

# From Laptop to the World

With Kubernetes

# Ray Tsang

Developer Advocate  
Google Cloud Platform

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# Ray Tsang

Developer

Architect

Traveler

Photographer

[flickr.com/saturnism](https://www.flickr.com/photos/saturnism/)





# Kubernetes

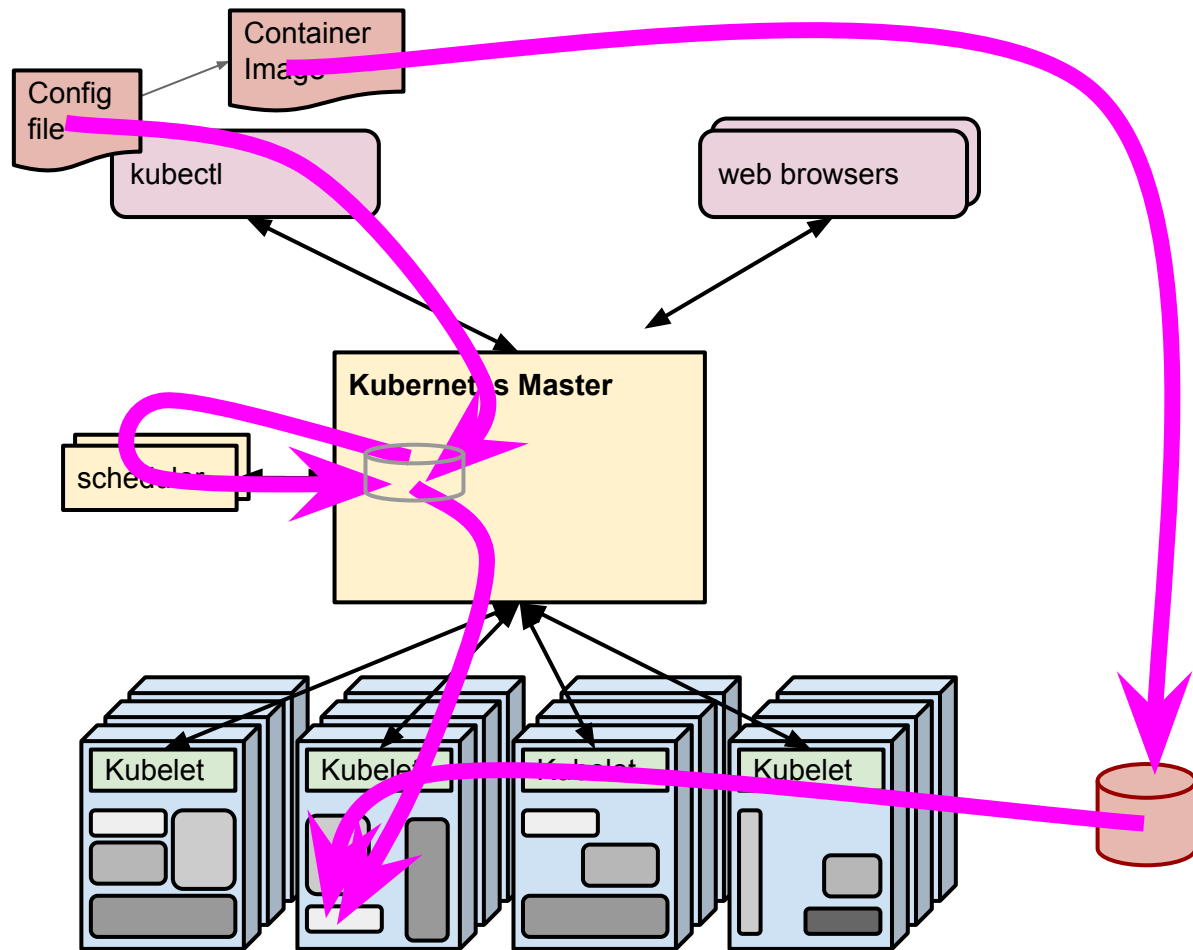
Greek for “*Helmsman*”; also the root of the words “*governor*” and “*cybernetic*”

- Manages container clusters
- Inspired and informed by Google’s experiences and internal systems
- Supports multiple cloud and bare-metal environments
- Supports multiple container runtimes
- **100% Open source**, written in Go

Manage applications, not machines

# Developer View

What just happened?



Every line of code you write



Business Value

# minikube

```
$ minikube start
Starting local Kubernetes cluster...
Running pre-create checks...
Creating machine...
Starting local Kubernetes cluster...
Kubernetes is available at https://192.168.99.100:443.

$ kubectl run hello-minikube --image=gcr.io/google_containers/
deployment "hello-minikube" created
$ curl http://$(minikube ip):8000
CLIENT VALUES:
client_address=192.168.99.1
command=GET
real path=/
...
$ minikube stop
Stopping local Kubernetes cluster...
Stopping "minikubeVM"...
```



**Ray Tsang** @saturnism · Jun 28

easy local #kubernetes installation w/ minikube #devnation @aronchick

[github.com/kubernetes/min...](https://github.com/kubernetes/minikube)



18



16

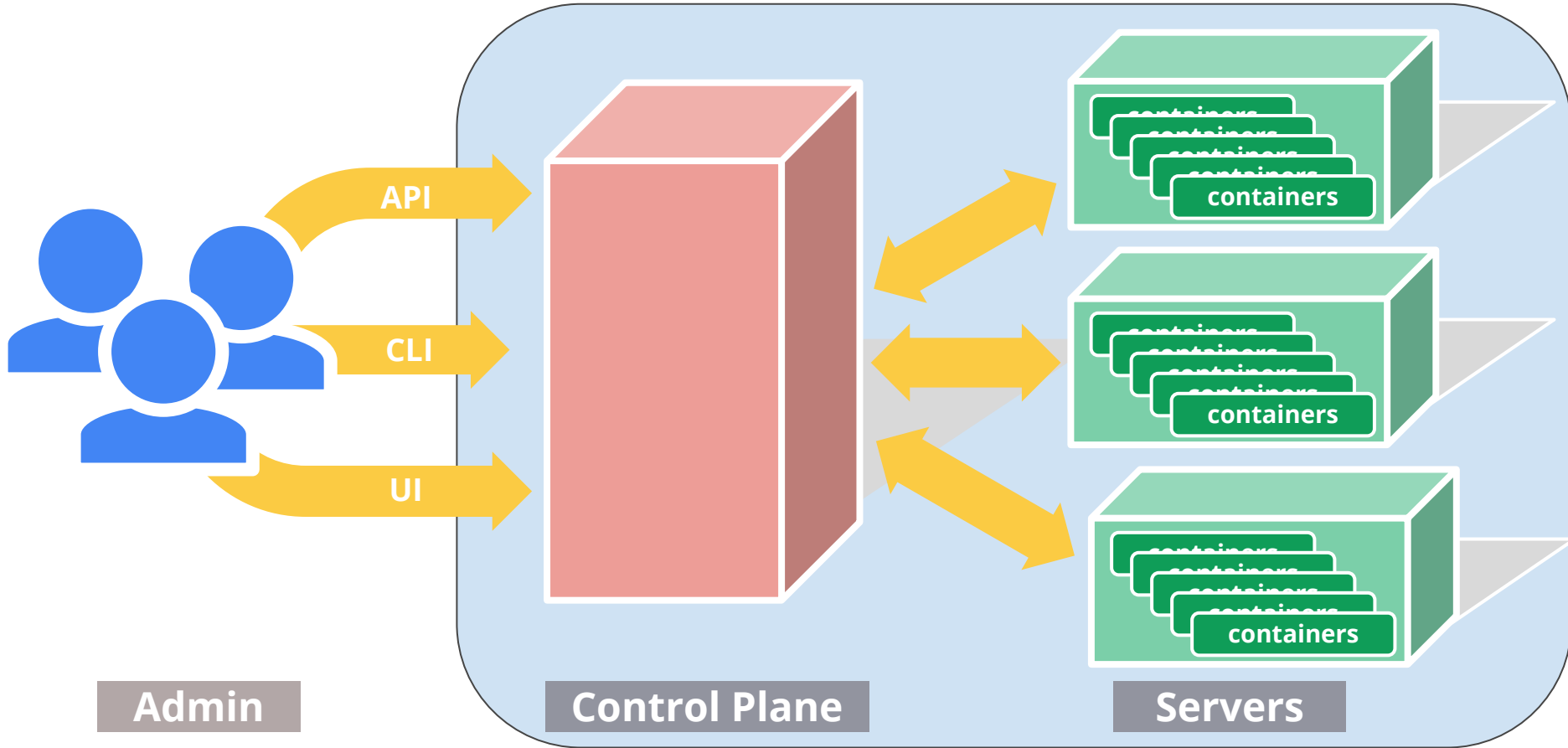


Next...

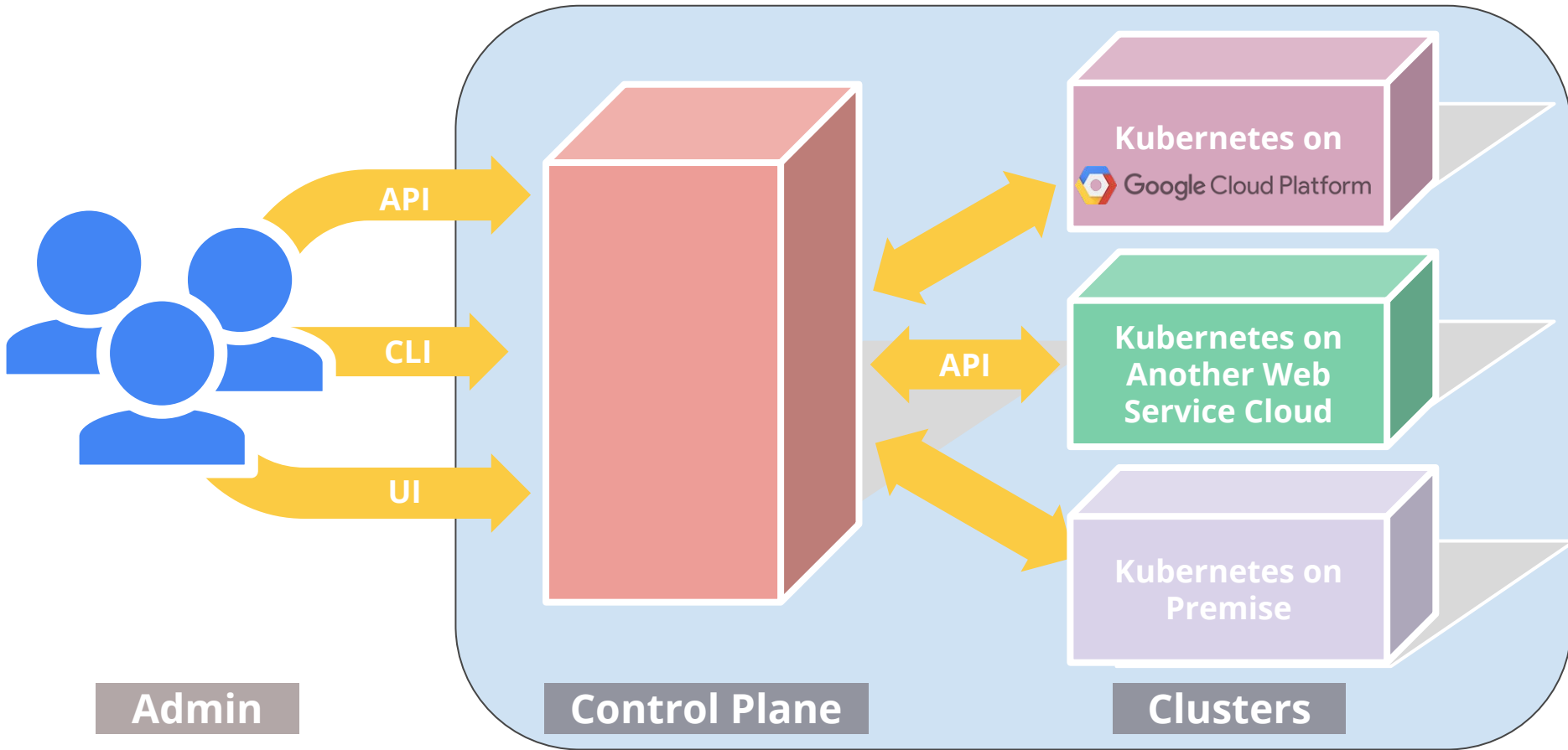
Someone else's computer!

# Next Step? Data Centers as One!

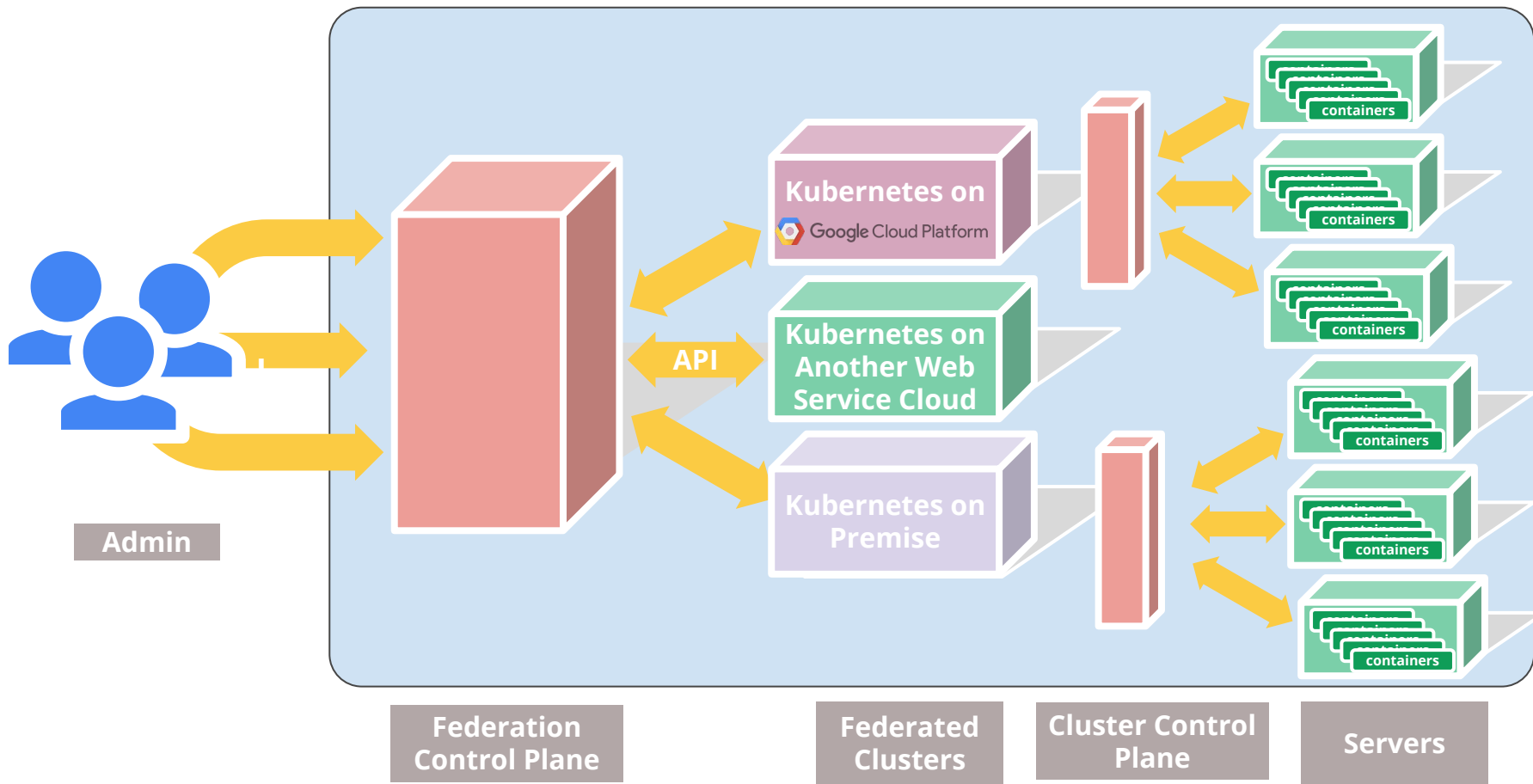
## Cluster / Data Center / Availability Zone



# Federation

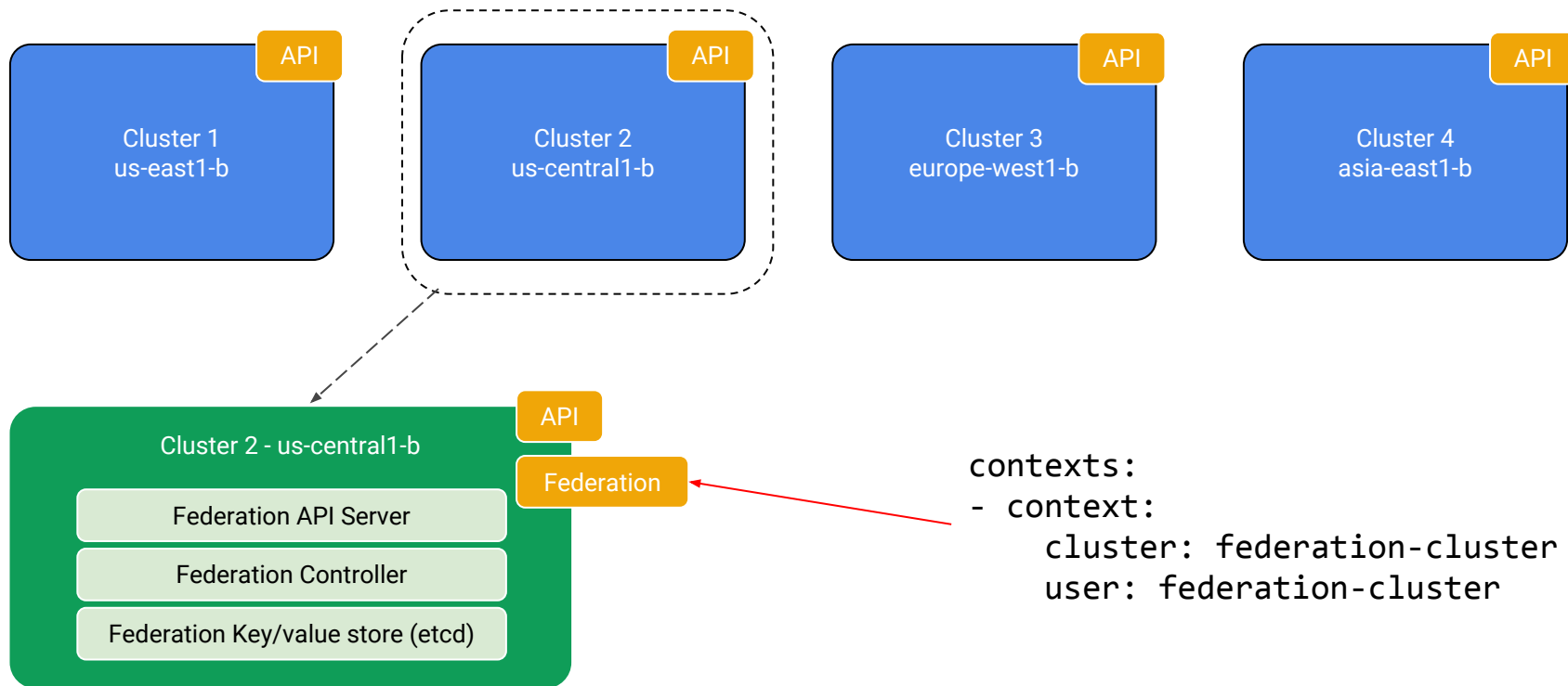


# Federation



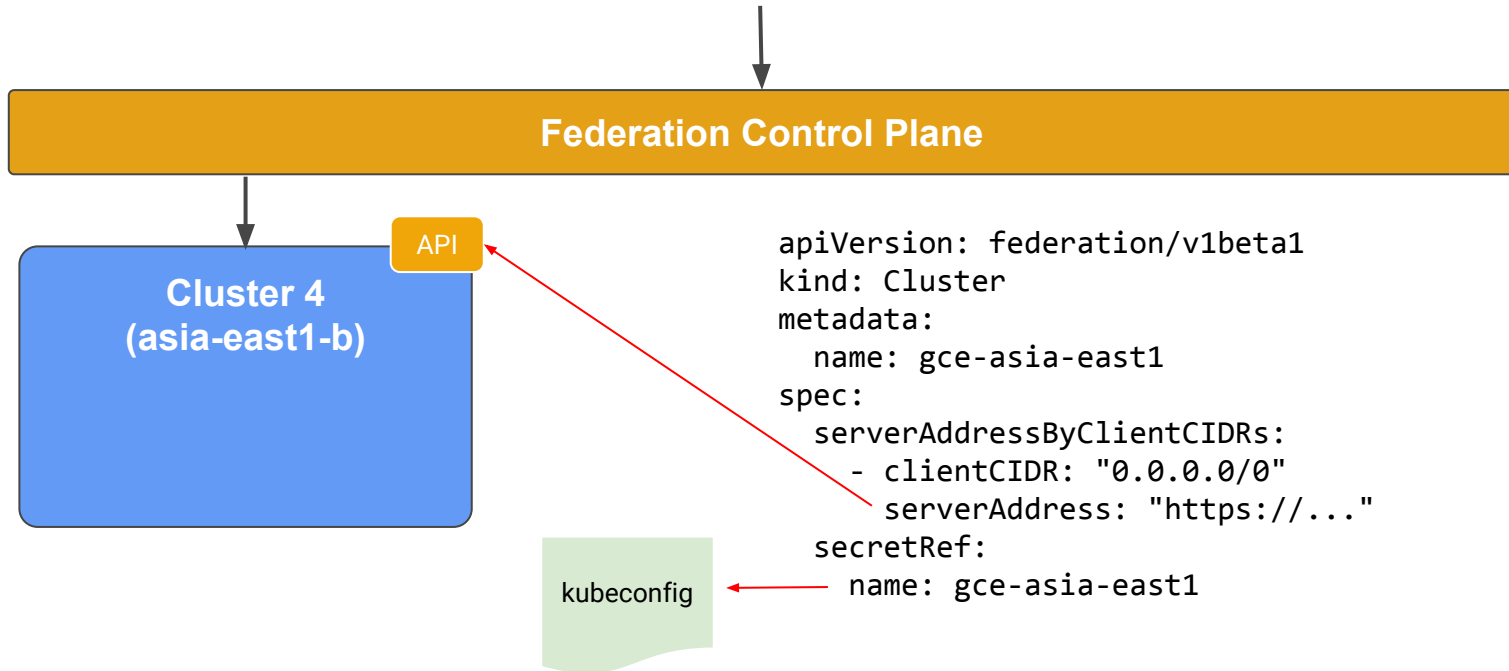
# Initialize Federation Control Plane

```
kubefed init my-federation --host-cluster-context=cluster-2 ...
```



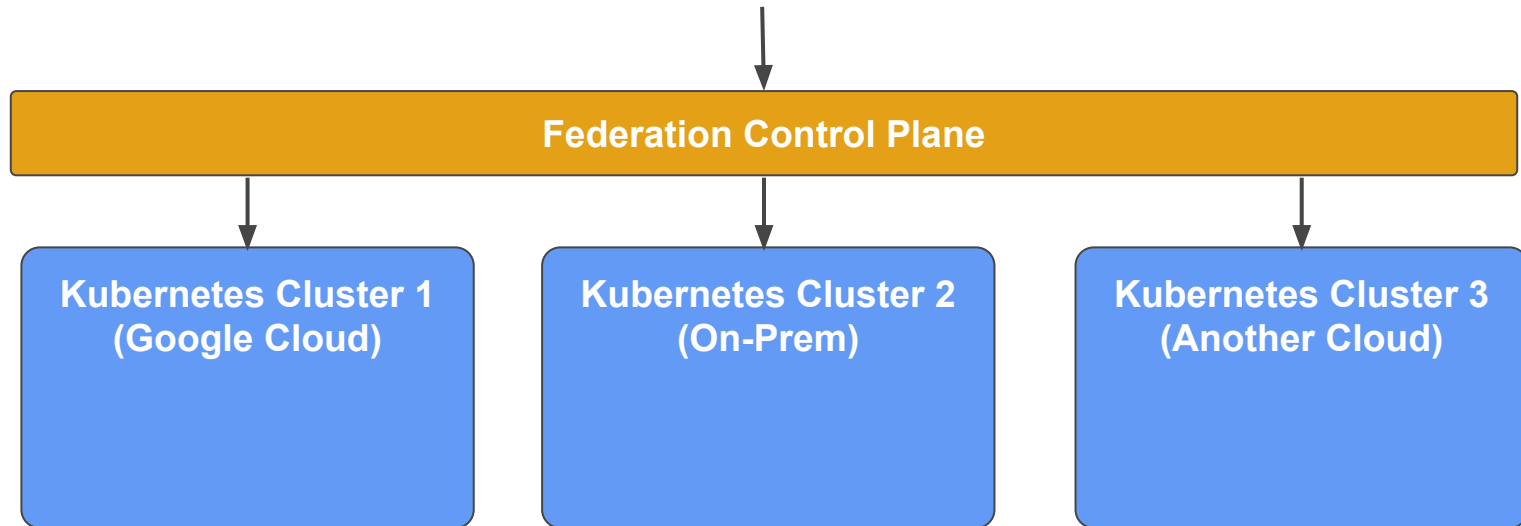
# Adding a Cluster

```
kubefed join cluster-4 --host-cluster-context=cluster2 ...
```



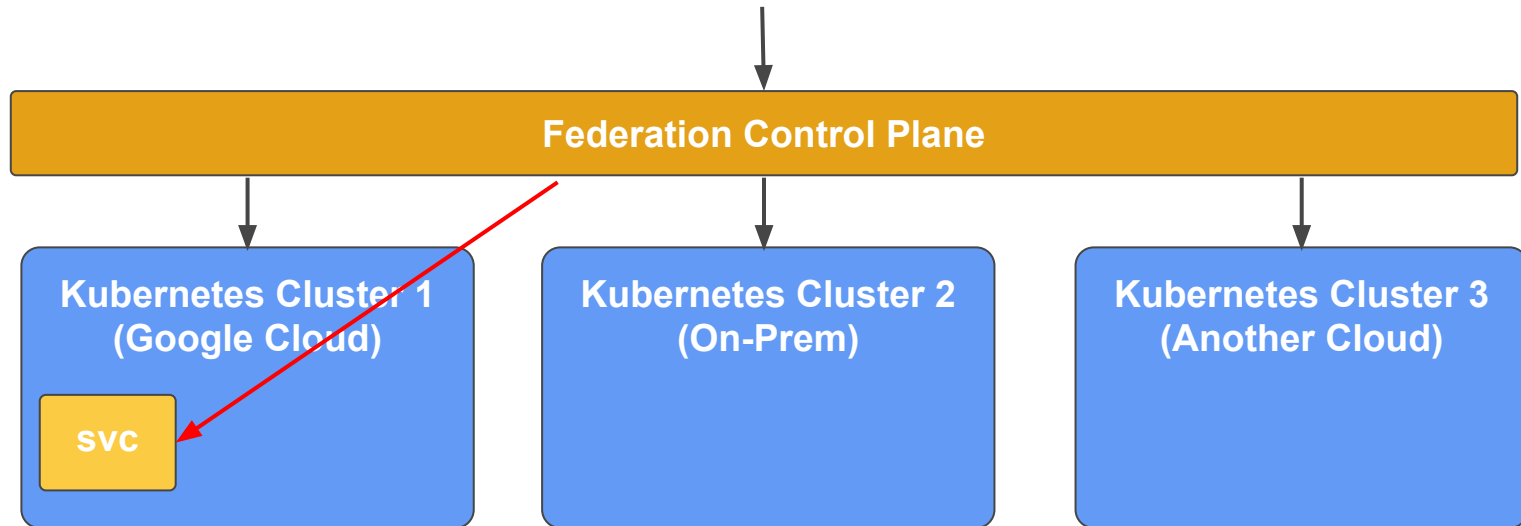
# Federated Service

```
kubectl create -f app-service.yaml
```



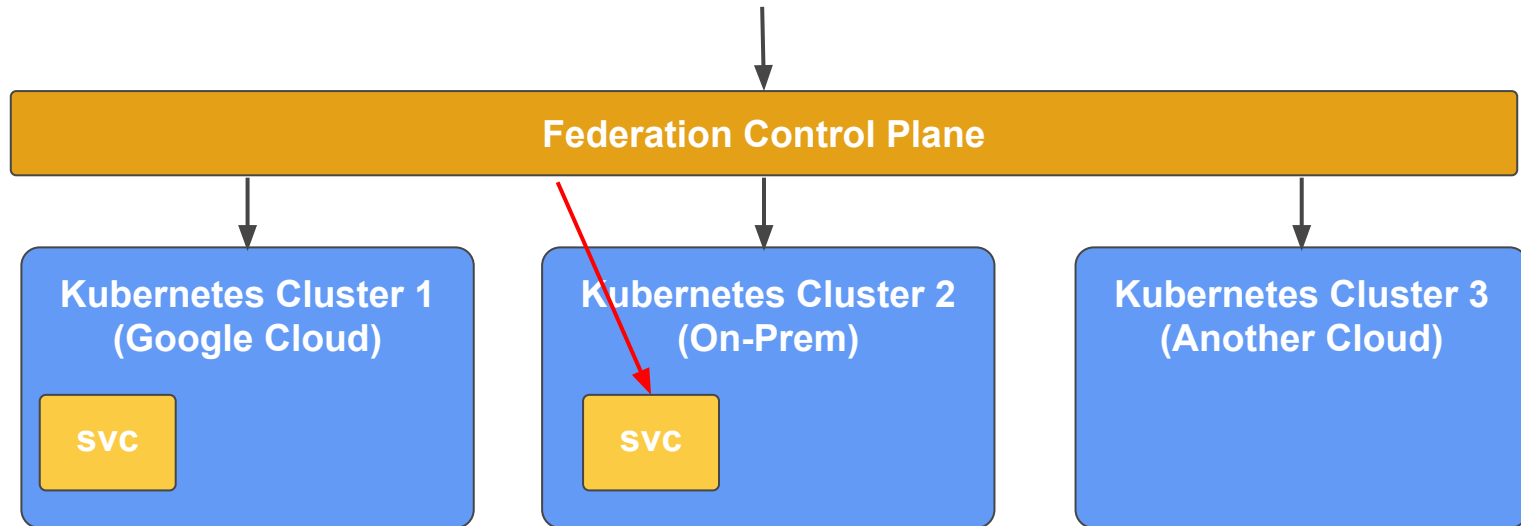
# Federated Service

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kubectl create -f app-service.yaml
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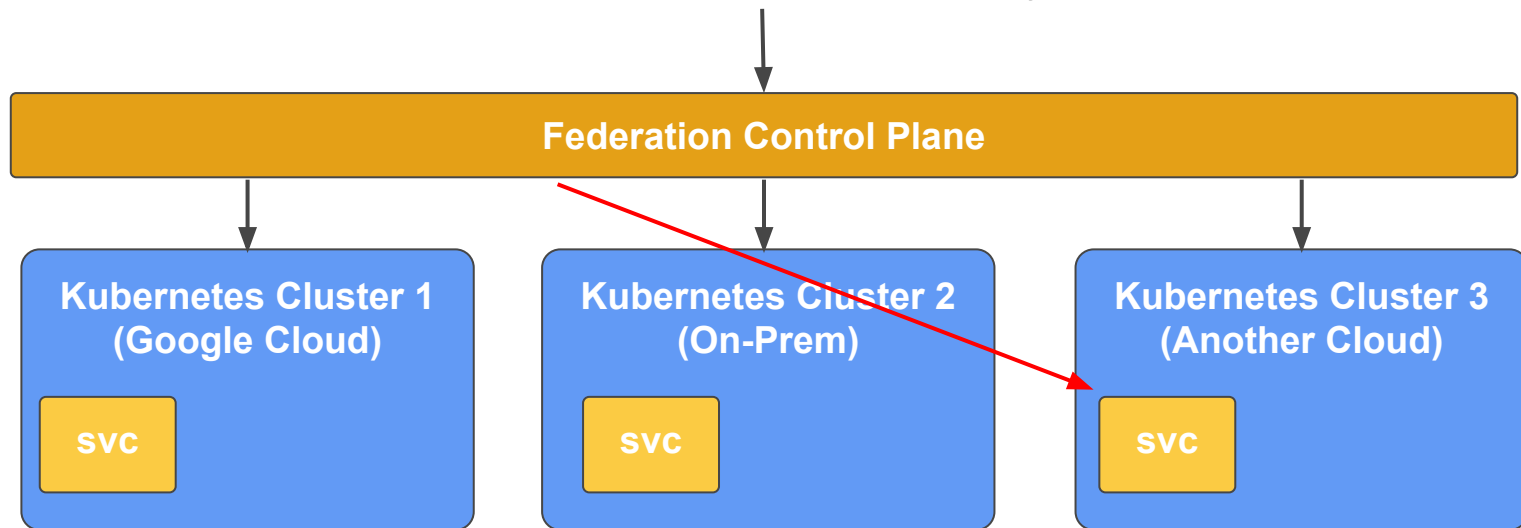
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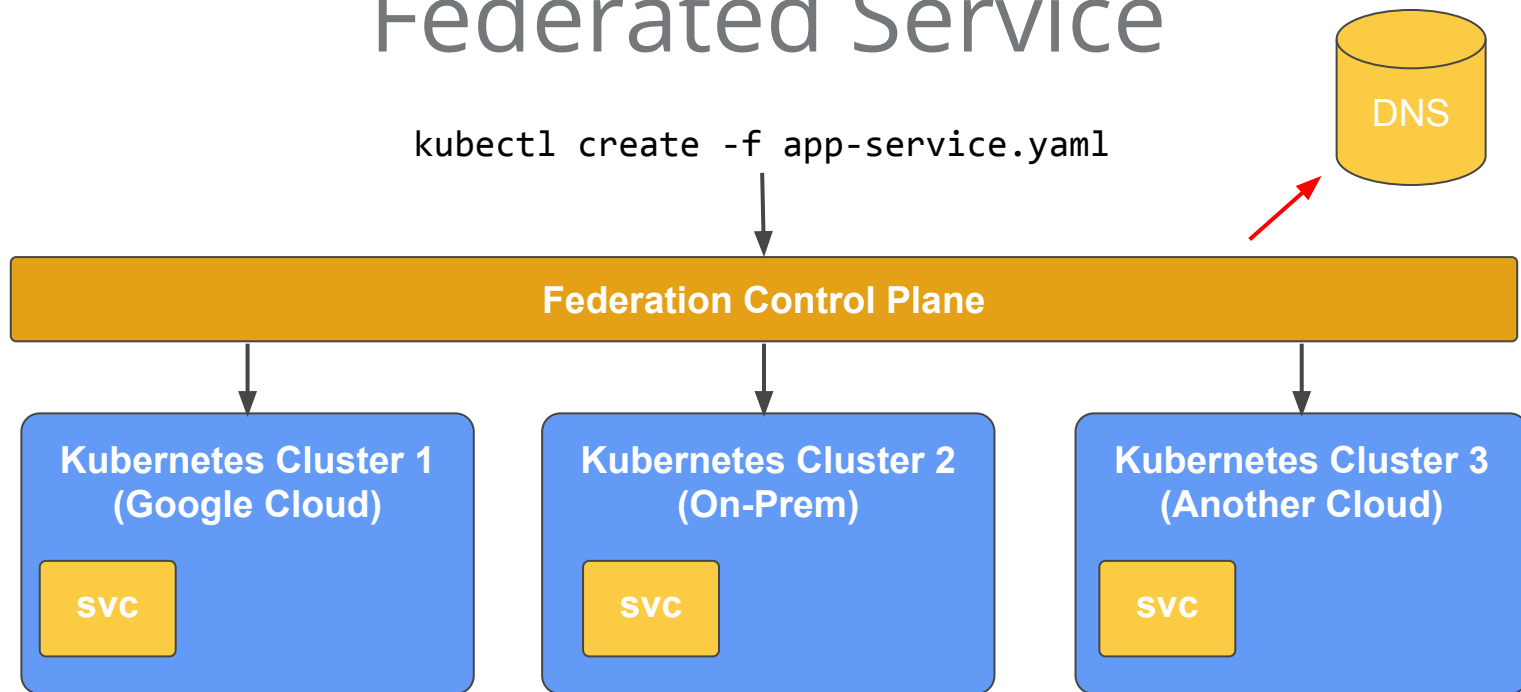
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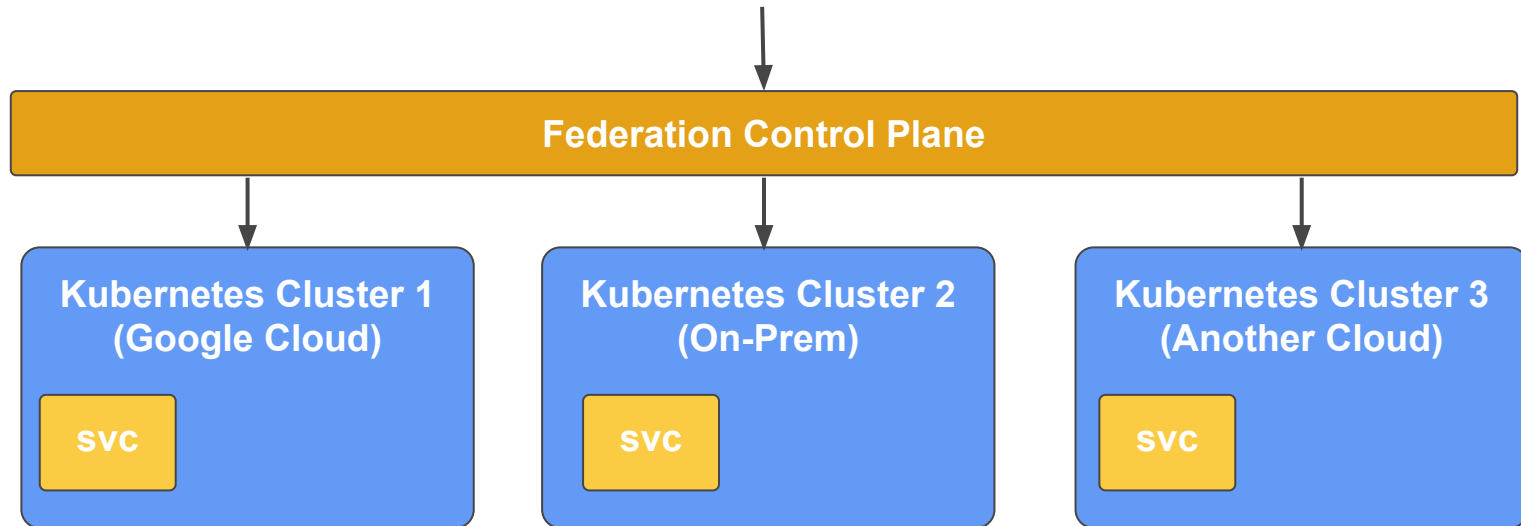
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```



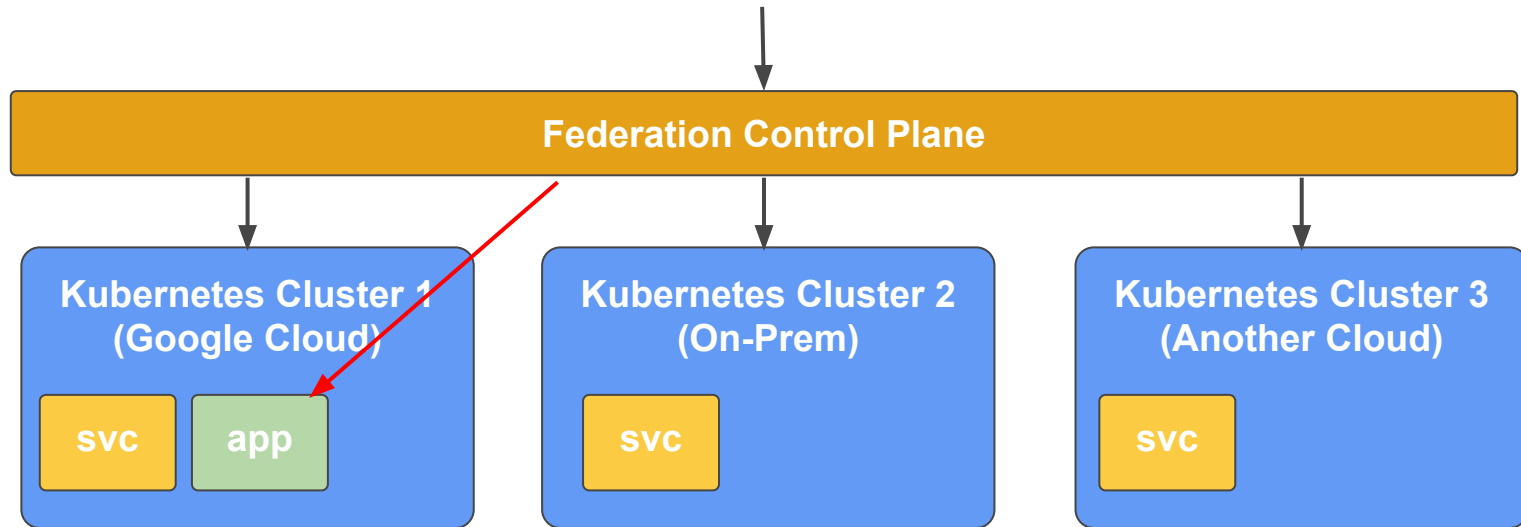
# Federated Deployment

```
kubectl create -f app-deployment.yaml
```



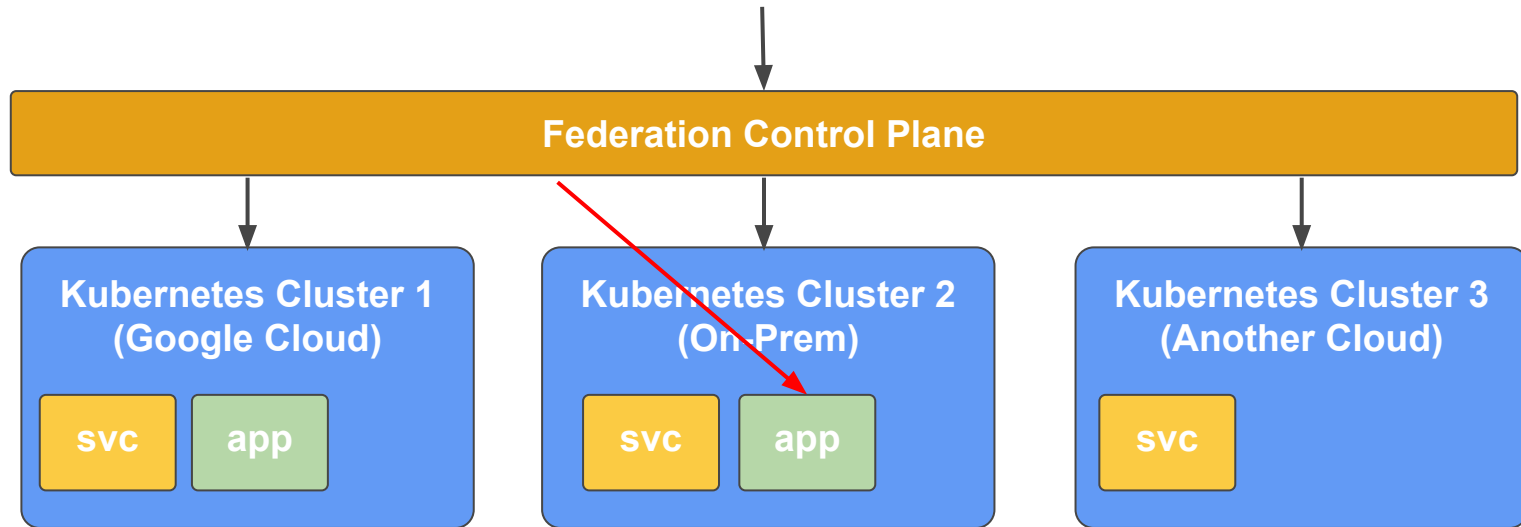
# Federated ReplicaSet

```
kubectl create -f app-deployment.yaml
```



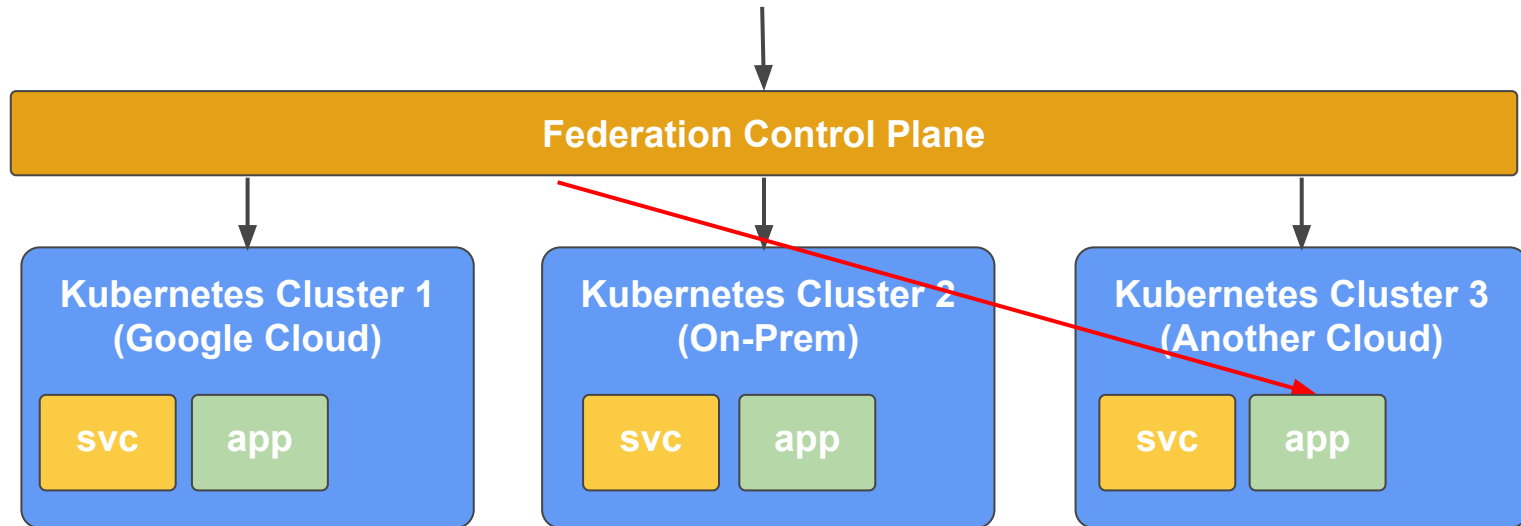
# Federated Deployment

```
kubectl create -f app-deployment.yaml
```



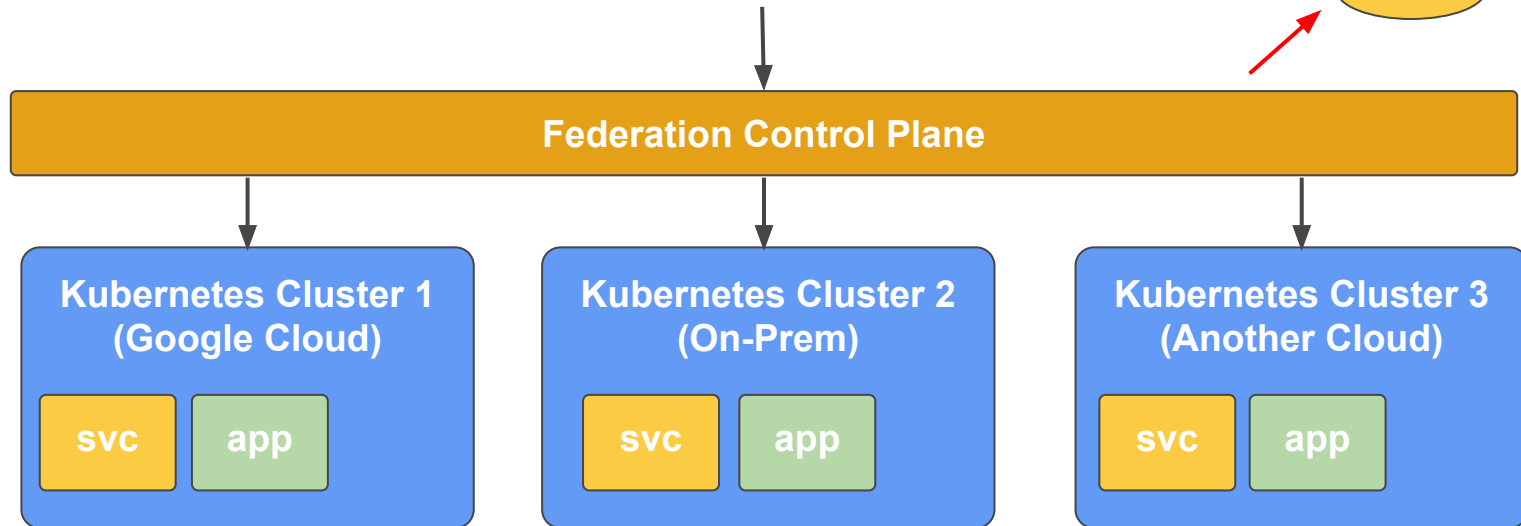
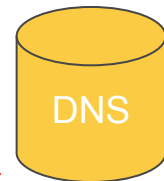
# Federated Deployment

```
kubectl create -f app-deployment.yaml
```



# Federated Deployment

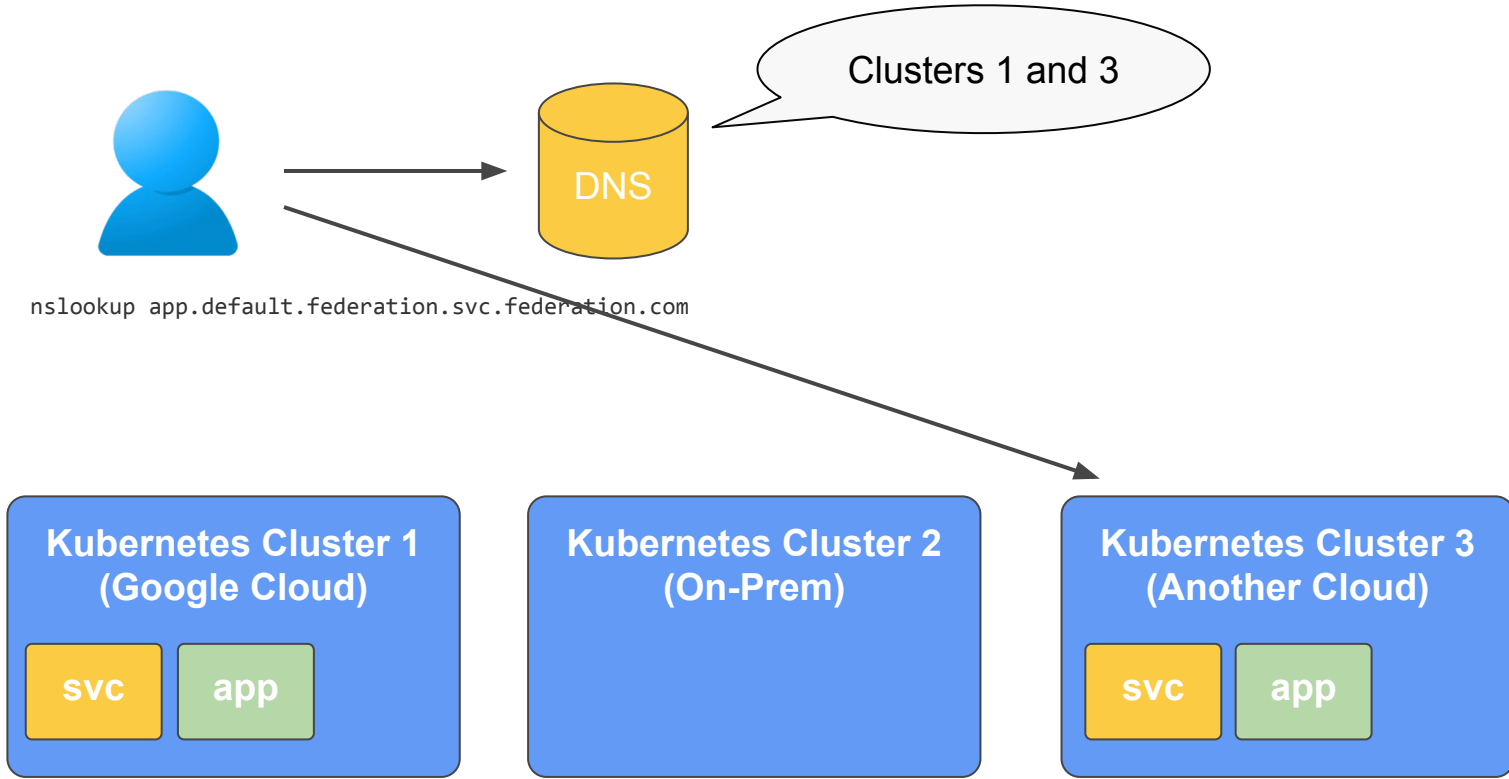
```
kubectl create -f app-deployment.yaml
```



## Resource Record Sets

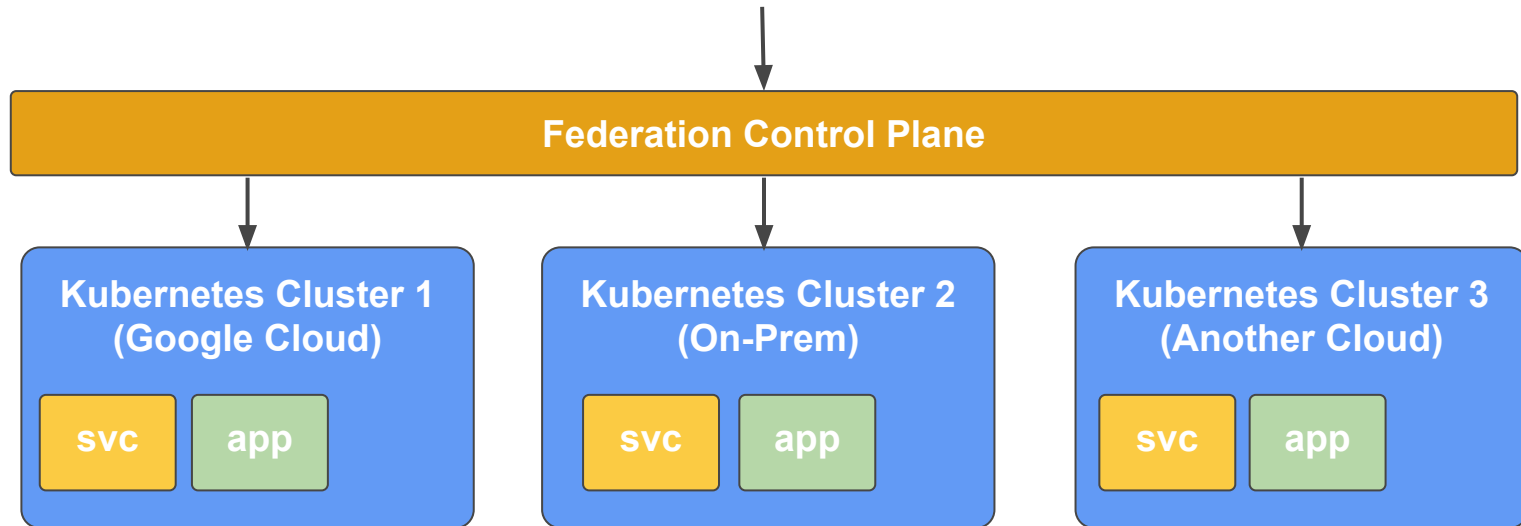
☐ [DNS Name](#) ^

|                                                                                                   | Type | TTL (seconds) | Data                                                                                                                                 |
|---------------------------------------------------------------------------------------------------|------|---------------|--------------------------------------------------------------------------------------------------------------------------------------|
| federation.com.                                                                                   | NS   | 21600         | ns-cloud-b1.googledomains.com.<br>ns-cloud-b2.googledomains.com.<br>ns-cloud-b3.googledomains.com.<br>ns-cloud-b4.googledomains.com. |
| federation.com.                                                                                   | SOA  | 21600         | ns-cloud-b1.googledomains.com. cloud-dns-hostmaster.google.com. 1 21600 3600 259200 300                                              |
| <input type="checkbox"/> nginx.default.federation.svc.asia-east1-b.asia-east1.federation.com.     | A    | 180           | 104.199.198.18                                                                                                                       |
| <input type="checkbox"/> nginx.default.federation.svc.asia-east1.federation.com.                  | A    | 180           | 104.199.198.18                                                                                                                       |
| <input type="checkbox"/> nginx.default.federation.svc.europe-west1-b.europe-west1.federation.com. | A    | 180           | 23.251.129.13                                                                                                                        |
| <input type="checkbox"/> nginx.default.federation.svc.europe-west1.federation.com.                | A    | 180           | 23.251.129.13                                                                                                                        |
| <input type="checkbox"/> nginx.default.federation.svc.federation.com.                             | A    | 180           | 104.155.179.91<br>104.199.198.18<br>104.196.155.68<br>23.251.129.13                                                                  |
| <input type="checkbox"/> nginx.default.federation.svc.us-central1.federation.com.                 | A    | 180           | 104.155.179.91                                                                                                                       |
| <input type="checkbox"/> nginx.default.federation.svc.us-central1-b.us-central1.federation.com.   | A    | 180           | 104.155.179.91                                                                                                                       |
| <input type="checkbox"/> nginx.default.federation.svc.us-east1.federation.com.                    | A    | 180           | 104.196.155.68                                                                                                                       |
| <input type="checkbox"/> nginx.default.federation.svc.us-east1-b.us-east1.federation.com.         | A    | 180           | 104.196.155.68                                                                                                                       |



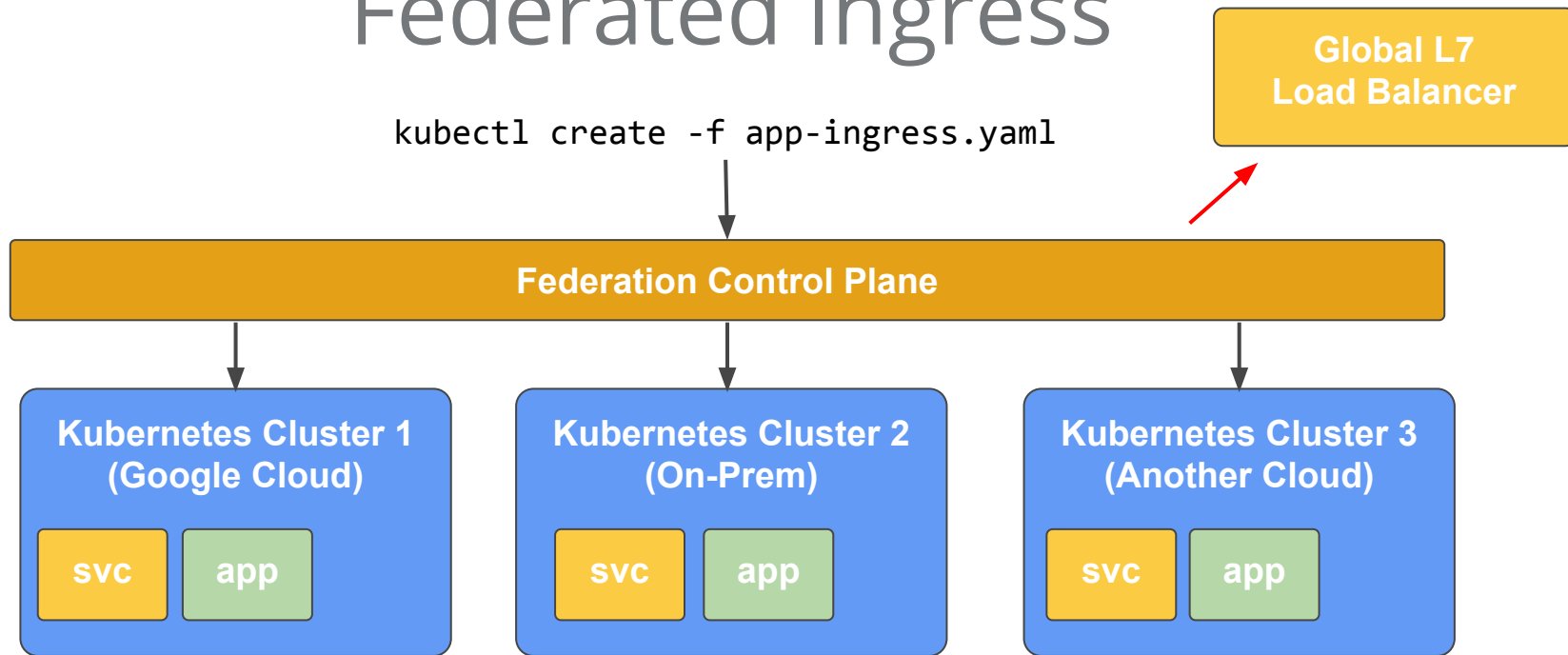
# Federated Ingress

```
kubectl create -f app-ingress.yaml
```



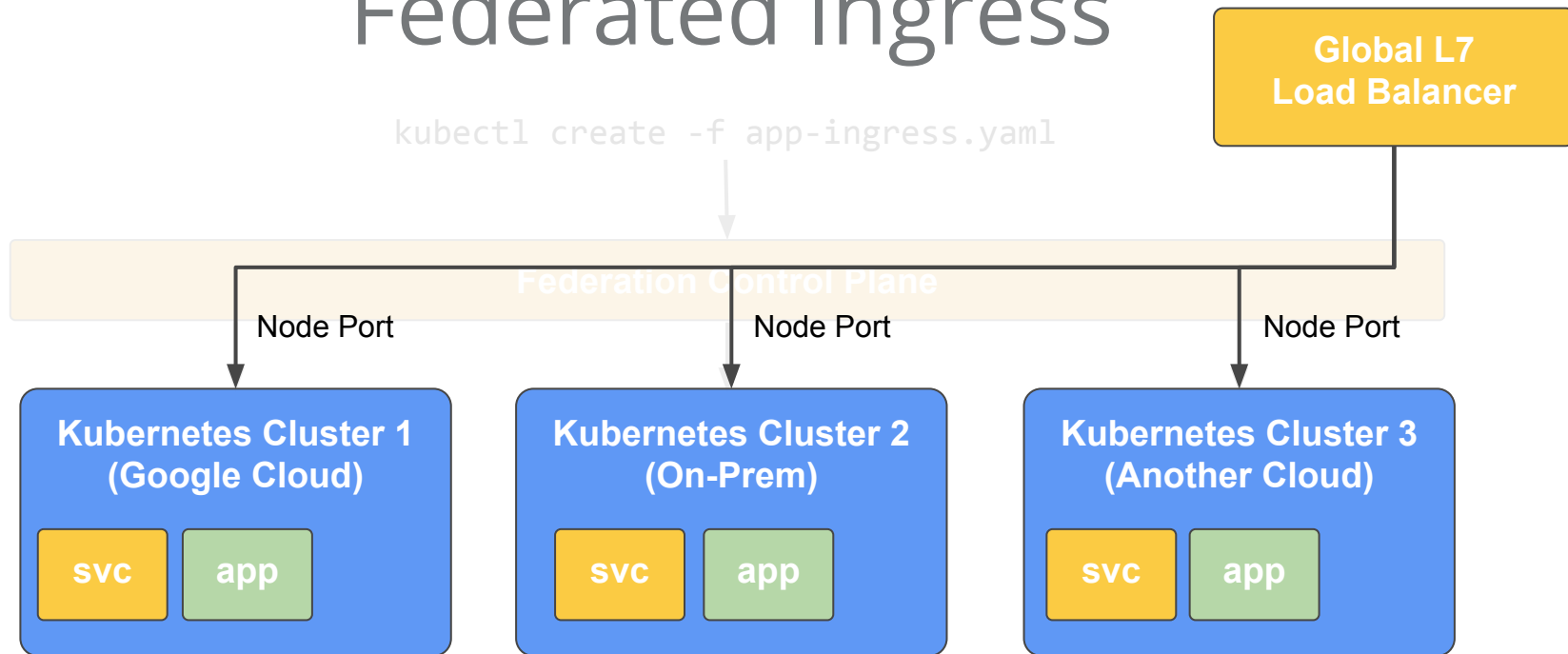
# Federated Ingress

```
kubectl create -f app-ingress.yaml
```



# Federated Ingress

```
kubectl create -f app-ingress.yaml
```



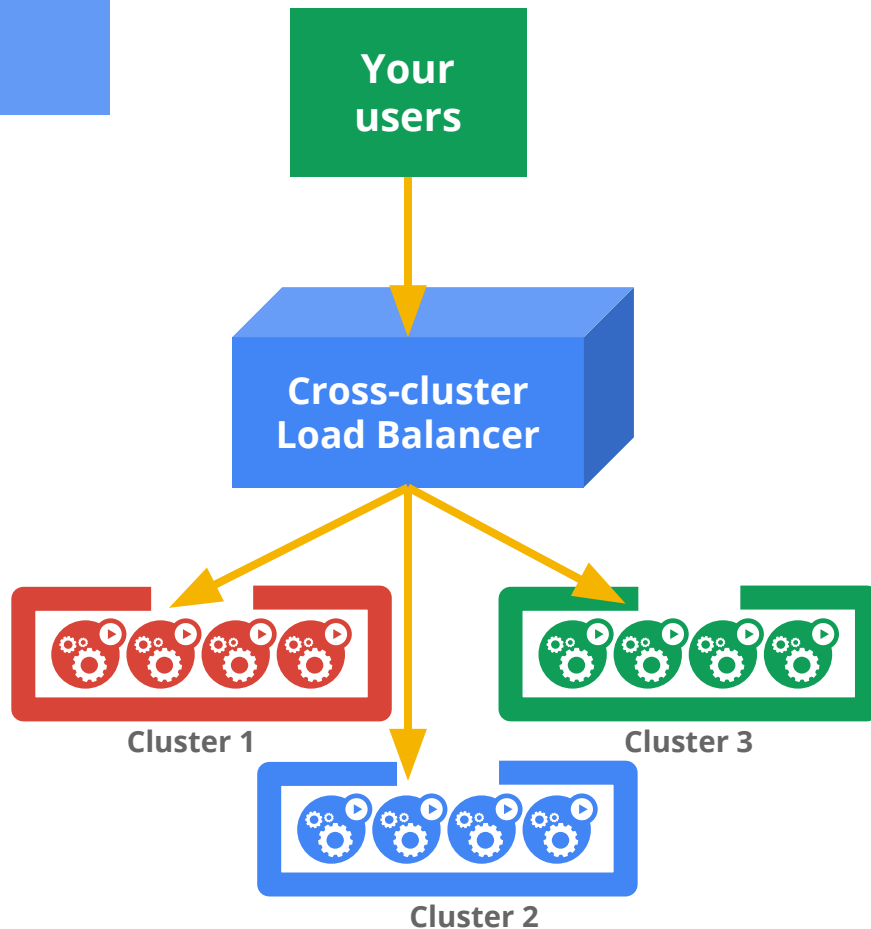
# Use Cases

Higher Availability

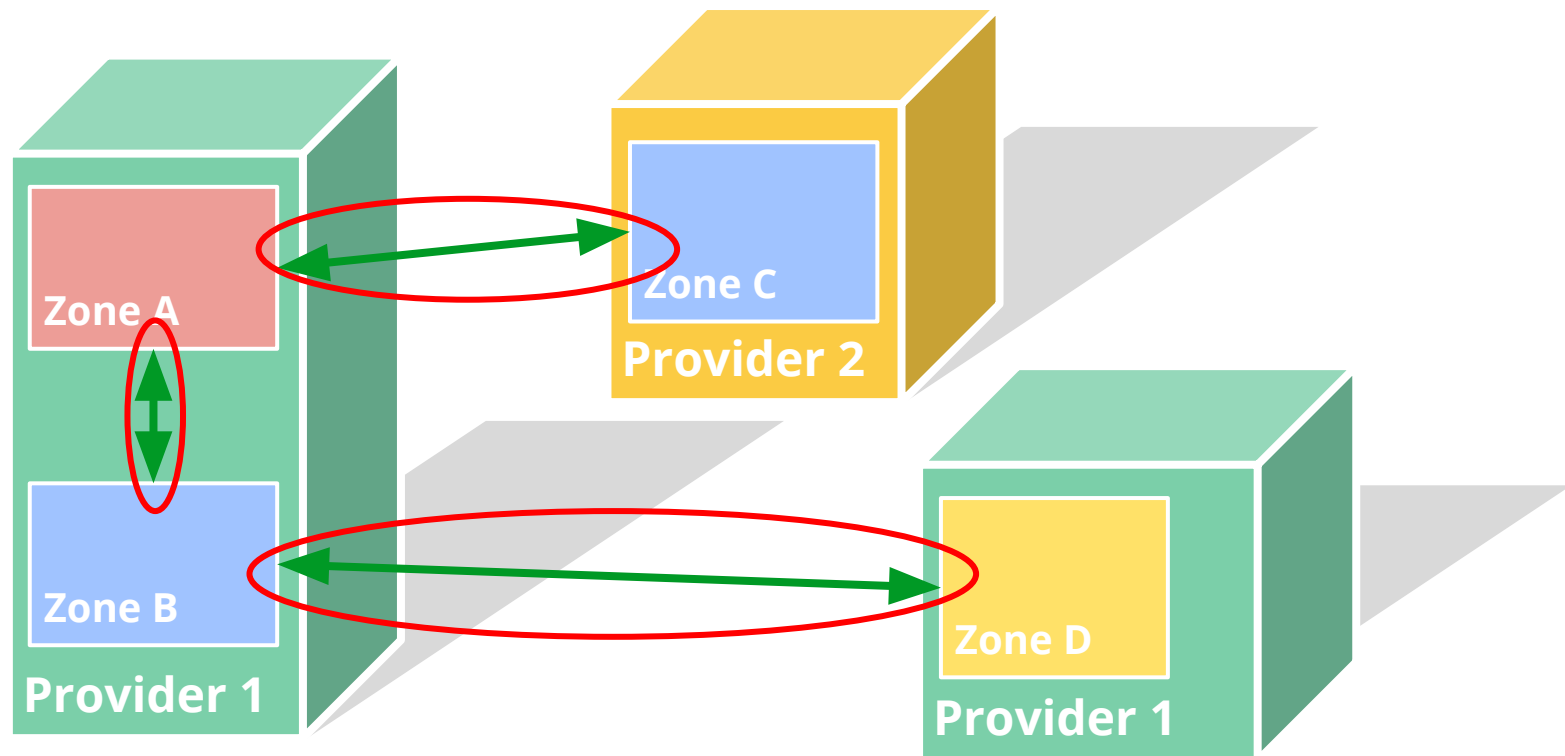
Easy Application Migration

Avoid Vendor Lock-in

Capacity Overflow



# Challenges

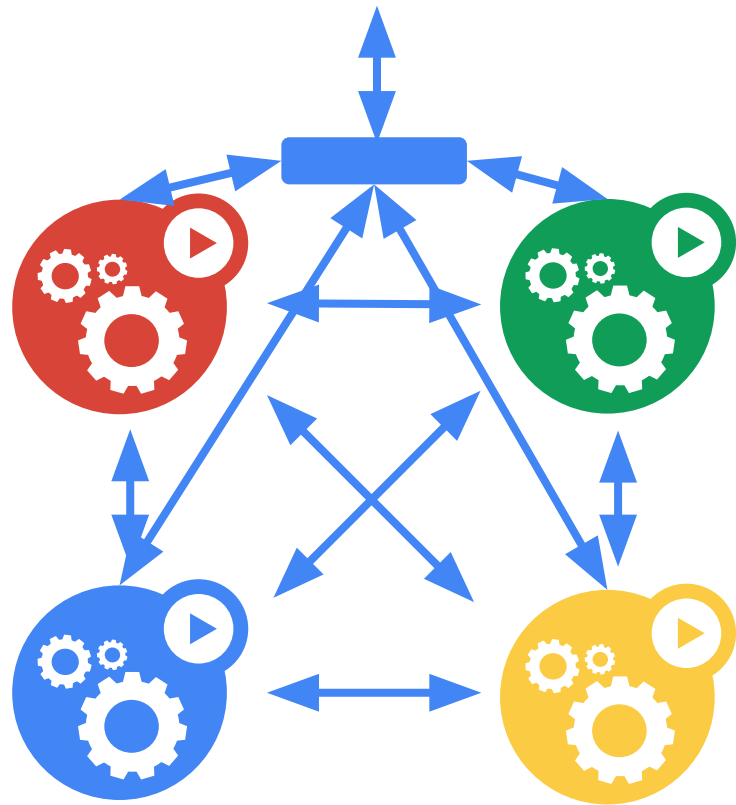


# Cross-cluster Load Balancing

Geographically aware DNS gets clients to the "closest" healthy cluster.

Standard Kubernetes service load balancing within each cluster.

Can be extended to divert traffic away from "healthy-but-saturated" clusters.



# Location affinity

## **Strictly coupled** pods/applications

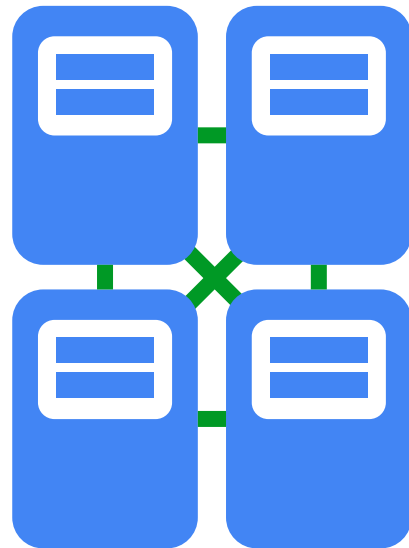
- High bandwidth requirements
- Low latency requirements
- High fidelity requirements
- Cannot easily span clusters

## **Loosely coupled**

- Opposite of above
- Relatively easily distributed across clusters

## **Preferentially coupled**

- Strongly coupled but can be migrated piecemeal.



# Location affinity continued...

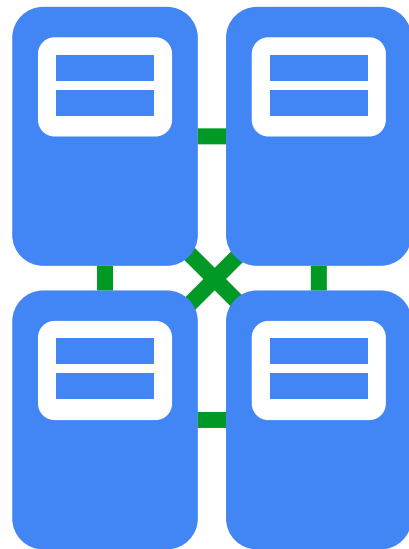
## Negative Affinity

- Don't run my replicas in the same failure domain (host/rack/zone)

## Topology

- Same host
- Same rack
- Same zone
- Same metro region
- Same sub-continent

## Absolute affinity



# Resources

Google Container Engine: <https://cloud.google.com/container-engine/>

Minikube: <https://github.com/kubernetes/minikube>

Spring Boot Example: <https://github.com/saturnism/spring-boot-docker>

Federation Example: <https://github.com/saturnism/buttonmasher>

Visualizer: <https://github.com/saturnism/gcp-live-k8s-visualizer>

Code Lab (with Federation): [bit.ly/k8s-lab](https://bit.ly/k8s-lab)

A wide-angle, high-angle photograph of a vast, modern data center. The space is filled with rows of server racks, some of which are illuminated with blue and yellow lights. A complex network of metal racks and cables is visible, creating a sense of depth and scale. The ceiling is high with a visible steel truss structure and numerous hanging lights. The floor is a light-colored, polished tile.

Thanks!

<http://kubernetes.io>