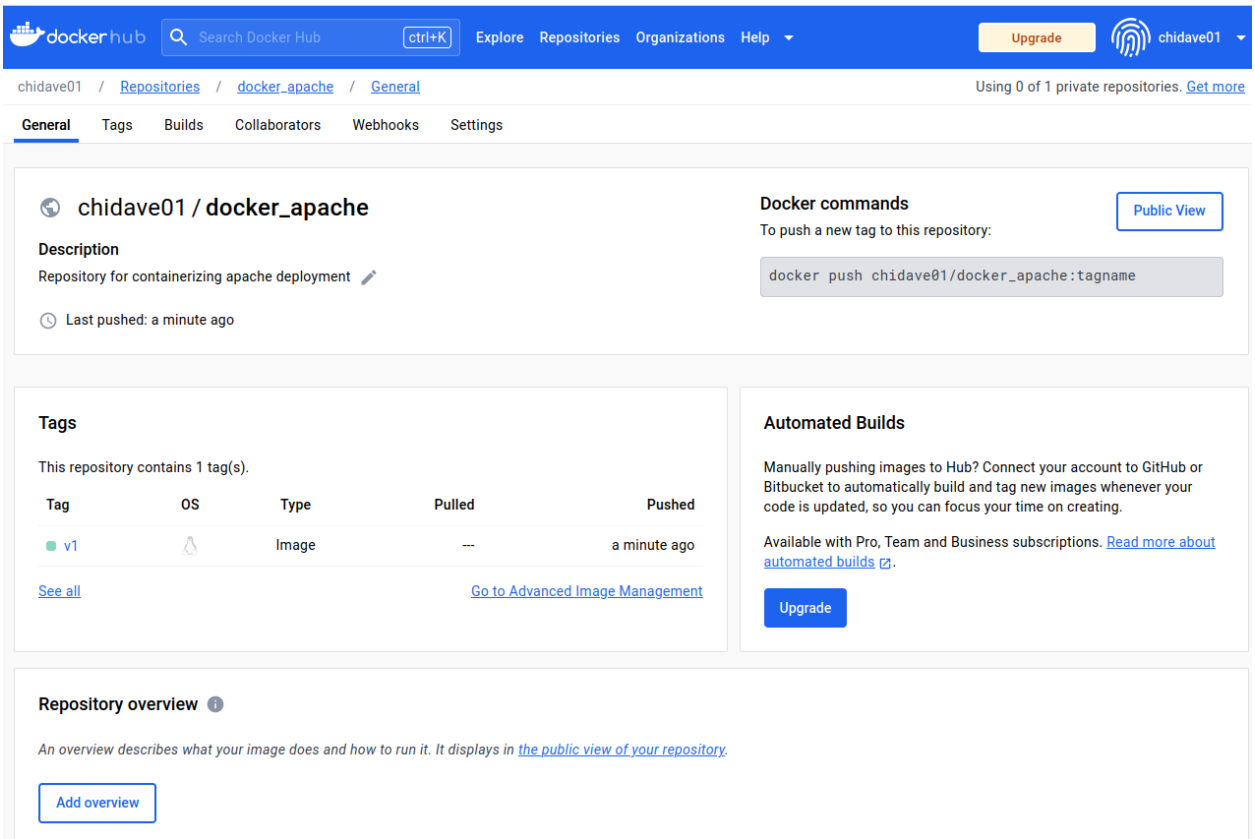
I’ll need to have a repository in my dockerhub account where I want the image to be stored in.



I will be using the docker_apache repository in my dockerhub account.

Next, I need to tag the image using the “docker tag” command. And push to my dockerhub repository.

```
[ec2-user@ip-10-0-9-10 ~]$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED          SIZE
apacheimage   v1        8c3323a18bb2   41 minutes ago   802MB
ubuntu        latest    e4c58958181a   7 weeks ago      77.8MB
hello-world   latest    9c7a54a9a43c   6 months ago     13.3kB
ubuntu        16.04     b6f507652425   2 years ago      135MB
[ec2-user@ip-10-0-9-10 ~]$ docker tag 8c3323a18bb2 chidave01/docker_apache:v1
[ec2-user@ip-10-0-9-10 ~]$ docker push chidave01/docker_apache:v1
The push refers to repository [docker.io/chidave01/docker_apache]
2868607cc1cf: Pushed
bcaad06ea8e7: Pushed
f10028744f66: Pushed
174f56854903: Pushed
v1: digest: sha256:ceb35cffb1a88f4abe50a849174d48ced19350953b12f31e97dd109a72631898 size: 1161
[ec2-user@ip-10-0-9-10 ~]$
```



Successfully pushed to the docker hub repo.

Note: If you don't have a repo on your dockerhub and you push, dockerhub will create a repo automatically for you.