Running and Managing Pods

Anthony E. Nocentino
ENTERPRISE ARCHITECT @ CENTINO SYSTEMS
@nocentino www.centinosystems.com

Course Overview

Using the Kubernetes API

Managing Objects with Labels, Annotations, and Namespaces

Running and Managing Pods

Overview

Understanding Pods

Controllers and Pods

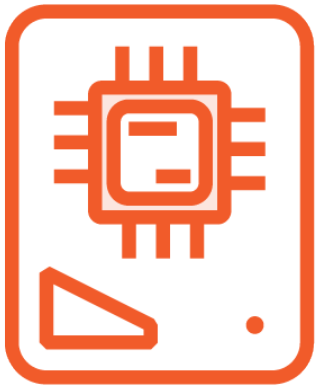
Multi-container Pods

Managing Pod Health with Probes

What Is a Pod?

Wrapper around your container based application

One or more containers



Resources

What Is a Pod? (con't)

Unit of scheduling

- **Allocating work**
- **A process that's running in your cluster**

Unit of deployment

- **Your application configuration**
- **Resources - Networking and Storage**

Why do we need Pods?

Provide higher level abstraction over a container for manageability

How Pods Manage Containers

Single Container Pods

Multi-Container Pods

Single Container Pods

Most common deployment scenario

Generally a single process running in a container

Often leads to easier application scaling

Controllers and Pods

Controllers keep your apps in the desired state

Responsible for starting and stopping Pods

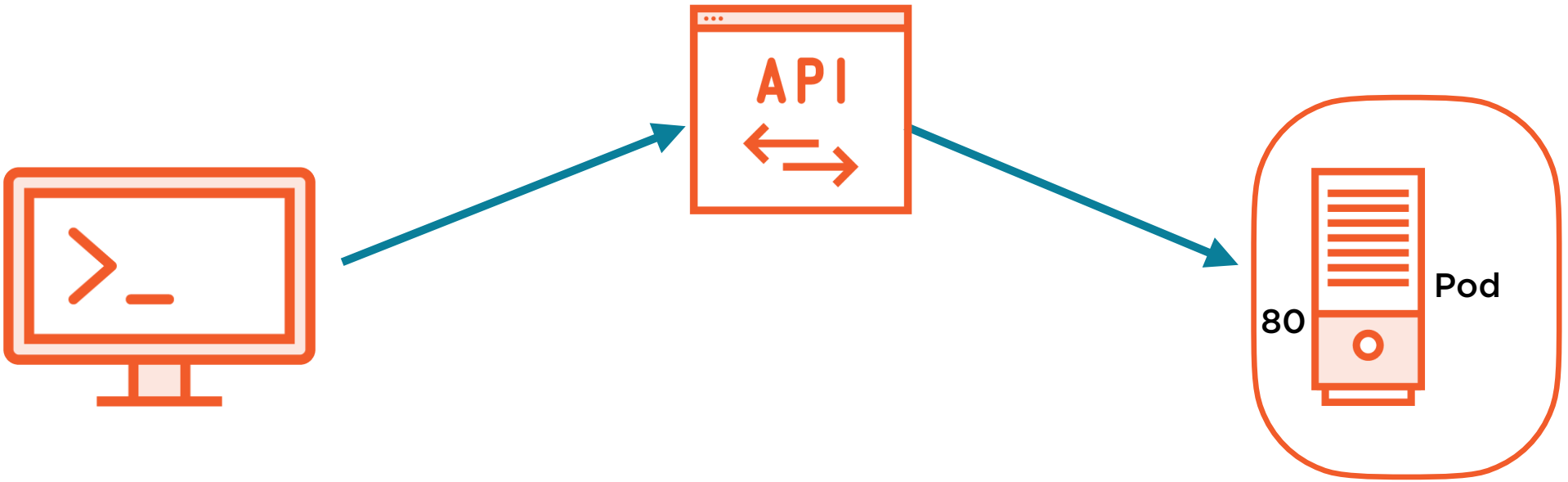
Application scaling

Application recovery

You don’t want to run bare/naked Pods

They won’t be recreated in the event of a failure

Working with Pods - kubectl




```
kubectl exec -it POD1 --container CONTAINER1 -- /bin/bash
    kubectl logs POD1 --container CONTAINER1
kubectl port-forward pod POD1 LOCALPORT:CONTAINERPORT
```

Demo

Running Pods

- **Bare Pods**
- **Creating Pods in a Deployment**
- **Using port-forward to access a Pod's application**

Multi-container Pods

Tightly coupled applications

Scheduling processes together

Requirement on some shared resource

Usually something generating data while the other process consumes

Don’t use this to influence scheduling, we use other techniques for that!

Multi-container Pods

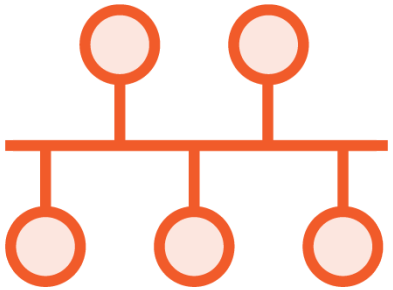
```
apiVersion: v1
kind: Pod
metadata:
  name: multicontainer-pod
spec:
  containers:
  - name: nginx
    image: nginx
     ports:
     - containerPort: 80
   ...
  - name: alpine
    image: alpine
```

Common Anti-Pattern for Multi-container Pods

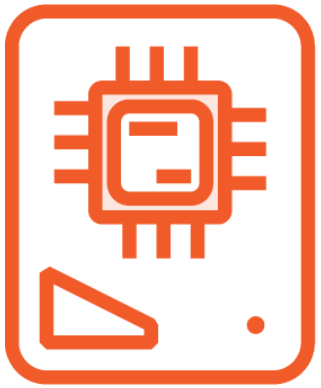
Recovery Options

Limits Scaling

Shares Resources Inside a Pod

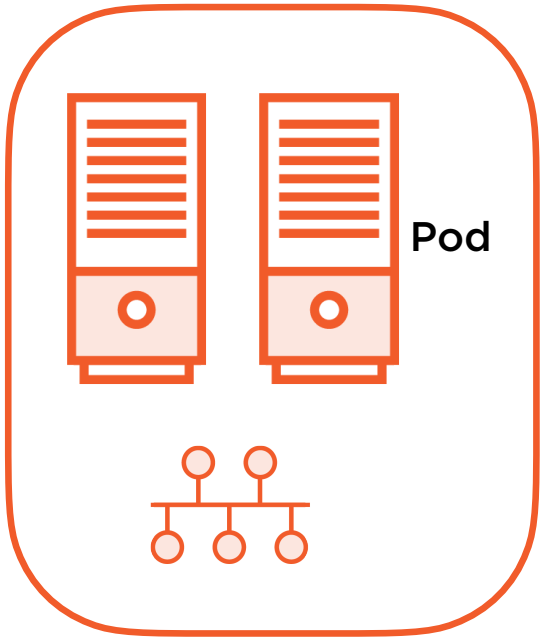


Networking



Storage

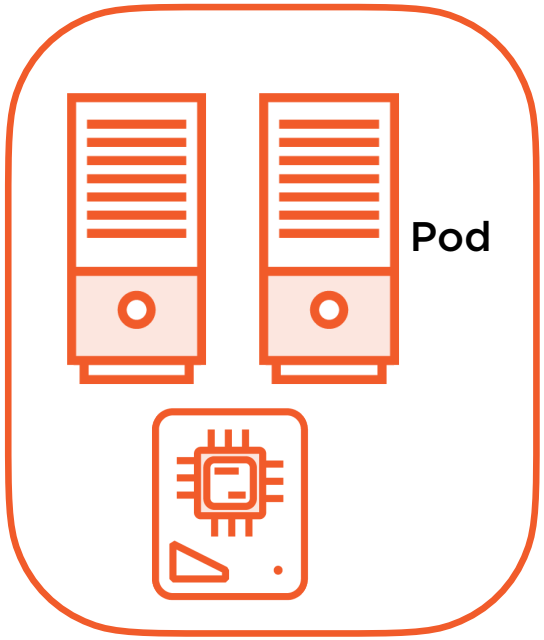
Shared Resources Inside a Pod - Networking



Shared loopback interface, used for communication over localhost

Be mindful of application port conflicts

Shared Resources Inside a Pod - Storage



Each container image has it's own file system

Volumes are defined at the Pod level

Shared amongst the containers in a Pod

Mounted into the containers' file system

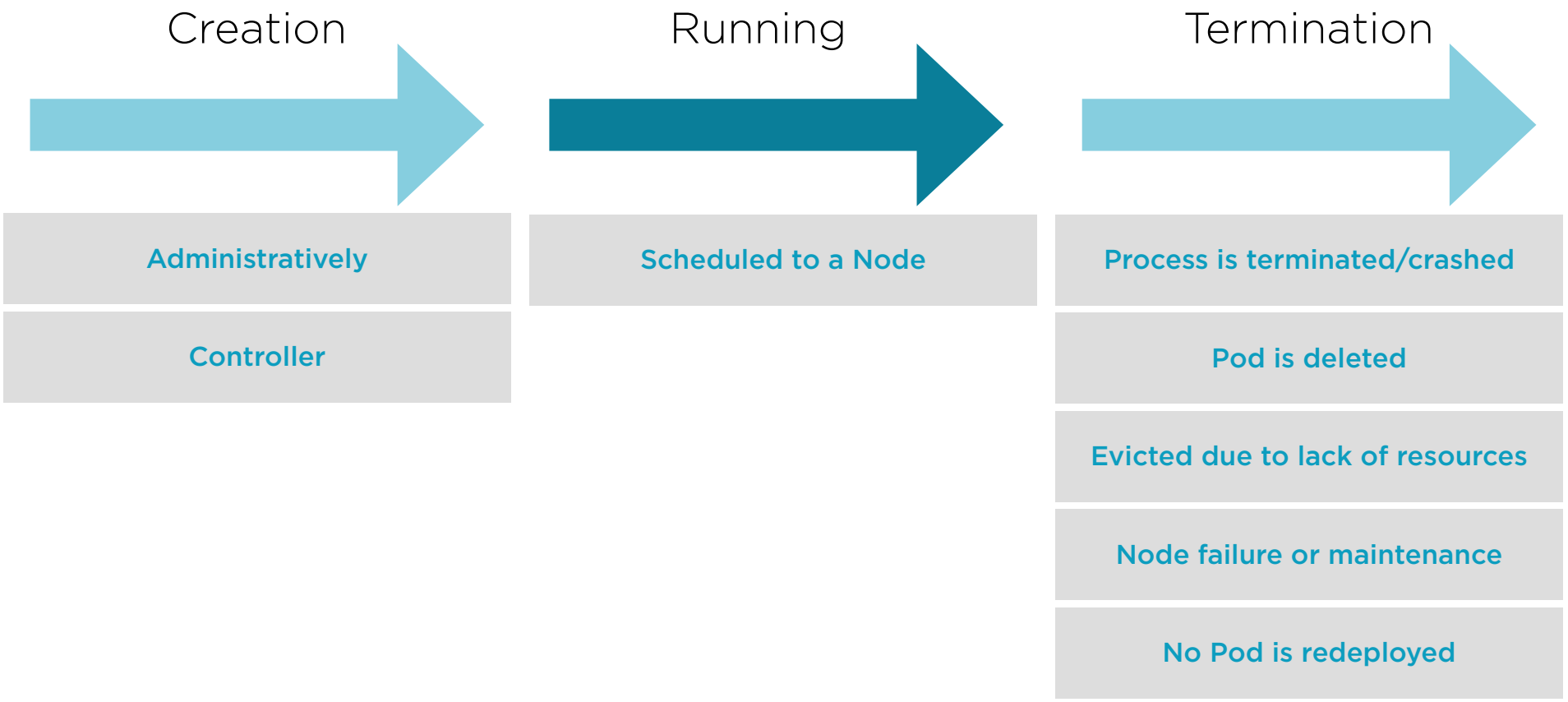
Common way for containers to exchange data

Demo

Running Multi-container Pods

Sharing data between containers in a Pod

Pod Lifecycle



Stopping/Terminating Pods

Grace Period Timer (30 sec default)	Pods changes to Terminating	SIGTERM
Service Endpoints and Controllers updated	IF > Grace Period SIGKILL	API and etcd are updated


```
kubectl delete pod --grace-period=<seconds>
```

Force Deletion - Immediately deletes records in API and etcd

```
kubectl delete pod --grace-period=0 --force
```

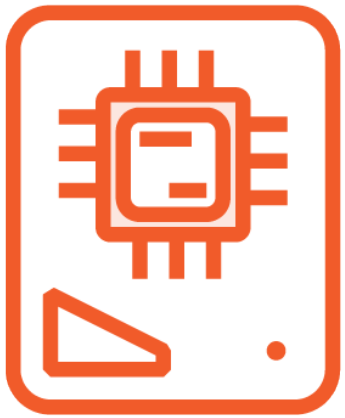
Persistency of Pods

A Pod is never redeployed

If a Pod stops, a new one is created based on its Controller

Go back to the original container image(s) in the Pod definition

Persistency of Pods



Configuration is managed externally

- **Pod Manifests, secrets and ConfigMaps**
- **Passing environment variables into containers**

Data Persistency is managed externally

- `PersistentVolume`
- `PersistentVolumeClaim`

Container Restart Policy

A container in a Pod can restart independent of the Pod

Applies to containers inside a Pod and defined inside the Pod's Spec

The Pod is the environment the container runs in

Not rescheduled to another Node, but restarted by the Kubelet on that Node

Restarts with an exponential backoff, 10s, 20s, 40s capped at 5m and reset to 0 after 10m of successful runtime

Container Restart Policy

`Always` (default) - will restart all containers inside a Pod

`OnFailure` - Non-graceful termination

`Never`

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: nginx-pod
spec:
  containers:
  - name: nginx
    image: nginx
  restartPolicy: OnFailure
```

Pod with Container Restart Policy

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

Demo

Pod lifecycle

Killing a container process

Container Restart Policy

Defining Pod Health

A Pod is considered ready when all containers are ready

But we'd like to be able to understand a little more about our applications

We can add additional intelligence to our Pod's state and health

Container Probes

`livenessProbe`

`readinessProbe`

livenessProbes

Runs a diagnostic check on a container

Per container setting

On failure, the Kubelet restarts the container

Container Restart Policy

Give Kubernetes a better understanding of our application

readinessProbes

Runs a diagnostic check on the container

Per container setting

On startup, your application won't receive traffic until ready

On failure, removes Pod from load balancing or replication controller

Applications have long startup times

Prevents users from seeing errors

Types of Diagnostic Checks for Probes

Exec	tcpSocket	httpGet
Process exit code	Successfully Open a Port	Return Code 200 => and < 400
Success	Failure	Unknown

Configuring Container Probes

`initialDelaySeconds` **- number of seconds after the container has started before running container probes**

`periodSeconds` **- probe interval, default 10 seconds**

`timeoutSeconds` **Probe timeout 1 seconds**

`failureThreshold` **- number of missed checks before reporting failure, default 3**

`successThreshold` **- number of probes to be considered successful and live, default 1**

```
spec:
  containers:
    ...
    livenessProbe:
      tcpSocket:
          port: 8080
      initialDelaySeconds: 15
      periodSeconds: 20
```

```
readinessProbe:
   tcpSocket:
     port: 8080
   initialDelaySeconds: 5
   periodSeconds: 10
```

livenessProbes and readinessProbes

Demo

Implementing container probes

- **livenessProbes**
- **readinessProbes**

Summary

Understanding Pods

Controllers and Pods

Multi-container Pods

Managing Pod Health with Probes

Thank You!

@nocentino

www.centinosystems.com