[Container Conf] 2018

redhat

Extending Kubernetes 101

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Developer Advocate, Red Hat

2018-11-15, ContainerConf, Mannheim

$ whois mhausenblas

- Developer Advocate @ Red Hat (Go, Kubernetes, OpenShift)
- Developer Advocate @ Mesosphere (Mesos, DC/OS, Kubernetes)
- Chief Data Engineer @ MapR (HDFS, HBase, Drill, etc.)
- Applied research (4y in Ireland, 7y in Austria)
- Nowadays mainly developing tools in Go (Python, Node, Java, C++)
- Kinda developer turned ops (aka appops)

admin

developer

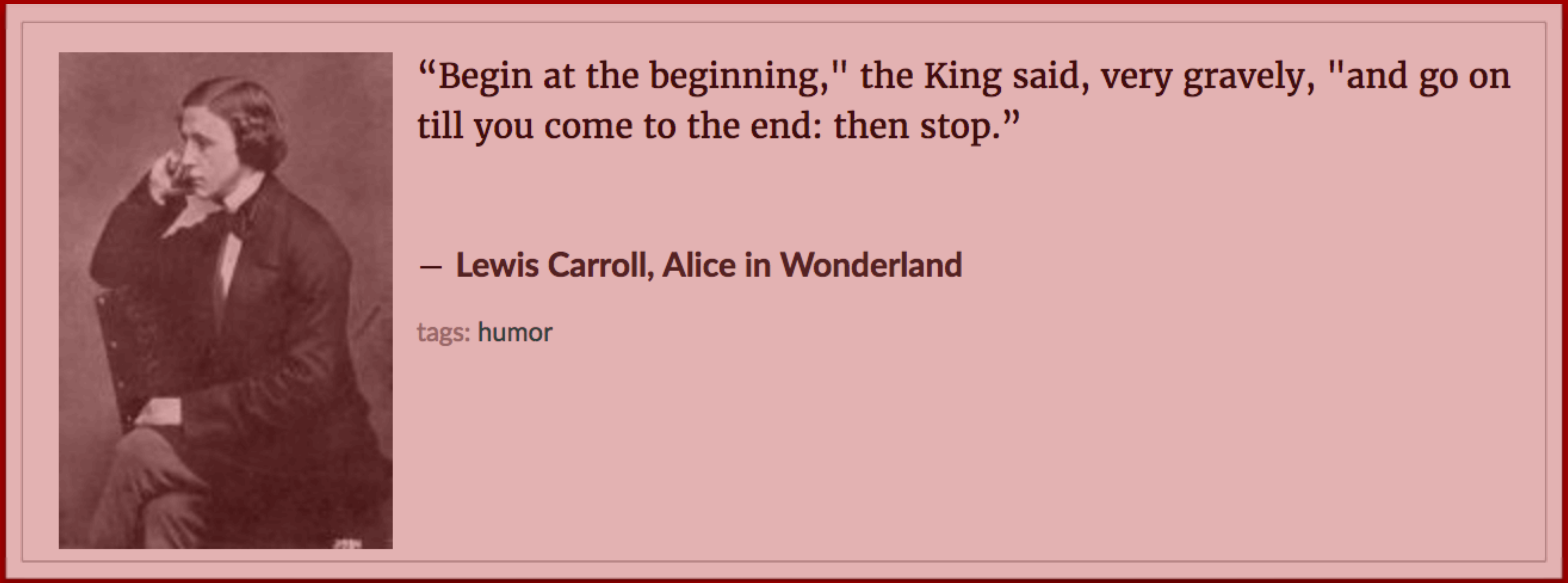
architect

SRE

infosec

PM

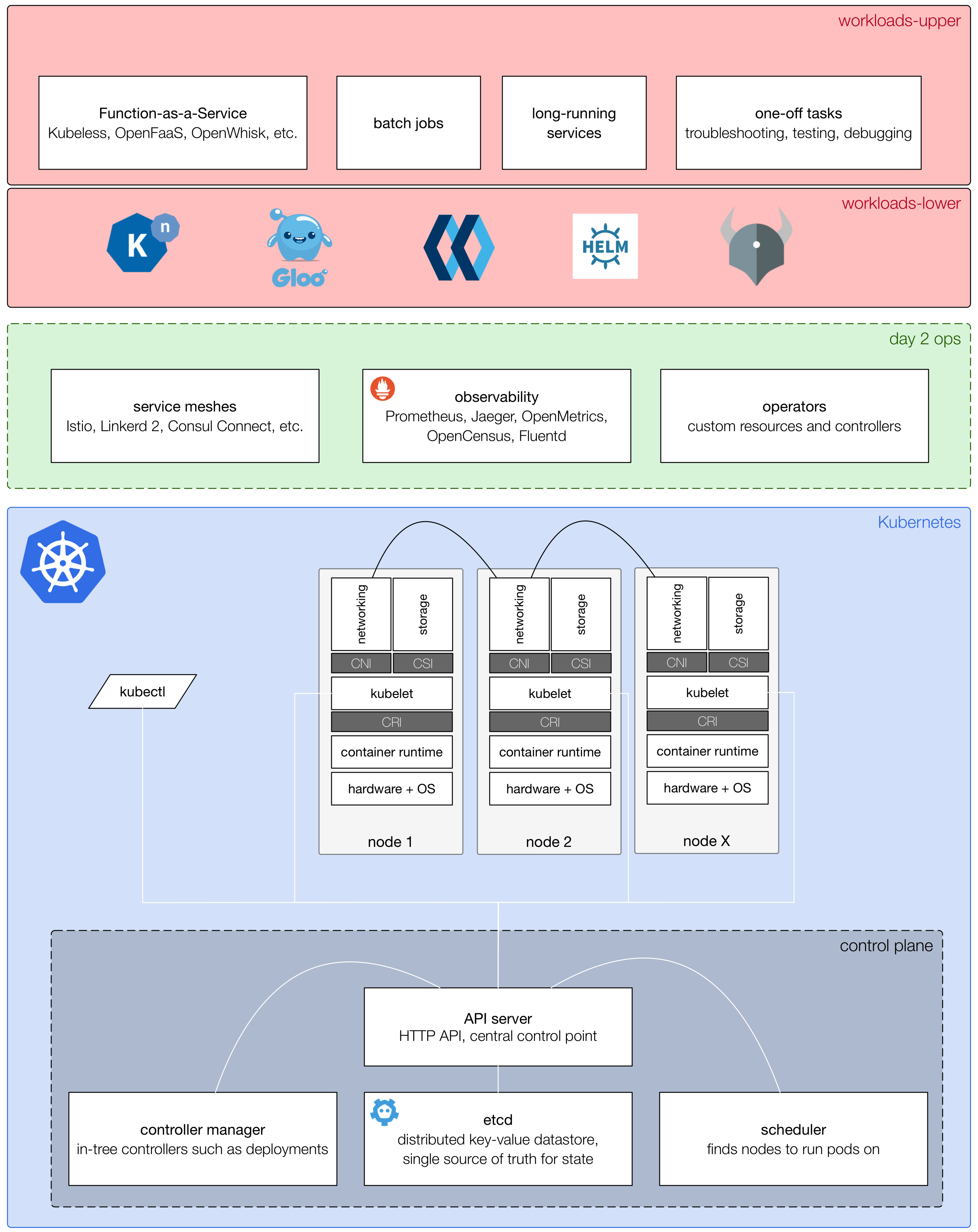
Kubernetes 101



“Begin at the beginning," the King said, very gravely, "and go on till you come to the end: then stop.”

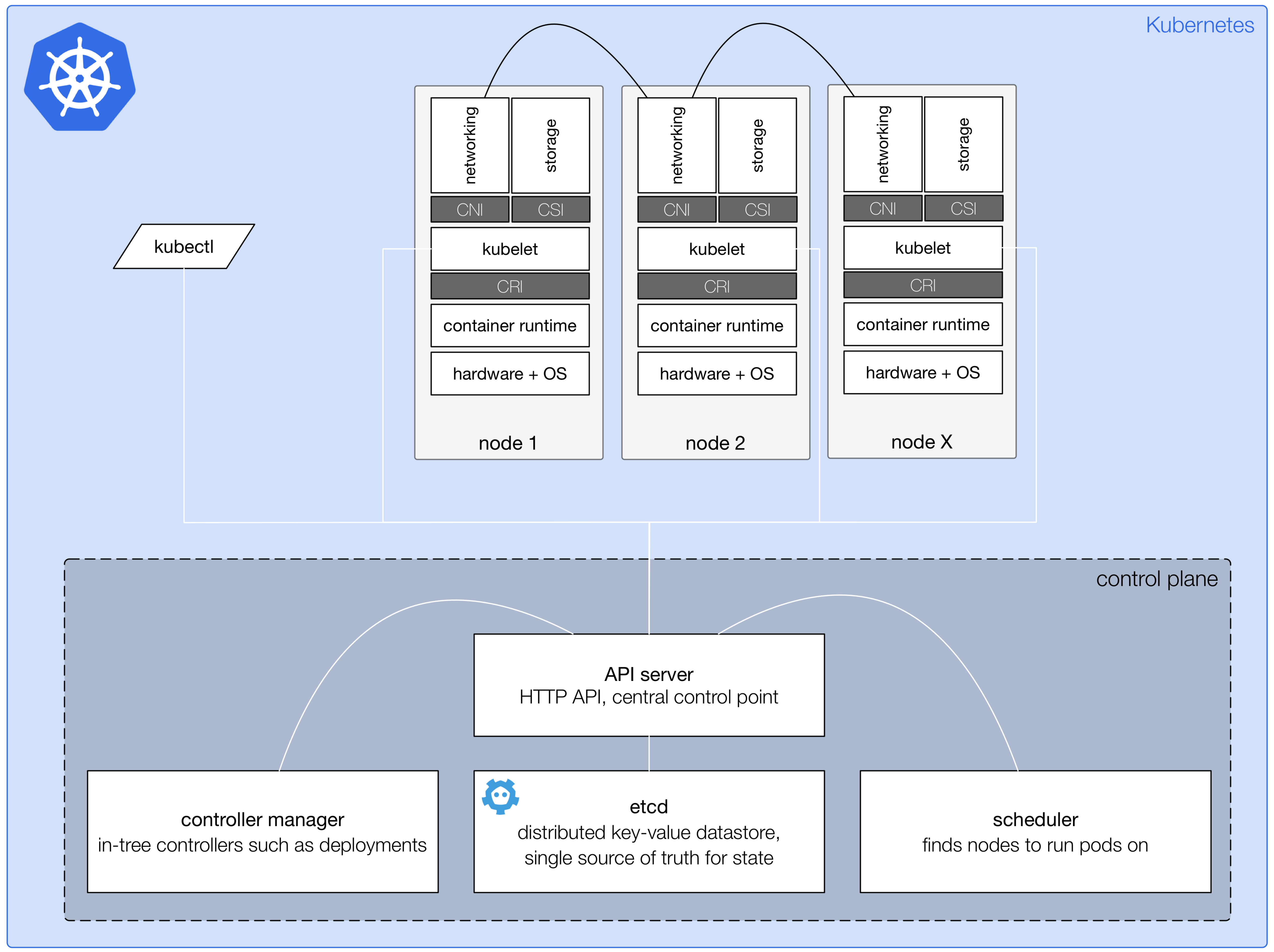
― Lewis Carroll, Alice in Wonderland

tags: humor


workloads-upper
Function-as-a-Service
Kubeless, OpenFaaS, OpenWhisk, etc.
batch jobs
long-running services
one-off tasks
troubleshooting, testing, debugging
workloads-lower
Gloo
HELM
day 2 ops
service meshes
Istio, Linkerd 2, Consul Connect, etc.
observability
Prometheus, Jaeger, OpenMetrics, OpenCensus, Fluentd
operators
custom resources and controllers
Kubernetes
kubectl
networking
storage
CNI
CSI
kubelet
CRI
container runtime
hardware + OS
node 1
node 2
node X
control plane
API server
HTTP API, central control point
controller manager
in-tree controllers such as deployments
etcd
distributed key-value datastore, single source of truth for state
scheduler
finds nodes to run pods on

Kubernetes

- Container lifecycle management
- Declarative API + control loops
- Robust, flexible, scalable
- Extensible



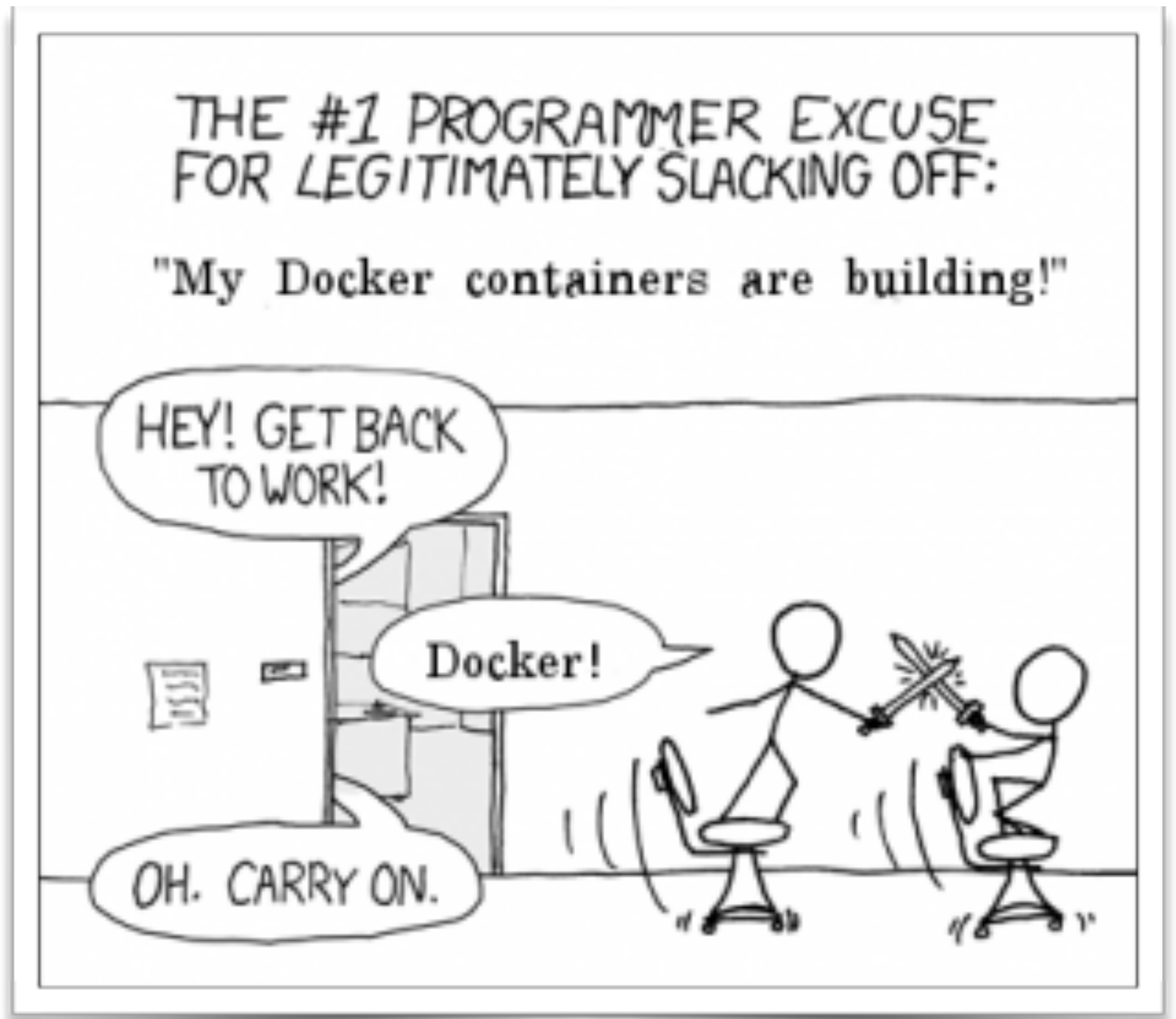
Kubernetes
kubectl
networking
storage
CNI
CSI
kubelet
CRI
container runtime
hardware + OS
node 1
node 2
node X
control plane
API server
HTTP API, central control point
controller manager
in-tree controllers such as deployments
etcd
distributed key-value datastore, single source of truth for state
scheduler
finds nodes to run pods on

kubernetes.io

redhat.

Roles and responsibilities

- infrastructure admin
- namespace admin
- developer


THE #1 PROGRAMMER EXCUSE FOR LEGITIMATELY SLACKING OFF:
"My Docker containers are building!"
HEY! GET BACK TO WORK!
Docker!
OH. CARRY ON.

How can I customize Kubernetes?

Customization options in principle

- in-tree (upstream) via SIG or direct PR
- maintain your own fork
- built-in customization approaches

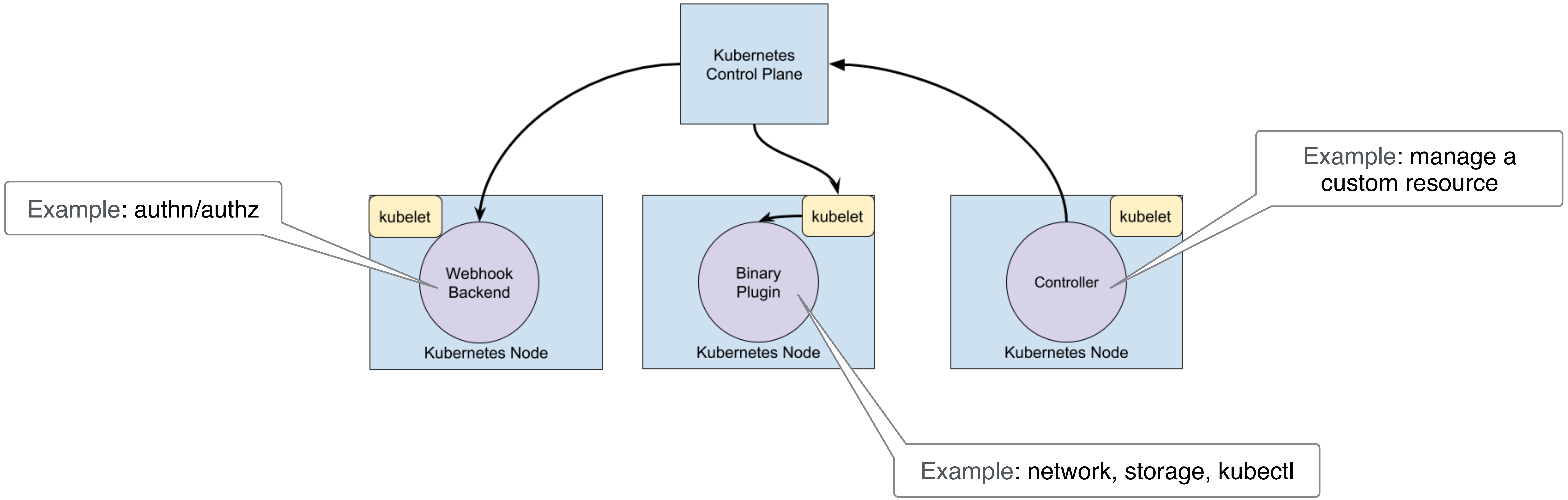
infrastructure I

API A

Customization approaches

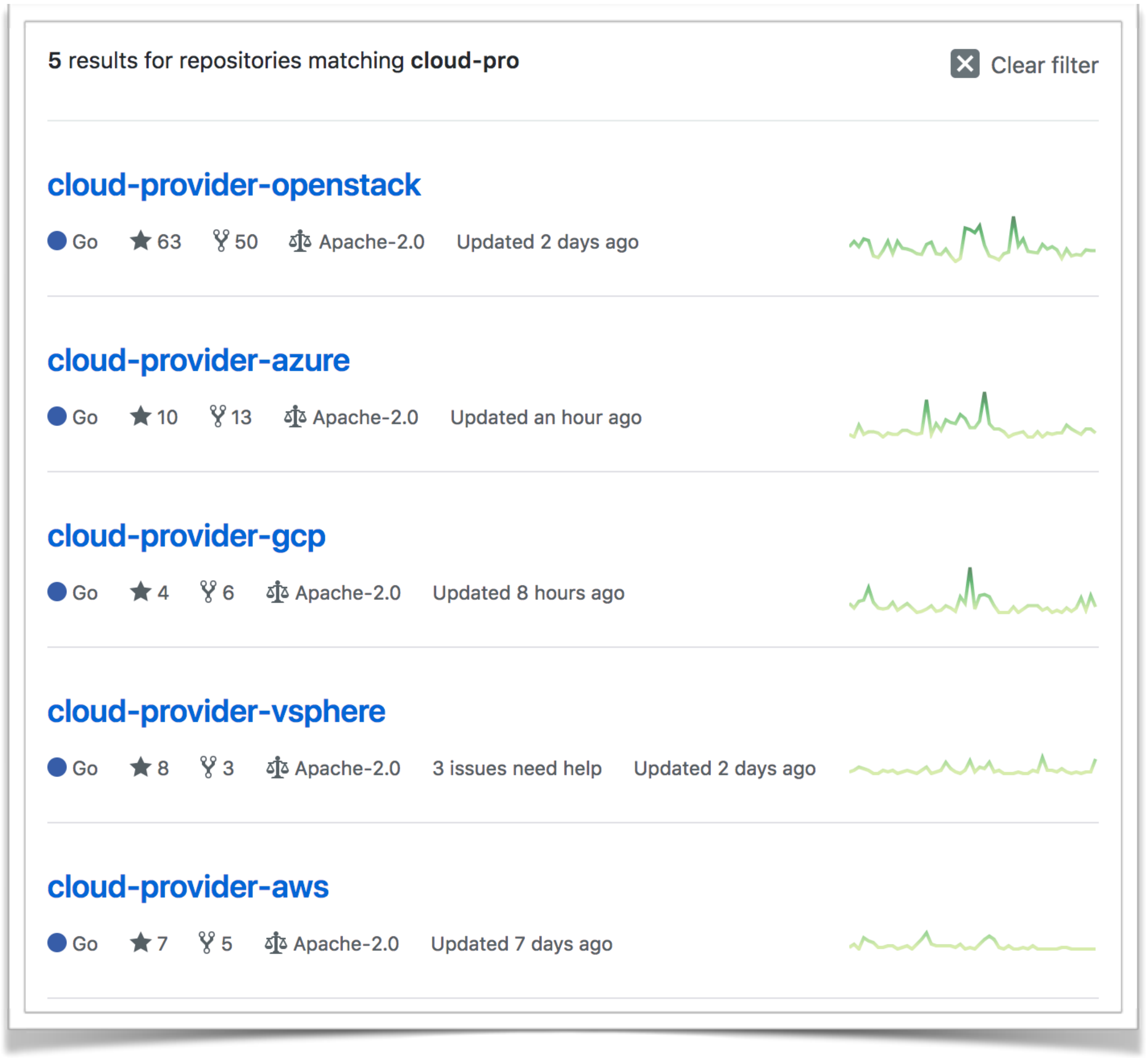
- configuration files and flags (`kubelet`, `kube-apiserver`, etc.)
- extension points
  - cloud providers I
  - `kubelet` (plugins for network/devices/storage and container runtimes) I
  - `kubectl` plugins I
  - access extensions in the API server A
  - custom resources/controllers A
  - extension API servers A
  - scheduler extensions I

Extension patterns



Cloud providers

- in-tree libraries/controller manager
- interfaces for things like:
  - load balancers
  - network routes
  - nodes/VMs



5 results for repositories matching **cloud-pro**

Clear filter

cloud-provider-openstack
Go ★ 63 50 Apache-2.0 Updated 2 days ago

cloud-provider-azure
Go ★ 10 13 Apache-2.0 Updated an hour ago

cloud-provider-gcp
Go ★ 4 6 Apache-2.0 Updated 8 hours ago

cloud-provider-vsphere
Go ★ 8 3 Apache-2.0 3 issues need help Updated 2 days ago

cloud-provider-aws
Go ★ 7 5 Apache-2.0 Updated 7 days ago

github.com/kubernetes

redhat.

`kubelet`: network/device/storage plugins

- Network—standard: CNI

  FEATURE STATE: `Kubernetes v1.12` alpha

  github.com/containernetworking/cni

  kubernetes.io/docs/concepts/extend-kubernetes/compute-storage-net/network-plugins

- Devices—GPUs, FPGAs, etc.

  FEATURE STATE: `Kubernetes v1.12` beta

  kubernetes.io/docs/concepts/extend-kubernetes/compute-storage-net/device-plugins

- Storage—20+ in-tree, up-and-coming standard: CSI

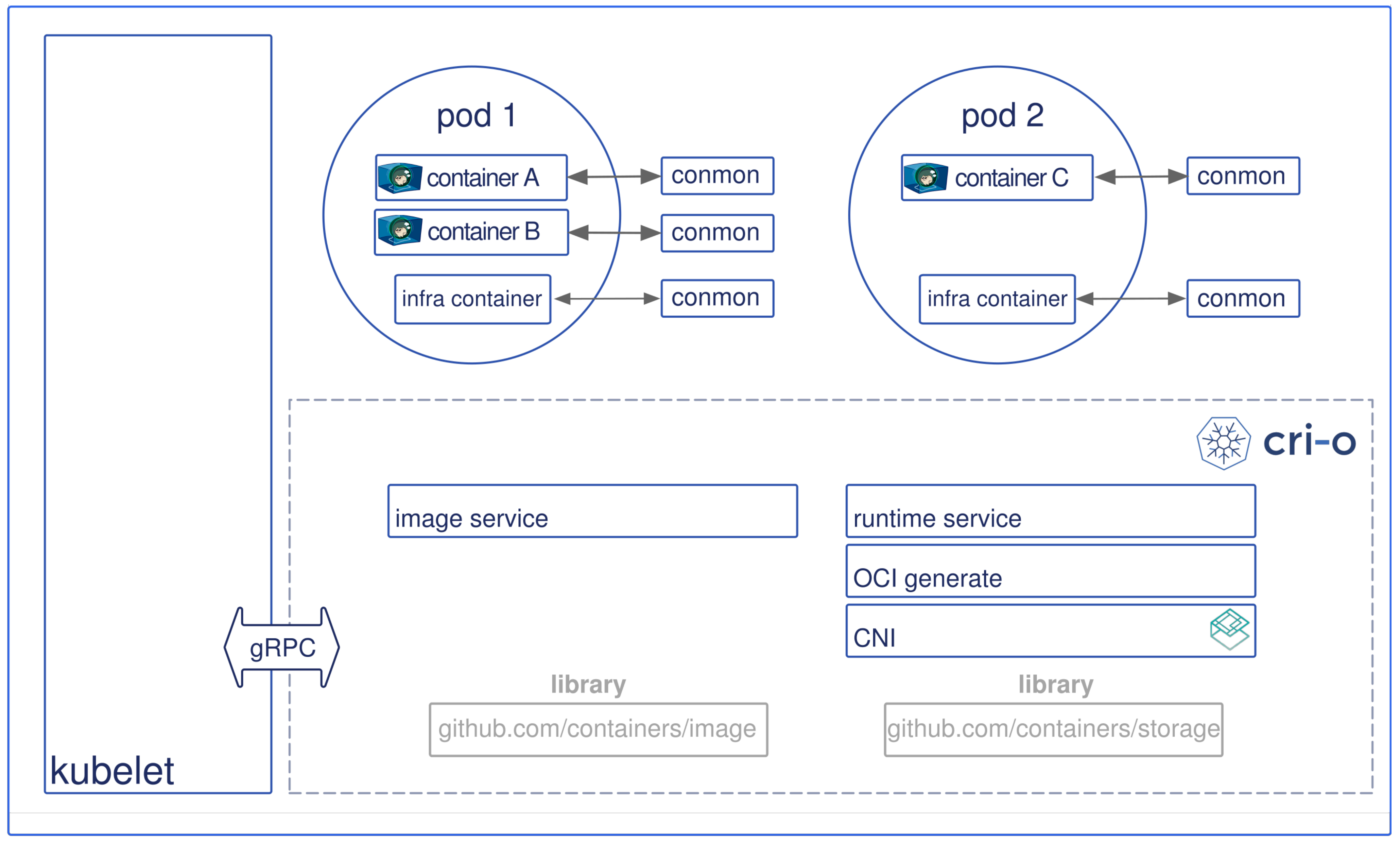
  FEATURE STATE: `Kubernetes v1.10` beta

  kubernetes.io/docs/concepts/storage/volumes/#types-of-volumes

  kubernetes.io/blog/2018/04/10/container-storage-interface-beta

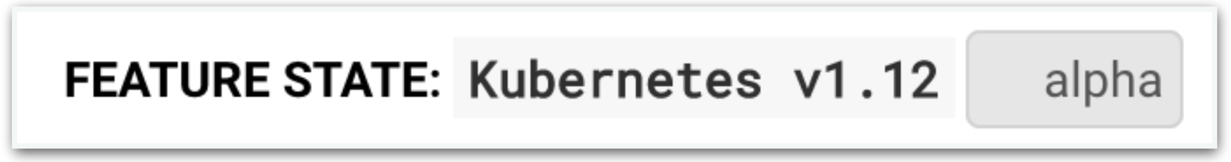
`kubelet`: container runtimes

- Container runtime—standard: CRI (since Kubernetes 1.5)
  kubernetes.io/blog/2016/12/container-runtime-interface-cri-in-kubernetes
- Nowadays multiple options:
  - runc
  - containerd
  - Kata containers
  - gVisor
  - hyper.sh



cri-o.io

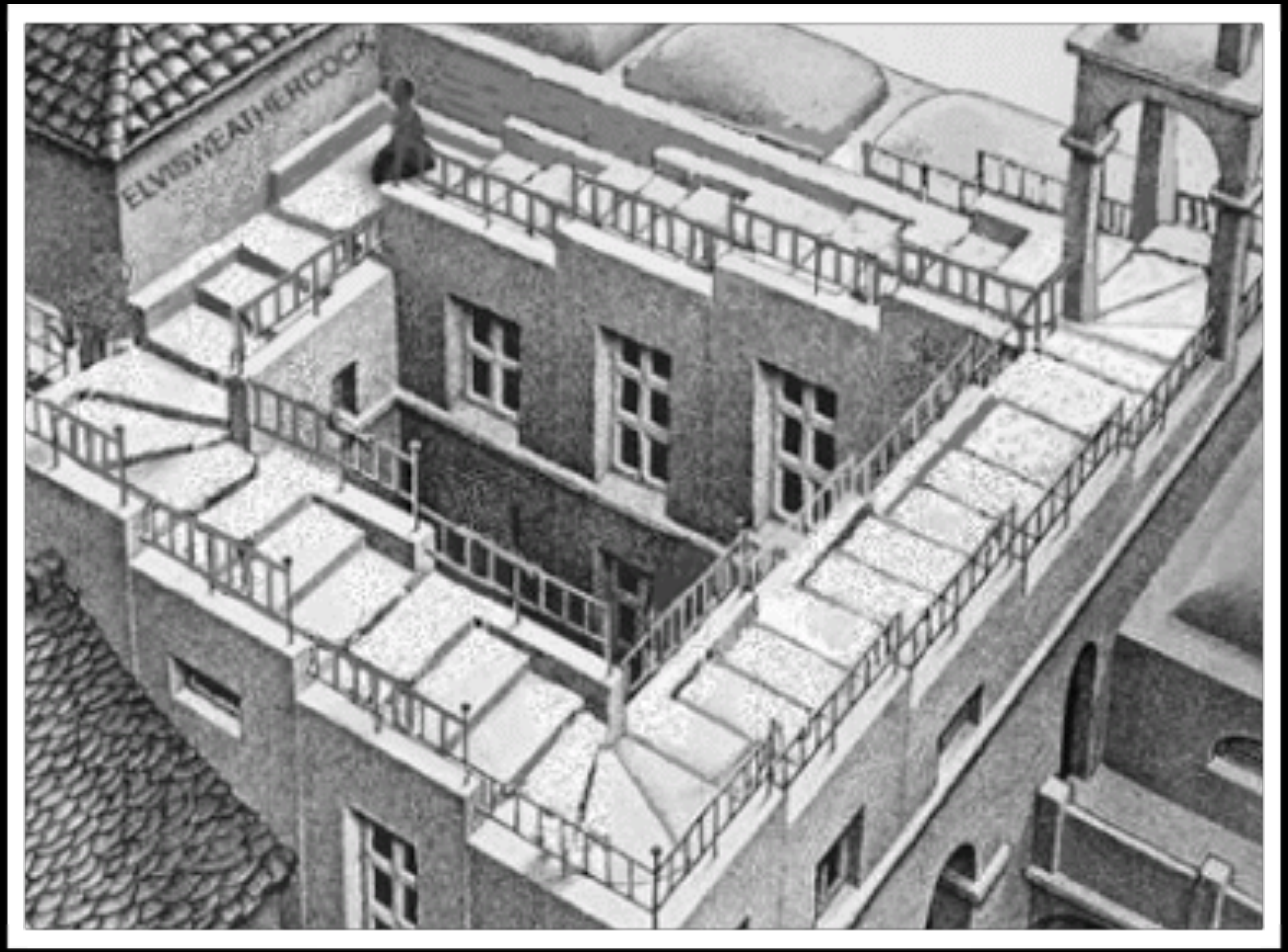
`kubectl` plugins


FEATURE STATE: `Kubernetes v1.12` alpha

- Extend the set of commands

  kubernetes.io/docs/tasks/extend-kubectl/kubectl-plugins

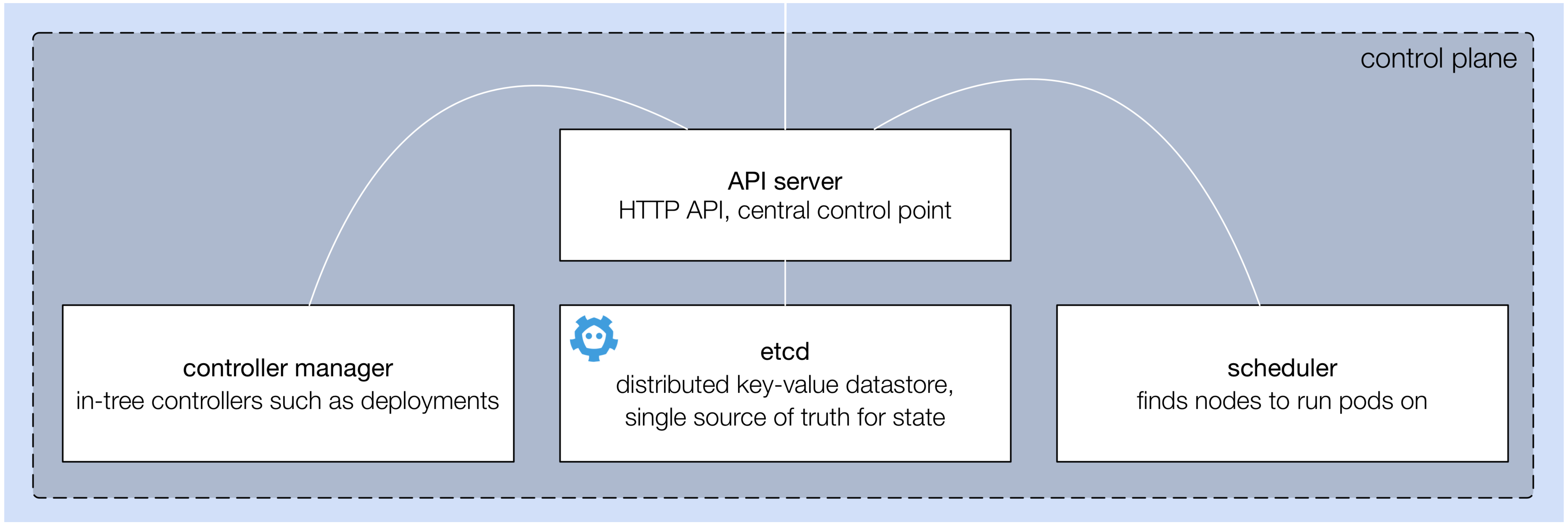
- Write in any programming language (note: these are binary extensions)
- Examples: context control, service catalog, user verification



as simple plugin in action: `kubectl inspect`

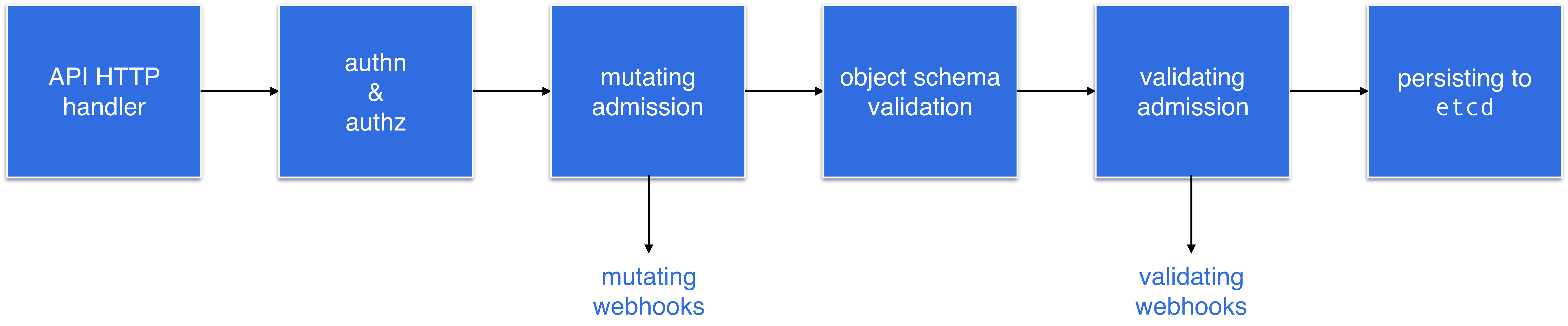
Extending the Kubernetes API

Quick control plane refresher


control plane
API server
HTTP API, central control point
controller manager
in-tree controllers such as deployments
etcd
distributed key-value datastore,
single source of truth for state
scheduler
finds nodes to run pods on

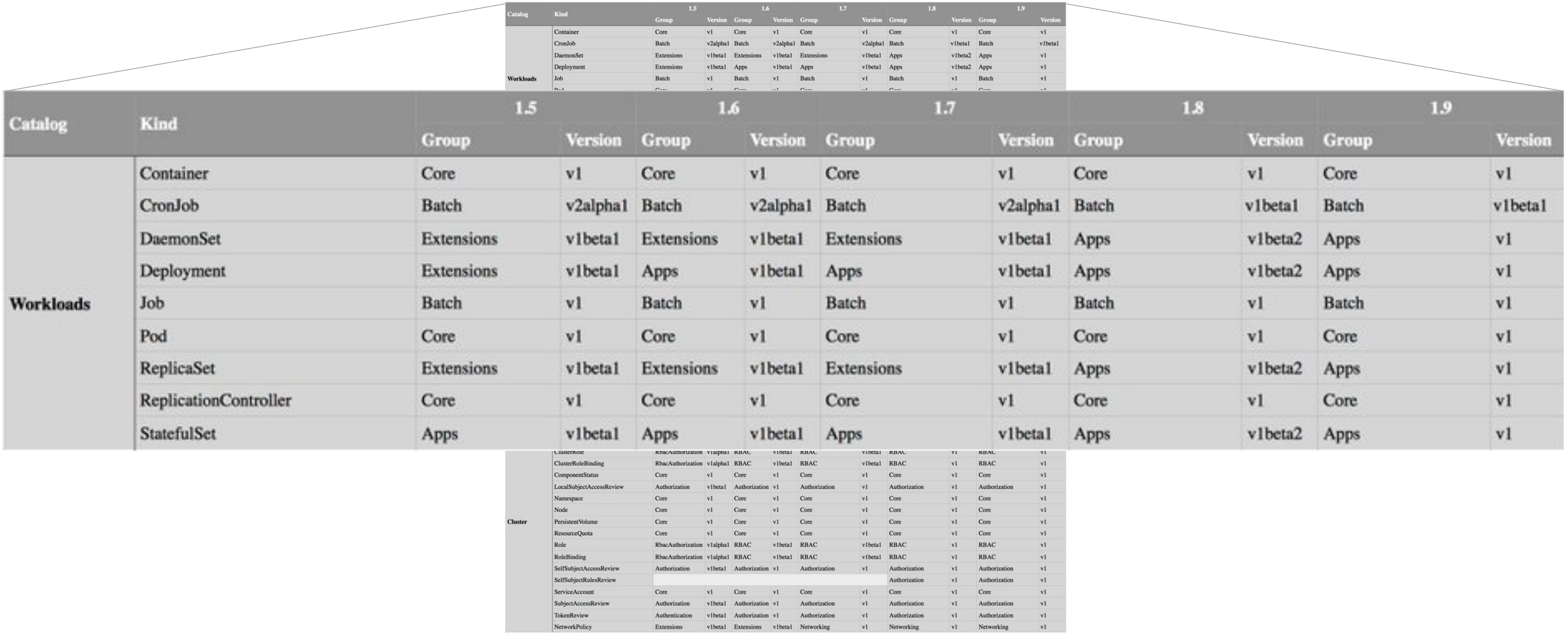
redhat.

The life of an API request



Flow diagram is based on Extensible Admission is Beta and Kubernetes deep dive: API Server – part 1.

What are (in-tree) core resources?



Catalog	Kind	1.5		1.6		1.7		1.8		1.9	
		Group	Version	Group	Version	Group	Version	Group	Version	Group	Version
Workloads	Container	Core	v1	Core	v1	Core	v1	Core	v1	Core	v1
	CronJob	Batch	v2alpha1	Batch	v2alpha1	Batch	v2alpha1	Batch	v1beta1	Batch	v1beta1
	DaemonSet	Extensions	v1beta1	Extensions	v1beta1	Extensions	v1beta1	Apps	v1beta2	Apps	v1
	Deployment	Extensions	v1beta1	Apps	v1beta1	Apps	v1beta1	Apps	v1beta2	Apps	v1
	Job	Batch	v1	Batch	v1	Batch	v1	Batch	v1	Batch	v1
	Pod	Core	v1	Core	v1	Core	v1	Core	v1	Core	v1
	ReplicaSet	Extensions	v1beta1	Extensions	v1beta1	Extensions	v1beta1	Apps	v1beta2	Apps	v1
	ReplicationController	Core	v1	Core	v1	Core	v1	Core	v1	Core	v1
	StatefulSet	Apps	v1beta1	Apps	v1beta1	Apps	v1beta1	Apps	v1beta2	Apps	v1
Cluster	ClusterRole	RbacAuthorization	v1alpha1	RBAC	v1beta1	RBAC	v1beta1	RBAC	v1	RBAC	v1
	ClusterRoleBinding	RbacAuthorization	v1alpha1	RBAC	v1beta1	RBAC	v1beta1	RBAC	v1	RBAC	v1
	ComponentStatus	Core	v1	Core	v1	Core	v1	Core	v1	Core	v1
	LocalSubjectAccessReview	Authorization	v1beta1	Authorization	v1	Authorization	v1	Authorization	v1	Authorization	v1
	Namespace	Core	v1	Core	v1	Core	v1	Core	v1	Core	v1
	Node	Core	v1	Core	v1	Core	v1	Core	v1	Core	v1
	PersistentVolume	Core	v1	Core	v1	Core	v1	Core	v1	Core	v1
	ResourceQuota	Core	v1	Core	v1	Core	v1	Core	v1	Core	v1
	Role	RbacAuthorization	v1alpha1	RBAC	v1beta1	RBAC	v1beta1	RBAC	v1	RBAC	v1
	RoleBinding	RbacAuthorization	v1alpha1	RBAC	v1beta1	RBAC	v1beta1	RBAC	v1	RBAC	v1
	SelfSubjectAccessReview	Authorization	v1beta1	Authorization	v1	Authorization	v1	Authorization	v1	Authorization	v1
	SelfSubjectRulesReview							Authorization	v1	Authorization	v1
	ServiceAccount	Core	v1	Core	v1	Core	v1	Core	v1	Core	v1
	SubjectAccessReview	Authorization	v1beta1	Authorization	v1	Authorization	v1	Authorization	v1	Authorization	v1
	TokenReview	Authentication	v1beta1	Authorization	v1	Authorization	v1	Authorization	v1	Authorization	v1
	NetworkPolicy	Extensions	v1beta1	Extensions	v1beta1	Networking	v1	Networking	v1	Networking	v1

kubernetes.io/docs/reference/generated/kubernetes-api/v1.12/

A

Access extensions in the API server

- Admission controllers (in-tree, via configuration of the API server)

  https://kubernetes.io/docs/reference/access-authn-authz/admission-controllers/

- Dynamic Admission Control

  https://kubernetes.io/docs/reference/access-authn-authz/extensible-admission-controllers/

  - Admission Webhooks (beta)
  - *Initializers (alpha)*

A

Custom resources

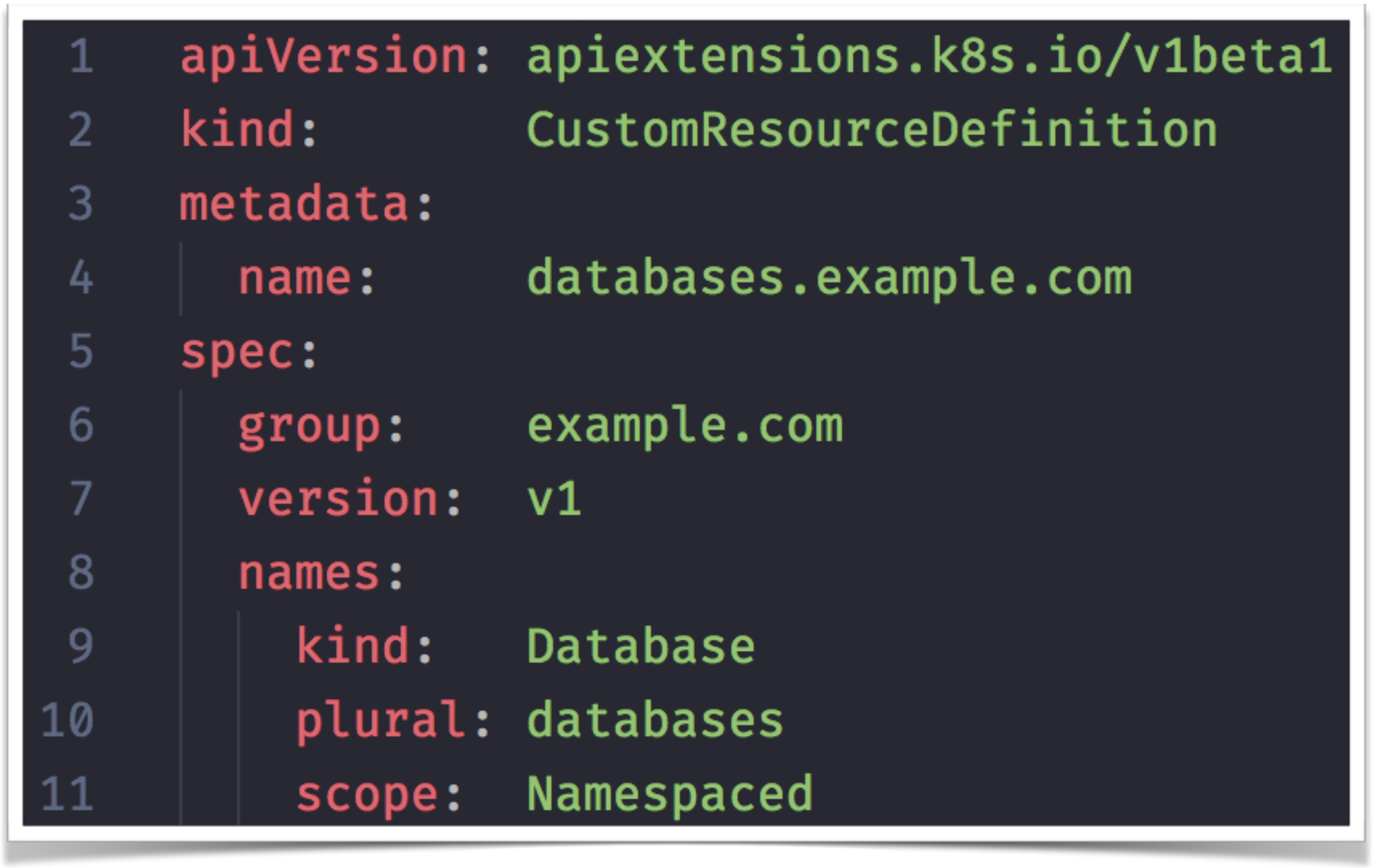
- Support for “known” resources beyond core resources

  kubernetes.io/docs/concepts/extend-kubernetes/api-extension/custom-resources

  blog.openshift.com/kubernetes-deep-dive-api-server-part-3a
- Use the API server to manage custom resources in `etcd` for you
- Custom resource definition (CRD) and instances
- Use the CLI to interact with custom resources in the usual way, for example: `kubectl get mycustomresource`

A

Custom resource—example



```yaml
apiVersion: apiextensions.k8s.io/v1beta1
kind:       CustomResourceDefinition
metadata:
  name:     databases.example.com
spec:
  group:    example.com
  version:  v1
  names:
    kind:   Database
    plural: databases
    scope:  Namespaced
```

A

Custom controller

- Implement control loops beyond what thee (in-tree) controller manager supports
- Custom controller
  - dealing with core resources
    github.com/kelseyhightower/secrets-controller
  - dealing with custom resources (aka operator)
    github.com/kubernetes/sample-controller

redhat.

A

Custom resources and controllers

	resource		controller	
	core	custom	in-tree	custom
Kubernetes control plane	X		X	
simple controller	X			X
operator		X		X

redhat.

Operators

A

Operators

operator = custom resource + custom controller

- Motivation: application lifecycle management
- Use one of 30+ available operators or write your own with:
  - Kubebuilder
  - Kubernetes Operator Kit
  - kutil
  - Metacontroller
  - Operator SDK

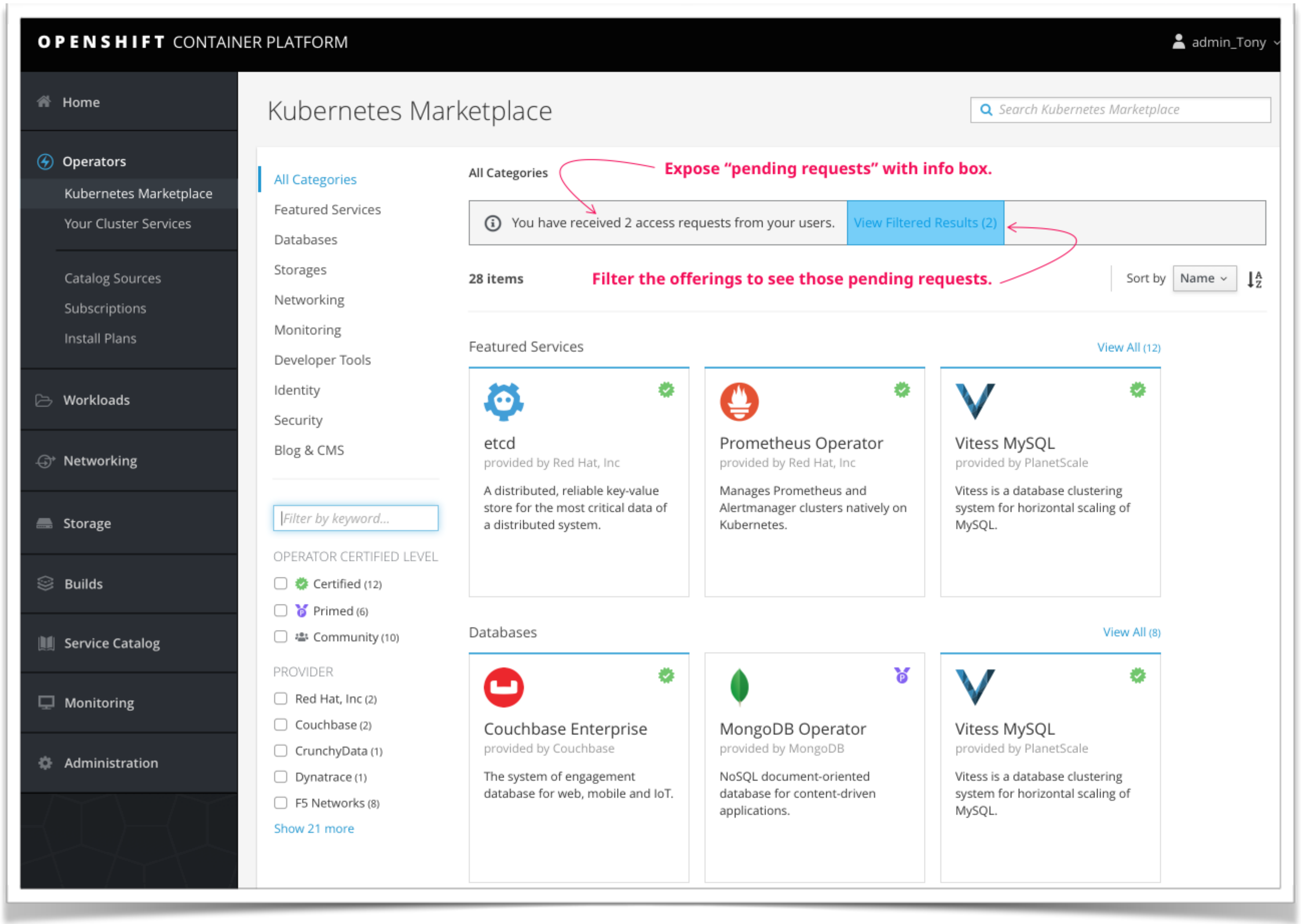
redhat.

Operator use cases

- zero-downtime upgrades of the app the operator supervises
- workflow automations
- policy enforcement
- managing stateful workloads
    - resizing of followers in a distributed datastore
    - backup & restore of a database
    - re-balancing of a distributed message queue

Operator examples

- etcd
- Prometheus
- Postgres
- Vitess MySQL
- MongoDB
- Couchbase
- Kafka



OPENSHIFT CONTAINER PLATFORM

admin_Tony

Home

Operators

Kubernetes Marketplace

Your Cluster Services

Catalog Sources

Subscriptions

Install Plans

Workloads

Networking

Storage

Builds

Service Catalog

Monitoring

Administration

Kubernetes Marketplace

Search Kubernetes Marketplace

All Categories

Featured Services

Databases

Storages

Networking

Monitoring

Developer Tools

Identity

Security

Blog & CMS

Filter by keyword...

OPERATOR CERTIFIED LEVEL

- Certified (12)
- Primed (6)
- Community (10)

PROVIDER

- Red Hat, Inc (2)
- Couchbase (2)
- CrunchyData (1)
- Dynatrace (1)
- F5 Networks (8)

Show 21 more

All Categories

Expose "pending requests" with info box.

You have received 2 access requests from your users. View Filtered Results (2)

28 items

Filter the offerings to see those pending requests.

Sort by Name

Featured Services

View All (12)

etcd
provided by Red Hat, Inc
A distributed, reliable key-value store for the most critical data of a distributed system.

Prometheus Operator
provided by Red Hat, Inc
Manages Prometheus and Alertmanager clusters natively on Kubernetes.

Vitess MySQL
provided by PlanetScale
Vitess is a database clustering system for horizontal scaling of MySQL.

Databases

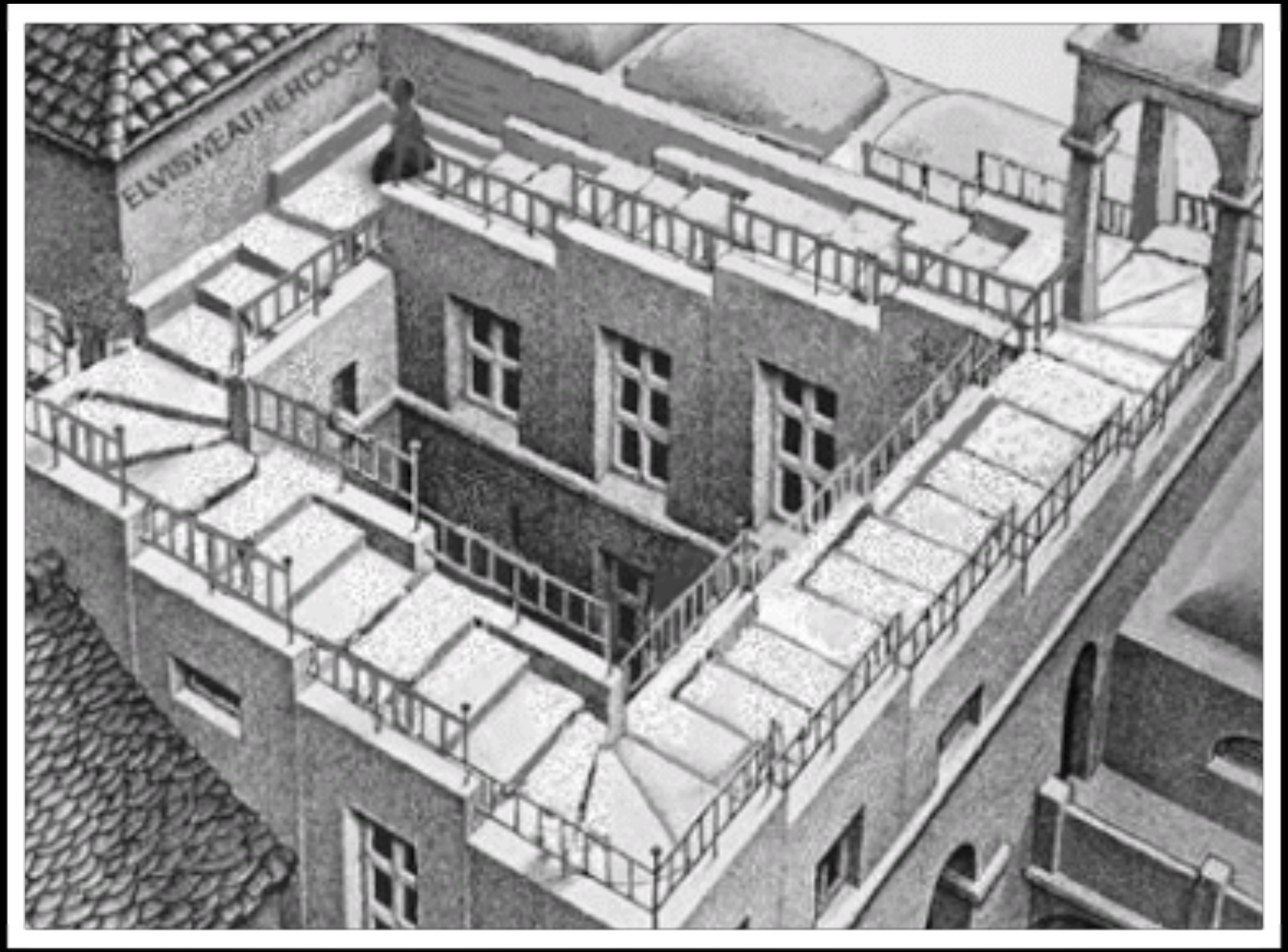
View All (8)

Couchbase Enterprise
provided by Couchbase
The system of engagement database for web, mobile and IoT.

MongoDB Operator
provided by MongoDB
NoSQL document-oriented database for content-driven applications.

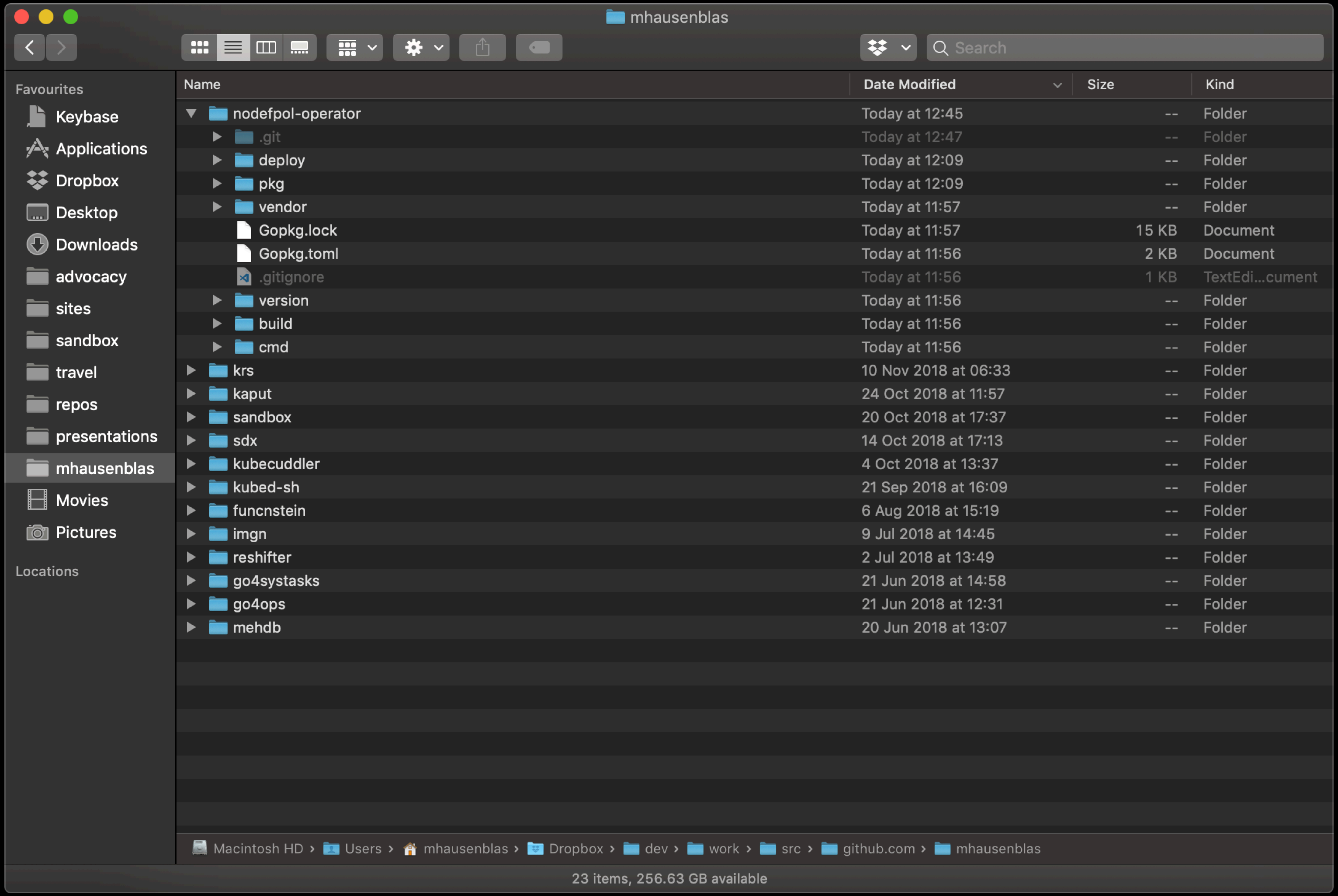
Vitess MySQL
provided by PlanetScale
Vitess is a database clustering system for horizontal scaling of MySQL.

github.com/mhausenblas/operator-101



a simple operator in action: `NoDefaultsPolicy`

```
$ operator-sdk new nodefpol-operator
```

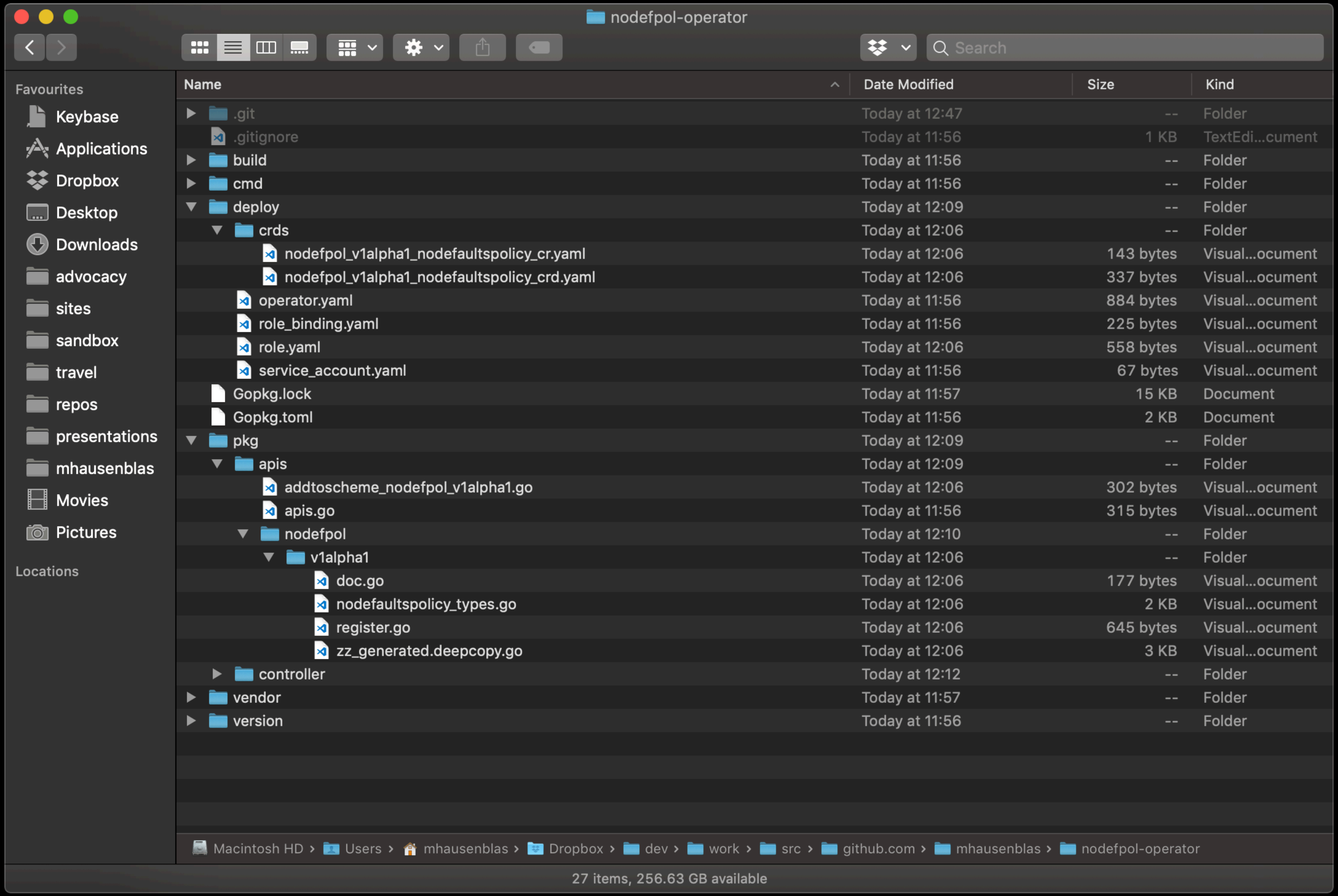


Name	Date Modified	Size	Kind
nodefpol-operator	Today at 12:45	--	Folder
.git	Today at 12:47	--	Folder
deploy	Today at 12:09	--	Folder
pkg	Today at 12:09	--	Folder
vendor	Today at 11:57	--	Folder
Gopkg.lock	Today at 11:57	15 KB	Document
Gopkg.toml	Today at 11:56	2 KB	Document
.gitignore	Today at 11:56	1 KB	TextEdi...cument
version	Today at 11:56	--	Folder
build	Today at 11:56	--	Folder
cmd	Today at 11:56	--	Folder
krs	10 Nov 2018 at 06:33	--	Folder
kaput	24 Oct 2018 at 11:57	--	Folder
sandbox	20 Oct 2018 at 17:37	--	Folder
sdx	14 Oct 2018 at 17:13	--	Folder
kubecuddler	4 Oct 2018 at 13:37	--	Folder
kubed-sh	21 Sep 2018 at 16:09	--	Folder
funcnstein	6 Aug 2018 at 15:19	--	Folder
imgn	9 Jul 2018 at 14:45	--	Folder
reshifter	2 Jul 2018 at 13:49	--	Folder
go4systasks	21 Jun 2018 at 14:58	--	Folder
go4ops	21 Jun 2018 at 12:31	--	Folder
mehdb	20 Jun 2018 at 13:07	--	Folder

Macintosh HD › Users › mhausenblas › Dropbox › dev › work › src › github.com › mhausenblas

23 items, 256.63 GB available

```
$ operator-sdk add api --api-version=nodefpol.k8space.io/v1alpha1 --kind=NoDefaultsPolicy
```



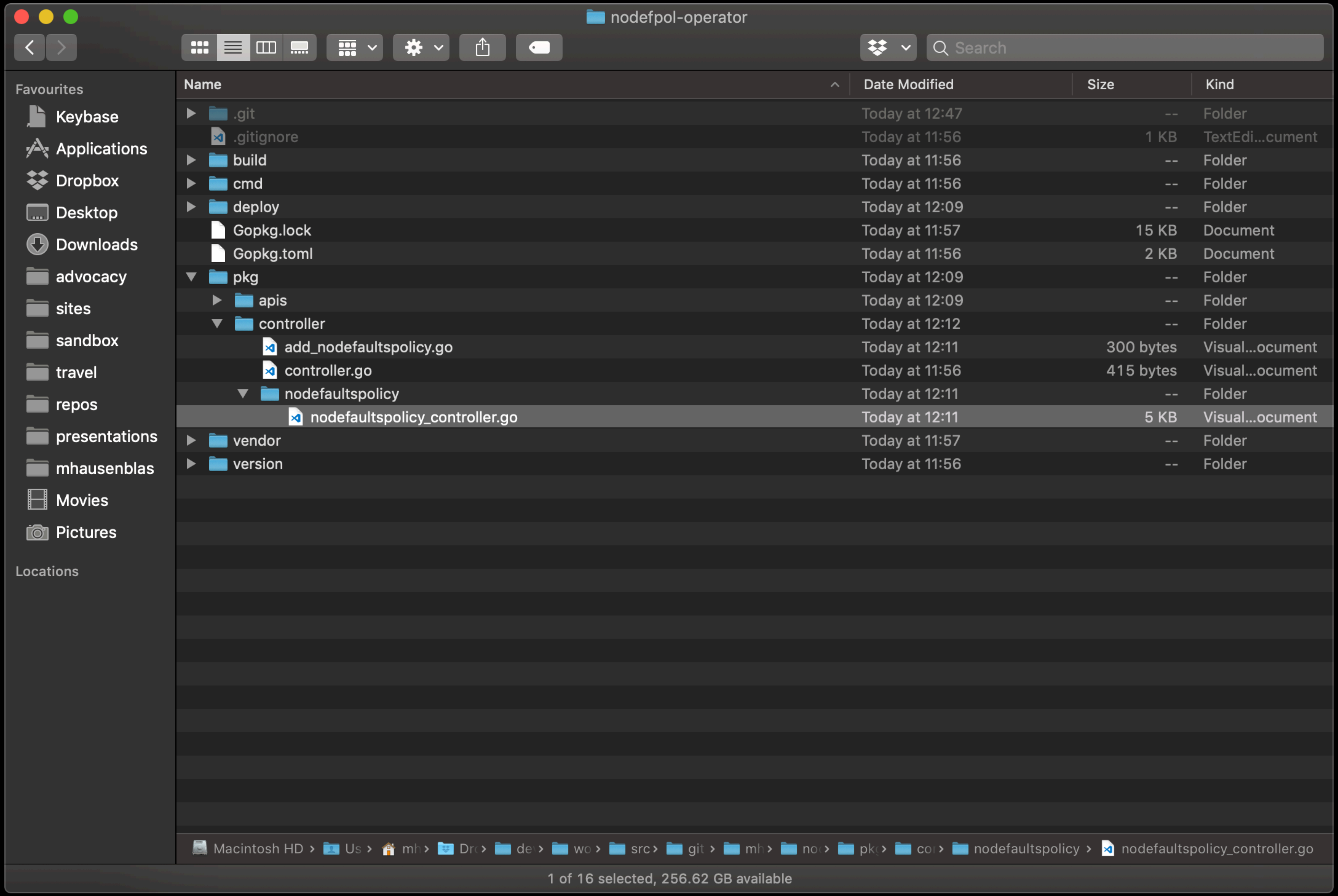
nodefpol-operator

```
Name                                              Date Modified     Size       Kind
▶ .git                                            Today at 12:47    --         Folder
  .gitignore                                      Today at 11:56    1 KB       TextEdi...cument
▶ build                                           Today at 11:56    --         Folder
▶ cmd                                             Today at 11:56    --         Folder
▼ deploy                                          Today at 12:09    --         Folder
  ▼ crds                                          Today at 12:06    --         Folder
      nodefpol_v1alpha1_nodefaultspolicy_cr.yaml  Today at 12:06    143 bytes  Visual...ocument
      nodefpol_v1alpha1_nodefaultspolicy_crd.yaml Today at 12:06    337 bytes  Visual...ocument
    operator.yaml                                 Today at 11:56    884 bytes  Visual...ocument
    role_binding.yaml                             Today at 11:56    225 bytes  Visual...ocument
    role.yaml                                     Today at 12:06    558 bytes  Visual...ocument
    service_account.yaml                          Today at 11:56    67 bytes   Visual...ocument
  Gopkg.lock                                      Today at 11:57    15 KB      Document
  Gopkg.toml                                      Today at 11:56    2 KB       Document
▼ pkg                                             Today at 12:09    --         Folder
  ▼ apis                                          Today at 12:09    --         Folder
      addtoscheme_nodefpol_v1alpha1.go            Today at 12:06    302 bytes  Visual...ocument
      apis.go                                     Today at 11:56    315 bytes  Visual...ocument
    ▼ nodefpol                                    Today at 12:10    --         Folder
      ▼ v1alpha1                                  Today at 12:06    --         Folder
          doc.go                                  Today at 12:06    177 bytes  Visual...ocument
          nodefaultspolicy_types.go               Today at 12:06    2 KB       Visual...ocument
          register.go                             Today at 12:06    645 bytes  Visual...ocument
          zz_generated.deepcopy.go                Today at 12:06    3 KB       Visual...ocument
  ▶ controller                                    Today at 12:12    --         Folder
▶ vendor                                          Today at 11:57    --         Folder
▶ version                                         Today at 11:56    --         Folder
```

Macintosh HD › Users › mhausenblas › Dropbox › dev › work › src › github.com › mhausenblas › nodefpol-operator

27 items, 256.63 GB available

```
$ operator-sdk add controller --api-version=nodefpol.k8space.io/v1alpha1 --kind=NoDefaultsPolicy
```



Name	Date Modified	Size	Kind
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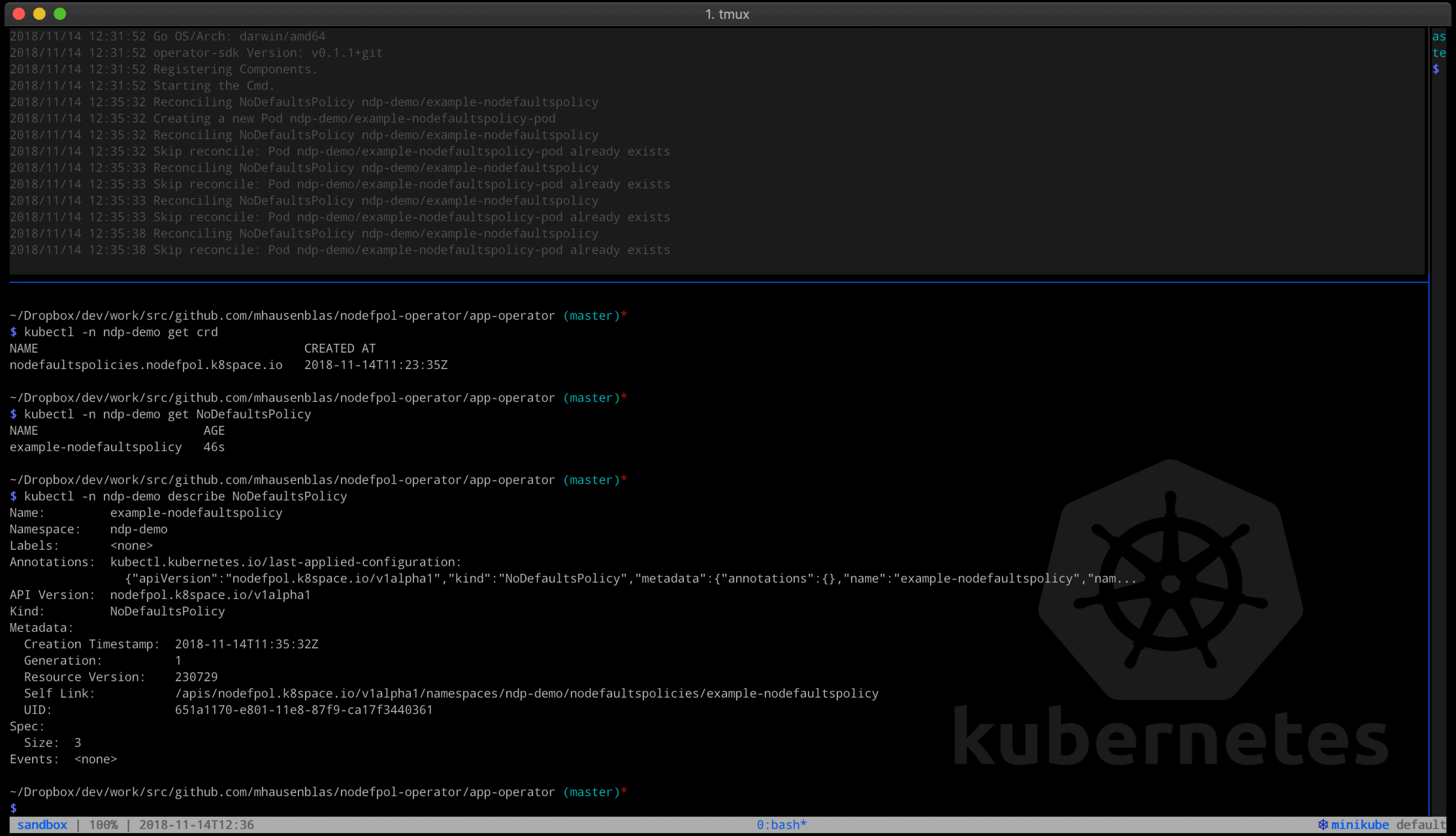
deploy	Today at 12:09	--	Folder
Gopkg.lock	Today at 11:57	15 KB	Document
Gopkg.toml	Today at 11:56	2 KB	Document
pkg	Today at 12:09	--	Folder
apis	Today at 12:09	--	Folder
controller	Today at 12:12	--	Folder
add_nodefaultspolicy.go	Today at 12:11	300 bytes	Visual...ocument
controller.go	Today at 11:56	415 bytes	Visual...ocument
nodefaultspolicy	Today at 12:11	--	Folder
nodefaultspolicy_controller.go	Today at 12:11	5 KB	Visual...ocument
vendor	Today at 11:57	--	Folder
version	Today at 11:56	--	Folder

nodefpol-operator
Favourites
Keybase
Applications
Dropbox
Desktop
Downloads
advocacy
sites
sandbox
travel
repos
presentations
mhausenblas
Movies
Pictures
Locations
Search
Macintosh HD › Us › mh › Dr › de › wo › src › git › mh › no › pk › co › nodefaultspolicy › nodefaultspolicy_controller.go
1 of 16 selected, 256.62 GB available

```
$ kubectl -n ndp-demo apply -f deploy/crds/nodefpol_v1alpha1_nodefaultspolicy_crd.yaml
$ OPERATOR_NAME=nodefpol-operator operator-sdk up local --namespace "ndp-demo"
```



```
1. tmux
2018/11/14 12:31:52 Go OS/Arch: darwin/amd64
2018/11/14 12:31:52 operator-sdk Version: v0.1.1+git
2018/11/14 12:31:52 Registering Components.
2018/11/14 12:31:52 Starting the Cmd.
2018/11/14 12:35:32 Reconciling NoDefaultsPolicy ndp-demo/example-nodefaultspolicy
2018/11/14 12:35:32 Creating a new Pod ndp-demo/example-nodefaultspolicy-pod
2018/11/14 12:35:32 Reconciling NoDefaultsPolicy ndp-demo/example-nodefaultspolicy
2018/11/14 12:35:32 Skip reconcile: Pod ndp-demo/example-nodefaultspolicy-pod already exists
2018/11/14 12:35:33 Reconciling NoDefaultsPolicy ndp-demo/example-nodefaultspolicy
2018/11/14 12:35:33 Skip reconcile: Pod ndp-demo/example-nodefaultspolicy-pod already exists
2018/11/14 12:35:33 Reconciling NoDefaultsPolicy ndp-demo/example-nodefaultspolicy
2018/11/14 12:35:33 Skip reconcile: Pod ndp-demo/example-nodefaultspolicy-pod already exists
2018/11/14 12:35:38 Reconciling NoDefaultsPolicy ndp-demo/example-nodefaultspolicy
2018/11/14 12:35:38 Skip reconcile: Pod ndp-demo/example-nodefaultspolicy-pod already exists

~/Dropbox/dev/work/src/github.com/mhausenblas/nodefpol-operator/app-operator (master)*
$ kubectl -n ndp-demo get crd
NAME                                     CREATED AT
nodefaultspolicies.nodefpol.k8space.io   2018-11-14T11:23:35Z

~/Dropbox/dev/work/src/github.com/mhausenblas/nodefpol-operator/app-operator (master)*
$ kubectl -n ndp-demo get NoDefaultsPolicy
NAME                        AGE
example-nodefaultspolicy    46s

~/Dropbox/dev/work/src/github.com/mhausenblas/nodefpol-operator/app-operator (master)*
$ kubectl -n ndp-demo describe NoDefaultsPolicy
Name:         example-nodefaultspolicy
Namespace:    ndp-demo
Labels:       <none>
Annotations:  kubectl.kubernetes.io/last-applied-configuration:
                {"apiVersion":"nodefpol.k8space.io/v1alpha1","kind":"NoDefaultsPolicy","metadata":{"annotations":{},"name":"example-nodefaultspolicy","nam...
API Version:  nodefpol.k8space.io/v1alpha1
Kind:         NoDefaultsPolicy
Metadata:
  Creation Timestamp:  2018-11-14T11:35:32Z
  Generation:          1
  Resource Version:    230729
  Self Link:           /apis/nodefpol.k8space.io/v1alpha1/namespaces/ndp-demo/nodefaultspolicies/example-nodefaultspolicy
  UID:                 651a1170-e801-11e8-87f9-ca17f3440361
Spec:
  Size:  3
Events:  <none>

~/Dropbox/dev/work/src/github.com/mhausenblas/nodefpol-operator/app-operator (master)*
$
sandbox | 100% | 2018-11-14T12:36                    0:bash*                    ⎈ minikube default
```

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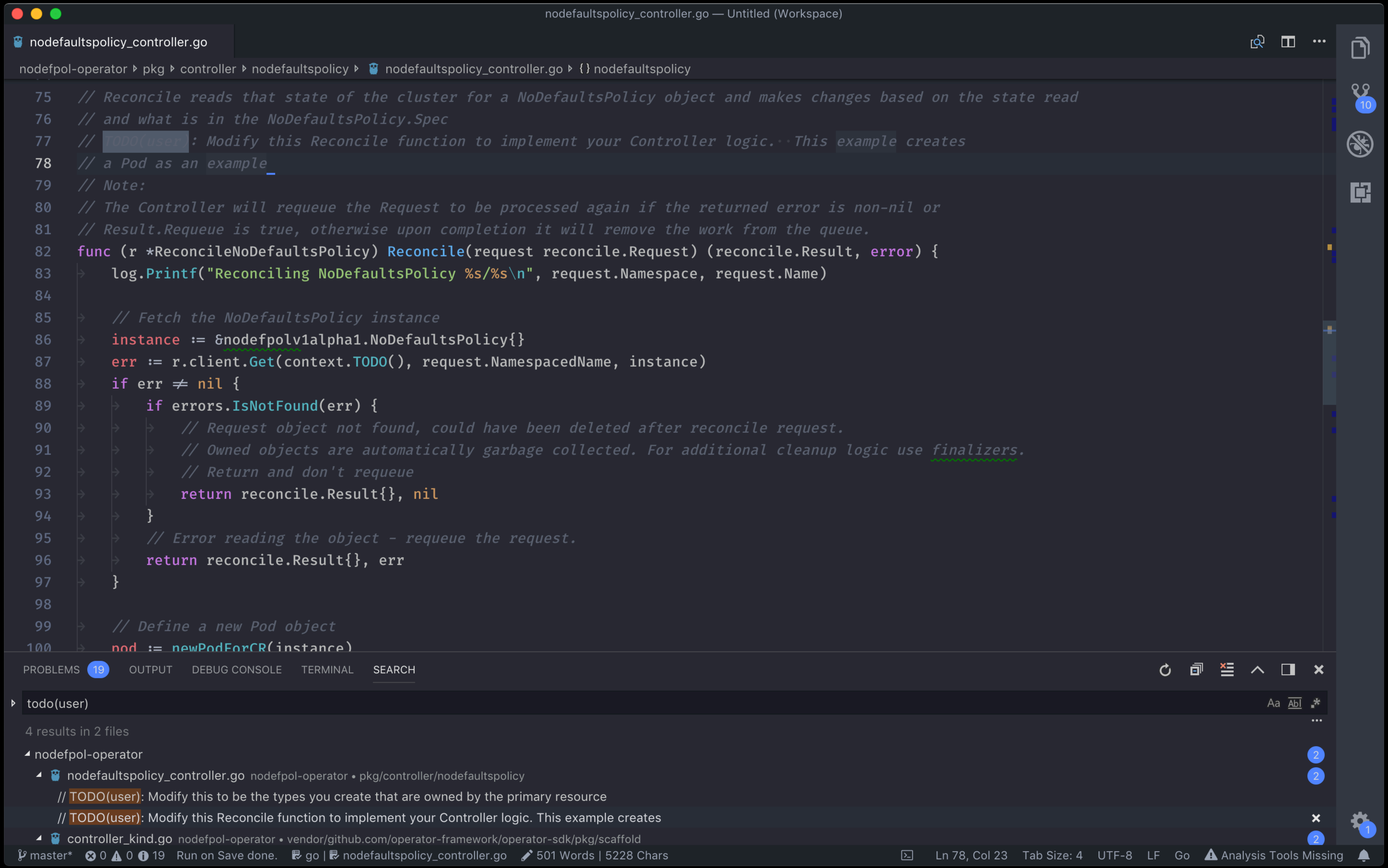
grep '//TODO(user)'



nodefaultspolicy_controller.go — Untitled (Workspace)

nodefpol-operator › pkg › controller › nodefaultspolicy › nodefaultspolicy_controller.go › {} nodefaultspolicy

```go
// Reconcile reads that state of the cluster for a NoDefaultsPolicy object and makes changes based on the state read
// and what is in the NoDefaultsPolicy.Spec
// TODO(user): Modify this Reconcile function to implement your Controller logic.  This example creates
// a Pod as an example
// Note:
// The Controller will requeue the Request to be processed again if the returned error is non-nil or
// Result.Requeue is true, otherwise upon completion it will remove the work from the queue.
func (r *ReconcileNoDefaultsPolicy) Reconcile(request reconcile.Request) (reconcile.Result, error) {
	log.Printf("Reconciling NoDefaultsPolicy %s/%s\n", request.Namespace, request.Name)

	// Fetch the NoDefaultsPolicy instance
	instance := &nodefpolv1alpha1.NoDefaultsPolicy{}
	err := r.client.Get(context.TODO(), request.NamespacedName, instance)
	if err != nil {
		if errors.IsNotFound(err) {
			// Request object not found, could have been deleted after reconcile request.
			// Owned objects are automatically garbage collected. For additional cleanup logic use finalizers.
			// Return and don't requeue
			return reconcile.Result{}, nil
		}
		// Error reading the object - requeue the request.
		return reconcile.Result{}, err
	}

	// Define a new Pod object
	pod := newPodForCR(instance)
```

PROBLEMS 19 · OUTPUT · DEBUG CONSOLE · TERMINAL · SEARCH

```
todo(user)
4 results in 2 files
nodefpol-operator
  nodefaultspolicy_controller.go nodefpol-operator • pkg/controller/nodefaultspolicy
    // TODO(user): Modify this to be the types you create that are owned by the primary resource
    // TODO(user): Modify this Reconcile function to implement your Controller logic. This example creates
  controller_kind.go nodefpol-operator • vendor/github.com/operator-framework/operator-sdk/pkg/scaffold
```

master* ⊗ 0 ⚠ 0 ⓘ 19 Run on Save done. go | nodefaultspolicy_controller.go 501 Words | 5228 Chars Ln 78, Col 23 Tab Size: 4 UTF-8 LF Go ⚠ Analysis Tools Missing

A

Extension API servers

- Full control but a lot of effort and responsibility
  kubernetes.io/docs/tasks/access-kubernetes-api/setup-extension-api-server
- Typically more LOC than an controller or operator
- You might end up to manage storage in `etcd` yourself
- And beyond: the Open Service Broker API and the service catalog
  kubernetes.io/docs/concepts/extend-kubernetes/service-catalog
  openservicebrokerapi.org

redhat.

I

Scheduler extensions

A scheduler selects a node to run your pods on, based on resource requirements, QoS, affinity, etc.

jvns.ca/blog/2017/07/27/how-does-the-kubernetes-scheduler-work

- You can modify policies or run multiple schedulers (with pod opt-in)

  kubernetes.io/docs/tasks/administer-cluster/configure-multiple-schedulers

  embano1.github.io/post/sched-reconcile

- You can use a Webhook

  github.com/kubernetes/community/blob/master/contributors/design-proposals/scheduling/scheduler_extender.md

Other stuff you can customize in Kubernetes

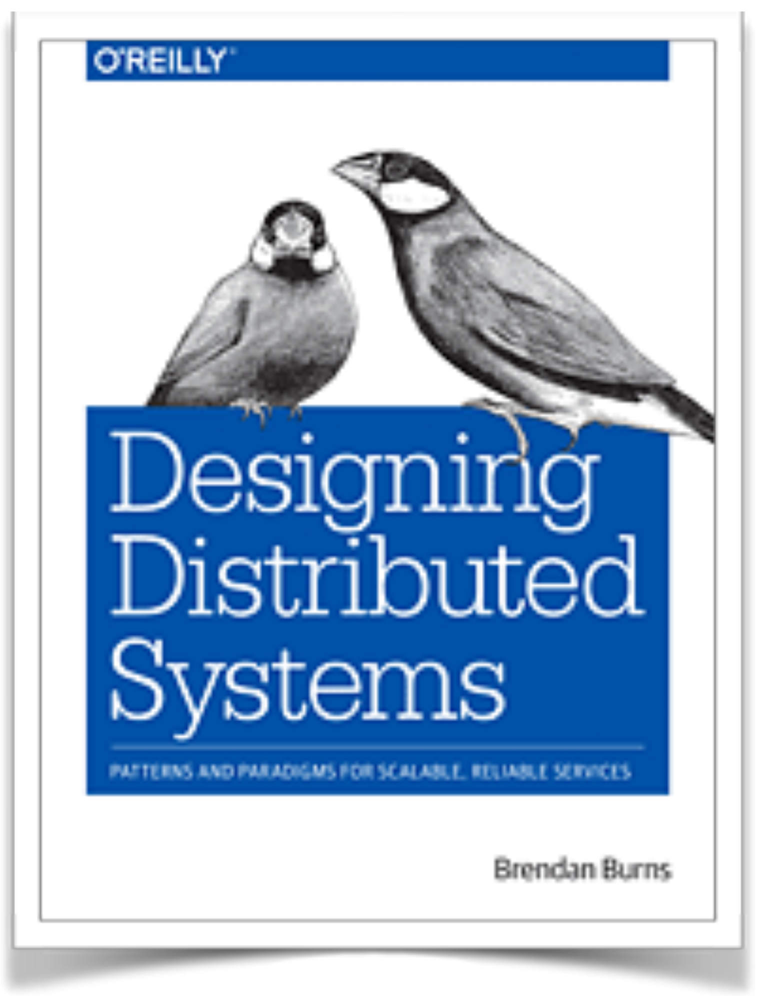
- Monitoring & alerting (Prometheus/Grafana), logging (ELK/EFK stack)
- Secret management (encryption at rest, Vault)
- Ingress

  kubernetes.io/docs/concepts/services-networking/ingress
- DNS

  kubernetes.io/docs/tasks/administer-cluster/dns-custom-nameservers
- kube-proxy

  kubernetes.io/blog/2018/07/09/ipvs-based-in-cluster-load-balancing-deep-dive

Resources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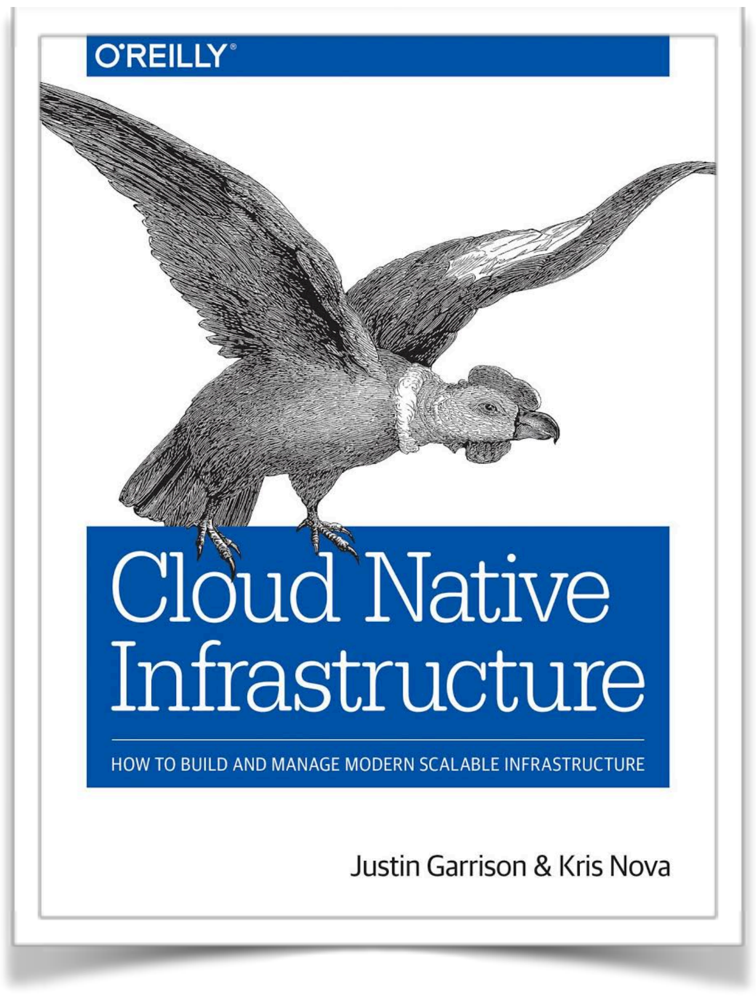
Designing Distributed Systems

PATTERNS AND PARADIGMS FOR SCALABLE, RELIABLE SERVICES

Brendan Burns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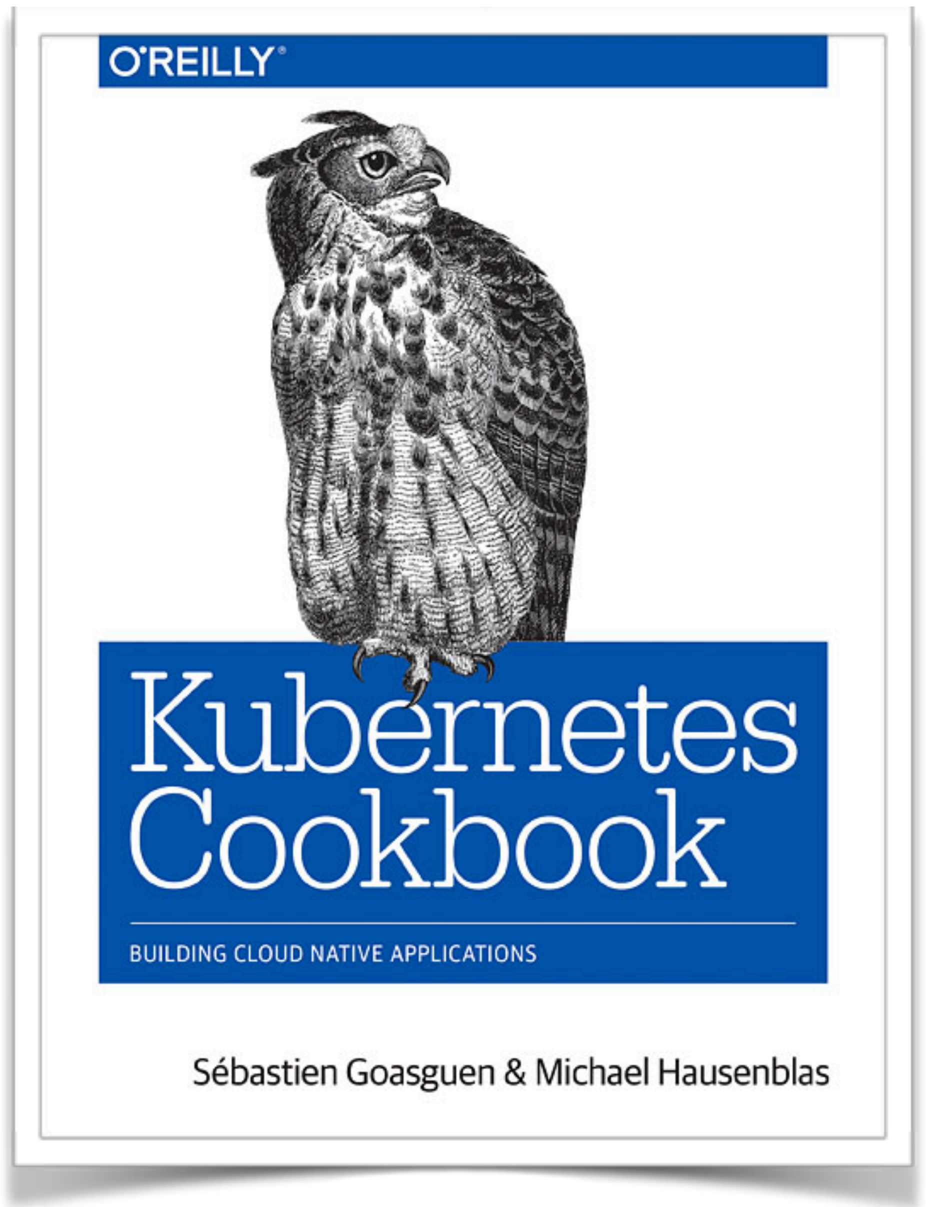
Cloud Native Infrastructure

HOW TO BUILD AND MANAGE MODERN SCALABLE INFRASTRUCTURE

Justin Garrison & Kris Nova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Kubernetes Cookbook

BUILDING CLOUD NATIVE APPLICATIONS

Sébastien Goasguen & Michael Hausenblas

FREE eBOOK:

The Cloud Native Attitude

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Cloud Native but were afraid to ask.

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Your guide to Cloud Native:
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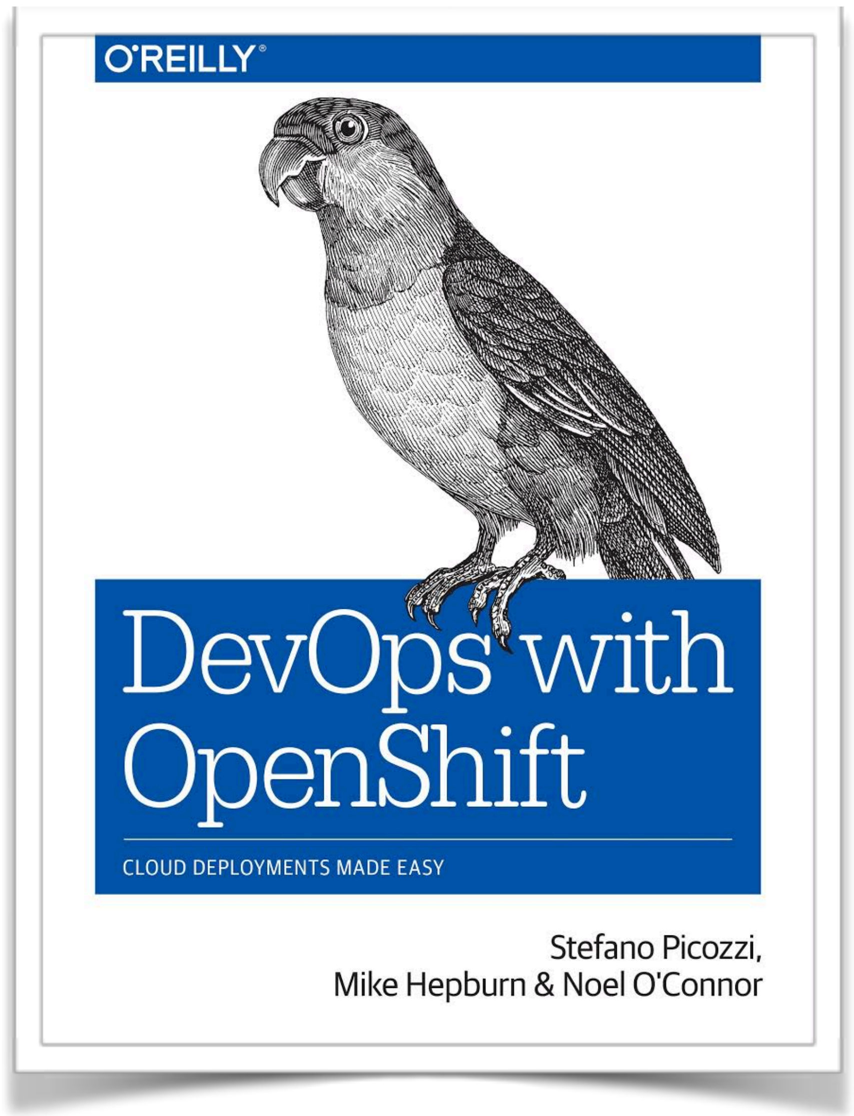
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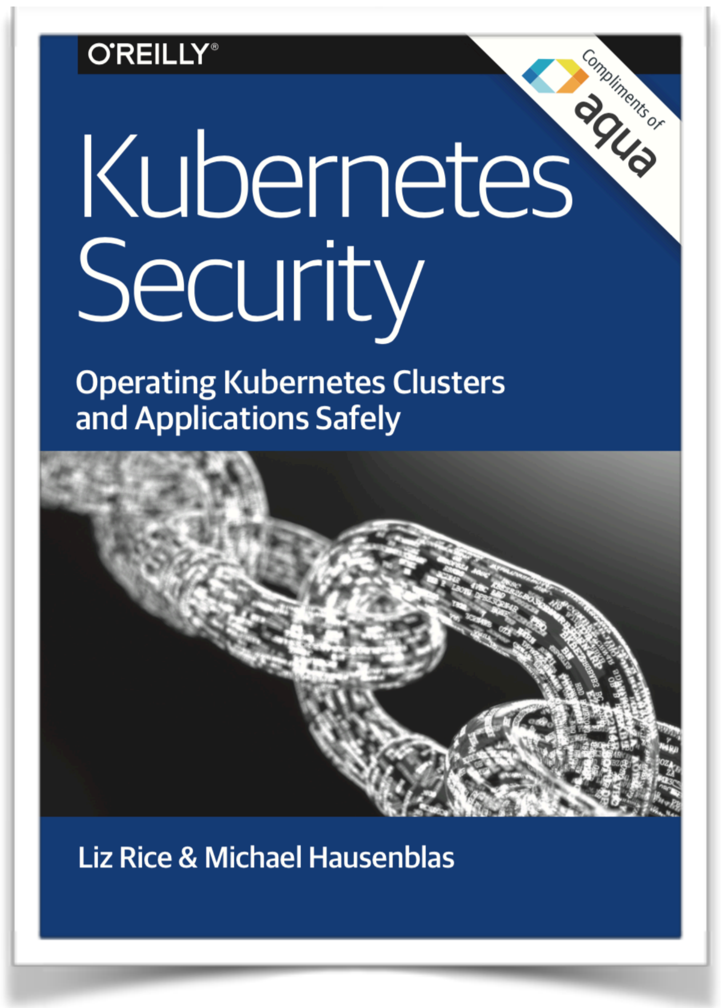
DevOps with OpenShift

CLOUD DEPLOYMENTS MADE EASY

Stefano Picozzi,
Mike Hepburn & Noel O'Connor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Compliments of aqua

Kubernetes Security

Operating Kubernetes Clusters
and Applications Safely

Liz Rice & Michael Hausenblas

redhat.

Articles and slide decks

- *Tim Hockin*—Kubernetes Extensibility
  speakerdeck.com/thockin/kubernetes-extensibility
- *Jonathan Berkhahn & Carolyn Van Slyck*—Kubectl Plugins 101
  kccnceu18.sched.com/event/DqwJ/kubectl-plugins-101-jonathan-berkhahn-ibm-carolyn-van-slyck-microsoft-intermediate-skill-level-slides-attached
- *Adrien Trouillaud*—Kubernetes Custom Resource, Controller & Operator Development Tools
  admiralty.io/kubernetes-custom-resource-controller-and-operator-development-tools.html
- *Toader Sebastian*—A complete guide to Kubernetes Operator SDK
  banzaicloud.com/blog/operator-sdk/
- *Rob Szumski*—Building an Kubernetes Operator for Prometheus and Thanos
  robszumski.com/building-an-operator/

Repos, examples, tooling

- github.com/kubernetes/kubectl/tree/master/pkg/pluginutils
- github.com/carolynvs/kubectl-flags-plugin
- github.com/jordanwilson230/kubectl-plugins
- github.com/kelseyhightower/denyenv-validating-admission-webhook
- github.com/kubernetes-sigs/controller-tools
- github.com/kubernetes-sigs/kubebuilder
- metacontroller.app
- github.com/yaronha/kube-crd
- github.com/operator-framework/operator-sdk
- github.com/operator-framework/awesome-operators
- reactiveops.github.io/rbac-manager

Kubernetes docs and blog posts

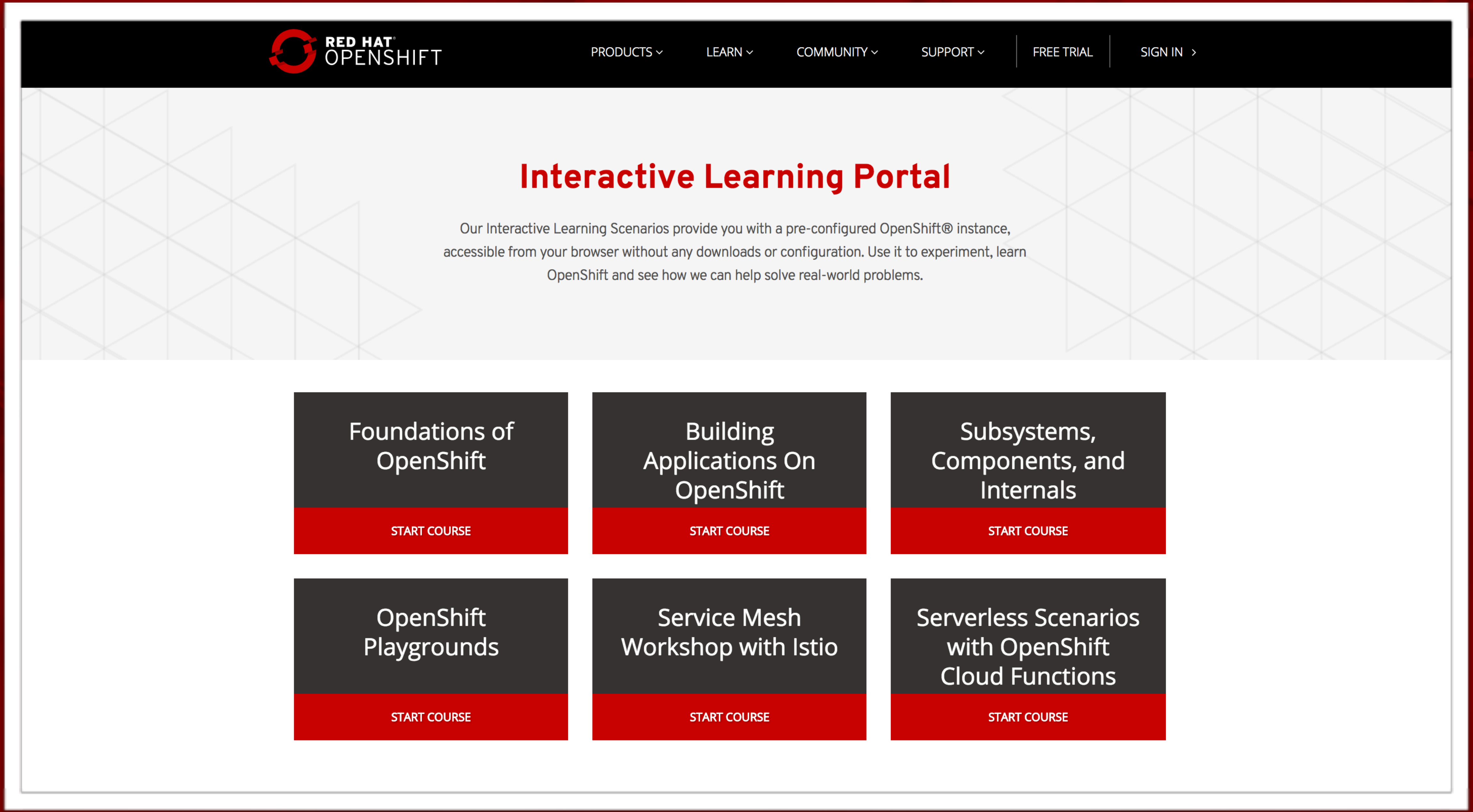
- kubernetes.io/docs/concepts/extend-kubernetes/extend-cluster/
  - kubernetes.io/docs/concepts/extend-kubernetes/api-extension/custom-resources/
  - kubernetes.io/docs/concepts/extend-kubernetes/api-extension/apiserver-aggregation/
  - kubernetes.io/docs/tasks/access-kubernetes-api/setup-extension-api-server/
- kubernetes.io/docs/tasks/extend-kubectl/kubectl-plugins/
- kubernetes.io/docs/reference/access-authn-authz/webhook/
- kubernetes.io/docs/setup/scratch/#cloud-provider
- kubernetes.io/blog/2018/01/extensible-admission-is-beta/

Videos

- *Tim Hockin & Michael Rubin*—Kubernetes Distributions and ‘Kernels' https://www.youtube.com/watch?v=fXBjA2hH-CQ
- *Stefan Schimanski*:
    - Kubernetes as a API driven platform, Reykjavík Kubernetes Meetup https://www.youtube.com/watch?v=BiE7oKeEzDU
    - SIG API Machinery Deep Dive https://www.youtube.com/watch?v=XsFH7OEIIvI
- *James Munnelly*—Extending the Kubernetes API: What the Docs Don't Tell You https://www.youtube.com/watch?v=PYLFZVv68lM

redhat

learn.openshift.com



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