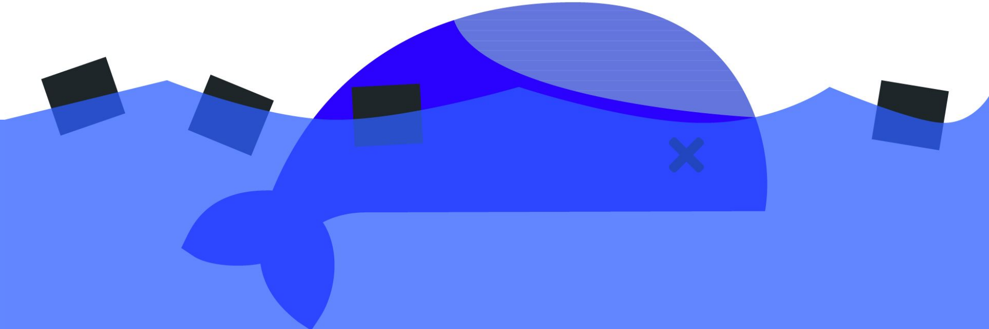
inovex

The whale is dead - containers without Docker



Timo Heinrichs

Timo Heinrichs

Cloud Platform Engineer

- in second generation
- but with identity crisis

When I grow up, I want to be a Developer :)

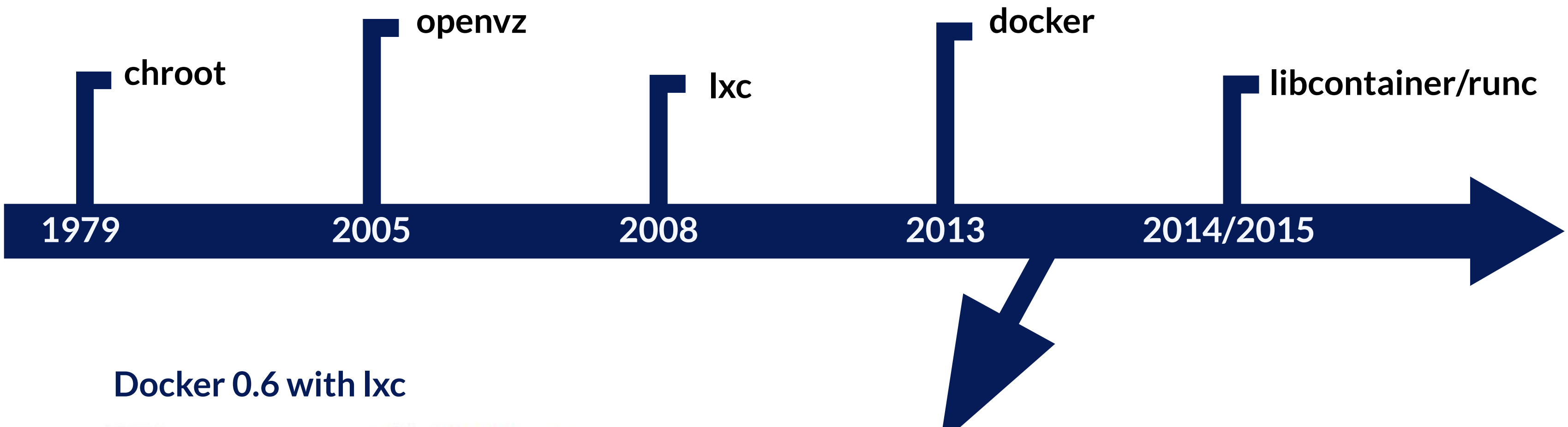
Kubernetes Certified Service Provider
Kubernetes Training Partner
Members
Special
CLOUD NATIVE Landscape
CLOUD NATIVE COMPUTING FOUNDATION
Redpoint
Amplify
l.cncf.io
inovex

This landscape is intended as a map through the previously uncharted terrain of cloud native technologies. There are many routes to deploying a cloud native application, with CNCF Projects representing a particularly well-traveled path.

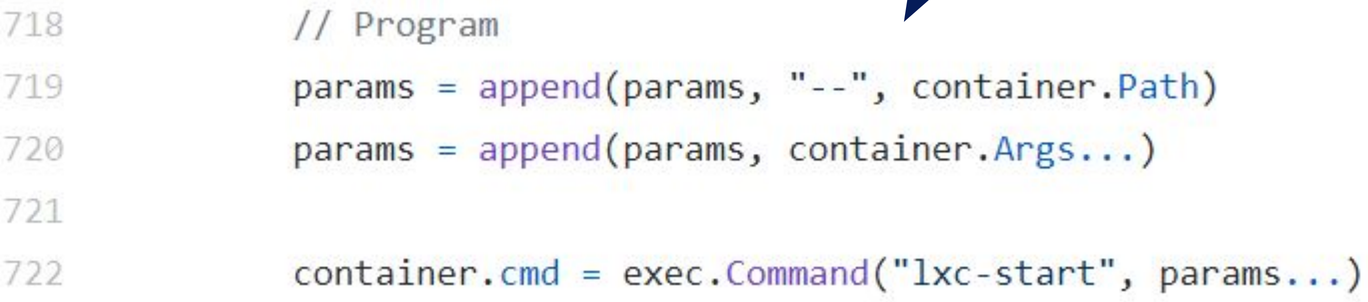
Here's inovex!

Look mum! I'm on the CNCF landscape!!!

Container technology timeline



Docker 0.6 with lxc



```
        // Program
        params = append(params, "--", container.Path)
        params = append(params, container.Args...)

        container.cmd = exec.Command("lxc-start", params...)
```

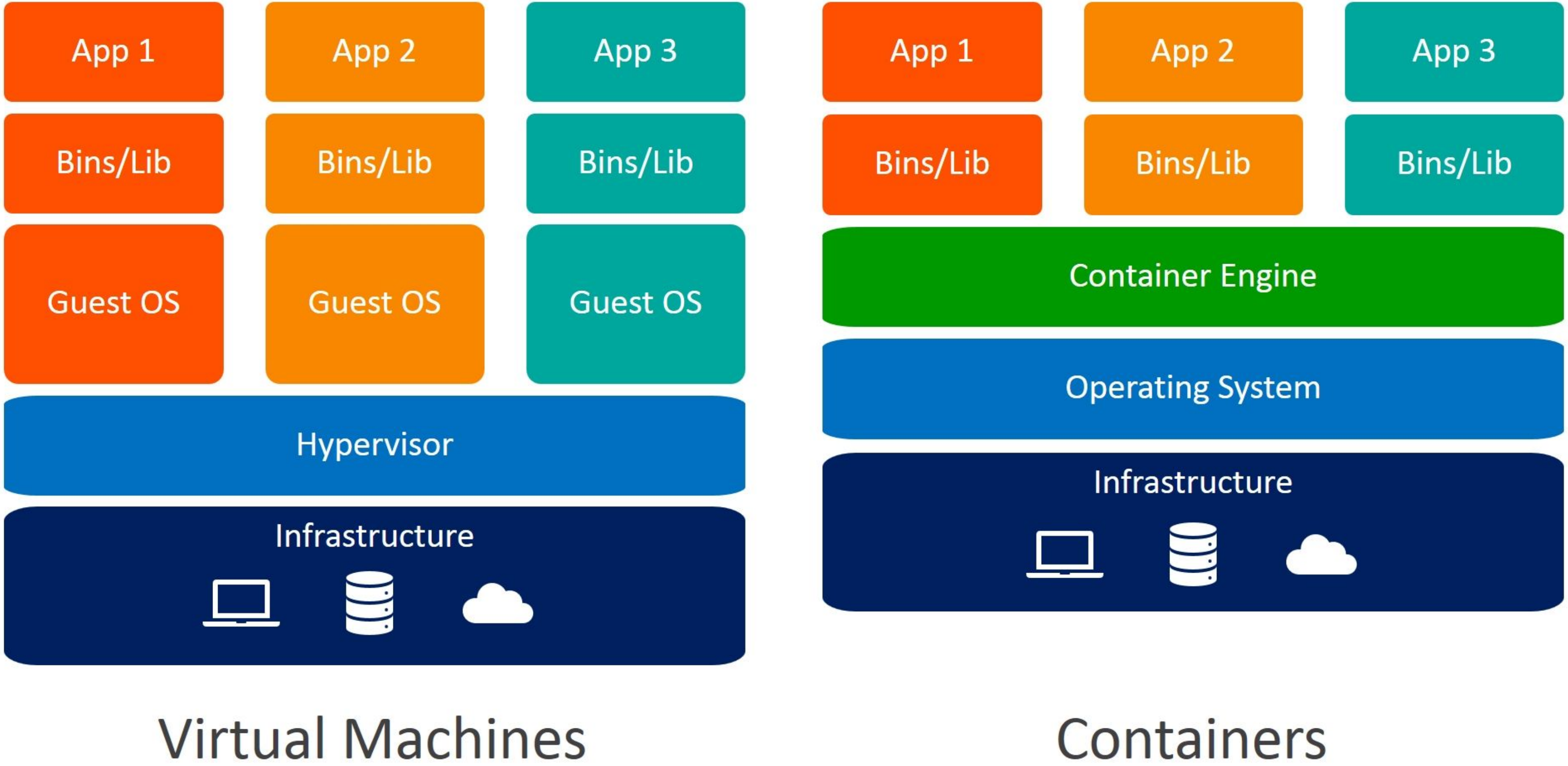
https://github.com/moby/moby/blob/f4a4f1ca875a1f68d5950e67b34b57542f504ecd/container.go#L722

Container basics

- OS-level “virtualization”
- It’s a process
- Isolation works with (kernel) namespaces
  - pids, ipc, time, etc.
  - cgroups
  - network namespaces
  - overlay fs
- It’s not a VM!

Repeat after me:

IT’S NOT A VM!



https://www.weave.works/blog/a-practical-guide-to-choosing-between-docker-containers-and-vms

OPEN CONTAINER INITIATIVE

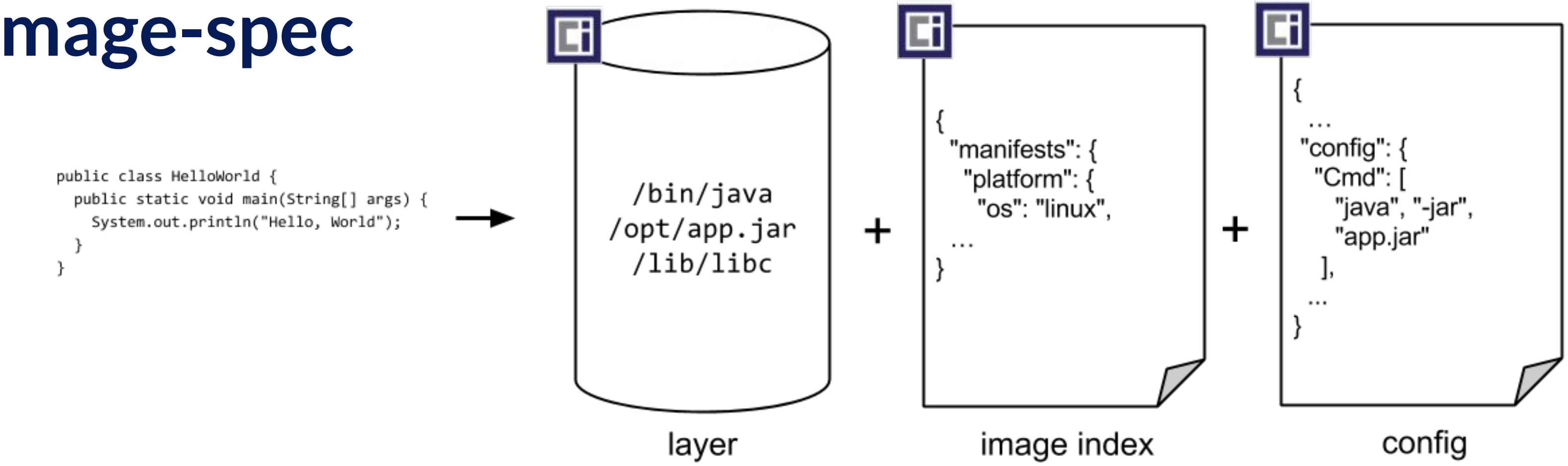
“The Open Container Initiative is an open governance structure for the express purpose of creating open industry standards around container formats and runtimes.”

Quickfacts

- Announced June 2015
- Docker, CoreOS & Others
- 28+ member companies
- Initial specifications reached 1.0 in June 2017

github.com/opencontainers
opencontainers.org

image-spec



```
public class HelloWorld {
  public static void main(String[] args) {
    System.out.println("Hello, World");
  }
}
```

```
/bin/java
/opt/app.jar
/lib/libc
```

```
{
  "manifests": {
    "platform": {
      "os": "linux",
  ...
}
```

```
{
  ...
  "config": {
    "Cmd": [
      "java", "-jar",
      "app.jar"
    ],
  ...
}
```

- Original docker image format is now industry standard
- It’s JSON and .tar.gz … Don’t be sad!
- Media Types between Docker and OCI different but compatible

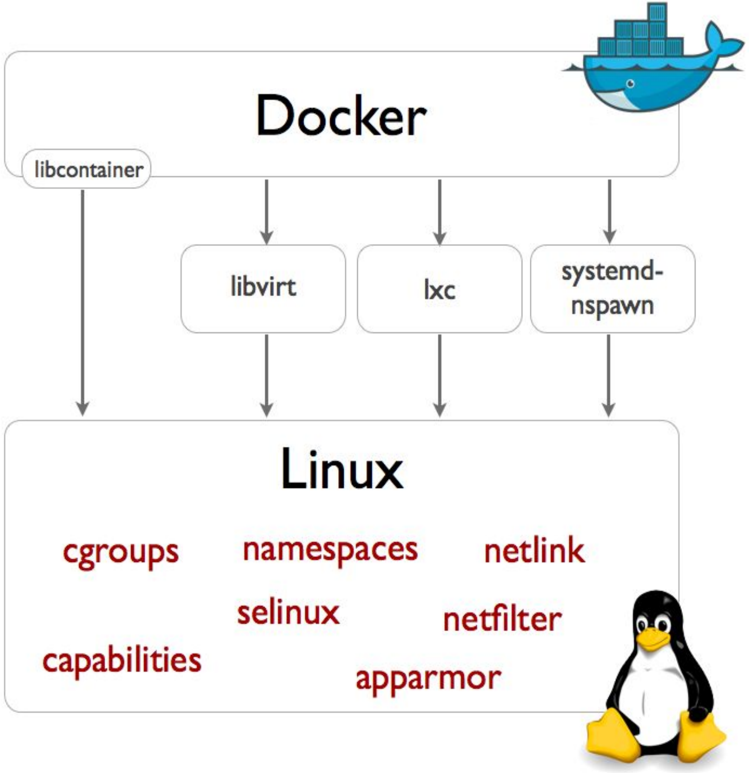
https://github.com/opencontainers/image-spec/blob/master/spec.md

runtime-spec

- Original docker runtime is now industry standard

Defines:

- On-Disk format “FS Bundle”
- lifecycle verbs
  - `create, start, kill, delete, state`
- runc “reference” implementation



https://www.docker.com/blog/docker-0-9-introducing-execution-drivers-and-libcontainer/

Build

`docker build`

- Works fine on my machine.
- But not great in pipelines!

Ship

`docker push / pull`

- Works fine on my machine.
- But needs central registry & automation

Run

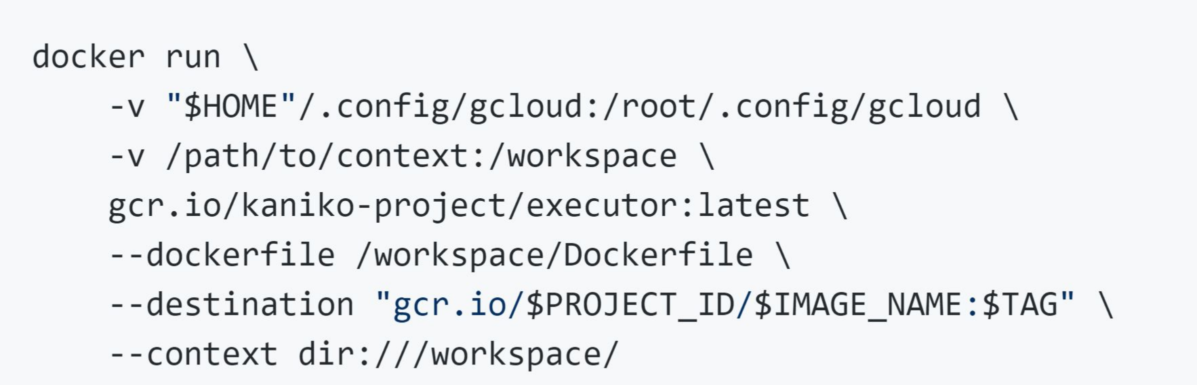
`docker run`

- Works fine on my machine.
- But not in kubernetes!

Build, ship and run...but not anywhere!

Kaniko

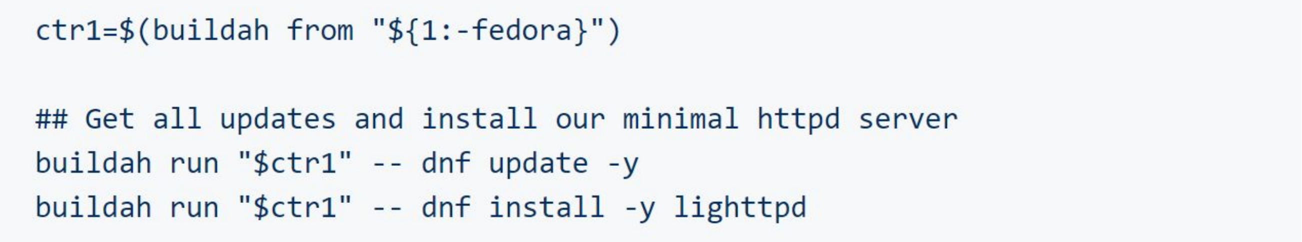
- From Google
- Build (OCI) images
- Running in containers and without root possible



```
docker run \
    -v "$HOME"/.config/gcloud:/root/.config/gcloud \
    -v /path/to/context:/workspace \
    gcr.io/kaniko-project/executor:latest \
    --dockerfile /workspace/Dockerfile \
    --destination "gcr.io/$PROJECT_ID/$IMAGE_NAME:$TAG" \
    --context dir:///workspace/
```

buildah

- From “containers” organization (RedHat)
- Focus on building OCI images
- Drop-in replacement with `buildah bud -f Dockerfile`

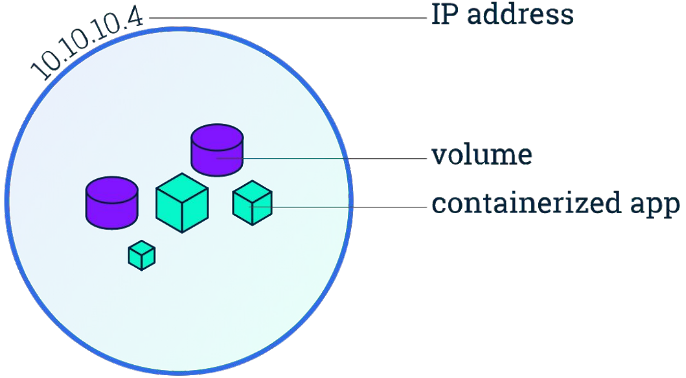


```
ctr1=$(buildah from "${1:-fedora}")

## Get all updates and install our minimal httpd server
buildah run "$ctr1" -- dnf update -y
buildah run "$ctr1" -- dnf install -y lighttpd
```

podman

- From “containers” organization (RedHat)
- Drop-in replacement for docker client
- rootless
- daemonless
- REST API
- podman-compose
- knows the “pod” concept



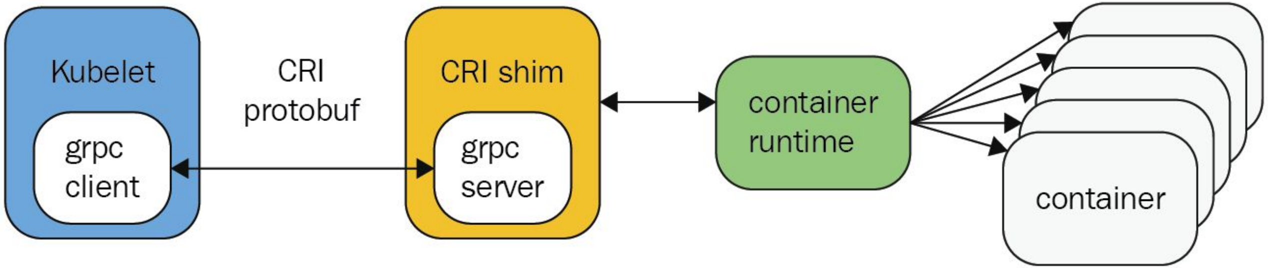
Additional tools

- Skopeo
  - Copy / Sync images between registries
  - List image tags, mark for deletion
- img
  - Image builder, built on top of **BuildKit**
  - `build,tag,push,pull,login,logout,save`
- reg
  - download layers from images
  - list all repos in a registry
  - Get vulnerability with clair image scanning

img & reg don't have a cool
logo. They probably suck...

The role of Kubernetes

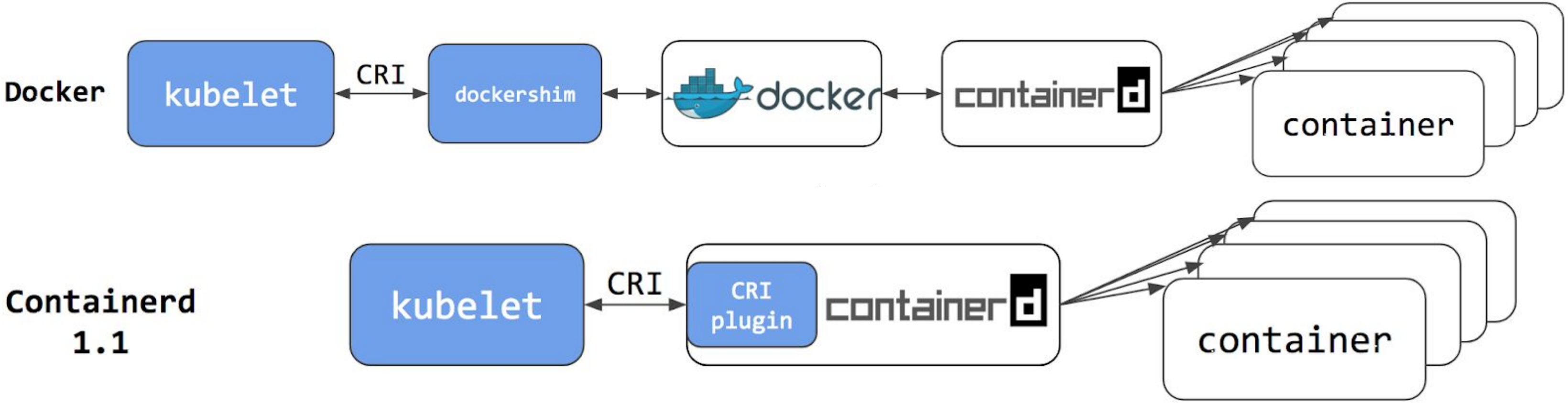
- First docker alternative `rkt` already in 1.3
- Needs no `build,tag,push,volume,network`
- Container-Runtime-Interface for pluggable runtime
- **dockershim** component is deprecated now
- Removed in Kubernetes after 1.22 (later this year)



https://kubernetes.io/blog/2016/12/container-runtime-interface-cri-in-kubernetes/

containerd

- Graduated CNCF project
- “industry-standard container runtime”
- Probably the thing you’ve been using all the time!
- Use `ctr` or `critctl` to manage pods/containers

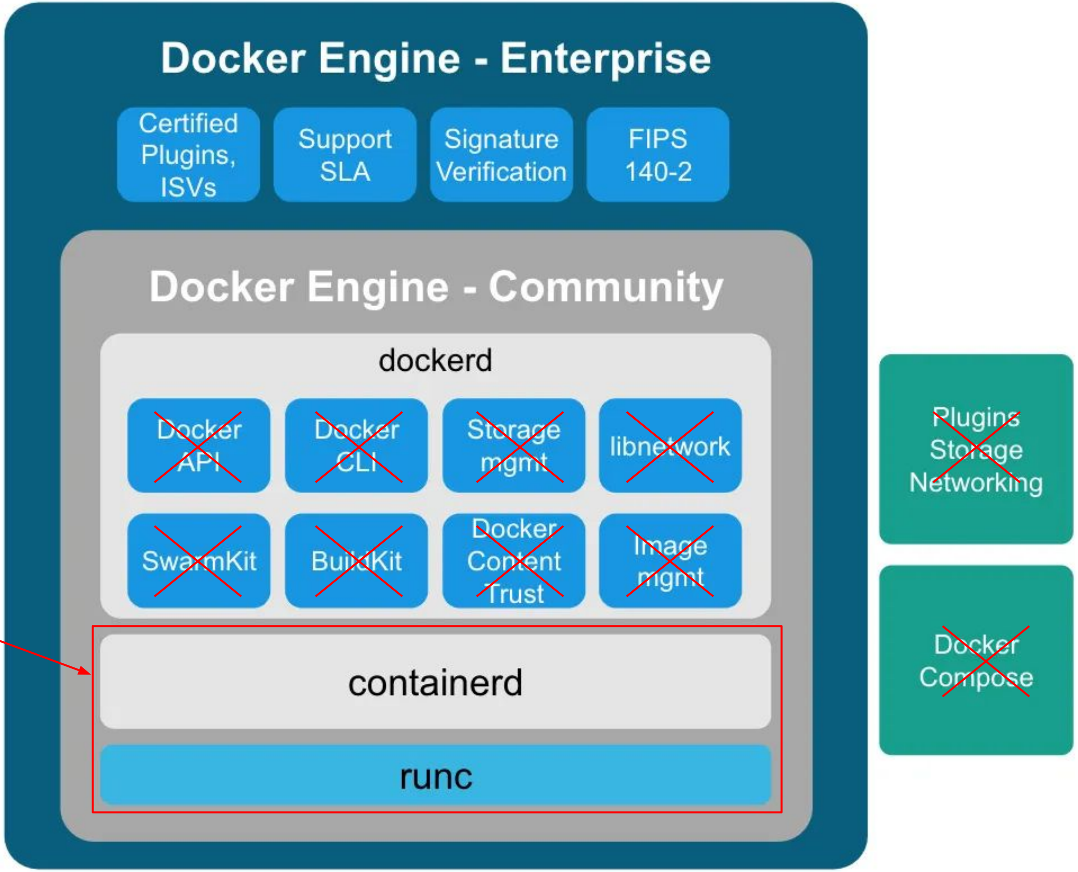


Docker
kubelet
CRI
dockershim
docker
containerd
container

Containerd 1.1
kubelet
CRI
CRI plugin
containerd
container

https://kubernetes.io/blog/2018/05/24/kubernetes-containerd-integration-goes-ga/

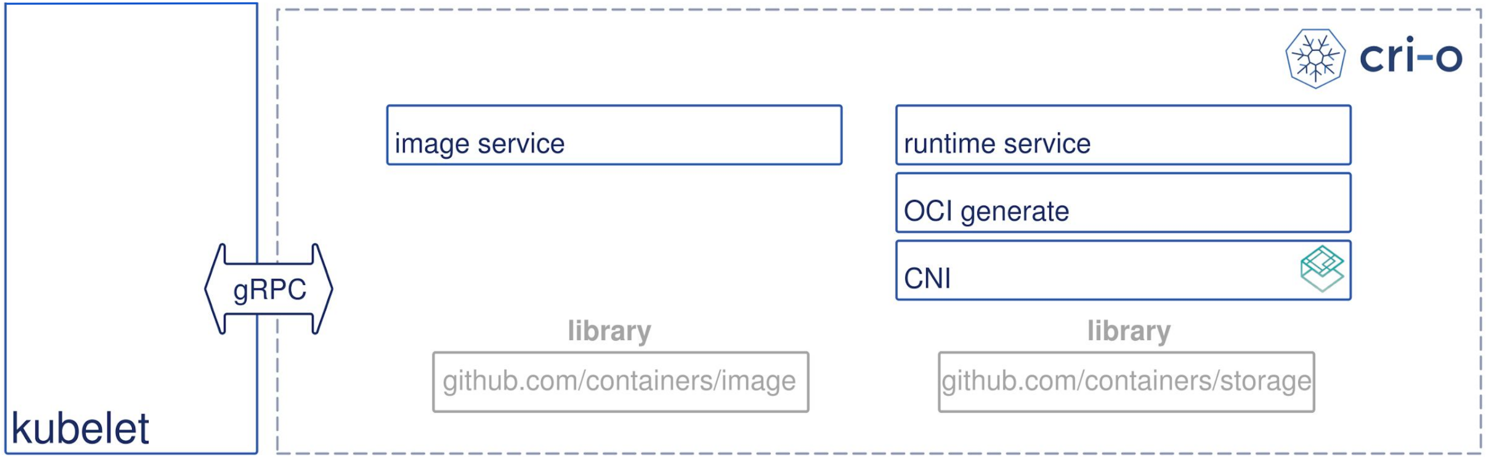
You are here



https://www.docker.com/blog/introducing-docker-engine-18-09/

cri-o

- Made by RedHat
- Default in OpenShift
- Purpose built as a kubernetes CRI
- Use `critctl` to manage pods/containers



kubelet

gRPC

cri-o

image service

runtime service

OCI generate

CNI

library

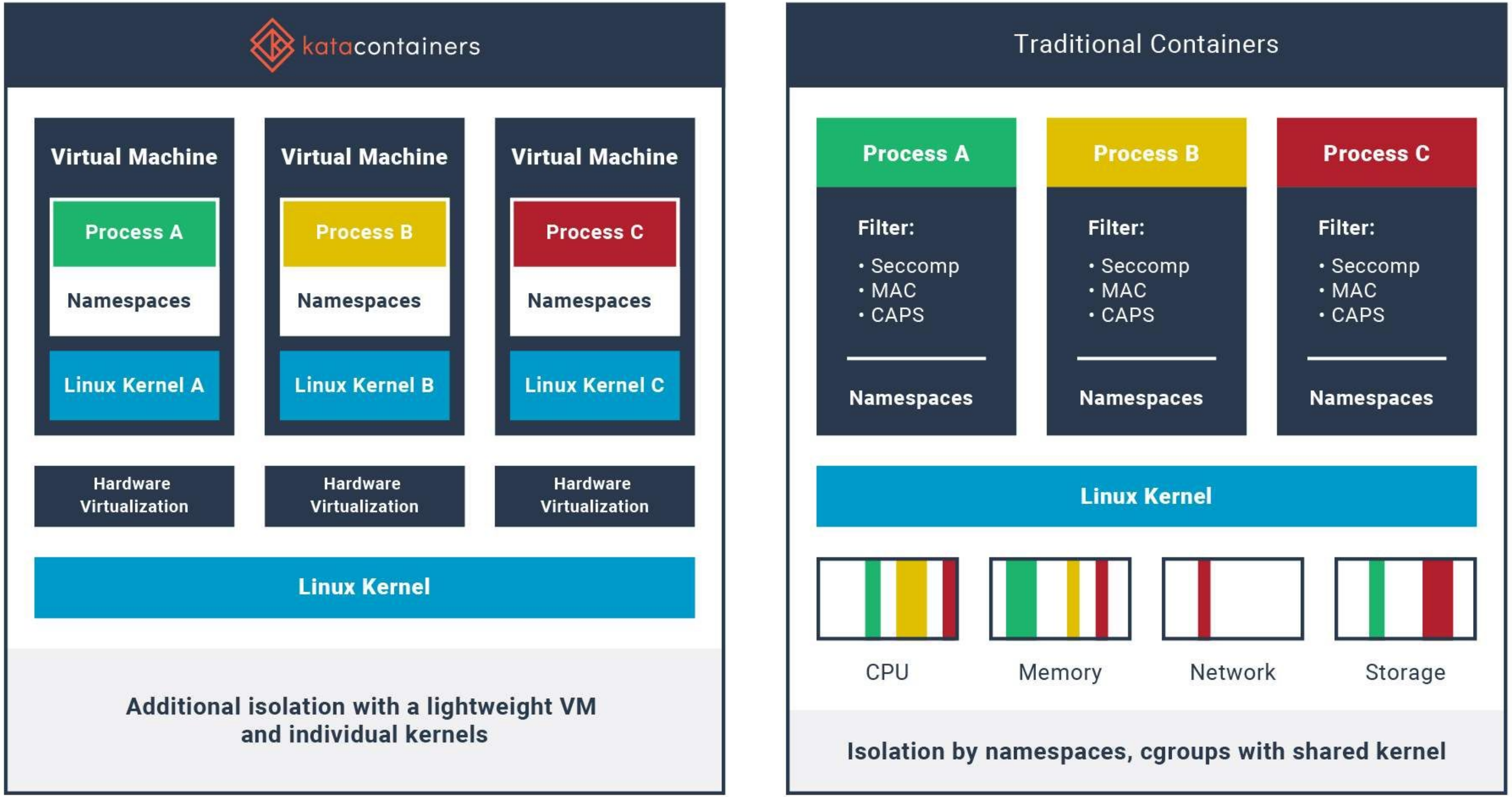
github.com/containers/image

library

github.com/containers/storage

https://cri-o.io/

Kata Containers



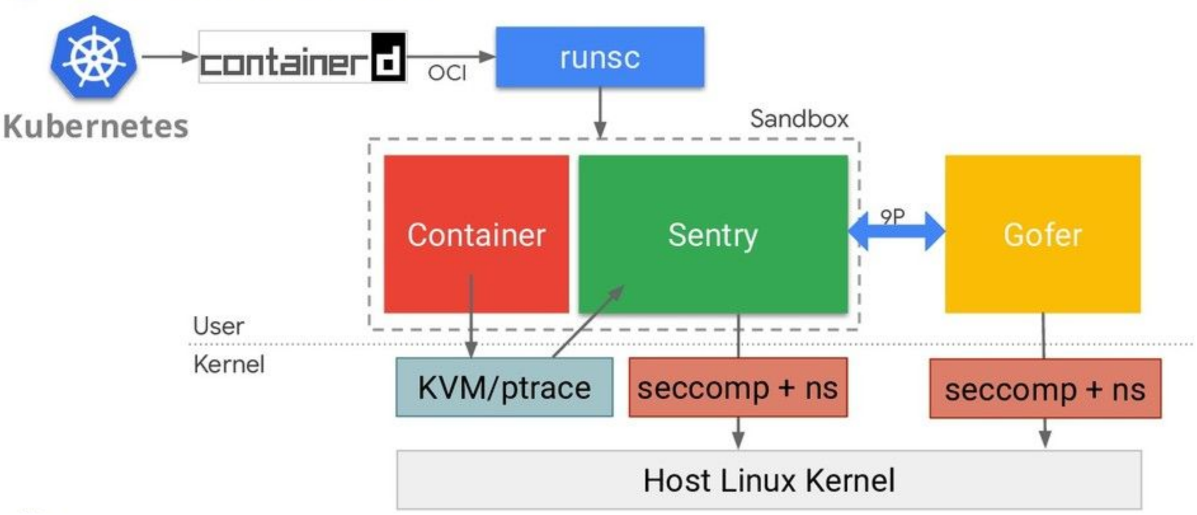
Additional isolation with a lightweight VM and individual kernels

Isolation by namespaces, cgroups with shared kernel

https://katacontainers.io/learn/

gVisor

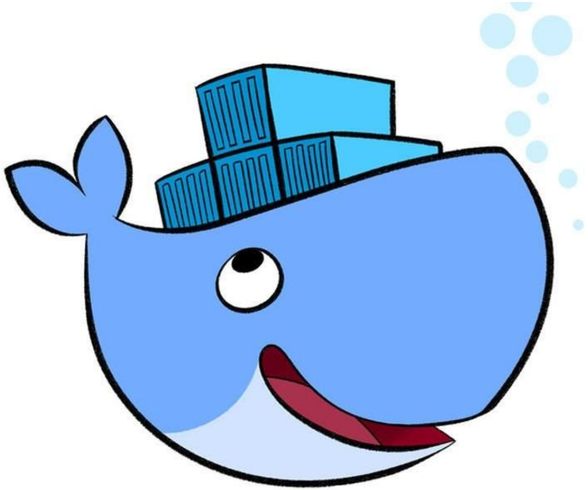
- Made by Google
- *gVisor is an application kernel for containers that provides efficient defense-in-depth anywhere.*



https://gvisor.dev/

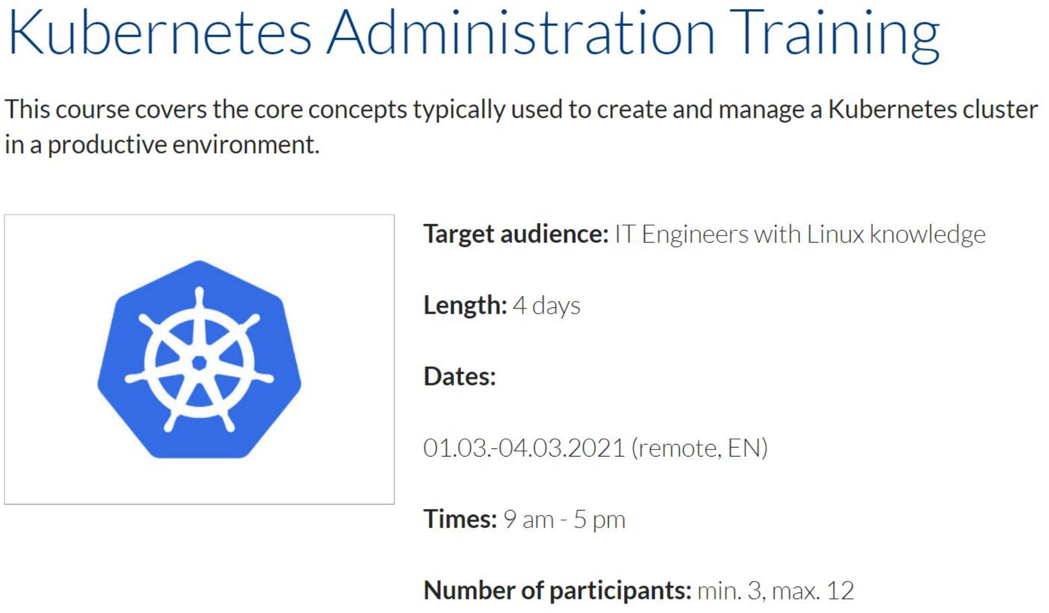
Docker is dead, right?

- Not yet!
- Docker Enterprise -> Mirantis k8s Engine
- Focus is shifted towards developers
- Default for poor Mac Users
- Irrelevant for running large scale containers



inovex

“I only understand train station!”



Kubernetes Administration Training

This course covers the core concepts typically used to create and manage a Kubernetes cluster in a productive environment.

Target audience: IT Engineers with Linux knowledge

Length: 4 days

Dates:

01.03.-04.03.2021 (remote, EN)

Times: 9 am - 5 pm

Number of participants: min. 3, max. 12

https://www.inovex.de/de/leistungen/trainings-workshops/kubernetes-administration-training/
https://www.inovex.de/en/our-services/training-workshops/kubernetes-administration-training