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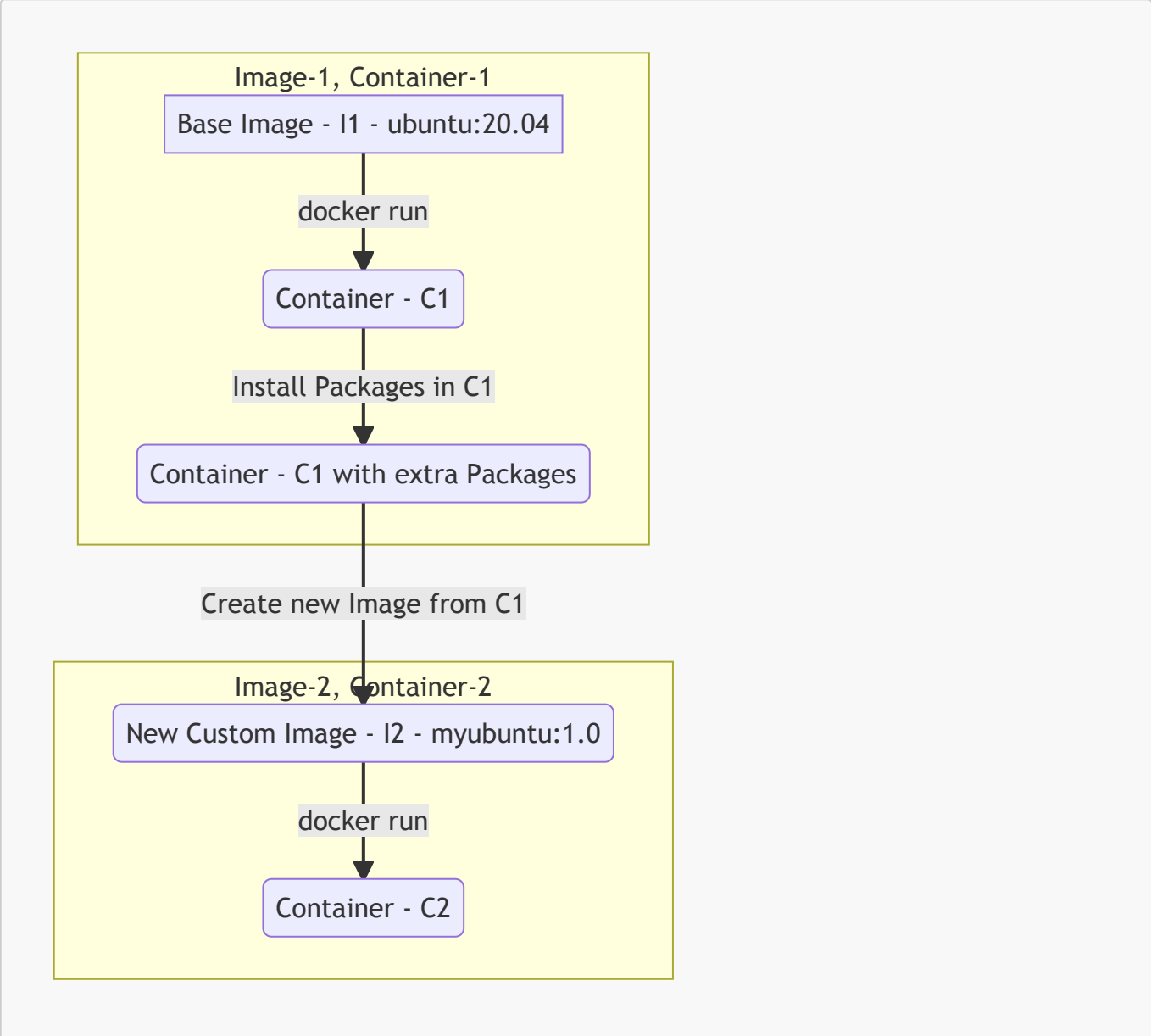
Creating Docker Images

Using container



> I1 - ubuntu 20.04 > C1 > install wget or any package in C1 > I2-Custom image > C2 from I2

- Check existing images and run a container using image. #Use ubuntu image as base image , install wget inside the container , then create an image from runnning container

> This setup is not preferred in a deployment environment.

```
sudo docker images
sudo docker run --name=base-image-container -i -t ubuntu:20.04 /bin/bash
```

- Run below commands inside container

```
whereis wget
apt-get update && apt-get install -y wget
whereis wget
```

- From another linux shell, use below `docker diff` command to check changes made in the above container

```
sudo docker diff <CONTAINER_NAME>
```

- To create a new image from exising running container

```
docker images
sudo docker commit 99a7ac739cbd ubuntudocker/ubuntu_wget
sudo docker images
sudo docker run -i -t ubuntudocker/ubuntu_wget:latest /bin/bash
whereis wget
```

- Below is the information for the details related to `docker images` command
  - `REPOSITORY`: This is the name of the repository or image.
  - `TAG`: This is the tag associated with the image
  - `IMAGE ID`: Every image is associated with a unique ID.
  - `CREATED`: Indicates the time when the image was created.
  - `SIZE`: Highlights the virtual size of the image.

Using Dockerfile

- A **Dockerfile** is a script that consists of instructions to build Docker images which can then be used to deploy a Docker container.
- The commands and information within the Dockerfile can be configured to use specific software versions and dependencies for stable deployments.

- Once a `Dockerfile` is written, you can use the `docker build` command to generate a Docker image based on the Dockerfile's instructions.
- Create a Docker image using DockerFile

```
touch Dockerfile
```

- Copy the below content into `Dockerfile`

```
# Base Image will be as below
FROM ubuntu:20.04
ARG SDLC_ARG
ENV SDLC_ENV=${SDLC_ARG}
RUN echo "ARG value for SDLC_ENV is $SDLC_ENV"
RUN echo "ENV value for SDLC_ENV is $SDLC_ENV"
# To Set a default value
# ARG SDLC_ENV=test
ENV DEBIAN_FRONTEND=noninteractive
# Install dependencies
RUN apt-get update
RUN apt-get install -y apache2
RUN apt-get install -y apache2-utils
# Replace content of Apache Home Page
RUN echo "Docker Image created using Dockerfile for $SDLC_ENV" >
/var/www/html/index.html
# Expose Container Port
EXPOSE 80
# Execute command at container launch
CMD ["apache2ctl", "-D", "FOREGROUND"]
```

> The `DEBIAN_FRONTEND=noninteractive` instruction ensures that the subsequent RUN apt-get commands execute without requiring additional user input when building images.

Dockerfile Definitions

- Basic Definitions
  - **FROM**: Define the base image, such as ubuntu or debian, used to start the build process. `Required` for each Dockerfile.
- Variables
  - **ENV**: Set environment variables that persist when the container is deployed.
  - **ARG**: It is only available during the build of a Docker image (`RUN` etc), not after the image is created and containers are started from it. It is used to Pass a variable during Image build. Variable set as ARG does not persist when container is deployed from the image.
- Command Execution
  - **RUN**: Execute commands, such as package installation commands that runs on a new intermediate container.

    - **CMD**: Execute a specific command within the container that is deployed with the image. Only one is used per Dockerfile.
    - **ENTRYPOINT**: Set a default application to be used every time a container is deployed with the image. Only one is used per Dockerfile.
    - **WORKDIR**: Set the container path where subsequent Dockerfile commands are executed.
- Data Management
    - **ADD**: Copy files from a source to the image's filesystem at the set destination along with remote URL handling
    - **COPY**: Similar to ADD but without automatic tarball and remote URL handling.
- Networking
    - **EXPOSE**: Expose a specific port to enable networking between the container and the Host.
- Use below command to build an image locally using Dockerfile.

```
docker build -t docker-apache2 . --build-arg SDLC_ARG="dev"
docker build -t docker-apache2 -f Dockerfile --build-arg SDLC_ENV="dev"
docker images
```

> `.` in the above command specifies the path of the `Dockerfile`

> This Dockerfile uses the `ubuntu:20.04` image. The `RUN` instructions will simply run the linux commands for that image and then write the some content to the web server's document root.

- Run a container with the newly built image and keep docker running in detached mode with `-d` parameter
- The `-p 80:80` option maps the exposed port 80 on the container to port 80 on the EC2 host system.

> `-p <HOST_PORT>:<CONTAINER_PORT>`

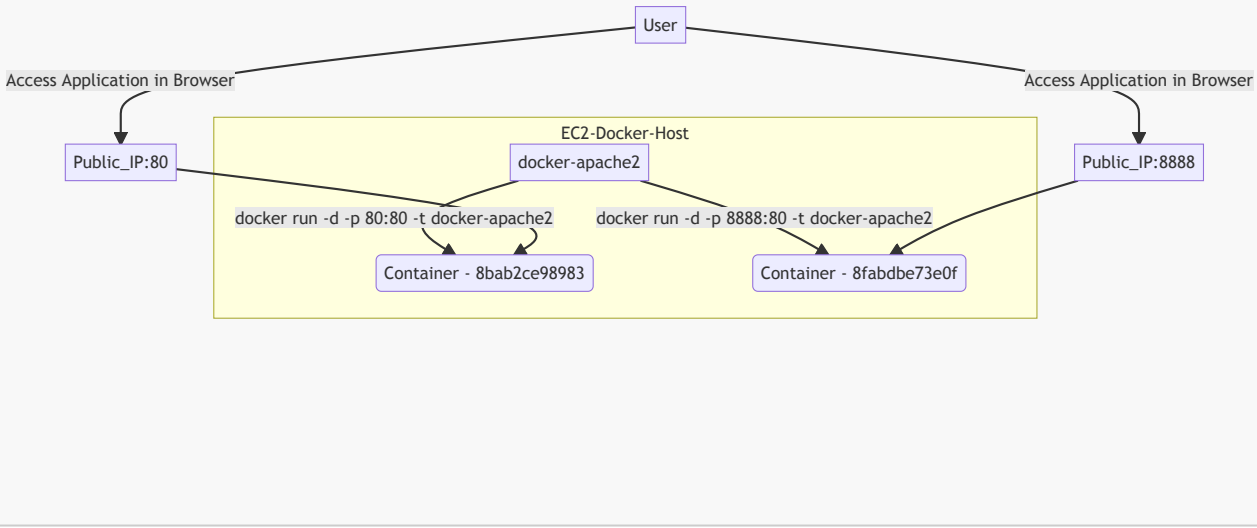
```
netstat -nltp
docker run -d -p 80:80 -t docker-apache2
docker ps
CONTAINER ID    IMAGE           COMMAND                  CREATED          STATUS
PORTS               NAMES
86c6b6c2212e    docker-test     "apache2ctl -D FOREG…"   2 seconds ago    Up 1
second      0.0.0.0:80->80/tcp   relaxed_curie

netstat -nltp

# Launch another container on another port with same image
docker run -d -p 8888:80 -t docker-apache2

docker ps
#
CONTAINER ID        IMAGE               COMMAND                  CREATED
STATUS              PORTS                  NAMES
8bab2ce98983        docker-apache2      "apache2ctl -D FOREG…"   20 seconds ago
Up 19 seconds       0.0.0.0:8888->80/tcp   amazing_nash
```

```
8fabdbe73e0f        docker-apache2      "apache2ctl -D FOREG…"   2 minutes ago
Up 2 minutes        0.0.0.0:80->80/tcp     loving_goodall
```

- The general syntax for above command is:

```
docker run --name <container_name> -p <host_port>:<container_port> -d
<container_image_label or ID>
```

- Test the content of the html file in the browser using public ip, make sure you have port 80 open in security group.




```
curl localhost:80
curl localhost:8888
```

- Checking Docker Image Size

```
docker image ls
docker image inspect <IMAGE_NAME>
```

- Docker images are stored at `/var/lib/docker/overlay2`

```
du -sh -m /var/lib/docker/overlay2
```

- We can use the `docker rmi` command to remove the images:

```
docker rmi <IMAGE_NAME>
du -sh -m /var/lib/docker/overlay2
```

Docker Image Registry

Amazon ECR

- Attach a role to ec2 instance with ECR Permissions to create ECR Repository and push images to ECR Repository
- Create a ECR repository

```
aws ecr describe-repositories --region ap-south-1
aws ecr create-repository --repository-name docker-testing --region ap-south-1
```

- Use the following steps to authenticate and push an image to your repository.
    - Retrieve an authentication token and authenticate your Docker client to your registry.

```
aws ecr get-login-password --region ap-south-1 | docker login --username AWS --
password-stdin <ACCOUNT_ID>.dkr.ecr.<REGION_NAME>.amazonaws.com
```

- After the docker build is completed, check for local docker images present and tag your image so you can push the image to this repository:

> `docker tag` is what we use to define which repository an image will be pushed to, and `docker push` is the command that does the upload itself.

```
docker tag docker-apache2:latest <ACCOUNT_ID>.dkr.ecr.
<REGION_NAME>.amazonaws.com/docker-testing:latest

docker images
```

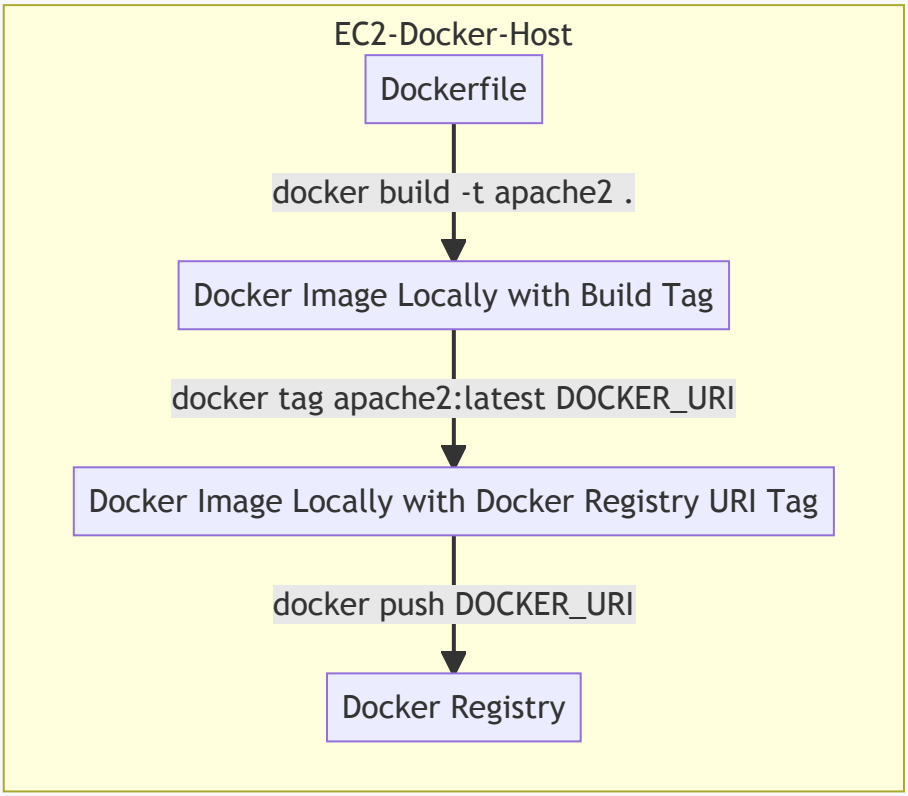
> Note that the image id remains the same between the 2 versions of the image. This is ideally the same image, just with 2 references.

- Run the following command to push this image to your newly created AWS repository:

```
docker push 01234567890.dkr.ecr.ap-south-1.amazonaws.com/docker-testing:latest
```

- Check whether docker image is available in ECR using AWS Console OR CLI

```
aws ecr describe-images --repository-name docker-testing --region us-east-1
```



- To Delete the ECR Repository use below command

```
aws ecr delete-repository --repository-name docker-testing --region us-east-1 --
force
```

> As part of the AWS Free Tier, new Amazon ECR customers get 500 MB-month of storage for one year for your private repositories. As a new or existing customer, Amazon ECR offers you 50 GB-month of always-free storage for your public repositories.

Docker Hub

- Sign Up to create a Docker Hub Acocunt on https://hub.docker.com/
- Login to docker from CLI using `docker login` command.
    - Execute this command from a Shell or Terminal where docker is installed.

```
docker login

#Login with your Docker ID to push and pull images from Docker Hub. If you don't
have a Docker ID, head over to https://hub.docker.com to create one.
# Username:
```

```
# Password:
# WARNING! Your password will be stored unencrypted in /root/.docker/config.json
```

- Once Docker Login is successful in Local Shell/Terminal,Tag the local image with a name matching to your profile name with command.

```
docker tag docker-apache2:latest <Dockerhub_Username>/ docker-apache2:latest
```

- Check the local docker images again to verify the tag.

```
docker images
```

- Push the docker image to docker hub using `docker push <username>/ image:tag`

```
docker push <Dockerhub_Username>/docker-apache2:latest
```

- Validate whether Image is available in Docker Hub Account from browser.

Docker ECR Push Shell Script

- Below is the shell script that will create docker image using Dockerfile and push the Docker Image in ECR Repo.
- Create a shell script file `docker_ecr_push.sh` with code.

```
#!/bin/bash
# set -e
# This script shows how to build the Docker image and push it to ECR

# The argument to this script is the image name. This will be used as the image on
the local machine and combined with the account and region to form the repository
name for ECR.
SDLC_ENVIRONMENT=$1
image=$2
region=$3

echo "value of image is $image"
if [ "$image" == "" ]
then
    echo "Usage: $0 <image-name> not specified"
    exit 1
fi

# Get the account number associated with the current IAM credentials
account=$(aws sts get-caller-identity --query Account --output text)
```

```
if [ $? -ne 0 ]
then
    exit 255
fi

# region="ap-south-1"
ecr_repo_name=$image"-ecr-repo"
image_name=$SDLC_ENVIRONMENT-$image
# If the repository doesn't exist in ECR, create it.
echo "Checking ECR Repo with name $ecr_repo_name"
# || means if the first command succeed the second will never be executed
aws ecr describe-repositories --repository-names ${ecr_repo_name} --region $region
|| aws ecr create-repository --repository-name ${ecr_repo_name} --region $region

# Get the login command from ECR and execute docker login
aws ecr get-login-password | docker login --username AWS --password-stdin
${account}.dkr.ecr.${region}.amazonaws.com

# Build the docker image locally with the image name and then push it to ECR with
the full name.

docker build -t ${image_name} .
fullname="${account}.dkr.ecr.${region}.amazonaws.com/${ecr_repo_name}:$image_name"
echo "fullname is $fullname"

# Tag the locally created docker image with the ECR Repo URI
docker tag ${image_name} ${fullname}
# docker images
docker push ${fullname}

if [ $? -eq 0 ]
then
        echo "Docker Push Event is successfull with ${fullname}"
else
        echo "Docker Push Event failed."
fi
```

- As this shell script accepts below Command Line Arguments as:
    - SDLC_ENVIRONMENT
    - image
    - region
- Use below command to run the shell script:

```
bash docker_ecr_push.sh dev testimage ap-south-1
```

Docker - Essential Commands

- Below are the list of `essential commands` for docker

Commands	Description
`docker version`	Show the Docker version information
`docker ps`	List all running containers
`docker ps -a`	List all containers `stopped`, `running`
`docker stop CONTAINER_ID`	Stop the container which is running
`docker start CONTAINER_ID`	Start the container which is stopped
`docker restart CONTAINER_ID`	Restart the container which is running
`docker port CONTAINER_ID`	List port mappings of a specific container
`docker rm CONTAINER_ID or name`	Remove the stopped container
`docker rm -f CONTAINER_ID or name`	Remove the running container forcefully
`docker pull IMAGE_NAME:TAG`	Pull the image from docker hub repository
`docker exec -it container-name /bin/bash`	Connect to linux container and execute commands in container
`docker rmi image-id`	Remove the docker image
`docker login -u username -p password`	Login to docker hub
`docker logout`	Logout from docker hub
`docker stats`	Display a live stream of container(s) resource usage statistics