



## **Department of Computing**

### **SE-315: Cloud Computing**

#### **Lab 10: App Dev: Deploying the Application into Kubernetes Engine - Python**

**CLO4: Display** skills to effectively use cloud centric solutions such as serverless application development.

**Date: 27.11.24**



## **Lab 10: App Dev: Deploying the Application into Kubernetes Engine - Python**

### **Introduction:**

Google Kubernetes Engine provides a managed environment for deploying, managing, and scaling your containerized applications using Google infrastructure. The environment Kubernetes Engine provides consists of multiple machines (specifically, Compute Engine instances) grouped together to form a cluster.

Kubernetes provides the mechanisms through which you interact with your cluster. You use Kubernetes commands and resources to deploy and manage your applications, perform administration tasks and set policies, and monitor the health of your deployed workloads.

In this lab, you deploy the Quiz application into Kubernetes Engine, leveraging Google Cloud resources, including Container Builder and Container Registry, and Kubernetes resources, such as Deployments, Pods, and Services.

### **Lab Tasks**

Go through the following link:

<https://www.cloudskillsboost.google/focuses/1073?parent=catalog>

which will take you to the 'App Dev: Deploying the Application into Kubernetes Engine – Python' page. The list of tasks is given below. Make sure to take screenshots of each task as you will need to add them in the solution section given below.



## 1. Setup and requirements

creating a qwiklabs account:

The screenshot shows a web interface for a Qwiklabs lab. At the top, there is a red 'End Lab' button and a timer displaying '00:49:45'. Below this is a 'Caution' message: 'When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. [Learn more.](#)'. A button labeled 'Open Google Cloud console' is present. The login section includes three fields: 'Username' with the value 'student-00-77ff46b64d7a', 'Password' with the value 'udB7Tko9q2Xa', and 'Project ID' with the value 'qwiklabs-gcp-03-b4853c5f'. Each field has a copy icon to its right.

Activating cloud shell:

`gcloud auth list`

```
student_00_77ff46b64d7a@cloudshell:~ (qwiklabs-gcp-03-b4853c5b98d7)$ gcloud auth list
Credentialed Accounts

ACTIVE: *
ACCOUNT: student-00-77ff46b64d7a@qwiklabs.net

To set the active account, run:
$ gcloud config set account `ACCOUNT`
```

`gcloud config list project`

```
student_00_77ff46b64d7a@cloudshell:~ (qwiklabs-gcp-03-b4853c5b98d7)$ gcloud config list project
[core]
project = qwiklabs-gcp-03-b4853c5b98d7

Your active configuration is: [cloudshell-13874]
```



## 2. Prepare the Quiz application.

### Clone source code in Cloud Shell

```
student_00_77ff46b64d7a@cloudshell:~ (qwiklabs-gcp-03-b4853c5b98d7) $ git clone https://github.com/GoogleCloudPlatform/training-data-analyst
Cloning into 'training-data-analyst'...
remote: Enumerating objects: 65494, done.
remote: Counting objects: 100% (61/61), done.
remote: Compressing objects: 100% (50/50), done.
Receiving objects: 48% (31438/65494), 544.25 MiB | 20.68 MiB/s
```

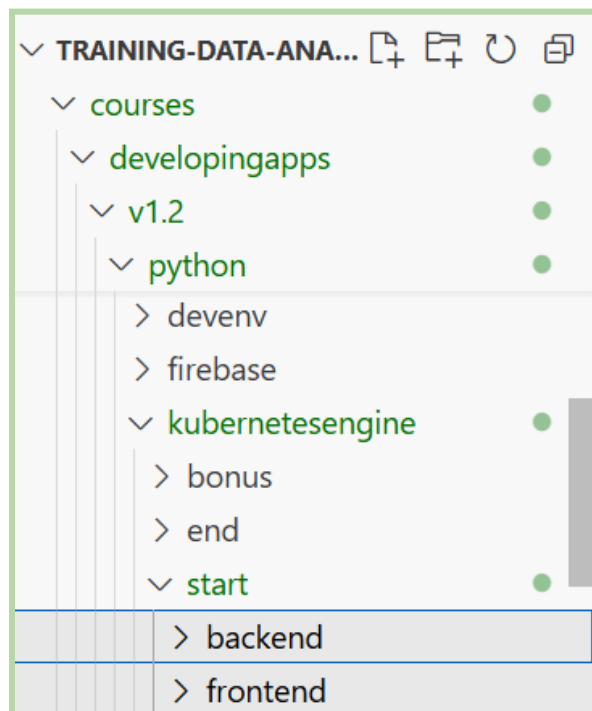
### Configure the Quiz application

```
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7) $ . prepare_environment.sh
Creating quiz-account Service Account
Created service account [quiz-account].
created key [57e48db1c04e26e48alad4307elf34576a1337fc] of type [json] as [key.json] for [quiz-account@qwiklabs-gcp-03-b4853c5b98d7.iam.gse
Setting quiz-account IAM Role
Updated IAM policy for project [qwiklabs-gcp-03-b4853c5b98d7].
bindings:
- members:
  - serviceAccount:qwiklabs-gcp-03-b4853c5b98d7@qwiklabs-gcp-03-b4853c5b98d7.iam.gserviceaccount.com
    role: roles/bigquery.admin
- members:
```

## 3. Review the code.

Examining the code at;

[training-data-analyst/courses/developingapps/v1.2/python/kubernetesengine/start](https://github.com/GoogleCloudPlatform/training-data-analyst/courses/developingapps/v1.2/python/kubernetesengine/start)





## 4. Create and connect to a Kubernetes Engine Cluster

Create a Kubernetes Engine cluster

Name

quiz-cluster

Cluster names must start with a lowercase letter followed by up to 39 lowercase letters, numbers, or hyphens. They can't end with a hyphen. You cannot change the cluster's name once it's created.

Location type

Resource prices may vary between certain regions. [Learn more](#)

☒ Zonal

☐ Regional

Zone

us-east4-a

▼ ?

Granting full access through default Pool > Security > Access scopes

Security

Metadata

CLUSTER

Automation

Networking

Security

Backup plan

Metadata

GKE uses this service account for tasks like logging and monitoring. Ensure that the service account has, at a minimum, the [Kubernetes Engine Default Node Service Account role](#) permissions on your project.

Access scopes

Access scopes are permanent. Select the type and level of API access to grant the VM. [Learn more](#)

☐ Allow default access

☒ Allow full access to all Cloud APIs

☐ Set access for each API

☐ Enable sandbox with gvisor

Created cluster:

OVERVIEW						
OBSERVABILITY						
COST OPTIMIZATION						
Filter Enter property name or value						
<input type="checkbox"/> Status	Name ↑	Location	Tier ?	Number of nodes	Total vCPUs	Total memory
<input checked="" type="checkbox"/>	quiz-cluster	us-east4-a	Standard	3	6	12 GB

Connect to the cluster:

```
Project ID: qwiklabs-gcp-03-b4853c5b98d7
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (quwiklabs-gcp-03-b4853c5b98d7) $ gcloud container clusters get-credentials quiz-cluster --zone us-east4-a --project qwiklabs-gcp-03-b4853c5b98d7
Fetching cluster endpoint and auth data.
kubeconfig entry generated for quiz-cluster.
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (quwiklabs-gcp-03-b4853c5b98d7) $ kubectl get pods
No resources found in default namespace.
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (quwiklabs-gcp-03-b4853c5b98d7) $
```



## 5. Build Docker images using Container Builder

frontend docker file:

```
Dockerfile M X
courses > developingapps > v1.2 > python > kubernetesengine > start > frontend > Dockerfile
5  ENV VIRTUAL_ENV /env
6  ENV PATH /env/bin:$PATH
7
8  ADD requirements.txt /app/requirements.txt
9  RUN pip install -r /app/requirements.txt
10
11 ADD . /app
12
13 CMD gunicorn -b 0.0.0.0:$PORT quiz:app
14
```

backend dockerfile:

```
Dockerfile M X
courses > developingapps > v1.2 > python > kubernetesengine > start > backend > Dockerfile
5  ENV VIRTUAL_ENV /env
6  ENV PATH /env/bin:$PATH
7
8  ADD requirements.txt /app/requirements.txt
9  RUN pip install -r /app/requirements.txt
10
11 ADD . /app
12
13 CMD python -m quiz.console.worker
```



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### building the Docker images:

#### frontend:

```
gcloud builds submit -t gcr.io/$DEVSHIELD_PROJECT_ID/quiz-frontend ./frontend/
```

```
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7)$ gcloud builds submit -t gcr.io/$DEVSHIELD_PROJECT_ID/quiz-frontend ./frontend/
Creating temporary archive of 29 file(s) totalling 40.1 KiB before compression.
Uploading tarball of [./frontend/] to [gs://qwiklabs-gcp-03-b4853c5b98d7_cloudbuild/source/1732697565.280599-5e8725eb4da54e789d3bb93db45d887f.tgz]
Created [https://cloudbuild.googleapis.com/v1/projects/qwiklabs-gcp-03-b4853c5b98d7/locations/global/builds/619aab97-1e9d-47f9-8f57-11edcfc0bde4].
Logs are available at [ https://console.cloud.google.com/cloud-build/builds/619aab97-1e9d-47f9-8f57-11edcfc0bde4?project=756262782430 ].
Waiting for build to complete. Polling interval: 1 second(s).

----- REMOTE BUILD OUTPUT -----
starting build "619aab97-1e9d-47f9-8f57-11edcfc0bde4"

FETCHSOURCE
Fetching storage object: gs://qwiklabs-gcp-03-b4853c5b98d7_cloudbuild/source/1732697565.280599-5e8725eb4da54e789d3bb93db45d887f.tgz#1732697566912840
Copying gs://qwiklabs-gcp-03-b4853c5b98d7_cloudbuild/source/1732697565.280599-5e8725eb4da54e789d3bb93db45d887f.tgz#1732697566912840...
/ [1 files] [ 8.8 KiB / 8.8 KiB]
Operation completed over 1 objects/8.8 KiB.
BUILD
Already have image (with digest): gcr.io/cloud-builders/docker
Sending build context to Docker daemon 69.12kB
```

#### backend:

```
gcloud builds submit -t gcr.io/$DEVSHIELD_PROJECT_ID/quiz-backend ./backend/
```

```
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7)$ gcloud builds submit -t gcr.io/$DEVSHIELD_PROJECT_ID/quiz-backend ./backend/
Creating temporary archive of 9 file(s) totalling 8.4 KiB before compression.
Uploading tarball of [./backend/] to [gs://qwiklabs-gcp-03-b4853c5b98d7_cloudbuild/source/1732697639.030633-f399ba10694240cca295a9725ef53a1c.tgz]
Created [https://cloudbuild.googleapis.com/v1/projects/qwiklabs-gcp-03-b4853c5b98d7/locations/global/builds/f7ebcd51-df29-4f5b-993d-e4cab562667e].
Logs are available at [ https://console.cloud.google.com/cloud-build/builds/f7ebcd51-df29-4f5b-993d-e4cab562667e?project=756262782430 ].
Waiting for build to complete. Polling interval: 1 second(s).

----- REMOTE BUILD OUTPUT -----
starting build "f7ebcd51-df29-4f5b-993d-e4cab562667e"

FETCHSOURCE
Fetching storage object: gs://qwiklabs-gcp-03-b4853c5b98d7_cloudbuild/source/1732697639.030633-f399ba10694240cca295a9725ef53a1c.tgz#1732697639861558
```

Message that the backend Docker image is ready:

```
DONE
-----
ID: f7ebcd51-df29-4f5b-993d-e4cab562667e
CREATE_TIME: 2024-11-27T08:54:00+00:00
DURATION: 39S
SOURCE: gs://qwiklabs-gcp-03-b4853c5b98d7_cloudbuild/source/1732697639.030633-f399ba10694240cca295a9725ef53a1c.tgz#1732697639861558
IMAGES: gcr.io/qwiklabs-gcp-03-b4853c5b98d7/quiz-backend (+1 more)
STATUS: SUCCESS
```



## 6. Create Kubernetes deployment and service resources.

finding Gcloud projectID, Bucket and image name

```
CREATE_TIME: 2024-11-27T08:54:00+00:00
DURATION: 39S
SOURCE: gs://qwiklabs-gcp-03-b4853c5b98d7_cloudbuild/source/1732697639.030633-f399ba10694240cca295a9725ef53a1c.tgz
IMAGES: gcr.io/qwiklabs-gcp-03-b4853c5b98d7/quiz-backend (+1 more)
STATUS: SUCCESS
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7) $ echo $GCP_PROJECT
qwiklabs-gcp-03-b4853c5b98d7
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7) $ ^C
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7) $ echo $GCP_BUCKET
qwiklabs-gcp-03-b4853c5b98d7-media
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7) $ ^C
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7) $
```

Replace the placeholders in the **frontend-deployment.yaml**:

```
7 spec:
13   template:
17     tier: frontend
18     spec:
19       containers:
20       - name: quiz-frontend
21         image: gcr.io/qwiklabs-gcp-03-b4853c5b98d7/quiz-frontend
22         imagePullPolicy: Always
23         ports:
24         - name: http-server
25           containerPort: 8080
26         env:
27         - name: GCP_PROJECT
28           value: "qwiklabs-gcp-03-b4853c5b98d7"
29         - name: GCP_BUCKET
30           value: "qwiklabs-gcp-03-b4853c5b98d7-media"
31
```





Replace the placeholders in the **backend-deployment.yaml**:

```
! backend-deployment.yaml 2, M × ! frontend-deployment.yaml 2, M
s > developingapps > v1.2 > python > kubernetesengine > start > ! backend-deployment.yaml > {} spec > {} template > {} spec > [ ] c
7 spec:
13   template:
14     metadata:
15       labels:
17         tier: backend
18     spec:
19       containers:
20       - name: quiz-backend
21         image: gcr.io/qwiklabs-gcp-03-b4853c5b98d7/quiz-backend
22         imagePullPolicy: Always
23         env:
24         - name: GCLOUD_PROJECT
25           value: "qwiklabs-gcp-03-b4853c5b98d7"
26         - name: GCLOUD_BUCKET
27           value: "qwiklabs-gcp-03-b4853c5b98d7-media"
28
```

Execute the deployment and service Files:

```
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7)$ kubectl create -f ./backend-deployment.yaml
deployment.apps/quiz-backend created
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7)$ kubectl apply --dry-run=client -f ./backend-deployment.yaml
deployment.apps/quiz-backend configured (dry run)
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7)$

student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7)$ kubectl create -f ./backend-deployment.yaml
deployment.apps/quiz-backend created
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7)$ kubectl apply --dry-run=client -f ./backend-deployment.yaml
deployment.apps/quiz-backend configured (dry run)
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7)$ kubectl create -f ~/kubernetesengine/start/frontend-deployment.yaml
deployment.apps/quiz-frontend created
student_00_77ff46b64d7a@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-03-b4853c5b98d7)$
```



## 7. Test the Quiz Application

Review the deployed resources:

Workloads																											
<div>REFRESH DEPLOY CREATE JOB DELETE</div>																											
<div>Cluster Namespace RESET SAVE</div>																											
<div>OVERVIEW OBSERVABILITY COST OPTIMIZATION</div>																											
<div>Filter Is system object : False Filter workloads</div>																											
<table><thead><tr><th><input type="checkbox"/></th><th>Name ↑</th><th>Status</th><th>Type</th><th>Pods</th><th>Namespace</th><th>Cluster</th></tr></thead><tbody><tr><td><input type="checkbox"/></td><td><a href="#">quiz-backend</a></td><td>OK</td><td>Deployment</td><td>2/2</td><td>default</td><td><a href="#">quiz-cluster</a></td></tr><tr><td><input type="checkbox"/></td><td><a href="#">quiz-frontend</a></td><td>OK</td><td>Deployment</td><td>3/3</td><td>default</td><td><a href="#">quiz-cluster</a></td></tr></tbody></table>							<input type="checkbox"/>	Name ↑	Status	Type	Pods	Namespace	Cluster	<input type="checkbox"/>	<a href="#">quiz-backend</a>	OK	Deployment	2/2	default	<a href="#">quiz-cluster</a>	<input type="checkbox"/>	<a href="#">quiz-frontend</a>	OK	Deployment	3/3	default	<a href="#">quiz-cluster</a>
<input type="checkbox"/>	Name ↑	Status	Type	Pods	Namespace	Cluster																					
<input type="checkbox"/>	<a href="#">quiz-backend</a>	OK	Deployment	2/2	default	<a href="#">quiz-cluster</a>																					
<input type="checkbox"/>	<a href="#">quiz-frontend</a>	OK	Deployment	3/3	default	<a href="#">quiz-cluster</a>																					

Managed pods within quiz-frontend:

the Endpoints IP Address for the quiz application is **34.86.253.225:80**

Kubernetes Engine

E

[Learn about Enterprise](#)

All Fleets

Resource Management

Marketplace

Release Notes

Replica Set de...

 REFRESH  EDIT  DELETE  ACTIONS ▾  KUBECTL ▾  OPERATIONS

Managed pods

Name	Status	Restarts	Created on ↑
<a href="#">quiz-frontend-6b7b8b8d48-9wg26</a>	Running	0	Nov 27, 2024, 2:54:42 PM
<a href="#">quiz-frontend-6b7b8b8d48-l7zkk</a>	Running	0	Nov 27, 2024, 2:54:42 PM
<a href="#">quiz-frontend-6b7b8b8d48-7tqm8</a>	Running	0	Nov 27, 2024, 2:54:42 PM

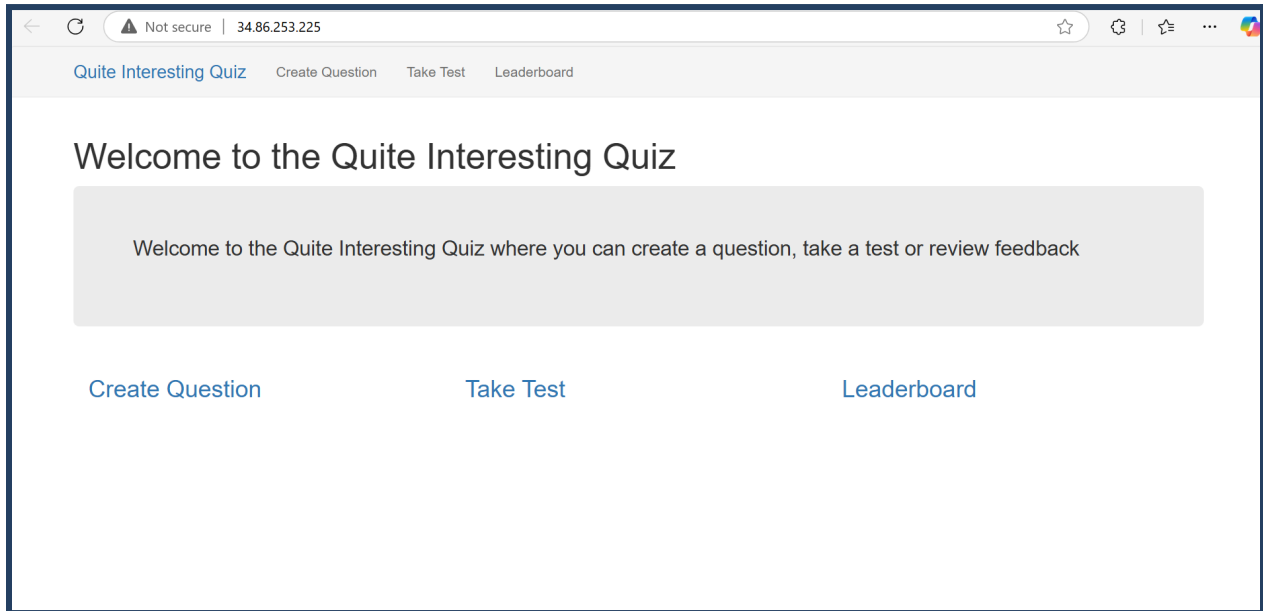
Exposing services

Name ↑	Type	Endpoints
<a href="#">quiz-frontend</a>	Load balancer	<a href="#">34.86.253.225:80</a>



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Opening in browser:



Lab Completion:

