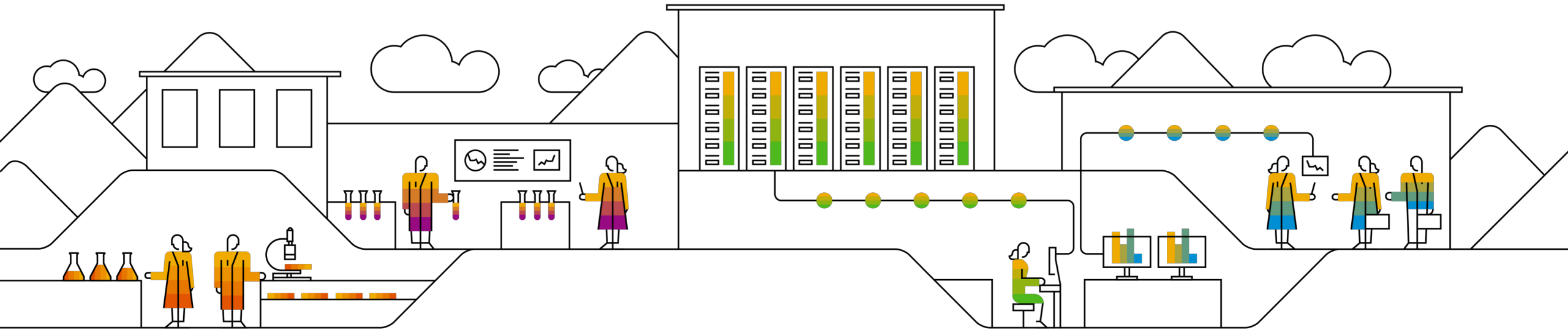




Mateusz Szostok

Developer  
at SAP Labs Poland



# 101 ways to extend the **Kubernetes** platform

Mateusz Szostok, SAP

# Agenda

- Introduction to Cloud Native
- What is the CNCF?
- Kubernetes Basics
  - Pods
  - Deployments
  - Statefulsets
  - Secrets/ConfigMaps
  - Services
  - LoadBalancing
  - CRD
  - Informers
- How to extend the Kubernetes?
- Examples
  - Sample Controller
  - Kubebuilder
  - Operator SDK
  - Metacontroller
  - Knative
  - Controller Runtime
- Admission Controllers
  - MutatingAdmissionWebhook
  - ValidatingAdmissionWebhook
- How to handle update properly (relist)
- Sending Events to CRD
- Custom indexing
- Patterns
  - OwnerReference
  - Finalizers


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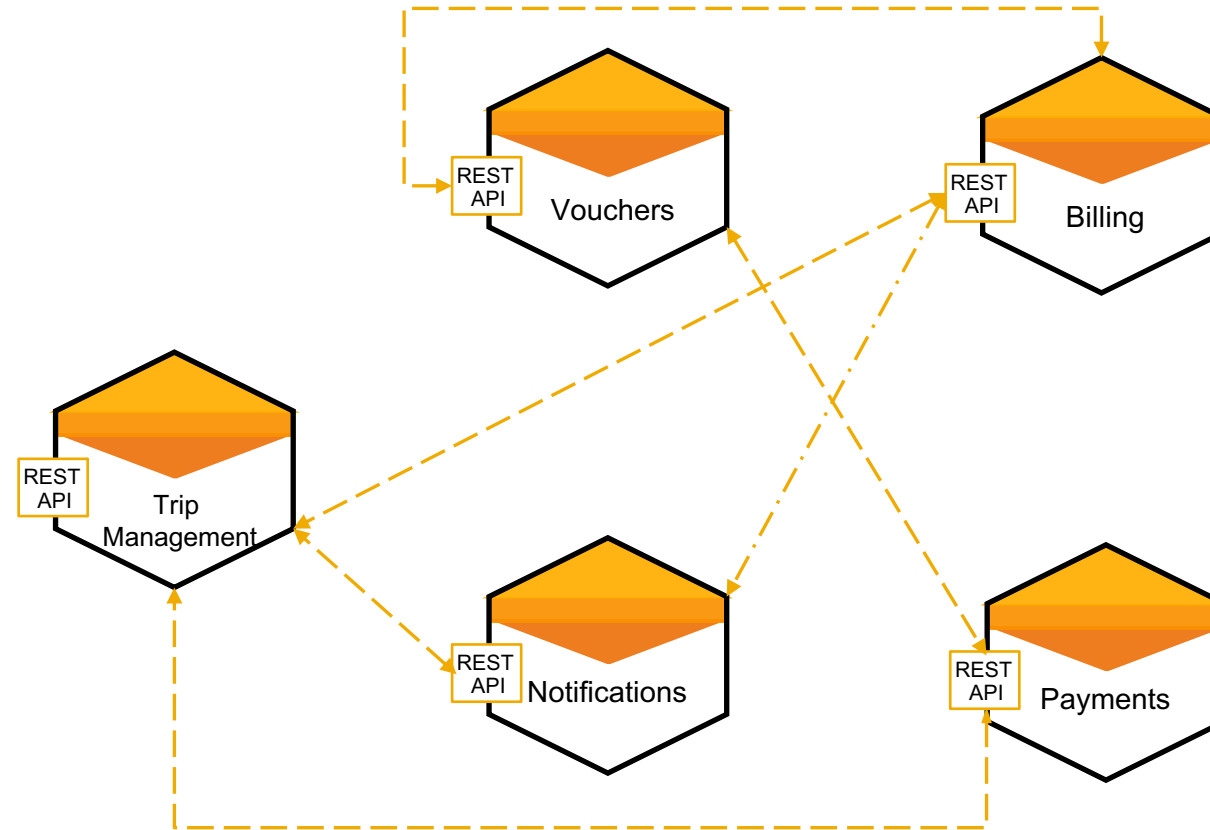
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# Agenda

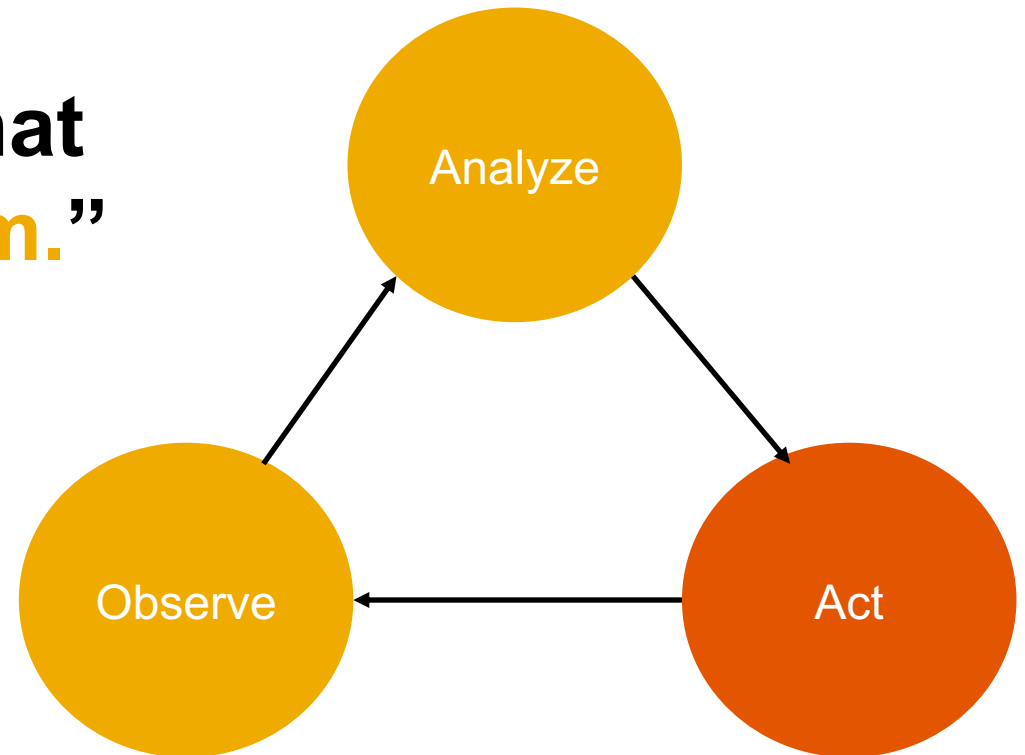
- ❑ How to extend the Kubernetes?
- ❑ Our demo use-case
- ❑ **for** ctrl := **range** []string{"Sample Controller", "Kubebuilder"}
  - ctrl.Overview()
  - ctrl.LiveCoding()
  - ctrl.Summary()
- ❑ This is just the beginning
- ❑ Bonus – tips to save your life 

# Communication



## Controller pattern – let's have the common understanding

**“(..)** is a non-terminating loop that **regulates the state of the system.**”





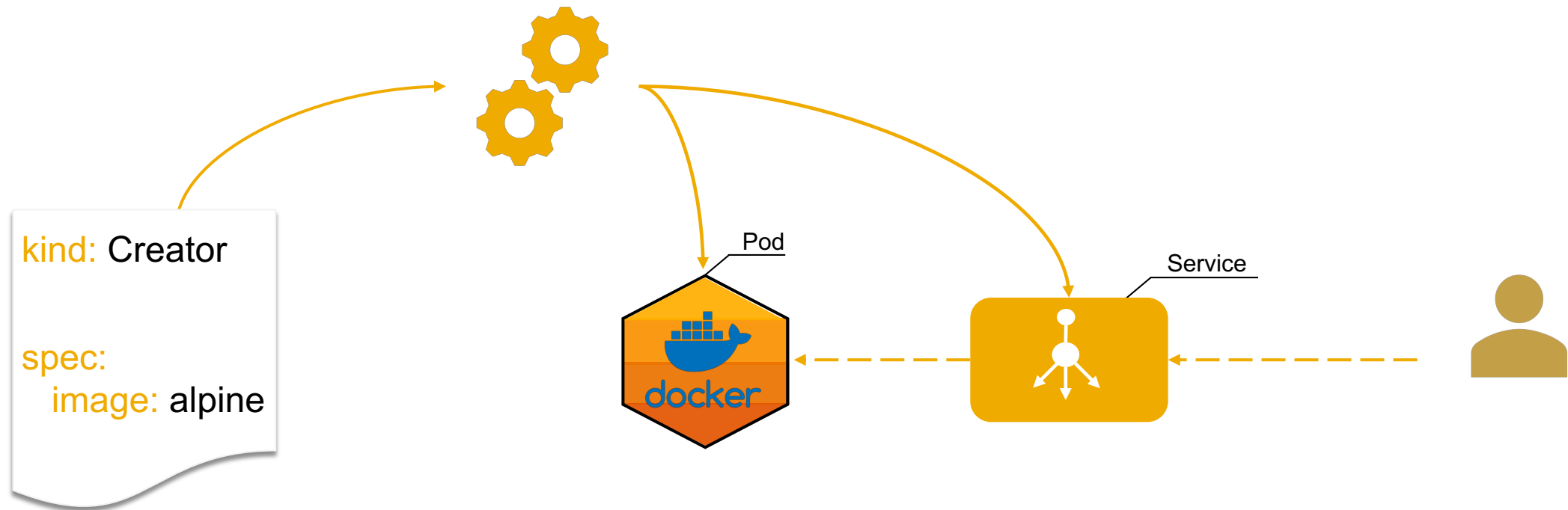
# Controller pattern – let's have the common understanding

## Kube-controller-manager

- Deployment
- Replicaset
- Service
- Endpoint
- Job
- ResourceQuote
- Statefulset
- ...

```
for {  
    desired := getDesiredState()  
    current := getCurrentState()  
    makeChanges(desired, current)  
}
```

# Our use case



Demo **time**



# Custom Resource Definition

**apiVersion:** apiextensions.k8s.io/v1beta1

**kind:** CustomResourceDefinition

**metadata:**

**name:** creators.samplecontroller.k8s.io

**spec:**

**group:** samplecontroller.k8s.io

**version:** v1alpha1

**names:**

**kind:** Creator

**plural:** creators

**scope:** Namespaced

**validation:**

**openAPIV3Schema:**

**properties:**

**spec:**

**properties:**

**image:**

**type:** string

**minLength:** 1

**apiVersion:** samplecontroller.k8s.io/v1alpha1

**kind:** Creator

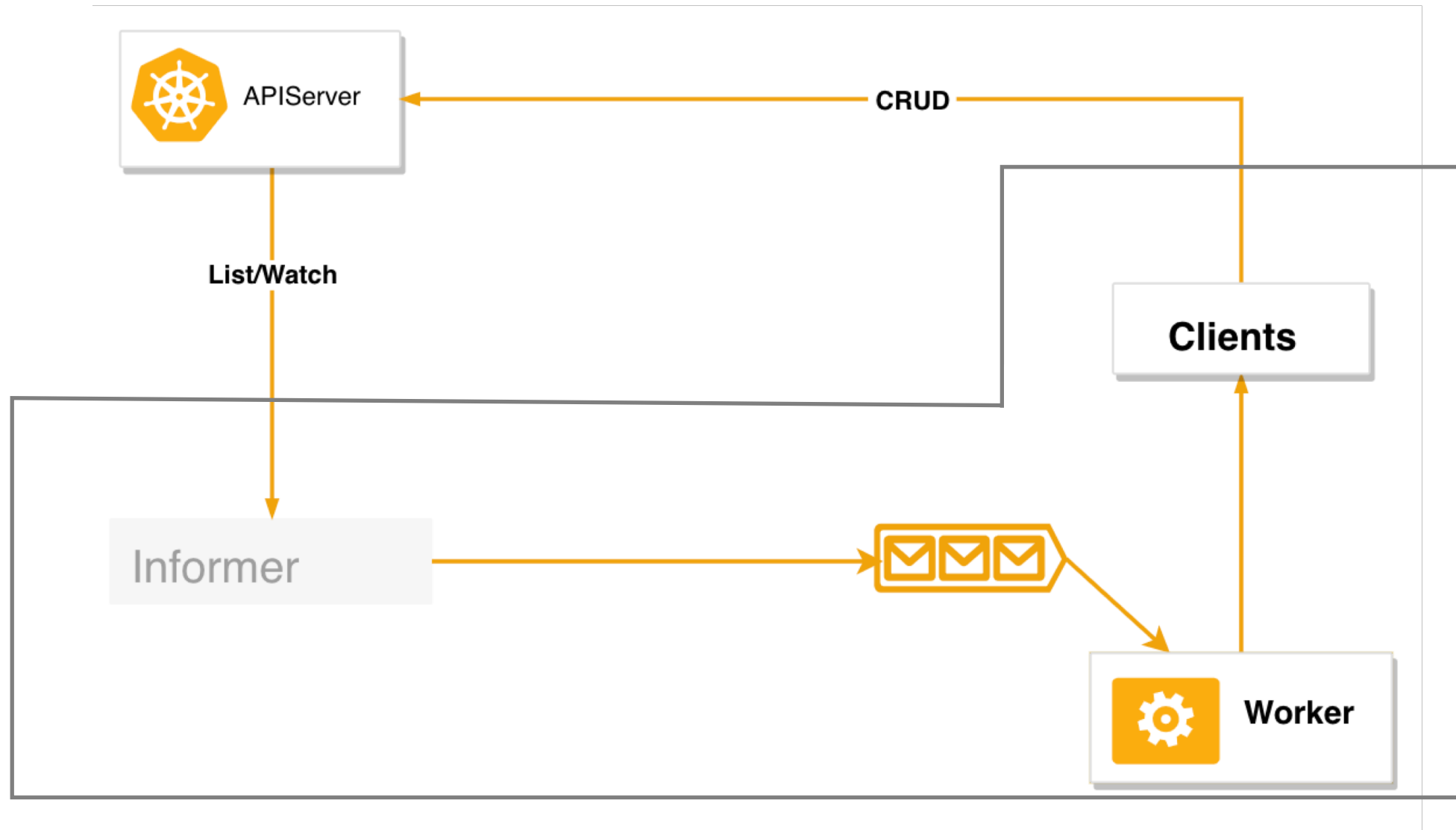
**metadata:**

**name:** do-it

**spec:**

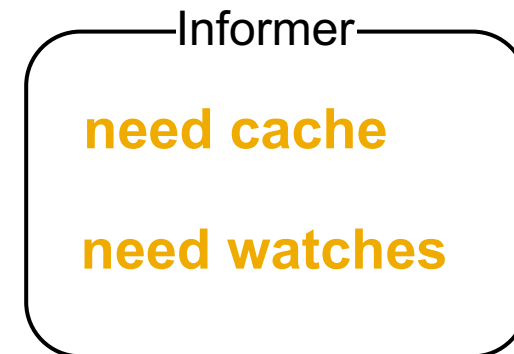
**image:** alpine:latest

# Under the hood

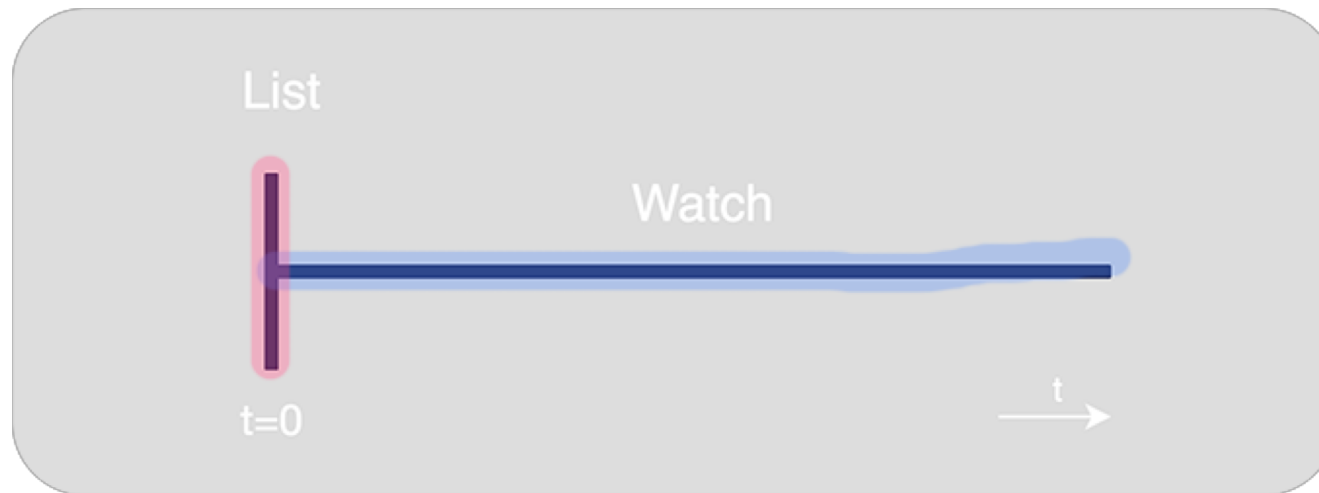


# Observer

- Re-listing from API can become expensive
- `client.Get()` / `client.List()` multiple times in code
- Want to be notified of object changes

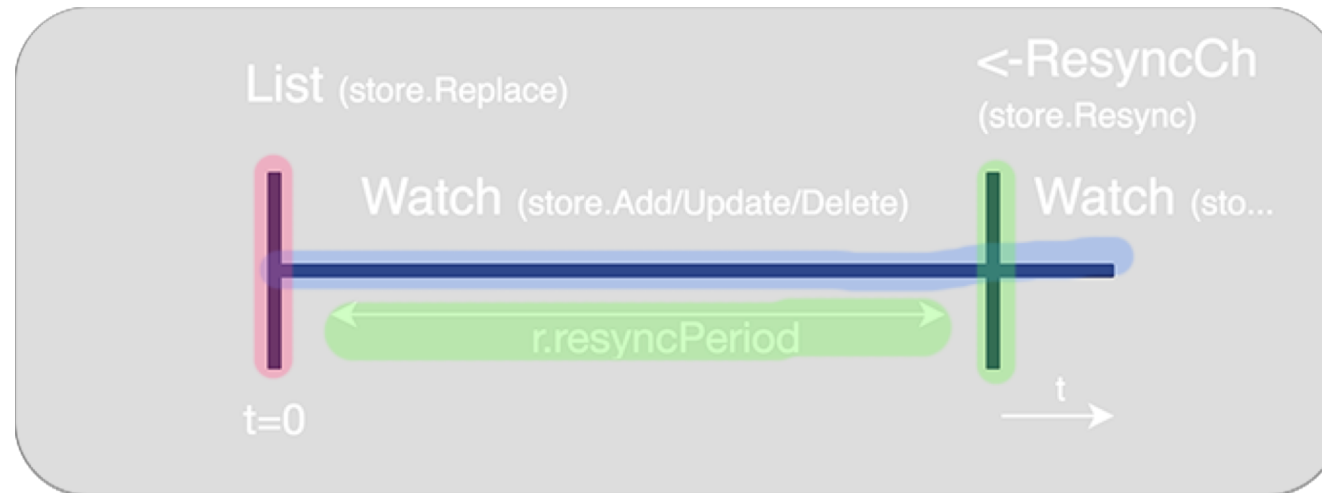


# Informer - object cache & event handling



source: <http://borismattijssen.github.io/articles/kubernetes-informers-controllers-reflectors-stores>

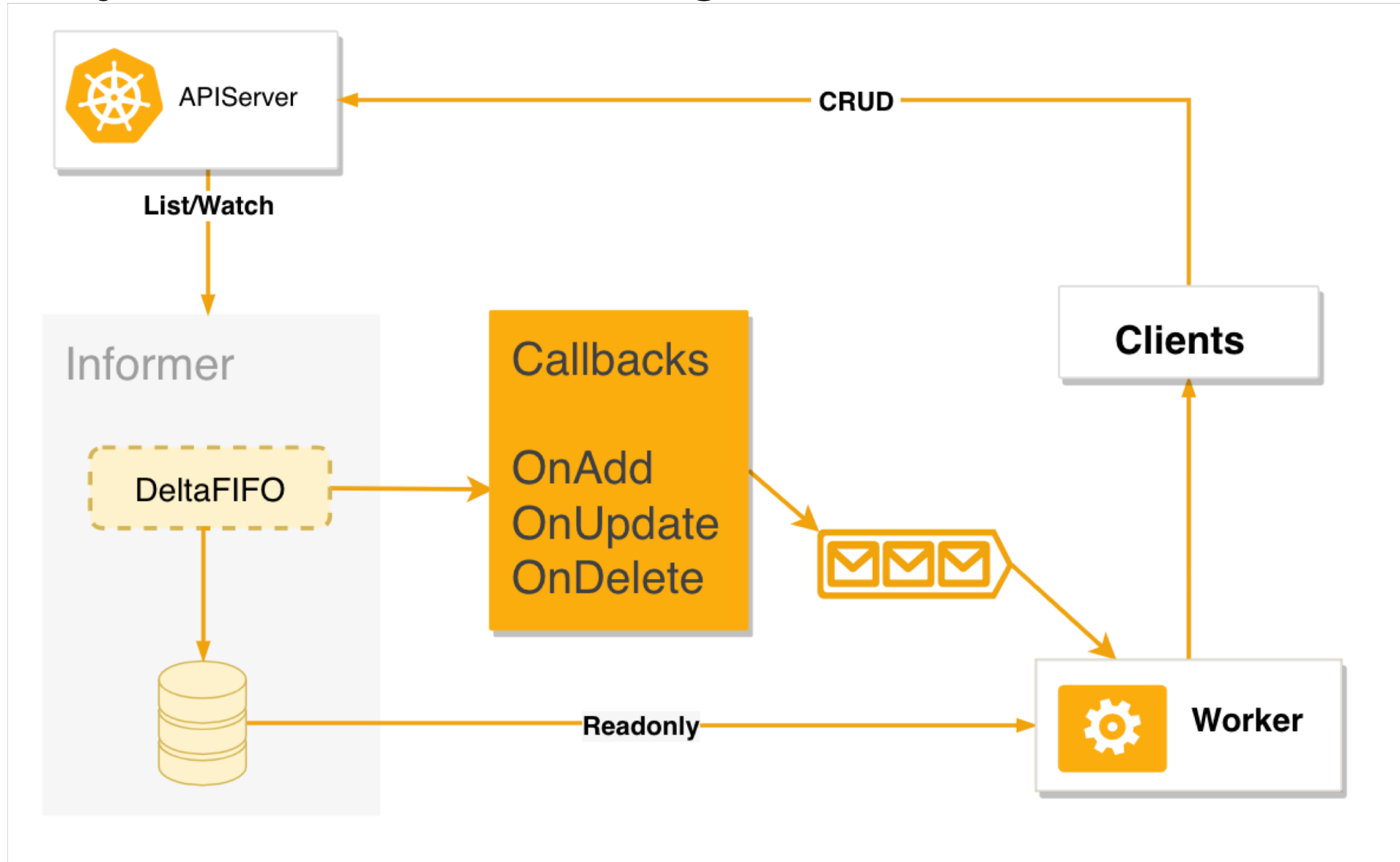
# Informer - object cache & event handling



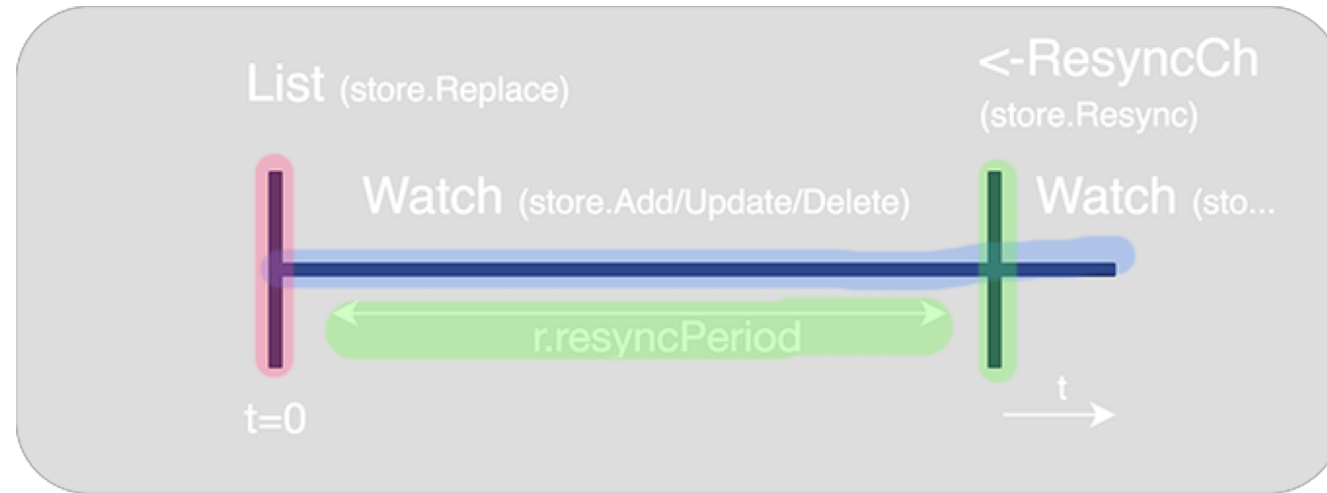
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# Informer - object cache & event handling



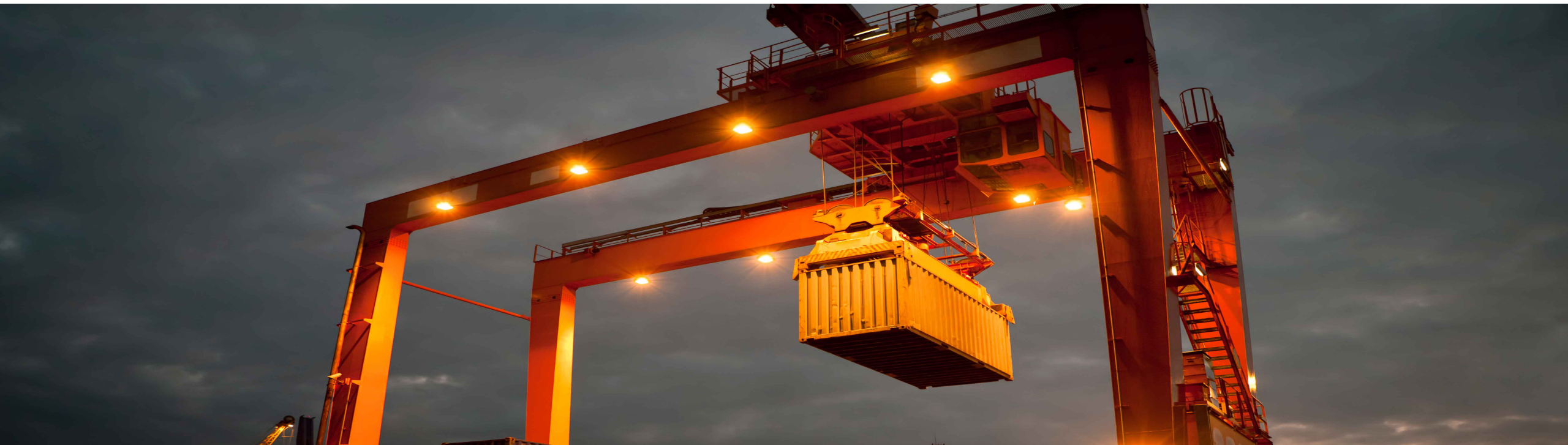
# Informer - object cache & event handling



**Re-listed objects triggers the  
update function.**

# 1<sup>st</sup> approach

## Sample Controller



# Simplicity

## Pros

- Simply – there is no magic

## Cons

- Create and maintain your client-sets
- No generics
- Missing auto-updates



# 2<sup>st</sup> approach

## Kubebuilder



# Controller that you can "just run"

## Pros

- Bootstraps project
- Generate clients and schema validators
- Generic client-sets
- Easy updates
- Testing cases
- Controller Manager Pattern

## Cons

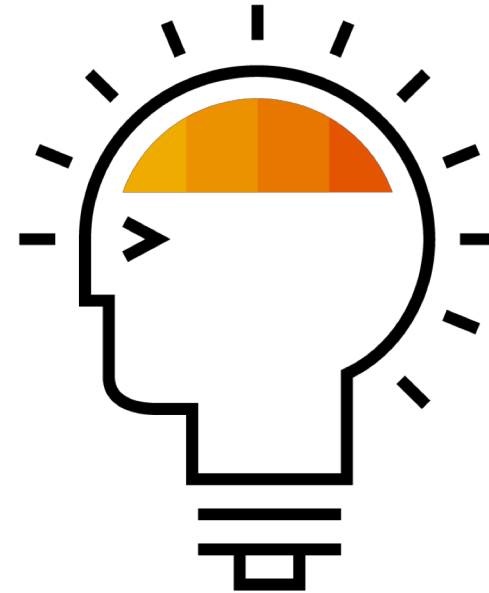
- Autogenerate + generic = **magic**



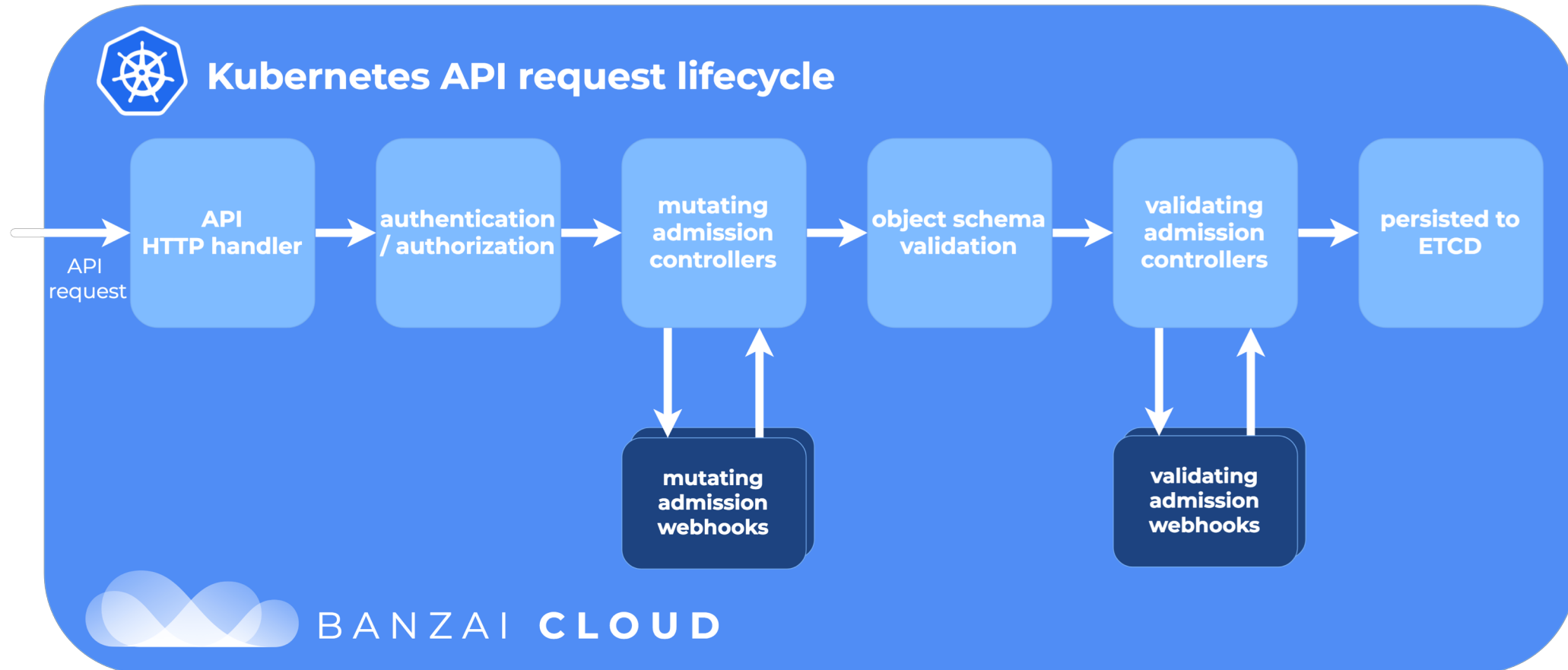
# This is just the beginning

But wait.. there is still something there

- ❑ OperatorSDK
  - ❑ Controller-Runtime
  - ❑ Knative
  - ❑ Metacontroller
- 
- ❑ MutatingAdmissionWebhook
  - ❑ ValidatingAdmissionWebhook



# Webhooks





# Gophers Silesia

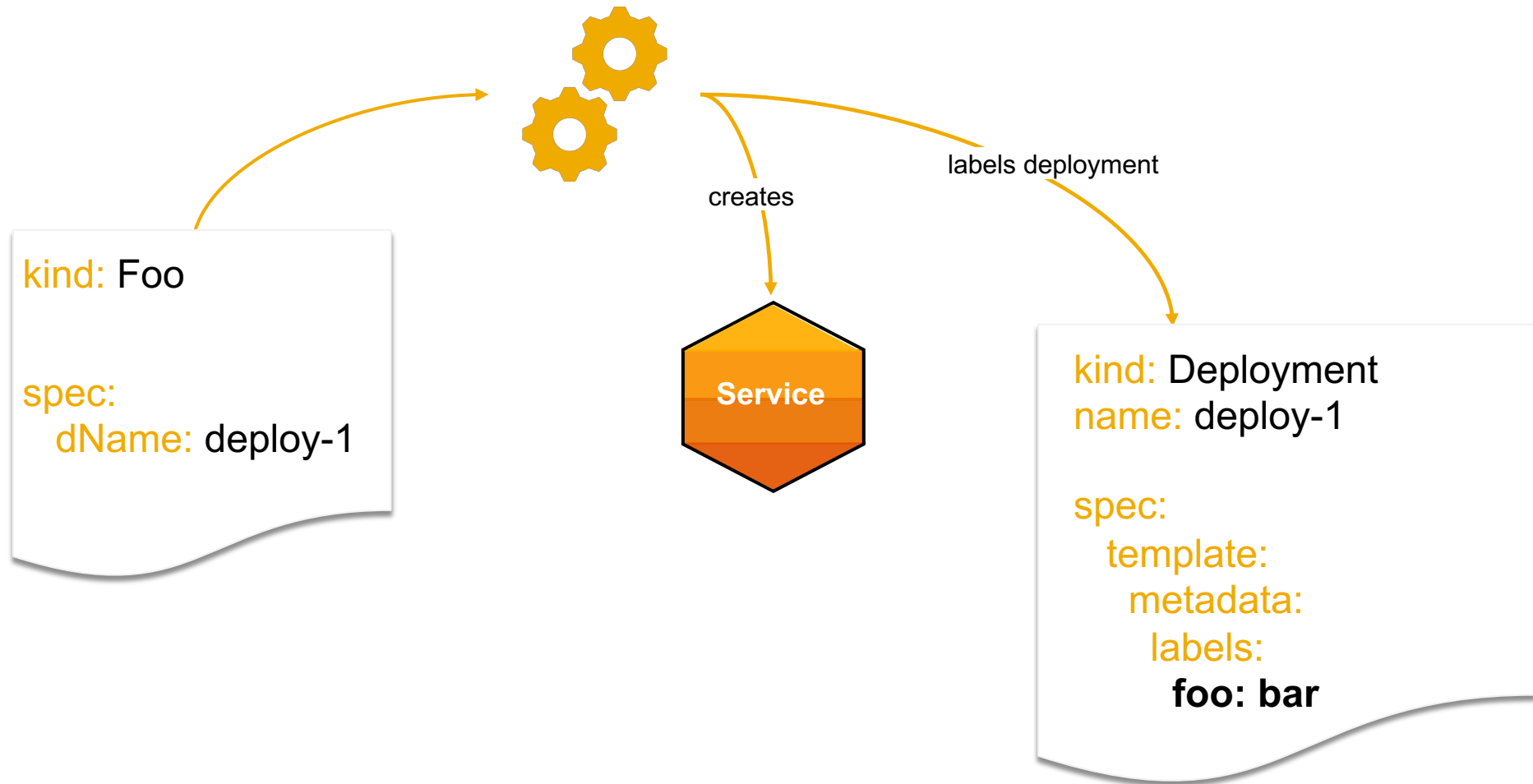
GO & CLOUD NATIVE MEETUP



# Bonus – tips & tricks to save your life



# Bonus – tips & tricks to save your life



# Finalizers

**apiVersion:** samplecontroller.k8s.io/v1alpha1

**kind:** Foo

**metadata:**

**name:** pico-bello

**finalizers:**

- kyma.cx/foo

**apiVersion:** samplecontroller.k8s.io/v1alpha1

**kind:** Foo

**metadata:**

**name:** do-it

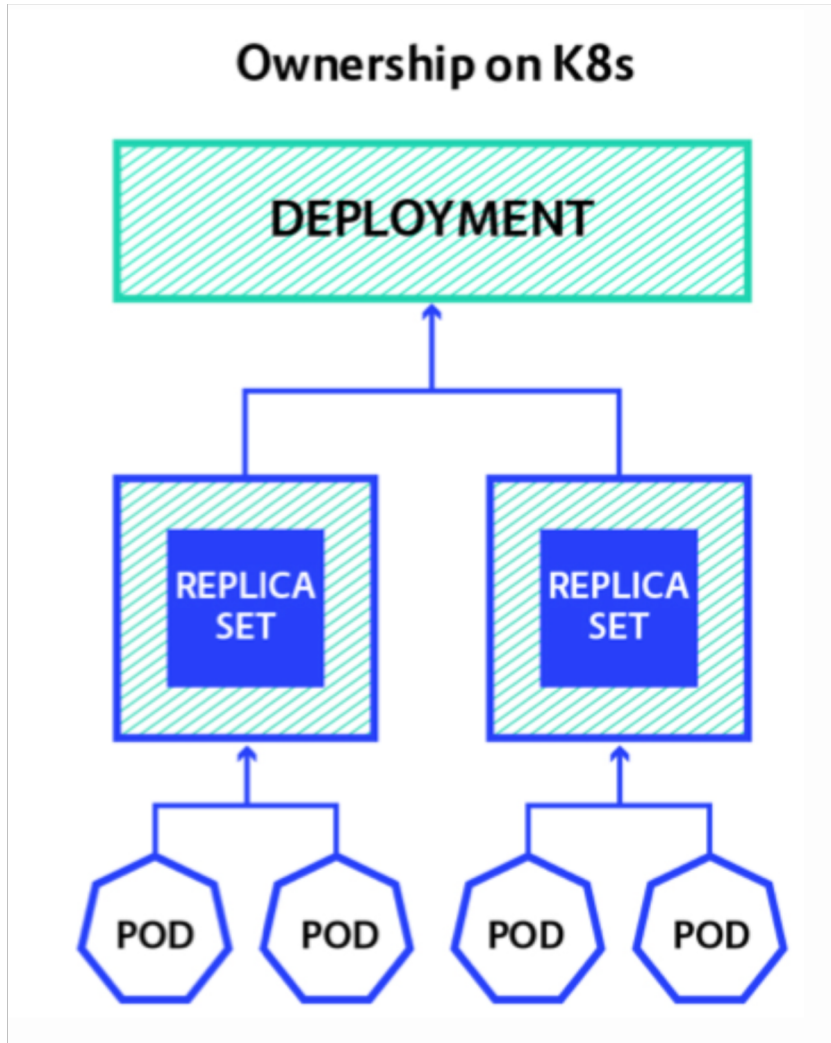
**finalizers:**

- kyma.cx/foo

**deletionGracePeriodSeconds:** 0

**deletionTimestamp:** 2018-11-28T03:50:13Z

# Owner Reference



**apiVersion:** v1

**kind:** Pod

**metadata:**

**name:** hakuna-matata

**namespace:** system

**ownerReferences:**

- **apiVersion:** extensions/v1beta1

**blockOwnerDeletion:** true

**controller:** true

**kind:** ReplicaSet

**name:** rs-for-hakuna-matata

**uid:** 17287eb4-f180-11e8-8e09-000d3a2fa33e

# Links

## Design:

- <https://github.com/kubernetes/community/blob/master/contributors/devel/controllers.md>
- <https://github.com/kubernetes/community/blob/master/contributors/devel/api-conventions.md#types-kinds>
- <https://github.com/kubernetes/community/blob/master/contributors/design-proposals/architecture/principles.md>
- <https://godoc.org/sigs.k8s.io/controller-runtime/pkg>

## Controllers:

- <https://github.com/operator-framework/operator-sdk>
- <https://github.com/kubernetes-sigs/kubebuilder>
- <https://github.com/GoogleCloudPlatform/metacontroller>
- <https://github.com/kubernetes-sigs/controller-runtime>
- <https://github.com/kubernetes/sample-controller>



**Kelsey Hightower** ✓

@kelseyhightower

Obserwuj



Controllers are the foundation of Kubernetes; this is a natural extension. Not sure the "Operators" name will stick, but the pattern will.

**„Follow upstream patterns for building your controllers - but remember that there is no singular ,right way’ „**

Mateusz Szostok



# Q&A



# Thank you.

Contact information:

**Mateusz Szostok**

SAP Microservice Developer  
mateusz.szostok@sap.com