Managing Ingress Traffic Patterns for Kubernetes Services

USING THE KUBERNETES SERVICE API OBJECT TO EXPOSE WORKLOADS

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What Is Ingress?

Enabling Traffic

Opening the cluster to receive external traffic

Traffic Routing

Defining traffic routes to backend services

Traffic Reliability

Ensuring reliable, secure communication

Modul
e
Outline

Networking in Kubernetes

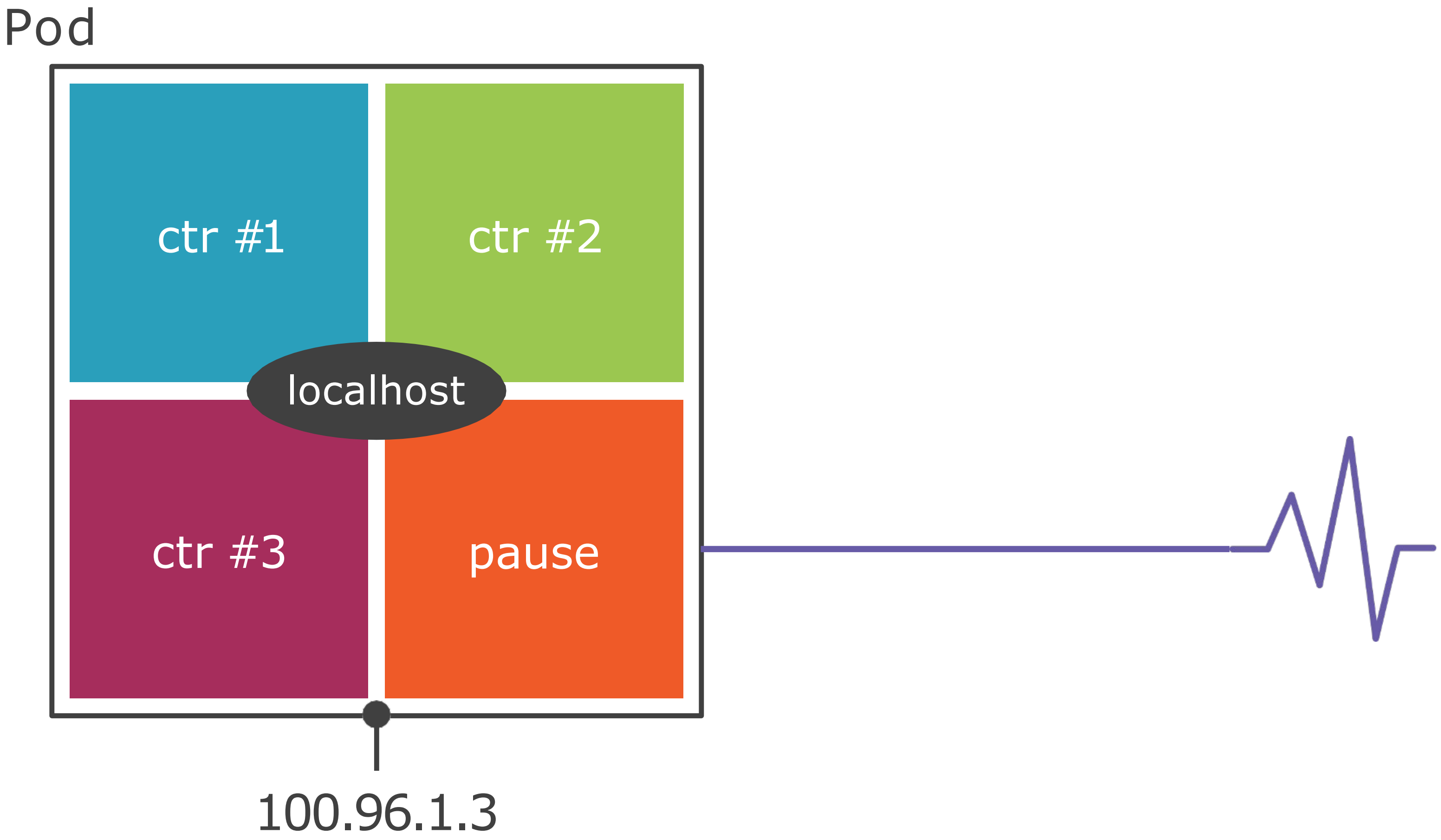
Abstracting pod workloads as services

Using the Service API to manage ingress

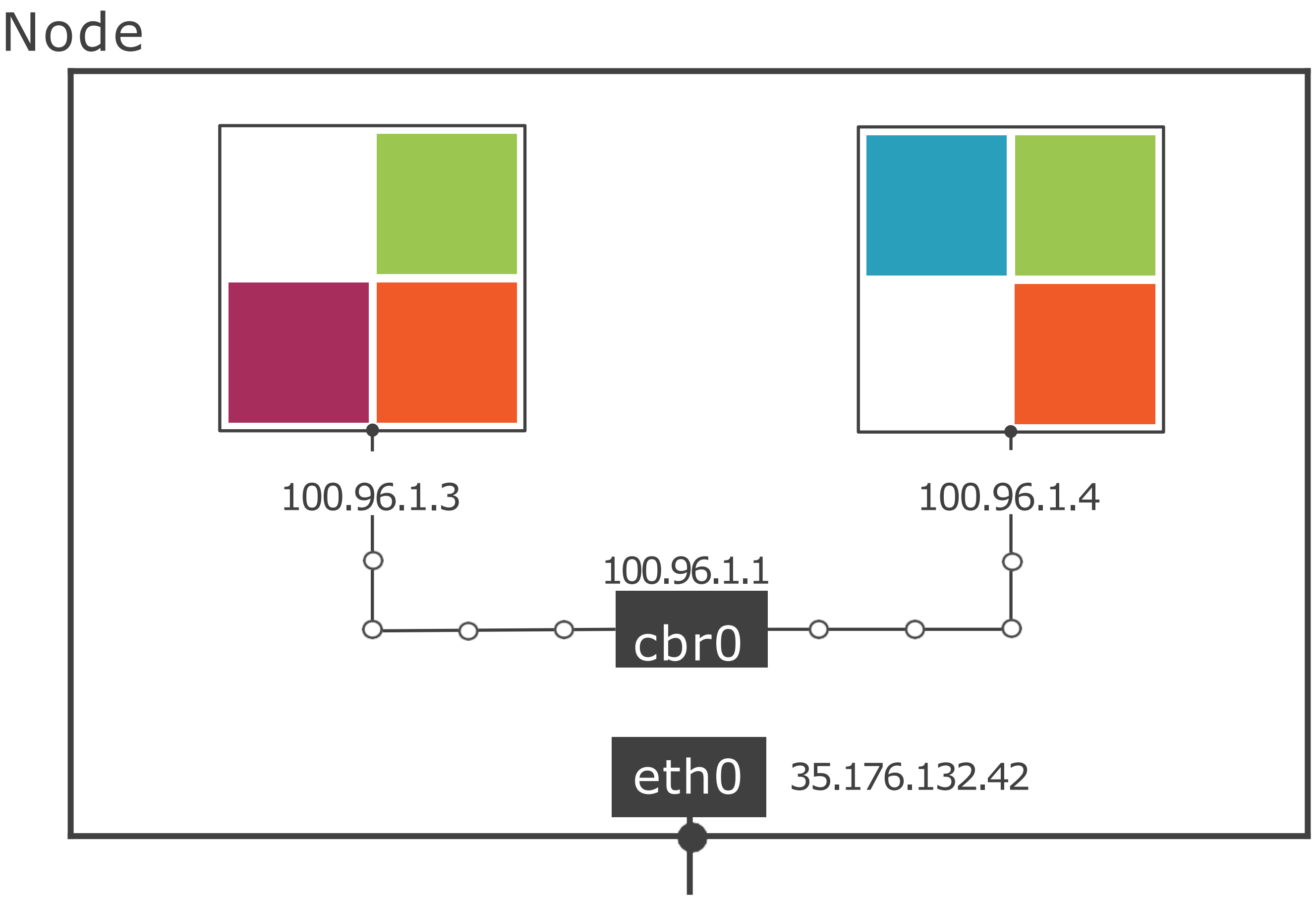
Exposing workloads with the Service API

The limitations of the Service API

Container Networking



Pod Networking – Same Node



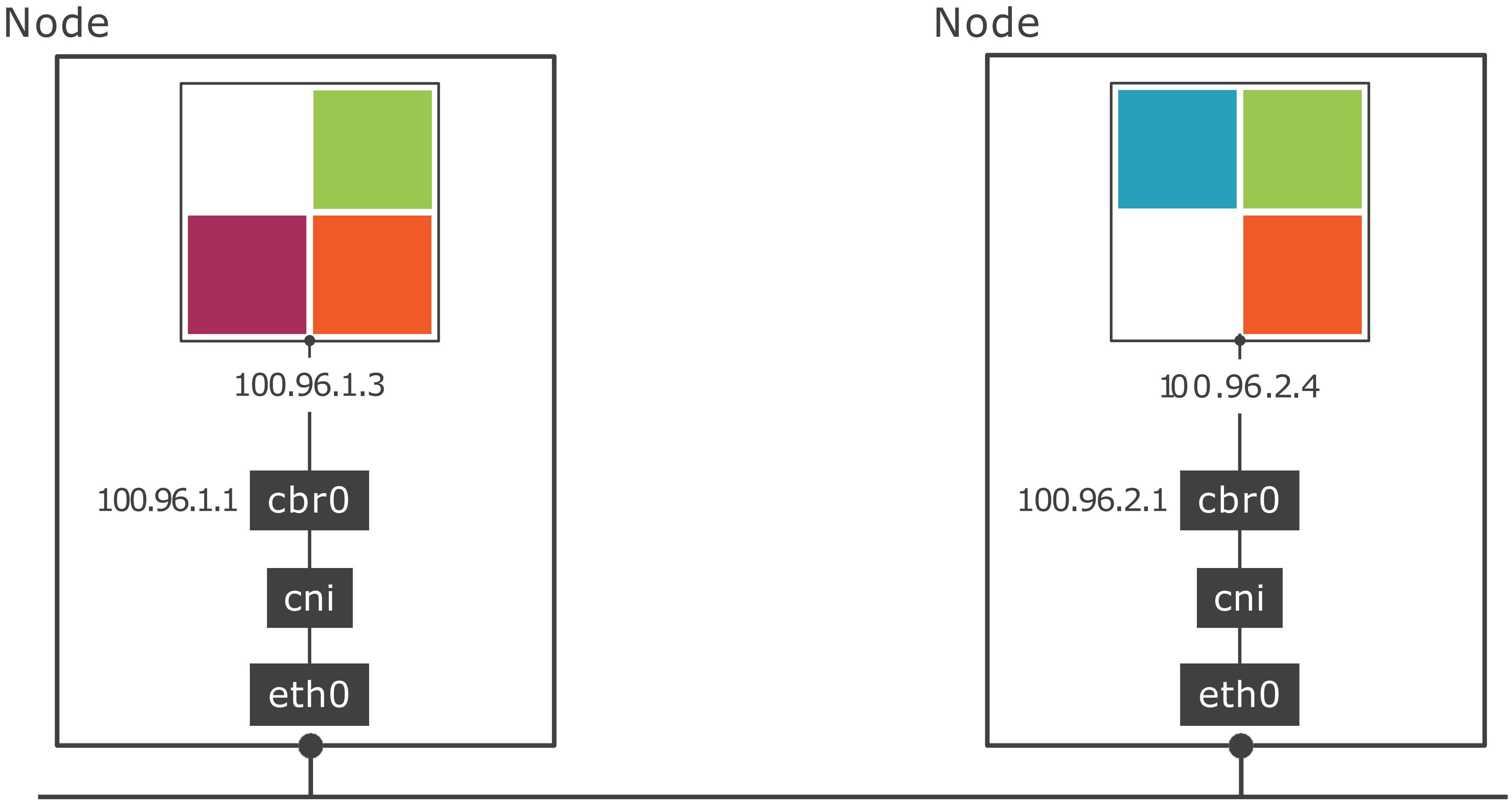
Kubernetes Networking Rules

All pods can communicate with all other pods without Network Address Translation (NAT)

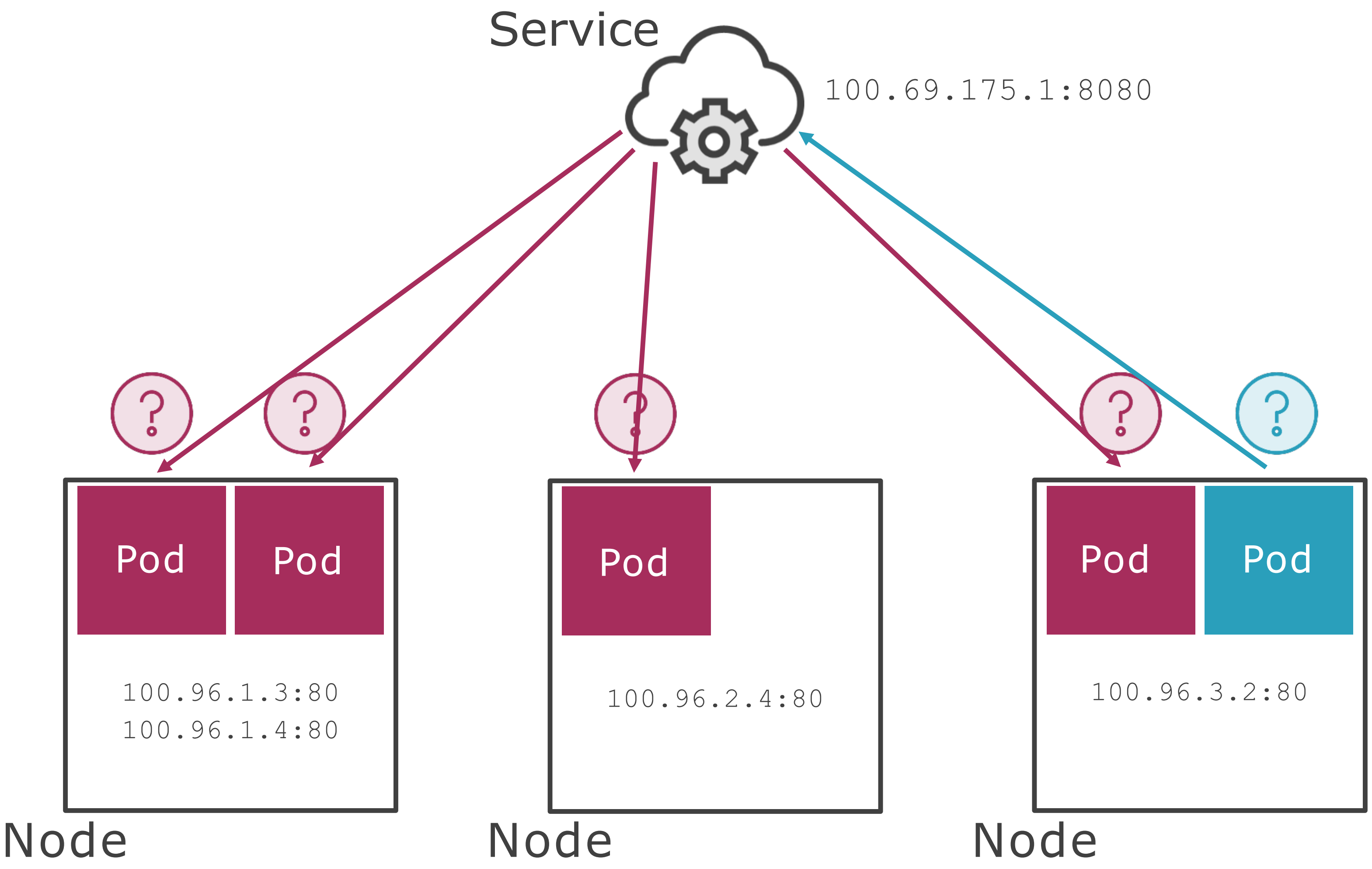
All nodes can communicate with all pods (and vice-versa) without NAT

The IP address that a pod sees itself as, is the same IP address that others see it as

Pod Networking – Across Nodes



Using the Service Abstraction



```
apiVersion: v1
kind: Service
metadata:
  labels:
    app: nginx
  name: nginx
spec:
  clusterIP: 100.69.175.1
  ports:
  - port: 8080
    protocol: TCP
    targetPort: 80
  selector:
    app: nginx
type: ClusterIP
```

- The service’s virtual IP address
- Ports exposed by the service
- Labels used to select target pods
- Type defines how service is exposed

```
$ kubectl get endpoints nginx
NAME    ENDPOINTS                                   AGE
nginx   100.96.1.3:80,100.96.1.4:80,100.96.2.4:80   3h
```

Service Endpoints

Endpoints API objects hold information on each of a service’s pods

```
$ kubectl run -it --rm nwutils --restart=Never \
          --image=nbrown/nwutils -- nslookup nginx
Server:      10.96.0.10
Address:  10.96.0.10#53

Name: nginx.default.svc.cluster.local
Address: 100.69.175.1
```

Service Discovery

Services can be found using environment variables, but …

… it’s better to rely on an in-cluster DNS for looking up services

Proxying Traffic to Service Endpoints

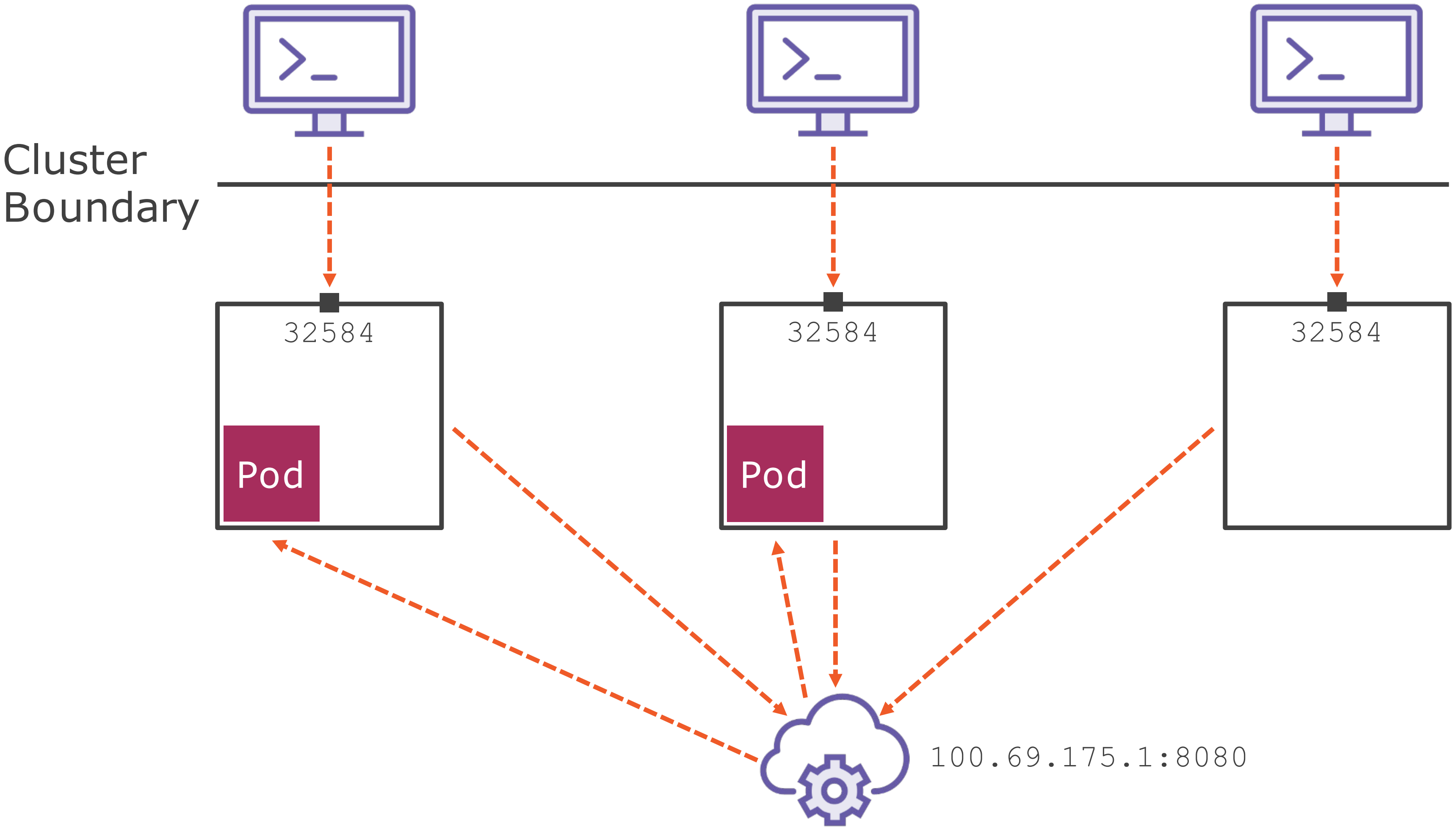
The kube-proxy is the cluster component that enables traffic routing

It load balances traffic between pods using iptables or IP Virtual Server (IPVS)

It watches for state change, and re-defines the proxy configuration accordingly

By default, services are isolated from clients external to the cluster

NodePort Type

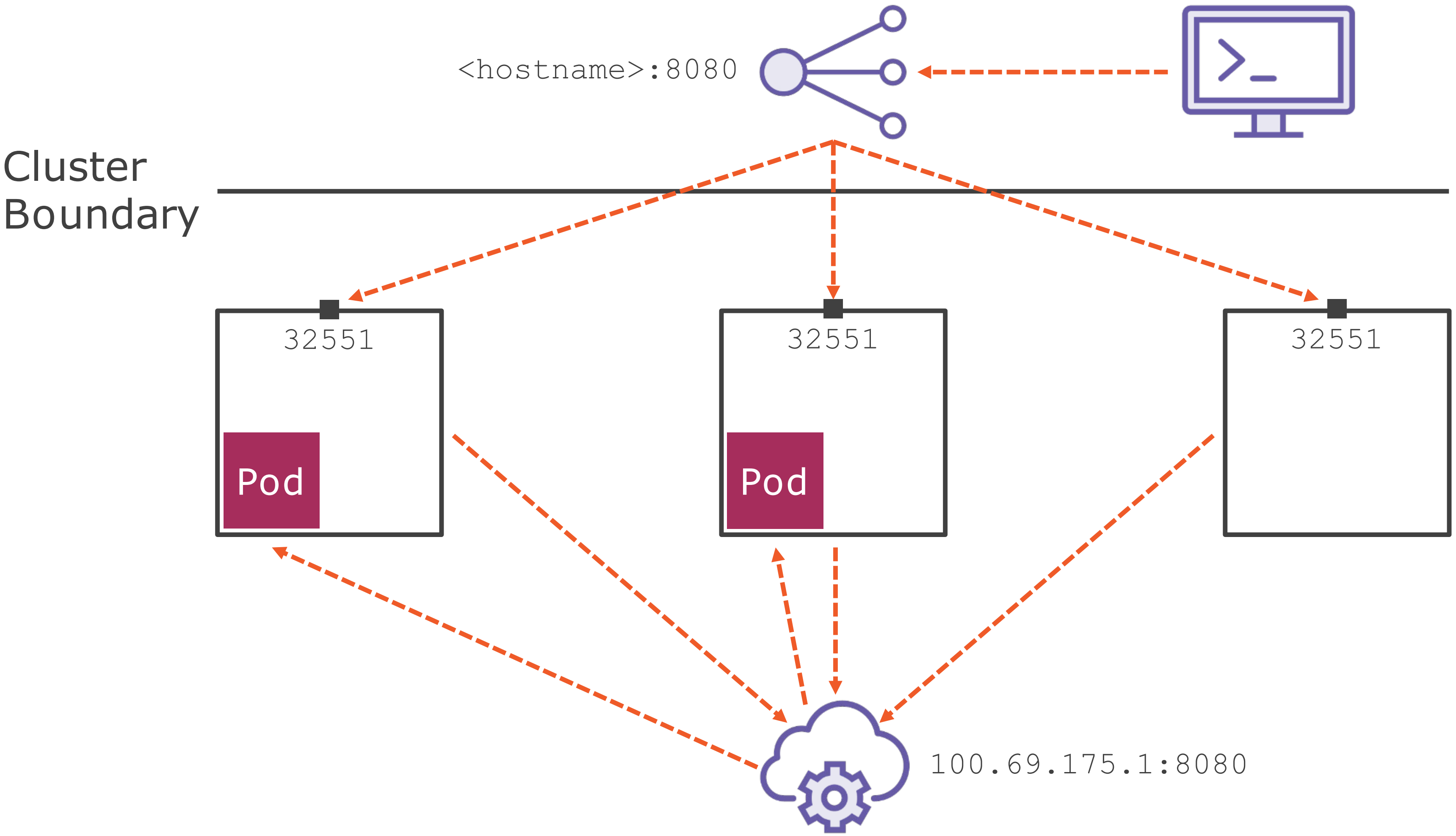


```yaml
apiVersion: v1
kind: Service
metadata:
  labels:
    app: nginx
  name: nginx
spec:
  clusterIP: 100.69.175.1
  externalTrafficPolicy: Cluster
  ports:
  - nodePort: 32584
    port: 8080
    protocol: TCP
    targetPort: 80
  selector:
    app: nginx
type: NodePort
```

- Service retains clusterIP
- Policy for traffic routing
- Node port for external traffic

- Service type set to NodePort

LoadBalancer Type



```
apiVersion: v1
kind: Service
metadata:
  labels:
    app: nginx
  name: nginx
spec:
  clusterIP: 100.69.175.1
  externalTrafficPolicy: Cluster
  ports:
  - nodePort: 32551
    port: 8080
    protocol: TCP
    targetPort: 80
  selector:
    app: nginx
type: LoadBalancer
  ingress:
  - hostname: ...
```

- Service retains clusterIP
- Policy for traffic routing
- Node port used by external load balancer

- Service type is LoadBalancer

Demo

How to expose a workload using a Service API object

Workload will be exposed in-cluster, before being configured for ingress

The Kubernetes cluster runs on the AWS cloud platform

Limitations of the Service API

- Manual configuration of load balancer when using NodePort type
- Potential latency due to the network hops introduced by kube-proxy
- A load balancer per service can quickly escalate operational costs
- The Service API cannot cater for advanced ingress traffic patterns

Module Summary

The Kubernetes Service API is built on top of a flat networking model

The Service API allows for abstracting replicated workloads

The Service API is able to cater for basic ingress requirements