Challenges: → Env
→ shipping of code
→ Standard PKging (jar, war, dll → .net)

Docker

Java: write once run Anywhere.

PODA → Package Once, Deploy AnyWhere.

Modern App Demands:

→ ~~Zero downtime (High AVL)~~
→ Portability.
→ Scalability / elasticity
Prop. of Sy. to handle growing amount of work ~~by adding resources to the sy.~~
- scalability: Horizontal (Increasing RAM, HardDisk, processes cap.)
- Vertical S - Increasing No. of m/c (Servers)

Cloud → provides scalability easily.

O ←http→ O ←TCP→ O

→ Use right tool for right job
~~functionally~~ a tool might be able to do a job but not suitable.

TAP (Technology Agnostic Protocols)
e.g. Http, Https, TCP etc
↓
(REST)

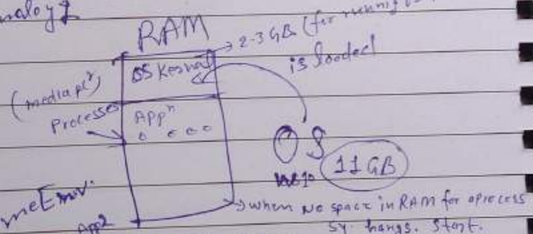
VM → H/W virtualiz^n

we enjoyed around 15 yrs.

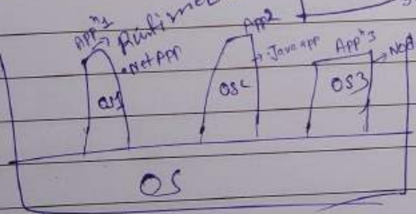
(H/W: Int^l. RAM, HardDisk, motherboard, CPU, sec storage CD/DVD; Ext^l: i/p: K.B., mouse; o/p: printer, monitor)

(H/W sharing) (companies working on this)
⇓
Hypervisors Technology → VMware, oracle VBox.

VM Backup: .vmdk file size 20GB ⇓ contain OS → Not portable easily.



→ Low spin up time.



VM → container (runtime env for app^n)

OS Sharing / OS Virtualiz^n → Containerization < Docker company / Docket company
→ lighter
→ portability.

O.S. Virt^n is supported by → Linux or OS having flavors of Linux { ubuntu, Centos, Fedora, Redhat }
not by windows

H/W virtualiz^n
OS/ V^n
AWS

Linux OS = Kernal + supporting files (drivers for K.B Ifo etc.)

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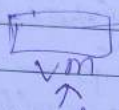
Container → backed by an Image
runs as process inside ↓ set of files (app^n + dept OS)
RAM of host m/c.

app dep.



Docker file → Recipie (Ingredients)
↓ I/P
Instruction on how to build an image.
SQL S^w dep → will be downloaded & made up running.
etc.

Docker Engine

↓ o/p

Image → can be uploaded to (docker hub.com) → SAAS
hub.docker.com

docker pull <img name>

Cloud
- IAAS (Infrastructure)
- SAAS (Software As A Service) e.g. hub.docker.com (images)
- PAAS (Plateform)

We just use & don't own (gets on rent basis)

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Compute

EC2 (VM) Elastic ~~Cloud~~ Compute Cloud.

container.

→ provides secure, resizable compute capacity in the cloud.

→ we can develop & deploy app^n faster.

→ we can scale up/down any many No. of virtual servers as per need.

Storage: S3 (Simple Storage Service)

Bucket.

region: N. Virginia.

EC2 → Instances 1 → Instances → Launch Instance, VM/cont^r

- choose AMI (Amazon M/C Image) → Template (OS + app's + app)
- ubuntu [Select]
- → Add Tags — Name: mydo^r M/C
- → mydocker secgp (firewall)
  - SSH — 22 — custom
  - Http — 80 — Anywhere
- → Create Key pair.
  - Name [docker private KeyPair]
  - Download Key pair
- Launch. →

Secgroup → firewall

SSH — port 22

Cryptography

- pub key → for encryp^n
- pvt key → for decryp^n

- Sym → same key.
- ASY: Pub & Pri Key

KAAS → Kubernetis

container is a process but complete runtime env of app^n

// files^r tx — f^n → f^n → Training Content → Chand. A → MobaXTerm

hubdocker → SAAS

Session → SSH

RemoteHost [ ] PublicIP   UserName [ubuntu]

Advance SSH

Use Keypair [ ] browse key^r file

[OK]

① sudo su — ⇒ go to root

② root > apt update ⇒

③ > apt install docker.io

docker client CLI ↕ Rest ↕ Daemon S/W (Docker Engine)

select os → Actions → Instance State → stop

→ docker images

→ docker ps → To check running containers (every c^r has an ID)

→ docker ps -a → all (even exited/stopped one)

1) pull ready made Img → spawn cont^r → download the img as well if not AVL locally

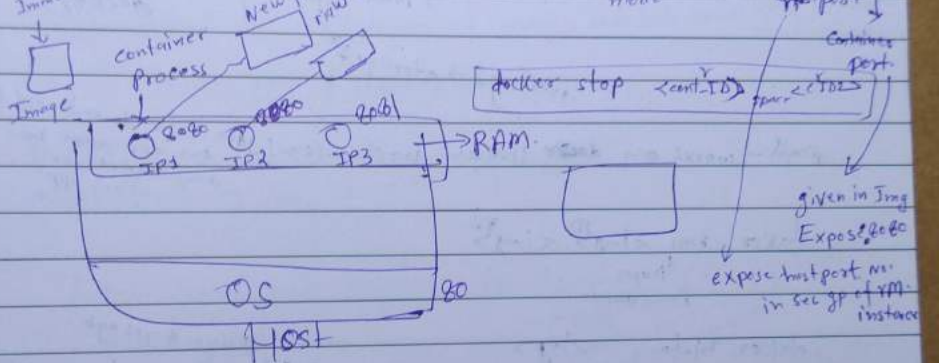
docker pull <img> → docker run <Img-Name>

docker run hello-world

- docker → client
- starts a cont^r from an img.
- name of docker img.

docker run -d --name web -p 80:8080 nginx

- -d → detached mode
- -it → interactive mode
- -p → port mapping
- nginx → Img



{ host port cannot be same for two processes

Name → maps ~~assigns~~ → Automatically to an AVL port

→ docker run -d --name -P <Img>

→ docker stop $(docker ps -aq) → only displays numerical IDs.

→ docker ps --help

{ After starting c^r, ~~image cannot be~~ deleted until cont^r is deleted.

- Knew Basic Linux commands.

To login into container (-it mode)

docker run -it --name temp ubuntu:16.04 /bin/bash
(pull img, run it & login into it.)
latest

root@hostip → -it

root@ContID pwd

ls -ltr

cat → To show content of a file
/etc/hosts → host ip details.

apt update

-ltr → show o/p as long list with various Attributes
sort by modified date
reverse sort order

@host → ls /var/lib/docker → All file sy created by docker

overlay2 → storage DR

pull → works on Union mechanism (Java file downloaded for one app won't be downloaded for other app.

docker rmi <img ID> <img ID>
↑ images
rm → docker

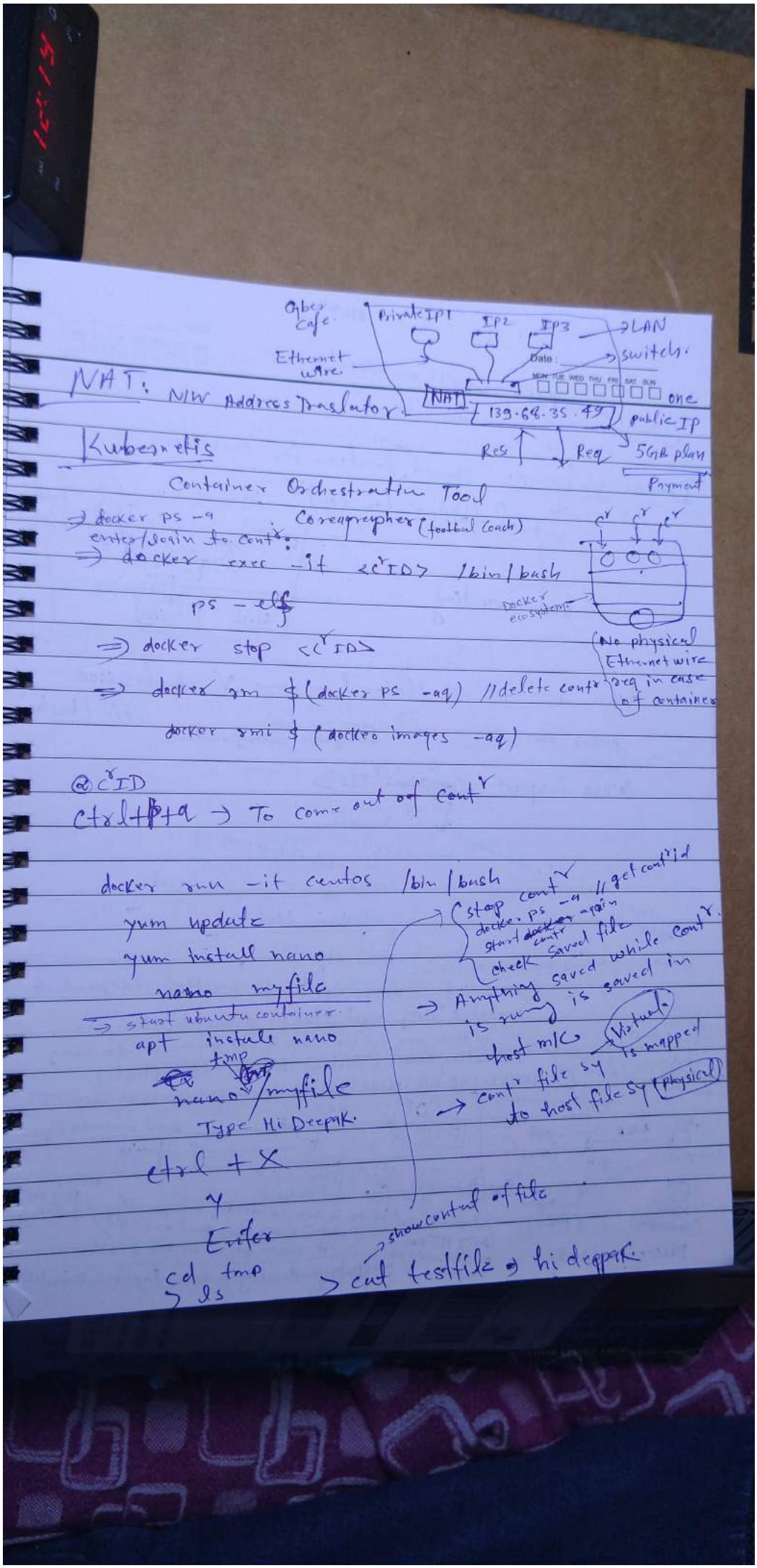
docker history <img>
Time 4 yrs ago
shows what all files & size image have.

@CId → ubuntu specific
apt update
apt install docker.io
Need to start daemons inside cont^r
ping 8.8.8.8 ⇒ cont^r is lightest form of OS
apt install iputils-ping (ping utility needs to installed in cont^r)

→ docker exec -it <c^r Id> /bin/bash ⇒ run a new command in a running container

→ docker start -a -i <c^r Id> : To start a stopped container.

↪ docker restart -t 10 <c^r Id> To restart a running c^r. -t: time to wait for stop (sec) before killing c^r


Cyber Cafe
Private IP1
IP2
IP3
LAN
Ethernet wire
Date :
switch
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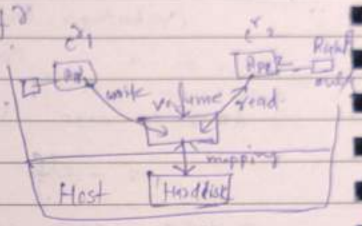
one
NAT
139.68.35.47
public IP
Req
Res
5GB plan
Payment
Container Orchestration Tool
Coreographer (football coach)
Docker ecosystem
No physical Ethernet wire req in case of containers
NAT: NW Address Translator
Kubernetis
docker ps -a
enter/login to cont^r:
docker exec -it <c^rID> /bin/bash
ps -elf
docker stop <c^rID>
docker rm $(docker ps -aq) //delete cont^r
docker rmi $(docker images -aq)
@c^rID
ctrl+p+q → To come out of cont^r
docker run -it centos /bin/bash
yum update
yum install nano
nano myfile
→ start ubuntu container
apt install nano
tmp
nano myfile
Type Hi Deepak.
ctrl + X
Y
Enter
cd tmp
ls
cat testfile → hi deepak
show content of file
stop cont^r
docker ps -a // get cont^r id
start docker cont^r -ai
check saved file
→ Anything saved while cont^r is running is saved in host m/c (Virtual)
→ cont^r file sy is mapped to host file sy (physical)

Cloud Native App → works on cloud:
Kubernetis

Docker volume: shared storage location for containers.
→ virtual folder for cont^r
↕
host mounting




```
docker run -it -v /test-val --name V ubuntu:16:00 /bin/bash
```
→ spawn the cont^r along with creating a volume.

```
docker ps
```

```
docker inspect <~~docker~~ c-ID>
```
→ c^r Kundali

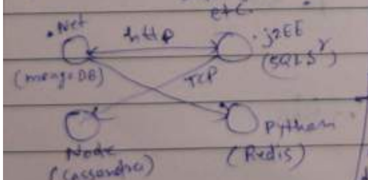
mounts{
source — – – – /test-val → Actual host mapping
volume — /test-val
}

more Downtime (whole s^r needs to be stopped)
Not scalable

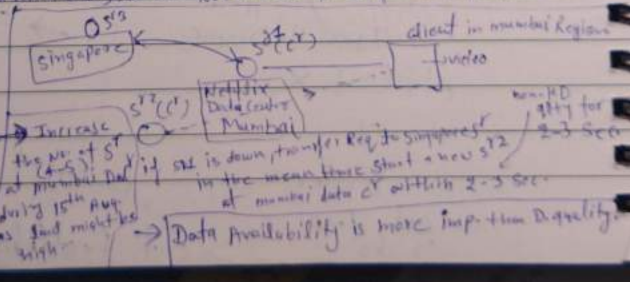
monolithic → microservices (→ ~~Kubernetes~~)
→ Break the large App^n into smaller independent modules "using right tool for right job". They can run in their own run time env & can communicate using Technology Agnostic Protocol (HTTP, TCP, rest etc)

- .Net Tech stack
- J2EE stack
- Node Tech stack
- Python

Similarly one D.B cannot be suitable for all types job.
cart → Redis (In RAM D.B.) → RDBMS not suitable from performance pt of view
shipping → mongo D.B.
etc.



Microservices →



Creating a Docker Image:

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Dockerfile: → A text document that contains all the commands a user could call on the command line to assemble an image.

① cd

mkdir /test

cd /test

Create file → touch /test/Dockerfile (uppercase, lowercase)

→ nano /test/index.html → paste some html content; ctrl+X → Y → Enter

<h1> Hi Deepak </h1>

nano Dockerfile — ctrl+X → Y → ENTER

FROM centos:latest → Take centos OS

MAINTAINER CITUSTEC

RUN yum -y install httpd (server)

COPY index.html /var/www/html/ (copy the index.html file on server given path)

To run the app^n packaged in Img → CMD ["/usr/sbin/httpd", "-D", "FOREGROUND"] → start the server

EXPOSE 80

Build Img:

To give a tag name to image.

```
docker build /test/ -t webserver:v1
                       tagName
```

↓ Dockerfile & indexfile both are at same location

↓ spawn cont^r

```
docker run -d -p 1234:80 webserver:v1
```

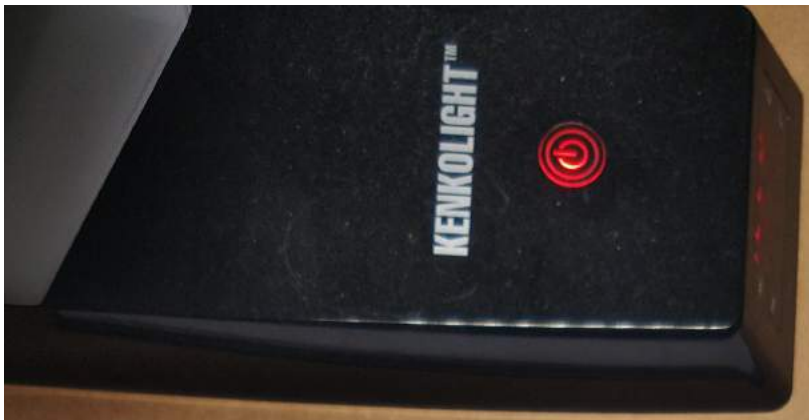
To see result on web browser: <I.P. Address>:1234

→ specific module S^r can be set up at loc^n where load is more monolithic cannot do it

→ As per load on a part^r modules, we can increase the No of S^r for that specific module

→ but in case of monolithic we have to replicate S^r for all modules.

→ All these headache of creating, running, monitoring of S^r (containers) can be taken care of by Kubernetes.



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Container-linking : So that Two apps running in two containers can communicate each other
→ It is better option than exposing ports.

docker run -idt --name vote --link redis:alias-src -P schoolof devops/vote

↓ already running container Name

↓ Alias for running container Name.

while spawning a new container just link the already running container.

> env ⇒ will show the new env variables for linking with the already container.

→ We can create a docker image from a running container
We spawn the container
We installed some new S/W
& now we would all the changes done in new img

Docker commit : To create new img from container's changes

docker commit <C. Name> <New img-Name>

Dockerfile is input to docker Engine
docker-compose.yml is i/p to { docker-compose, docker swarm, or Kubernetis

Docker-compose: ⇒ A tool for defining & running multi-container docker apps
→ With compose, we use a YAML file to configure your app's services
→ Then with a single command, we create & start all the services from our config

docker-compose.yml

↓

utility to run yml file.

paste content
ctr+X, Y → Enter

[root]/home/ubuntu#> nano docker-compose.yml

→ apt install docker-compose

docker-compose up -d

Using Compose is a 3 step process:

1. Define your app's env with a Dockerfile so it can be reproduced anywhere.
2. Define the services (VI, Services, DB etc) that make up your app in docker-compose.yml so they can be run together in an isolated env.
3. Run 'docker-compose up' & compose starts & runs your entire app

Sample

```
1. version: '3'
2. services:
     web:
       build: .          → path where Dockerfile is kept
                         → root of proj
       ports:
         - "5000:80"     → C port (app running inside the C is exposed at port 80)
           ↓
         host port

       volumes:
         - .:/code
         - logvolume01:/var/log

       links:
         - redis

     redis:
       image: redis:alpine
3. volumes:
     logvolume01: {}
```

To access it http://{HostIP}:5000

Layers :→ UI → controller → Service → DAO → D.B.
(DATA Access)
object

In CI/CD → an isolated test env is created & e2e tests are run & env is destroyed.

$ docker-compose up -d
$ ./run-tests
$ docker-compose down.

⇒ Create 3 VMs (EC2) on AWS :

VM1 — Mr — 30GB RAM
VM1 (ubuntu 16.04)
↳ Linux m/c

VM2 — 30GB — Node1

VM3 — 30GB — Node2

⇒ To use Kubernetes/docker we need VMs
⇓
Linux based
⇓
As it support OS virtualiz'n

Kubernetes → for Automated app^n deployment, scaling & mgmt
→ open source
contr^r orchestr^n sy.

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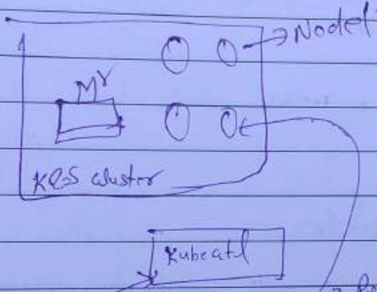
docker swarm → alternative of Kubernetes but less powerful than K

→ orchestrator for microservice apps.

K8S cluster → Kubernetes cl.



Master Compt:

1 kube - api server. gives instr^n to below 3, Restful

kubectl → client tool to comm with master

2. Kube - Controller-Manager (Node Control^r) → watchman (Desired state, Actual state) the ReplicaSet → To scale out the pod if some node is experiencing heavy traffic.

3. Kube - Scheduler → Assign works to node.

4 Cluster store (Source of truth) Backup plan

⇓

All 4 runs as pods

→ containers are wrapped in pods in K8S. In docker c^r used to be naked.

GCS: Google cloud Service
ACS: Azure cloud S "
ECS: Elastic " "

Nodes are minions

1) Kubelet (main K8s agent) → listens to API server & takes care of spawning / stopping containers
2) Container engine (docker)
3) Kube proxy : Network of pods → to put containers (running inside RAM of nodes)
   NW where processes can communicate.

Reg' Node with cluster
Instantiate pods
~~Exposes endpoints on 10255~~

Kubectl get nodes

Kubectl ~~config~~ get pods --all-namespaces
⇓
To see running pods of Master

→ Pod → env (c^r)
→ one pod can have multiple cont^rs.
(docker engine takes care of OS virtualizⁿ)
→ if c^rs are tightly coupled we can put them in one pod
→ But if c^rs are independent → use 1 c^r per pod.

Pods are mortal in Nature

So Accessed by services

Air object → Services → has fixed ip & port, DNS (myservice)
Abstⁿ layer

Kubectl api-resources

{ --namespace
-n

Date:

Kubectl create -f pod.yml → Replica controller
rc.yml → has selector
→ ensures scalability

Kubectl get pods (--all-namespaces)
-n kube-system

- namespaces: all pods which are part of same app given same namespace.

Kubectl delete pod hello-pod

Kubectl create -f rc.yml
apply svc.yml.

Kubectl get rc

Service Type: (svc)
- clusterIP (Int'l Access)
- NodePort (Ext'l Access)
- Load Balancer

Based on from where its being accessed

Kubectl get svc
Kubectl delete svc hello-svc

How to update running container with Zero Downtime
(Update Deployment)

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Kubectl ~~create~~ apply -f deploy.yml

Kubectl get rs (replica set)

Kubectl describe deployment hello-deploy

Activities

→ ~~Creating~~ own Img & pushing it to docker hub

→ How to create pvt repo in docker hub

→ How ~~configure~~ create custom registry (maven Repo of hub)