
3. Containerization with Docker:

🔧 Tool: Docker Desktop, VS code, Eclipse

📁 Program:

- Write a `Dockerfile` for a Python or Node.js application.
- Build and run a Docker image.
- Push the image to Docker Hub.
- Use Docker Compose to manage multi-container applications

Docker basic commands:

1. Docker Version

- `docker --version`
Docker version 24.0.2, build 12345abc

2. List Docker Images

- `docker images`

3. Download Image from Docker Hub

- `docker pull <image_name>:<tag>`

Example: `docker pull nginx:latest`

4. Build Docker Image

- `docker build -t <image_name>:<tag> .`

Example: `docker build -t myapp:1.0 .`

5. List Running Containers

- `docker ps`

6. List All Containers (Including Stopped)

- `docker ps -a`

7. Start a Container

- `docker start <container_name>/<container_id>`

8. Stop a Container

- `docker stop <container_name>/<container_id>`

9. Restart a Container

```
docker restart <container_name>/ <container_id>
```

10. Run a Container (Interactive Mode)

- `docker run -it -d <image_name> / <container_id>`

11. Run with Port Mapping

- `docker run -p <host_port>:<container_port> <image_name>`

Example : `docker run -p 8080:80 nginx`

12. Tag an Image for Pushing to Docker Hub

If you want to push an image to Docker Hub, it must be tagged with your Docker Hub username.

```
docker tag myapp:v1.0 myusername/myapp:v1.0
```

□ myusername is your Docker Hub username.

□ myapp:v1.0 is the image you're tagging.

Push the Image to Docker Hub:

```
docker push myusername/myapp:v1.
```

Write a Dockerfile for an application.

Step-1: Create maven project with .war format

Step-2: Create one html/jsp file in “src/main/webapp/index.html” and add

HTML code to it.

Step-3: Create “src/main/webapp/WEB-INF” folder. In that

“src/main/webapp/WEB-INF/web.xml” file.

Step-4: Include below plugin in “web.xml”

```
<plugin>
<groupId>org.apache.maven.plugins</groupId>
<artifactId>maven-war-plugin</artifactId>
<configuration>
<webXml>src/main/webapp/WEB-INF/index.jsp</webXml> (mention which
page to start)
</configuration>
</plugin>
```

Step-5: Update project – Maven clean install compile test (make sure build

Successful)

Prerequisites:

Make sure you have the following installed:

1. **Docker Desktop** (running)
2. **VS Code**
3. **Docker extension for VS Code** (optional but helpful)
4. A .war file ready to use (e.g., sample.war)

Step 1: Place your .war File on VS code Terminal

- Right-click the project folder in Eclipse □select properties→ Copy the project path
- Open VS code terminal □type cd\ command --> now you are in local disk c:\> type cd
paste the project path
- Go to File > Open Folder
- Select the eclipse project folder you copied
- VS Code will load the project

Step 2: Create a new file with name Dockerfile inside ur project folder□include below lines of code

```
FROM tomcat:9.0
RUN rm -rf /usr/local/tomcat/webapps/*
COPY /target/sample.war /usr/local/tomcat/webapps/ROOT.war
EXPOSE 8080
```

Step 3: Build the Docker Image by running the following command

```
docker build -t sample-app .
```

Step 4: Run the Container

```
docker run -d -p 8095(give unused port number ):8080 sample-app;
```

Step 5: Access the App (Goto web browser)

```
http://localhost:8095
```

- **To Stop and Clean Up**

```
docker ps # get container ID
docker stop <container_id>
docker rm <container_id>
```

- **Use Docker Compose to manage multi-container applications**

To containerize two simple applications, enable communication between them, and deploy them on a local server using Docker

Multi-container-app (create one main folder)

```
├── app1/ (subfolder)
│   ├── app.py
│   ├── requirements.txt
│   └── Dockerfile
├── app2/ (subfolder)
│   ├── app.py
│   ├── requirements.txt
│   └── Dockerfile
└── docker-compose.yml
```

Step 1: Create App 1 (Service Provider Folder in VS-CODE)

app1/app.py(File)

```
from flask import Flask
app = Flask(__name__)
@app.route('/')
def hello():
    return "Hello from App 1!"
if __name__ == '__main__':
    app.run(host='0.0.0.0', port=5000)
```

app1/requirements.txt (file)

```
flask==3.0.0
```

app1/Dockerfile (file)

```
FROM python:3.12-slim
WORKDIR /app

COPY requirements.txt .
RUN pip install --no-cache-dir -r requirements.txt
COPY app.py .
EXPOSE 5000
CMD ["python", "app.py"]
```

Step 2: Create App 2 (Service Consumer Folder in VS-CODE)

app2/app.py (file)

```
import requests
response = requests.get("http://app1:5000/")
print("Response from App 1:", response.text)
```

app2/requirements.txt (file)

```
requests==2.31.0
```

app2/Dockerfile(file)

```
FROM python:3.12-slim
WORKDIR /app

COPY requirements.txt .
RUN pip install --no-cache-dir -r requirements.txt
COPY app.py .
CMD ["python", "app.py"]
```

Step 3: Create Docker Compose File

docker-compose.yml

```
version: '3.9'
services:
  app1:
    build: ./app1
    networks:
      - app-network
    ports:
      - "5000:5000"

  app2:
    build: ./app2
    networks:
      - app-network
    depends_on:
      - app1

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

Explanation:

- Networks → Both apps are on the same network (app-network) to communicate.
- Depends_on → Ensures App 1 starts before App 2.
- app1:5000 → App 2 can communicate with App 1 using the service name app1.

Step 4: Build and Run the Containers

1. Build the Docker images:

```
docker-compose build
```

2. Start the containers:

```
docker-compose up
```

Step 5: Access the Applications

- **Check logs from App 2** to see the response from App 1:

```
docker-compose logs app2
```

You should see:

Response from App 1: Hello from App 1!

- **Manually test App 1** by opening a browser and visiting:

<http://localhost:5000>