Docker Lab Exercises

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Exercise 1: Getting Started with Containers

docker run hello-world

```
PS M:\Mohit\Docker Assignment> docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
17eec7bbc9d7: Pull complete
Digest: sha256:a0dfb02aac212703bfcb339d77d47ec32c8706ff250850ecc0e19c8737b18567
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
    (amd64)
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
    to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
 $ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
 https://hub.docker.com/

For more examples and ideas, visit:
 https://docs.docker.com/get-started/
```

docker run -d -p 8080:80 nginx

```
PS M:\Mohit\Docker Assignment> docker run -d -p 8080:80 nginx
2924c96db170663b1f6bbe40e6e8d26a66f2d536e6e64edeae539e1f275b4654
PS M:\Mohit\Docker Assignment> |
```

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.

docker run -it alpine sh

```
PS M:\Mohit\Docker Assignment> docker run -it alpine sh
/ # whoami
root
/ # exit
PS M:\Mohit\Docker Assignment>
```

docker ps

```
PS M:\Mohit\Docker Assignment> docker ps
CONTAINER ID   IMAGE     COMMAND               CREATED         STATUS          PORTS                    NAMES
e0d7a8a1f950   nginx     "/docker-entrypoint.…"  3 minutes ago   Up 3 minutes    0.0.0.0:8080->80/tcp     reverent_galileo
PS M:\Mohit\Docker Assignment>
```

docker ps -a

```
PS M:\Mohit\Docker Assignment> docker ps -a
CONTAINER ID   IMAGE              COMMAND               CREATED         STATUS                     PORTS                    NAMES
48c492cb4fcc   alpine             "sh"                  4 minutes ago   Exited (0) 3 minutes ago                            infallible_bhabha
e0d7a8a1f950   nginx              "/docker-entrypoint.…"  6 minutes ago   Up 5 minutes               0.0.0.0:8080->80/tcp     reverent_galileo
c71aa8faae4c   alpine             "sh"                  9 minutes ago   Exited (127) 6 minutes ago                          wizardly_elion
7f5f69d01a59   alpine             "sh"                  25 hours ago    Exited (255) 13 minutes ago                         priceless_roentgen
2924c96db170   nginx              "/docker-entrypoint.…"  25 hours ago    Exited (0) 19 hours ago                             compassionate_kirch
8860d009ccbf   nginx              "/docker-entrypoint.…"  26 hours ago    Created                                             relaxed_shaw
caba9f26d2f5   nginx              "/docker-entrypoint.…"  26 hours ago    Exited (0) 25 hours ago                             exciting_tu
52031259ee99   hello-world        "/hello"              26 hours ago    Exited (0) 26 hours ago                             condescending_diffie
cba859851c38   hello-world        "/hello"              26 hours ago    Exited (0) 26 hours ago                             competent_banzai
29613959f5ef   n8nio/n8n:latest   "tini -- /docker-ent…"  3 months ago    Exited (0) 3 months ago                             romantic_edison
94a4c432f9f3   n8nio/n8n          "tini -- /docker-ent…"  3 months ago    Exited (0) 3 months ago                             n8n-docker-n8n-1
1900725da09d   n8nio/n8n:latest   "tini -- /docker-ent…"  3 months ago    Exited (0) 3 months ago                             gallant_brown
fa50ea1a9d9b   n8nio/n8n:latest   "tini -- /docker-ent…"  3 months ago    Exited (143) 3 months ago                           flamboyant_wright
3a6e9d705c6b   n8nio/n8n:latest   "tini -- /docker-ent…"  3 months ago    Exited (0) 3 months ago                             intelligent_shtern
PS M:\Mohit\Docker Assignment>
```

docker run --rm alpine echo "Temporary container"

```
PS M:\Mohit\Docker Assignment> docker run --rm alpine echo "Temporary container"
Temporary container
```

docker run -d nginx

```
PS M:\Mohit\Docker Assignment> docker run -d nginx
57f151b3ee59d2109ba259b471450be1179c70bee90a8b5e3fdef6cd76d6f890
PS M:\Mohit\Docker Assignment>
```

docker exec 57f151b3ee59 ps aux

```
PS M:\Mohit\Docker Assignment> docker exec 57f151b3ee59 ps aux
USER       PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root         1  0.0  0.2  11472  7424 ?        Ss   12:02   0:00 nginx: master process nginx -g daemon off;
nginx       29  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       30  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       31  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       32  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       33  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       34  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       35  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       36  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       37  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       38  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       39  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
nginx       40  0.0  0.1  11936  3176 ?        S    12:02   0:00 nginx: worker process
root       243 60.0  0.1   8104  4224 ?        Rs   12:22   0:00 ps aux
```

docker logs 8f8d8a4b3c2d

```
PS M:\Mohit\Docker Assignment> docker logs 57f151b3ee59
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/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.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
2025/08/24 12:03:57 [notice] 1#1: using the "epoll" event method
2025/08/24 12:03:57 [notice] 1#1: nginx/1.29.1
2025/08/24 12:03:57 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14+deb12u1)
2025/08/24 12:03:57 [notice] 1#1: OS: Linux 6.6.87.2-microsoft-standard-WSL2
2025/08/24 12:03:57 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2025/08/24 12:03:57 [notice] 1#1: start worker processes
2025/08/24 12:03:57 [notice] 1#1: start worker process 29
2025/08/24 12:03:57 [notice] 1#1: start worker process 30
2025/08/24 12:03:57 [notice] 1#1: start worker process 31
2025/08/24 12:03:57 [notice] 1#1: start worker process 32
2025/08/24 12:03:57 [notice] 1#1: start worker process 33
2025/08/24 12:03:57 [notice] 1#1: start worker process 34
2025/08/24 12:03:57 [notice] 1#1: start worker process 35
2025/08/24 12:03:57 [notice] 1#1: start worker process 36
2025/08/24 12:03:57 [notice] 1#1: start worker process 37
2025/08/24 12:03:57 [notice] 1#1: start worker process 38
2025/08/24 12:03:57 [notice] 1#1: start worker process 39
2025/08/24 12:03:57 [notice] 1#1: start worker process 40
PS M:\Mohit\Docker Assignment>
```

Checkpoint:

What happens if a container doesn't run in detached mode? What if ports aren't mapped?

Without the -d flag, the container runs in the foreground, and it attach the terminal to the container's process. This means we can' use the terminal for other command, we need to stop it first.

If the ports aren't mapped, the container's services are only accessible within the container or Docker network, not from the host or external network.

Exercise 2: Working with Container State

docker run -it ubuntu bash

```
PS M:\Mohit\Docker Assignment> docker run -it ubuntu bash
Unable to find image 'ubuntu:latest' locally
latest: Pulling from library/ubuntu
b71466b94f26: Pull complete
Digest: sha256:7c06e91f61fa88c08cc74f7e1b7c69ae24910d745357e0dfe1d2c0322aaf20f9
Status: Downloaded newer image for ubuntu:latest
root@ff9383c364b1:/#
```

apt-get install -y curl vim

```
root@ff9383c364b1:/# apt-get install -y curl vim
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  ca-certificates krb5-locales libbrotli1 libcurl4t64 libexpat1 libgpm2 libgssapi-krb5-2 libk5crypto3 libkeyutils1 libkrb5-3 libkrb5support0
  libldap-common libldap2 libnghttp2-14 libpsl5t64 libpython3.12-minimal libpython3.12-stdlib libpython3.12t64 libreadline8t64 librtmp1 libsasl2
-2
  libsasl2-modules libsasl2-modules-db libsodium23 libsqlite3-0 libssh-4 media-types netbase openssl publicsuffix readline-common tzdata vim-com
mon
  vim-runtime xxd
Suggested packages:
  gpm krb5-doc krb5-user libsasl2-modules-gssapi-mit | libsasl2-modules-gssapi-heimdal libsasl2-modules-ldap libsasl2-modules-otp libsasl2-modul
es-sql
  readline-doc ctags vim-doc vim-scripts
The following NEW packages will be installed:
  ca-certificates curl krb5-locales libbrotli1 libcurl4t64 libexpat1 libgpm2 libgssapi-krb5-2 libk5crypto3 libkeyutils1 libkrb5-3 libkrb5support
0
  libldap-common libldap2 libnghttp2-14 libpsl5t64 libpython3.12-minimal libpython3.12-stdlib libpython3.12t64 libreadline8t64 librtmp1 libsasl2
-2
  libsasl2-modules libsasl2-modules-db libsodium23 libsqlite3-0 libssh-4 media-types netbase openssl publicsuffix readline-common tzdata vim vim
-common
  vim-runtime xxd
0 upgraded, 37 newly installed, 0 to remove and 1 not upgraded.
Need to get 19.9 MB of archives.
```

docker commit 3a4b5c6d7e8f ubuntu-tools

```
PS M:\Mohit\Docker Assignment> docker commit ff9383c364b1 ubuntu-tools
sha256:5e78c8032b97cabfdc0c19d6bca44cd3484e97308648b3e94325432e0156bc2d
PS M:\Mohit\Docker Assignment>
```

docker images

```
PS M:\Mohit\Docker Assignment> docker images
REPOSITORY       TAG      IMAGE ID       CREATED              SIZE
ubuntu-tools     latest   5e78c8032b97   About a minute ago   323MB
nginx            latest   33e0bbc7ca9e   10 days ago          279MB
hello-world      latest   a0dfb02aac21   2 weeks ago          20.3kB
ubuntu           latest   7c06e91f61fa   3 weeks ago          117MB
alpine           latest   4bcff63911fc   5 weeks ago          12.8MB
n8nio/n8n        latest   6ea146fde4ff   3 months ago         1.2GB
PS M:\Mohit\Docker Assignment>
```
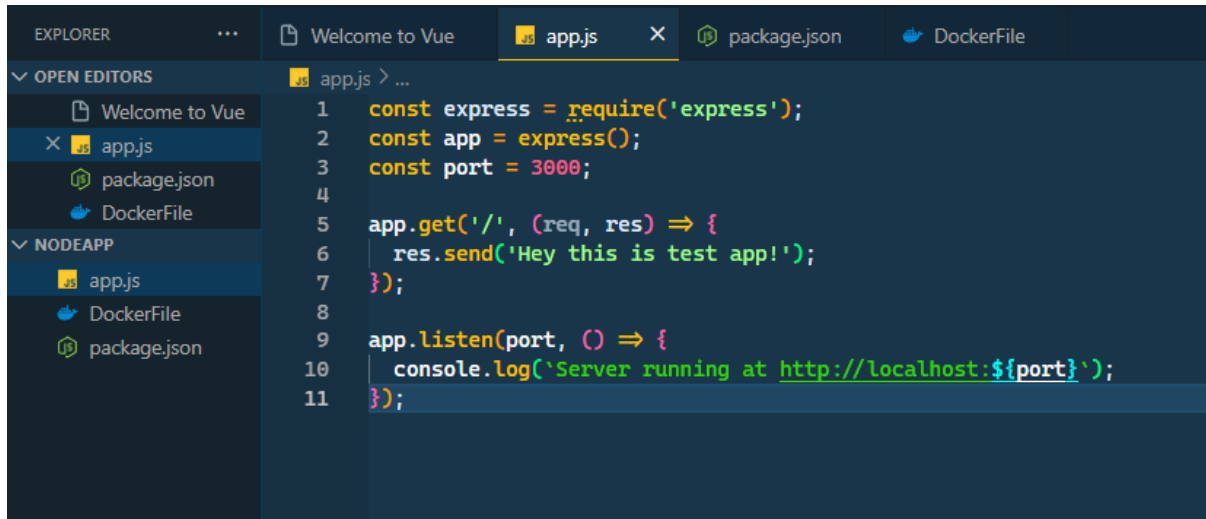
docker tag ubuntu-tools MohitNamdev22/ubuntu-tools:v1

```
PS M:\Mohit\Docker Assignment> docker tag ubuntu-tools MohitNamdev22/ubuntu-tools:v1
PS M:\Mohit\Docker Assignment> docker images
REPOSITORY                    TAG      IMAGE ID       CREATED           SIZE
MohitNamdev22/ubuntu-tools    v1       5e78c8032b97   11 minutes ago    323MB
ubuntu-tools                  latest   5e78c8032b97   11 minutes ago    323MB
nginx                         latest   33e0bbc7ca9e   10 days ago       279MB
hello-world                   latest   a0dfb02aac21   2 weeks ago       20.3kB
ubuntu                        latest   7c06e91f61fa   3 weeks ago       117MB
alpine                        latest   4bcff63911fc   5 weeks ago       12.8MB
n8nio/n8n                     latest   6ea146fde4ff   3 months ago      1.2GB
PS M:\Mohit\Docker Assignment>
```
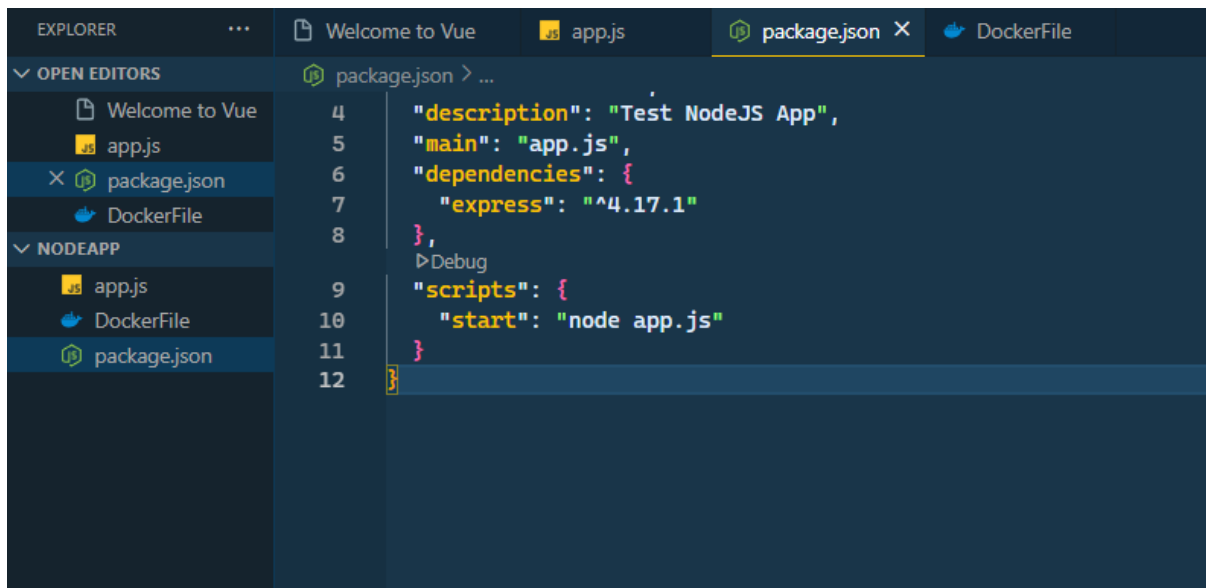
Exercise 3: Build Custom Images Using Dockerfile

Create a simple Node or Python web server.

app.js

Package.json -

Write a Dockerfile to copy the code and expose a port.

```
FROM node:18-slim

WORKDIR /app

COPY package.json .
RUN npm install

COPY . .

LABEL maintainer="namdevmohit0@gmail.com"
LABEL version="1.0"
LABEL description="Nodejs application"

EXPOSE 3000

CMD ["npm", "start"]
```
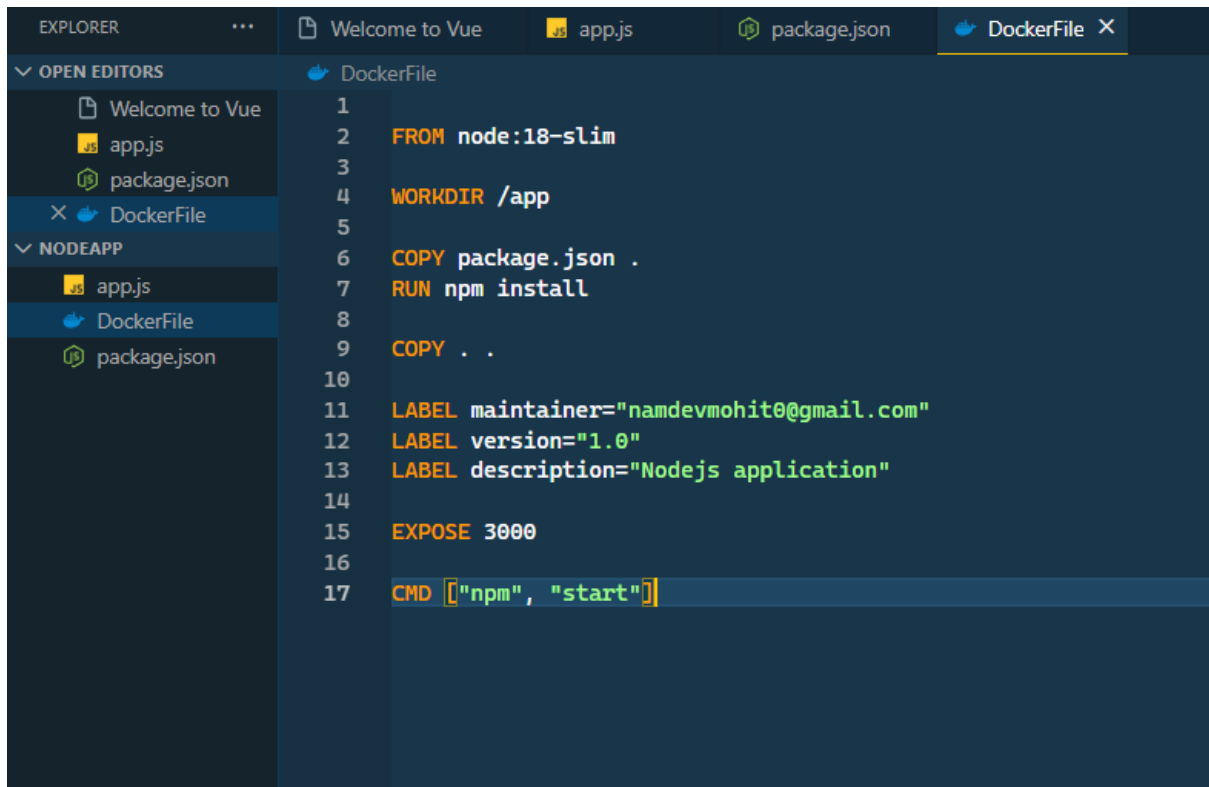
docker build -t my-node-app
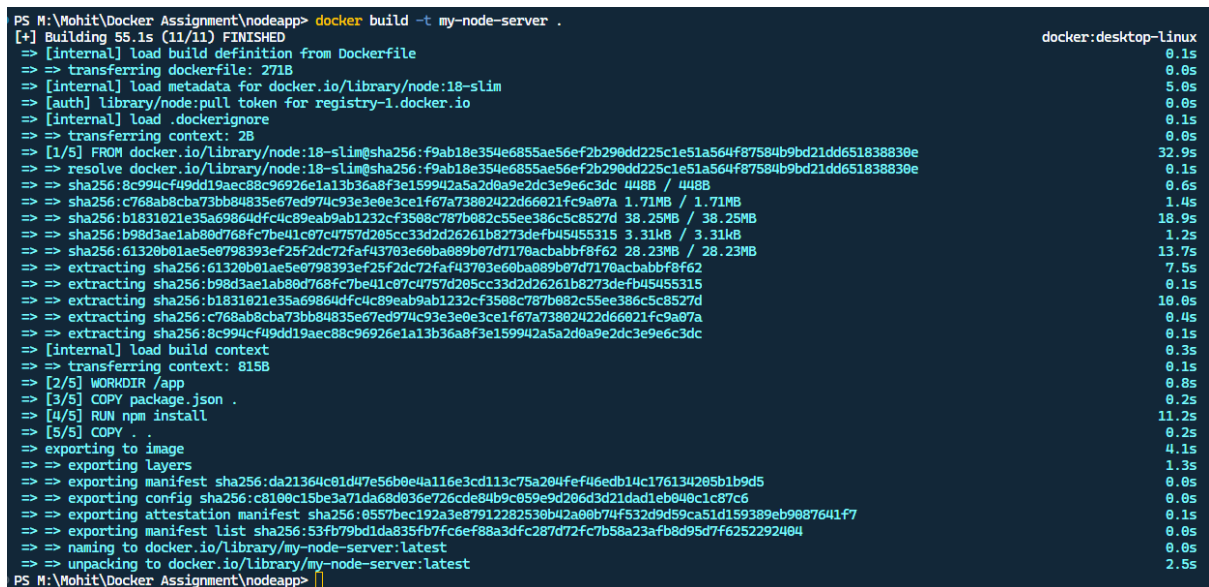
docker images

```
PS M:\Mohit\Docker Assignment> cd nodeapp
PS M:\Mohit\Docker Assignment\nodeapp> docker images
REPOSITORY                      TAG       IMAGE ID       CREATED           SIZE
my-node-server                  latest    53fb79bd1da8   2 minutes ago     294MB
ubuntu-tools                    latest    5e78c8032b97   38 minutes ago    323MB
MohitNamdev22/ubuntu-tools      v1        5e78c8032b97   38 minutes ago    323MB
nginx                           latest    33e0bbc7ca9e   10 days ago       279MB
hello-world                     latest    a0dfb02aac21   2 weeks ago       20.3kB
ubuntu                          latest    7c06e91f61fa   3 weeks ago       117MB
alpine                          latest    4bcff63911fc   5 weeks ago       12.8MB
n8nio/n8n                       latest    6ea146fde4ff   3 months ago      1.2GB
PS M:\Mohit\Docker Assignment\nodeapp>
```

docker run -d -p 3000:3000 my-node-server

```
PS M:\Mohit\Docker Assignment\nodeapp> docker run -d -p 3000:3000 my-node-server
55f270abc86f8233560248b164fc5375eb5e3be30e2190e86e77df6bc73e382e
PS M:\Mohit\Docker Assignment\nodeapp>
```

curl http://localhost:3000

```
PS M:\Mohit\Docker Assignment\nodeapp> curl http://localhost:3000

StatusCode        : 200
StatusDescription : OK
Content           : Hey this is test app!
RawContent        : HTTP/1.1 200 OK
                    Connection: keep-alive
                    Keep-Alive: timeout=5
                    Content-Length: 21
                    Content-Type: text/html; charset=utf-8
                    Date: Sun, 24 Aug 2025 13:32:26 GMT
                    ETag: W/"15-qNp9UbolR1hDa1sC75L6nf9Gpr8...
Forms             : {}
Headers           : {[Connection, keep-alive], [Keep-Alive, timeout=5], [Content-Length, 21], [Content-Type, text/html; charset=utf-8]...}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 21
```

Exercise 4: Sharing Images

docker login

```
PS M:\Mohit\Docker Assignment\nodeapp> docker login
Authenticating with existing credentials... [Username: mohitnamdev22]

 i Info → To login with a different account, run 'docker logout' followed by 'docker login'


Login Succeeded
PS M:\Mohit\Docker Assignment\nodeapp>
```

docker tag my-node-app mohitnamdev22/my-node-server:1.0

```
PS M:\Mohit\Docker Assignment\nodeapp> docker tag my-node-server MohitNamdev22/my-node-server:1.0
PS M:\Mohit\Docker Assignment\nodeapp> docker images
REPOSITORY                    TAG       IMAGE ID       CREATED          SIZE
MohitNamdev22/my-node-server  1.0       53fb79bd1da8   13 minutes ago   294MB
my-node-server                latest    53fb79bd1da8   13 minutes ago   294MB
MohitNamdev22/ubuntu-tools    v1        5e78c8032b97   49 minutes ago   323MB
ubuntu-tools                  latest    5e78c8032b97   49 minutes ago   323MB
nginx                         latest    33e0bbc7ca9e   10 days ago      279MB
hello-world                   latest    a0dfb02aac21   2 weeks ago      20.3kB
ubuntu                        latest    7c06e91f61fa   3 weeks ago      117MB
alpine                        latest    4bcff63911fc   5 weeks ago      12.8MB
n8nio/n8n                     latest    6ea146fde4ff   3 months ago     1.2GB
PS M:\Mohit\Docker Assignment\nodeapp>
```

docker push mohitnamdev22/my-node-server:1.0

```
PS M:\Mohit\Docker Assignment\nodeapp> docker push mohitnamdev22/my-node-server:1.0
The push refers to repository [docker.io/mohitnamdev22/my-node-server]
c768ab8cba73: Pushed
61320b01ae5e: Pushed
8c20b55305c9: Pushed
8c994cf49dd1: Pushed
651252ca88a9: Pushed
b5000bfb5a83: Pushed
b98d3ae1ab80: Pushed
9bf54f1c2779: Pushed
b1831021e35a: Pushed
ce09e6bd4569: Pushed
1.0: digest: sha256:53fb79bd1da835fb7fc6ef88a3dfc287d72fc7b58a23afb8d95d7f6252292404 size: 856
PS M:\Mohit\Docker Assignment\nodeapp>
```

docker pull mohitnamdev22/my-node-server:1.0

```
PS M:\Mohit\Docker Assignment\nodeapp> docker pull mohitnamdev22/my-node-server:1.0
1.0: Pulling from mohitnamdev22/my-node-server
Digest: sha256:53fb79bd1da835fb7fc6ef88a3dfc287d72fc7b58a23afb8d95d7f6252292404
Status: Downloaded newer image for mohitnamdev22/my-node-server:1.0
docker.io/mohitnamdev22/my-node-server:1.0
PS M:\Mohit\Docker Assignment\nodeapp>
```

Reflection:

Why is image tagging important, and what sort of tagging strategy can we use?

Tagging ensure that images are unique versioned, and thus prevent confusion while sharing or deploying. We can create different versions (1.0, 2.0) and also environments (prod, dev) making it easier to manage updates and rollbacks.

Tagging strategy:

Versioning: Use semantic versioning (e.g., v1.0.0) for releases to track changes clearly.

Environment-specific tags: Tag images with environment names (e.g., myapp:prod, myapp:dev) for deployment clarity.

Latest tag caution: Avoid over-relying on latest as it can cause ambiguity; always push specific version tags.

Build identifiers: Include build numbers or commit hashes (e.g., myapp:1.0.0-abc123) for traceability in CI/CD pipelines.

Exercise 5: Data Persistence with Volumes

docker volume create mydata

```
PS M:\Mohit\Docker Assignment\nodeapp> docker volume create mydata
mydata
PS M:\Mohit\Docker Assignment\nodeapp>
```

docker run -v mydata:/data -it busybox sh

```
PS M:\Mohit\Docker Assignment\nodeapp> docker run -v mydata:/data -it busybox sh
Unable to find image 'busybox:latest' locally
latest: Pulling from library/busybox
80bfbb8a41a2: Pull complete
Digest: sha256:ab33eacc8251e3807b85bb6dba570e4698c3998eca6f0fc2ccb60575a563ea74
Status: Downloaded newer image for busybox:latest
/ #
```

echo "Persistent data" > /data/sample.txt

cat /data/sample.txt

```
/ # echo "Persistent data" > /data/sample.txt
/ # cat /data/sample.txt
Persistent data
/ # exit
PS M:\Mohit\Docker Assignment\nodeapp>
```

docker rm $(docker ps -a -q -f ancestor=busybox)

```
PS M:\Mohit\Docker Assignment\nodeapp> docker rm $(docker ps -a -q -f ancestor=busybox)
f8c4b08ee659
PS M:\Mohit\Docker Assignment\nodeapp>
```

docker run -v mydata:/data -it busybox sh

```
PS M:\Mohit\Docker Assignment\nodeapp> docker run -v mydata:/data -it busybox sh
/ # cat /data/sample.txt
Persistent data
/ # exit
PS M:\Mohit\Docker Assignment\nodeapp>
```

docker run -v "C:\Users\namde\data:/data" -it busybox sh

```
PS M:\Mohit\Docker Assignment\nodeapp\data> docker run -v "C:\Users\namde\data:/data" -it busybox sh
/ # cat /data/bind.txt
♦♦Bind mount data
/ # exit
PS M:\Mohit\Docker Assignment\nodeapp\data>
```

Compare:

Named volume vs bind mount. Pros/cons?

- **Named Volume**: Managed by Docker, stored in Docker's storage directory. Ideal for persisting data across containers when you don't need direct host access.
  Pros: Easy to manage, portable across hosts via Docker tools.
  Cons: Less transparent as data isn't directly accessible on the host filesystem without Docker commands.

- **Bind Mount**: Maps a specific host directory to a container path, giving direct access to host files. Best for development or when you need to edit files directly on the host.
  Pros: Full control over data location, easy to access or to edit.
  Cons: Less portable, requires host path management, potential security risks if sensitive directories are exposed.

Exercise 6: Container Networking Basics

docker network create my-network

```
PS M:\Mohit\Docker Assignment\nodeapp\data> docker network create my-network
6c5e925bfc5f276dec1004ad64c1978d8f87c1affe73ddf2550c7a6e0085c554
PS M:\Mohit\Docker Assignment\nodeapp\data>
```

docker run -d --name nginx-server --network my-network nginx

```
PS M:\Mohit\Docker Assignment\nodeapp\data> docker run -d --name nginx-server --network my-network nginx
c9d81cf1ac9f472ae58852a98ee77925a4d8b8d62c96d8426c5dcad91d665fef
PS M:\Mohit\Docker Assignment\nodeapp\data>
```

docker run -it --name busybox-client --network my-network busybox sh

wget -q -O - http://nginx-server

```
PS M:\Mohit\Docker Assignment\nodeapp\data> docker run -it --name busybox-client --network my-network busybox sh
/ # wget -q -O - http://nginx-server
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
html { color-scheme: light dark; }
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial, sans-serif; }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<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
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>

<p><em>Thank you for using nginx.</em></p>
</body>
</html>
/ #
```

docker inspect nginx-server | Select-String -Pattern "IPAddress"

```
PS M:\Mohit\Docker Assignment\nodeapp\data> docker inspect nginx-server | Select-String -Pattern "IPAddress"
        "SecondaryIPAddresses": null,
        "IPAddress": "",
            "IPAddress": "172.19.0.2",

PS M:\Mohit\Docker Assignment\nodeapp\data>
```

docker inspect busybox-client | Select-String -Pattern "IPAddress"

```
PS M:\Mohit\Docker Assignment\nodeapp\data> docker inspect busybox-client | Select-String -Pattern "IPAddress"

          "SecondaryIPAddresses": null,
          "IPAddress": "",
                "IPAddress": "",

PS M:\Mohit\Docker Assignment\nodeapp\data>
```

docker run -d --name nginx-default nginx

```
PS M:\Mohit\Docker Assignment\nodeapp\data> docker run -d --name nginx-default nginx
153f95b79053b7ab56412307c51a374a11c1e4adee86b60b25b4340f1e3816a6
PS M:\Mohit\Docker Assignment\nodeapp\data>
```

View IPs with docker inspect. Try without a custom network—what's different?

With Custom Network: Containers on a user-defined bridge network can communicate using container names ie nginx-server due to Docker's built-in DNS resolution. IPs are assigned from the network's subnet, and communication is isolated from other networks.

Without Custom Network: On the default bridge network, containers don't have DNS resolution for container names, requiring IP addresses for communication. This is less convenient and requires manual IP lookup via docker inspect. So it is limiting inter-container communication unless ports are explicitly linked.

Exercise 7: Building a Two-Tier App

docker network create app-network

```
PS M:\Mohit\Docker Assignment\two-tier-app> docker network create app-network
8ecd8c72b1e0913885938d48fdaee4759dd99854dff604587e22b8005e4e14e5
PS M:\Mohit\Docker Assignment\two-tier-app>
```

docker run -d --name postgres-db --network app-network -e POSTGRES_USER=myuser -e POSTGRES_PASSWORD=mypassword -e POSTGRES_DB=mydb postgres:17

```
PS M:\Mohit\Docker Assignment\two-tier-app> docker run -d --name postgres-db --network app-network -e POSTGRES_USER=myus
er -e POSTGRES_PASSWORD=mypassword -e POSTGRES_DB=mydb postgres:17
Unable to find image 'postgres:17' locally
17: Pulling from library/postgres
085f0a899c07: Pull complete
f7f2afaa1b41: Pull complete
36b4e7f51364: Pull complete
c166c949e1c3: Pull complete
ae28e2b99a62: Pull complete
7fa725c973af: Pull complete
396b1da7636e: Pull complete
1f6dfcaad4e9: Pull complete
5d91a345d79a: Pull complete
b7a79609094c: Pull complete
85558a023eea: Pull complete
be9fdbdba096: Pull complete
901a9540064a: Pull complete
f5465e2fc020: Pull complete
Digest: sha256:29e0bb09c8e7e7fc265ea9f4367de9622e55bae6b0b97e7cce740c2d63c2ebc0
Status: Downloaded newer image for postgres:17
8d41faf7d50968c761398d0f64c2fc5b867ed43473a156b920cb4d020b04bb76
PS M:\Mohit\Docker Assignment\two-tier-app> docker run -d --name postgres-db --network app-network -e POSTGRES_USER=myus
er -e POSTGRES_PASSWORD=mypassword -e POSTGRES_DB=mydb postgres:17
```

docker build -t web-app .

```
PS M:\Mohit\Docker Assignment\two-tier-app> docker build -t web-app .
[+] Building 26.3s (10/10) FINISHED                                                    docker:desktop-linux
 => [internal] load build definition from Dockerfile                                                  0.2s
 => => transferring dockerfile: 174B                                                                  0.1s
 => [internal] load metadata for docker.io/library/python:3.9-slim                                    2.2s
 => [auth] library/python:pull token for registry-1.docker.io                                         0.0s
 => [internal] load .dockerignore                                                                     0.1s
 => => transferring context: 2B                                                                       0.0s
 => [1/4] FROM docker.io/library/python:3.9-slim@sha256:914169c7c8398b1b90c0b0ff921c8027445e39d7c25dc44  7.0s
 => => resolve docker.io/library/python:3.9-slim@sha256:914169c7c8398b1b90c0b0ff921c8027445e39d7c25dc44  0.1s
 => => sha256:5ec99fe17015e703c289d110b020e4e362d5b425be957d68bfb400d56d83f234 13.37MB / 13.37MB      4.6s
 => => sha256:0219e1e5e6ef3ef9d91f78826576a112b1c20622c10c294a4a105811454d1cb1 1.29MB / 1.29MB        0.9s
 => => sha256:ea3499df304f0a84e9f076a05f0cfe2a64d8fcb884894ce682df9204c6a18a91 249B / 249B            1.5s
 => => extracting sha256:0219e1e5e6ef3ef9d91f78826576a112b1c20622c10c294a4a105811454d1cb1             0.7s
 => => extracting sha256:5ec99fe17015e703c289d110b020e4e362d5b425be957d68bfb400d56d83f234             2.0s
 => => extracting sha256:ea3499df304f0a84e9f076a05f0cfe2a64d8fcb884894ce682df9204c6a18a91             0.0s
 => [internal] load build context                                                                     0.1s
 => => transferring context: 1.37kB                                                                   0.0s
 => [2/4] WORKDIR /app                                                                                 0.3s
 => [3/4] COPY . .                                                                                     0.1s
 => [4/4] RUN pip install --no-cache-dir -r requirements.txt                                          11.7s
 => exporting to image                                                                                4.2s
 => => exporting layers                                                                               2.7s
 => => exporting manifest sha256:0d57d20a5879c6f3e6ca8dc17e24bc52f9b9275d409b0873fb26f7be9559b9d9     0.0s
 => => exporting config sha256:8cb306fc6c642b3d83a6c171f9d88f36af909f85cdaf16d872c73caaebd0f66e       0.0s
 => => exporting attestation manifest sha256:b9d03cf0f52740c28bacae289eb6aaddb5f0f6815bfa517c694c31c5c8  0.1s
 => => exporting manifest list sha256:32d0ebb44c8278b7f2a1cc8aaab529e2550562b3bf20c267e2c4d383b5815ee5  0.0s
 => => naming to docker.io/library/web-app:latest                                                     0.0s
 => => unpacking to docker.io/library/web-app:latest                                                  1.3s
PS M:\Mohit\Docker Assignment\two-tier-app>
```

docker run -d --name web-app --network app-network -p 5000:5000 web-app

```
PS M:\Mohit\Docker Assignment\two-tier-app> docker run -d --name web-app --network app-network -p 5000:5000 web-app
0fc0010bf32ed90d3c5ed4eccc01c0e6e8b942bfc004751630fdf506e23cf22f
PS M:\Mohit\Docker Assignment\two-tier-app>
```

curl http://localhost:5000

```
PS M:\Mohit\Docker Assignment\two-tier-app> curl http://localhost:5000


StatusCode       : 200
StatusDescription : OK
Content          : Connected to Postgres! Data: [(1, 'Test User')]
RawContent       : HTTP/1.1 200 OK
                   Connection: close
                   Content-Length: 47
                   Content-Type: text/html; charset=utf-8
                   Date: Sun, 24 Aug 2025 15:34:38 GMT
                   Server: Werkzeug/3.1.3 Python/3.9.23

                   Connected to Postgres! Data...
Forms            : {}
Headers          : {[Connection, close], [Content-Length, 47], [Content-Type, text/html; charset=utf-8], [Date, Sun, 24 Aug 2025 15:34:38
                   GMT]...}
Images           : {}
InputFields      : {}
Links            : {}
ParsedHtml       : mshtml.HTMLDocumentClass
RawContentLength : 47


PS M:\Mohit\Docker Assignment\two-tier-app> |
```

Extension

docker rm -f postgres-db

```
PS M:\Mohit\Docker Assignment\two-tier-app> docker rm -f postgres-db
postgres-db
PS M:\Mohit\Docker Assignment\two-tier-app>
```

docker run -d --name postgres-db --network app-network -v pgdata:/var/lib/postgresql/data -e POSTGRES_USER=myuser -e POSTGRES_PASSWORD=mypassword -e POSTGRES_DB=mydb postgres:17

```
PS M:\Mohit\Docker Assignment\two-tier-app> docker run -d --name postgres-db --network app-network -v pgdata:/var/lib/postgresql/data -e POSTGRE
S_USER=myuser -e POSTGRES_PASSWORD=mypassword -e POSTGRES_DB=mydb postgres:17
e2049cd656d6e0c4ae0badc5728144d47e75f6a5730e9d24c74029907e89c790
PS M:\Mohit\Docker Assignment\two-tier-app>
```

curl http://localhost:5000

```
PS M:\Mohit\Docker Assignment\two-tier-app> curl http://localhost:5000


StatusCode       : 200
StatusDescription : OK
Content          : Connected to Postgres! Data: [(1, 'Test User')]
RawContent       : HTTP/1.1 200 OK
                   Connection: close
                   Content-Length: 47
                   Content-Type: text/html; charset=utf-8
                   Date: Sun, 24 Aug 2025 15:36:30 GMT
                   Server: Werkzeug/3.1.3 Python/3.9.23

                   Connected to Postgres! Data...
Forms            : {}
Headers          : {[Connection, close], [Content-Length, 47], [Content-Type, text/html; charset=utf-8], [Date, Sun, 24 Aug 2025 15:36:30
                   GMT]...}
Images           : {}
InputFields      : {}
Links            : {}
ParsedHtml       : mshtml.HTMLDocumentClass
RawContentLength : 47
```
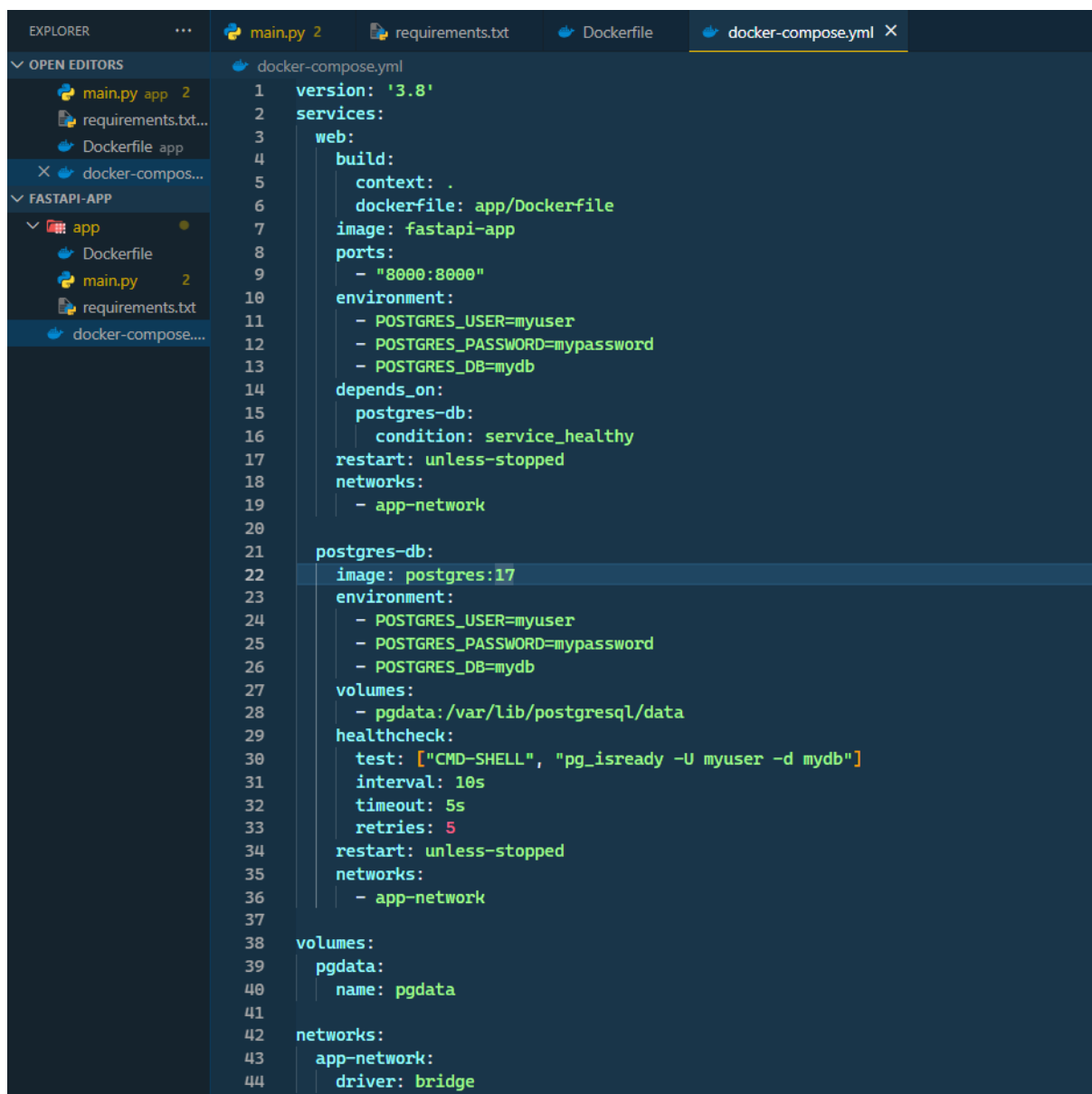
docker volume ls

```
PS M:\Mohit\Docker Assignment\two-tier-app> docker volume ls
DRIVER     VOLUME NAME
local      3f39e3808e65032b4d6e5d2c9c399a613a663e922ba790a28318896badb9f1e9
local      mydata
local      pgdata
PS M:\Mohit\Docker Assignment\two-tier-app>
```

Exercise 8: Docker Compose Basics

Write a docker-compose.yml for FastAPI + Postgres.

```yaml
version: '3.8'
services:
  web:
    build:
      context: .
      dockerfile: app/Dockerfile
    image: fastapi-app
    ports:
      - "8000:8000"
    environment:
      - POSTGRES_USER=myuser
      - POSTGRES_PASSWORD=mypassword
      - POSTGRES_DB=mydb
    depends_on:
      postgres-db:
        condition: service_healthy
    restart: unless-stopped
    networks:
      - app-network

  postgres-db:
    image: postgres:17
    environment:
      - POSTGRES_USER=myuser
      - POSTGRES_PASSWORD=mypassword
      - POSTGRES_DB=mydb
    volumes:
      - pgdata:/var/lib/postgresql/data
    healthcheck:
      test: ["CMD-SHELL", "pg_isready -U myuser -d mydb"]
      interval: 10s
      timeout: 5s
      retries: 5
    restart: unless-stopped
    networks:
      - app-network

volumes:
  pgdata:
    name: pgdata

networks:
  app-network:
    driver: bridge
```

docker compose up -d


```
PS M:\Mohit\Docker Assignment\fastapi-app> docker compose up -d
time="2025-08-24T23:47:15+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\fastapi-app\\docker-compose.yml: the attribute 'version' is obsolete, it will be ignored, please remove it to avoid potential confusion"
[+] Running 15/15
 ! web Warning         pull access denied for fastapi-app, repository does not exist or may require 'docker login'    2.4s
 ✔ postgres-db Pulled                                                                                                63.6s
   ✔ c6bcc2c9a041 Pull complete                                                                                       9.6s
   ✔ f5dfd246bc6e Pull complete                                                                                      50.2s
   ✔ fca2566eba32 Pull complete                                                                                       1.4s
   ✔ 606bd164980e Pull complete                                                                                       1.7s
   ✔ d903e777080c Pull complete                                                                                      50.5s
   ✔ 04adcb462801 Pull complete                                                                                       1.9s
   ✔ 799f859abbbd Pull complete                                                                                      50.4s
   ✔ 5c10925b29ff Pull complete                                                                                       1.7s
   ✔ 631fe8c6d606 Pull complete                                                                                       0.1s
   ✔ ac4b721eb66f Pull complete                                                                                       1.8s
   ✔ 77c7071c4414 Pull complete                                                                                       6.3s
   ✔ ba7036bb0a60 Pull complete                                                                                      50.3s
   ✔ 2d9e29180a27 Pull complete                                                                                       9.5s
Compose can now delegate builds to bake for better performance.
 To do so, set COMPOSE_BAKE=true.
[+] Building 36.9s (11/11) FINISHED                                                                  docker:desktop-linux
 => [web internal] load build definition from Dockerfile                                                             0.2s
 => => transferring dockerfile: 220B                                                                                 0.1s
 => [web internal] load metadata for docker.io/library/python:3.9-slim                                               3.0s
 => [web auth] library/python:pull token for registry-1.docker.io                                                   0.0s
 => [web internal] load .dockerignore                                                                                0.1s
 => => transferring context: 2B                                                                                      0.0s
 => [web 1/4] FROM docker.io/library/python:3.9-slim@sha256:914169c7c8398b1b90c0b0ff921c8027445e39d7c25dc440337e56ce0f2566e6  0.1s
 => => resolve docker.io/library/python:3.9-slim@sha256:914169c7c8398b1b90c0b0ff921c8027445e39d7c25dc440337e56ce0f2566e6  0.1s
 => [web internal] load build context                                                                               0.0s
 => => transferring context: 1.38kB                                                                                  0.0s
 => CACHED [web 2/4] WORKDIR /app                                                                                    0.0s
 => [web 3/4] COPY . /app .                                                                                          2.1s
 => [web 4/4] RUN pip install --no-cache-dir -r requirements.txt                                                    23.8s
 => [web] exporting to image                                                                                         7.8s
 => => exporting layers                                                                                              5.8s
 => => exporting manifest sha256:e833743b1a6b0701c32d1997a4897281194117f2c7565ce6e21c4f39442eeb49                    0.1s
 => => exporting config sha256:09dcd49b44cab0b44387a51cd379da5e7dd443dddb218c50a56606c9a94957683                     0.1s
 => => exporting attestation manifest sha256:96535d89e002eede8f17c1f956823db4010027ec4f58eec89d89faab9fc9ebe0        0.1s
 => => exporting manifest list sha256:cae30cec599d59f3a419d70a2aab4bcf152be5aa8fff5311e4b0bacfdd850f79               0.0s
 => => naming to docker.io/library/fastapi-app:latest                                                                0.0s
 => => unpacking to docker.io/library/fastapi-app:latest                                                             1.5s
 => [web] resolving provenance for metadata file                                                                     0.1s
[+] Running 1/2
 ✔ web                                Built                                                                           0.0s
[+] Running 4/4api-app_app-network  Creating                                                                         0.3s
 ✔ web                                Built                                                                           0.0s
 ✔ Network fastapi-app_app-network   Created                                                                         0.2s
 ✘ Container fastapi-app-postgres-db-1  Error                                                                        0.5s
 ✔ Container fastapi-app-web-1       Created                                                                         0.5s
dependency failed to start: container fastapi-app-postgres-db-1 is unhealthy
PS M:\Mohit\Docker Assignment\fastapi-app> docker compose up -d
time="2025-08-24T23:52:22+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\fastapi-app\\docker-compose.yml: the attribute 'version' is obsolete, it will be ignored, please remove it to avoid potential confusion"
time="2025-08-24T23:52:22+05:30" level=warning msg="volume \"pgdata\" already exists but was not created by Docker Compose. Use `external: true` to use an existing volume"
[+] Running 2/2
 ✔ Container fastapi-app-web-1       Started                                                                        14.0s
 ✔ Container fastapi-app-postgres-db-1  Healthy                                                                     11.5s
PS M:\Mohit\Docker Assignment\fastapi-app> docker compose up -d
```

docker ps


```
PS M:\Mohit\Docker Assignment\fastapi-app> docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS                   PORTS                    NAMES
ac85e7f6ceb0   postgres:17    "docker-entrypoint.s…"   4 minutes ago  Up 4 minutes (healthy)   5432/tcp                 fastapi-app-postgres-db-1
0e15e223bf55   fastapi-app    "uvicorn main:app --…"   7 minutes ago  Up 4 minutes             0.0.0.0:8000->8000/tcp   fastapi-app-web-1
8adf9a06a502   web-app        "python web-app.py"      3 hours ago    Up 3 hours               0.0.0.0:5000->5000/tcp   web-app
153f95b79053   nginx          "/docker-entrypoint.…"   3 hours ago    Up 3 hours               80/tcp                   nginx-default
c9d81cf1ac9f   nginx          "/docker-entrypoint.…"   4 hours ago    Up 4 hours               80/tcp                   nginx-server
55f270abc86f   53fb79bd1da8   "docker-entrypoint.s…"   5 hours ago    Up 5 hours               0.0.0.0:3000->3000/tcp   fervent_varahamihira
57f151b3ee59   nginx          "/docker-entrypoint.…"   6 hours ago    Up 6 hours               80/tcp                   clever_goldwasser
e0d7a8a1f950   nginx          "/docker-entrypoint.…"   7 hours ago    Up 7 hours               0.0.0.0:8080->80/tcp     reverent_galileo
PS M:\Mohit\Docker Assignment\fastapi-app>
```

docker compose logs web


```
PS M:\Mohit\Docker Assignment\fastapi-app> docker compose logs web
time="2025-08-24T23:58:18+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\fastapi-app\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored
, please remove it to avoid potential confusion"
web-1  | INFO:     Started server process [1]
web-1  | INFO:     Waiting for application startup.
web-1  | INFO:     Application startup complete.
web-1  | INFO:     Uvicorn running on http://0.0.0.0:8000 (Press CTRL+C to quit)
web-1  | INFO:     172.21.0.1:37792 - "GET / HTTP/1.1" 200 OK
web-1  | INFO:     172.21.0.1:37792 - "GET /favicon.ico HTTP/1.1" 404 Not Found
web-1  | INFO:     172.21.0.1:37958 - "GET / HTTP/1.1" 200 OK
web-1  | INFO:     172.21.0.1:53868 - "GET / HTTP/1.1" 200 OK
PS M:\Mohit\Docker Assignment\fastapi-app>
```

docker compose logs postgres-db

PS M:\Mohit\Docker Assignment\fastapi-app> docker compose logs postgres-db
time="2025-08-24T23:59:00+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\fastapi-app\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored
, please remove it to avoid potential confusion"
postgres-db-1 |
postgres-db-1 | PostgreSQL Database directory appears to contain a database; Skipping initialization
postgres-db-1 |
postgres-db-1 | 2025-08-24 18:22:24.230 UTC [1] LOG: starting PostgreSQL 17.6 (Debian 17.6-1.pgdg13+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 14.2.0-19) 14.2.0
, 64-bit
postgres-db-1 | 2025-08-24 18:22:24.233 UTC [1] LOG: listening on IPv4 address "0.0.0.0", port 5432
postgres-db-1 | 2025-08-24 18:22:24.234 UTC [1] LOG: listening on IPv6 address "::", port 5432
postgres-db-1 | 2025-08-24 18:22:24.246 UTC [1] LOG: listening on Unix socket "/var/run/postgresql/.s.PGSQL.5432"
postgres-db-1 | 2025-08-24 18:22:24.272 UTC [29] LOG: database system was interrupted; last known up at 2025-08-24 15:36:11 UTC
postgres-db-1 | 2025-08-24 18:22:25.152 UTC [29] LOG: database system was not properly shut down; automatic recovery in progress
postgres-db-1 | 2025-08-24 18:22:25.166 UTC [29] LOG: redo starts at 0/19159D0
postgres-db-1 | 2025-08-24 18:22:25.184 UTC [29] LOG: invalid record length at 0/193A7F0: expected at least 24, got 0
postgres-db-1 | 2025-08-24 18:22:25.184 UTC [29] LOG: redo done at 0/193A7B8 system usage: CPU: user: 0.00 s, system: 0.01 s, elapsed: 0.01 s
postgres-db-1 | 2025-08-24 18:22:25.204 UTC [27] LOG: checkpoint starting: end-of-recovery immediate wait
postgres-db-1 | 2025-08-24 18:22:25.271 UTC [27] LOG: checkpoint complete: wrote 53 buffers (0.3%); 0 WAL file(s) added, 0 removed, 0 recycled; write=0.019 s, sync=0.02
7 s, total=0.071 s; sync files=40, longest=0.004 s, average=0.001 s; distance=147 kB, estimate=147 kB; lsn=0/193A7F0, redo lsn=0/193A7F0
postgres-db-1 | 2025-08-24 18:22:25.337 UTC [1] LOG: database system is ready to accept connections
postgres-db-1 | 2025-08-24 18:27:25.432 UTC [27] LOG: checkpoint starting: time
postgres-db-1 | 2025-08-24 18:27:26.741 UTC [27] LOG: checkpoint complete: wrote 12 buffers (0.1%); 0 WAL file(s) added, 0 removed, 0 recycled; write=1.231 s, sync=0.01
6 s, total=1.311 s; sync files=11, longest=0.006 s, average=0.002 s; distance=9 kB, estimate=133 kB; lsn=0/193CD20, redo lsn=0/193CC90
PS M:\Mohit\Docker Assignment\fastapi-app>

curl http://localhost:8000

PS M:\Mohit\Docker Assignment\fastapi-app> curl http://localhost:8000

StatusCode   : 200
StatusDescription : OK
Content   : {"message":"Connected to Postgres!","data":[{"id":1,"name":"Test User"},{"id":34,"name":"Test User"},{"id":35,"nam
e":"Test User"},{"id":36,"name":"Test User"},{"id":37,"name":"Test
                     User"}]}
RawContent   : HTTP/1.1 200 OK
                     Content-Length: 189
                     Content-Type: application/json
                     Date: Sun, 24 Aug 2025 18:29:45 GMT
                     Server: uvicorn

                     {"message":"Connected to Postgres!","data":[{"id":1,"name":"Test User"},{"...
Forms   : {}
Headers   : {[Content-Length, 189], [Content-Type, application/json], [Date, Sun, 24 Aug 2025 18:29:45 GMT], [Server, uvicorn]
}
Images   : {}
InputFields   : {}
Links   : {}
ParsedHtml   : mshtml.HTMLDocumentClass
RawContentLength   : 189

PS M:\Mohit\Docker Assignment\fastapi-app>

docker compose restart web

PS M:\Mohit\Docker Assignment\fastapi-app> docker compose restart web
time="2025-08-25T00:04:45+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\fastapi-app\\docker-compose.yml: the attribute `vers
ion` is obsolete, it will be ignored, please remove it to avoid potential confusion"
[+] Restarting 1/1
 ✔ Container fastapi-app-web-1 Started   2.4s
PS M:\Mohit\Docker Assignment\fastapi-app> | Speakers (AB13X USB Audio): 50%

curl http://localhost:8000

PS M:\Mohit\Docker Assignment\fastapi-app> curl http://localhost:8000

StatusCode   : 200
StatusDescription : OK
Content   : {"message":"Connected to Postgres!","data":[{"id":1,"name":"Test User"},{"id":34,"name":"Test
                     User"},{"id":35,"name":"Test User"},{"id":36,"name":"Test User"},{"id":37,"name":"Test User"},{"id":38,"na...
RawContent   : HTTP/1.1 200 OK
                     Content-Length: 247
                     Content-Type: application/json
                     Date: Sun, 24 Aug 2025 18:37:59 GMT
                     Server: uvicorn

                     {"message":"Connected to Postgres!","data":[{"id":1,"name":"Test User"},{"...
Forms   : {}
Headers   : {[Content-Length, 247], [Content-Type, application/json], [Date, Sun, 24 Aug 2025 18:37:59 GMT], [Server,
                     uvicorn]}
Images   : {}
InputFields   : {}
Links   : {}
ParsedHtml   : mshtml.HTMLDocumentClass
RawContentLength   : 247

Exercise 9: Healthchecks and Best Practices

docker build -t fastapi-prod/app .

```
PS M:\Mohit\Docker Assignment\fastapi-prod> docker build -t fastapi-prod/app .
[+] Building 43.2s (10/10) FINISHED                                                    docker:desktop-linux
 => [internal] load build definition from Dockerfile                                                   0.0s
 => => transferring dockerfile: 527B                                                                   0.0s
 => [internal] load metadata for docker.io/library/python:3.9-alpine                                   1.3s
 => [internal] load .dockerignore                                                                      0.1s
 => => transferring context: 2B                                                                        0.0s
 => [1/5] FROM docker.io/library/python:3.9-alpine@sha256:372f3cfc1738ed91b64c7d36a7a02d5c3468ec1f60c906872c3fd34  9.5s
 => => resolve docker.io/library/python:3.9-alpine@sha256:372f3cfc1738ed91b64c7d36a7a02d5c3468ec1f60c906872c3fd34  0.1s
 => => sha256:696282ba7530403087147a86e1fd4c2b83d3507ff200fa6f1e58db0004f89010 447.74kB / 447.74kB    0.9s
 => => sha256:e9a57d92e270674b2a656977030520f3b8e3047191a8cd973cc3626969bc7bb2 248B / 248B            1.7s
 => => sha256:d325733a625202bb5fe7304c973b984f63bebdb83f9fb2c56c7cb769e7d9e459 14.88MB / 14.88MB      5.9s
 => => extracting sha256:696282ba7530403087147a86e1fd4c2b83d3507ff200fa6f1e58db0004f89010              1.1s
 => => extracting sha256:d325733a625202bb5fe7304c973b984f63bebdb83f9fb2c56c7cb769e7d9e459              3.0s
 => => extracting sha256:e9a57d92e270674b2a656977030520f3b8e3047191a8cd973cc3626969bc7bb2              0.1s
 => [internal] load build context                                                                      0.2s
 => => transferring context: 1.26kB                                                                    0.0s
 => [2/5] WORKDIR /app                                                                                 1.1s
 => [3/5] COPY ./app/requirements.txt .                                                                0.2s
 => [4/5] RUN pip install --no-cache-dir -r requirements.txt                                          26.1s
 => [5/5] COPY ./app .                                                                                 0.2s
 => exporting to image                                                                                 5.6s
 => => exporting layers                                                                                3.7s
 => => exporting manifest sha256:61918971dfab1ae1d21de9f3a76f18cfad36558a06722b540c73eda5ec1198d5      0.0s
 => => exporting config sha256:89b5a39bf02848053c9458af78873c9f530a67a360a0c151a467303c64daf8c5        0.1s
 => => exporting attestation manifest sha256:e941cb1d4de9a83c2f83fcedd92e57e4f6ada41176c62bded532d00d8588cff7  0.1s
 => => exporting manifest list sha256:78a95ae4411ec1174951fdad48ce9a174d9c9d0f709329db2589bcac288fcb31  0.0s
 => => naming to docker.io/fastapi-prod/app:latest                                                     0.0s
 => => unpacking to docker.io/fastapi-prod/app:latest                                                  1.7s
PS M:\Mohit\Docker Assignment\fastapi-prod>
```

docker run -d --name fastapi-prod --network app-network -p 8000:8000 fastapi-prod:latest

```
PS M:\Mohit\Docker Assignment\fastapi-prod> docker run -d --name fastapi-prod --network app-network -p 8000:8000 fastapi-prod:latest
4020a3e5c7d6542d9b54f1c0c622dbad39ffdaa72bc6410b2deff85a3c7ce4e6
PS M:\Mohit\Docker Assignment\fastapi-prod>
```

curl http://localhost:8000

```
PS M:\Mohit\Docker Assignment\fastapi-prod> curl http://localhost:8000

StatusCode        : 200
StatusDescription : OK
Content           : {"message":"Connected to Postgres!","data":[{"id":1,"name":"Test User"}]}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 73
                    Content-Type: application/json
                    Date: Sun, 24 Aug 2025 20:24:08 GMT
                    Server: uvicorn

                    {"message":"Connected to Postgres!","data":[{"id":1,"name":"Test User"}]}
Forms             : {}
Headers           : {[Content-Length, 73], [Content-Type, application/json], [Date, Sun, 24 Aug 2025 20:24:08 GMT], [Server, uvicorn]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 73
```

curl http://localhost:8000/health

```
PS M:\Mohit\Docker Assignment\fastapi-prod> curl http://localhost:8000/health


StatusCode      : 200
StatusDescription : OK
Content         : {"status":"healthy"}
RawContent      : HTTP/1.1 200 OK
                  Content-Length: 20
                  Content-Type: application/json
                  Date: Sun, 24 Aug 2025 20:28:12 GMT
                  Server: uvicorn

                  {"status":"healthy"}
Forms           : {}
Headers         : {[Content-Length, 20], [Content-Type, application/json], [Date, Sun, 24 Aug 2025 20:28:12 GMT], [Server, uvicorn]}
Images          : {}
InputFields     : {}
Links           : {}
ParsedHtml      : mshtml.HTMLDocumentClass
RawContentLength : 20
```

docker inspect postgres-db

```
PS M:\Mohit\Docker Assignment\fastapi-prod> docker inspect postgres-db
[
    {
        "Id": "44f21eb6445814c586a0c28a8214768bbe8a8aa67a309fda278792e3ebd77447",
        "Created": "2025-08-24T20:14:44.874277165Z",
        "Path": "docker-entrypoint.sh",
        "Args": [
            "postgres"
        ],
        "State": {
            "Status": "exited",
            "Running": false,
            "Paused": false,
            "Restarting": false,
            "OOMKilled": false,
            "Dead": false,
            "Pid": 0,
            "ExitCode": 255,
            "Error": "",
            "StartedAt": "2025-08-24T20:14:45.621572652Z",
            "FinishedAt": "2025-08-25T05:11:21.732419033Z"
        },
        "Image": "sha256:aedabd10a05c7304233d006a186a42d7d350b11e702d227dc09a99882dafa142",
        "ResolvConfPath": "/var/lib/docker/containers/44f21eb6445814c586a0c28a8214768bbe8a8aa67a309fda278792e3ebd77447/resolv.conf",
        "HostnamePath": "/var/lib/docker/containers/44f21eb6445814c586a0c28a8214768bbe8a8aa67a309fda278792e3ebd77447/hostname",
        "HostsPath": "/var/lib/docker/containers/44f21eb6445814c586a0c28a8214768bbe8a8aa67a309fda278792e3ebd77447/hosts",
        "LogPath": "/var/lib/docker/containers/44f21eb6445814c586a0c28a8214768bbe8a8aa67a309fda278792e3ebd77447/44f21eb6445814c586a0c28a8214768bbe8a8aa67a309fda278792e3ebd77447-json.log",
        "Name": "/postgres-db",
        "RestartCount": 0,
        "Driver": "overlayfs",
        "Platform": "linux",
        "MountLabel": "",
        "ProcessLabel": "",
        "AppArmorProfile": "",
        "ExecIDs": null,
        "HostConfig": {
            "Binds": null,
            "ContainerIDFile": "",
            "LogConfig": {
                "Type": "json-file",
                "Config": {}
            },
            "NetworkMode": "app-network",
            "PortBindings": {},
            "RestartPolicy": {
                "Name": "no",
                "MaximumRetryCount": 0
            },
            "AutoRemove": false,
            "VolumeDriver": "",
            "VolumesFrom": null,
            "ConsoleSize": [
                46,
                153
            ],
            "CapAdd": null,
            "CapDrop": null,
            "CgroupnsMode": "private",
            "Dns": [],
            "DnsOptions": [],
            "DnsSearch": [],
            "ExtraHosts": null,
            "GroupAdd": null,
            "IpcMode": "private",
```

```
        },
        "NetworkSettings": {
            "Bridge": "",
            "SandboxID": "",
            "SandboxKey": "",
            "Ports": {},
            "HairpinMode": false,
            "LinkLocalIPv6Address": "",
            "LinkLocalIPv6PrefixLen": 0,
            "SecondaryIPAddresses": null,
            "SecondaryIPv6Addresses": null,
            "EndpointID": "",
            "Gateway": "",
            "GlobalIPv6Address": "",
            "GlobalIPv6PrefixLen": 0,
            "IPAddress": "",
            "IPPrefixLen": 0,
            "IPv6Gateway": "",
            "MacAddress": "",
            "Networks": {
                "app-network": {
                    "IPAMConfig": null,
                    "Links": null,
                    "Aliases": null,
                    "MacAddress": "",
                    "DriverOpts": null,
                    "GwPriority": 0,
                    "NetworkID": "8ecd8c72b1e0913885938d48fdaee4759dd99854dff604587e22b8005e4e14e5",
                    "EndpointID": "",
                    "Gateway": "",
                    "IPAddress": "",
                    "IPPrefixLen": 0,
                    "IPv6Gateway": "",
                    "GlobalIPv6Address": "",
                    "GlobalIPv6PrefixLen": 0,
                    "DNSNames": [
                        "postgres-db",
                        "44f21eb64458"
                    ]
                }
            }
        },
        "ImageManifestDescriptor": {
            "mediaType": "application/vnd.oci.image.manifest.v1+json",
            "digest": "sha256:fb8ba6ea5d5ac99439116f1301368c71d0c20ca75e067dc3cd4a00f2bae672bf",
            "size": 3626,
            "annotations": {
                "com.docker.official-images.bashbrew.arch": "amd64",
                "org.opencontainers.image.base.digest": "sha256:f2306da7a8fb6440535937baed0ce0018736742d6dc5beec9d6a31355b259726",
                "org.opencontainers.image.base.name": "debian:trixie-slim",
                "org.opencontainers.image.created": "2025-08-14T18:18:23Z",
                "org.opencontainers.image.revision": "1984f1787ad448db351da121bfe8708769d0f8a7",
                "org.opencontainers.image.source": "https://github.com/docker-library/postgres.git#1984f1787ad448db351da121bfe8708769d0f8a7:13/trixie",
                "org.opencontainers.image.url": "https://hub.docker.com/_/postgres",
                "org.opencontainers.image.version": "13.22"
            },
            "platform": {
                "architecture": "amd64",
                "os": "linux"
            }
        }
    }
]
PS M:\Mohit\Docker Assignment\fastapi-prod>
```

Exercise 10: Debugging, Cleanup & Troubleshooting

Container with a Bad Command

docker run -d --name wrong-command busybox xyzcommand

docker ps -a

docker inspect --format '{{.State.Status}}' wrong-command

docker inspect --format '{{.State.ExitCode}}' wrong-command

docker rm wrong-command
docker run -d --name wrong-command busybox sleep 3600

docker ps

```
PS M:\Mohit\Docker Assignment> docker ps
CONTAINER ID   IMAGE        COMMAND               CREATED         STATUS                    PORTS       NAMES
223301c95681   busybox      "sleep 3600"          54 seconds ago  Up 53 seconds                         wrong-command
ac85e7f6ceb0   postgres:17  "docker-entrypoint.s…" 11 hours ago    Up 22 minutes (healthy)   5432/tcp    fastapi-app-postgres-db-1
PS M:\Mohit\Docker Assignment> docker ps
```

Container with Missing Port Mapping

docker run -d --name no-port-nginx nginx

```
PS M:\Mohit\Docker Assignment> docker run -d --name no-port-nginx nginx
3a87e52deae87bf86ee7ac356d18d090dde249d20cc99e4dd7f1f74e0526259a
PS M:\Mohit\Docker Assignment>
```

curl http://localhost:80

```
PS M:\Mohit\Docker Assignment> curl http://localhost:80
curl : Unable to connect to the remote server
At line:1 char:1
+ curl http://localhost:80
+ ~~~~~~~~~~~~~~~~~~~~~~~~~
    + CategoryInfo          : InvalidOperation: (System.Net.HttpWebRequest:HttpWebRequest) [Invoke-WebRequest], WebException
    + FullyQualifiedErrorId : WebCmdletWebResponseException,Microsoft.PowerShell.Commands.InvokeWebRequestCommand

PS M:\Mohit\Docker Assignment>
```

docker inspect no-port-nginx | Select-String -Pattern "port"

```
PS M:\Mohit\Docker Assignment> docker inspect no-port-nginx | Select-String -Pattern "port"

        "Name": "/no-port-nginx",
            "PortBindings": {},
            "PublishAllPorts": false,
            "ExposedPorts": {
            "Ports": {

PS M:\Mohit\Docker Assignment>
```

docker rm -f no-port-nginx

docker run -d --name no-port-nginx -p 8080:80 nginx

```
PS M:\Mohit\Docker Assignment> docker rm -f no-port-nginx
no-port-nginx
PS M:\Mohit\Docker Assignment> docker run -d --name no-port-nginx -p 8080:80 nginx
89e14e195fde391544f26e927618399ecb5868a497f328a42f5cc4c43dca67eb
PS M:\Mohit\Docker Assignment>
```

curl http://localhost:8080

```
PS M:\Mohit\Docker Assignment> curl http://localhost:8080


StatusCode      : 200
StatusDescription : OK
Content         : <!DOCTYPE html>
                  <html>
                  <head>
                  <title>Welcome to nginx!</title>
                  <style>
                  html { color-scheme: light dark; }
                  body { width: 35em; margin: 0 auto;
                  font-family: Tahoma, Verdana, Arial, sans-serif; }
                  </style...
RawContent      : HTTP/1.1 200 OK
                  Connection: keep-alive
                  Accept-Ranges: bytes
                  Content-Length: 615
                  Content-Type: text/html
                  Date: Mon, 25 Aug 2025 05:40:13 GMT
                  ETag: "689ca245-267"
                  Last-Modified: Wed, 13 Aug 2025 ...
Forms           : {}
Headers         : {[Connection, keep-alive], [Accept-Ranges, bytes], [Content-Length, 615], [Content-Type, text/html]...}
Images          : {}
InputFields     : {}
Links           : {@{innerHTML=nginx.org; innerText=nginx.org; outerHTML=<A href="http://nginx.org/">nginx.org</A>; outerText=nginx.org; tagName=A;
                  href=http://nginx.org/}, @{innerHTML=nginx.com; innerText=nginx.com; outerHTML=<A href="http://nginx.com/">nginx.com</A>; outerText=nginx.com;
                  tagName=A; href=http://nginx.com/}}
ParsedHtml      : mshtml.HTMLDocumentClass
RawContentLength : 615
```

Cleanup of Unused Resources

docker ps -a

```
PS M:\Mohit\Docker Assignment> docker ps -a
CONTAINER ID   IMAGE           COMMAND                  CREATED         STATUS                      PORTS                      NAMES
89e14e195fde   nginx           "/docker-entrypoint.…"   2 minutes ago   Up 2 minutes                0.0.0.0:8080->80/tcp       no-port-nginx
223301c95681   busybox         "sleep 3600"             8 minutes ago   Up 8 minutes                                           wrong-command
2cab80d5f0db   fastapi-prod    "uvicorn main:app --…"   9 hours ago     Exited (255) 30 minutes ago 0.0.0.0:8000->8000/tcp     fastapi-prod
44f21eb64458   postgres:13     "docker-entrypoint.s…"   9 hours ago     Exited (255) 30 minutes ago 5432/tcp                   postgres-db
ac85e7f6ceb0   postgres:17     "docker-entrypoint.s…"   11 hours ago    Up 30 minutes (healthy)     5432/tcp                   fastapi-app-postgres-db-1
0e15e223bf55   fastapi-app     "uvicorn main:app --…"   11 hours ago    Exited (0) 11 hours ago                                fastapi-app-web-1
8adf9a06a502   web-app         "python web-app.py"      14 hours ago    Exited (255) 30 minutes ago 0.0.0.0:5000->5000/tcp     web-app
ab112cd24a4a   busybox         "sh"                     15 hours ago    Exited (1) 15 hours ago                                busybox-default
153f95b79053   nginx           "/docker-entrypoint.…"   15 hours ago    Exited (255) 30 minutes ago 80/tcp                     nginx-default
3122ac68a8d9   busybox         "sh"                     15 hours ago    Exited (0) 15 hours ago                                busybox-client
c9d81cf1ac9f   nginx           "/docker-entrypoint.…"   15 hours ago    Exited (255) 30 minutes ago 80/tcp                     nginx-server
3869e5ee3c84   busybox         "sh"                     15 hours ago    Exited (0) 15 hours ago                                flamboyant_swirles
6de186f15115   busybox         "sh"                     15 hours ago    Exited (1) 15 hours ago                                vibrant_jang
5df4a2273299   busybox         "sh"                     15 hours ago    Exited (0) 15 hours ago                                elastic_lamport
55f270abc86f   53fb79bd1da8    "docker-entrypoint.s…"   16 hours ago    Exited (255) 30 minutes ago 0.0.0.0:3000->3000/tcp     fervent_varahamihira
20bec5a3f4d9   ubuntu-tools    "bash"                   17 hours ago    Exited (127) 17 hours ago                              ecstatic_chatterjee
27d590b7e421   ubuntu-tools    "bash"                   17 hours ago    Exited (0) 17 hours ago                                cool_blackwell
ff9383c364b1   ubuntu          "bash"                   17 hours ago    Exited (127) 17 hours ago                              hopeful_yonath
a1ea49e2b296   alpine          "sh"                     17 hours ago    Exited (127) 17 hours ago                              wizardly_gates
57f151b3ee59   nginx           "/docker-entrypoint.…"   18 hours ago    Exited (255) 30 minutes ago 80/tcp                     clever_goldwasser
48c492cb4fcc   alpine          "sh"                     18 hours ago    Exited (0) 18 hours ago                                infallible_bhabha
e0d7a8a1f950   nginx           "/docker-entrypoint.…"   18 hours ago    Exited (255) 30 minutes ago 0.0.0.0:8080->80/tcp       reverent_galileo
c71aa8faae4c   alpine          "sh"                     18 hours ago    Exited (127) 18 hours ago                              wizardly_elion
7f5f69d01a59   alpine          "sh"                     43 hours ago    Exited (255) 18 hours ago                              priceless_roentgen
2924c96db170   nginx           "/docker-entrypoint.…"   43 hours ago    Exited (0) 37 hours ago                                compassionate_kirch
8860d009ccbf   nginx           "/docker-entrypoint.…"   43 hours ago    Created                                                relaxed_shaw
caba9f26d2f5   nginx           "/docker-entrypoint.…"   43 hours ago    Exited (0) 43 hours ago                                exciting_tu
52031259ee99   hello-world     "/hello"                 44 hours ago    Exited (0) 44 hours ago                                condescending_diffie
cba859851c38   hello-world     "/hello"                 44 hours ago    Exited (0) 44 hours ago                                competent_banzai
29613959f5ef   n8nio/n8n:latest "tini -- /docker-ent…"  3 months ago    Exited (0) 3 months ago                                romantic_edison
94a4c432f9f3   n8nio/n8n       "tini -- /docker-ent…"   3 months ago    Exited (0) 3 months ago                                n8n-docker-n8n-1
1900725da09d   n8nio/n8n:latest "tini -- /docker-ent…"  3 months ago    Exited (0) 3 months ago                                gallant_brown
fa50ea1a9d9b   n8nio/n8n:latest "tini -- /docker-ent…"  3 months ago    Exited (143) 3 months ago                              flamboyant_wright
3a6e9d705c6b   n8nio/n8n:latest "tini -- /docker-ent…"  3 months ago    Exited (0) 3 months ago                                intelligent_shtern
PS M:\Mohit\Docker Assignment>
```

docker container prune

```
PS M:\Mohit\Docker Assignment> docker container prune
WARNING! This will remove all stopped containers.
Are you sure you want to continue? [y/N] y
Deleted Containers:
2cab80d5f0db08af470561159c76cc9b9ec5891ba949b6d884a658236664048e
44f21eb6445814c586a0c28a8214768bbe8a8aa67a309fda278792e3ebd77447
0e15e223bf558ac284339399ce3b3c3a7bb4f1e3b9763f535dddc52ce00a3b07
8adf9a06a502d3cd58df63beb359abfcae24a8faf311d66acc9bb3b86fd934f2
ab112cd24a4a86efd865a6b0b772c3f1887c77df85d5cfa22e2910d3e85e36b5
153f95b79053b7ab56412307c51a374a11c1e4adee86b60b25b4340f1e3816a6
3122ac68a8d971e5ae78ce5ecf66c023f6785044a4ad82ab2b8de422afa037aa
c9d81cf1ac9f472ae58852a98ee77925a4d8b8d62c96d8426c5dcad91d665fef
3869e5ee3c84d4563bf3797bf271dad65bf60d9490203ed07ead965bfb2f4490
6de186f151158ed2f907157138454c5e78b79f006a37c750016e79f4e5d3f56d
5df4a2273299f388eb8424fb8f6dc3be092cb9f1df211a4150494c8a658bcd76
55f270abc86f8233560248b164fc5375eb5e3be30e2190e86e77df6bc73e382e
20bec5a3f4d91e63db39d26f25033cb1a35fb190a6806b4392239a2f079c3945
27d590b7e42114ddc7869092818fc7230afb9d38e0f2c7daa4c73b65c1a6a12a
ff9383c364b1d3c97d3ca0c427c71d819274c0de9b965aa065d069c31d79565e
a1ea49e2b296fa7457e8017aca79e482a70fe786a5d0451df591cbbbc356b54
57f151b3ee59d2109ba2599471450be1179c70bee90a8b5e3fde f6cd76d6f890
48c492cb4fcc4514539d80dc9c8f22d52ae6e3f1c73827bf31db9fc11e65ee8d
e0d7a8a1f9507363704feb1fff1ebd743a1f19ee783c946eec9cb82999a7de4c
c71aa8faae4c2a6f4a2572e5efdb5b93c2d0067b82e2bb025b7d3a21f1e42d2d
7f5f69d01a59daa1bcf9c50bd46ef7fc51f9adf284fa1d7848b7e21c1d473755
2924c96db170663b1f6bbe40e6e8d26a66f2d536e6e64edeae539e1f275b4654
8860d009ccbf9e7446df739d37d3fef9023b337619870fc83a1e86ab91fef99a
caba9f26d2f503f1a03c11f6c4026a3f43f48df7f029da9d2eb0dc01041751ce
52031259ee991faaae104d01870bd577eaec07c08d8b0cf4c9f4700a6a381b64
cba859851c382403bab6a6f2fc67e4876ea88646d64a1a9a47d8fad4a579ccf2
29613959f5efa46101edd1b971f4e2460408d157dfc357f6c6ab8d9f3c4dc8d1
94a4c432f9f3d6912229182a5d7c40ca17661093e9c81f418fa72fb51e14f183
1900725da09d4b876f03ac55e64d067213f19bca7b50ad4c8eb5621dbc4c0816
fa50ea1a9d9b53f9d25c7690d0eb5fbb0eb20490d4844baf9e098e3a3447fb77
3a6e9d705c6beef51afa735a520cc7f60e3701923b5ed943752ce691335f8d49


Total reclaimed space: 386.1MB
```

docker images

```
PS M:\Mohit\Docker Assignment> docker images
REPOSITORY                      TAG       IMAGE ID       CREATED         SIZE
fastapi-prod                    latest    bbb789f42668   11 hours ago    115MB
fastapi-prod/app                latest    78a95ae4411e   11 hours ago    115MB
fastapi-app                     latest    cae30cec599d   11 hours ago    221MB
web-app                         latest    4166826805f3   14 hours ago    208MB
MohitNamdev22/my-node-server    1.0       53fb79bd1da8   16 hours ago    294MB
mohitnamdev22/my-node-server    1.0       53fb79bd1da8   16 hours ago    294MB
MohitNamdev22/ubuntu-tools      v1        5e78c8032b97   17 hours ago    323MB
ubuntu-tools                    latest    5e78c8032b97   17 hours ago    323MB
postgres                        17        29e0bb09c8e7   10 days ago     641MB
postgres                        15        bc51cf4f1fe0   10 days ago     629MB
postgres                        13        aedabd10a05c   10 days ago     620MB
nginx                           latest    33e0bbc7ca9e   11 days ago     279MB
hello-world                     latest    a0dfb02aac21   2 weeks ago     20.3kB
ubuntu                          latest    7c06e91f61fa   3 weeks ago     117MB
alpine                          latest    4bcff63911fc   5 weeks ago     12.8MB
n8nio/n8n                       latest    6ea146fde4ff   3 months ago    1.2GB
busybox                         latest    ab33eacc8251   11 months ago   6.78MB
```

docker rmi hello-world

```
PS M:\Mohit\Docker Assignment> docker rmi hello-world
Untagged: hello-world:latest
Deleted: sha256:a0dfb02aac212703bfcb339d77d47ec32c8706ff250850ecc0e19c8737b18567
```

docker volume ls

```
PS M:\Mohit\Docker Assignment> docker volume ls
DRIVER     VOLUME NAME
local      3f39e3808e65032b4d6e5d2c9c399a613a663e922ba790a28318896badb9f1e9
local      60e1a6e4f74e0896515b8700c8d0e7c83cab2b3899005f4bfa8830fba7f0609a
local      mydata
local      pgdata
```
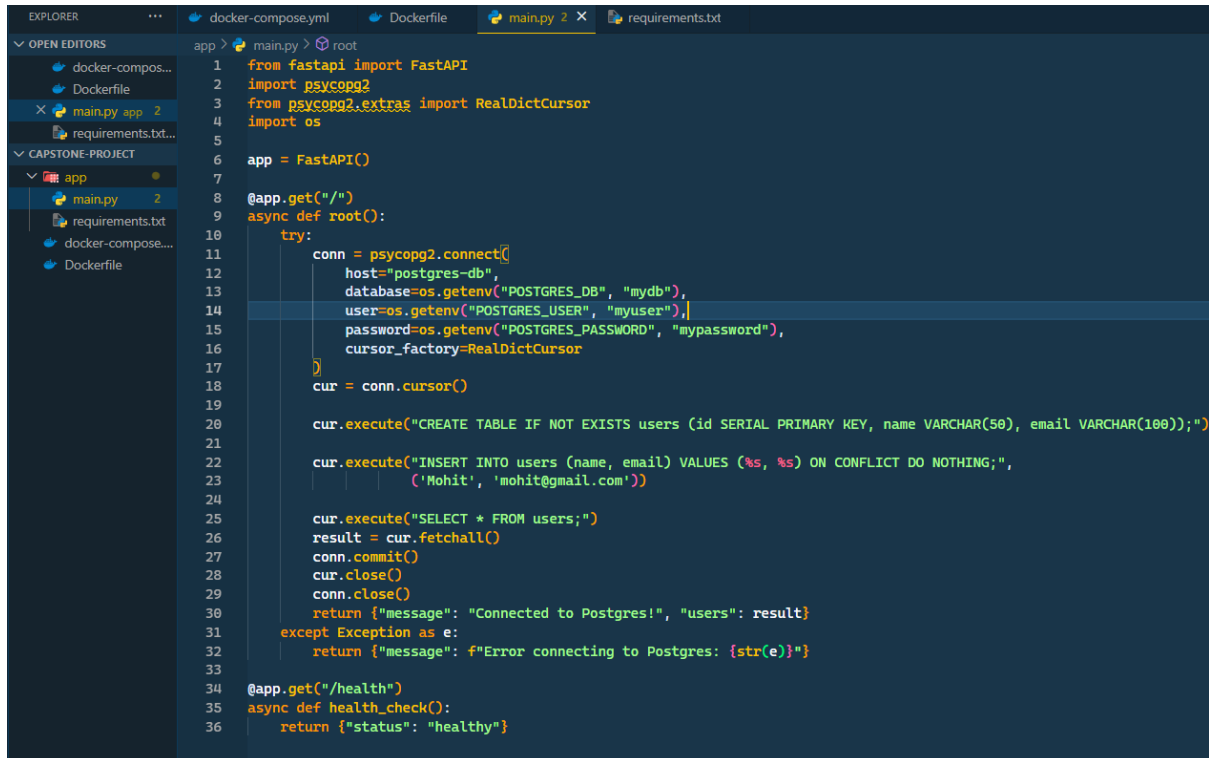
docker volume rm
3f39e3808e65032b4d6e5d2c9c399a613a663e922ba790a28318896badb9f1e9

```
PS M:\Mohit\Docker Assignment> docker volume rm 3f39e3808e65032b4d6e5d2c9c399a613a663e922ba790a28318896badb9f1e9
3f39e3808e65032b4d6e5d2c9c399a613a663e922ba790a28318896badb9f1e9
PS M:\Mohit\Docker Assignment>
```
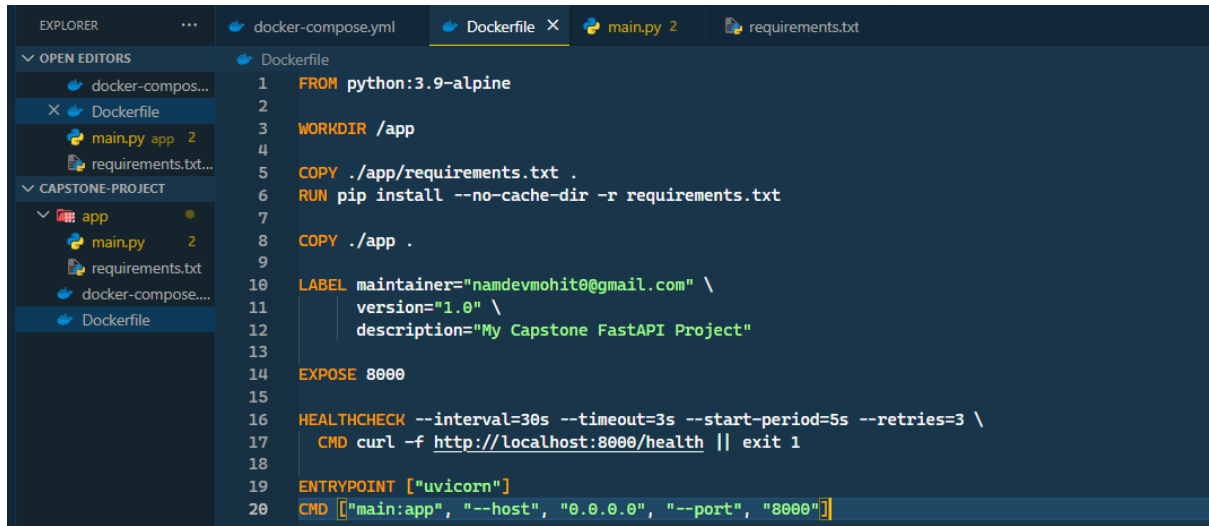
Capstone Project: Dockerizing FastAPI + Postgres

main.py

```python
from fastapi import FastAPI
import psycopg2
from psycopg2.extras import RealDictCursor
import os

app = FastAPI()

@app.get("/")
async def root():
    try:
        conn = psycopg2.connect(
            host="postgres-db",
            database=os.getenv("POSTGRES_DB", "mydb"),
            user=os.getenv("POSTGRES_USER", "myuser"),
            password=os.getenv("POSTGRES_PASSWORD", "mypassword"),
            cursor_factory=RealDictCursor
        )
        cur = conn.cursor()

        cur.execute("CREATE TABLE IF NOT EXISTS users (id SERIAL PRIMARY KEY, name VARCHAR(50), email VARCHAR(100));")

        cur.execute("INSERT INTO users (name, email) VALUES (%s, %s) ON CONFLICT DO NOTHING;",
                    ('Mohit', 'mohit@gmail.com'))

        cur.execute("SELECT * FROM users;")
        result = cur.fetchall()
        conn.commit()
        cur.close()
        conn.close()
        return {"message": "Connected to Postgres!", "users": result}
    except Exception as e:
        return {"message": f"Error connecting to Postgres: {str(e)}"}

@app.get("/health")
async def health_check():
    return {"status": "healthy"}
```

Dockerfile

```dockerfile
FROM python:3.9-alpine

WORKDIR /app

COPY ./app/requirements.txt .
RUN pip install --no-cache-dir -r requirements.txt

COPY ./app .

LABEL maintainer="namdevmohit0@gmail.com" \
      version="1.0" \
      description="My Capstone FastAPI Project"

EXPOSE 8000

HEALTHCHECK --interval=30s --timeout=3s --start-period=5s --retries=3 \
  CMD curl -f http://localhost:8000/health || exit 1

ENTRYPOINT ["uvicorn"]
CMD ["main:app", "--host", "0.0.0.0", "--port", "8000"]
```

docker-compose.yml

```yaml
version: '3.8'
services:
  web:
    build:
      context: .
      dockerfile: Dockerfile
    image: fastapi-app
    ports:
      - "8000:8000"
    environment:
      - POSTGRES_USER=myuser
      - POSTGRES_PASSWORD=mypassword
      - POSTGRES_DB=mydb
    depends_on:
      postgres-db:
        condition: service_healthy
    restart: unless-stopped
    networks:
      - app-network

  postgres-db:
    image: postgres:17
    environment:
      - POSTGRES_USER=myuser
      - POSTGRES_PASSWORD=mypassword
      - POSTGRES_DB=mydb
    volumes:
      - pgdata:/var/lib/postgresql/data
    healthcheck:
      test: ["CMD-SHELL", "pg_isready -U myuser -d mydb"]
      interval: 10s
      timeout: 5s
      retries: 5
    restart: unless-stopped
    networks:
      - app-network

volumes:
  pgdata:
    name: pgdata

networks:
  app-network:
    driver: bridge
```

docker compose up

```
PS M:\Mohit\Docker Assignment\capstone-project> docker-compose up -d
time="2025-08-25T12:06:28+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\capstone-project\\docker-compose.yml: the attribute 'version' is obsolet
e, it will be ignored, please remove it to avoid potential confusion"
[+] Running 0/1
 - Network capstone-project_app-network  Creating                                                                                           0.1s
[+] Running 3/35T12:06:29+05:30" level=warning msg="volume \"pgdata\" already exists but was not created by Docker Compose. Use 'external: true' to use an
 ✔ Network capstone-project_app-network      Created                                                                                        0.2s
 ✔ Container capstone-project-postgres-db-1   Healthy                                                                                       12.0s
 ✔ Container capstone-project-web-1           Started                                                                                       12.1s
PS M:\Mohit\Docker Assignment\capstone-project>
```

docker ps

```
PS M:\Mohit\Docker Assignment\capstone-project> docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED          STATUS                    PORTS                      NAMES
a4beec81c446   fastapi-app    "uvicorn main:app --…"   57 seconds ago   Up 45 seconds             0.0.0.0:8000->8000/tcp     capstone-project-web-1
7dd35df259f5   postgres:17    "docker-entrypoint.s…"   57 seconds ago   Up 56 seconds (healthy)   5432/tcp                   capstone-project-postgres-db-1
89e14e195fde   nginx          "/docker-entrypoint.…"   57 minutes ago   Up 57 minutes             0.0.0.0:8080->80/tcp       no-port-nginx
ac85e7f6ceb0   postgres:17    "docker-entrypoint.s…"   12 hours ago     Up About an hour (healthy) 5432/tcp                  fastapi-app-postgres-db-1
PS M:\Mohit\Docker Assignment\capstone-project>
```

docker compose logs web

```
PS M:\Mohit\Docker Assignment\capstone-project> docker compose logs web
time="2025-08-25T12:08:08+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\capstone-project\\docker-compose.yml: the attribute 'version' is obsolete, it will be ig
nored, please remove it to avoid potential confusion"
web-1  | INFO:     Started server process [1]
web-1  | INFO:     Waiting for application startup.
web-1  | INFO:     Application startup complete.
web-1  | INFO:     Uvicorn running on http://0.0.0.0:8000 (Press CTRL+C to quit)
PS M:\Mohit\Docker Assignment\capstone-project>
```

docker compose logs postgres-db

```
PS M:\Mohit\Docker Assignment\capstone-project> docker compose logs postgres-db
time="2025-08-25T12:08:41+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\capstone-project\\docker-compose.yml: the attribute `version` is obsolete, it will be ig
nored, please remove it to avoid potential confusion"
postgres-db-1  |
postgres-db-1  | PostgreSQL Database directory appears to contain a database; Skipping initialization
postgres-db-1  |
postgres-db-1  | 2025-08-25 06:36:31.210 UTC [1] LOG:  starting PostgreSQL 17.6 (Debian 17.6-1.pgdg13+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 14.2.0-19) 14.2.0
, 64-bit
postgres-db-1  | 2025-08-25 06:36:31.214 UTC [1] LOG:  listening on IPv4 address "0.0.0.0", port 5432
postgres-db-1  | 2025-08-25 06:36:31.214 UTC [1] LOG:  listening on IPv6 address "::", port 5432
postgres-db-1  | 2025-08-25 06:36:31.225 UTC [1] LOG:  listening on Unix socket "/var/run/postgresql/.s.PGSQL.5432"
postgres-db-1  | 2025-08-25 06:36:31.244 UTC [29] LOG:  database system was interrupted; last known up at 2025-08-25 06:32:42 UTC
postgres-db-1  | 2025-08-25 06:36:32.027 UTC [29] LOG:  database system was not properly shut down; automatic recovery in progress
postgres-db-1  | 2025-08-25 06:36:32.037 UTC [29] LOG:  redo starts at 0/193DB98
postgres-db-1  | 2025-08-25 06:36:32.037 UTC [29] LOG:  invalid record length at 0/193DBD0: expected at least 24, got 0
postgres-db-1  | 2025-08-25 06:36:32.037 UTC [29] LOG:  redo done at 0/193DB98 system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
postgres-db-1  | 2025-08-25 06:36:32.048 UTC [27] LOG:  checkpoint starting: end-of-recovery immediate wait
postgres-db-1  | 2025-08-25 06:36:32.075 UTC [27] LOG:  checkpoint complete: wrote 3 buffers (0.0%); 0 WAL file(s) added, 0 removed, 0 recycled; write=0.008 s, sync=0.004
 s, total=0.031 s; sync files=2, longest=0.002 s, average=0.002 s; distance=0 kB, estimate=0 kB; lsn=0/193DBD0, redo lsn=0/193DBD0
postgres-db-1  | 2025-08-25 06:36:32.096 UTC [1] LOG:  database system is ready to accept connections
PS M:\Mohit\Docker Assignment\capstone-project>
```

curl http://localhost:8000

```
PS M:\Mohit\Docker Assignment\capstone-project> curl http://localhost:8000


StatusCode        : 200
StatusDescription : OK
Content           : {"message":"Connected to Postgres!","data":[{"id":1,"name":"Test User"},{"id":34,"name":"Test User"},{"id":35,"name":"Test
                    User"},{"id":36,"name":"Test User"},{"id":37,"name":"Test User"},{"id":38,"na...
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 276
                    Content-Type: application/json
                    Date: Mon, 25 Aug 2025 06:39:08 GMT
                    Server: uvicorn

                    {"message":"Connected to Postgres!","data":[{"id":1,"name":"Test User"},{"...
Forms             : {}
Headers           : {[Content-Length, 276], [Content-Type, application/json], [Date, Mon, 25 Aug 2025 06:39:08 GMT], [Server, uvicorn]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 276


PS M:\Mohit\Docker Assignment\capstone-project>
```

curl http://localhost:8000/health

```
PS M:\Mohit\Docker Assignment\capstone-project> curl http://localhost:8000/health


StatusCode        : 200
StatusDescription : OK
Content           : {"status":"healthy"}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 20
                    Content-Type: application/json
                    Date: Mon, 25 Aug 2025 07:38:52 GMT
                    Server: uvicorn

                    {"status":"healthy"}
Forms             : {}
Headers           : {[Content-Length, 20], [Content-Type, application/json], [Date, Mon, 25 Aug 2025 07:38:52 GMT], [Server, uvicorn]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 20
```

docker compose down

docker compose up -d

curl http://localhost:8000

```
PS M:\Mohit\Docker Assignment\capstone-project> docker compose down
time="2025-08-25T13:10:55+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\capstone-project\\docker-compose.yml: the attribute `version` is obsolete, it will be ig
nored, please remove it to avoid potential confusion"
[+] Running 3/3
 ✔Container capstone-project-web-1       Removed                                                                                                            0.7s
 ✔Container capstone-project-postgres-db-1  Removed                                                                                                         1.1s
 ✔Network capstone-project_app-network   Removed                                                                                                            0.5s
PS M:\Mohit\Docker Assignment\capstone-project> docker compose up -d
time="2025-08-25T13:11:04+05:30" level=warning msg="M:\\Mohit\\Docker Assignment\\capstone-project\\docker-compose.yml: the attribute `version` is obsolete, it will be ig
nored, please remove it to avoid potential confusion"
[+] Running 0/1
 - Network capstone-project_app-network  Creating
[+] Running 3/35T13:11:05+05:30" level=warning msg="volume \"pgdata\" already exists but was not created by Docker Compose. Use `external: true` to use an existing volume
 ✔Network capstone-project_app-network   Created                                                                                                            0.1s
 ✔Container capstone-project-postgres-db-1  Healthy                                                                                                         11.1s
 ✔Container capstone-project-web-1       Started                                                                                                            11.3s
PS M:\Mohit\Docker Assignment\capstone-project> curl http://localhost:8000


StatusCode      : 200
StatusDescription : OK
Content         : {"message":"Connected to Postgres!","users":[{"id":1,"name":"Mohit","email":"mohit@gmail.com"},{"id":2,"name":"Mohit","email":"mohit@gmail.com"},{"id
                  ":3,"name":"Mohit","email":"mohit@gmail.com"},{"id...
RawContent      : HTTP/1.1 200 OK
                  Content-Length: 246
                  Content-Type: application/json
                  Date: Mon, 25 Aug 2025 07:43:56 GMT
                  Server: uvicorn

                  {"message":"Connected to Postgres!","users":[{"id":1,"name":"Mohit","email...
Forms           : {}
Headers         : {[Content-Length, 246], [Content-Type, application/json], [Date, Mon, 25 Aug 2025 07:43:56 GMT], [Server, uvicorn]}
Images          : {}
InputFields     : {}
Links           : {}
ParsedHtml      : mshtml.HTMLDocumentClass
RawContentLength : 246


PS M:\Mohit\Docker Assignment\capstone-project>
```

docker inspect capstone-project-web-1 | Select-String -Pattern "Health"

```
PS M:\Mohit\Docker Assignment\capstone-project> docker inspect capstone-project-web-1 | Select-String -Pattern "Health"

            "Health": {
                "Status": "unhealthy",
            "Healthcheck": {
                    "curl -f http://localhost:8000/health || exit 1"
                "com.docker.compose.depends_on": "postgres-db:service_healthy:false",
```