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Building a Platform Engineering API Layer with kcp

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Agenda

1. Kubernetes as an API Layer
2. Lightweight Clusters to the Rescue
3. What is kcp?
    a. Workspaces
4. The API Marketplace
    a. Create APIs with APIExports
    b. Enable APIs with APIBindings
    c. Implement APIs with Virtual Workspaces
5. Wrapping Up

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Kubernetes as the API layer

for your platform

Kubernetes' API design is awesome!

(that's it. that's the ~~tweet~~ slide)

Kubernetes as an API layer

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KnativeCon NORTH AMERICA

But …

- CRDs are cluster-scoped, so everyone shares them.
- Scaling becomes a problem at some point.
- You don’t need the workload orchestration part for APIs.

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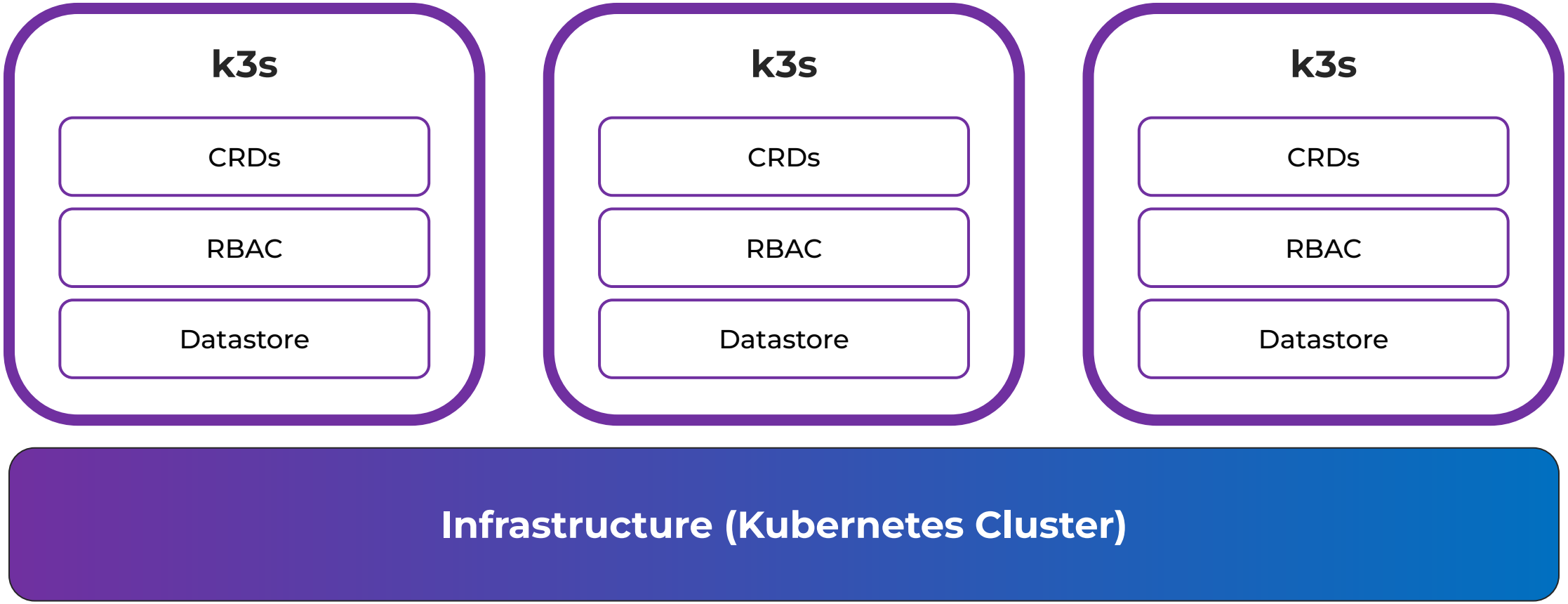
Lightweight Clusters

to the rescue

Lightweight Clusters



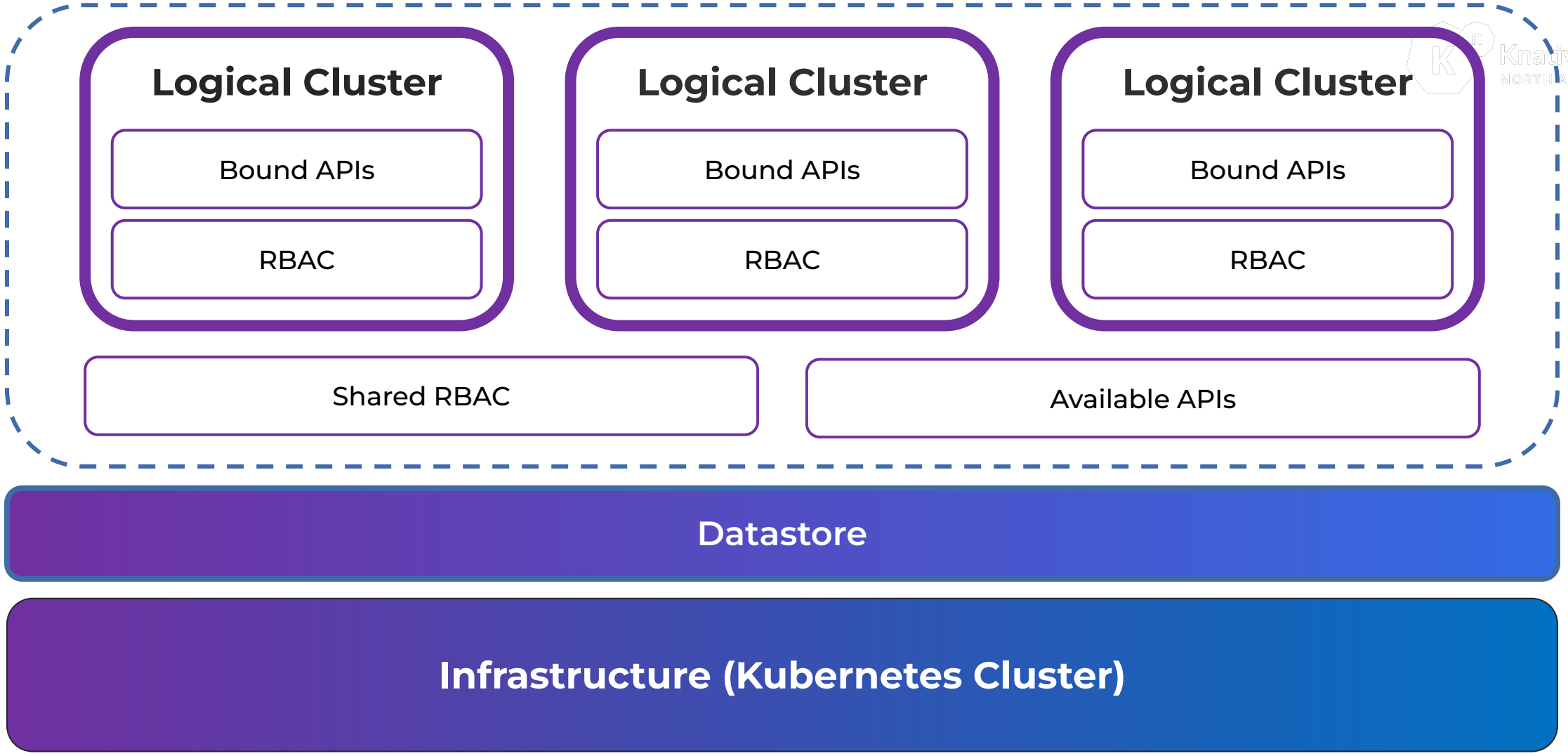
Lightweight Clusters

But what if ...

Lightweight Clusters

we “virtualized” API servers?

Logical Clusters



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What is kcp?

What is kcp?

A horizontally scalable control plane for Kubernetes-style APIs.

What is kcp?

CLOUD NATIVE COMPUTING FOUNDATION

Sandbox project (since end of 2023)

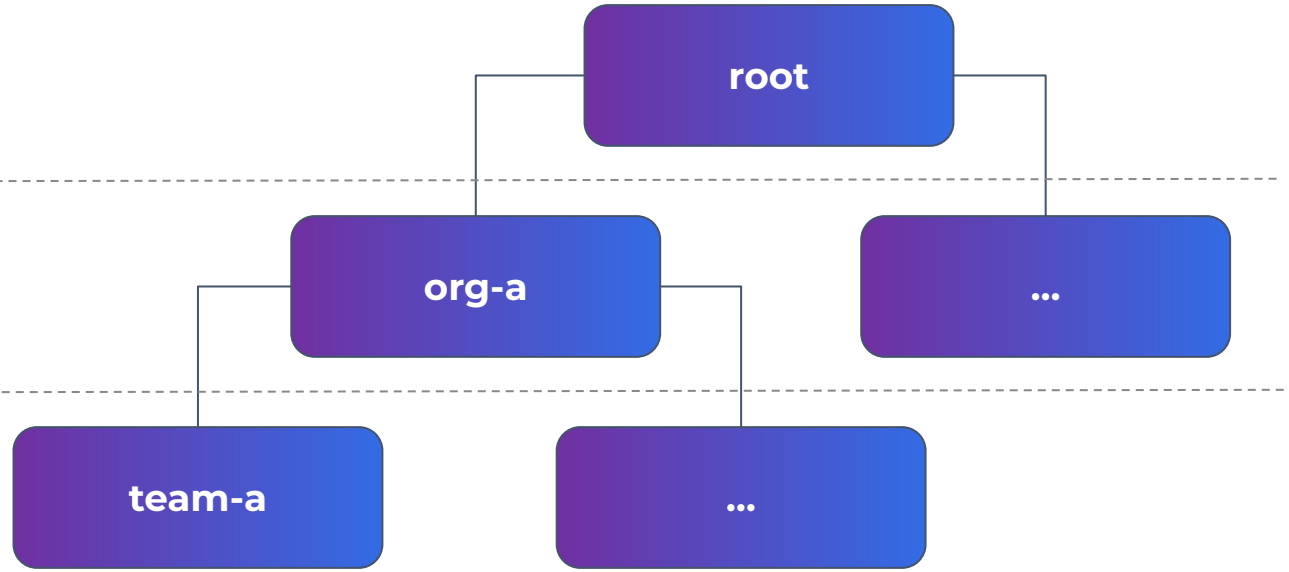
Workspaces

Workspaces implement the concept of logical clusters.

`https://kcp:6443/clusters/root`

`https://kcp:6443/clusters/root:org-a`

`https://kcp:6443/clusters/root:org-a:team-a`



Workspaces

And you can navigate them!

```
$ kubectl ws .
Current workspace is "root".

$ kubectl get ws
NAME    TYPE           REGION   PHASE   URL          AGE
org-a   organization            Ready   https://…    69d
org-b   organization            Ready   https://…    65d

$ kubectl ws org-a
Current workspace is "root:org-a" (type root:organization).

$ kubectl get ws
NAME     TYPE   REGION   PHASE   URL          AGE
team-a   team            Ready   https://…    3m23s
team-b   team            Ready   https://…    3m18s


$ kubectl ws team-a
Current workspace is "root:org-a:team-a" (type root:team).
```

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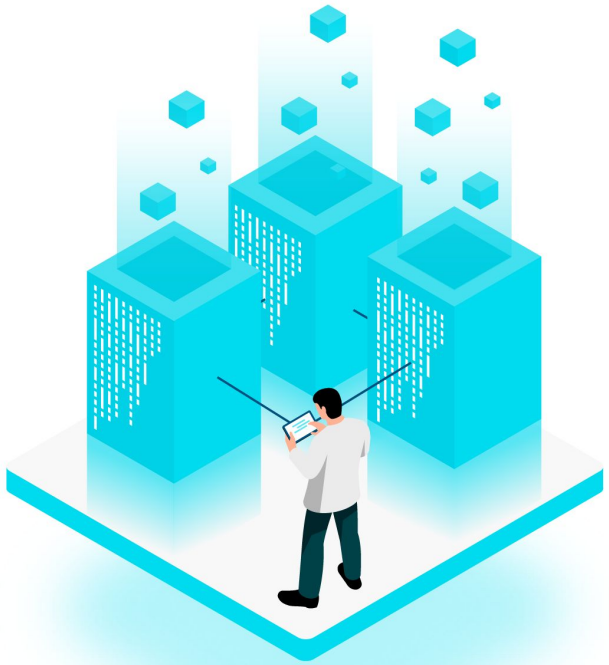
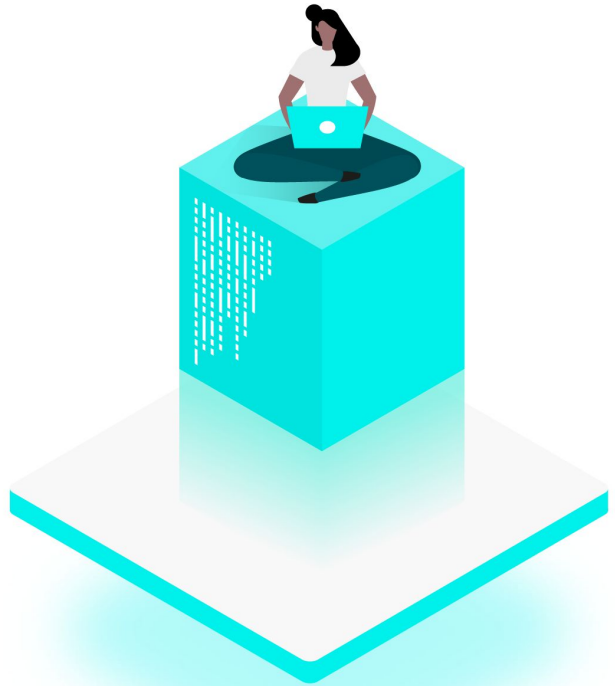
The API Marketplace

The API Marketplace



APIs



Infrastructure + Service Providers

Developers + Other Users

The API Marketplace

Infrastructure + Service teams are not in the business of making APIs discoverable and consumable.

Platform teams are.

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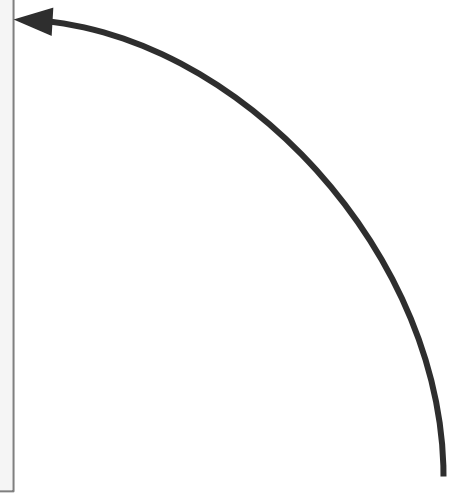
Create APIs

with APIExports

APIResourceSchema


```
apiVersion: apis.kcp.io/v1alpha1
kind: APIResourceSchema
  name: v1.certificates.demo.embik.me
spec:
  group: certificates.demo.embik.me
  names:
    kind: Certificate
    listKind: CertificateList
    plural: certificates
    singular: certificate
  scope: Namespaced
  versions:
    [...]
```



Hey, this is a CRD!

APIResourceSchema


```
$ kubectl kcp crd snapshot --filename=crd.yaml --prefix=vc517860e
```

– or –

```
kcpv1alpha1.CRDToAPIResourceSchema(crd, prefix)
```

APIExport


```
apiVersion: apis.kcp.io/v1alpha1
kind: APIExport
metadata:
  name: demo.embik.me
spec:
  latestResourceSchemas:
    - v1.certificates.demo.embik.me
    - v1.pizzas.demo.embik.me
```

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Enable APIs

with APIBindings

APIs in Workspaces

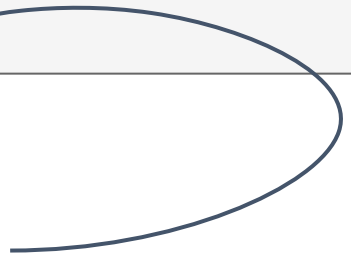
https://kcp:6443/clusters/root:org-a/**api**

```
$ kubectl api-resources
NAME                  SHORTNAMES   APIVERSION                  NAMESPACED  KIND
configmaps            cm           v1                          true        ConfigMap
events                ev           v1                          true        Event
namespaces            ns           v1                          false       Namespace
resourcequotas        quota        v1                          true        ResourceQuota
secrets                            v1                          true        Secret
serviceaccounts       sa           v1                          true        ServiceAccount
[...]
workspaces            ws           tenancy.kcp.io/v1alpha1     false       Workspace
workspacetypes                     tenancy.kcp.io/v1alpha1     false       WorkspaceType
[...]
```

Binding APIExports


```
$ kubectl get apibindings
NAME                        AGE    READY
tenancy.kcp.io-3wb5h        30d    True
topology.kcp.io-cua3o       30d    True
```

```
apiVersion: apis.kcp.io/v1alpha1
kind: APIBinding
metadata:
  name: tenancy.kcp.io-3wb5h
spec:
  reference:
    export:
      name: tenancy.kcp.io
      path: root
```



This references an APIExport in a different workspace!

Binding APIExports

Binding to exported APIs requires RBAC permissions on the **APIExport**

(in the APIExport workspace)

```
apiVersion:
rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
   name: bind-apiexport
rules:
- apiGroups:
  - apis.kcp.io
  resources:
  - apiexports
  verbs:
  - use
  resourceNames:
  - demo.embik.me
```

Binding APIExports


```
$ kubectl api-resources
NAME                  SHORTNAMES   APIVERSION                  NAMESPACED   KIND
configmaps            cm           v1                          true         ConfigMap
events                ev           v1                          true         Event
namespaces            ns           v1                          false        Namespace
resourcequotas        quota        v1                          true         ResourceQuota
secrets                            v1                          true         Secret
serviceaccounts       sa           v1                          true         ServiceAccount
[...]
workspaces            ws           tenancy.kcp.io/v1alpha1     false        Workspace
workspacetypes                     tenancy.kcp.io/v1alpha1     false        WorkspaceType
[...]
certificates          certs        demo.embik.me/v1            true         Certificate
pizzas                             demo.embik.me/v1            false        Pizza
```

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Implement APIs

with virtual workspaces

Virtual Workspaces

Proxies that provide computed views of the data in kcp.

APIExport Virtual Workspace

Provides a view on all resources created from an APIExport.

Building kcp-aware controllers

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1 Use kcp-aware client and cache

```
MapperProvider: kcp.NewClusterAwareMapperProvider,
NewClient:      kcp.NewClusterAwareClient,
NewCache:       kcp.NewClusterAwareCache,
NewAPIReader:   kcp.NewClusterAwareAPIReader,
```

2 Reconcile in VW via `Cluster`

`sigs.k8s.io/controller-runtime/pkg/cluster.Cluster`

3 Reconcile with logical cluster in context

```
ctx = kontext.WithCluster(ctx, logicalcluster.Name(request.ClusterName))
```

github.com/kcp-dev/controller-runtime

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Let’s wrap up

Let’s wrap up

1. kcp is building a global control plane for API-driven platforms.
2. Workspaces allow to reconstruct organizational hierarchy.
3. Providing Kubernetes-style APIs at scale is incredibly easy.

It’s a community project! We welcome everyone to build the project’s future together.

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Thank You!

Catch me at the **Kubermatic** booth – **L11, Hall 7.2**.

#kcp-dev

on Kubernetes Slack