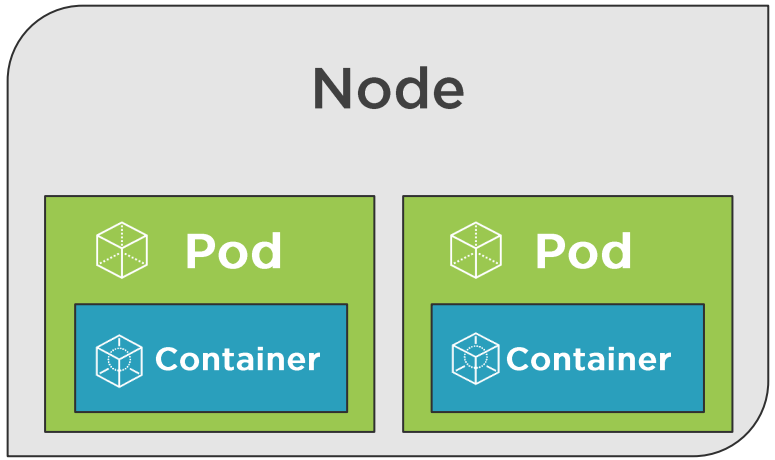
A Pod is the basic execution unit of a Kubernetes application–the smallest and simplest unit in the Kubernetes object model that you create or deploy.

Kubernetes Pods



Smallest object of the Kubernetes object model

Environment for containers

Organize application "parts" into Pods (server, caching, APIs, database, etc.)

Pod IP, memory, volumes, etc. shared across containers

Scale horizontally by adding Pod replicas

Pods live and die but never come back to life

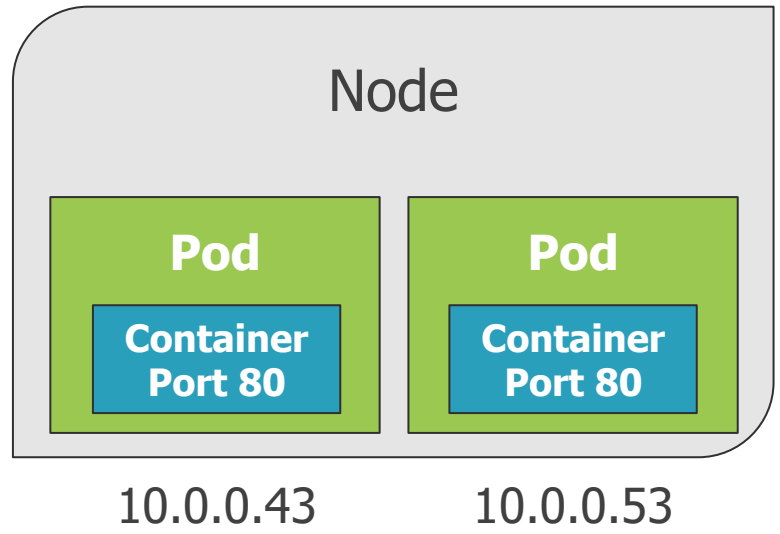
Pod containers share the same Network namespace (share IP/port)

Pod containers have the same loopback network interface (localhost)

Container processes need to bind to different ports within a Pod

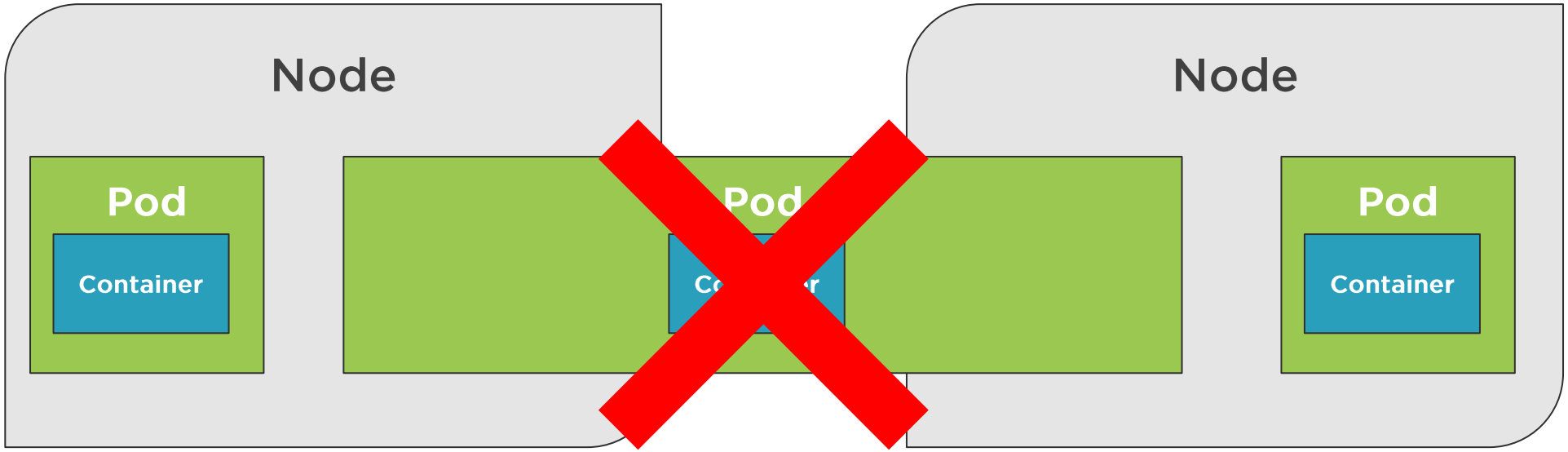
Ports can be reused by containers in separate Pods

Pods, IPs, and Ports



Nodes and Pods

Pods do not span nodes



Running a Pod

There are several different ways to schedule a Pod:

- **kubectl run command**
- **kubectl create/apply command with a yaml file**

```
# Run the nginx:alpine container in a Pod
kubectl run [podname] --image=nginx:alpine
```

```
# List only Pods
kubectl get pods

# List all resources
kubectl get all
```

Get Information about a Pod

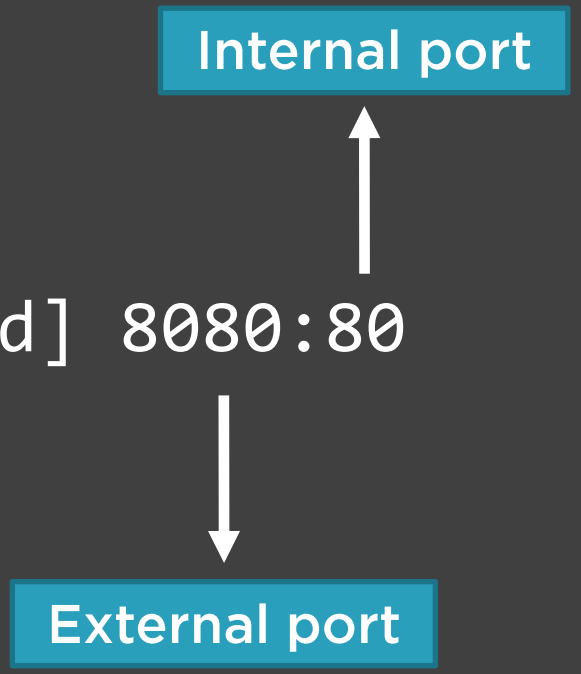
The kubectl get command can be used to retrieve information about Pods and many other Kubernetes objects

Expose a Pod Port

Pods and containers are only accessible within the Kubernetes cluster by default

One way to expose a container port externally: kubectl port-forward

```
# Enable Pod container to be
# called externally
kubectl port-forward [name-of-pod] 8080:80
```



```
# Will cause pod to be recreated
kubectl delete pod [name-of-pod]


# Delete Deployment that manages the Pod
kubectl delete deployment [name-of-deployment]
```

Deleting a Pod

Running a Pod will cause a Deployment to be created

To delete a Pod use kubectl delete pod or find the deployment and use kubectl delete deployment

```
kubectl run [pod-name] --image=nginx:alpine

kubectl get pods

kubectl port-forward [pod-name] 8080:80

kubectl delete pod [pod-name]
```

Working with Pods using kubectl

Different kubectl commands can be used to run, view, and delete Pods

YAML Review

YAML files are composed of maps and lists

Indentation matters (be consistent!)

Always use spaces

Maps:

- name: value pairs
- Maps can contain other maps for more complex data structures

Lists:

- Sequence of items
- Multiple maps can be defined in a list

Introduction to YAML

```
key: value
complexMap:
  key1: value
  key2:
    subKey: value
items:
  - item1
  - item2
itemsMap:
  - map1: value
    map1Prop: value
  - map2: value
    map2Prop: value
```

- YAML maps define a key and value
- More complicated map structures can be defined using a key that references another map
- YAML lists can be used to define a sequence of items
- YAML lists can define a sequence maps

Note:
- Indentation matters
- Use spaces NOT tabs

Defining a Pod with YAML

Pod

+ kubectl =

nginx.pod.yml

```
apiVersion: v1
kind: Pod
metadata:
  name: my-nginx
spec:
  containers:
  - name: my-nginx
    image: nginx:alpine
```

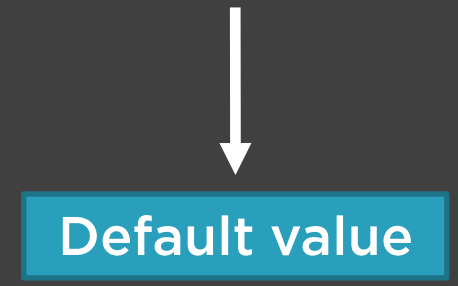
- Kubernetes API version
- Type of Kubernetes resource
- Metadata about the Pod
- The spec/blueprint for the Pod
- Information about the containers that will run in the pod

Creating a Pod Using YAML

To create a pod using YAML use the kubectl create command along with the --filename or -f switch

```
# Perform a "trial" create and also validate the YAML
kubectl create -f file.pod.yml --dry-run --validate=true


# Create a Pod from YAML
# Will error if Pod already exists
kubectl create -f file.pod.yml
```



Creating or Applying Changes to a Pod

To create or apply changes to a pod using YAML use the kubectl apply command along with the --filename or -f switch

```
# Alternate way to create or apply changes to a
# Pod from YAML
kubectl apply -f file.pod.yml

# Use --save-config when you want to use
# kubectl apply in the future
kubectl create –f file.pod.yml --save-config
```

Using kubectl create --save-config

```
apiVersion: v1

kind: Pod

metadata:

  annotations:
    kubectl.kubernetes.io/
    last-applied-configuration:
   {"apiVersion":"v1","kind":"Pod",
    "metadata":{
      "name": "my-nginx"
     ...
    }

   }

...
```

- **--save-config** causes the resource's configuration settings to be saved in the annotations
- Example of saved configuration
- Having this allows in-place changes to be made to a Pod in the future using **kubectl apply**

In-place/non-disruptive changes can also be made to a Pod using **kubectl edit** or **kubectl patch.**

Deleting a Pod

To delete a Pod use kubectl delete

```
# Delete Pod
kubectl delete pod [name-of-pod]

# Delete Pod using YAML file that created it
kubectl delete -f file.pod.yml
```

```
kubectl create –f nginx.pod.yml --save-config
kubectl describe pod [pod-name]
kubectl apply –f nginx.pod.yml
kubectl exec [pod-name] -it sh
kubectl edit -f nginx.pod.yml
kubectl delete –f nginx.pod.yml
```

Creating and Inspecting Pods with kubectl

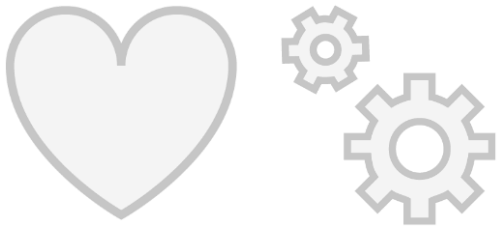
Several different commands can be used to create and modify Pods

Kubernetes relies on Probes to determine the health of a Pod container.

A Probe is a diagnostic performed periodically by the kubelet on a Container.

Types of Probes

Types of Probes



Liveness probes determine if a Pod is healthy and running as expected

Readiness probes determine if a Pod should receive requests

Failed Pod containers are recreated by default (**restartPolicy** defaults to **Always**)

ExecAction – Executes an action inside the container

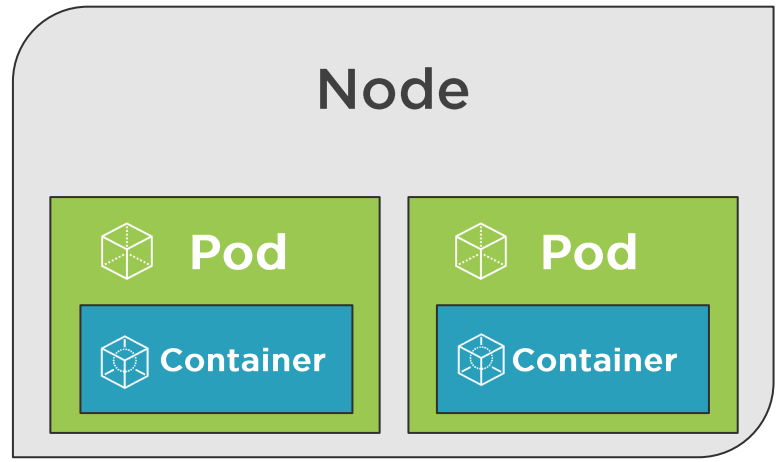
TCPSocketAction – TCP check against the container's IP address on a specified port

HTTPGetAction – HTTP GET request against container

Probes can have the following results:

- Success
- Failure
- Unknown

Probe Types



Defining an HTTP Liveness Probe

```
apiVersion: v1

kind: Pod

...

spec:
  containers:
  - name: my-nginx
    image: nginx:alpine
    livenessProbe:
      httpGet:
        path: /index.html
        port: 80
      initialDelaySeconds: 15
      timeoutSeconds: 2
      periodSeconds: 5
      failureThreshold: 1
```

- Define liveness probe
- Check /index.html on port 80
- Wait 15 seconds
- Timeout after 2 seconds
- Check every 5 seconds
- Allow 1 failure before failing Pod

Defining an ExecAction Liveness Probe

```
apiVersion: v1
kind: Pod
...
spec:
  containers:
  - name: liveness
    image: k8s.gcr.io/busybox
    args:
    - /bin/sh
    - -c
    - touch /tmp/healthy; sleep 30;
      rm -rf /tmp/healthy; sleep 600
    livenessProbe:
      exec:
        command:
        - cat
        - /tmp/healthy
      initialDelaySeconds: 5
      periodSeconds: 5
```

- Define args for container
- Define liveness probe
- Define action/command to execute

Defining a Readiness Probe

```
apiVersion: v1

kind: Pod

...

spec:
  containers:
  - name: my-nginx
    image: nginx:alpine
    readinessProbe:
      httpGet:
        path: /index.html
        port: 80
      initialDelaySeconds: 2
      periodSeconds: 5
```

- Define readiness probe
- Check /index.html on port 80

- Wait 2 seconds
- Check every 5 seconds

Readiness Probe:

When should a container start receiving traffic?

Liveness Probe:

When should a container restart?