

# Final Project



## Objectives

In this lab, you will:

- Build and deploy a simple Guestbook application
- Autoscale the Guestbook application using Horizontal Pod Autoscaler
- Perform Rolling Updates and Rollbacks

## Project Overview

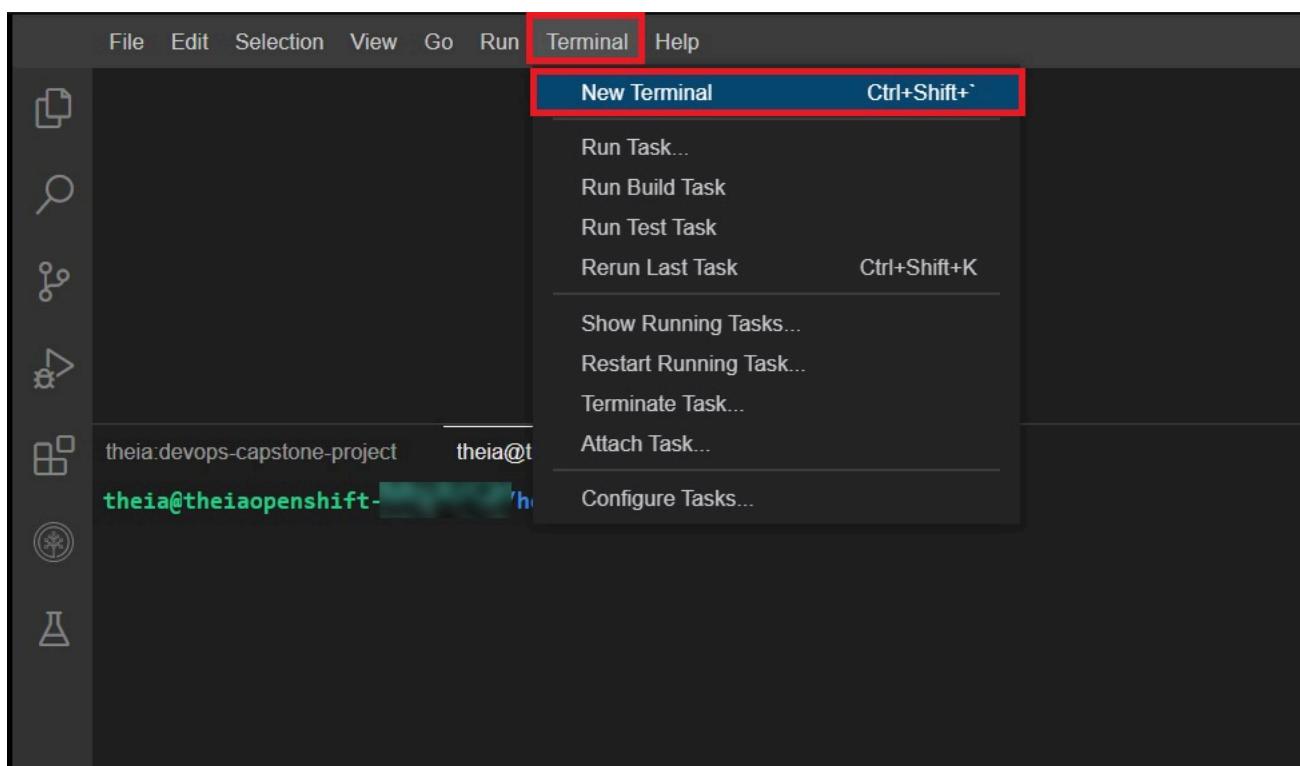
### Guestbook application

Guestbook is a simple web application that we will build and deploy with Docker and Kubernetes. The application consists of a web front end which will have a text input where you can enter any text and submit. For all of these we will create Kubernetes Deployments and Pods. Then we will apply Horizontal Pod Scaling to the Guestbook application and finally work on Rolling Updates and Rollbacks.

## Verify the environment and command line tools

1. If a terminal is not already open, open a terminal window by using the menu in the editor: Terminal > New Terminal.

**Note:** Please wait for some time for the terminal prompt to appear.



2. Change to your project folder.

**Note:** If you are already on the /home/project folder, please skip this step.

```
cd /home/project
```

3. Clone the git repository that contains the artifacts needed for this lab.

```
[ ! -d 'guestbook' ] && git clone https://github.com/ibm-developer-skills-network/guestbook
```

```
theia@theiaopenshift- [ ~ ] /home/project$ [ ! -d 'guestbook' ] && git clone https://github.com/ibm-developer-skills-network/guestbook
Cloning into 'guestbook'...
remote: Enumerating objects: 78, done.
remote: Counting objects: 100% (78/78), done.
remote: Compressing objects: 100% (61/61), done.
remote: Total 78 (delta 26), reused 30 (delta 6), pack-reused 0
Unpacking objects: 100% (78/78), done.
theia@theiaopenshift- [ ~ ] /home/project$
```

4. Change to the directory for this lab.

```
cd guestbook
```

5. List the contents of this directory to see the artifacts for this lab.

```
ls
```

## Build the guestbook app

To begin, we will build and deploy the web front end for the guestbook app.

1. Change to the v1/guestbook directory.

```
cd v1/guestbook
```

2. Dockerfile incorporates a more advanced strategy called multi-stage builds, so feel free to read more about that [here](#).

Complete the Dockerfile with the necessary Docker commands to build and push your image. The path to this file is guestbook/v1/guestbook/Dockerfile.

▼ Hint!

The FROM instruction initializes a new build stage and specifies the base image that subsequent instructions will build upon.

The COPY command enables us to copy files to our image.

The ADD command is used to copy files/directories into a Docker image.

The RUN instruction executes commands.

The EXPOSE instruction exposes a particular port with a specified protocol inside a Docker Container.

The CMD instruction provides a default for executing a container, or in other words, an executable that should run in your container.

Take a screenshot of the completed dockerfile and save it as **Dockerfile.png**.

3. Export your namespace as an environment variable so that it can be used in subsequent commands.

```
export MY_NAMESPACE=sn-labs-$USERNAME
```

```
theia@theiaopenshift- [ /home/project/guestbook/v1/guestbook$ export MY_NAMESPACE=sn-labs-$USERNAME  
theia@theiaopenshift- [ /home/project/guestbook/v1/guestbook$
```

4. Build the guestbook app using the Docker Build command.

▼ Hint!

```
docker build . -t us.icr.io/$MY_NAMESPACE/guestbook:v1
```

```
theia@theiaopenshift- [ /home/project/guestbook/v1/guestbook$ docker build . -t us.icr.io/$MY_NAMESPACE/guestbook:v1  
Sending build context to Docker daemon 98.3kB  
Step 1/14 : FROM golang:1.15 as builder  
1.15: Pulling from library/golang  
627b765e08d1: Pull complete  
c040670e5e55: Pull complete  
073a180f4992: Pull complete  
bf76209566d0: Pull complete  
6182a456504b: Pull complete  
73e3d3d88c3c: Pull complete  
5946d17734ce: Pull complete  
Digest: sha256:ea080cc817b02a946461d42c02891bf750e3916c52f7ea8187bccde8f312b59f  
Status: Downloaded newer image for golang:1.15  
--> 40349a2425ef  
Step 2/14 : RUN go get github.com/codegangsta/negroni  
--> Running in f0ae405f6c93  
Removing intermediate container f0ae405f6c93  
--> ff3c71a6a901  
Step 3/14 : RUN go get github.com/gorilla/mux github.com/xyproto/simpleredis  
--> Running in 5414403396b8  
Removing intermediate container 5414403396b8  
--> 414074738399  
Step 4/14 : COPY main.go .  
--> 7a25b8c69819  
Step 5/14 : RUN go build main.go  
--> Running in 8f6951d3434b  
Removing intermediate container 8f6951d3434b  
--> aa17b6f49c23  
Step 6/14 : FROM ubuntu:18.04  
18.04: Pulling from library/ubuntu  
08a6abff8943: Pull complete  
Digest: sha256:982d72c16416b09ffd2f71aa381f761422085eda1379dc66b668653607969e38  
Status: Downloaded newer image for ubuntu:18.04  
--> f5cbed4244ba  
Step 7/14 : COPY --from=builder /go//main /app/guestbook  
--> dab533567691
```

5. Push the image to IBM Cloud Container Registry.

▼ Hint!

```
docker push us.icr.io/$MY_NAMESPACE/guestbook:v1
```

```
theia@theiaopenshift- [ /home/project/guestbook/v1/guestbook$ docker push us.icr.io/$MY_NAMESPACE/guestbook:v1  
The push refers to repository [us.icr.io/sn-labs-[REDACTED]/guestbook]  
0791a8c653f4: Pushed  
fd382c0f22b7: Pushed  
aeb42d7f3c54: Pushed  
54deeds58a6a4: Pushed  
5dddb4b5996f: Pushed  
95c443da13bf: Pushed  
v1: digest: sha256:459dc3814b3b0d59aee57f684db436c69abfa52a492fbcd84e75c6c42188fe40 size: 1570  
theia@theiaopenshift- [ /home/project/guestbook/v1/guestbook$
```

**Note:** If you have tried this lab earlier, there might be a possibility that the previous session is still persistent. In such a case, you will see a ‘Layer already Exists’ message instead of the ‘Pushed’ message in the above output. We recommend you to proceed with the next steps of the lab.

6. Verify that the image was pushed successfully.

```
ibmcloud cr images
```

```

theia@theiaopenshift-lavanyar: /home/project/guestbook/v1/guestbook ×
theia@theiaopenshift-[REDACTED] /home/project/guestbook/v1/guestbook$ ibmcloud cr images
Listing images...

Repository                                Tag      Digest          Namespace     Created
us.icr.io/sn-labs-[REDACTED]/guestbook    v1       61e06d36213c  sn-labs-[REDACTED]  21 minutes ago
us.icr.io/sn-labsassets/instructions-splitter  latest   2af122cfe4ee  sn-labsassets  2 years ago
us.icr.io/sn-labsassets/pgadmin-theia        latest   0adf67ad81a3  sn-labsassets  2 years ago
us.icr.io/sn-labsassets/phpmyadmin           latest   b66c30786353  sn-labsassets  2 years ago
us.icr.io/sn-labsassets/tts-standalone       latest   56ce85280714  sn-labsassets  1 week ago

OK
theia@theiaopenshift-[REDACTED] /home/project/guestbook/v1/guestbook$ █

```

Take a screenshot of the output of Step 6 and save it as a .jpg or .png with the filename `crimages.png`. You will be prompted to upload the screenshot in the Peer Assignment.

7. Open the `deployment.yaml` file in the `v1/guestbook` directory & view the code for the deployment of the application:

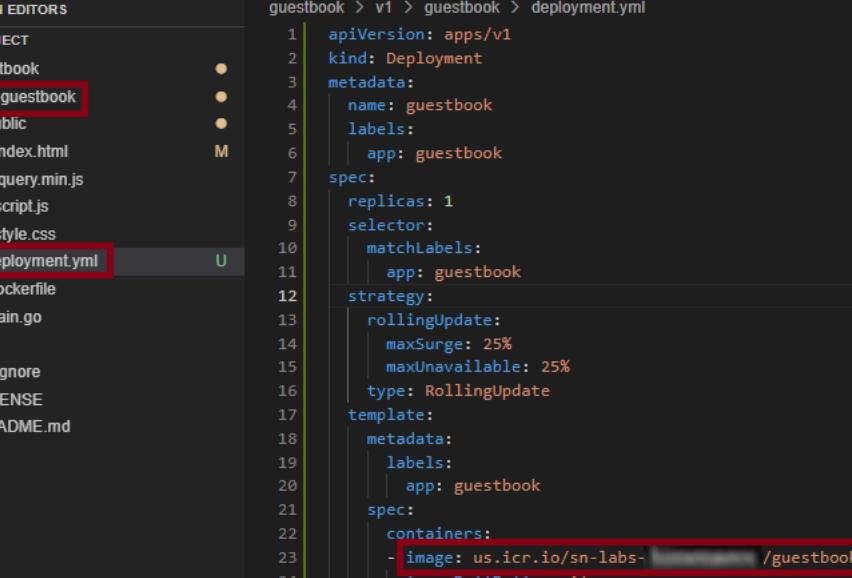
```

apiVersion: apps/v1
kind: Deployment
metadata:
  name: guestbook
  labels:
    app: guestbook
spec:
  replicas: 1
  selector:
    matchLabels:
      app: guestbook
  strategy:
    rollingUpdate:
      maxSurge: 25%
      maxUnavailable: 25%
    type: RollingUpdate
  template:
    metadata:
      labels:
        app: guestbook
    spec:
      containers:
        - image: us.icr.io/<your sn labs namespace>/guestbook:v1
          imagePullPolicy: Always
          name: guestbook
          ports:
            - containerPort: 3000
              name: http
          resources:
            limits:
              cpu: 50m
            requests:
              cpu: 20m

```

**Note:** Replace `<your sn labs namespace>` with your SN labs namespace. To check your SN labs namespace, please run the command `ibmcloud cr namespaces`

- It should look as below:



The screenshot shows a code editor interface with a dark theme. The left sidebar contains project files: `v1/guestbook` (highlighted with a red box), `public`, `index.html`, `jquery.min.js`, `script.js`, `style.css`, `deployment.yml` (highlighted with a red box), `Dockerfile`, `main.go`, `v2`, `.gitignore`, `LICENSE`, and `README.md`. The main editor area displays the `deployment.yml` file content:

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: guestbook
  labels:
    app: guestbook
spec:
  replicas: 1
  selector:
    matchLabels:
      app: guestbook
  strategy:
    rollingUpdate:
      maxSurge: 25%
      maxUnavailable: 25%
    type: RollingUpdate
  template:
    metadata:
      labels:
        app: guestbook
    spec:
      containers:
        - image: us.icr.io/sn-labs-REDACTED/guestbook:v1
          imagePullPolicy: Always
          name: guestbook
          ports:
            - containerPort: 3000
```

8. Apply the deployment using:

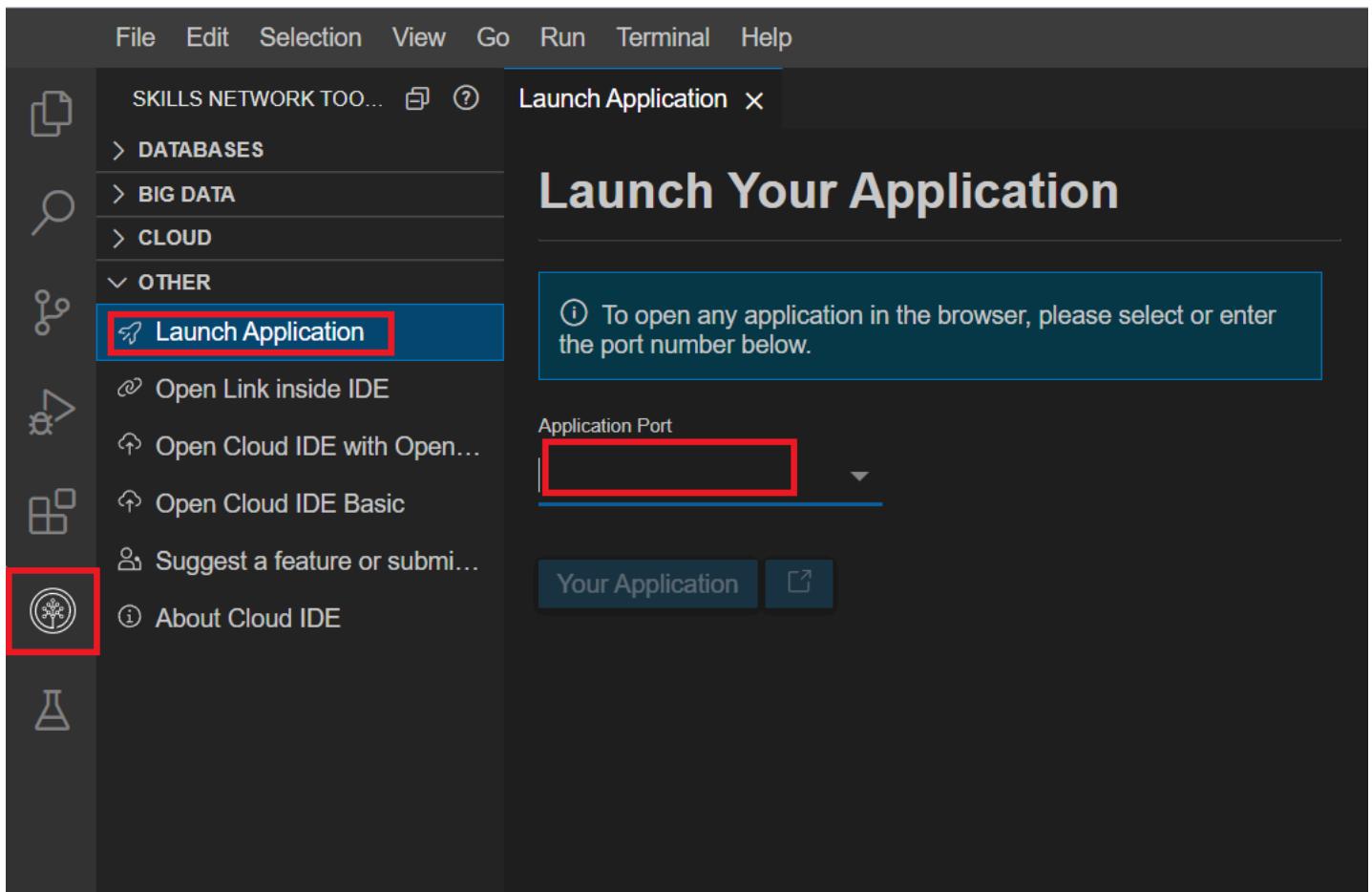
```
kubectl apply -f deployment.yml
```

```
theia@theiaopenshift-:~/home/project/guestbook/v1/guestbook$ kubectl apply -f deployment.yaml  
deployment.apps/guestbook configured
```

9. Open a New Terminal and enter the below command to view your application:

```
kubectl port-forward deployment.apps/guestbook 3000:3000
```

10. Launch your application on port 3000. Click on the Skills Network button on the right, it will open the “**Skills Network Toolbox**”. Then click the **Other** then **Launch Application**. From there you should be able to enter the port and launch.



11. Now you should be able to see your running application. Please copy the app URL which will be given as below:

Guestbook - v'

https://-3000.theiaopenshift-0-labs-prod-theiaopenshift-  
[/env](#) [/info](#)

Take a screenshot of your deployed application and save it as a .jpg or .png with the filename `app.png`. You will be prompted to upload the screenshot in the Peer Assignment.

12. Try out the guestbook by putting in a few entries. You should see them appear above the input box after you hit **Submit**.

## Autoscale the Guestbook application using Horizontal Pod Autoscaler

- Autoscale the Guestbook deployment using `kubectl autoscale deployment`

▼ Hint!

```
kubectl autoscale deployment guestbook --cpu-percent=5 --min=1 --max=10
```

```
theia@theiaopenshift-2-labs-prod-theiaopenshift-4-tor01.proxy.cognitiveclass.ai:/home/project$ kubectl autoscale deployment guestbook --cpu-percent=5 --min=1 --max=10
horizontalpodautoscaler.autoscaling/guestbook autoscaled
```

2. You can check the current status of the newly-made HorizontalPodAutoscaler, by running:

```
kubectl get hpa guestbook
```

The current replicas is 0 as there is no load on the server.

Take a screenshot of your Horizontal Pod Autoscaler and save it as a .jpg or .png with the filename `hpa.png`. You will be prompted to upload the screenshot in the Peer Assignment.

3. Open another new terminal and enter the below command to generate load on the app to observe the autoscaling (Please ensure your port-forward command is running. In case you have stopped your application, please run the port-forward command to re-run the application at port 3000.)

```
kubectl run -i --tty load-generator --rm --image=busybox:1.36.0 --restart=Never -- /bin/sh -c "while sleep 0.01; do wget -q -O- <your app URL>;
```

- Please replace your app URL in the `<your app URL>` part of the above command.

Note: Use the same copied URL which you obtained in step 11 of the previous task.

The command will be as below:

```
theia@theiaopenshift-2-labs-prod-theiaopenshift-4-tor01.proxy.cognitiveclass.ai:/home/project$ kubectl run -i --tty load-generator-7 --rm --image=busybox:1.28 --restart=Never -- > /dev/null
[...]
```

**Note:** In case you get a Load generator already exists error, please suffix a number after `load-generator` eg. `load-generator-1`, `load-generator-2`.

- You will keep getting an output similar as below which will indicate the increasing load on the app:

```
</div>
<div id="guestbook-entries">
  <link href="https://afeld.github.io/emoji-css/emoji.css" rel="stylesheet">
  <p>Waiting for database connection... <i class='em em-boat'></i></p>
</div>
<div>
  <form id="guestbook-form">
    <input autocomplete="off" id="guestbook-entry-content" type="text">
    <a href="#" id="guestbook-submit">Submit</a>
  </form>
</div>
<div>
  <p><h2 id="guestbook-host-address"></h2></p>
  <p><a href="env">/env</a>
  <a href="info">/info</a></p>
</div>
<script src="jquery.min.js"></script>
<script src="script.js"></script>
</body>
</html>
```

**Note:** Continue further commands in the 1st terminal

4. Run the below command to observe the replicas increase in accordance with the autoscaling:

```
kubectl get hpa guestbook --watch
```

```
theia@theiaopenshift: /home/project$ kubectl get hpa guestbook --watch
NAME      REFERENCE   TARGETS   MINPODS  MAXPODS  REPLICAS AGE
guestbook Deployment/guestbook <unknown>/5%    1        10       0        51s
```

5. Run the above command again after 5-10 minutes and you will see an increase in the number of replicas which shows that your application has been autoscaled.

```
theia@theiaopenshift: /home/project$ kubectl get hpa guestbook --watch
NAME      REFERENCE   TARGETS   MINPODS  MAXPODS  REPLICAS AGE
guestbook Deployment/guestbook <unknown>/5%    1        10       0        2m54s
guestbook Deployment/guestbook <unknown>/5%    1        10       1        3m31s
```

Take a screenshot of your Autoscaler details and save it as a .jpg or .png with the filename hpa2.png. You will be prompted to upload the screenshot in the Peer Assignment.

6. Run the below command to observe the details of the horizontal pod autoscaler:

```
kubectl get hpa guestbook
```

```
theia@theiaopenshift: /home/project$ kubectl get hpa guestbook
NAME      REFERENCE   TARGETS   MINPODS  MAXPODS  REPLICAS AGE
guestbook Deployment/guestbook <unknown>/5%    1        10       1        8m2s
```

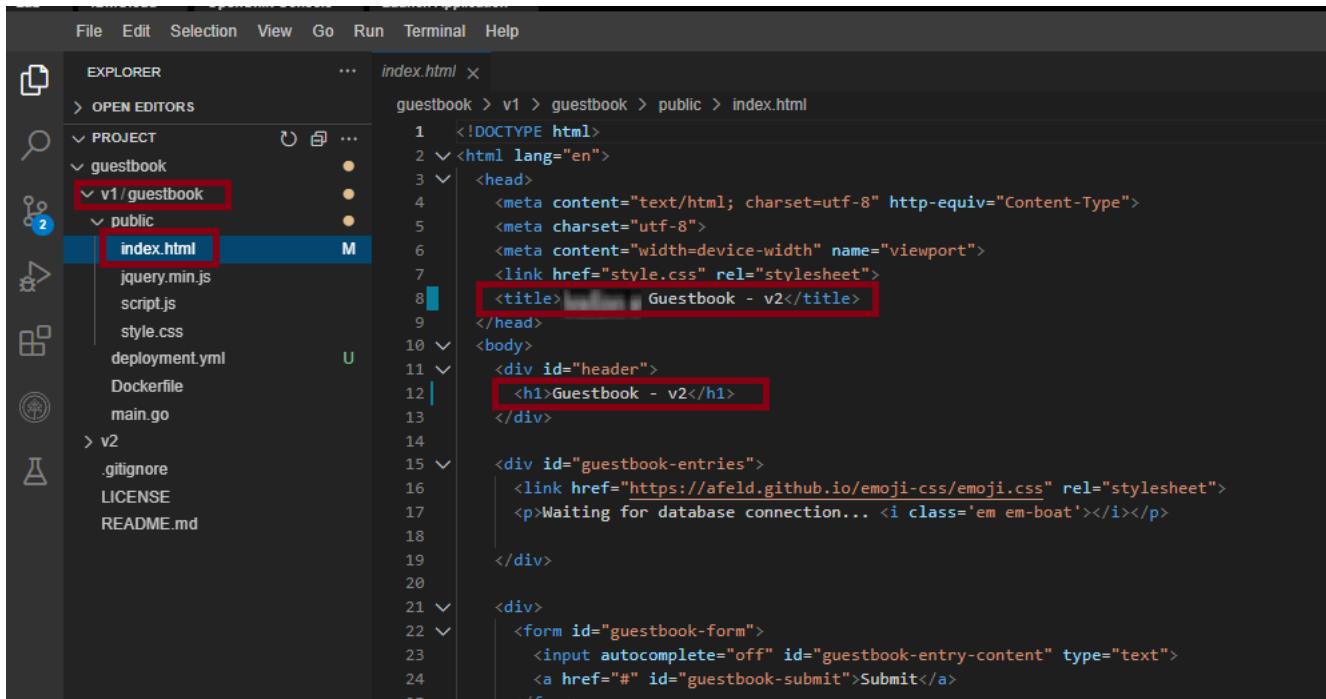
- Please close the other terminals where load generator and port-forward commands are running.

## Perform Rolling Updates and Rollbacks on the Guestbook application

**Note:** Please run all the commands in the 1st terminal unless mentioned to use a new terminal.

1. Please update the title and header in `index.html` to any other suitable title and header like <Your name> Guestbook - v2 & Guestbook - v2.

▼ Hint!



```
File Edit Selection View Go Run Terminal Help
EXPLORER      ... index.html x
PROJECT
  guestbook
    v1/guestbook
      public
        index.html M
          jquery.min.js
          script.js
          style.css
          deployment.yml U
          Dockerfile
          main.go
v2
  .gitignore
  LICENSE
  README.md

index.html
1  <!DOCTYPE html>
2  <html lang="en">
3  <head>
4    <meta content="text/html; charset=utf-8" http-equiv="Content-Type">
5    <meta charset="utf-8">
6    <meta content="width=device-width" name="viewport">
7    <link href="style.css" rel="stylesheet">
8    <title>[REDACTED] Guestbook - v1</title>
9  </head>
10 <body>
11 <div id="header">
12   <h1>Guestbook - v1</h1>
13 </div>
14
15 <div id="guestbook-entries">
16   <link href="https://afeld.github.io/emoji-css/emoji.css" rel="stylesheet">
17   <p>Waiting for database connection... <i class='em em-boat'></i></p>
18 </div>
19
20
21 <div>
22   <form id="guestbook-form">
23     <input autocomplete="off" id="guestbook-entry-content" type="text">
24     <a href="#" id="guestbook-submit">Submit</a>
25   </form>
```

2. Run the below command to build and push your updated app image:

▼ Hint!

```
docker build . -t us.icr.io/$MY_NAMESPACE/guestbook:v1 && docker push us.icr.io/$MY_NAMESPACE/guestbook:v1
```

```
theia@theiaopenshift- [ /home/project/guestbook/v1/guestbook$ docker build . -t us.icr.io/$MY_NAMESPACE/guestbook:v1 && do
Sending build context to Docker daemon 99.84kB
Step 1/14 : FROM golang:1.15 as builder
--> 40349a2425ef
Step 2/14 : RUN go get github.com/codegangsta/negroni
--> Using cache
--> a99ca8836baa
Step 3/14 : RUN go get github.com/gorilla/mux github.com/xypproto/simpleredis
--> Using cache
--> 223b1eb7b632
Step 4/14 : COPY main.go .
--> Using cache
--> 61e55377f285
Step 5/14 : RUN go build main.go
--> Using cache
--> 9c5a2fefb95d
Step 6/14 : FROM ubuntu:18.04
--> ad080923604a
Step 7/14 : COPY --from=builder /go//main /app/guestbook
--> Using cache
--> 6814c3996683
Step 8/14 : ADD public/index.html /app/public/index.html
--> 4a33338902f5
Step 9/14 : ADD public/script.js /app/public/script.js
--> 142fb28cd864
Step 10/14 : ADD public/style.css /app/public/style.css
--> 15e2bd7e80d6
```

Take a screenshot of your updated image and save it as a .jpg or .png with the filename upguestbook.png. You will be prompted to upload the screenshot in the Peer Assignment.

3. Update the values of the CPU in the deployment.yml to **cpu: 5m** and **cpu: 2m** as below:

▼ Hint!

```
File Edit Selection View Go Run Terminal Help
EXPLORER ... deployment.yml x
PROJECT OPEN EDITORS guestbook > v1 > guestbook > deployment.yml
guestbook > v1 > guestbook > deployment.yml
16 type: RollingUpdate
17 template:
18   metadata:
19     labels:
20       | app: guestbook
21     spec:
22       containers:
23         - image: us.icr.io/sn-labs/[REDACTED]/guestbook:v1
24           imagePullPolicy: Always
25           name: guestbook
26           ports:
27             - containerPort: 3000
28               name: http
29             resources:
30               limits:
31                 | cpu: 5m
32               requests:
33                 | cpu: 2m
34     replicas: 1
```

4. Apply the changes to the deployment.yml file.

▼ Hint!

```
kubectl apply -f deployment.yml
```

```
theia@theiaopenshift- [ /home/project/guestbook/v1/guestbook$ kubectl apply -f deployment.yml
deployment.apps/guestbook configured
```

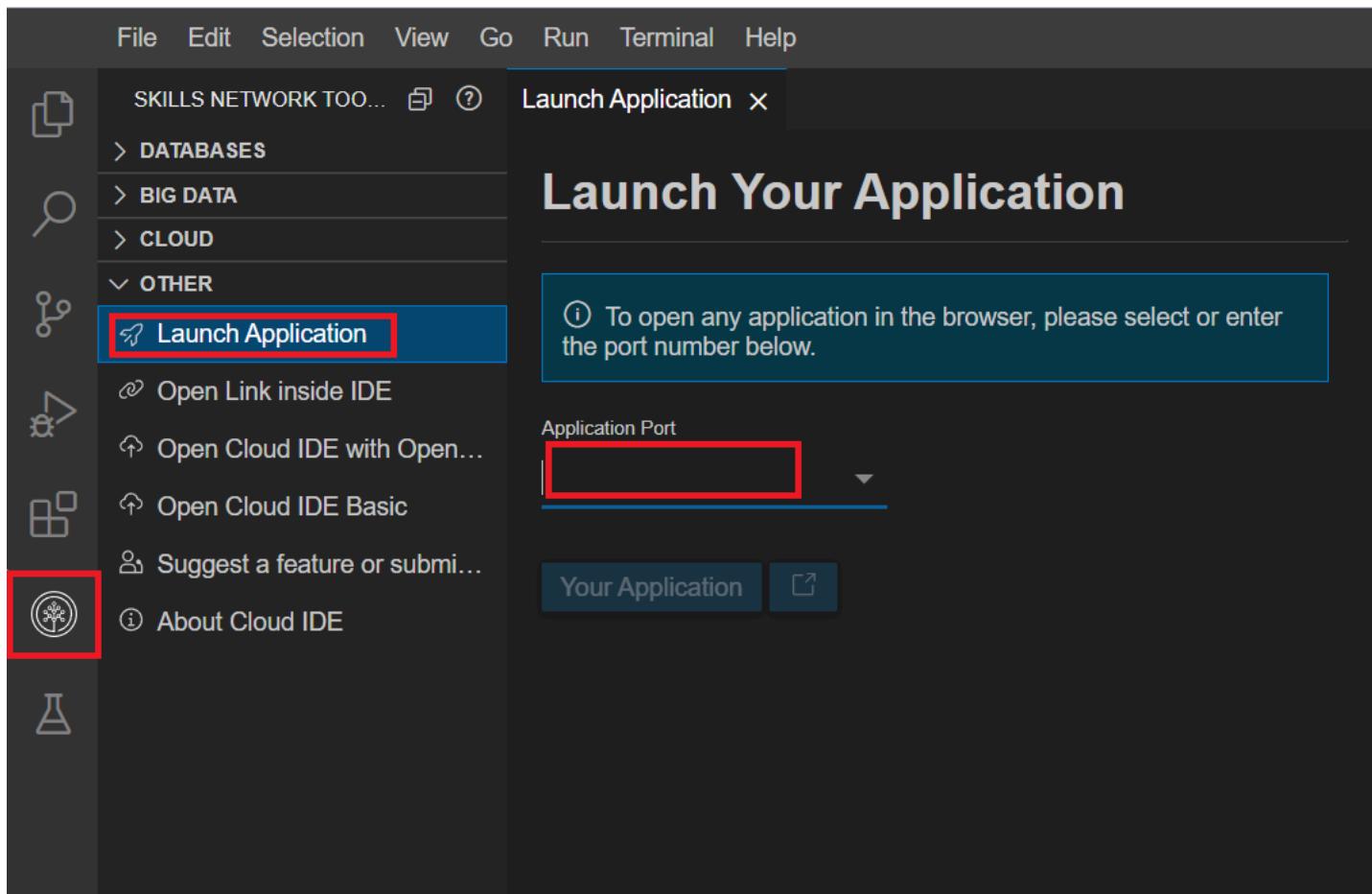
Take a screenshot of the details of the output of Step 4 and save it as a .jpg or .png with the filename deployment.png. You will be prompted to upload the screenshot in the Peer Assignment.

5. Run the port-forward command again to start the app:

```
kubectl port-forward deployment.apps/guestbook 3000:3000
```

```
theia@theiaopenshift: /home/project/guestbook/v1/guestbook$ kubectl port-forward deployment.apps/guestbook 3000:3000
Forwarding from 127.0.0.1:3000 -> 3000
Forwarding from [::1]:3000 -> 3000
Handling connection for 3000
```

6. Launch your application on port 3000. Click on the Skills Network button on the right, it will open the “Skills Network Toolbox”. Then click the **Other** then **Launch Application**. From there you should be able to enter the port and launch.



7. You will notice the updated app content as below:

# Guestbook - v2

[https://\[REDACTED\]:3000](https://[REDACTED]:3000) [theiaopenshift-2-labs-prod-theiaopenshift-4-torC](#)  
[/env](#) [/info](#)

Take a screenshot of your updated application and save it as a .jpg or .png with the filename up-app.png. You will be prompted to upload the screenshot in the Peer Assignment.

**Note:** Please stop the application before running the next steps.

8. Run the below command to see the history of deployment rollouts:

```
kubectl rollout history deployment/guestbook
```

```
theia@theiaopenshift- [REDACTED] /home/project/guestbook/v1/guestbook$ kubectl rollout history deployment/guestbook
deployment.apps/guestbook
REVISION  CHANGE-CAUSE
1          <none>
2          <none>
```

9. Run the below command to see the details of Revision of the deployment rollout:

```
kubectl rollout history deployments guestbook --revision=2
```

```
theia@theiaopenshift- [REDACTED] /home/project/guestbook/v1/guestbook$ kubectl rollout history deployments guestbook --revision=2
deployment.apps/guestbook with revision #2
Pod Template:
  Labels:      app=guestbook
               pod-template-hash=6bdb7c74c6
  Containers:
    guestbook:
      Image:      us.icr.io/sn-labs-[REDACTED]/guestbook:v1
      Port:       3000/TCP
      Host Port: 0/TCP
      Limits:
        cpu:      5m
      Requests:
        cpu:      2m
      Environment:   <none>
      Mounts:     <none>
      Volumes:    <none>
```

Take a screenshot of the details of the correct Revision and save it as a .jpg or .png with the filename rev.png. You will be prompted to upload the screenshot in the Peer Assignment.

10. Run the below command to get the replica sets and observe the deployment which is being used now:

```
kubectl get rs
```

```
theia@theiaopenshift- [~] /home/project/guestbook/v1/guestbook$ kubectl get rs
NAME          DESIRED   CURRENT   READY   AGE
guestbook-5997448ccb   0         0         0      17m
guestbook-6bdb7c74c6   1         1         1      105s
```

11. Run the below command to undo the deployment and set it to Revision 1:

```
kubectl rollout undo deployment/guestbook --to-revision=1
```

```
theia@theiaopenshift- [~] /home/project/guestbook/v1/guestbook$ kubectl rollout undo deployment/guestbook --to-revision=1
deployment.apps/guestbook rolled back
```

12. Run the below command to get the replica sets after the Rollout has been undone. The deployment being used would have changed as below:

```
kubectl get rs
```

```
theia@theiaopenshift- [~] /home/project/guestbook/v1/guestbook$ kubectl get rs
NAME          DESIRED   CURRENT   READY   AGE
guestbook-5997448ccb   1         1         1      19m
guestbook-6bdb7c74c6   0         0         0      3m40s
```

Take a screenshot of the output of Step 9 and save it as a .jpg or .png with the filename rs.png. You will be prompted to upload the screenshot in the Peer Assignment.

Congratulations! You have completed the final project for this course. Do not log out of the lab environment (you can close the browser though) or delete any of the artifacts created during the lab, as these will be needed for the next lab.  
Optional: Deploy Guestbook App from the OpenShift Internal Registry.

© IBM Corporation. All rights reserved.