Report to homework 3 – “*Microservices using Hazelcast Distributed Map*”

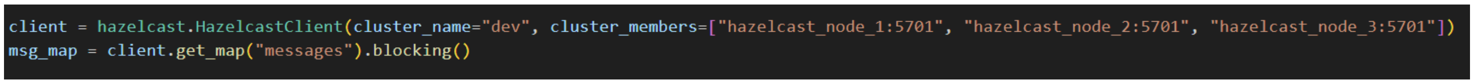
Part 1:

- 3 instances of the logging_service are connecting to their nodes of the Hazelcast cluster (in my case, the “dev” cluster)
- If logging_service fails – the node is disconnecting; if logging_service restarts – the node restarts as well
- facade_service randomly chooses logging_service and writes a message to the distributed map. If logging_service is unavailable – choose another one

Implementation:

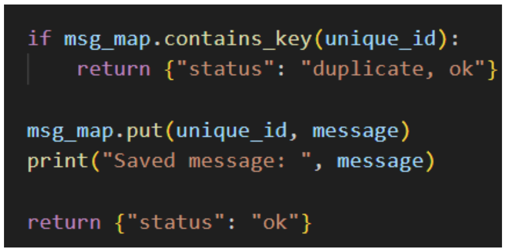
I used a *docker-compose* to run the services. It is easier for me to manage the whole system this way. I am starting 3 logging_service services with names: *logging_service_1, logging_service_2, logging_service_3*. Using these names, all services will communicate with each other.
For each *logging_service_#,* we should have a node from the hazelcast. They depend on the logging_service_# (if this server runs, the node should also be running). Hazelcast is using port 5701.

In the *logging_service,* I added usage of the hazelcast distributed map:



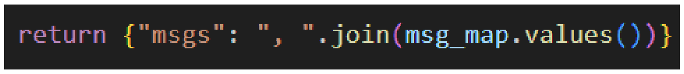
```
client = hazelcast.HazelcastClient(cluster_name="dev", cluster_members=["hazelcast_node_1:5701", "hazelcast_node_2:5701", "hazelcast_node_3:5701"])
msg_map = client.get_map("messages").blocking()
```

“.../fetching_message” saves messages to the distributed map, i.e.:



```
if msg_map.contains_key(unique_id):
    return {"status": "duplicate, ok"}

msg_map.put(unique_id, message)
print("Saved message: ", message)

return {"status": "ok"}
```

“.../get_fetched_messages” returns all messages from the distributed map, i.e.:

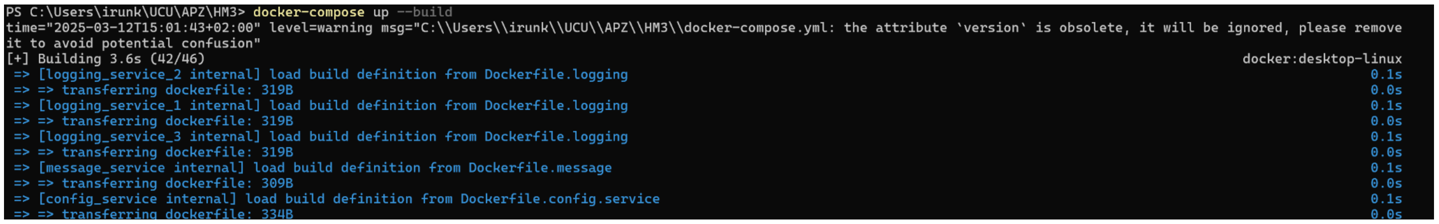


```
return {"msgs": ", ".join(msg_map.values())}
```

If this service stops, it stops, and the node has to be restarted, so it was decided to use a *.sh* file that monitors events.

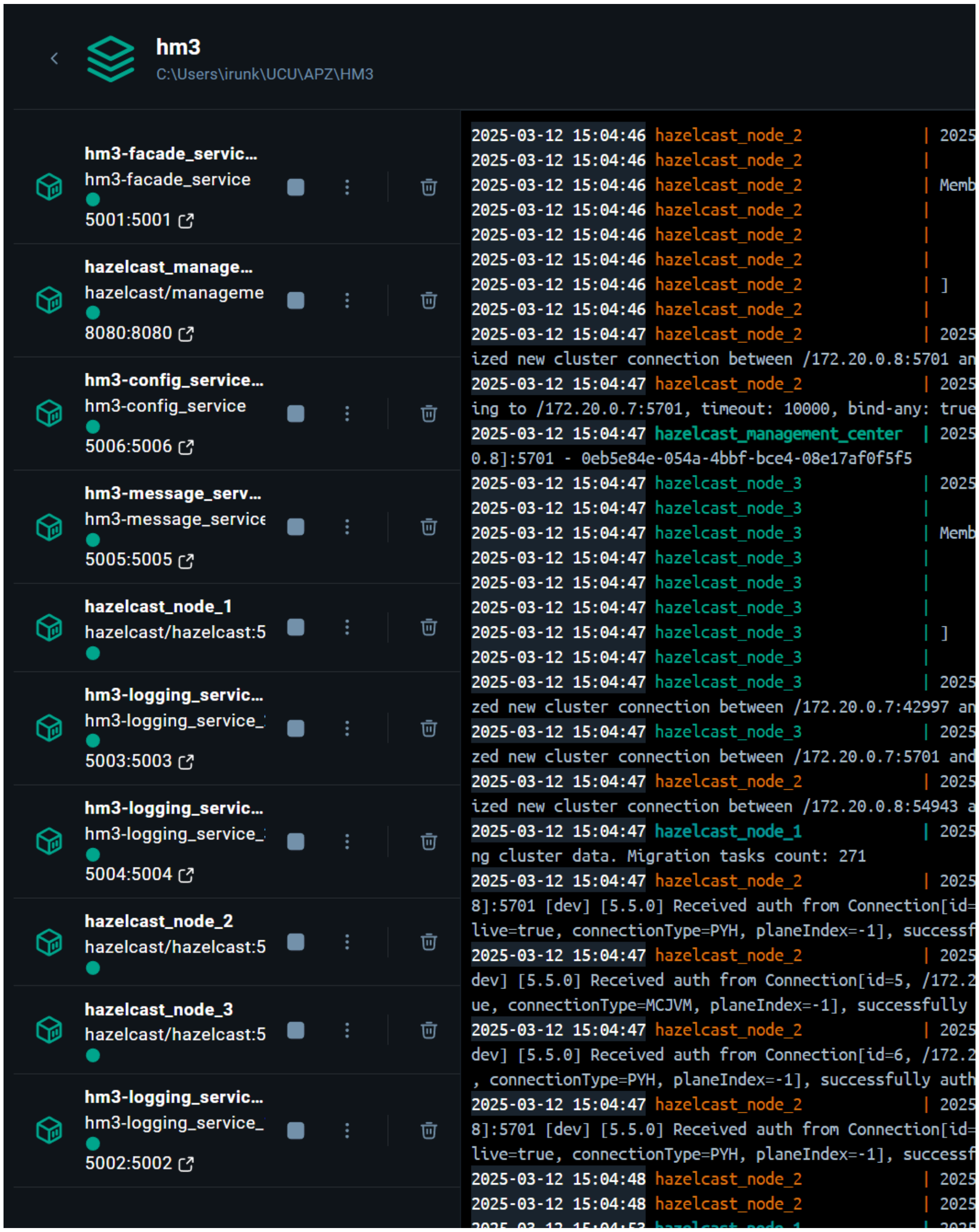
Tests:

I used commands to run the docker-compose:



```
PS C:\Users\irunk\UCU\APZ\HM3> docker-compose up --build
time="2025-03-12T15:01:43+02:00" level=warning msg="C:\\Users\\irunk\\UCU\\APZ\\HM3\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored, please remove
it to avoid potential confusion"
[+] Building 3.6s (42/46)                                                                                                    docker:desktop-linux
 => [logging_service_2 internal] load build definition from Dockerfile.logging                                                               0.1s
 => => transferring dockerfile: 319B                                                                                                         0.0s
 => [logging_service_1 internal] load build definition from Dockerfile.logging                                                               0.1s
 => => transferring dockerfile: 319B                                                                                                         0.0s
 => [logging_service_3 internal] load build definition from Dockerfile.logging                                                               0.1s
 => => transferring dockerfile: 319B                                                                                                         0.0s
 => [message_service internal] load build definition from Dockerfile.message                                                                 0.1s
 => => transferring dockerfile: 309B                                                                                                         0.0s
 => [config_service internal] load build definition from Dockerfile.config.service                                                           0.1s
 => => transferring dockerfile: 334B                                                                                                         0.0s
```

Result (all container running):

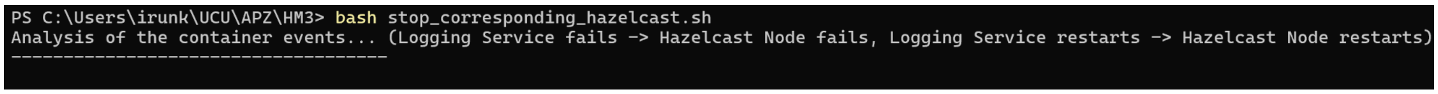


hm3
C:\Users\irunk\UCU\APZ\HM3

```
hm3-facade_servic...      hm3-facade_service         5001:5001
hazelcast_manage...       hazelcast/manageme         8080:8080
hm3-config_service...     hm3-config_service         5006:5006
hm3-message_serv...       hm3-message_service        5005:5005
hazelcast_node_1          hazelcast/hazelcast:5
hm3-logging_servic...     hm3-logging_service_       5003:5003
hm3-logging_servic...     hm3-logging_service_       5004:5004
hazelcast_node_2          hazelcast/hazelcast:5
hazelcast_node_3          hazelcast/hazelcast:5
hm3-logging_servic...     hm3-logging_service_       5002:5002
```

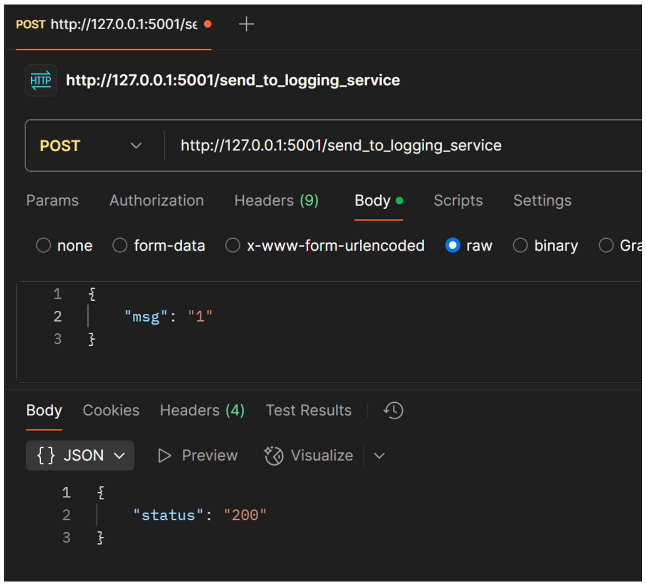
```
2025-03-12 15:04:46 hazelcast_node_2           | 2025
2025-03-12 15:04:46 hazelcast_node_2           |
2025-03-12 15:04:46 hazelcast_node_2           | Memb
2025-03-12 15:04:46 hazelcast_node_2           |
2025-03-12 15:04:46 hazelcast_node_2           |
2025-03-12 15:04:46 hazelcast_node_2           |
2025-03-12 15:04:46 hazelcast_node_2           | ]
2025-03-12 15:04:46 hazelcast_node_2           |
2025-03-12 15:04:47 hazelcast_node_2           | 2025
ized new cluster connection between /172.20.0.8:5701 an
2025-03-12 15:04:47 hazelcast_node_2           | 2025
ing to /172.20.0.7:5701, timeout: 10000, bind-any: true
2025-03-12 15:04:47 hazelcast_management_center | 2025
0.8]:5701 - 0eb5e84e-054a-4bbf-bce4-08e17af0f5f5
2025-03-12 15:04:47 hazelcast_node_3           | 2025
2025-03-12 15:04:47 hazelcast_node_3           |
2025-03-12 15:04:47 hazelcast_node_3           | Memb
2025-03-12 15:04:47 hazelcast_node_3           |
2025-03-12 15:04:47 hazelcast_node_3           |
2025-03-12 15:04:47 hazelcast_node_3           |
2025-03-12 15:04:47 hazelcast_node_3           | ]
2025-03-12 15:04:47 hazelcast_node_3           |
2025-03-12 15:04:47 hazelcast_node_3           | 2025
zed new cluster connection between /172.20.0.7:42997 an
2025-03-12 15:04:47 hazelcast_node_3           | 2025
zed new cluster connection between /172.20.0.7:5701 and
2025-03-12 15:04:47 hazelcast_node_2           | 2025
ized new cluster connection between /172.20.0.8:54943 a
2025-03-12 15:04:47 hazelcast_node_1           | 2025
ng cluster data. Migration tasks count: 271
2025-03-12 15:04:47 hazelcast_node_2           | 2025
8]:5701 [dev] [5.5.0] Received auth from Connection[id=
live=true, connectionType=PYH, planeIndex=-1], successf
2025-03-12 15:04:47 hazelcast_node_2           | 2025
dev] [5.5.0] Received auth from Connection[id=5, /172.2
ue, connectionType=MCJVM, planeIndex=-1], successfully
2025-03-12 15:04:47 hazelcast_node_2           | 2025
dev] [5.5.0] Received auth from Connection[id=6, /172.2
, connectionType=PYH, planeIndex=-1], successfully auth
2025-03-12 15:04:47 hazelcast_node_2           | 2025
8]:5701 [dev] [5.5.0] Received auth from Connection[id=
live=true, connectionType=PYH, planeIndex=-1], successf
2025-03-12 15:04:48 hazelcast_node_2           | 2025
2025-03-12 15:04:48 hazelcast_node_2           | 2025
```

Also started a bash file:



```
PS C:\Users\irunk\UCU\APZ\HM3> bash stop_corresponding_hazelcast.sh
Analysis of the container events... (Logging Service fails -> Hazelcast Node fails, Logging Service restarts -> Hazelcast Node restarts)
------------------------------------
```

I submitted 10 messages using *Postman*:



POST http://127.0.0.1:5001/send_to_logging_service

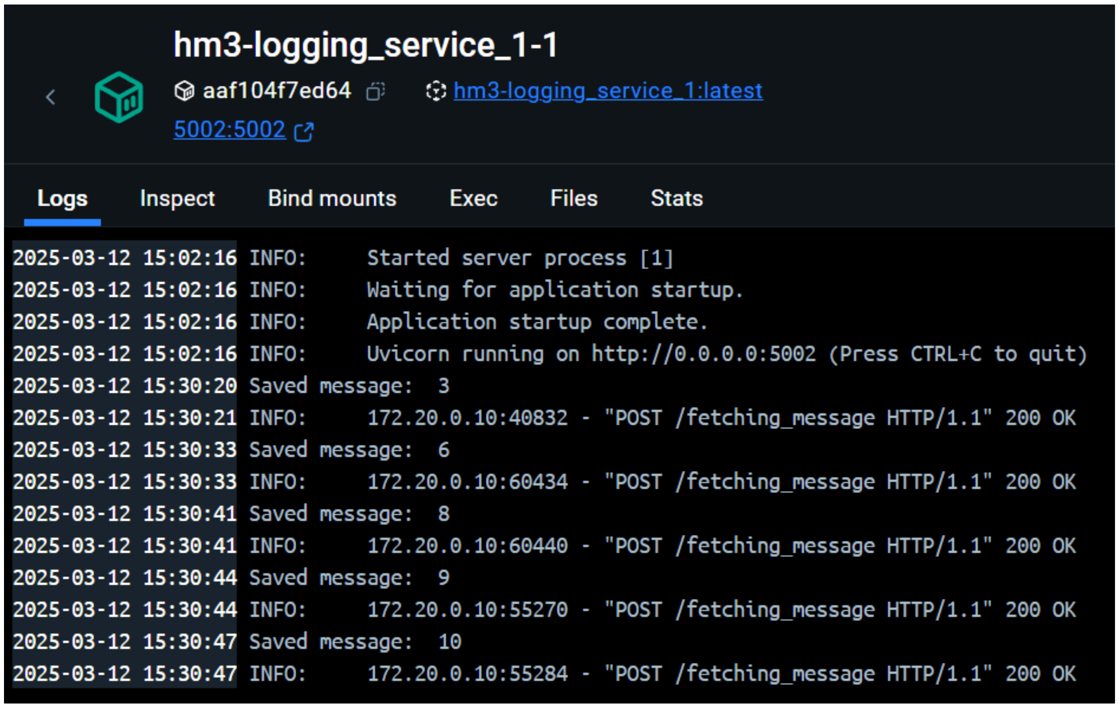
Body: raw

```
{
    "msg": "1"
}
```

Response Body (JSON):

```
{
    "status": "200"
}
```

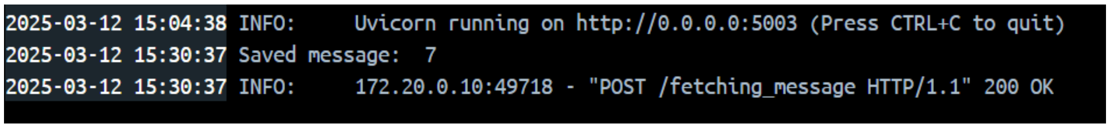
We can take a look into logs to understand which *logging_service_#* was used to write down a message (because they are chosen randomly):



hm3-logging_service_1-1
aaf104f7ed64 hm3-logging_service_1:latest
5002:5002

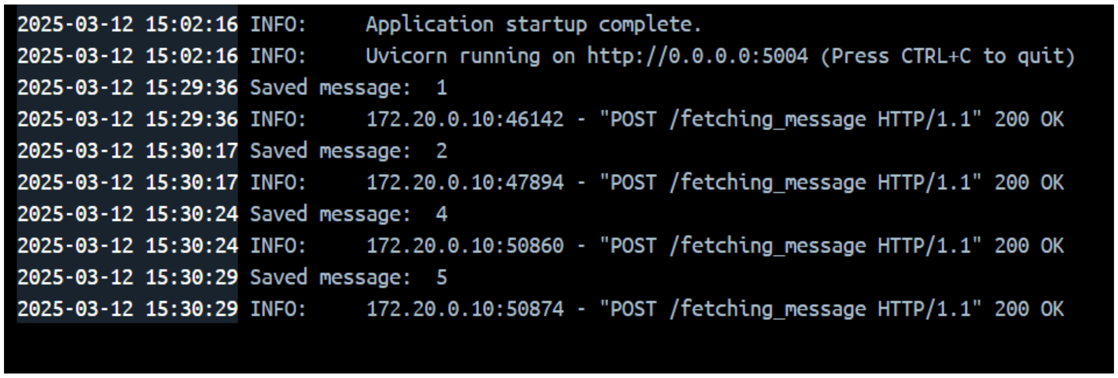
```
2025-03-12 15:02:16 INFO:     Started server process [1]
2025-03-12 15:02:16 INFO:     Waiting for application startup.
2025-03-12 15:02:16 INFO:     Application startup complete.
2025-03-12 15:02:16 INFO:     Uvicorn running on http://0.0.0.0:5002 (Press CTRL+C to quit)
2025-03-12 15:30:20 Saved message:  3
2025-03-12 15:30:21 INFO:     172.20.0.10:40832 - "POST /fetching_message HTTP/1.1" 200 OK
2025-03-12 15:30:33 Saved message:  6
2025-03-12 15:30:33 INFO:     172.20.0.10:60434 - "POST /fetching_message HTTP/1.1" 200 OK
2025-03-12 15:30:41 Saved message:  8
2025-03-12 15:30:41 INFO:     172.20.0.10:60440 - "POST /fetching_message HTTP/1.1" 200 OK
2025-03-12 15:30:44 Saved message:  9
2025-03-12 15:30:44 INFO:     172.20.0.10:55270 - "POST /fetching_message HTTP/1.1" 200 OK
2025-03-12 15:30:47 Saved message:  10
2025-03-12 15:30:47 INFO:     172.20.0.10:55284 - "POST /fetching_message HTTP/1.1" 200 OK
```

(For the second service)



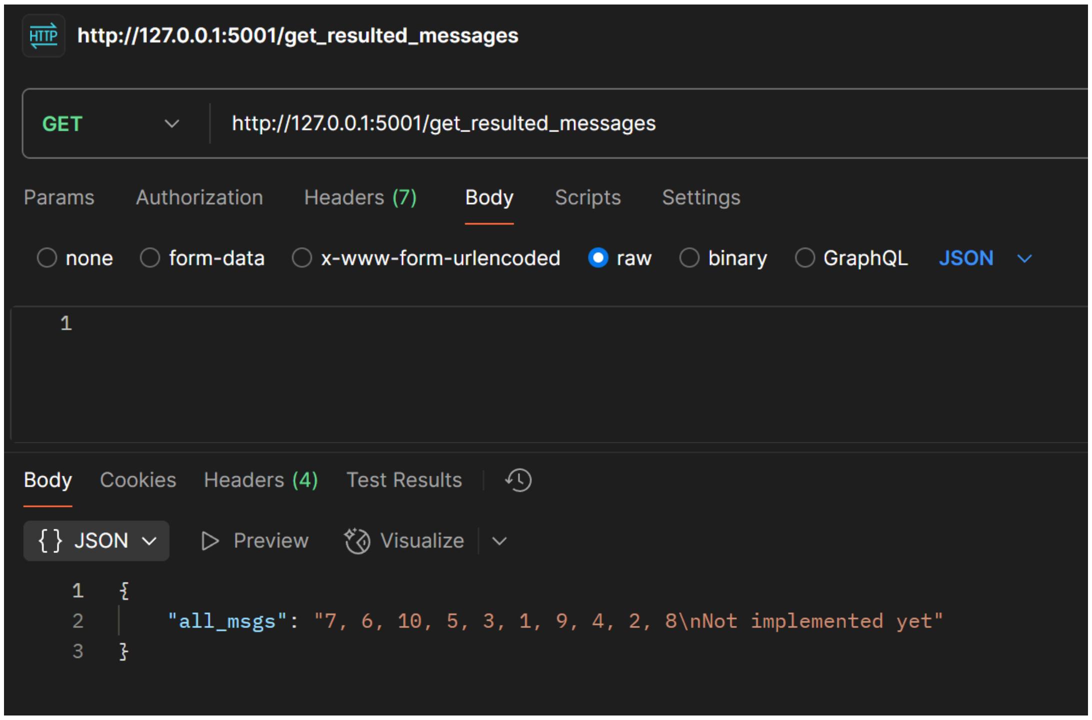
```
2025-03-12 15:04:38 INFO:     Uvicorn running on http://0.0.0.0:5003 (Press CTRL+C to quit)
2025-03-12 15:30:37 Saved message:  7
2025-03-12 15:30:37 INFO:     172.20.0.10:49718 - "POST /fetching_message HTTP/1.1" 200 OK
```

(For the third service)



```
2025-03-12 15:02:16 INFO:     Application startup complete.
2025-03-12 15:02:16 INFO:     Uvicorn running on http://0.0.0.0:5004 (Press CTRL+C to quit)
2025-03-12 15:29:36 Saved message:  1
2025-03-12 15:29:36 INFO:     172.20.0.10:46142 - "POST /fetching_message HTTP/1.1" 200 OK
2025-03-12 15:30:17 Saved message:  2
2025-03-12 15:30:17 INFO:     172.20.0.10:47894 - "POST /fetching_message HTTP/1.1" 200 OK
2025-03-12 15:30:24 Saved message:  4
2025-03-12 15:30:24 INFO:     172.20.0.10:50860 - "POST /fetching_message HTTP/1.1" 200 OK
2025-03-12 15:30:29 Saved message:  5
2025-03-12 15:30:29 INFO:     172.20.0.10:50874 - "POST /fetching_message HTTP/1.1" 200 OK
```

We can try to get all messages (use GET) to understand if all of them are in the map:



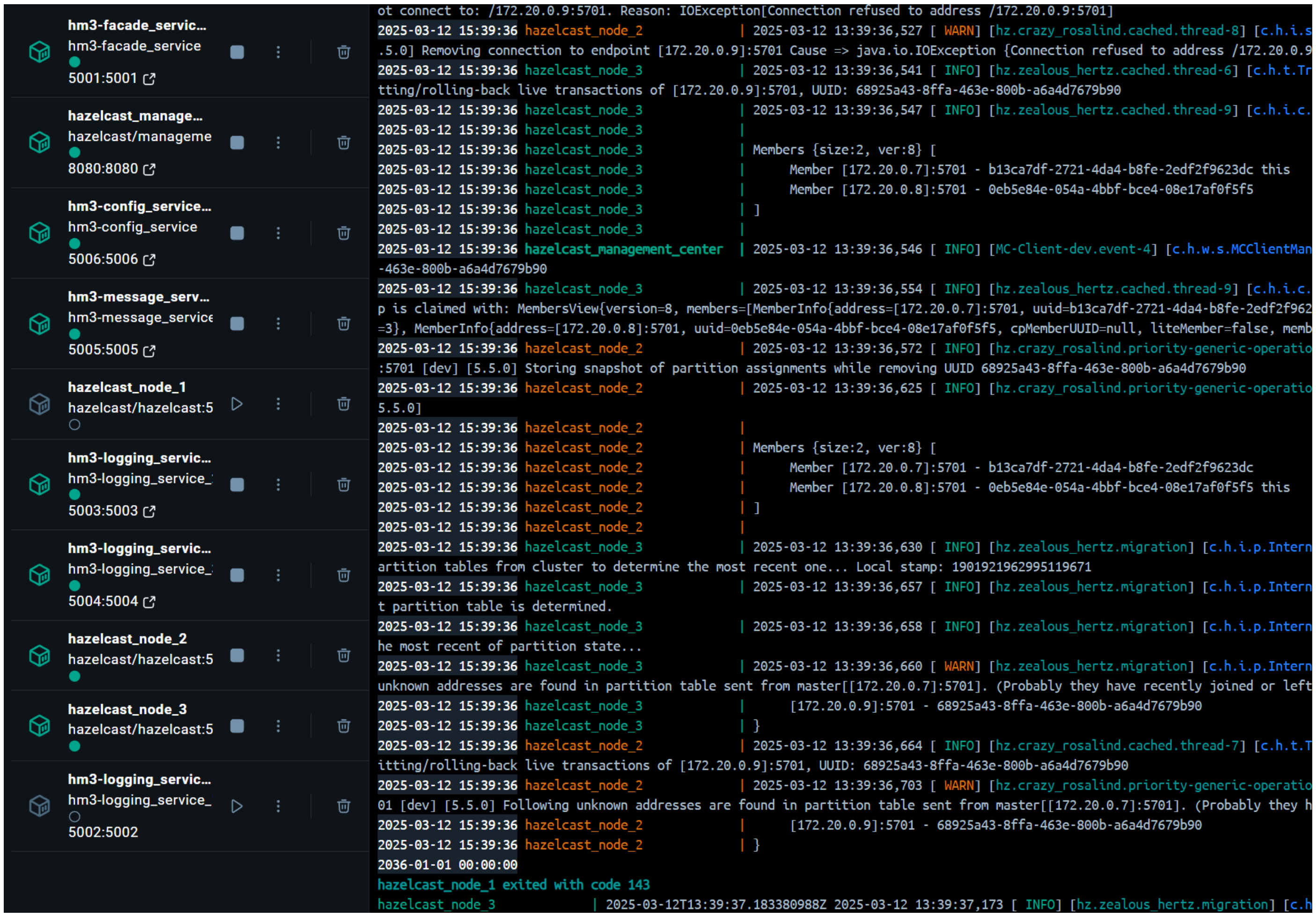
http://127.0.0.1:5001/get_resulted_messages

GET http://127.0.0.1:5001/get_resulted_messages

```
{
    "all_msgs": "7, 6, 10, 5, 3, 1, 9, 4, 2, 8\nNot implemented yet"
}
```

As we can see, all messages are saved.

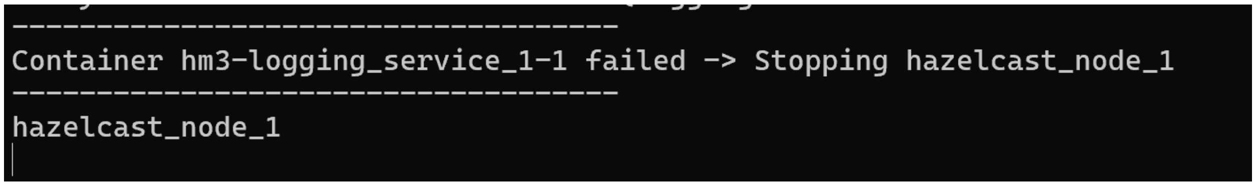
We can try to disconnect one *logging_service_#*:



```
hm3-facade_servic...
hm3-facade_service
5001:5001

hazelcast_manage...
hazelcast/manageme
8080:8080

hm3-config_service...
hm3-config_service
5006:5006

hm3-message_serv...
hm3-message_service
5005:5005

hazelcast_node_1
hazelcast/hazelcast:5

hm3-logging_servic...
hm3-logging_service_
5003:5003

hm3-logging_servic...
hm3-logging_service_
5004:5004

hazelcast_node_2
hazelcast/hazelcast:5

hazelcast_node_3
hazelcast/hazelcast:5

hm3-logging_servic...
hm3-logging_service_
5002:5002
```

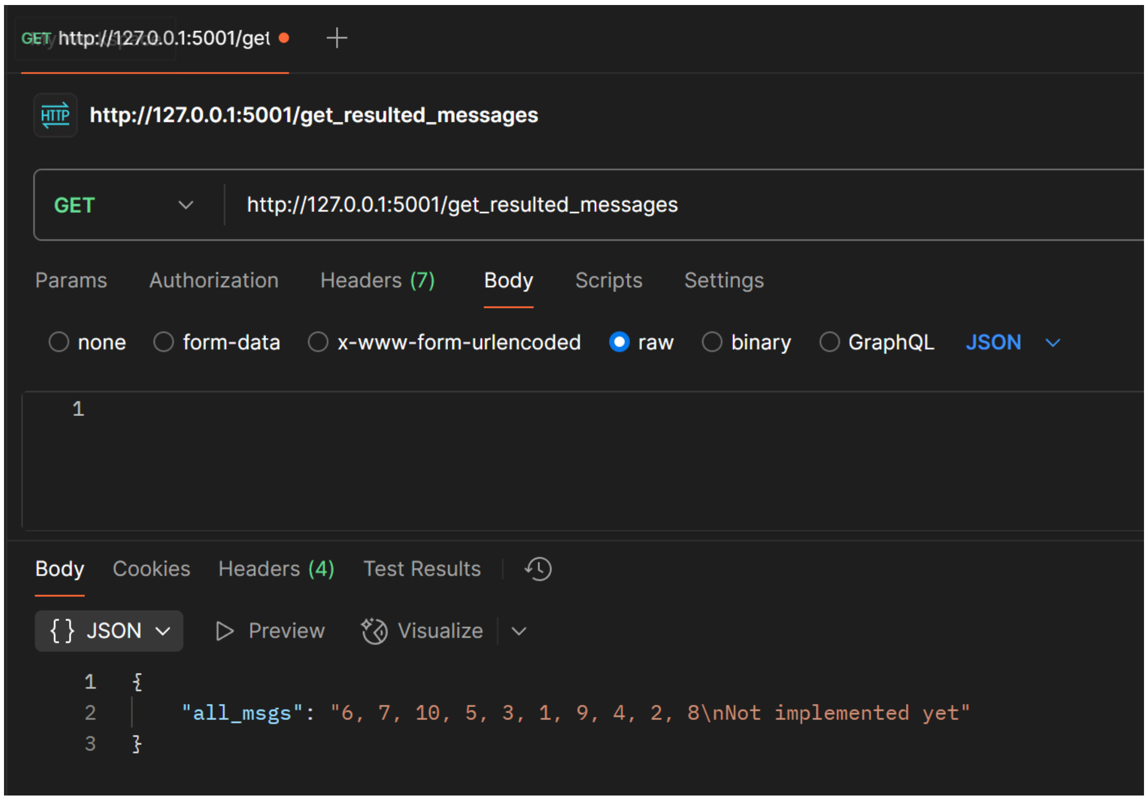
```
ot connect to: /172.20.0.9:5701. Reason: IOException[Connection refused to address /172.20.0.9:5701]
2025-03-12 15:39:36 hazelcast_node_2            | 2025-03-12 13:39:36,527 [ WARN] [hz.crazy_rosalind.cached.thread-8] [c.h.i.s
.5.0] Removing connection to endpoint [172.20.0.9]:5701 Cause => java.io.IOException {Connection refused to address /172.20.0.9
2025-03-12 15:39:36 hazelcast_node_3            | 2025-03-12 13:39:36,541 [ INFO] [hz.zealous_hertz.cached.thread-6] [c.h.t.Tr
tting/rolling-back live transactions of [172.20.0.9]:5701, UUID: 68925a43-8ffa-463e-800b-a6a4d7679b90
2025-03-12 15:39:36 hazelcast_node_3            | 2025-03-12 13:39:36,547 [ INFO] [hz.zealous_hertz.cached.thread-9] [c.h.i.c.
2025-03-12 15:39:36 hazelcast_node_3            |
2025-03-12 15:39:36 hazelcast_node_3            | Members {size:2, ver:8} [
2025-03-12 15:39:36 hazelcast_node_3            |       Member [172.20.0.7]:5701 - b13ca7df-2721-4da4-b8fe-2edf2f9623dc this
2025-03-12 15:39:36 hazelcast_node_3            |       Member [172.20.0.8]:5701 - 0eb5e84e-054a-4bbf-bce4-08e17af0f5f5
2025-03-12 15:39:36 hazelcast_node_3            | ]
2025-03-12 15:39:36 hazelcast_node_3            |
2025-03-12 15:39:36 hazelcast_management_center | 2025-03-12 13:39:36,546 [ INFO] [MC-Client-dev.event-4] [c.h.w.s.MCClientMan
-463e-800b-a6a4d7679b90
2025-03-12 15:39:36 hazelcast_node_3            | 2025-03-12 13:39:36,554 [ INFO] [hz.zealous_hertz.cached.thread-9] [c.h.i.c.
p is claimed with: MembersView{version=8, members=[MemberInfo{address=[172.20.0.7]:5701, uuid=b13ca7df-2721-4da4-b8fe-2edf2f962
=3}, MemberInfo{address=[172.20.0.8]:5701, uuid=0eb5e84e-054a-4bbf-bce4-08e17af0f5f5, cpMemberUUID=null, liteMember=false, memb
2025-03-12 15:39:36 hazelcast_node_2            | 2025-03-12 13:39:36,572 [ INFO] [hz.crazy_rosalind.priority-generic-operatio
:5701 [dev] [5.5.0] Storing snapshot of partition assignments while removing UUID 68925a43-8ffa-463e-800b-a6a4d7679b90
2025-03-12 15:39:36 hazelcast_node_2            | 2025-03-12 13:39:36,625 [ INFO] [hz.crazy_rosalind.priority-generic-operatio
5.5.0]
2025-03-12 15:39:36 hazelcast_node_2            |
2025-03-12 15:39:36 hazelcast_node_2            | Members {size:2, ver:8} [
2025-03-12 15:39:36 hazelcast_node_2            |       Member [172.20.0.7]:5701 - b13ca7df-2721-4da4-b8fe-2edf2f9623dc
2025-03-12 15:39:36 hazelcast_node_2            |       Member [172.20.0.8]:5701 - 0eb5e84e-054a-4bbf-bce4-08e17af0f5f5 this
2025-03-12 15:39:36 hazelcast_node_2            | ]
2025-03-12 15:39:36 hazelcast_node_2            |
2025-03-12 15:39:36 hazelcast_node_3            | 2025-03-12 13:39:36,630 [ INFO] [hz.zealous_hertz.migration] [c.h.i.p.Intern
artition tables from cluster to determine the most recent one... Local stamp: 1901921962995119671
2025-03-12 15:39:36 hazelcast_node_3            | 2025-03-12 13:39:36,657 [ INFO] [hz.zealous_hertz.migration] [c.h.i.p.Intern
t partition table is determined.
2025-03-12 15:39:36 hazelcast_node_3            | 2025-03-12 13:39:36,658 [ INFO] [hz.zealous_hertz.migration] [c.h.i.p.Intern
he most recent of partition state...
2025-03-12 15:39:36 hazelcast_node_3            | 2025-03-12 13:39:36,660 [ WARN] [hz.zealous_hertz.migration] [c.h.i.p.Intern
unknown addresses are found in partition table sent from master[[172.20.0.7]:5701]. (Probably they have recently joined or left
2025-03-12 15:39:36 hazelcast_node_3            |       [172.20.0.9]:5701 - 68925a43-8ffa-463e-800b-a6a4d7679b90
2025-03-12 15:39:36 hazelcast_node_3            | }
2025-03-12 15:39:36 hazelcast_node_2            | 2025-03-12 13:39:36,664 [ INFO] [hz.crazy_rosalind.cached.thread-7] [c.h.t.T
itting/rolling-back live transactions of [172.20.0.9]:5701, UUID: 68925a43-8ffa-463e-800b-a6a4d7679b90
2025-03-12 15:39:36 hazelcast_node_2            | 2025-03-12 13:39:36,703 [ WARN] [hz.crazy_rosalind.priority-generic-operatio
01 [dev] [5.5.0] Following unknown addresses are found in partition table sent from master[[172.20.0.7]:5701]. (Probably they h
2025-03-12 15:39:36 hazelcast_node_2            |       [172.20.0.9]:5701 - 68925a43-8ffa-463e-800b-a6a4d7679b90
2025-03-12 15:39:36 hazelcast_node_2            | }
2036-01-01 00:00:00
hazelcast_node_1 exited with code 143
hazelcast_node_3            | 2025-03-12T13:39:37.183380988Z 2025-03-12 13:39:37,173 [ INFO] [hz.zealous_hertz.migration] [c.h
```

I stopped the first container of this service, and the node was automatically disconnected (from the logs, you can see two members in the cluster after that).



```
-----------------------------------
Container hm3-logging_service_1-1 failed -> Stopping hazelcast_node_1
-----------------------------------
hazelcast_node_1
```

I also checked what happened with the data in the map:



GET http://127.0.0.1:5001/get_resulted_messages

Body: raw [✓ raw] JSON

```
{
    "all_msgs": "6, 7, 10, 5, 3, 1, 9, 4, 2, 8\nNot implemented yet"
}
```

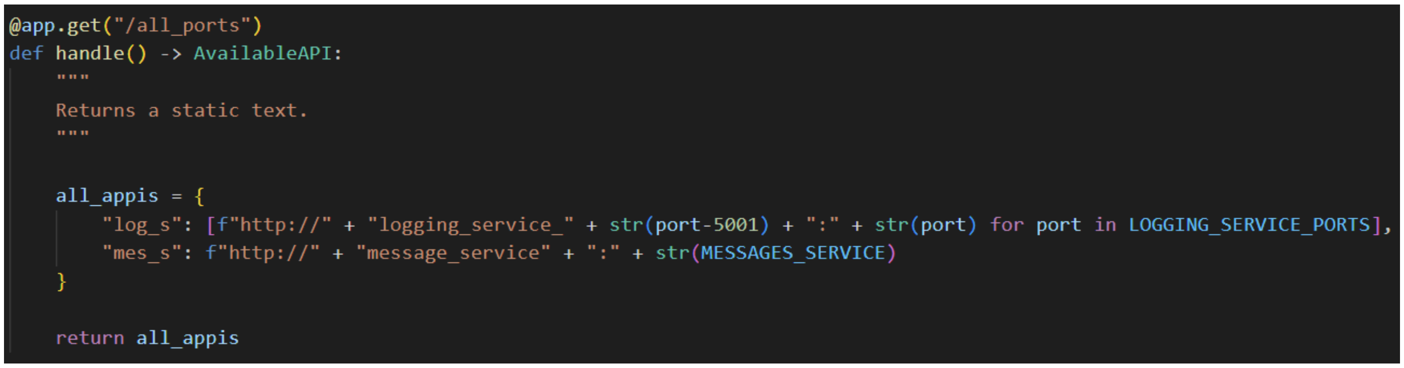
As it can be seen, all the data remained the same, i.e., in the map it just regrouped.

Part 2:

- Create a config file with all available ports
- *facade_service* should make a request to the *config_service*, which returns *urls* to all available ports
- *facade_service* randomly chooses a port and tries to send a message

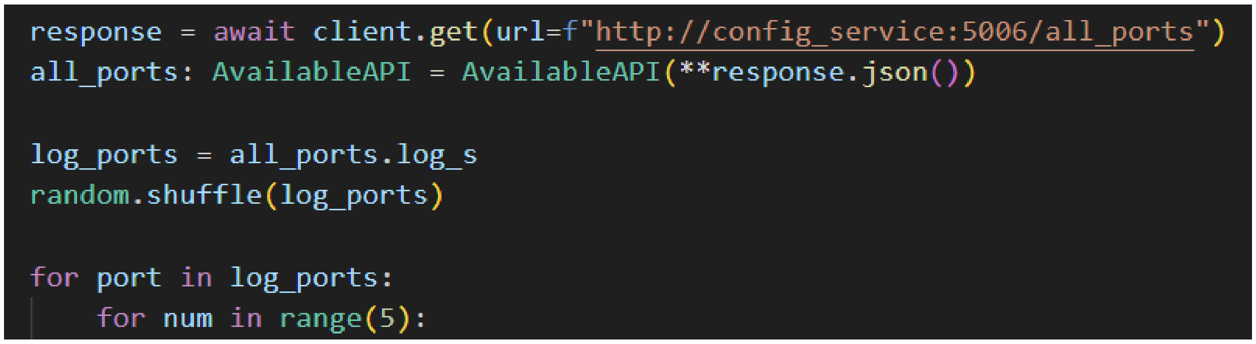
Implementation:

I added a new *FastAPI* application, which has an endpoint *“.../all_ports”*:



```python
@app.get("/all_ports")
def handle() -> AvailableAPI:
    """
    Returns a static text.
    """

    all_appis = {
        "log_s": [f"http://" + "logging_service_" + str(port-5001) + ":" + str(port) for port in LOGGING_SERVICE_PORTS],
        "mes_s": f"http://" + "message_service" + ":" + str(MESSAGES_SERVICE)
    }

    return all_appis
```

In *facade_service,* I am making a request and then sorting all available ports (to make it random):



```python
response = await client.get(url=f"http://config_service:5006/all_ports")
all_ports: AvailableAPI = AvailableAPI(**response.json())

log_ports = all_ports.log_s
random.shuffle(log_ports)

for port in log_ports:
    for num in range(5):
```

That is all, (no need on test examples to this part because the first part uses this code already)

Git: link