



# EXTENDING KUBERNETES: ZERO TOUCH AUTOMATION WITH OPERATORS

 @MARIOAPARDO0

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**Kubernetes (#6)**  
06th Nov. 2019  
Bogotá



# kubectl whoami !



 /marioapardo

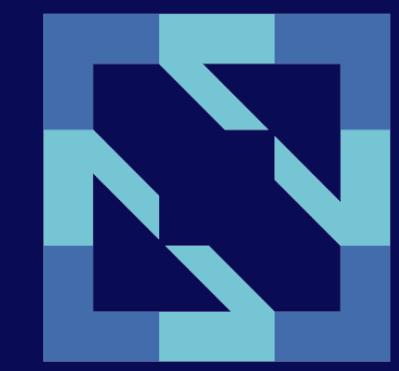
 @marioapardo0



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Mario Pardo	Infra/Cloud	DevOps/SRE	LIFTIT	Bogota, CO
PROFESSION	EXPERIENCE	HOBBIES	UID	
Systems Engineer	+10 years	Photography and Music	@marioapardo	@marioapardo0



# Kubectl get agenda!



Session	Name
I	Motivation and the road to operators
I	Hello Operator, what are you exactly?
I	The Problem, Why Operators?
I	The components of an operator
I	Development of operators with SDK
I	Bazinga Operator and Coffee-Secrets
II	We live with third party operators!
III	Q/A



# Motivation and the road to operators



## 2016 - IoT Project with Docker/Rancher

- Problems:
  - \* Orchestration, automation, integration, configuration, monitoring
- Solved:
  - \* Mini-Operator with Python.

## 2017 - Voice as a Service (VaaS) over K8S

- Problems:
  - \* Configuration, scaling, automation and monitoring.
- Solved:
  - \* Partial-Operator with Python.
  - \* Third party operators.



# Motivation and the road to operators



## 2018 - Monitoring as a Service over K8S

- Problems:
  - \* Configure and manage applications, autoscaling, many manifest, centralized control, storage, resilience, automation.
- Solved:
  - \* Operator development with Go and Python.
  - \* Third party operators.



# Hello Operator, what are you exactly?



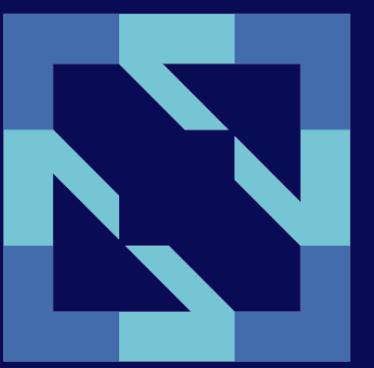
- “Operators are the way of packaging, deploying and managing your application that runs atop Kubernetes”



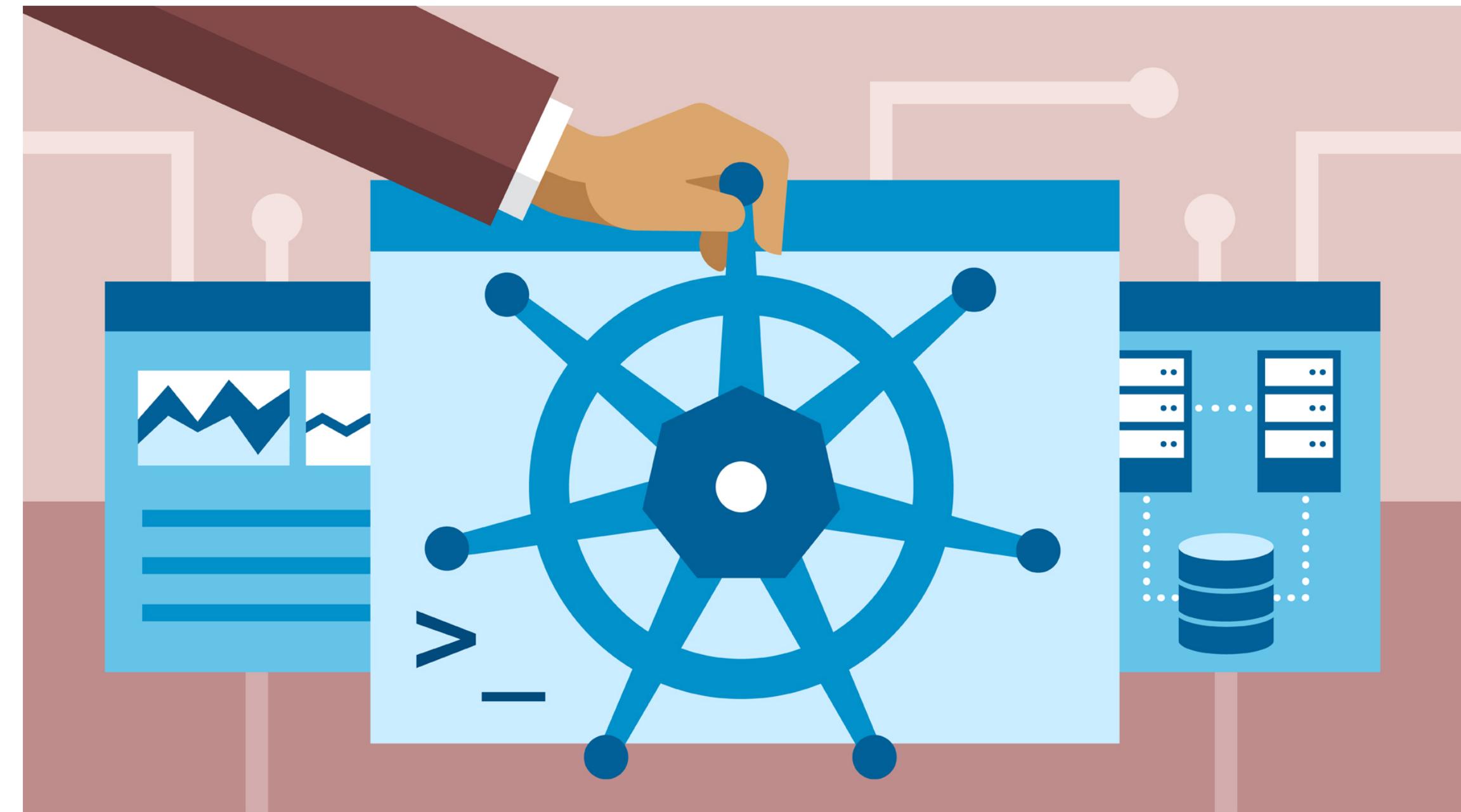
“An Operator essentially is codified knowledge on how to run the Kubernetes application.” by. CoreOS-2016



# Hello Operator, what are you exactly?

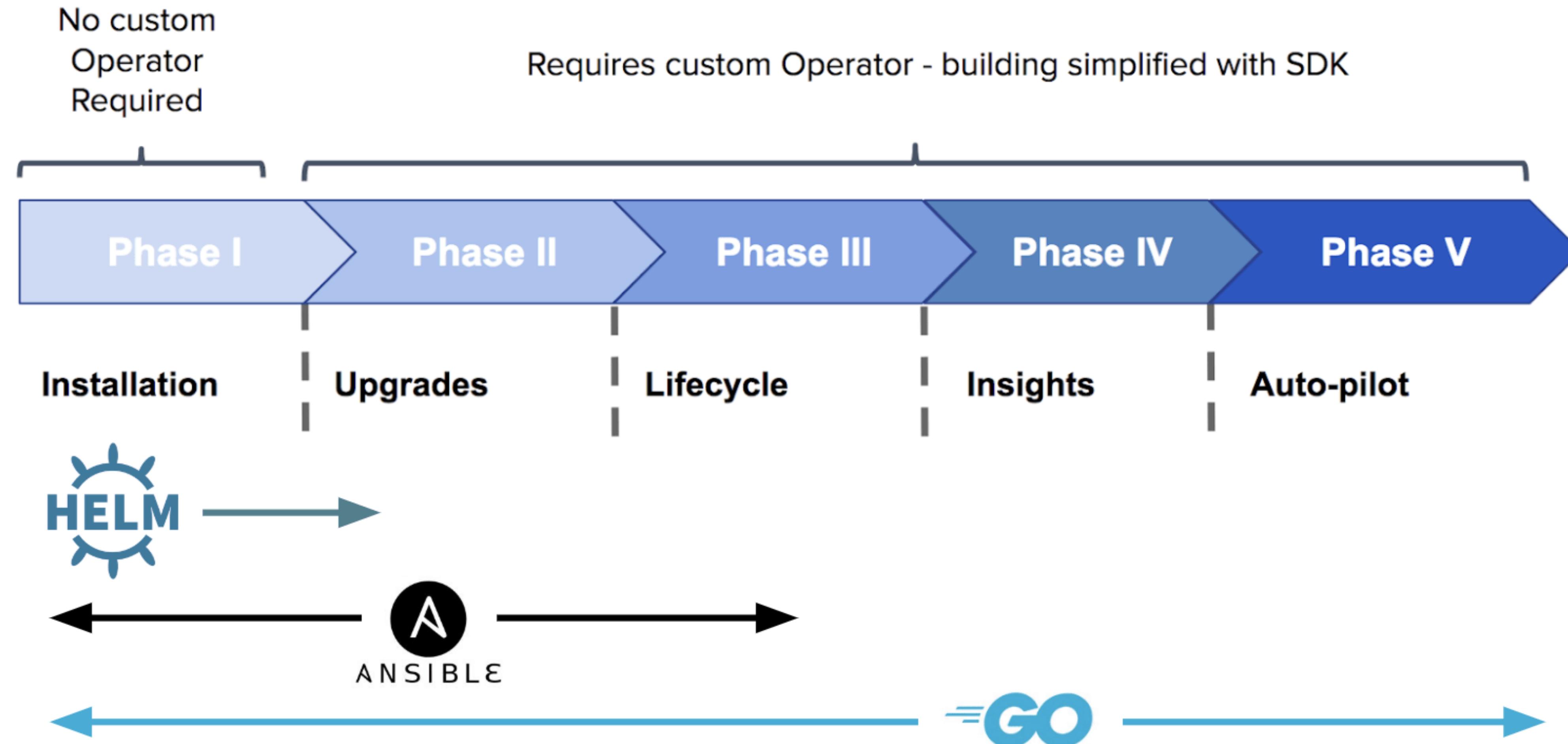


- Operators help:
  - Automation
  - Scaling
  - Backup
  - Restore
  - Resilience
  - ..



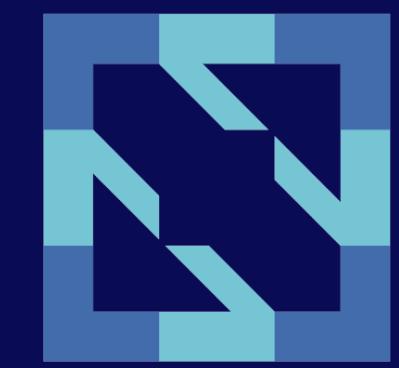


# Hello Operator, what are you exactly?





# The Problem?



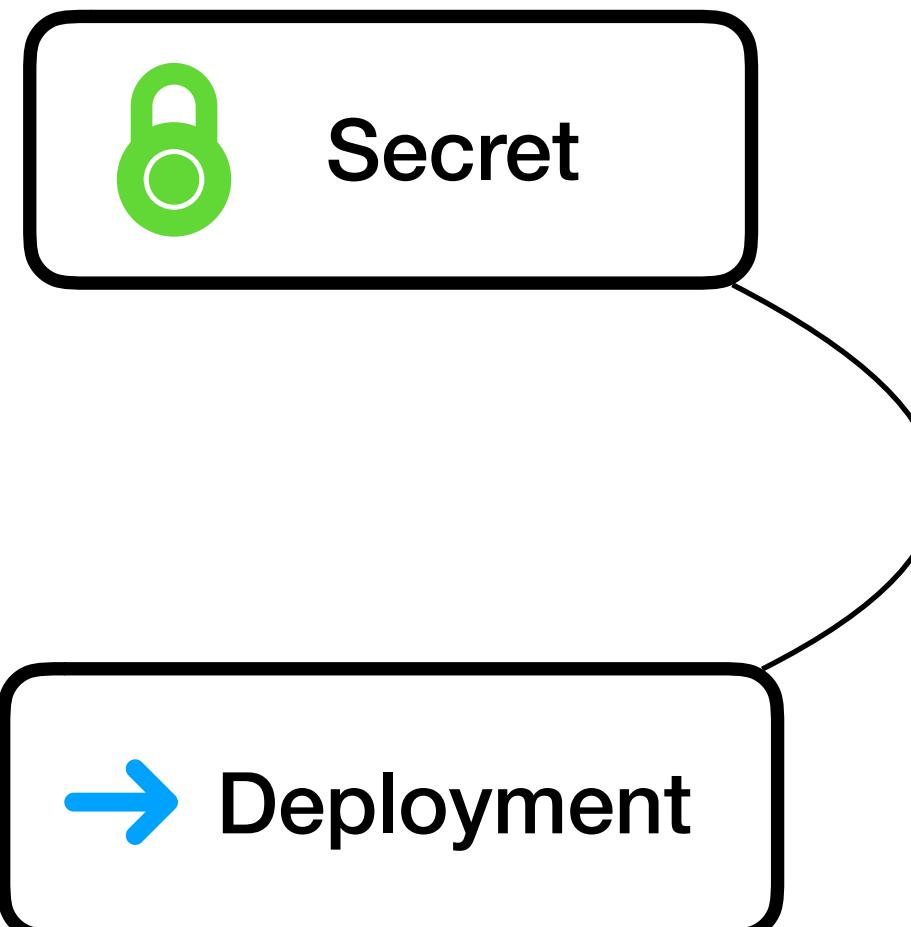


# The Problem, Why Operators?



- The development of Coffee-Shop and its continuous change of environment variables. (Secrets and restart of pods)

Change or add a new secret



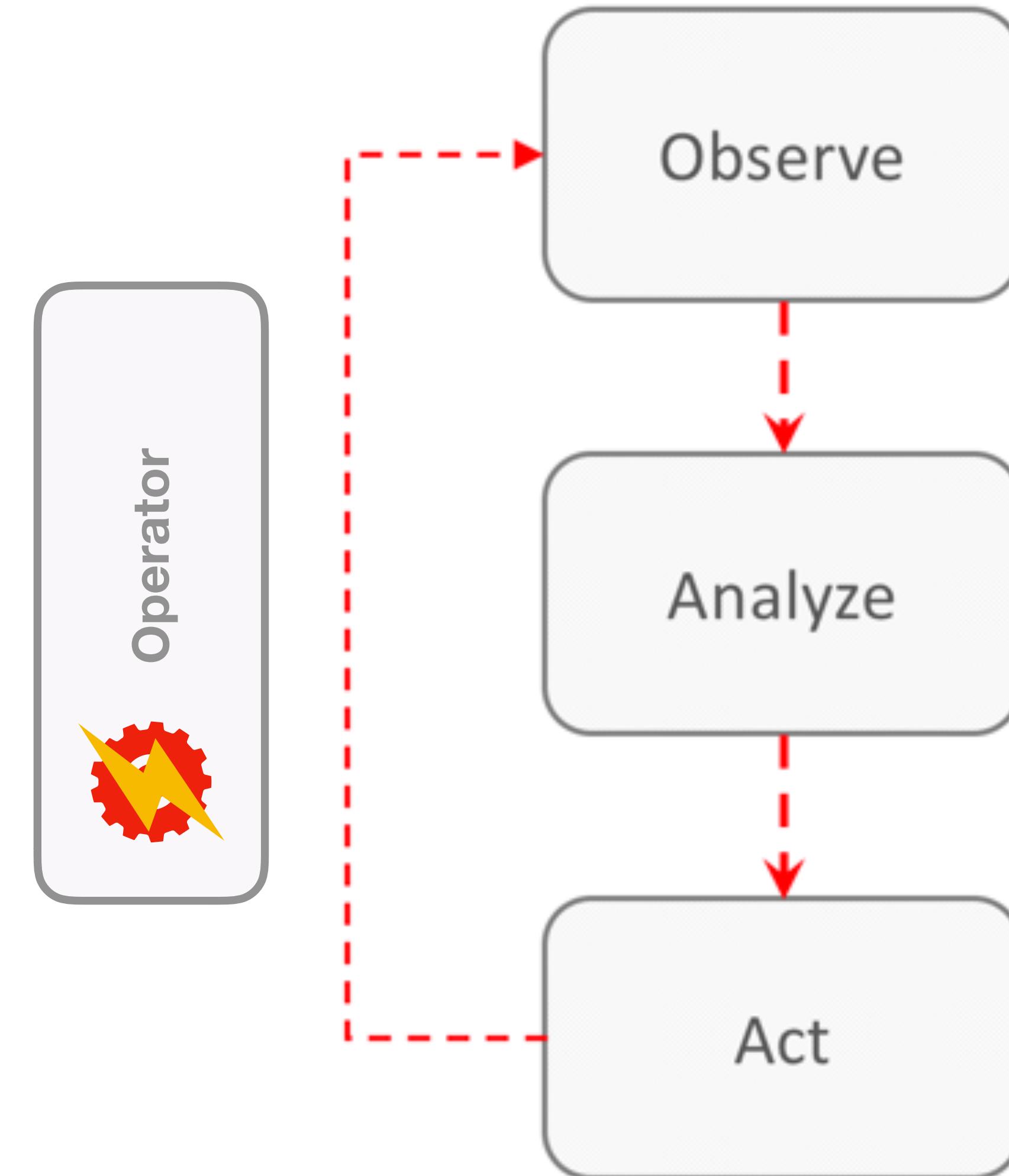
Manual reset of the pods



\* `kubectl v1.15` now provides a `rollout restart` sub-command that allows you to restart Pods in a Deployment

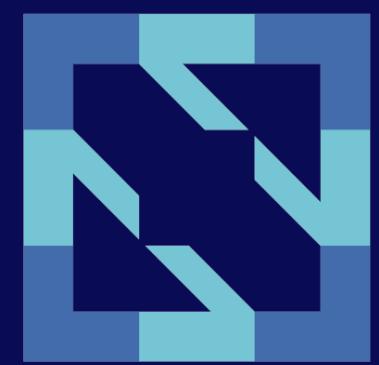


# The Problem, Why Operators?

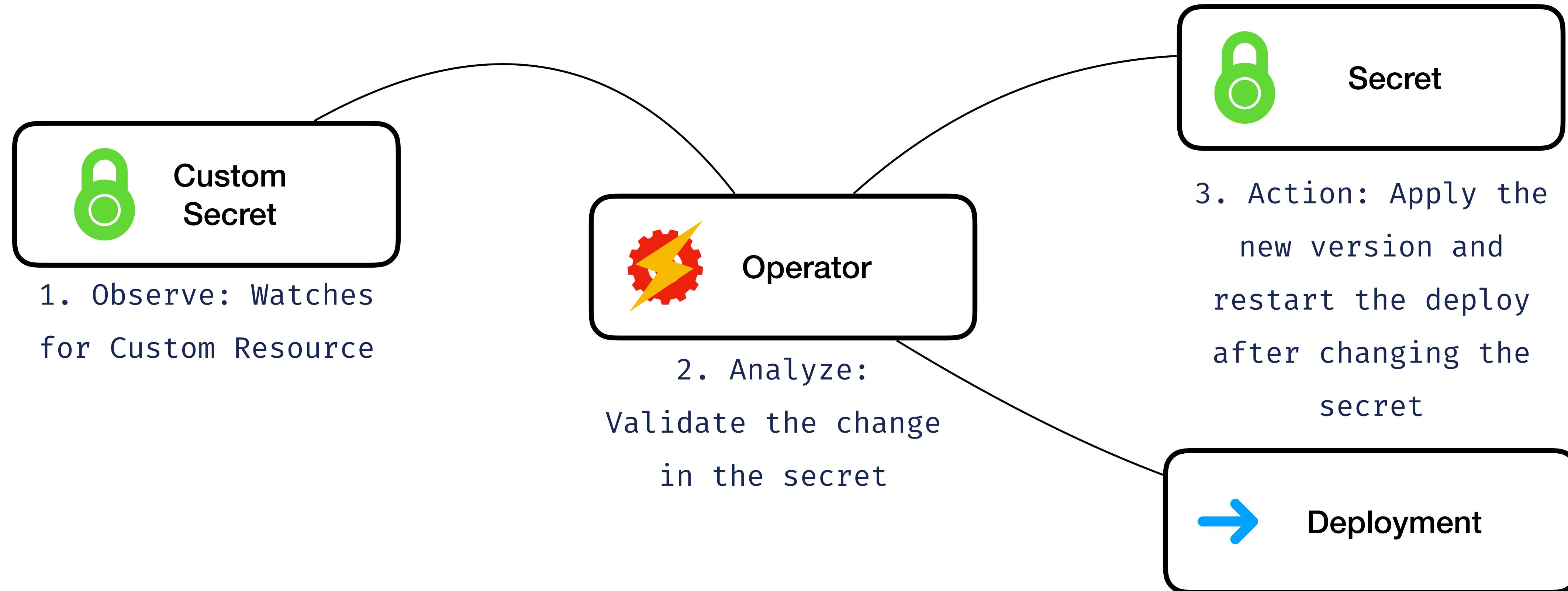




# The Problem, Why Operators?



- Automatic reset of the pods when a change in the secret is received.

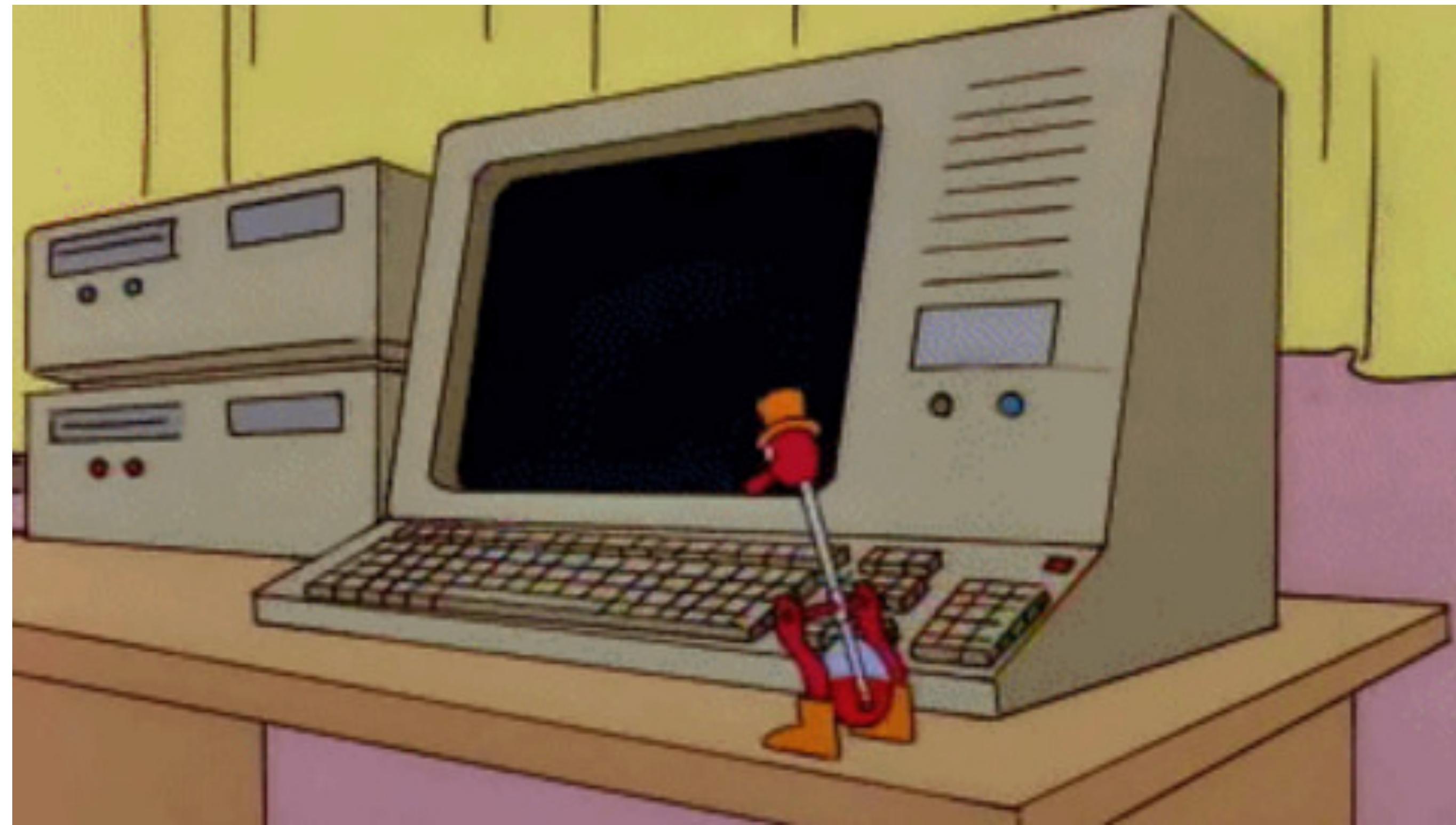




# The components of an operator



**Operator** = Custom Resource Definition (CRD) + Controller





# The components of an operator



**CRD:** Definition of the objects that the controller will manage.

- **TypeMeta:**
  - Kind
  - APIVersion
- **ObjectMeta:**
  - Name
  - Namespace
  - Labels
  - Annotations
  - ..

```
apiVersion: apiextensions.k8s.io/v1beta1
kind: CustomResourceDefinition
metadata:
  name: secretz.bazinga.io
  namespace: meetup
spec:
  group: bazinga.io
  versions:
  - name: v1
    served: true
    storage: true
  scope: Namespaced
  names:
    plural: secretz
    singular: secret
    kind: Secret
    shortNames:
    - bs
```



# The components of an operator



**Spec:** Own information we need

**Status:** Information about the state of our objects.

```
validation:  
openAPIV3Schema:  
required:  
- spec  
properties:  
spec:  
type: object  
required:  
- secretName  
- data  
- deployName  
properties:  
secretName:  
type: string  
data:  
items:  
type: string  
deployName:  
type: string
```



# The components of an operator



## Controller: ListerWatcher + Handler

- **ListerWatcher:**
  - Lister
  - Watcher
- **Handler:**
  - Add
  - Delete
  - Update
  - Events
- **Reconciliation Loop.**

```
@kopf.on.create('bazinga.io', 'v1', 'secretz')
def create_secret(body, meta, spec, status, logger, **kwargs):
    secretName = spec.get('secretName')
    print(f"Create Secret.... {secretName}")

    data = _render_yaml(spec, meta)

    obj = Secret(api, data)
    try:
        obj.create()
    except HTTPError as e:
        obj.update()
        if e.code == 409:
            logger.info(
                "Element {:s} exist!!!".format(secretName))
            return
    raise e

    logger.info(f"Add new secret {secretName}!!!")

@kopf.on.update('bazinga.io', 'v1', 'secretz')
def update_secret(body, meta, spec, status, old, new, diff, logger, **kwargs):
    secretName = spec.get('secretName')
    print(f'Update Secret.... {secretName}')

    data = _render_yaml(spec, meta)

    obj = Secret(api, data)
    obj.update()

    logger.info(f"Secret {secretName} update!!!")
```



# Development of operators with SDK



**OPERATOR  
FRAMEWORK**

[operatorhub.io](https://operatorhub.io)

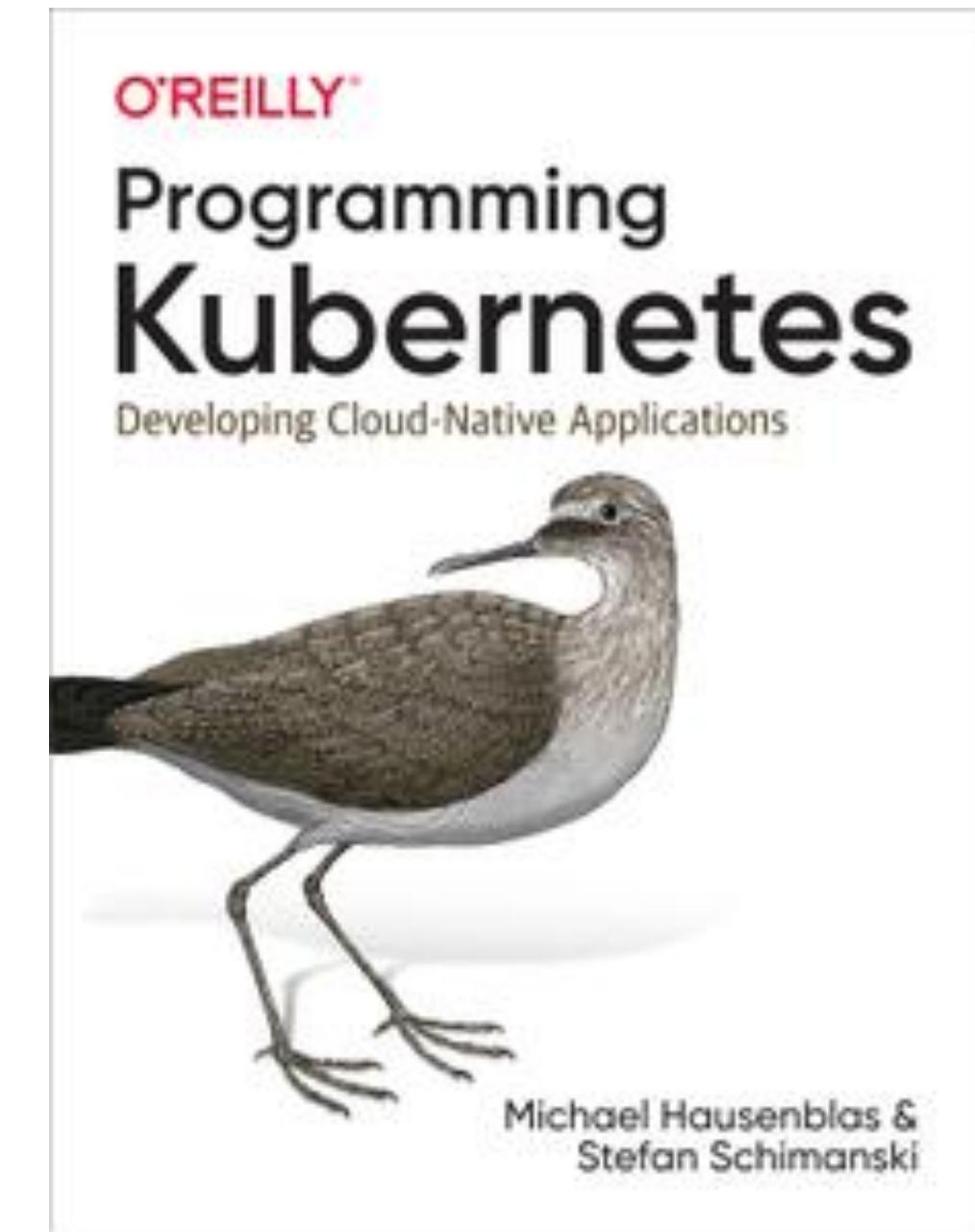
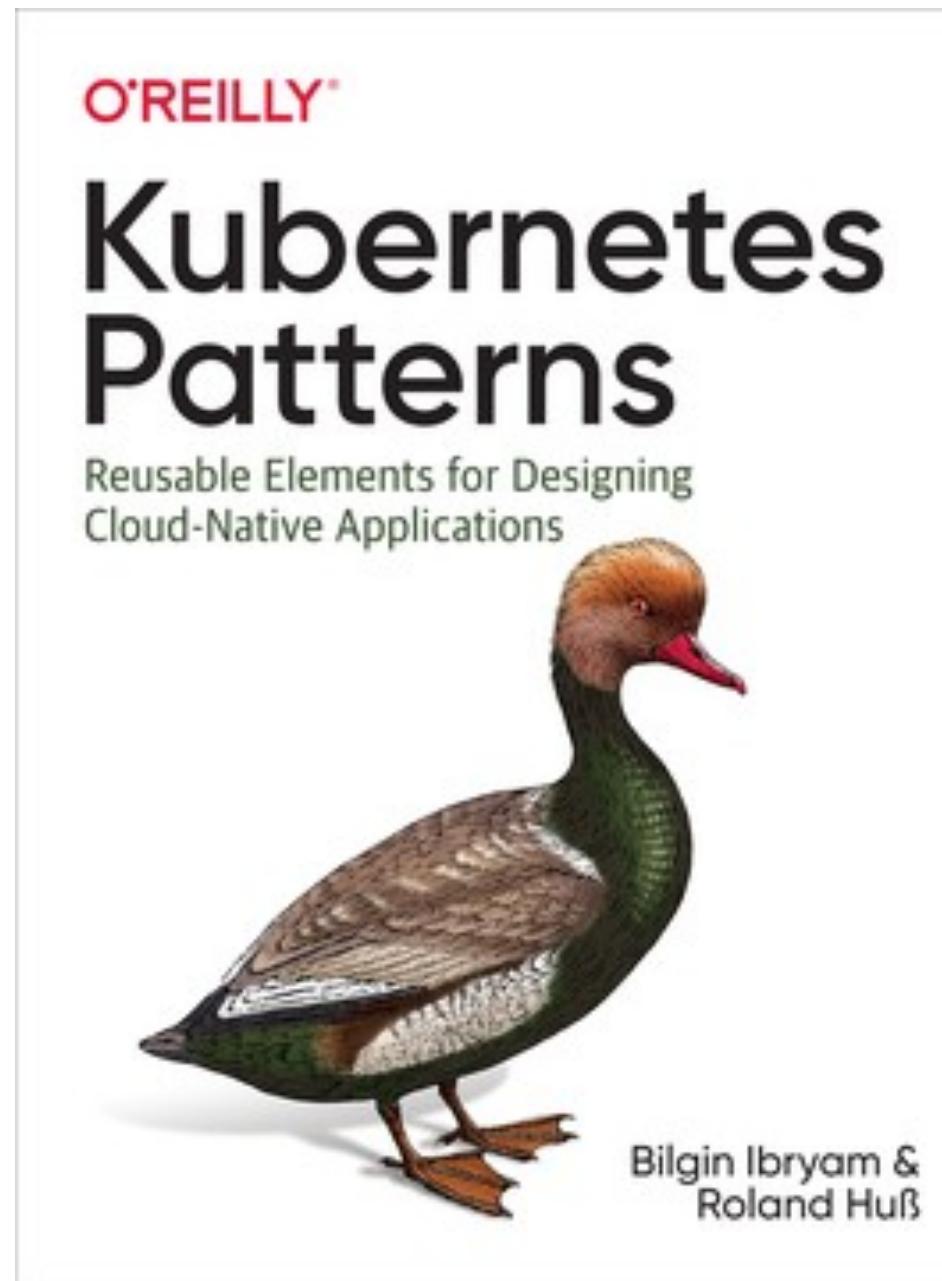
[github.com/operator-framework/operator-sdk](https://github.com/operator-framework/operator-sdk)



[github.com/zalando-incubator/kopf](https://github.com/zalando-incubator/kopf)



# Development of operators with SDK



**ISBN-13: 978-1492050285**

**ISBN-13: 978-1492047100**

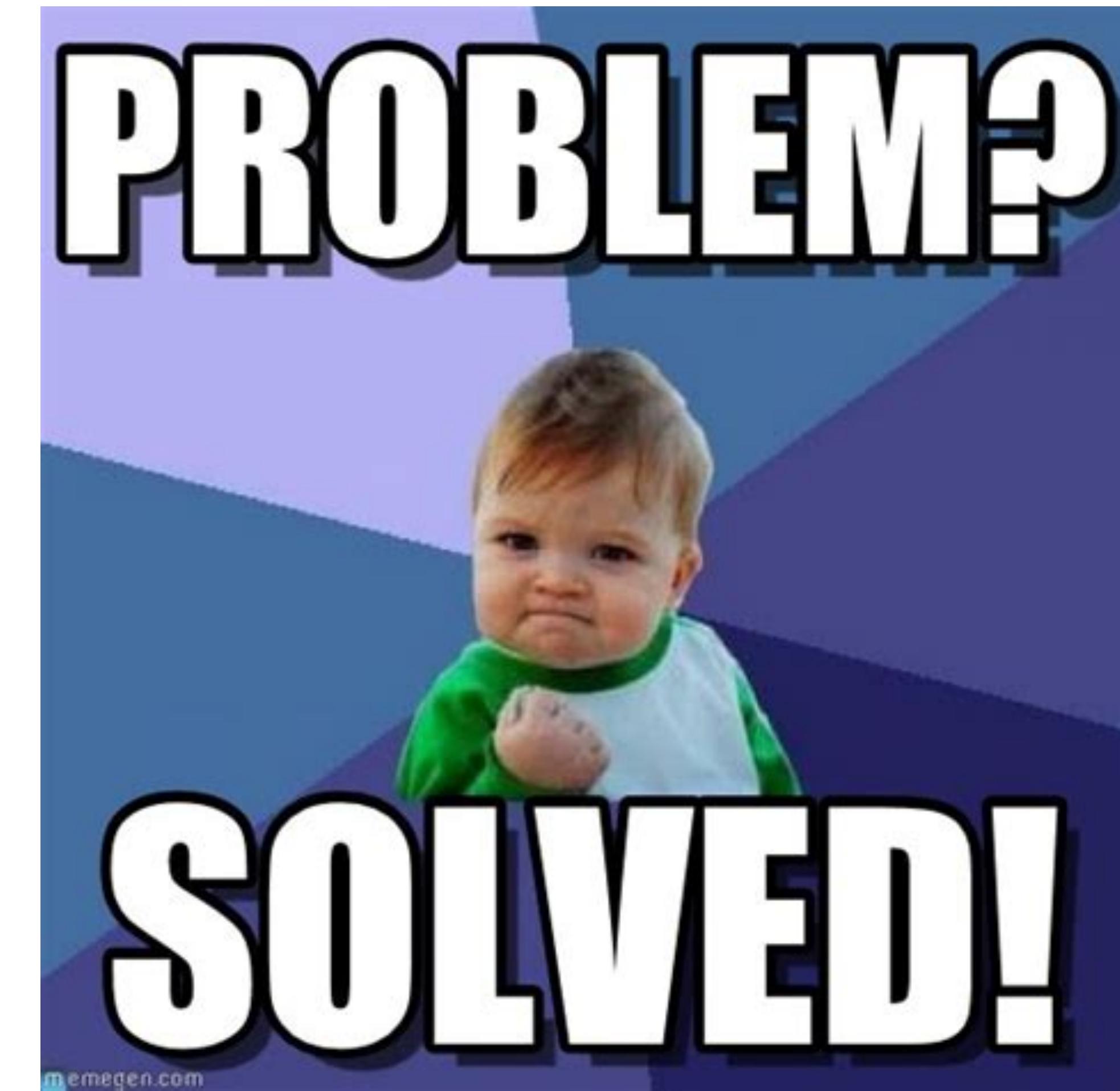


# Bazinga Operator





So lved !

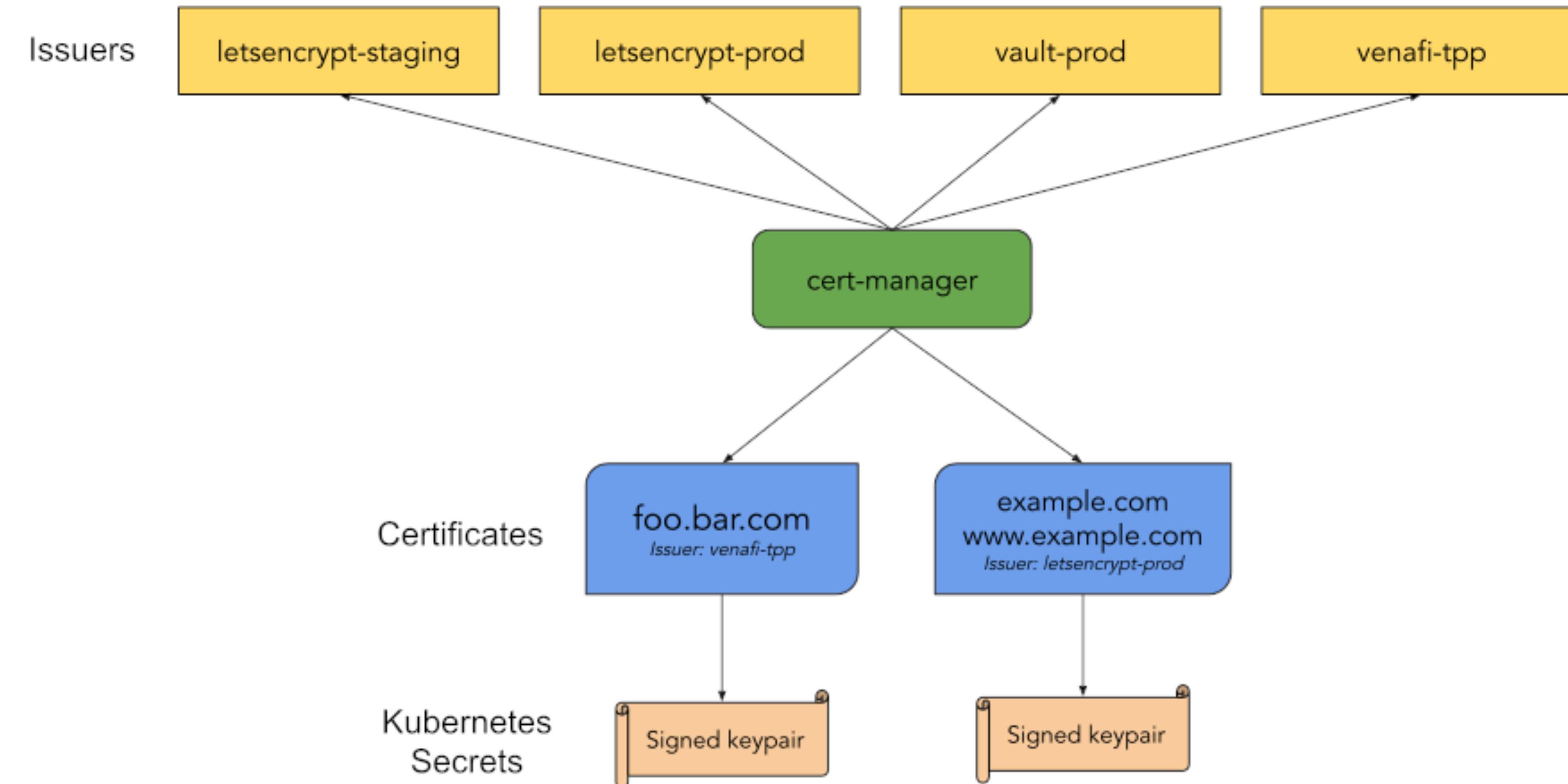




# We live with third party operators!



**Cert-Manager:** <https://github.com/jetstack/cert-manager>





# We live with third party operators!



## Istio: <https://istio.io>

```
apiVersion: networking.istio.io/v1alpha3
kind: Gateway
metadata:
  name: helloworld-gateway
spec:
  selector:
    istio: ingressgateway # use istio default controller
  servers:
  - port:
      number: 80
      name: http
      protocol: HTTP
  hosts:
  - "*"
```

```
apiVersion: networking.istio.io/v1alpha3
kind: VirtualService
metadata:
  name: helloworld
spec:
  hosts:
  - "*"
  gateways:
  - helloworld-gateway
  http:
  - match:
    - uri:
        exact: /hello
    route:
    - destination:
        host: helloworld
        port:
          number: 5000
```



# We live with third party operators!



**Elastic\_Cloud-on-k8s:** <https://github.com/elastic/cloud-on-k8s>

```
cat <<EOF | kubectl apply -f -
apiVersion: elasticsearch.k8s.elastic.co/v1beta1
kind: Elasticsearch
metadata:
  name: quickstart
spec:
  version: 7.4.2
  nodeSets:
  - name: default
    count: 1
    config:
      node.master: true
      node.data: true
      node.ingest: true
      node.store.allow_mmap: false
EOF
```

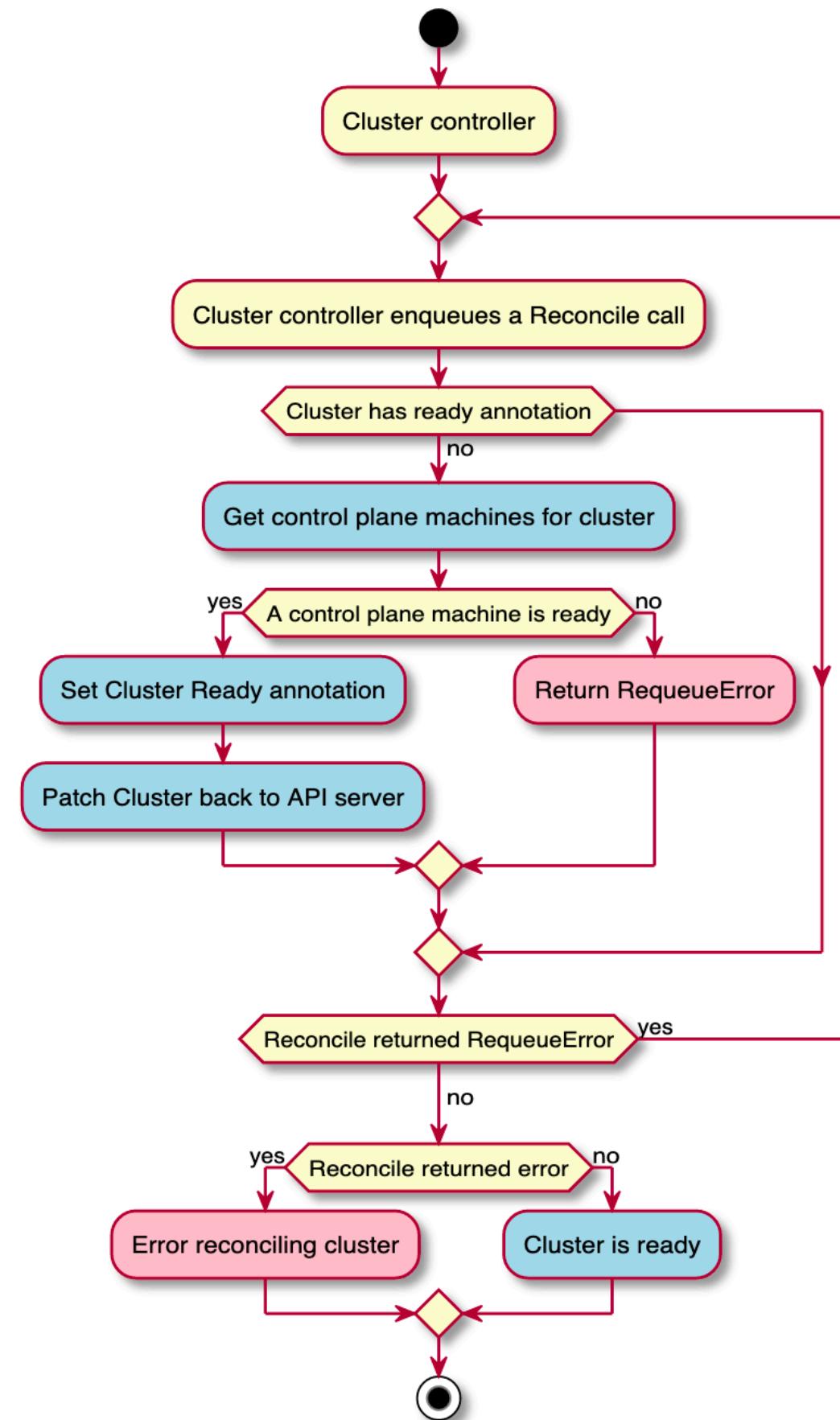


# We live with third party operators!



**Cluster-API:** <https://cluster-api.sigs.k8s.io/>

## Cluster Controller



```
apiVersion: cluster.x-k8s.io/v1alpha2
kind: Cluster
metadata:
  name: capi-quickstart
spec:
  clusterNetwork:
    pods:
      cidrBlocks: ["192.168.0.0/16"]
  infrastructureRef:
    apiVersion: infrastructure.cluster.x-k8s.io/v1alpha2
    kind: AWSCluster
    name: capi-quickstart
---
apiVersion: infrastructure.cluster.x-k8s.io/v1alpha2
kind: AWSCluster
metadata:
  name: capi-quickstart
spec:
  # Change this value to the region you want to deploy the cluster in.
  region: us-east-1
  # Change this value to a valid SSH Key Pair present in your AWS Account.
  sshKeyName: default
```



# We live with third party operators!



## OperatorHub: <https://operatorhub.io>

OperatorHub.io

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CATEGORIES 82 ITEMS VIEW ▾ SORT A-Z ▾

Category	Provider	Operator Name	Description
AI/Machine Learning			
Application Runtime			
Big Data	Akka	Akka Cluster Operator	provided by Lightbend, Inc. Run Akka Cluster applications on OpenShift.
Cloud Provider	Altinity	Altinity ClickHouse Operator	provided by Altinity ClickHouse Operator manages full lifecycle of ClickHouse clusters.
Database	Anchore	Anchore Engine Operator	provided by Anchore Inc. Anchore Engine - container image scanning service for policy-based security, best
Developer Tools	Apache	Apache CouchDB	provided by IBM Apache CouchDB is a highly available NOSQL database for web and mobile
Integration & Delivery			
Logging & Tracing			
Monitoring			
Networking			
OpenShift Optional			
Security	AppSody	Apache Spark Operator	provided by radanalytics.io An operator for managing the Apache Spark clusters and intelligent applications that
Storage			
Streaming & Messaging	Aqua Security	Apache Spark Operator	provided by radanalytics.io An operator for managing the Apache Spark clusters and intelligent applications that
PROVIDER	AtlasMap	AtlasMap Operator	provided by Red Hat AtlasMap is a data mapping solution with an interactive web based user interface, t
<input type="checkbox"/> Altinity (1)			
<input type="checkbox"/> Amazon Web Services (1)			
<input type="checkbox"/> Anchore (1)			
		AWS S3 Operator	provided by Amazon Web Services, Inc. The AWS Service Operator allows you to manage AWS
		AWS Service Operator	provided by Amazon Web Services, Inc. The AWS Service Operator allows you to manage AWS



Q/A