BATCH : B107 AWS-DevOps

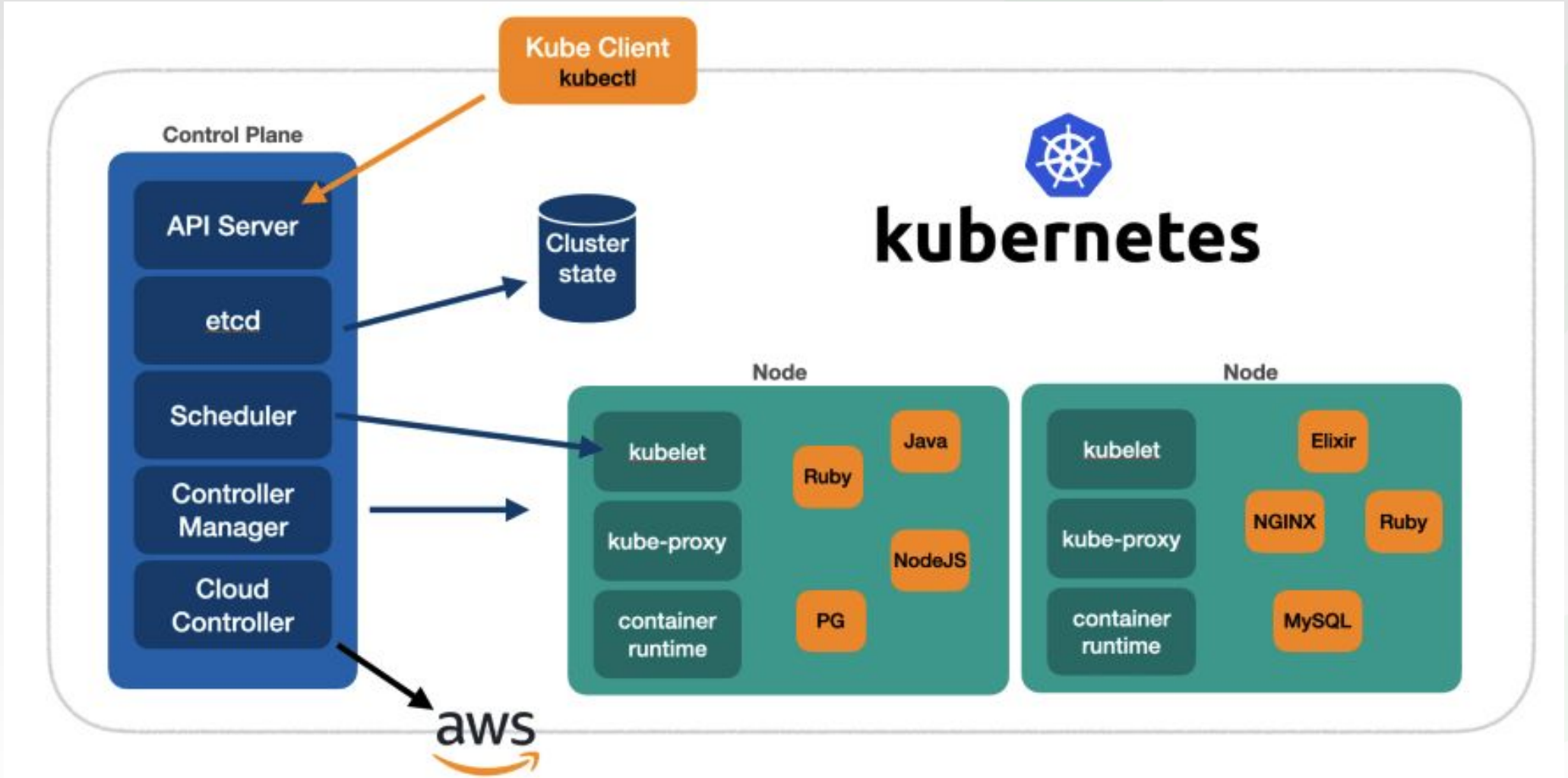
LESSON : **Kubernetes**

DATE : 22.05.2023

SUBJECT : **Networking**

ZOOM GİRİŞLERİNİZİ LÜTFEN **LMS** SİSTEMİ ÜZERİNDEN YAPINIZ

Kubernetes

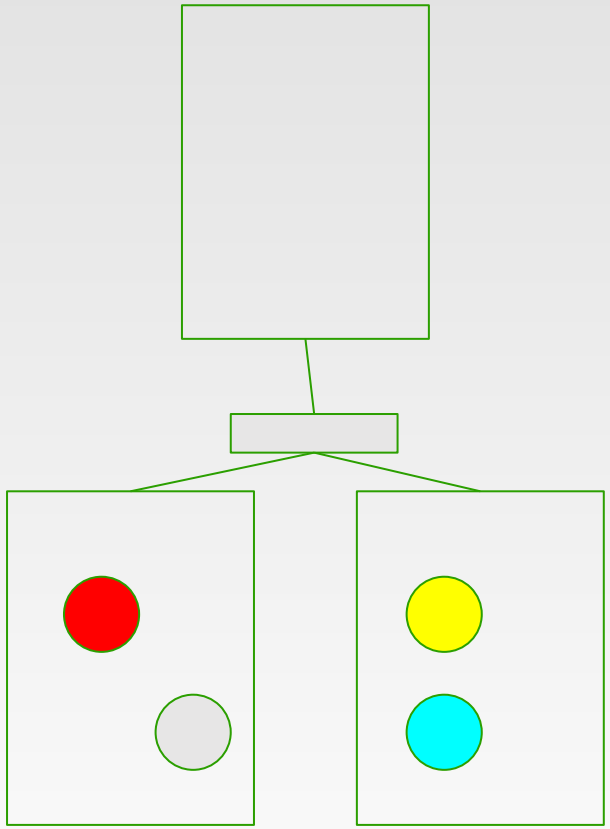

Kube Client
kubectl
Control Plane
API Server
etcd
Scheduler
Controller Manager
Cloud Controller
Cluster state
kubernetes
Node
kubelet
kube-proxy
container runtime
Ruby
Java
NodeJS
PG
Node
kubelet
kube-proxy
container runtime
Elixir
NGINX
Ruby
MySQL
aws

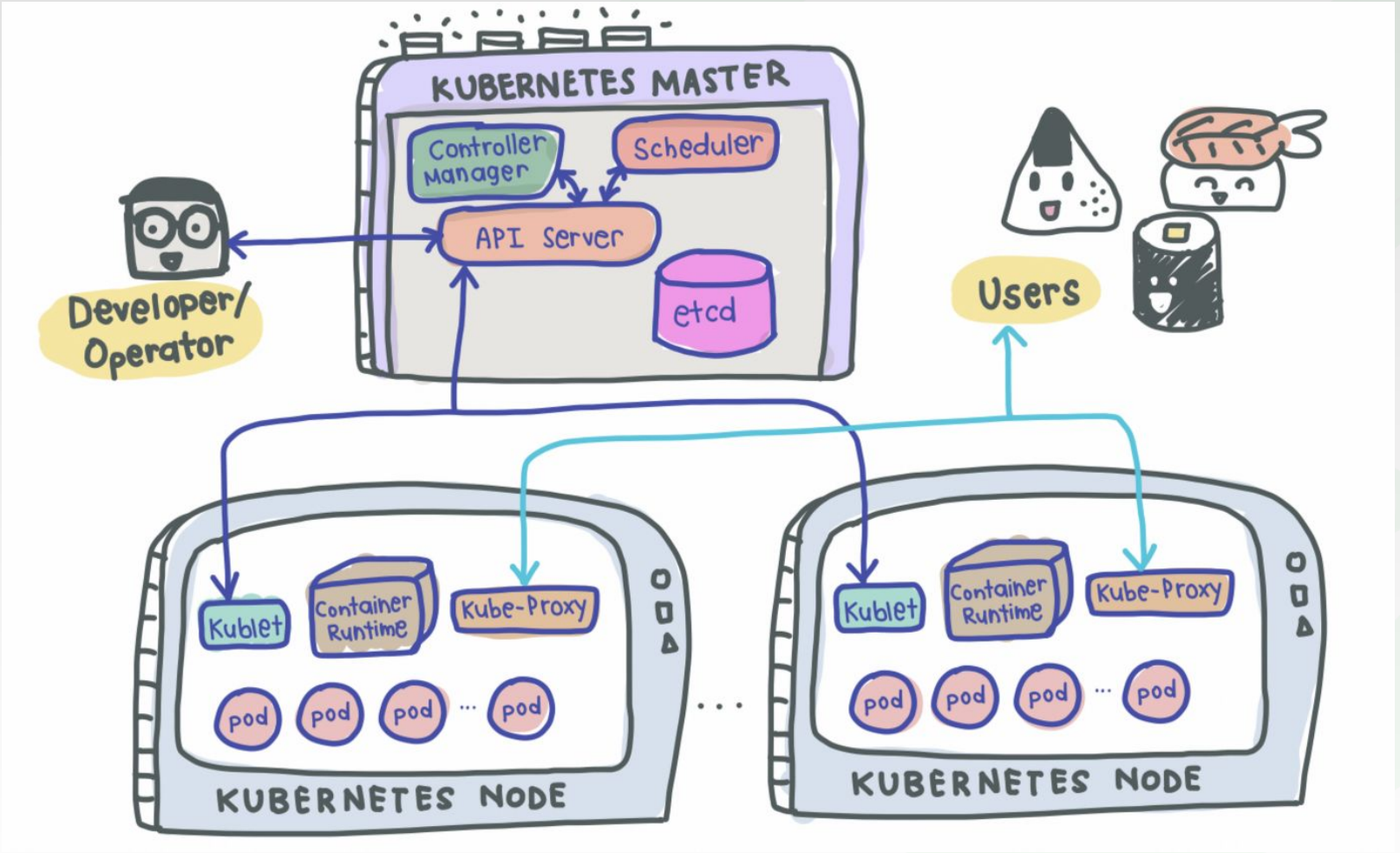
Review

In a K8s cluster:

○ I need to start a containerized app. Solution: use ..	Pod
○ I need to launch a containerized app of 10 replicas. Solution: use ..	ReplicaSet
○ I need to configure updates on a containerized app. Solution: use ..	Deployment
○ I need to make sure a specific group of Pods are run on a specific node.	Labels, Selectors
○ I need to separate resources of Java Dev from the rest of the team.	Namespaces

Cluster Networking





Cluster Networking

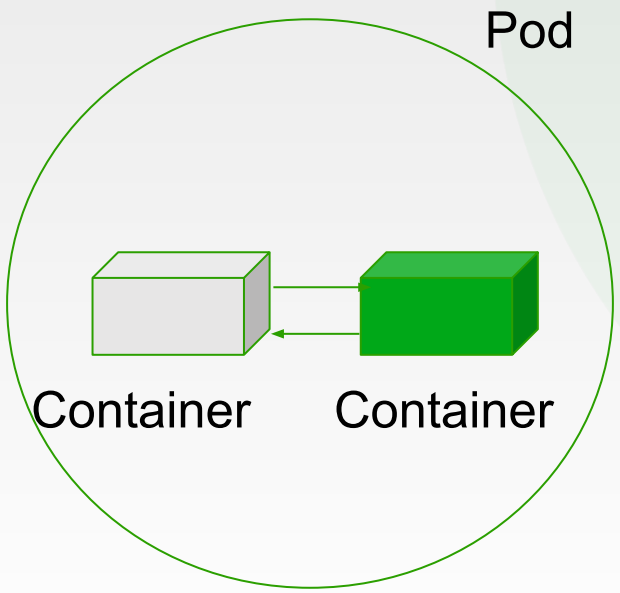
There are 4 distinct networking problems to address:

- Container-to-container communications:
- Pod-to-Pod communications:
- Pod-to-Service communications: this is covered by services.
- External-to-Service communications: this is covered by services.

Cluster Networking

- Container to Container

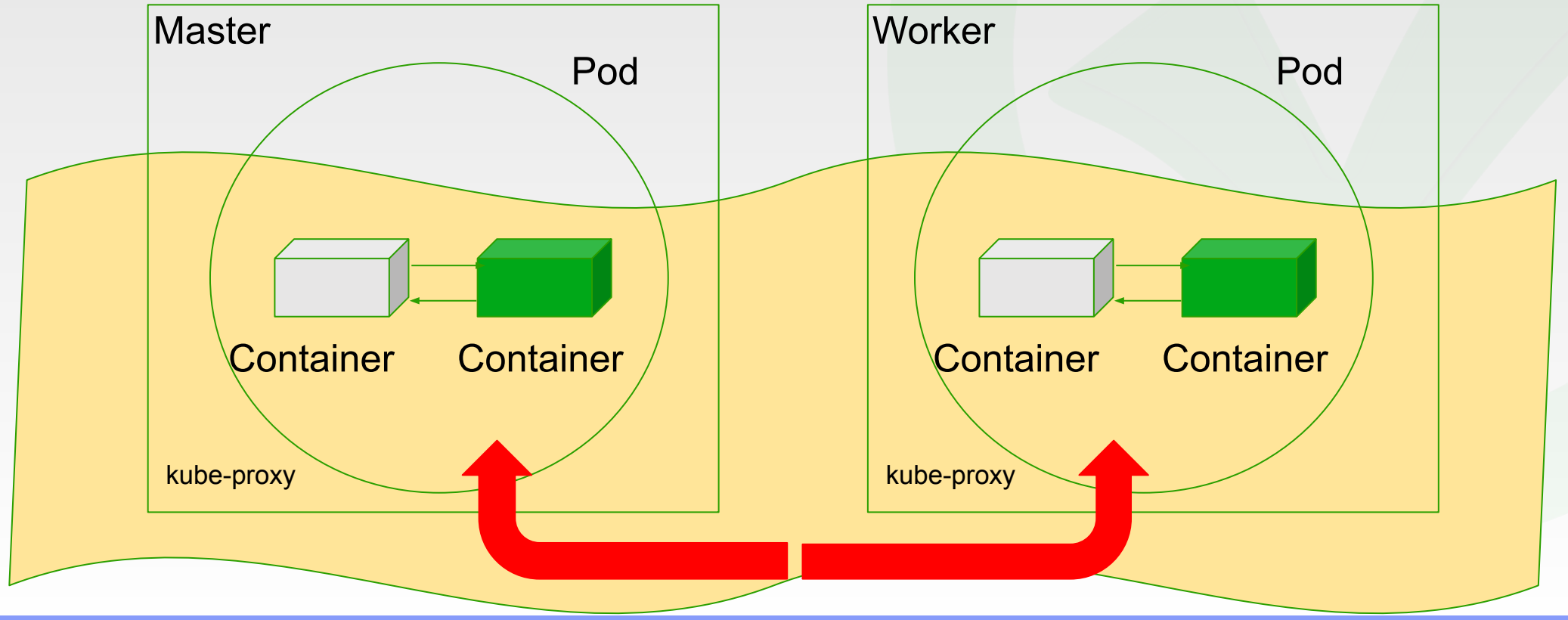
  Using “localhost:port”



Cluster Networking

- Pod to Pod

  Using networking plugins



Cluster Networking

- Pod to Pod
  - Using networking plugins
- CNI (Container Network Interface)

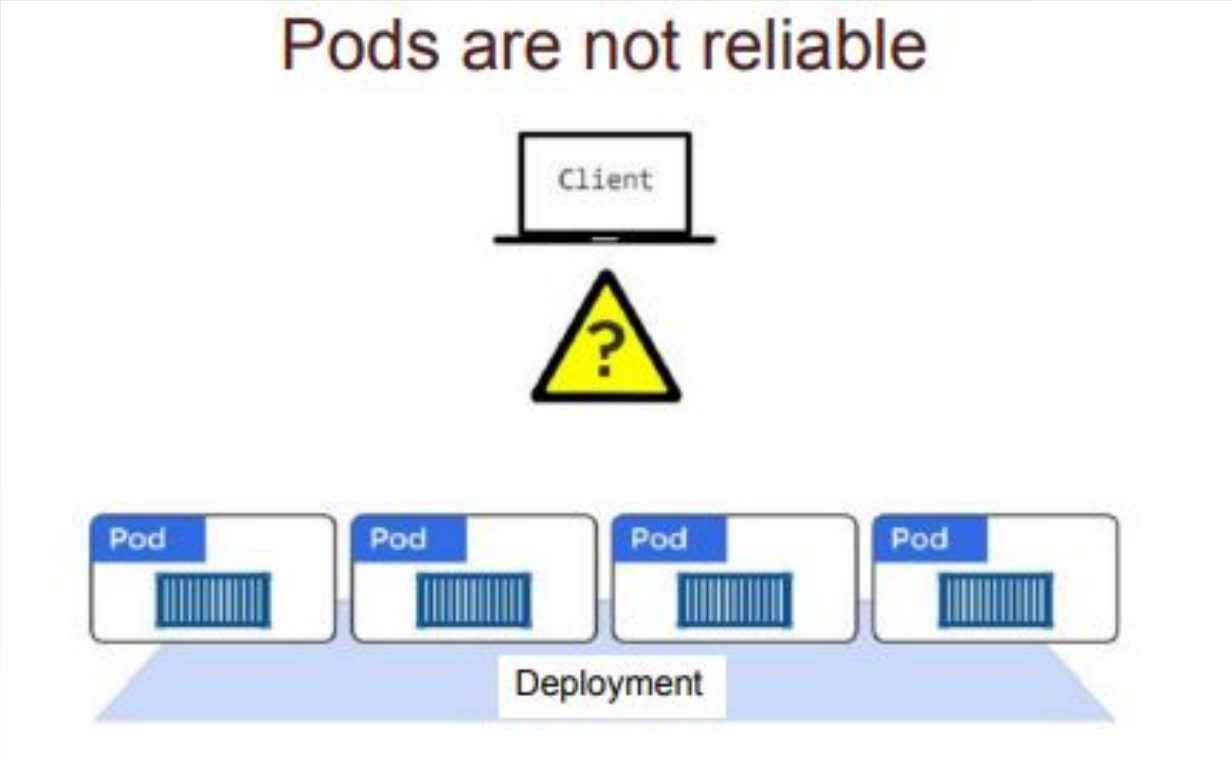
It is a framework for dynamically configuring networking resources.

Some common plugins: Calico, Flannel

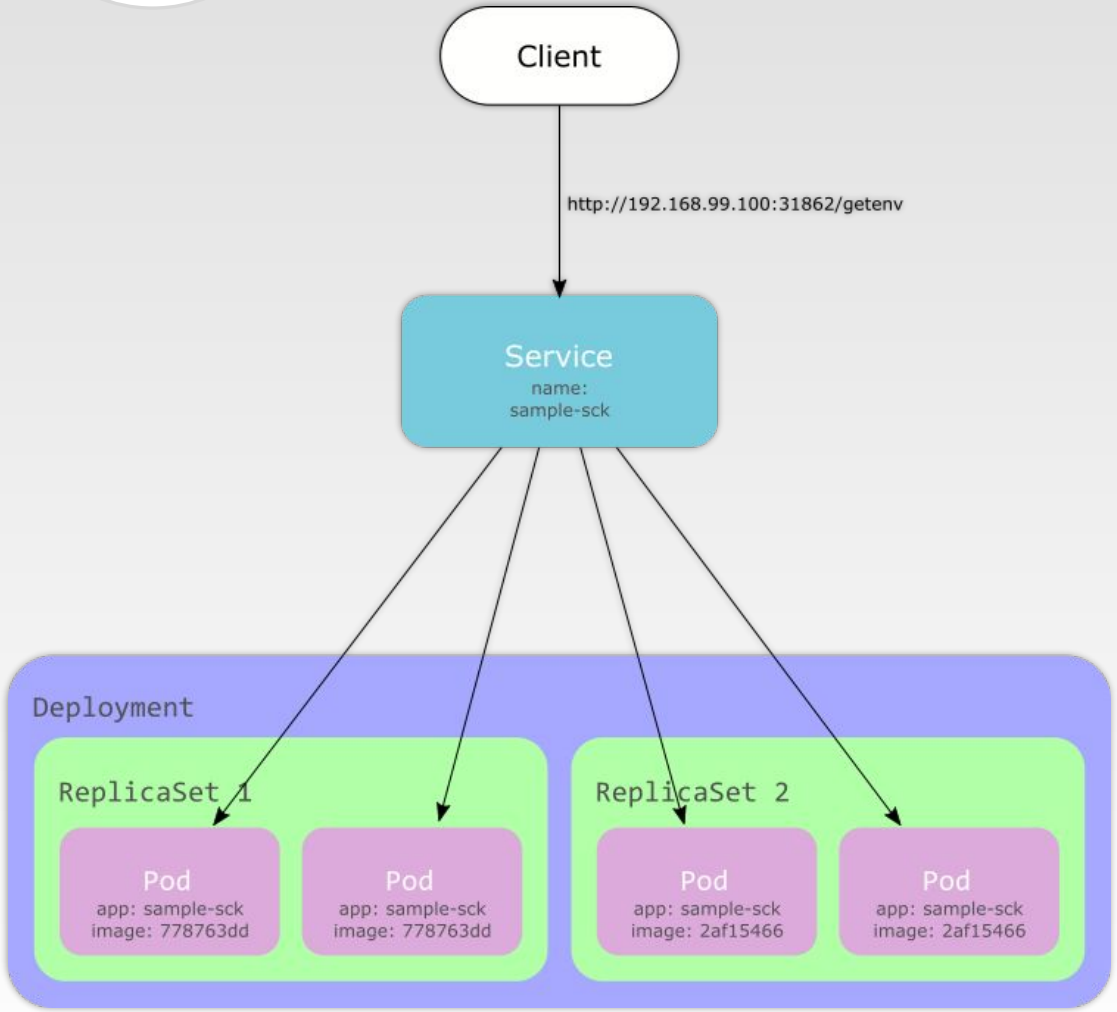
flannel

Services

Thanks to plugins, pods can communicate over IP addresses, however ..

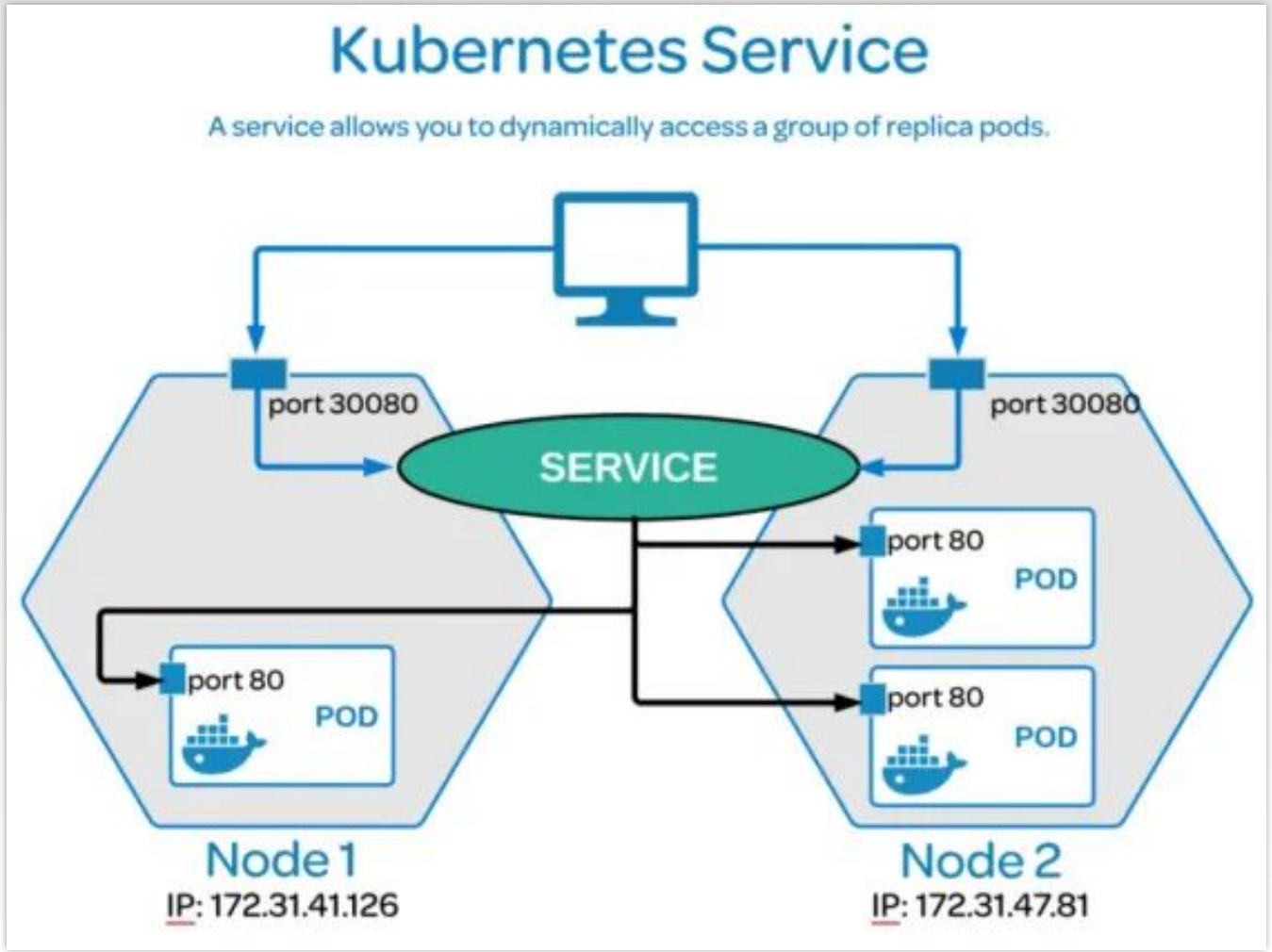


Services



- A Service offers a single DNS entry for a containerized application managed by the Kubernetes cluster.
- The Service is associated with the Pods, and provides them with a **stable IP,** DNS and port. It also **load-balances** requests across the Pods.
- Service **logically groups Pods** and defines a policy to access them. This grouping is achieved via **Labels and Selectors.**

Services



- Kubernetes Services enable communication between various components within and outside of the application.
- Kubernetes Services help us connect applications together with other applications or users.

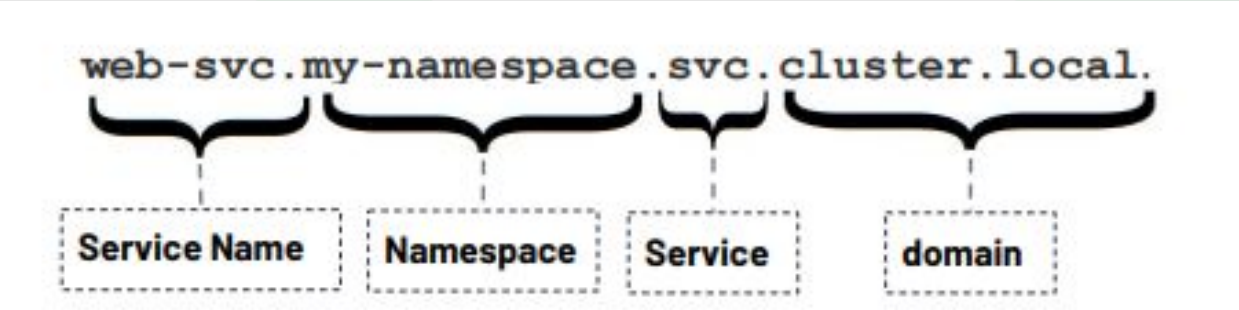
kube-proxy

Each cluster node runs a daemon called kube-proxy

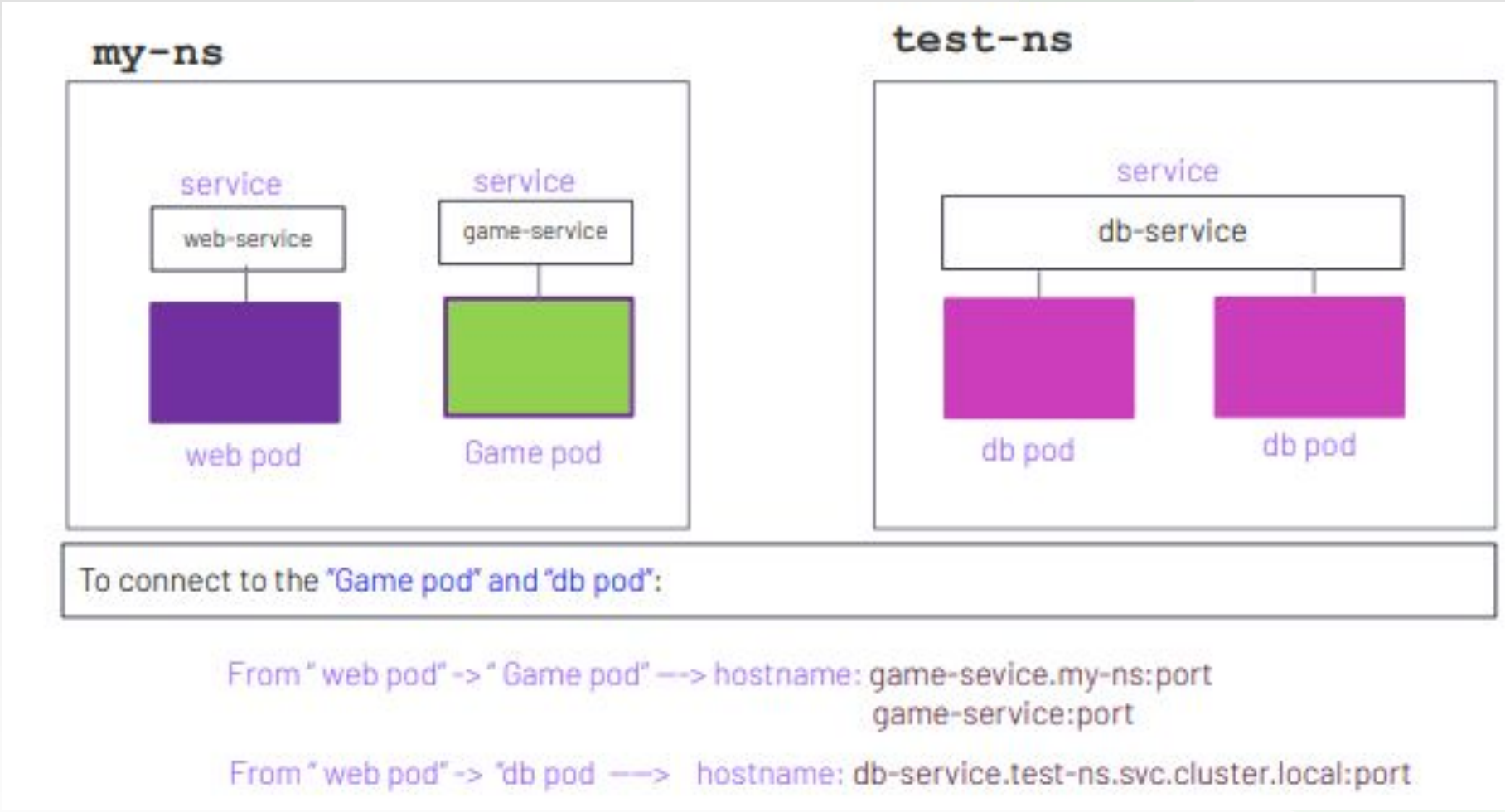
- kube-proxy is responsible for implementing the Service **configuration** on behalf of an administrator or developer
- For each new Service, on each node, kube-proxy configures **iptables rules** to capture the traffic for its ClusterIP and forwards it to one of the Service's endpoints.
- When the Service is removed, kube-proxy removes the corresponding iptables rules on all nodes as well.
- If **kube-proxy fails** the node goes into **Not Ready** state

Service Discovery

- Kubernetes has an **add-on for DNS**, which creates a DNS record for each Service and its format is



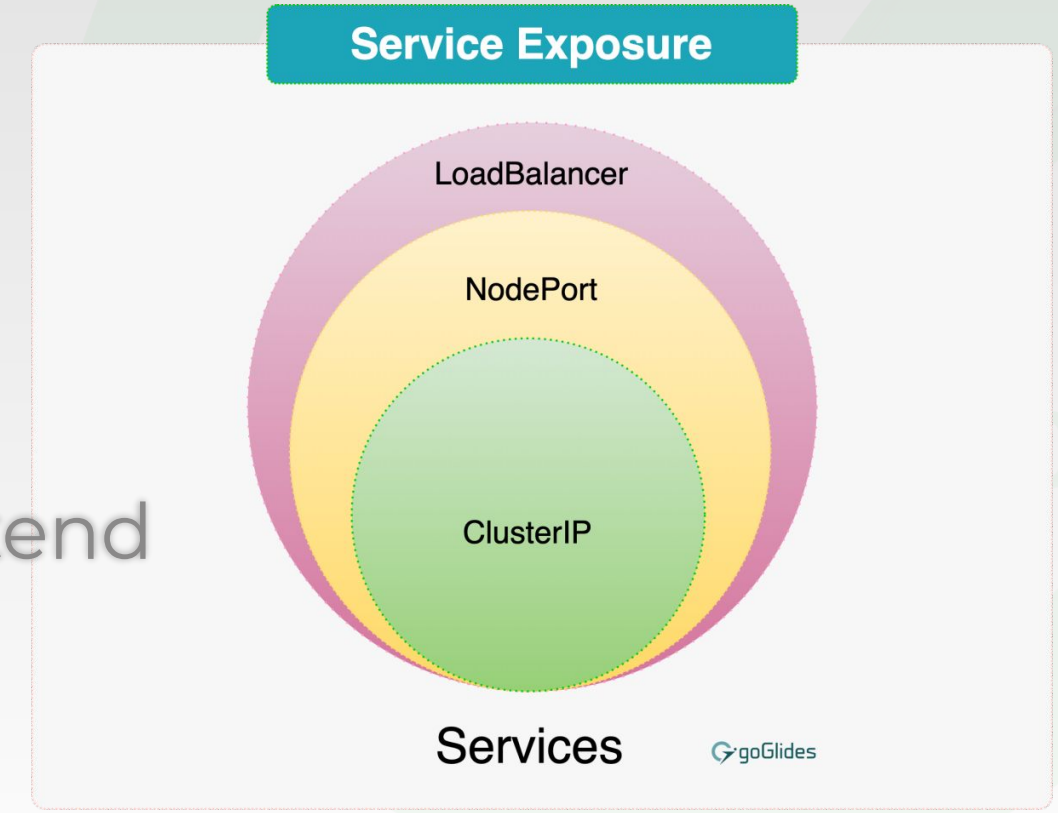
- Services within the same Namespace **find other Services just by their names**.
- If we add a Service redis-master in my-ns Namespace, all Pods in the same my-ns Namespace lookup the Service just by its name, ex. redis-master.


my-ns
test-ns
service
web-service
service
game-service
service
db-service
web pod
Game pod
db pod
db pod
To connect to the "Game pod" and "db pod":
From " web pod" -> " Game pod" —> hostname: game-sevice.my-ns:port
game-service:port
From " web pod" -> "db pod —> hostname: db-service.test-ns.svc.cluster.local:port

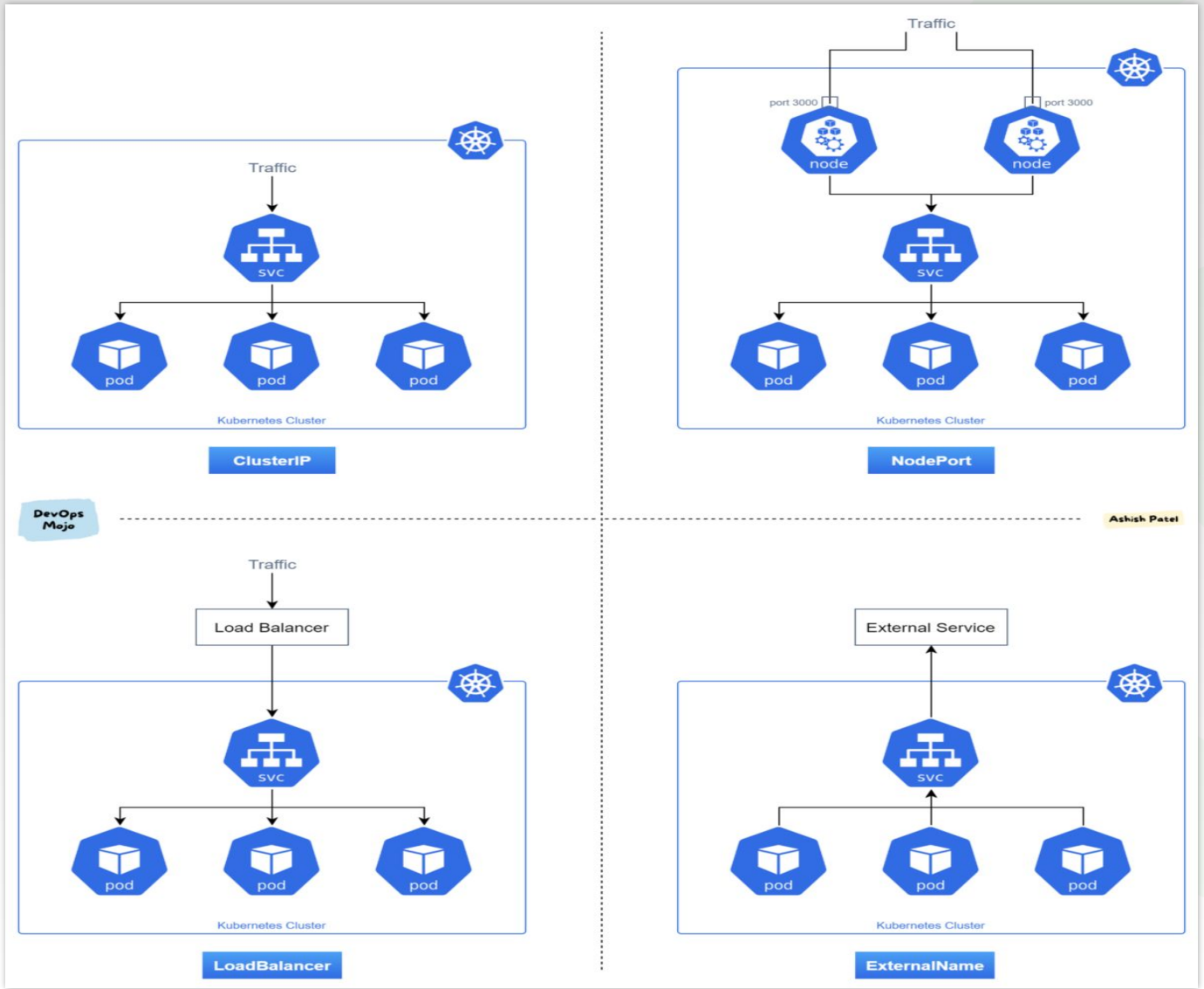
Service Types

There are 4 major service types:

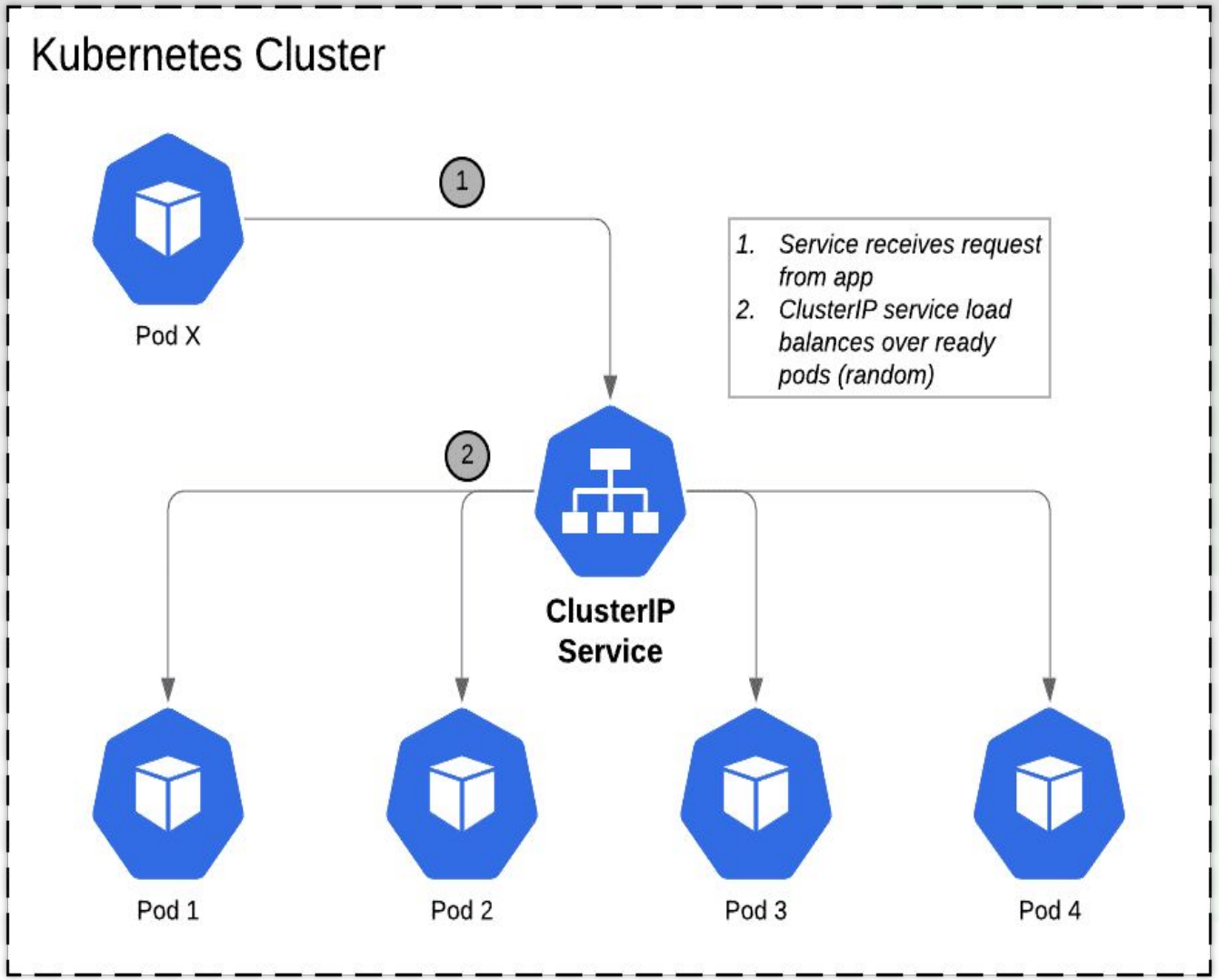
- ClusterIP (default)
  - **Network inside cluster**
- NodePort
  - **Network coming from**
    - Internet, usually for Frontend
- LoadBalancer
  - **Used by cloud provider**
- ExternalName



Service Types



Services


Kubernetes Cluster
Pod X
1
1. Service receives request from app
2. ClusterIP service load balances over ready pods (random)
2
ClusterIP Service
Pod 1
Pod 2
Pod 3
Pod 4

ClusterIP Service

```yaml
apiVersion: v1
kind: Service
metadata:
  name: example-prod
spec:
  selector:
    app: nginx
    env: prod
  ports:
  - protocol: TCP
    port: 80
    targetPort: 80
```

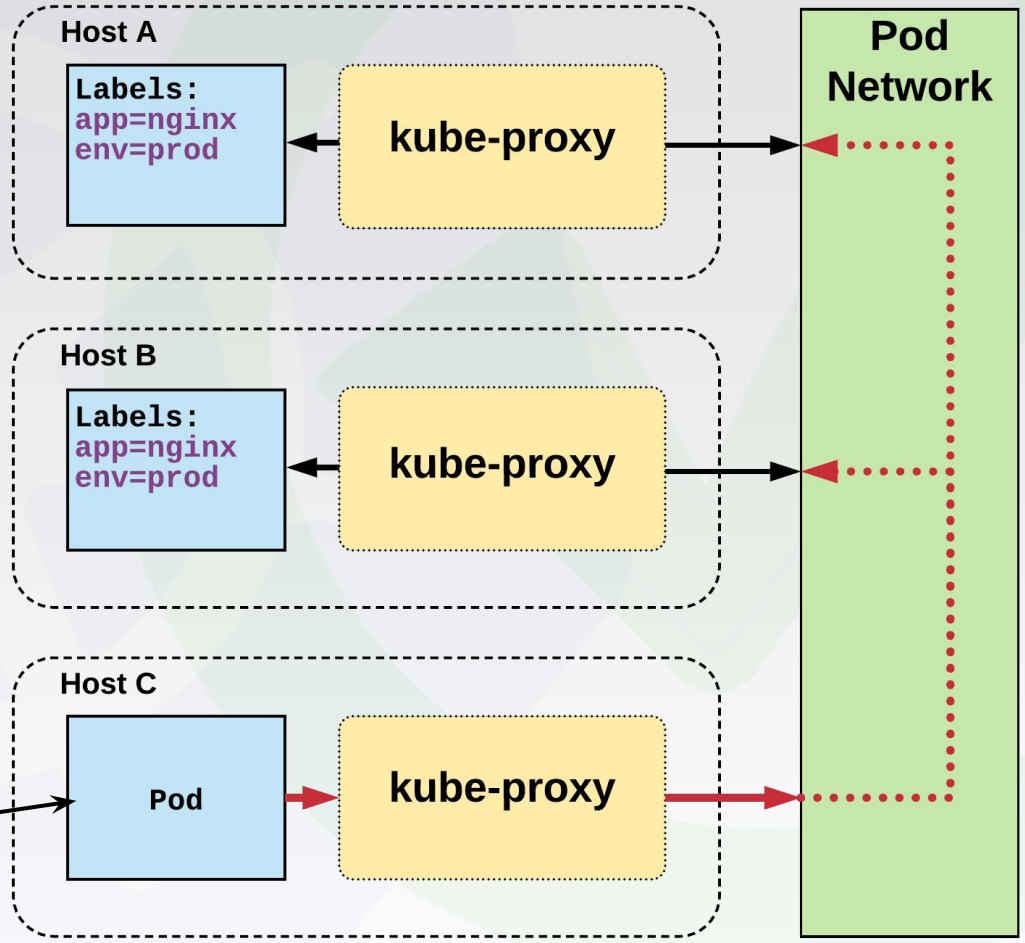
➔ **ClusterIP service exposes a service on a strictly cluster internal virtual IP.**

Cluster IP Service

```
Name:              example-prod
Selector:          app=nginx,env=prod
Type:              ClusterIP
IP:                10.96.28.176
Port:              <unset>  80/TCP
TargetPort:        80/TCP
Endpoints:         10.255.16.3:80,
                   10.255.16.4:80
```

```
/ # nslookup example-prod.default.svc.cluster.local

Name:      example-prod.default.svc.cluster.local
Address 1: 10.96.28.176
example-prod.default.svc.cluster.local
```



NodePort Service

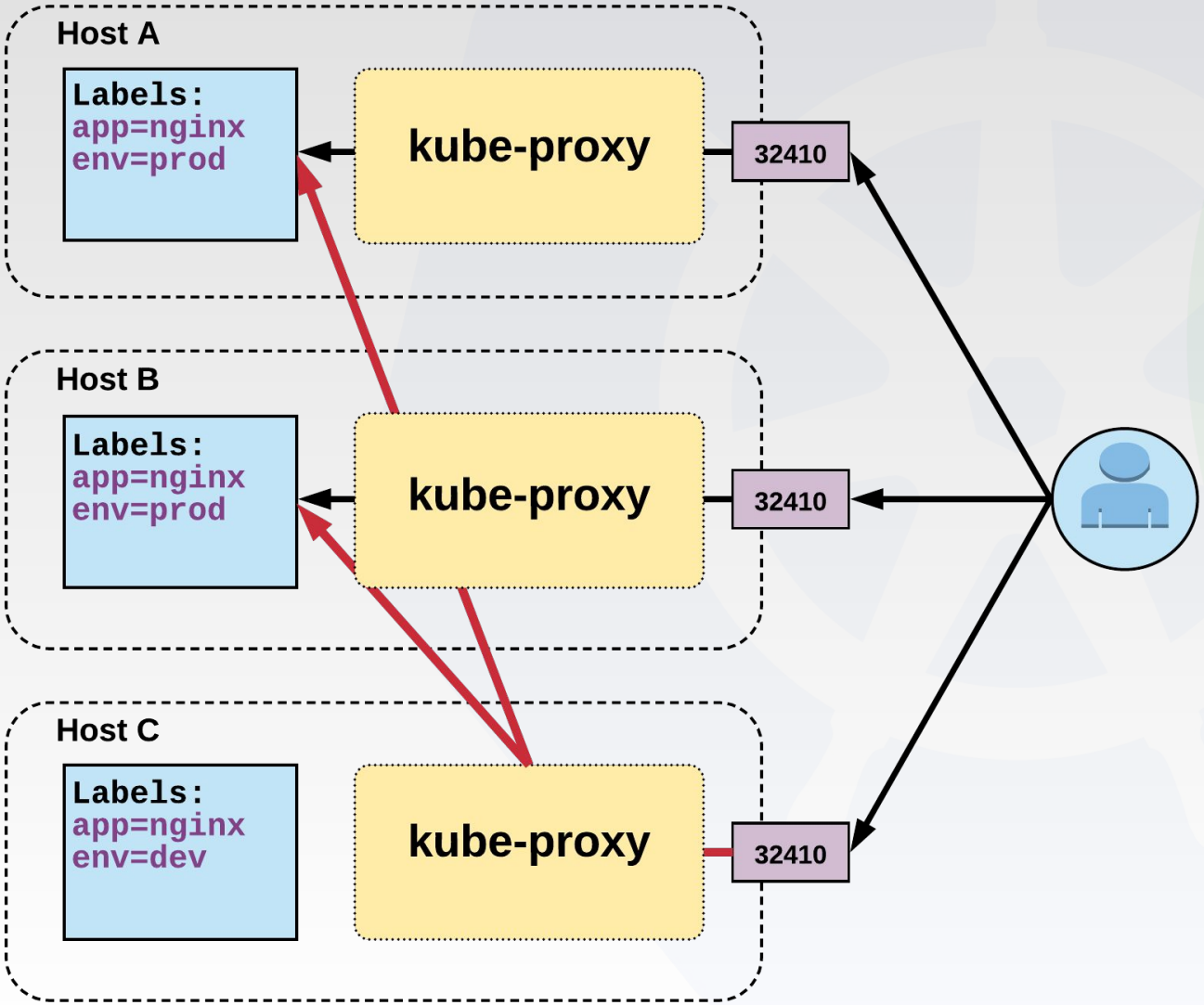
```yaml
apiVersion: v1
kind: Service
metadata:
  name: example-prod
spec:
  type: NodePort
  selector:
    app: nginx
    env: prod
  ports:
  - nodePort: 32410
    protocol: TCP
    port: 80
    targetPort: 80
```

→ NodePort services extend the ClusterIP service.

→ Exposes a port on every node's IP.

→ Port can either be statically defined, or dynamically taken from a range between 30000-32767.

NodePort Service



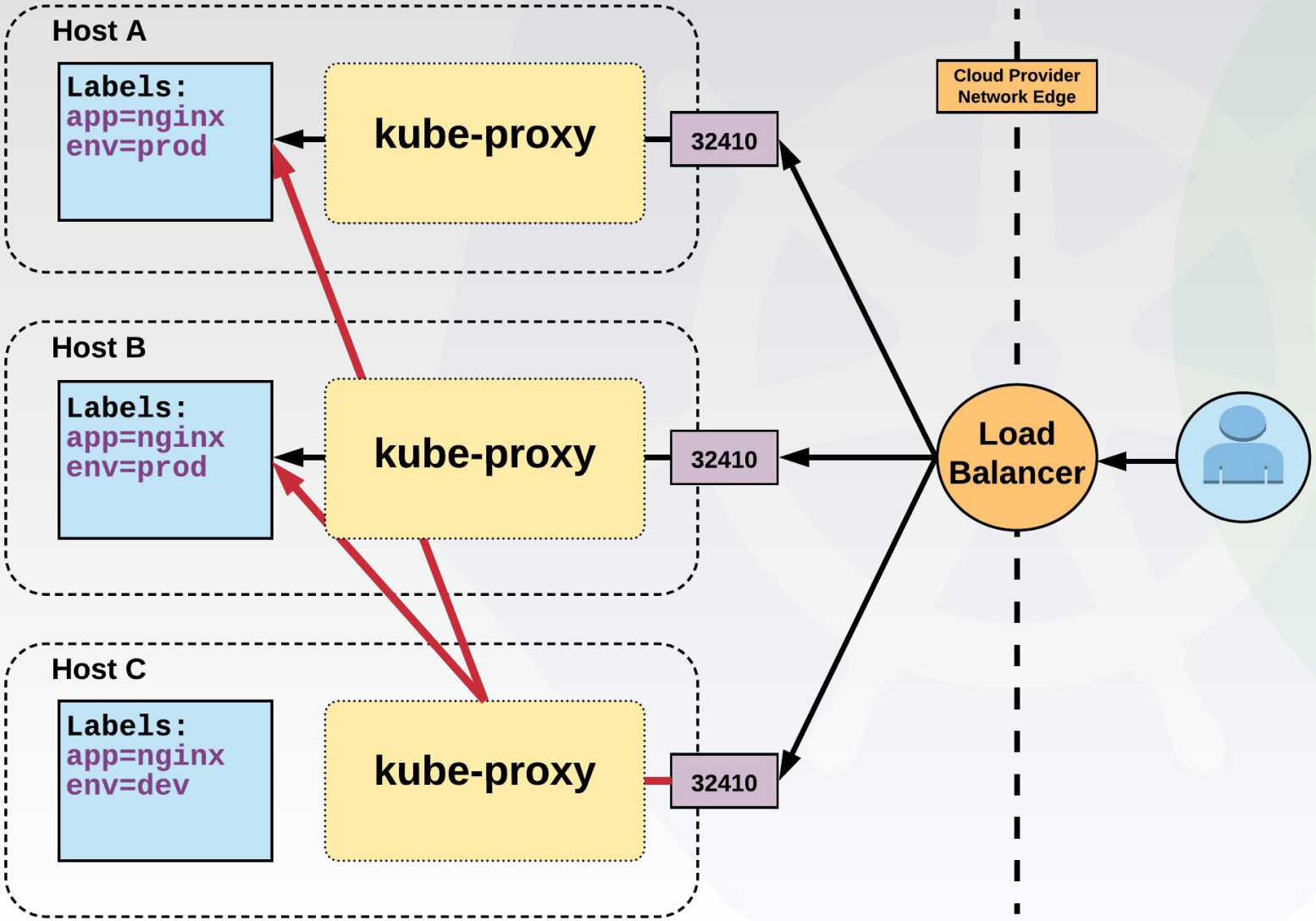

```
Name:           example-prod
Selector:       app=nginx,env=prod
Type:           NodePort
IP:             10.96.28.176
Port:           <unset>  80/TCP
TargetPort:     80/TCP
NodePort:       <unset>  32410/TCP
Endpoints:      10.255.16.3:80,
                10.255.16.4:80
```

LoadBalancer Service

```yaml
apiVersion: v1
kind: Service
metadata:
  name: example-prod
spec:
  type: LoadBalancer
  selector:
    app: nginx
    env: prod
  ports:
    protocol: TCP
    port: 80
    targetPort: 80
```

- **LoadBalancer** services extend **NodePort.**
- Works in conjunction with an external system (cloud providers) to map a cluster external IP to the exposed service.

LoadBalancer Service




```
Name:           example-prod
Selector:       app=nginx,env=prod
Type:           LoadBalancer
IP:             10.96.28.176
LoadBalancer
Ingress:        172.17.18.43
Port:           <unset>  80/TCP
TargetPort:     80/TCP
NodePort:       <unset>  32410/TCP
Endpoints:      10.255.16.3:80,
                10.255.16.4:80
```

ExternalName Service

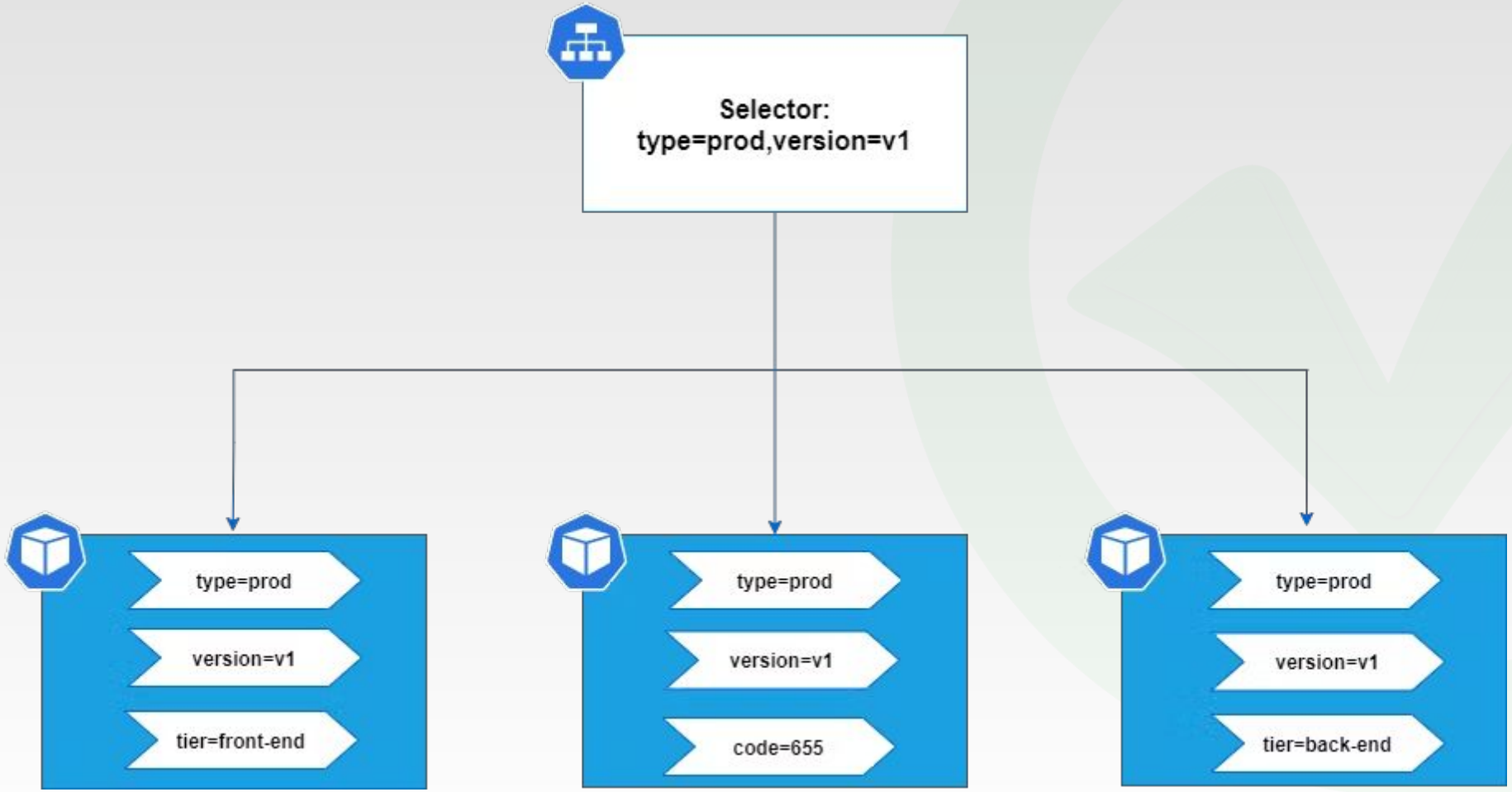
- **ExternalName** is used to reference endpoints **OUTSIDE** the cluster.
- Creates an internal **CNAME** DNS entry that aliases another.

```
apiVersion: v1
kind: Service
metadata:
  name: example-prod
spec:
  type: ExternalName
spec:
  externalName: example.com
```

Labels and loose coupling

- Labels and Selectors use a key/value pair format.
- Pods and Services are loosely coupled via labels and label selectors.
- For a Service to match a set of Pods, and therefore provide stable networking and load-balance, it only needs to match some of the Pods labels.
- However, for a Pod to match a Service, the Pod must match all of the values in the Service's label selector.

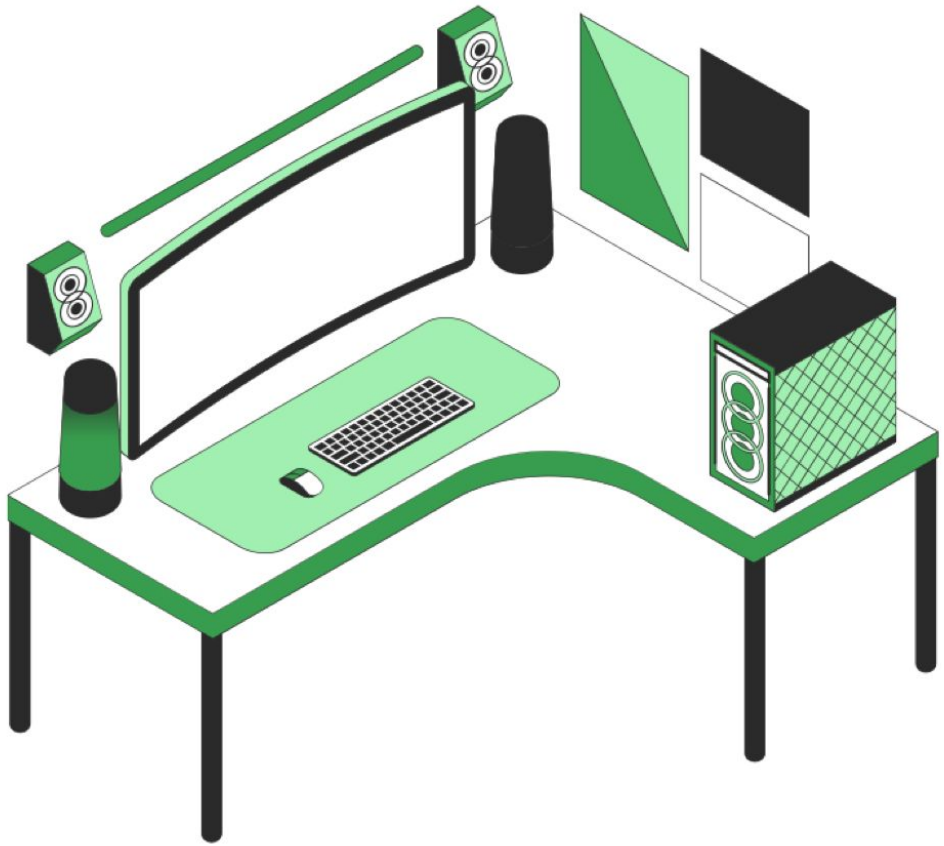
Labels and loose coupling



Summary

In a K8s cluster:

○ For communication inside cluster use service ..	ClusterIP
○ For traffic coming out of the cluster use ..	NodePort
○ For traffic coming out of the cloud cluster use ..	LoadBalancer
○ For the service to pick up the proper pods use ..	Labels, Selectors



Do you have any questions?

Send it to us! We hope you learned something new.