

CS 203: Software Tools & Techniques for AI
IIT Gandhinagar
Sem-II - 2024-25

Assignment 07

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- GitHub repository: [Team 3](#)
- Docker Hub Image Links:

Frontend: [shivraj19/fastapi-frontend general | Docker Hub](https://hub.docker.com/repository/docker/hetpathak/fastapi-frontend/general)

Backend:

<https://hub.docker.com/repository/docker/hetpathak/fastapi-backend/general>

Elasticsearch:

<https://hub.docker.com/repository/docker/hetpathak/elasticsearch/general>

- Google Drive link for dockerfile used to create images:

Frontend:

[https://drive.google.com/file/d/1YR0ZNufTB5fvnAT_NLc0UYEa96sTMV9w/vie w?usp=sharing](https://drive.google.com/file/d/1YR0ZNufTB5fvnAT_NLc0UYEa96sTMV9w/view?usp=sharing)

Backend + Elastic Search:

[https://drive.google.com/file/d/1Iy_gopO4V7E10pEJQHOyp_0VjJt5ba5M/vie w?usp=sharing](https://drive.google.com/file/d/1Iy_gopO4V7E10pEJQHOyp_0VjJt5ba5M/view?usp=sharing)

- Screenshots:

VM Instances created: Configuration used (same for both VMs)

The screenshot shows the Google Cloud Compute Engine interface. On the left, a sidebar navigation includes 'Compute Engine' (selected), 'Overview' (selected), 'Virtual machines' (selected), 'VM instances' (selected), and other options like 'Instance templates', 'Sole-tenant nodes', 'Machine images', 'TPUs', 'Committed use discounts', 'Reservations', 'Migrate to Virtual Machine', 'Storage' (with 'Disks' and 'Storage Pools'), 'Marketplace', and 'Release Notes'. The main content area displays the 'Details' tab for the instance 'instance-202...'. The 'Basic information' section contains the following details:

| | |
|-------------------------|------------------------------------|
| Name | instance-20250325-204309 |
| Instance Id | 7766215758145563105 |
| Description | None |
| Type | Instance |
| Status | Stopped |
| Creation time | Mar 26, 2025, 2:20:23 AM UTC+05:30 |
| Location | us-central1-a |
| Instance template | None |
| In use by | None |
| Physical host | None |
| Maintenance status | — |
| Reservations | Automatically choose |
| Labels | goog-ops-a...:v2-x86-tem... |
| Tags | — |
| Deletion protection | Disabled |
| Confidential VM service | Disabled |

At the bottom of the main content area, there is a link to 'Equivalent code'. The browser's address bar shows 'console.cloud.google.com/compute/instancesDetail/zones/us-central1-a/instances/instance-20250325-204309?project=...'. The system tray at the bottom right shows icons for battery, signal, volume, and date/time (26-03-2025).

[Details](#) [Observability](#) [OS Info](#) [Screenshot](#)

Machine configuration

| | |
|---|--|
| Machine type | e2-custom-2-4096 (2 vCPUs, 4 GB Memory) |
| CPU platform | Unknown CPU Platform |
| Minimum CPU platform | None |
| Architecture | x86/64 |
| vCPUs to core ratio <small>(?)</small> | — |
| Custom visible cores <small>(?)</small> | — |
| All-core turbo-only mode <small>(?)</small> | — |
| Display device | Disabled Enable to use screen capturing and recording tools |
| GPUs | None |
| Resource policies | |

Networking

| | |
|-----------------------------|------|
| Public DNS PTR Record | None |
| Total egress bandwidth tier | — |
| NIC type | — |

[→ View in Network Topology](#)

Firewalls

| | |
|-----------------------------------|-----|
| HTTP traffic | On |
| HTTPS traffic | On |
| Allow Load Balancer Health checks | Off |

Network tags

[http-server](#) [https-server](#)

Network interfaces

| Name ↑ | Network | Subnetwork | Primary internal IP address | Alias IP ranges | IP stack type | External IP address |
|--------|---------|------------|-----------------------------|-----------------|---------------|---------------------|
| nic0 | default | default | 10.128.0.2 | | IPv4 | Ephemeral |

Storage

Boot disk

| Name ↑ | Image | Interface type | Size (GB) | Device name | Type | Architecture | Encryption | Mode |
|--------------------------|-----------------------------|----------------|-----------|--------------------------|--------------------------|--------------|----------------|------------|
| instance-20250325-204309 | ubuntu-2004-focal-v20250313 | SCSI | 30 | instance-20250325-204309 | Balanced persistent disk | x86/64 | Google-managed | Block read |

Local disks

None

Additional disks

None

Backup plan ②

Managed by [Backup and DR Service](#) 

CREATE ON-DEMAND BACKUP

| | |
|--|----------------|
| Backup schedule state ② | Not configured |
| Backup plan | — |

Security and access

Shielded VM ②

| | |
|---|-----|
| Secure Boot ② | Off |
| vTPM ② | On |
| Integrity Monitoring ② | On |

SSH Keys

| | |
|-----------------------------|------|
| SSH keys | None |
| Block project-wide SSH keys | Off |

API and identity management

| | |
|-------------------------|--|
| Service account | 656667028286-compute@developer.gserviceaccount.com |
| Cloud API access scopes | Allow default access |

 [Show details](#)

Management

Data Encryption

| | |
|----------|---|
| Key ID | — |
| Key name | — |

Availability policies

| | |
|--|-----------------------|
| VM provisioning model ? | Spot |
| Max duration ? | None |
| Preemptibility | On |
| On VM termination ? | Stop |
| Graceful shutdown maximum duration | — |
| On host maintenance | Terminate VM instance |
| Host error timeout ? | — |
| Automatic restart | Off |
| Customer Managed Encryption Key <small>(CMEK) revocation policy</small> | Do nothing |

| VM provisioning model | SPUR |
|--|-----------------------|
| Max duration | None |
| Preemptibility | On |
| On VM termination | Stop |
| Graceful shutdown maximum duration | — |
| On host maintenance | Terminate VM instance |
| Host error timeout | — |
| Automatic restart | Off |
| Customer Managed Encryption Key (CMEK) revocation policy | Do nothing |

Sole-tenancy

| | |
|----------------|----------|
| CPU Overcommit | Disabled |
|----------------|----------|

Custom metadata

| Key | Value |
|-----------------|-------|
| enable-osconfig | TRUE |

- **Screenshot** when performing all the tasks. (Dockerfile code, building command and its output, running container, and its output)

Dockerfile codes, build and run commands, running and output

VM1: Frontend

Build command: docker build -t fastapi:1

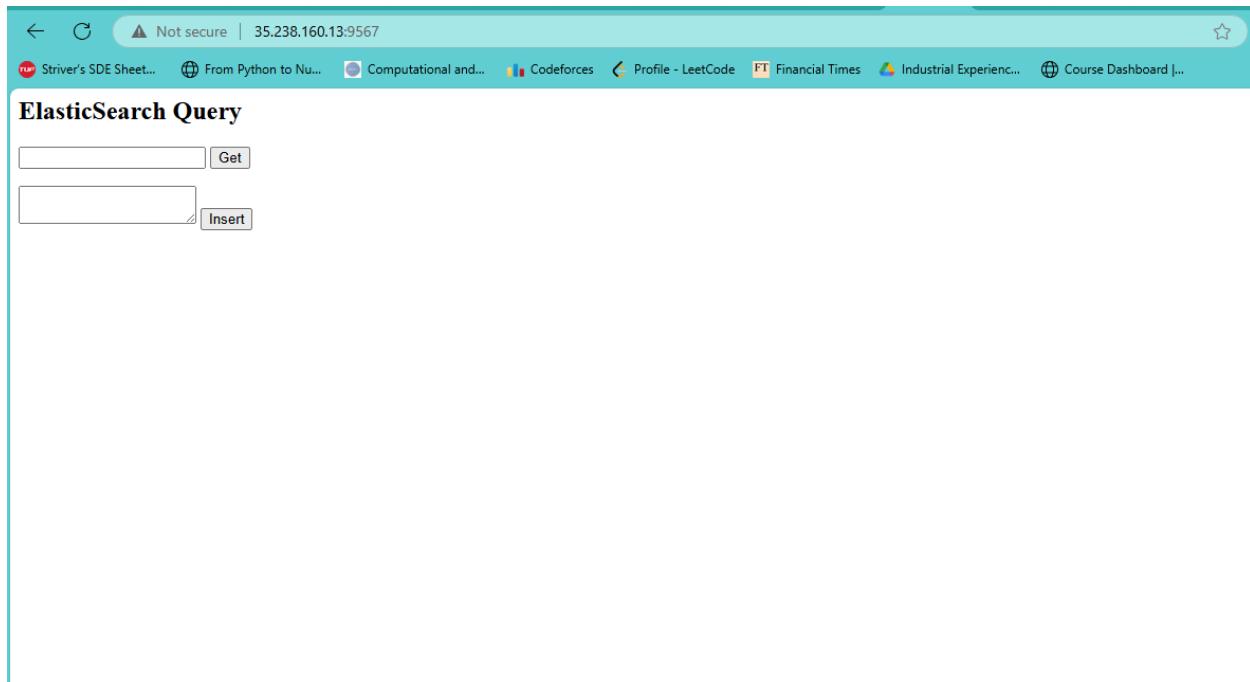
Run command: docker run -d --name frontend -p 9567:9567 fastapi:1

The screenshot shows an SSH session on a Google Cloud instance. The terminal window title is "SSH-in-browser". The session starts with the URL of the SSH connection. Below it, the Dockerfile content is displayed:

```
GNU nano 4.8
FROM python:3.10-slim
WORKDIR /app
COPY app /app
RUN pip install fastapi[all] requests
EXPOSE 9567
CMD ["uvicorn", "main:app", "--host", "0.0.0.0", "--port", "9567"]
```

The Dockerfile defines a Python 3.10-slim image, sets the working directory to /app, copies the app directory, installs fastapi and requests dependencies, exposes port 9567, and runs the app using uvicorn.

```
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ docker ps
CONTAINER ID        IMAGE           COMMAND       CREATED          STATUS          PORTS
AMES                fastapi:1      "uvicorn main:app ..."   20 hours ago    Up 20 hours   0.0.0.0:9567->9567/tcp, :::9567->9567/tcp
rontend
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$
```



VM2: Backend

Build command: docker build -t fastapi:2 .

Run command: docker run -d --name backend --net lab08-net -p 9567:9567 fastapi:2

```
ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true - Brave
% ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true
SSH-in-browser
Modified
/home/het_pachak/lab08/backend/Dockerfile
 UPLOAD FILE DOWNLOAD FILE
CMD ["uvicorn", "main:app", "--host", "0.0.0.0", "--port", "9567"]
```

The screenshot shows a terminal window titled "SSH-in-browser" connected to a Google Cloud instance. The terminal displays a Dockerfile for a FastAPI application. The Dockerfile starts with a base image of Python 3.10-slim, copies the application code from the current directory to the /app directory, installs dependencies using pip, exposes port 9567, and runs the application using Uvicorn.

```

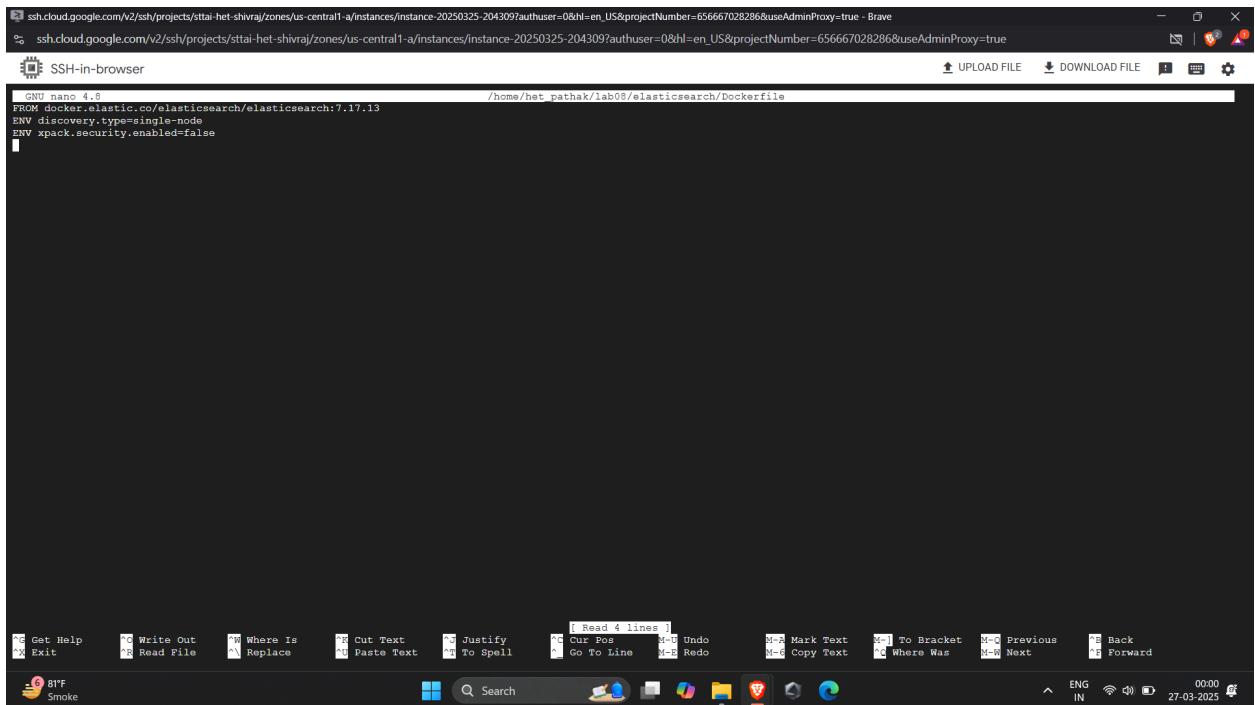
het_pathak@instance-20250325-204309:~/lab08/backend$ nano Dockerfile
het_pathak@instance-20250325-204309:~/lab08/backend$ docker ps
CONTAINER ID   IMAGE          COMMAND       CREATED      STATUS      PORTS          NAMES
40911e7bed43   fastapi:2    "uvicorn main:app ..."   20 hours ago  Up 20 hours  0.0.0.0:9567->9567/tcp, :::9567->9567/tcp   backend
f50f304daadc   elasticsearch:lab08  "/bin/tini -- /usr/l..."  20 hours ago  Up 20 hours  9200/tcp, 9300/tcp   es
het_pathak@instance-20250325-204309:~/lab08/backend$ 

```

VM2: Elastic Search

Build command: docker build -t elasticsearch:lab08 .

Run command: docker run -d --name es --net lab08-net -v esdata:/usr/share/elasticsearch/data elasticsearch:lab08



- Screenshot of “netstat -antp | grep LISTEN” on Base Linux OS, where the container is running.

VM1: Frontend

```

shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ netstat -antp | grep LISTEN
(Not all processes could be identified, non-owned process info
 will not be shown, you would have to be root to see it all)
tcp        0      0 0.0.0.0:9567          0.0.0.0:*                  LISTEN      -
tcp        0      0 0.0.0.0:20202         0.0.0.0:*                  LISTEN      -
tcp        0      0 127.0.0.53:53        0.0.0.0:*                  LISTEN      -
tcp        0      0 0.0.0.0:22          0.0.0.0:*                  LISTEN      -
tcp6       0      0 :::9567             :::*                   LISTEN      -
tcp6       0      0 :::20201            :::*                   LISTEN      -
tcp6       0      0 :::22              :::*                   LISTEN      -

```

VM2: Backend + Elasticsearch

```
het_pathak@instance-20250325-204309:~/lab08/backend$ netstat -antp | grep LISTEN
(Not all processes could be identified, non-owned process info
 will not be shown, you would have to be root to see it all.)
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 0.0.0.0:22            0.0.0.0:*
LISTEN      -
tcp      0      0 127.0.0.53:53         0.0.0.0:*
LISTEN      -
tcp6     0      0 :::20201             ::::*
LISTEN      -
tcp6     0      0 :::9567              ::::*
LISTEN      -
tcp6     0      0 :::22               ::::*
LISTEN      -
het_pathak@instance-20250325-204309:~/lab08/backend$
```

- Screenshot of “docker images”

VM1: Frontend

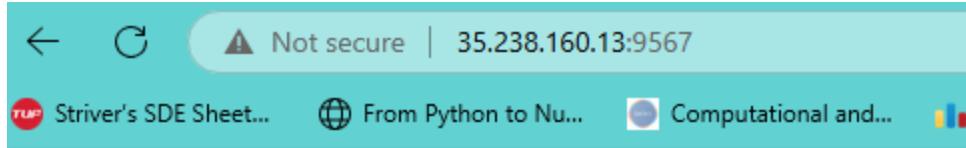
```
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ docker images
REPOSITORY          TAG      IMAGE ID      CREATED       SIZE
fastapi              1        22754c1e3740  21 hours ago  200MB
shivraji9/fastapi-frontend  1        22754c1e3740  21 hours ago  200MB
<none>              <none>   7e063fabe0f1  22 hours ago  200MB
python               3.10-slim 643092d2b296  3 months ago  127MB
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$
```

VM2: Backend + Elasticsearch

```
het_pathak@instance-20250325-204309:~/lab08$ docker images
REPOSITORY          TAG      IMAGE ID      CREATED       SIZE
hetpathak/fastapi-backend  2        92ddee356e90  22 hours ago  200MB
fastapi              2        92ddee356e90  22 hours ago  200MB
hetpathak/elasticsearch  latest   1de41e4630e4  22 hours ago  623MB
elasticsearch        lab08    1de41e4630e4  22 hours ago  623MB
python               3.10-slim 643092d2b296  3 months ago  127MB
docker.elastic.co/elasticsearch/elasticsearch  7.17.13  5e5e53187282  19 months ago  623MB
het_pathak@instance-20250325-204309:~/lab08$
```

- Screenshot when testing both get and insert query. Then stop and delete all three 3 containers and run it again, showing that the inserted query still exists. (It must been shown clearly before that the get query output is different compared to when it has been inserted later)

VM1: Frontend



ElasticSearch Query

```
← ⌂ Not secure | 35.238.160.13:9567/get
Striver's SDE Sheet... From Python to Nu... Computational and... Codeforces Profile - LeetCode Financial Times Industrial Experience Course Dashboard ...
Pretty-print □

{
  "took": 4,
  "timed_out": false,
  "shards": {
    "total": 1,
    "successful": 1,
    "skipped": 0,
    "failed": 0
  },
  "hits": {
    "total": {
      "value": 1,
      "relation": "eq"
    },
    "max_score": 1.3253797,
    "hits": [
      {
        "index": "india",
        "type": "doc",
        "id": "Y64e1jU8q9OXfnynP1",
        "score": 1.3253797,
        "ignored": false,
        "text": {
          "value": "In the early medieval era, Christianity, Islam, Judaism, and Zoroastrianism became established on India's southern coasts. [44] Muslim armies from Central Asia intermittently overran India's northern plains. [45] The resulting Delhi Sultanate drew northern India into the cosmopolitan networks of medieval Islam. [46] In south India, the Vijayanagara Empire created a long-lasting composite Hindu culture. [47] In the Punjab, Sikhism emerged, rejecting institutionalised religion. [48] The Mughal Empire, in 1526, ushered in two centuries of relative peace, [49] leaving a legacy of luminous architecture. [m] [50] Gradually expanding rule of the British East India Company turned India into a colonial economy but consolidated its sovereignty. [51] British Crom rule began in 1858. The rights promised to Indians were granted slowly, [52][53] but technological changes were introduced, and modern ideas of education and public life took root. [54] A pioneering and influential nationalist movement, noted for nonviolent resistance, became the major factor in ending British rule. [55][56] In 1947, the British Indian Empire was partitioned into two independent dominions, [57][58][59][60] a Hindu-majority dominion of India and a Muslim-majority dominion of Pakistan. A large-scale loss of life and an unprecedented migration accompanied the partition. [61]"))
      }
    ]
  }
}
```

Restarting docker container

```
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ docker images
REPOSITORY           TAG      IMAGE ID      CREATED       SIZE
fastapi              1        22754c1e3740   21 hours ago  200MB
shivrajsinh/fastapi-frontend  1        22754c1e3740   21 hours ago  200MB
<none>               <none>   7e063fabef1   22 hours ago  200MB
python               3.10-slim 643092d2b296   3 months ago  127MB
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ docker stop frontend
frontend
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ docker ps
CONTAINER ID   IMAGE      COMMAND   CREATED     STATUS    PORTS     NAMES
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ docker start frontend
frontend
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ docker ps
CONTAINER ID   IMAGE      COMMAND      CREATED     STATUS     PORTS
NAMES
0e82a3f62f20   fastapi:1  "uvicorn main:app ..."  20 hours ago  Up 3 seconds  0.0.0.0:9567->9567/tcp, :::9567->9567/tcp
frontend
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$
```

Testing the docker container after restart

Docker logs

```

shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ docker logs frontend
INFO:     Started server process [1]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://0.0.0.0:9567 (Press CTRL+C to quit)
INFO:     14.139.98.80:10553 - "GET / HTTP/1.1" 200 OK
INFO:     14.139.98.80:10554 - "POST /get HTTP/1.1" 200 OK
INFO:     147.185.133.11:62794 - "GET / HTTP/1.1" 200 OK
INFO:     147.185.133.95:64530 - "GET / HTTP/1.1" 200 OK
INFO:     14.139.98.80:10400 - "GET / HTTP/1.1" 200 OK
INFO:     14.139.98.80:10400 - "GET /favicon.ico HTTP/1.1" 404 Not Found
INFO:     40.77.167.93:46929 - "GET /robots.txt HTTP/1.1" 404 Not Found
INFO:     52.167.144.157:1586 - "GET / HTTP/1.1" 200 OK
INFO:     52.167.144.206:45196 - "GET / HTTP/1.1" 200 OK
INFO:     14.139.98.80:10402 - "GET / HTTP/1.1" 200 OK
INFO:     14.139.98.80:10402 - "GET /favicon.ico HTTP/1.1" 404 Not Found
INFO:     14.139.98.80:10408 - "POST /insert HTTP/1.1" 200 OK
INFO:     14.139.98.80:10407 - "POST /get HTTP/1.1" 200 OK
INFO:     14.139.98.80:10410 - "GET / HTTP/1.1" 200 OK
INFO:     14.139.98.80:10410 - "POST /get HTTP/1.1" 200 OK
INFO:     14.139.98.80:10411 - "GET / HTTP/1.1" 200 OK
INFO:     Shutting down
INFO:     Waiting for application shutdown.
INFO:     Application shutdown complete.
INFO:     Finished server process [1]
INFO:     Started server process [1]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://0.0.0.0:9567 (Press CTRL+C to quit)
INFO:     14.139.98.80:10413 - "GET / HTTP/1.1" 200 OK
INFO:     14.139.98.80:10415 - "POST /get HTTP/1.1" 200 OK
shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend$ 

```

VM2: Backend + Elasticsearch

The screenshot shows a web browser window with the URL `35.238.160.13:9567`. The page title is "ElasticSearch Query". There is a search bar with a "Get" button. The main content area displays a paragraph about India's geography and borders. A floating toolbar with a lightbulb icon and a "3" badge is visible. An "Insert" button is located at the bottom right.

India, officially the Republic of India,[j][21] is a country in South Asia. It is the seventh-largest country by area; the most populous country from June 2023 onwards;[22] [23] and since its independence in 1947, the world's most populous democracy.[24][25] [26] Bounded by the Indian Ocean on the south, the Arabian Sea on the southwest, and the Bay of Bengal on the southeast, it shares land borders with Pakistan to the west; [k] China, Nepal, and Bhutan to the north; and Bangladesh and Myanmar to the east. In the Indian Ocean, India is near Sri Lanka and the Maldives; its Andaman and Nicobar Islands share a maritime border with Thailand, Myanmar, and Indonesia.

The screenshot shows a web browser window with the URL `35.238.160.13:9567`. The page title is "ElasticSearch Query". There is a search bar with a "Get" button. The main content area displays a paragraph about the Valley Civilisation. A floating toolbar with a lightbulb icon and a "3" badge is visible. An "Insert" button is located at the bottom right.

Valley Civilisation of the third millennium BCE.[32] By 1200 BCE, an archaic form of Sanskrit, an Indo-European language, had diffused into India from the northwest. [33][34] Its hymns recorded the dawning of Hinduism in India.[35] India's pre-existing Dravidian languages were supplanted in the northern regions.[36] By 400 BCE, caste had emerged within Hinduism,[37] and Buddhism and Jainism had arisen, proclaiming social orders unlinked to heredity.[38] Early political consolidations gave rise to the loose-knit Maurya and Gupta Empires.[39] Widespread creativity suffused this era,[40] but the status of women declined,[41] and untouchability became an organized belief.[42] In South India, the Middle kingdoms exported Dravidian language scripts and religious cultures to the kingdoms of Southeast Asia.[43]

The screenshot shows a web browser window with the URL `35.238.160.13:9567/insert`. The page title is "ElasticSearch Query". There is a search bar with a "Get" button. The main content area displays the raw JSON response from Elasticsearch. A floating toolbar with a lightbulb icon and a "3" badge is visible. An "Insert" button is located at the bottom right.

```
{"_index": "india", "_type": "_doc", "_id": "bh-L2JUB3WqA6opWcxFv", "_version": 1, "result": "created", "_shards": {"total": 2, "successful": 1, "failed": 0}, "_seq_no": 4, "_primary_term": 2}
```

```

het_pathak@instance-20250325-204309:~/lab08$ docker stop backend es
backend
es
het_pathak@instance-20250325-204309:~/lab08$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
het_pathak@instance-20250325-204309:~/lab08$ docker start backend es
backend
es
het_pathak@instance-20250325-204309:~/lab08$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
40911e7bed43      fastapi:2          "uvicorn main:app ..."   20 hours ago     Up 3 seconds      0.0.0.0:9567->9567/tcp, :::9567->9567/tcp
f50f304daadc      elasticsearch:lab08  "/bin/sh -c /usr/l..."  20 hours ago     Up 2 seconds      9200/tcp, 9300/tcp
het_pathak@instance-20250325-204309:~/lab08$ 

```

```

het_pathak@instance-20250325-204309:~/lab08$ docker logs backend
INFO:     Started server process [1]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://0.0.0.0:9567 (Press CTRL+C to quit)
INFO:     10.128.0.3:47516 - "POST /query HTTP/1.1" 200 OK
INFO:     162.216.149.237:57798 - "GET / HTTP/1.1" 404 Not Found
INFO:     147.185.133.44:61838 - "GET / HTTP/1.1" 404 Not Found
INFO:     147.185.133.95:61916 - "GET / HTTP/1.1" 404 Not Found
INFO:     10.128.0.3:57102 - "POST /insert HTTP/1.1" 200 OK
INFO:     10.128.0.3:38410 - "POST /query HTTP/1.1" 200 OK
INFO:     10.128.0.3:52722 - "POST /query HTTP/1.1" 200 OK
INFO:     Shutting down
INFO:     Waiting for application shutdown.
INFO:     Application shutdown complete.
INFO:     Finished server process [1]
INFO:     Started server process [1]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://0.0.0.0:9567 (Press CTRL+C to quit)
INFO:     10.128.0.3:41378 - "POST /query HTTP/1.1" 200 OK

```

- Screenshot of “docker inspect” for all the 3 tasks, both container and images. (Give the whole output in the screenshot it is essential to verify whether the task was done properly or not)

VM1: Frontend

SSH-in-browser

```
shivraj@inh_bhosale@instance-20250325-205228:~/lab08/frontend$ docker inspect frontend
[{"Id": "0e82a3f62f20fffea971f2583ce76d745e5fd333ab9319c15fe6ce59bdc7afaa", "Created": "2025-03-26T20:33:07.704646266Z", "Path": "unicorn", "Args": ["main:app", "--host", "0.0.0.0", "--port", "9567"], "State": {"Status": "running", "Running": true, "Paused": false, "Restarting": false, "OOMKilled": false, "Dead": false, "Pid": 72520, "ExitCode": 0, "Error": "", "StartedAt": "2025-03-27T17:02:02.495626574Z", "FinishedAt": "2025-03-27T17:01:22.244039876Z"}, "Image": "sha256:22754c1e3740af0cb64297chb34b0b23f427898ee0fcf8114a7df3ae9301a5cd", "ResolvConfPath": "/var/lib/docker/containers/0e82a3f62f20fffea971f2583ce76d745e5fd333ab9319c15fe6ce59bdc7afaa/resolv.conf", "HostnamePath": "/var/lib/docker/containers/0e82a3f62f20fffea971f2583ce76d745e5fd333ab9319c15fe6ce59bdc7afaa/hostname", "HostPath": "/var/lib/docker/containers/0e82a3f62f20fffea971f2583ce76d745e5fd333ab9319c15fe6ce59bdc7afaa/hosts", "LogPath": "/var/lib/docker/containers/0e82a3f62f20fffea971f2583ce76d745e5fd333ab9319c15fe6ce59bdc7afaa/0e82a3f62f20fffea971f2583ce76d745e5fd333ab9319c15fe6ce59bdc7afaa-json.log", "Name": "frontend", "RestartCount": 0, "Updated": "2025-03-27T17:02:02.495626574Z", "Platform": "linux", "MountLabel": "", "ProcessLabel": "", "AppArmorProfile": "docker-default", "ExecIDs": null, "HostConfig": {"Binds": null, "ContainerIDFile": "", "LogConfig": {"Type": "json-file", "Config": {}}, "NetworkMode": "default", "PortBindings": {"9567/tcp": [{}]}}, "NetworkMode": "default", "PortBindings": {"9567/tcp": [{}]}
```

SSH-in-browser

```
"NetworkMode": "default", "PortBindings": {"9567/tcp": [{"HostIp": "", "HostPort": "9567"}]}, "RestartPolicy": {"Name": "no", "MaximumRetryCount": 0}, "AutoRemove": false, "VolumeDriver": "", "VolumesFrom": null, "CapAdd": null, "CapDrop": null, "CgroupnsMode": "host", "Dns": [], "DnsOptions": [], "DnsSearch": [], "ExtraHosts": null, "GroupAdd": null, "IpcMode": "private", "OomScoreAdj": 0, "Links": null, "OomScoreAdj": 0, "PidMode": "", "Privileged": false, "PublishAllPorts": false, " ReadonlyRootfs": false, "SecurityOpt": null, "UTSMode": "", "UsernsMode": "", "UserSpecified": 67108864, "Runtime": "runc", "ConsoleSize": [0, 0], "Isolation": "", "QoSClasses": 0, "Memory": 0, "NanoCpus": 0, "CgroupParent": "", "BlkioWeight": 0, "BlkioWeightDevice": [], "BlkioDeviceReadBps": null}
```

```
SSH-in-browser
{
  "blkioWeight": 0,
  "blkioDeviceReadBps": null,
  "blkioDeviceWriteBps": null,
  "blkioDeviceReadIOPS": null,
  "blkioDeviceWriteIOPS": null,
  "CpuPeriod": 0,
  "CpuQuota": 0,
  "CpuRealtimePeriod": 0,
  "CpuRealtimeRuntime": 0,
  "CpuShares": 0,
  "CpuUsage": 0,
  "Devices": [],
  "DeviceGroupRules": null,
  "DeviceRequests": null,
  "KernelMemory": 0,
  "KernelMemoryTCP": 0,
  "MemoryReservation": 0,
  "MemorySwap": 0,
  "MemoryUsage": null,
  "OomKillDisable": false,
  "PidsLimit": null,
  "Ulimits": null,
  "CpuCount": 0,
  "CpuPercent": 0,
  "IOMaximumOps": 0,
  "IOMaximumBandwidth": 0,
  "MaskedPaths": [
    "/proc/asound",
    "/proc/acpi",
    "/proc/kcore",
    "/proc/keys",
    "/proc/latency_stats",
    "/proc/timer_list",
    "/proc/timer_stats",
    "/proc/sched_debug",
    "/proc/scsi",
    "/sys/firmware"
  ],
  " ReadonlyPaths": [
    "/proc/bus",
    "/proc/fs",
    "/proc/irq",
    "/proc/sys",
    "/proc/sysrq-trigger"
  ],
  "GraphDriver": {
    "Data": {}
  }
}
```

```
SSH-in-browser
{
  "GraphDriver": {
    "Data": {
      "LowerDir": "/var/lib/docker/overlay2/9550cf487fd8ede5cc0f7db7edc74c45838f423dacc3ff233926c5db27f215-init/diff:/var/lib/docker/overlay2/9ef53c7aab7756a74759fhabbla3993f5cbad9eacf1a3fc185b293d5aae9/diff:/var/lib/docker/overlay2/8d7d420c652329f570be6034fc066ee2ab7891c94c0b2ea323c941a08d1/diff:/var/lib/docker/overlay2/5e7a932d215fd2ebce1cceaa67bb7424e1287bc3aa45f037e99a751431992/diff:/var/lib/docker/overlay2/97ade42d20aafaa876ea23b312e231c52bb389fcabb373380ab5f2e9aaab1/diff:/var/lib/docker/overlay2/f456d58442sae511e03696300bd6d3976740174790ea7259dbb9e6130544b0/diff:/var/lib/docker/overlay2/183631531fb96aac7e9d1c88140323788080265ccbfe71c0f0924cdc96126c5b/diff",
      "UpperDir": "/var/lib/docker/overlay2/9550cf487fd8ede5cc0f7db7edc74c45838f423dacc3ff233926c5db27f215/diff",
      "Workdir": "/var/lib/docker/overlay2/9550cf487fd8ede5cc0f7db7edc74c45838f423dacc3ff233926c5db27f215/work"
    },
    "Name": "overlay2"
  },
  "Mounts": [],
  "Config": {
    "Hostname": "0e82a3f62f20",
    "Domainname": "",
    "User": "",
    "AttachStdin": false,
    "AttachStdout": false,
    "AttachStderr": false,
    "ExposedPorts": {
      "8067/tcp": {}
    },
    "Tty": false,
    "OpenStdin": false,
    "Stdimage": false,
    "Env": [
      "PATH=/usr/local/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin",
      "LANG=C.UTF-8",
      "GPG_KEY=A035C8C19219BA821ECEA86B64E628F8D684696D",
      "PYTHON_VERSION=3.10.16",
      "PYTHON_SHA256=bfb249609990220491alb92850a07135ed0831e41738cf681d63cf01b2a8fb1d"
    ],
    "Cmd": [
      "vi:corn",
      "main:app",
      "-host",
      "0.0.0.0",
      "-port",
      "9567"
    ],
    "Image": "fastapi:1",
    "Volumes": null,
    "WorkingDir": "/app",
    "Entrypoint": null,
    "OnBuild": null,
    "Labels": {}
  }
}
```

```

{
  "Bridge": "",
  "SandboxID": "449d2e0985ef7d9ef8c74b121f359762553ba681adf48e2edc97a8d6cbd067e1",
  "HairpinMode": false,
  "LinkLocalIPv6Address": "",
  "LinkLocalIPv6PrefixLen": 0,
  "Ports": [
    {
      "HostIP": "0.0.0.0",
      "HostPort": "5567"
    },
    {
      "HostIp": "::",
      "HostPort": "5567"
    }
  ],
  "SandboxKey": "/var/run/docker/netns/449d2e0985ef",
  "SecondaryIPAddresses": null,
  "SecondaryIPv6Addresses": null,
  "EndpointID": "5991abf591898c93bc03f01c2c2f845801d2a9db515a8bd708ffea136eb339e0",
  "Gateway": "172.17.0.1",
  "GlobalIPv4Address": "",
  "GlobalIPv6Address": "",
  "GlobalIPv6PrefixLen": 0,
  "IPAddress": "172.17.0.2",
  "IPPrefixLen": 16,
  "IPv6Gateway": "::",
  "MacAddress": "02:42:ac:11:00:02",
  "Networks": [
    {
      "bridge": "",
      "IPAMConfig": null,
      "links": null,
      "aliases": null,
      "NetID": "8628652f8c95df9472771dab3f3199c5c7d0e610c9705957594b49c07c2de",
      "EndpointID": "5991abf591898c93bc03f01c2c2f845801d2a9db515a8bd708ffea136eb339e0",
      "Gateway": "172.17.0.1",
      "IPAddress": "172.17.0.2",
      "IPPrefixLen": 16,
      "Links": null,
      "GlobalIPv4Address": "",
      "GlobalIPv6Address": "",
      "GlobalIPv6PrefixLen": 0,
      "MacAddress": "02:42:ac:11:00:02",
      "DriverOpts": null
    }
  ]
}

```

shivrajsinh_bhosal@instance-20250325-205228:~/lab08/frontend\$

VM2: Backend + Elasticsearch

```

ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true&pageViewId=5F6AD005-A038-44D6-9296-53608003620F - Bra...
ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true&pageViewId=5F6AD005-A038-44D6-9296-53608003620F - Bra...
SSH-in-browser
het pathak@instance-20250325-204309:~/lab08$ docker inspect backend
[{"Id": "40911e7bed43833bc8ef1545cb29b16e672b0f15aed6d54a674d7ca5e6ead54", "Created": "2025-03-26T20:33:03.037077891Z", "Path": "uvicorn", "Args": ["main:app", "--host", "0.0.0.0", "--port", "9567"], "State": {"Status": "running", "Running": true, "Paused": false, "Restarting": false, "OOMKilled": false, "Dead": false, "ExitCode": 0, "Error": "", "StartedAt": "2025-03-27T17:01:44.399519206Z", "FinishedAt": "2025-03-27T17:01:03.162849311Z"}, "Image": "sha256:92dee356e9028430583188dd0892e27df253c12c4afaddb53fb00cf3439f0ca", "ResolvConfPath": "/var/lib/docker/containers/40911e7bed43833bc8ef1545cb29b16e672b0f15aed6d54a674d7ca5e6ead54/resolv.conf", "HostnamePath": "/var/lib/docker/containers/40911e7bed43833bc8ef1545cb29b16e672b0f15aed6d54a674d7ca5e6ead54/hostname", "HostPath": "/var/lib/docker/containers/40911e7bed43833bc8ef1545cb29b16e672b0f15aed6d54a674d7ca5e6ead54/hosts", "Name": "/backend", "RestartCount": 0, "Driver": "overlay2", "Platform": "linux", "MountLabel": "", "ProcLabel": "", "AppArmorProfile": "docker-default", "ExecID": null, "HostConfig": {"Binds": null, "ContainerIDFile": "", "LogConfig": {"Type": "json-file", "Config": {}}, "HostConfig": {}}, "Ports": [{"HostPort": 9567}], "NetworkSettings": {"Bridge": "host", "ContainerID": "40911e7bed43833bc8ef1545cb29b16e672b0f15aed6d54a674d7ca5e6ead54", "GlobalIPv4Address": "172.17.0.2", "GlobalIPv6Address": "", "IPAddress": "172.17.0.2", "IPPrefixLen": 16, "Links": null, "MacAddress": "02:42:ac:11:00:02", "Networks": [{"Name": "host", "IP": "172.17.0.1"}]}]

```

het pathak@instance-20250325-204309:~/lab08\$

```
ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true&pageViewId=5F6AD005-A03B-44D6-9296-53608003620F - Bra... — ×
ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true&pageViewId=5F6AD0... ↵ | 🔍 🌐 🌐 🌐 🔍 ↵
SSH-in-browser
SSH-in-browser
"NetworkMode": "lab08-net",
"PortBindings": [
  {
    "HostIp": "",
    "HostPort": "9567"
  }
],
"RestartPolicy": {
  "Name": "no",
  "MaximumRetryCount": 0
},
"AutoRemove": false,
"VolumeDriver": "",
"VolumesFrom": null,
"CapAdd": null,
"CapDrop": null,
"ContainerMode": "host",
"Dns": [],
"DnsOptions": [],
"DnsSearch": [],
"ExtraHosts": null,
"GroupAdd": null,
"IpcMode": "private",
"Links": null,
"OomScoreAdj": 0,
"PidMode": "",
"Privileged": false,
"PublishAllPorts": false,
" ReadonlyRootfs": false,
"SecurityOpt": null,
"UTSMode": "",
"UserNamespace": "",
"ShmSize": 67108864,
"Runtime": "runc",
"ConsoleSize": [
  0,
  0
],
"Isolation": "",
"CpuShares": 0,
"Memory": 0,
"NanoCpus": 0,
"CgroupParent": ""
},
92°F
Smoke
Search
Upload File
Download File
ENG IN 22:36 27-03-2025
```

```
ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true&pageViewId=5F6AD005-A03B-44D6-9296-53608003620F - Bra... — ×
ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true&pageViewId=5F6AD0... ↵ | 🔍 🌐 🌐 🌐 🔍 ↵
SSH-in-browser
SSH-in-browser
"BlkioDeviceReadBps": null,
"BlkioDeviceWriteBps": null,
"BlkioDeviceReadIOPS": null,
"BlkioDeviceWriteIOPS": null,
"CpuPeriod": 0,
"CpuQuota": 0,
"CpuRealtimePeriod": 0,
"CpuRealtimeRuntime": 0,
"CpusetCpus": "",
"CpusetMems": "",
"Device": [],
"DeviceCgroupRules": null,
"DeviceRequests": null,
"KernelMemory": 0,
"KernelMemoryTCP": 0,
"MemoryReservation": 0,
"MemorySwap": 0,
"MemorySwappiness": null,
"OomKillDisable": false,
"PidSlice": null,
"Ulimits": null,
"CpuCount": 0,
"CpuPercent": 0,
"IOMaximumIOPS": 0,
"IOMaximumBandwidth": 0,
"MountPaths": [
  "/proc/asound",
  "/proc/acpi",
  "/proc/kcore",
  "/proc/keys",
  "/proc/latency_stats",
  "/proc/timer_list",
  "/proc/timer_stats",
  "/proc/sched_debug",
  "/proc/scsi",
  "/sys/firmware"
],
" ReadonlyPaths": [
  "/proc/bus",
  "/proc/fs",
  "/proc/irq",
  "/proc/sys",
  "/proc/syrq-trigger"
],
"GraphDriver": [
  {
    "Name": "loopback"
  }
]
},
92°F
Smoke
Search
Upload File
Download File
ENG IN 22:37 27-03-2025
```

ssh.cloud.google.com/v2/ssh/projects/stta1-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true&pageViewId=5f6AD005-A03B-44D6-9296-53608003620F - Bra...
ssh.cloud.google.com/v2/ssh/projects/stta1-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true&pageViewId=5f6AD0...     

SSH-in-browser

NetworkSettings: {
 "Bridge": "",
 "SandboxID": "4ad00149ff2e",
 "HairpinMode": false,
 "LinkLocalIPv6Address": "",
 "LinkLocalIPv6Prefixlen": 0,
 "Ports": [
 "9567/tcp": [
 {
 "HostIp": "0.0.0.0",
 "HostPort": "9567"
 },
 {
 "HostIp": "::",
 "HostPort": "9567"
 }
]
,
 "SandboxKey": "/var/run/docker/netns/4ad00149ff2e",
 "SecondaryIPAddresses": null,
 "SecondaryIPv6Addresses": null,
 "EndpointID": "",
 "Gateway": "",
 "GlobalIPv6Address": "",
 "GlobalIPv6Prefixlen": 0,
 "IPAddress": "",
 "IPPrefixlen": 0,
 "IPv6Gateway": "",
 "MacAddress": "",
 "Networking": {
 "lab00-net": {
 "IPAMConfig": null,
 "Links": null,
 "Aliases": [
 "40911e7bed43"
],
 "NetworkID": "fe80:fe80:fe80::2e10:08ee:1d72e575ecb00d6b42c3d4a5c180403dd170b153ca9",
 "EndpointID": "ba46d39c19beabc63a352873e079cd0d4426dbe76b8469cc9de710dabb5c2",
 "Gateway": "172.18.0.1",
 "IPAddress": "172.18.0.2",
 "IPPrefixlen": 16,
 "IPV6Gateway": "",
 "GlobalIPv6Address": "",
 "GlobalIPv6Prefixlen": 0,
 "MacAddress": "02:42:ac:12:00:02",
 "DriverOpts": null
 }
 }
}

 82°F  Smoke  Search          ENG IN   22:37 27-03-2025

```

{
  "Ports": [
    {
      "9567/tcp": [
        {
          "HostIp": "0.0.0.0",
          "HostPort": "9567"
        },
        {
          "HostIp": "::",
          "HostPort": "9567"
        }
      ]
    }
  ],
  "SandboxKey": "/var/run/docker/netns/4ad00149ff2e",
  "SecondaryIPv6Addresses": null,
  "SecondaryIPv6Addressess": null,
  "EndpointID": "",
  "Gateway": "",
  "GlobalIPv6Address": "",
  "GlobalIPv6Prefixlen": 0,
  "IP4Address": "",
  "IP4Prefixlen": 0,
  "IP6Address": "",
  "IP6Prefixlen": 0,
  "IP6Gateway": "",
  "MacAddress": "",
  "Networks": [
    {
      "lab03-net": {
        "IP4config": null,
        "links": null,
        "Aliases": [
          "40911e7bed43"
        ],
        "NetworkID": "ff800fe9a2e1010ee1d727e575ecb00d6b42c3d4a5c5180403dd170b153ca9",
        "EndpointID": "8a46ad39c19beabc63a352873e079cd0d44246dbe76b8469cc39de710dabb5c2",
        "Gateway": "172.18.0.1",
        "IP4Address": "172.18.0.2",
        "IP4Prefixlen": 16,
        "IP6Gateway": "",
        "GlobalIPv6Address": "",
        "GlobalIPv6Prefixlen": 0,
        "MacAddress": "02:42:ac:12:00:02",
        "DriverOpts": null
      }
    }
  ]
}

```

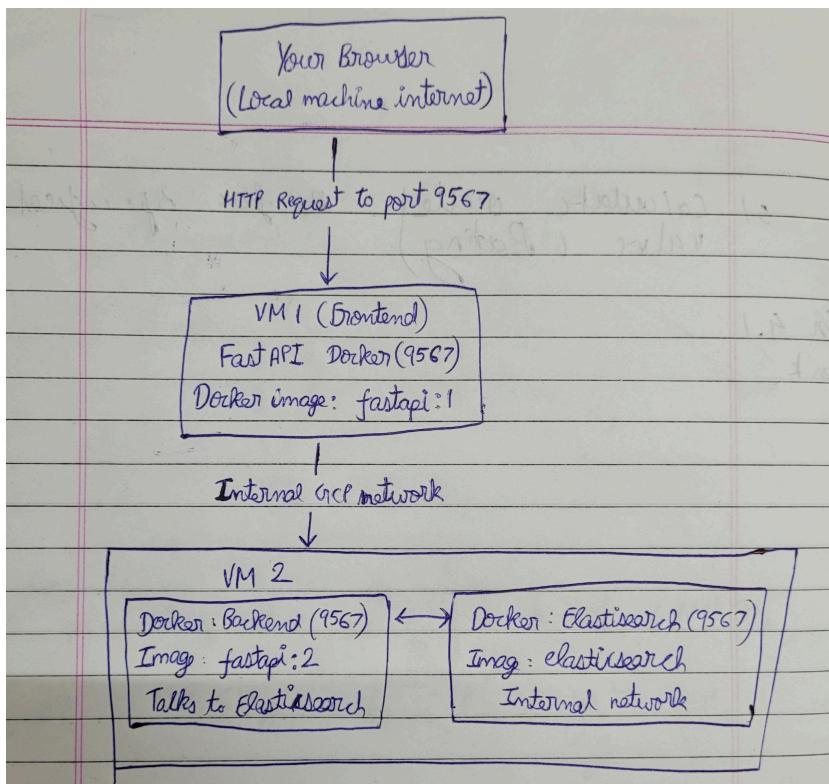
het_pathak@instance-20250325-204309:~/lab08\$

82°F Smoke

Search

ENG IN 22:37 27-03-2025

- VM creation steps are taken, and screenshots are on Google Cloud (Start of the doc)
- Give a detailed architectural diagram.



Uploading to Docker Hub

```
ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-205228?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true - IIT Gandhinagar - Microsoft Edge
https://ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-205228?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true
SSH-in-browser
ker.com to create one.
Username: shivrajsinh
Password:
WARNING! Your password will be stored unencrypted in /home/shivrajsinh_bhosale/.docker/config.json.
Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
shivrajsinh_bhosale@instance-20250325-205228:~$ docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
fastapi 1 22754c1e3740 20 hours ago 200MB
<none> <none> 7e063fabe0f1 21 hours ago 200MB
python 3.10-slim 643092d2b296 3 months ago 127MB
shivrajsinh_bhosale@instance-20250325-205228:~$ docker tag fastapi:1
"docker tag" requires exactly 2 arguments.
See 'docker tag --help'.

Usage: docker tag SOURCE_IMAGE[:TAG] TARGET_IMAGE[:TAG]

Create a tag TARGET IMAGE that refers to SOURCE IMAGE
shivrajsinh_bhosale@instance-20250325-205228:~$ docker tag fastapi:1 shivrajsinh/fastapi-frontend:1
shivrajsinh_bhosale@instance-20250325-205228:~$ docker push shivrajsinh/fastapi-frontend:1
The push refers to repository [docker.io/shivrajsinh/fastapi-frontend]
fa6fc249276f: Pushed
32ae15605408: Pushed
b93387a8535f: Pushed
6ada3f409cd7: Mounted from library/python
5elf050c2155: Mounted from library/python
cb7d55d6aea4: Mounted from library/python
1287fbecdfcc: Mounted from library/python
1: digest: sha256:943ae1ef133ce9178d29aad2fc64eb585ed45b51125ef060bad8a3e7e6bf7232 size: 1784
shivrajsinh_bhosale@instance-20250325-205228:~$ 
```

```
ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true - Brave
ssh.cloud.google.com/v2/ssh/projects/sttai-het-shivraj/zones/us-central1-a/instances/instance-20250325-204309?authuser=0&hl=en_US&projectNumber=656667028286&useAdminProxy=true
SSH-in-browser
het pathak@instance-20250325-204309:~$ docker login
Login with your Docker ID to push and pull images from Docker Hub. If you don't have a Docker ID, head over to https://hub.docker.com to create one.
Username: hetpathak
Password:
WARNING! Your password will be stored unencrypted in /home/het_pathak/.docker/config.json.
Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
het pathak@instance-20250325-204309:~$ docker tag fastapi:2 hetpathak/fastapi-backend:2
het pathak@instance-20250325-204309:~$ docker tag elasticsearch hetpathak/elasticsearch:latest
Error response from daemon: No such image: elasticsearch:latest
het pathak@instance-20250325-204309:~$ c
het pathak@instance-20250325-204309:~$ docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
fastapi 2 92dee356e90 21 hours ago 200MB
hetpathak/fastapi-backend 2 92dee356e90 21 hours ago 200MB
elasticsearch latest 1de4f44444 21 hours ago 6523MB
python 3.10-slim 643092d2b296 3 months ago 127MB
docker.elastic.co/elasticsearch/elasticsearch 7.17.13 5e553187282 19 months ago 61MB
het pathak@instance-20250325-204309:~$ c
het pathak@instance-20250325-204309:~$ docker tag elasticsearch:lab0 hetpathak/elasticsearch:latest
het pathak@instance-20250325-204309:~$ docker push hetpathak/fastapi-backend:2
The push refers to repository [docker.io/hetpathak/fastapi-backend]
6e54ef0bf3e8: Pushed
57005555954f: Pushed
814346a10111: Pushed
Gada3f409cd7: Mounted from library/python
5elf050c2155: Mounted from library/python
cb7d55d6aea4: Mounted from library/python
1287fbecdfcc: Mounted from library/python
2: digest: sha256:1a4549e3a70be8e4497b96a9f504e763ea19fe2163bbc102c76a20753450392 size: 1784
het pathak@instance-20250325-204309:~$ docker push hetpathak/elasticsearch:latest
The push refers to repository [docker.io/hetpathak/elasticsearch]
3b30655955ef: Pushed
9a0ed1150d6f: Pushed
a66115944b45: Pushed
2e59d1607699: Pushed
ca50e97381c28: Pushed
ee225b570f32: Pushed
5f70bf1ba066: Pushed
c22d217a0846: Pushed
287139593444: Pushed
954c82d8eb5f: Pushed
latest: digest: sha256:46a2228814bad38a7ade9521c444a2cddb81df593552ade1bbdf0c007b118b5b size: 2411
het pathak@instance-20250325-204309:~$ 
```

Optimization

We used `python:3.10-slim` as the base image to reduce size. Only necessary libraries (`fastapi`, `requests`) were installed. Dockerfiles were kept minimal with proper `EXPOSE` and `CMD`. Elasticsearch used a named volume to persist data. Containers start quickly and images are lightweight.