Docker Day –01

Setup docker in ubuntu: end to end docker process:

I have created one aws ec2 instance with instance type c7iflex.large --> availability zone -> eu-north-1b.

And connected to above server by git bash using below commands

ssh -i /c/Users/kasev/Downloads/aws_key_manju_mail.pem.pem ubuntu@16.171.36.240

Step 1: Install Docker on Ubuntu

Run these commands one by one in your EC2 terminal 👇

```
# Update your packages
sudo apt update -y

# Install Docker engine
sudo apt install docker.io -y

# Enable and start Docker service
sudo systemctl enable docker
sudo systemctl start docker

# Check Docker version
docker --version
```

✅ You should see output like:

```
Docker version 24.x.x, build ...
```

👨‍💻 Step 2: Add your user to the Docker group

This lets you run `docker` commands without using `sudo` every time.

```
sudo usermod -aG docker $USER
```

Then **logout and login again**, or run:

```
newgrp docker
```

To verify:

```
docker ps
```

If it shows no errors → good to go ✅

🗂️ Step 3: Create the Project

Create a simple directory for our app:

```
mkdir docker-flask-app
cd docker-flask-app
```

🧩 Step 4: Create Flask App Files

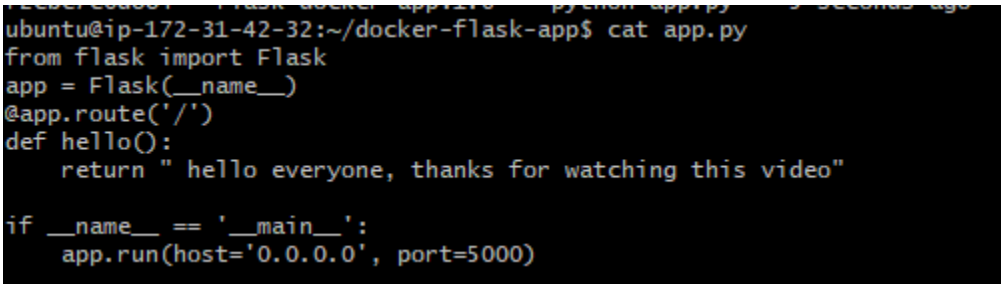
1️⃣ Create `app.py`

```
nano app.py
```

Paste this code:

```
from flask import Flask

app = Flask(__name__)

@app.route('/')

def hello():

    return "Hello Everyone, Thanks for watching this video!! please like this video and subscribe my channel!!"

if __name__ == '__main__':

   app.run(host='0.0.0.0', port=5000)
```

:wq!



2️⃣ Create `requirements.txt`

```
flask
```

3️⃣ Create `Dockerfile`

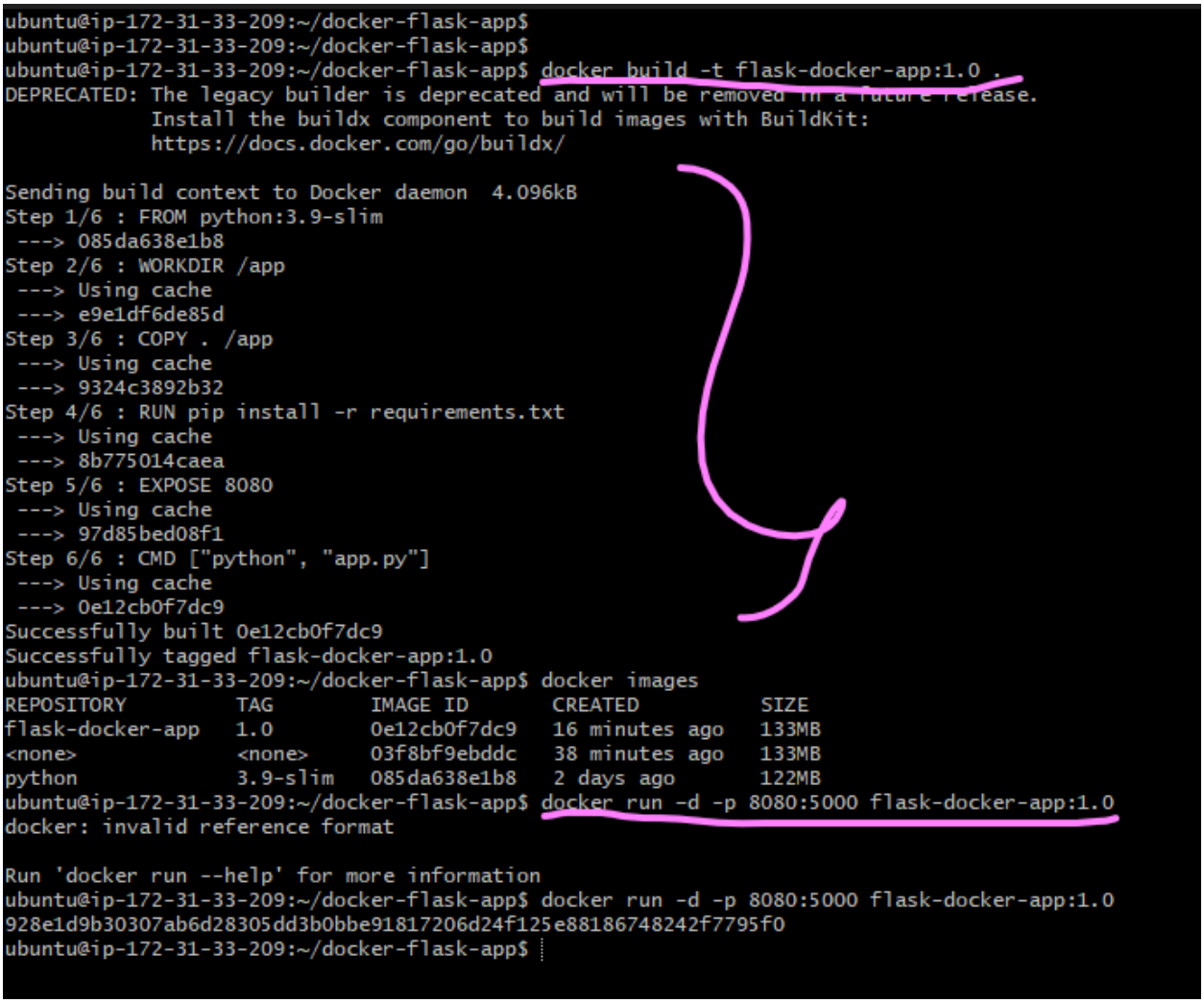
```
nano Dockerfile
```

Paste this:

```
FROM python:3.9-slim
WORKDIR /app
COPY . /app
RUN pip install -r requirements.txt
EXPOSE 8080
CMD ["python", "app.py"]
```

Save and exit.

Step 5: Build Docker Image




```
docker build -t flask-docker-app:1.0 .
```

Step 6: Verify the Image

docker images

You should see flask-docker-app:1.0 in the list.

☑ What Happened

- Docker pulled the **Python 3.9 base image.**
- Installed **Flask** and its dependencies (click, werkzeug, jinja2, etc.) inside the image.
- Successfully completed the **RUN pip install -r requirements.txt** step.
- Finally executed the CMD ["python", "app.py"] instruction — meaning when you run the container, it'll start your Flask app automatically.
- The image flask-docker-app:1.0 is now ready.

The **warning about "running pip as root"** is harmless inside containers — you can safely ignore it since containers are isolated environments.

Step 7: Run Container

docker run –d -p 8080:5000 flask-docker-app:1.0 -- to create and start the new container from the flask-docker-app image

or

docker run –p hostpoart:containrport <imagename>

Now your container is running!

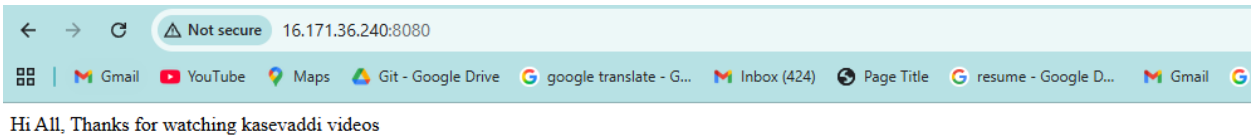
Check with:

docker ps

Step 7: Test Your App

Go to your AWS instance's **Public IP**, open in browser:

http://<your-public-ip>:8080



You should see:

Hello, Docker! 🚀 Flask app running inside AWS EC2 container.

the above content we can edit in app.py file.

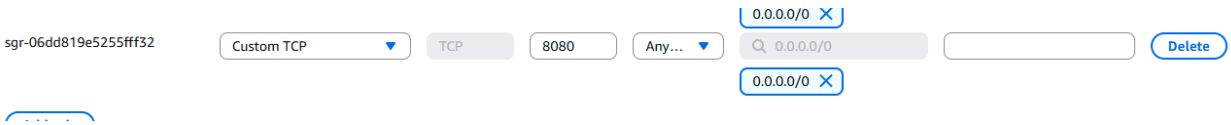
⚠️ If You Don't See It:

Make sure your **EC2 Security Group** allows **Inbound Rule: Port 8080 (TCP).**

To fix:

- Go to **AWS Console → EC2 → Security Groups → Inbound Rules → Edit**
- Add:
  - Type: Custom TCP
  - Port Range: 8080
  - Source: 0.0.0.0/0

Then reload your browser.



✅ **Congratulations!**
You just completed:

Docker Build → Run → Deploy → Access via Public IP on AWS EC2

NOTE: IF YOU MAKE ANY CHANGES IN APP.PY WE SHOULD RUN BELOW COMMANDS

2. Rebuild your Docker image (so the fixed app.py is used):

```
docker build -t flask-docker-app:1.0 .
```

3. Run the container again:

```
docker run –d -p 8080:5000 flask-docker-app:1.0 -- before run this command pls stop existed containers or change port numbers on above command.
Host server port no is 8080, container port no is 5000
                      8080:500
```

Finally, Flask app is now **successfully deployed and running** inside the Docker container, and you can access it through the browser (e.g., http://<your-EC2-public-IP>:8080).

Docker day -02

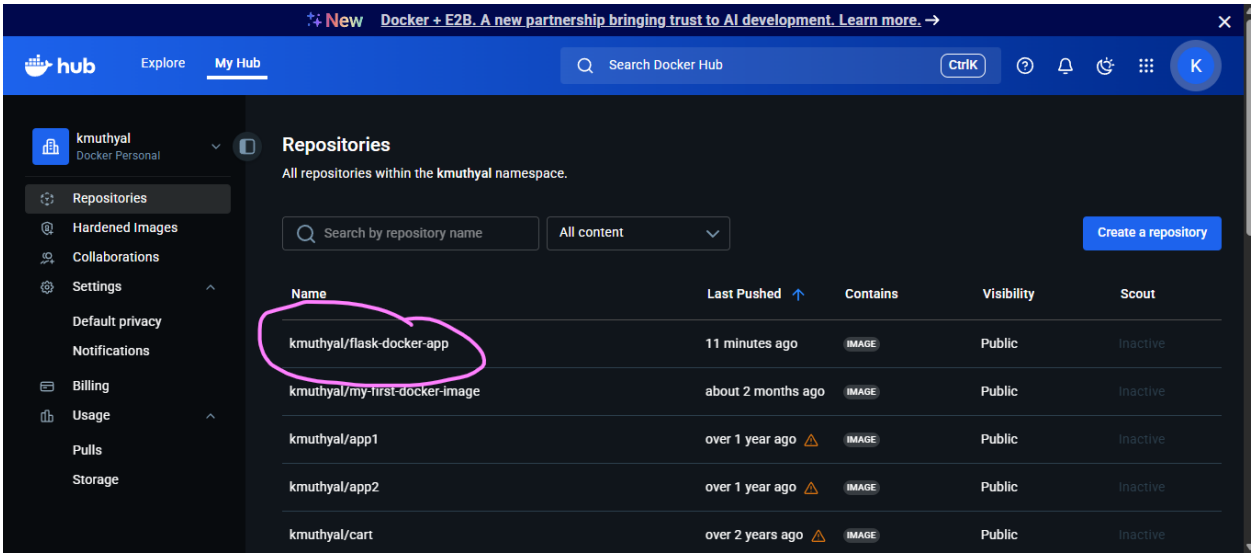
Step 8: push the image to docker hub (registry)

docker tag <local-image-name>:<tag> <dockerhub-username>/<repository-name>:<tag>

docker tag flask-docker-app:1.0 kmuthyal/flask-docker-app:1.0

docker push kasevaddi/myapp:latest

```
ubuntu@ip-172-31-33-209:~/docker-flask-app$
ubuntu@ip-172-31-33-209:~/docker-flask-app$ docker login

USING WEB-BASED LOGIN

i Info → To sign in with credentials on the command line, use 'docker login -u <username>'


Your one-time device confirmation code is: RGZK-GVGN
Press ENTER to open your browser or submit your device code here: https://login.docker.com/activate

Waiting for authentication in the browser…
^Clogin canceled
ubuntu@ip-172-31-33-209:~/docker-flask-app$ docker login -u kmuthyal

i Info → A Personal Access Token (PAT) can be used instead.
         To create a PAT, visit https://app.docker.com/settings


Password:

WARNING! Your credentials are stored unencrypted in '/home/ubuntu/.docker/config.json'.
Configure a credential helper to remove this warning. See
https://docs.docker.com/go/credential-store/

Login Succeeded
ubuntu@ip-172-31-33-209:~/docker-flask-app$ docker tag flask-docker-app:1.0 kmuthyal/flask-docker-app:1.0
ubuntu@ip-172-31-33-209:~/docker-flask-app$ docker tag
docker: 'docker tag' requires 2 arguments

Usage:  docker tag SOURCE_IMAGE[:TAG] TARGET_IMAGE[:TAG]

Run 'docker tag --help' for more information
ubuntu@ip-172-31-33-209:~/docker-flask-app$ docker push kmuthyal/flask-docker-app:1.0
The push refers to repository [docker.io/kmuthyal/flask-docker-app]
538496566941: Pushed
3a7c0c1b74c7: Pushed
05a7e960f516: Pushed
c8f6b54339a8: Mounted from library/python
298992e09a03: Mounted from library/python
4f237755fbae: Mounted from library/python
d7c97cb6f1fe: Mounted from library/python
1.0: digest: sha256:03ba5f7c4cde603ff2d483ee27aede1526d22df10b3a4fa483e2d0d7bae3240d size: 1783
ubuntu@ip-172-31-33-209:~/docker-flask-app$
```



Topic: how to pull and use the existed image form docker-hub

Perfect 👏 — since you've already pushed our Docker image to **Docker Hub**, pulling and running it on a **new Ubuntu server** is very straightforward. Let's go step-by-step.

🧭 Step-by-step: Pull and run your image on a new server

☑️ Step 1 — Install Docker (if not installed yet)

If your new Ubuntu server doesn't have Docker installed, run:

```
sudo apt update
sudo apt install -y docker.io
sudo systemctl start docker
sudo systemctl enable docker
```

You can verify Docker is running:

```
docker –version
```

Step : Add your user to the Docker group

This lets you run `docker` commands without using `sudo` every time.

```
sudo usermod -aG docker $USER
```

Then **logout and login again**, or run:

```
newgrp docker
```

☑ Step 2 — Log in to Docker Hub

Use your Docker Hub credentials to log in so the new server can pull private or public images:

```
docker login –u kmuthyal (username of dockerhub)
Passwd: password of above user
```

It will prompt for your **Docker Hub username** and **password (or access token)**.

☑ Step 3 — Pull your image

Now, pull your image from Docker Hub:

```
docker pull <your-dockerhub-username>/<image-name>:<tag>
```

Example:

```
docker pull kmuthyal/flask-docker-app:1.0
```

This downloads the image layers to your new server.

You can verify it's there:

```
docker images
```

☑ Step 4 — Run the container

Now run the Flask app container and expose it on your desired port:

```
docker run -d -p 8080:5000 --name flask-app kmuthyal/flask-docker-app:1.0
```

Explanation:

- `-d` → run in detached mode
- `-p 8080:5000` → map host port 8080 to container's internal port 5000 (Flask default)
- `--name flask-app` → container name
- `kmuthyal/flask-docker-app:1.0` → image from Docker Hub

☑ Step 5 — Verify it's running

```
docker ps
```

You should see something like:

```
CONTAINER ID   IMAGE                          COMMAND           STATUS
PORTS                     NAMES
abcd1234efgh   kmuthyal/flask-docker-app:1.0   "python app.py"   Up 5
seconds    0.0.0.0:8080->5000/tcp   flask-app
```

```
Step: please enable inbound rules (tcp and 8080 port) in aws server.
Before access in browser
```

☑ Step 6 — Access in browser

Now open your Flask app in the browser using your new server's **public IP**:

http://<your-server-public-ip>:8080

You should see your Flask app page (e.g., “Hello World!”).

Docker day –03

Docker is a lightweight process to create containers we should use docker for deploy and run the application inside the containers.

Topic: what is virtualization and containerization?

What is Virtualization?

Virtualization is a technology that allows you to run multiple **virtual machines (VMs)** on a single **physical machine**.
Each VM has its **own operating system (OS)**, kernel, libraries, and applications — behaving like a separate computer.

Example:

- You can run **Windows**, **Linux**, and **Ubuntu** virtual machines on one physical server.
- Tools: **VMware**, **VirtualBox**, **Hyper-V**, **KVM**

What is Containerization?

Containerization is a lightweight alternative to virtualization.
It packages applications and their dependencies into **containers** that share the **same host OS kernel** but run in isolated environments.

Tools: **Docker**, **Podman**, **Kubernetes**

How it works:

- Containers run on a **container runtime** (like Docker Engine).
- They share the host OS kernel but are isolated using Linux features (namespaces, cgroups).
- Containers start quickly and use less memory than VMs.

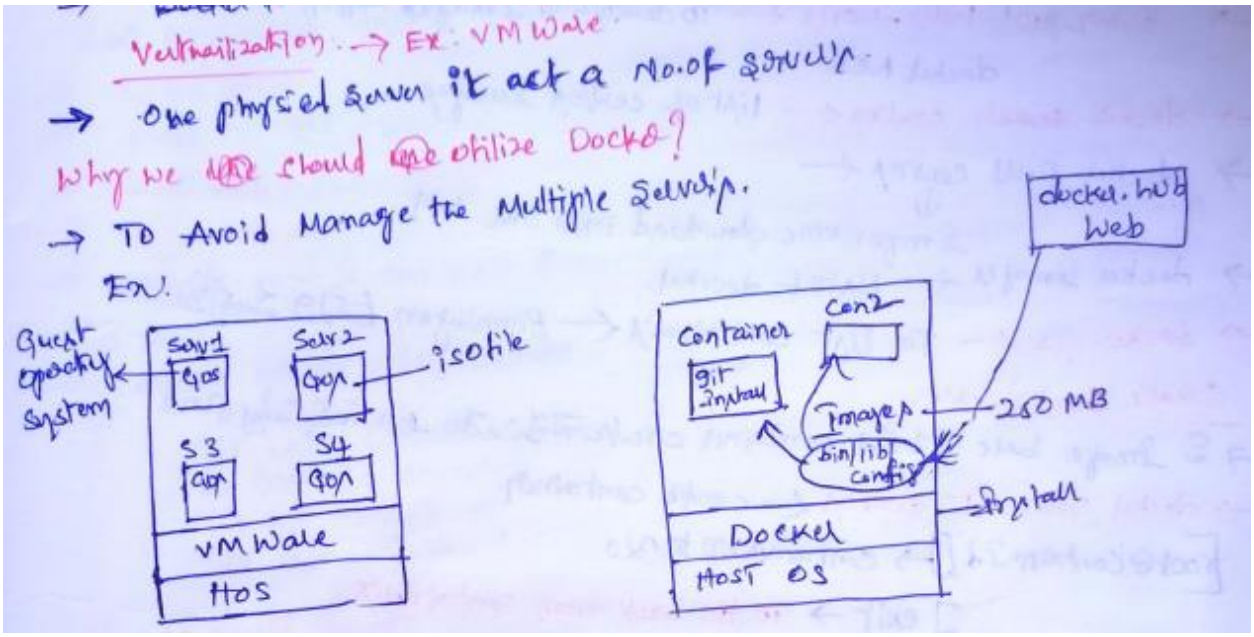
⚖️ Difference Between Virtualization and Containerization

Feature	Virtualization	Containerization
Definition	Runs multiple OS instances on a single host	Runs multiple isolated apps on the same OS kernel
Abstraction Level	Hardware level (via hypervisor)	OS level (via container runtime)
Component	Virtual Machine (VM)	Container
Guest OS	Each VM has its own OS	All containers share the host OS kernel
Startup Time	Slow (minutes)	Fast (seconds)
Resource Usage	Heavy (each VM needs OS, memory, disk)	Lightweight (shares kernel, fewer resources)
Isolation	Strong (full OS isolation)	Moderate (process-level isolation)
Use Case	Running multiple different OS environments	Deploying microservices, fast CI/CD pipelines
Examples	VMware, VirtualBox, KVM	Docker, Podman, Kubernetes

🧠 In Simple Terms

- **Virtualization = multiple computers (VMs)** on one machine.
- **Containerization = multiple apps (containers)** on one OS.

Diff between virtualization and containerization?



Above scenario:

If we utilize the docker directly we can download the images from docker hub

After running the image container will be creating

We can create multiple containers using image

It will take time 1 or 2 seconds to create the containers from image

In containerization booting process is very easy

Maintain and integration is simple

Once install the docker – need to run below commands:

1st command of docker –---> docker info -- > to list info of all containers nd images,

Docker images - list images

Docker search centos – to list centos images

docker pull eclipse/centos – centos image download into our LM

docker images – to list all images

Container creation:

We should remember that create the container using what image(centos/mysql-57-centos7)

docker run -itd eclipse/centos – to just create the container from image

docker run -it eclipse/centos /bin/bash -- to stop the container with exit command

docker exec -it --user root 17ab0cd9b1cd /bin/bash

docker run -it eclipse/centos /bin/bash

```
ubuntu@ip-172-31-33-149:~/docker-flask-app$ docker attach 32d246d7a684
bash-4.2$ export PS1="[\u@\h \W]\$ "
[mysql@32d246d7a684 opt]$ pwd
```

Now we are inside the container – we can use this container as new server

It means we can install the packages,

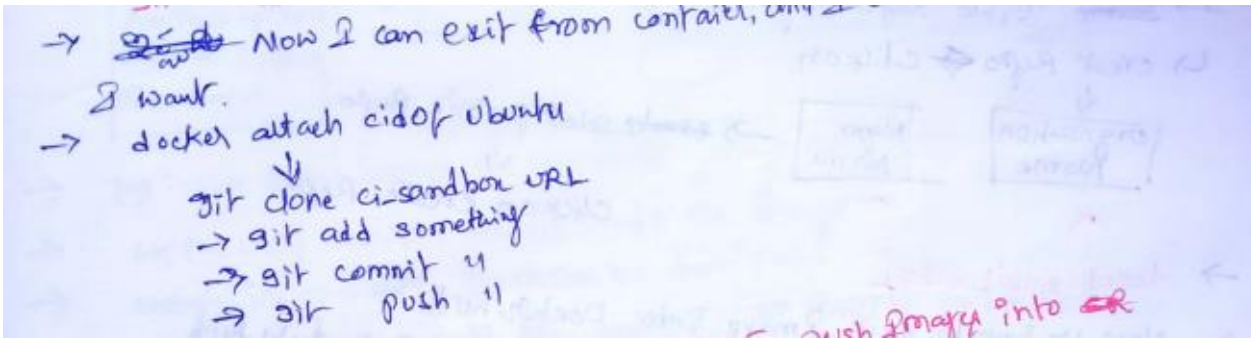
Example git, maven, sonarqube, jenkins etc .. we can clone git...

apt update && apt install -y git

git --version

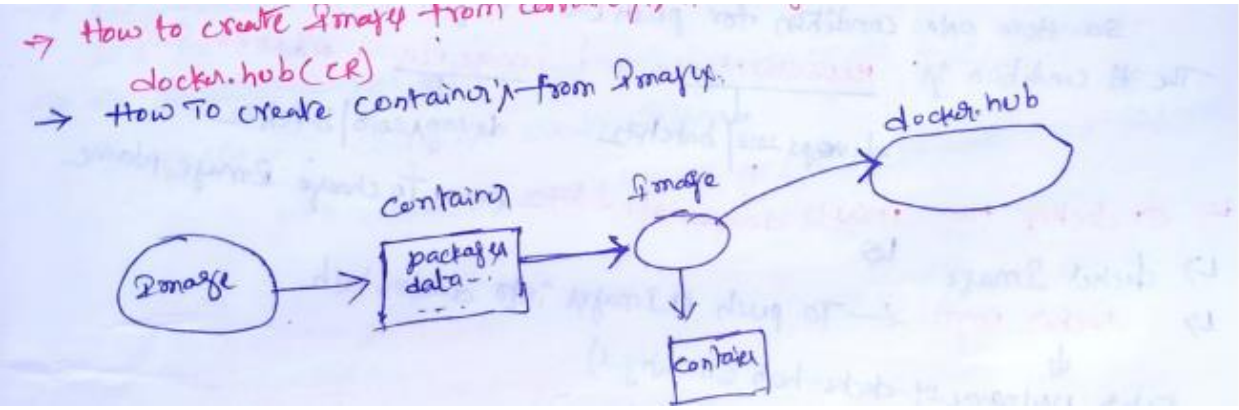
cat /etc/os-release

If you want add files or directories using git follow below



Docker day -04

How to create image from containers and how to push images to docker hub:



If see the above image it shows:

1.Create containers from image – installed git in this container

Docker run –itd centos or ubuntu – create containers based on image. Without pulling the image this cmd download the image from central repo and place into LM

Docker attach cid -- to login container

apt update

apt install git –y

```
ubuntu@ip-172-31-33-149:~/docker-flask-app$ docker images
REPOSITORY                 TAG       IMAGE ID       CREATED      SIZE
kmuthyal/flask-docker-app  1.0       7d153c000721   5 days ago   133MB
flask-docker-app           1.0       7d153c000721   5 days ago   133MB
ubuntu@ip-172-31-33-149:~/docker-flask-app$ docker run -itd ubuntu
Unable to find image 'ubuntu:latest' locally
latest: Pulling from library/ubuntu
4b3ffd8ccb52: Pull complete
Digest: sha256:66460d557b25769b102175144d538d88219c077c678a49af4afca6fbfc1b5252
Status: Downloaded newer image for ubuntu:latest
cf0b00038841ade1d4f310f8fefe70bd28ec667f1aed21aef8a1b5e38e3c317c
ubuntu@ip-172-31-33-149:~/docker-flask-app$ docker images
REPOSITORY                 TAG       IMAGE ID       CREATED       SIZE
kmuthyal/flask-docker-app  1.0       7d153c000721   5 days ago    133MB
flask-docker-app           1.0       7d153c000721   5 days ago    133MB
ubuntu                     latest    97bed23a3497   5 weeks ago   78.1MB
ubuntu@ip-172-31-33-149:~/docker-flask-app$ docker ps -a
CONTAINER ID   IMAGE                  COMMAND           CREATED          STATUS                      PORTS     NAMES
cf0b00038841   ubuntu                 "/bin/bash"       16 seconds ago   Up 16 seconds                         gallant_villani
b98f25be2e9b   flask-docker-app:1.0   "python app.py"   5 days ago       Exited (137) 41 hours ago             xenodochial_satoshi
ubuntu@ip-172-31-33-149:~/docker-flask-app$ docker attach cf0b00038841
root@cf0b00038841:/# touch kasevaddi
root@cf0b00038841:/# apt update && apt install git -y
```

git –version

Git clone **docker-install-commands** **-- clone this repo**

2. image creation from container

docker commit b6e6e0fae29b -- (of image(centos/ubuntu) _ - here new image will create, using existed container (
Docker images -- to list

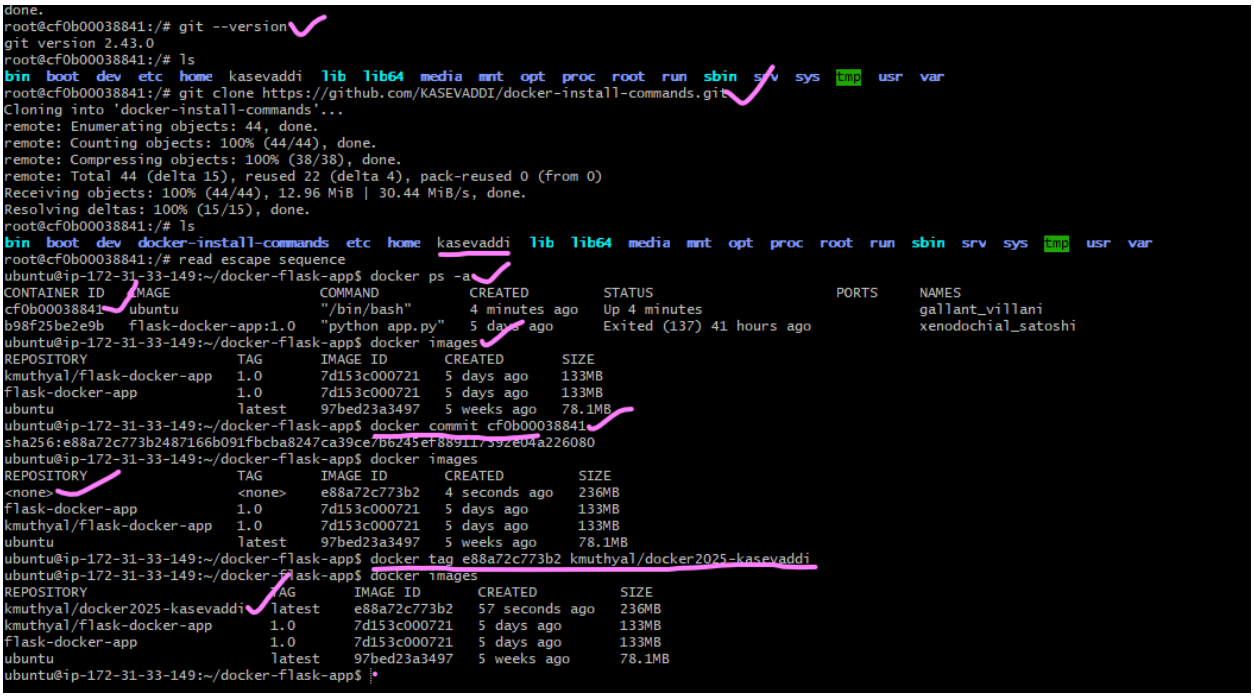
3. Docker tag imageid (above image id) kmuthyal/docker2025-kasevaddi -- to change re name of above image becoz while creatiing above there is no name. Using this image id we can rename the image name (custom name) kmuthyal/docker2025-kasevaddi

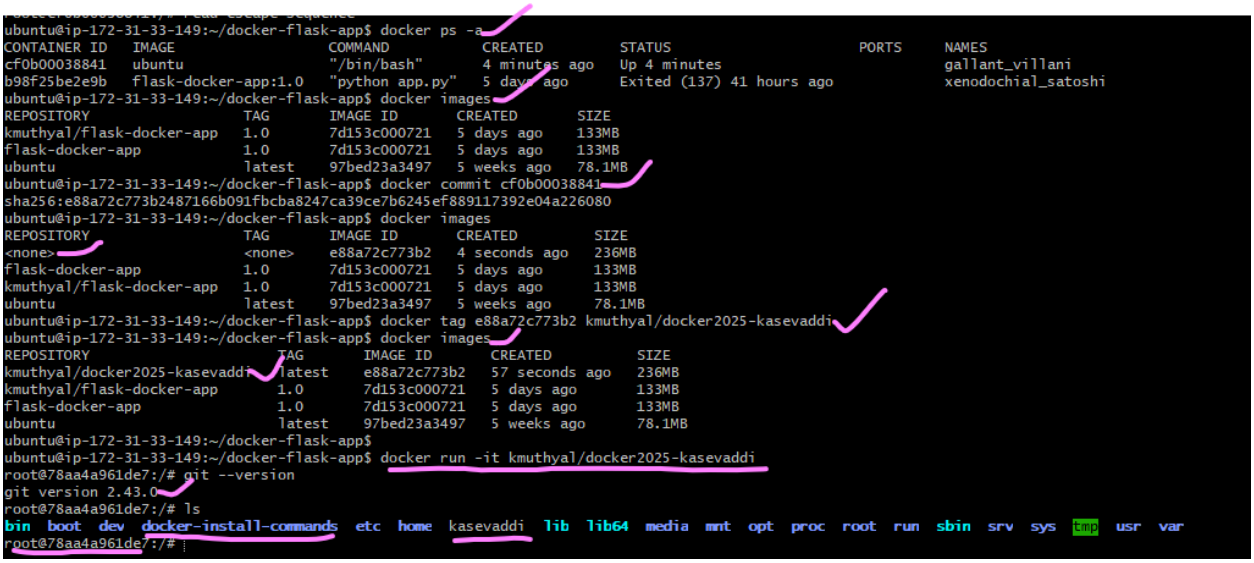
Docker images – above image can see

If we create containers from above image kmuthyal/docker2025-kasevaddi then inside that container git and repo should be there.

4. Docker run –it kmuthyal/docker2025-kasevaddi -- to login to the containr

So as per above process download new image ---> created container using new image (installed git and cloned repo inthis container) --> again created kmuthyal/docker2025-kasevaddi custom image --> again created container (verified git and cloned repo) whether data copied or not). It means we have copied data. Between isolated containers.





How do push docker image from lm to docker hub:

Process:

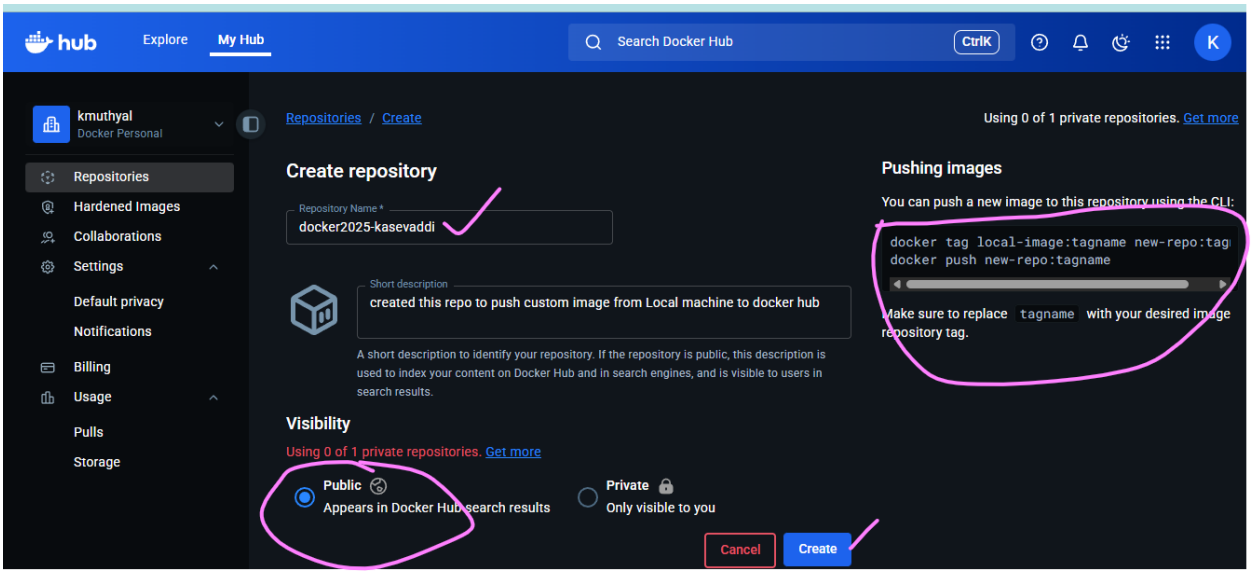
1. Need to create docker hub account— search in web— hub.docker.com --> need to login with mail id,username
   Once login to docker hub --> we can create repos like git gub

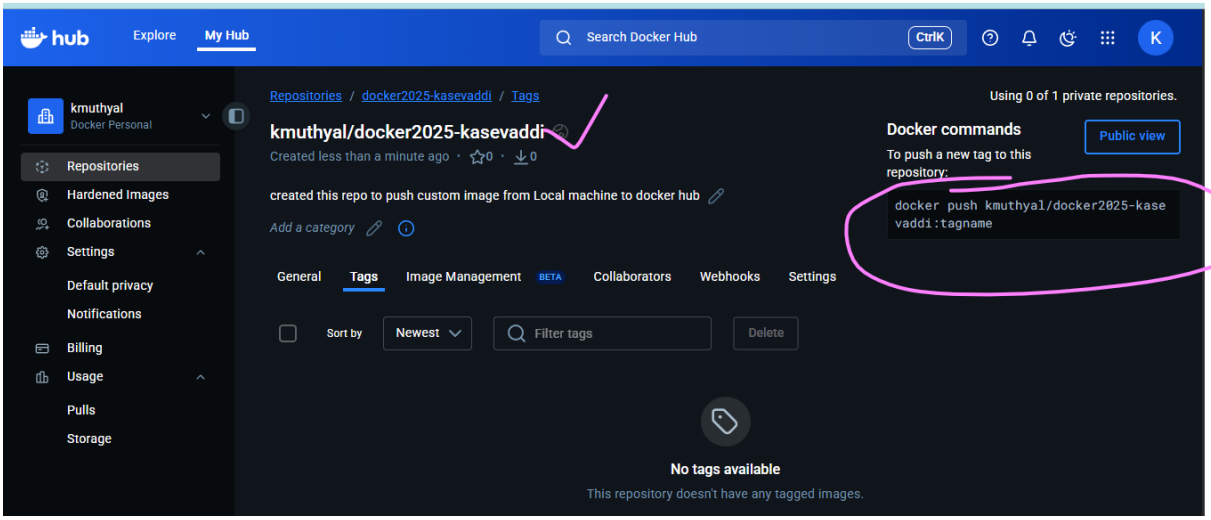
Process:

Click on home – repos – click on crate repo pls check below image

Condition: docker image name and docker repo name must be same

Example; kmuthyal/docker2025-kasevaddi – this cutom image name and docker repos name.





Pcoess to push image to docker hub:

To push exit from container:

Docker images

Docker login –u kmuthyal

Docker push imagename