Managing Kubernetes Controllers and Deployments

INTRODUCTION AND USING CONTROLLERS TO DEPLOY APPLICATIONS

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Course Overview

Using Controllers to Deploy Applications and Deployment Basics

Maintaining Applications with Deployments

Deploying and Maintaining Applications with DaemonSets and Jobs

Overview

Controllers in Kubernetes

How Controllers Work

Types of Controllers

`Deployment` Controller Basics

Understanding `ReplicaSets`

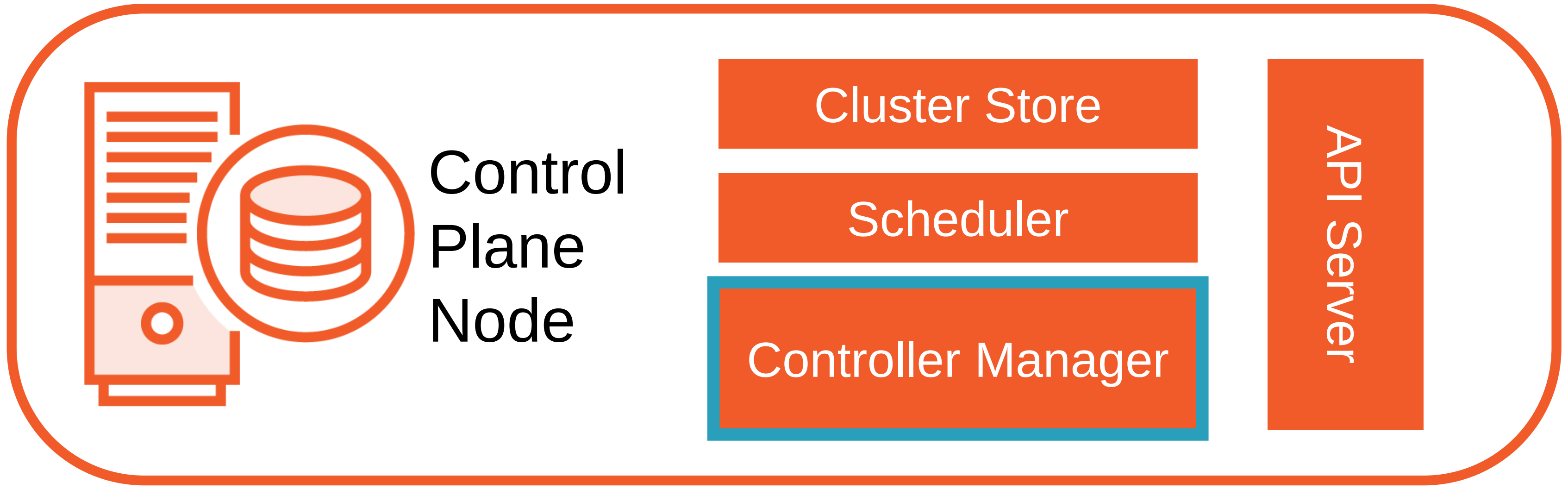
Kubernetes Principles

Desired State
Declarative
Configuration

Controllers
Control Loops

The API Server

Control Plane Components



Control Plane Node

Cluster Store

Scheduler

Controller Manager

API Server

Controller Manager

kube-controller-manager

cloud-controller-manager

Controller Operations

Watch State

Operations

API Server

Controllers in Kubernetes

Pod Controllers

Other Controllers

Pod Controllers

ReplicaSet

Deployment

DaemonSet

StatefulSet

Job

CronJob

Other Controllers

Node

Service

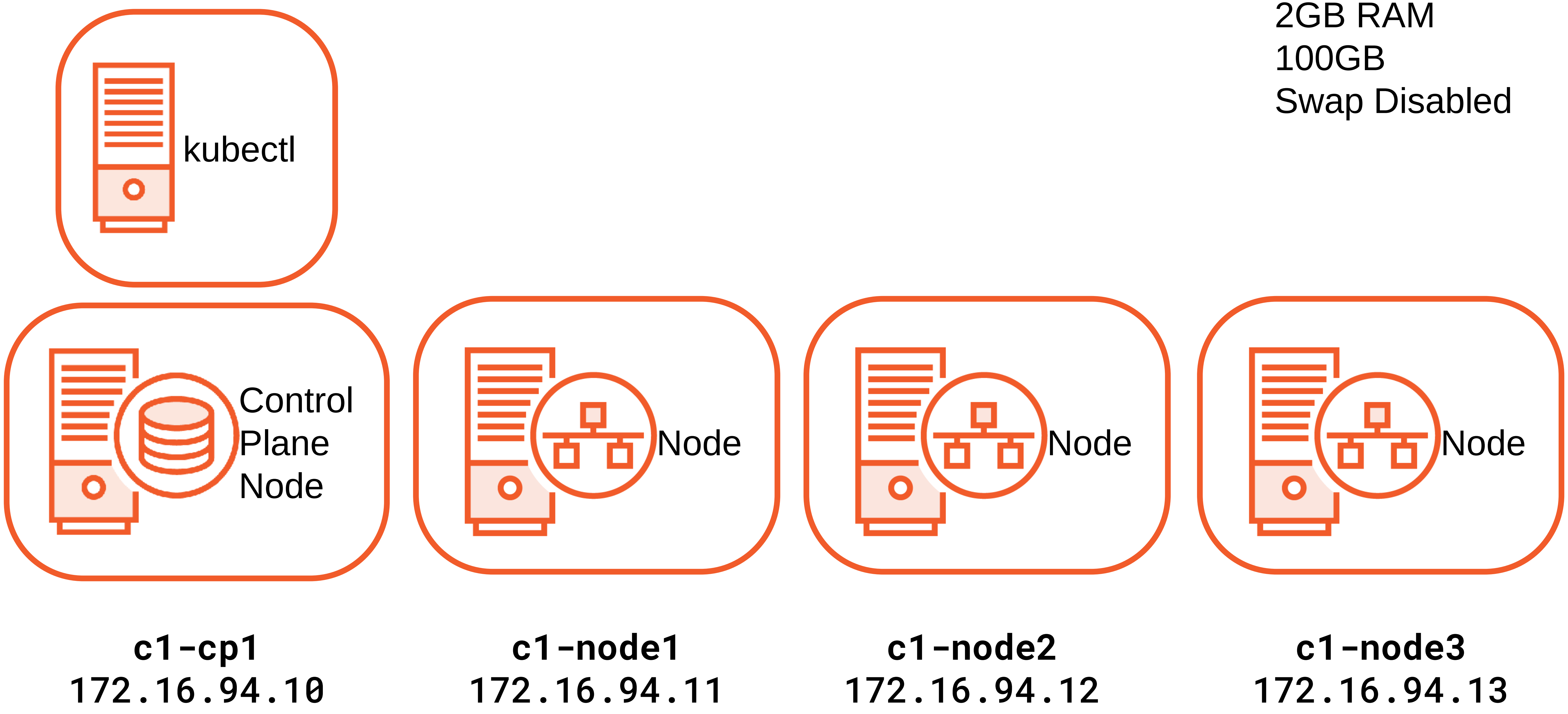
Endpoint

Many more…

Hostnames set
Host file on each

Lab Environment

Ubuntu 18.0.4
VMware Fusion VMs
2vCPU
2GB RAM
100GB
Swap Disabled



kubectl

Control Plane Node

Node

Node

Node

c1-cp1
`172.16.94.10`

c1-node1
`172.16.94.11`

c1-node2
`172.16.94.12`

c1-node3
`172.16.94.13`

Demo

Examining System Pods and their Controllers

Deployment Controller

Declarative Updates

Orchestration

Managing Application State

Managing Application State with Deployments

Creating

Updating

Scaling

Creating Deployments

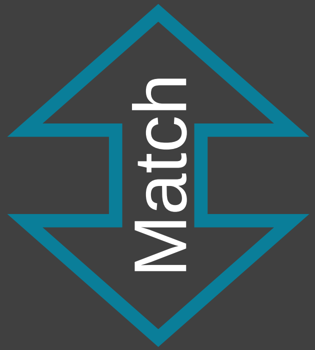
- Declaratively
  - Writing a `Deployment` Spec in code (YAML)
    - `Selector`
    - `Replicas`
    - `Pod Template`
- Imperatively

```
kubectl create deployment hello-world --image=gcr.io/google-samples/hello-app:1.0
```

```
kubectl scale deployment hello-world --replicas=5
```

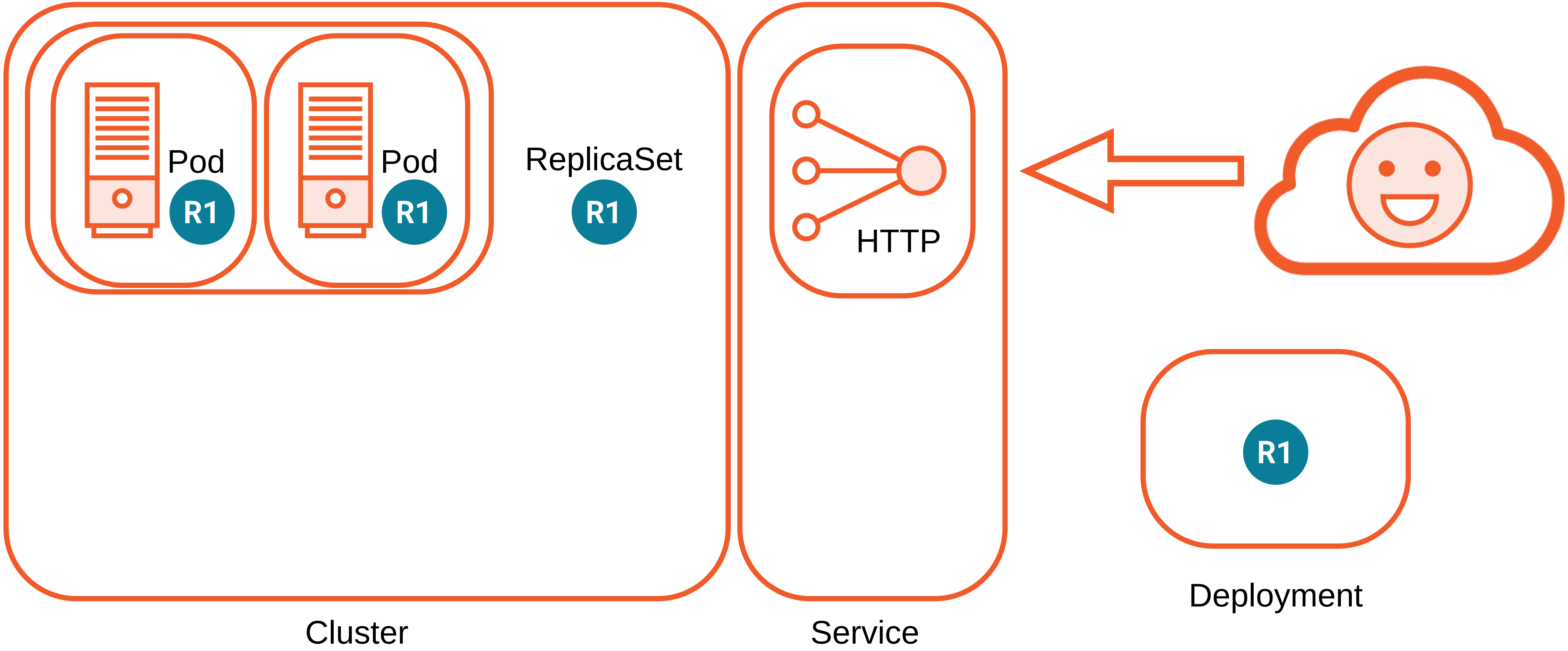
Defining a Basic Deployment

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: hello-world
spec:
  replicas: 5
  selector:
    matchLabels:
      app: hello-world
  template:
    metadata:
      labels:
        app: hello-world
    spec:
      containers:
 ...
```



```
kubectl apply -f deployment.yaml
```

Controller Operations - Deployment

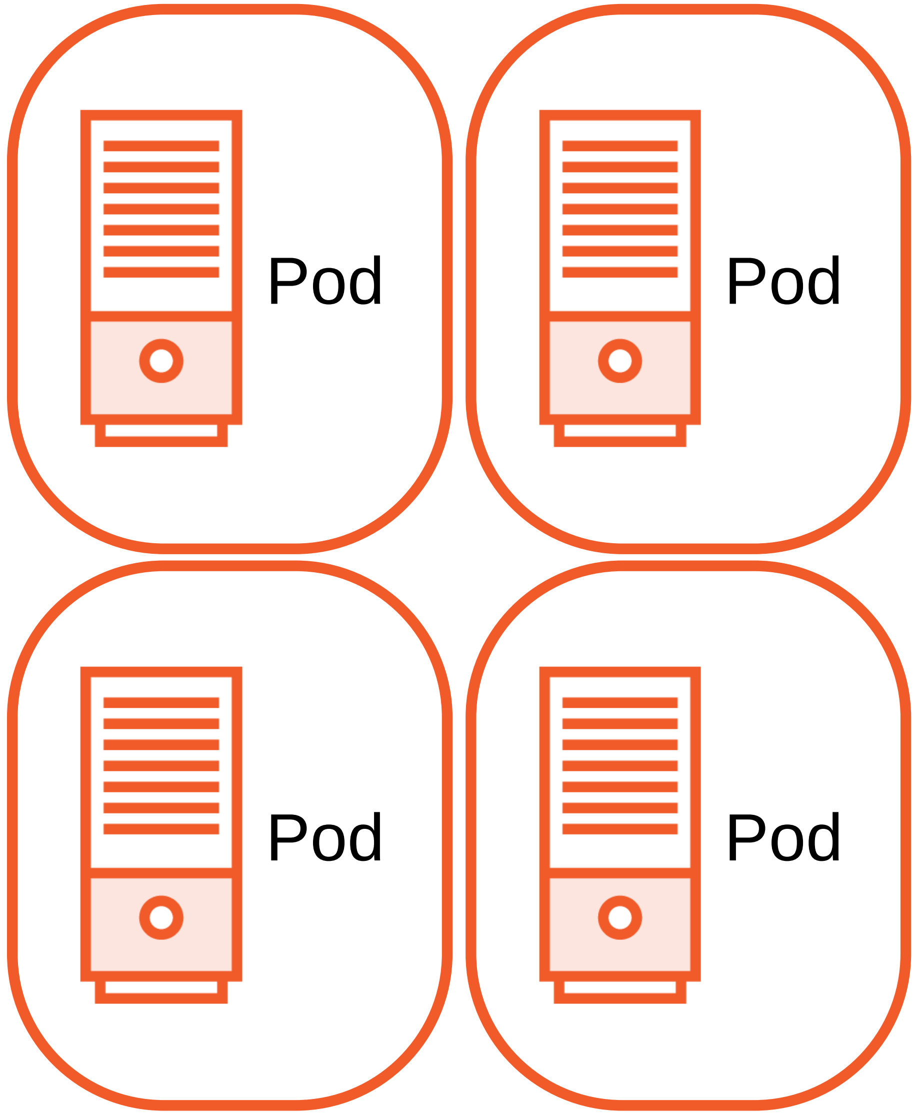


Demo

Creating a `Deployment`

- Imperatively
- Declaratively

Understanding ReplicaSets



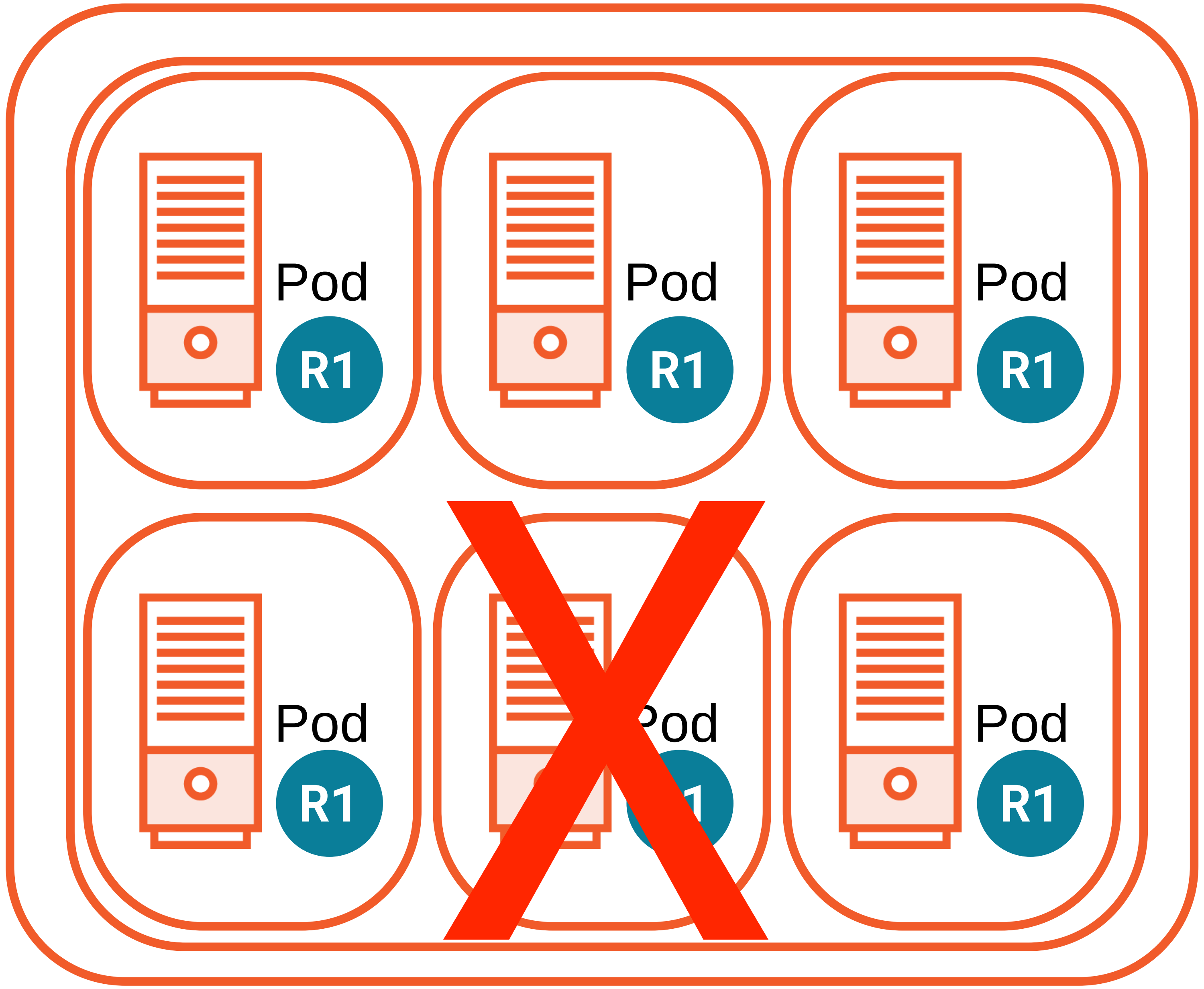
Deploys a defined number of Pods

Consists of a Selector, Number of Replicas (Pods) and a Pod Template

Generally speaking you don’t create `ReplicaSets` directly

- You create `Deployments`

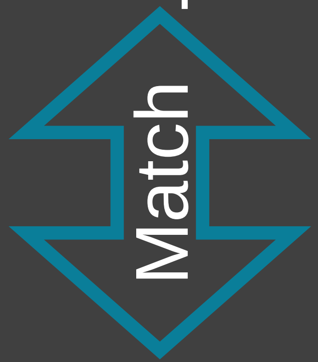
ReplicaSets Pod Operations



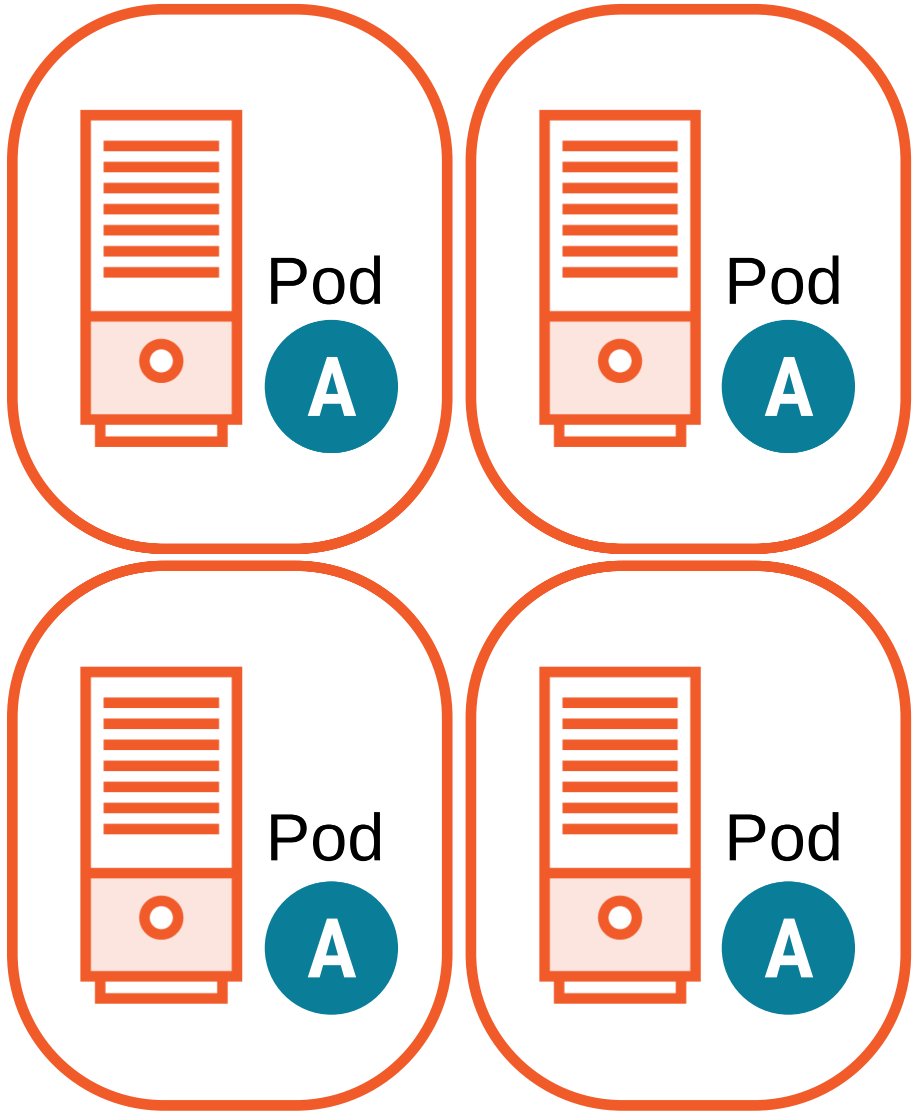
Cluster

ReplicaSet

```yaml
apiVersion: apps/v1
kind: ReplicaSet
...
spec:
  replicas: 1
  selector:
    matchLabels:
      app: hello-world-pod
  template:
    metadata:
      labels:
        app: hello-world-pod
    spec:
      containers:
      ...
```



ReplicaSet Selectors



`ReplicaSets` allow for more complex, set based selectors

`matchExpressions` as the selector

- `Operators`
  - `In, NotIn, Exists and DoesNotExist`
- `Keys`
- `Values`

```yaml
apiVersion: apps/v1
kind: ReplicaSet
...
spec:
  replicas: 1
  selector:
    matchLabels:
      app: hello-world-pod
  template:
    metadata:
      labels:
        app: hello-world-pod
    spec:
      containers:
      ...
```

```yaml
apiVersion: apps/v1
kind: ReplicaSet
...
spec:
  replicas: 1
  selector:
    matchExpressions:
      - key: app
        operator: In
        values:
          - hello-world-pod-me
  template:
    metadata:
      labels:
        app: hello-world-pod-me
    spec:
      containers:
      ...
```

ReplicaSets and Failures

Pod Failures

  Rescheduled and a new Pod is started in the cluster

Node Failures

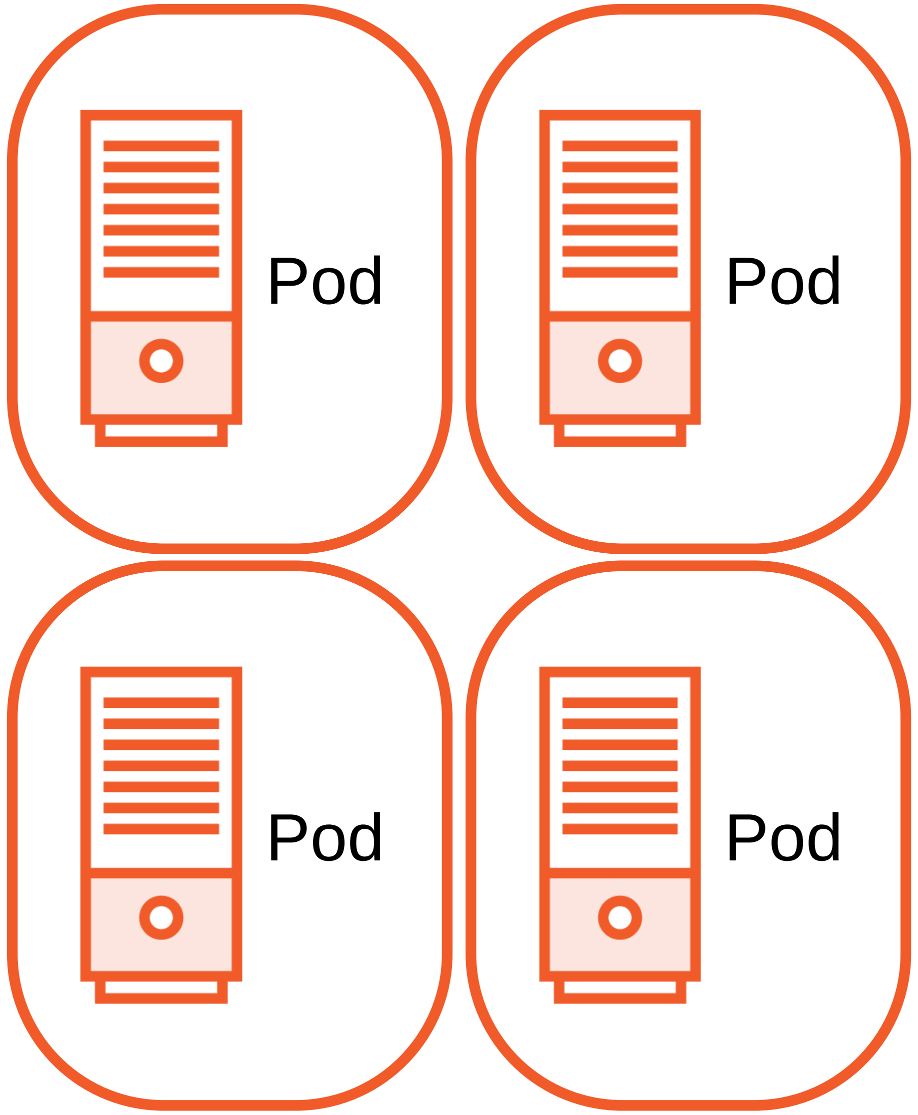
  Transient failure

  Permanent failure

kube-controller-manager

  `pod-eviction-timeout` - 5 minutes (default)

A Side Note on Replication Controllers



Legacy documentation and code samples

`ReplicationController`

- Only a single label (key and value pair)

`ReplicaSets` allow for more expressive representations of state with set based selectors

Demo

Create a `Deployment` (`ReplicaSet`)

Deleting a Pod in a `ReplicaSet`

Isolating a Pod from a `ReplicaSet`

Taking over an existing Pod in a `ReplicaSet`

Node failures and `ReplicaSets`

ReplicaSets or Deployments?

Deployments to manage our ReplicaSets

ReplicaSets are the building blocks of Deployments

Review

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`Deployment` Controller Basics

Understanding `ReplicaSets`

What’s Next!

Deploying and Maintaining Applications with Deployments