Cloud Data Centres
Lab 3

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March 2025

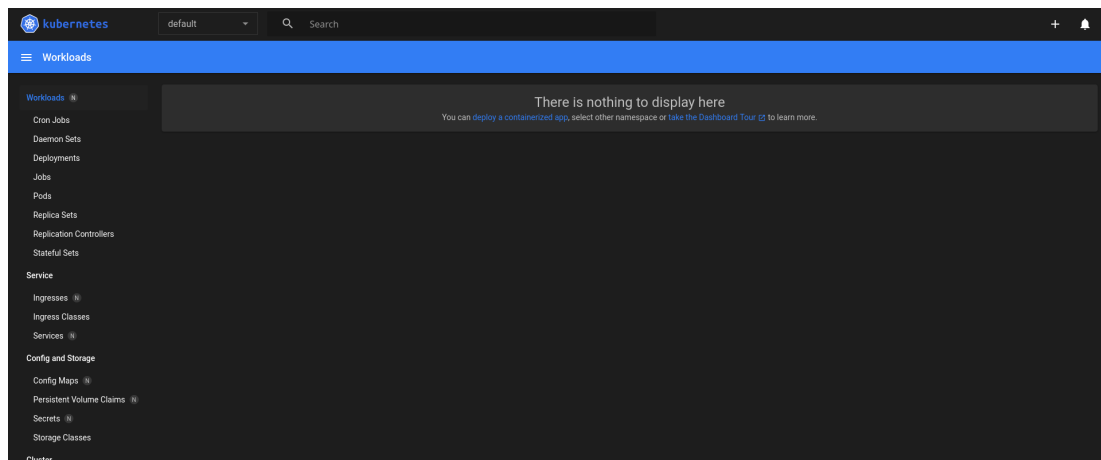# Contents

1 Using Minikube to Create a Cluster

```
 ~ minikube start
😄  minikube v1.35.0 on Debian 12.9
✨  Automatically selected the docker driver. Other choices: qemu2, ssh
🎯  Using Docker driver with root privileges
❗  For an improved experience it's recommended to use Docker Engine instead of Docker Desktop.
Docker Engine installation instructions: https://docs.docker.com/engine/install/#server
👍  Starting "minikube" primary control-plane node in "minikube" cluster
🚜  Pulling base image v0.0.46 ...
💾  Downloading Kubernetes v1.32.0 preload ...
    > gcr.io/k8s-minikube/kicbase...:  500.31 MiB / 500.31 MiB  100.00% 5.37 Mi
    > preloaded-images-k8s-v18-v1...:  333.57 MiB / 333.57 MiB  100.00% 3.14 Mi
🔥  Creating docker container (CPUs=2, Memory=5657MB) ...
🐳  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
 ~ 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.sha256:  64 B / 64 B [--------------------------] 100.00% ? p/s 0s
    > kubectl:  54.67 MiB / 54.67 MiB [-------------] 100.00% 8.06 MiB p/s 7.0s
🤔  Verifying proxy health ...
🎉  Opening http://127.0.0.1:41855/api/v1/namespaces/kubernetes-dashboard/services/http:kubernetes-dashboard:/proxy/ in your default browser...
```

2   Running Pod and Viewing Logs

3   Creating a Service

4 Enabling Addons

```
→  ~ 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)       |
|----------------------------|----------|--------------|--------------------------------|
→  ~ 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
```

```
→  ~ kubectl get pod,svc -n kube-system
NAME                                        READY   STATUS              RESTARTS          AGE       CPU(cores)   MEMORY
pod/coredns-668d6bf9bc-g66fc                1/1     Running             0                 7m8s                   6Mi
pod/coredns-668d6bf9bc-tcqsv                1/1     Running             0                 7m8s
pod/etcd-minikube                           1/1     Running             0                 7m14s
pod/kube-apiserver-minikube                 1/1     Running             0                 7m14s
pod/kube-controller-manager-minikube       1/1     Running             0                 7m14s
pod/kube-proxy-ckq4l                        1/1     Running             0                 7m9s
pod/kube-scheduler-minikube                 1/1     Running             0                 7m14s
pod/metrics-server-7fbb699795-xjhb2         0/1     ContainerCreating   0                 5s
pod/storage-provisioner                     1/1     Running             1 (6m38s ago)     7m13s

NAME                      TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)                   AGE
service/kube-dns          ClusterIP   10.96.0.10      <none>        53/UDP,53/TCP,9153/TCP    7m14s
service/metrics-server    ClusterIP   10.106.87.243   <none>        443/TCP                   5s
→  ~ kubectl top pods
error: Metrics API not available
→  ~ kubectl top pods
error: Metrics API not available
→  ~ kubectl top pods
error: Metrics API not available
→  ~ minikube addons disable metrics-server
🔵  "The 'metrics-server' addon is disabled
→  ~
```

Was unable to get metrics running.

5   Clean Up


```
→  ~ kubectl delete service hello-node
kubectl delete deployment hello-node
service "hello-node" deleted
deployment.apps "hello-node" deleted
→  ~ minikube stop
✋  Stopping node "minikube"  ...
🔴  Powering off "minikube" via SSH ...
🔴  1 node stopped.
→  ~
```

6 Using kubectl to Create a Deployment

```
→  ~ kubectl create deployment kubernetes-bootcamp --image=gcr.io/google-samples/kubernetes-bootcamp:v1
deployment.apps/kubernetes-bootcamp created
→  ~
→  ~ |
```

```
→  ~ kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   1/1     1            1           78s
→  ~ export POD_NAME=$(kubectl get pods -o go-template --template '{{range .items}}{{.metadata.name}}{{"\n"}}{{end}}')
echo Name of the Pod: $POD_NAME
Name of the Pod: kubernetes-bootcamp-9bc58d867-n8bsh
```

```
→  ~ curl http://localhost:8001/api/v1/namespaces/default/pods/$POD_NAME:8080/proxy/
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-n8bsh | v=1
→  ~ |
```

7 Viewing Pods and Nodes

```
→  ~ kubectl get pods
NAME                                   READY    STATUS    RESTARTS    AGE
kubernetes-bootcamp-9bc58d867-n8bsh    1/1      Running   0           4m26s
→  ~ kubectl proxy
Starting to serve on 127.0.0.1:8001
```

```
+ ~ kubectl describe pods
Name:                kubernetes-bootcamp-9bc58d867-n8bsh
Namespace:           default
Priority:            0
Service Account:     default
Node:                minikube/192.168.49.2
Start Time:          Wed, 19 Mar 2025 11:21:15 +0000
Labels:              app=kubernetes-bootcamp
                     pod-template-hash=9bc58d867
Annotations:         <none>
Status:              Running
IP:                  10.244.0.13
IPs:
  IP:                10.244.0.13
Controlled By:       ReplicaSet/kubernetes-bootcamp-9bc58d867
Containers:
  kubernetes-bootcamp:
    Container ID:    docker://15fc4dd5afeb0254a78b82b6520d200c1047868caabfb48b8fdb3c0802871e97
    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:       Wed, 19 Mar 2025 11:21:28 +0000
    Ready:           True
    Restart Count:   0
    Environment:     <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-mmk2j (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-mmk2j:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    ConfigMapOptional:       <nil>
    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  5m15s  default-scheduler   Successfully assigned default/kubernetes-bootcamp-9bc58d867-n8bsh to minikube
  Normal  Pulling    5m15s  kubelet             Pulling image "gcr.io/google-samples/kubernetes-bootcamp:v1"
  Normal  Pulled     5m3s   kubelet             Successfully pulled image "gcr.io/google-samples/kubernetes-bootcamp:v1" in 12.339s (12.339s including waiting). Image size: 211336459 bytes.
  Normal  Created    5m3s   kubelet             Created container: kubernetes-bootcamp
  Normal  Started    5m3s   kubelet             Started container kubernetes-bootcamp
```

```
+ ~ export POD_NAME=$(kubectl get pods -o go-template --template '{{range .items}}{{.metadata.name}}{{"\n"}}{{end}}')
echo Name of the Pod: $POD_NAME
Name of the Pod: kubernetes-bootcamp-9bc58d867-n8bsh
+ ~ curl http://localhost:8001/api/v1/namespaces/default/pods/$POD_NAME:8080/proxy/
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-n8bsh | v=1
+ ~ kubectl logs "$POD_NAME"
Kubernetes Bootcamp App Started At: 2025-03-19T11:21:28.659Z | Running On:  kubernetes-bootcamp-9bc58d867-n8bsh

Running On: kubernetes-bootcamp-9bc58d867-n8bsh | Total Requests: 1 | App Uptime: 135.168 seconds | Log Time: 2025-03-19T11:23:43.828Z
Running On: kubernetes-bootcamp-9bc58d867-n8bsh | Total Requests: 2 | App Uptime: 345.978 seconds | Log Time: 2025-03-19T11:27:14.637Z
+ ~ kubectl exec "$POD_NAME" -- env
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
HOSTNAME=kubernetes-bootcamp-9bc58d867-n8bsh
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
KUBERNETES_PORT_443_TCP_ADDR=10.96.0.1
KUBERNETES_SERVICE_HOST=10.96.0.1
KUBERNETES_SERVICE_PORT=443
NPM_CONFIG_LOGLEVEL=info
NODE_VERSION=6.3.1
HOME=/root
+ ~ kubectl exec -ti $POD_NAME -- bash
root@kubernetes-bootcamp-9bc58d867-n8bsh:/# echo 'hello!'
hello!
root@kubernetes-bootcamp-9bc58d867-n8bsh:/# exit
exit
+ ~
```

8   Exposing App via Service


```
→  ~ kubectl get pods
NAME                                  READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-n8bsh   1/1     Running   0          9m9s
→  ~ kubectl get services
NAME          TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)   AGE
kubernetes    ClusterIP   10.96.0.1      <none>        443/TCP   23m
→  ~ kubectl expose deployment/kubernetes-bootcamp --type="NodePort" --port 8080
service/kubernetes-bootcamp exposed
→  ~ 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:                       10.110.173.49
IPs:                      10.110.173.49
Port:                     <unset>  8080/TCP
TargetPort:               8080/TCP
NodePort:                 <unset>  31537/TCP
Endpoints:                10.244.0.13:8080
Session Affinity:         None
External Traffic Policy:  Cluster
Internal Traffic Policy:  Cluster
Events:                   <none>
→  ~ export NODE_PORT="$(kubectl get services/kubernetes-bootcamp -o go-template='{{(index .spec.ports 0).nodePort}}')"
echo "NODE_PORT=$NODE_PORT"
NODE_PORT=31537
→  ~ curl http://"$(minikube ip):$NODE_PORT"
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-n8bsh | v=1
→  ~
```

9

```
→  ~ kubectl describe deployment
Name:                   kubernetes-bootcamp
Namespace:              default
CreationTimestamp:      Wed, 19 Mar 2025 11:21:15 +0000
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  10m    deployment-controller  Scaled up replica set kubernetes-bootcamp-9bc58d867 from 0 to 1
→  ~ kubectl get pods -l app=kubernetes-bootcamp
NAME                                READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-n8bsh   1/1   Running   0          10m
→  ~ kubectl get services -l app=kubernetes-bootcamp
NAME                  TYPE       CLUSTER-IP      EXTERNAL-IP   PORT(S)          AGE
kubernetes-bootcamp   NodePort   10.110.173.49   <none>        8080:31537/TCP   90s
→  ~ export POD_NAME="$(kubectl get pods -o go-template --template '{{range .items}}{{.metadata.name}}{{"\n"}}{{end}}')"
echo "Name of the Pod: $POD_NAME"
Name of the Pod: kubernetes-bootcamp-9bc58d867-n8bsh
→  ~ kubectl label pods "$POD_NAME" version=v1
```

```
→ ~ kubectl describe pods "$POD_NAME"
Name:              kubernetes-bootcamp-9bc58d867-n8bsh
Namespace:         default
Priority:          0
Service Account:   default
Node:              minikube/192.168.49.2
Start Time:        Wed, 19 Mar 2025 11:21:15 +0000
Labels:            app=kubernetes-bootcamp
                   pod-template-hash=9bc58d867
                   version=v1
Annotations:       <none>
Status:            Running
IPs:               10.244.0.13
IPs:
  IP:              10.244.0.13
Controlled By:     ReplicaSet/kubernetes-bootcamp-9bc58d867
Containers:
  kubernetes-bootcamp:
    Container ID:   docker://15fc4dd5afeb0254a78b82b6520d200c1047868caabfb48b8fdb3c0802871e97
    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:      Wed, 19 Mar 2025 11:21:28 +0000
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-mmk2j (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-mmk2j:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    ConfigMapOptional:       <nil>
    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  11m   default-scheduler   Successfully assigned default/kubernetes-bootcamp-9bc58d867-n8bsh to minikube
  Normal  Pulling    11m   kubelet             Pulling image "gcr.io/google-samples/kubernetes-bootcamp:v1"
  Normal  Pulled     11m   kubelet             Successfully pulled image "gcr.io/google-samples/kubernetes-bootcamp:v1" in 12.339s (12.339s including waiting). Image size: 211336459 bytes.
  Normal  Created    11m   kubelet             Created container: kubernetes-bootcamp
  Normal  Started    11m   kubelet             Started container kubernetes-bootcamp
```

```
→ ~ kubectl get pods -l version=v1
NAME                                   READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-9bc58d867-n8bsh    1/1     Running   0          12m
→ ~ kubectl delete service kubernetes-bootcamp
service "kubernetes-bootcamp" deleted
→ ~ kubectl delete service -l app=kubernetes-bootcamp
No resources found
→ ~ kubectl get services
NAME         TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP   26m
→ ~ curl http://"$(minikube ip):$NODE_PORT"
curl: (7) Failed to connect to 192.168.49.2 port 31537 after 0 ms: Couldn't connect to server
→ ~ kubectl exec -ti $POD_NAME -- curl http://localhost:8080
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-n8bsh | v=1
→ ~
```

9 Running Multiple Instances

```
→  ~ kubectl expose deployment/kubernetes-bootcamp --type="LoadBalancer" --port 8080
service/kubernetes-bootcamp exposed
→  ~ kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   1/1     1            1           14m
→  ~ kubectl get rs
NAME                             DESIRED   CURRENT   READY   AGE
kubernetes-bootcamp-9bc58d867    1         1         1       14m
→  ~ kubectl scale deployments/kubernetes-bootcamp --replicas=4
deployment.apps/kubernetes-bootcamp scaled
→  ~ kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   4/4     4            4           14m
→  ~ kubectl get pods -o wide
NAME                                  READY   STATUS    RESTARTS   AGE   IP            NODE       NOMINATED NODE   READINESS GATES
kubernetes-bootcamp-9bc58d867-2jckl   1/1     Running   0          8s    10.244.0.15   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-7gzbn   1/1     Running   0          8s    10.244.0.14   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-krc7m   1/1     Running   0          8s    10.244.0.16   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-n8bsh   1/1     Running   0          15m   10.244.0.13   minikube   <none>           <none>
```

```
→  ~ kubectl describe deployments/kubernetes-bootcamp
Name:                   kubernetes-bootcamp
Namespace:              default
CreationTimestamp:      Wed, 19 Mar 2025 11:21:15 +0000
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  16m   deployment-controller  Scaled up replica set kubernetes-bootcamp-9bc58d867 from 0 to 1
  Normal  ScalingReplicaSet  72s   deployment-controller  Scaled up replica set kubernetes-bootcamp-9bc58d867 from 1 to 4
```

```
→ ~ kubectl describe services/kubernetes-bootcamp
Name:                    kubernetes-bootcamp
Namespace:               default
Labels:                  app=kubernetes-bootcamp
Annotations:             <none>
Selector:                app=kubernetes-bootcamp
Type:                    LoadBalancer
IP Family Policy:        SingleStack
IP Families:             IPv4
IP:                      10.108.27.209
IPs:                     10.108.27.209
Port:                    <unset>  8080/TCP
TargetPort:              8080/TCP
NodePort:                <unset>  31681/TCP
Endpoints:               10.244.0.13:8080,10.244.0.14:8080,10.244.0.15:8080 + 1 more...
Session Affinity:        None
External Traffic Policy: Cluster
Internal Traffic Policy: Cluster
Events:                  <none>
→ ~ export NODE_PORT="$(kubectl get services/kubernetes-bootcamp -o go-template='{{(index .spec.ports 0).nodePort}}')"
echo NODE_PORT=$NODE_PORT
NODE_PORT=31681
→ ~ curl http://"$(minikube ip):$NODE_PORT"
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-krc7m | v=1
→ ~ minikube service kubernetes-bootcamp --url
http://192.168.49.2:31681
→ ~ curl http://"$(minikube ip):$NODE_PORT"
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-7gzbn | v=1
→ ~ curl http://"$(minikube ip):$NODE_PORT"
^[[AHello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-krc7m | v=1
→ ~ curl http://"$(minikube ip):$NODE_PORT"
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-2jckl | v=1
→ ~ curl http://"$(minikube ip):$NODE_PORT"
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-2jckl | v=1
→ ~ curl http://"$(minikube ip):$NODE_PORT"
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-7gzbn | v=1
→ ~ curl http://"$(minikube ip):$NODE_PORT"
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-n8bsh | v=1
→ ~ curl http://"$(minikube ip):$NODE_PORT"
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-9bc58d867-2jckl | v=1
→ ~ kubectl scale deployments/kubernetes-bootcamp --replicas=2
deployment.apps/kubernetes-bootcamp scaled
→ ~ kubectl get deployments
NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp   2/2     2            2           17m
→ ~ kubectl get pods -o wide
NAME                                   READY   STATUS        RESTARTS   AGE     IP            NODE       NOMINATED NODE   READINESS GATES
kubernetes-bootcamp-9bc58d867-2jckl    1/1     Terminating   0          3m11s   10.244.0.15   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-7gzbn    1/1     Terminating   0          3m11s   10.244.0.14   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-krc7m    1/1     Running       0          3m11s   10.244.0.16   minikube   <none>           <none>
kubernetes-bootcamp-9bc58d867-n8bsh    1/1     Running       0          18m     10.244.0.13   minikube   <none>           <none>
→ ~ |
```

10   Performing a Rollout Update

```
→ ~ kubectl get pods
NAME                                   READY   STATUS        RESTARTS   AGE
kubernetes-bootcamp-5c4f7cb664-27vx2   1/1     Running       0          33s
kubernetes-bootcamp-5c4f7cb664-jknr8   1/1     Running       0          30s
kubernetes-bootcamp-9bc58d867-krc7m    1/1     Terminating   0          5m6s
kubernetes-bootcamp-9bc58d867-n8bsh    1/1     Terminating   0          19m
→ ~ export NODE_PORT="$(kubectl get services/kubernetes-bootcamp -o go-template='{{(index .spec.ports 0).nodePort}}')"
echo "NODE_PORT=$NODE_PORT"
NODE_PORT=31681
→ ~ curl http://"$(minikube ip):$NODE_PORT"
Hello Kubernetes bootcamp! | Running on: kubernetes-bootcamp-5c4f7cb664-27vx2 | v=2
→ ~ kubectl rollout status deployments/kubernetes-bootcamp
deployment "kubernetes-bootcamp" successfully rolled out
```

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```
→  ~ kubectl set image deployments/kubernetes-bootcamp kubernetes-bootcamp=gcr.io/google-samples/kubernetes-bootcamp:v10
deployment.apps/kubernetes-bootcamp image updated
→  ~ kubectl get deployments
NAME                 READY   UP-TO-DATE   AVAILABLE   AGE
kubernetes-bootcamp  2/2     1            2           21m
→  ~ kubectl get pods
NAME                                    READY   STATUS        RESTARTS   AGE
kubernetes-bootcamp-5c4f7cb664-27vx2    1/1     Running       0          2m10s
kubernetes-bootcamp-5c4f7cb664-jknr8    1/1     Running       0          2m7s
kubernetes-bootcamp-75bd5fd495-wdp7h    0/1     ErrImagePull  0          10s
→  ~ kubectl rollout undo deployments/kubernetes-bootcamp
deployment.apps/kubernetes-bootcamp rolled back
→  ~ kubectl get pods
NAME                                    READY   STATUS    RESTARTS   AGE
kubernetes-bootcamp-5c4f7cb664-27vx2    1/1     Running   0          2m19s
kubernetes-bootcamp-5c4f7cb664-jknr8    1/1     Running   0          2m16s
→  ~ kubectl delete deployments/kubernetes-bootcamp services/kubernetes-bootcamp
deployment.apps "kubernetes-bootcamp" deleted
service "kubernetes-bootcamp" deleted
→  ~ 5;4u
```