



# kubernetes



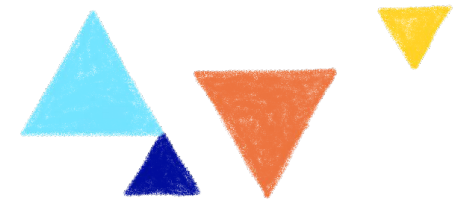
## OVHcloud Kubernetes Tech Lab Spain

Horacio Gonzalez

2023-03-14 / 2023-03-15 - Madrid



@LostInBrittany



# Who are we?

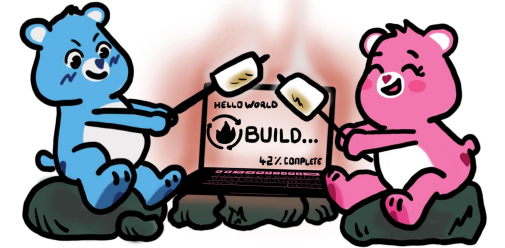
Introducing myself and  
introducing OVHcloud



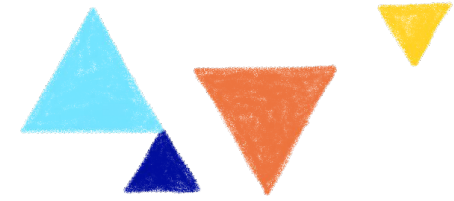
# Horacio Gonzalez

**@LostInBrittany**

Spaniard Lost in Brittany



# OVHcloud



**Web Cloud & Telecom**



**Private Cloud**



**Public Cloud**



**Storage**



**Network & Security**



**30 Data Centers**  
in 12 locations



**34 Points of Presence**  
on a 20 TBPS Bandwidth Network



**2200 Employees**  
worldwide



**115K Private Cloud**  
VMS running



**300K Public Cloud**  
instances running



**380K Physical Servers**  
running in our data centers



**1 Million+ Servers**  
produced since 1999



**1.5 Million Customers**  
across 132 countries



**3.8 Million Websites**  
hosting



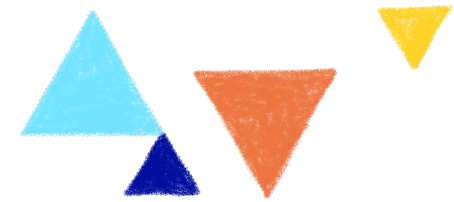
**1.5 Billion Euros Invested**  
since 2016



**P.U.E. 1.09**  
Energy efficiency indicator

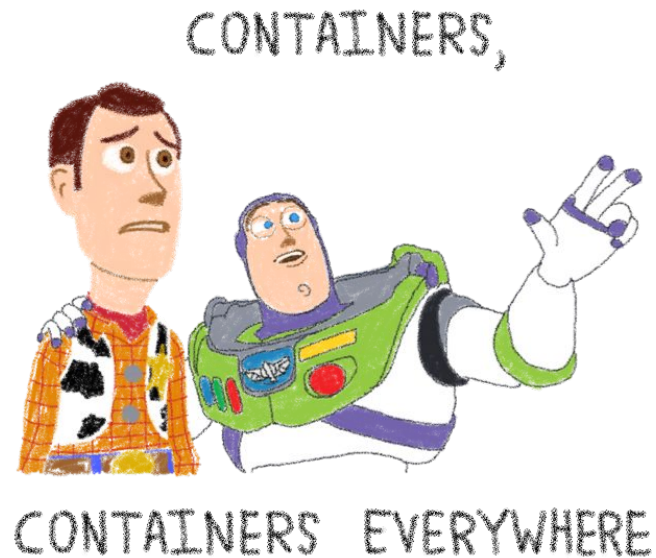


**20+ Years in Business**  
Disrupting since 1999

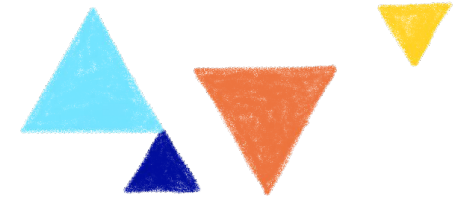


# Why do we need Kubernetes?

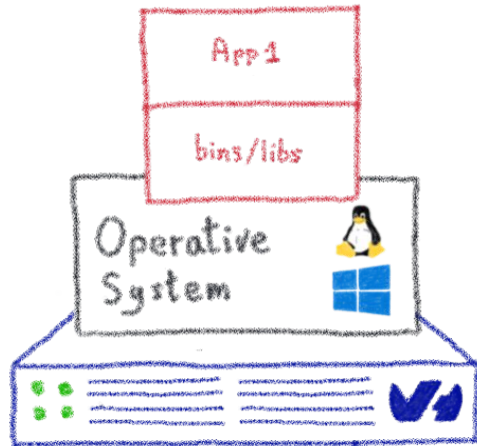
Taming the complexity of operating containers



# From bare metal to containers



Bare metal  
servers

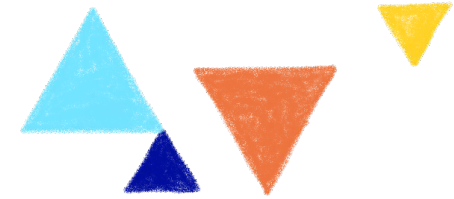


Linux

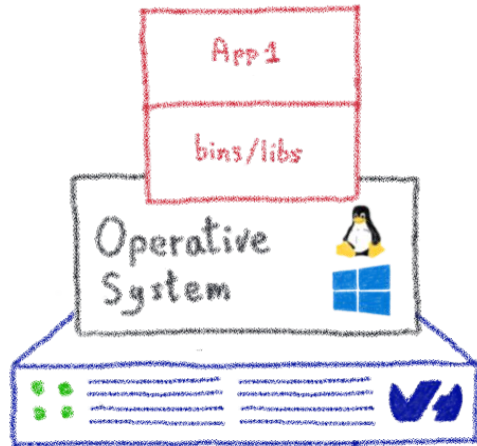


Windows

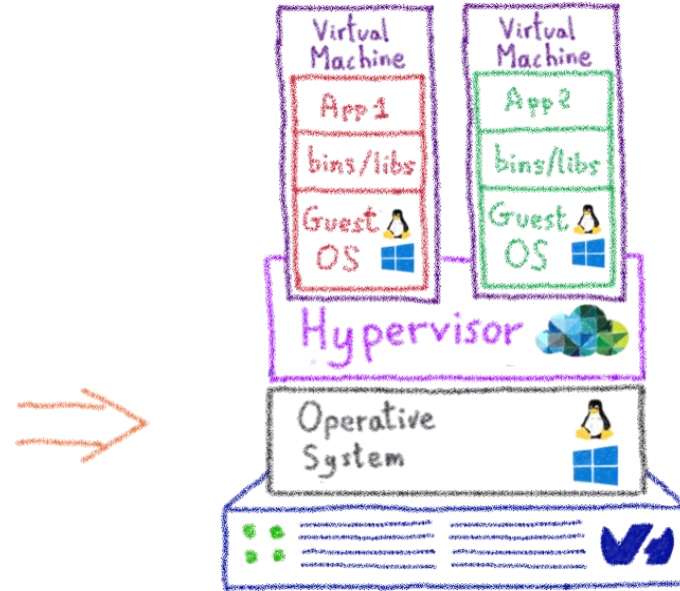
# From bare metal to containers



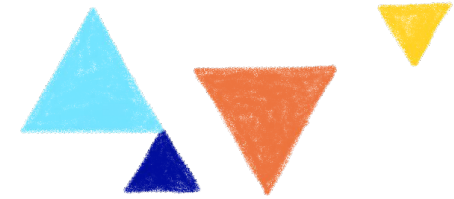
Bare metal servers



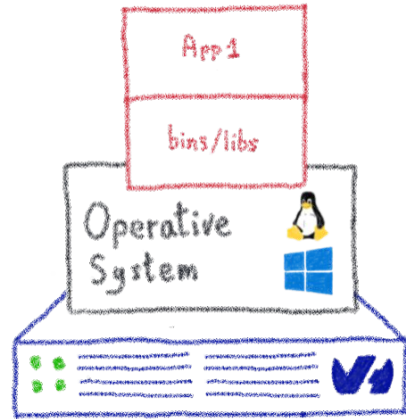
Virtual Machines



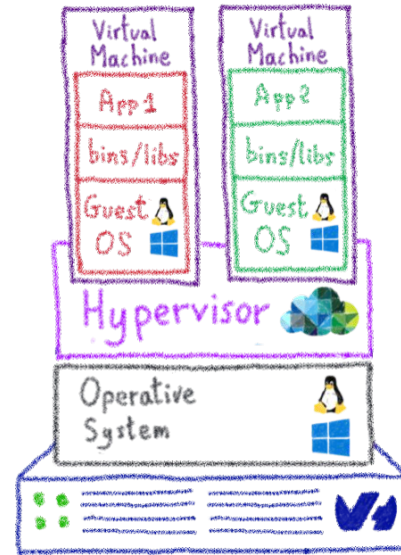
# From bare metal to containers



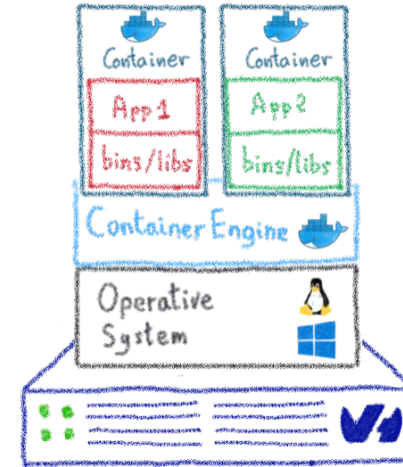
Bare metal servers



Virtual Machines

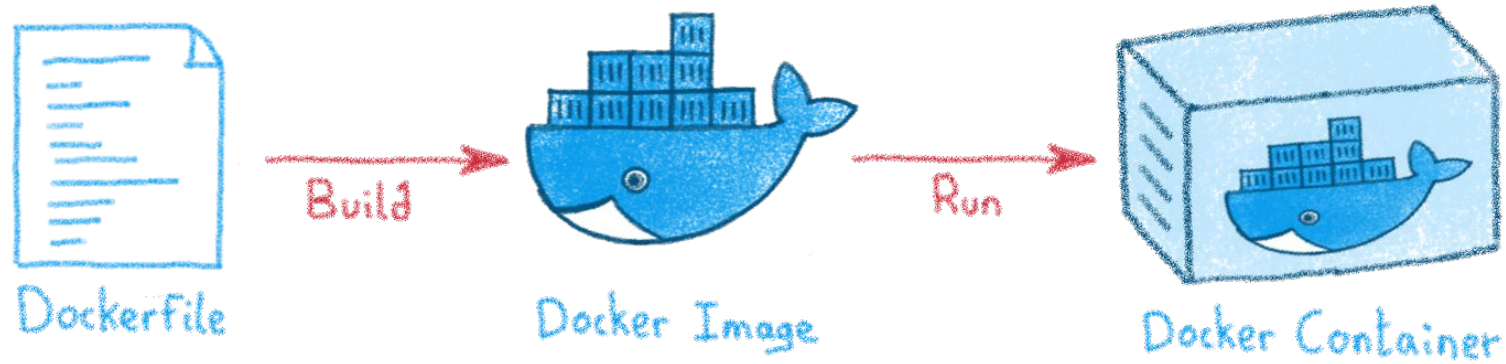
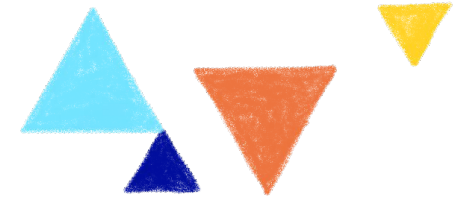


Containers

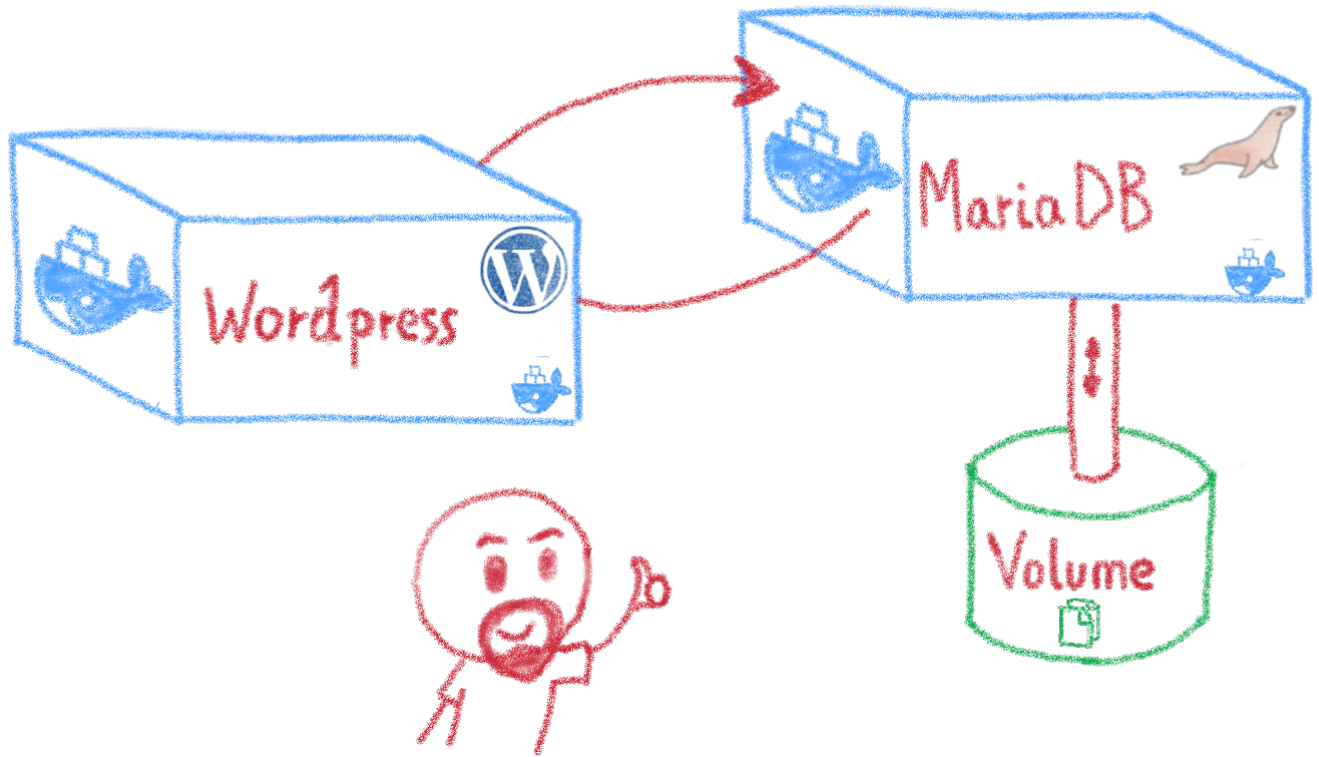
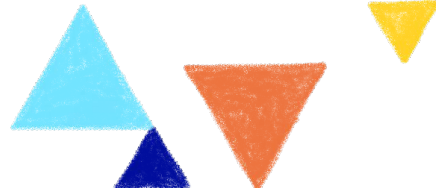




# Dockerfiles, images and containers

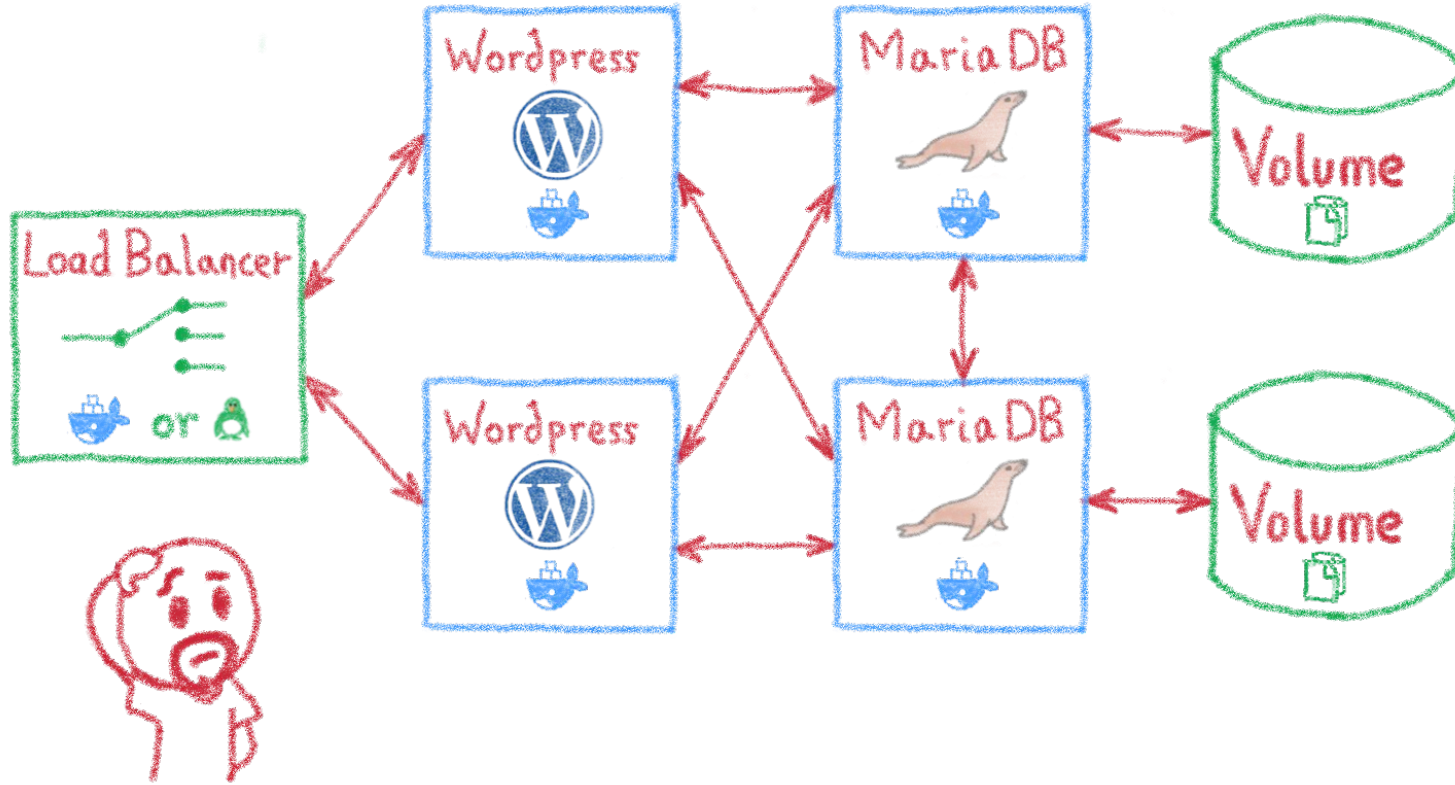
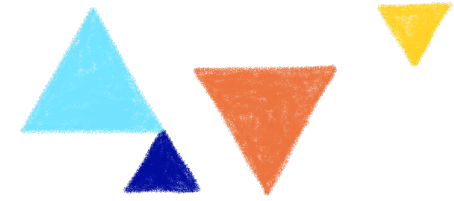


# Containers are easy...



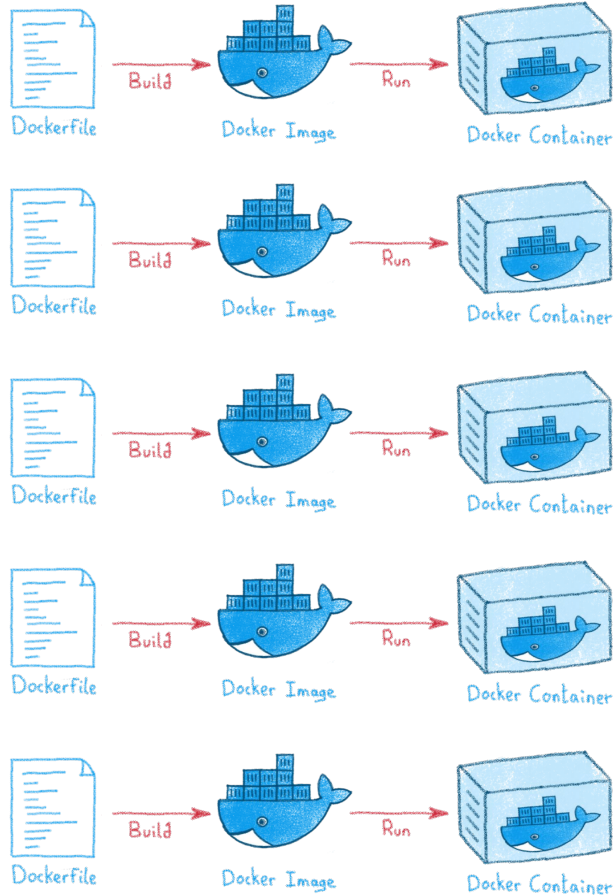
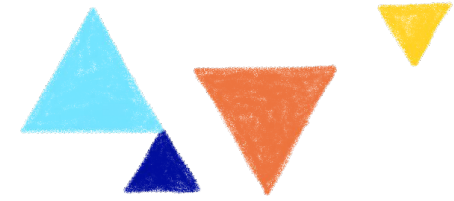
For developers

# Less simple if you must operate them



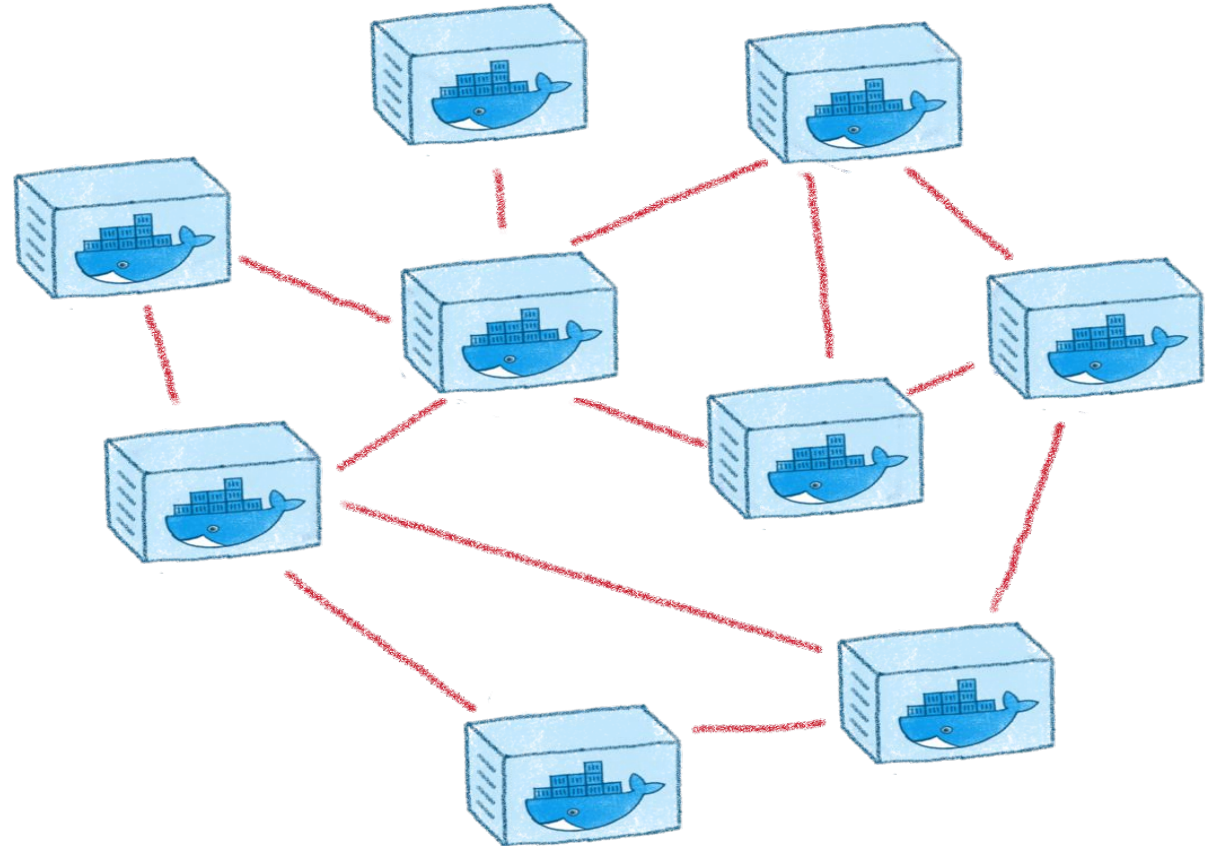
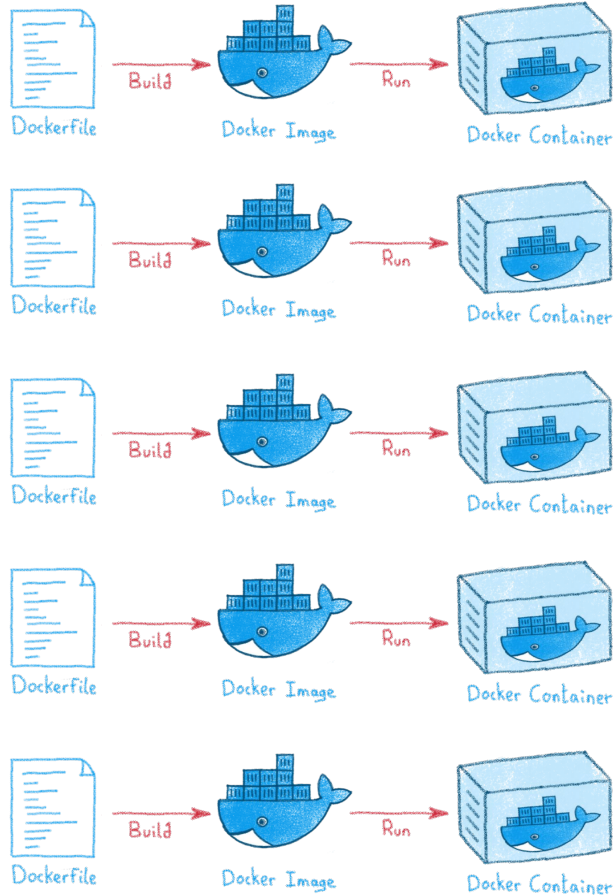
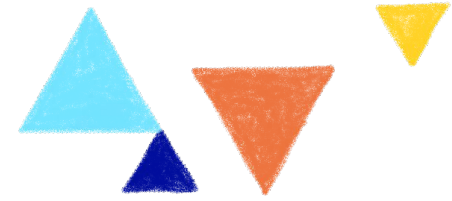
Like in a production context

# And what about microservices?



Are you sure you want to operate them by hand?

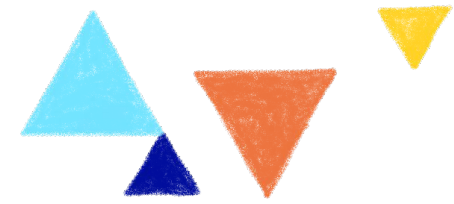
# And what about microservices?



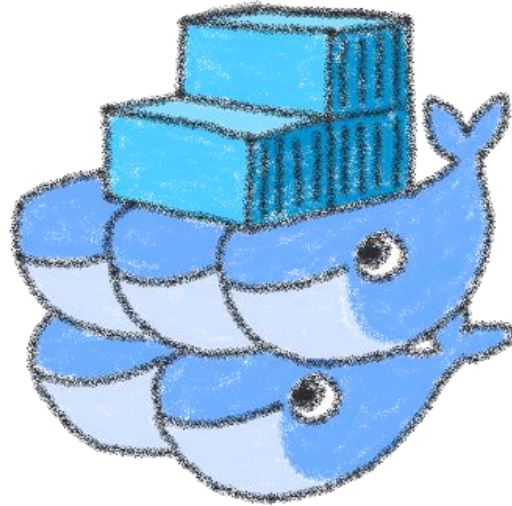
Are you sure you want to operate them by hand?



# Helping to tame de complexity



Docker  
Compose

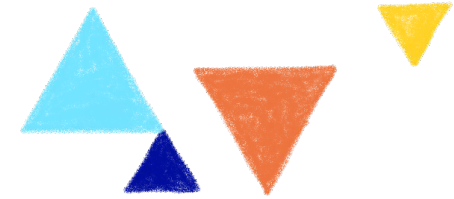


Docker  
Swarm



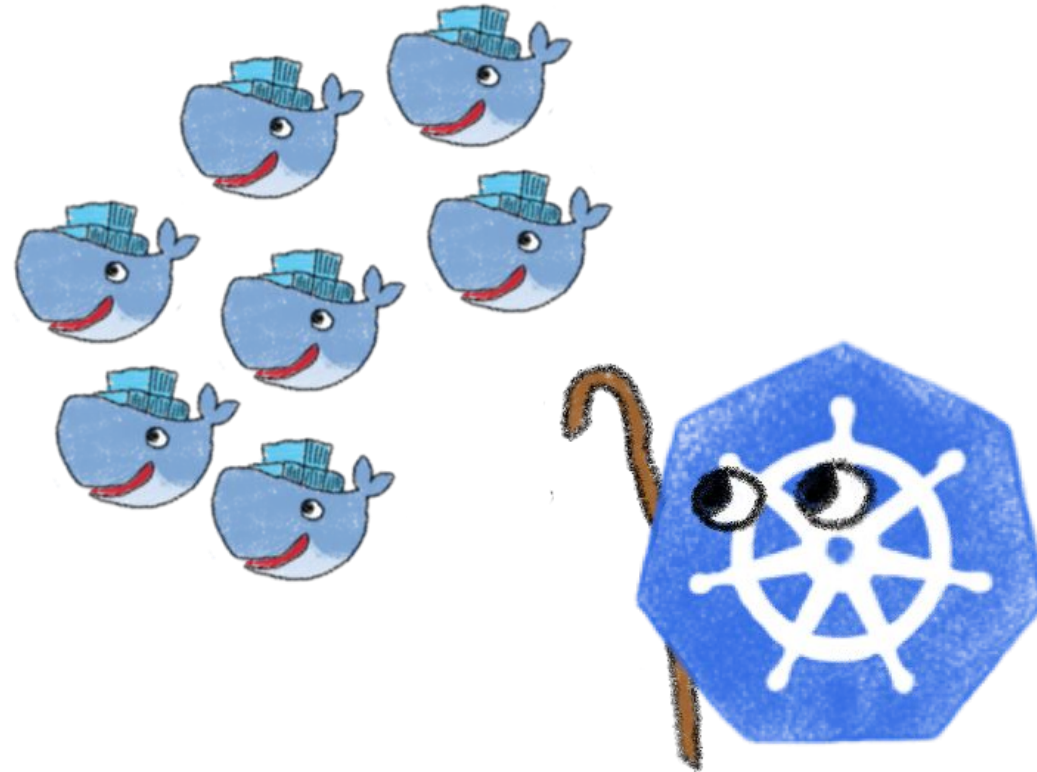
kubernetes

# Kubernetes: a full orchestrator

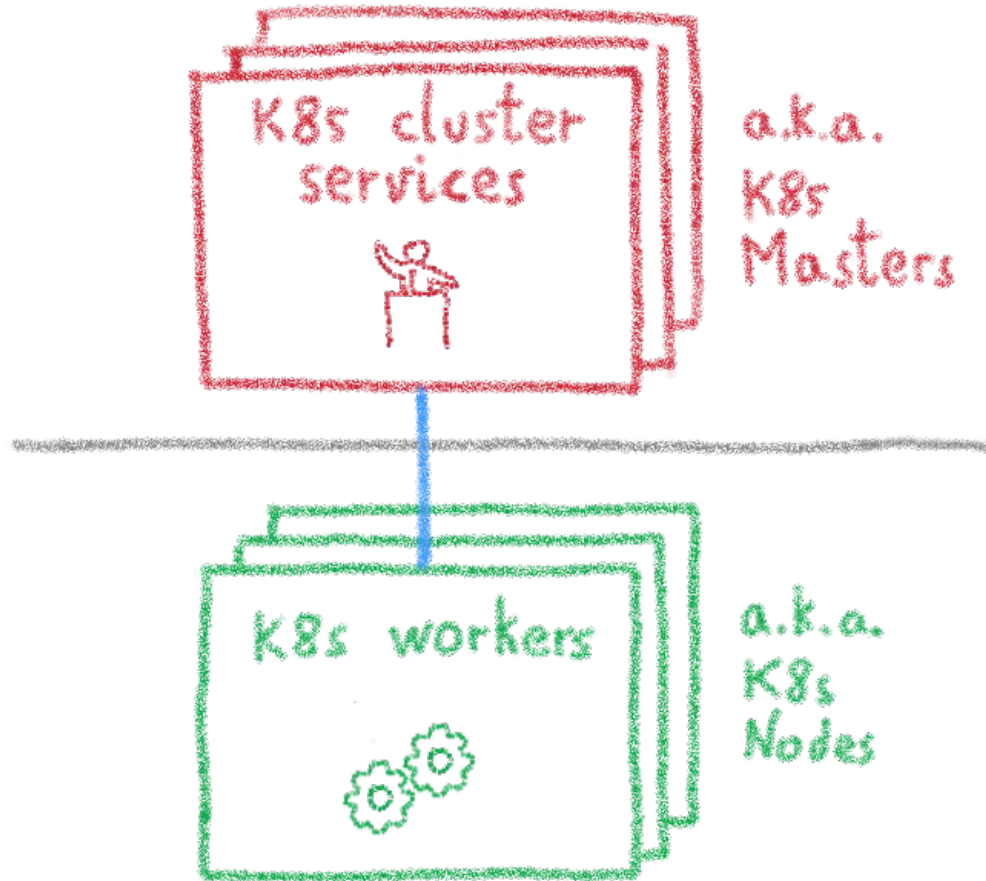
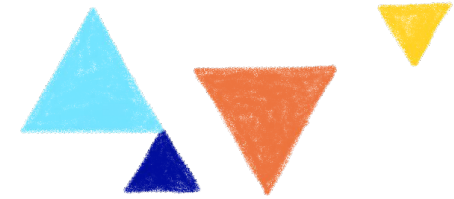


Takes care of:

- Deployment
- Scaling
- Monitoring
- Repairing
- Securing
- ...

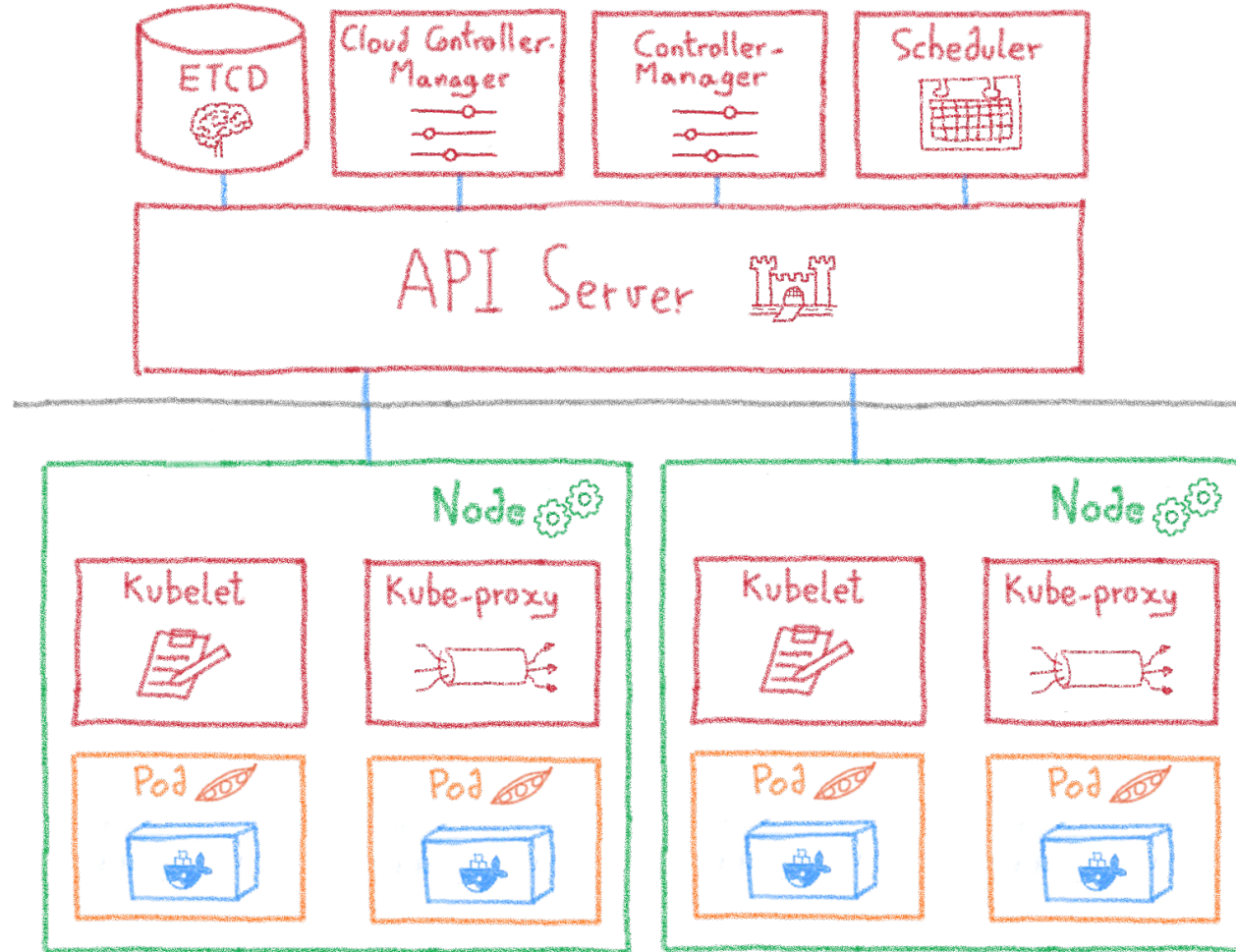
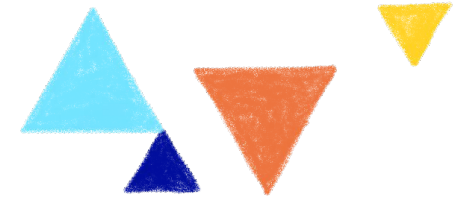


# Kubernetes cluster: masters and nodes

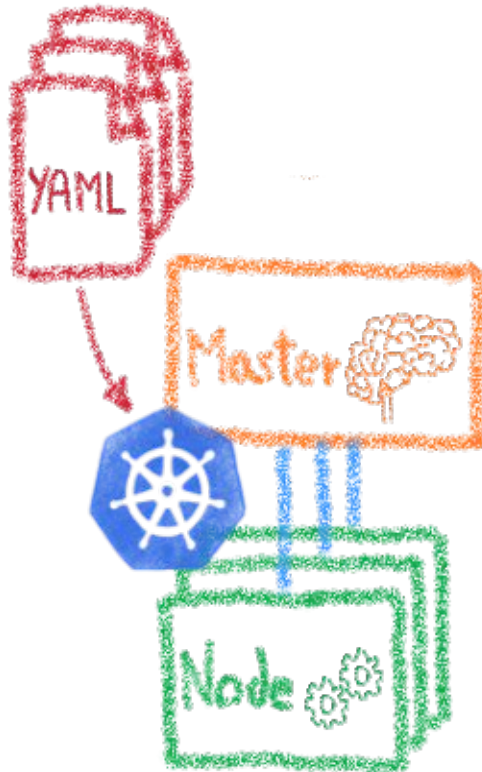
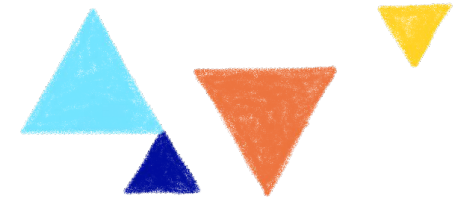




# Kubernetes cluster: more details



# Desired State Management

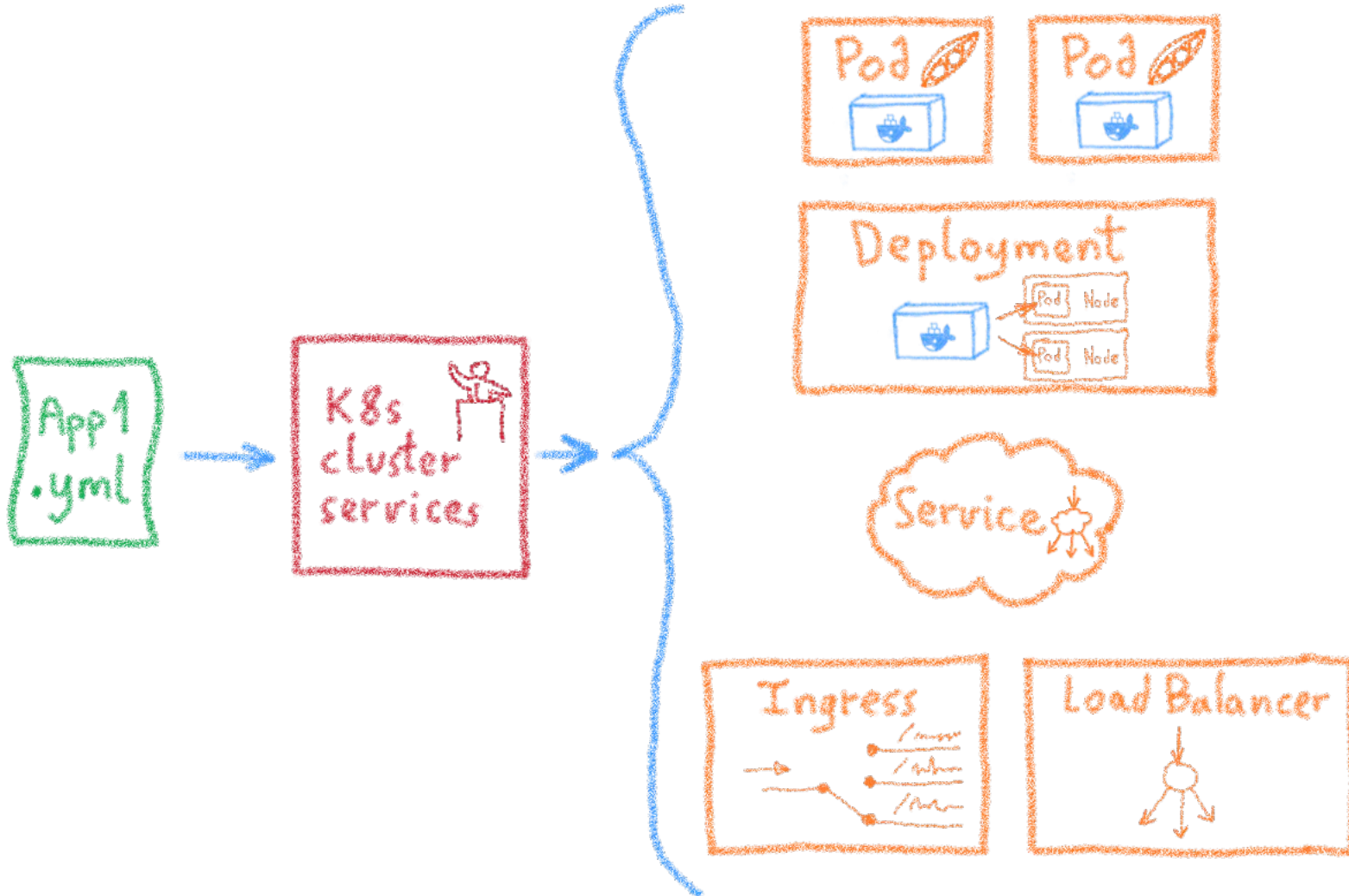
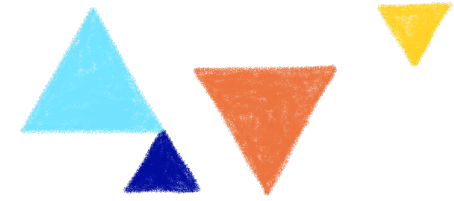


Manifest files:

Text files in YAML format  
High-level description of  
the target architecture

Declarative infrastructure

# Desired State Management



Ingress

Services

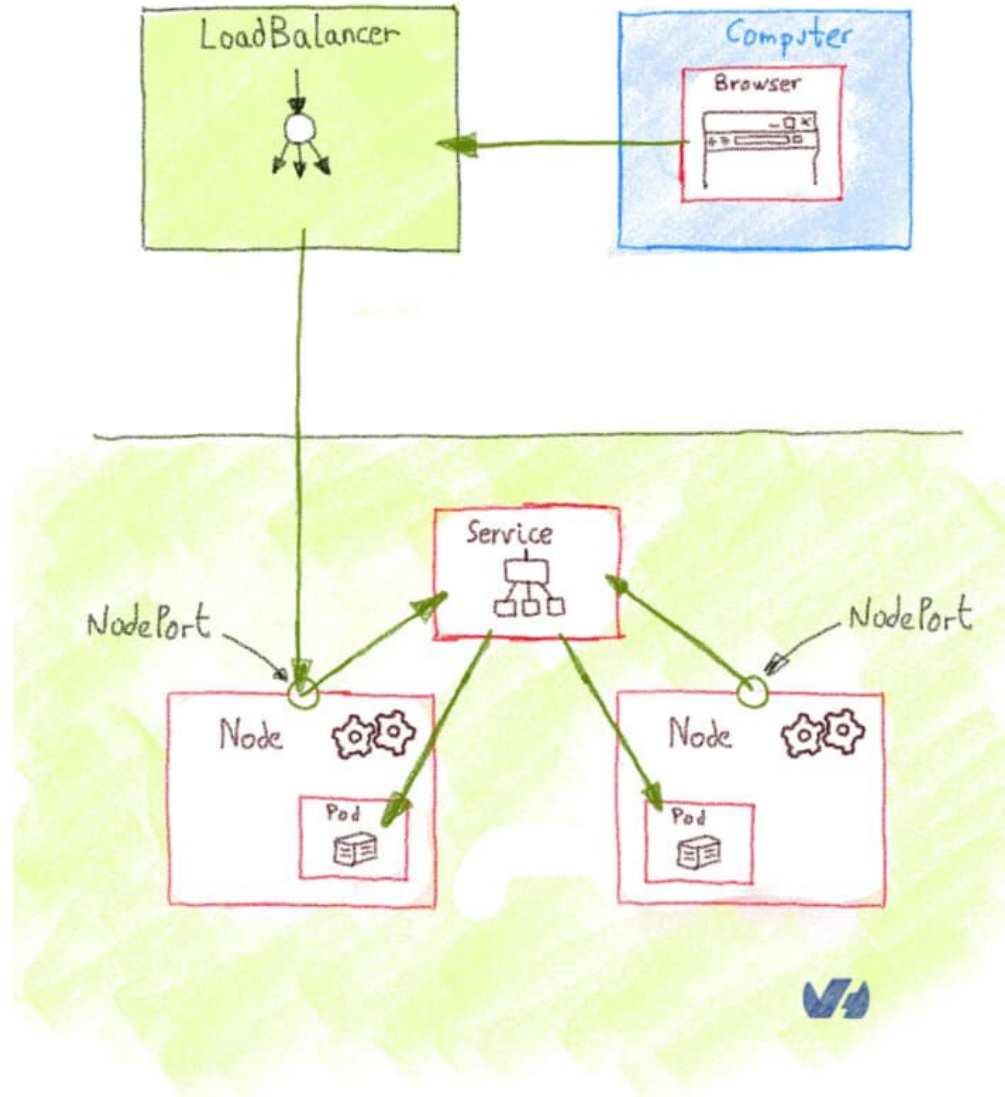
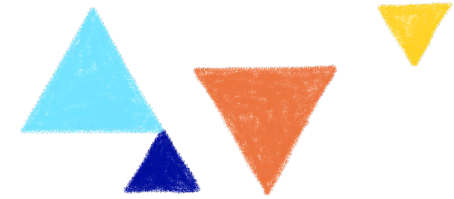
Deployments

Pods

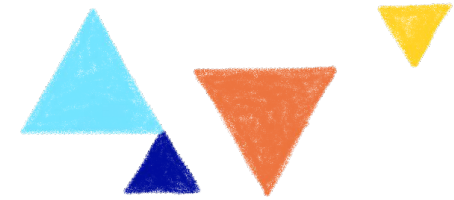
Sidecars

Replica Sets

# Let's deploy an application



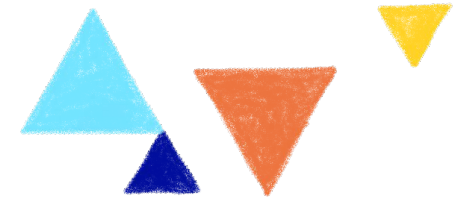
# Demo: Hello Kubernetes World



The screenshot shows the OVHcloud website header with navigation links: "My customer account", "Contact Sales", "Webmail", "Support", "Communities", and "OVHcloud Blog". Below the header is a secondary navigation bar with links for "Bare Metal Cloud", "Hosted Private Cloud", "Public Cloud", "Web Hosting & Domains", "Enterprise", "Ecosystem", and "About". The main content area has a breadcrumb trail: "Public Cloud > Managed Kubernetes (k8s) > Deploying a Hello World application with the OVHcloud Control Panel". A language selector shows "English (GB)". The main heading is "Deploying a Hello World application with the OVHcloud Control Panel" with a play button icon to the left. Below the heading is the text "Find out how to deploy a Hello World application with the OVHcloud Control Panel".

<https://docs.ovh.com/gb/en/kubernetes/deploying-hello-world/>

# Needed tools: kubectl



The screenshot shows the Kubernetes documentation website. The top navigation bar includes links for 'Kubernetes Documentation', 'Kubernetes Blog', 'Training', 'Partners', 'Community', 'Case Studies', 'Versions', and 'English'. A search bar is located on the left side of the page. The main content area is titled 'Install Tools' and 'kubectl'. The text describes kubectl as the Kubernetes command-line tool and provides a link to the 'kubectl reference documentation'. A list of links for installing kubectl on different operating systems is visible at the bottom of the page.

Kubernetes Documentation / Tasks / Install Tools

## Install Tools

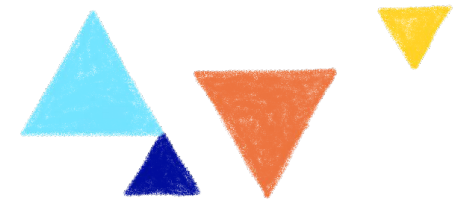
### kubectl

The Kubernetes command-line tool, [kubectl](#), allows you to run commands against Kubernetes clusters. You can use kubectl to deploy applications, inspect and manage cluster resources, and view logs. For more information including a complete list of kubectl operations, see the [kubectl reference documentation](#).

kubectl is installable on a variety of Linux platforms, macOS and Windows. Find your preferred operating system below.

- [Install kubectl on Linux](#)

<https://kubernetes.io/docs/tasks/tools/>



# Putting Kubernetes in production

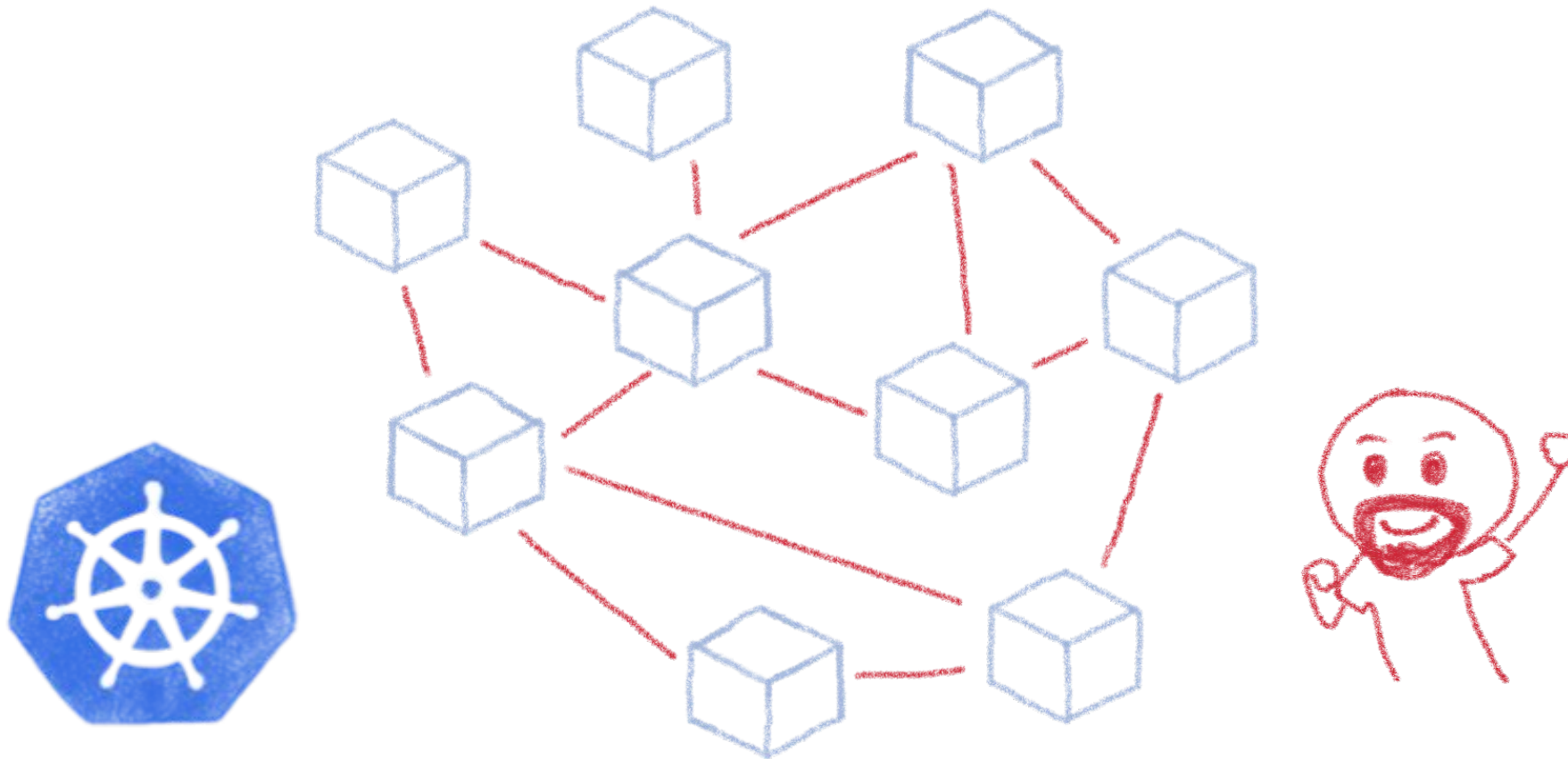
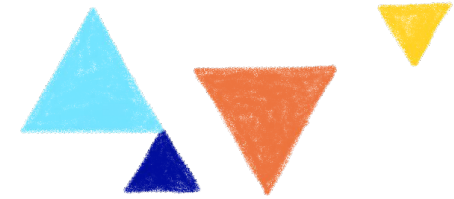
A journey not for the faint of heart

ONE DOES NOT SIMPLY



DEPLOYS K8S IN PRODUCTION

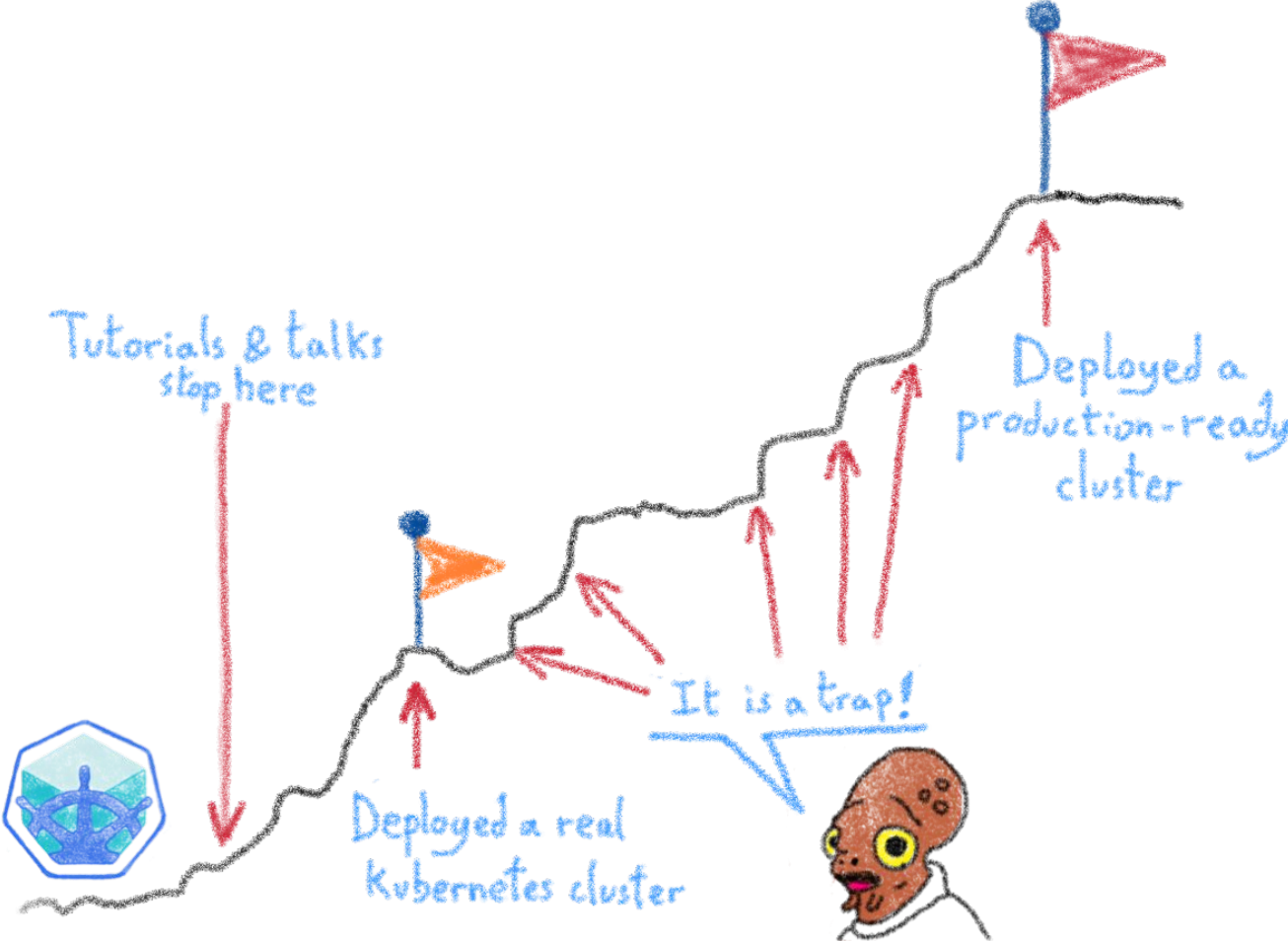
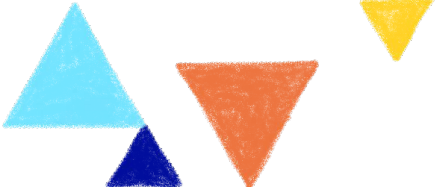
# Kubernetes can be wonderful



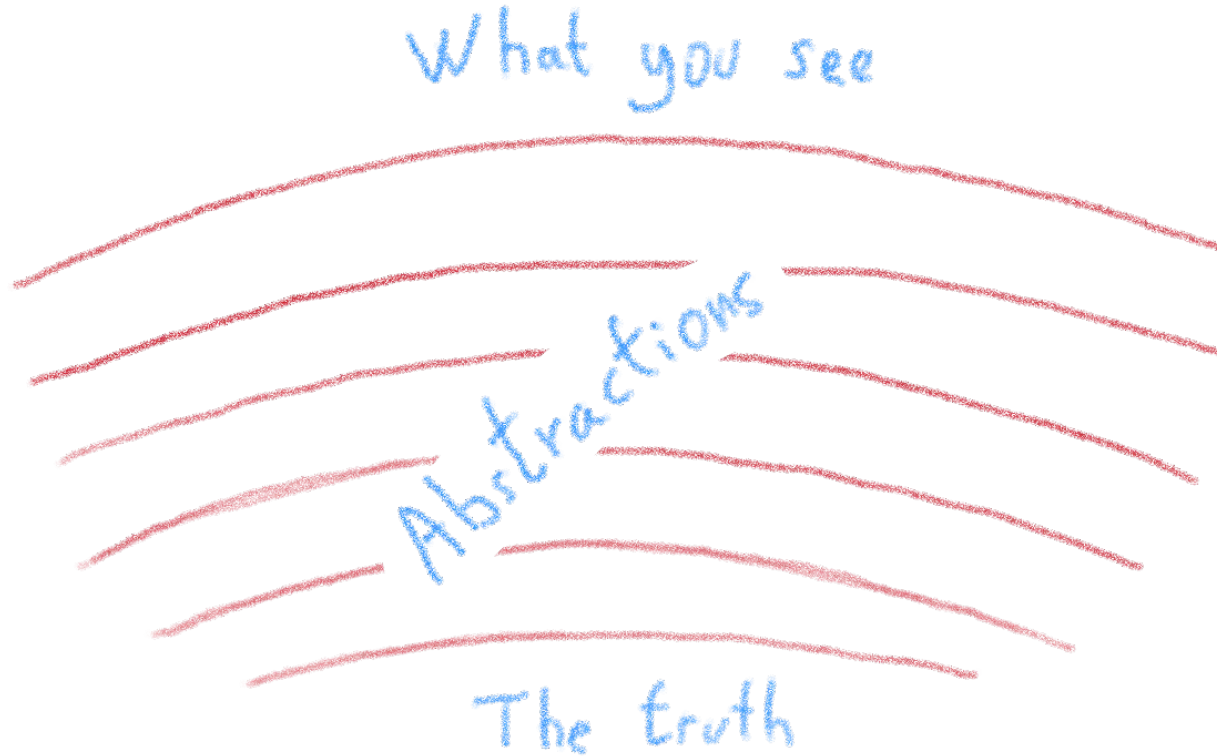
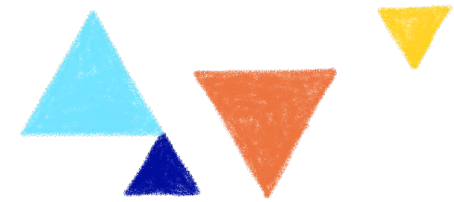
For both developers and devops



# The journey from dev to production

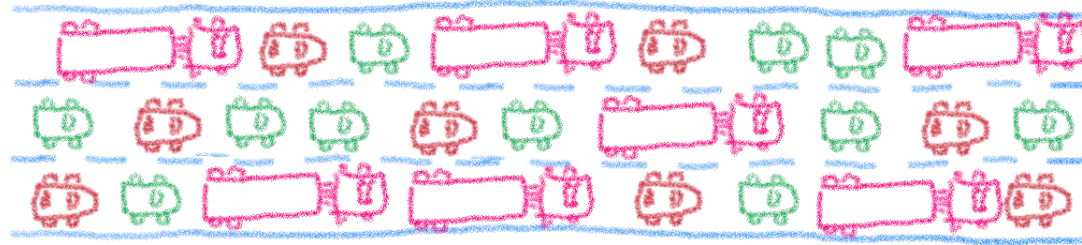
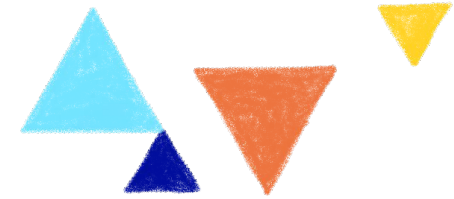


# It's a complex technology



Lots of abstraction layers

# Kubernetes networking is complex...



All this traffic...  
is it normal?



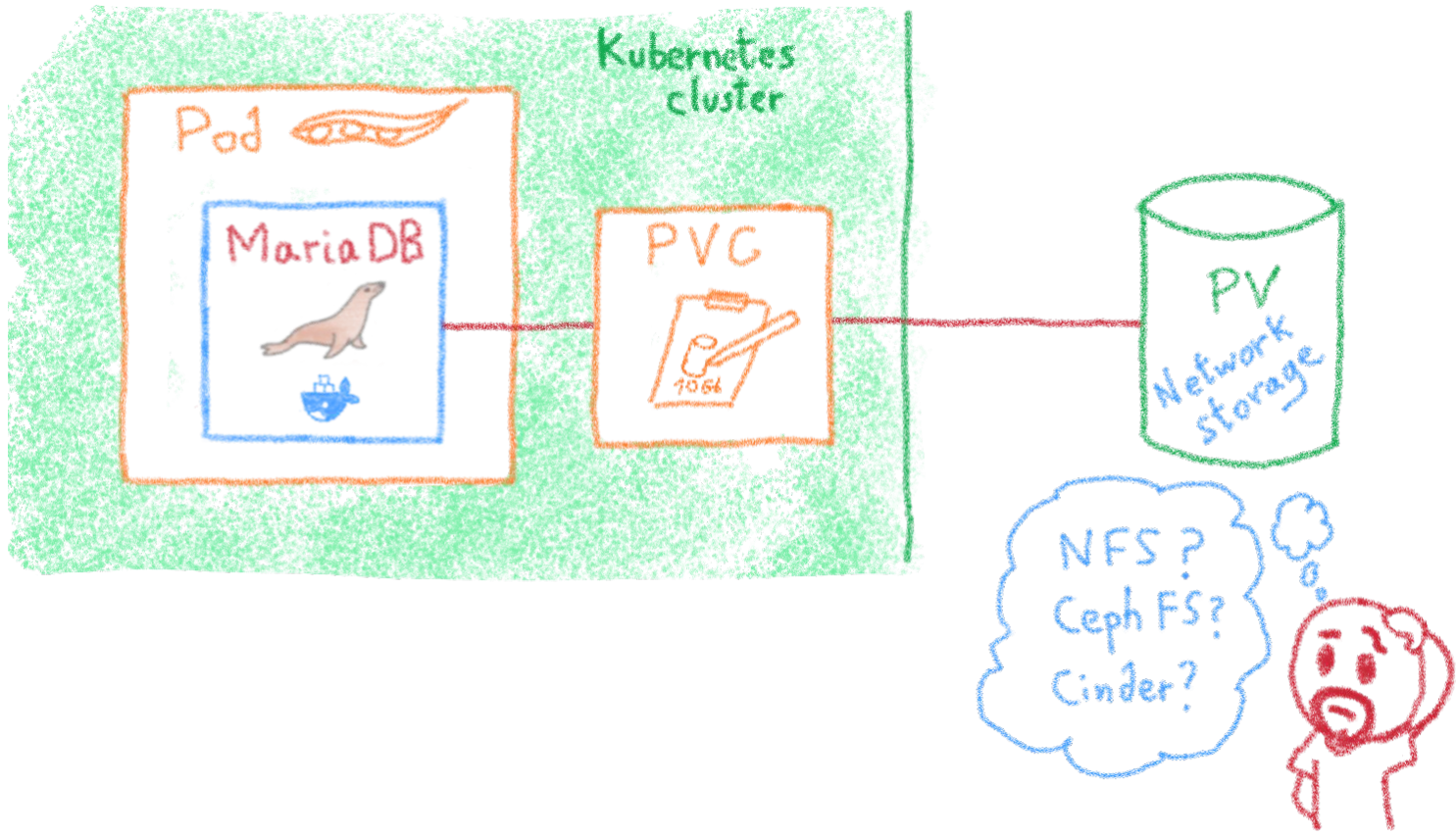
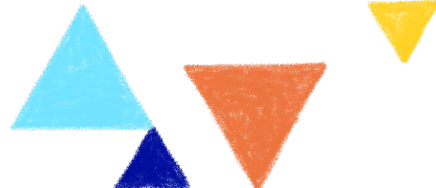
Network plugins (Flannel, Calico, Weave...)

- IPAM
- iptables
- routing
- crossnode networking

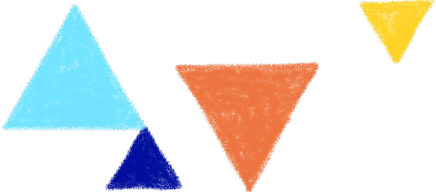
Cluster IP, NodePort, Ingress

Service Meshes, Istio

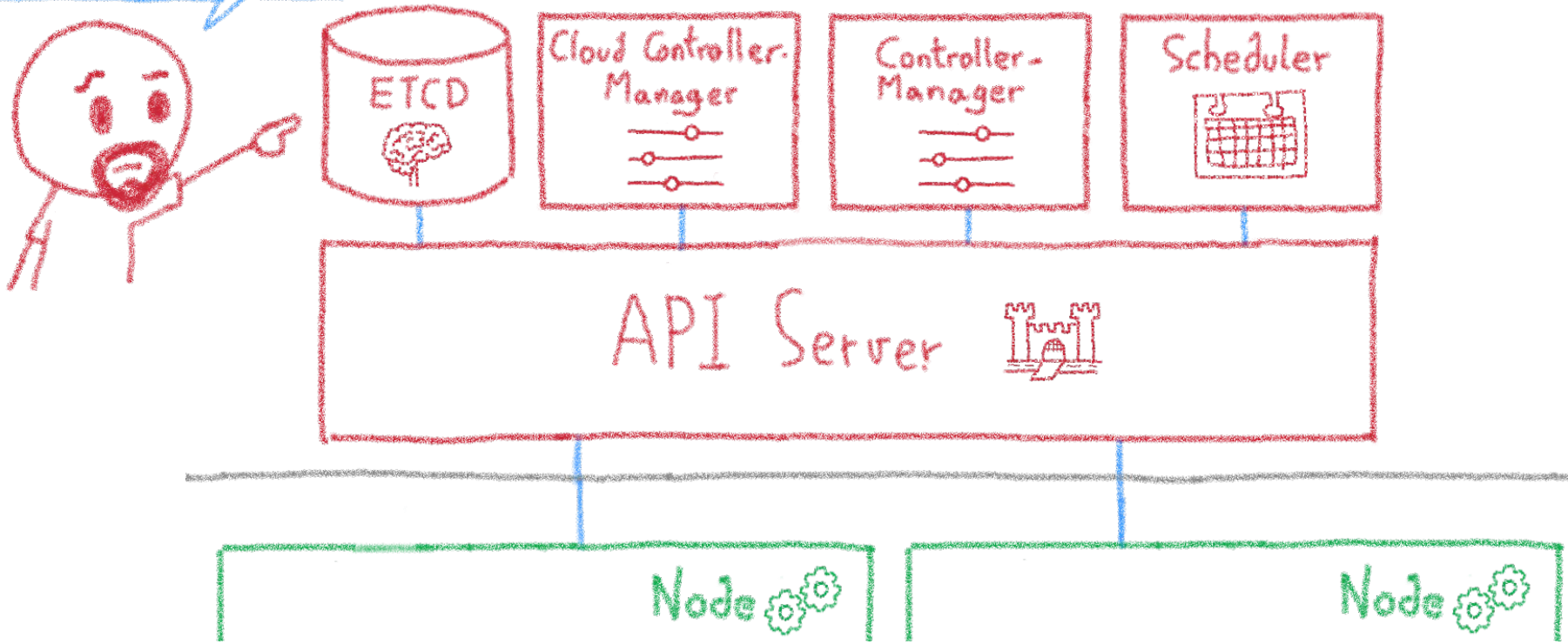
# The storage dilemma



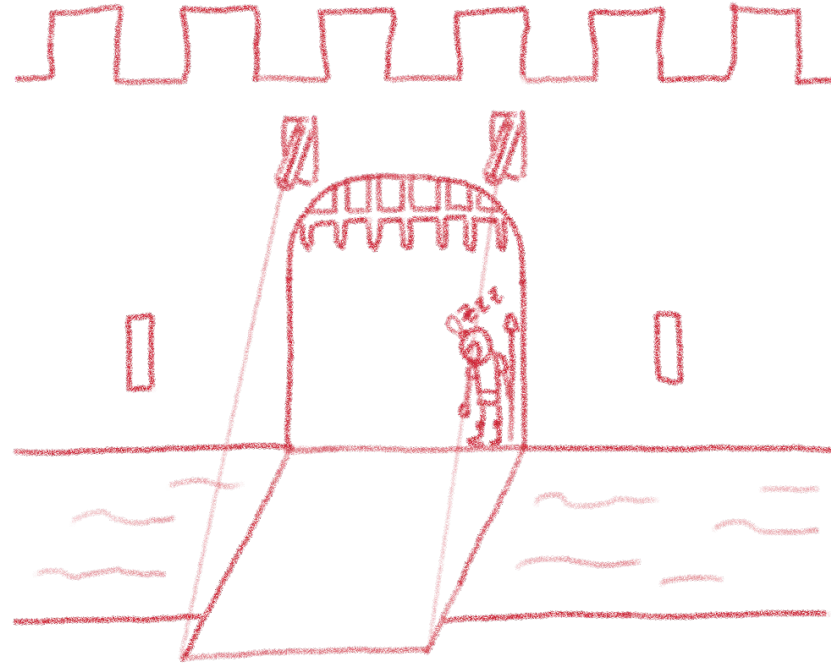
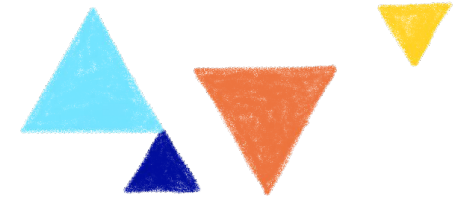
# The ETCD vulnerability



A single instance ETCD?  
Are you sure?



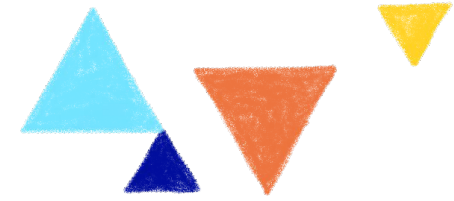
# Kubernetes is insecure by design\*



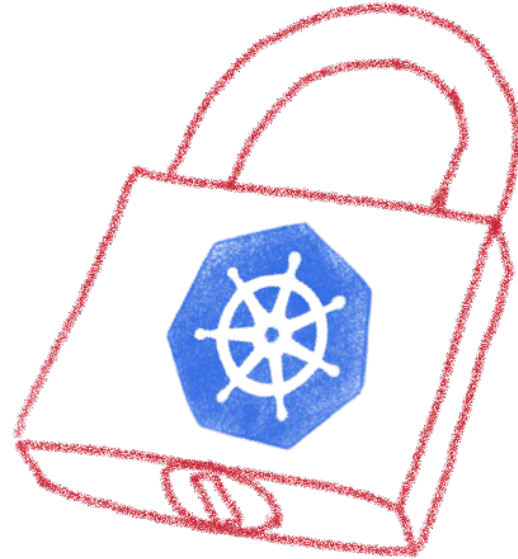
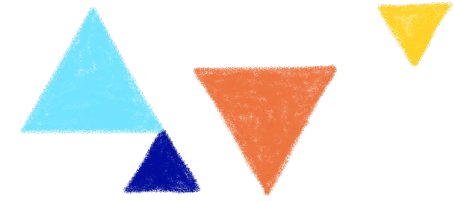
It's a feature, not a bug.

Up to K8s admin to secure it according to needs

# Not everybody has the same security needs

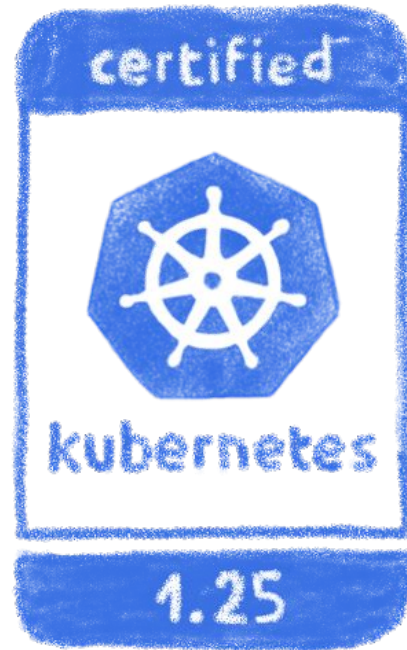
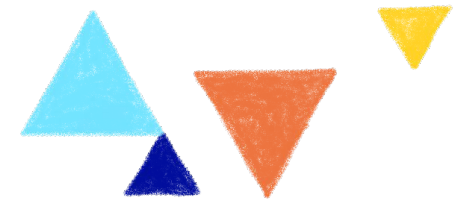


# Kubernetes allows to enforce security practices as needed



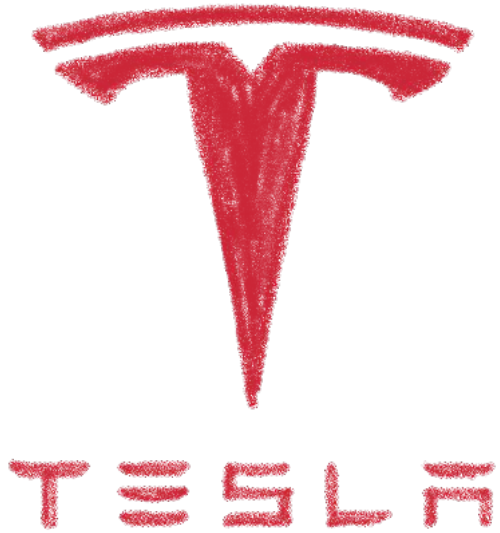
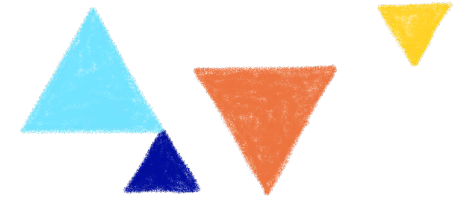


# Always keep up to date



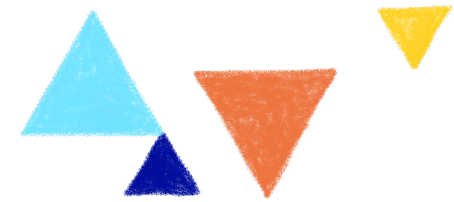
Both Kubernetes and plugins

# And remember, even the best can get hacked



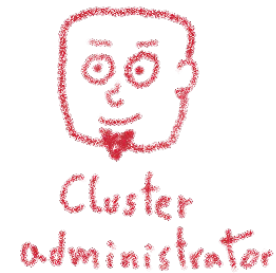
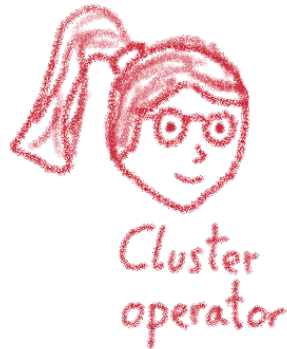
One of Tesla's cluster got hacked  
via an unprotected K8s API endpoint,  
and was used to mine cryptocurrency...

Remain attentive, don't get too confident

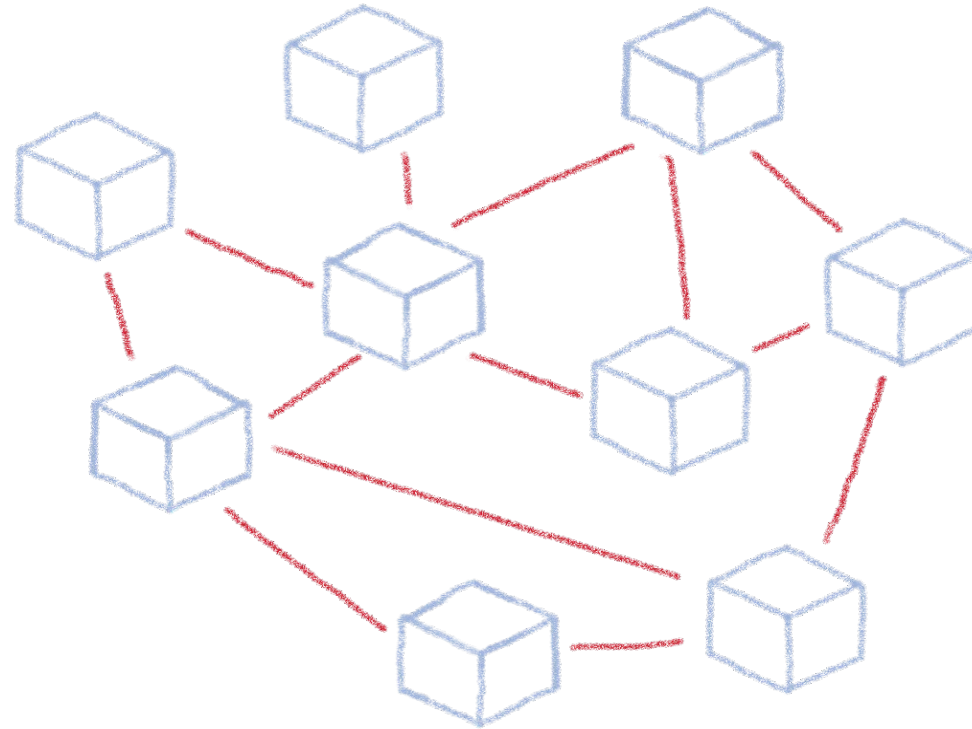
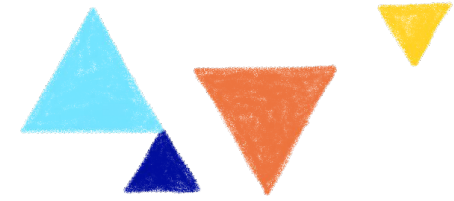


# A managed Kubernetes

**Because your company job is to use Kubernetes,  
not to operate it!**

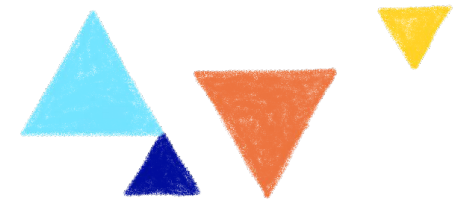


# Kubernetes is powerful



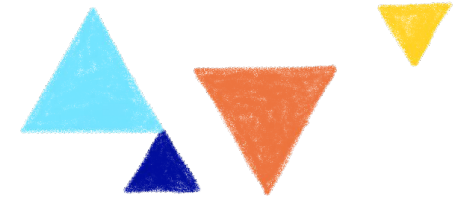
It can make Developers' and  
DevOps' lives easier

# But there is a price: operating it



Lot of things to think about

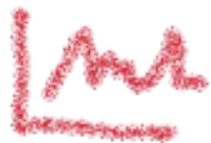
# We have seen some of them



Security



Deployment

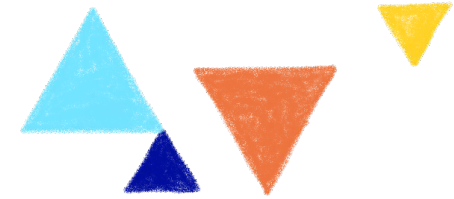


Monitoring



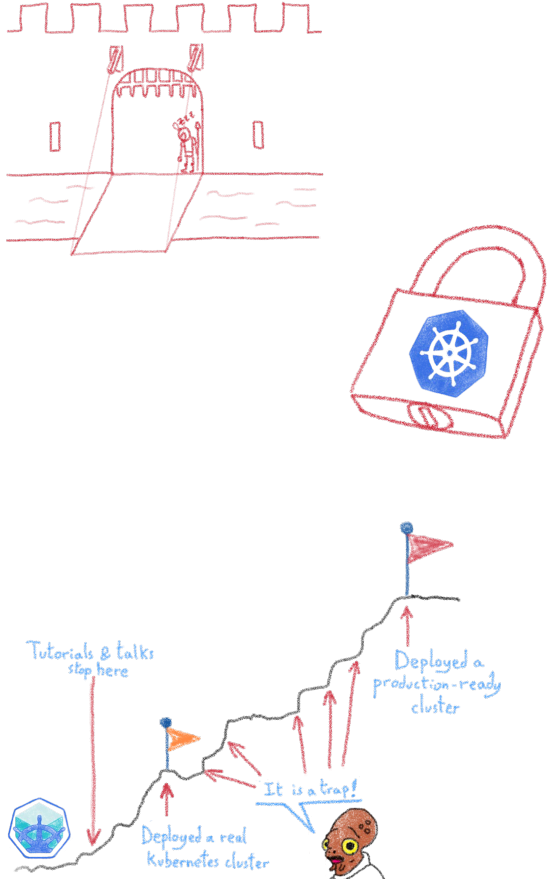
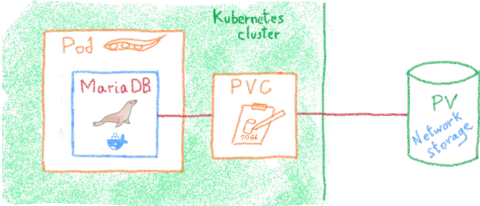
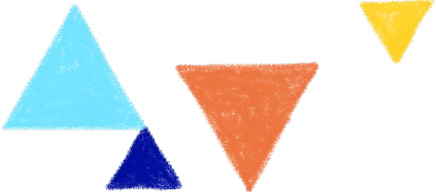
Backups

# Different roles



Each role asks for very different knowledge and skill sets

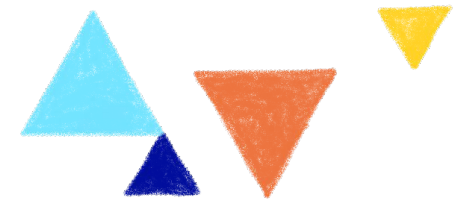
# Operating a Kubernetes cluster is hard



But we have a good news...



# Most companies don't need to do it!



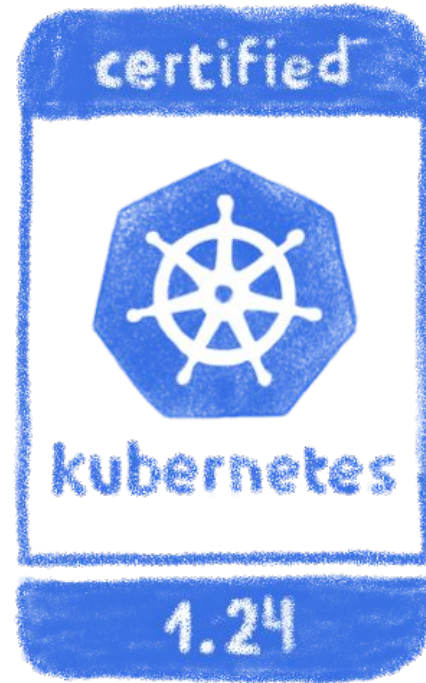
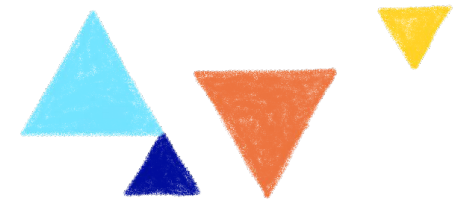
Developer



Cluster  
administrator

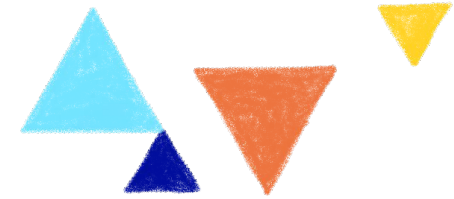
As they don't build and rack  
their own servers!

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



You get the cluster, the operator  
get the problems

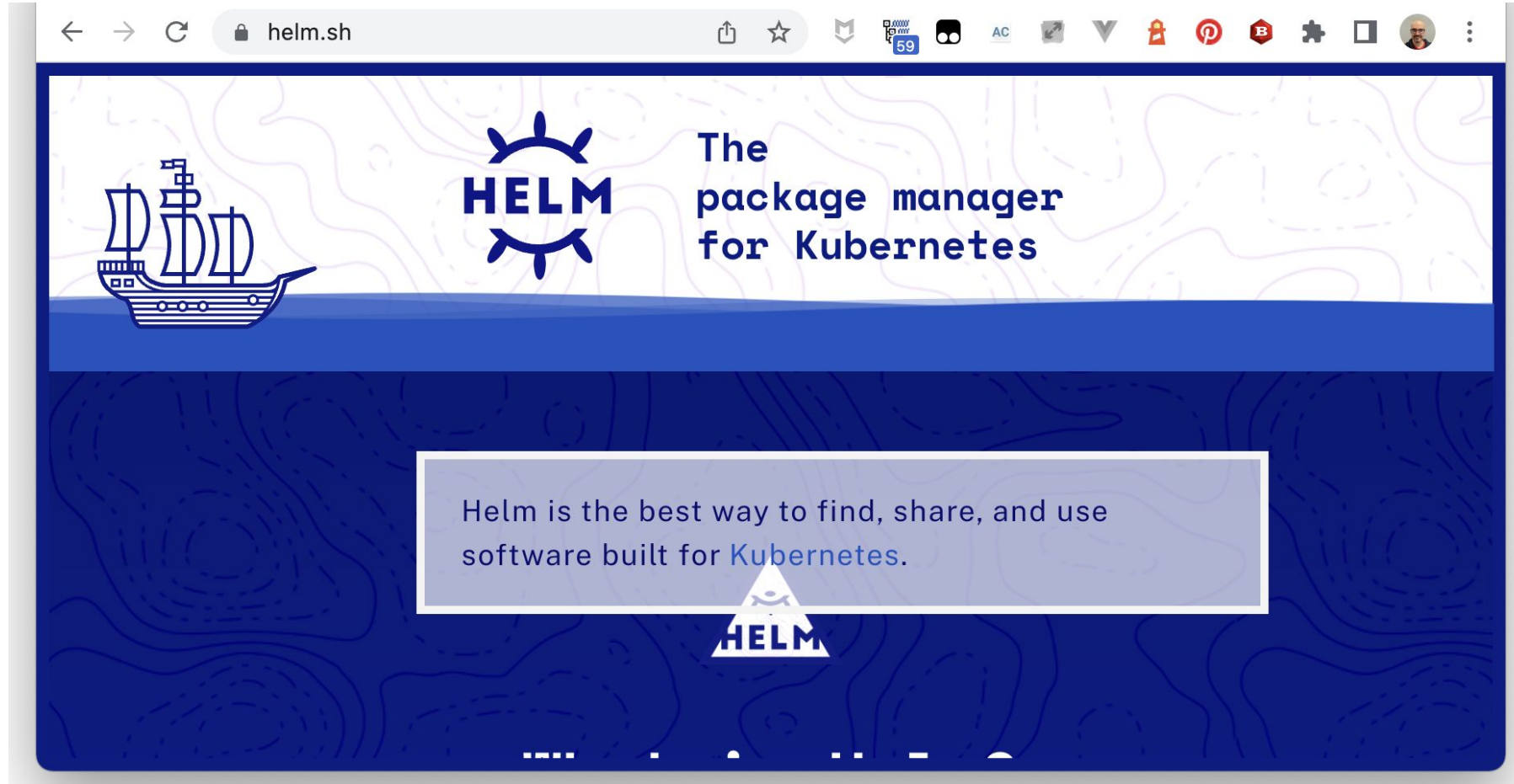
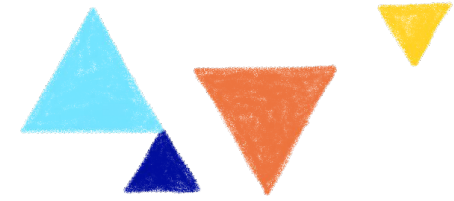
# Demo: A complete app - Wordpress



The screenshot shows the OVHcloud website header with navigation links: "Bare Metal Cloud", "Hosted Private Cloud", "Public Cloud", "Web Hosting & Domains", "Enterprise", "Ecosystem", and "About". The breadcrumb trail is "Public Cloud > Managed Kubernetes (k8s) > Installing WordPress on OVHcloud Managed Kubernetes". A language selector shows "English (GB)". The main heading is "Installing WordPress on OVHcloud Managed Kubernetes" with a play button icon to the left. Below the heading is the text "Find out how to install WordPress on OVHcloud Managed Kubernetes". At the bottom, there is a search bar with the placeholder text "Search OVHcloud documentation".

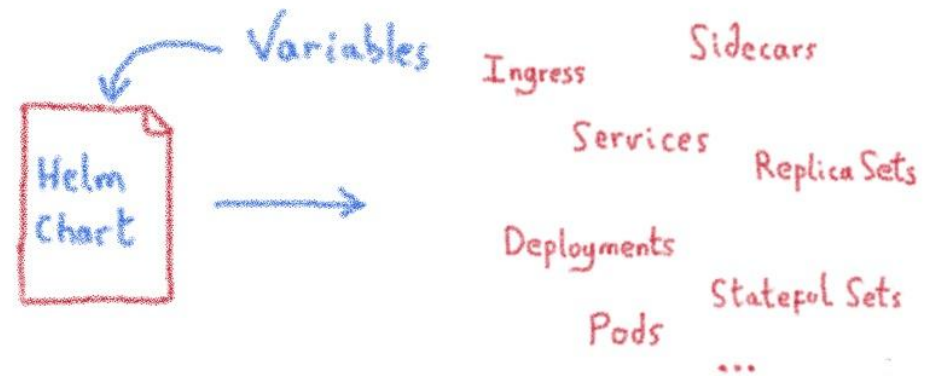
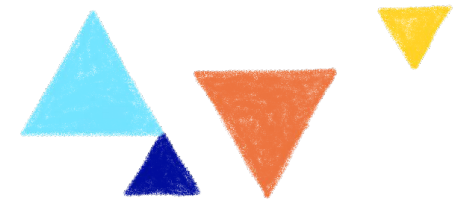
<https://docs.ovh.com/gb/en/kubernetes/installing-wordpress/>

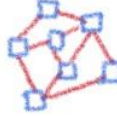

# Needed tools: helm



<https://helm.sh/>

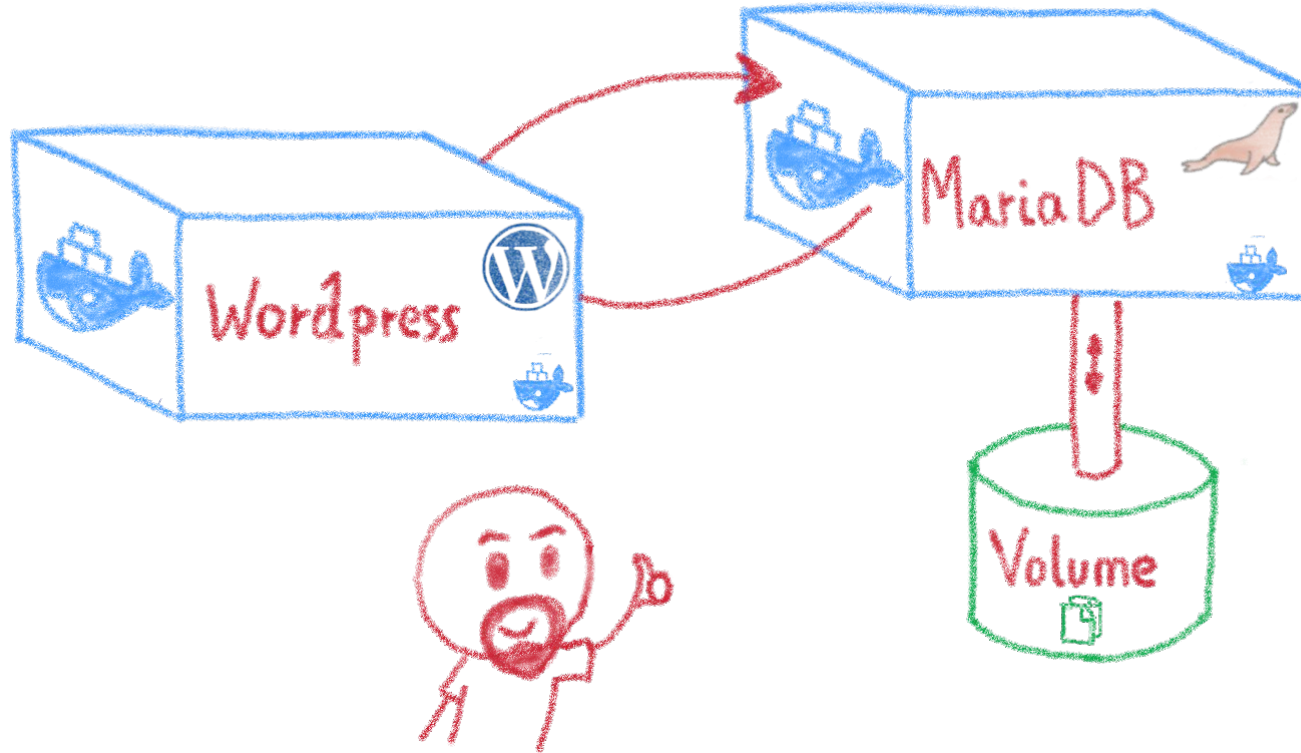
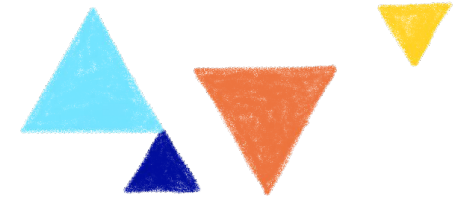
# Helm: a package manager for K8s



- Manage complexity 
- Simple sharing 

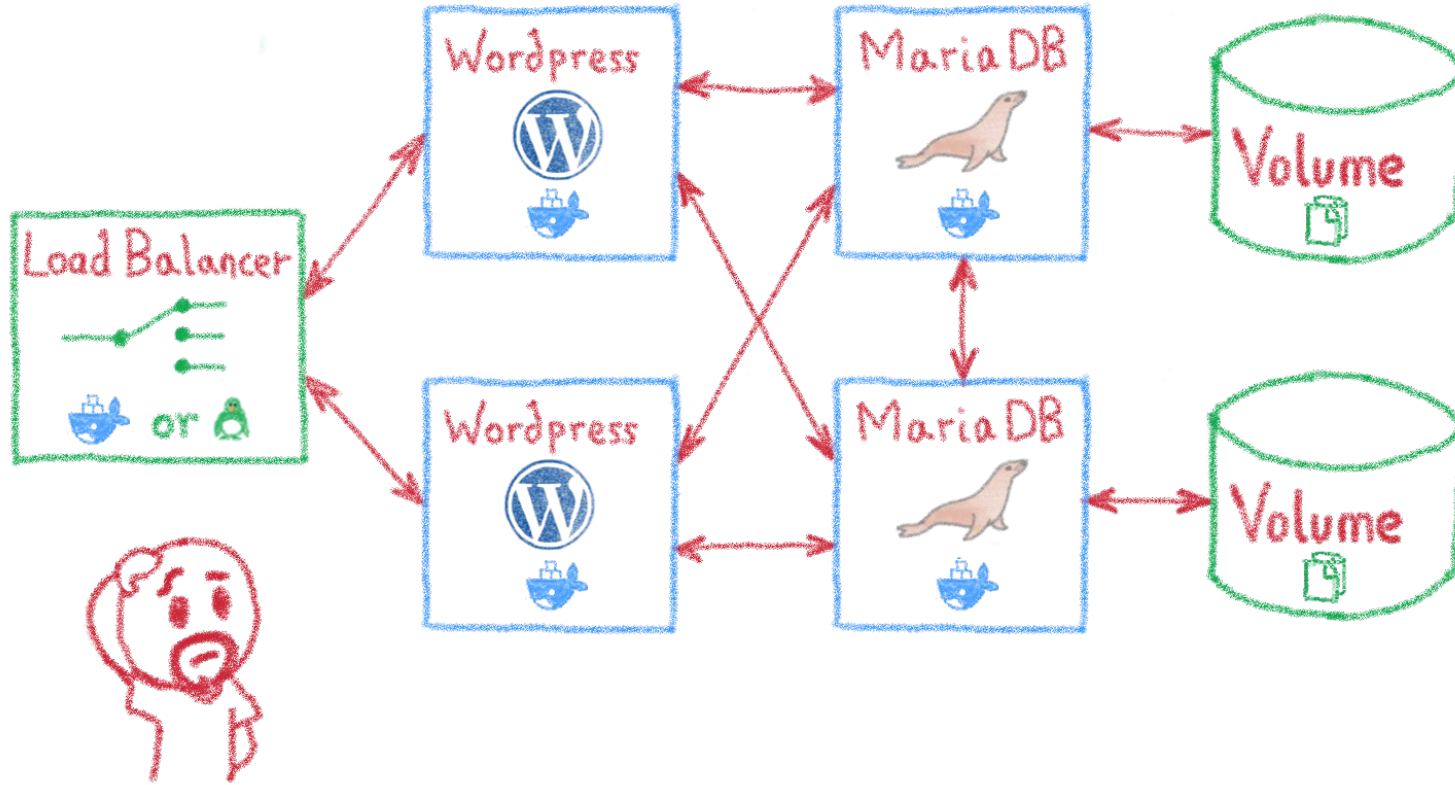
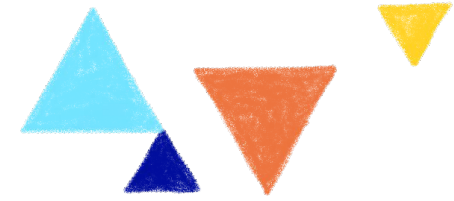
- Easy upgrades 
- Easy rollbacks 

# Wordpress is easy...



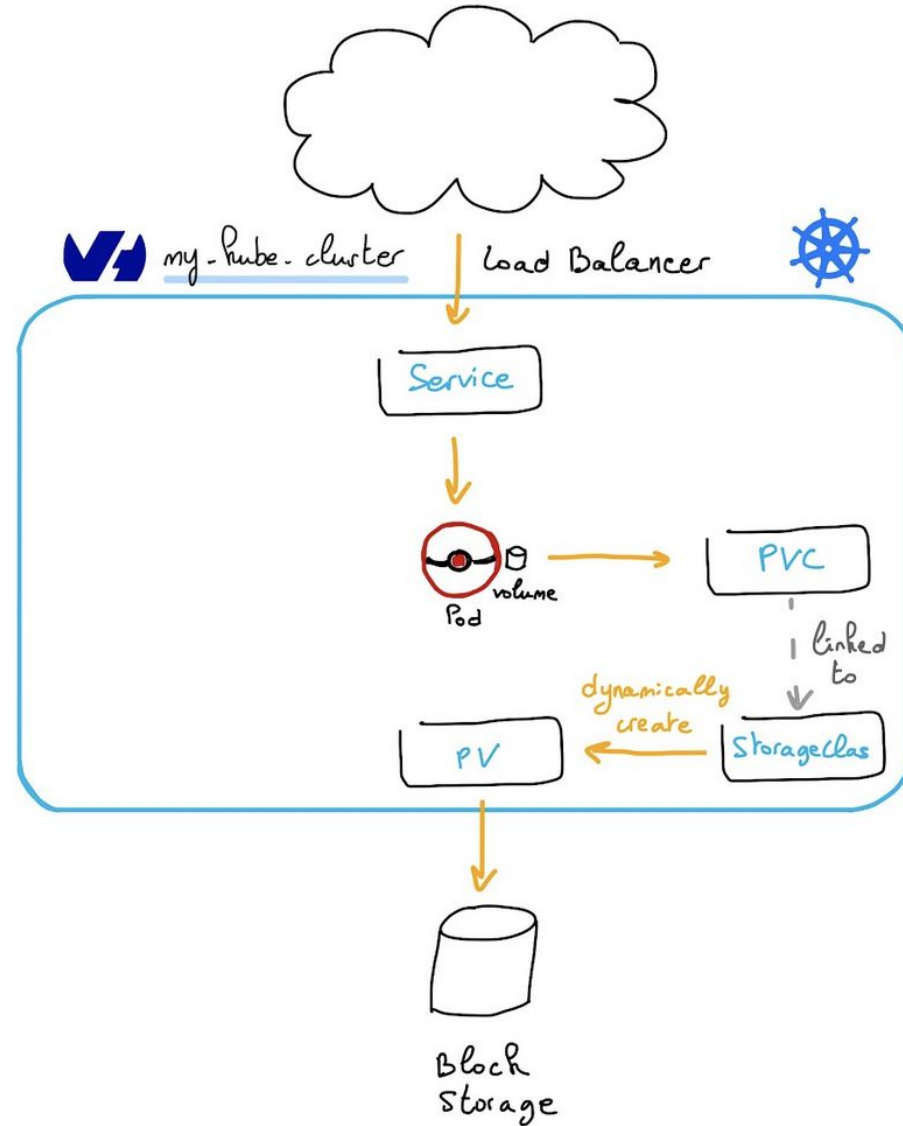
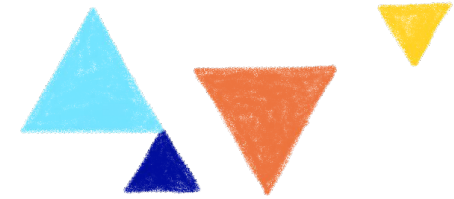
Two pods and a persistent volume

# Yet is a complete app

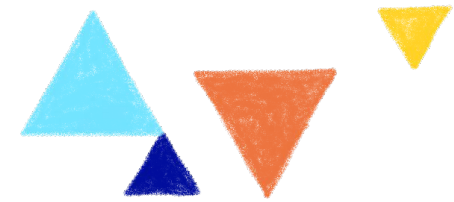


Specially when deployed in production context

# Persistent storage in Kubernetes

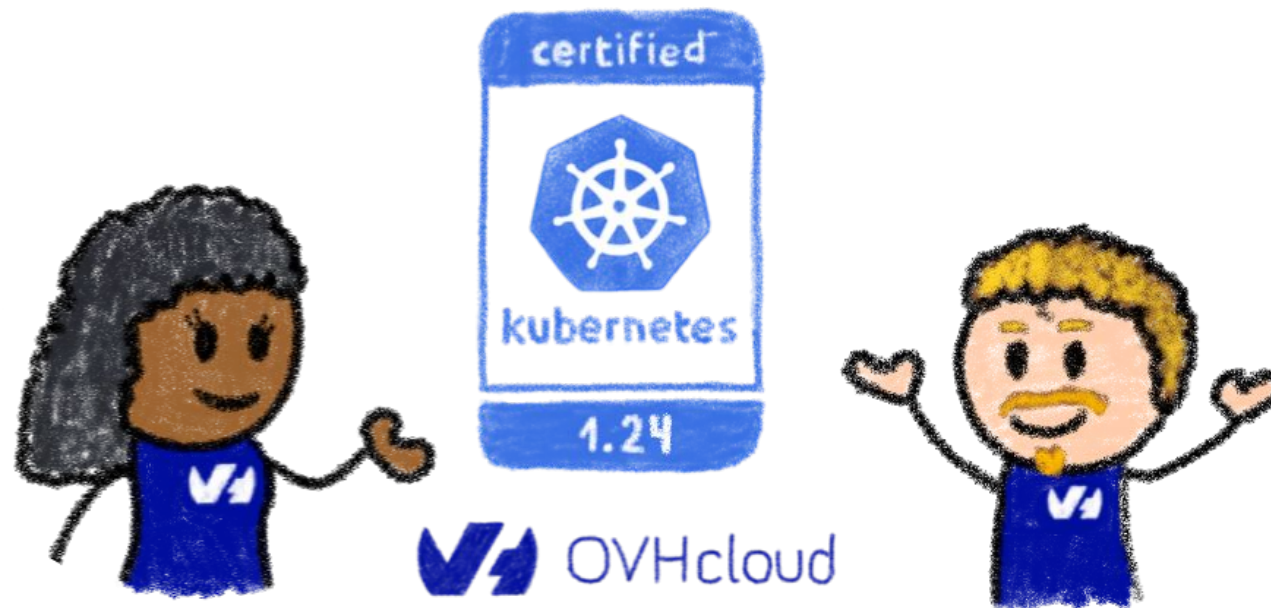




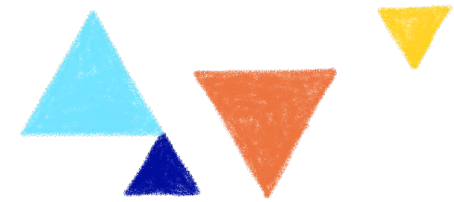


# OVHcloud Managed Kubernetes

Why would you choose ours?



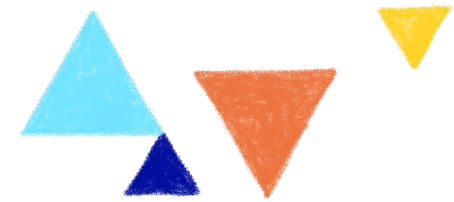
# Certified Kubernetes platform



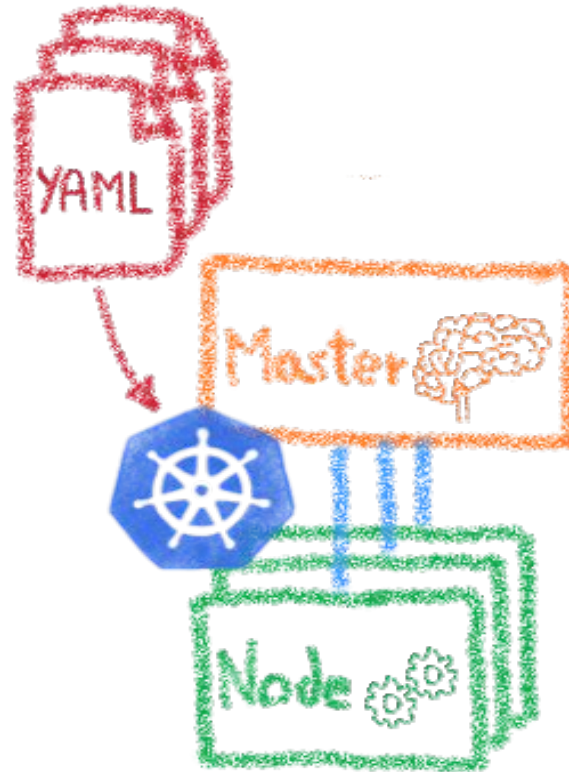
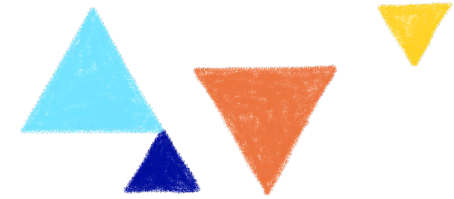
Managed Kubernetes  
certified Kubernetes 1.24



# OVHcloud Managed Private Registry

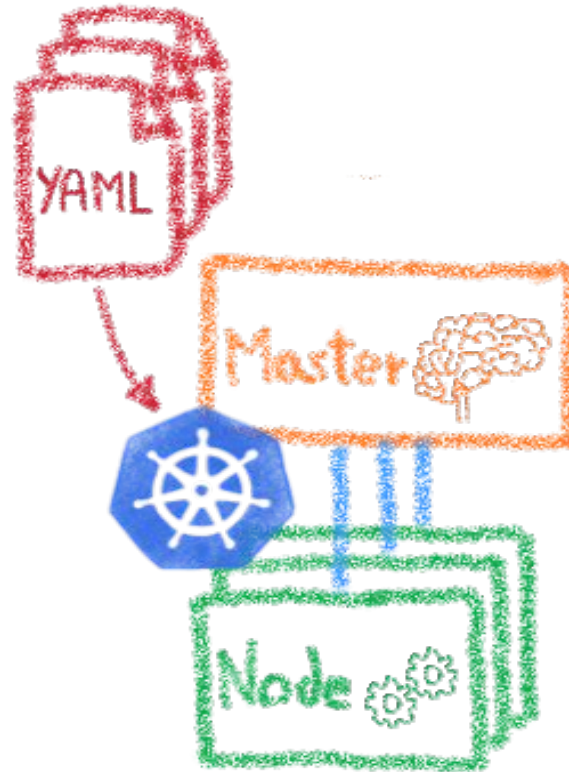
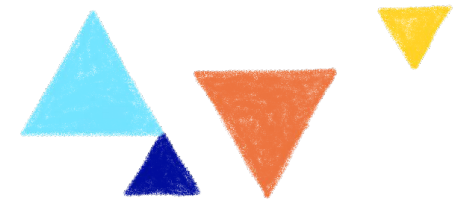


# Node Pools



Users can define node pools  
controlled from inside Kubernetes

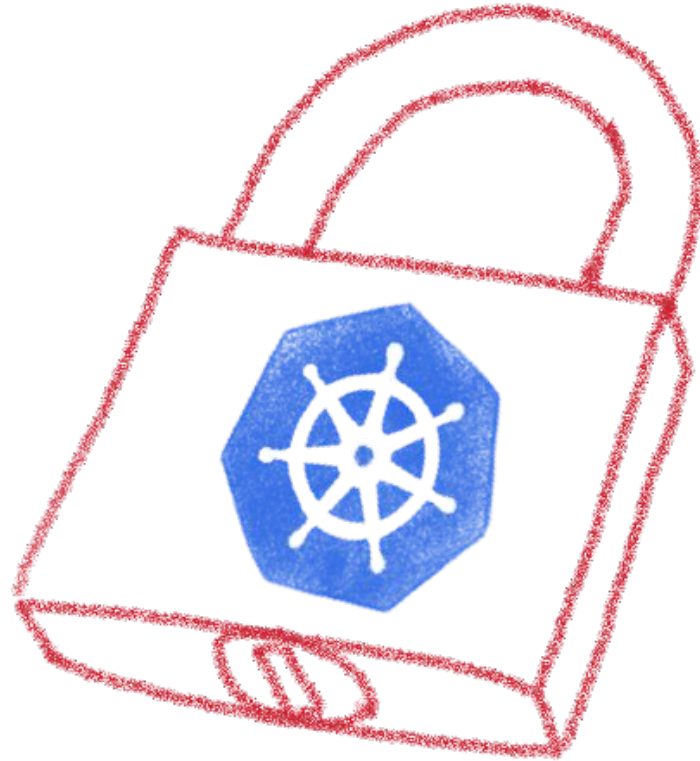
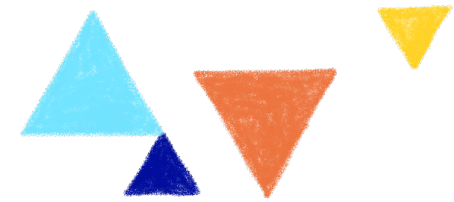
# Autoscaling



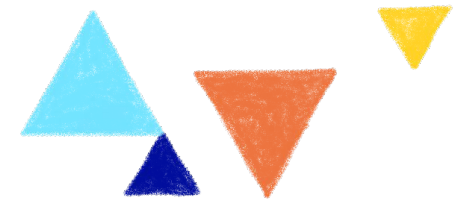
Based on node pools

New instances are spawned or released based on load

# Kubernetes in a private network



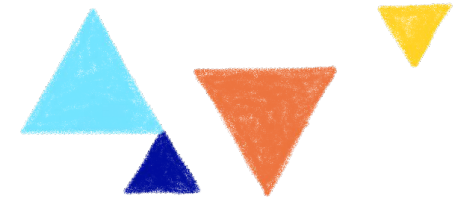
# Other features



- Healthcare HDS 1 conformity
- ISO 27001/27701/27017/27018 conformity
- Terraform provider
- Control plane audit logs
- API server IP restrictions
- ...

<https://github.com/ovh/public-cloud-roadmap/projects/1>

# Demo: cluster auto-scaling

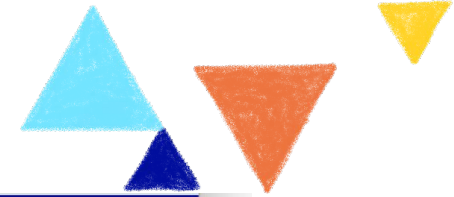


The screenshot shows the OVHcloud website interface. At the top, there's a navigation bar with the OVHcloud logo, a user account icon, and links for 'Contact Sales', 'Webmail', 'Support', 'Communities', and 'OVHcloud Blog'. Below this is a secondary navigation bar with categories like 'Bare Metal Cloud', 'Hosted Private Cloud', 'Public Cloud', 'Web Hosting & Domains', 'Enterprise', 'Ecosystem', and 'About'. The main content area has a breadcrumb trail: 'Public Cloud > Managed Kubernetes (k8s) > Cluster autoscaler example'. A language selector shows 'English (GB)'. The title 'Cluster autoscaler example' is prominently displayed with a play button icon. Below the title is a search bar for 'Search OVHcloud documentation'. The text below the search bar indicates the page was 'Last updated May 17<sup>th</sup>, 2022.' and describes the 'OVHcloud Managed Kubernetes service provides you Kubernetes clusters without the hassle of installing or operating them.' There are also 'Contribute' and 'Share' buttons visible.

<https://docs.ovh.com/gb/en/kubernetes/cluster-autoscaler-example/>

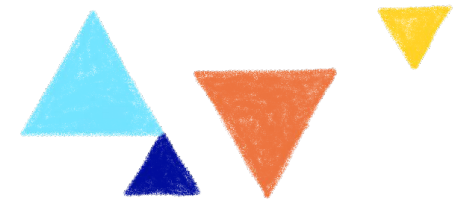


# Demo: Working with OVHcloud API



The screenshot shows the OVHcloud website interface. At the top, there is a dark blue navigation bar with the OVHcloud logo on the left and links for 'My customer account', 'Contact Sales', 'Webmail', 'Support', 'Communities', and 'OVHcloud Blog' on the right. Below this is a white navigation bar with links for 'Bare Metal Cloud', 'Hosted Private Cloud', 'Public Cloud', 'Web Hosting & Domains', 'Enterprise', 'Ecosystem', and 'About'. The main content area has a dark blue background. On the left, there is a white play button icon. The title 'Deploying a Hello World with the OVHcloud API' is centered in large white text. Below the title, a subtitle reads 'Find out how to deploy a Hello World application with the OVHcloud API'. At the top right of the main area, there is a language selector set to 'English (GB)'. At the bottom, there is a search bar with the placeholder text 'Search OVHcloud documentation' and a magnifying glass icon.

<https://docs.ovh.com/gb/en/kubernetes/deploying-hello-world-ovh-api/>

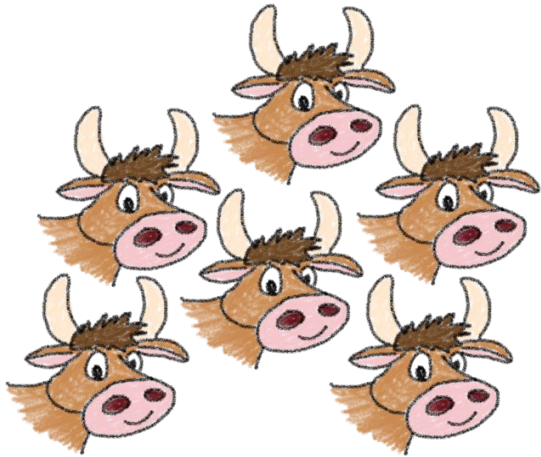
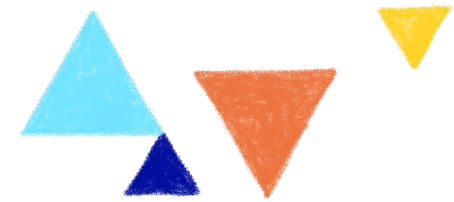


# Infrastructure as Code

The perfect companion to a cloud



# Infrastructure as Code (IaC)

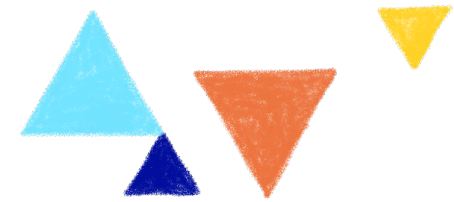


**Imperative** – Instructions to follow step by step

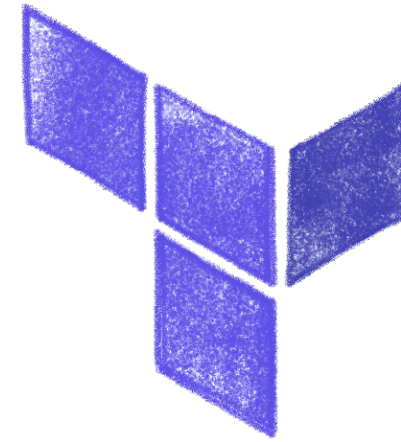
**Declarative** – Desired state description

**Environment Aware** – Intelligent desired state management

# IaC tools



ANSIBLE

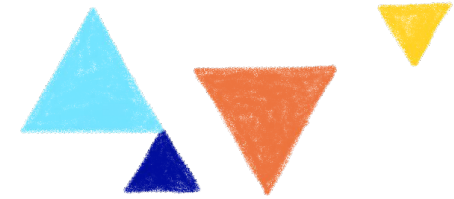


HashiCorp




Terraform



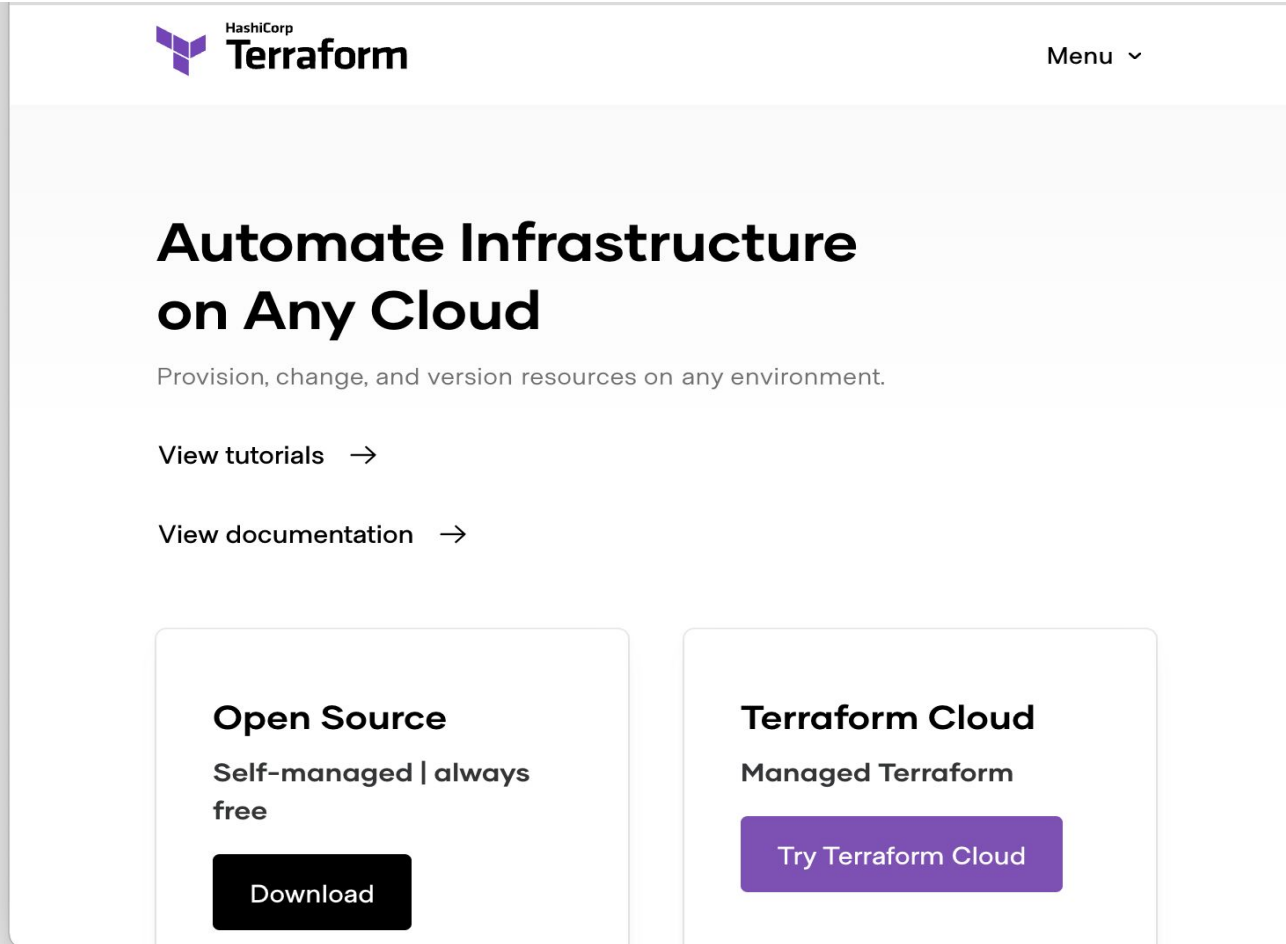
# HashiCorp Terraform



## Terraform

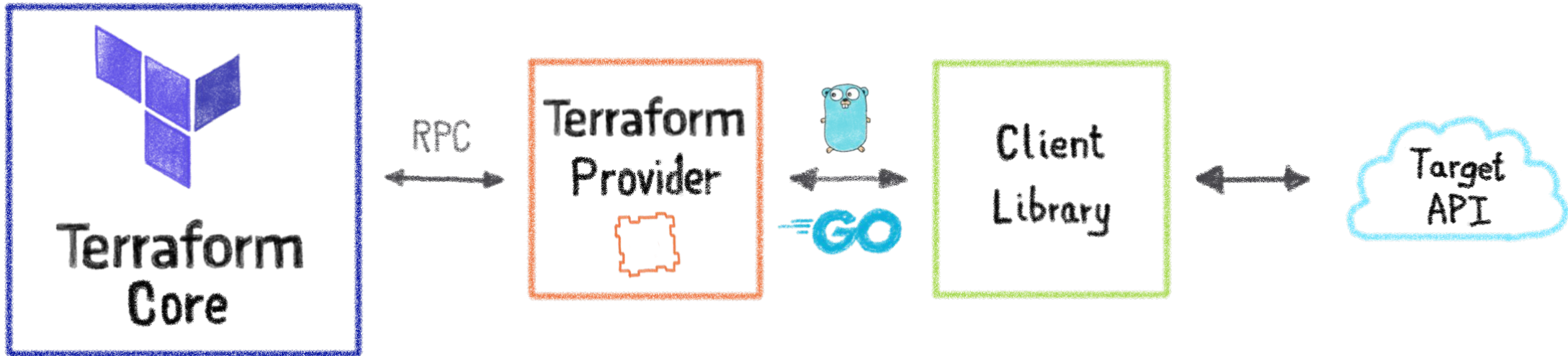
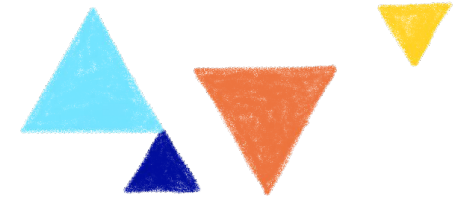
- Build 
- Modify 
- Version 

your infrastructure

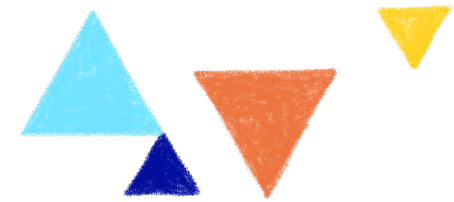


The screenshot shows the HashiCorp Terraform website. At the top left is the HashiCorp Terraform logo, and at the top right is a 'Menu' dropdown. The main heading is 'Automate Infrastructure on Any Cloud', followed by the subtext 'Provision, change, and version resources on any environment.' Below this are two links: 'View tutorials →' and 'View documentation →'. At the bottom, there are two cards: 'Open Source' with the text 'Self-managed | always free' and a 'Download' button, and 'Terraform Cloud' with the text 'Managed Terraform' and a 'Try Terraform Cloud' button.

# Modular architecture: providers



# Configuration packages: modules



Modules :  
Collection of  
configuration files



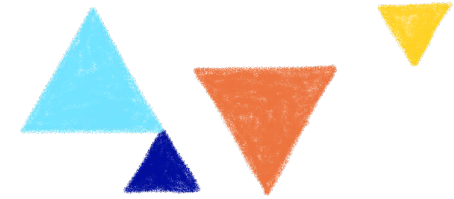
# Terraform registry

Terraform  
Registry

Providers

&

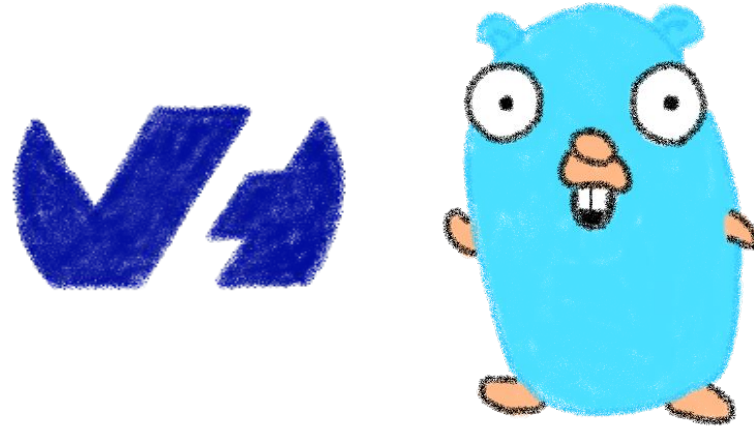
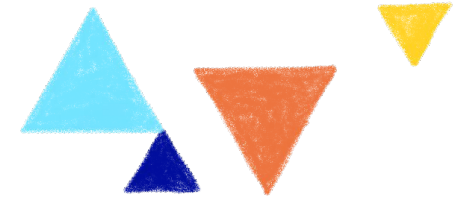
Modules



The screenshot shows the Terraform Registry homepage. At the top left is the HashiCorp Terraform logo. To its right is the word 'Registry' and a hamburger menu icon. Below the logo is a search bar with the placeholder text 'Search Providers and Modules'. The main heading is 'Terraform Registry'. Below this is a paragraph: 'Discover Terraform providers that power all of Terraform's resource types, or find modules for quickly deploying common infrastructure configurations.' There are four buttons: 'Browse Providers' (with a globe icon), 'Browse Modules' (with a folder icon), 'Browse Policy Libraries' (with a shield icon), and 'Browse Run Tasks' (with a play button icon). At the bottom, it says '2595 providers, 11144 modules & counting'.



# OVHcloud Terraform Provider



ovh

Partner by: [ovh](#)

Public Cloud

VERSION

0.26.0

PUBLISHED

15 days ago

SOURCE CODE

[ovh/terraform-provider-ovh](#) -ovh

Provider Downloads

All versions ▾

Downloads this week

4712

Downloads this month

4712

Downloads this year

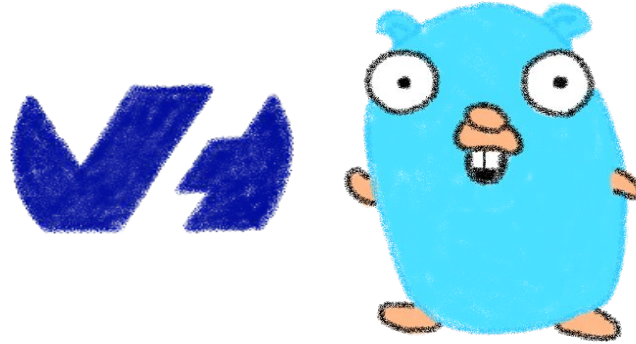
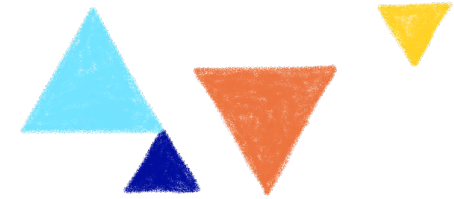
51287

Downloads over all time

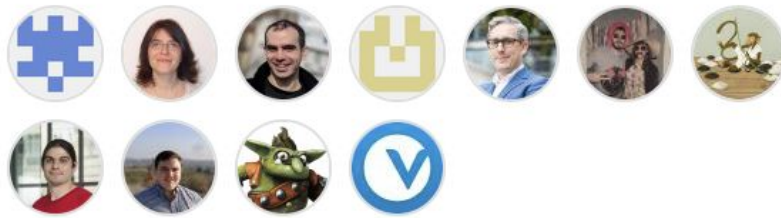
839388

<https://registry.terraform.io/providers/ovh/ovh/latest/docs>

# OVHcloud Terraform Provider



Contributors 59



+ 48 contributors

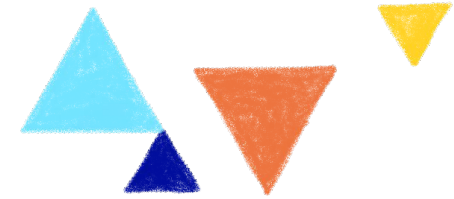
Releases 22

v0.26.0 **Latest**  
2 weeks ago

+ 21 releases

<https://github.com/ovh/terraform-provider-ovh>

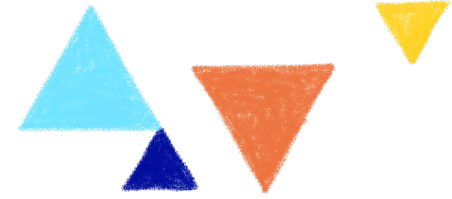
# Demo: Using Terraform




The screenshot shows the OVHcloud website header with the logo and navigation links: "My customer account", "Contact Sales", "Webmail", "Support", "Communities", and "OVHcloud Blog". Below the header is a secondary navigation bar with links for "Bare Metal Cloud", "Hosted Private Cloud", "Public Cloud", "Web Hosting & Domains", "Enterprise", "Ecosystem", and "About". The main content area has a breadcrumb trail: "Public Cloud > Managed Kubernetes (k8s) > Creating a cluster through Terraform". A language selector shows "English (GB)". The main heading is "Creating a cluster through Terraform" with a large play button icon to its left. Below the heading is the subtext "Creates a Kubernetes cluster through Terraform". At the bottom of the page is a search bar with the placeholder text "Search OVHcloud documentation" and a magnifying glass icon.

<https://docs.ovh.com/gb/en/kubernetes/creating-a-cluster-through-terraform/>

# Needed tools: terraform



Just announced | HashiConf Global full schedule: keynotes, sessions, labs & more. ×

 HashiCorp Terraform Menu ▾

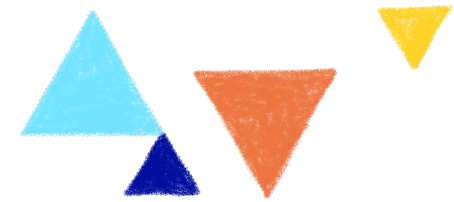
## Automate Infrastructure on Any Cloud

Provision, change, and version resources on any

**Open Source**  
Self-managed | always free

[Download](#)

<https://www.terraform.io/>

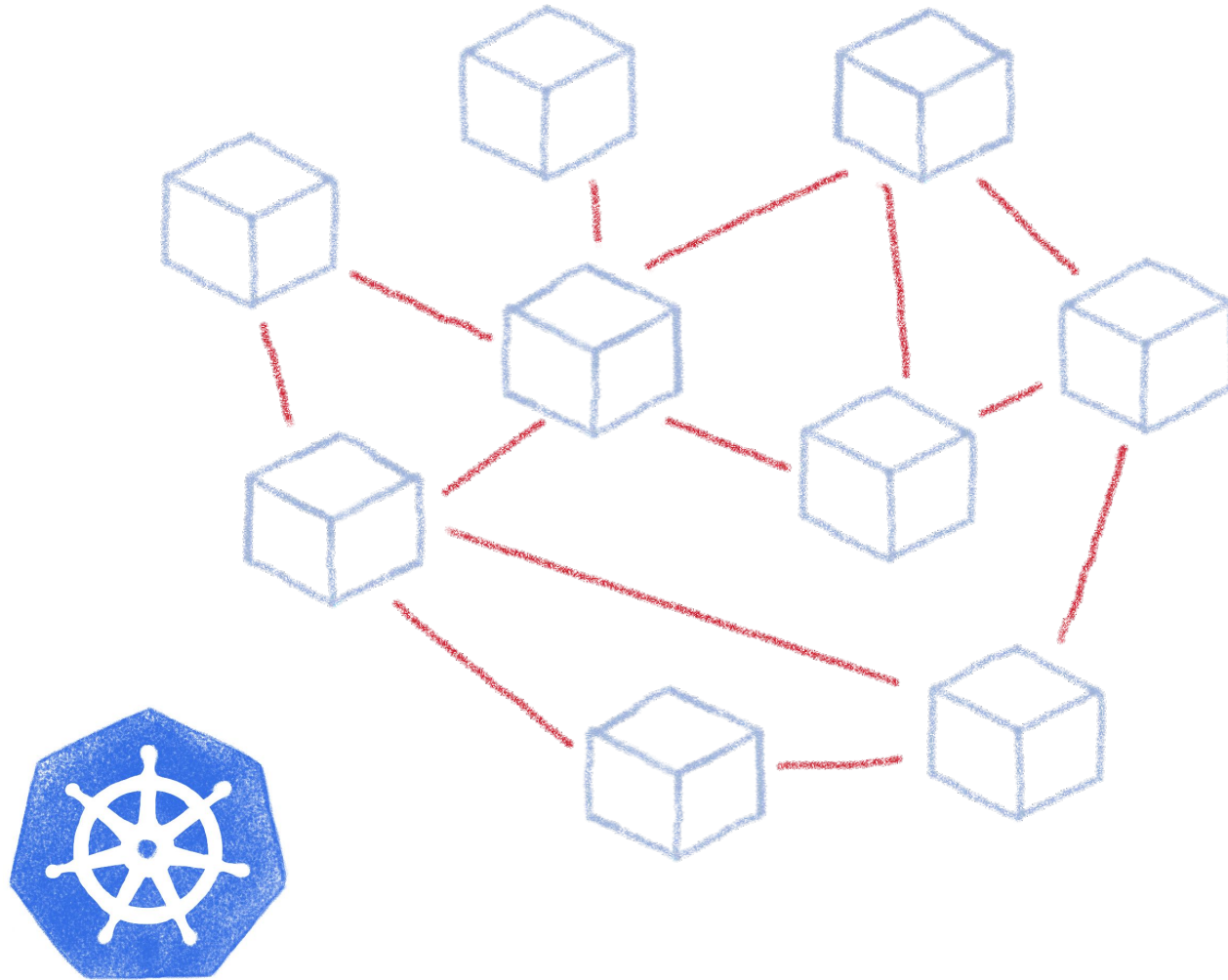
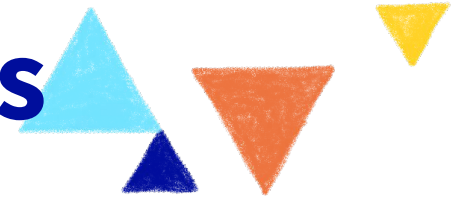


# Kubernetes Operators

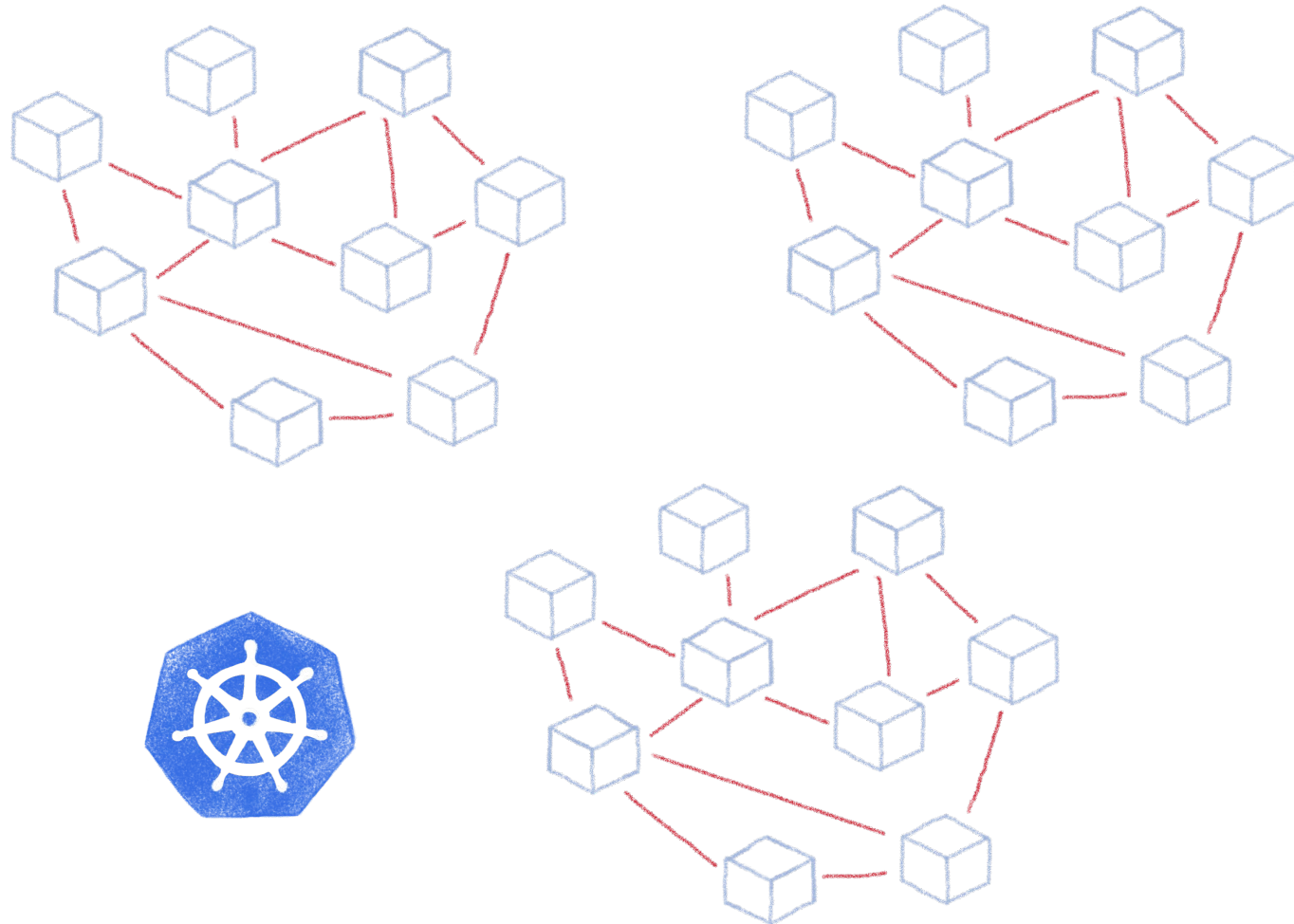
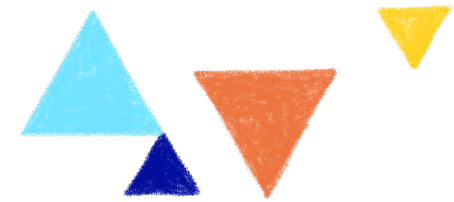
Helping to tame the complexity of K8s Ops



# Taming microservices with Kubernetes



# What about complex deployments



Ingress

Services

Deployments

Pods

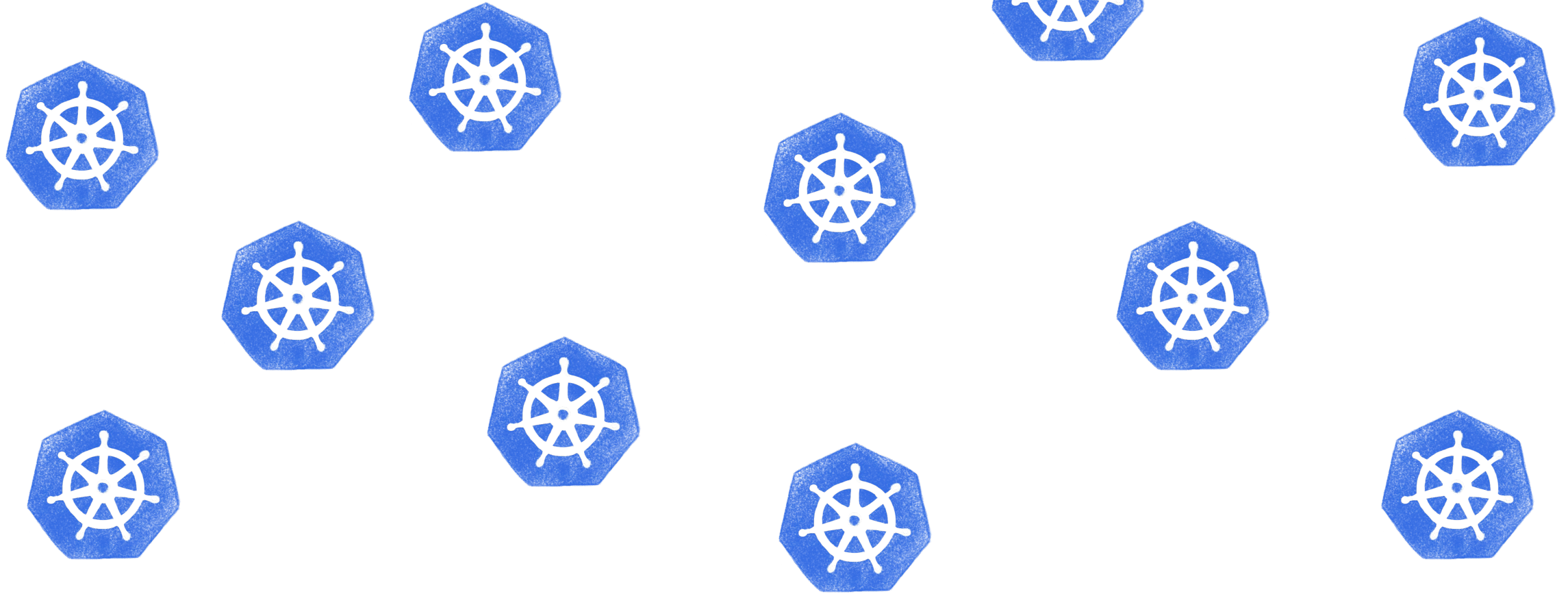
Sidecars

Replica Sets

Stateful Sets



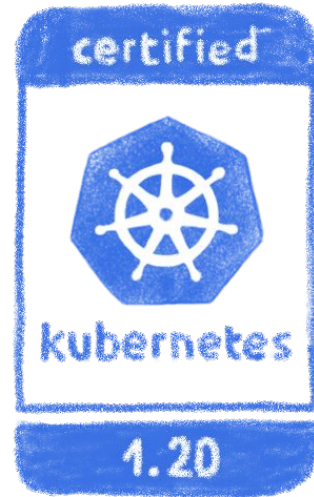
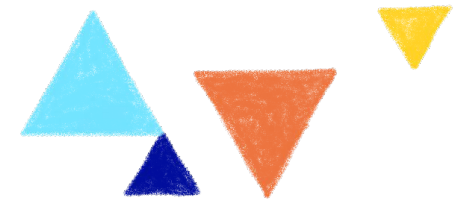
# Specially at scale



Lots of clusters with lots and lots of deployments

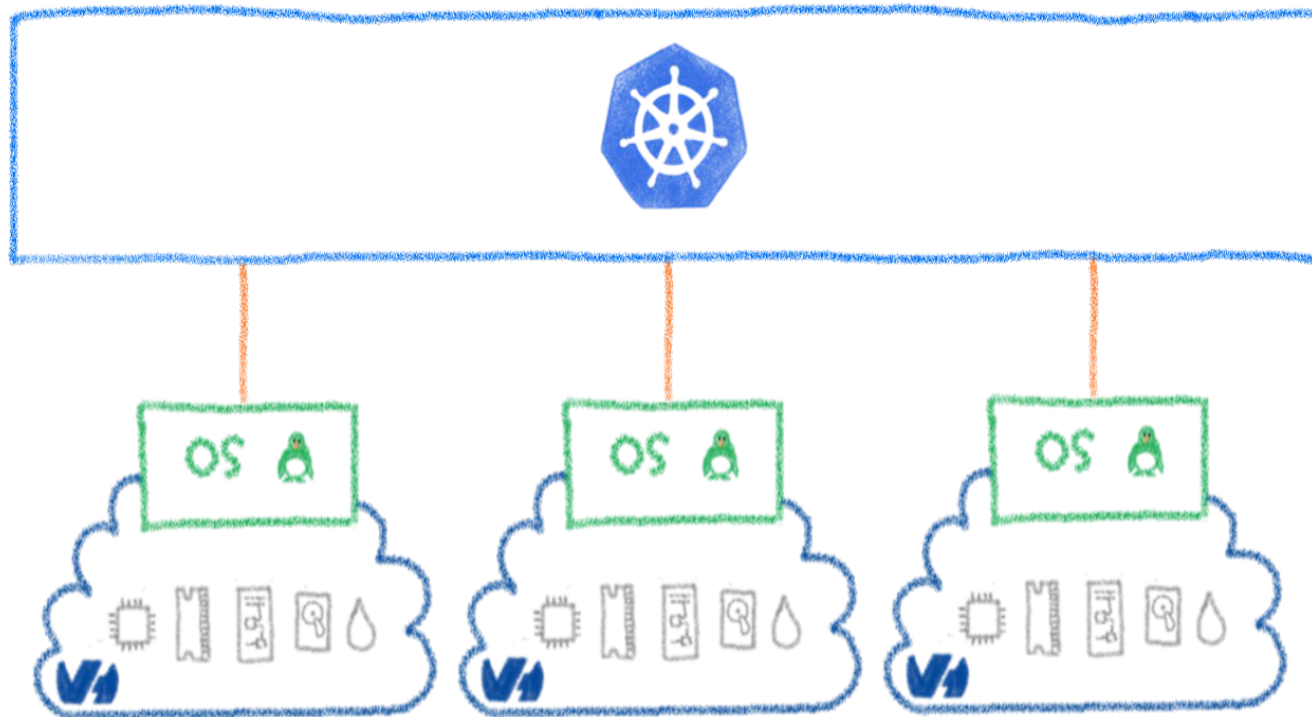
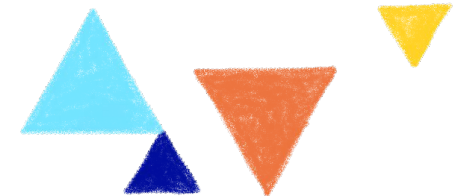


# That's just our case

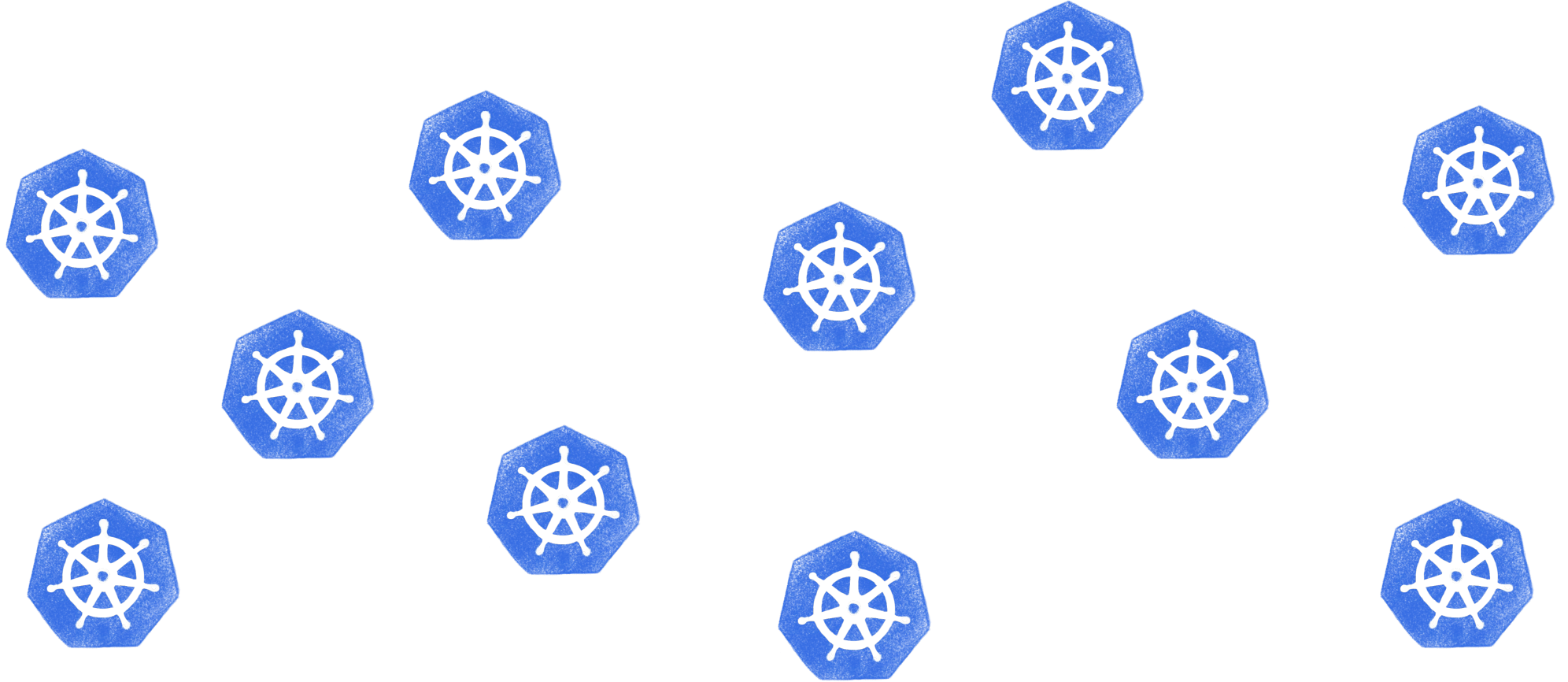
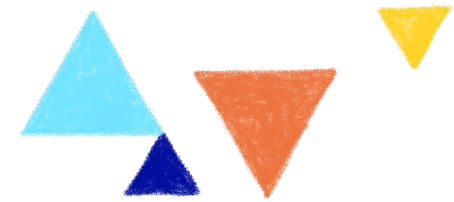


We both use Kubernetes and  
operate a Managed Kubernetes platform

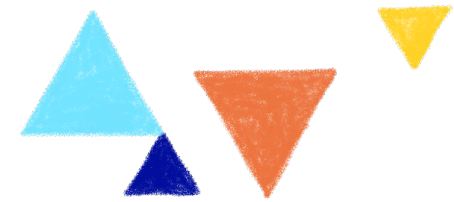
# Built over our Openstack based Public Cloud



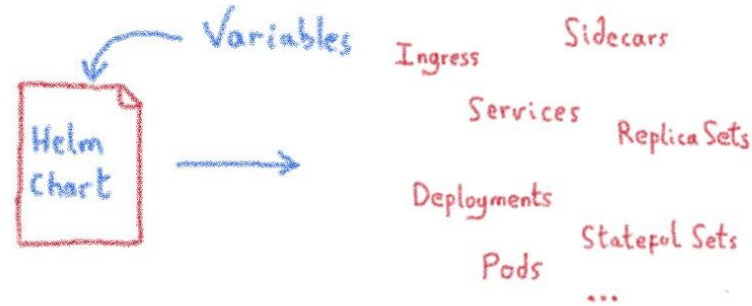
# We need to tame the complexity

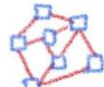





# Taming the complexity



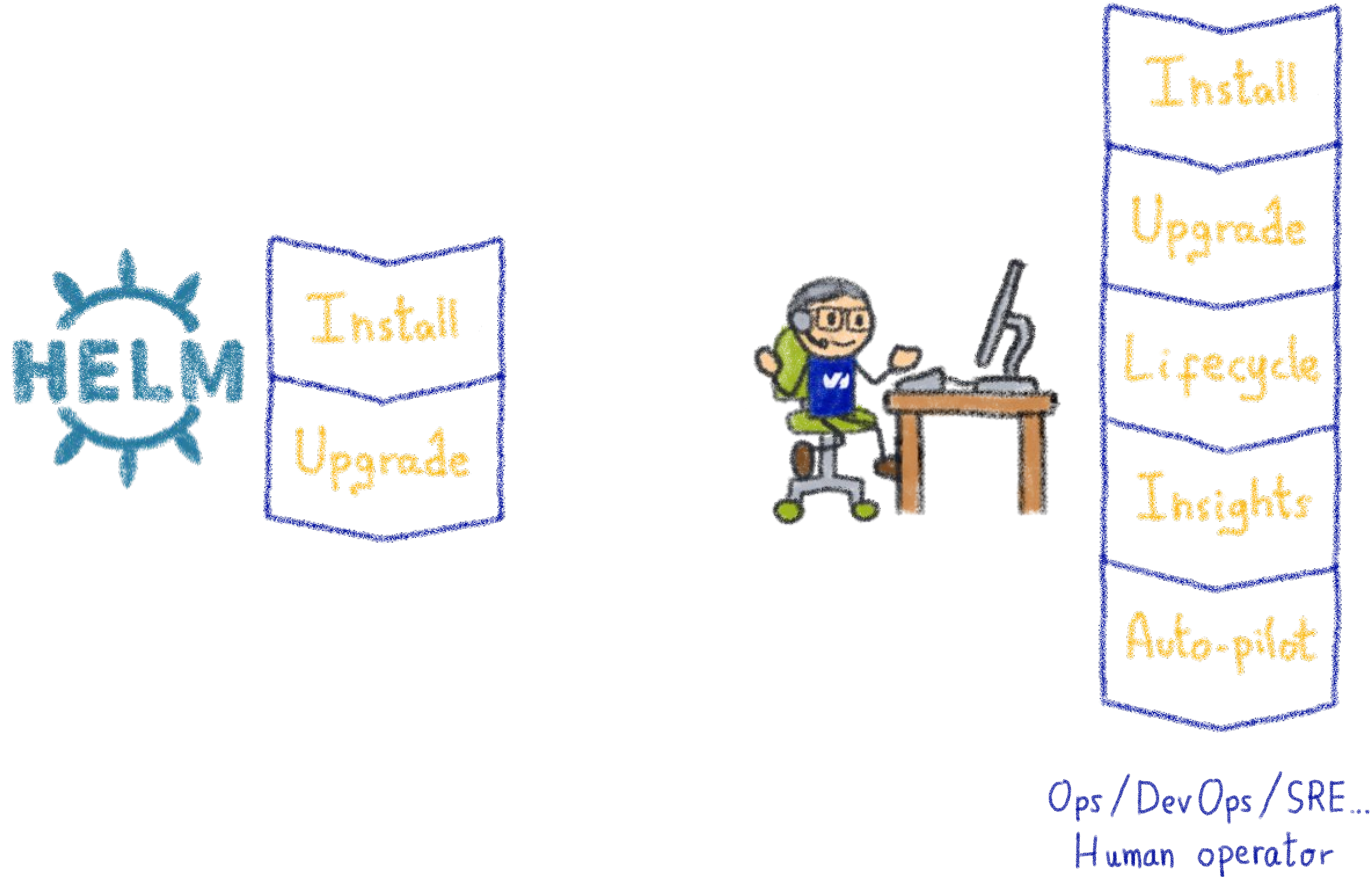
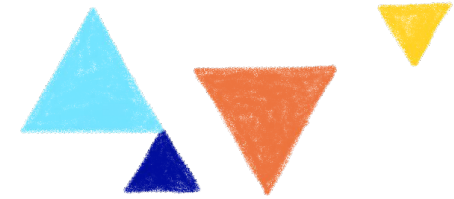
A package manager for Kubernetes



- Manage complexity 
- Simple sharing 

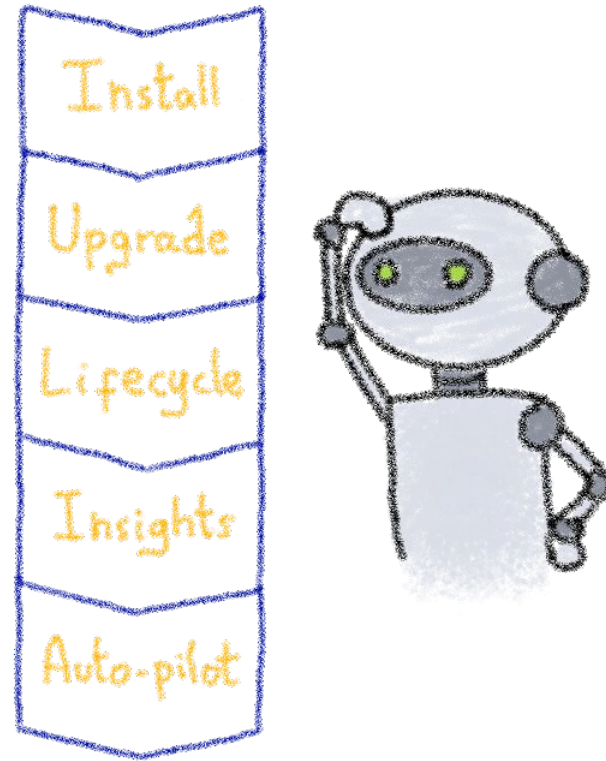
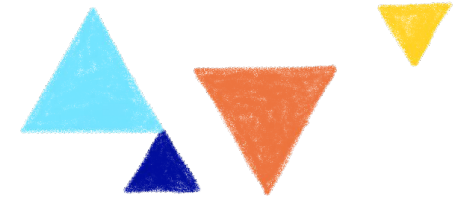
- Easy upgrades 
- Easy rollbacks 

# Helm Charts are configuration



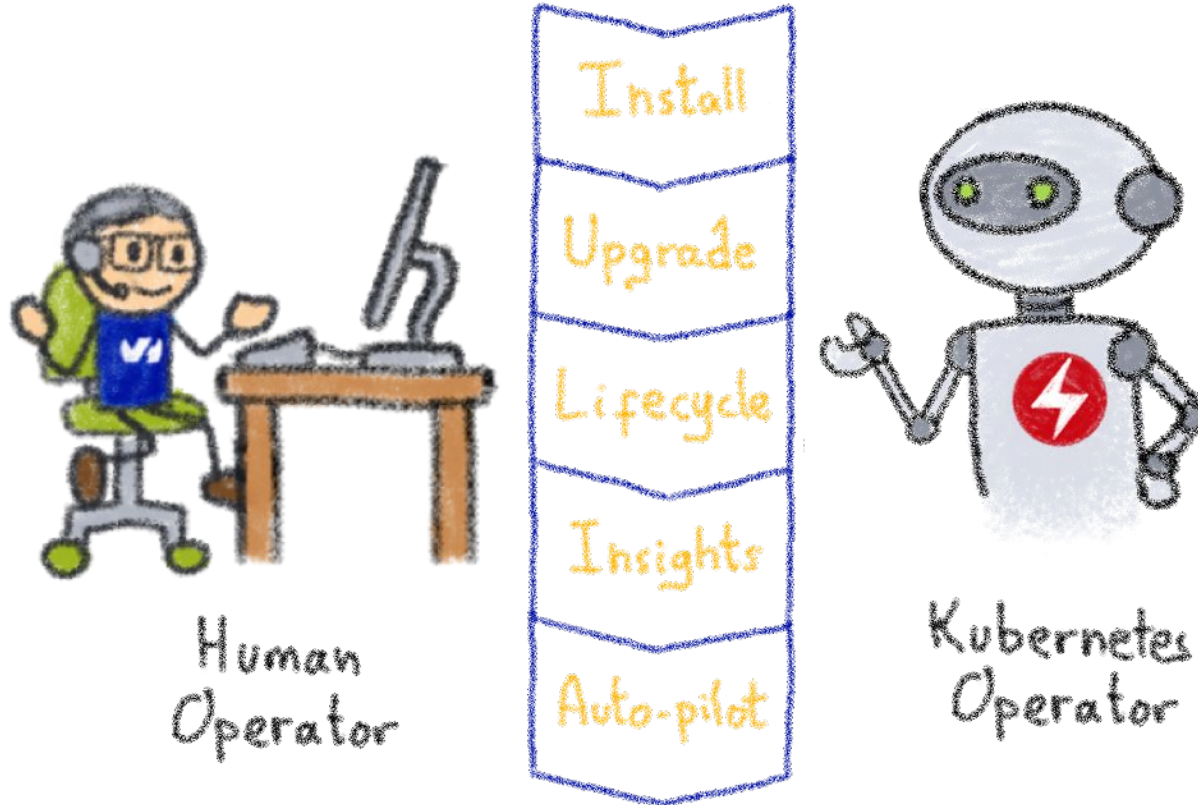
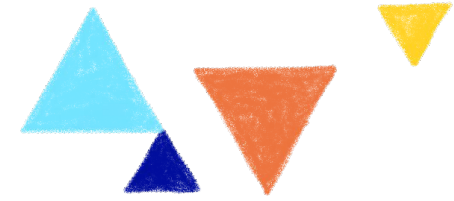
Operating is more than installs & upgrades

# Kubernetes is about automation



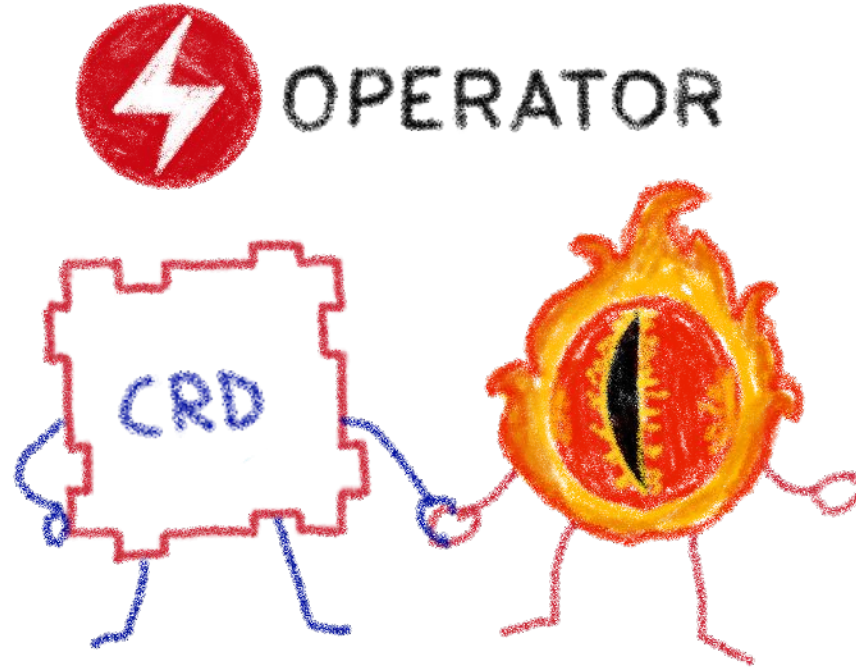
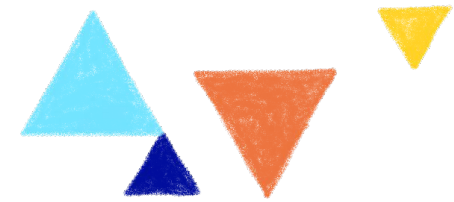
How about automating human operators?

# Kubernetes Operators



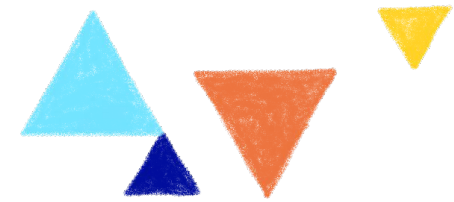
A Kubernetes version of the human operator

# Building operators



Basic K8s elements: Controllers and Custom Resources



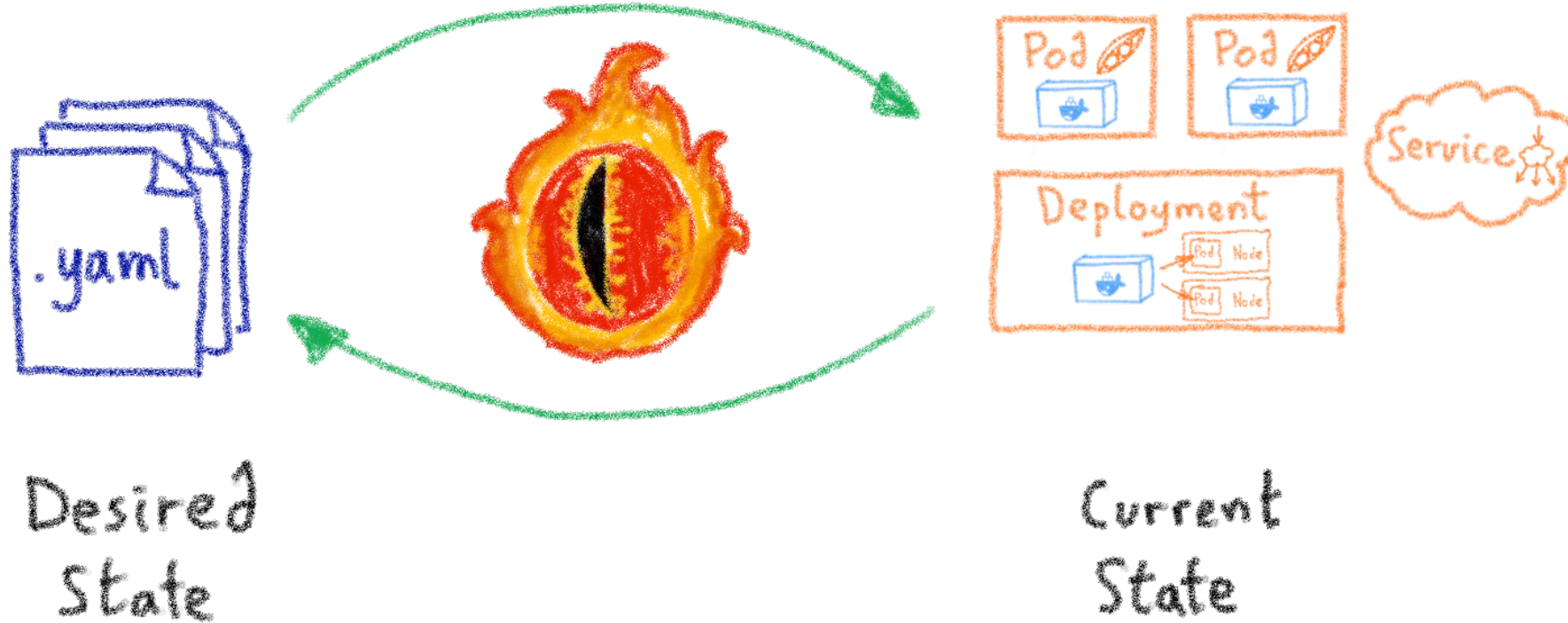
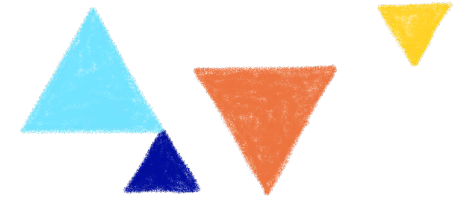


# Kubernetes Controllers

Keeping an eye on the resources

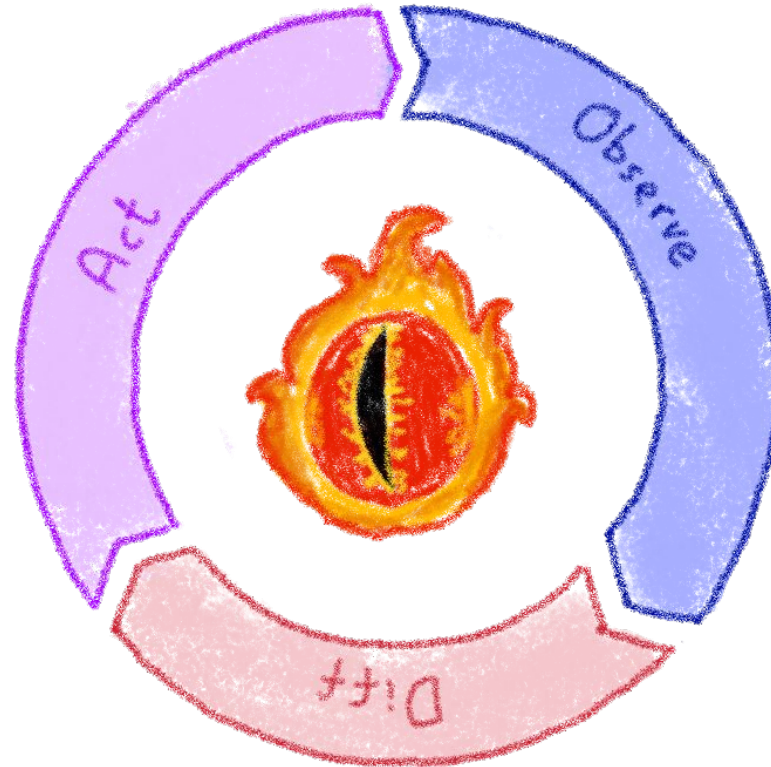
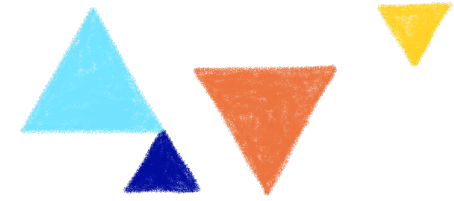


# A control loop

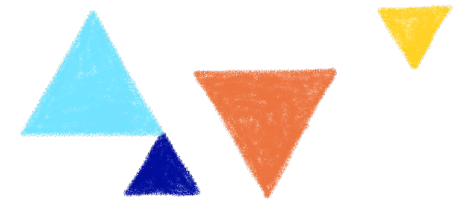


They watch the state of the cluster,  
and make or request changes where needed

# A reconcile loop

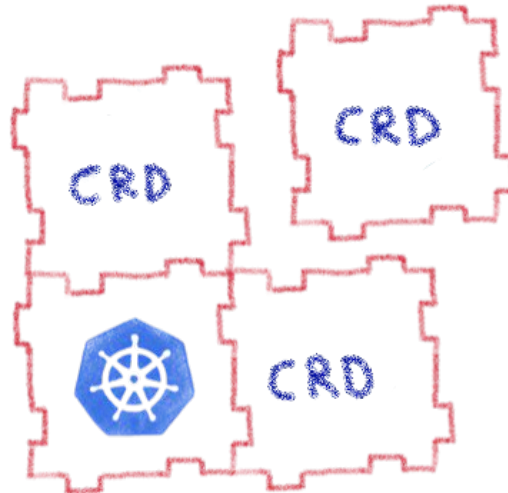


Strives to reconcile current state and desired state

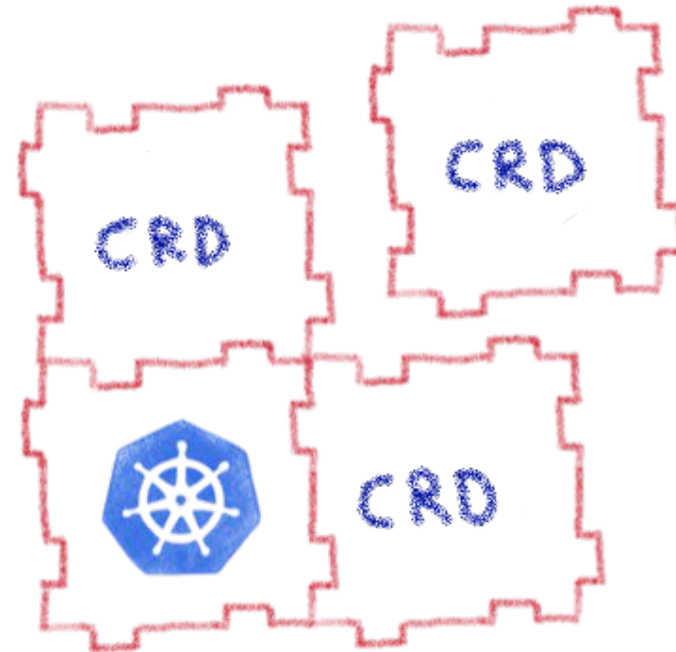
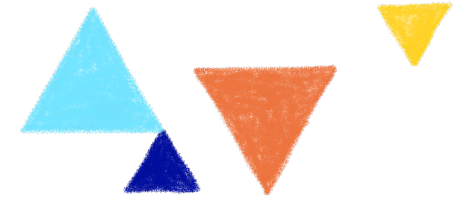


# Custom Resource Definitions

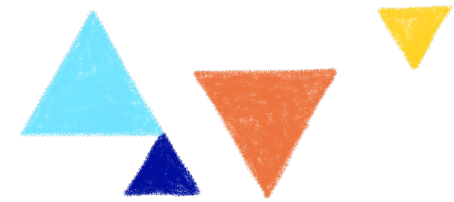
## Extending Kubernetes API



# Extending Kubernetes API



By defining new types of resources

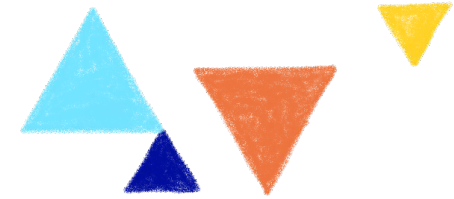


# Kubernetes Operator

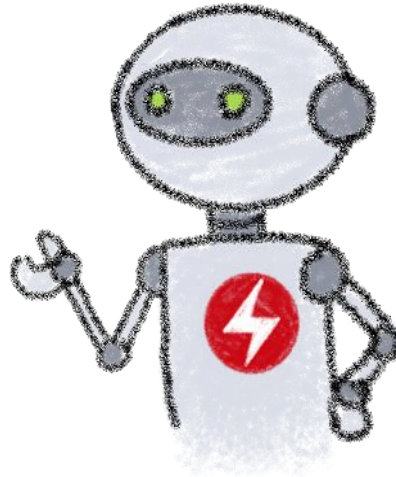
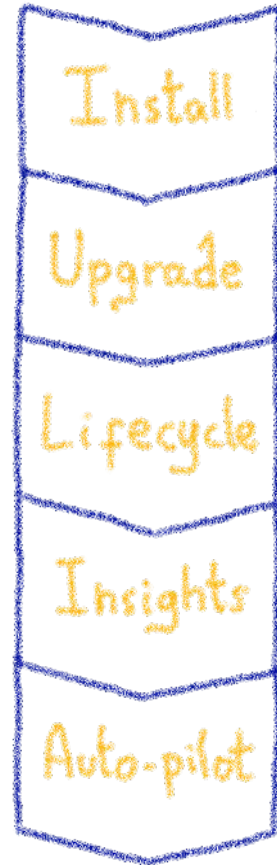
Automating operations



# What's a Kubernetes Operator?



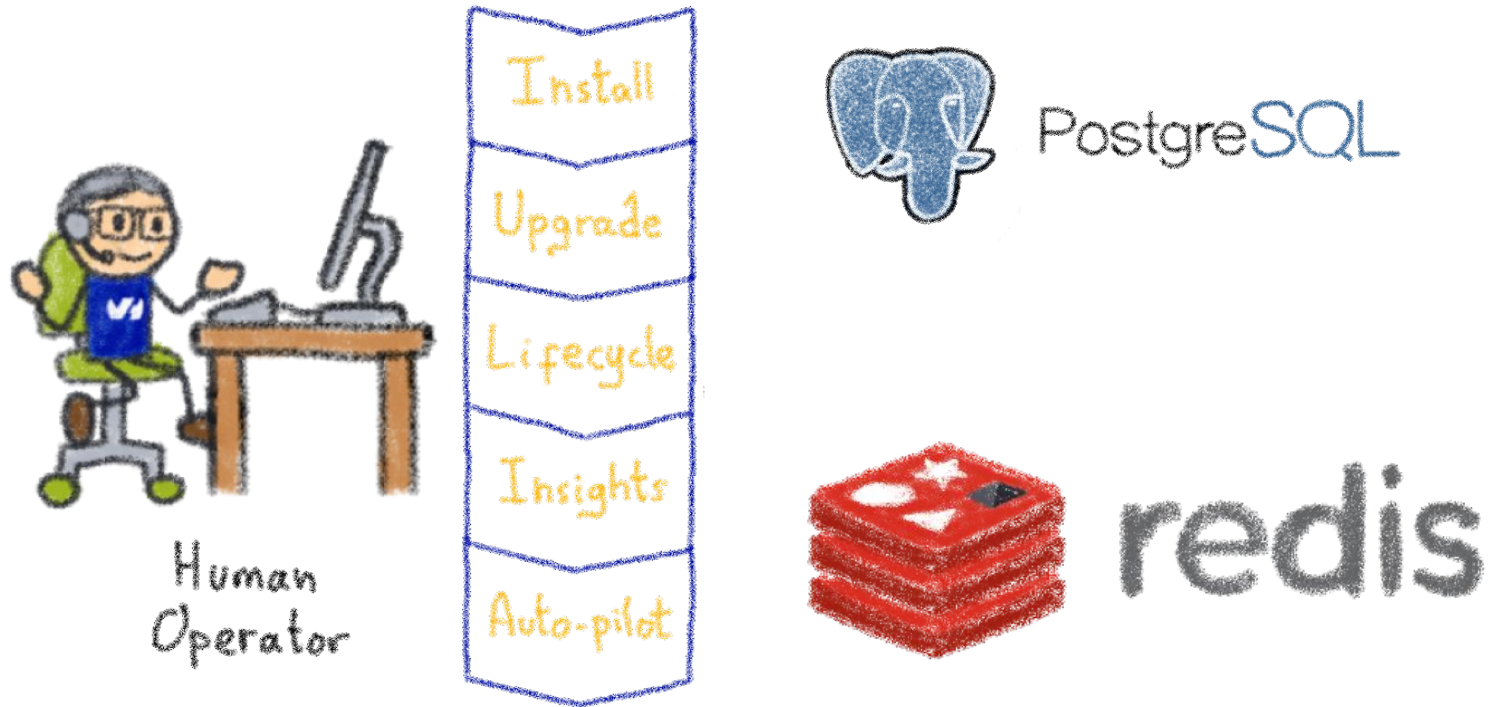
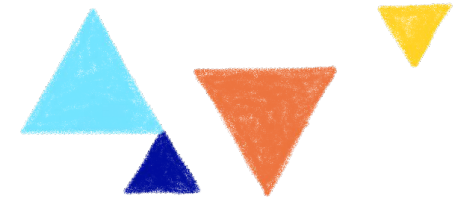
Human Operator



Kubernetes Operator

An Operator represents human operational knowledge in software to reliably manage an application

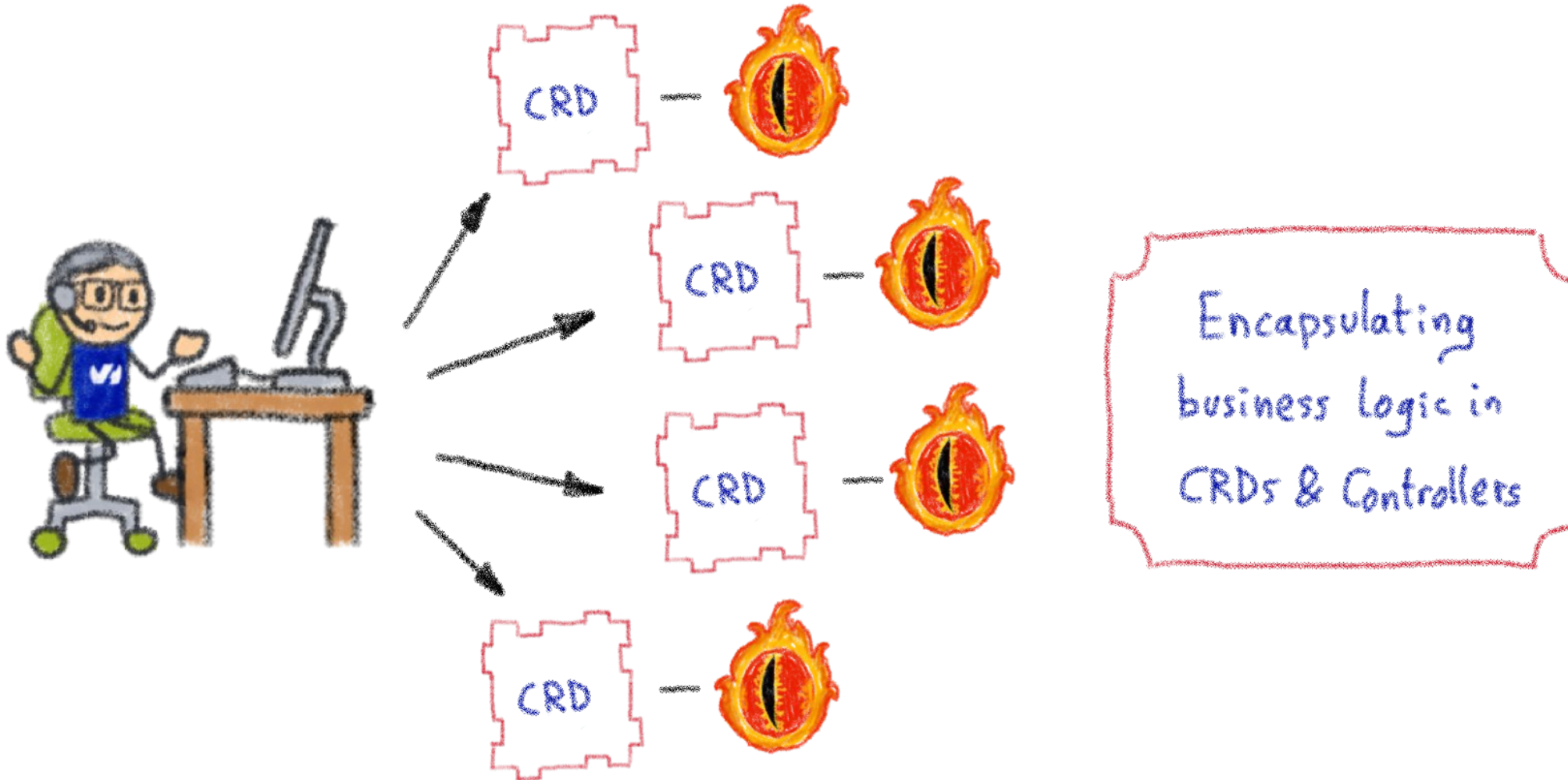
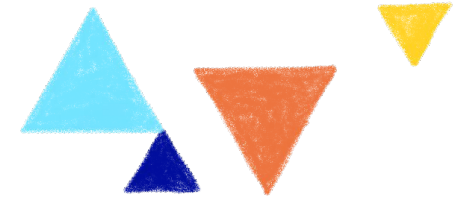
# Example: databases



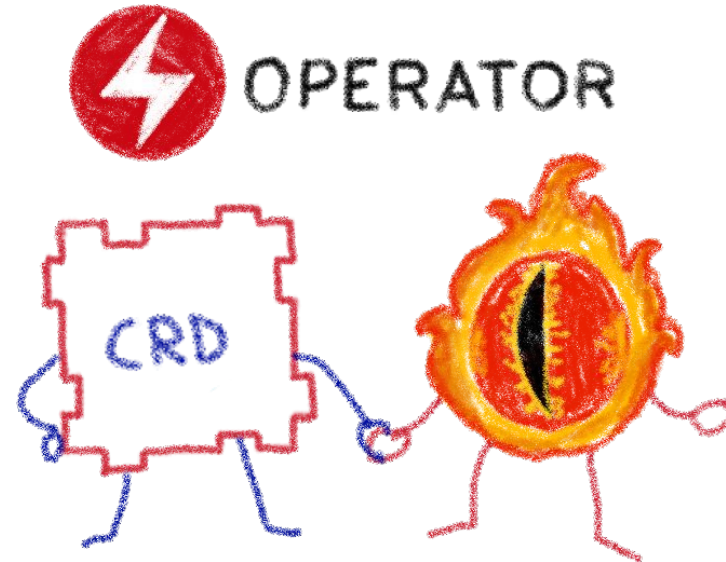
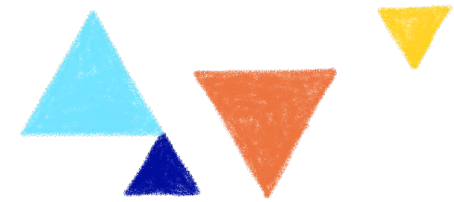
Things like adding an instance to a pool,  
doing a backup, sharding...



# Knowledge encoded in CRDs and Controllers

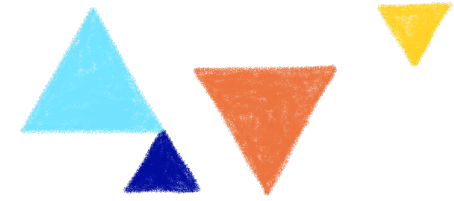


# Custom Controllers for Custom Resources

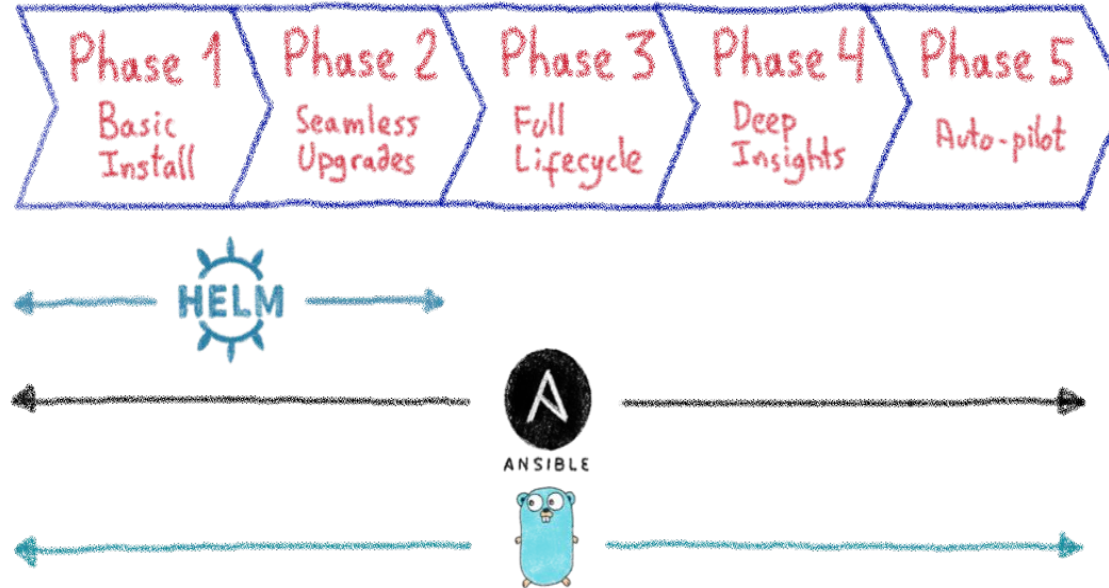
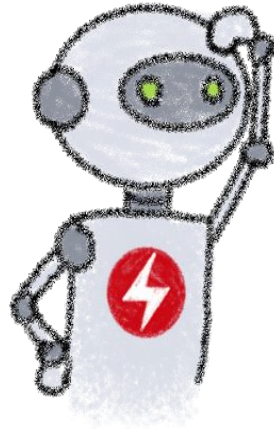


Operators implement and manage Custom Resources using custom reconciliation logic

# Operator Capability Model



OPERATOR  
CAPABILITY MODEL



Gauging the operator maturity

