

Week 11 : SOFTWARE DEVELOPMENT TOOLS AND ENVIRONMENTS

# Dockerfile

- Dockerfile is instructions to build Docker Image
  - How to run commands
  - Add files or directories
  - Create environment variables
  - What process to run when launching container
- Result from building Dockerfile is Docker Image

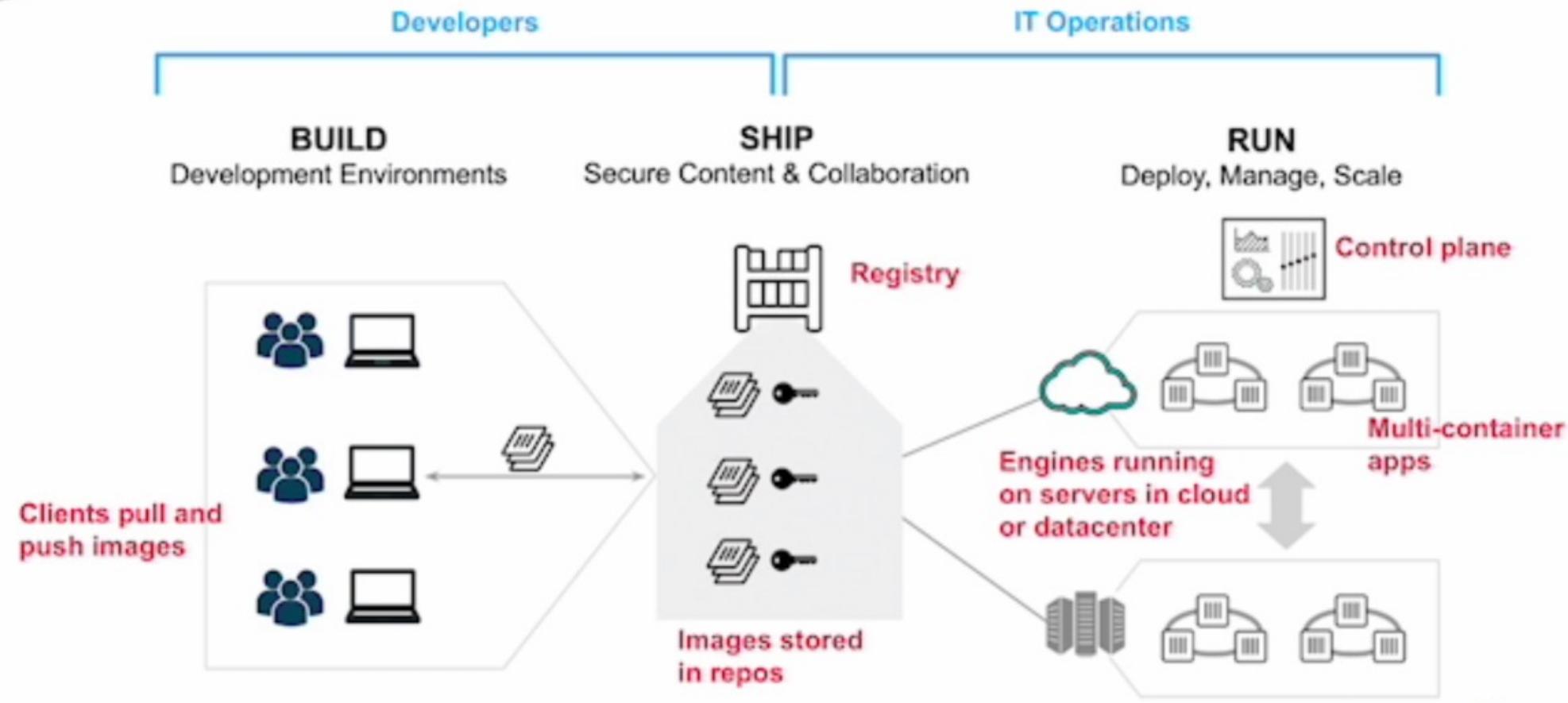


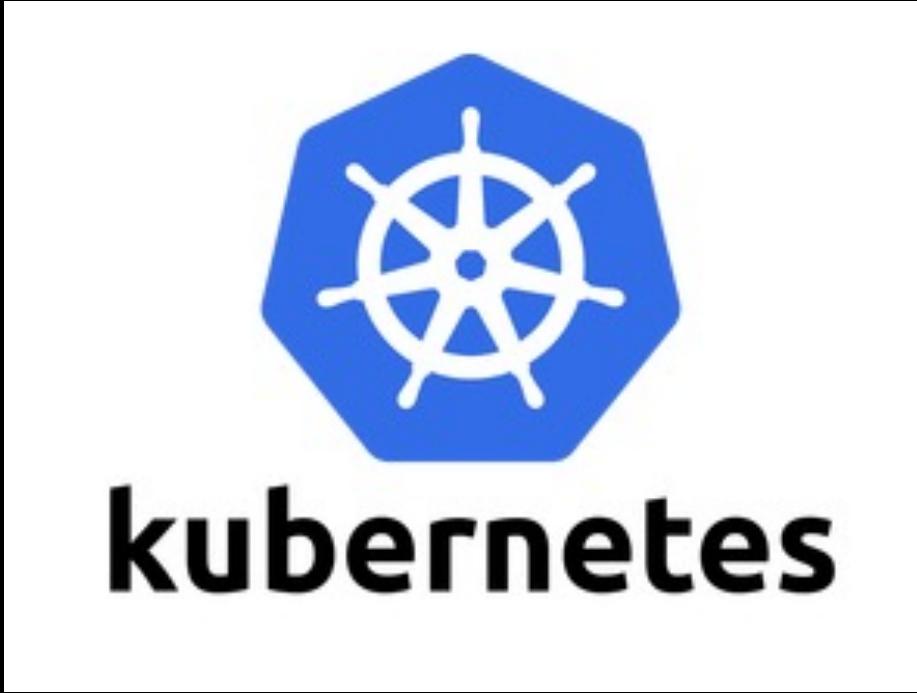
Dockerfile

# Sample Dockerfile

```
FROM node:14.15.0-alpine3.12 ← OS + System Packages
COPY . /nodejs/.           ← Source Code
WORKDIR /nodejs
RUN npm install             ← Library Dependencies
ENV VERSION 1.0            ← Configuration
EXPOSE 8081
CMD ["node", "/nodejs/main.js"]
```

# Docker and DevOps





# Introduction to Kubernetes

# What is Kubernetes?

- **Kubernetes**, in Greek, means the Helmsman, or pilot of the ship, pilot of a ship of containers
- Kubernetes is a software written in **Go** for **automating deployment, scaling, and management** of containerized applications
- Focus on manage **applications**, not machines
- Open source, open API container **orchestrator**
- Supports **multiple cloud** and **bare-metal** environments
- Inspired and informed by 15 years of Google's experiences and internal systems

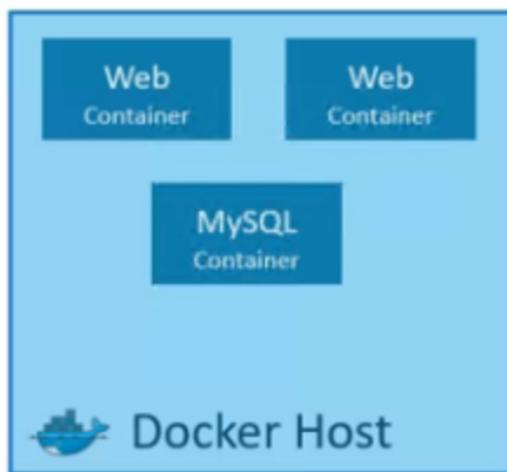


# The Why's and What's of Kubernetes

---

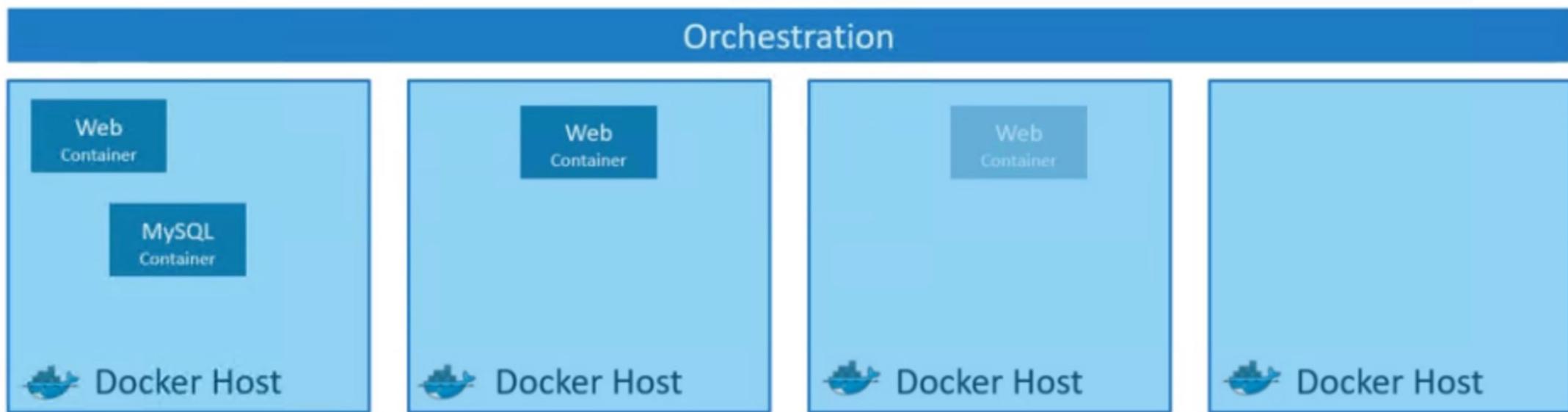
# Container orchestration

---



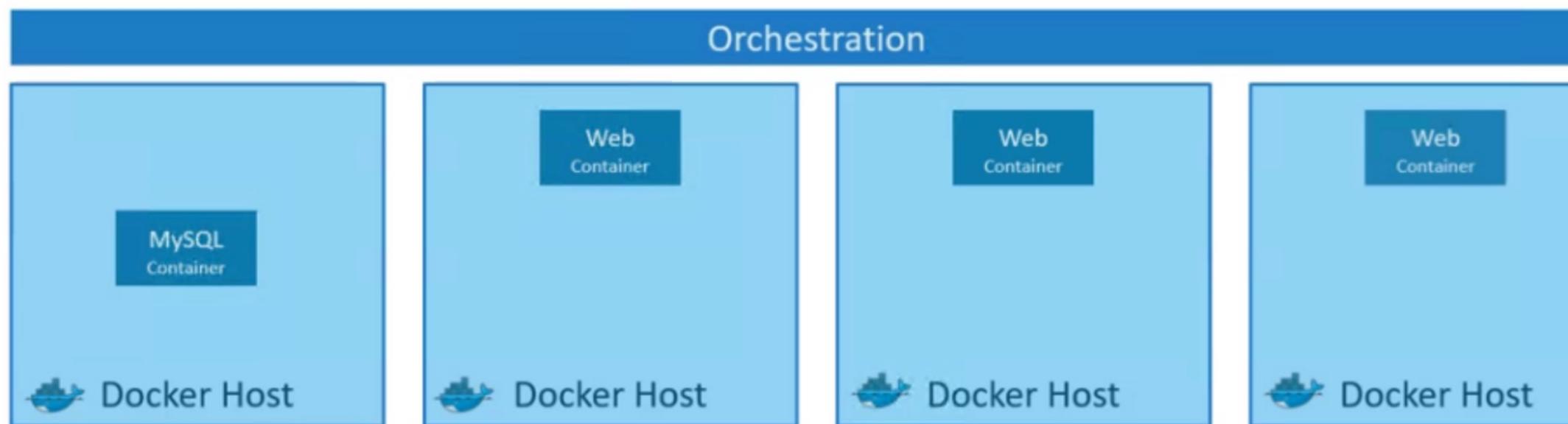
# Container orchestration

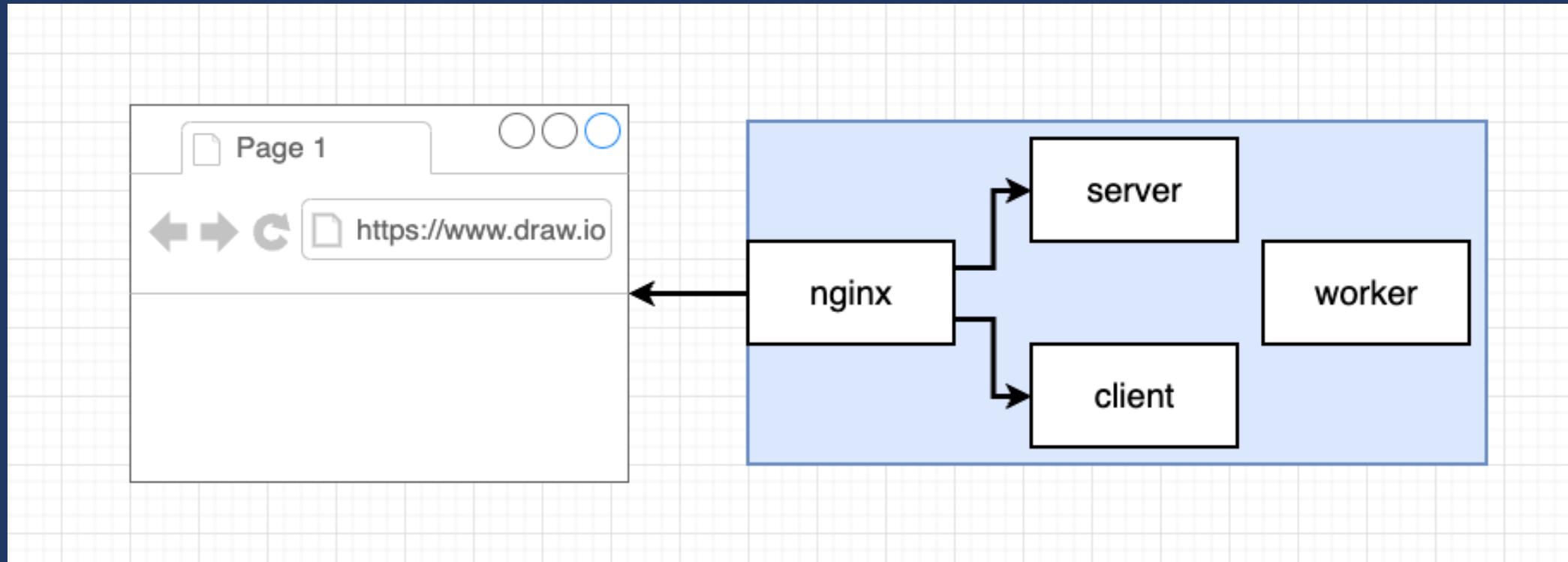
---

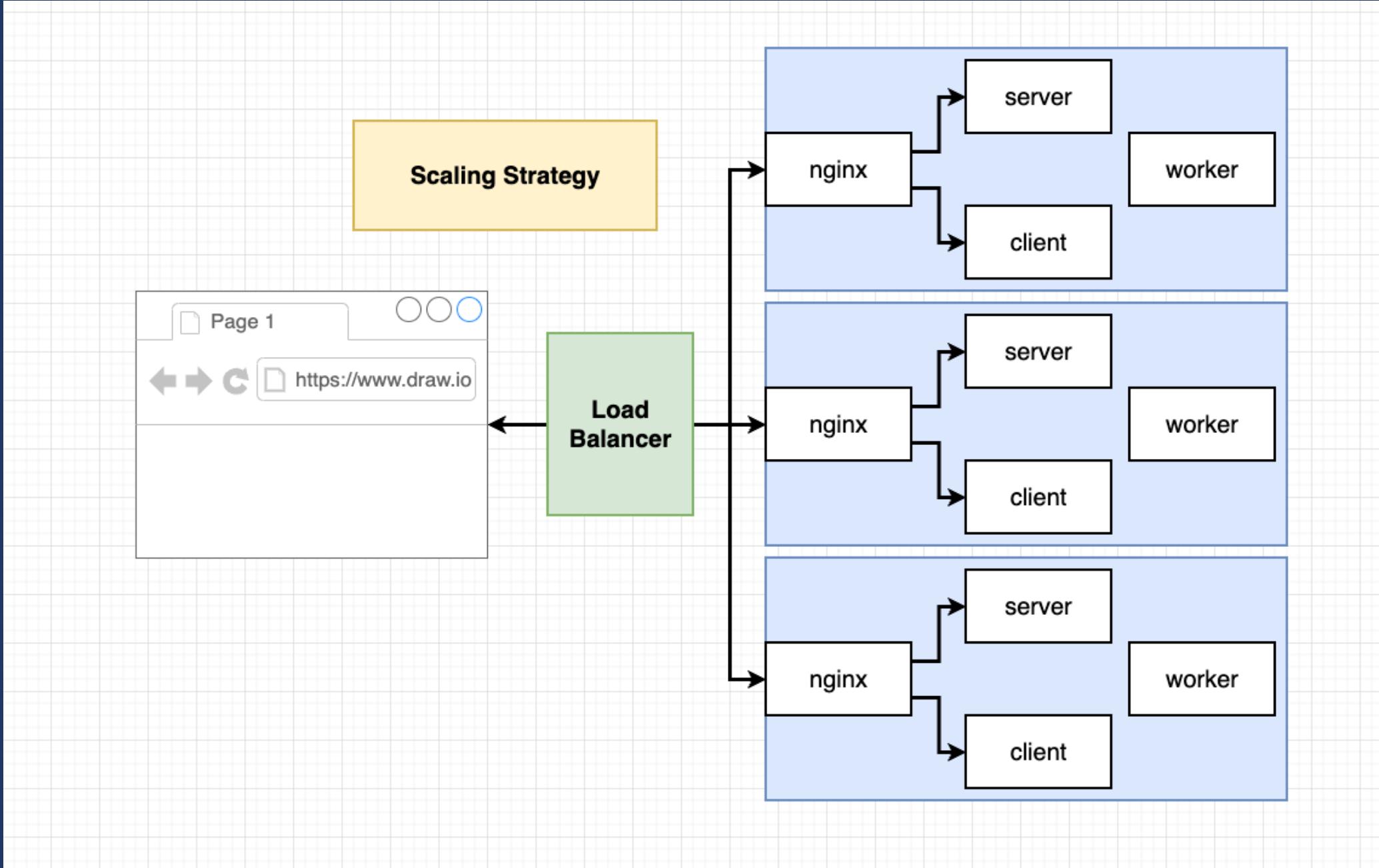


# Container orchestration

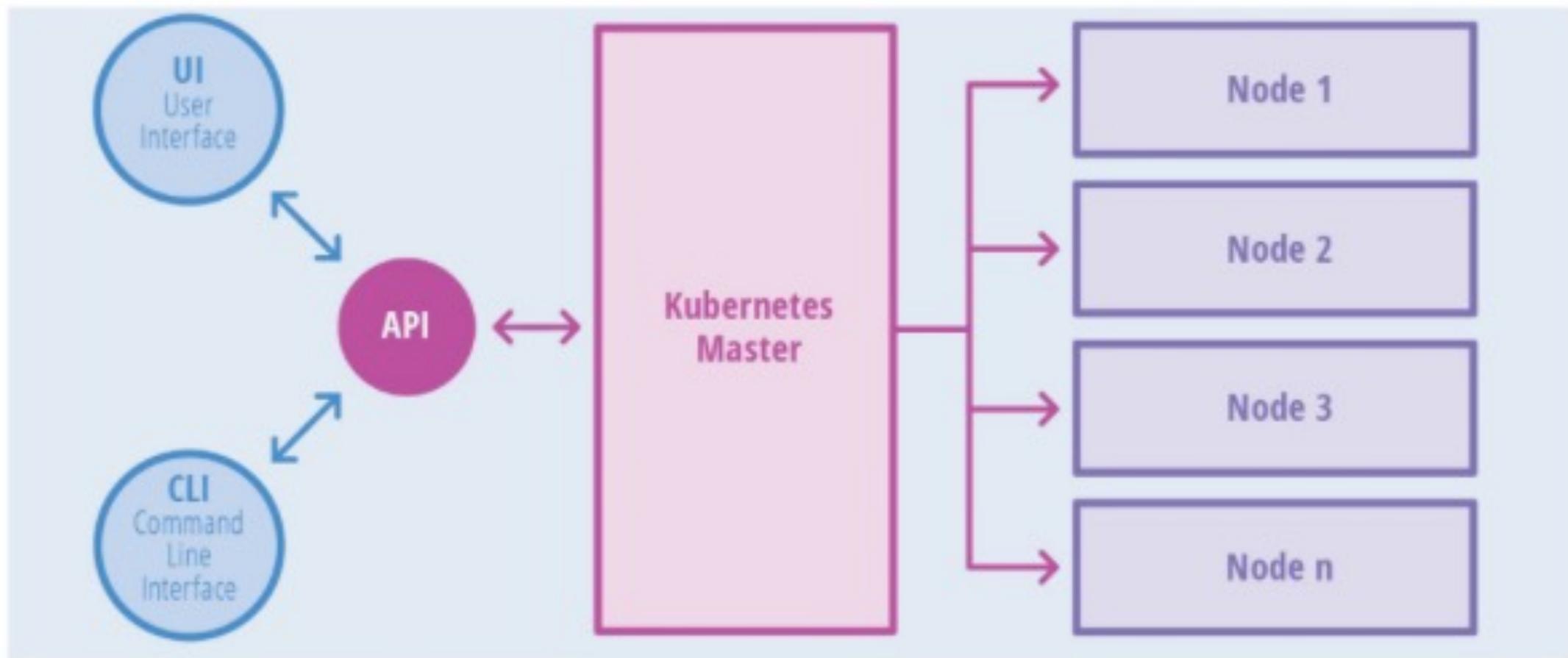
---

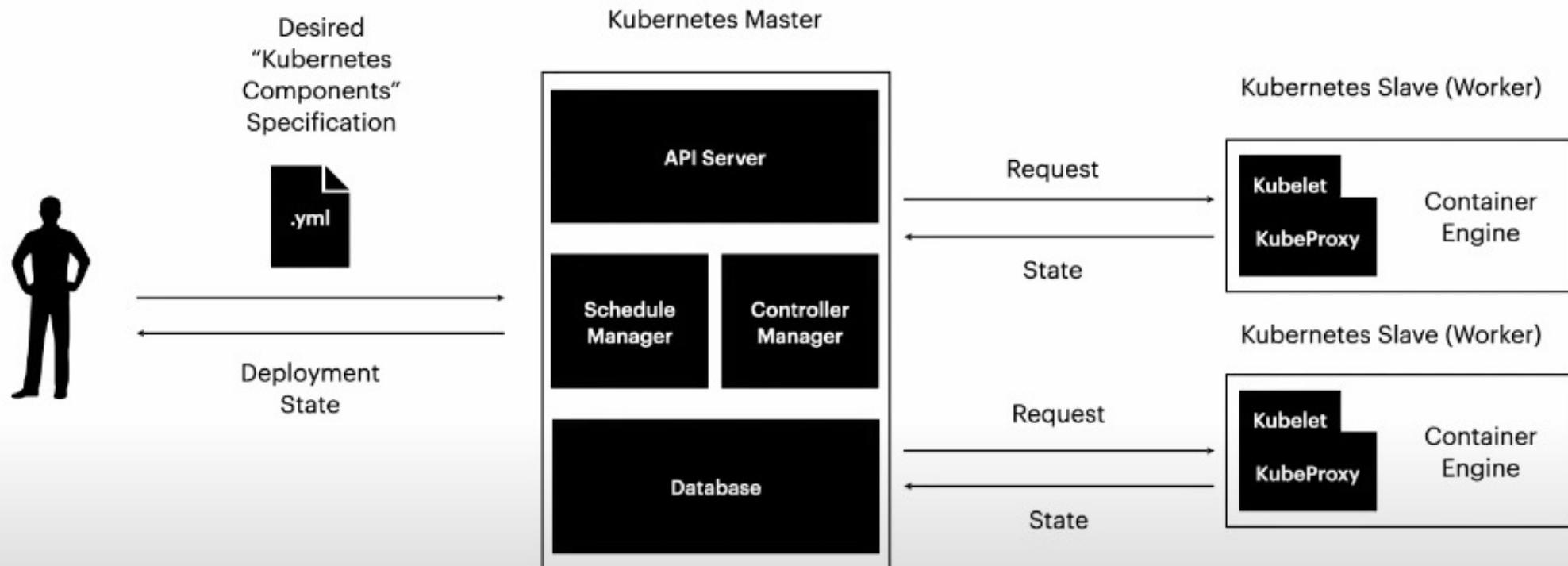


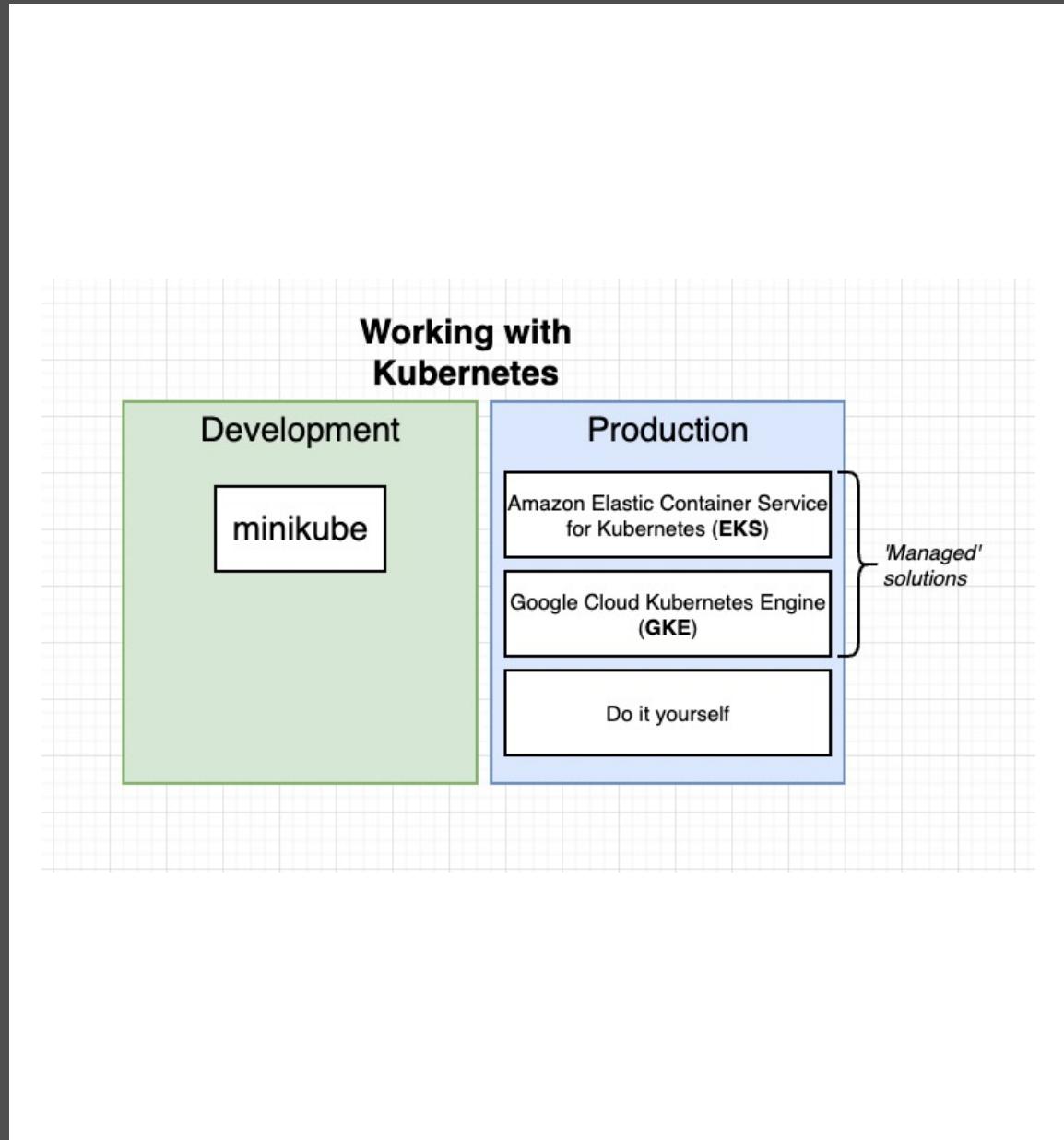
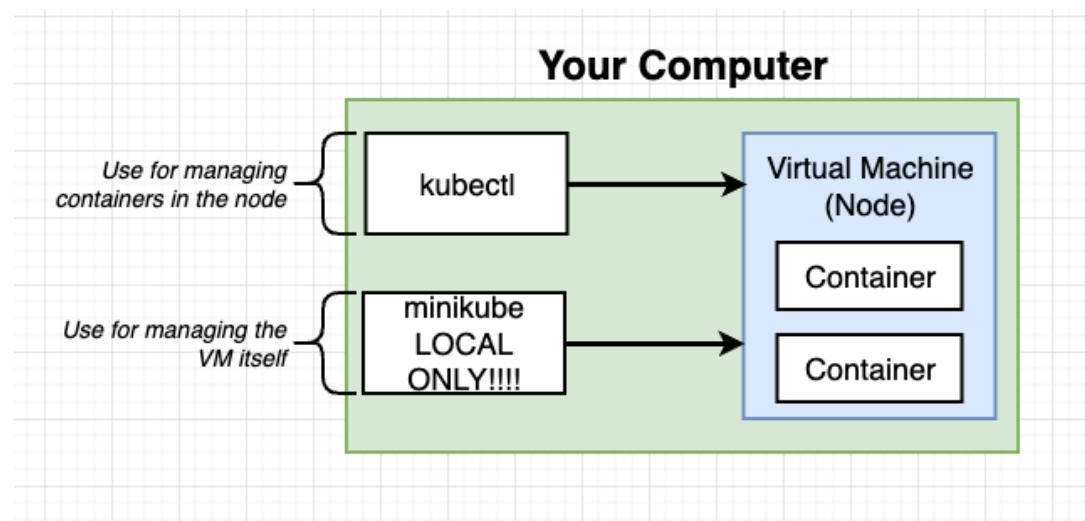




# Kubernetes Architecture







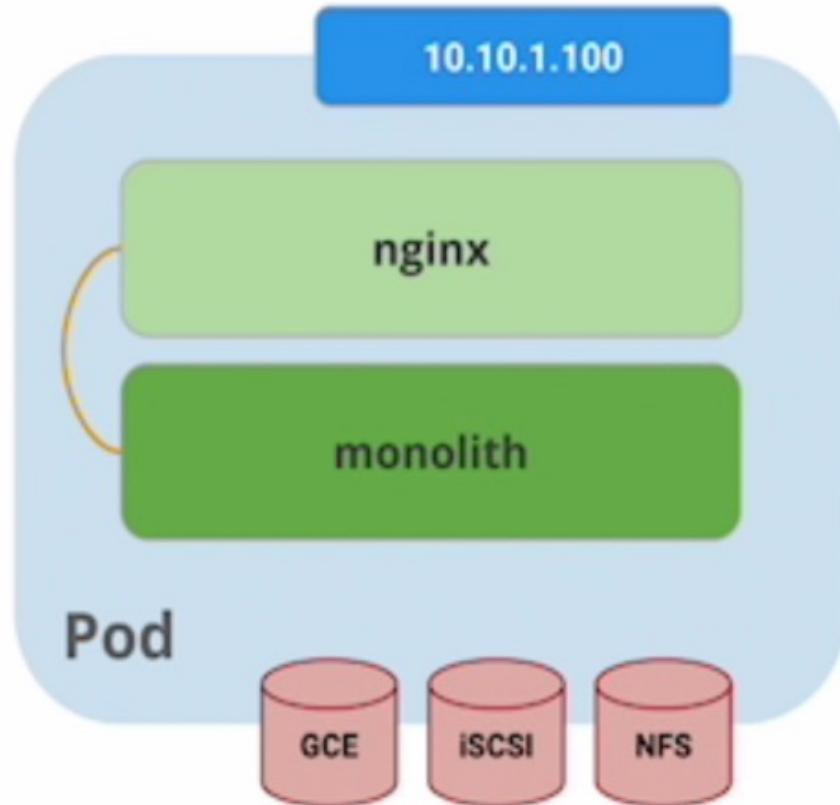
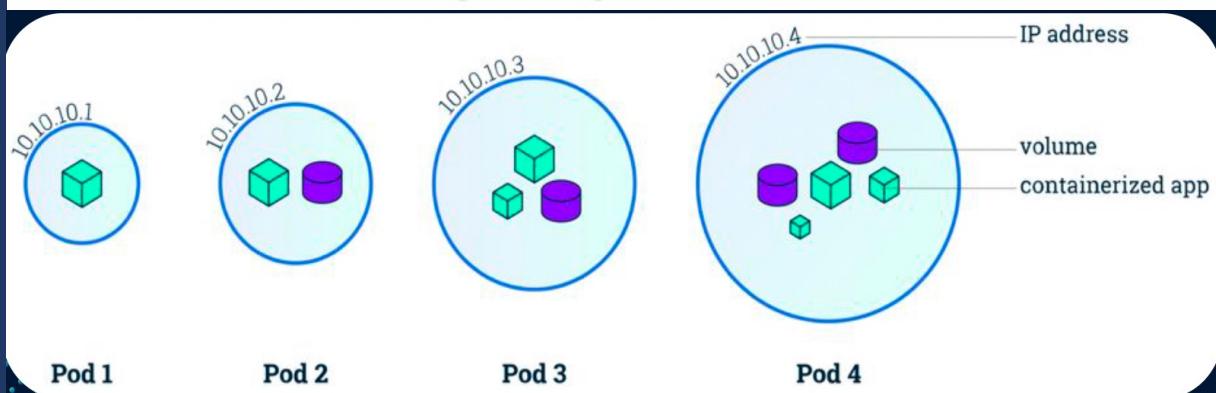
# Concept of pods replica deployments service and namespace Rolling update

---

# Pods

## Logical Application

- One or more containers and volumes
- Shared namespaces
- One IP per pod



# Deployment and replica

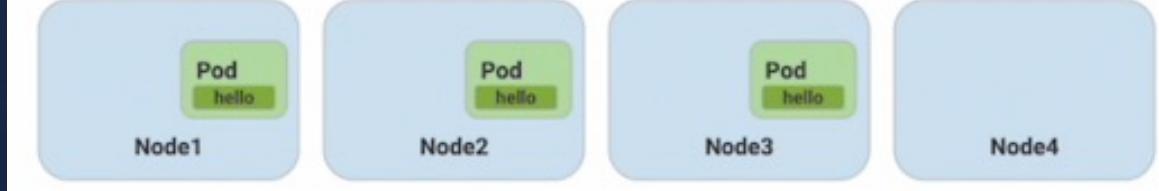
Drive current state towards desired state

app: hello  
replicas: 1



Drive current state towards desired state

app: hello  
replicas: 3



## Deployments

Drive current state towards desired state

app: hello  
replicas: 3

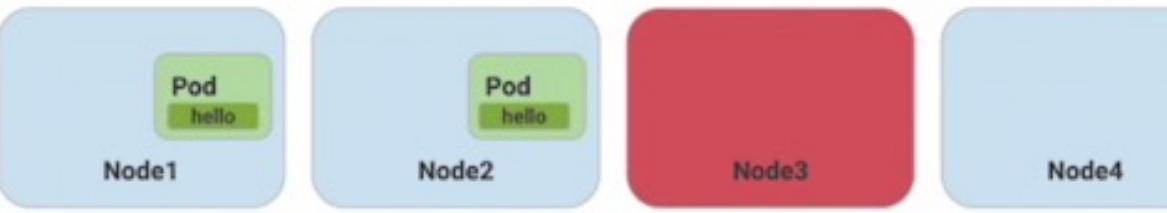


## Deployments

Drive current state towards desired state

app: hello  
replicas: 3

Dead 1 Node



## Deployments

Drive current state towards desired state

app: hello  
replicas: 3

Sol :Dead 1 Node



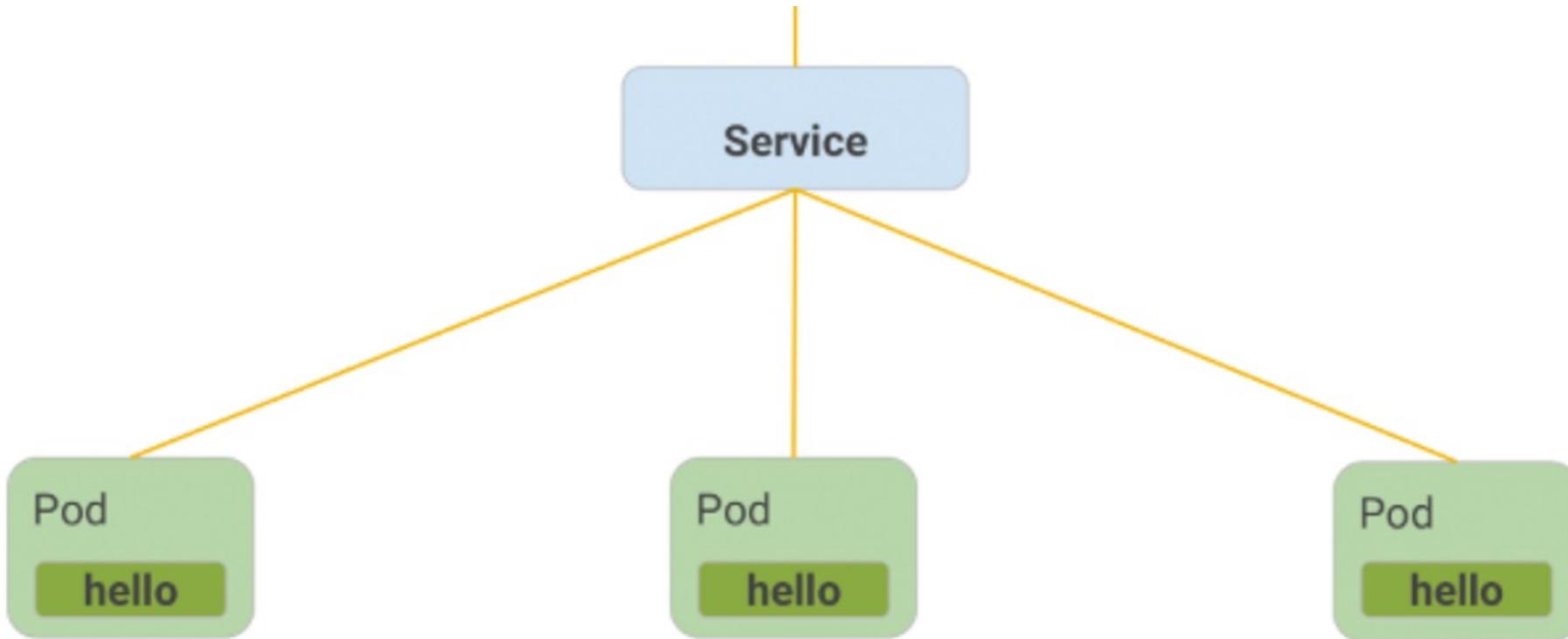
## Deployments

Drive current state towards desired state

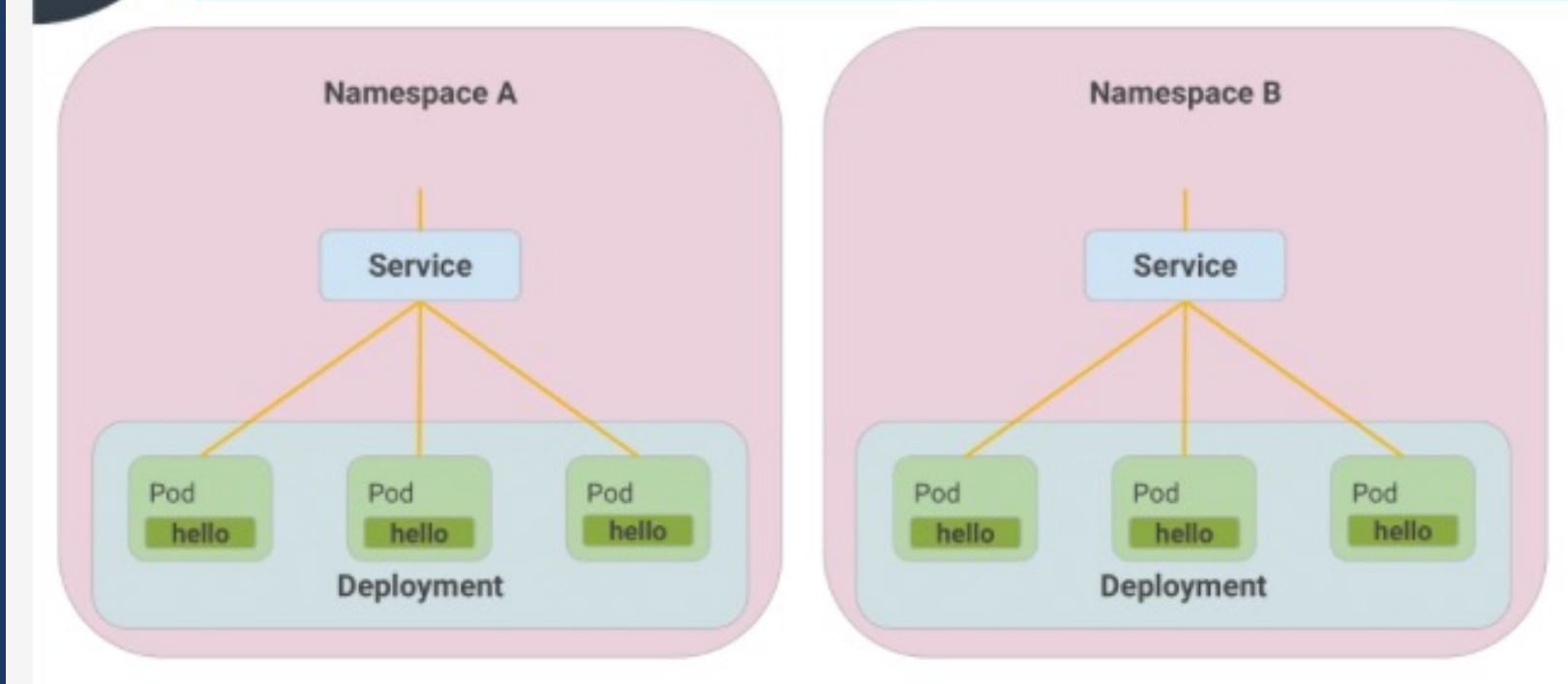
app: hello  
replicas: 3



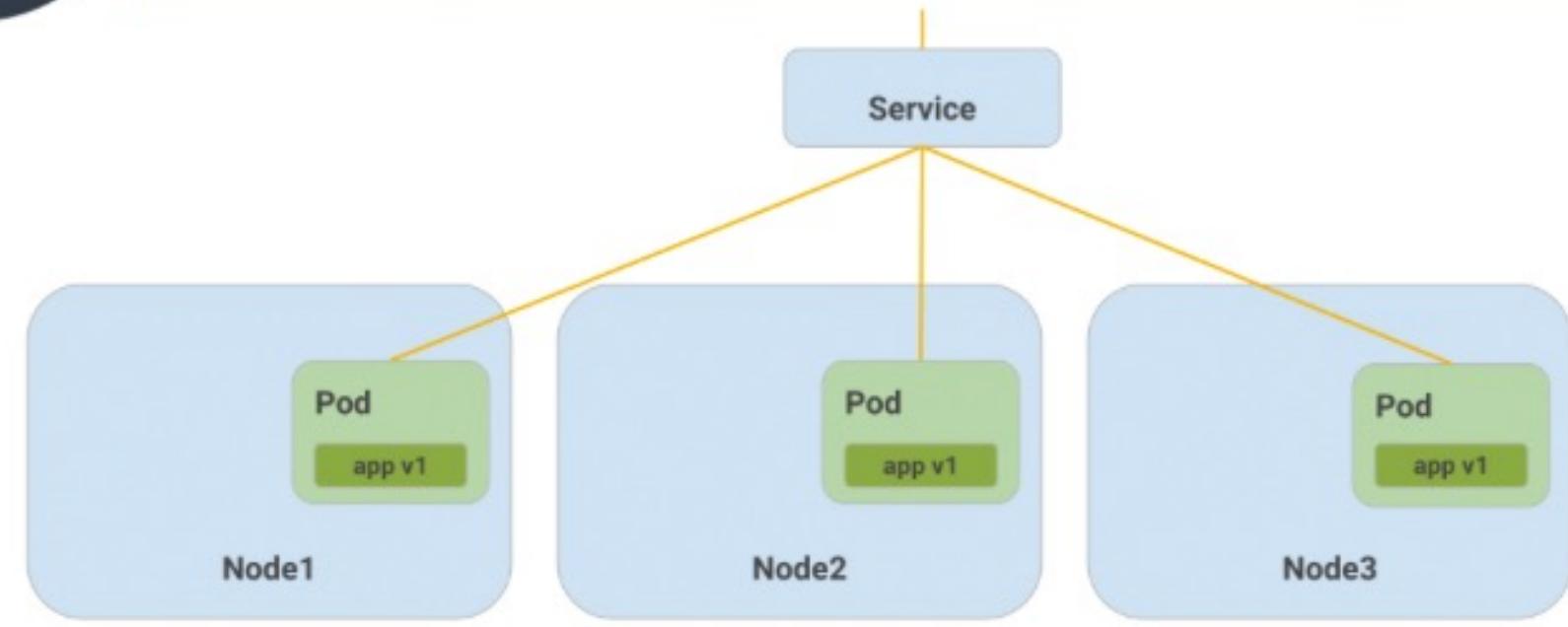
# Service



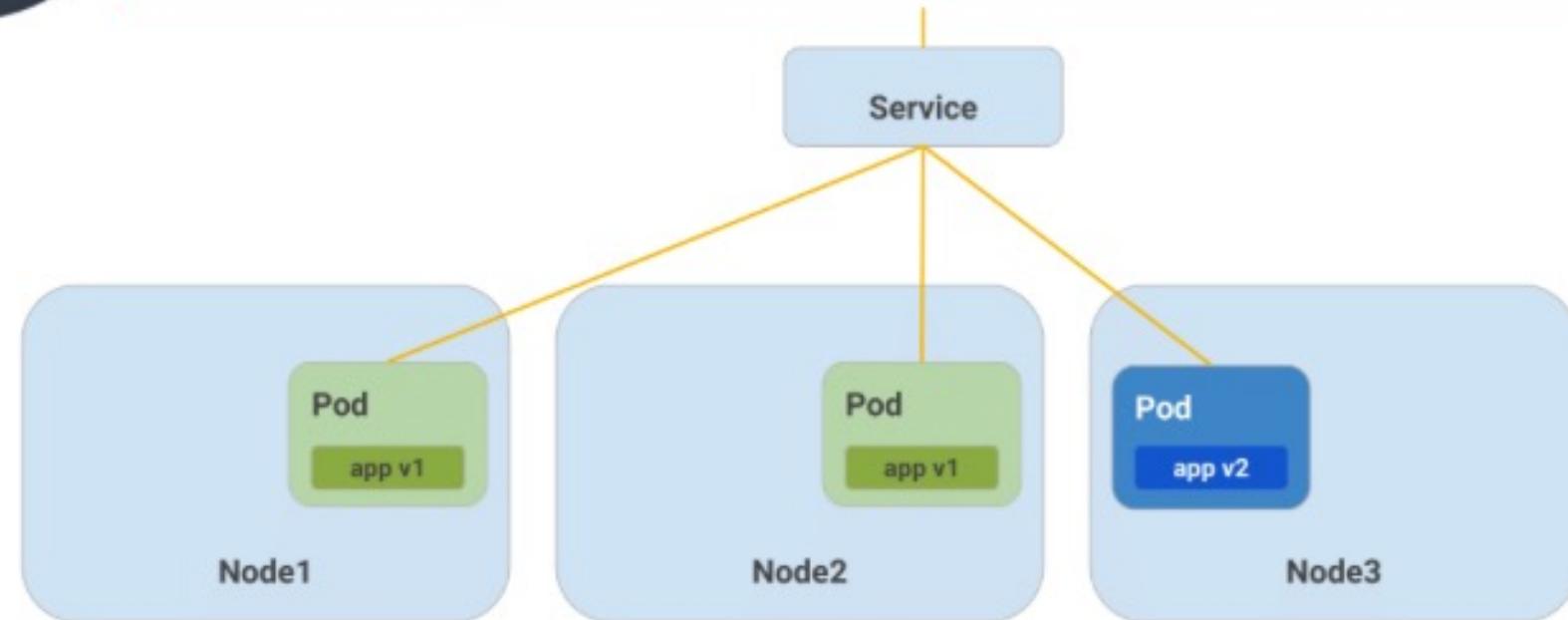
# Namespace



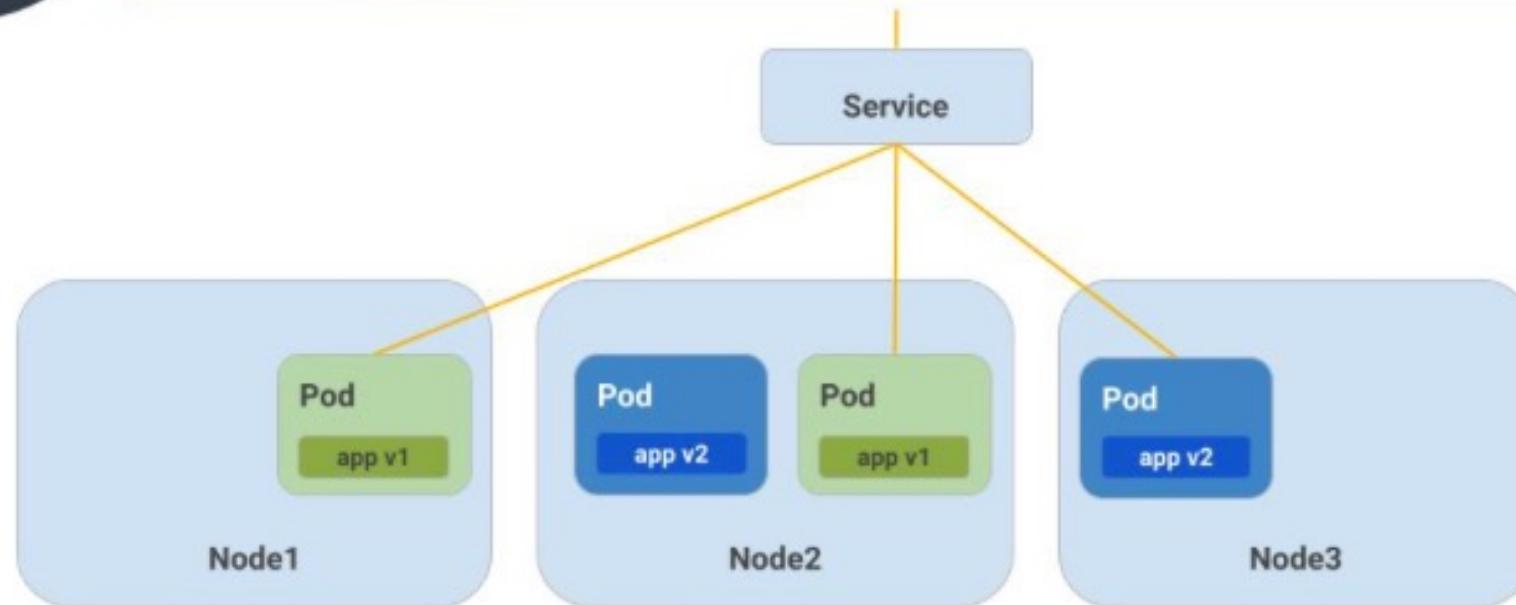
## Rolling Update



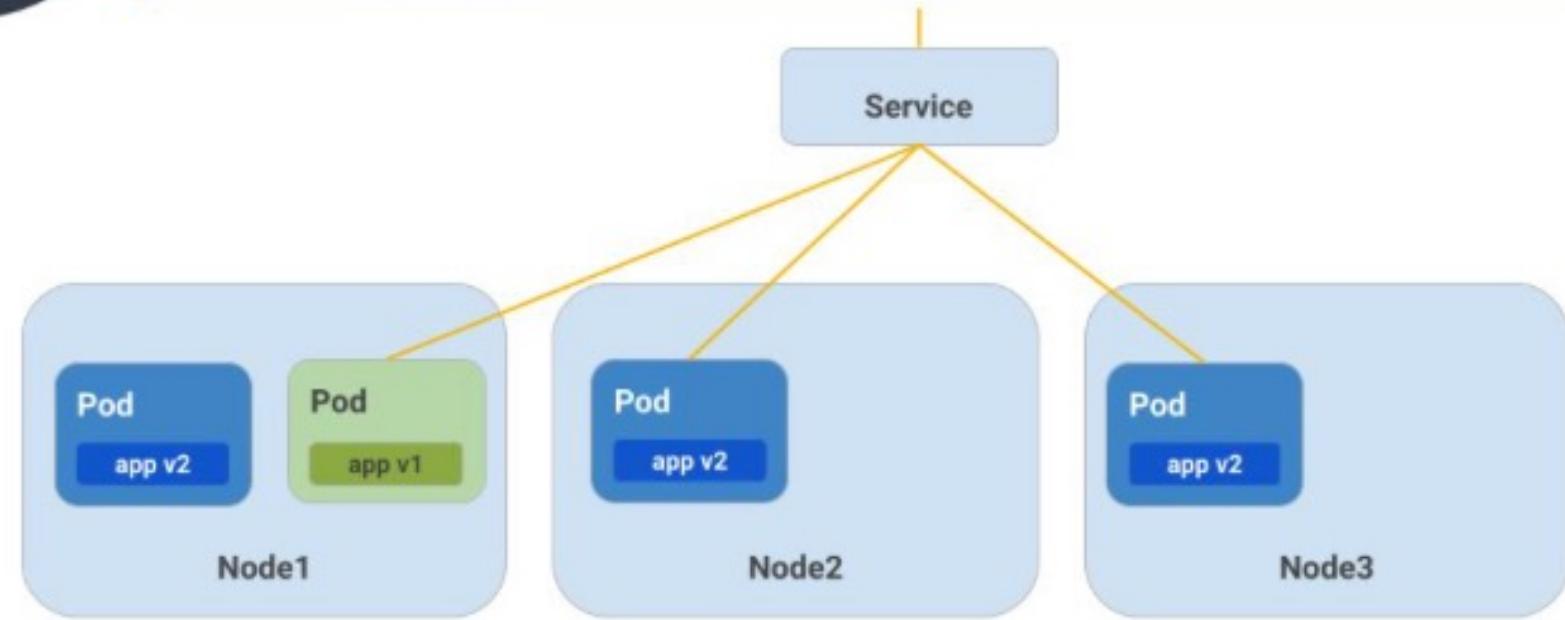
## Rolling Update



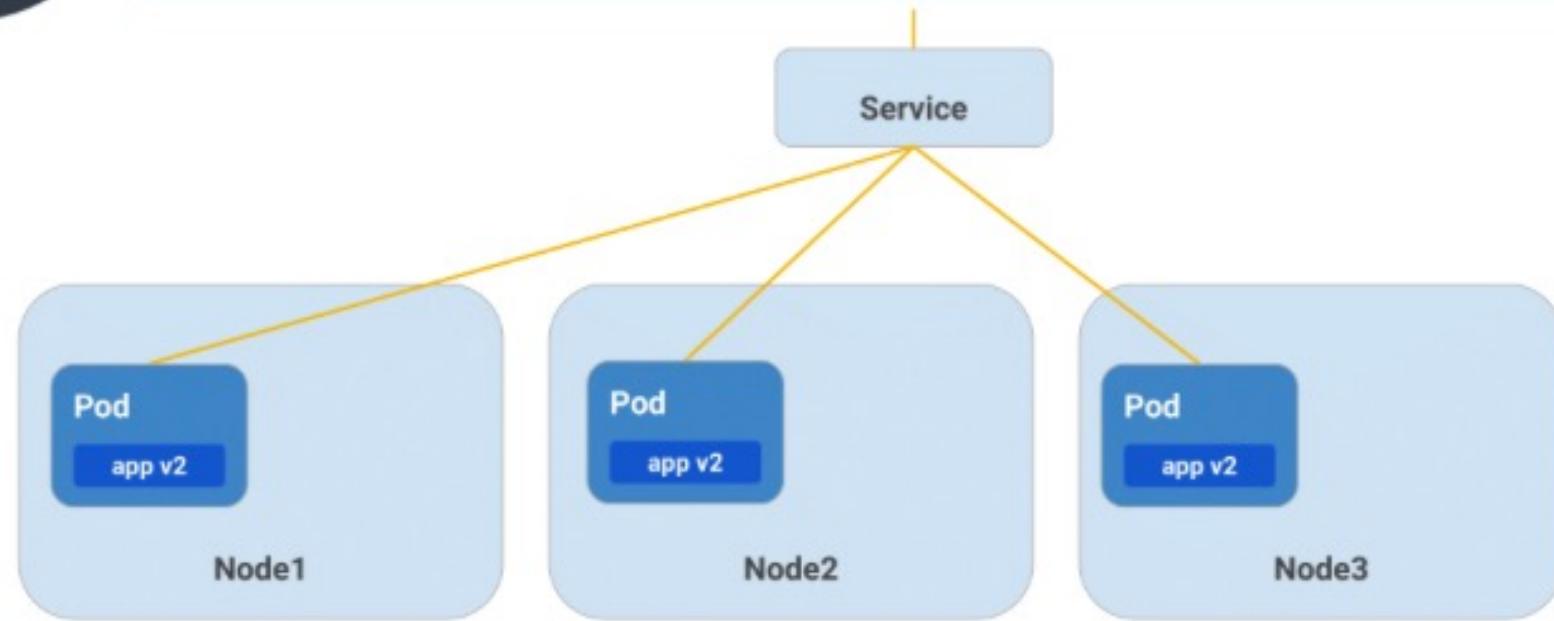
# Rolling Update



## Rolling Update



## Rolling Update



## Workflow for docker and kubernetes deployment:



Docker and Kubernetes Workflow



- Pod

<https://kubernetes.io/docs/concepts/workloads/pods/>

- Replicas set

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

- Deployment

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

# Basic Command

---

Kubernetes Basic Command (get) :

**kubectl get {object} –n {namespace}**

kubectl get pod –n kube-system

kubectl get replicaset –n kube-system

kubectl get deployment –n kube-system

Kubernetes Basic Command (describe):

**kubectl describe {object} {pod name} –n {namespace}**

`kubectl describe pod {pod name} –n kube-system`

`kubectl describe replicaset {replicaset name} –n kube-system`

`kubectl describe deployment {deplotment name} –n kube-system`

Kubernetes Basic Command (log) :

**kubectl logs {pod name} –n {namespace}**

**kubectl logs pod {pod name} –n kube-system**

Kubernetes Basic Command (log) :

**kubectl exec -it {pod name} –n {namespace} -- sh/bash**

**kubectl exec -it {pod name} –n {namespace} -- sh/bash**

# LAB basic-command

---

- <https://github.com/Tuchsanai/SOFTWARE-DEVELOPMENT-TOOLS-AND-ENVIRONMENTS/tree/main/Week11/basic-command>

Open a terminal window and run the following command to check the version of kubectl:

```
kubectl version
```

displays a table of all the nodes in the cluster

```
kubectl get node
```

display all the namespaces in the cluster, including their names, statuses

```
kubectl get namespace
```

**Get information about resources in a specific namespace:**

To get all pods across all namespaces in Kubernetes

```
kubectl get pods --all-namespaces
```

Get a list of all pods in the kube-system namespace:

```
kubectl get pods -n kube-system
```

Get a list of all services in the kube-system namespace:

```
kubectl get services -n kube-system
```

Get a list of all deployments in the kube-system namespace:

```
kubectl get deployments -n kube-system
```

# Pod

---

# YAML

---

- YAML is markup language. It is **human-readable** and easy to understand syntax.
- YAML has format for specific **configuration** information such as POD & Deployment definitions.
- Many software relate like **Kubernetes**, **SDN** and **OpenStack** etc.
- Similar **JSON language**
- Advantage to use YAML format
  - **Infrastructure as a code** (IAAC) - keep it on standard template.
  - **Stability** - keep it on version control, keep history change.
  - **Flexibility** - higher dynamic than use command line.

```
---  
# Identity customer records  
group_one:  
  name: John Franky  
  job: Developer  
  skills:  
    - Python  
    - Ruby  
    - customer
```

# YAML in Kubernetes

---

```
pod-definition.yml
```

```
apiVersion:  
kind:  
metadata:
```

```
spec:
```

# Kubernetes Manifest File

```
apiVersion: v1
kind: Pod
metadata:
  name: busybox
  namespace: default
spec:
  containers:
    - name: busybox
      image: busybox
      command:
        - sleep
        - "3600"
```

This is what called  
**Infrastructure as Code**  
**(IaC)**

# Manifest Structure

```
---  
apiVersion: v1      ← Define resource APIs  
kind: Pod          ← Define resource kind  
metadata:  
  name: static-web ← Define name of Pod  
  labels:           ← Define toggle label of Pod  
  role: myrole  
spec:              ← Define metadata like  
  containers:  
    - name: web  
      image: nginx  
      ports:  
        - name: web  
          containerPort: 80  
          protocol: TCP
```

Define resource APIs

Define resource kind

Define name of Pod

Define toggle label of Pod

Define metadata like  
name, image and port of container(s)

# YAML in Kubernetes

pod-definition.yml

```
apiVersion: v1
kind: Pod
metadata:
  name: myap

spec:
```

Kind	Version
POD	v1
Service	v1
ReplicaSet	apps/v1
Deployment	apps/v1

# YAML in Kubernetes

pod-definition.yml

```
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
    type: front-end
spec:
```

Kind	Version
POD	v1
Service	v1
ReplicaSet	apps/v1
Deployment	apps/v1

# YAML in Kubernetes

pod-definition.yml

```
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
    type: front-end
spec:
  containers:
    - name: nginx-container
      image: nginx
```

Kind	Version
POD	v1
Service	v1
ReplicaSet	apps/v1
Deployment	apps/v1

# YAML in Kubernetes

pod-definition.yml

```
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
    type: front-end
spec:
  containers:
    - name: nginx-container
      image: nginx
```

Kind	Version
POD	v1
Service	v1
ReplicaSet	apps/v1
Deployment	apps/v1

```
kubectl create -f pod-definition.yml
```

# LAB Pod

1 Create a new file called nginx-pod.yaml with the following content:

```
nano nginx-pod.yaml
```



2 Add the following content

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

3. Save and close the file.

```
Ctrl+X, then Y, then Enter.
```

4. Create the Nginx pod

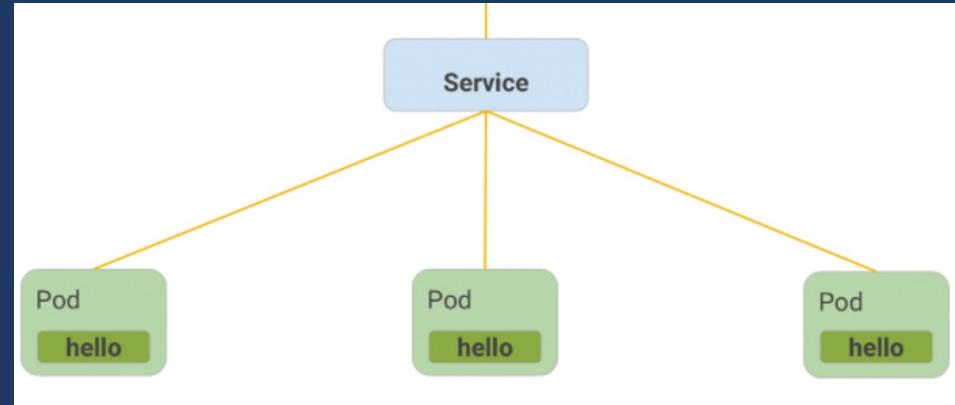
```
kubectl apply -f nginx-pod.yaml
```

5. Check the status of the pod

```
kubectl get pods
```

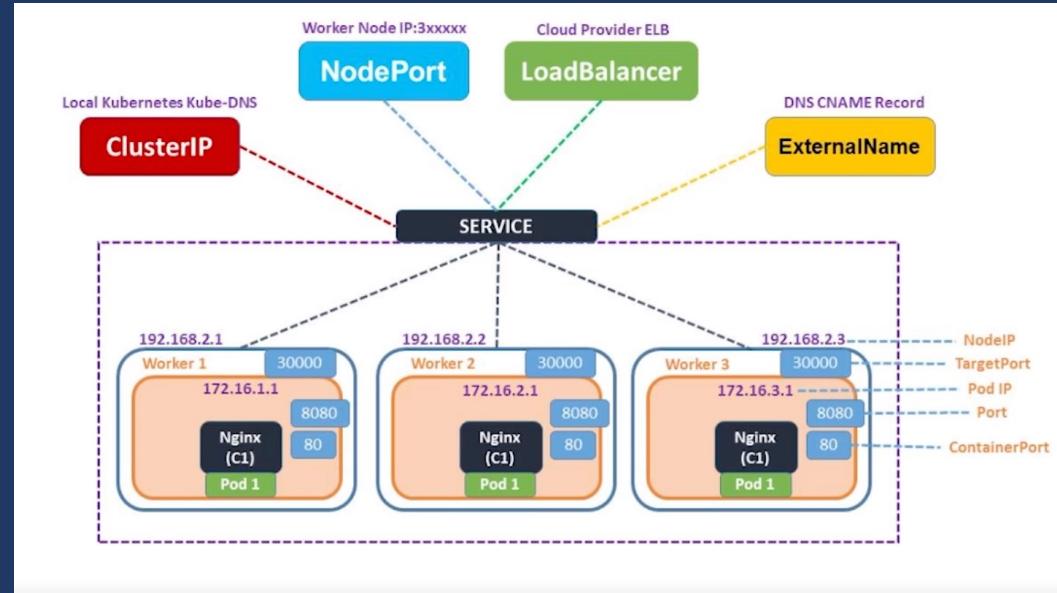
<https://github.com/it63070105/SOFTWARE-DEVELOPMENT-TOOLS-AND-ENVIRONMENTS/tree/main/Week11/Pod>

# Service



In Kubernetes, there are generally three types of services

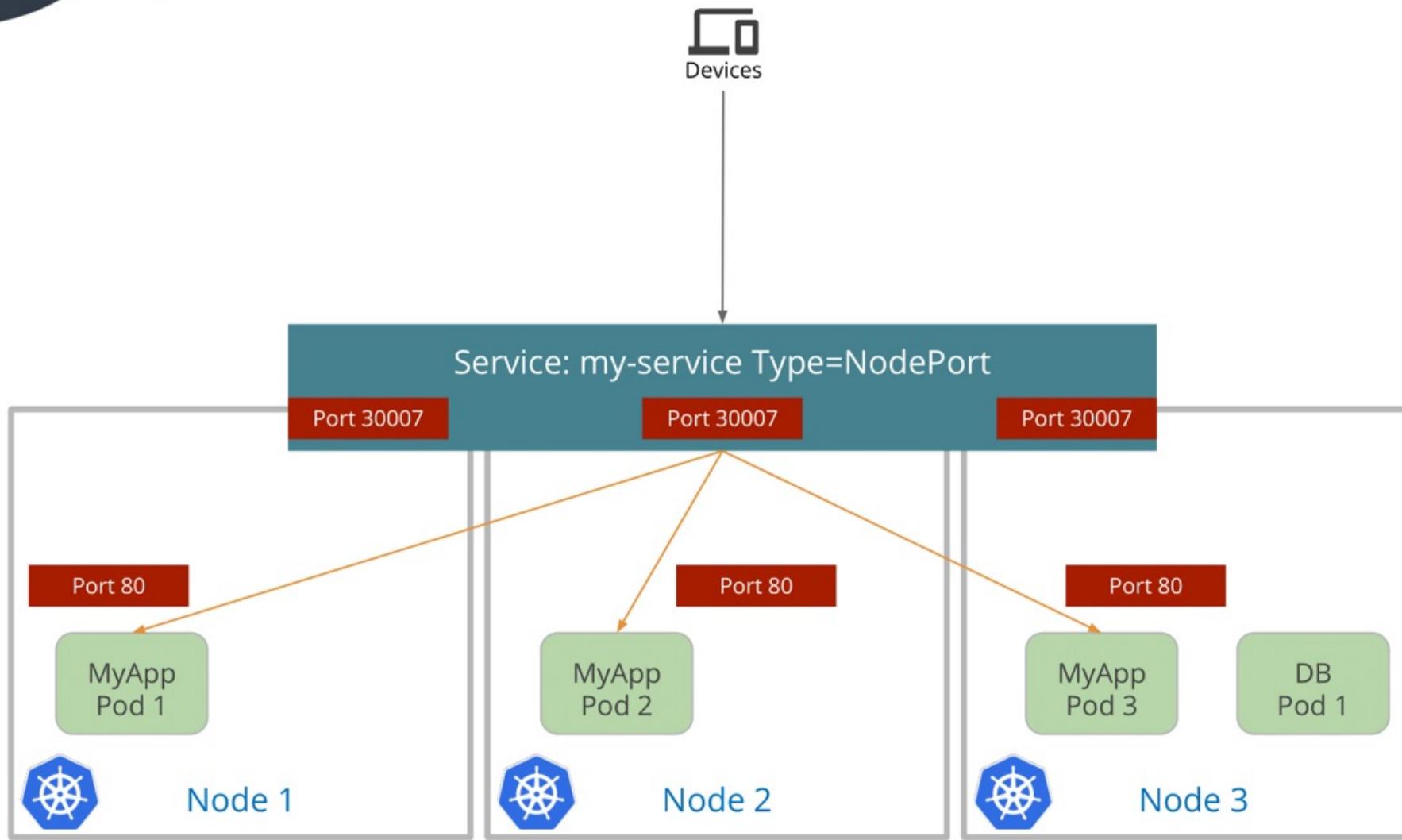
1. NodePort: This service type allows the pods to be accessed from outside the cluster via a static port on each worker node. This is often used for development and testing purposes, but not recommended for production use as it can pose security risks.
2. ClusterIP: This is the default service type in Kubernetes. It provides a stable IP address and DNS name to access a set of pods within the same Kubernetes cluster. This type of service is used for internal communication between components within the cluster.
3. LoadBalancer: This service type is used to expose pods to the internet or other external networks by creating a load balancer in a public cloud provider, such as AWS or GCP. It provides a single entry point for traffic to reach the pods and distributes the traffic across multiple nodes.



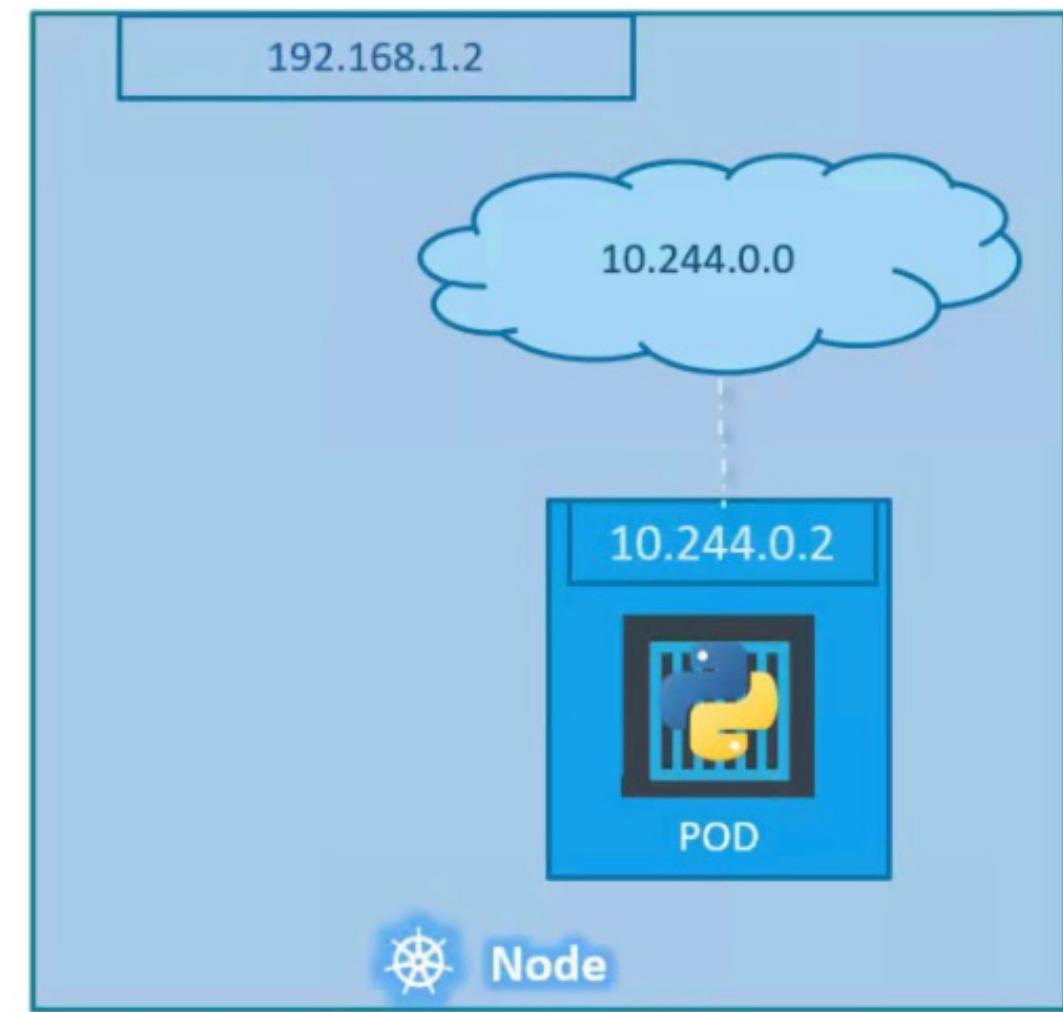
# Node Pod

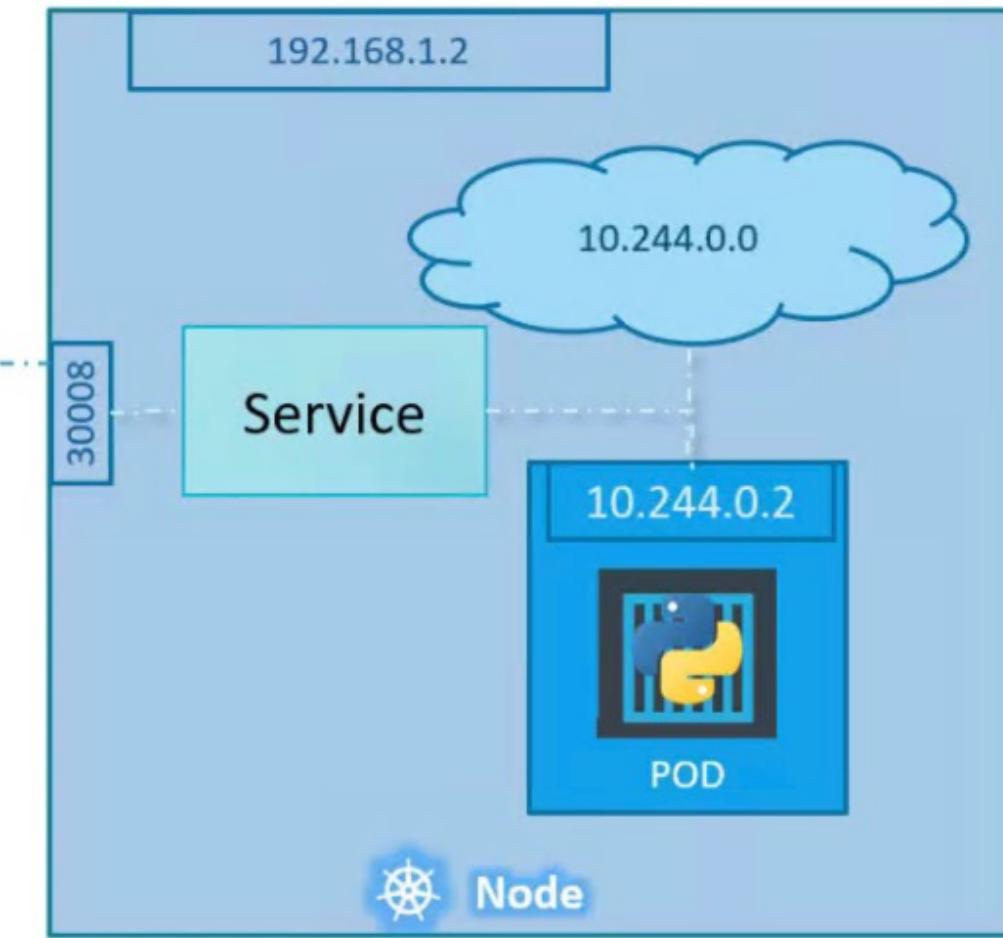
---

# Service Type: Node Port

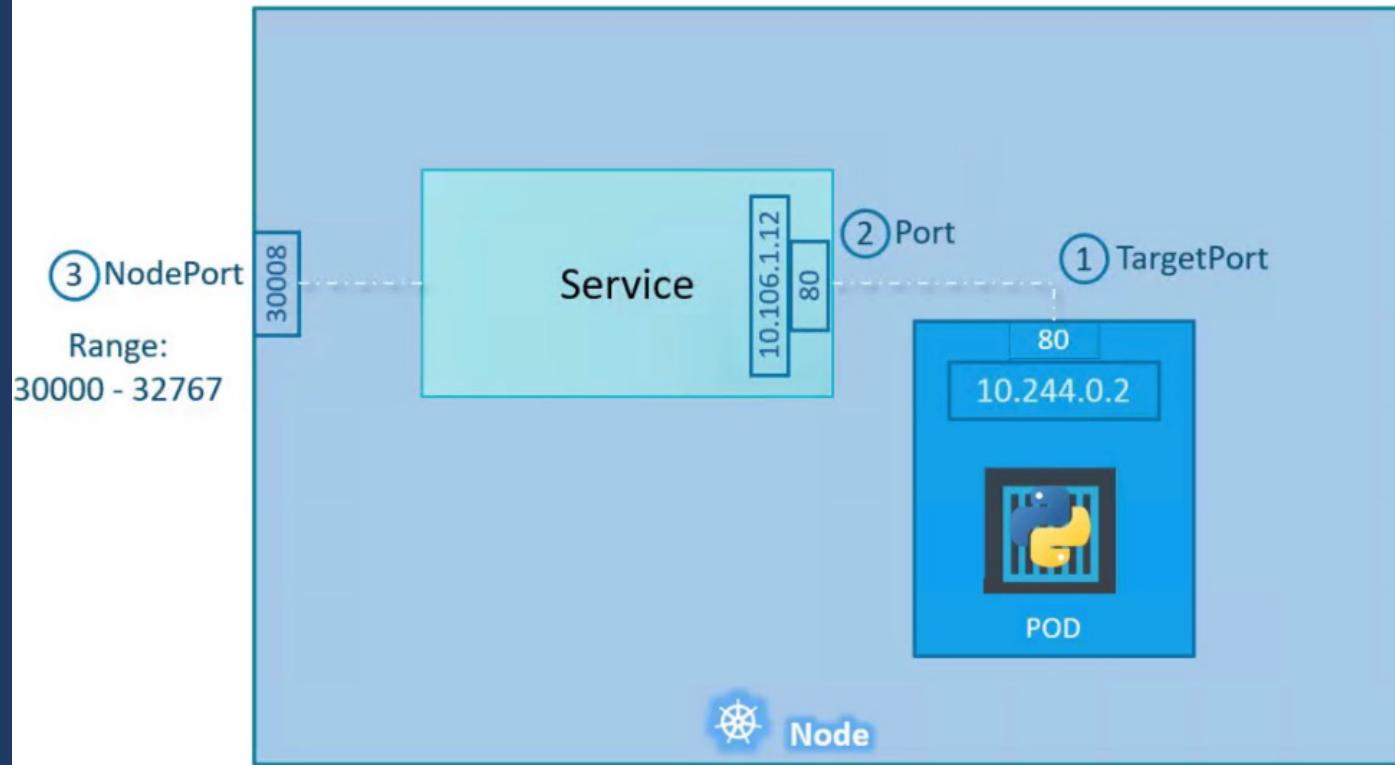


```
apiVersion: v1
kind: Service
metadata:
  name: my-service
spec:
  type: NodePort
  selector:
    app: MyApp
  ports:
    # By default and for
    # convenience, the
    `targetPort` is set to the
    same value as the `port`
    # field.
    - port: 80
      targetPort: 80
      # Optional field
      # By default and for
      # convenience, the Kubernetes
      control plane will allocate
      a port from a range
      (default: 30000-32767)
      nodePort: 30007
```





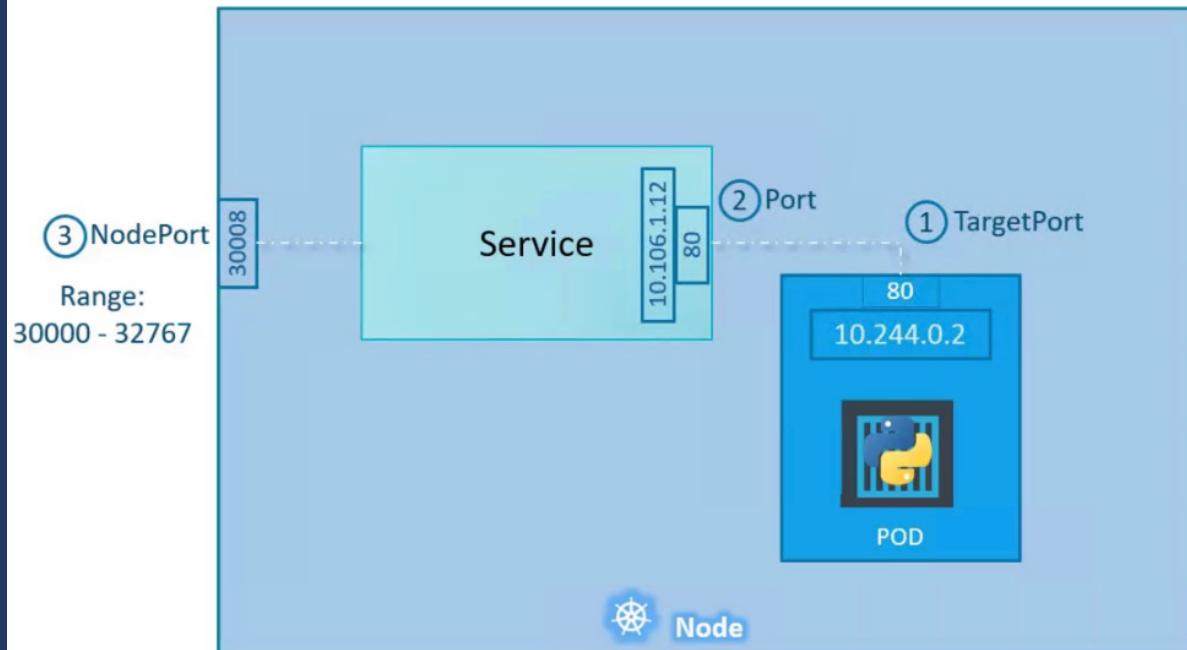
# Service - NodePort



```
service-definition.yml
```

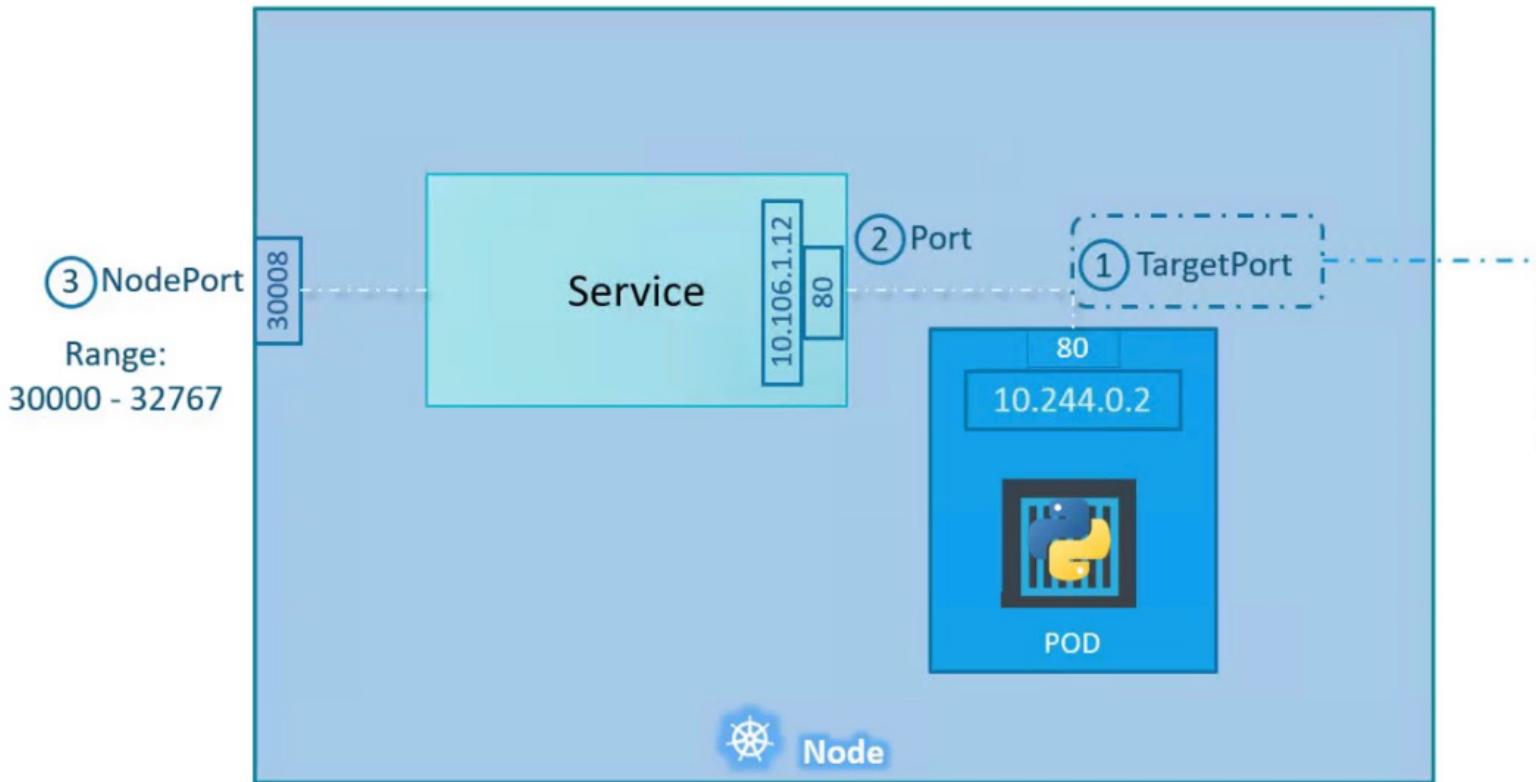
```
apiVersion: v1
kind: Service
metadata:
spec:
```

# Service - NodePort



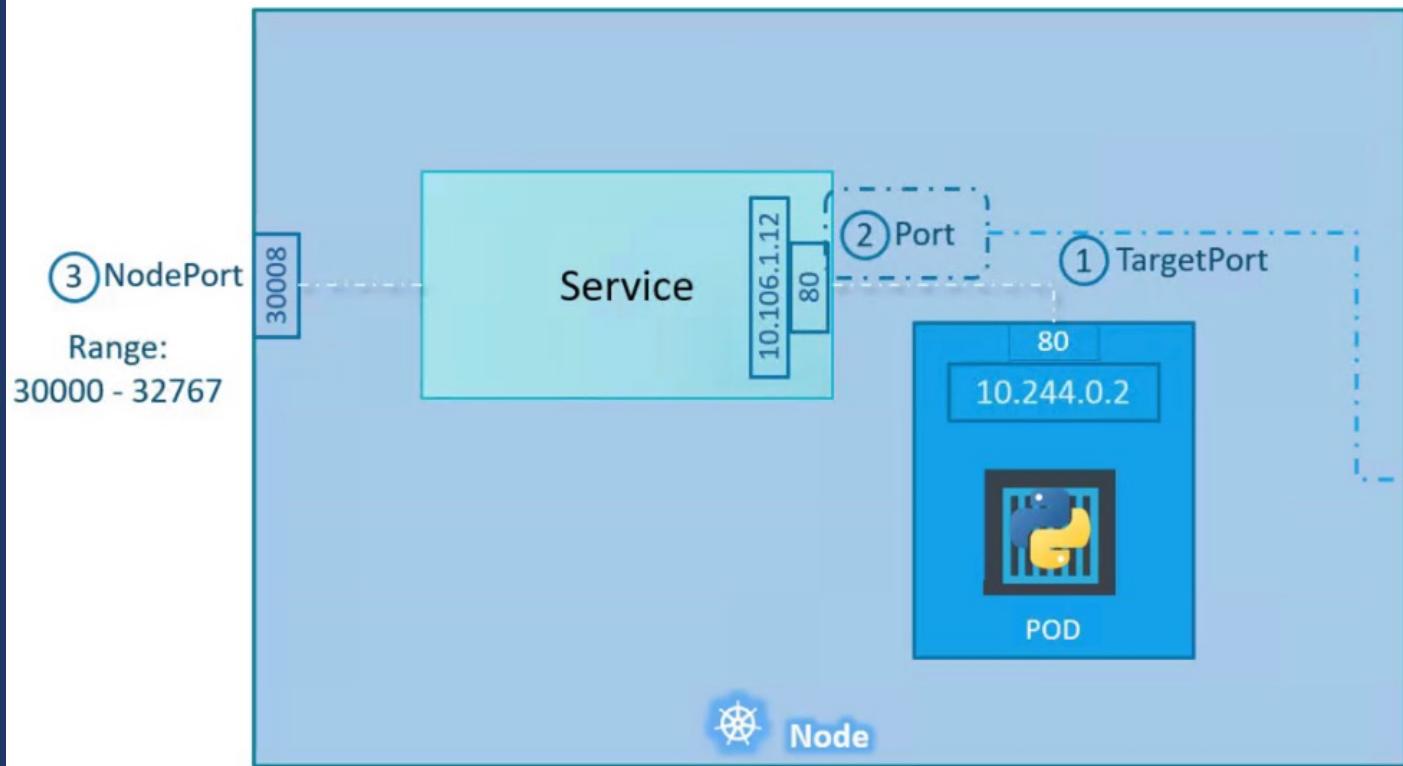
```
service-definition.yml
apiVersion: v1
kind: Service
metadata:
  name: myapp-service
spec:
  type: NodePort
  ports:
    - targetPort: 80
      *port: 80
      nodePort: 30008
```

# Service - NodePort



```
service-definition.yml  
apiVersion: v1  
kind: Service  
metadata:  
  name: myapp-service  
spec:  
  type: NodePort  
  ports:  
    - targetPort: 80  
      port: 80  
      nodePort: 30008
```

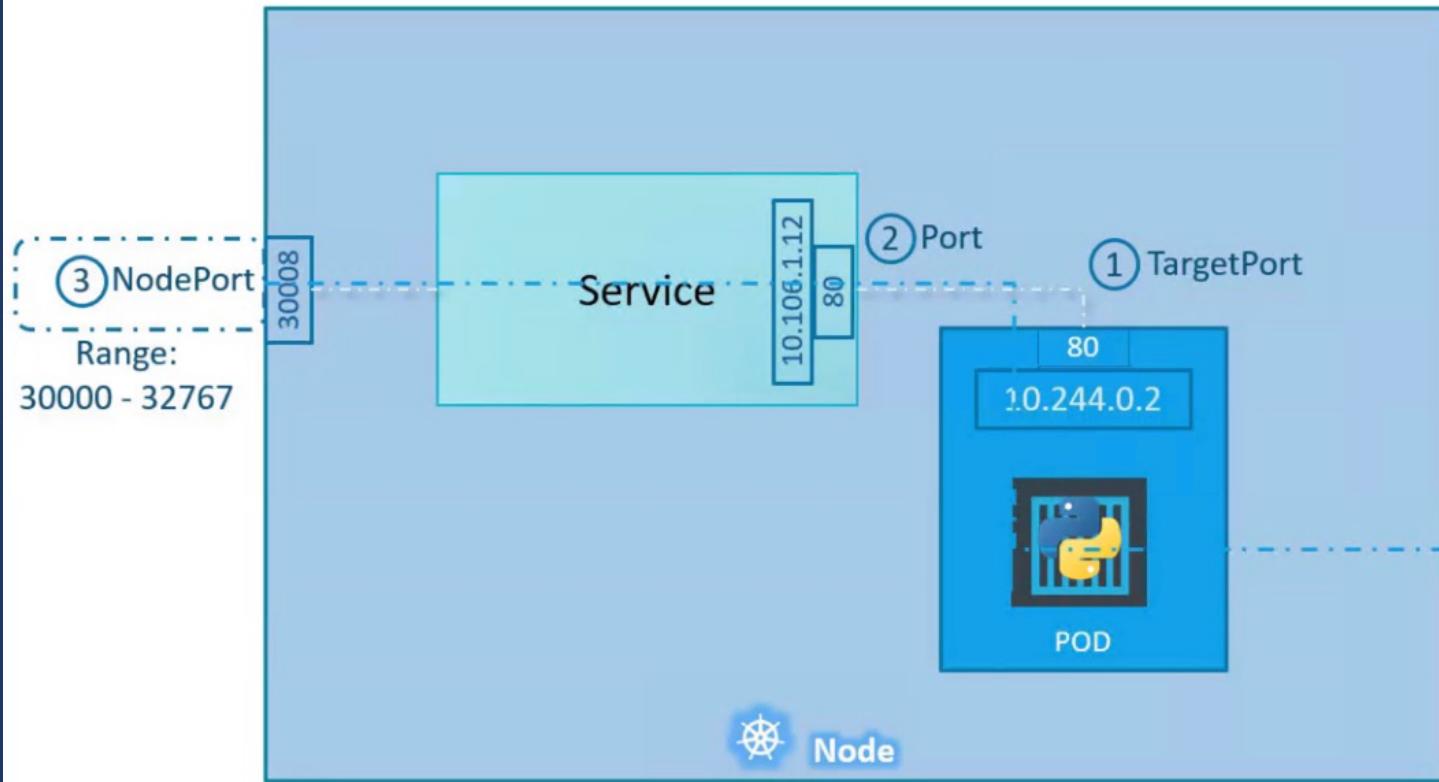
# Service - NodePort



service-definition.yml

```
apiVersion: v1
kind: Service
metadata:
  name: myapp-service
spec:
  type: NodePort
  ports:
    - targetPort: 80
      port: 80
      nodePort: 30008
```

# Service - NodePort



```
service-definition.yml
apiVersion: v1
kind: Service
metadata:
  name: myapp-service
spec:
  type: NodePort
  ports:
    - targetPort: 80
      port: 80
      nodePort: 30008
```

# Service - NodePort

---

```
service-definition.yml
```

```
apiVersion: v1
kind: Service
metadata:
  name: myapp-service

spec:
  type: NodePort
  ports:
    - targetPort: 80
      port: 80
      nodePort: 30008
  selector:
```

# Service - NodePort

```
service-definition.yml
```

```
apiVersion: v1
kind: Service
metadata:
  name: myapp-service
spec:
  type: NodePort
  ports:
    - targetPort: 80
      port: 80
      nodePort: 30008
  selector:
```



```
pod-definition.yml
```

```
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
    type: front-end
spec:
  containers:
    - name: nginx-container
      image: nginx
```

# Service - NodePort

service-definition.yml

```
apiVersion: v1
kind: Service
metadata:
  name: myapp-service
spec:
  type: NodePort
  ports:
    - targetPort: 80
      port: 80
      nodePort: 30008
  selector:
    app: myapp
    type: front-end
```

pod-definition.yml

```
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
spec:
  containers:
    - name: nginx-container
      image: nginx
```

# Service - NodePort

---

```
service-definition.yml
```

```
apiVersion: v1
kind: Service
metadata:
  name: myapp-service

spec:
  type: NodePort
  ports:
    - targetPort: 80
      port: 80
      nodePort: 30008
  selector:
    app: myapp
    type: front-end
```

```
> kubectl create -f service-definition.yml
service "myapp-service" created
```

# Service - NodePort

```
service-definition.yml
```

```
apiVersion: v1
kind: Service
metadata:
  name: myapp-service
spec:
  type: NodePort
  ports:
    - targetPort: 80
      port: 80
      nodePort: 30008
  selector:
    app: myapp
    type: front-end
```

```
> kubectl create -f service-definition.yml
service "myapp-service" created
```

```
> kubectl get services
```

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
kubernetes	ClusterIP	10.96.0.1	<none>	443/TCP	16d
myapp-service	NodePort	10.106.127.123	<none>	80:30008/TCP	5m

# Service - NodePort

```
service-definition.yml
```

```
apiVersion: v1
kind: Service
metadata:
  name: myapp-service
spec:
  type: NodePort
  ports:
    - targetPort: 80
      port: 80
      nodePort: 30008
  selector:
    app: myapp
    type: front-end
```

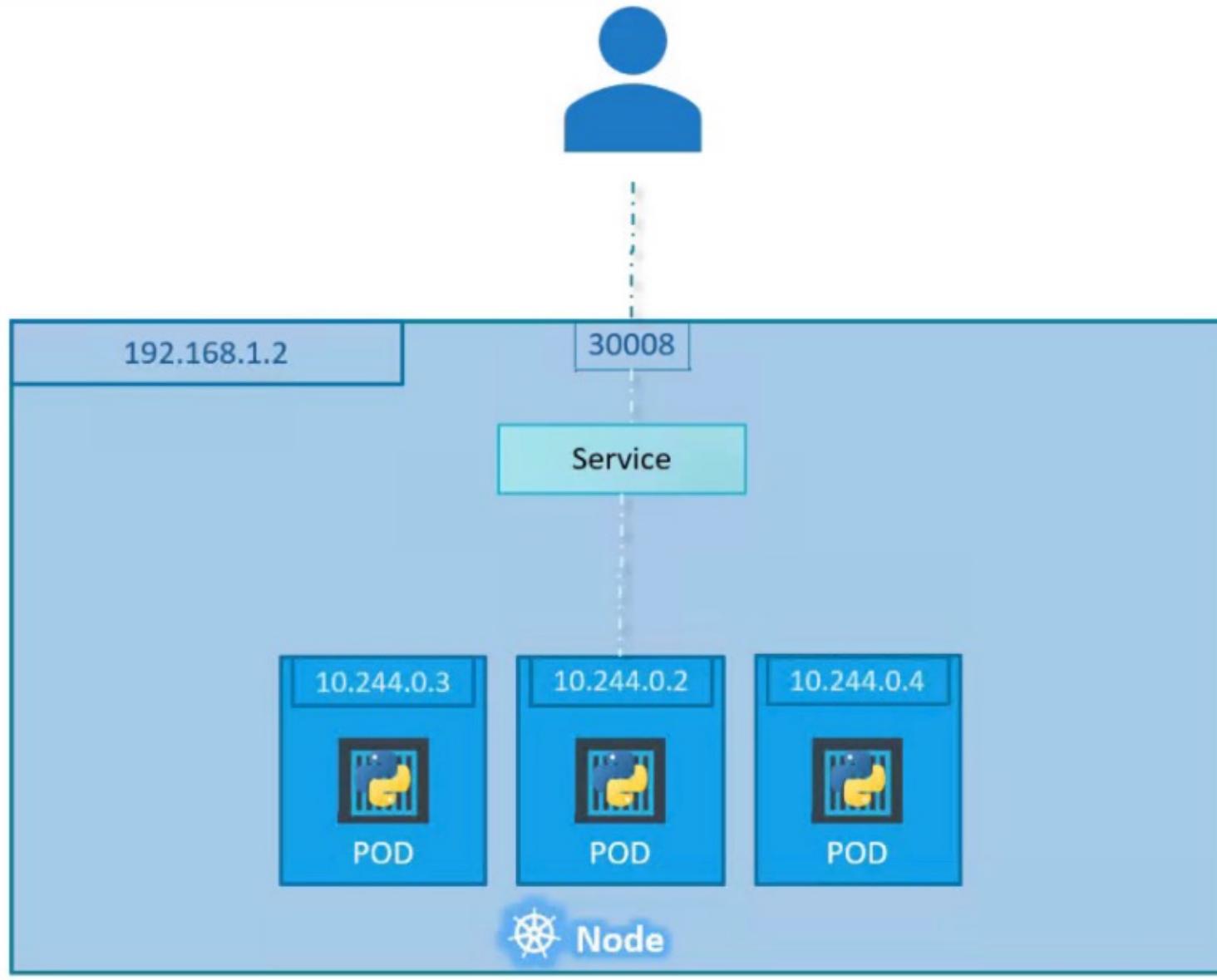
```
> kubectl create -f service-definition.yml
service "myapp-service" created
```

```
> kubectl get services
```

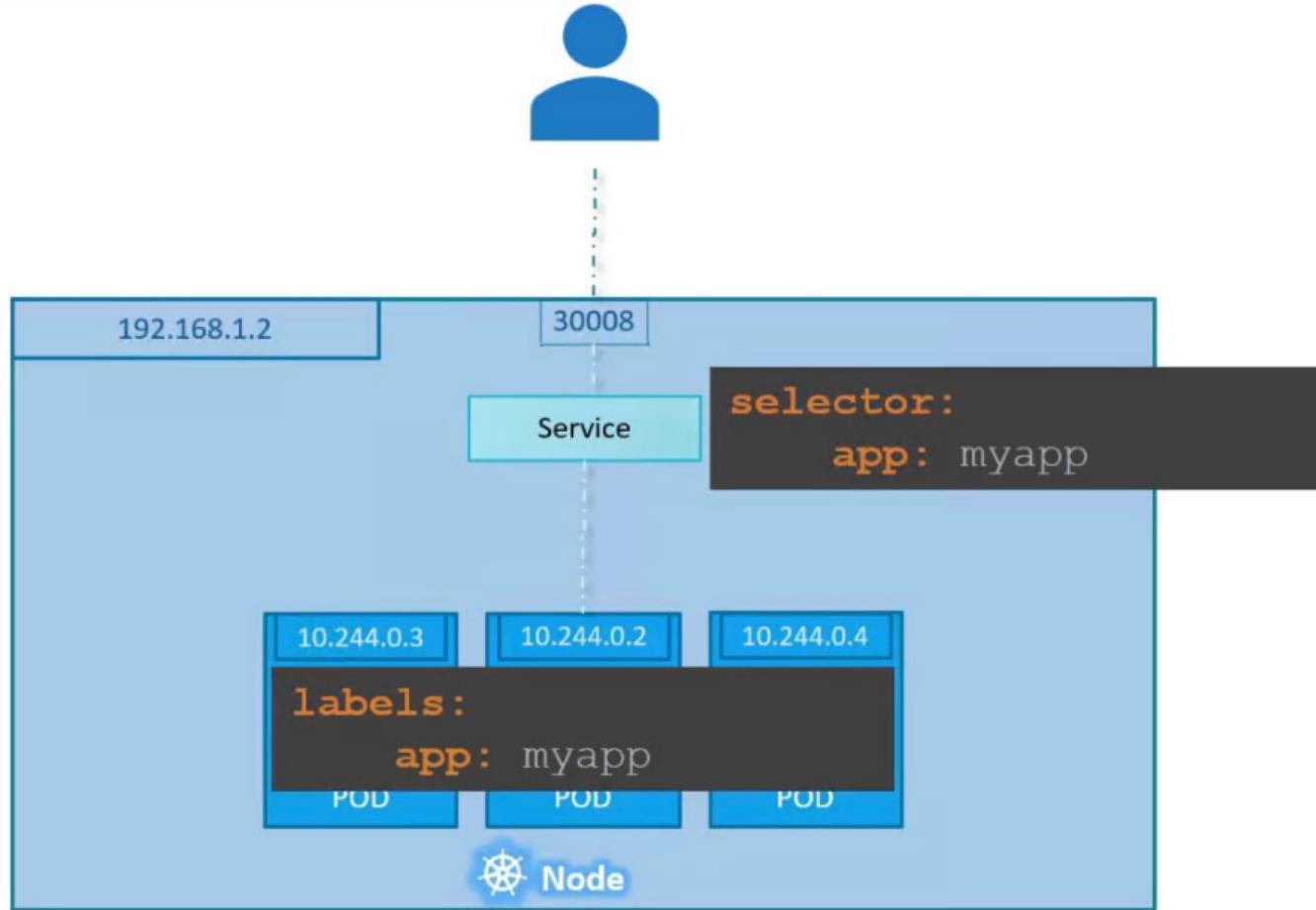
NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
kubernetes	ClusterIP	10.96.0.1	<none>	443/TCP	16d
myapp-service	NodePort	10.106.127.123	<none>	80:30008/TCP	5m

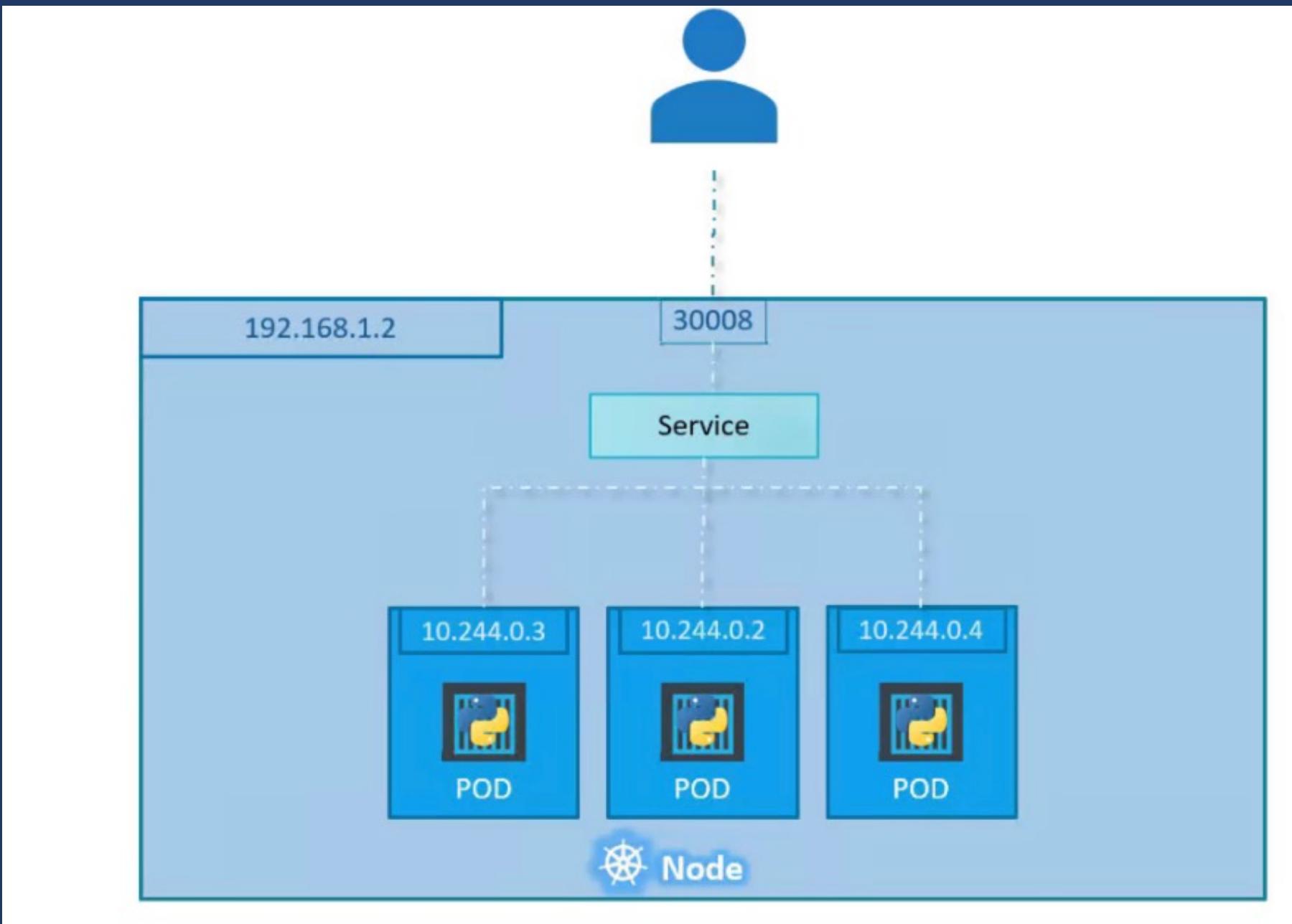
```
> curl http://192.168.1.2:30008
```

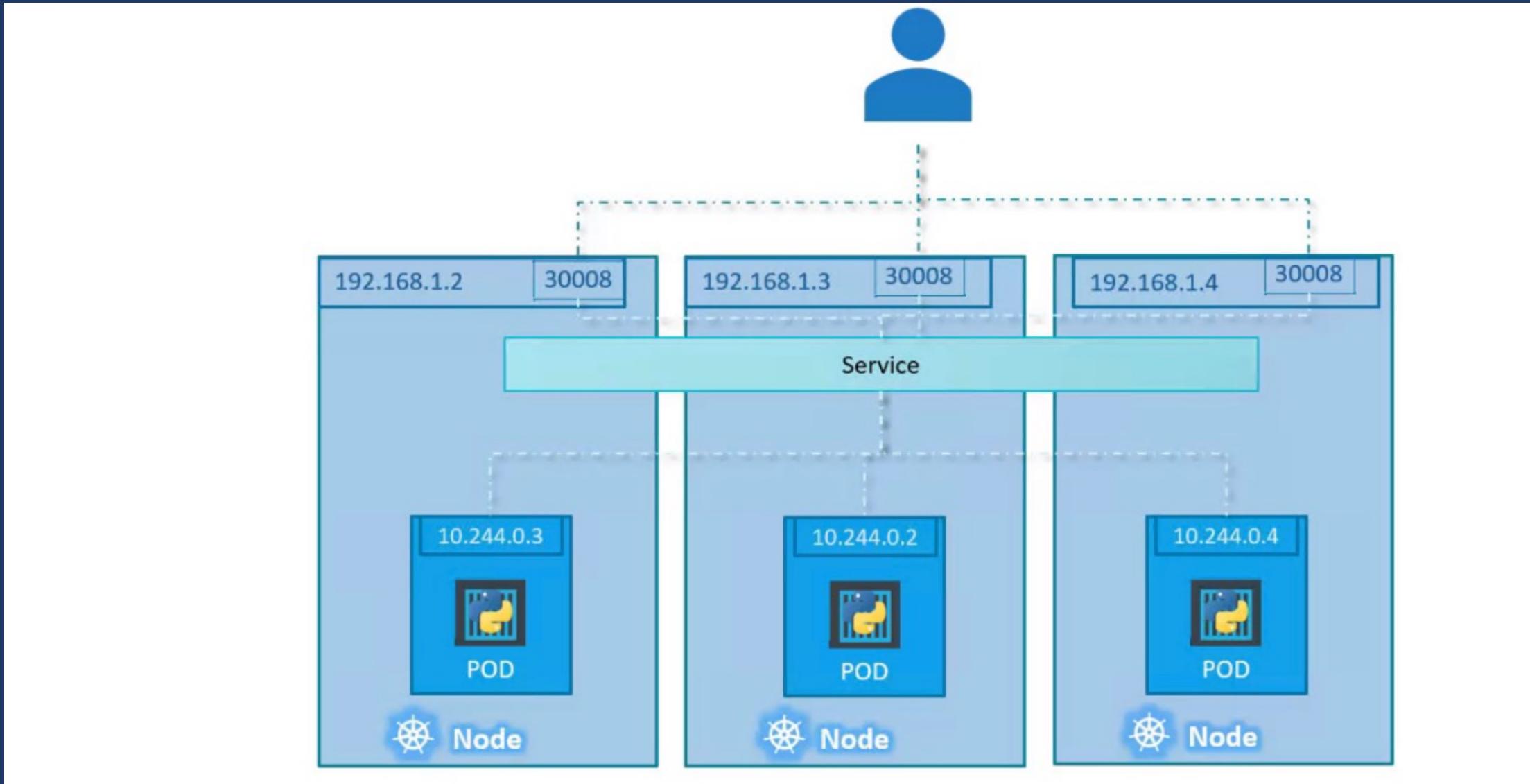
```
<html>
<head>
<title>Welcome to nginx!</title>
<style>
  body {
    width: 35em;
    margin: 0 auto;
    font-family: Tahoma, Verdana, Arial, sans-serif;
  }
</style>
</head>
<body>
```

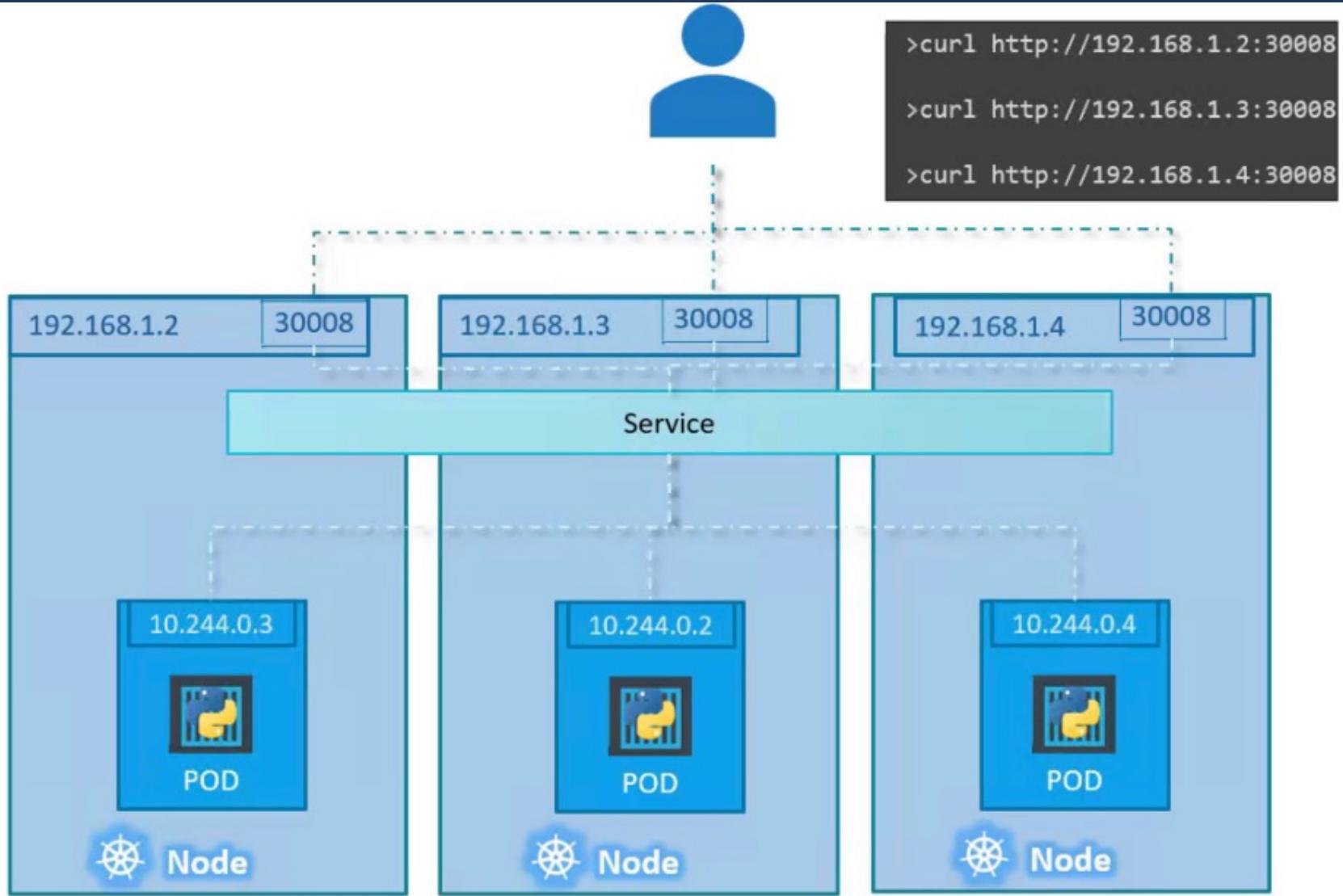


# Service - NodePort





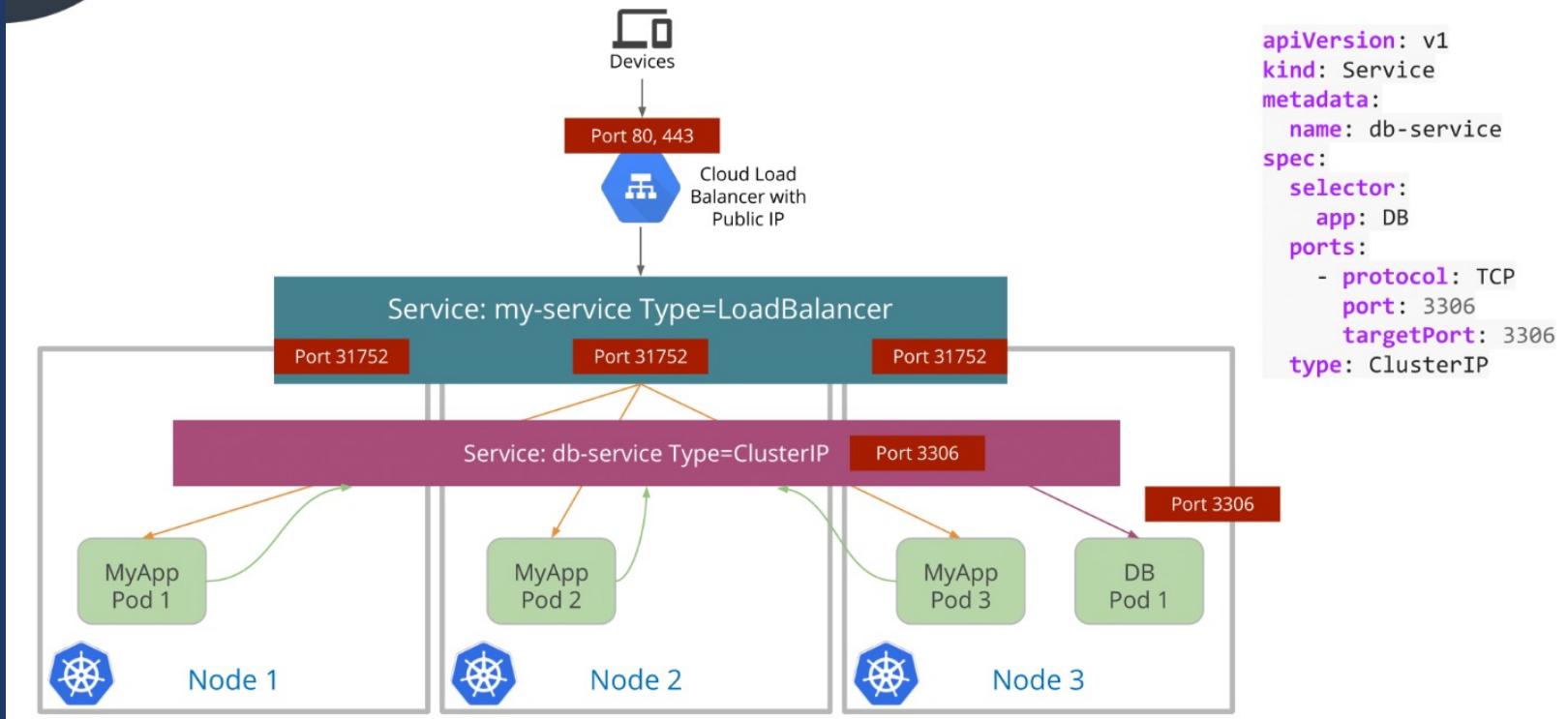


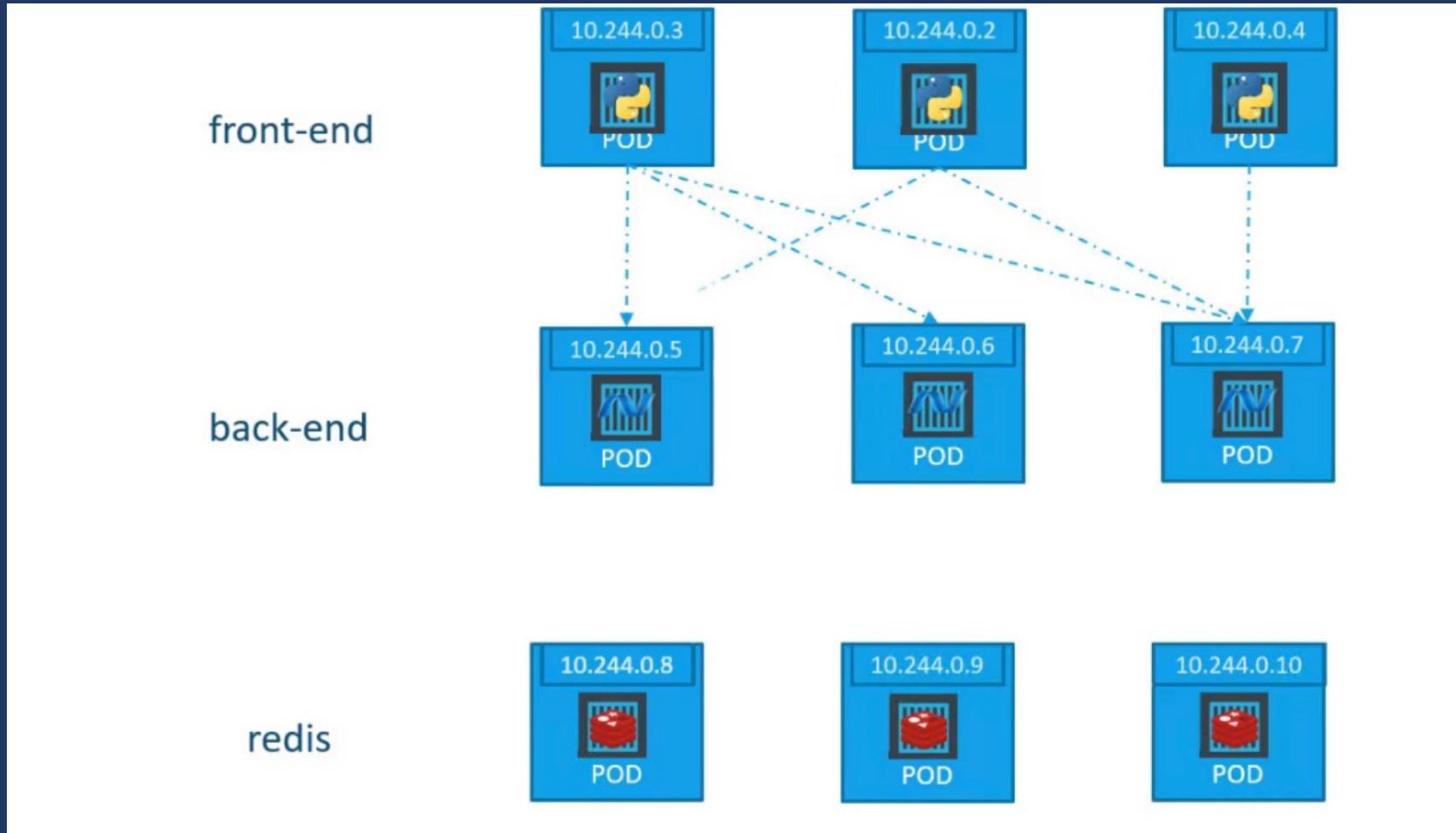


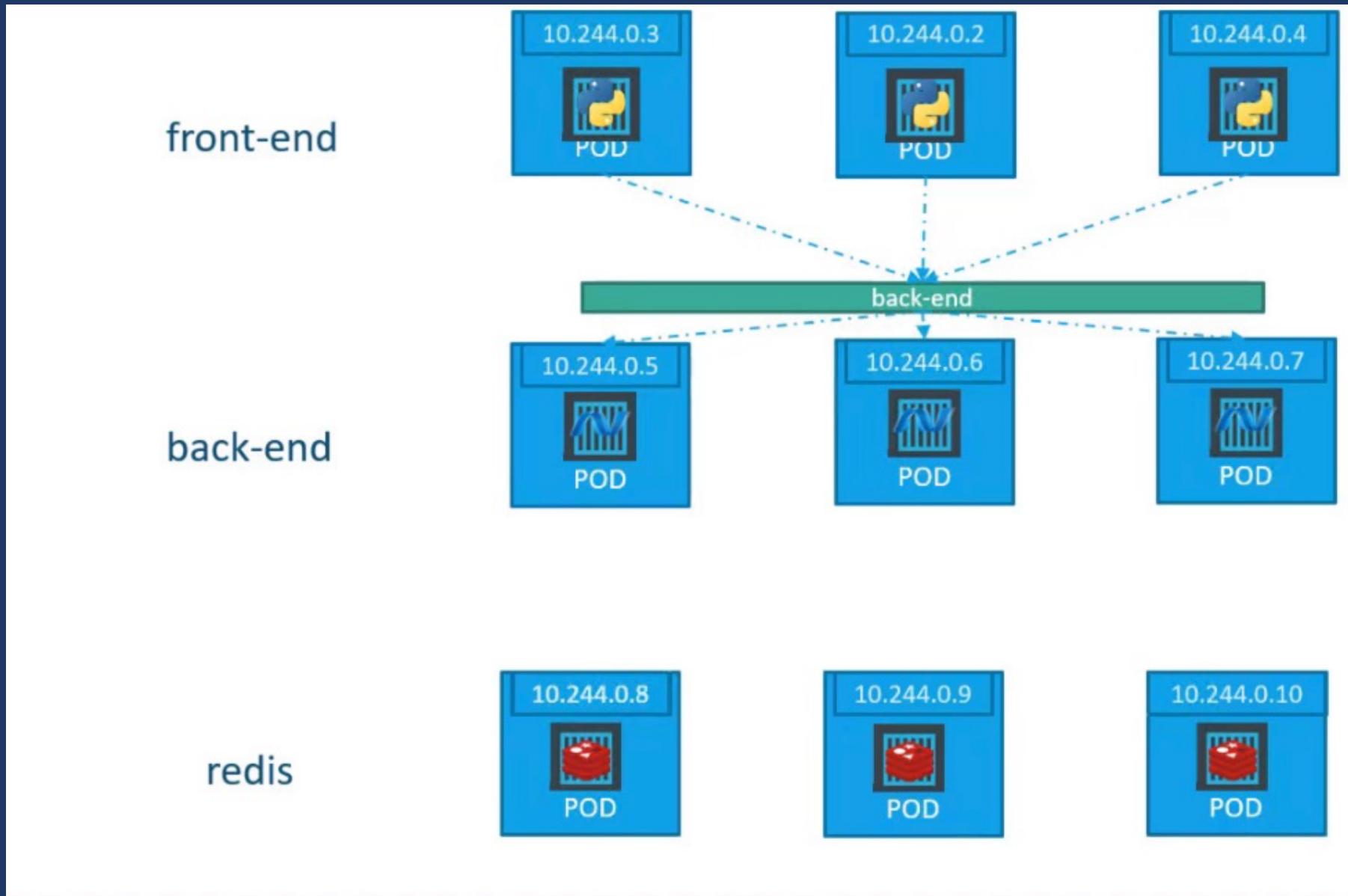
# ClusterIP

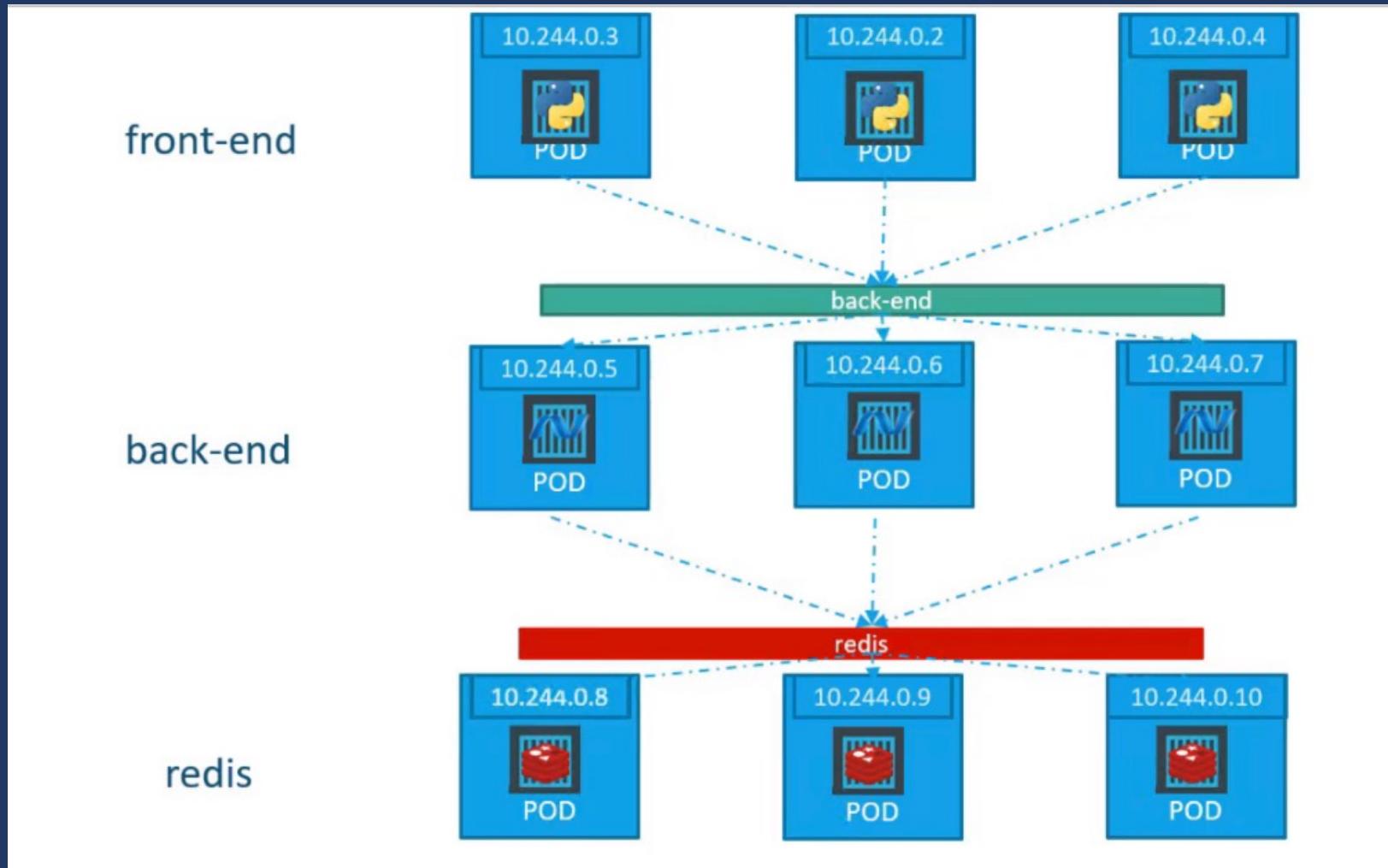
---

# Service Type: ClusterIP









```
service-definition.yml
```

```
apiVersion: v1
kind: Service
metadata:
  name: back-end

spec:
  type: ClusterIP
  ports:
    - targetPort: 80
      port: 80
```

```
service-definition.yml
apiVersion: v1
kind: Service
metadata:
  name: back-end
spec:
  type: ClusterIP
  ports:
    - targetPort: 80
      port: 80
  selector:
    app: myapp
    type: back-end
```

```
pod-definition.yml
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
spec:
  containers:
    - name: nginx-container
      image: nginx
```

```
service-definition.yml
```

```
apiVersion: v1
kind: Service
metadata:
  name: back-end
spec:
  type: ClusterIP
  ports:
    - targetPort: 80
      port: 80
  selector:
    app: myapp
    type: back-end
```

```
> kubectl create -f service-definition.yml
service "back-end" created
```

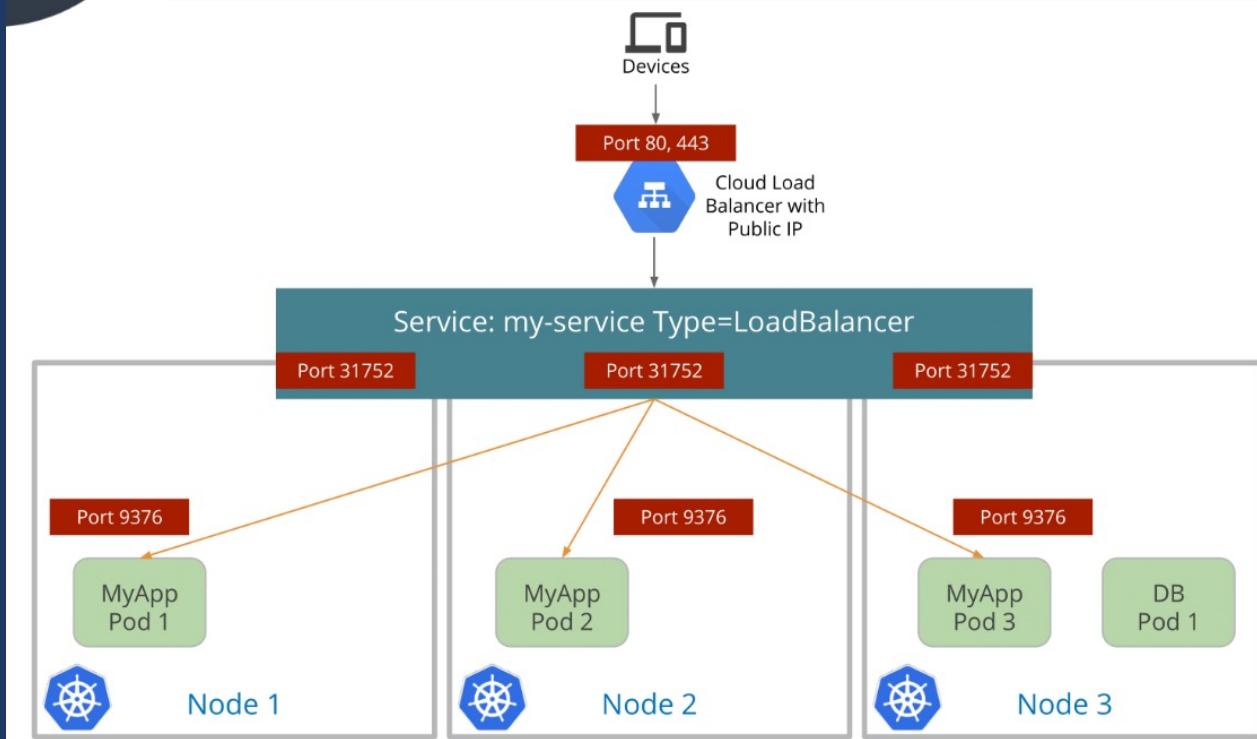
```
> kubectl get services
```

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
kubernetes	ClusterIP	10.96.0.1	<none>	443/TCP	16d
back-end	ClusterIP	10.106.127.123	<none>	80/TCP	2m

# LoadBalancer

---

# Service Type: LoadBalancer



```
apiVersion: v1
kind: Service
metadata:
  name: my-service
spec:
  selector:
    app: MyApp
  ports:
    - protocol: TCP
      port: 80
      targetPort: 9376
  type: LoadBalancer
```