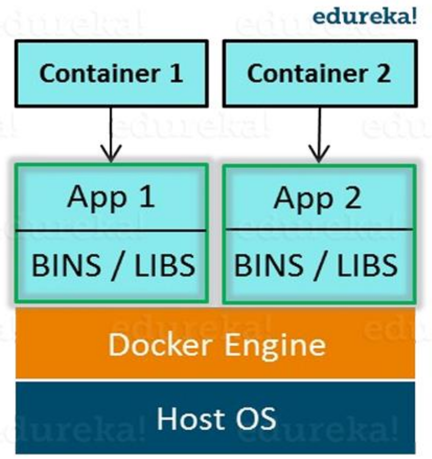
What is docker?

Let me give you an introduction to Docker first. Docker is a containerization platform that packages your application and all its dependencies together in the form of Containers to ensure that your application works seamlessly in any environment.



As a developer, I can build a container which has different applications installed on it and give it to my QA team who will only need to run the container to replicate the developer environment.

Key concepts:

- **Containers**: Lightweight, standalone, and executable packages
- **Images**: Read-only templates used to create containers. They contain the application and its dependencies. You can think of images as the blueprint for containers.
- **Docker file**: A text file containing a series of instructions on how to build a Docker image. It includes commands for installing software, copying files, setting environment variables, and more.
- **Docker Engine**: The runtime that manages containers on your system. It includes both the Docker Daemon (which runs in the background and handles container operations) and the Docker CLI (command-line interface).
- **Docker Hub**: A cloud-based repository for sharing Docker images. It's a central place where you can find and upload images.

How Docker Works:

1. **Write a docker file**: Define your application's environment in a docker file. Specify the base image (e.g., node, python), and include instructions for installing necessary packages and copying your application code.
2. **Build an Image**: Use the Docker CLI to build an image from your docker file. The command docker build -t myapp . creates an image tagged myapp.
3. **Run a Container**: Start a container using the image you built.

For example: docker run -d --name mycontainer -p 80:80 myapp runs a container in detached mode, name of the container and maps port 80 of the container to port 80 on the host.

Manage Containers: Use Docker commands to start, stop, restart, and remove containers.

IMAGES:

1. docker push <image_name> -Share your images by pushing them to Docker Hub
2. docker pull <image_name> - You can also pull images from Docker Hub
3. **Write a docker file [all docker files given below]**
4. From the docker file we **build an Image**
5. **docker build -t myapp . –** execute docker file and create docker image from docker file. creates an image tagged myapp.
6. docker images – list all images
7. docker rmi <image name> - remove docker images.

Containerization is a method of packaging an application and its dependencies into a standardized unit called a container. This approach helps ensure that applications run consistently across various computing environments.

Why use containers:

1. Isolation
2. Resource Efficiency
3. Scalability and Flexibility
4. Faster Deployment

Use cases:

1. Development and Testing
2. Continuous Integration/Continuous Deployment (CI/CD)

CONTAINERS:

1. docker run -d --name mycontainer -p 80:80 mynodeimage [container name- mycontainer, 80- ec2 port no: , 80: web browser port no: , already created image name- mynodeimage]
2. docker ps - lists running containers
3. docker ps -a - list all running and stopped container
4. docker stop <container_id> - stops a container
5. docker exec - to run commands inside a running Docker container. It allows you to interact with a container that's already up and running, which is useful for debugging, maintenance, or administrative tasks
6. docker inspect – details of images and containers

VOLUMES:

1. docker volume create my-vol – create a volume
2. docker volume ls – list all volumes
3. docker pull mysql – pull mysql image in dockerhub
4. docker run --name mysqlcontainer -d -e MYSQL_ROOT_PASSWORD =admin -v my-vol:/var/lib/mysql mysql

   - mysqlcontainer →container name

   - MYSQL_ROOT_PASSWORD →while using mysql image , we must give an environmental variable . admin [password we have to set] This sets the root password for MySQL

   - my-vol → already created volume name

   - -v my-vol:/var/lib/mysql: Binds the volume my-vol to /var/lib/mysql in the container, which is where MySQL stores its data.

   - mysql: Specifies the image to use. By default, Docker will pull the latest MySQL image from Docker Hub.

4. docker volume rm volume1 volume2 volume3 – remove multiple volumes

Developer gives

1. .json file →it denotes write docker file for node.js
2. .txt file → it denotes write docker file for python
3. .jar file → it denotes write docker file for java
4. .xml file → it denotes write docker file for java.

   → But developer does not give .jar file. We can create .jar file using build tool [maven /gradel]

   1. Maven [pom.xml]
   2. Gradel [build.gradle]

File format	Docker file	Package management tool
package. json	Node.js	Npm [Node Package Manager]
requirement.txt	python	pip
app.jar pom.xml	java	Maven [pom.xml] Gradel [build.gradle]

Suppose package.json file [default file name] not given in github repo, it means it’s an already build application. For run that application, we need web server [nginx or Apache]

APPLICATION	EXPOSE	CMD/ENTRYPOINT
python	5000 (our choice)	["python" , "app.py"]
java	8000 (our choice)	["java" , "-jar" , "app.jar"]
maven	-	-
Nodejs (nginx webserver)	80 (must be 80)	["nginx", "-g", "daemon off;"]
Nodejs	5000 (our choice)	[“node” , “app.js”]

app.py - file name. Got that file from developer

app.jar -jar file name

web root [where website files are served from]

1. Apache - /var/www/html/
2. Nginx - /usr/share/nginx/html

CMD – CMD instruction specifies the default command that will be executed when a container is started from the built image.

docker file: [nginx]

```
FROM nginx:latest
WORKDIR /usr/share/nginx/html
COPY build/ .     (or)  COPY . .     [hint: in given link, we have build folder, so gave build. Everything in build file can copied in docker image]
EXPOSE 80
CMD ["nginx", "-g", "daemon off;"]
```

docker file: [node]

```
FROM node: latest
WORKDIR /app
COPY package.json ./
RUN npm install
COPY . .
EXPOSE 80
CMD [“node” , “app.json”]
```

docker file: [python]

```
FROM python:latest
WORKDIR /app
COPY . . (OR) COPY requirements.txt .
RUN pip install -r requirements.txt .
COPY . .
EXPOSE 5000
CMD [“python” , “app.py”]
```

docker file: [java]

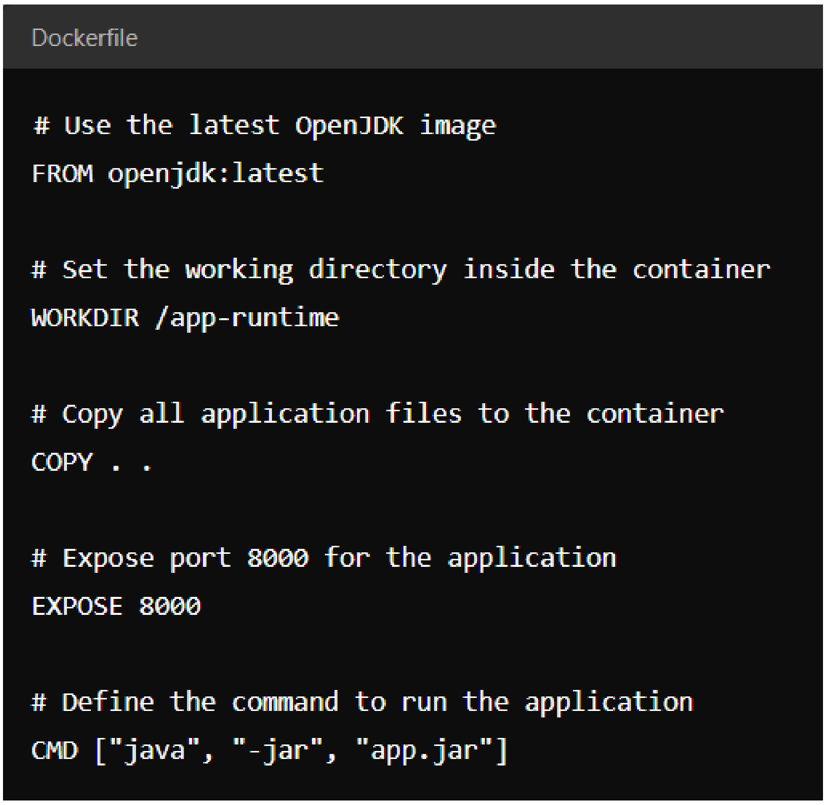
FROM openjdk: latest

WORKDIR /app-runtime

COPY . .

EXPOSE 8000

CMD [“java” , “-jar” “app.jar”]



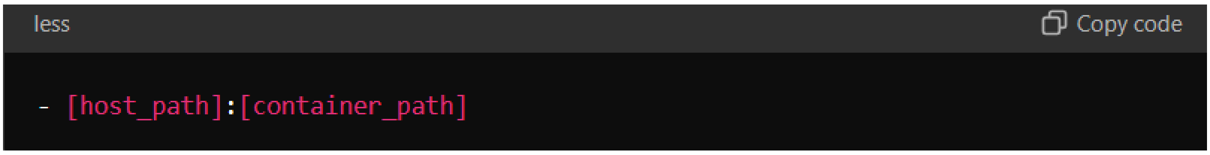
Dockerfile

```
# Use the latest OpenJDK image
FROM openjdk:latest

# Set the working directory inside the container
WORKDIR /app-runtime

# Copy all application files to the container
COPY . .

# Expose port 8000 for the application
EXPOSE 8000

# Define the command to run the application
CMD ["java", "-jar", "app.jar"]
```

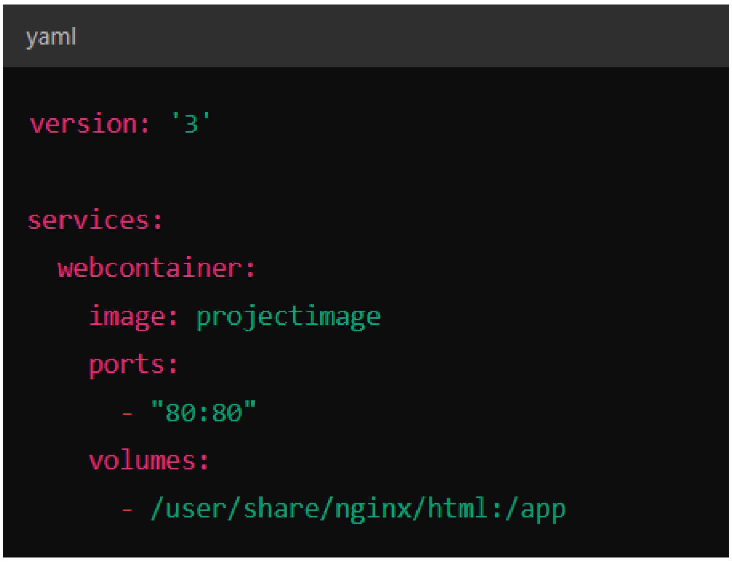
Docker compose:

```
version: '3'


services:
  webcontainer:
      image: projectimage
      ports:
        -  "80:80"
      volumes:
        -      /user/share/nginx/html:/build
```

The volumes key should be a list where each item is a mapping between the host path and the container path. The format is:



```less
- [host_path]:[container_path]
```



```yaml
version: '3'

services:
  webcontainer:
    image: projectimage
    ports:
      - "80:80"
    volumes:
      - /user/share/nginx/html:/app
```

Build:

```
#!/bin/bash

#build the docker image

docker build -t projectimage .
```

deploy:

```
#!/bin/bash

docker login -u sharmi2504 -p dckr_pat_9SQ5F6VWmpfq_5dLNHHeqxN2XZI

if [ $GIT_BRANCH = "dev" ]; then

   # Build your project

   sh 'chmod +x build.sh'

   sh './build.sh'

   docker tag projectimage sharmi2504/dev

   docker push sharmi2504/dev


elif [ $GIT_BRANCH = "master" ]; then

   sh 'chmod +x build.sh'

   sh './build.sh'

   docker tag projectimage sharmi2504/prod

   docker push sharmi2504/prod

fi
```

Jenkins file:

```
pipeline {

   agent any


   stages {

      stage('changing file permission') {

         steps {

            sh 'chmod +x build.sh'

            sh 'chmod +x deploy.sh'

         }

      }


      stage('Build') {
```

```
      steps {
        script {
          // Build Docker image using build script file
          sh './build.sh'
        }
      }
    }

    stage('Login') {
      steps {
        withCredentials([usernamePassword(credentialsId: 'docker-password-id', passwordVariable: 'DOCKER_PASSWORD', usernameVariable: 'DOCKER_USERNAME')]) {
          sh 'echo $DOCKER_PASSWORD | docker login -u $DOCKER_USERNAME --password-stdin'
        }
      }
    }
    stage('Deploy') {
      steps {
        script {
          sh './deploy.sh'
          }
        }
      }
    }
  }
```