SWE 645

Component-based Software Development

Assignment 3

By:

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This readme is for explaining how we implemented the extra credit assignment. It is divided into two parts. The first explains the creation of an ingress into the HW3 service application using a DNS.

The second explains how we created a simple NGINX web server application and deployed it onto a cluster and created an ingress for it as well.

Section 1

Part 1: Creating a global static IP address.

- To create a static IP address on GCP we need to head over to the VPC Network homepage.
- Under the VPC Network category choose the IP address subcategory. At the top of this page is an option to reserve a static IP address. Click on it.
- An IP creation page opens up. Give a name to your IP address. In the network type select Premium and in the IP Version select IPv4.
- In the region type select global.
- Leave the attached section as none (default).
- Click on reserve this will create a global static IP address.

Name	IP address	Access type	Region	Type	Version
nat-auto-ip-10434490-2-1690855512682081	35.245.242.62	External	us-east4	Static	IPv4
nginx-test	34.86.147.13	External	us-east4	Static	IPv4
test-ip	34.86.124.111	External	us-east4	Static	IPv4
–	10.150.0.35	Internal	us-east4	Ephemeral	IPv4

- The next step is to assign this IP address to the Load Balancer that is created when creating an Ingress.

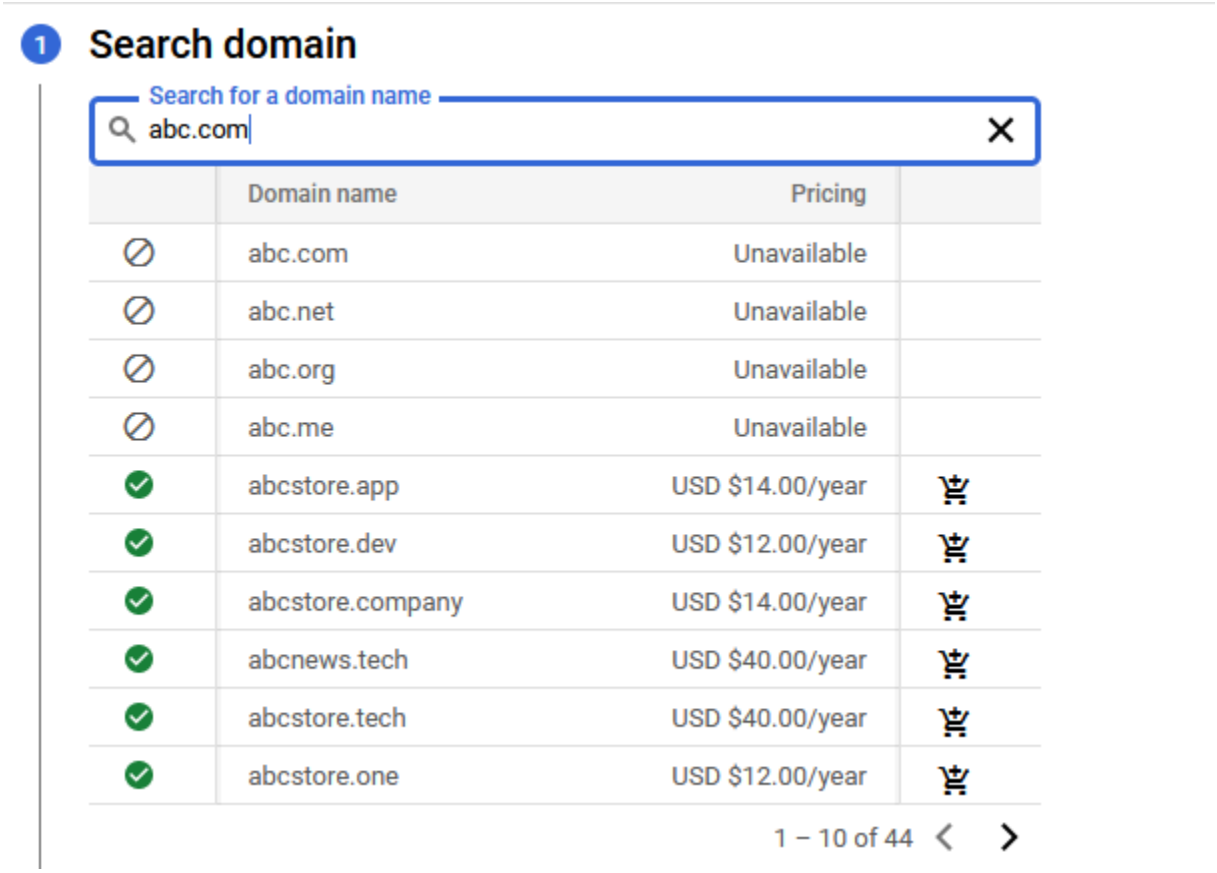
- To do this we need to modify the Ingress YAML file. Under annotations we specify that a global static IP address, with the same name as the IP address you created previously, should be assigned to the Load Balancer that is created when creating Ingress.

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: hw3-ingress1
  annotations:
    kubernetes.io/ingress.global-static-ip-name: "ip-hw3"
  labels:
    name: hw3-ingress1
spec:
  defaultBackend:
    service:
      name: myapp-svc
      port:
```

- The reason for assigning a static IP address is that whenever the ingress is deleted and recreated it assigns the same external IP to the load balancer. Not doing this might cause the application to not load as the IP to which the DNS is attached to and the IP of the LB is mismatched.
- So, setting a static external IP will always ensure that the new load balancer always points to the same IP every single time it is created.

Part 2: Creating a Domain.

- To register our very own domain we need to head over to the Cloud Domains section under Network Services.
- On the top of the page we can see a “Register Domain” .
- Enter the domain name you would like to create. Something abc.com. This will list all the available domain names similar to the one you wanted to create. Choose one from the options and click continue.



- Next, we must create our very own DNS. Under the DNS Provider menu, we must choose “Use Cloud DNS” and in the drop down choose “Set up new zone”.

- This will open a side panel in which the zone name is already entered, you can leave it as it is or could change if you wish to. Then click on Save and Continue.
- Next, we turn on Privacy protection and provide our contact information.
- Finally, we click on REGISTER.
- And voila we have our very own domain.

Part 3: Creating Record sets for our DNS.

- Click on the zone you created in the previous step. And then click on “Add Standard”. Here you will already see the domain you created in the previous step.
- Here you will give a DNS name which appended to your domain.
- In the IPV4 address section we give the static IP address of the Ingress Load Balancer.
- Then click on create.

In total we should have created

1. A Domain.
2. A DNS Zone (through the domain).
3. A standard/DNS Name.
4. An IPv4 address.

Part1: Creating the Hello World Web Application

- To create a simple Web Application, we first need to create an HTML template that displays the message hello world to the web browser.

```html
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Hello World</title>
</head>
<body>
    <div><h1>Hello World!!!</h1></div>
</body>
</html>
```

- This is a simple boiler plate code. That displays Hello World!!!.

Part 2: Creating the Dockerfile:

- Since this is an NGINX web server web application we need to use the nginx image from docker hub and move out html template to the /usr/share/nginx/html/index.html in the nginx image.

```
FROM nginx:latest
COPY ./hello-world.html /usr/share/nginx/html/index.html
```

Part 3: Building the Docker Image

- To build our image we need to open a terminal in the directory where the Dockerfile is present.
- In the terminal give the following commands.
    - docker build -t <IMAGE_NAME> .
    - docker tag <IMAGE_NAME> <REPOSITORY_NAME>/<IMAGE_NAME>
    - docker push <REPOSITORY_NAME>/<IMAGE_NAME>

Part 4: Creating the YAML files.

- Since we need to deploy the web application onto a cluster, we need to create deployment and service yaml files.
- Here is the deployment.yaml file.

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
    name: nginx-hello-world
    namespace: nginx-app-namespace
spec:
    replicas: 3
    selector:
        matchLabels:
            app: nginx-hello-world
    template:
        metadata:
            labels:
                app: nginx-hello-world
        spec:
            containers:
            - name: nginx-cont
              image: asdpkp/nginx-webapp
              ports:
                  - containerPort: 80
```

Since the specification for this extra credit was to create deployment in a separate namespace to the main project, I deployed these pods in the namespace nginx-app-namspace. It will be deployed onto 3 nodes and the

image it will use is the asdpkp/nginx-webapp with container name and port as nginx-cont and 80 respectively.

- This is my Service.yaml:

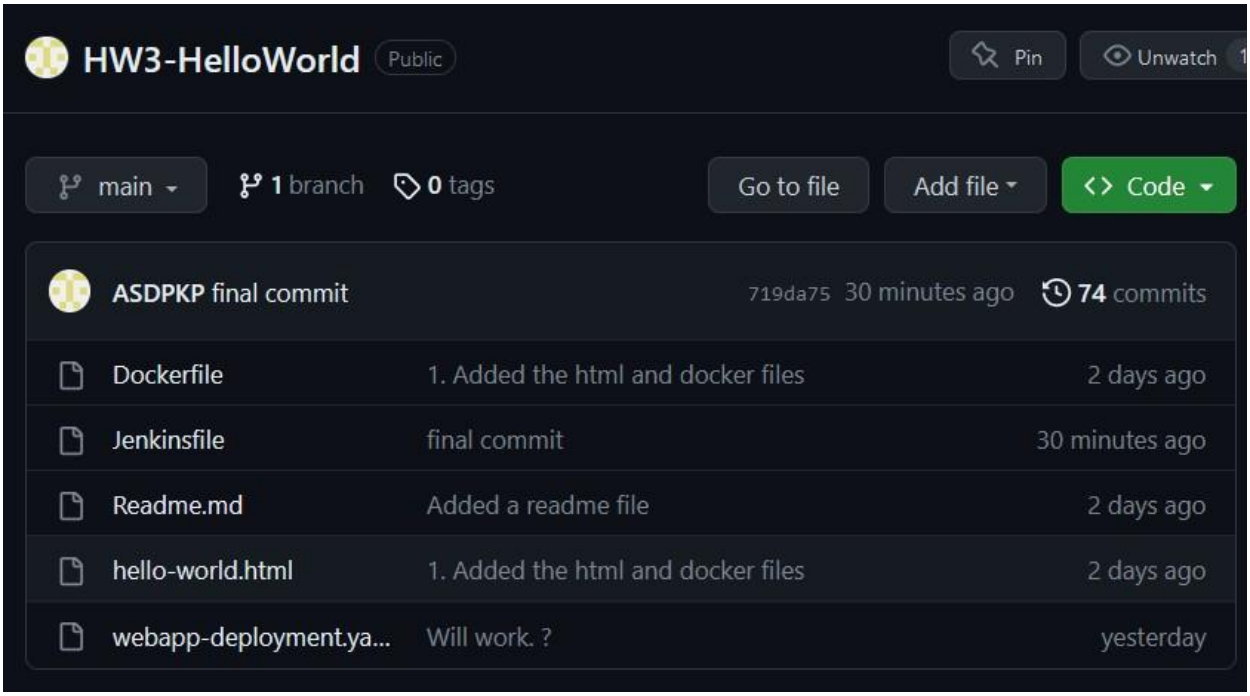
```yaml
apiVersion: v1
kind: Service
metadata:
    name: nginx-hello-worlds-svc
    namespace: nginx-app-namespace
spec:
    selector:
        app: nginx-hello-world
    ports:
        -   protocol: "TCP"
            port: 80
            targetPort: 80

    type: NodePort
    #loadBalancerIP: 34.86.147.13
```

I followed the same process as I did in Section 1 and assigned a static IP to the Load Balancer created for this service.

Part 5: Create a GitHub repo.

- Create a new github repository and put all these files into that repository using the following commands.
    - git init
    - git add –all
    - git commit -am “First Commit”
    - git push <URL_TO_GITHUB_REPO>



Part 6: Creating a Jenkinsfile.

- Now that we have created deployment and service files, we need to create Jenkinsfile to create the CI/CD pipeline.
- My Jenkinsfile looks like this.

```
pipeline {
    agent any
    environment {
        docker_creds = credentials('docker-credentials')
    }
    stages {
        stage('Hello') {
            steps{
                echo 'Hello!!!'
                }
        }

        stage('Loging into Docker') {
            steps {
            sh "docker login -u ${docker_creds_USR} -p ${docker_creds_PSW}"
            }
        }

        stage('Building the Docker Image') {
            steps {
                script {
                    dockerImage = docker.build("asdpkp/nginx-webapp")
                    dockerImage.push("latest")
                }
            }
        }

        stage('Cleaning the cluster') {
            steps {
                    echo 'Hello'
                    sh 'kubectl delete deployment nginx-hello-world -n nginx-app-namespace'
                    sh 'kubectl delete svc nginx-hello-worlds-svc -n nginx-app-namespace'
                    //sh 'kubectl delete namespace nginx-app-namespace'
                }
        }

        stage('Deploying the WebApp to the cluster') {
            steps{
                //sh 'kubectl create namespace nginx-app-namespace'
                sh 'kubectl apply -f webapp-deployment.yaml -n nginx-app-namespace'
                sh 'kubectl apply -f ingress-test.yaml -n nginx-app-namespace'
                //sh 'kubectl apply -f ingress.yaml -n nginx-app-namespace'
                }
        }
    }
}
```

It functions the same way as it does for the main project.

Part 7: Creating the CI/CD pipeline.

- Similar to the main project, we need to create a new item and select the pipeline option from the below options and give a name to our pipeline.
- We need to select the “Poll SCM” option and give the following as the input: - * * * * *
- Under the Pipeline definition page, we must select the “Pipeline script from SCM” option and in the SCM selection window we select Git.
- This will open a Repositories section. In repository URL give the url to your GitHub repo and in credential dropdown choose the same credential you did for the main project i.e Docker Credentials.
- Change the branch from */master to */main.
- Click on Apply and then on save. The Jenkins file is automatically from the github repository.
- The build process starts automatically and deploys the pods to the cluster.

Stage View

	Declarative: Checkout SCM	Checking for updates to the GitHub master repo	Logging into Docker	Building and Pushing Docker Image	Cleaning the cluster	Deploying the MySQL container	Deploying the Web Application container
Average stage times: (Average full run time: ~35s)	992ms	531ms	1s	5s	34s	2s	1s
#15 Aug 04 17:00 1 commit	623ms	488ms	4s	4s	37s	3s	2s
#14 Aug 03 21:17 No Changes	517ms	485ms	871ms	5s	32s	3s	2s
#13							

Part 8: Creating an Ingress.

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: hw3-ingress1
  annotations:
    kubernetes.io/ingress.global-static-ip-name: "ip-hw3"
  labels:
    name: hw3-ingress1
spec:
  defaultBackend:
    service:
      name: myapp-svc
      port:
        number: 8080
  rules:
    - host: app.atnk-studentsurvey.com
      http:
        paths:
        - path: /
          pathType: ImplementationSpecific
          backend:
            service:
              name: nginx-hello-worlds-svc
              port:
                number: 80
        - path: /survey
          pathType: ImplementationSpecific
          backend:
            service:
              name: myapp-svc
              port:
                number: 8080
```

The ingress is created using a yaml manifest file with the following specifications. A static global IP every time the LB is created. A default backend service that routes to the main application when appended by “/survey”. The record set name. The routing rules. “/” takes us to the nginx web app and “/survey" takes us to the spring boot application.

Links:

GitHub Repo: https://github.com/ASDPKP/MAIN-HW3-SWE645.git

MyApp DNS: app.atnk-studentsurvey.com/survey

NGINX-APP DNS: app.atnk-studentsurvey.com/