SRE TRAINING (DAY 11) - CONTAINERIZATION

CONTAINERIZATION

Containerization is a technology that allows you to package an application along with all its dependencies (such as libraries, configuration files, and environment variables) into a single unit called a container. This ensures that the application runs consistently across different computing environments, whether it's on a developer's local machine, on a testing server, or in production.

DOCKER

Docker is an open-source platform that automates the deployment, scaling, and management of applications using containers.

Key Docker Components:

1. **Docker Engine:** The core part of Docker that runs on the host machine and allows you to build, run, and manage containers.
2. **Docker Images:** Read-only templates that define the container's contents.
3. **Docker Containers:** Running instances of Docker images, providing an isolated environment for applications.
4. **Dockerfile:** A script containing instructions to build a Docker image.

Dockerfile

```
1   FROM python:3.9-slim
2   WORKDIR /app
3   COPY requirements.txt .
4   RUN pip install --no-cache-dir -r requirements.txt
5   COPY . .
6   ENV FLASK_APP=src/main.py
7   ENV FLASK_ENV=development
8   ENV PYTHONPATH=/app
9   EXPOSE 5000
10  CMD ["gunicorn","--bind","0.0.0.0:5000","src.main:app"]
```

5. **Docker Hub:** A cloud-based registry where Docker images can be stored and shared publicly or privately.

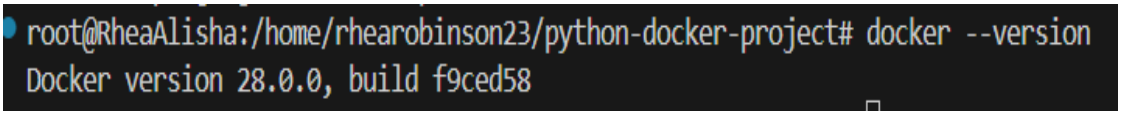
6. **Docker Compose:** A tool for defining and running multi-container Docker applications using a `docker-compose.yml` file.
7. **Docker CLI -** command-line interface used to interact with the Docker Engine. It allows you to build, run, manage, and monitor Docker containers, images, networks, and volumes using simple commands.

Basic Docker Workflow

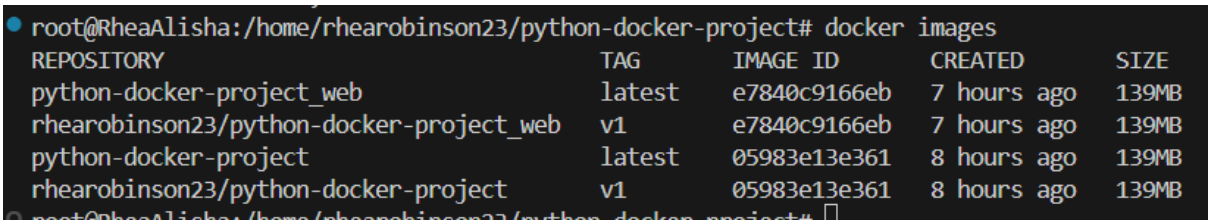
1. Write a **Dockerfile.**
2. **Build** an image from a Dockerfile.
3. **Run** a container from the image.
4. **Manage** images, containers, volumes, and networks.
5. **Push/Pull** images to/from Docker Hub.

Common Docker CLI Commands

- **docker --version** Displays the installed Docker version.



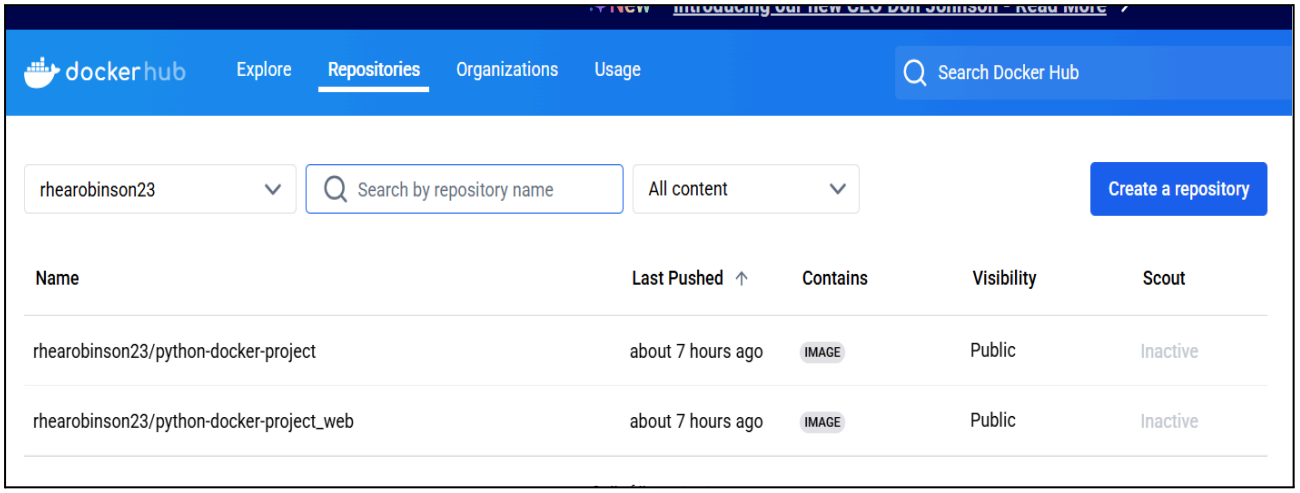
- **docker images** Lists all Docker images on the local machine.



- **docker build -t <image-name> .** Builds an image from a Dockerfile in the current directory.
- **docker pull <image-name>** Pulls an image from Docker Hub.
- **docker run -d -p 8080:80 <image-name>** Runs a container in detached mode with port mapping.
- **docker ps** List running containers

```
root@RheaAlisha:/home/rhearobinson23/python-docker-project# docker ps
CONTAINER ID   IMAGE                  COMMAND                  CREATED         STATUS         PORTS
                          NAMES
83e61813fa3d   python-docker-project  "gunicorn --bind 0.0…"   18 seconds ago  Up 17 seconds  5000/tcp, 0.0.0.0:8
```

- **docker stop <container-id>** Stops a running container.
- **docker start <container-id>** Starts a stopped container.
- **docker push <username>/<image-name>** Pushes an image to Docker Hub.



- **docker system prune** Cleans up unused containers, images, networks, and volumes.
- **docker-compose up -d** Starts all services defined in docker-compose.yml in detached mode.

AUTHENTICATION - docker login

The **`docker login`** command is used to authenticate your Docker CLI session with Docker Hub or any Docker registry. You will need to connect your device with an access token for the first time.

```
root@RheaAlisha:/home/rhearobinson23/python-docker-project# docker login
Authenticating with existing credentials... [Username: rhearobinson23]

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


Login Succeeded
root@RheaAlisha:/home/rhearobinson23/python-docker-project#
```

🐳 DOCKER COMPOSE

Docker Compose is a tool that allows you to define and manage **multi-container Docker applications** using a simple YAML configuration file. With Docker Compose, you can define services, networks, and volumes in a single file (`docker-compose.yml`) and manage them easily.

```
root@RheaAlisha:/home/rhearobinson23/python-docker-project# docker-compose --version
docker-compose version 1.29.2, build unknown
```

docker-compose.yml

```yaml
version: '3.8'
services:
  web:
    build: .
    ports:
      - "5000:5000"
    volumes:
      - .:/app
    environment:
      - FLASK_APP=src/main.py
      - FLASK_ENV=development
    command: flask run --host=0.0.0.0
```

DOCKER IMAGE TAGS

In Docker, **tags** are used to identify and differentiate images. Tags typically represent different versions, environments, or configurations of an image.

```
root@RheaAlisha:/home/rhearobinson23/python-docker-project# docker images
REPOSITORY                                TAG       IMAGE ID       CREATED          SIZE
python-docker-project_web                 latest    e7840c9166eb   9 hours ago      139MB
rhearobinson23/python-docker-project_web  v1        e7840c9166eb   9 hours ago      139MB
python-docker-project                     latest    05983e13e361   9 hours ago      139MB
rhearobinson23/python-docker-project      v1        05983e13e361   9 hours ago      139MB
```

DOCKER BUILDS

Docker build is the process of creating a Docker image from a **Dockerfile** and application source code. The build process packages the application and its dependencies into an image that can run on any machine with Docker installed. **Build once, run anywhere**.