Kubernetes
operator pattern

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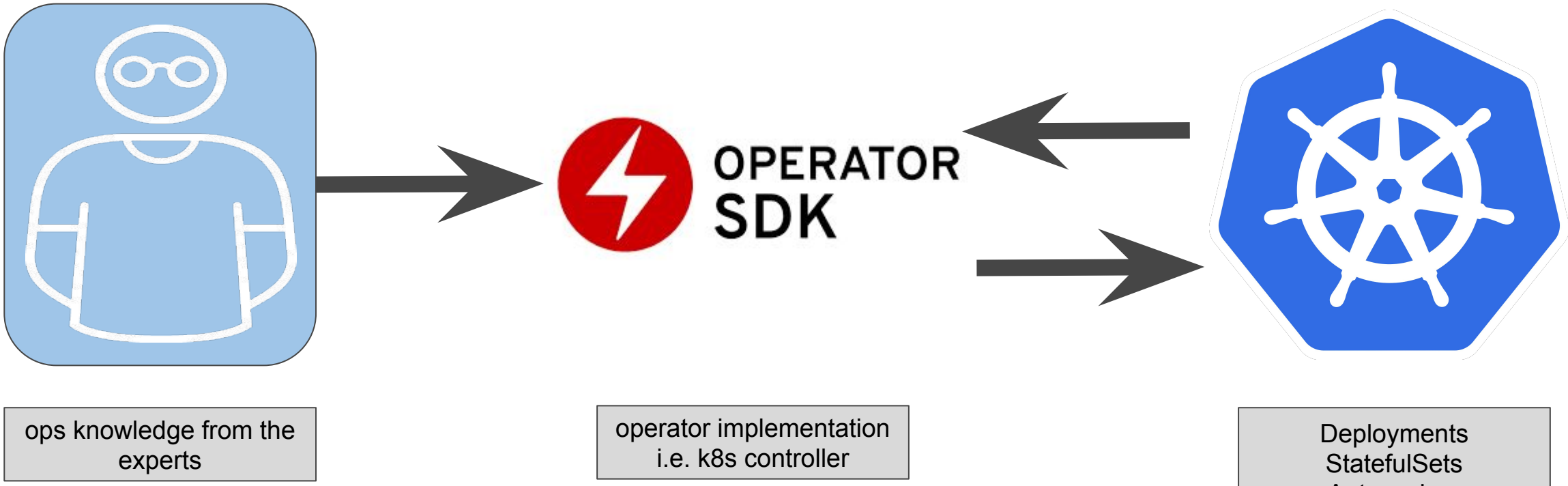
Operator across the industry

Operator across the industry

OperatorHub.io | The registry for Kubernetes Operators

What is an Operator?

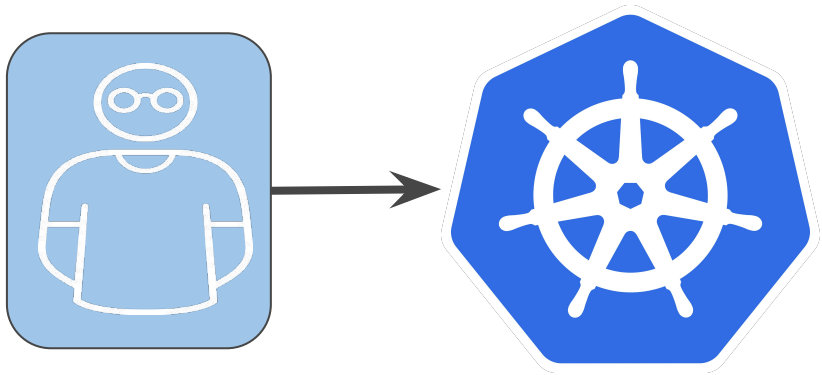
Operators embed ops knowledge from the experts



See

- https://kubernetes.io/docs/concepts/extend-kubernetes/operator/
- https://cloud.google.com/blog/products/containers-kubernetes/best-practices-for-building-kubernetes-operators-and-stateful-apps

How does an operator works?



Software Developer
Kubernetes user

K8s API

Kubernetes operator

Native Kubernetes
resources

Custom resource

```
kind: ProductionReadyDatabase
apiVersion: database.example.com/v1alpha1
metadata:
 name: my-important-database
spec:
 connectionPoolSize: 300
 readReplicas: 2
 image: productionreadydatabase:v4.0.1
```

Custom Kubernetes controller

Watch Event

Reconcile

Custom resource definition

here ProductionReadyDatabase

Deployments
StatefulSets
Autoscalers
Secrets
Config maps

Why should you use an operator?

Operators: both sysadmin + application experts

- Resize/Upgrade
- Reconfigure
- Backup
- Healing

The Sysadmin

What make a good operator?

Operators: best practices for development

- One Operator per managed application
- Write an Operator-of-Operators for complex, multi-tier application stacks
- CRD can only be owned by a single Operator, shared CRDs should be owned by a separate Operator
- One controller per custom resource definition
- Use an SDK like Operator SDK
- Do not hard-code namespaces or resources names
- Make watch namespace configurable
- Use semver / observe Kubernetes guidelines on versioning APIs
- Use OpenAPI spec on CRDs

Operators: best practices for development

- Does not run as root
- Does not self-register CRDs
- Writes meaningful status information on Custom Resources objects
- Is capable of updating from a previous version of the Operator
- Is capable of managing an Operand from an older Operator version
- Does not deploy other Operators
- Uses CRD conversion (webhooks) if API/CRDs change
- Uses Admission Webhooks to reject invalid CRs
- Should always be able to deploy and come up without user input
- Offers configuration via an “Configuration CR”

Multiple operator frameworks

Operators

- **kudo**: simple, no need to code, not so popular: https://github.com/kudobuilder/operators/tree/master/repository
- **metacontroller:** simple, no need to code, started at Google

Based on kubernetes-sigs/controller-runtime: Repo for the controller-runtime subproject of kubebuilder (sig-apimachinery)

and kubernetes-sigs/controller-tools: Tools to use with the controller-runtime libraries

- **operator-framework:** complex, code in golang, popular, well-documented (book)
- **kubebuilder**: complex, code in golang, popular, well-documented (book)

See https://gist.github.com/tiewei/d98c663cf76b61bf835c1ebf87b36999

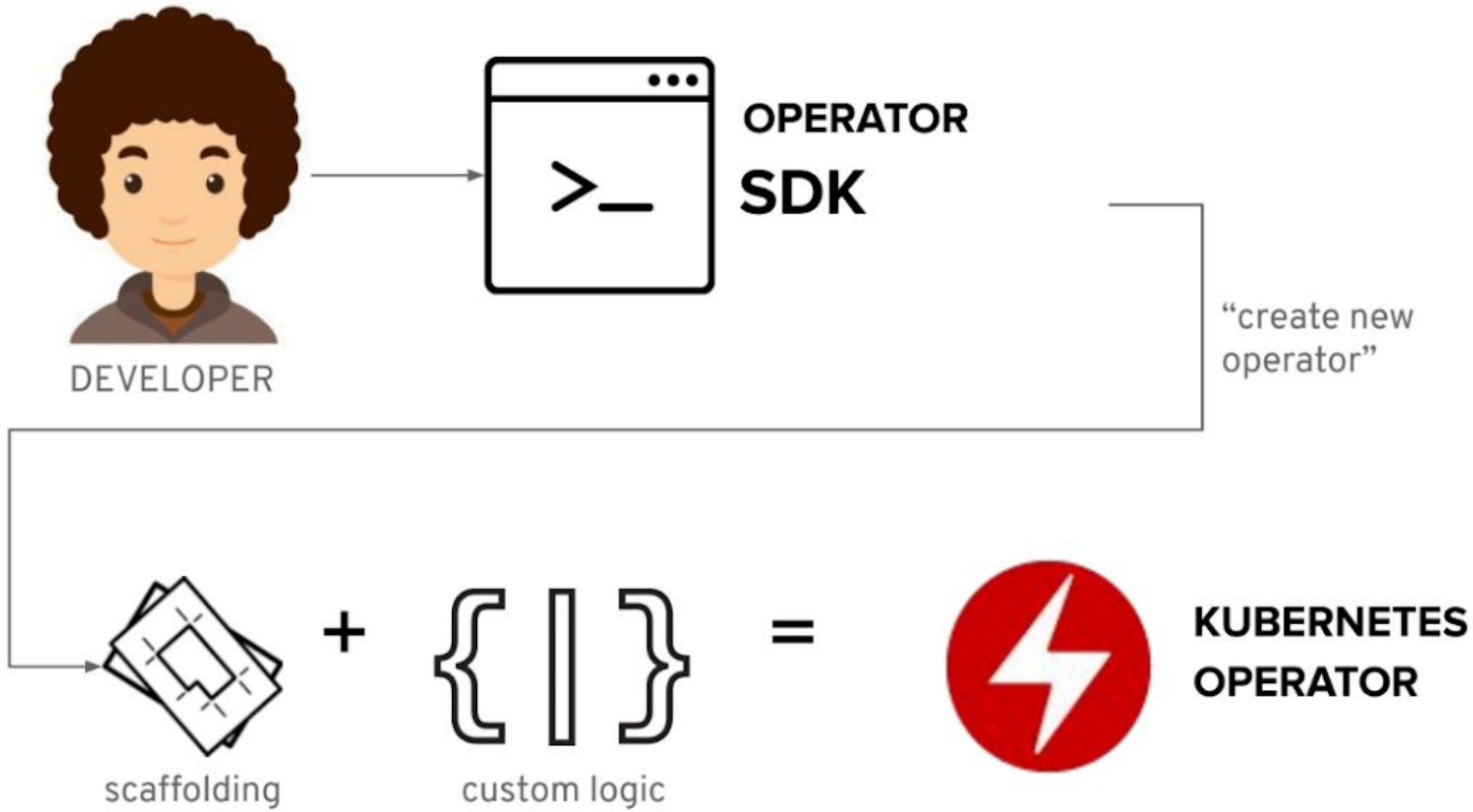
operator-framework

Operator framework in action

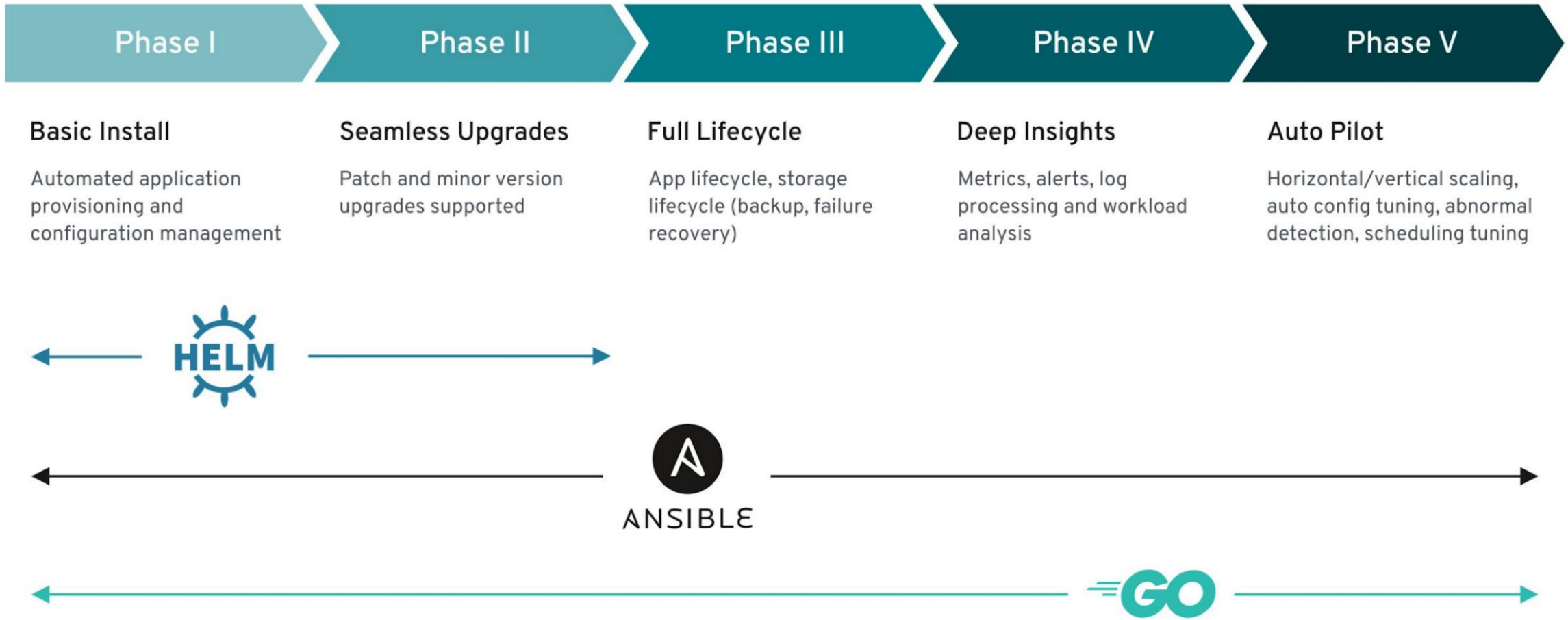
Based on KubeBuilder libraries:

[kubernetes-sigs/controller-runtime: Repo for the controller-runtime subproject of kubebuilder (sig-apimachinery)]

[kubernetes-sigs/controller-tools: Tools to use with the controller-runtime libraries]



Operator SDK: types of operators



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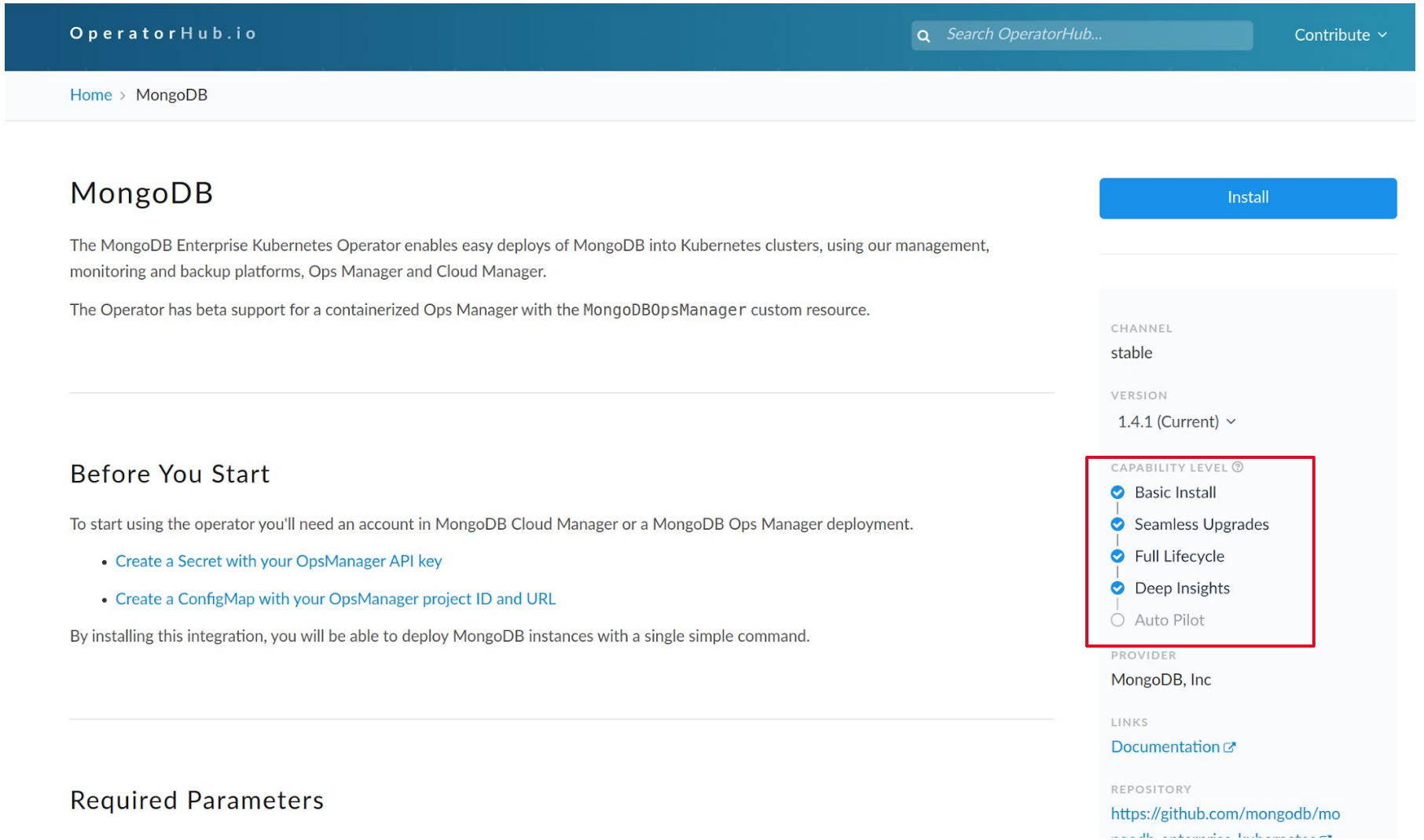
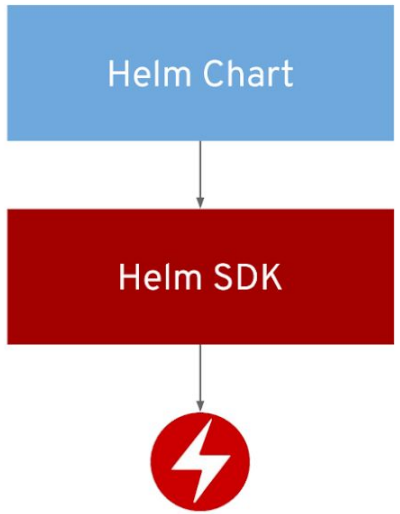
OperatorHub: the MongoDb example



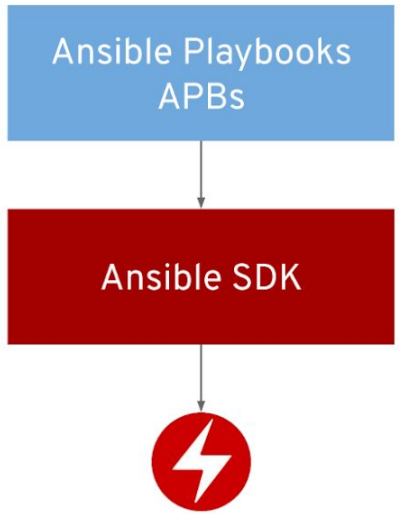
Operator SDK: types of operators

Perfectly integrated with Openshift ;-)

CNCF project : incubating



Build operators from Helm chart, without any coding



Build operators from Ansible playbooks and APBs

Build advanced operators for full lifecycle management

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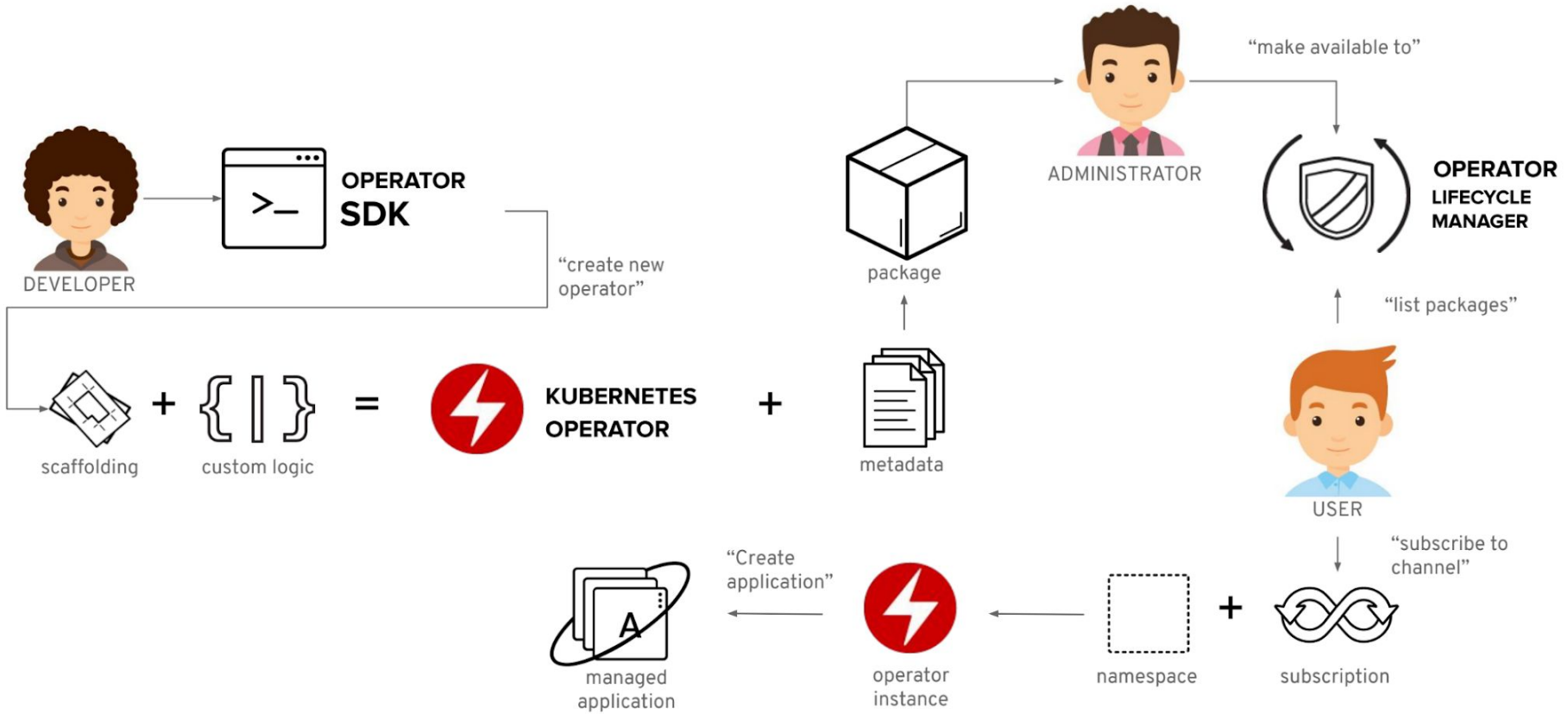
Operator framework: the full stack



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Summary

What we have seen:

- Operators **ease application delivery and management** over Kubernetes.
- Operator goal is to **automate sysadmins tasks.**
- **Multiple operator frameworks** are competing right now.
- **For complex application, KubeBuilder and Operator-SDK** are serious tracks.
- **OperatorHub.io** provides lots of operators, with possible source code examples.

Demos

Redis with KubeDB: https://travis-ci.com/k8s-school/kubedb-example
Qserv-operator: https://travis-ci.org/lsst/qserv-operator/builds/651390166

Questions?

Merci!

@fjammes on Github

https://k8s-school.fr