Kubernetes Pods

- Pods have 3 types of containers
 - init containers
 - containers
 - ephemeral containers (debugging)
- init containers
 - o are executed in a sequential order
 - o are expected to be completed
- containers:
 - here we run the application or application component
 - if we write mutliple containers they start in parallel.
 - o first container in spec is referred as main car and rest of containers are referred as side cars.
 - All containers in a Pod share same network namespace i.e. they can communicate with each other on localhost.
 - When we define containers its a good idea and best practice always to also incude atleast max memory and cpu in the manifest.
 - Always specify port information
- For verifying the basic manifest we can use playgrounds
 - k8s playground
 - o killercoda Refer Here

Labels

- Refer Here for official docs
- Labels can be applied to k8s objects and later can be queried
- Querying k8s objects based on labels is referred as selctors in k8s
- Selectors
 - o equality based:
 - we have two options equals and not equals
 - o set hased
 - This gives more comprehensive way to select, we have multiple operators such as
 - in
 - not in
 - exists

Resources Requests and limits

- Using this we can specify the k8s resources limits Refer Here
- Requests: refer to lower boundary
- limits: refer to upper boundary

Refer Here for the changeset with pod spec

```
controlplane $ pwd
/root/manifests
controlplane $ kubectl apply -f activity1.yaml
pod/activity1 created
controlplane $ kubectl get po
NAME
            READY
                    STATUS
                                        RESTARTS
                                                    AGE
activity1
            0/1
                    ContainerCreating
                                        a
                                                    95
controlplane $ kubectl get po -w
            READY
NAME
                    STATUS
                                        RESTARTS
                                                    AGE
activity1
            0/1
                    ContainerCreating
                                                    12s
```

• Apply the manifest

describe the pods

```
controlplane $ kubectl describe pod activity1
                 activity1
Name:
Namespace:
                 default
Priority:
Service Account: default
Node:
                 node01/172.30.2.2
Start Time:
                 Thu, 13 Jun 2024 02:30:26 +0000
Labels:
                 app=nop
                 env=dev
                 purpose=understanding
                 cni.projectcalico.org/containerID: 4cc6d1725684b0faced9f37983dd3b558e7b3f40a27d7f1869ded752f8c9d696
Annotations:
                 cni.projectcalico.org/podIP: 192.168.1.4/32
                 cni.projectcalico.org/podIPs: 192.168.1.4/32
Status:
                 Running
                 192.168.1.4
IP:
IPs:
IP: 192.168.1.4
Containers:
 nop:
   Container ID: containerd://24b78a3db501cedfdbff3b5e2e3ec0002c29c098470e4d5fd3480df09155d842
                   shaikkhajaibrahim/nopcommercejune2024:070624
   Image:
                   docker.io/shaikkhajaibrahim/nopcommercejune2024@sha256:deb0549b0368340eb26db30c8e584cafb3ffca52c15eba74
    Image ID:
e4f3ffd07aa07939
   Port:
                   5000/TCP
   Host Port:
                   0/TCP
   State:
                   Running
                   Thu, 13 Jun 2024 02:31:23 +0000
     Started:
   Ready:
                   True
    Restart Count: 0
   Limits:
              500m
```

• Each pod gets an ip address

```
controlplane $ kubectl get pods -o wide
           READY
                   STATUS
                                                                                      READINESS GATES
NAME
                            RESTARTS
                                       AGE
                                               ΙP
                                                             NODE
                                                                      NOMINATED NODE
activity1
           1/1
                   Running
                                        4m42s
                                               192.168.1.4
                                                             node01
                                                                                       <none>
controlplane \
```

When we get any k8s object we can ask to show labels

```
controlplane $ kubectl get pods -o wide
          READY STATUS RESTARTS
                                      AGE
                                              ΙP
                                                           NODE
                                                                   NOMINATED NODE
                                                                                   READINESS GATES
activity1 1/1
                  Running 0
                                      4m42s
                                              192.168.1.4
                                                           node01
                                                                                   <none>
controlplane $ kubectl get pods --show-labels
           READY STATUS RESTARTS AGE
NAME
                                              LABELS
activity1 1/1
                  Running 0
                                      5m58s
                                              app=nop,env=dev,purpose=understanding
controlplane $ [
```

• Note we can create k8s pods with imperative commands

```
controlplane $ kubectl run --image nginx app1
pod/app1 created
controlplane $ kubectl run --image nginx app2
pod/app2 created
controlplane $ kubectl run --image nginx app3
pod/app3 created
controlplane $ kubectl get po
            READY
                                        RESTARTS
NAME
                    STATUS
                                                   AGE
activity1
            1/1
                    Running
                                                   8m29s
            1/1
                    Running
                                        0
                                                   10s
app1
app2
            0/1
                    ContainerCreating
                                        0
                                                   95
            0/1
                                        0
app3
                    ContainerCreating
                                                   7s
controlplane $ |
```

• We can select pods by labels

```
controlplane $ kubectl get pods --show-labels
                  STATUS
NAME
           READY
                           RESTARTS AGE
                                           LABELS
activity1
          1/1
                  Running 0
                                     9m8s
                                            app=nop,env=dev,purpose=understanding
                                    495
app1
          1/1
                  Running 0
          1/1
                  Running 0
                                    48s
                                            run=app2
app2
          1/1
                  Running 0
                                     46s
                                            run=app3
app3
controlplane $ kubectl get pods -1 "env=dev"
          READY
                  STATUS RESTARTS
          1/1
activity1
                  Running
                                     9m43s
controlplane $ kubectl get pods -1 "env"
NAME
          READY
                  STATUS
                         RESTARTS AGE
activity1 1/1
                  Running 0
                                     9m53s
controlplane $ kubectl get pods _-1 "run"
      READY STATUS
                      RESTARTS AGE
             Running 0
app1
      1/1
                                 995
      1/1
             Running
                                 98s
app2
                     0
арр3
      1/1
             Running 0
                                 96s
controlplane $ [
```

- Delete the pods
 - o declartive kubectl delete -f <manifest>

o command kubectl delete pod <name>

```
Editor Tab 1 +
controlplane $ kubectl delete -f activity1.yaml
pod "activity1" deleted
controlplane $ kubectl get po
NAME READY STATUS RESTARTS
                                  AGE
app1 1/1
app2 1/1
app3 1/1
              Running 0
              Running 0
                                  3m49s
app3 1/1
              Running 0
                                  3m47s
controlplane $ kubectl delete pod app1
pod "app1" deleted
controlplane $ kubectl delete pod app2
pod "app2" deleted
controlplane $ kubectl get po
NAME READY STATUS
                      RESTARTS
                                  AGE
              Running 0
app3 1/1
                                  4m3s
controlplane $ kubectl delete pod app3
pod "app3" deleted
controlplane $ kubectl get po
No resources found in default namespace.
controlplane $ [
```

Activity 2: Demonstrate init containers

- Order of creation is
 - o init containers one by one
 - o containers all at one shot

```
Editor Tab 1 +
controlplane $ kubectl apply -f activity2.yaml
pod/activity2 created
controlplane $ kubectl get po -w
NAME
        READY STATUS RESTARTS AGE
activity2 0/2
                     Init:0/2
                                 0
                                              25
activity2 0/2
                    Init:0/2 0
                                             65
activity2 0/2 Init:1/2 0
activity2 0/2 Init:1/2 0
activity2 0/2 PodInitializing
activity2 2/2 Running
                                            16s
                                             18s
                     PodInitializing 0
                                                      295
                                         0
                                                     32s
^Ccontrolplane $ [
```

• in docker we can get into container and execute commands

```
docker container exec
docker container exec -it
```

Refer Here

k8s also allows you to execute commands in container

```
kubectl exec podname -- command
kubectl exec -it podname -- command
```

```
Editor __Tobl__ +

controlplane $ kubectl exec activity2 -- pwd

Defaulted container "maincar" out of: maincar, sidecar1, precondition1 (init), precondition2 (init)

/

controlplane $ kubectl exec activity2 -c sidecar1 -- uname

Linux

controlplane $ kubectl exec activity2 -c maincar -- uname

Linux

controlplane $ kubectl exec activity2 -c maincar -- uname -r

5.4.0-131-generic

controlplane $ kubectl exec activity2 -c sidecar1 -- uname -r

5.4.0-131-generic

controlplane $ []
```

```
controlplane $ kubectl exec activity2 -c sidecar1 -it -- /bin/sh
/ # nslookup kubernetes
Server:
               10.96.0.10
Address:
               10.96.0.10:53
** server can't find kubernetes.cluster.local: NXDOMAIN
       kubernetes.default.svc.cluster.local
Name:
Address: 10.96.0.1
** server can't find kubernetes.svc.cluster.local: NXDOMAIN
** server can't find kubernetes.cluster.local: NXDOMAIN
** server can't find kubernetes.svc.cluster.local: NXDOMAIN
/ # cat /etc/resolv.conf
search default.svc.cluster.local svc.cluster.local cluster.local
nameserver 10.96.0.10
options ndots:5
/#
```

- Exercise 3: create a pod manifest for mysql where we need to pass environmental variables
- Exercise 4: create a pod manifest for postgres where we need to pass environmental variables
- Desired state of k8s pod is to ensure container is in running,
- lets write a k8s spec where containers go into exited state after some time

```
apiVersion: v1
kind: Pod
metadata:
name: experiment1
```

```
labels:
   purpose: experiment
spec:
   containers:
    - name: suicidal
    image: alpine
    args:
    - sleep
    - 5s
```

```
Tab1 +
Editor
controlplane $ kubectl apply -f experimental1.yaml
pod/experiment1 created
controlplane $ kubectl get po -o wide
NAME
             READY STATUS
                                  RESTARTS
                                             AGE
                                                   ΙP
                                                                NODE
                                                                         NOMINATED NODE READINESS GATES
                     Terminating
activity2
             2/2
                                  0
                                             16m
                                                   192.168.1.7 node01 <none>
                                                                                          <none>
experiment1
                     Running
                                             85
                                                   192.168.1.8 node01 <none>
             1/1
                                  0
                                                                                          <none>
experiment1
             0/1
                     Completed
                                                   192.168.1.8 node01
                                                                         <none>
                                                                                          <none>
experiment1
             1/1
                     Running
                                  1 (3s ago)
                                              10s 192.168.1.8 node01 <none>
                                                                                            <none>
activity2
             2/2
                     Terminating
                                  0
                                               17m 192.168.1.7 node01
                                                                          <none>
                                                                                            <none>
activity2
             0/2
                     Terminating
                                                    <none>
                                  0
                                               17m
                                                                  node01
                                                                          <none>
                                                                                            <none>
                                                     192.168.1.7 node01
activity2
             0/2
                     Terminating
                                  0
                                               17m
                                                                          <none>
                                                                                            <none>
                                                     192.168.1.7 node01
activity2
             0/2
                     Terminating
                                  0
                                               17m
                                                                           <none>
                                                                                            <none>
activity2
             0/2
                     Terminating
                                  0
                                               17m
                                                     192.168.1.7
                                                                  node01
                                                                           <none>
                                                                                            <none>
experiment1
             0/1
                     Completed
                                  1 (8s ago)
                                               15s
                                                     192.168.1.8
                                                                  node01
                                                                           <none>
                                                                                            <none>
                     CrashLoopBack )ff
experiment1
             0/1
                                      1 (169
                                              ago)
                                                     30s 192.168.1.8 node01
                                                                                <none>
                                                                                                  <none>
                     Running
                                                         192.168.1.8 node01
experiment1
             1/1
                                       2 (179
                                              ago)
                                                     31s
                                                                                 <none>
                                                                                                  <none>
                                                         192.168.1.8 node01
experiment1
             0/1
                     Completed
                                       2 (229
                                              ago)
                                                     36s
                                                                                 <none>
                                                                                                  <none>
experiment1
             0/1
                     CrashLoopBack )ff
                                       2 (169
                                              ago)
                                                     52s
                                                         192.168.1.8 node01
                                                                                 <none>
                                                                                                  <none>
experiment1
             1/1
                     Running
                                       3 (299
                                              ago)
                                                     65s
                                                           192.168.1.8 node01
                                                                                 <none>
                                                                                                  <none>
                                              ago)
experiment1
                     Completed
                                       3 (349
                                                           192.168.1.8
             0/1
                                                     70s
                                                                        node01
                                                                                 <none>
                                                                                                  <none>
experiment1
             0/1
                     CrashLoopBack)ff
                                       3 (149
                                                     84s
                                                           192.168.1.8
                                                                        node01
                                              ago)
                                                                                 <none>
                                                                                                  <none>
```

• kuberenetes will restart the container and display the error as CrashloopBackoff.