Kubernetes Operators

In Action

Skokie Kubernetes Meetup User Group

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Who am I?

Ken Lee

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AGENDA

What we'll be discussing today

The Problem ...Which Birthed the Operator Pattern

What's an Operator?

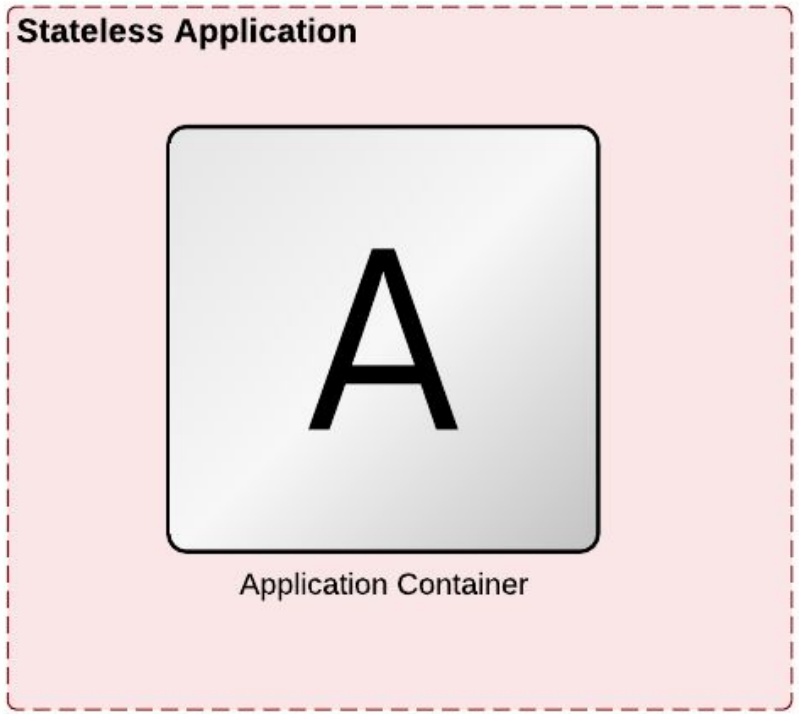
How does an Operator Work?

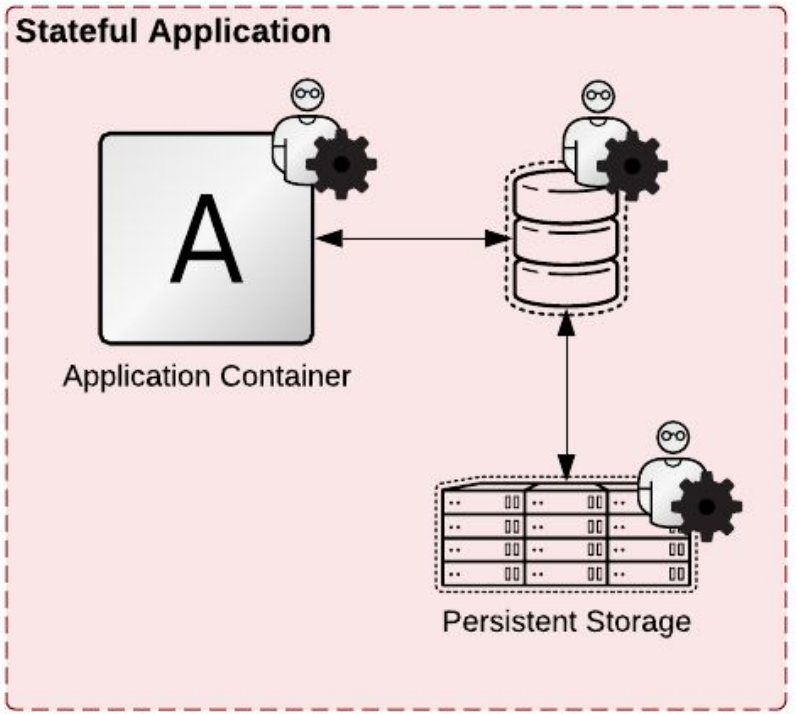
How do I make One?

Demo

The Problem ... Which Birthed the Operator Pattern

Stateless versus Stateful





How do you effectively automate Stateful applications on Kubernetes?

OPERATORS

What's an Operator?

What's an Operator?

"An operator is a Kubernetes controller that understands 2 domains: Kubernetes and something else. By combining knowledge of both domains, it can automate tasks that usually require a human operator that understands both domains."

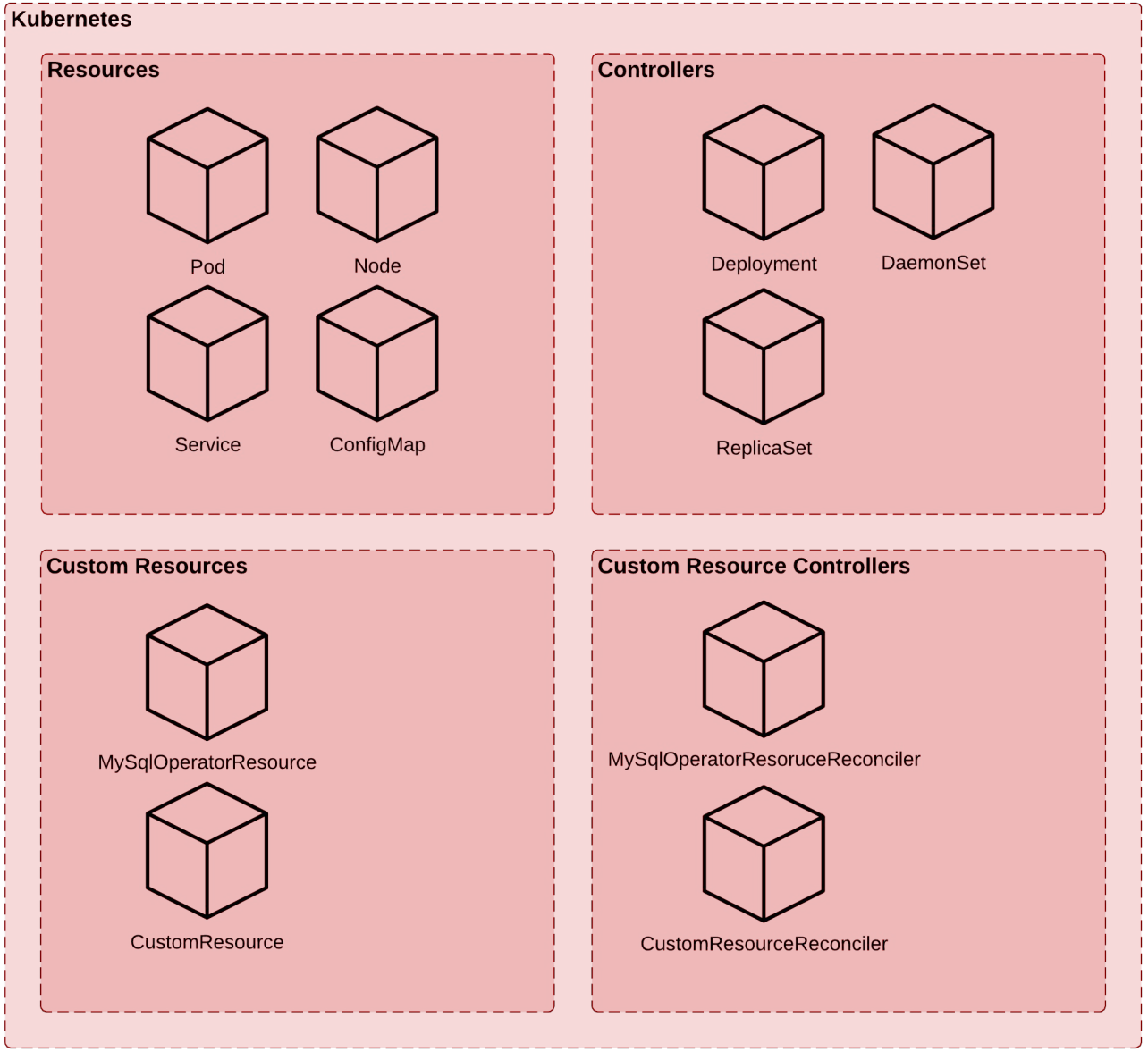
-Jimmy Zelinskie - Product and Engineering - CoreOS

https://bit.ly/3iS6AFx

What's an Operator?

Operator = Resource(s) + Controller(s) + Domain Specific Knowledge

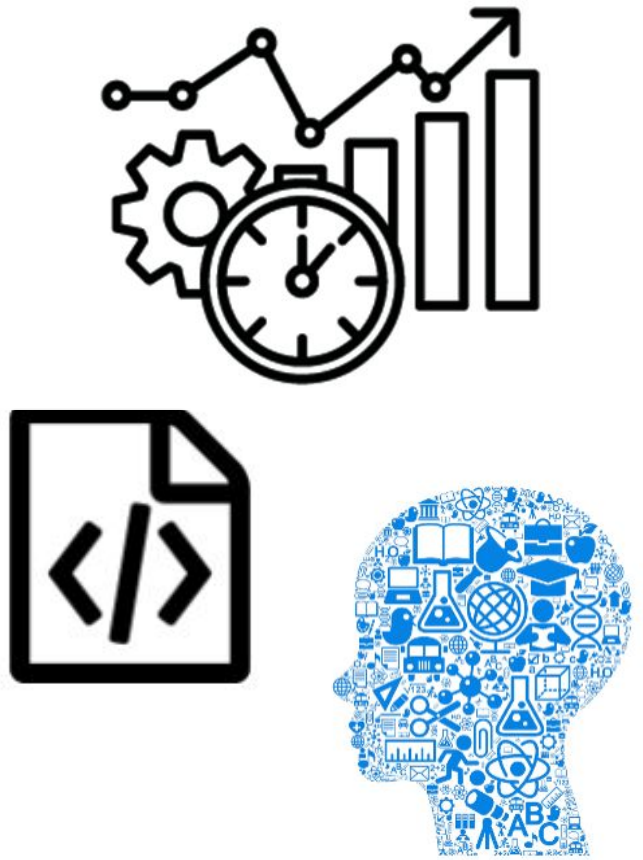
Kubernetes: Resources + Controllers



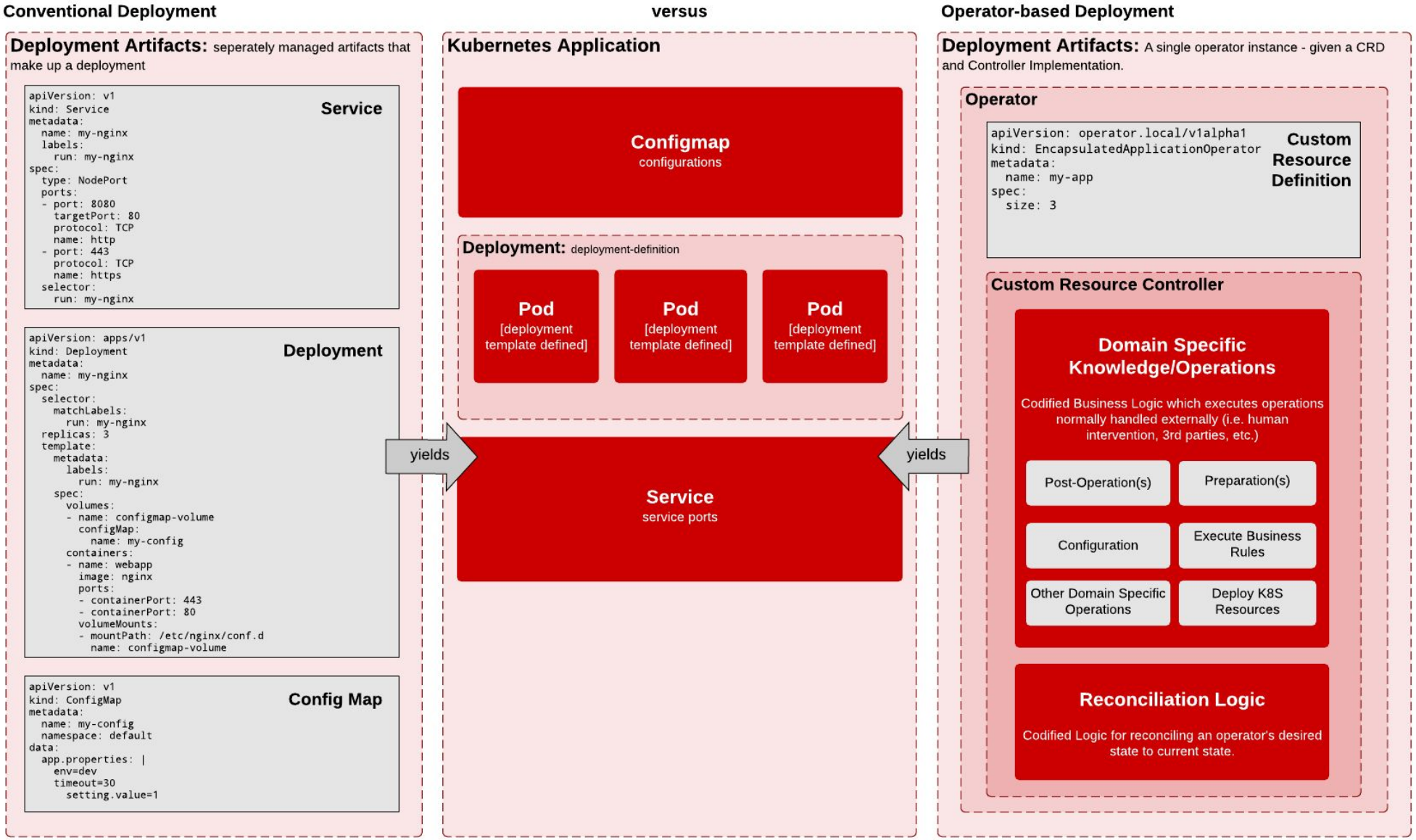
Domain Specific Knowledge/Operations

Examples of Domain Specific Knowledge/Operations (but not limited too)

- Fulfilling Configuration requirements
- Fulfilling Installation requirements
- Fulfilling Logging/Security requirements
- Fulfilling HA/Scaling requirements
- Application start-up and shutdown routines
- Process and workflow triggers
- Etc.



Example: Conventional vs Operator based Deployments

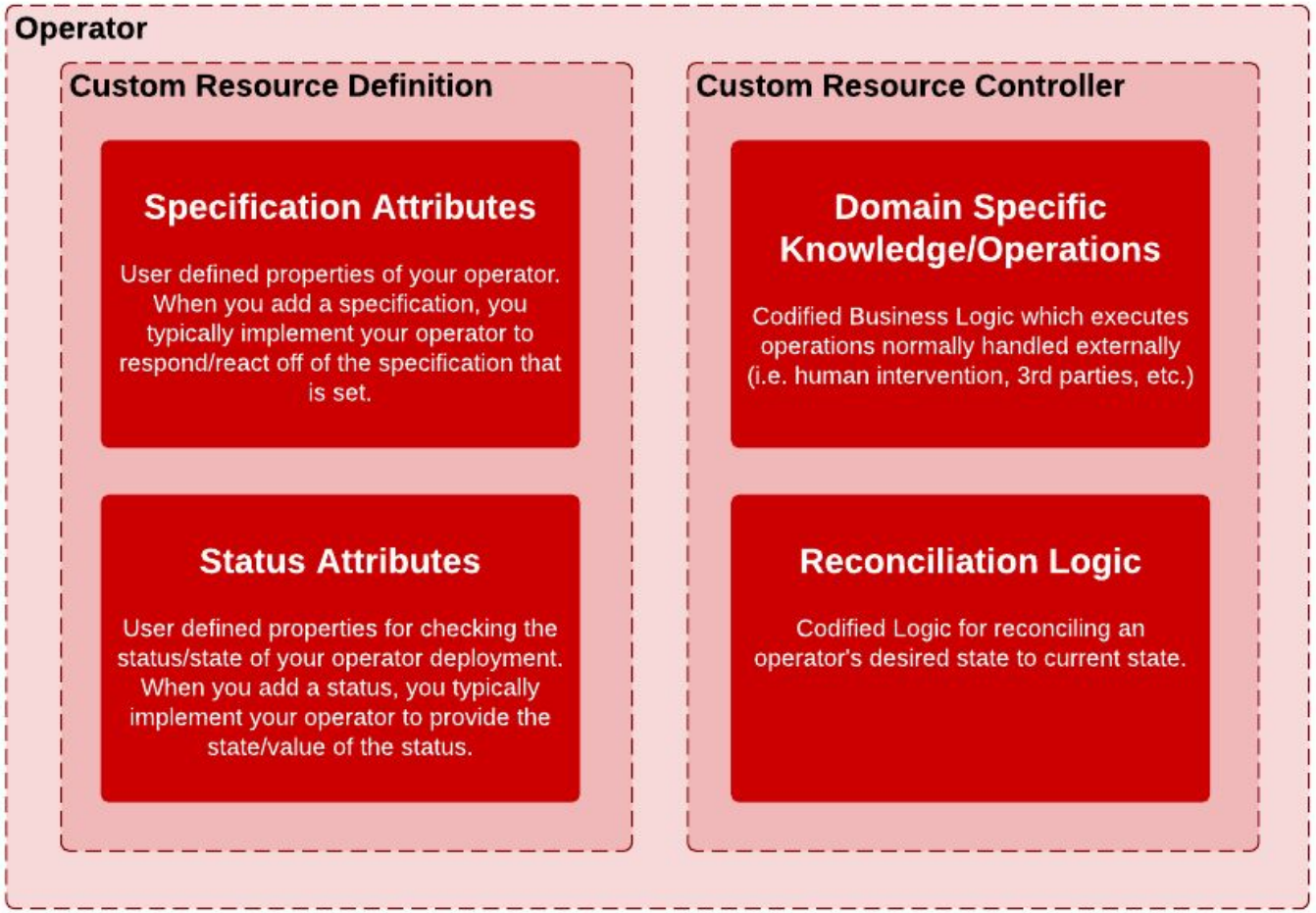


*** Operational specific tasks are carried out manually or potentially automated through other means.

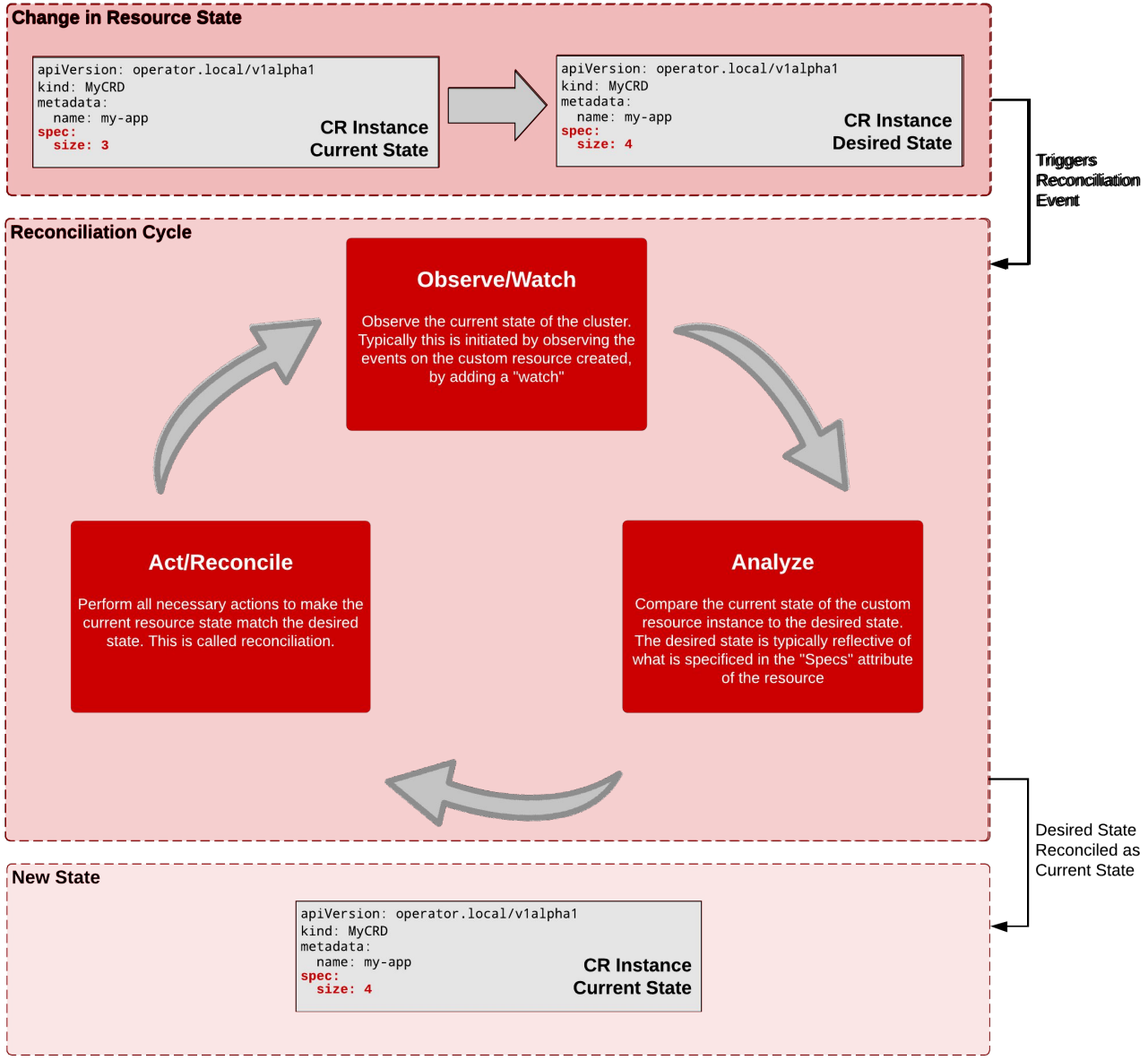
How does an Operator work?

Operator Components

Operator = Resource(s) + Controller(s) + Domain Specific Knowledge



Custom Resource Controller - Reconciliation Cycle - Example

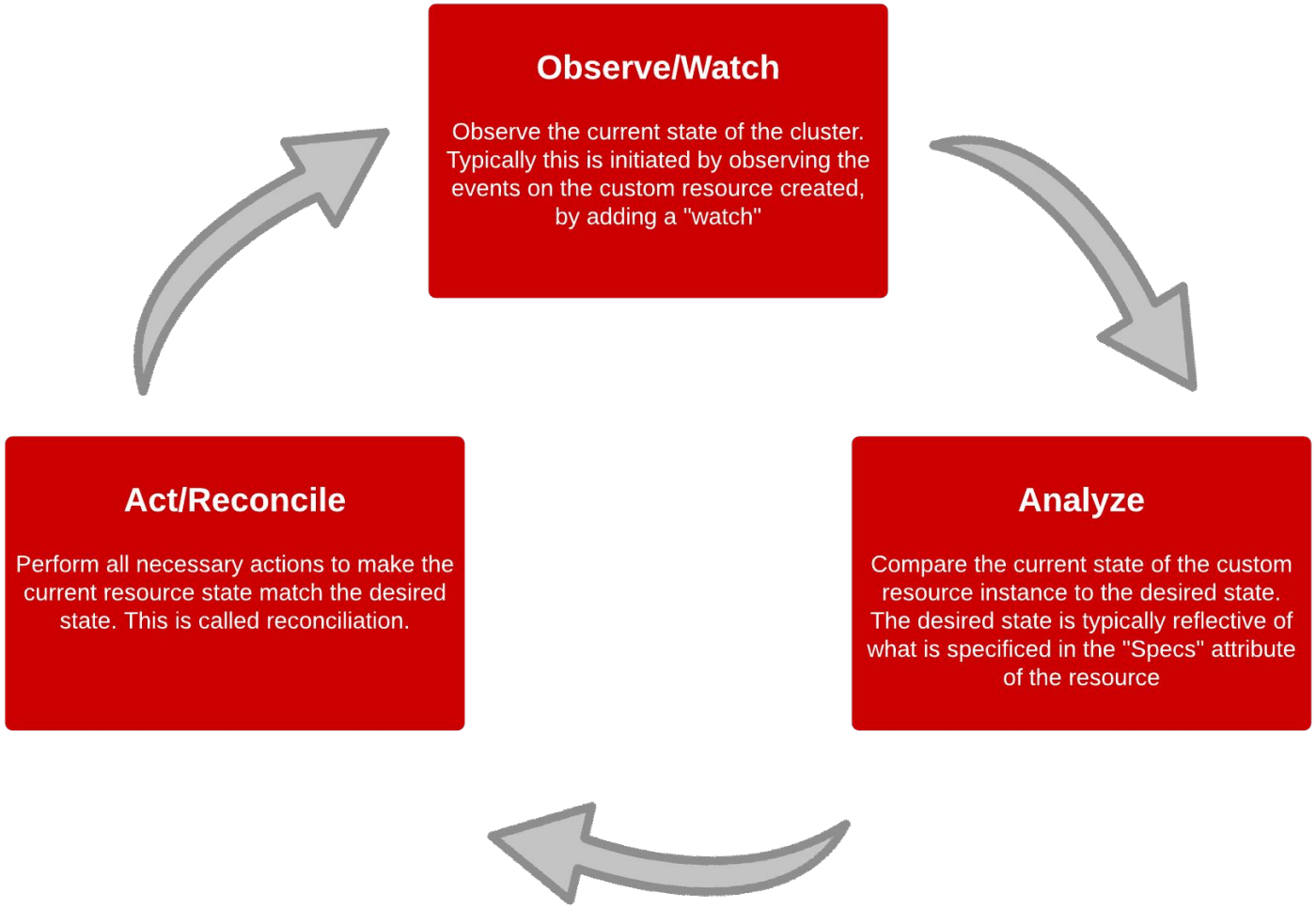


How do I make one?

Resources - Operator Frameworks and Libraries

- https://sdk.operatorframework.io/build/
  - Golang
  - Ansible
  - Helm
- https://book.kubebuilder.io/
  - Golang
- https://kudo.dev/
  - Yaml
- https://github.com/metacontroller/metacontroller
  - Jsonnet
- https://github.com/zalando-incubator/kopf
  - Python
- https://github.com/ContainerSolutions/java-operator-sdk
  - Java
- https://github.com/dot-i/k8s-operator-node
  - Typescript/NodeJS
- https://github.com/TremoloSecurity/kubernetes-javascript-operator
  - Javascript

Know the Reconciliation Cycle

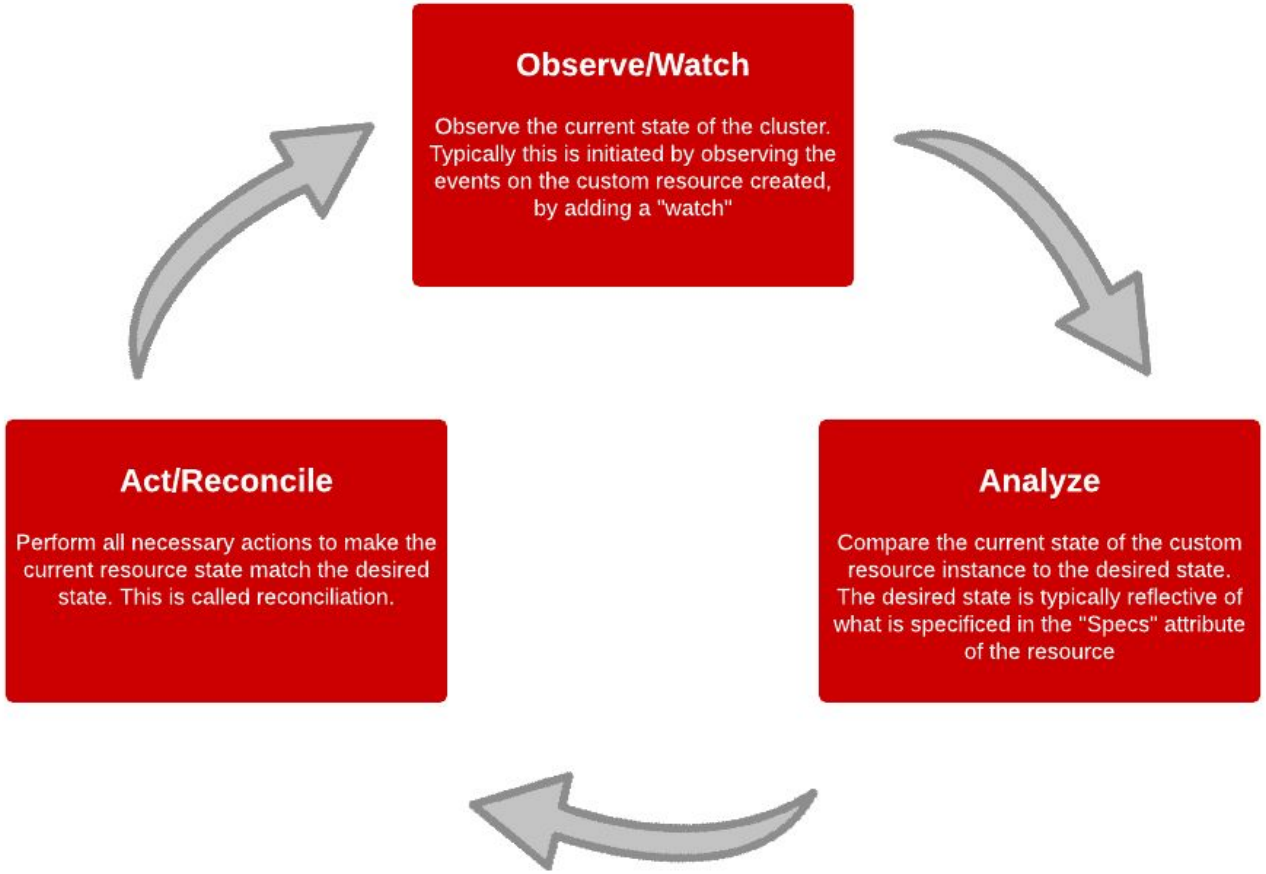


Resources - Learn more about Operators

- https://kubernetes.io/docs/concepts/extend-kubernetes/operator/
- https://enterprisersproject.com/article/2019/2/kubernetes-operators-plain-english
- https://coreos.com/blog/introducing-operators.html
- https://www.openshift.com/blog/operator-framework-moves-to-cncf-for-incubation
- https://www.openshift.com/blog/kubernetes-operators-best-practices
- https://www.youtube.com/watch?v=8_DaCcRMp5I&t=3453s
- https://github.com/k8s-operators-over-ez/k8s-operators-over-ez.labs

Demo

Example Operator



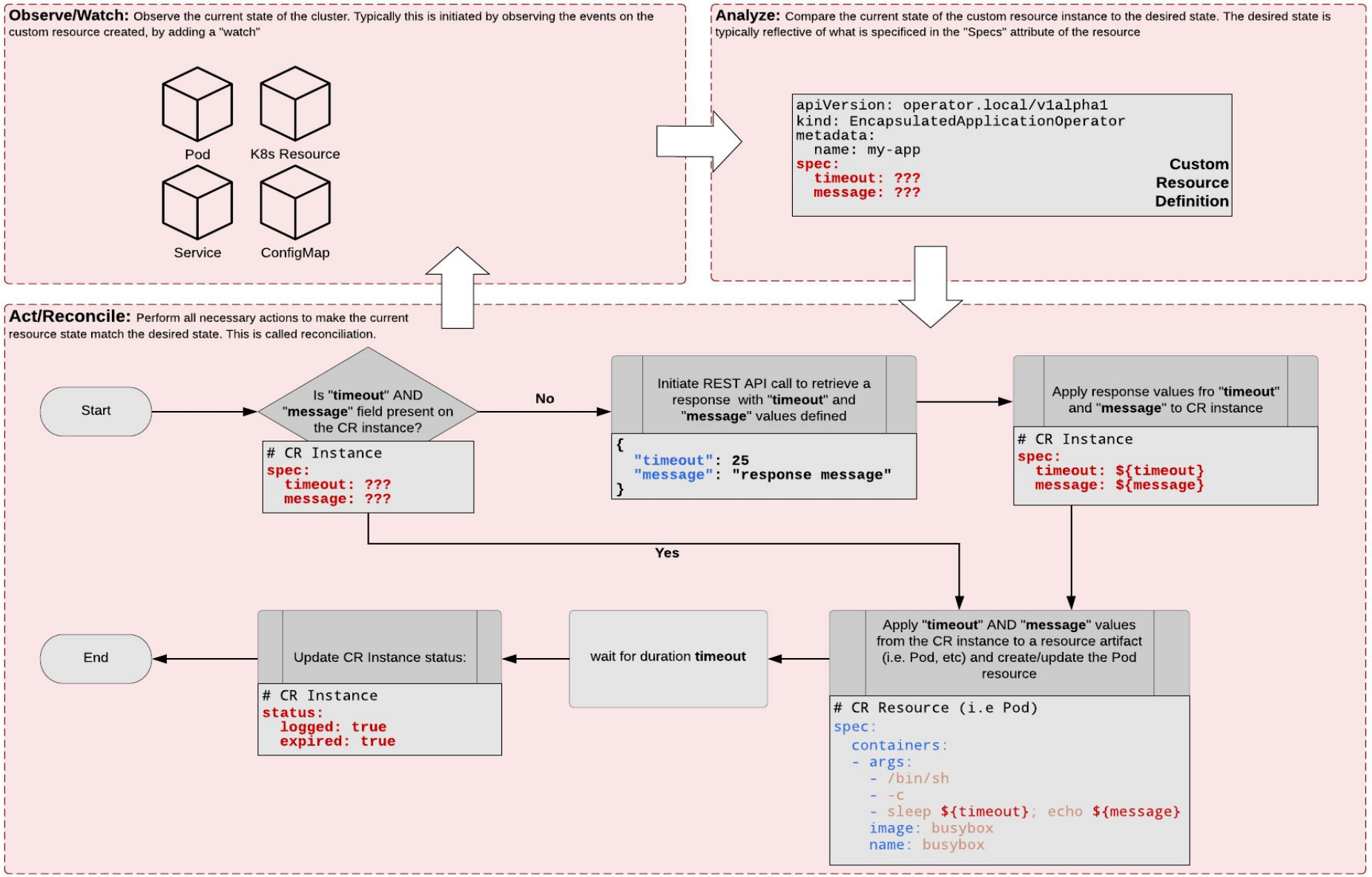

```yaml
apiVersion:
operators-over-ez.mydomain.com/v1alpha1
kind: OpsOverEasy
metadata:
  name: opsovereasy-sample
spec
  # Add fields here
  timeout: 15
  message: "my message"
```

Custom Resource (CR) Instance

```yaml
apiVersion: v1
kind: Pod
metadata:
  labels:
    run: busybox
  name: busybox
spec:
  containers:
  - args:
    - /bin/sh
    - -c
    - sleep ${timeout}; echo ${message}
    image: busybox
    name: busybox
  dnsPolicy: ClusterFirst
  restartPolicy: Never
status: {}
```

CR Artifact (i.e. Pod)

Example Operator



Thank you

Appendix

Additional Points of Interest

- What about Statefulsets? Can't I use those for managing and persisting State?
  - Short answer, YES
  - Think about what a Statefulset is. It's a resource controller too. The controller will manage the state of your pods with the use of persistent storage and a headless service.
  - Operators, offer a way for **you** to manage the state of your application, through **your** code.
- What about Helm Charts? When would you use a Chart vs an Operator?
  - We can try to use this as a general rule of thumb. If you need to codify operational knowledge of your K8S application as well as maintain state, then leveraging the Operator Pattern to facilitate the development of your K8S application, will serve you well.
  - However, if that's not the case, or the Operator pattern is just not your thing, you're not out of luck. You can still leverage constructs like Statefulsets to help you maintain state in your Kubernetes application, yet alone package a Statefulset configuration as part of your Helm Chart. The thing you have to keep in mind is how you manage and automate Domain Specific tasks and operations.