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### 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>`

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## 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

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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 pate 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**

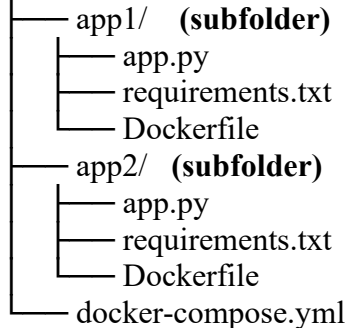
```
docker ps # get container ID
docker stop <container_id>
docker rm <container_id>
```

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- **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)**



**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)
```

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### **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
```

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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`