KUBERNETES **12-03-2025**

What is Kubernetes?

Kubernetes (often abbreviated as **K8s**) is an **orchestration tool** that helps manage **containers** automatically. Think of it as a **traffic controller** for applications running in containers, making sure they are running **smoothly, efficiently, and reliably**.

Why Do We Need Kubernetes?

Imagine you have an app that runs inside **containers** (small, portable environments that include everything needed to run software). Managing one or two containers manually is easy, but what if your app needs **hundreds or thousands** of containers across multiple machines? That's where Kubernetes helps!

Kubernetes **automates**:
✅ **Deployment** – Launching new containers automatically.
✅ **Scaling** – Increasing or decreasing the number of running containers based on demand.
✅ **Load Balancing** – Distributing traffic evenly so no single part gets overloaded.
✅ **Self-Healing** – Restarting failed containers automatically.
✅ **Resource Management** – Optimizing memory and CPU usage.

How Does Kubernetes Work?

Kubernetes has different parts that work together:

1. **Cluster** 🏢 – A collection of machines where your app runs.
2. **Nodes** 🖥️ – Each machine (physical or virtual) in the cluster is a **node**.
3. **Pods** 📦 – The smallest unit in Kubernetes. A **pod** holds one or more containers.
4. **Master Node (Control Plane)** 🧠 – The brain of Kubernetes, responsible for managing everything. It includes:
    - **API Server** – The entry point for commands and communication.
    - **Scheduler** – Decides which node runs which pod.
    - **Controller Manager** – Ensures the system is running as expected.
5. **Worker Nodes** 👷 – The machines where the actual work happens, running the containers inside pods.
6. **Kubelet** 🔌 – Runs on each worker node and talks to the master node.
7. **Kube-Proxy** 🔄 – Manages networking between pods.

Key Features of Kubernetes

✔️ **Self-Healing** – If a container crashes, Kubernetes restarts it automatically.
✔️ **Auto-Scaling** – Kubernetes can increase or decrease the number of running containers based on traffic.
✔️ **Rolling Updates** – Deploy a new version of an app without downtime.
✔️ **Service Discovery & Load Balancing** – Manages network traffic between different parts of an application.

Real-World Example

Imagine you run an **online shopping website**. During normal days, 10 containers handle traffic. But on **Black Friday**, traffic increases 10x. Instead of manually starting more servers, Kubernetes automatically **scales up** new containers. Once the sale is over, it scales them **down** to save costs.

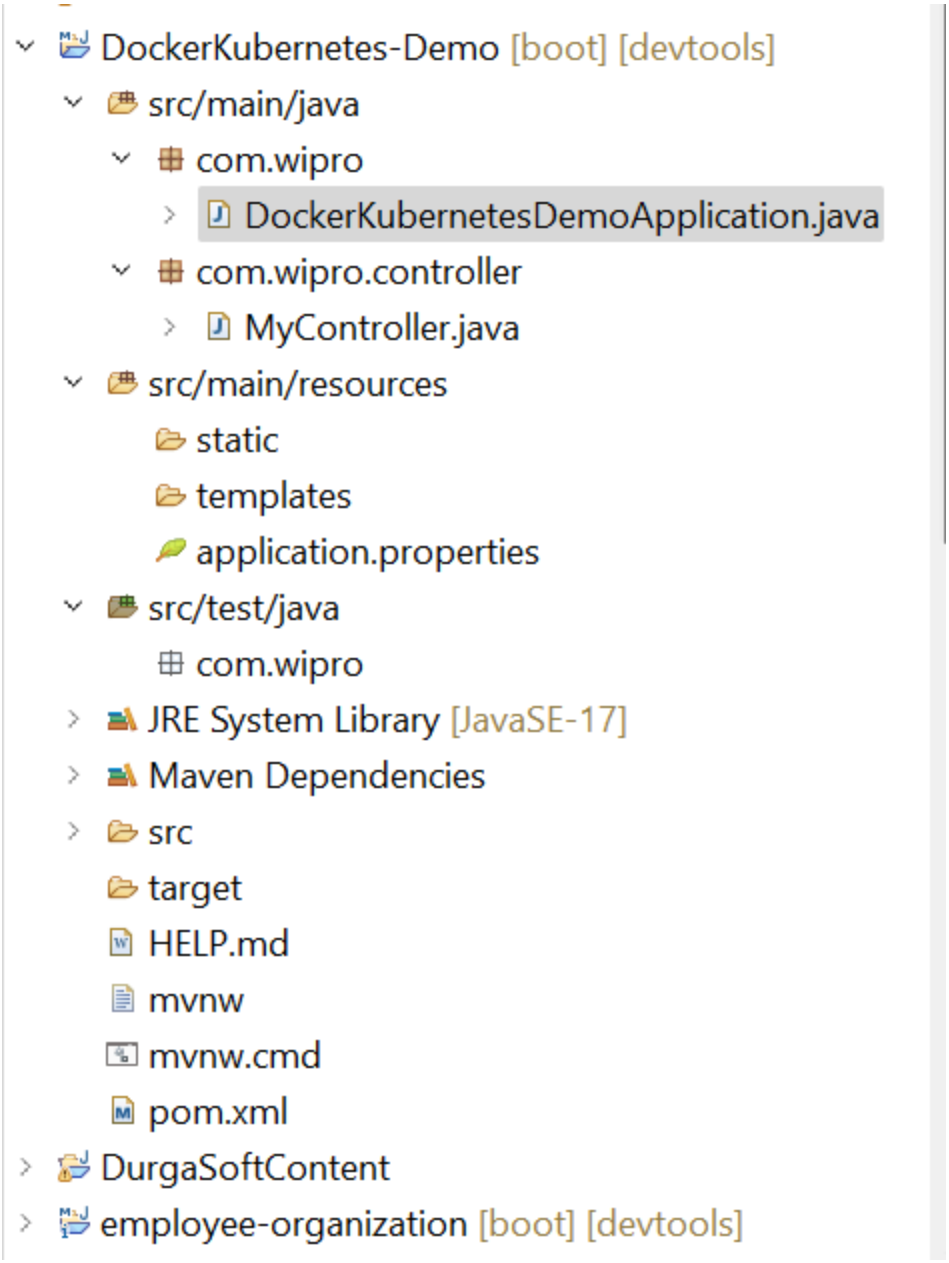
Why Use Kubernetes?

🚀 **Efficient** – Saves time and effort in managing containers.
💡 **Smart** – Can heal itself and optimize resources.
🔀 **Flexible** – Works with any cloud provider (AWS, Google Cloud, Azure) or even on-premises.
🔄 **Continuous Deployment** – Easily update applications without downtime.

Demo

https://www.youtube.com/watch?v=SzbeDqBSRkc

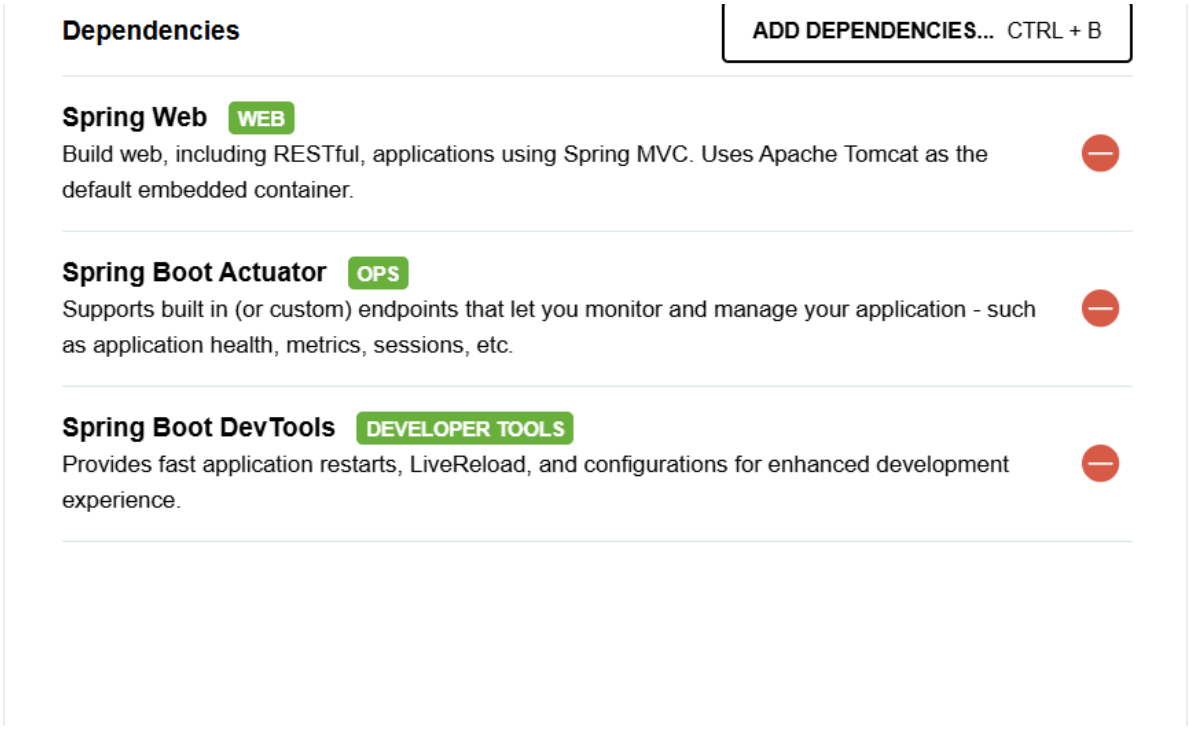
Refer this vide for the demo


DockerKubernetes-Demo [boot] [devtools]
src/main/java
com.wipro
DockerKubernetesDemoApplication.java
com.wipro.controller
MyController.java
src/main/resources
static
templates
application.properties
src/test/java
com.wipro
JRE System Library [JavaSE-17]
Maven Dependencies
src
target
HELP.md
mvnw
mvnw.cmd
pom.xml
DurgaSoftContent
employee-organization [boot] [devtools]

DockerKubernetes-Demo/pom.xml MyController.java application.properties

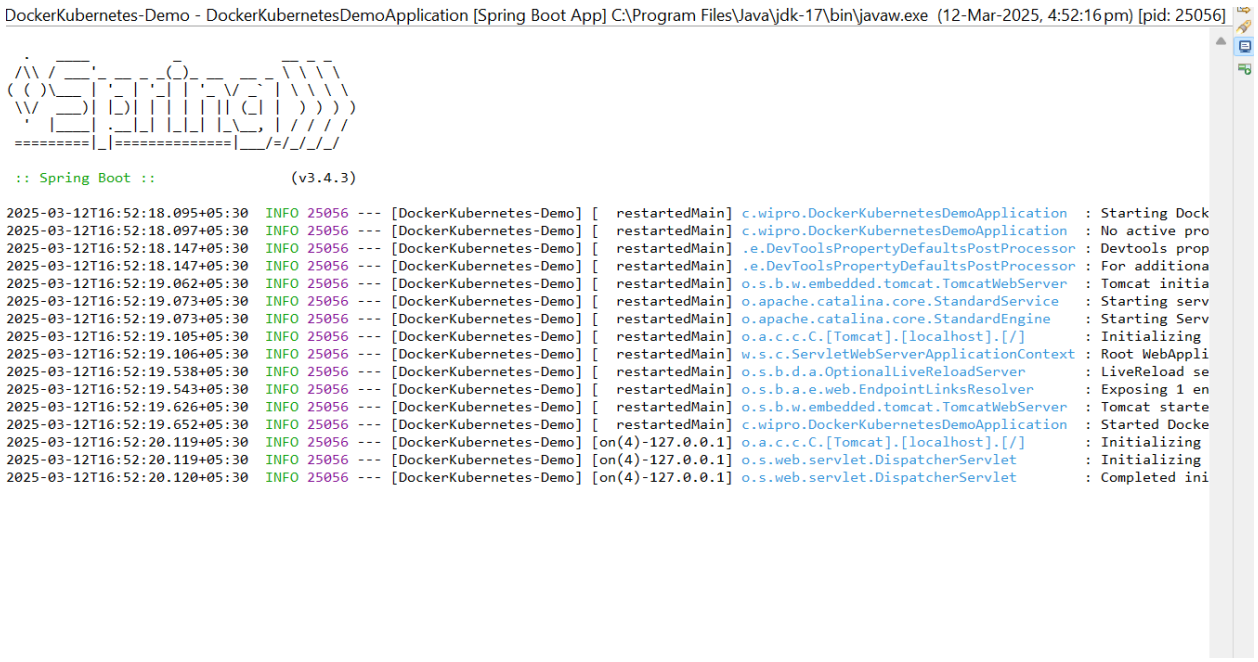
```java
package com.wipro;

import org.springframework.boot.SpringApplication;

@SpringBootApplication
public class DockerKubernetesDemoApplication {

    public static void main(String[] args) {
        SpringApplication.run(DockerKubernetesDemoApplication.class, args);
    }

}
```

```java
package com.wipro.controller;

import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RestController;

@RestController
public class MyController {

    @GetMapping("/test-docker")
    public String getData() {
        return "in docker tutorial project of play java";
    }
}
```

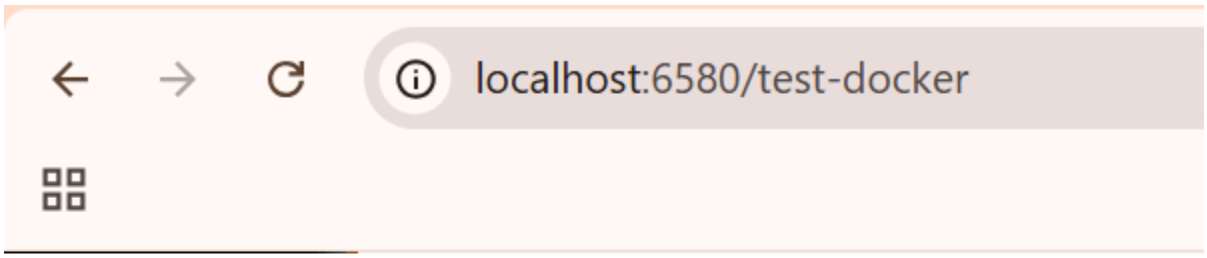


These are the dev tools i have added

Now run the application



Now check this in the local browser whether it is working or not

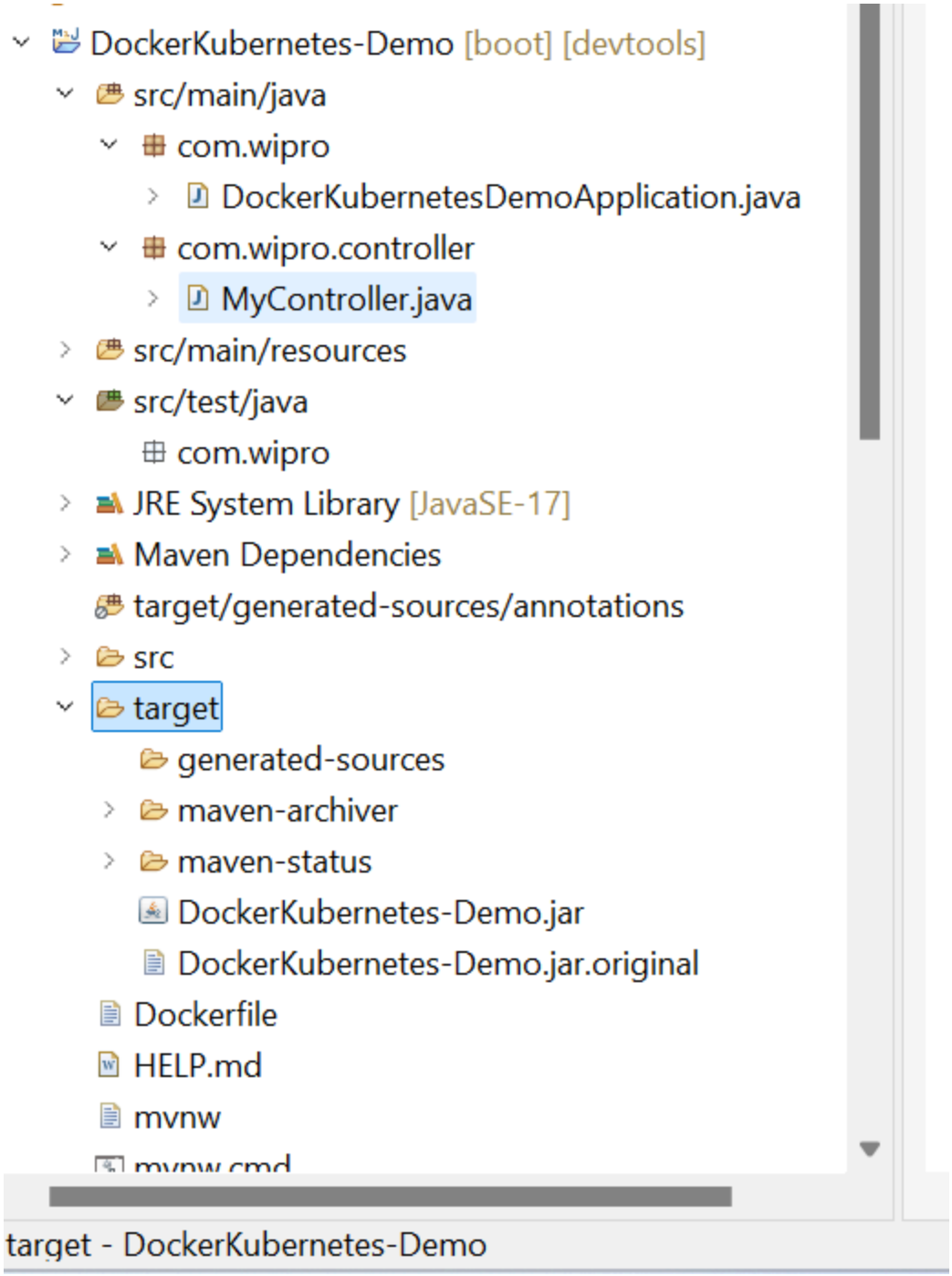


Now stop the server

Now we r going to create the docker file

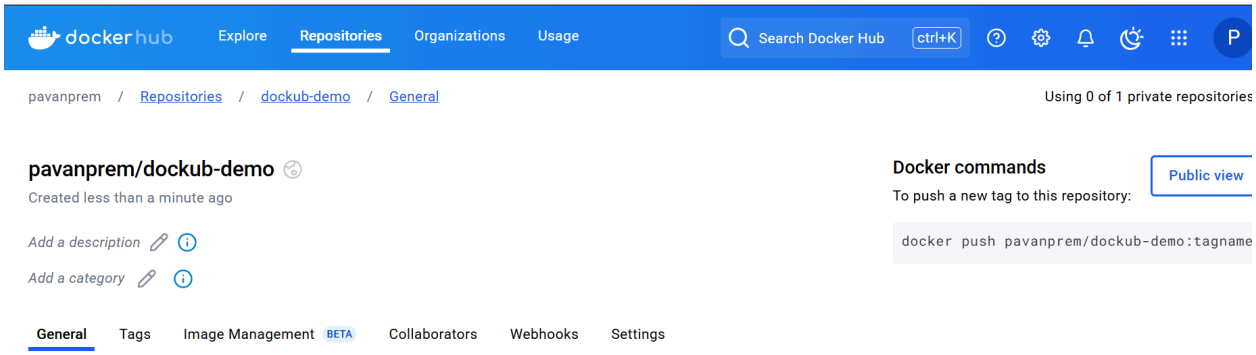
```
1 FROM java:8
2
3 EXPOSE 6580
4
5 ADD target/DockerKubernetes-Demo.jar DockerKubernetes-Demo.jar
6
7 ENTRYPOINT ["java", "-jar", "DockerKubernetes-Demo.jar"]
8
```

Now we need to create the jar file
RightClick>>runas>maven build>clean package>apply



Close the server

Now create the repository in the docker hub



Now open the cmd and enter “docker login”

```
C:\Users\miniMiracle>docker login
Authenticating with existing credentials...
Login Succeeded

C:\Users\miniMiracle>
```

Now go to the dockerfile destination and open the command prompt

```
C:\Users\miniMiracle\eclipse-workspace\DockerKubernetes-Demo\DockerKubernetes-Demo>docker build -t docker-demo .
[+] Building 43.0s (6/8)                                                                    docker:desktop-linux
 => [internal] load build definition from Dockerfile                                                       0.0s
 => => transferring dockerfile: 415B                                                                       0.0s
 => [internal] load metadata for docker.io/library/openjdk:17                                              2.8s
 => [auth] library/openjdk:pull token for registry-1.docker.io                                             0.0s
 => [internal] load .dockerignore                                                                          0.0s
 => => transferring context: 2B                                                                            0.0s
 => [1/3] FROM docker.io/library/openjdk:17@sha256:528707081fdb9562eb819128a9f85ae7fe000e2fbaeaf9f87662e7b3f38cb  39.5s
 => => resolve docker.io/library/openjdk:17@sha256:528707081fdb9562eb819128a9f85ae7fe000e2fbaeaf9f87662e7b3f38cb7  0.0s
 => => sha256:a7203ca35e75e068651c9907d659adc721dba823441b78639fde66fc988f042f 187.53MB / 187.53MB        36.1s
 => => sha256:de849f1cfbe60b1c06a1db83a3129ab0ea397c4852b98e3e4300b12ee57ba111 13.53MB / 13.53MB           5.3s
 => => sha256:38a980f2cc8accf69c23deae6743d42a87eb34a54f02396f3fcfd7c2d06e2c5b 42.11MB / 42.11MB          10.0s
 => => extracting sha256:38a980f2cc8accf69c23deae6743d42a87eb34a54f02396f3fcfd7c2d06e2c5b                   3.3s
 => => extracting sha256:de849f1cfbe60b1c06a1db83a3129ab0ea397c4852b98e3e4300b12ee57ba111                   1.3s
 => => extracting sha256:a7203ca35e75e068651c9907d659adc721dba823441b78639fde66fc988f042f                   3.2s
 => [internal] load build context                                                                          2.6s
 => => transferring context: 23.36MB                                                                       2.5s
```

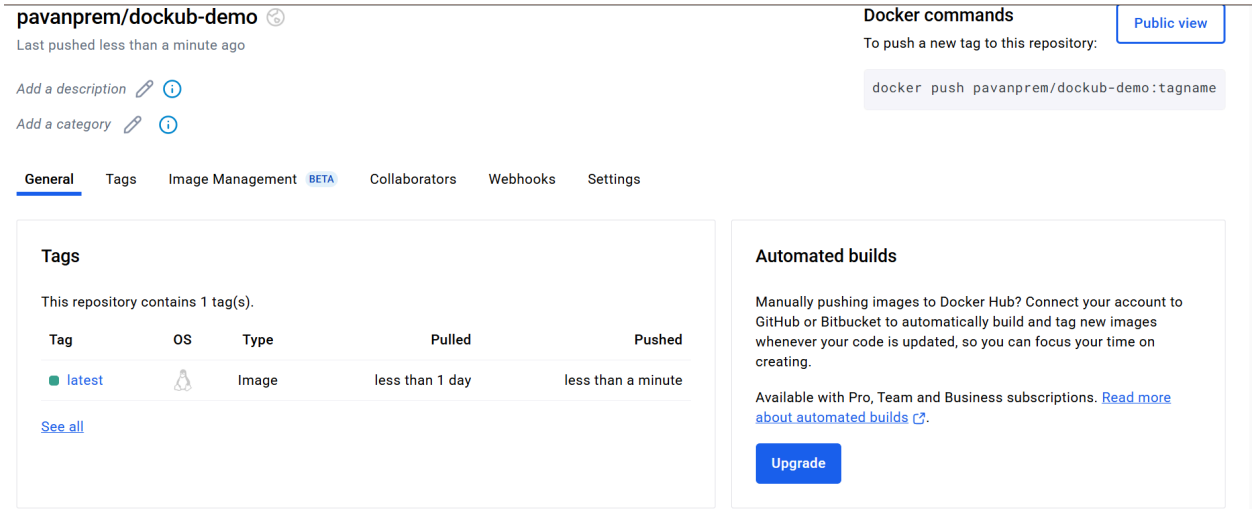
Now check whether the docker images are created are not

```
C:\Users\miniMiracle\eclipse-workspace\DockerKubernetes-Demo\DockerKubernetes-Demo>docker images
REPOSITORY                          TAG                        IMAGE ID       CREATED          SIZE
docker-demo                         latest                     e508119f50d3   19 seconds ago   771MB
pavanprem/dockerkubernetes-demo     latest                     598ec528eb1b   28 minutes ago   848MB
pavanprem/myapp                     latest                     8abbdf968a15   2 days ago       681MB
springboot-restful-webservices      0.1.RELEASE                f71027d27a51   3 days ago       855MB
springboot-docker-demo              0.1.RELEASE                e264a36fd66c   6 days ago       778MB
pavanprem/springboot-docker-demo    0.1.RELEASE                e264a36fd66c   6 days ago       778MB
openzipkin/zipkin                   latest                     d9316e7ff757   3 weeks ago      377MB
mysql                               latest                     146682692a3a   6 weeks ago      1.09GB
mongo                               6.0                        453e114d98c3   7 weeks ago      1.01GB
rabbitmq                            3.13.7-management-alpine   d759525efd68   5 months ago     279MB
```

Now push the image to the docker hub

```
C:\Users\miniMiracle\eclipse-workspace\DockerKubernetes-Demo\DockerKubernetes-Demo>docker tag docker-demo pavanprem/dock
ub-demo

C:\Users\miniMiracle\eclipse-workspace\DockerKubernetes-Demo\DockerKubernetes-Demo>docker push pavanprem/dockub-demo
Using default tag: latest
The push refers to repository [docker.io/pavanprem/dockub-demo]
de849f1cfbe6: Pushing [==================================================>]  13.53MB/13.53MB
9bcb3b002419: Pushed
b18e50bd113a: Pushed
a15a60594b7e: Pushed
38a980f2cc8a: Pushing [======================>                            ]  19.92MB/42.11MB
a7203ca35e75: Pushing [>                                                  ]  3.146MB/187.5MB
```

Now reload the docker hub..it will show the new images which we pushed just now




```
C:\Users\miniMiracle\eclipse-workspace\DockerKubernetes-Demo\DockerKubernetes-Demo>docker images
REPOSITORY                          TAG                       IMAGE ID       CREATED          SIZE
docker-demo                         latest                    e508119f50d3   4 minutes ago    771MB
pavanprem/dockub-demo               latest                    e508119f50d3   4 minutes ago    771MB
pavanprem/dockerkubernetes-demo     latest                    598ec528eb1b   32 minutes ago   848MB
pavanprem/myapp                     latest                    8abbdf968a15   2 days ago       681MB
springboot-restful-webservices      0.1.RELEASE               f71027d27a51   3 days ago       855MB
springboot-docker-demo              0.1.RELEASE               e264a36fd66c   6 days ago       778MB
pavanprem/springboot-docker-demo    0.1.RELEASE               e264a36fd66c   6 days ago       778MB
openzipkin/zipkin                   latest                    d9316e7ff757   3 weeks ago      377MB
mysql                               latest                    146682692a3a   6 weeks ago      1.09GB
mongo                               6.0                       453e114d98c3   7 weeks ago      1.01GB
rabbitmq                            3.13.7-management-alpine  d759525efd68   5 months ago     279MB
```

Now we can see 2 images ie docker-remo and dockub-demo which is created in hub and other one is local one

Now pull the image from the docker hub before that we need to remove them

Now we will remove the images which we had created

```
C:\Users\miniMiracle\eclipse-workspace\DockerKubernetes-Demo\DockerKubernetes-Demo>docker rmi docker-demo pavanprem/dock
ub-demo
Untagged: docker-demo:latest
Untagged: pavanprem/dockub-demo:latest
Deleted: sha256:e508119f50d38d794945fb200ef52e05e13e92468c3dcc8fa87149b4e6fd1d6e
```

```
C:\Users\miniMiracle\eclipse-workspace\DockerKubernetes-Demo\DockerKubernetes-Demo>docker images
REPOSITORY                          TAG                        IMAGE ID       CREATED          SIZE
pavanprem/dockerkubernetes-demo     latest                     598ec528eb1b   35 minutes ago   848MB
pavanprem/myapp                     latest                     8abbdf968a15   2 days ago       681MB
springboot-restful-webservices      0.1.RELEASE                f71027d27a51   3 days ago       855MB
springboot-docker-demo              0.1.RELEASE                e264a36fd66c   6 days ago       778MB
pavanprem/springboot-docker-demo    0.1.RELEASE                e264a36fd66c   6 days ago       778MB
openzipkin/zipkin                   latest                     d9316e7ff757   3 weeks ago      377MB
mysql                               latest                     146682692a3a   6 weeks ago      1.09GB
mongo                               6.0                        453e114d98c3   7 weeks ago      1.01GB
rabbitmq                            3.13.7-management-alpine   d759525efd68   5 months ago     279MB

C:\Users\miniMiracle\eclipse-workspace\DockerKubernetes-Demo\DockerKubernetes-Demo>
```

```
C:\Users\miniMiracle>ping 6580

Pinging 0.0.25.180 with 32 bytes of data:
PING: transmit failed. General failure.
PING: transmit failed. General failure.
PING: transmit failed. General failure.
PING: transmit failed. General failure.

Ping statistics for 0.0.25.180:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\Users\miniMiracle>
```

Now we will pull from the docker hub

```
C:\Users\miniMiracle\eclipse-workspace\DockerKubernetes-Demo\DockerKubernetes-Demo>docker run -p 6580:6580 pavanprem/doc
kub-demo
Unable to find image 'pavanprem/dockub-demo:latest' locally
latest: Pulling from pavanprem/dockub-demo
a15a60594b7e: Already exists
9bcb3b002419: Already exists
Digest: sha256:e508119f50d38d794945fb200ef52e05e13e92468c3dcc8fa87149b4e6fd1d6e
Status: Downloaded newer image for pavanprem/dockub-demo:latest

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 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/

 :: Spring Boot ::                (v3.4.3)
```
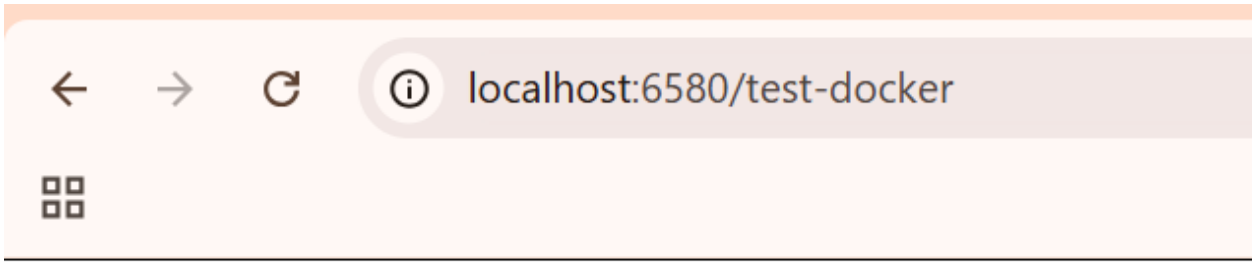
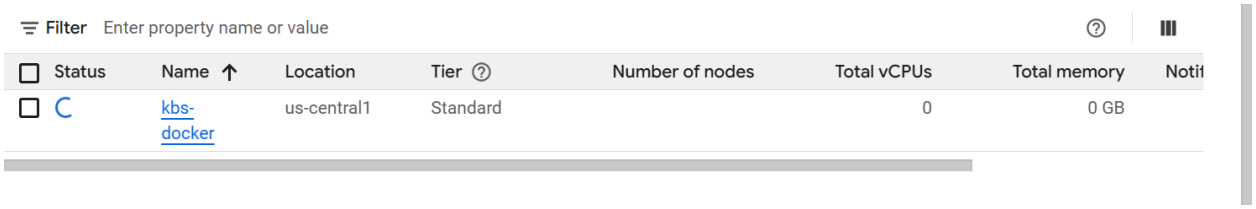



Now open the “google cloud platform” to deploy our service

Now go to the kubernetes tab after successfully created acc and payment method

Watch the video for cluster creation

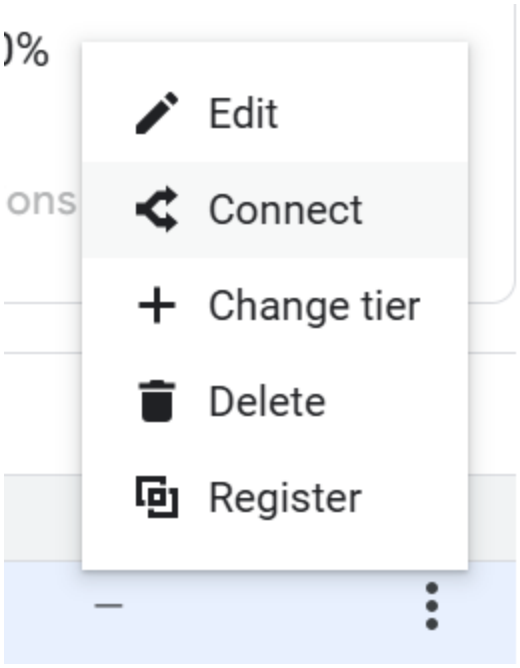


Now create the yml file in our eclipse

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: docker-k8s-demo-deployment
  labels:
    app: docker-k8s-demo
spec:
  replicas: 1
  selector:
    matchLabels:
      app: docker-k8s-demo
  template:
    metadata:
      labels:
        app: docker-k8s-demo
    spec:
      containers:
        - name: docker-k8s-demo
          image: pavanprem/dockub-demo
          ports:
            - containerPort: 6580

```

Our cluster is created now

Now click on



Connect to the cluster

You can connect to your cluster via command-line or using a dashboard.

Command-line access

Configure kubectl command line access by running the following command:

```
$ gcloud container clusters get-credentials kbs-docker --region us-central1 --project galvanic-circle-453512-q6
```

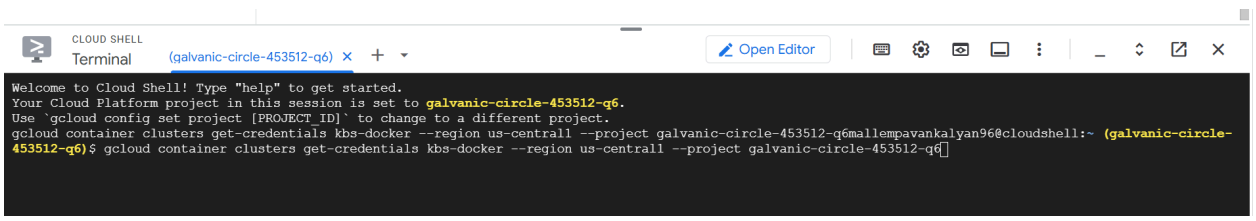
Run in Cloud Shell

Cloud Console dashboard

You can view the workloads running in your cluster in the Cloud Console Workloads dashboard .

Open Workloads dashboard

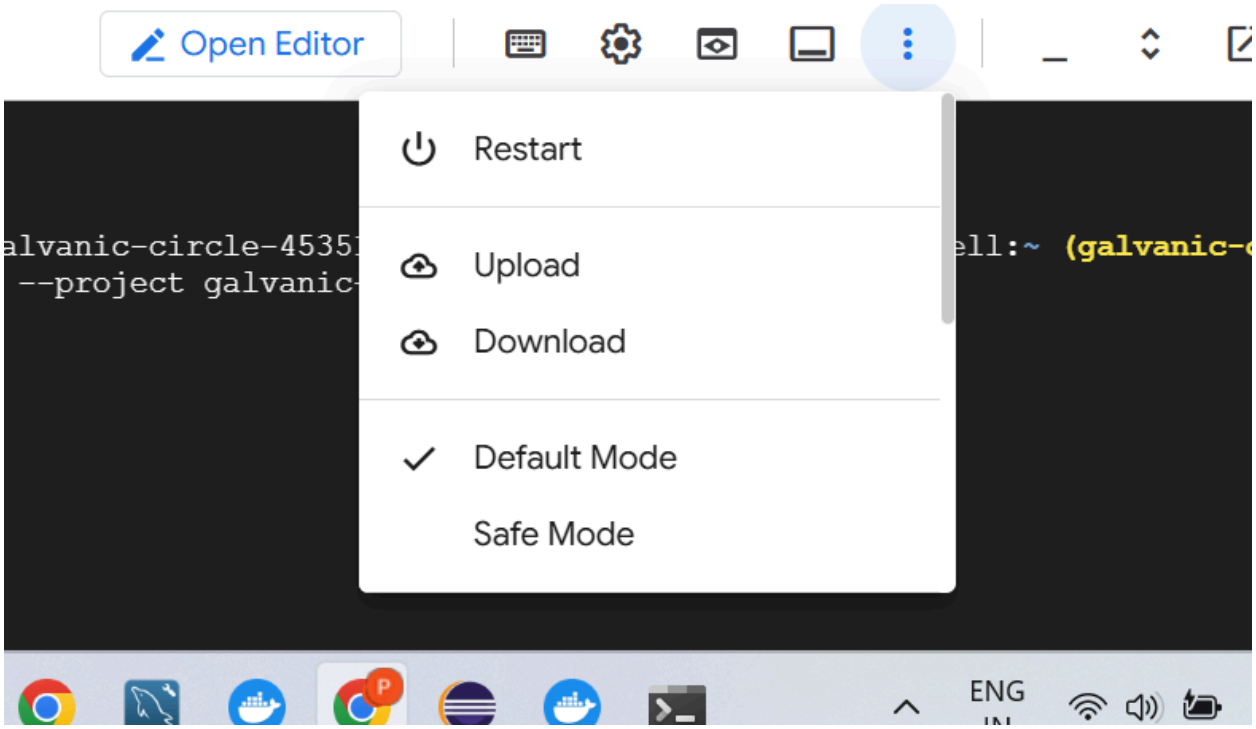
Click on cloud shell



Now hit enter

```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to galvanic-circle-453512-q6.
Use `gcloud config set project [PROJECT_ID]` to change to a different project.
gcloud container clusters get-credentials kbs-docker --region us-central1 --project galvanic-circle-453512-q6mallempavankalyan96@cloudshell:~ (galvanic-circle-
453512-q6)$ gcloud container clusters get-credentials kbs-docker --region us-central1 --project galvanic-circle-453512-q6
Fetching cluster endpoint and auth data.
kubeconfig entry generated for kbs-docker.
mallempavankalyan96@cloudshell:~ (galvanic-circle-453512-q6)$
```

Now upload the yml file

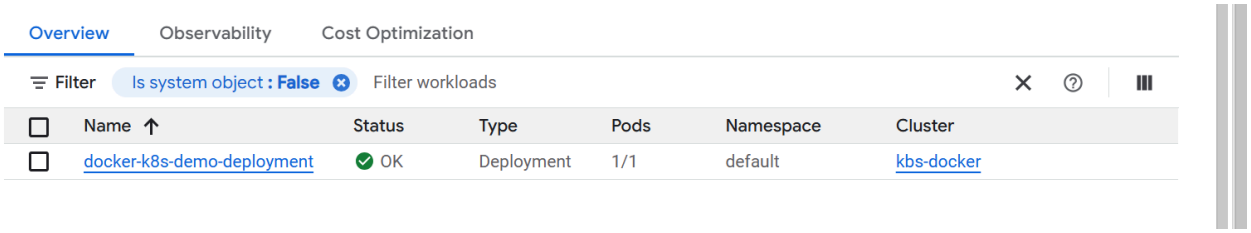


Check whether the file is submitted or not

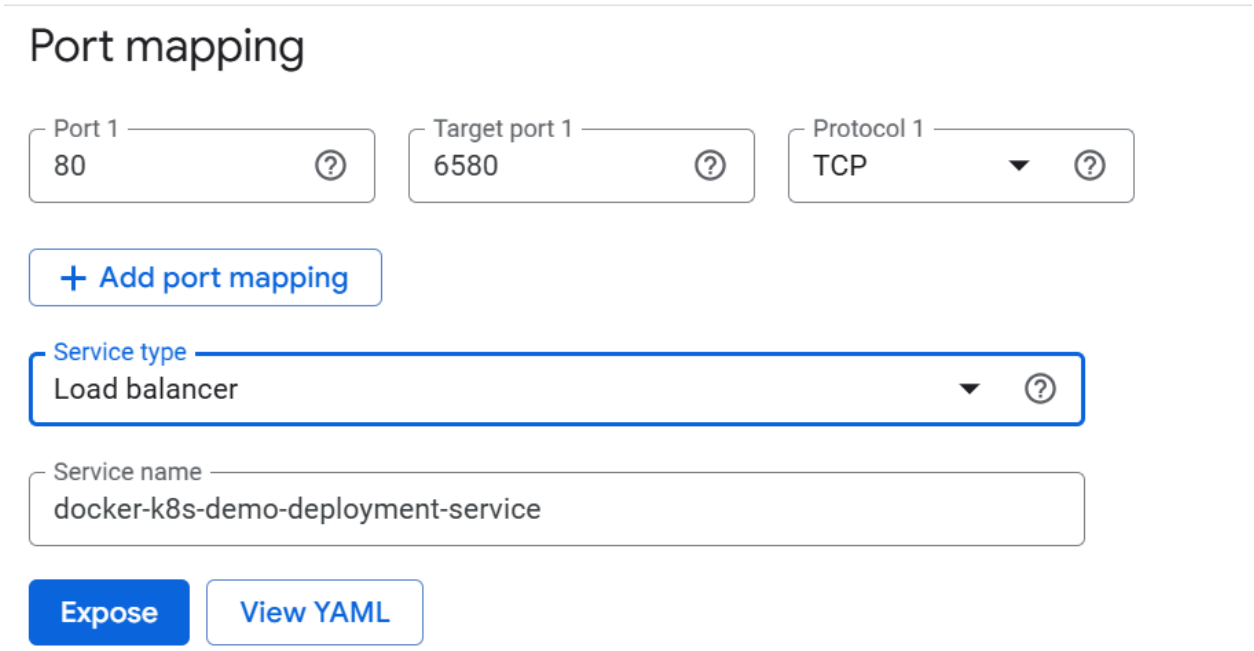
```
mallempavankalyan96@cloudshell:~ (galvanic-circle-453512-q6)$ ls
dockerdeployment.yml  README-cloudshell.txt
mallempavankalyan96@cloudshell:~ (galvanic-circle-453512-q6)$
```

```
mallempavankalyan96@cloudshell:~ (galvanic-circle-453512-q6)$ kubectl apply -f dockerdeployment.yml
Warning: autopilot-default-resources-mutator:Autopilot updated Deployment default/docker-k8s-demo-deployment: defaulted unspecified 'cpu' resource for containe
rs [docker-k8s-demo] (see http://g.co/gke/autopilot-defaults).
deployment.apps/docker-k8s-demo-deployment created
mallempavankalyan96@cloudshell:~ (galvanic-circle-453512-q6)$
```

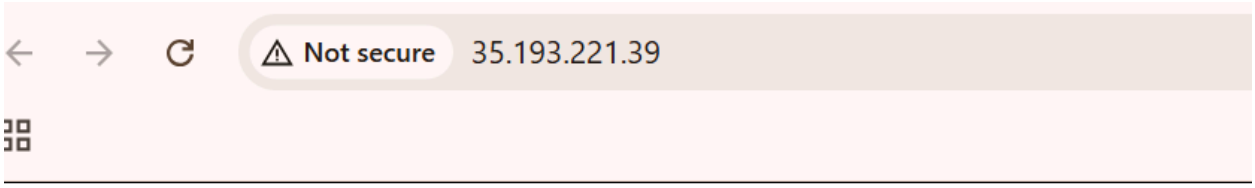
Now go to the workloads and refresh



Now we need to expose it



Once it is done….click on the external end point



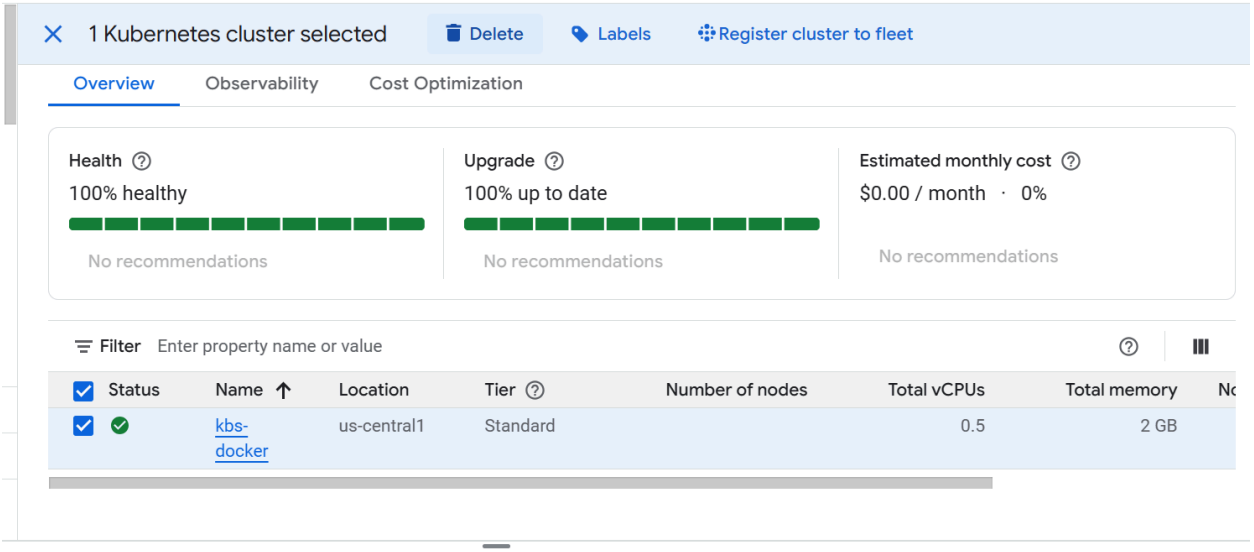
Whitelabel Error Page

'his application has no explicit mapping for /error, so you are seeing this as a fallback.

Ved Mar 12 13:15:28 UTC 2025
'here was an unexpected error (type=Not Found, status=404).

Use our endpoint which is exist in the program

Now finally our service is deployed on the cloud



To avoid extra billing we need to delete the cluster