

CS 203 - Software Tools and Techniques for AI

Assignment - 8

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Github: https://github.com/HarshilShah1804/CS203_Assignment8

Docker Hub Links:

Fastapi:1 - <https://hub.docker.com/repository/docker/harshilshah18042005/fastapi1>

Fastapi:2 - <https://hub.docker.com/repository/docker/harshilshah18042005/fastapi2>

ElasticSearch - <https://hub.docker.com/repository/docker/harshilshah18042005/fastapi2>

Google Drive Links:

Fastapi:1 = [Fastapi:1](#)

Fastapi:2 = [fastapi:2](#)

ElasticSearch = [elastic-search](#)

Creating Instance:

← Create an instance

✦ Create VM from...

Machine configuration

e2-medium, us-central1

OS and storage

Debian GNU/Linux 12 (bookworm)

Data protection

Snapshot schedules

Networking

1 network interface

Observability

Install Ops Agent

Security

Advanced

Machine configuration

Name *
instance-20250327-174400 ⓘ

Region *
us-central1 (Iowa) ⓘ
Region is permanent

Zone *
Any ⓘ
Google will choose a zone on your behalf, maximizing VM obtainability. Zone is permanent.

General purpose

Compute optimized

Memory optimized

Storage optimized

GPUs

Machine types for common workloads, optimized for cost and flexibility

| Series ⓘ | Description | vCPUs ⓘ | Memory ⓘ | CPU Platfor |
|-------------------------------------|---|-----------|--------------|----------------|
| <input type="radio"/> C4 | Consistently high performance | 2 - 192 | 4 - 1,488 GB | Intel Emerald |
| <input type="radio"/> C4A | Arm-based consistently high performance | 1 - 72 | 2 - 576 GB | Google Axion |
| <input type="radio"/> N4 | Flexible & cost-optimized | 2 - 80 | 4 - 640 GB | Intel Emerald |
| <input type="radio"/> C3 | Consistently high performance | 4 - 192 | 8 - 1,536 GB | Intel Sapphire |
| <input type="radio"/> C3D | Consistently high performance | 4 - 360 | 8 - 2,880 GB | AMD Genoa |
| <input checked="" type="radio"/> E2 | Low cost, day-to-day computing | 0.25 - 32 | 1 - 128 GB | Intel Broadwe |
| <input type="radio"/> N2 | Balanced price & performance | 2 - 128 | 2 - 864 GB | Intel Cascade |
| <input type="radio"/> N2D | Balanced price & performance | 2 - 224 | 2 - 896 GB | AMD Milan |
| <input type="radio"/> T2A | Scale-out workloads | 1 - 48 | 4 - 192 GB | Ampere Altra |
| <input type="radio"/> T2D | Scale-out workloads | 1 - 60 | 4 - 240 GB | AMD Milan |
| <input type="radio"/> N1 | Balanced price & performance | 0.25 - 96 | 0.6 - 624 GB | Intel Haswell |

Machine type
Choose a machine type with preset amounts of vCPUs and memory that suit most workloads. Or, you can create a custom machine for your workload's particular needs. [Learn more](#) ⓘ

Preset

Custom

Create

Cancel

⌨ Equivalent code

Monthly estimate

\$25.46

That's about \$0.03 hourly

Pay for what you use: no upfront costs and per second billing

| Item | Monthly estimate |
|-----------------------------------|-------------------------------|
| 2 vCPU + 4 GB memory | \$24.46 |
| 10 GB balanced persistent disk | \$1.00 |
| Logging | Cost varies ⓘ |
| Monitoring | Cost varies ⓘ |
| Snapshot schedule | Cost varies ⓘ |
| Total | \$25.46 |

[Compute Engine pricing](#) ⓘ

[Cloud Operations pricing](#) ⓘ

⤴ Less

- Change the region to Montreal (as it has the lowest cost)
- In OS and storage, change the OS to Ubuntu and Version to 24.04 LTS x86_64, and storage size to 30 GB.
- In Networkings, allow the http and https traffic on the network
- In advanced, change Provisioning Model, to spot instead of Standard.

Creating Firewall Rule:

Network Security

Secure Web Proxy

Cloud Armor

DDoS Dashboard

Cloud Armor policies

Adaptive Protection

Cloud Armor Service Tier

Cloud IDS

IDS Dashboard

IDS Endpoints

IDS Threats

Cloud NGFW

Dashboard

Firewall policies

Threats

Firewall endpoints

Common components

Address groups

Security profiles

TLS inspection policies

SSL policies

Authentication Configur...

Firewall policies

Create firewall policy

Create firewall rule

Learn

Get started with real-time analytics

Use Network Intelligence Center for comprehensive monitoring and troubleshooting. [Learn more](#)

Visualize your network resources

Diagnose and prevent connectivity issues

View packet loss and latency metrics

Keep your firewall rules strict and efficient

Try now

Remind me later

You don't have required permissions:

compute.organizations.listAssociations

to view the firewall policies inherited by this project.

VPC firewall rules

Firewall rules control incoming or outgoing traffic to an instance. By default, incoming traffic from outside your network is blocked. [Learn more](#)

Note: App Engine firewalls are managed in the [App Engine Firewall rules section](#).

SMTP port 25 disallowed in this project. [Learn more](#)

Refresh

Configure logs

Delete

| Name | Type | Targets | Filters | Protocols / ports | Action | Priority | Network | Logs | Hit count | ... |
|--------------------|---------|-------------|------------|-------------------|--------|----------|---------|------|-----------|-----|
| default-allow-http | Ingress | http-server | IP ranges: | tcp:80 | Allow | 1000 | default | Off | - | ... |

Firewall rules control incoming or outgoing traffic to an instance. By default, incoming traffic from outside your network is blocked. [Learn more](#)

Name *

Lowercase letters, numbers, hyphens allowed

Description

Logs

Turning on firewall logs can generate a large number of logs which can increase costs in Logging. [Learn more](#)

On

Off

Network *

default

Priority *

1000

Compare

Priority can be 0 - 65535

Direction of traffic

Ingress

Egress

Action on match

Allow

Deny

Targets

All instances in the network

Source filter

IPv4 ranges

- Create a new firewall rule.
- Give any name and description. Keep the direction as ingress.
- In target types, apply to all instances.
- In the Source IPV4 ranges, give 0.0.0.0.
- Check the TCP protocol, and write 9567 in the port.

Install Docker:

- Go to link: <https://download.docker.com/linux/ubuntu/dists/noble/pool/stable/amd64/>
- Download the last instances of all using wget
- Run: `sudo dpkg -i {package_name}`

Make the frontend and backend:

- The codes for the index.html, app.py and Dockerfile are available on the GitHub link provided.

Now, the frontend and backend are connected and to run, go to:

<http://{frontend-external-ip}/9567>

Screenshots:

Frontend DockerFile:

```
g23110132@frontend-1:~/frontend$ cat Dockerfile
FROM python:3.9-slim
WORKDIR /app
COPY . .
RUN pip install --no-cache-dir requests fastapi[standard] uvicorn
CMD ["uvicorn", "app:app", "--host", "0.0.0.0", "--port", "9567"]
```

build:

```
g23110132@frontend-1:~/frontend$ sudo docker build -t fastapi .
[+] Building 16.2s (9/9) FINISHED
=> [internal] load build definition from Dockerfile                                docker:default 0.0s
=> => transferring dockerfile: 214B                                              0.0s
=> [internal] load metadata for docker.io/library/python:3.9-slim                0.2s
=> [internal] load .dockerignore                                                  0.0s
=> => transferring context: 2B                                                    0.0s
=> [1/4] FROM docker.io/library/python:3.9-slim@sha256:e52ca5f579cc58fed41efcbb55a0ed5dccc6c7a156cba76acf 0.0s
=> [internal] load build context                                                  0.0s
=> => transferring context: 2.23kB                                                0.0s
=> CACHED [2/4] WORKDIR /app                                                       0.0s
=> [3/4] COPY . .                                                                0.0s
=> [4/4] RUN pip install --no-cache-dir requests fastapi[standard] uvicorn       15.3s
=> exporting to image                                                            0.5s
=> => exporting layers                                                            0.5s
=> => writing image sha256:14a68de9a277a587ab38a76e13f0c777d91b6c245b3031e31d18ec47c4b279fa 0.0s
=> => naming to docker.io/library/fastapi                                         0.0s
g23110132@frontend-1:~/frontend$ sudo docker run -d -p 9567:9567 fastapi
26aa7115f547ac09a8b079a6c4fb3fb6e7dd0816f1e5db9745bfb22b0242ae53
```

Running docker container:

```
g23110132@frontend-1:~/frontend$ sudo docker ps
```

| CONTAINER ID | IMAGE | COMMAND | CREATED | STATUS | PORTS |
|-----------------|---------|--------------------------|----------------|---------------|---|
| 26aa7115f547 | fastapi | "uvicorn app:app --h..." | 22 minutes ago | Up 22 minutes | 0.0.0.0:9567->9567/tcp, [::]:9567->9567/tcp |
| suspicious_cray | | | | | |

Backend Dockerfile:

```
FROM python:3.9-slim
WORKDIR /app
COPY . .
RUN pip install --no-cache-dir fastapi[standard] elasticsearch requests
CMD ["uvicorn", "main:app", "--host", "0.0.0.0", "--port", "9567"]
```

Docker-compose.yml:

```
g23110295@instance-20250327-170909:~/backend$ cat docker-compose.yml
version: '3'
services:
  elasticsearch:
    image: docker.elastic.co/elasticsearch/elasticsearch:8.10.2
    container_name: elasticsearch
    environment:
      - discovery.type=single-node
      - xpack.security.enabled=false
    ports:
      - "9200:9200"
    networks:
      - mynetwork
    healthcheck:
      test: ["CMD-SHELL", "curl -f http://localhost:9200/_cluster/health || exit 1"]
      interval: 3s
      retries: 10

  fastapi:
    build: .
    container_name: fastapi2
    depends on:
      elasticsearch:
        condition: service_healthy
    environment:
      - ES_HOST=http://elasticsearch:9200
    networks:
      - mynetwork
    ports:
      - "9567:9567"

networks:
  mynetwork:
    driver: bridge
```

Running docker-compose.yml:

```
g23110295@instance-20250327-170909:~/backend$ sudo docker compose up -d --build
WARN[0000] /home/g23110295/backend/docker-compose.yml: the attribute `version` is obsolete, it will be ignored,
please remove it to avoid potential confusion
Compose can now delegate builds to bake for better performance.
To do so, set COMPOSE_BAKE=true.
[+] Building 17.6s (11/11) FINISHED                                docker:default
=> [fastapi internal] load build definition from Dockerfile        0.0s
=> => transferring dockerfile: 221B                                0.0s
=> [fastapi internal] load metadata for docker.io/library/python:3.9-slim 0.4s
=> [fastapi auth] library/python:pull token for registry-1.docker.io 0.0s
=> [fastapi internal] load .dockerignore                           0.0s
=> => transferring context: 2B                                       0.0s
=> [fastapi 1/4] FROM docker.io/library/python:3.9-slim@sha256:e52ca5f579cc58fed41efcbb55a0ed5dccf6c7a15 0.0s
=> [fastapi internal] load build context                           0.0s
=> => transferring context: 2.18kB                                    0.0s
=> CACHED [fastapi 2/4] WORKDIR /app                               0.0s
=> [fastapi 3/4] COPY . .                                           0.0s
=> [fastapi 4/4] RUN pip install --no-cache-dir fastapi[standard] elasticsearch requests 16.2s
=> [fastapi] exporting to image                                     0.7s
=> => exporting layers                                              0.7s
=> => writing image sha256:3a79328de7cfe80313a14355adf09de648a7f36cee79346867328274a1b4ffaa 0.0s
=> => naming to docker.io/library/backend-fastapi                  0.0s
=> [fastapi] resolving provenance for metadata file                 0.0s
[+] Running 4/4
 ✓ fastapi Built 0.0s
 ✓ Network backend_mynetwork Created 0.1s
 ✓ Container elasticsearch Healthy 25.9s
 ✓ Container fastapi2 Started 26.0s
g23110295@instance-20250327-170909:~/backend$ sudo docker ps
CONTAINER ID   IMAGE                                COMMAND                  CREATED
STATUS        PORTS
2f9db3d6f3e6   backend-fastapi                     "uvicorn main:app --..." About a minute ago
Up 56 seconds  0.0.0.0:9567->9567/tcp, [::]:9567->9567/tcp fastapi2
9dc6861d8e04   docker.elastic.co/elasticsearch/elasticsearch:8.10.2 "/bin/tini -- /usr/l..." About a minute ago
Up About a minute (healthy) 0.0.0.0:9200->9200/tcp, [::]:9200->9200/tcp, 9300/tcp elasticsearch
g23110295@instance-20250327-170909:~/backend$
```

netstat -antp | grep LISTEN:

```
^[[Ag23110132@frontend-1:~/frontend$ netstat -antp | grep LISTEN
(No info could be read for "-p": geteuid()=1001 but you should be root.)
tcp        0      0 0.0.0.0:20202          0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:9567          0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:54:53         0.0.0.0:*               LISTEN      -
tcp        0      0 0.0.0.0:53:53         0.0.0.0:*               LISTEN      -
tcp6       0      0 :::20201              :::*                   LISTEN      -
tcp6       0      0 :::9567               :::*                   LISTEN      -
tcp6       0      0 :::22                 :::*                   LISTEN      -
```

Website screenshot for insert:

Elasticsearch Interface

Shah Harshil Hardik - 23110132

Shah Tirth - 23110295

Output:

```
{  
  "result": "created",  
  "id": "26b8352f-1da4-4d66-aff1-e972610e44e6"  
}
```

Website screenshot for get:

Elasticsearch Interface

Shah Harshil Hardik - 23110132

Shah Tirth - 23110295

Insert

txt

Query

Output:

```
{
  "hits": [
    {
      "_index": "documents",
      "_id": "26b8352f-1da4-4d66-aff1-e972610e44e6",
      "_score": 2.583037,
      "_source": {
        "id": "26b8352f-1da4-4d66-aff1-e972610e44e6",
        "text": "Temp txt"
      }
    }
  ]
}
```

Docker Hub push:

```
g23110132@frontend-1:~/frontend$ dockerhub login -u harshilshah18042005
dockerhub: command not found
g23110132@frontend-1:~/frontend$ docker login -u harshilshah18042005

Info → A Personal Access Token (PAT) can be used instead.
       To create a PAT, visit https://app.docker.com/settings

Password:
Login Succeeded
g23110132@frontend-1:~/frontend$ docker images
REPOSITORY                                TAG      IMAGE ID      CREATED        SIZE
harshilshah18042005/fastapi1             latest   14a68de9a277   About an hour ago   181MB
fastapi                                  latest   14a68de9a277   About an hour ago   181MB
g23110132@frontend-1:~/frontend$ ^C
g23110132@frontend-1:~/frontend$ docker push harshilshah18042005/fastapi1:latest
The push refers to repository [docker.io/harshilshah18042005/fastapi1]
a164a0b6242a: Pushed
0158c05328b9: Pushed
3ae44366cb26: Pushed
0796a33961ef: Mounted from library/python
04f6e4cfc28e: Mounted from library/python
140ec0aa8af0: Mounted from library/python
1287fbecdfcc: Mounted from library/python
latest: digest: sha256:d918c74feae48fd8acf9114cb57256604c8e250fea132b5b61ae6a95cea75908 size: 1785
g23110132@frontend-1:~/frontend$
```



```
g23110132@instance-20250327-170909:~$ sudo docker images
```

| REPOSITORY | TAG | IMAGE ID | CREATED | SIZE |
|---|--------|--------------|---------------|--------|
| tirthshah2504/cs203 | latest | 5329a51915c8 | 2 hours ago | 309MB |
| tirthshah2504/cs203final | latest | 5329a51915c8 | 2 hours ago | 309MB |
| harshilshah18042005/fastapi2 | latest | 5329a51915c8 | 2 hours ago | 309MB |
| g23110295-fastapi | latest | 5329a51915c8 | 2 hours ago | 309MB |
| docker.elastic.co/elasticsearch/elasticsearch | 8.10.2 | bb20157f1390 | 18 months ago | 1.34GB |
| harshilshah18042005/elasticsearch | 8.10.2 | bb20157f1390 | 18 months ago | 1.34GB |

```
g23110132@frontend-1:~$ sudo docker images
```

| REPOSITORY | TAG | IMAGE ID | CREATED | SIZE |
|------------------------------|--------|--------------|-------------|-------|
| harshilshah18042005/fastapi1 | latest | 14a68de9a277 | 2 hours ago | 181MB |
| fastapi | latest | 14a68de9a277 | 2 hours ago | 181MB |

Screenshot for VM logs (insert):

```
INFO: 10.162.0.7:34430 - "GET /insert/India%20has%20been%20a%20federal%20republic%20since%201950%2C%20governe
d%20through%20a%20democratic%20parliamentary%20system.%20It%20is%20a%20pluralistic%2C%20multilingual%20and%20mult
i-ethnic%20society.%20India%27s%20population%20grew%20from%20361%20million%20in%201951%20to%20over%201.4%20billio
n%20in%202023.%20During%20this%20time%2C%20its%20nominal%20per%20capita%20income%20increased%20from%20US%
2464%20annually%20to%20US%242%2C%20and%20its%20literacy%20rate%20from%2016.6%25%20to%2074%25.%20A%20compa
ratively%20destitute%20country%20in%201951%2C%20India%20has%20become%20a%20fast-growing%20major%20economy%2
0and%20hub%20for%20information%20technology%20services%20it%20has%20ant%20expanding%20middle%20class.%20I
ndian%20movies%20and%20music%20increasingly%20influence%20global%20culture.%20India%20has%20reduced%20i
ts%20poverty%20rate%20though%20at%20the%20cost%20of%20increasing%20economic%20inequality.%20It%20is%20
a%20nuclear-weapon%20state%20that%20ranks%20high%20in%20military%20expenditure.%20It%20has%20disputes%20over%20Ka
shmir%20with%20its%20neighbours%2C%20Pakistan%20and%20China%2C%20unresolved%20since%20the%20mid-20th%20century.%2
0Among%20the%20socio-economic%20challenges%20India%20faces%20are%20gender%20inequality%2C%20child%20malnu
trition%2C%20rising%20levels%20of%20air%20pollution.%20India%27s%20and%20is%20megadiverse%
20with%20four%20biodiversity%20hotspots.%20India%27s%20wildlife%2C%20which%20has%20traditionally%20been%2
0viewed%20with%20tolerance%20in%20its%20culture%2C%20is%20supported%20in%20protected%20habitats. HTTP/1.1
" 200 OK
```

Screenshot for VM logs (get)"

```
txt
INFO: 10.162.0.7:59642 - "GET /get/txt HTTP/1.1" 200 OK
```

Docker inspect (frontend):

```
Run 'docker --help' for more information
g23110132@frontend-1:~/frontend$ docker inspect e277cd12fce
```

```
[
  {
    "Id": "e277cd12fce8c1e84f2e4bf75ceb59571e1c9160c3841b69a022847e997840b",
    "Created": "2025-03-27T19:53:43.563554098Z",
    "Path": "uvicorn",
    "Args": [
      "app:app",
      "--host",
      "0.0.0.0",
      "--port",
      "9567"
    ],
    "State": {
      "Status": "running",
      "Running": true,
      "Paused": false,
      "Restarting": false,
      "OOMKilled": false,
      "Dead": false,
      "Pid": 15027,
      "ExitCode": 0,
      "Error": "",
      "StartedAt": "2025-03-27T19:53:43.650232911Z",
      "FinishedAt": "0001-01-01T00:00:00Z"
    },
    "Image": "sha256:14a68de9a277a587ab38a76e13f0c777d91b6c245b3031e31d18ec47c4b279fa",
    "ResolveConfPath": "/var/lib/docker/containers/e277cd12fce8c1e84f2e4bf75ceb59571e1c9160c3841b69a022847e997840b/resol",
    "HostnamePath": "/var/lib/docker/containers/e277cd12fce8c1e84f2e4bf75ceb59571e1c9160c3841b69a022847e997840b/hostname",
    "HostsPath": "/var/lib/docker/containers/e277cd12fce8c1e84f2e4bf75ceb59571e1c9160c3841b69a022847e997840b/hosts",
    "LogPath": "/var/lib/docker/containers/e277cd12fce8c1e84f2e4bf75ceb59571e1c9160c3841b69a022847e997840b/e277cd12fce8c1e84f2e4bf75ceb59571e1c9160c3841b69a022847e997840b.log"
  }
]
```

Architectural Diagram:

