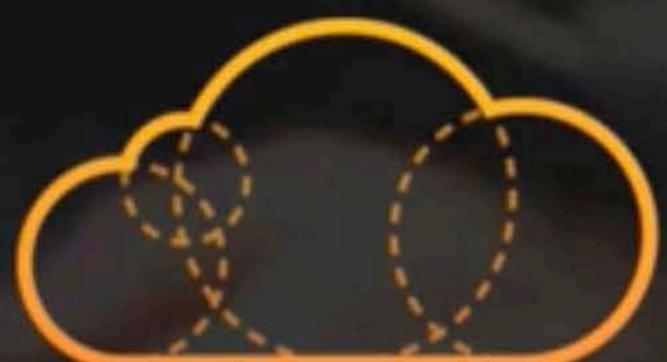


Kubernetes Deep Dive

Nigel Poulton



A CLOUD GURU

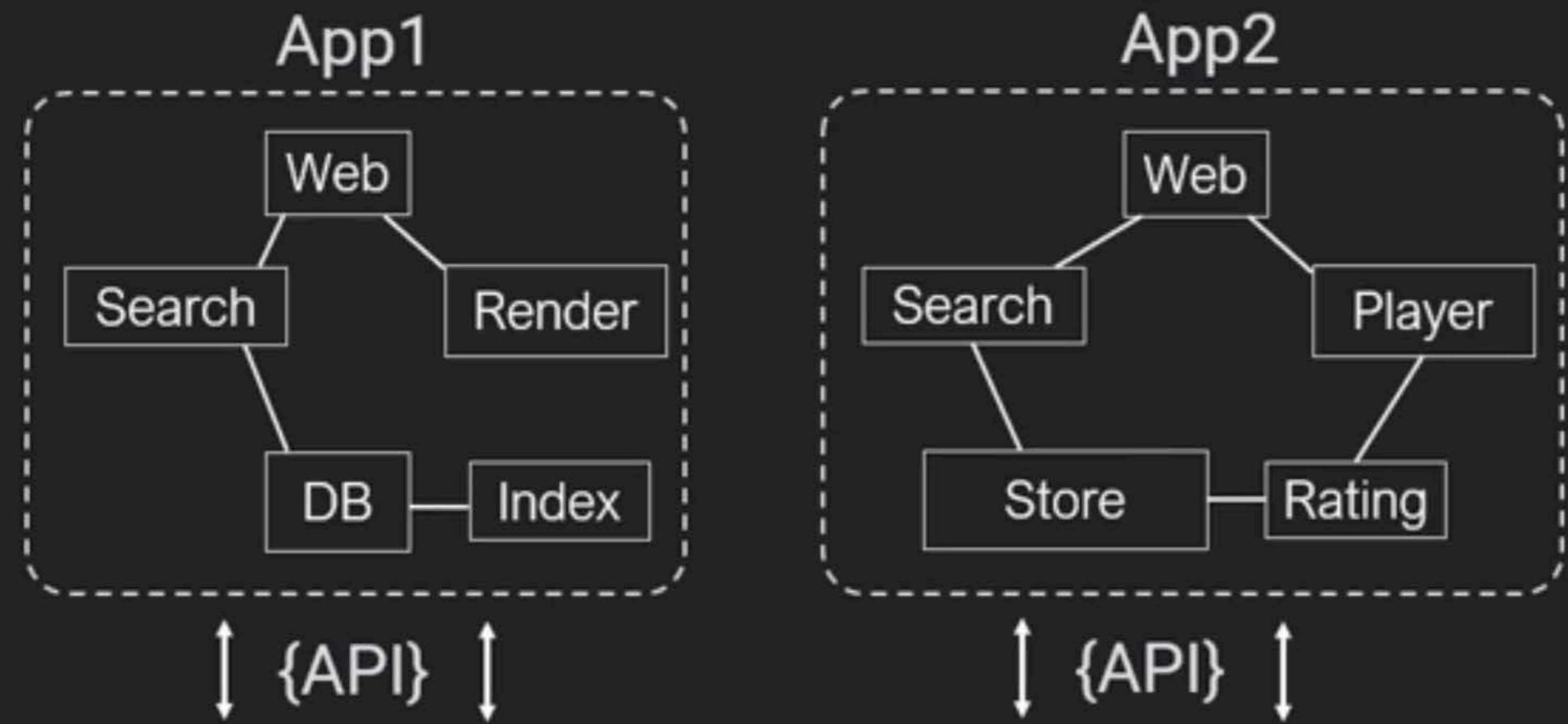
Why Kubernetes



kubernetes

Becoming the de facto cloud-native standard...

Why Kubernetes



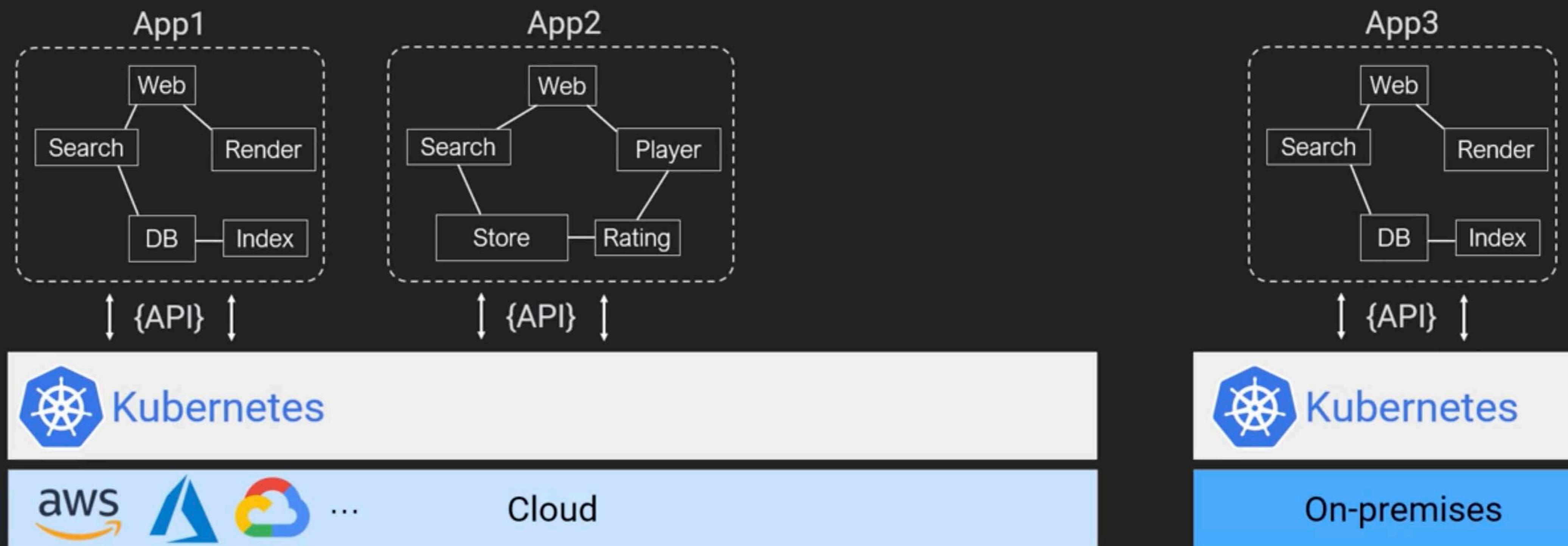
Kubernetes



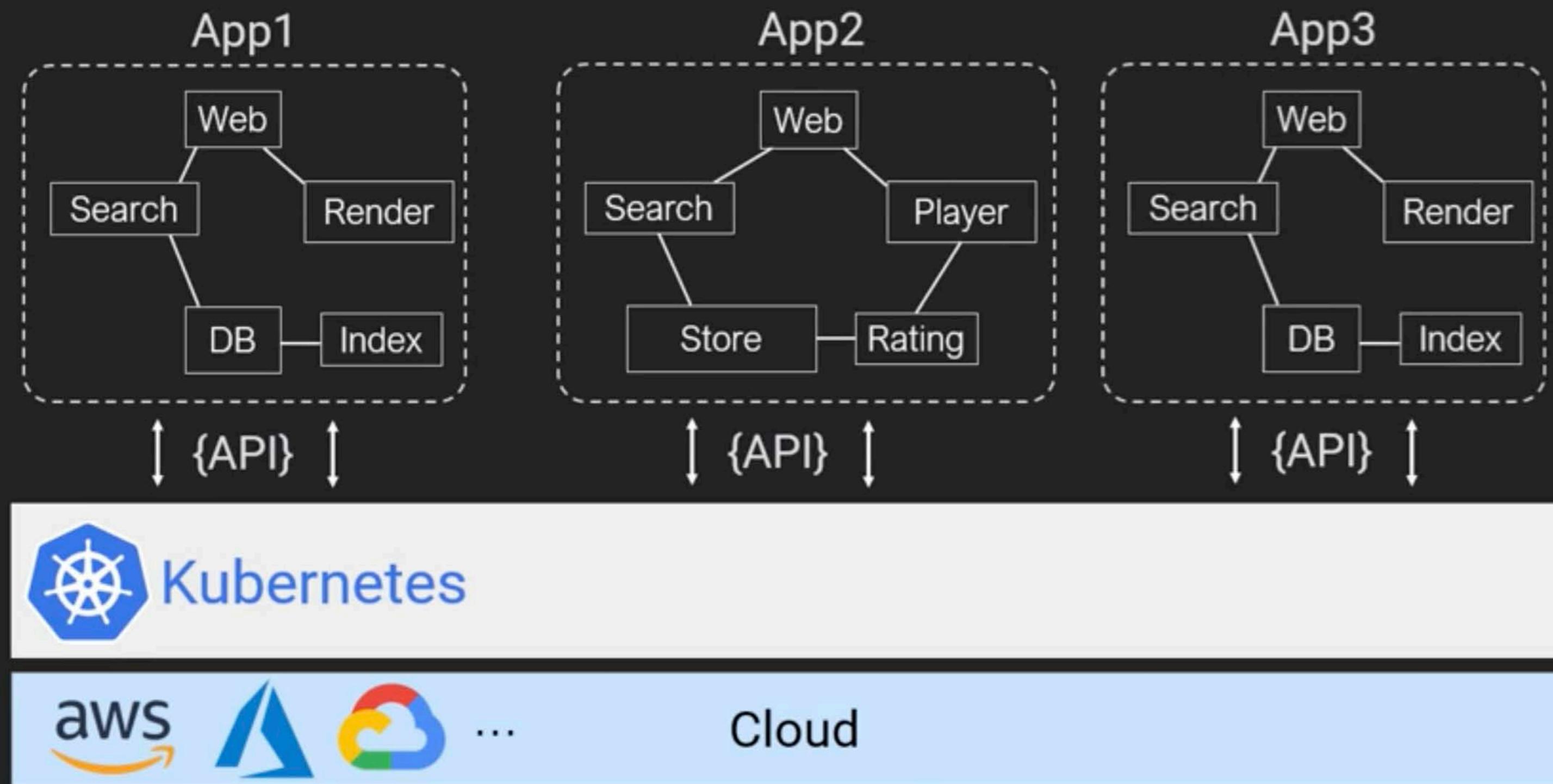
...

Cloud

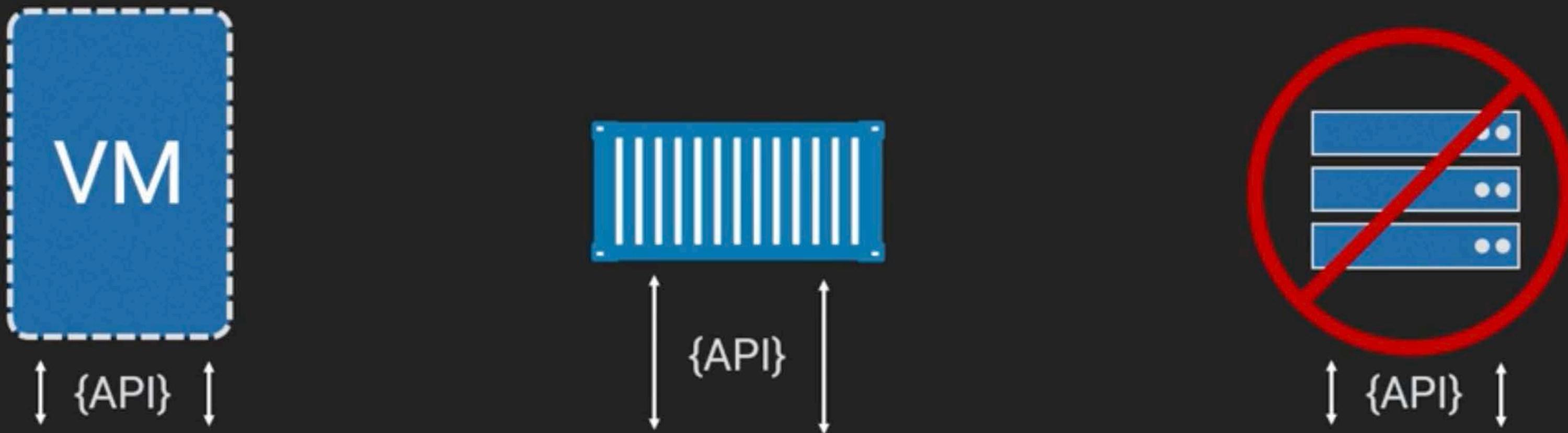
Why Kubernetes



Why Kubernetes



Why Kubernetes

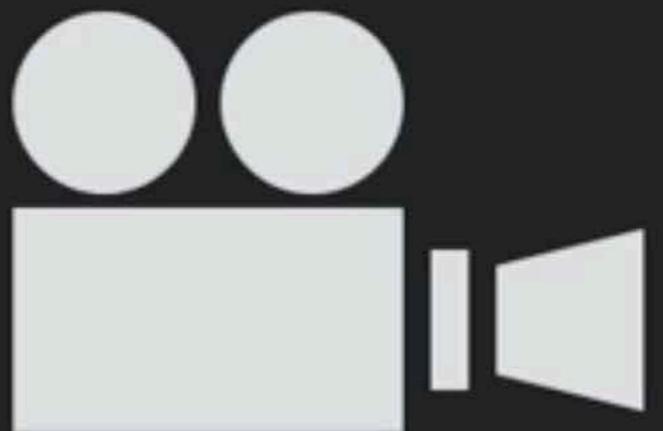
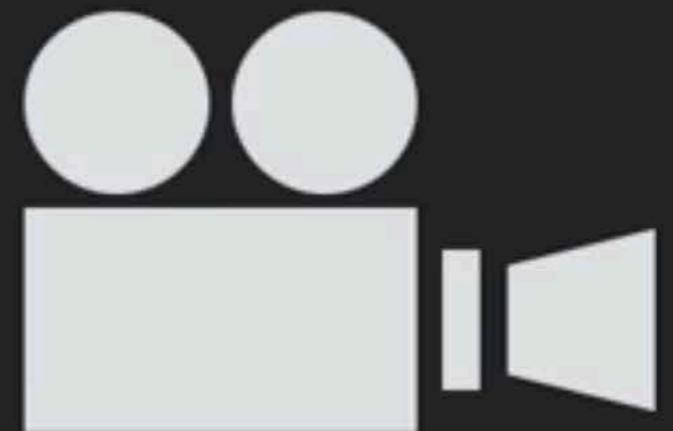
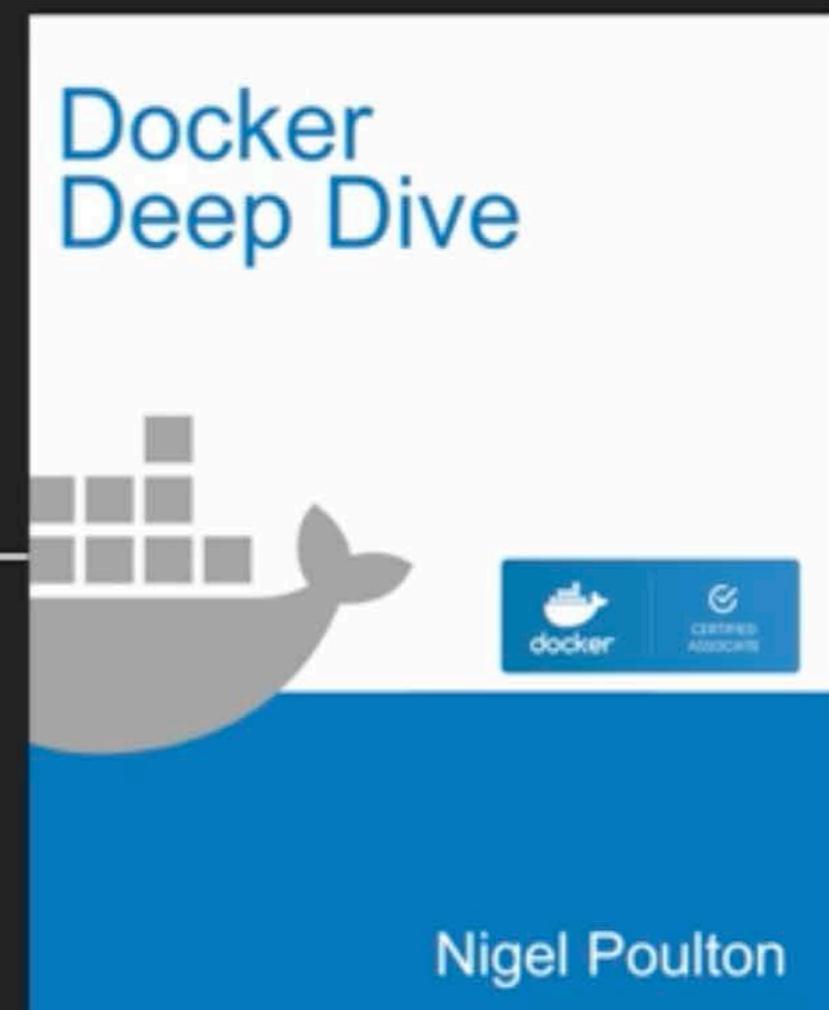
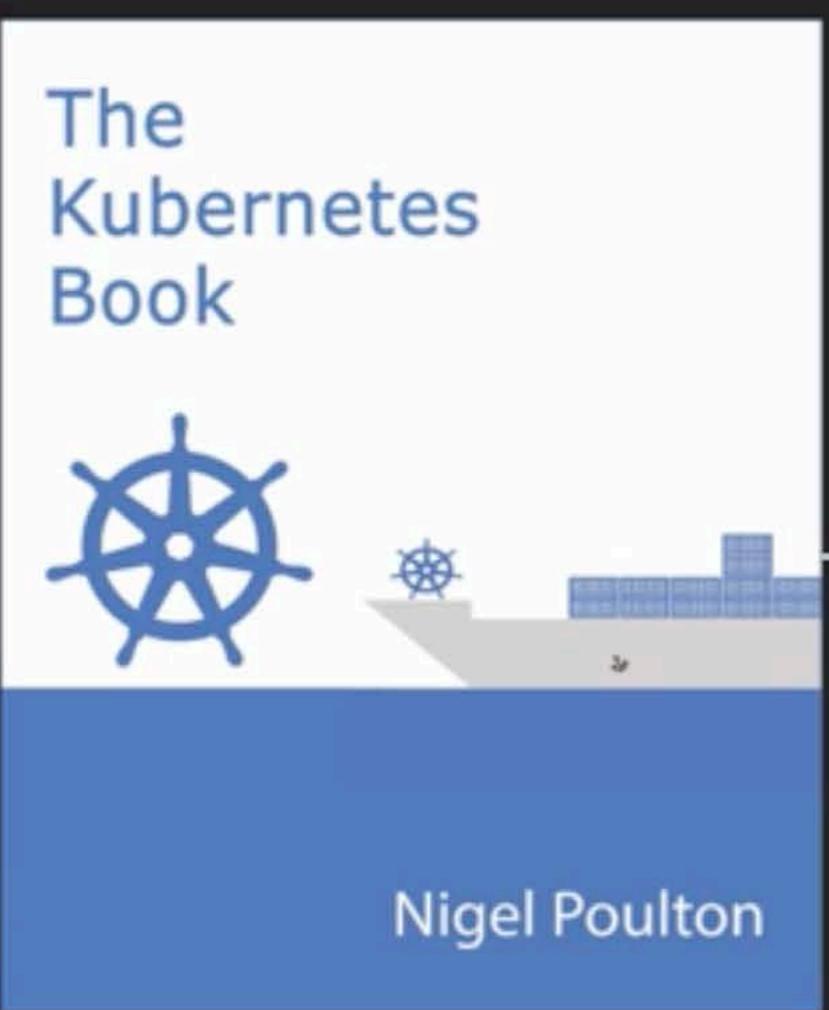


Cloud

About Me



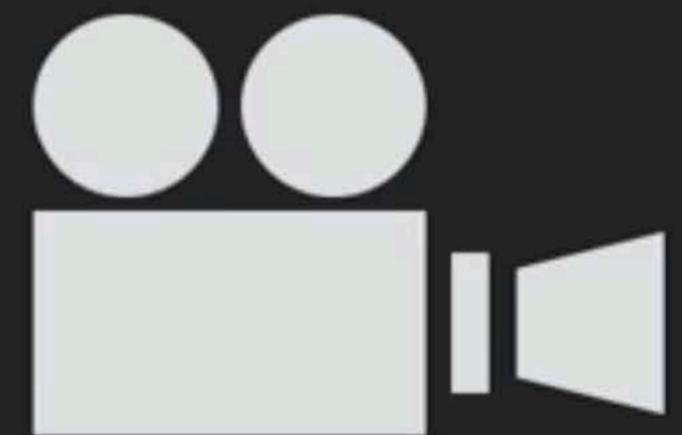
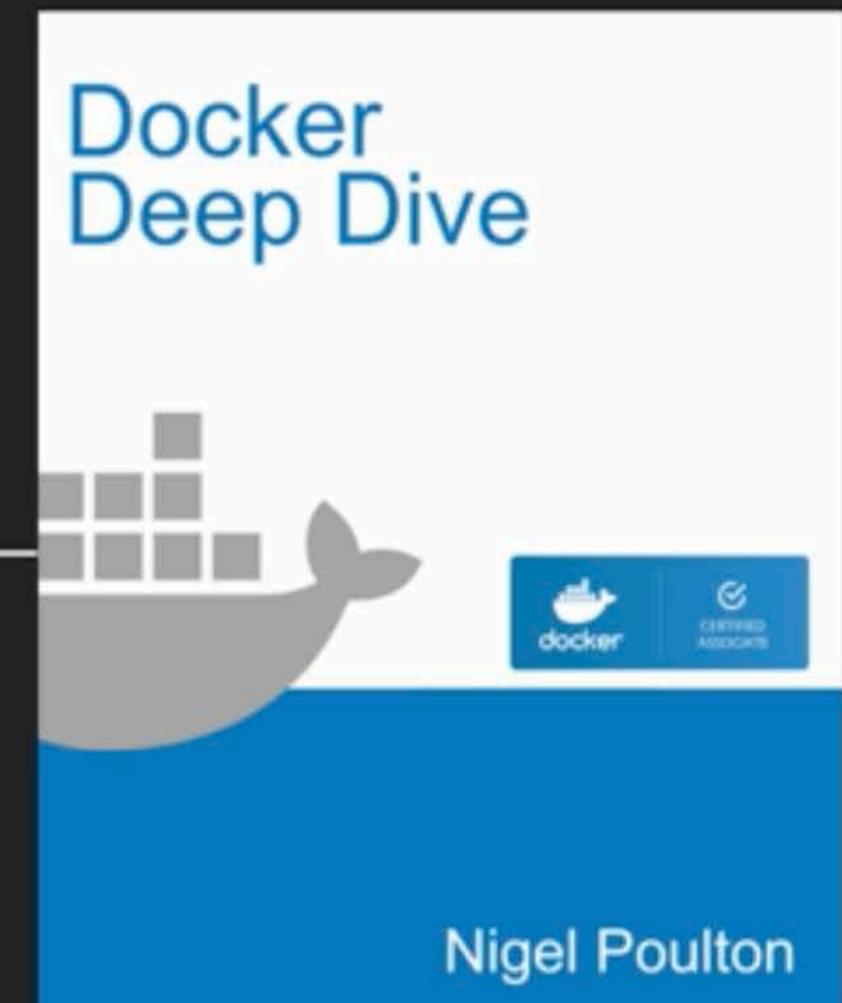
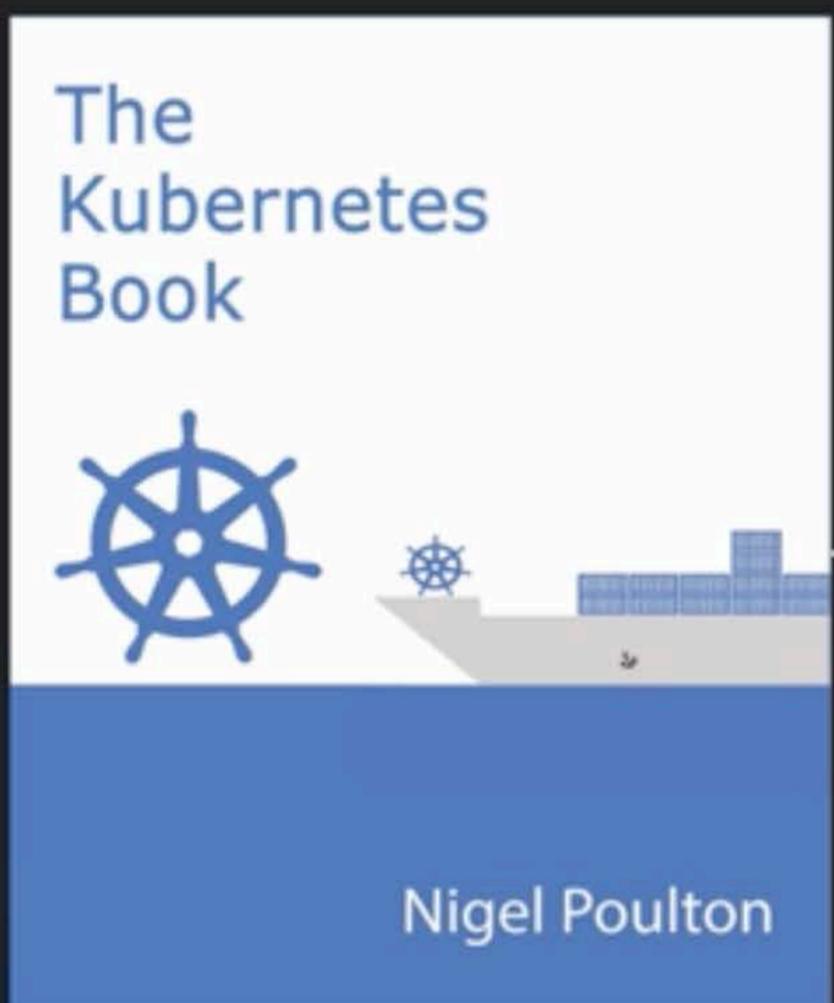
A CLOUD GURU



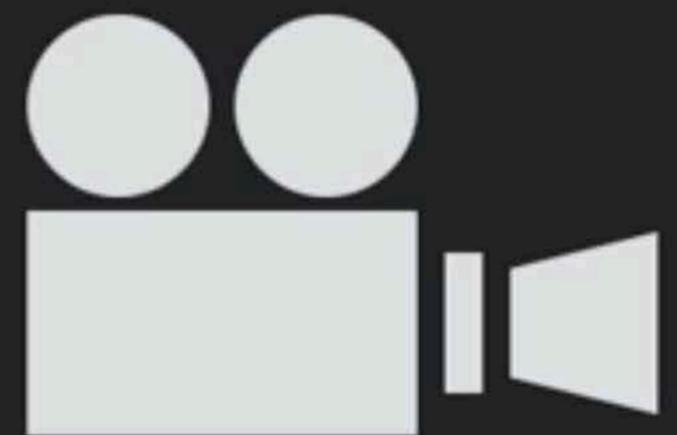
About Me



A CLOUD GURU



@nigelpoulton





How Deep?

Individual parts



K8s platform



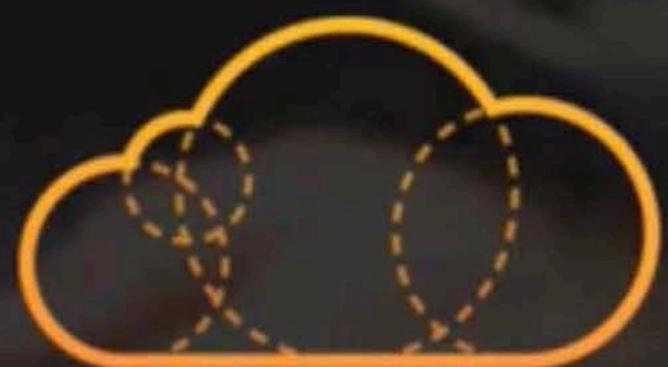
K8s is shorthand for **Kubernetes**.
The **8** represents the 8 letters between the **K** and the **s**.

The Course



Developing FAST!

Schedule



A CLOUD GURU

Lesson Plan

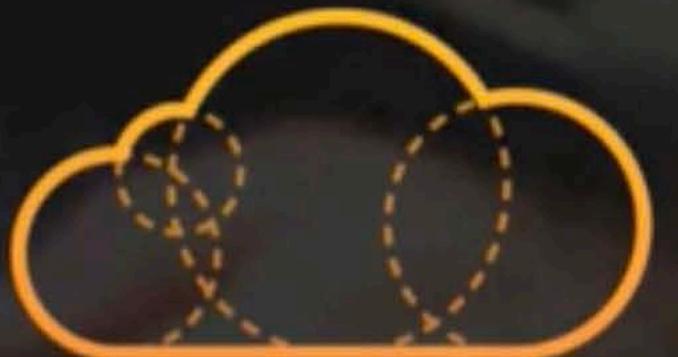


- Kubernetes Big Picture
- Kubernetes App Architecture
- Kubernetes Networking
- Kubernetes Storage
- From Code to Kubernetes
- Kubernetes Deployments
- Scaling Kubernetes Apps
- RBAC and Admission Control
- Other Kubernetes Stuff
- What Next

***SORRY** about the bullet-points!!



Course Prereqs



A CLOUD GURU

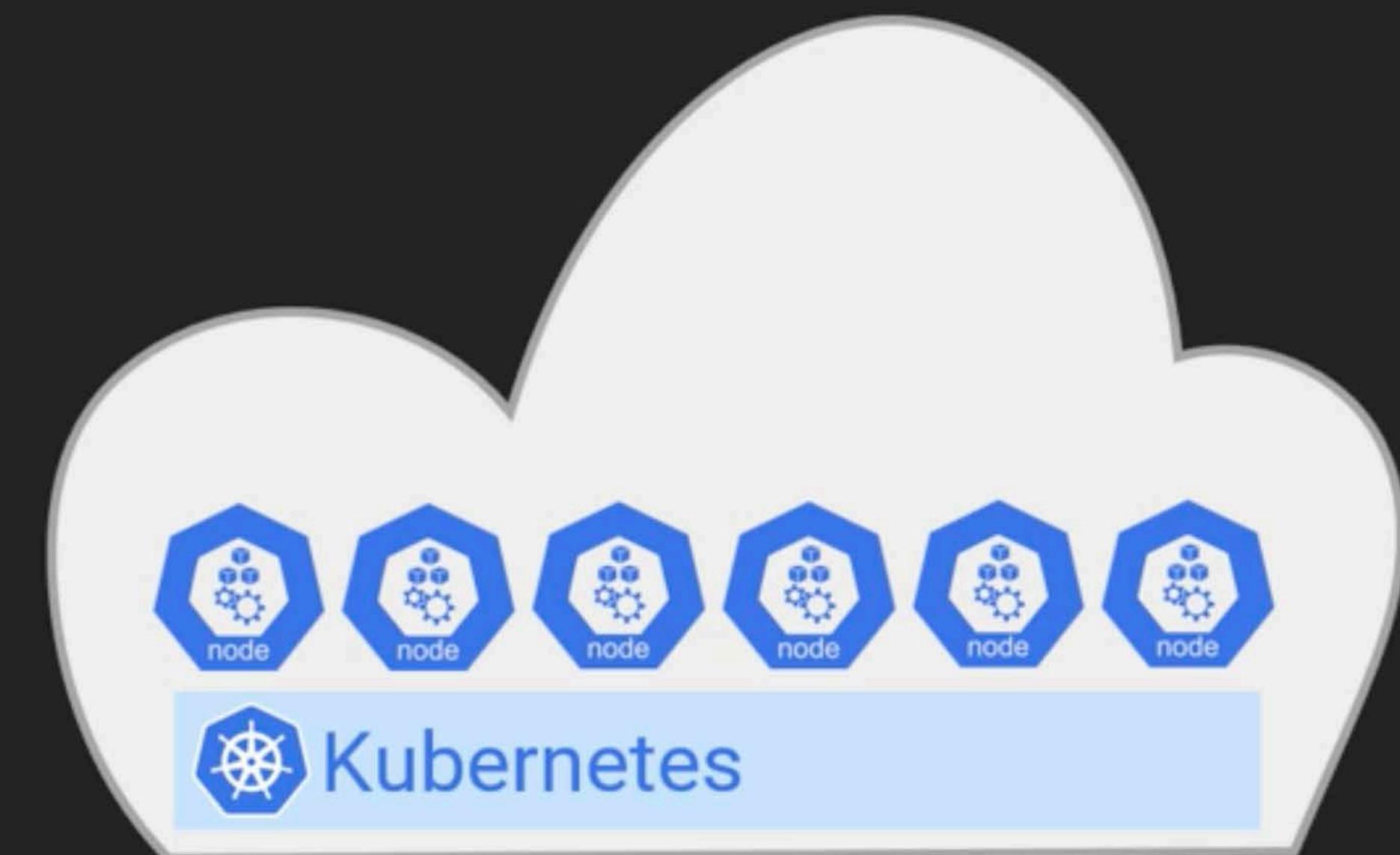
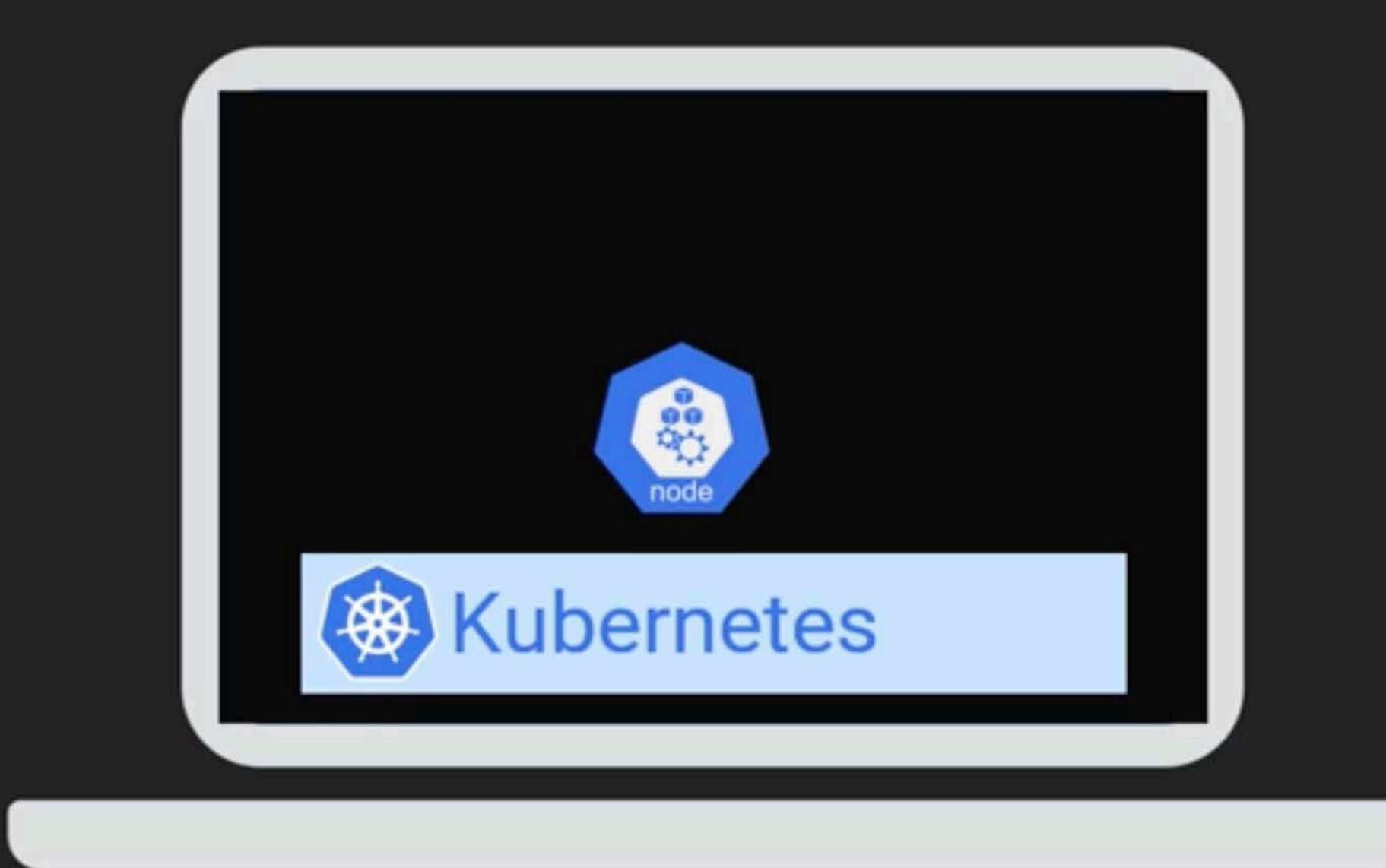
The Course



A CLOUD GURU

WWW

The Course



The Course



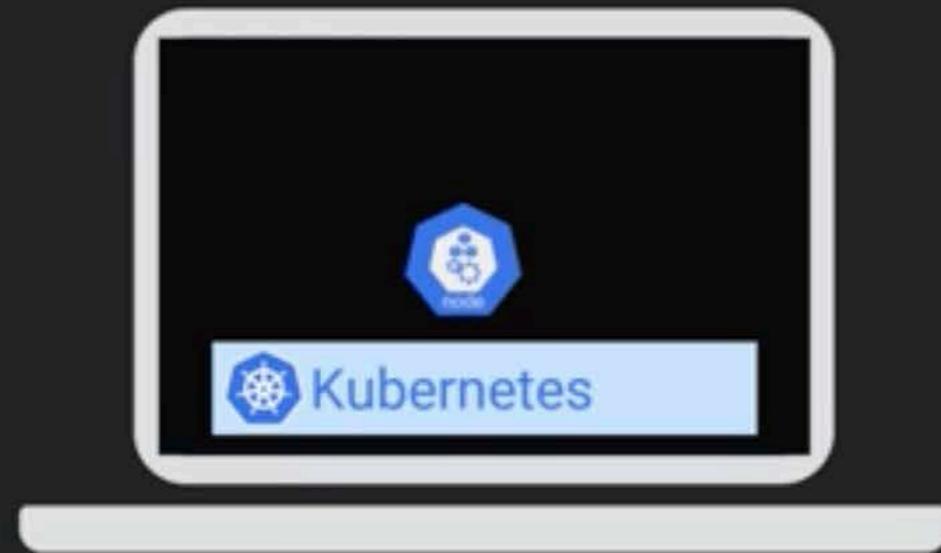
A CLOUD GURU



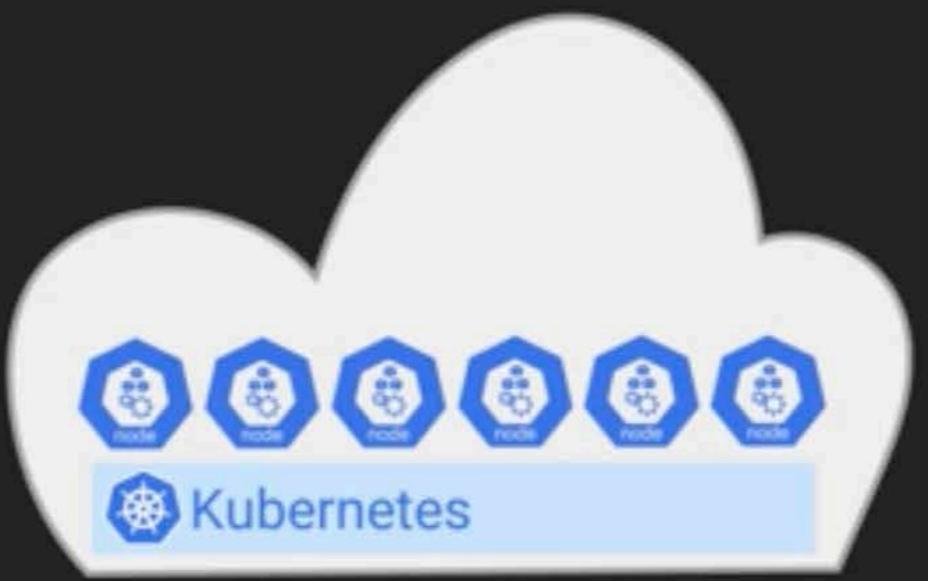
Installations...



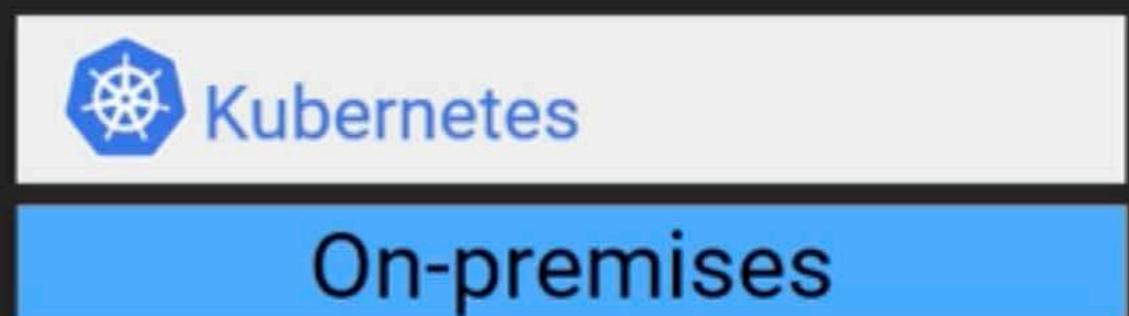
A CLOUD GURU



- Minikube
- Docker for Desktop

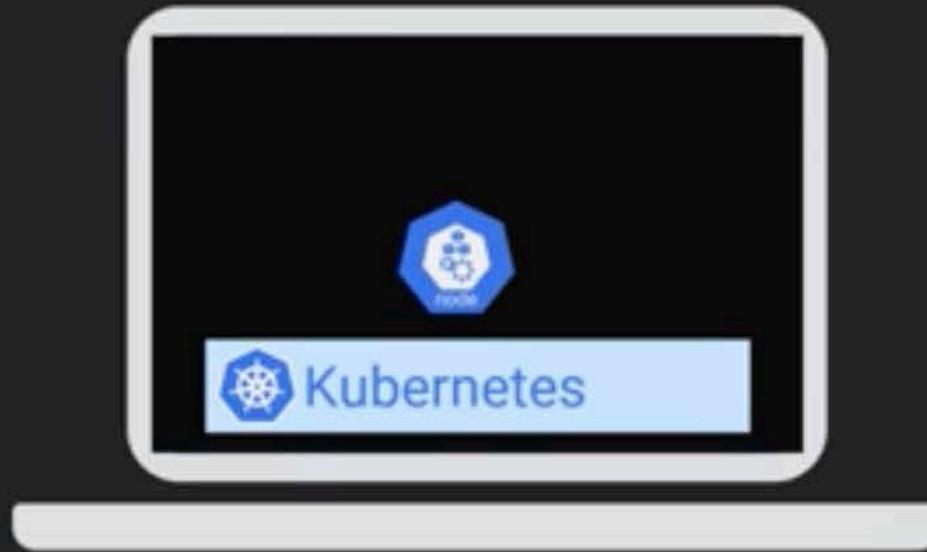


- AKS (hosted)
- EKS (hosted)
- GKE (hosted)
- Kops

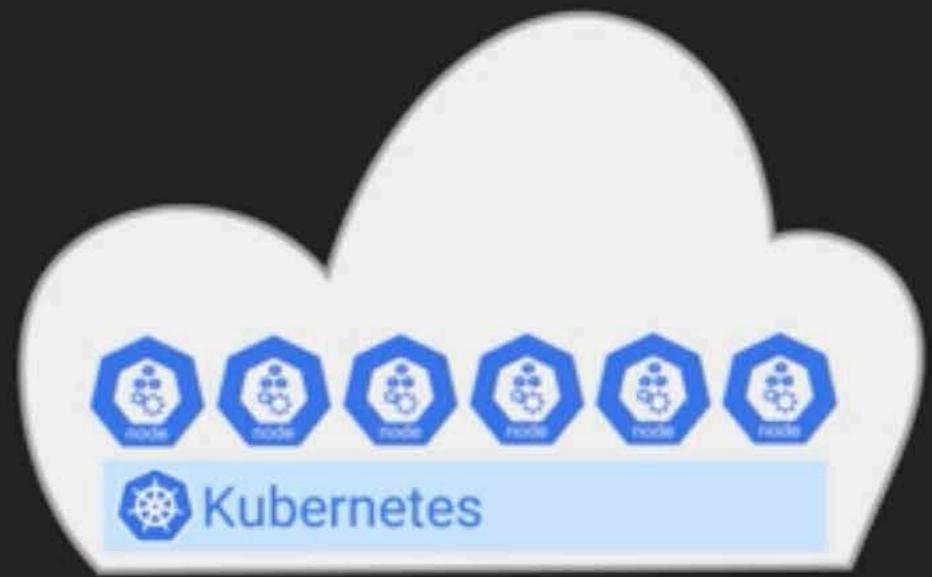


Cloud options may incur costs!

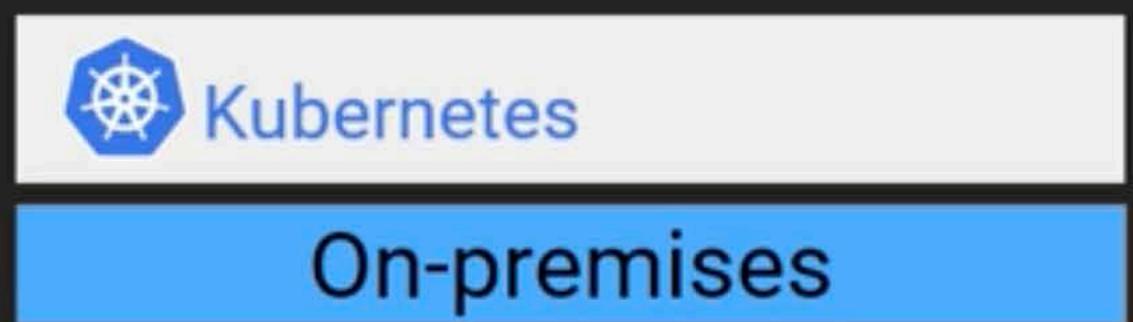
Installations...



- Minikube
- Docker for Desktop



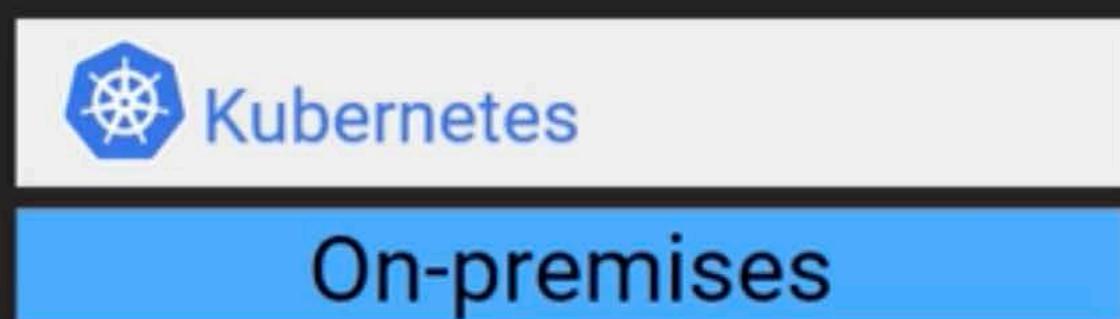
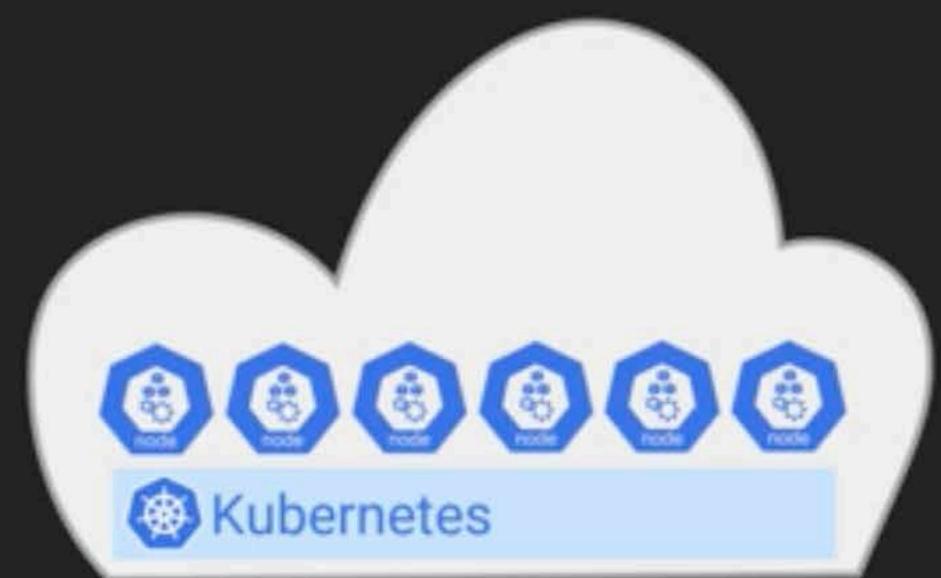
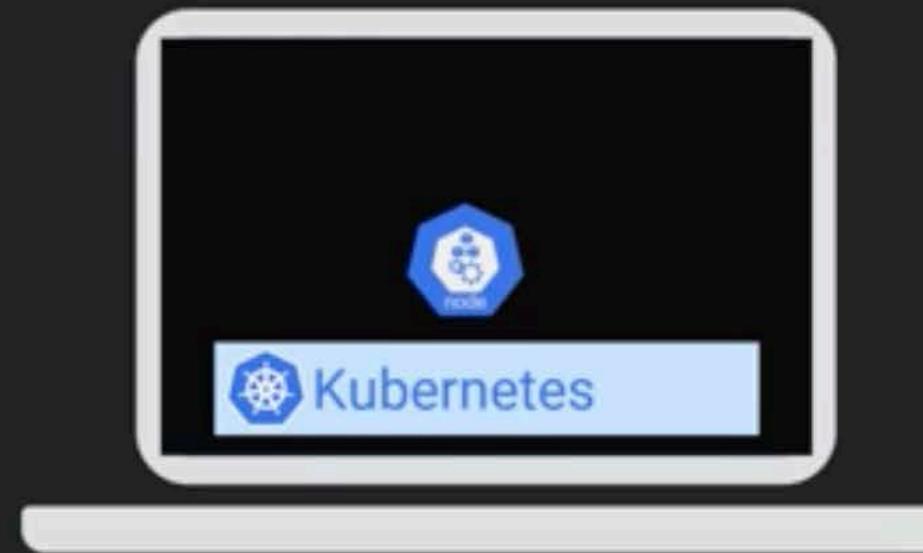
- AKS (hosted)
- EKS (hosted)
- GKE (hosted)
- Kops



- Kubeadm

* Play with Kubernetes (PWK)
<http://play-with-k8s.com>

Installations...



- Minikube ●
- Docker for Desktop ●

- AKS (hosted) ●
- EKS (hosted) ●
- GKE (hosted) ●
- Kops ●

- Kubeadm ●

Ease/speed of installation

● Fairly easy

● Really easy

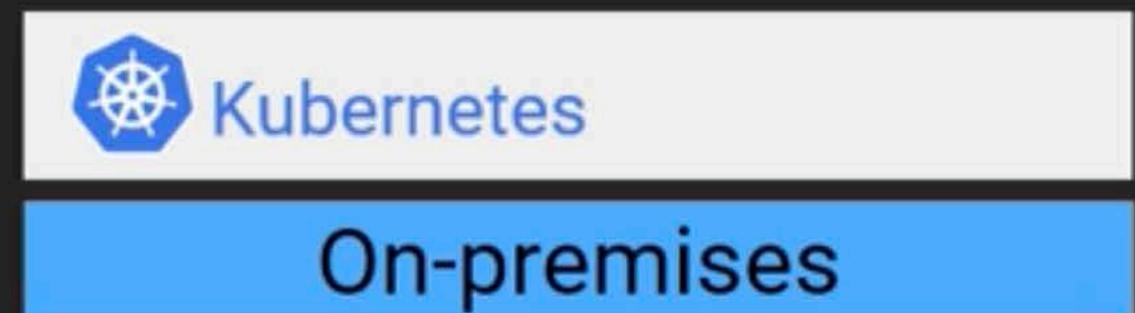
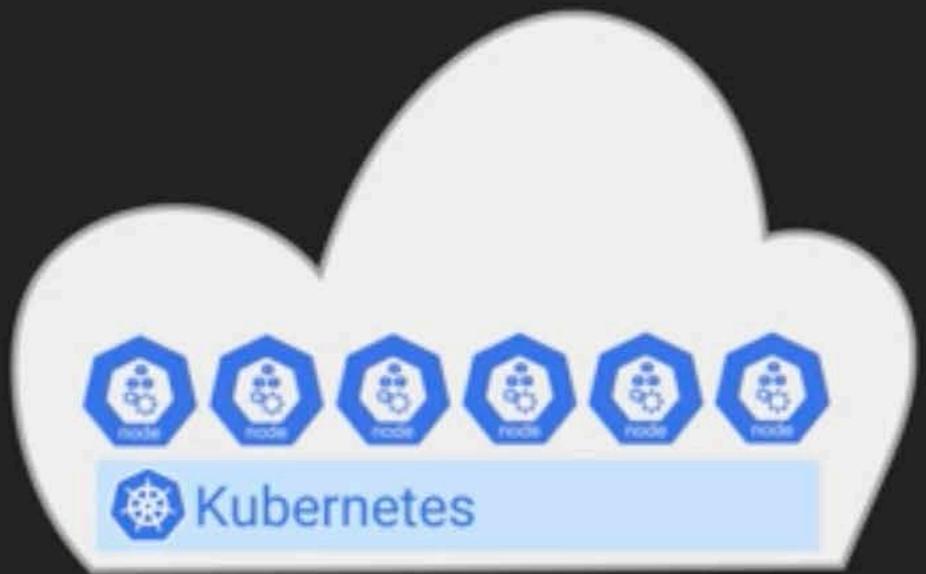
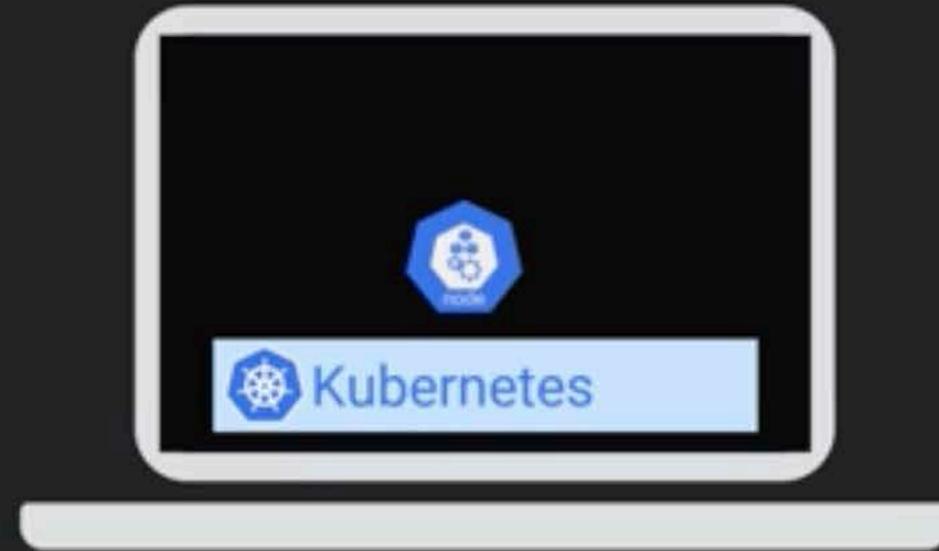
● Really really easy

* Play with Kubernetes (PWK)
<http://play-with-k8s.com>

Installations...



A CLOUD GURU



- Minikube ● (Yellow)
- Docker for Desktop ● (Green)

Ease/speed of installation

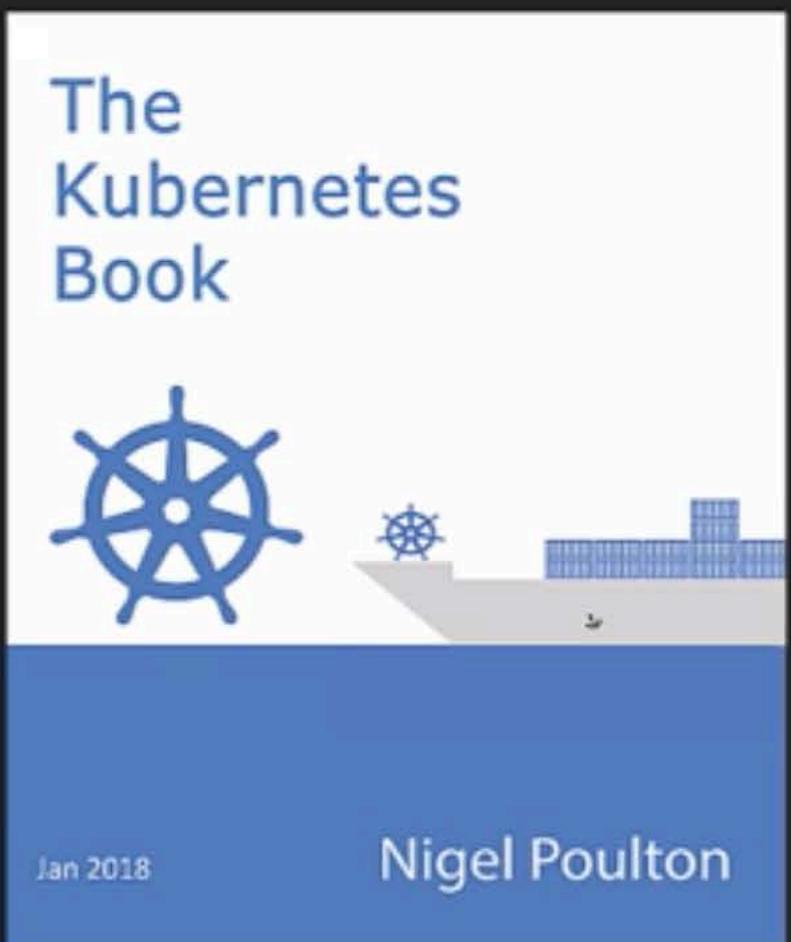
● Fairly easy

● Really easy

● Really really easy

- AKS (hosted) ● (Green)
- EKS (hosted) ● (Green)
- GKE (hosted) ● (Green)
- Kops ● (Red)

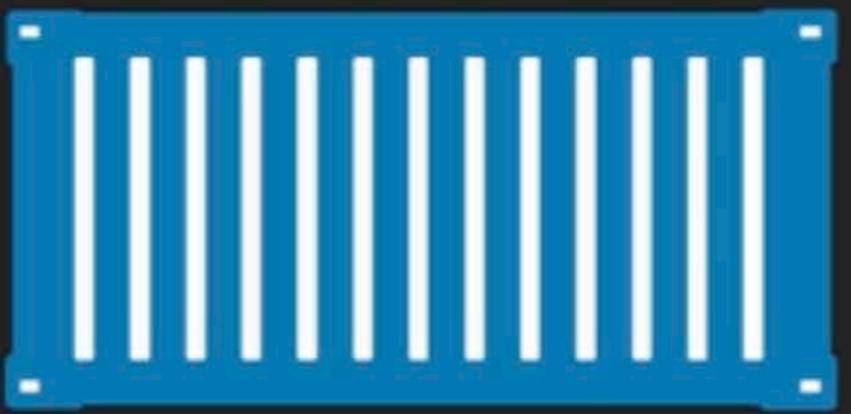
* Play with Kubernetes (PWK)
<http://play-with-k8s.com>



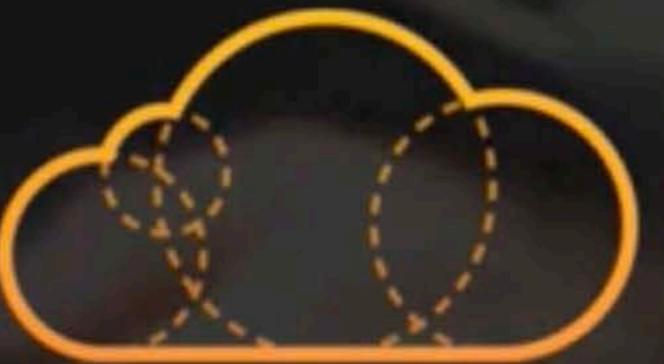
Prereqs



Understanding of the cloud and containers is beneficial



Kubernetes Big Picture



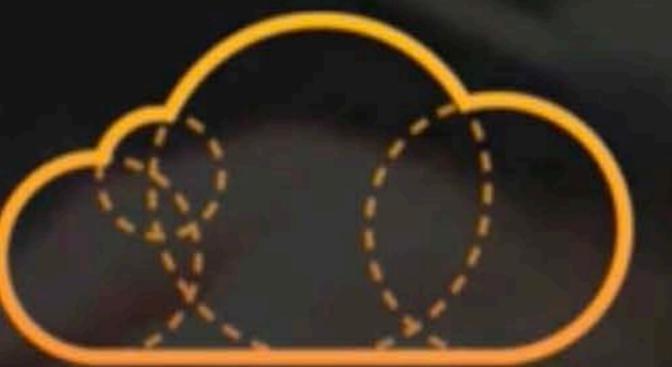
A CLOUD GURU

Lesson Plan



- Kubernetes Primer
- Kubernetes API
- Kubernetes Objects
- Getting a Quick Kubernetes Cluster

Kubernetes Primer



A CLOUD GURU

Big Picture



A CLOUD GURU

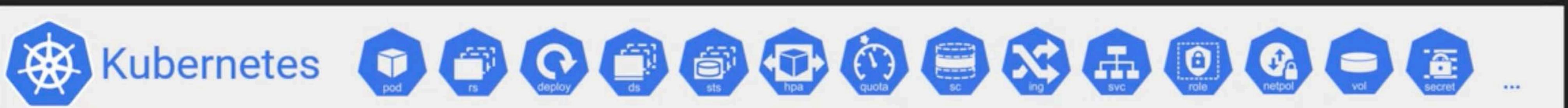


Infrastructure

(On-premises/cloud)



Cloud-native App

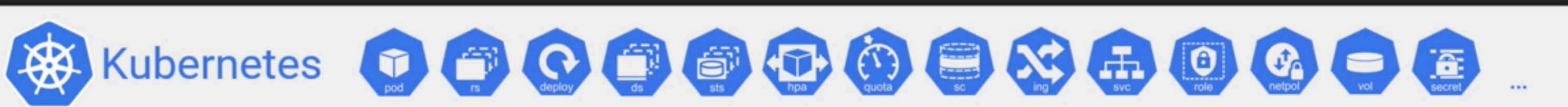
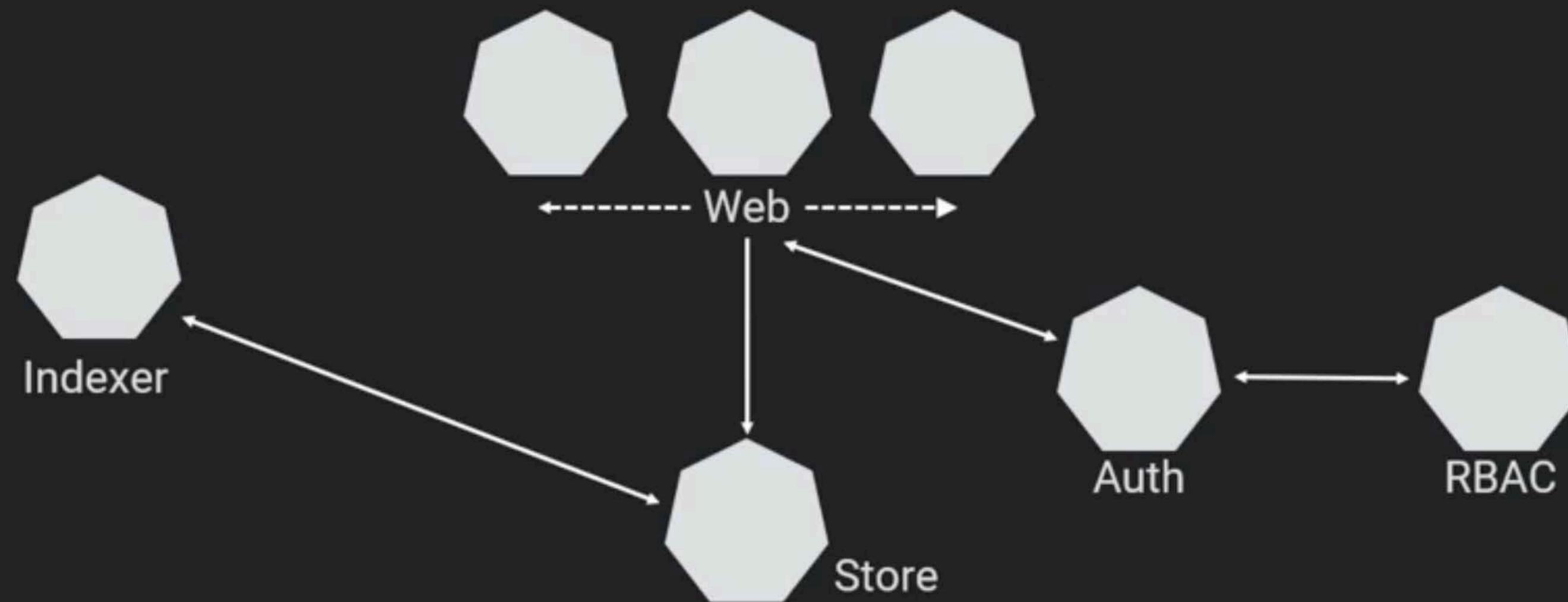


Infrastructure

(On-premises/cloud)



Cloud-native App



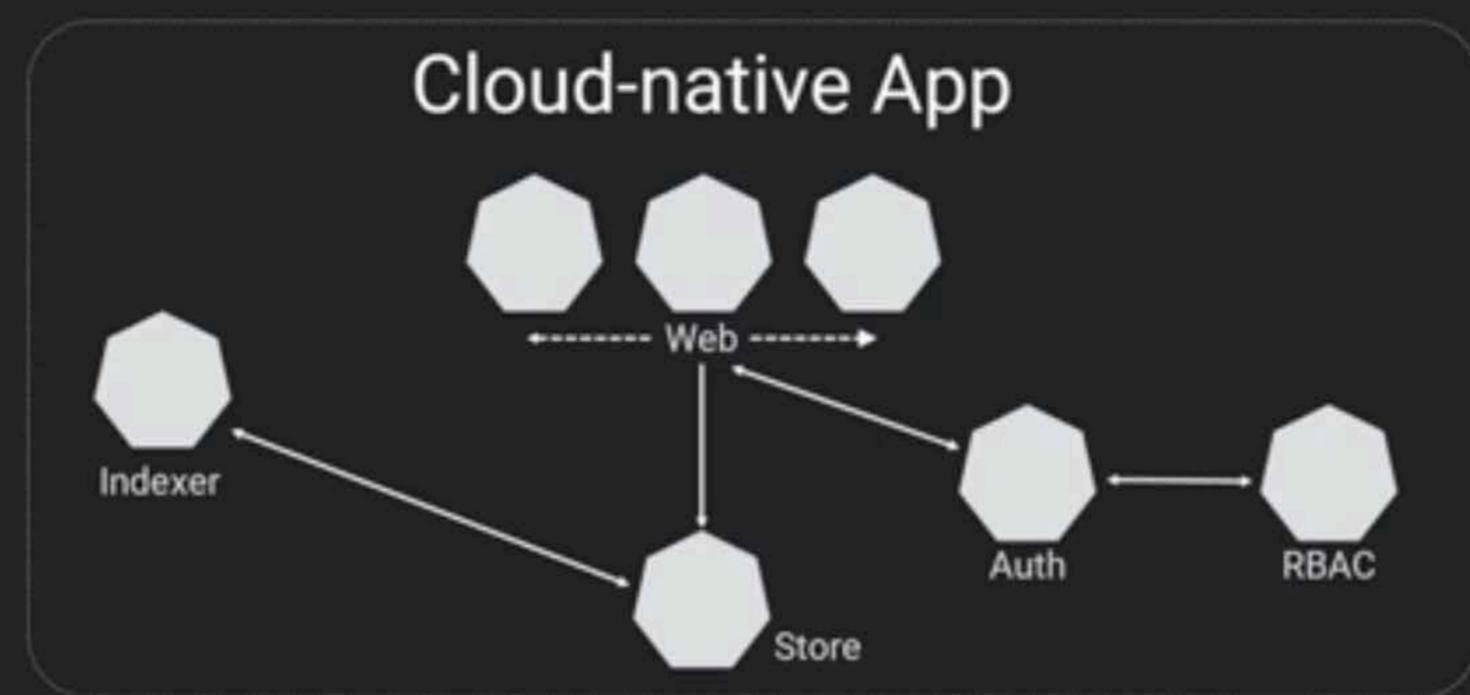
Infrastructure

(On-premises/cloud)

Big Picture



A CLOUD GURU

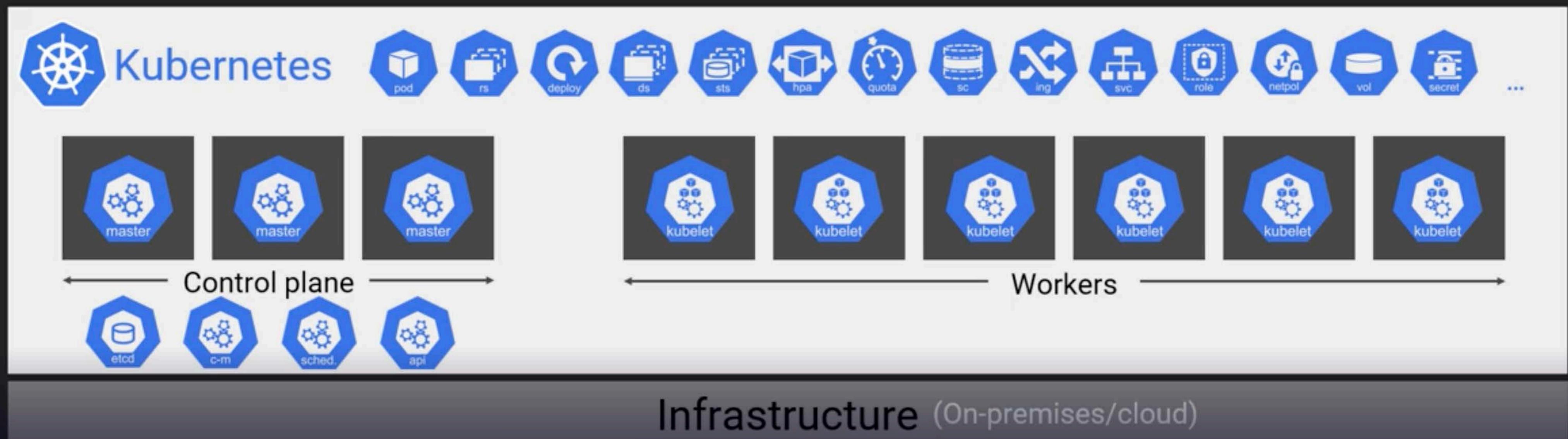
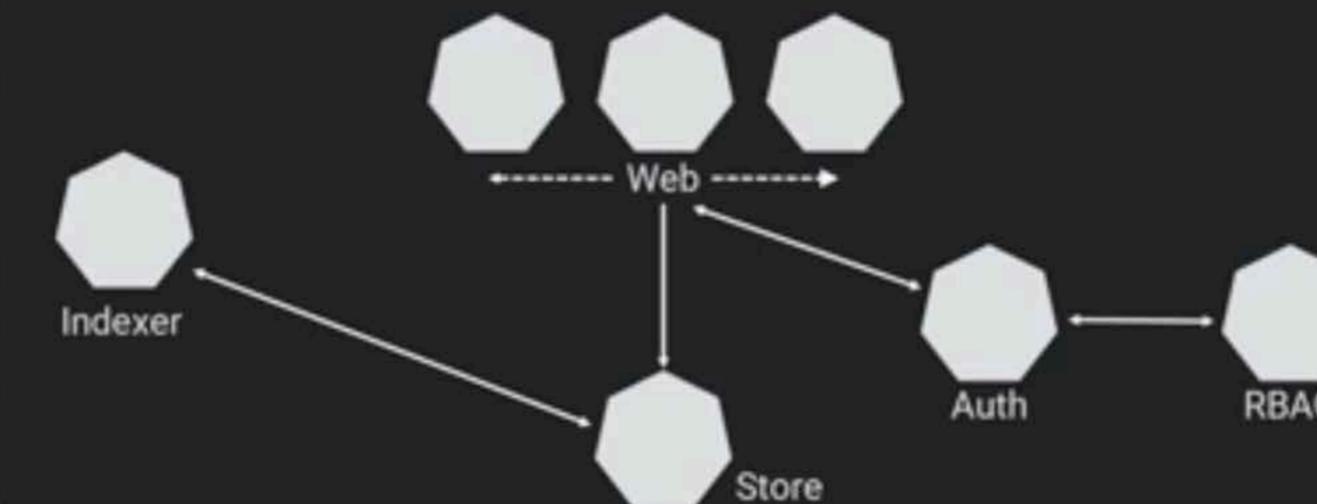


Big Picture



A CLOUD GURU

Cloud-native App



Big Picture

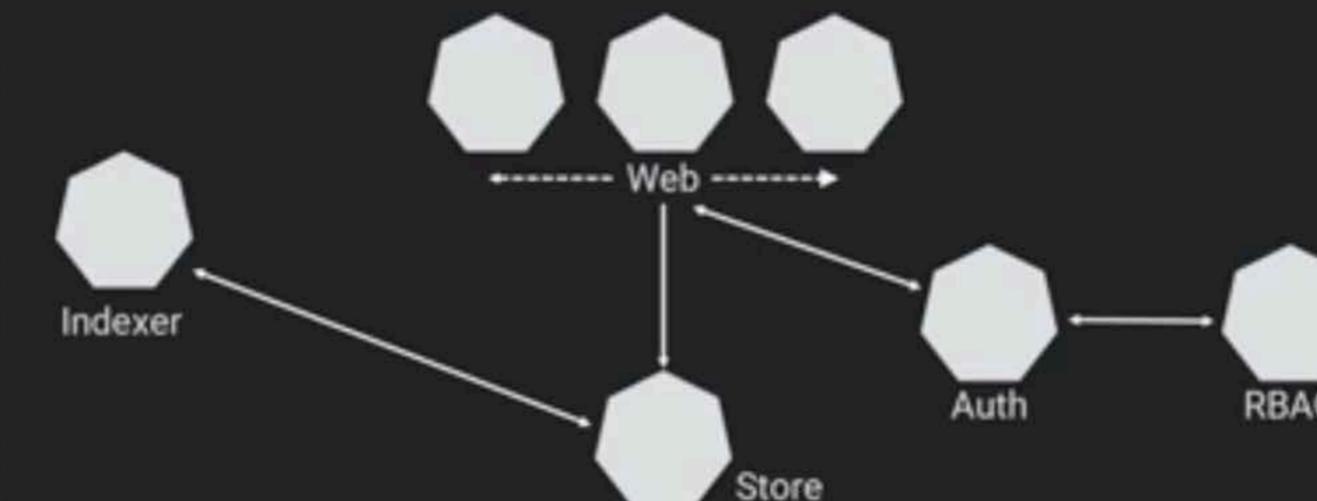


A CLOUD GURU

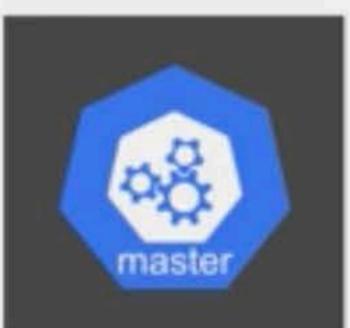
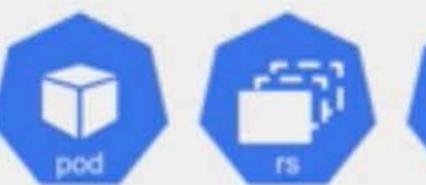


Stateful

Cloud-native App



Kubernetes



Control plane



Workers

Infrastructure (On-premises/cloud)

Big Picture



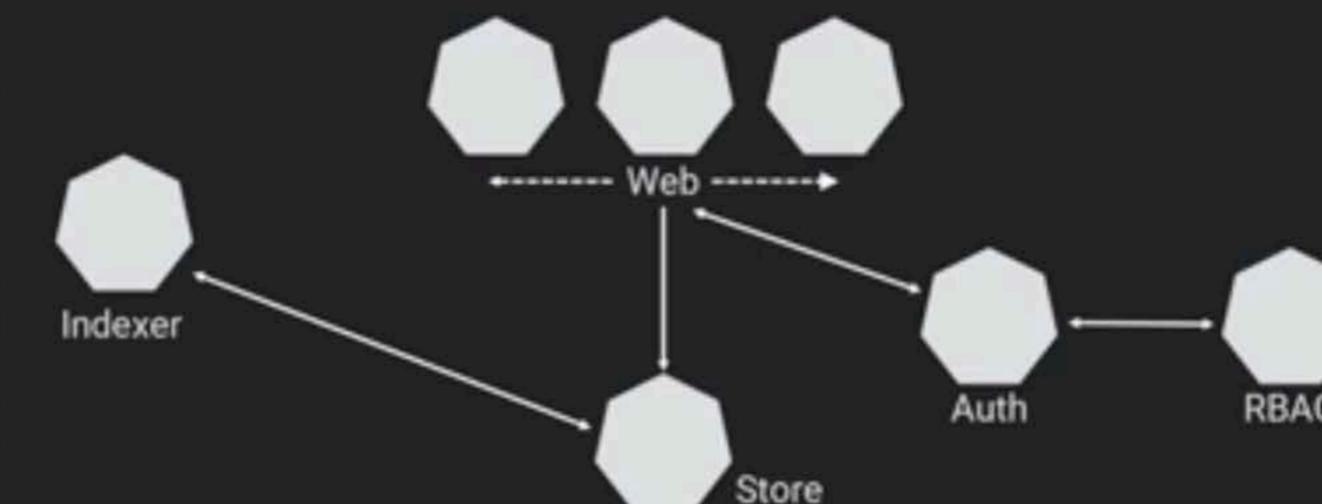
A CLOUD GURU



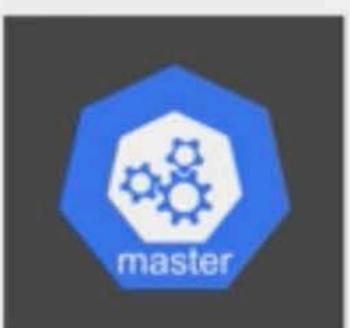
Stateful

Beware at scale

Cloud-native App



Kubernetes



Control plane



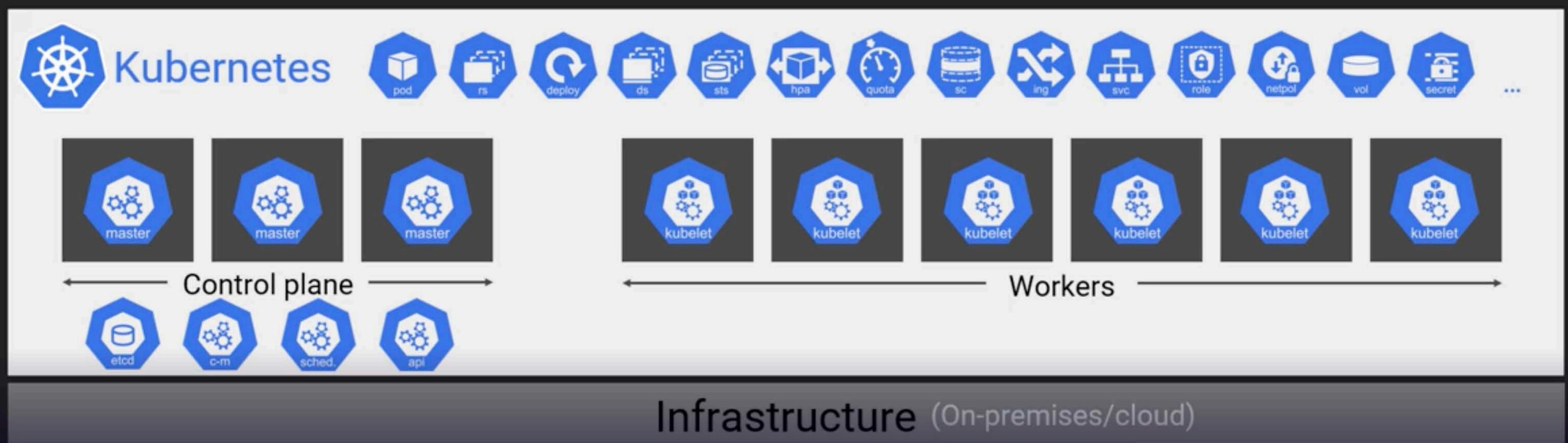
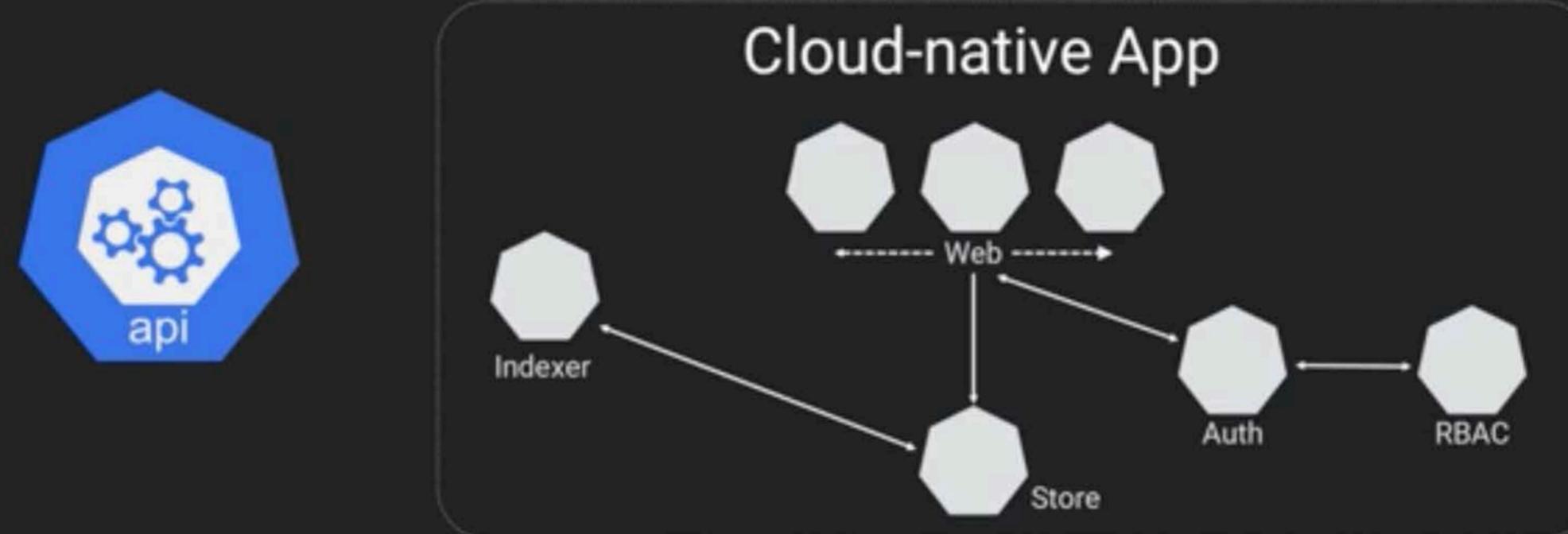
Workers

Infrastructure (On-premises/cloud)

Big Picture



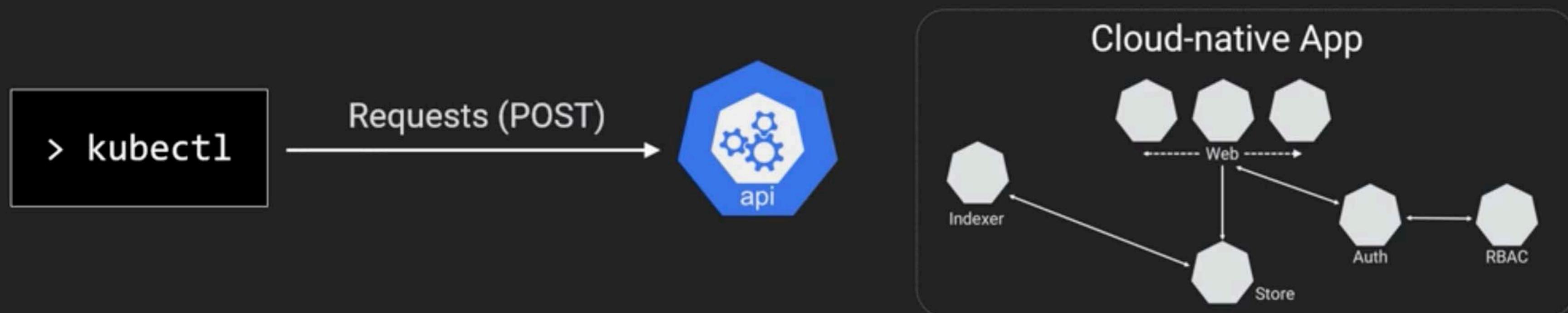
A CLOUD GURU



Big Picture



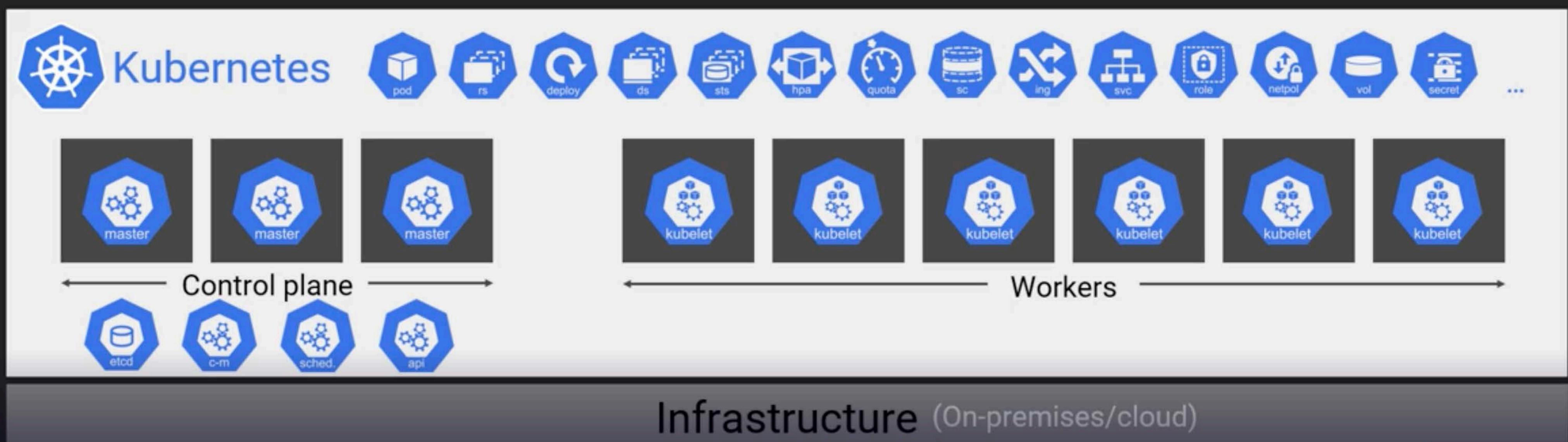
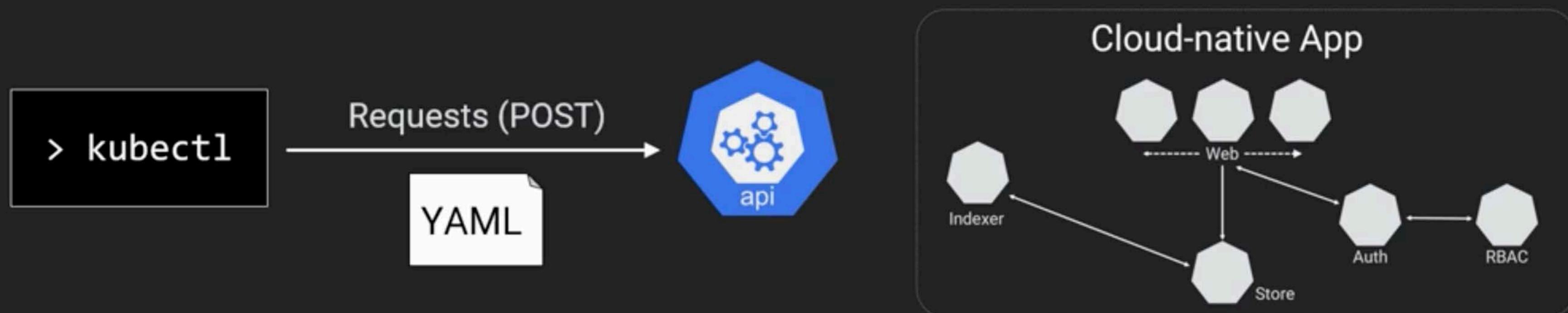
A CLOUD GURU



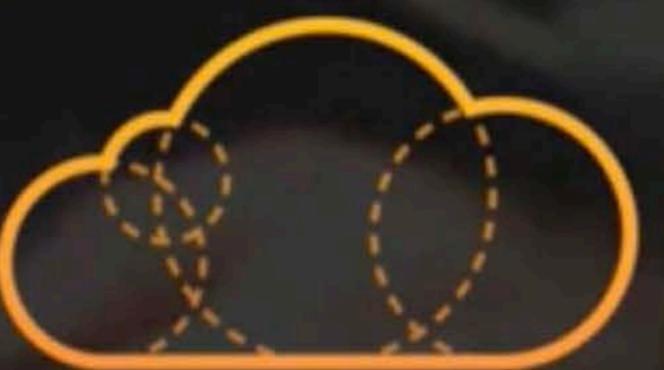
Big Picture



A CLOUD GURU



The Kubernetes API



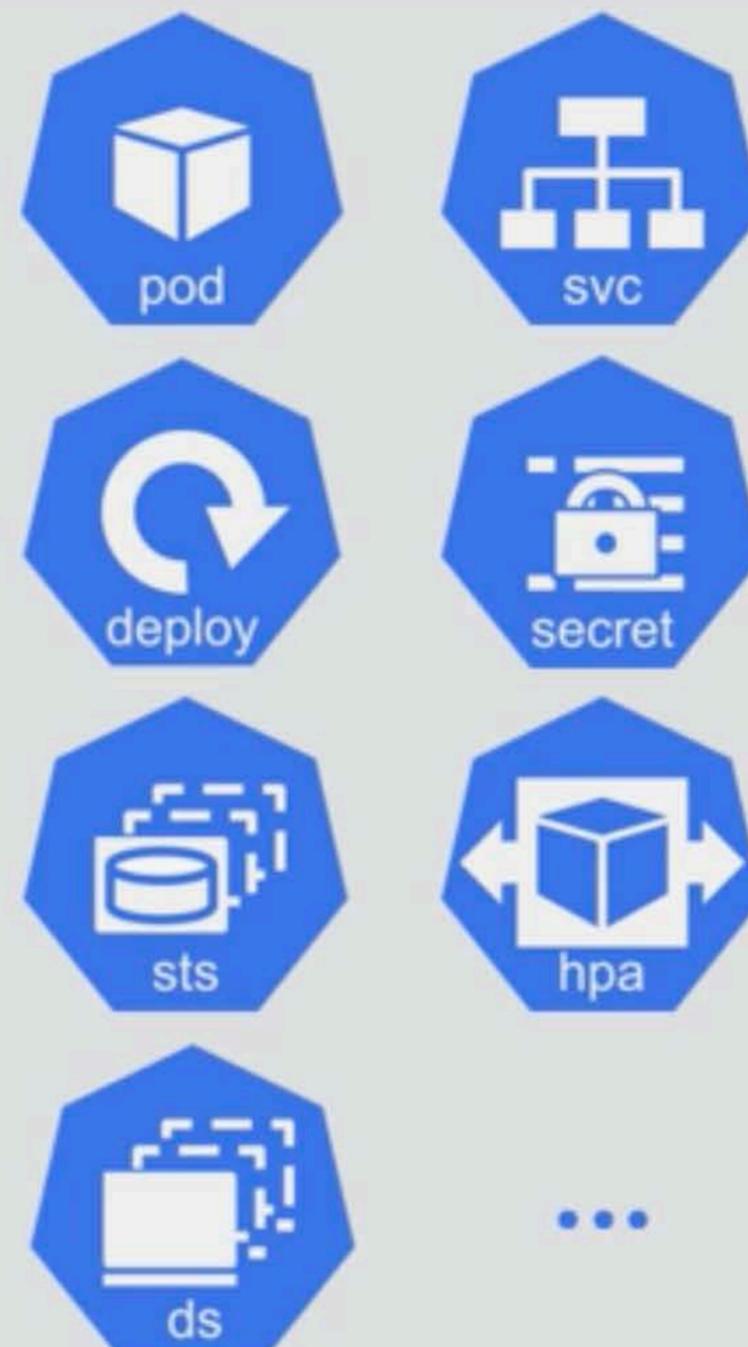
A CLOUD GURU

The Kubernetes API



A CLOUD GURU

{API}



The Kubernetes API



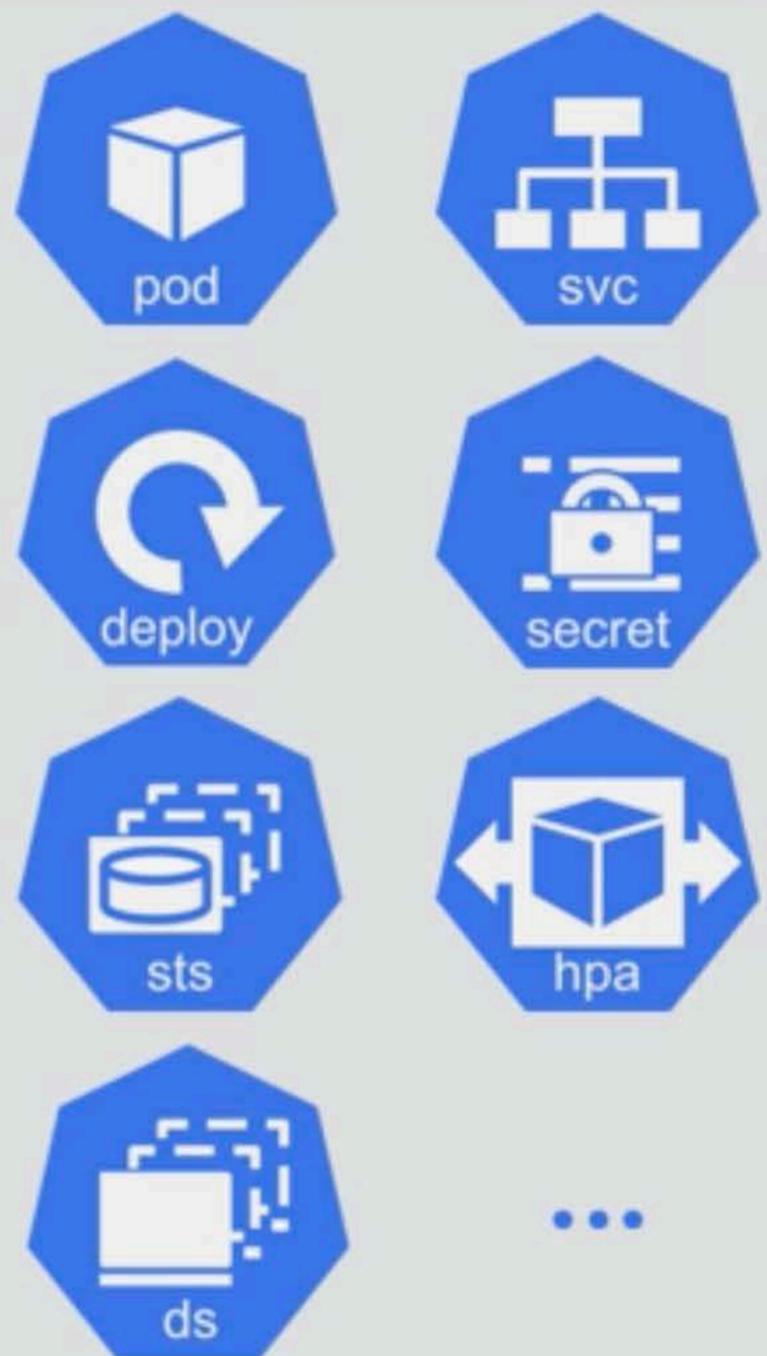
A CLOUD GURU

REST

CRUD

- Create
- Read
- Update
- Delete

{API}

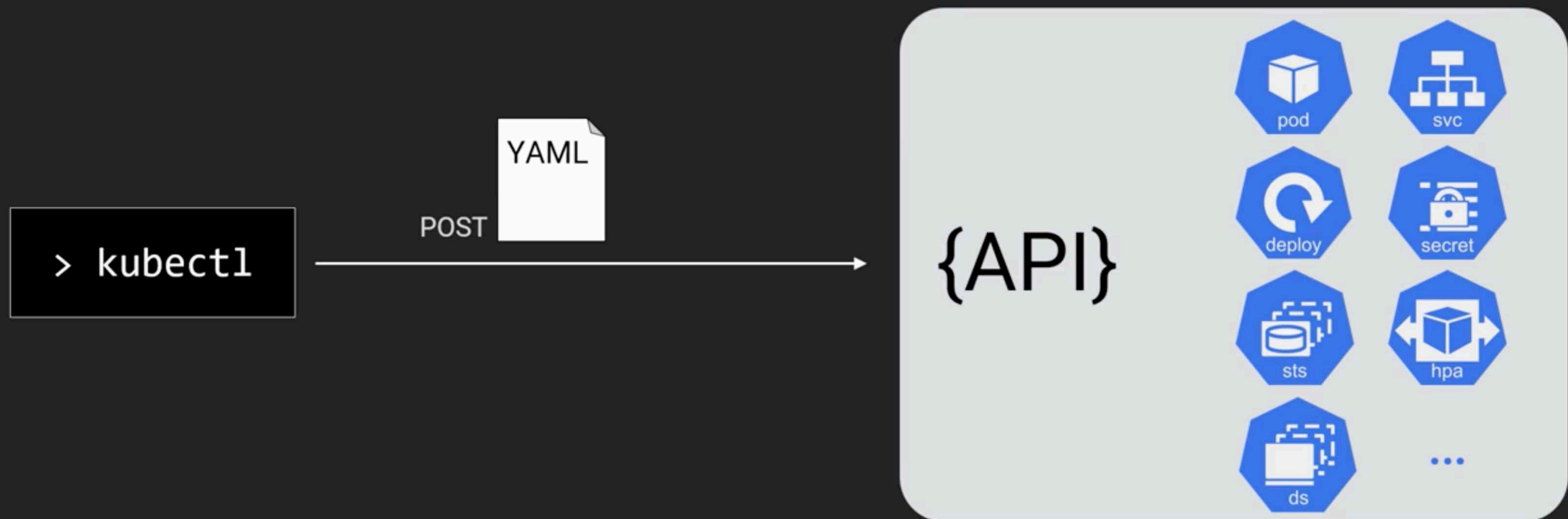


GET POST PATCH UPDATE PUT DELETE

The Kubernetes API



A CLOUD GURU





Declarative Configuration

Desired
state

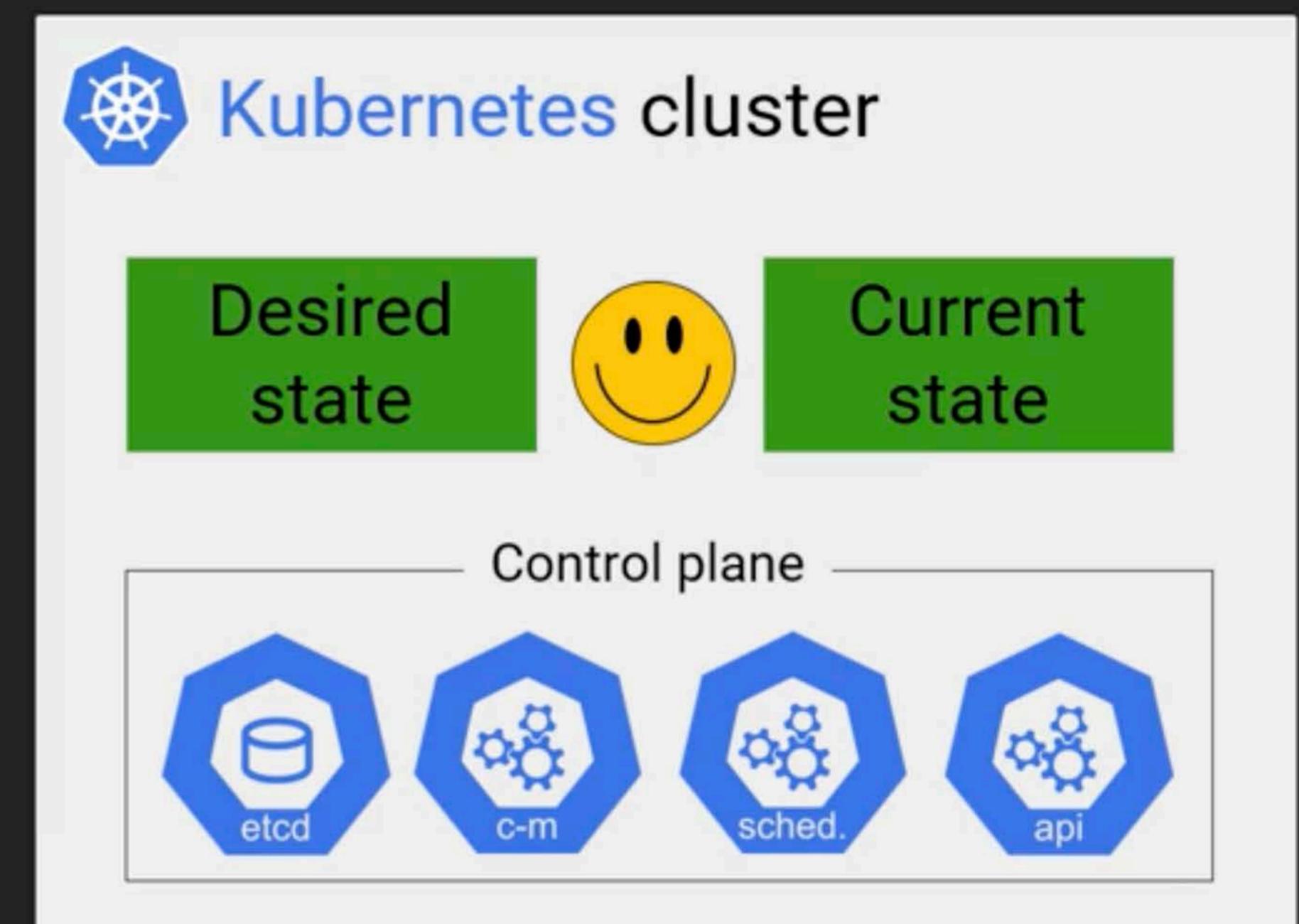
Current
state



The Kubernetes API



A CLOUD GURU

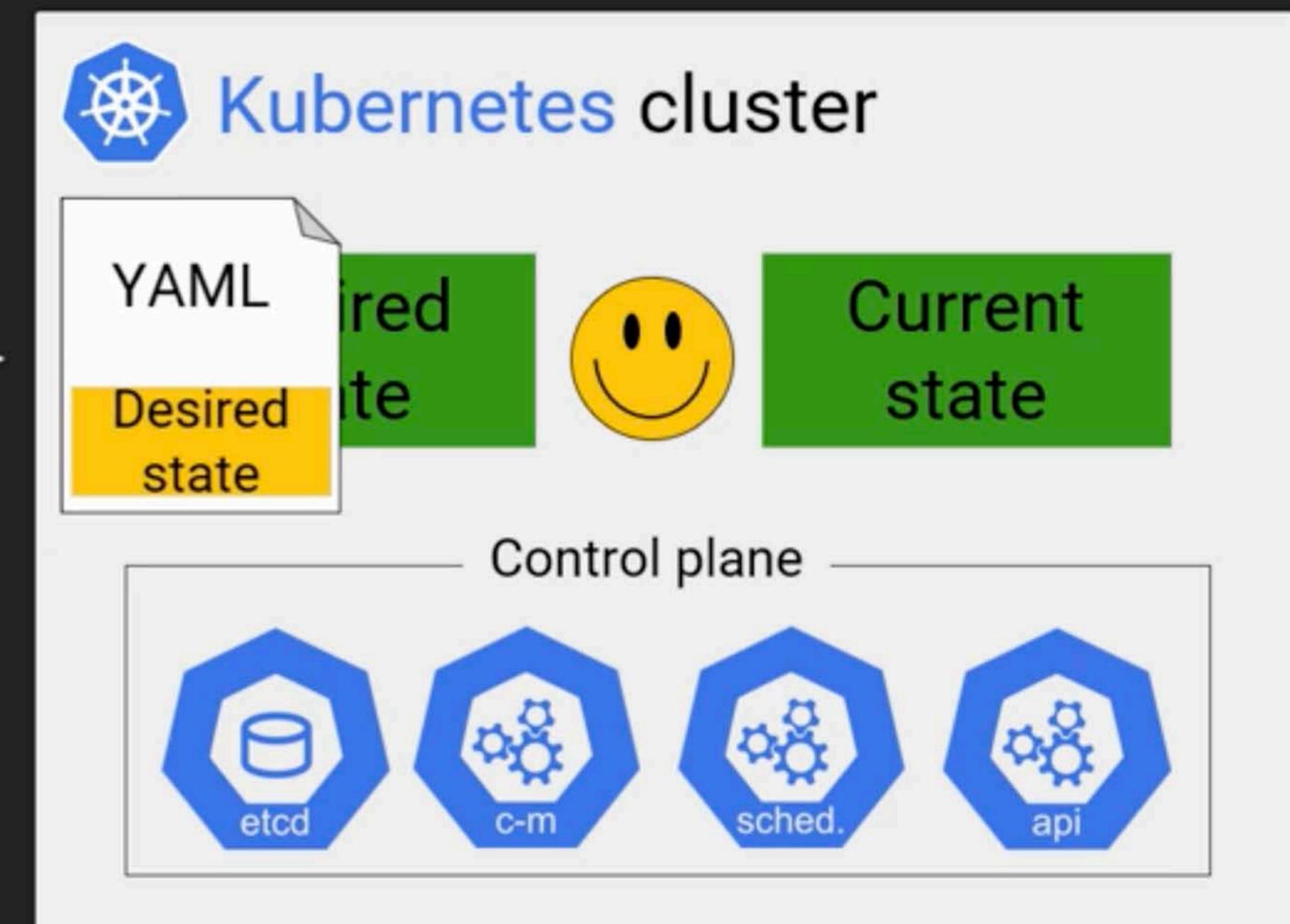


The Kubernetes API



A CLOUD GURU

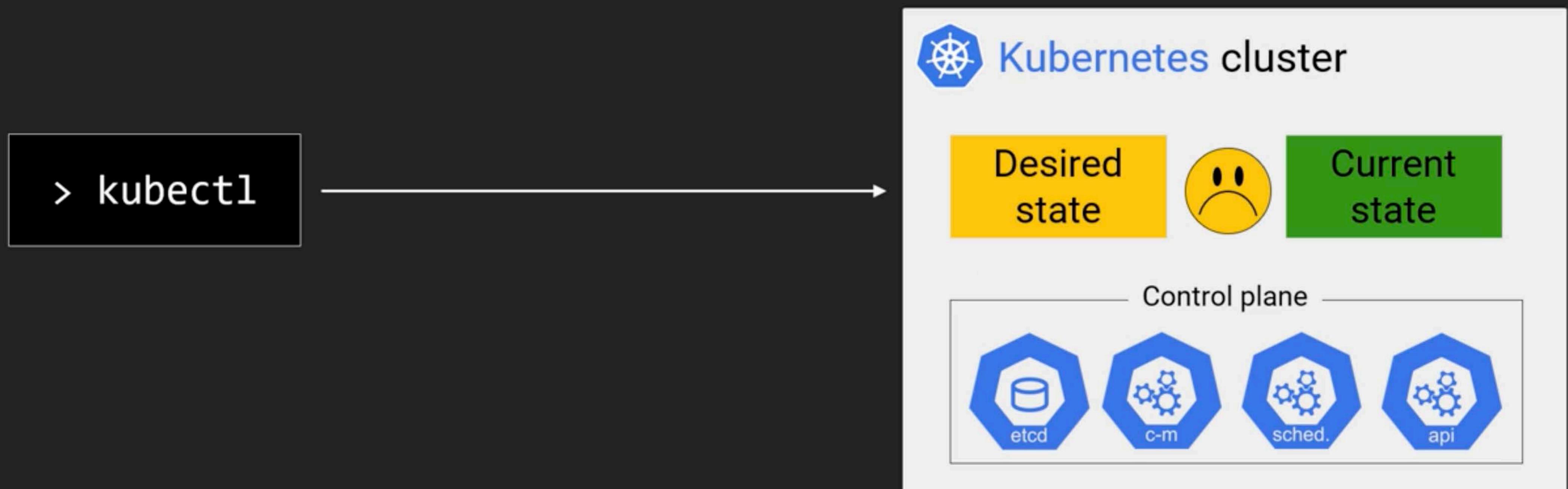
```
> kubectl
```



The Kubernetes API



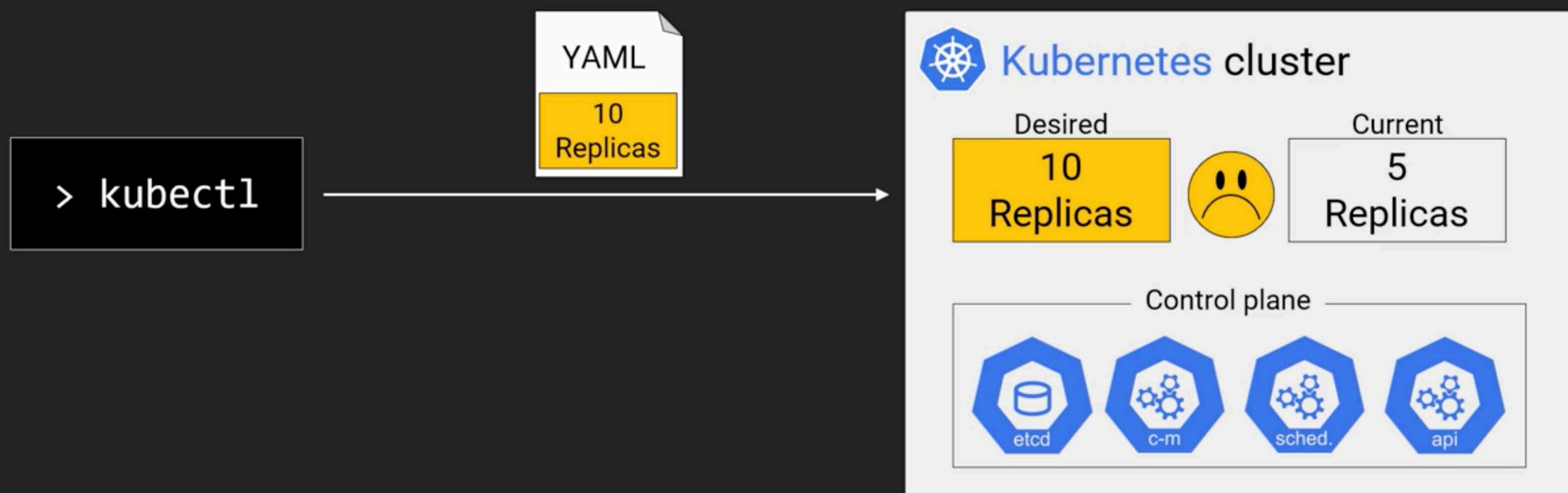
A CLOUD GURU



The Kubernetes API



A CLOUD GURU



The Kubernetes API

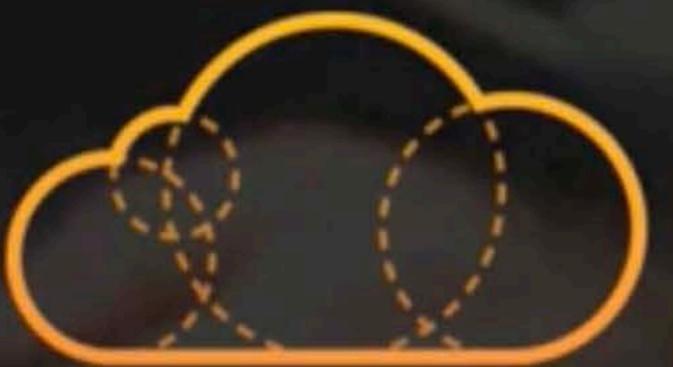


A CLOUD GURU



The core API group is often referred to with empty quotes - ""

Kubernetes Objects

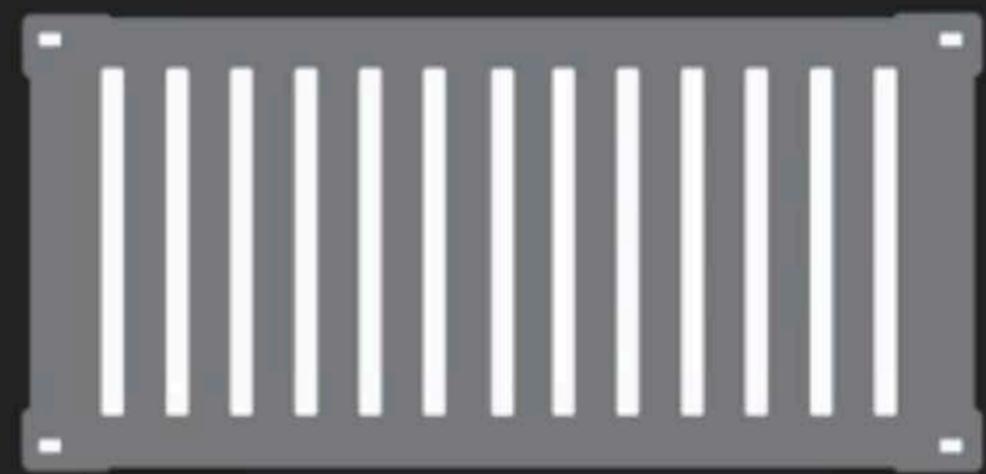


A CLOUD GURU

Kubernetes Objects



A CLOUD GURU



Kubernetes Objects



Contains one or more containers
Atomic unit of scheduling
Object on the cluster
Defined in the **v1** API group

Kubernetes Objects



Object on the cluster

Defined in the **apps/v1** API group

Scaling

Rolling updates

Kubernetes Objects



Wrap one or more containers



Scalability and application releases



One Pod per node



Stateful app components

Kubernetes Objects



A CLOUD GURU



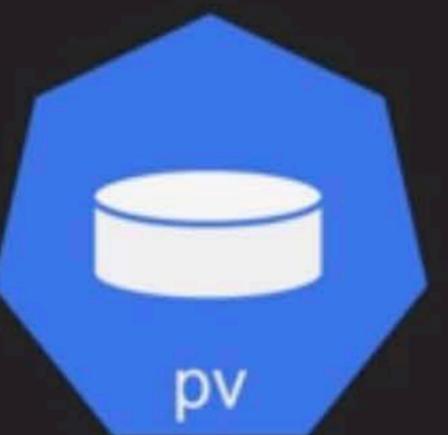
pod



secret



deploy



pv

...



ds



svc

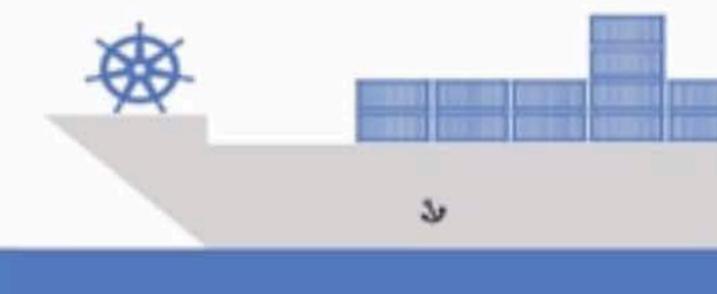


sts



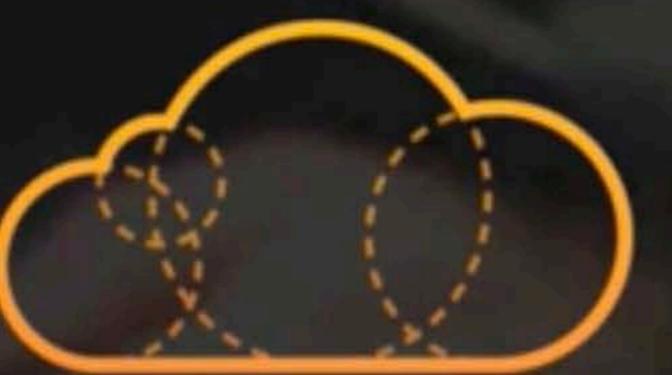
ing

The
Kubernetes
Book



Nigel Poulton

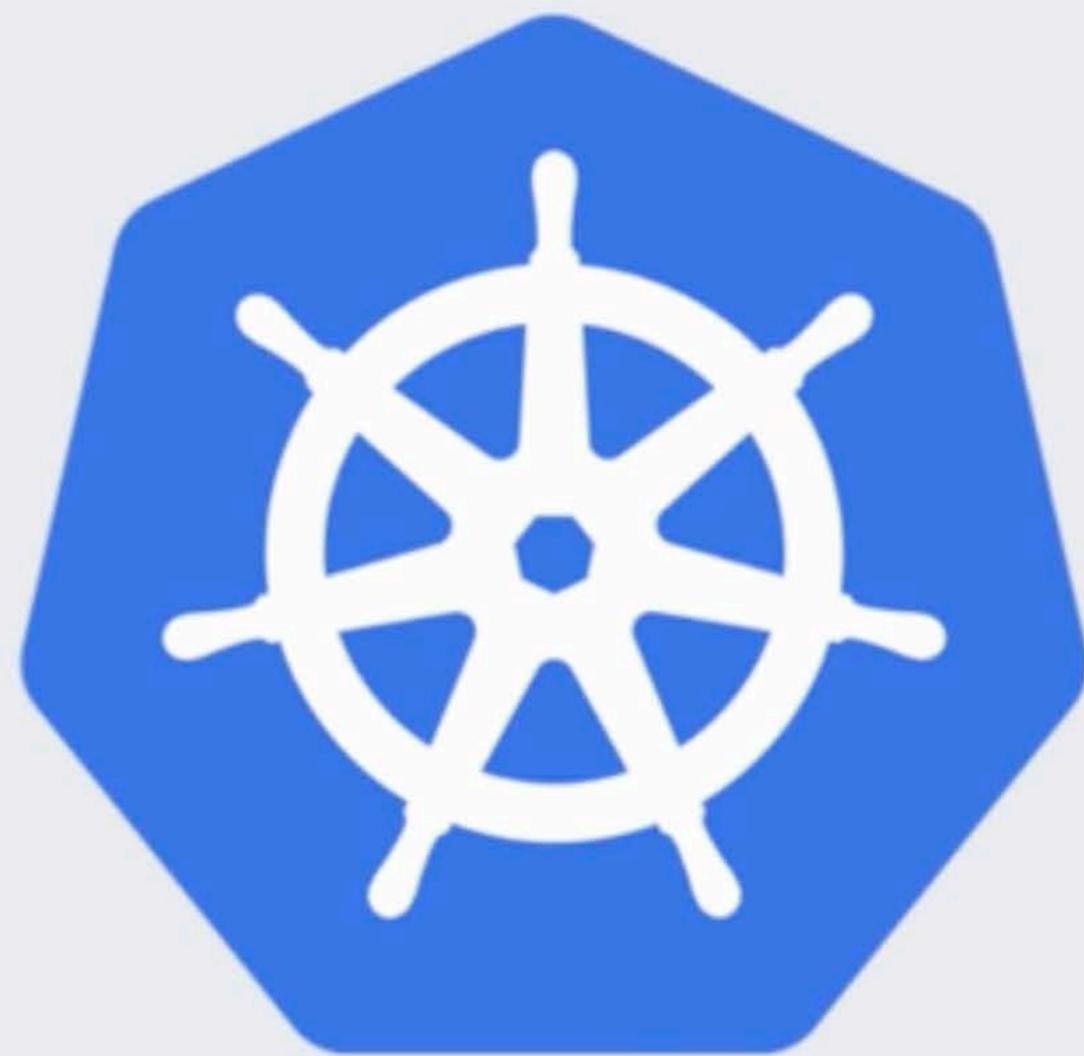
Spin-up a quick Kubernetes cluster



A CLOUD GURU

[Contribute](#)

<https://play-with-k8s.com>



Play with Kubernetes

A simple, interactive ar

github

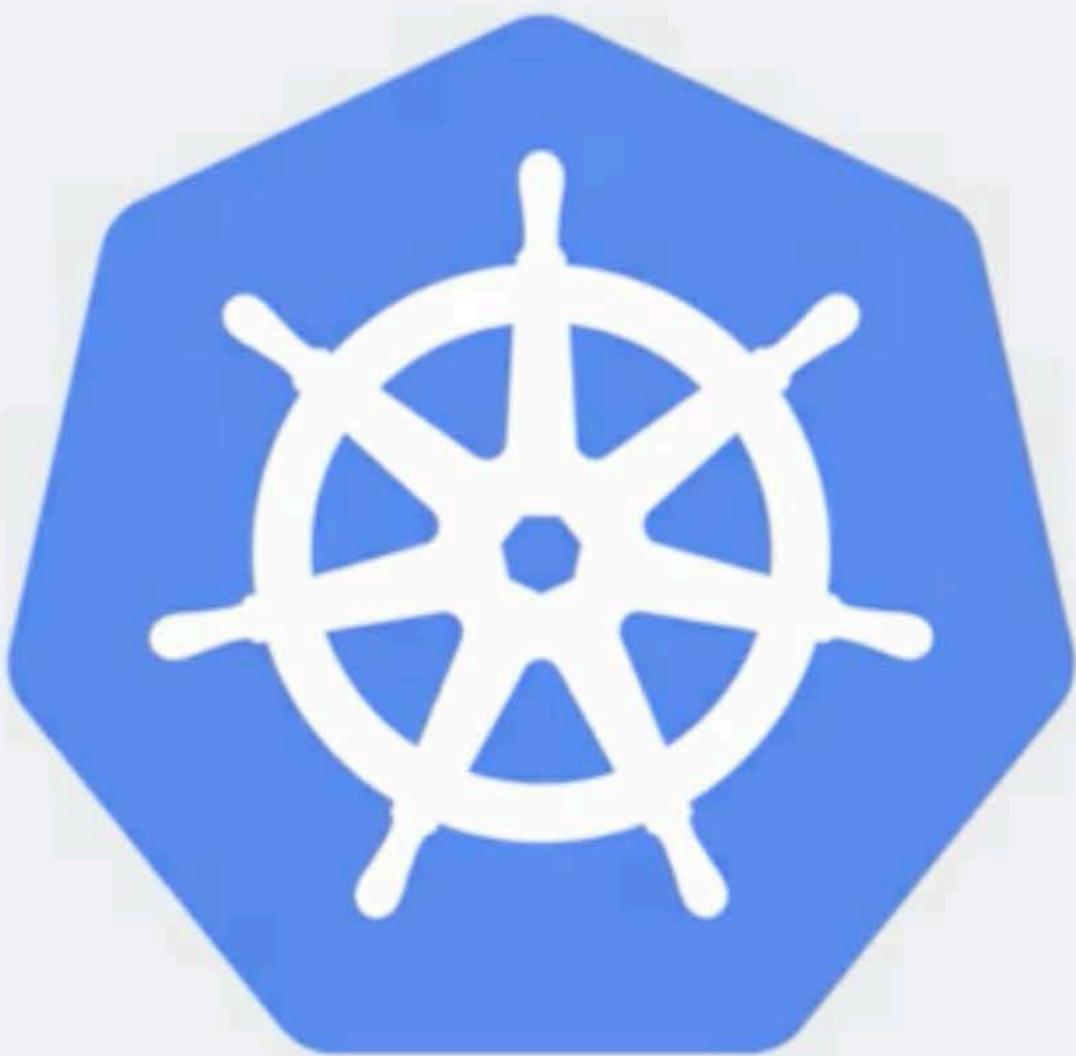
docker

to learn Kubernetes

Login ▾

[Contribute](#)

<https://play-with-k8s.com>



Play with Kubernetes

A simple, interactive area to learn Kubernetes

github
docker

[Contribute](#)

<https://play-with-k8s.com>



Play with Kubernetes

A simple, interactive and fun playground to learn Kubernetes

Start

03:59:57

Add instances to your playground.

CLOSE SESSION

Sessions and all their instances are deleted after 03:59:57 hours.

Instances



+ ADD NEW INSTANCE

03:59:49

CLOSE SESSION

Instances



+ ADD NEW INSTANCE

192.168.0.8

node1

be7qj7qo_be7qj92o2l8g00d4gtkg

IP

192.168.0.8

Memory

CPU

URL

ip172-18-0-41-be7qj7qo2l8g00d4gtk0.direct.labs.play-with-k8s.com

DELETE

You can bootstrap a cluster as follows:

1. Initializes cluster master node:

```
kubeadm init --apiserver-advertise-address $(hostname -i)
```

2. Initialize cluster networking:

```
kubectl apply -n kube-system -f \
  "https://cloud.weave.works/k8s/net?k8s-version=$(kubectl version | base64 | tr -d '\n')"
```

3. (Optional) Create an nginx deployment:

```
kubectl apply -f https://raw.githubusercontent.com/kubernetes/website/master/contrib/docs/user-guide/nginx-app.yaml
```

The PWK team.

[node1 ~]\$ █



Product Support Company Partners Contact Us



www.docker.com

Why Docker?

Products

Solutions

Customers

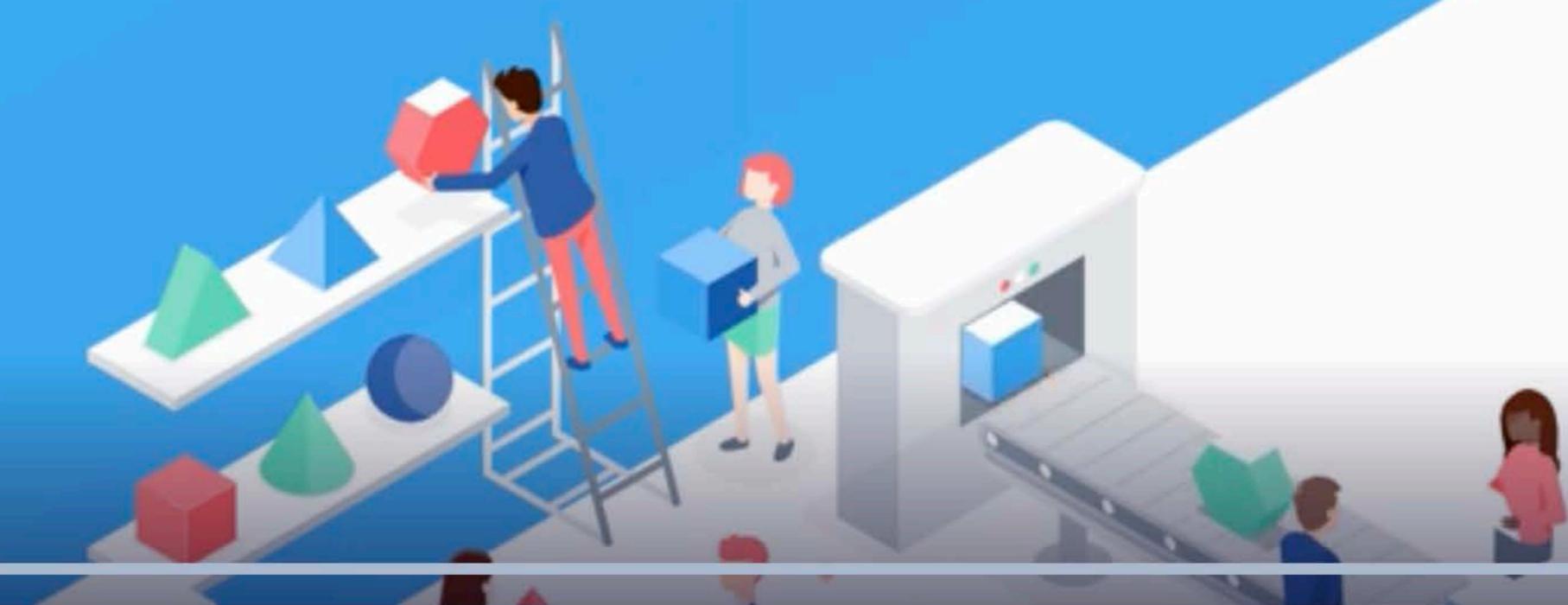
Resources

Get Started

Build, Manage and Secure Your Apps Anywhere. Your Way.

The Dev to Ops Choice for Container Platforms

Learn More





Product Support Company Partners Contact Us

www.docker.com



Why Docker? Products Solutions Customers Resources

Get Started

Build, Manage, Run Apps Anywhere.

The Dev to Ops Choice for

- Docker Enterprise
Enterprise-grade Container Platform
- Docker Desktop
Complete Dev Environment
- Docker Engine
Industry-standard Container Engine
- Docker Hub
Largest Container Content Library

Learn More

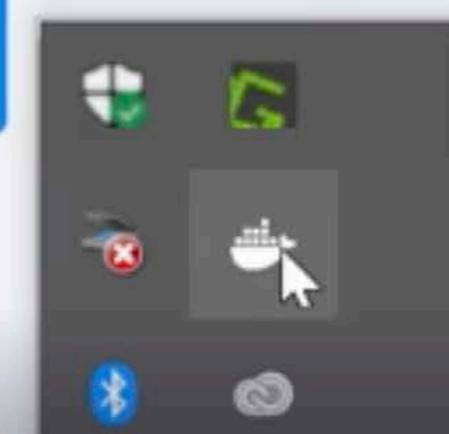


www.docker.com

[Why Docker?](#) [Products](#) [Solutions](#) [Customers](#) [Resources](#)[Get Started](#)

Docker Desktop

The preferred choice for millions of developers that are building containerized applications

[Download for Mac](#)[Download for Windows](#)



www.docker.com

Why Docker? Products Solutions Customers Resources

Get Started

Docker Desktop

The preferred choice for millions of developers building containerized applications.

Download for Mac

Do

- About Docker
- Discover Docker Enterprise Edition
- Settings
- [Check for Updates](#)
- Diagnose and Feedback...
- Switch to Windows containers...
- Docker Store
- Documentation
- Kitematic
- nigelpoulton
 - Repositories
 - Kubernetes
- Restart...
- Quit Docker



 Settings

General

Shared Drives

Advanced

Network

Proxies

Daemon

Kubernetes

Reset

 Docker is running

 Kubernetes is running

Kubernetes

Configure and manage the kubernetes cluster



Enable Kubernetes

Starts a Kubernetes single-node cluster when starting Docker.

Default orchestrator for docker stack commands
(changes ~/.docker/config.json):

Kubernetes

Swarm

Show system containers (advanced)

Show kubernetes internal containers when using Docker commands.

Apply

Contact Us

Started

Windows PowerShell

Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\k8s> kubectl get nodes

NAME	STATUS	ROLES	AGE	VERSION
docker-for-desktop	Ready	master	27d	v1.10.3

PS C:\k8s>

DASHBOARD

ACTIVITY

CUSTOMIZE

Project info

Project name
acg1

Project ID
acg1-206211

Project number
292661174106

→ Go to project settings

Resources

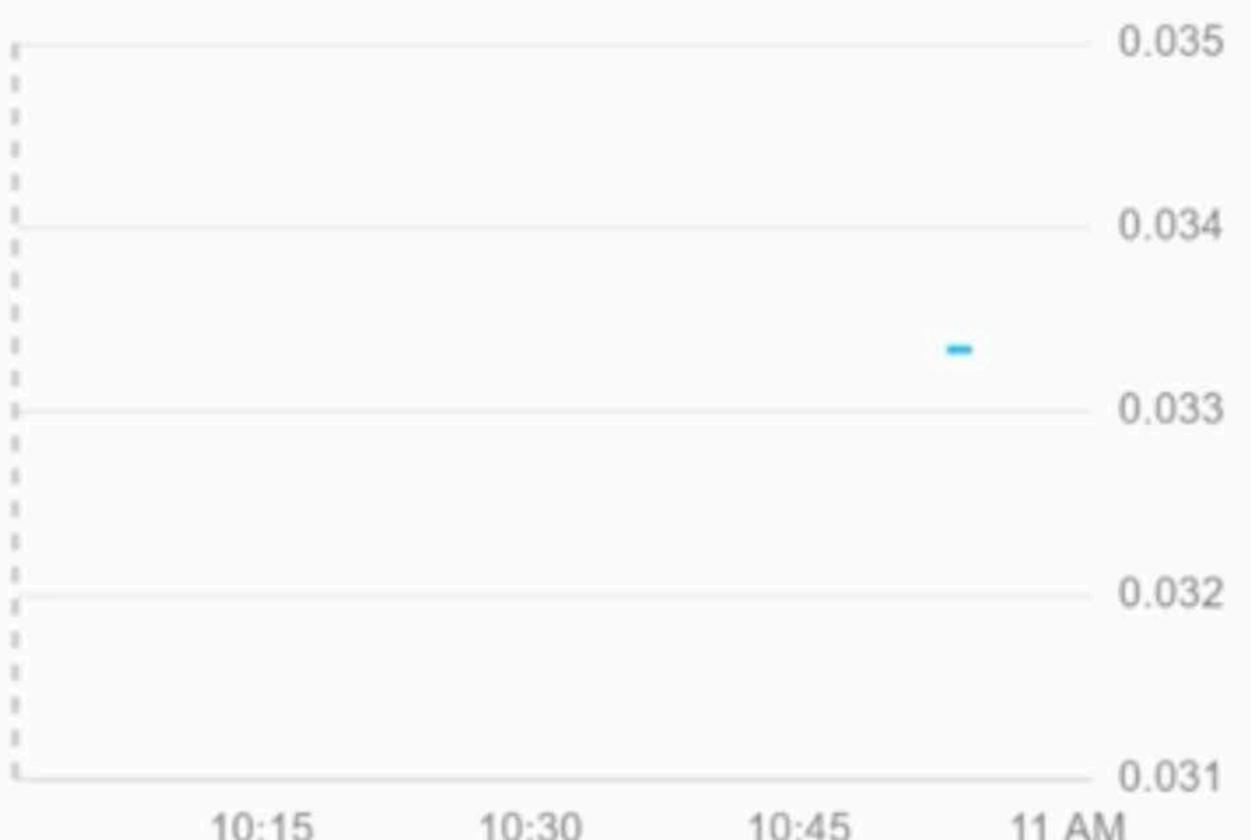
This project has no resources

Trace

No trace data from the past 7 days

API APIs

Requests (requests/sec)



api/request_count:consumed_api:REDUCE_SUM(acg1-
206211)
: 0.033

→ Go to APIs overview

Google Cloud Platform status

All services normal

→ Go to Cloud status dashboard

Billing

Estimated charges GBP £0.38
For the billing period Sep 1 – 4, 2018

→ View detailed charges

Error Reporting

No sign of any errors. Have you set up Error Reporting?

→ Learn how to set up Error Reporting

[Home](#)[CUSTOMIZE](#)[Marketplace](#)[Billing](#)[APIs & Services](#)[Support](#)[IAM & admin](#)[Getting started](#)[Security](#)

COMPUTE

[App Engine](#)[Compute Engine](#)[Kubernetes Engine](#)

API APIs

Requests (requests/sec)



Clusters

Workloads

Services

Applications

Configuration

Storage

[Go to APIs overview](#)

Google Cloud Platform status

All services normal

[Go to Cloud status dashboard](#)

Billing

Estimated charges

GBP £0.38

For the billing period Sep 1 – 4, 2018

[View detailed charges](#)

Error Reporting

No sign of any errors. Have you set up Error Reporting?

[Learn how to set up Error Reporting](#)



Google Cloud Platform

acg1 ▾

cloud.google.com



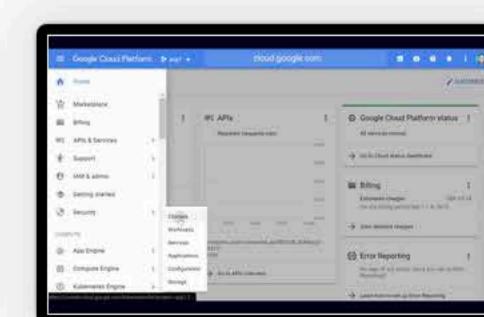
Clusters



Kubernetes Engine

Kubernetes clusters

Containers package an application so it can be easily deployed to run in its own isolated environment. Containers are managed in clusters that automate VM creation and maintenance. [Learn more](#)

[Create cluster](#)[Deploy container](#)[Take the quickstart](#)



Create a Kubernetes cluster

Name

cluster-1

Location type

 Zonal Regional

Zone

europe-west2-b

Master version

1.10.6-gke.2

Node pools

default-pool

Number of nodes

3

Machine type

Customize to select cores, memory and GPUs

1 vCPU

3.75 GB memory

Customize

Advanced edit



← Create a Kubernetes cluster

1.10.6-gke.2

Node pools

default-pool

Number of nodes

3

Machine type

Customize to select cores, memory and GPUs

1 vCPU

3.75 GB memory

Customize

Advanced edit

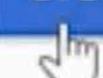
+ Add node pool

Advanced options

You will be billed for the 3 nodes (VM instances) in your cluster. [Learn more](#)

Create

Cancel



Equivalent REST or command line



Kubernetes clusters

CREATE CLUSTER

DEPLOY

REFRESH



SHOW INFO PANEL



A Kubernetes cluster is a managed group of uniform VM instances for running Kubernetes. [Learn more](#)



Filter by label or name



<input type="checkbox"/> Name ^	Location	Cluster size	Total cores	Total memory	Notifications	Labels
<input checked="" type="checkbox"/> cluster-1	europe-west2-b	3	3 vCPUs	11.25 GB		





Go



INFO PANEL

Connect to the cluster

You can connect to your cluster via command-line or using a dashboard.

Command-line access

Configure [kubectl](#) command line access by running the following command:

```
$ gcloud container clusters get-credentials cluster-1 --zone europe-west2-b --project acg1-206211
```



Copied

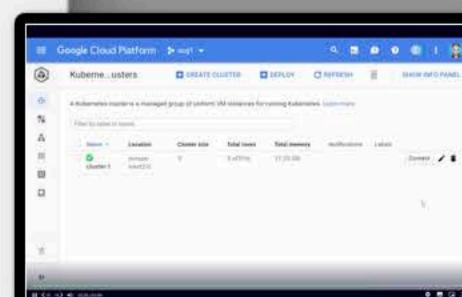
[Run in Cloud Shell](#)

Cloud Console dashboard

You can view the workloads running in your cluster in the Cloud Console [Workloads dashboard](#).

[Open Workloads dashboard](#)

OK



Windows PowerShell

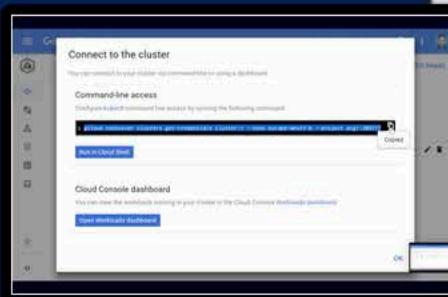
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\k8s> kubectl get nodes

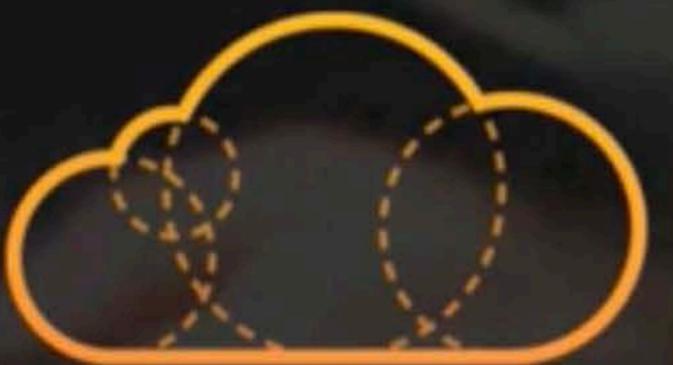
NAME	STATUS	ROLES	AGE	VERSION
docker-for-desktop	Ready	master	27d	v1.10.3

PS C:\k8s>

PS C:\k8s>

PS C:\k8s> gcloud container clusters get-credentials cluster-1 --zone europe-west2
-b --project acg1-206211

App Architecture



A CLOUD GURU

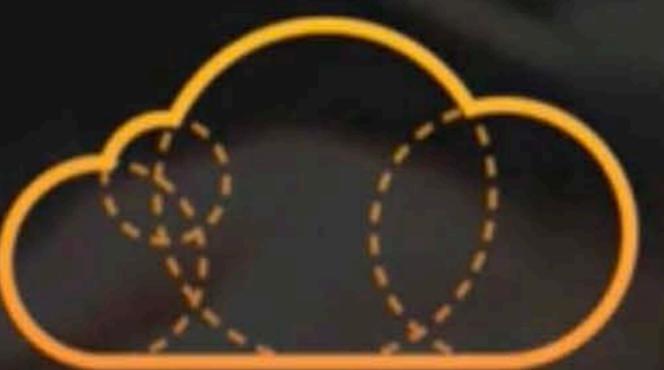
Lesson Plan



A CLOUD GURU

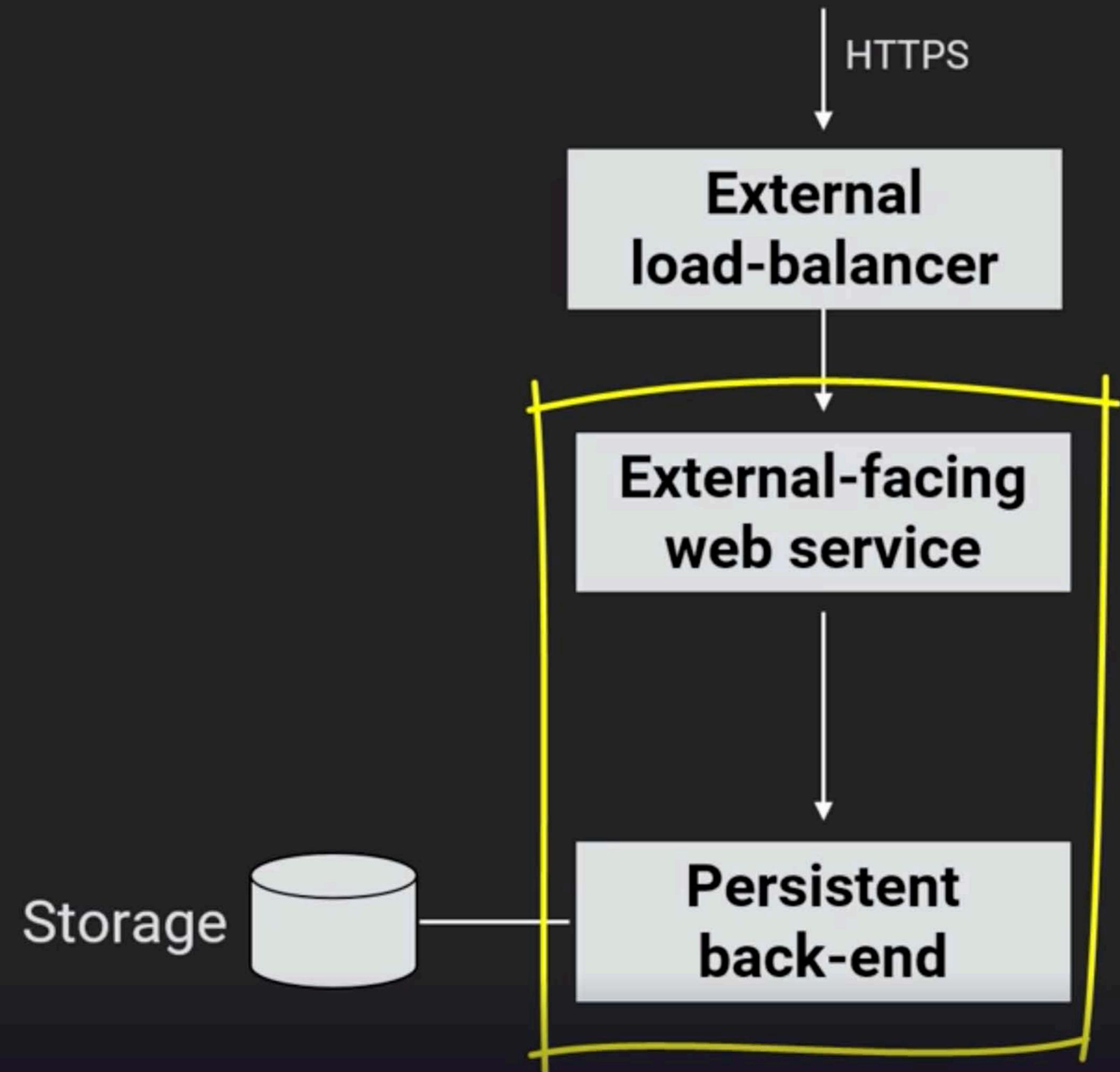
- Kubernetes App Theory
- Sample Kubernetes App
- Recap

Kubernetes App Theory

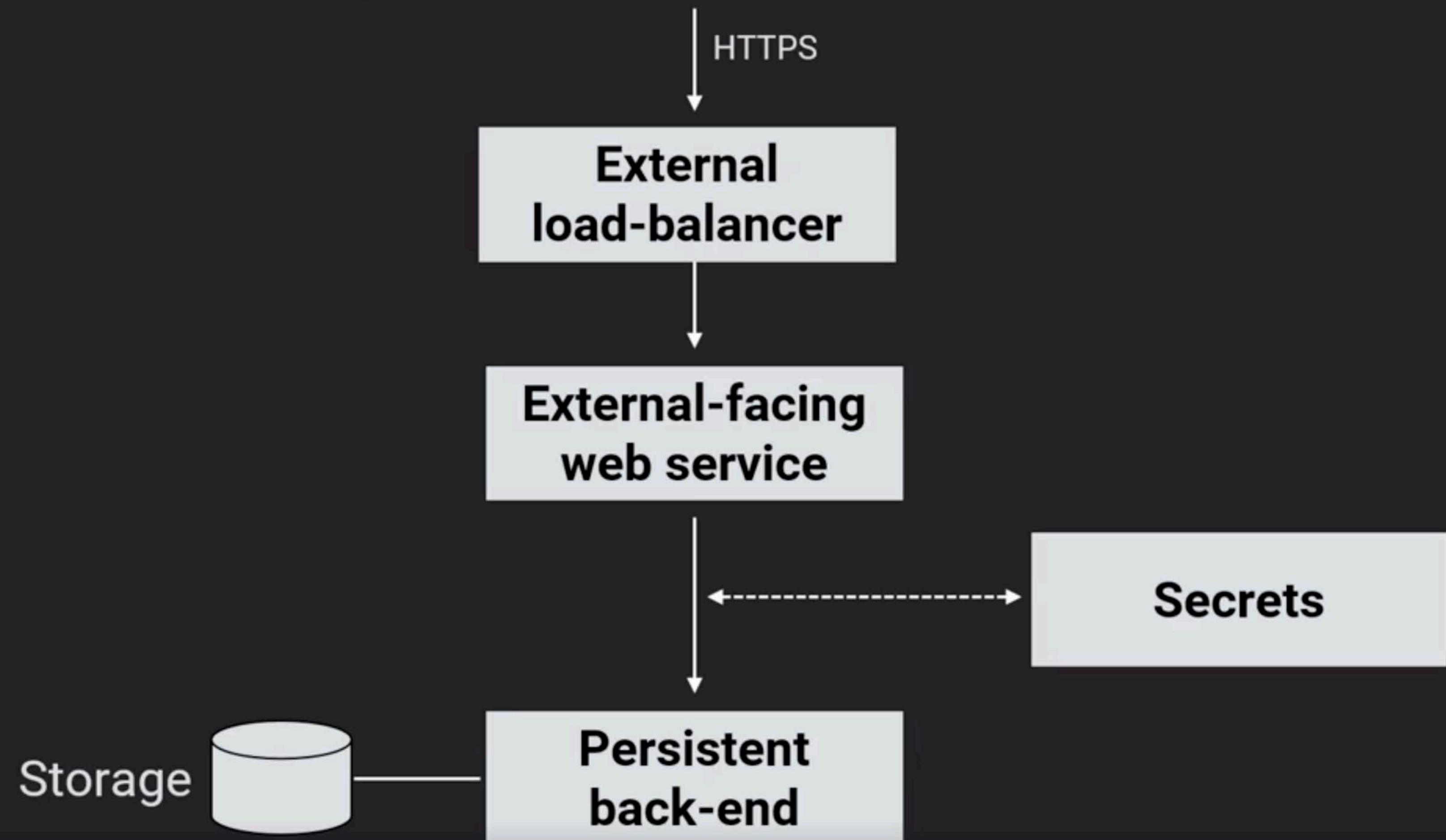


A CLOUD GURU

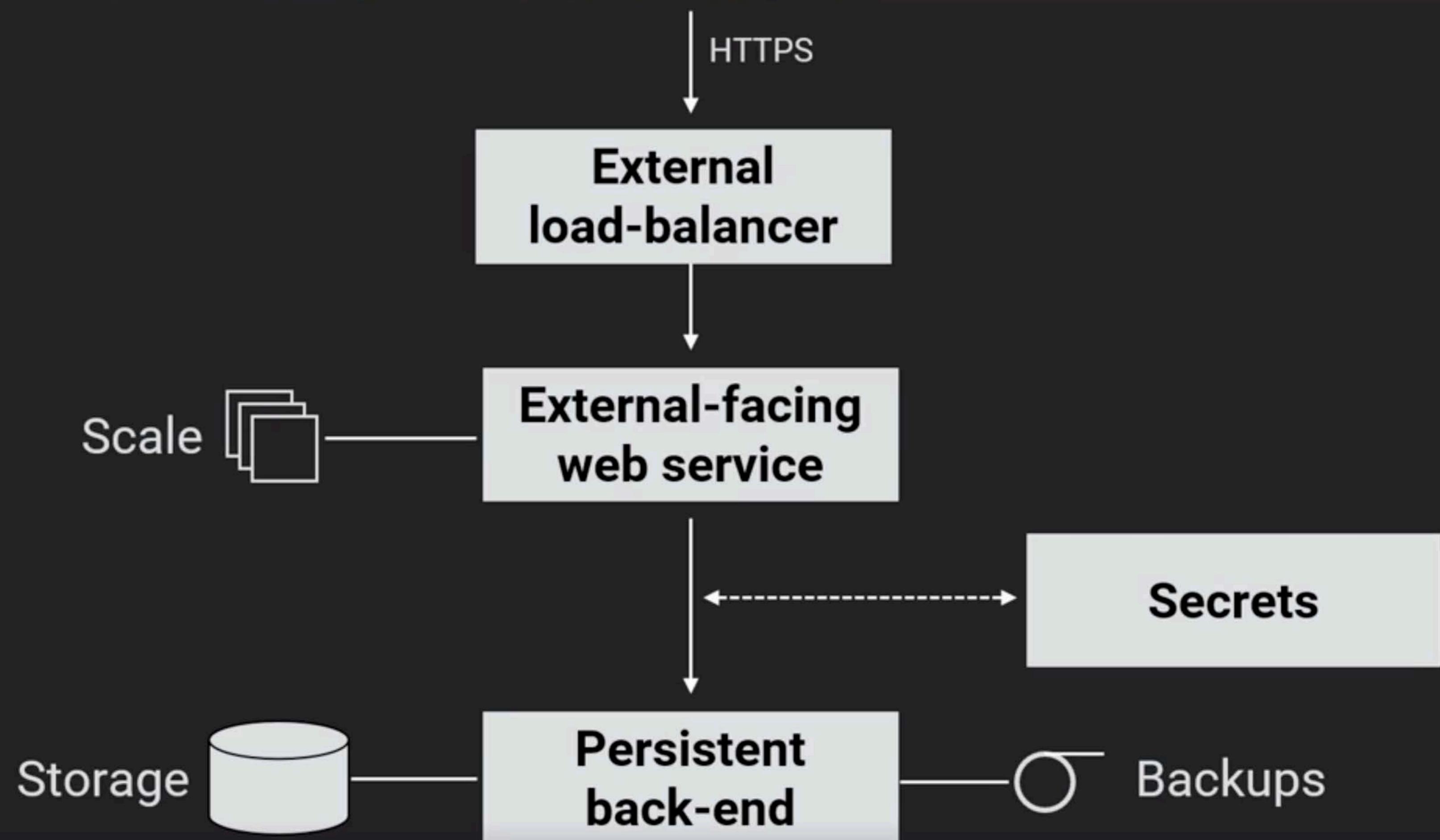
Kubernetes App Theory



Kubernetes App Theory



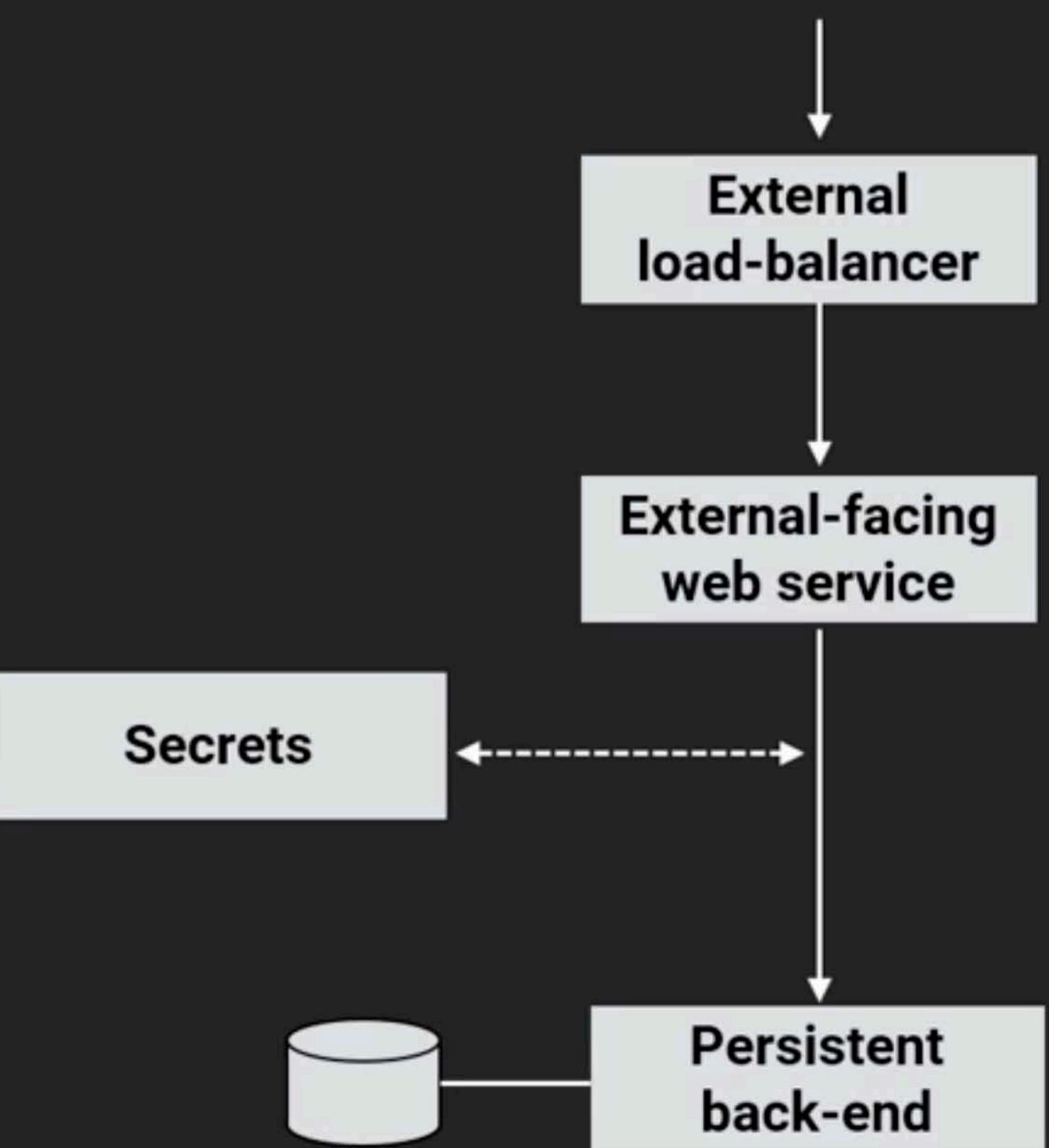
Kubernetes App Theory



Kubernetes App Theory



A CLOUD GURU



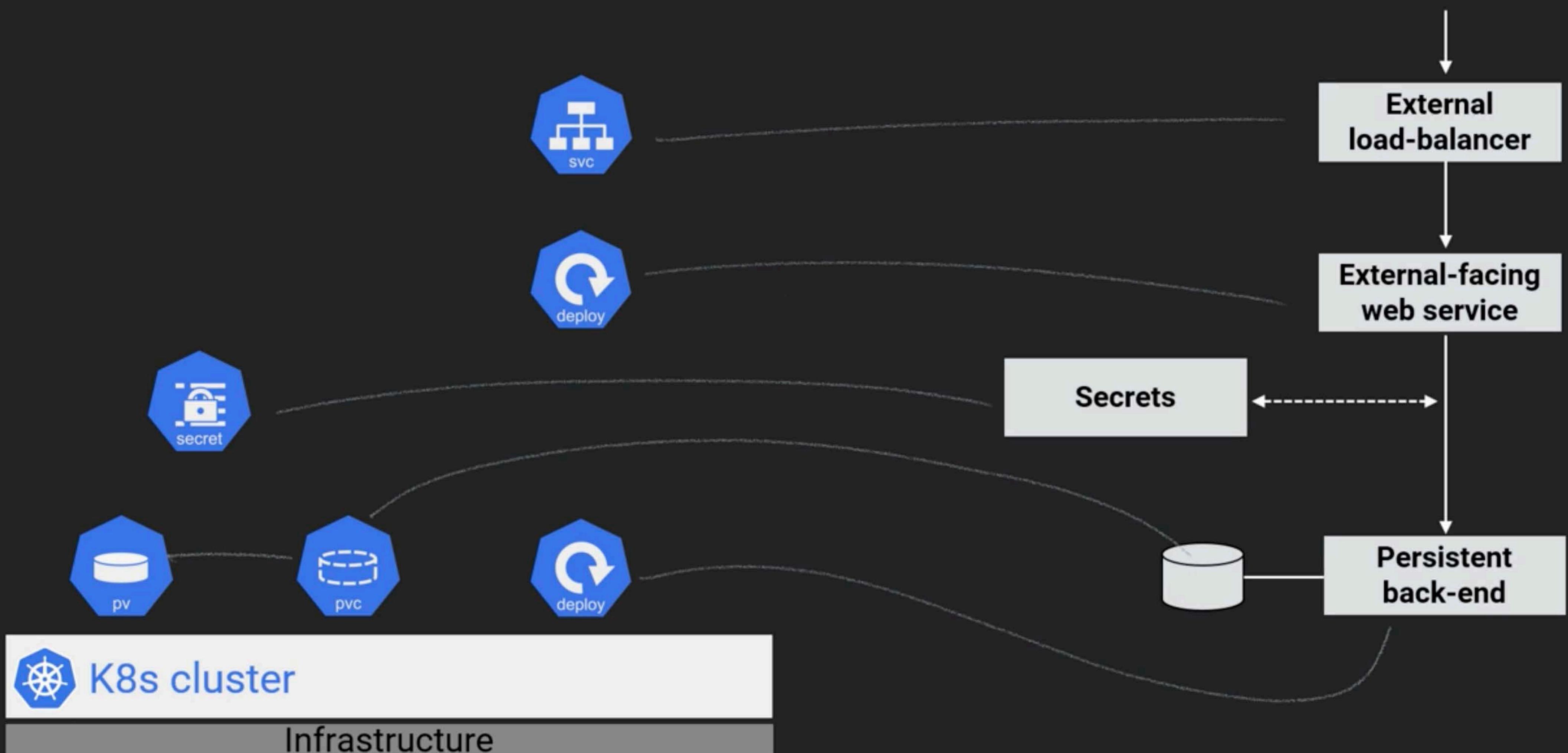
K8s cluster

Infrastructure

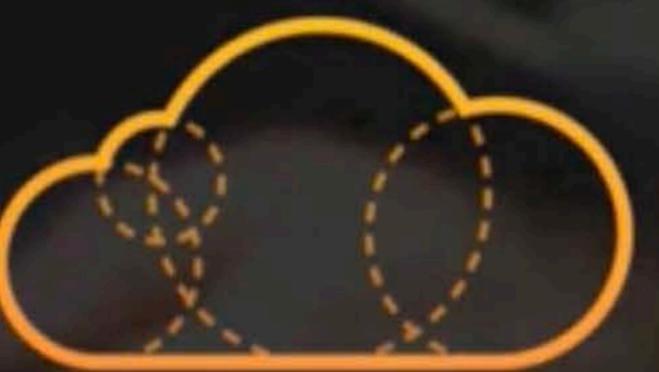
Kubernetes App Theory



A CLOUD GURU



Kubernetes Sample App

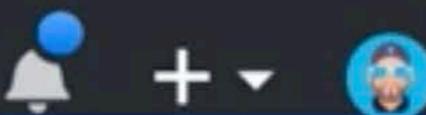


A CLOUD GURU



Search or jump to...

/ Pull requests Issues Marketplace Explore



nigelpoulton / k8s-sample-apps

forked from kubernetes/examples

Code

Pull requests 0

Projects 0

Wiki

Insights

Settings

Branch: master ▾

k8s-sample-apps / mysql-wordpress-pd /

This branch is 28 commits behind kubernetes:master.



jheyduk and ahmetb add missing comment (#195)

..

OWNERS

Move maintained examples to root, update README

README.md

Redirect tutorials to the docs site (#85)

WordPress.png

Move maintained examples to root, update README

gce-volumes.yaml

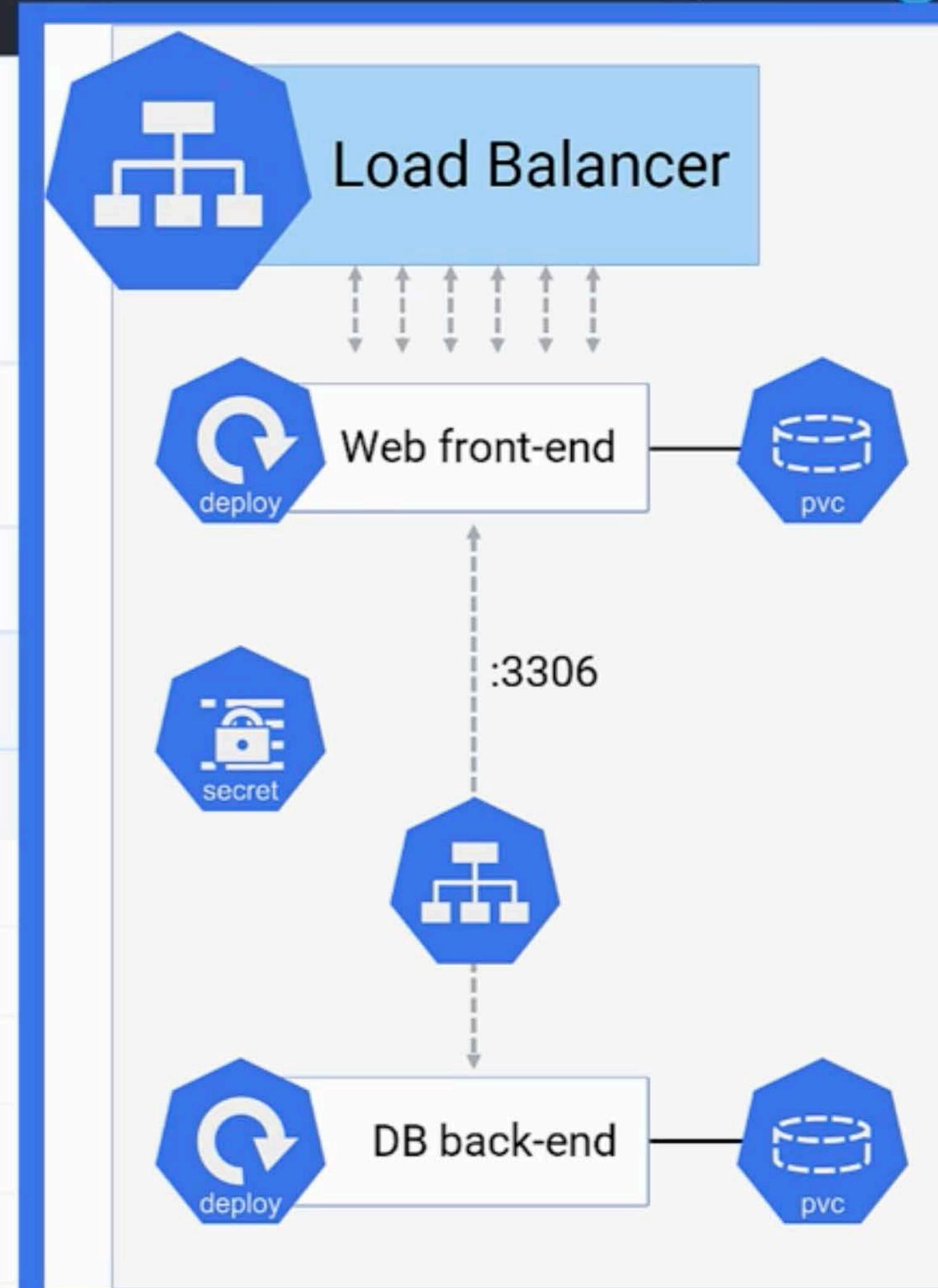
Move maintained examples to root, update README

local-volumes.yaml

Move maintained examples to root, update README

mysql-deployment.yaml

add missing comment (#195)



Branch: master ▾

k8s-sample-apps / mysql-wordpress-pd /

This branch is 28 commits behind kubernetes:master.



jheyduk and ahmetb add missing comment (#195)

..

[OWNERS](#)

[README.md](#)

[WordPress.png](#)

[gce-volumes.yaml](#)

[local-volumes.yaml](#)

[mysql-deployment.yaml](#)

[wordpress-deployment.yaml](#)

[README.md](#)

Move maintained examples to root, update README

Redirect tutorials to the docs site (#85)

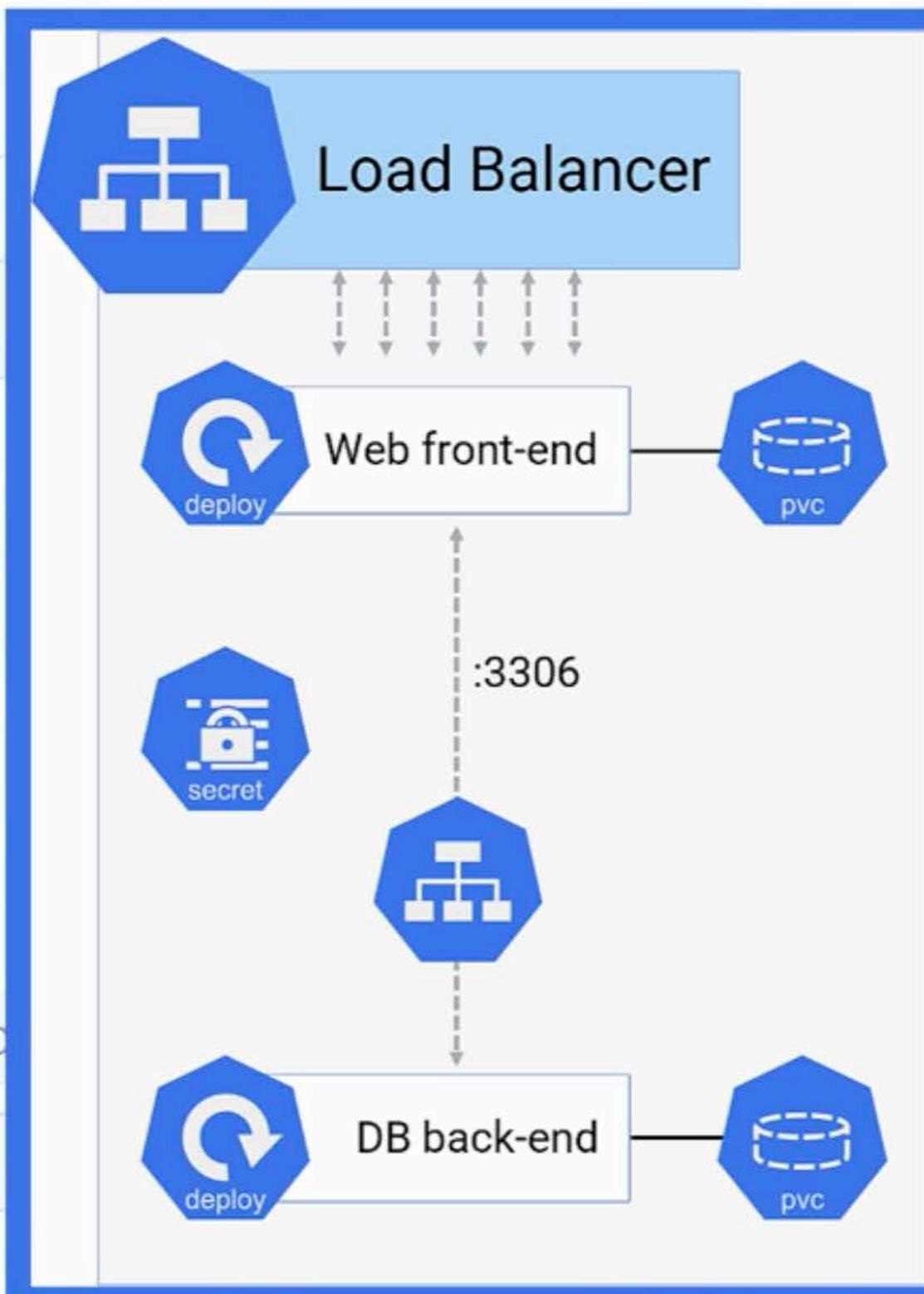
Move maintained examples to root, update README

Move maintained examples to root, update README

Move maintained examples to root, update README

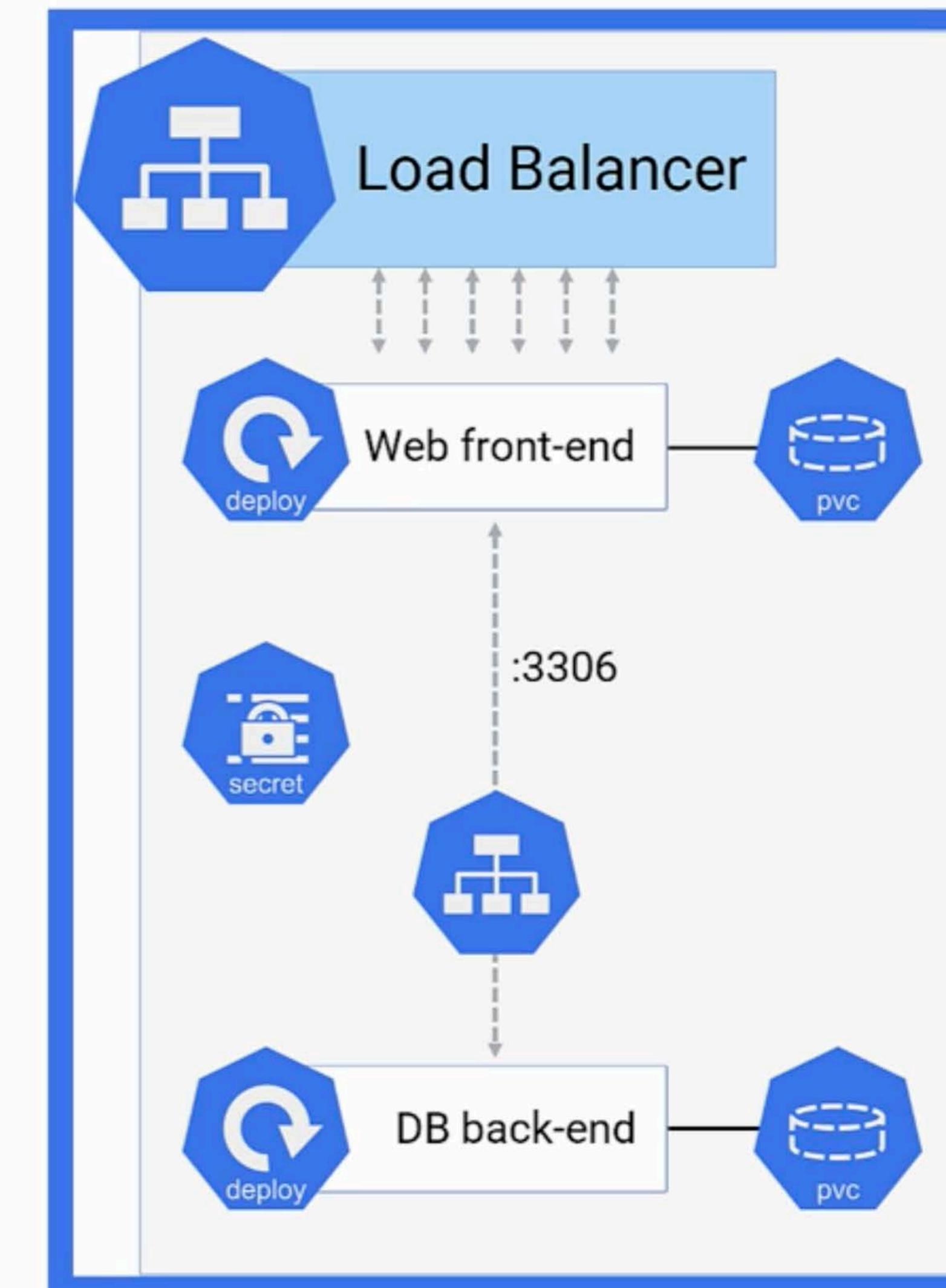
add missing comment (#195)

update all Deployment API version to apps/v1 in k8s v1.9.0

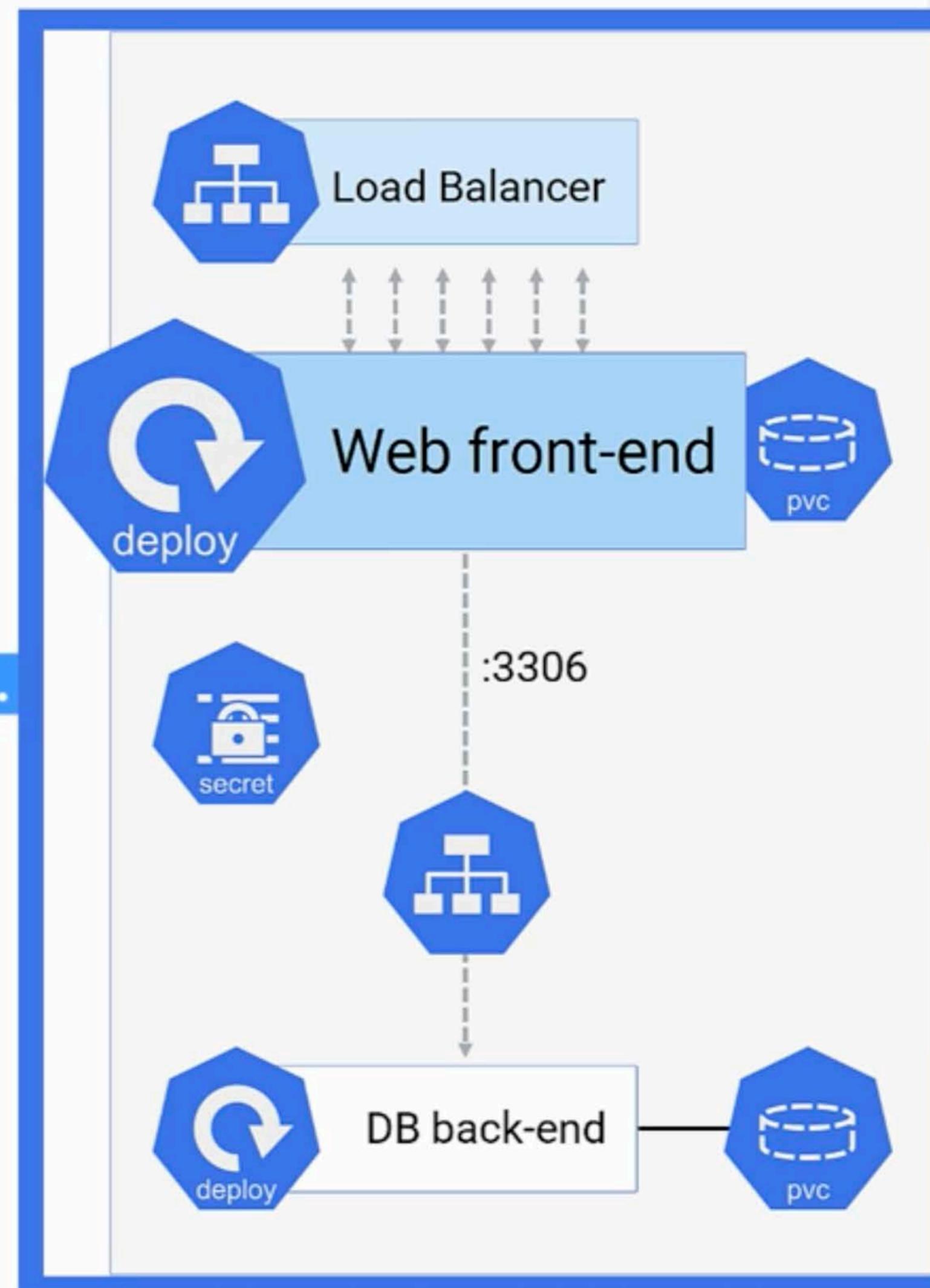


Example: WordPress and MySQL on Kubernetes

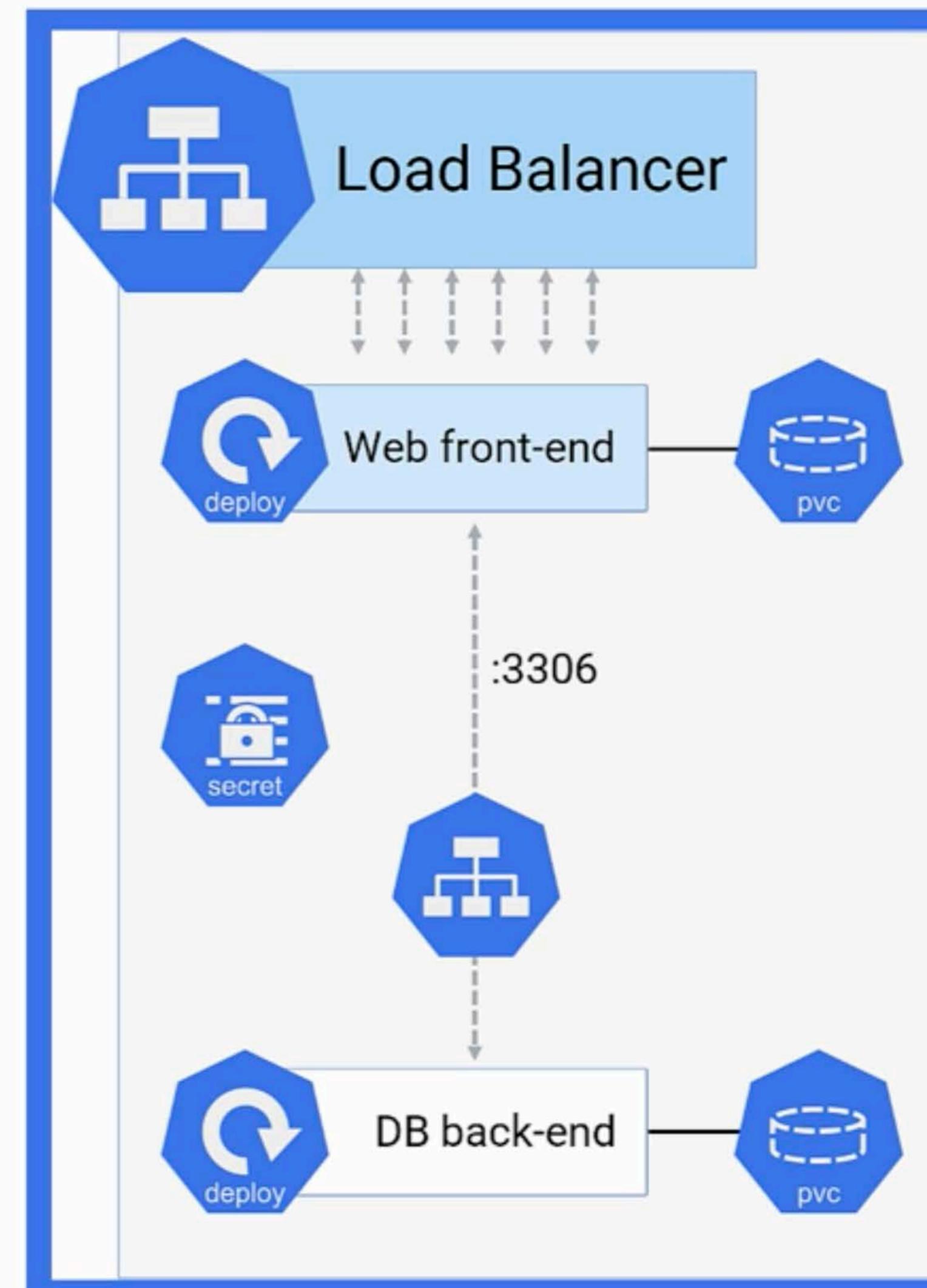
```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: wordpress
5   labels:
6     app: wordpress
7 spec:
8   ports:
9     - port: 80
10  selector:
11    app: wordpress
12    tier: frontend
13    type: LoadBalancer
14  ---
15  apiVersion: v1
16  kind: PersistentVolumeClaim
17  metadata:
```



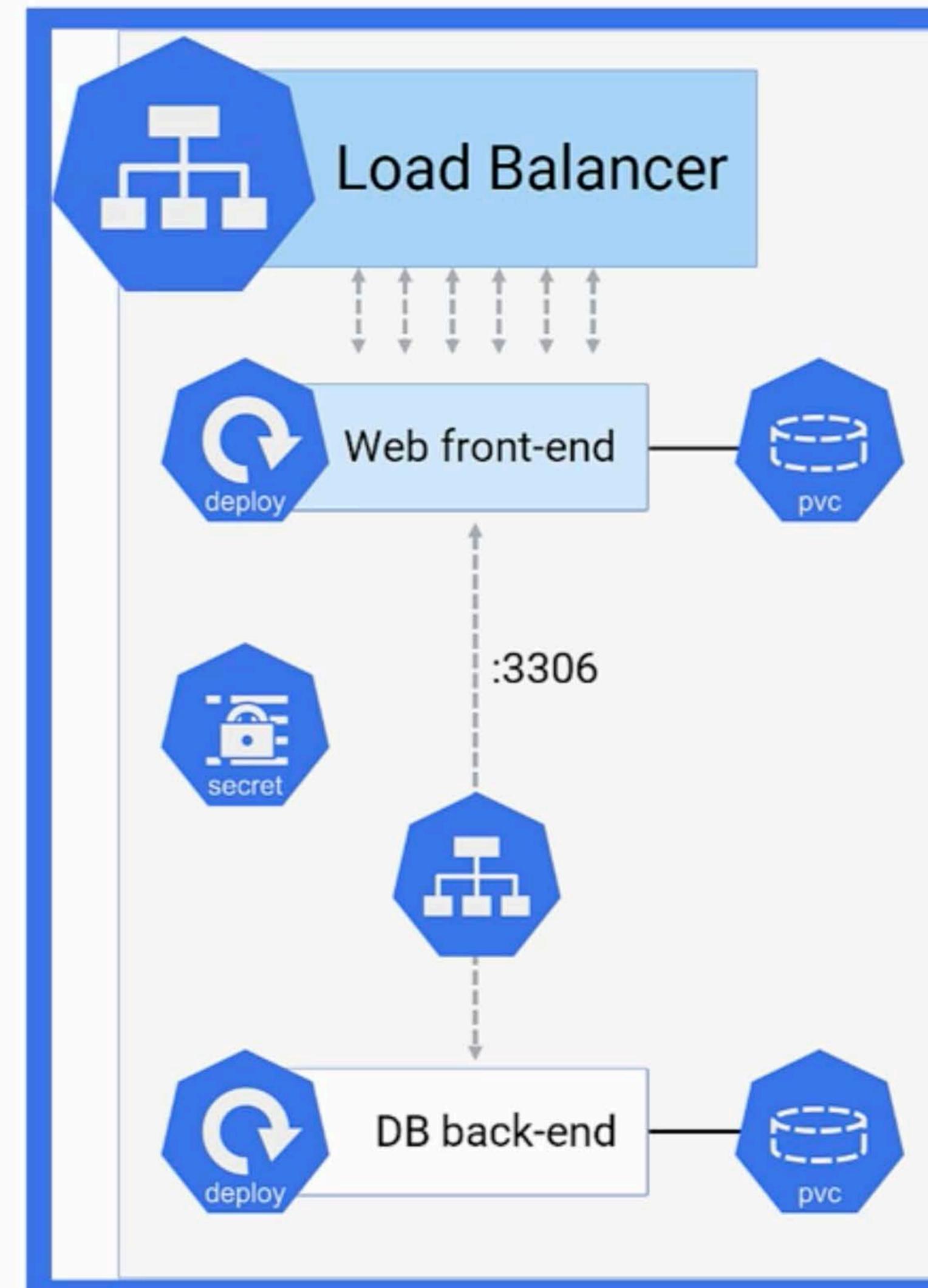
```
19      labels:  
20        app: wordpress  
21  
22      spec:  
23        accessModes:  
24          - ReadWriteOnce  
25  
26      resources:  
27        requests:  
28          storage: 20Gi  
29  
30      ---  
31  
32      apiVersion: apps/v1 # for k8s versions before 1.  
33      kind: Deployment  
34      metadata:  
35        name: wordpress  
36  
37      labels:  
38        app: wordpress  
39  
40      spec:  
41        selector:  
42          matchLabels:  
43
```



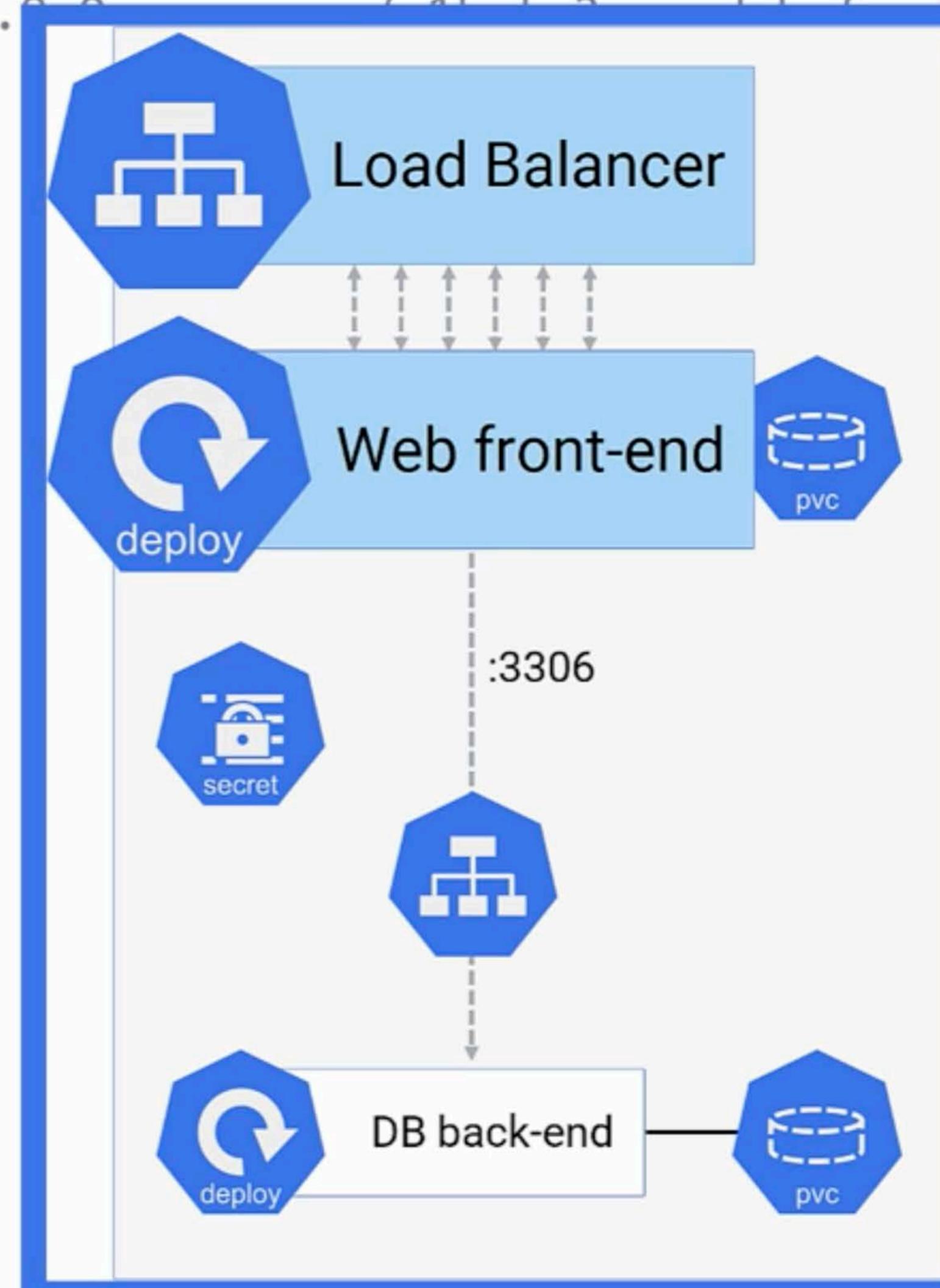
```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    ports:
9      - port: 80
10   selector:
11     app: wordpress
12     tier: frontend
13   type: LoadBalancer -----> {API}
14   ---
15   apiVersion: v1           [Create load-balancer
16   kind: PersistentVolumeClaim   on cloud platform]
17   metadata:
```



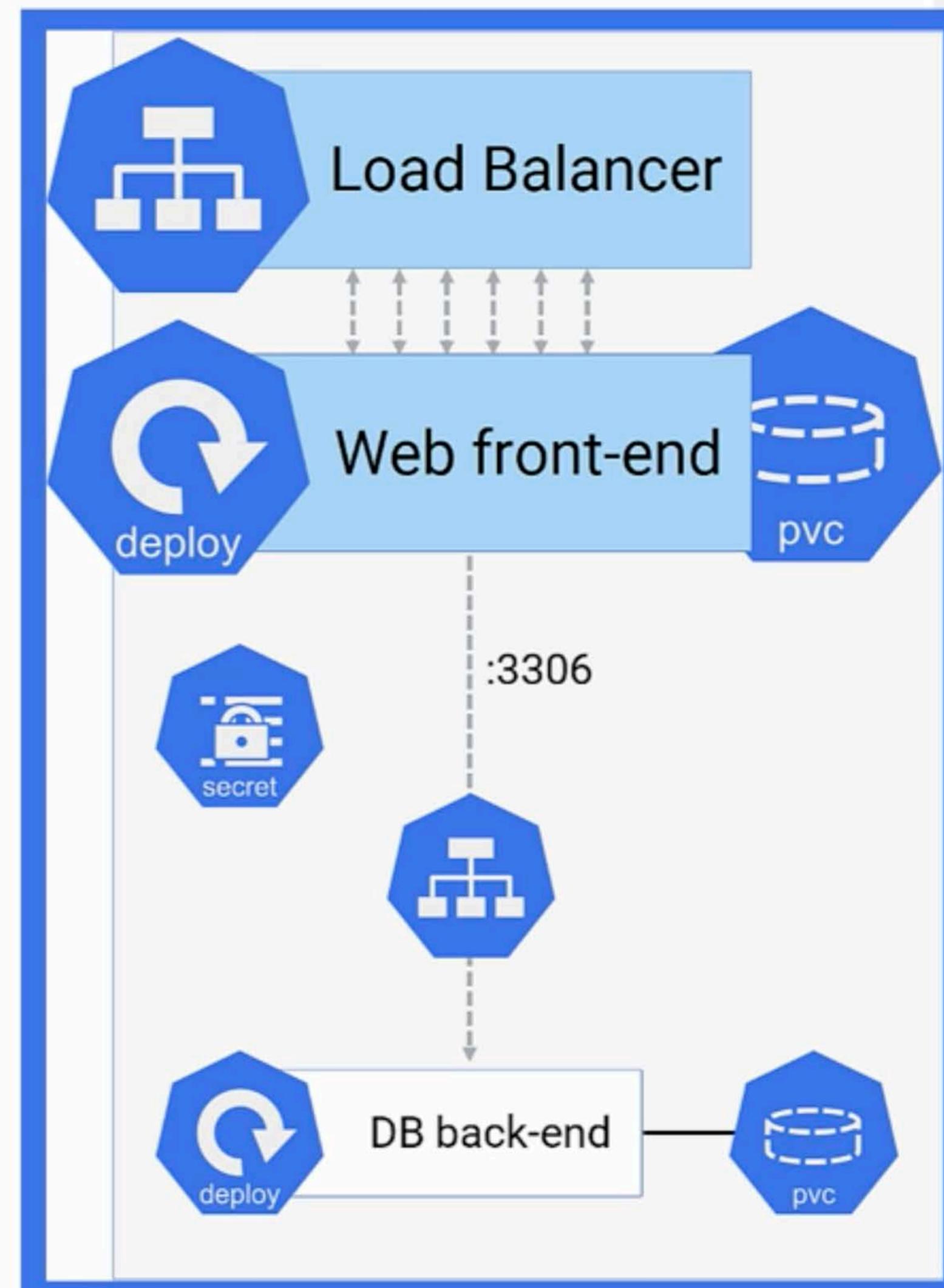
```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: wordpress
5   labels:
6     app: wordpress
7 spec:
8   ports:
9     - port: 80
10  selector:
11    app: wordpress
12    tier: frontend
13  type: LoadBalancer
14  ---
15  apiVersion: v1
16  kind: PersistentVolumeClaim
17  metadata:
```



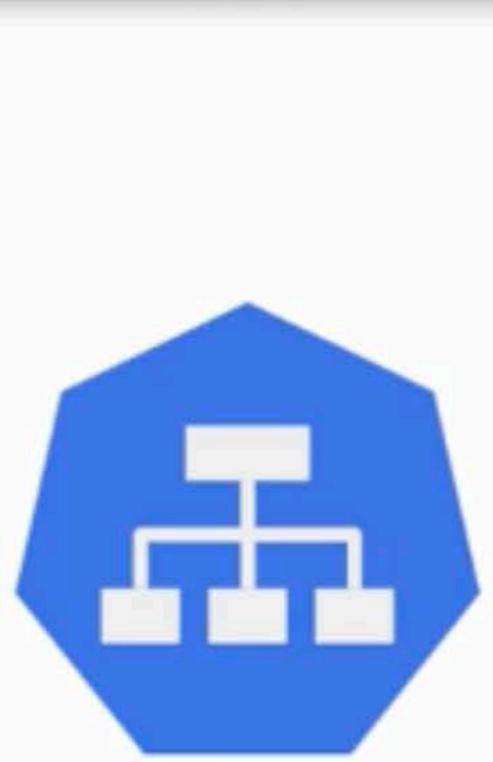
```
27 ---  
28     apiVersion: apps/v1 # for k8s versions before 1.8.0  
29     kind: Deployment  
30     metadata:  
31         name: wordpress  
32         labels:  
33             app: wordpress  
34     spec:  
35         selector:  
36             matchLabels:  
37                 app: wordpress  
38                 tier: frontend  
39         strategy:  
40             type: Recreate  
41         template:  
42             metadata:  
43                 labels:
```



```
12      tier: frontend  
13      type: LoadBalancer  
14  ---  
15  apiVersion: v1  
16  kind: PersistentVolumeClaim  
17  metadata:  
18    name: wp-pv-claim  
19    labels:  
20      app: wordpress  
21  spec:  
22    accessModes:  
23      - ReadWriteOnce  
24    resources:  
25      requests:  
26        storage: 20Gi  
27  ---  
28  apiVersion: apps/v1 # for k8s versions before 1.9.0 use apps/v1beta2 and before
```



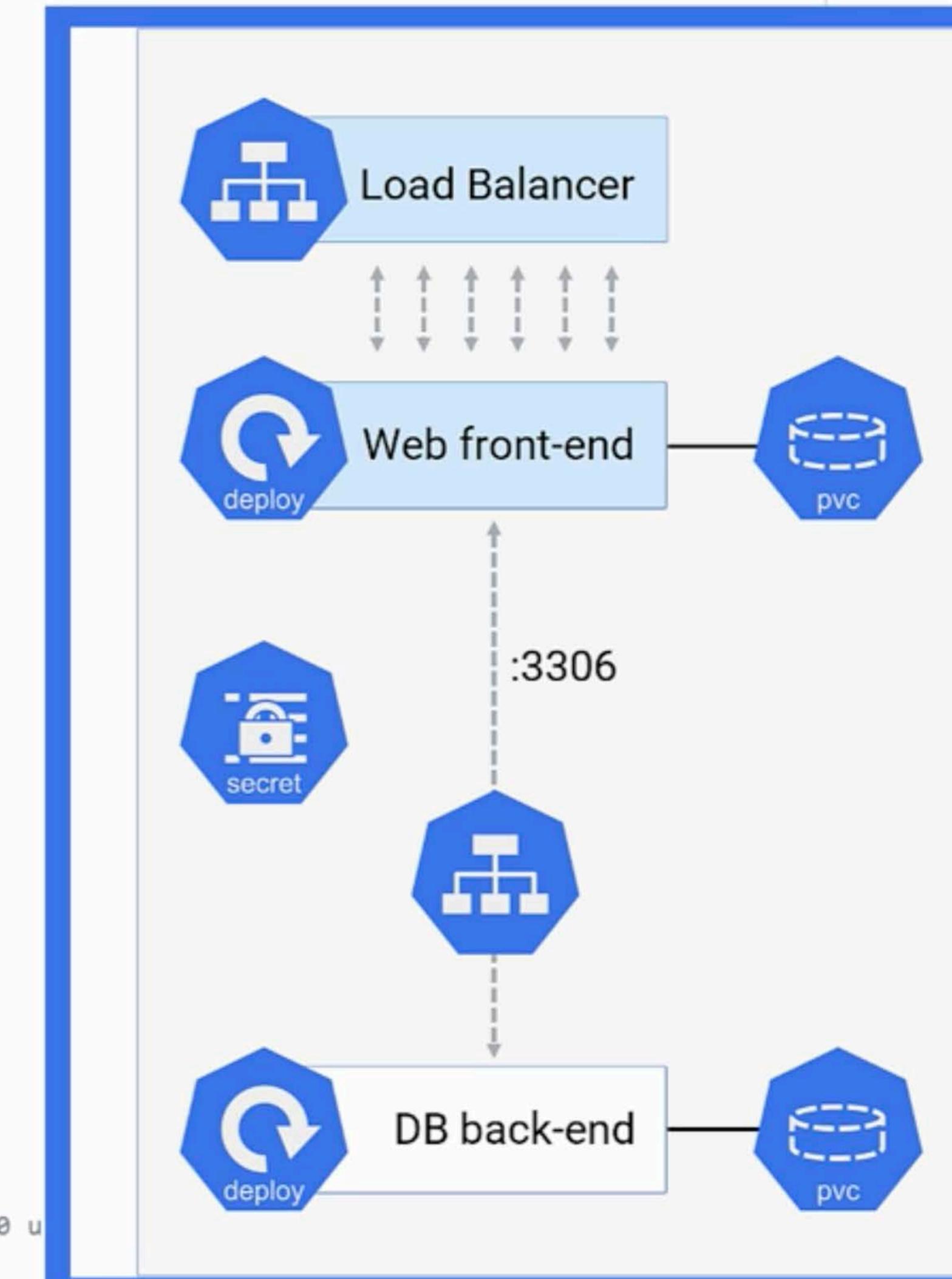
```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    ports:
9      - port: 80
10   selector:
11     app: wordpress
12     tier: frontend
13   type: LoadBalancer
14 ---
15
16  apiVersion: v1
17  kind: PersistentVolumeClaim
18  metadata:
19    name: wp-pv-claim
20    labels:
21      app: wordpress
22  spec:
23    accessModes:
24      - ReadWriteOnce
25  resources:
26    requests:
27      storage: 20Gi
28  ---
29  apiVersion: apps/v1 #
30  kind: Deployment
31  metadata:
32    name: wordpress
33    labels:
```



```
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
```



ns before 1.9.0 use apps/v1beta2 and before 1.8.0 u



This branch is 28 commits behind kubernetes:master.



jheyduk and ahmetb add missing comment (#195)

..

[OWNERS](#)

[README.md](#)

[WordPress.png](#)

[gce-volumes.yaml](#)

[local-volumes.yaml](#)

[mysql-deployment.yaml](#)

[wordpress-deployment.yaml](#)

[README.md](#)

Move maintained examples

Redirect tutorials to the docs

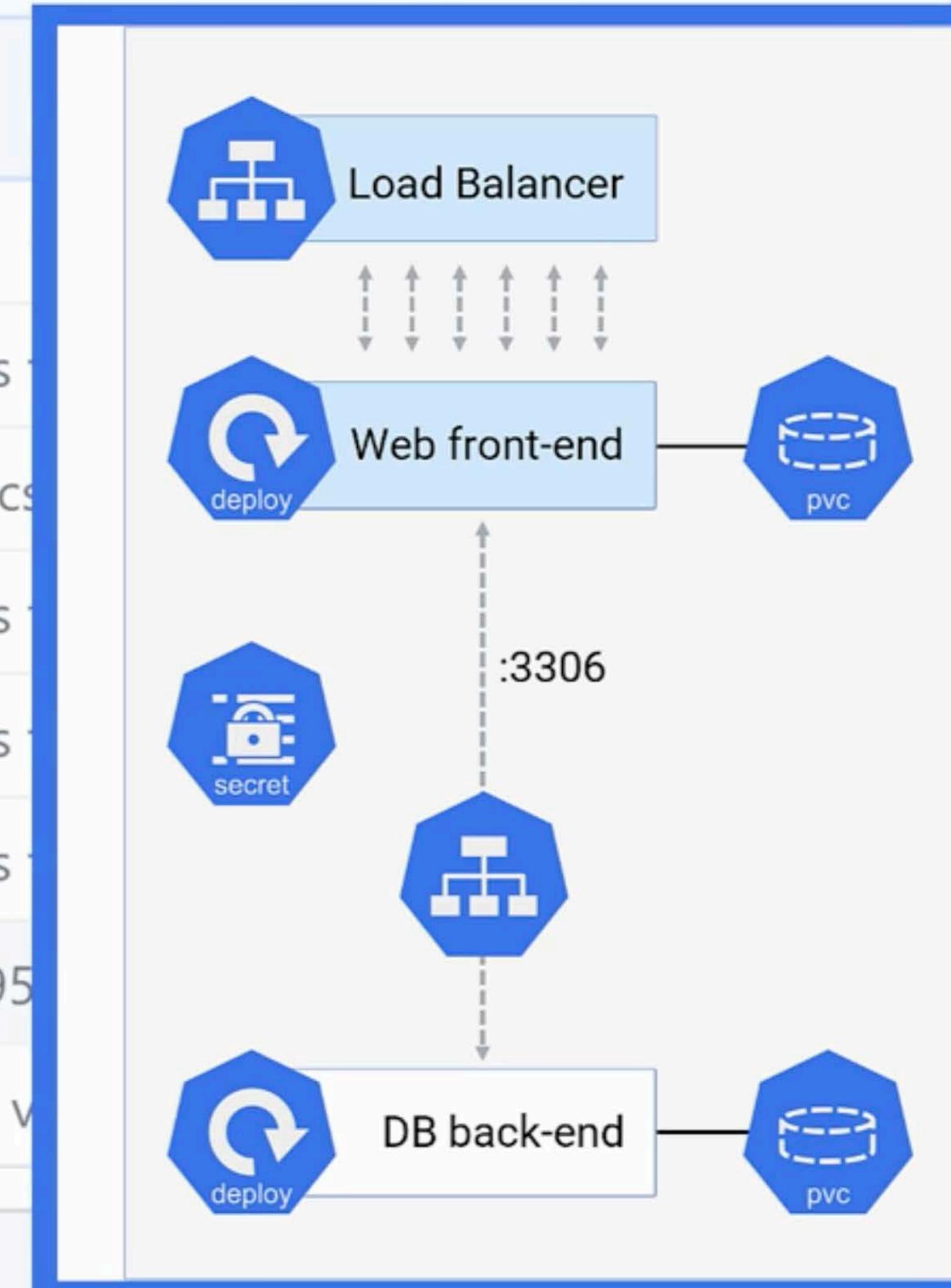
Move maintained examples

Move maintained examples

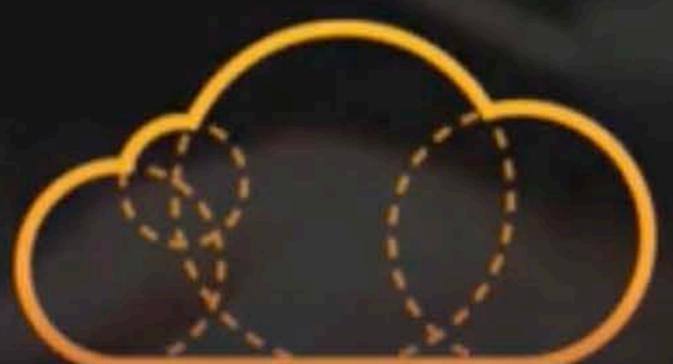
Move maintained examples

add missing comment (#195)

update all Deployment API v

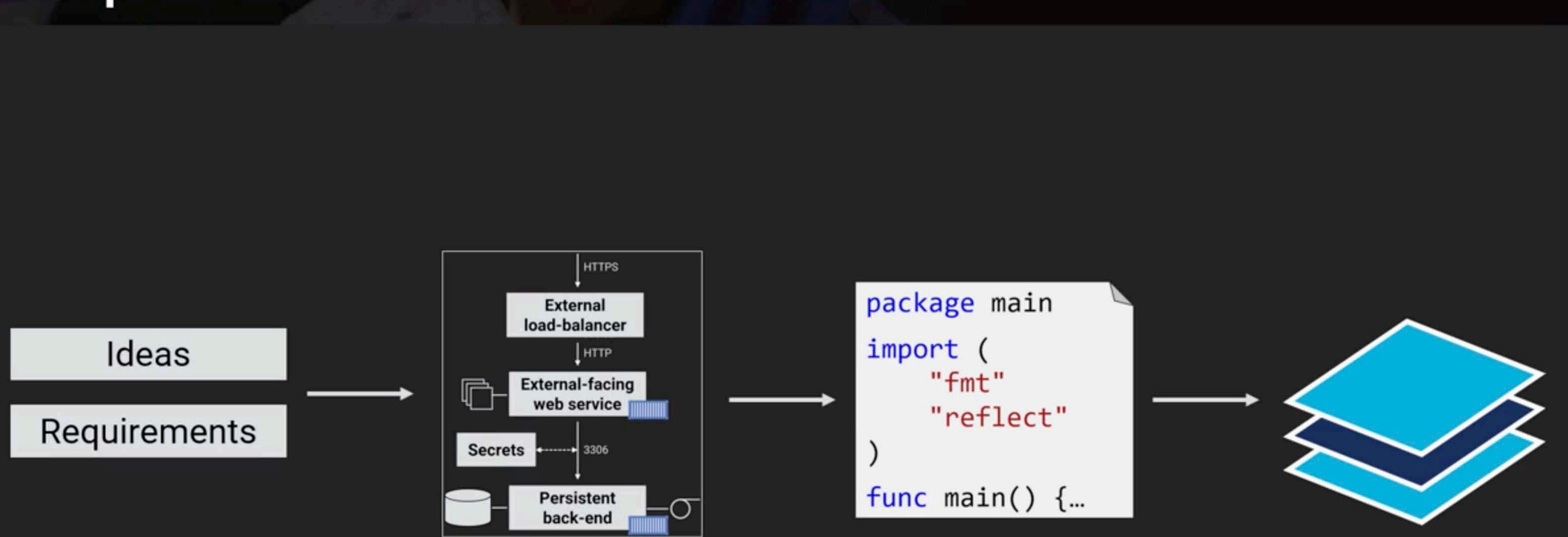


Recap

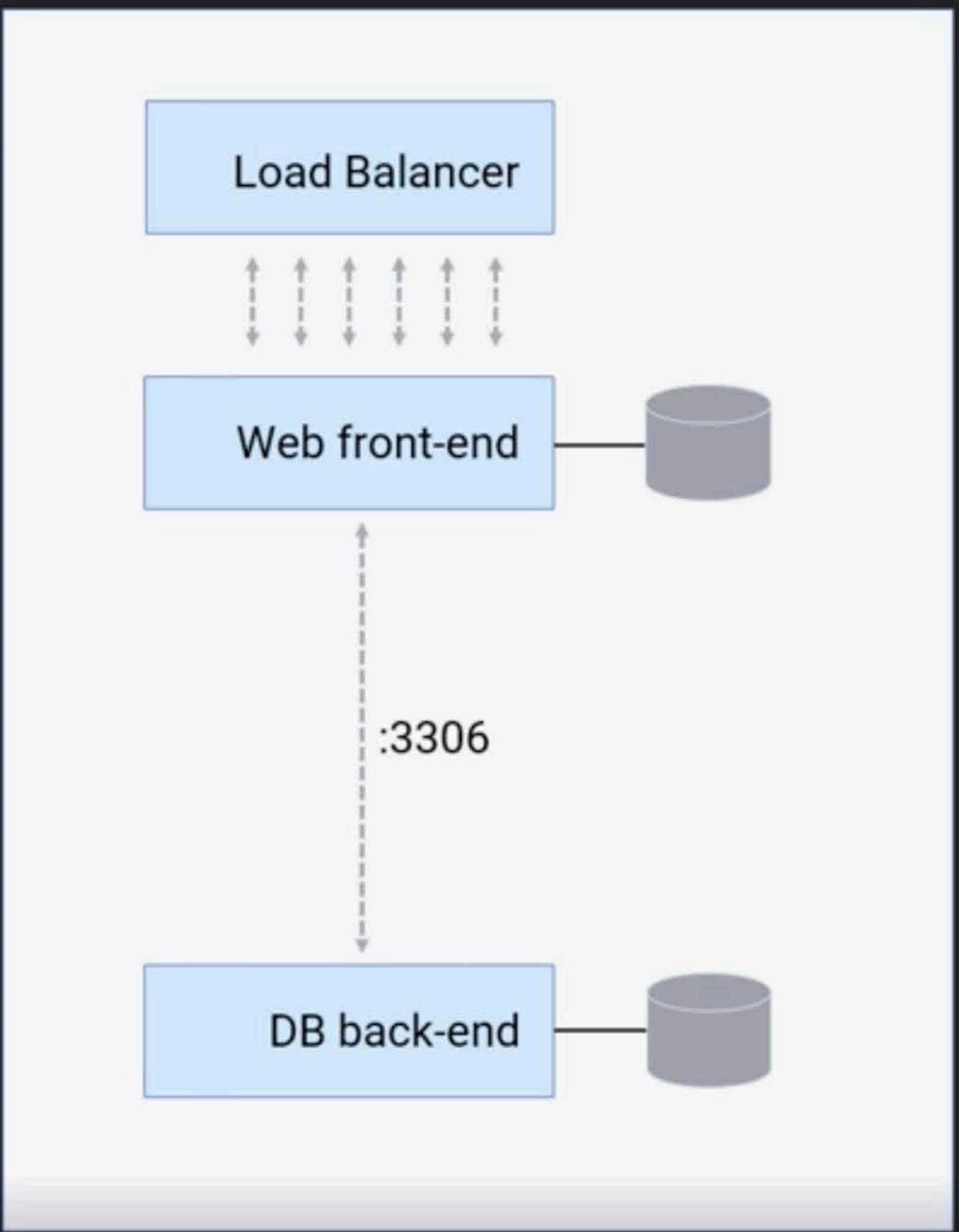


A CLOUD GURU

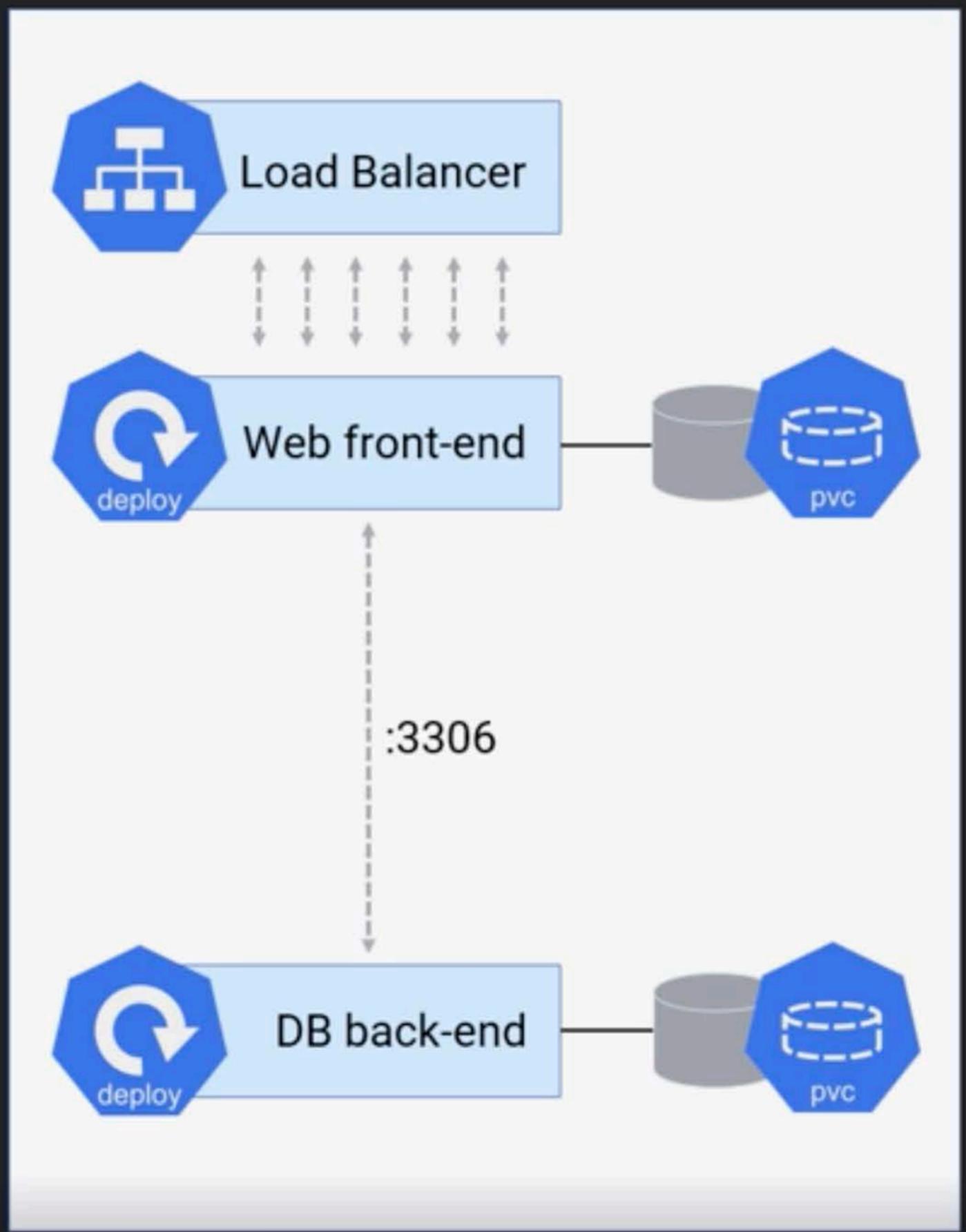
Recap



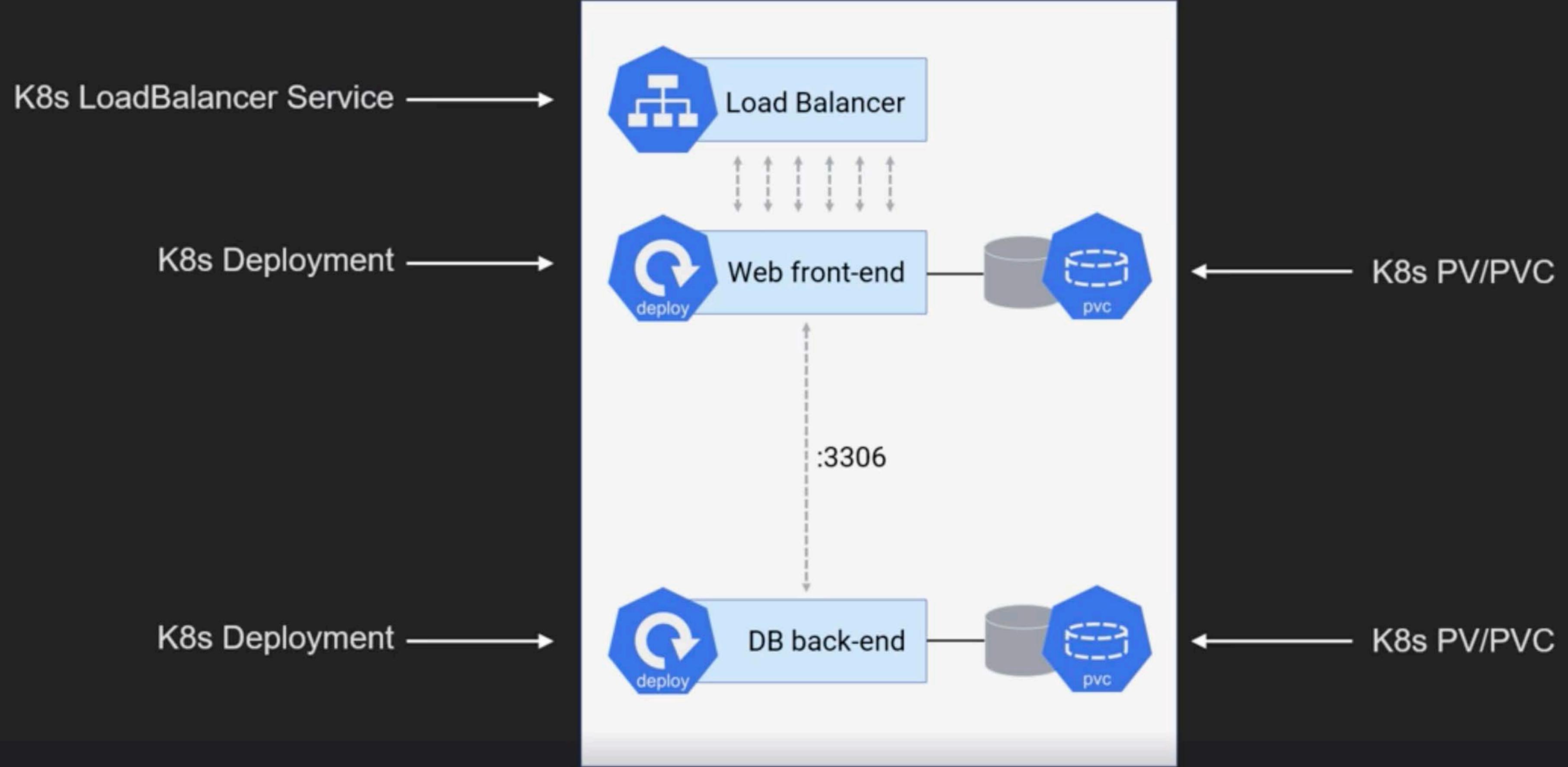
Recap



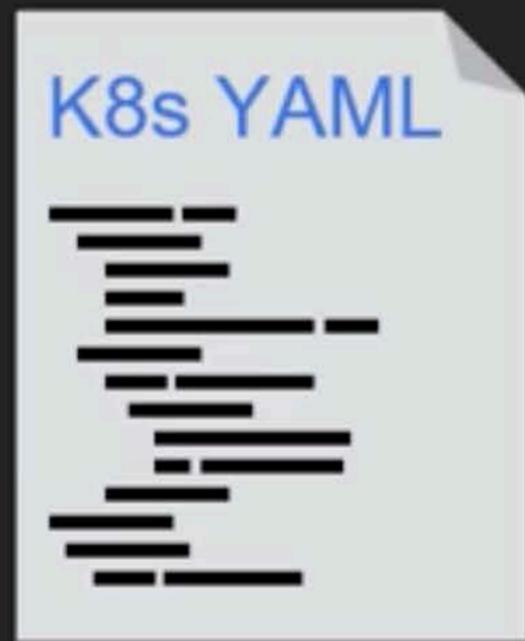
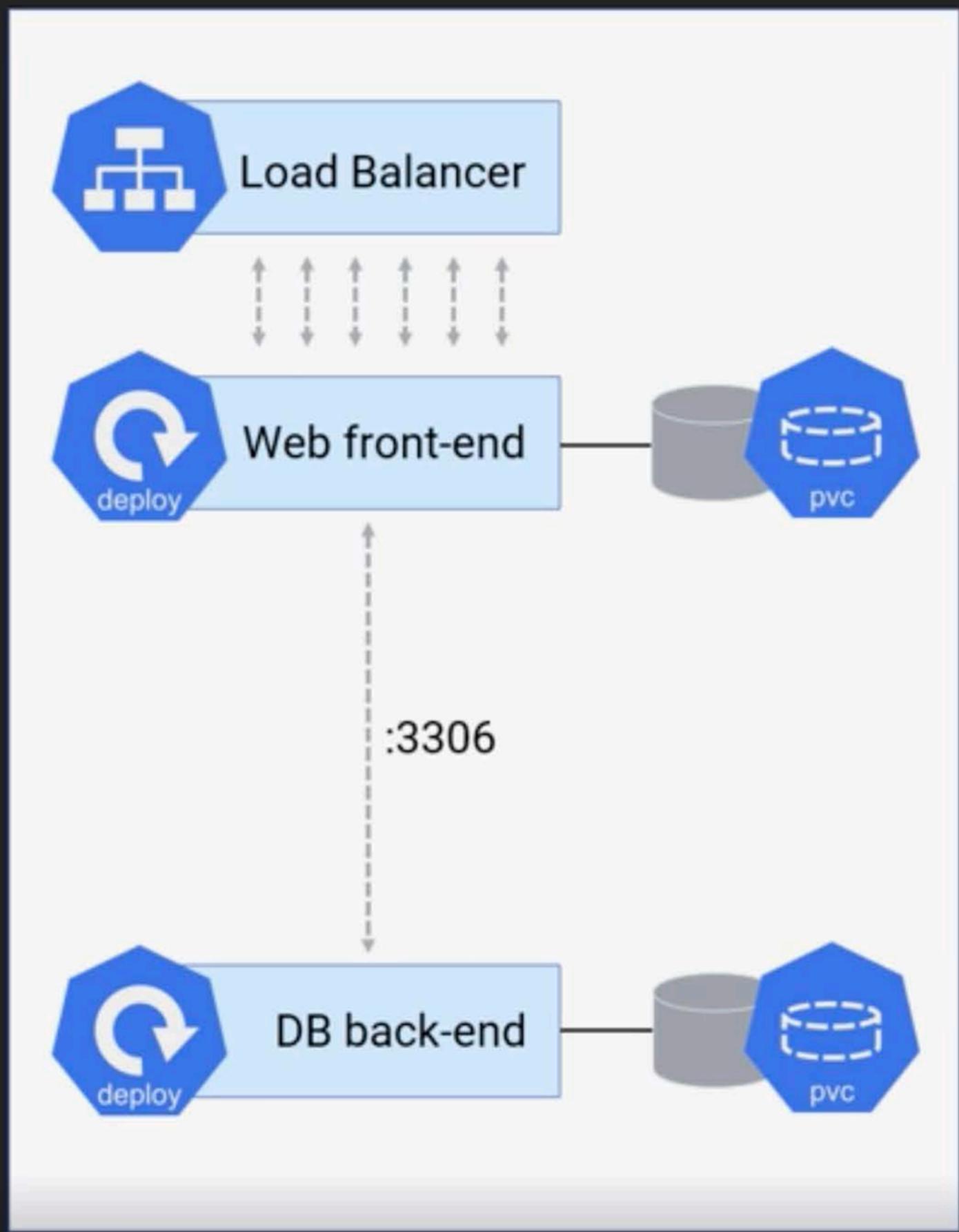
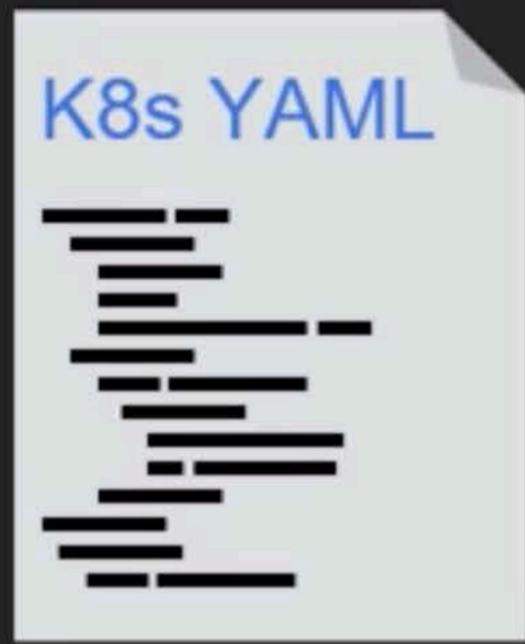
Recap



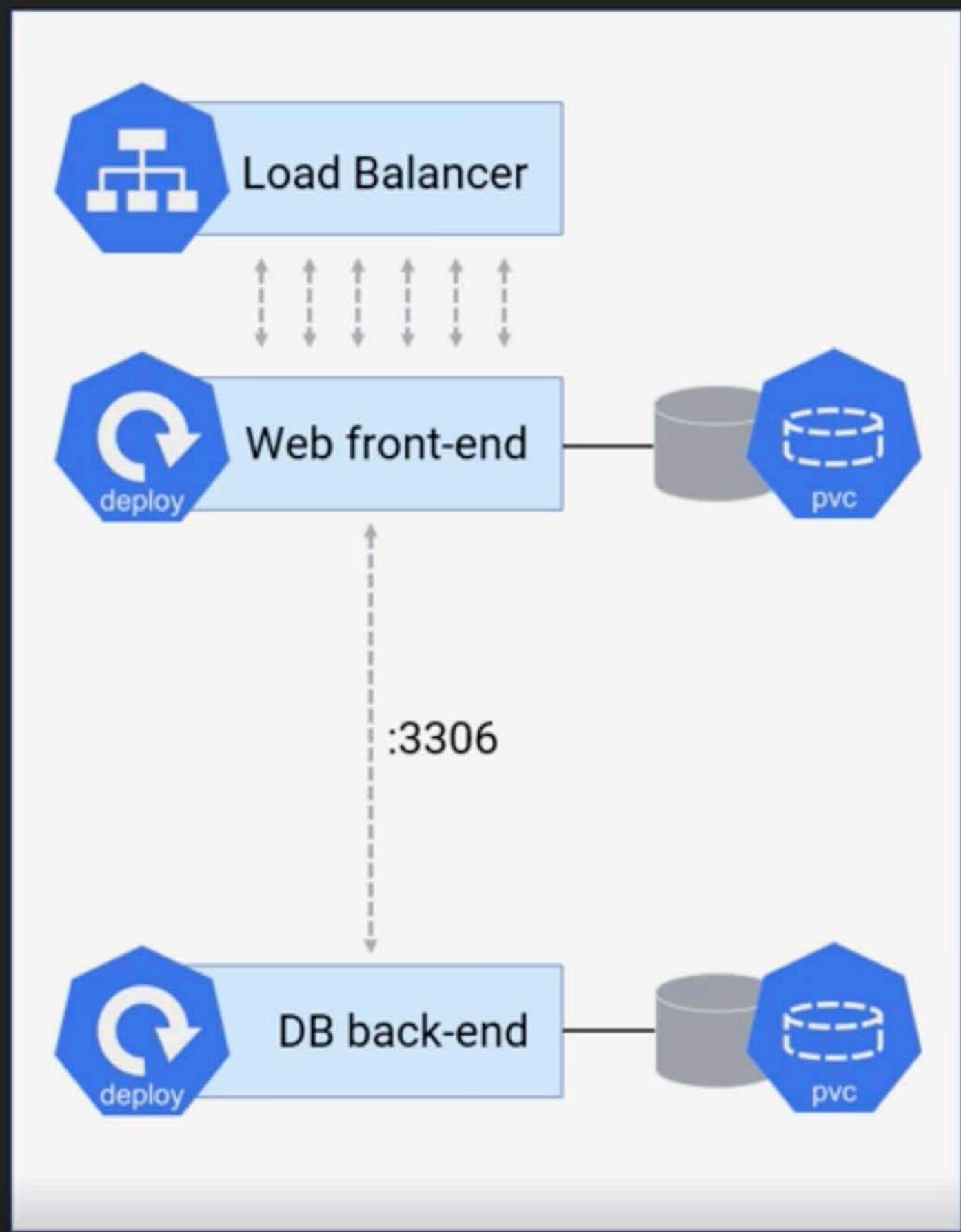
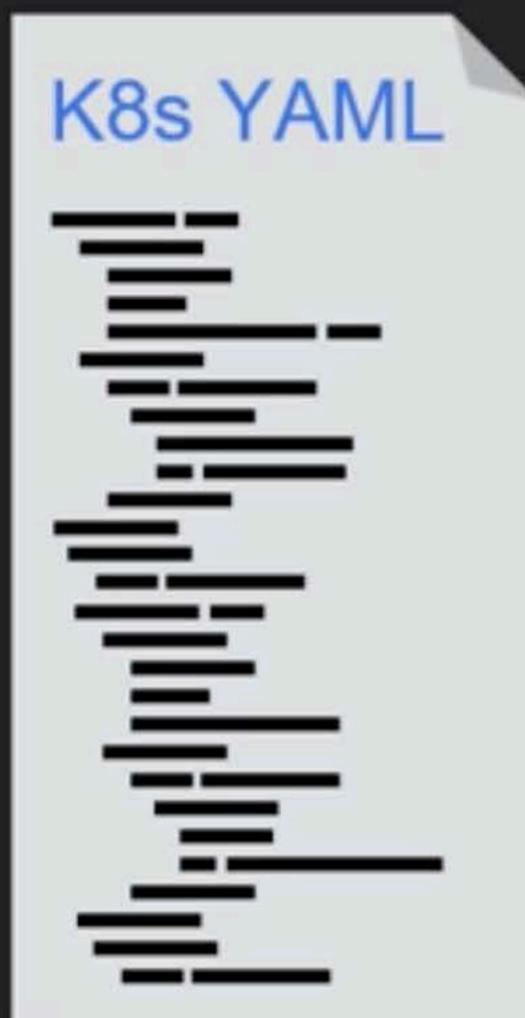
Recap



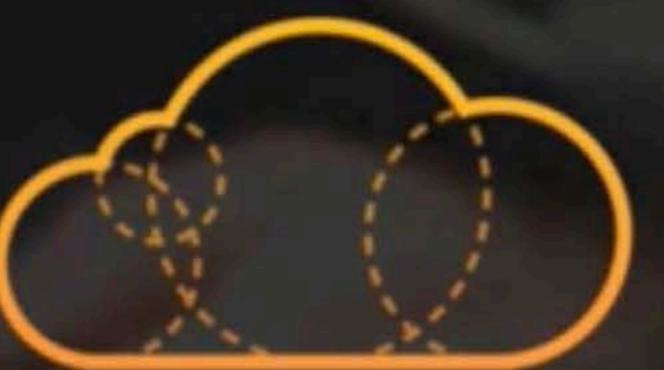
Recap



Recap



Kubernetes Networking



A CLOUD GURU

Lesson Plan



A CLOUD GURU

Networking's important!

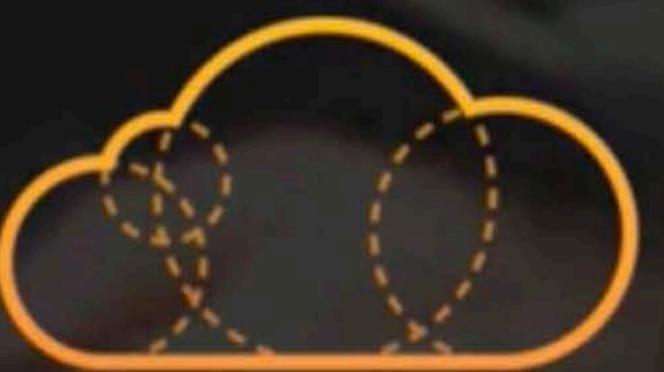
Don't skip over this!

Lesson Plan



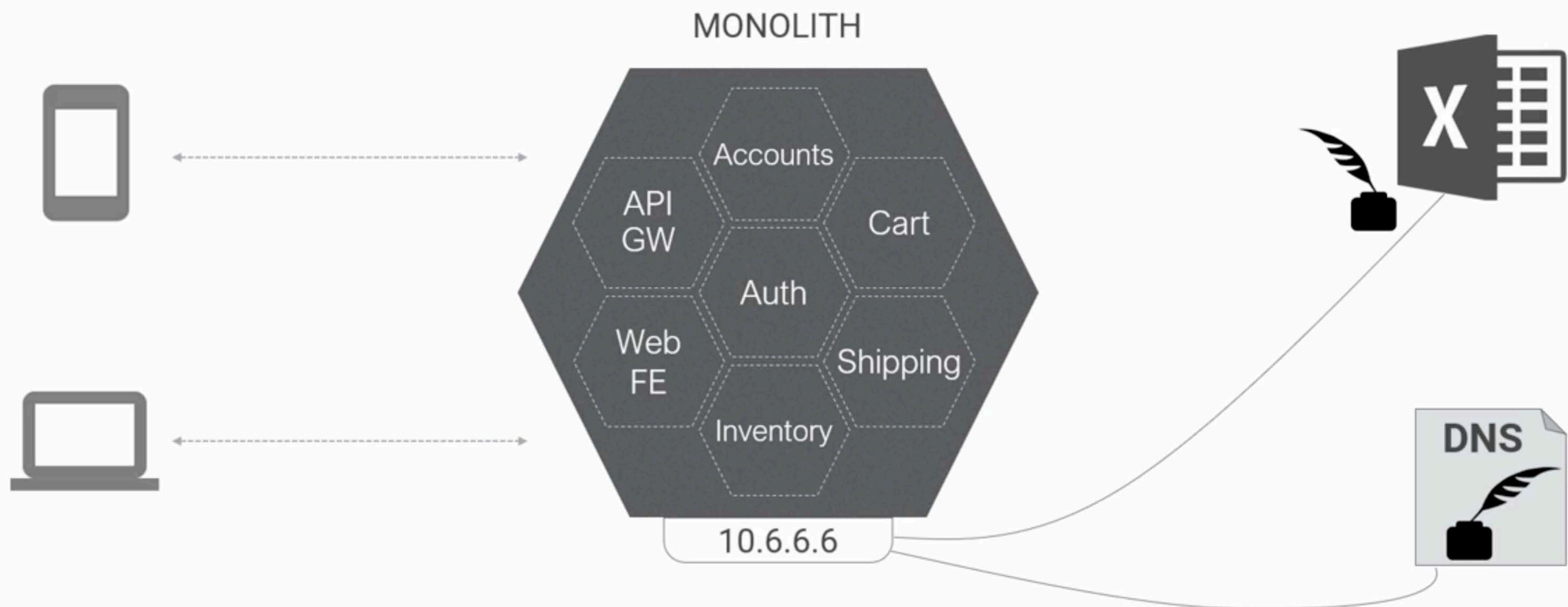
- Common Networking Requirements
- Networking in the Sample App
- Kubernetes Networking Basics
- Services
- Service Types
- The Service Network
- Lab
- Summary

Common Networking Requirements



A CLOUD GURU

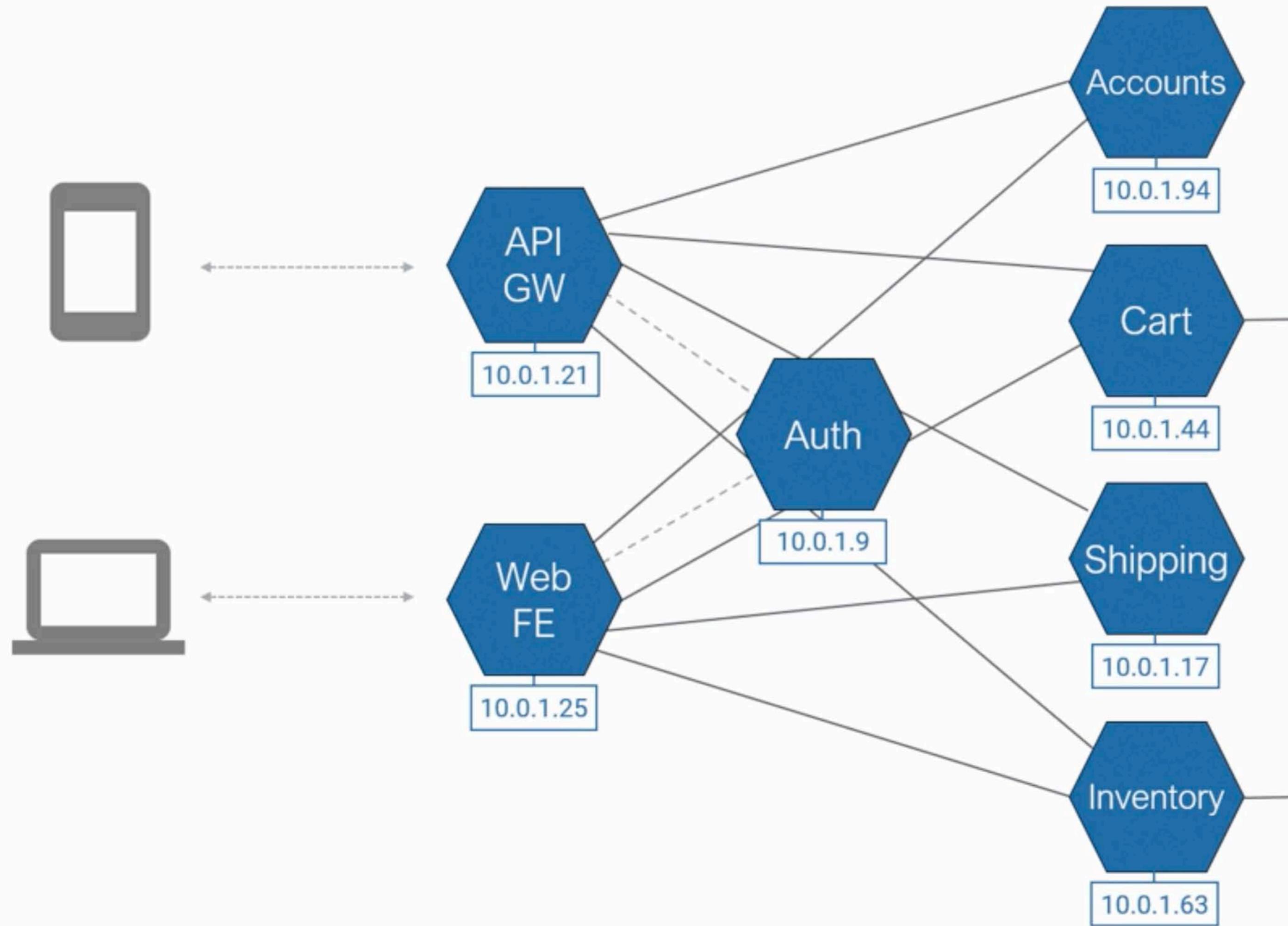
Common Networking Requirements



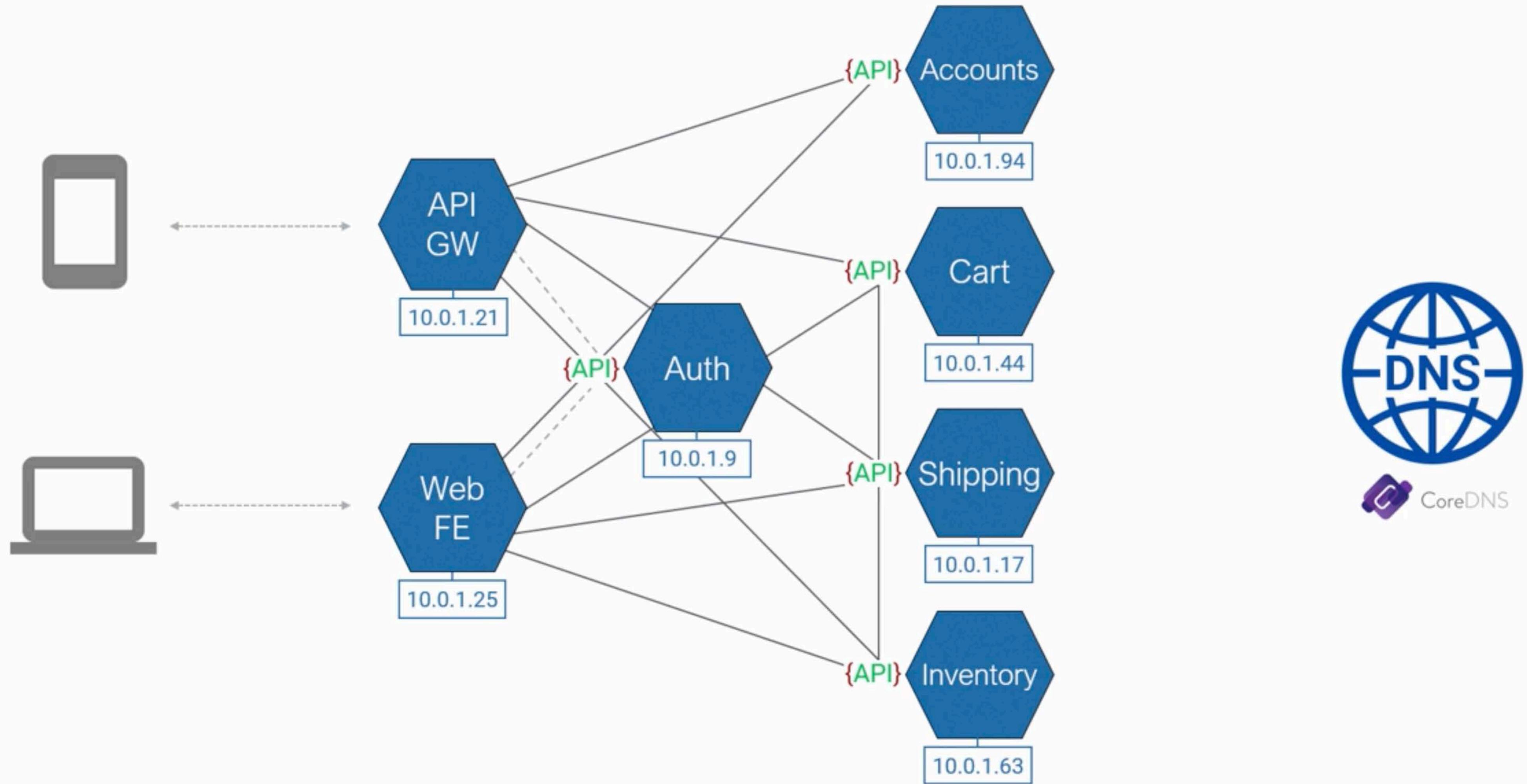
Common Networking Requirements



Common Networking Requirements



Common Networking Requirements



Common Networking Requirements



Highly dynamic networks are the **new normal!**



Common Networking Requirements



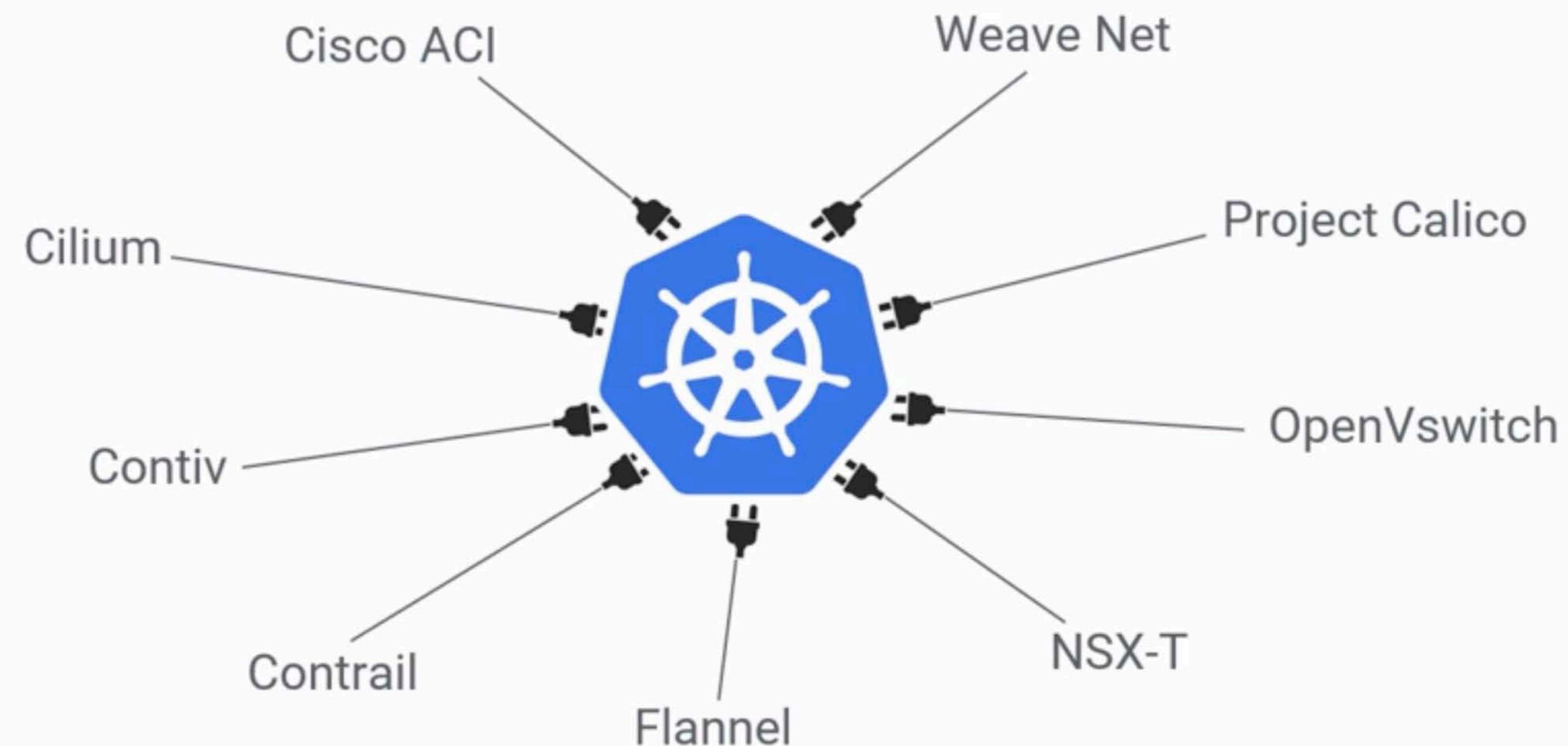
Highly dynamic networks are the **new normal!**



Common Networking Requirements

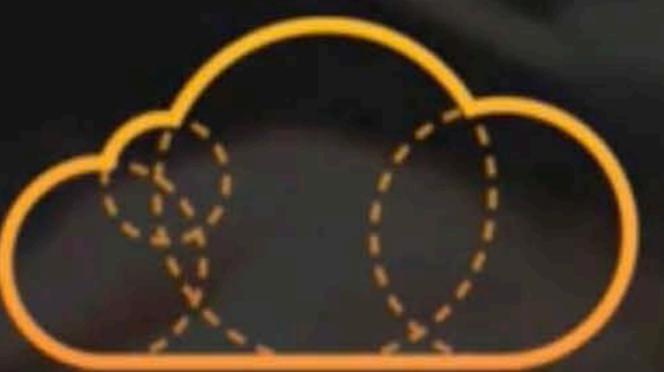


Highly dynamic networks are the **new normal!**



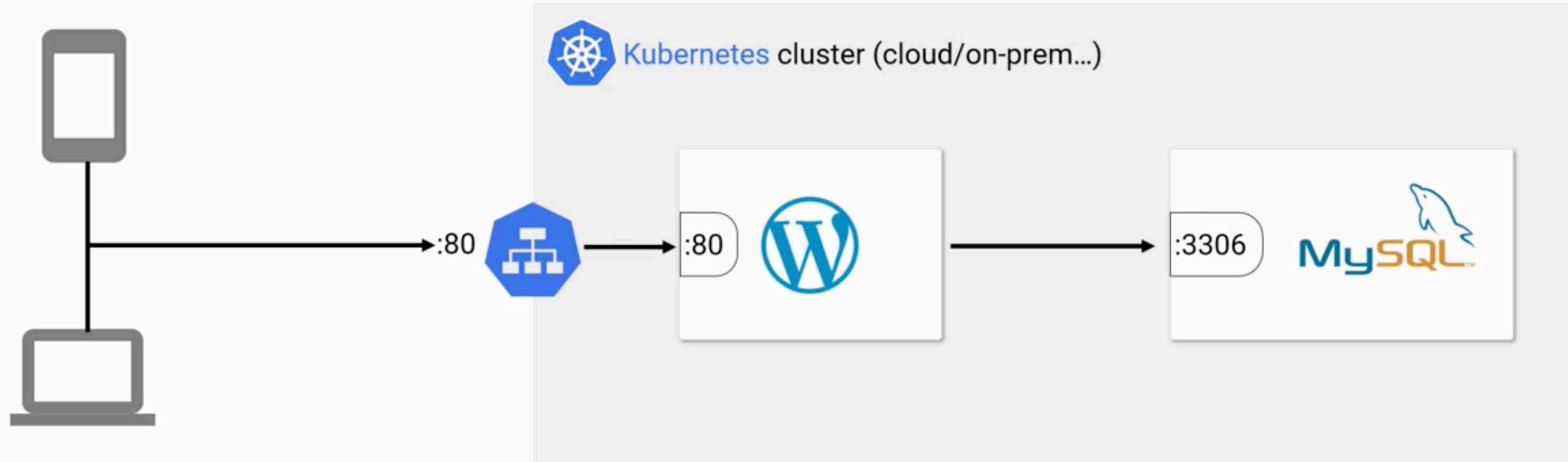
Some of the 3rd-party CNI plugins.
Others also exist.

Networking in the Sample App



A CLOUD GURU

Networking in the Sample App



Kubernetes application example tutorials

[Edit](#)[Add topics](#)

1,840 commits

2 branches

0 releases

323 contributors

Apache-2.0

Branch: master ▾

New pull request

Create new file

Upload files

Find file

Clone or download ▾

This branch is 8 commits behind kubernetes:master.

[Pull request](#) [Compare](#) **k8s-ci-robot** Merge pull request #232 from adelton/create_psp_policy ...

Latest commit 90145b4 on 24 May

 cassandra	Merge pull request #201 from aledbf/docker	3 months ago
 guestbook-go	[guestbook-go] Use multi-stage build (#211)	4 months ago
 guestbook	update all Deployment API version to apps/v1 in k8s v1.9.0 and add ac...	5 months ago
 mysql-wordpress-pd	add missing comment (#195)	5 months ago
 staging	Creation of PSP by hack/local-up-cluster.sh is not as automatic as th...	2 months ago
 .gitignore	We do not have a git ignore, modified version from core	a year ago
 LICENSE	Initial commit	a year ago
 OWNERS	Update owners for k/examples (#203)	4 months ago
 README.md	Fix broken cassandra link in README	a year ago
 code-of-conduct.md	Add code-of-conduct.md (#161)	7 months ago



Search or jump to...

/

Pull requests Issues Marketplace Explore

nigelpoulton / k8s-sample-apps
forked from kubernetes/examples

Unwatch ▾

1

Star

0

Fork

649

Code

Pull requests 0

Projects 0

Wiki

Insights

Settings

Branch: master ▾

k8s-sample-apps / mysql-wordpress-pd /

Create new file

Upload files

Find file

History

This branch is 8 commits behind kubernetes:master.

Pull request Compare

 jheyduk and ahmetb add missing comment (#195)

Latest commit 173927b on 12 Feb

..

 OWNERS

Move maintained examples to root, update README

a year ago

 README.md

Redirect tutorials to the docs site (#85)

10 months ago

 WordPress.png

Move maintained examples to root, update README

a year ago

 gce-volumes.yaml

Move maintained examples to root, update README

a year ago

 local-volumes.yaml

Move maintained examples to root, update README

a year ago

 mysql-deployment.yaml

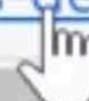
add missing comment (#195)

5 months ago

 wordpress-deployment.yaml

update all Deployment API version to apps/v1 in k8s v1.9.0 and add ac...

5 months ago



github.com/nigelpoulton/k8s-sample-apps/.../wordpress-deployment.yaml

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: wordpress
5   labels:
6     app: wordpress
7 spec:
8   ports:
9     - port: 80
10  selector:
11    app: wordpress
12    tier: frontend
13  type: LoadBalancer
14 ---
15 apiVersion: v1
16 kind: PersistentVolumeClaim
17 metadata:
18   name: wp-pv-claim
19   labels:
20     app: wordpress
21 spec:
22   accessModes:
23     - ReadWriteOnce
24   resources:
25     requests:
26       storage: 20Gi
27 ---
28 apiVersion: apps/v1 # for k8s versions before 1.9.0 use apps/v1beta2 and before 1.8.0 use extensions/v1beta1
```

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: wordpress
5   labels:
6     app: wordpress
7 spec:
8   ports:
9     - port: 80
10  selector:
11    app: wordpress
12    tier: frontend
13  type: LoadBalancer
14 ---
15 apiVersion: v1
16 kind: PersistentVolumeClaim
17 metadata:
```

```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    ports:
9      - port: 80
10   selector:
11     app: wordpress
12     tier: frontend
13   type: LoadBalancer
14 ---
15  apiVersion: v1
16  kind: PersistentVolumeClaim
17  metadata:
```

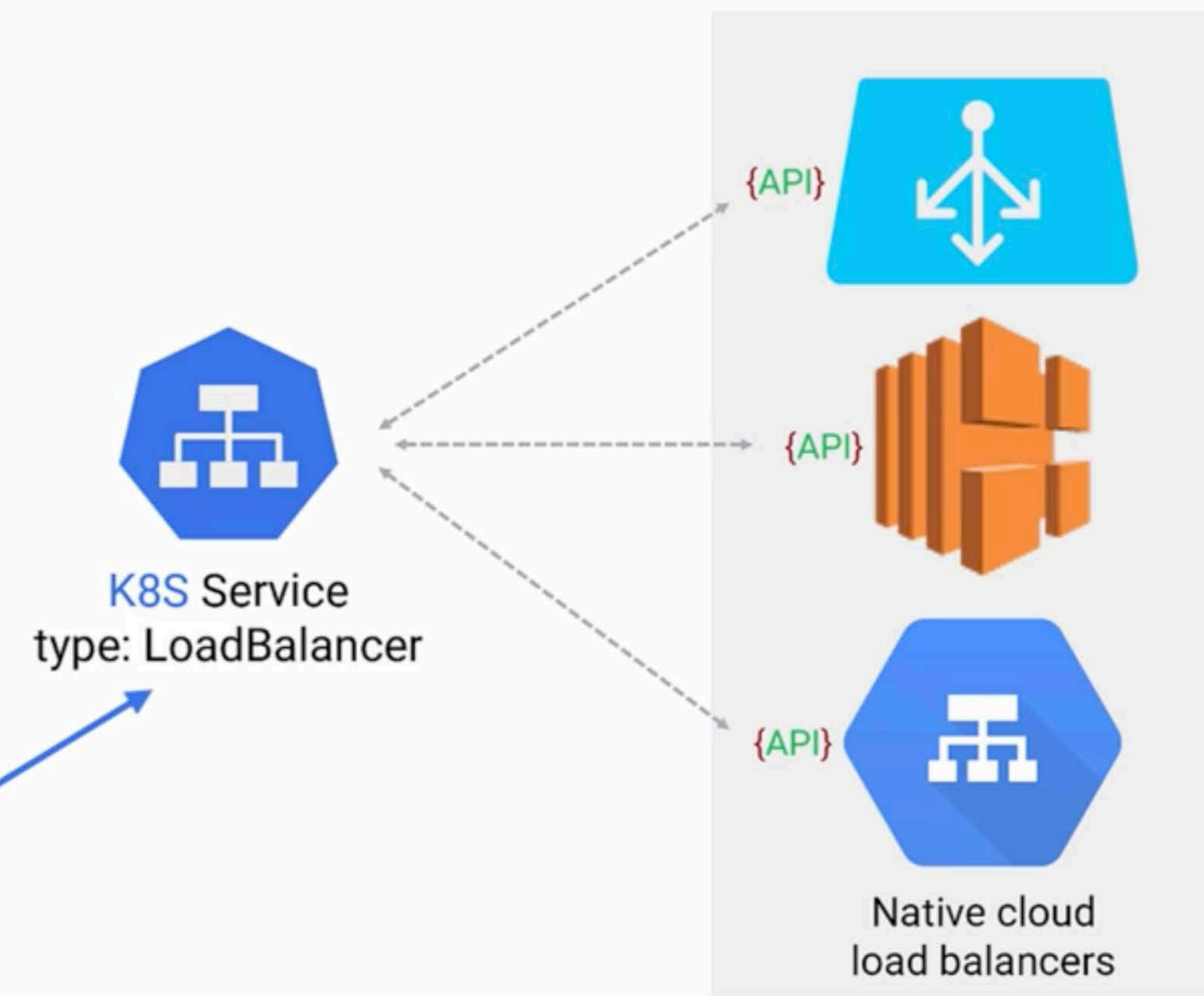


```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    ports:
9      - port: 80
10   selector:
11     app: wordpress
12     tier: frontend
13   type: LoadBalancer
14 ---
15  apiVersion: v1
16  kind: PersistentVolumeClaim
17  metadata:
```

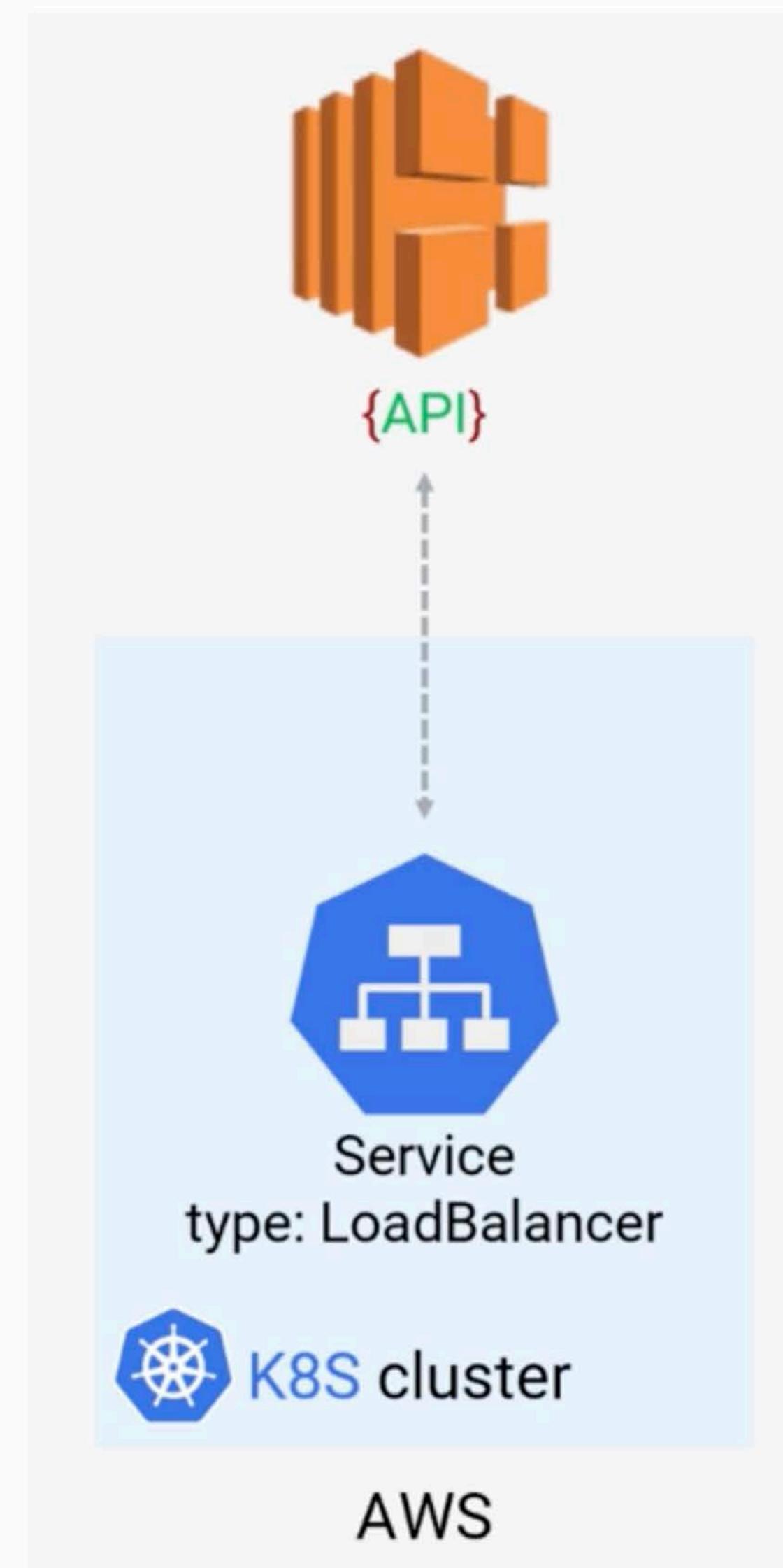


CoreDNS

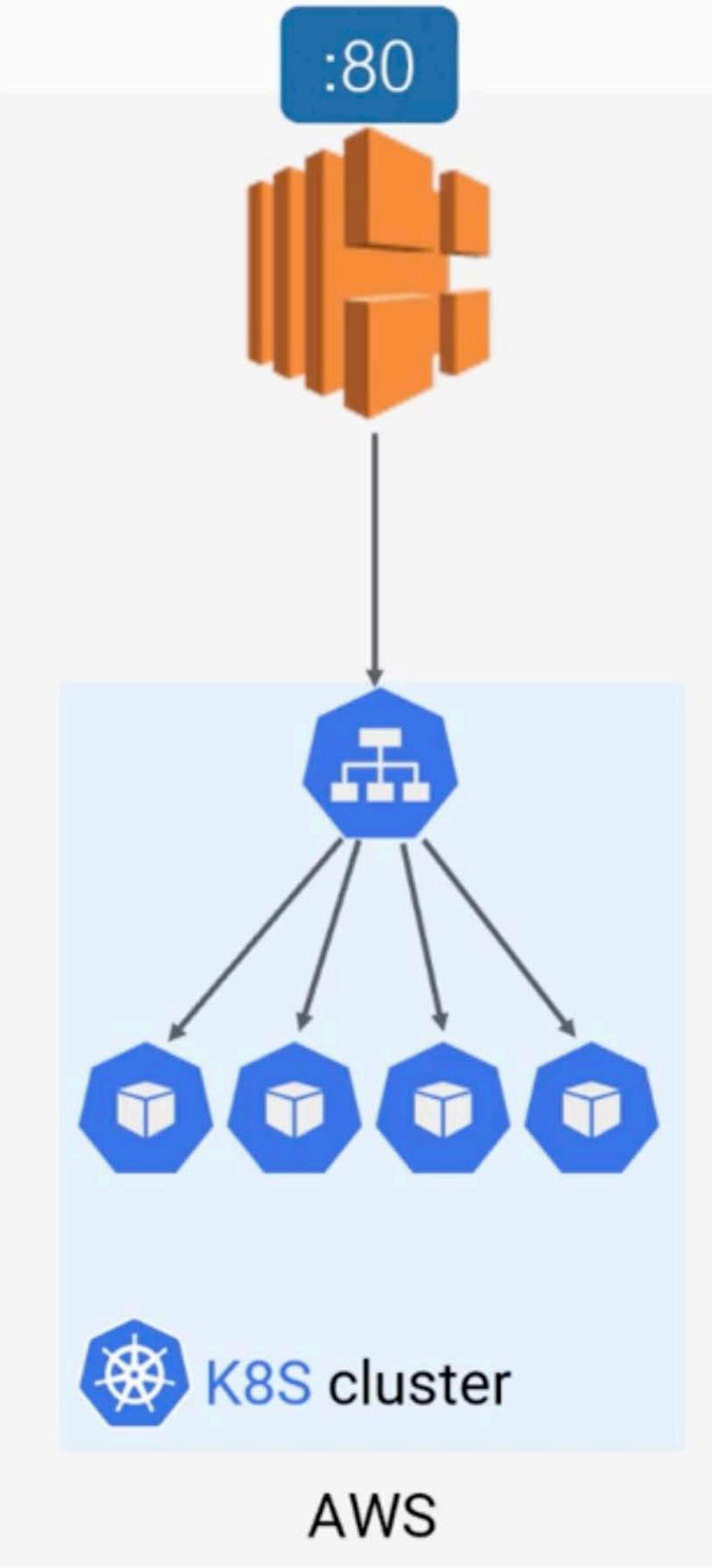
```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    ports:
9      - port: 80
10   selector:
11     app: wordpress
12     tier: frontend
13     type: LoadBalancer
14   ---
15   apiVersion: v1
16   kind: PersistentVolumeClaim
17   metadata:
```



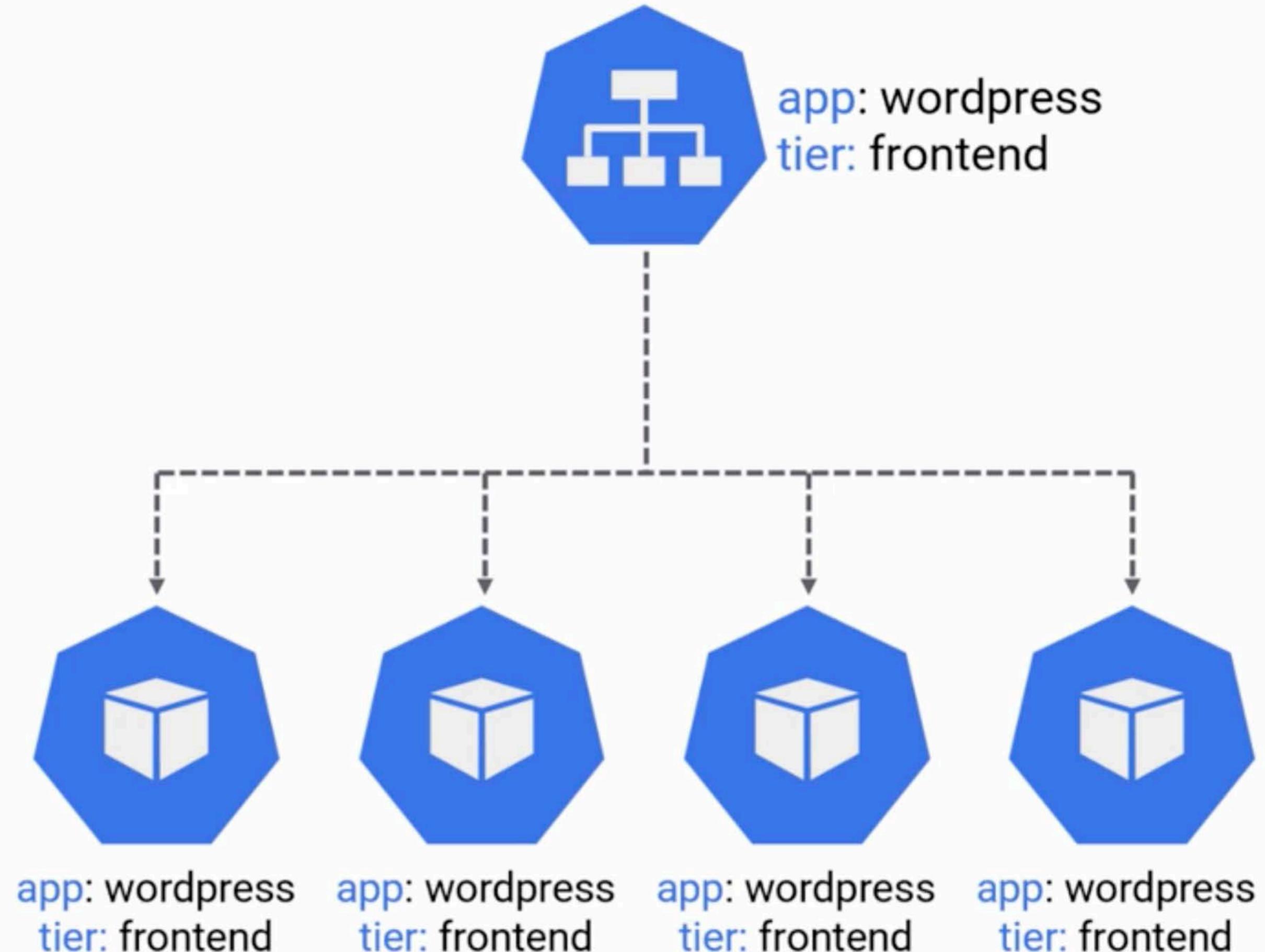
```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    ports:
9      - port: 80
10   selector:
11     app: wordpress
12     tier: frontend
13   type: LoadBalancer
14   ---
15  apiVersion: v1
16  kind: PersistentVolumeClaim
17  metadata:
```



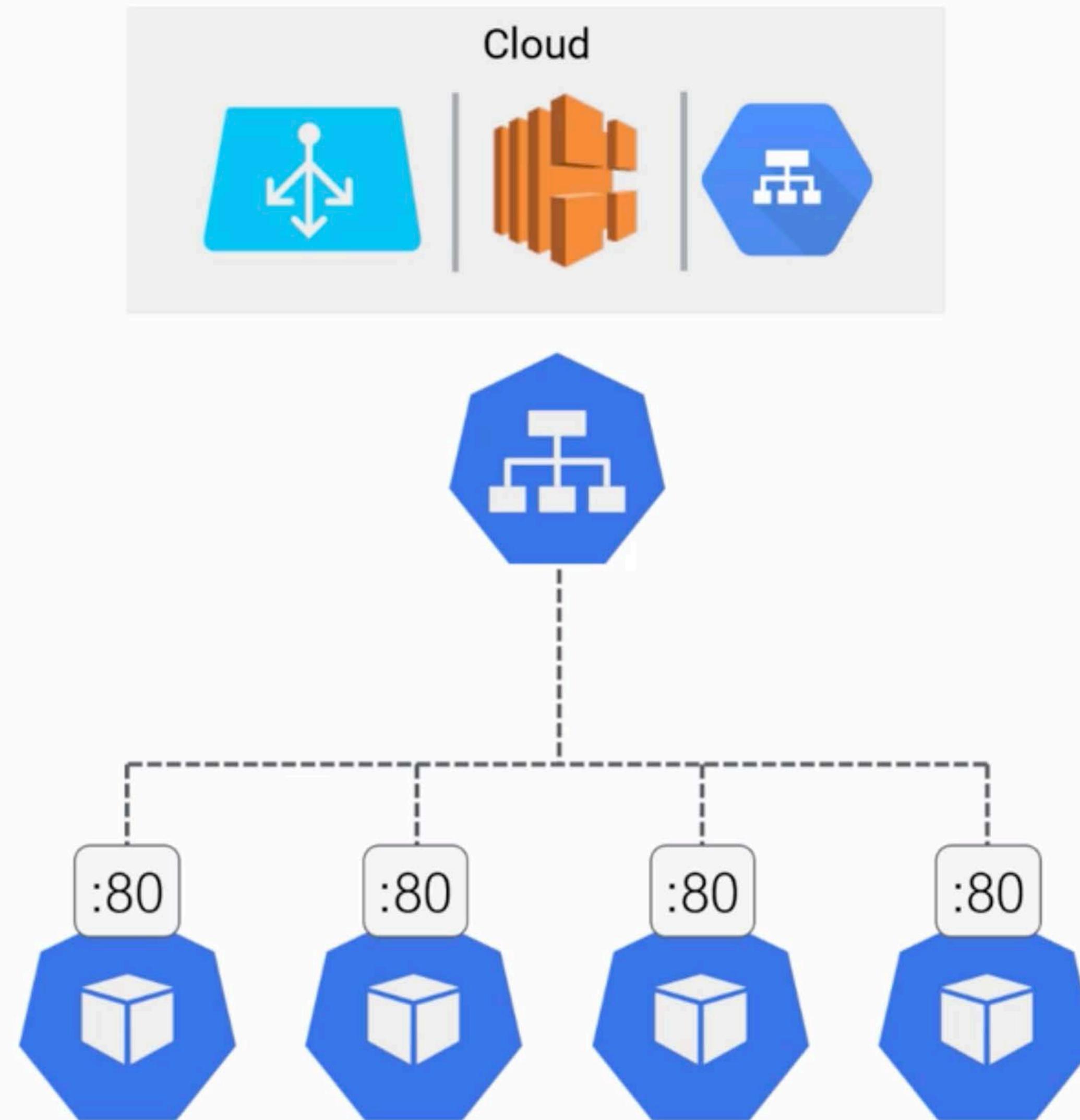
```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    ports:
9      - port: 80
10   selector:
11     app: wordpress
12     tier: frontend
13   type: LoadBalancer
14 ---
15  apiVersion: v1
16  kind: PersistentVolumeClaim
17  metadata:
```



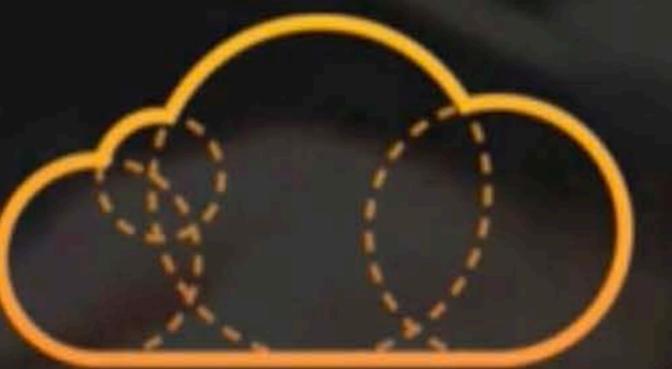
```
57  
28 apiVersion: apps/v1 # for k8s versions before 1.9.0 use apps/v1beta2 and before 1.8.0 use extensions/v1beta1  
29 kind: Deployment  
30 metadata:  
31   name: wordpress  
32   labels:  
33     app: wordpress  
34 spec:  
35   selector:  
36     matchLabels:  
37       app: wordpress  
38       tier: frontend  
39 strategy:  
40   type: Recreate  
template:  
41   metadata:  
42     labels:  
43       app: wordpress  
44       tier: frontend  
45     spec:  
46       containers:  
47         - image: wordpress:4.8-apache  
48           name: wordpress  
49  
50   env:
```



```
57  
28 apiVersion: apps/v1 # for k8s versions before 1.9.0 use apps/v1beta2 and before 1.8.0 use extensions/v1beta1  
29 kind: Deployment  
30 metadata:  
31   name: wordpress  
32   labels:  
33     app: wordpress  
34 spec:  
35   selector:  
36     matchLabels:  
37       app: wordpress  
38       tier: frontend  
39   strategy:  
40     type: Recreate  
41 template:  
42   metadata:  
43     labels:  
44       app: wordpress  
45       tier: frontend  
46     spec:  
47       containers:  
48         - image: wordpress:4.8-apache  
49         name: wordpress  
50       env:
```



Kubernetes Networking Basics



A CLOUD GURU



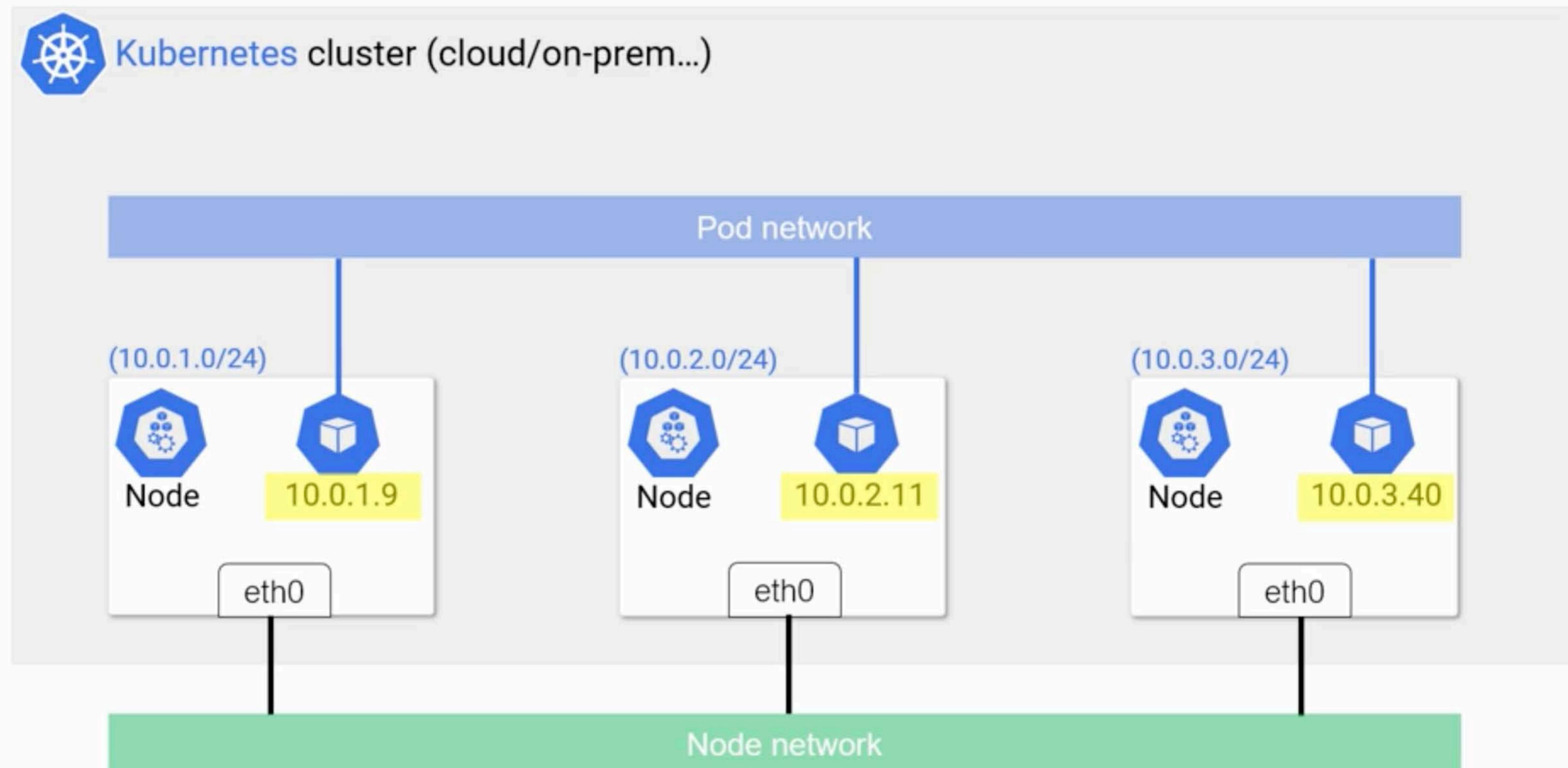
House Rules

All Nodes can
talk

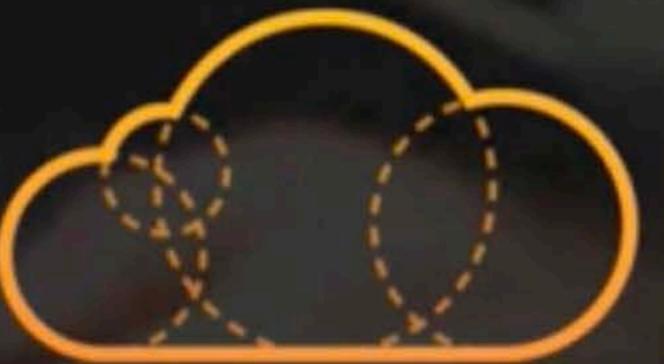
All Pods can
talk
(No NAT)

Every Pod gets
its own IP

Kubernetes Networking Basics



Kubernetes Services



A CLOUD GURU

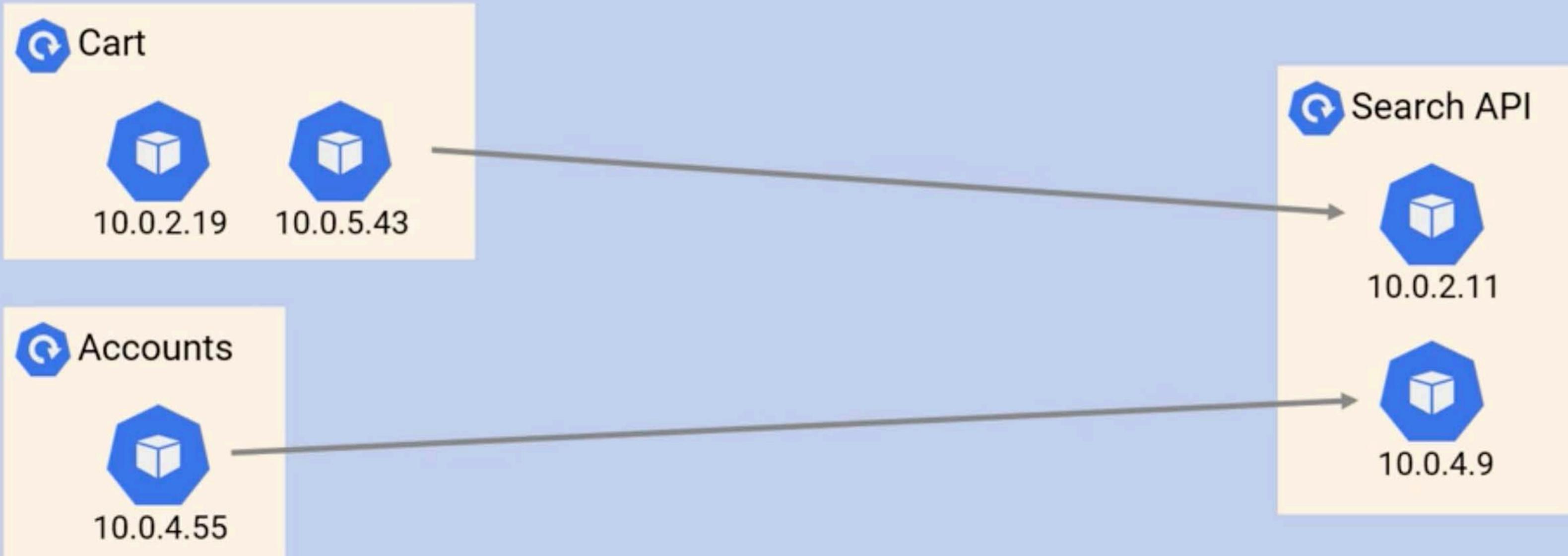
Kubernetes Services



A CLOUD GURU



Kubernetes cluster (cloud/on-prem...)



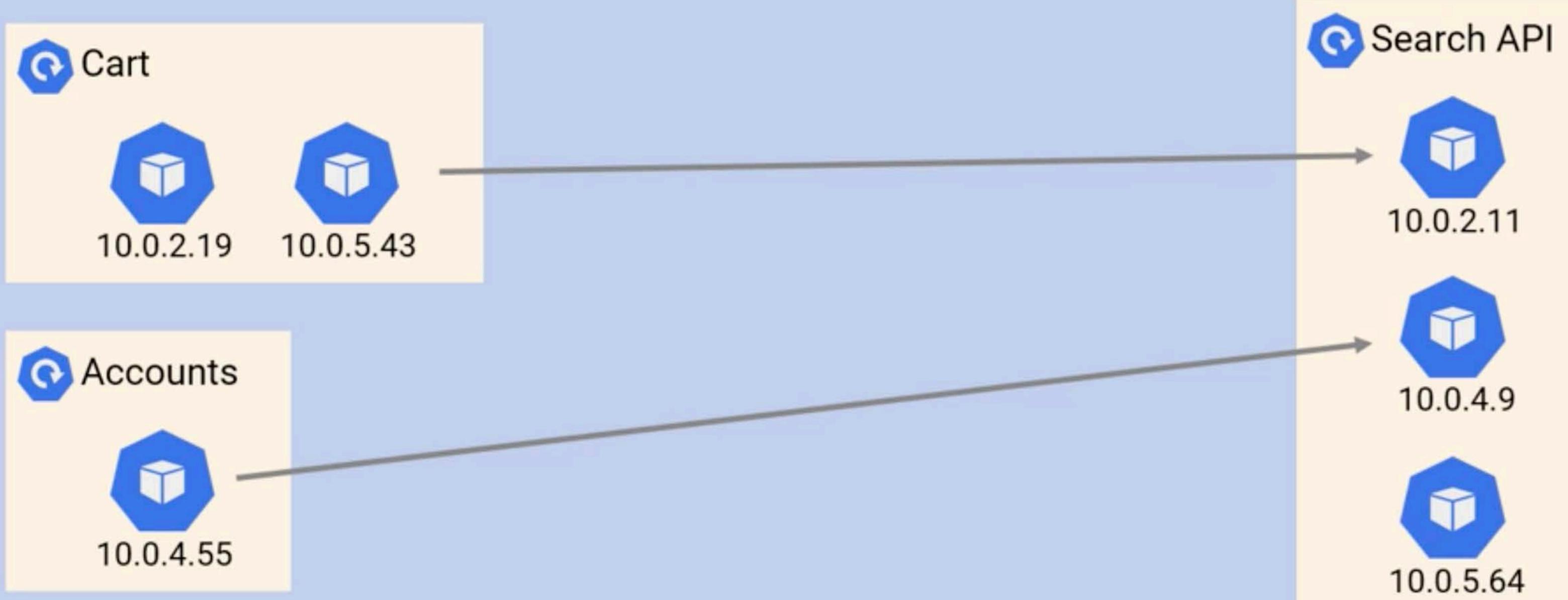
Kubernetes Services



A CLOUD GURU



Kubernetes cluster (cloud/on-prem...)



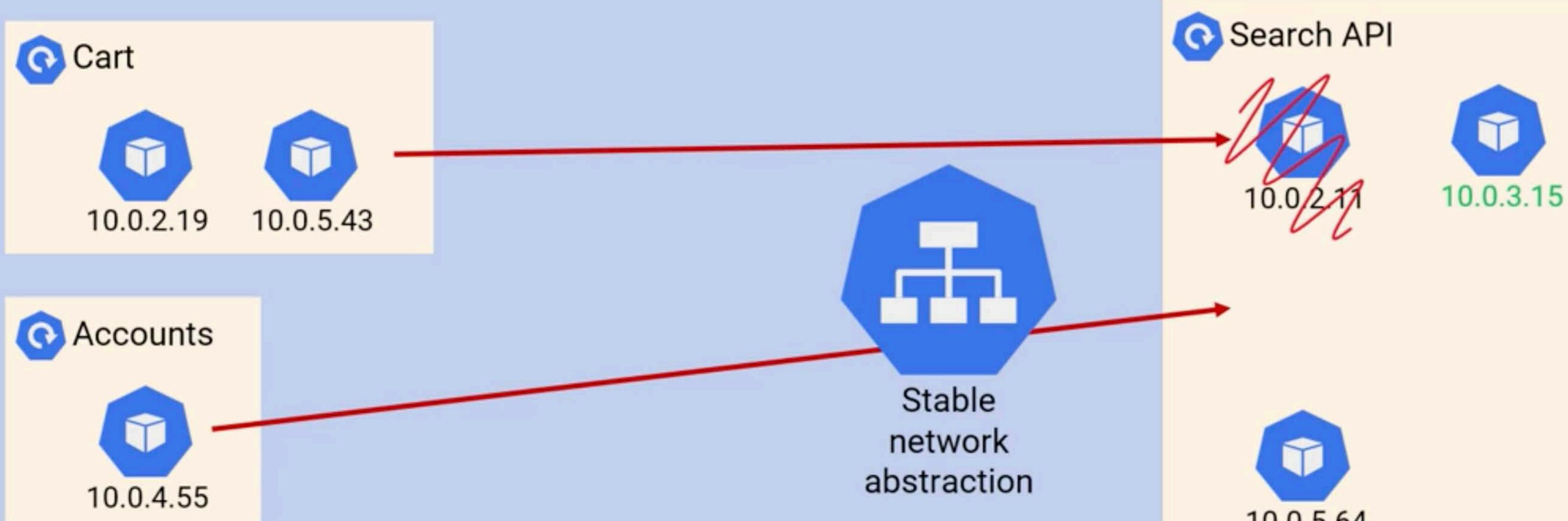
Kubernetes Services



A CLOUD GURU



Kubernetes cluster (cloud/on-prem...)



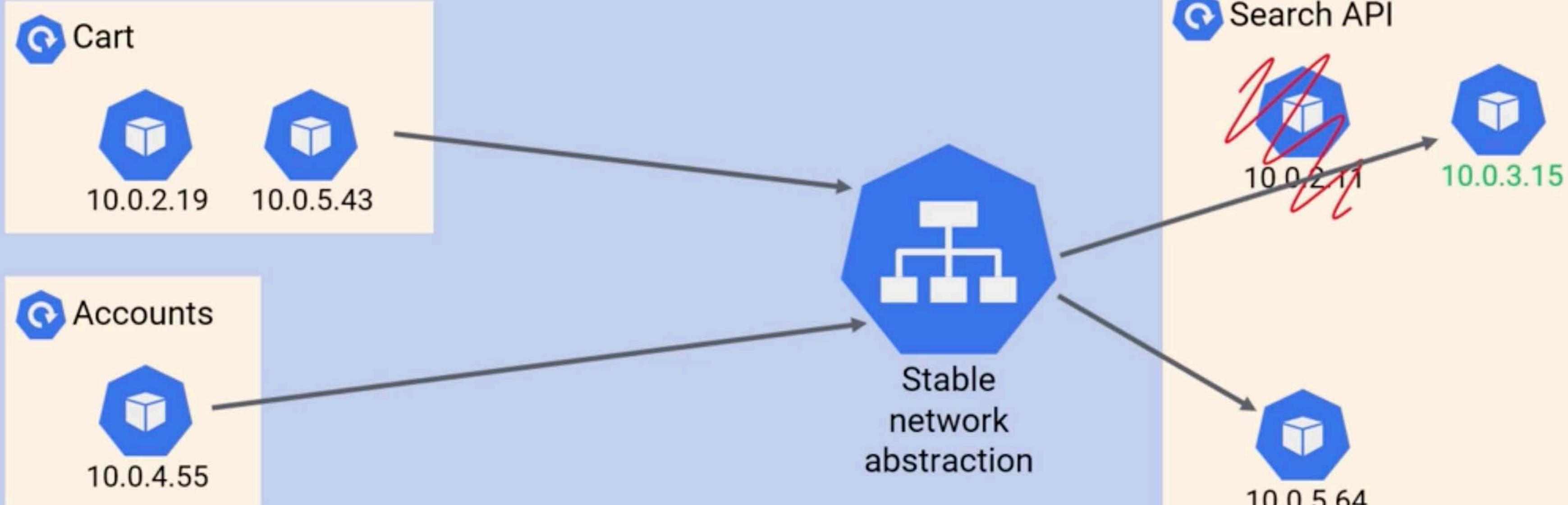
Kubernetes Services



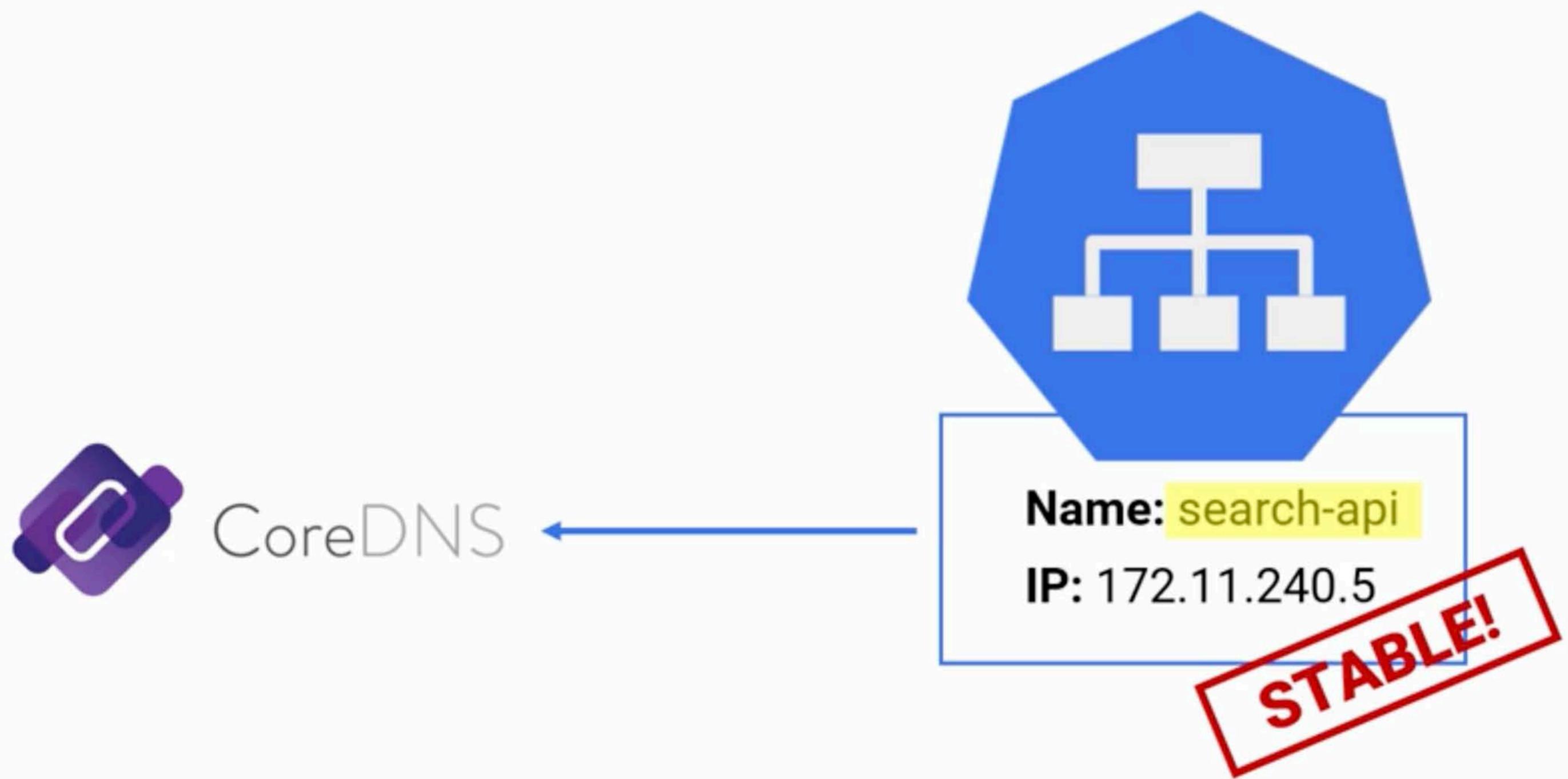
A CLOUD GURU



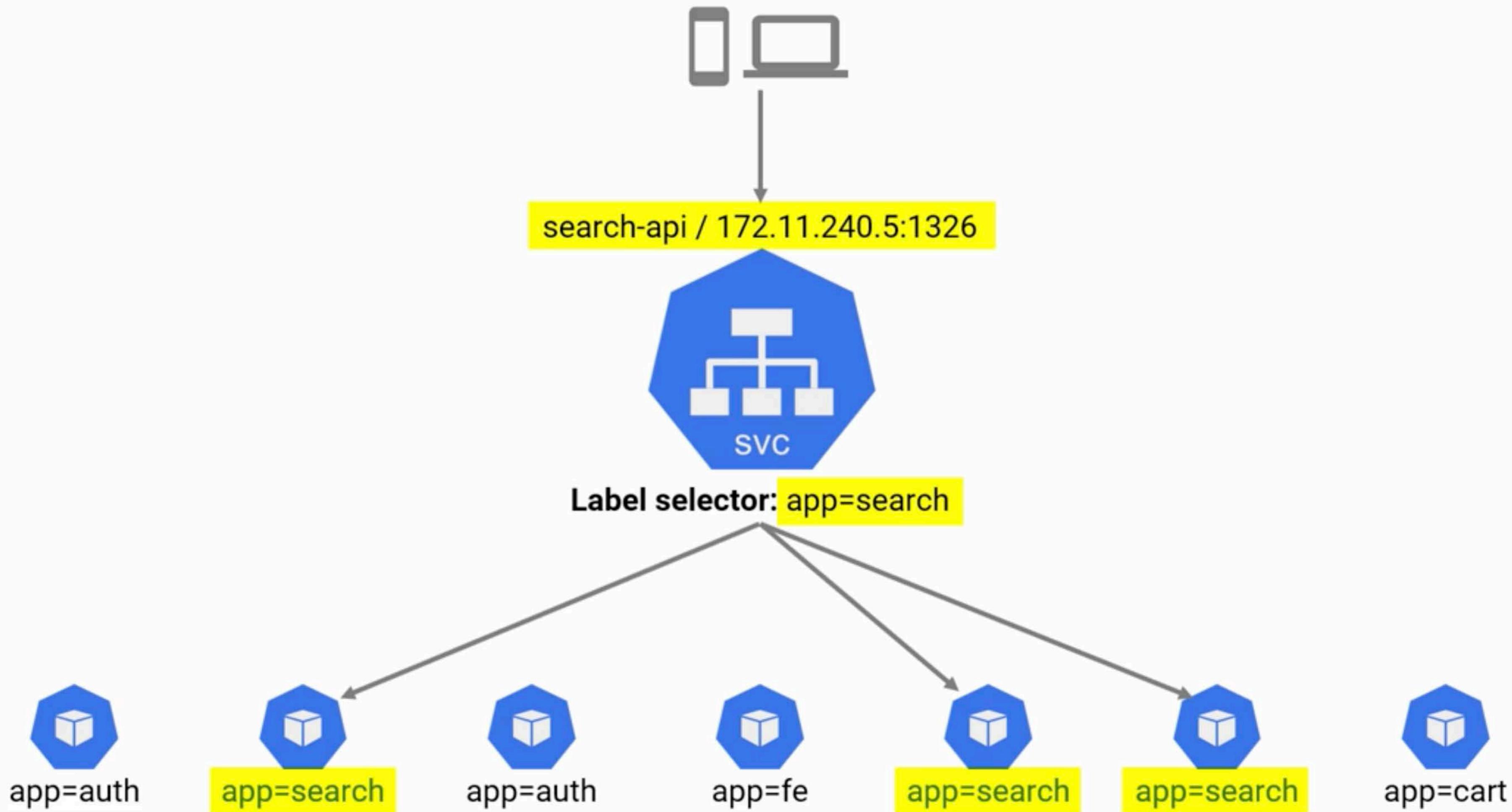
Kubernetes cluster (cloud/on-prem...)



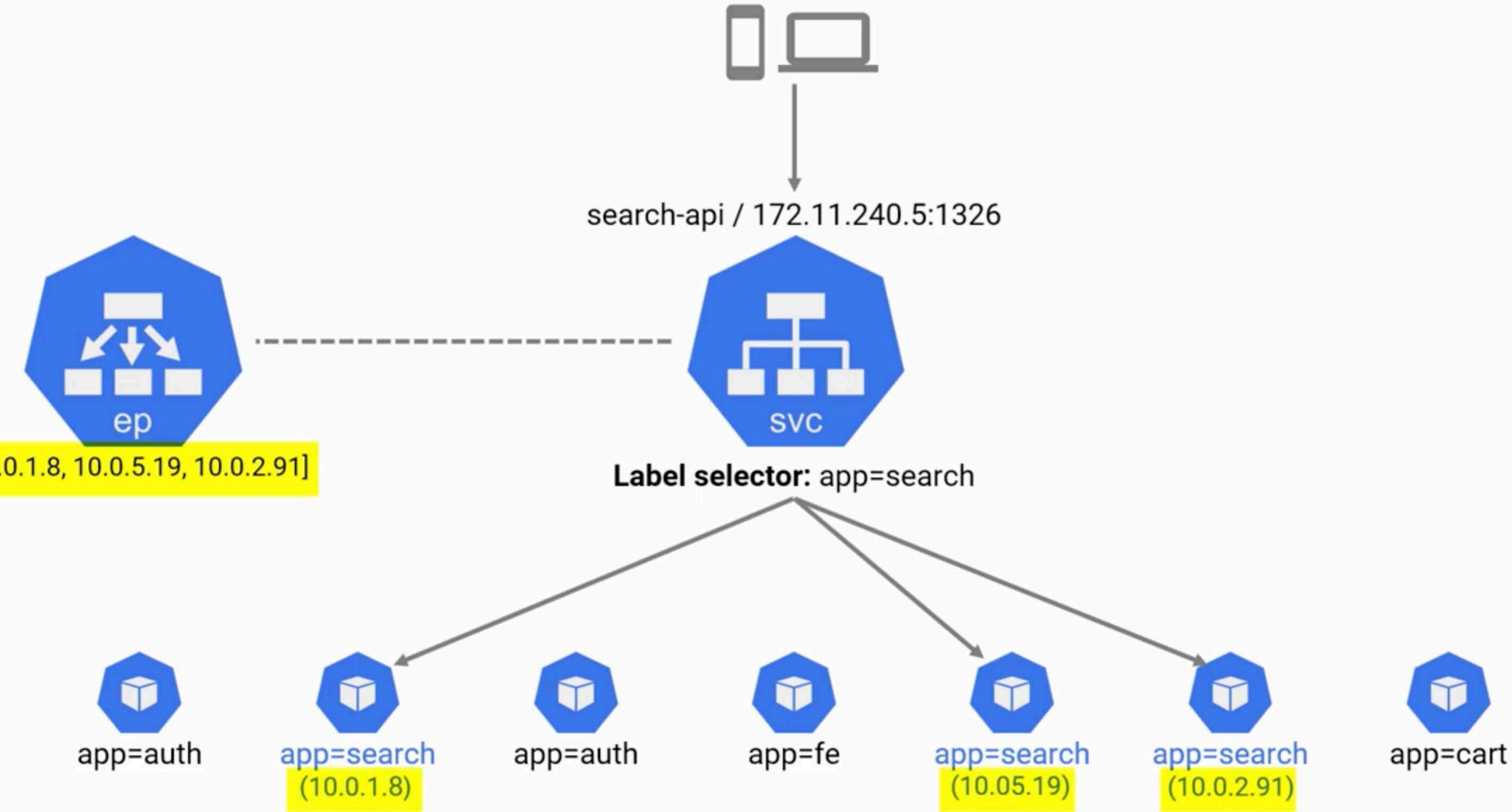
Kubernetes Services



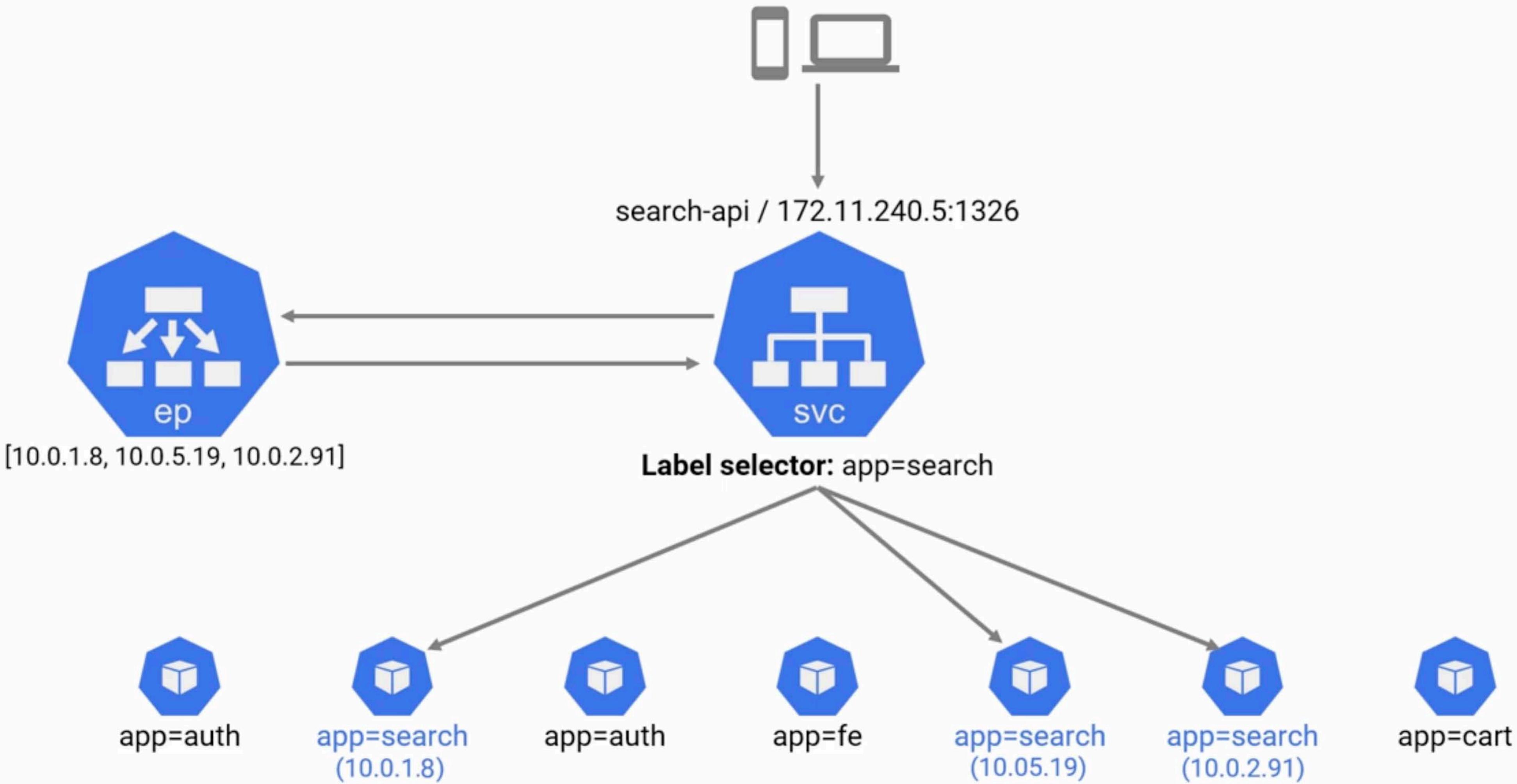
Kubernetes Services



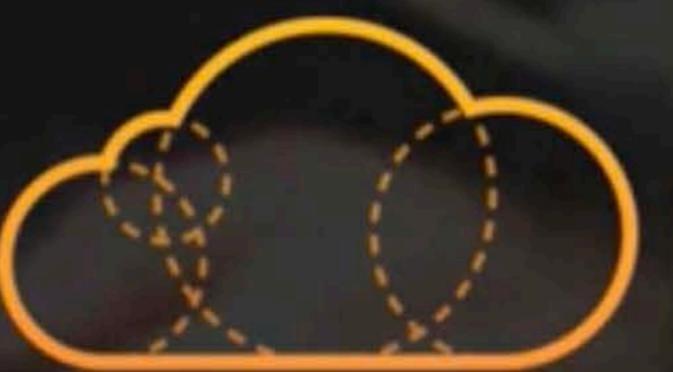
Kubernetes Services



Kubernetes Services

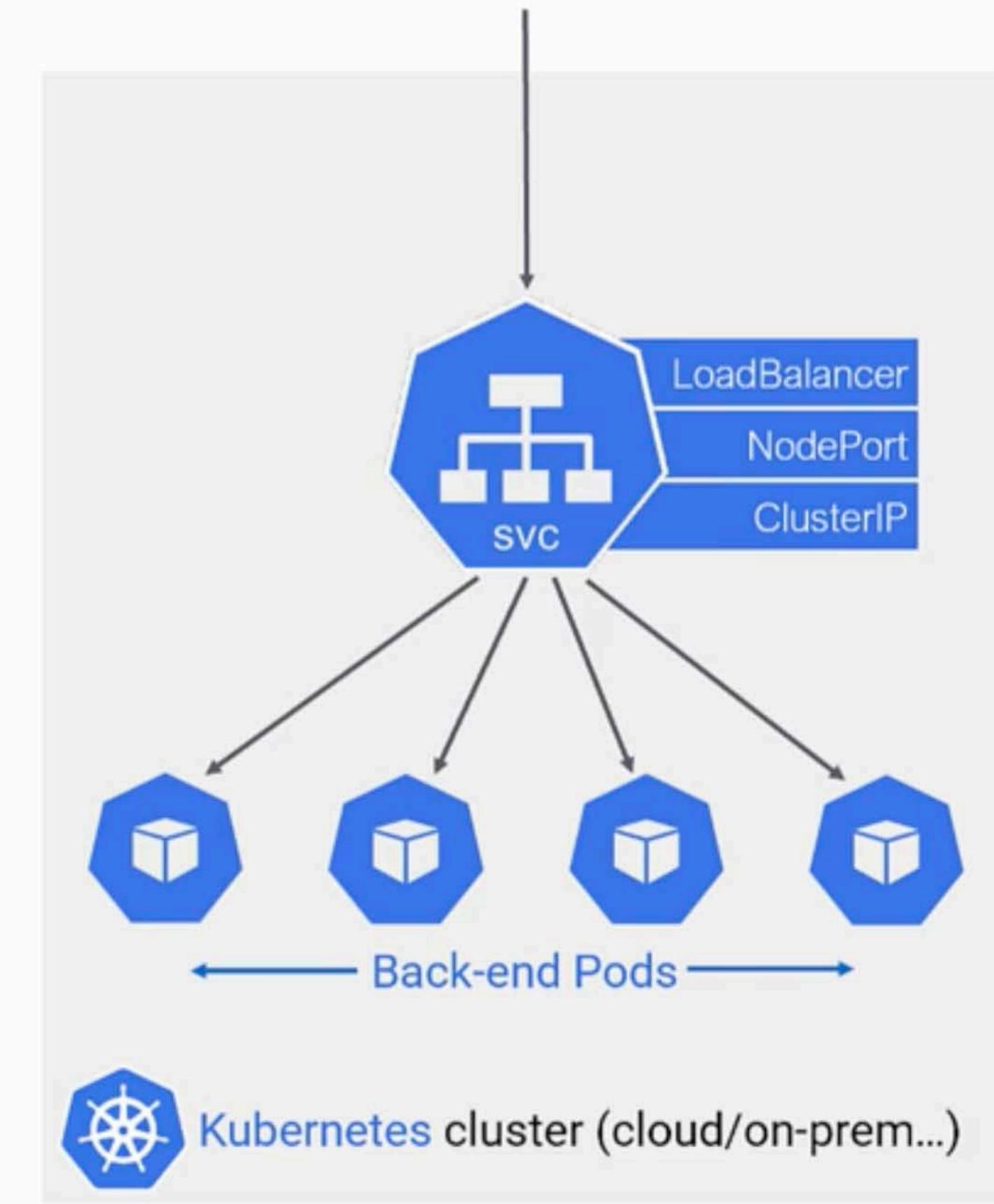


Service Types



A CLOUD GURU

```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    ports:
9      - port: 80
10   selector:
11     app: wordpress
12     tier: frontend
13   type: LoadBalancer
14 ---
```



Kubernetes Services

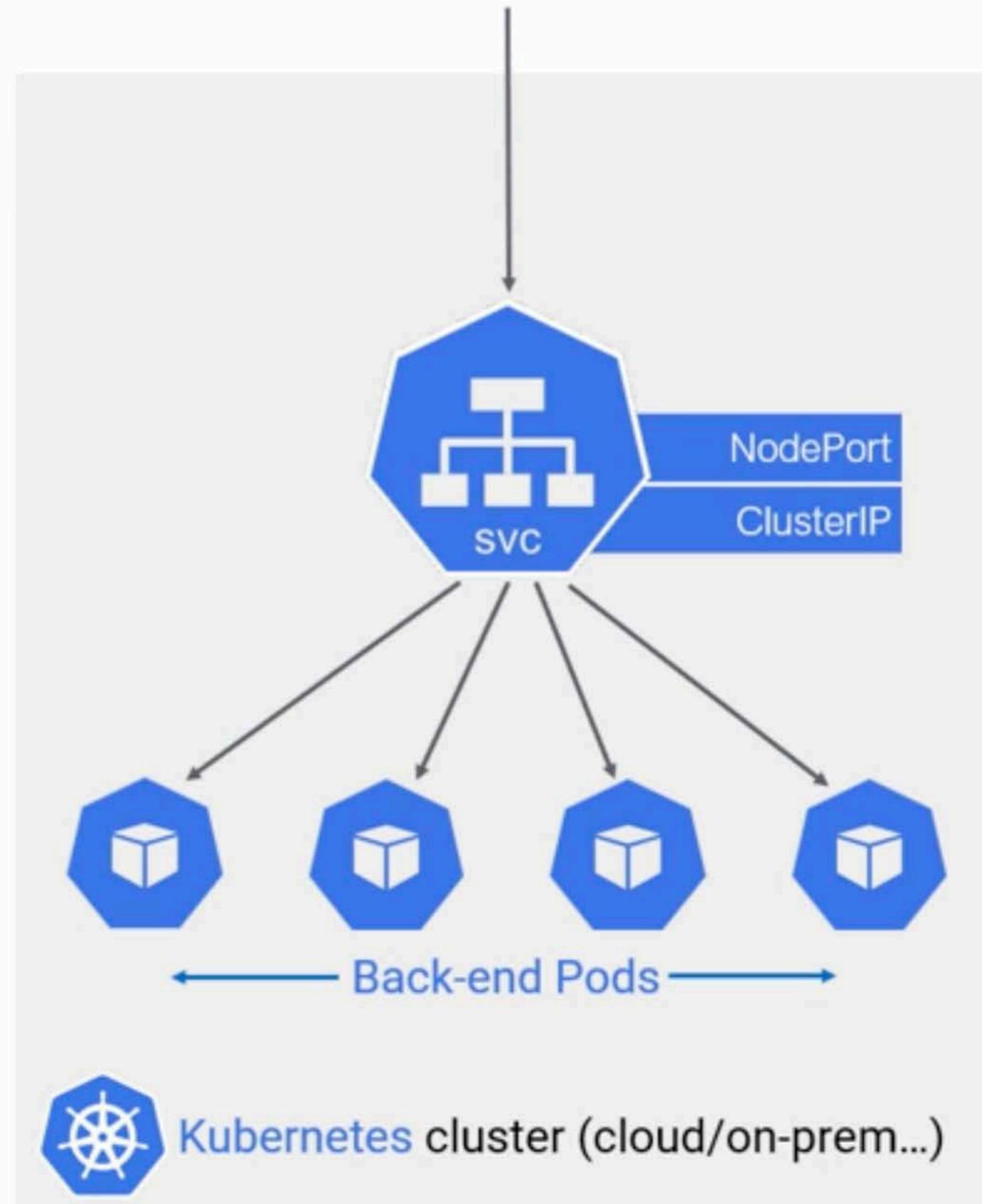


NodePort:

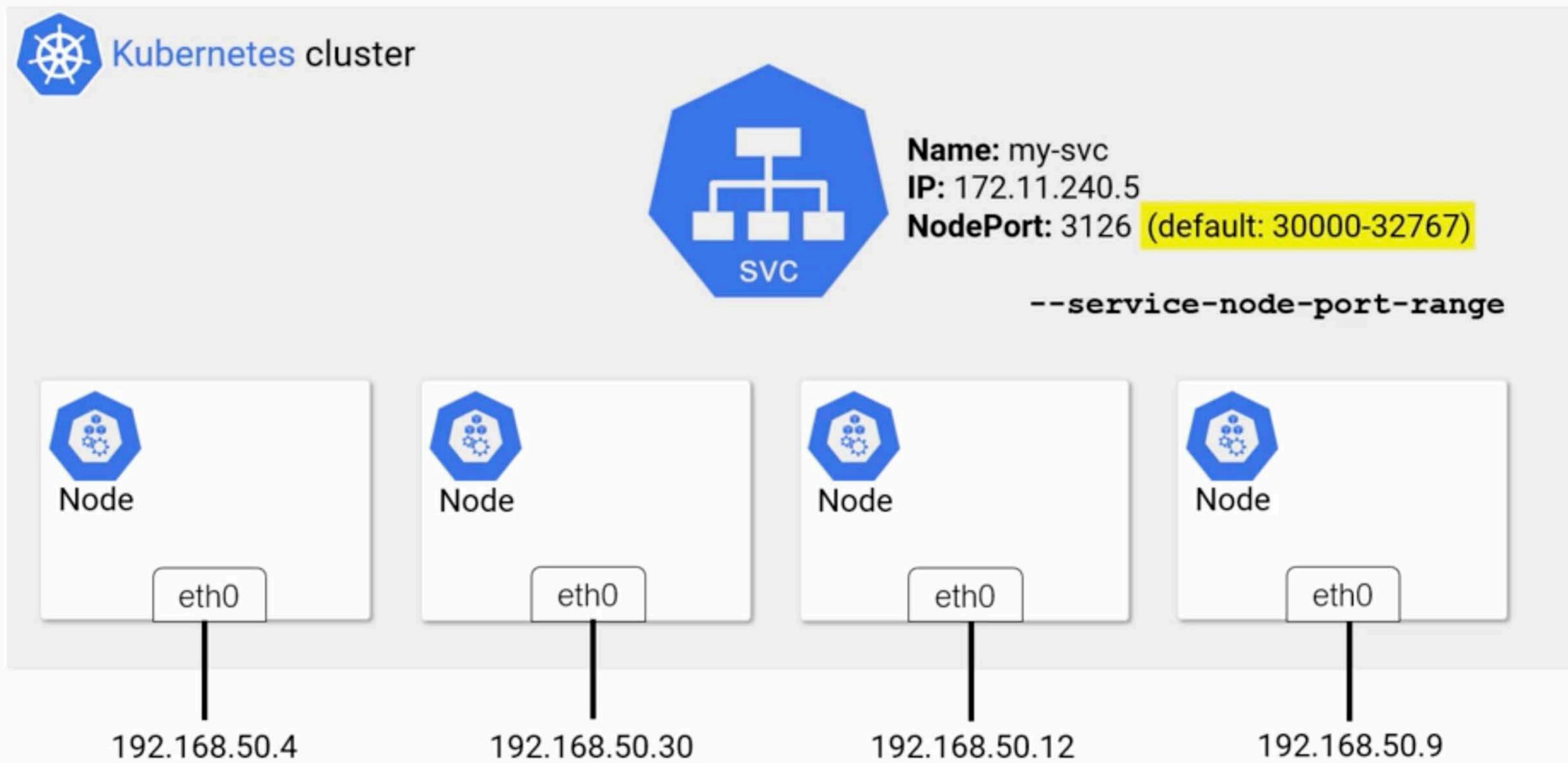
- Gets cluster-wide **port**
- Also accessible from outside of cluster

ClusterIP (default):

- Gets own IP
- Only accessible from within cluster



Kubernetes Networking Basics



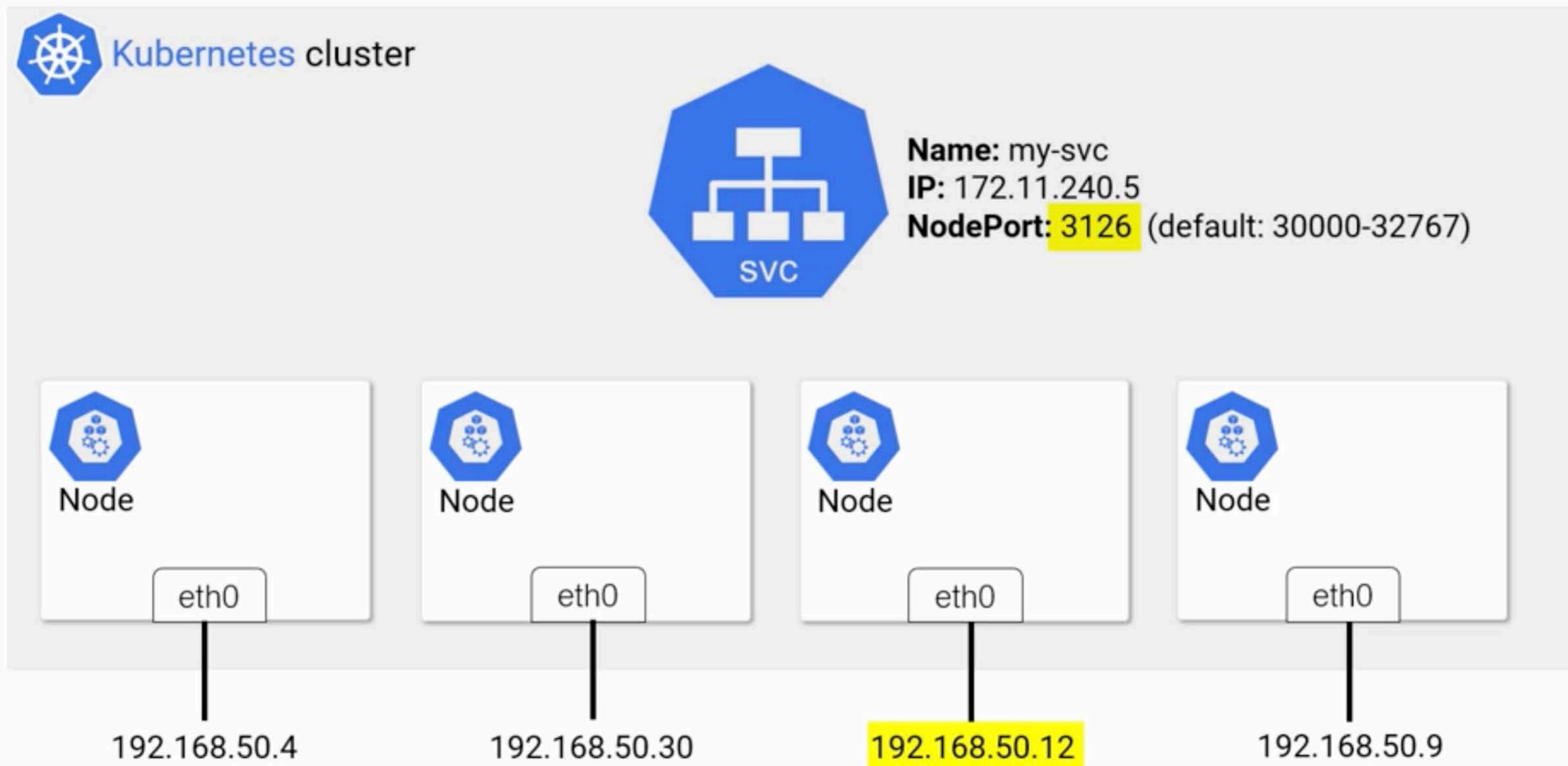
```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: wordpress
5    labels:
6      app: wordpress
7  spec:
8    type: NodePort
9    ports:
10   - port: 80
11     nodePort: 30080
12   selector:
13     app: wordpress
14
```

Port that the Pods are listening on

Cluster-wide port that the service listens on



Kubernetes Networking Basics



Kubernetes Services



LoadBalancer:

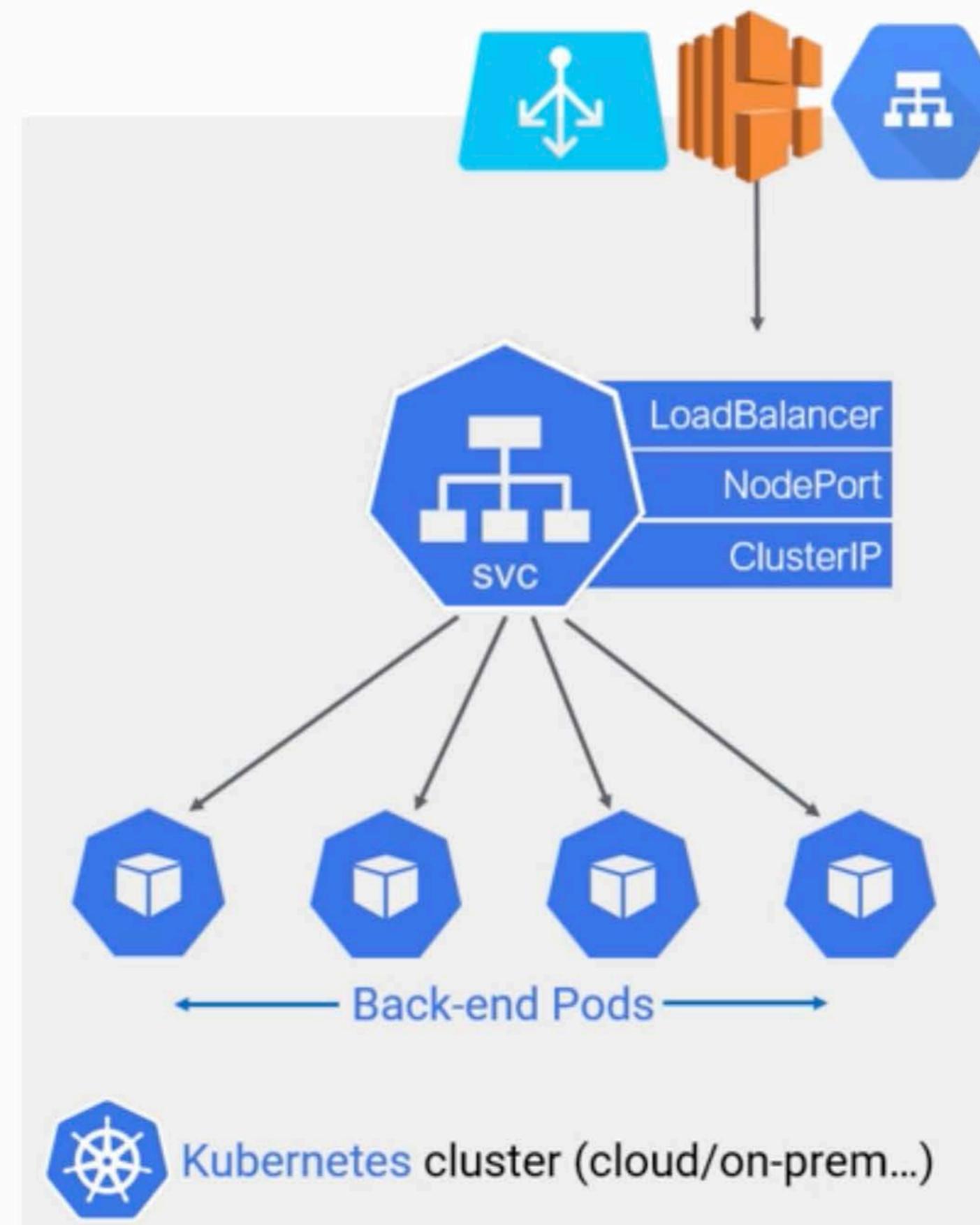
- Integrates with public cloud platform

NodePort:

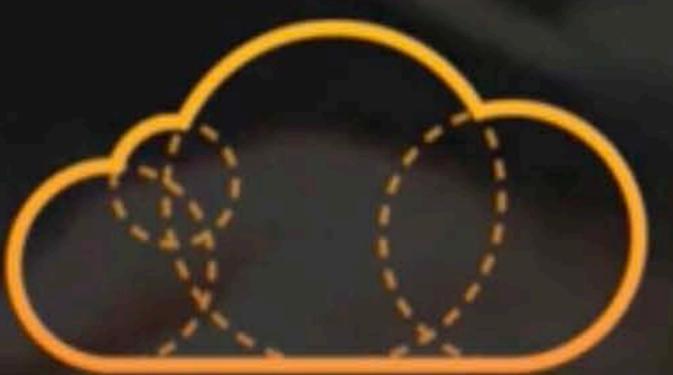
- Gets cluster-wide **port**
- Also accessible from outside of cluster

ClusterIP (default):

- Gets own IP
- Only accessible from within cluster



The Service Network



A CLOUD GURU

The Service Network

**Pod network**

- 10.0.0.0/16

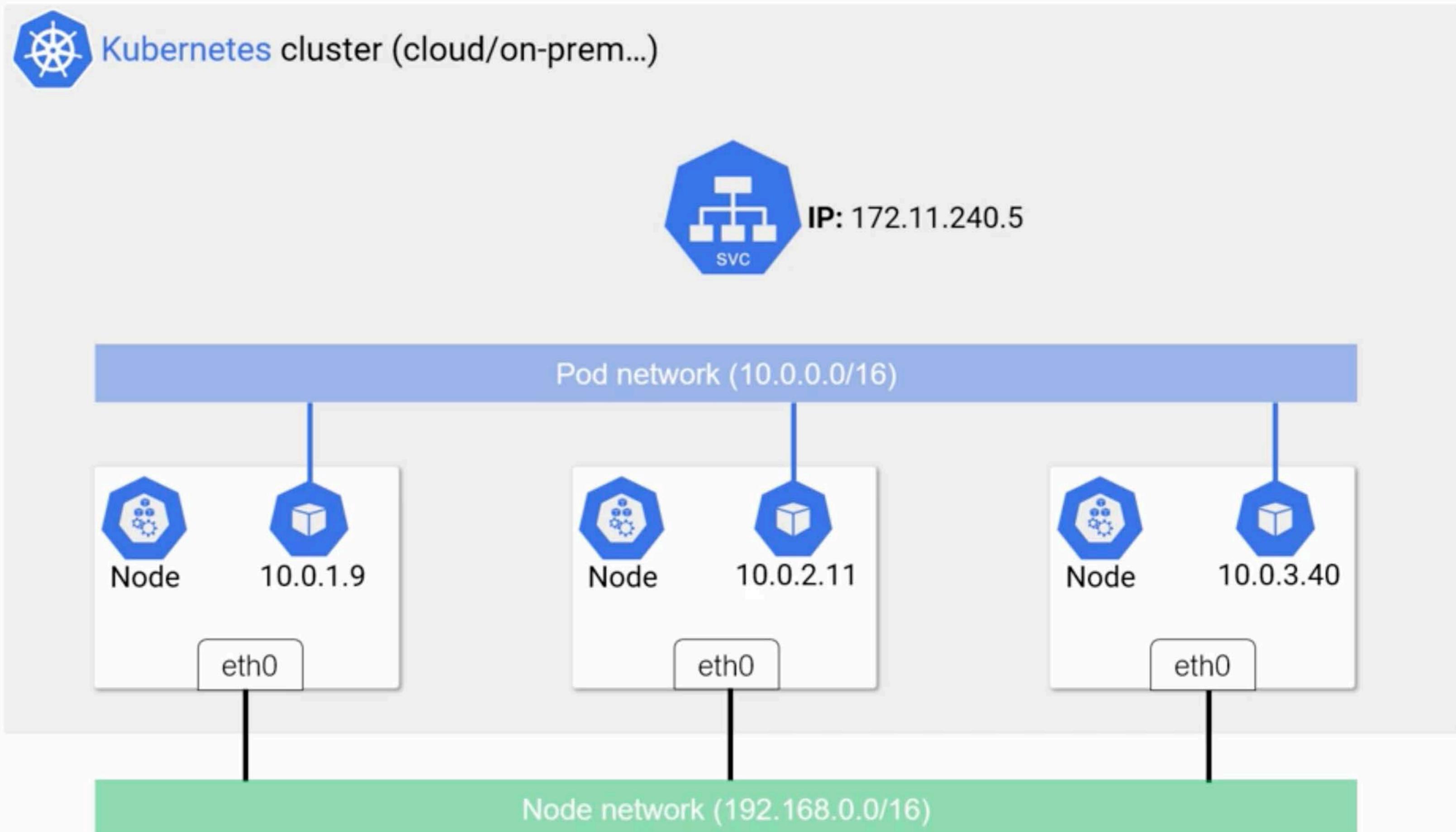
Node network

- 192.168.0.0/16

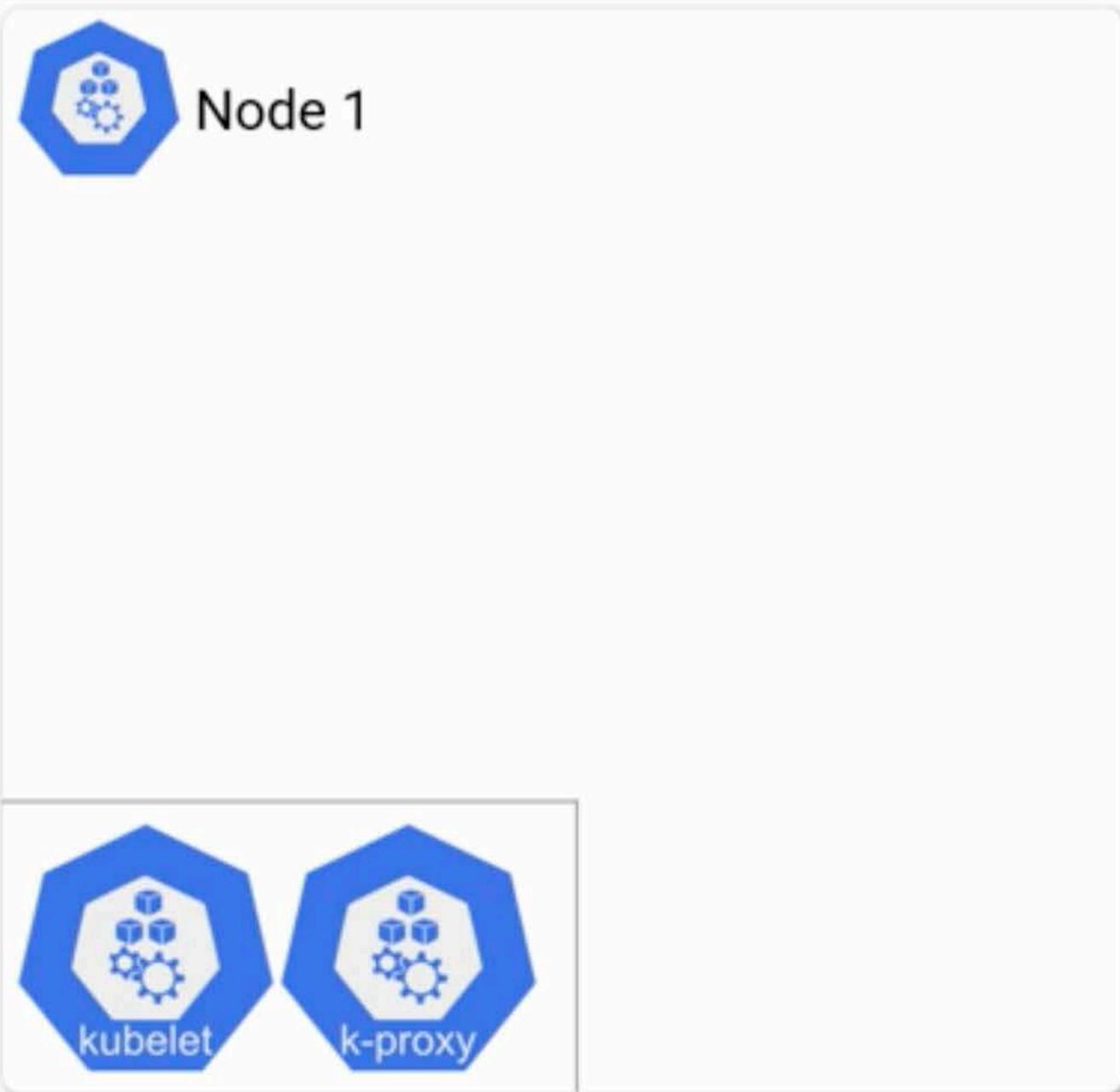
Service network

- 172.11.11.0/24

* Example network addresses for maximum clarity. Not the defaults that Kubernetes uses.



The Service Network

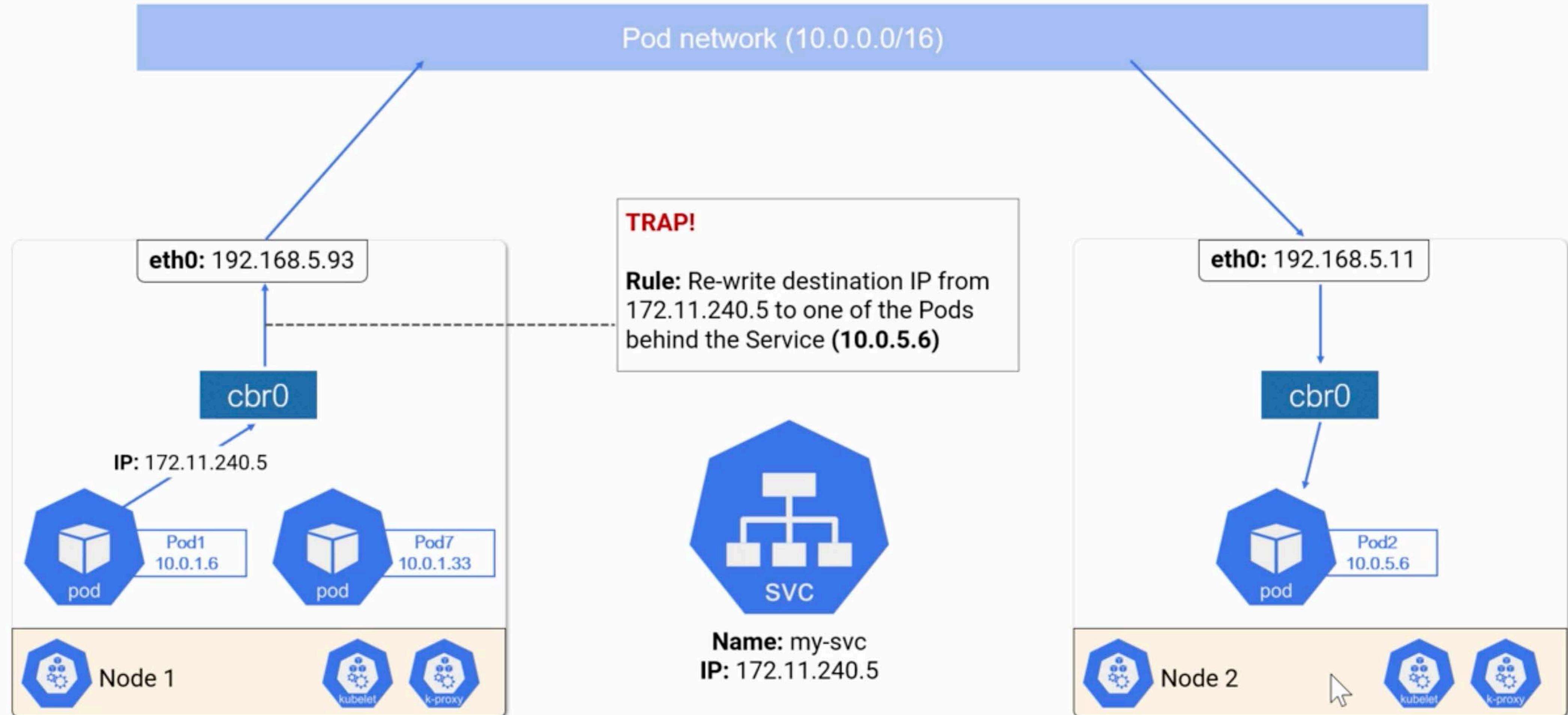


"kube-proxy"

The Service Network



The Service Network



The Service Network



Kube-proxy IPTABLES Mode

- Default since Kubernetes 1.2
- Doesn't scale well
- Not really designed for load balancing

Kube-proxy IPVS Mode

- Stable since Kubernetes 1.11
- Uses Linux kernel IP Virtual Server

The Service Network



Kube-proxy IPTABLES Mode

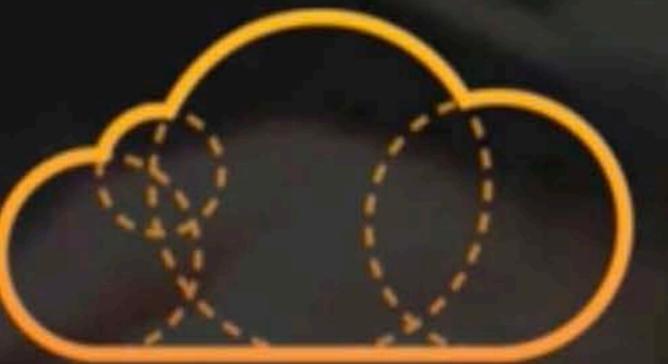
- Default since Kubernetes 1.2
- Doesn't scale well
- Not really designed for load balancing

Kube-proxy IPVS Mode

- Stable (GA) since Kubernetes 1.11
- Uses Linux kernel IP Virtual Server
- Native Layer-4 load balancer
- Supports more algorithms

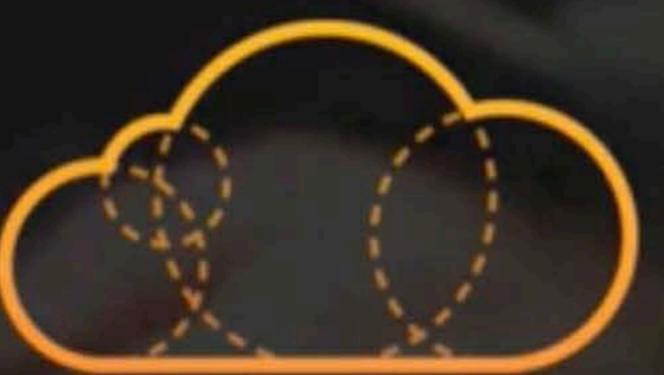


Demo time!



A CLOUD GURU

Kubernetes Networking Recap



A CLOUD GURU

Recap



Node Network

All nodes need to be able to talk

- Kubelet \longleftrightarrow API Server
- Pod network ports

Not implemented by Kubernetes

Pod Network

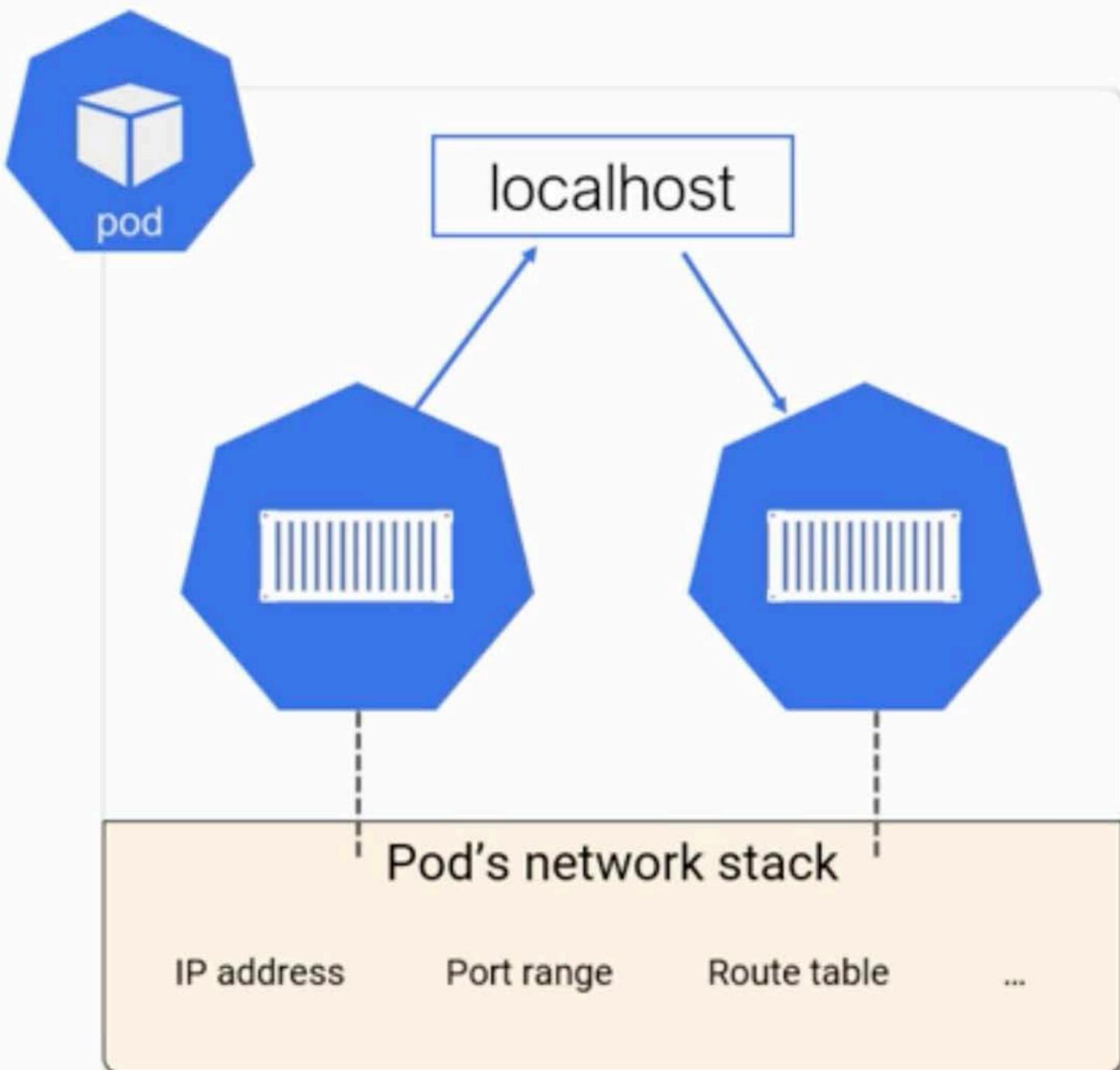
Implemented via CNI plugins

Big & flat

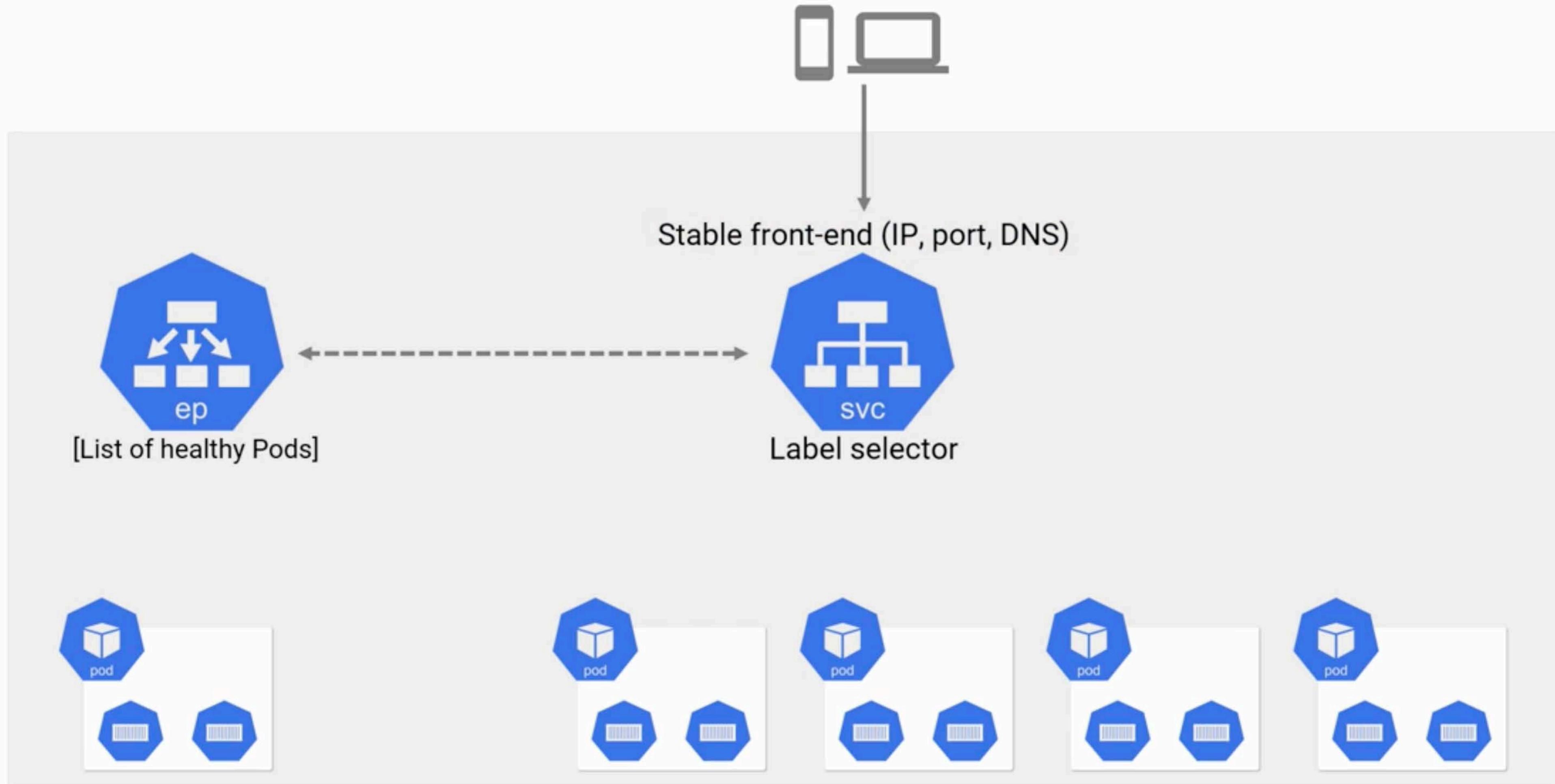
IP-per-Pod

All Pods can communicate

Recap



Recap





The Service Network

~~WTF~~

(It's not really a network)

```
$ kubectl describe svc nginx-service
```

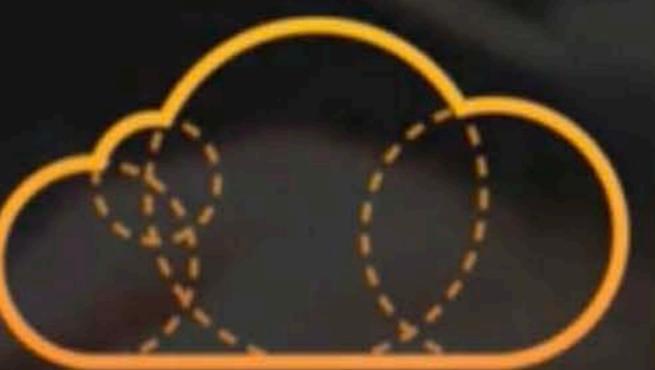
```
Name: my-svc
...
Type: ClusterIP
IP: 10.11.240.5
Port: http 3080/TCP
Endpoints: 10.244.0.44:8080,10.244.1.39:8080
Session Affinity: None
```

```
$ ipvsadm -ln
```

```
IP Virtual Server version 1.2.1 (size=4096)
Prot LocalAddress:Port Scheduler Flags
  -> RemoteAddress:Port      Forward Weight ActiveConn InActConn
TCP  10.11.240.5:3080  rr
  -> 10.244.0.44:8080        Masq    1      0      0
  -> 10.244.1.39:8080        Masq    1      0      0
```

* Kube-proxy in **IPVS** mode does create dummy interfaces on the *Service Network* (usually called `kube-ipvs0`). Kube-proxy in **IPTABLES** mode does not.

Storage in Kubernetes



A CLOUD GURU

Lesson Plan



A CLOUD GURU

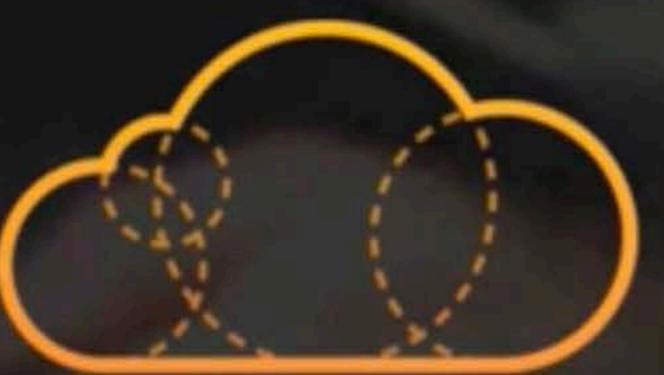
Master a few concepts, and
Kubernetes storage is a breeze!

Lesson Plan



- High-level storage requirements
- Container Storage Interface (CSI)
- The Kubernetes PersistentVolume Subsystem
- StorageClasses
- Lab/demo
- Recap

High-level Storage Requirements



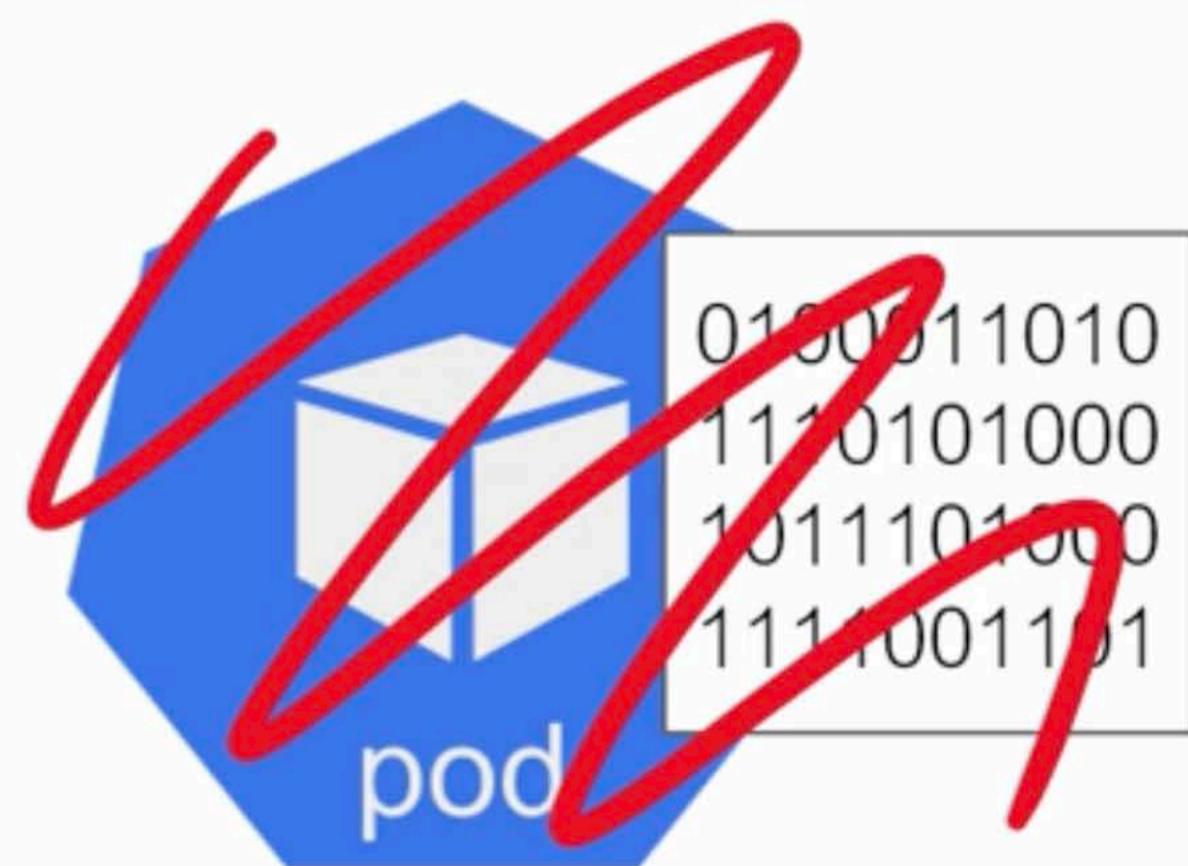
A CLOUD GURU

High-level Storage Requirements

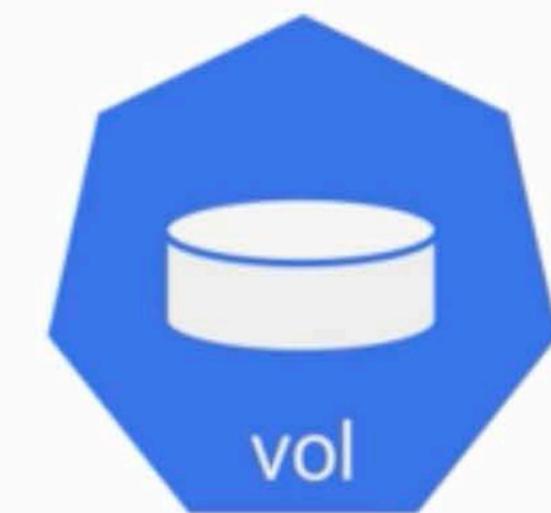
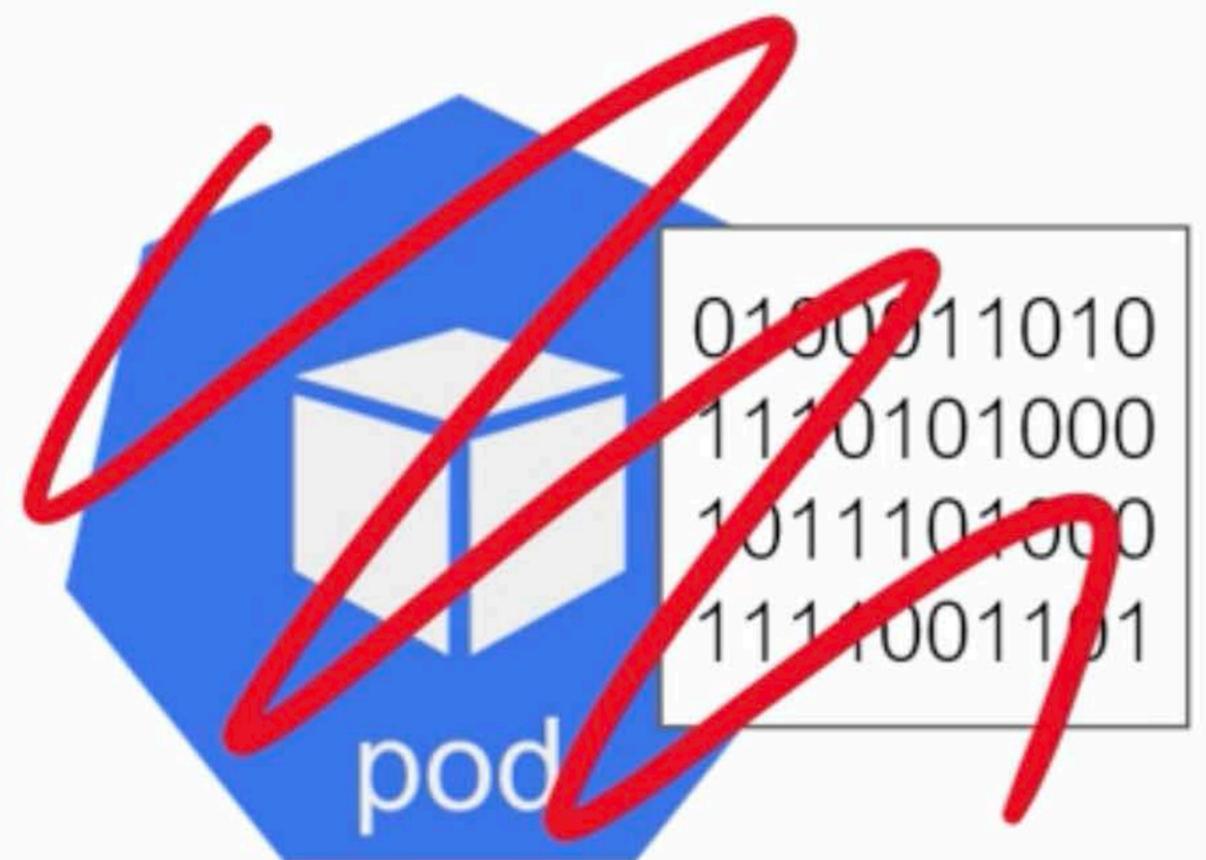


Kubernetes Volumes

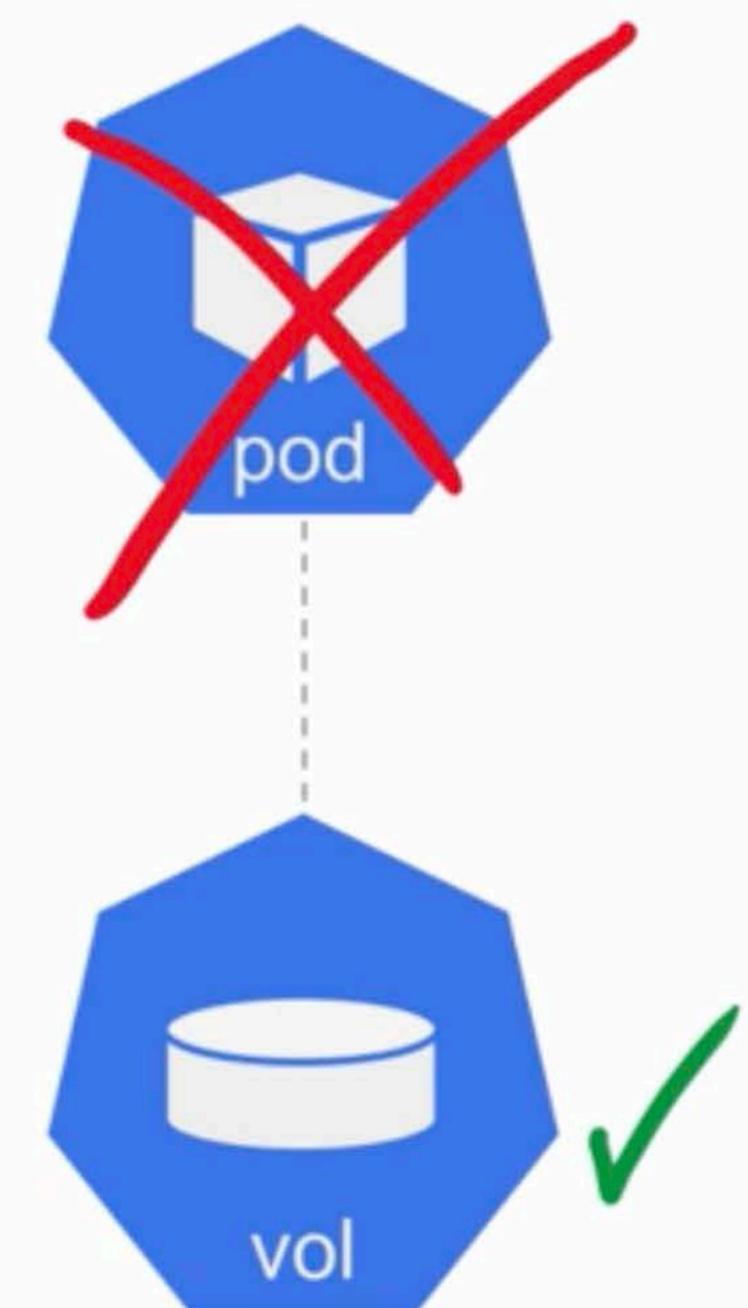
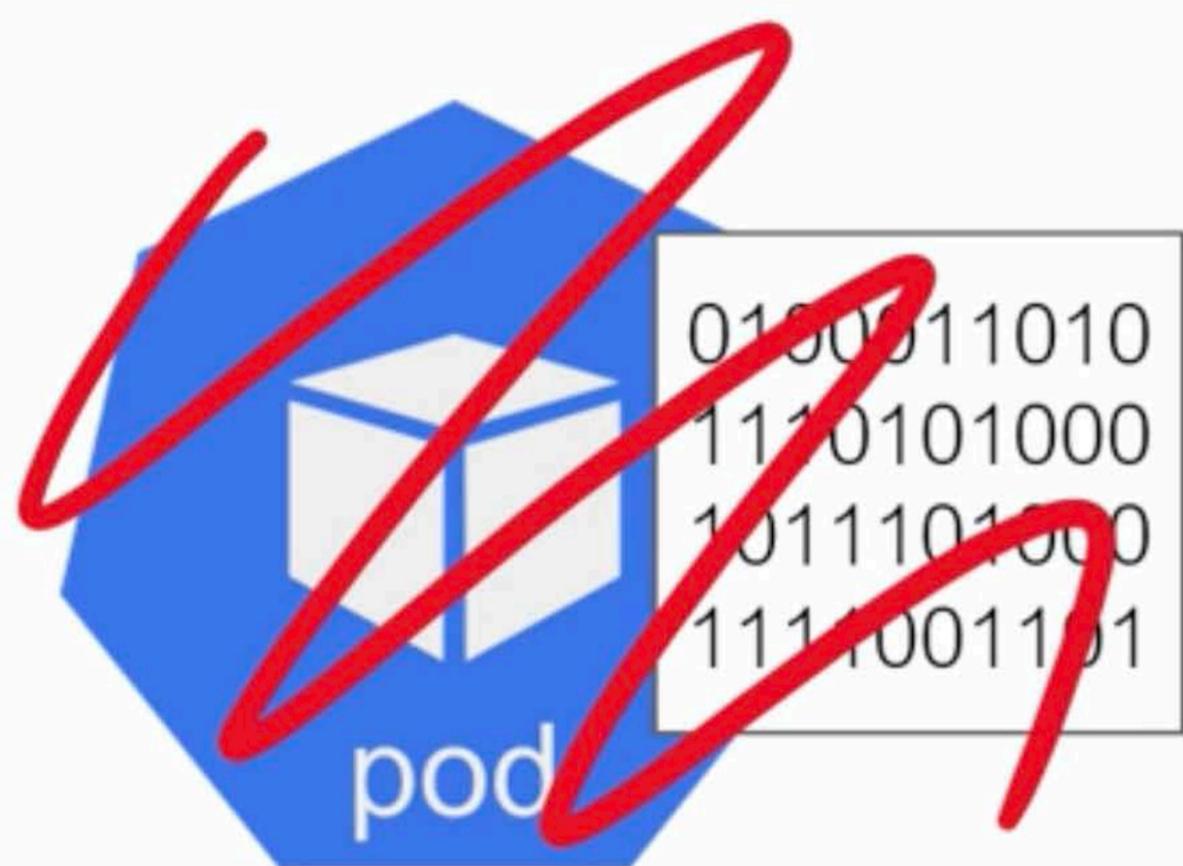
All about decoupling storage
from Pods



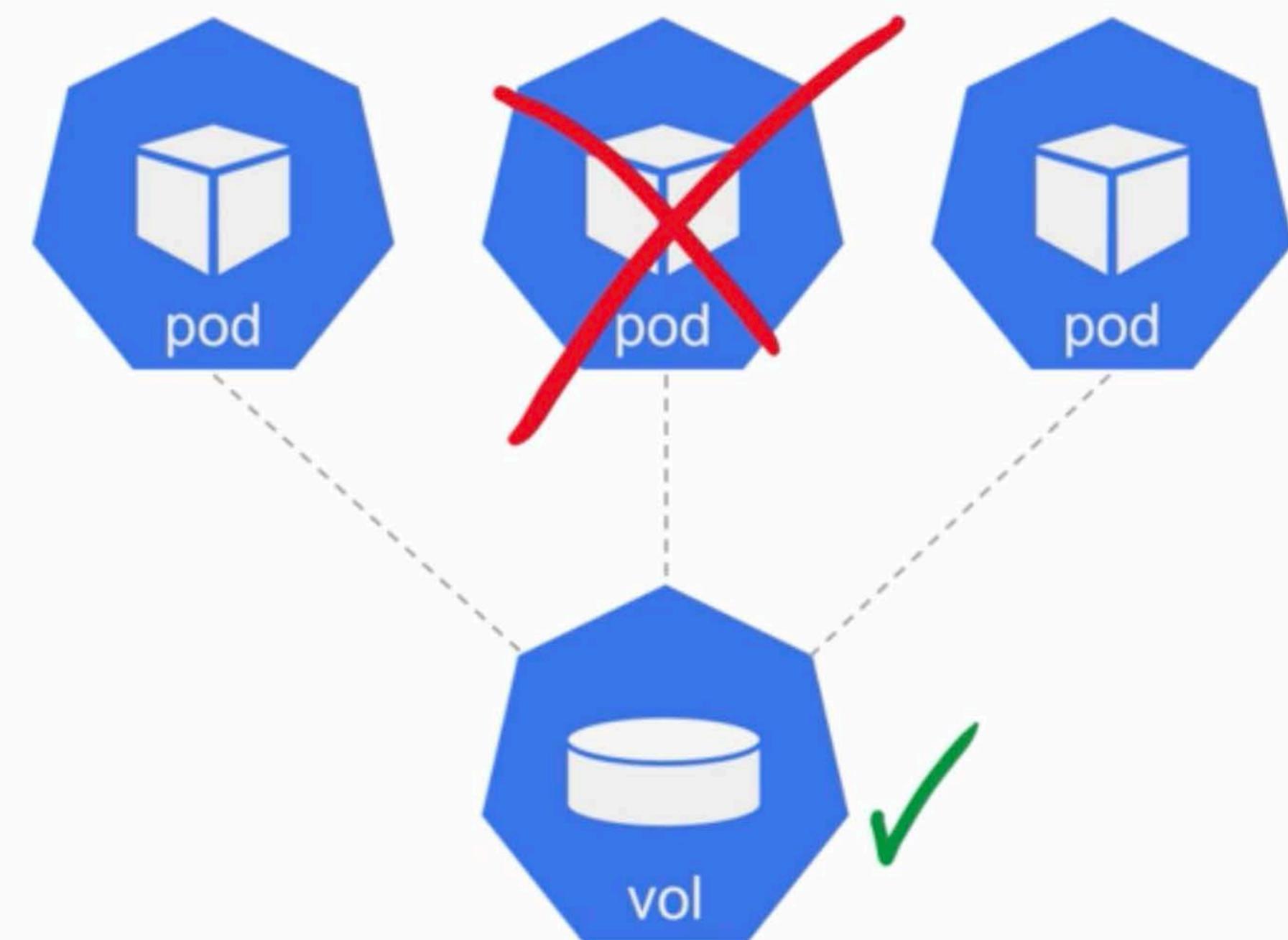
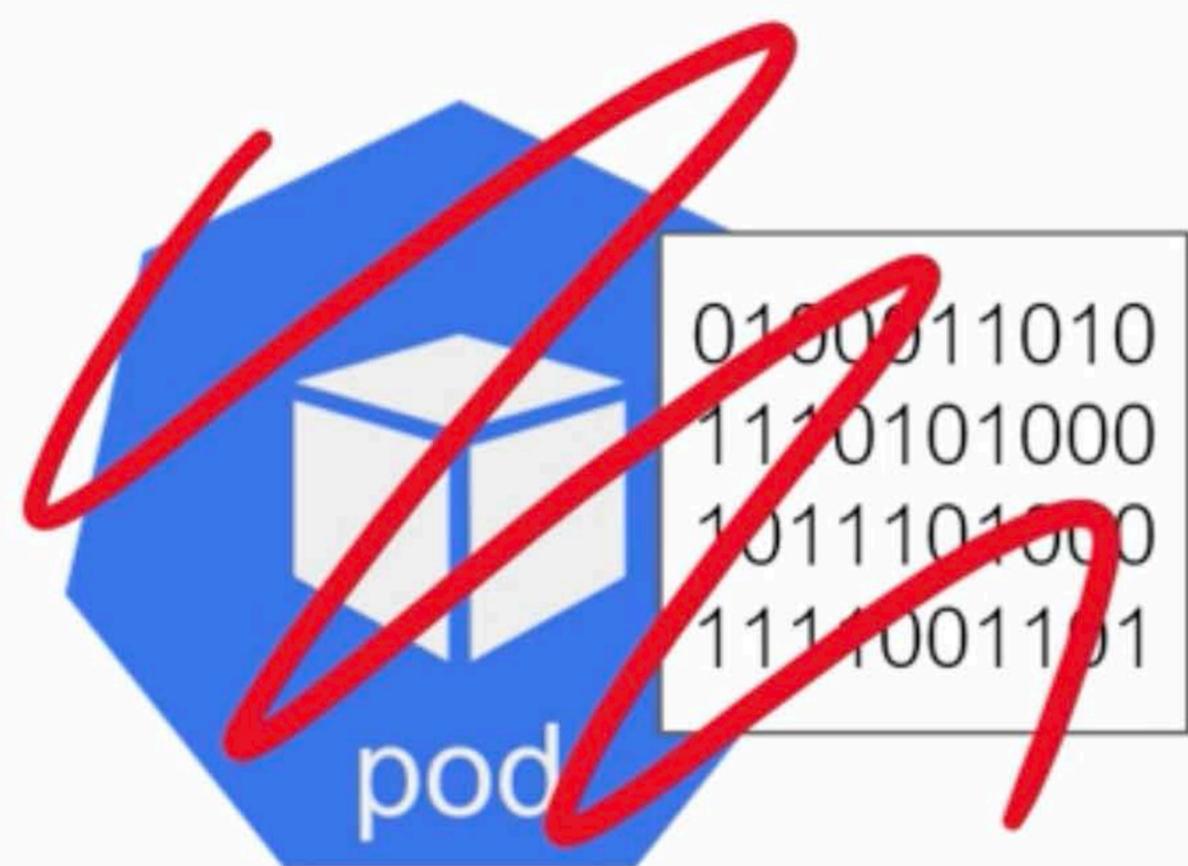
High-level Storage Requirements



High-level Storage Requirements



High-level Storage Requirements



High-level Storage Requirements



Volumes

[LUNs, devices, shares, mounts, spaces...]

High-level Storage Requirements



Storage is Vital!

File & Block
First-class Citizens in
Kubernetes

High-level Storage Requirements



File & Block
First-class Citizens in
Kubernetes

- Standards-based
- Pluggable backend
- Rich API

High-level Storage Requirements



Fundamental storage
requirements

Storage Backend

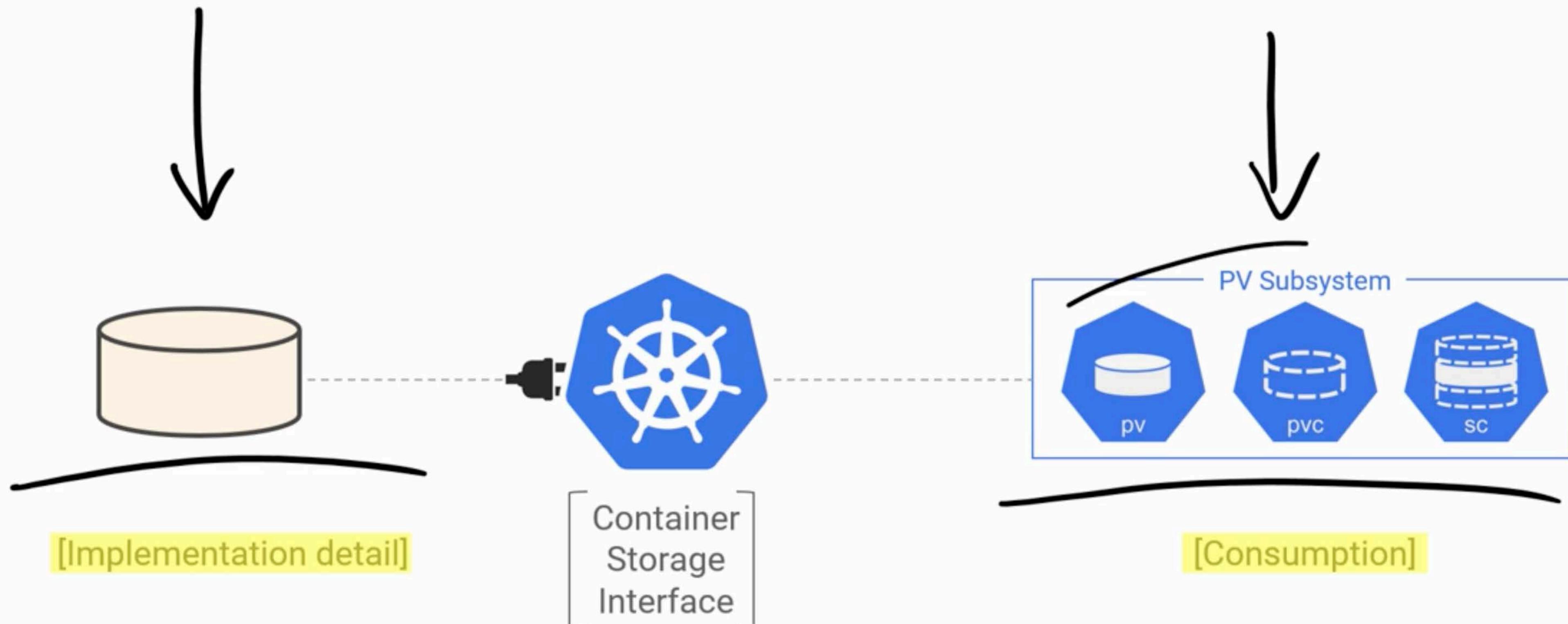
Speed

Replicated

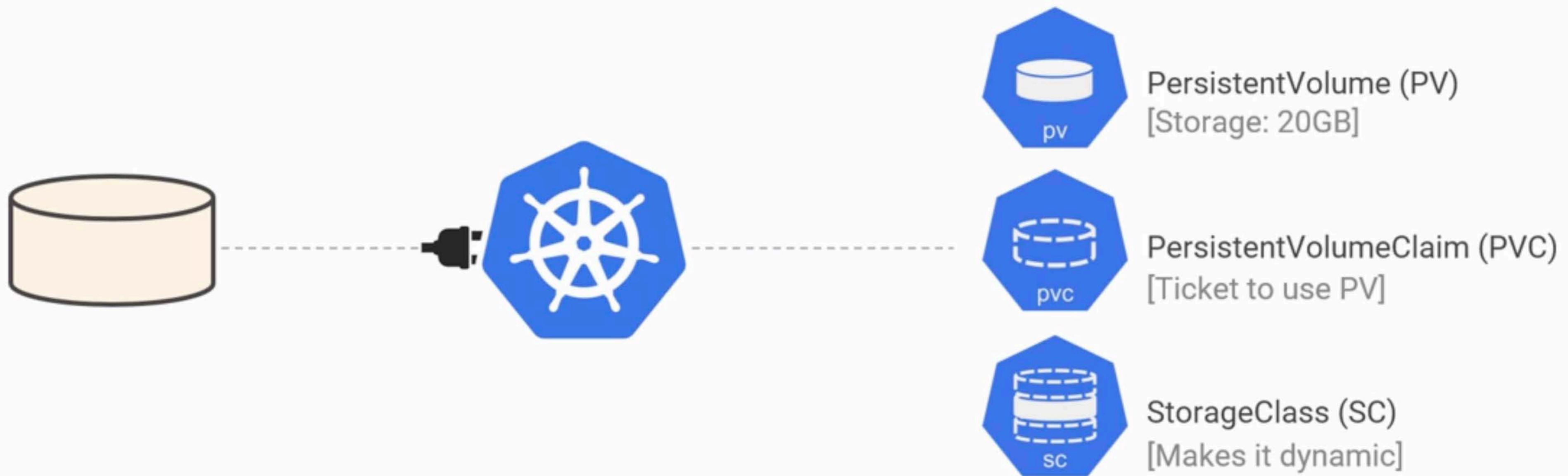
Resiliency

...

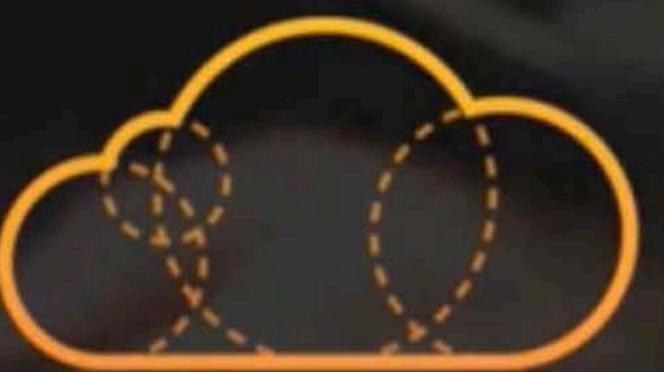
High-level Storage Requirements



High-level Storage Requirements



Container Storage Interface (CSI)



A CLOUD GURU

Container Storage Interface (CSI)



"Mare" = short for "nightmare"

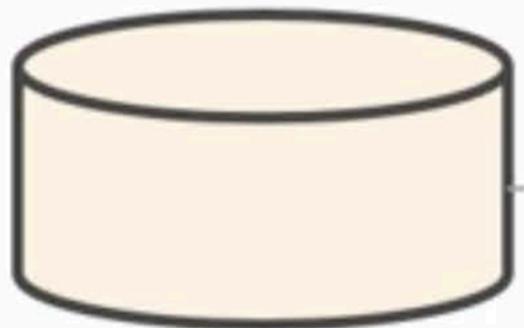


Maintain external code in K8s

Tied to K8s release cycle

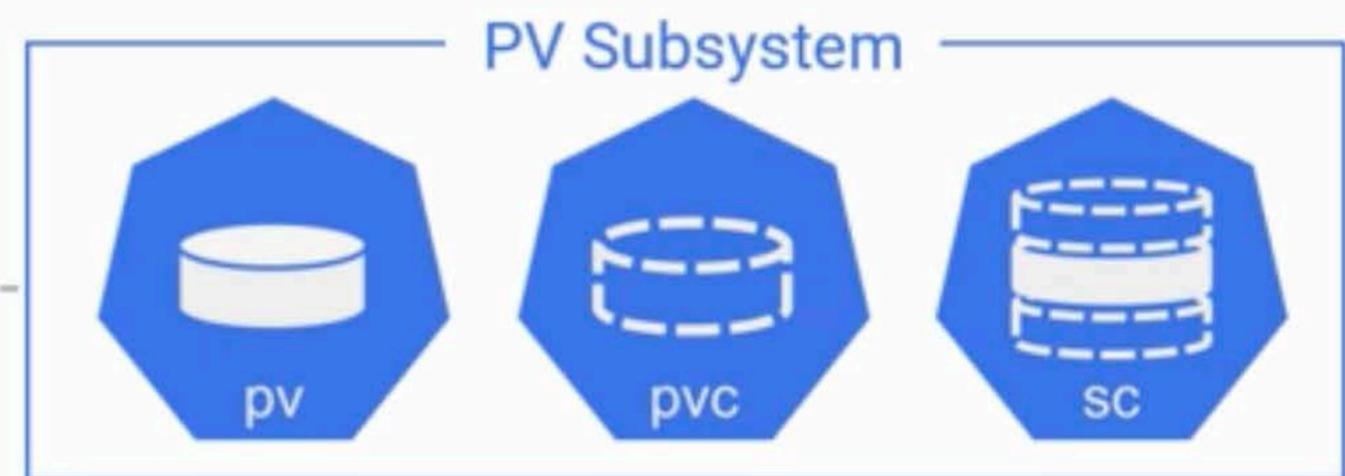
Driver code must be open-source

Container Storage Interface (CSI)



Out-of-tree

Open-standard

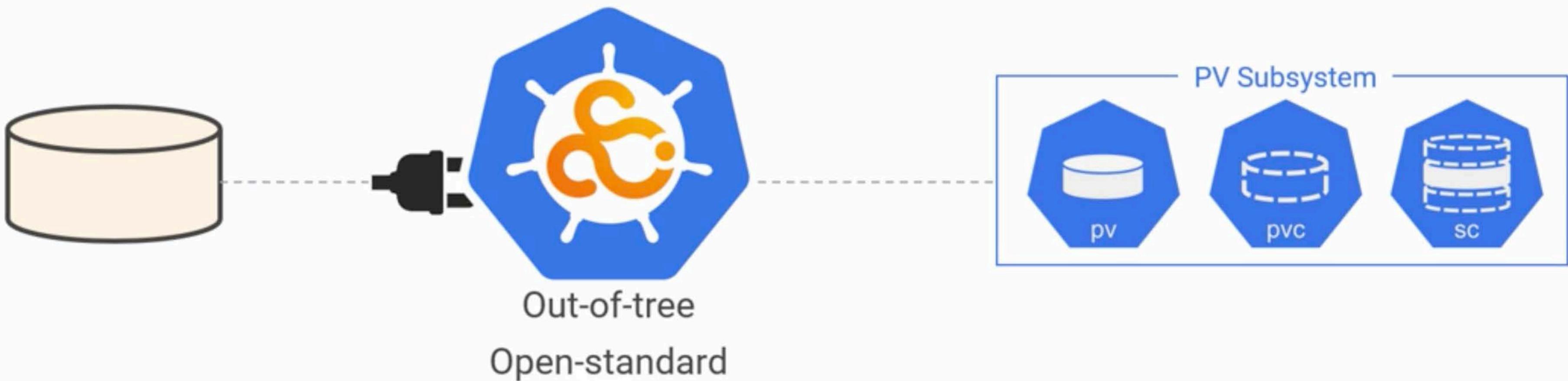


<https://github.com/container-storage-interface/spec>

Container Storage Interface (CSI)



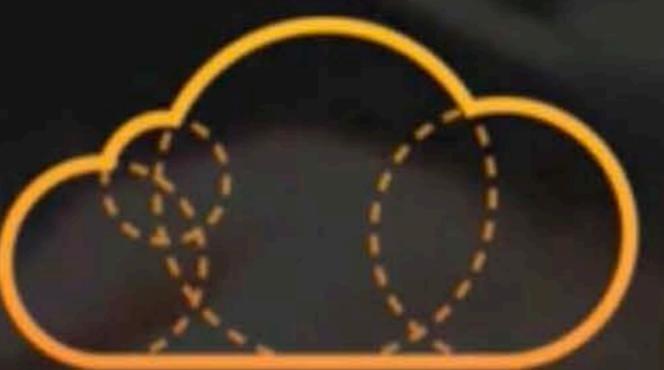
@nigelpoulton



<https://github.com/container-storage-interface/spec>

Still Beta in K8s 1.11

The Kubernetes PersistentVolume Subsystem

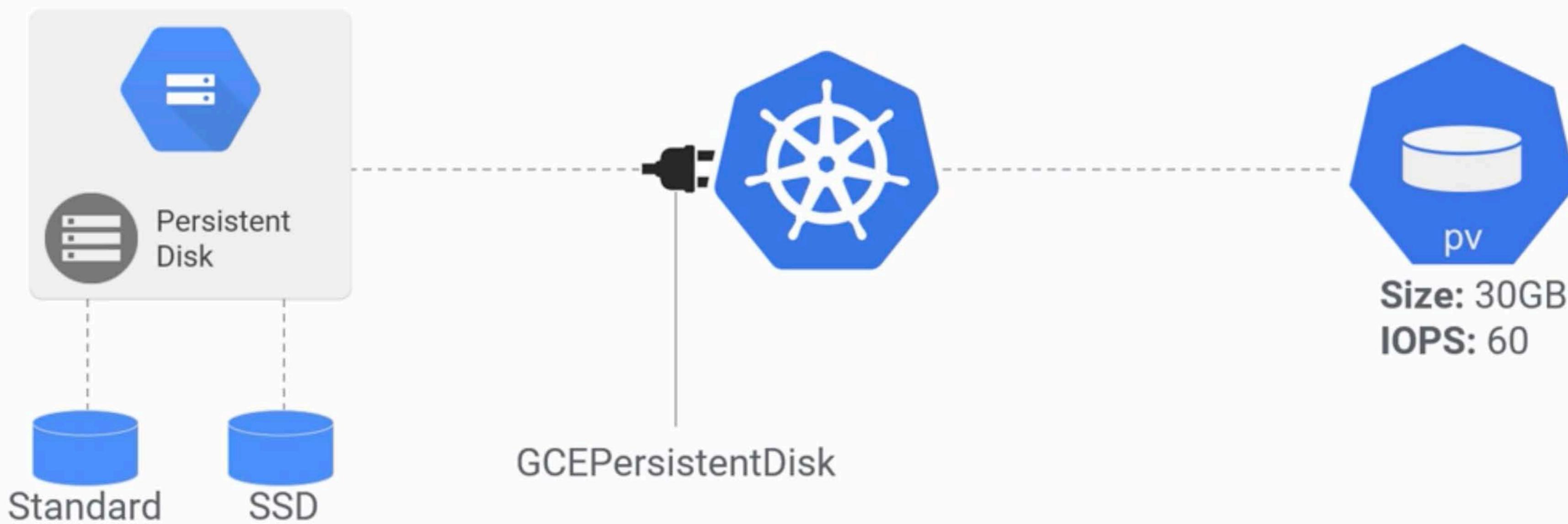


A CLOUD GURU

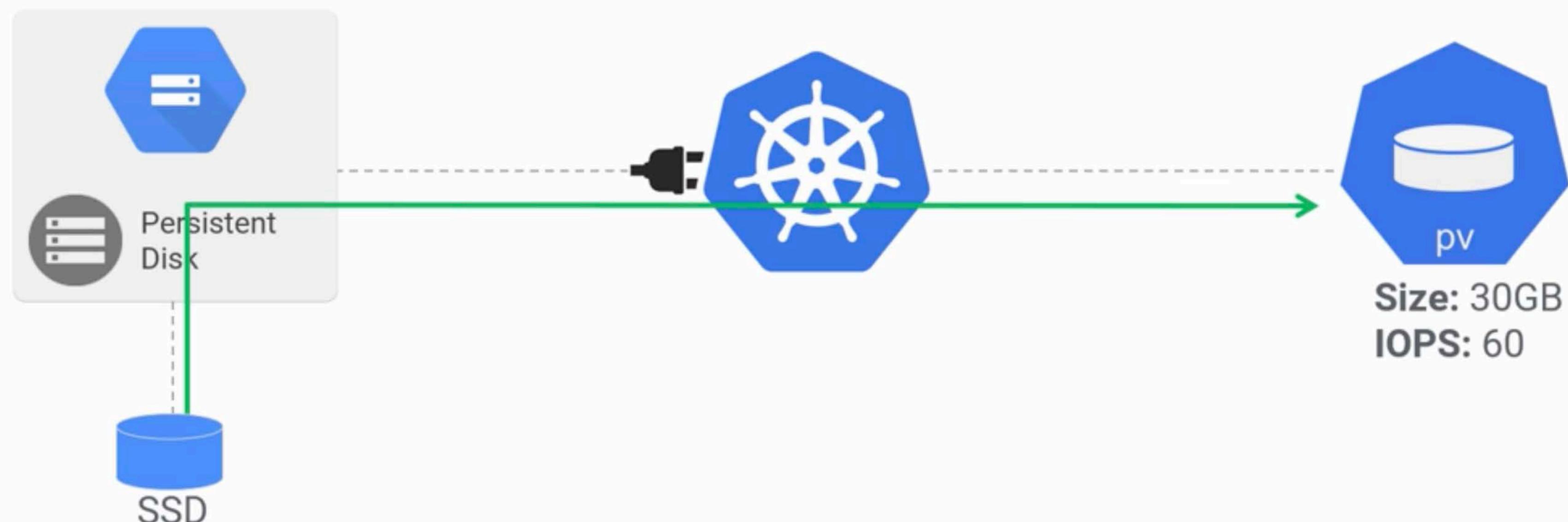
The K8s PersistentVolume Subsystem



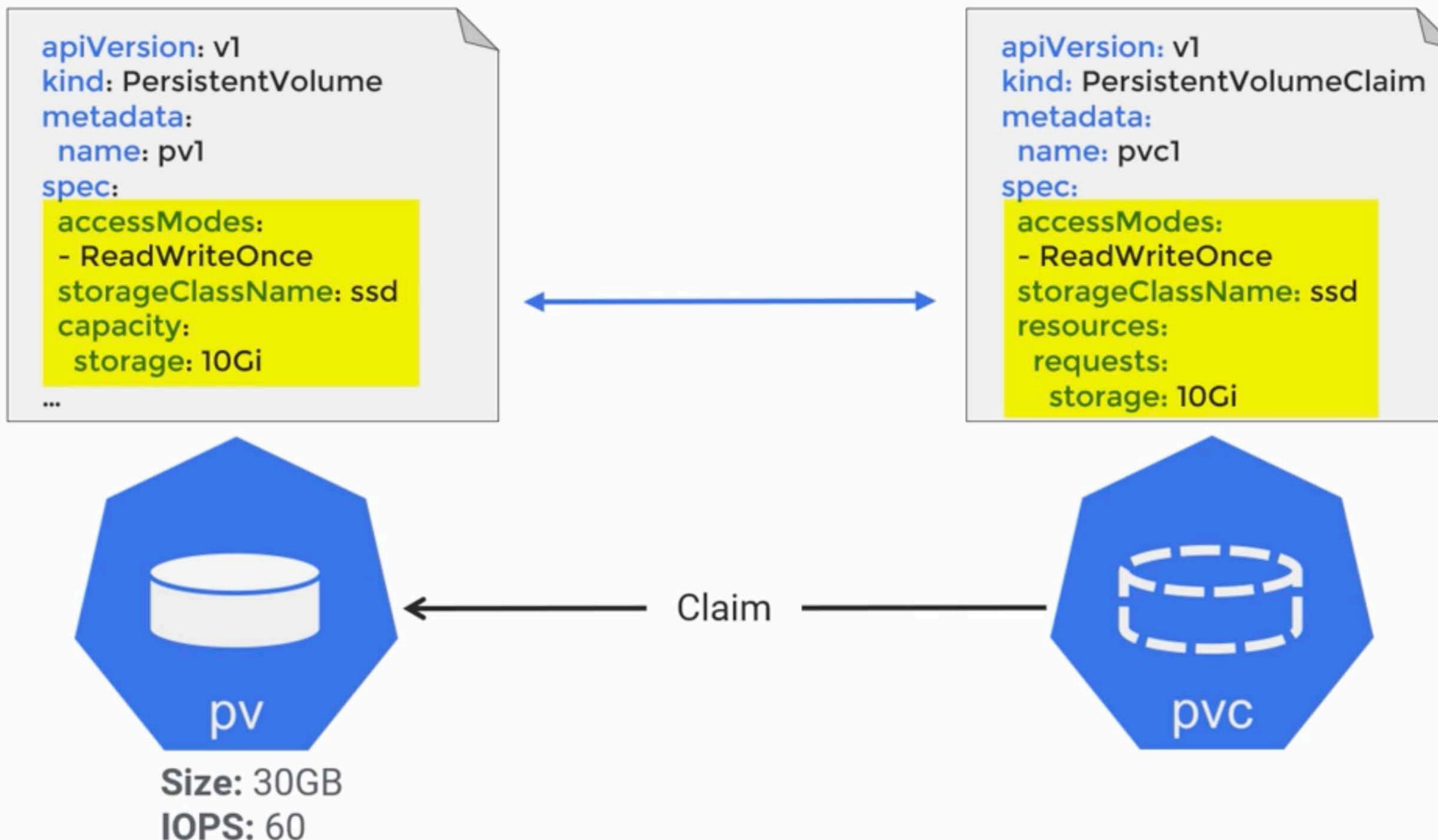
The K8s PersistentVolume Subsystem



The K8s PersistentVolume Subsystem



The K8s PersistentVolume Subsystem



! gke-pv.yml

! gke-pvc.yml

! gke-volpod.yml



```
1 apiVersion: v1
2 kind: PersistentVolume
3 metadata:
4   name: pv1
5 spec:
6   accessModes:
7     - ReadWriteOnce
8   storageClassName: ssd
9   capacity:
10    storage: 20Gi
11   persistentVolumeReclaimPolicy: Retain
12   gcePersistentDisk:
13     pdName: uber-disk
14
```



! gke-pv.yml ●

! gke-pvc.yml

! gke-volpod.yml

□ ...

```
1 apiVersion: v1
2 kind: PersistentVolume
3 metadata:
4   name: pv1
5 spec:
6   accessModes:
7     - ReadWriteOnce
8   storageClassName: ssd
9   capacity:
10    storage: 20Gi
11   persistentVolumeReclaimPolicy: Retain
12   gcePersistentDisk:
13     pdName: uber-disk
```





Disks

CREATE DISK

REFRESH

DELETE

SHOW INFO PANEL

Filter resources

Columns

Name	Type	Size	Zone	In use by
gke-cluster-1-70b82dc9-pvc-c2606c6d-899e-11e8-bb6b-42010a9a0089	Standard persistent disk	22 GB	europe-west2-b	
gke-cluster-1-default-pool-98763ba1-fht0	Standard persistent disk	100 GB	europe-west2-c	gke-cluster-1-default-pool-98763ba1-fht0
gke-cluster-1-default-pool-98763ba1-hw4j	Standard persistent disk	100 GB	europe-west2-c	gke-cluster-1-default-pool-98763ba1-hw4j
gke-cluster-1-default-pool-98763ba1-vdq7	Standard persistent disk	100 GB	europe-west2-c	gke-cluster-1-default-pool-98763ba1-vdq7
uber-disk	SSD persistent disk	20 GB	europe-west2-c	



Disks

CREATE INSTANCE

CREATE SNAPSHOT

CREATE IMAGE

EDIT

DELETE

uber-disk**Description**

Test PD for ACG storage lesson

Type

SSD persistent disk

Size**20 GB****Zone**

europe-west2-c

Estimated performance

Operation type	Read	Write
Sustained random IOPS limit	600.00	600.00
Sustained throughput limit (MB/s)	9.60	9.60

Encryption type

Google managed

Equivalent REST

```
PS C:\k8s\5>
PS C:\k8s\5>
PS C:\k8s\5> kubectl get nodes
NAME                               STATUS  ROLES   AGE    VERSION
gke-cluster-1-default-pool-98763ba1-fht0  Ready   <none>  9m    v1.10.5-gke.2
gke-cluster-1-default-pool-98763ba1-hw4j  Ready   <none>  9m    v1.10.5-gke.2
gke-cluster-1-default-pool-98763ba1-vdq7  Ready   <none>  9m    v1.10.5-gke.2
PS C:\k8s\5>
PS C:\k8s\5>
PS C:\k8s\5> kubectl apply -f .\gke-pv.yml
persistentvolume "pv1" created
PS C:\k8s\5>
PS C:\k8s\5>
PS C:\k8s\5> kubectl get pv
NAME      CAPACITY  ACCESS MODES  RECLAIM POLICY  STATUS    CLAIM     STORAGECLASS  REASON  AGE
pv1       20Gi      RWO          Retain        Available  null      ssd           8s
```

RWO: ReadWriteOnce
RWM: ReadWriteMany
ROM: ReadOnlyMany

*Not all volumes support all modes

*A PV can only have one active PVC/AccessMode

```
PS C:\k8s\5>  
PS C:\k8s\5>  
PS C:\k8s\5> kubectl get nodes
```

NAME	STATUS	ROLES	AGE	VERSION
gke-cluster-1-default-pool-98763ba1-fht0	Ready	<none>	9m	v1.10.5-gke.2
gke-cluster-1-default-pool-98763ba1-hw4j	Ready	<none>	9m	v1.10.5-gke.2
gke-cluster-1-default-pool-98763ba1-vdq7	Ready	<none>	9m	v1.10.5-gke.2

```
PS C:\k8s\5>
```

```
PS C:\k8s\5>
```

```
PS C:\k8s\5> kubectl apply -f .\gke-pv.yml
```

```
persistentvolume "pv1" created
```

```
PS C:\k8s\5>
```

```
PS C:\k8s\5>
```

```
PS C:\k8s\5> kubectl get pv
```

NAME	CAPACITY	ACCESS MODES	RECLAIM POLICY	STATUS	CLAIM	STORAGECLASS	REASON	AGE
pv1	20Gi	RWO	Retain	Available		ssd		8s

```
PS C:\k8s\5> ■
```



! gke-pv.yml • ! gke-pvc.yml ✘ ! gke-volpod.yml

```
1 apiVersion: v1
2 kind: PersistentVolumeClaim
3 metadata:
4   name: pvc1
5 spec:
6   accessModes:
7     - ReadWriteOnce
8   storageClassName: ssd
9   resources:
10    requests:
11      storage: 20Gi
```



0 0 ▲ 0

Ln 4, Col 13 (4 selected)

Spaces: 2

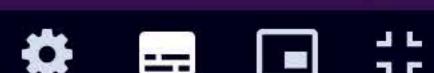
UTF-8

CRLF

YAML



|| < 15 15 > 🔍 05:35 / 08:30



Side-by-side compare of PVC and PV

```
1 apiVersion: v1
2 kind: PersistentVolumeClaim
3 metadata:
4   name: pvc1
5 spec:
6   accessModes:
7     - ReadWriteOnce
8   storageClassName: ssd
9   resources:
10    requests:
11      storage: 20Gi
```

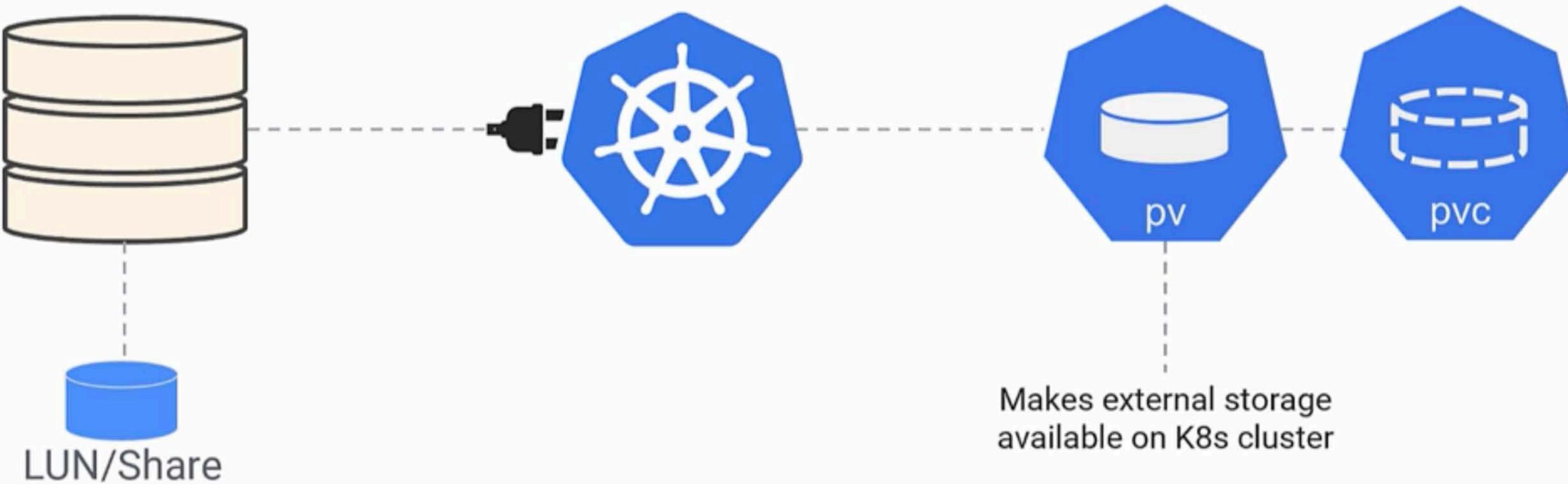
PVC

```
1 apiVersion: v1
2 kind: PersistentVolume
3 metadata:
4   name: pv1
5 spec:
6   accessModes:
7     - ReadWriteOnce
8   storageClassName: ssd
9   capacity:
10    storage: 20Gi
11   persistentVolumeReclaimPolicy: Retain
12   gcePersistentDisk:
13     pdName: uber-disk
14
```

PV



```
1 apiVersion: v1
2 kind: PersistentVolumeClaim
3 metadata:
4   name: pvc1
5 spec:
6   accessModes:
7     - ReadWriteOnce
8   storageClassName: ssd
9 resources:
10  requests:
11    storage: 20Gi
```



! gke-pv.yml • ! gke-pvc.yml

! gke-volpod.yml x

□ ...



```
1  apiVersion: v1
2  kind: Pod
3  metadata:
4    name: volpod
5  spec:
6    volumes:
7      - name: data
8        persistentVolumeClaim:
9          claimName: pvc1
10   containers:
11     - image: ubuntu:latest
12       name: ubuntu-ctr
13       command:
14         - /bin/bash
15         - "-c"
16         - "sleep 60m"
17       imagePullPolicy: IfNotPresent
18       volumeMounts:
19         - mountPath: /data
20           name: data
21
22
23
```



! gke-pv.yml • ! gke-pvc.yml

! gke-volpod.yml ✘

□ ...



```
1  apiVersion: v1
2  kind: Pod
3  metadata:
4    name: volpod
5  spec:
6    volumes:
7      - name: data
8        persistentVolumeClaim:
9          claimName: pvc1
10   containers:
11     - image: ubuntu:latest
12       name: ubuntu-ctr
13       command:
14         - /bin/bash
15         - "-c"
16         - "sleep 60m"
17       imagePullPolicy: IfNotPresent
18       volumeMounts:
19         - mountPath: /data
20           name: data
21
22
23
```



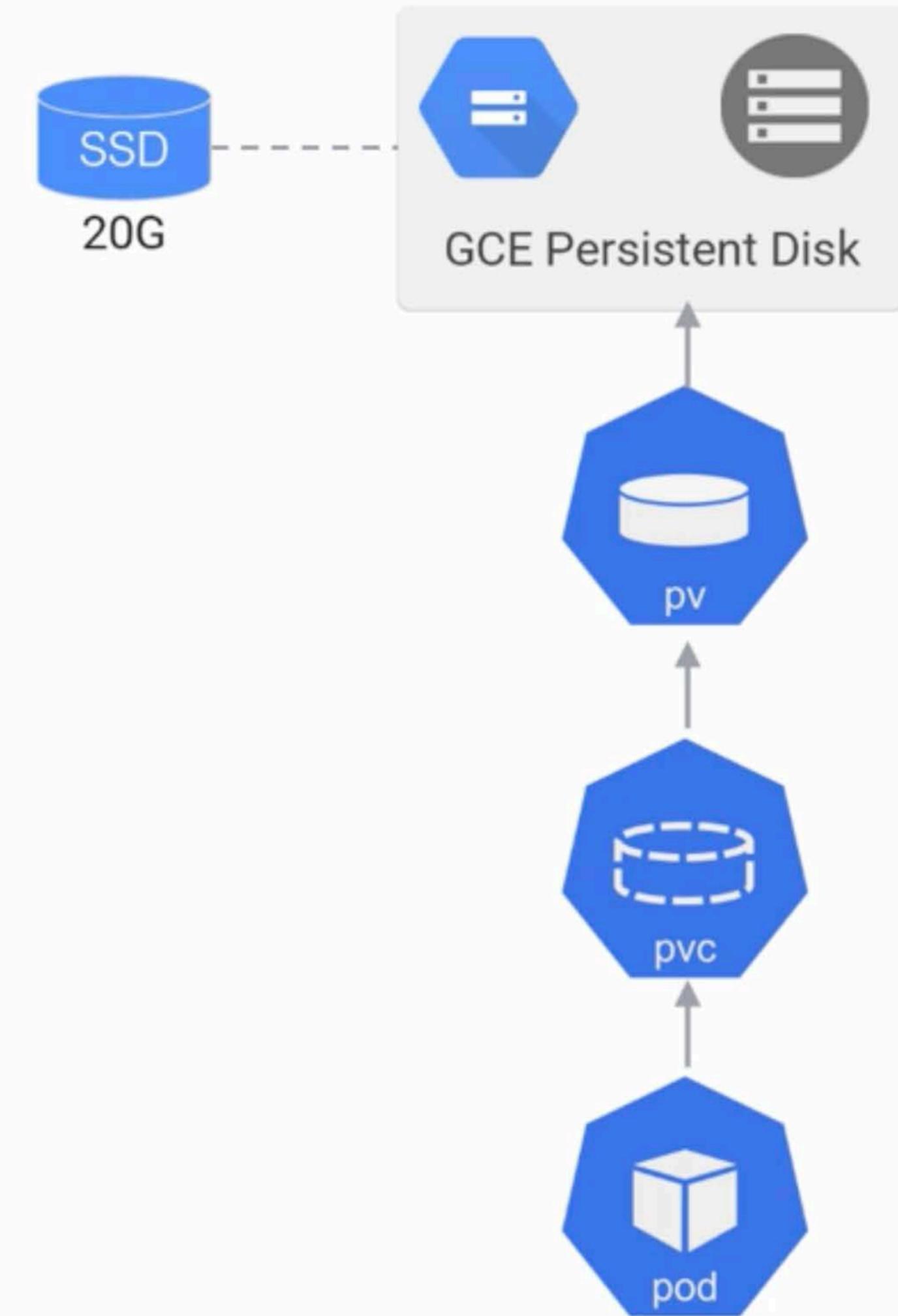
! gke-pv.yml

! gke-pvc.yml

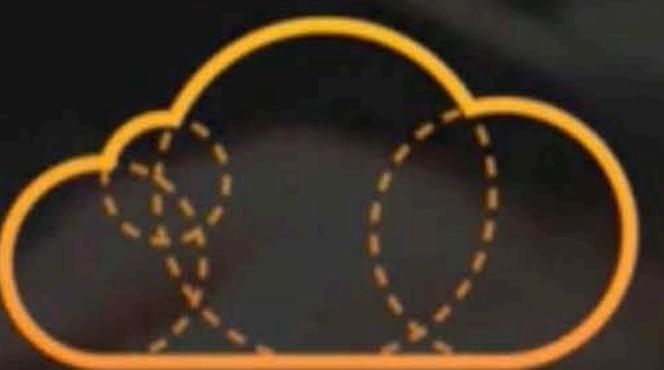
! gke-volpod.yml

...

```
1  apiVersion: v1
2  kind: Pod
3  metadata:
4    name: volpod
5  spec:
6    volumes:
7      - name: data
8        persistentVolumeClaim:
9          claimName: pvc1
10   containers:
11     - image: ubuntu:latest
12       name: ubuntu-ctr
13       command:
14         - /bin/bash
15         - "-c"
16         - "sleep 60m"
17       imagePullPolicy: IfNotPresent
18       volumeMounts:
19         - mountPath: /data
20           name: data
21
22
23
```

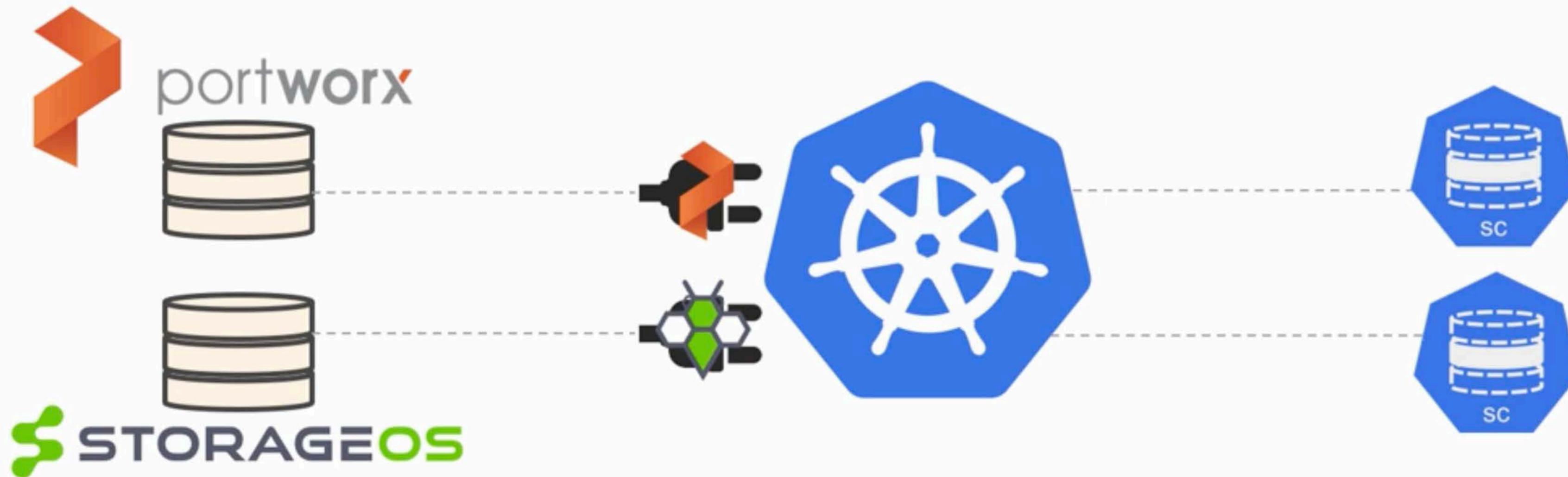


Dynamic Provisioning with StorageClasses



A CLOUD GURU

Dynamic Provisioning with StorageClasses



*Other storage backends do exist.

Dynamic Provisioning with StorageClasses



```
kind: StorageClass
apiVersion: storage.k8s.io/v1
metadata:
  name: sc-fast
provisioner: kubernetes.io/aws-ebs
parameters:
  type: gp2
reclaimPolicy: Retain
```

Dynamic Provisioning with StorageClasses



```
kind: StorageClass
apiVersion: storage.k8s.io/v1
metadata:
  name: sc-fast
provisioner: kubernetes.io/aws-ebs
parameters:
  type: pinkFluffySSD
reclaimPolicy: Retain
```

Dynamic Provisioning with StorageClasses



```
kind: StorageClass
apiVersion: storage.k8s.io/v1
metadata:
  name: sc-fast
provisioner: kubernetes.io/aws-ebs
parameters:
  type: pinkFluffySSD
reclaimPolicy: Retain
```

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: pvc1
...
storageClassName: sc-fast
```

```
apiVersion: apps/v1
kind: Pod | Deployment
...
spec:
...
volumes:
- name: my-vol
  persistentVolumeClaim:
    claimName: pvc1
```

! sc.yml • ! portworx.yml

```
1 kind: StorageClass
2 apiVersion: storage.k8s.io/v1
3 metadata:
4   name: fast
5   provisioner: kubernetes.io/aws-ebs
6   parameters:
7     type: io1
8     zones: eu-west-1a
9     iopsPerGB: "10"
10 ---
11 kind: StorageClass
12 apiVersion: storage.k8s.io/v1
13 metadata:
14   name: slow
15   annotations:
16     storageclass.kubernetes.io/is-default-class: "true"
17   provisioner: kubernetes.io/aws-ebs
18   parameters:
19     type: gp2
20     zones: eu-west-1a
21   reclaimPolicy: Retain
22   mountOptions:
23     - debug
```



```
1 kind: StorageClass
2 apiVersion: storage.k8s.io/v1
3 metadata:
4   name: fast
5   provisioner: kubernetes.io/aws-ebs
6   parameters:
7     type: io1
8     zones: eu-west-1a
9     iopsPerGB: "10"
10 ...
11 kind: StorageClass
12 apiVersion: storage.k8s.io/v1
13 metadata:
14   name: slow
15   annotations:
16     storageclass.kubernetes.io/is-default-class: "true"
17   provisioner: kubernetes.io/aws-ebs
18   parameters:
19     type: gp2
20     zones: eu-west-1a
21   reclaimPolicy: Retain
22   mountOptions:
23     - debug
```

This is a feature of an AWS **io1** block device. It may not be available on other storage backends.



! sc.yml • ! portworx.yml

```
parameters:
  type: io1
  zones: eu-west-1a
  iopsPerGB: "10"
---
kind: StorageClass
apiVersion: storage.k8s.io/v1
metadata:
  name: slow
  annotations:
    storageclass.kubernetes.io/is-default-class: "true"
provisioner: kubernetes.io/aws-ebs
parameters:
  type: gp2
  zones: eu-west-1a
  reclaimPolicy: Retain
  mountOptions:
    - debug
```



```
1 kind: StorageClass
2 apiVersion: storage.k8s.io/v1
3 metadata:
4   name: fast
5 provisioner: kubernetes.io/aws-ebs
6 parameters:
7   type: io1
8   zones: eu-west-1a
9   iopsPerGB: "10"
10 ---
11 kind: StorageClass
12 apiVersion: storage.k8s.io/v1
13 metadata:
14   name: slow
15 annotations:
16   storageclass.kubernetes.io/is-default-class: "true"
17 provisioner: kubernetes.io/aws-ebs
18 parameters:
19   type: gp2
20   zones: eu-west-1a
21 reclaimPolicy: Retain
22 mountOptions:
23   - debug
```



! sc.yml

! portworx.yml x



```
1 kind: StorageClass
2 apiVersion: storage.k8s.io/v1
3 metadata:
4   name: portworx-db-secure I
5   provisioner: kubernetes.io/portworx-volume
6 parameters:
7   fs: "xfs"
8   block_size: "32"
9   repl: "2"
10  snap_interval: "30"
11  io_priority: "medium"
12  secure: "true"
13
```



```
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$ kubectl get nodes  
NAME                               STATUS   ROLES      AGE     VERSION  
ip-172-20-38-122.eu-west-1.compute.internal  Ready    master    8h      v1.11.0  
ip-172-20-46-95.eu-west-1.compute.internal  Ready    node      8h      v1.11.0  
ip-172-20-58-139.eu-west-1.compute.internal  Ready    node      8h      v1.11.0  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$ kubectl get sc  
No resources found.  
ubuntu@mgr1:~$
```

```
ubuntu@mgr1:~$ No resources found.  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$ cat sc.yml  
kind: StorageClass  
apiVersion: storage.k8s.io/v1  
metadata:  
  name: fast  
provisioner: kubernetes.io/aws-ebs  
parameters:  
  type: io1  
  zones: eu-west-1a  
  iopsPerGB: "10"  
---  
kind: StorageClass  
apiVersion: storage.k8s.io/v1  
metadata:  
  name: slow  
  annotations:  
    storageclass.kubernetes.io/is-default-class: "true"  
provisioner: kubernetes.io/aws-ebs  
parameters:  
  type: gp2  
  zones: eu-west-1a  
reclaimPolicy: Retain  
mountOptions:  
  - debug  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$ kubectl apply -f sc.yml
```

```
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$ kubectl apply -f sc.yml  
storageclass.storage.k8s.io/fast created  
storageclass.storage.k8s.io/slow created  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$ kubectl get sc  
NAME          PROVISIONER          AGE  
fast          kubernetes.io/aws-ebs  6s  
slow (default) kubernetes.io/aws-ebs  6s  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$ kubectl describe sc fast  
Name:           fast  
IsDefaultClass: No  
Annotations:   kubectl.kubernetes.io/last-applied-configuration={"apiVersion":"storage.k8s.io/v1","kind":"StorageClass","metadata":{"annotations":{},"name":"fast","namespace":""}, "parameters":{"iopsPerGB":"10","type":"io1","zones":"eu-west-1a"}, "provisioner":"kubernetes.io/aws-ebs"}  
  
Provisioner:      kubernetes.io/aws-ebs  
Parameters:       iopsPerGB=10,type=io1,zones=eu-west-1a  
AllowVolumeExpansion: <unset>  
MountOptions:     <none>  
ReclaimPolicy:    Delete  
VolumeBindingMode: Immediate  
Events:  
ubuntu@mgr1:~$
```

```
ubuntu@mgr1:~ AllowVolumeExpansion: <unset>
MountOptions: <none>
ReclaimPolicy: Delete
VolumeBindingMode: Immediate
Events: <none>
ubuntu@mgr1:~$ ubuntu@mgr1:~$ ubuntu@mgr1:~$ ubuntu@mgr1:~$ kubectl get pv
No resources found.
ubuntu@mgr1:~$ kubectl get pvc
No resources found.
ubuntu@mgr1:~$ ubuntu@mgr1:~$ ubuntu@mgr1:~$ ubuntu@mgr1:~$ cat aws-pvc.yml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: aws-fast
spec:
  accessModes:
  - ReadWriteOnce
  storageClassName: fast
  resources:
    requests:
      storage: 10Gi
ubuntu@mgr1:~$ ubuntu@mgr1:~$ ubuntu@mgr1:~$ ubuntu@mgr1:~$
```

```
ubuntu@mgr1:~$ ReclaimPolicy: Delete
ubuntu@mgr1:~$ VolumeBindingMode: Immediate
ubuntu@mgr1:~$ Events: <none>
ubuntu@mgr1:~$ 
ubuntu@mgr1:~$ 
ubuntu@mgr1:~$ kubectl get pv
No resources found.
ubuntu@mgr1:~$ kubectl get pvc
No resources found.
ubuntu@mgr1:~$ 
ubuntu@mgr1:~$ 
ubuntu@mgr1:~$ 
ubuntu@mgr1:~$ cat aws-pvc.yml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: aws-fast
spec:
  accessModes:
  - ReadWriteOnce
  storageClassName: fast
resources:
  requests:
    storage: 10Gi
ubuntu@mgr1:~$ 
ubuntu@mgr1:~$ 
ubuntu@mgr1:~$ 
ubuntu@mgr1:~$ kubectl apply -f aws-pvc.yml
persistentvolumeclaim/aws-fast created
ubuntu@mgr1:~$ 
```

Name: aws-fast
Size: 10G
StorageClassName: fast

ubuntu@mgr1:~\$

ubuntu@mgr1:~\$

ubuntu@mgr1:~\$

ubuntu@mgr1:~\$ kubectl get pv

No resources found.

ubuntu@mgr1:~\$ kubectl get pvc

No resources found.

ubuntu@mgr1:~\$

ubuntu@mgr1:~\$

ubuntu@mgr1:~\$

ubuntu@mgr1:~\$ cat aws-pvc.yml

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
```

```
  name: aws-fast
```

```
spec:
```

```
  accessModes:
```

```
  - ReadWriteOnce
```

```
  storageClassName: fast
```

```
resources:
```

```
  requests:
```

```
    storage: 10Gi
```

ubuntu@mgr1:~\$

ubuntu@mgr1:~\$

ubuntu@mgr1:~\$

ubuntu@mgr1:~\$ kubectl apply -f aws-pvc.yml

persistentvolumeclaim/aws-fast created

ubuntu@mgr1:~\$ kubectl get pvc

NAME	STATUS	VOLUME	CAPACITY	ACCESS MODES	STORAGECLASS	AGE
aws-fast	Bound	pvc-3ec88edf-8ab6-11e8-8a01-060a650e58be	10Gi	RWO	fast	26s

ubuntu@mgr1:~\$

Name: aws-fast

Size: 10G

StorageClassName: fast



Services ▾

Resource Groups ▾

EC2

CloudFormation

VPC

EKS



Nigel Poulton

Ireland

Support

EC2 Dashboard

Events

Tags

Reports

Limits

INSTANCES

Instances

Launch Templates

Spot Requests

Reserved Instances

Dedicated Hosts

Scheduled Instances

IMAGES

AMIs

Bundle Tasks

ELASTIC BLOCK STORE

Volumes

Snapshots

Lifecycle Manager

NETWORK & SECURITY

Security Groups

Create Volume

Actions ▾

Filter by tags and attributes or search by keyword

? < < 1 to 9 of 9 > >

	Name	Volume ID	Size	Volume Type	IOPS	Snapshot	Created	Availability Zone	State	Alarm Sta
■	acg.k8s.local-dyna...	vol-0b5d2fb5...	10 GiB	io1	100		July 18, 2018 at 7:1...	eu-west-1a	available	None
■		vol-054e8ca...	128 GiB	gp2	384 / 3000	snap-0009045...	July 18, 2018 at 10:...	eu-west-1a	in-use	None
■		vol-0136278...	128 GiB	gp2	384 / 3000	snap-0009045...	July 18, 2018 at 10:...	eu-west-1a	in-use	None
■		vol-00bc557...	64 GiB	gp2	192 / 3000	snap-0009045...	July 18, 2018 at 10:...	eu-west-1a	in-use	None
■	a.etcd-main.acg.k8...	vol-071308c...	20 GiB	gp2	100 / 3000		July 18, 2018 at 10:...	eu-west-1a	in-use	None
■	a.etcd-events.acg.k...	vol-0f2c4e2b...	20 GiB	gp2	100 / 3000		July 18, 2018 at 10:...	eu-west-1a	in-use	None
■		vol-0f152d66...	8 GiB	gp2	100 / 3000	snap-0a584c0...	July 17, 2018 at 3:0...	eu-west-1a	in-use	None
■		vol-0a8bc77...	8 GiB	gp2	100 / 3000	snap-0a584c0...	July 17, 2018 at 3:0...	eu-west-1a	in-use	None
■		vol-0ac9f520...	8 GiB	gp2	100 / 3000	snap-0a584c0...	July 17, 2018 at 3:0...	eu-west-1a	in-use	None

Volumes: vol-0b5d2fb58460a9e14 (acg.k8s.local-dynamic-pvc-3ec88edf-8ab6-11e8-8a01-060a650e58be)



Description

Status Checks

Monitoring

Tags

Volume ID: vol-0b5d2fb58460a9e14

Alarm status: None

Size: 10 GiB

Snapshot:

ubuntu@mgr1:~

```
ubuntu@mgr1:~$  
ubuntu@mgr1:~$ cat aws-pvc.yml  
apiVersion: v1  
kind: PersistentVolumeClaim  
metadata:  
  name: aws-fast  
spec:  
  accessModes:  
    - ReadWriteOnce  
  storageClassName: fast  
resources:  
  requests:  
    storage: 10Gi
```

ubuntu@mgr1:~\$

```
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$
```

```
ubuntu@mgr1:~$ kubectl apply -f aws-pvc.yml  
persistentvolumeclaim/aws-fast created
```

ubuntu@mgr1:~\$ kubectl get pvc

NAME	STATUS	VOLUME	CAPACITY	ACCESS MODES	STORAGECLASS	AGE
aws-fast	Bound	pvc-3ec88edf-8ab6-11e8-8a01-060a650e58be	10Gi	RWO	fast	26s

```
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$  
ubuntu@mgr1:~$
```

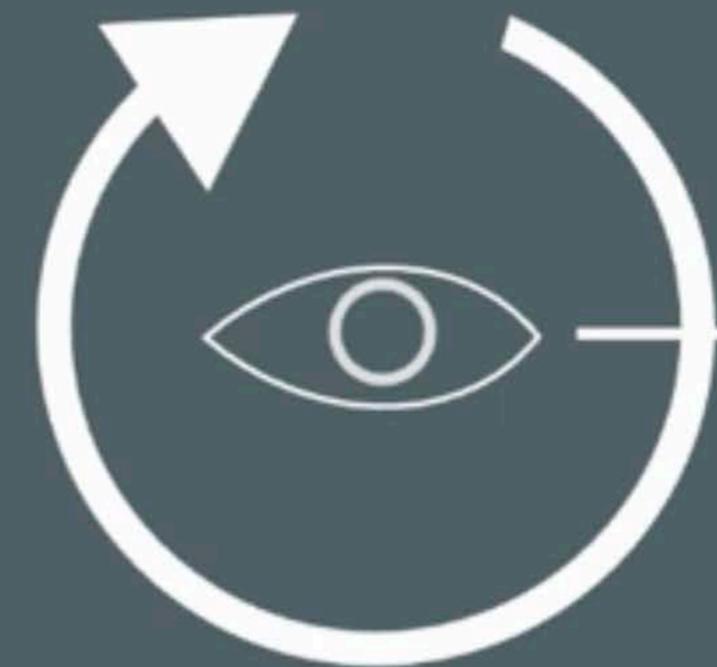
ubuntu@mgr1:~\$ kubectl get pv

NAME	CAPACITY	ACCESS MODES	RECLAIM POLICY	STATUS	CLAIM	STORAGECLASS
pvc-3ec88edf-8ab6-11e8-8a01-060a650e58be	10Gi	RWO	Delete	Bound	default/aws-fast	fast
	1m					

ubuntu@mgr1:~\$



Dynamically
create new PV

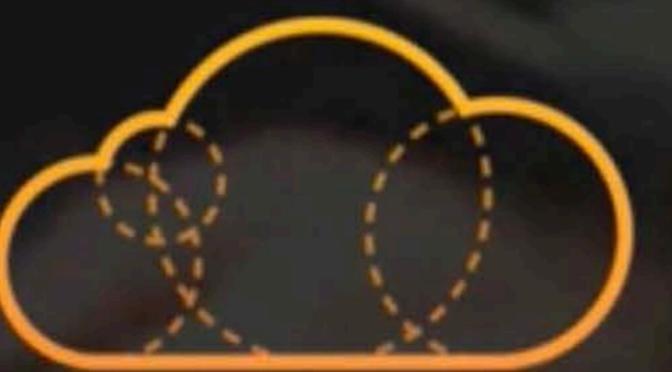


PV Subsystem
Control Loop

K8s API
Server

!!NEW PVC!!

Demo/Lab



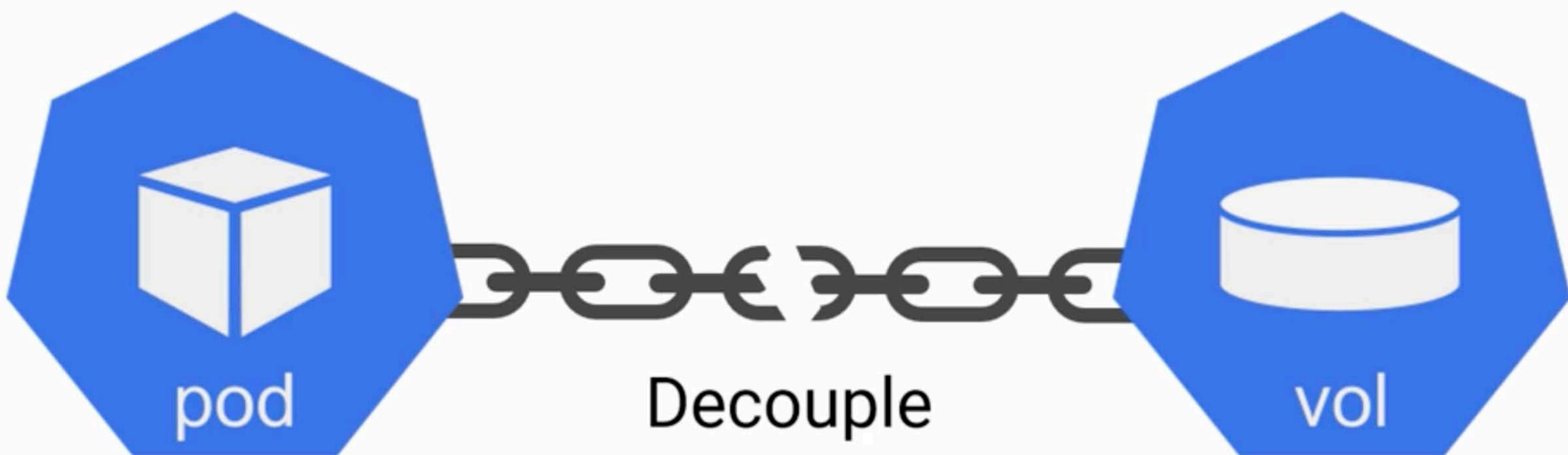
A CLOUD GURU

Recap

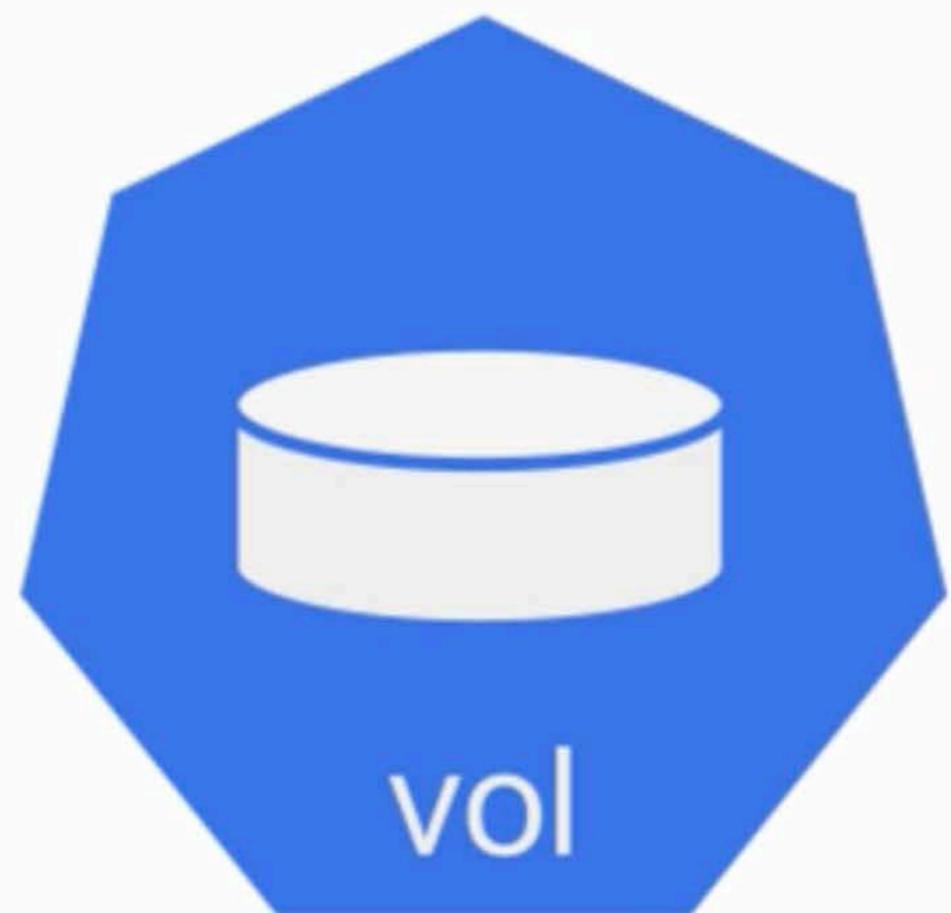


A CLOUD GURU

Recap

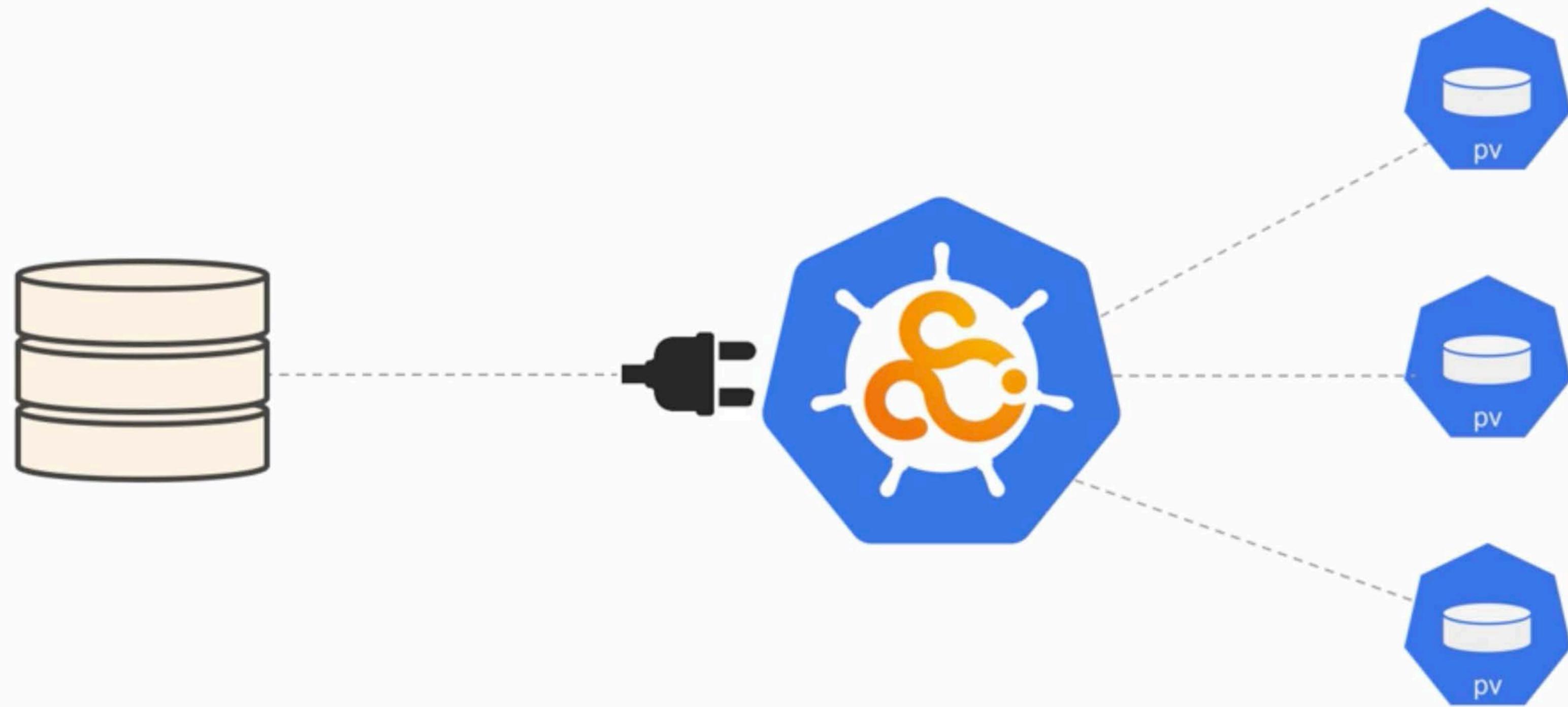


Recap

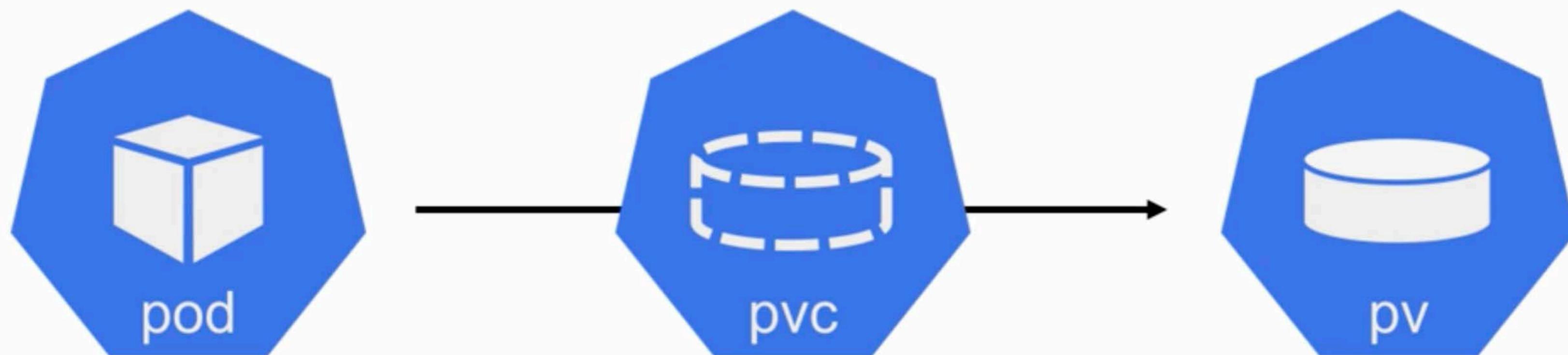


First Class Citizen

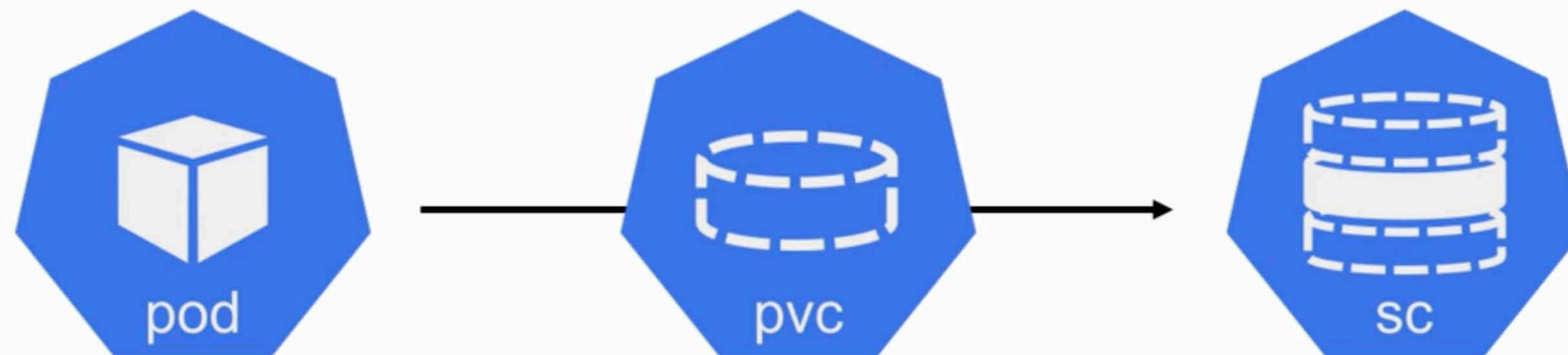
Recap



Recap



Recap



Making things
dynamic!

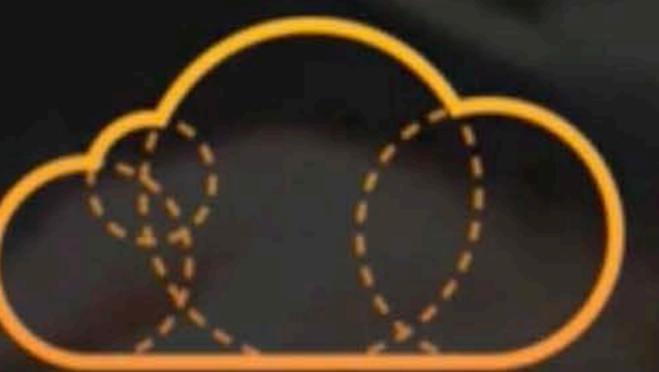
Coming up next...



A CLOUD GURU

Code & Docker Images

From Code to Kubernetes



A CLOUD GURU

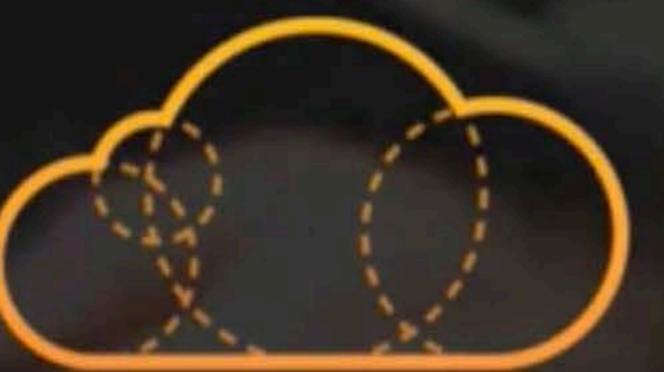
Lesson Plan



A CLOUD GURU

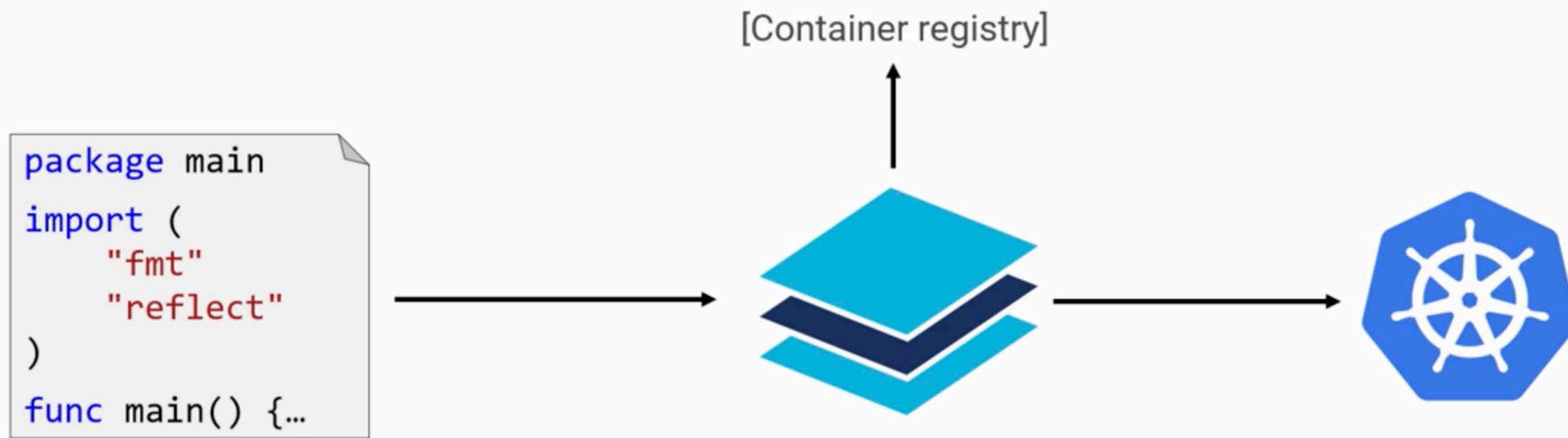
- Big Picture
- Walk-through example
- Recap

The Big Picture

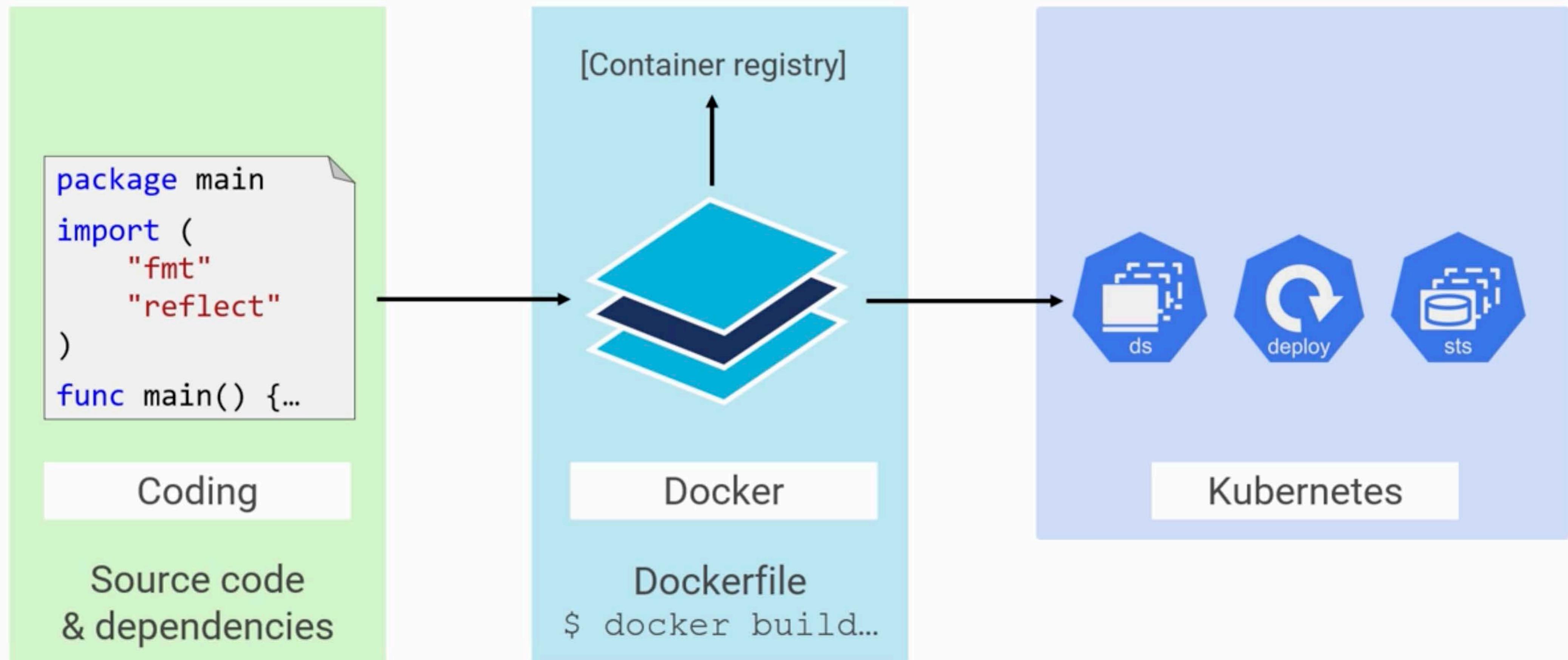


A CLOUD GURU

The Big Picture



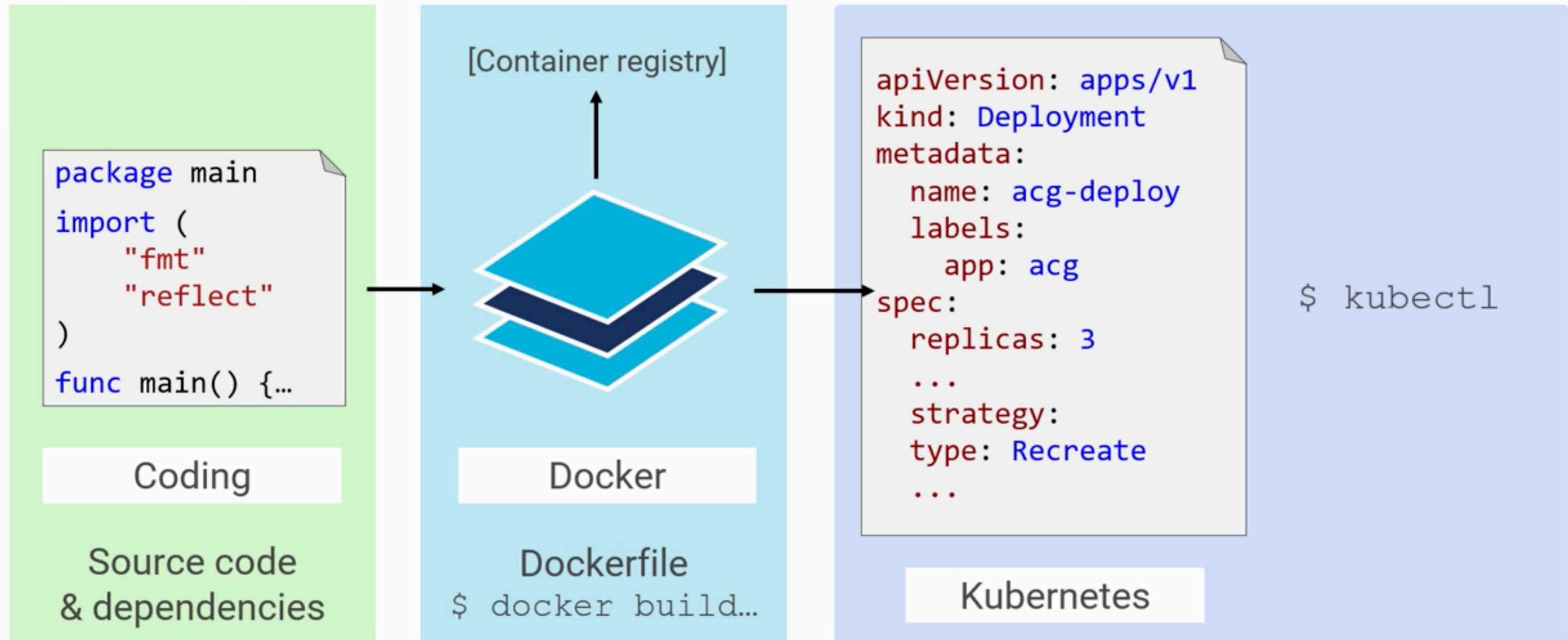
The Big Picture



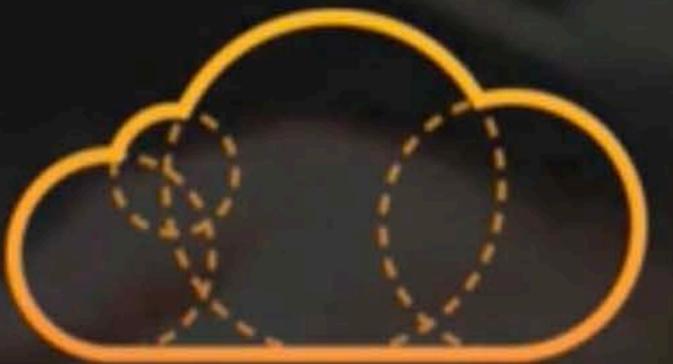
The Big Picture



From code to Kubernetes

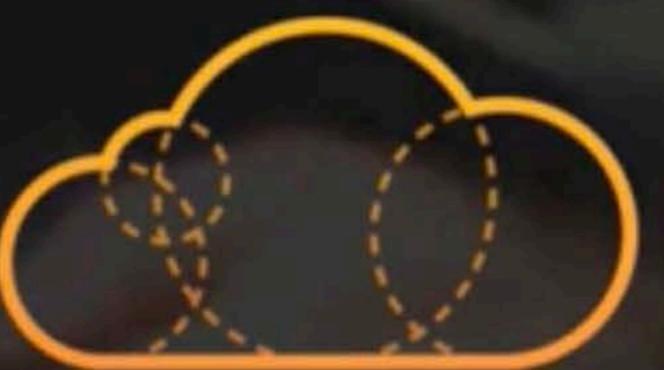


Demo Time!



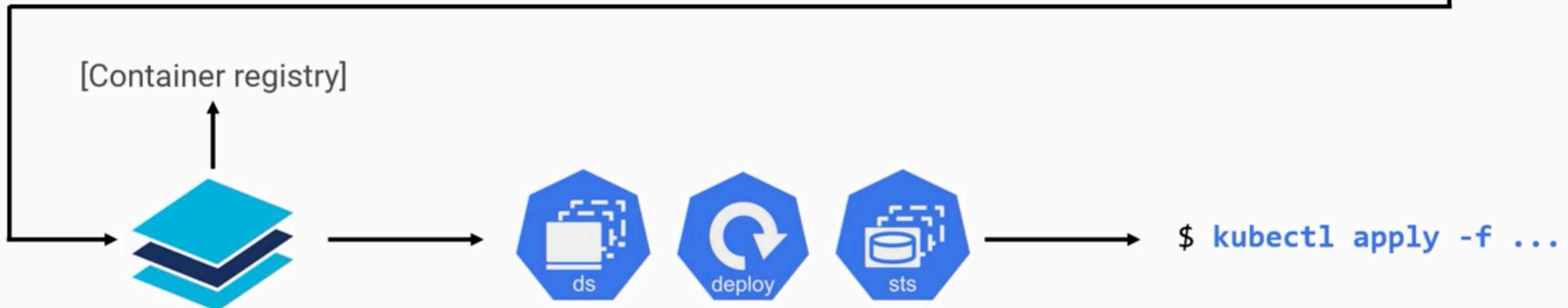
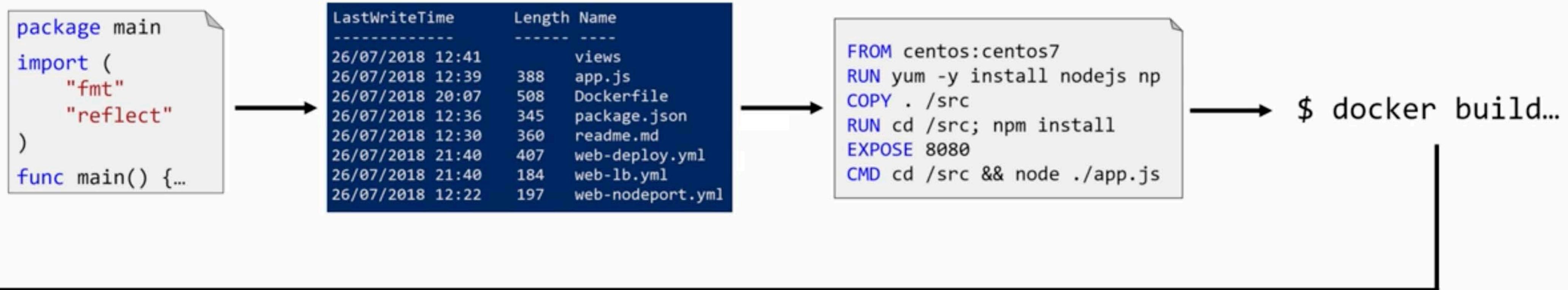
A CLOUD GURU

Recap



A CLOUD GURU

Recap



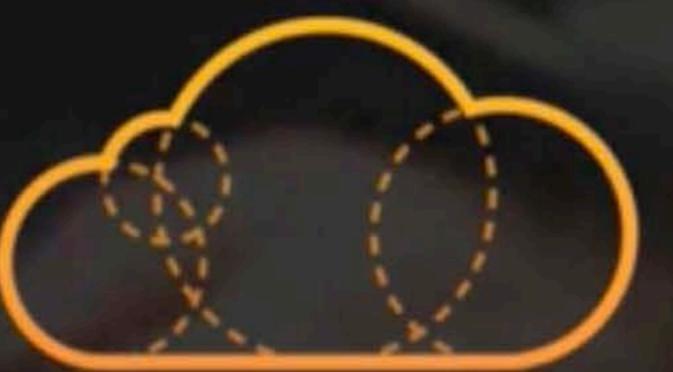
Coming up next...



A CLOUD GURU

Deployments

Kubernetes Deployments



A CLOUD GURU

Lesson Plan



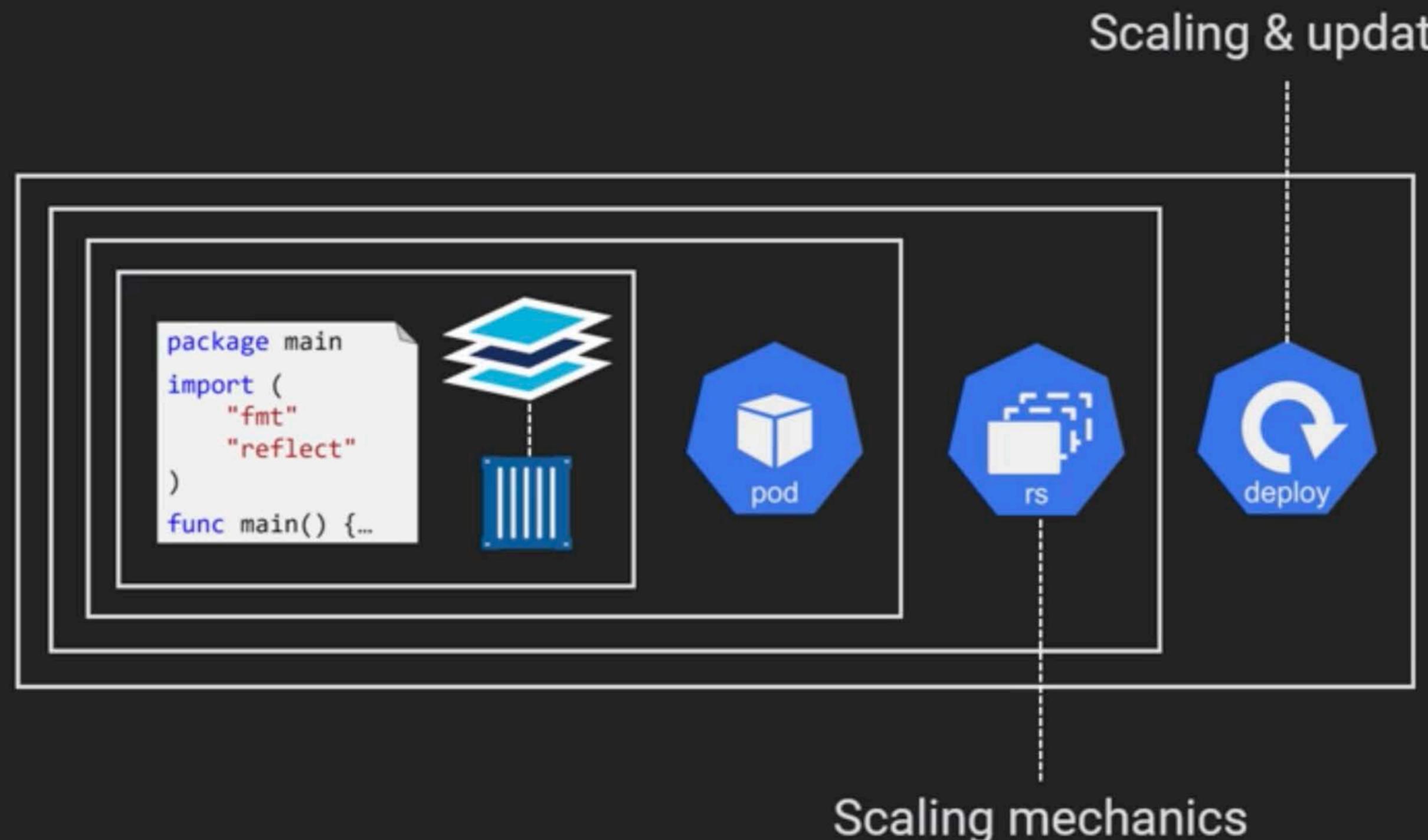
- Theory
- Demo
- Recap

Kubernetes Deployments



A CLOUD GURU

Deployment Theory



! deployment.yml ●

```
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    labels:
5      run: prod-redis
6      name: prod-redis
7  spec:
8    selector:
9      matchLabels:
10     run: prod-redis
11   replicas: 1
12   minReadySeconds: 300
13   strategy:
14     rollingUpdate:
15       maxSurge: 1
16       maxUnavailable: 0
17       type: RollingUpdate
18   template:
19     metadata:
```



! deployment.yml

```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11  replicas: 1  
12  minReadySeconds: 300  
13  strategy:  
14    rollingUpdate:  
15      maxSurge: 1  
16      maxUnavailable: 0  
17      type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22      spec:  
23        containers:  
24          - image: redis:4.0  
25            name: redis
```



1



...



1



! deployment.yml

```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11    replicas: 1  
12    minReadySeconds: 300  
13    strategy:  
14      rollingUpdate:  
15        maxSurge: 1  
16        maxUnavailable: 0  
17        type: RollingUpdate  
18    template:  
19      metadata:  
20        labels:  
21          run: prod-redis  
22      spec:  
23        containers:  
24          - image: redis:4.0  
25          name: redis  
26
```



! deployment.yml

```
8 selector:  
9   matchLabels:  
10    run: prod-redis  
11    replicas: 3  
12    minReadySeconds: 300  
13  strategy:  
14    rollingUpdate:  
15      maxSurge: 1  
16      maxUnavailable: 0  
17      type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22    spec:  
23      containers:  
24        - image: redis:4.0  
25        name: redis  
26
```

Handled by ReplicaSet (RS)



! deployment.yml

```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11  replicas: 3  
12  minReadySeconds: 300  
13  strategy:  
14    type (string)  
15    rolling: maxS Type of deployment. Can be "Recreate" or "RollingUpdate". Default is  
16    maxU RollingUpdate.  
17    type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22    spec:  
23      containers:  
24        - image: redis:4.11  
25        name: redis  
26
```



1



...



1



! deployment.yml

```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11  replicas: 3  
12  minReadySeconds: 300  
13  strategy:  
14    rollingUpdate:  
15      maxSurge: 1  
16      maxUnavailable: 0  
17    type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22    spec:  
23      containers:  
24        - image: redis:4.11  
25        name: redis  
26
```



pod



pod



pod

v4.0

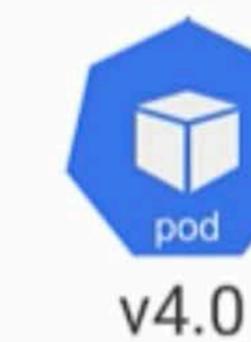
v4.0

v4.0

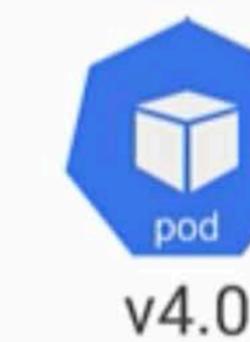


! deployment.yml

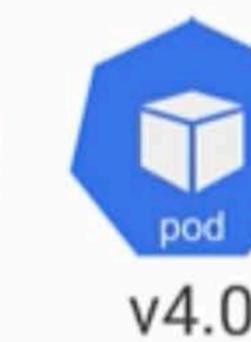
```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11  replicas: 3  
12  minReadySeconds: 300  
13  strategy:  
14    rollingUpdate:  
15      maxSurge: 1  
16      maxUnavailable: 0  
17    type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22    spec:  
23      containers:  
24        - image: redis:4.11  
25        name: redis  
26
```



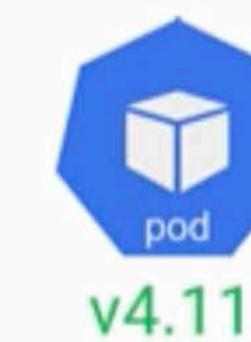
v4.0



v4.0



v4.0

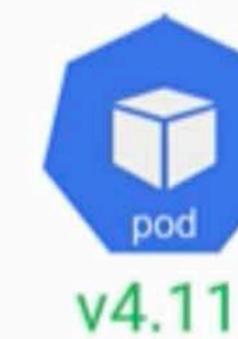


v4.11



! deployment.yml

```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11  replicas: 3  
12  minReadySeconds: 300  
13  strategy:  
14    rollingUpdate:  
15      maxSurge: 1  
16      maxUnavailable: 0  
17    type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22    spec:  
23      containers:  
24        - image: redis:4.11  
25        name: redis  
26
```



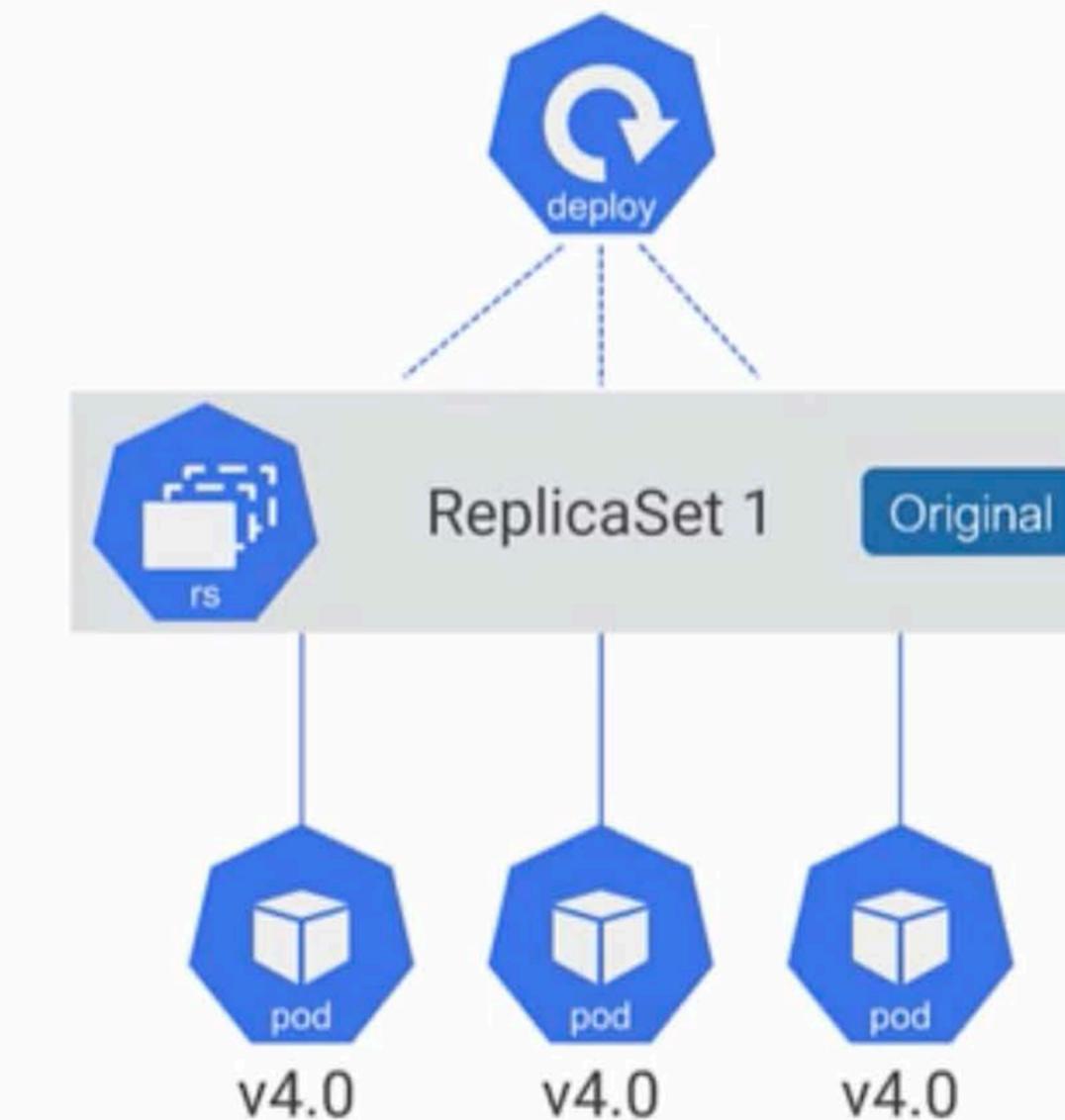
! deployment.yml

```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11  replicas: 3  
12  minReadySeconds: 300  
13  strategy:  
14    rollingUpdate:  
15      maxSurge: 1  
16      maxUnavailable: 0  
17    type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22  spec:  
23    containers:  
24      - image: redis:4.11  
25        name: redis  
26
```



! deployment.yml

```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11  replicas: 3  
12  minReadySeconds: 300  
13  strategy:  
14    rollingUpdate:  
15      maxSurge: 1  
16      maxUnavailable: 0  
17    type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22  spec:  
23    containers:  
24      - image: redis:4.11  
25        name: redis  
26
```



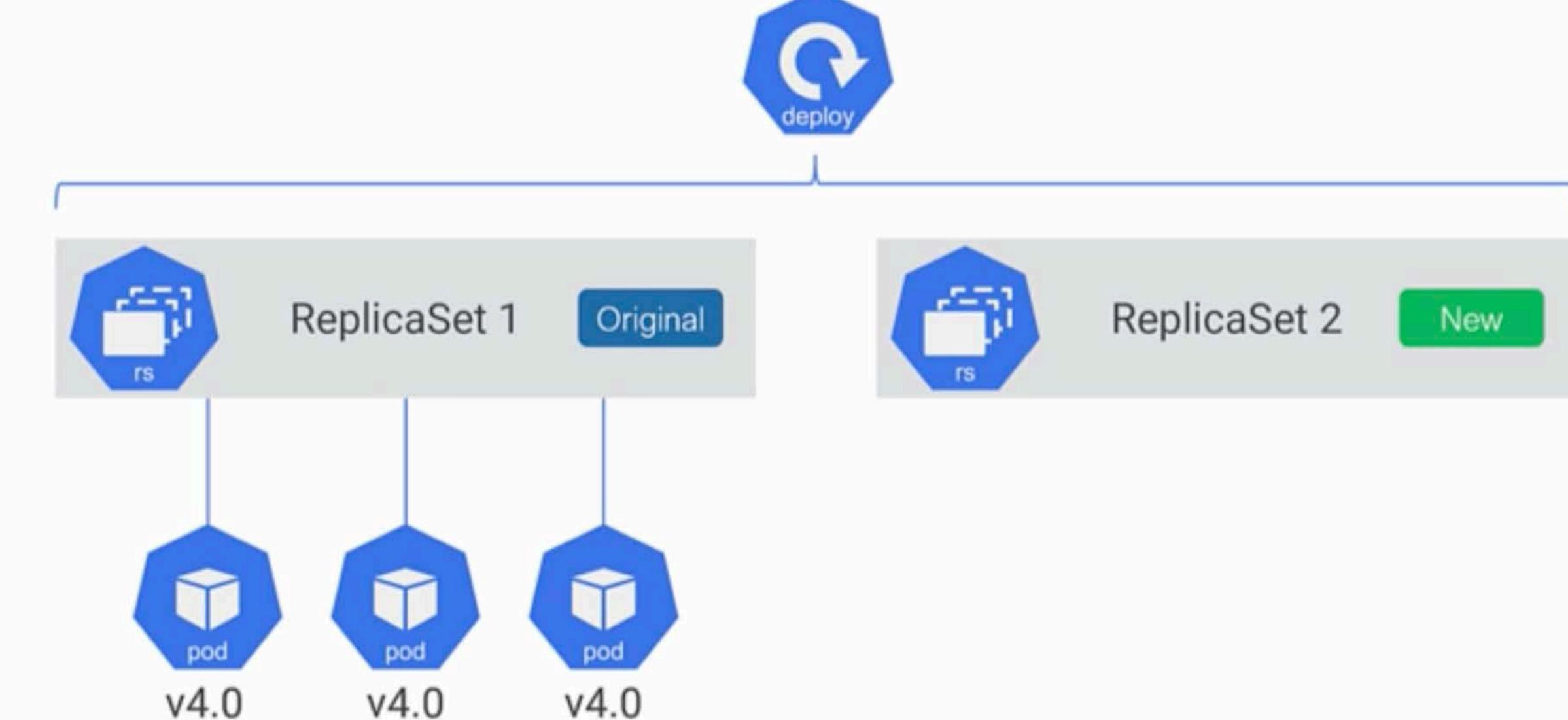
1



1

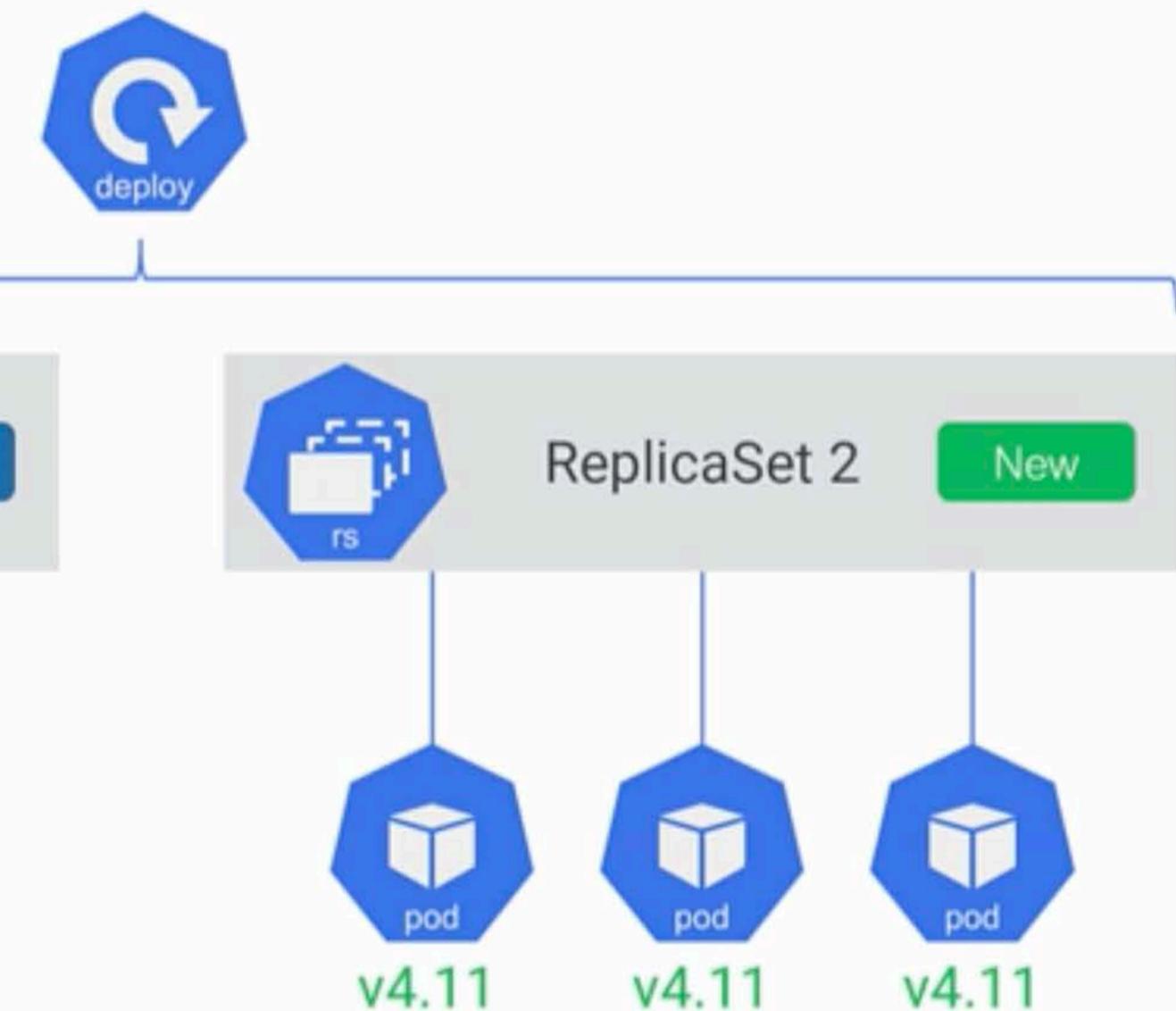
! deployment.yml

```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11  replicas: 3  
12  minReadySeconds: 300  
13  strategy:  
14    rollingUpdate:  
15      maxSurge: 1  
16      maxUnavailable: 0  
17    type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22  spec:  
23    containers:  
24      - image: redis:4.11  
25        name: redis  
26
```

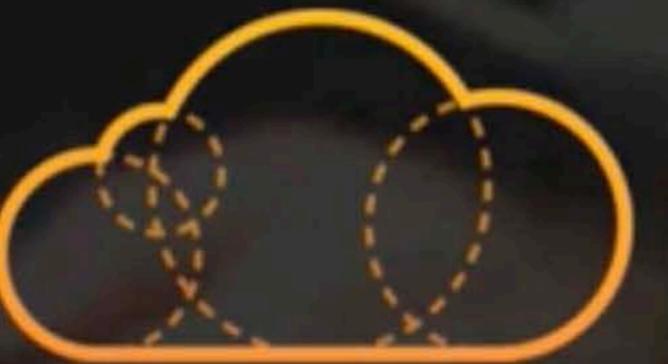


! deployment.yml

```
8   selector:  
9     matchLabels:  
10    run: prod-redis  
11  replicas: 3  
12  minReadySeconds: 300  
13  strategy:  
14    rollingUpdate:  
15      maxSurge: 1  
16      maxUnavailable: 0  
17    type: RollingUpdate  
18  template:  
19    metadata:  
20      labels:  
21        run: prod-redis  
22    spec:  
23      containers:  
24        - image: redis:4.11  
25        name: redis
```

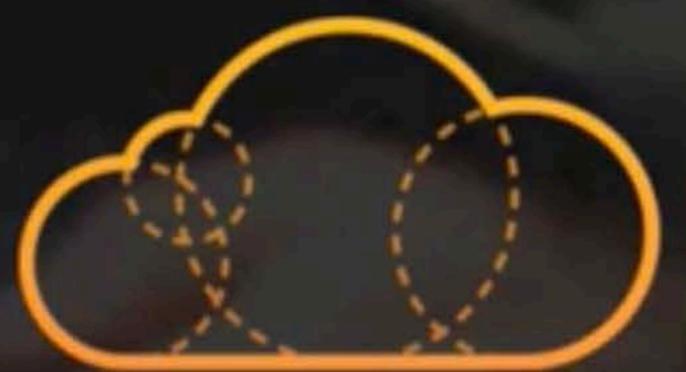


Demo Time!



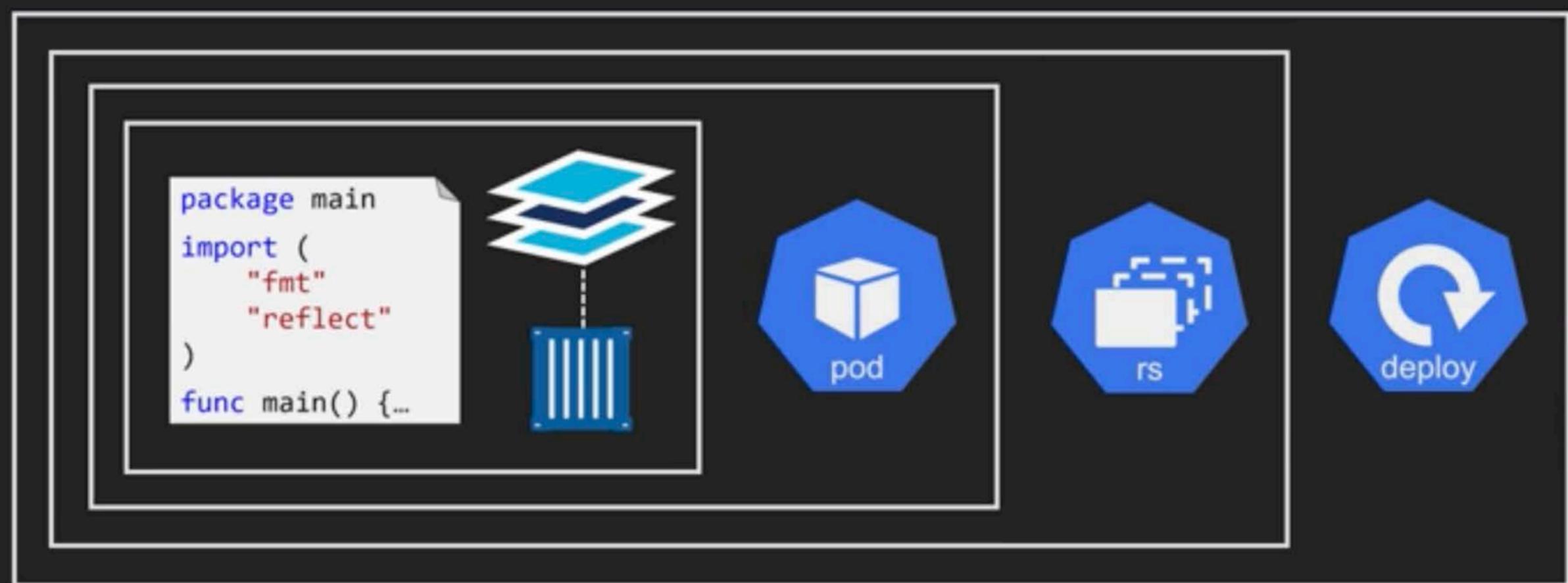
A CLOUD GURU

Recap

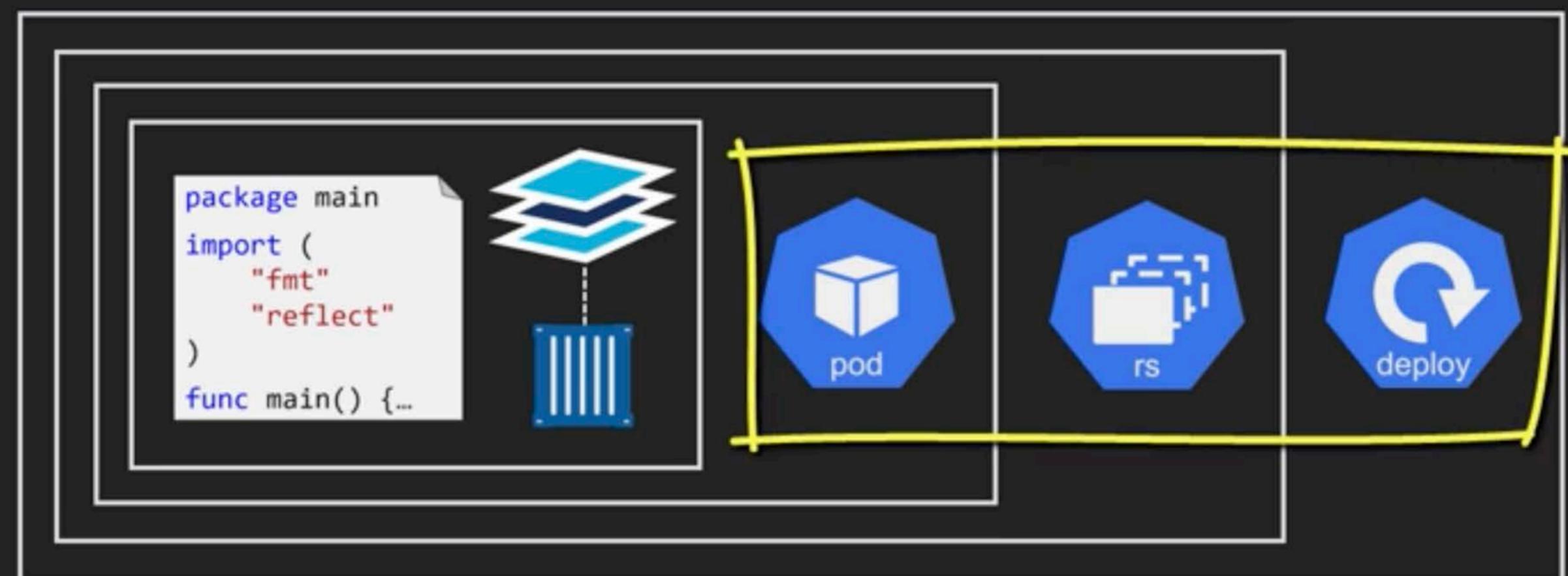


A CLOUD GURU

Recap

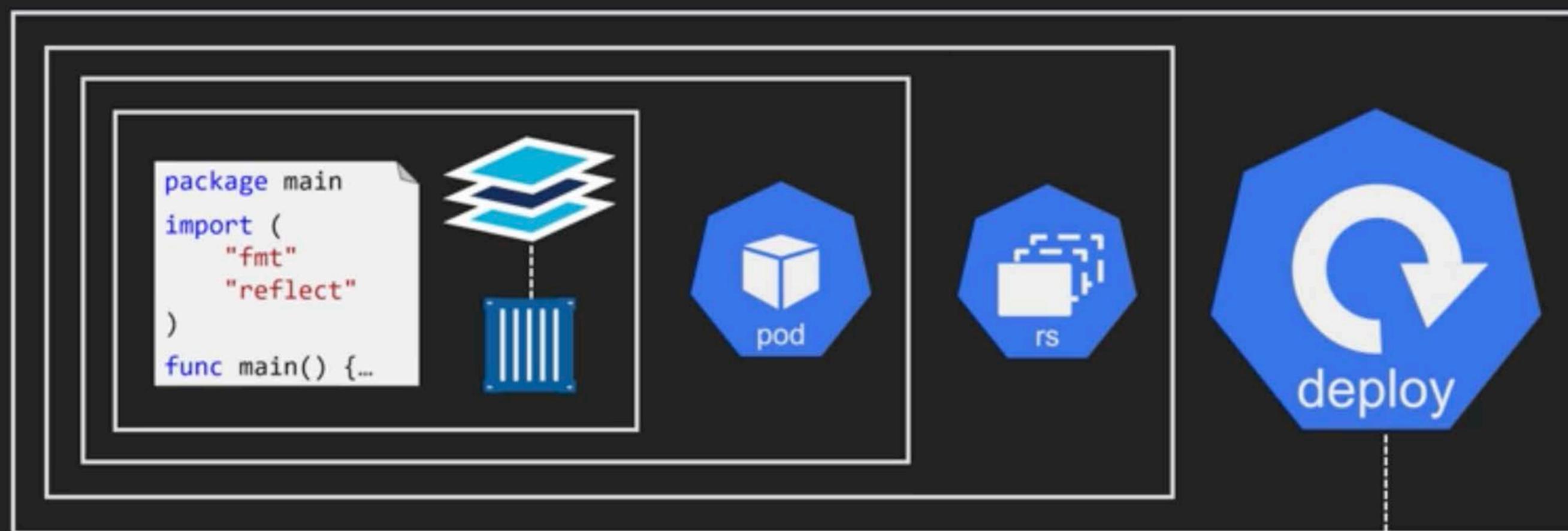


Recap



Kubernetes icons from
<https://github.com/octo-technology/kubernetes-icons>

Recap

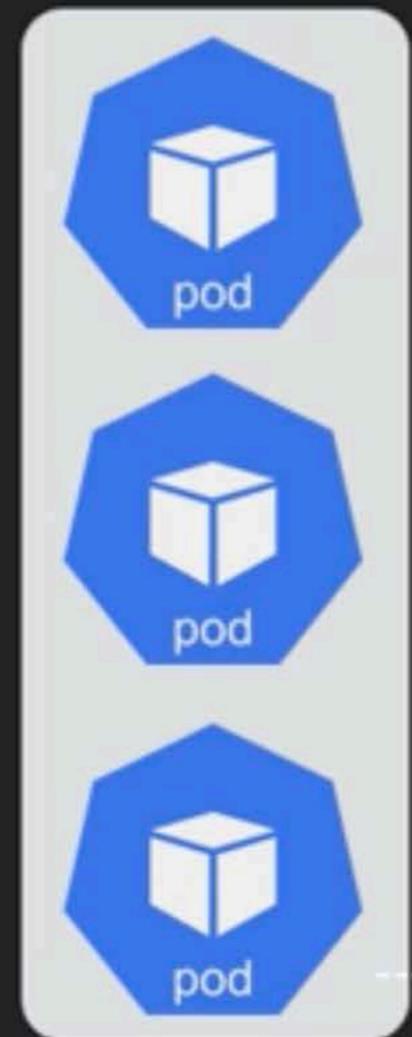


Manage via this

Recap



---- Label: **app=acg-transcode**



---- Label: **app=acg-web**

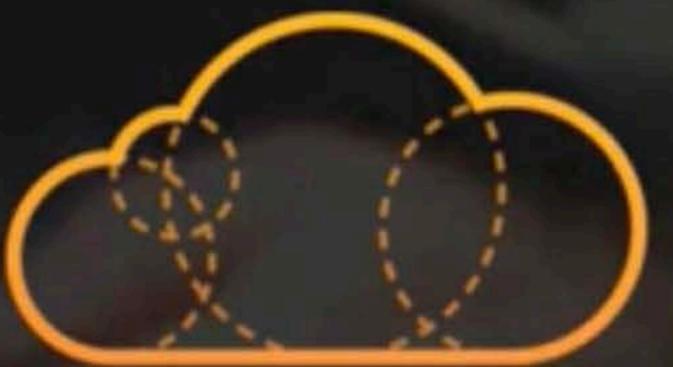


Label selector: **app=acg-web**



Declarative

Scaling Applications



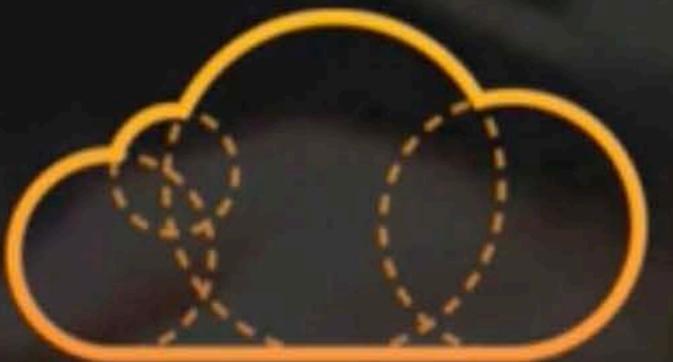
A CLOUD GURU

Lesson Plan



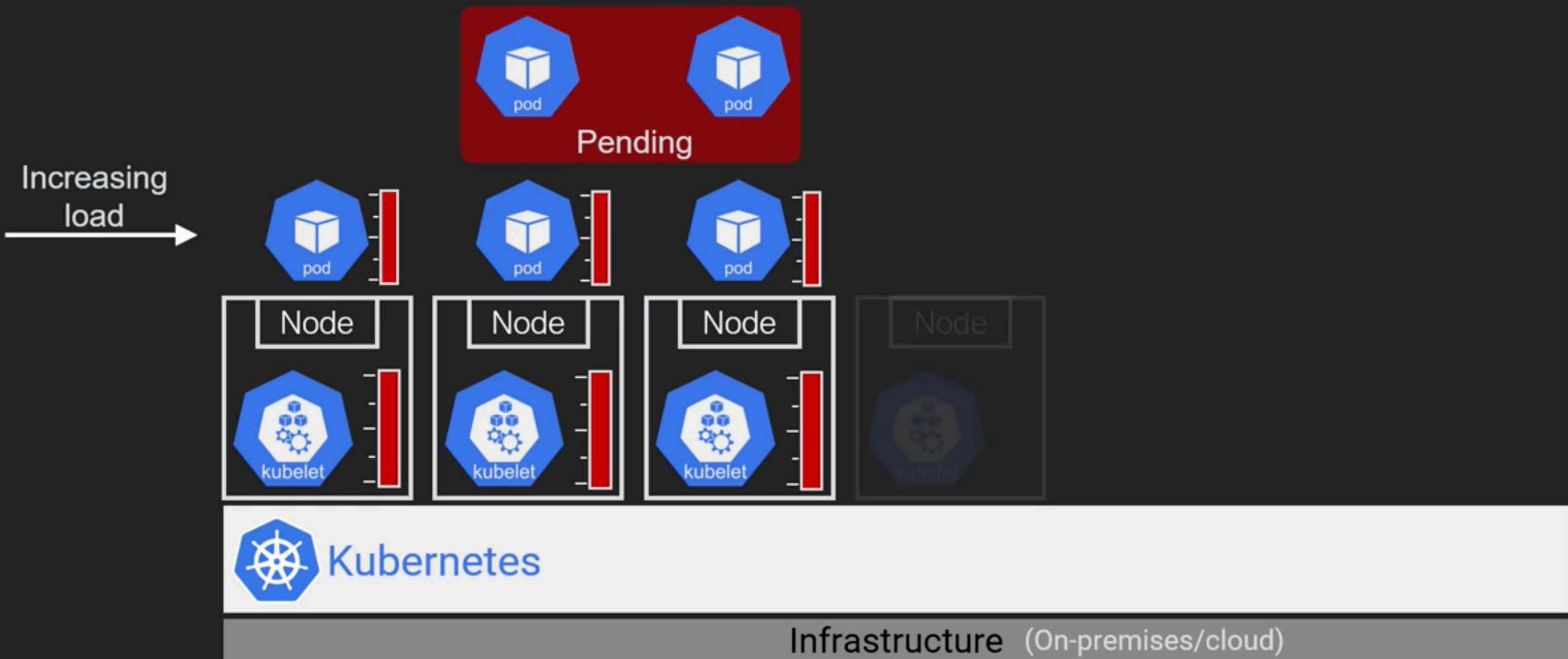
- Big Picture
- Horizontal Pod Autoscaler (HPA)
 - Theory
 - Demo
- Cluster Autoscaler(CA)
 - Theory
 - Demo
- Vertical Pod Autoscaler (VPA)
- Recap

Big Picture



A CLOUD GURU

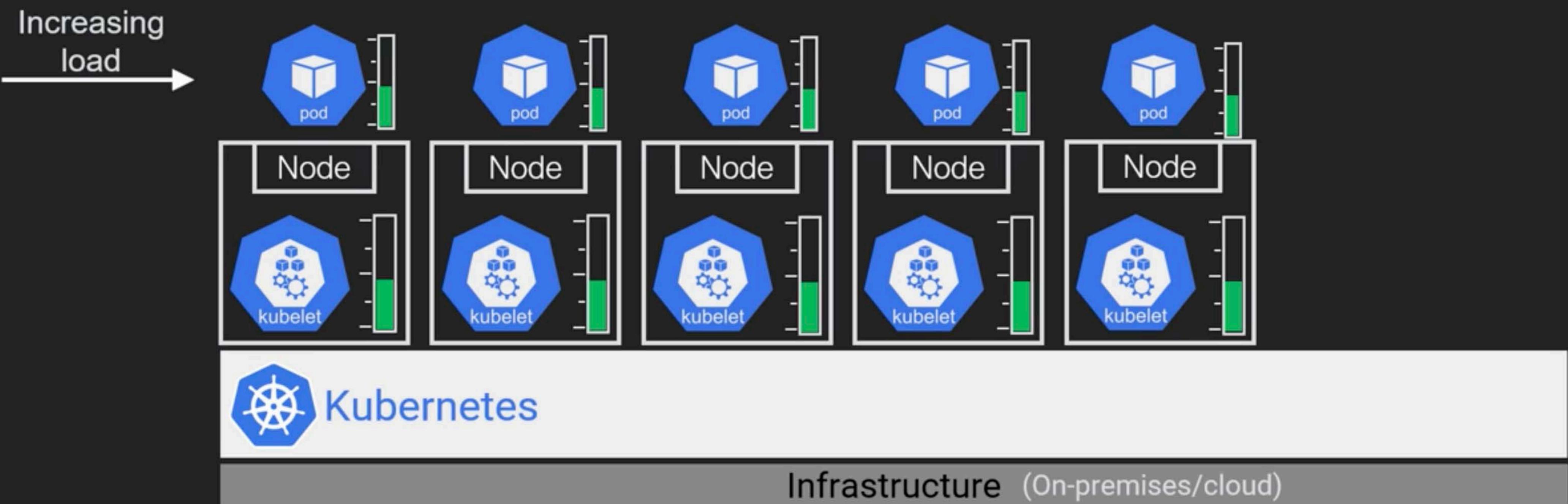
Big Picture



autoscaling/v1 only supports CPU metric

autoscaling/v2xx adds support for memory and custom metrics

Big Picture



autoscaling/v1 only supports CPU metric

autoscaling/v2xx adds support for memory and custom metrics

Big Picture



```
apiVersion: apps/v1
kind: Deployment
metadata:
  labels:
    run: prod-redis
  name: prod-redis
spec:
  selector:
    matchLabels:
      run: prod-redis
  replicas: 3
  minReadySeconds: 300
```

Big Picture



```
apiVersion: apps/v1
kind: Deployment
metadata:
  labels:
    run: prod-redis
  name: prod-redis
spec:
  selector:
    matchLabels:
      run: prod-redis
  replicas: 5
  minReadySeconds: 300
```

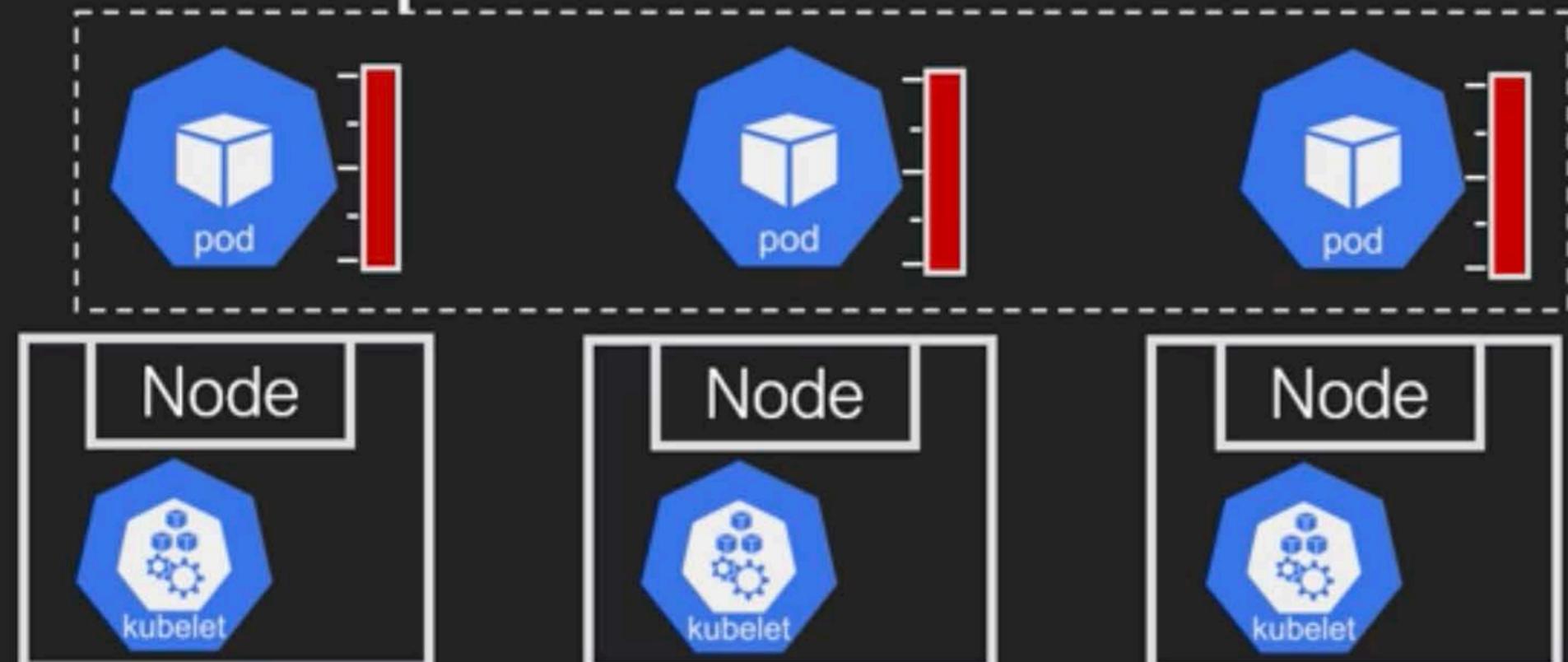
Big Picture



```
apiVersion: apps/v1
kind: Deployment
...
spec:
  replicas: 4
  ...
```

Scale to 4

```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
...
spec:
  scaleTargetRef:
    name: my-deployment
  ...
```



Infrastructure (On-premises/cloud)

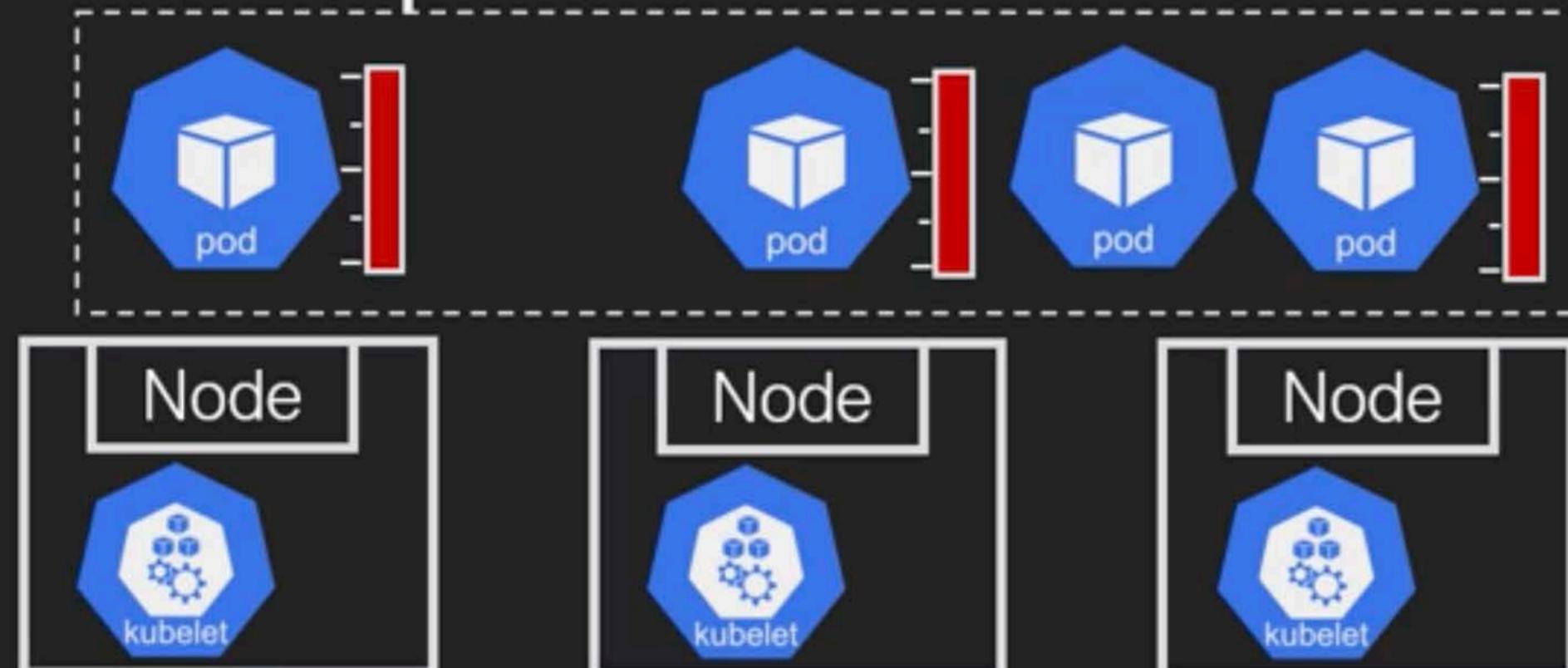
Big Picture



```
apiVersion: apps/v1
kind: Deployment
...
spec:
  replicas: 4
  ...
```

Scale to 4

```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
...
spec:
  scaleTargetRef:
    name: my-deployment
  ...
```



Infrastructure (On-premises/cloud)

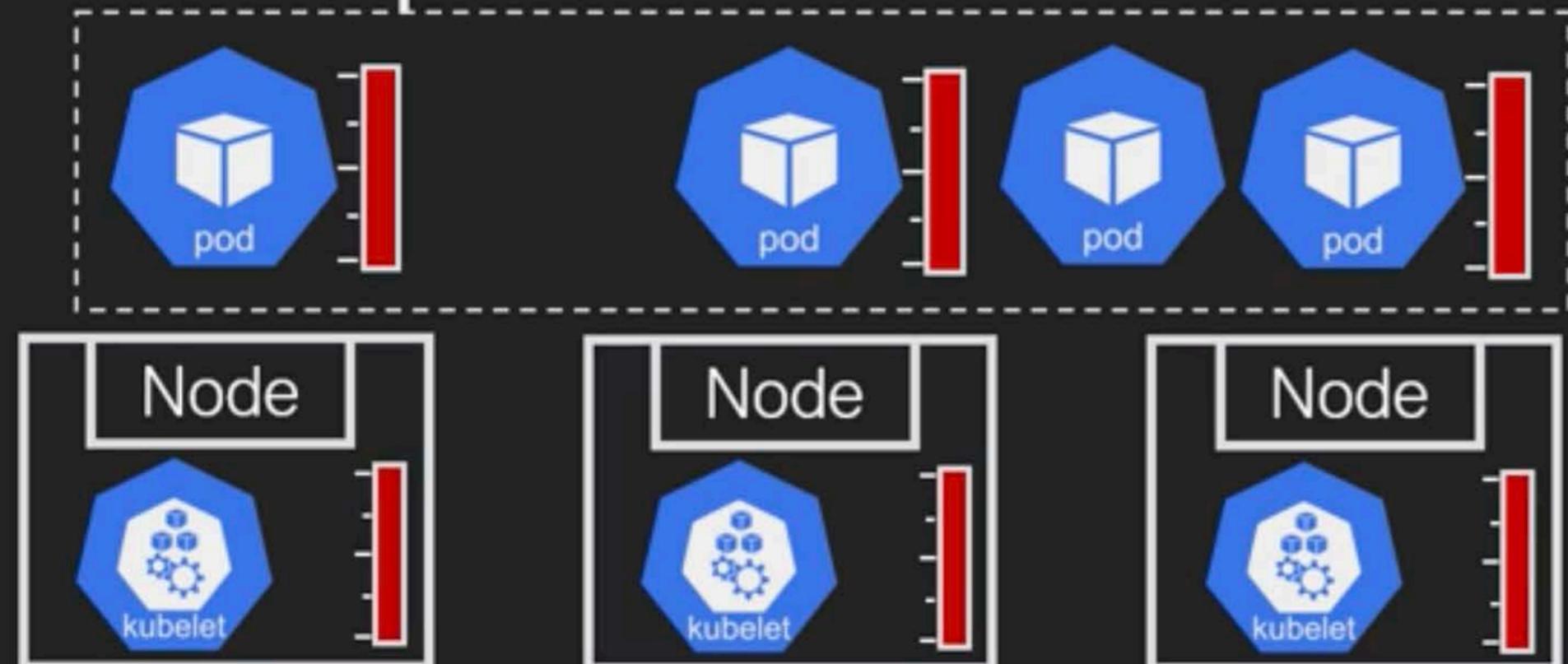
Big Picture



```
apiVersion: apps/v1
kind: Deployment
...
spec:
  replicas: 4
  ...
```

Scale to 4

```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
...
spec:
  scaleTargetRef:
    name: my-deployment
  ...
```



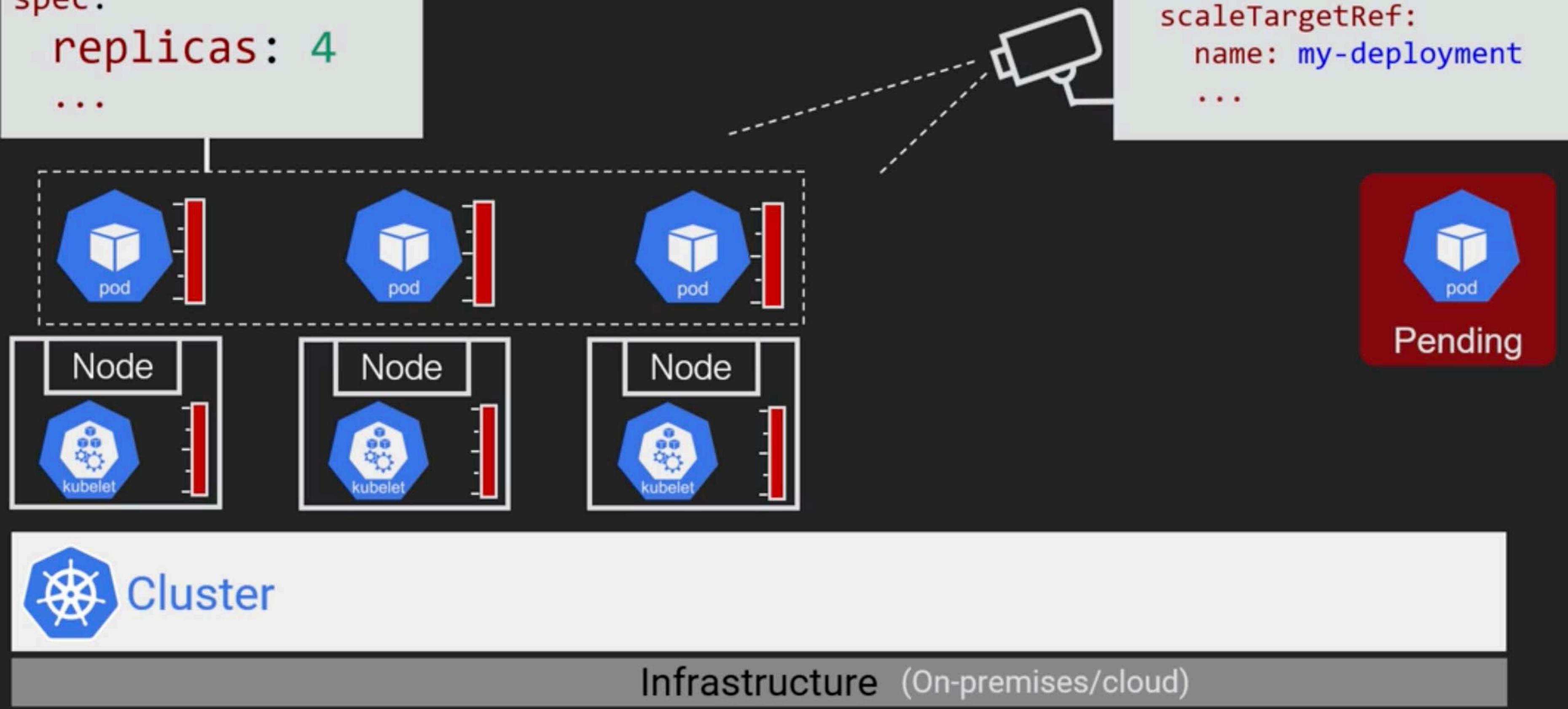
Infrastructure (On-premises/cloud)

Big Picture



```
apiVersion: apps/v1  
kind: Deployment  
...  
spec:  
replicas: 4  
...
```

```
apiVersion: autoscaling/v1  
kind: HorizontalPodAutoscaler  
...  
spec:  
scaleTargetRef:  
  name: my-deployment  
...
```

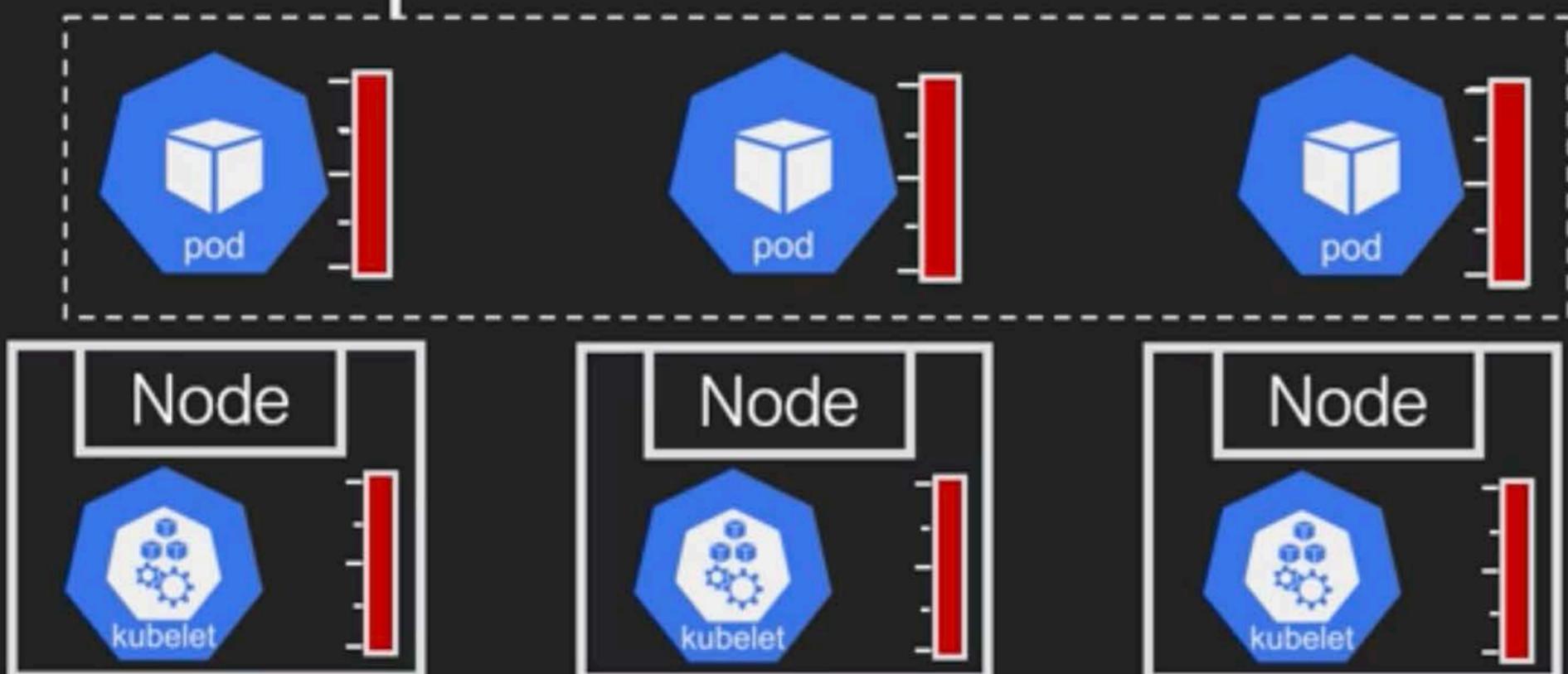


Big Picture



```
apiVersion: apps/v1  
kind: Deployment  
...  
spec:  
replicas: 4  
...
```

```
apiVersion: autoscaling/v1  
kind: HorizontalPodAutoscaler  
...  
spec:  
  scaleTargetRef:  
    name: my-deployment  
    ...
```



Cluster
Autoscaler



Infrastructure (On-premises/cloud)

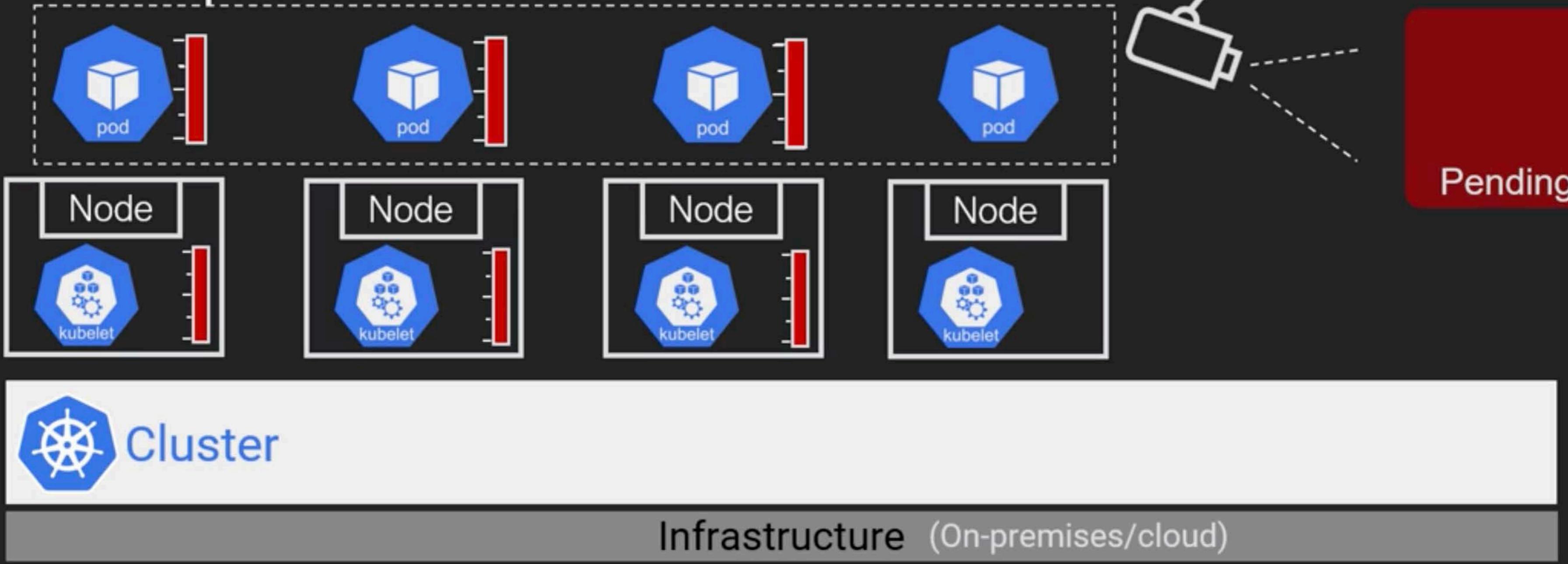
Big Picture



```
apiVersion: apps/v1  
kind: Deployment  
...  
spec:  
replicas: 4  
...
```

```
apiVersion: autoscaling/v1  
kind: HorizontalPodAutoscaler  
...  
spec:  
scaleTargetRef:  
  name: my-deployment  
  ...
```

Cluster
Autoscaler



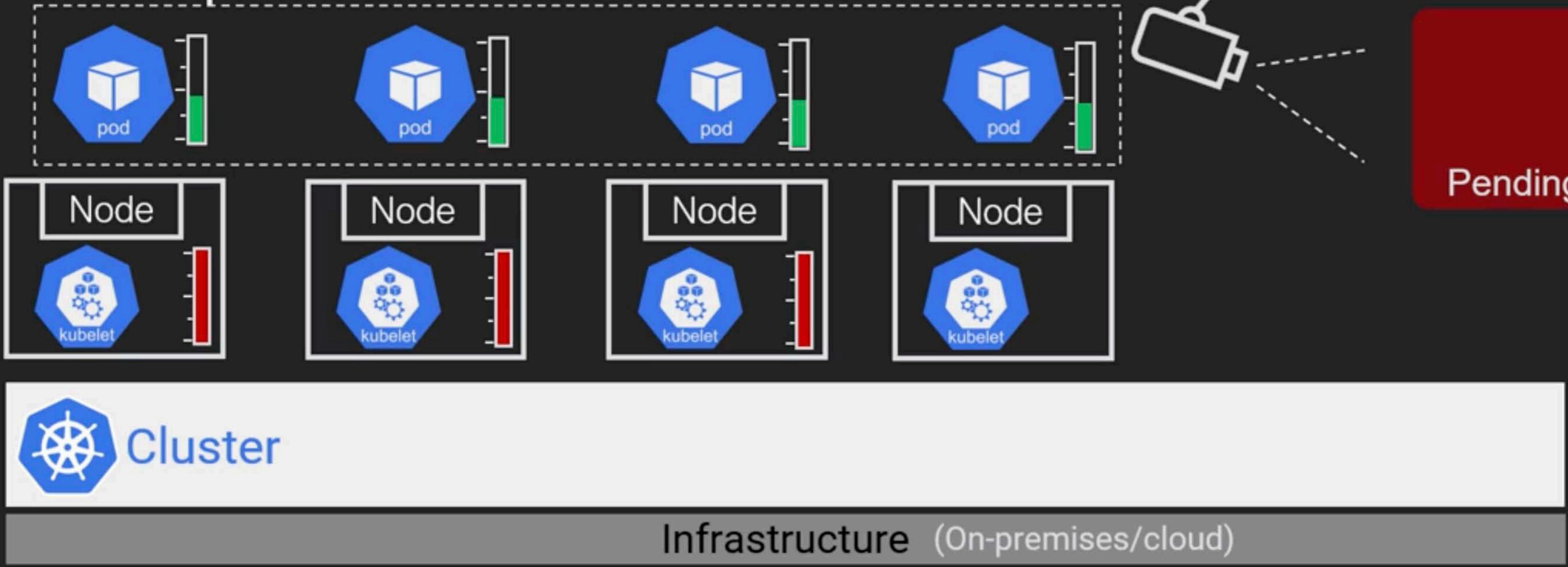
Big Picture



```
apiVersion: apps/v1  
kind: Deployment  
...  
spec:  
replicas: 4  
...
```

```
apiVersion: autoscaling/v1  
kind: HorizontalPodAutoscaler  
...  
spec:  
scaleTargetRef:  
  name: my-deployment  
  ...
```

Cluster
Autoscaler





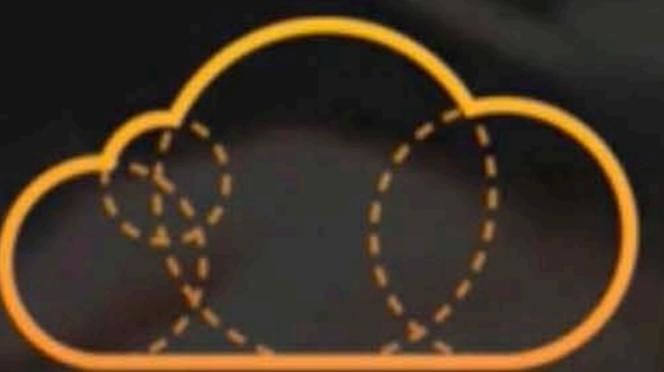
Vertical Pod Autoscaler (VPA)



Alpha product



Horizontal Pod Autoscaler Theory



A CLOUD GURU

Horizontal Pod Autoscaler - Theory



Horizontal Pod Autoscaler

Horizontal Pod Autoscaler - Theory



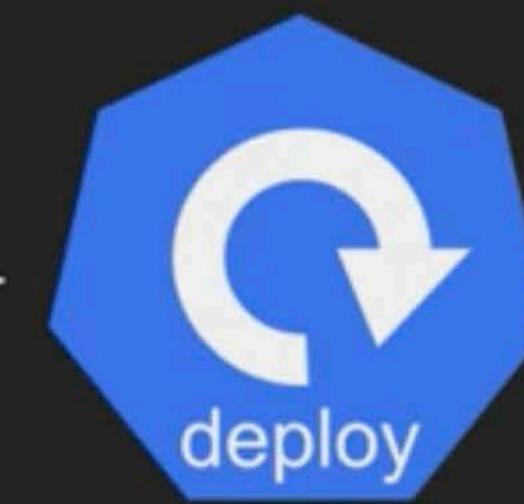
Horizontal Pod Autoscaler

Horizontal Pod Autoscaler - Theory



Horizontal Pod Autoscaler

Horizontal Pod Autoscaler - Theory

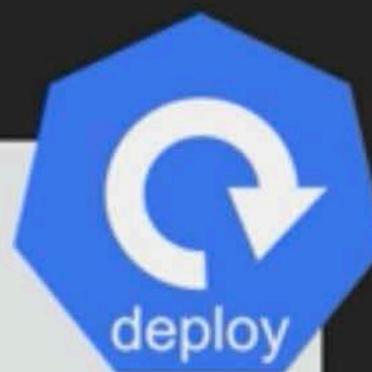


Horizontal Pod Autoscaler - Theory



```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: acg-test
  namespace: acg
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: acg-deploy
  minReplicas: 1
  maxReplicas: 10
  targetCPUUtilizationPercentage: 50
```

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: acg-deploy
spec:
  replicas: 2
  ...
  spec:
    containers:
    - image: nginx:1.12
      name: nginx
    resources:
      limits:
        cpu: 1
      requests:
        cpu: 0.2
```



Horizontal Pod Autoscaler - Theory



```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: acg-test
  namespace: acg
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: acg-deploy
  minReplicas: 1
  maxReplicas: 10
  targetCPUUtilizationPercentage: 50
```

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: acg-deploy
spec:
  replicas: 2
  ...
  spec:
    containers:
    - image: nginx:1.12
      name: nginx
    resources:
      limits:
        cpu: 1
      requests:
        cpu: 0.2
```



Horizontal Pod Autoscaler - Theory



```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: acg-test
  namespace: acg
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: acg-deploy
  minReplicas: 1
  maxReplicas: 10
  targetCPUUtilizationPercentage: 50
```



```
1000m = 1CPU
1 = 1CPU

500m = %CPU
0.5 = %CPU

250m = %CPU
0.25 = %CPU
```

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: acg-deploy
spec:
  replicas: 2
  ...
  spec:
    containers:
    - image: nginx:1.12
      name: nginx
    resources:
      limits:
        cpu: 1
      requests:
        cpu: 0.2 "200m"
```



Horizontal Pod Autoscaler - Theory



```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: acg-test
  namespace: acg
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: acg-deploy
  minReplicas: 1
  maxReplicas: 10
  targetCPUUtilizationPercentage: 50
```



```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: acg-deploy
spec:
  replicas: 2
  ...
  spec:
    containers:
      - image: nginx:1.12
        name: nginx
    resources:
      limits:
        cpu: 1
      requests:
        cpu: 0.2
```



Horizontal Pod Autoscaler - Theory



```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: acg-test
  namespace: acg
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: acg-deploy
  minReplicas: 1
  maxReplicas: 10
  targetCPUUtilizationPercentage: 50
```



50% of 20% of a CPU is 10% of a CPU :-D

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: acg-deploy
spec:
  replicas: 2
  ...
  spec:
    containers:
      - image: nginx:1.12
        name: nginx
    resources:
      limits:
        cpu: 1
      requests:
        cpu: 0.2
```



Horizontal Pod Autoscaler - Theory



```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: acg-test
  namespace: acg
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: acg-deploy
  minReplicas: 1
  maxReplicas: 10
  targetCPUUtilizationPercentage: 50
```



```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: acg-deploy
spec:
  replicas: 2
  ...
  spec:
    containers:
      - image: nginx:1.12
        name: nginx
    resources:
      limits:
        cpu: 1
      requests:
        cpu: 0.2
```



The autoscaling/v2 API will bring custom metrics etc.

Horizontal Pod Autoscaler - Theory



```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: acg-test
  namespace: acg
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: acg-deploy
  minReplicas: 1
  maxReplicas: 10
  targetCPUUtilizationPercentage: 50
```

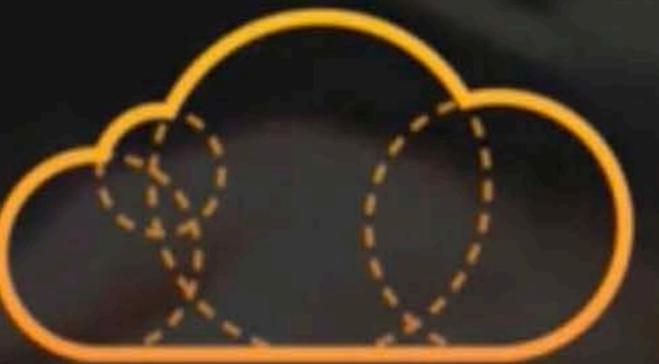


```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: acg-deploy
spec:
  replicas: 10
  ...
  spec:
    containers:
      - image: nginx:1.12
        name: nginx
    resources:
      limits:
        cpu: 1
      requests:
        cpu: 0.2
```



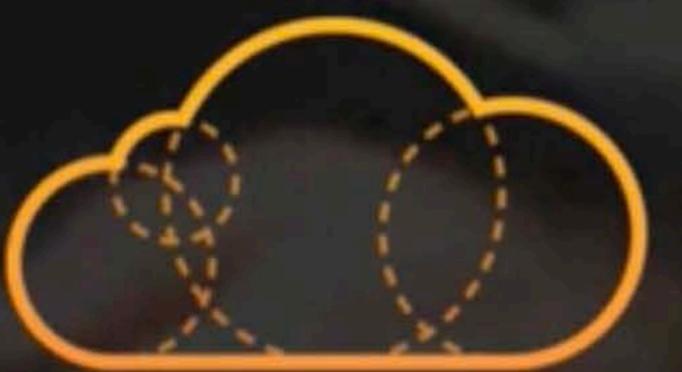
The autoscaling/v2 API will bring custom metrics etc.

Horizontal Pod Autoscaler Demo



A CLOUD GURU

Cluster Autoscaler Theory



A CLOUD GURU

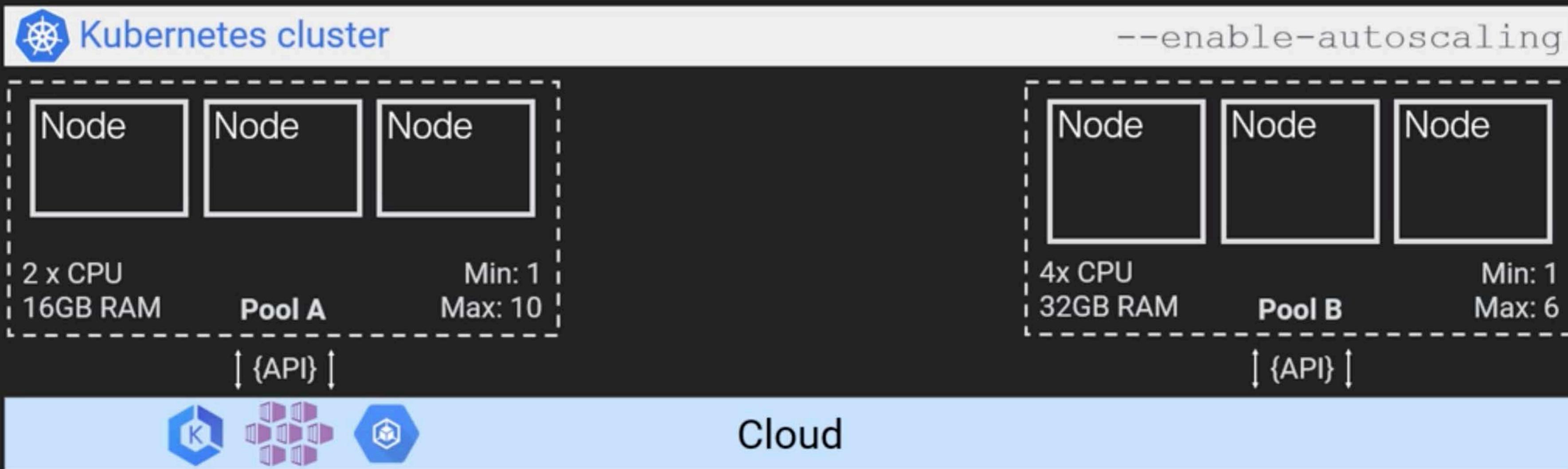
Cluster Autoscaler - Theory



```
apiVersion: apps/v1
kind: Deployment
spec:
...
  spec:
    resources:
      requests:
        cpu: 1
```



Always use
Pod Resource Requests

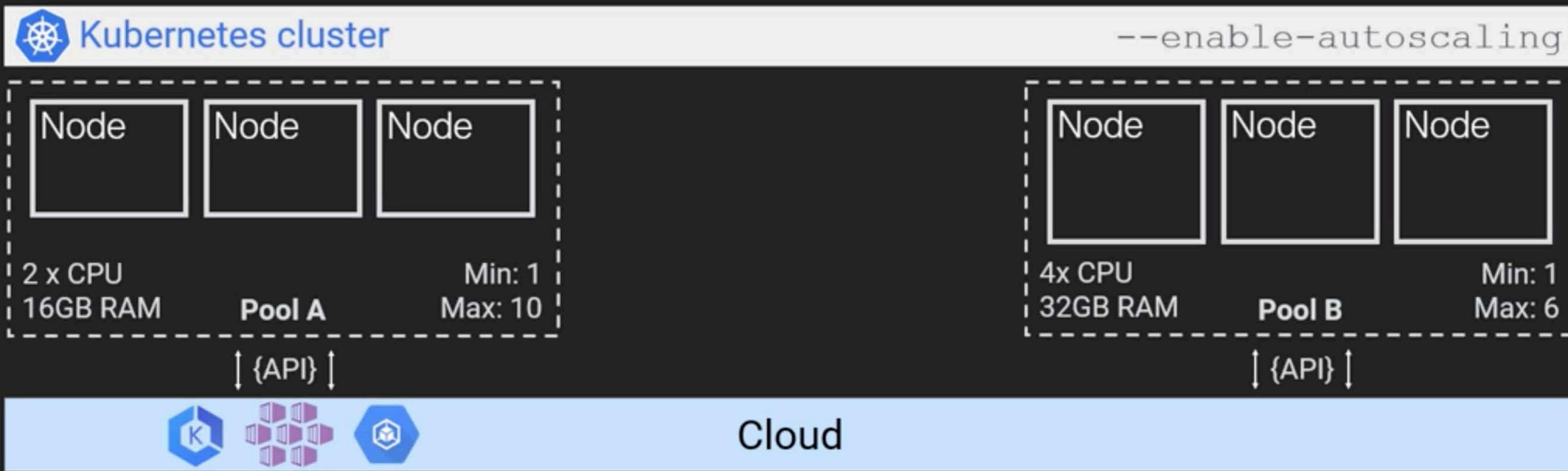
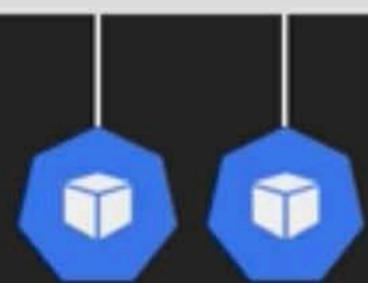


Cluster Autoscaler - Theory



A CLOUD GURU

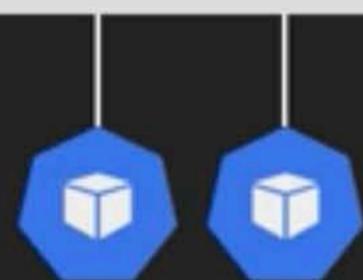
```
apiVersion: apps/v1
kind: Deployment
spec:
...
  spec:
    resources:
      requests:
        cpu: 1
```



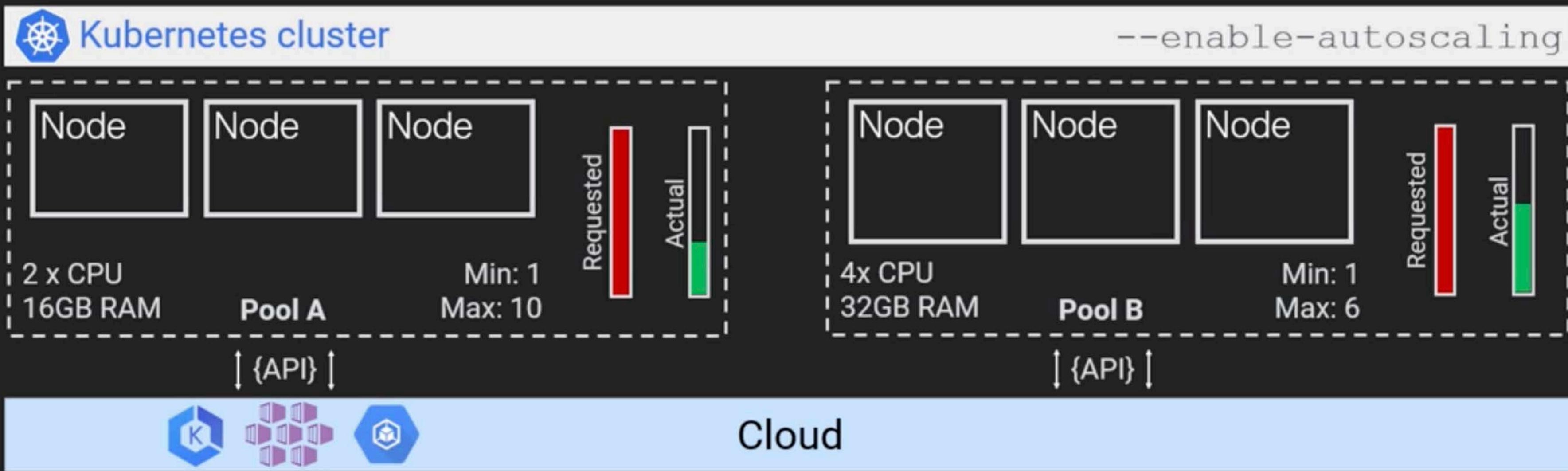
Cluster Autoscaler - Theory



```
apiVersion: apps/v1
kind: Deployment
spec:
...
  spec:
    resources:
      requests:
        cpu: 1
```



Pending

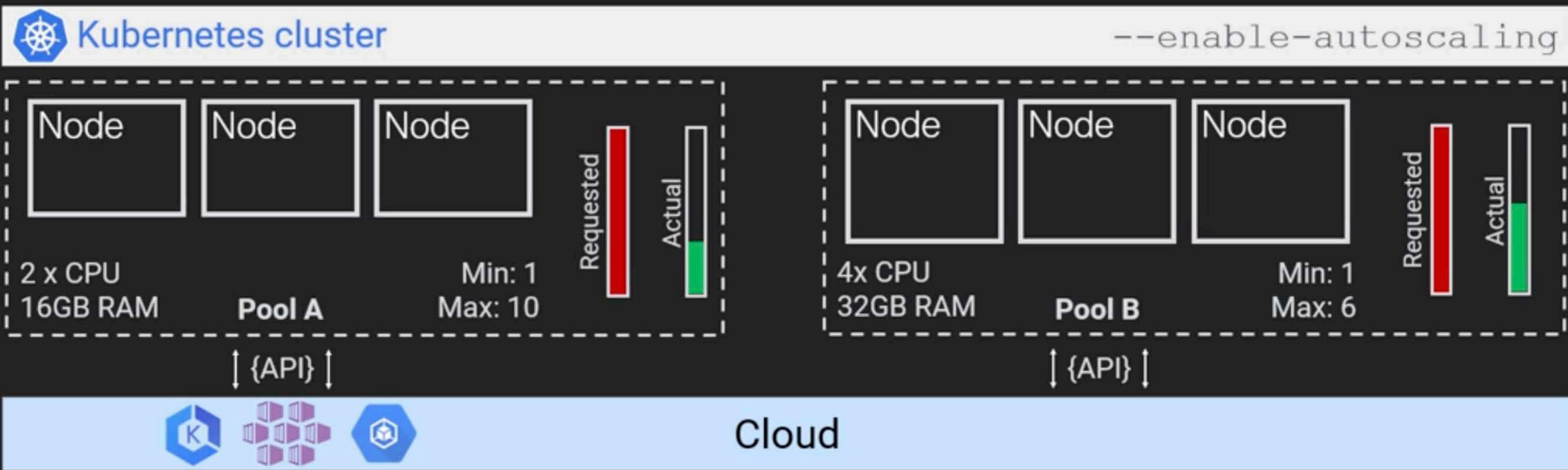
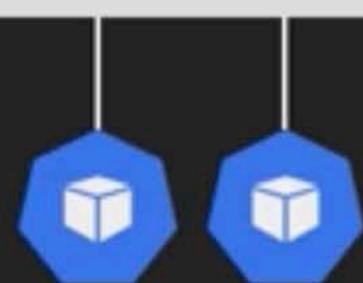


Cluster Autoscaler - Theory



A CLOUD GURU

```
apiVersion: apps/v1
kind: Deployment
spec:
...
  spec:
    resources:
      requests:
        cpu: 1
```



Cluster Autoscaler - Theory



Cluster Autoscaler

Works on requested values

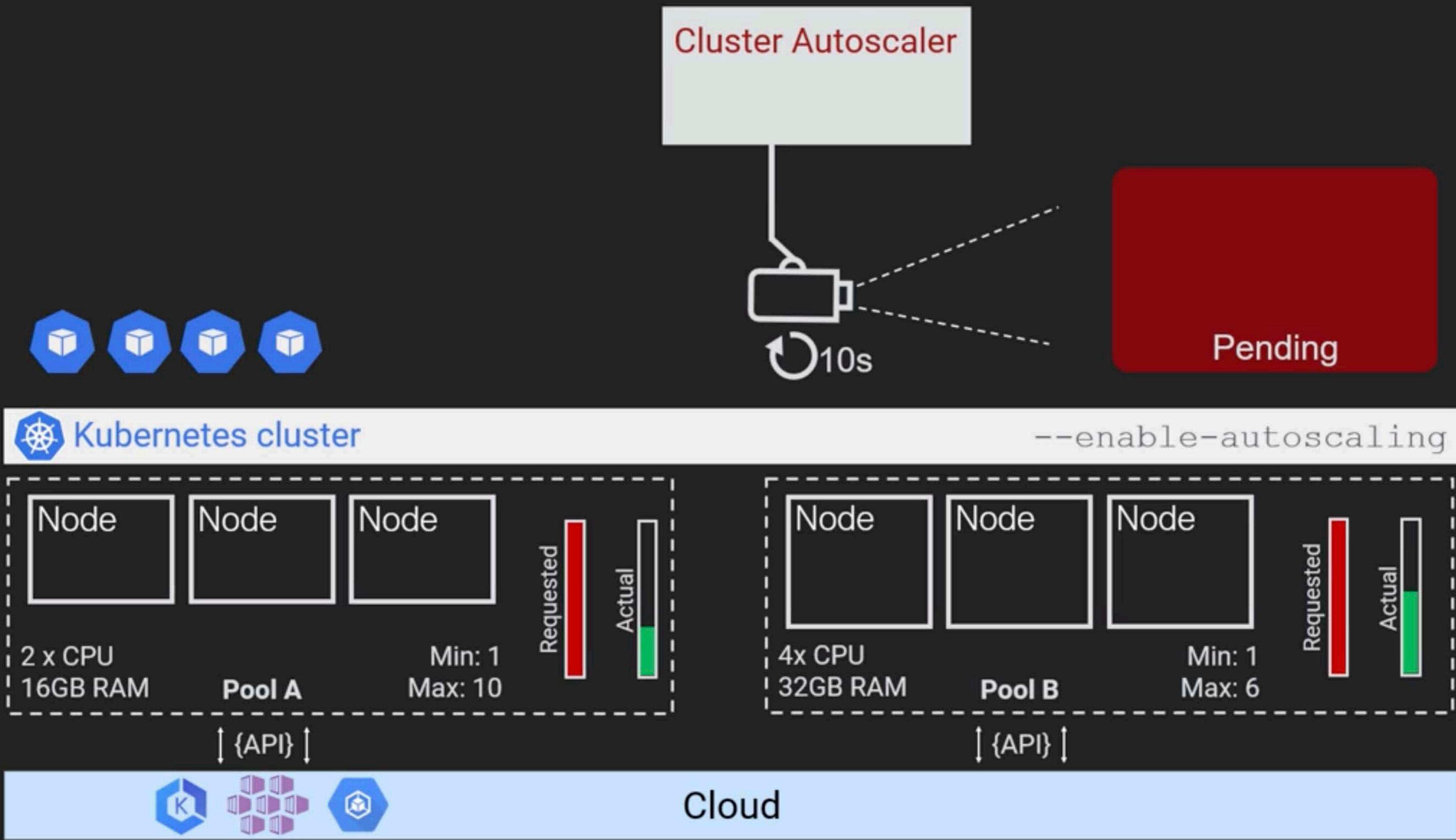
Horizontal Pod Autoscaler

Works on actual values

Cluster Autoscaler - Theory



A CLOUD GURU



Cluster Autoscaler - Theory

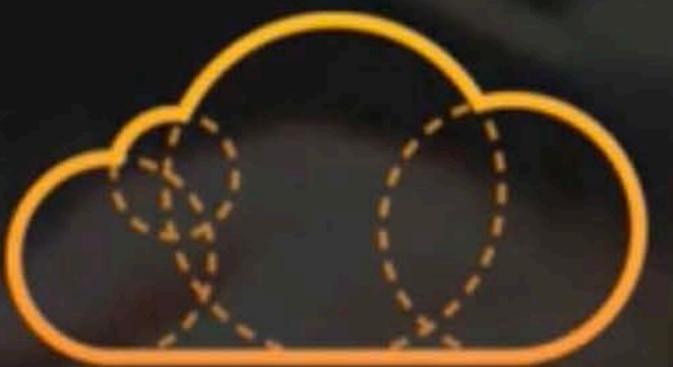


Don't mess with the node pools

Check your cloud for support

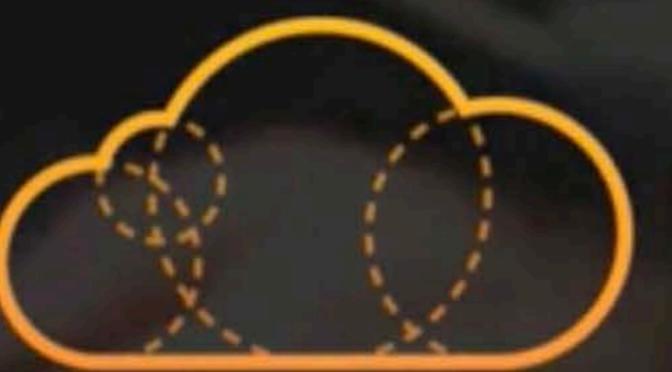
Test performance on big clusters

Cluster Autoscaler Demo



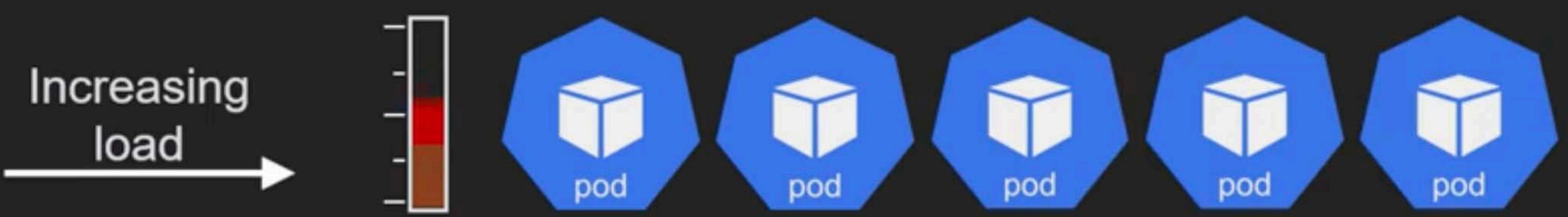
A CLOUD GURU

Recap



A CLOUD GURU

Recap



 Kubernetes cluster

--enable-autoscaling

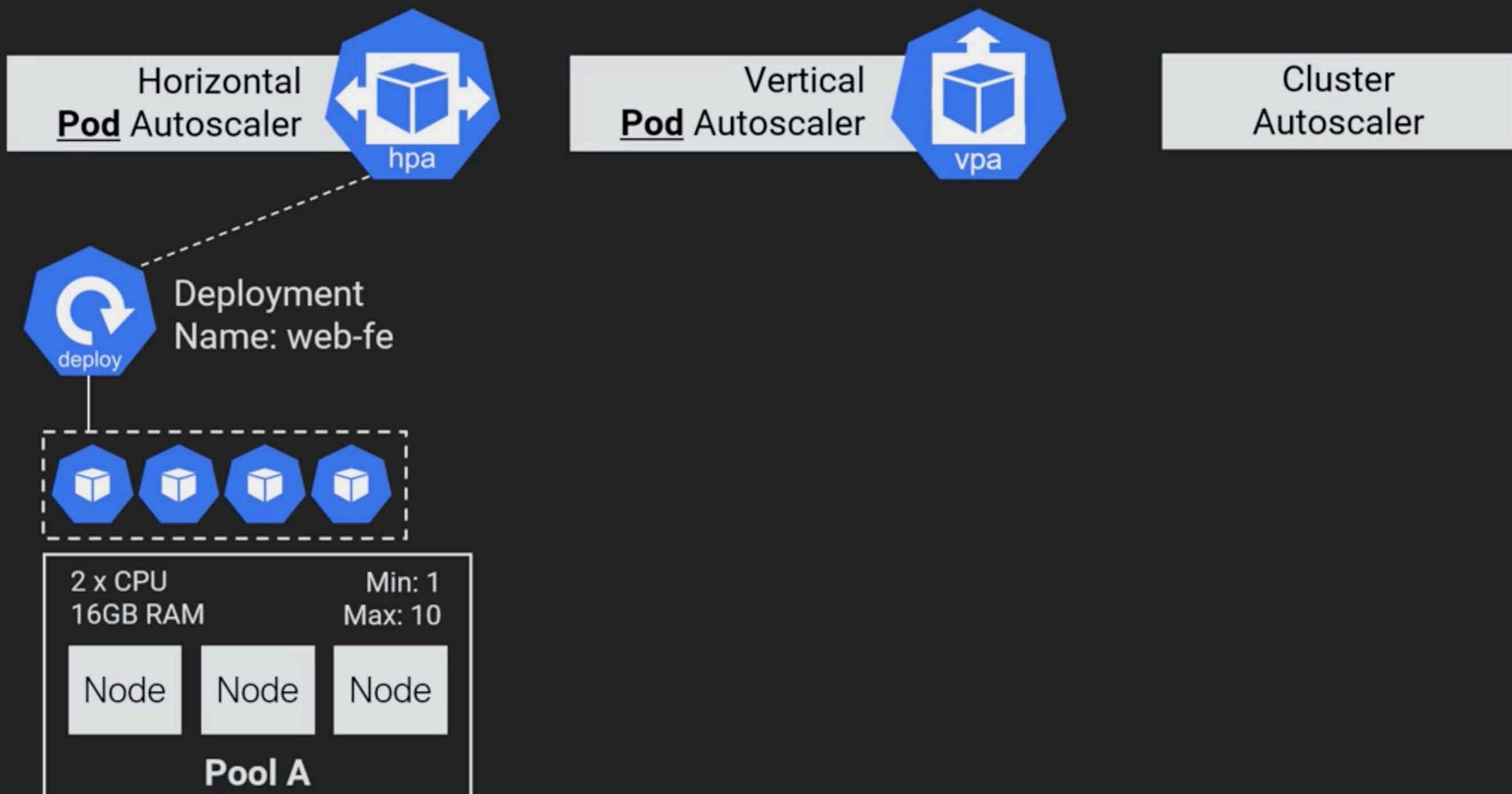
Recap



 Kubernetes cluster

--enable-autoscaling

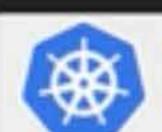
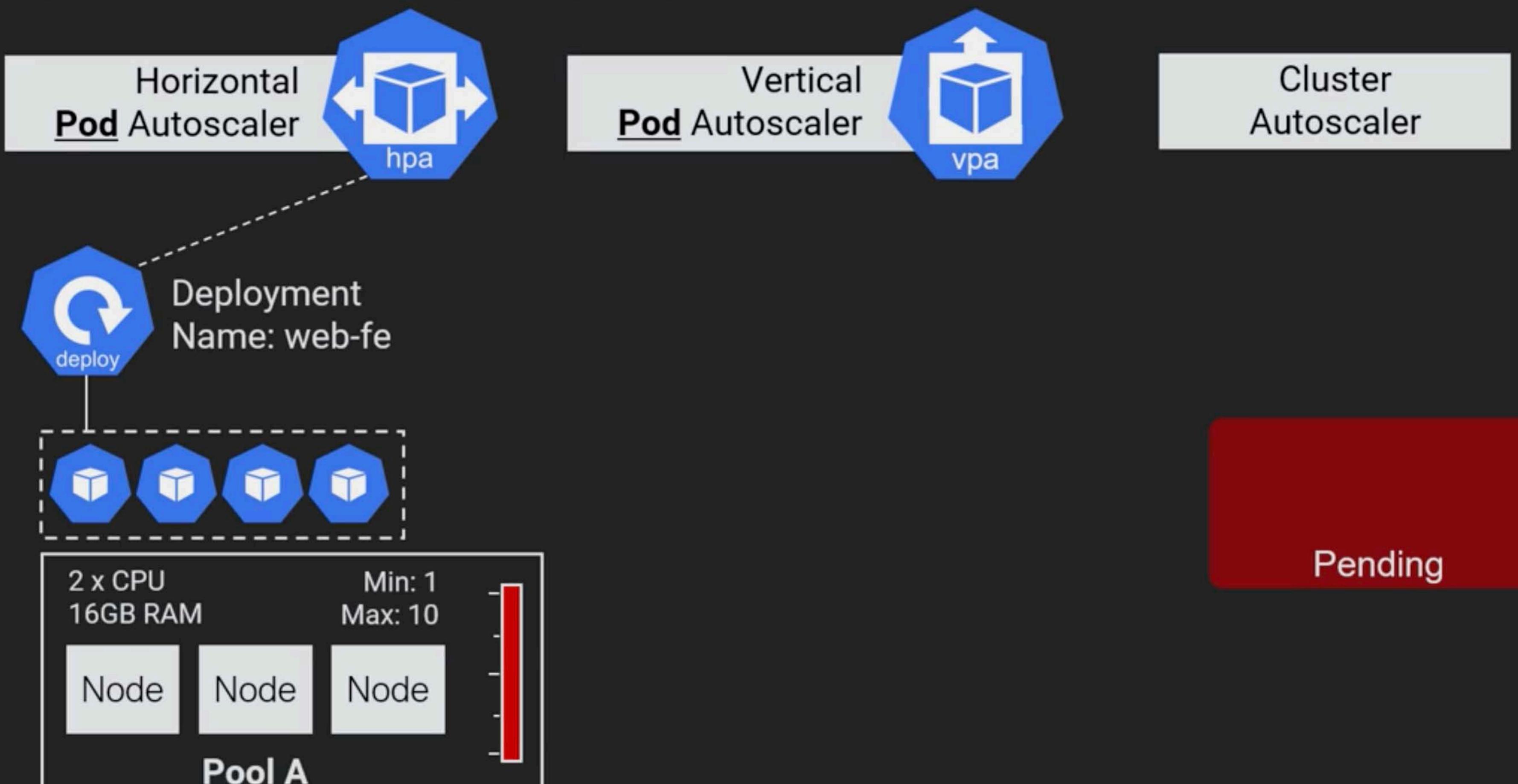
Recap



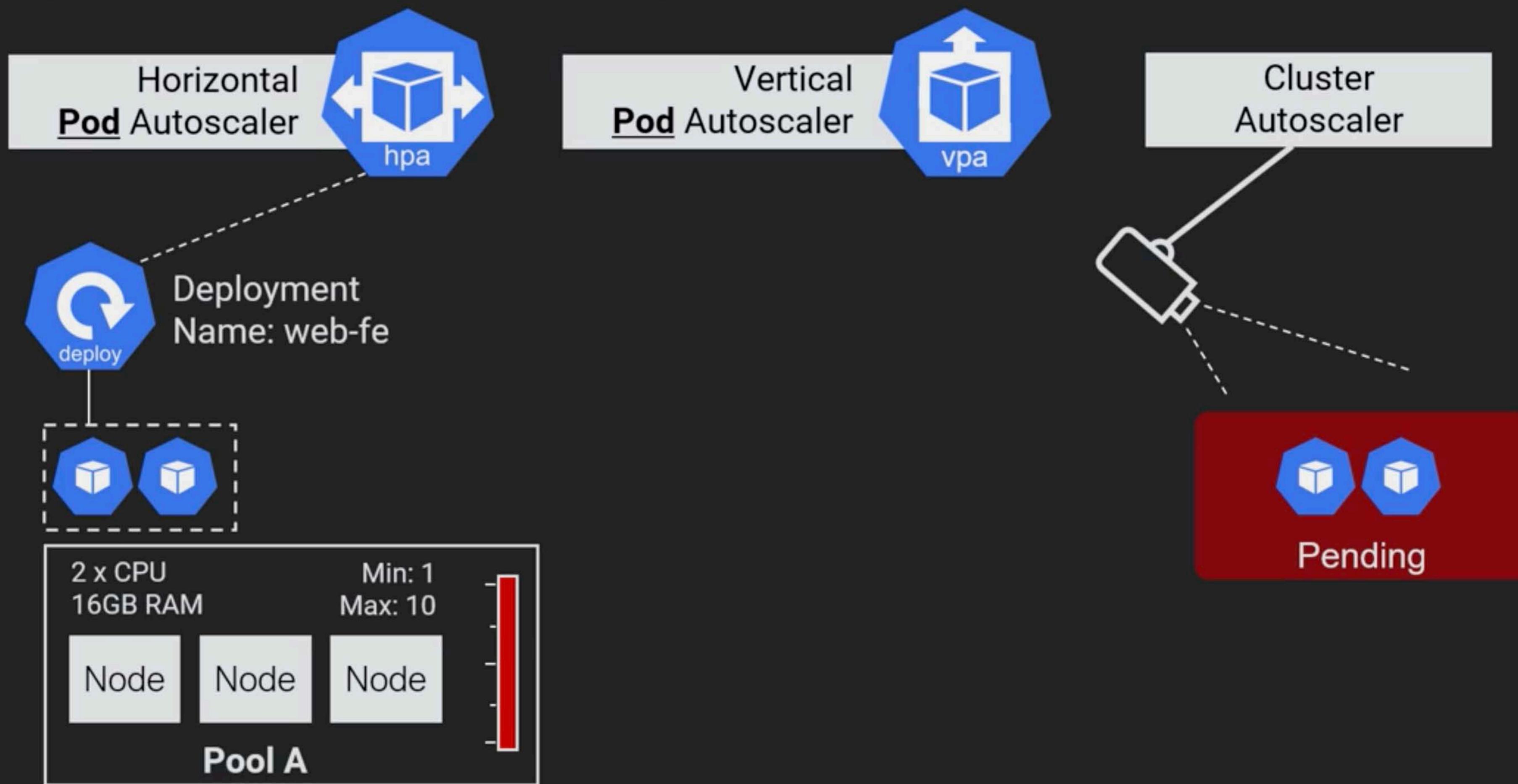
Kubernetes cluster

--enable-autoscaling

Recap



Recap

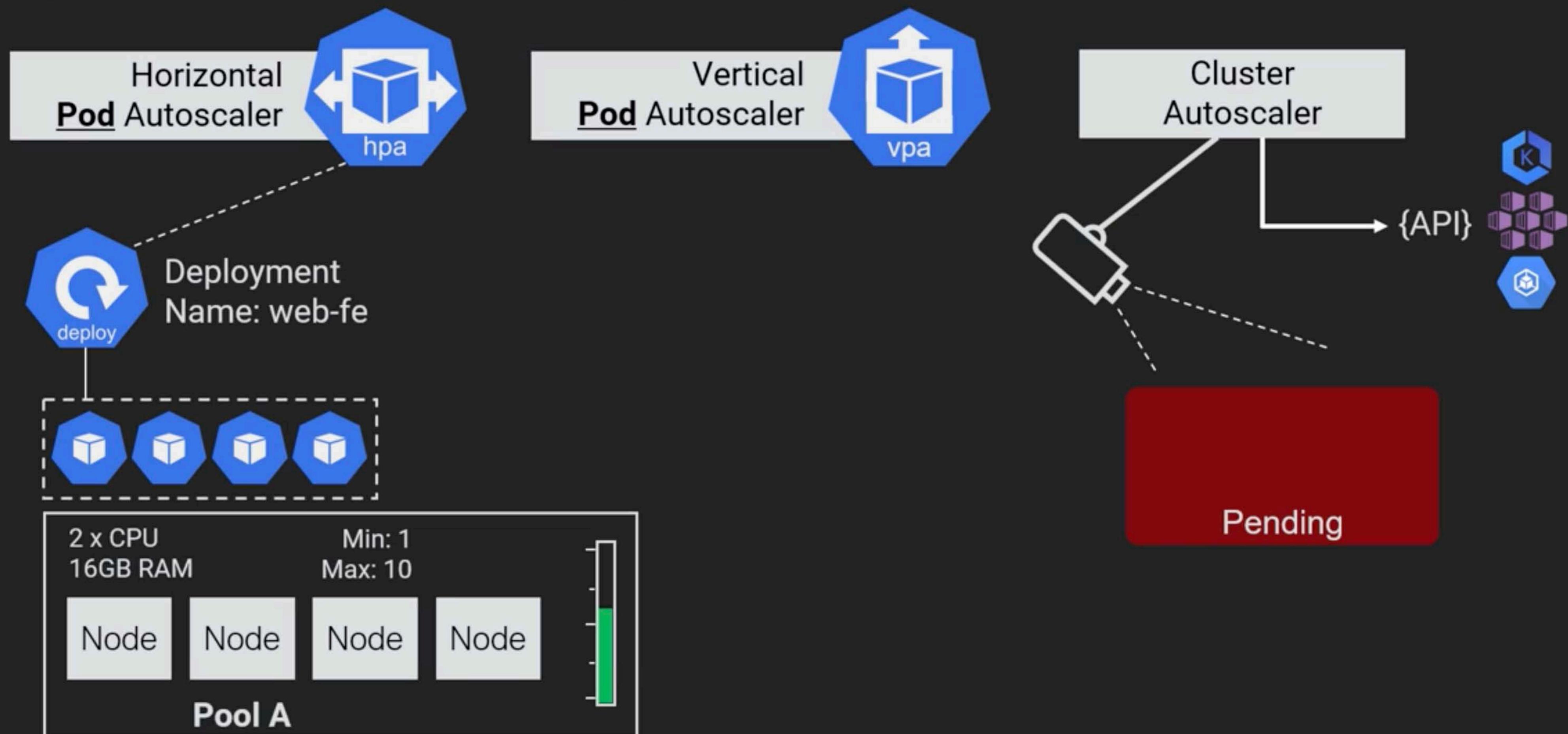


--enable-autoscaling

Recap



A CLOUD GURU



Kubernetes cluster

Recap



A CLOUD GURU



autoscaling/v1
- CPU

autoscaling/v2
- CPU, memory, **custom metrics**

RBAC and Admission Control



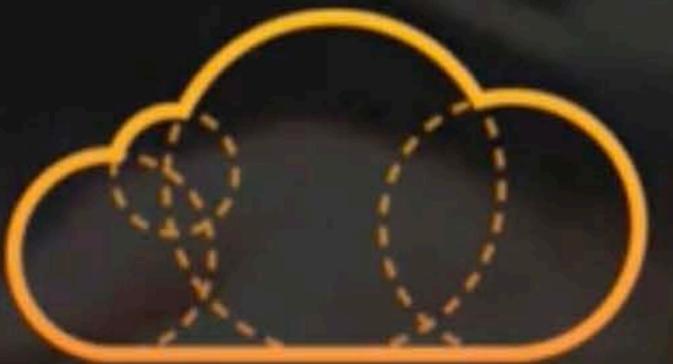
A CLOUD GURU

Lesson Plan



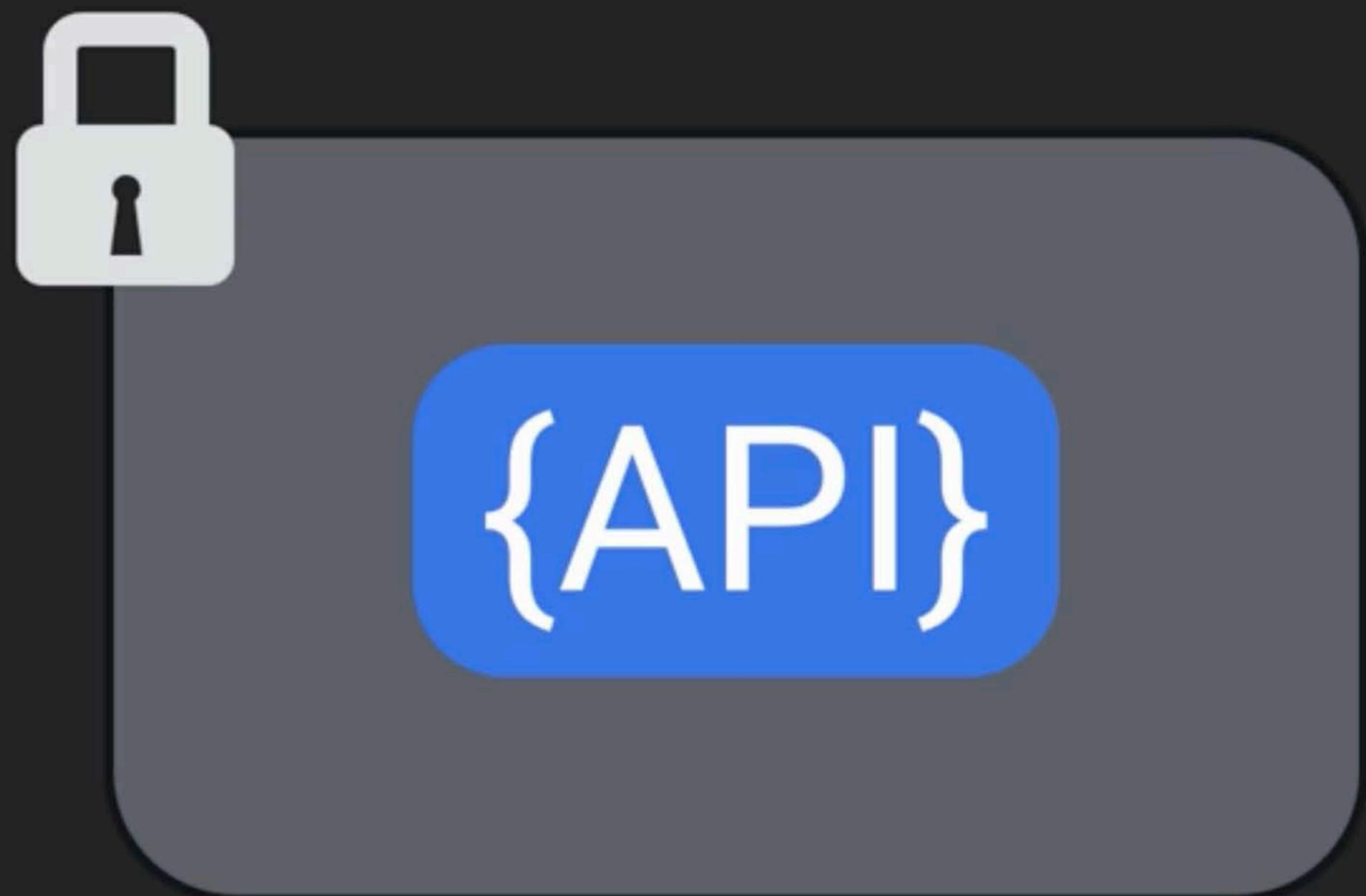
- Big Picture
- Authentication (AuthN)
- Authorization (AuthZ)
- Admission Control

Big Picture

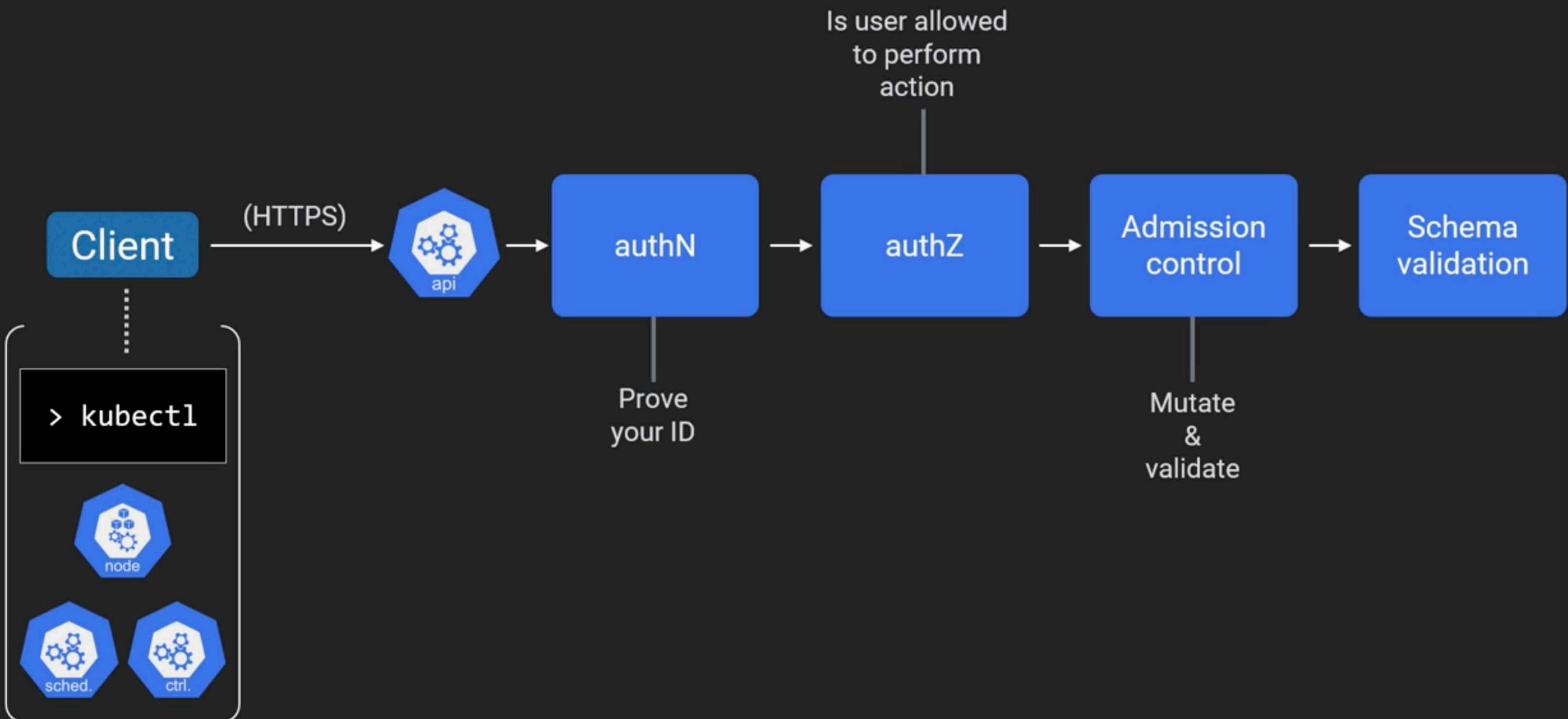


A CLOUD GURU

Big Picture



Big Picture



Big Picture



Some clusters open an insecure local port!
Bypasses authN and authZ!!
Disable for prod!





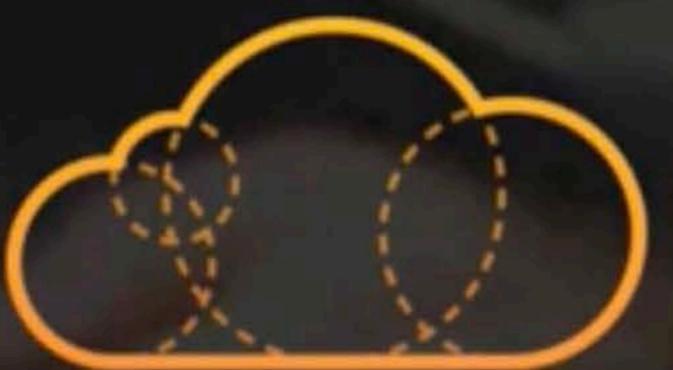
RBAC

Enabled since 1.6

GA since 1.8

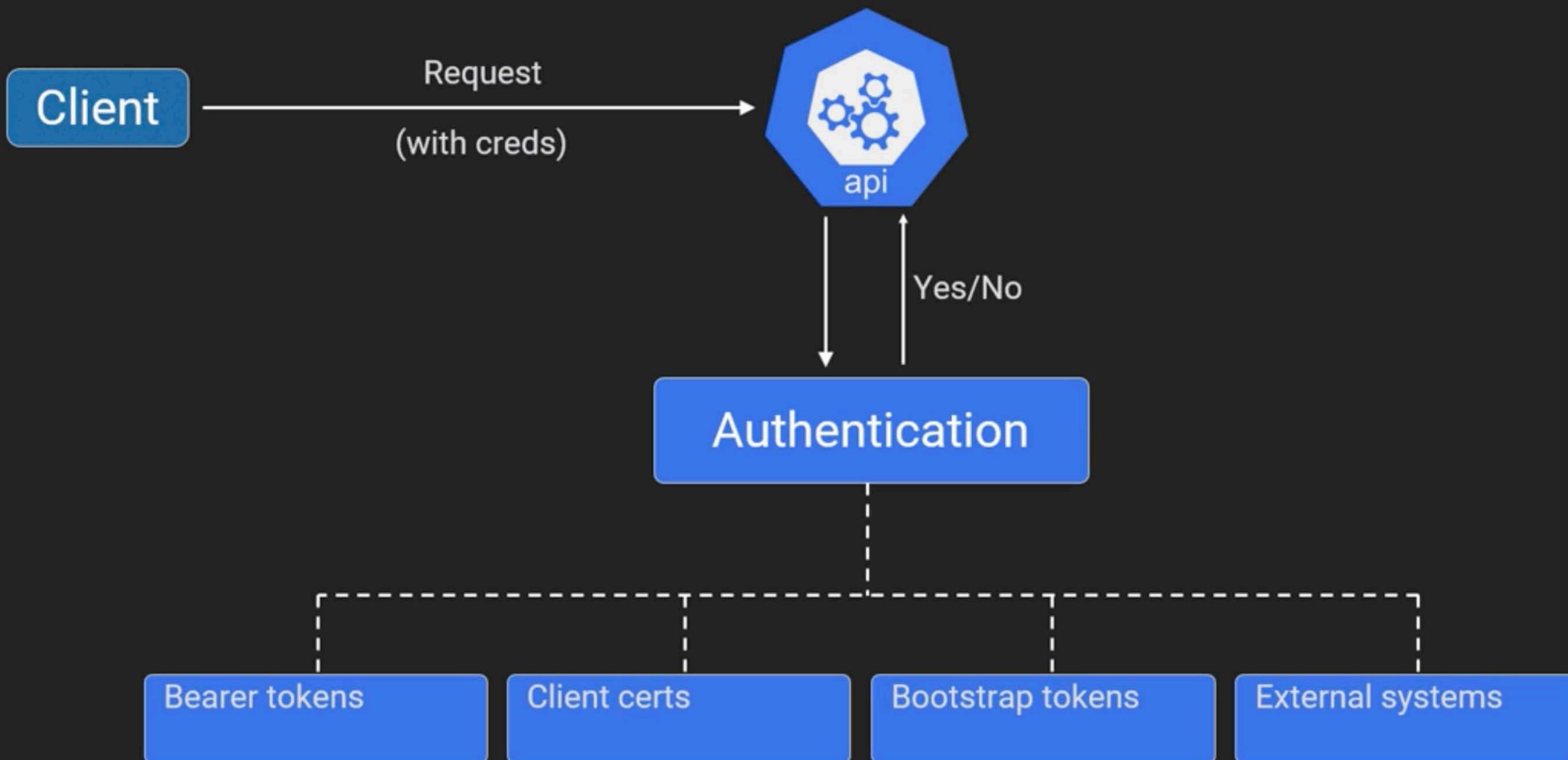
Deny-by-default

Authentication (authN)



A CLOUD GURU

Authentication





Kubernetes
does **NOT** do Users!!



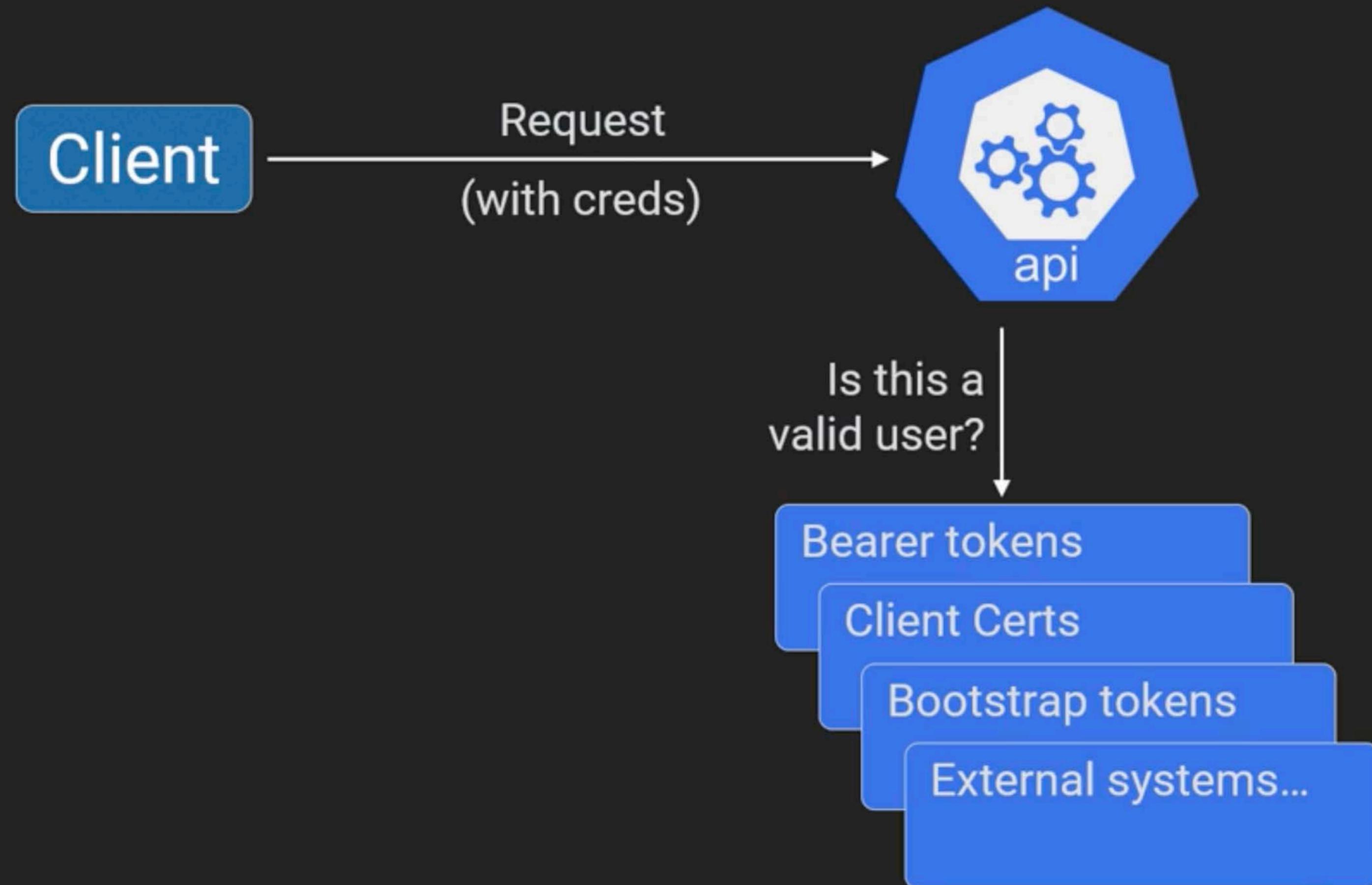
Manage Users externally

Active Directory

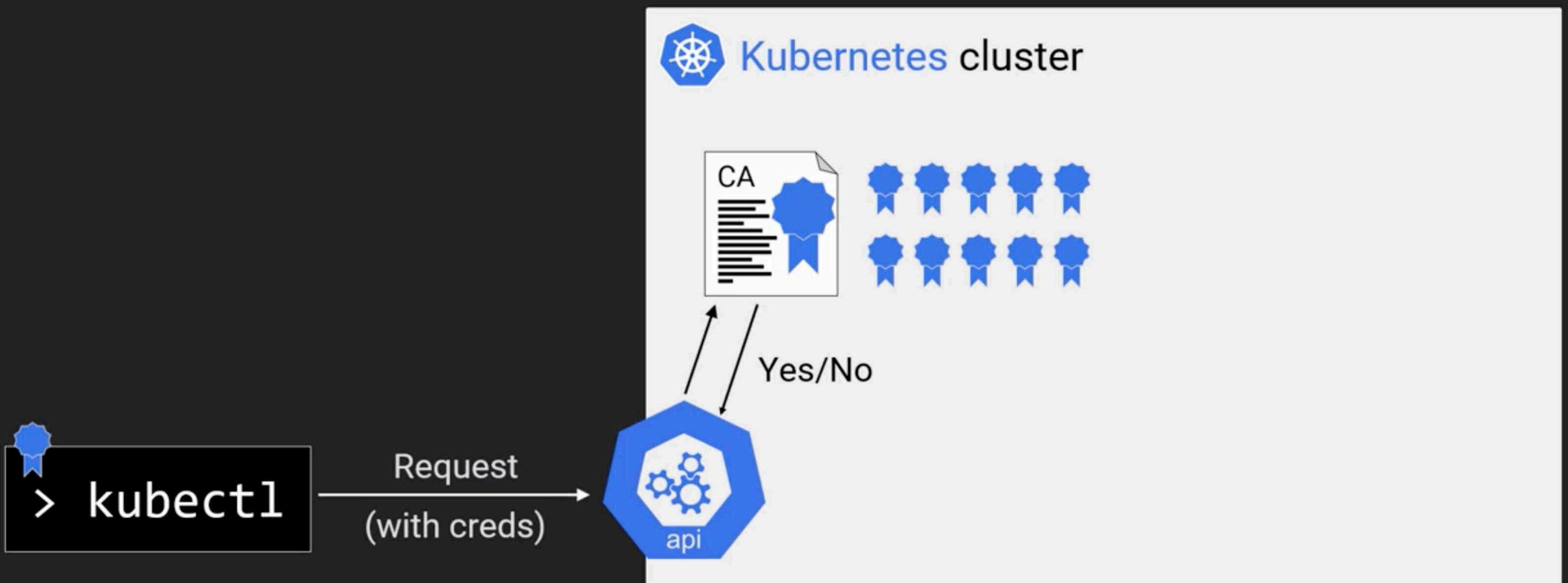
IAM

Other...

Authentication



Authentication





Service Accounts

For System components

Managed by Kubernetes

You can (should) manage
them

Authentication



> kubectl

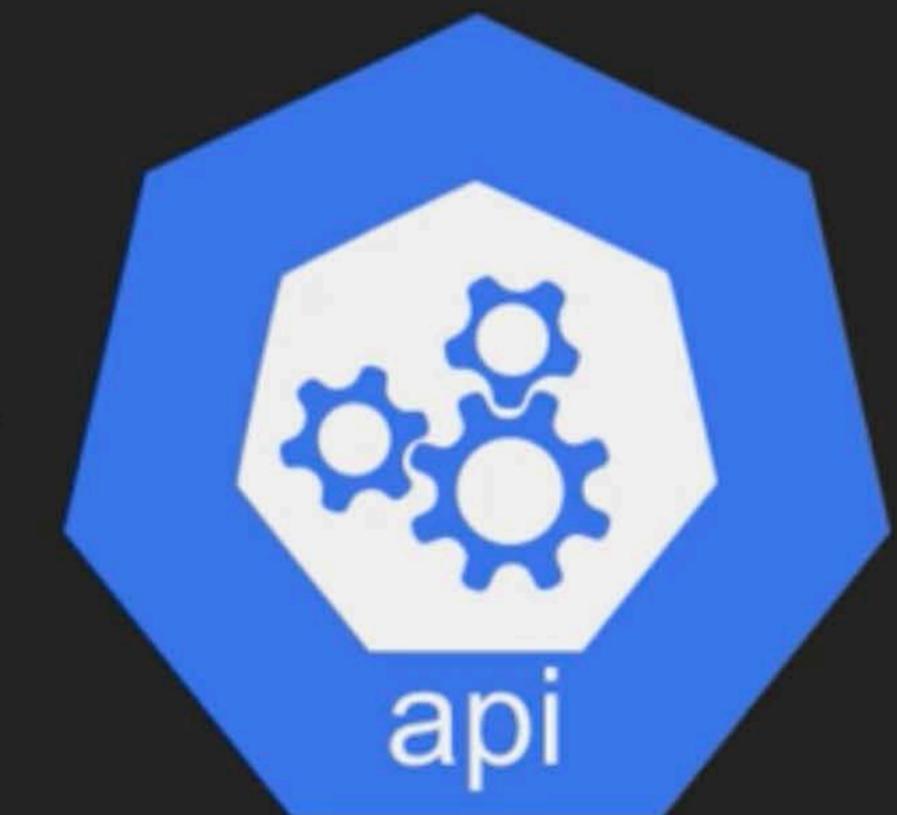
POST:

/apis/apps/v1/namespaces/acg-ns/deployments

Auth: Token FGg5dYFnsdY%351tg..

{ "apiVersion": "1", "kind": "Deployment", ... }

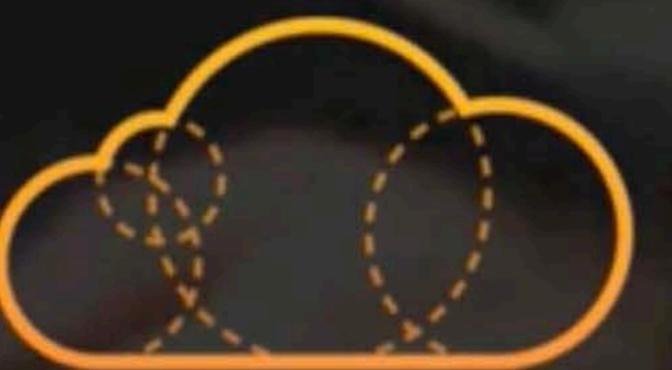
...



API Group:	apps/v1
Subject:	nigel
Verb:	create (HTTP POST method)
Resource:	Deployments
Namespace:	acg

Authorization

(authz)

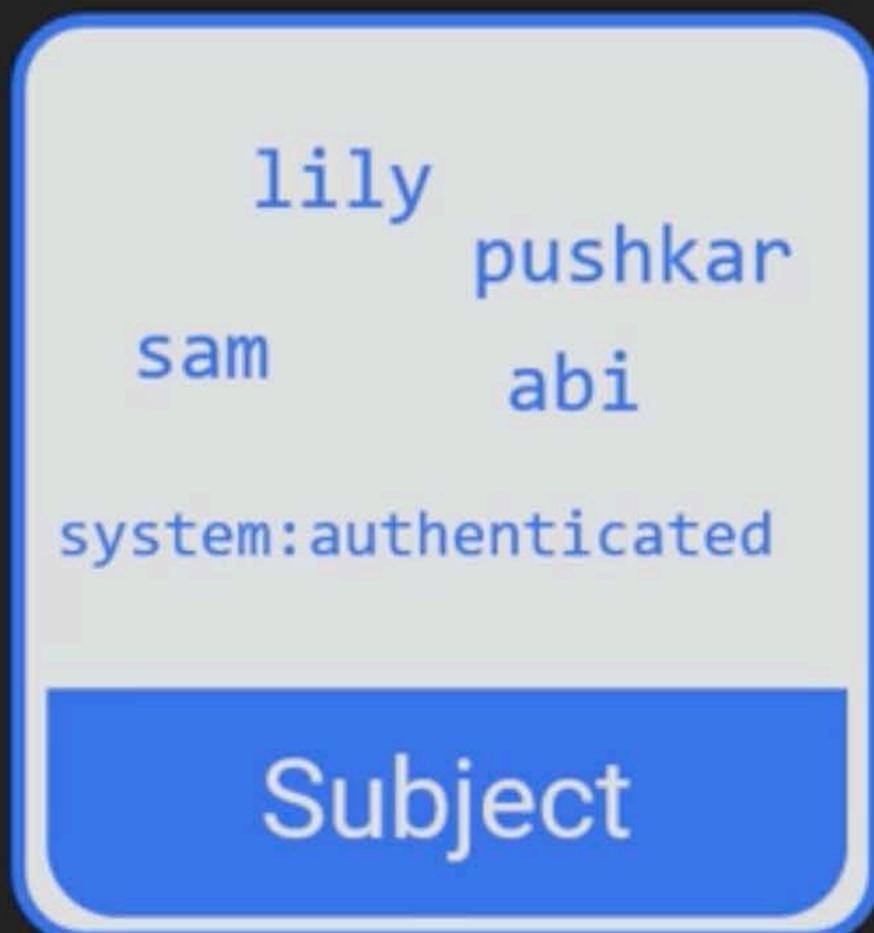


A CLOUD GURU

Authorization



Who can perform which actions on which resources?



Authorization



Powerful default users
(Too powerful for production)

Roles & RoleBindings
(For *least privilege*)

Authorization



RBAC Role

```
kind: Role
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
rules:
- apiGroups: []
  resources: ["pods"]
  verbs: ["get", "list", "watch"]
```

RBAC RoleBinding

```
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
subjects:
- kind: User
  name: nigel@acg.com
  apiGroup: ""
roleRef:
  kind: Role
  name: acgrbac
  apiGroup: ""
```

Authorization



RBAC Role

```
kind: Role
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
rules:
- apiGroups: []
  resources: ["pods"]
  verbs: ["get", "list", "watch"]
```

RBAC RoleBinding

```
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
subjects:
- kind: User
  name: nigel@acg.com
  apiGroup: ""
- kind: Group
  name: ops
  apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: Role
  name: acgrbac
  apiGroup: ""
```

Authorization



RBAC Role

```
kind: Role
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
rules:
- apiGroups: []
  resources: ["pods"]
  verbs: ["get", "list", "watch"]
- apiGroups: "*"
  resources: "*"
  verbs: ["*"]
```

RBAC RoleBinding

```
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
subjects:
- kind: User
  name: nigel@acg.com
  apiGroup: ""
- kind: Group
  name: ops
  apiGroup: rbac.authorization.k8s.io
- kind: Group
  name: system:masters
  apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: Role
  name: acgrbac
  apiGroup: ""
```

Authorization



Role | ClusterRole

```
kind: Role | ClusterRole
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
rules:
- apiGroups: []
  resources: ["pods"]
  verbs: ["get", "list", "watch"]
- apiGroups: [*]
  resources: [*]
  verbs: [*]
```

RoleBinding | ClusterRoleBinding

```
kind: RoleBinding | ClusterRoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
subjects:
- kind: User
  name: nigel@acg.com
  apiGroup: ""
- kind: Group
  name: ops
  apiGroup: rbac.authorization.k8s.io
- kind: Group
  name: system:masters
  apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: Role
  name: acgrbac
  apiGroup: ""
```

Authorization



Role | ClusterRole

```
kind: ClusterRole
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
rules:
- apiGroups: []
  resources: ["pods"]
  verbs: ["get", "list", "watch"]
- apiGroups: [*]
  resources: [*]
  verbs: [*]
```

RoleBinding | ClusterRoleBinding

```
kind: ClusterRoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
subjects:
- kind: User
  name: nigel@acg.com
  apiGroup: ""
- kind: Group
  name: ops
  apiGroup: rbac.authorization.k8s.io
- kind: Group
  name: system:masters
  apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: Role
  name: acgrbac
  apiGroup: ""
```

Authorization



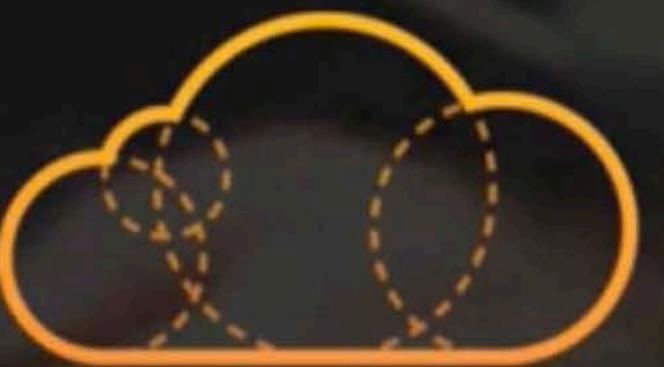
ClusterRole

```
kind: ClusterRole
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
rules:
- apiGroups: []
  resources: ["pods"]
  verbs: ["get", "list", "watch"]
- apiGroups: [*]
  resources: [*]
  verbs: [*]
```

RoleBinding

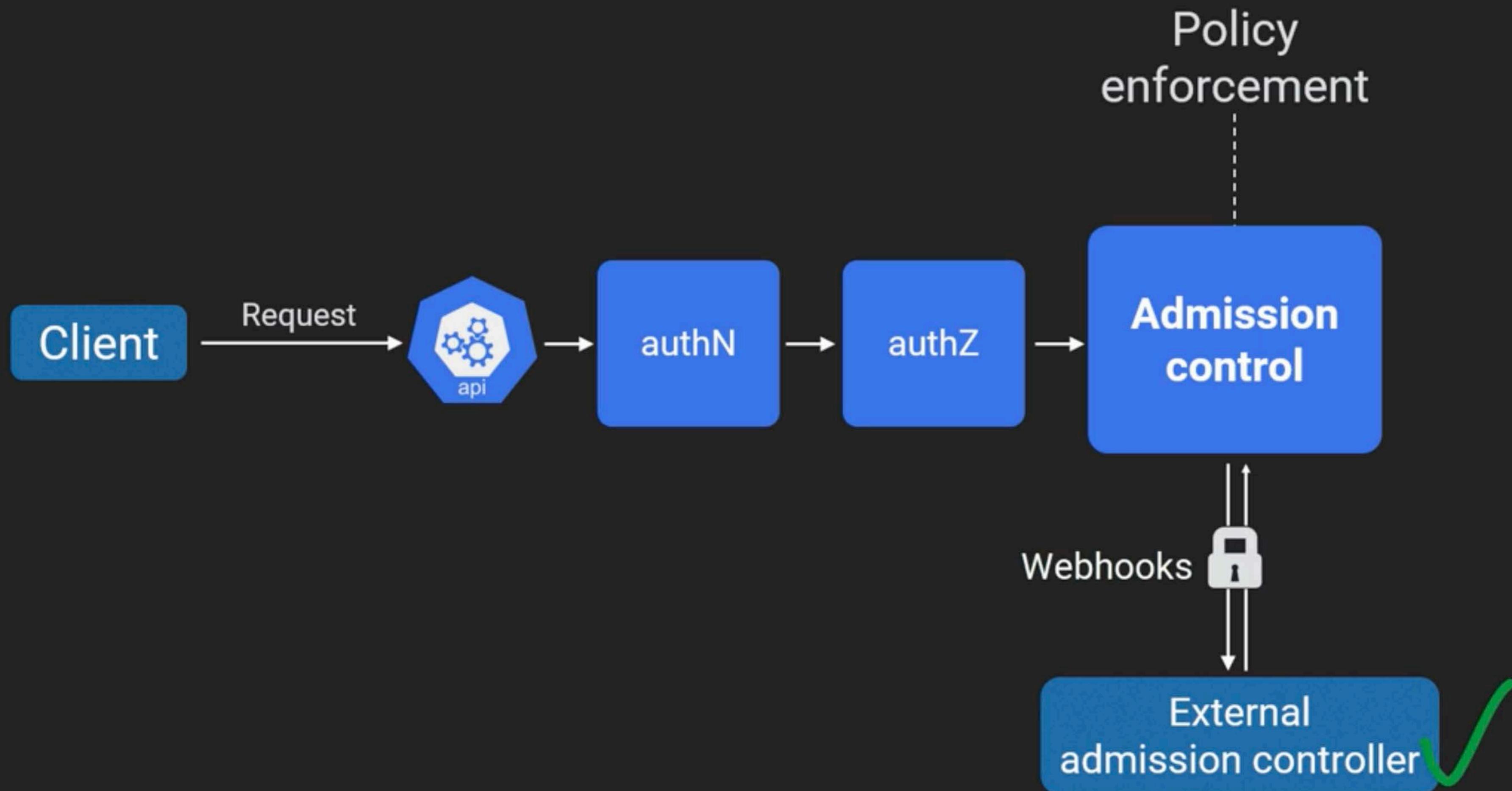
```
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
subjects:
- kind: User
  name: nigel@acg.com
  apiGroup: ""
- kind: Group
  name: ops
  apiGroup: rbac.authorization.k8s.io
- kind: Group
  name: system:masters
  apiGroup: rbac.authorization.k8s.io
roleRef:
  kind: Role
  name: acgrbac
  apiGroup: ""
```

Admission Control



A CLOUD GURU

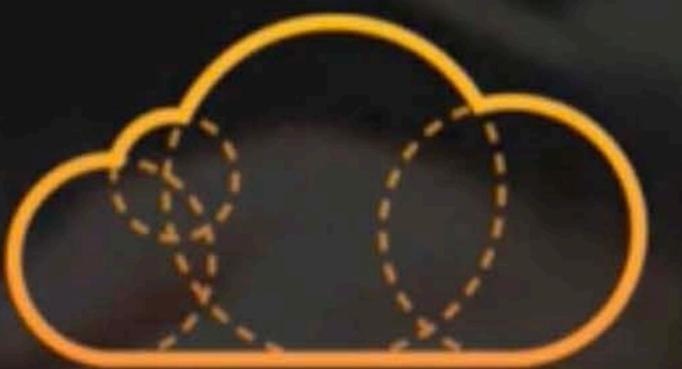
Admission Control



Admission Control

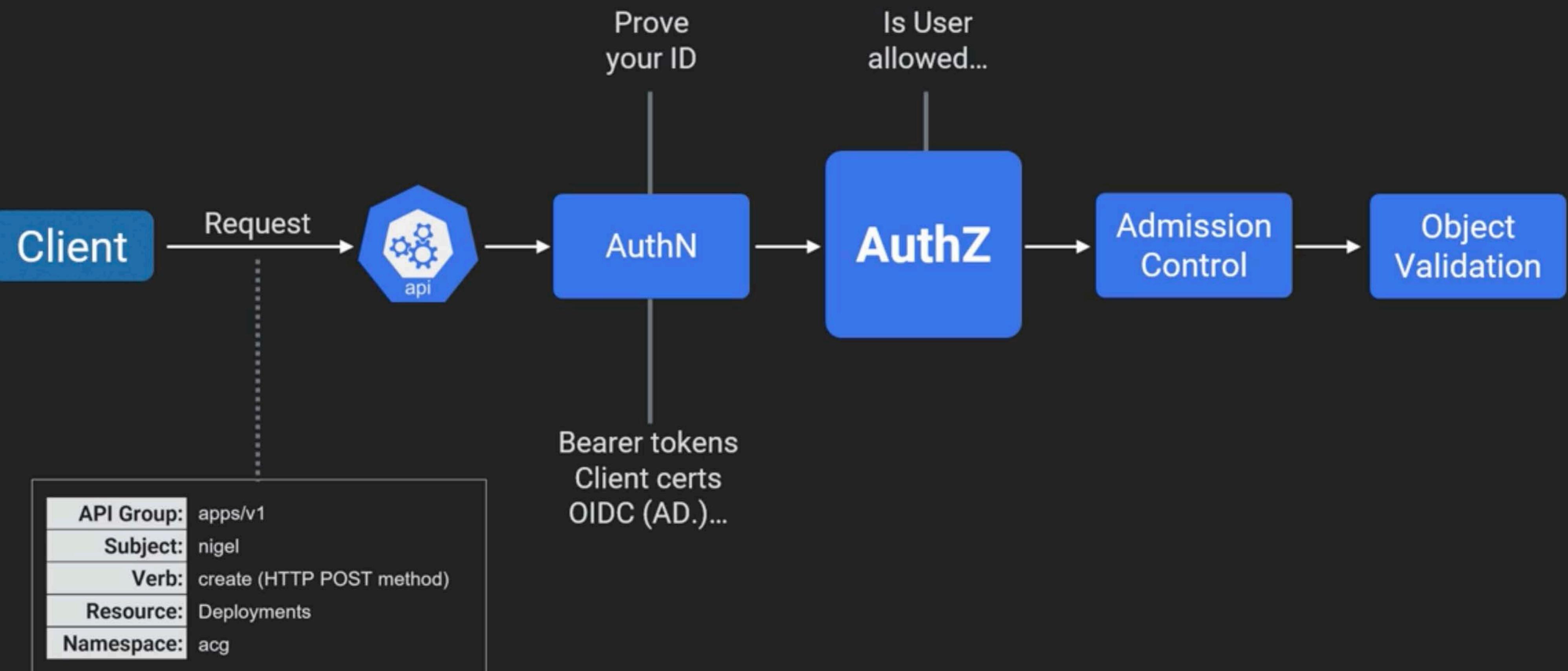


Recap

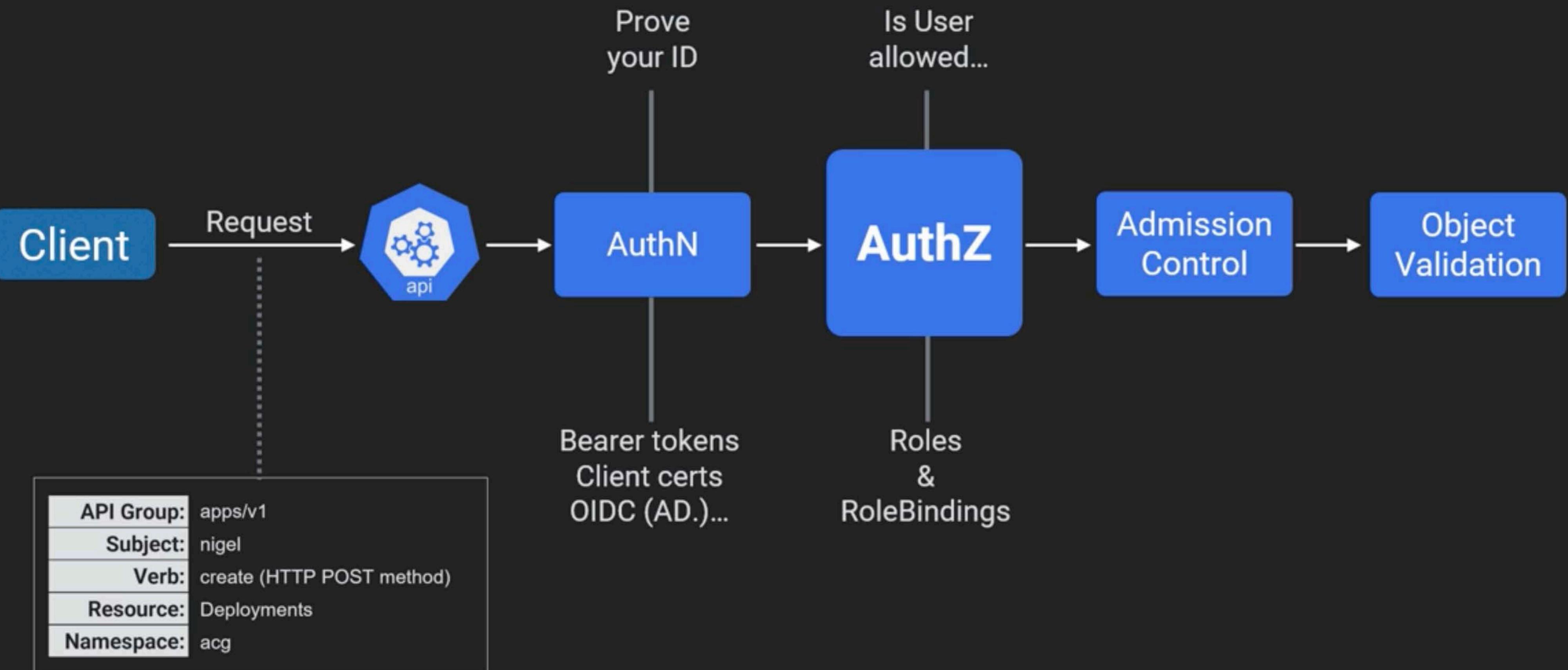


A CLOUD GURU

Recap



Recap



Recap



RBAC Role

```
kind: Role
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
rules:
- apiGroups: ["apps"]
  resources: ["deployments"]
  verbs: ["get", "list", "watch",
    "create", "update", "patch", "delete"]
```

RBAC RoleBinding

```
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acg-test
  namespace: acg
subjects:
- kind: User
  name: nigel
  apiGroup: ""
roleRef:
  kind: Role
  name: acgrbac
  apiGroup: ""
```

Recap



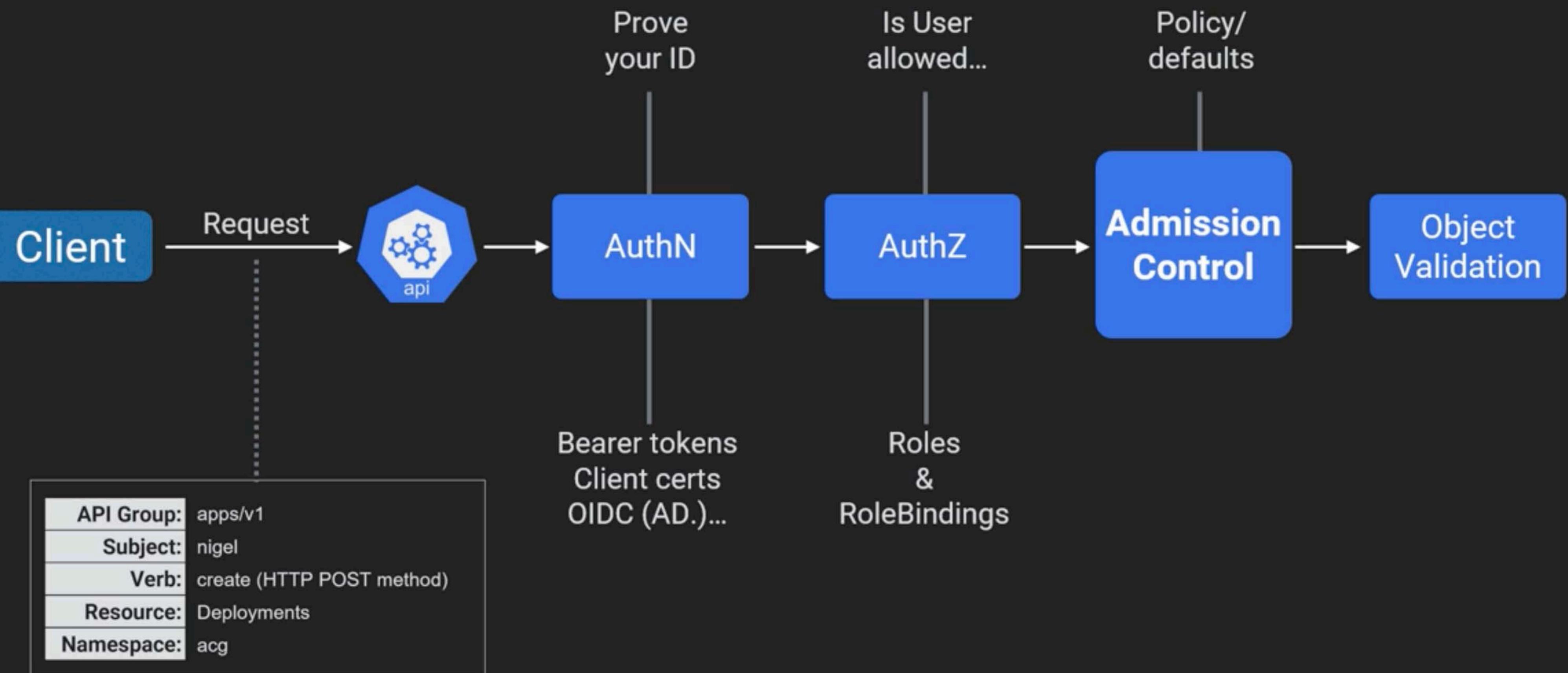
RBAC Role

```
kind: Role
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acgrbac
  namespace: acg
rules:
- apiGroups: ["apps"]
  resources: ["deployments"]
  verbs: ["get", "list", "watch",
    "create", "update", "patch", "delete"]
```

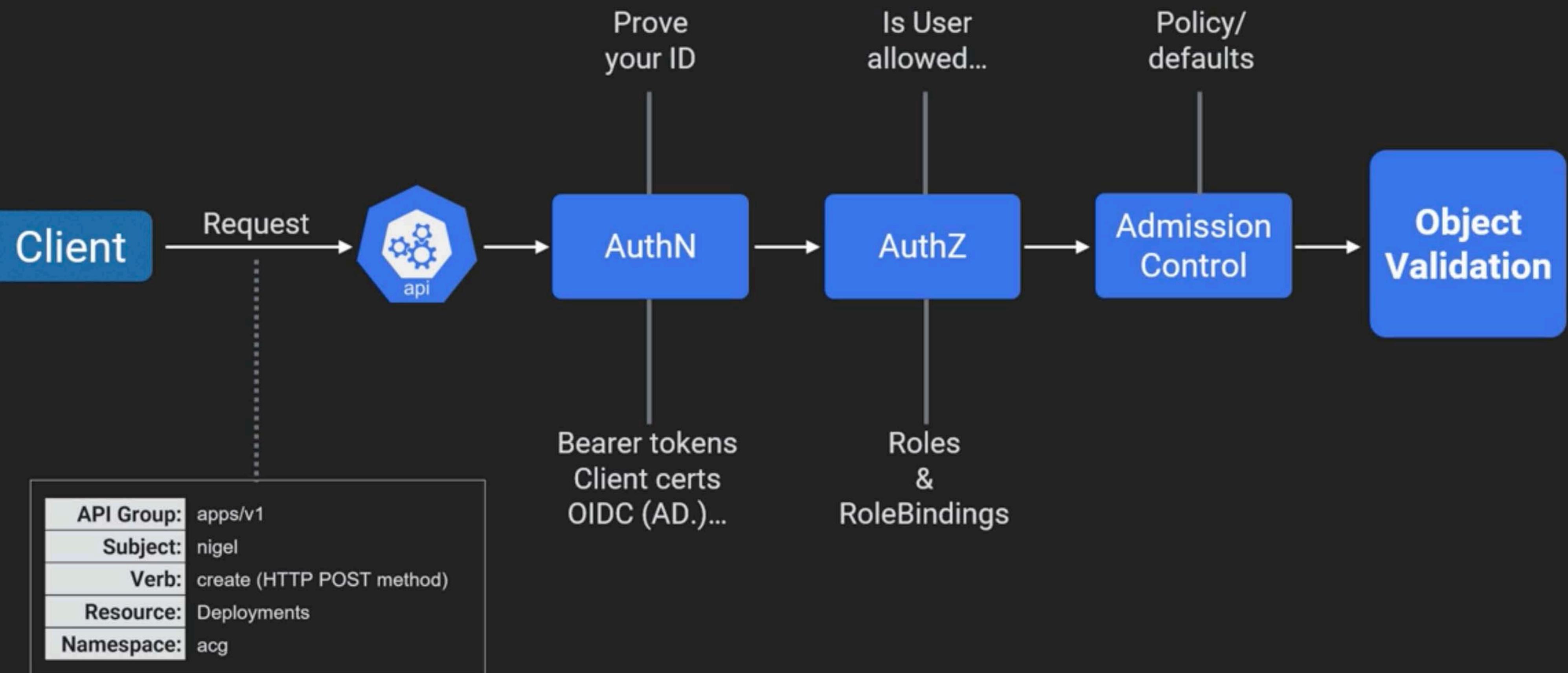
RBAC RoleBinding

```
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: acg-test
  namespace: acg
subjects:
- kind: User
  name: nigel
  apiGroup: ""
roleRef:
  kind: Role
  name: acgrbac
  apiGroup: ""
```

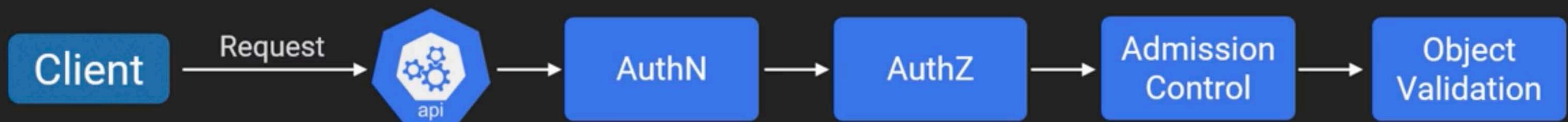
Recap



Recap



Recap

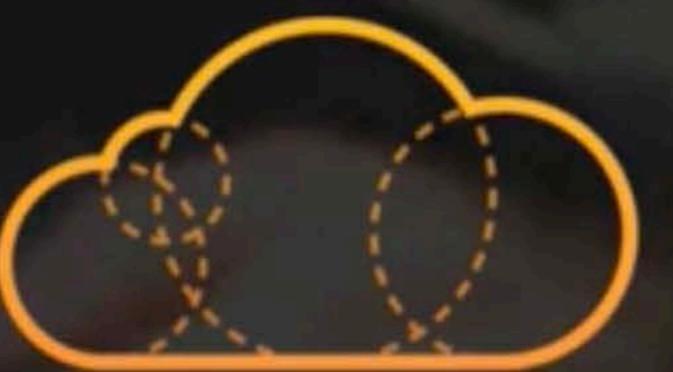


RBAC is stable

PLAN
your
implementation

Additive model

Other Kubernetes Stuff...



A CLOUD GURU

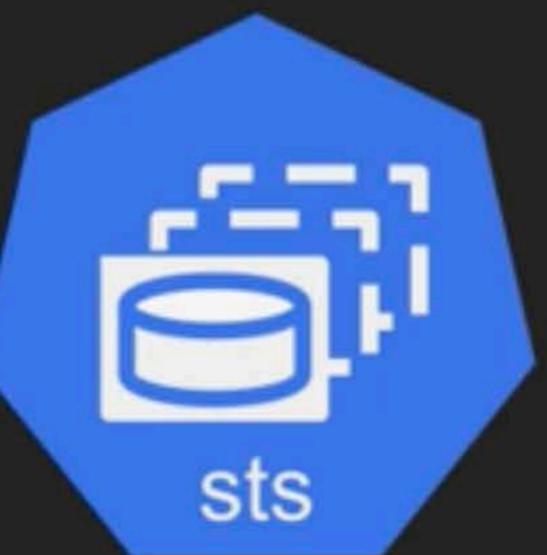
Other Kubernetes Stuff...



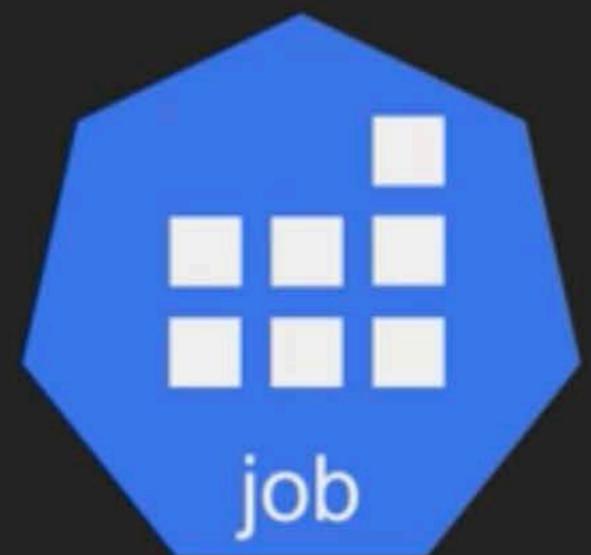
A CLOUD GURU



DaemonSet



StatefulSet



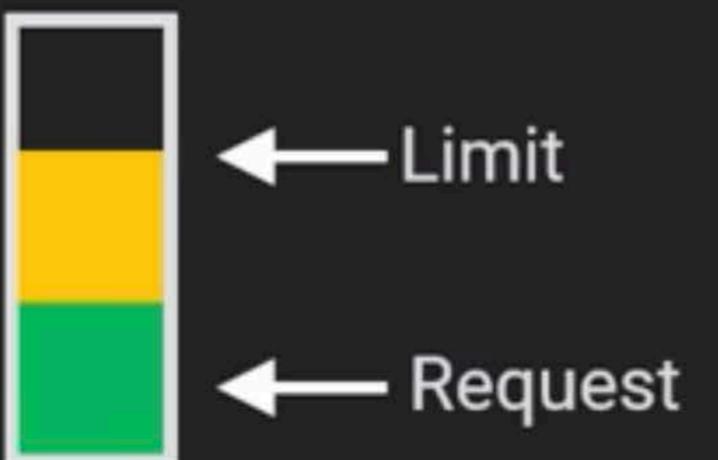
Job



CronJob



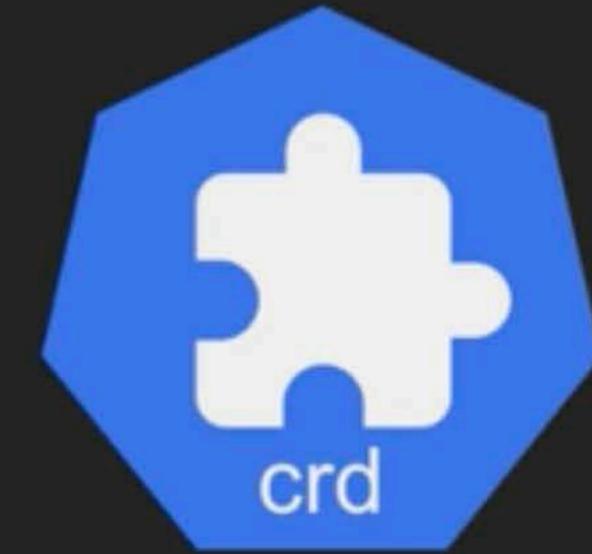
PodSecurityPolicy



Pod resource
requests and limits

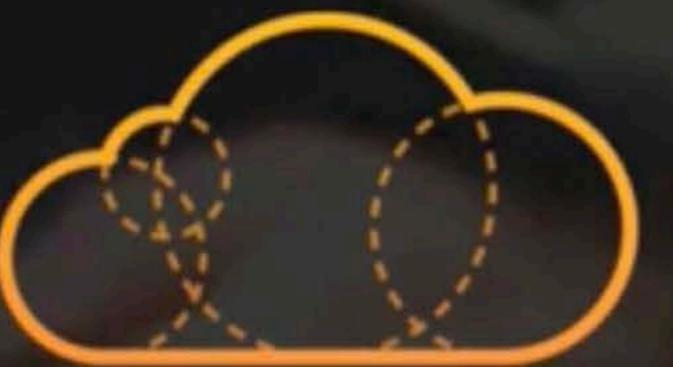


ResourceQuota



CustomResourceDefinition

What Next...

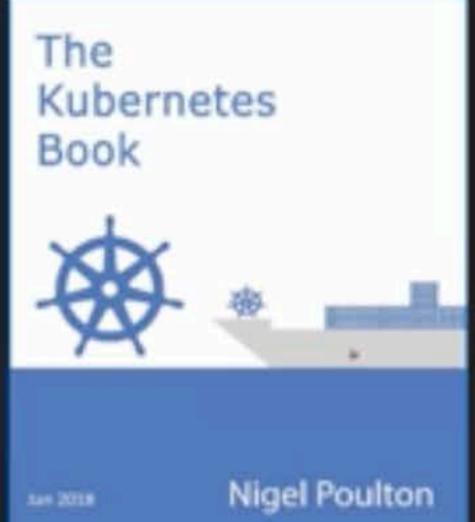


A CLOUD GURU

What Next...



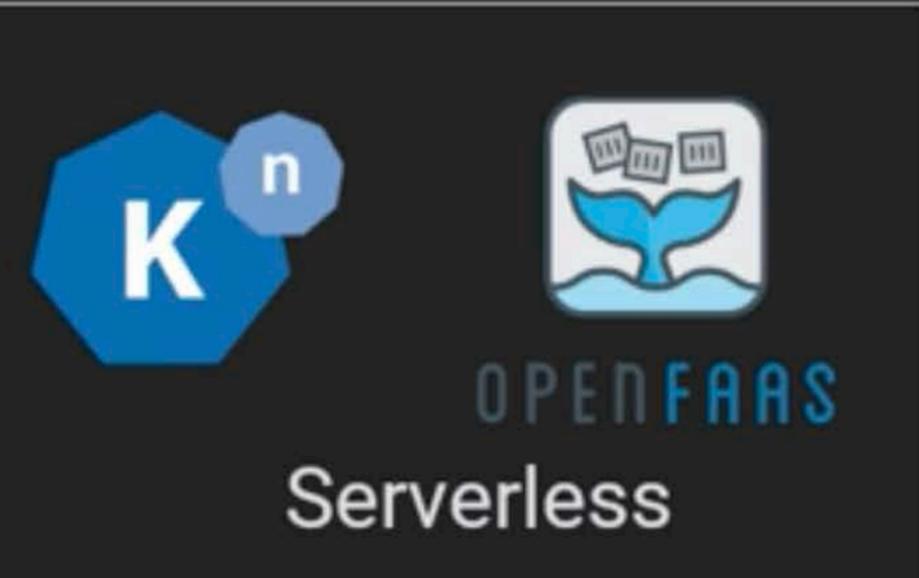
A CLOUD GURU



Community



KubeCon



Service Meshes



Prometheus

{ API }



> kubectl apply...

@nigelpoulton