

kubernetes

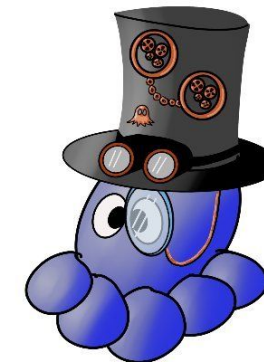


OVHcloud Kubernetes Tech Lab Italy

Olivier Beautier - Horacio Gonzalez

2022-10-26 - Milano

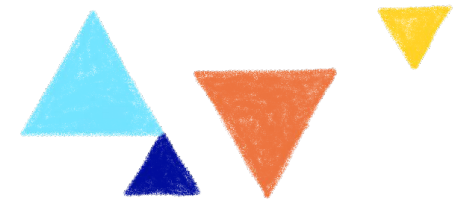
2022-10-27 - Bologna



@RacLePoulpe

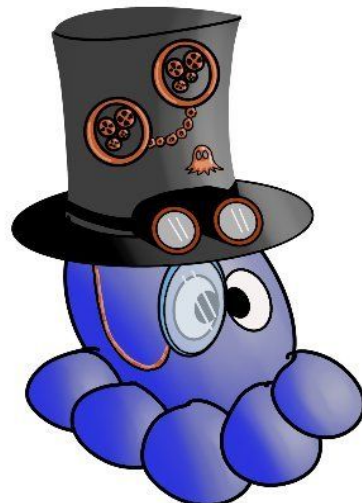


@LostInBrittany

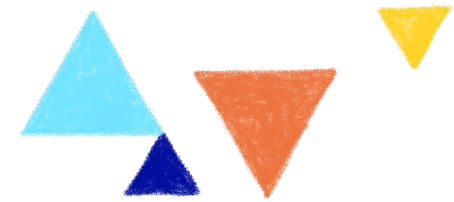


Who are we?

Introducing myself and
introducing OVHcloud

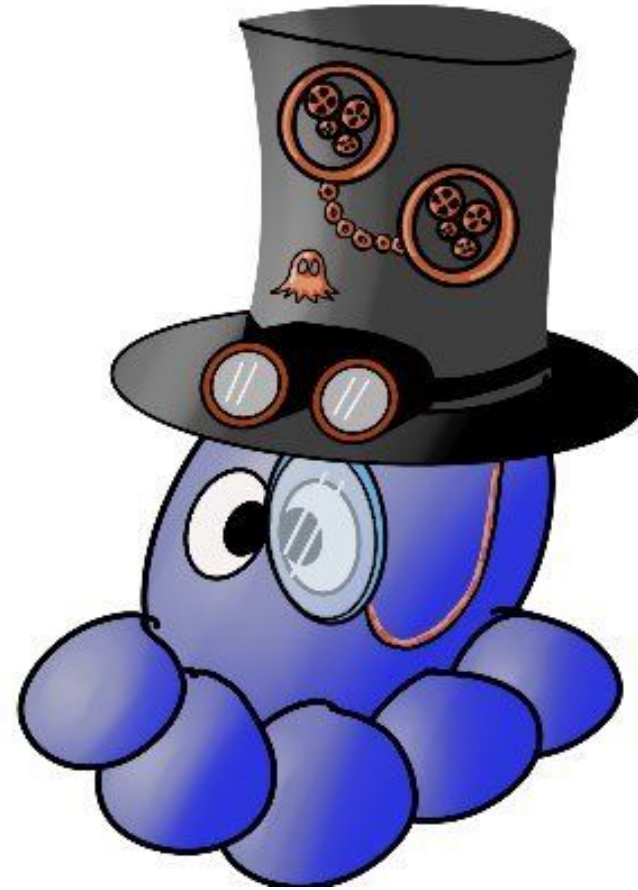


Olivier Beautier



@RacLePoulpe

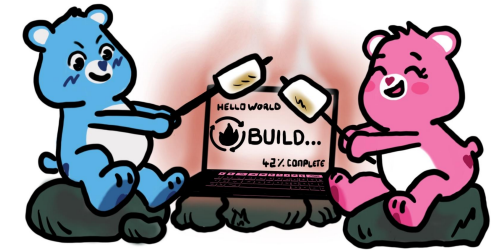
Octopus with style



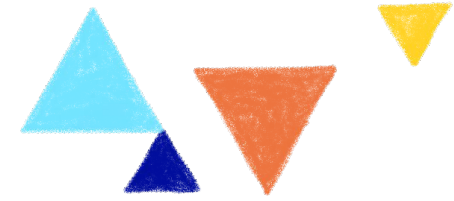
Horacio Gonzalez

@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



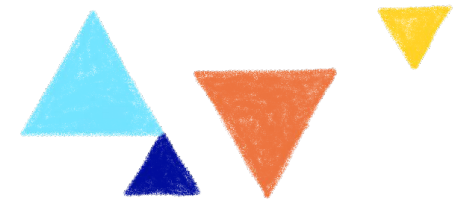
1.5 Billion Euros Invested
since 2016



P.U.E. 1.09
Energy efficiency indicator

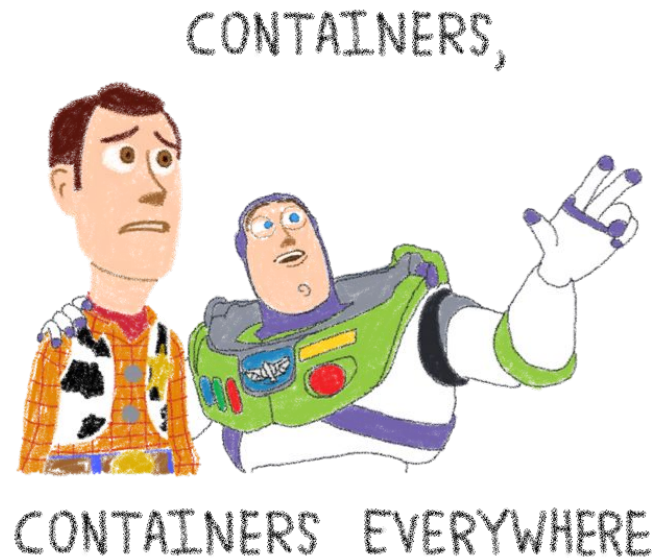


20+ Years in Business
Disrupting since 1999

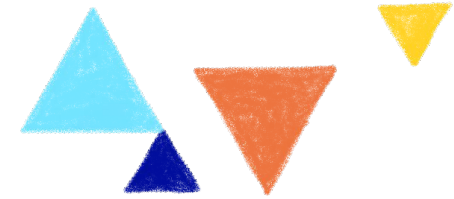


Why do we need Kubernetes?

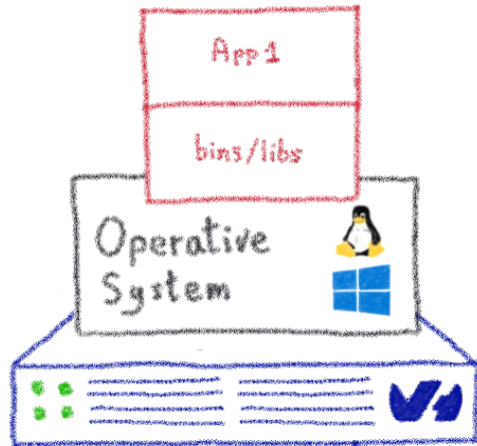
Taming the complexity of operating containers



From bare metal to containers



Bare metal
servers

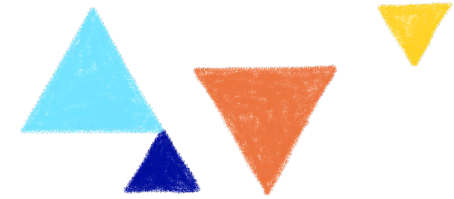


Linux

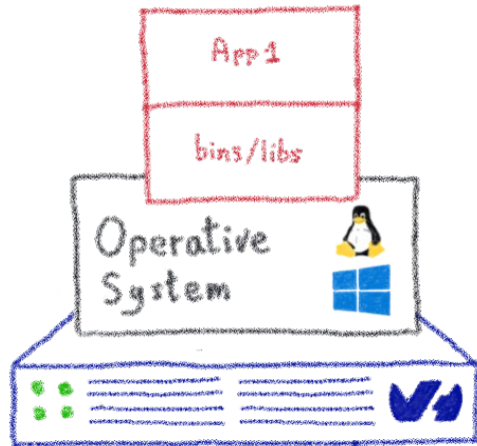


Windows

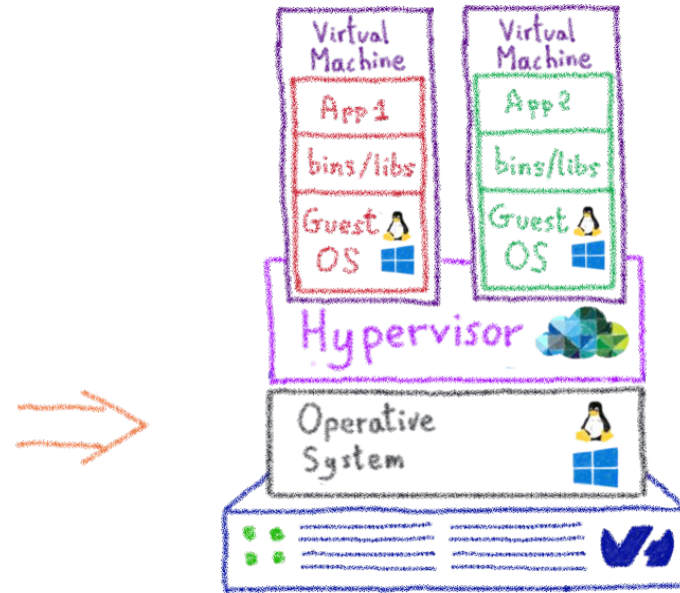
From bare metal to containers



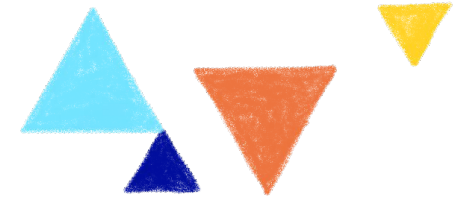
Bare metal servers



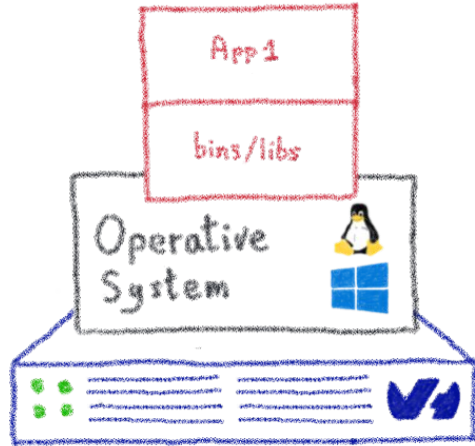
Virtual Machines



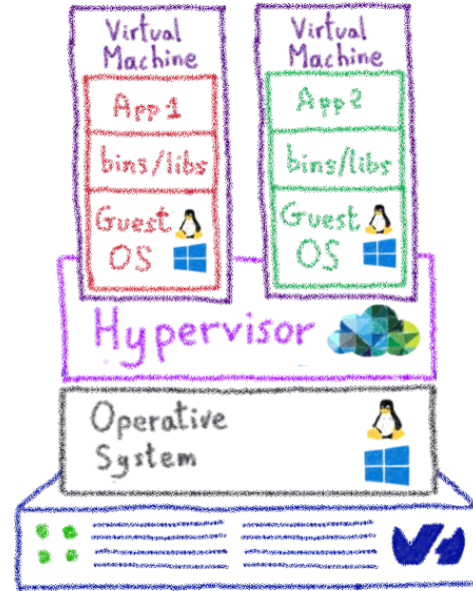
From bare metal to containers



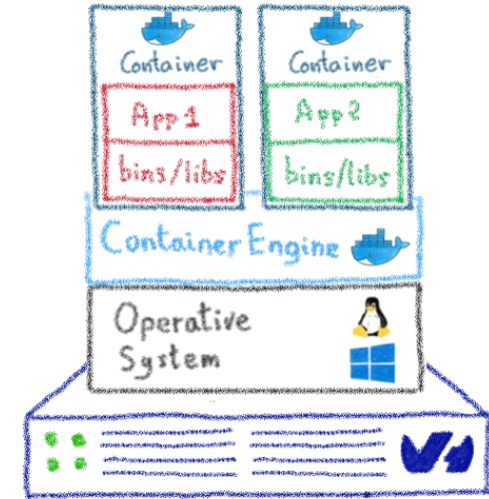
Bare metal servers



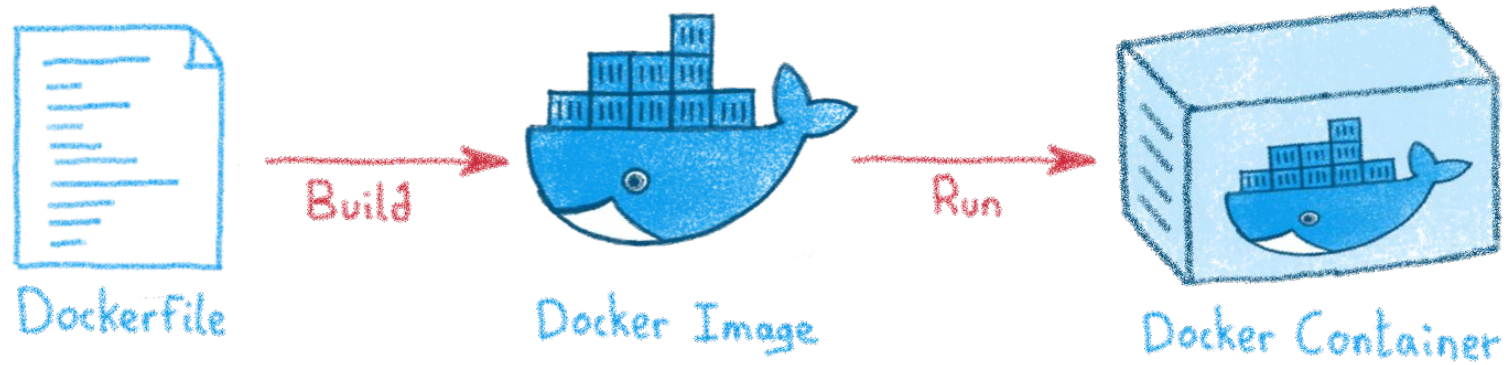
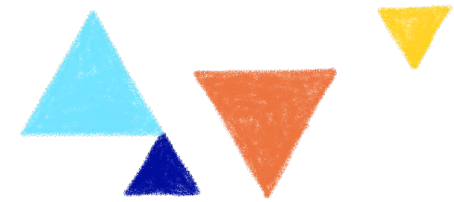
Virtual Machines



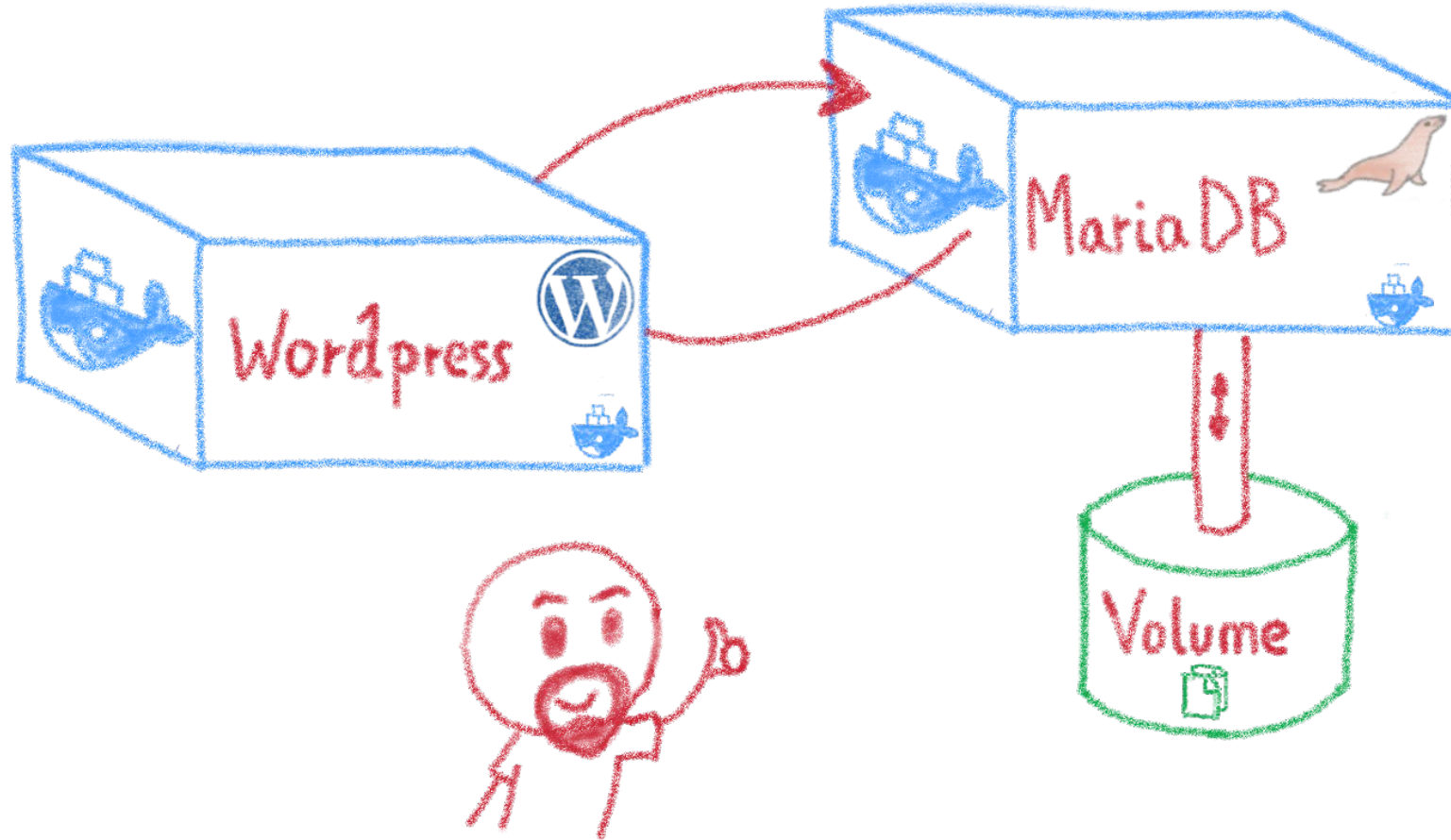
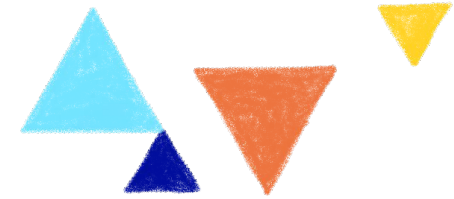
Containers



Dockerfiles, images and containers

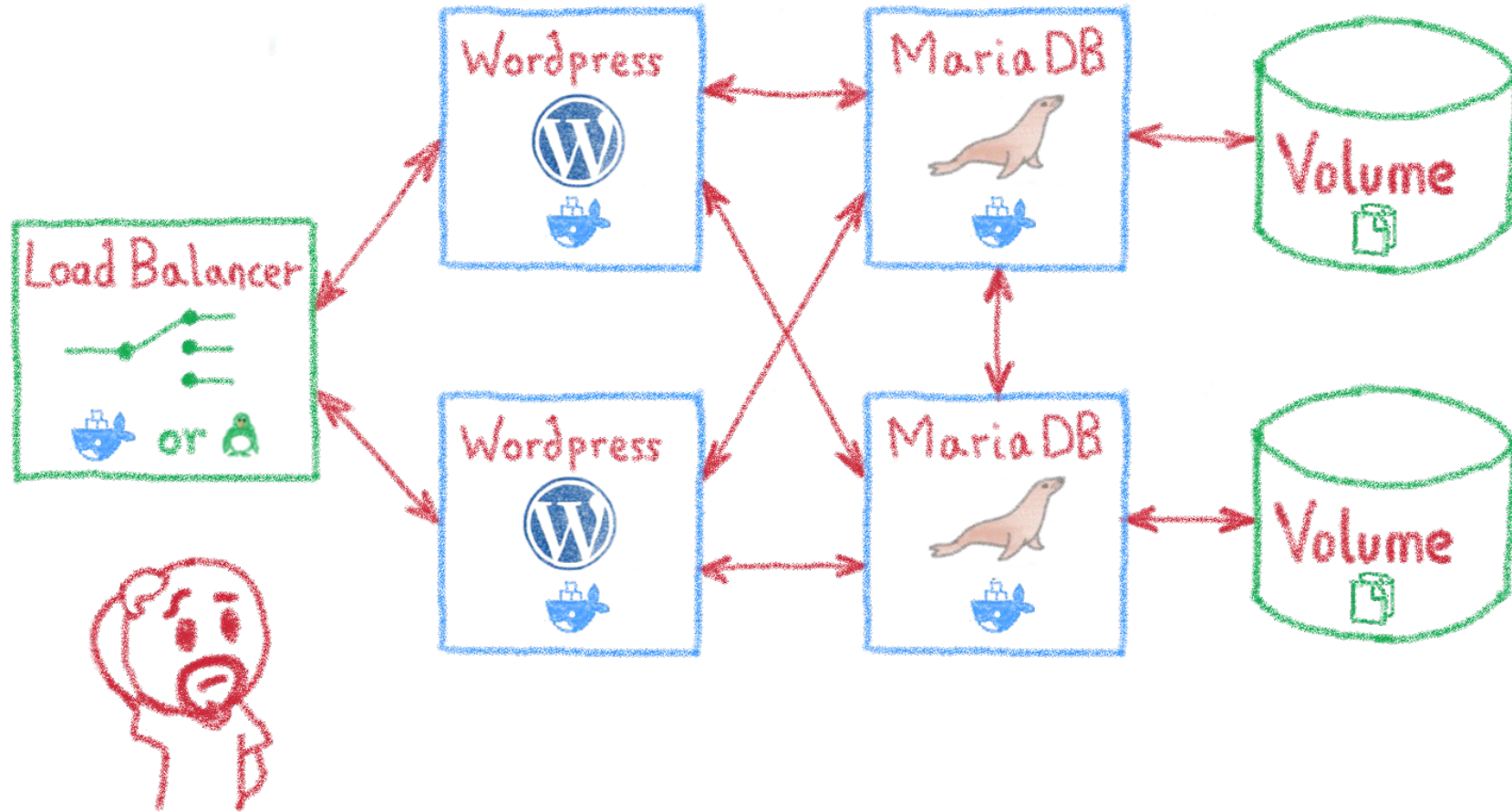
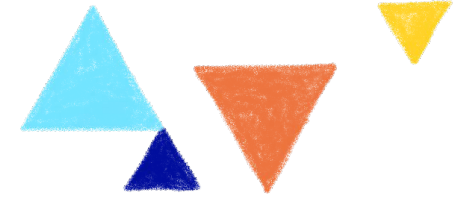


Containers are easy...



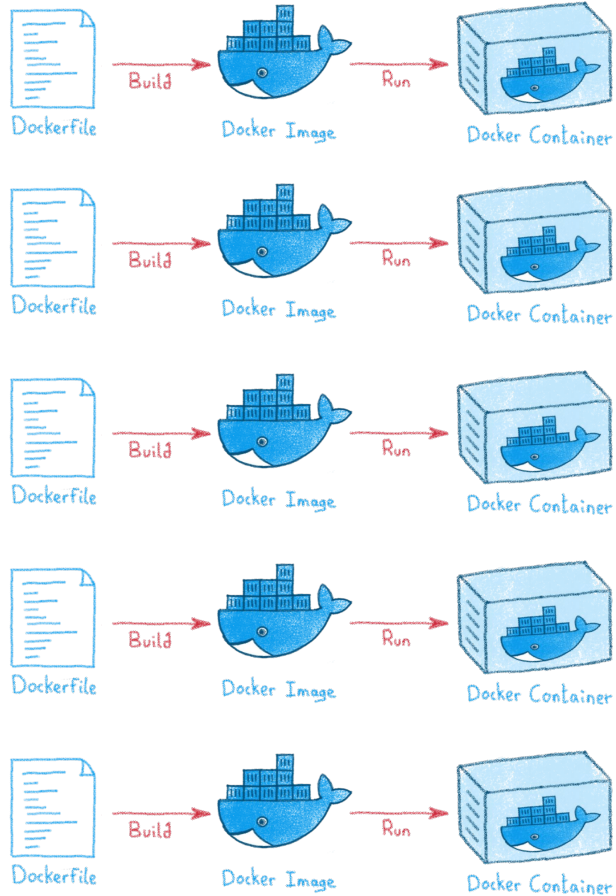
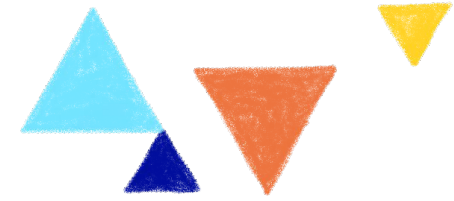
For developers

Less simple if you must operate them



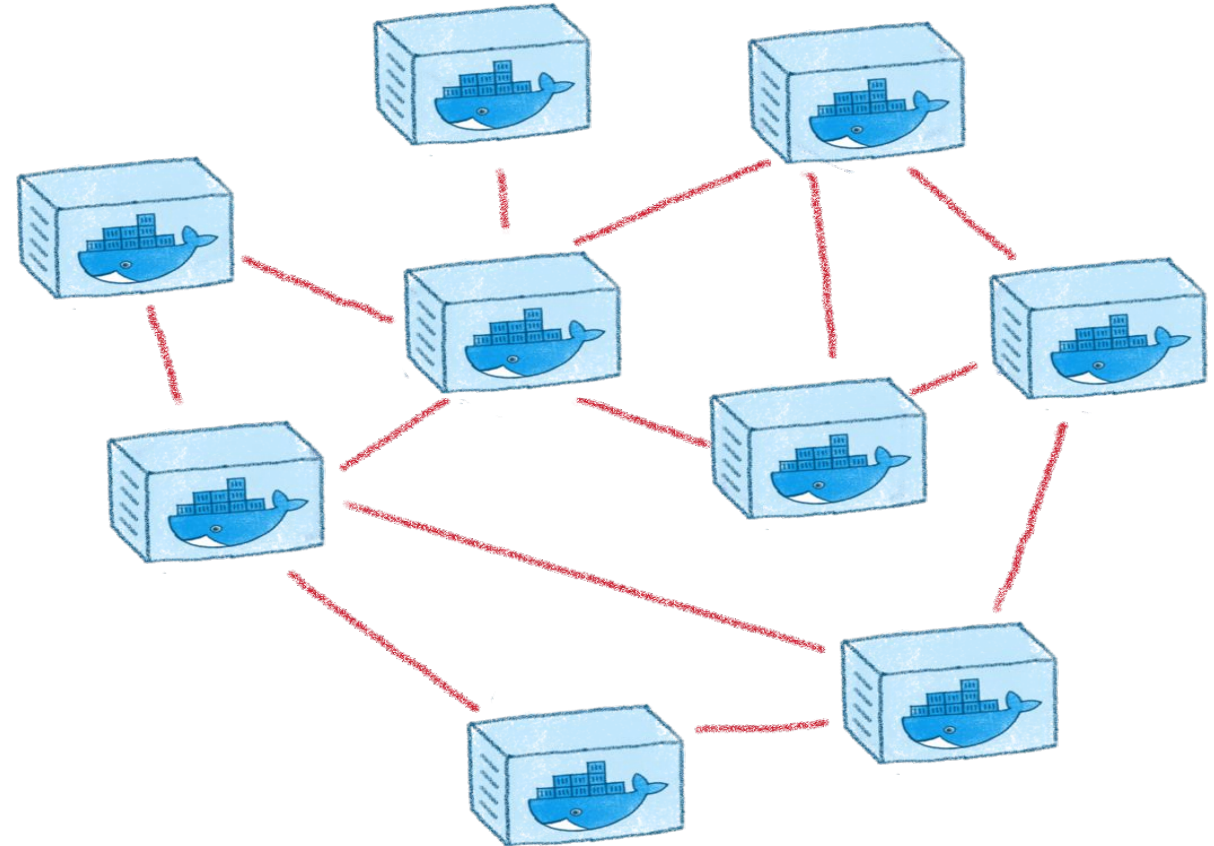
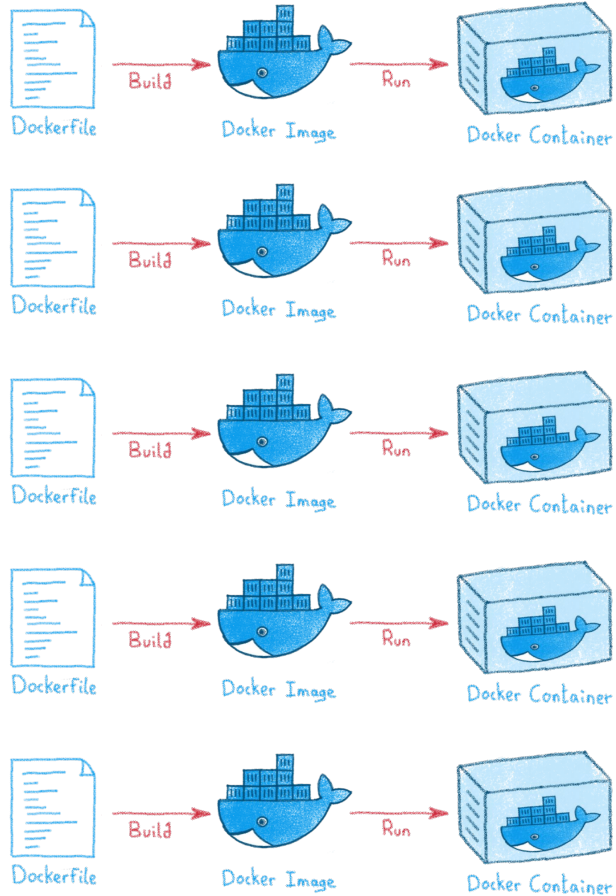
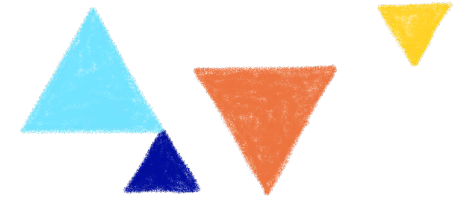
Like in a production context

And what about microservices?



Are you sure you want to operate them by hand?

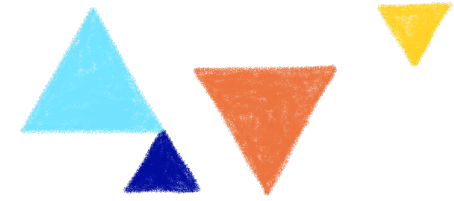
And what about microservices?



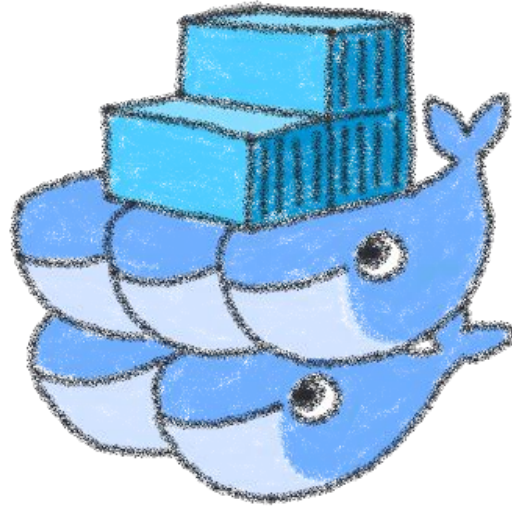
Are you sure you want to operate them by hand?



Helping to tame de complexity



Docker
Compose

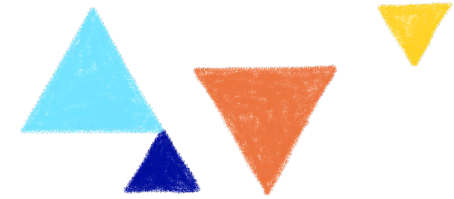


Docker
Swarm



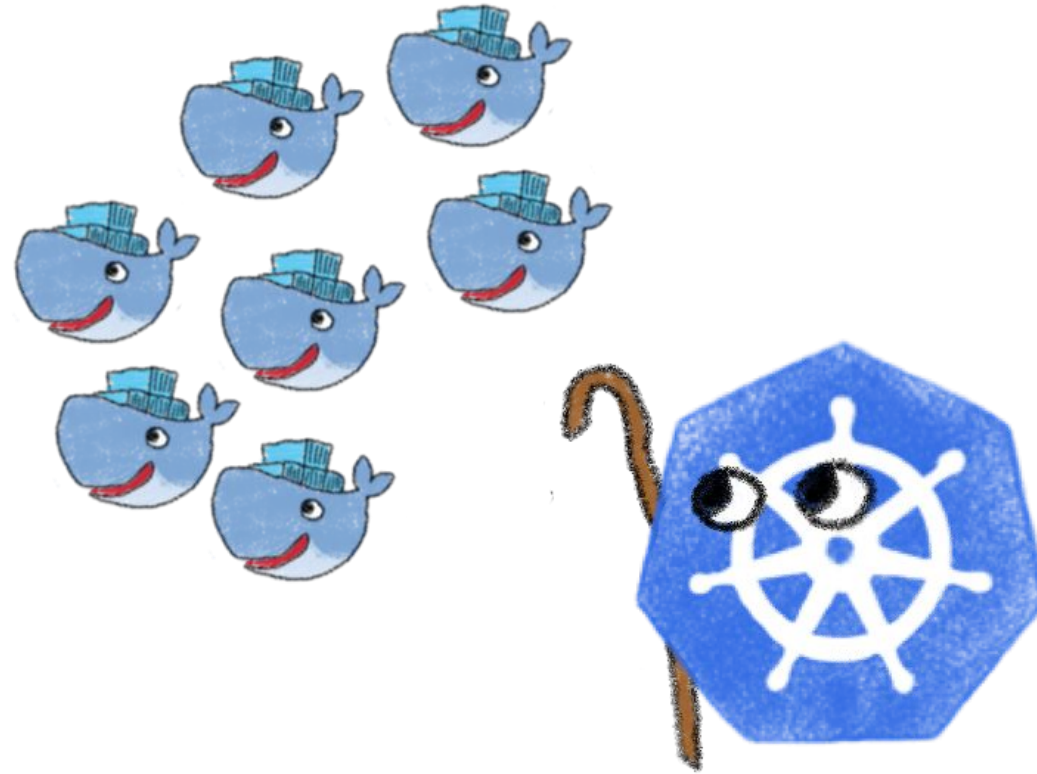
kubernetes

Kubernetes: a full orchestrator

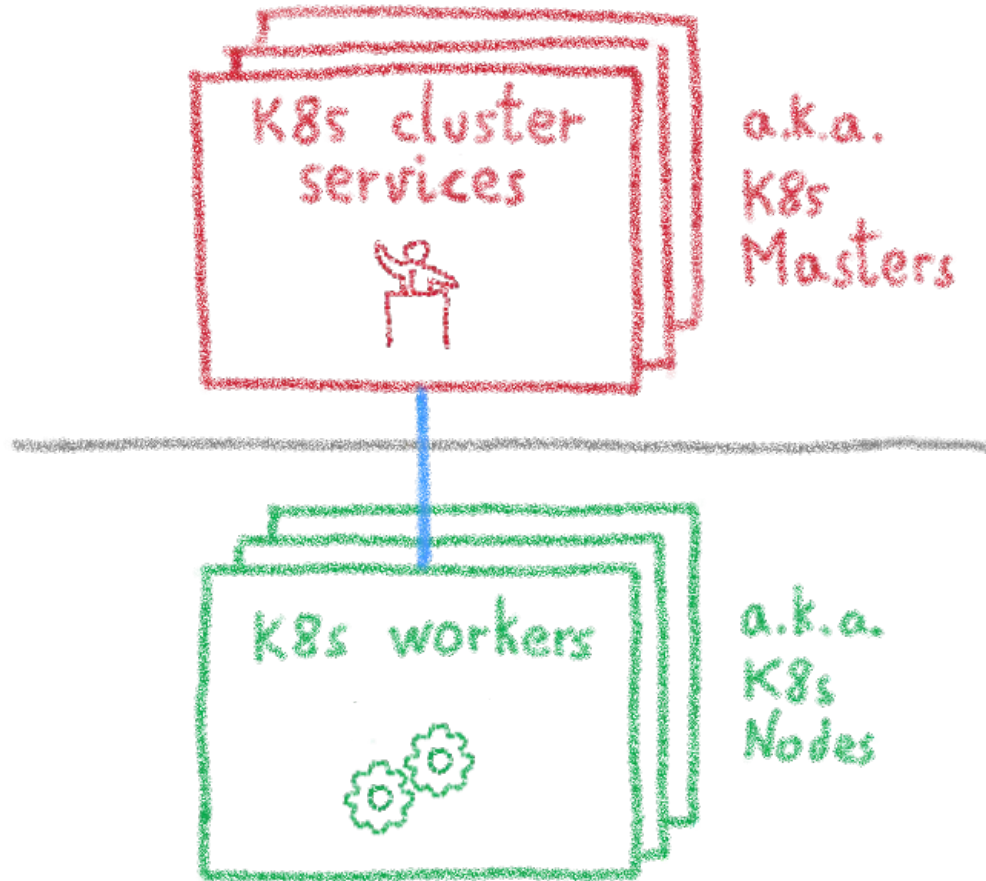
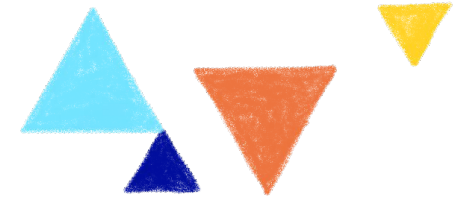


Takes care of:

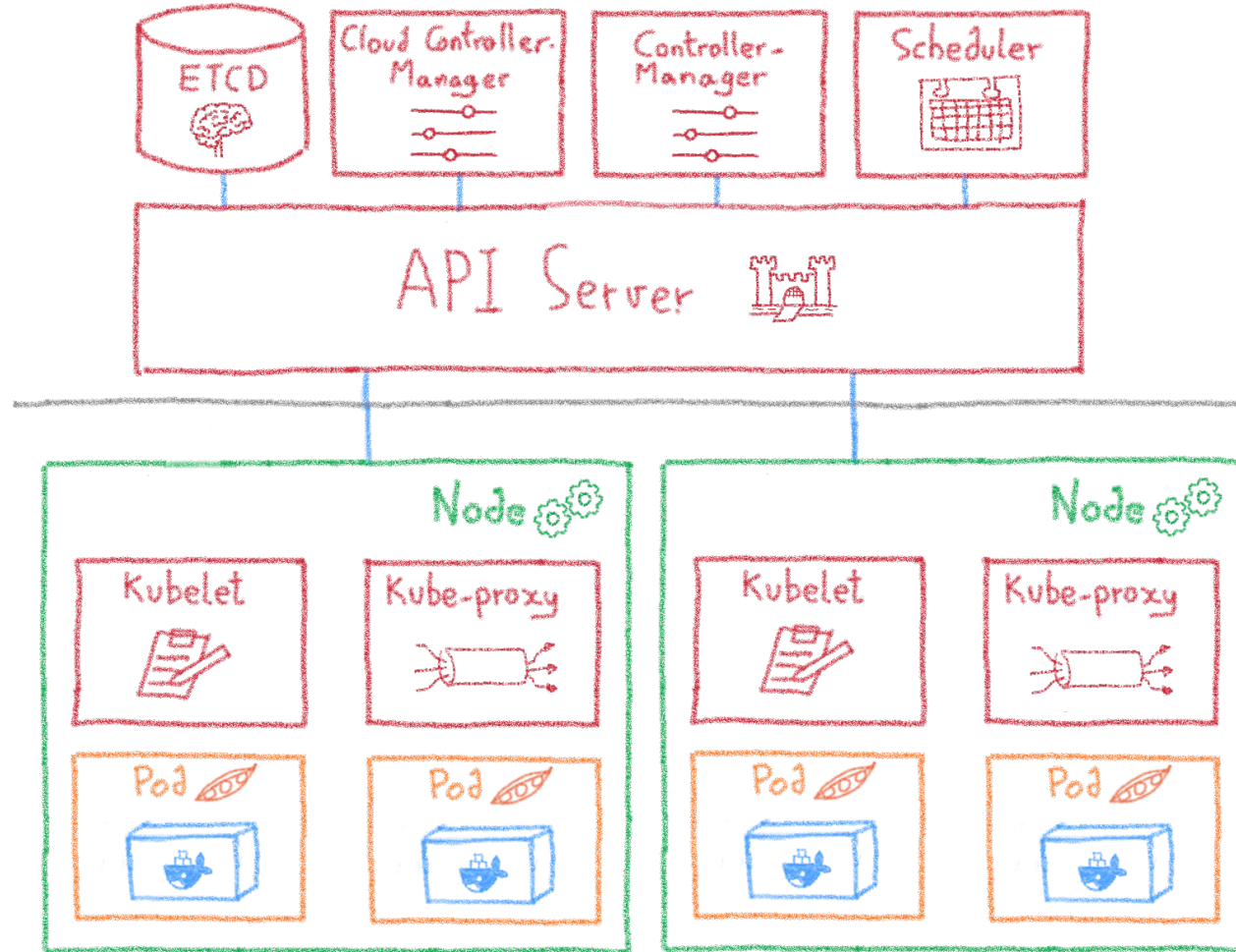
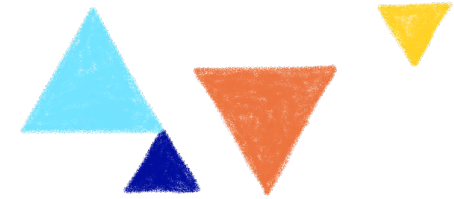
- Deployment
- Scaling
- Monitoring
- Repairing
- Securing
- ...



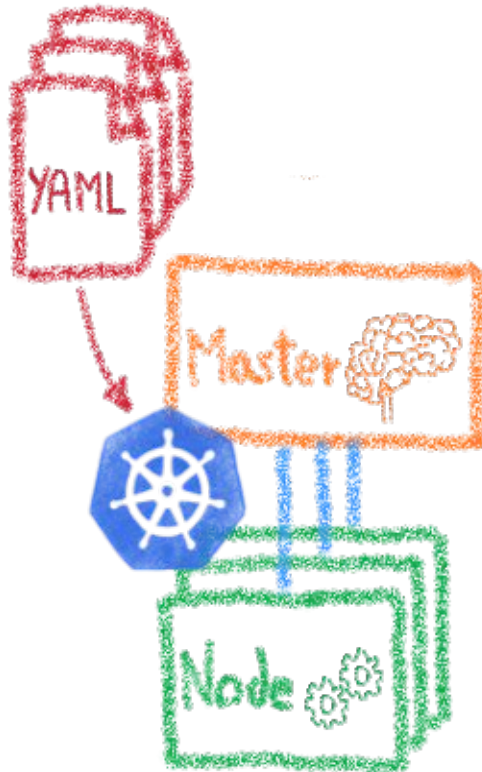
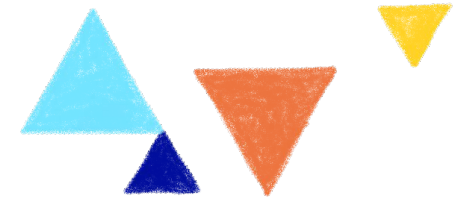
Kubernetes cluster: masters and nodes



Kubernetes cluster: more details



Desired State Management

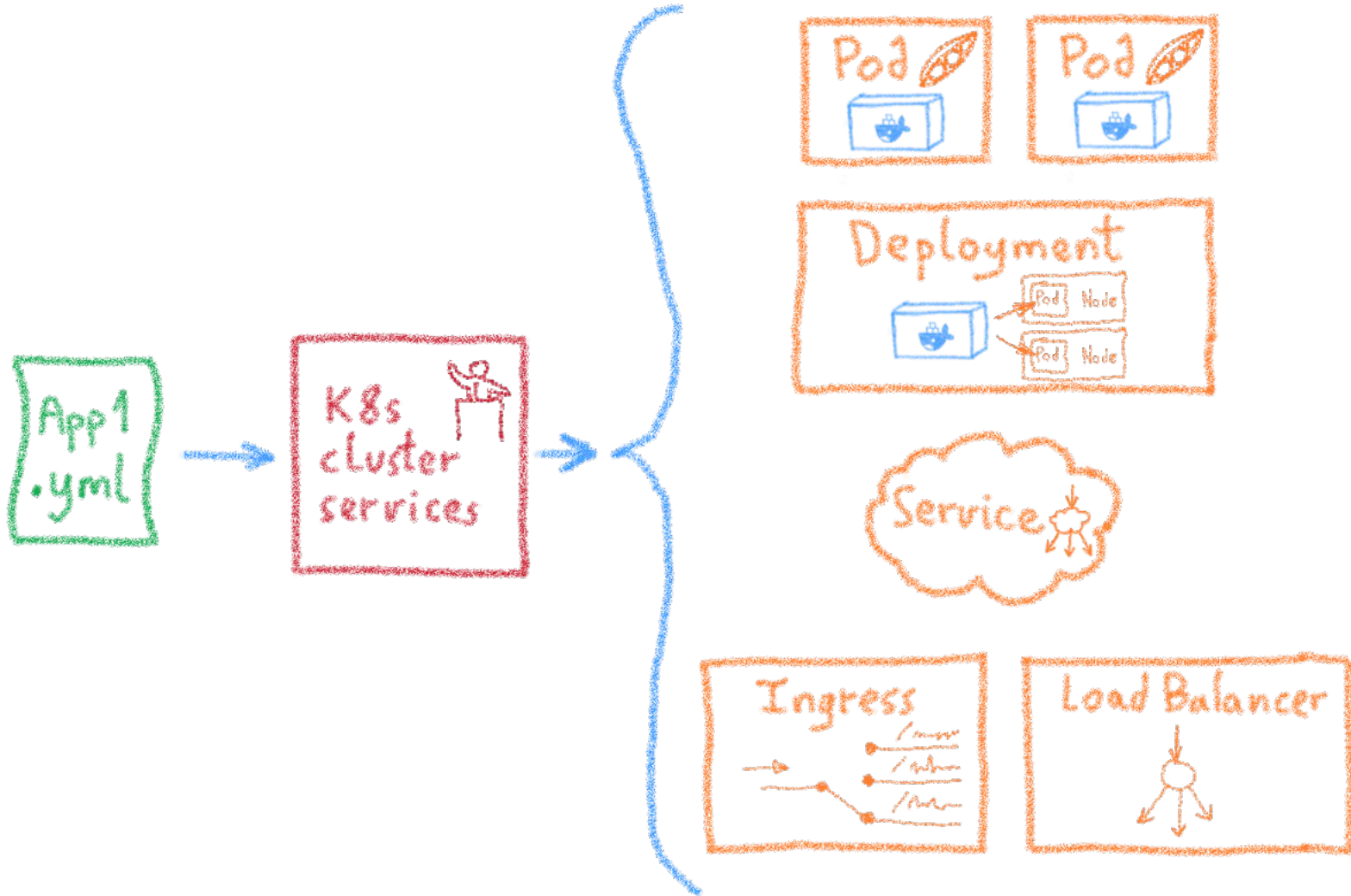
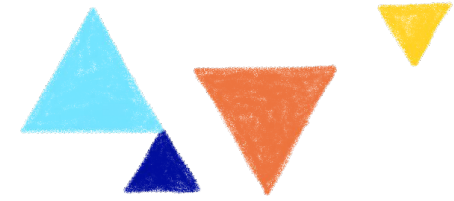


Manifest files:

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

Declarative infrastructure

Desired State Management



Ingress

Services

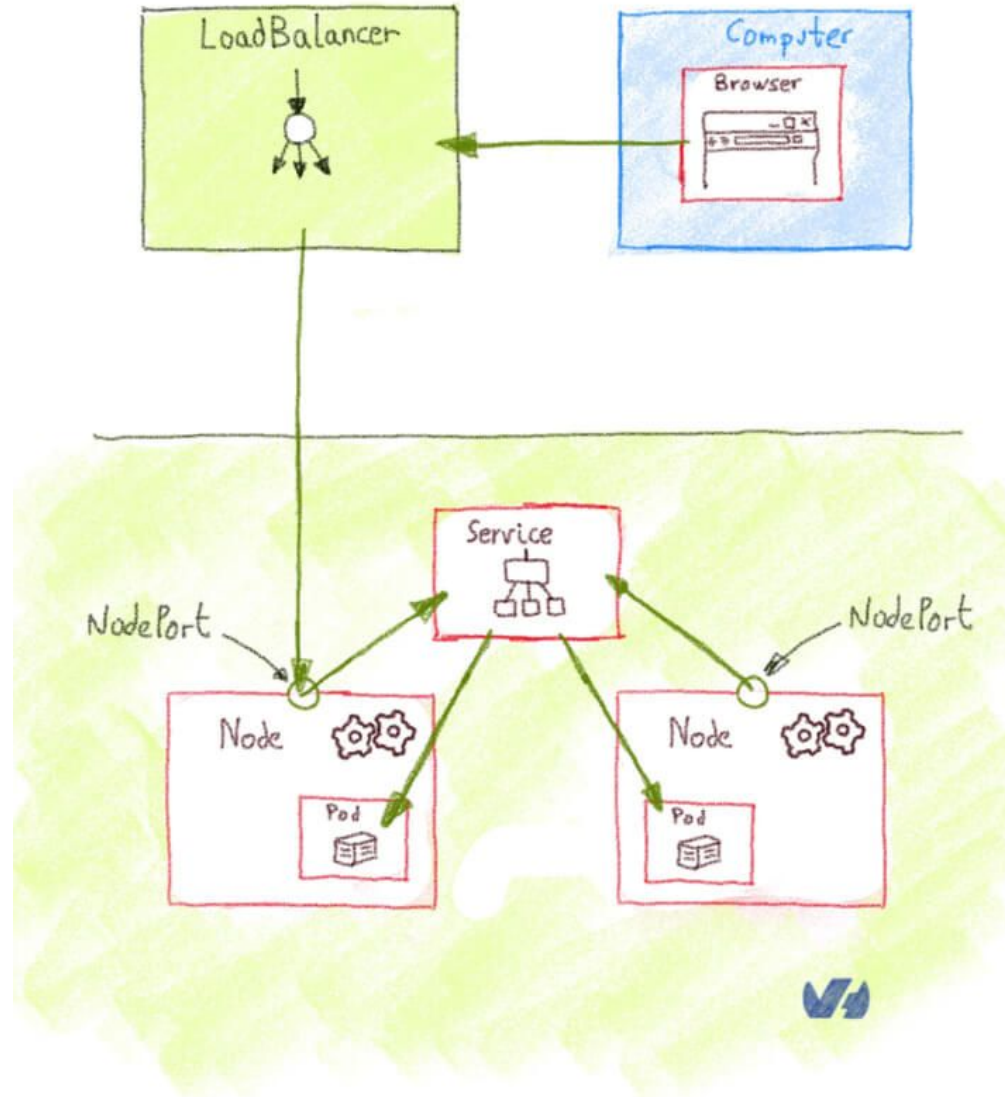
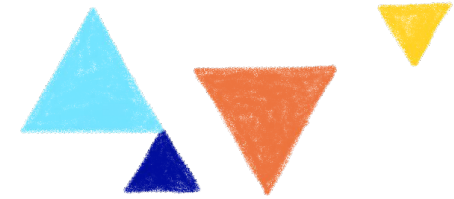
Deployments

Pods

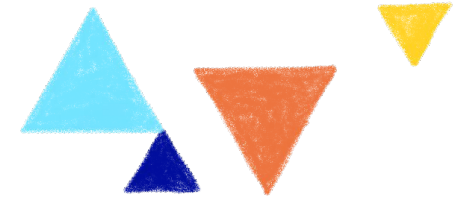
Sidecars

Replica Sets

Let's deploy an application



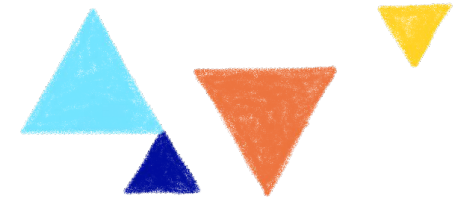
Demo: Hello Kubernetes World



The screenshot shows the OVHcloud website interface. At the top, there is a 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 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 dropdown is set to 'English (GB)'. The main heading is 'Deploying a Hello World application with the OVHcloud Control Panel', accompanied by a large white play button icon on the left. Below the heading, the text reads: 'Find out how to deploy a Hello World application with the OVHcloud Control Panel'.

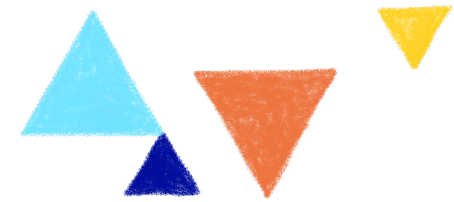
<https://docs.ovh.com/gb/en/kubernetes/deploying-hello-world/>

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 used for running commands against clusters, deploying applications, and managing resources. It mentions that kubectl is installable on Linux, macOS, and Windows. A link for 'Install kubectl on Linux' is visible at the bottom of the page.

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



Putting Kubernetes in production

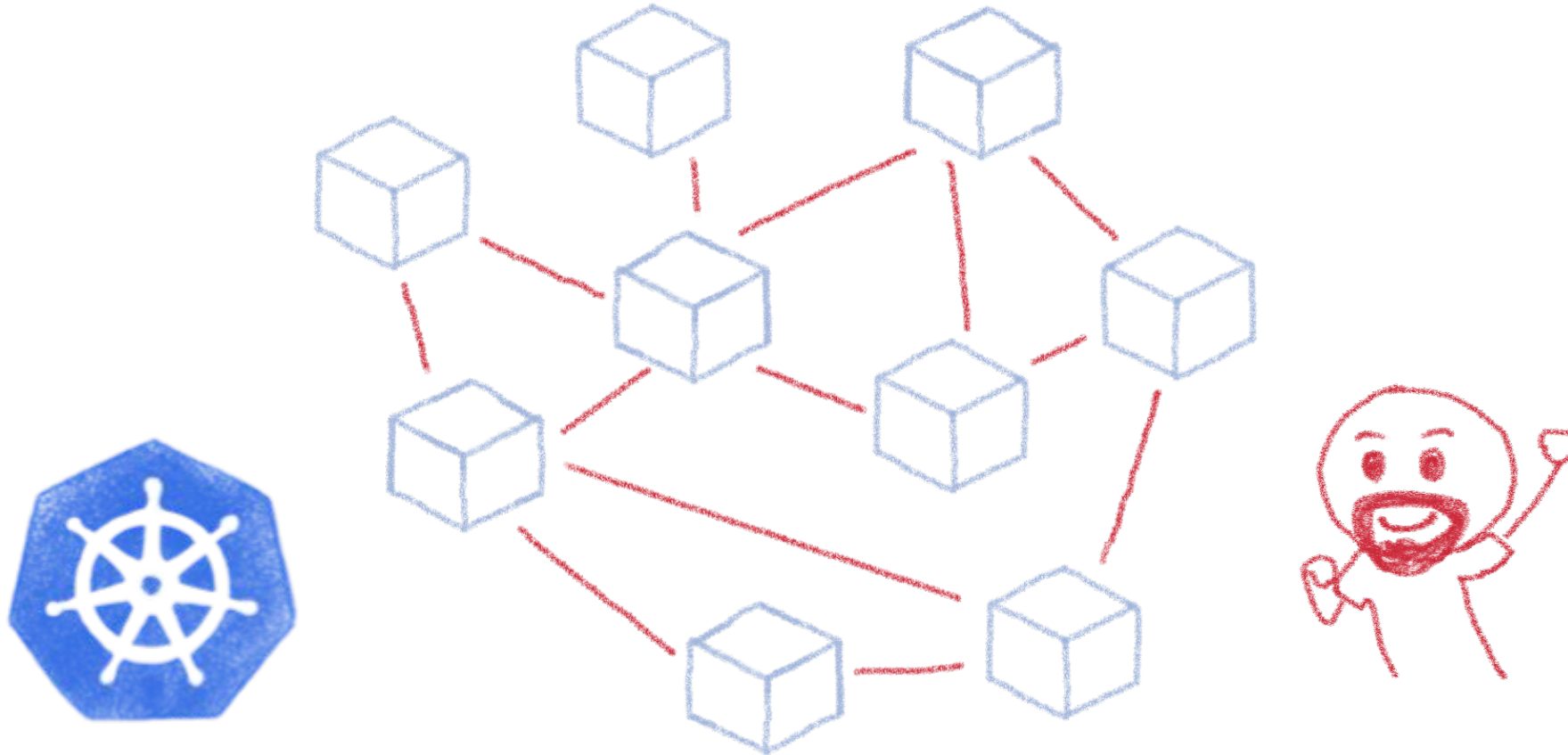
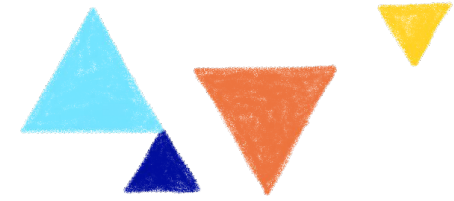
A journey not for the faint of heart

ONE DOES NOT SIMPLY



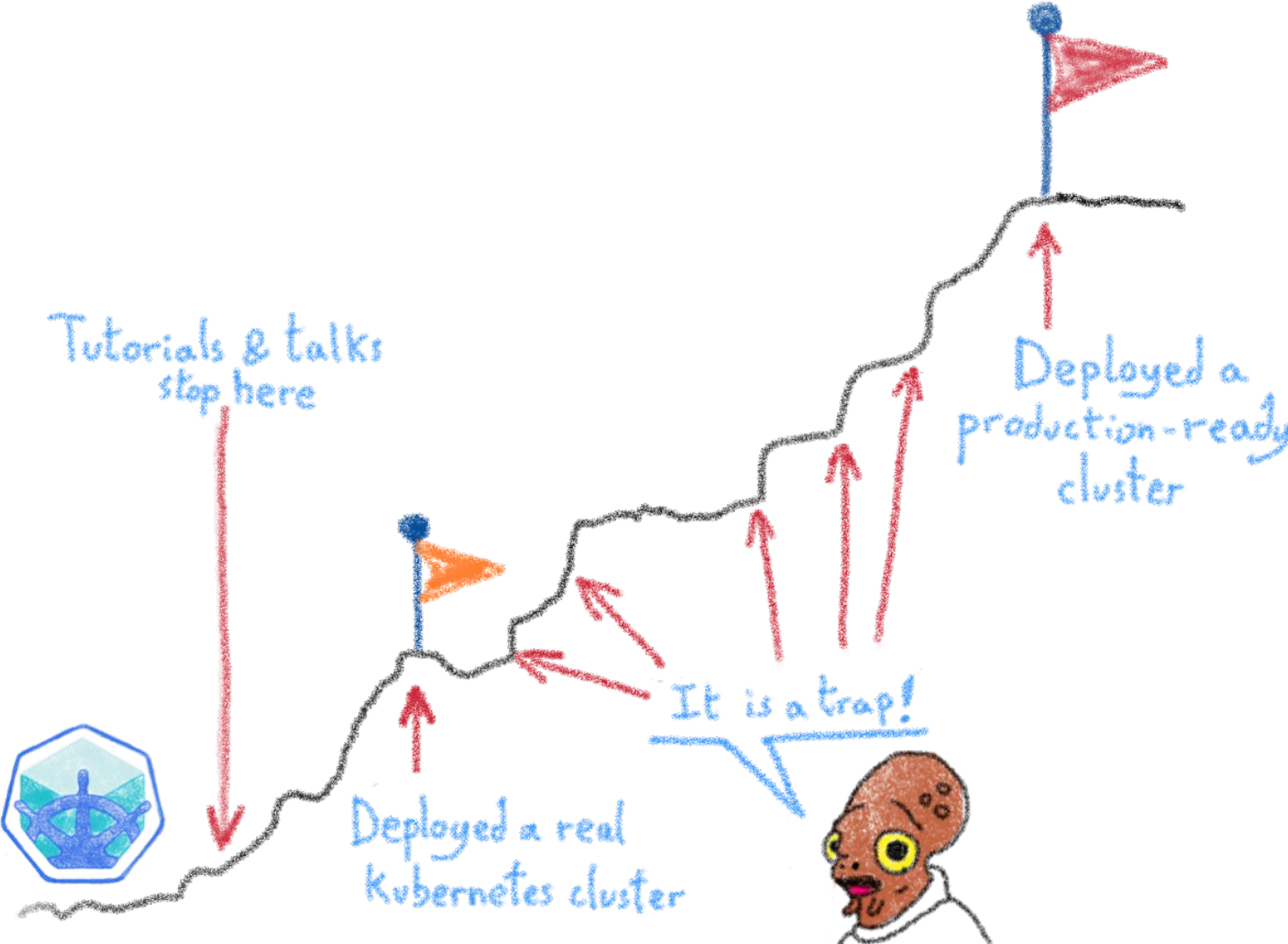
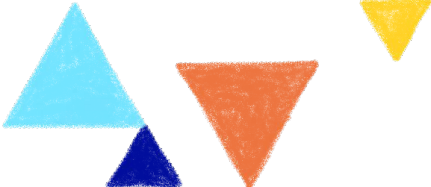
DEPLOYS K8S IN PRODUCTION

Kubernetes can be wonderful

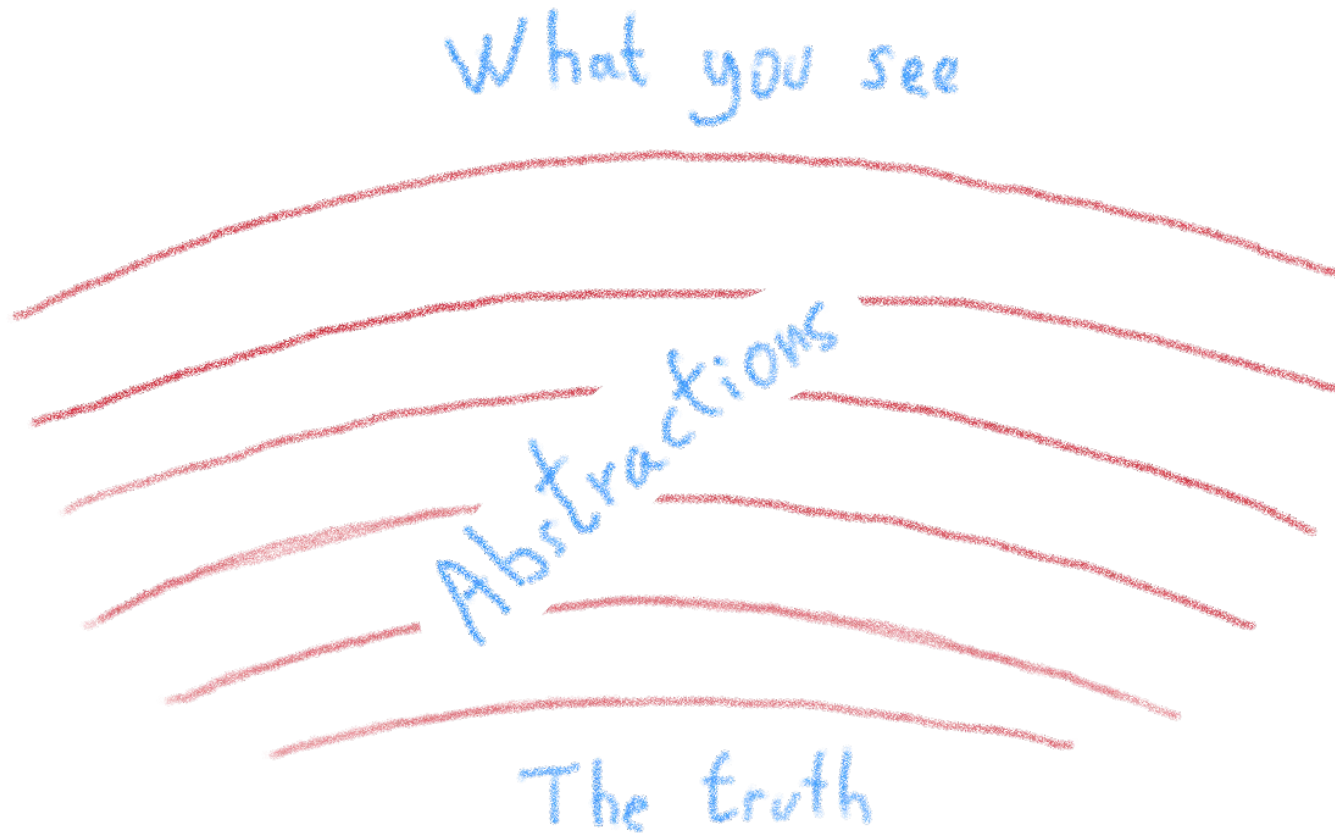
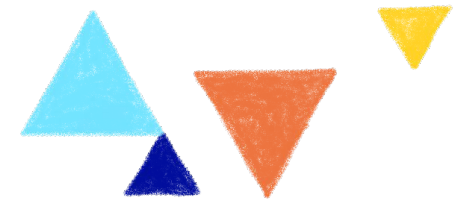


For both developers and devops

The journey from dev to production

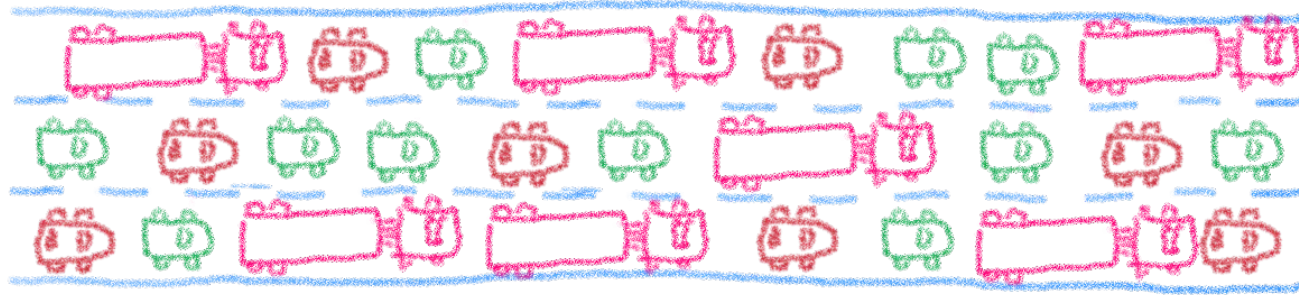
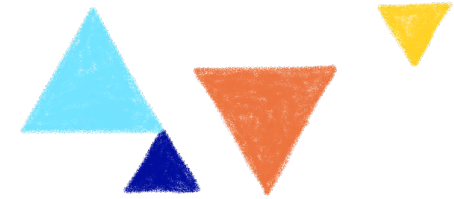


It's a complex technology



Lots of abstraction layers

Kubernetes networking is complex...



All this traffic...
is it normal?



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

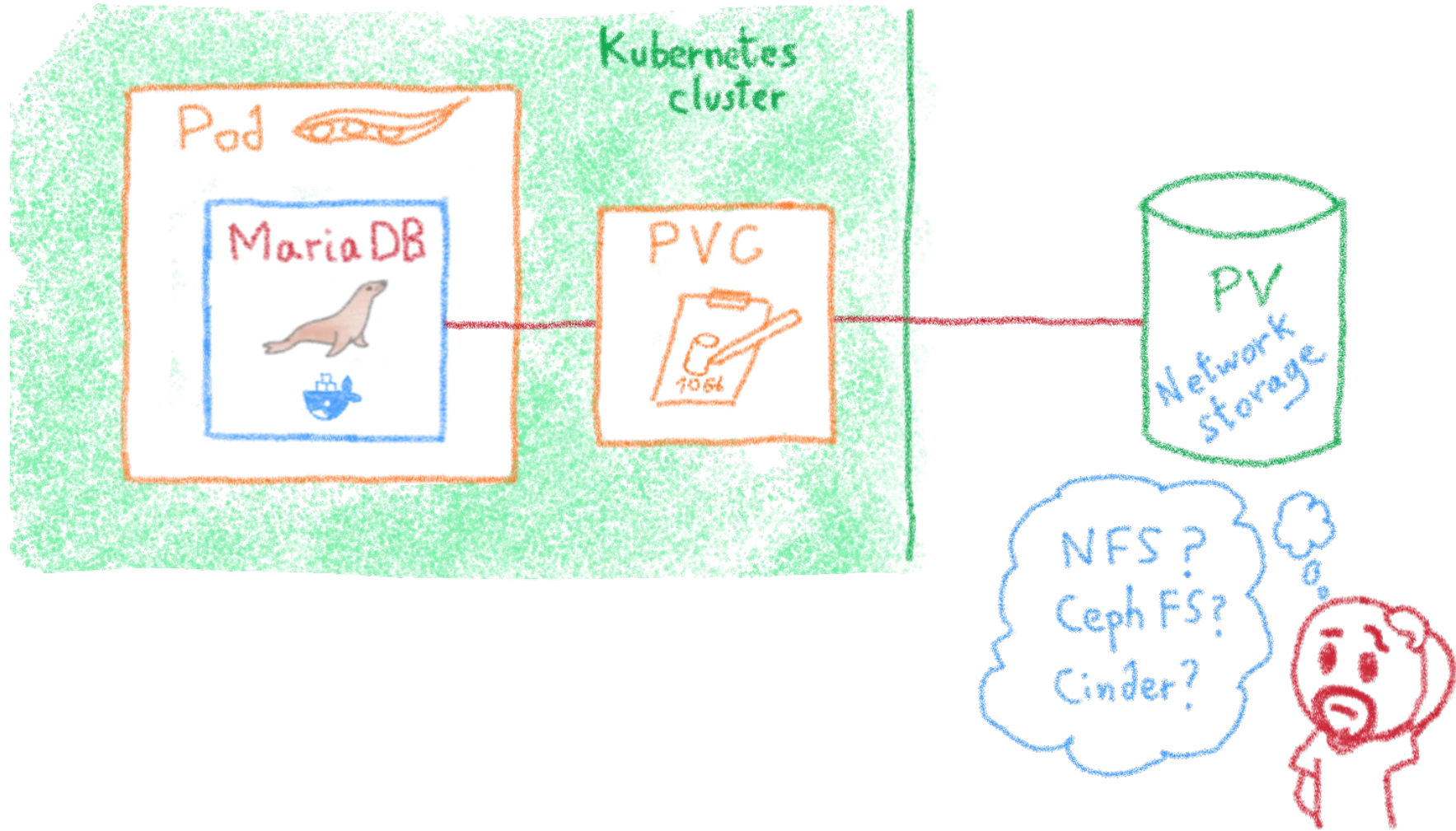
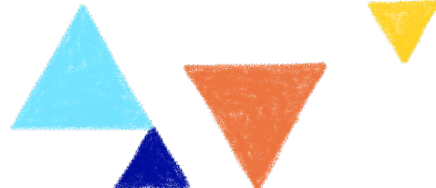
- IPAM
- iptables
- routing
- crossnode networking

Cluster IP, NodePort, Ingress

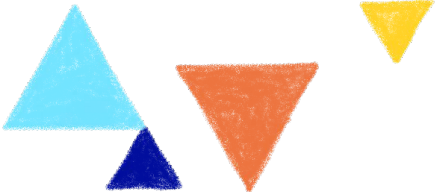
Service Meshes, Istio



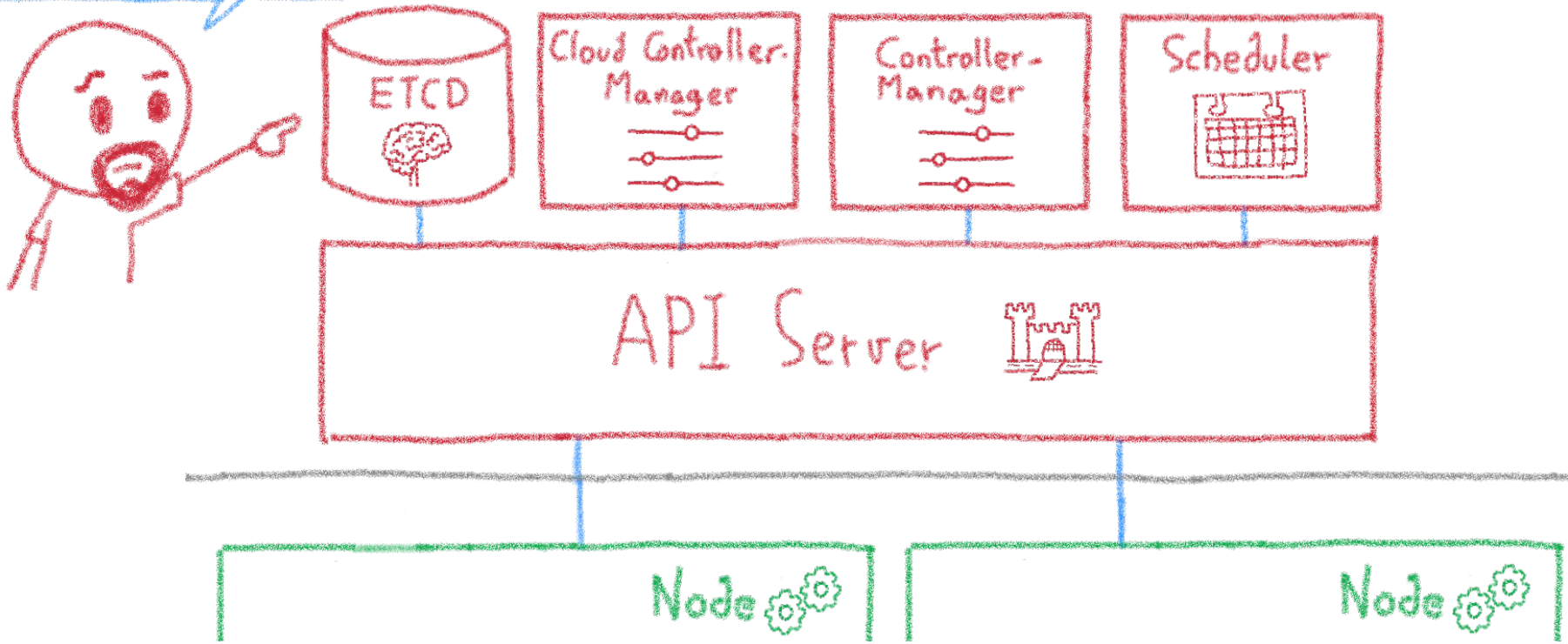
The storage dilemma



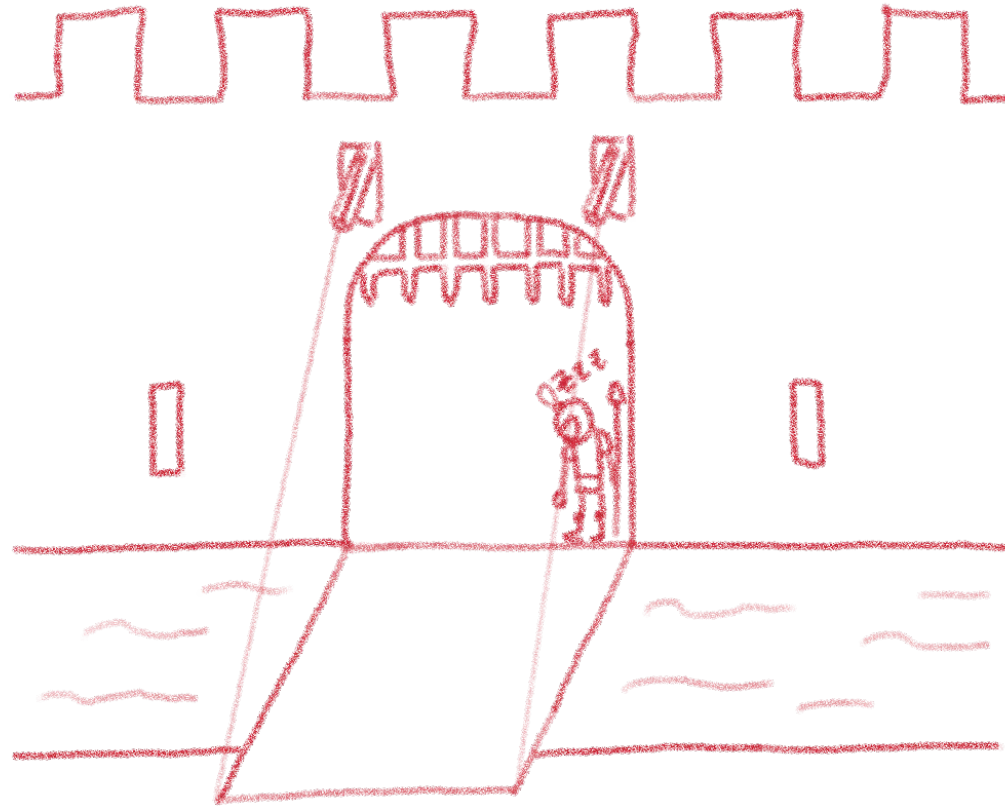
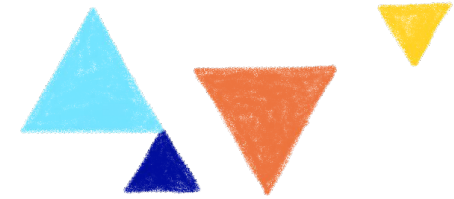
The ETCD vulnerability



A single instance ETCD?
Are you sure?



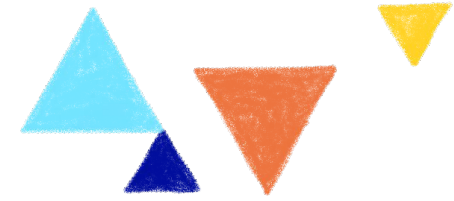
Kubernetes is insecure by design*



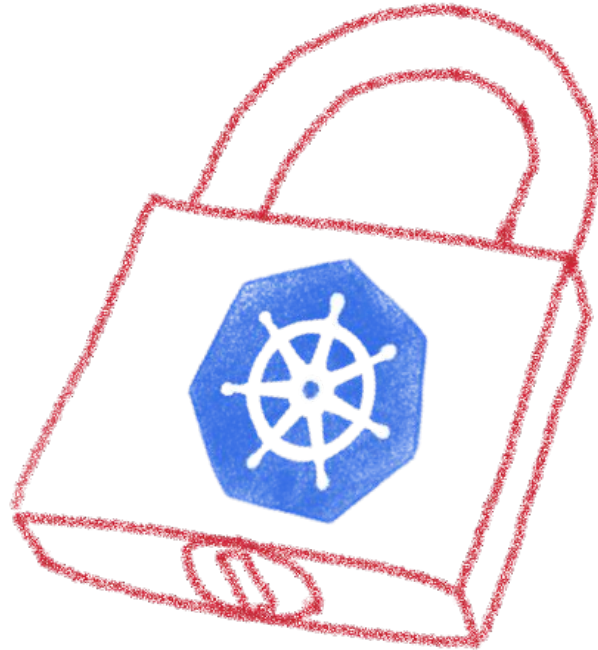
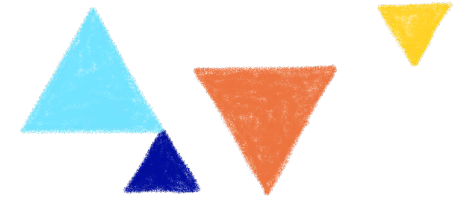
It's a feature, not a bug.

Up to K8s admin to secure it according to needs

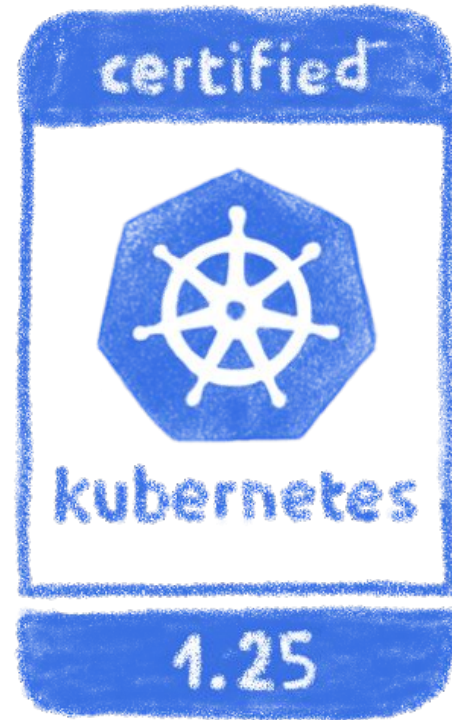
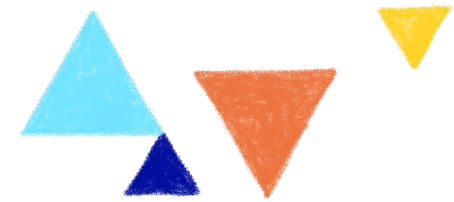
Not everybody has the same security needs



Kubernetes allows to enforce security practices as needed

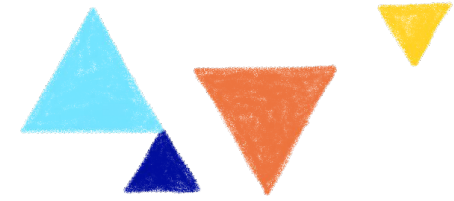


Always keep up to date



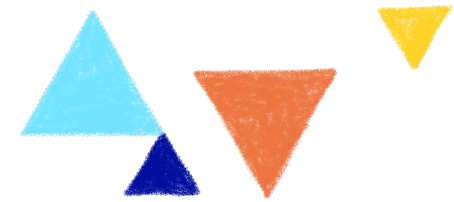
Both Kubernetes and plugins

And remember, even the best can get hacked



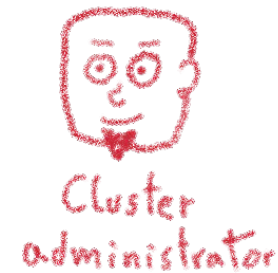
One of Tesla's cluster got hacked
via an unprotected K8s API endpoint,
and was used to mine cryptocurrency...

Remain attentive, don't get too confident

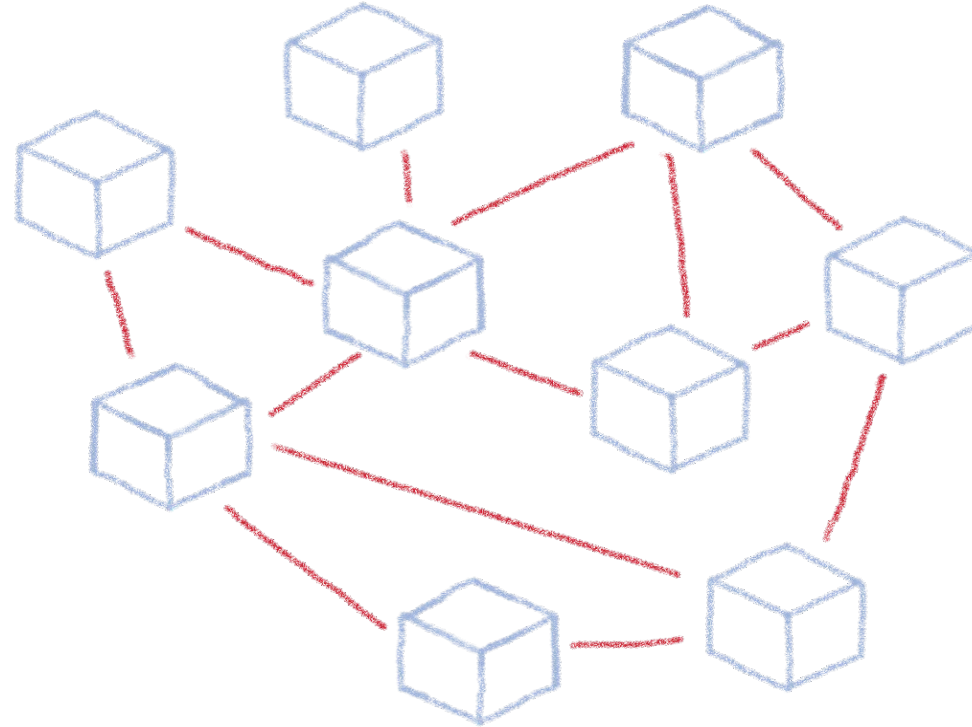
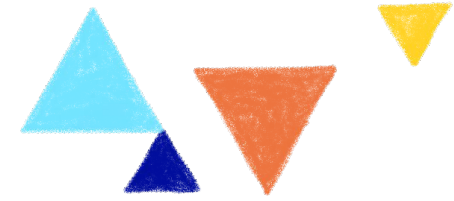


A managed Kubernetes

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

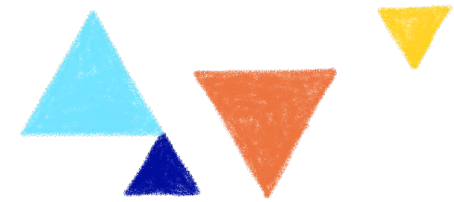


Kubernetes is powerful



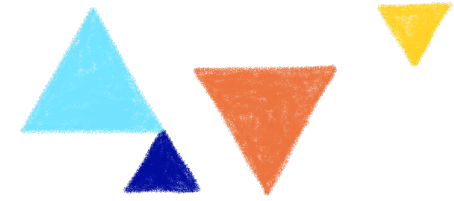
It can make Developers' and
DevOps' lives easier

But there is a price: operating it



Lot of things to think about

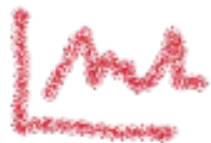
We have seen some of them



Security



Deployment

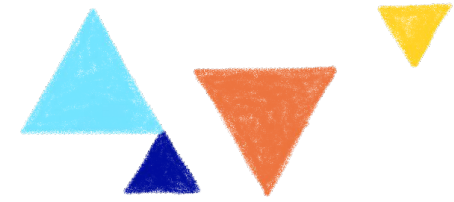


Monitoring



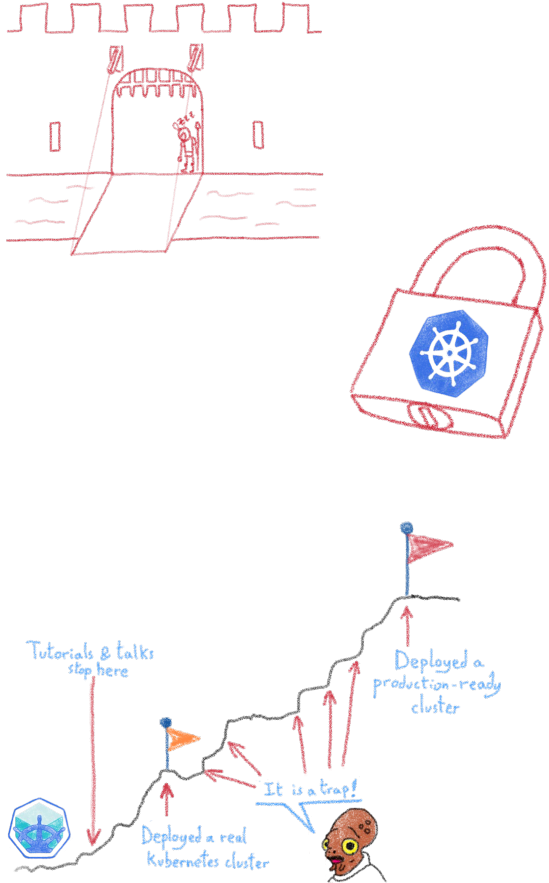
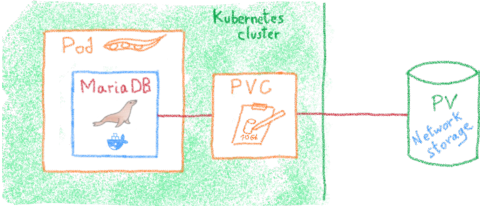
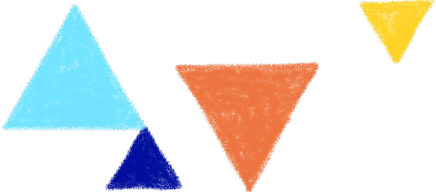
Backups

Different roles



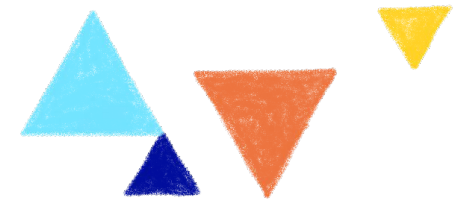
Each role asks for very different knowledge and skill sets

Operating a Kubernetes cluster is hard



But we have a good news...

Most companies don't need to do it!



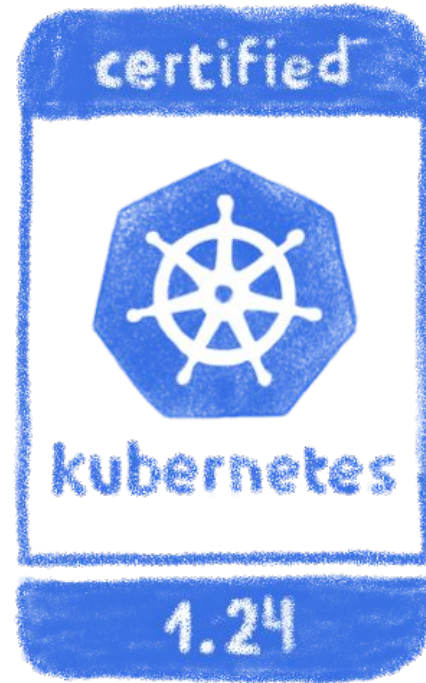
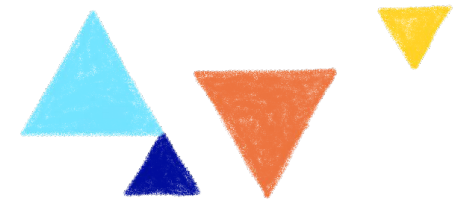
Developer



Cluster
administrator

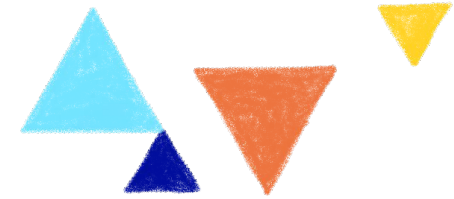
As they don't build and rack
their own servers!

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



You get the cluster,
the operator get the problems

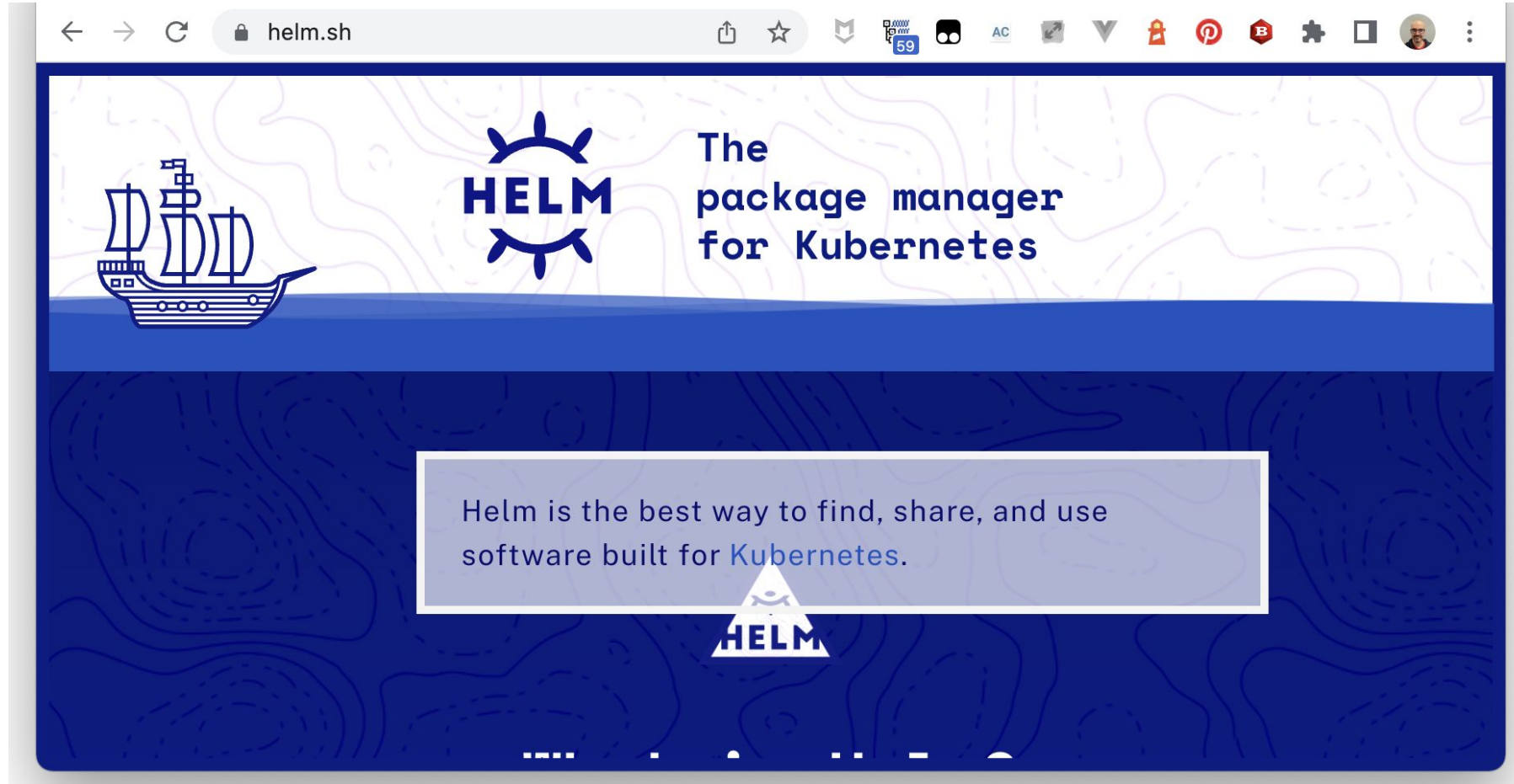
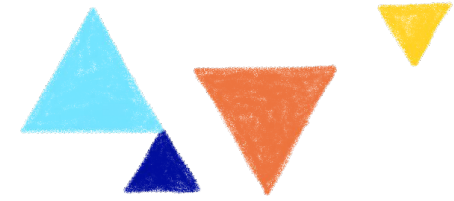
Demo: A complete app - Wordpress



The screenshot shows the OVHcloud website navigation and a specific documentation page. The top navigation bar includes the OVHcloud logo, a user account icon, and links for 'My customer account', 'Contact Sales', 'Webmail', 'Support', 'Communities', and 'OVHcloud Blog'. Below this is a secondary menu with categories like 'Bare Metal Cloud', 'Hosted Private Cloud', 'Public Cloud', 'Web Hosting & Domains', 'Enterprise', 'Ecosystem', and 'About'. The breadcrumb trail indicates the current page is 'Installing WordPress on OVHcloud Managed Kubernetes' under 'Public Cloud > Managed Kubernetes (k8s)'. A language selector is set to 'English (GB)'. The main content area features a large white play button icon on the left and the title 'Installing WordPress on OVHcloud Managed Kubernetes' in large white text. Below the title is the subtitle 'Find out how to install WordPress on OVHcloud Managed Kubernetes'. At the bottom of the page, there is a search bar with the placeholder text 'Search OVHcloud documentation'.

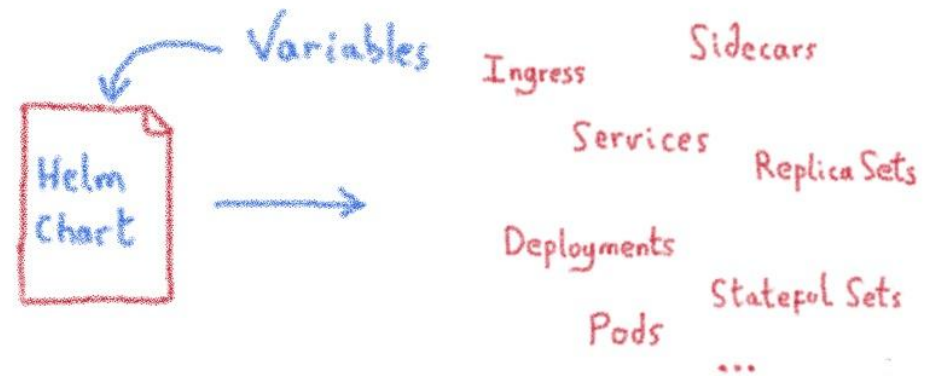
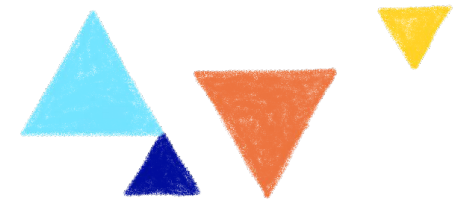
<https://docs.ovh.com/gb/en/kubernetes/installing-wordpress/>

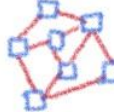
Needed tools: helm





<https://helm.sh/>

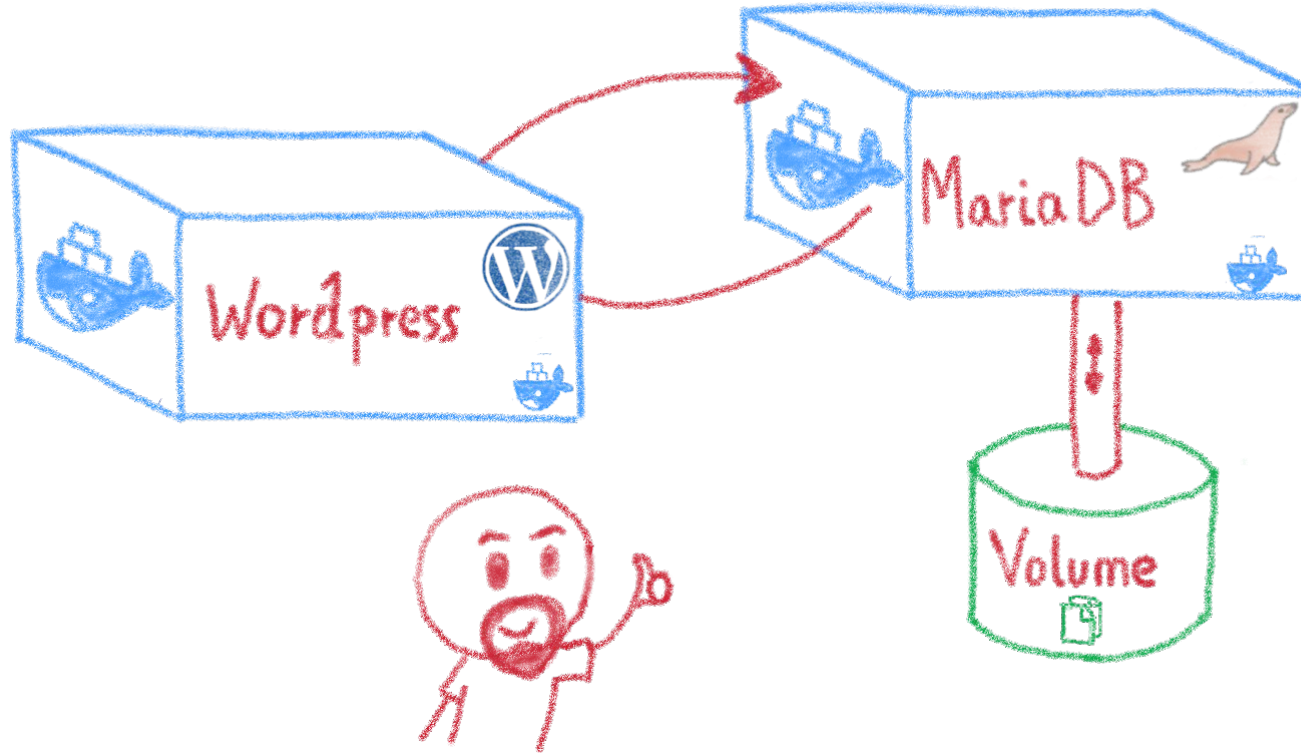
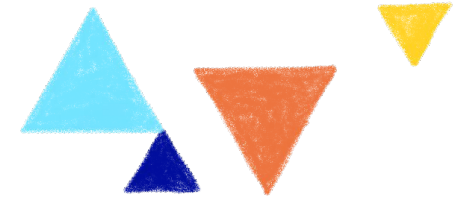
Helm: a package manager for K8s



- Manage complexity 
- Simple sharing 

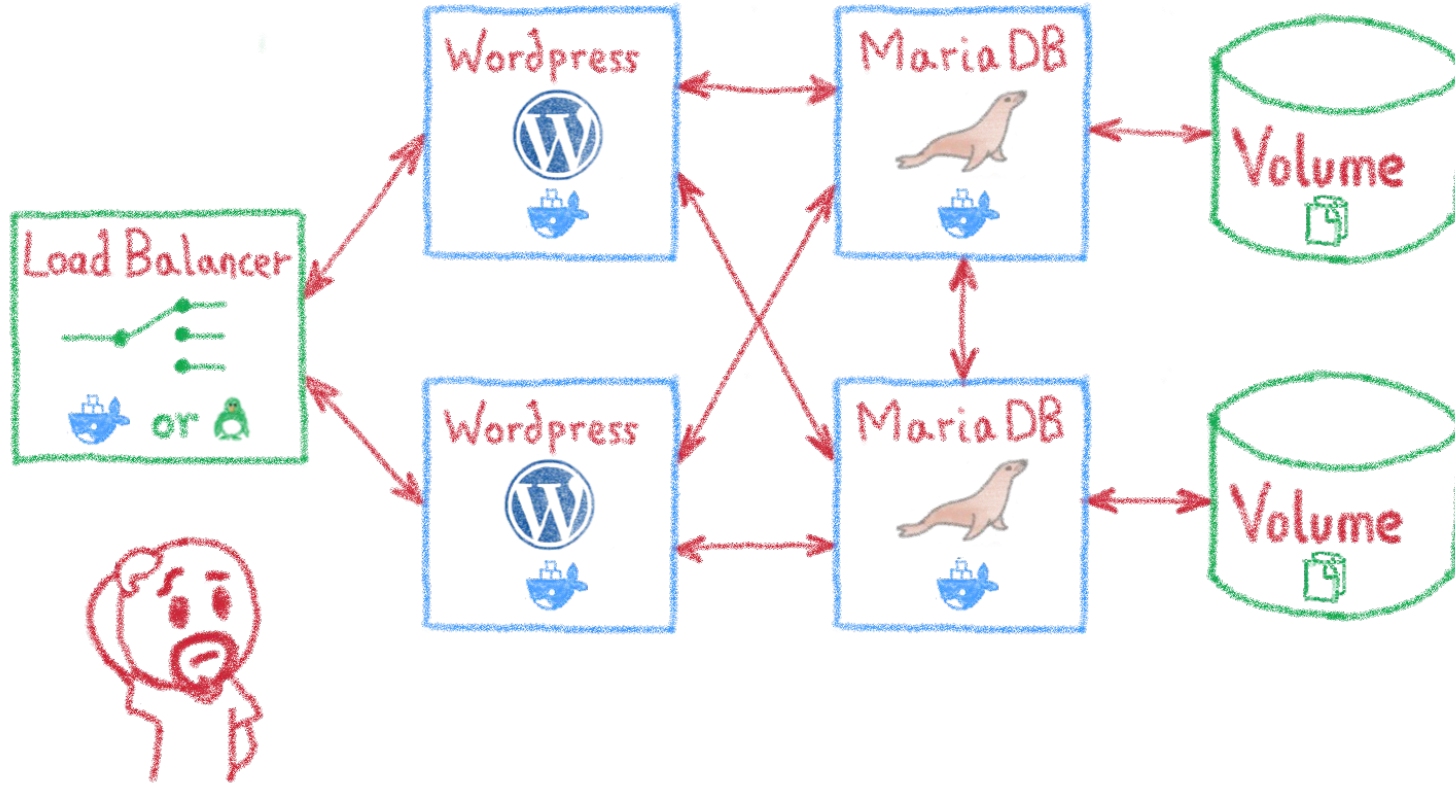
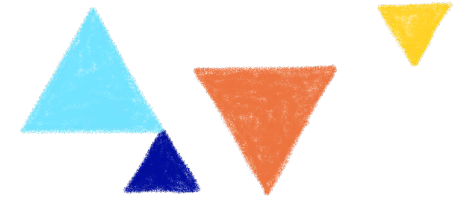
- Easy upgrades 
- Easy rollbacks 

Wordpress is easy...



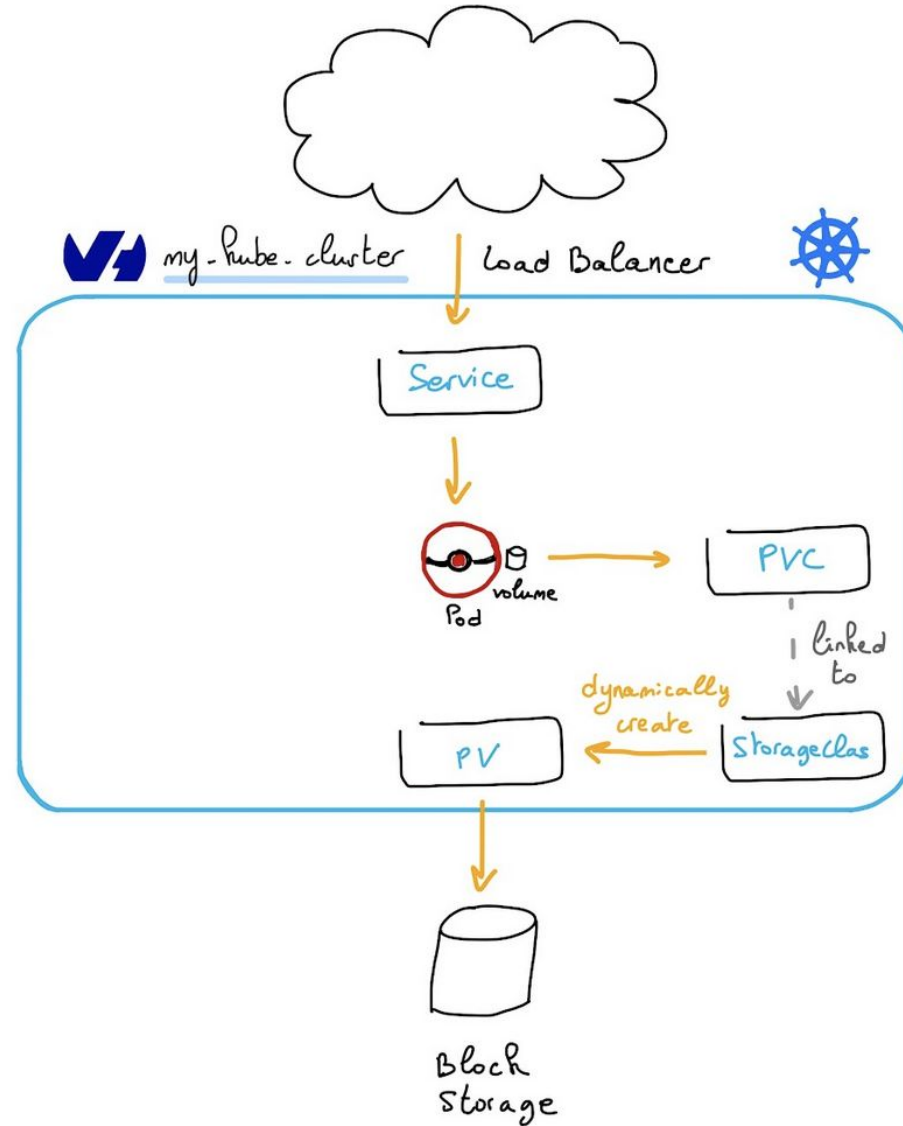
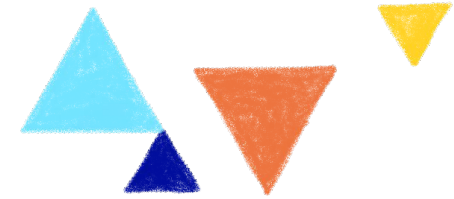
Two pods and a persistent volume

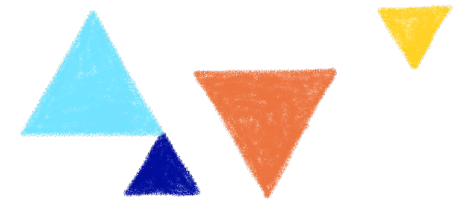
Yet is a complete app



Specially when deployed in production context

Persistent storage in Kubernetes



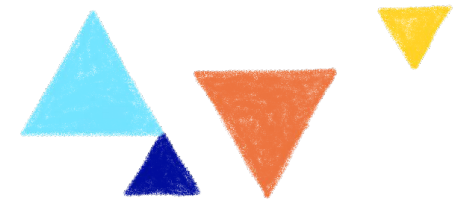


OVHcloud Managed Kubernetes

Why would you choose ours?



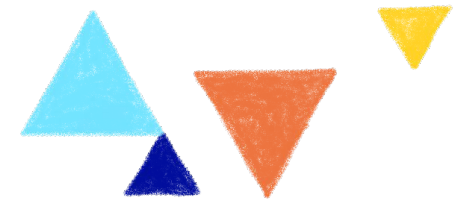
Certified Kubernetes platform



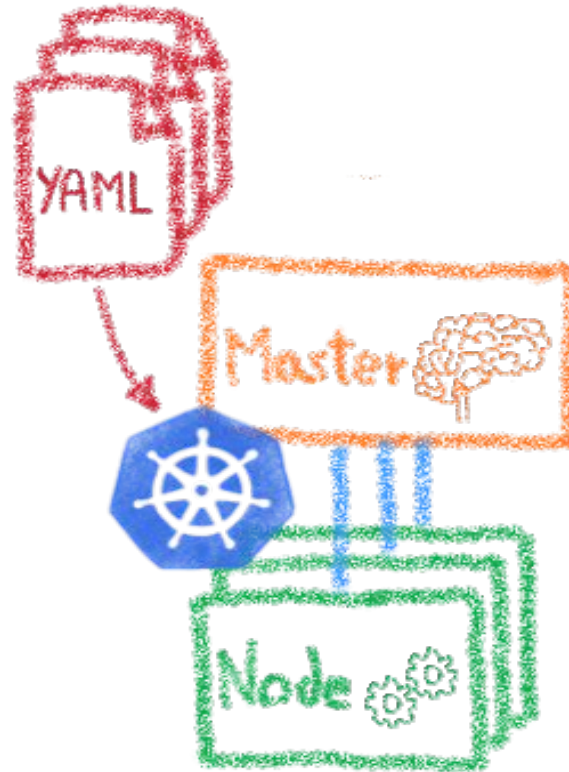
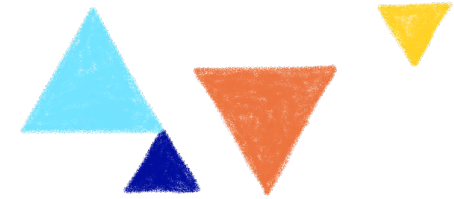
Managed Kubernetes
certified Kubernetes 1.24



OVHcloud Managed Private Registry

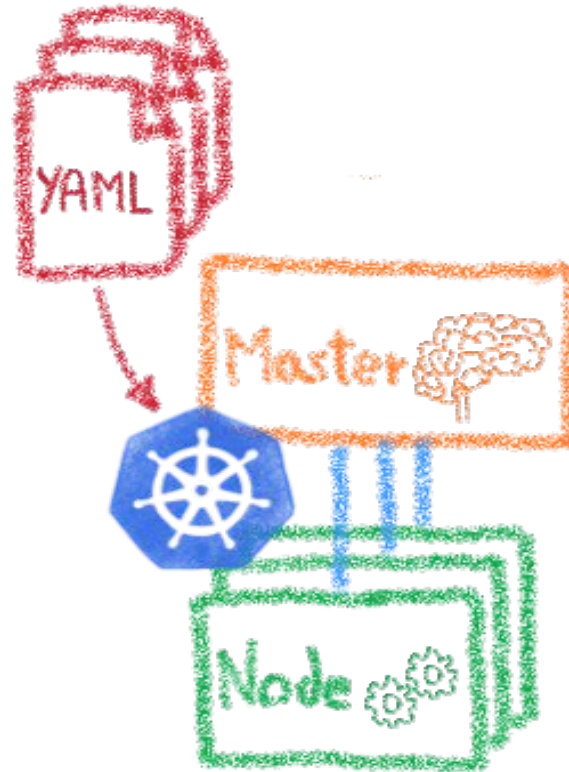
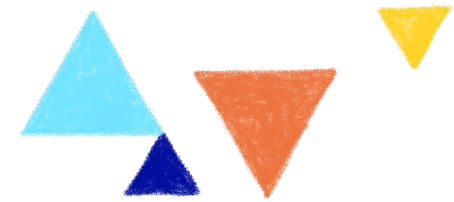


Node Pools



Users can define node pools
controlled from inside Kubernetes

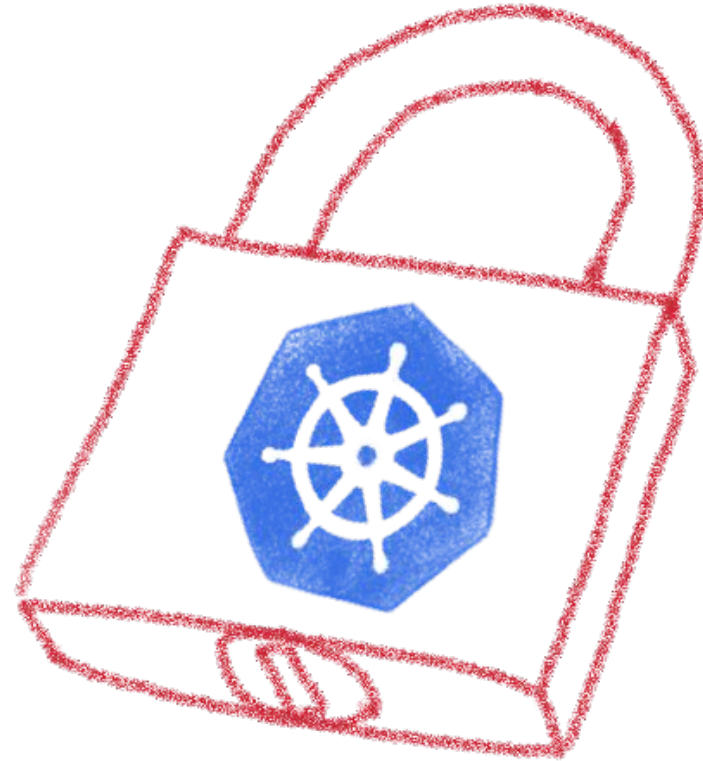
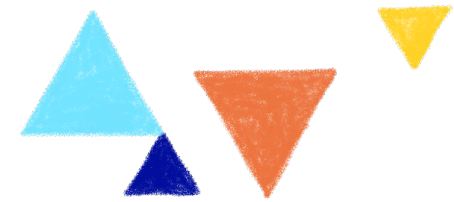
Autoscaling



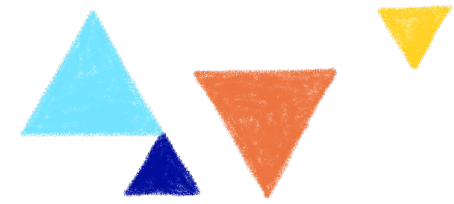
Based on node pools

New instances are spawned or released based on load

Kubernetes in a private network



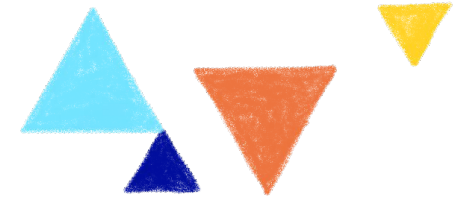
Other features



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

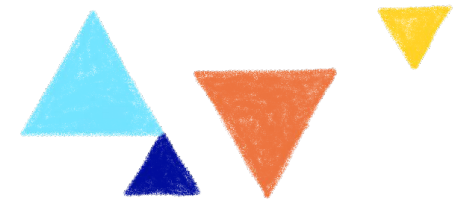
<https://github.com/ovh/public-cloud-roadmap/projects/1>

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 is set to 'English (GB)'. The title 'Cluster autoscaler example' is prominently displayed with a play button icon to its left. Below the title is a search bar for 'Search OVHcloud documentation'. The text below the search bar indicates the page was 'Last updated May 17th, 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.

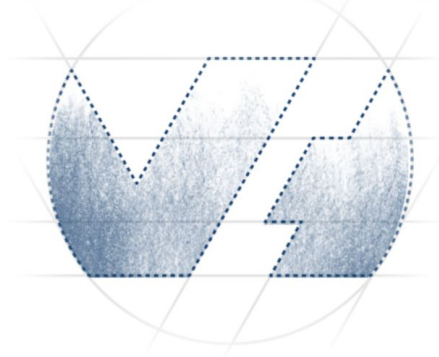
<https://docs.ovh.com/gb/en/kubernetes/cluster-autoscaler-example/>



The OVHcloud API

Because some people don't like GUI

 API.OVH.com



Welcome to OVH API

Build your own OVH world.

- DISCOVER OVH products API & functions
- Simple & secure way to USE all available functions
- CREATE your own projects based on OVH API functions

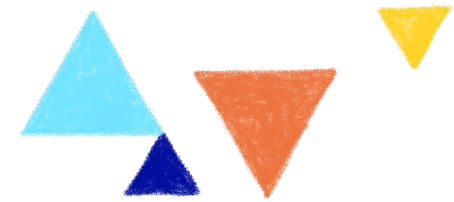
[What is the OVH API ?](#)

[Go to \[www.ovh.com\]\(http://www.ovh.com\)](#)

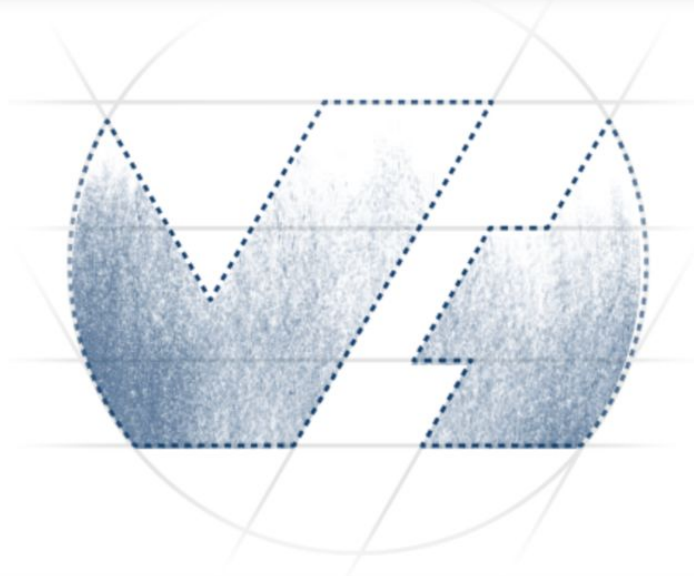
Explore the OVH API

First steps with the OVH API

The OVHcloud API



 API.OVH.com



Welcome to OVH API

Build your own OVH world.

- DISCOVER OVH products API & functions
- Simple & secure way to USE all available functions
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[What is the OVH API ?](#)

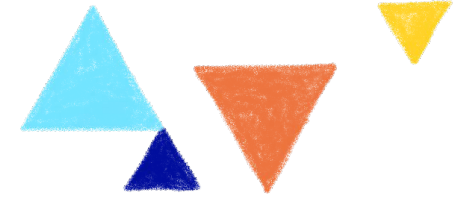
[Go to www.ovh.com](http://www.ovh.com)

Explore the OVH API

First steps with the OVH API

<https://api.ovh.com>

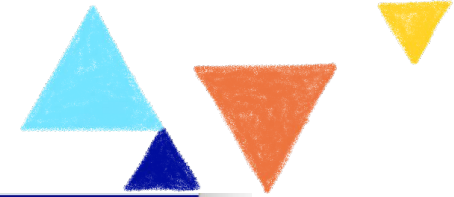
Hundreds of functions



API.OVH.com		gh62311-ovh
GET	/cloud/project/{serviceName}/kube	List your managed Kubernetes clusters
POST	/cloud/project/{serviceName}/kube	Create a new managed Kubernetes cluster
GET	/cloud/project/{serviceName}/kube/regions	List Kubernetes available regions
DELETE	/cloud/project/{serviceName}/kube/{kubeld}	Delete your managed Kubernetes cluster
GET	/cloud/project/{serviceName}/kube/{kubeld}	Get information about your managed Kubernetes cluster
PUT	/cloud/project/{serviceName}/kube/{kubeld}	Update information about your managed Kubernetes cluster
POST	/cloud/project/{serviceName}/kube/{kubeld}/auditLogs	Generate a temporary url to retrieve auditlogs
GET	/cloud/project/{serviceName}/kube/{kubeld}/customization	Get cluster customization
PUT	/cloud/project/{serviceName}/kube/{kubeld}/customization	Update cluster customization
GET	/cloud/project/{serviceName}/kube/{kubeld}/flavors	List all flavors available
GET	/cloud/project/{serviceName}/kube/{kubeld}/ipRestrictions	List your ip restrictions on your cluster
POST	/cloud/project/{serviceName}/kube/{kubeld}/ipRestrictions	Append a list of ip restrictions on your cluster
PUT	/cloud/project/{serviceName}/kube/{kubeld}/ipRestrictions	Remove the current list and add a list of ip restrictions on your...
DELETE	/cloud/project/{serviceName}/kube/{kubeld}/ipRestrictions/{ip}	Delete an ip restriction from your cluster

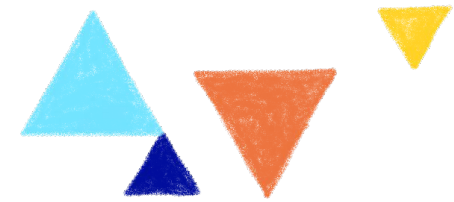
Pilot every OVHcloud product via the API

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/>

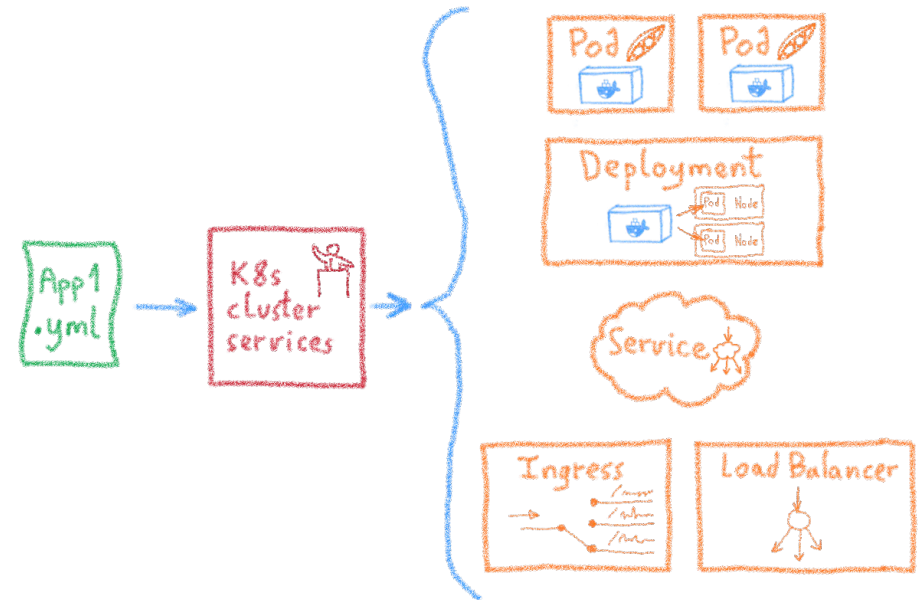
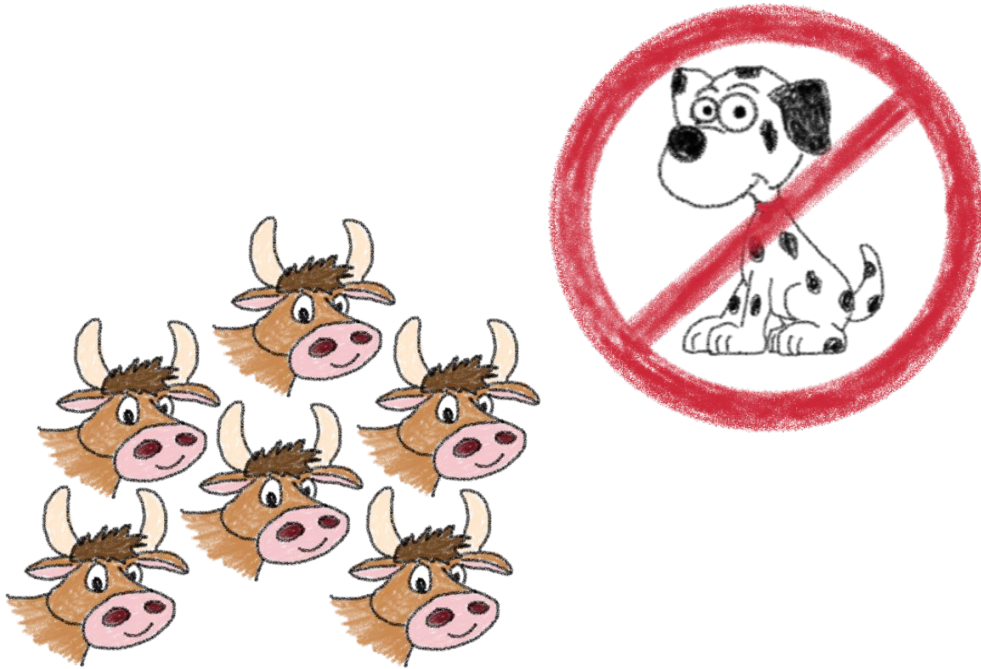
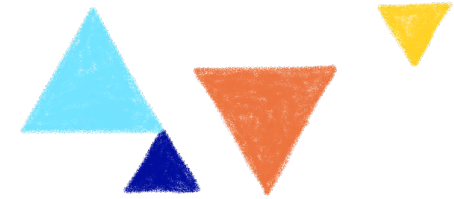


Infrastructure as Code

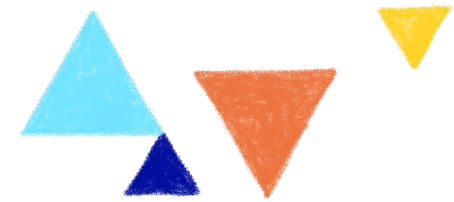
The perfect companion to a cloud



Infrastructure as Code (IaC)



Types of IaC



Imperative – Instructions to follow step by step

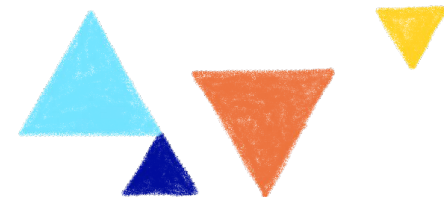
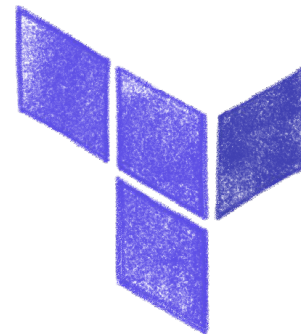
Declarative – Desired state description

Environment Aware – Intelligent desired state management

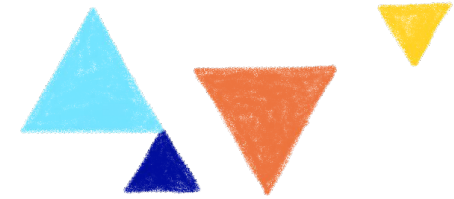
IaC tools



ANSIBLE



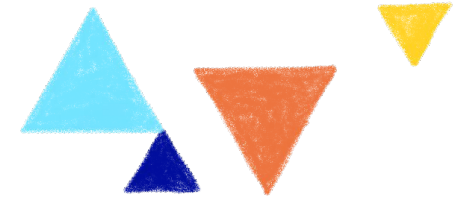
Demo: Using Terraform




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. ✕

 Menu ▾

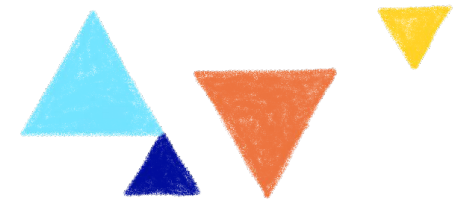
Automate Infrastructure on Any Cloud

Provision, change, and version resources on any

Open Source
Self-managed | always free

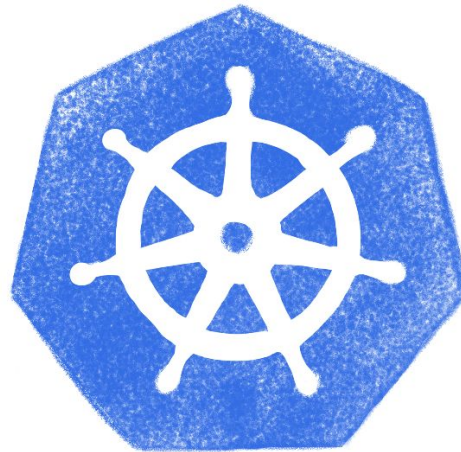
[Download](#)

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

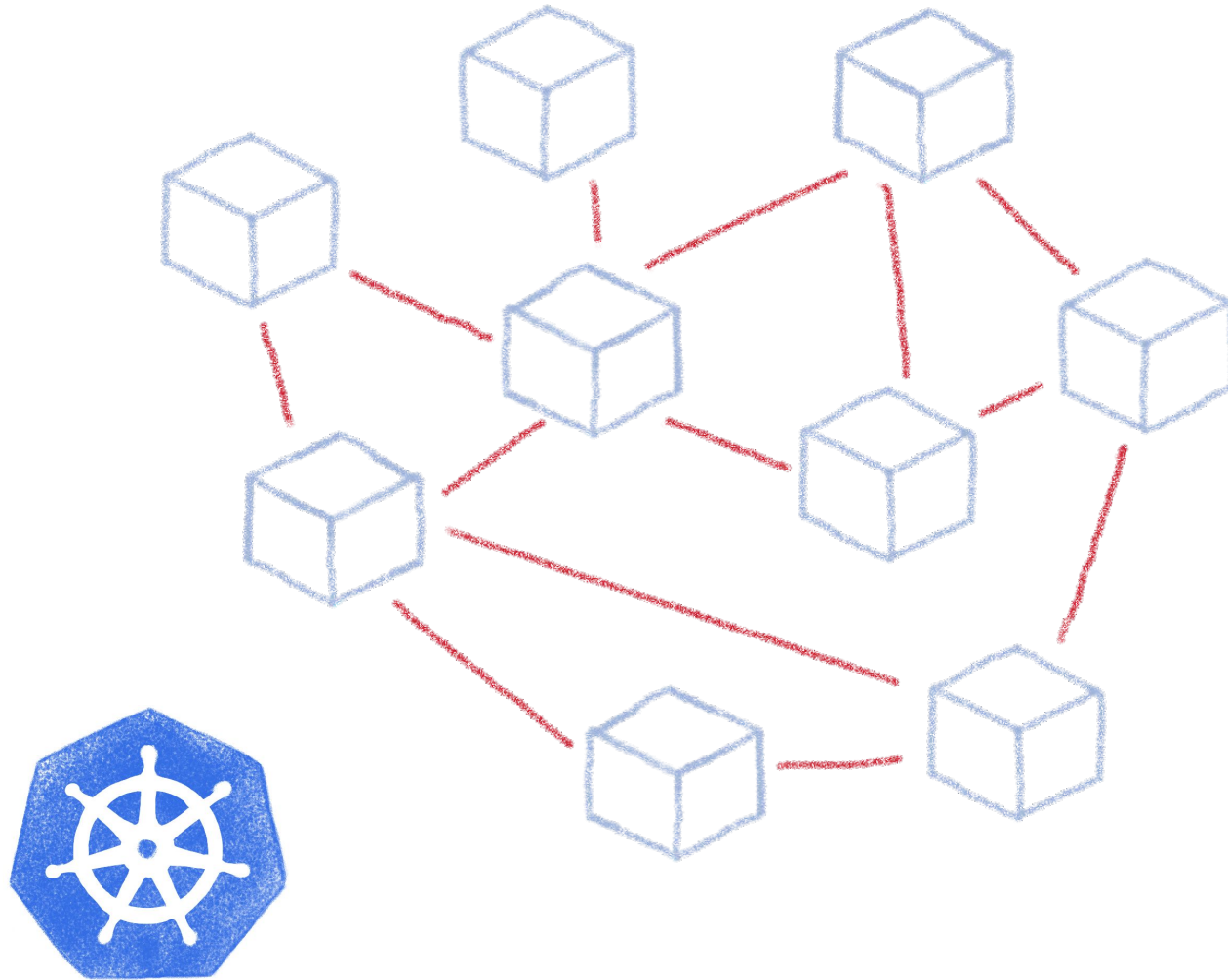
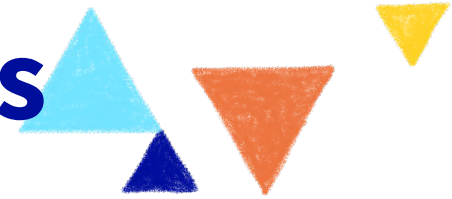


Kubernetes Operators

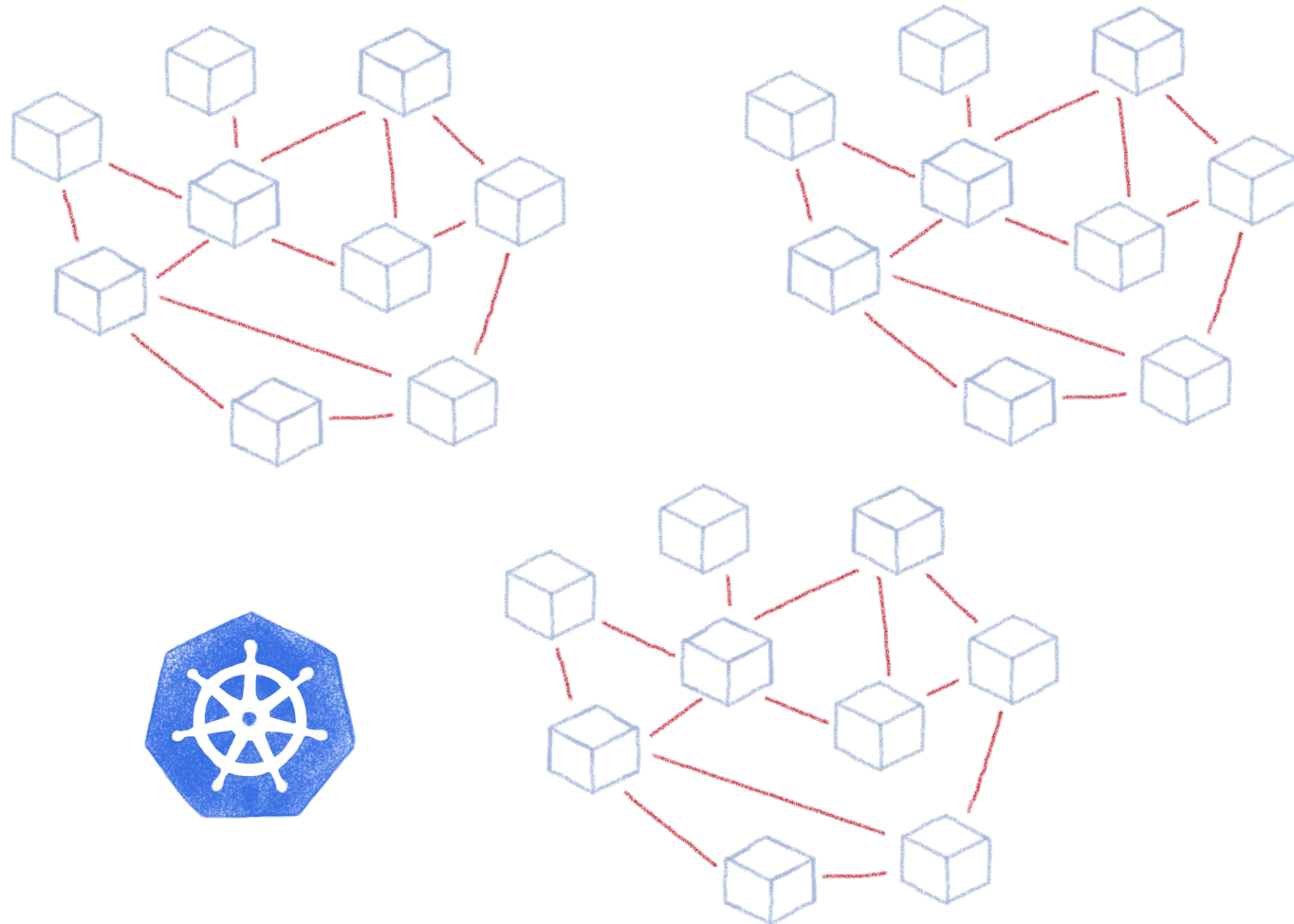
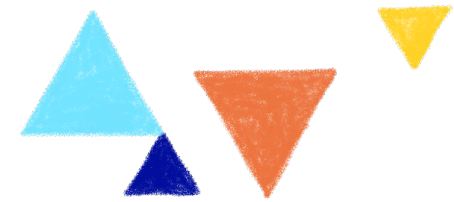
Helping to tame the complexity of K8s Ops



Taming microservices with Kubernetes



What about complex deployments



Ingress

Services

Deployments

Pods

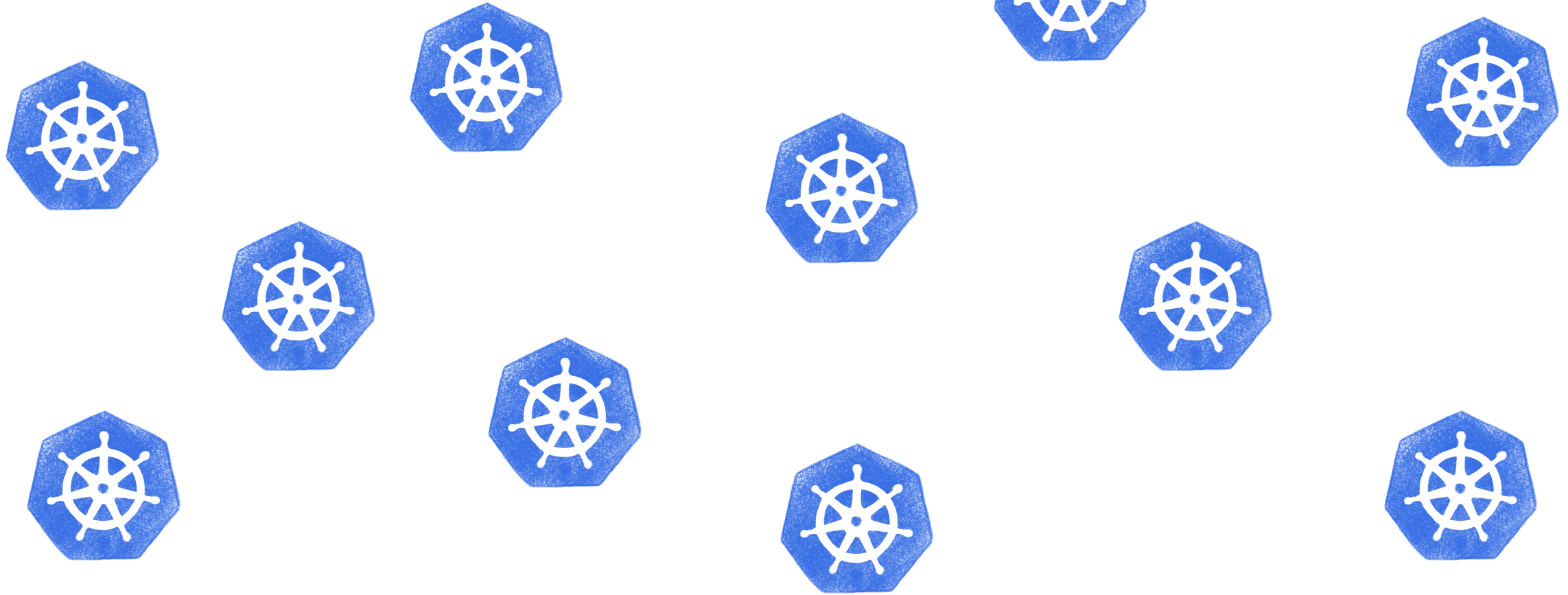
Sidecars

Replica Sets

Stateful Sets

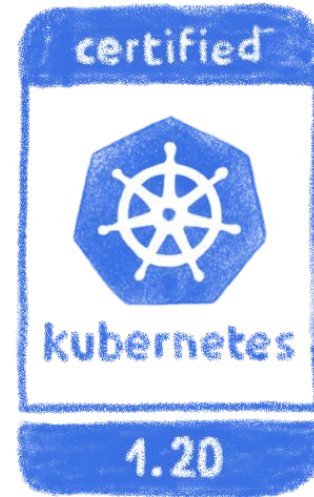
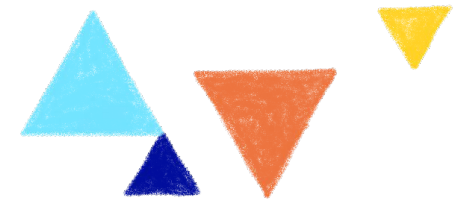


Specially at scale



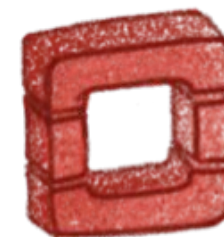
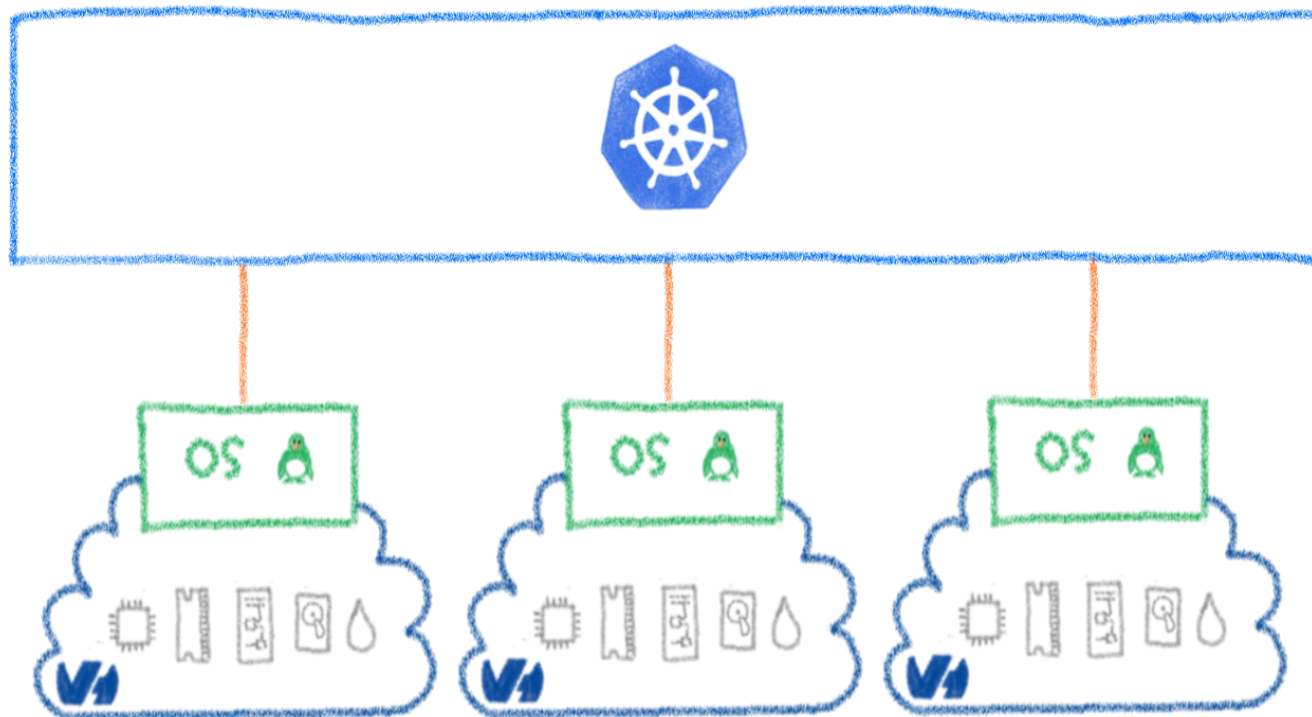
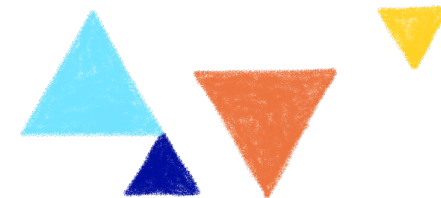
Lots of clusters with lots and lots of deployments

That's just our case

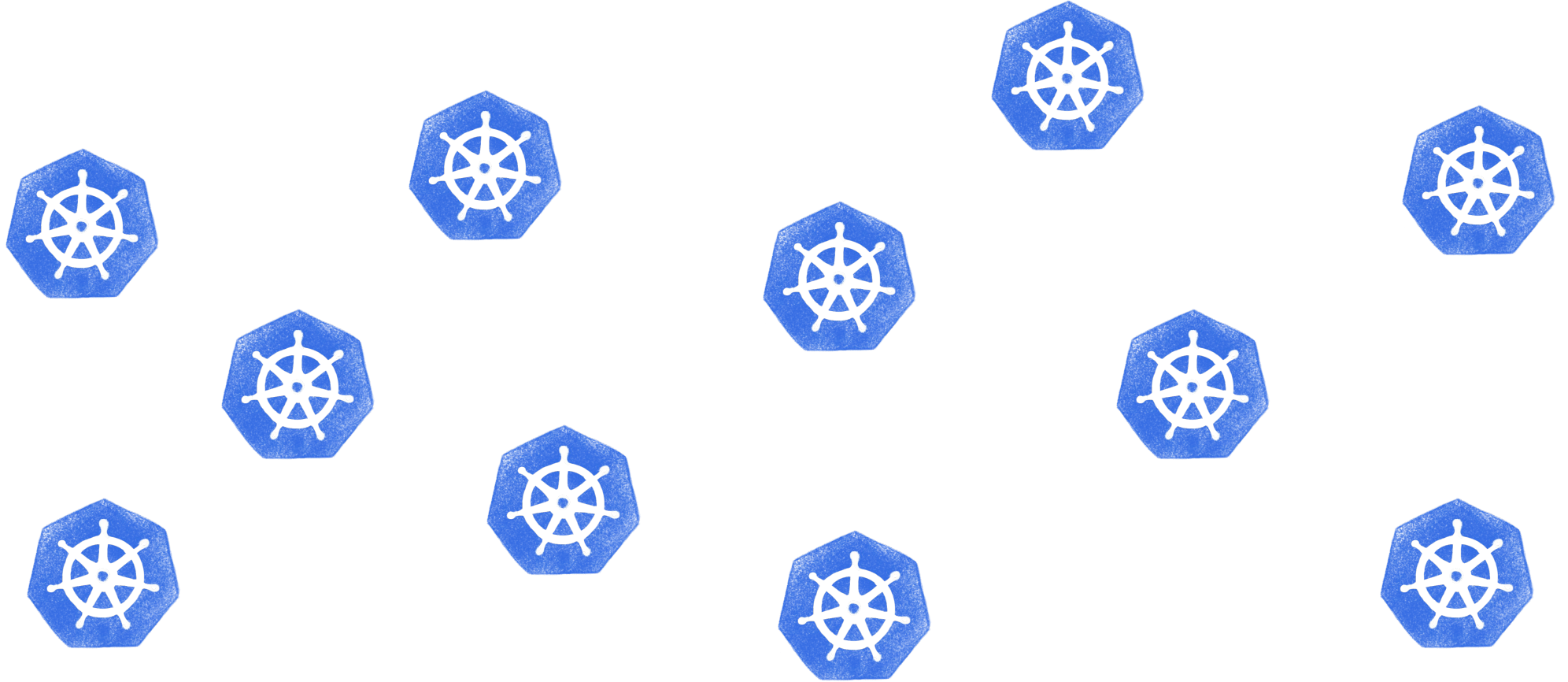
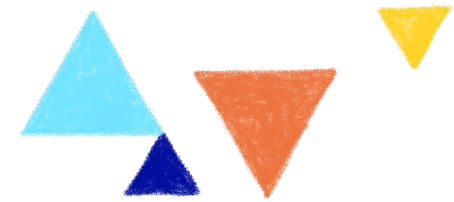


We both use Kubernetes and
operate a Managed Kubernetes platform

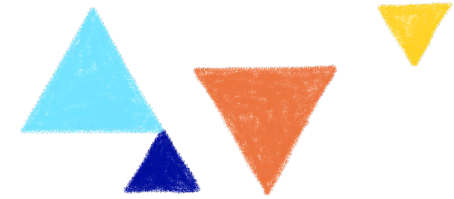
Built over our Openstack based Public Cloud



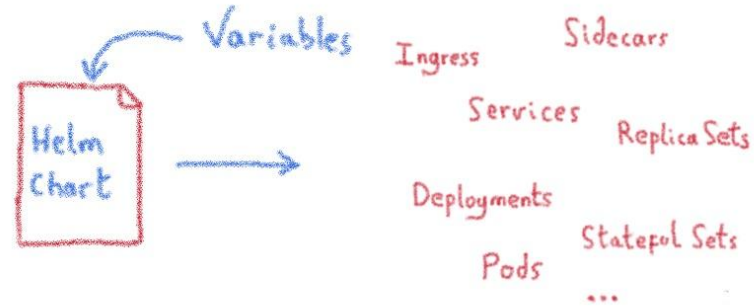
We need to tame the complexity



Taming the complexity



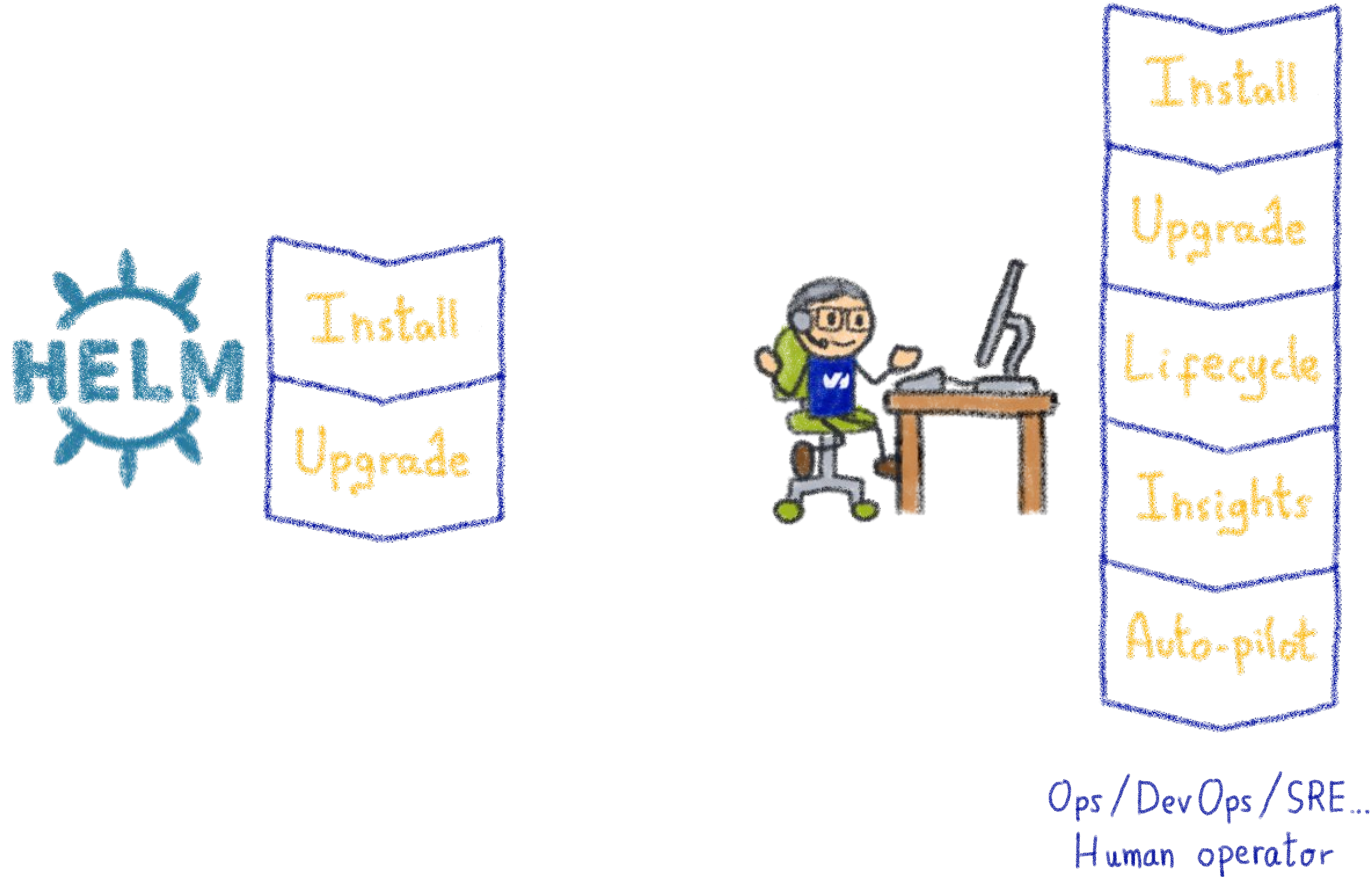
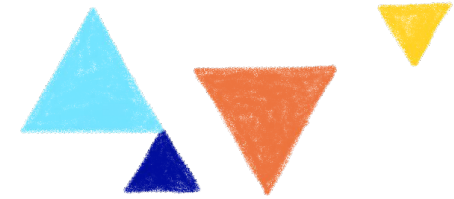
A package manager for Kubernetes



- Manage complexity
- Simple sharing

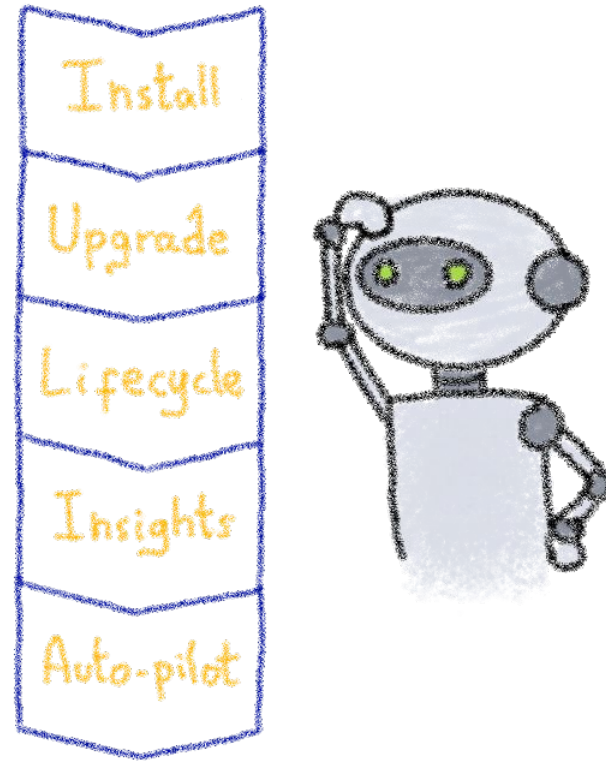
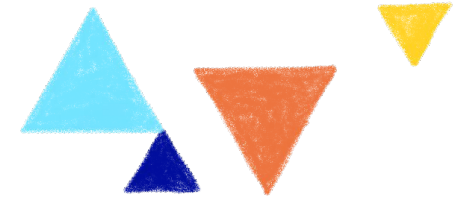
- Easy upgrades
- Easy rollbacks

Helm Charts are configuration



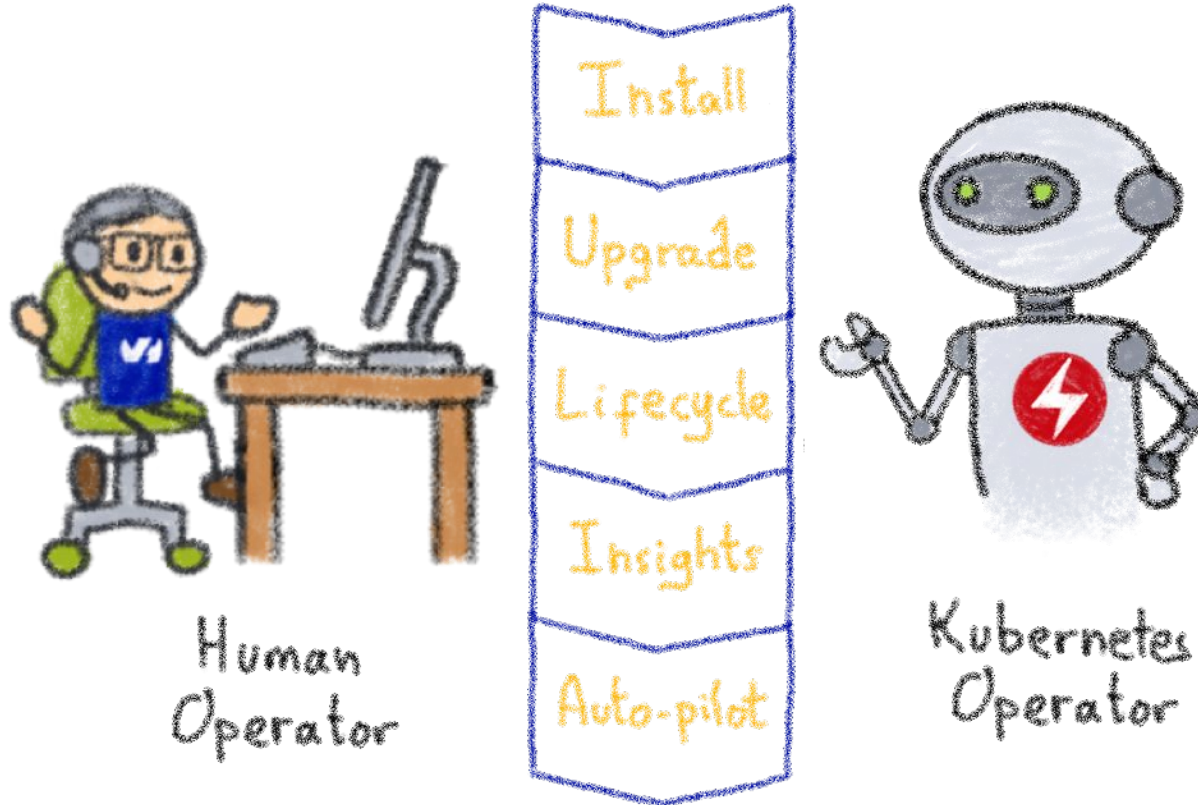
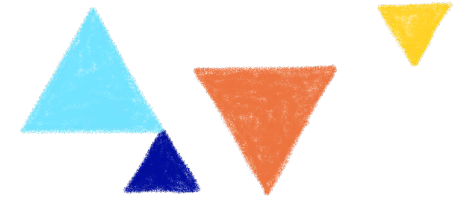
Operating is more than installs & upgrades

Kubernetes is about automation



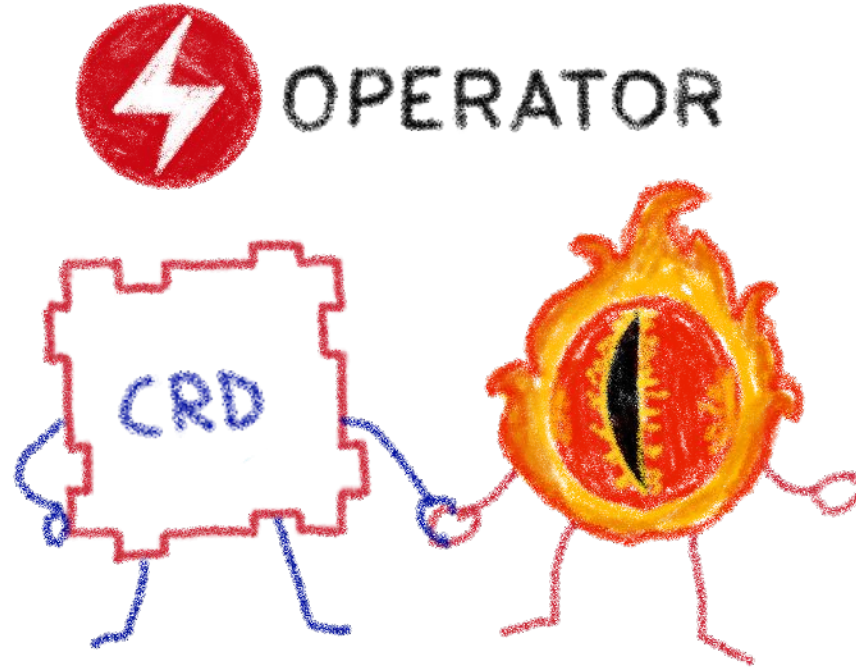
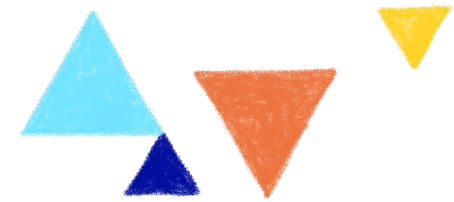
How about automating human operators?

Kubernetes Operators

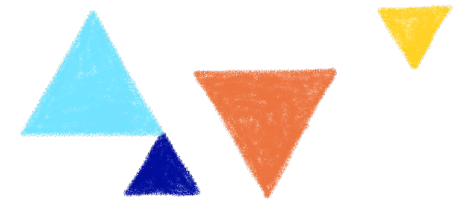


A Kubernetes version of the human operator

Building operators



Basic K8s elements: Controllers and Custom Resources

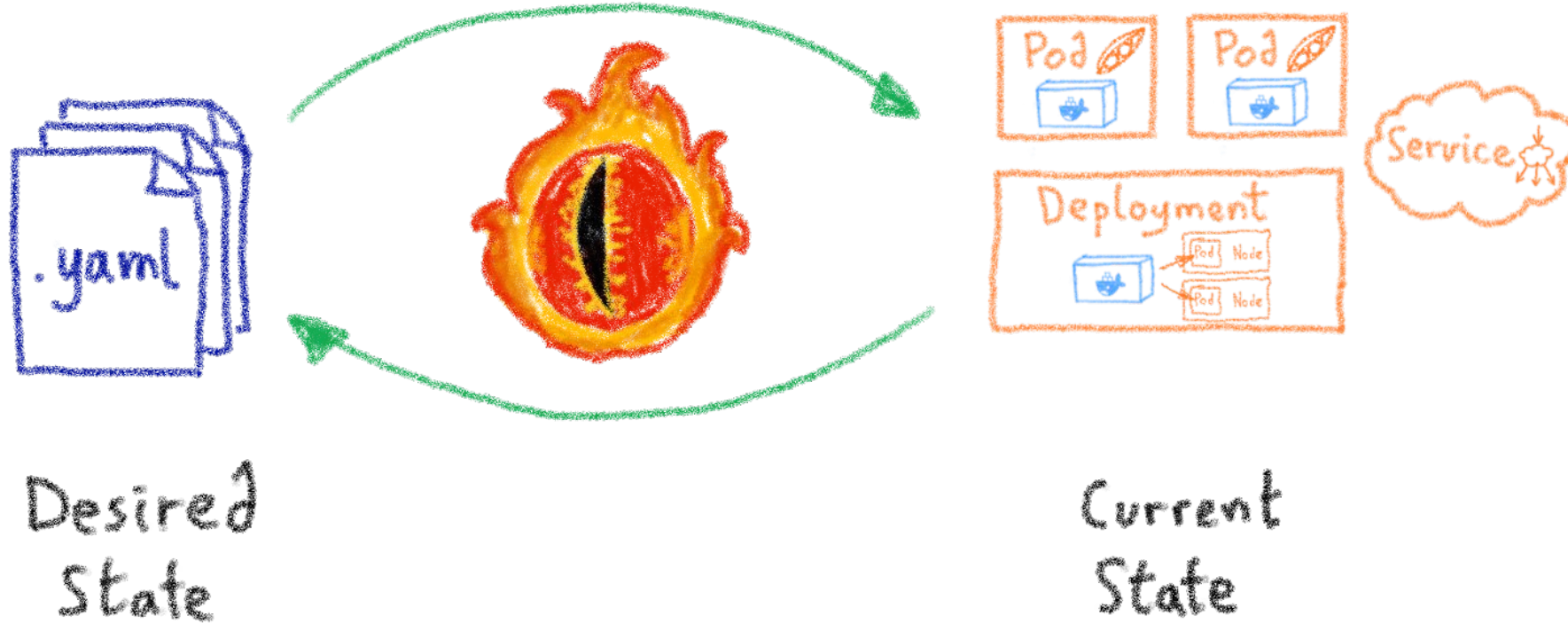
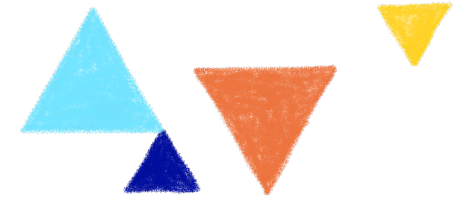


Kubernetes Controllers

Keeping an eye on the resources

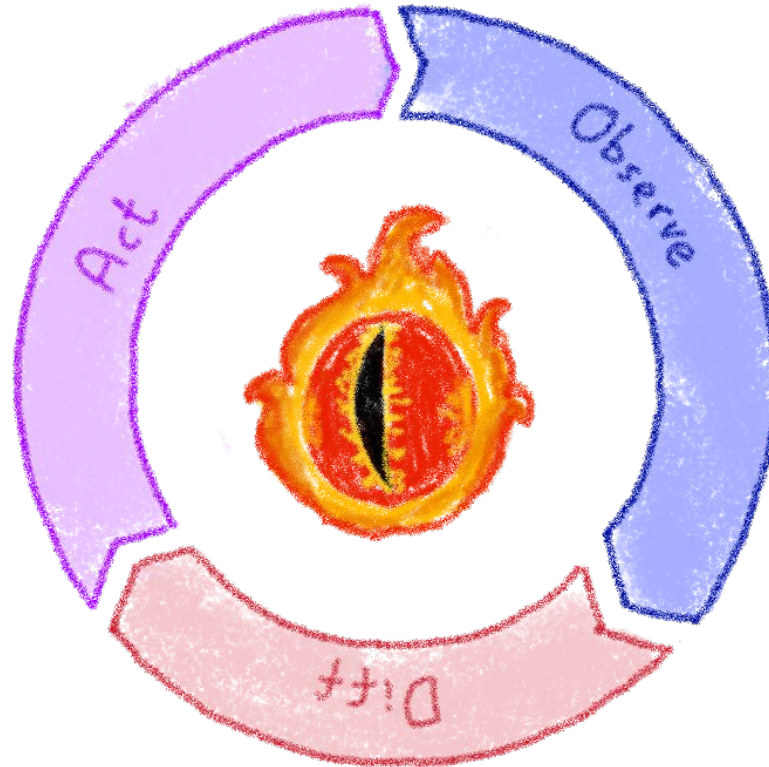
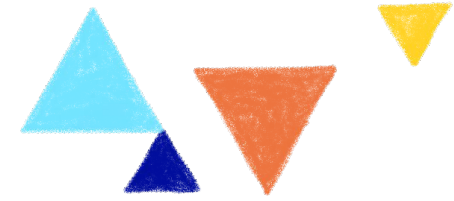


A control loop

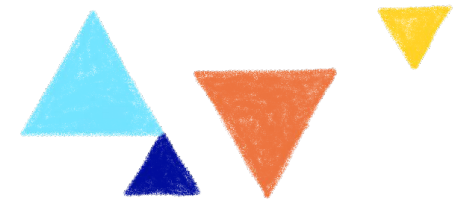


They watch the state of the cluster,
and make or request changes where needed

A reconcile loop

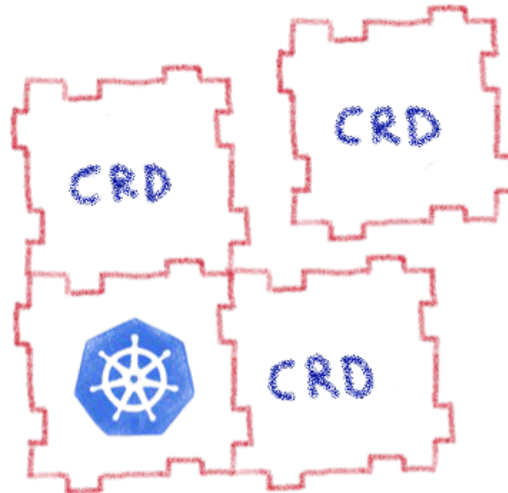


Strives to reconcile current state and desired state

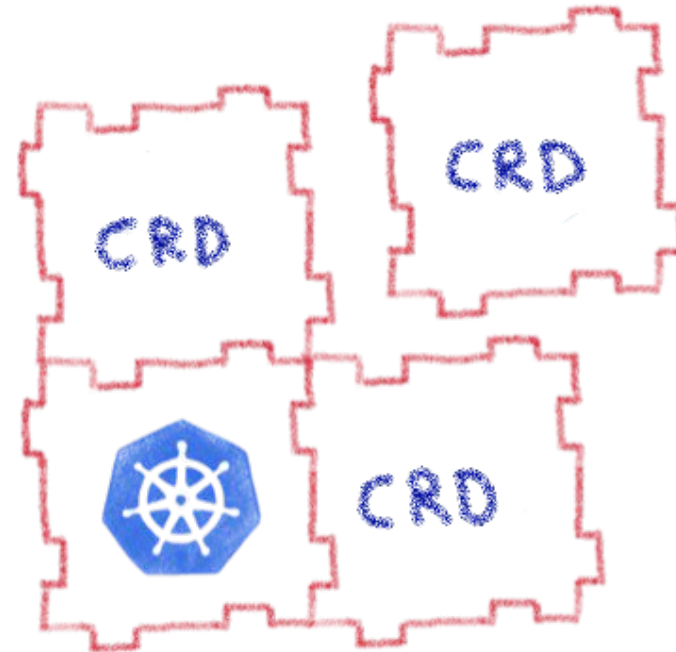
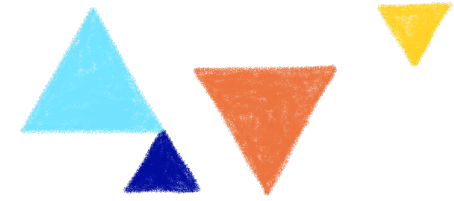


Custom Resource Definitions

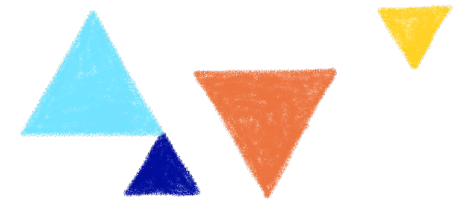
Extending Kubernetes API



Extending Kubernetes API



By defining new types of resources

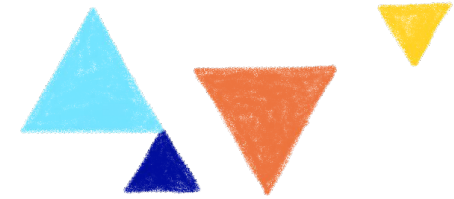


Kubernetes Operator

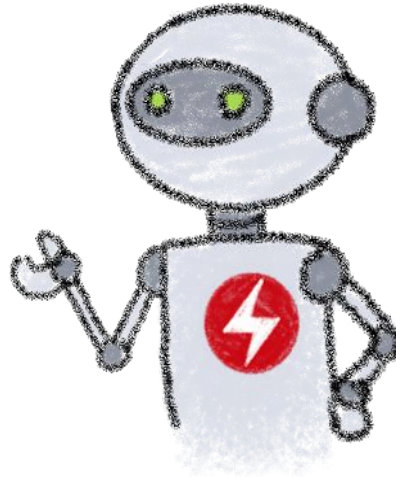
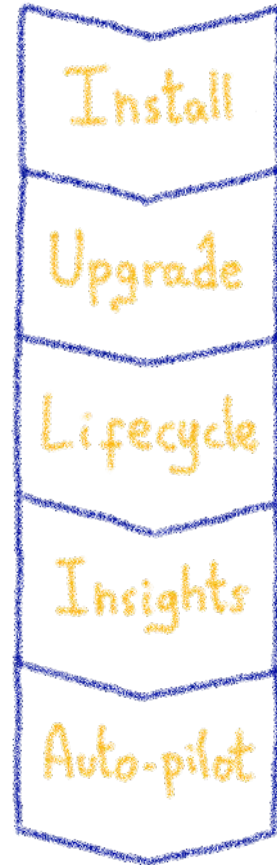
Automating operations



What's a Kubernetes Operator?



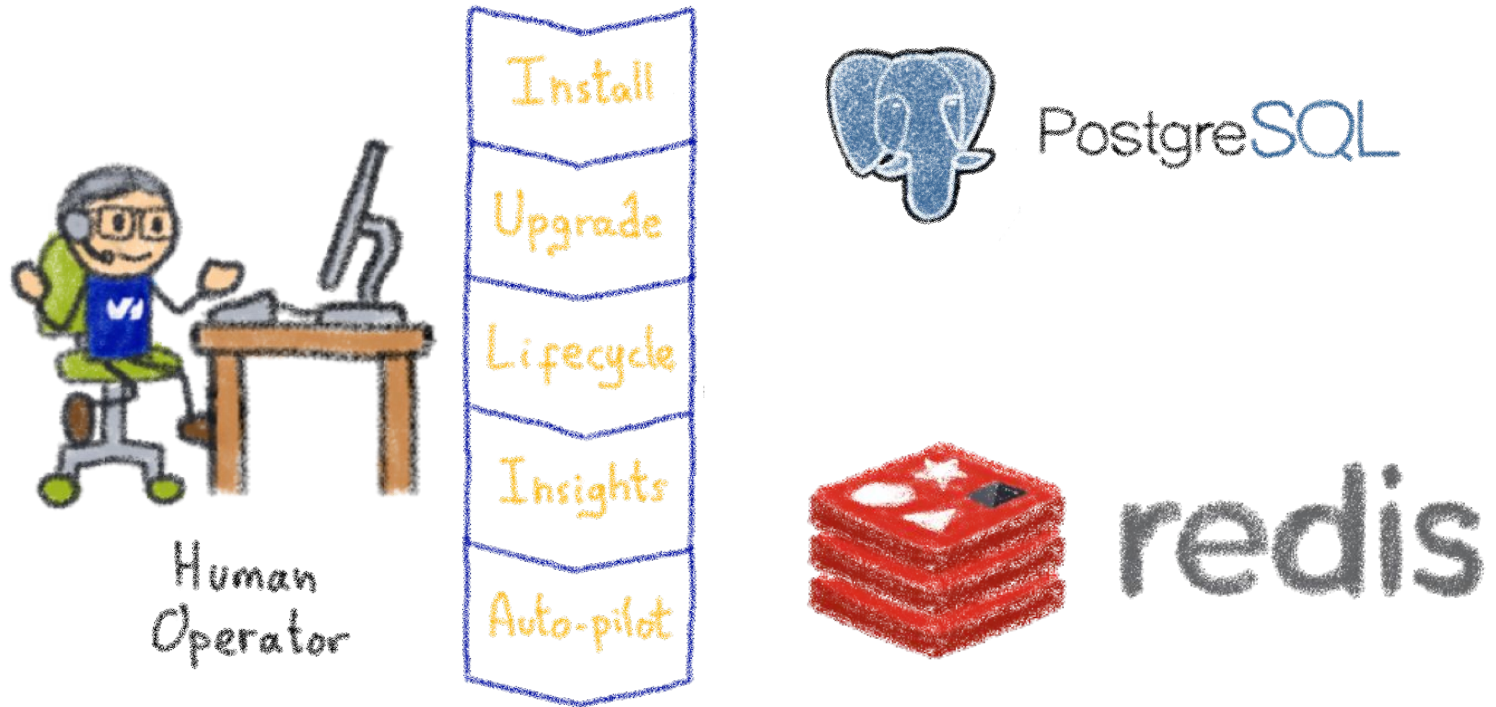
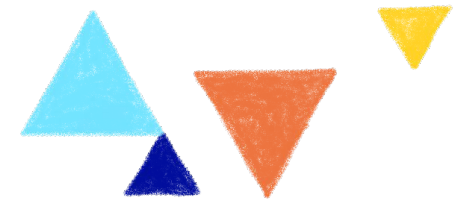
Human Operator



Kubernetes Operator

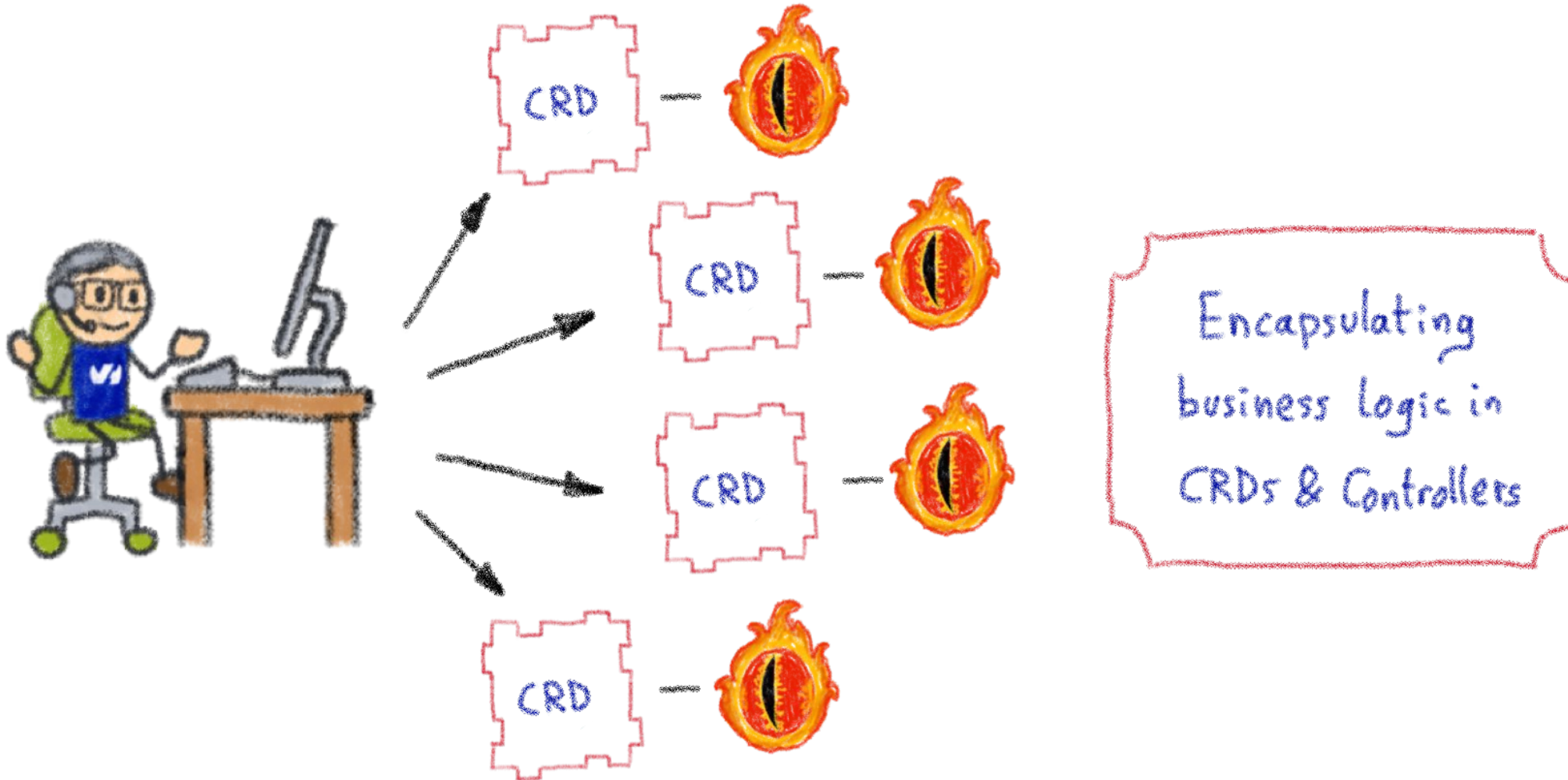
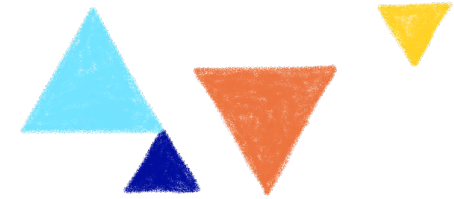
An Operator represents human operational knowledge in software to reliably manage an application

Example: databases

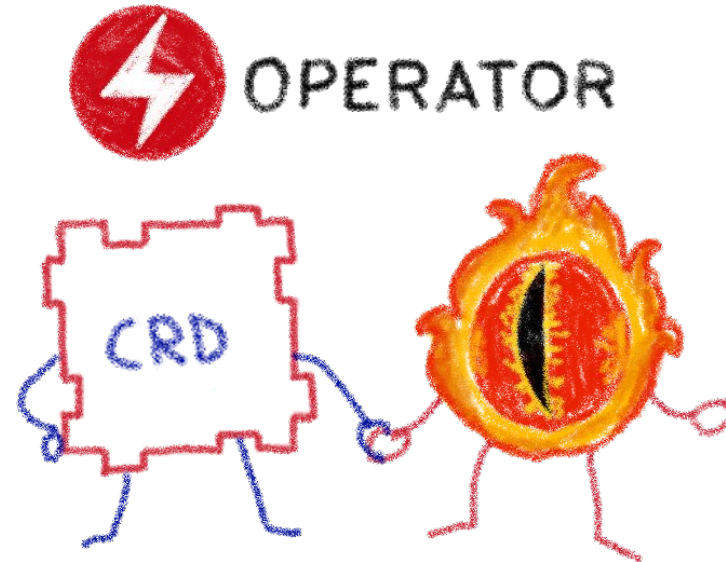
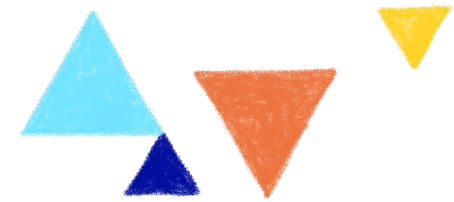


Things like adding an instance to a pool,
doing a backup, sharding...

Knowledge encoded in CRDs and Controllers

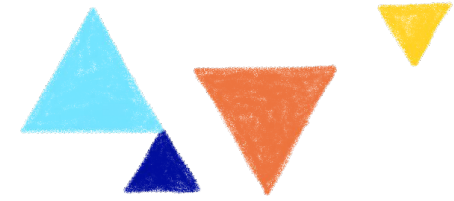


Custom Controllers for Custom Resources

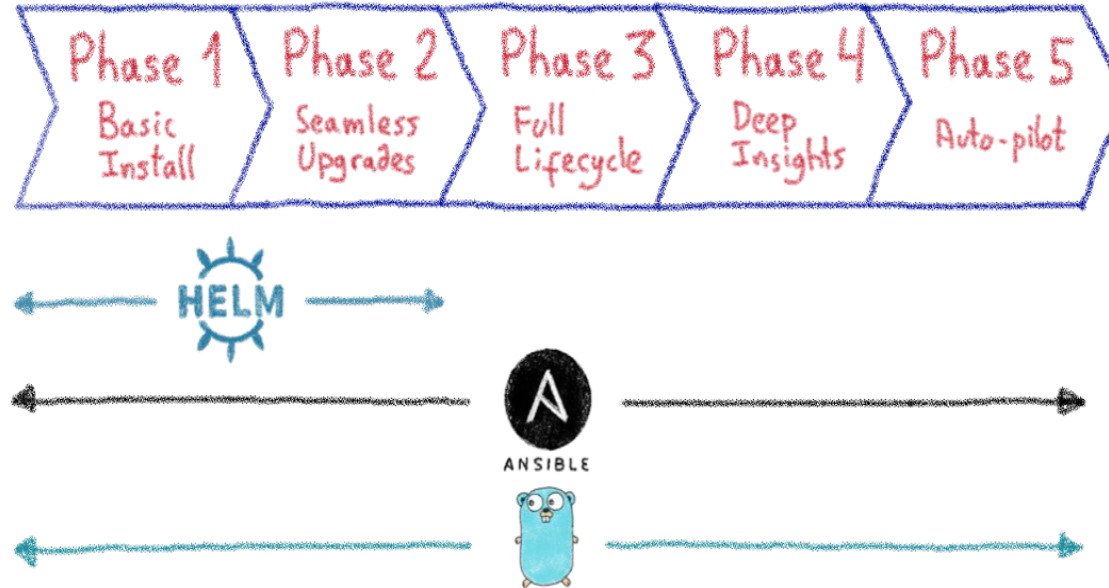
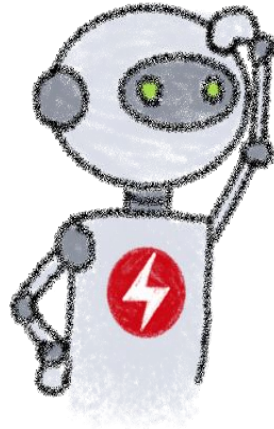


Operators implement and manage Custom Resources using custom reconciliation logic

Operator Capability Model



OPERATOR
CAPABILITY MODEL



Gauging the operator maturity

