SIT323 - Cloud Native Application Development

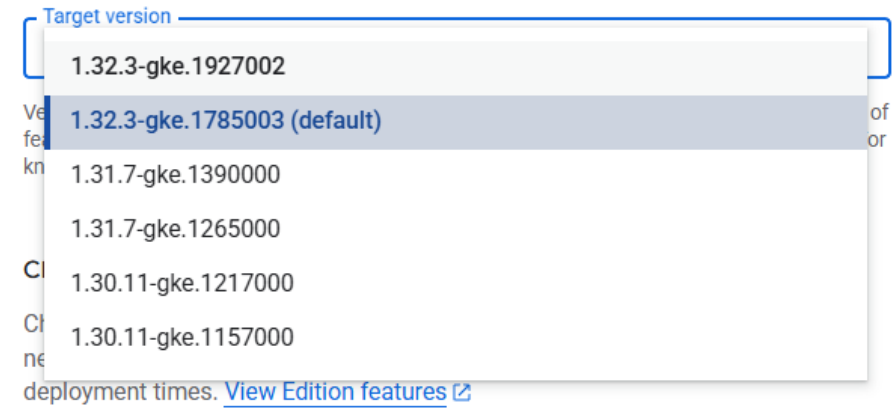
10.1P: Monitoring and Visibility

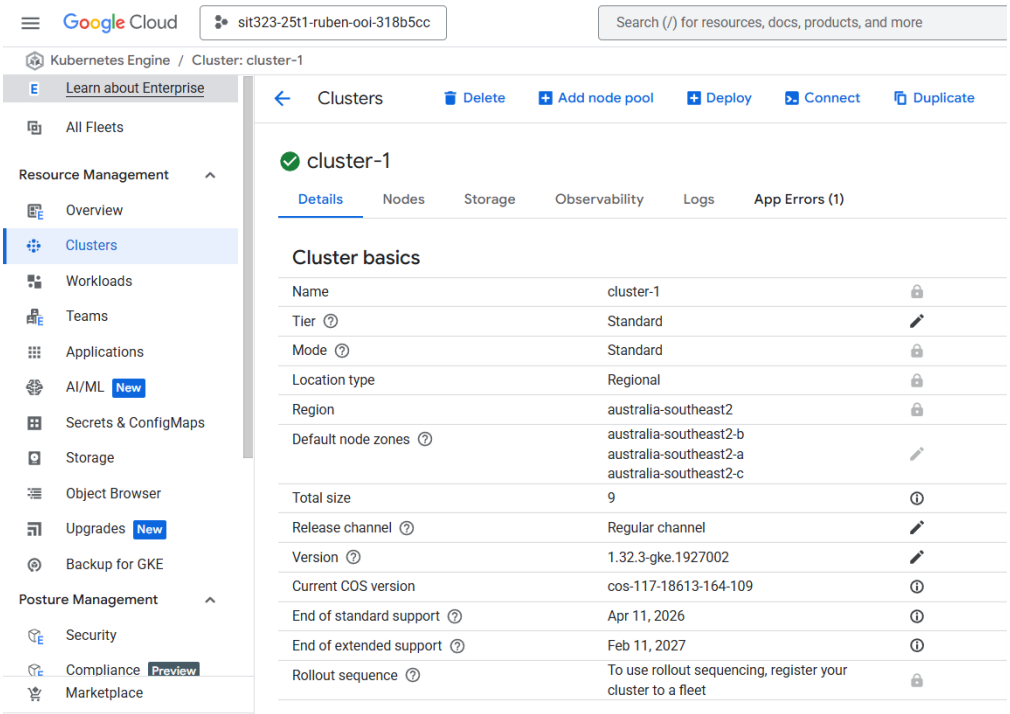
GitHub Repository Link

https://github.com/11Ruben/sit323-2025-prac10p.git

Steps to complete this task:

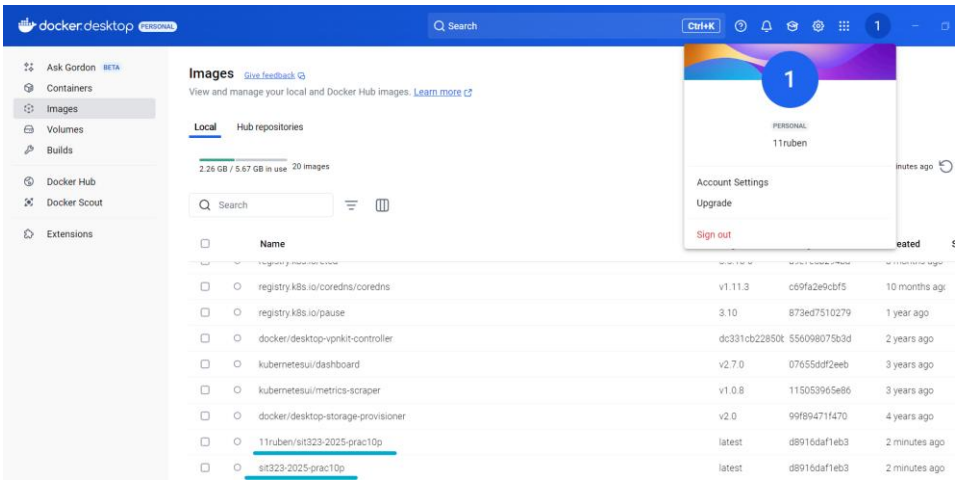
1. **Create a GCP Kubernetes cluster**
    1) Ensure to select the 1st version of the list instead of the default (In the example below, select "1.32.3-gke.1927002" instead of "1.32.3-gke.1785003 (default)")

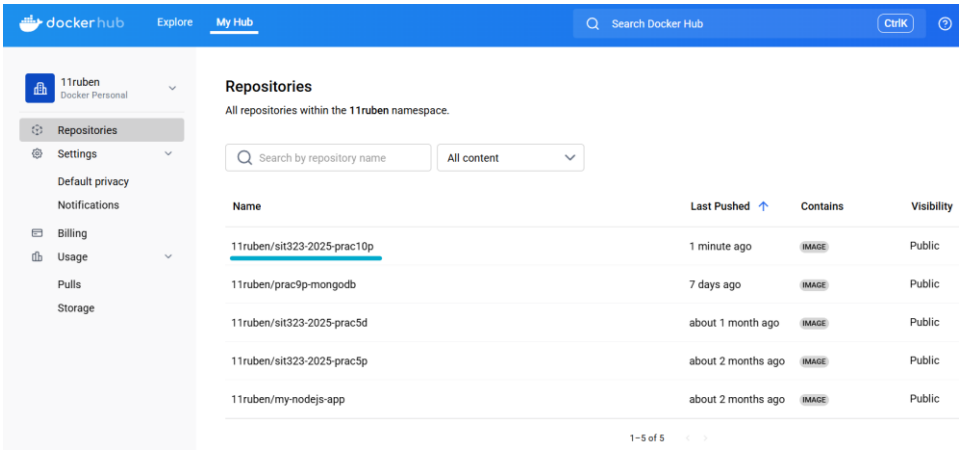




2. Build & Push the docker image to Docker Hub

- docker build -t sit323-2025-prac10p .
- docker tag sit323-2025-prac10p 11ruben/sit323-2025-prac10p
- docker push 11ruben/sit323-2025-prac10p





3. Login to GCP and set project

1) gcloud auth login

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>gcloud auth login
Your browser has been opened to visit:

    https://accounts.google.com/o/oauth2/auth?response_type=code&client_id=32555940559.apps.googleusercontent.com&redire
ct_uri=http%3A%2F%2Flocalhost%3A8085%2F&scope=openid+https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fuserinfo.email+https%3A%2
F%2Fwww.googleapis.com%2Fauth%2Fcloud-platform+https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fappengine.admin+https%3A%2F%2Fw
ww.googleapis.com%2Fauth%2Fsqlservice.login+https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fcompute+https%3A%2F%2Fwww.googleap
is.com%2Fauth%2Faccounts.reauth&state=BXGBSoF98iF4Rhq8JLe8XXczBGuoIZ&access_type=offline&code_challenge=F4cPt3ypMMK_GbSq
b7zomFJHuNMlVVtRa-nc6ylF70I&code_challenge_method=S256


You are now logged in as [s223960951@deakin.edu.au].
Your current project is [sit323-25t1-ruben-ooi-318b5cc].  You can change this setting by running:
  $ gcloud config set project PROJECT_ID
```

2) gcloud config set project sit323-25t1-ruben-ooi-318b5cc

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>gcloud config set project sit323-25t1
-ruben-ooi-318b5cc
Updated property [core/project].

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>
```

4. **Configure Kubernetes to use GCP cluster**
    - gcloud container clusters get-credentials cluster-1 --region australia-southeast2

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>gcloud container clusters
 get-credentials cluster-1 --region australia-southeast2
Fetching cluster endpoint and auth data.
kubeconfig entry generated for cluster-1.
```

5. **Apply the MongoDB yaml files**

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl apply -f mongo-pv.yaml
persistentvolume/mongo-pv created

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl apply -f mongo-pvc.yaml
persistentvolumeclaim/mongo-pvc created

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl apply -f mongo-deployment.yaml
deployment.apps/mongo created

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl apply -f mongo-service.yaml
service/mongo created

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get pods
NAME                     READY   STATUS              RESTARTS   AGE
mongo-54b85c45f4-xd6vn   0/1     ContainerCreating   0          14s

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get deployment
NAME    READY   UP-TO-DATE   AVAILABLE   AGE
mongo   0/1     1            0           23s

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get pods
NAME                     READY   STATUS    RESTARTS   AGE
mongo-54b85c45f4-xd6vn   1/1     Running   0          76s

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get deployment
NAME    READY   UP-TO-DATE   AVAILABLE   AGE
mongo   1/1     1            1           81s
```

6. **Create a MongoDB user**

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get pods
NAME                     READY   STATUS    RESTARTS   AGE
mongo-54b85c45f4-xd6vn   1/1     Running   0          5m38s

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl exec -it mongo
-54b85c45f4-xd6vn -- bash
root@mongo-54b85c45f4-xd6vn:/# mongosh
Current Mongosh Log ID: 682a81a75943fe499bd861df
Connecting to:          mongodb://127.0.0.1:27017/?directConnection=true&serverSelectionTimeoutMS=2000&
appName=mongosh+2.5.0
Using MongoDB:          8.0.9
Using Mongosh:          2.5.0
mongosh 2.5.1 is available for download: https://www.mongodb.com/try/download/shell

For mongosh info see: https://www.mongodb.com/docs/mongodb-shell/

------
   The server generated these startup warnings when booting
   2025-05-19T00:50:58.410+00:00: Using the XFS filesystem is strongly recommended with the WiredTiger
storage engine. See http://dochub.mongodb.org/core/prodnotes-filesystem
   2025-05-19T00:50:58.663+00:00: Access control is not enabled for the database. Read and write access
 to data and configuration is unrestricted
   2025-05-19T00:50:58.663+00:00: For customers running the current memory allocator, we suggest changi
ng the contents of the following sysfsFile
   2025-05-19T00:50:58.663+00:00: For customers running the current memory allocator, we suggest changi
ng the contents of the following sysfsFile
   2025-05-19T00:50:58.663+00:00: We suggest setting the contents of sysfsFile to 0.
   2025-05-19T00:50:58.663+00:00: vm.max_map_count is too low
------

test> use myDB
switched to db myDB
myDB> db.createUser({
... user: "admin",
... pwd: "password113",
... roles: [ { role: "readWrite", db: "myDB" } ]
... })
myDB>
myDB>
```

7. **Apply the deployment.yaml file**
    1) kubectl apply -f deployment.yaml

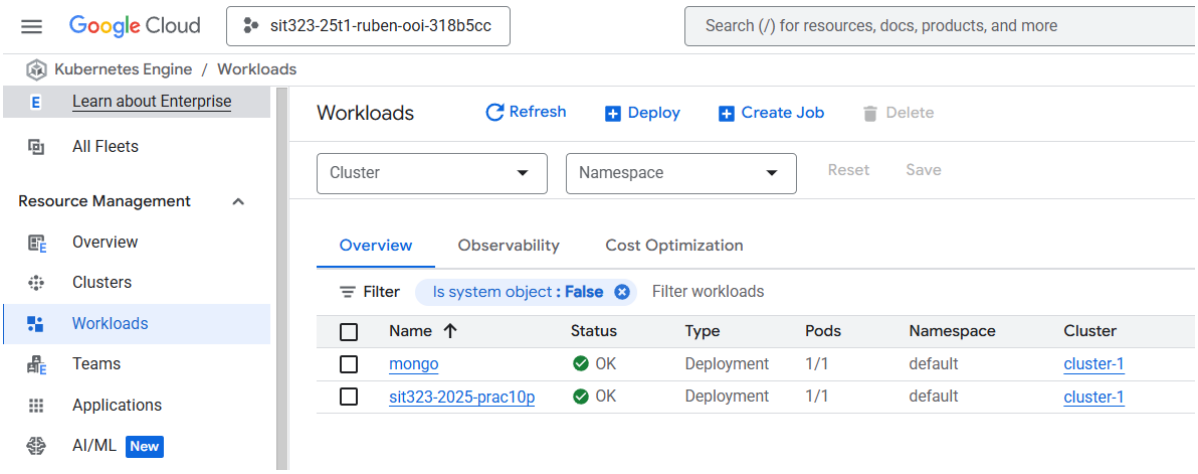
```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl apply -f
 mongo-secret.yaml
secret/mongo-secret created

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl apply -f
 deployment.yaml
deployment.apps/sit323-2025-prac10p created
```

8. **Ensure the pods are running**
    1) kubectl get pods
    2) kubectl get deployment

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get pods
NAME                                 READY   STATUS    RESTARTS   AGE
mongo-54b85c45f4-xd6vn               1/1     Running   0          12m
sit323-2025-prac10p-678689964-mnhbr   1/1     Running   0          73s

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get deployment
NAME                 READY   UP-TO-DATE   AVAILABLE   AGE
mongo                1/1     1            1           12m
sit323-2025-prac10p   1/1     1            1           79s
```



9. **Expose to external IP**
    1) kubectl expose deployment sit323-2025-prac10p –type=LoadBalancer –port=80 –target-port=3040

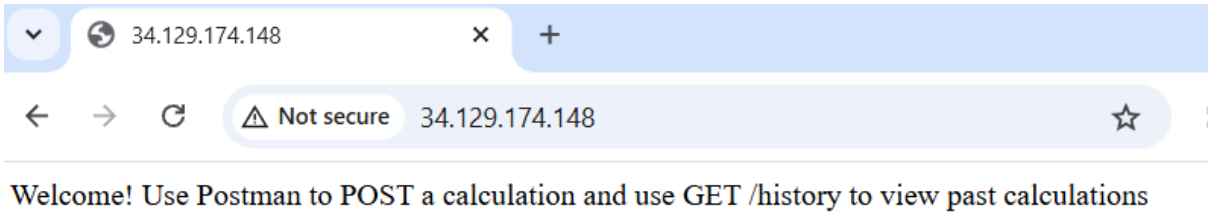
```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl expose deployment
 sit323-2025-prac10p --type=LoadBalancer --port=80 --target-port=3040
service/sit323-2025-prac10p exposed
```

10. Get service & access to application

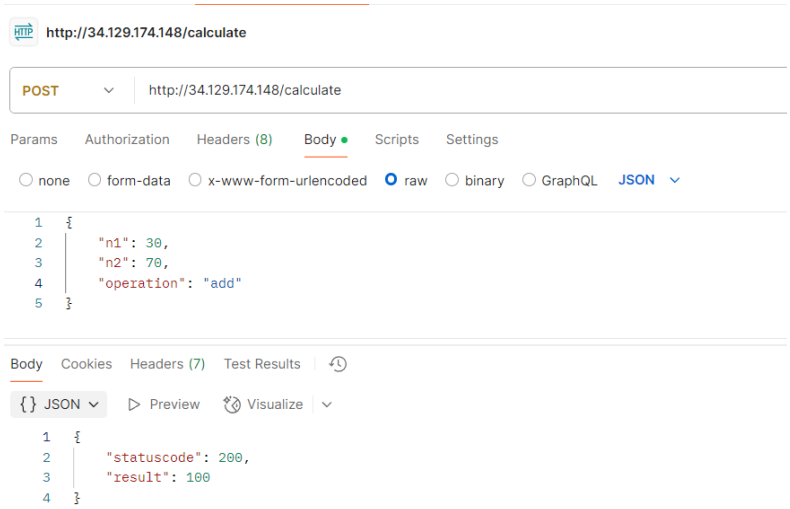
1) kubectl get service

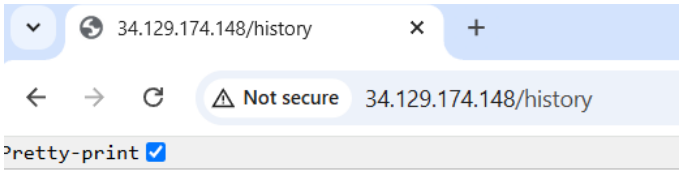
```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get service
NAME                 TYPE           CLUSTER-IP       EXTERNAL-IP      PORT(S)        AGE
kubernetes           ClusterIP      34.118.224.1     <none>           443/TCP        36m
mongo                ClusterIP      34.118.234.94    <none>           27017/TCP      15m
sit323-2025-prac10p  LoadBalancer   34.118.235.126   34.129.174.148   80:30106/TCP   67s
```

- http://34.129.174.148/



11. Perform CRUD operation

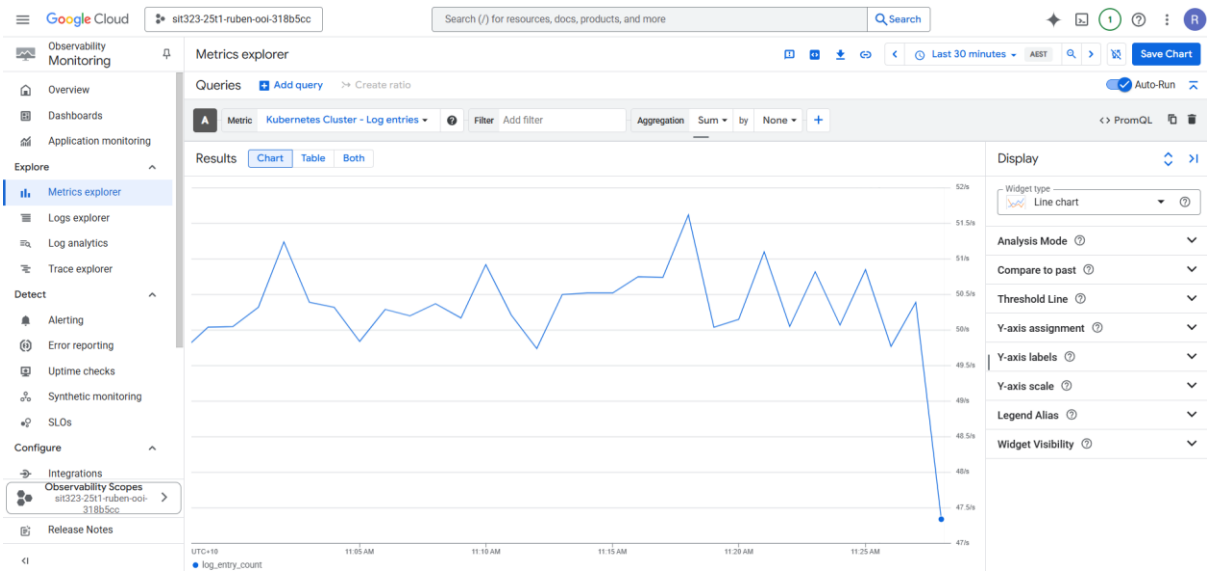




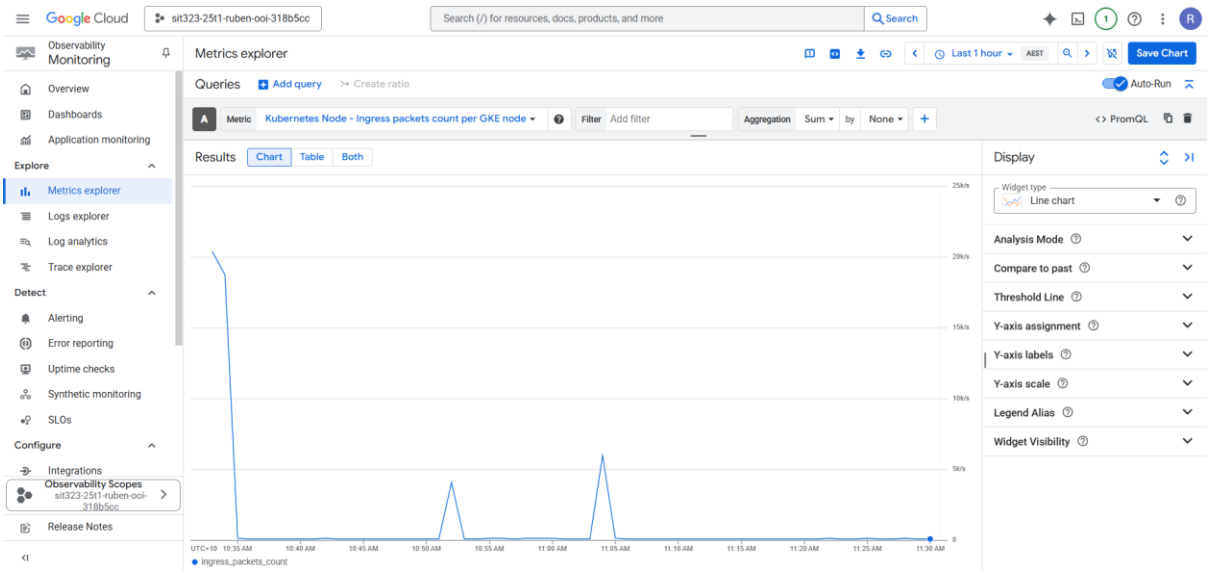

```
[
  {
    "_id": "682a859818300820d92e54d7",
    "operation": "add",
    "n1": 30,
    "n2": 70,
    "result": 100,
    "timestamp": "2025-05-19T01:12:56.357Z"
  }
]
```

12. Monitor the application

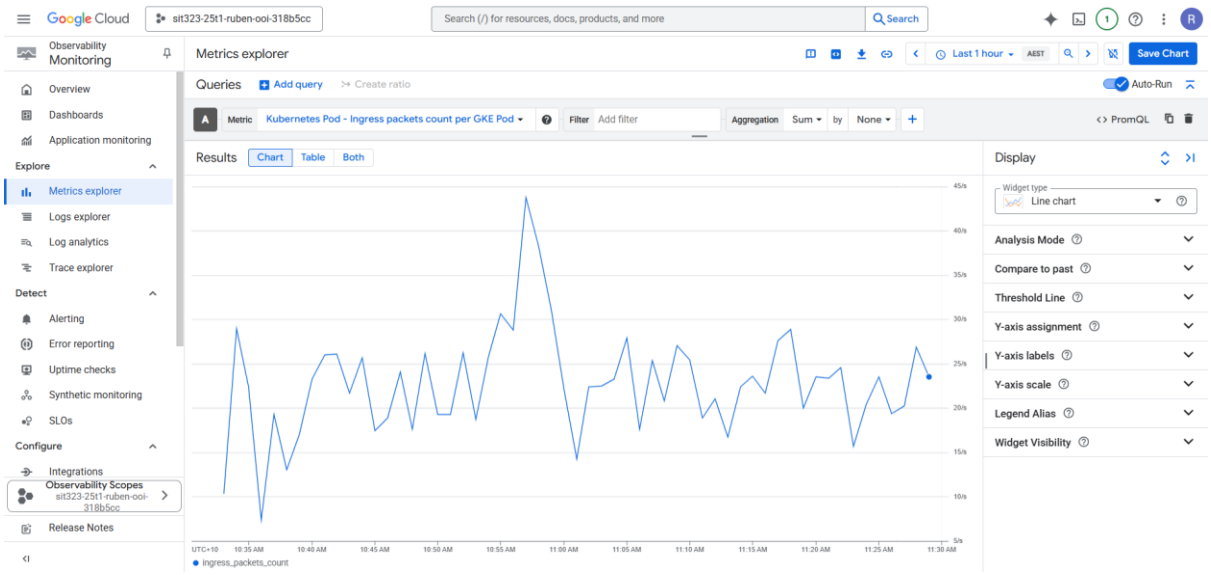
1) Chart 1: Kubernetes Cluster – Log Entries



2) Chart 2: Kubernetes Node – Ingress packets count per GKE node



3) Chart 3: Kubernetes Pod – Ingress packets count per GKE Pod



4) kubectl top nodes

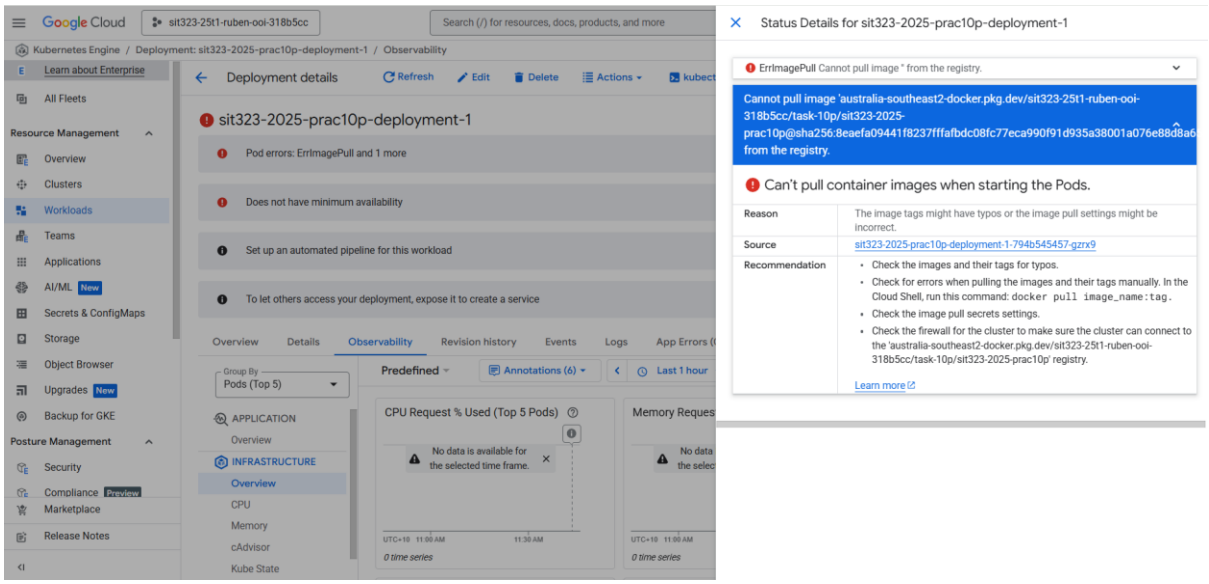
```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl top nodes
NAME                                        CPU(cores)   CPU(%)   MEMORY(bytes)   MEMORY(%)
gke-cluster-1-default-pool-79996477-4970    71m          7%       684Mi           24%
gke-cluster-1-default-pool-79996477-rvxv    38m          4%       1226Mi          43%
gke-cluster-1-default-pool-79996477-t380    72m          7%       898Mi           32%
gke-cluster-1-default-pool-ba93a66e-j1cq    50m          5%       682Mi           24%
gke-cluster-1-default-pool-ba93a66e-l930    65m          6%       698Mi           24%
gke-cluster-1-default-pool-ba93a66e-zpw1    52m          5%       702Mi           25%
gke-cluster-1-default-pool-dda8e1a2-87cc    59m          6%       931Mi           33%
gke-cluster-1-default-pool-dda8e1a2-cbm7    72m          7%       1349Mi          48%
gke-cluster-1-default-pool-dda8e1a2-nkkc    57m          6%       935Mi           33%
```

5) kubectl top pods

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl top pods
NAME                                  CPU(cores)   MEMORY(bytes)
mongo-54b85c45f4-xd6vn                5m           86Mi
sit323-2025-prac10p-678689964-mnhbr   1m           40Mi
```

Issues Encountered

Issue 1: ImagePullBackOff Error



When I was trying to deploy my application from the Artifact Registry to the GKE Cluster but I have encountered `ImagePullBackOff Error` and `ErrImagePull` which it doesn't allow me to pull my image from the Artifact Registry due to permission issue. Therefore, for the solution, I have built and push my docker image to Docker Hub as suggested by the teaching team and deployed the application through `kubectl deployment.yaml` file, which solve the permission issue and allowed the image to be pull by the GKE Cluster successfully.

Issue 2: gke-gcloud-auth-plugin Not Installed

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>gcloud container clusters
 get-credentials cluster-1 --region australia-southeast2
Fetching cluster endpoint and auth data.
CRITICAL: ACTION REQUIRED: gke-gcloud-auth-plugin, which is needed for continued use of kubectl, was not f
ound or is not executable. Install gke-gcloud-auth-plugin for use with kubectl by following https://cloud.
google.com/kubernetes-engine/docs/how-to/cluster-access-for-kubectl#install_plugin
kubeconfig entry generated for cluster-1.
```

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>gcloud components install
 gke-gcloud-auth-plugin

Restarting command:
  $ gcloud components install gke-gcloud-auth-plugin


C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>gke-gcloud-auth-plugin --
version
Kubernetes v1.30.0+03fcd0f8cb9eac57e97a3ed59c702bad8c73be81

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>gcloud container clusters
 get-credentials cluster-1 --region australia-southeast2
Fetching cluster endpoint and auth data.
kubeconfig entry generated for cluster-1.
```

When I was trying to configure Kubernetes to use GKE cluster, I have encountered as I haven't installed the plugin to use the kubectl command. So I have search up the Google Cloud Platform Documentation to find the installation command which is gcloud components install gke-gcloud-auth-plugin. After installing the plugin, I have checked the version of the plugin with gke-gcloud-auth-plugin –version to verified if the plugin was installed successfully. The version was displayed and I am able to configure Kubernetes to use the GKE cluster.

Issue 3: Missing Kubernetes Secret Referencing

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get pods
NAME                                    READY   STATUS                       RESTARTS   AGE
sit323-2025-prac10p-678689964-5f5hj   0/1     CreateContainerConfigError   0          71s
```

```
Events:
  Type     Reason     Age                From               Message
  ----     ------     ----               ----               -------
  Normal   Scheduled  95s                default-scheduler  Successfully assigned default/sit323-2025-prac10p-678689964-5f5hj to gke-cluster-1-default-pool-7
e496e43-wxt2
  Normal   Pulled     68s                kubelet            Successfully pulled image "11ruben/sit323-2025-prac10p:latest" in 27.378s (27.378s including wait
ing). Image size: 412550073 bytes.
  Normal   Pulled     67s                kubelet            Successfully pulled image "11ruben/sit323-2025-prac10p:latest" in 479ms (479ms including waiting)
. Image size: 412550073 bytes.
  Normal   Pulled     54s                kubelet            Successfully pulled image "11ruben/sit323-2025-prac10p:latest" in 334ms (334ms including waiting)
. Image size: 412550073 bytes.
  Normal   Pulled     43s                kubelet            Successfully pulled image "11ruben/sit323-2025-prac10p:latest" in 204ms (204ms including waiting)
. Image size: 412550073 bytes.
  Normal   Pulled     28s                kubelet            Successfully pulled image "11ruben/sit323-2025-prac10p:latest" in 658ms (658ms including waiting)
. Image size: 412550073 bytes.
  Normal   Pulled     12s                kubelet            Successfully pulled image "11ruben/sit323-2025-prac10p:latest" in 668ms (668ms including waiting)
. Image size: 412550073 bytes.
  Normal   Pulling    0s (x7 over 95s)   kubelet            Pulling image "11ruben/sit323-2025-prac10p:latest"
  Warning  Failed     0s (x7 over 68s)   kubelet            Error: secret "mongo-secret" not found
  Normal   Pulled     0s                 kubelet            Successfully pulled image "11ruben/sit323-2025-prac10p:latest" in 215ms (215ms including waiting)
. Image size: 412550073 bytes.
```

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl apply -f mongo-secret.yaml
secret/mongo-secret created

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl delete -f deployment.yaml
deployment.apps "sit323-2025-prac10p" deleted

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl apply -f deployment.yaml
deployment.apps/sit323-2025-prac10p created

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get pods
NAME                                    READY   STATUS    RESTARTS   AGE
sit323-2025-prac10p-678689964-fc2ll   1/1     Running   0          6s
```

After I have applied the deployment.yaml file to deploy the application to the GKE Cluster and checked whether the pod is running. It turns out that the pod is not running due to CreateContainerConfigError, so I went ahead and check the events of the pod and I found out that it is due to deployment.yaml references environment variables sourced from a Kubernetes Secret file – mongo-secret.yaml. So the solution for this issue is to apply the mongo-secret.yaml file and reapplied the deployment.yaml. After doing these steps, the pod is running as intended shown in the image above.

Clean Up

After deployment, it is important to clean up as it will cost money to run the resources in the background.

Steps to clean up:

1. Delete the services

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get service
NAME                 TYPE           CLUSTER-IP       EXTERNAL-IP      PORT(S)        AGE
kubernetes           ClusterIP      34.118.224.1     <none>           443/TCP        112m
mongo                ClusterIP      34.118.234.94    <none>           27017/TCP      91m
sit323-2025-prac10p  LoadBalancer   34.118.235.126   34.129.174.148   80:30106/TCP   77m

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl delete service sit323-2025-prac10p
service "sit323-2025-prac10p" deleted

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl delete service mongo
service "mongo" deleted
```

2. Delete the deployments

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl get deployment
NAME                 READY   UP-TO-DATE   AVAILABLE   AGE
mongo                1/1     1            1           93m
sit323-2025-prac10p  1/1     1            1           81m

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl delete deployment sit323-2025-prac10p
deployment.apps "sit323-2025-prac10p" deleted

C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>kubectl delete deployment mongo
deployment.apps "mongo" deleted
```

3. Delete the GKE cluster

```
C:\Users\Ruben\Desktop\Deakin\Year2\Sem1\SIT_323_CAD\Task 10\sit323-2025-prac10p>gcloud container clusters
 delete cluster-1 --region=australia-southeast2
The following clusters will be deleted.
 - [cluster-1] in [australia-southeast2]

Do you want to continue (Y/n)?  Y

Deleting cluster cluster-1...done.
Deleted [https://container.googleapis.com/v1/projects/sit323-25t1-ruben-ooi-318b5cc/zones/australia-southe
ast2/clusters/cluster-1].
```