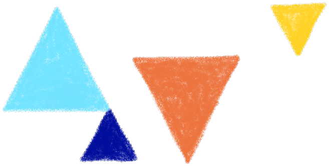


Kubernetes for your startup

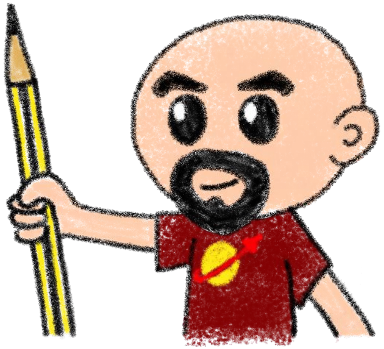
Horacio Gonzalez

2021-02-18

@LostInBrittany

Who are we?

Introducing ourselves and introducing OVHcloud



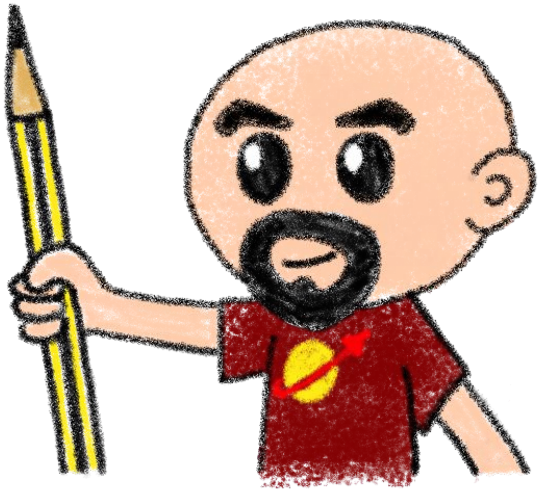
Horacio Gonzalez

@LostInBrittany

Spaniard lost in Brittany, developer, dreamer and all-around geek

OVHcloud

DevRel Leader



DevFest du Bout du Monde

Finist Devs

GDG Finistère

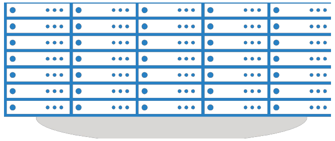
Google Developers Experts 2019

Web Technologies GDE
Flutter

OVHcloud: A Global Leader

200k Private cloud VMs running

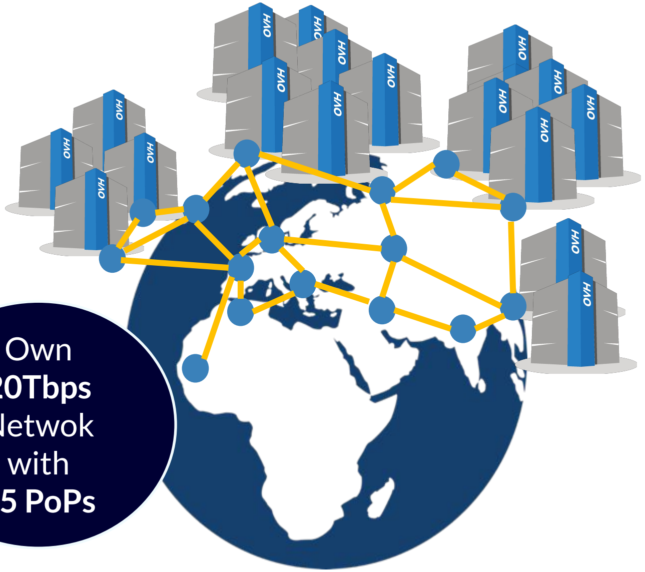
1 **Dedicated IaaS Europe**



Hosting capacity : **1.3M** Physical Servers

360k Servers already deployed

Own **20Tbps** Netwok with **35 PoPs**



30 Datacenters

> **1.4M** Customers in **138** Countries

OVHcloud: 4 Universes of Products

Domain / Email

Domain names, DNS, SSL, Redirect

Email, Open-Xchange, Exchange

Collaborative Tools, NextCloud

PaaS for Web

Mutu, CloudWeb

Plesk, CPanel

PaaS with Platform.sh

Virtual servers

VPS, Dedicated Server

SaaS

Wordpress, Magento, Prestashop

CRM, Billing, Payment, Stats

MarketPlace

Support, Managed

Support Basic

Support thought Partners

Managed services

Standalone, Cluster

General Purpose
SuperPlan
Game
Virtualization
Storage
Database
Bigdata
HCI
AI
VDI Cloud Game
Network

T2 >20e
T3 >80e
T4 >300e
T5 >600e
12KVA /32KVA

VPS aaS

pCC DC

Virtuozzo Cloud

Wholesales

IT Integrators, Cloud Storage,

CDN, Database, ISV, WebHosting

High Intensive CPU/GPU,

Encrypt

KMS, HSM

Encrypt (SGX, Network, Storage)

Compute

VM
Baremetal

K8S, IA IaaS
PaaS for DevOps

Storage

File, Block, Object, Archive

Databases

SQL, noSQL, Messaging,

Dashboard

Network

IP FO, NAT, LB, VPN, Router,

DNS, DHCP, TCP/SSL Offload

Security

IAM, MFA, Encrypt, KMS

IA, DL

Standard Tools for AI, AI Studio,

IA IaaS, Hosting API AI

Bigdata, ML, Analytics

Datalake, ML, Dashboard

Hosted Private Cloud

VMware

SDDC, vSAN 1AZ / 2AZ
vCD, Tanzu, Horizon, DBaaS,
DRaaS

Nutanix

HCI 1AZ / 2AZ, Databases,
DRaaS, VDI

OpenStack

IAM, Compute (VM, K8S)
Stortage, Network, Databases

Storage

Ontap Select, Nutanix File
OpenIO, MinIO, CEPH
Zerto, Veeam, Atempo

AI

ElementAI, HuggingFace,
Deepopmatic, Systran,
EarthCube

Bigdata / Analitics / ML

Cloudera over S3, Dataiku,
Saagie, Tableau,

Hybrid Cloud

vRack Connect, Edge-DC, Private DC

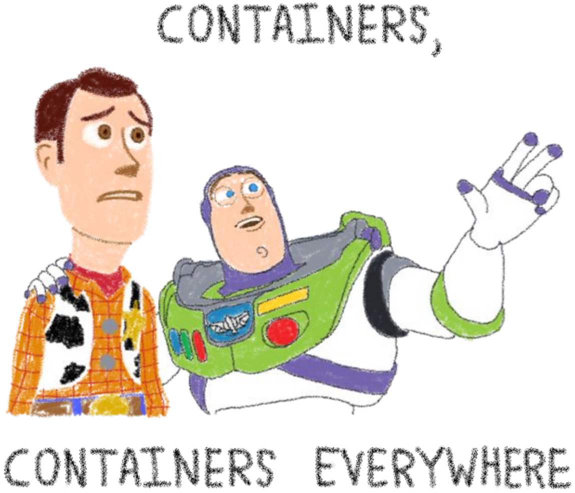
Dell, HP, Cisco, OCP, MultiCloud

Secured Cloud

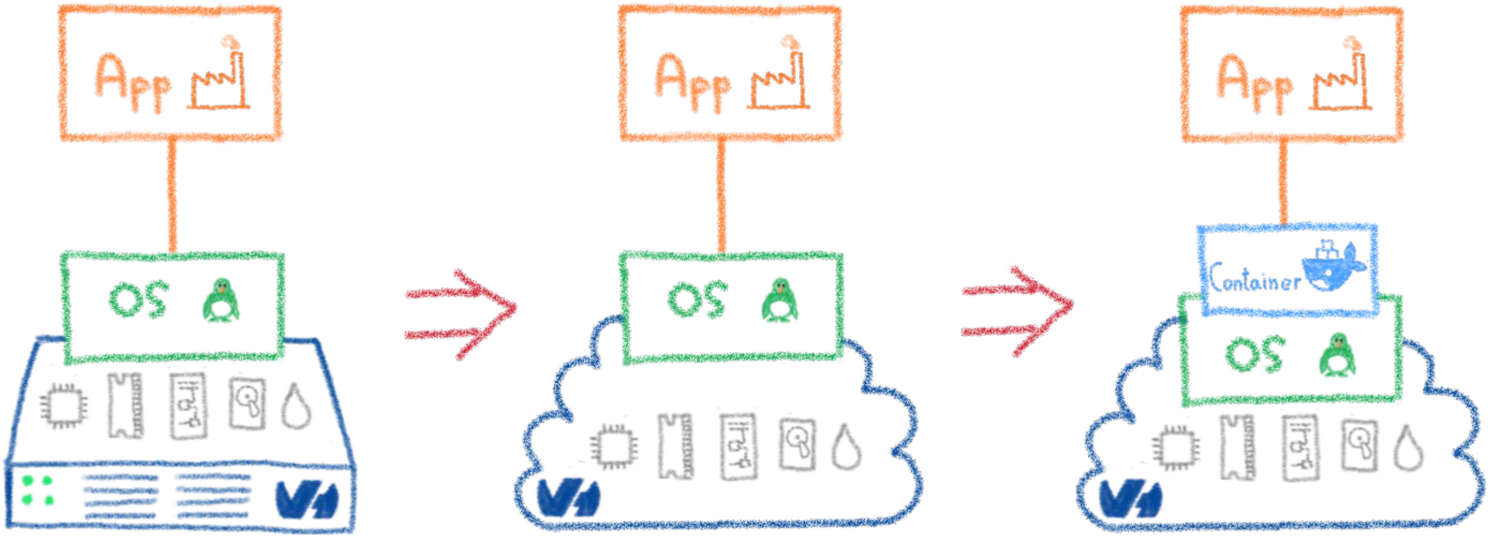
GOV, FinTech, Retail, HealtCare

Orchestrating containers

Like herding cats… but in hard mode!

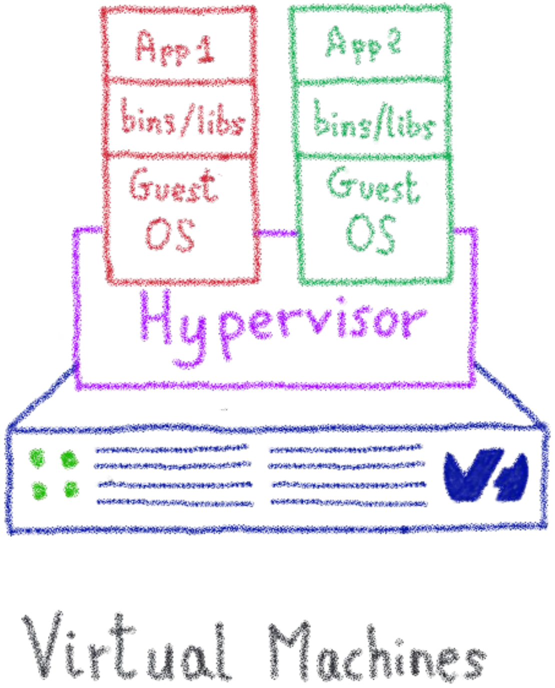


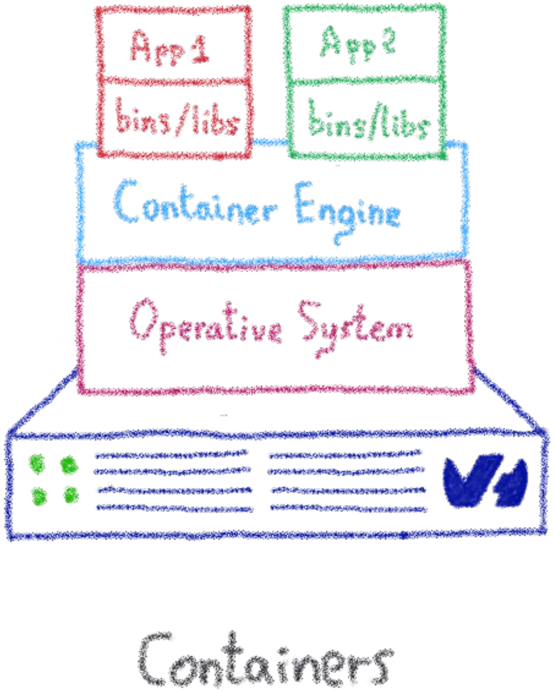
From bare metal to containers



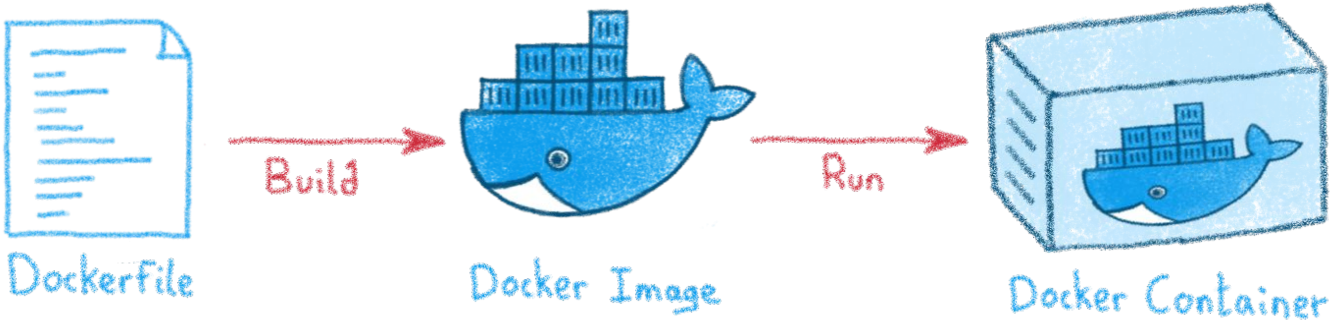
Another paradigm shift

Virtual machines vs Containers

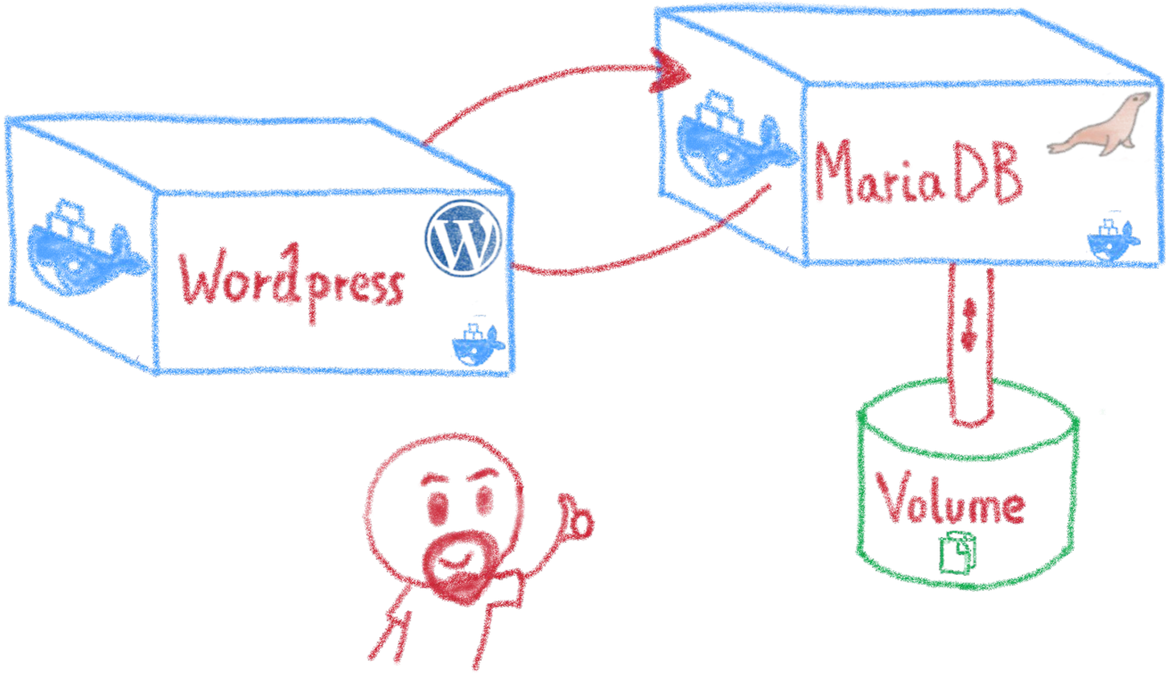




Dockerfiles, images and containers

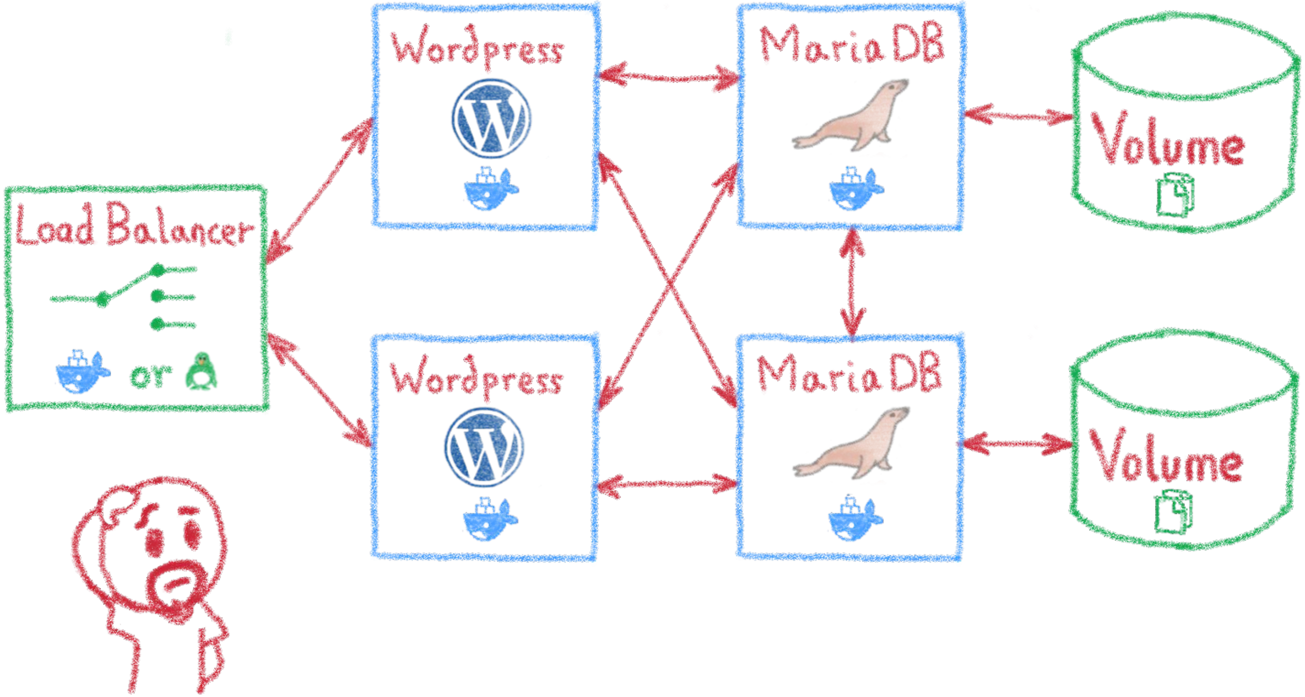


Containers are easy…



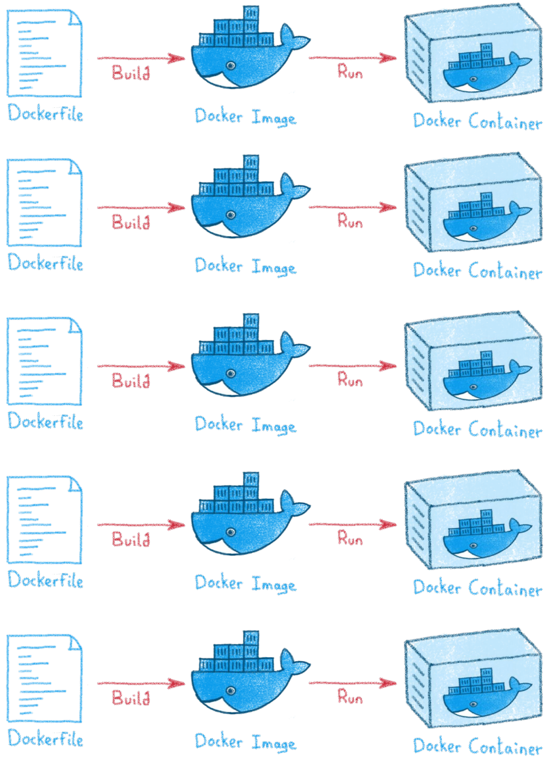
For developers

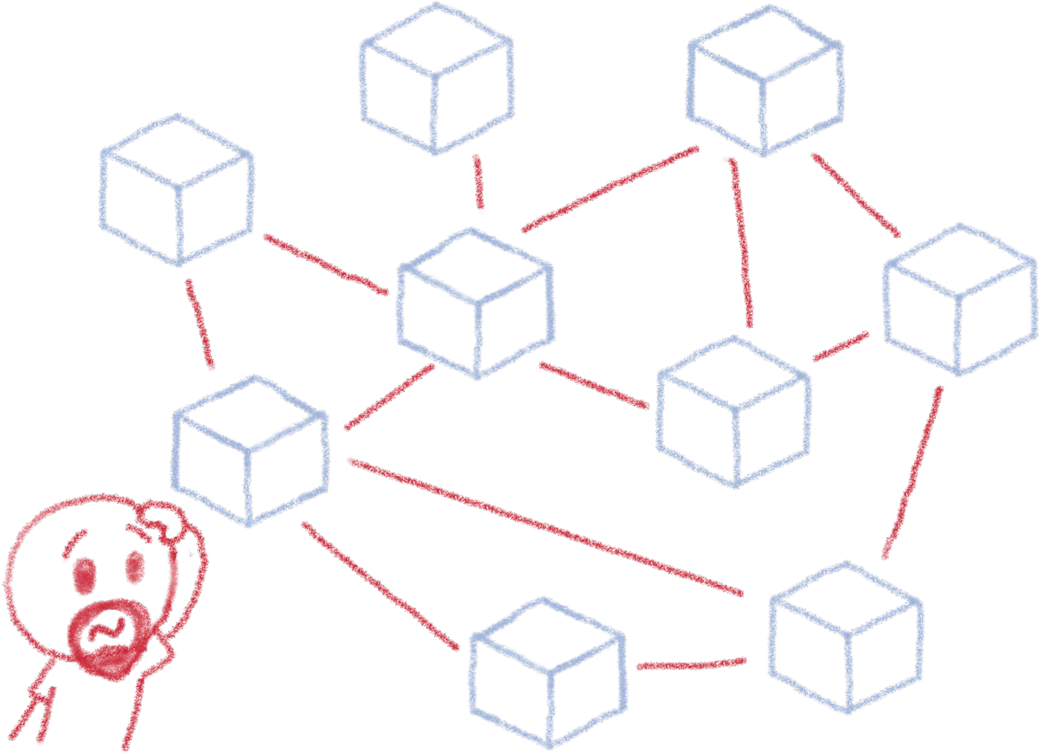
Less simple if you must operate them



Like in a production context

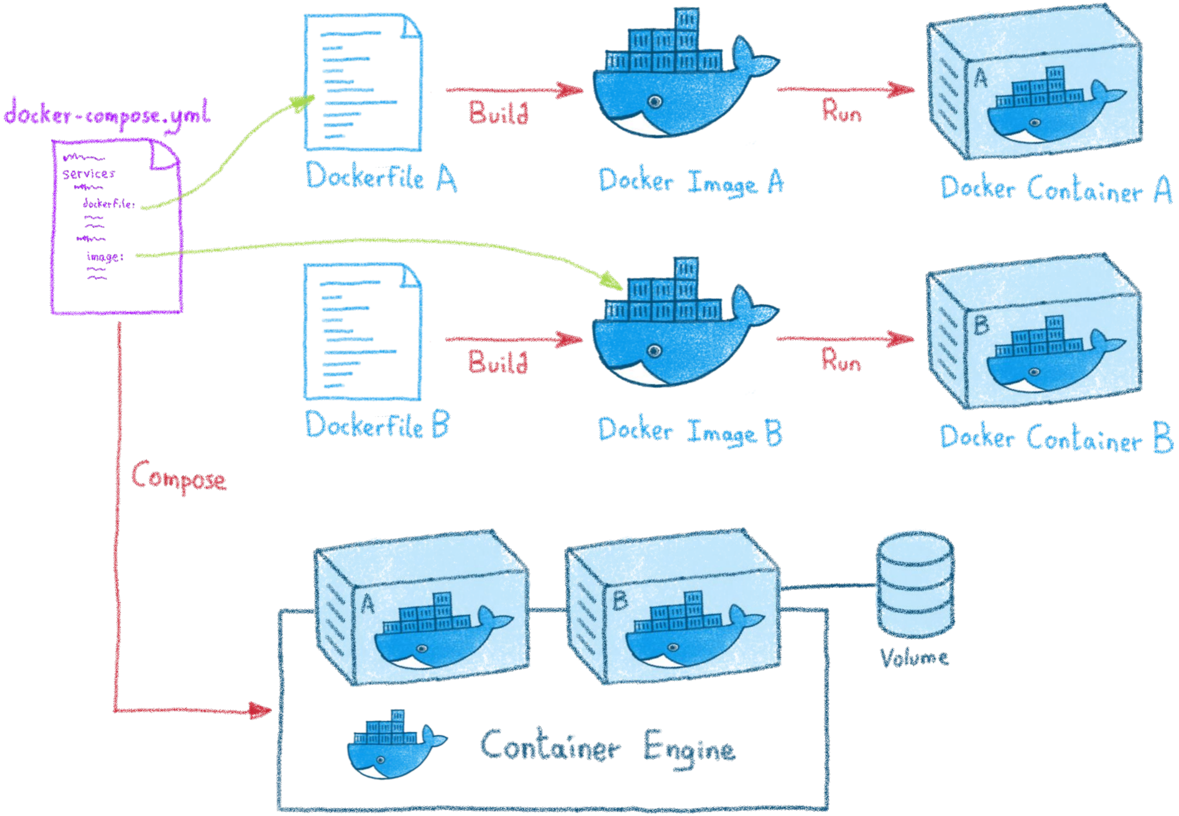
And what about microservices?





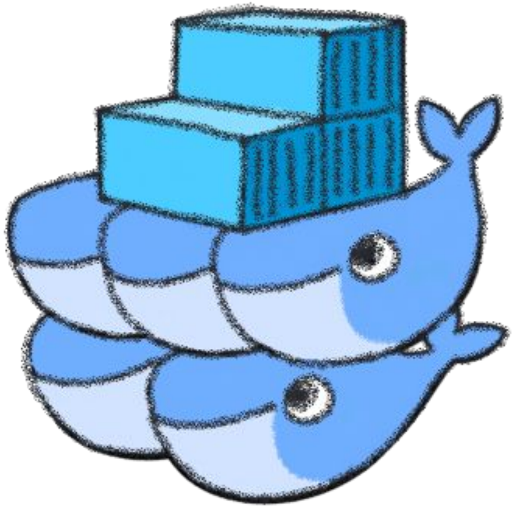
Are you sure you want to operate them by hand?

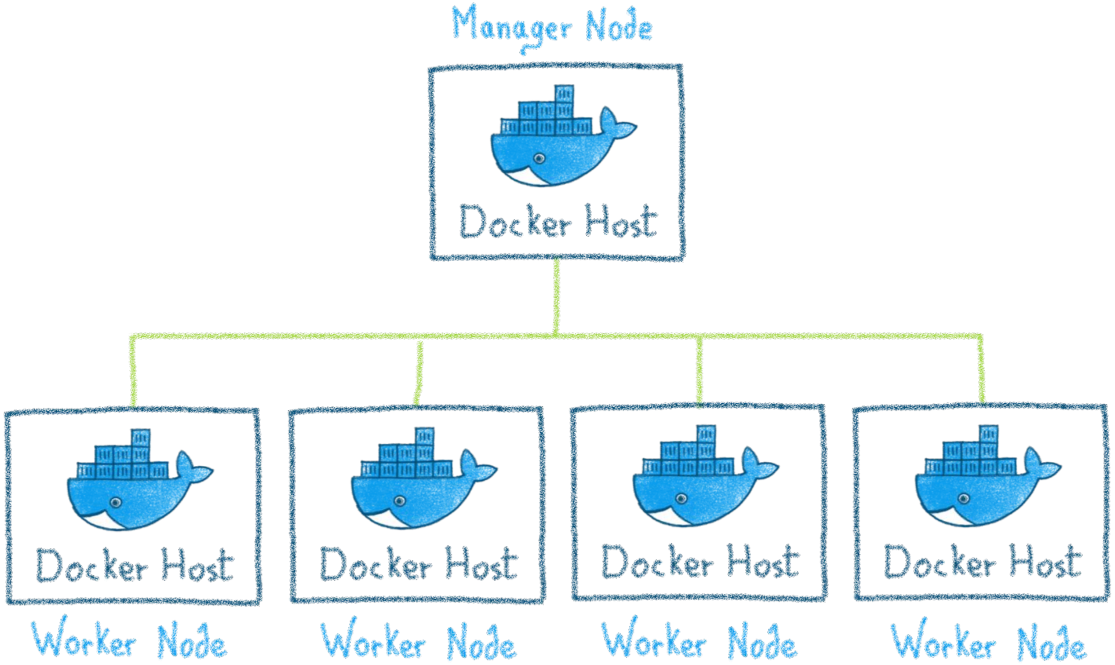
Docker Compose: managing stacks



Stack: multi-container application

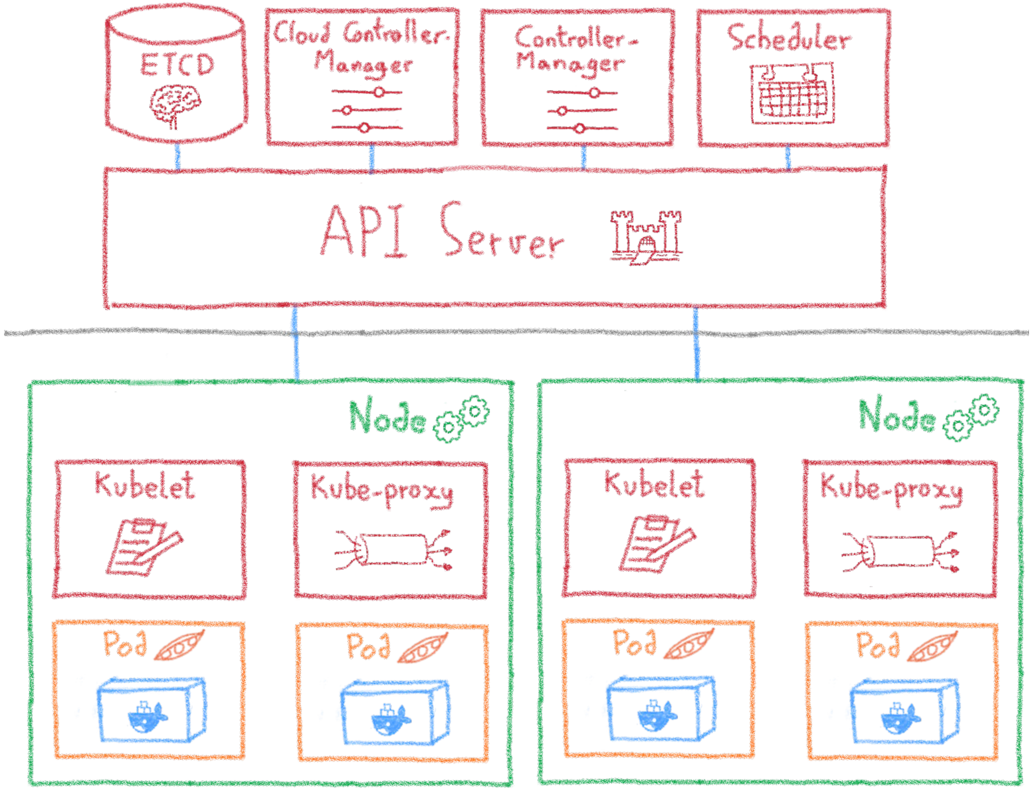
Docker Swarm: managing clusters





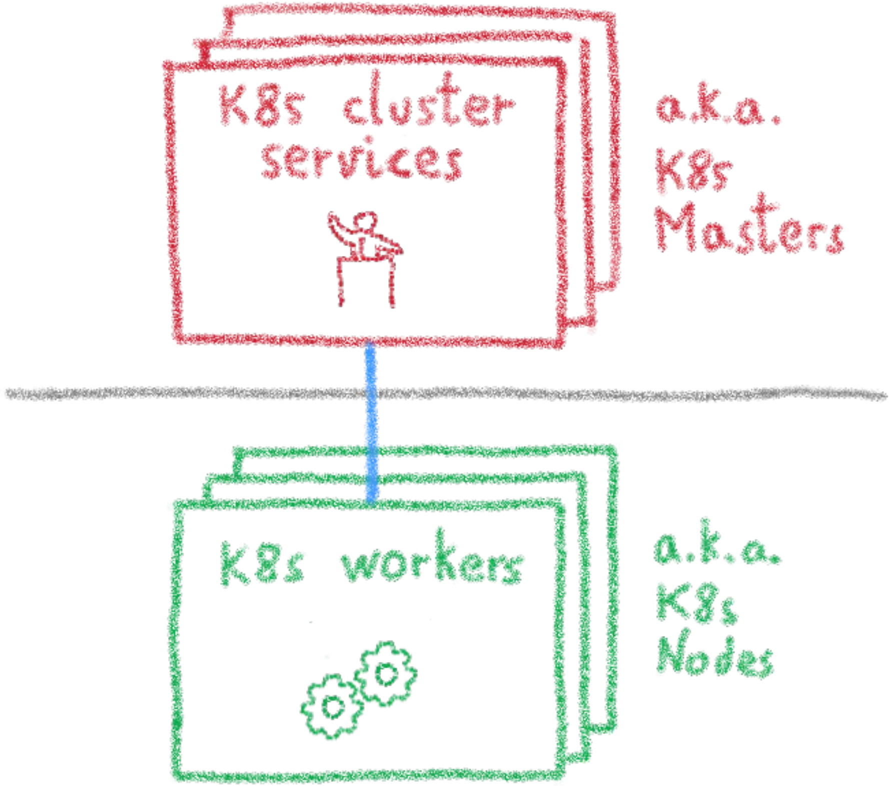
Consolidates Docker hosts into a cluster

Kubernetes: a full orchestrator

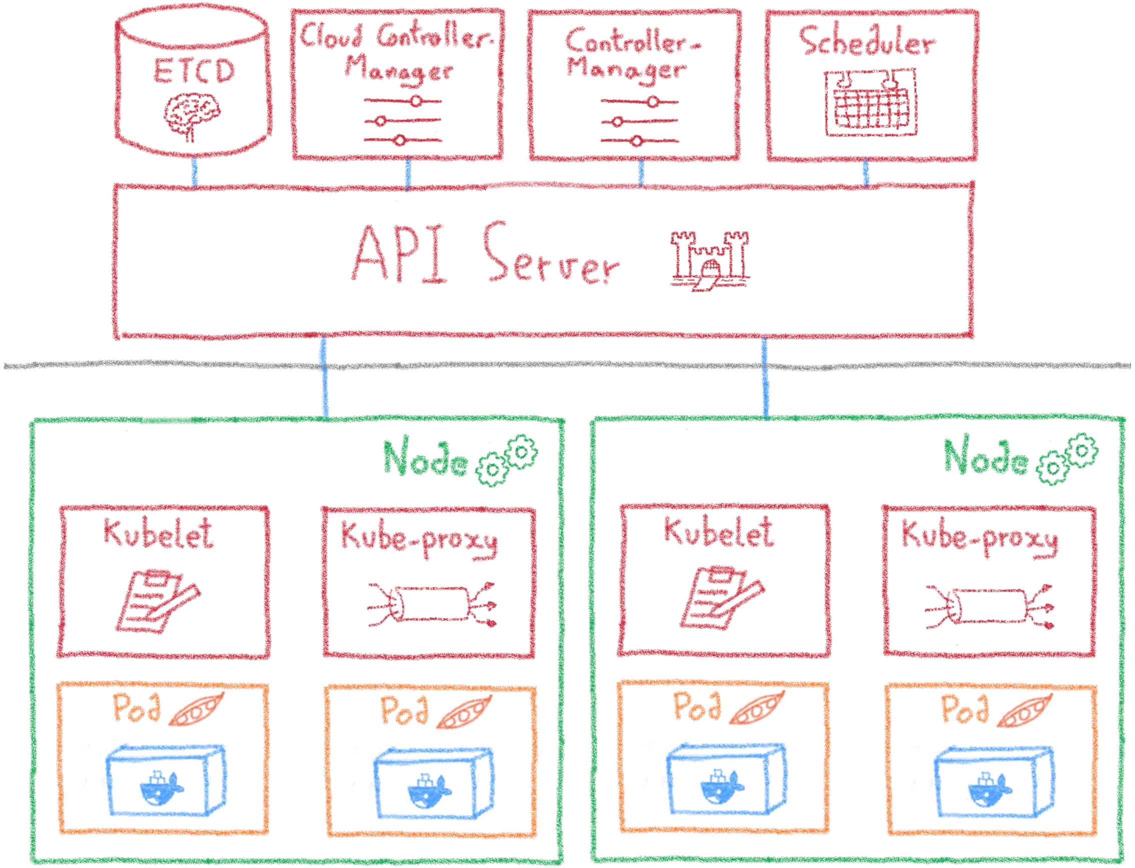


Let's dive into Kubernetes

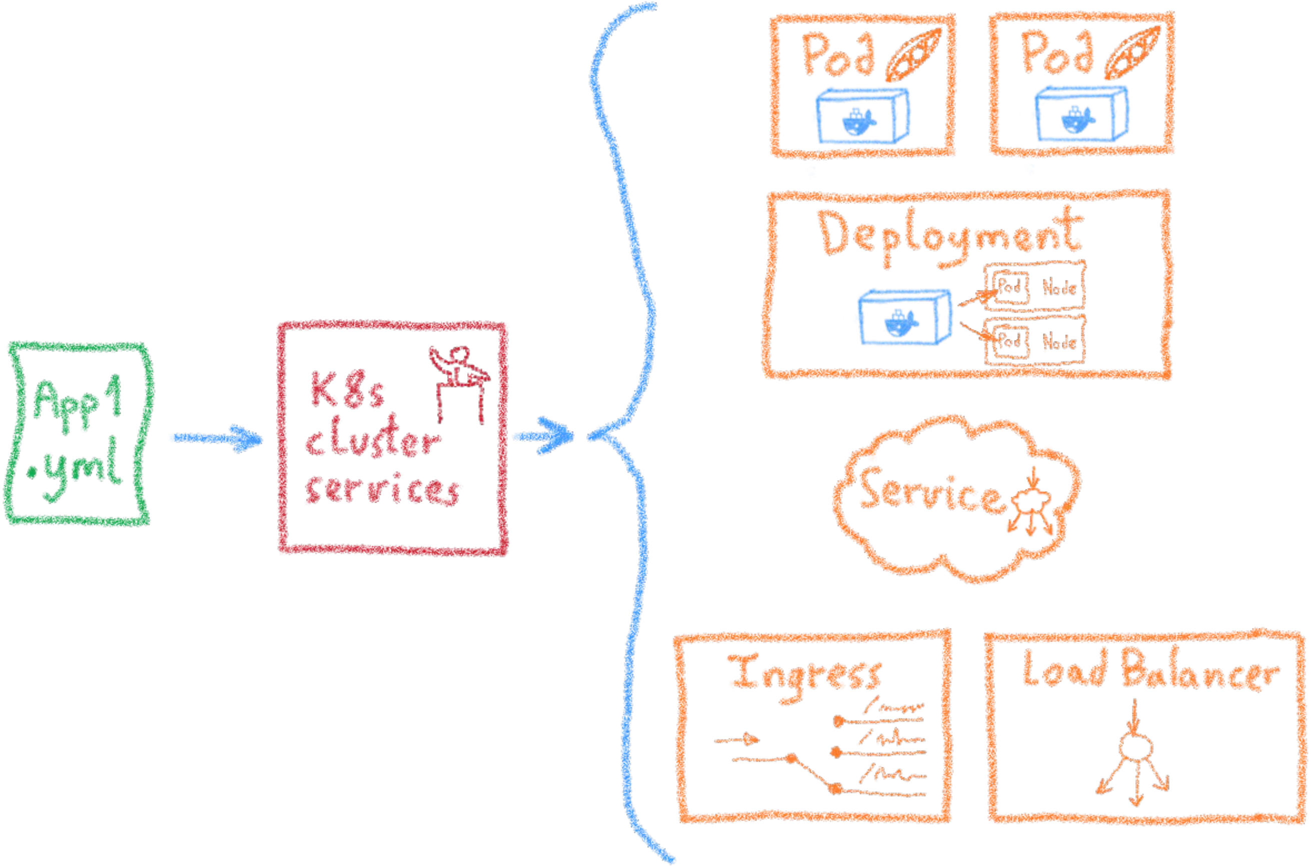
Kubernetes cluster: masters and nodes



Kubernetes cluster: more details



Desired State Management



Ingress

Services

Deployments

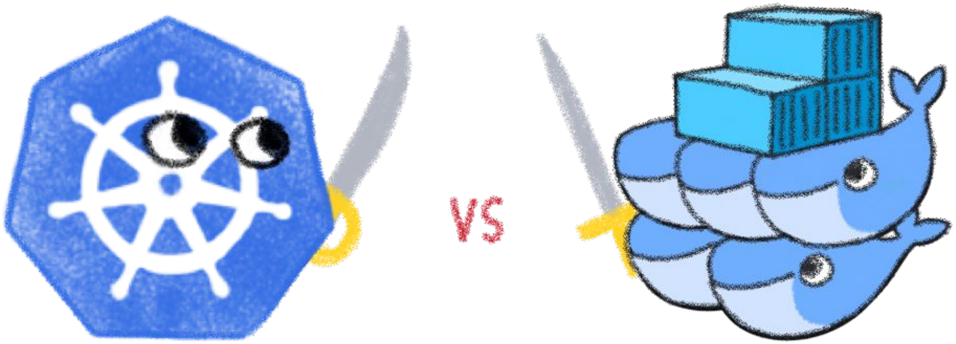
Pods

Sidecars

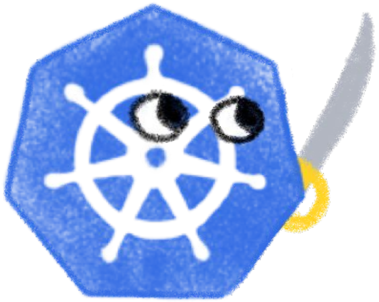
Replica Sets

Kubernetes vs Docker Swarm

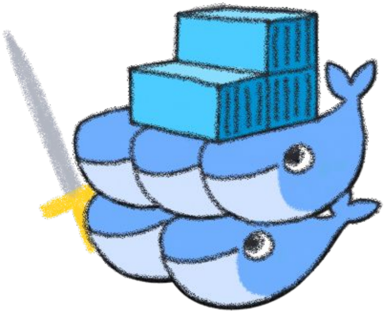
Not really equivalent...



Application definition



VS



Richer definitions:

- Services
- Deployments
- Pods

Defined with K8s YAML & APIs

Services composed of:

- Containers
- Stacks multi-container

Defined with Dockerfiles & Docker API

Scalability

Built for distributed systems

More complicated and providing guaranties.

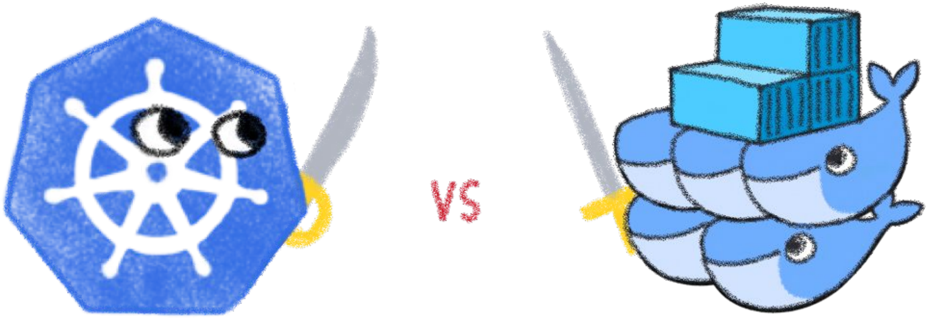
Slower deployments & scaling

Both cluster & pod autoscaler

Simpler architecture less guaranties

Faster deployments & scaling

High availability



Built for HA

- Self-healing
- Load balancing & dynamic pod distribution
- Multi-node master
- External ETCD cluster

HA features

- Services replicated in worker nodes
- Replicated manager nodes

Networking

Flat network between worker nodes.

Flexible network policies

Network implemented as overlay needing two CIDRs: pods & services

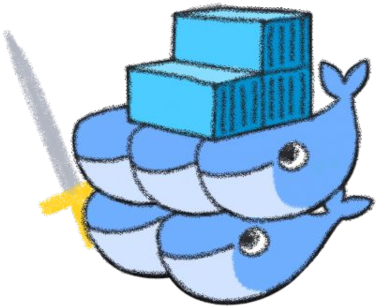
Overlay for services running in every host, docker bridge for other containers

Optional encryption when creating overlay network

Other advantages & drawbacks

- 👍 Huge community
- 👍 Backed by the CNCF
- 👍 Very flexible service organisation

- 👎 Learning curve
- 👎 Specific tooling

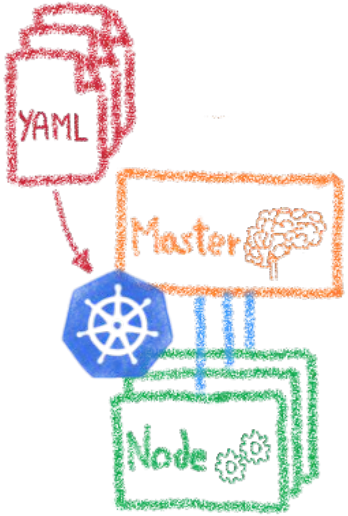


- 👍 Easy & lightweight
- 👍 Integrated with Docker tools

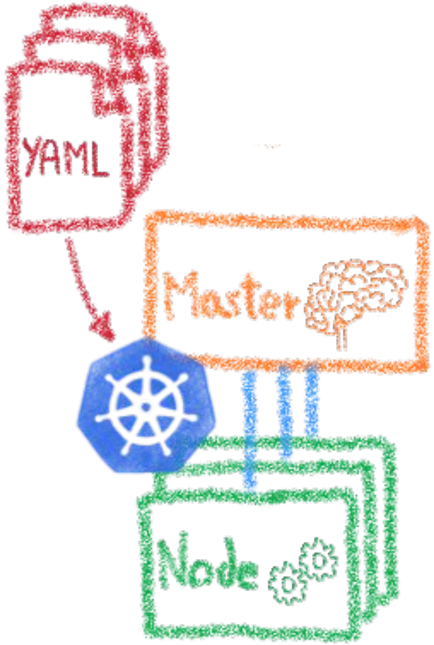
- 👎 Limited functionality
- 👎 Limited fault tolerancy
- 👎 Smaller community

Multi-environment made easy

Dev, staging, prod, multi-cloud...

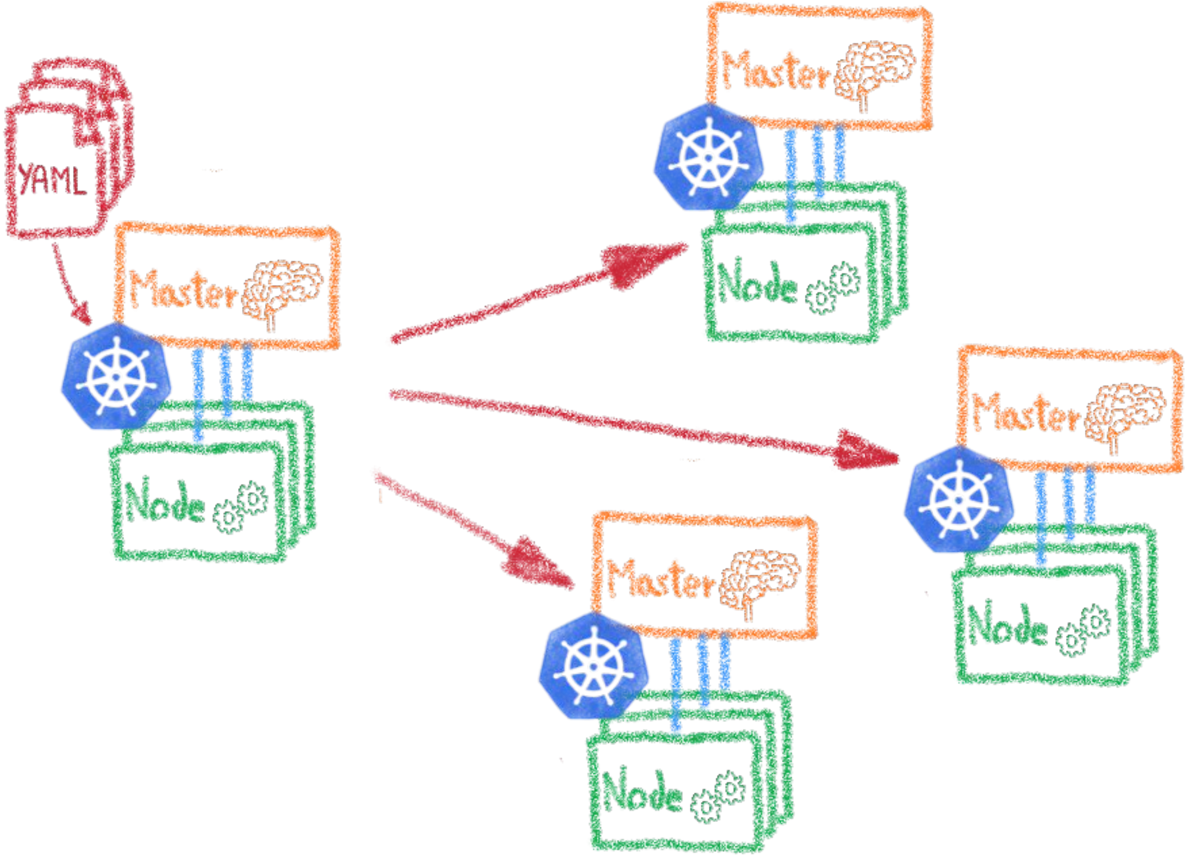


Declarative infrastructure



Multi-environment made easy

Having identical, software defined environments



Dev envs

Staging

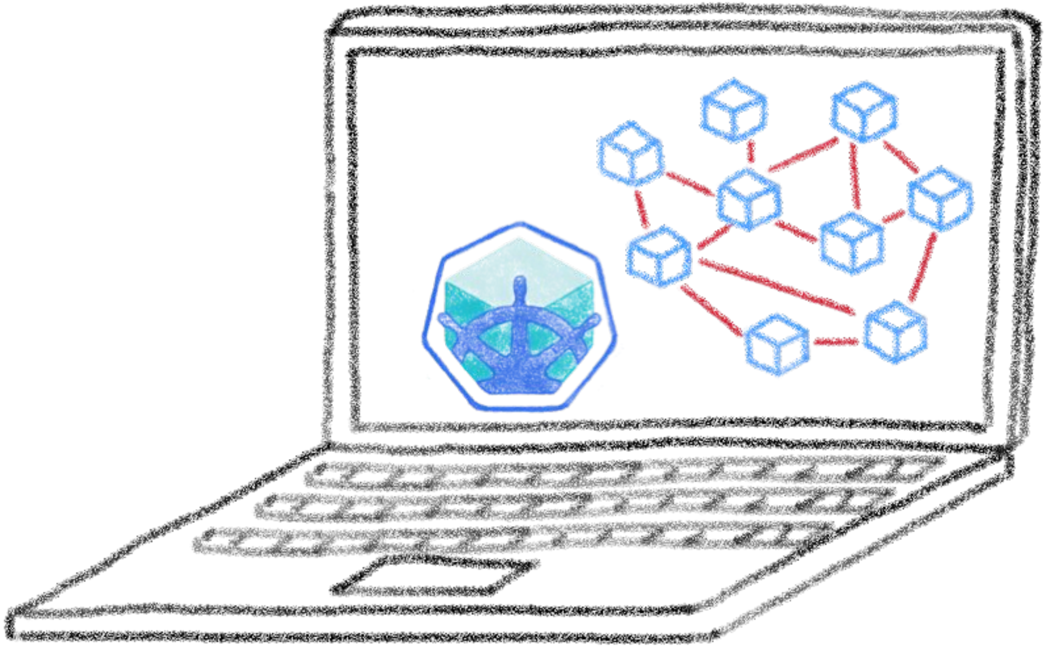
Multi-cluster

Multi-cloud

I have deployed on Minikube, woah!

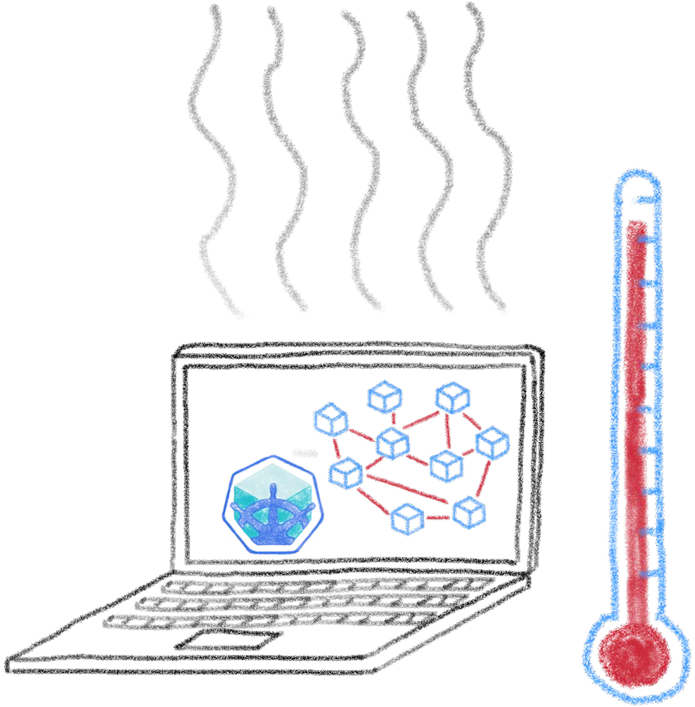
A great fastlane into Kubernetes

Running a full K8s in your laptop



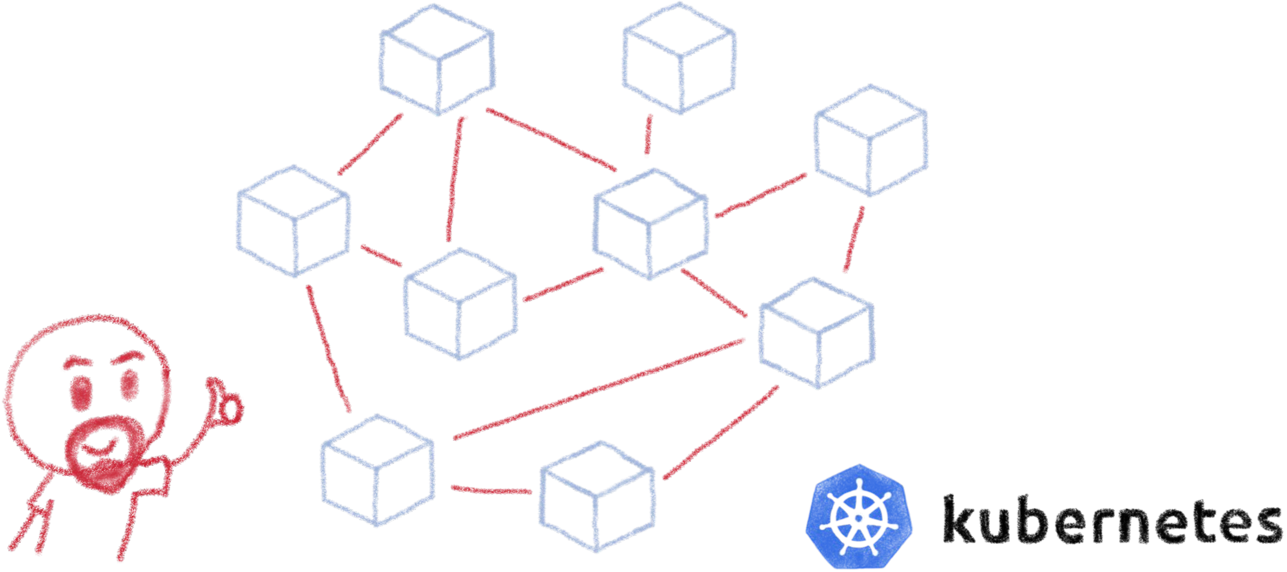
A great learning tool

Your laptop isn't a true cluster



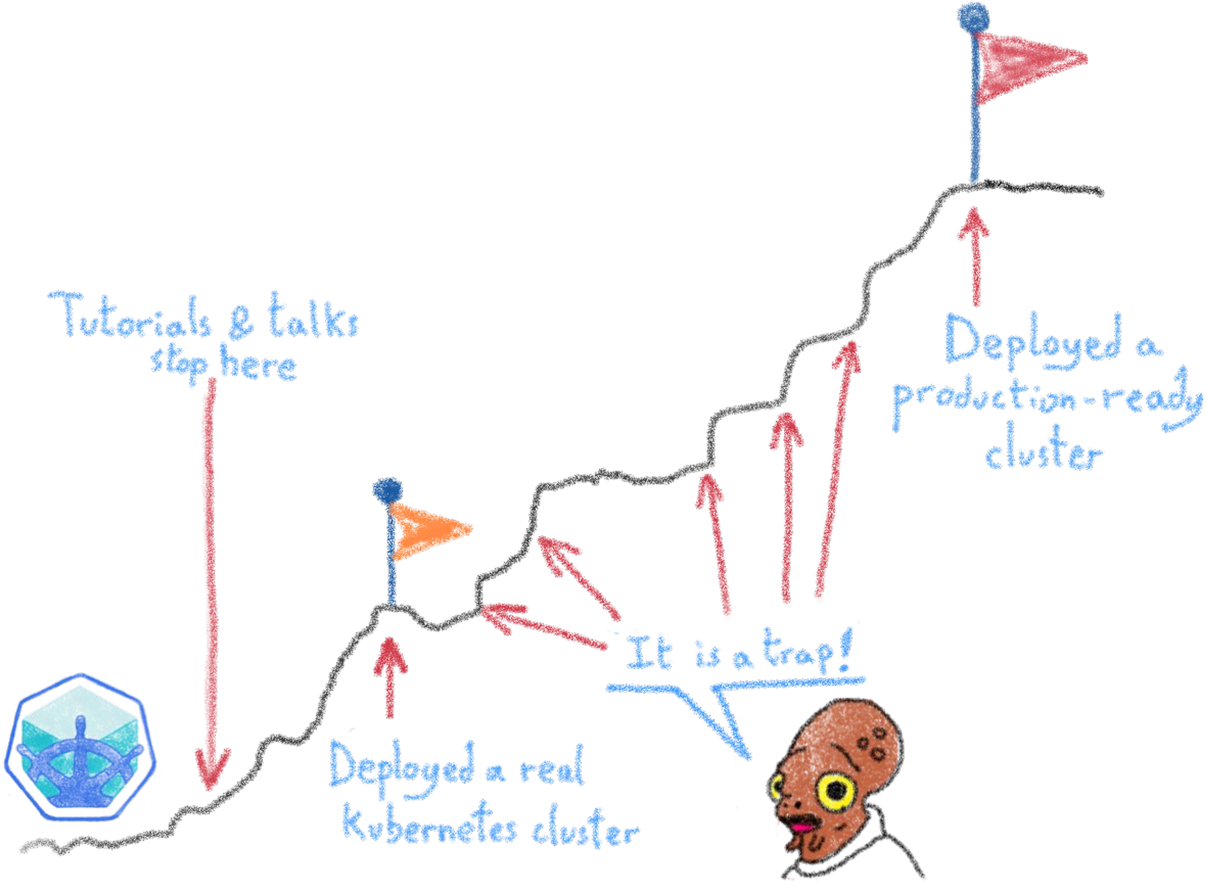
Don't expect real performances

Beyond the first deployment



So I've deployed my distributed architecture on K8s, everything is good now, isn't it?

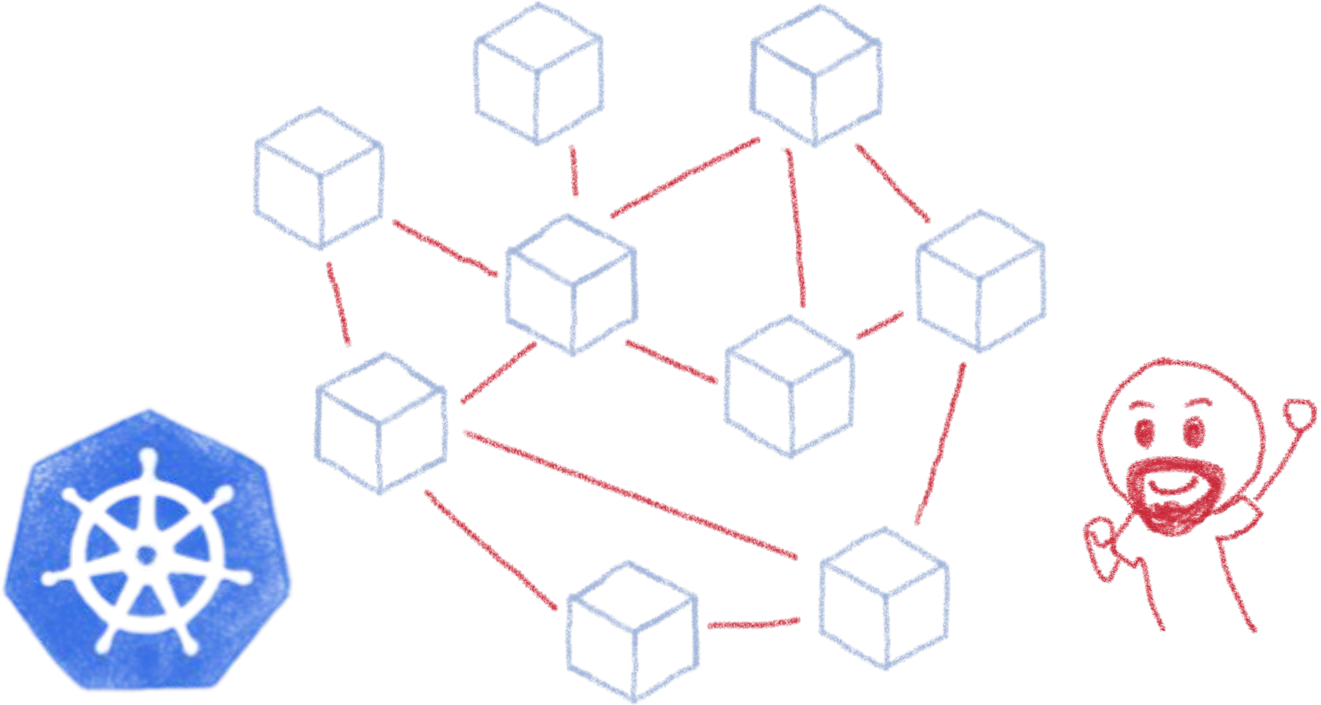
Minikube is only the beginning


Tutorials & talks stop here
Deployed a real Kubernetes cluster
It is a trap!
Deployed a production-ready cluster

From Minikube to prod

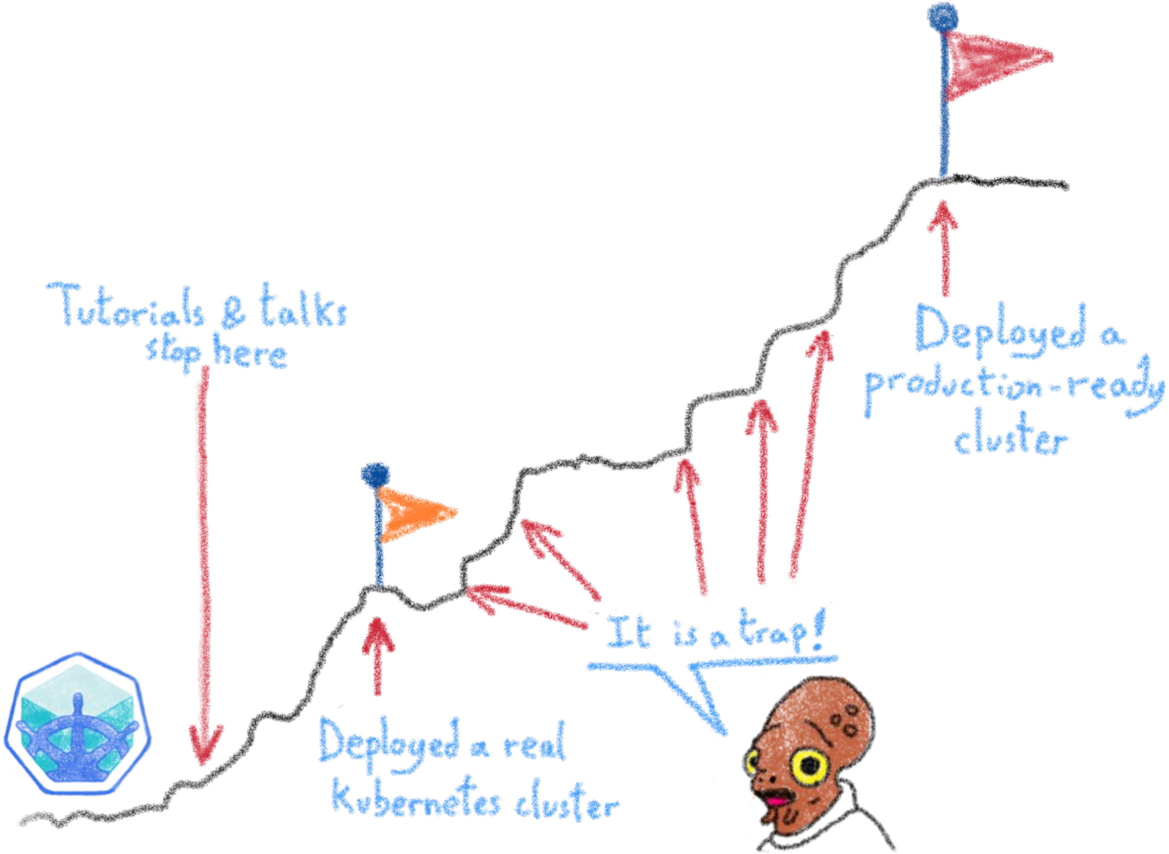
A journey not for the faint of heart

Kubernetes can be wonderful

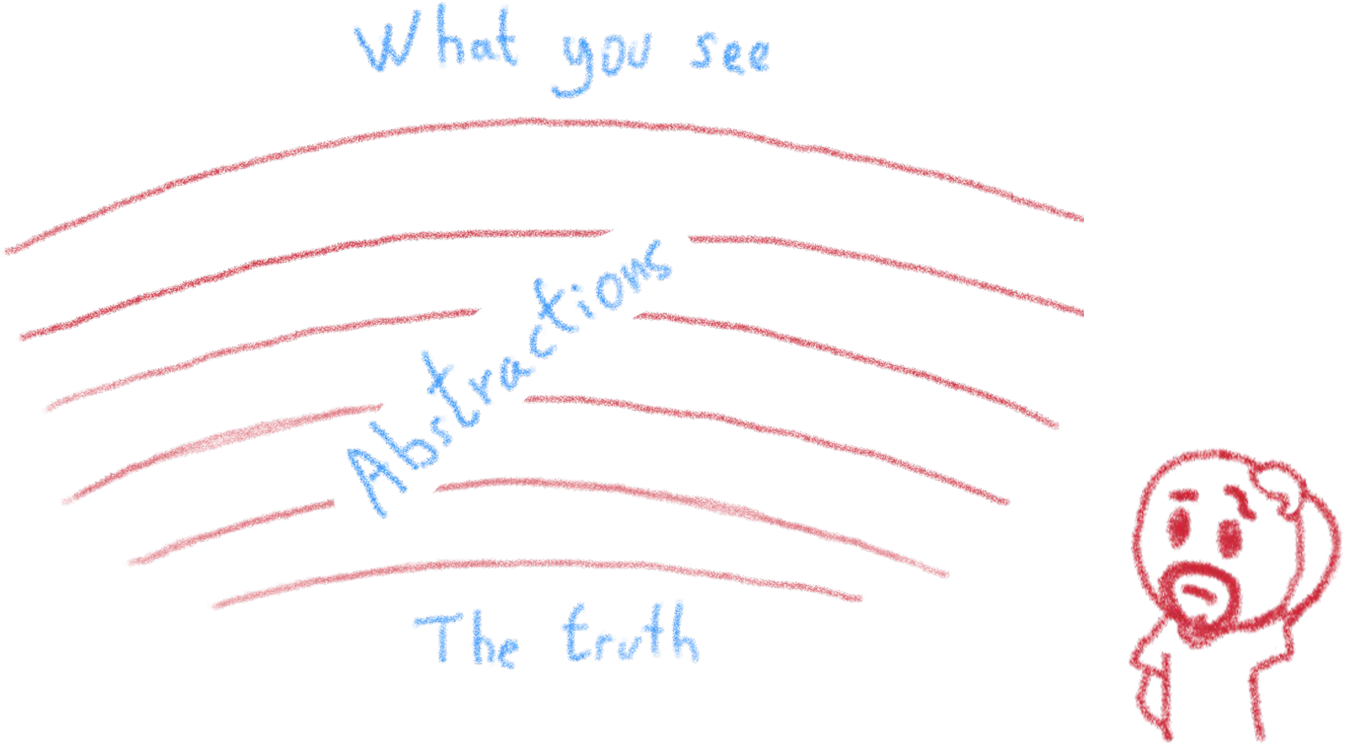


For both developers and devops

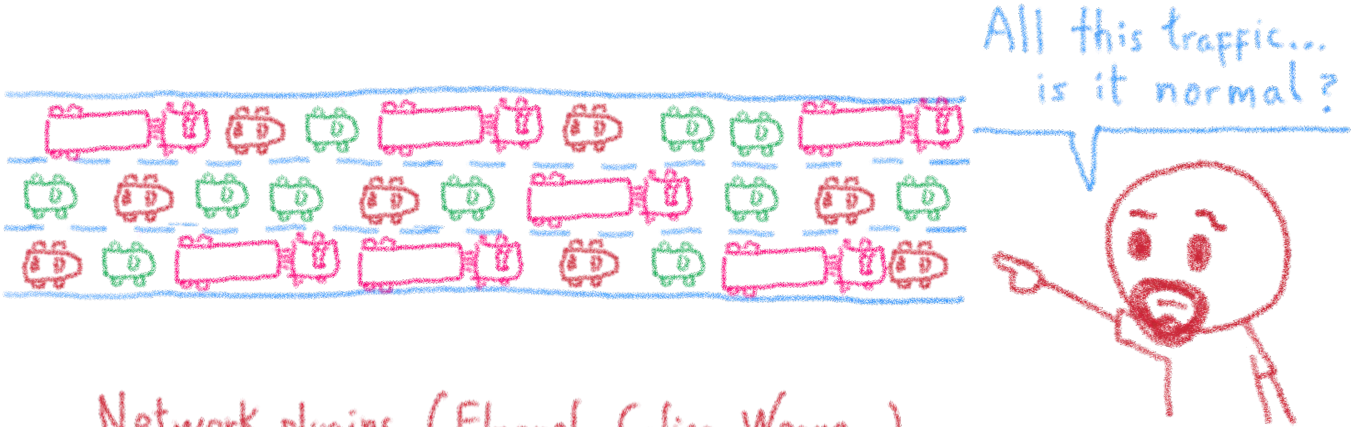
But it comes with a price...


Tutorials & talks stop here
Deployed a real Kubernetes cluster
It is a trap!
Deployed a production-ready cluster

The truth is somewhere inside...



Kubernetes networking is complex...



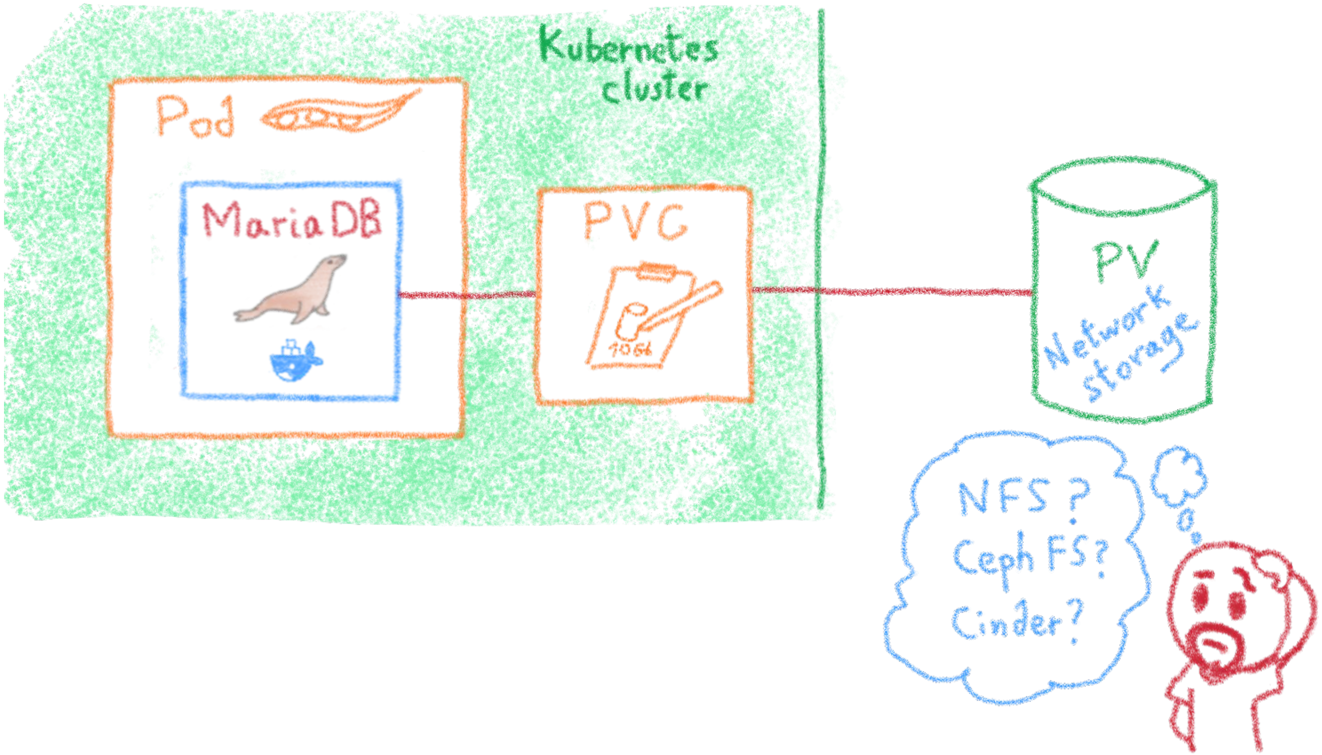
Network plugins (Flannel, Calico, Weave...)

- IPAM
- routing
- iptables
- crossnode networking

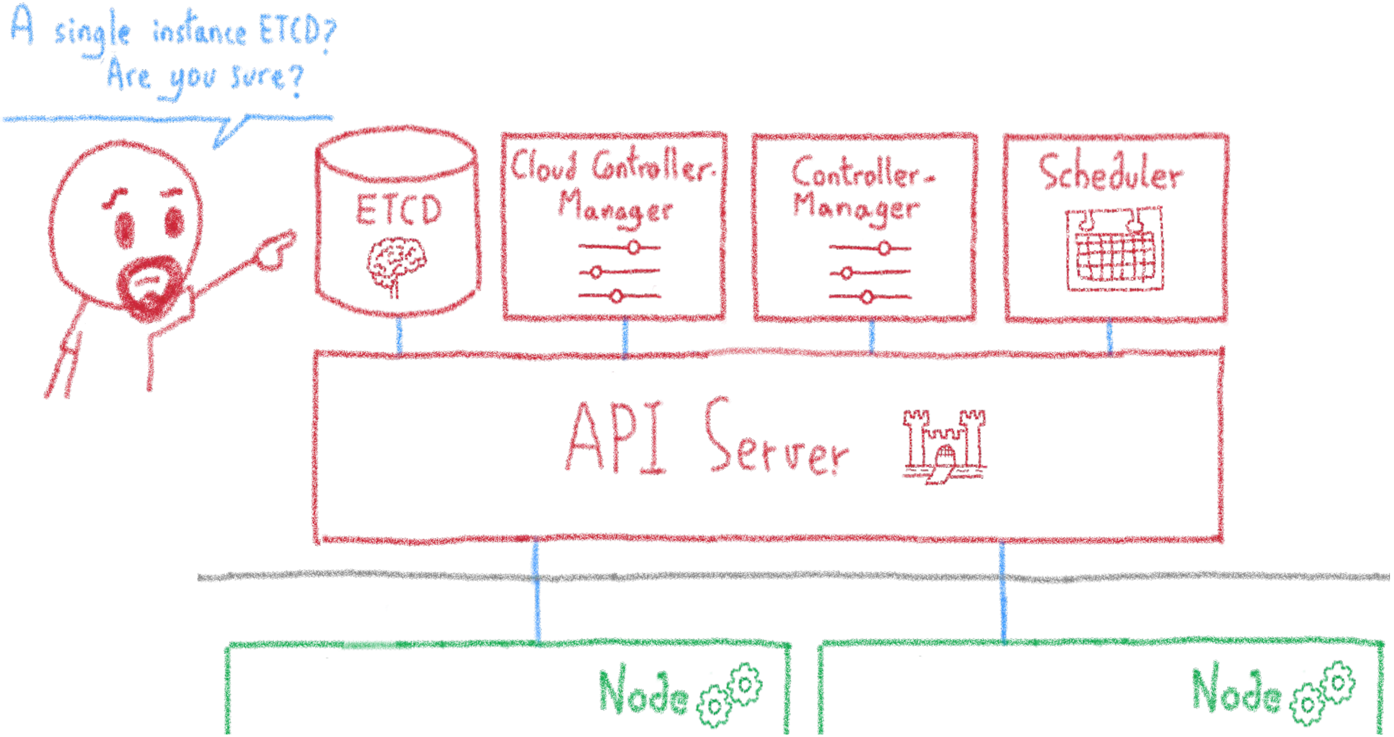
Cluster IP, NodePort, Ingress

Service Meshes, Istio

The storage dilemma

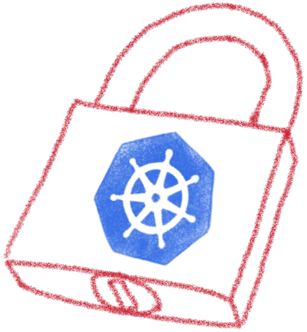


The ETCD vulnerability

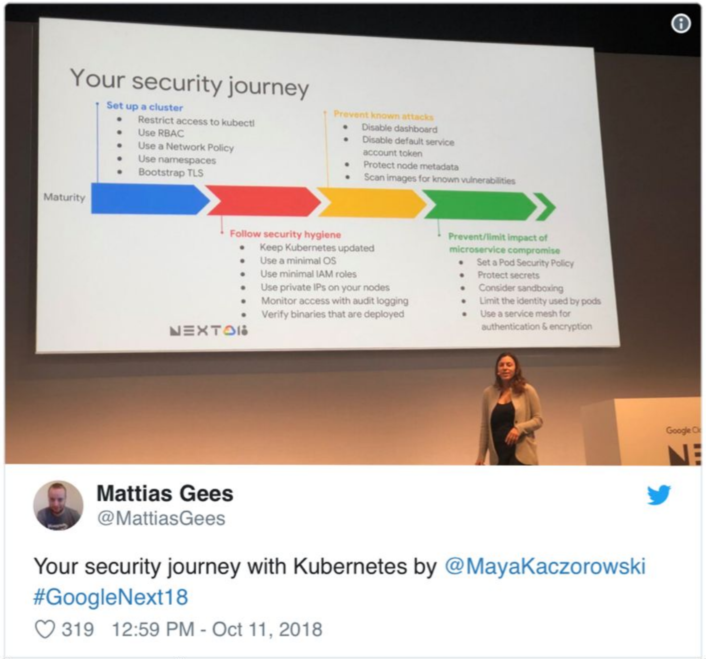


Security

Hardening your Kubernetes



The security journey



Your security journey

Maturity

Set up a cluster
- Restrict access to kubectl
- Use RBAC
- Use a Network Policy
- Use namespaces
- Bootstrap TLS

Follow security hygiene
- Keep Kubernetes updated
- Use a minimal OS
- Use minimal IAM roles
- Use private IPs on your nodes
- Monitor access with audit logging
- Verify binaries that are deployed

Prevent known attacks
- Disable dashboard
- Disable default service account token
- Protect node metadata
- Scan images for known vulnerabilities

Prevent/limit impact of microservice compromise
- Set a Pod Security Policy
- Protect secrets
- Consider sandboxing
- Limit the identity used by pods
- Use a service mesh for authentication & encryption

NEXT18

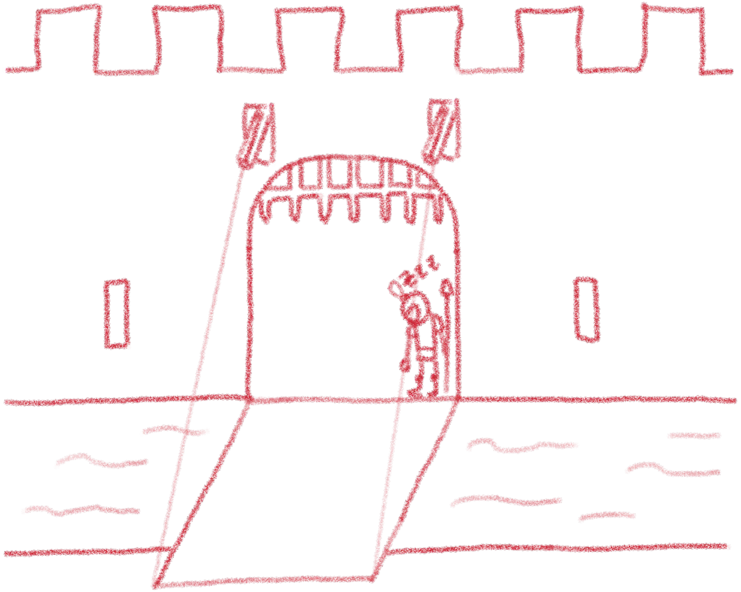
Mattias Gees
@MattiasGees

Your security journey with Kubernetes by @MayaKaczorowski #GoogleNext18

♡ 319 12:59 PM - Oct 11, 2018

Open ports (e.g. etcd 2379/TCP)
Kubernetes API (e.g. Tesla hacking)
Exploits (lots of CVEs)
RBAC (e.g. badly defined roles)

Kubernetes is insecure by design*

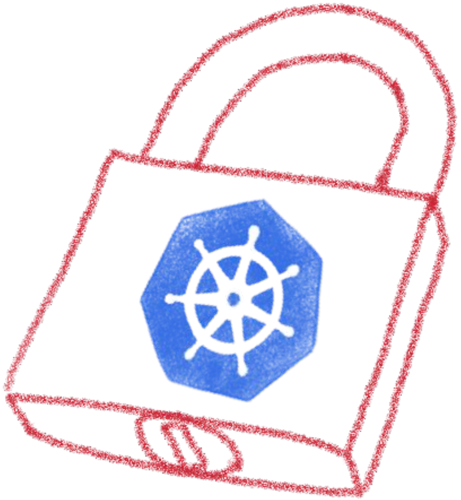


It's a feature, not a bug.

Up to K8s admin to secure it according to needs

Not everybody has the same security needs

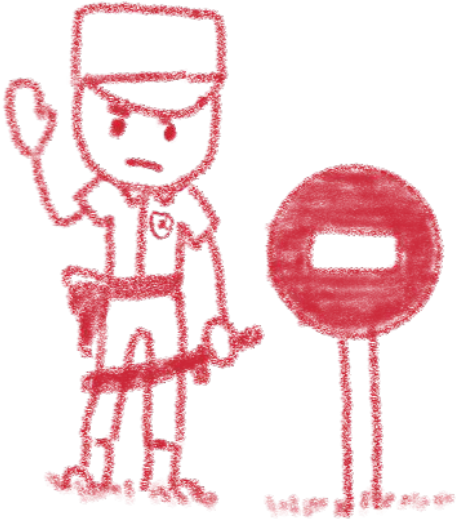
Kubernetes allows to enforce security practices as needed



Listing some good practices

- Close open access
- Define and implement RBAC
- Define and implement Network Policies
- Isolate sensitive workloads

Close open access



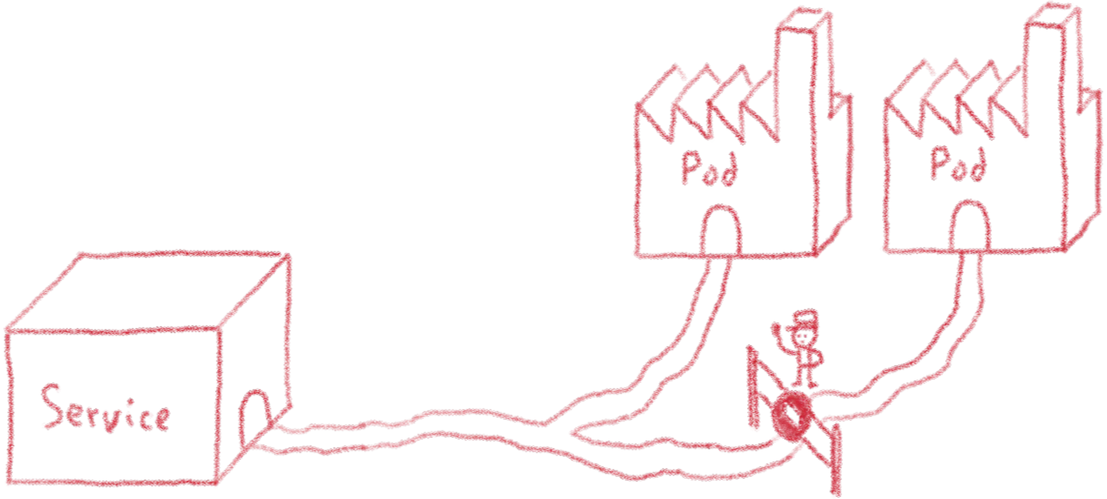
Close all by default, open only the needed ports

Follow the least privileged principle

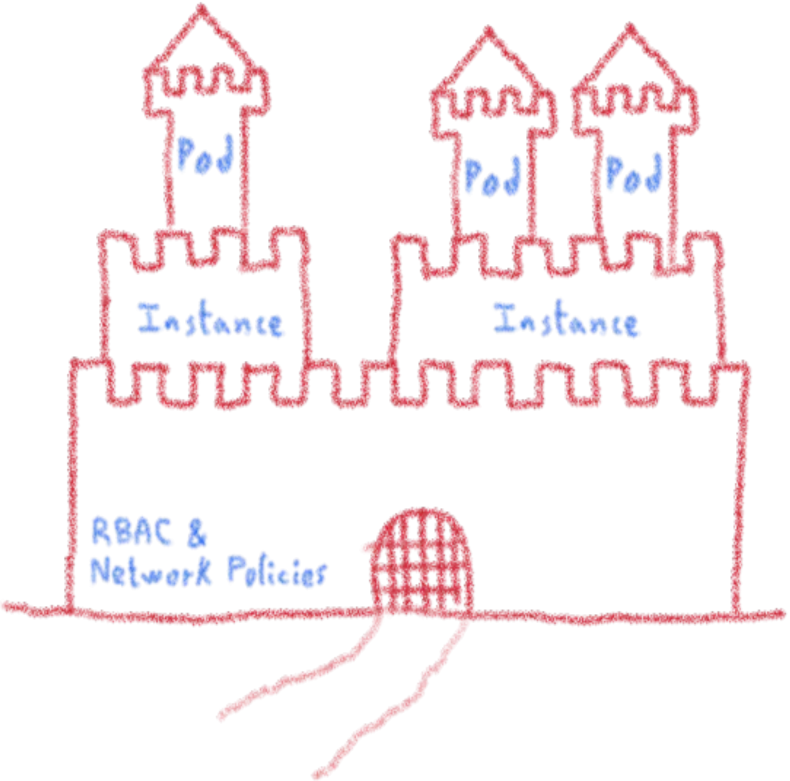
Define and implement RBAC

According to your needs

Define and implement network policies



Use RBAC and Network Policies to isolate your sensitive workload



Always keep up to date

certified
kubernetes
1.18

Both Kubernetes and plugins

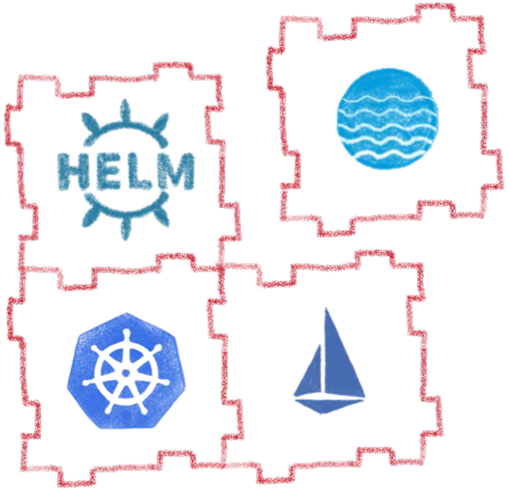
And remember,
even the best can get hacked

One of Tesla's cluster got hacked via an unprotected K8s API endpoint, and was used to mine cryptocurrency...

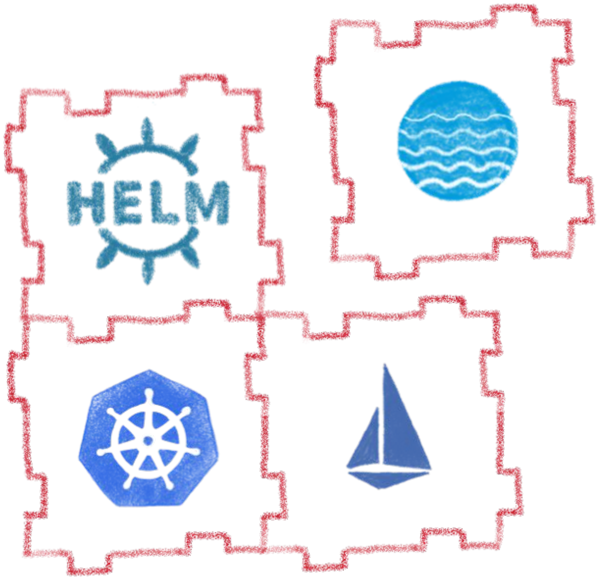
Remain attentive, don't get too confident

Extensibility

Enhance your Kubernetes



Kubernetes is modular



Fully extensible

- Kubernetes API
- Cluster demons
- Controllers
- Custom resources
- ...

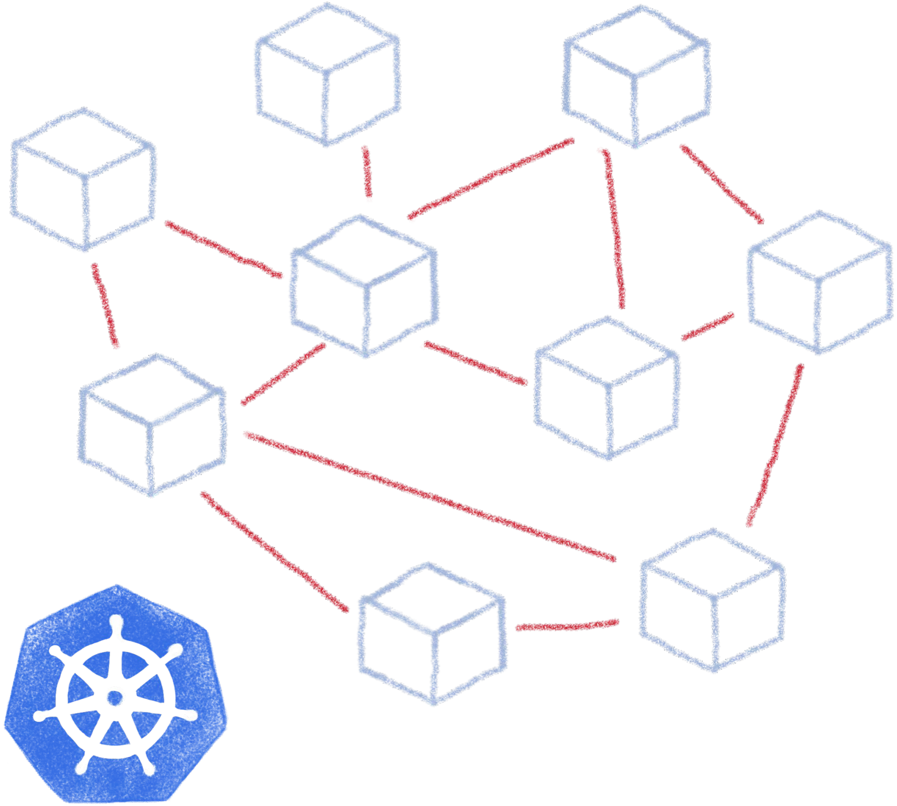
Operators

Let's see how some of those plugins can help you

Helm

A package management for K8s

Complex deployments



Ingress

Services

Deployments

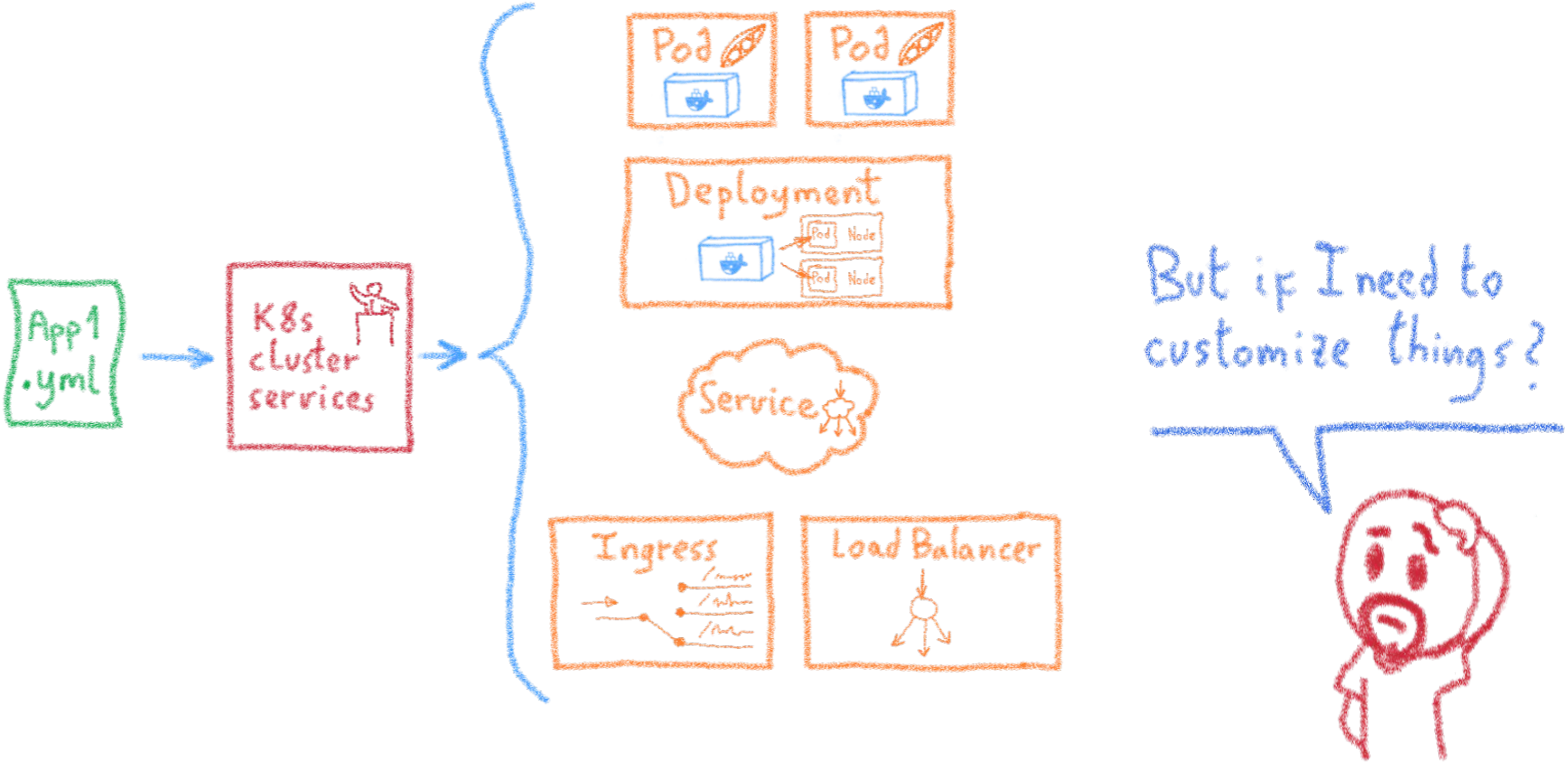
Pods

Sidecars

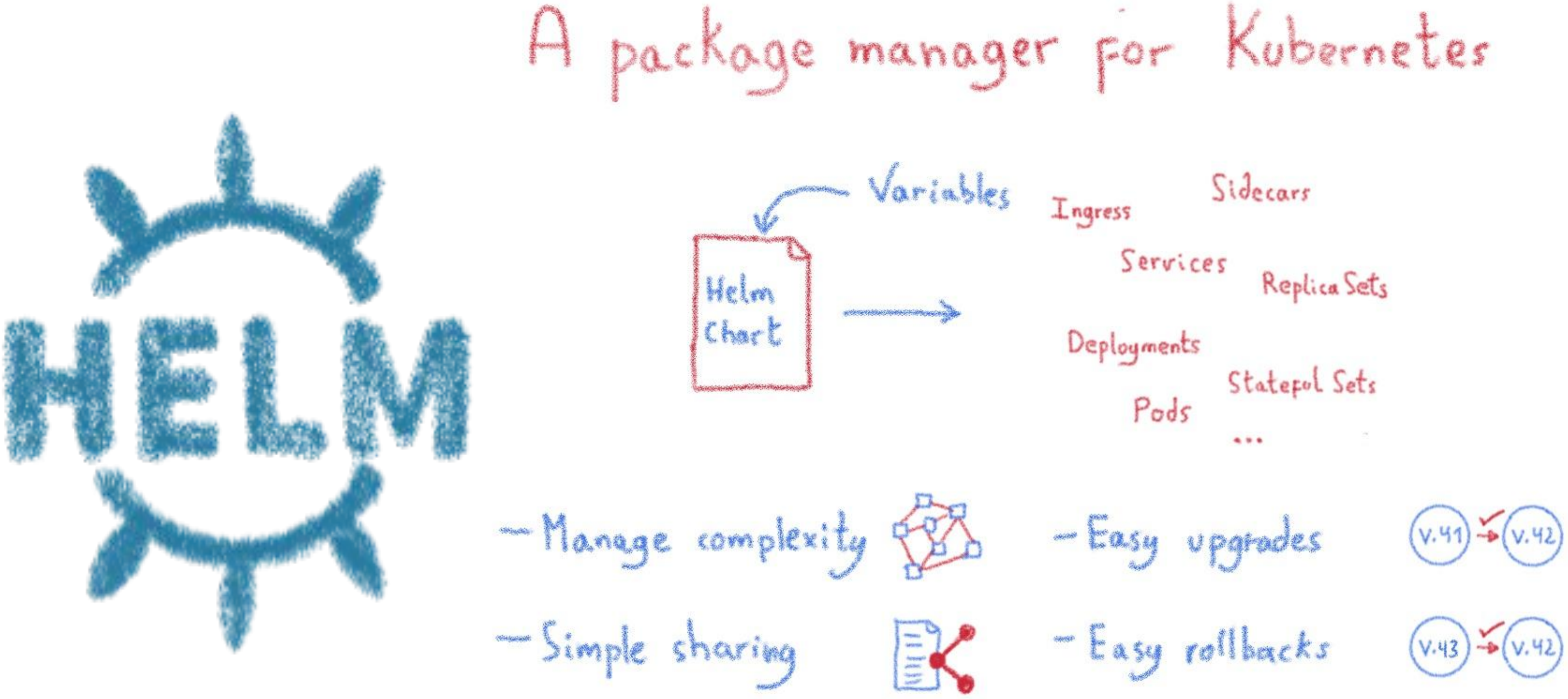
Replica Sets

Stateful Sets

Using static YAML files

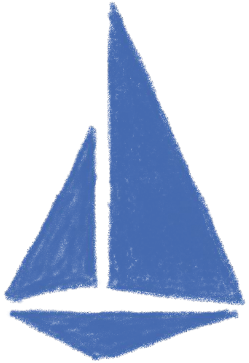


Complex deployments

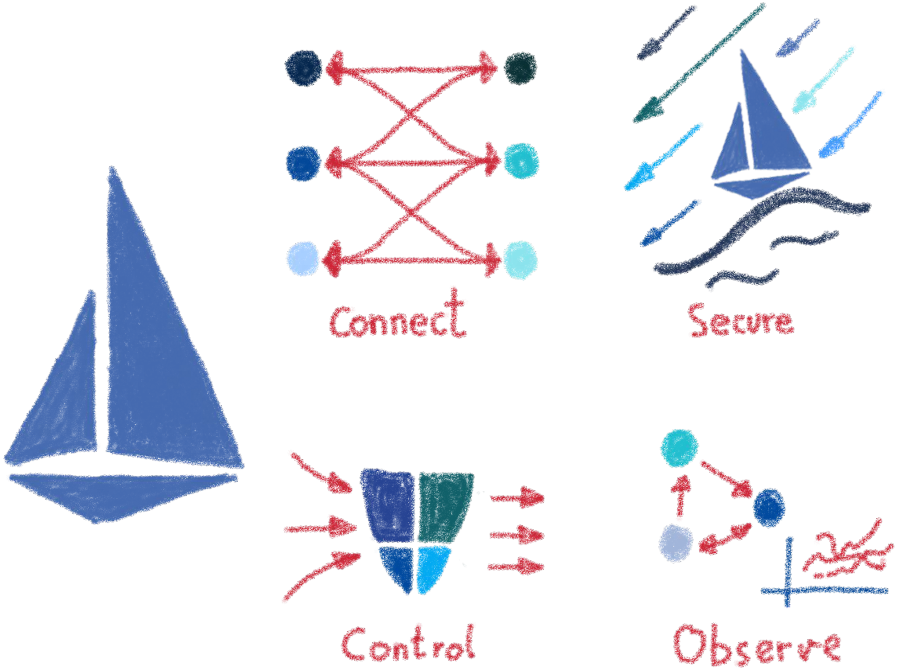


Istio

A service mesh for Kubernetes…
and much more!



Istio: A service mesh... but not only



Rolling upgrades

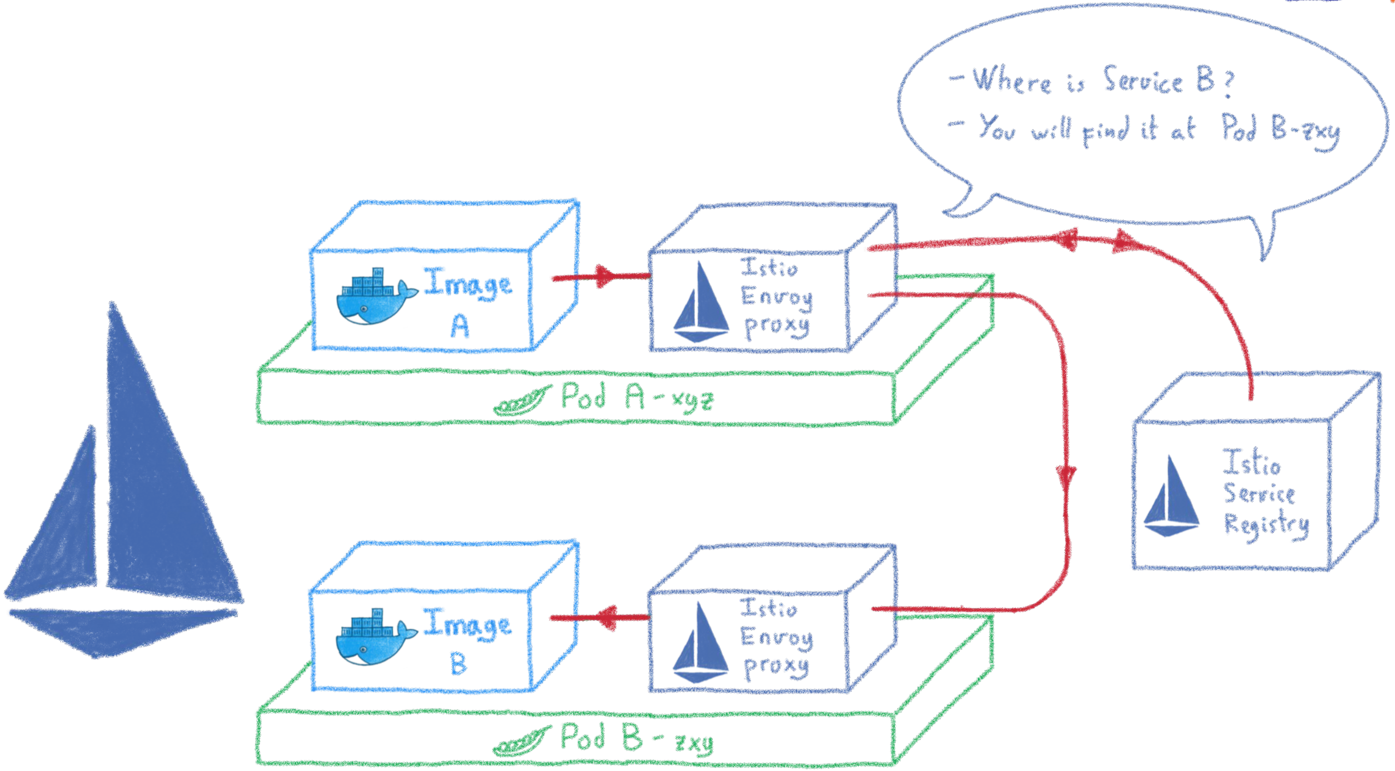
A/B Testing

Canary Testing

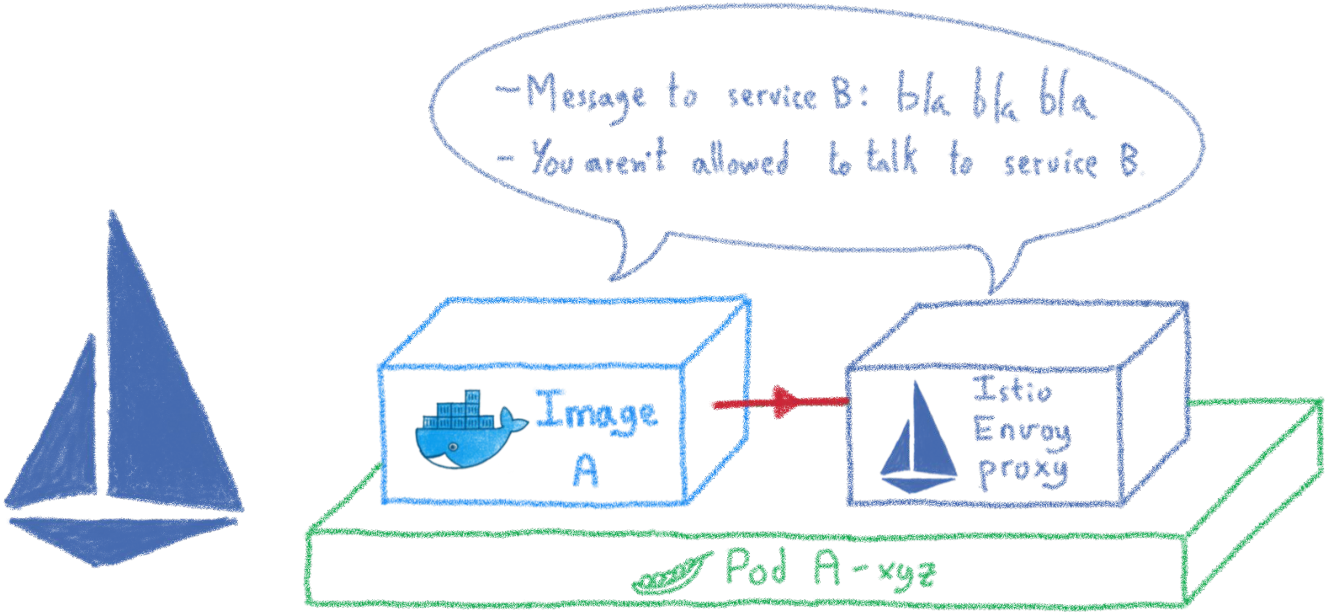
Edge traffic management

Multicluster service mesh

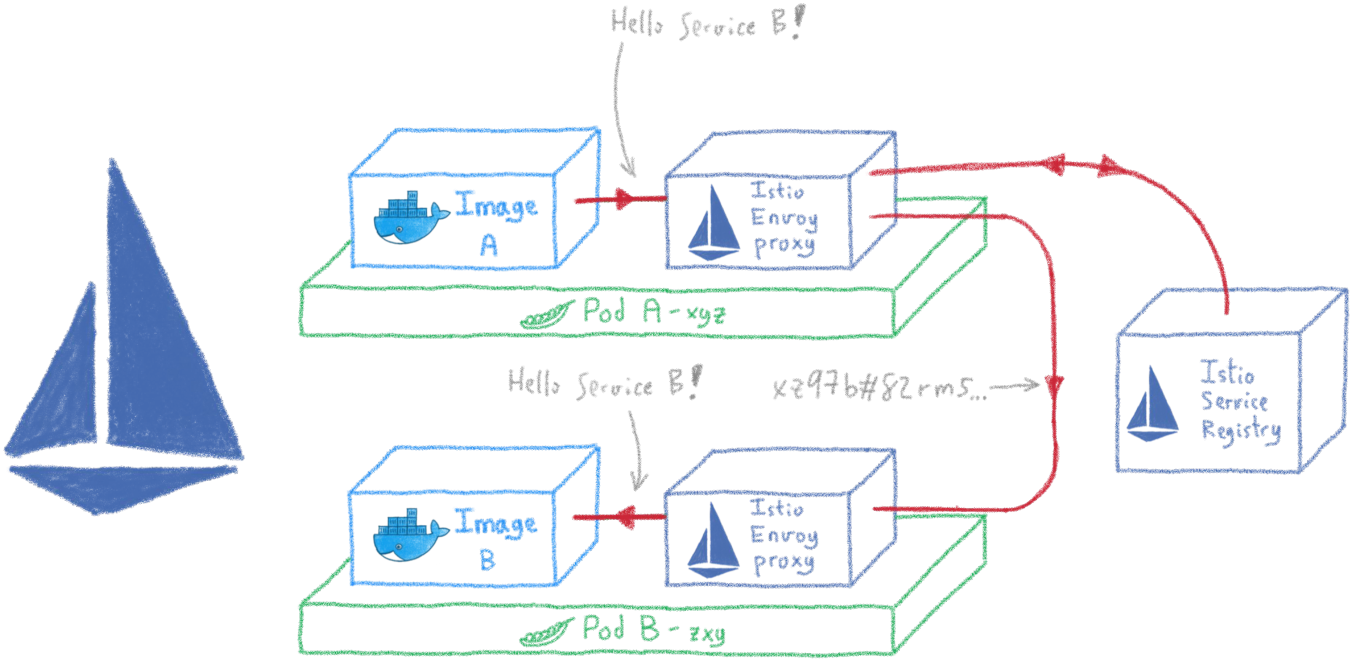
Service discovery



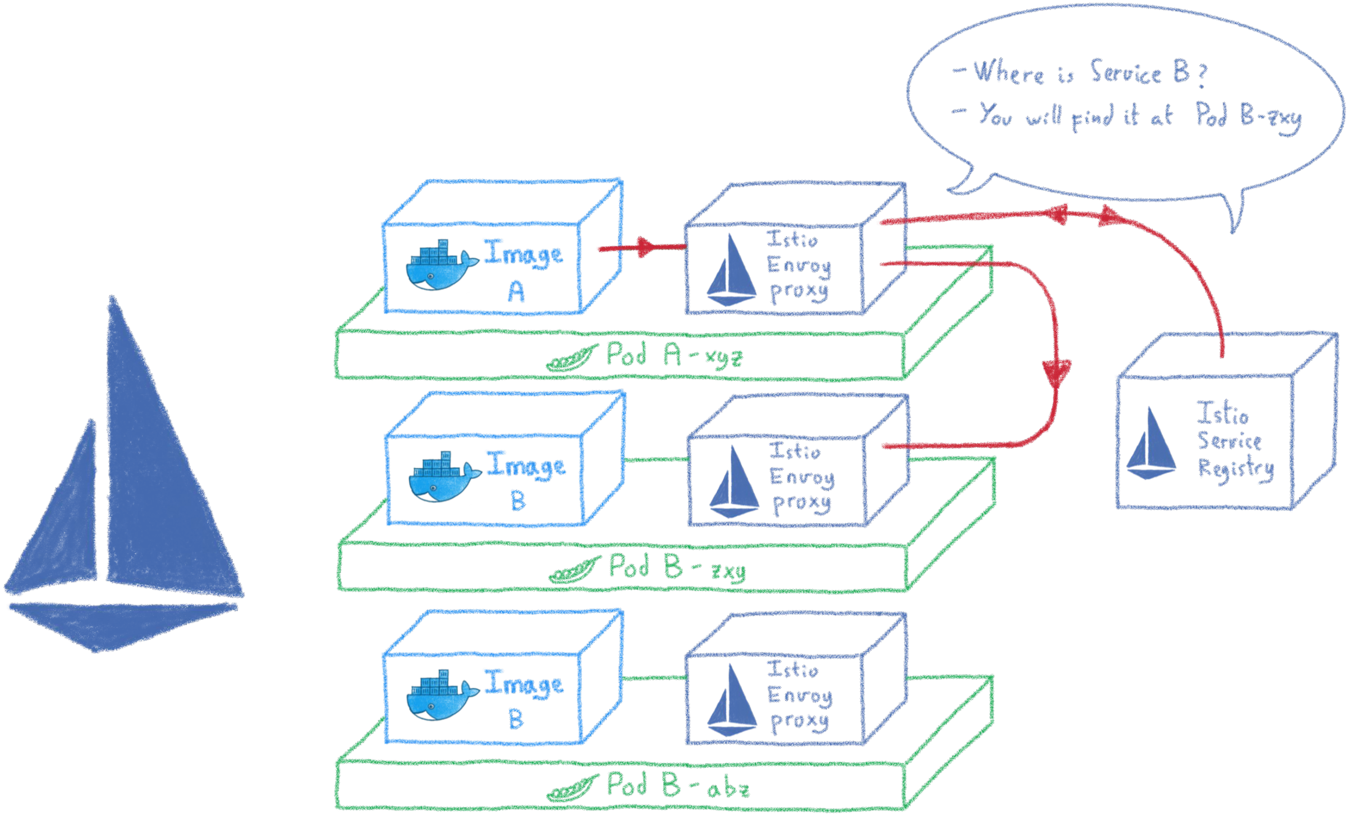
Traffic control


- Message to service B: bla bla bla
- You aren't allowed to talk to service B.
Image A
Istio Envoy proxy
Pod A-xyz

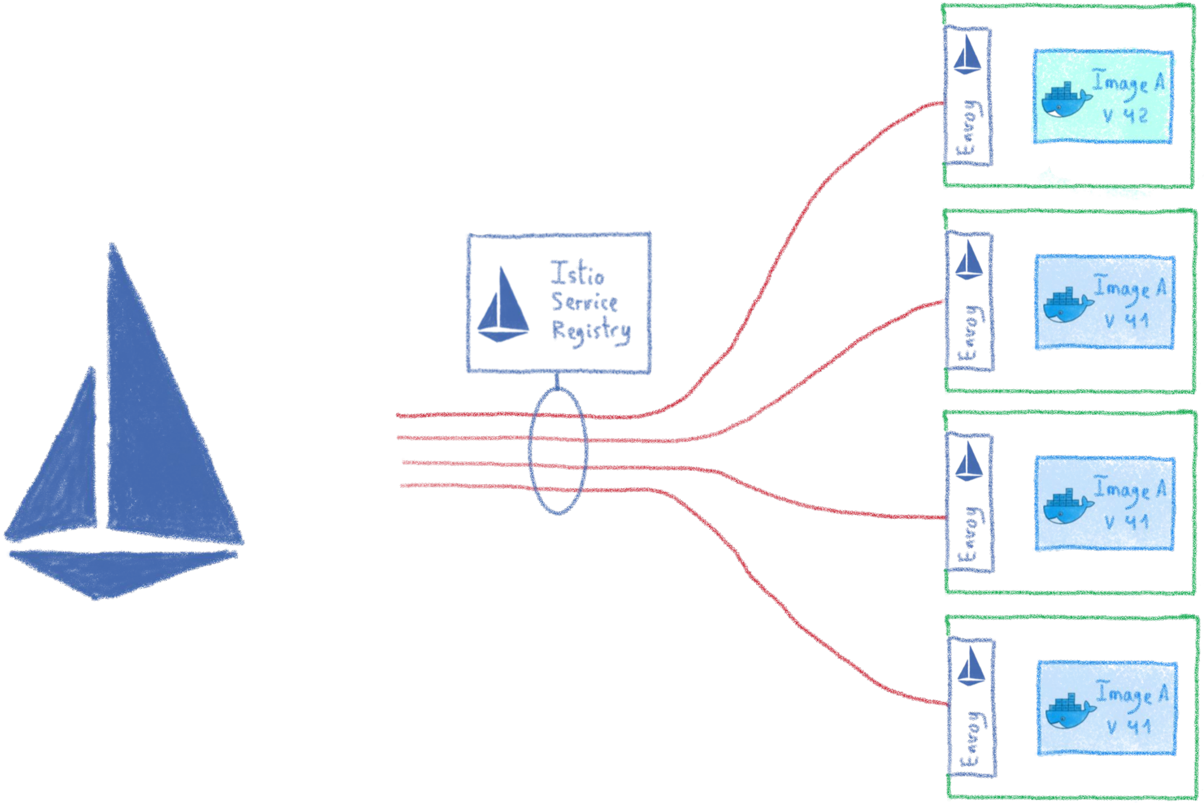
Encrypting internal communications



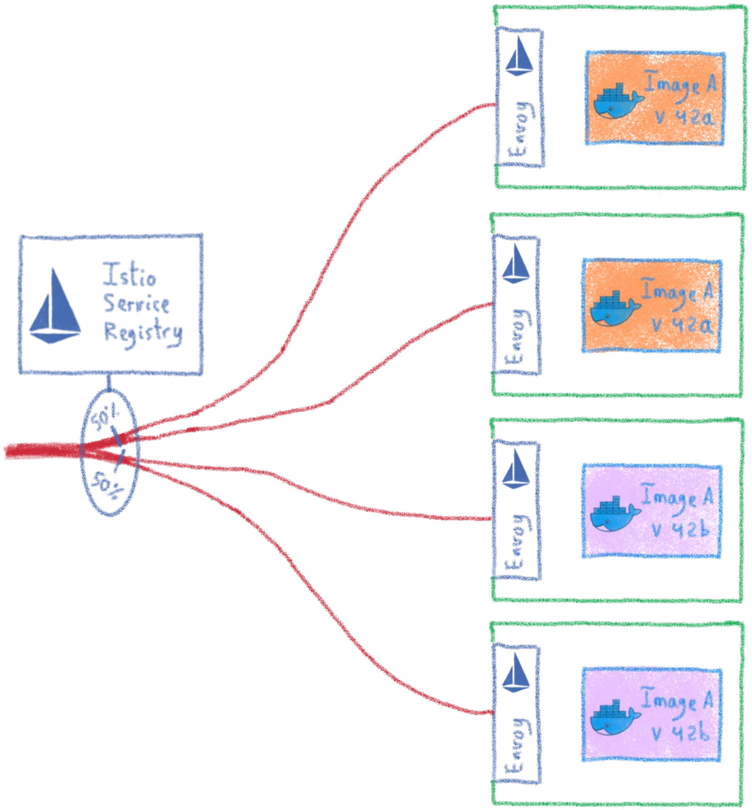
Routing and load balancing



Rolling upgrades



A/B testing

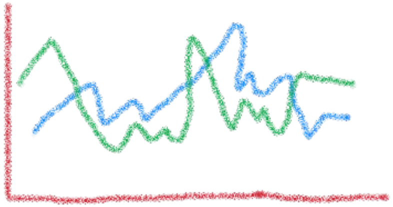

Istio
Service
Registry
50%
50%
Envoy
Image A
v 42a
Envoy
Image A
v 42a
Envoy
Image A
v 42b
Envoy
Image A
v 42b

Monitoring your cluster

- Metrics
- Logs
- Tracing

at

- Envoy level
- Control plane level

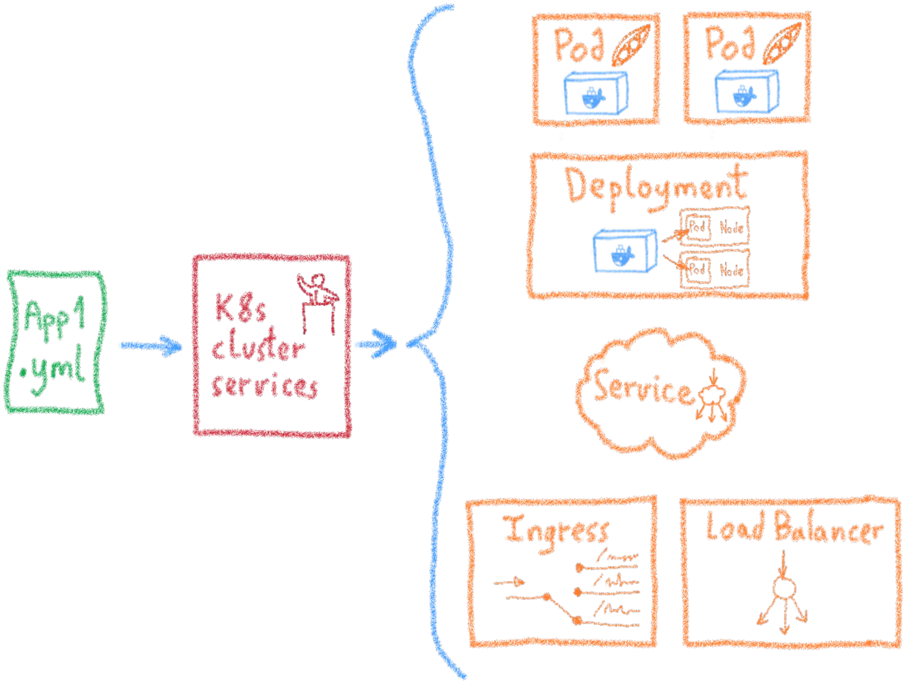


Dashboards

Velero

Backing up your Kubernetes

Kubernetes:
Desired State Management



Ingress

Services

Deployments

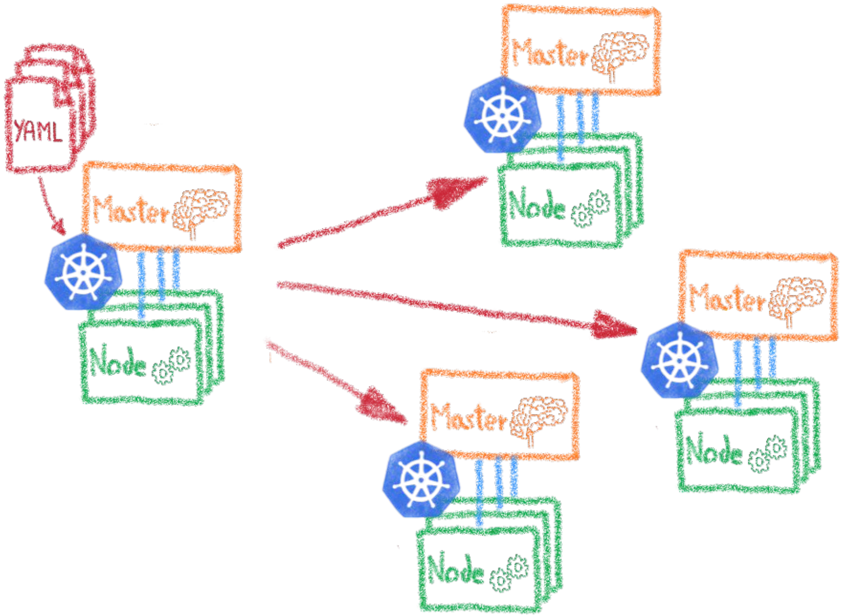
Pods

Sidecars

Replica Sets

Stateful Sets

YAML files allows to clone a cluster



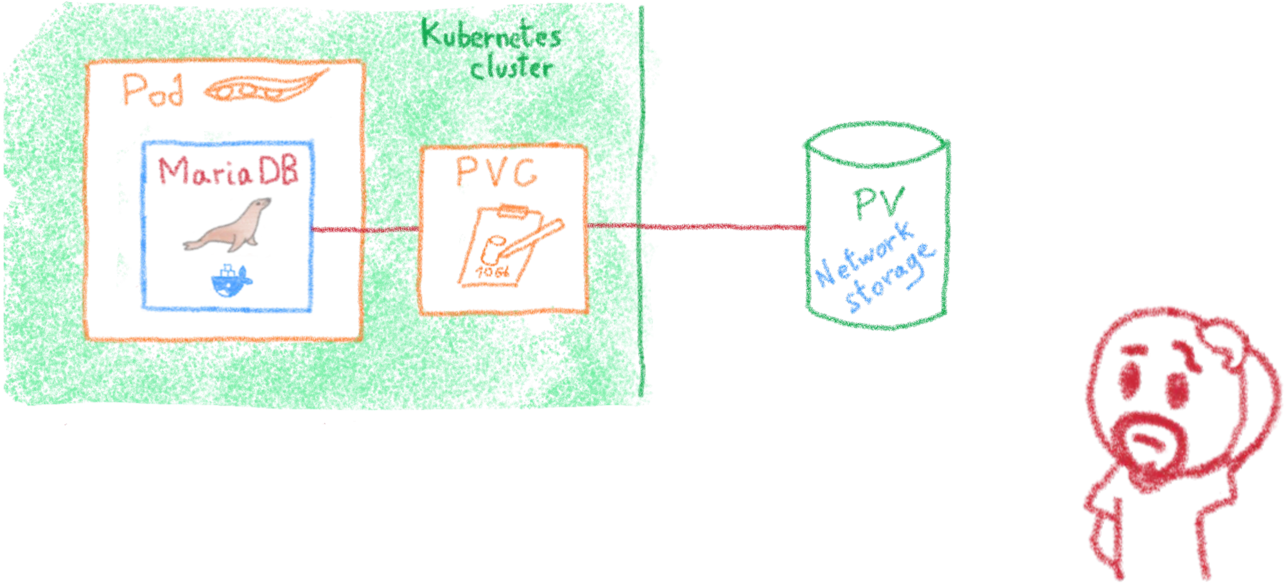
Dev envs

Staging

Multi-cluster

Multi-cloud

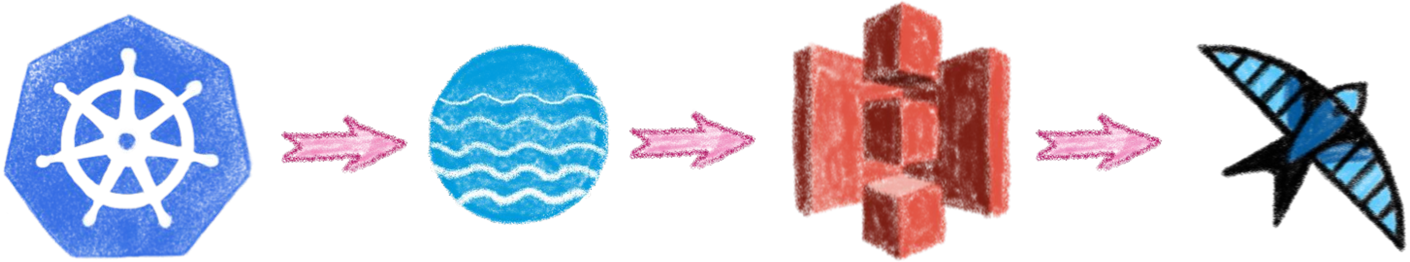
But what about the data?



Velero

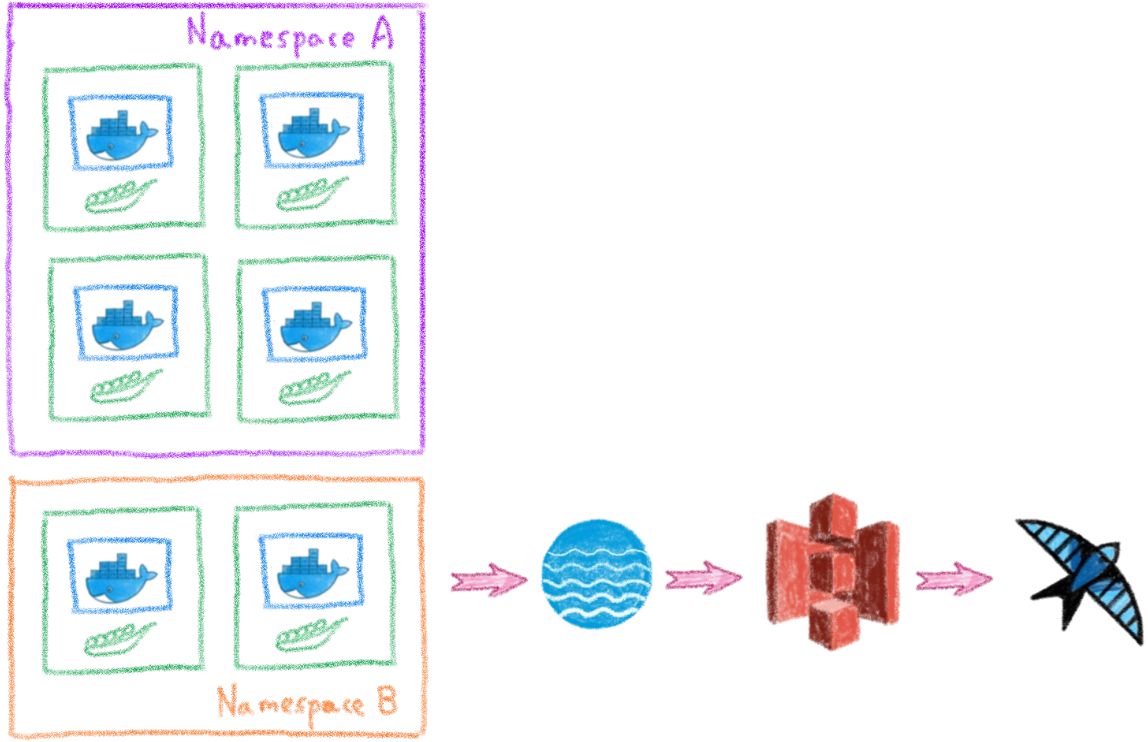
Backup and migrate Kubernetes applications and their persistent volumes

S3 based backup

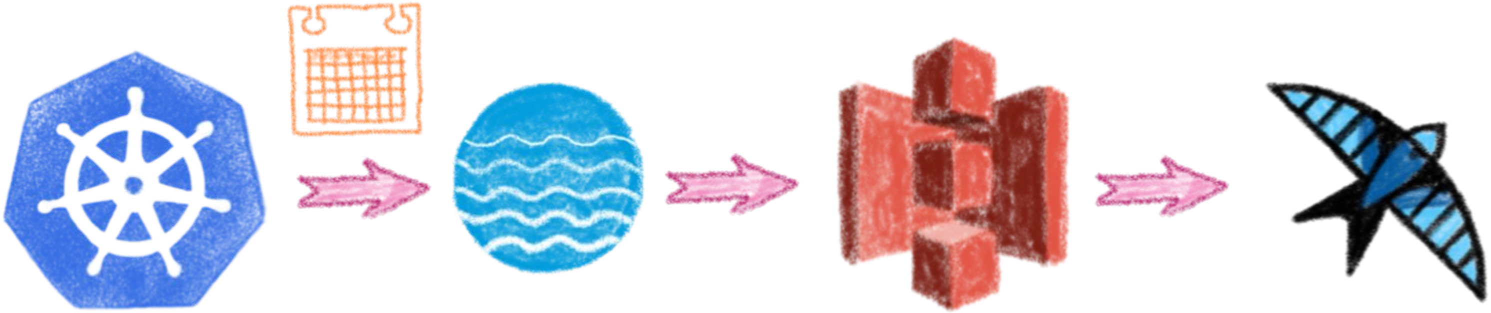


On any S3 protocol compatible store

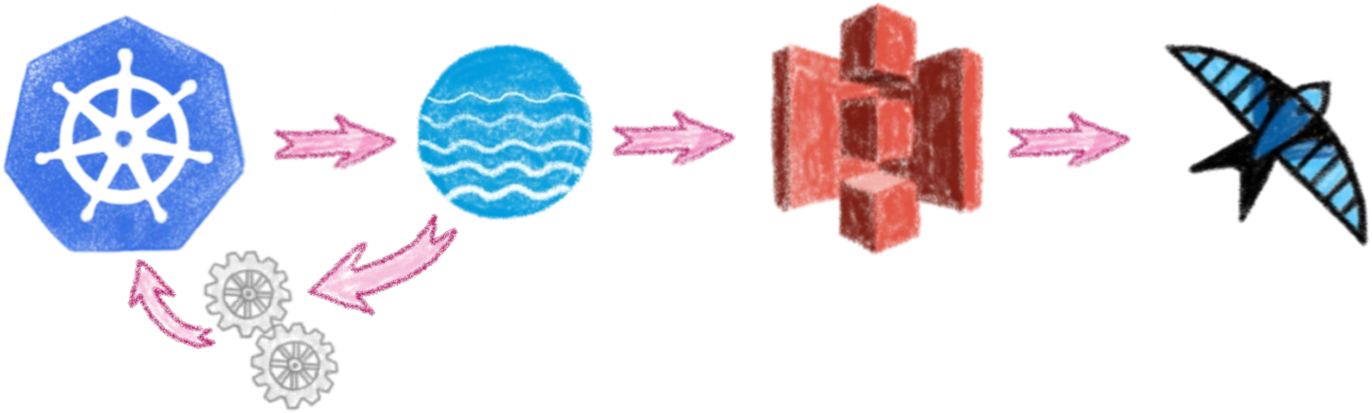
Backup all or part of a cluster



Schedule backups



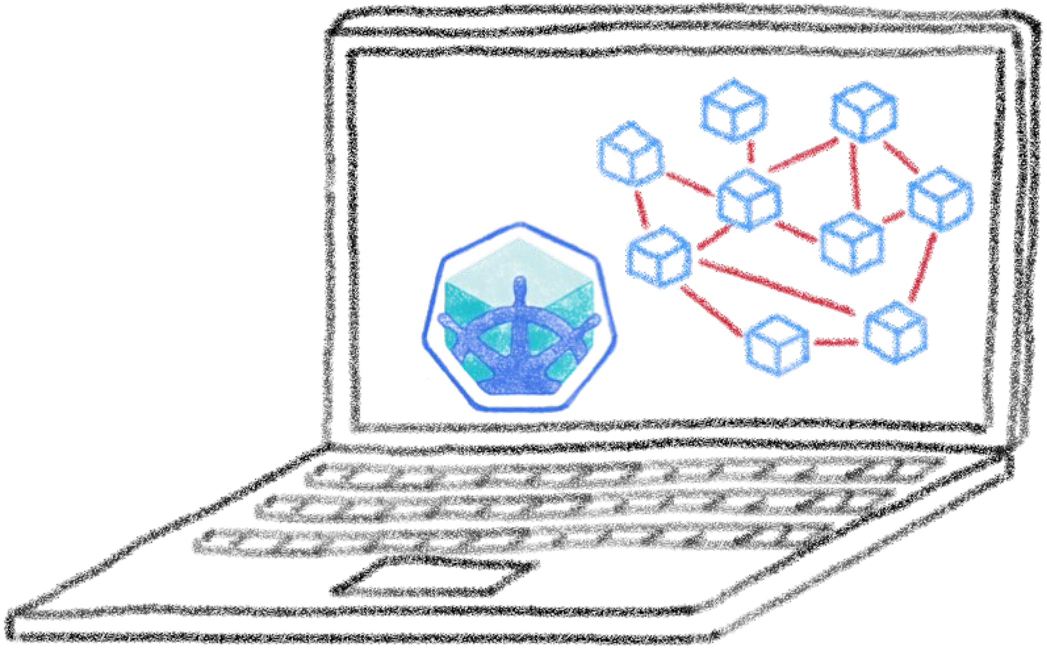
Backups hooks



Conclusion

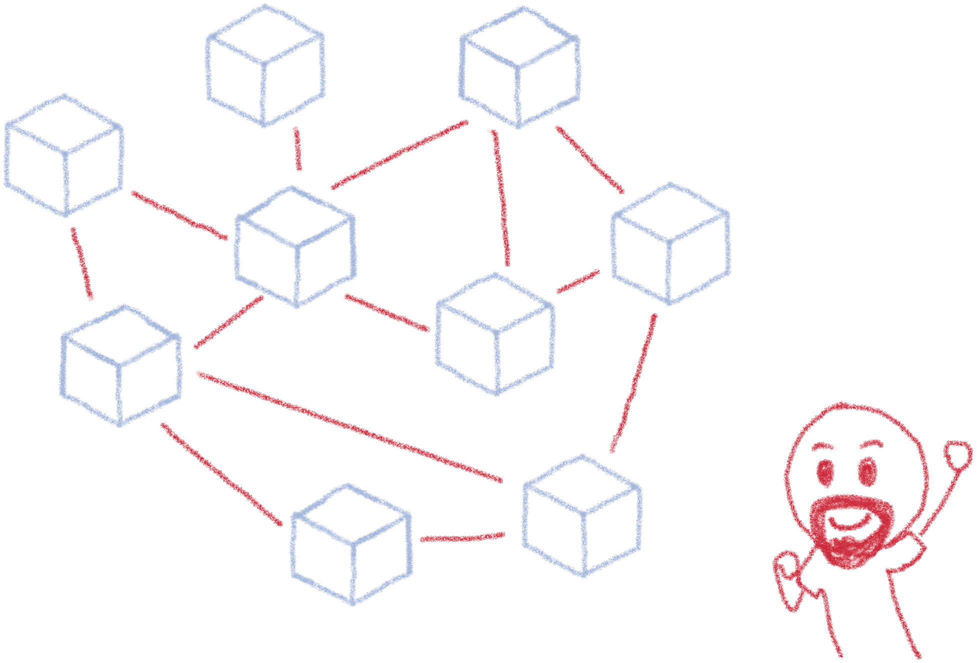
And one more thing...

Kubernetes is easy to begin with



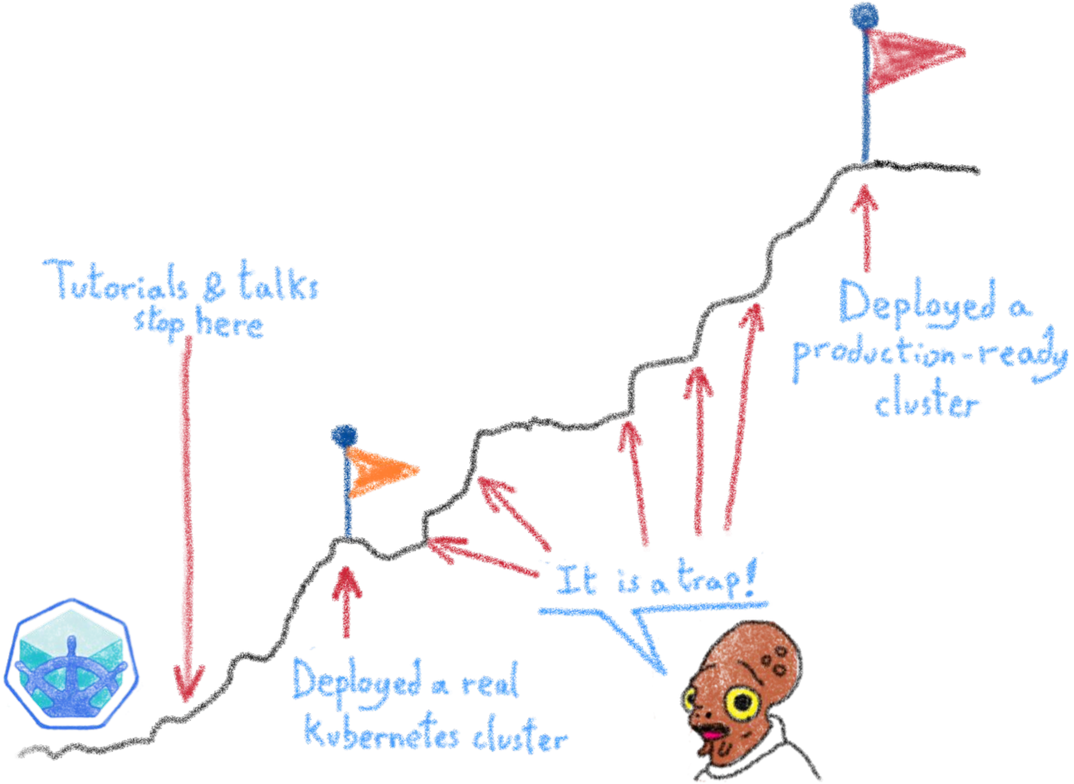
Minikube, K3s...

Kubernetes is powerful



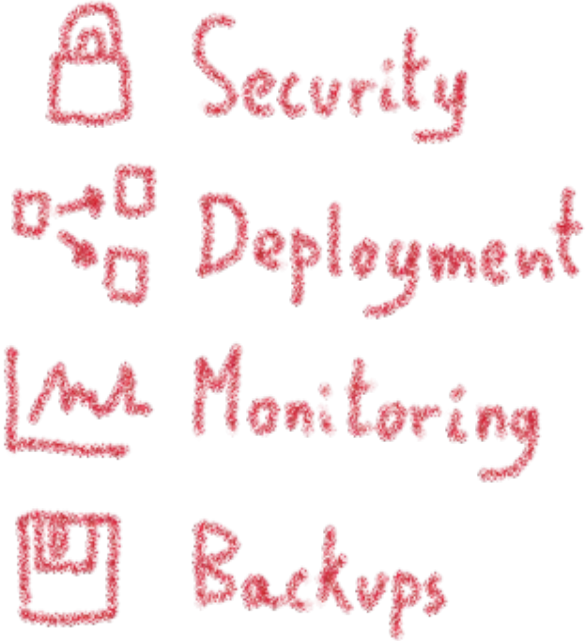
It can make Developers' and DevOps' lives easier

But there is a price: operating it

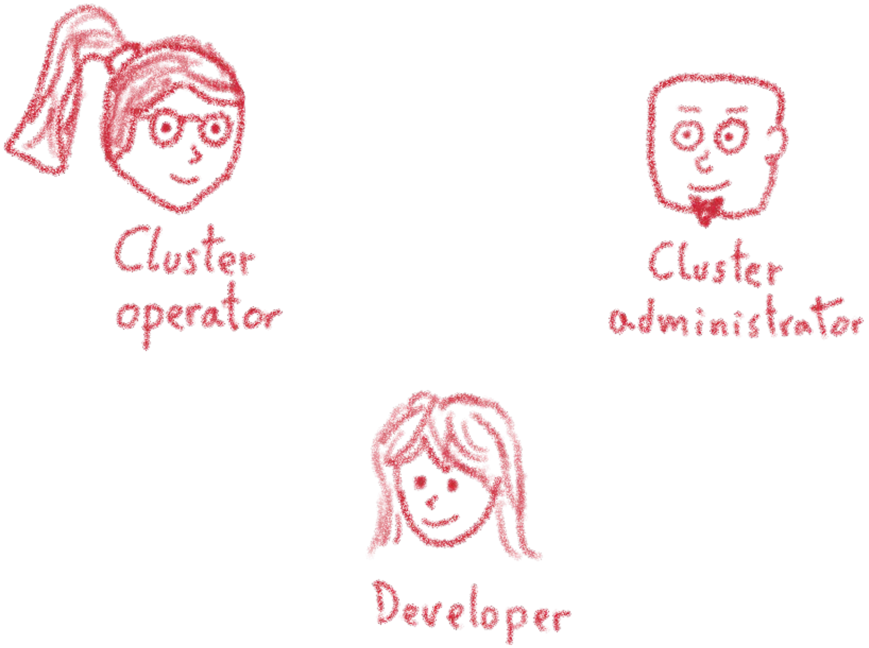

Tutorials & talks stop here
Deployed a real Kubernetes cluster
It is a trap!
Deployed a production-ready cluster

Lot of things to think about

We have seen some of them

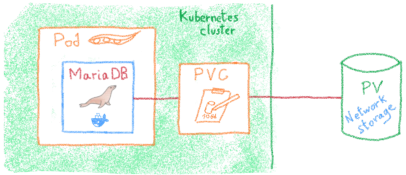


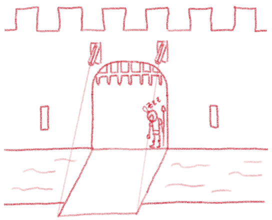
Different roles

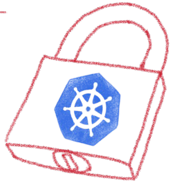


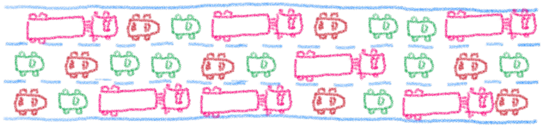
Each role asks for very different knowledge and skill sets

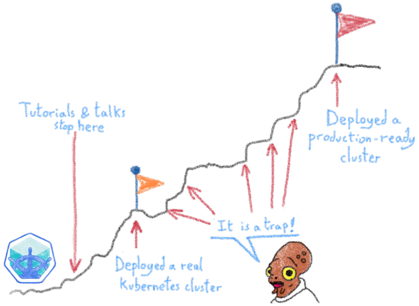
Operating a Kubernetes cluster is hard





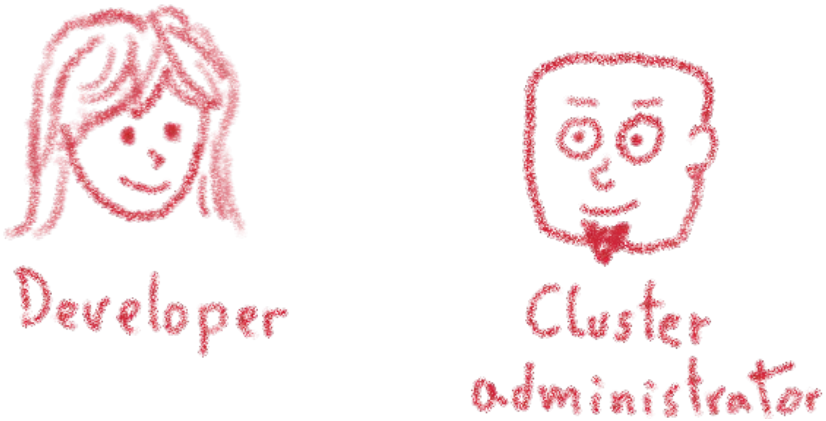





Tutorials & talks stop here
Deployed a production-ready cluster
It is a trap!
Deployed a real Kubernetes cluster

But we have a good news...

Most companies don't need to do it!



As they don't build and rack their own servers!

If you don't need to build it, choose a certified managed solution

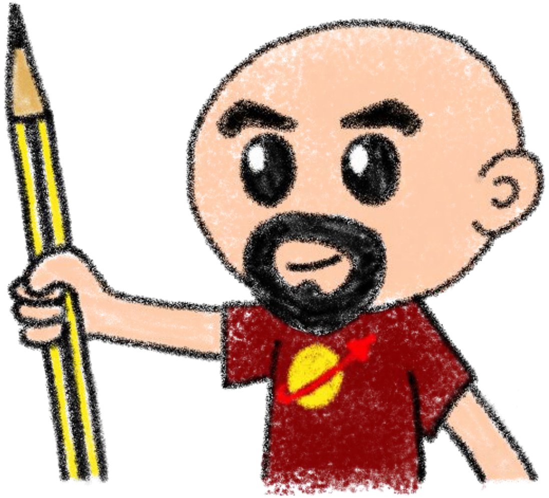
You get the cluster, the operator
get the problems

Like our OVH Managed Kubernetes

OVHcloud

Made with ❤️ by the Platform team

Do you want to try?



Send me an email to get some vouchers…

horacio.gonzalez@ovhcloud.com

Thank you for listening