



Kubernetes

In Practice





Somkiat Puisungnoen

Update Info 1 View Activity Log 10+ ...

Timeline About Friends 3,138 Photos More

When did you work at Opendream? X

... 22 Pending Items

Post Photo/Video Live Video Life Event

What's on your mind?

Public Post

Intro

Software Craftsmanship

Software Practitioner at สยามช่างนาฏกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

Somkiat Puisungnoen 15 mins · Bangkok · ...

Java and Bigdata

Somkiat Puisungnoen

Search

Somkiat | Home

Timeline About Friends 3,138 Photos More

When did you work at Opendream? X

... 22 Pending Items

Post Photo/Video Live Video Life Event

What's on your mind?

Public Post

Intro

Software Craftsmanship

Software Practitioner at สยามช่างนาฏกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

Somkiat Puisungnoen 15 mins · Bangkok · ...

Java and Bigdata



Facebook somkiat.cc

Page Messages Notifications 3 Insights Publishing Tools Settings Help ▾

somkiat.cc
@somkiat.cc

Home Posts Videos Photos

Liked Following Share ... + Add a Button

Help people take action on this Page. ×



Agenda Day 1

1. Cloud Native Application
2. Kubernetes architecture
3. Key-features
4. Pods and Containers
5. Service
6. Replication Controller (RC)
7. Deployment and ReplicaSet (RS)
8. Volume



Agenda Day 2

1. Resource management
2. Horizontal Pods Autoscaler (HPA)
3. ConfigMap and Secret
4. Log and monitoring
5. Ingress network
6. Working with Persistence storage

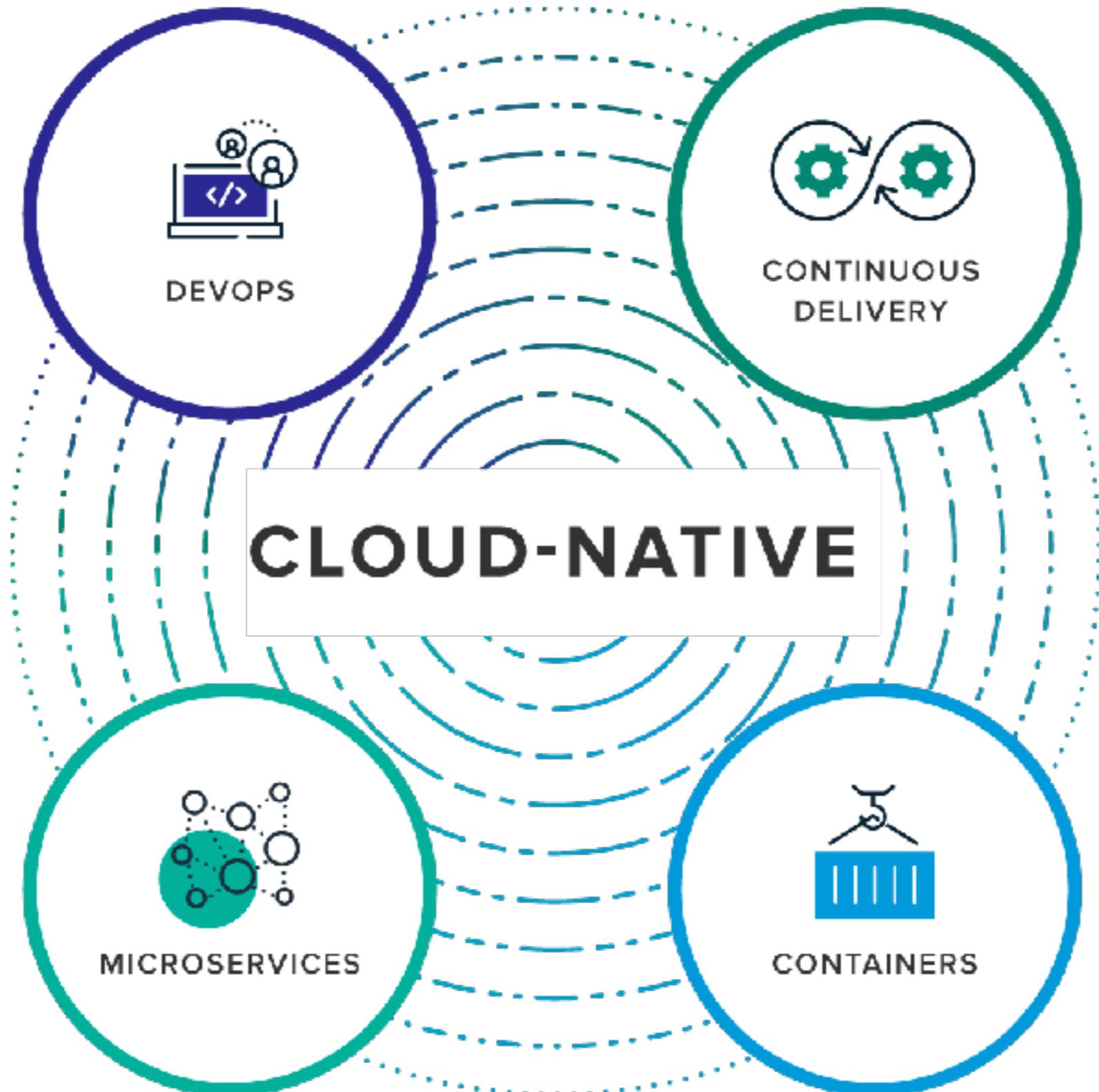


<https://github.com/up1/course-kubernetes-in-practice>



Cloud Native Application





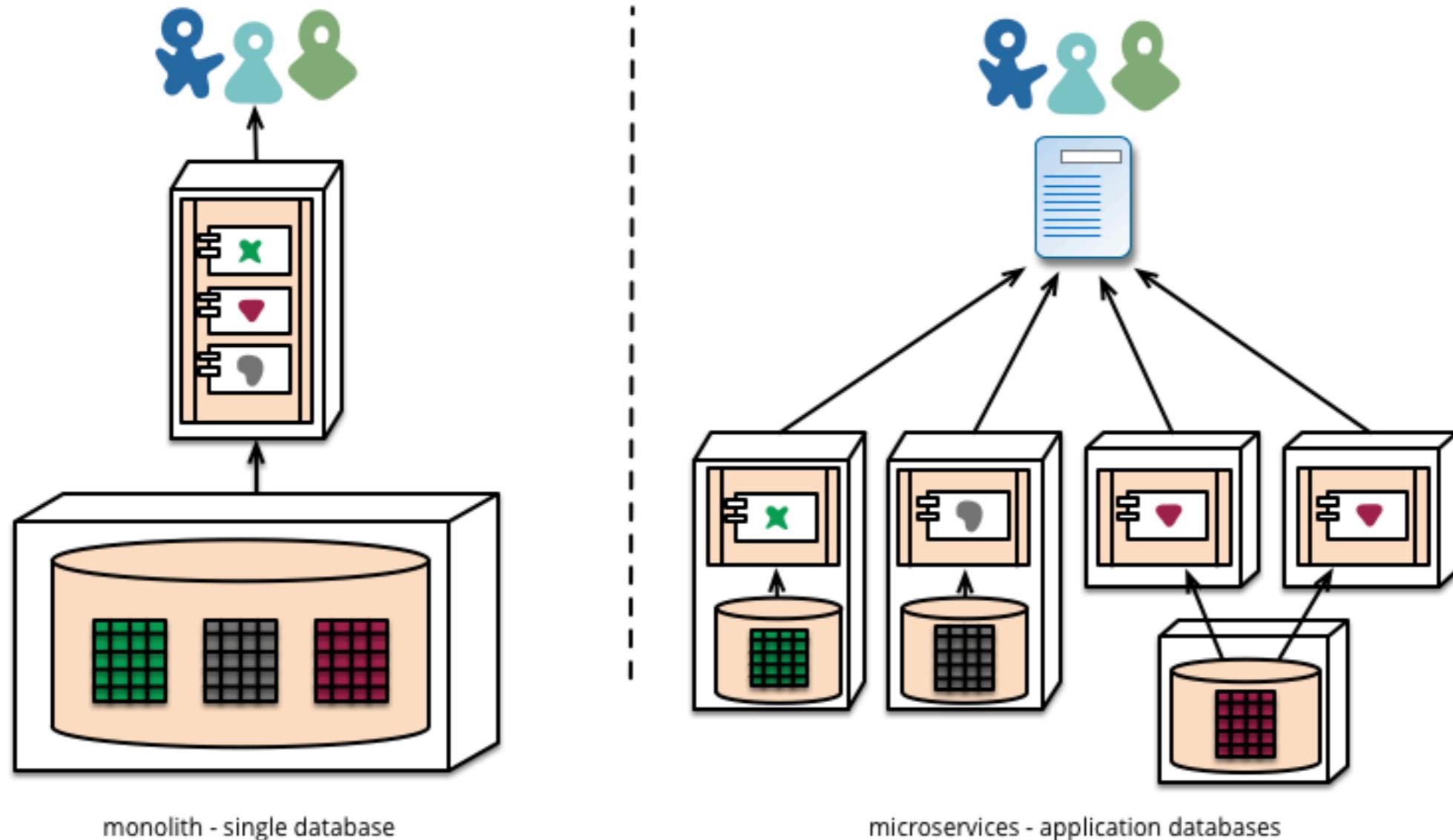
<https://pivotal.io/cloud-native>



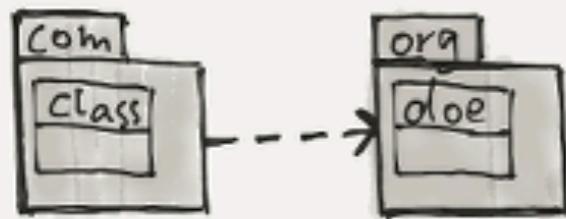
Evolution of Architecture



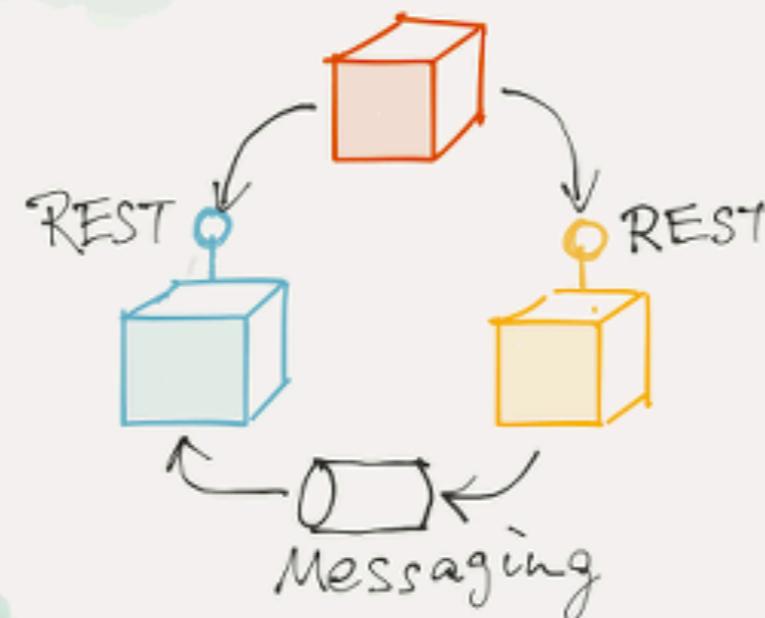
Microservices



Architecture



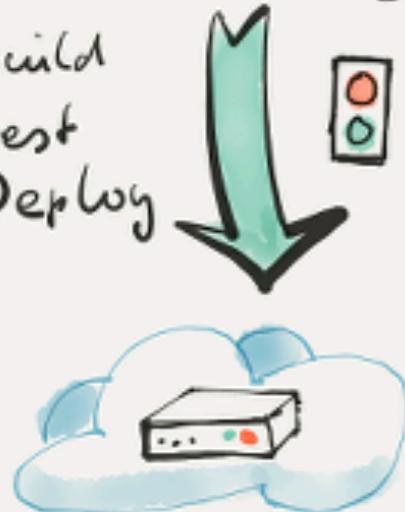
Microservices



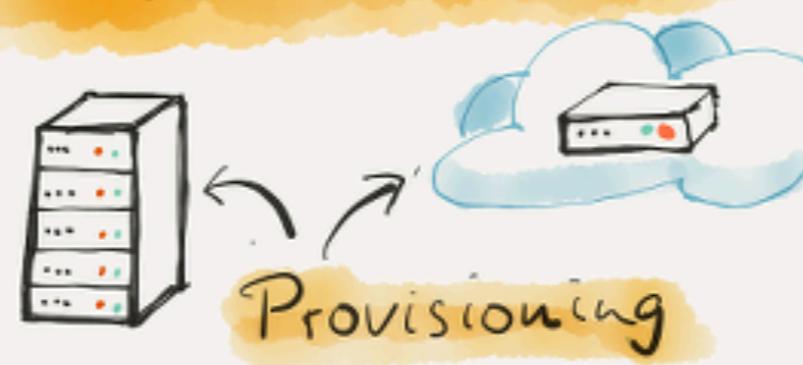
Deployment

Continuous Delivery

`{ var i=1; }`
Build
Test
Deploy



Infrastructure

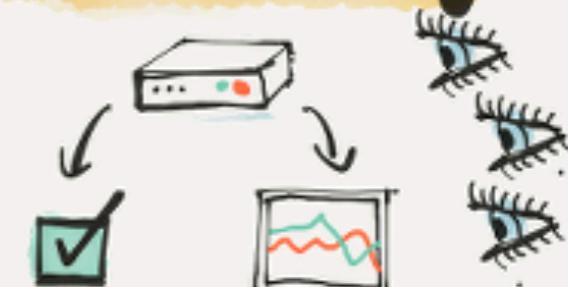


People & Teams



Communication
Collaboration

Monitoring

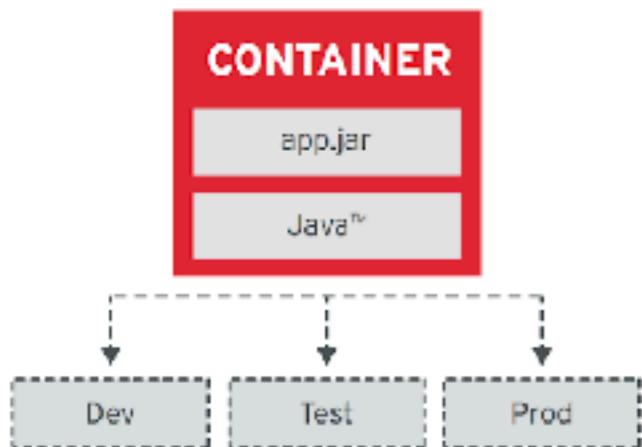


Features & Technology



Container design principles

Image Immutability Principle



High Observability Principle



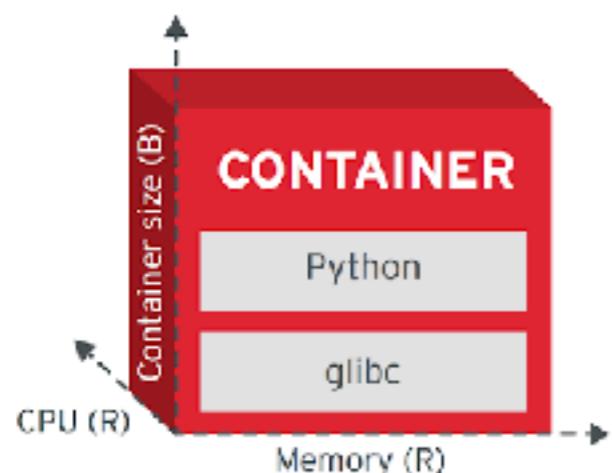
Process Disposability Principle



Lifecycle Conformance Principle



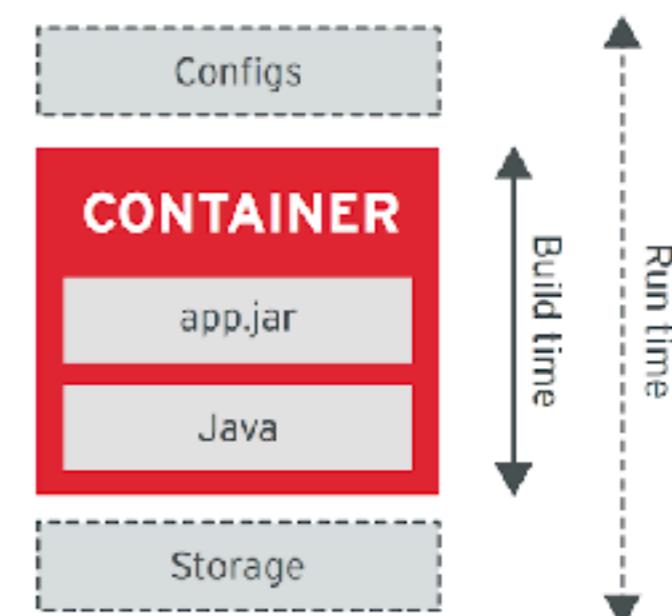
Runtime Confinement Principle



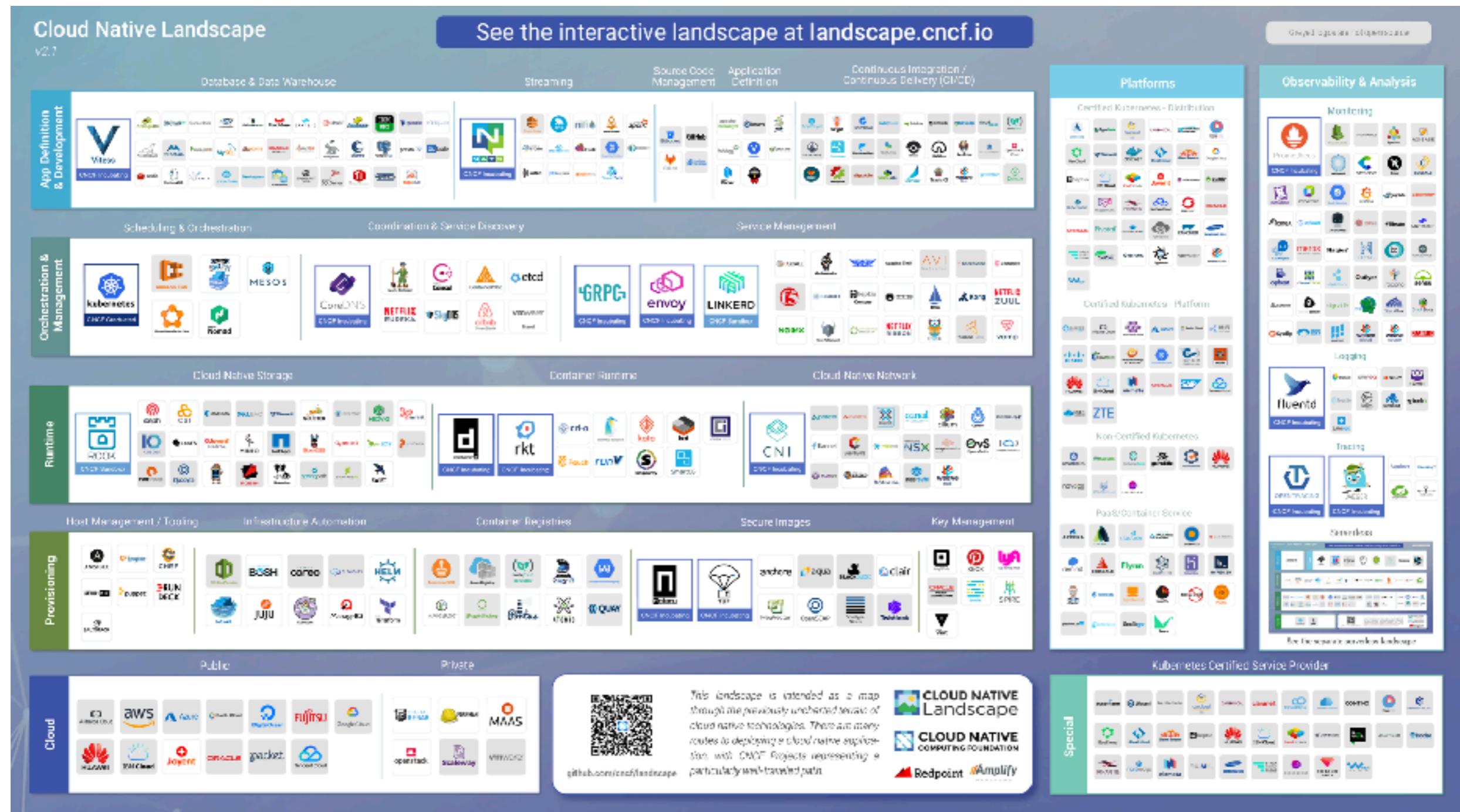
Single Concern Principle



Self-Containment Principle



Cloud native landscape



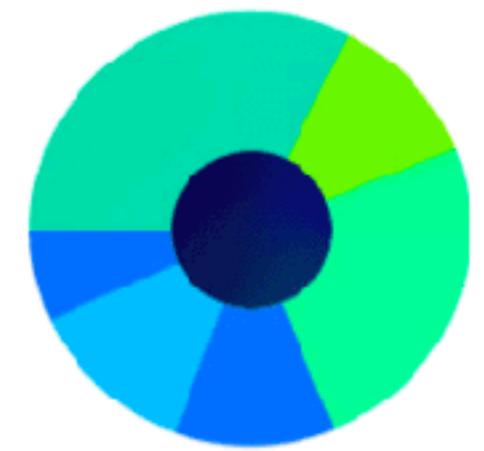
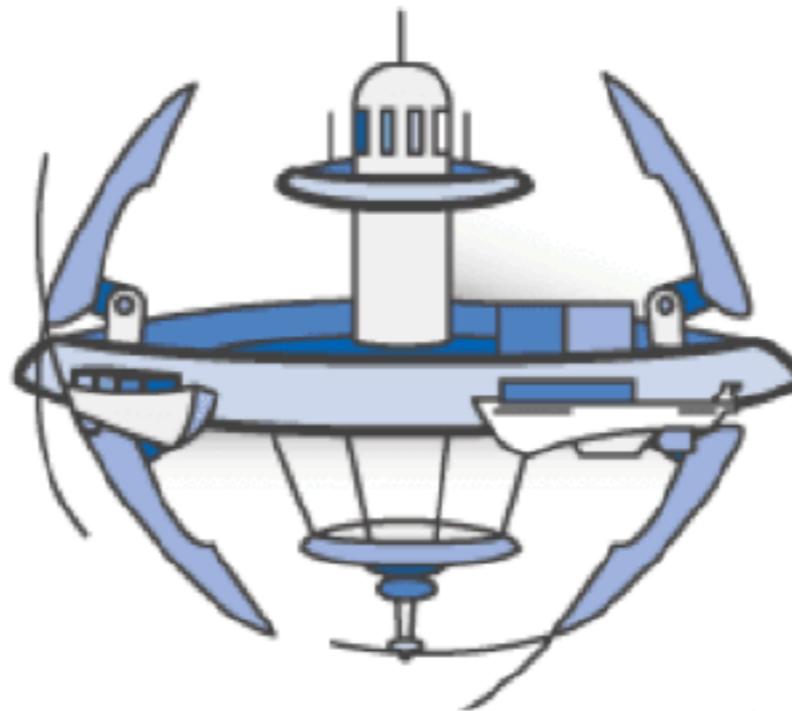
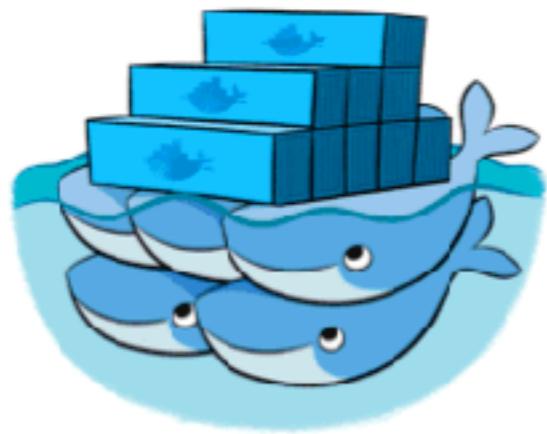
<https://github.com/cncf/landscape>







MESOS



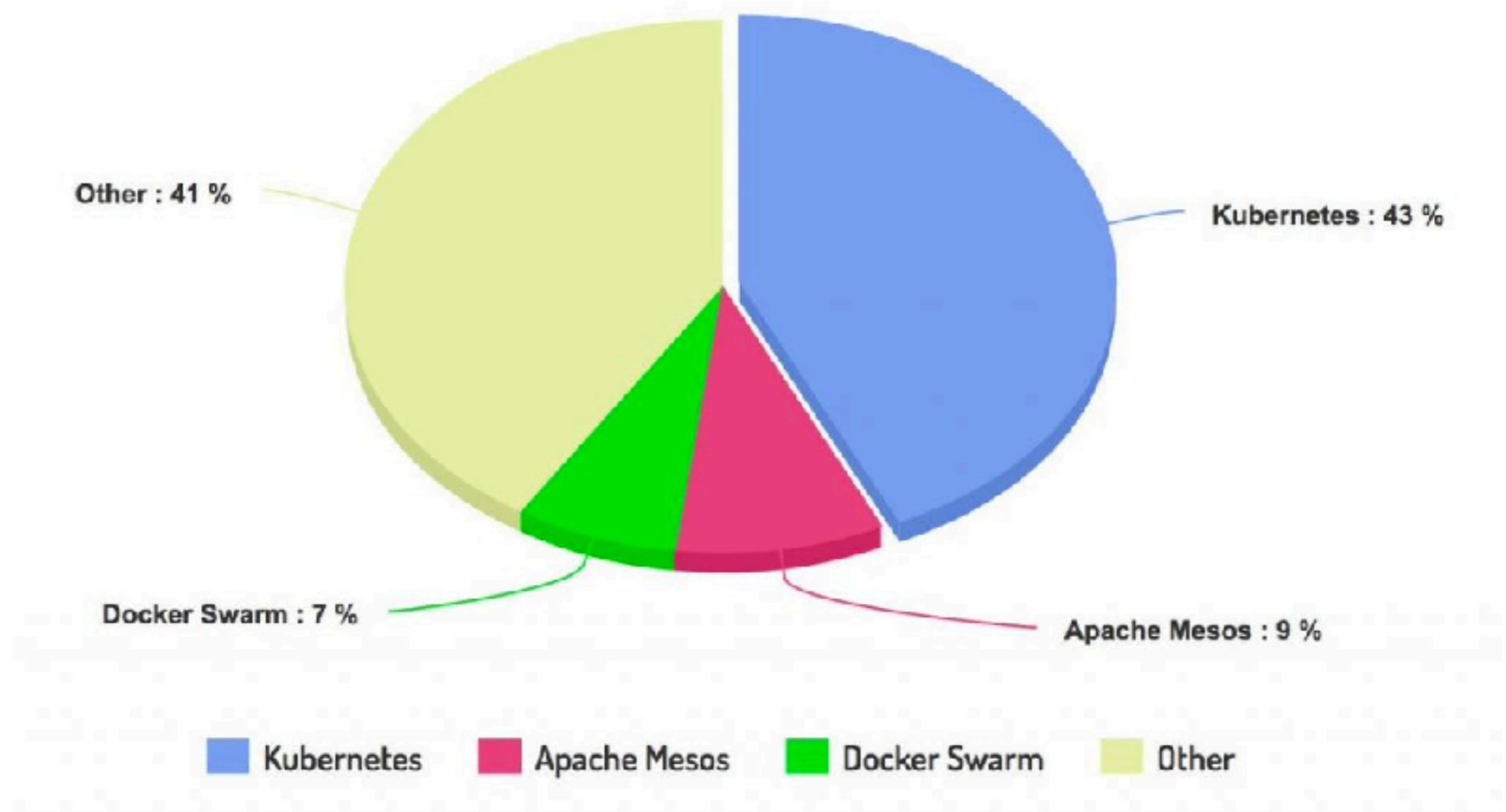
Marathon



kubernetes
by Google



Container Orchestrators in Sysdig's 2017 Docker Usage Report



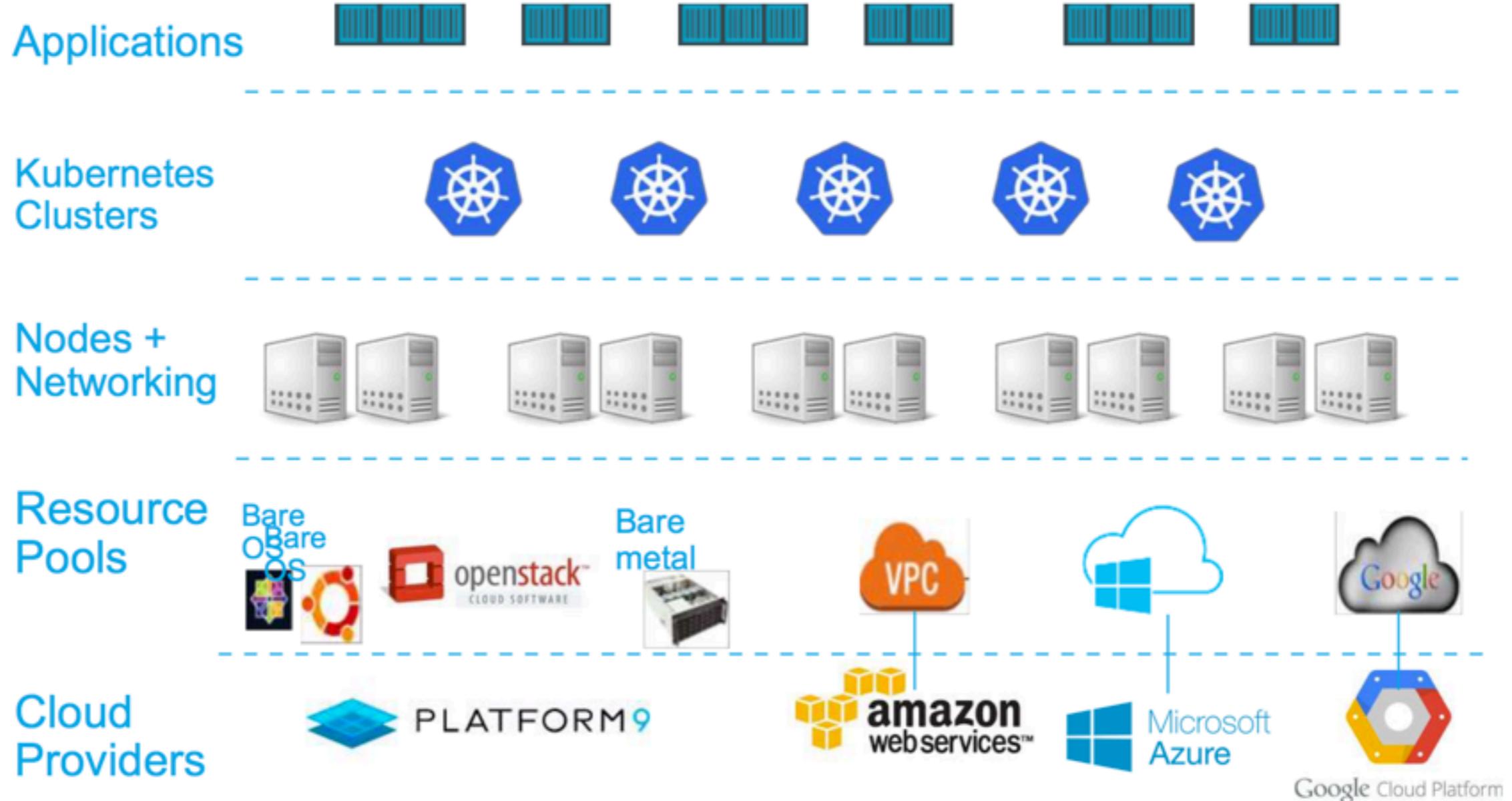
<https://sysdig.com/blog/sysdig-docker-usage-report-2017/>



Why Kubernetes ?



Write once, run anywhere



Write once, run anywhere

Eliminate infrastructure lock-in

Use containers

Provides management for containers



Modular app design

Monolithic app makes everything worse

- Larger teams slow thing down

- Spaghetti dependencies

Lack of ownership for sharing components

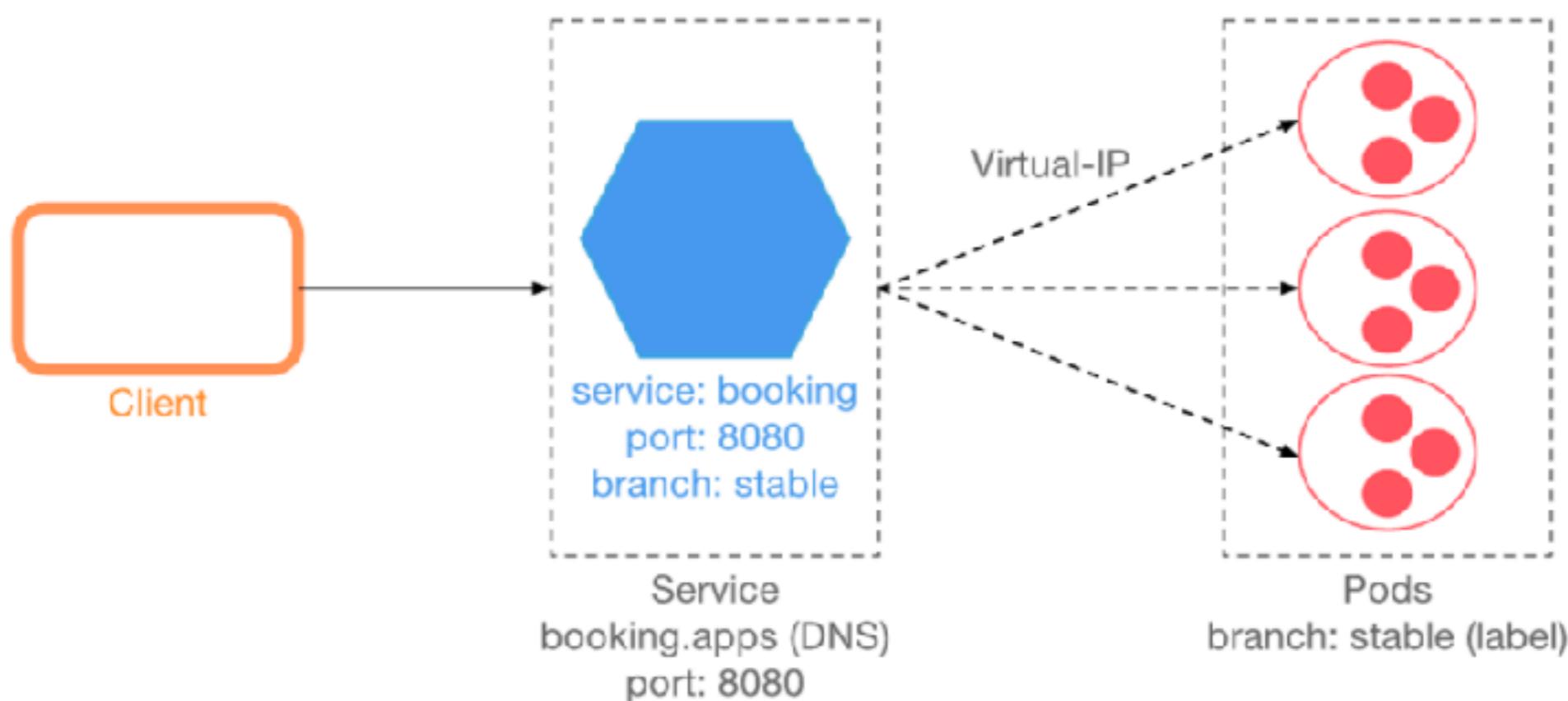
- Complexity to testing

- Slow building



Modular app design

Container/Image boundary similar to class
How to use/manage a collection of container ?



Fault-tolerant by design

Design for failure

Infrastructure provisioning/re-provisioning

Configuration networking and load balance

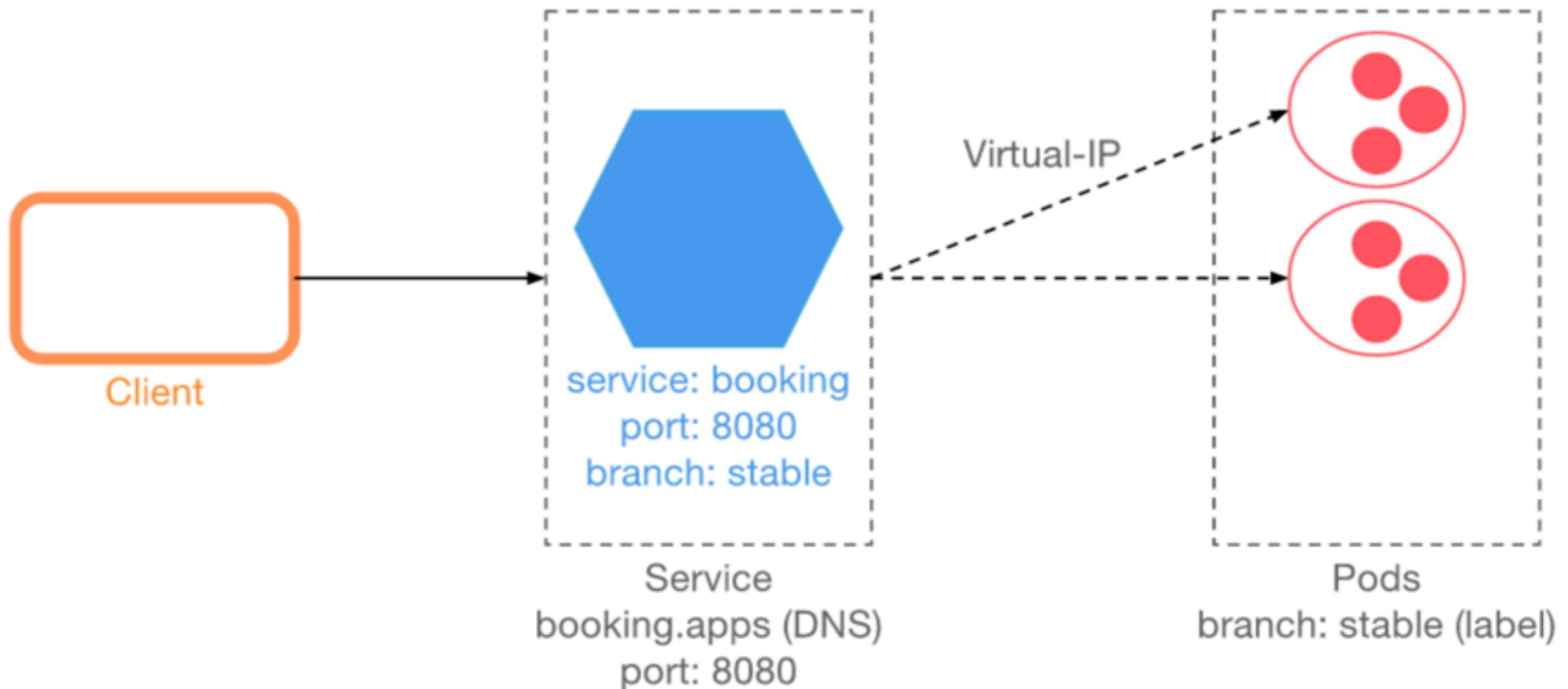
Redundancy (scale-out)

Lifecycle management (Software update)



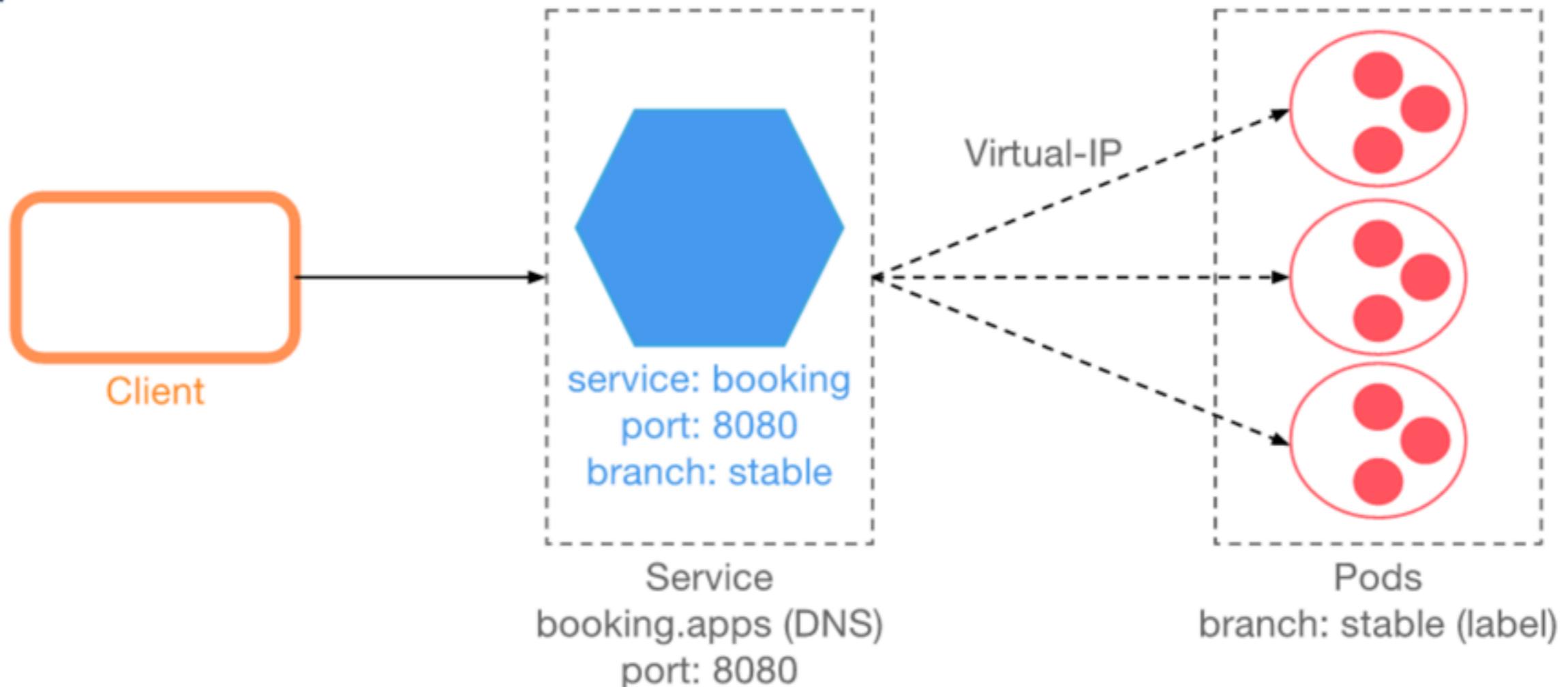
Fault-tolerant by design

replicas = 2



Fault-tolerant by design

replicas = 3



Deployment, not Infrastructure

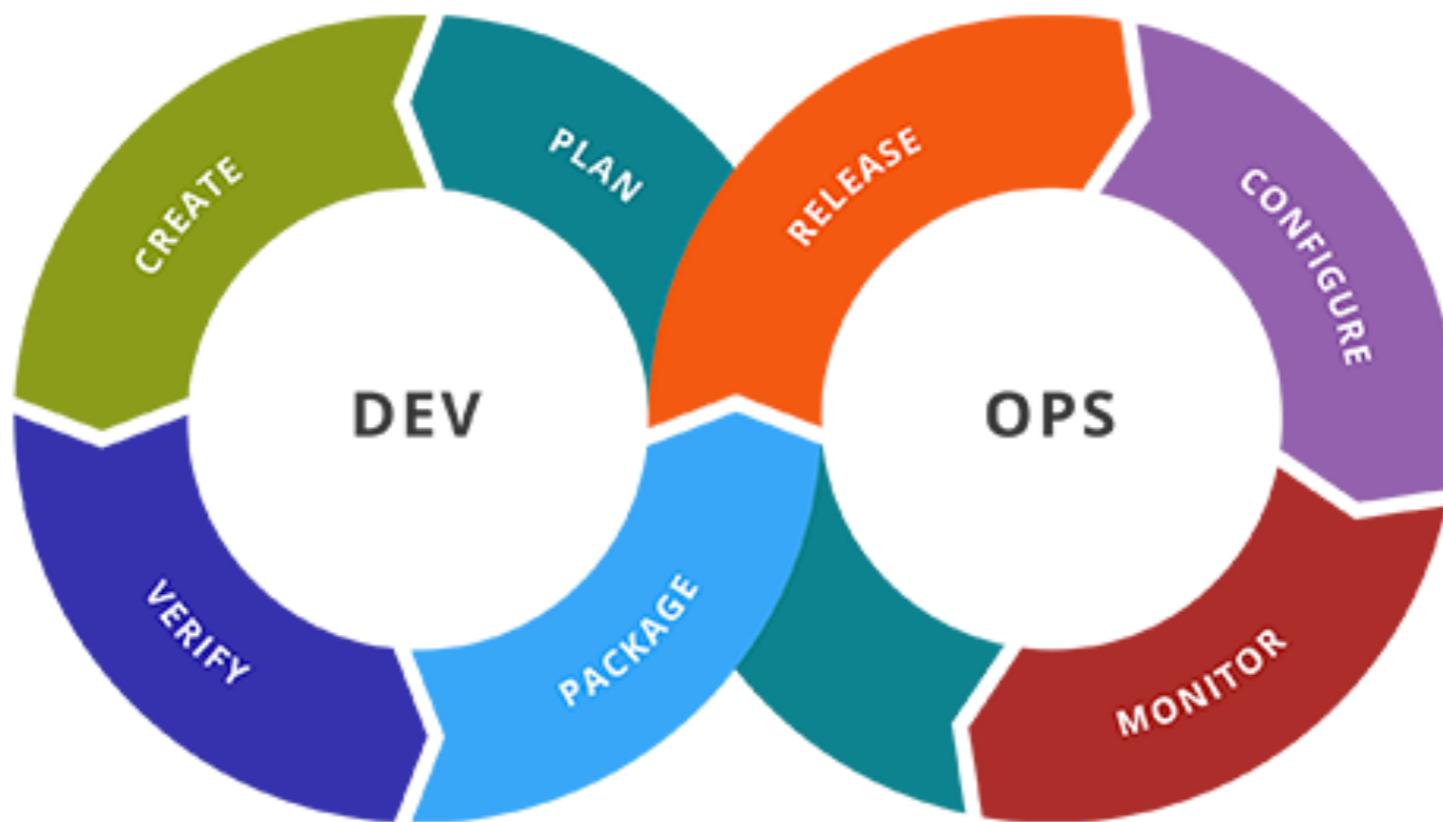
Software deployment is hard
Infrastructure provisioning/re-provisioning
Configuration networking and load balance
Redundancy (scale-out)
Lifecycle management (Software update)



Deployment, not Infrastructure

Kubernetes support for deployment
Controllers are in focus
Scale-out service
Rolling update for new version
Rollback to a previous version
Pause and resume a deployment
Horizontal auto-scaling
Canary deployment





Let's start !!



Installation



Software requirement

minkube



minikube

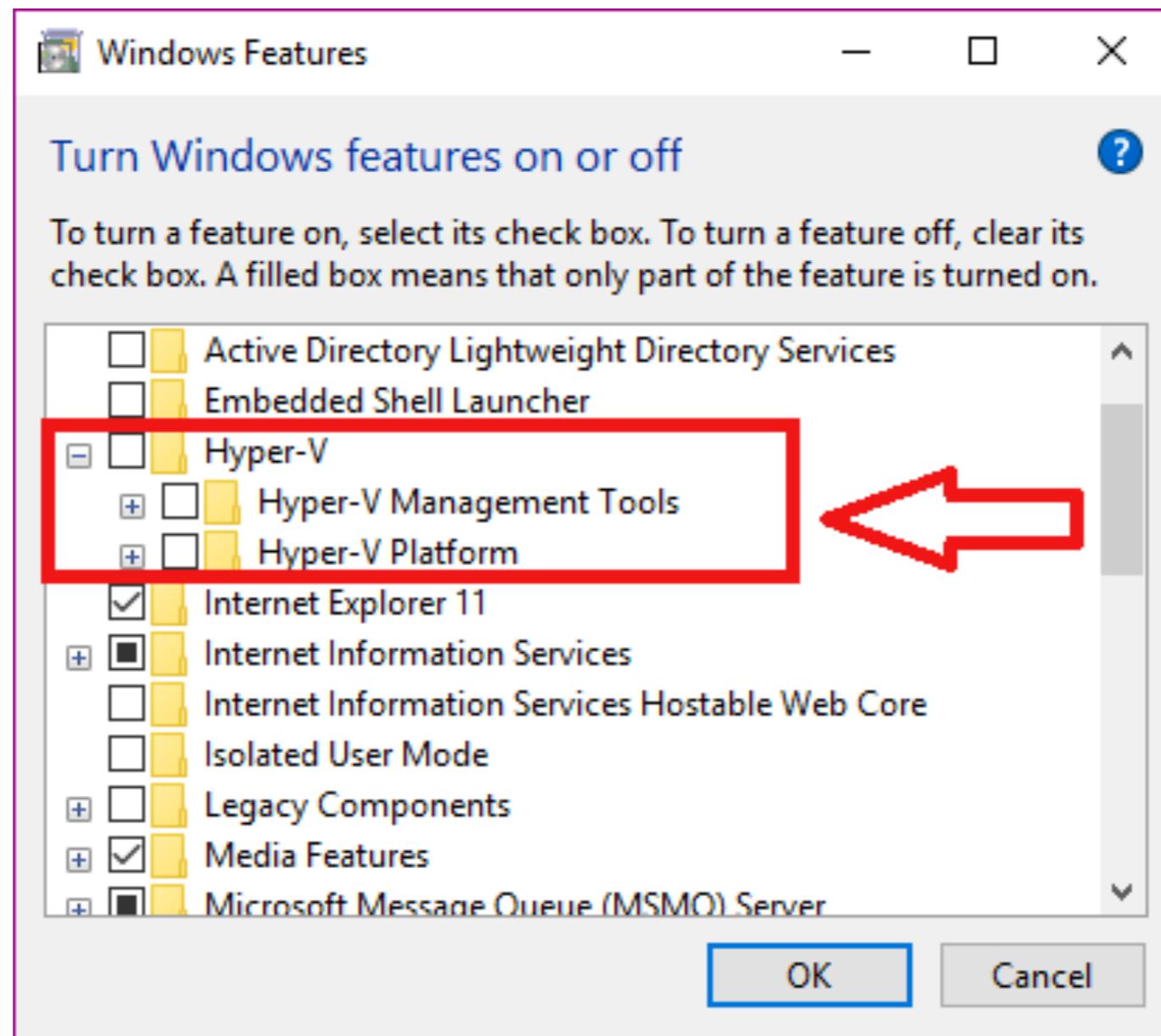


<https://github.com/kubernetes/minikube>



For Windows OS

Disable Hyper-V



Starting minikube

```
$minikube start  
$minikube status
```



Software requirement

Kubernetes command-line tool (kubectl)

<https://kubernetes.io/docs/tasks/tools/install-kubectl/#install-kubectl-binary-via-curl>



Version of Kubernetes

```
$kubectl get nodes -o yaml
```

```
nodeInfo:
```

```
  architecture: amd64
  bootID: 7c769465-27e5-4dd8-a89f-319ba1b8ef57
  containerRuntimeVersion: docker://17.9.0
  kernelVersion: 4.9.64
  kubeProxyVersion: v1.9.4
  kubeletVersion: v1.9.4
  machineID: edffd4ca8bf24253a736ea86d2448185
  operatingSystem: linux
  osImage: Buildroot 2017.11
  systemUUID: 98BAE0EF-8C9E-45DF-9AC7-F0E05806B189
```



Play with K8S

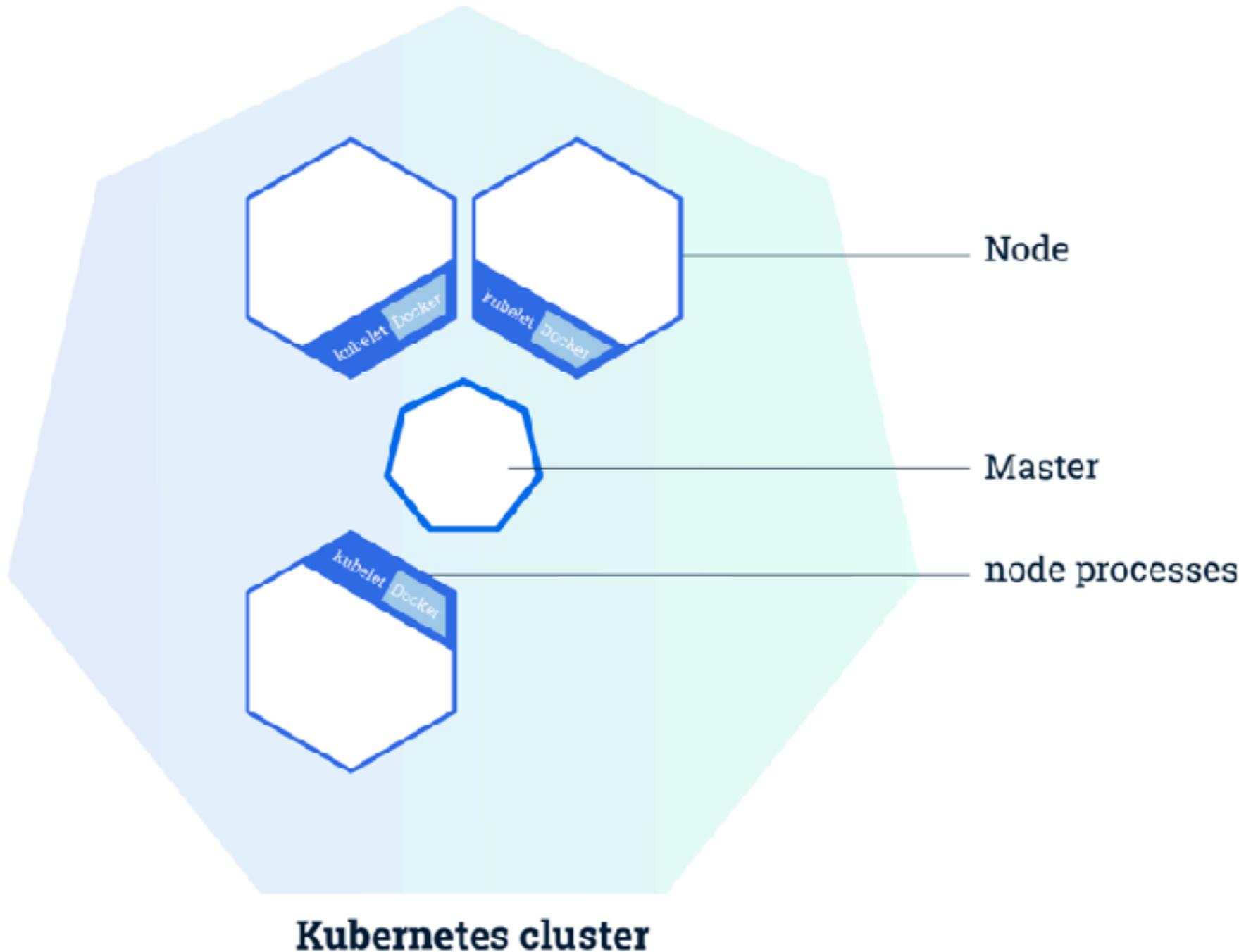
<https://labs.play-with-k8s.com/>



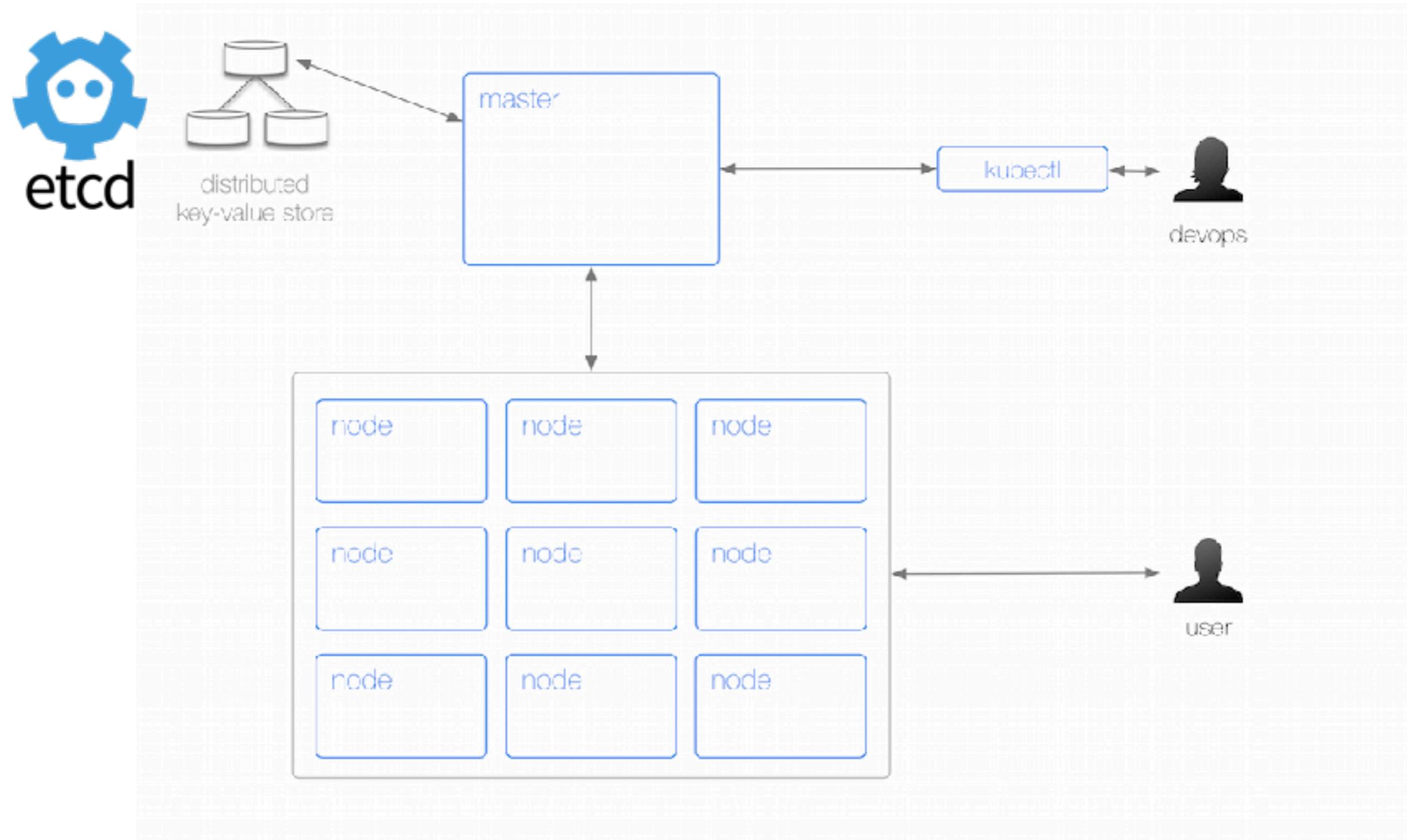
Basic of Kubernetes



Kubernetes cluster



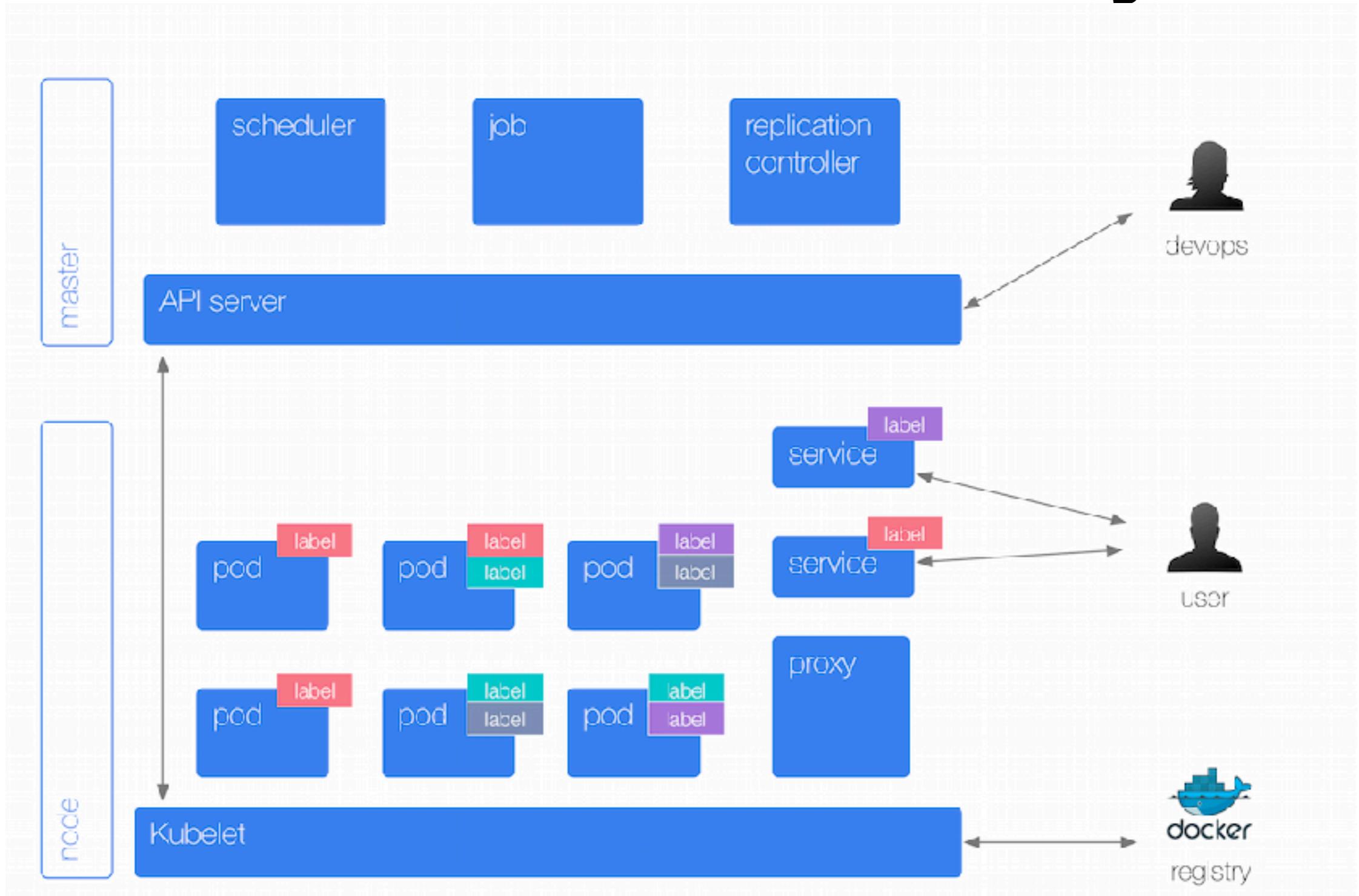
Kubernetes physical layout



<http://k8s.info/cs.html>



Kubernetes abstraction layout



<http://k8s.info/cs.html>



Hello with Kubernetes

file /01-hello/instruction.txt



Hello with Kubernetes

file /01-hello/instruction2.txt



Hello Kubernetes

Working with **kubectl** in command line
Try to run image from Docker hub



Try to use somkiat/hello

The screenshot shows the Docker Hub interface for the repository `somkiat/hello`. At the top, there's a dark header bar with a search bar, a dashboard icon, and navigation links for Dashboard, Explore, Organizations, Create, and a user profile for `somkiat`. Below the header, the repository name `somkiat/hello` is displayed with a star icon, indicating it's a public repository. A note says "Last pushed: 2 months ago". There are tabs for Repo Info, Tags, Collaborators, Webhooks, and Settings, with the Tags tab currently selected. A table lists three tags: `v3`, `v2`, and `latest`, each with a compressed size of 5 MB and a last updated date of "2 months ago". Each tag row has a small trash can icon for deletion.

Tag Name	Compressed Size	Last Updated	
v3	5 MB	2 months ago	
v2	5 MB	2 months ago	
latest	5 MB	2 months ago	

<https://hub.docker.com/r/somkiat/hello>



Kubernetes in practice

© 2017 - 2018 Siam Chamnkit Company Limited. All rights reserved.

Create a container

```
$kubectl run hello --image=somkiat/hello  
--port=8080 --generator=run/v1
```



Create a container

```
$kubectl run hello --image=somkiat/hello  
--port=8080 --generator=run/v1
```

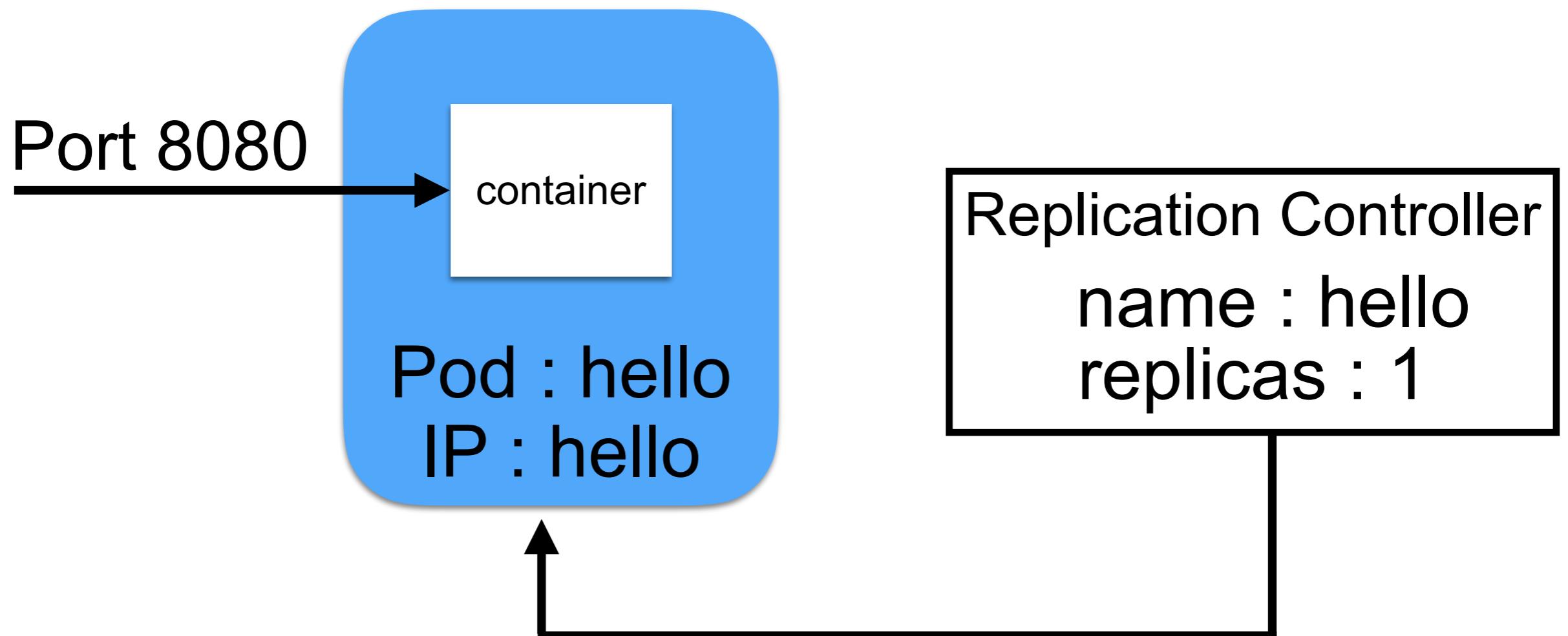


Create Replication Controller (RC)

<https://kubernetes.io/docs/reference/kubectl/conventions/#generators>



Create a container

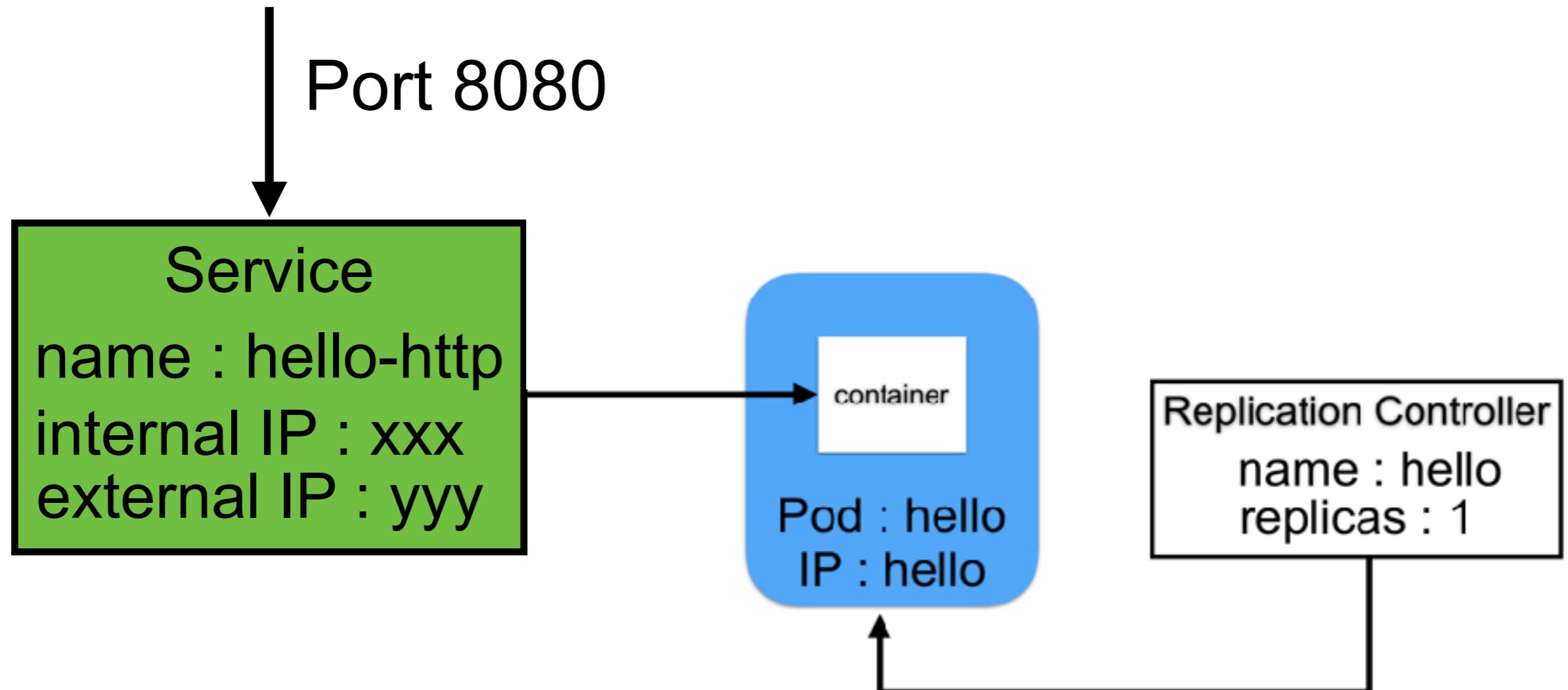


Expose RC with service

```
$kubectl expose rc hello  
--type=LoadBalancer --name hello-http
```



Expose RC with service



Access service with minikube

```
$minikube service hello-http
```

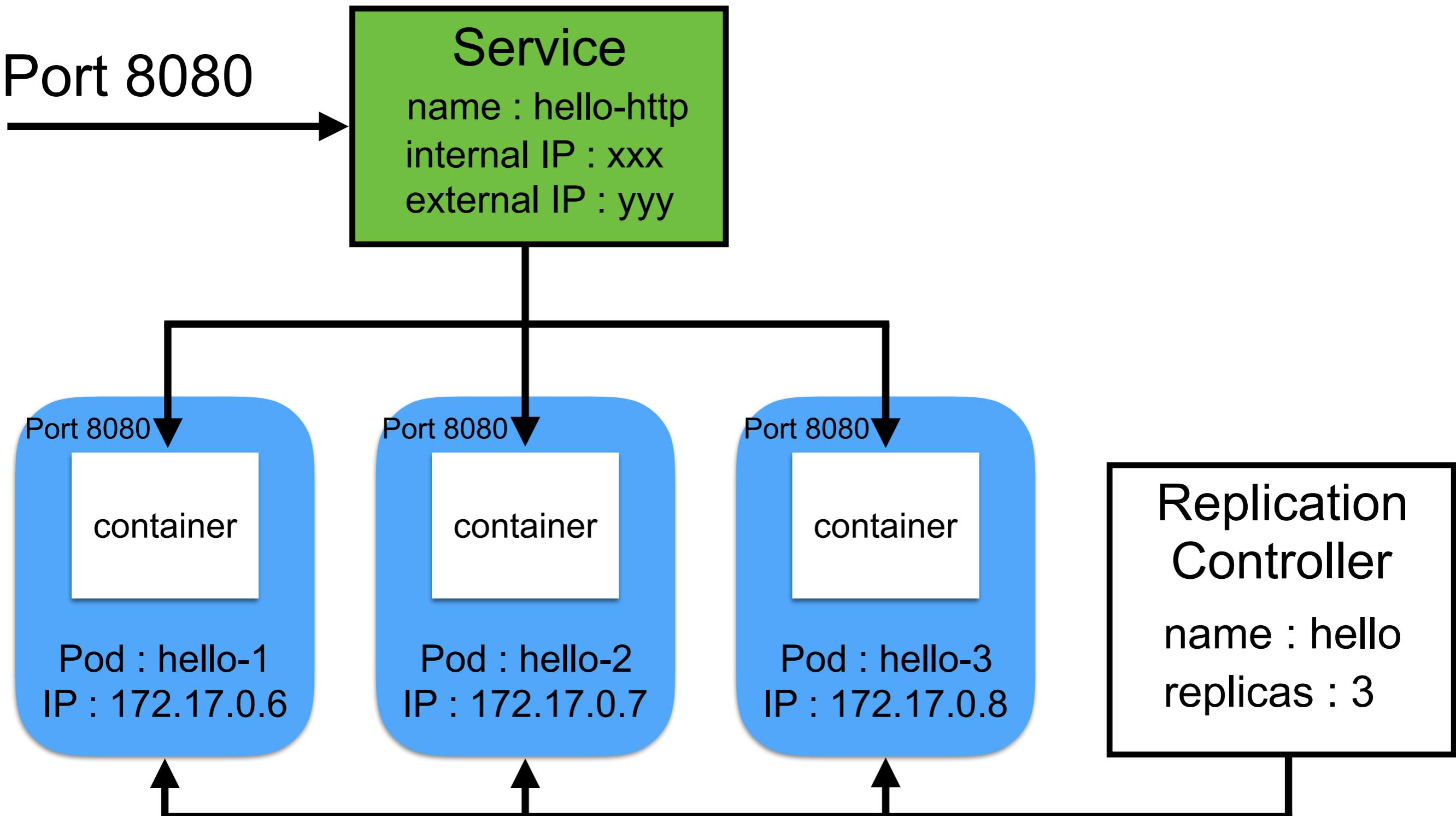


Scaling the application

```
$ kubectl scale rc hello --replicas=3
```



Scaling the application



List of RC

\$kubectl get rc

NAME	DESIRED	CURRENT	READY	AGE
hello	3	3	3	35m



List of Pods

\$kubectl get pod -o wide

NAME	READY	STATUS	RESTARTS	AGE	IP	NODE
hello-lw2p7	1/1	Running	0	29m	172.17.0.8	minikube
hello-pqnpz	1/1	Running	0	36m	172.17.0.6	minikube
hello-wwsnh	1/1	Running	0	29m	172.17.0.7	minikube



Testing

```
export SERVICE=192.168.99.100:32614
```

```
$curl http://$SERVICE  
Hello, "/" on hello-wwsnh
```

```
$curl http://$SERVICE  
Hello, "/" on hello-pqnzp
```

```
$curl http://$SERVICE  
Hello, "/" on hello-lw2p7
```



Kubernetes dashboard

\$minikube dashboard

The screenshot shows the Kubernetes dashboard interface. At the top, there is a navigation bar with a 'kubernetes' logo, a search bar, and a '+ CREATE' button. Below the navigation bar, a blue header bar displays the text 'Overview'. On the left side, there is a sidebar under the heading 'Cluster' containing links for Namespaces, Nodes, Persistent Volumes, Roles, and Storage Classes. Under 'Namespaces', 'default' is selected. Below the sidebar, there are two tabs: 'Overview' (which is active) and 'Workloads'. The main content area is divided into two sections: 'Workloads Statuses' and 'Pods'.

Workloads Statuses

- Pods: 100.00%
- Replication Controllers: 100.00%

Pods

Name	Node	Status	Restarts	Age	⋮
hello-lw2p7	minikube	Running	0	53 minutes	⋮
hello-wwsnh	minikube	Running	0	53 minutes	⋮
hello-pqnpz	minikube	Running	0	59 minutes	⋮



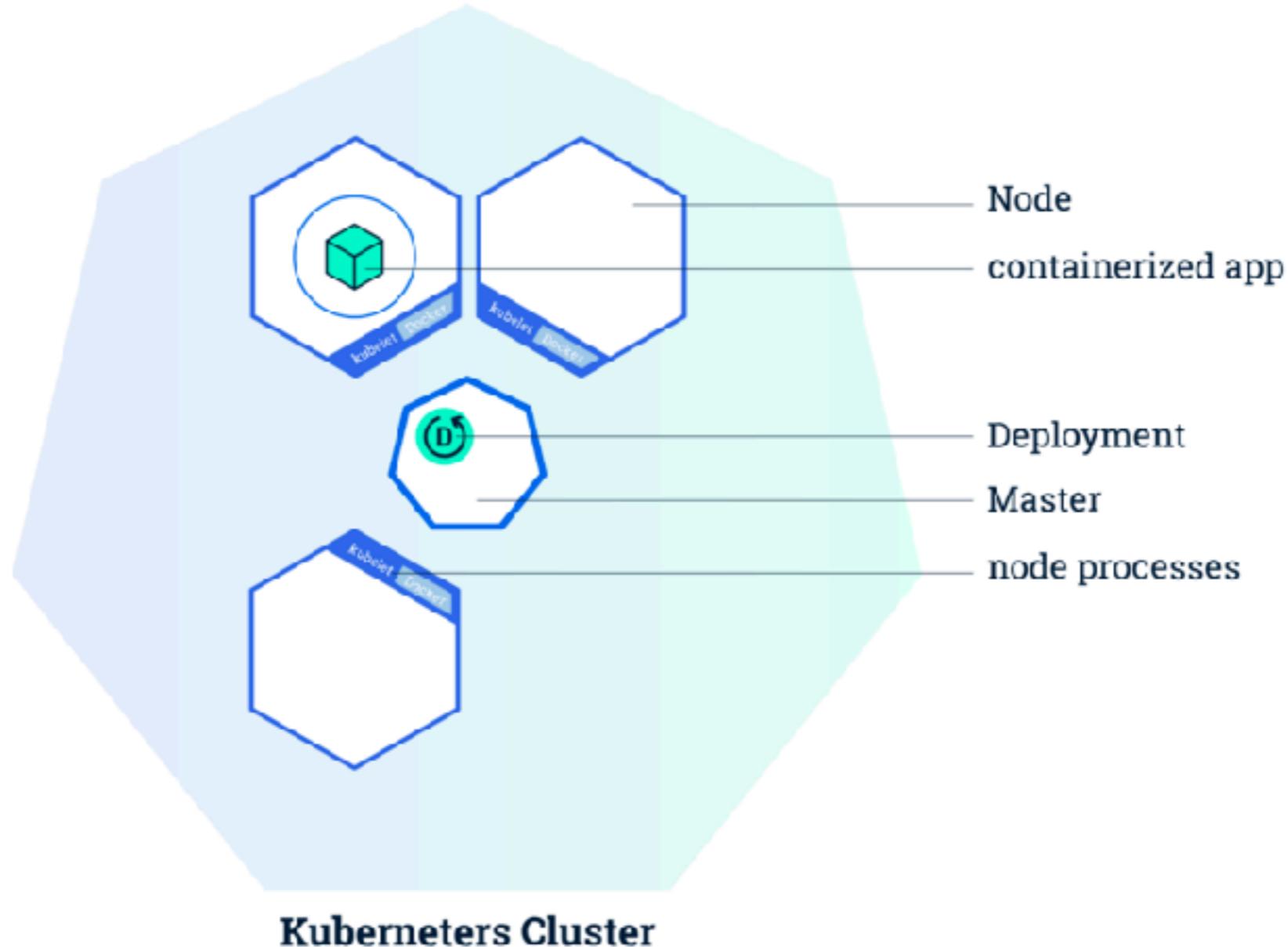
Welcome to Kubernetes



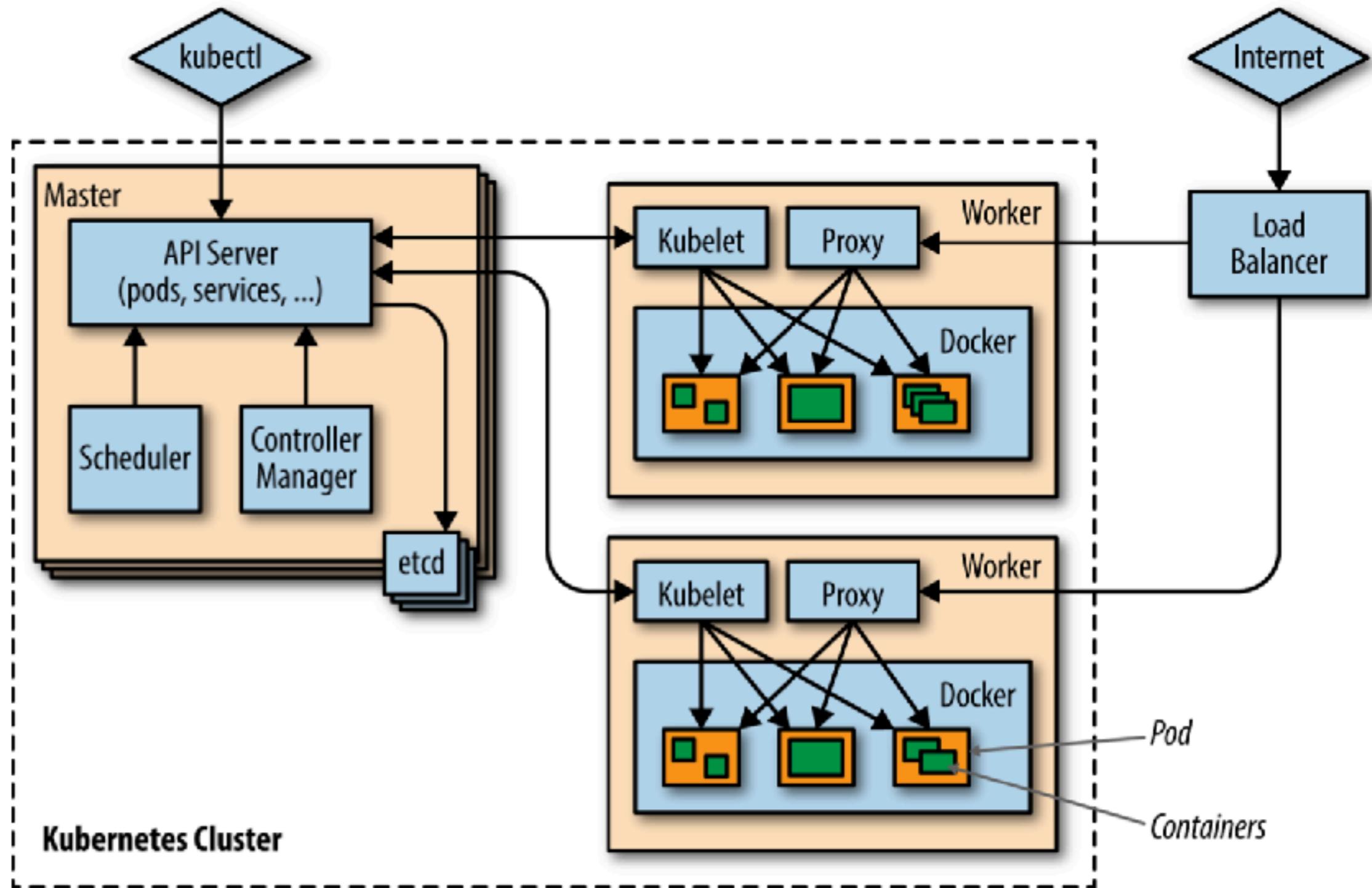
Kubernetes Architecture



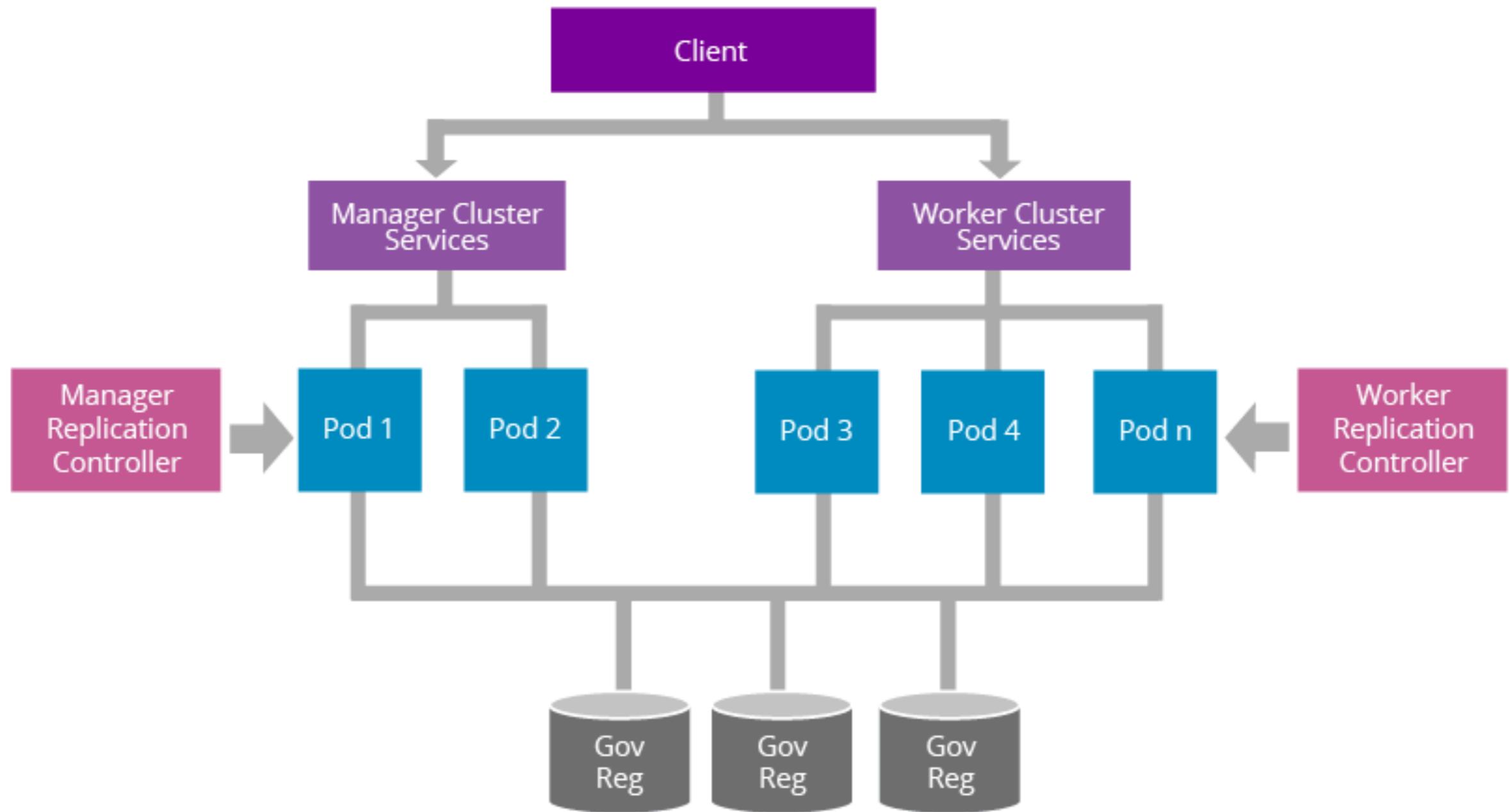
Kubernetes cluster



Kubernetes architecture



Kubernetes architecture



<https://wso2.com/whitepapers/a-reference-architecture-for-deploying-wso2-middleware-on-kubernetes/>



Key features

<https://kubernetes.io/>



Key features

- Automatic binpacking
- Horizontal Pod Autoscaler (HPA)
- Automated rollouts and rollbacks
- Storage orchestration



Key features

Self-healing

Service discovery and Load Balancing (LB)

Secret and config management

Batch execution



Automatic binpacking



Automatic binpacking

Limit of CPU/Memory can define on Pods
Schedule will select a node that have enough resources



Automatic binpacking

When reach the Memory limit ?

1. Kill current Pod
2. If Pod have restart flag, try to create in other node



Automatic binpacking

When reach the CPU limit ?

1. Schedule not kill Pod
2. Schedule waiting it back to normal state



Automatic binpacking

Try to check resources of node

\$kubectl describe node

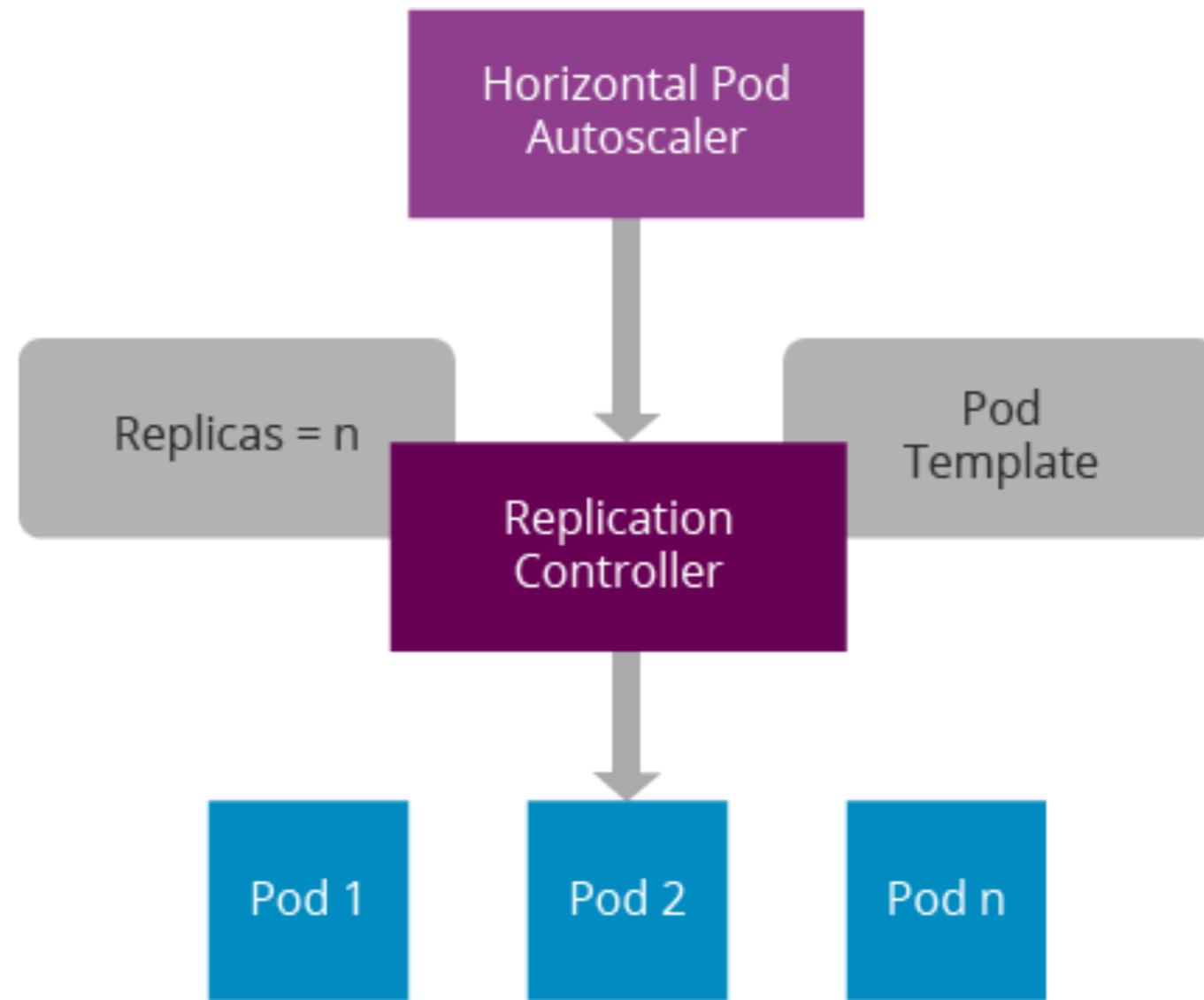
CPU Requests	CPU Limits	Memory Requests	Memory Limits
5m (0%)	0 (0%)	50Mi (2%)	0 (0%)
260m (13%)	0 (0%)	110Mi (5%)	170Mi (8%)
0 (0%)	0 (0%)	0 (0%)	0 (0%)
0 (0%)	0 (0%)	0 (0%)	0 (0%)



Horizontal Pod Autoscaler (HPA)



Horizontal Pod Autoscaler



Horizontal Pod Autoscaler

Monitor workload on Pods (based on CPU)
and automatic scaling-up application

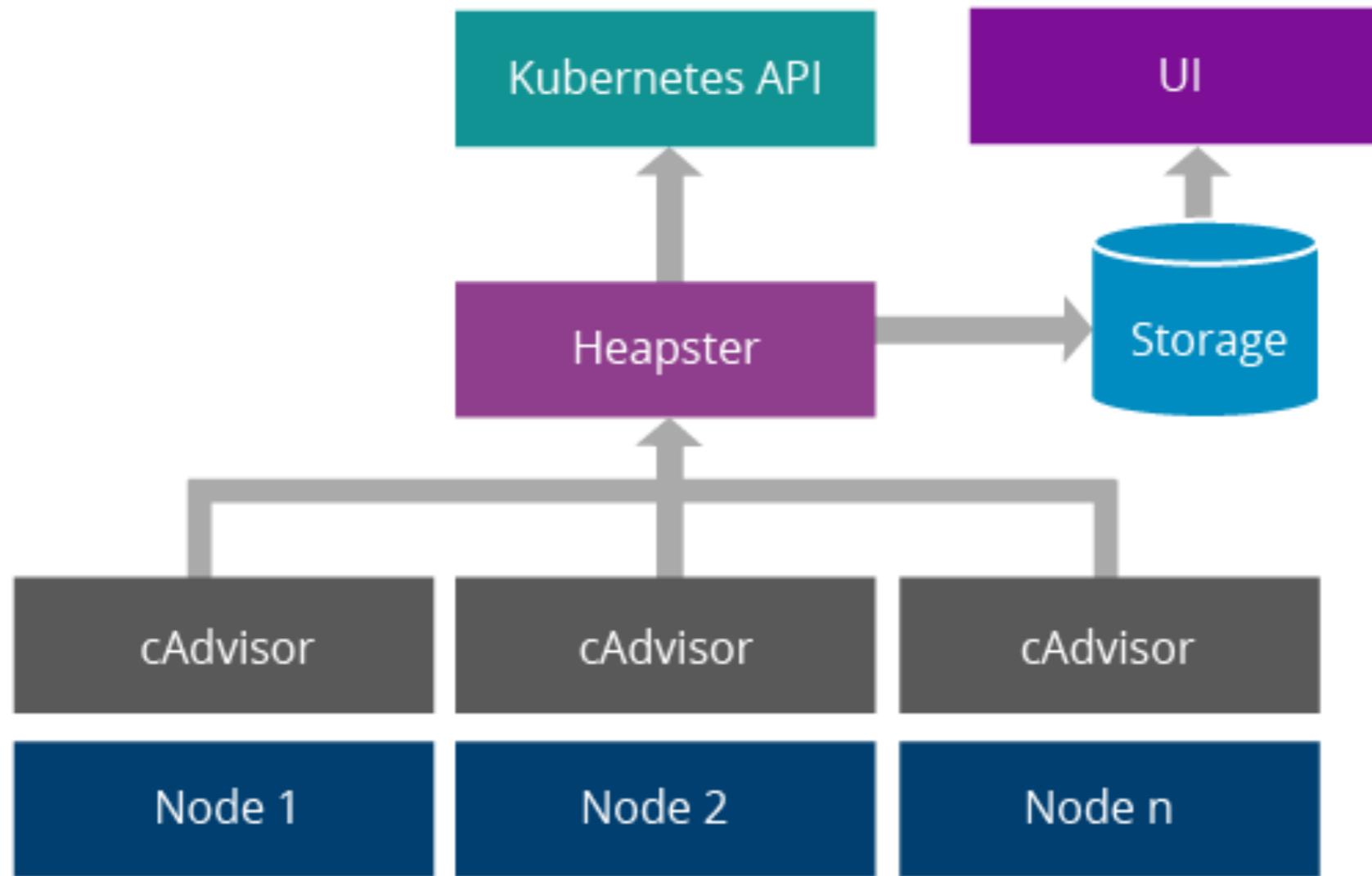
Scaling-up and down for your app need !!



Resource usage monitoring



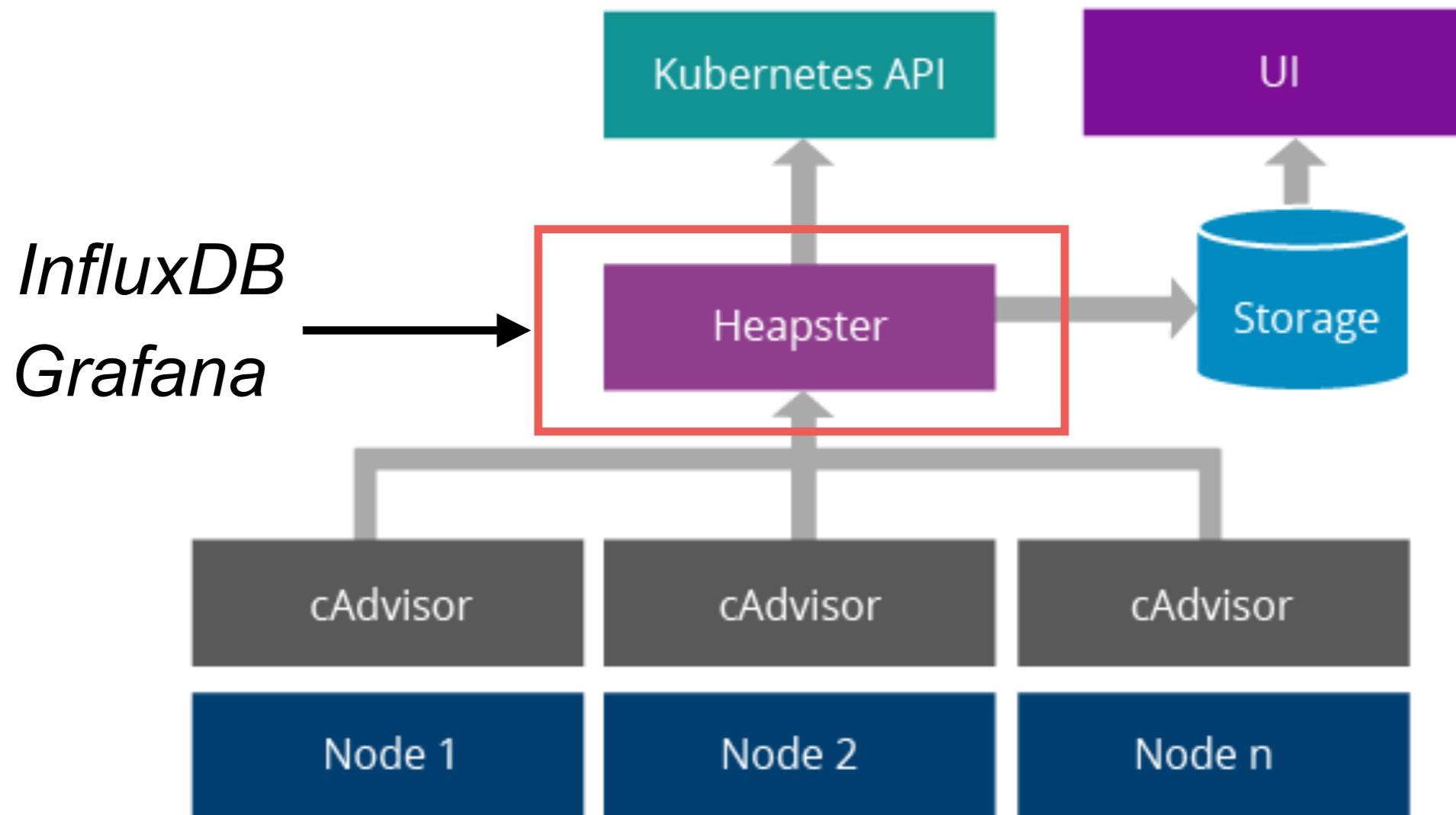
Resource usage monitoring



<https://github.com/kubernetes/heapster>



Resource usage monitoring



<https://github.com/kubernetes/heapster>



Heapster deprecation timeline

Kubernetes	Action	Policy and Support
v 1.11	Initial deprecation	No new feature + fix bugs
v 1.12	Setup removal	The optional to install heapster in Kubernetes
v 1.13	Removal	No new fix bug, move to retired organization

<https://github.com/kubernetes/heapster/blob/master/docs/deprecation.md>



Try Kubernetes Metric Server

Starting from Kubernetes 1.8

Resources usage metrics => CPU and memory

Use via Metric API and Metric server

<https://github.com/kubernetes-incubator/metrics-server>

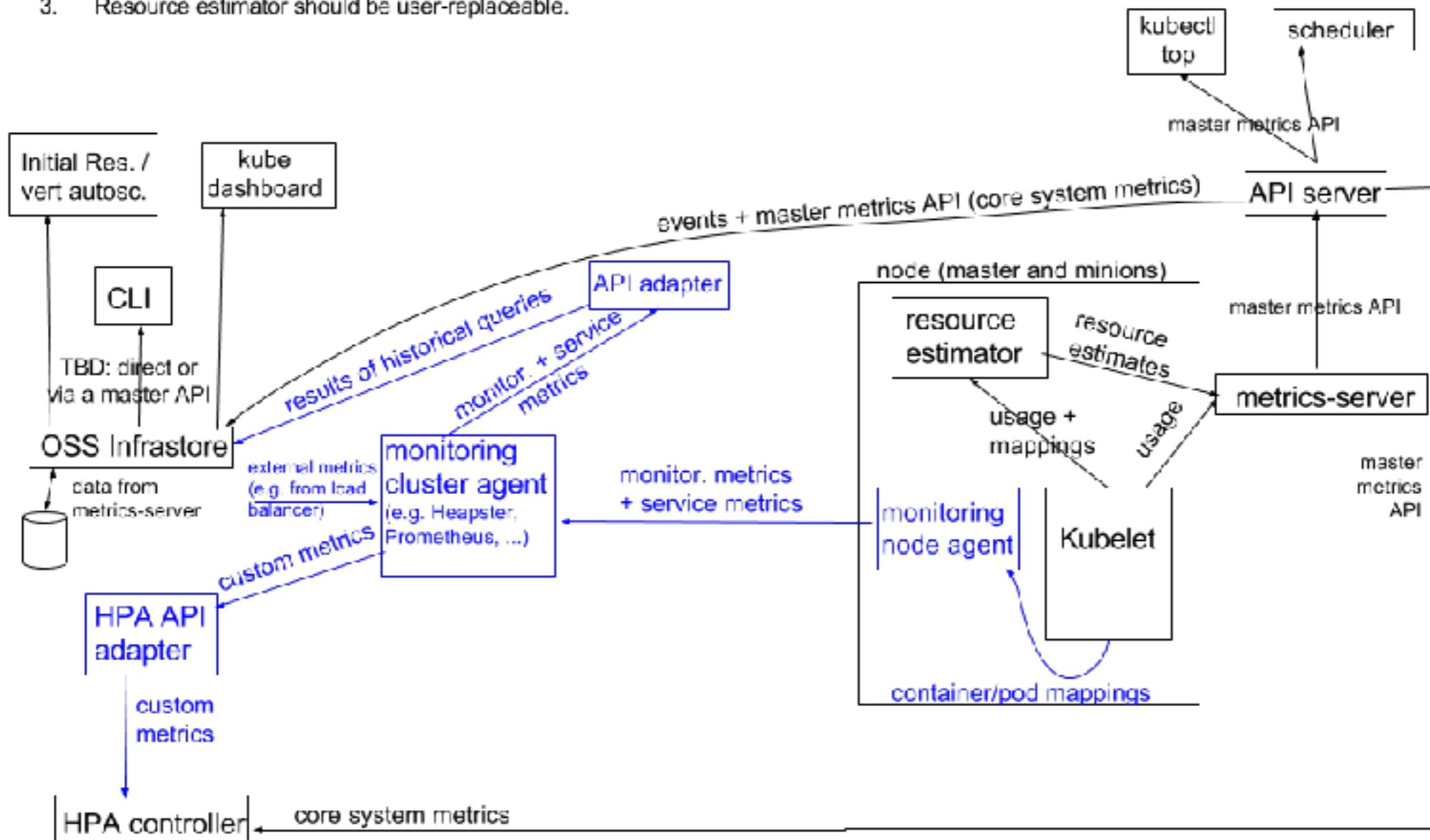


Architecture diagram

Monitoring architecture proposal: OSS
(arrows show direction of metrics flow)

Notes

1. Arrows show direction of metrics flow.
2. Monitoring pipeline is in blue. It is user-supplied and optional.
3. Resource estimator should be user-replaceable.



https://github.com/kubernetes/community/blob/master/contributors/design-proposals/instrumentation/monitoring_architecture.md

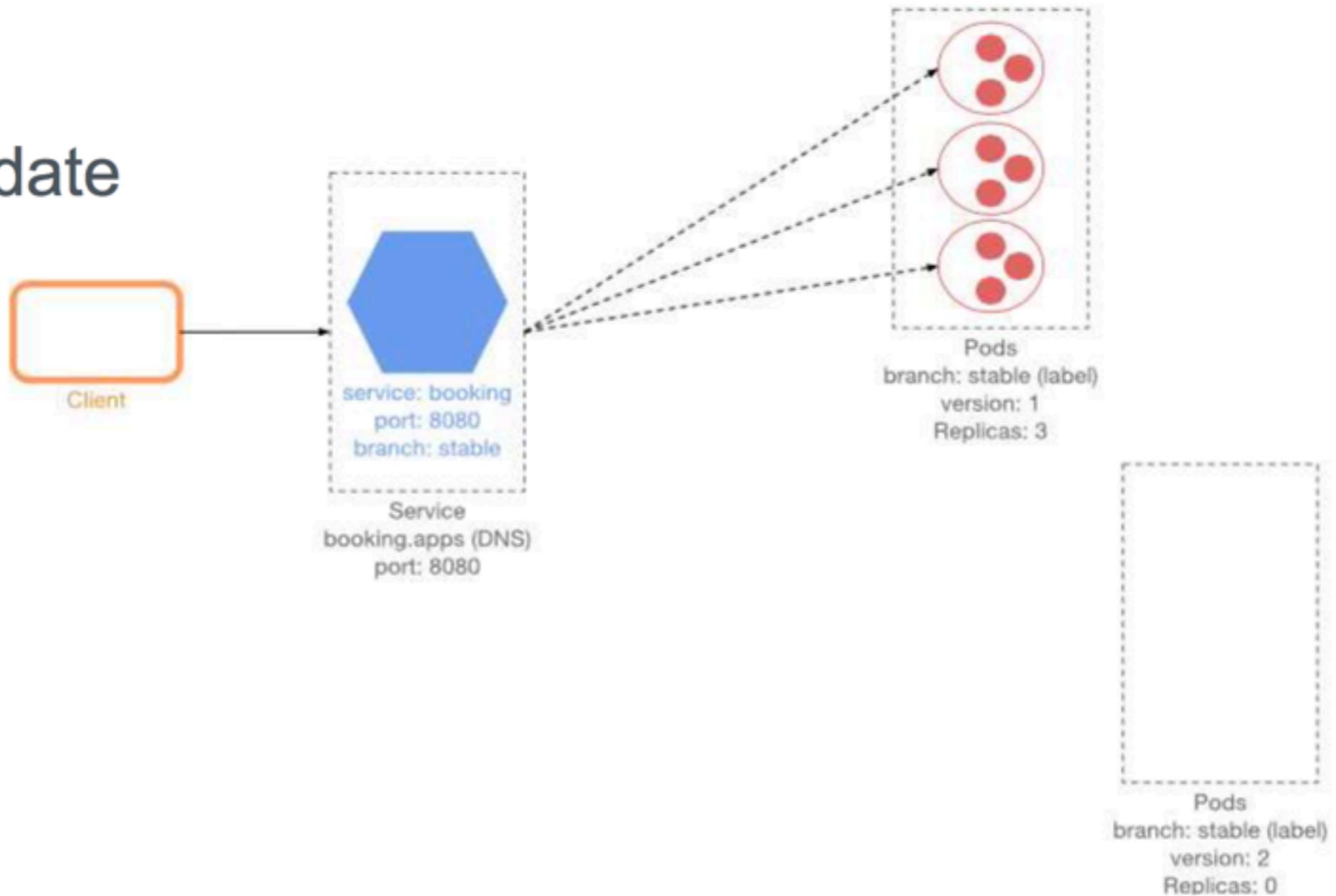


Automated rollouts & rollbacks



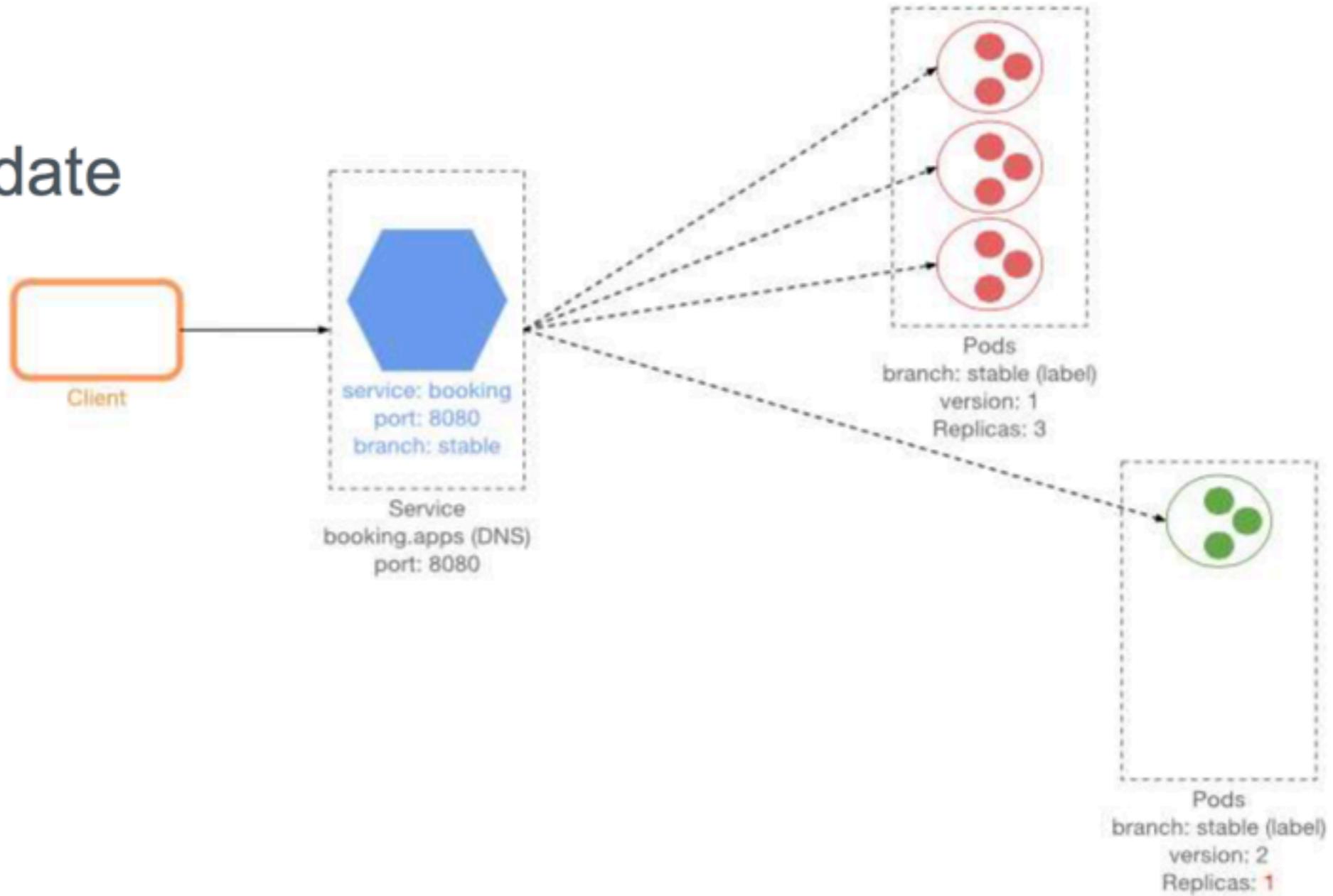
Rolling update (1)

Rolling Update



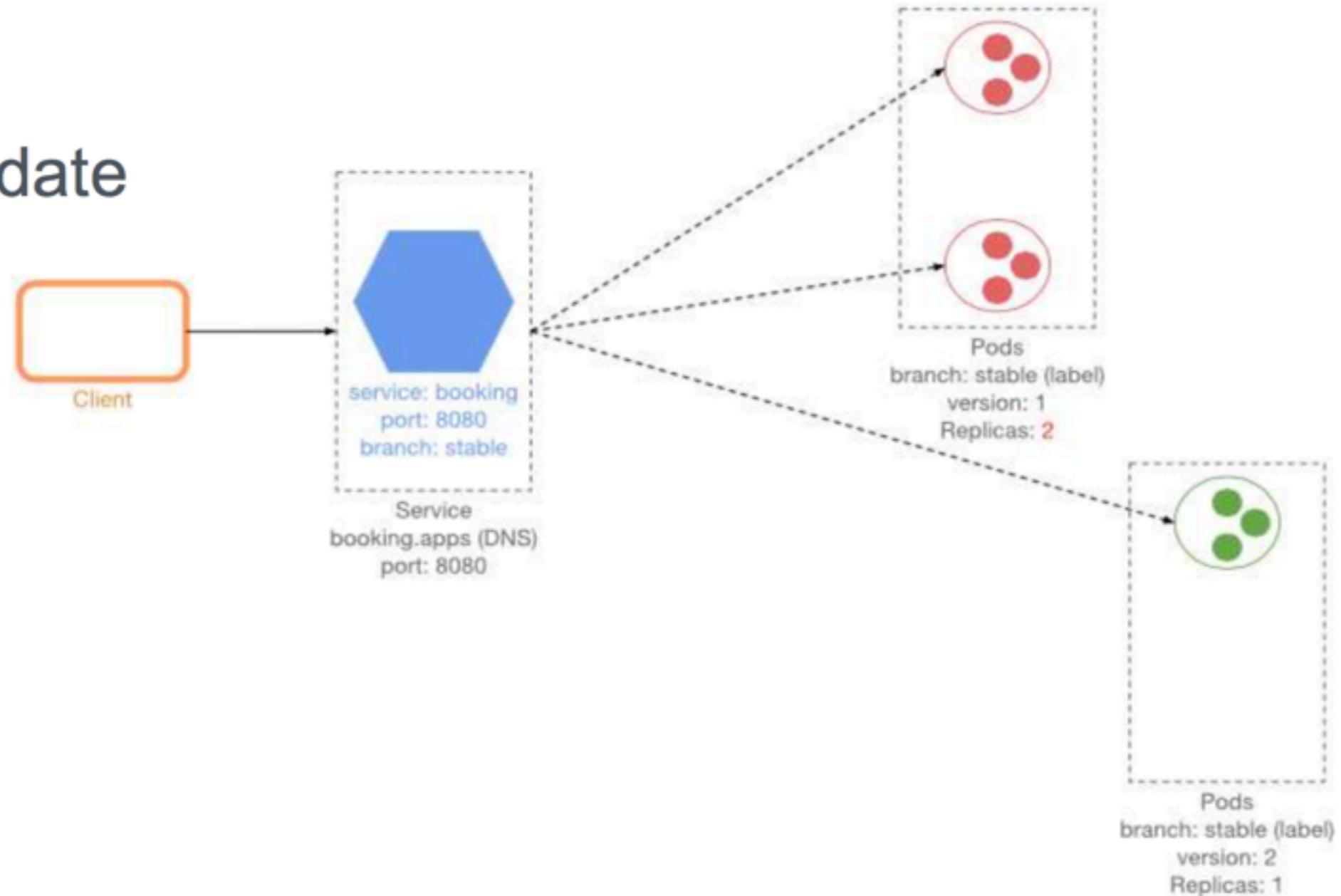
Rolling update (2)

Rolling Update



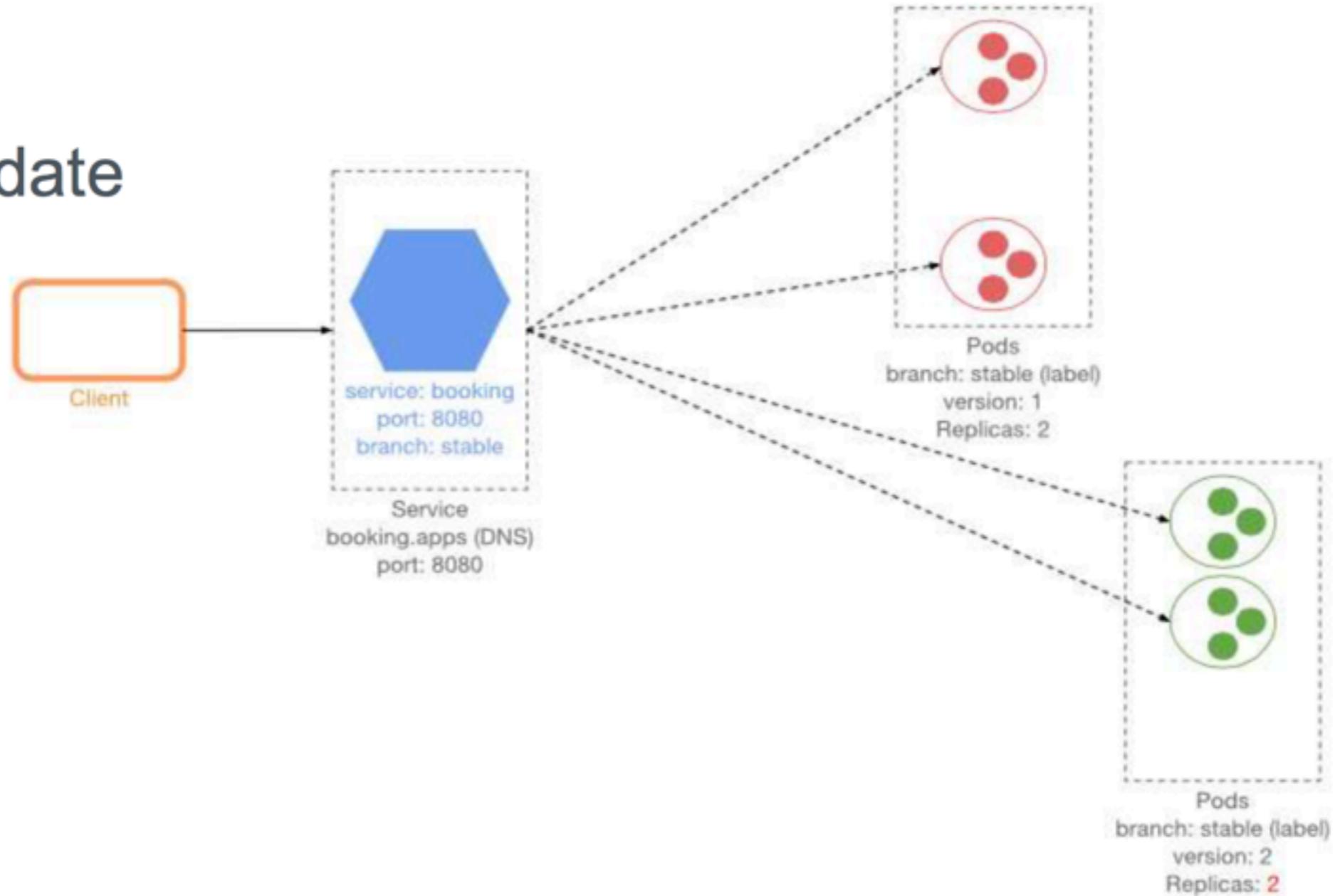
Rolling update (3)

Rolling Update



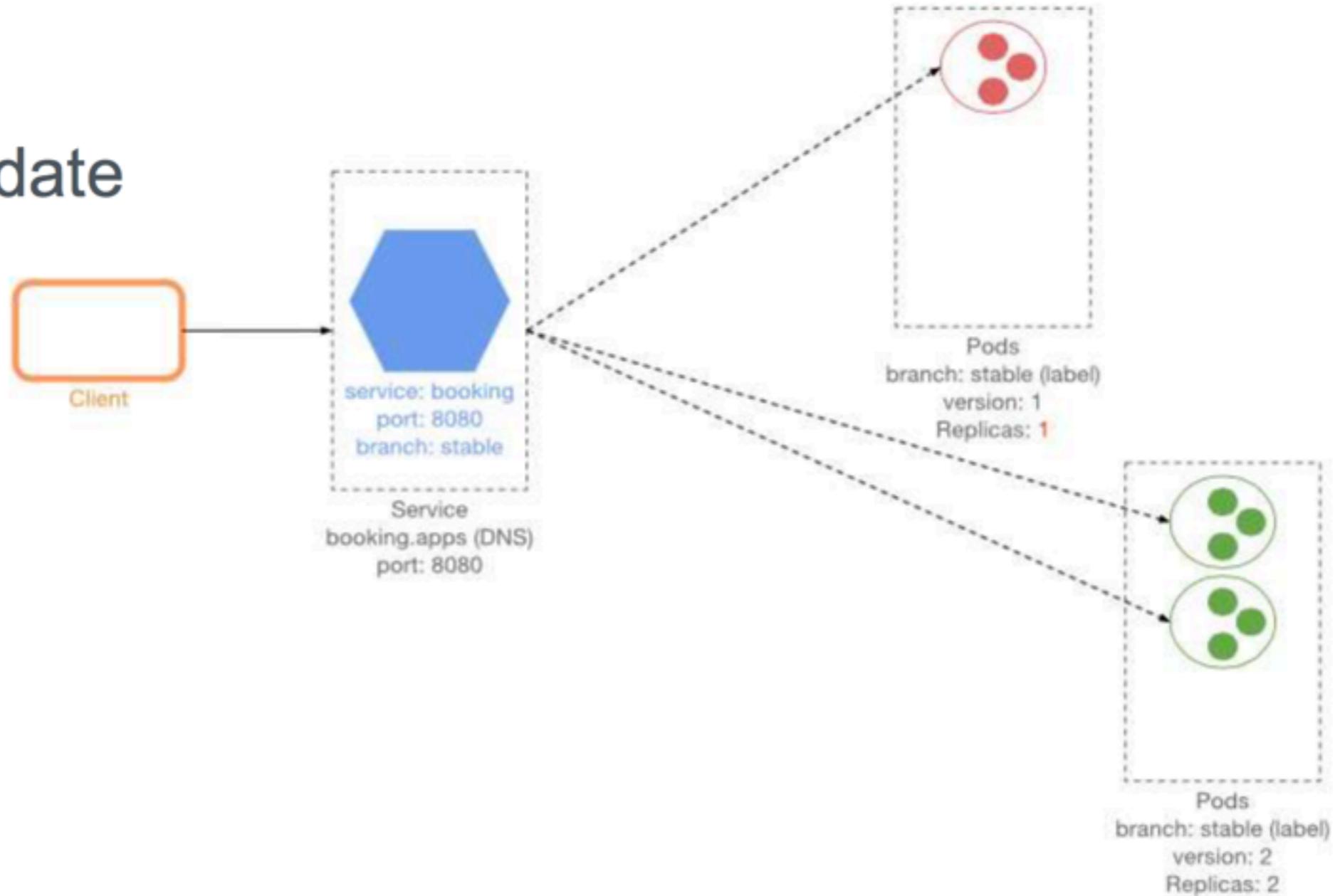
Rolling update (4)

Rolling Update



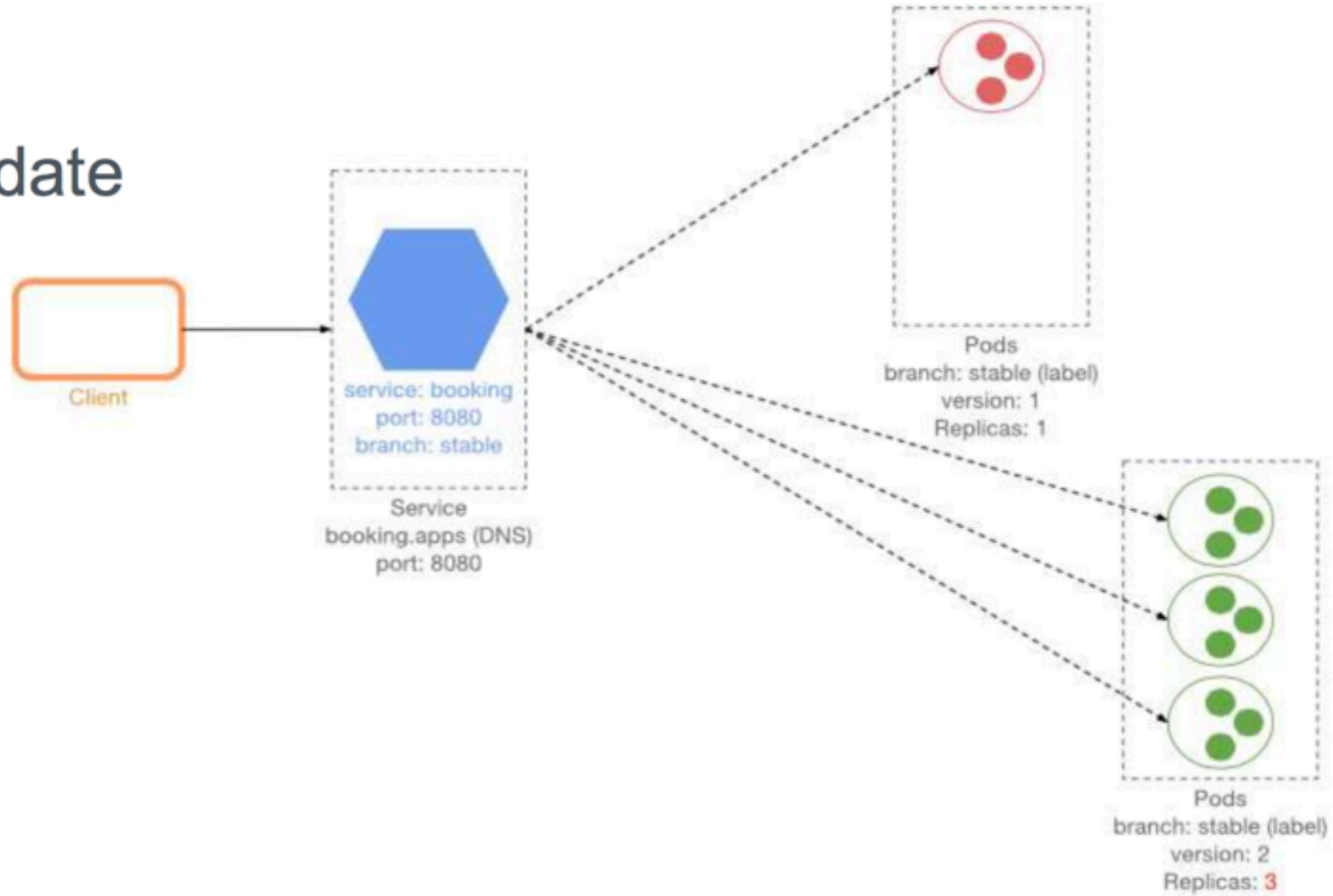
Rolling update (5)

Rolling Update



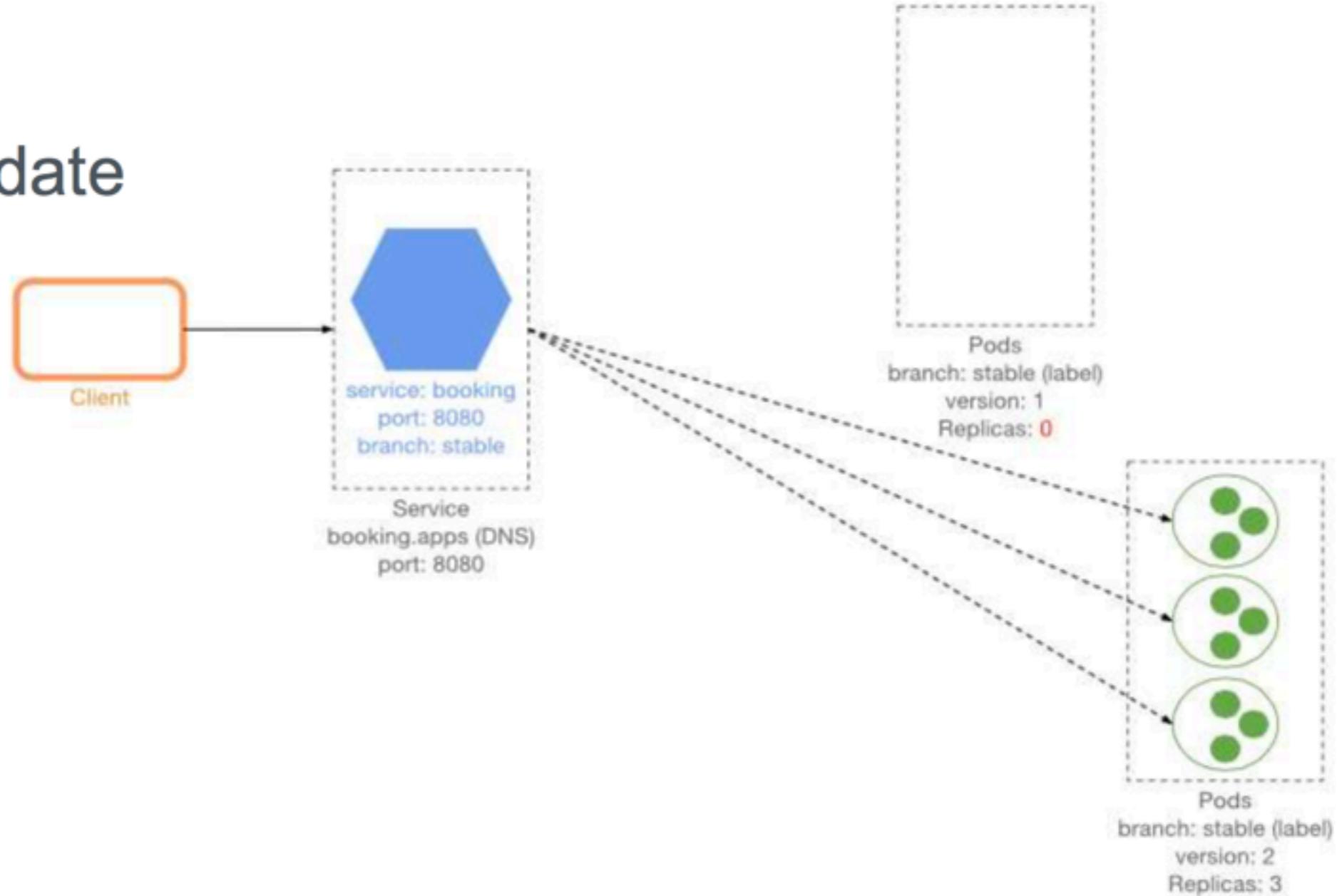
Rolling update (6)

Rolling Update



Rolling update (7)

Rolling Update



Storage orchestration



Storage orchestration

Support many type of storages

1. Local storage
2. Network storage (NFS, GlusterFS, Ceph)
3. Cloud storage (GCE, AWS, Azure)



Self-healing



Provide well known ports for Kubernetes services



Service Discovery and Load balance

Service is the connector/proxy for client to connect with Pod

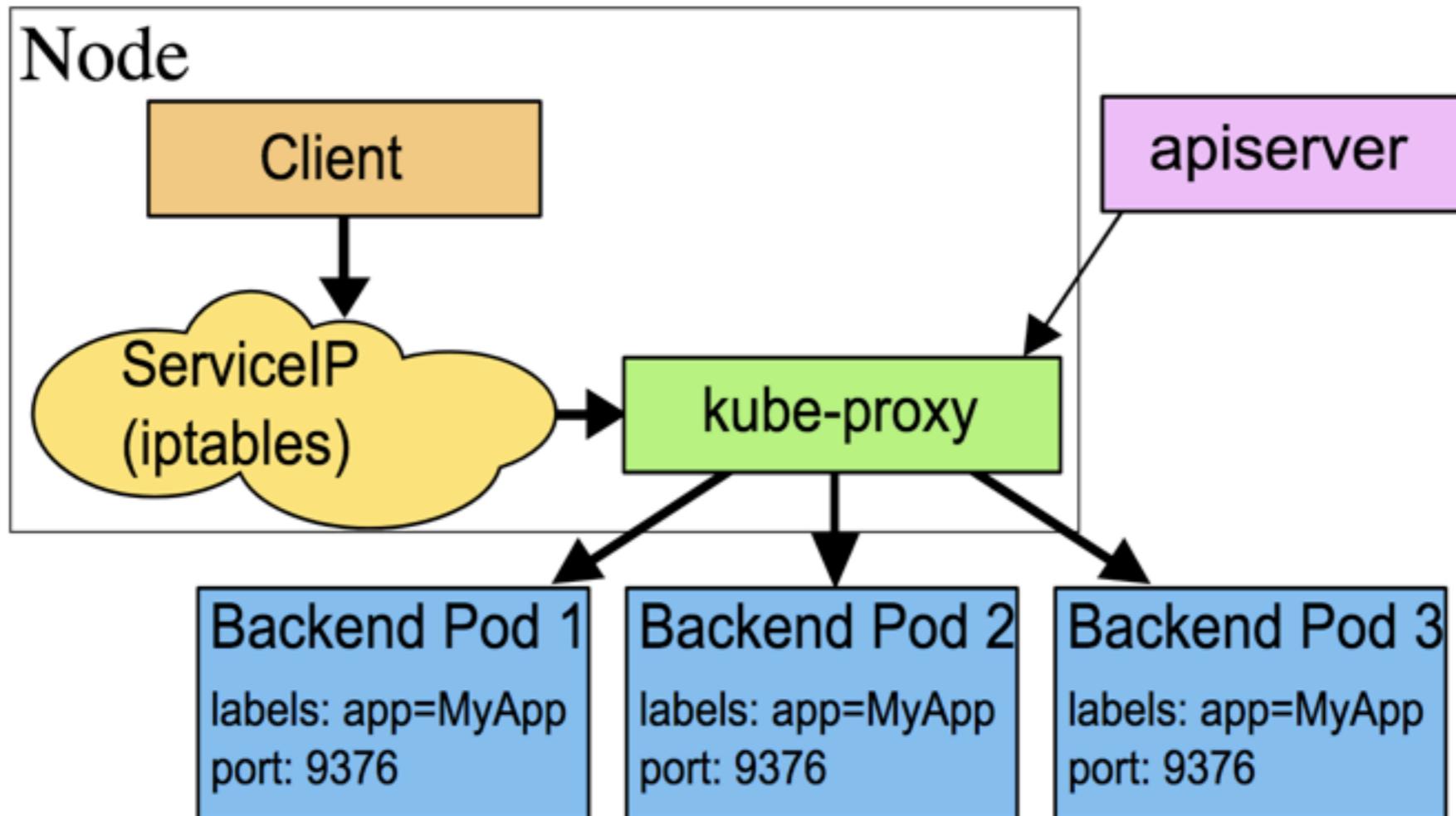
Discovery use for service to look Pod

Support load balance between Pods (replica)

<https://kubernetes.io/docs/concepts/services-networking/service/>



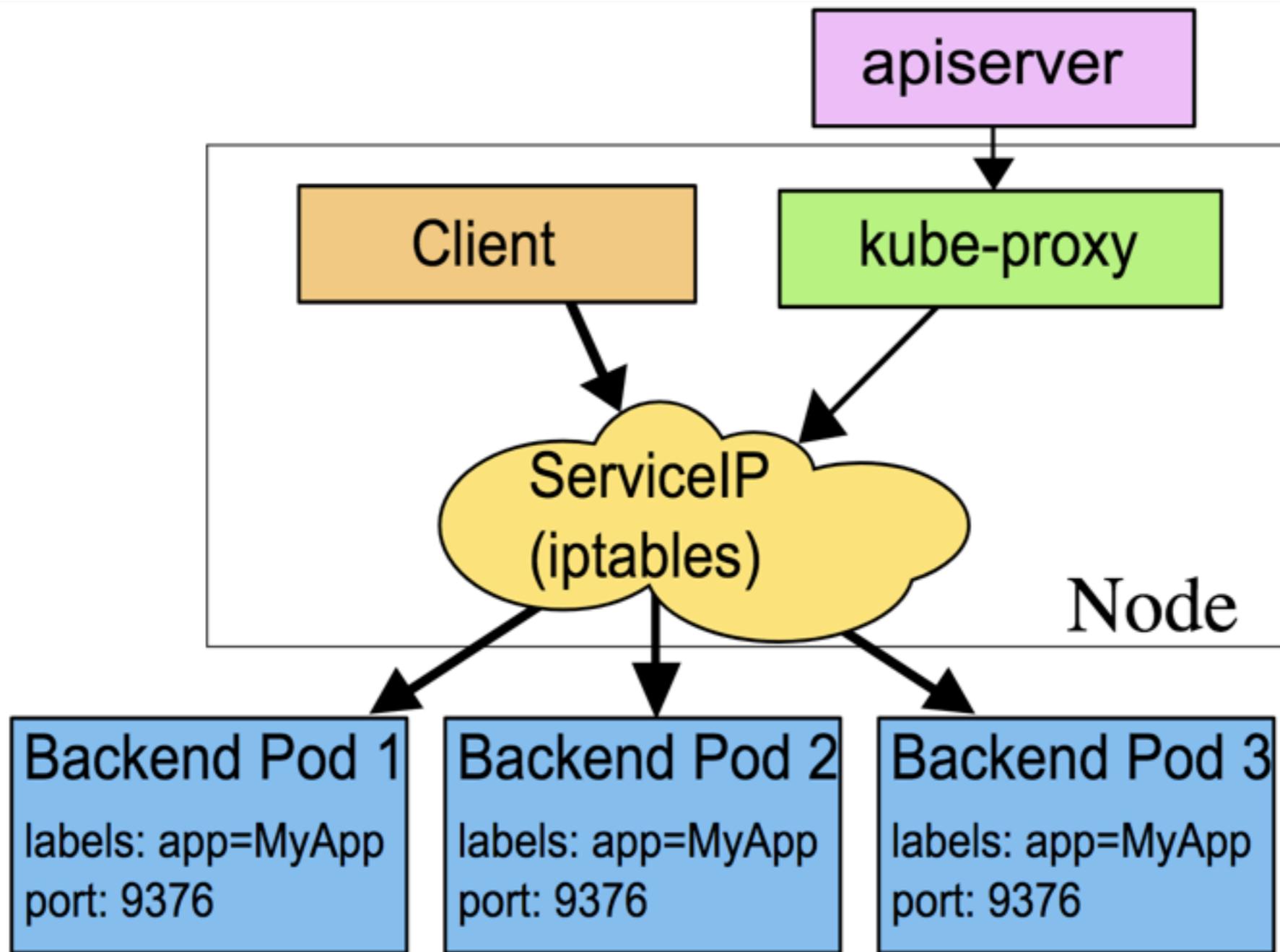
Proxy-mode: userspace



Note that in the above diagram, `clusterIP` is shown as `ServiceIP`.



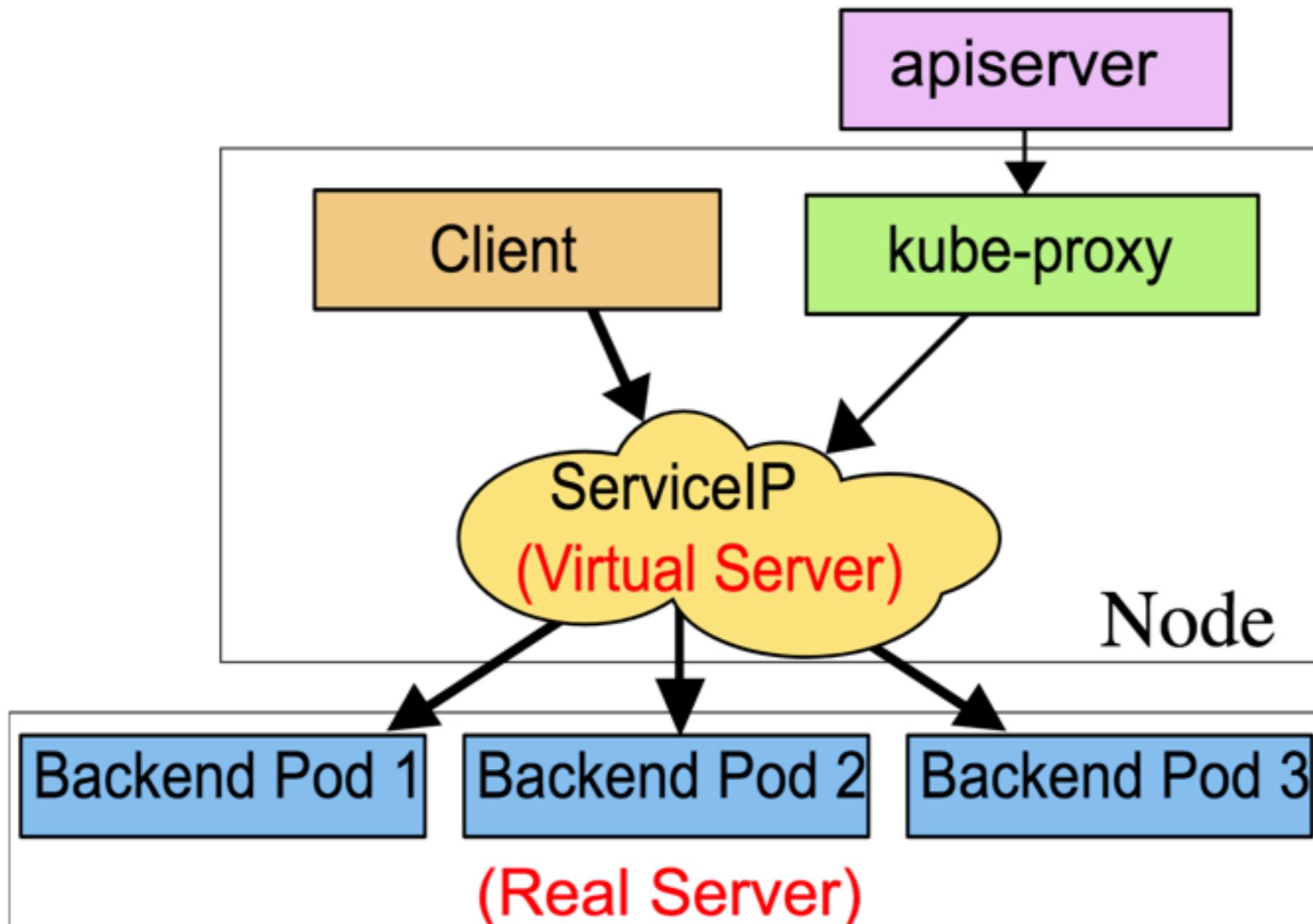
Proxy-mode: iptables



Note that in the above diagram, `clusterIP` is shown as `ServiceIP`.



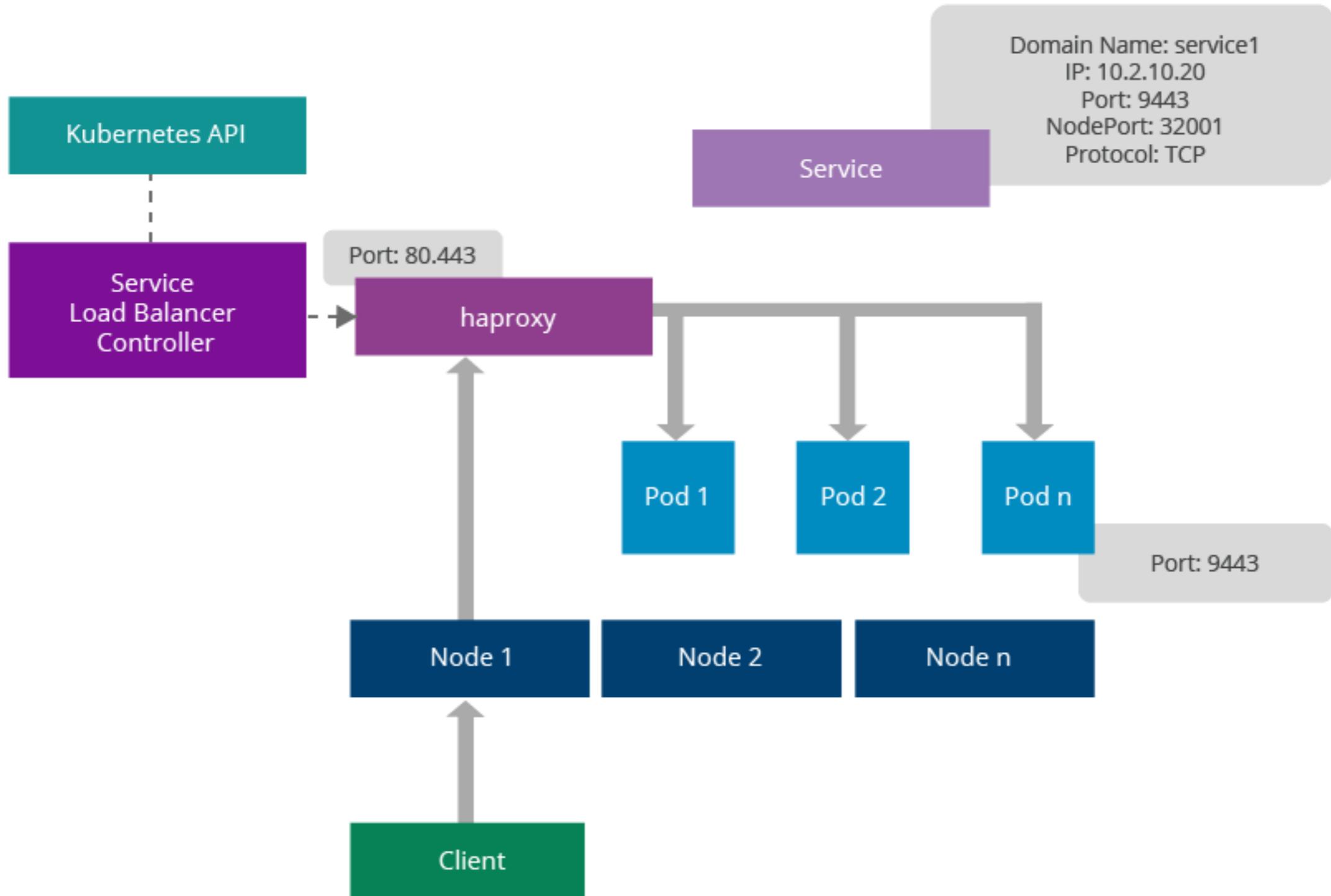
Proxy-mode: ipvs (beta 1.9)



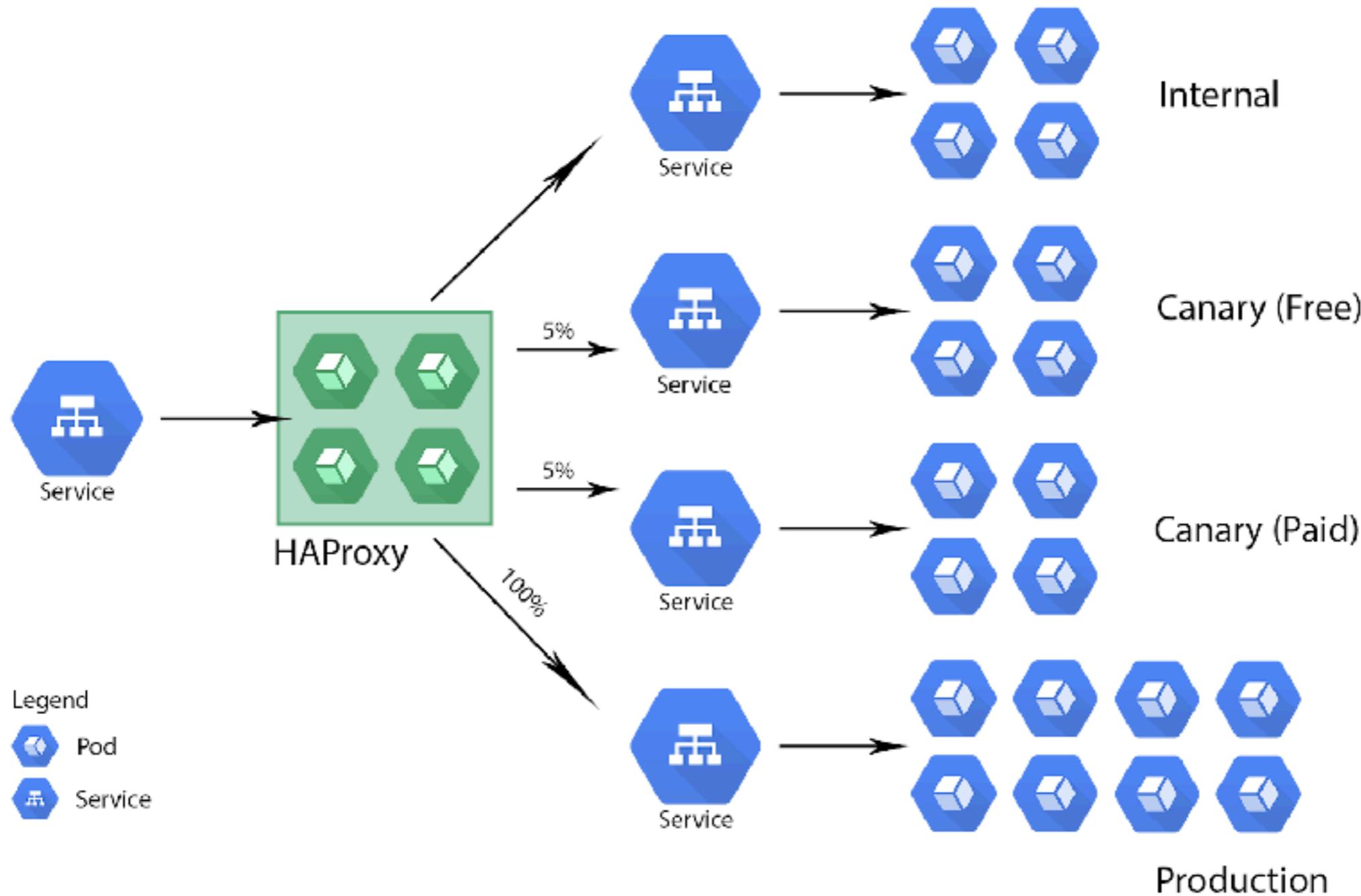
Sticky session management using Service Load Balancers



Service Load Balancer



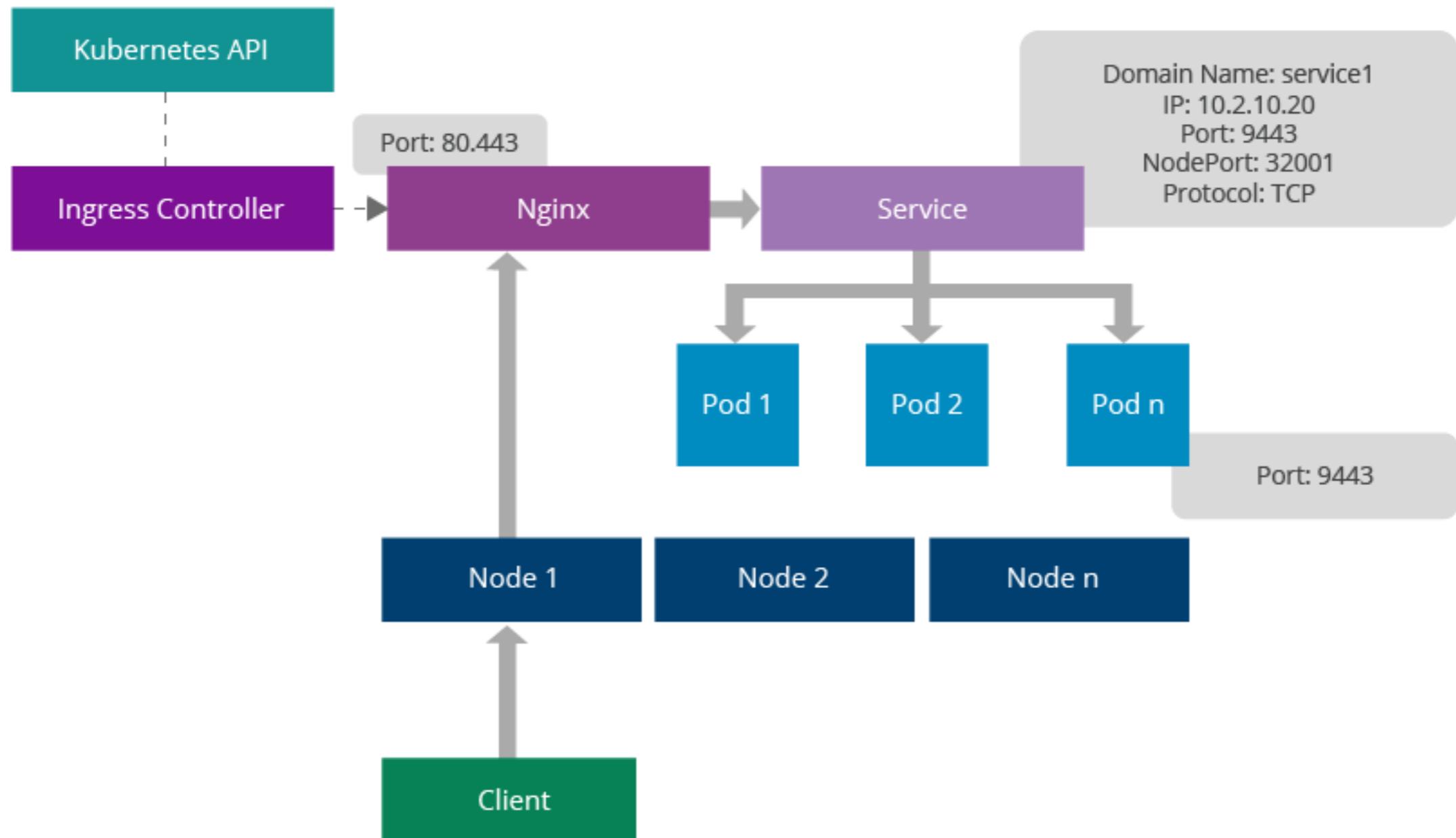
Service Load Balancer



<https://kubernetes.io/blog/2017/04/multi-stage-canary-deployments-with-kubernetes-in-the-cloud-onprem/>



Ingress controller



Secret and configuration management



Secret and configuration mgt

From **12factor** app

Store config in environments
(dev/qa/staging/prod)

<https://12factor.net/>



Secret and configuration mgt

Keep confidential data to running app in
encryption format

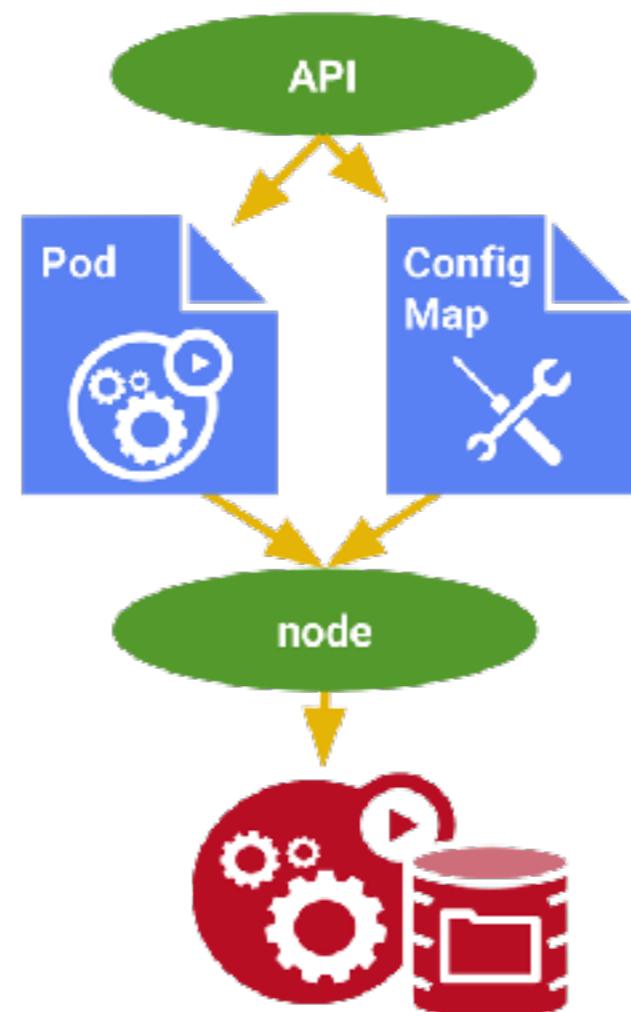
\$kubectl get secret

NAME	TYPE	DATA	AGE
default-token-26swm	kubernetes.io/service-account-token	3	2h



Secret and configuration mgt

Use **ConfigMap** to define all configuration that reference from Pod

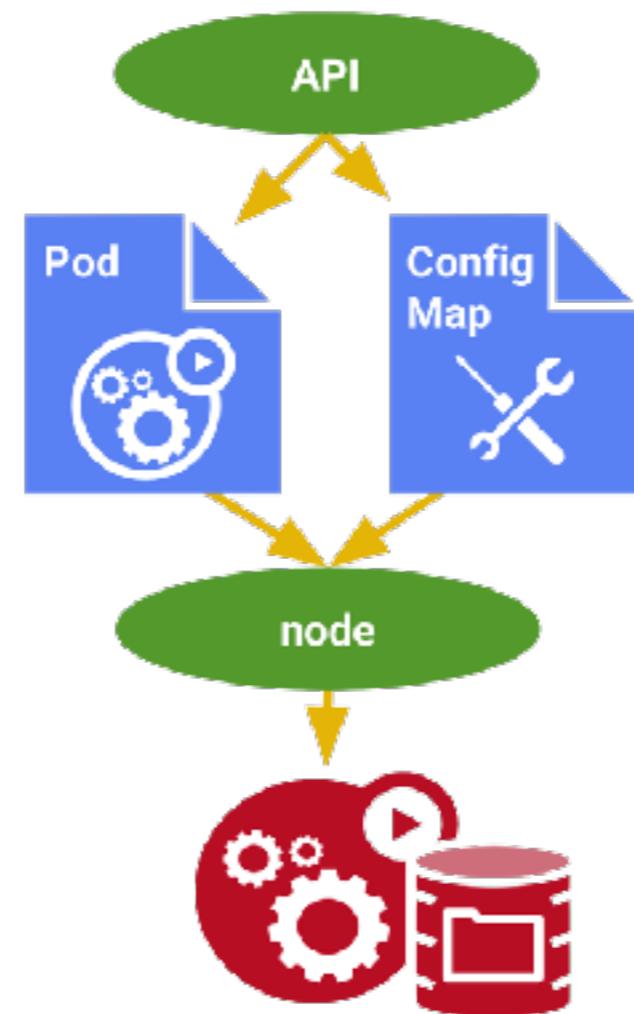


<https://kubernetes.io/docs/tasks/configure-pod-container/configure-pod-configmap/>



Secret and configuration mgt

Come from **12 factor app** :: config come from the environment



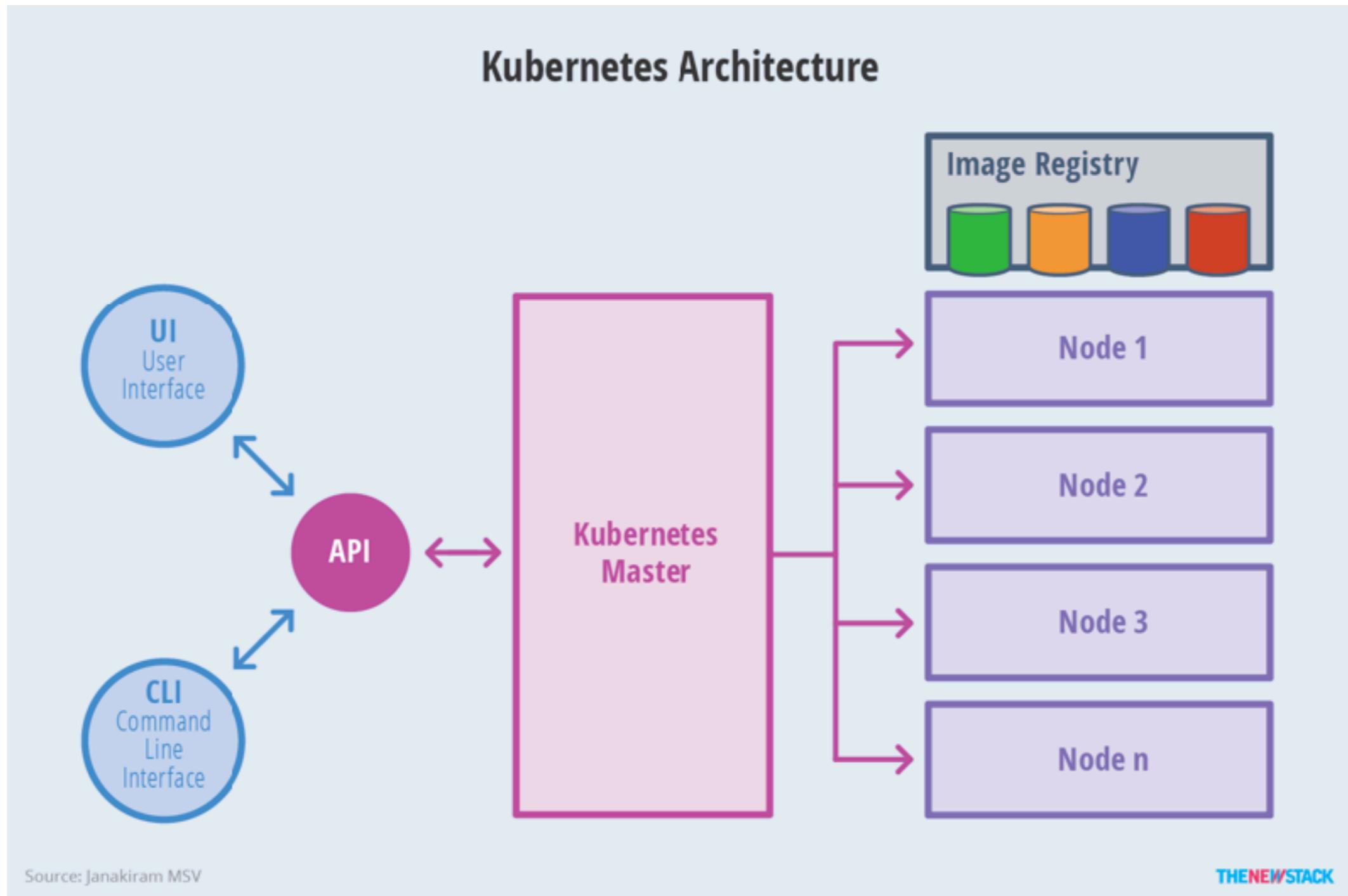
<https://12factor.net/>



System architecture



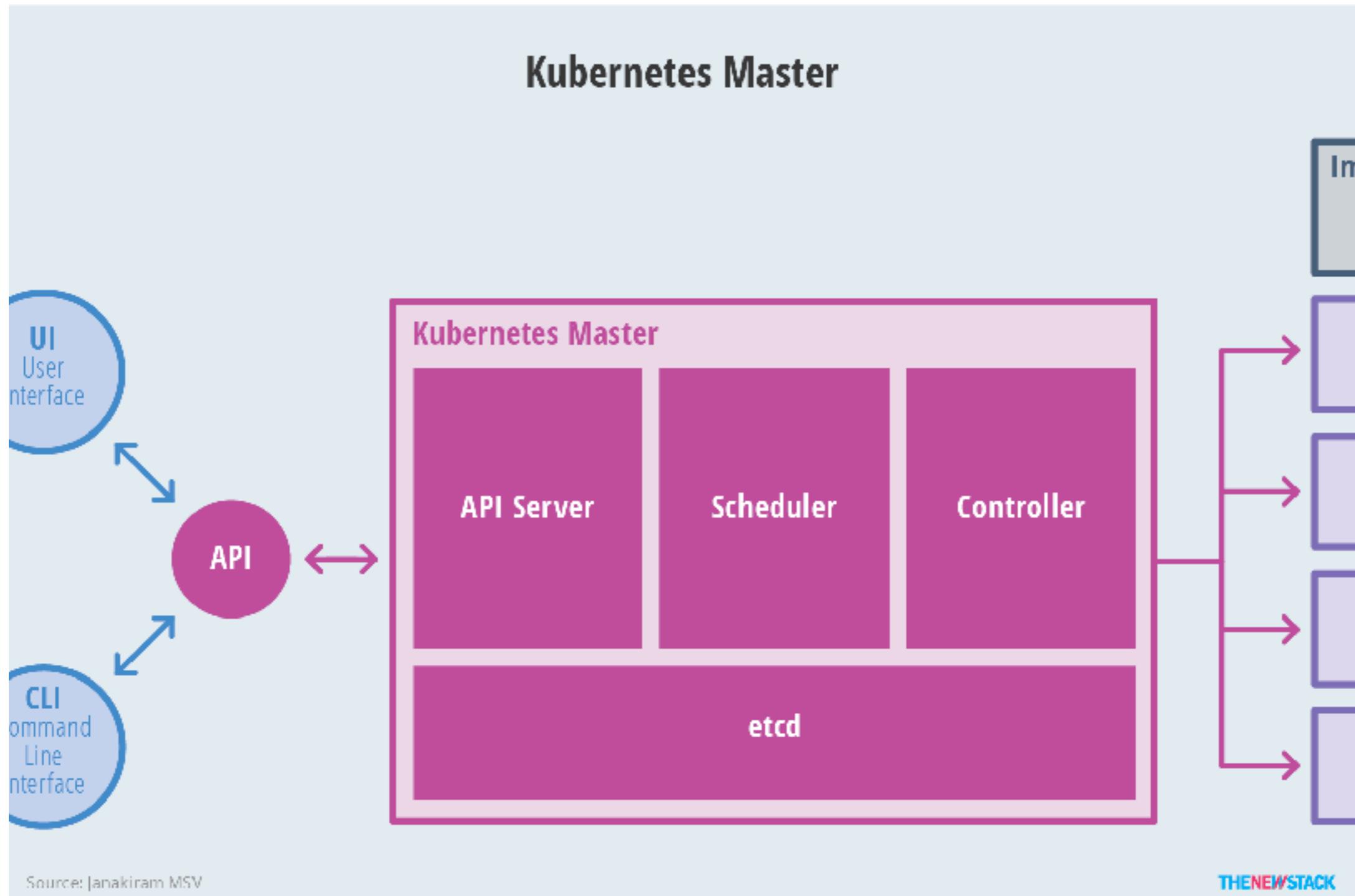
System architecture



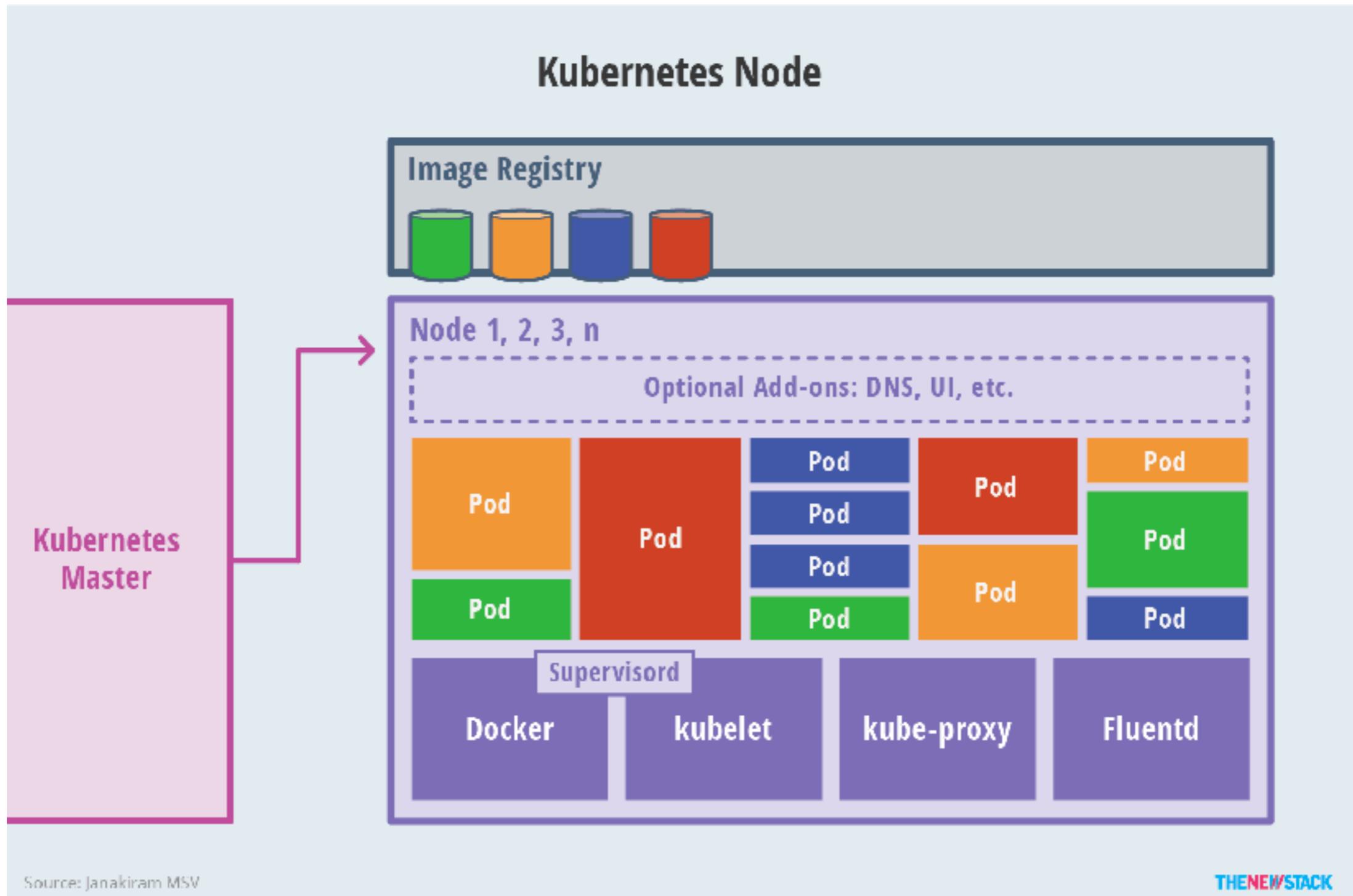
<https://thenewstack.io/kubernetes-an-overview/>



Master



Node



<https://thenewstack.io/kubernetes-an-overview/>



Core concepts of Kubernetes



Core concepts

Pods vs containers

Services

Replication Controllers

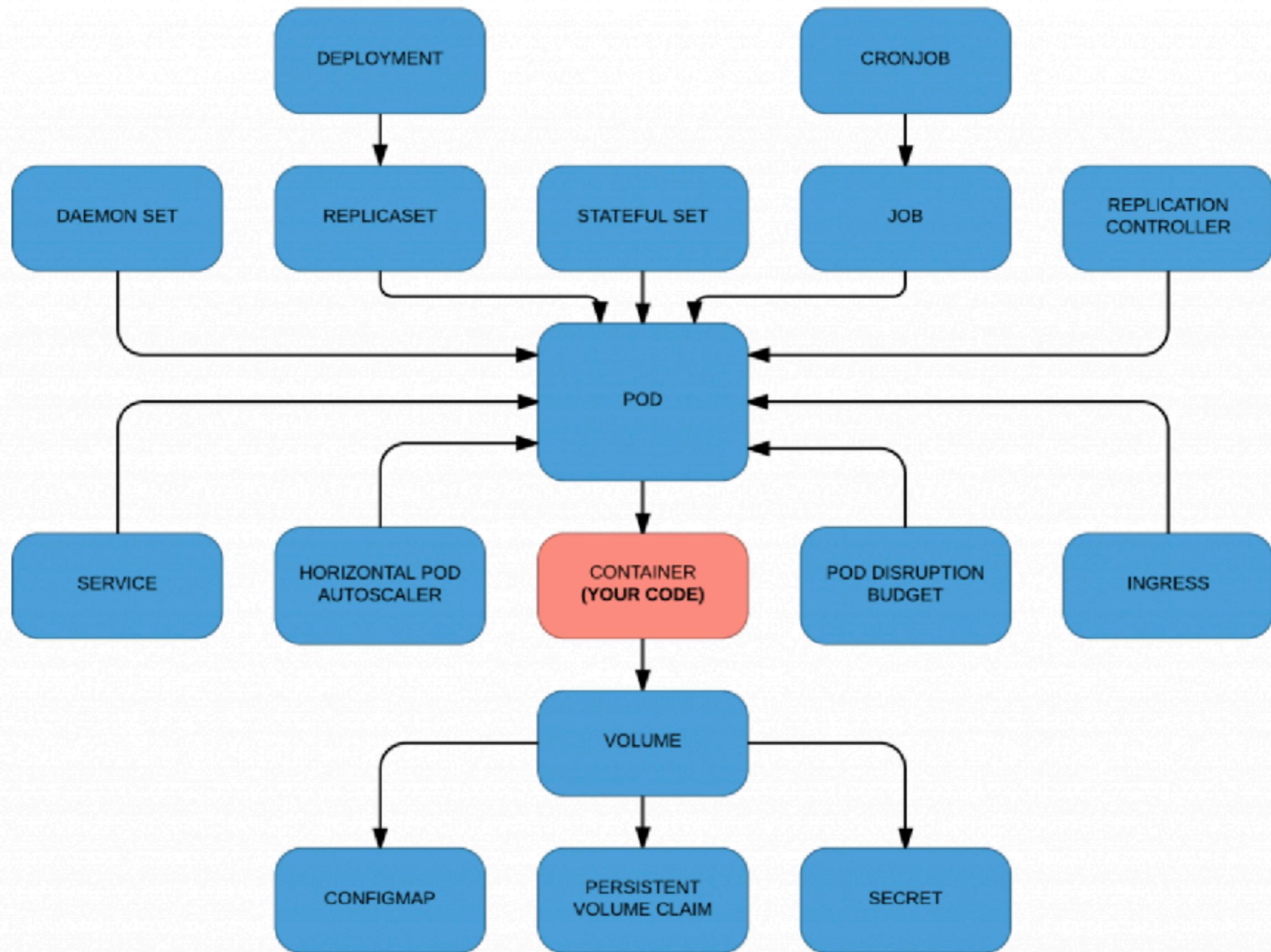
Deployments

ConfigMap and Secret

Volumes

StatefulSets



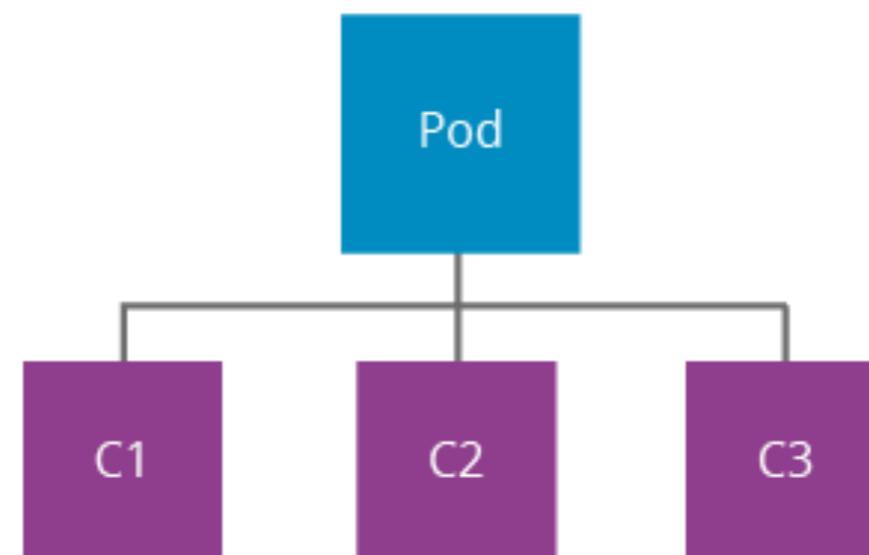


Pods vs containers



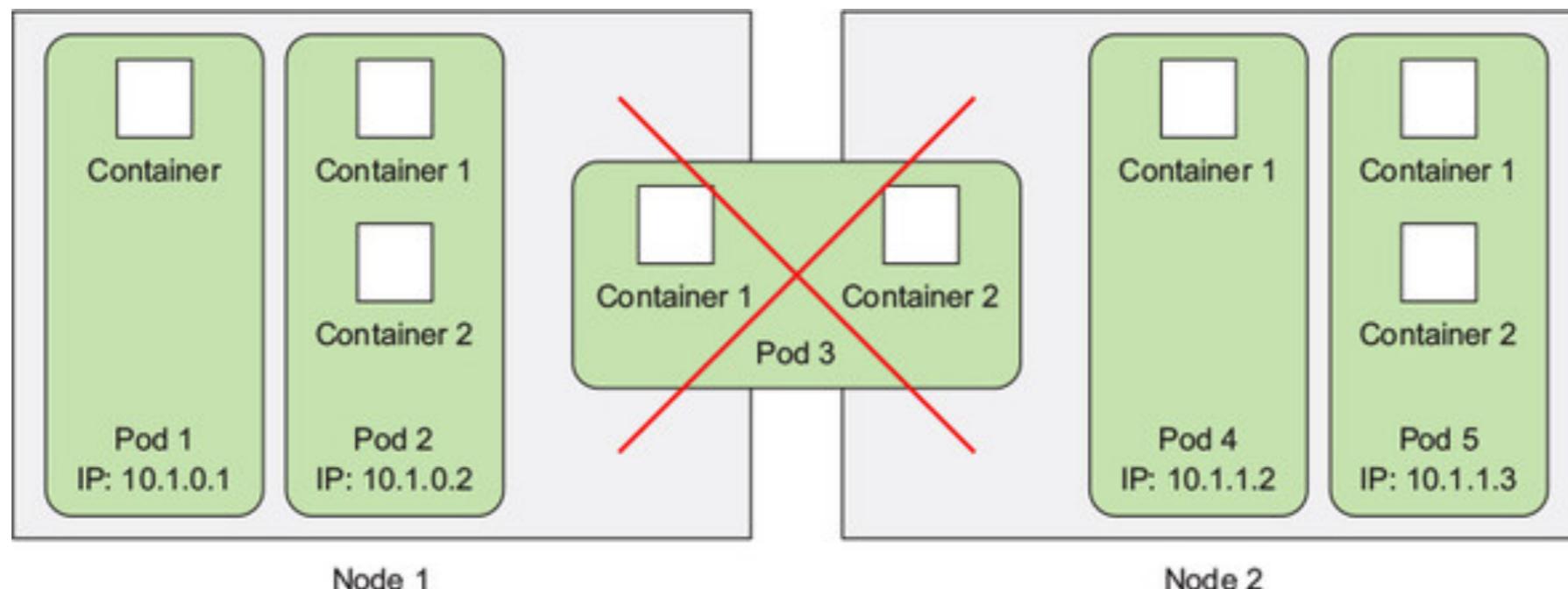
Pods

Small group of co-located containers
Optionally shared volume between containers
Basic deployment unit in Kubernetes



Pods

1 pods = 1 container
1 pods = N containers



All containers in same Pods

Share process ID

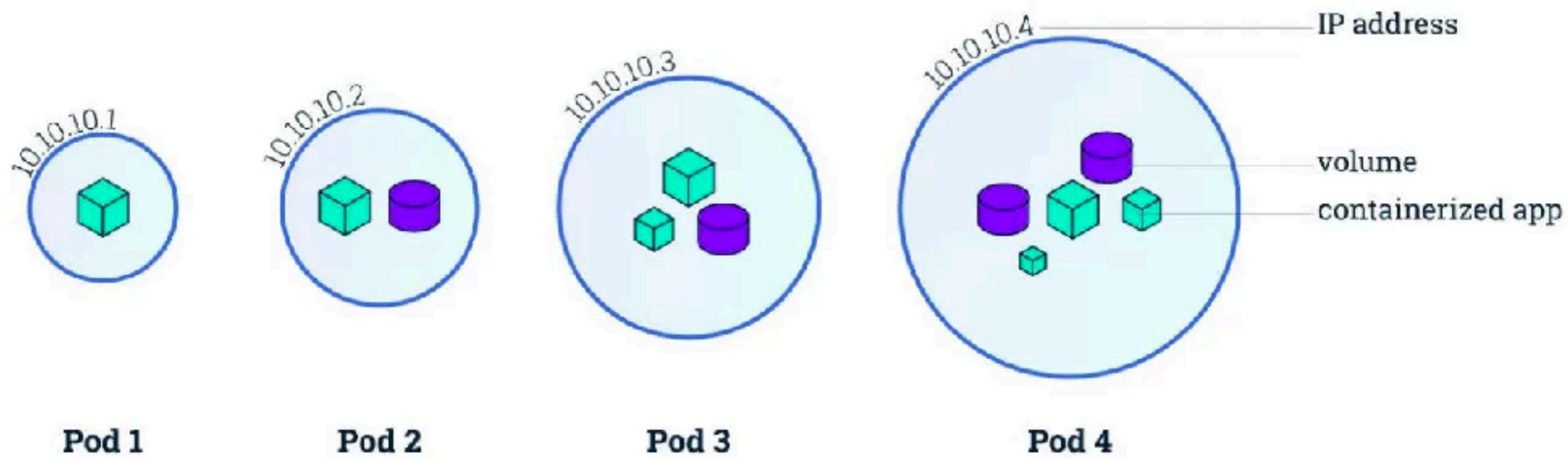
Share network interface

Share Hostname/IP/Port

Share Unix Time Sharing (UTS)



Pods

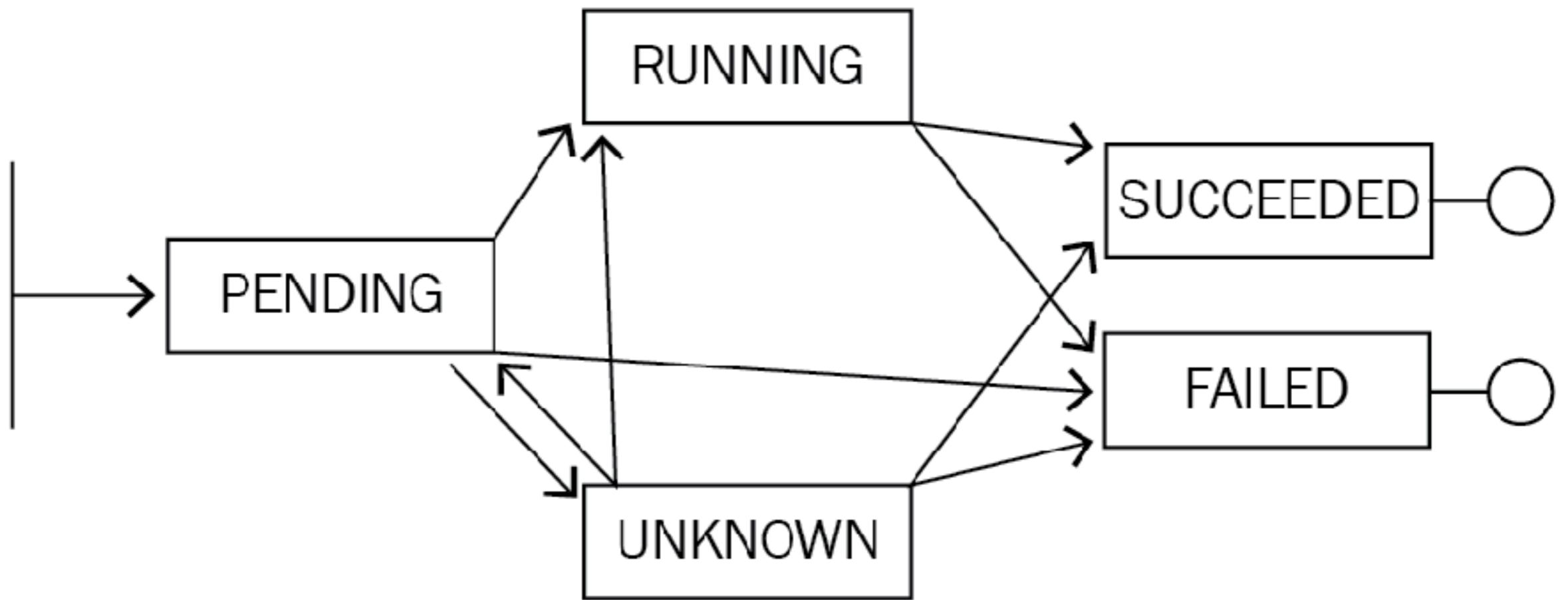


Pods lifecycle

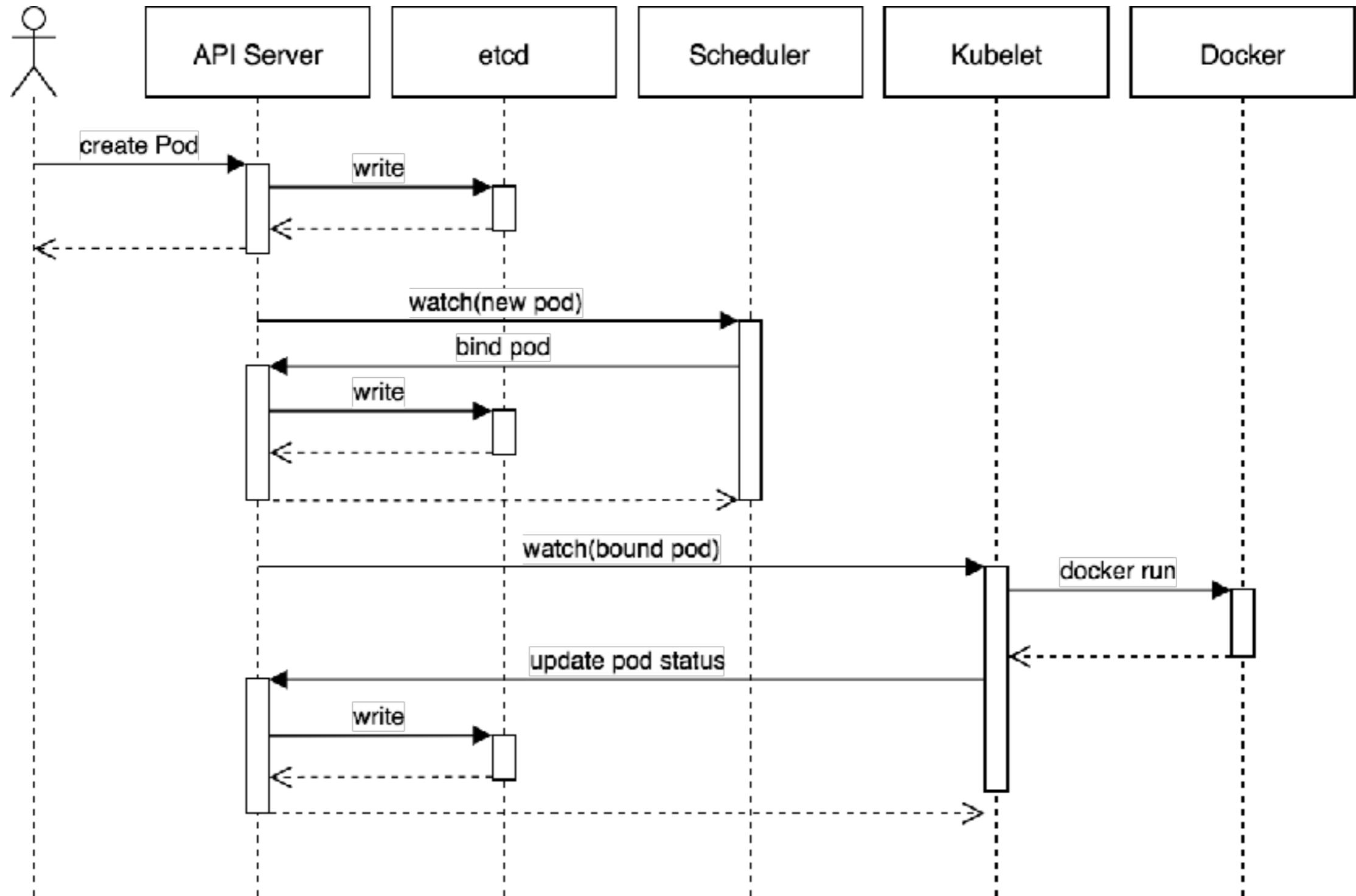
Phase	Description
Pending	Accepted by kubernetes but container not created yet
Running	Pods bound to the node, all containers created and at least one container is running/start/restarting
Successed	Containers exited with status 0
Failed	All containers exit and at least one exited with non-zero status
Unknown	State of Pods can't be determined due to communication issues with its node



Pods lifecycle



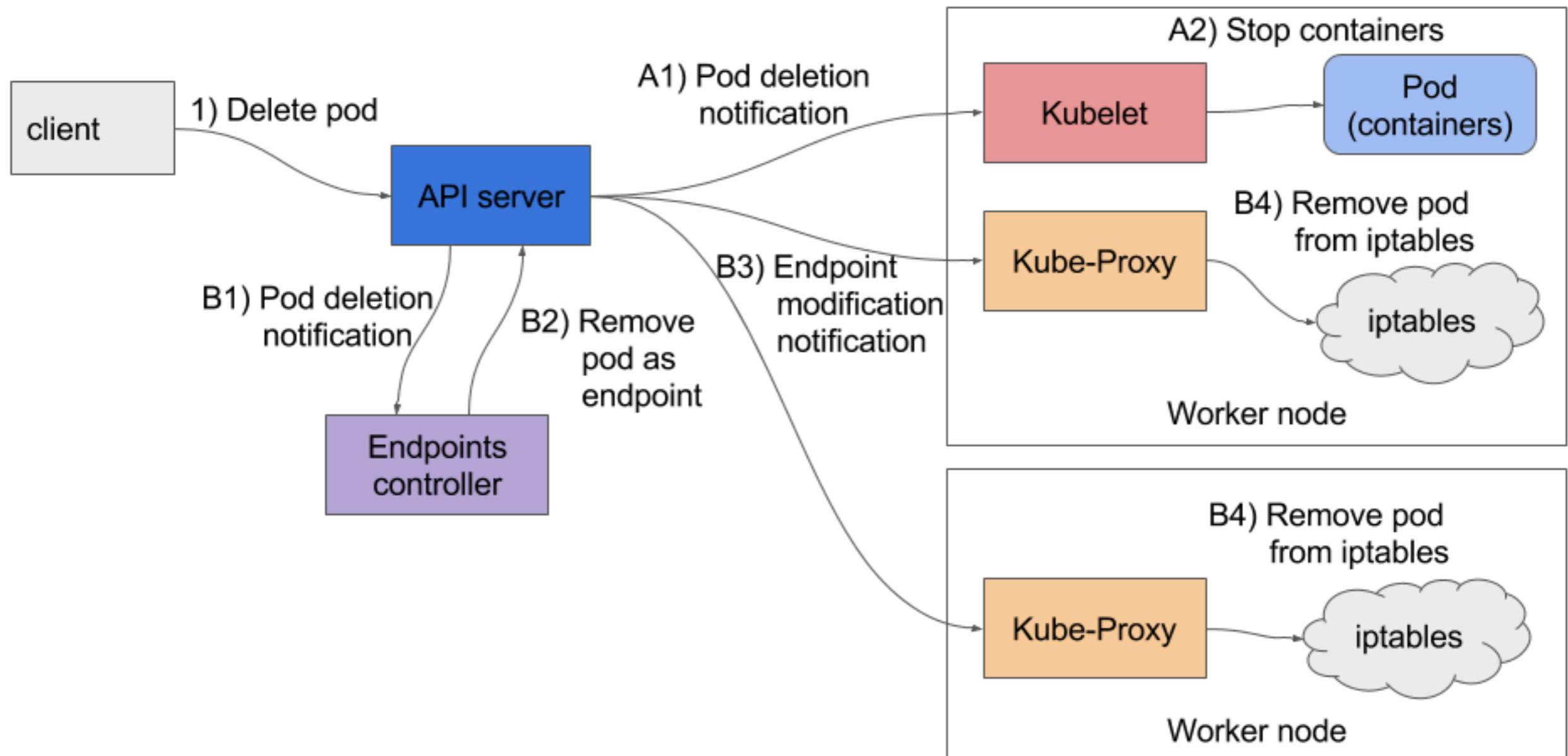
How to create Pods ?



<https://blog.heptio.com/core-kubernetes-jazz-improv-over-orchestration-a7903ea92ca>



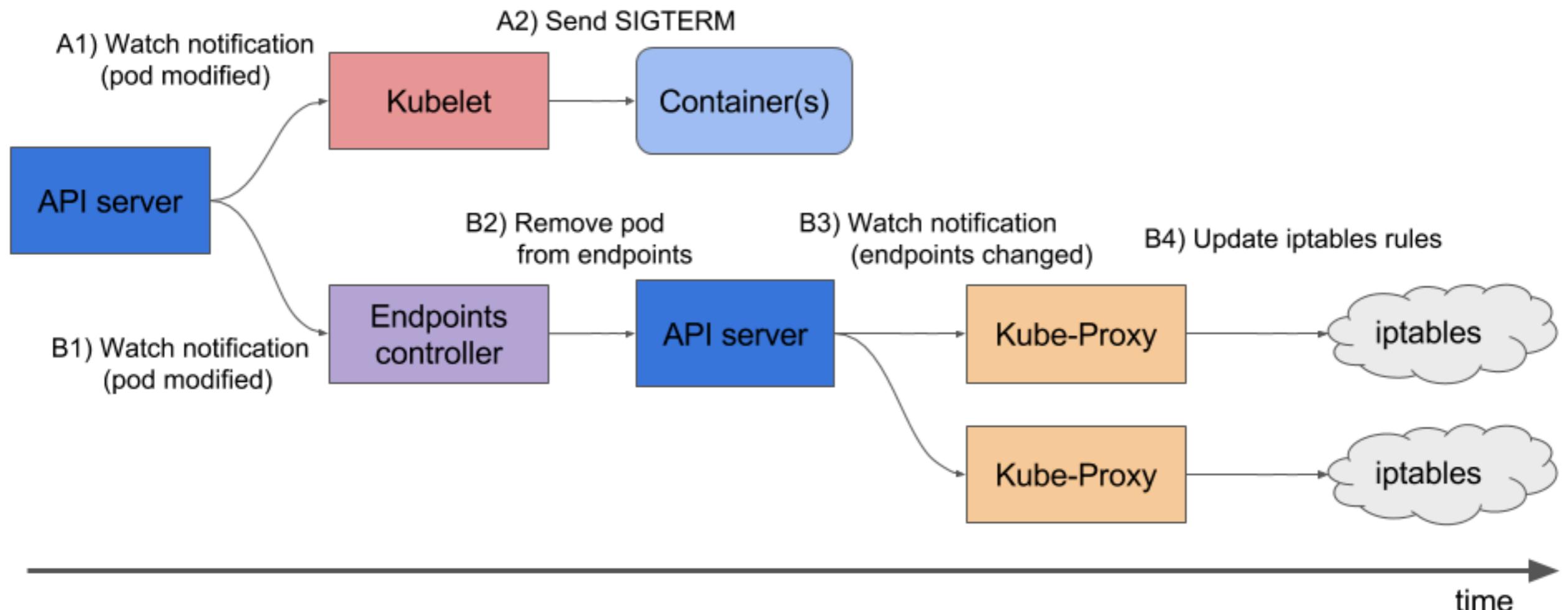
How to delete Pods ?



<https://freecontent.manning.com/handling-client-requests-properly-with-kubernetes/>



How to delete Pods ?

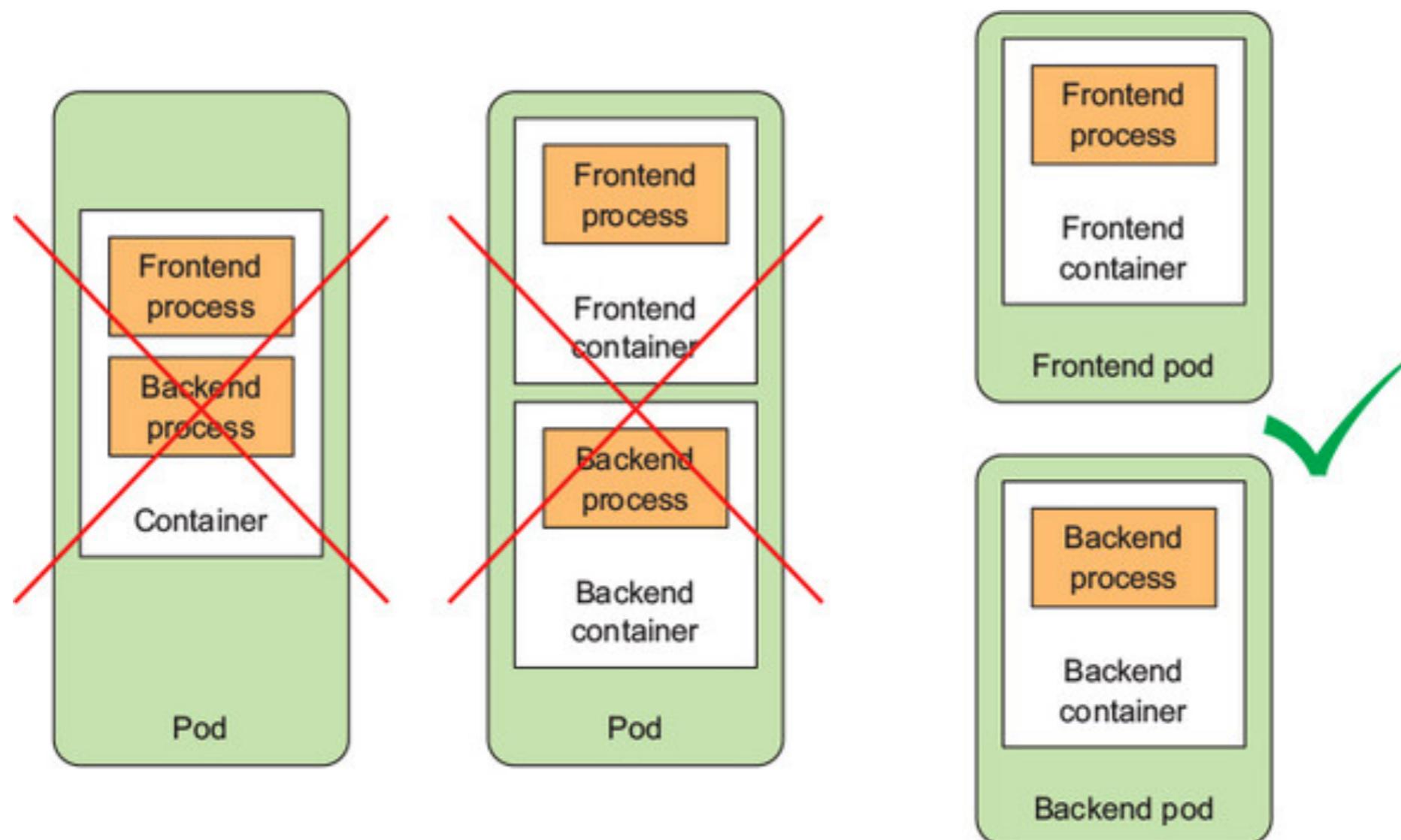


<https://freecontent.manning.com/handling-client-requests-properly-with-kubernetes/>



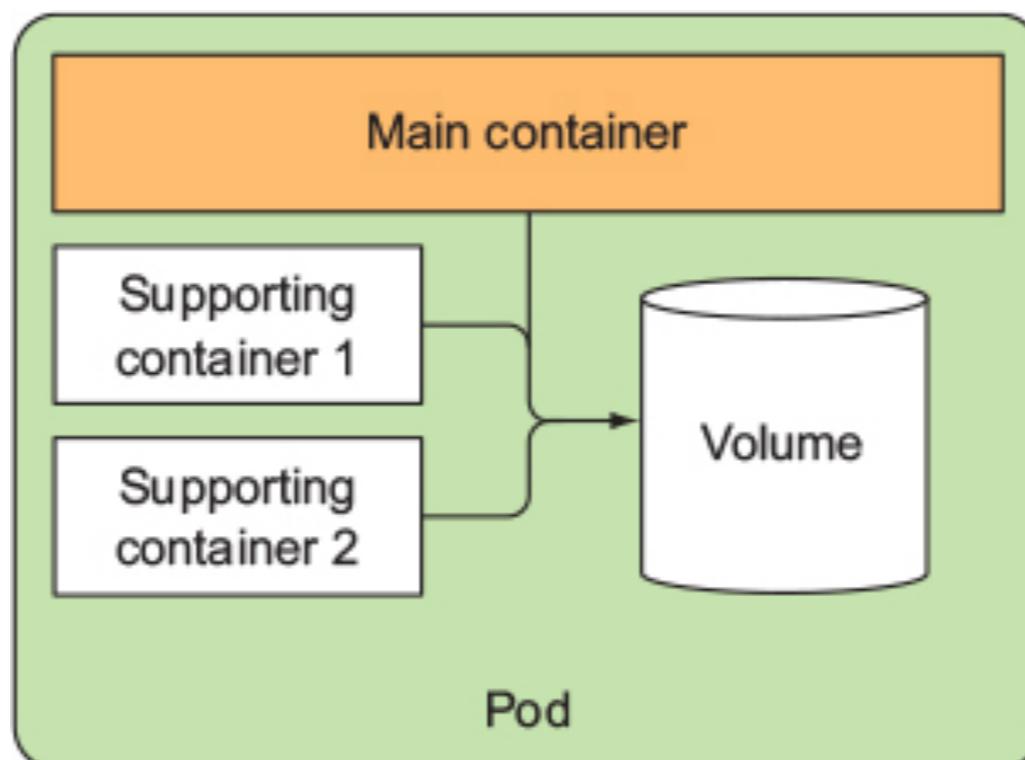
Organize container across Pods

Split multi-tiers app into multiple pods



Organize container across Pods

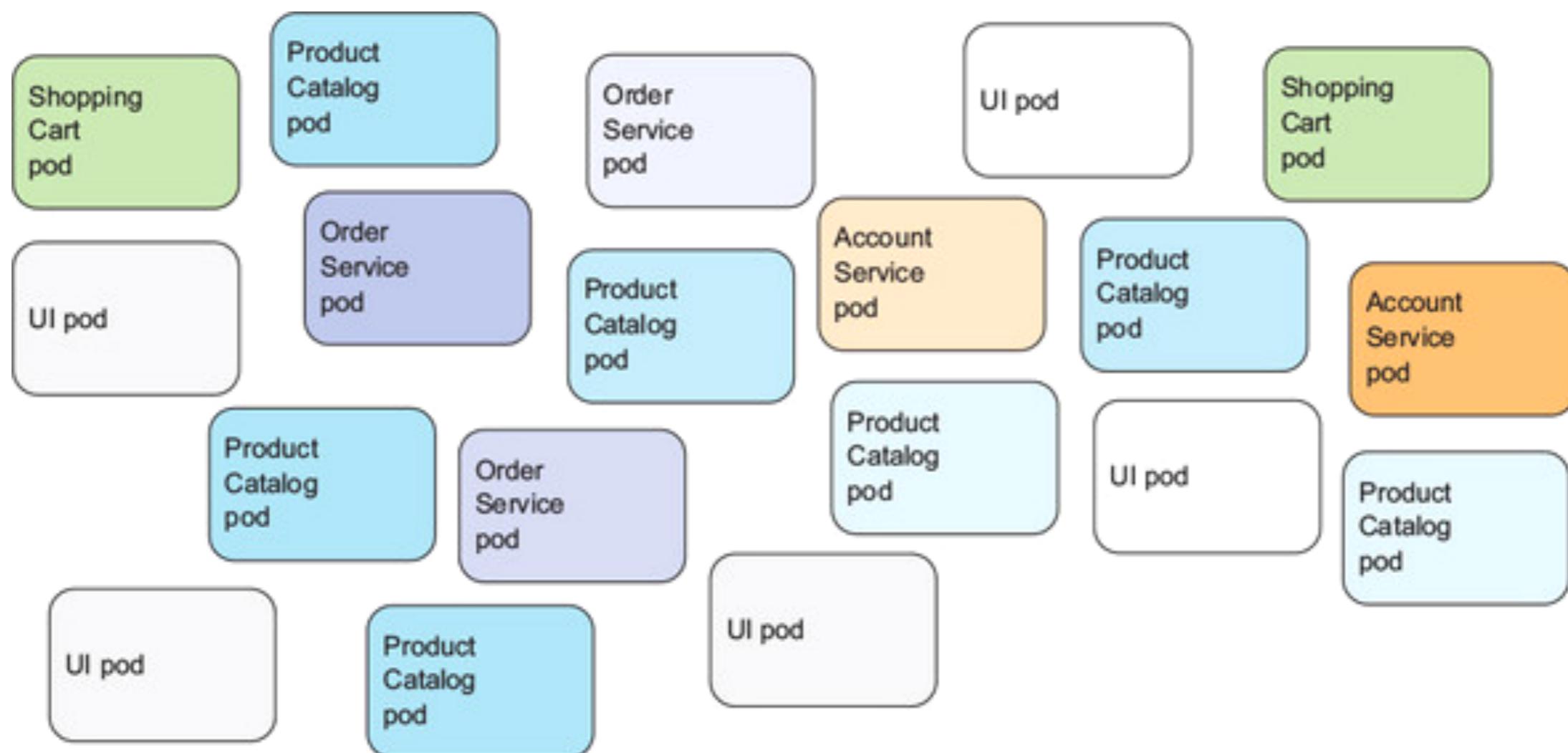
When to use multiple containers in a pods



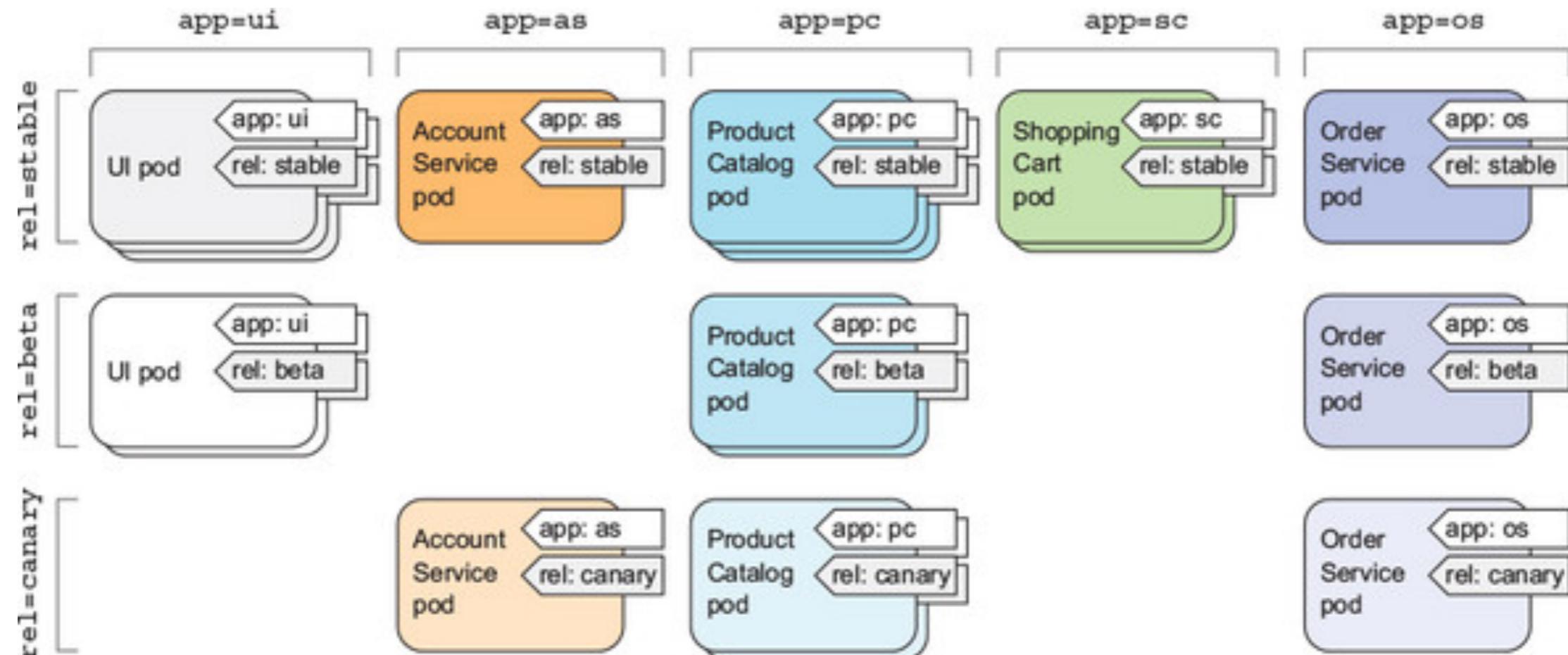
Organize pods with Labels



Organize pods with Labels

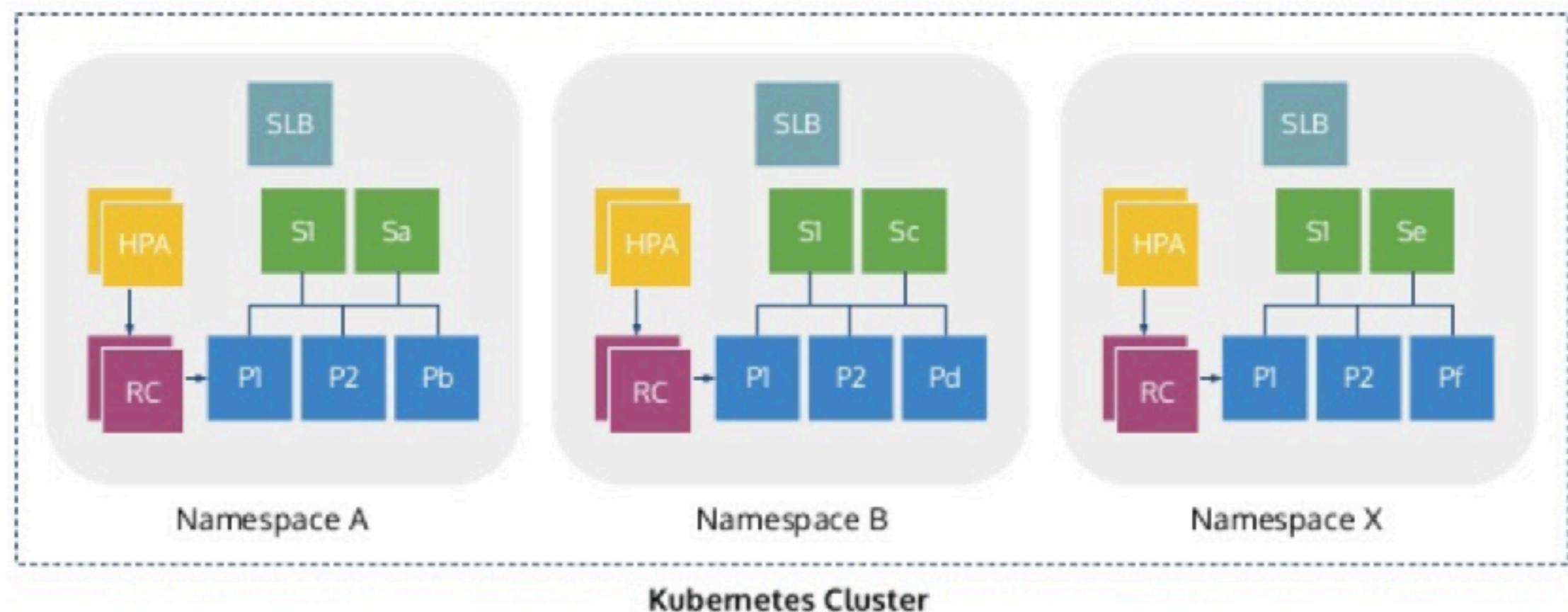


Organize pods with Labels



Pods namespaces

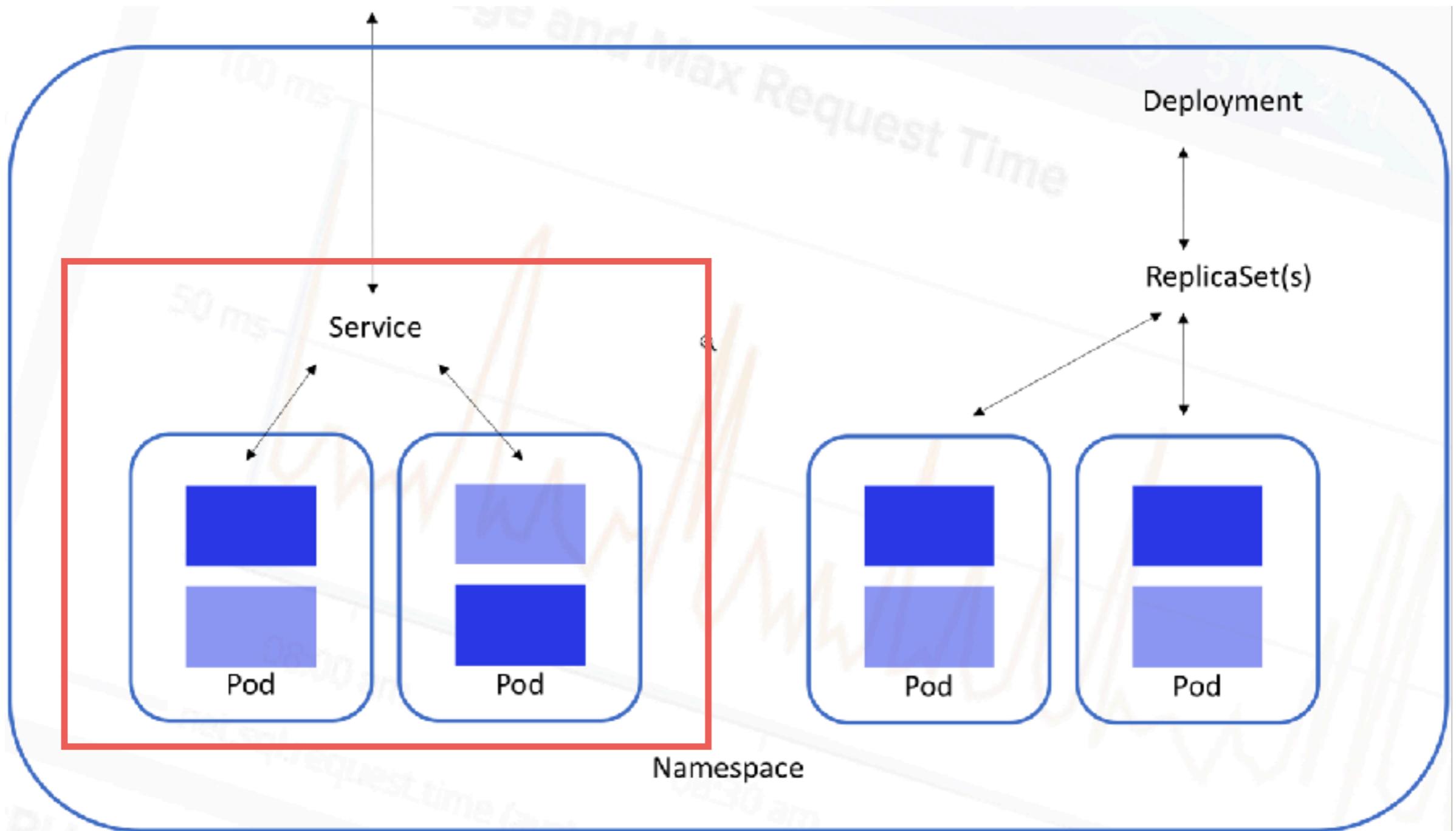
Allow different teams to use the same cluster



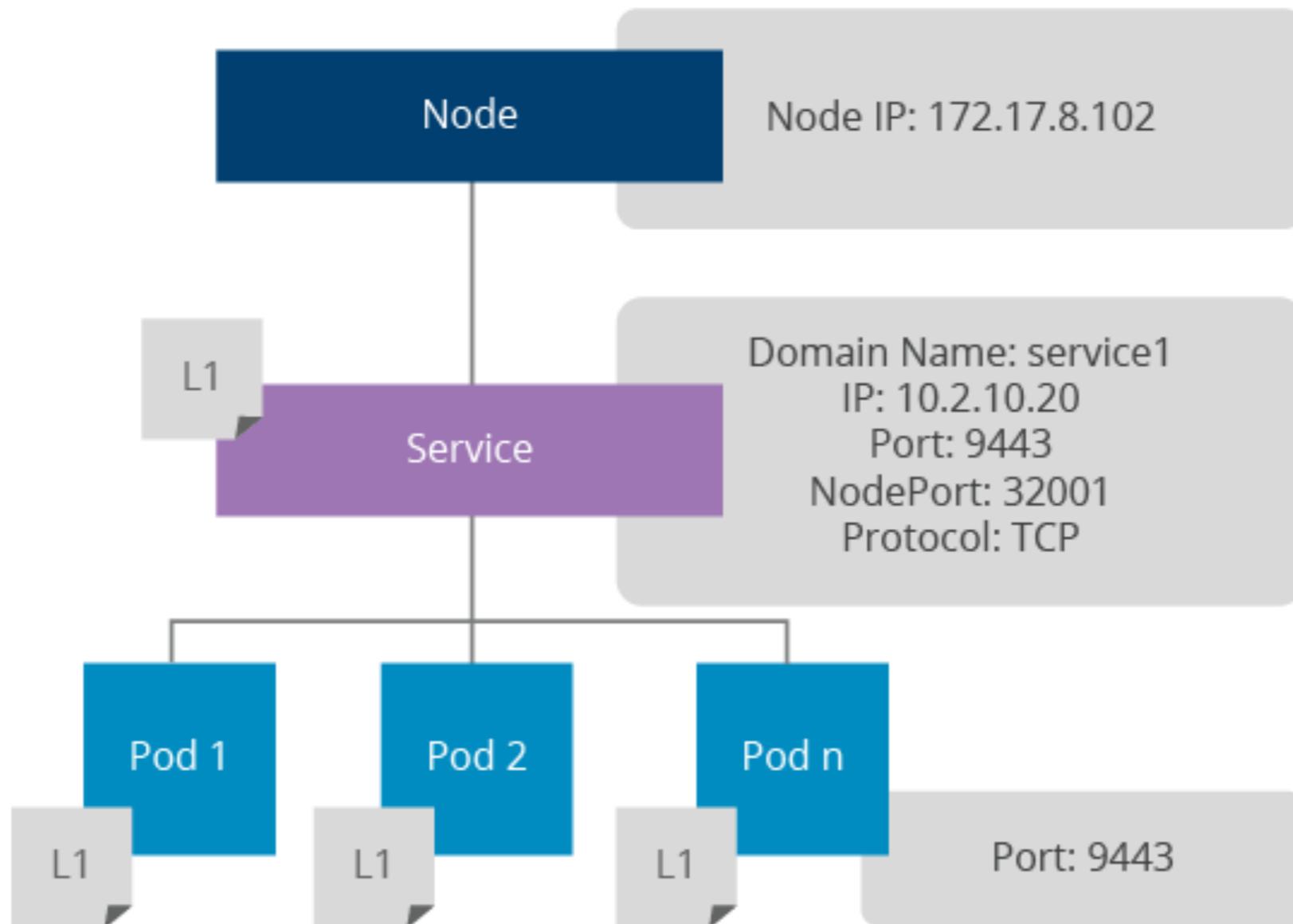
Services discovery and Load balancing



Services



Services

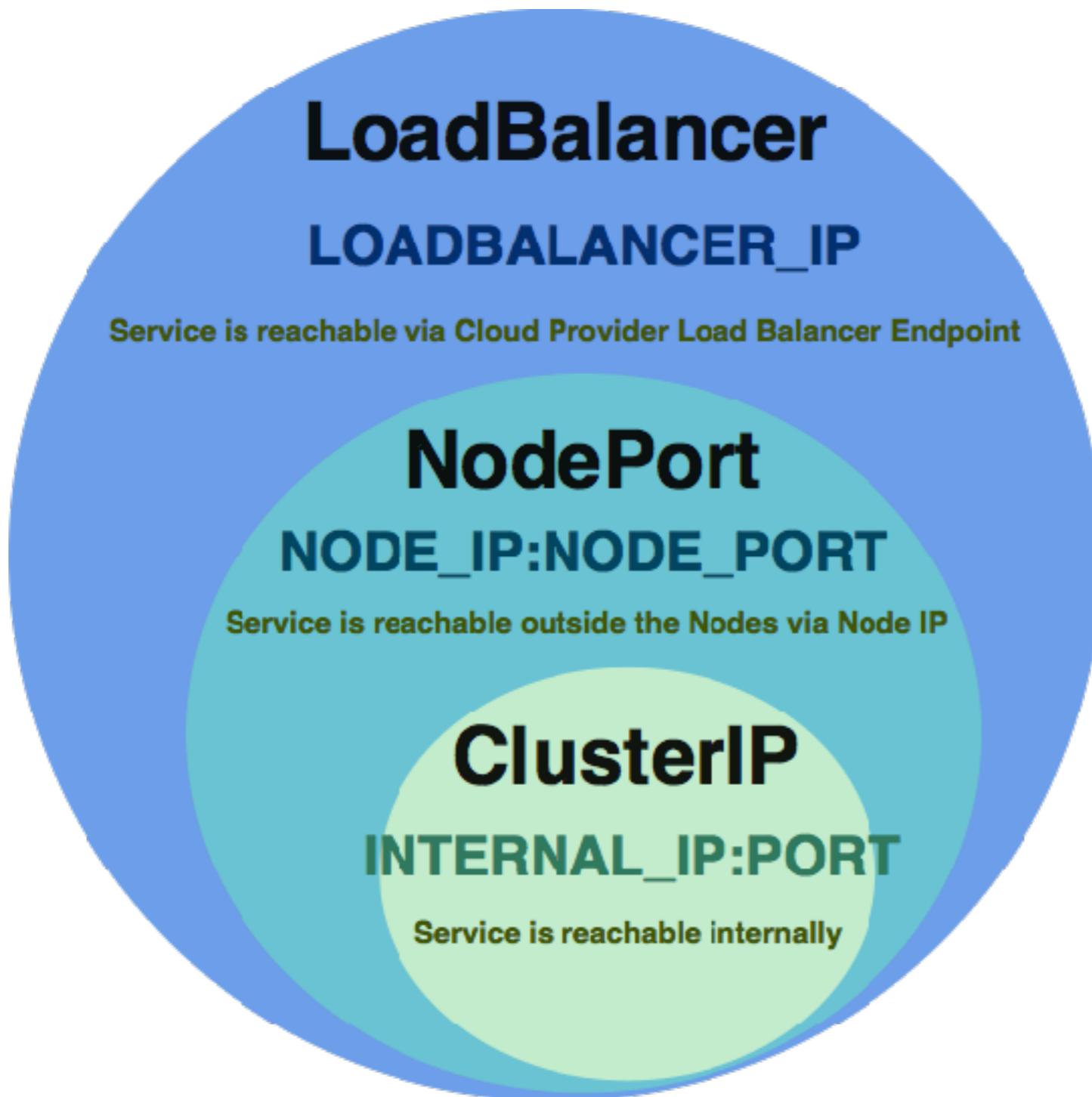


Services

- Independent from Pods
- Abstraction layer of Pods
- Provide load balance
- Expose access Pods/Load balance
- Find Pods by label selector



3 types of services



Kubernetes Object Management



Kubernetes Object Management

1. Imperative command
2. Imperative object configuration
3. Declarative object configuration

<https://kubernetes.io/docs/concepts/overview/object-management-kubectl/overview/>



1. Imperative command

```
$kubectl run nginx --image nginx
```

```
$kubectl create deployment nginx --image nginx
```



2. Imperative object configuration

```
$kubectl create -f nginx.yaml
```

```
$kubectl delete -f nginx.yaml
```



3. Declarative object configuration

```
$kubectl apply -f configs/  
$kubectl apply -R -f configs/
```



Kubernetes Object Management

Management technique	Operates on	Recommended environment	Supported writers	Learning curve
Imperative commands	Live objects	Development projects	1+	Lowest
Imperative object configuration	Individual files	Production projects	1	Moderate
Declarative object configuration	Directories of files	Production projects	1+	Highest

Warning: A Kubernetes object should be managed **using only one technique**. Mixing and matching techniques for the same object results in undefined behavior.



Workshop :: Pods & Services

1 container per Pods

**file /02-pod-service/single-pod/
workshop_instruction.txt**



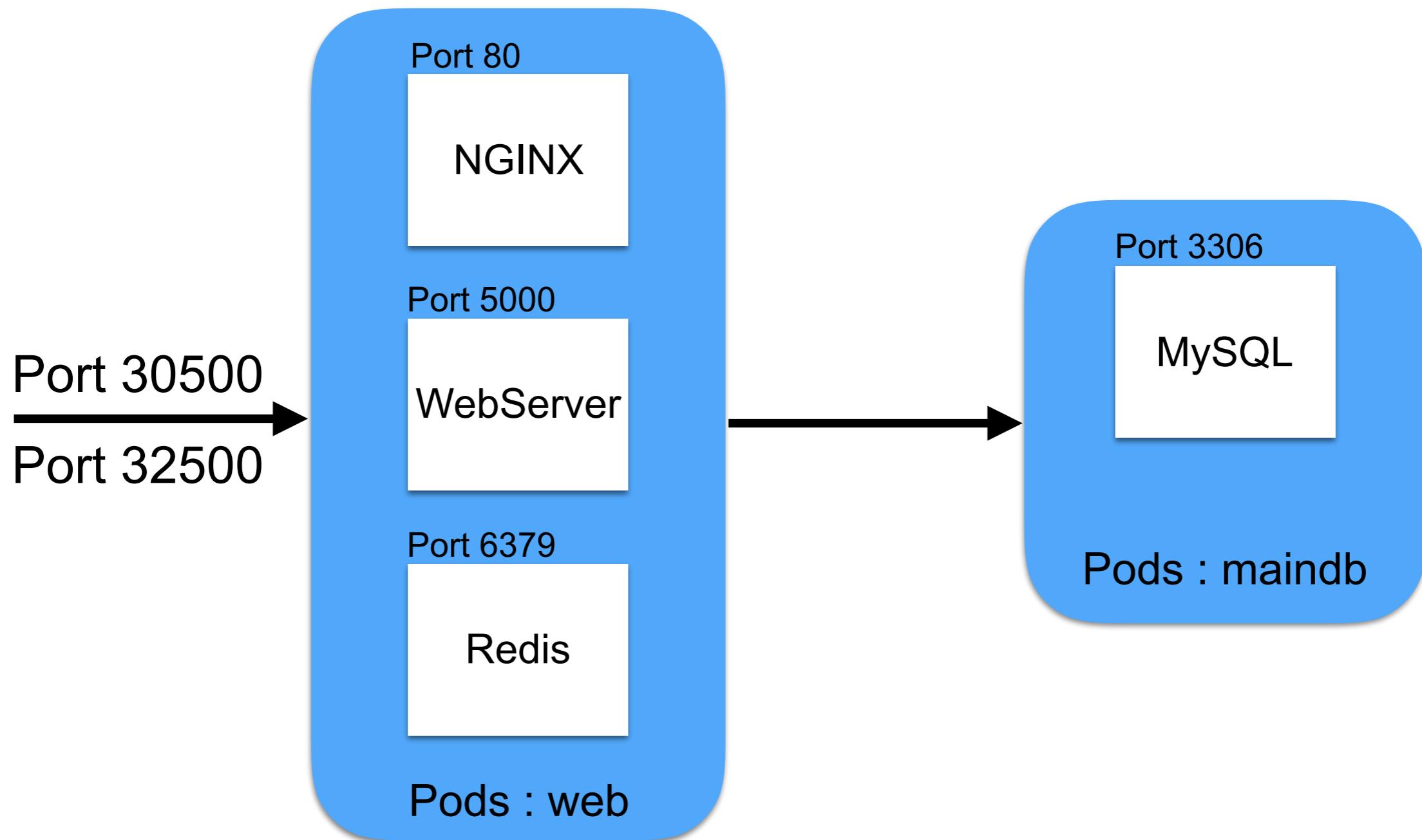
Workshop :: Pods & Services

N container per Pods

file /02-pod-service/multiple-pod/
workshop_instruction.txt



Workshop



Workshop :: Expose port of Pods to outside cluster

file /02-pod-service/expose/expose-pod-service.txt



Expose Pods to outside cluster

HostNetwork

HostPort

NodePort of service

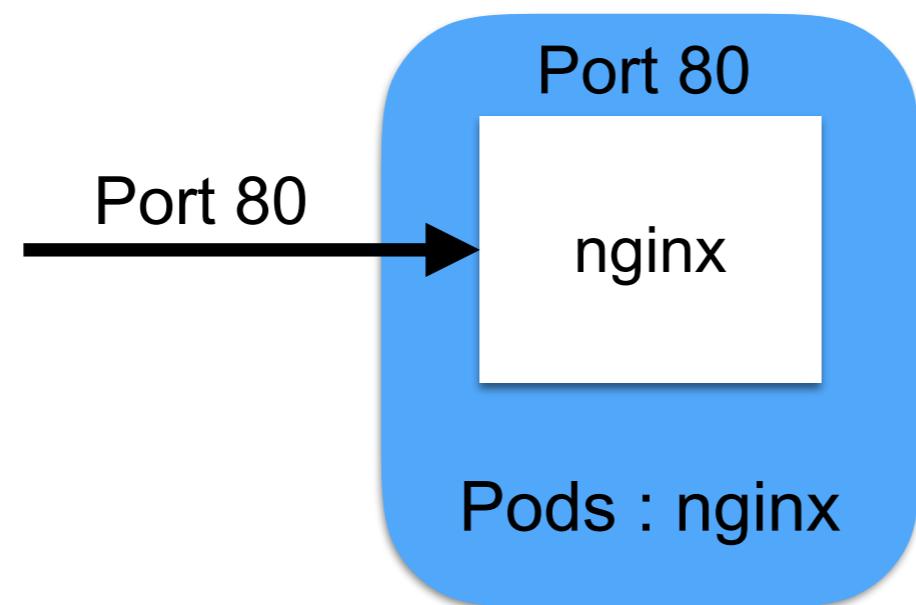
LoadBalance of service

Ingress controller



HostNetwork

Applications running in such a pod can directly see the network interfaces of the host machine where the pod was started.



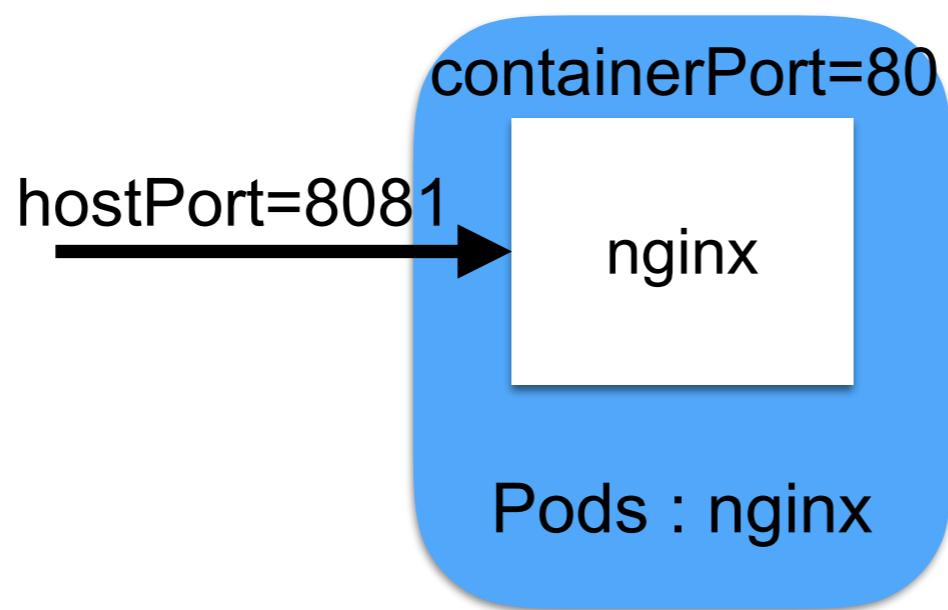
HostNetwork

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx
spec:
  hostNetwork: true
  containers:
    - name: nginx
      image: nginx
```



HostPort

The container port will be exposed to the external network at **<hostIP>:<hostPort>**, where the **hostIP** is the IP address of the Kubernetes node where the container is running and the **hostPort** is the port requested by the user.



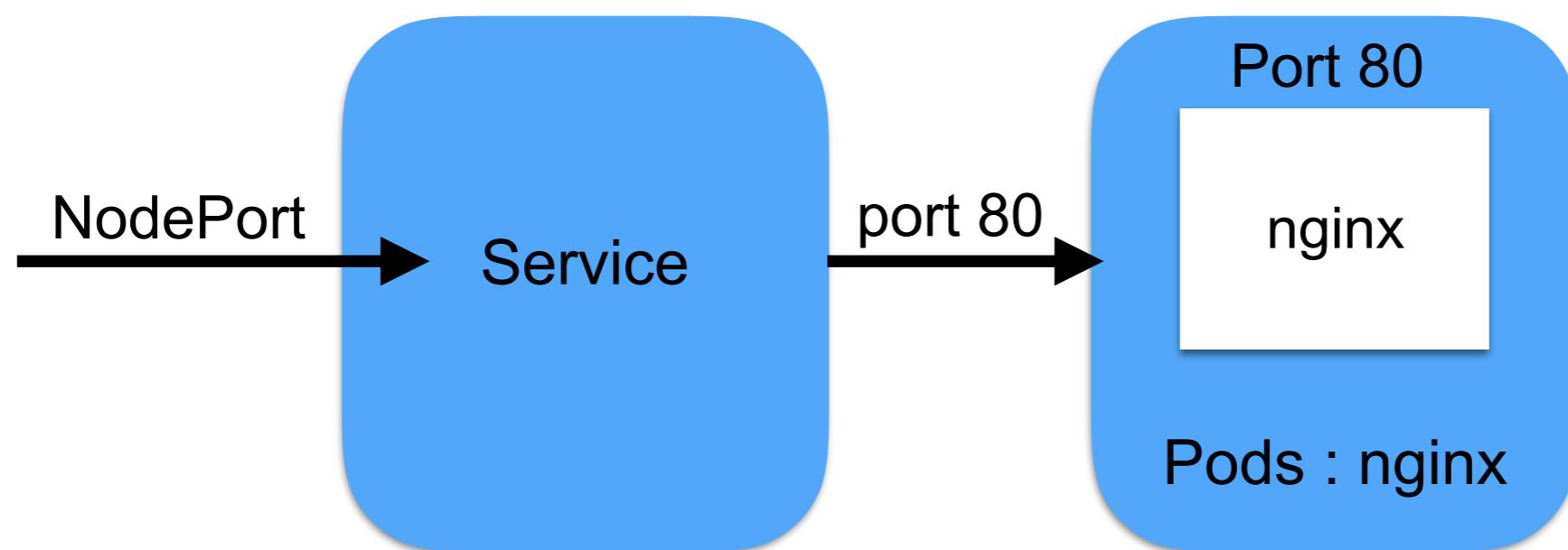
HostPort

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx
spec:
  containers:
    - name: nginx
      image: nginx
      ports:
        - containerPort: 80
          hostPort: 8081
```



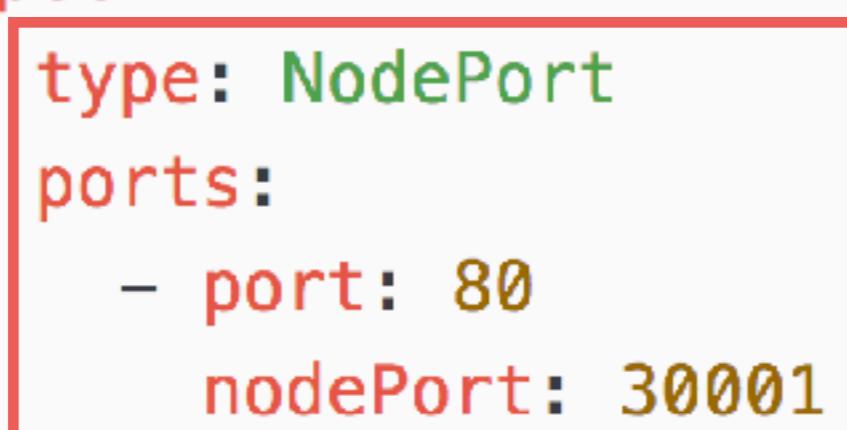
NodePort

When creating a NodePort service, the user can specify a port from the range **30000-32767**, and each Kubernetes node will proxy that port to the pods selected by the service.



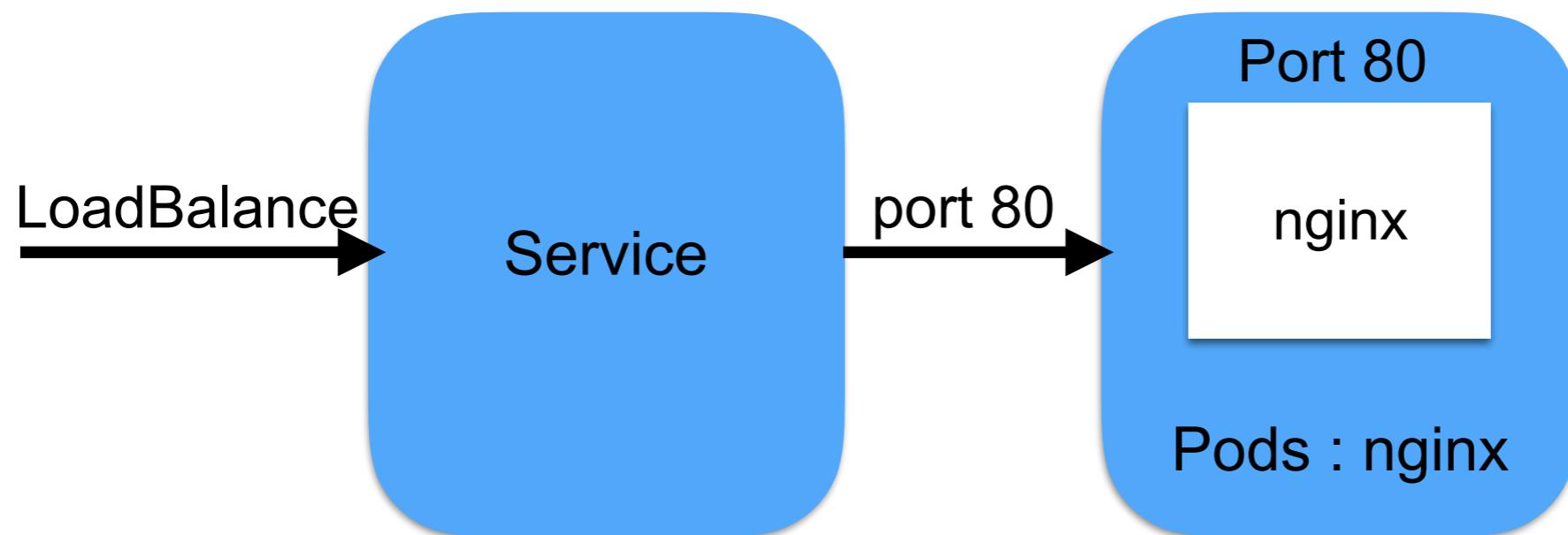
NodePort

```
kind: Service
apiVersion: v1
metadata:
  name: nginx
spec:
  type: NodePort
  ports:
    - port: 80
      nodePort: 30001
  selector:
    name: nginx
apiVersion: v1
kind: Pod
metadata:
  name: nginx
  labels:
    name: nginx
spec:
  containers:
    - name: nginx
      image: nginx
      ports:
        - containerPort: 80
```



LoadBalancer

a cloud provider has to be enabled in the configuration of the Kubernetes cluster. As of version 1.6, Kubernetes can provision load balancers on AWS, Azure, CloudStack, GCE and OpenStack.



LoadBalancer

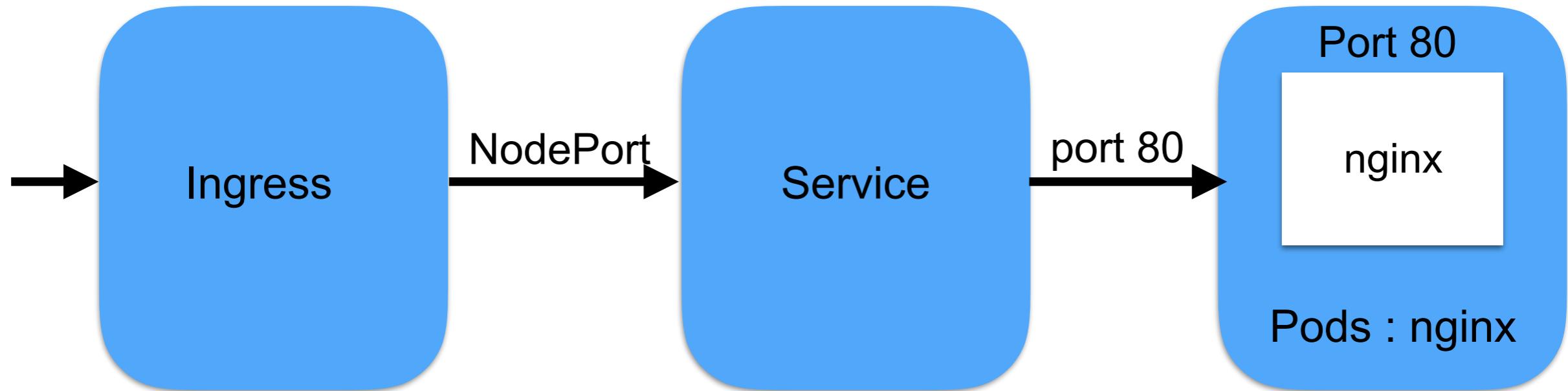
```
kind: Service
apiVersion: v1
metadata:
  name: nginx
spec:
  type: LoadBalancer
  ports:
    - port: 80
selector:
  name: nginx
```

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx
  labels:
    name: nginx
spec:
  containers:
    - name: nginx
      image: nginx
      ports:
        - containerPort: 80
```



Ingress controller

The Ingress controller is deployed as a Docker container on top of Kubernetes. Its Docker image contains a load balancer like nginx or HAProxy and a controller daemon.



<https://kubernetes.io/docs/concepts/services-networking/ingress/>



Ingress controller

```
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: nginx
spec:
  rules:
    - host: nginx.kube.example.com
      http:
        paths:
          - web:
              serviceName: nginx
              servicePort: 80
```

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx
  labels:
    name: nginx
spec:
  containers:
    - name: nginx
      image: nginx
      ports:
        - containerPort: 80
```



Replication Controller (RC)



Replication Controller

Create and maintain Pods

Keep copy of Pods by design

Maintain on cluster level

Auto-healing if Pods crash with any reason

Ensure Pods is up and run with desired number



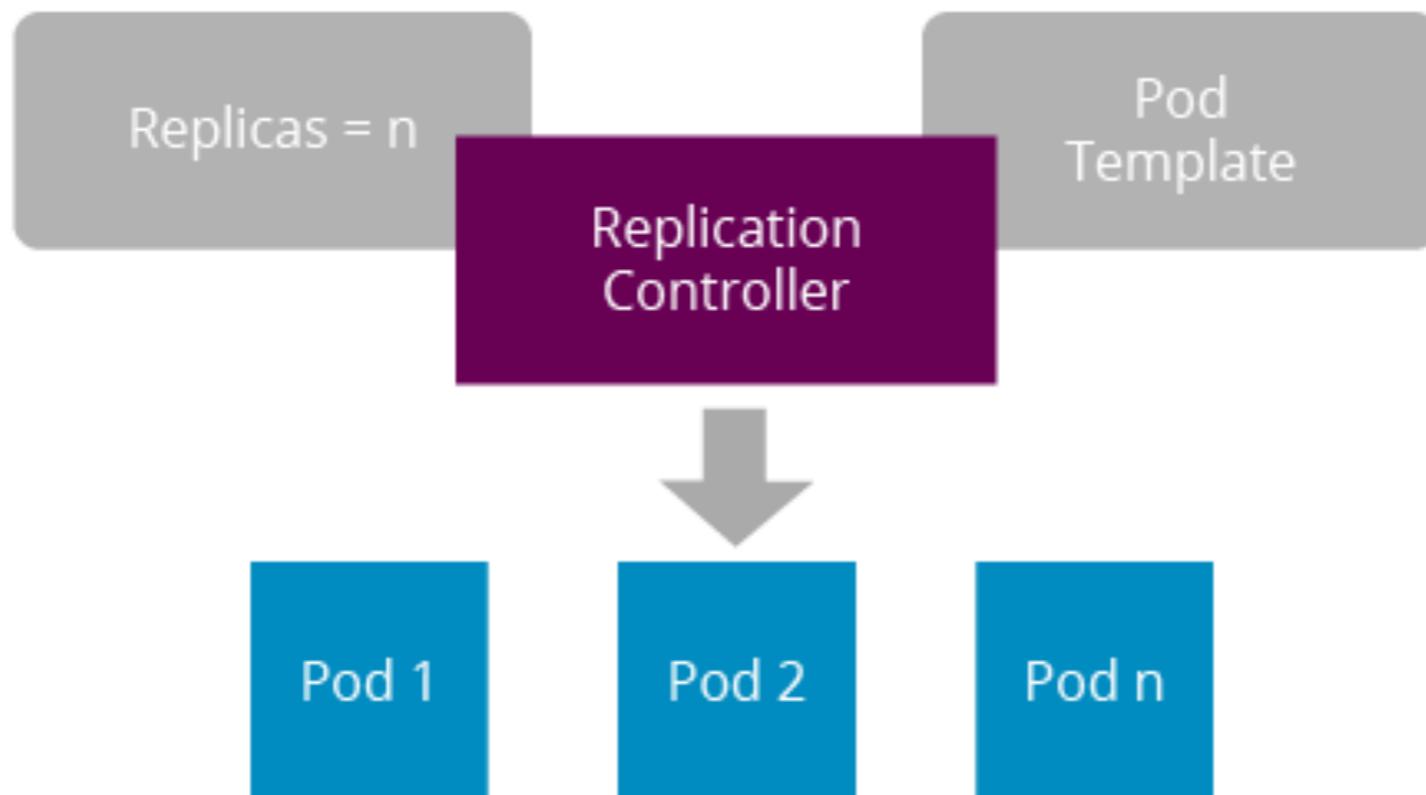
Replication Controller

Running based on label type
Equality-based requirement

```
selector:  
  name: web  
  version: "1.0"  
  module: WebServer  
  environment: development
```



Replication Controller



Scale up replicas of RC

```
$kubectl scale <option>  
--replicas=<number>  
<type or name>
```

```
bash-3.2$ kubectl get rc  
NAME      DESIRED   CURRENT   READY      AGE  
hello     5          5          5          15m  
bash-3.2$ kubectl get pods  
NAME        READY   STATUS    RESTARTS   AGE  
hello-jptv7  1/1     Running   0          43s  
hello-kdbsc  1/1     Running   0          43s  
hello-rn545  1/1     Running   0          15m  
hello-w6t5q  1/1     Running   0          43s  
hello-x6x8k  1/1     Running   0          43s
```



Detail of RC

\$kubectl describe rc <name>

Containers:

```
hello:  
  Image:      somkiat/hello:latest  
  Port:       8080/TCP  
  Host Port:  0/TCP  
  Environment: <none>  
  Mounts:     <none>  
  Volumes:    <none>
```

Events:

Type	Reason	Age	From	Message
Normal	SuccessfulCreate	16m	replication-controller	Created pod: hello-rn545
Normal	SuccessfulCreate	16m	replication-controller	Created pod: hello-pfnwj
Normal	SuccessfulCreate	16m	replication-controller	Created pod: hello-jfqfl
Normal	SuccessfulCreate	13m	replication-controller	Created pod: hello-6pfqm
Normal	SuccessfulCreate	11m	replication-controller	Created pod: hello-l4lqc
Normal	SuccessfulCreate	11m	replication-controller	Created pod: hello-pfgr2
Normal	SuccessfulDelete	9m	replication-controller	Deleted pod: hello-l4lqc
Normal	SuccessfulDelete	9m	replication-controller	Deleted pod: hello-pfnwj
Normal	SuccessfulDelete	9m	replication-controller	Deleted pod: hello-6pfqm
Normal	SuccessfulDelete	9m	replication-controller	Deleted pod: hello-pfgr2
Normal	SuccessfulCreate	2m	replication-controller	Created pod: hello-kdbsc
Normal	SuccessfulCreate	2m	replication-controller	Created pod: hello-jptv7
Normal	SuccessfulCreate	2m	replication-controller	Created pod: hello-x6x8k

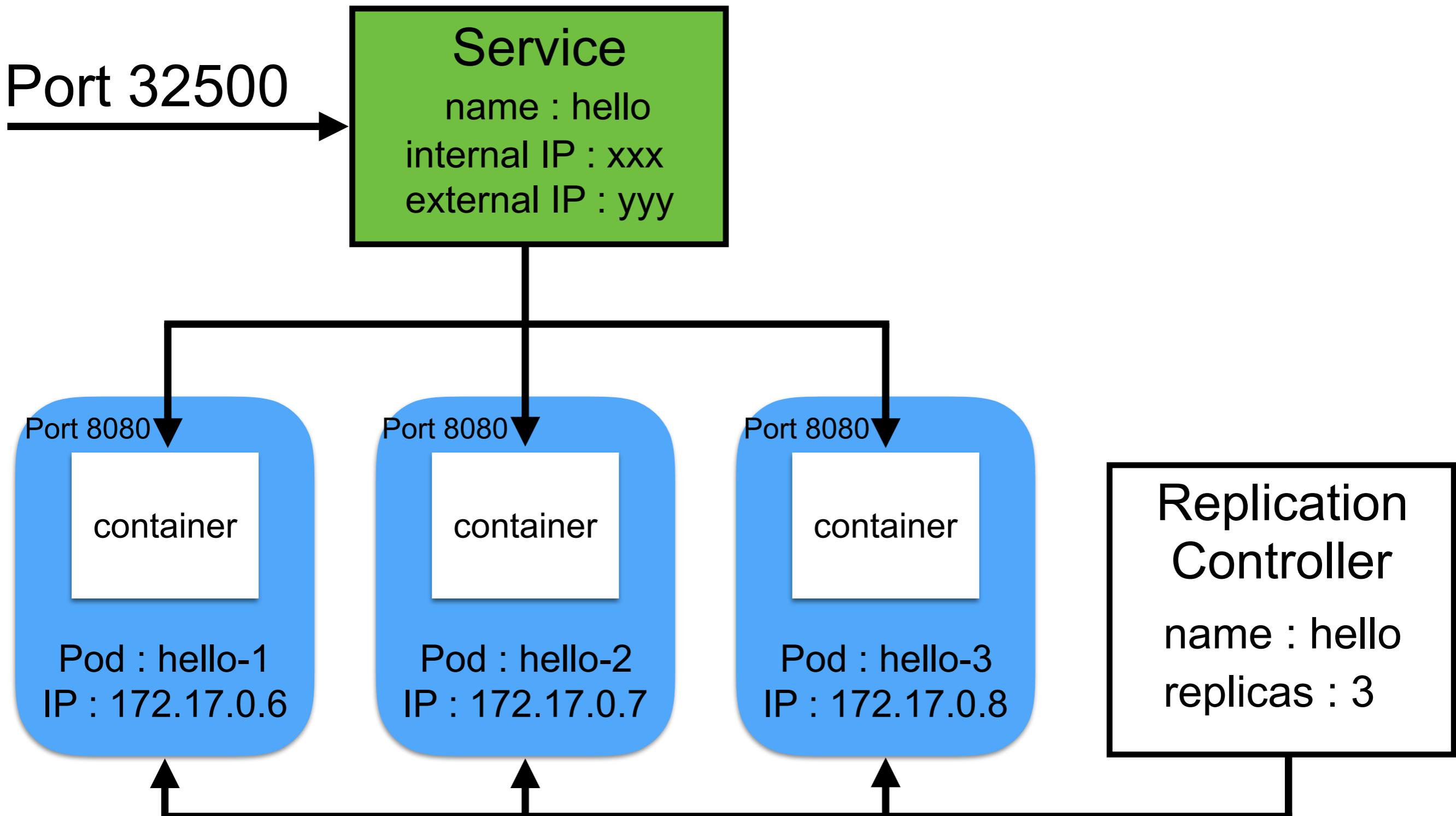


Workshop Replication Controller

file /03-replication-controller



Scaling the application

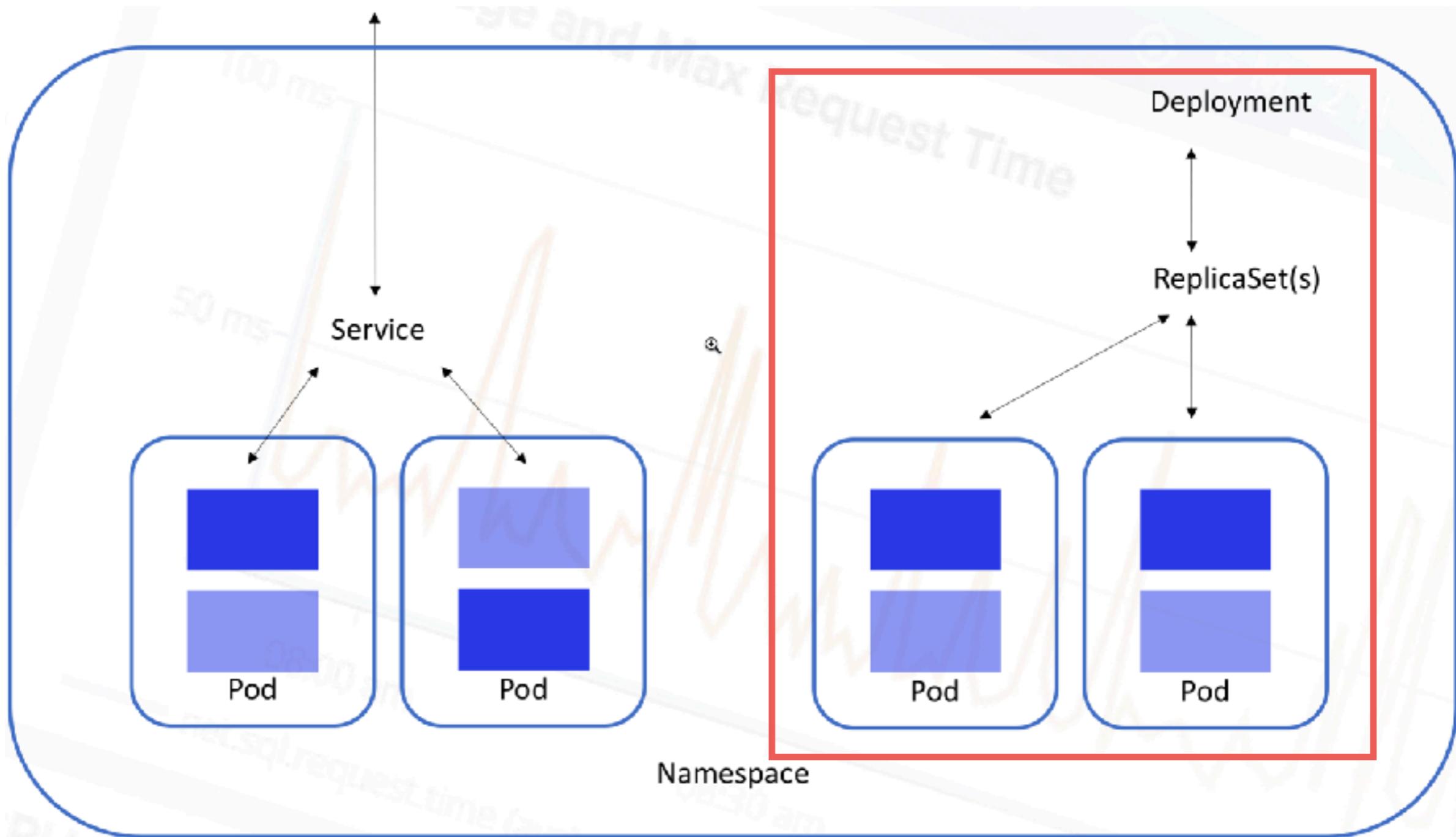


Deployment and ReplicaSet (RS)

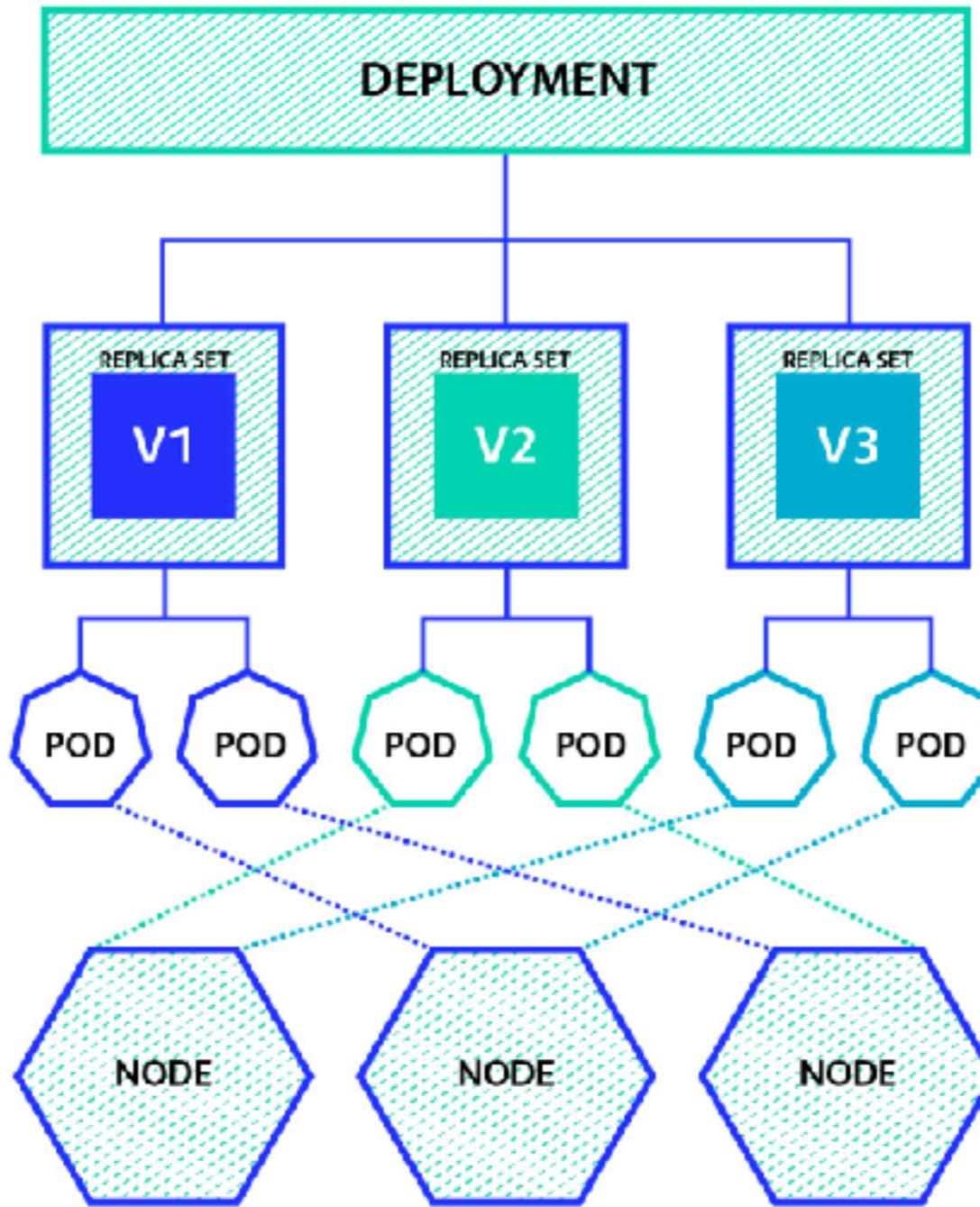
file /04-deployment-and-replica-set



Deployment and ReplicaSet



Deployment and ReplicaSet



<https://thenewstack.io/kubernetes-deployments-work/>



Deployment and ReplicaSet

Next-generation of RC

Provide function to maintain versioning of Pods

Update new version (Rollout)

Revert to old version (Rollback)

Scale a deployment

Pause/Resume process



New version from Deployment

Create new RS

Start to scale as desired

Scale down existing RS to 0

Delete existing RS



Deployment/RS vs RC

RS more dynamic than RC

RS support label with methods:

- Equality-based requirement
- Set-based requirement

<https://kubernetes.io/docs/concepts/overview/working-with-objects/labels/>



Label selector

Equality-based requirement

```
spec:  
  replicas: 3  
  selector:  
    app: nginx  
    environment: production  
    tier: frontend
```

Set-based requirement

```
spec:  
  replicas: 3  
  selector:  
    matchLabels:  
      tier: frontend  
    matchExpressions:  
      - {key: tier, operator: In, values: [frontend]}
```



Set-based requirement can be
mixed with equality-based
requirement



Rollout strategy

Set online

Edit online

Modify YAML file and apply



Set online

```
$kubectl set image deployment/hello  
hello=somkiat/hello:v2
```

```
Waiting for rollout to finish: 1 out of 3 new replicas have been updated...  
Waiting for rollout to finish: 1 out of 3 new replicas have been updated...  
Waiting for rollout to finish: 1 out of 3 new replicas have been updated...  
Waiting for rollout to finish: 1 out of 3 new replicas have been updated...  
Waiting for rollout to finish: 1 out of 3 new replicas have been updated...  
Waiting for rollout to finish: 1 out of 3 new replicas have been updated...  
Waiting for rollout to finish: 2 out of 3 new replicas have been updated...  
Waiting for rollout to finish: 2 out of 3 new replicas have been updated...  
Waiting for rollout to finish: 2 old replicas are pending termination...  
Waiting for rollout to finish: 1 old replicas are pending termination...  
Waiting for rollout to finish: 1 old replicas are pending termination...  
deployment "hello" successfully rolled out
```



Edit online

\$kubectl edit deployment hello

```
# Please edit the object below. Lines beginning with a '#' will be ignored,
# and an empty file will abort the edit. If an error occurs while saving this file it
# will be reopened with the relevant failures.
#
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
  annotations:
    deployment.kubernetes.io/revision: "6"
    kubectl.kubernetes.io/last-applied-configuration: |
      {"apiVersion":"apps/v1","kind":"Deployment","metadata":{},"annotations":{},"
      "namespace":"default","spec":{"replicas":3,"revisionHistoryLimit":1,"selector":{},"template":{"metadata":{"labels":{"app":"web"}},"
      "spec":{"containers":[{"image":"nginx:1.13","name":"nginx","ports":[{"containerPort":8080,"protocol":"TCP"}]}]}}}
  creationTimestamp: 2018-04-01T17:17:51Z
  generation: 10
  labels:
    app: web
  name: hello
  namespace: default
  resourceVersion: "33405"
  selfLink: /apis/extensions/v1beta1/namespaces/default/deployments/hello
  uid: 9b773859-35d0-11e8-9d36-0800275c6c60
```



Modify YAML file and apply

```
$kubectl apply -f hello_deployment.yml
```



Show history of rollout

```
$kubectl rollout history deployment/hello
```

```
deployments "hello"
REVISION  CHANGE-CAUSE
2          <none>
3          <none>
4          <none>
```

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: hello
  labels:
    app: web
spec:
  replicas: 3
  revisionHistoryLimit: 1
  selector:
    matchLabels:
      app: web
```

spec.revisionHistory = 2 (default)
spec.revisionHistory = 0 (clean all)



Try to rollback to revision

```
$kubectl rollout undo deployment/hello  
--to-revision=2
```



Try to scale a deployment

\$kubectl scale deployment hello --replicas=5

```
bash-3.2$ kubectl scale deployment hello --replicas=3
```

```
deployment.extensions "hello" scaled
```

```
bash-3.2$ kubectl get deployment -o wide
```

NAME	DESIRED	CURRENT	UP-TO-DATE	AVAILABLE	AGE	CONTAINERS	IMAGES	SELECTOR
hello	3	3	3	3	21m	hello	somkiat/hello	app=web

```
bash-3.2$ kubectl scale deployment hello --replicas=5
```

```
deployment.extensions "hello" scaled
```

```
bash-3.2$ kubectl get deployment -o wide
```

NAME	DESIRED	CURRENT	UP-TO-DATE	AVAILABLE	AGE	CONTAINERS	IMAGES	SELECTOR
hello	5	5	5	5	21m	hello	somkiat/hello	app=web

```
bash-3.2$ kubectl scale deployment hello --replicas=1
```

```
deployment.extensions "hello" scaled
```

```
bash-3.2$ kubectl get deployment -o wide
```

NAME	DESIRED	CURRENT	UP-TO-DATE	AVAILABLE	AGE	CONTAINERS	IMAGES	SELECTOR
hello	1	1	1	1	21m	hello	somkiat/hello	app=web



Pause and resume rollout

\$kubectl rollout pause deployment/hello

\$kubectl rollout resume deployment/hello



Workshop

Deployment/ReplicaSet

file /04-deployment-and-replica-set



Horizontal Pods Autoscale (HPA)

File /working-with-java/03-hpa



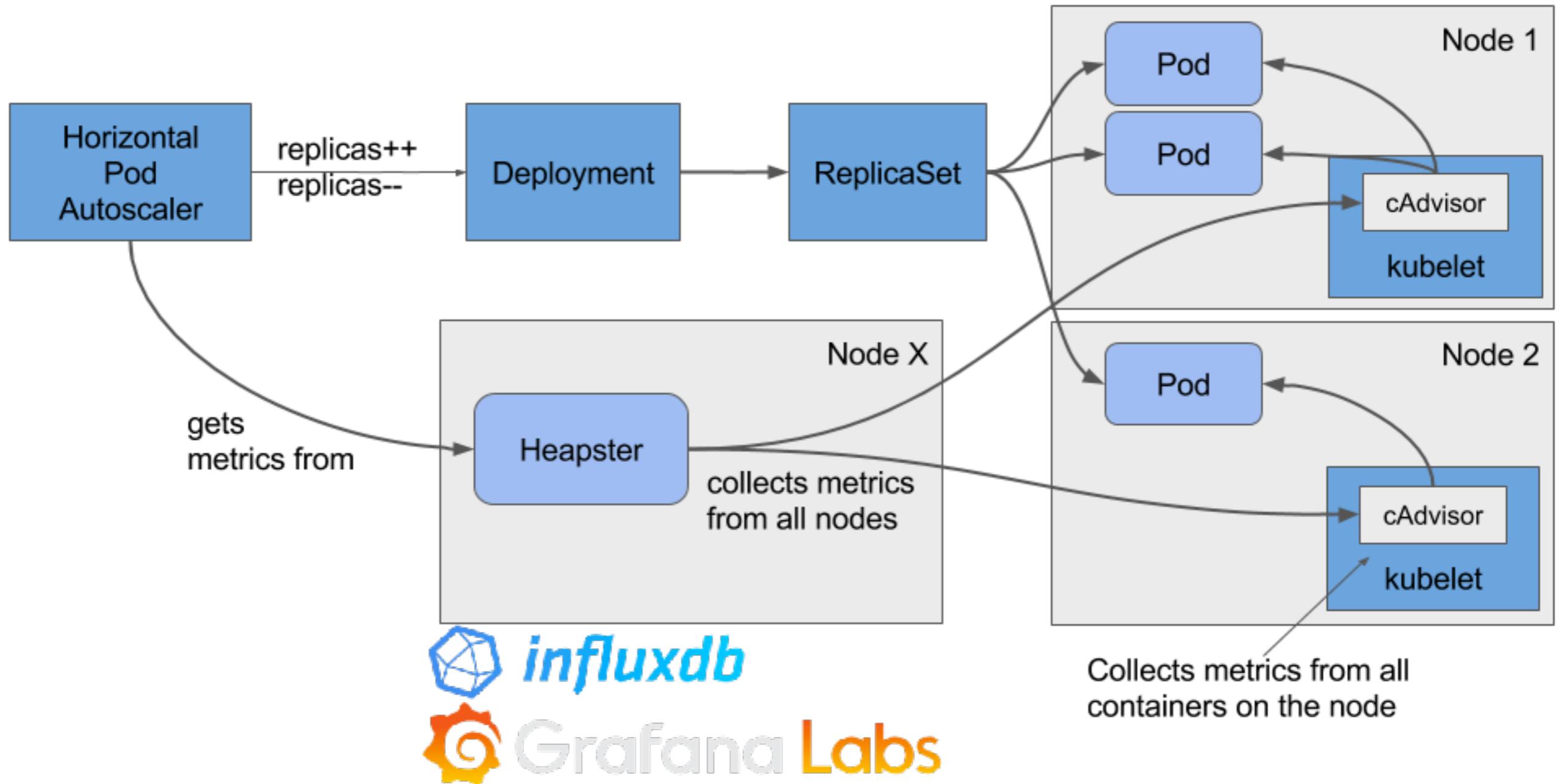
Horizontal Pod Autoscaler

Monitor workload on Pods (based on CPU)
and automatic scaling-up application

Scaling-up and down for your app need !!



Components in Autoscaling



<https://kubernetes.io/docs/tasks/run-application/horizontal-pod-autoscale-walkthrough/>



1. Enable hipster in minikube

\$minikube addons enable heapster

\$minikube addons start heapster

\$minikube addons open heapster



See all pods from heapster

\$kubectl get pods --all-namespaces

NAMESPACE	NAME	READY	STATUS	RESTARTS	AGE
default	mongo-controller-xdh28	1/1	Running	0	9h
default	spring-boot-service-deployment-74f5df876f-gxn24	1/1	Running	0	4h
kube-system	default-http-backend-kf92s	1/1	Running	0	4h
kube-system	heapster-2ssh2	1/1	Running	0	8h
kube-system	influxdb-grafana-vk6j6	2/2	Running	0	8h
kube-system	kube-addon-manager-minikube	1/1	Running	2	1d
kube-system	kube-dns-54cccfbd8-xkpl6	3/3	Running	6	1d
kube-system	kubernetes-dashboard-77d8b98585-n49sg	1/1	Running	4	1d
kube-system	metrics-server-bb9ffc6b8-5mgnv	1/1	Running	0	8h
kube-system	nginx-ingress-controller-nrk4d	1/1	Running	0	4h
kube-system	storage-provisioner	1/1	Running	2	1d



See all services from heapster

\$kubectl get service --all-namespaces

NAMESPACE	NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
default	kubernetes	ClusterIP	10.96.0.1	<none>	443/TCP	1d
default	mongo-service	ClusterIP	10.99.242.178	<none>	27017/TCP	9h
default	spring-boot-service	NodePort	10.98.105.78	<none>	80:32132/TCP	4h
kube-system	default-http-backend	NodePort	10.102.221.170	<none>	80:30001/TCP	1h
kube-system	heapster	ClusterIP	10.100.221.108	<none>	80/TCP	8h
kube-system	Kube-dns	ClusterIP	10.96.0.10	<none>	53/UDP, 53/TCP	1d
kube-system	kubernetes-dashboard	NodePort	10.99.243.227	<none>	80:30000/TCP	1d
kube-system	metrics-server	ClusterIP	10.107.38.180	<none>	443/TCP	8h
kube-system	monitoring-grafana	NodePort	10.104.125.177	<none>	80:30002/TCP	8h
kube-system	monitoring-influxdb	ClusterIP	10.99.175.232	<none>	8083/TCP, 8086/TCP	8h



See result in Grafana

<http://192.168.99.100:30002>

The screenshot shows the Grafana Home Dashboard at the URL <http://192.168.99.100:30002/?orgId=1>. The dashboard features a top navigation bar with icons for search, refresh, and other settings. Below the navigation is a "Home Dashboard" title. A "Getting Started with Grafana" section contains five steps: "Install Grafana" (checkmark), "Create your first data source" (checkmark), "Create your first dashboard" (checkmark), "Add Users" (highlighted in green), and "Install apps & plugins" (sun icon). To the left, sections for "Starred dashboards" (Pods) and "Recently viewed dashboards" (Cluster) are shown. On the right, sections for "Installed Apps", "Installed Panels", and "Installed Datasources" all indicate "None installed. Browse Grafana.net".



2. Create metric server

Starting from Kubernetes 1.8, resource usage metrics, such as container CPU and memory usage, are available in Kubernetes through the Metrics API. These metrics can be either accessed directly by user, for example by using `kubectl top` command, or used by a controller in the cluster, e.g. Horizontal Pod Autoscaler, to make decisions.

<https://github.com/kubernetes-incubator/metrics-server>



3. Deploy Springboot service

```
$kubectl create -f boot-deployment.yaml  
$kubectl create -f boot-service.yaml
```



4. Create HPA in command line

```
$kubectl autoscale  
deployment/spring-boot-service-deployment  
--min=1 --max=5 --cpu-percent=5
```

min = minimum of replica

max = maximum of replica

cpu-percent = average of % of CPU usage



4. Create HPA in command line

\$kubectl get hpa

REFERENCE	TARGETS	MINPODS	MAXPODS
Deployment/spring-boot-service-deployment	0%/5%	1	5



4. Create HPA in command line

**Scale-up can only happen if there was no rescaling
within the last 3 minutes**

**Scale-down will wait for 5 minutes from the last
rescaling**

<https://github.com/kubernetes/community/blob/master/contributors/design-proposals/autoscaling/horizontal-pod-autoscaler.md#autoscaling-algorithm>



5. Load testing with command line

`http://spring-boot-service.default.svc.cluster.local:
8080/user`



6. See result (1)

\$kubectl get pods

NAME	READY	STATUS	RESTARTS	AGE
load-test-6f86656986-9qvdl	0/1	Error	0	4m
mongo-controller-xdh28	1/1	Running	0	1h
spring-boot-service-deployment-86c7b47b7b-9l9sn	1/1	Running	0	15m
spring-boot-service-deployment-86c7b47b7b-9srkg	1/1	Running	0	1m
spring-boot-service-deployment-86c7b47b7b-kbtrl	1/1	Running	0	1m
spring-boot-service-deployment-86c7b47b7b-pqbsm	1/1	Running	0	1m



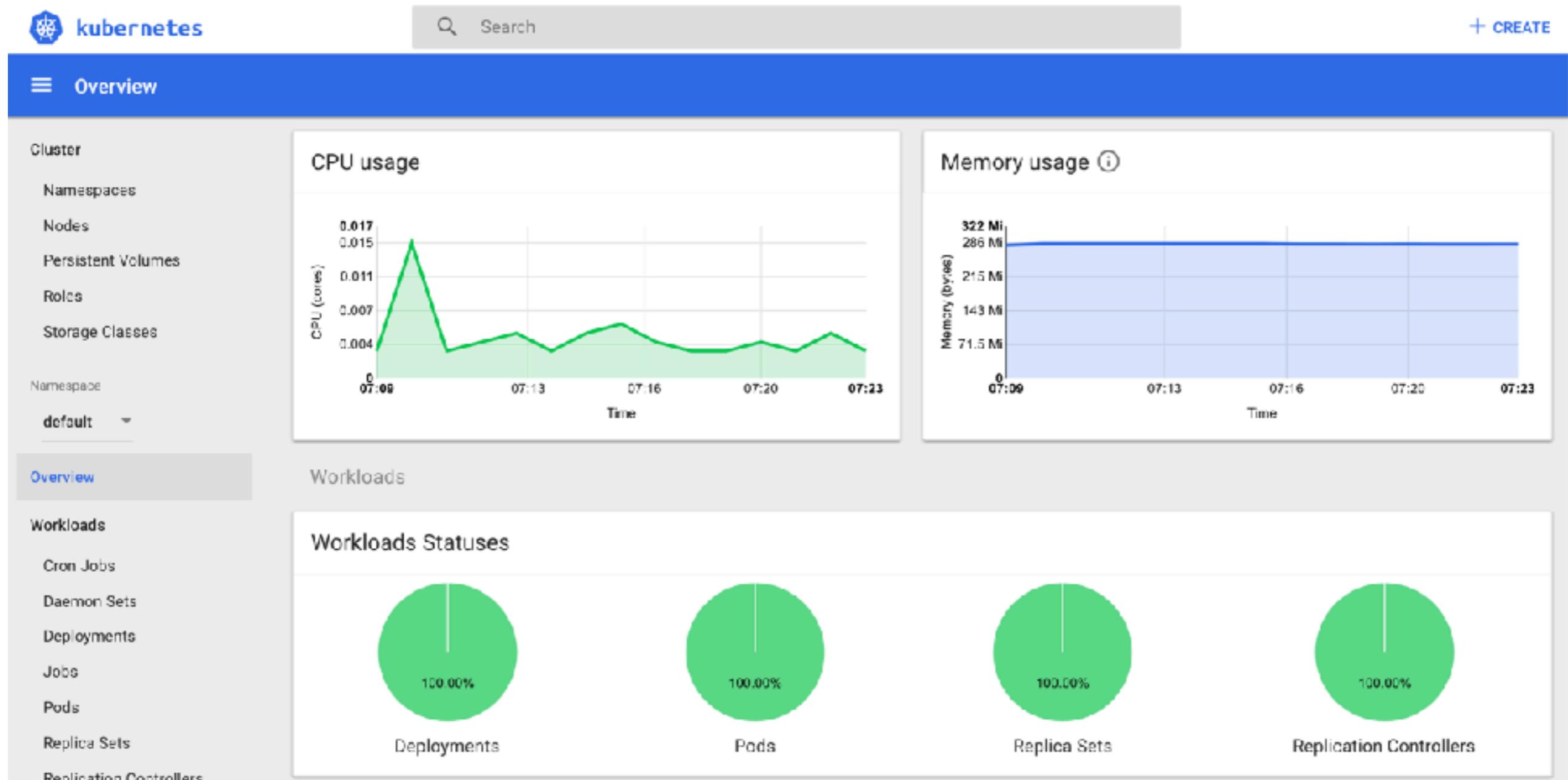
6. See result (2)

\$kubectl describe hpa

```
Metrics:                               ( current / target )
  resource cpu on pods  (as a percentage of request): 134% (269m) / 5%
Min replicas:                           1
Max replicas:                           5
Conditions:
  Type      Status  Reason            Message
  ----      ----   ----
  AbleToScale False   BackoffBoth    the time since the previous scale is still within both the downscale and upscale to
  rbidden windows
  ScalingActive True    ValidMetricFound the HPA was able to successfully calculate a replica count from cpu resource utilization (percentage of request)
  ScalingLimited True   TooManyReplicas the desired replica count is more than the maximum replica count
Events:
  Type      Reason          Age      From            Message
  ----      ----           ----   ----
  Normal   SuccessfulRescale 1m      horizontal-pod-autoscaler  New size: 4; reason: cpu resource utilization (percentage of request) above target
  Warning  FailedGetResourceMetric 19s      horizontal-pod-autoscaler  unable to get metrics for resource cpu: unable to fetch metrics from API: the server could not find the requested resource (get pods.metrics.k8s.io)
  Warning  FailedUpdateStatus     19s      horizontal-pod-autoscaler  Operation cannot be fulfilled on horizontalpodautoscalers.autoscaling "spring-boot-service-deployment": the object has been modified; please apply your changes to the latest version and try again
  Warning  FailedComputeMetricsReplicas 19s      horizontal-pod-autoscaler  failed to get cpu utilization: unable to get metrics for resource cpu: unable to fetch metrics from API: the server could not find the requested resource (get pods.metrics.k8s.io)
```



7. See result in dashboard (1)



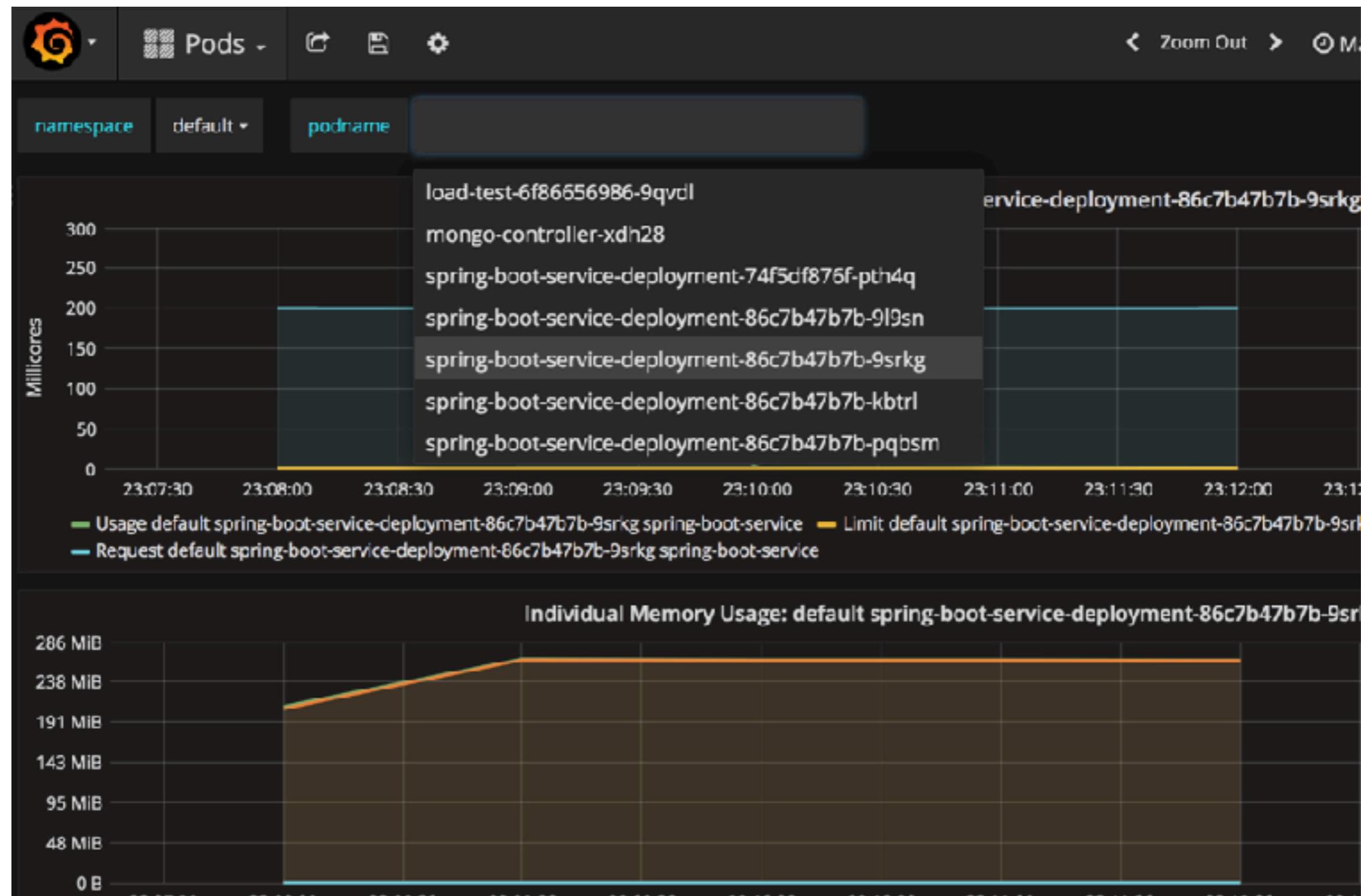
7. See result in dashboard (2)

Pods							
	Name	Node	Status	Restarts	Age	CPU (cores)	Memory (bytes)
✓	spring-boot-service-de	minikube	Running	0	2 minutes	 0.249	265.926 Mi
✓	spring-boot-service-de	minikube	Running	0	2 minutes	 0.03	254.156 Mi
✓	spring-boot-service-de	minikube	Running	0	2 minutes	 0.001	94.840 Mi
✓	load-test-6f86656986-	minikube	Running	1	5 minutes	 0	688 Ki
✓	spring-boot-service-de	minikube	Running	0	16 minutes	 0.018	33.211 Mi
✓	mongo-controller-xdh2	minikube	Running	0	an hour	 0.004	24.453 Mi



8. See result

In Grafana dashboard



Stateful Application Deployment



Stateless vs Stateful

Stateless

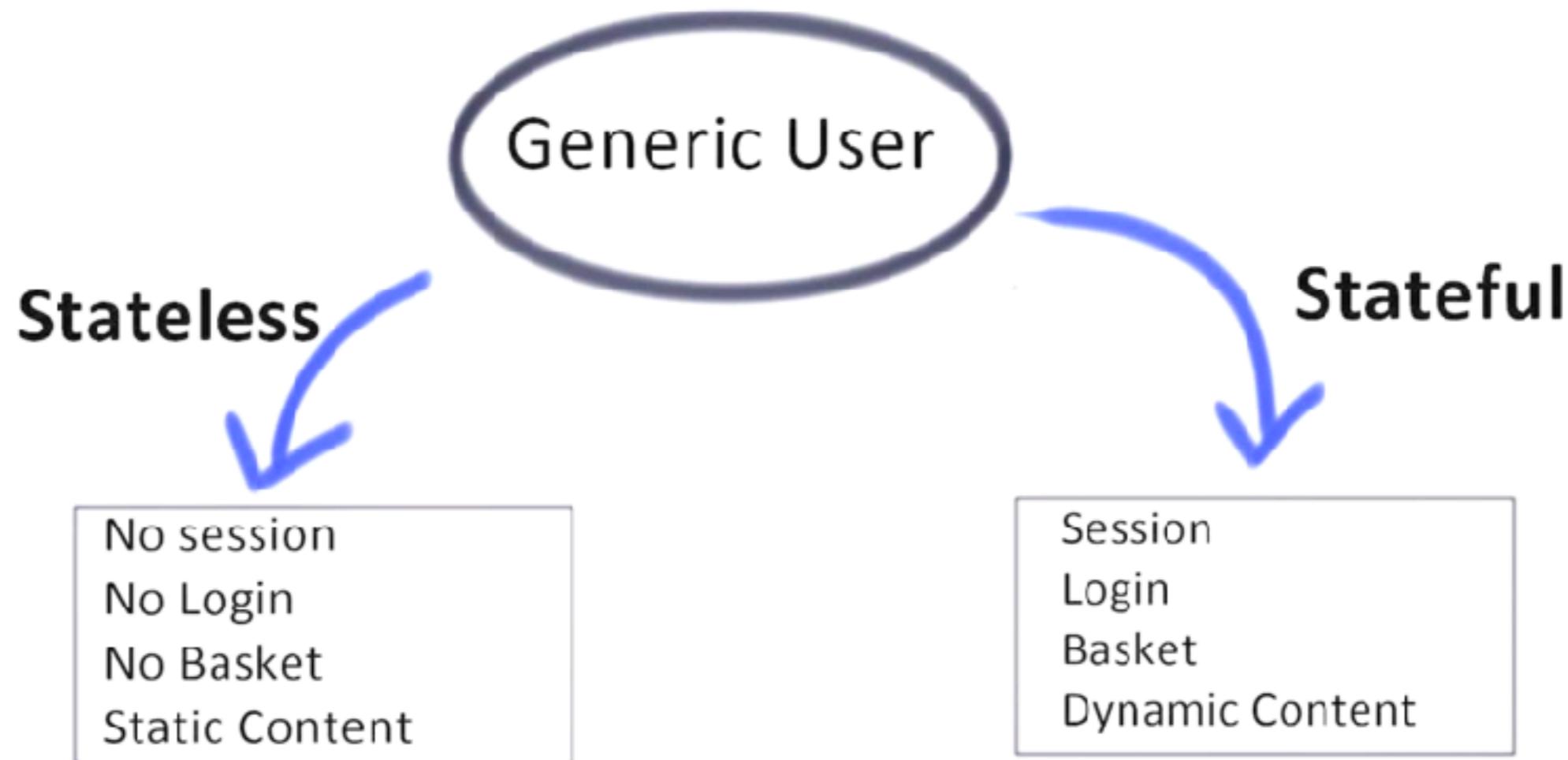
No information about a transaction/request is maintained after it is processed.

Stateful

State information is kept even after a transaction/request has been processed.



Stateless vs Stateful



Container world

Container designed for **Stateless** application

All Load Balance/dispatch process is **not** aware about **state** of application



Solution for Stateful

Share centralize storage pool for all node

Web and Application server

- Keep session and files in storage pool
- Every servers are read/write data on the same place



Solution for Stateful

Share centralize storage pool for all node

Database server

- Active/Active
- Active/Standby
- Keep data in storage pool

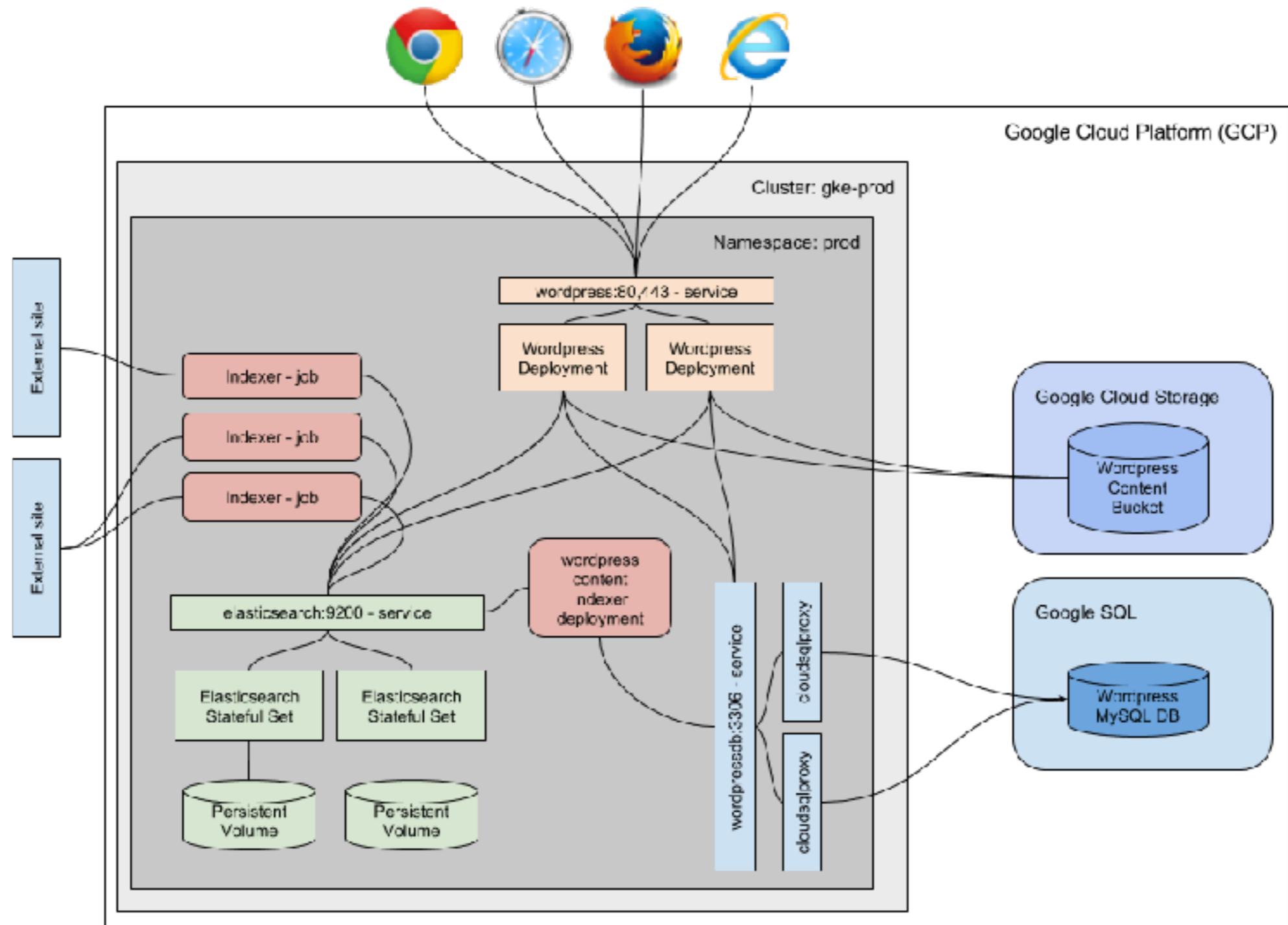


Stateful with Kubernetes

Volume
Statefulset



Stateful with Kubernetes



<http://blogs.avalonconsult.com/blog/enterprise-web/cloud-computing/architecting-for-kubernetes/>

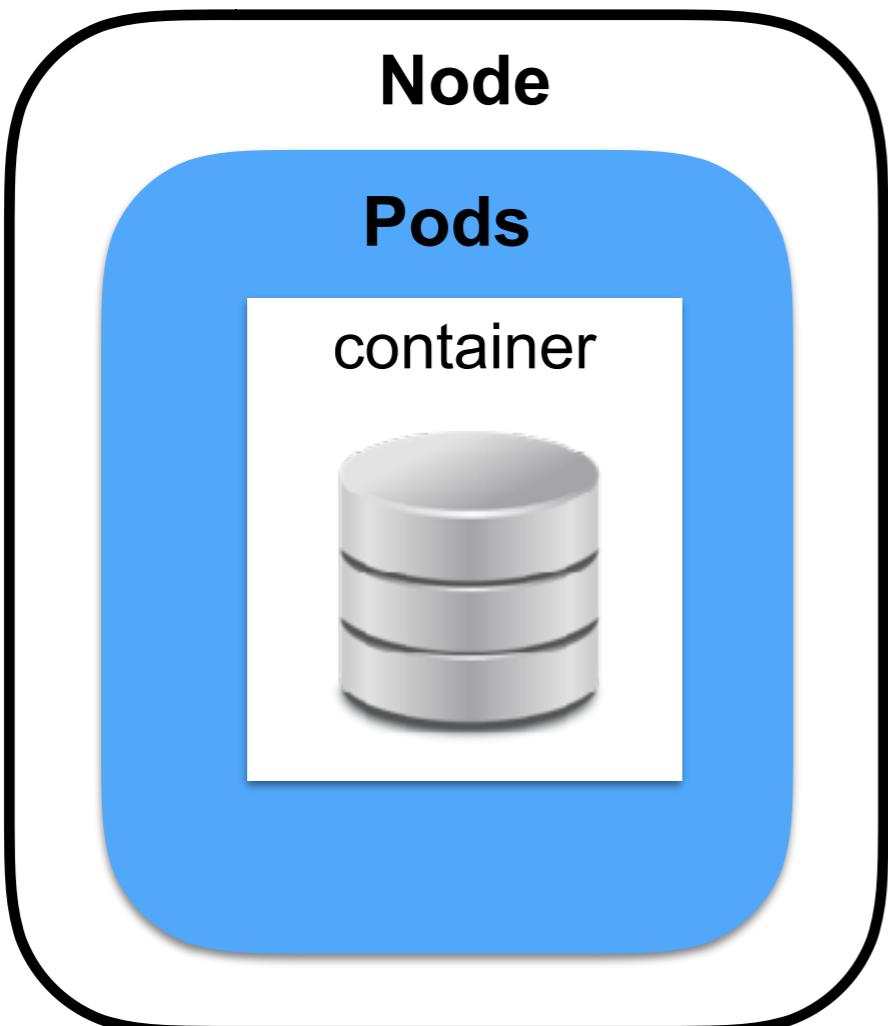


Volume in Kubernetes

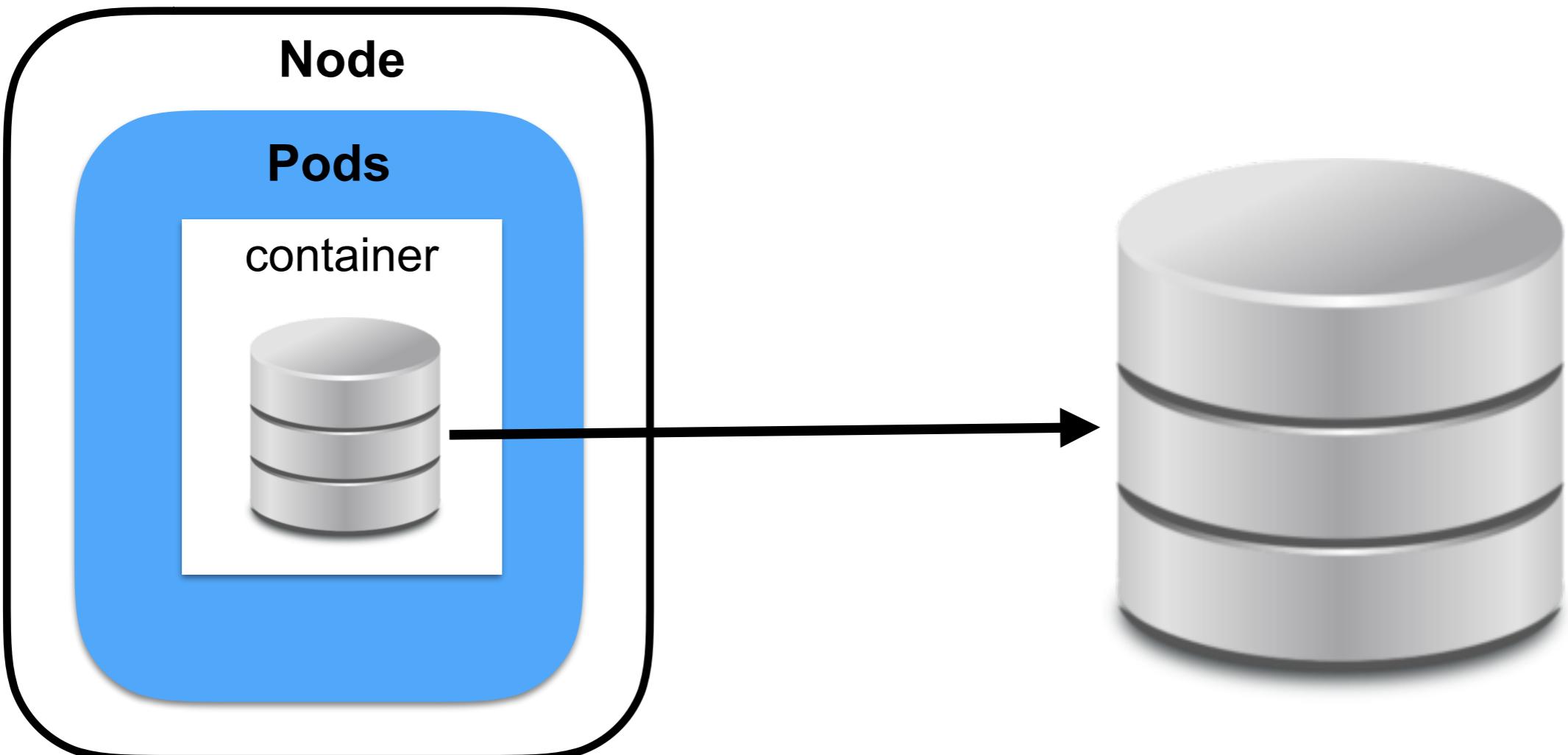
<https://kubernetes.io/docs/concepts/storage/volumes/>



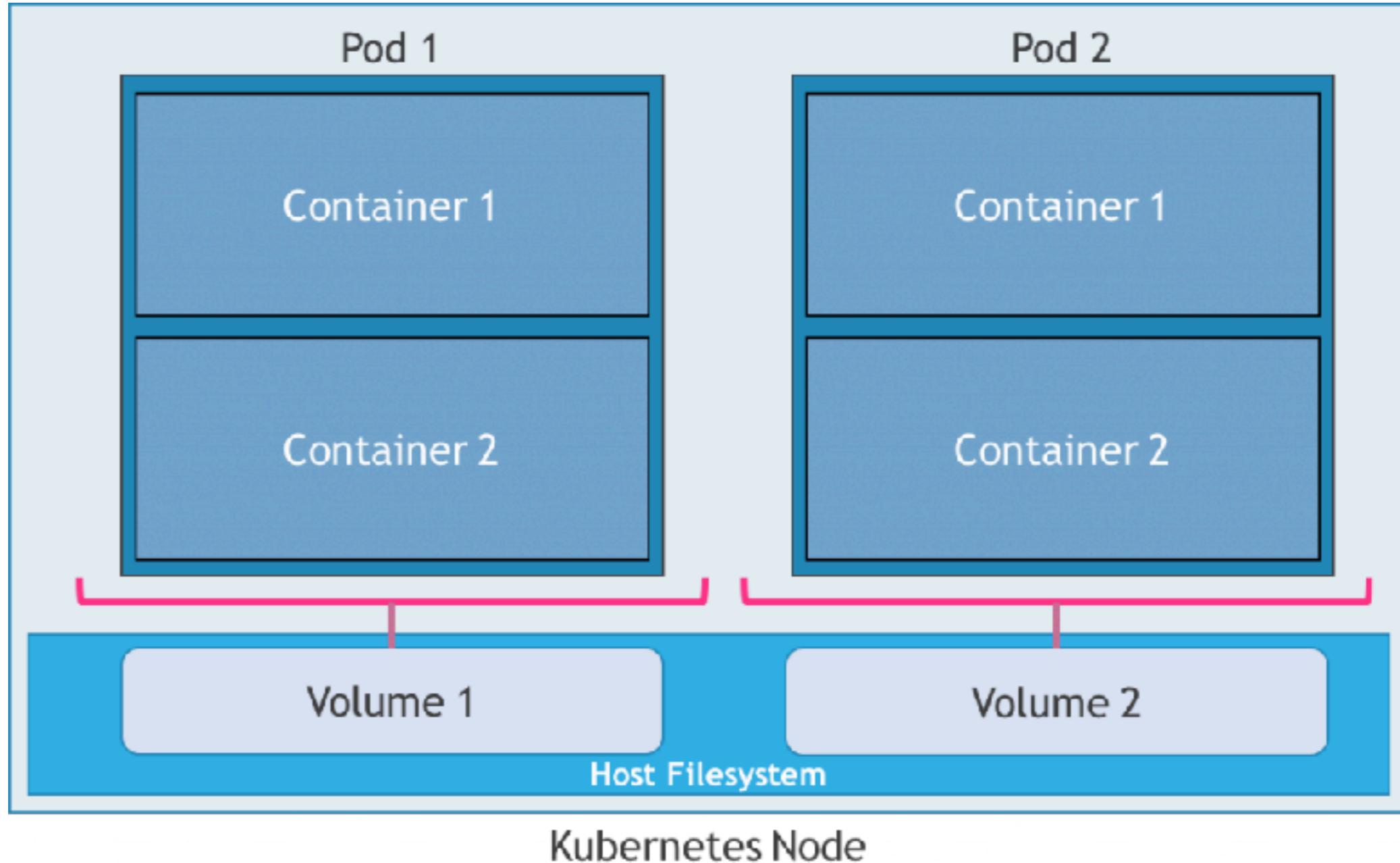
Volume



Volume



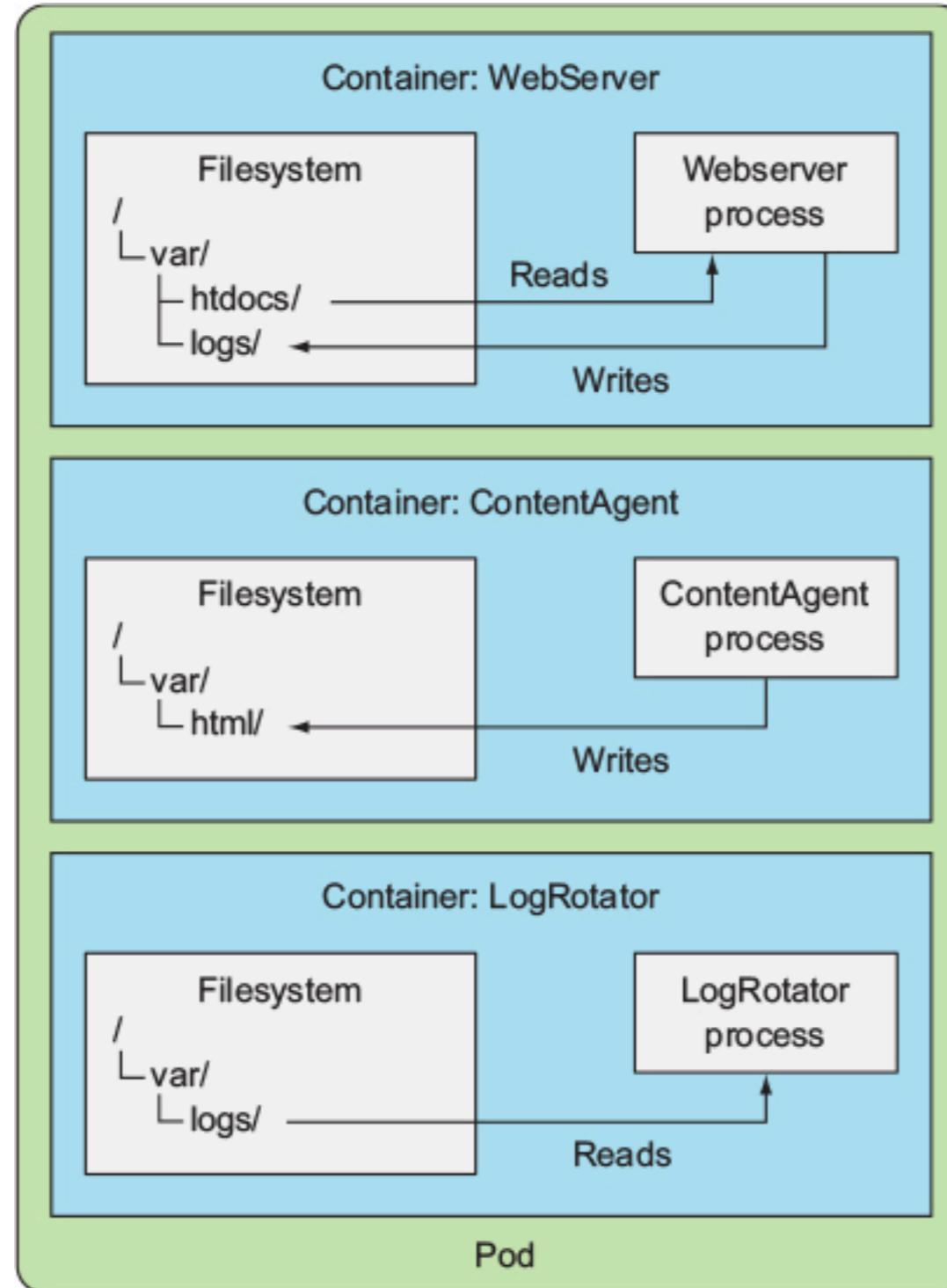
Containers shared volume



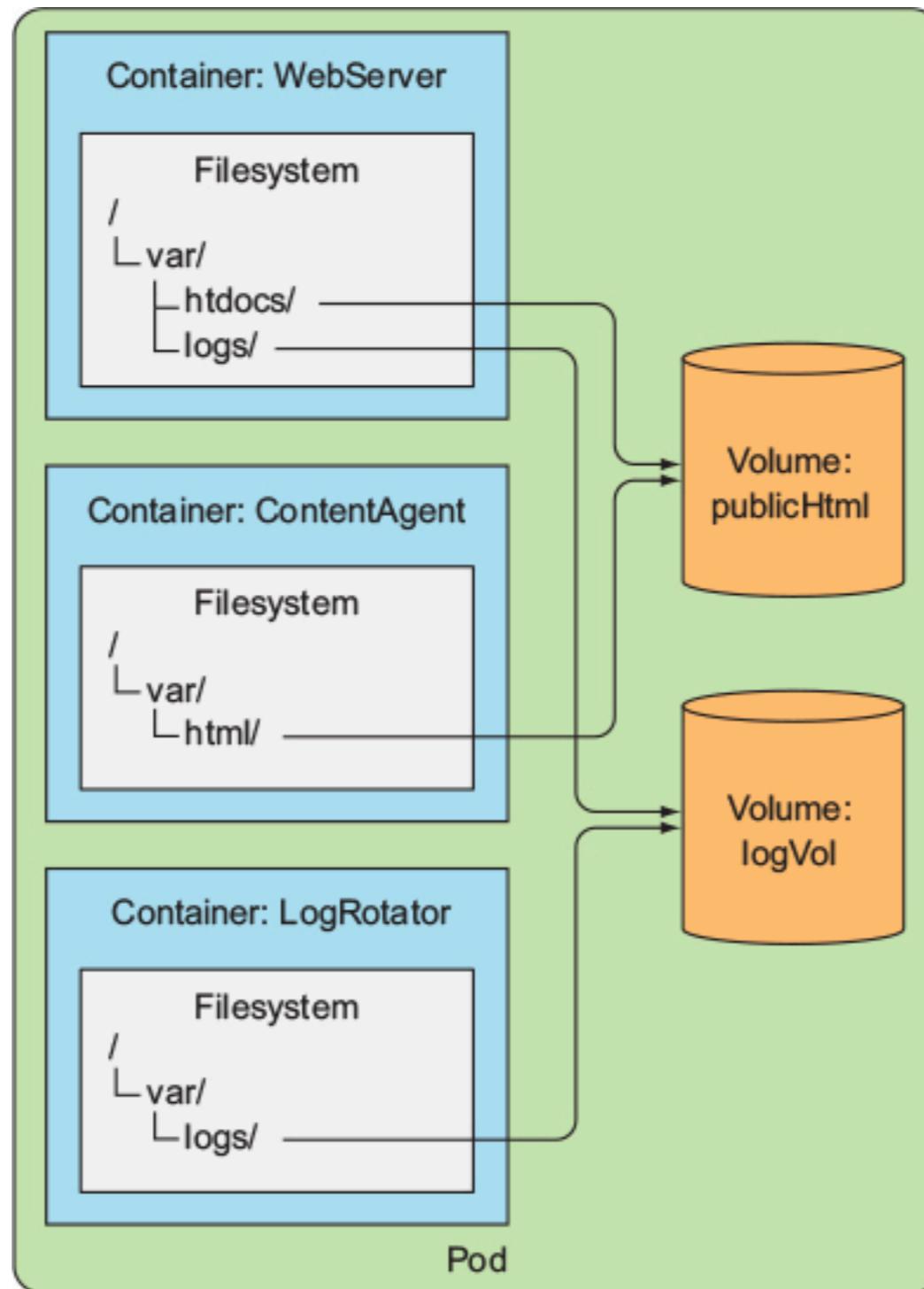
<https://thenewstack.io/strategies-running-stateful-applications-kubernetes-volumes/>



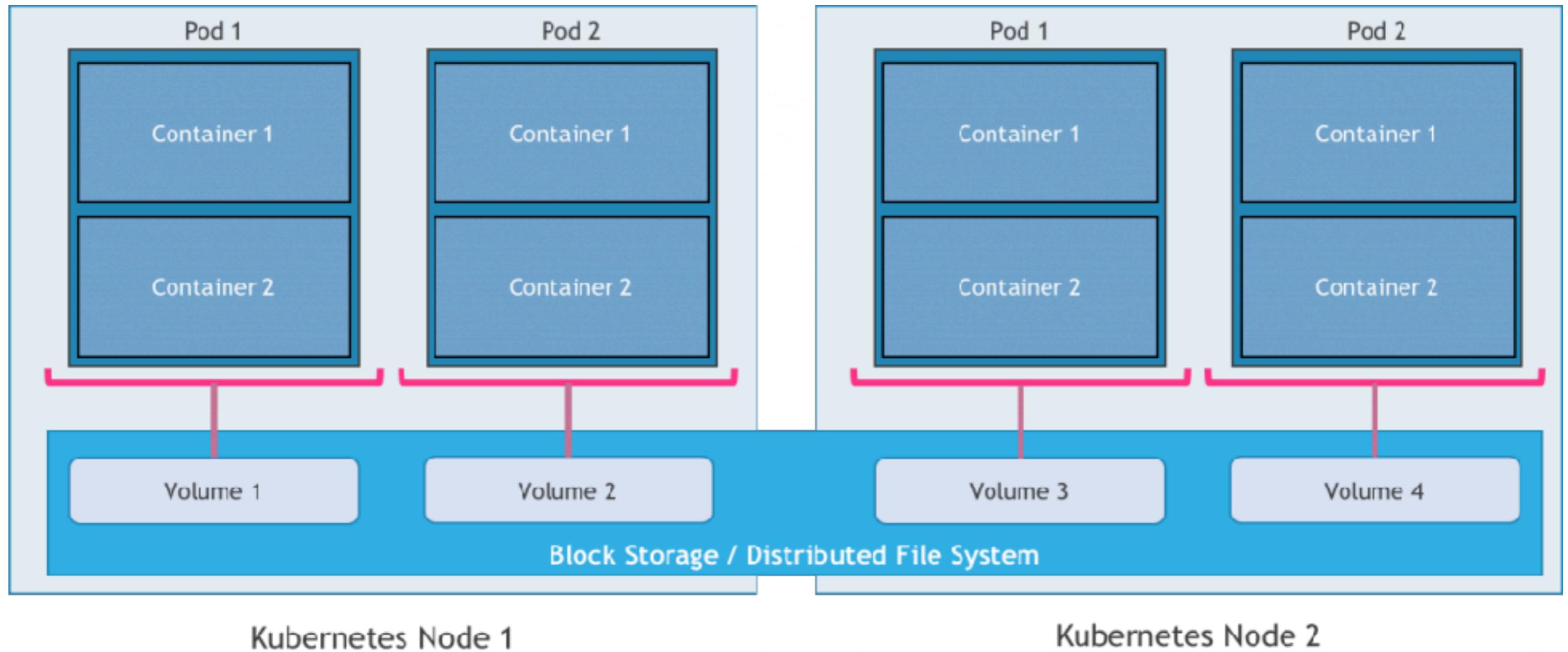
Without shared storage



Containers shared volume



Nodes shared volume



<https://thenewstack.io/strategies-running-stateful-applications-kubernetes-volumes/>



Volume

Containers in the same Pods share storage
(EmptyDir)

- Read and write for all containers in Pods
- Container crash not effect to this storage
- When Pods is deleted then Empty will deleted

Data of Pods/container is **ephemeral**
all data may loss when Pods is restarted



Volume on Kubernetes

`EmptyDir`

`hostPath`

`gitRepo`

`NFS`

`icePersistentDisk`

`Flocker`

Persistent Volume Claim (PVC)

<https://kubernetes.io/docs/concepts/storage/volumes/>



Volume on Kubernetes

EmptyDir

HostPath

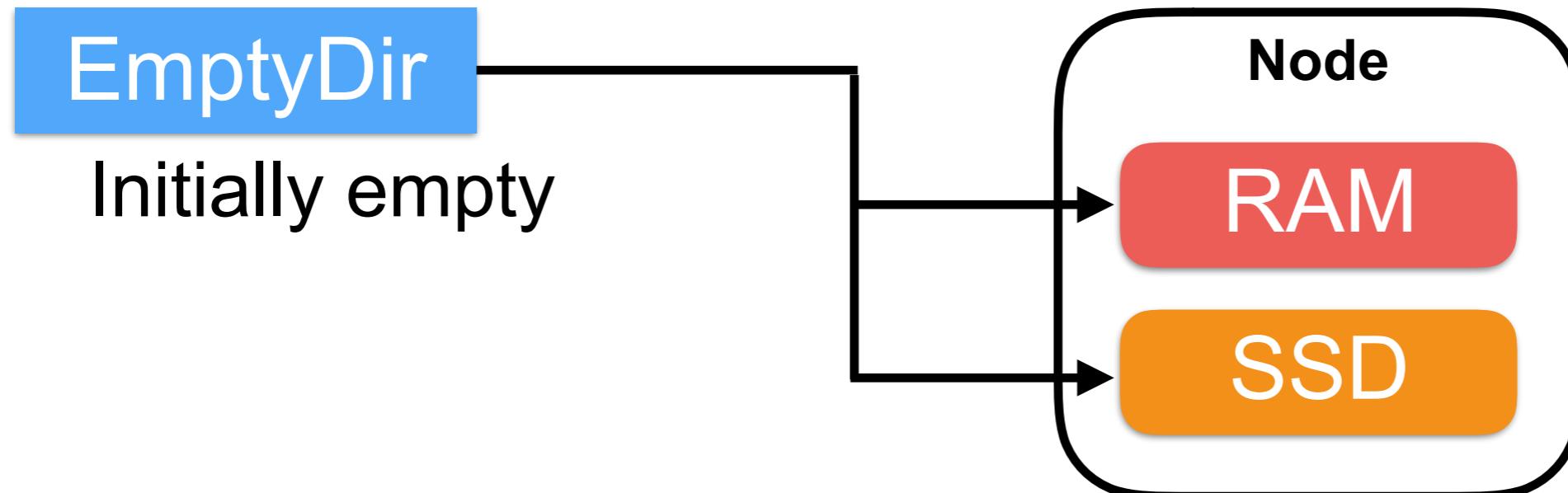
NFS

Cloud Volume

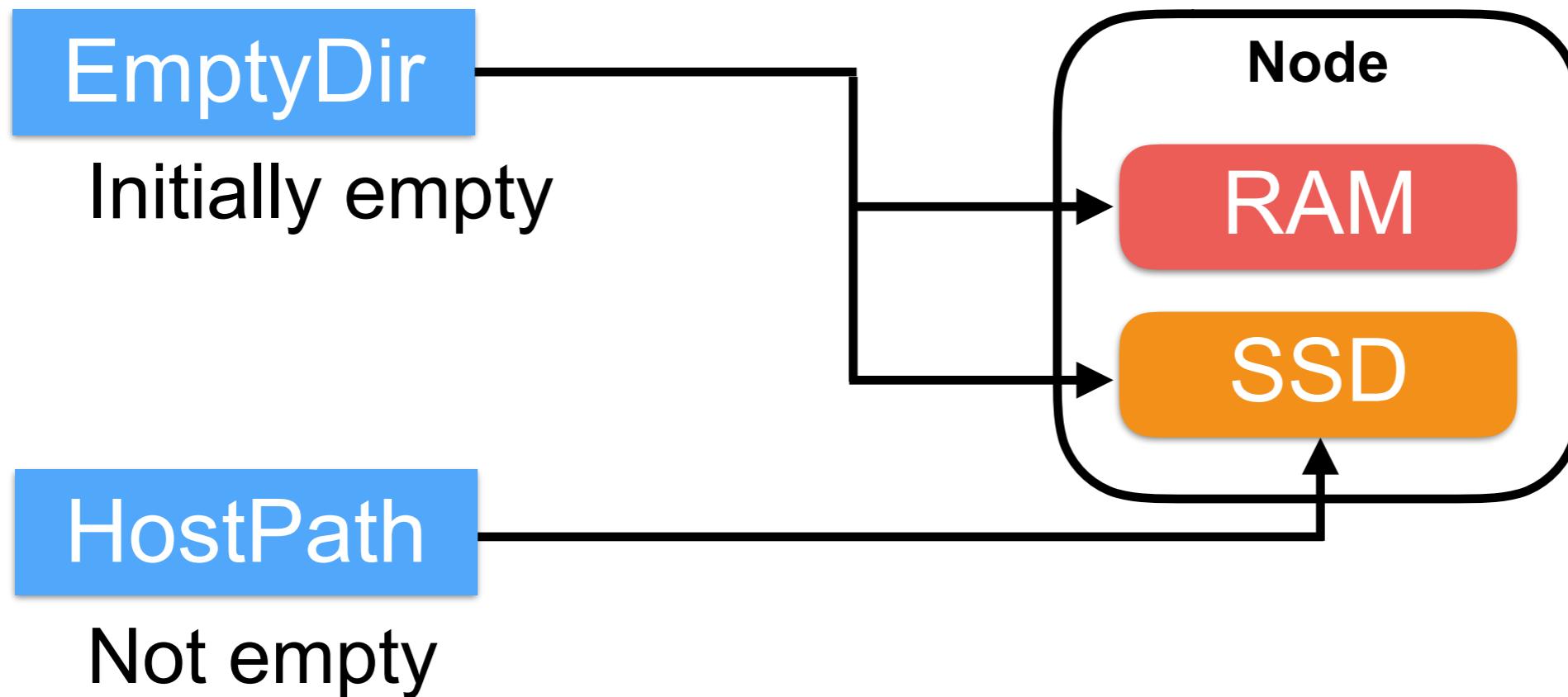
Persistent Volume Claim



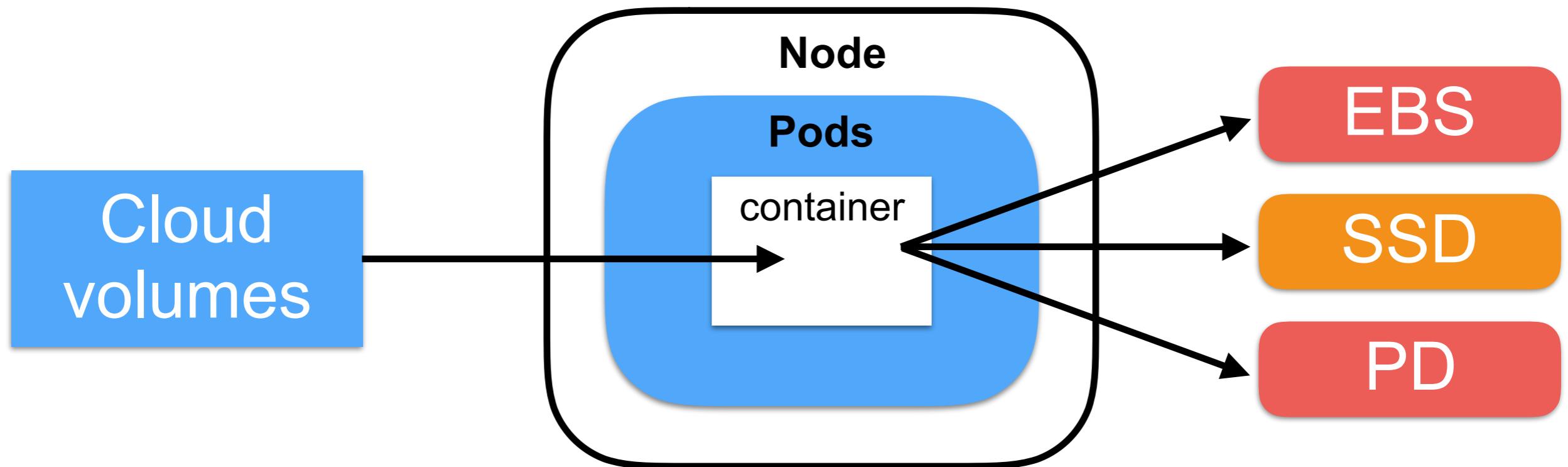
Volume on Kubernetes



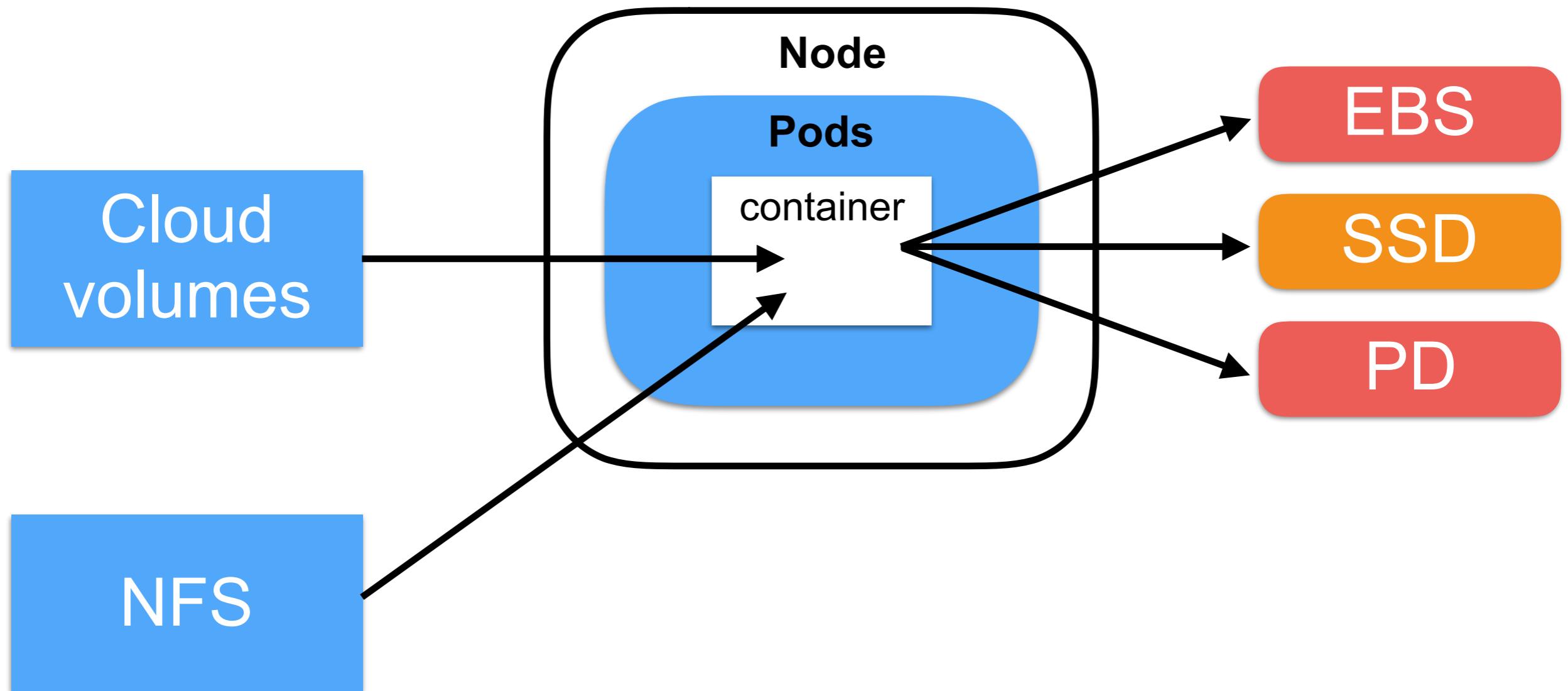
Volume on Kubernetes



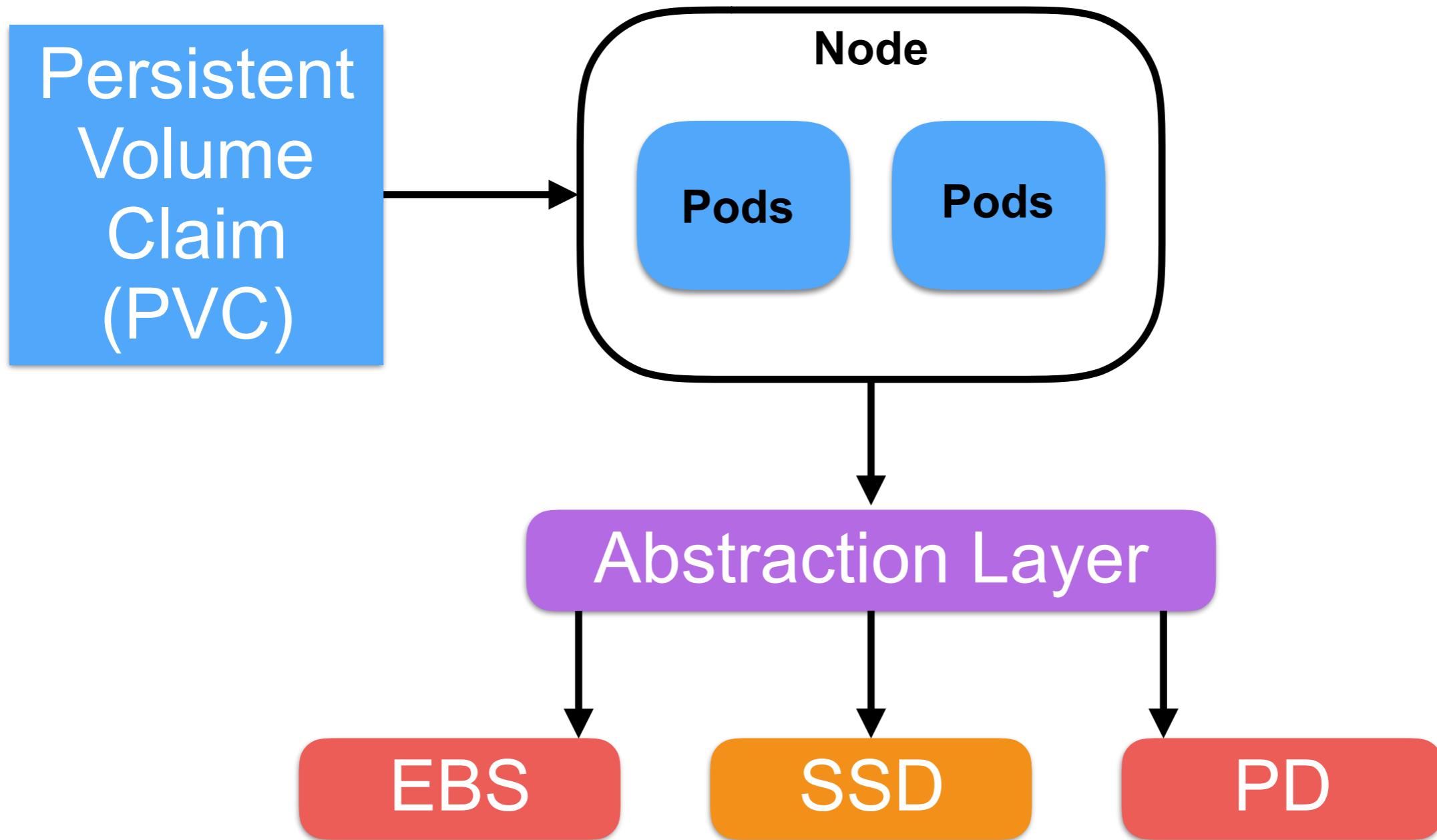
Volume on Kubernetes



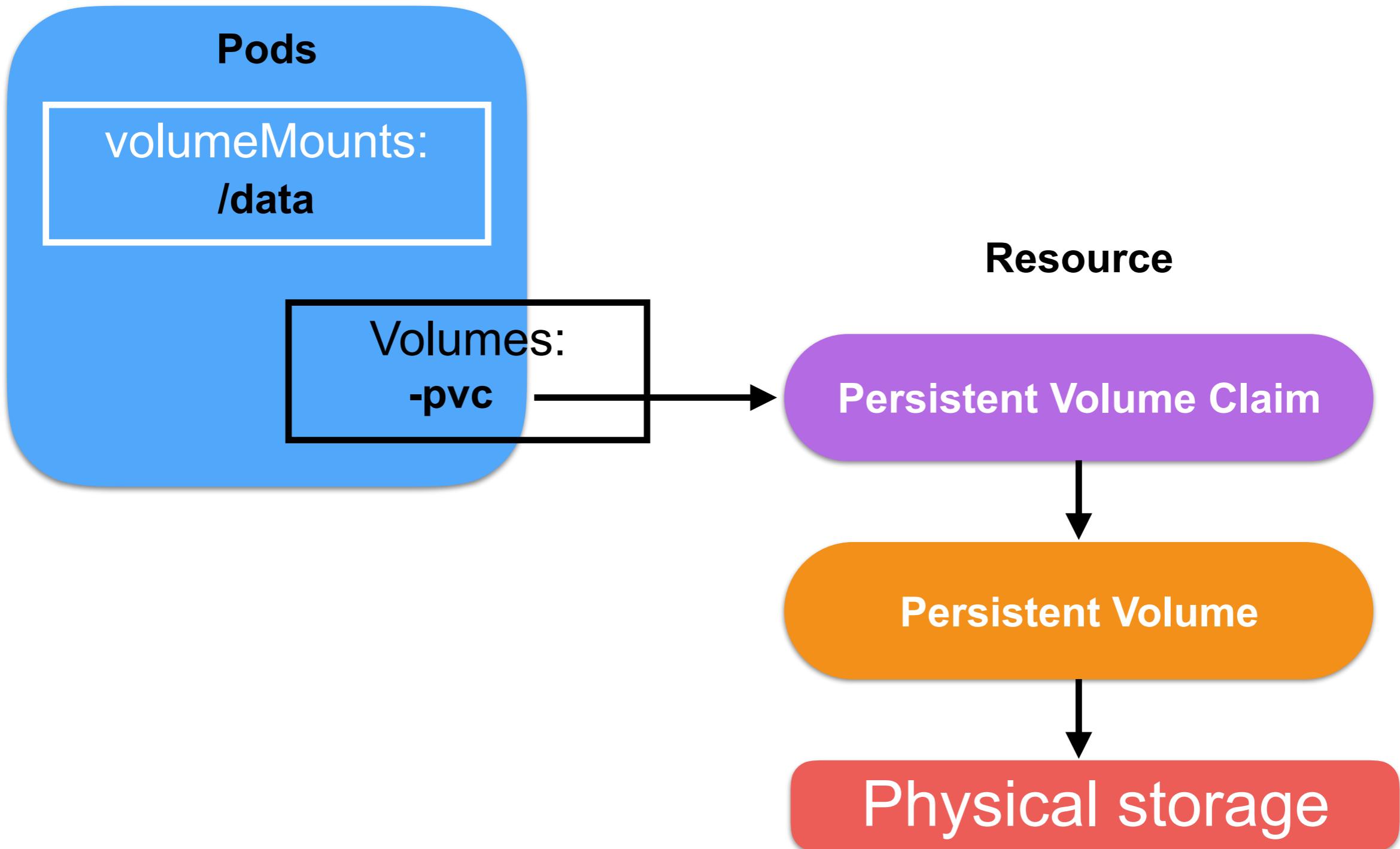
Volume on Kubernetes



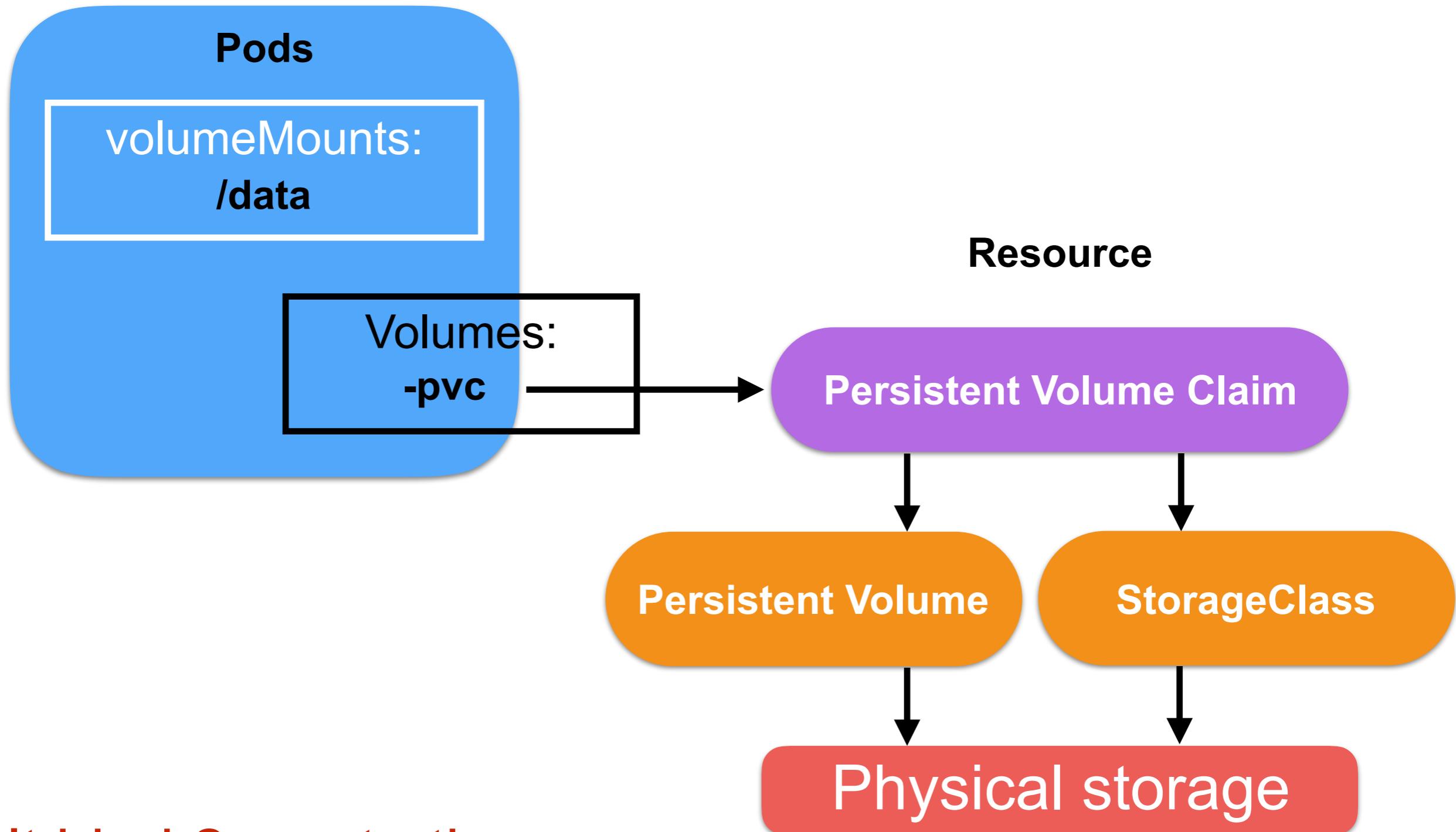
Volume on Kubernetes



Volume on Kubernetes



Volume on Kubernetes



Can't bind 2 pvc to the same pv.



Persistent Volume

Provide and APIs for user and administrator
Abstraction layer to hide detail of storage

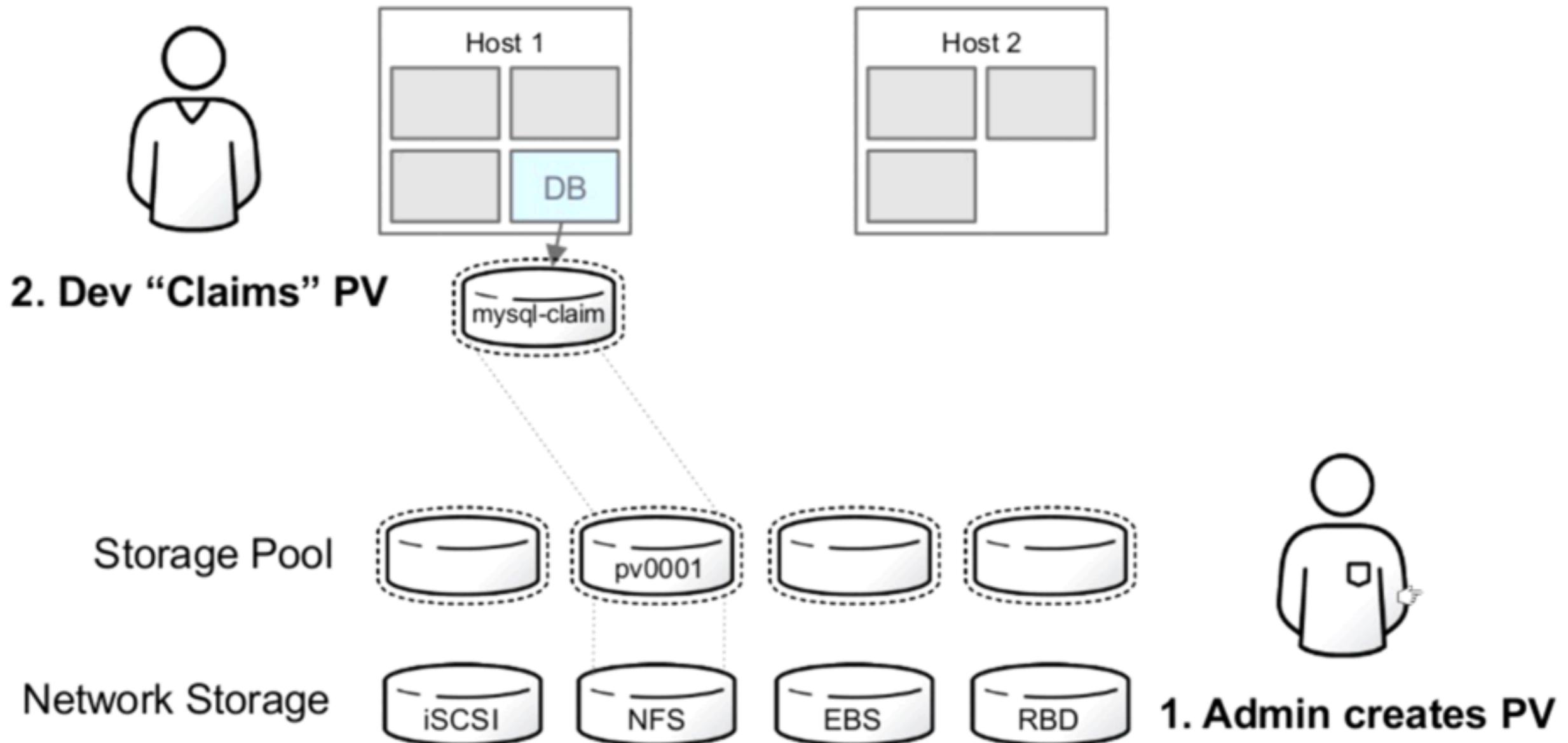
Provide 2 apis for manage your storage

1. PersistentVolume (PV)
2. PersistentVolumeClaim (PVC)

<https://kubernetes.io/docs/concepts/storage/persistent-volumes/>



Persistent Volume



PersistentVolume (PV)

PV is a piece of network storage in the cluster
Piece of storage that independence from Pods
Long lifecycle independent of any Pods
Provisioning by administrator



PersistentVolume (PV)

```
apiVersion: v1
kind: PersistentVolume
metadata:
  name: pv0003
spec:
  capacity:
    storage: 5Gi
  volumeMode: Filesystem
  accessModes:
    - ReadWriteOnce
  persistentVolumeReclaimPolicy: Recycle
  storageClassName: slow
  mountOptions:
    - hard
    - nfsvers=4.1
  nfs:
    path: /tmp
    server: 172.17.0.2
```



PersistentVolumeClaim (PVC)

Request for resources/storage by user
Allows specific resource requests eg. size,
access modes



PersistentVolumeClaim (PVC)

```
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: myclaim
spec:
  accessModes:
    - ReadWriteOnce
  volumeMode: Filesystem
  resources:
    requests:
      storage: 8Gi
  storageClassName: slow
  selector:
    matchLabels:
      release: "stable"
    matchExpressions:
      - {key: environment, operator: In, values: [dev]}
```



Access modes

ReadWriteOnce (RWO)

the volume can be mounted as read-write by a single node

ReadOnlyMany (ROX)

the volume can be mounted read-only by many nodes

ReadWriteMany (RWX)

the volume can be mounted as read-write by many nodes



Access modes

Volume Plugin	ReadWriteOnce	ReadOnlyMany	ReadWriteMany
AWSElasticBlockStore	✓	-	-
AzureFile	✓	✓	✓
AzureDisk	✓	-	-
CephFS	✓	✓	✓
Cinder	✓	-	-
FC	✓	✓	-
FlexVolume	✓	✓	-
Flocker	✓	-	-
GCEPersistentDisk	✓	✓	-
Glusterfs	✓	✓	✓
HostPath	✓	-	-
iSCSI	✓	✓	-
Quobyte	✓	✓	✓
NFS	✓	✓	✓



Lifecycle of volume and claim



Lifecycle of volume

1. Provisioning
2. Binding
3. Using
4. Reclaim (retain, recycle, delete)



Phase of volume

1. Available

Free resource that is not yet bound to a claim

2. Bound

Volume is bound to a claim

3. Released

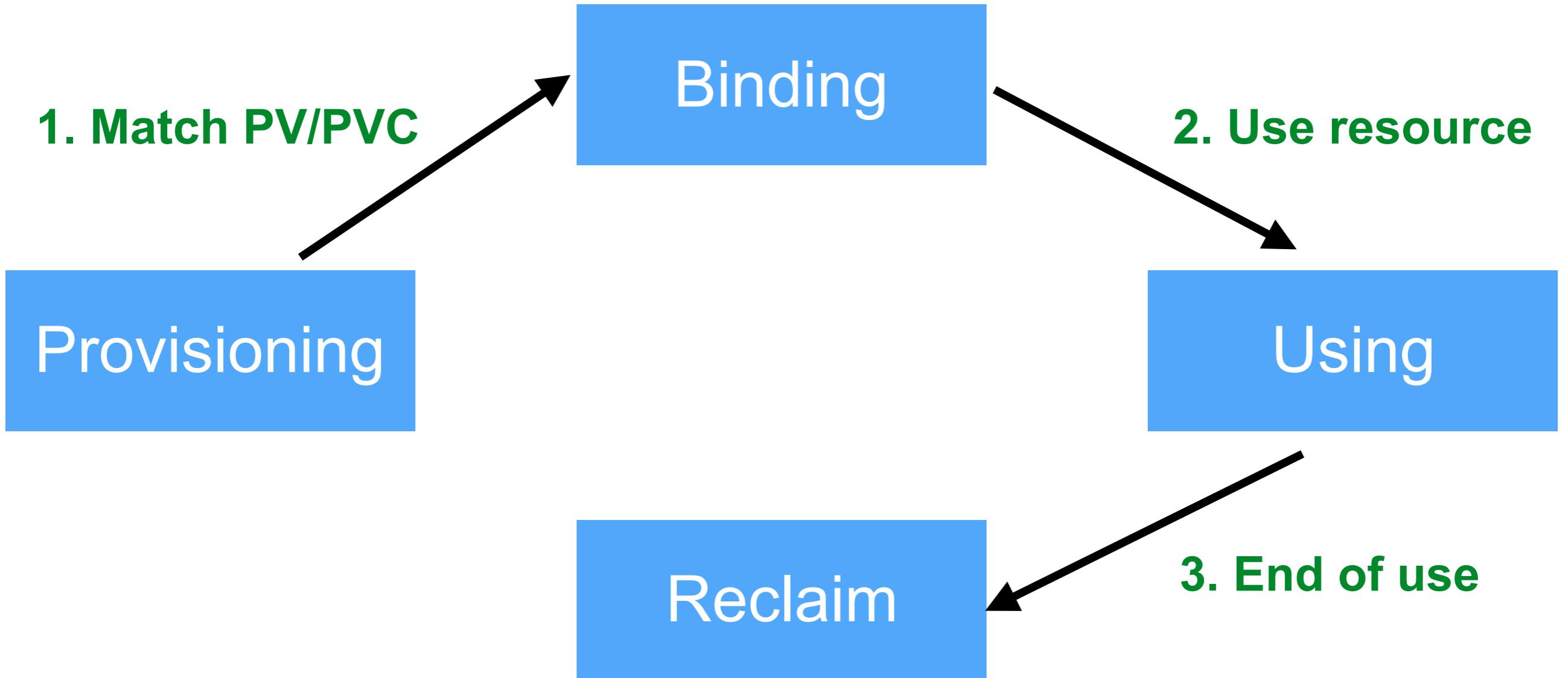
The claim has been deleted, but the resource is not yet reclaimed by the cluster

4. Failed

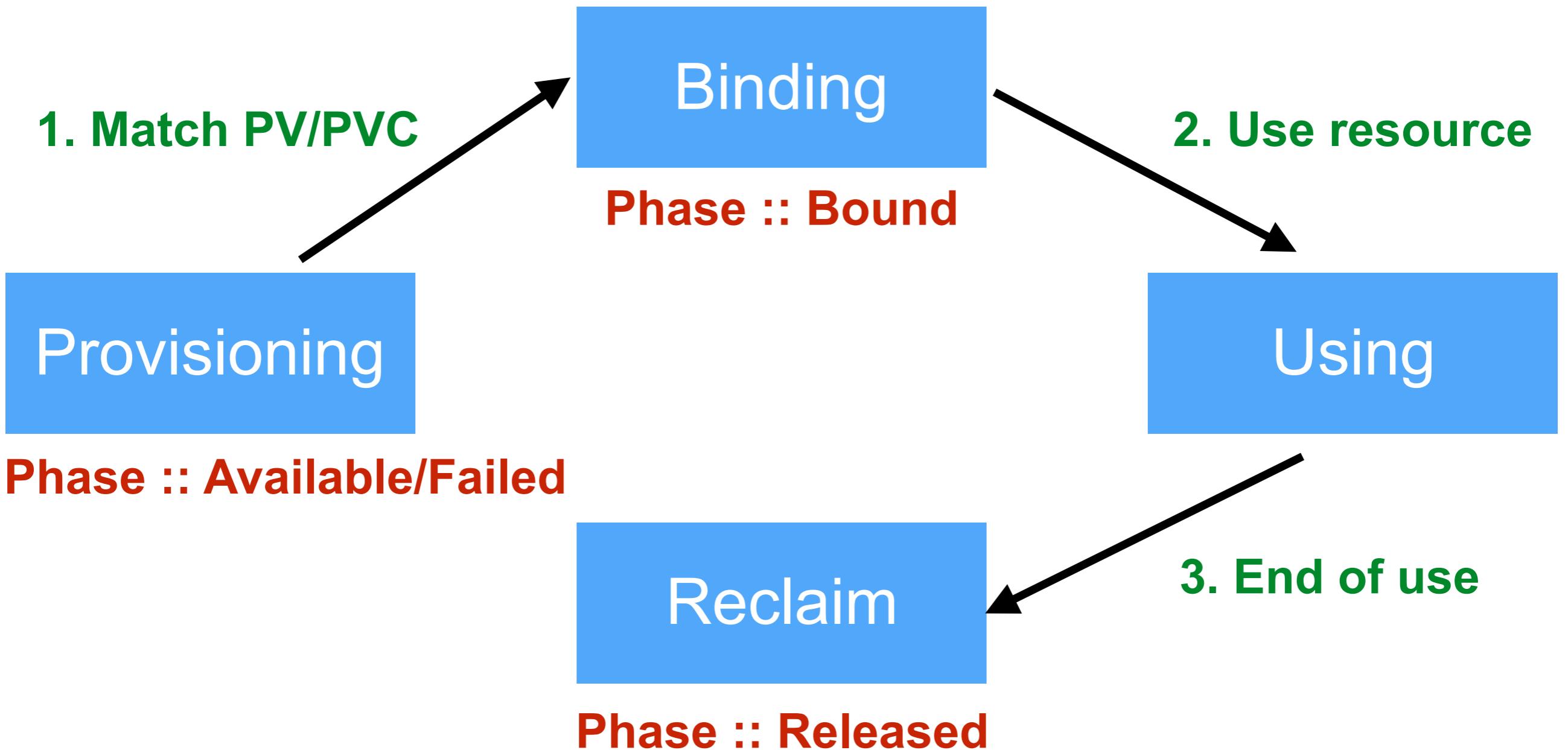
Volume has failed its automatic reclamation



Lifecycle of volume



Phase of volume



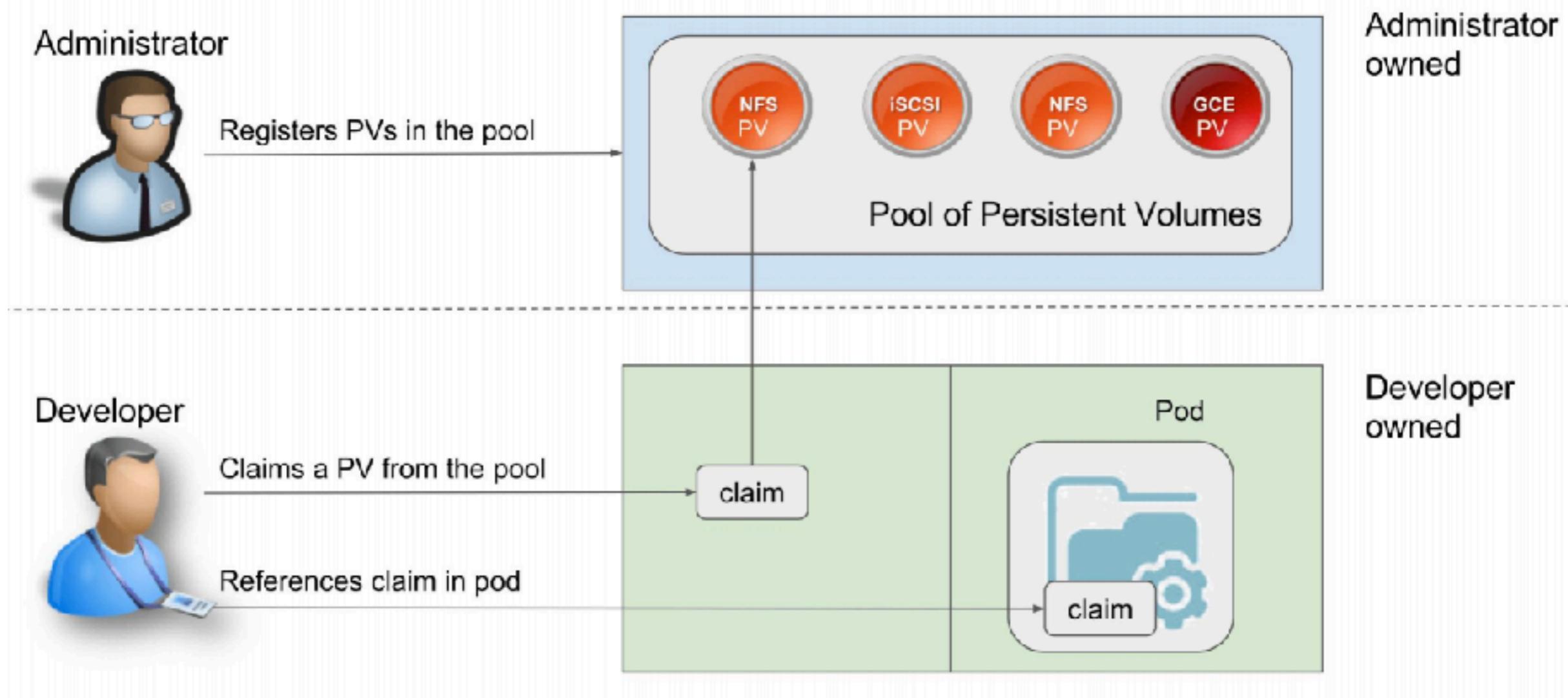
Provisioning

Static
Dynamic



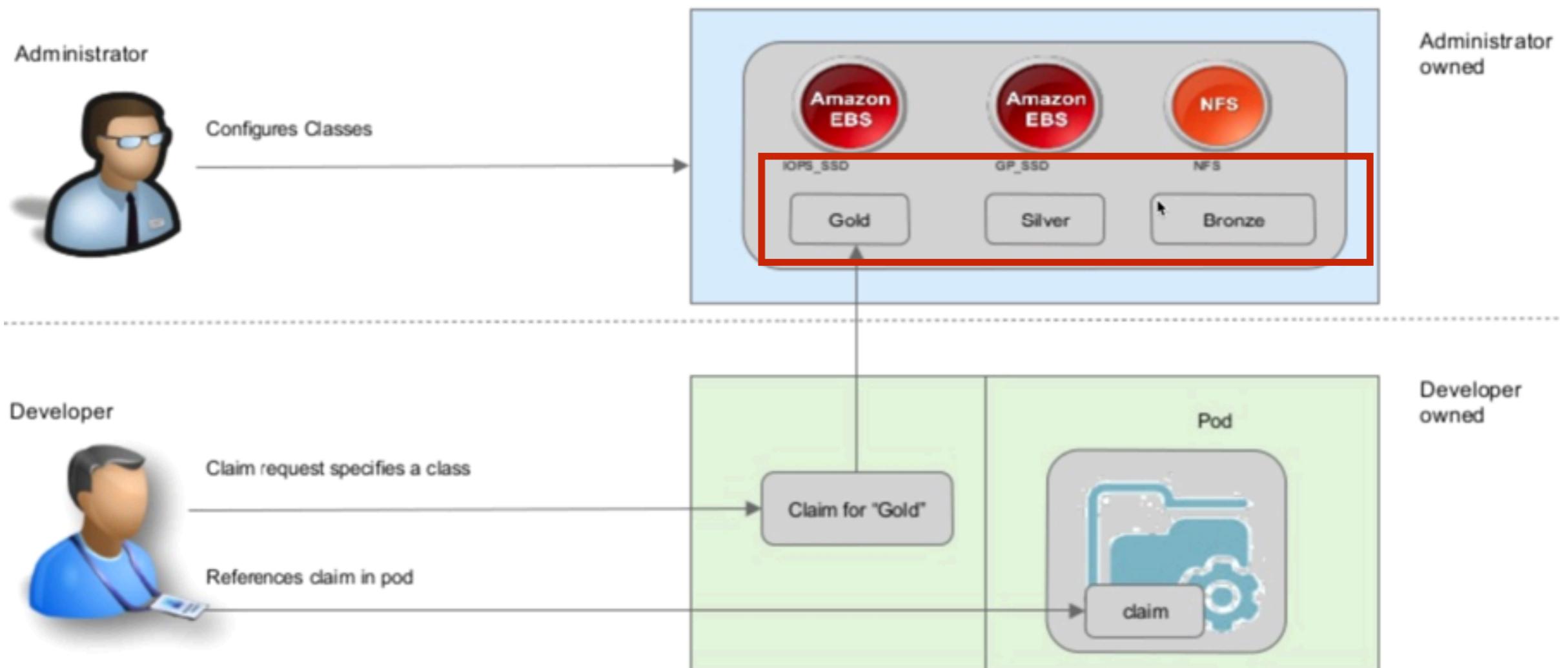
Static

Administrator create all PV
User need to know the detail of storage in each PV



Dynamic

Provisioning based on **StorageClass**
Create and configure by administrator



Using PV/PVC from Pods

```
kind: Pod
apiVersion: v1
metadata:
  name: mypod
spec:
  containers:
    - name: myfrontend
      image: dockerfile/nginx
      volumeMounts:
        - mountPath: "/var/www/html"
          name: mypd
  volumes:
    - name: mypd
      persistentVolumeClaim:
        claimName: myclaim
```



Workshop with Volume

File /working-with-volume/nfs

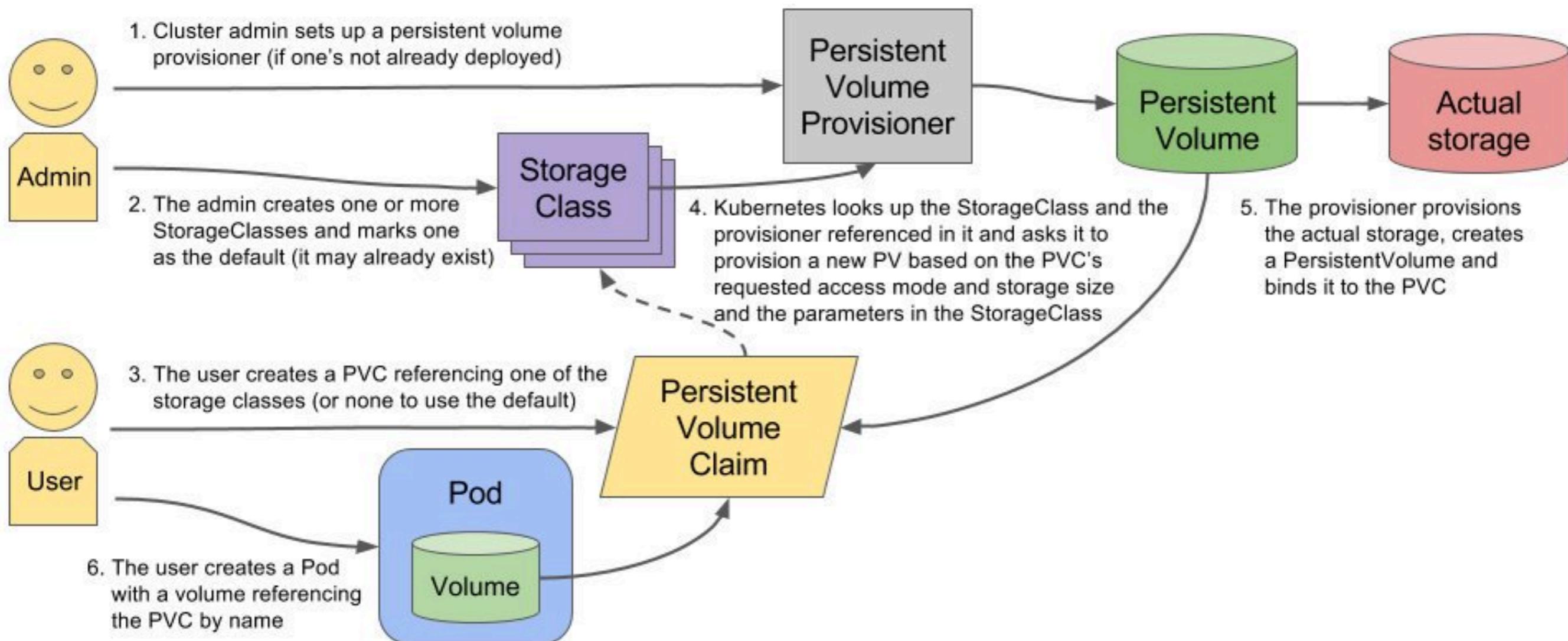


Step to working with PV/PVC

1. Create PV
2. Create PVC
3. Create Deployment
4. Testing



Step to working with PV/PVC



Setup storage engine

NFS (Network File System)
Cloud storage



Create PV and PVC

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: pvc-nfs
  labels:
    name: pvc-nfs
    environment: development
spec:
  accessModes:
    - ReadWriteMany
  storageClassName: ""
resources:
  requests:
    storage: 500Mi
selector:
  matchLabels:
    name: pv-nfs
    environment: development
```

```
apiVersion: v1
kind: PersistentVolume
metadata:
  name: pv-nfs
  labels:
    name: pv-nfs
    environment: development
spec:
  capacity:
    storage: 1Gi
  storageClassName: ""
  accessModes:
    - ReadWriteMany
  nfs:
    server: 10.148.0.2
    path: "/var/nfs/general"
```



Use PV with PVC from deployment

```
spec:  
  containers:  
    - name: nginx  
      image: nginx:1.8  
      ports:  
        - containerPort: 80  
      volumeMounts:  
        - name: try-nfs  
          mountPath: "/usr/share/nginx/html"  
  volumes:  
    - name: try-nfs  
      persistentVolumeClaim:  
        claimName: pvc-nfs
```

```
apiVersion: v1  
kind: PersistentVolumeClaim  
metadata:  
  name: pvc-nfs  
  labels:  
    name: pvc-nfs  
    environment: development  
spec:  
  accessModes:  
    - ReadWriteMany  
  storageClassName: ""  
  resources:  
    requests:  
      storage: 500Mi  
  selector:  
    matchLabels:  
      name: pv-nfs  
      environment: development
```



Dynamic provisioning with StorageClass



StatefulSet

<https://kubernetes.io/docs/concepts/workloads/controllers/statefulset/>



Kubernetes in practice

© 2017 - 2018 Siam Chamnankit Company Limited. All rights reserved.

StatefulSet

Bringing the concept of ReplicaSets to **stateful** Pods

Enable running Pods in **cluster** mode

Ideal for deploy **highly** available database workload



StatefulSet for application

Stable, unique network identifiers

Stable, persistent storage

Ordered, graceful deployment and scaling

Ordered, graceful deletion and termination



Key concepts

Depend on a **Headless service** for Pods

Each Pods get s DNS name accessible to other Pods

Leverage PV and PVC

Each Pods is suffix with a predictable
(mysql-01, mysql-02)



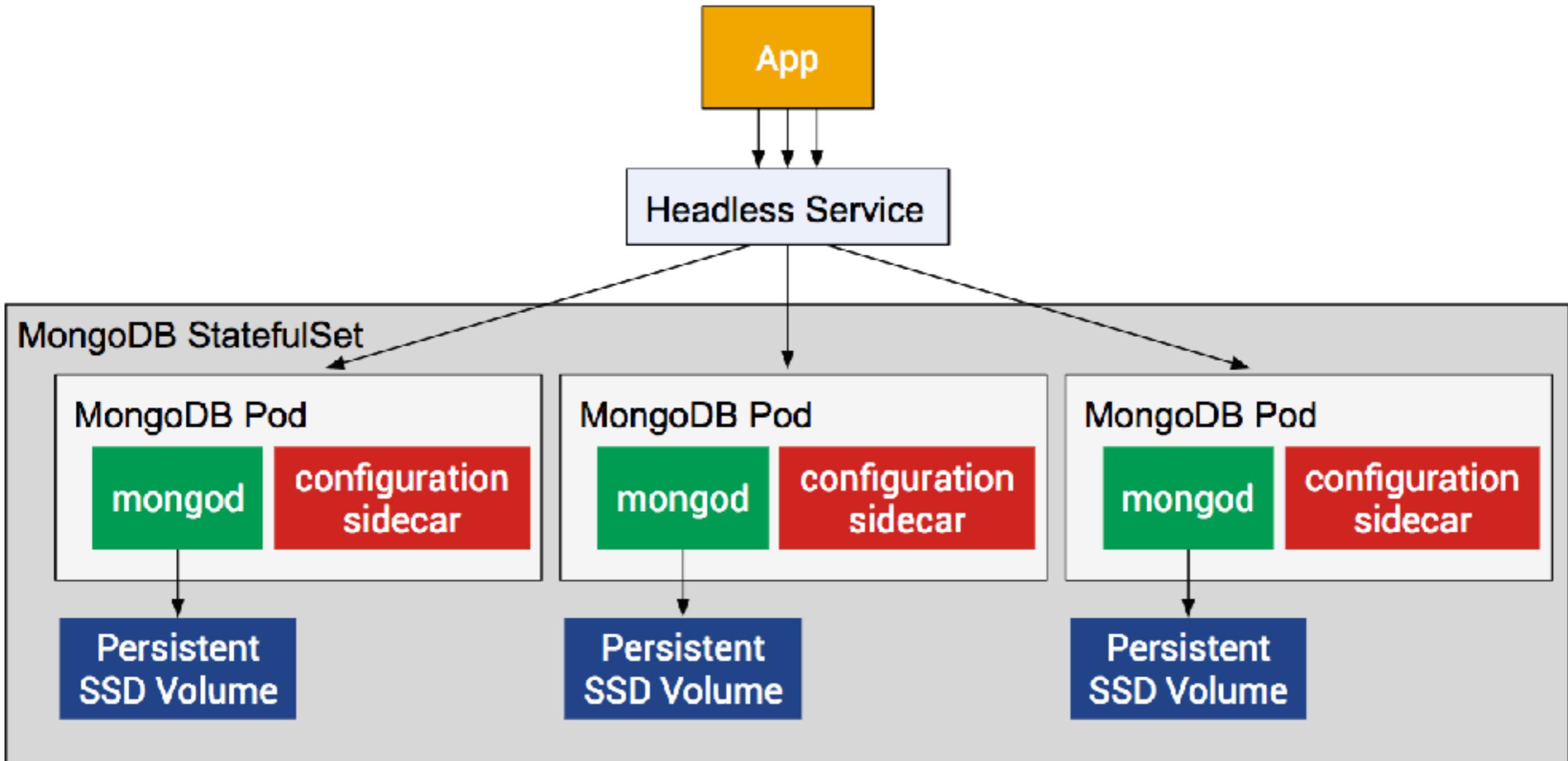
Key concepts

Pods are created sequentially

Pods are terminated in LiFo (Last in, First out)



StatefulSet



<https://kubernetes.io/blog/2017/01/running-mongodb-on-kubernetes-with-statefulsets/>



Key concepts

Pods are created sequentially

Pods are terminated in LiFo (Last in, First out)



Workshop with StatefulSet

File /working-with-stateful-set



Application Deployment Strategies



Strategies to deploy

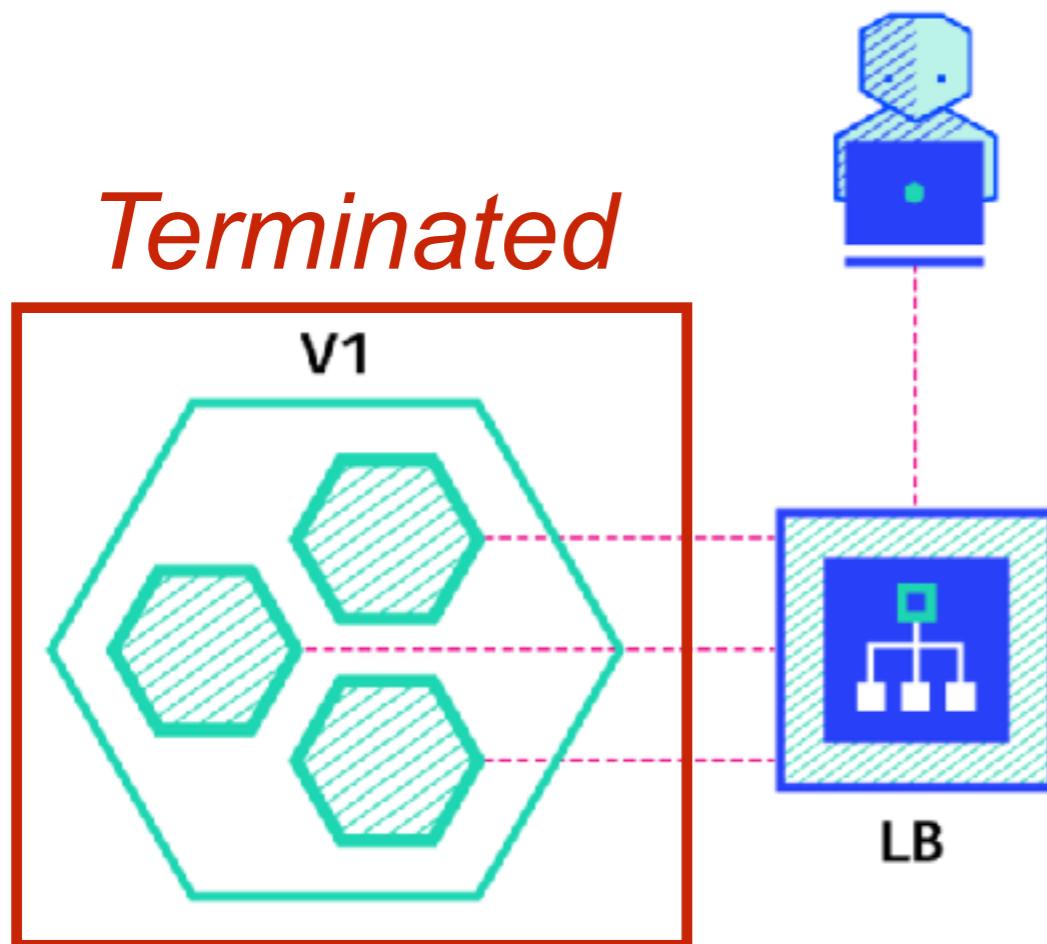
Recreate
Ramped
Blue/Green
Canary
A/B testing
Shadow

<https://thenewstack.io/deployment-strategies/>



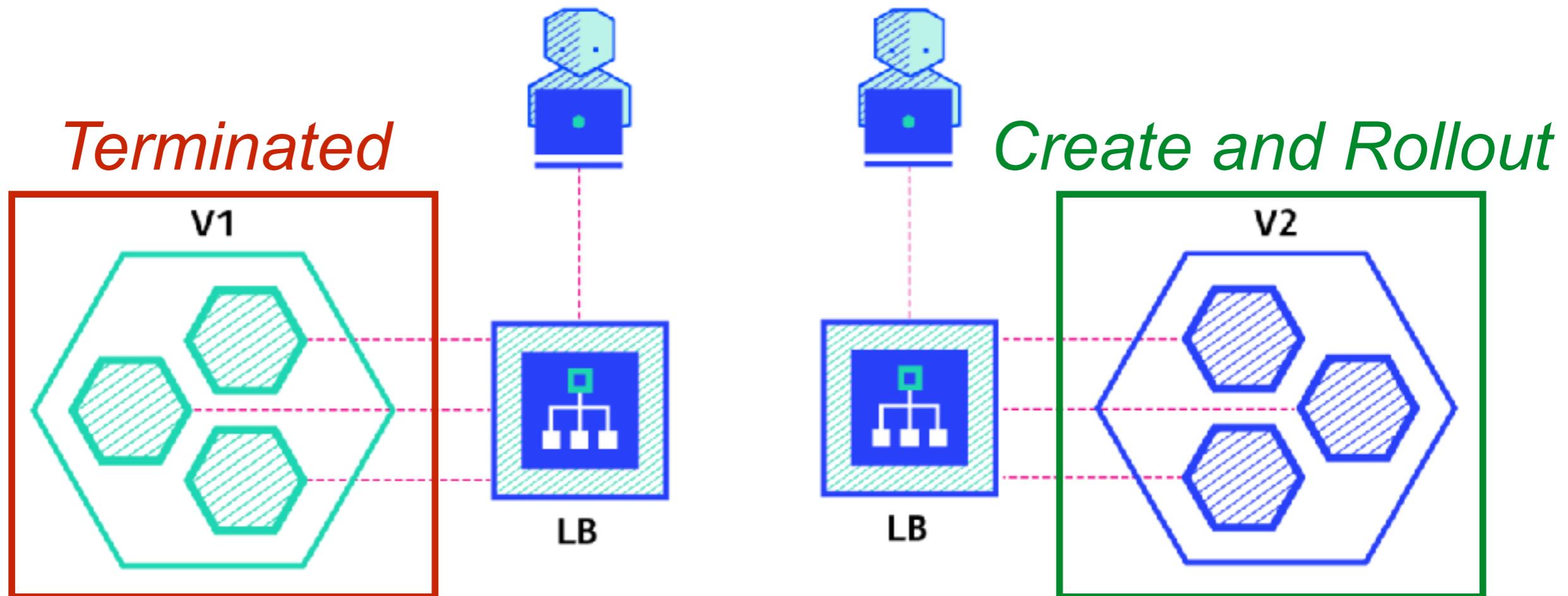
1. Recreate

Version A is terminated then version B is rollout



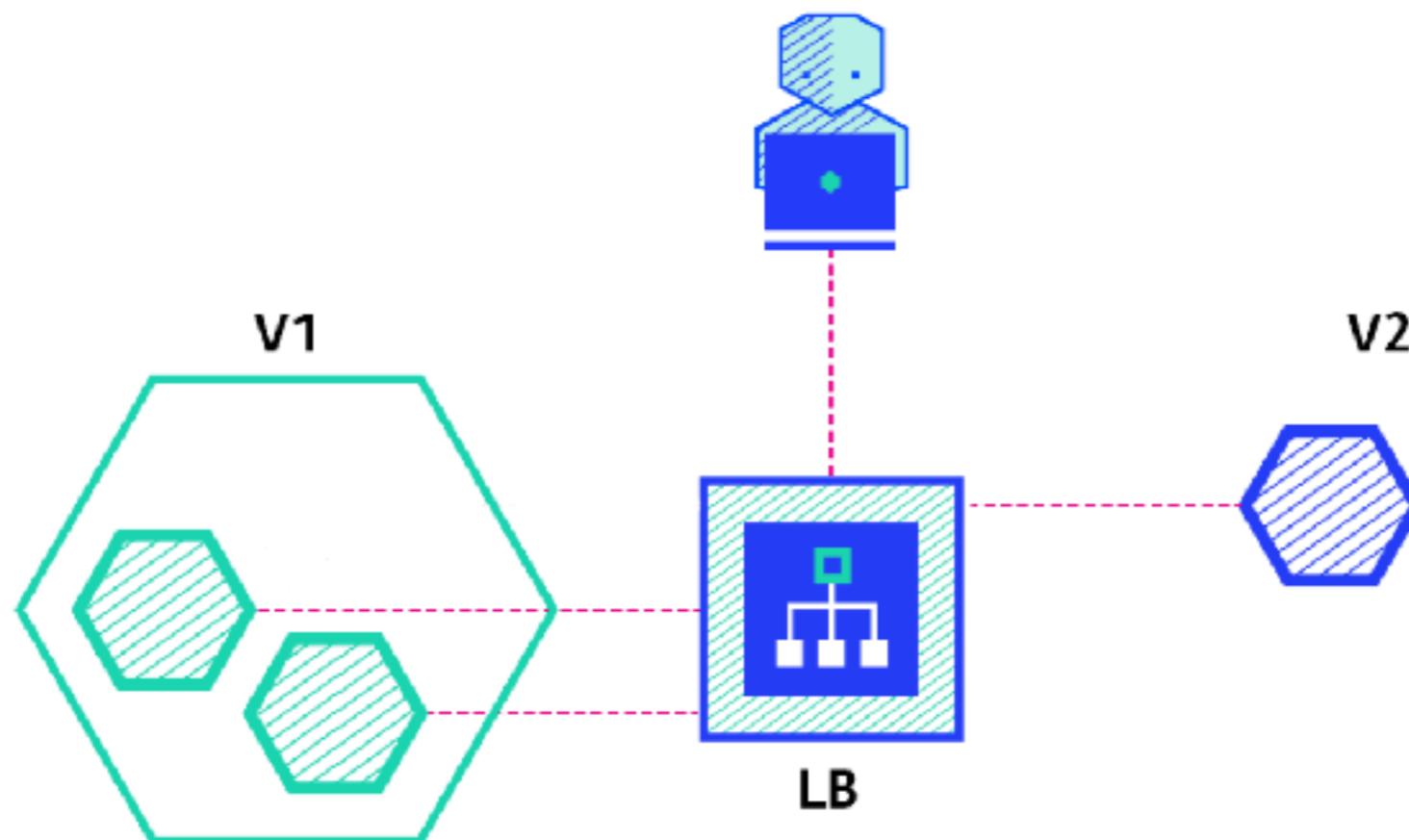
1. Recreate

Version A is terminated then version B is rollout



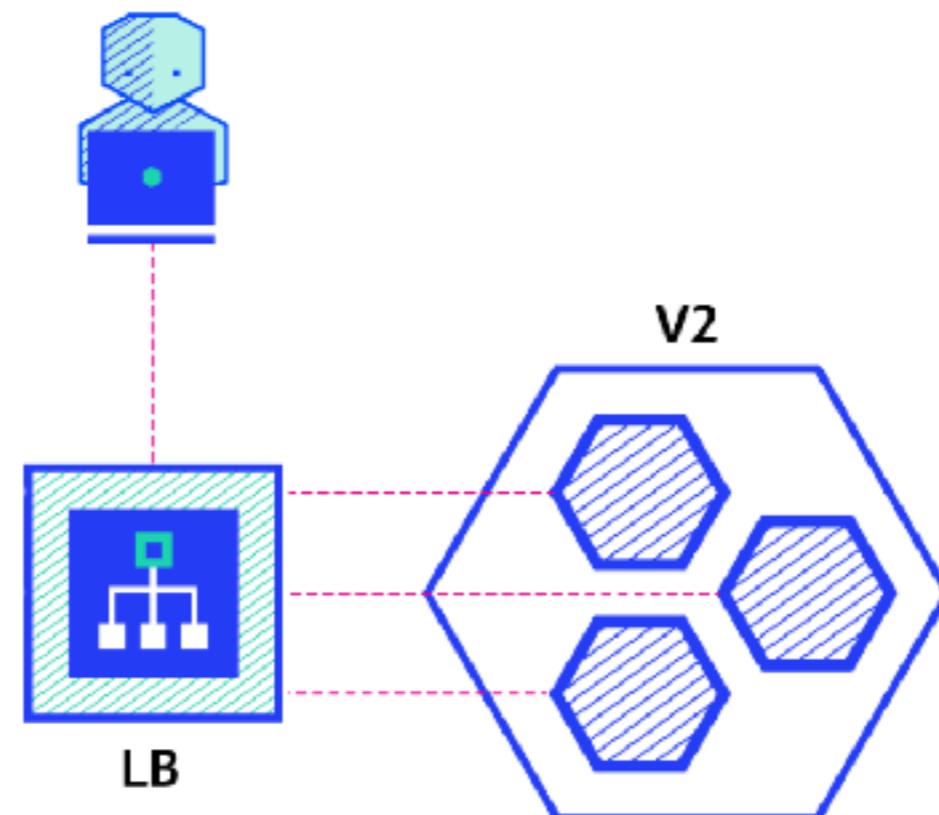
2. Ramped

Slow roll out by replace instance one-by-one



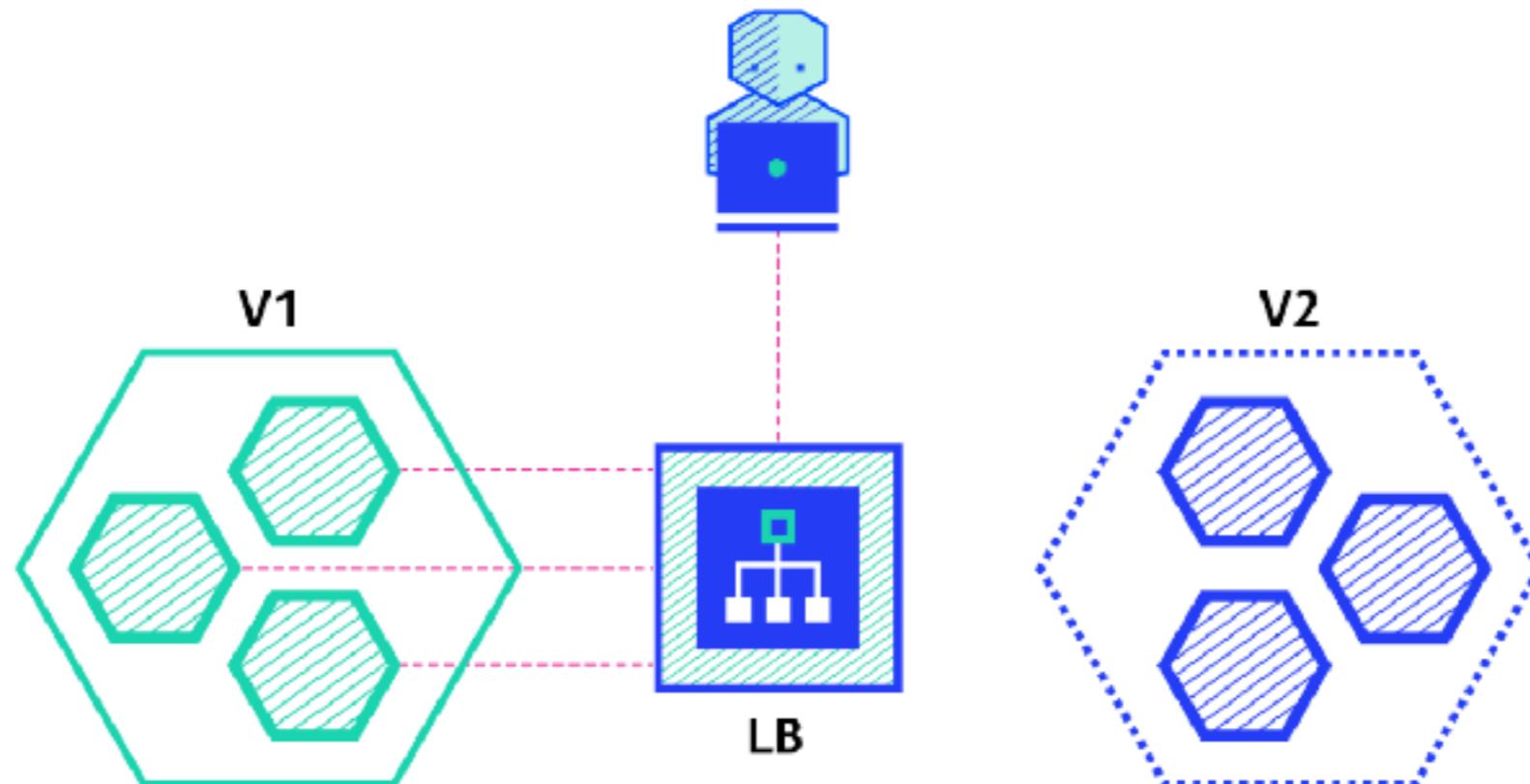
2. Ramped

Slow roll out by replace instance one-by-one



3. Blue/Green

Current version is called **Blue**
New version is called **Green**

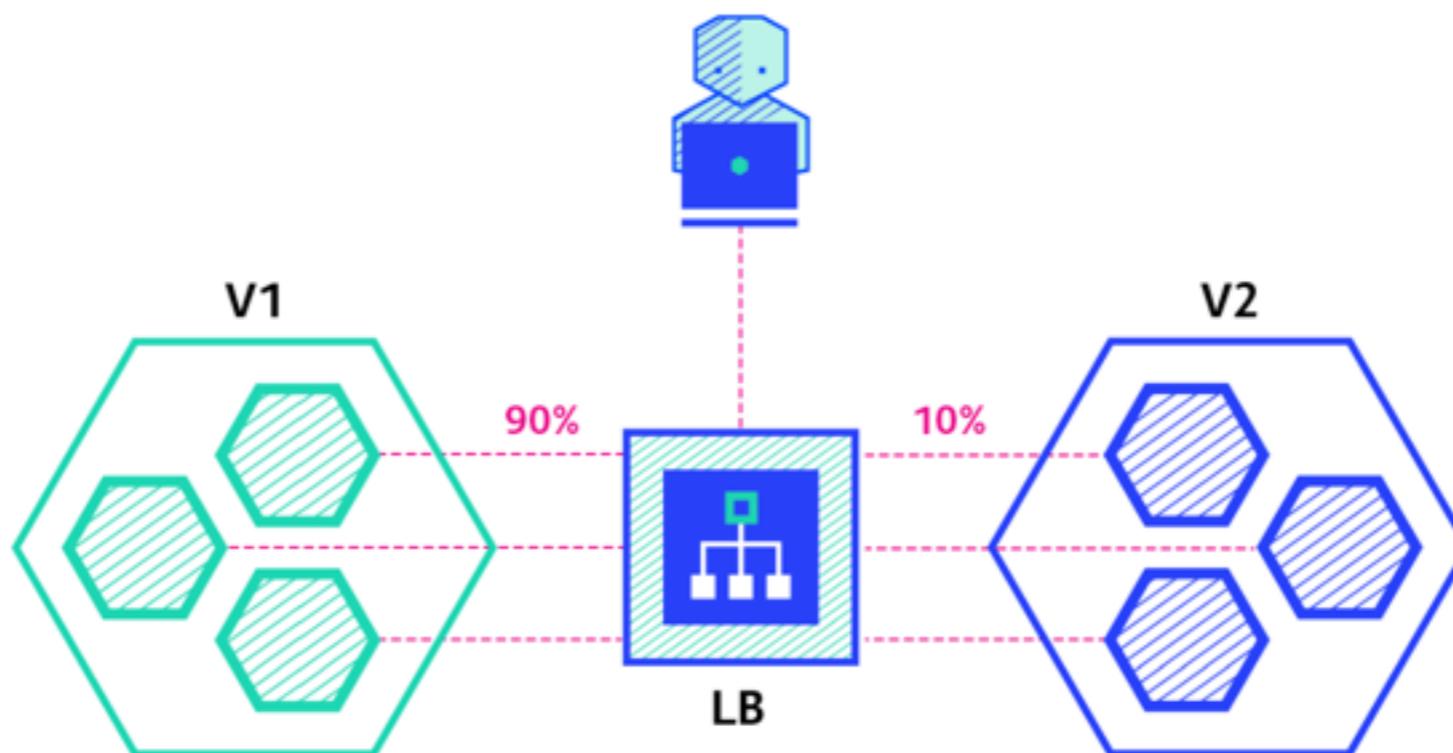


4. Canary

Shift production traffic from version A to B

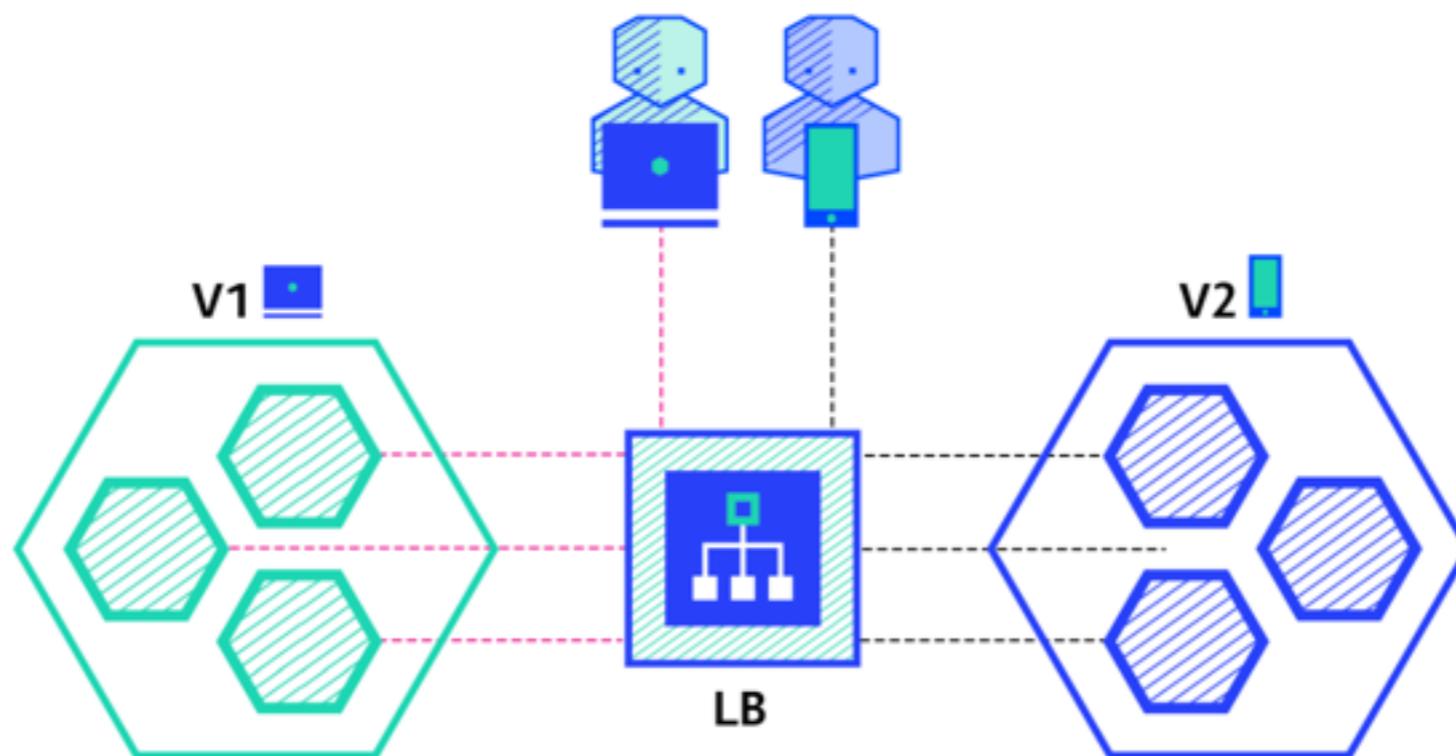
Traffic is split based-on weight

Use when tests are lacking/not reliable and less confident in system



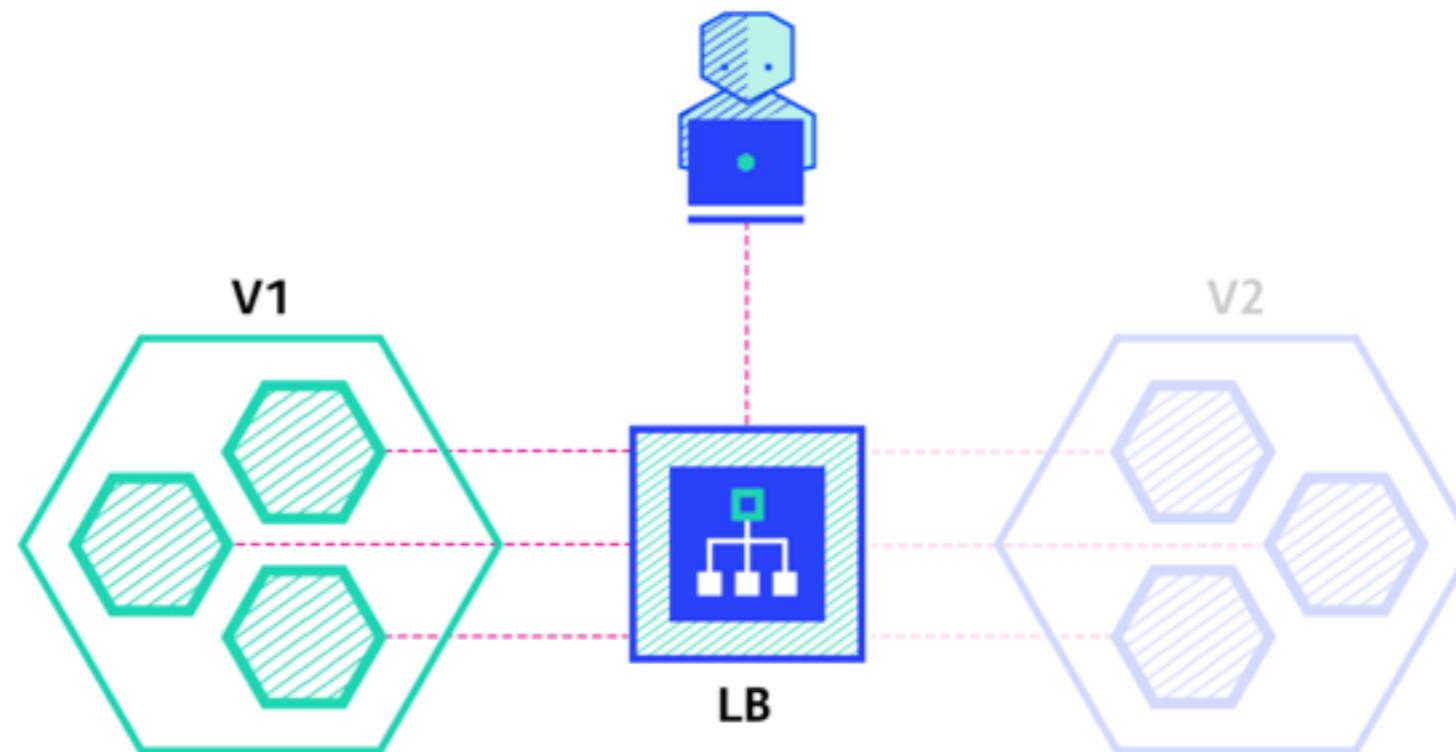
5. A/B testing

Routing the subset of users to new services under the specific condition



6. Shadow

Release version B alongside version A
Send request's A to B without production impact



DEPLOYMENT STRATEGIES

When it comes to production, a ramped or blue/green deployment is usually a good fit, but proper testing of the new platform is necessary.

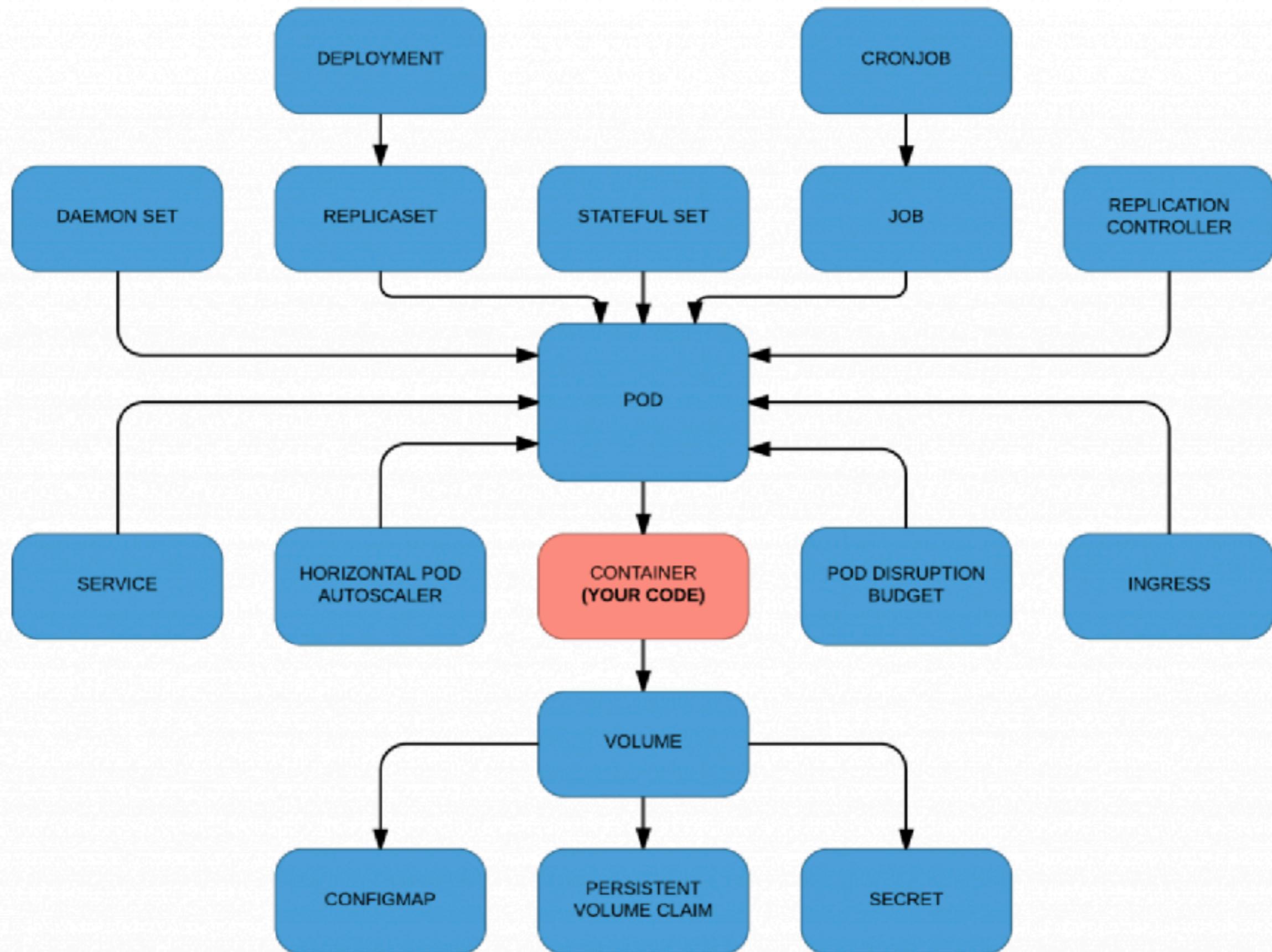
Blue/green and shadow strategies have more impact on the budget as it requires double resource capacity. If the application lacks in tests or if there is little confidence about the impact/stability of the software, then a canary, a/b testing or shadow release can be used.

If your business requires testing of a new feature amongst a specific pool of users that can be filtered depending on some parameters like geolocation, language, operating system or browser features, then you may want to use the a/b testing technique.



Strategy	ZERO DOWNTIME	REAL TRAFFIC TESTING	TARGETED USERS	CLOUD COST	ROLLBACK DURATION	NEGATIVE IMPACT ON USER	COMPLEXITY OF SETUP
RECREATE version A is terminated then version B is rolled out	✗	✗	✗	■ ■ ■	■ ■ ■	■ ■ ■	□ □ □
RAMPED version B is slowly rolled out and replacing version A	✓	✗	✗	■ ■ ■	■ ■ ■	■ □ □	■ □ □
BLUE/GREEN version B is released alongside version A, then the traffic is switched to version B	✓	✗	✗	■ ■ ■	□ □ □	■ ■ □	■ ■ □
CANARY version B is released to a subset of users, then proceed to a full rollout	✓	✓	✗	■ ■ ■	□ □ □	■ □ □	■ ■ □
A/B TESTING version B is released to a subset of users under specific condition	✓	✓	✓	■ ■ ■	□ □ □	■ □ □	■ ■ ■
SHADOW version B receives real world traffic alongside version A and doesn't impact the response	✓	✓	✗	■ ■ ■	□ □ □	□ □ □	■ ■ ■



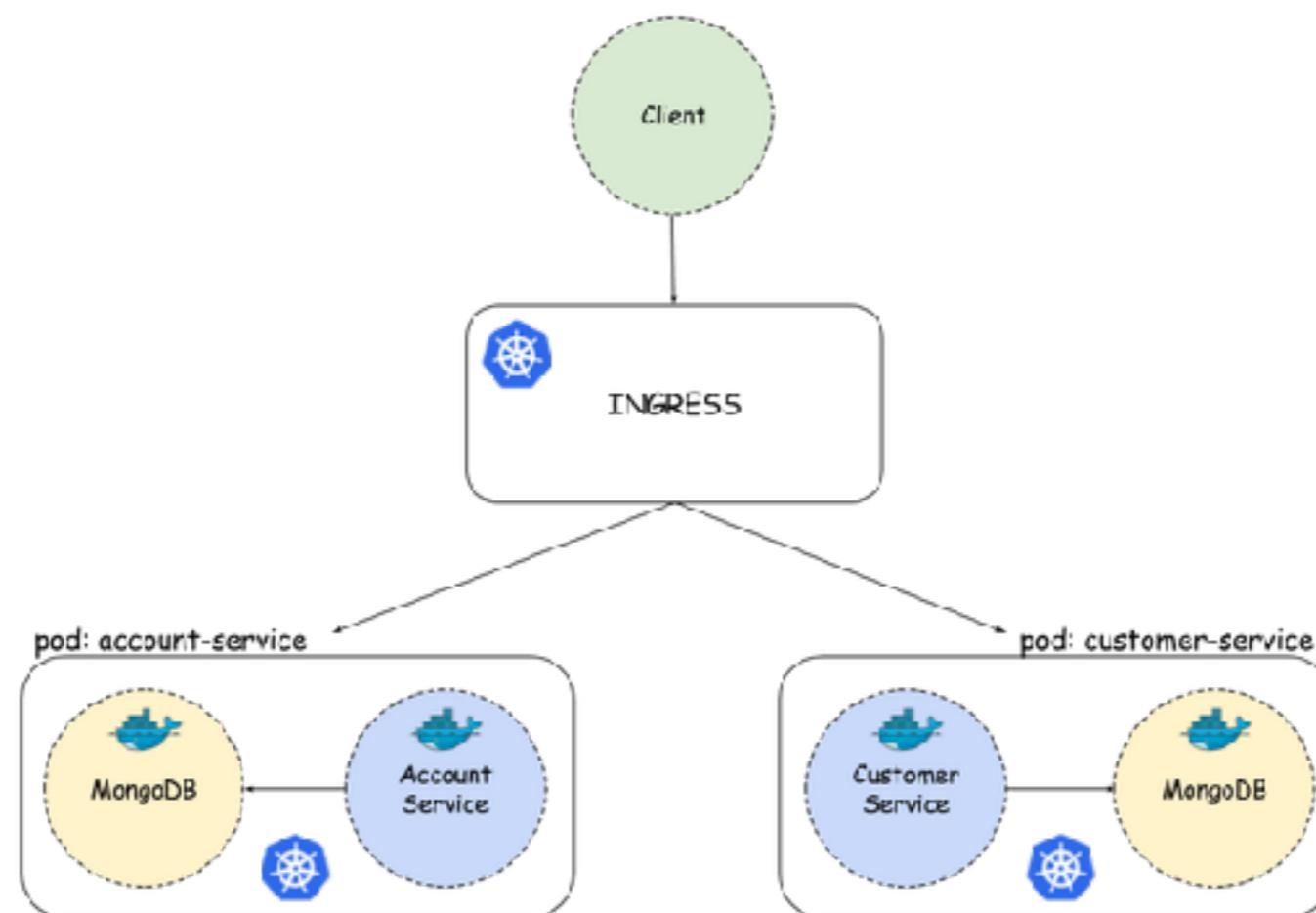


Ingress Network



Ingress Network

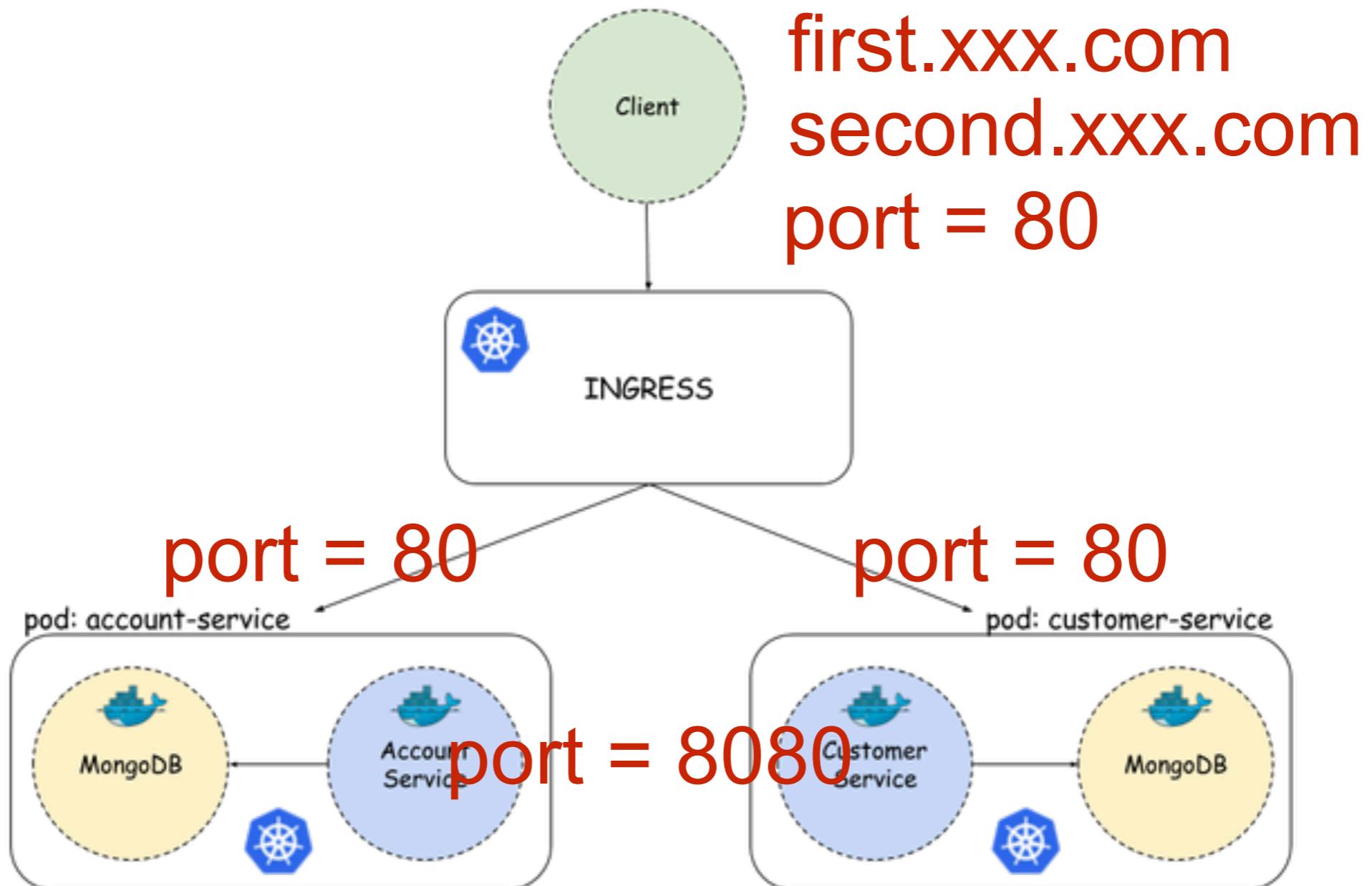
How to handle multiple services in same port ?
How to limit protocol to access ?



<https://kubernetes.io/docs/concepts/services-networking/ingress/>



Ingress Network



Create ingress

```
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: ingresswebtest
spec:
  rules:
    - host: first.xxx.com
      http:
        paths:
          - backend:
              serviceName: spring-boot-service
              servicePort: 80
    - host: second.xxx.com
      http:
        paths:
          - backend:
              serviceName: spring-boot-service
              servicePort: 80
```



Service

```
apiVersion: v1
kind: Service
metadata:
  name: spring-boot-service
spec:
  selector:
    app: spring-boot-service
  type: NodePort
  ports:
    - port: 80
      name: http
      targetPort: 8080
      protocol: TCP
```



Workshop

Ingress Network

File /working-with-java/05-ingress



Liveness and Readiness probe

<https://kubernetes.io/docs/tasks/configure-pod-container/configure-liveness-readiness-probes/>



Type of health checks

Readiness
Liveness



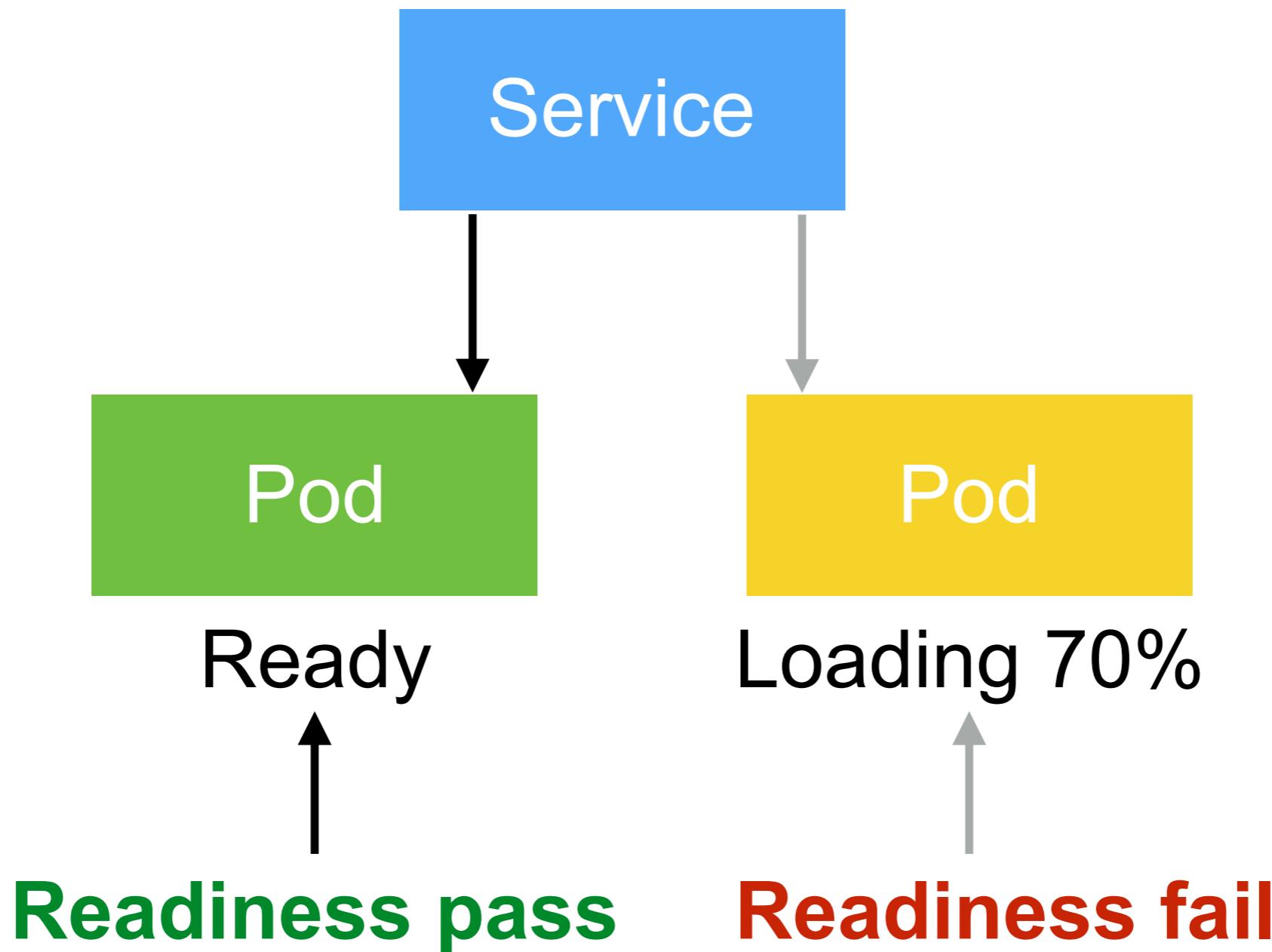
Readiness

Readiness probes are designed to let Kubernetes know when your app is ready to serve traffic.

If a readiness probe starts to **fail**, Kubernetes stops sending traffic to the pod until it passes.



Readiness



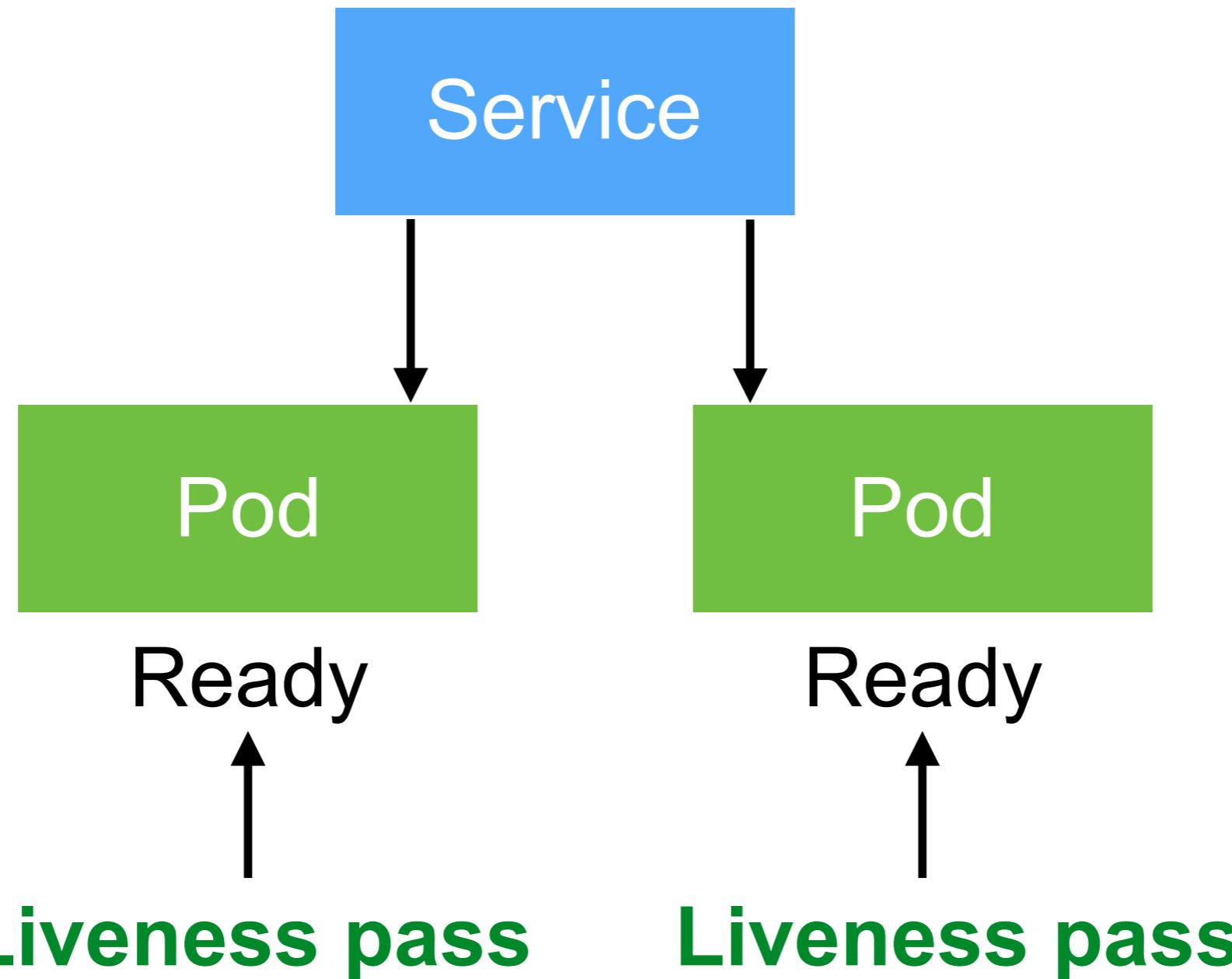
Liveness

Liveness probes let Kubernetes know if your app is alive or dead. If your app is **alive**, then Kubernetes leaves it alone

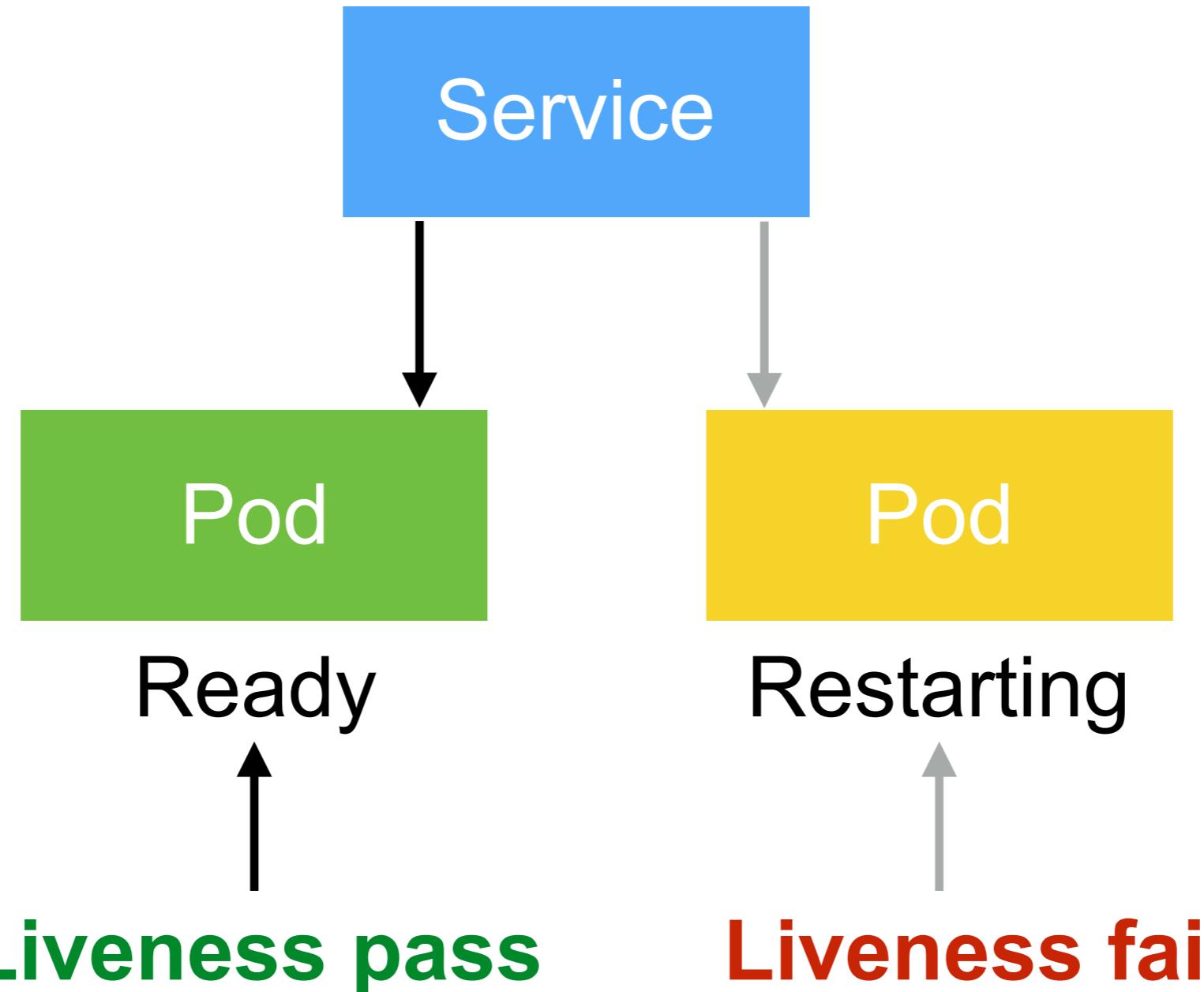
If your app is **dead**, Kubernetes removes the Pod and starts a new one to replace it.



Liveness (Pass)



Liveness (Fail)



Type of probes

HTTP
Command
TCP



HTTP probe

```
spec:  
  containers:  
    - name: liveness  
      image: k8s.gcr.io/liveness  
      args:  
        - /server  
      livenessProbe:  
        httpGet:  
          path: /healthz  
          port: 8080  
        httpHeaders:  
          - name: X-Custom-Header  
            value: Awesome
```



Command probe

```
spec:  
  containers:  
    - name: liveness  
      image: k8s.gcr.io/busybox  
      livenessProbe:  
        exec:  
          command:  
            - cat  
            - /tmp/healthy
```



TCP probe

```
spec:  
  containers:  
    - name: goproxy  
      image: k8s.gcr.io/goproxy:0.1  
      ports:  
        - containerPort: 8080  
      readinessProbe:  
        tcpSocket:  
          port: 8080  
      initialDelaySeconds: 5  
      periodSeconds: 10  
    livenessProbe:  
      tcpSocket:  
        port: 8080  
      initialDelaySeconds: 15  
      periodSeconds: 20
```



Configuring probes

initialDelaySeconds
periodSeconds
timeoutSeconds
successThreshold
failureThreshold



Configuring probes

initialDelaySeconds

Number of seconds after the container has started before liveness or readiness probes are initiated.

periodSeconds

How often (in seconds) to perform the probe.
Default to 10 seconds. Minimum value is 1.

timeoutSeconds

Number of seconds after which the probe times out.
Defaults to 1 second. Minimum value is 1.



Configuring probes

successThreshold

Minimum consecutive successes for the probe to be considered successful after having failed. **Defaults to 1.** Must be 1 for liveness. Minimum value is 1.

failureThreshold

When a Pod starts and the probe fails, Kubernetes will try failureThreshold times before giving up. Giving up in case of liveness probe means restarting the Pod. In case of readiness probe the Pod will be marked Unready. **Defaults to 3.** Minimum value is 1.



Workshop Ingress Network

File /workshop/readiness-and-liveness



Wordpress and MySQL

File /workshop-wordpress

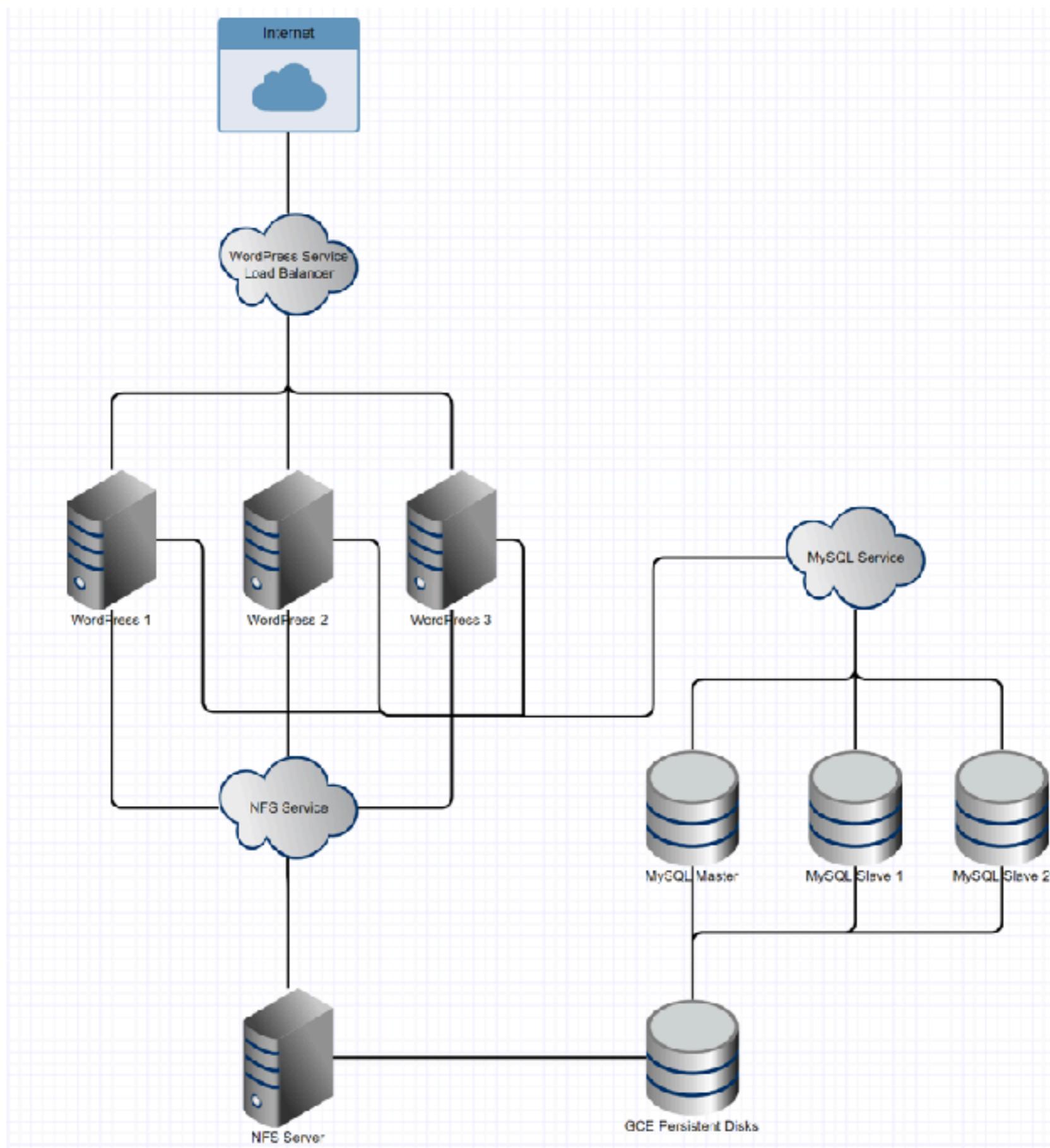


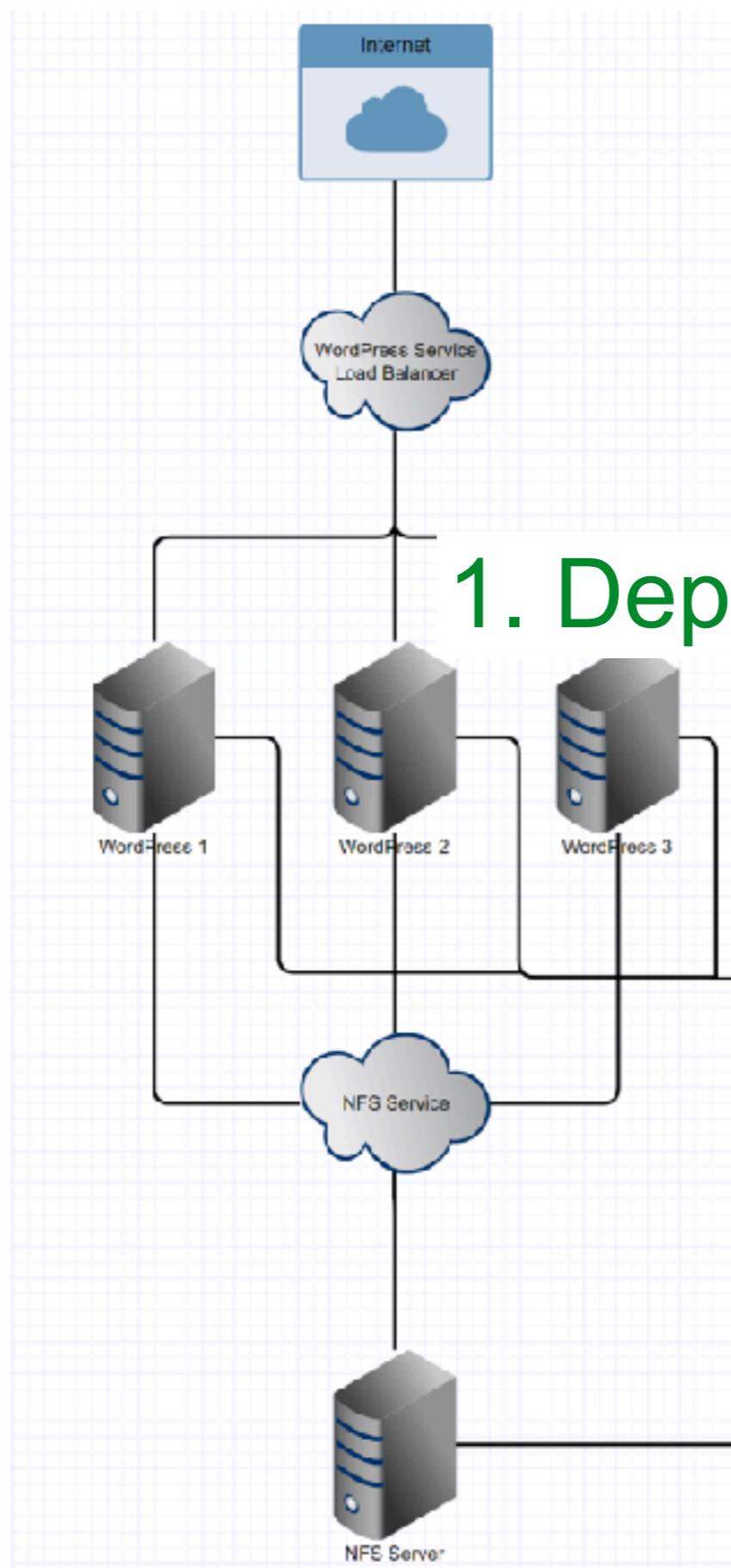
Architecture

Storage for Wordpress application file with **NFS**
Database cluster with **MySQL**

Use Kubernetes load balance and **service** networking

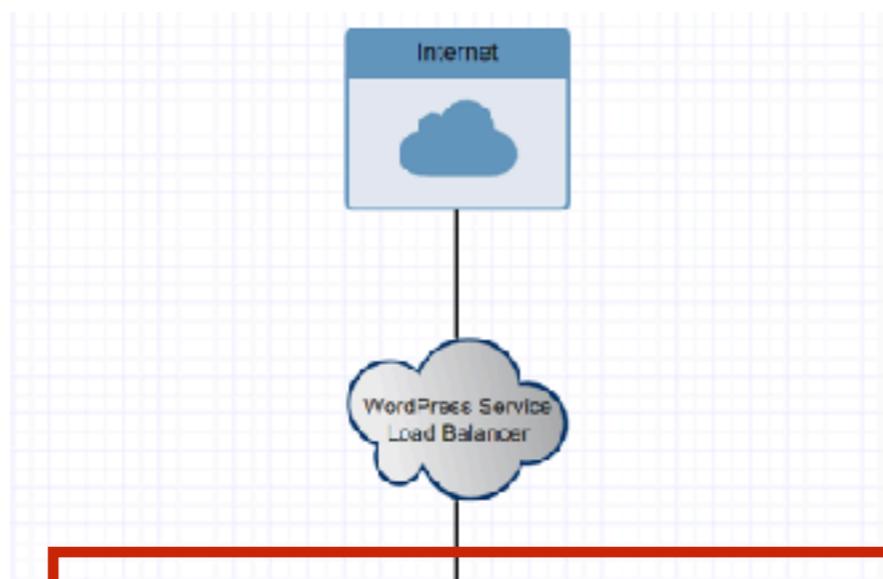




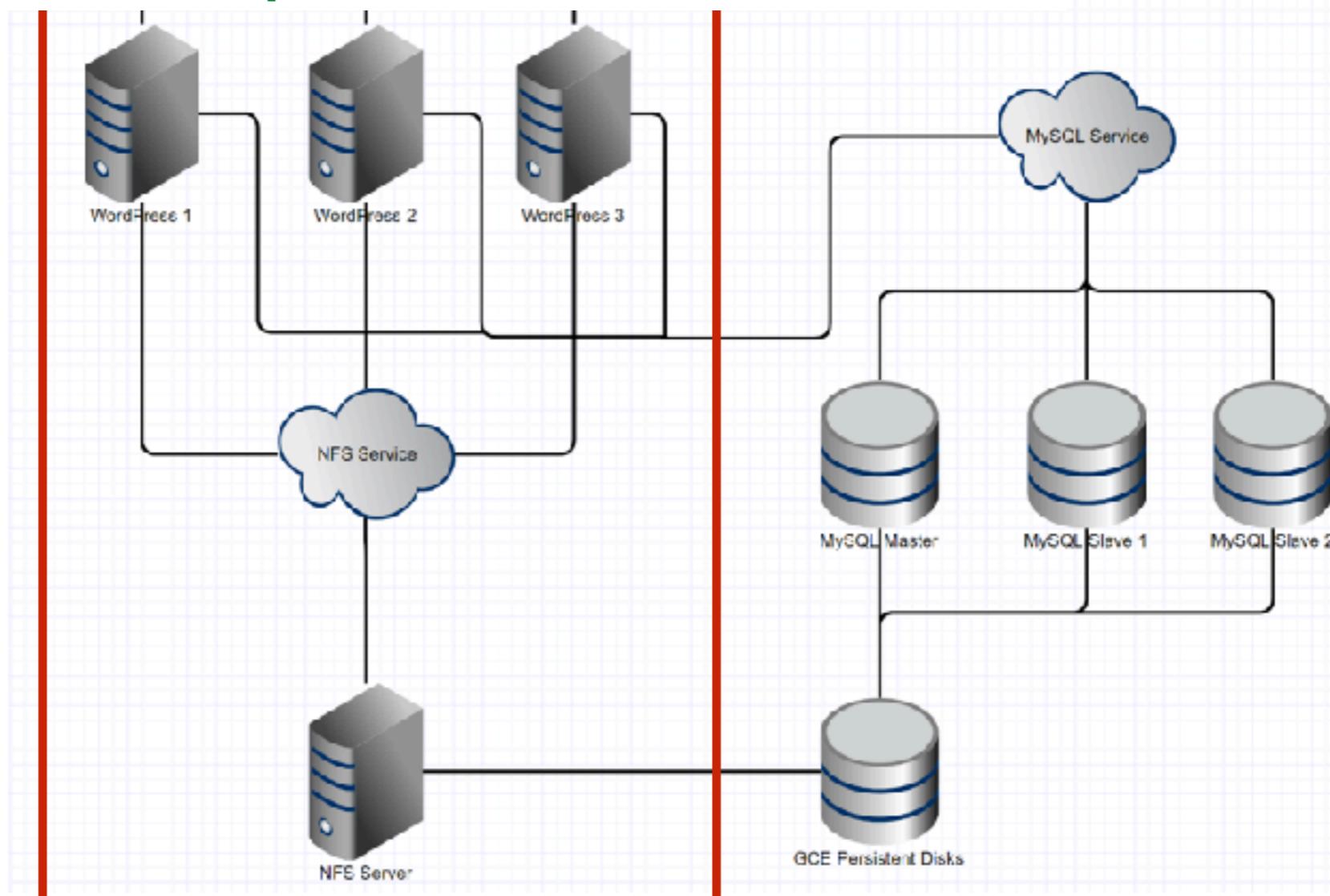


1. Deploy MySQL with StatefulSet

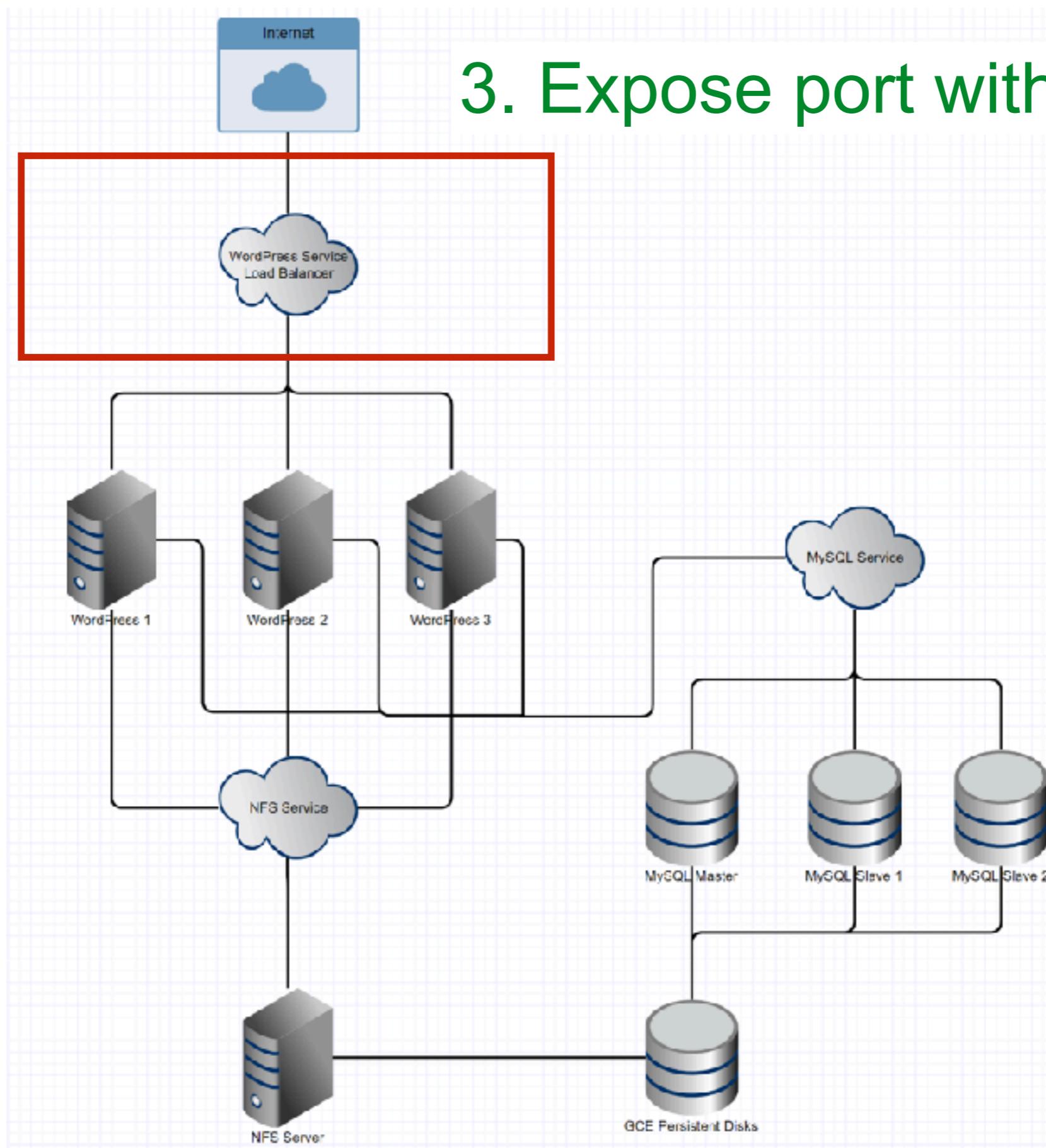




2. Share wordpress files with NFS



3. Expose port with service



Logging

<https://kubernetes.io/docs/concepts/cluster-administration/logging/>



Logging Levels

Pods
Node
Cluster



Demo Logging with Papertrail

File /workshop/logging



Job and Cronjob



Thank you

