



BUILDING FOR THE ROAD AHEAD

DETROIT 2022

Kcp: Towards 1,000,000 Clusters, Name^WWorkspaced CRDs



Stefan Schimanski
@the_sttts

Proposal: Initial namespaces proposal #1114

8y ago

Merged

thockin merged 1 commit into [kubernetes:master](#) from [derekwayncarr:namespace_proposal](#) on 26 Sep 2014

Conversation 72

Commits 1

Checks 0

Files changed 1



derekwayncarr commented on 29 Aug 2014

Member ...

This is based on feedback and discussion that came out of [#1017](#)

There was discussion that the term project may be problematic, so have removed it in favor of namespace.

I think this aligns nicely with the ACL model discussed thus far.

Feedback appreciated.

@erictune @lavalamp @smarterclayton

Add and validate namespace to pod, service, replication controller objects #1495

Merged

thockin merged 6 commits into [kubernetes:master](#) from [derekwayncarr:introduce_context_obj](#) on 1 Oct 2014

What if namespaces provided more isolation than just names?

like:

discovery, CRDs, different URL, independent permission model, namespace owner is admin

kcp

Workspaces
~~NAMESPACES~~

kcp

1,000,000 Workspaces
~~Namespaces~~

kcp

1,000,000 Workspaces
~~Namespaces~~

Make ppl not to care about clusters anymore.

Is this the better Kube?  

Can I install operators in a namespace finally?

Can we build this into Kubernetes itself?

Is this the better Kube?  

Can I install operators in a namespace finally?

Can we build this into Kubernetes itself?

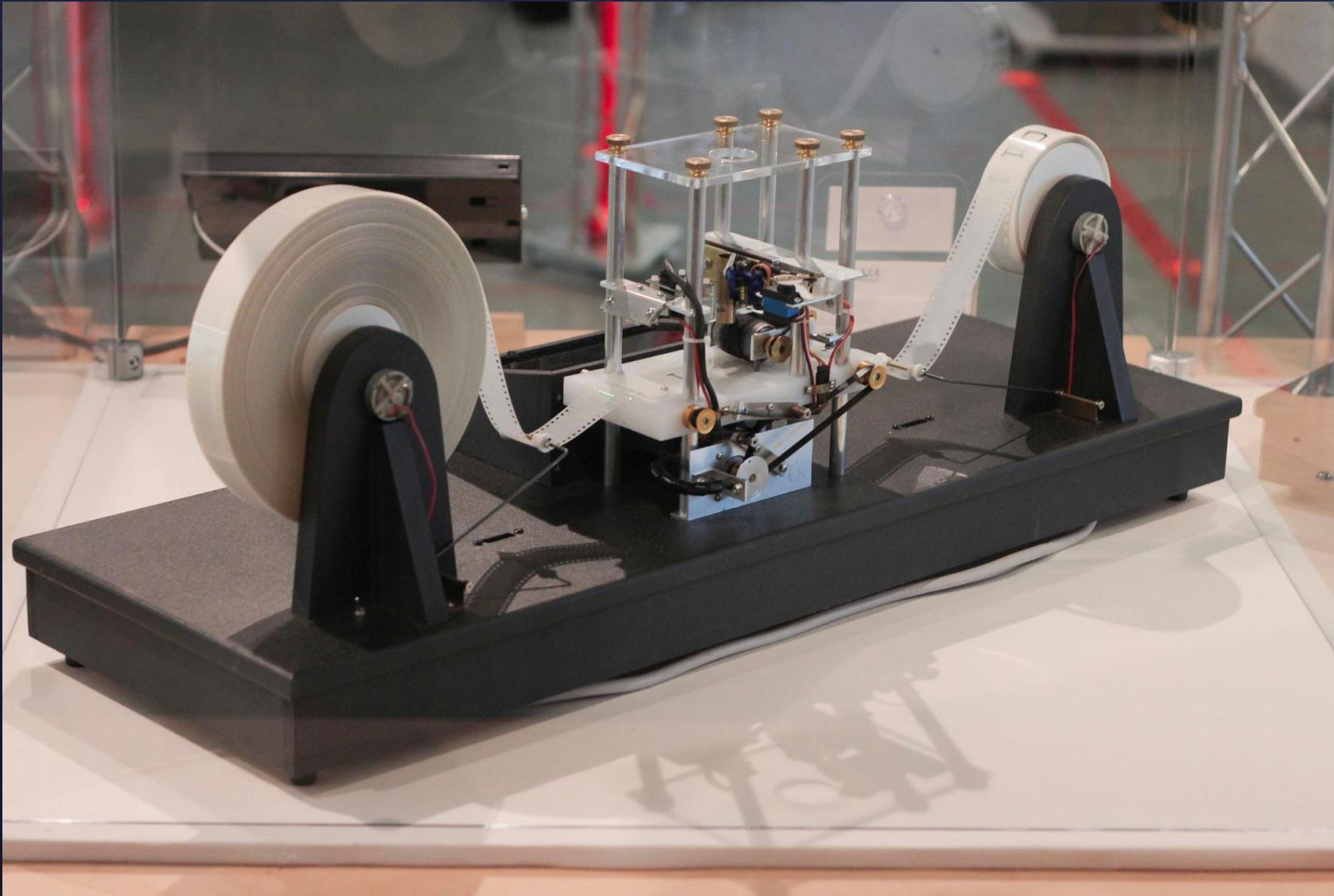
DETROIT 2022

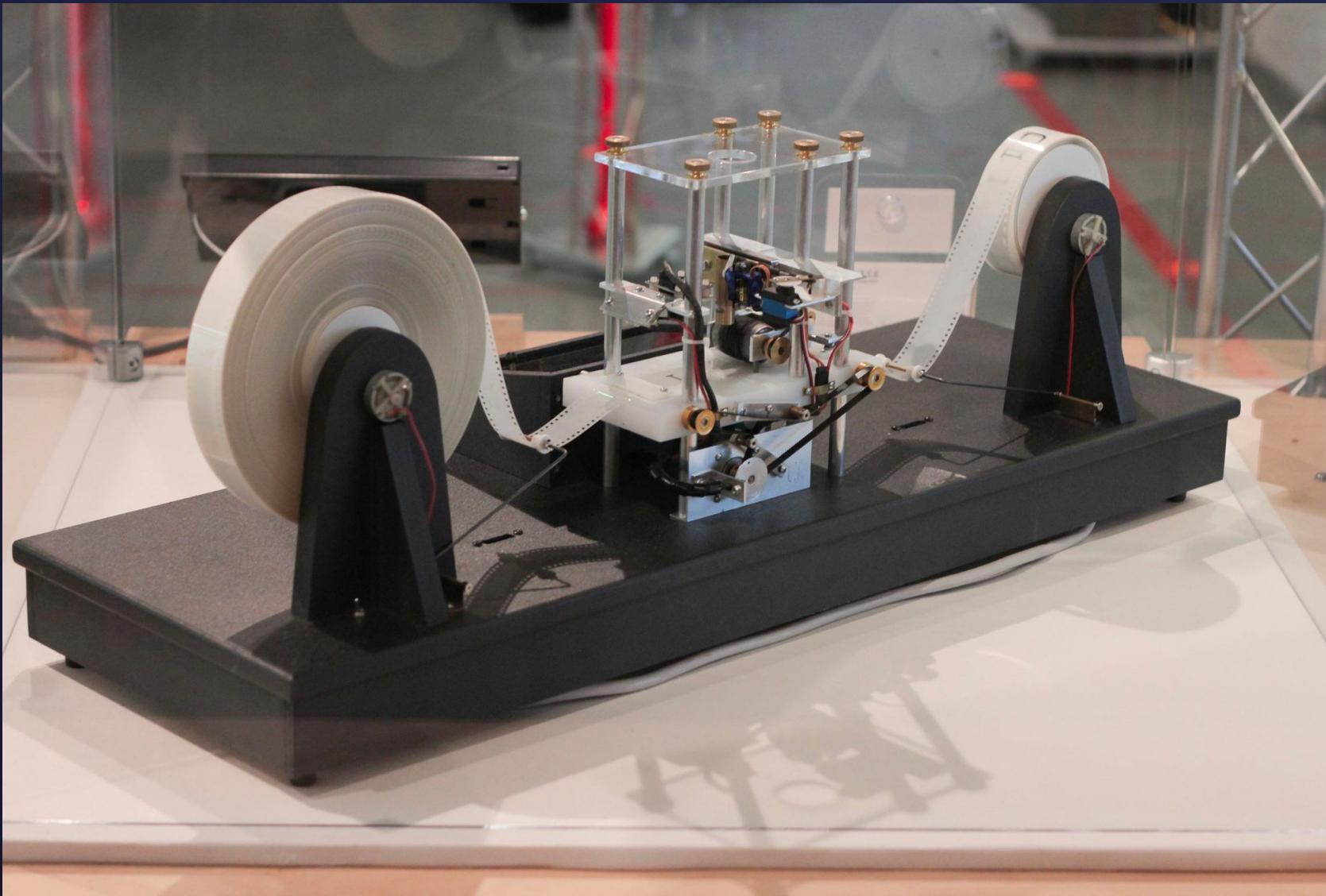


kcp
Machine

BUILDING FOR THE ROAD AHEAD

DETROIT 2022





A physical Turing
machine
with a finite tape

We are going to talk about a compute model:
the kcp machine

We are NOT building the better Kubernetes*.

*An open-source system for automating deployment,
scaling, and management of containerized applications.

For this talk:

Forget about containers.

kcp is not about containers.

For this talk:

Forget about Kubernetes and all its concrete APIs.

A generic apiserver with only CRDs.

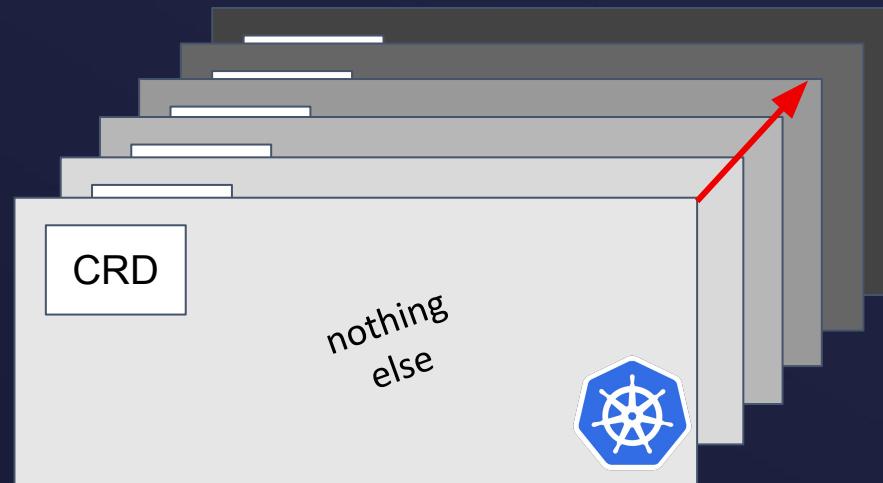


We are going to talk about a compute model:
the kcp machine

We are going to add 3 dimensions in this talk.

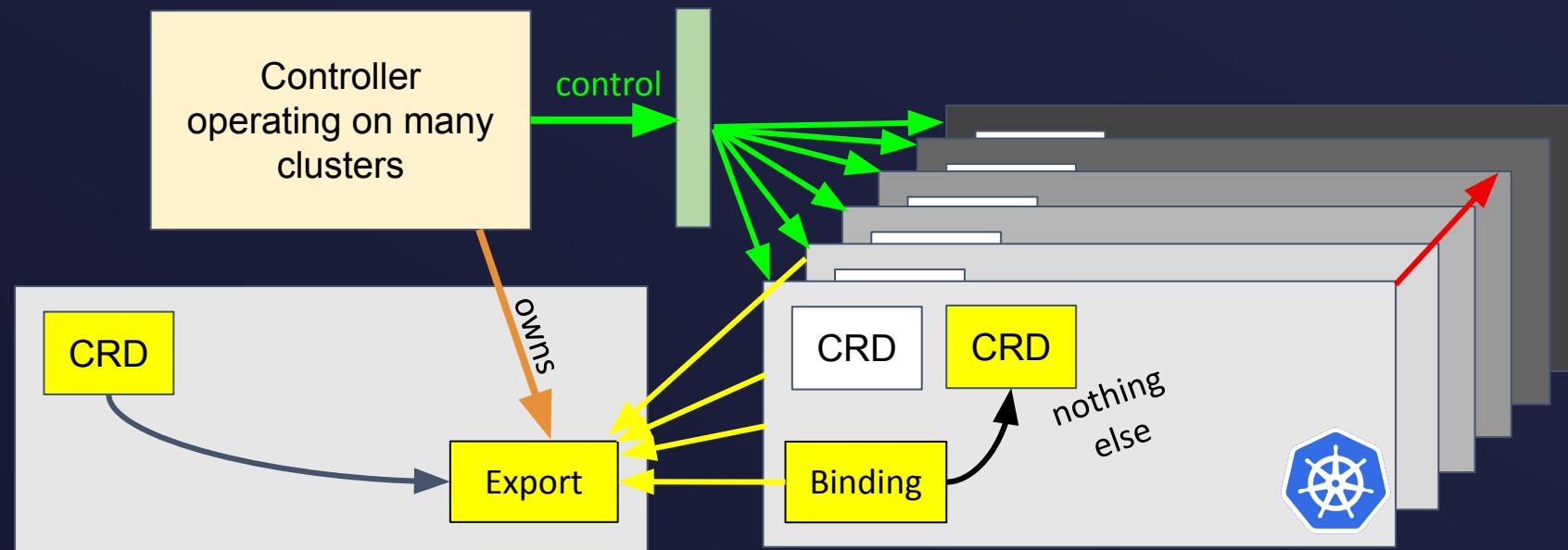


1



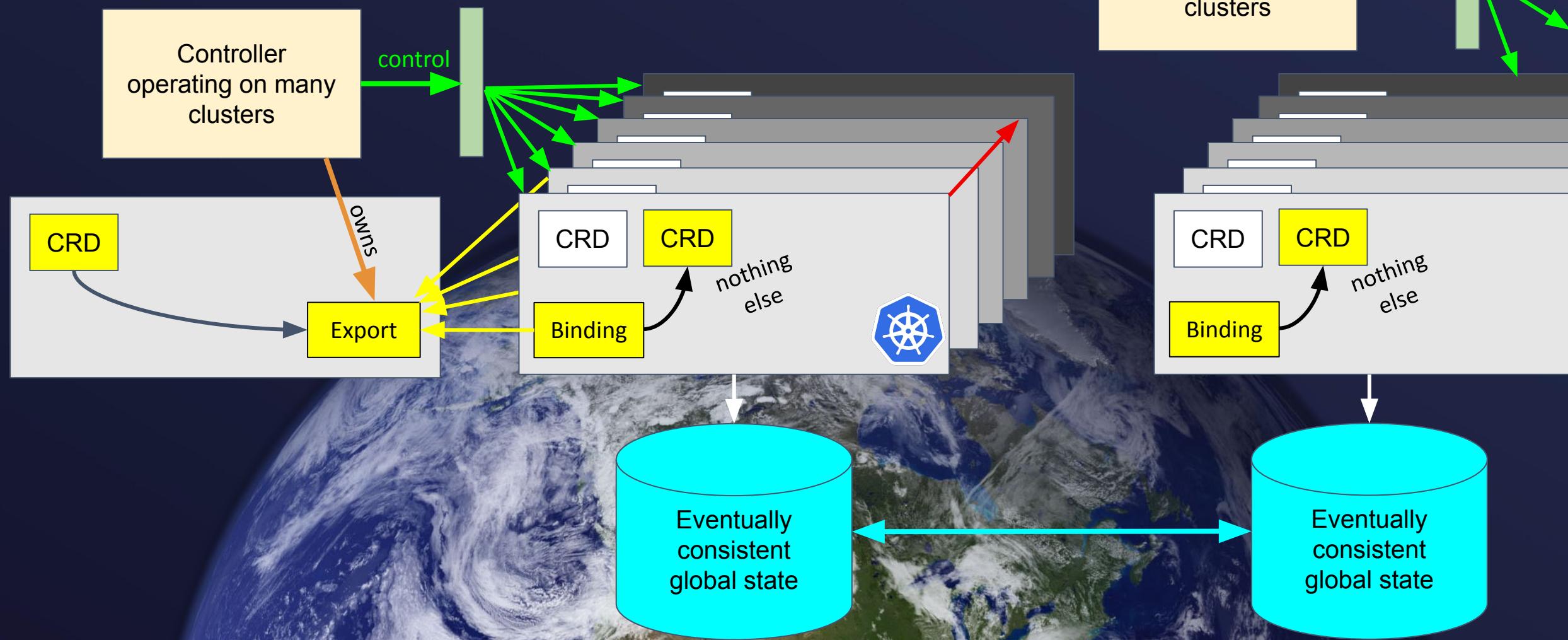
1,000,000

2



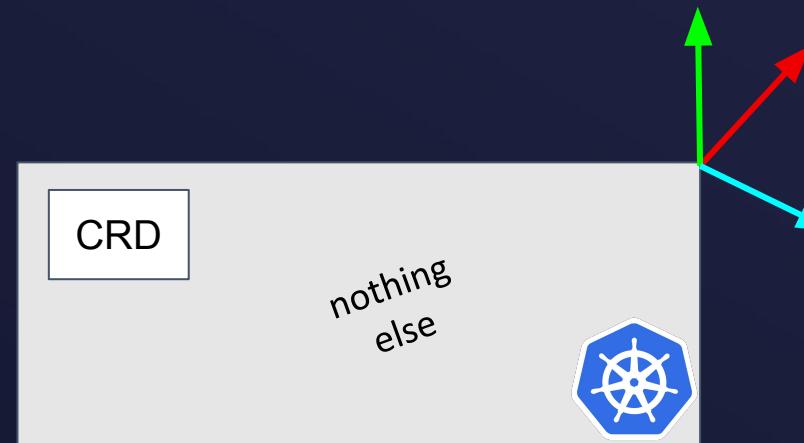
1,000,000

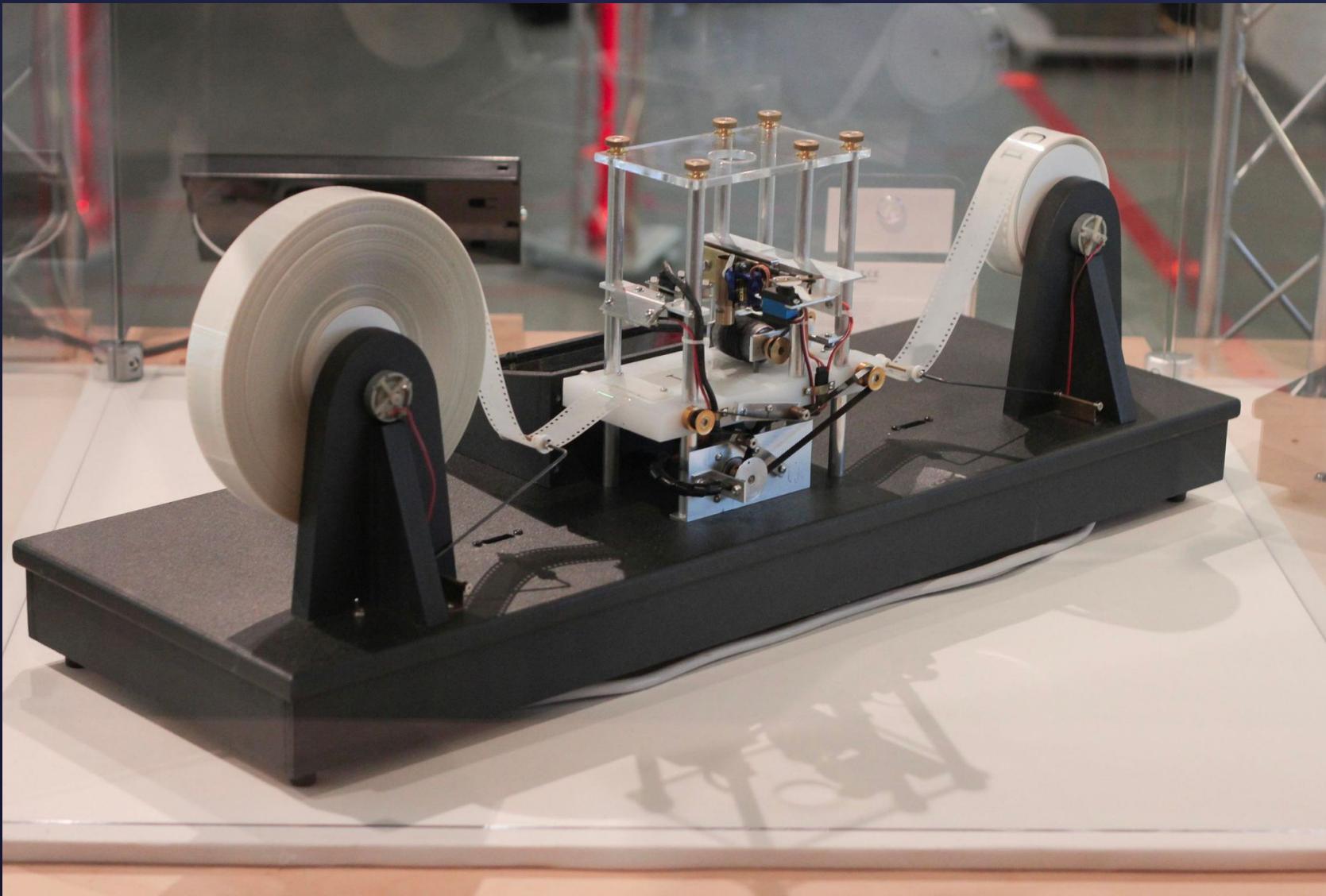
3



Three added dimensions:

1. horizontal scaling
2. API service provider persona
3. planet scale w/ eventual consistent shared state

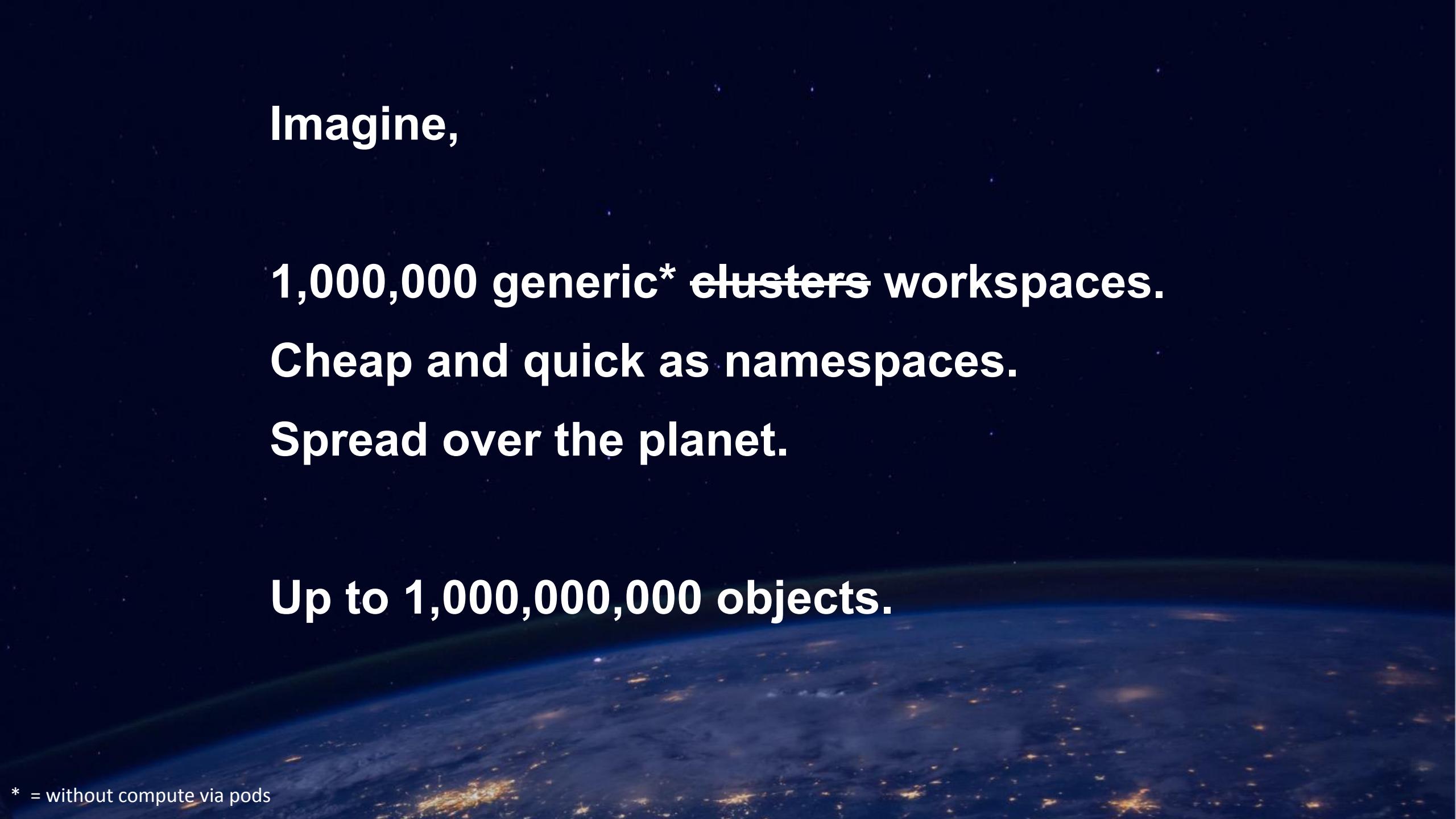




A physical Turing
machine
with a finite tape

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What can you build on the kcp machine?



Imagine,

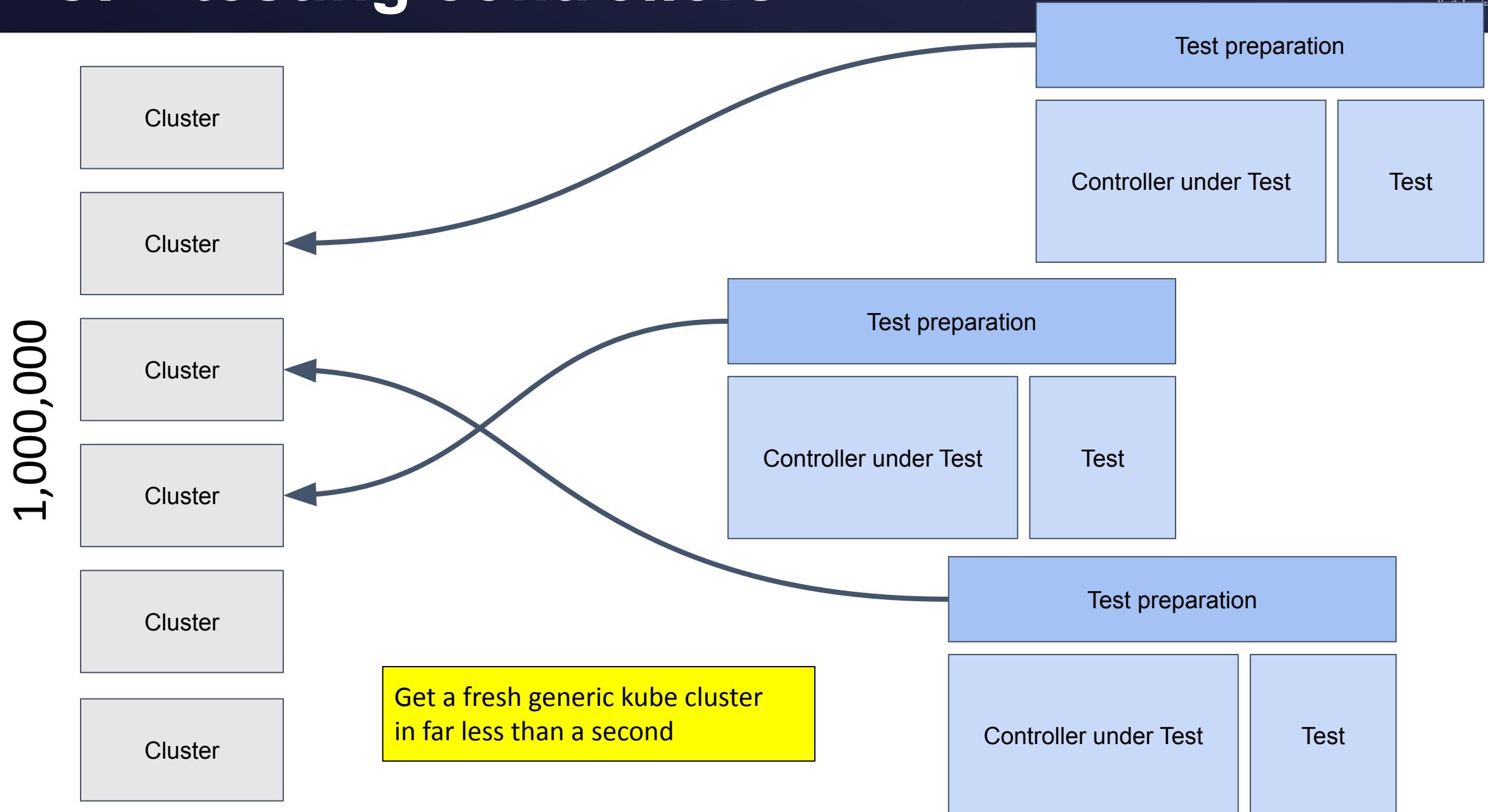
1,000,000 generic* clusters workspaces.

Cheap and quick as namespaces.

Spread over the planet.

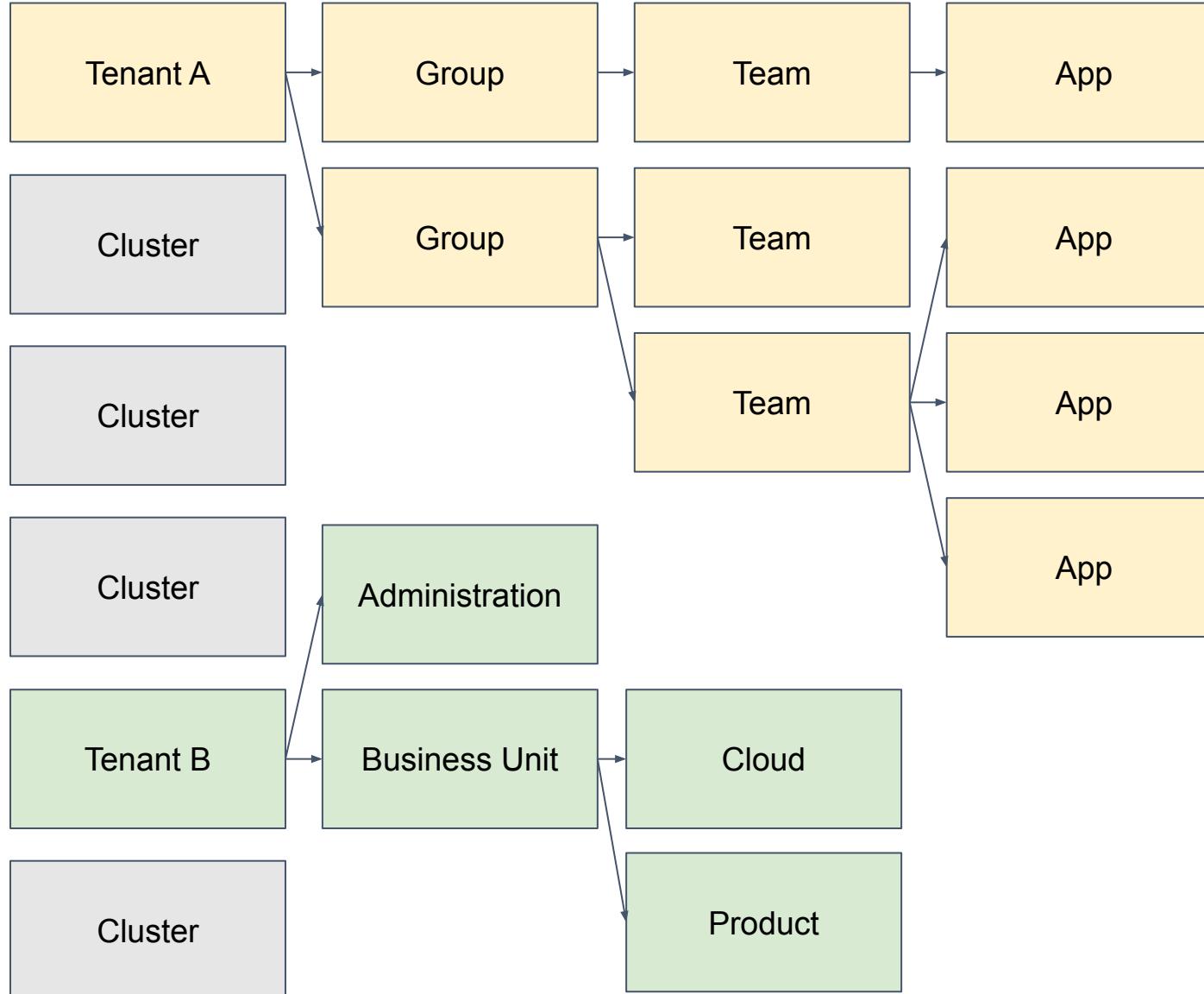
Up to 1,000,000,000 objects.

CI – testing controllers



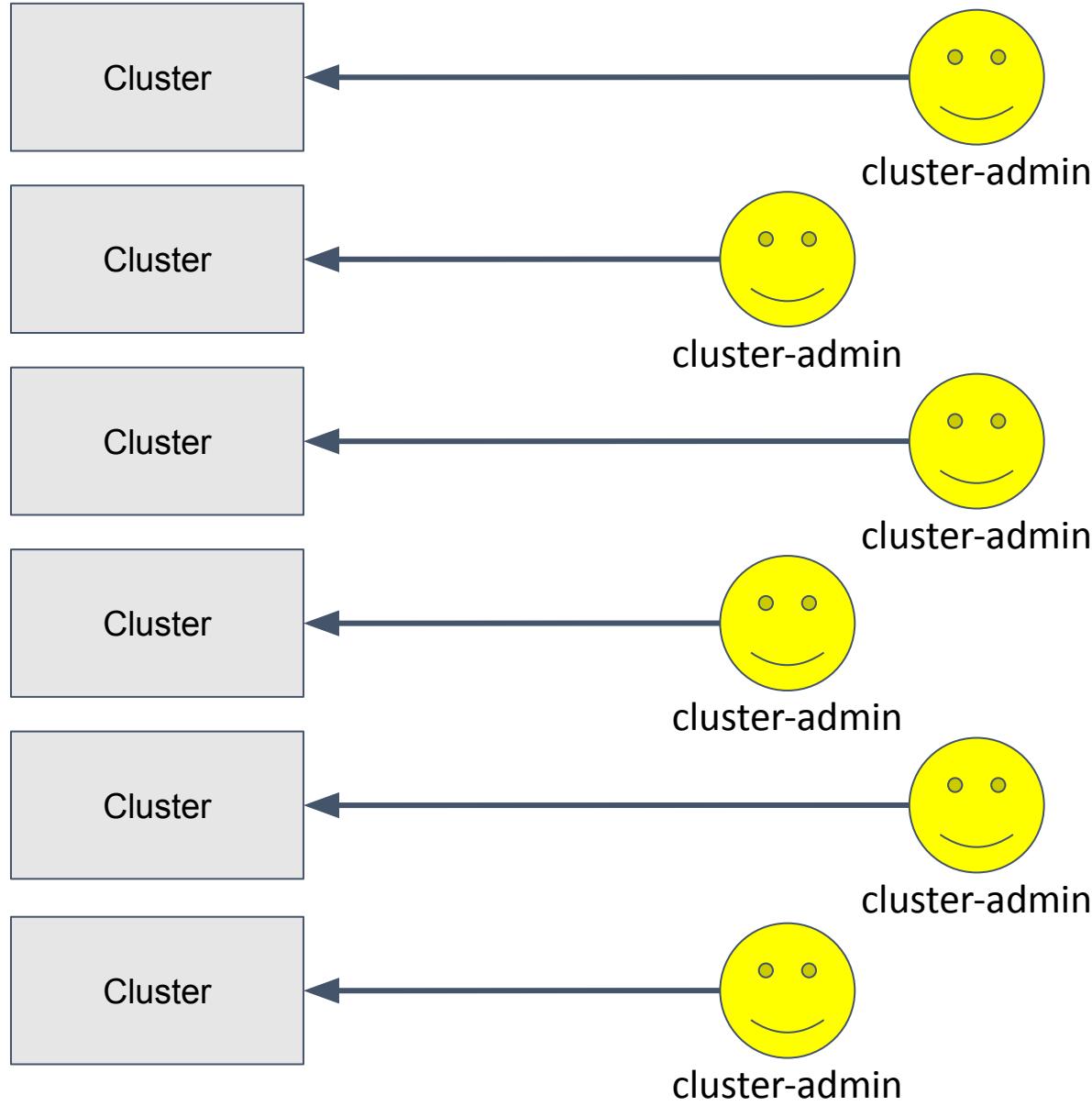
Org Hierarchies

1,000,000



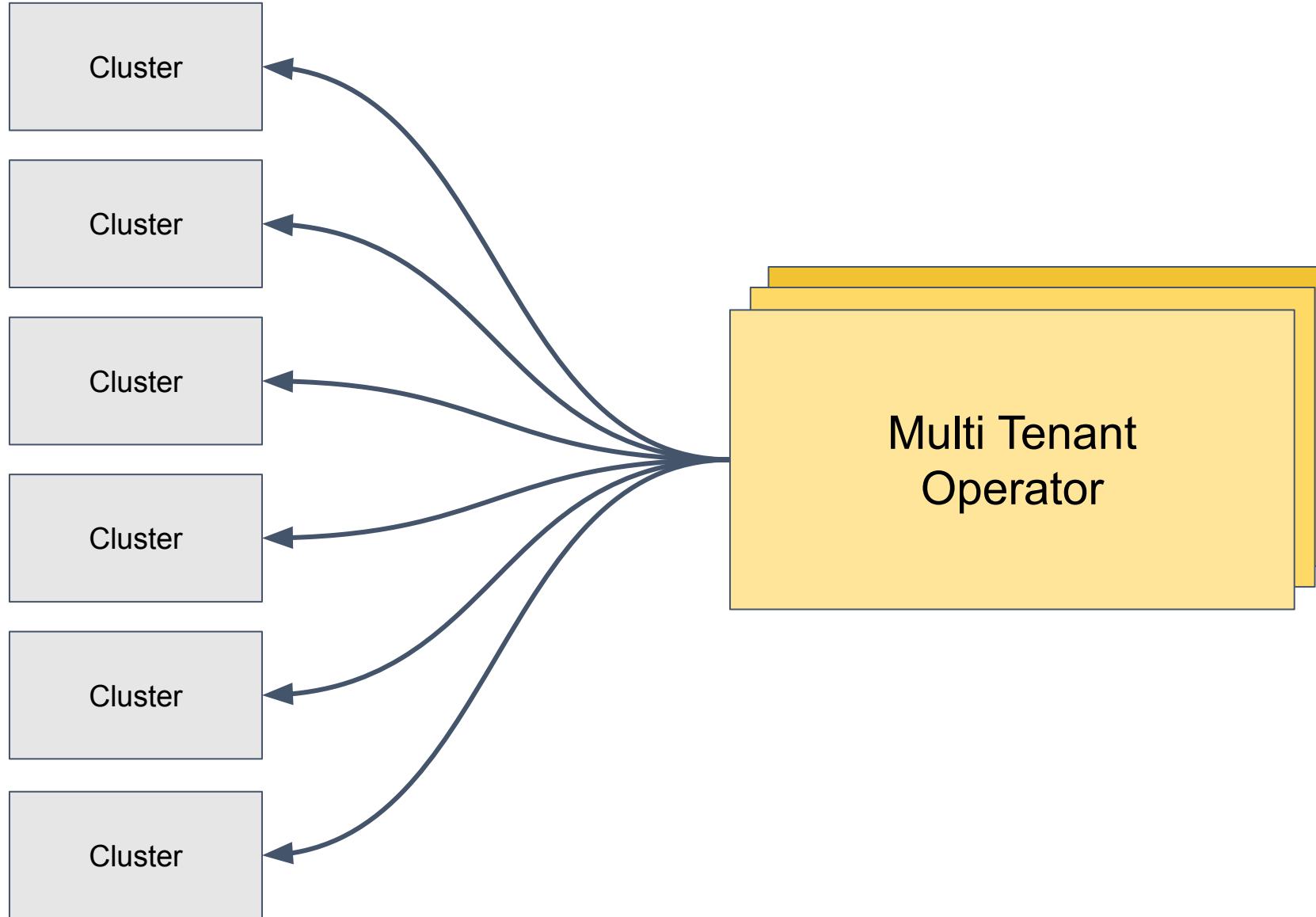
Everybody cluster-admin

1,000,000



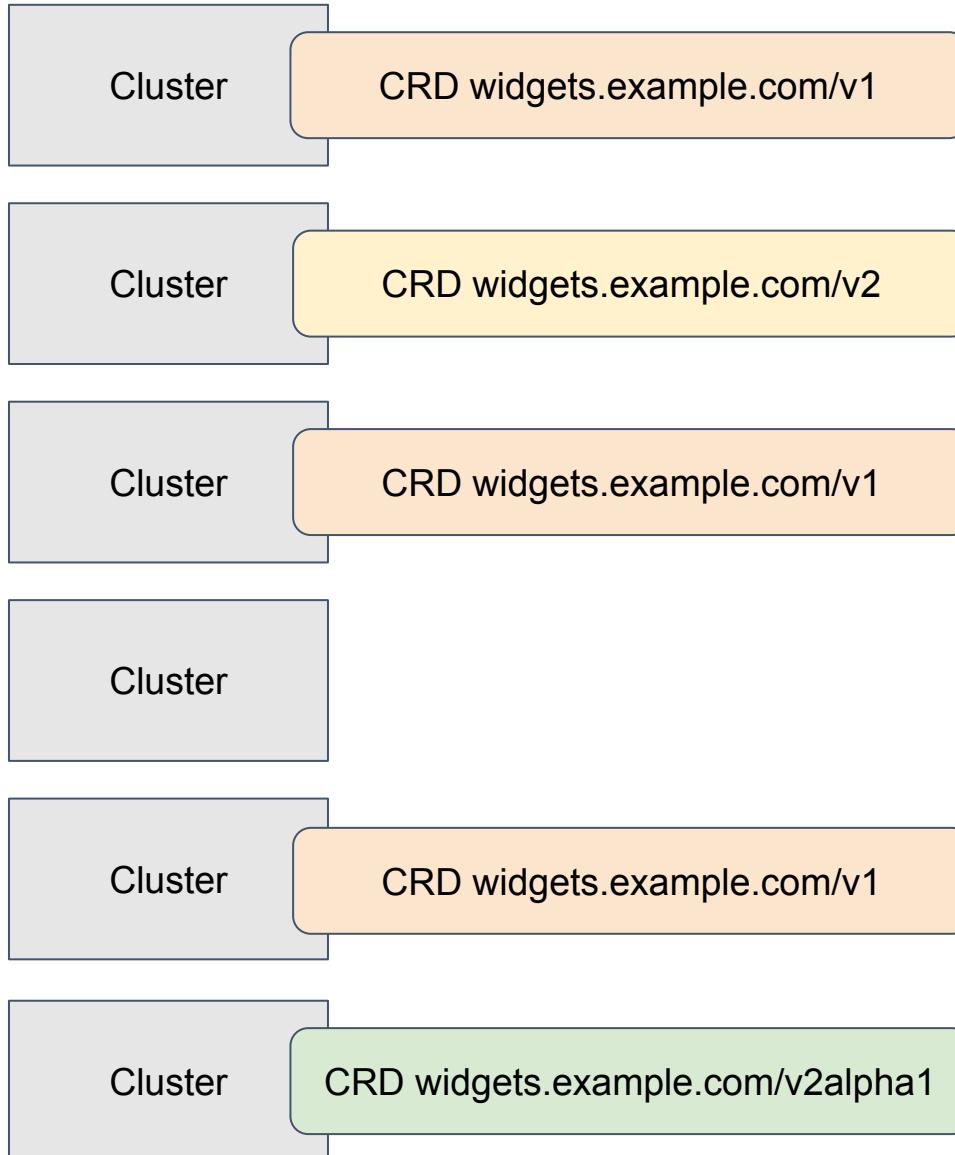
Multi-Tenant Controllers

1,000,000

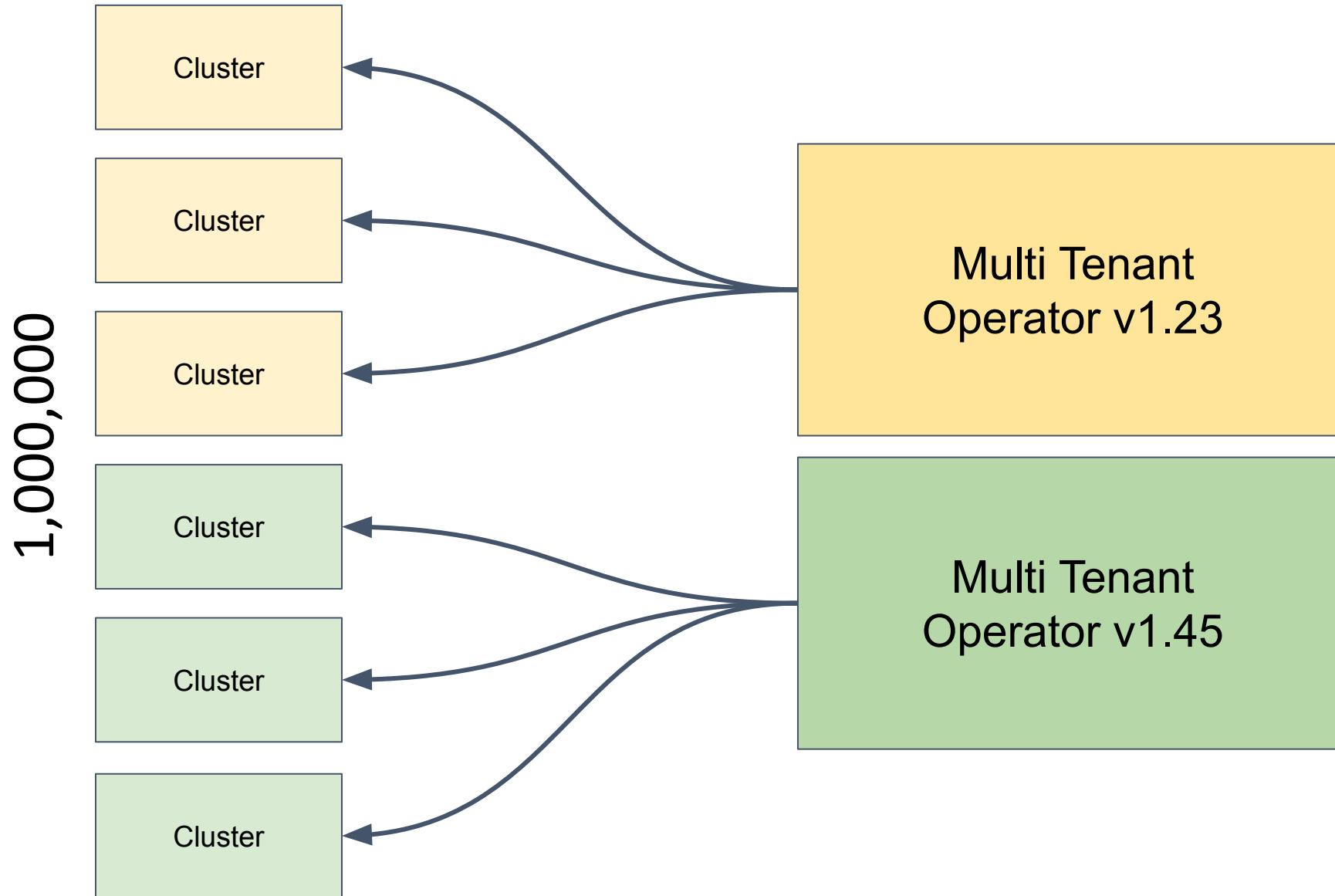


Independent CRD Versions

1,000,000

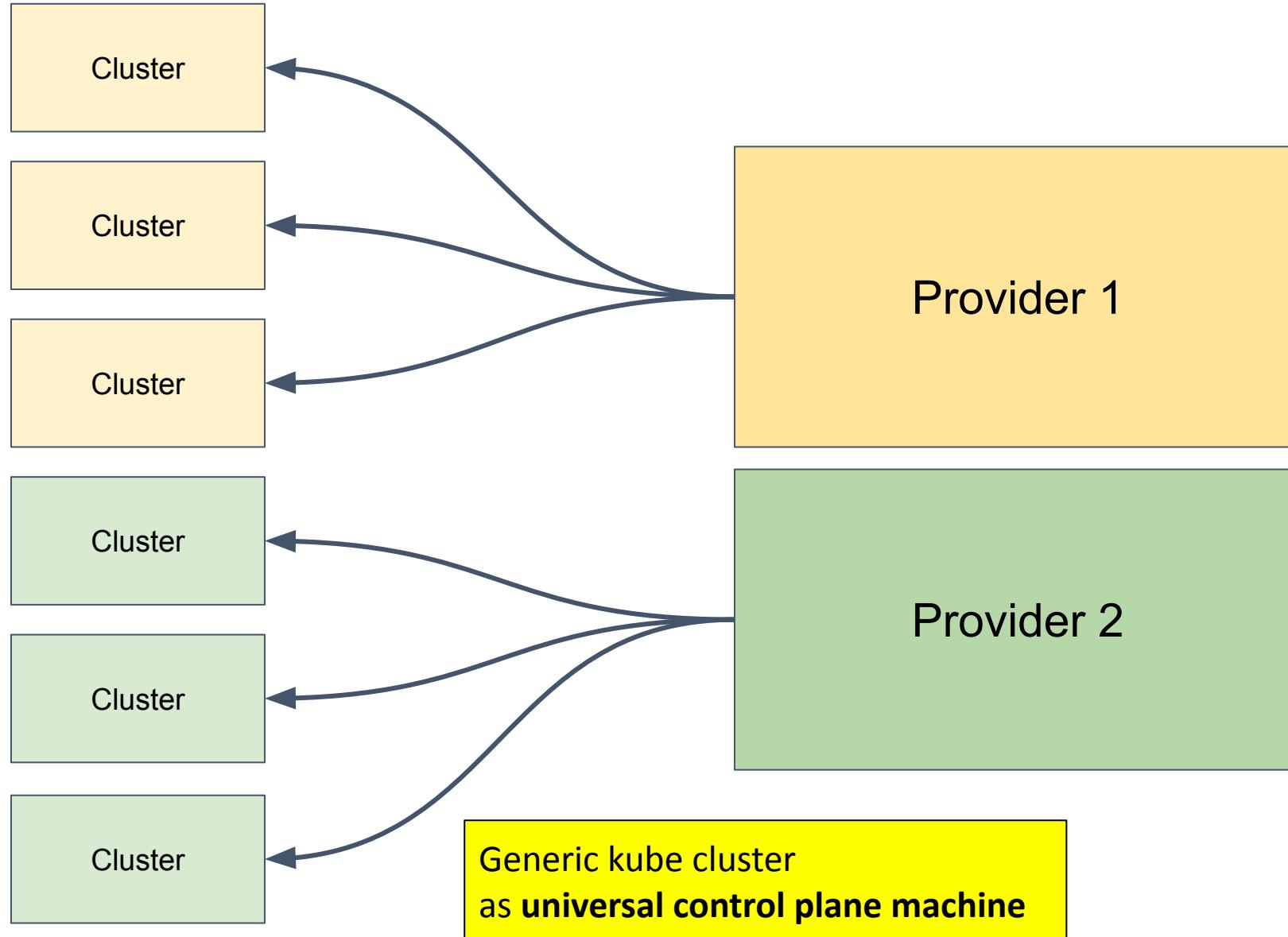


Multi-Tenant Controllers – Versioning



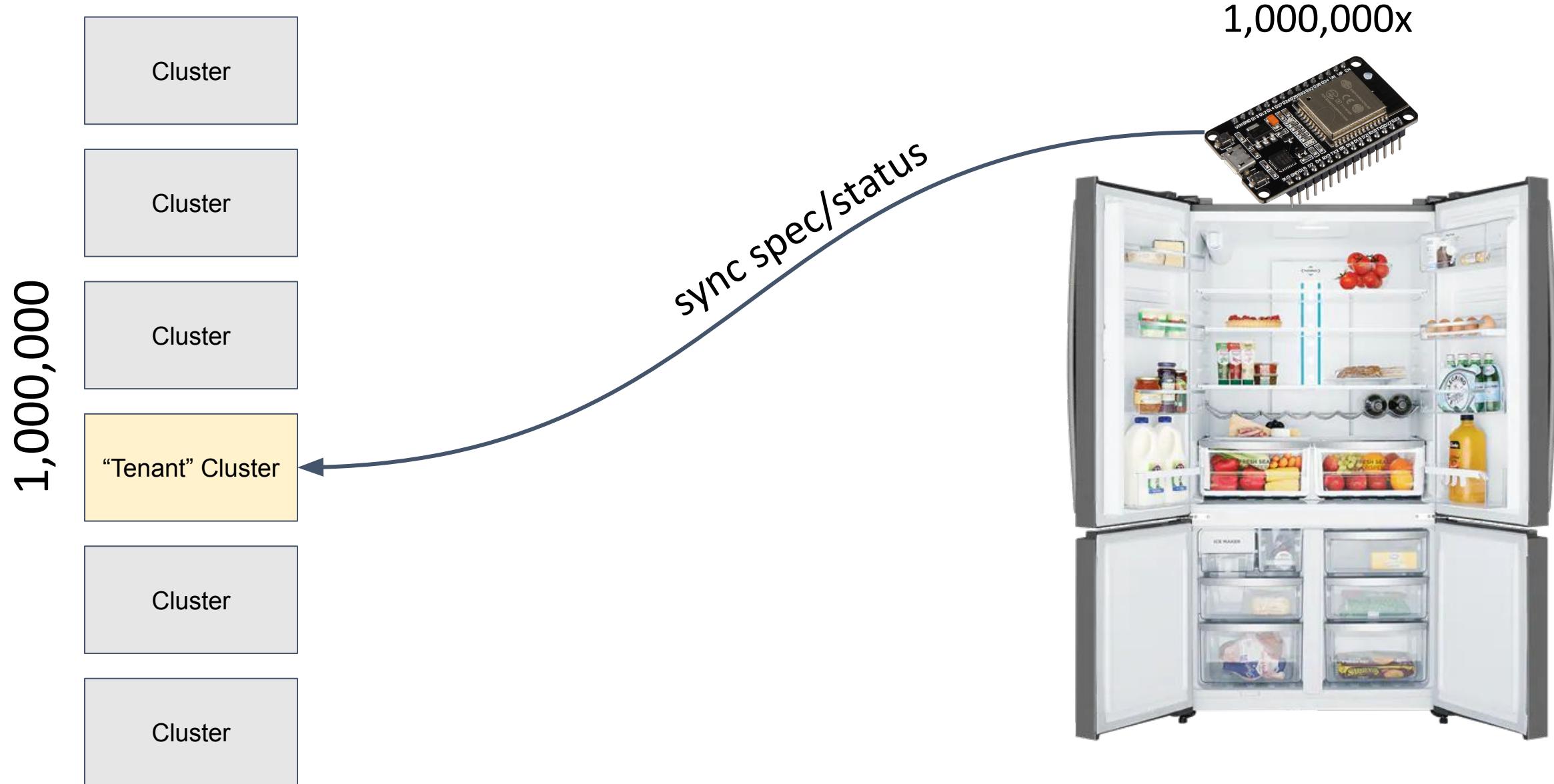
Crossplane Object Model

1,000,000



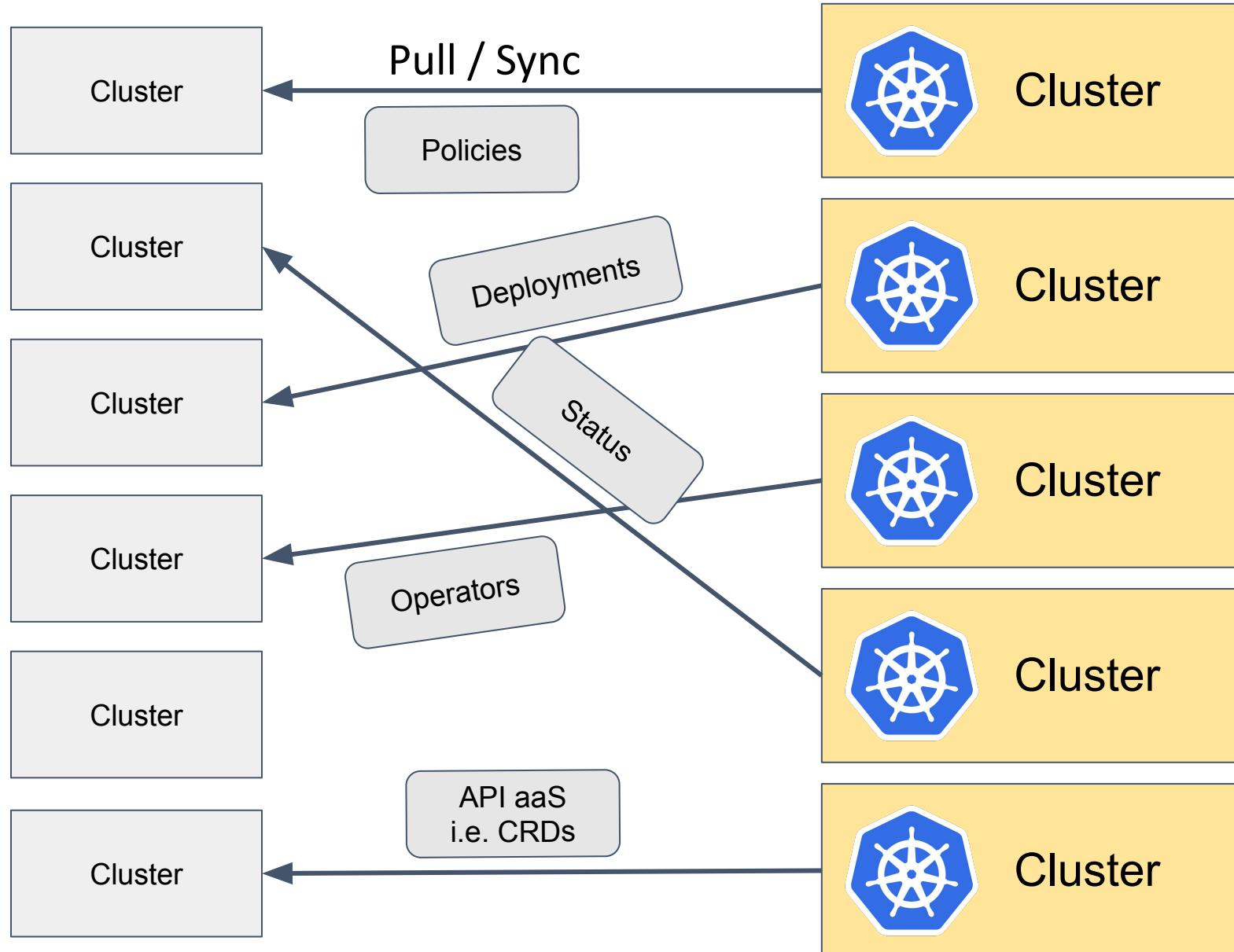
Crossplane

Edge



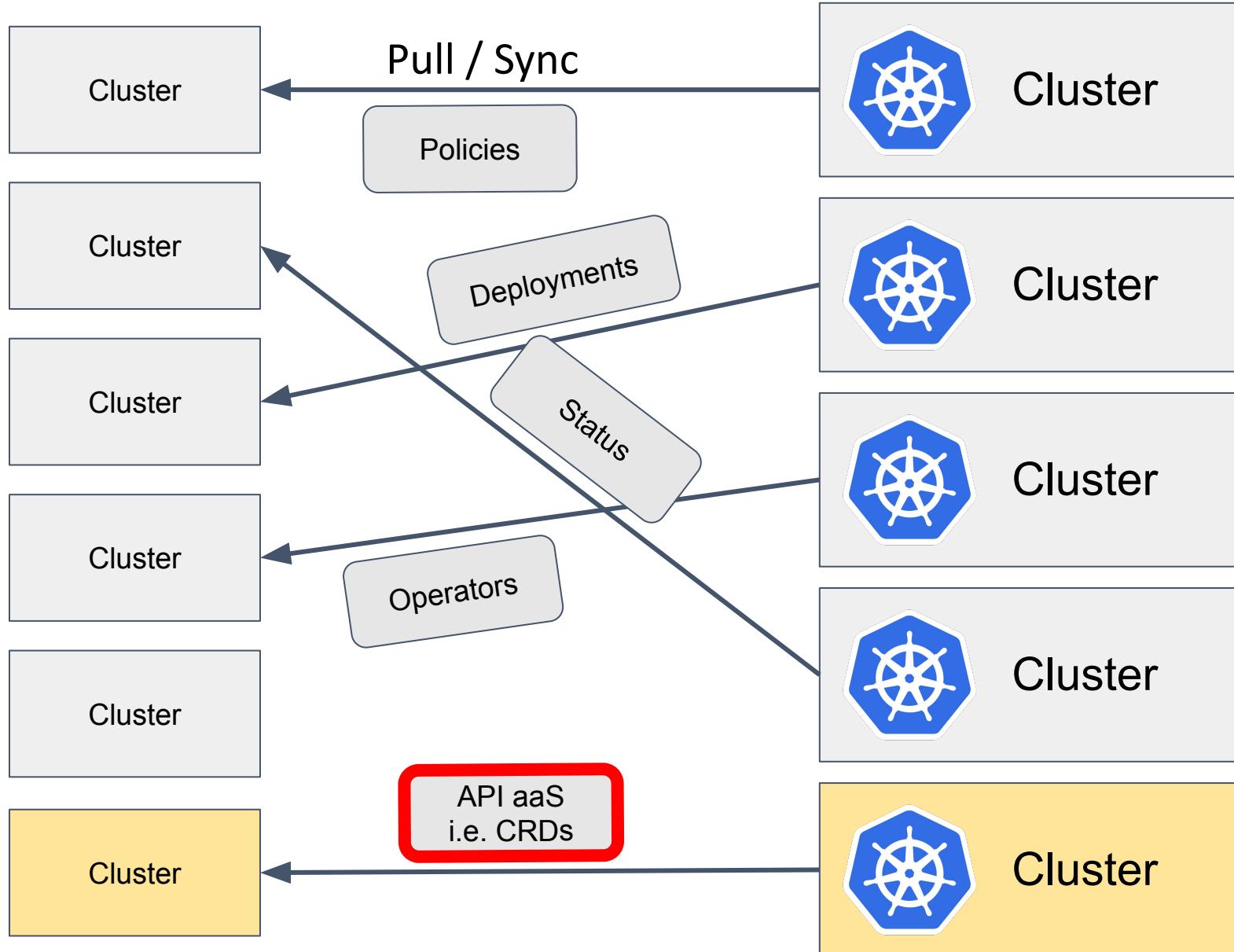
Augmenting Kube

1,000,000



Augmenting Kube

1,000,000



Talk on Thursday, BoF on Friday

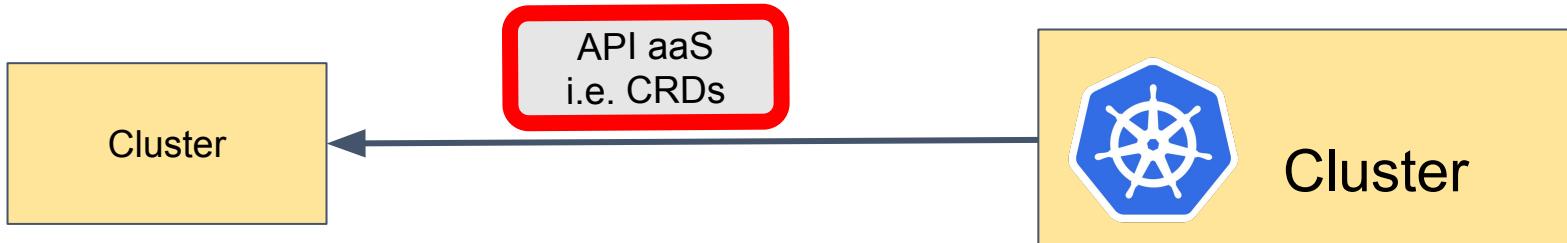
China 2019
<https://github.com/kube-bind/kube-bind>
<https://kubectl-bind.io>

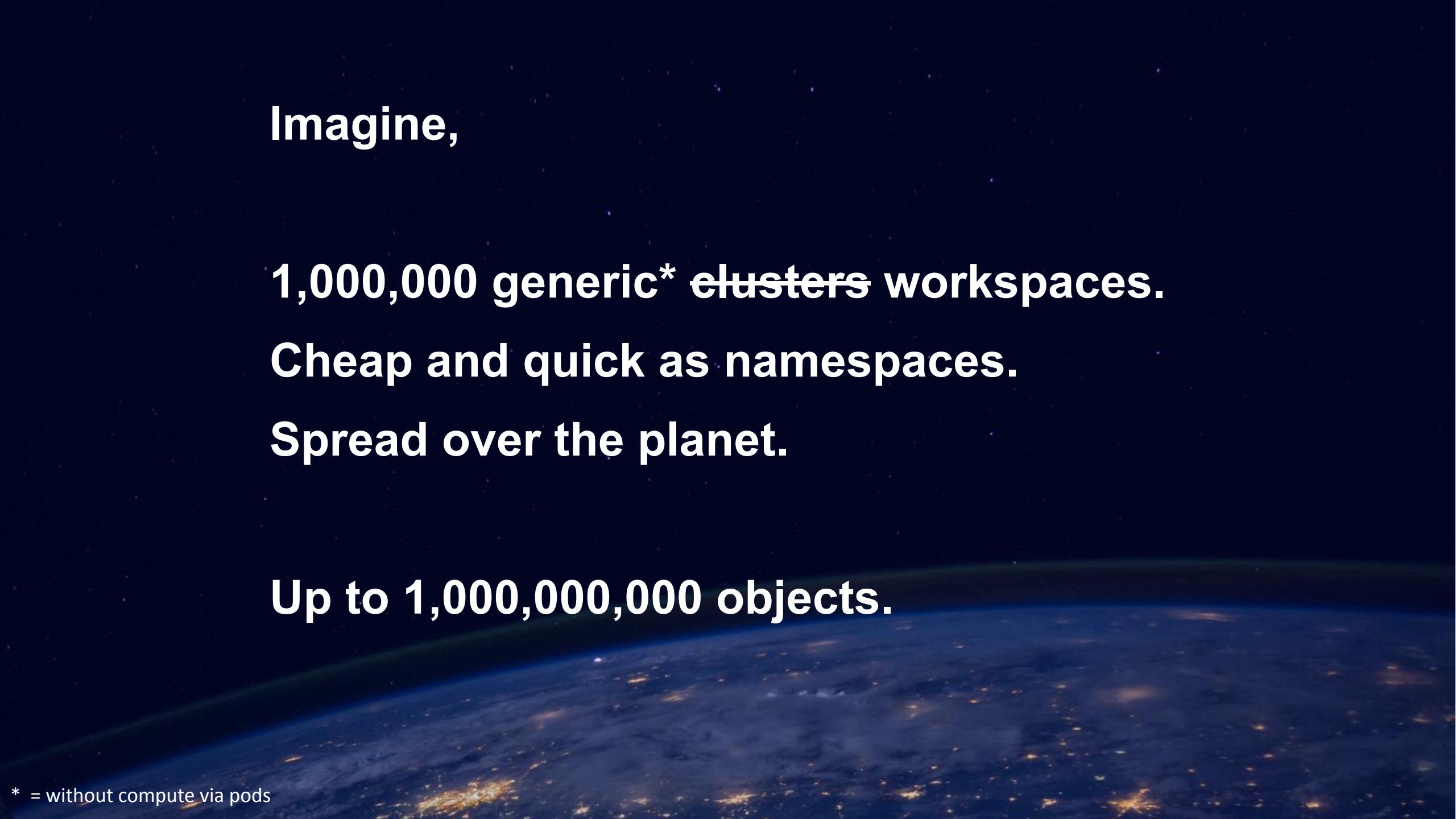
Thursday, October 27 • 11:55am - 12:30pm

Towards Something Better Than CRDs In a Post-Operator World - Stefan Schimanski, Red Hat

Friday, October 28 • 11:00am - 12:00pm

 BoF - Seeding kubectl bind - a vision for a post-CRD world - Sebastian Scheele, Kubermatic & Stefan Schimanski, Red Hat





Imagine,

1,000,000 generic* clusters workspaces.

Cheap and quick as namespaces.

Spread over the planet.

Up to 1,000,000,000 objects.

Consumer Workspace

```
apiVersion: apis.kcp.dev/v1alpha1
kind: APIBinding
spec:
  reference:
    workspace:
      path: root:cert-manager
      exportName: stable
```

APIBinding

```
apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
spec:
  names:
    kind: Certificate
    listKind: CertificateList
    plural: certificates
    singular: certificate
  ...

```

System shadow workspace

Service Provider

```
apiVersion: apis.kcp.dev/v1alpha1
kind: APIExport
metadata:
  name: stable
spec:
  latestResourceSchemas:
    - certificates.cert-manager.io
    - certificaterequests.cert-manager.io
    - issuers.cert-manager.io
    - clusterissuers.cert-manager.io
```

```
apiVersion: apis.kcp.dev/v1alpha1
kind: APIResourceSchema
spec:
  names:
    kind: Certificate
    listKind: CertificateList
    plural: certificates
    singular: certificate
  ...

```

APIExport

Consumer Workspace

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apiVersion: apis.kcp.dev/v1alpha1
kind: APIResourceSchema
spec:
  names:
    kind: Certificate
    listKind: CertificateList
    plural: certificates
    singular: certificate
  ...

```

APIExport

Think about it:

In the **SaaS**, there is basically
zero SaaS support in Kubernetes



Consuming an API service

```
$ kubectl bind apiexport root:cert-manager:stable
```



kcp – Simplifying building massively multi-tenant services. Together.

An OpenSource horizontally scalable Control Plane for Kubernetes APIs.



Isolation through Workspaces

A large number of independent, fully isolated “logical clusters” known as workspaces.



Massively multi-tenant API services

Enabling API service providers to offer Kubernetes-native APIs centrally using multi-tenant operators.



SaaS-like API Consumption

Easy API consumption for users in their workspaces in a SaaS-like fashion.

kcp.io



1. Every workspace is Kubernetes (with pod APIs disabled)
2. Kubernetes tooling just works
3. 100% pure Kubernetes APIs (technically everything is a CRD)

Rule set in stone: behavioral changes to the API are forbidden.

We live and breathe Kubernetes and the community. No compromises.

* we are adding virtual clusters via context.Context and change etcd paths accordingly. We are not changing anything user-facing.

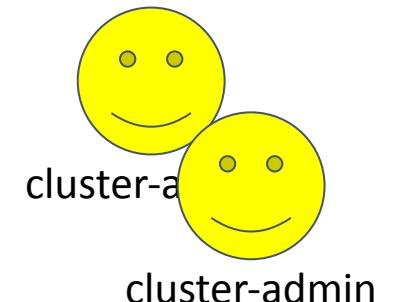


Isolation through Workspaces

A large number of independent, fully-isolated “logical clusters” known as workspaces.



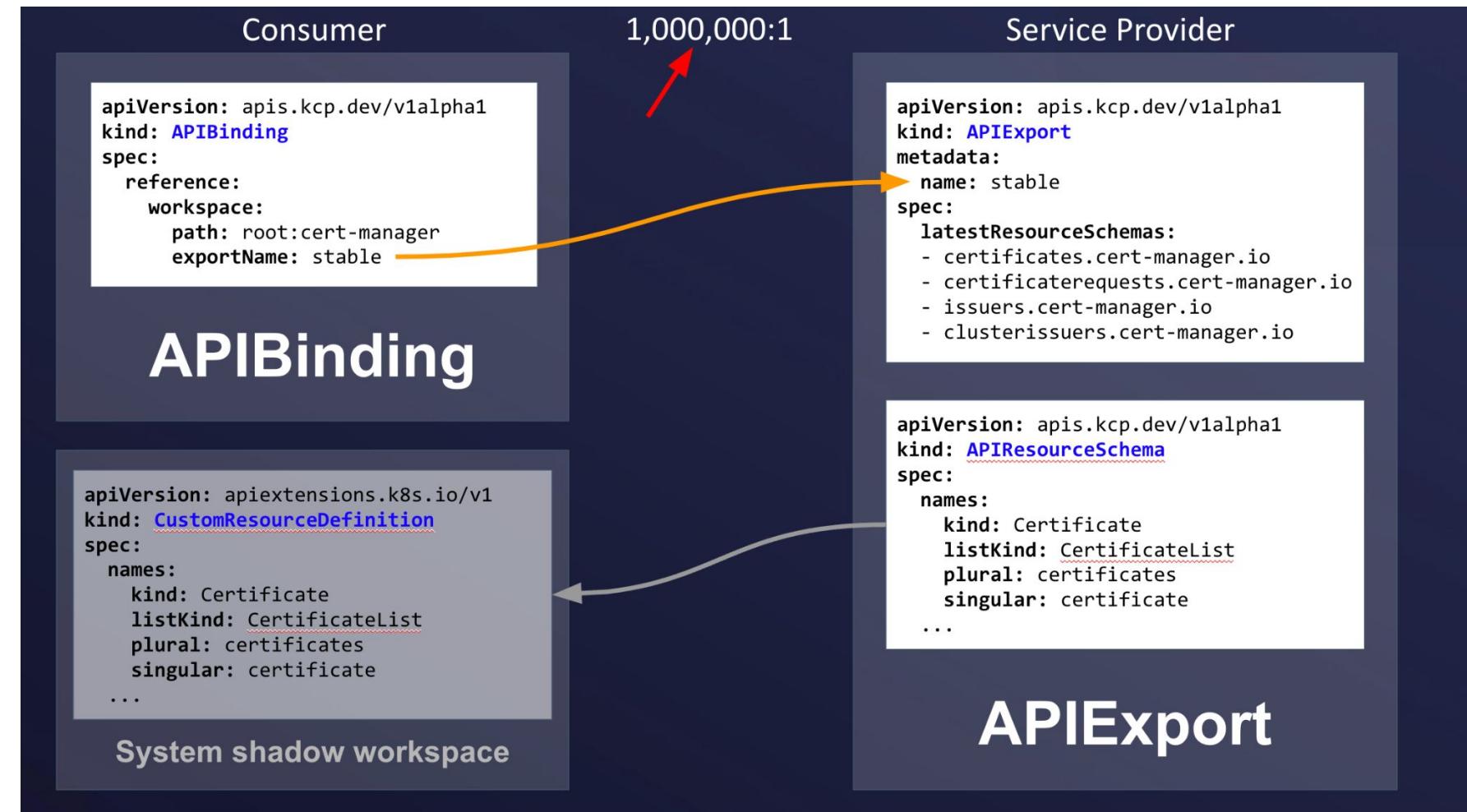
1,000,000x





Massively multi-tenant API services

Enabling API service providers to offer
Kubernetes-native APIs centrally
using multi-tenant operators.





SaaS-like API Consumption

Easy API consumption for users in their workspaces in a SaaS-like fashion.



```
$ kubectl bind apiexport root:cert-manager:stable
```

Horizontally scalable, distributed



A walled garden named kcp?



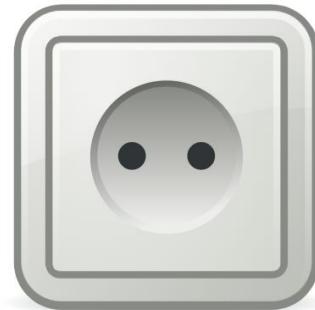
A walled garden named kep?

Thursday, October 27

11:55am EDT

Towards Something Better Than CRDs In a Post-Operator World - Stefan Schimanski, Red Hat
PORTSIDE BALLROOM (ROOM 260)

README.md



kube-bind

Disclaimer: work in progress and not ready for production use.

kube-bind is a prototype project with the goal to establish a new extension model for Kubernetes clusters:

- APIs should be bindable into a cluster and operated by a service provider
- these APIs should not require (custom) controllers/operators run locally in the consuming cluster
- only a single vendor-neutral, OpenSource agent should be required.

This is the 3 line pitch:

```
$ kubectl krew install bind
$ kubectl bind https://mangodb/exports
Redirect to the brower to authenticate via OIDC.
BOOM - the MongoDB API is available in the local cluster,
without anything MongoDB-specific running.
$ kubectl get mangodbs
```

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kcp is a Kubernetes-like control plane
for workloads on many clusters

[kubernetes](#) [k8s](#) [multitenancy](#)[Readme](#)[Apache-2.0 license](#)[Code of conduct](#)[1.7k stars](#)[42 watching](#)[280 forks](#)[Releases 19](#) v0.9.1 Latest

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 tools Merge pull request #2169 1

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kubernetes k8s multitenancy

Readme

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\$ git clone https://github.com/kcp-dev/kcp.git



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Readme

Apache-2.0 license

\$ git clone https://github.com/kcp-dev/kcp.git

Cloning into 'kcp'...

\$ make

\$ export PATH=\$PWD/bin:\$PATH

\$ kcp start &> kcp.log &



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\$ kcp start &> kcp.log &

[1] 50414

\$



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kubernetes k8s multitenancy

Readme

Apache-2.0 license

```
$ kcp start &> kcp.log &  
[1] 50414  
  
$ export KUBECONFIG=$PWD/.kcp/admin.kubeconfig  
$
```



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Readme

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```
$ kcp start &> kcp.log &  
[1] 50414  
  
$ export KUBECONFIG=$PWD/.kcp/admin.kubeconfig  
  
$ kubectl ws .
```



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Readme

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\$ kcp start &> kcp.log &

[1] 50414

\$ export KUBECONFIG=\$PWD/.kcp/admin.kubeconfig

\$ kubectl ws .

Current workspace is "root".

\$



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Readme

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\$ kcp start &> kcp.log &

[1] 50414

\$ export KUBECONFIG=\$PWD/.kcp/admin.kubeconfig

\$ kubectl ws .

Current workspace is "root".

\$ kubectl ws create kubecon



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config

Merge pull request #2164



contrib

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docs

Update syncer doc on apie



hack

Merge pull request #2120



manifest

Add owners files and notes



pkg

Merge pull request #2202



test

Merge pull request #2169



third_party

resolved several review co

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for workloads on many clusters

kubernetes

k8s

multitenancy

Readme

Apache-2.0 license

```
$ kubectl ws .
```

Current workspace is "root".

```
$ kubectl ws create kubecon
```

Workspace "kubecon" (type root:organization) created.

```
$
```



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test Merge pull request #2169 ...

third_party resolved several review co ...

kcp is a Kubernetes-like control plane for workloads on many clusters

kubernetes k8s multitenancy

Readme

Apache-2.0 license

\$ kubectl ws .

Current workspace is "root".

\$ kubectl ws create kubecon

Workspace "kubecon" (type root:organization) created.

\$ kubectl ws kubecon []



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\$ |

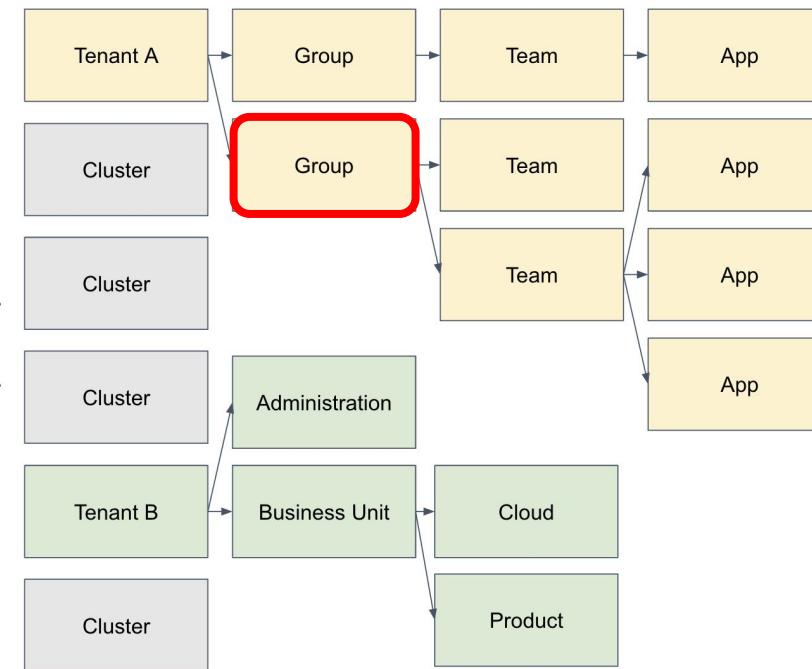


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4

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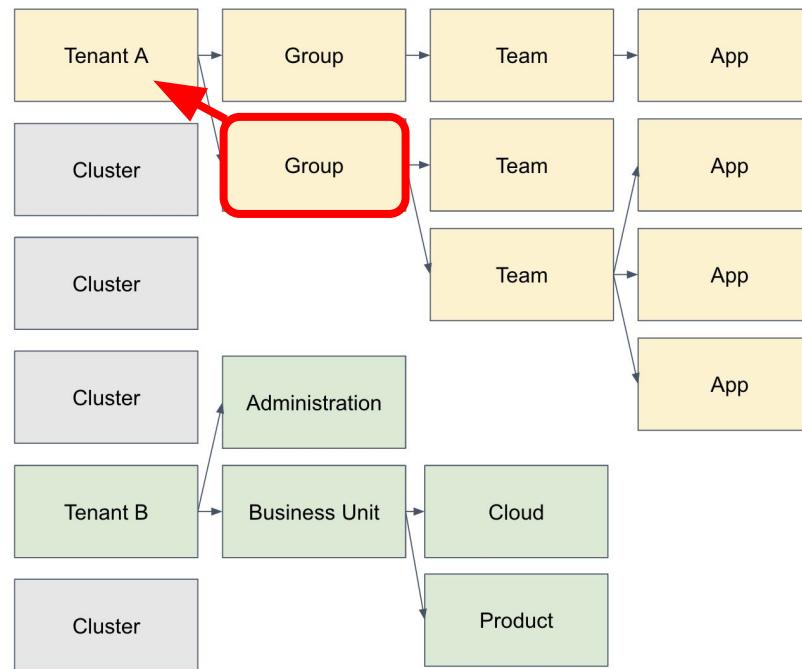
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```
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```

Current workspace is "root:kubecon".

```
$ kubectl ws ..
```

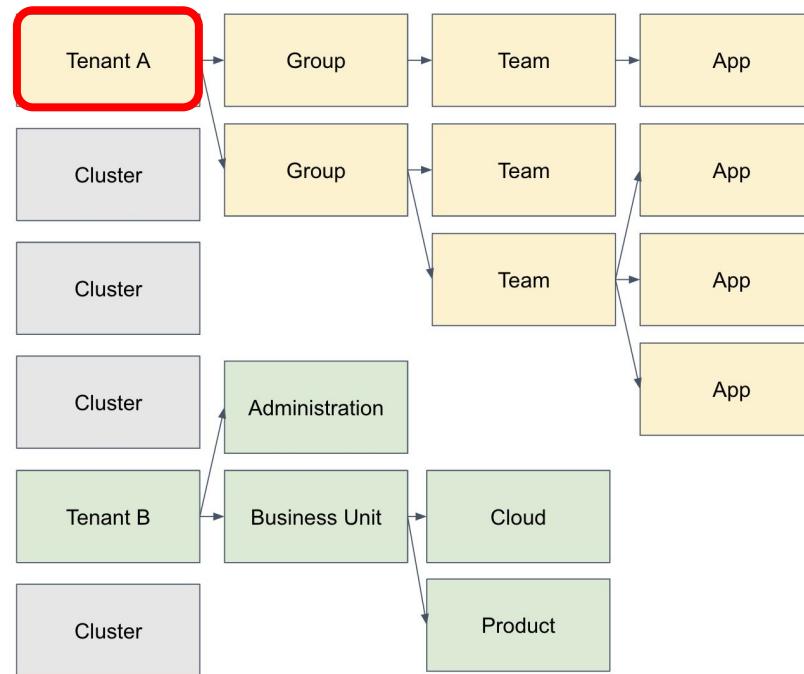


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Org Hierarchies



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- | | |
|---|----------------------------|
|  docs | Update syncer doc on api |
|  hack | Merge pull request #2120 |
|  manifest | Add owners files and note |
|  pkg | Merge pull request #2202 |
|  test | Merge pull request #2169 |
|  third_party | resolved several review co |
|  tools | Merge pull request #2169 |

1s Actions Projects 1 Wiki Security 1 Insights Settings

Go to file Add file ▾ Code ▾

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About

kcp is a Kubernetes-like control plane for workloads on many clusters

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64 \$ kubectl ws kubecon

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```
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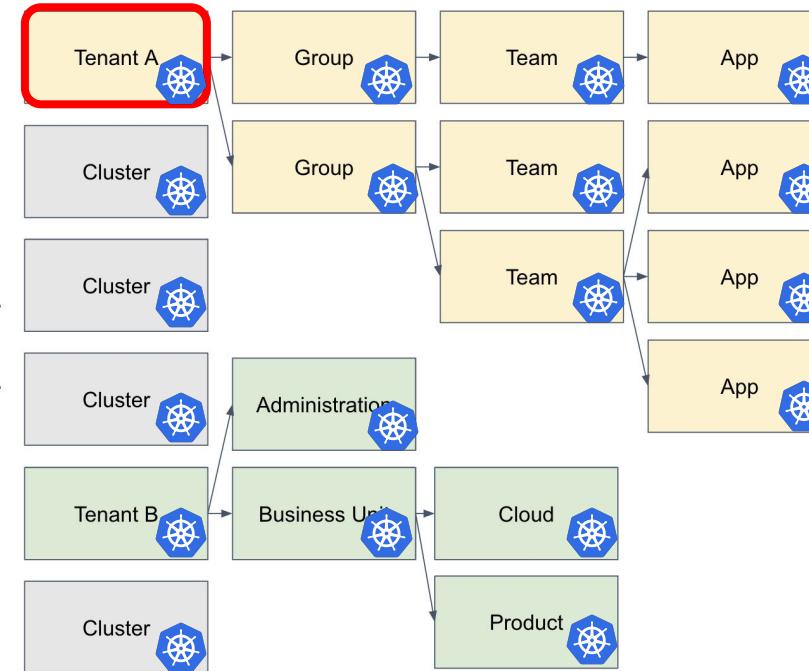


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docs	Update syncer doc on api...
hack	Merge pull request #2120
manifest	Add owners files and notes
pkg	Merge pull request #2202
test	Merge pull request #2169
third_party	resolved several review co...
third_party	Merge pull request #2169

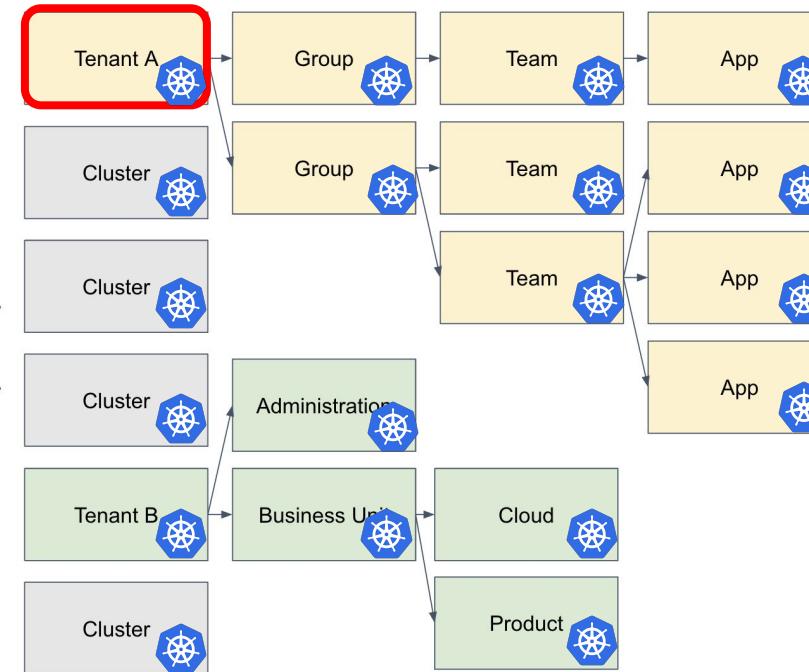


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4

Org Hierarchies



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docs	Update syncer doc on api...
hack	Merge pull request #2120
manifest	Add owners files and notes
pkg	Merge pull request #2202
test	Merge pull request #2169
third_party	resolved several review co...
tools	Moving code to Hugo

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\$ kubectl api-resources | less

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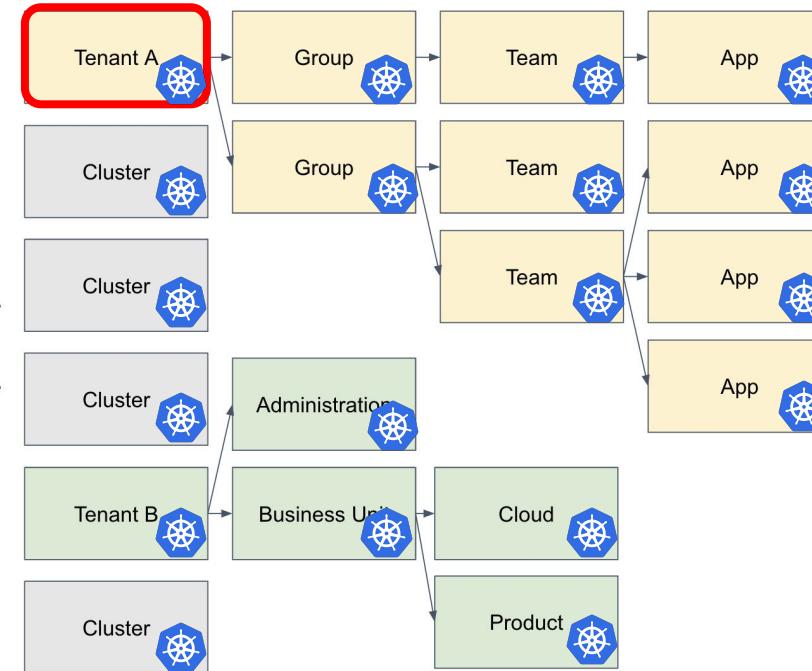


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```
$ kubectl api-resources | less
```

NAME	SHORTNAMES	APIVERSION	NAMESPACED	KIND
configmaps	cm	v1	true	ConfigMap
events	ev	v1	true	Event
limitranges	limits	v1	true	LimitRange
namespaces	ns	v1	false	Namespace
resourcequotas	quota	v1	true	ResourceQuota
secrets		v1	true	Secret
serviceaccounts	sa	v1	true	ServiceAccount
...				

docs	Update syncer doc on api...
hack	Merge pull request #2120
manifest	Add owners files and notes
pkg	Merge pull request #2202
test	Merge pull request #2169
third_party	resolved several review co...
third_party/...	Moved to third_party...



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6 days ago

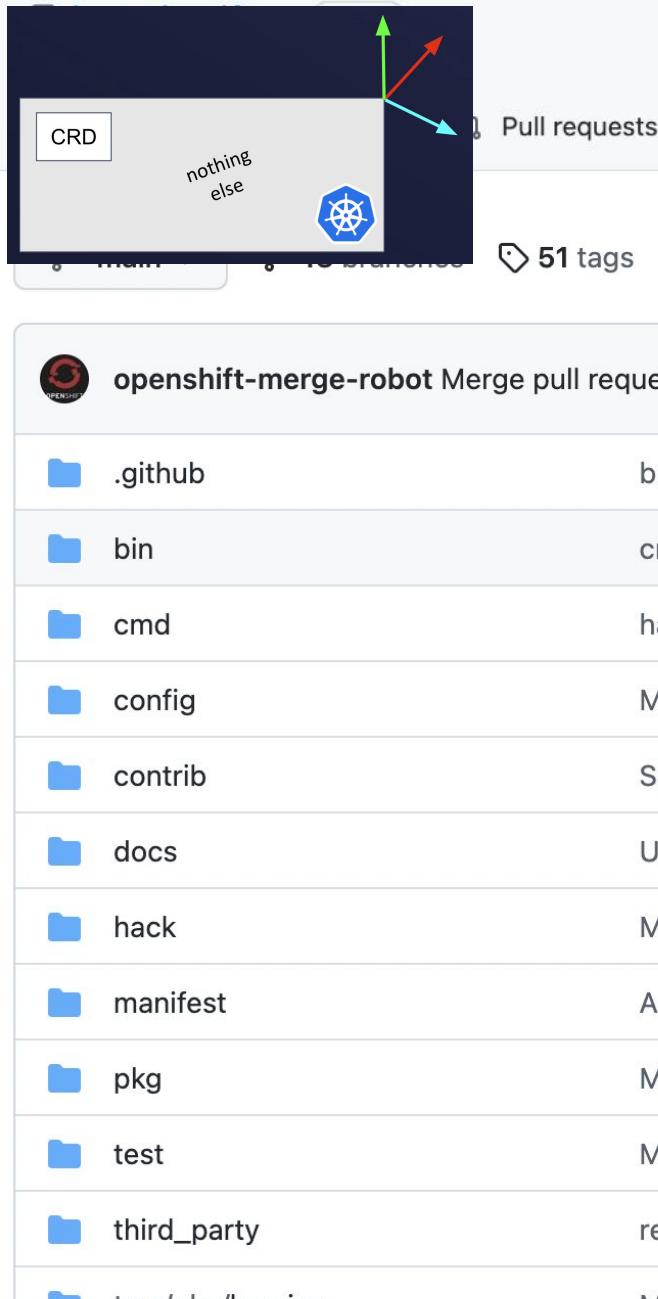
+ 18 releases



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What you will find:

1. generic control-plane (no pods)
2. workspaces
super cheap and quick
`kubectl ws`
3. APIExports and APIBindings
4. Sharding (WIP)

6 days ago

+ 18 releases

Toppings on-top



- We had said we have removed the pods.

Toppings on-top

- We had said we have removed the pods.
- One service on-top:

Transparent Multi Cluster (tmc)

An elastic cluster-less compute service.

- Connect -clusters & schedule compute to it:

```
$ kubectl apply -f deployment.yaml
```



Toppings on-top

- We had said we have removed the pods.



Compute is just an API on-top
Let's replace it.

Toppings on-top



- We had said we have removed the pods.
- Investigations in Edge specific compute

kcp community call about “**kcp-SIG-edge**” Nov 2:
<https://github.com/kcp-dev/kcp/issues/2229>

Compute is just an API on-top
Let's replace it.



kcp – Simplifying building massively multi-tenant services. Together.

An OpenSource horizontally scalable Control Plane for Kubernetes APIs.



Isolation through Workspaces

A large number of independent, fully isolated “logical clusters” known as workspaces.



Massively multi-tenant API services

Enabling API service providers to offer Kubernetes-native APIs centrally using multi-tenant operators.



SaaS-like API Consumption

Easy API consumption for users in their workspaces in a SaaS-like fashion.

kcp.io

 We love
collaboration.

#kcp-dev on



-Slack



kcp-dev@googlegroups.com



<https://github.com/kcp-dev/kcp>



<https://bit.ly/3DnufJB>



Community Meeting every Tuesday, 5pm CET

Towards 1,000,000 Clusters, Name^WWorkspaced CRDs



BUILDING FOR THE ROAD AHEAD

DETROIT 2022



KubeCon



CloudNativeCon

North America 2022

BUILDING FOR THE ROAD AHEAD

DETROIT 2022

October 24-28, 2021



Stefan Schimanski
Senior Principal Software Engineer



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