

# Managing Kubernetes Controllers and Deployments

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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**

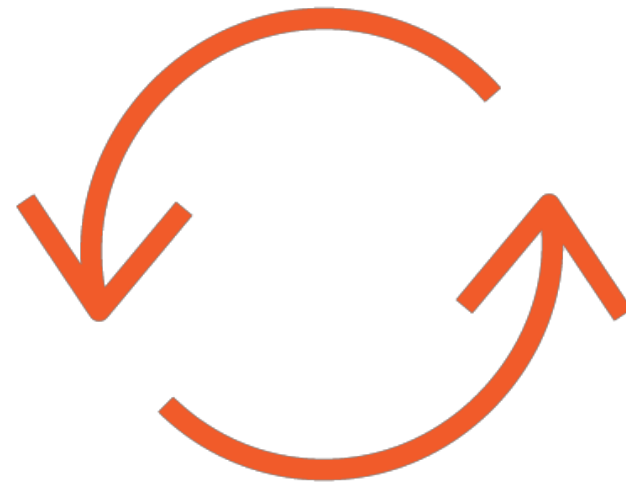
**Deployment Controller Basics**

**Understanding ReplicaSets**

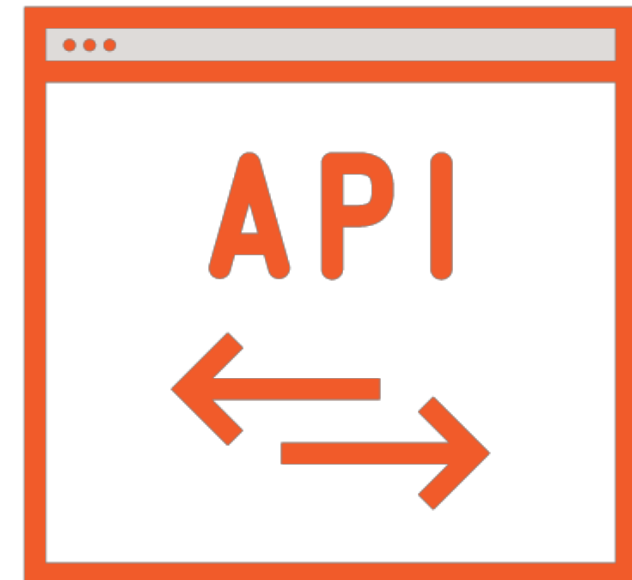
# Kubernetes Principles



**Desired State  
Declarative  
Configuration**



**Controllers  
Control Loops**



**One Master  
The API Server**

# Master - Control Plane Components



# Controller Manager



**kube-controller-manager**

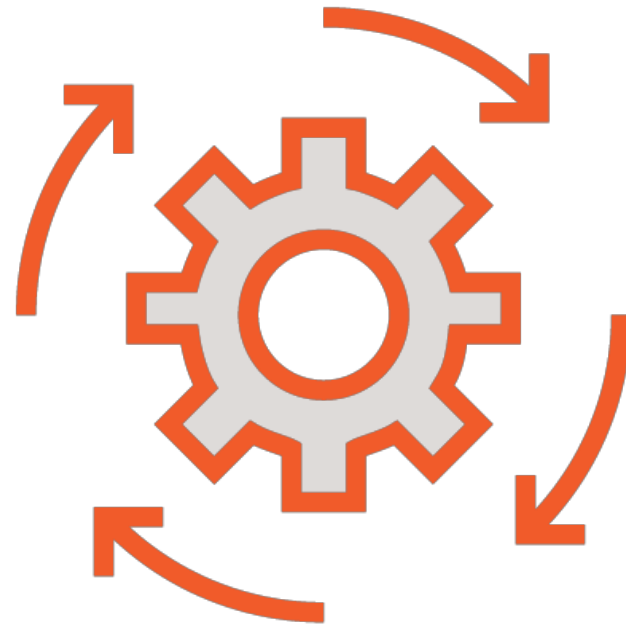


**cloud-controller-manager**

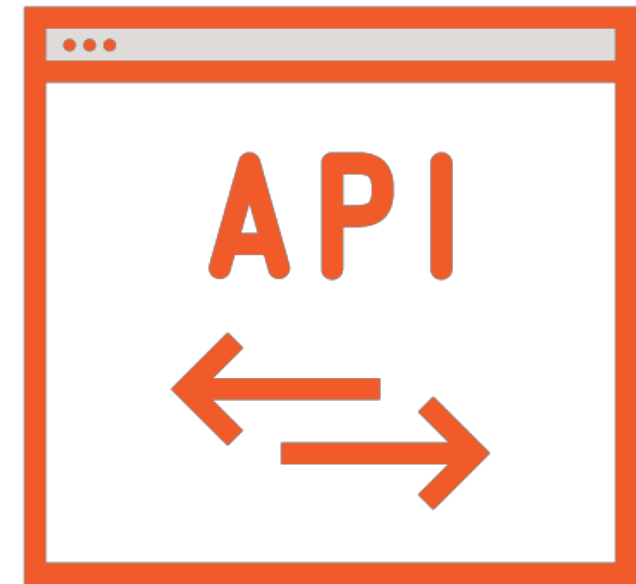
# Controller Operations



Watch State



Operations



API Server

<https://github.com/kubernetes/kubernetes/tree/master/pkg/controller/>

# Controllers in Kubernetes



**Pod Controllers**



**Other Controllers**



# Pod Controllers



ReplicaSet

Deployment

DaemonSet

StatefulSet

Job

CronJob

# Other Controllers



Node

Service

Endpoint

**Many more...**

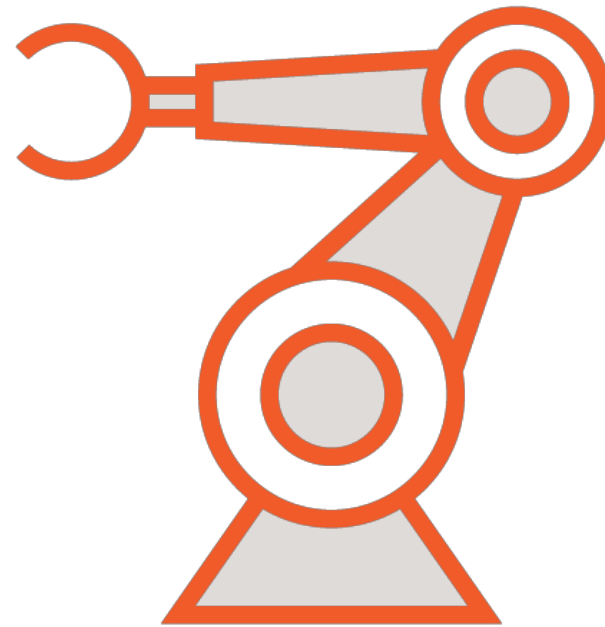
Demo

## **Examining System Pods and their Controllers**

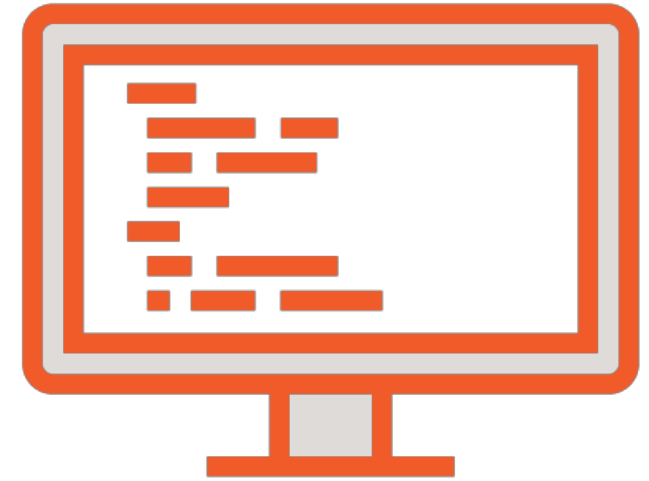
# Deployment Controller



**Declarative  
Updates**



**Orchestration**

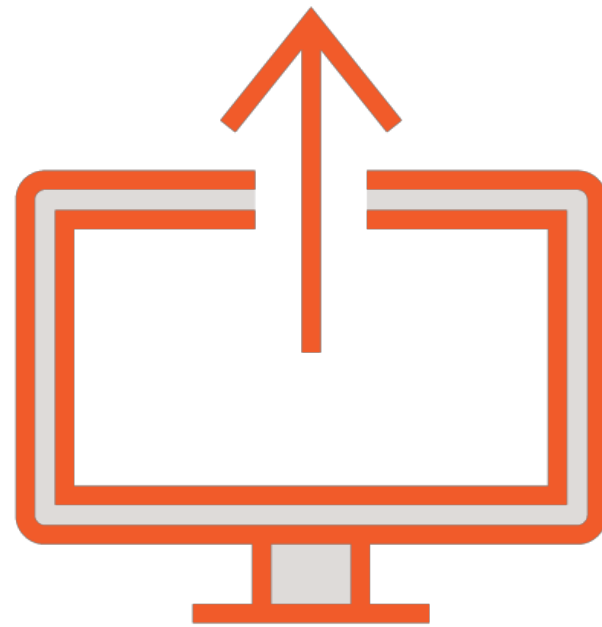


**Managing  
Application State**

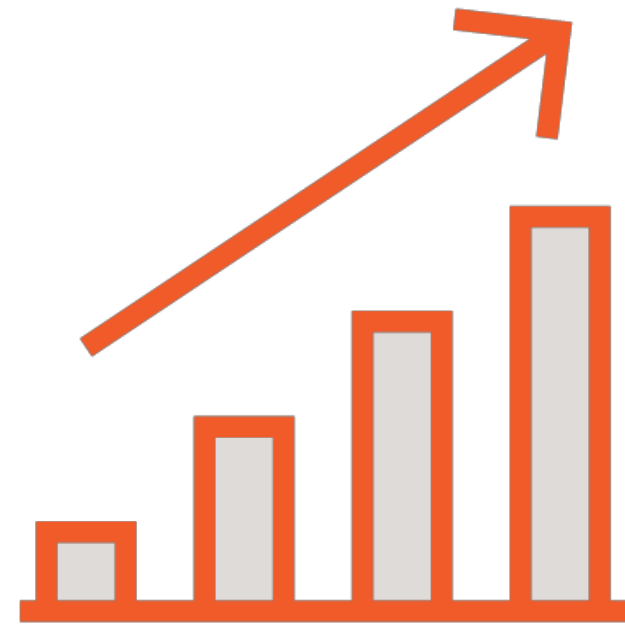
# Managing Application State with Deployments



**Creating**



**Updating**



**Scaling**

# Creating Deployments

## **Declaratively**

### **Writing a Deployment Spec in code (YAML)**

Selector

Replicas

Pod Template

## **Imperatively**

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

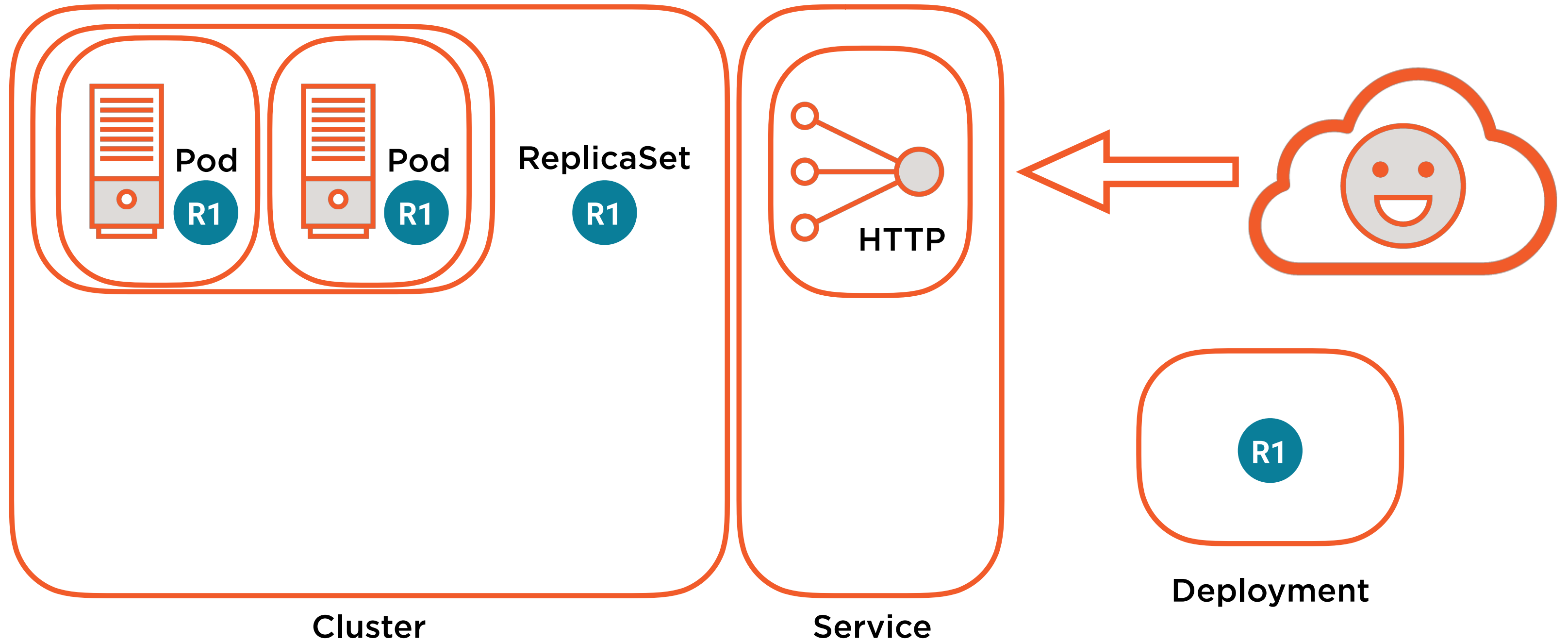
# Defining a Basic Deployment

```
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



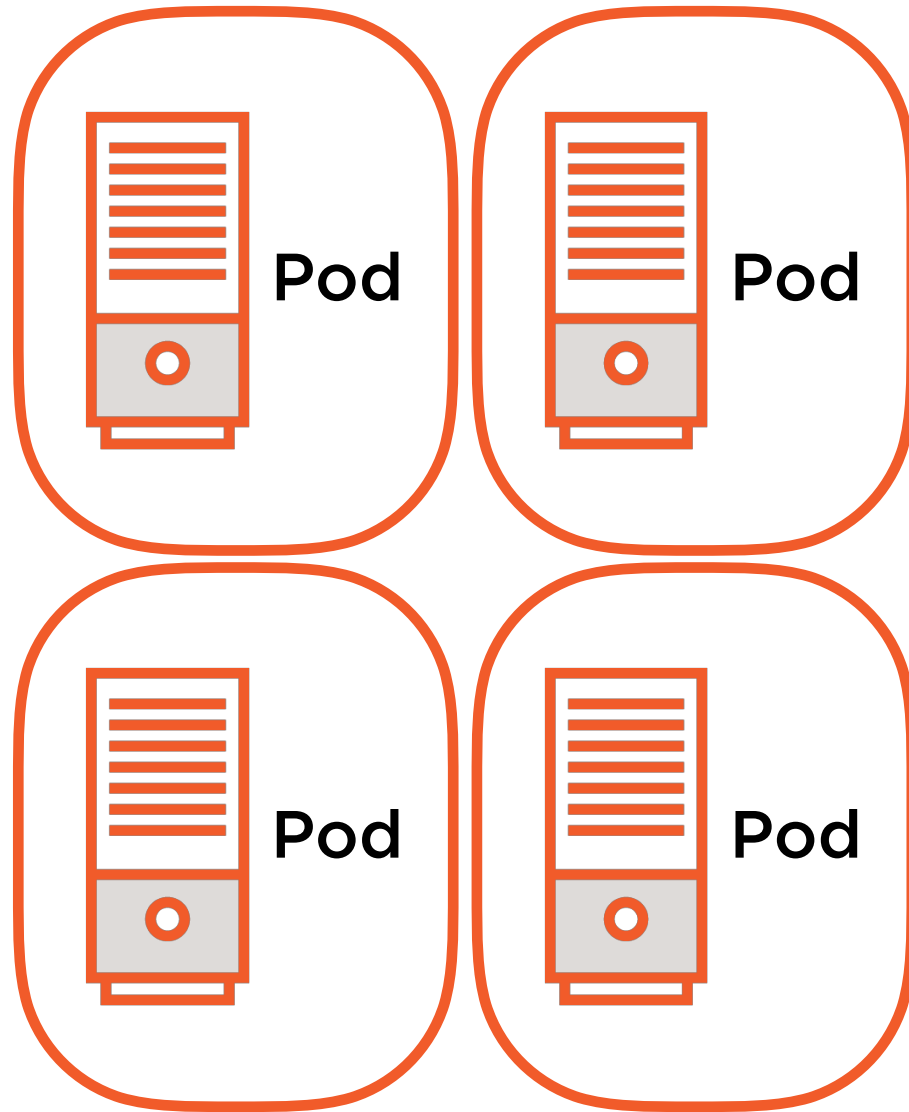


# Demo

## **Creating a Deployment**

- **Imperatively**
- **Declaratively**

# Understanding ReplicaSets



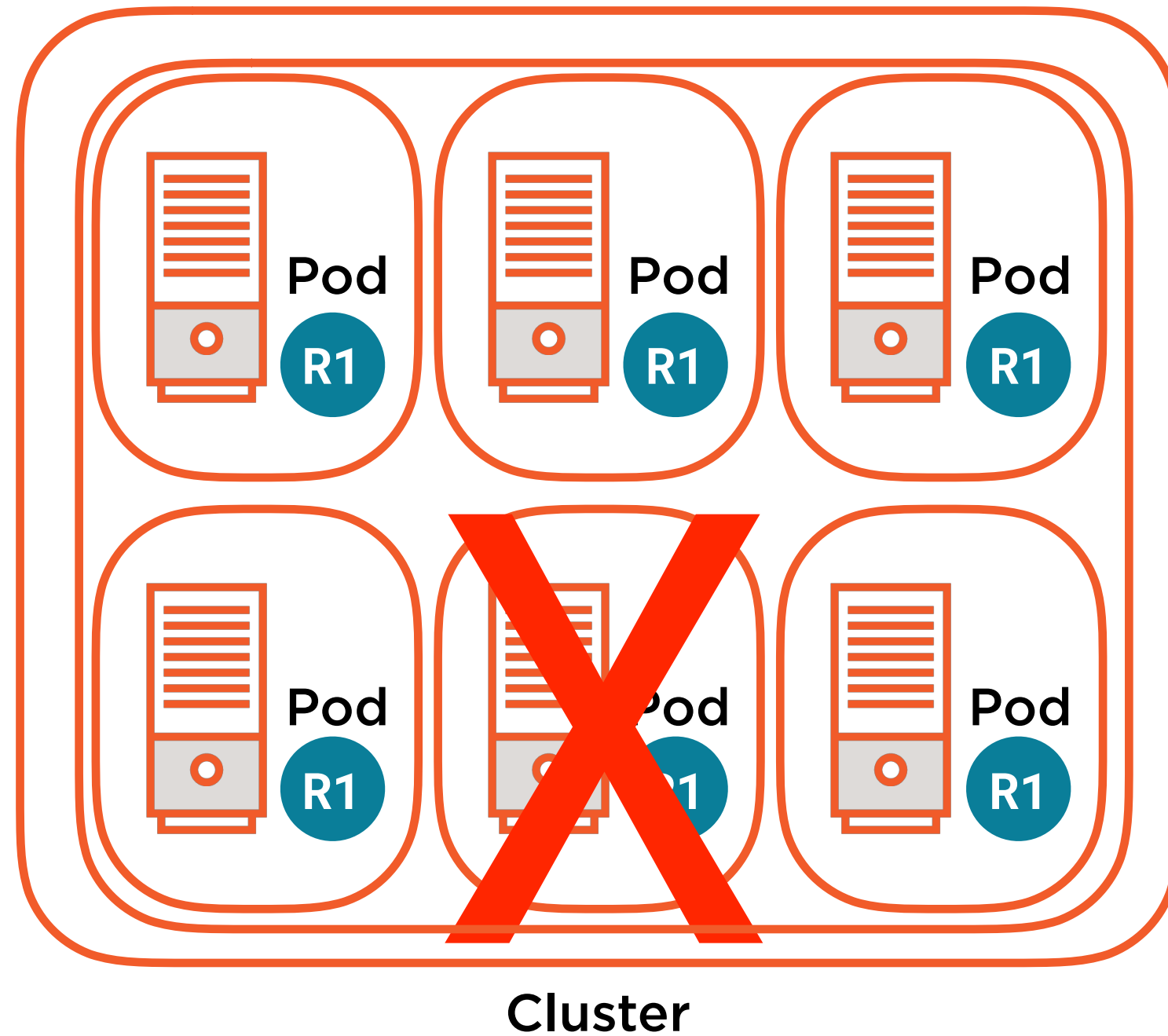
**Deploys a defined number of Pods**

**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

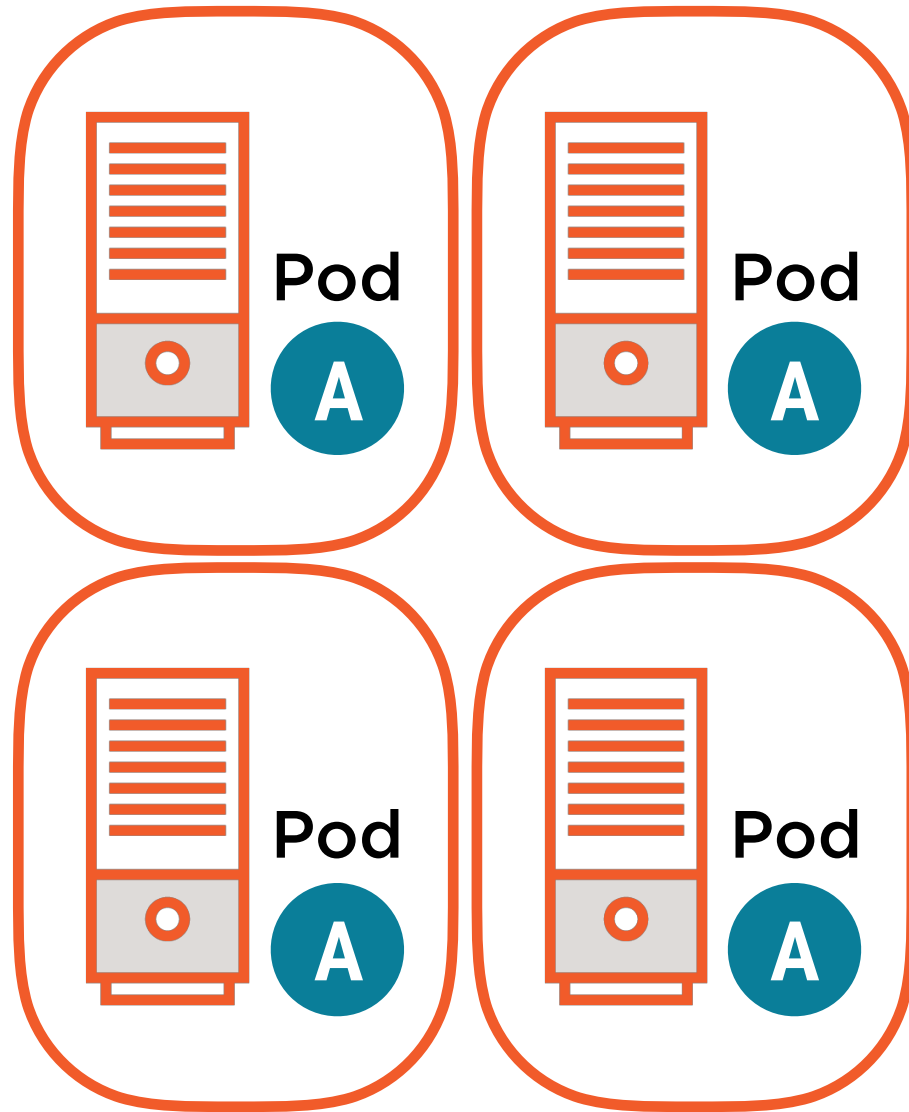


# ReplicaSet

```
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

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

```
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

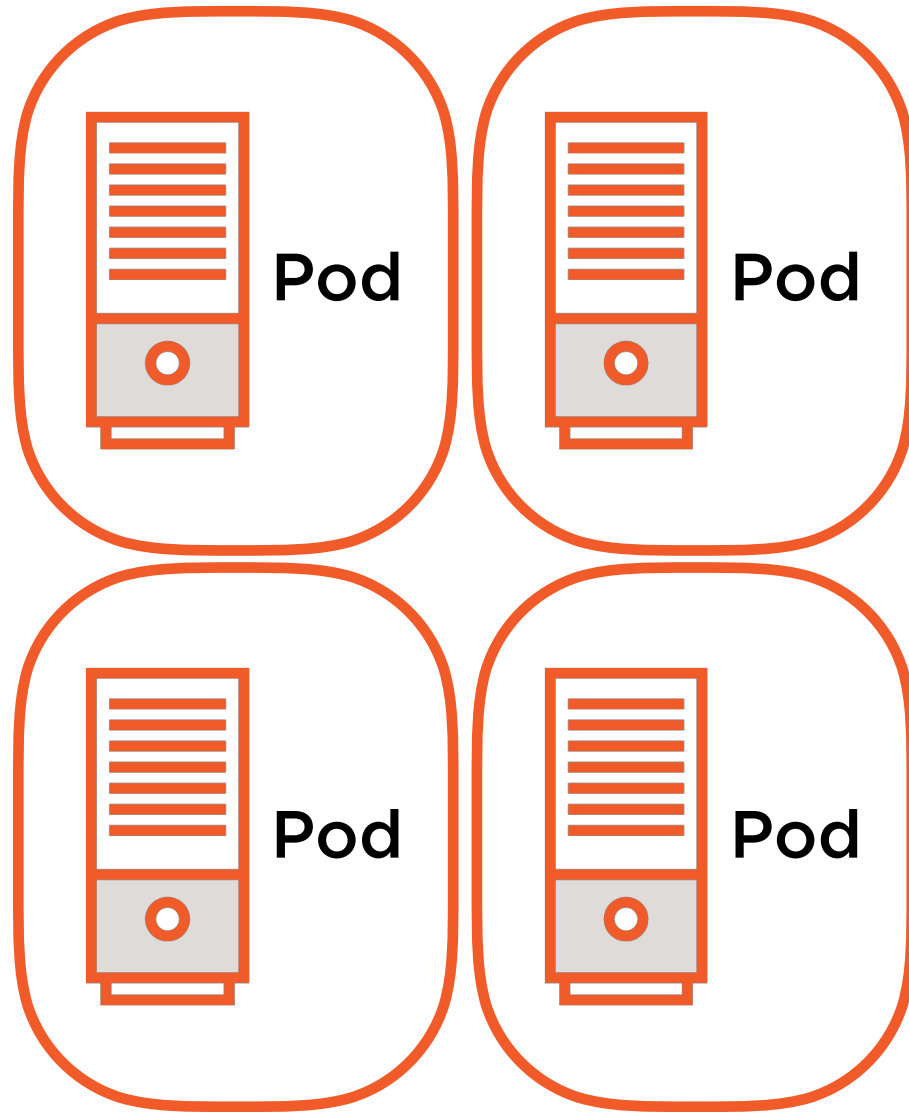
Transient failure

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

**Controllers in Kubernetes**

**How Controllers Work**

**Types of Controllers**

**Deployment Controller Basics**

**Understanding ReplicaSets**

What's Next!

**Deploying and Maintaining Applications with Deployments**