

GitHub

<https://github.com/dkhh8788/devops-demo-docker-kubernetes-prometheus-graphana/tree/main>

Task-1

The screenshot shows a Mac desktop environment. In the top-left, a terminal window titled 'app-2023mt03164' displays Python code for a FastAPI application named 'main.py'. The code includes imports for os, uvicorn, and logging, and defines a FastAPI app with a single endpoint '/get_info' that returns a JSON object with 'app_version' and 'app_title'. In the top-right, another terminal window titled 'deepak -- zsh' shows the output of a curl command to the local host at port 8000, which matches the JSON response from the application. Below these, a web browser window is open to '127.0.0.1', showing the same JSON response. The bottom of the screen features the macOS Dock with various application icons.

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % pwd
/Users/deepak/WORK/Devops/app-2023mt03164
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % cat main.py
from fastapi import FastAPI
import os
import uvicorn
import logging

app = FastAPI()

logging.basicConfig(level=logging.INFO)
logger = logging.getLogger(__name__)

@app.get("/get_info")
async def get_info():
    """
    This endpoint returns application information.
    """
    logger.info('get_info endpoint is called')
    app_version = os.getenv("APP_VERSION", "default_version") # Get from environment or default
    app_title = os.getenv("APP_TITLE", "default_title")
    return {"app_version": app_version, "app_title": app_title}

if __name__ == "__main__":
    import uvicorn
    uvicorn.run("main:app", host="0.0.0.0", port=8000, reload=True)
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % export APP_VERSION=1.0; export APP_TITLE='my-assignment-app'; python3 main.py
INFO: Will watch for changes in these directories: ['/Users/deepak/WORK/Devops/app-2023mt03164']
INFO: Uvicorn running on http://0.0.0.0:8000 (Press CTRL+C to quit)
INFO: Started reloader process [24218] using StatReload
INFO: Started server process [24220]
INFO: Waiting for application startup.
INFO: Application startup complete.
INFO:main:get_info endpoint is called
INFO: 127.0.0.1:59808 - "GET /get_info HTTP/1.1" 200 OK
INFO:main:get_info endpoint is called
INFO: 127.0.0.1:59816 - "GET /get_info HTTP/1.1" 200 OK
INFO:main:get_info endpoint is called
INFO: 127.0.0.1:60001 - "GET /get_info HTTP/1.1" 200 OK
```

1. created directory.
2. source code.
3. calling app with env var.
4. curl output
5. browser output.

The screenshot shows the Docker Desktop application window on a Mac OS X desktop. The title bar reads "Docker Desktop Edit View" and the main window title is "docker desktop". The left sidebar includes icons for Containers, Images, Volumes, Builds, Dev Environments (BETA), Docker Scout, Extensions, and a "Add Extensions" button. The main "Containers" section displays a table with one row:

	Name	Image	Status	Port(s)	CPU (%)	Last started	Actions
<input type="checkbox"/>	minikube a9399d278444	gcr.io/k8s-minikube/kicbase:v0.0	Running	30000:30000	0%	2 days ago	⋮ ⋮ ⋮ ⋮

Container statistics at the top right show "Container CPU usage" at 2.23% / 800% and "Container memory usage" at 184.09MB / 3.74GB. A "Search for images, containers, volumes, extensio..." bar is at the top right, along with various system icons. A red box highlights the "Task-2" button in the top right corner of the main window. A red callout box in the bottom right corner contains the text "1. docker installed
2. docker desktop running". The status bar at the bottom shows "Engine running", system resources (RAM 3.66 GB, CPU 1.77%, Disk 47.25 GB available of 62.67 GB), user status ("Signed in"), and a "New version available" notification.

Task-2

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % pwd  
/Users/deepak/WORK/Devops/app-2023mt03164  
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %  
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % cat Dockerfile  
# Use a Python base image  
FROM python:3.9  
  
# Create a working directory within the container  
WORKDIR /app  
  
# Copy the application code  
COPY main.py .  
  
# Install dependencies  
RUN pip install fastapi uvicorn  
  
# Expose port 8000  
EXPOSE 8000  
  
# Set the command to run the application on container start  
CMD ["uvicorn", "main:app", "--host", "0.0.0.0", "--port", "8000"]  
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
```

docker file for app

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker build -t bits2023mt03164/img-2023mt3164 .
[+] Building 41.0s (10/10) FINISHED
=> [internal] load build definition from Dockerfile
=> => transferring dockerfile: 405B
=> [internal] load metadata for docker.io/library/python:3.9
=> [auth] library/python:pull token for registry-1.docker.io
=> [internal] load .dockignore
=> => transferring context: 2B
=> FROM docker.io/library/python:3.9@sha256:332741499f49a3f3e7749dad70e6ecf1129f00a269fdd6111da2ed2693fbe50e
=> => resolve docker.io/library/python:3.9@sha256:332741499f49a3f3e7749dad70e6ecf1129f00a269fdd6111da2ed2693fbe50e
=> => sha256:1a3f1864ec54b1398987bbe673e93d8b09842ecd51e86ab87d64857b70d188b1 49.59MB / 49.59MB
=> => sha256:464fb864cfcaa846fb1b8a889827404e18374f805d29d77c288a813ae8c4f6d91 23.60MB / 23.60MB
=> => sha256:332741499f49a3f3e7749dad70e6ecf1129f00a269fdd6111da2ed2693fbe50e 10.35KB / 10.35KB
=> => sha256:1798c5b7e228bfd513e859f56b87b3a92cc0921238341b359369ccf3354927286 2.33KB / 2.33KB
=> => sha256:1aff959d2ab1ae809a8dc94653cf005da02ddd2ca784495eaabcf7d64e292a 6.31KB / 6.31KB
=> => sha256:8bc6ea9985d6735252067a2041e797c0dedef261a9695671fa4ef7891a96e4b5 64.35MB / 64.35MB
=> => sha256:9cbd322119a1fddeeb9df75f74273f9136ccdf6317336352e605b41d5e5cf941f 202.68MB / 202.68MB
=> => sha256:5f9666b12a04a0ed3402576db1e4357487dfe7f514df12131a97175fab203908 6.24MB / 6.24MB
=> => extracting sha256:1a3f1864ec54b1398987bbe673e93d8b09842ecd51e86ab87d64857b70d188b1
=> => sha256:ea7dbc91df226121996e4caeef778919240d32006a36683413f77ca9509a597d 19.27MB / 19.27MB
=> => sha256:33a56867d0926334dda4a24052473b70abc827a3ad5799b8215bc9eb53923ebf 250B / 250B
=> => extracting sha256:464f864cfcaa846fb1b8a889827404e18374f805d29d77c288a813ae8c4f6d91
=> => extracting sha256:8bc6ea9985d6735252067a2041e797c0dedef261a9695671fa4ef7891a96e4b5
=> => extracting sha256:9cbd322119a1fd6eb9df75f74273f9136ccdf6317336352e605b41d5e5cf941f
=> => extracting sha256:5f9666b12a04a0ed3402576db1e4357487dfe7f514df12131a97175fab203908
=> => extracting sha256:ea7dbc91df226121996e4caeef778919240d32006a36683413f77ca9509a597d
=> => extracting sha256:33a56867d0926334dda4a24052473b70abc827a3ad5799b8215bc9eb53923ebf
=> [internal] load build context
=> => transferring context: 672B
=> [2/4] WORKDIR /app
=> [3/4] COPY main.py .
=> [4/4] RUN pip install fastapi uvicorn
=> exporting to image
=> => exporting layers
=> => writing image sha256:3717312301a7837b8c11f993edbe3abb61d3b1082621aafc0d1b67c1bea5780b
=> => naming to docker.io/bits2023mt03164/img-2023mt3164
```

View build details: docker-desktop://dashboard/build/desktop-linux/desktop-linux/iu0da4tgtyjby7g21oekajzup

What's Next?

View a summary of image vulnerabilities and recommendations → [docker scout quickview](#)

Task-2

docker:desktop-linux
0.0s
0.0s
3.4s
0.0s
0.0s
0.0s
0.0s
33.1s
0.0s
11.9s
13.5s
0.0s
0.0s
0.0s
0.0s
18.4s
28.2s
13.4s
2.2s
23.9s
13.9s
0.6s
2.6s
4.1s
0.2s
0.4s
0.0s
4.1s
0.1s
0.1s
0.0s
0.0s

build container image

(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker image ls

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
bits2023mt03164/img-2023mt3164	latest	3717312301a7	19 seconds ago	1.03GB

Task-2

Task-2

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker login
Authenticating with existing credentials...
Login Succeeded
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker tag img-2023mt03164 bits2023mt03164/img-2023mt03164:latest
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker push bits2023mt03164/img-2023mt03164:latest
The push refers to repository [docker.io/bits2023mt03164/img-2023mt03164]
0ee4bc6b6387: Layer already exists
c9ae22931cfb: Layer already exists
7ebff54bf89a: Layer already exists
8b7f9dbdde5d: Layer already exists
b47b2fdbbd9b2: Layer already exists
4a5f18b2b537: Layer already exists
a2b8ce9d73a5: Layer already exists
59c47e88439d: Layer already exists
afc6ebde4174: Layer already exists
5968baa45665: Layer already exists
latest: digest: sha256:3ed3b7844a21256993970709770ff7e94f31756d37990080e12e62000d24c690 size: 2421
```

push docker image to
docker hub

Terminal Shell Edit View Window Help Fri 15 Nov 2:08PM

Search (Cmd+E) wilp.bits-pilani... DK

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
a9399d278444 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 4 days ago Up 2 days 0.0.0.0:30000->30000/tcp, 127.0.0.1:61057->22/tcp, 127.0.0.1:61058->2376/tcp, 127.0.0.1:61055->5000/tcp, 127.0.0.1:61056->8443/tcp, 127.0.0.1:61054->32443/tcp minikube
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker run -e APP_VERSION=1.0 -e APP_TITLE='my-assignment-app' --name cnr-2023mt03164 -it -p 8000:8000 bits2023mt03164/img-2023mt03164
1. start container with docker image.
2. verify if container is running
3. accessing the app on browser.
```

Task-3

127.0.0.1 {"app_version": "1.0", "app_title": "my-assignment-app"}

```
(base) deepak@Nakshs-MacBook-Air ~ % curl 127.0.0.1:8000/get_info
{"app_version": "1.0", "app_title": "my-assignment-app"}
(base) deepak@Nakshs-MacBook-Air ~ %
(base) deepak@Nakshs-MacBook-Air ~ %
(base) deepak@Nakshs-MacBook-Air ~ % docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
782051612d7e bits2023mt03164/img-2023mt03164 "uvicorn main:app ..." About a minute ago Up About a minute 0.0.0.0:8000->8000
0/tcp
cnr-2023mt03164
a9399d278444 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 4 days ago Up 2 days 0.0.0.0:30000->30000/tcp, 127.0.0.1:61057->22/tcp, 127.0.0.1:61058->2376/tcp, 127.0.0.1:61055->5000/tcp, 127.0.0.1:61056->8443/tcp, 127.0.0.1:61054->32443/tcp minikube
(base) deepak@Nakshs-MacBook-Air ~ %
```

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % cat config-2023mt03164.yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: config-2023mt03164
data:
  APP_VERSION: "1.0"
  APP_TITLE: "2023mt03164 FastAPI App"
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % cat deployment-2023mt03164.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: deployment-2023mt03164
spec:
  replicas: 2
  selector:
    matchLabels:
      app: my-fastapi-app
  template:
    metadata:
      labels:
        app: my-fastapi-app
  spec:
    containers:
      - name: cnr-2023mt03164
        image: bits2023mt03164/img-2023mt03164
        envFrom:
          - configMapRef:
              name: config-2023mt03164
        ports:
          - containerPort: 8000
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
```

Task-4

1. create config Map
2. Kubernetes deployment file with 2 replica set

```
((base) deepak@Nakshs-MacBook-Air devops-demo-docker-kubernetes-prometheus-graphana % cat service-2023mt03164.yaml
apiVersion: v1
kind: Service
metadata:
  name: service-2023mt03164
spec:
  type: LoadBalancer
  selector:
    app: my-fastapi-app
  ports:
  - protocol: TCP
    port: 80
    targetPort: 8000
(base) deepak@Nakshs-MacBook-Air devops-demo-docker-kubernetes-prometheus-graphana %
```

1. loadbalancer service file

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl apply -f service-2023mt03164.yaml  
service/service-2023mt03164 created
```

run deployment and svc

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl get all
```

Task-4

NAME	READY	STATUS	RESTARTS	AGE
pod/deployment-2023mt03164-54b4cf6dc6-hvsfk	1/1	Running	0	7m17s
pod/deployment-2023mt03164-54b4cf6dc6-xs6fw	1/1	Running	0	7m17s

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
service/kubernetes	ClusterIP	10.96.0.1	<none>	443/TCP	2d6h
service/service-2023mt03164	LoadBalancer	10.105.209.186	<pending>	80:30336/TCP	5s

NAME	READY	UP-TO-DATE	AVAILABLE	AGE
deployment.apps/deployment-2023mt03164	2/2	2	2	7m17s

NAME	DESIRED	CURRENT	READY	AGE
replicaset.apps/deployment-2023mt03164-54b4cf6dc6	2	2	2	7m17s

Task-5

```
[(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %  
[(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % minikube tunnel  
✓ Tunnel successfully started
```

 NOTE: Please do not close this terminal as this process must stay alive for the tunnel to be accessible ...

 ! The service/ingress service-2023mt03164 requires privileged ports to be exposed: [80]
sudo permission will be asked for it.
Starting tunnel for service service-2023mt03164.

1. starting minikube tunnel
for loadbalancer to get
localhost as external IP

```
Terminal Shell Edit View Window Help
```

deepak — log-pod-1 — zsh — 159x13

```
(base) deepak@Nakshs-MacBook-Air ~ % kubectl logs -f deployment-2023mt03164-54b4cf6dc6-hvsfk
```

Task-5

checking logs of pod-1

```
deepak — log_pod_2 — zsh — 159x13
```

```
(base) deepak@Nakshs-MacBook-Air ~ % kubectl logs -f deployment-2023mt03164-54b4cf6dc6-xs6fw
```

checking logs of pod-2

```
deepak — zsh — 159x18
```

```
((base) deepak@Nakshs-MacBook-Air ~ % echo "sending 20 requests" for i in {1..10}; do curl http://127.0.0.1:80/get_info ; echo ""; sleep 1; done  
((base) deepak@Nakshs-MacBook-Air ~ %  
((base) deepak@Nakshs-MacBook-Air ~ % kubectl get pods  
NAME READY STATUS RESTARTS AGE  
deployment-2023mt03164-54b4cf6dc6-hvsfk 1/1 Running 0 33m  
deployment-2023mt03164-54b4cf6dc6-xs6fw 1/1 Running 0 33m  
((base) deepak@Nakshs-MacBook-Air ~ % echo "sending 20 requests"; sleep 1; for i in {1..10}; do curl http://127.0.0.1:80/get_info ; echo ""; sleep 1; done
```

sending 20 curl requests to endpoint



deepak — log-pod-1 — kubectl logs -f deployment-2023mt03164-54b4cf6dc6-hvsfk — 159x13

```

INFO: 10.244.0.1:34243 - "GET /get_info HTTP/1.1" 200 OK
INFO: 10.244.0.1:46786 - "GET /get_info HTTP/1.1" 200 OK
INFO: 10.244.0.1:1599 - "GET /get_info HTTP/1.1" 200 OK

```

Task-5

deepak — log_pod_2 — kubectl logs -f deployment-2023mt03164-54b4cf6dc6-xs6fw — 159x13

```

INFO: 10.244.0.1:61931 - "GET /get_info HTTP/1.1" 200 OK
INFO: 10.244.0.1:45561 - "GET /get_info HTTP/1.1" 200 OK
INFO: 10.244.0.1:38777 - "GET /get_info HTTP/1.1" 200 OK
INFO: 10.244.0.1:56160 - "GET /get_info HTTP/1.1" 200 OK

```


deepak — log_pod_2 — kubectl logs -f deployment-2023mt03164-54b4cf6dc6-xs6fw — 159x13

```

INFO: 10.244.0.1:63468 - "GET /get_info HTTP/1.1" 200 OK
INFO: 10.244.0.1:24502 - "GET /get_info HTTP/1.1" 200 OK
INFO: 10.244.0.1:56835 - "GET /get_info HTTP/1.1" 200 OK
INFO: 10.244.0.1:7490 - "GET /get_info HTTP/1.1" 200 OK
INFO: 10.244.0.1:4468 - "GET /get_info HTTP/1.1" 200 OK

```

showing loadbalancer sending request to both pods

deepak — zsh — 159x18

```

(base) deepak@Nakshs-MacBook-Air ~ % kubectl get pods
NAME READY STATUS RESTARTS AGE
deployment-2023mt03164-54b4cf6dc6-hvsfk 1/1 Running 0 33m
deployment-2023mt03164-54b4cf6dc6-xs6fw 1/1 Running 0 33m
(base) deepak@Nakshs-MacBook-Air ~ % echo "sending 20 requests"; sleep 1; for i in {1..10}; do curl http://127.0.0.1:80/get_info ; echo ""; sleep 1; done
sending 20 requests
{"app_version": "1.0", "app_title": "2023mt03164 FastAPI App"}

```

Response from Endpoint



Task-6

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % brew install helm
==> Auto-updating Homebrew...
Adjust how often this is run with HOMEBREW_AUTO_UPDATE_SECS or disable with
HOMEBREW_NO_AUTO_UPDATE. Hide these hints with HOMEBREW_NO_ENV_HINTS (see `man brew`).
==> Downloading https://ghcr.io/v2/homebrew/portable-ruby/portable-ruby/blobs/sha256:303bed4c7fc431a685db3c3c151d8737
40114adbcdcc23762ea2d1e39ea78f47
#####
100.0%
==> Pouring portable-ruby-3.3.6.arm64_big_sur.bottle.tar.gz
==> Auto-updated Homebrew!
Updated 3 taps (hashicorp/tap, homebrew/core and homebrew/cask).
==> New Formulae
beautysh      bibtex-tidy    comtrya      fileql       gplugin      kuzco        tcl-tk@8     typos-lsp
==> New Casks
aide-app       ba-connected   fathom       kimis        mythic
==> Deleted Installed Formulae
pkg-config x

You have 11 outdated formulae installed.

==> Downloading https://ghcr.io/v2/homebrew/core/helm/manifests/3.16.3
#####
100.0%
==> Fetching helm
==> Downloading https://ghcr.io/v2/homebrew/core/helm/blobs/sha256:b91608810e5b6a549a48f4cb1752600fc0ed5ccd7baf135a0b
#####
100.0%
==> Pouring helm--3.16.3.arm64_sonoma.bottle.tar.gz
==> Caveats
zsh completions have been installed to:
  /opt/homebrew/share/zsh/site-functions
==> Summary
🍺 /opt/homebrew/Cellar/helm/3.16.3: 66 files, 55.4MB
==> Running `brew cleanup helm`...
Disable this behaviour by setting HOMEBREW_NO_INSTALL_CLEANUP.
Hide these hints with HOMEBREW_NO_ENV_HINTS (see `man brew`).
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % helm version
version.BuildInfo{Version:"v3.16.3", GitCommit:"cf07493f46efc9debd9cc1b02a0961186df7fdf", GitTreeState:"dirty", GoVe
rsion:"go1.23.3"}
```

installing helm tool

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % helm repo add prometheus-community https://prometheus-community.github.io/helm-charts
"prometheus-community" already exists with the same configuration, skipping
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % helm repo add grafana https://grafana.github.io/helm-charts
```

Task-6

```
"grafana" already exists with the same configuration, skipping
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % helm repo update
```

```
Hang tight while we grab the latest from your chart repositories...
...Successfully got an update from the "grafana" chart repository
...Successfully got an update from the "prometheus-community" chart repository
Update Complete. *Happy Helming!*
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % helm install prometheus prometheus-community/kube-prometheus-stack
```

- 1.helm: prometheus, grafana repo add.
2. installing prometheus using helm
3. installing grafana in next page.

(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % helm install grafana grafana/grafana

|  

Task-6

```
...d-1 — kubectl port-forward svc/grafana 3000:80 ... ...theus-kube-prometheus-prometheus 9090:9090 ~/WORK/Devops/app-2023mt03164 --zsh ~/WORK/Devops/app-2023mt03164 --zsh +
```

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl get pods
NAME                                         READY   STATUS    RESTARTS   AGE
alertmanager-prometheus-kube-prometheus-alertmanager-0   2/2     Running   0          101m
debug                                         1/1     Running   0          65m
deployment-2023mt03164-54b4cf6dc6-dggj7      1/1     Running   0          2m29s
deployment-2023mt03164-54b4cf6dc6-g6r6p      1/1     Running   0          2m29s
grafana-956f647c9-pdshv   1/1     Running   0          101m
prometheus-grafana-54c599b864-r2cjv        3/3     Running   0          83m
| prometheus-kube-prometheus-operator-75cd999c5c-qdl9n  1/1     Running   0          83m
| prometheus-kube-state-metrics-5b9dd96fd4-r5lbj      1/1     Running   0          83m
| prometheus-prometheus-kube-prometheus-prometheus-0  2/2     Running   0          101m
| prometheus-prometheus-node-exporter-m9rcf         1/1     Running   0          102m
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl get svc
NAME                           TYPE      CLUSTER-IP   EXTERNAL-IP   PORT(S)           AGE
alertmanager-operated       ClusterIP  None         <none>        9093/TCP,9094/TCP,9094/UDP  102m
fastapi-service              ClusterIP  10.105.76.140 <none>        8000/TCP          2m38s
grafana                      ClusterIP  10.96.42.50  <none>        80/TCP            101m
kubernetes                   ClusterIP  10.96.0.1   <none>        443/TCP           2d15h
prometheus-grafana          ClusterIP  10.101.197.205 <none>        80/TCP            102m
| prometheus-kube-prometheus-alertmanager   ClusterIP  10.96.242.244 <none>        9093/TCP,8080/TCP  102m
| prometheus-kube-prometheus-operator        ClusterIP  10.97.176.129 <none>        443/TCP           102m
| prometheus-kube-prometheus-prometheus     ClusterIP  10.110.61.30  <none>        9090/TCP,8080/TCP  102m
| prometheus-kube-state-metrics             ClusterIP  10.100.19.164 <none>        8080/TCP          102m
| prometheus-operated                     ClusterIP  None         <none>        9090/TCP           102m
| prometheus-prometheus-node-exporter      ClusterIP  10.99.74.214  <none>        9100/TCP          102m
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl get servicemonitor
NAME                           AGE
fastapi-monitor                116s
prometheus-grafana            102m
| prometheus-kube-prometheus-alertmanager   102m
| prometheus-kube-prometheus-apiserver      102m
| prometheus-kube-prometheus-coredns        102m
| prometheus-kube-prometheus-kube-controller-manager 102m
| prometheus-kube-prometheus-kube-etcd       102m
| prometheus-kube-prometheus-kube-proxy      102m
| prometheus-kube-prometheus-kube-scheduler  102m
| prometheus-kube-prometheus-kubelet        102m
| prometheus-kube-prometheus-operator        102m
| prometheus-kube-prometheus-prometheus     102m
| prometheus-kube-state-metrics             102m
| prometheus-prometheus-node-exporter      102m
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
```

prometheus, grafana -
pods, services, service
monitors

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % cat main.py
from fastapi import FastAPI
import os
import uvicorn
import logging
from prometheus_client import Counter, Gauge, generate_latest
from prometheus_client import CONTENT_TYPE_LATEST
from fastapi.responses import Response
import psutil

app = FastAPI()

logging.basicConfig(level=logging.INFO)
logger = logging.getLogger(__name__)

# Define Prometheus metrics
REQUEST_COUNTER = Counter("my_endpoint_api_requests_total", "Total number of API requests to my endpoint get_info", ["endpoint"])
CPU_USAGE = Gauge("my_app_cpu_usage_percent", "CPU usage of My FastAPI application")
MEMORY_USAGE = Gauge("my_app_memory_usage_bytes", "Memory usage of My FastAPI application")

@app.get("/get_info")
async def get_info():
    """
    This endpoint returns application information.
    """
    REQUEST_COUNTER.labels(endpoint="/get_info").inc() # Increment request counter
    logger.info('get_info endpoint is called')
    app_version = os.getenv("APP_VERSION", "default_version") # Get from environment or default
    app_title = os.getenv("APP_TITLE", "default_title")
    return {"app_version": app_version, "app_title": app_title}

@app.get('/metrics')
def metrics():
    logger.info('Metrics endpoint was called for Main App')
    # Update CPU and memory usage metrics
    process = psutil.Process()
    CPU_USAGE.set(process.cpu_percent(interval=1))
    MEMORY_USAGE.set(process.memory_info().rss) # Resident Set Size in bytes
    return Response(generate_latest(), media_type=CONTENT_TYPE_LATEST)

if __name__ == "__main__":
    import uvicorn
    uvicorn.run("main:app", host="0.0.0.0", port=8000, reload=True)
```

Task-6

1. instrumented application with prometheus metrics.
2. exposing /metrics endpoint to access application metrics to prometheus

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % cat Dockerfile
# Use a Python base image
FROM python:3.9
```

Task-6

```
# Create a working directory within the container
WORKDIR /app
```

```
# Copy the application code
COPY main.py .
```

```
# Copy the requirements file to the container
COPY requirements.txt .
```

```
# Install the required Python packages
RUN pip install --no-cache-dir -r requirements.txt
```

```
# Expose port 8000
EXPOSE 8000
```

1.docker file for instrumented app.
2. required packages

```
# Set the command to run the application on container start
CMD ["uvicorn", "main:app", "--host", "0.0.0.0", "--port", "8000"]
```

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % cat requirements.txt
fastapi==0.95.0
uvicorn==0.22.0
prometheus-client==0.16.0
psutil
```

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
```

```
[base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker build -t bits2023mt03164/img-2023mt03164 .
[+] Building 7.2s (11/11) FINISHED
=> [internal] load build definition from Dockerfile
=> => transferring dockerfile: 511B
=> [internal] load metadata for docker.io/library/python:3.9
=> [auth] library/python:pull token for registry-1.docker.io
=> [internal] load .dockerignore
=> => transferring context: 2B
=> [1/5] FROM docker.io/library/python:3.9@sha256:332741499f49a3f3e7749dad70e6ecf1129f00a269fdd6111da2ed2693f
=> [internal] load build context
=> => transferring context: 1.72kB
=> CACHED [2/5] WORKDIR /app
=> [3/5] COPY main.py .
=> [4/5] COPY requirements.txt .
=> [5/5] RUN pip install --no-cache-dir -r requirements.txt
=> exporting to image
=> => exporting layers
=> => writing image sha256:64c55da53dadcfcf6943b3292ff0fb8a834844188a2e4c84044dc81c3bc254226
=> => naming to docker.io/bits2023mt03164/img-2023mt03164
```

Task-6

1. build docker container image for instrumented app

```
((base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker login
Authenticating with existing credentials...
Login Succeeded
((base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker tag bits2023mt03164/img-2023mt03164 bits2023mt03164/img-2023mt03164
((base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker push bits2023mt03164/img-2023mt03164
Using default tag: latest
The push refers to repository [docker.io/bits2023mt03164/img-2023mt03164]
f9a342fe70d9: Pushed
a992dc9f48b1: Pushed
e3ca0ce6bee6: Pushed
a1036f88adcf: Pushed
4aa1b5bab737: Mounted from library/python
fc32441baab1: Mounted from library/python
0d7307cee637: Mounted from library/python
c5d4093056ba: Mounted from library/python
29842e18ccdd: Mounted from library/python
de0d18f93508: Mounted from library/python
ec8ae7dad7ab: Mounted from library/python
latest: digest: sha256:c56db9938565eed6596913d2e9155fc95f2aacae38b487a798b69bd4dc1e10e size: 2627
```

Task-6

1. push docker container image to docker hub

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % docker run -e APP_TITLE="instrumented_app" -e APP_VERSION=2.0 -p 8000:8000 bits2023mt03164/img-2023mt031  
64:latest  
INFO:     Started server process [1]  
INFO:     Waiting for application startup.  
INFO:     Application startup complete.  
INFO:     Uvicorn running on http://0.0.0.0:8000 (Press CTRL+C to quit)  
INFO:main:get_info endpoint is called  
INFO: 192.168.65.1:60467 - "GET /get_info HTTP/1.1" 200 OK  
INFO:main:get_info endpoint is called  
INFO: 192.168.65.1:60468 - "GET /get_info HTTP/1.1" 200 OK
```

1.run docker container for instrumented app.

Task-6

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % curl http://localhost:8000/get_info
{"app_version":"2.0","app_title":"instrumented_app"}%
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % curl http://localhost:8000/get_info
{"app_version":"2.0","app_title":"instrumented_app"}%
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
```

Task-6

access app on localhost

```
(base) deepak@Nakshs-MacBook-Air devops-demo-docker-kubernetes-prometheus-graphana % cat deployment-2023mt03164.yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: deployment-2023mt03164
  labels:
    app: my-fastapi-app
spec:
  replicas: 2
  selector:
    matchLabels:
      app: my-fastapi-app
  template:
    metadata:
      labels:
        app: my-fastapi-app
    spec:
      containers:
        - name: cnr-2023mt03164
          image: bits2023mt03164/img-2023mt03164
          envFrom:
            - configMapRef:
                name: config-2023mt03164
          ports:
            - containerPort: 8000
---
apiVersion: v1
kind: Service
metadata:
  name: fastapi-service
  labels:
    app: my-fastapi-app # Ensure this matches the ServiceMonitor's selector
spec:
  selector:
    app: my-fastapi-app # Ensure this matches the labels in the Deployment
  ports:
    - name: http # This name must match the 'port' in ServiceMonitor
      protocol: TCP
      port: 8000 # The port exposed by the service
      targetPort: 8000 # The container port to forward to
(base) deepak@Nakshs-MacBook-Air devops-demo-docker-kubernetes-prometheus-graphana %
```

Task-6

1. deployment and service kubernetes configuration for instrumented app

```
Terminal Shell Edit View Window Help app-2023mt03164 — zsh — 155x42 Fri 15 Nov 11:29 PM
...-1 — kubectl port-forward svc/grafana 3000:80 ... ...eus-kube-prometheus-prometheus 9090:9090 ~/WORK/Devops/app-2023mt03164 — zsh ~/WORK/Devops/app-2023mt03164 — zsh
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % cat config-2023mt03164.yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: config-2023mt03164
data:
  APP_VERSION: "1.0"
  APP_TITLE: "2023mt03164 FastAPI App"
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % ls
Dockerfile          config-2023mt03164.yaml      main.py           service-2023mt03164.yaml
__pycache__          deployment-2023mt03164.yaml   requirements.txt  servicemonitor-2023mt03164.yaml
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % cat servicemonitor-2023mt03164.yaml
apiVersion: monitoring.coreos.com/v1
kind: ServiceMonitor
metadata:
  name: fastapi-monitor
labels:
  release: prometheus # Must match your Prometheus release
spec:
  selector:
    matchLabels:
      app: my-fastapi-app
  namespaceSelector:
    matchNames:
      - default # Namespace where FastAPI is deployed
endpoints:
  - port: http
    path: /metrics
    interval: 15s
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %

Task-6
```

1. config map configurations
2. service monitor configurations

Task-6

```
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl apply -f deployment-2023mt03164.yaml
deployment.apps/deployment-2023mt03164 created
service/fastapi-service created
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl apply -f
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % vim config-2023mt03164.yaml
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl apply -f deployment-2023mt03164.yaml
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl apply -f deployment-2023mt03164.yaml
deployment.apps/deployment-2023mt03164 unchanged
service/fastapi-service unchanged
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl apply -f config-2023mt03164.yaml
configmap/config-2023mt03164 unchanged
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 %
(base) deepak@Nakshs-MacBook-Air app-2023mt03164 % kubectl apply -f servicemonitor-2023mt03164.yaml
servicemonitor.monitoring.coreos.com/fastapi-monitor created
```

apply deployment, svc, configmap, svc monitor

```
(base) deepak@Nakshs-MacBook-Air ~ % kubectl port-forward svc/prometheus-kube-prometheus-prometheus 9090:9090
Forwarding from 127.0.0.1:9090 -> 9090
Forwarding from [::1]:9090 -> 9090
Handling connection for 9090
Handling connection for 9090
```

access prometheus dashboard on localhost:9000

Task-6

Prometheus Alerts Graph Status ▾ Help

Targets

All scrape pools ▾ All Unhealthy Expand All Filter by endpoint or labels Task-6

Unknown Unhealthy Healthy

serviceMonitor/default/fastapi-monitor/0 (2/2 up)

1. showing prometheus dashboard monitoring our service and pods

Endpoint	State	Labels	Last Scrape	Scrape Duration	Error
http://10.244.0.149:8000/metrics	UP	container="cnr-2023mt03164" endpoint="http" instance="10.244.0.149:8000" job="fastapi-service" namespace="default" pod="deployment-2023mt03164-54b4cf6dc6-g6r6p" service="fastapi-service" ▾	6.469s ago	1.337s	pod1 /metrics
http://10.244.0.148:8000/metrics	UP	container="cnr-2023mt03164" endpoint="http" instance="10.244.0.148:8000" job="fastapi-service" namespace="default" pod="deployment-2023mt03164-54b4cf6dc6-dggj7" service="fastapi-service" ▾	15.554s ago	1.65s	pod2 /metrics

```
(base) deepak@Nakshs-MacBook-Air ~ % kubectl port-forward svc/grafana 3000:80  
Forwarding from 127.0.0.1:3000 -> 3000  
Forwarding from [::1]:3000 -> 3000
```

Task-6

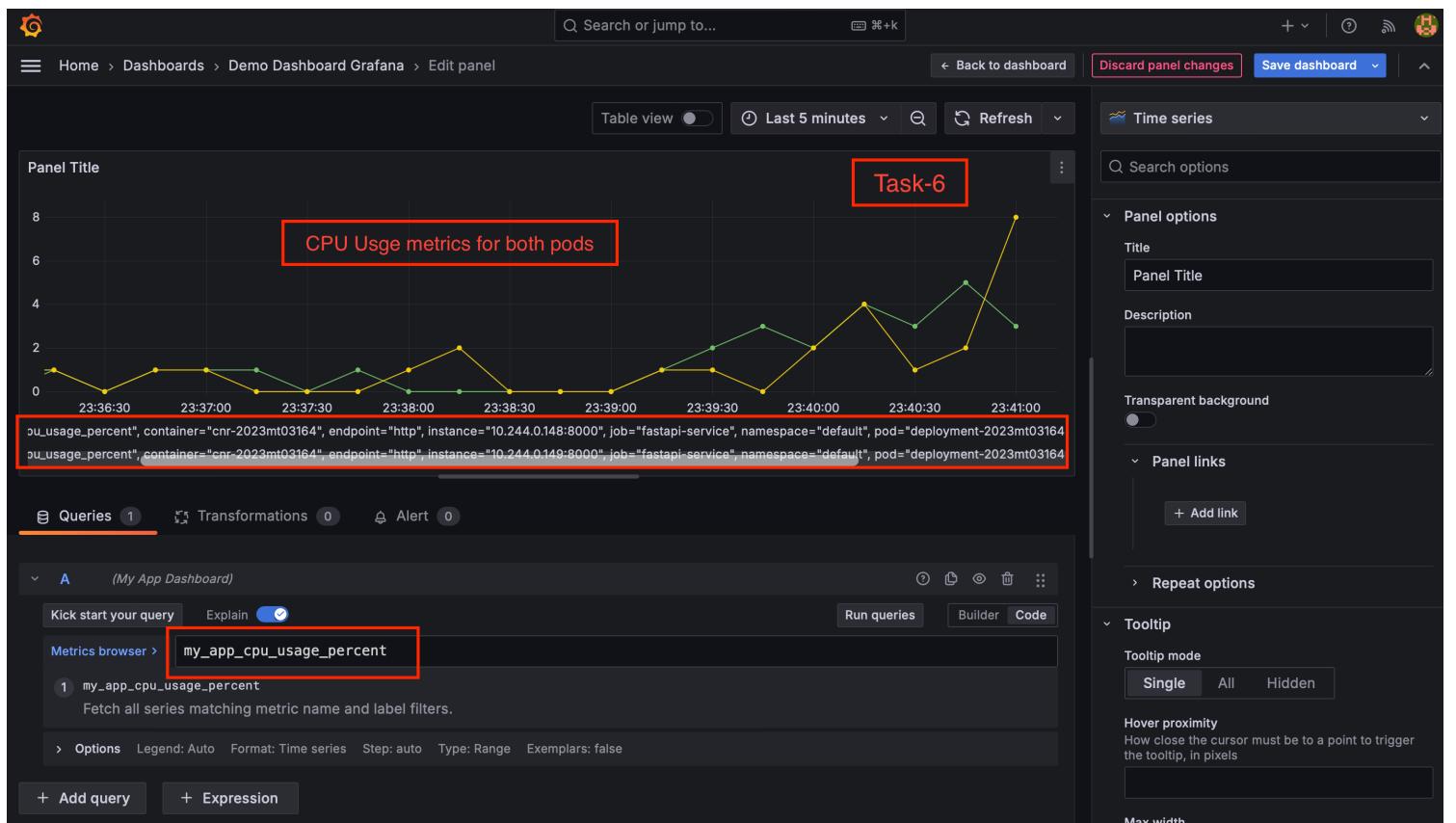
access grafana dashboard on localhost:3000

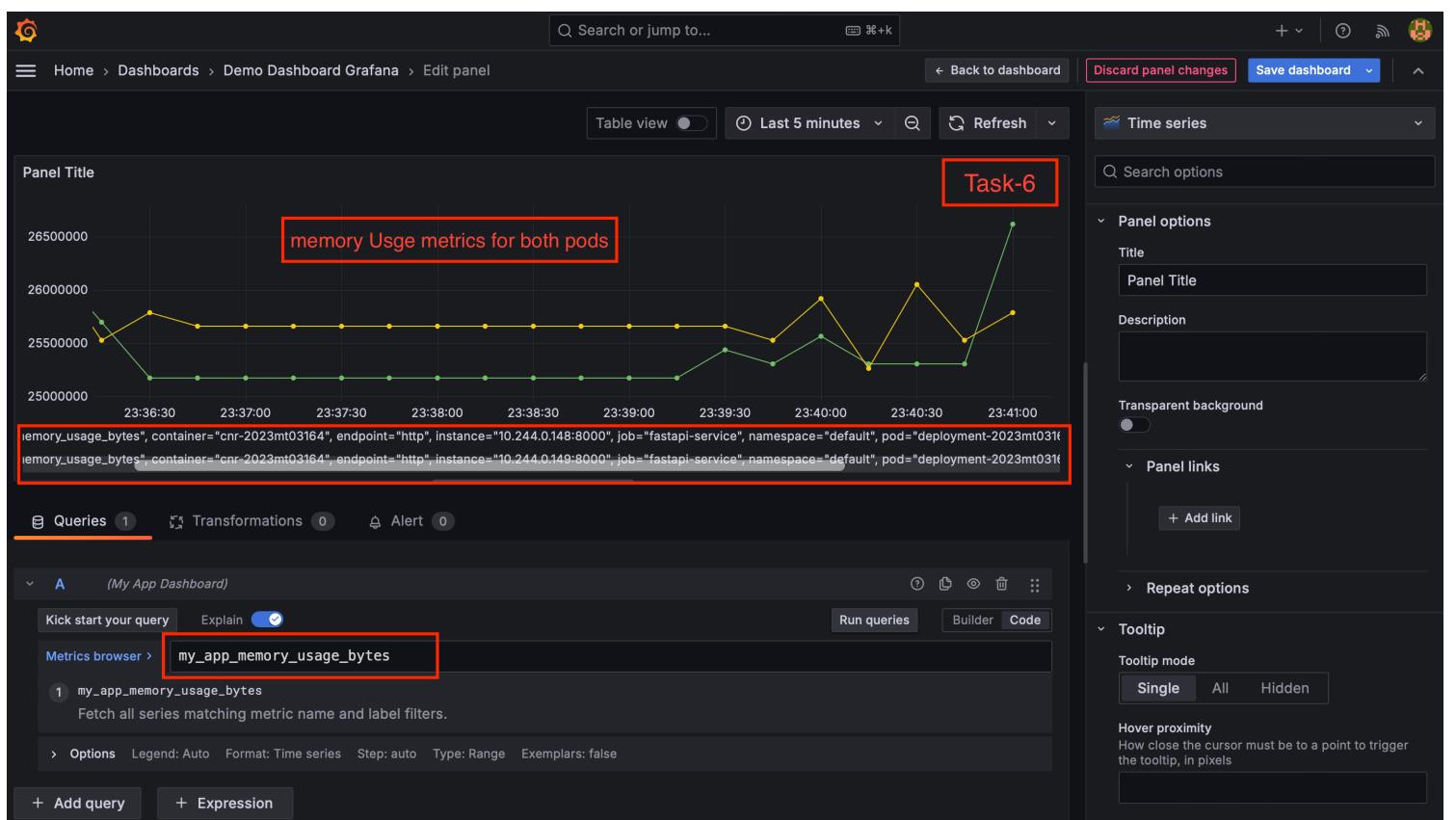
```
(base) deepak@Nakshs-MacBook-Air Devops % for i in {1..2000}; do curl http://127.0.0.1:54321/get_info; echo; sleep .2; done
{"app_version":"1.0","app_title":"2023mt03164 FastAPI App"}
```

Task-6

trigger 2000 curl requests from localhost to our application service to see metrics on dashboard (next)







Github

<https://github.com/dkhh8788/devops-demo-docker-kubernetes-prometheus-graphana/tree/main>