NJIT

Kubernetes

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Local K8s Cluster Options

- Docker Desktop - Supports running a single-machine Kubernetes instance. Edit settings from the task-bar icon.
- minikube - Single-machine solution for developing on / testing Kubernetes.
- k3s - Lightweight Kubernetes that can run on embedded devices. Great for k8s on an Raspberry Pi.
- Kind - Runs Kubernetes inside a Docker container.

Kubectl

- The most common CLI to a Kubernetes cluster
- Can switch between contexts (different clusters)
- Can apply objects, read logs, get status, etc.
- Most things build off of these commands or at least reference them.

Kubectl Example

```
  $ kubectl cluster-info
  Kubernetes master is running at https://kubernetes.docker.internal:6443
  KubeDNS is running at https://kubernetes.docker.internal:6443/api/v1/namespaces/kube-system/
services/kube-dns:dns/proxy

  To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.

  $ kubectl config view
  apiVersion: v1
  clusters:
  - cluster:
      certificate-authority-data: DATA+OMITTED
      server: https://kubernetes.docker.internal:6443
    name: docker-desktop
  - cluster:
      certificate-authority: C:\Users\rxt1077\.minikube\ca.crt
      server: https://192.168.18.66:8443
    name: minikube
  contexts:
  - context:
  <snip>
```

Pods

- A pod is the minimum unit of compute in Kubernetes. It typically runs a single container.
- `kubectl get pod` is a good starting point when troubleshooting
- `kubectl describe <pod-name>` will give you even more info

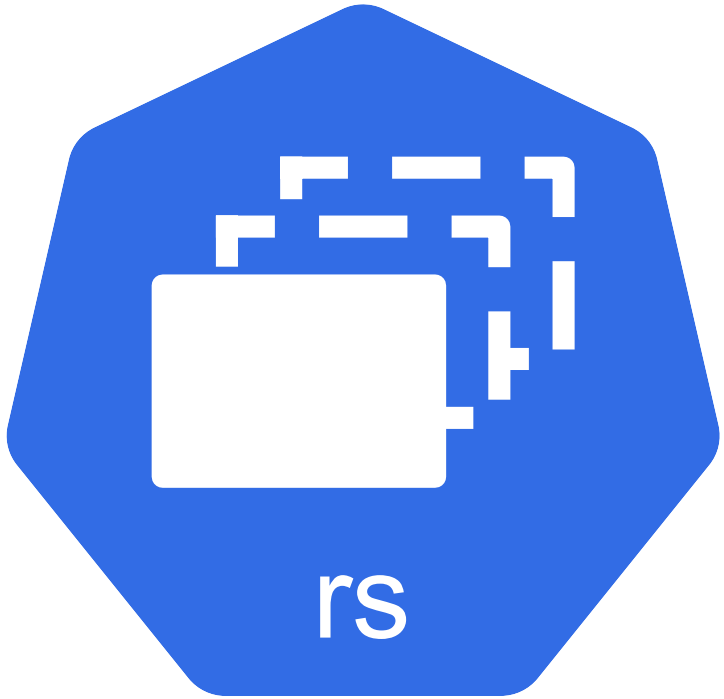
Pod Example

```
$ kubectl get pod
NAME                           READY   STATUS    RESTARTS   AGE
hello-node-7dc7987866-xnbxz    1/1     Running   0          22s

$ kubectl describe pod hello-node-7dc7987866-xnbxz
Name:         hello-node-7dc7987866-xnbxz
Namespace:    default
Priority:     0
Node:         docker-desktop/192.168.65.3
Start Time:   Thu, 09 Jul 2020 16:22:31 -0400
Labels:       app=hello-node
              pod-template-hash=7dc7987866
Annotations:  <none>
Status:       Running
IP:           10.1.0.7
IPs:
  IP:           10.1.0.7
Controlled By:  ReplicaSet/hello-node-7dc7987866
Containers:
  echoserver:
<snip>
```

ReplicaSets

- A ReplicaSet is a grouping of pods that Kubernetes attempts to keep running
- Kubernetes can detect failure (configurable) and restart a pod
- Kubernetes will back-off if something keeps failing



ReplicaSet Example

```
$ kubectl get replicasets
NAME                    DESIRED   CURRENT   READY   AGE
hello-node-7dc7987866   1         1         1       4m4s

$ kubectl describe replicaset hello-node-7dc7987866
Name:           hello-node-7dc7987866
Namespace:      default
Selector:       app=hello-node,pod-template-hash=7dc7987866
Labels:         app=hello-node
                pod-template-hash=7dc7987866
Annotations:    deployment.kubernetes.io/desired-replicas: 1
                deployment.kubernetes.io/max-replicas: 2
                deployment.kubernetes.io/revision: 1
Controlled By:  Deployment/hello-node
Replicas:       1 current / 1 desired
Pods Status:    1 Running / 0 Waiting / 0 Succeeded / 0 Failed
Pod Template:
  Labels:  app=hello-node
           pod-template-hash=7dc7987866
  Containers:
<snip>
```

Deployments

- A Deployment creates ReplicaSets to support the *deployment* of an app
- Deployments also support update strategies

Deployment Example

```
$ kubectl get deployments
NAME         READY   UP-TO-DATE   AVAILABLE   AGE
hello-node   1/1     1            1           7m18s

$ kubectl describe deployment hello-node
Name:                   hello-node
Namespace:              default
CreationTimestamp:      Thu, 09 Jul 2020 16:22:31 -0400
Labels:                 app=hello-node
Annotations:            deployment.kubernetes.io/revision: 1
Selector:               app=hello-node
Replicas:               1 desired | 1 updated | 1 total | 1 available | 0 unavailable
StrategyType:           RollingUpdate
MinReadySeconds:        0
RollingUpdateStrategy:  25% max unavailable, 25% max surge
Pod Template:
  Labels:  app=hello-node
  Containers:
   echoserver:
    Image:        k8s.gcr.io/echoserver:1.4
<snip>
```

Working with YAML objects

- Define your objects in YAML files instead of just via the command line.
- `kubectl apply -f <file>` will apply your file to make the cluster provide the resources you specified.
- Similar to ansible, this is *descriptive*: if you want three replicas and you already have two, it'll just make the third.

YAML Deployment Example

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: nginx-deployment
  labels:
    app: nginx
spec:
    replicas: 3
    selector:
      matchLabels:
        app: nginx
    template:
      metadata:
        labels:
          app: nginx
      spec:
        containers:
        - name: nginx
          image: nginx:1.14.2
          ports:
          - containerPort: 80
```

- What k8s objects will this create?
- How many pods will the cluster start?
- What container image is being used?

YAML from a running deployment

```
$ kubectl get deployment -o yaml
apiVersion: v1
items:
- apiVersion: apps/v1
  kind: Deployment
  metadata:
    annotations:
      deployment.kubernetes.io/revision: "1"
    creationTimestamp: "2020-07-09T20:22:31Z"
    generation: 1
    labels:
      app: hello-node
    name: hello-node
    namespace: default
    resourceVersion: "1816"
    selfLink: /apis/apps/v1/namespaces/default/deployments/hello-node
    uid: 31356fed-0365-49df-8327-3c3c6ff0cb32
  spec:
    progressDeadlineSeconds: 600
    replicas: 1
<snip>
```

Services

Services make ports on pods available to other parts of the cluster *or* the outside world:

```
$ kubectl expose deployment hello-node --type=LoadBalancer --port=8080
service/hello-node exposed

$ kubectl get services
NAME         TYPE           CLUSTER-IP       EXTERNAL-IP   PORT(S)          AGE
hello-node   LoadBalancer   10.105.154.187   localhost     8080:30031/TCP   100s
kubernetes   ClusterIP      10.96.0.1        <none>        443/TCP          32m
```

Addition Kubenetes Resources

- kubectl Cheat sheet
- Deployments
- Hello Minikube
- Services

Kubernetes 3 Wishes is used under fair use