



Kubernetes Extension Points

With Deep Dive into Custom Resource Definitions

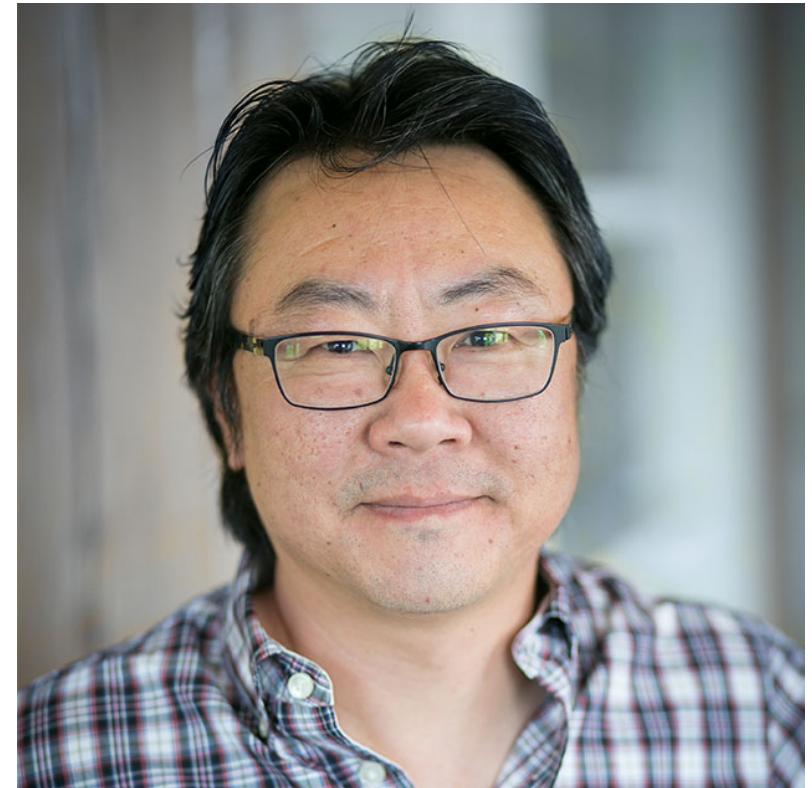
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In 90 minutes...

- Quick overview of Kubernetes extensions points then focus on Custom Resource Definitions (CRDs) and Custom Controllers
- Deep dive into CRDs, the basis for “Operators”
 - Use-cases from the community
 - Prometheus Operator
 - Roll your own example to get the concept
 - Using Kubebuilder
 - Using Operator SDK



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<https://github.com/jungho/k8s-crds>

Desired Outcome

- Learn how extensible K8S can be
- Understand better the inner workings of Kubernetes
- Spark your imagination to leverage Kubernetes in more powerful ways
- Start your journey to becoming Kubernetes ninjas!



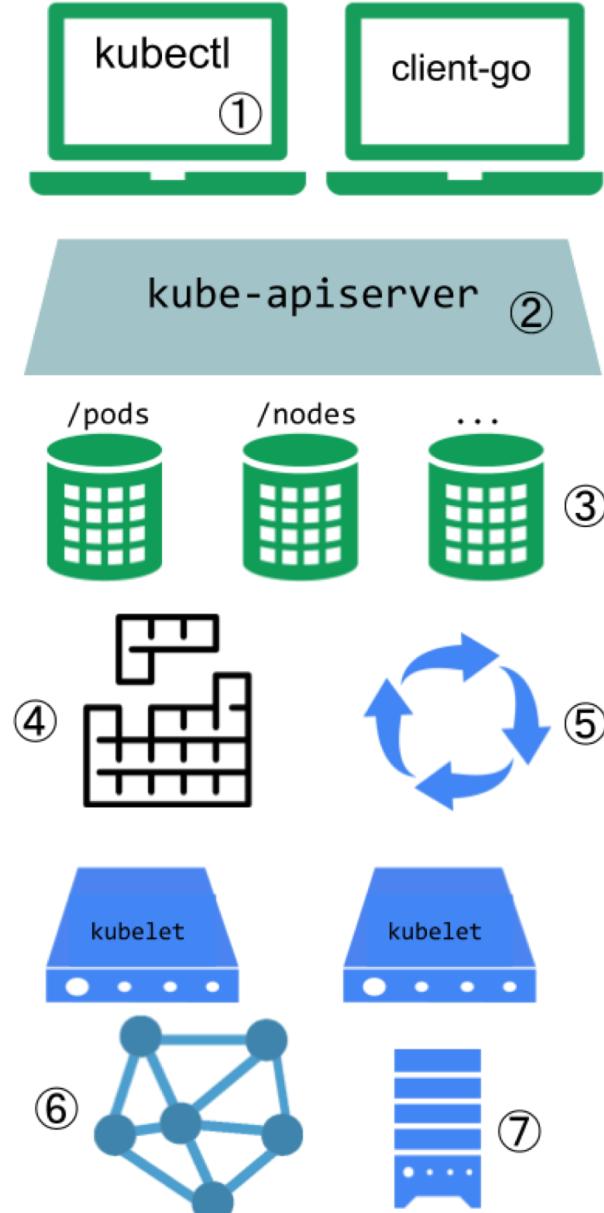
Extend



all the things!

Kubernetes Extension Points

- K8S is incredibly extensible
- Designed with well-defined extension points to extend/customize the platform
 1. Plugins for kubectl to add additional kubectl commands (you can't overwrite existing commands)
 2. Authn/Authr, Webhooks, Admission Controllers, Dynamic Admission Control, API Aggregation
 3. **Custom Resource Definitions**
 4. Scheduler extensions. You can replace the default scheduler, use multiple schedulers, extend scheduler behaviours via webhooks
 5. **Controllers that reconciles current-state to desired state.**
 6. Network Plugins e.g. Container Network Interface (CNI) plugins such as Cilium, Calico, Azure CNI
 7. Storage Plugins e.g. Flex Volumes



<https://bit.ly/2r6qKTP>

Custom Resource Definitions

- Means to define new API resources to model your domain
- Can leverage kubectl, helm to work with your CRDs

```
apiVersion: apiextensions.k8s.io/v1beta1
kind: CustomResourceDefinition
metadata:
  #the name must be the plural form + api group
  name: websites.extensions.example.com
spec:
  # Can be namespaced or cluster scope
  scope: Namespaced
  #All resources have a version and are part of an api group
  group: extensions.example.com
  version: v1
  # The names of the resource when using kubectl
  names:
    kind: Website
    singular: website
    plural: websites
    shortNames: ['ws']
```

```
apiVersion: extensions.example.com/v1
kind: Website
metadata:
  name: kubia
spec:
  gitRepo: https://github.com/luksa/kubia-website-example.git
```

The CRD

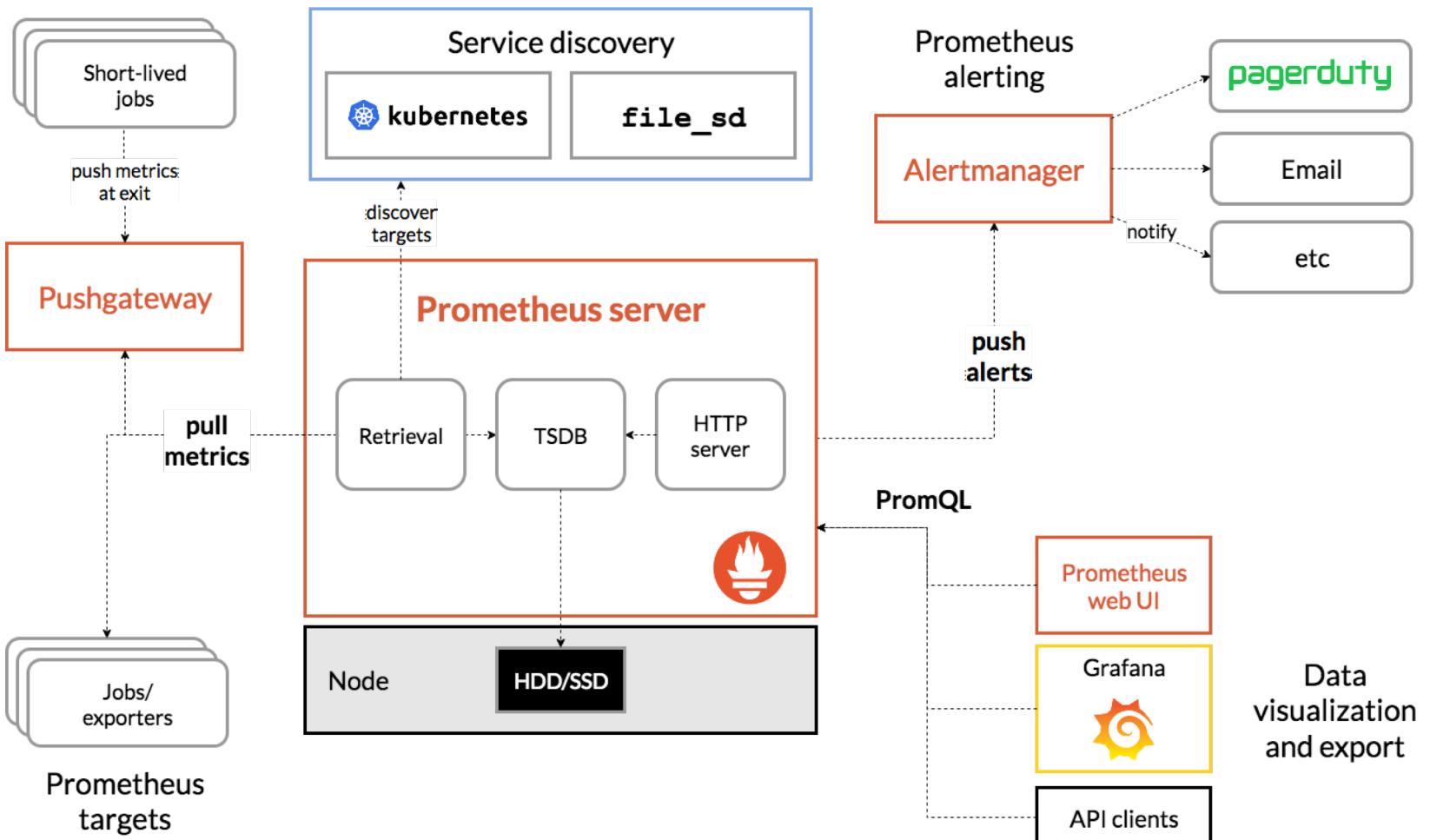


Instance of CRD

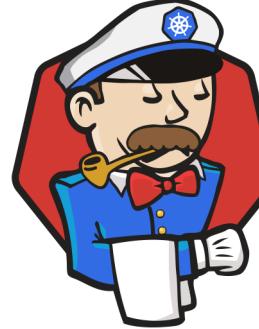
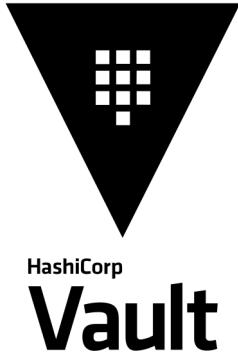
Custom Controllers

- CRDs alone don't do anything
- Something needs to consume instances of a CRD and take action, that is the **Controller**
- In simple terms, a controller is responsible for:
 - Watching for specific resource types e.g. Website
 - Reconciling the desired state, and doing so continuously (this is what makes K8S so resilient!!)

Prometheus



Operators

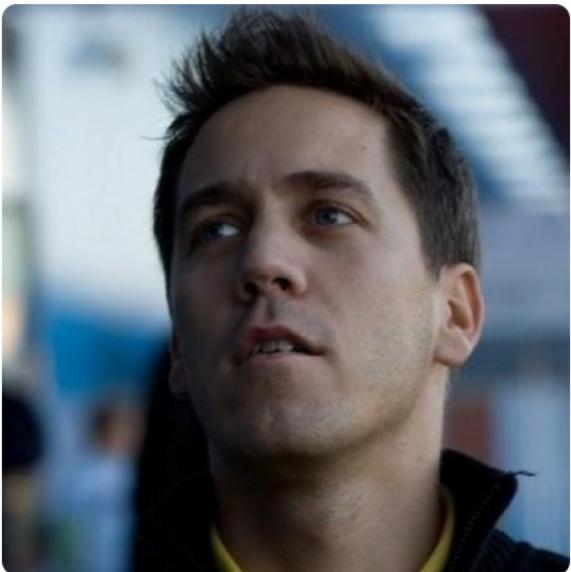


<https://github.com/operator-framework/awesome-operators>

PAWSUPGAGALOVE



First CRD Example.... Thank You Lukša!



Marko Lukša
luksa

Software engineer at Red Hat.
Author of Kubernetes in Action.

[Overview](#) [Repositories 105](#) [Stars 36](#) [Fol](#)

Popular repositories

[kubernetes-in-action](#)

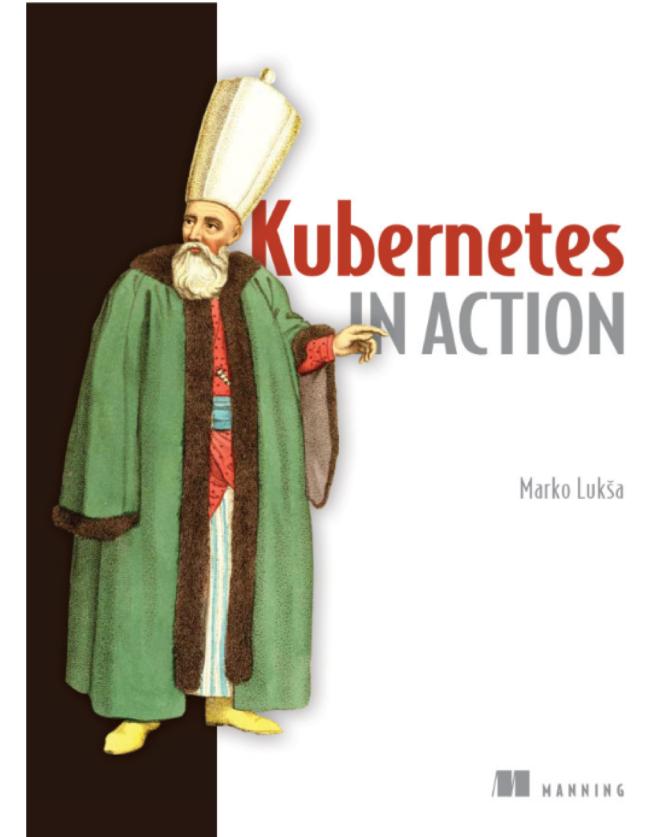
Code from the Kubernetes in Action book

● JavaScript ★ 146 ⚡ 106

[k8s-website-controller](#)

A barely working example of a Kubernetes controller

● Go ★ 11 ⚡ 2



<https://github.com/luksa/k8s-website-controller>

KubeBuilder

- Part of the apimachinery SIG (Special Interest Group)
 - <https://github.com/kubernetes-sigs>
- GA version v1.0.5, so stable
- Excellent documentation at <https://book.kubebuilder.io/>
- Provides scaffolding to quickly get started including:
 - Generate CRD, CRD instance
 - Golang code for Controller, Manager, CRD Types, Reconciler, tests
 - Deployment manifests
 - RBAC manifests
 - Makefile to build, test, deploy your CRD and custom controller
 - Annotations to validate CRD validation using OpenAPI v3 schema



Operator SDK

- Created by the CoreOS team that coined "Operator"
- Still "alpha" but used for many published operators
- Supports both golang and Ansible implementations
- Leverages controller-runtime package which is a sub-project of kubebuilder
- Excellent documentation here <https://bit.ly/2U8RXCt>
- Provides scaffolding to quickly get started including:
 - Generate CRD, CRD instance
 - Golang code for Controller, Manager, CRD Types, Reconciler
 - Deployment manifests
 - RBAC manifests
- Does not provide a nice Makefile to help with workflow so you need to write some scripts



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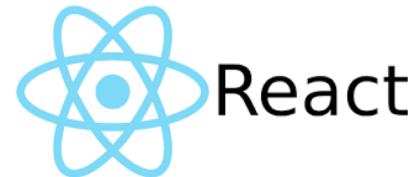


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We're trying to become an organization that's constantly rethinking the problems we're solving in the market today and looking to bring new value to clients in ways that they haven't thought of yet. Architech is instrumental to us throughout this journey.

Hugh Cumming, Chief Technology Officer, Finastra (\$2B+ fintech)

Open Source Experts in the Cloud



kubernetes



- Reduced Costs
- Enhanced Supportability
- Massive Global Adoption

- Avoid Vendor Lock-In
- Availability, Resiliency, Security
- Achieve True Business Agility

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