Lab 3

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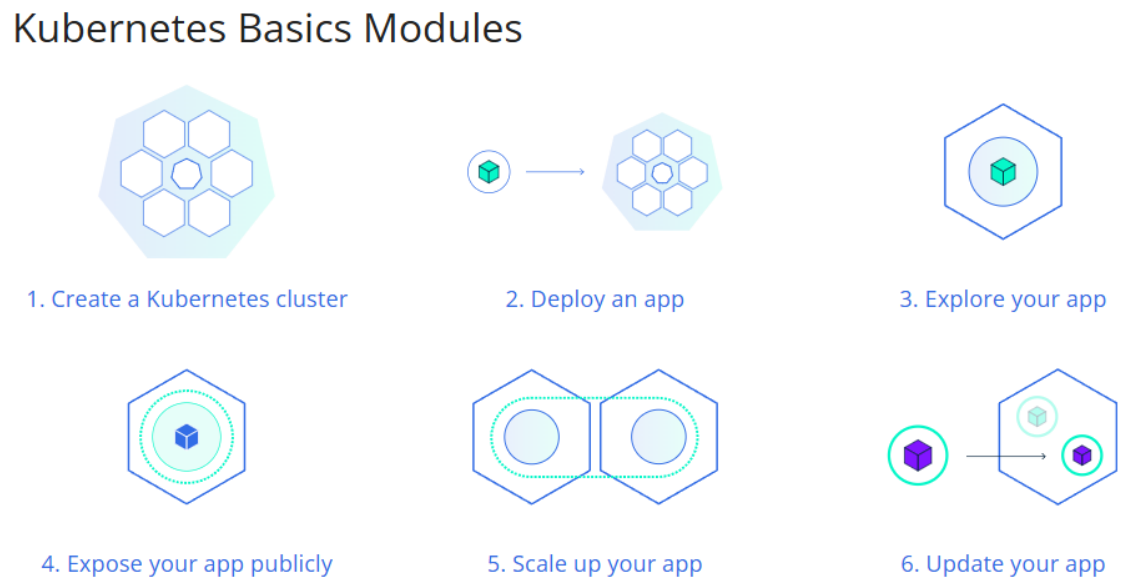
Objective

In this lab for Kubernetes Basics the objective is to

- Deploy a containerized application on a cluster.
- Scale the deployment.
- Update the containerized application with a new software version.
- Debug the containerized application

Kubernetes Basic Module



Using Minikube to Create a Cluster

Begin Hello Minikube tutorial

https://kubernetes.io/docs/tutorials/hello-minikube/

Install Kubectl

Then continue on with running Minikube start

Note: Windows CMD doesn't support export or $, use kubectl get pods to copy the pod name manually instead.

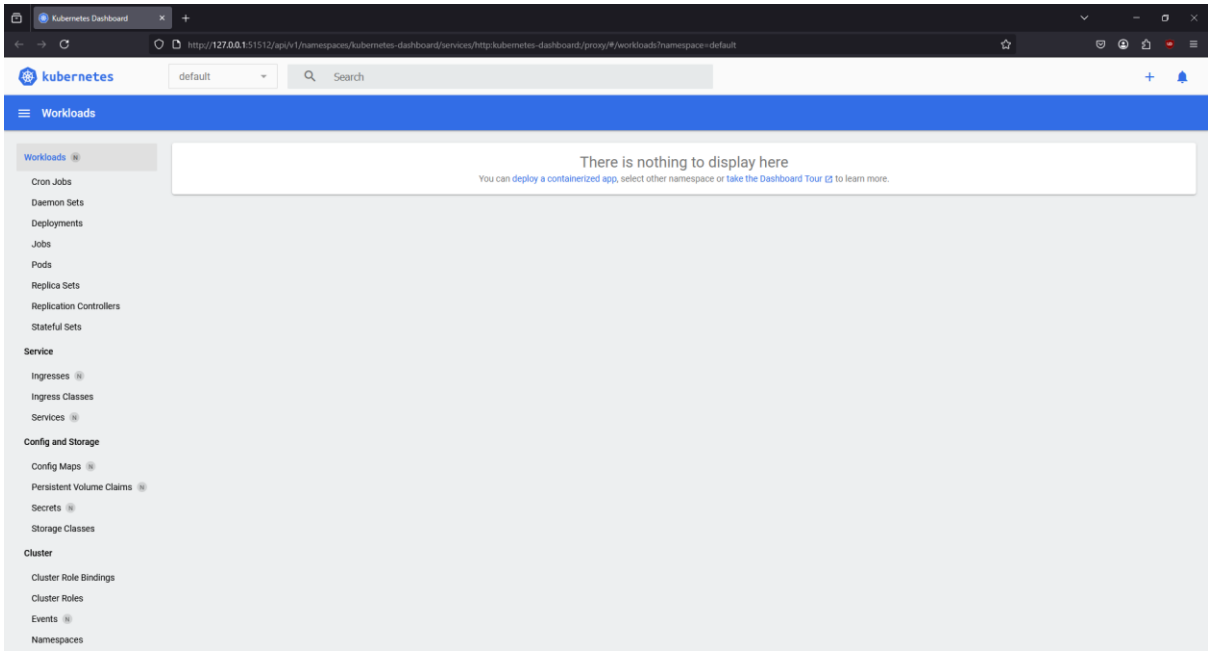
Hello Minikube Tutorial

Create a Minikube cluster

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube start
* minikube v1.35.0 on Microsoft Windows 11 Home 10.0.26100.4061 Build 26100.4061
* Automatically selected the docker driver. Other choices: hyperv, virtualbox, ssh
* Using Docker Desktop driver with root privileges
* Starting "minikube" primary control-plane node in "minikube" cluster
* Pulling base image v0.0.46 ...
* Downloading Kubernetes v1.32.0 preload ...
    > preloaded-images-k8s-v18-v1...:  333.57 MiB / 333.57 MiB  100.00% 37.18 M
    > gcr.io/k8s-minikube/kicbase...:  500.31 MiB / 500.31 MiB  100.00% 3.30 Mi
* Creating docker container (CPUs=2, Memory=3900MB) ...
! Failing to connect to https://registry.k8s.io/ from inside the minikube container
* To pull new external images, you may need to configure a proxy: https://minikube.sigs.k8s.io/docs/reference/networking/proxy/
* Preparing Kubernetes v1.32.0 on Docker 27.4.1 ...
  - Generating certificates and keys ...
  - Booting up control plane ...
  - Configuring RBAC rules ...
* Configuring bridge CNI (Container Networking Interface) ...
* Verifying Kubernetes components...
  - Using image gcr.io/k8s-minikube/storage-provisioner:v5
* Enabled addons: storage-provisioner, default-storageclass
* kubectl not found. If you need it, try: 'minikube kubectl -- get pods -A'
* Done! kubectl is now configured to use "minikube" cluster and "default" namespace by default
```

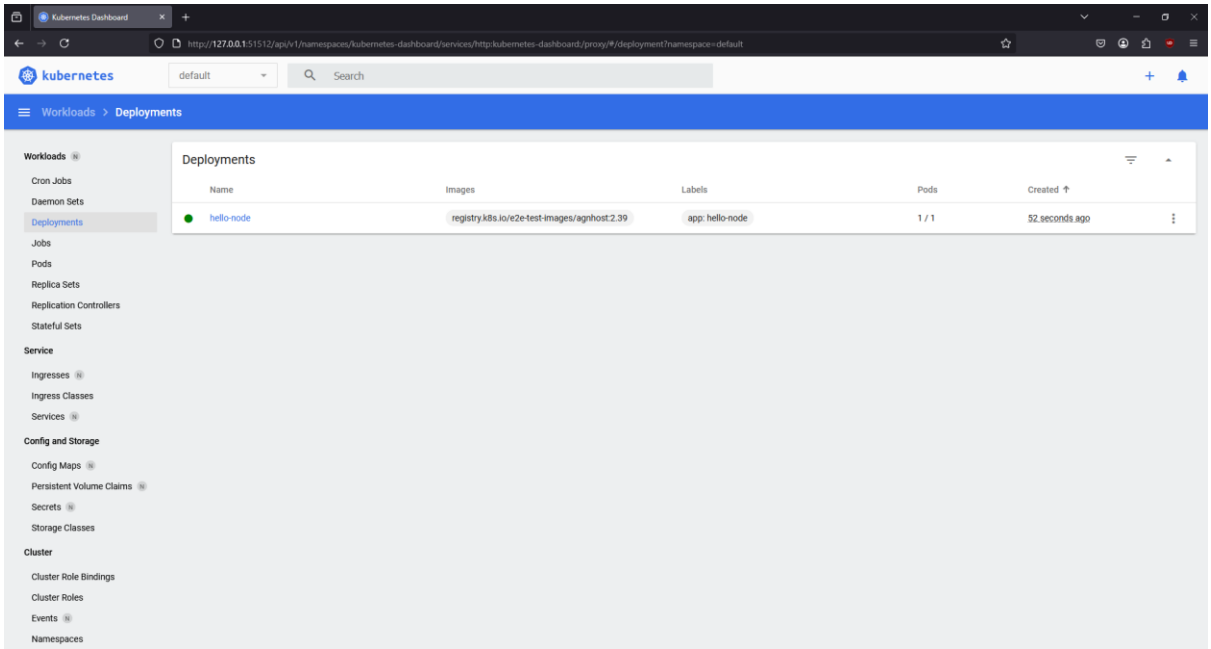
Open the Dashboard

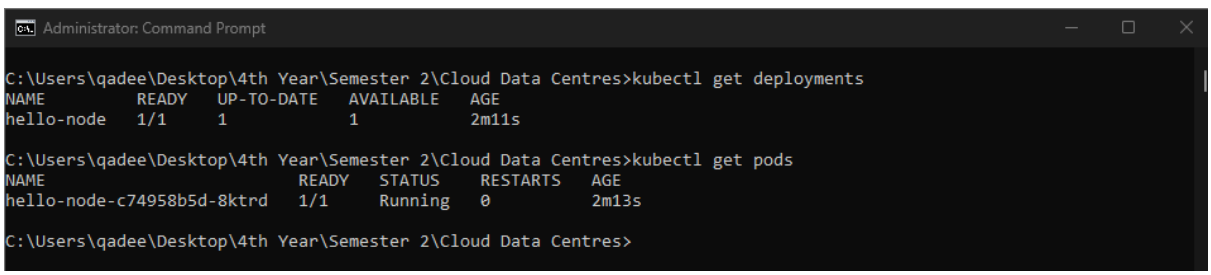
```
Administrator: Command Prompt - minikube  dashboard

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube dashboard
* Enabling dashboard ...
  - Using image docker.io/kubernetesui/dashboard:v2.7.0
  - Using image docker.io/kubernetesui/metrics-scraper:v1.0.8
* Some dashboard features require the metrics-server addon. To enable all features please run:

        minikube addons enable metrics-server

* Verifying dashboard health ...
* Launching proxy ...
    > kubectl.exe.sha256:  64 B / 64 B [--------------------] 100.00% ? p/s 0s
    > kubectl.exe:  56.13 MiB / 56.13 MiB [--------] 100.00% 45.46 MiB p/s 1.4s
* Verifying proxy health ...
* Opening http://127.0.0.1:51512/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/ in your default browser...
```

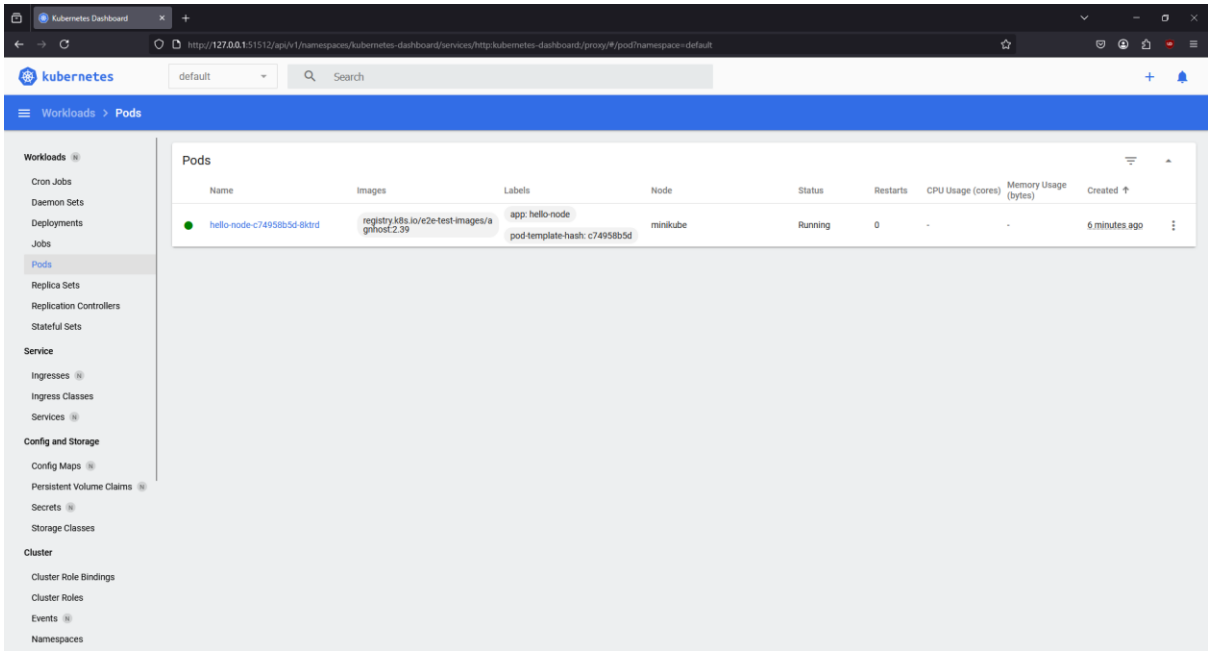


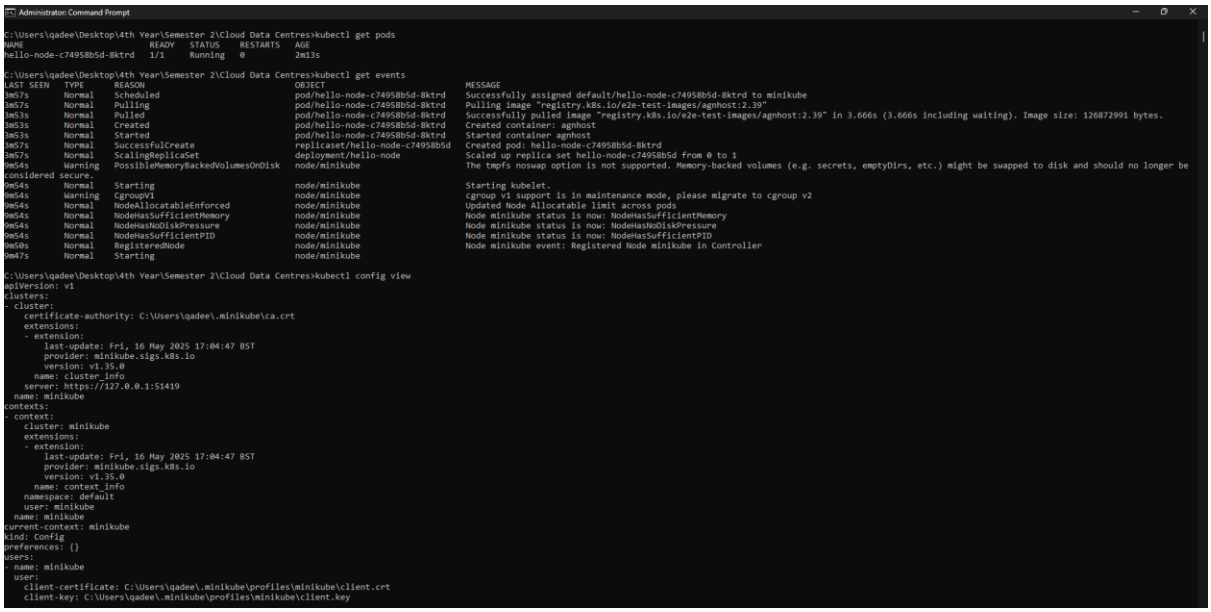
Create a deployment

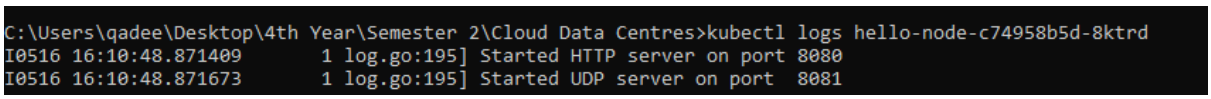
```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl create deployment hello-node --image=registry.k8s.io/e2e-test-
images/agnhost:2.39 -- /agnhost netexec --http-port=8080
deployment.apps/hello-node created

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get deployments
NAME         READY   UP-TO-DATE   AVAILABLE   AGE
hello-node   1/1     1            1           6s
```



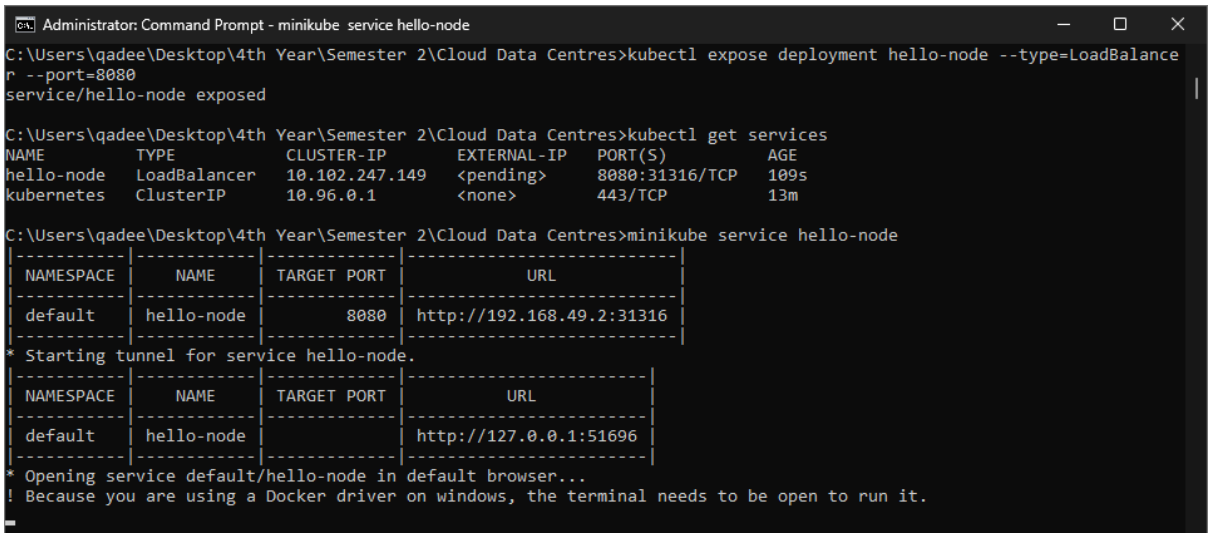


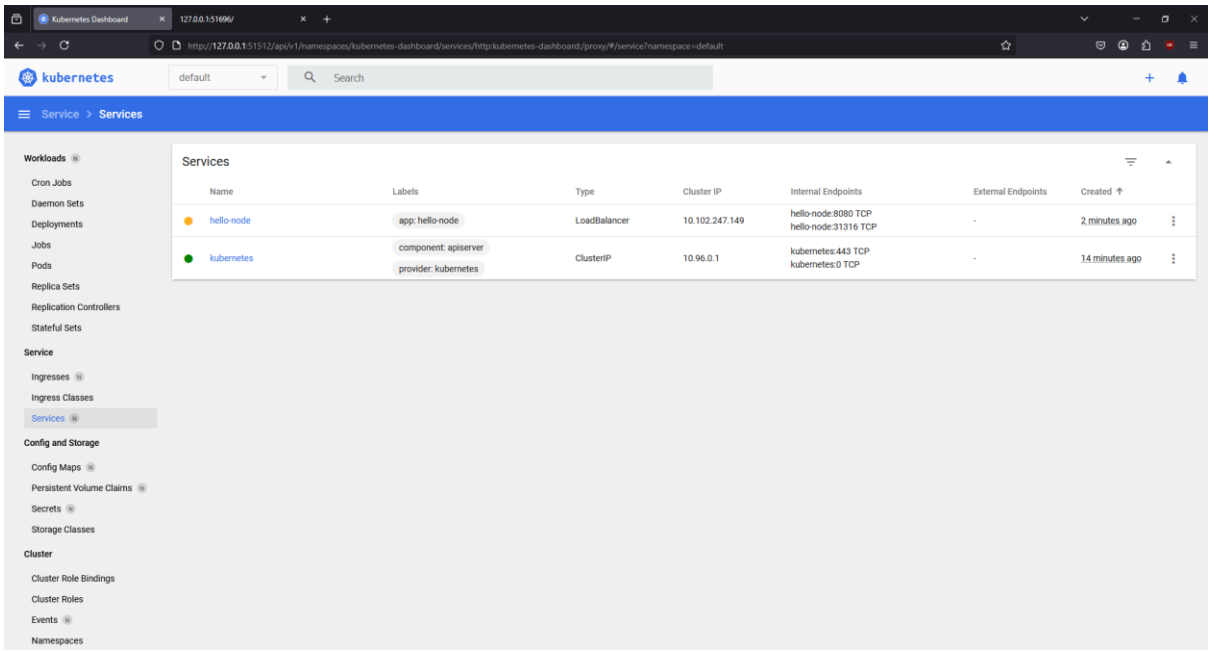

Kubernetes Dashboard
http://127.0.0.1:51512/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/#/pod?namespace=default
kubernetes
default
Search
Workloads > Pods
Workloads
Cron Jobs
Daemon Sets
Deployments
Jobs
Pods
Replica Sets
Replication Controllers
Stateful Sets
Service
Ingresses
Ingress Classes
Services
Config and Storage
Config Maps
Persistent Volume Claims
Secrets
Storage Classes
Cluster
Cluster Role Bindings
Cluster Roles
Events
Namespaces
Pods
Name
Images
Labels
Node
Status
Restarts
CPU Usage (cores)
Memory Usage (bytes)
Created
hello-node-c74958b5d-8ktrd
registry.k8s.io/e2e-test-images/agnhost:2.39
app: hello-node
pod-template-hash: c74958b5d
minikube
Running
0
-
-
6 minutes ago


Administrator: Command Prompt
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME READY STATUS RESTARTS AGE
hello-node-c74958b5d-8ktrd 1/1 Running 0 2m13s
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get events
LAST SEEN TYPE REASON OBJECT MESSAGE
2m57s Normal Scheduled pod/hello-node-c74958b5d-8ktrd Successfully assigned default/hello-node-c74958b5d-8ktrd to minikube
2m57s Normal Pulling pod/hello-node-c74958b5d-8ktrd Pulling image "registry.k8s.io/e2e-test-images/agnhost:2.39"
2m53s Normal Pulled pod/hello-node-c74958b5d-8ktrd Successfully pulled image "registry.k8s.io/e2e-test-images/agnhost:2.39" in 3.666s (3.666s including waiting). Image size: 126872991 bytes.
2m53s Normal Created pod/hello-node-c74958b5d-8ktrd Created container: agnhost
2m53s Normal Started pod/hello-node-c74958b5d-8ktrd Started container agnhost
2m57s Normal SuccessfulCreate replicaset/hello-node-c74958b5d Created pod: hello-node-c74958b5d-8ktrd
2m57s Normal ScalingReplicaSet deployment/hello-node Scaled up replica set hello-node-c74958b5d from 0 to 1
9m54s Warning PossibleMemoryBackedVolumesOnDisk node/minikube The tmpfs noswap option is not supported. Memory-backed volumes (e.g. secrets, emptyDirs, etc.) might be swapped to disk and should no longer be considered secure.
9m54s Normal Starting node/minikube Starting kubelet.
9m54s Warning CgroupV1 node/minikube cgroup v1 support is in maintenance mode, please migrate to cgroup v2
9m54s Normal NodeAllocatableEnforced node/minikube Updated Node Allocatable limit across pods
9m54s Normal NodeHasSufficientMemory node/minikube Node minikube status is now: NodeHasSufficientMemory
9m54s Normal NodeHasNoDiskPressure node/minikube Node minikube status is now: NodeHasNoDiskPressure
9m54s Normal NodeHasSufficientPID node/minikube Node minikube status is now: NodeHasSufficientPID
9m54s Normal RegisteredNode node/minikube Node minikube event: Registered Node minikube in Controller
9m47s Normal Starting node/minikube
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl config view
apiVersion: v1
clusters:
- cluster:
certificate-authority: C:\Users\qadee\.minikube\ca.crt
extensions:
- extension:
last-update: Fri, 16 May 2025 17:04:47 BST
provider: minikube.sigs.k8s.io
version: v1.35.0
name: cluster_info
server: https://127.0.0.1:51419
name: minikube
contexts:
- context:
cluster: minikube
extensions:
- extension:
last-update: Fri, 16 May 2025 17:04:47 BST
provider: minikube.sigs.k8s.io
version: v1.35.0
name: context_info
namespace: default
user: minikube
name: minikube
current-context: minikube
kind: Config
preferences: {}
users:
- name: minikube
user:
client-certificate: C:\Users\qadee\.minikube\profiles\minikube\client.crt
client-key: C:\Users\qadee\.minikube\profiles\minikube\client.key

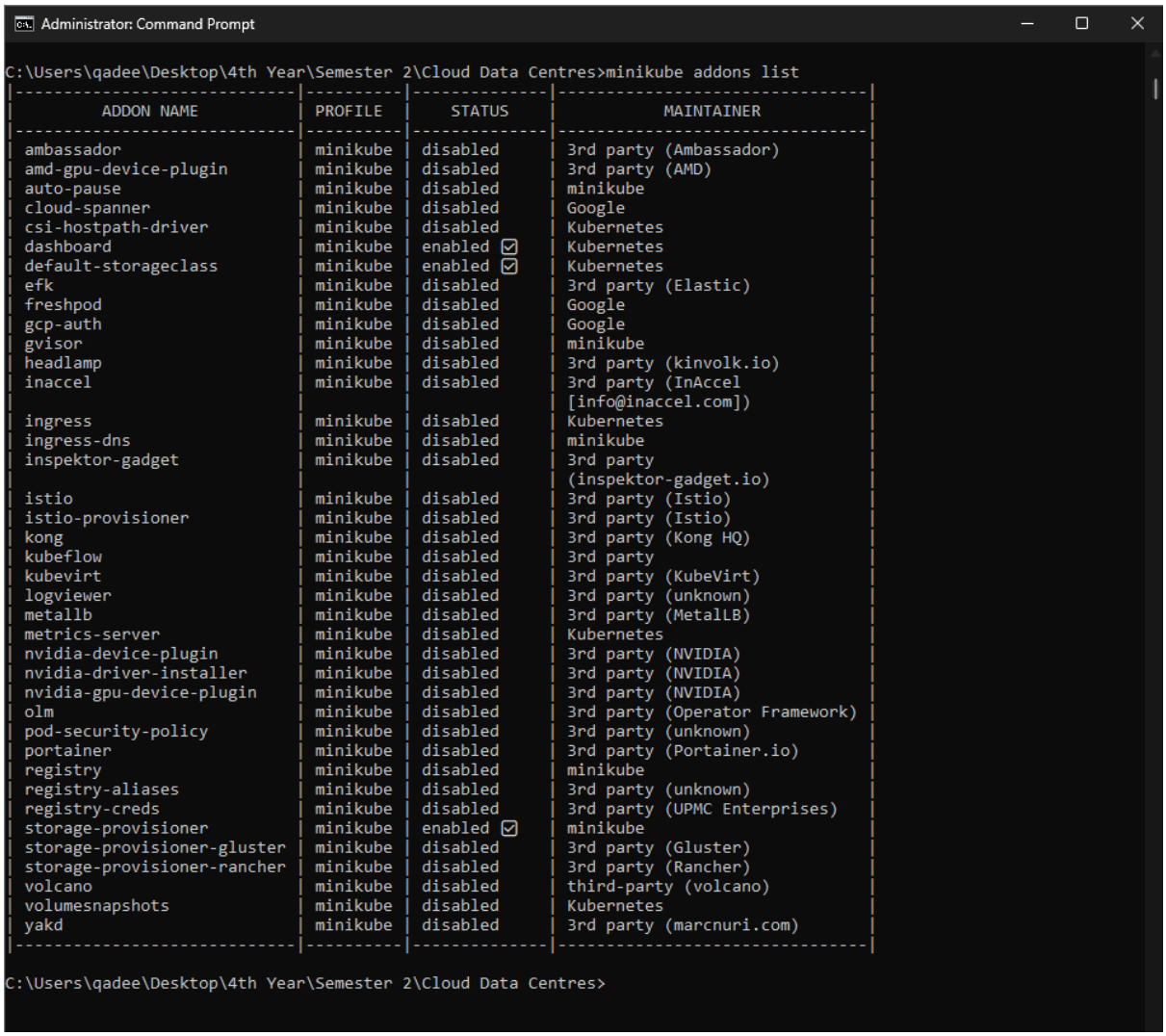

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl logs hello-node-c74958b5d-8ktrd
I0516 16:10:48.871409 1 log.go:195] Started HTTP server on port 8080
I0516 16:10:48.871673 1 log.go:195] Started UDP server on port 8081

Create a Service

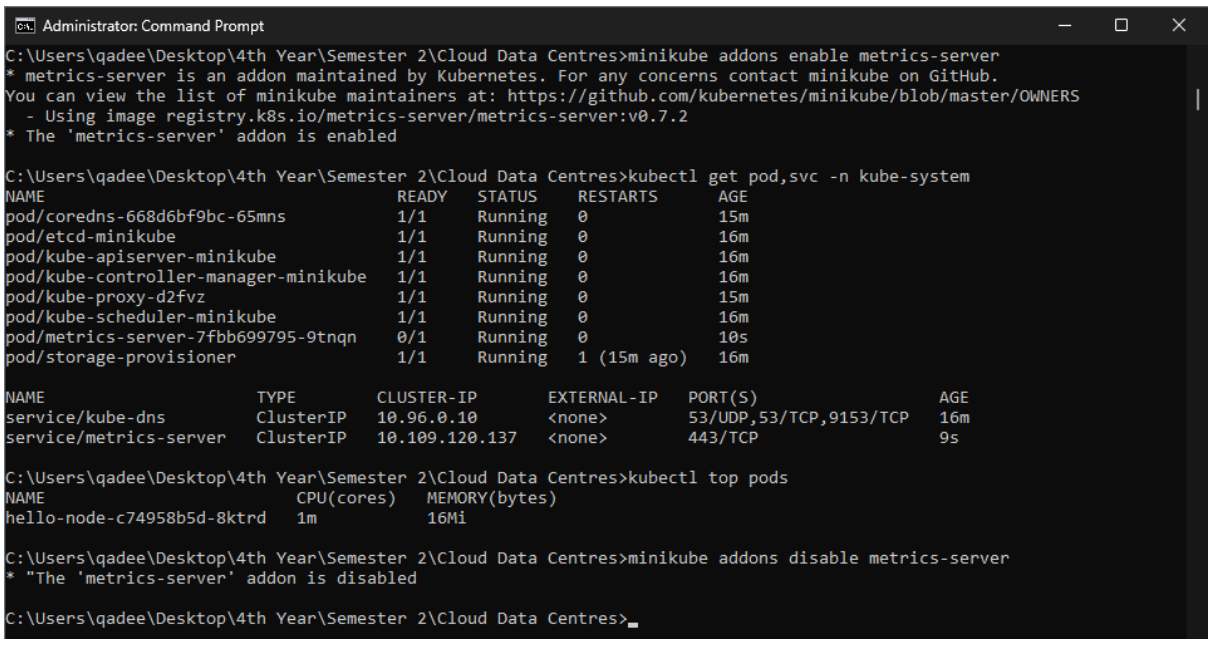




Enable addons

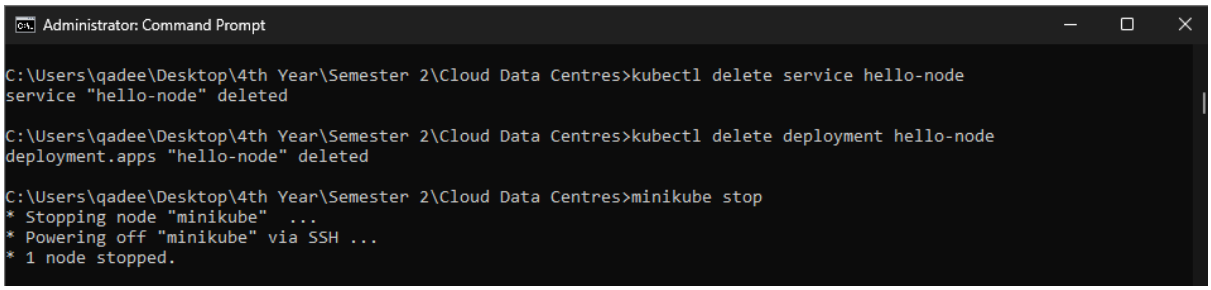


```
Administrator: Command Prompt

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube addons list
|-----------------------------|----------|--------------|--------------------------------|
|         ADDON NAME          | PROFILE  |    STATUS    |           MAINTAINER           |
|-----------------------------|----------|--------------|--------------------------------|
| ambassador                  | minikube | disabled     | 3rd party (Ambassador)         |
| amd-gpu-device-plugin       | minikube | disabled     | 3rd party (AMD)                |
| auto-pause                  | minikube | disabled     | minikube                       |
| cloud-spanner               | minikube | disabled     | Google                         |
| csi-hostpath-driver         | minikube | disabled     | Kubernetes                     |
| dashboard                   | minikube | enabled ☑    | Kubernetes                     |
| default-storageclass        | minikube | enabled ☑    | Kubernetes                     |
| efk                         | minikube | disabled     | 3rd party (Elastic)            |
| freshpod                    | minikube | disabled     | Google                         |
| gcp-auth                    | minikube | disabled     | Google                         |
| gvisor                      | minikube | disabled     | minikube                       |
| headlamp                    | minikube | disabled     | 3rd party (kinvolk.io)         |
| inaccel                     | minikube | disabled     | 3rd party (InAccel             |
|                             |          |              | [info@inaccel.com])            |
| ingress                     | minikube | disabled     | Kubernetes                     |
| ingress-dns                 | minikube | disabled     | minikube                       |
| inspektor-gadget            | minikube | disabled     | 3rd party                      |
|                             |          |              | (inspektor-gadget.io)          |
| istio                       | minikube | disabled     | 3rd party (Istio)              |
| istio-provisioner           | minikube | disabled     | 3rd party (Istio)              |
| kong                        | minikube | disabled     | 3rd party (Kong HQ)            |
| kubeflow                    | minikube | disabled     | 3rd party                      |
| kubevirt                    | minikube | disabled     | 3rd party (KubeVirt)           |
| logviewer                   | minikube | disabled     | 3rd party (unknown)            |
| metallb                     | minikube | disabled     | 3rd party (MetalLB)            |
| metrics-server              | minikube | disabled     | Kubernetes                     |
| nvidia-device-plugin        | minikube | disabled     | 3rd party (NVIDIA)             |
| nvidia-driver-installer     | minikube | disabled     | 3rd party (NVIDIA)             |
| nvidia-gpu-device-plugin    | minikube | disabled     | 3rd party (NVIDIA)             |
| olm                         | minikube | disabled     | 3rd party (Operator Framework) |
| pod-security-policy         | minikube | disabled     | 3rd party (unknown)            |
| portainer                   | minikube | disabled     | 3rd party (Portainer.io)       |
| registry                    | minikube | disabled     | minikube                       |
| registry-aliases            | minikube | disabled     | 3rd party (unknown)            |
| registry-creds              | minikube | disabled     | 3rd party (UPMC Enterprises)   |
| storage-provisioner         | minikube | enabled ☑    | minikube                       |
| storage-provisioner-gluster | minikube | disabled     | 3rd party (Gluster)            |
| storage-provisioner-rancher | minikube | disabled     | 3rd party (Rancher)            |
| volcano                     | minikube | disabled     | third-party (volcano)          |
| volumesnapshots             | minikube | disabled     | Kubernetes                     |
| yakd                        | minikube | disabled     | 3rd party (marcnuri.com)       |
|-----------------------------|----------|--------------|--------------------------------|

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>
```



```
Administrator: Command Prompt

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube addons enable metrics-server
* metrics-server is an addon maintained by Kubernetes. For any concerns contact minikube on GitHub.
You can view the list of minikube maintainers at: https://github.com/kubernetes/minikube/blob/master/OWNERS
  - Using image registry.k8s.io/metrics-server/metrics-server:v0.7.2
* The 'metrics-server' addon is enabled

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pod,svc -n kube-system
NAME                                   READY   STATUS    RESTARTS      AGE
pod/coredns-668d6bf9bc-65mns           1/1     Running   0             15m
pod/etcd-minikube                      1/1     Running   0             16m
pod/kube-apiserver-minikube            1/1     Running   0             16m
pod/kube-controller-manager-minikube   1/1     Running   0             16m
pod/kube-proxy-d2fvz                   1/1     Running   0             15m
pod/kube-scheduler-minikube            1/1     Running   0             16m
pod/metrics-server-7fbb699795-9tnqn    0/1     Running   0             10s
pod/storage-provisioner                1/1     Running   1 (15m ago)   16m

NAME                     TYPE        CLUSTER-IP       EXTERNAL-IP   PORT(S)                  AGE
service/kube-dns         ClusterIP   10.96.0.10       <none>        53/UDP,53/TCP,9153/TCP   16m
service/metrics-server   ClusterIP   10.109.120.137   <none>        443/TCP                  9s

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl top pods
NAME                          CPU(cores)   MEMORY(bytes)
hello-node-c74958b5d-8ktrd    1m           16Mi

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube addons disable metrics-server
* "The 'metrics-server' addon is disabled

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>_
```

Clean up


Administrator: Command Prompt
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl delete service hello-node
service "hello-node" deleted
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl delete deployment hello-node
deployment.apps "hello-node" deleted
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube stop
* Stopping node "minikube" ...
* Powering off "minikube" via SSH ...
* 1 node stopped.

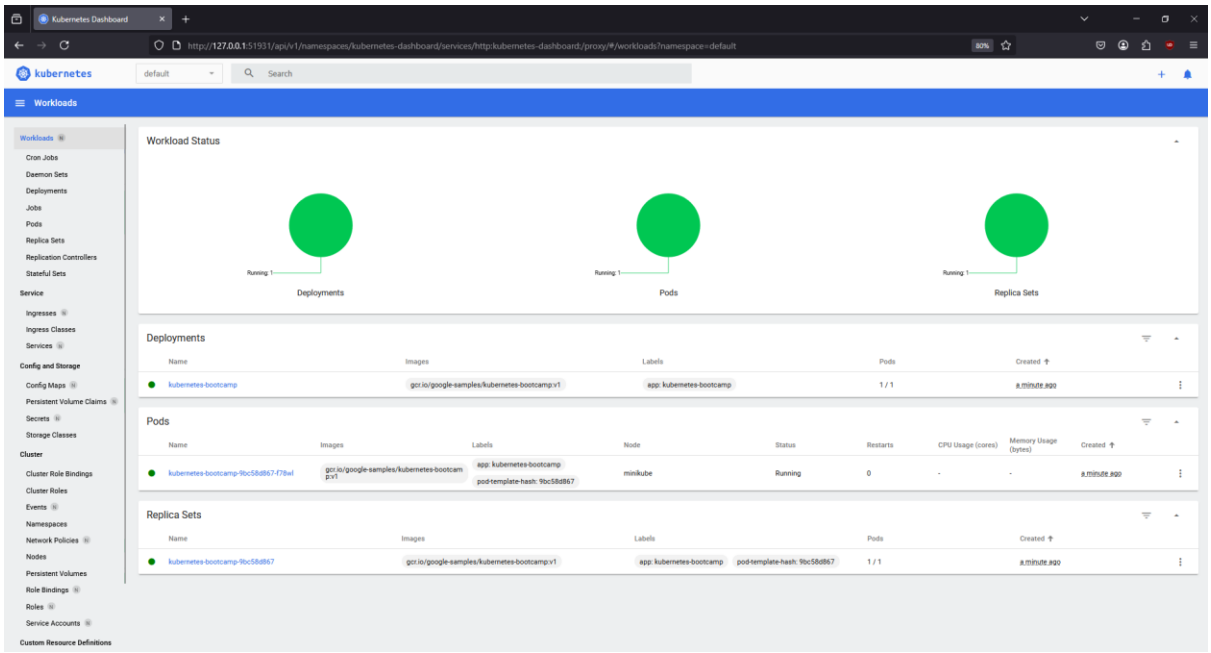
Using kubectl to Create a Deployment

Deploying your first app on Kubernetes

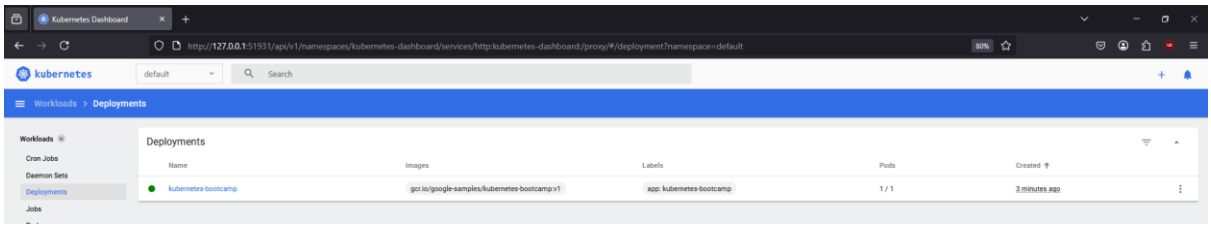
kubectl basics

Deploy an app

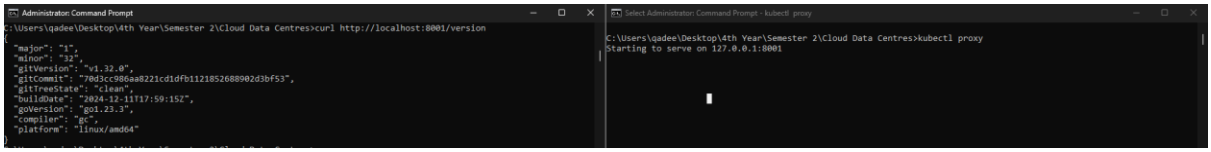
```
Administrator: Command Prompt

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl create deployment kubernetes-bootcamp --image=gcr.io/google-samples/kubernetes-bootcamp:v1
deployment.apps/kubernetes-bootcamp created

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>
```




```
Administrator: Command Prompt

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   1/1     1            1           2m17s
```



View the app

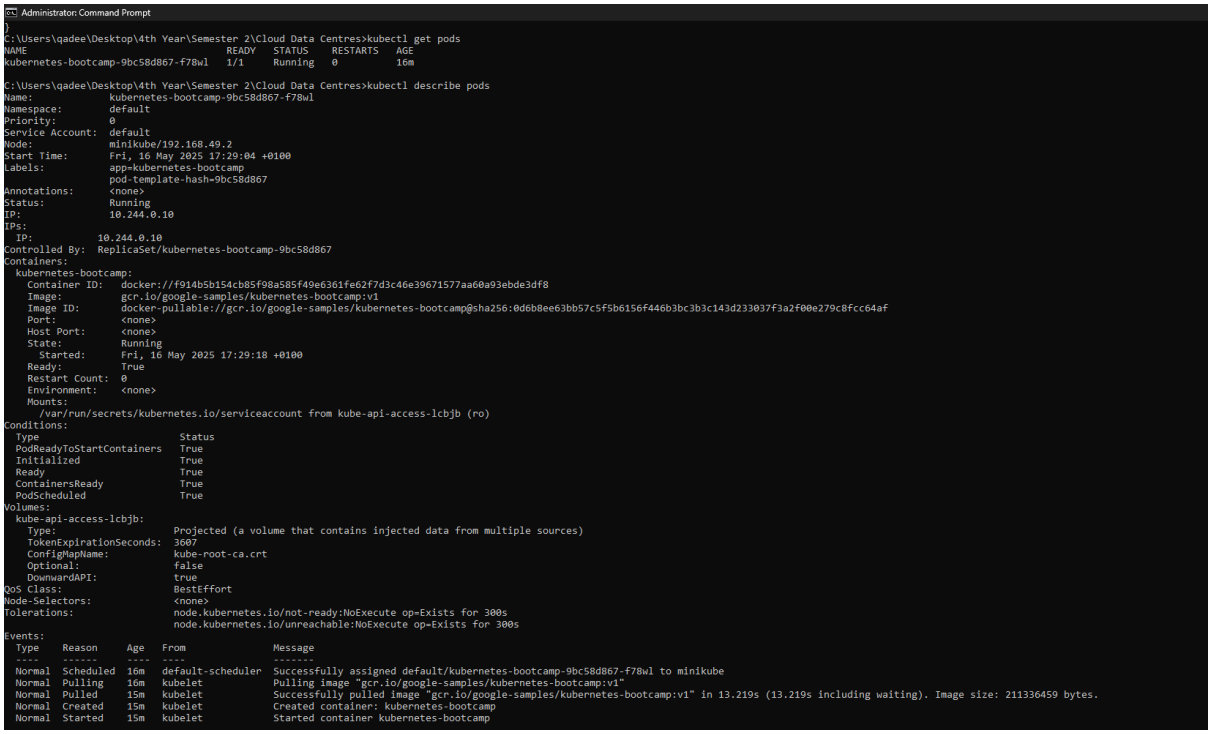



```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                  READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Running   0          10m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>curl http://localhost:8001/api/v1/namespaces/default/po
ds/kubernetes-bootcamp-9bc58d867-f78wl:8080/proxy/
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-f78wl | v=1
```

Viewing Pods and Nodes

Troubleshooting with kubectl

Check application configuration



```
Administrator: Command Prompt

}
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Running   0          16m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe pods
Name:             kubernetes-bootcamp-9bc58d867-f78wl
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 17:29:04 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=9bc58d867
Annotations:      <none>
Status:           Running
IP:               10.244.0.10
IPs:
  IP:           10.244.0.10
Controlled By:  ReplicaSet/kubernetes-bootcamp-9bc58d867
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://f914b5b154cb85f98a585f49e6361fe62f7d3c46e39671577aa60a93ebde3df8
    Image:          gcr.io/google-samples/kubernetes-bootcamp:v1
    Image ID:       docker-pullable://gcr.io/google-samples/kubernetes-bootcamp@sha256:0d6b8ee63bb57c5f5b6156f446b3bc3b3c143d233037f3a2f00e279c8fcc64af
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 17:29:18 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-lcbjb (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-lcbjb:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason     Age   From               Message
  ----    ------     ----  ----               -------
  Normal  Scheduled  16m   default-scheduler  Successfully assigned default/kubernetes-bootcamp-9bc58d867-f78wl to minikube
  Normal  Pulling    16m   kubelet            Pulling image "gcr.io/google-samples/kubernetes-bootcamp:v1"
  Normal  Pulled     15m   kubelet            Successfully pulled image "gcr.io/google-samples/kubernetes-bootcamp:v1" in 13.219s (13.219s including waiting). Image size: 211336459 bytes.
  Normal  Created    15m   kubelet            Created container: kubernetes-bootcamp
  Normal  Started    15m   kubelet            Started container kubernetes-bootcamp
```

Show the app in the terminal

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Running   0          10m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>curl http://localhost:8001/api/v1/namespaces/default/po
ds/kubernetes-bootcamp-9bc58d867-f78wl:8080/proxy/
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-f78wl | v=1
```

Executing commands on the container

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                  READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Running   0          26m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl exec kubernetes-bootcamp-9bc58d867-f78wl -- env
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
HOSTNAME=kubernetes-bootcamp-9bc58d867-f78wl
KUBERNETES_PORT_443_TCP_ADDR=10.96.0.1
KUBERNETES_SERVICE_HOST=10.96.0.1
KUBERNETES_SERVICE_PORT=443
KUBERNETES_SERVICE_PORT_HTTPS=443
KUBERNETES_PORT=tcp://10.96.0.1:443
KUBERNETES_PORT_443_TCP=tcp://10.96.0.1:443
KUBERNETES_PORT_443_TCP_PROTO=tcp
KUBERNETES_PORT_443_TCP_PORT=443
NPM_CONFIG_LOGLEVEL=info
NODE_VERSION=6.3.1
HOME=/root

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl exec -ti kubernetes-bootcamp-9bc58d867-f78wl -- bash
root@kubernetes-bootcamp-9bc58d867-f78wl:/# cat server.js
var http = require('http');
var requests=0;
var podname= process.env.HOSTNAME;
var startTime;
var host;
var handleRequest = function(request, response) {
  response.setHeader('Content-Type', 'text/plain');
  response.writeHead(200);
  response.write("Hello Kubernetes bootcamp! | Running on: ");
  response.write(host);
  response.end(" | v=1\n");
  console.log("Running On:" ,host, "| Total Requests:", ++requests,"| App Uptime:", (new Date() - startTime)/1000 , "seconds", "| Log Time:",new Date());
}
var www = http.createServer(handleRequest);
www.listen(8080,function () {
    startTime = new Date();;
    host = process.env.HOSTNAME;
    console.log ("Kubernetes Bootcamp App Started At:",startTime, "| Running On: " ,host, "\n" );
});
```

```
root@kubernetes-bootcamp-9bc58d867-f78wl:/# curl http://localhost:8080
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-f78wl | v=1
root@kubernetes-bootcamp-9bc58d867-f78wl:/# exit
exit

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>
```

Using a Service to Expose Your App

Services and Labels

Step 1: Creating a new Service

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                  READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Running   0          34m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get services
NAME         TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP   59m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl expose deployment/kubernetes-bootcamp --type="NodePort" --port 8080
service/kubernetes-bootcamp exposed

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe services/kubernetes-bootcamp
Name:                     kubernetes-bootcamp
Namespace:                default
Labels:                   app=kubernetes-bootcamp
Annotations:              <none>
Selector:                 app=kubernetes-bootcamp
Type:                     NodePort
IP Family Policy:         SingleStack
IP Families:              IPv4
IP:                       10.108.23.182
IPs:                      10.108.23.182
Port:                     <unset>  8080/TCP
TargetPort:               8080/TCP
NodePort:                 <unset>  32339/TCP
Endpoints:                10.244.0.10:8080
Session Affinity:         None
External Traffic Policy:  Cluster
Internal Traffic Policy:  Cluster
Events:                   <none>
```

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get service kubernetes-bootcamp
NAME                  TYPE       CLUSTER-IP      EXTERNAL-IP   PORT(S)          AGE
kubernetes-bootcamp   NodePort   10.108.23.182   <none>        8080:32339/TCP   96s

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube ip
192.168.49.2
```

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube service kubernetes-bootcamp
|-----------|----------------------|-------------|---------------------------|
| NAMESPACE |         NAME         | TARGET PORT |            URL            |
|-----------|----------------------|-------------|---------------------------|
| default   | kubernetes-bootcamp  |        8080 | http://192.168.49.2:32339 |
|-----------|----------------------|-------------|---------------------------|
* Starting tunnel for service kubernetes-bootcamp.
|-----------|----------------------|-------------|------------------------|
| NAMESPACE |         NAME         | TARGET PORT |          URL           |
|-----------|----------------------|-------------|------------------------|
| default   | kubernetes-bootcamp  |             | http://127.0.0.1:52540 |
|-----------|----------------------|-------------|------------------------|
* Opening service default/kubernetes-bootcamp in default browser...
! Because you are using a Docker driver on windows, the terminal needs to be open to run it.
```

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>curl http://127.0.0.1:52540
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-f78wl | v=1
```

Step 2: Using labels

```
Administrator: Command Prompt

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe deployment
Name:                   kubernetes-bootcamp
Namespace:              default
CreationTimestamp:      Fri, 16 May 2025 17:29:04 +0100
Labels:                 app=kubernetes-bootcamp
Annotations:            deployment.kubernetes.io/revision: 1
Selector:               app=kubernetes-bootcamp
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=kubernetes-bootcamp
  Containers:
   kubernetes-bootcamp:
    Image:         gcr.io/google-samples/kubernetes-bootcamp:v1
    Port:          <none>
    Host Port:     <none>
    Environment:   <none>
    Mounts:        <none>
  Volumes:         <none>
  Node-Selectors:  <none>
  Tolerations:     <none>
Conditions:
  Type           Status  Reason
  ----           ------  ------
  Available      True    MinimumReplicasAvailable
  Progressing    True    NewReplicaSetAvailable
OldReplicaSets:  <none>
NewReplicaSet:   kubernetes-bootcamp-9bc58d867 (1/1 replicas created)
Events:
  Type    Reason             Age   From                   Message
  ----    ------             ----  ----                   -------
  Normal  ScalingReplicaSet  49m   deployment-controller  Scaled up replica set kubernetes-bootcamp-9bc58d867 from 0 to 1

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods -l app=kubernetes-bootcamp
NAME                                   READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Running   0          49m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get services -l app=kubernetes-bootcamp
NAME                  TYPE       CLUSTER-IP      EXTERNAL-IP   PORT(S)          AGE
kubernetes-bootcamp   NodePort   10.108.23.182   <none>        8080:32339/TCP   14m
```

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                   READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Running   0          51m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl label pods kubernetes-bootcamp-9bc58d867-f78wl version=v1
pod/kubernetes-bootcamp-9bc58d867-f78wl labeled
```

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe pods kubernetes-bootcamp-9bc58d867-f78wl
Name:             kubernetes-bootcamp-9bc58d867-f78wl
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 17:29:04 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=9bc58d867
                  version=v1
Annotations:      <none>
Status:           Running
IP:               10.244.0.10
IPs:
  IP:           10.244.0.10
Controlled By:  ReplicaSet/kubernetes-bootcamp-9bc58d867
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://f914b5b154cb85f98a585f49e6361fe62f7d3c46e39671577aa60a93ebde3df8
    Image:          gcr.io/google-samples/kubernetes-bootcamp:v1
    Image ID:       docker-pullable://gcr.io/google-samples/kubernetes-bootcamp@sha256:0d6b8ee63bb57c5f5b6156f446b3bc3b3c143d233037f3a2f00e279c8fcc64af
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 17:29:18 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-lcbjb (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-lcbjb:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason     Age   From               Message
  ----    ------     ----  ----               -------
  Normal  Scheduled  52m   default-scheduler  Successfully assigned default/kubernetes-bootcamp-9bc58d867-f78wl to minikube
  Normal  Pulling    52m   kubelet            Pulling image "gcr.io/google-samples/kubernetes-bootcamp:v1"
  Normal  Pulled     52m   kubelet            Successfully pulled image "gcr.io/google-samples/kubernetes-bootcamp:v1" in 13.219s (13.219s including waiting). Image size: 211336459 bytes.
  Normal  Created    52m   kubelet            Created container: kubernetes-bootcamp
  Normal  Started    52m   kubelet            Started container kubernetes-bootcamp
```

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods -l version=v1
NAME                                  READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Running   0          52m
```

Step 3: Deleting a service

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl delete service -l app=kubernetes-bootcamp
service "kubernetes-bootcamp" deleted

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get services
NAME         TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP   77m
```

Running Multiple Instances of Your App

Scaling an application

Scaling a Deployment

```
Administrator: Command Prompt

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   1/1     1            1           59m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get rs
NAME                            DESIRED   CURRENT   READY   AGE
kubernetes-bootcamp-9bc58d867   1         1         1       59m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl scale deployments/kubernetes-bootcamp --replicas=4
deployment.apps/kubernetes-bootcamp scaled

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   4/4     4            4           59m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods -o wide
NAME                                   READY   STATUS    RESTARTS   AGE   IP            NODE       NOMINATED NODE   READINESS GATES
kubernetes-bootcamp-9bc58d867-5d9dj    1/1     Running   0          20s   10.244.0.13   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-f78wl    1/1     Running   0          59m   10.244.0.10   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-pzzt9    1/1     Running   0          20s   10.244.0.12   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-x247p    1/1     Running   0          20s   10.244.0.11   minikube   <none>           <none>

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe deployments/kubernetes-bootcamp
Name:                   kubernetes-bootcamp
Namespace:              default
CreationTimestamp:      Fri, 16 May 2025 17:29:04 +0100
Labels:                 app=kubernetes-bootcamp
Annotations:            deployment.kubernetes.io/revision: 1
Selector:               app=kubernetes-bootcamp
Replicas:               4 desired | 4 updated | 4 total | 4 available | 0 unavailable
StrategyType:           RollingUpdate
MinReadySeconds:        0
RollingUpdateStrategy:  25% max unavailable, 25% max surge
Pod Template:
  Labels:  app=kubernetes-bootcamp
  Containers:
   kubernetes-bootcamp:
    Image:         gcr.io/google-samples/kubernetes-bootcamp:v1
    Port:          <none>
    Host Port:     <none>
    Environment:   <none>
    Mounts:        <none>
  Volumes:         <none>
  Node-Selectors:  <none>
  Tolerations:     <none>
Conditions:
  Type           Status  Reason
  ----           ------  ------
  Progressing    True    NewReplicaSetAvailable
  Available      True    MinimumReplicasAvailable
OldReplicaSets:  <none>
NewReplicaSet:   kubernetes-bootcamp-9bc58d867 (4/4 replicas created)
Events:
  Type    Reason             Age   From                   Message
  ----    ------             ----  ----                   -------
  Normal  ScalingReplicaSet  59m   deployment-controller  Scaled up replica set kubernetes-bootcamp-9bc58d867 from 0 to 1
  Normal  ScalingReplicaSet  26s   deployment-controller  Scaled up replica set kubernetes-bootcamp-9bc58d867 from 1 to 4
```

Load Balancing

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe services/kubernetes-bootcamp
Name:                     kubernetes-bootcamp
Namespace:                default
Labels:                   app=kubernetes-bootcamp
Annotations:              <none>
Selector:                 app=kubernetes-bootcamp
Type:                     NodePort
IP Family Policy:         SingleStack
IP Families:              IPv4
IP:                       10.101.81.216
IPs:                      10.101.81.216
Port:                     <unset>  8080/TCP
TargetPort:               8080/TCP
NodePort:                 <unset>  32052/TCP
Endpoints:                10.244.0.10:8080,10.244.0.11:8080,10.244.0.12:8080 + 1 more...
Session Affinity:         None
External Traffic Policy:  Cluster
Internal Traffic Policy:  Cluster
Events:                   <none>
```

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube service kubernetes-bootcamp
|-----------|----------------------|-------------|---------------------------|
| NAMESPACE |         NAME         | TARGET PORT |            URL            |
|-----------|----------------------|-------------|---------------------------|
| default   | kubernetes-bootcamp  |        8080 | http://192.168.49.2:32052 |
|-----------|----------------------|-------------|---------------------------|
* Starting tunnel for service kubernetes-bootcamp.
|-----------|----------------------|-------------|------------------------|
| NAMESPACE |         NAME         | TARGET PORT |          URL           |
|-----------|----------------------|-------------|------------------------|
| default   | kubernetes-bootcamp  |             | http://127.0.0.1:53021 |
|-----------|----------------------|-------------|------------------------|
* Opening service default/kubernetes-bootcamp in default browser...
! Because you are using a Docker driver on windows, the terminal needs to be open to run it.
* Stopping tunnel for service kubernetes-bootcamp.

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>minikube service kubernetes-bootcamp
|-----------|----------------------|-------------|---------------------------|
| NAMESPACE |         NAME         | TARGET PORT |            URL            |
|-----------|----------------------|-------------|---------------------------|
| default   | kubernetes-bootcamp  |        8080 | http://192.168.49.2:32052 |
|-----------|----------------------|-------------|---------------------------|
* Starting tunnel for service kubernetes-bootcamp.
|-----------|----------------------|-------------|------------------------|
| NAMESPACE |         NAME         | TARGET PORT |          URL           |
|-----------|----------------------|-------------|------------------------|
| default   | kubernetes-bootcamp  |             | http://127.0.0.1:53056 |
|-----------|----------------------|-------------|------------------------|
* Opening service default/kubernetes-bootcamp in default browser...
! Because you are using a Docker driver on windows, the terminal needs to be open to run it.
```

Scale Down

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl scale deployments/kubernetes-bootcamp --replicas=2
deployment.apps/kubernetes-bootcamp scaled

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   2/2     2            2           131m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods -o wide
NAME                                  READY   STATUS        RESTARTS   AGE    IP            NODE       NOMINATED NODE   READINESS GATES
kubernetes-bootcamp-9bc58d867-5d9dj   1/1     Terminating   0          71m    10.244.0.13   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Running       0          131m   10.244.0.10   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-pzzt9   1/1     Terminating   0          71m    10.244.0.12   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-x247p   1/1     Running       0          71m    10.244.0.11   minikube   <none>           <none>
```

Performing a Rolling Update

Rolling updates overview

Update the version of the app

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   2/2     2            2           134m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                   READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-f78wl    1/1     Running   0          134m
kubernetes-bootcamp-9bc58d867-x247p    1/1     Running   0          74m
```

```
Select Administrator: Command Prompt
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe pods
Name:             kubernetes-bootcamp-9bc58d867-f78wl
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 17:29:04 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=9bc58d867
                  version=v1
Annotations:      <none>
Status:           Running
IP:               10.244.0.10
IPs:
  IP:           10.244.0.10
Controlled By:  ReplicaSet/kubernetes-bootcamp-9bc58d867
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://f914b5b154cb85f98a585f49e6361fe62f7d3c46e39671577aa60a93ebde3df8
    Image:          gcr.io/google-samples/kubernetes-bootcamp:v1
    Image ID:       docker-pullable://gcr.io/google-samples/kubernetes-bootcamp@sha256:0d6b8ee63bb57c5f5b6156f446b3bc3b3c143d233037f3a2f00e279c8fcc64af
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 17:29:18 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-lcbjb (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-lcbjb:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:                      <none>
```

```
Select Administrator: Command Prompt
Name:             kubernetes-bootcamp-9bc58d867-x247p
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 18:28:31 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=9bc58d867
Annotations:      <none>
Status:           Running
IP:               10.244.0.11
IPs:
  IP:           10.244.0.11
Controlled By:  ReplicaSet/kubernetes-bootcamp-9bc58d867
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://ecea622297eb88a1d12bf2d024a2ff51f3ed603f57b2e1352d79e39886fb8b1f
    Image:          gcr.io/google-samples/kubernetes-bootcamp:v1
    Image ID:       docker-pullable://gcr.io/google-samples/kubernetes-bootcamp@sha256:0d6b8ee63bb57c5f5b6156f446b3bc3b3c143d233037f3a2f00e279c8fcc64af
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 18:28:32 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-2fzp8 (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-2fzp8:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:                      <none>
```

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl set image deployments/kubernetes-bootcamp kubernetes-bootcamp=docker.io/jocatalin/kubernetes-bootcamp:v2
deployment.apps/kubernetes-bootcamp image updated

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                  READY   STATUS        RESTARTS   AGE
kubernetes-bootcamp-5c4f7cb664-h9pxq  1/1     Running       0          29s
kubernetes-bootcamp-5c4f7cb664-tdn2p  1/1     Running       0          25s
kubernetes-bootcamp-9bc58d867-f78wl   1/1     Terminating   0          137m
kubernetes-bootcamp-9bc58d867-x247p   1/1     Terminating   0          77m
```

Verify an update

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>curl http://127.0.0.1:53128/
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-5c4f7cb664-tdn2p | v=2
```

```
Administrator: Command Prompt
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl rollout status deployments/kubernetes-bootcamp
deployment "kubernetes-bootcamp" successfully rolled out

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe pods
Name:             kubernetes-bootcamp-5c4f7cb664-h9pxq
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 19:45:48 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=5c4f7cb664
Annotations:      <none>
Status:           Running
IP:               10.244.0.14
IPs:
  IP:           10.244.0.14
Controlled By:  ReplicaSet/kubernetes-bootcamp-5c4f7cb664
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://5c0eaadf6bc97e2951981a050338c8080e3fe953faa51087105b6e4cf8da7e9e
    Image:          docker.io/jocatalin/kubernetes-bootcamp:v2
    Image ID:       docker-pullable://jocatalin/kubernetes-bootcamp@sha256:fb1a3ced00cecfc1f83f18ab5cd14199e30adc1b49aa4244f5d65ad3f5feb2a5
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 19:45:52 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-t59pk (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-t59pk:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
```

```
Select Administrator: Command Prompt
Events:
  Type    Reason     Age    From               Message
  ----    ------     ----   ----               -------
  Normal  Scheduled  3m10s  default-scheduler  Successfully assigned default/kubernetes-bootcamp-5c4f7cb664-h9pxq to minikube
  Normal  Pulling    3m10s  kubelet            Pulling image "docker.io/jocatalin/kubernetes-bootcamp:v2"
  Normal  Pulled     3m7s   kubelet            Successfully pulled image "docker.io/jocatalin/kubernetes-bootcamp:v2" in 2.719s (2.719s including waiting). Image size: 211336459 bytes.
  Normal  Created    3m7s   kubelet            Created container: kubernetes-bootcamp
  Normal  Started    3m7s   kubelet            Started container kubernetes-bootcamp


Name:             kubernetes-bootcamp-5c4f7cb664-tdn2p
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 19:45:52 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=5c4f7cb664
Annotations:      <none>
Status:           Running
IP:               10.244.0.15
IPs:
  IP:           10.244.0.15
Controlled By:  ReplicaSet/kubernetes-bootcamp-5c4f7cb664
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://1fce57452f76ab26f95281fb4ecb1d5f58d6359b6b4c7db68969d0eecede517a
    Image:          docker.io/jocatalin/kubernetes-bootcamp:v2
    Image ID:       docker-pullable://jocatalin/kubernetes-bootcamp@sha256:fb1a3ced00cecfc1f83f18ab5cd14199e30adc1b49aa4244f5d65ad3f5feb2a5
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 19:45:53 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-jl6xf (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-jl6xf:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
```

```
Events:
  Type    Reason     Age   From               Message
  ----    ------     ----  ----               -------
  Normal  Scheduled  3m6s  default-scheduler  Successfully assigned default/kubernetes-bootcamp-5c4f7cb664-tdn2p to minikube
  Normal  Pulled     3m6s  kubelet            Container image "docker.io/jocatalin/kubernetes-bootcamp:v2" already present on machine
  Normal  Created    3m6s  kubelet            Created container: kubernetes-bootcamp
  Normal  Started    3m6s  kubelet            Started container kubernetes-bootcamp
```

Roll back an update

```
Administrator: Command Prompt
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl set image deployments/kubernetes-bootcamp kubernetes-bootcamp=gcr.io/google-samples/kubernetes-bootcamp:v10
deployment.apps/kubernetes-bootcamp image updated

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   2/2     1            2           142m

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                  READY   STATUS             RESTARTS   AGE
kubernetes-bootcamp-5c4f7cb664-h9pxq   1/1     Running            0          6m10s
kubernetes-bootcamp-5c4f7cb664-tdn2p   1/1     Running            0          6m6s
kubernetes-bootcamp-75bd5fd495-wcgv4   0/1     ImagePullBackOff   0          17s
```

```
Administrator: Command Prompt
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe pods
Name:             kubernetes-bootcamp-5c4f7cb664-h9pxq
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 19:45:48 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=5c4f7cb664
Annotations:      <none>
Status:           Running
IP:               10.244.0.14
IPs:
  IP:           10.244.0.14
Controlled By:  ReplicaSet/kubernetes-bootcamp-5c4f7cb664
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://5c0eaadf6bc97e2951981a050338c8080e3fe953faa51087105b6e4cf8da7e9e
    Image:          docker.io/jocatalin/kubernetes-bootcamp:v2
    Image ID:       docker-pullable://jocatalin/kubernetes-bootcamp@sha256:fb1a3ced00cecfc1f83f18ab5cd14199e30adc1b49aa4244f5d65ad3f5feb2a5
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 19:45:52 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-t59pk (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-t59pk:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason     Age    From               Message
  ----    ------     ----   ----               -------
  Normal  Scheduled  6m22s  default-scheduler  Successfully assigned default/kubernetes-bootcamp-5c4f7cb664-h9pxq to minikube
  Normal  Pulling    6m22s  kubelet            Pulling image "docker.io/jocatalin/kubernetes-bootcamp:v2"
  Normal  Pulled     6m19s  kubelet            Successfully pulled image "docker.io/jocatalin/kubernetes-bootcamp:v2" in 2.719s (2.719s including waiting). Image size: 211336459 bytes.
  Normal  Created    6m19s  kubelet            Created container: kubernetes-bootcamp
  Normal  Started    6m19s  kubelet            Started container kubernetes-bootcamp
```

```
Select Administrator: Command Prompt
Name:             kubernetes-bootcamp-5c4f7cb664-tdn2p
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 19:45:52 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=5c4f7cb664
Annotations:      <none>
Status:           Running
IP:               10.244.0.15
IPs:
  IP:           10.244.0.15
Controlled By:  ReplicaSet/kubernetes-bootcamp-5c4f7cb664
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://1fce57452f76ab26f95281fb4ecb1d5f58d6359b6b4c7db68969d0eecede517a
    Image:          docker.io/jocatalin/kubernetes-bootcamp:v2
    Image ID:       docker-pullable://jocatalin/kubernetes-bootcamp@sha256:fb1a3ced00cecfc1f83f18ab5cd14199e30adc1b49aa4244f5d65ad3f5feb2a5
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 19:45:53 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-jl6xf (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-jl6xf:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason     Age    From               Message
  ----    ------     ----   ----               -------
  Normal  Scheduled  6m18s  default-scheduler  Successfully assigned default/kubernetes-bootcamp-5c4f7cb664-tdn2p to minikube
  Normal  Pulled     6m18s  kubelet            Container image "docker.io/jocatalin/kubernetes-bootcamp:v2" already present on machine
  Normal  Created    6m18s  kubelet            Created container: kubernetes-bootcamp
  Normal  Started    6m18s  kubelet            Started container kubernetes-bootcamp
```

```
Administrator: Command Prompt
Name:             kubernetes-bootcamp-75bd5fd495-wcgv4
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 19:51:41 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=75bd5fd495
Annotations:      <none>
Status:           Pending
IP:               10.244.0.16
IPs:
  IP:           10.244.0.16
Controlled By:  ReplicaSet/kubernetes-bootcamp-75bd5fd495
Containers:
  kubernetes-bootcamp:
    Container ID:
    Image:          gcr.io/google-samples/kubernetes-bootcamp:v10
    Image ID:
    Port:           <none>
    Host Port:      <none>
    State:          Waiting
      Reason:       ErrImagePull
    Ready:          False
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-xgg76 (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       False
  ContainersReady             False
  PodScheduled                True
Volumes:
  kube-api-access-xgg76:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type     Reason     Age               From               Message
  ----     ------     ----              ----               -------
  Normal   Scheduled  29s               default-scheduler  Successfully assigned default/kubernetes-bootcamp-75bd5fd495-wcgv4 to minikube
  Normal   Pulling    16s (x2 over 29s)  kubelet            Pulling image "gcr.io/google-samples/kubernetes-bootcamp:v10"
  Warning  Failed     15s (x2 over 28s)  kubelet            Failed to pull image "gcr.io/google-samples/kubernetes-bootcamp:v10": Error response from daemon: manifest for gcr.io/google-samples/kubernetes-bootcamp:v10 not found: manifest
unknown: Failed to fetch "v10"
  Warning  Failed     15s (x2 over 28s)  kubelet            Error: ErrImagePull
  Normal   BackOff    1s (x2 over 28s)   kubelet            Back-off pulling image "gcr.io/google-samples/kubernetes-bootcamp:v10"
  Warning  Failed     1s (x2 over 28s)   kubelet            Error: ImagePullBackOff
```

```
Select Administrator: Command Prompt
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl rollout undo deployments/kubernetes-bootcamp
deployment.apps/kubernetes-bootcamp rolled back

C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl get pods
NAME                                   READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-5c4f7cb664-h9pxq   1/1     Running   0          8m13s
kubernetes-bootcamp-5c4f7cb664-tdn2p   1/1     Running   0          8m9s
```

```
Select Administrator: Command Prompt
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl describe pods
Name:             kubernetes-bootcamp-5c4f7cb664-h9pxq
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 19:45:48 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=5c4f7cb664
Annotations:      <none>
Status:           Running
IP:               10.244.0.14
IPs:
  IP:           10.244.0.14
Controlled By:  ReplicaSet/kubernetes-bootcamp-5c4f7cb664
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://5c0eaadf6bc97e2951981a050338c8080e3fe953faa51087105b6e4cf8da7e9e
    Image:          docker.io/jocatalin/kubernetes-bootcamp:v2
    Image ID:       docker-pullable://jocatalin/kubernetes-bootcamp@sha256:fb1a3ced00cecfc1f83f18ab5cd14199e30adc1b49aa4244f5d65ad3f5feb2a5
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 19:45:52 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-t59pk (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-t59pk:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason     Age    From               Message
  ----    ------     ----   ----               -------
  Normal  Scheduled  8m18s  default-scheduler  Successfully assigned default/kubernetes-bootcamp-5c4f7cb664-h9pxq to minikube
  Normal  Pulling    8m18s  kubelet            Pulling image "docker.io/jocatalin/kubernetes-bootcamp:v2"
  Normal  Pulled     8m15s  kubelet            Successfully pulled image "docker.io/jocatalin/kubernetes-bootcamp:v2" in 2.719s (2.719s including waiting). Image size: 211336459 bytes.
  Normal  Created    8m15s  kubelet            Created container: kubernetes-bootcamp
  Normal  Started    8m15s  kubelet            Started container kubernetes-bootcamp
```

Select Administrator: Command Prompt

```
Name:             kubernetes-bootcamp-5c4f7cb664-tdn2p
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Fri, 16 May 2025 19:45:52 +0100
Labels:           app=kubernetes-bootcamp
                  pod-template-hash=5c4f7cb664
Annotations:      <none>
Status:           Running
IP:               10.244.0.15
IPs:
  IP:           10.244.0.15
Controlled By:  ReplicaSet/kubernetes-bootcamp-5c4f7cb664
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://1fce57452f76ab26f95281fb4ecb1d5f58d6359b6b4c7db68969d0eecede517a
    Image:          docker.io/jocatalin/kubernetes-bootcamp:v2
    Image ID:       docker-pullable://jocatalin/kubernetes-bootcamp@sha256:fb1a3ced00cecfc1f83f18ab5cd14199e30adc1b49aa4244f5d65ad3f5feb2a5
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Fri, 16 May 2025 19:45:53 +0100
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-jl6xf (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-jl6xf:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    Optional:                false
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason     Age    From               Message
  ----    ------     ----   ----               -------
  Normal  Scheduled  8m14s  default-scheduler  Successfully assigned default/kubernetes-bootcamp-5c4f7cb664-tdn2p to minikube
  Normal  Pulled     8m14s  kubelet            Container image "docker.io/jocatalin/kubernetes-bootcamp:v2" already present on machine
  Normal  Created    8m14s  kubelet            Created container: kubernetes-bootcamp
  Normal  Started    8m14s  kubelet            Started container kubernetes-bootcamp
```

```
C:\Users\qadee\Desktop\4th Year\Semester 2\Cloud Data Centres>kubectl delete deployments/kubernetes-bootcamp services/kubernetes-bootcamp
deployment.apps "kubernetes-bootcamp" deleted
service "kubernetes-bootcamp" deleted
```