DOCKER

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- Container
  - A way to package application with all necessary dependencies and configuration
  - Portable artifact, easily stored & moved around
  - Makes development & deployment more efficient
  - Lightweight in nature

→ Common Problems Occuring When replicating an env.

(1) Need to manually install all dependencies
(2) There might be some version conflicts.
(3) Our system depends on a specific version of a dependency and when replicating we installed the latest one which would cause bugs.
(4) Installation problems.
(5) Some CLI Cmds that run on Linux might not run on MACOS / Windows.
(6) Installation process on each OS is different

→ A container helps us to bundle our application along with it dependencies & configurations in a single unit
↳ It is basically a standardized way of replicating enviornments

→ container is a running env for the image

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→ Each container has it's own isolated enviornment
→ Single cmd to install the app

class → image
object → container

- Image
→ Docker image is a blueprint that helps build/creat container
→ Docker image & container has similar relationship like that of Class & Object.
↳ Class is a blueprint that helps us create multiple objects
→ A single docker image can create multiple containers
→ Basically we share images with developer than from images containers are created
→ System resources are used by container not images same as the case is with class & object
→ Docker image is a static snapshot of what the local dev env should look like

actually these are also images

→ A dockes ~~container~~ image consist of multiple layers. like when we pull an image different layers of images are being downloaded. Like if I pull

→ Each image has a specific tag (version)

Docker desktop runs a small linux based VM that helps run our containers
↳ Docker was initially built for linux

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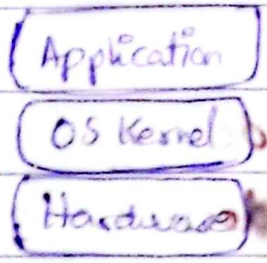
psql version 6 so it will download multiple layers.
And now if we install v10 so the layers which already exist will not be downloaded.



▷ Docker Vs Virtual Machine

↳ Docker only virtualizes the application layer whereas VM virtualize App + Kernal
↳ The VM has it's own kernel, docker uses kernel of host machine
↳ Docker is lightweight
↳ Docker is much faster

▷ Docker Commands

- docker pull IMAGE_NAME → fetches image from dockerhub
- docker images → List all images
- docker run IMAGE_NAME → fetches image if not available & run the container
  -i → to accept std input
- docker run -it IMAGE_NAME
  ↳ runs image in interactive mode
  -t ↳ terminal
- docker ps → To view running containers
- docker ps -a → View all containers

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docker inspect CONT_NAME → to get details about container

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- docker start CONTAINER_NAME or ID
  ↳ to start an already created container
- docker stop " or ID

- docker rmi IMAGE_NAME → used to remove an image
- docker rm CONT_NAME → " " " container
  ↳ to remove an image we would 1st need to remove all the containers build from it
- docker run -d redis → runs container in detached mode (run in background)
- docker run redis:4.0 → specifying version

- docker run -d -e MYSQL_ROOT_PASSWORD=hello mysql
  ↳ environment variable (must of mysql container)

- Giving custom names to container

docker run --name my-container mysql:8.0

↳ terminal

→ To attach to a container after running it in detached mode
↳ docker attach CONT_NAME/ID

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Unlike VM's containers are not meant to run Operating System. Therefore when we run ubuntu image it exits immideatly. Containers only runs when process inside it is alive

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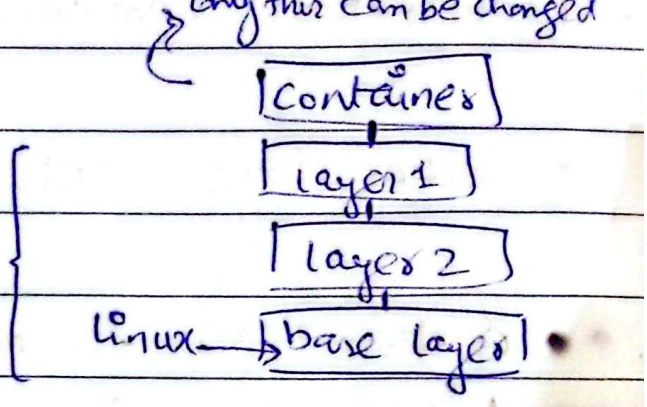
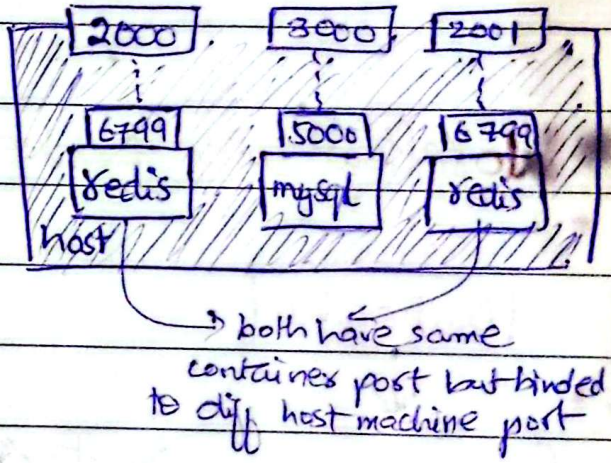
- Docker Image Layers



- Port Binding
  - ↳ Each container has a port associated with it
  - ↳ Therefore if we want to access redis we need to bind it to a host machine port



- docker run -p2000:6799 redis
  - ↳ Now the 2000 port of Host is binded with one container
    If we try to bind any other containes with 2000 it will give error

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We can also limit the amount of host's CPU utilization by a container

docker run --cpus=.5 ubuntu → container will not utilize more than 50% of host CPUs

docker run --memory=100m ubuntu

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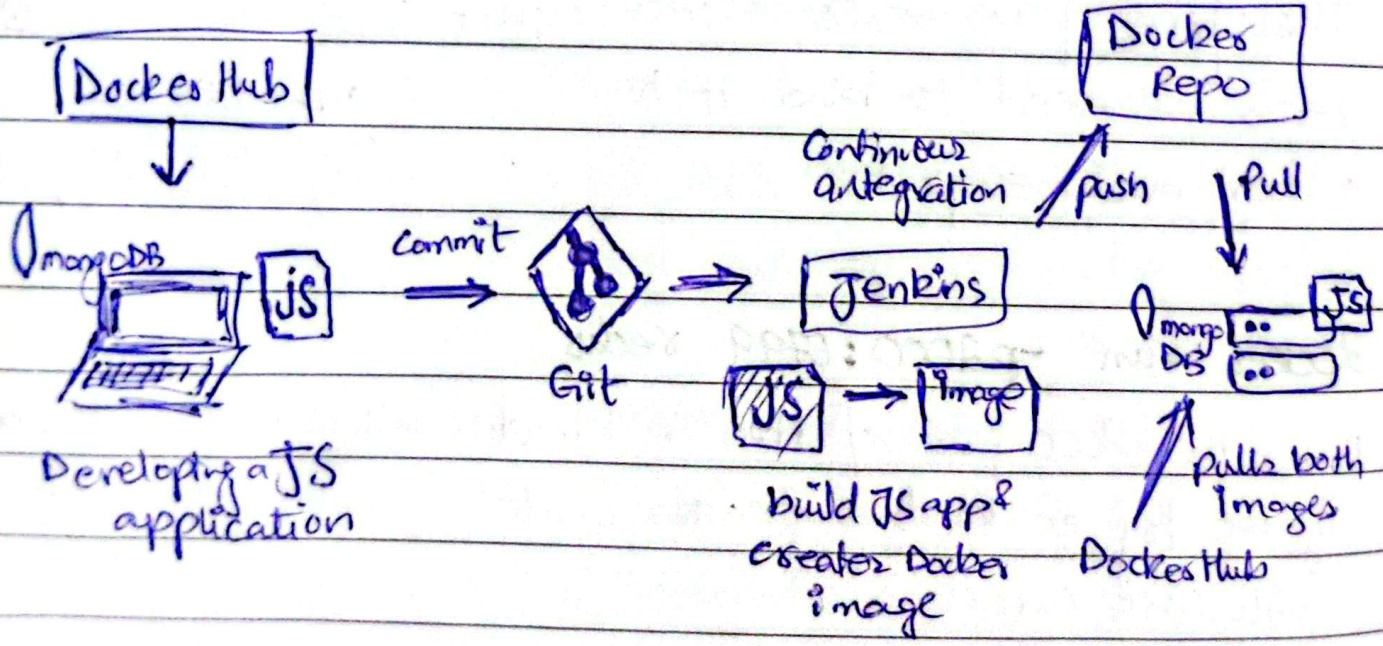
- Troubleshoot Commands

  - docker logs CONT_NAME

  - docker exec -it mysql-latest /bin/bash
  - docker exec -it mysql-latest /bin/sh

- Workflow with Dockers



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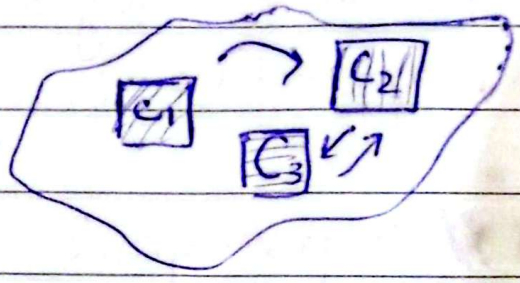
- Docker Network

→ If we want two containers to directly interact with each other without using any port or local host we can make network.



- docker network ls → view all docker networks
- docker network create NETWORK_NAME
- docker network rm "
- Running a MongoDb container

```
docker run -d \
> -p 27017:27017 \
> --name mongo-db \
> --network mongo-network \
> -e MONGO_INITDB_ROOT_USERNAME=admin \
> -e MONGO_INITDB_ROOT_PASSWORD=query \
> mongo
```

→ Docker has a built in DNS that maps the containes name to the pvt IP of the contain. So we can connect the apps using container name.

→ IP of DNS → 127.0.0.11

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- Docker Compose

  - Instead of using cmds on terminal we can run the cmds thru .yaml (yet Another Markup Language)
  - It is basically a tool for defining and running multi-container applications

// compose.yaml (for mongo containes)

```
services:
  mongo:
    image: mongo
    ports:
      - 27017:27017
    environment:
      MONGO_INITDB_ROOT_USERNAME: admin
      MONGO_INITDB_ROOT_PASSWORD: qwerty

  mongo-express:
    image: mongo-express
    ports:
      - 2021:8081
    environment
      ME_CONFIG
```

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→ Compose by default creates a seperate network for all the service in the file

- docker-compose (-f) compose.yaml up -d (-f → file)
- docker-compose (-f) 4 down → delets all container
  → will also delete data

- Dockerizing App
  ↳ Every image is build using a Dockerfile
  ↳ This file contains all the basic commands that are used to build an image.
  ↳ This processes of making our app into images is done by Jenkins
  ↳ "Dockerfile is basically a blue print to build a Docker image"
    ↳ It contains all instructions to dockerize our app

testapp
node
alpine
(the node itself has a base image)
(a node application needs node image)

FROM node → every image is build on a base image (layered structure)

WORKDIR → here we specify our working directory
  ↳ where files will be copied & cmds will be executed

COPY → to copy files from HOST to Image

ENTRYPOINT → FROM Ubuntu → docker run ubuntu-sleeper 10
ENTRYPOINT ["sleep"] ← the 10 appends here
or
CMD ["sleep", 10] → it is now hardcoded if we need to change sleep value we should change dockerfile each time

RUN → helps to run multiple cmds
>> we can have multiple RUN cmd but single CMD cmd

CMD → The last cmd which the container of this image will use to run.
like "python manage.py runserver"

EXPOSE → To expose the ports of an image
ENV → help defin env variables

// Dockerfile → for node application

```
FROM node                          → recommended to use env in compose
ENV  MONGO_DB_USERNAME=admin \
     M  4    PASSWORD=query
RUN  mkdir -p testapp
COPY . /testapp
```

. → current folder of host machine where we have dockerfile
/testapp → destination folder of container

testapp/
- Dockerfile
- src_code
- compose.yaml

```
CMD ["node", "/testapp/server.js"]
```

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any name of image

specify any tag (version)

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docker build -t testapp:1.0 . ← location of file

-> If we do any changes in Dockerfile we need to rebuild the image.

- Pushing Docker image

(1) Create any repo in DockerHub (samozeali)

(2) Now run docker build -t samozeali . ← should be same

(3) We now need to login

docker login

(4) After login then do docker push

- Docker Volumes

↳ Volumes are pessistent data stores for containers

- docker run -v /users/samoze/desktop/data/myfolder:/test/data ubu

absolute path of host machine — container path

↳ In Compose-yaml

services:

mongo:

...

volumes:

- /user/samoze/desktop/data:/data/db

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- docker volume ls → to view all volumes
- docker volume create myVolume
  - but it is isolated right now, not attached to any containers
  - ↳ by default the volume will be created at C:\ProgramData\Docker\Volumes
- docker volume rm myVolume

- Types of Docker Volume
  1. Named Volumes — docker run -v /opt/datadir:/var/lib/mysql
     - docker run -v VOL_Name : CONTAINER_DIR
       - ↳ most prefered way
  2. Anonymous Volumes
     - docker run -v MOUNT-PATH (container directory)

  } Volume managed by docker

  3. Bind Mount
     - docker run -v HOST_DIR : CONTAINER_DIR

  } volume managed by host machine

- docker volume prune → To delete unused volumes
  - ↳ by default targets anonymous volumes

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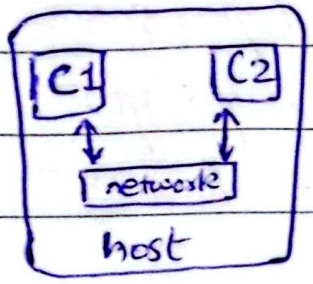
- Docker Network Drivers :

(1) Bridge

↳ It is the default network drives



(2) Host

↳ Removes network isolation b/w containers and the Docker host. Removes the IP address from containers Uses the host's network directly.

(3) Null

↳ When we need to make an isolated container. That doesn't interact either with any other container or host