Kubernetes in production: avoiding the pitfalls

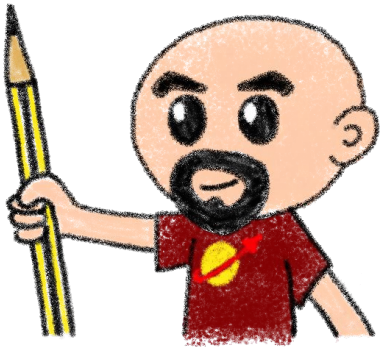
Horacio Gonzalez

@LostInBrittany

OVHcloud

Who are we?

Introducing ourselves and introducing OVHcloud



Horacio Gonzalez

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

OVHcloud

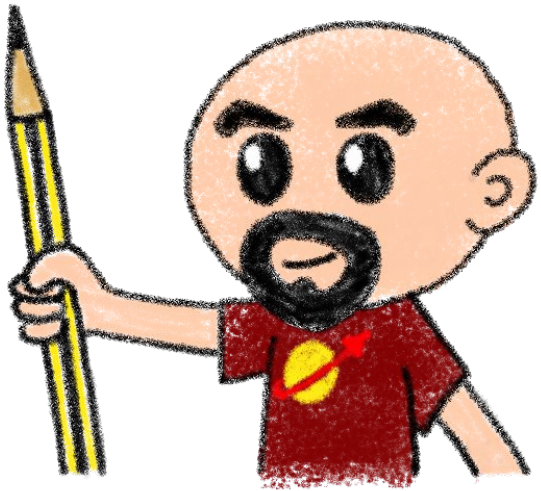
DevRel Leader

DevFest du Bout du Monde

Finist Devs

Google Developers Experts 2019

Web Technologies GDE Flutter



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OVHcloud: A Global Leader

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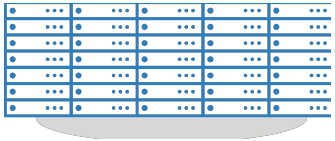
200k Private cloud VMs running

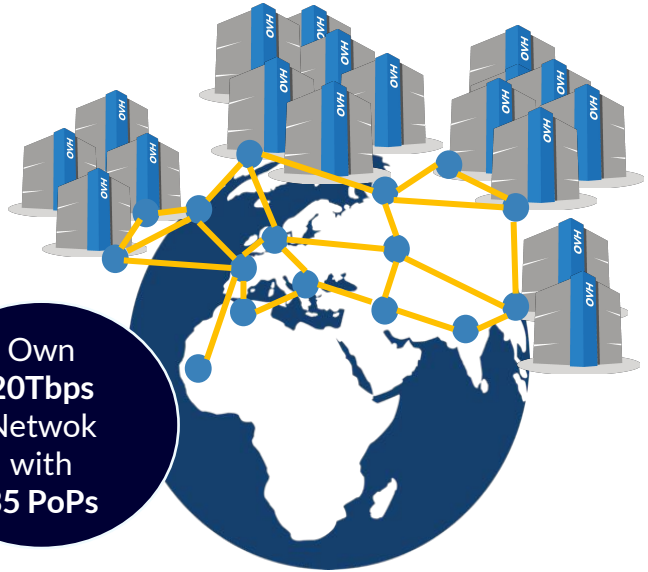
1

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

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OVHcloud: 4 Universes of Products

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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

K8S, IA IaaS

Baremetal

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

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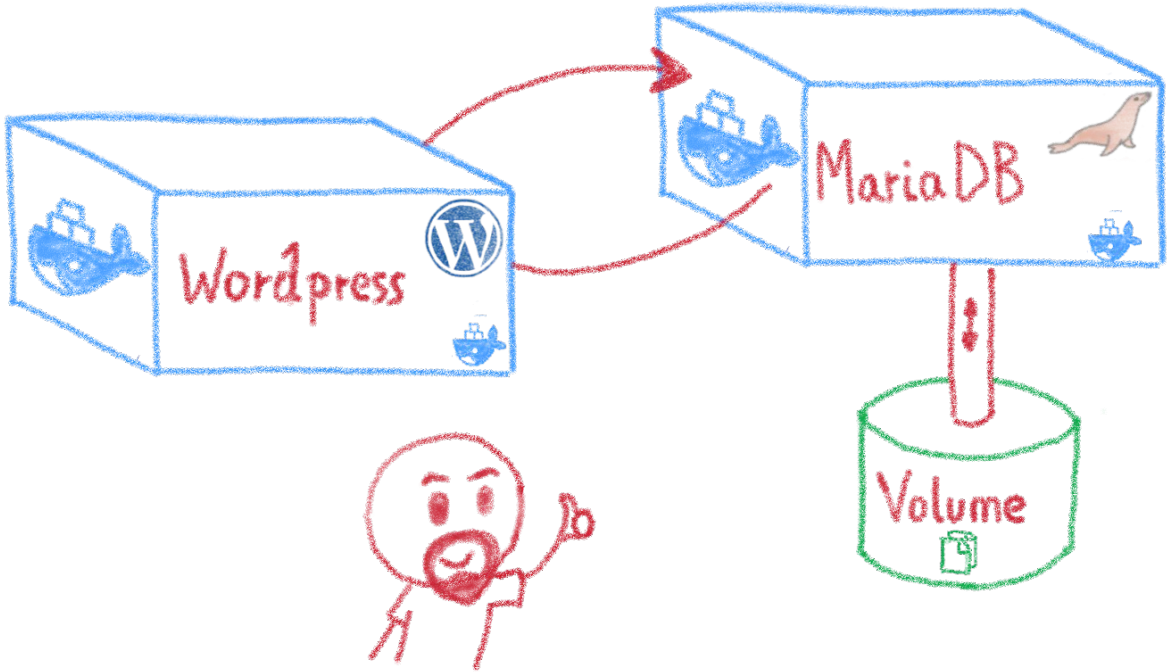
Orchestrating containers

Like herding cats… but in hard mode!

From bare metal to containers

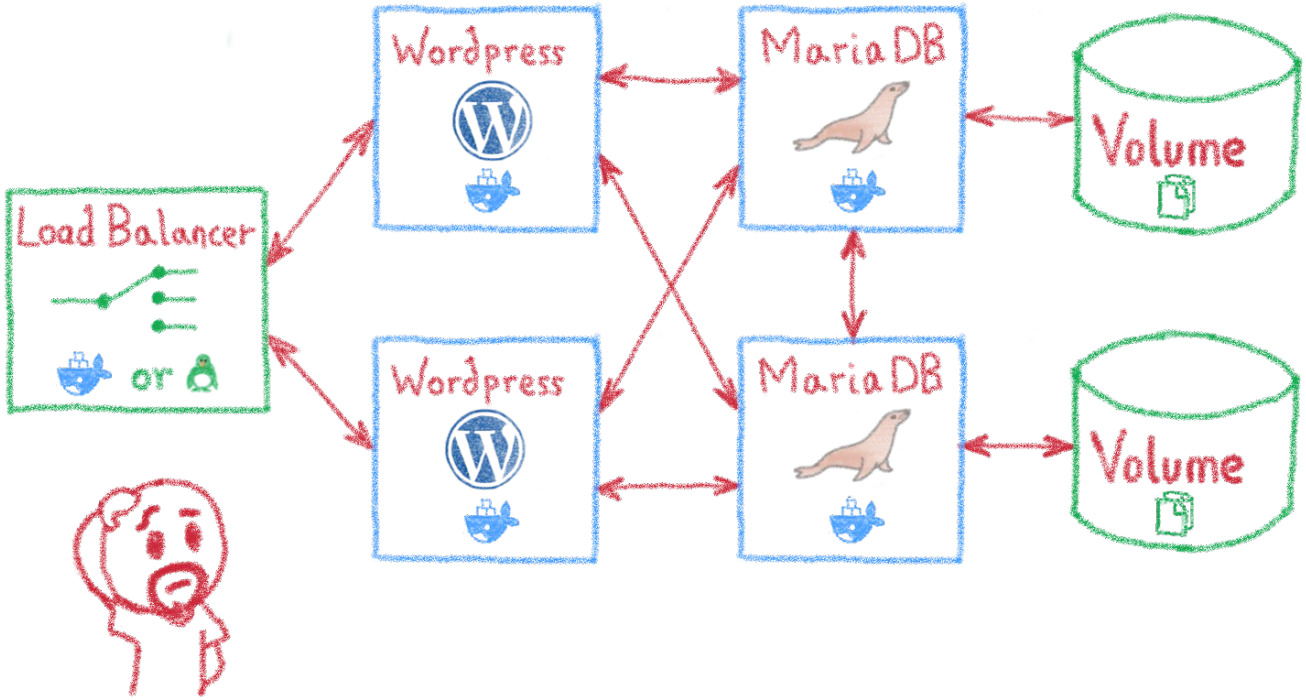
Another paradigm shift

Containers are easy…



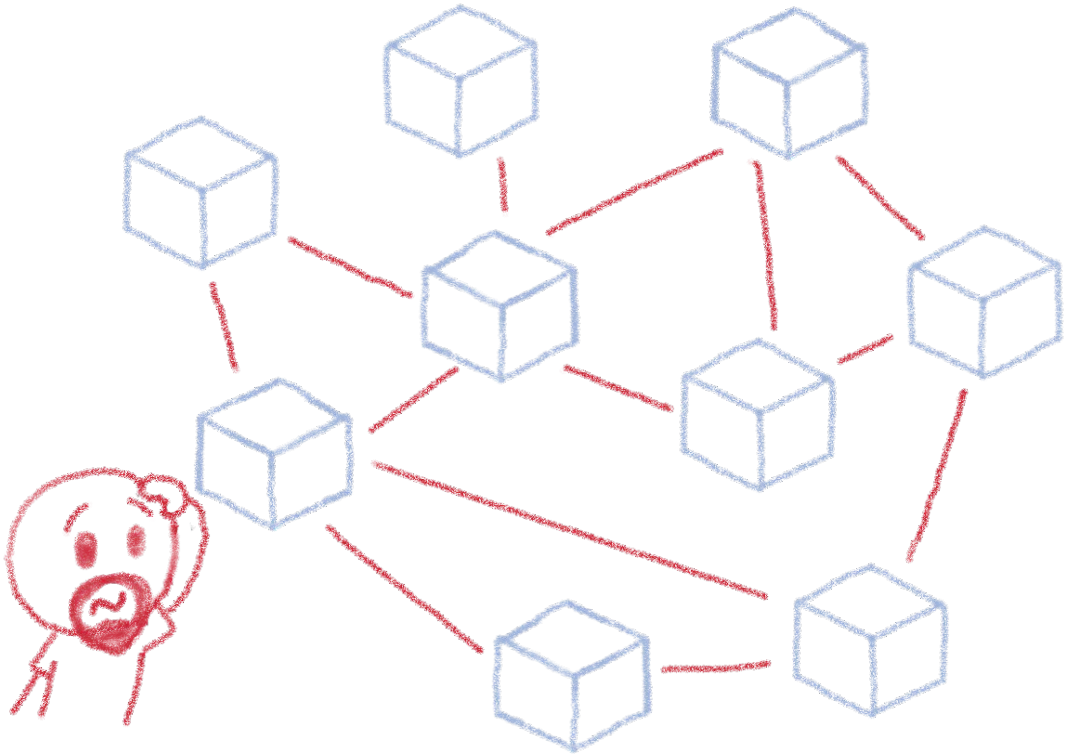
For developers

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?

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Taming microservices with Kubernetes

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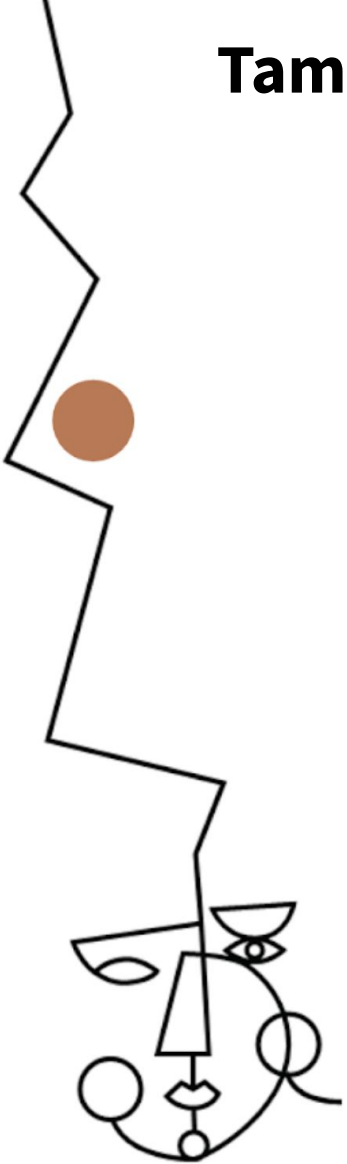

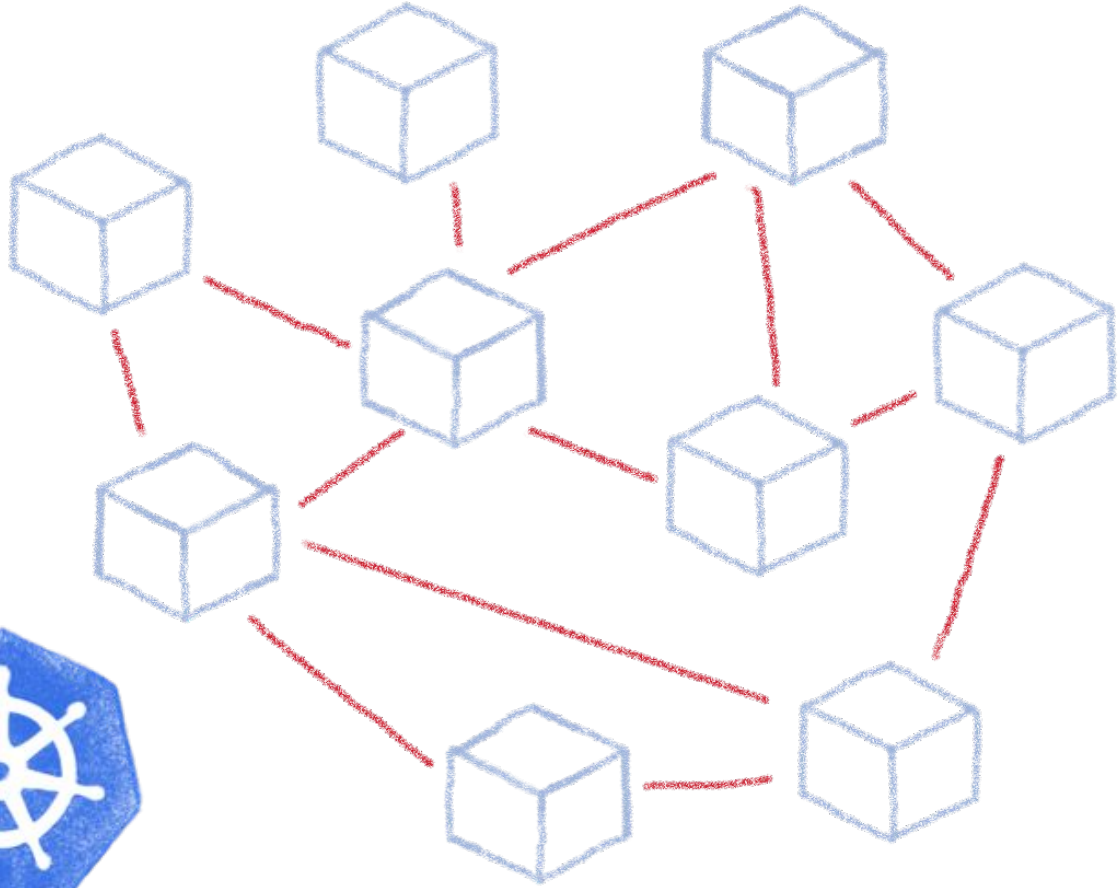

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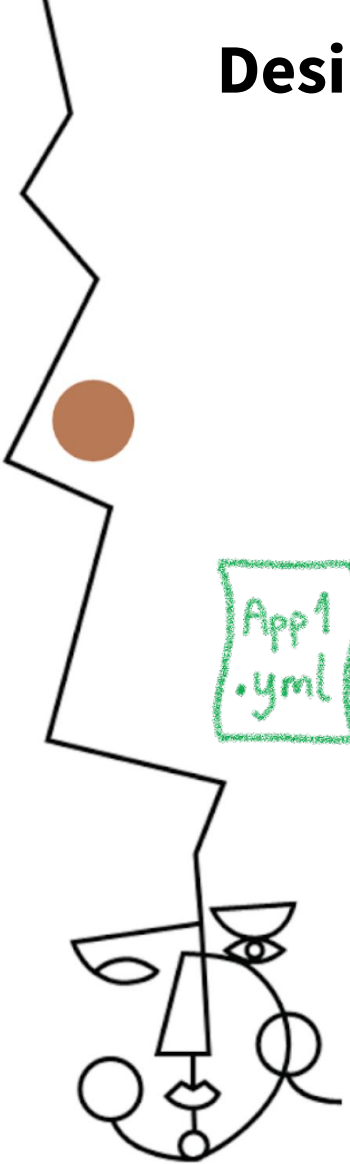
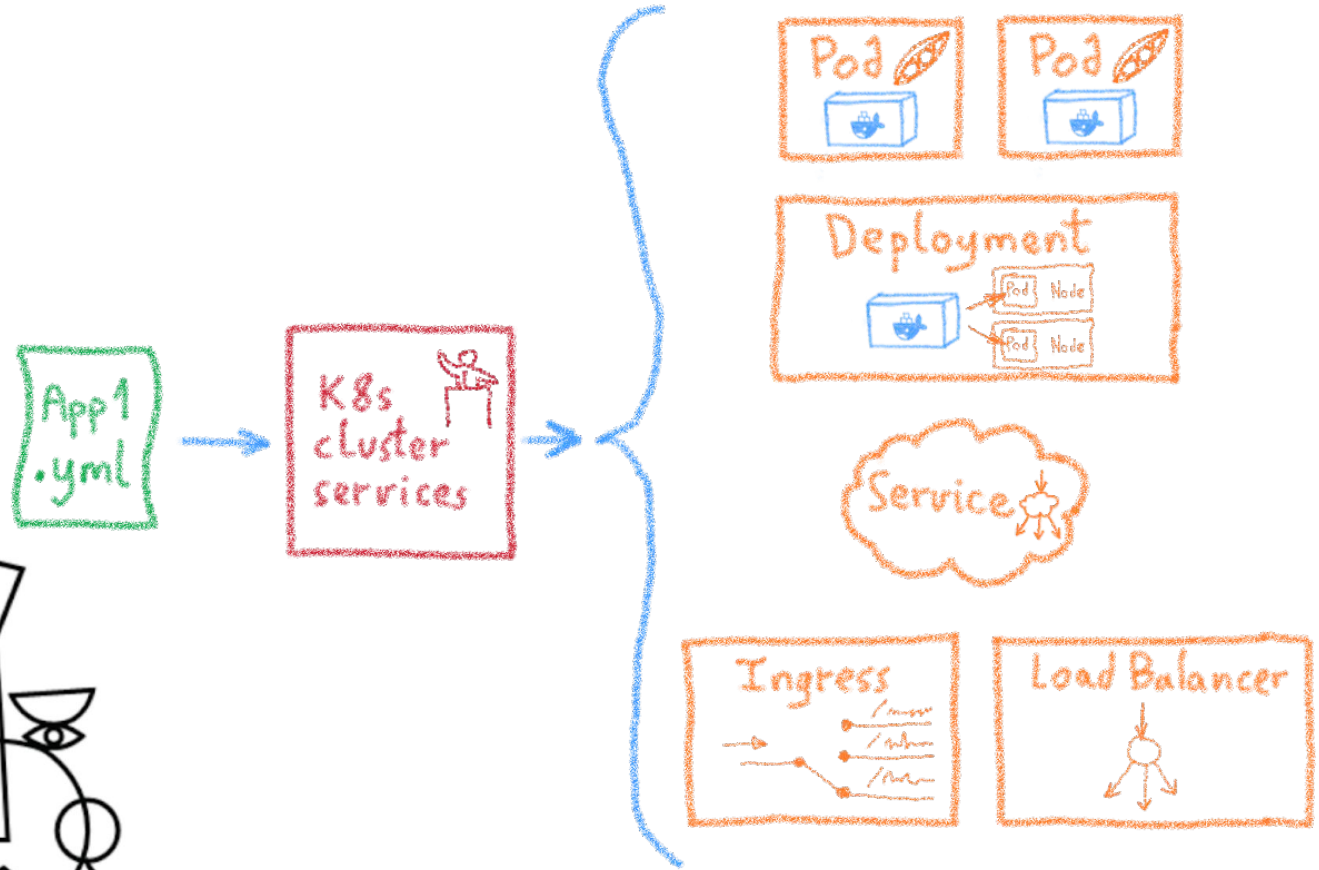
Desired State Management





Ingress

Services

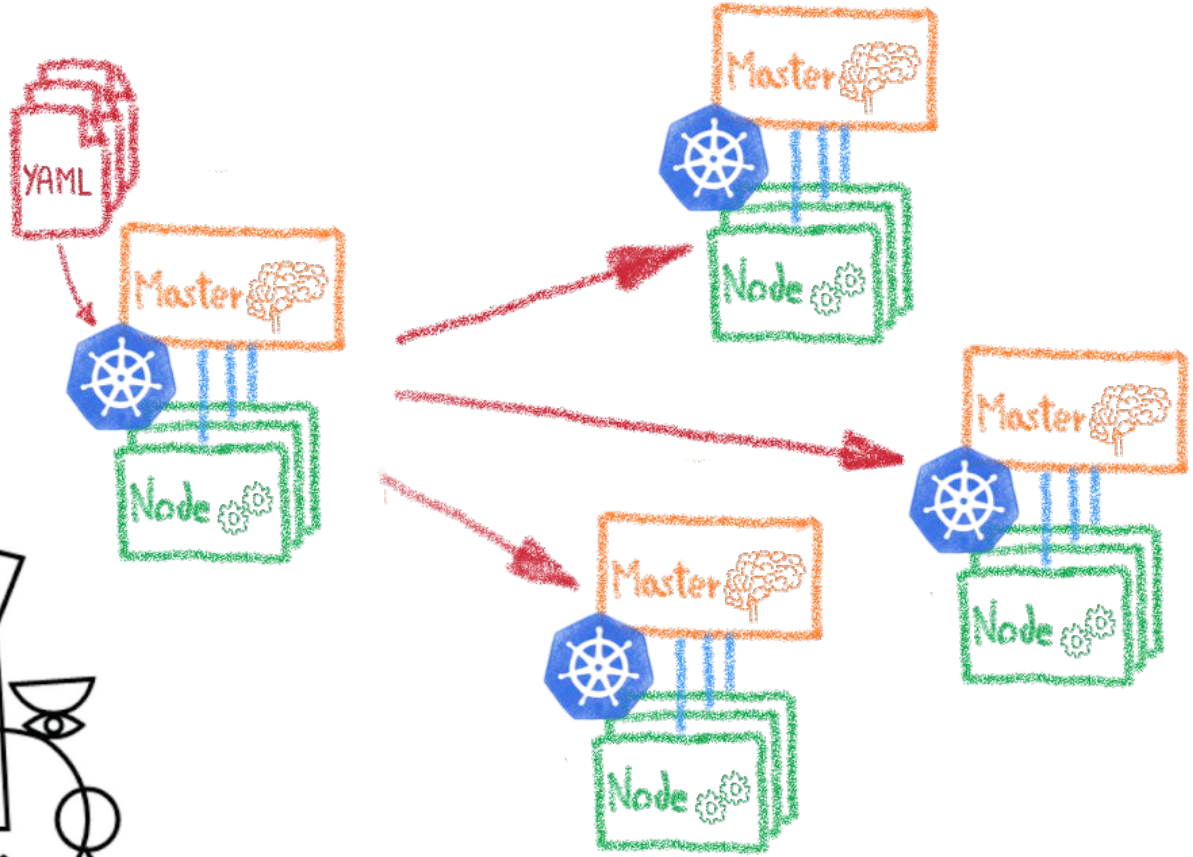
Deployments

Pods

Sidecars

Replica Sets

Having identical, software defined environments



Dev envs

Staging

Multi-cluster

Multi-cloud

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I have deployed on Minikube, woah!

A great fastlane into Kubernetes

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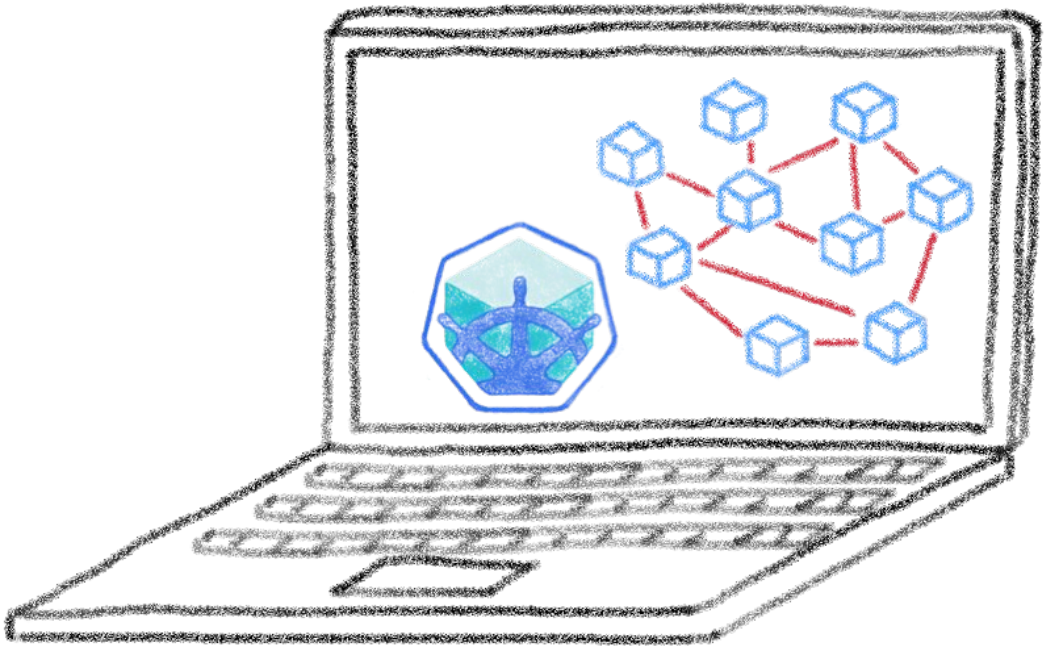
Running a full K8s in your laptop



A great learning tool

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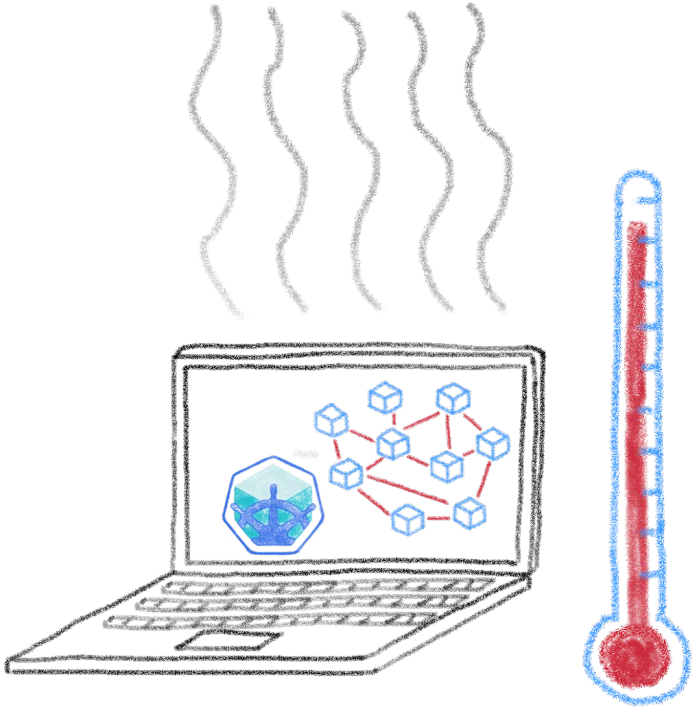
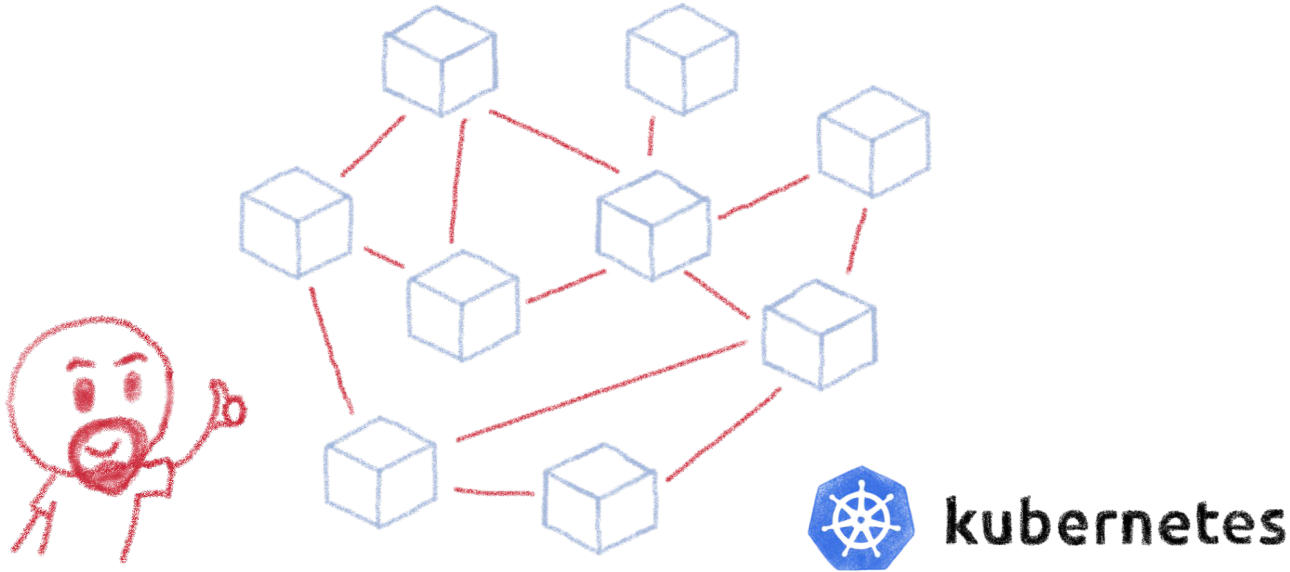
Your laptop isn't a true cluster



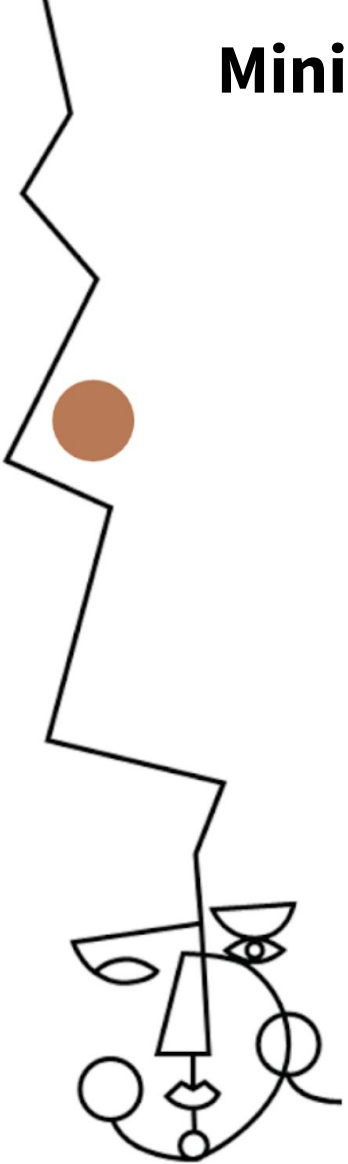
Don't expect real performances

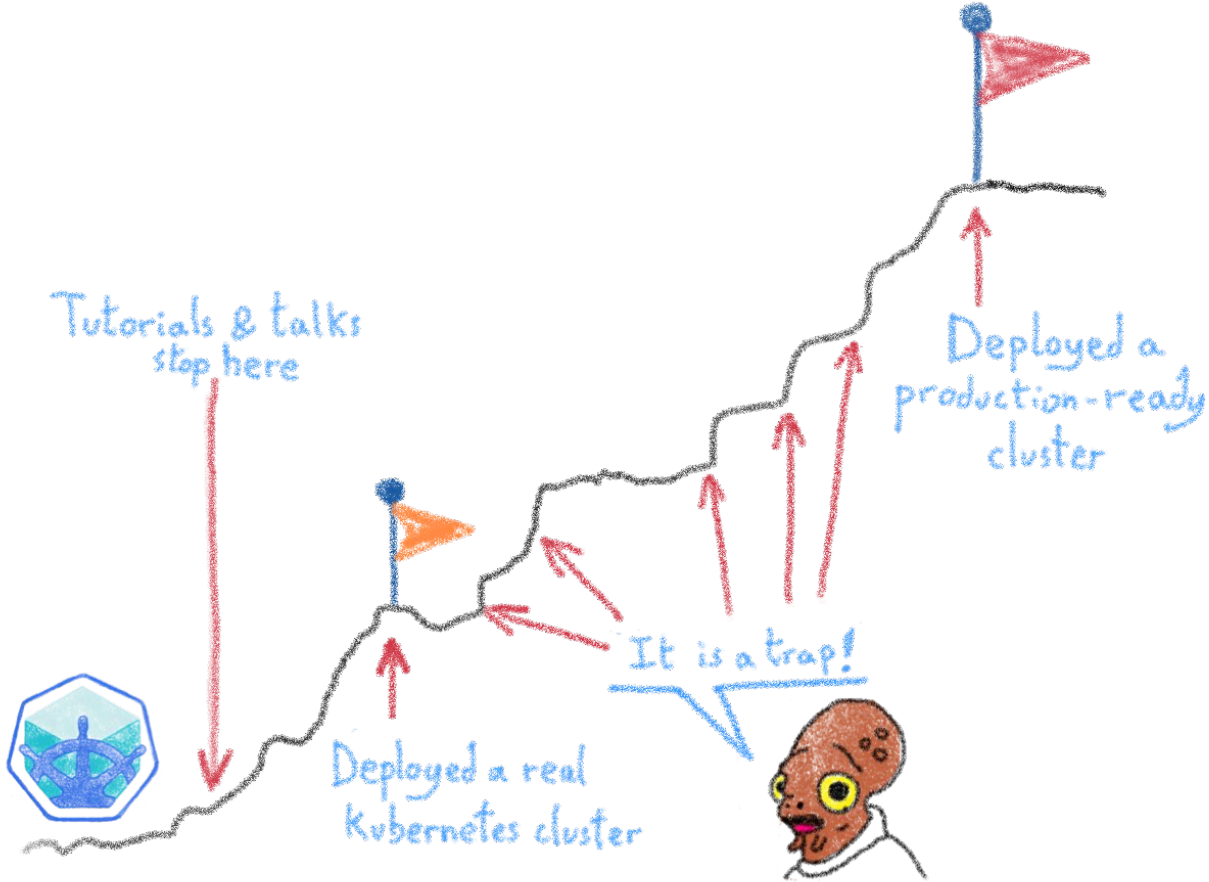
Beyond the first deployment



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

Minikube is only the beginning





From Minikube to prod

A journey not for the faint of heart

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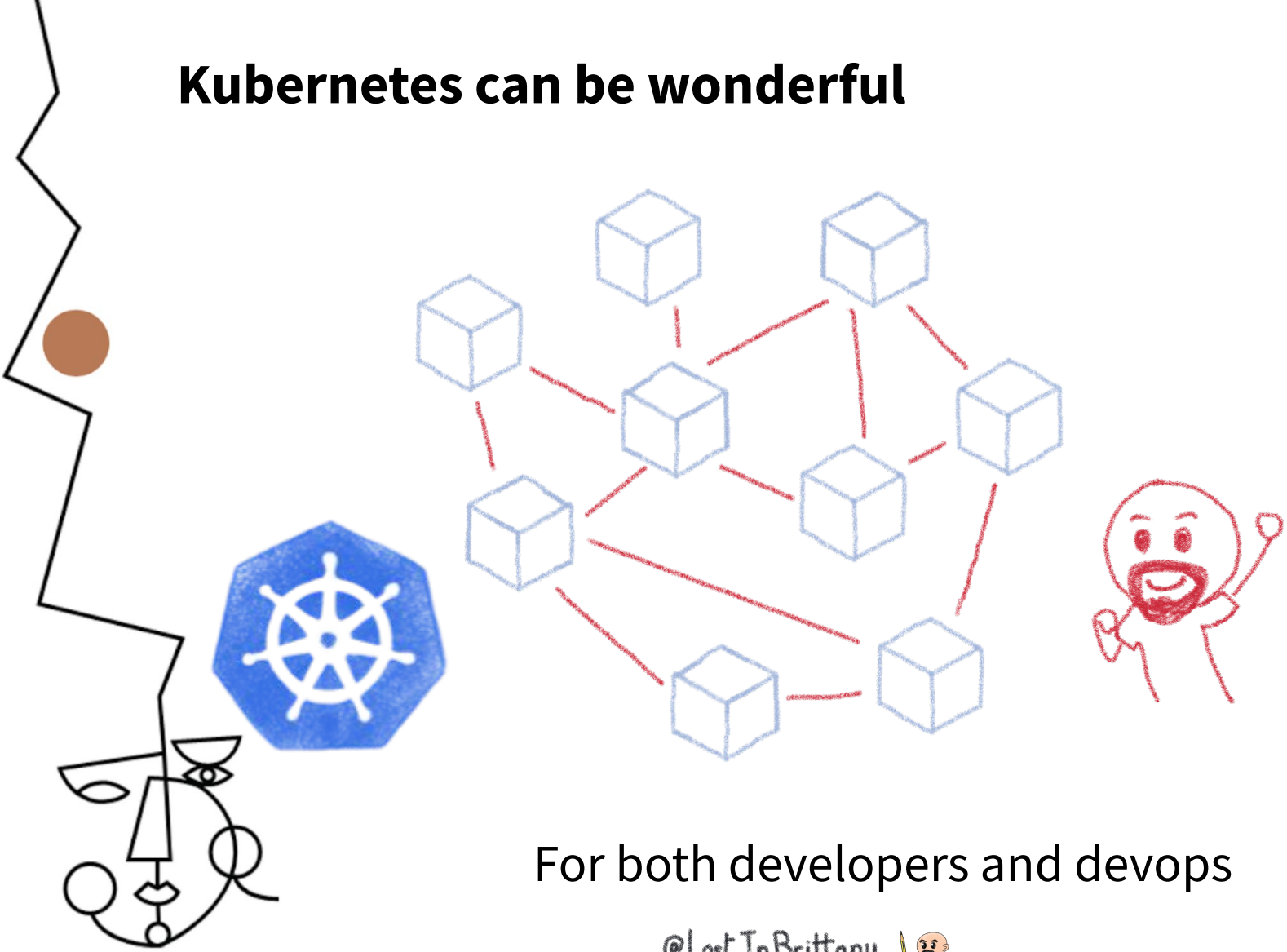
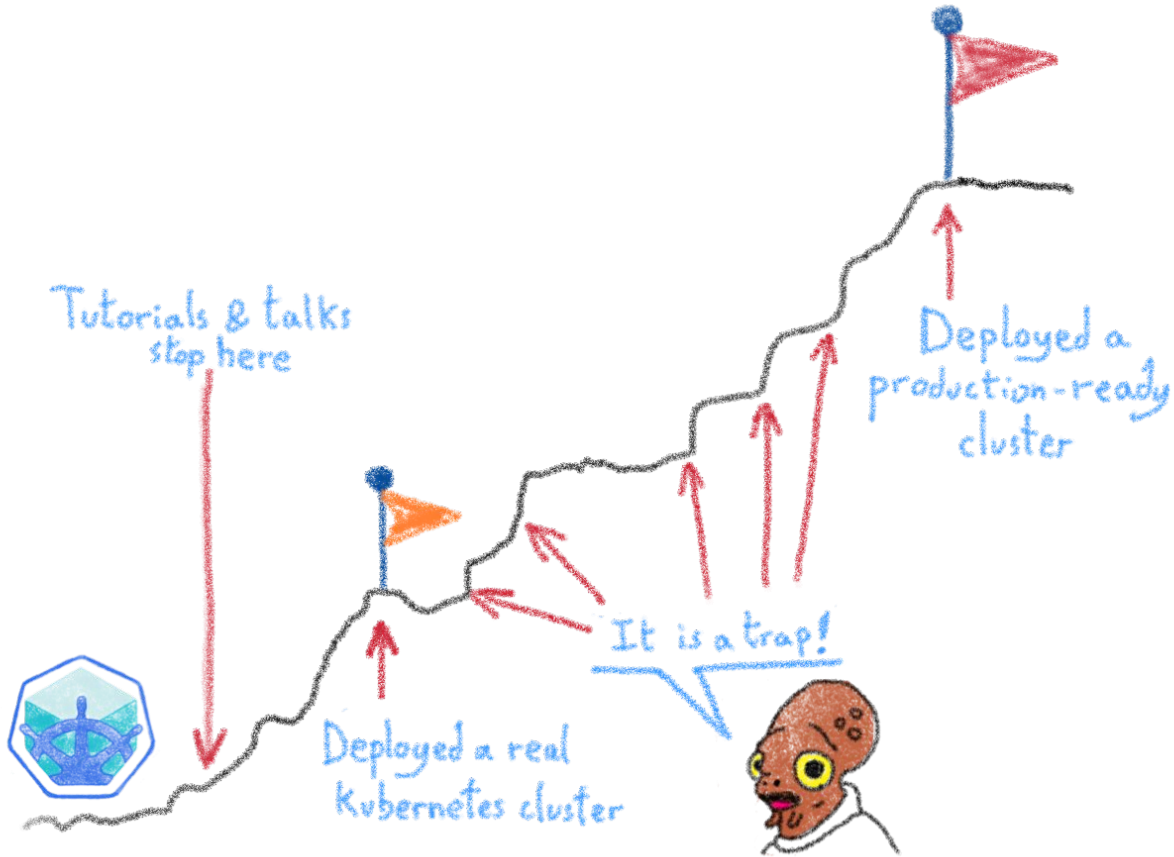
Kubernetes can be wonderful

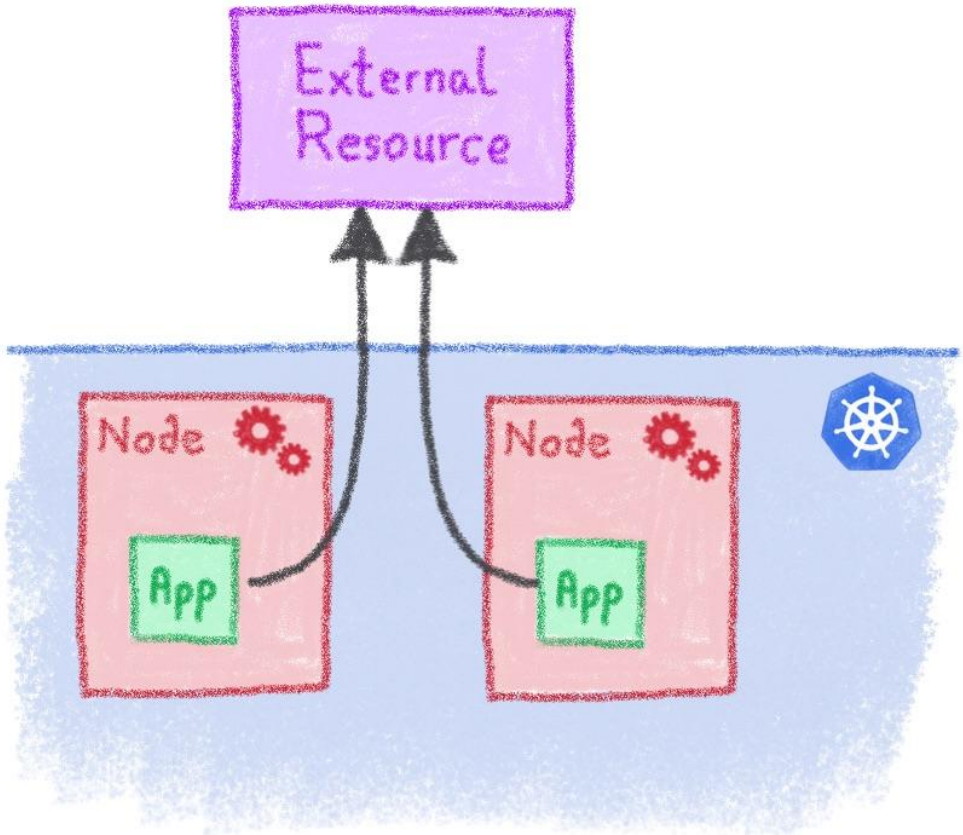


For both developers and devops

But it comes with a price...



An example among many others



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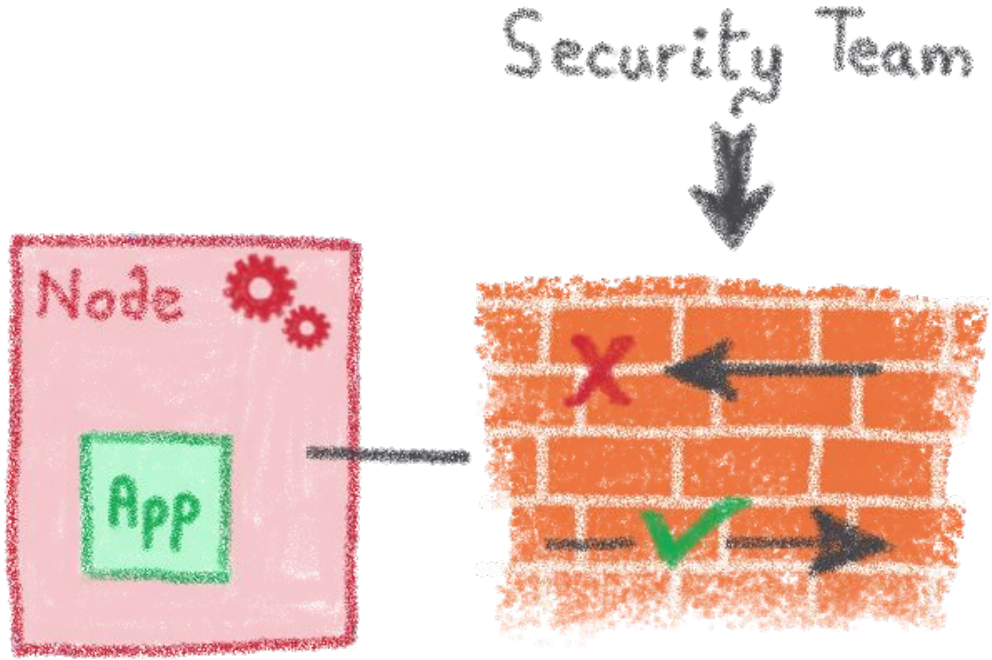
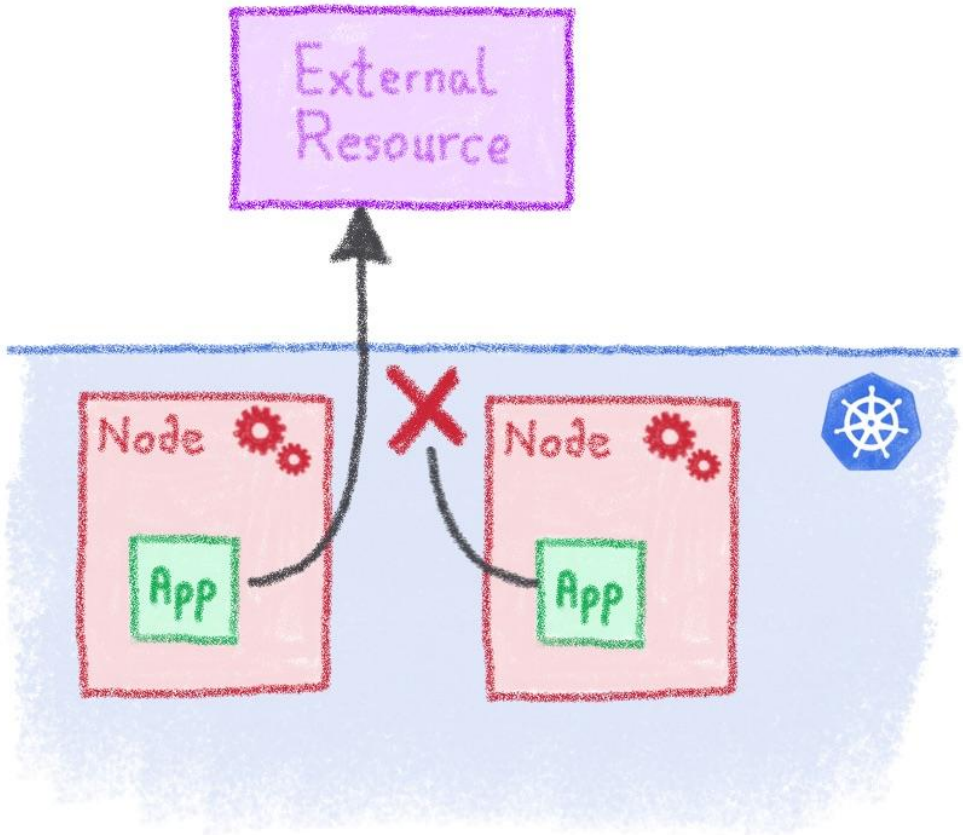
An example among many others



An example among many others



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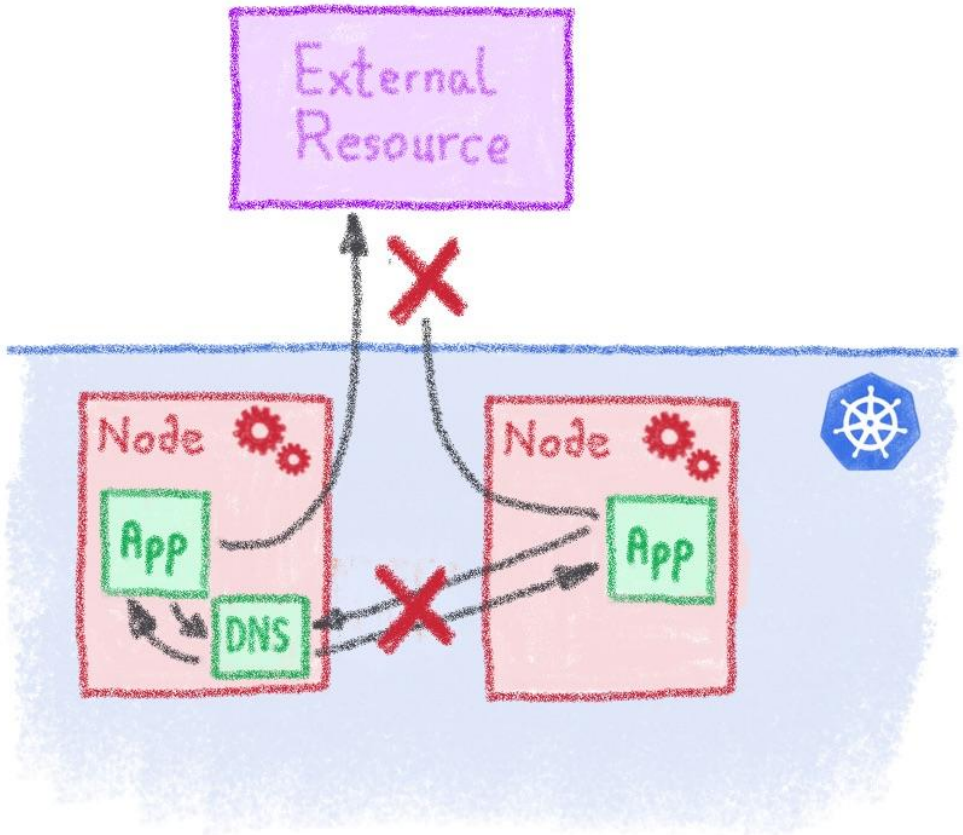
An example among many others



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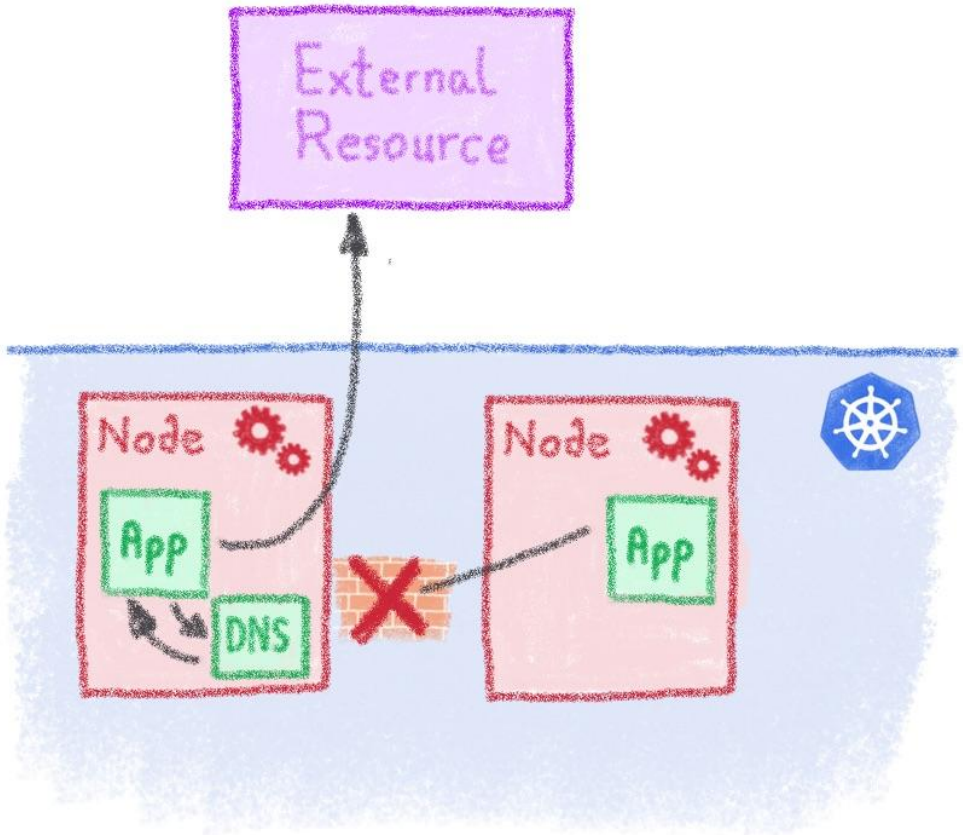
An example among many others



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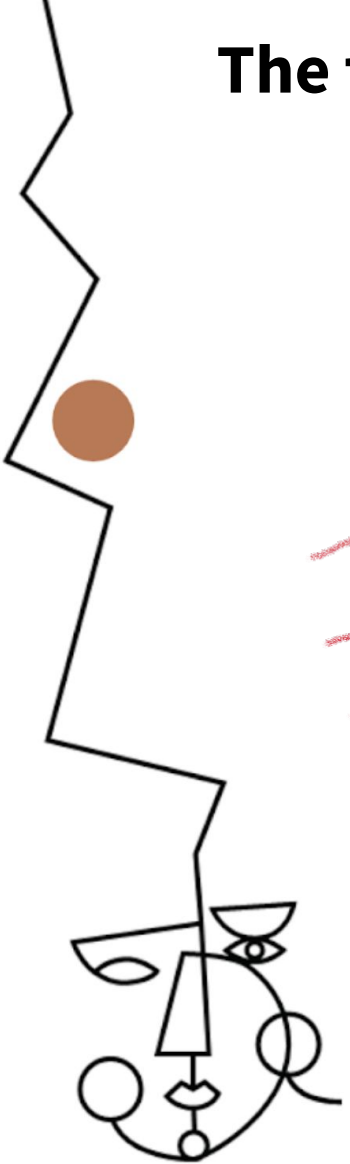
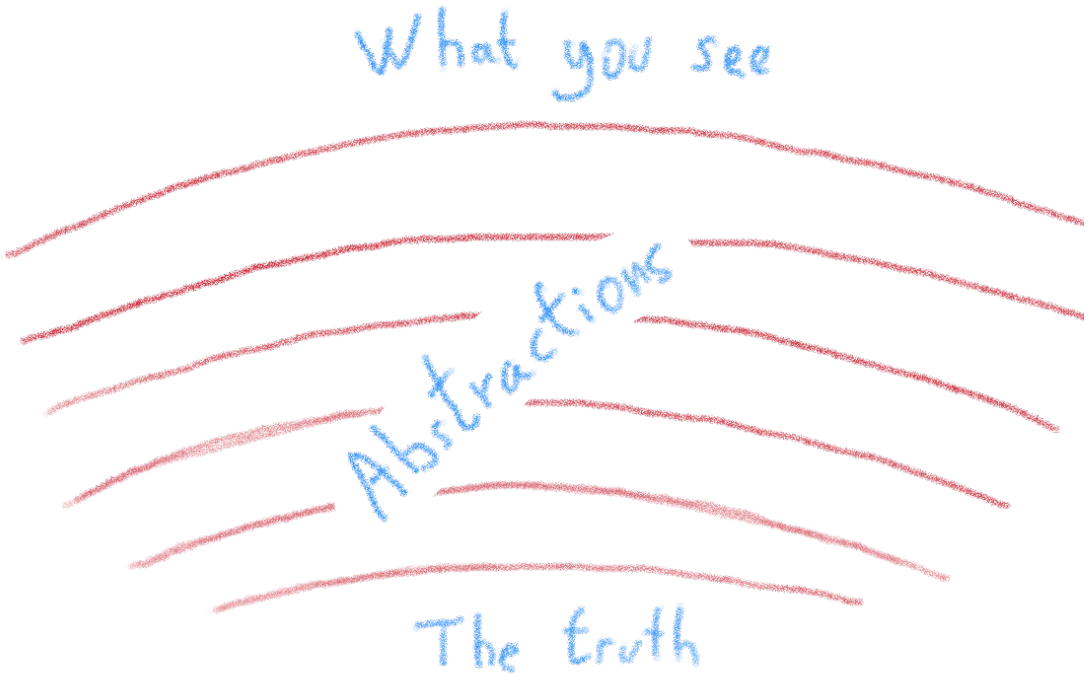
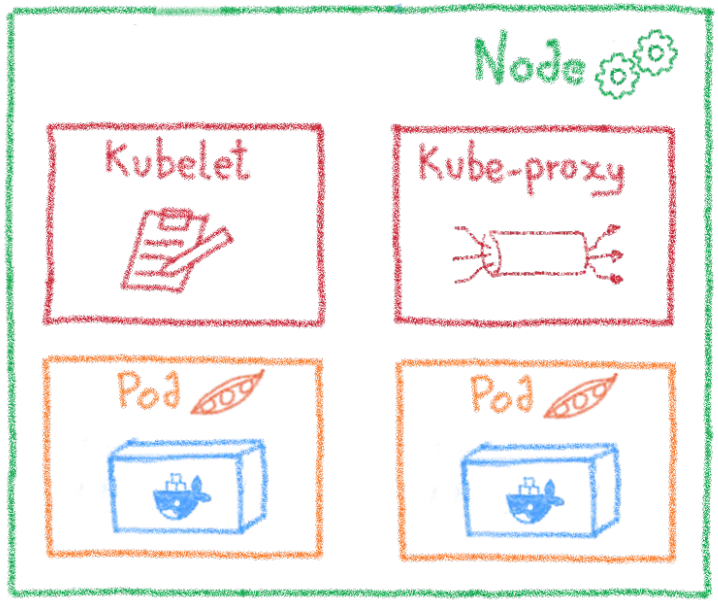
The truth is somewhere inside...





A network example: KubeProxy



KubeProxy:
3 proxy modes

- Userspace
- IPTables
- IPVS

A network example: KubeProxy

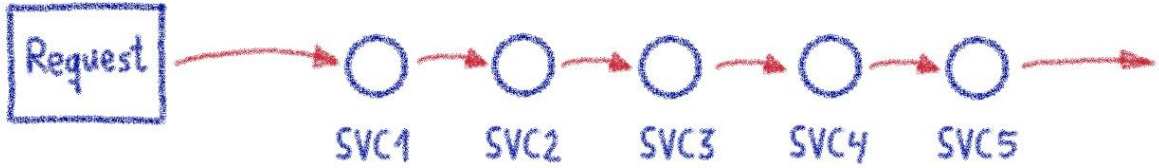
--proxy-mode ProxyMode

Which proxy mode to use: 'userspace' (older) or 'iptables' (faster) or 'ipvs'. If blank, use the best-available proxy (currently iptables). If the iptables proxy is selected, regardless of how, but the system's kernel or iptables versions are insufficient, this always falls back to the userspace proxy.

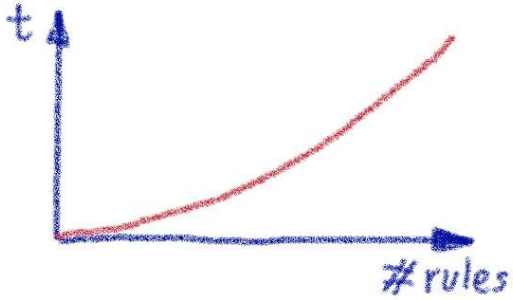
iptables by default

A network example: KubeProxy

IPtables are based on rule chains



More rules → More time to insert or evaluate them



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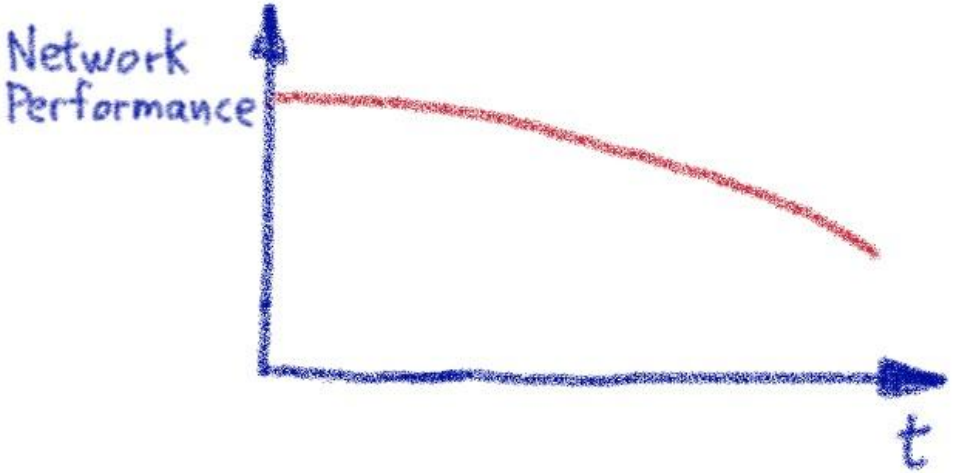
A network example: KubeProxy

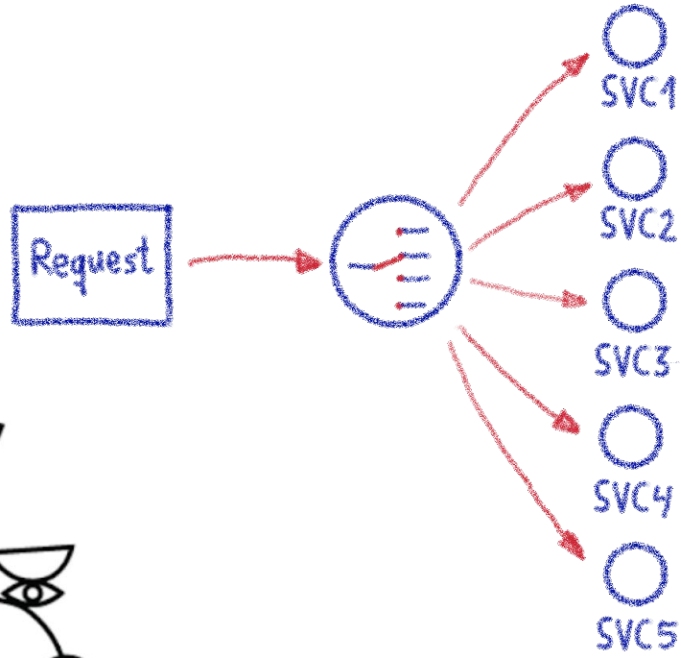


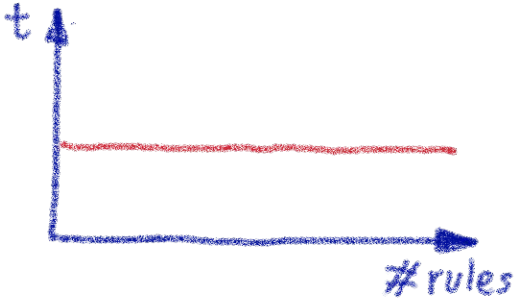
Cluster networking will be slower and slower

A network example: KubeProxy

IPVS is based on hash tables

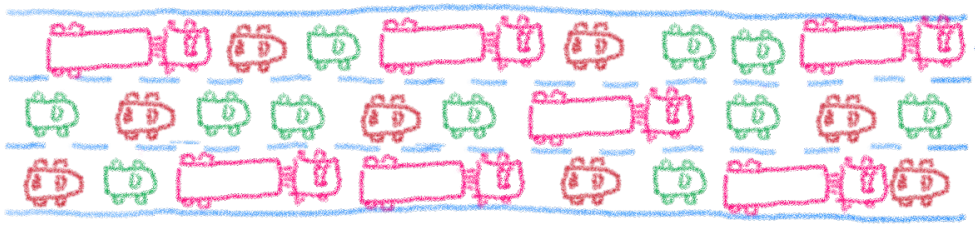
Constant time to insert or evaluate them





IPVS to the rescue!

Kubernetes networking is complex...



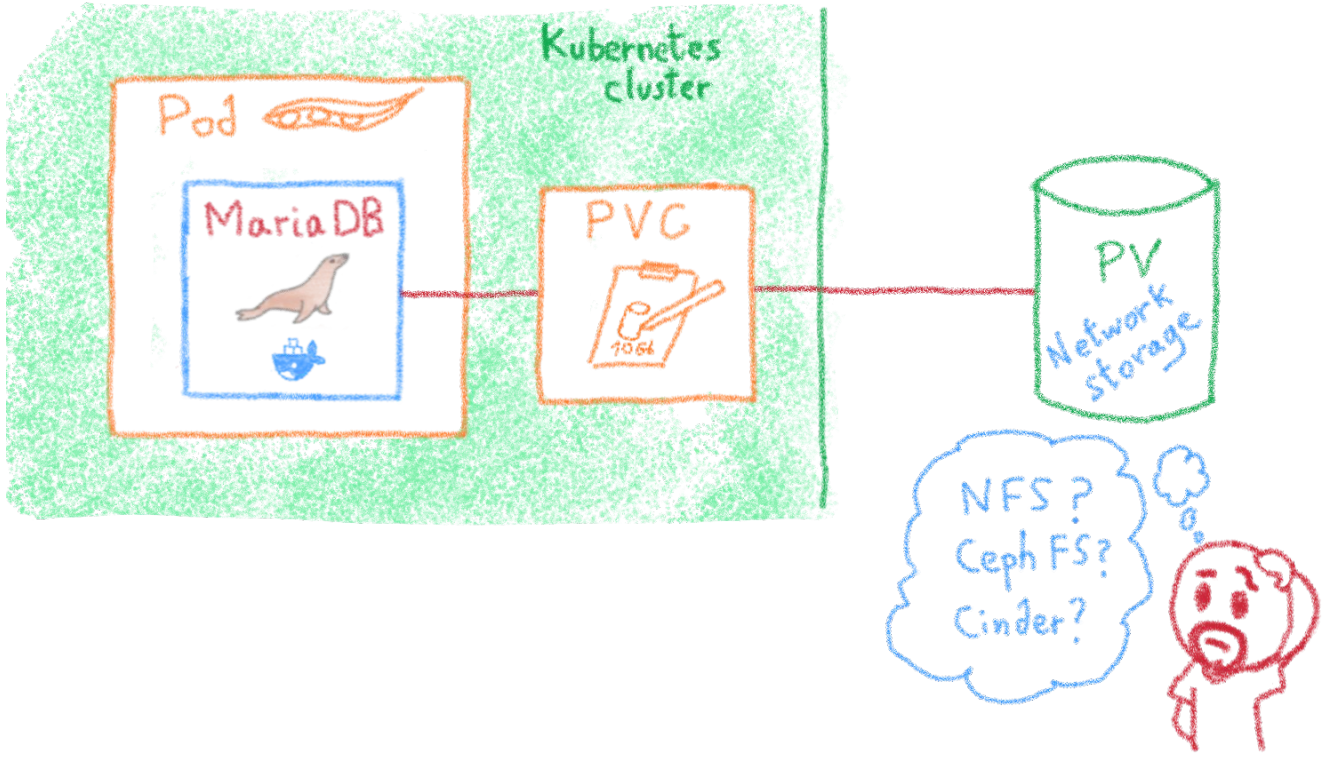
Network plugins (Flannel, Calico, Weave...)

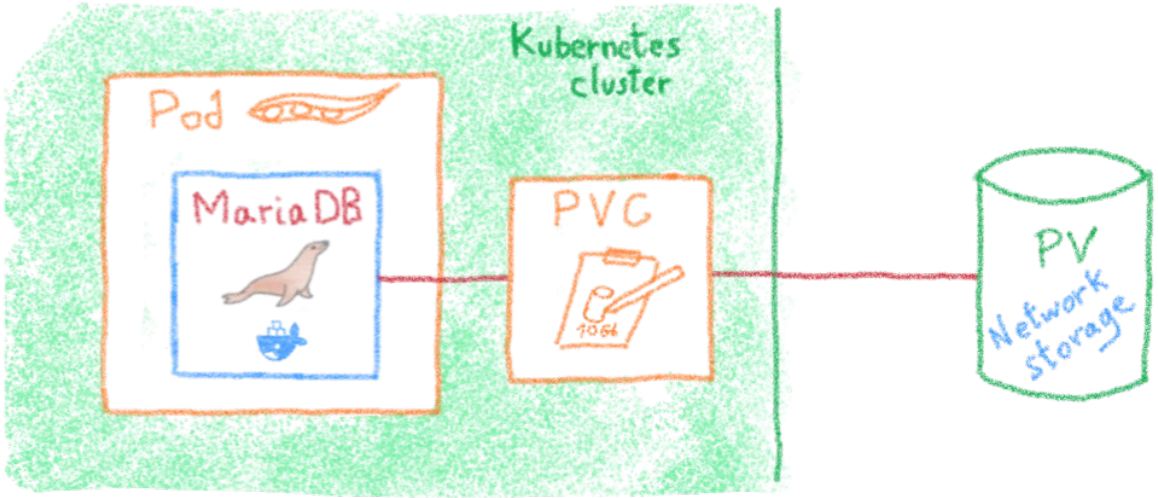
- IPAM
- iptables
- routing
- crossnode networking

Cluster IP, NodePort, Ingress

Service Meshes, Istio

The storage dilemma

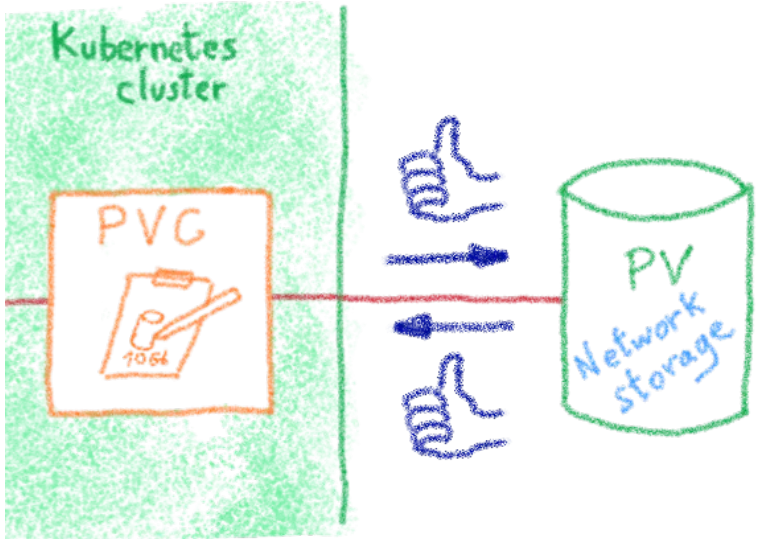


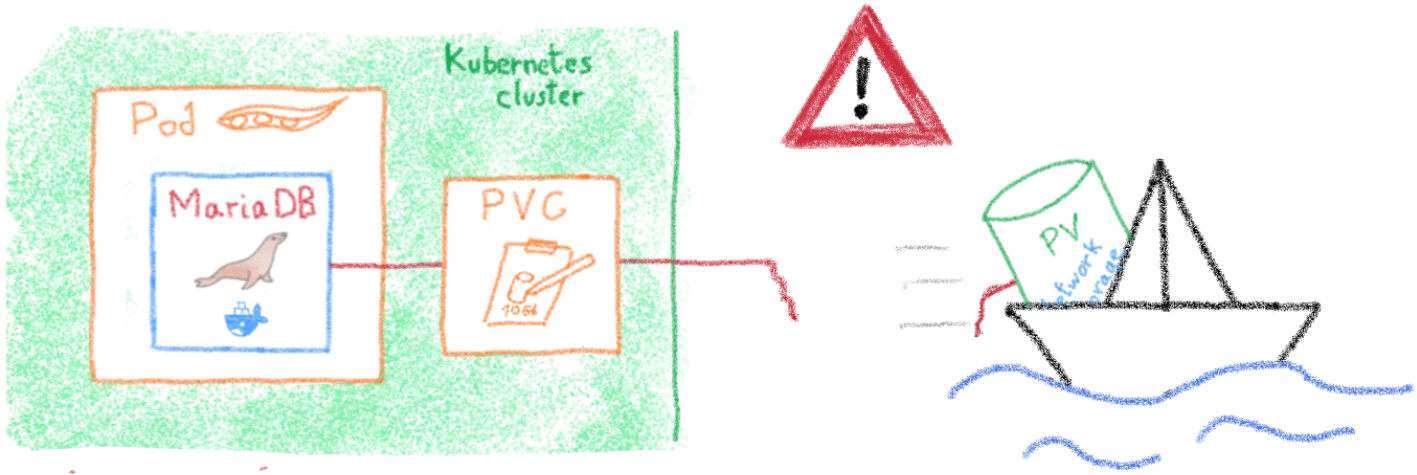


Volumes are handle through CSI

CSI provide an interface between Kubernetes and storage technologie

Most CSI assume perfect sync between Kubernetes and the storage backend

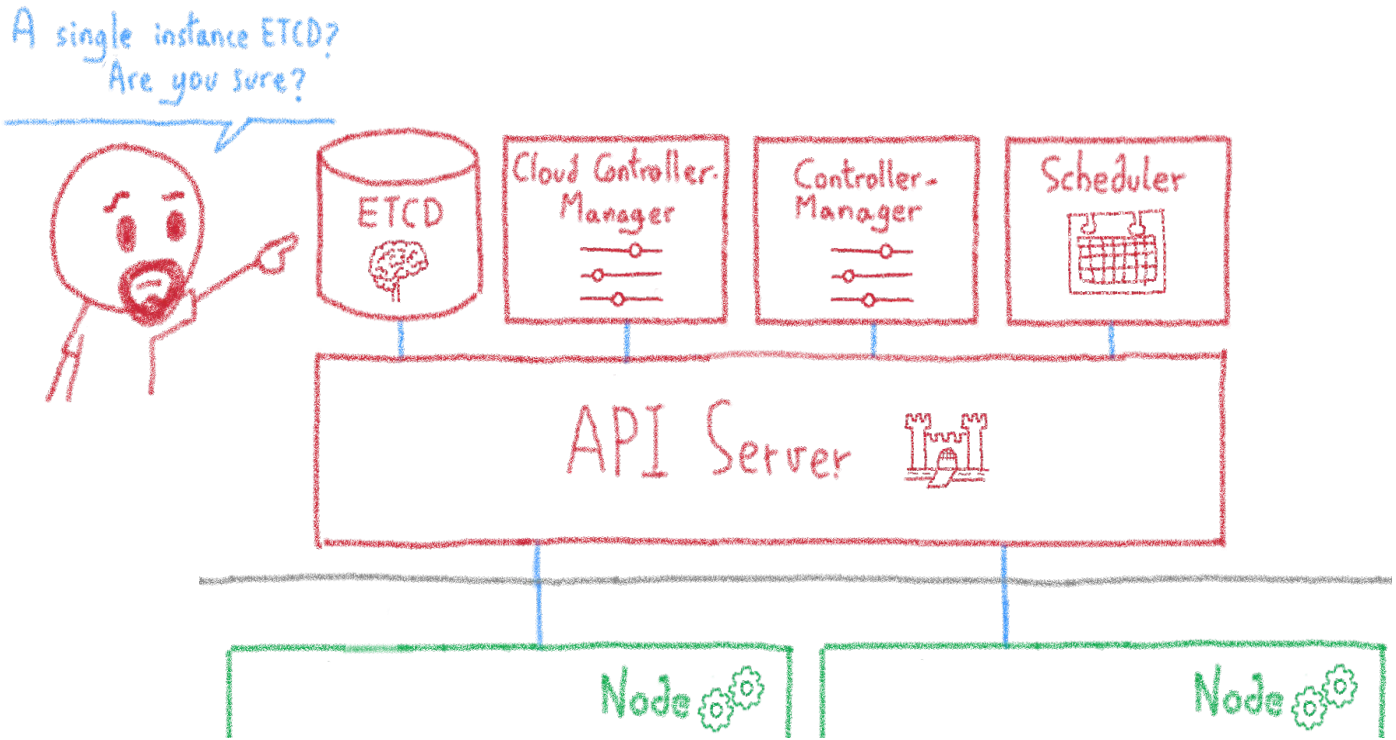




Storage backend are subject to errors or maintenance

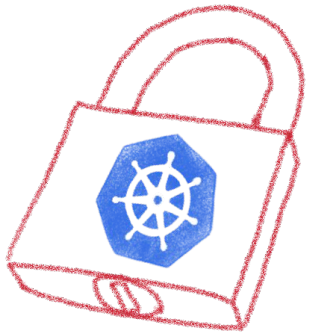
Potential state shifts between storage and Kubernetes

The ETCD vulnerability

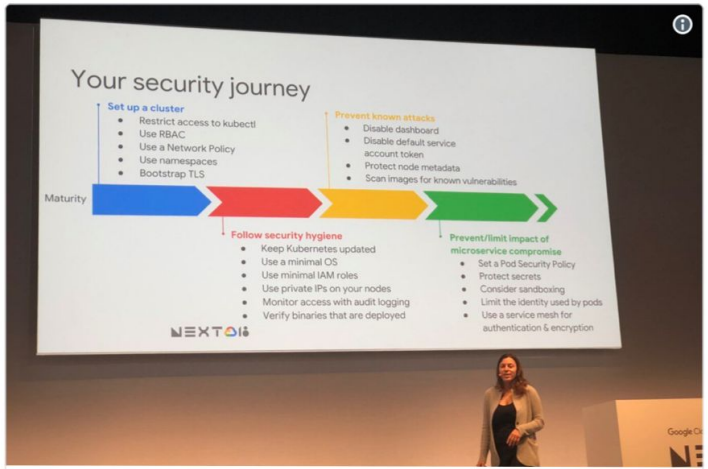


Security

Hardening your Kubernetes



The security journey



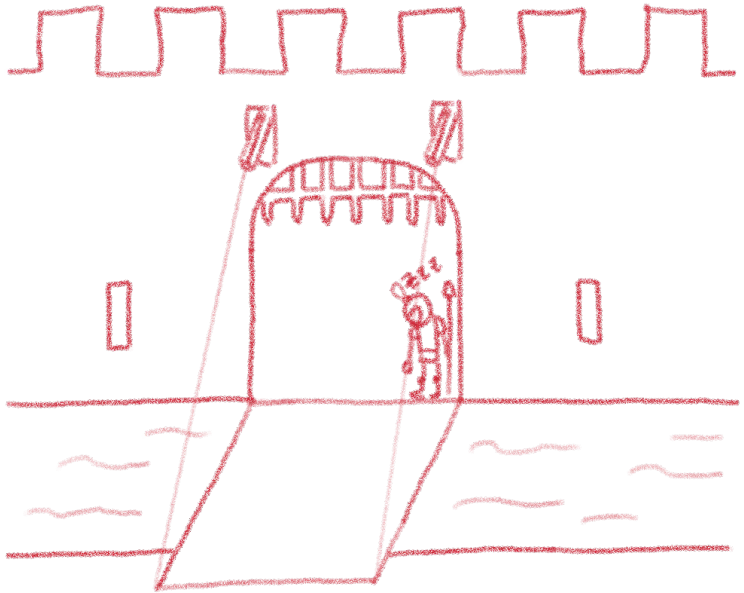
Mattias Gees
@MattiasGees

Your security journey with Kubernetes by @MayaKaczorowski #GoogleNext18

319 12:59 PM - Oct 11, 2018

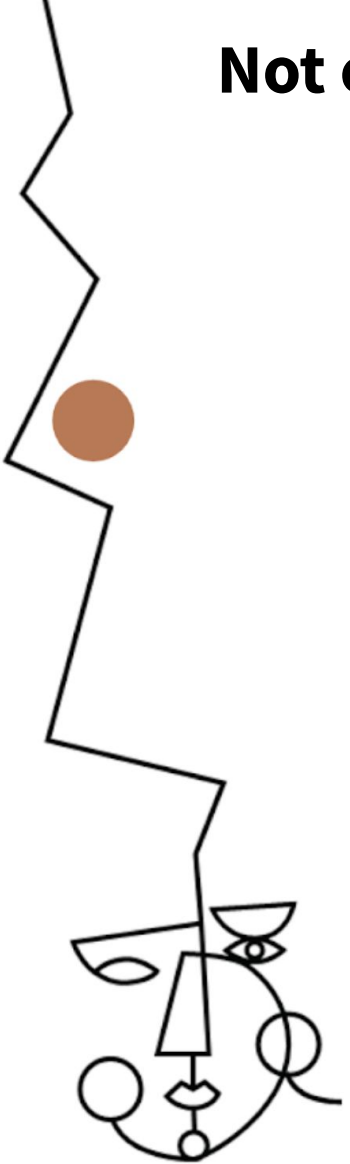
Open ports (e.g. etcd 2379/TCP)
Kubernetes API (e.g. Tesla hacking)
Exploits (lots of CVEs)
RBAC (e.g. badly defined roles)

Kubernetes is insecure by design*

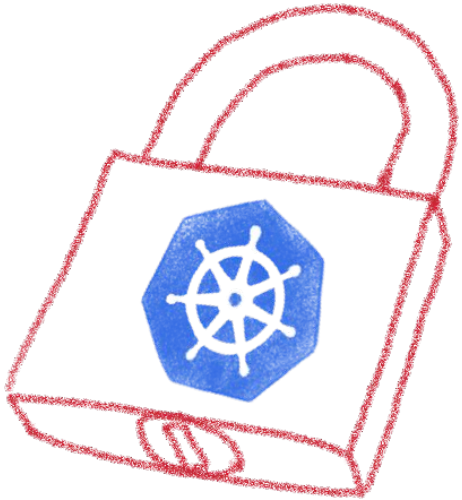


It's a feature, not a bug.
Up to K8s admin to secure it according to needs

Not everybody has the same security needs



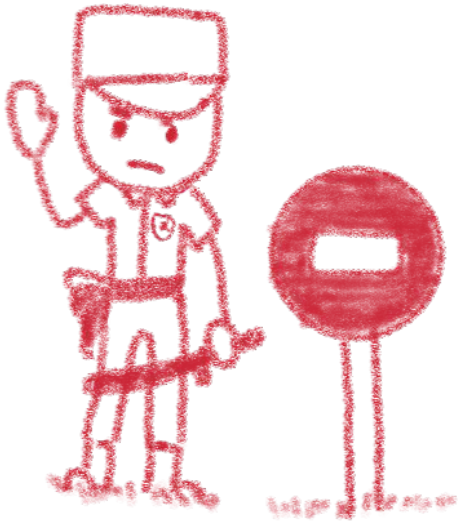
Kubernetes allows to enforce security practices as needed



Listing some good practices

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

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

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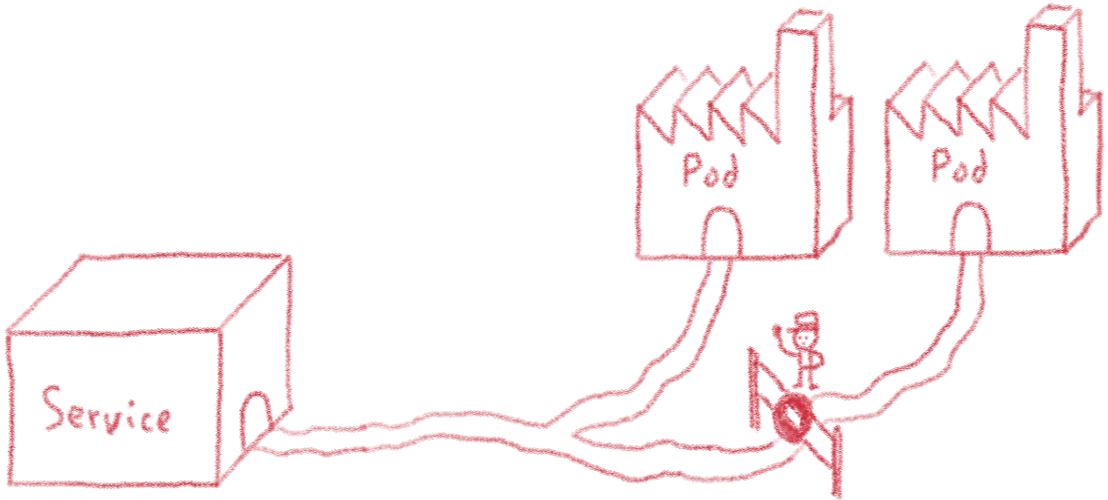
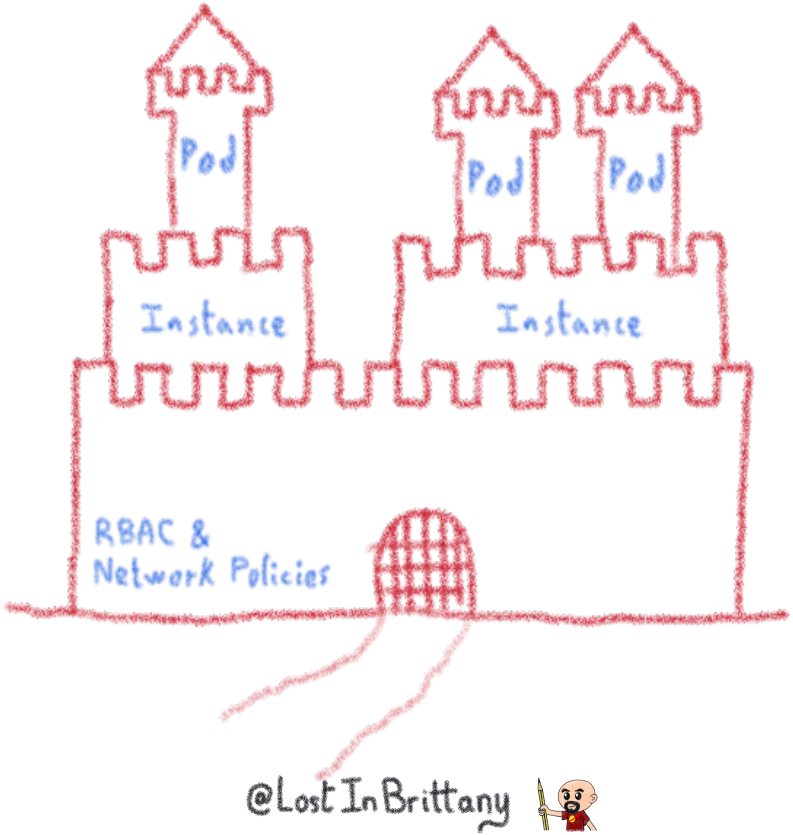
Define and implement network policies



Use RBAC and Network Policies to isolate your sensitive workload



Always keep up to date

Both Kubernetes and plugins

Because Kubernetes is a big target

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Kubernetes » Kubernetes : Vulnerability Statistics

Vulnerabilities (22) CVSS Scores Report Browse all versions Possible matches for this product Related Metasploit Modules

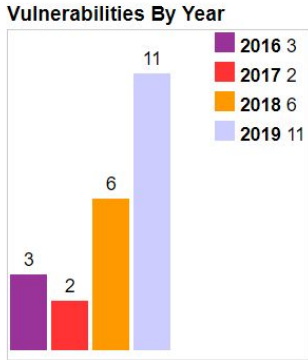
Related OVAL Definitions : Vulnerabilities (0) Patches (0) Inventory Definitions (0) Compliance Definitions (0)

Vulnerability Feeds & Widgets

Vulnerability Trends Over Time

Year	# of Vulnerabilities	DoS	Code Execution	Overflow	Memory Corruption	Sql Injection	XSS	Directory Traversal	Http Response Splitting	Bypass something	Gain Information	Gain Privileges	CSRF	File Inclusion	# of exploits
2016	3										1	1			
2017	2										1				
2018	6									1					
2019	11	2									1				
Total	22	2								1	3	1			
% Of All		9.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	13.6	4.5	0.0	0.0	

Warning : Vulnerabilities with publish dates before 1999 are not included in this table and chart. (Because there are not many of them and they make the page look bad; and they may years.)



And remember,
even the best can get hacked

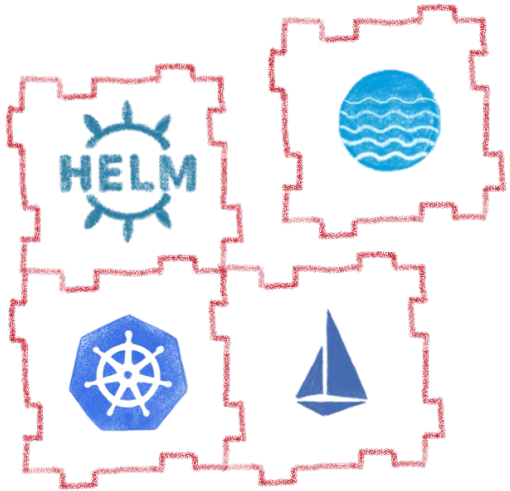
TESLA

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

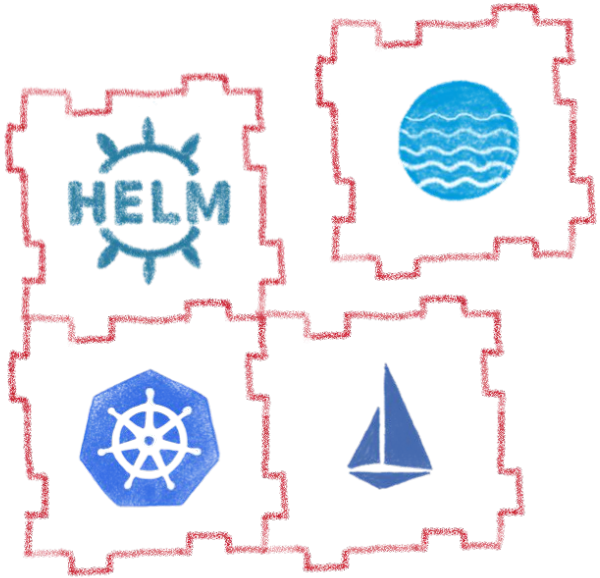
Remain attentive, don't get too confident

Extensibility

Enhance your Kubernetes



Kubernetes is modular



Fully extensible

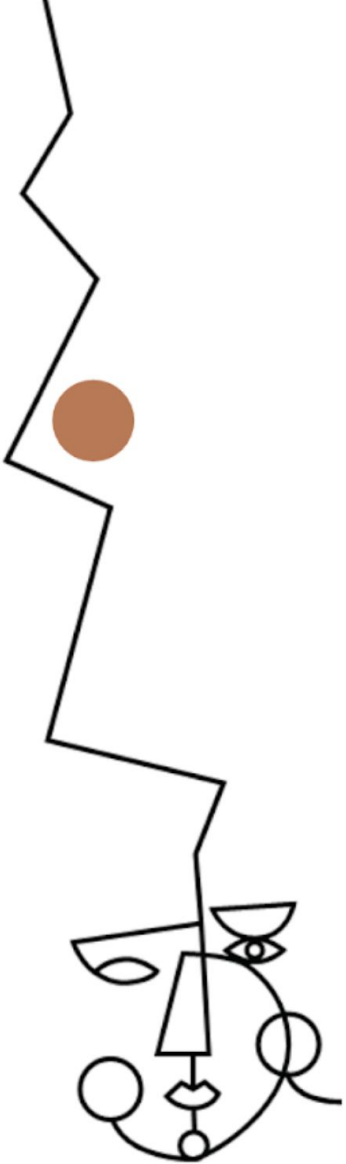
- Kubernetes API
- Cluster demons
- Controllers
- Custom resources
- ...

Operators

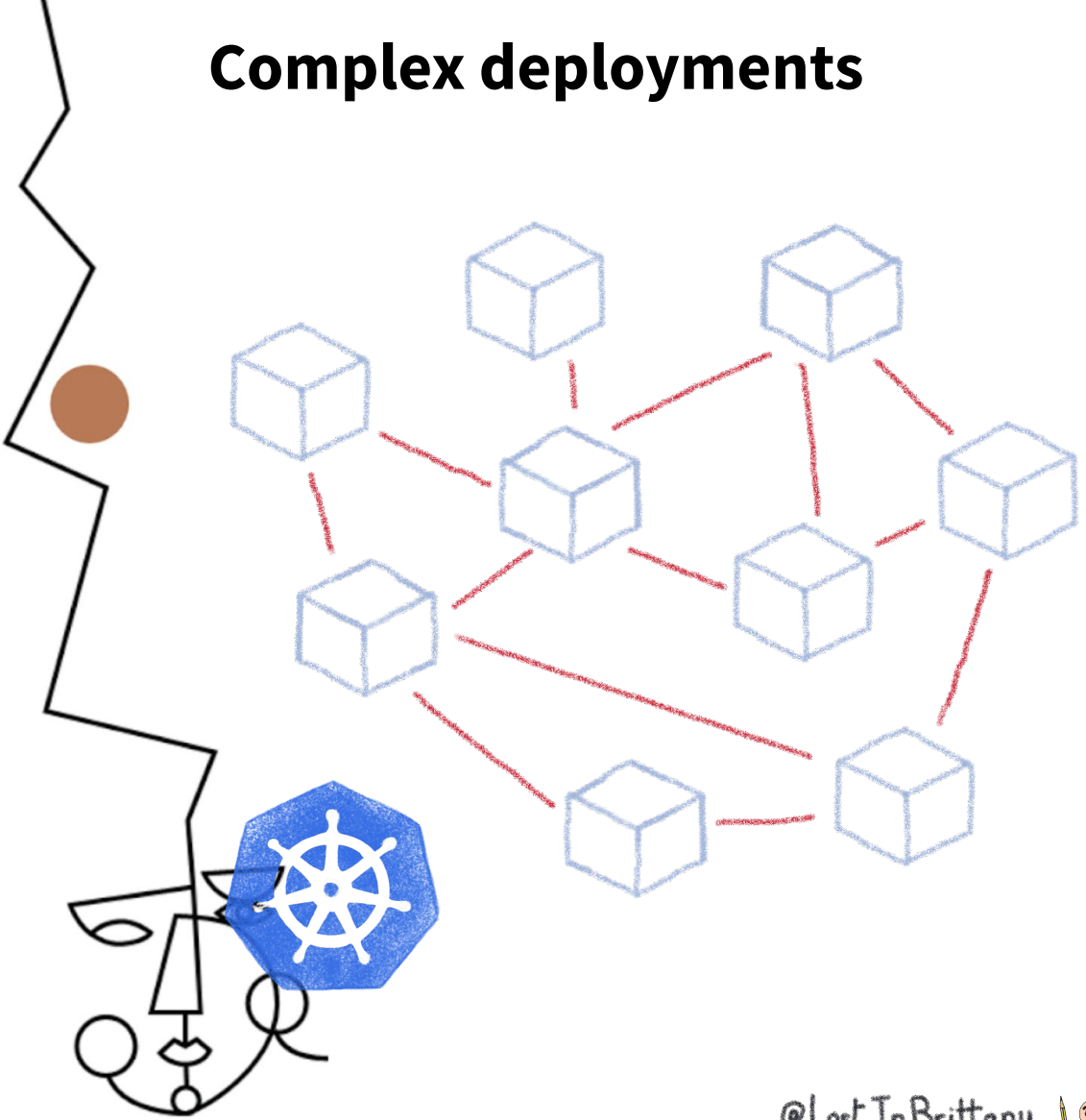
Let's see how some of those plugins can help you

Helm

A package management for K8s



Complex deployments



Ingress

Services

Deployments

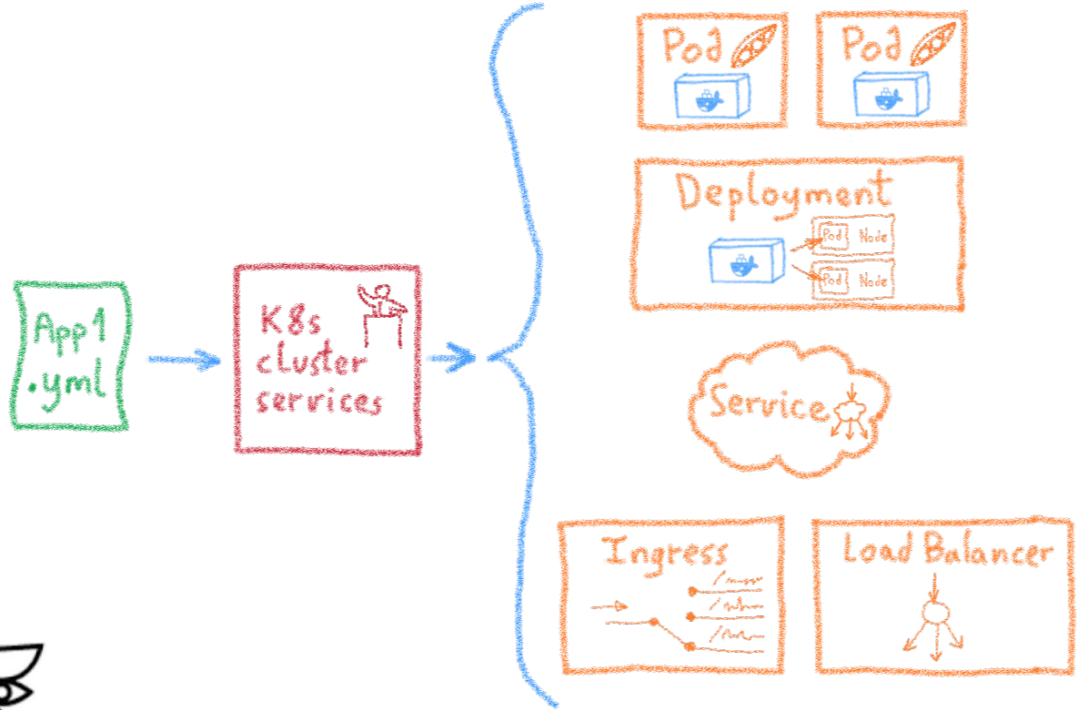
Pods

Sidecars

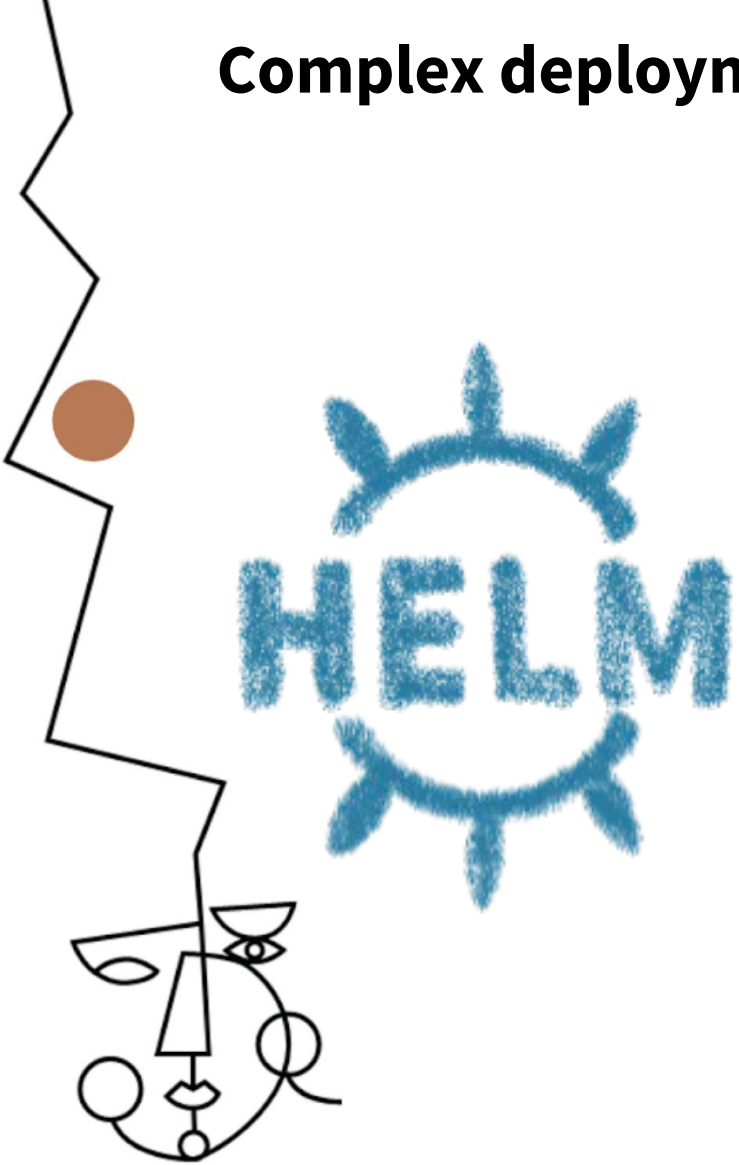
Replica Sets

Stateful Sets

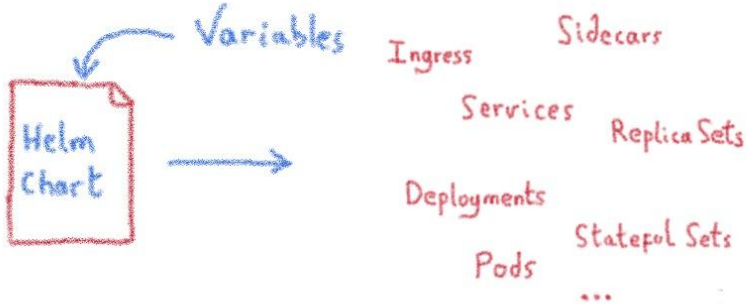
Using static YAML files



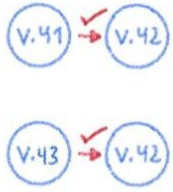
Complex deployments



A package manager for Kubernetes

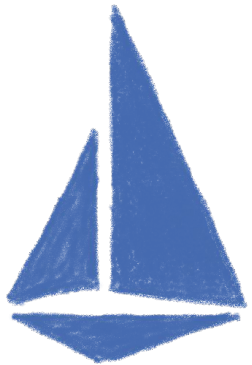


- Manage complexity
- Simple sharing
- Easy upgrades
- Easy rollbacks



Istio

A service mesh for Kubernetes…
and much more!



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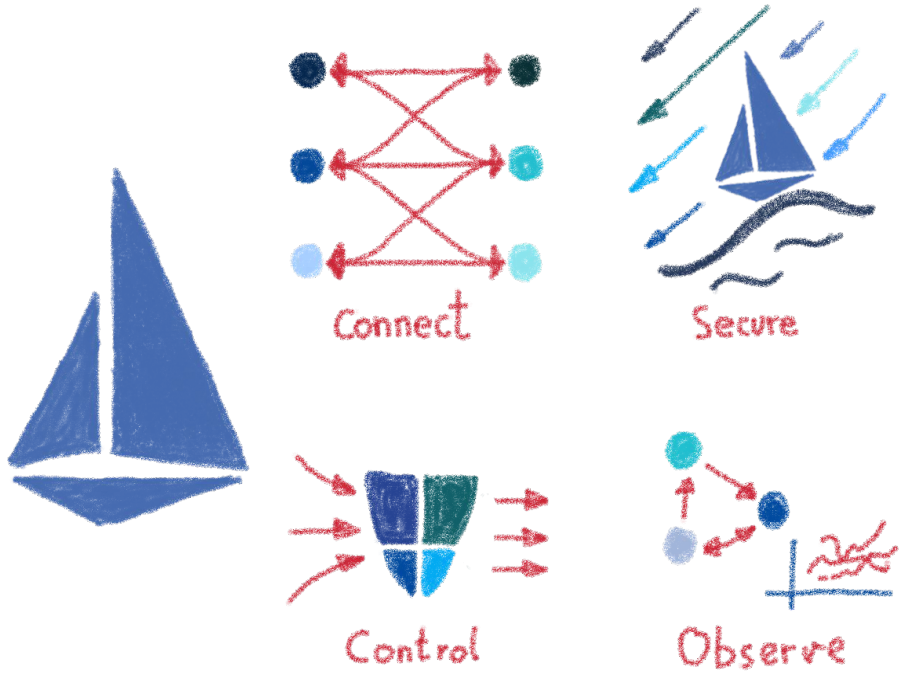
Istio: A service mesh...
but not only



Rolling upgrades

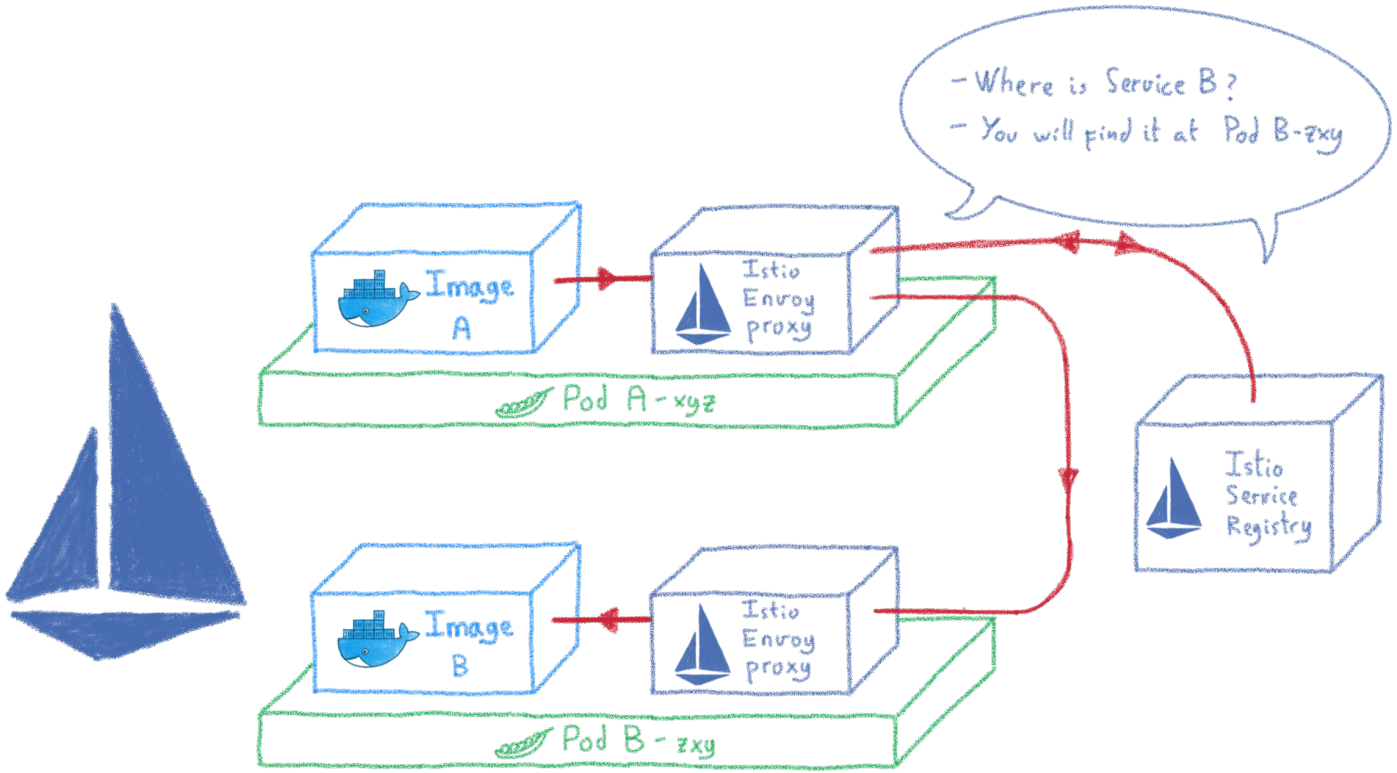
A/B Testing

Canary Testing

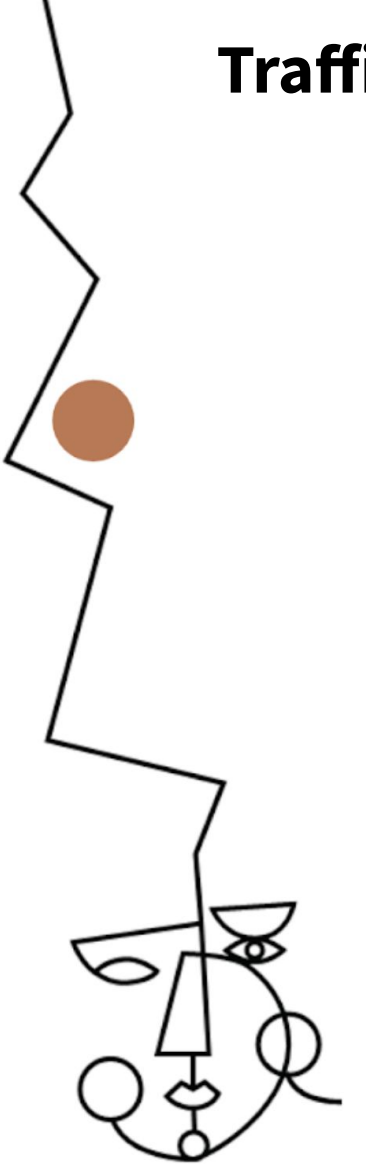
Edge traffic management

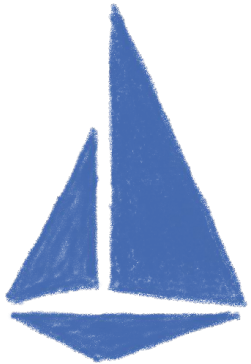
Multicluster service mesh

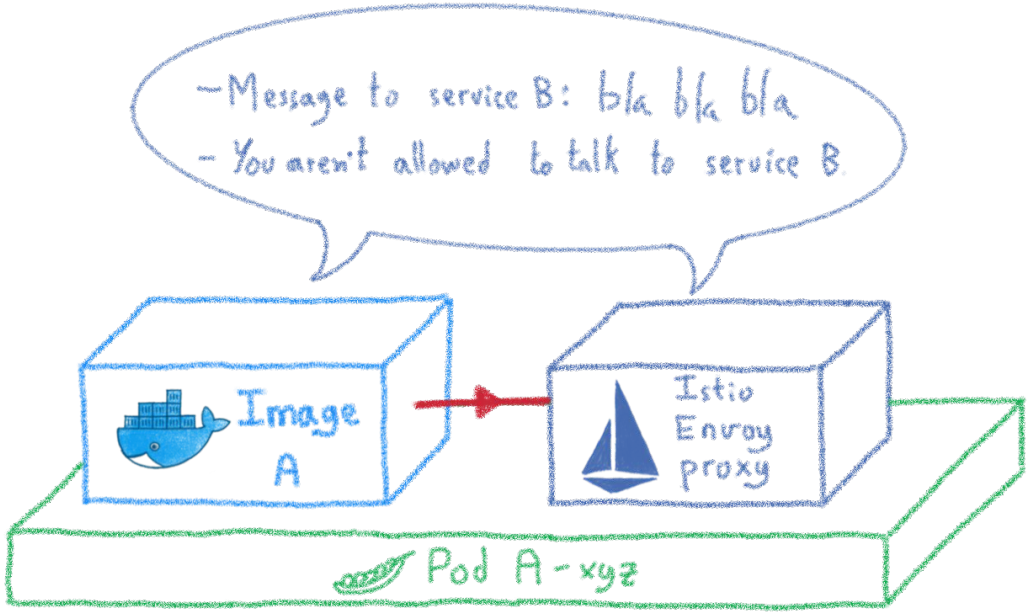
Service discovery



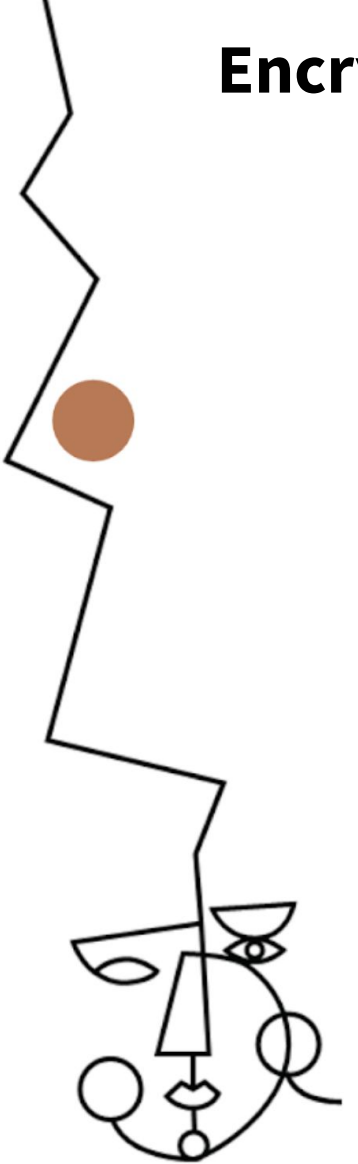
Traffic control

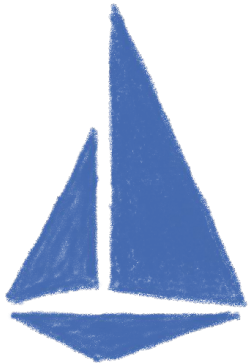


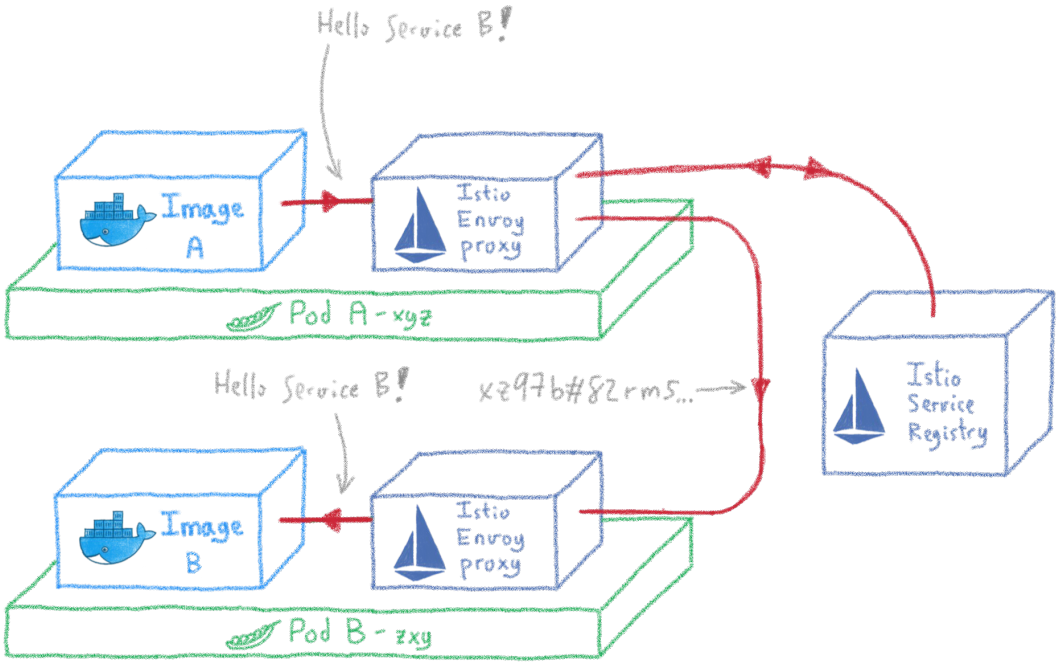




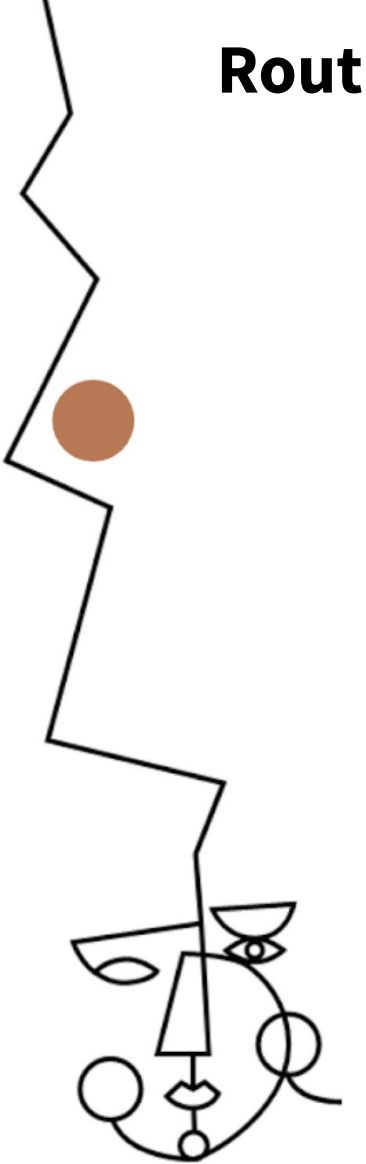
Encrypting internal communications

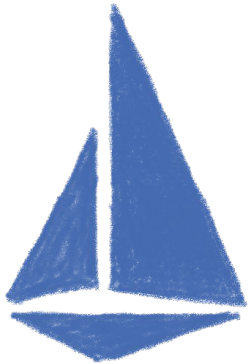


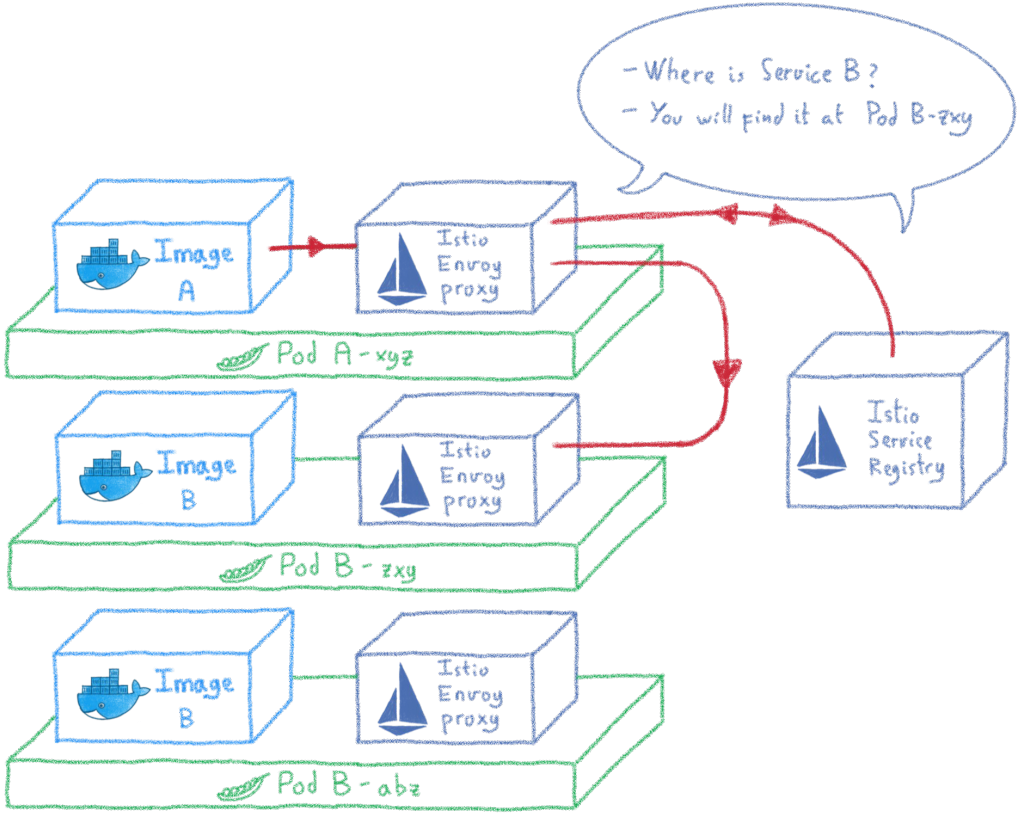




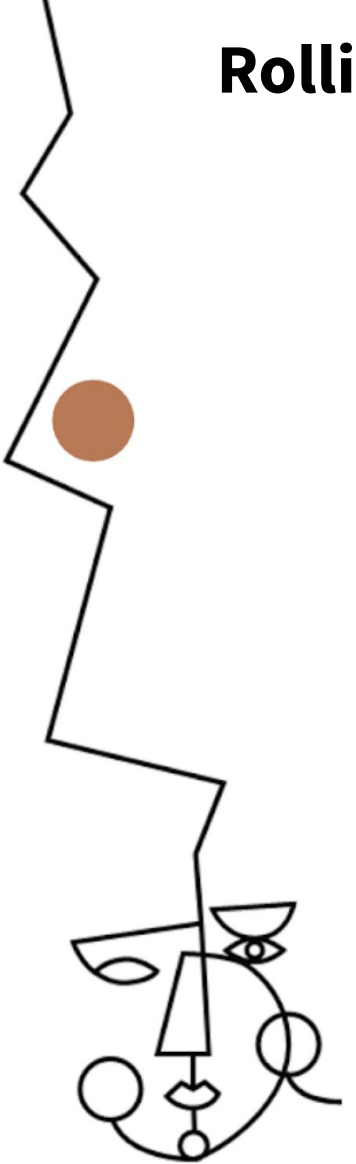
Routing and load balancing

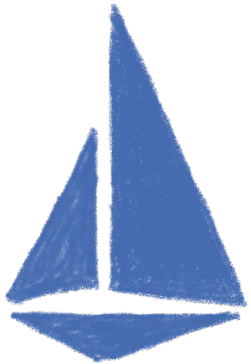


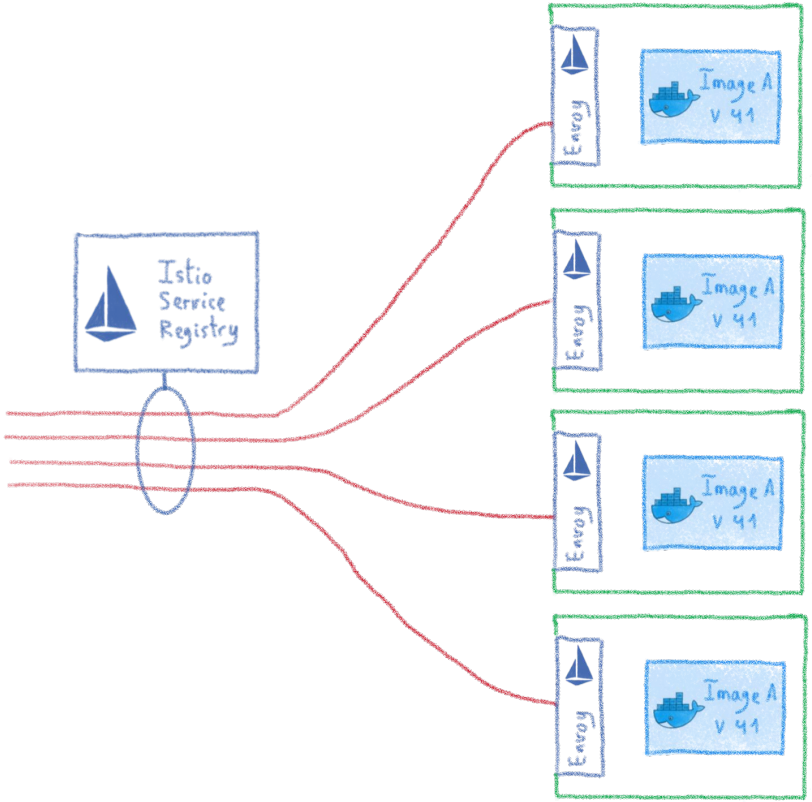




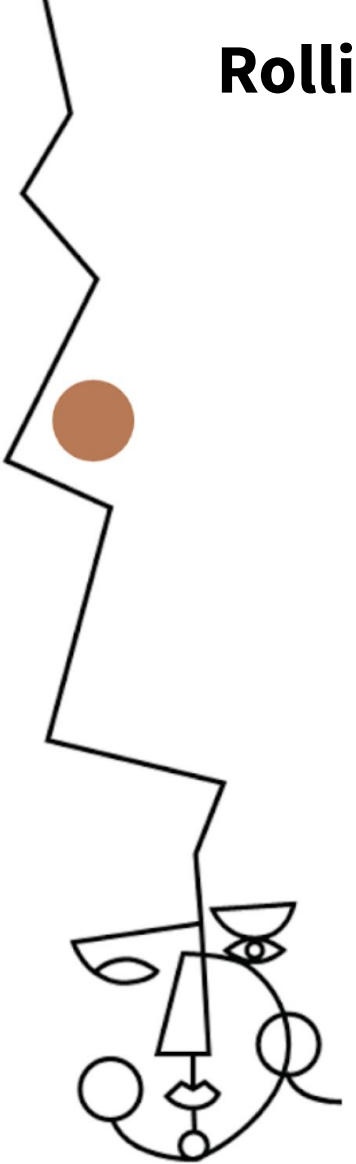
Rolling upgrades

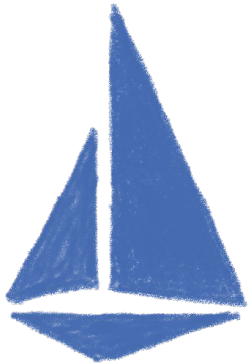


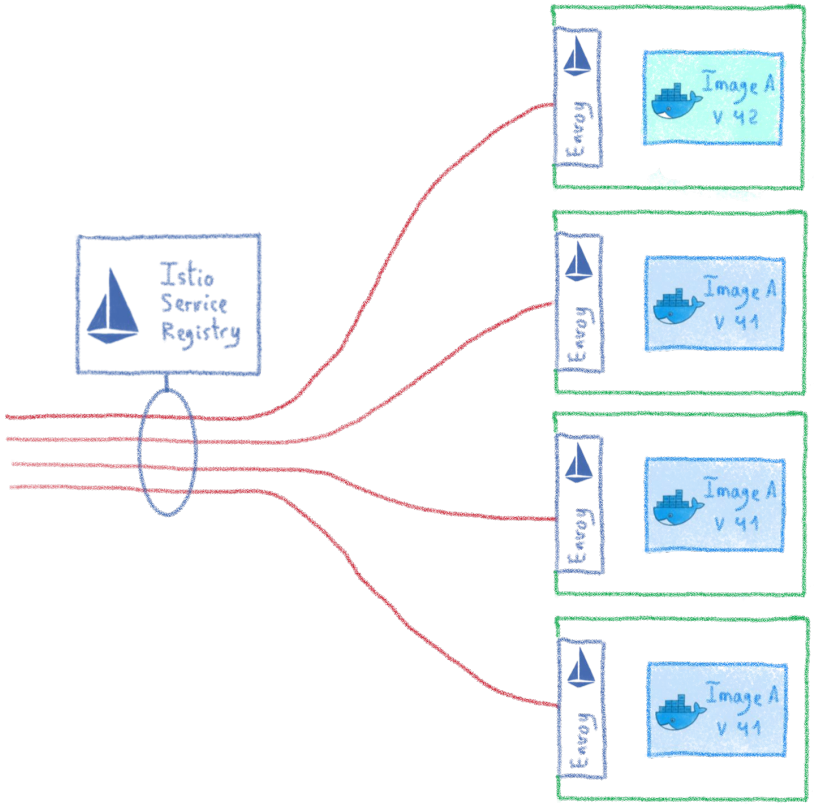




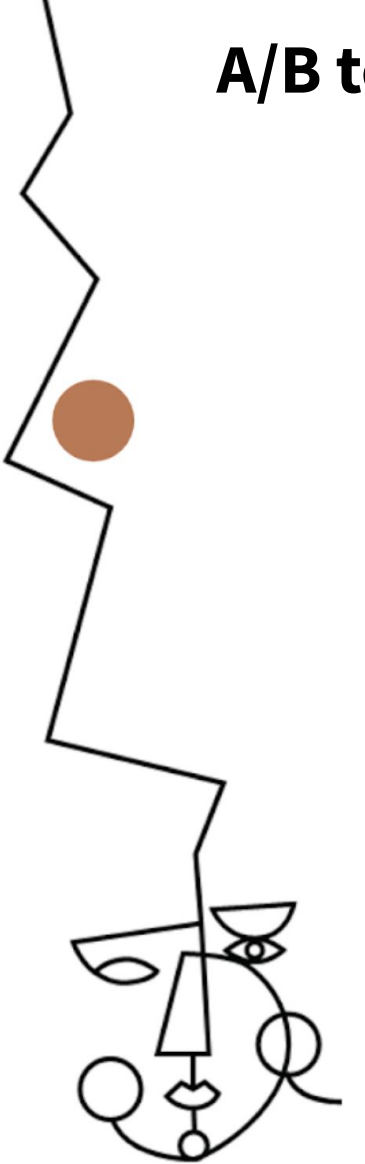
Rolling upgrades

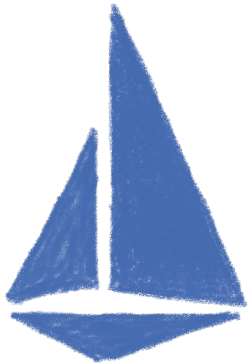


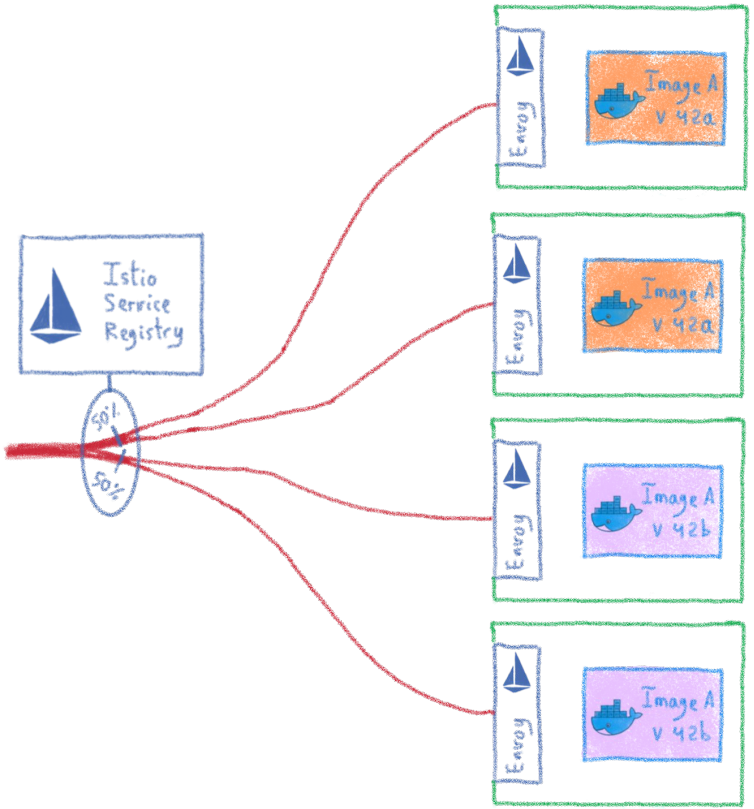




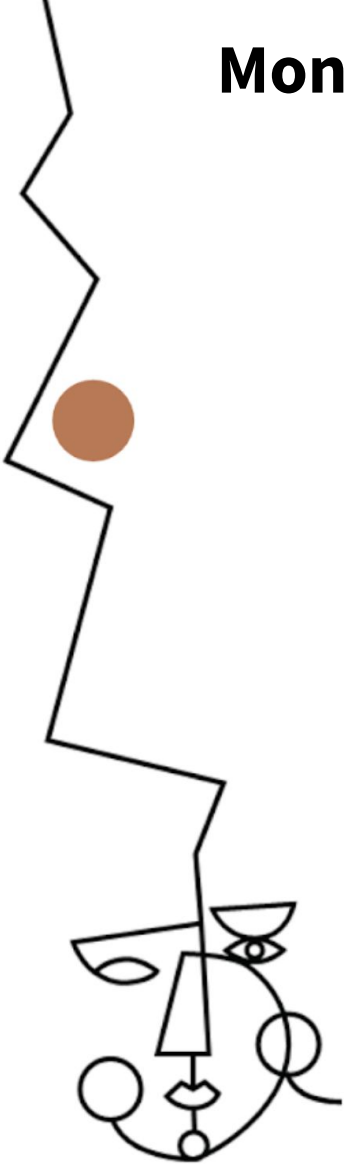
A/B testing

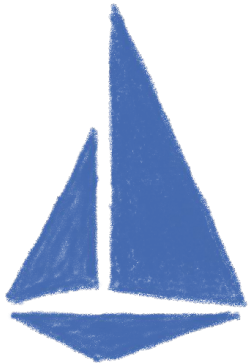





Istio
Service
Registry
50%
50%
Envoy
Envoy
Envoy
Envoy
Image A
v 42a
Image A
v 42a
Image A
v 42b
Image A
v 42b

Monitoring your cluster

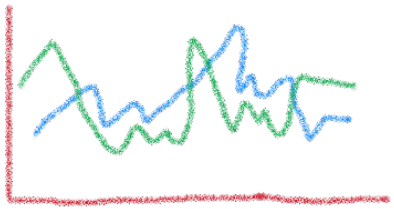




- Metrics
- Logs
- Tracing

} at {

- Envoy level
- Control plane level



Dashboards

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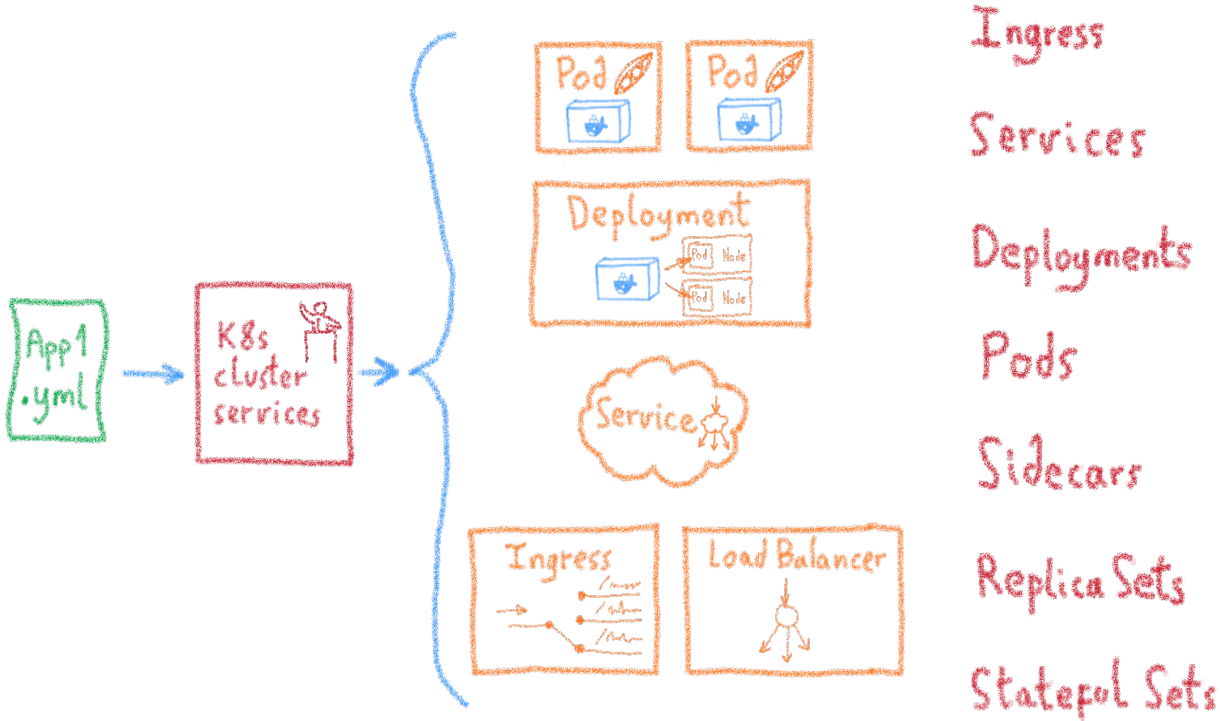
Velero

Backing up your Kubernetes

@LostInBrittany

OVHcloud

Kubernetes:
Desired State Management



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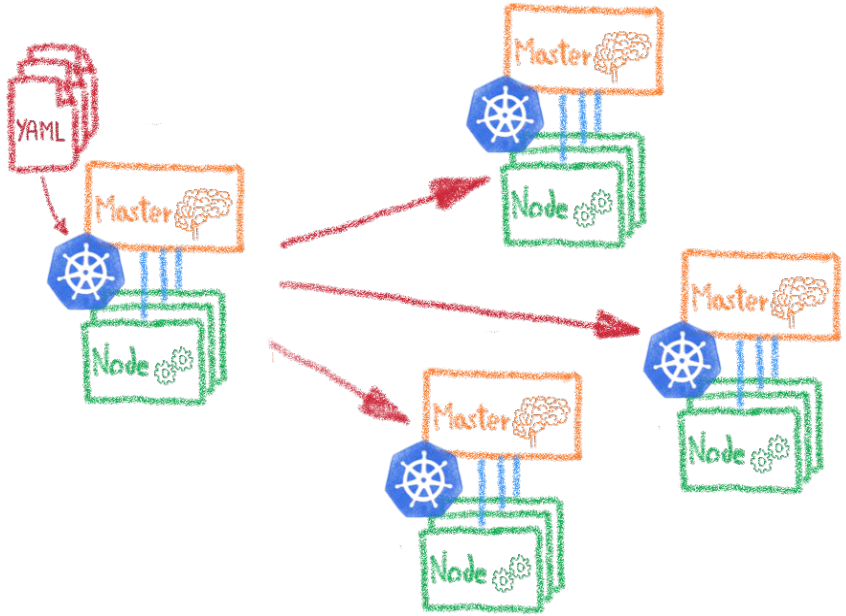
YAML files allows to clone a cluster



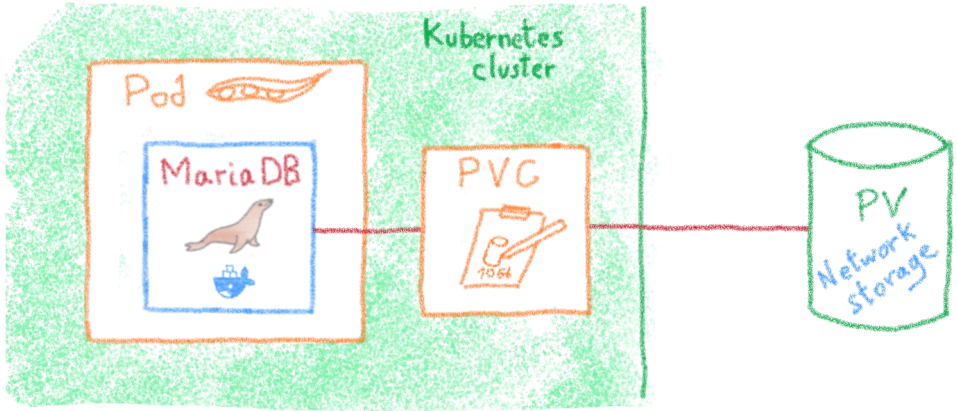
Dev envs

Staging

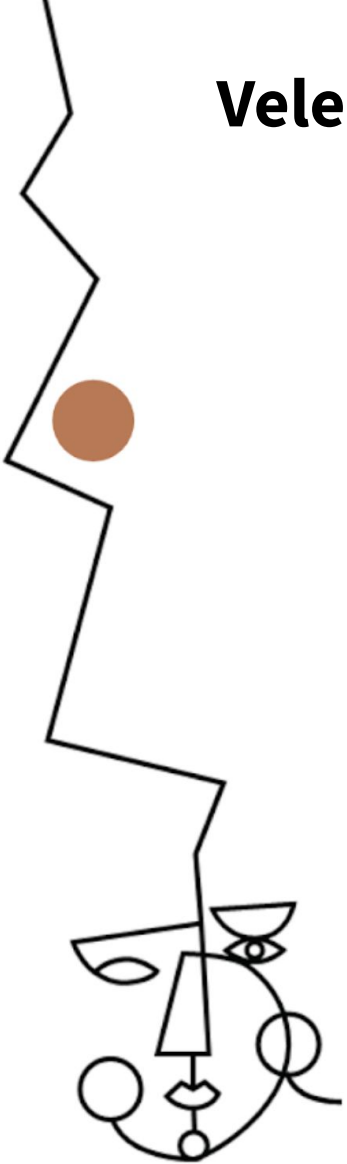
Multi-cluster

Multi-cloud

But what about the data?



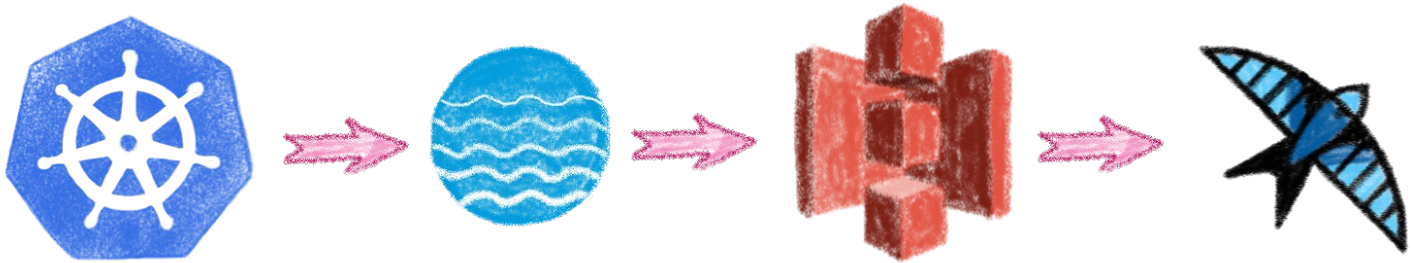
Velero



VELERO

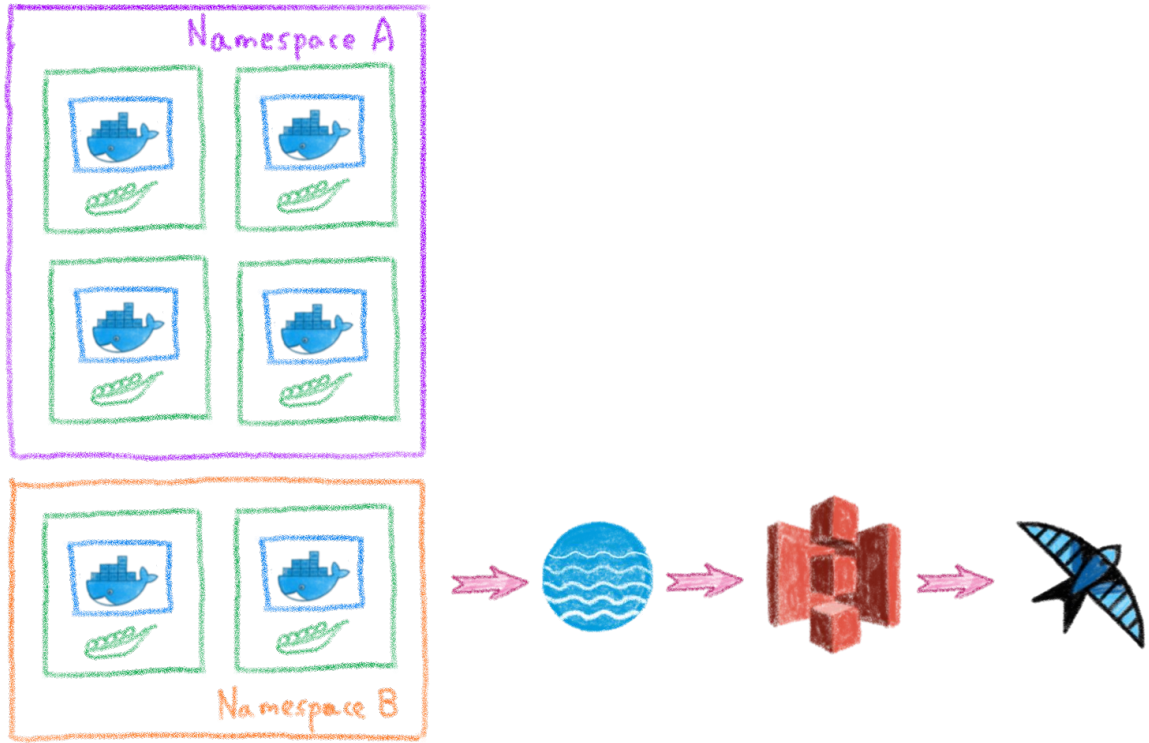
Backup and migrate Kubernetes applications
and their persistent volumes

S3 based backup

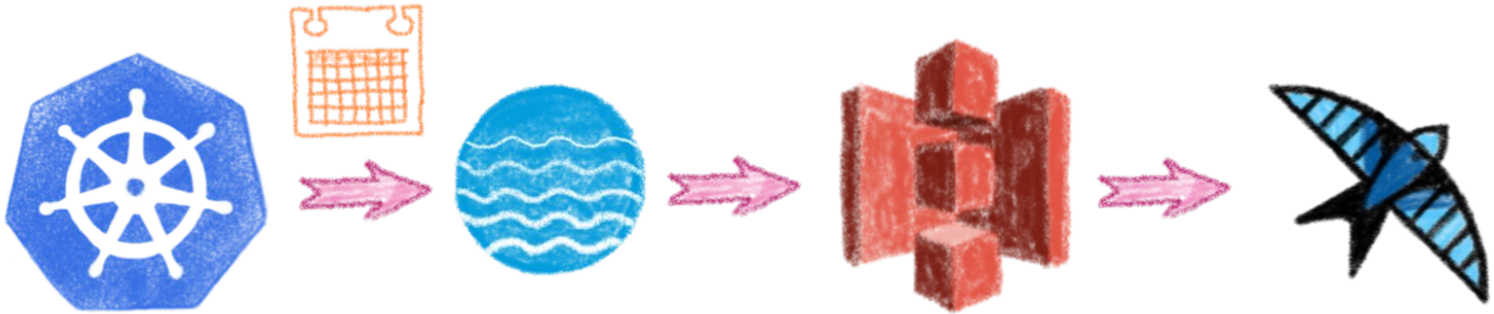


On any S3 protocol compatible store

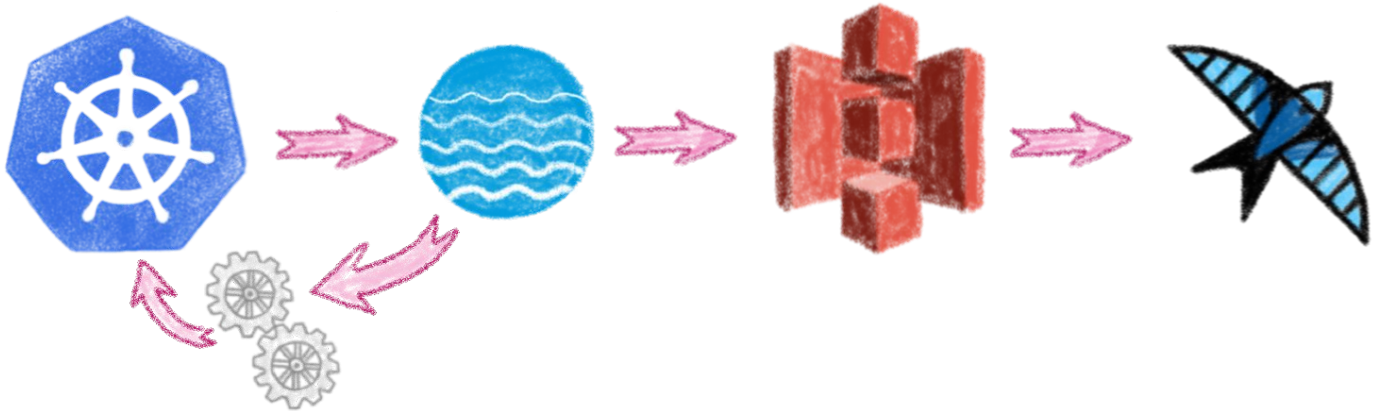
Backup all or part of a cluster



Schedule backups



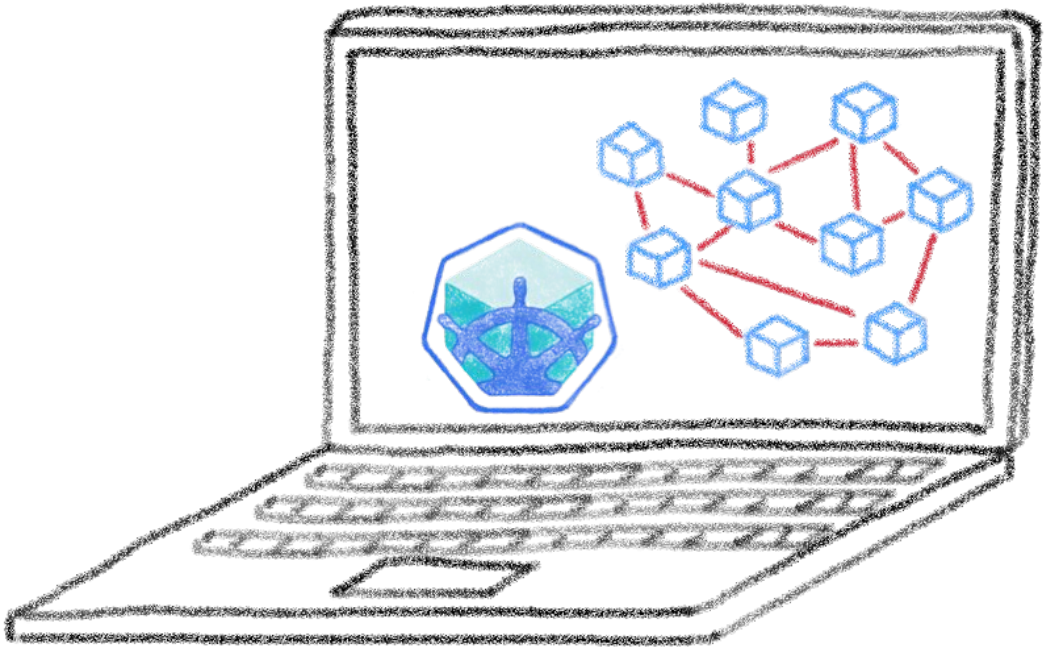
Backups hooks



Conclusion

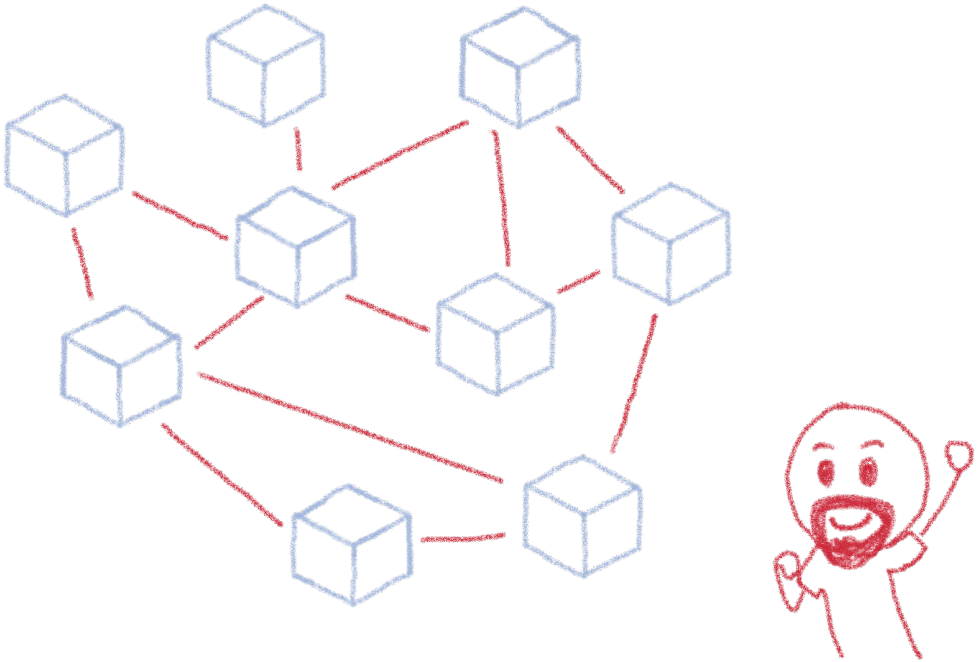
And one more thing…

Kubernetes is easy to begin with



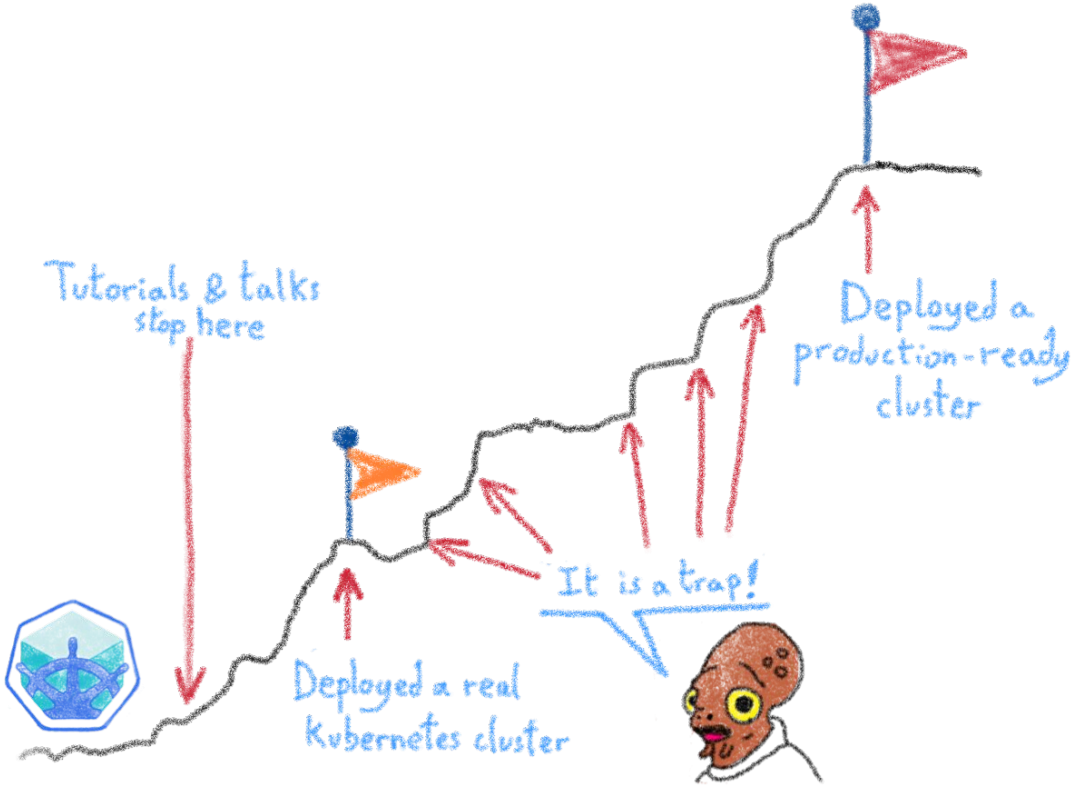
Minikube, K3s...

Kubernetes is powerful



It can make Developers' and DevOps' lives easier

But there is a price: operating it



Lot of things to think about

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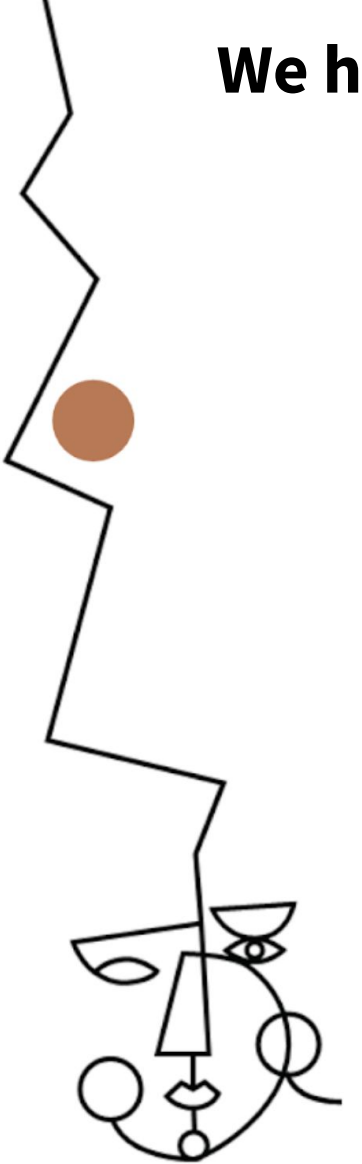
We have seen some of them



Different roles

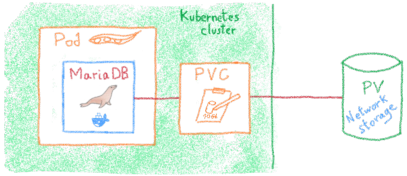
Cluster operator

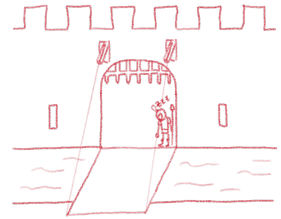
Cluster administrator

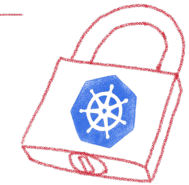
Developer

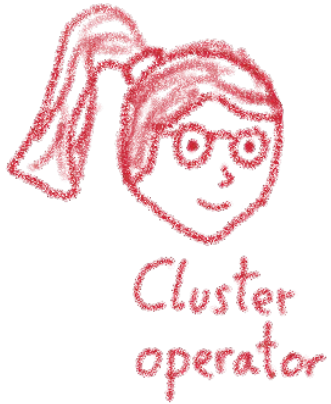
Each role asks for very different knowledge and skill sets

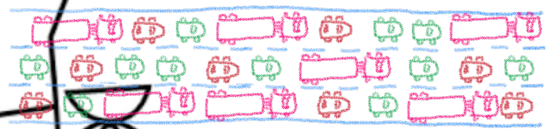
Operating a Kubernetes cluster is hard

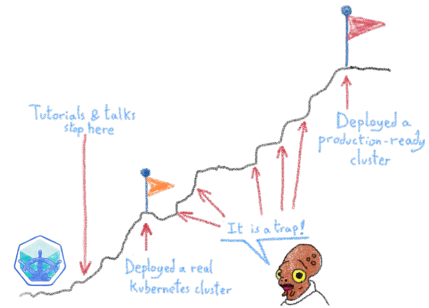






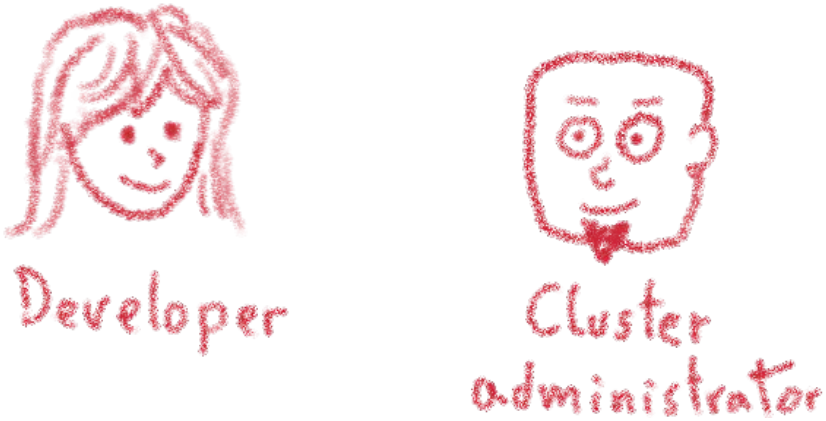






But we have a good news...

Most companies don't need to do it!



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

@LostInBrittany

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

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by CIONET

Thank you for listening!