

# Operators to the rescue: Manage your external data and legacy APIs from Kubernetes



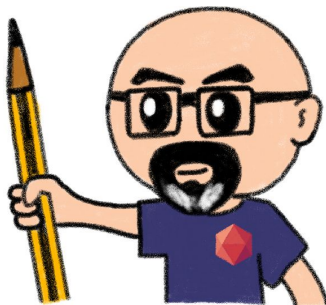
Horacio Gonzalez





# Who are we?

Introducing myself and  
introducing Clever Cloud



# Horacio Gonzalez

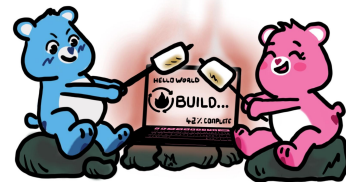
@LostInBrittany

Spaniard Lost in Brittany

Head of DevRel



clever cloud





# Clever Cloud

From Code to Product



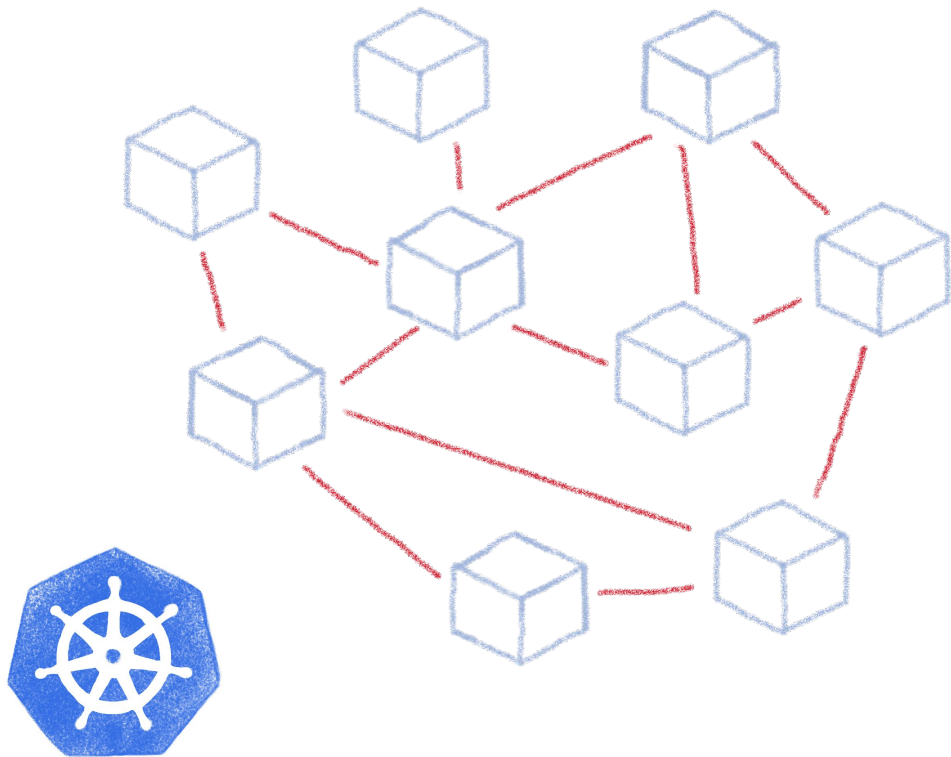
clever cloud

# Kubernetes operators

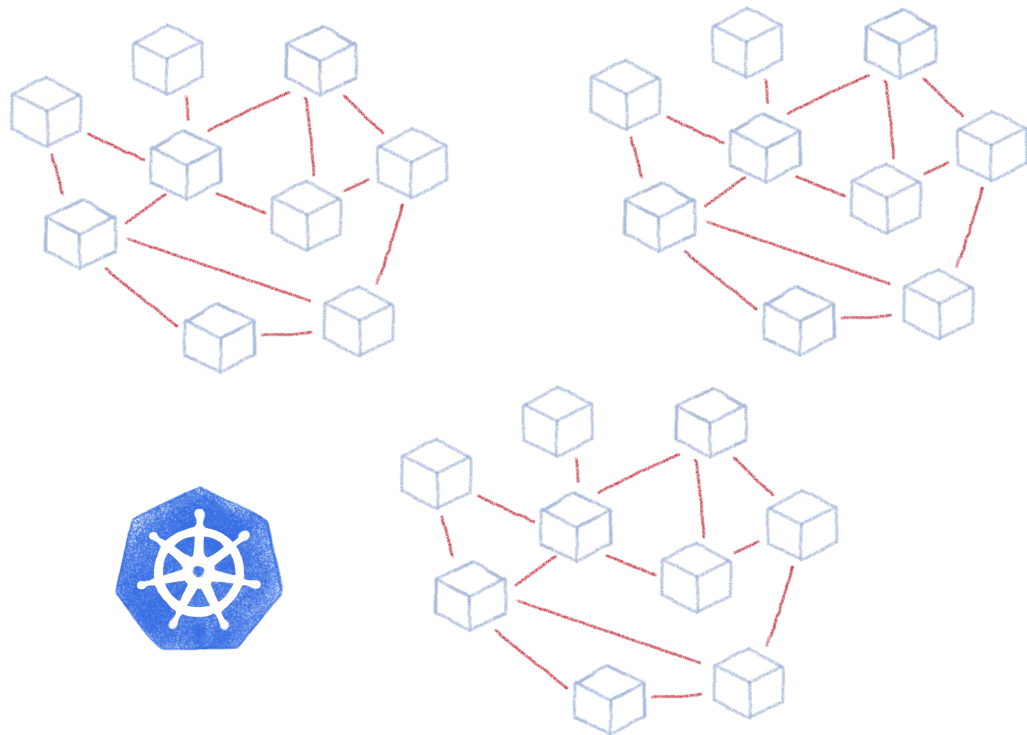
Helping to tame the complexity of K8s Ops



# Taming microservices with Kubernetes



# What about complex deployments



Ingress

Services

Deployments

Pods

Sidecars

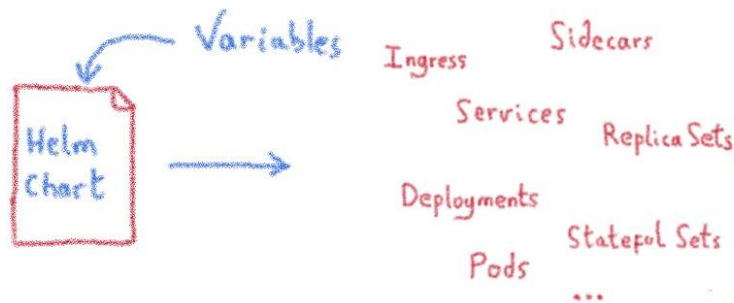
Replica Sets

Stateful Sets

# Tools like Helm helps with complexity



A package manager for Kubernetes



- Manage complexity 

- Easy upgrades 

- Simple sharing 

- Easy rollbacks 





# Helm Charts are configuration

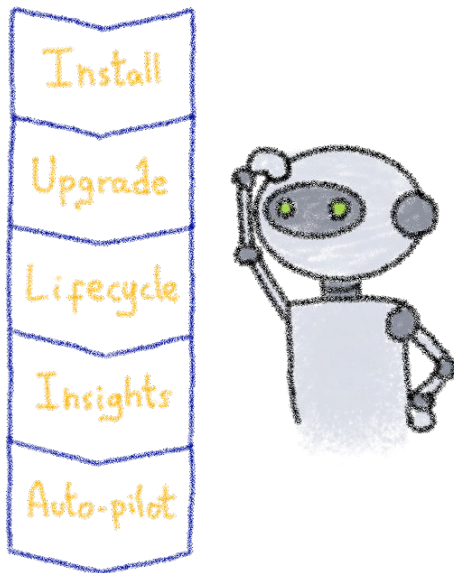


Ops/DevOps/SRE...  
Human operator



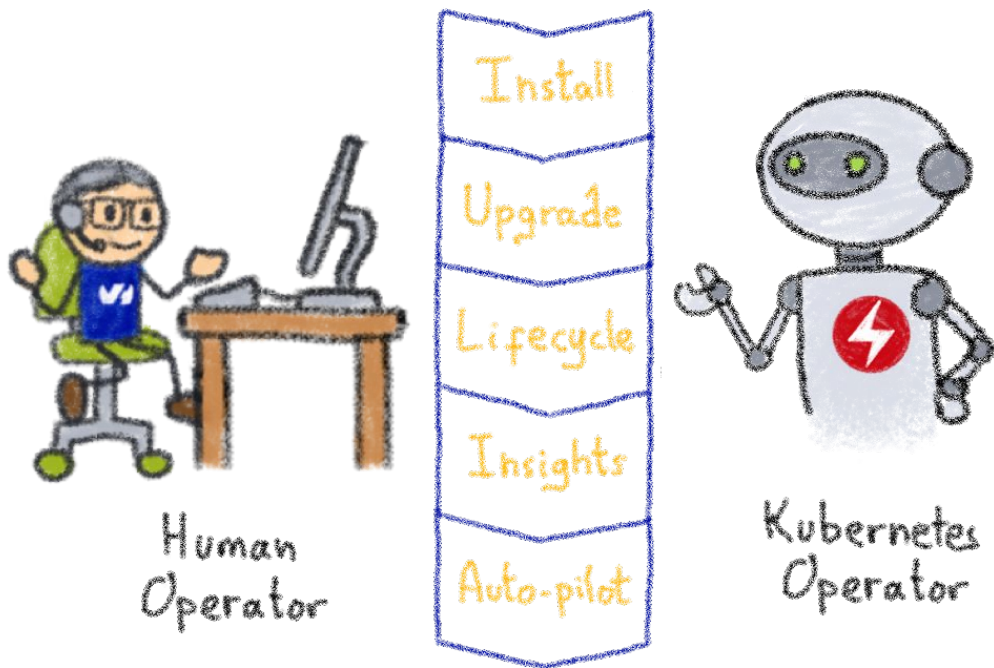
Operating is more than installs & upgrades

# Kubernetes is about automation



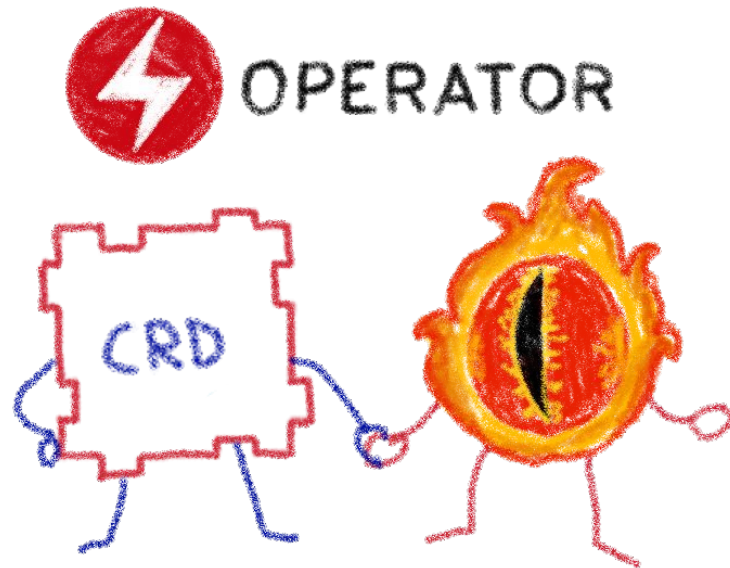
How about automating human operators?

# Kubernetes Operators



A Kubernetes version of the human operator

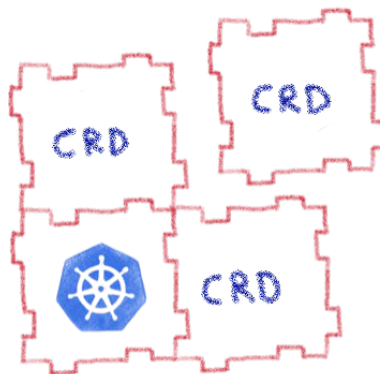
# Building operators



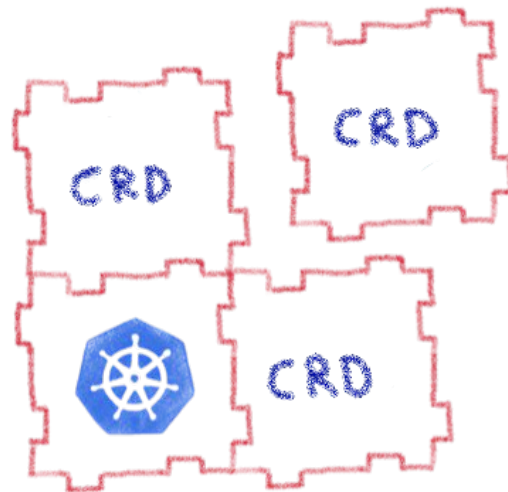
Basic K8s elements: Custom Resources & Controllers

# Custom Resource Definitions

Extending Kubernetes API



# Extending Kubernetes API

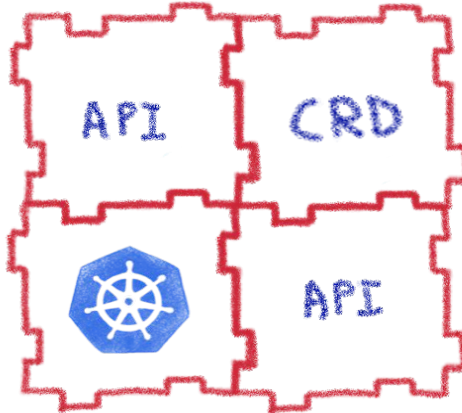


By defining new types of resources,  
internal or external to the cluster

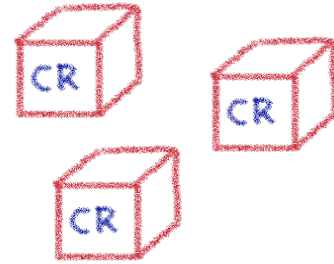
# With a CRD you can create CR in the cluster



Create new CRs  
from CRD type



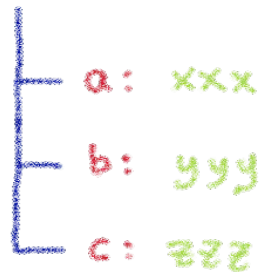
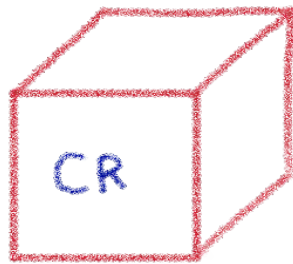
API server



Custom Resources

They are the blueprints of the Custom Resources

# Custom Resources are simply data



Only data,  
properties,  
no logic

All the logic must be in the Controller

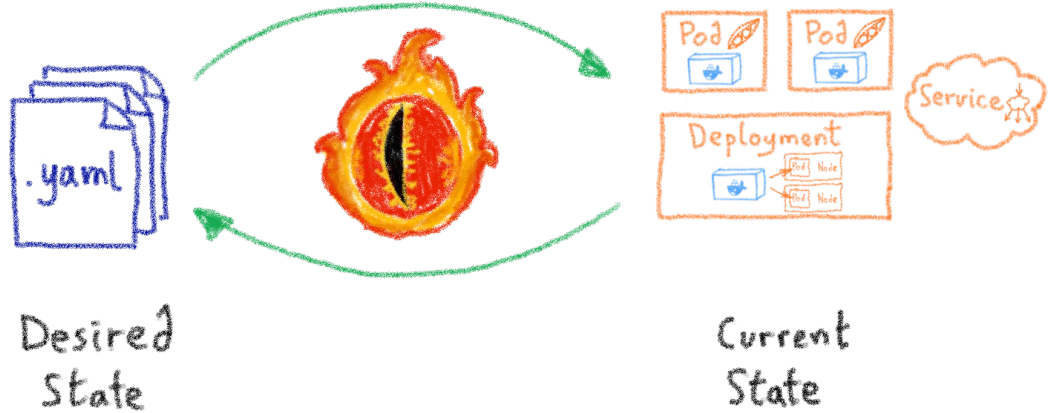


# Kubernetes Controllers

Keeping an eye on the resources



# A reconcile loop



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





# Kubernetes Operator

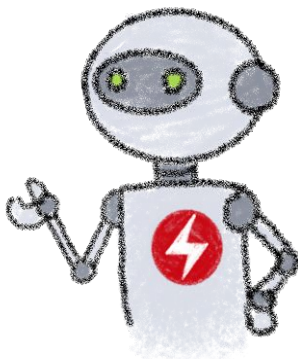
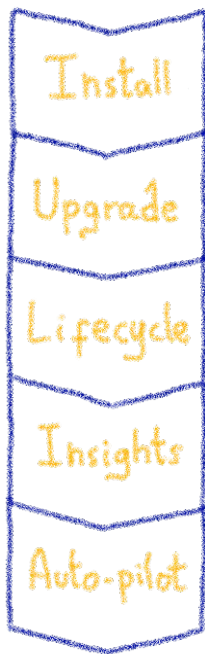
Automating operations



# What's a Kubernetes Operator?



Human Operator



Kubernetes Operator

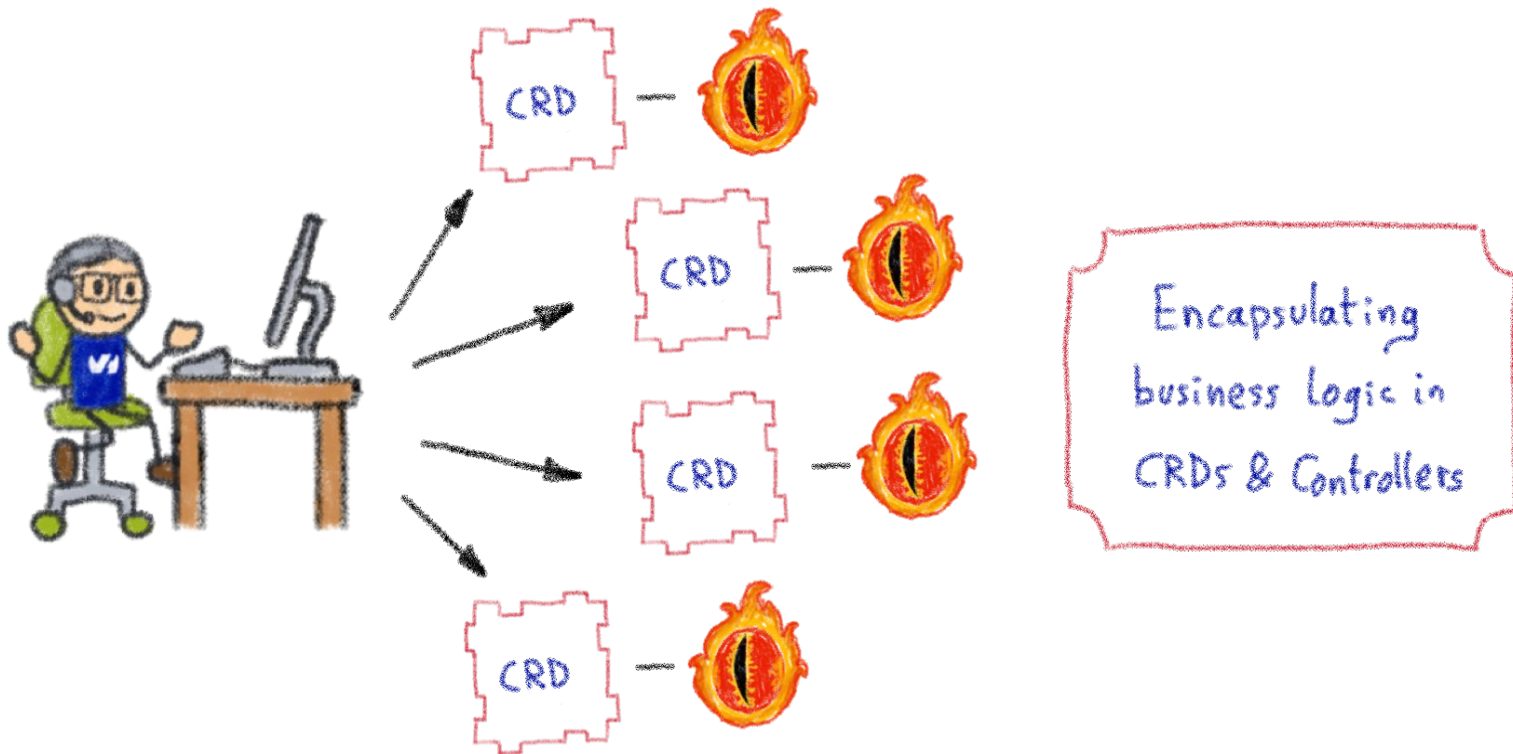
An Operator represents human operational knowledge in software to reliably manage an application

# Example: databases

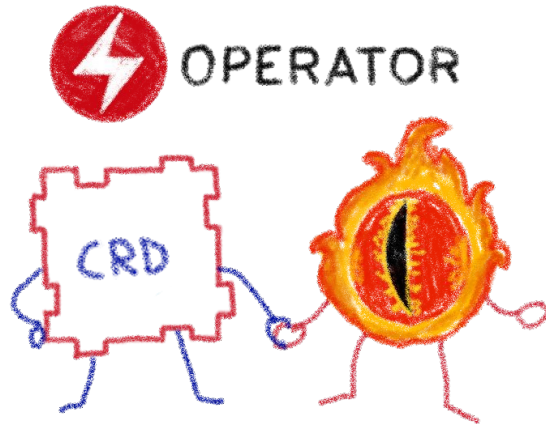


Things like adding an instance to a pool,  
doing a backup, sharding...

# Knowledge encoded in CRDs and Controllers



# Custom Controllers for Custom Resources

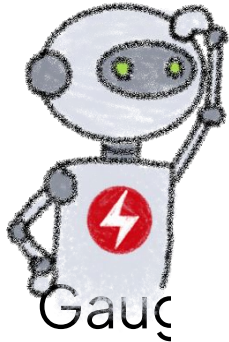


Operators implement and manage Custom Resources using custom reconciliation logic

# Operator Capability Model



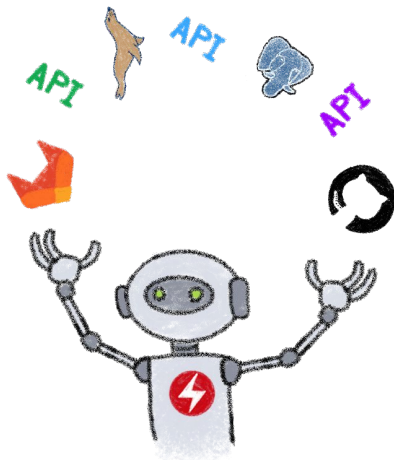
OPERATOR  
CAPABILITY MODEL



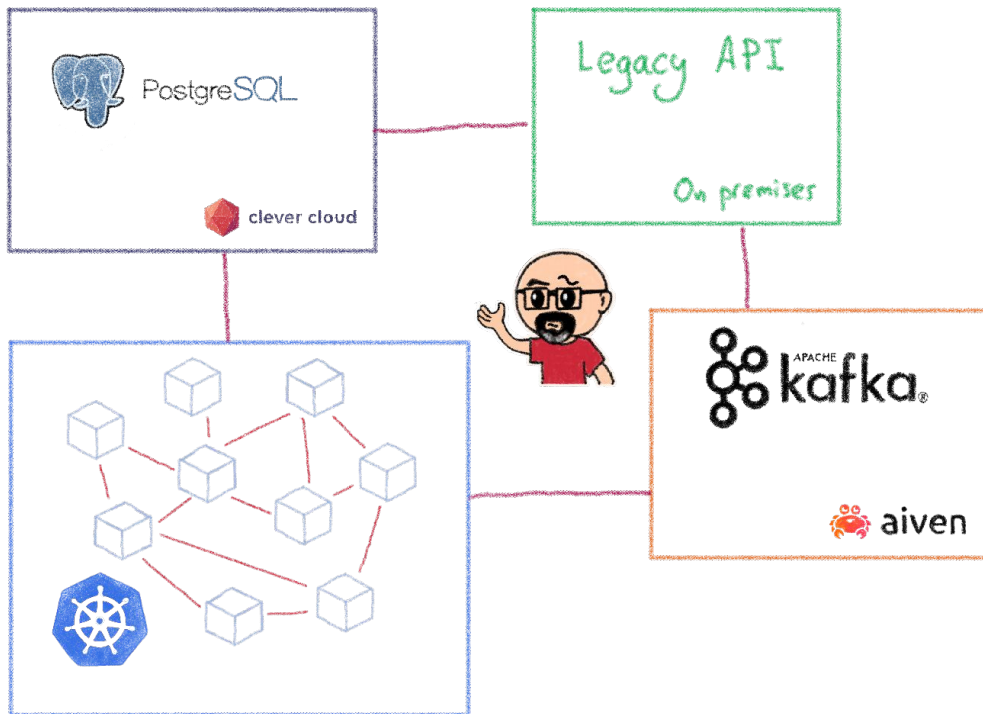


# Operators aren't limited to K8s

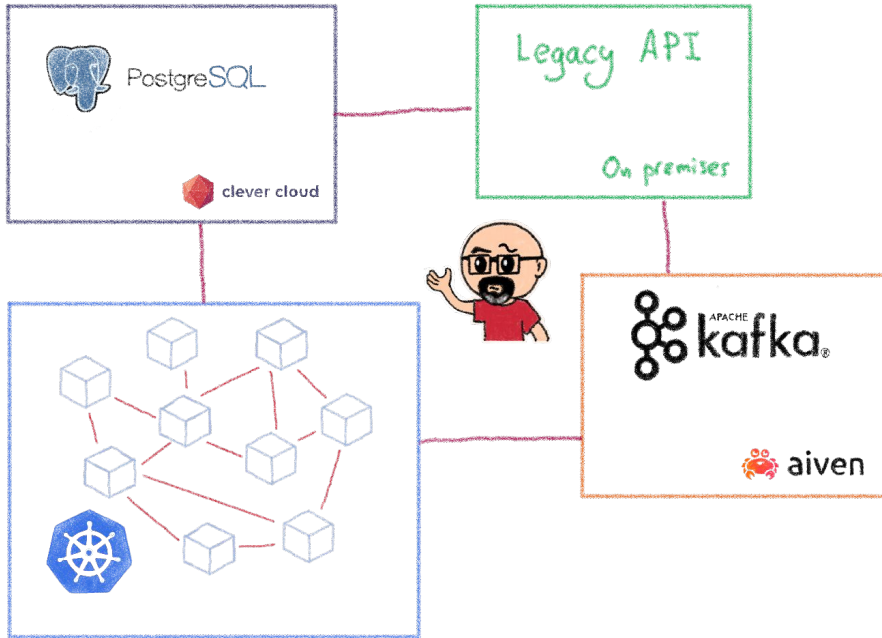
They can be used to pilot external APIs, i.e. non K8s software



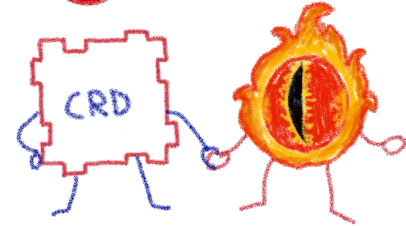
# Don't put everything into Kubernetes



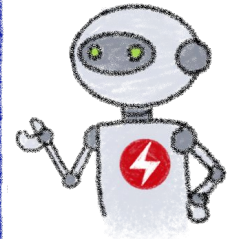
# Operators simplify Kubernetes integration



 OPERATOR



Human Operator



Kubernetes Operator





# A real, open-source example

The Clever Operator



clever cloud

# Available on Operator Hub & GitHub



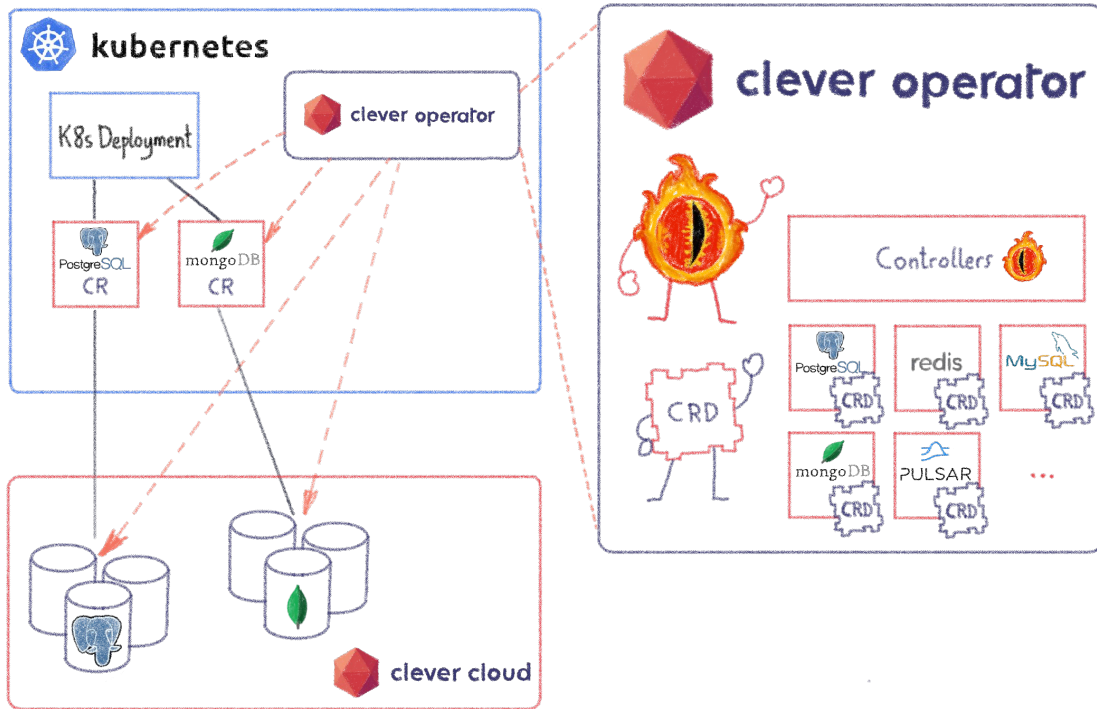
The screenshot shows the OperatorHub.io page for the 'clever-operator'. The header includes the OperatorHub.io logo, a search bar, and a 'Contribute' button. The main content area features the 'clever-operator' logo and a description: 'A kubernetes operator that expose clever cloud's resources through custom resource definition'. Below this, there is a grid of 'Custom Resource Definitions' including PostgreSQL, Redis, MySQL, MongoDB, Pulsar, and ConfigProvider. Each entry has a 'View YAML Example' link. To the right, there is an 'Install' button and a sidebar with details: CHANNEL (alpha), VERSION (0.5.5 (Current)), MIN K8S VERSION (v1.24.0), and CAPABILITY LEVEL (Basic Install, Seamless Upgrades, Full Lifecycle, Deep Insights).

<https://operatorhub.io/operator/clever-operator>

<https://github.com/CleverCloud/clever-operator>



# Exposing Clever Cloud resources as CRD



Allowing your apps to use our DBs as if they were in K8s

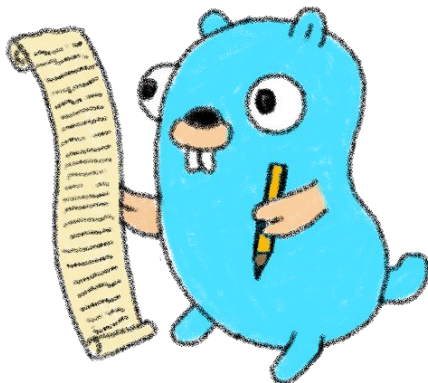
# Many possible use-cases



- External Service Health Monitor Operator
- External API Token Rotation Operator
- Database Synchronization Operator
- Legacy System Configuration Management Operator
- File Transfer Operator (FTP/SFTP Automation)
- Cloud Billing/Cost Monitoring Operator
- DNS Management Operator
- ...

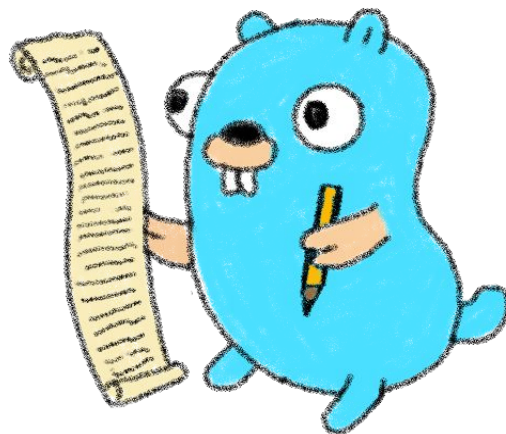
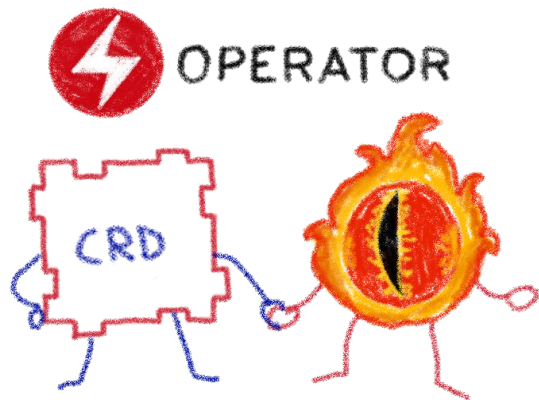
# How can we write Operators?

Which language? Any framework?



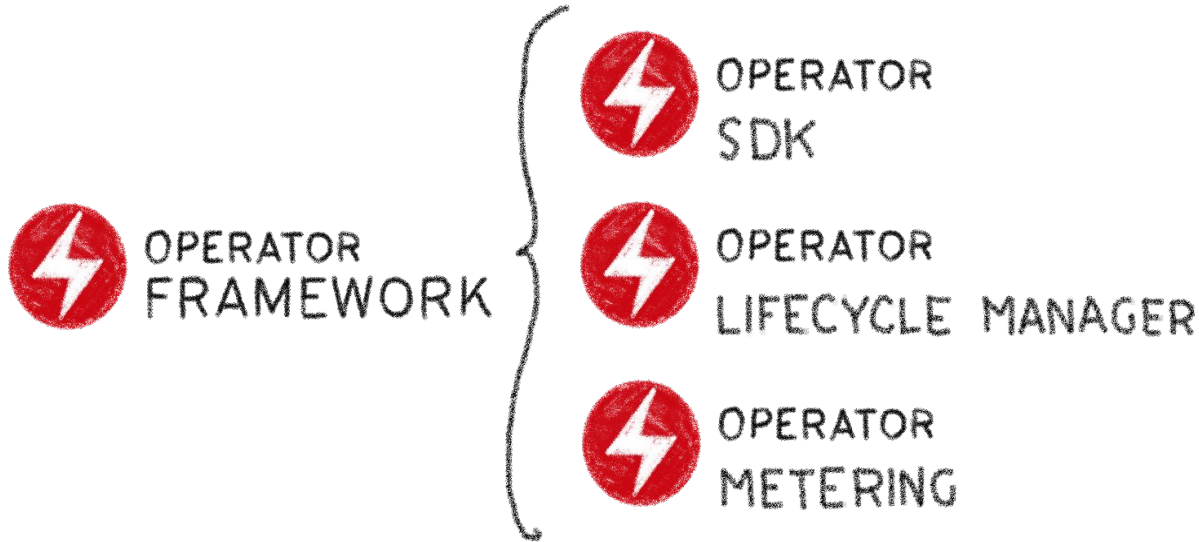


# They are simply pods and manifests



You can simply call Kubernetes APIs  
or use a compatible client

# The Operator Framework



Open source framework to accelerate the development of an Operator

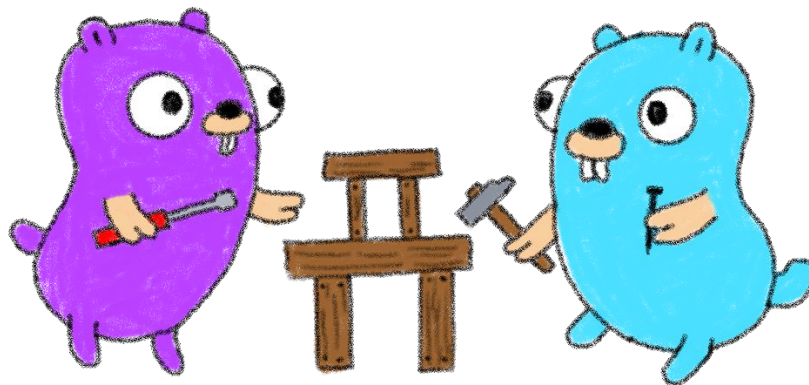
# Hey Devovx Morocco, operators ❤️ Java



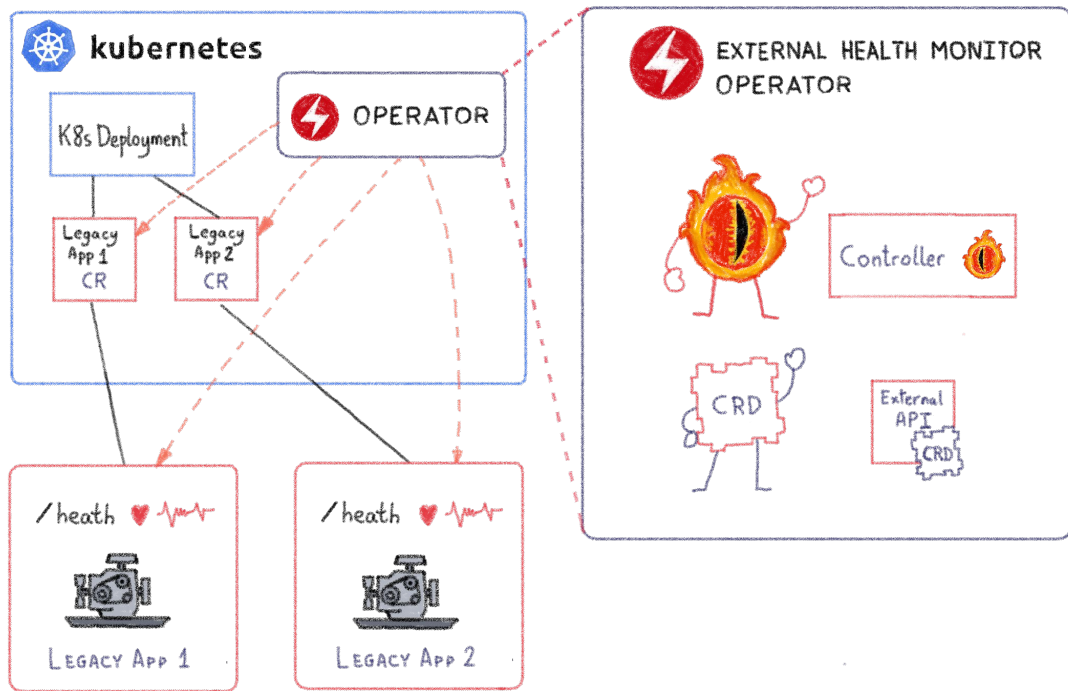
A screenshot of the Java Operator SDK website. The page has a dark orange header with the text "Java Operator SDK" on the left and navigation links "Docs", "Blog", "Community", and a search bar "Search this site..." on the right. The main content area features a background image of a cloudy sky. The title "Java Operator SDK" is centered in large white text. Below the title are two orange buttons: "Learn More" with a right-pointing arrow and "Download" with a download icon. Underneath these buttons is the text "Kubernetes operators in Java made easy!" followed by a light blue circular button with a white downward-pointing arrow.

# Let's build an operator together

Why? Because we can!

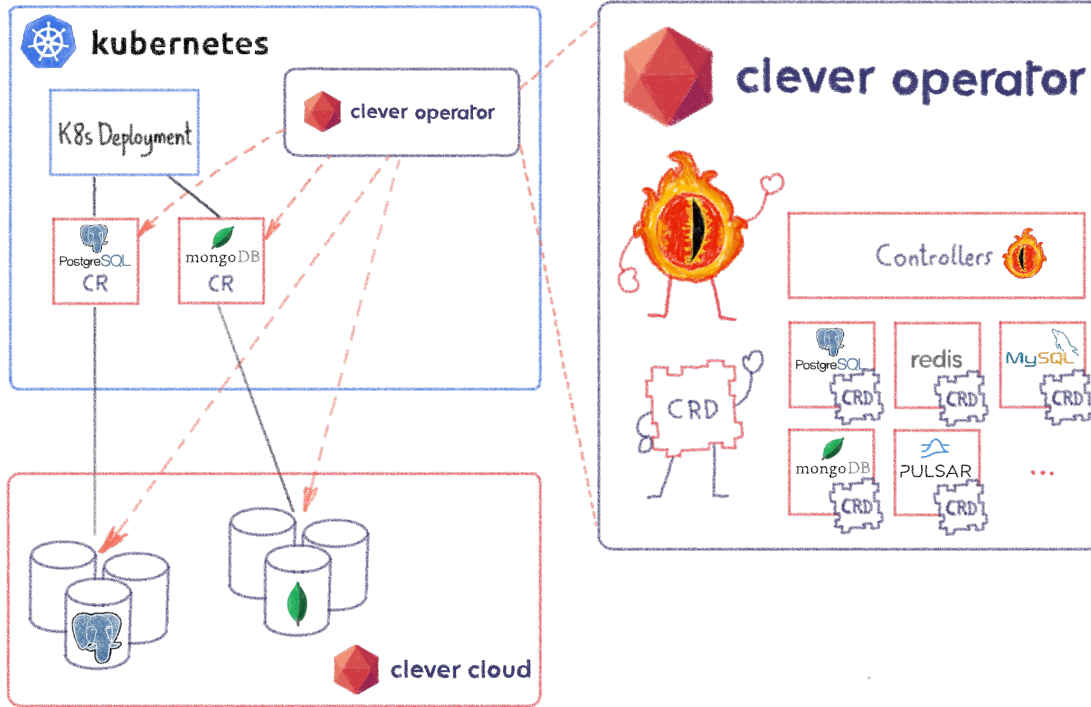


# Let's choose a use-case



## External Service Health Monitor Operator

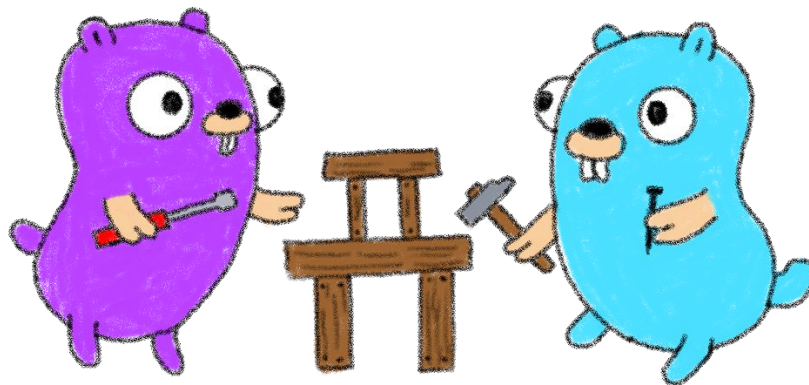
# Exposing Clever Cloud resources as CRD



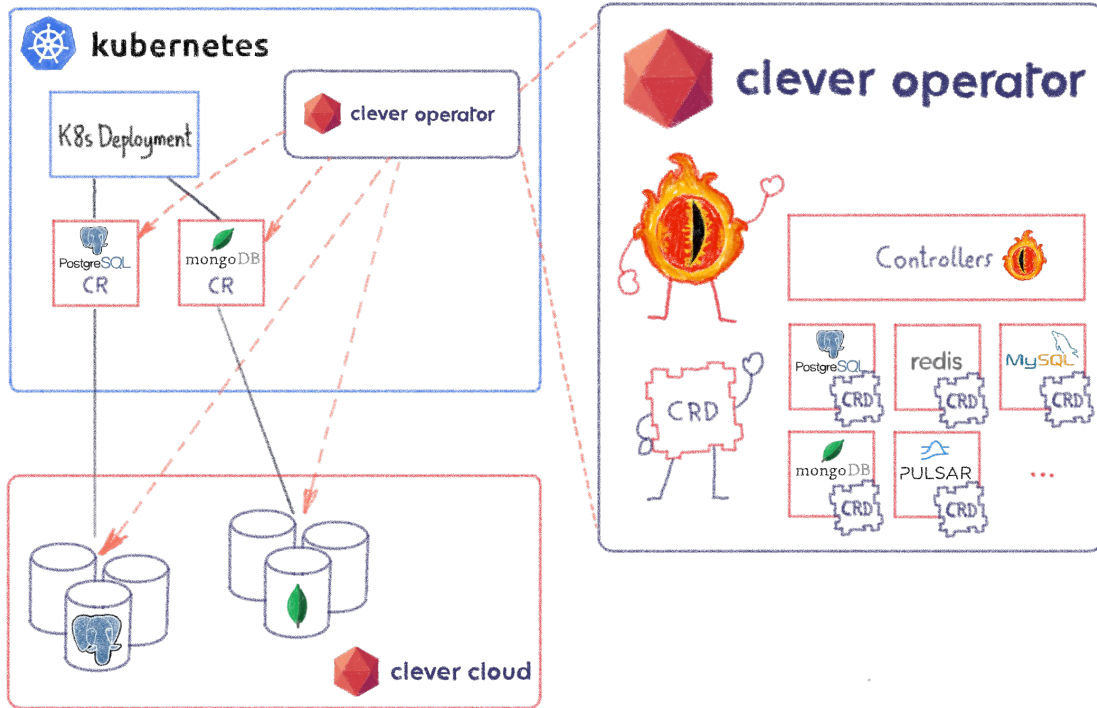
Allowing your apps to use our DBs as if they were in K8s

# Let's look at a real operator

Dealing with external databases



# Clever Cloud operator



Allowing your apps to use our DBs as if they were in K8s

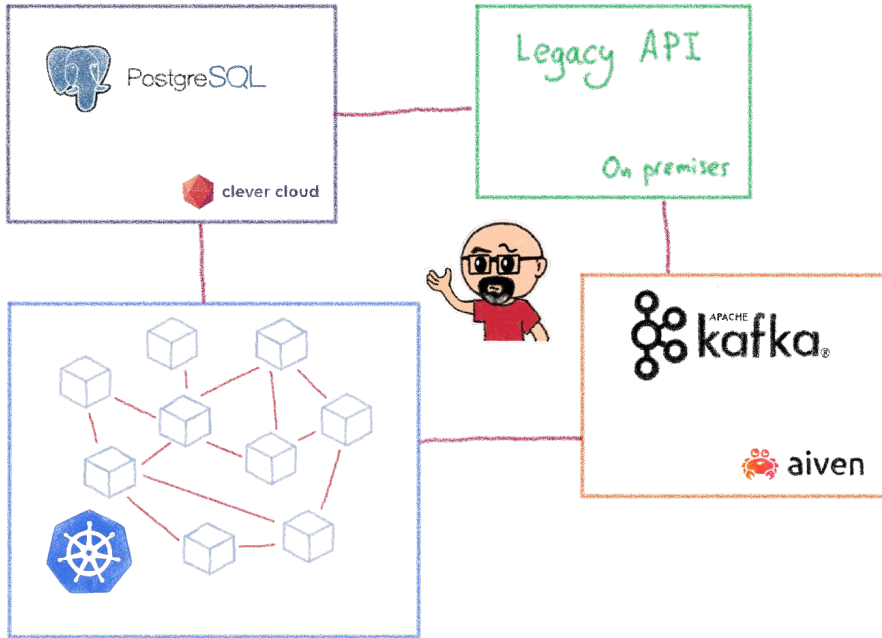




# Operators can get lots of options

Should devs need to know all of them?

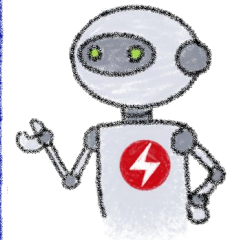
# Operators simplify Kubernetes integration



 OPERATOR



Human Operator



Kubernetes Operator



# So you have a bunch of operators...



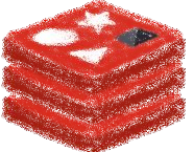
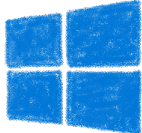
 <b>Aerospike Kubernetes Operator</b> provided by Aerospike The Aerospike Kubernetes Operator automates the...	 <b>Airflow Helm Operator</b> provided by ovelo An experimental operator that installs Apache Airflow.	 <b>Aiven Operator</b> provided by aiven Manage your https://aiven.io resources with Kubernetes.	 <b>Alkita Cluster Operator</b> provided by Lightbend, Inc. Run Alkita Cluster applications on Kubernetes.	 <b>Atility Operator for ClickHouse</b> provided by Atility ClickHouse Operator manages full lifecycle of ClickHouse...	 <b>Dapr Control Plane Operator</b> provided by dapr.io Dapr Control Plane Operator	 <b>DataDog Operator</b> provided by DataDog DataDog provides a modern monitoring and analytics platform. Gather metrics...	 <b>DataStax Kubernetes Operator for Apache Cassandra</b> provided by DataStax Simple provisioning, flexible...	 <b>DataTruckerIO</b> provided by DataTruckerIO	 <b>Debezium Operator</b> provided by Debezium Authors An Operator for installing and managing Debezium
 <b>Alsearic Imaging Ingestion Operator</b> provided by Alsearic The Alsearic Imaging Ingestion Operator provides a collection of...	 <b>Anchore Engine Operator</b> provided by Anchore Inc. Anchore Engine - container image scanning service for policy-based security.	 <b>Anolis Galaxy</b> provided by Galaxy Community Anolis Galaxy is Anolis's official hub for sharing...	 <b>Apache Spark Operator</b> provided by ramanalytics An operator for managing the Apache Spark clusters and intelligent applications...	 <b>API Operator for Kubernetes</b> provided by WSO2 API Operator provides a fully automated experience for...	 <b>Dell Container Storage Modules</b> provided by Dell Technologies Easily install and manage Dell's CSI Drivers and CSM.	 <b>Dell CSI Operator</b> provided by Dell Technologies	 <b>Deployment Validation Operator</b> provided by Red Hat The deployment validation operator	 <b>Devfile Registry Operator</b> provided by Red Hat Deploy and manage Devfile Registries on Kubernetes and OpenShift with the Devfile...	 <b>dnext-operator</b> provided by Merit Bridge dnext-operator
 <b>API Testing</b> provided by Ibsenium API Testing Operator provides a fully automated experience for API Testing applications.	 <b>APIcast</b> provided by Red Hat APIcast is an API gateway built on top of NGINX. It is part of the Red Hat SSO4 API.	 <b>Apicurio Registry Operator</b> provided by Apicurio Deploy and manage Apicurio Registry on Kubernetes.	 <b>APIMatic Operator</b> provided by APIMatic.io Generate client SDKs and interactive Documentation for your APIs in minutes.	 <b>App Director</b> provided by Red Hat Enable Developer Self-Service to Setup and Manage Applications on Multiple...	 <b>DNS Operator</b> provided by Red Hat A Kubernetes Operator to manage the lifecycle of DNS resources	 <b>druid-operator</b> provided by Apache Druid Community druid-operator allows creating Apache Druid cluster...	 <b>DynaTrace OneAgent</b> provided by Dynatrace LLC	 <b>DynaTrace Operator</b> provided by Dynatrace LLC	 <b>Eclipse Ditto</b> provided by Jens Remann Eclipse Ditto provides a Digital Twin platform. A digital twin is a virtual, cloud-based...
 <b>AppDynamics Operator for Kubernetes</b> provided by AppDynamics LLC AppDynamics Operator to install AppDynamics Clou...	 <b>Application Services Metering Operator</b> provided by Red Hat Collect the core usage of products from the Appli...	 <b>Appraxis CPS Operator</b> provided by Appraxis, Inc The Appraxis CPS operator enables you to back up and restore your...	 <b>Aqua Security Operator</b> provided by Aqua Security, Inc. The Aqua Security Operator runs within a OpenShift cluster and provides a means to...	 <b>ArangoDB</b> provided by ArangoDB GmbH ArangoDB Kubernetes Operator	 <b>Eclipse Hawkbit</b> provided by Red Hat Eclipse hawkbit is a firmware update platform.	 <b>ECR Secret Operator</b> provided by MOBB	 <b>EDB Postgres for Kubernetes</b> provided by EnterpriseDB Corporation Operator to manage Post...	 <b>EDP Keycloak Operator</b> provided by EPAM Delivery Platform An Operator for managing Keycloak.	 <b>EDP Nexus Operator</b> provided by EPAM Delivery Platform An Operator for managing Nexus entities.
 <b>Argo CD</b> provided by Argo CD Community Argo CD is a declarative, GitOps continuous delivery...	 <b>Argo CD Operator (Helm)</b> provided by OpenShift SRE Declarative Continuous Delivery following GitOps.	 <b>Astra Trident</b> provided by NetApp, Inc. Trident Operator, to manage Astra Trident installations	 <b>AtlasMap Operator</b> provided by AtlasMap AtlasMap is a data mapping solution with an interactive web-based user interface...	 <b>AuthInfo Operator</b> provided by Red Hat	 <b>EDP Sensor Operator</b> provided by EPAM Delivery Platform An Operator for managing Sensor entities.	 <b>eG Innovations Universal Agent Operator</b> provided by eG Innovations	 <b>Elasticsearch (ECK) Operator</b> provided by Elastic Run Elasticsearch, Kibana, APM Server, Beats, Emb...	 <b>Elasticsearch Index Operator</b> provided by IBM An operator for managing index installations...	 <b>Elasticsearch Phenix Operator</b> provided by Carroffor Manage Elasticsearch indices, templates lifecycle...



Too many options again...



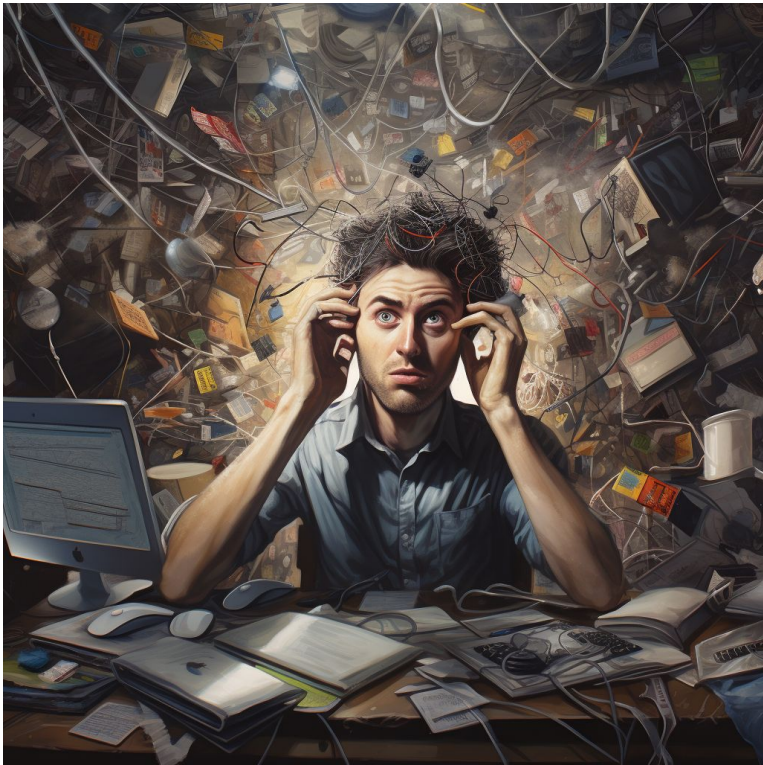
# So many things to learn...



# Managing the self-service commodity



# Shift left and Cognitive Load

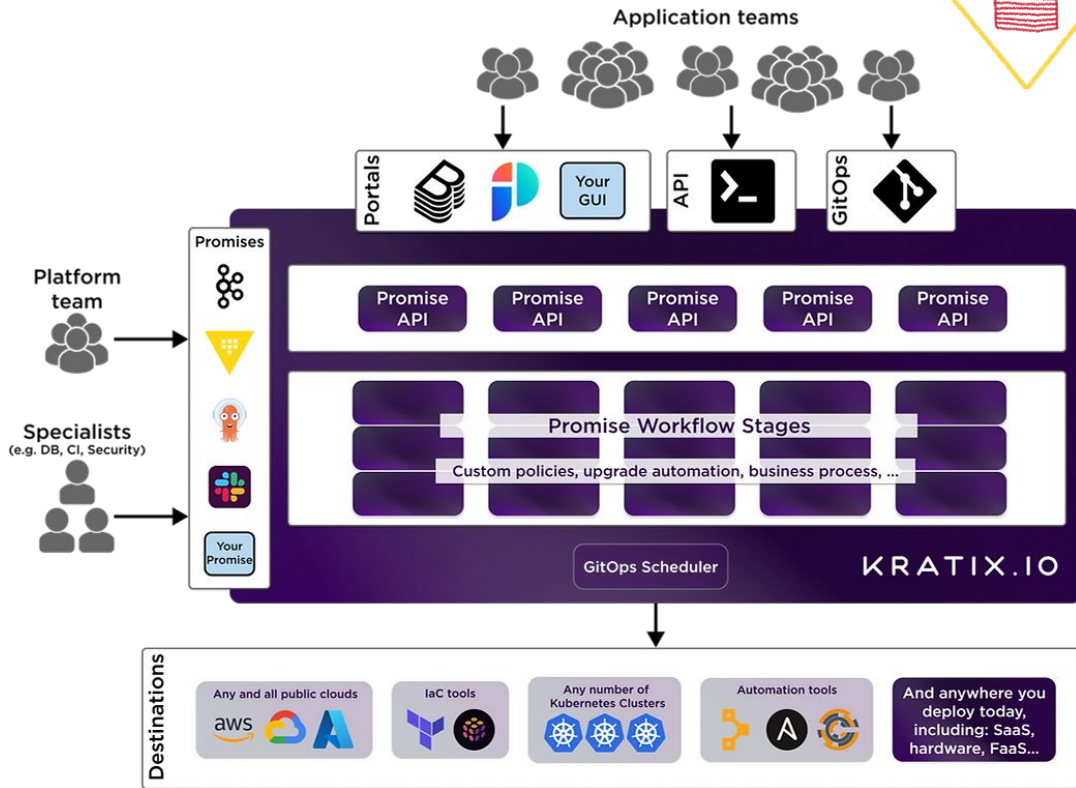


# How about an operator to operate operators?



One operator to rule them all

# How about a Platform Engineering framework?





# How about using an internal developer portal?



## Stakeholders



Developers



Dev Manager



VP Engineering



DevOps

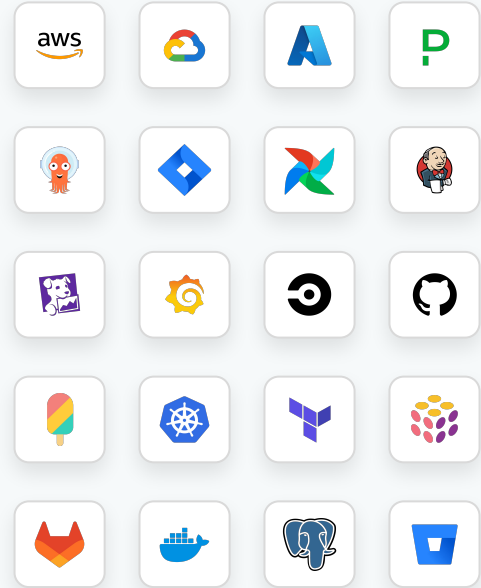


CISO



Internal  
developer portal

## Platform



# Portal's main pillars



 Dashboards



Software  
Catalog



Scorecards



Self-service



Workflow  
automations



RBAC

