kubectl -- Kubernetes Command Center

In this lab, we will demystify some common kubectl commands and see how we can use kubectl to control our Kubernetes cluster. We will begin this lab by taking a brief look at what the end-to-end process looks like when using kubectl commands to communicate with a Kubernetes cluster. Then, we will set up a few shortcuts and autocompletion for the Bash terminal. We will begin with the basics of using kubectl by learning how to create, delete, and manage Kubernetes objects. We will learn about the two approaches to managing resources in Kubernetes - declarative and imperative - with exercises. By the end of this lab, you will also have learned how to update a live application running on your Kubernetes cluster in real-time using kubectl.

Note: All commands in this lab should be run in `git bash` only.

Exercise 3.01: Setup Alias

In this exercise, we will show you how to set up alias. Perform the following steps to complete this exercise:

4. You can also set up an alias for your `kubectl` commands by using the `alias` keyword, as follows:

   ```
   alias k=kubectl
   ```

5. Similarly, if you want to set up an alias for some specific commands, you can use commands similar to the following:

   ```
   alias kcdp='kubectl describe po'
   alias kcds='kubectl describe svc'
   alias kcdd='kubectl describe deploy'
   ```

You can also use such as `k` instead of `kubectl` in your commands. However, to avoid confusion and maintain a standardized structure, we will use the full commands throughout this course.

Setting up the kubeconfig Configuration File

By default, kubectl looks for the file in the `$HOME/.kube` directory. In most scenarios, you can specify a `KUBECONFIG` environment variable or use the `--kubeconfig` flag to specify the kubeconfig files. Those files are usually saved in `$HOME/.kube/config`.

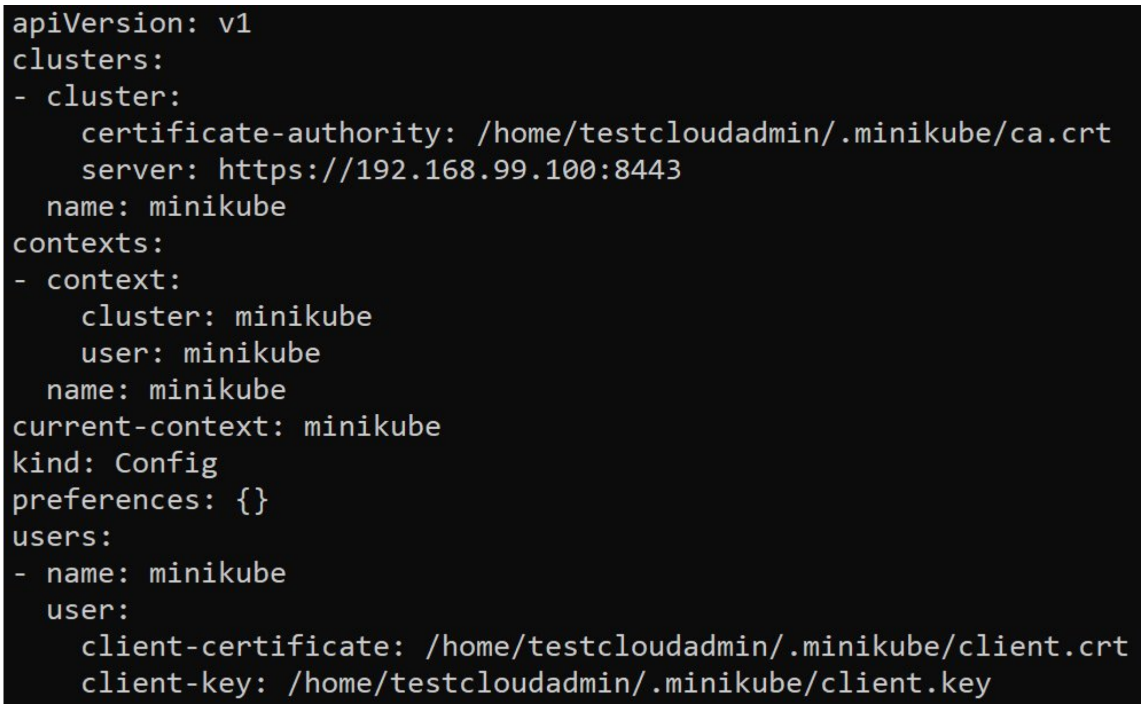
Let's take a look at the kubeconfig file to understand how this works. You can view the kubeconfig file using the following command:

```
kubectl config view
```

Alternatively, you can also use the following command:

```
cat $HOME/.kube/config
```

You should get an output similar to the following:



```
apiVersion: v1
clusters:
- cluster:
    certificate-authority: /home/testcloudadmin/.minikube/ca.crt
    server: https://192.168.99.100:8443
  name: minikube
contexts:
- context:
    cluster: minikube
    user: minikube
  name: minikube
current-context: minikube
kind: Config
preferences: {}
users:
- name: minikube
  user:
    client-certificate: /home/testcloudadmin/.minikube/client.crt
    client-key: /home/testcloudadmin/.minikube/client.key
```

A `context` is a set of information that you need to access a cluster. If we wanted to switch to a context named `minikube`, we would use the following command:

```
kubectl config use-context minikube
```

This would give an output similar to the following:

```
Switched to context "minikube".
```

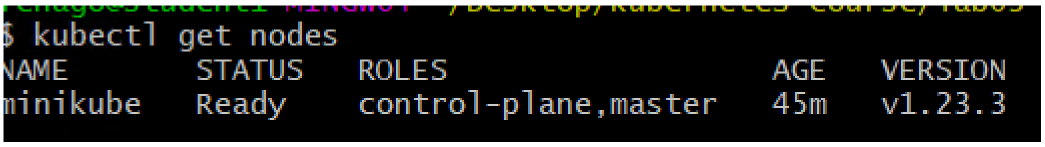
Walkthrough of Some Simple kubectl Commands

In this section, we're going to walk you through some of the commonly used kubectl commands. This section is mostly for demonstration purposes, so you may not see the exact output that you see in these images. However, this section will help you understand how these commands are used. You will use most of them extensively in later exercises, as well as throughout this course. Let's take a look:

- If you want to display nodes, use the following command:

  ```
  kubectl get nodes
  ```

  You will see an output similar to the following:



```
$ kubectl get nodes
NAME       STATUS   ROLES                  AGE   VERSION
minikube   Ready    control-plane,master   45m   v1.23.3
```

Since we set up aliases in *Exercise 3.01*, *Setting up Autocompletion*, you can also get the same result using the following command:

```
k get no
```

- If you want to display all current namespaces, you can use the following command:

  ```
  kubectl get namespaces
  ```

  You should see an output similar to the following:

  ```
  NAME                    STATUS          AGE
  default                 Active          7m5s
  kube-node-lease         Active          7m14s
  kube-public             Active          7m14s
  kube-system             Active          7m15s
  ```

  You can also get the same result using the following shortened command:

  ```
  k get ns
  ```

- If you want to check the version of `kubectl`, you can use the following command:

  ```
  kubectl version
  ```

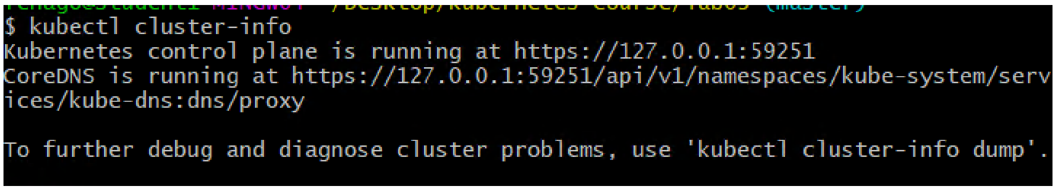
  You will see an output similar to the following:

  ```
  Client version: version.Info{Major:"1", Minor:"17", GitVersion:"v1.17.2,
  GitCommit: 59603c6e503c87169aea6106f57b9f242f64df89", GitTreeState:"clean",
  BuildDate:"2020-01-21T22:17:28Z, GoVersion:"go1.13.5", Compiler:"gc",
  Platform:"linux/amd64}
  Server version: version.Info{Major:"1", Minor:"17", GitVersion:"v1.17.2,
  GitCommit: 59603c6e503c87169aea6106f57b9f242f64df89", GitTreeState:"clean",
  BuildDate:"2020-01-18T23:22:30Z, GoVersion:"go1.13.5", Compiler:"gc",
  Platform:"linux/amd64}
  ```

- If you want to see some information regarding your current Kubernetes cluster, you can use the following command:

  ```
  kubectl cluster-info
  ```

  You should see an output similar to the following:



```
$ kubectl cluster-info
Kubernetes control plane is running at https://127.0.0.1:59251
CoreDNS is running at https://127.0.0.1:59251/api/v1/namespaces/kube-system/serv
ices/kube-dns:dns/proxy

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

Before we move on further with the demonstrations, we will mention a few commands that you can use to create a sample application, which we have already provided in the GitHub repository for this lab. Use the following command to fetch the YAML specification for all the objects required to run the application:

```
curl https://raw.githubusercontent.com/fenago/kubernetes-
course/master/lab03/Activity03.01/sample-application.yaml --output sample-
```

```
application.yaml
```

Now, you can deploy the `sample-application.yaml` file using the following command:

```
kubectl apply -f sample-application.yaml
```

If you can see the following output, this means that the sample application has been successfully created in your Kubernetes cluster:

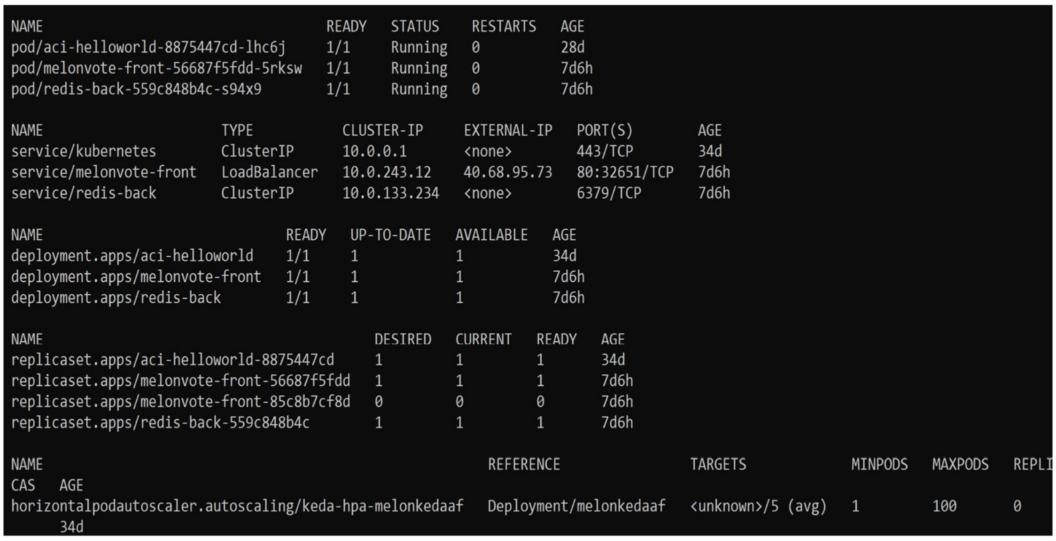
```
deployment.apps/redis-back created
service/redis-back created
deployment.apps/melonvote-front created
service/melonvote-front created
```

Now that you have deployed the provided application, if you try any of the commands shown later in this section, you will see the various objects, events, and so on related to this application. Note that your output may not exactly match the images shown here:

- You can use the following command to get everything in your cluster under the `default` namespace:

  ```
  kubectl get all
  ```

  This will give an output similar to the following:

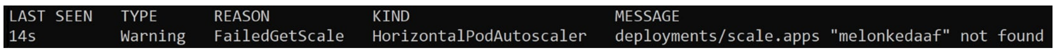
  

  ```
  NAME                                   READY   STATUS    RESTARTS   AGE
  pod/aci-helloworld-8875447cd-lhc6j     1/1     Running   0          28d
  pod/melonvote-front-56687f5fdd-5rksw   1/1     Running   0          7d6h
  pod/redis-back-559c848b4c-s94x9        1/1     Running   0          7d6h

  NAME                      TYPE           CLUSTER-IP     EXTERNAL-IP    PORT(S)        AGE
  service/kubernetes        ClusterIP      10.0.0.1       <none>         443/TCP        34d
  service/melonvote-front   LoadBalancer   10.0.243.12    40.68.95.73    80:32651/TCP   7d6h
  service/redis-back        ClusterIP      10.0.133.234   <none>         6379/TCP       7d6h

  NAME                              READY   UP-TO-DATE   AVAILABLE   AGE
  deployment.apps/aci-helloworld    1/1     1            1           34d
  deployment.apps/melonvote-front   1/1     1            1           7d6h
  deployment.apps/redis-back        1/1     1            1           7d6h

  NAME                                         DESIRED   CURRENT   READY   AGE
  replicaset.apps/aci-helloworld-8875447cd     1         1         1       34d
  replicaset.apps/melonvote-front-56687f5fdd   1         1         1       7d6h
  replicaset.apps/melonvote-front-85c8b7cf8d   0         0         0       7d6h
  replicaset.apps/redis-back-559c848b4c        1         1         1       7d6h

  NAME                                                     REFERENCE                TARGETS            MINPODS   MAXPODS   REPLI
  CAS   AGE
  horizontalpodautoscaler.autoscaling/keda-hpa-melonkedaaf   Deployment/melonkedaaf   <unknown>/5 (avg)   1         100       0
        34d
  ```

- Events describe what has happened so far in the Kubernetes cluster, and you can use events to get a better insight into your cluster and aid in any troubleshooting efforts. To list all the events in the default namespace, use the following command:

  ```
  kubectl get events
  ```

  This will give an output similar to the following:

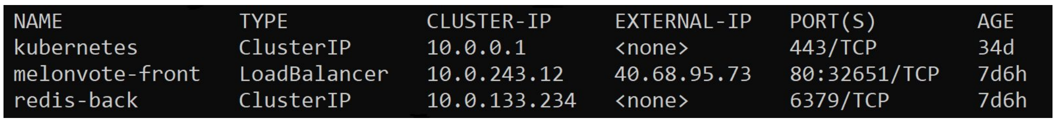
  

  ```
  LAST SEEN   TYPE      REASON           KIND                      MESSAGE
  14s         Warning   FailedGetScale   HorizontalPodAutoscaler   deployments/scale.apps "melonkedaaf" not found
  ```

- A service is an abstraction that's used to expose an application to the end-user. You will learn more about services in *Lab 8*, *Service Discovery*. You can use the following command to list all services:

  ```
  kubectl get services
  ```

  This will give an output similar to the following:

  ```
  NAME             TYPE           CLUSTER-IP     EXTERNAL-IP   PORT(S)        AGE
  kubernetes       ClusterIP      10.0.0.1       <none>        443/TCP        34d
  melonvote-front  LoadBalancer   10.0.243.12    40.68.95.73   80:32651/TCP   7d6h
  redis-back       ClusterIP      10.0.133.234   <none>        6379/TCP       7d6h
  ```

You can get the same result using the following shortened command:

```
k get svc
```

- A Deployment is an API object that allows us to easily manage and update pods. You will learn more about Deployments in *Lab 7*, *Kubernetes Controllers*. You can get the list of Deployments using the following command:

  ```
  kubectl get deployments
  ```

  This should give a response similar to the following:

  ```
  NAME               READY    UP-TO-DATE    AVAILABLE     AGE
  aci-helloworld     1/1      1             1             34d
  melonvote-front    1/1      1             1             7d6h
  redis-back         1/1      1             1             7d6h
  ```

  You can also get the same result using the following shortened version of the command:

  ```
  k get deploy
  ```

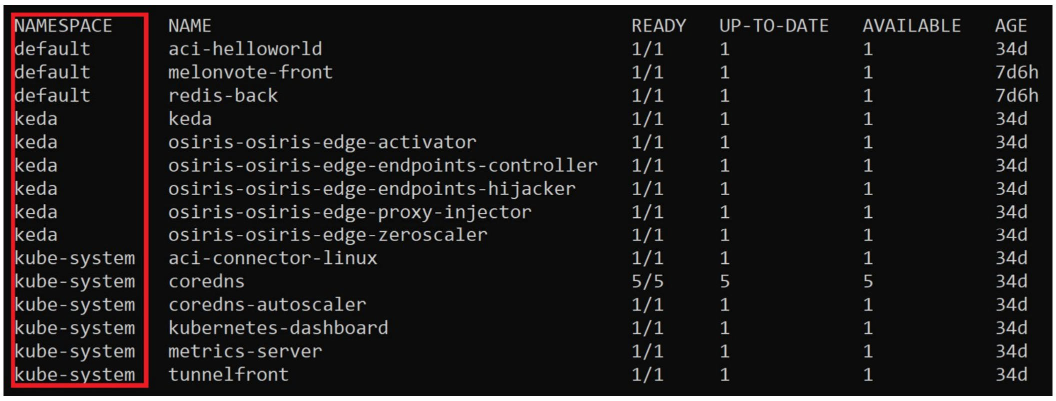
Some Useful Flags for the get Command

As you have seen, the `get` command is a pretty standard command that is used when we need to get the list of objects in our cluster. It also has several useful flags. Let's take a look at a few of them here:

- If you want to list a particular type of resource from all your namespaces, you can add the `--all-namespaces` flag in the command. For example, if we want to list all Deployments from all namespaces, we can use the following command:

  ```
  kubectl get deployments --all-namespaces
  ```

  This will give an output similar to this:



```
NAMESPACE    NAME                                   READY   UP-TO-DATE   AVAILABLE   AGE
default      aci-helloworld                         1/1     1            1           34d
default      melonvote-front                        1/1     1            1           7d6h
default      redis-back                             1/1     1            1           7d6h
keda         keda                                   1/1     1            1           34d
keda         osiris-osiris-edge-activator           1/1     1            1           34d
keda         osiris-osiris-edge-endpoints-controller 1/1    1            1           34d
keda         osiris-osiris-edge-endpoints-hijacker  1/1     1            1           34d
keda         osiris-osiris-edge-proxy-injector      1/1     1            1           34d
keda         osiris-osiris-edge-zeroscaler          1/1     1            1           34d
kube-system  aci-connector-linux                    1/1     1            1           34d
kube-system  coredns                                5/5     5            5           34d
kube-system  coredns-autoscaler                     1/1     1            1           34d
kube-system  kubernetes-dashboard                   1/1     1            1           34d
kube-system  metrics-server                         1/1     1            1           34d
kube-system  tunnelfront                            1/1     1            1           34d
```

You can also see that there is an additional column on the left-hand side that specifies the namespaces of the respective Deployments.

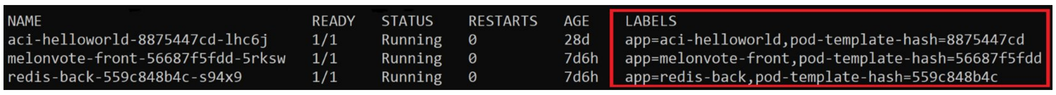
- If you want to list a specific type of resource from a specific namespace, you can use the `-n` flag. Here, the `-n` flag stands for `namespace`. For example, if you want to list all Deployments in a namespace called `default`, the following command would be used:

  ```
  kubectl get deployments -n default
  ```

- You can add the `--show-labels` flag to display the labels of the objects in the list. For example, if you wanted to get the list of all the pods in the `default` namespace, along with their labels, you would use the following command:

  ```
  kubectl get pods --show-labels
  ```

  This command should give an output similar to the following:



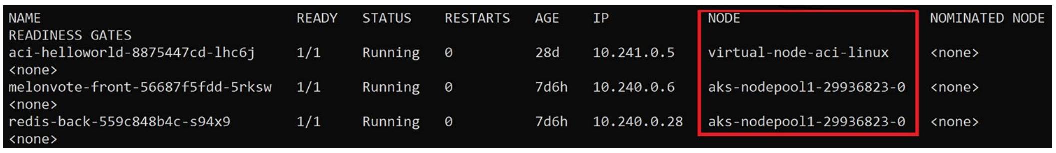
```
NAME                                 READY   STATUS    RESTARTS   AGE    LABELS
aci-helloworld-8875447cd-lhc6j       1/1     Running   0          28d    app=aci-helloworld,pod-template-hash=8875447cd
melonvote-front-56687f5fdd-5rksw     1/1     Running   0          7d6h   app=melonvote-front,pod-template-hash=56687f5fdd
redis-back-559c848b4c-s94x9          1/1     Running   0          7d6h   app=redis-back,pod-template-hash=559c848b4c
```

There is an additional column on the right-hand side that specifies the labels of the pods.

- You can use the `-o wide` flag to display more information about objects. Here, the `-o` flag stands for `output`. Let's look at a simple example of how to use this flag:

  ```
  kubectl get pods -o wide
  ```

  This will give an output similar to the following:



```
NAME                               READY   STATUS    RESTARTS   AGE    IP            NODE                        NOMINATED NODE
READINESS GATES
aci-helloworld-8875447cd-lhc6j     1/1     Running   0          28d    10.241.0.5    virtual-node-aci-linux      <none>
<none>
melonvote-front-56687f5fdd-5rksw   1/1     Running   0          7d6h   10.240.0.6    aks-nodepool1-29936823-0    <none>
<none>
redis-back-559c848b4c-s94x9        1/1     Running   0          7d6h   10.240.0.28   aks-nodepool1-29936823-0    <none>
<none>
```

You can also see there are additional columns on the right-hand side that specify which nodes the pods are running on, as well as the internal IP addresses of the node.

Populating Deployments in Kubernetes

You can create a Deployment by using kubectl imperative commands or by using declarative YAML manifest files. In the following exercise, we're going to deploy an application (we will go with Nginx for this exercise) in Kubernetes and learn how to interact with Deployments using kubectl commands, as well as how to modify the YAML manifest file.

Exercise 3.02: Creating a Deployment

There are two ways to create a Deployment in Kubernetes -- using the `kubectl create` / `run` command and creating a manifest file in YAML format and then using the `kubectl apply` command. We can achieve the same goal with those two options. Let's try both and then compare them:

1. Create a Deployment using the following command directly:

   ```
   kubectl create deployment kubeserve --image=nginx:1.7.8
   ```

   You can expect an output similar to the following:

   ```
   deployment.apps/kubeserve created
   ```

   Note

   You can also create a Deployment using the `kubectl run` command. To achieve the same results here, you could use the following commands:

   `kubectl run nginx --image=nginx:1.7.8`

Now that we have seen how to create a Deployment, in the next exercise, we will learn how to modify or update a Deployment that is already running. This is something that you will need to do quite often as the software is updated to new versions, bugs are identified and fixed, the demands on your application change, or your organization moves on to completely new solutions. We will also learn how to roll back a Deployment to an earlier version, which is something that you will want to do if an update does not lead to the expected outcome.

Exercise 3.03: Updating a Deployment

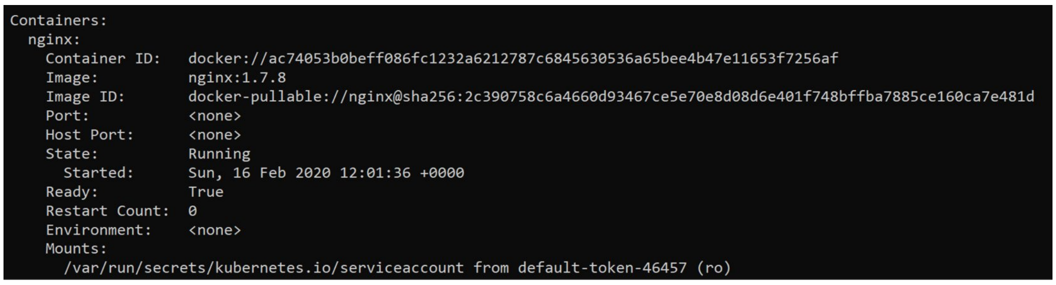
In this exercise, we will update the application that we deployed in the previous exercise to a more recent version and demonstrate how we can roll back the Deployment to a previous version if necessary.

Similar to the two approaches that we saw for creating a Deployment, there are two ways to update an application as well -- using the `kubectl set image` command and updating the YAML manifest file and then using the `kubectl apply` command. These steps will guide you through both approaches:

1. First, let's get the details of the current Deployment using the following command:

   ```
   kubectl describe deploy kubeserve
   ```

   You'll get an output similar to the following:


```
Containers:
  nginx:
    Container ID:   docker://ac74053b0beff086fc1232a6212787c6845630536a65bee4b47e11653f7256af
    Image:          nginx:1.7.8
    Image ID:       docker-pullable://nginx@sha256:2c390758c6a4660d93467ce5e70e8d08d6e401f748bffba7885ce160ca7e481d
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Sun, 16 Feb 2020 12:01:36 +0000
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from default-token-46457 (ro)
```

2. You can update the image using the following command:

```
kubectl set image deployment/kubeserve nginx=nginx:1.9.1
```

`nginx=nginx:1.9.1`, tells Kubernetes to look for the specific image tagged as `1.9.1` in the Docker Hub repository of NGINX. You can check out the available tags at https://hub.docker.com/_/nginx?tab=tags.

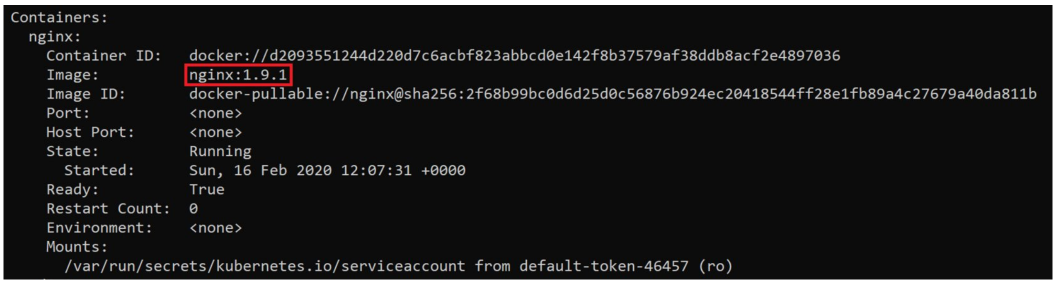
By applying this, you'll get an output similar to the following:

```
deployment.extensions/kubeserve image updated
```

3. Now, let's get the details of the Deployment using the following command:

```
kubectl describe deploy kubeserve
```

You should see the following output:


```
Containers:
  nginx:
    Container ID:   docker://d2093551244d220d7c6acbf823abbcd0e142f8b37579af38ddb8acf2e4897036
    Image:          nginx:1.9.1
    Image ID:       docker-pullable://nginx@sha256:2f68b99bc0d6d25d0c56876b924ec20418544ff28e1fb89a4c27679a40da811b
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Sun, 16 Feb 2020 12:07:31 +0000
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from default-token-46457 (ro)
```

In the preceding screenshot, you can see that the image has been

```
Another way to achieve the same result is to modify the YAML file
and then use the `kubectl apply` command. We will use the
same YAML file that we created in the previous exercise. If you do
not have the YAML file for an object, you can export the YAML
manifest using the following command:


```
kubectl get deploy kubeserve -o yaml > kubeserve-spec.yaml
```


This command will output a file named
```

```
`kubeserve-spec.yaml` with the manifest that is in effect
in the cluster. Then, you can use vim, nano, or any other text
editor to edit it and then apply the edited
`kubeserve-spec.yaml` manifest using the
`kubectl apply` command, as shown in the previous
exercise, with the addition of the `--record` flag.
```

4. If you want to perform a rollback, you can use the following command:

   ```
   kubectl rollout undo deployments kubeserve
   ```

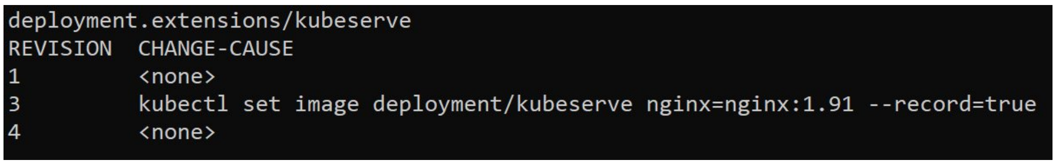
   You'll see an output similar to the following:

   ```
   deployment.extensions/kubeserve rolled back
   ```

5. You can use the `kubectl rollout history` command to check all the revisions for a specific Deployment, as shown here:

   ```
   kubectl rollout history deployment kubeserve
   ```

   You'll see an output similar to the following:

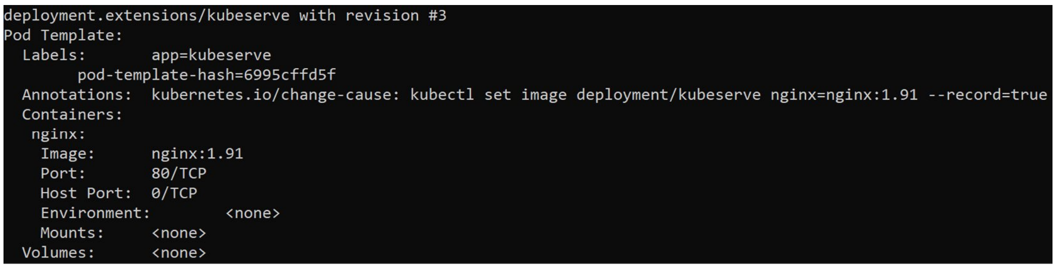


```
deployment.extensions/kubeserve
REVISION  CHANGE-CAUSE
1         <none>
3         kubectl set image deployment/kubeserve nginx=nginx:1.91 --record=true
4         <none>
```

6. You can also use the following command to check the details of a specific revision:

   ```
   kubectl rollout history deployment kubeserve --revision=3
   ```

   The output for this command will be as follows:



```
deployment.extensions/kubeserve with revision #3
Pod Template:
  Labels:       app=kubeserve
        pod-template-hash=6995cffd5f
  Annotations:  kubernetes.io/change-cause: kubectl set image deployment/kubeserve nginx=nginx:1.91 --record=true
  Containers:
   nginx:
    Image:      nginx:1.91
    Port:       80/TCP
    Host Port:  0/TCP
    Environment:        <none>
    Mounts:     <none>
  Volumes:      <none>
```

7. You can roll back a Deployment to a specific revision by specifying the `--to-revision` flag:

   ```
   kubectl rollout undo deployments kubeserve --to-revision=3
   ```

   You'll see an output similar to the following:

   ```
   deployment.extensions/kubeserve rolled back
   ```

In this exercise, we have learned how to update an already existing Deployment, as well as how to roll back a Deployment to its earlier specs.

Exercise 3.04: Deleting a Deployment

In this exercise, we will delete the Deployment we created in the previous exercise:

1. Get a list of existing Deployments using the following command:

   ```
   kubectl get deployment
   ```

   You can expect an output similar to the following:

   ```
   NAME             READY    UP-TO-DATE    AVAILABLE     AGE
   aci-helloworld   1/1      1             1             27d
   kubeserve        3/3      3             3             26m
   melonkedaaf      0/0      0             0             26d
   ```

2. Let's say that, for the purpose of this exercise, we want to delete the `kubeserve` Deployment that we created in the previous exercise. Use the following command to delete the Deployment:

   ```
   kubectl delete deployment kubeserve
   ```

   The sample output will be similar to the following:

   ```
   deployment.extensions "kubeserve" deleted
   ```

3. Get the list of Deployments to check and make sure that the target Deployment has been deleted successfully:

   ```
   kubectl get deployment
   ```

You can use the `kubectl delete` command to delete any other object as well. However, as we mentioned earlier, in cases such as pods managed by Deployments, it is pointless to delete individual pods as the Deployment will just recreate them, so you need to delete the Deployment.

Summary

This lab demystified how kubectl allows us to control our Kubernetes cluster using API calls. First, we learned how to set up an environment for kubectl commands and looked at a number of shortcuts. Furthermore, we covered how to create, edit, and delete a Kubernetes object using kubectl commands and looked at a Deployment as an example. Finally, we deployed a real-life application and showed you how to edit a live Deployment. Every example in this lab has been applied in a general context; however, we believe that the skills developed in this lab can help you resolve specific problems that you might encounter in a professional environment.

In the next lab, you'll explore the other side of this bridge and dive deeper into how the API server works. You will also take a closer look at REST API requests and how the API server deals with them.