

BU - DS561 - HW4 - DAVID EUIJOON KIM - U66545284 - VM Webserver

<https://github.com/dk-davidekim/Google-Cloud-Computing.git>

1. Create 1st VM Instance (Console)

The screenshot shows the Google Cloud Platform VM creation interface. It includes fields for Name (hw4-1), Region (us-east1), Zone (us-east1-b), and Machine Configuration (C3D). A monthly estimate of \$25.46 is displayed, along with a breakdown of costs for vCPUs, memory, and disk. Buttons for CREATE and CANCEL are at the bottom.

2. Allow 8080 Firewall

```
gcloud compute firewall-rules create allow-web-8080 \
--allow=tcp:8080 \
--target-tags=web-server \
--description="Allow port 8080 access to web servers"
```

```
gcloud compute instances add-tags hw4 --zone=us-east1-b --tags=web-server
```

```
davidekim@crc-dot1x-nat-10-239-144-196 hw4 % gcloud compute firewall-rules create allow-web-8080 \
--allow=tcp:8080 \
--target-tags=web-server \
--description="Allow port 8080 access to web servers"
gcloud compute instances add-tags hw4 --zone=us-east1-b --tags=web-server

Creating firewall...::Created [https://www.googleapis.com/compute/v1/projects/ds-561/global/firewalls/allow-web-8080].
Creating firewall...done.
NAME          NETWORK DIRECTION PRIORITY ALLOW    DENY   DISABLED
allow-web-8080 default  INGRESS    1000    tcp:8080  False
Updated [https://www.googleapis.com/compute/v1/projects/ds-561/zones/us-east1-b/instances/hw4].
```

3. Set up Service Account for VM

```
gcloud compute instances set-service-account hw4 \
--service-account=bu-ds561-dk98-sa@ds-561.iam.gserviceaccount.com \
--scopes=https://www.googleapis.com/auth/cloud-platform \
--zone=us-east1-b
```

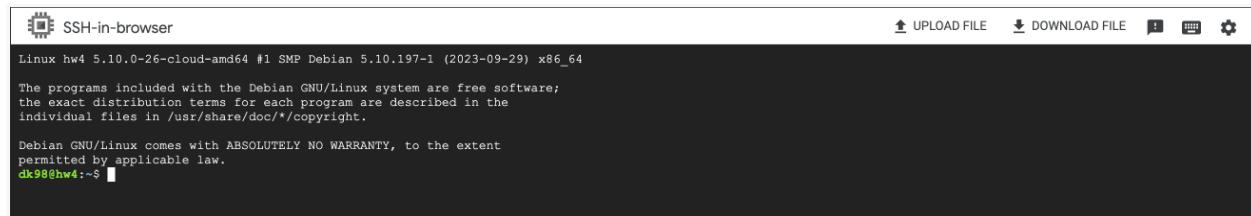
```
base ~ (1.701s)
gcloud compute instances set-service-account hw4 \
--service-account=bu-ds561-dk98-sa@ds-561.iam.gserviceaccount.com \
--scopes=https://www.googleapis.com/auth/cloud-platform \
--zone=us-east1-b
Updated [https://www.googleapis.com/compute/v1/projects/ds-561/zones/us-east1-b/instances/hw4].
```

4. Reserve Static Address

- Reserve Static Address:

IP addresses		RESERVE EXTERNAL STATIC IP ADDRESS		RESERVE INTERNAL STATIC IP ADDRESS		REFRESH		SHOW INFO PANEL	
ALL		INTERNAL IP ADDRESSES		EXTERNAL IP ADDRESSES		IPV4 ADDRESSES	IPV6 ADDRESSES		
<input type="text"/> Filter Enter property name or value 									
	Name	IP address	Access type	Region	Type	Version	In use by	Subnetwork	VPC Network
<input type="checkbox"/>	hw4-static-address-external	35.190.150.233	External	us-east1	Static	IPv4	VM instance hw4 (Zone us-east1-b)		
<input type="checkbox"/>	-	10.142.0.4	Internal	us-east1	Ephemeral	IPv4	VM instance hw4 (Zone us-east1-b)	default	default

5. Access SSH



6. Install Dependencies

```
sudo apt-get update
sudo apt-get install python3 python3-pip
pip3 install Flask google-cloud-storage google-cloud-pubsub google-cloud-logging
dk98@hw4:/home/davidekim$ pip3 install Flask google-cloud-storage google-cloud-pubsub google-cloud-logging
Requirement already satisfied: Flask in /home/dk98/.local/lib/python3.9/site-packages (3.0.0)
Requirement already satisfied: google-cloud-storage in /home/dk98/.local/lib/python3.9/site-packages (2.12.0)
Requirement already satisfied: google-cloud-pubsub in /usr/local/lib/python3.9/dist-packages (2.18.4)
Collecting google-cloud-logging
```

```

permitted by applicable law.
dk98@hw4:~$ sudo apt-get update
sudo apt-get install python3 python3-pip
pip3 install Flask google-cloud-storage
Get:1 https://packages.cloud.google.com/apt google-compute-engine-bullseye-stable InRelease [5146 B]
Get:2 https://packages.cloud.google.com/apt cloud-sdk-bullseye InRelease [6406 B]
Hit:3 https://deb.debian.org/debian bullseye InRelease
Get:4 https://deb.debian.org/debian-security bullseye-security InRelease [48.4 kB]
Get:5 https://deb.debian.org/debian bullseye-updates InRelease [44.1 kB]
Get:6 https://deb.debian.org/debian bullseye-backports InRelease [49.0 kB]
Get:7 https://packages.cloud.google.com/apt google-compute-engine-bullseye-stable/main amd64 Packages [1930 B]
Get:8 https://packages.cloud.google.com/apt cloud-sdk-bullseye/main amd64 Packages [376 kB]
Get:9 https://deb.debian.org/debian-security bullseye-security/main Sources [156 kB]
Get:10 https://deb.debian.org/debian-security bullseye-security/main amd64 Packages [254 kB]
Get:11 https://deb.debian.org/debian-security bullseye-security/main Translation-en [164 kB]
Get:12 https://deb.debian.org/debian bullseye-backports/main Sources.diff/Index [63.3 kB]
Get:13 https://deb.debian.org/debian bullseye-backports/main amd64 Packages.diff/Index [63.3 kB]
Get:14 https://deb.debian.org/debian bullseye-backports/main Sources T-2023-10-12-2014.16-F-2023-10-12-0803.19.pdiff [1508 B]
Get:14 https://deb.debian.org/debian bullseye-backports/main Sources T-2023-10-12-2014.16-F-2023-10-12-0803.19.pdiff [1508 B]
Get:15 https://deb.debian.org/debian bullseye-backports/main amd64 Packages T-2023-10-12-1403.27-F-2023-10-12-1403.27.pdiff [750 B]
Get:15 https://deb.debian.org/debian bullseye-backports/main amd64 Packages T-2023-10-12-1403.27-F-2023-10-12-1403.27.pdiff [750 B]
Fetched 1234 kB in 1s (1163 kB/s)
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
python3 is already the newest version (3.9.2-3).

```

7. app_one.py

```

app_two.py U app_one.py U
BU > DS561 > ds561-davidekim-U66545284 > hw4 > app_one.py > app_one

 1  from flask import Flask, request
 2  from google.cloud import storage, logging, pubsub_v1
 3
 4  app = Flask(__name__)
 5
 6  BANNED_COUNTRIES = ["North Korea", "Iran", "Cuba", "Myanmar",
 7  | | | | | "Iraq", "Libya", "Sudan", "Zimbabwe", "Syria"]
 8
 9  @app.route('/', defaults={'path': ''}, methods=['GET','POST','PUT', 'DELETE', 'HEAD', 'CONNECT', 'OPTIONS', 'TRACE', 'PATCH'])
10  @app.route('/<path:filename>', methods=['GET','POST','PUT', 'DELETE', 'HEAD', 'CONNECT', 'OPTIONS', 'TRACE', 'PATCH'])
11  def app_one(filename):
12      logging_client = logging.Client(project='ds-561')
13      logger = logging_client.logger('hw3')
14      pub = pubsub_v1.PublisherClient()
15      path = pub.topic_path('ds-561', 'hw3')
16
17      if request.method == 'GET':
18          country = request.headers.get("X-country", "")
19
20          if country in BANNED_COUNTRIES:
21              try:
22                  data = str({'400 Forbidden from country': country})
23                  future = pub.publish(path, data.encode("utf-8"))
24                  message_id = future.result()
25                  logger.log_text(f"Message published with ID: {message_id}")
26              except Exception as e:
27                  logger.log_text(f"PubSub Notification Failed {str(e)}")
28                  logger.log_text(f"Error Code 400: Forbidden: {str(country)}")
29              return "Permission Denied", 400
30
31          else:
32              try:
33                  filename = filename.replace('bu-ds561-dk98-bucket/', '')
34                  storage_client = storage.Client()
35                  bucket = storage_client.bucket('bu-ds561-dk98-bucket')
36                  blob = bucket.blob(filename)
37                  file_content = blob.download_as_text()
38                  logger.log_text(f"200: {filename}")
39                  return file_content, 200
40              except Exception as e:
41                  logger.log_text(f"Error Code 404: {filename}: {str(e)}")
42                  return 'File not found', 404
43          else:
44              logger.log_text(f"Error Code 501: {request.method}")
45          return 'Not implemented', 501
46
47  if __name__ == "__main__":
48      app.run(host='0.0.0.0', port=8080)
49

```

8. Send the Python File to VM

```
gcloud compute scp  
/Users/davidekim/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4/app_one.py  
hw4:~/app_one.py --zone us-east1-b

WARNING: The private SSH key file for gcloud does not exist.  

WARNING: The public SSH key file for gcloud does not exist.  

WARNING: You do not have an SSH key for gcloud.  

WARNING: SSH keygen will be executed to generate a key.  

Generating public/private rsa key pair.  

Enter passphrase (empty for no passphrase):  

Enter same passphrase again:  

Your identification has been saved in /Users/davidekim/.ssh/google_compute_engine  

Your public key has been saved in /Users/davidekim/.ssh/google_compute_engine.pub  

The key fingerprint is:  

SHA256:2tA5jSll2xTR6wAWwRGGnbqCPqmlmyasJVWeC50CM0 davidekim@crc-dot1x-nat-10-239-144-196.bu.edu  

The key's randomart image is:  

+---[RSA 3072]---+
| .o o.*++ .00 |
| ..E+ * *.o .. |
| o + * = *. . |
| ..+.0 . = o. |
| o=0 o o S |
| |=B . . = . |
| + o . |
| |
+---[SHA256]---+
Updating project ssh metadata...:Updated [https://www.googleapis.com/compute/v1/projects/ds-561].  

Updating project ssh metadata...done.  

Waiting for SSH key to propagate.  

Warning: Permanently added 'compute.2195805271631523210' (ED25519) to the list of known hosts.
```

● davidekim@crc-dot1x-nat-10-239-144-196 hw4 % gcloud compute scp /Users/davidekim/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4/app_one.py hw4:~/app_one.py --zone us-east1-b
Enter passphrase for key '/Users/davidekim/.ssh/google_compute_engine':
app_one.py 100% 1728 50.6KB/s 00:00

9. Check and Test File in VM SSH

```
dk98@hw4:/home$ ls  
davidekim dk98  
dk98@hw4:/home$ cd davidekim  
dk98@hw4:/home/davidekim$ ls  
app_one.py
```

```
dk98@hw4:/home/davidekim$ python3 app_one.py  
* Serving Flask app 'app_one'  
* Debug mode: off  
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.  
* Running on all addresses (0.0.0.0)  
* Running on http://127.0.0.1:8080  
* Running on http://10.142.0.4:8080  
Press CTRL+C to quit  
128.197.29.228 - - [15/Oct/2023 23:03:30] "GET /bu-ds561-dk98-bucket/hw2_output/539.html HTTP/1.1" 200 -  
128.197.29.228 - - [15/Oct/2023 23:04:30] "GET /bu-ds561-dk98-bucket/hw2_output/539.html HTTP/1.1" 200 -  
128.197.29.228 - - [15/Oct/2023 23:04:38] "GET /hw2_output/1234.html HTTP/1.1" 200 -
```

10. Web Server in VM

```
sudo nano /etc/systemd/system/hw4webserver.service
```



SSH-in-browser

```
GNU nano 5.4
```

```
[Unit]
Description=HW4 Web Server
```

```
[Service]
ExecStart=/usr/bin/python3 app_one.py
Restart=always
User=dk98
WorkingDirectory=/home/davidekim
```

```
[Install]
WantedBy=multi-user.target
```



SSH-in-browser

```
/etc/systemd/system/hw4webserver.service
[Unit]
Description=HW4 Web Server

[Service]
ExecStart=/usr/bin/python3 app_one.py
Restart=always
User=dk98
WorkingDirectory=/home/davidekim

[Install]
WantedBy=multi-user.target
```

11. Enable and Run Web Server

```
sudo systemctl enable hw4webserver
```

```
dk98@hw4:/home/davidekim$ sudo systemctl enable hw4webserver
Created symlink /etc/systemd/system/multi-user.target.wants/hw4webserver.service → /etc/systemd/system/hw4webserver.service.
```

```
sudo systemctl start hw4webserver
```

```
sudo systemctl status hw4webserver
```

```
dk98@hw4:/home/davidekim$ sudo systemctl status hw4webserver
● hw4webserver.service - HW4 Web Server
   Loaded: loaded (/etc/systemd/system/hw4webserver.service; enabled; vendor preset: enabled)
   Active: active (running) since Sun 2023-10-15 23:06:01 UTC; 6s ago
     Main PID: 1811 (python3)
        Tasks: 1 (limit: 4691)
       Memory: 43.5M
          CPU: 533ms
         CGroup: /system.slice/hw4webserver.service
                   └─1811 /usr/bin/python3 app_one.py

Oct 15 23:06:01 hw4 systemd[1]: Started HW4 Web Server.
Oct 15 23:06:02 hw4 python3[1811]: * Serving Flask app 'app_one'
Oct 15 23:06:02 hw4 python3[1811]: * Debug mode: off
Oct 15 23:06:02 hw4 python3[1811]: WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
Oct 15 23:06:02 hw4 python3[1811]: * Running on all addresses (0.0.0.0)
Oct 15 23:06:02 hw4 python3[1811]: * Running on http://127.0.0.1:8080
Oct 15 23:06:02 hw4 python3[1811]: * Running on http://10.142.0.4:8080
Oct 15 23:06:02 hw4 python3[1811]: Press CTRL+C to quit
```

12. Ensure the VM Automatically Starts the Web Server

Automation

Startup script

```
sudo systemctl enable hw4webserver
```

```
sudo systemctl start hw4webserver
```



2

You can choose to specify a startup script that will run when your instance boots up or restarts. Startup scripts can be used to install software and updates, and to ensure that services are running within the virtual machine. [Learn more](#)

13. Test the Webserver in Browser

http://35.190.150.233:8080/hw2_output/1234.html

14. Create 2nd VM Instance (Console)

2nd VM Instance

Google Cloud DS 561 Search (/) for resources, docs, products, and more Search 8 ? ≡ ≡ EQUIVALENT CODE ≡

[Create an instance](#)

To create a VM instance, select one of the options:

- New VM instance: Create a single VM instance from scratch
- New VM instance from template: Create a single VM instance from an existing template
- New VM instance from machine image: Create a single VM instance from an existing machine image
- Marketplace: Deploy a ready-to-go solution onto a VM instance

Name * hw4-2

Manage Tags and Labels

Region * us-east1 (South Carolina) Zone * us-east1-b

Machine configuration

TRY NOW

General purpose Compute optimized NEW Memory optimized GPUs

Machine types for common workloads, optimized for cost and flexibility

Series	Description	vCPUs	Memory
C3	Consistently high performance	4 - 176	8 - 1,408 GB
C3D	PREVIEW Consistently high performance	4 - 360	8 - 2,880 GB
E2	Low cost, day-to-day computing	0.25 - 32	1 - 128 GB
N2	Balanced price & performance	2 - 128	2 - 864 GB

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
Total	\$25.46

Compute Engine pricing ▾ ▲ LESS

CREATE CANCEL EQUIVALENT CODE

VM instances

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
✓	hw4	us-east1-b			10.142.0.4 (nic0)	35.190.150.233 (nic0)	SSH
✓	hw4-2	us-east1-b			10.142.0.5 (nic0)	34.23.17.232 (nic0)	SSH

15. Send the http-client.py File to VM 2

```
gcloud compute scp  
/Users/davidekim/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4/http-client.py hw4-2:~/http-client.py --zone us-east1-b
```

```
davidekim@crc-dot1x-nat-10-239-144-196 hw4 % gcloud compute scp /Users/davidekim/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4/http-client.py hw4-2:~/http-client.py --zone us-east1-b  
Warning: Permanently added 'compute.6243238247854627315' (ED25519) to the list of known hosts.  
Enter passphrase for key '/Users/davidekim/.ssh/google_compute_engine':  
http-client.py 100% 8949 74.6KB/s 00:00
```

16. Run http-client.py in VM 2

```
python3 http-client.py -d 35.190.150.233 -b /bu-ds561-dk98-bucket -w hw2_output -n 1  
-i 11000 -p 8080 -v -f
```

```

dk98hw4-2:/home/davidekim$ python3 http-client.py -d 35.190.150.233 -b /bu-ds561-dk98-bucket -w hw2_output -n 1 -i 11000 -p 8080 -v -f
Requesting /bu-ds561-dk98-bucket/hw2_output/4618.html from 35.190.150.233 8080
200 OK
Server: Werkzeug/3.0.0 Python/3.9.2
Date: Sun, 15 Oct 2023 23:06:46 GMT
Content-Type: text/html; charset=utf-8
Content-Length: 541
Connection: close

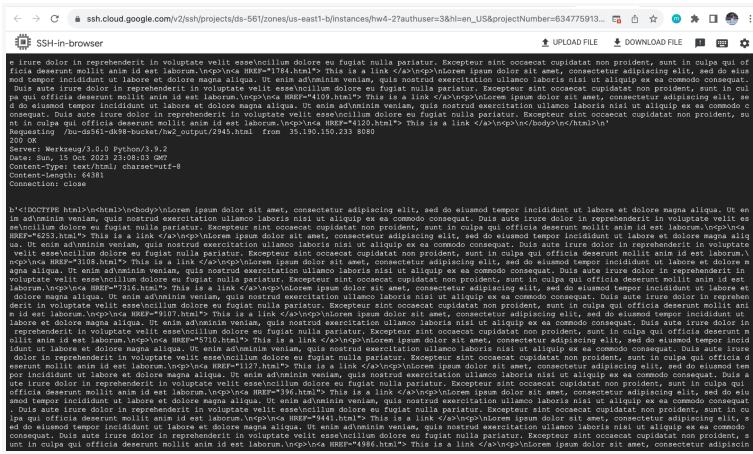
b'<!DOCTYPE html><html><body>\n<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.\n<p>\n<a href="6029.html"> This is a link </a>\n<p>\n</body>\n</html>\n'

```

```

python3 http-client.py -d 35.190.150.233 -b /bu-ds561-dk98-bucket -w hw2_output -n 100
-i 11000 -p 8080 -v -f

```



17. Curl 200

```

curl http://35.190.150.233:8080/hw2_output/1234.html

```

```

~ (0.619s)
curl http://35.190.150.233:8080/hw2_output/1234.html
<!DOCTYPE html>
<html>
<head>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<a href="2679.html"> This is a link </a>
<p>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<a href="5710.html"> This is a link </a>
<p>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<a href="1127.html"> This is a link </a>
<p>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<a href="396.html"> This is a link </a>
<p>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<a href="944.html"> This is a link </a>
<p>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>
<a href="4986.html"> This is a link </a>
<p>
<lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla paratur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.>

```

18. Curl 404

```

curl http://35.190.150.233:8080/hw2_output/12345.html

```

```

~ (0.377s)
curl http://35.190.150.233:8080/hw2_output/12345.html
File not found

```

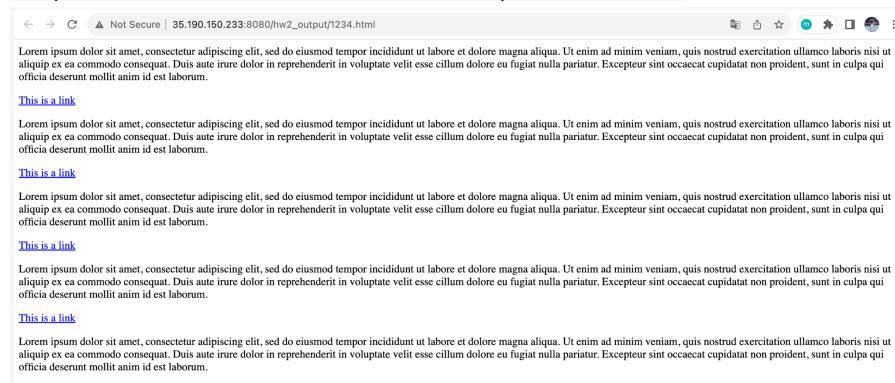
19. Curl 501

```
curl -X POST http://35.190.150.233:8080/hw2_output/12345.html
```

```
~ (0.357s)
curl -X POST http://35.190.150.233:8080/hw2_output/1234.html
Not implemented
```

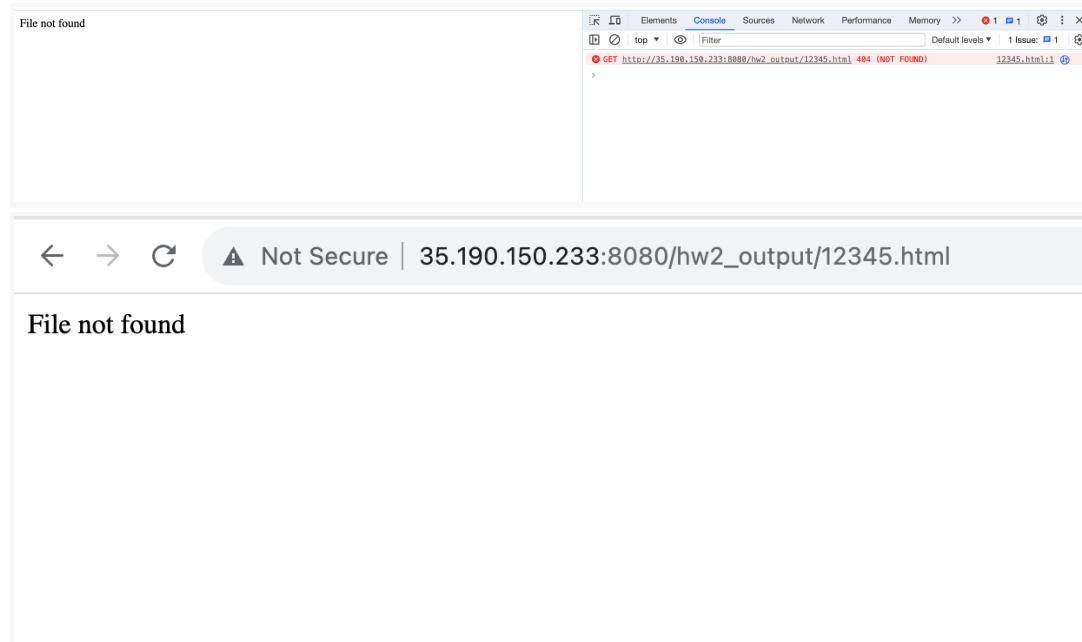
20. Browser 200

http://35.190.150.233:8080/hw2_output/1234.html



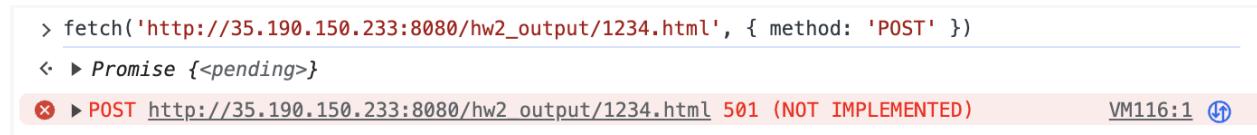
21. Browser 404

http://35.190.150.233:8080/hw2_output/12345.html



22. Browser 501

```
fetch('http://35.190.150.233:8080/hw2_output/1234.html', { method: 'POST' })
```



23. Create 3rd VM Instance (Console)

3rd VM Instance

The screenshot shows the "Machine configuration" section of the VM instance creation interface. It includes fields for Region (us-east1 (South Carolina)) and Zone (us-east1-b). A note says "Region is permanent" and "Zone is permanent". To the right, a "Monthly estimate" table shows costs for 2 vCPU + 4 GB memory, 10 GB balanced persistent disk, and a total of \$25.46. A "Compute Engine pricing" link is available.

Item	Monthly estimate
2 vCPU + 4 GB memory	\$24.46
10 GB balanced persistent disk	\$1.00
Total	\$25.46

The screenshot shows the "VM instances" list. It includes tabs for "INSTANCES", "OBSERVABILITY", and "INSTANCE SCHEDULES". A note says "Your project's VMs use global DNS names by default. To reduce the risk of cross-regional outages, we recommend you use zonal DNS instead." with links to "Learn more" and "USE ZONAL DNS". Below is a table of existing VM instances:

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
OK	hw4	us-east1-b			10.142.0.4 (nic0)	35.190.150.233 (nic0)	SSH
OK	hw4-2	us-east1-b			10.142.0.5 (nic0)	34.23.17.232 (nic0)	SSH
OK	hw4-3	us-east1-b			10.142.0.6 (nic0)	34.23.114.178 (nic0)	SSH

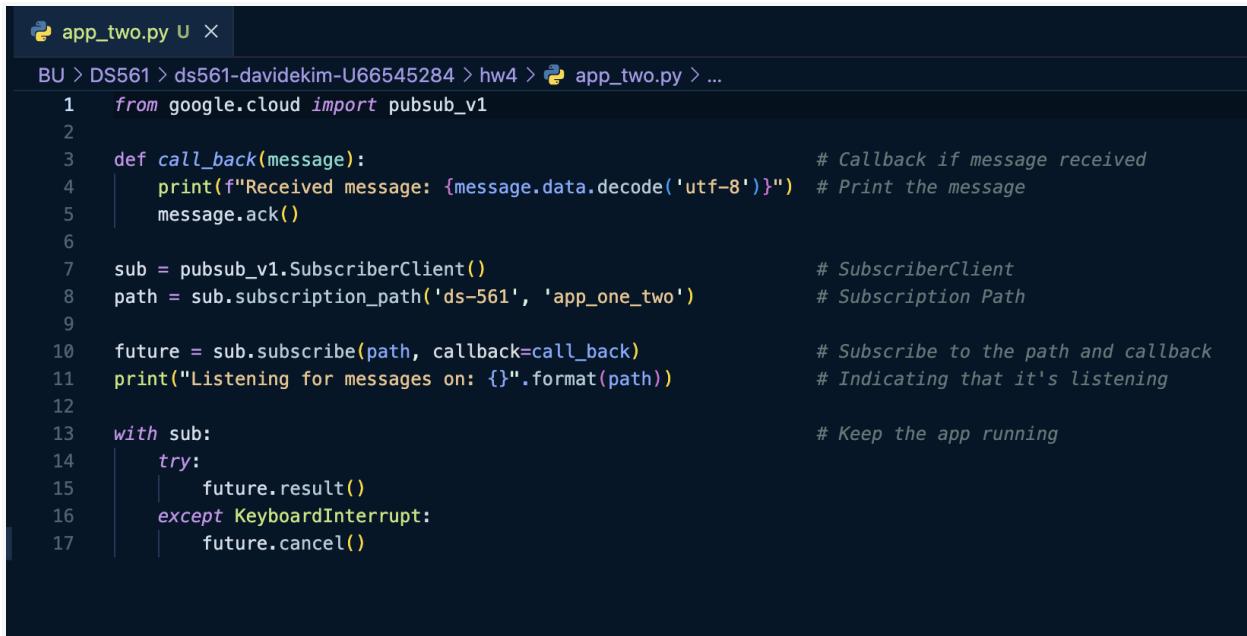
24. Set up Service Account for VM3 for PubSub

```
gcloud compute instances set-service-account hw4-3 \
--service-account=bu-ds561-dk98-sa@ds-561.iam.gserviceaccount.com \
--scopes=https://www.googleapis.com/auth/cloud-platform \
--zone=us-east1-b
```

```
base ~ (1.64s)
gcloud compute instances set-service-account hw4-3 \
--service-account=bu-ds561-dk98-sa@ds-561.iam.gserviceaccount.com \
--scopes=https://www.googleapis.com/auth/cloud-platform \
--zone=us-east1-b
```

```
Updated [https://www.googleapis.com/compute/v1/projects/ds-561/zones/us-east1-b/instances/hw4-3].
```

25. Send app_two.py to VM3



```
BU > DS561 > ds561-davidekim-U66545284 > hw4 > 📡 app_two.py > ...
1  from google.cloud import pubsub_v1
2
3  def call_back(message):                      # Callback if message received
4      print(f"Received message: {message.data.decode('utf-8')}") # Print the message
5      message.ack()
6
7  sub = pubsub_v1.SubscriberClient()            # SubscriberClient
8  path = sub.subscription_path('ds-561', 'app_one_two') # Subscription Path
9
10 future = sub.subscribe(path, callback=call_back) # Subscribe to the path and callback
11 print("Listening for messages on: {}".format(path)) # Indicating that it's listening
12
13 with sub:                                     # Keep the app running
14     try:
15         future.result()
16     except KeyboardInterrupt:
17         future.cancel()
```

```
gcloud compute scp
/Users/davidekim/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4/app_two.py
hw4-3:~/app_two.py --zone us-east1-b
● davidekim@crc-dotlx-nat-10-239-144-196 hw4 % gcloud compute scp /Users/davidekim/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4/ds-561-c49fc1ab1464.json hw4-3:~/ds-561-c49fc1ab1464.json --zone us-east1-b
Enter passphrase for key '/Users/davidekim/.ssh/google_compute_engine':
ds-561-c49fc1ab1464.json                                         100% 2348    36.0KB/s   00:00
```

26. Install Dependencies

```
sudo apt-get update
sudo apt-get install python3 python3-pip
```

```
pip3 install google-cloud-pubsub
```

```
dk98@hw4-3:~/home/davidekim$ sudo apt-get update
sudo apt-get install python3 python3-pip
pip3 install google-cloud-pubsub
Get:1 https://packages.cloud.google.com/apt google-compute-engine-bullseye-stable InRelease [5146 B]
Hit:2 https://deb.debian.org/debian bullseye InRelease
Get:3 https://deb.debian.org/debian-security/bullseye-security InRelease [48.4 kB]
Get:4 https://packages.cloud.google.com/apt cloud-sdk-bullseye InRelease [6406 B]
Get:5 https://deb.debian.org/debian bullseye-updates InRelease [44.1 kB]
Get:6 https://deb.debian.org/debian bullseye-backports InRelease [49.0 kB]
Get:7 https://packages.cloud.google.com/apt google-compute-engine-bullseye-stable/main amd64 Packages [1930 B]
Get:8 https://packages.cloud.google.com/apt cloud-sdk-bullseye/main amd64 Packages [376 kB]
Get:9 https://deb.debian.org/debian-security/bullseye-security/main Sources [156 kB]
Get:10 https://deb.debian.org/debian-security/bullseye-security/main amd64 Packages [254 kB]
Get:11 https://deb.debian.org/debian-security/bullseye-security/main Translation-en [164 kB]
Get:12 https://deb.debian.org/debian bullseye-backports/main Sources.diff/Index [63.3 kB]
Get:13 https://deb.debian.org/debian bullseye-backports/main amd64 Packages.diff/Index [63.3 kB]
Get:14 https://deb.debian.org/debian bullseye-backports/main Sources T-2023-10-12-2014.16-F-2023-10-12-0803.19.pdiff [1508 B]
Get:14 https://deb.debian.org/debian bullseye-backports/main Sources T-2023-10-12-2014.16-F-2023-10-12-0803.19.pdiff [1508 B]
Get:15 https://deb.debian.org/debian bullseye-backports/main amd64 Packages T-2023-10-12-1403.27-F-2023-10-12-1403.27.pdiff [750 B]
Get:15 https://deb.debian.org/debian bullseye-backports/main amd64 Packages T-2023-10-12-1403.27-F-2023-10-12-1403.27.pdiff [750 B]
Fetched 1234 kB in 1s (1058 kB/s)
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
```

27. Run app_two.py

```
dk98@hw4-3:/home/davidekim$ python3 app_two.py
Listening for messages on: projects/ds-561/subscriptions/app_one_two
[]
```

28. Run http-client.py in VM2

```
python3 http-client.py -d 35.190.150.233 -b /bu-ds561-dk98-bucket -w hw2_output -n 100  
-i 11000 -p 8080 -v -f
```

```
dk98@hw4-2:~/home/davidekim$ python3 http-client.py -d 35.190.150.233 -b /bu-ds561-dk98-bucket -w hw2_output -n 100 -i 11000 -p 8080 -v -f
```

29. Outputs

```
dk98@hw4-3:/home/davidekim$ python3 app_two.py
Listening for messages on: projects/ds-561/subscriptions/app_one_two
Received message: {'400 Forbidden from country': 'North Korea'}
Received message: {'400 Forbidden from country': 'Libya'}
Received message: {'400 Forbidden from country': 'Sudan'}
Received message: {'400 Forbidden from country': 'Myanmar'}
Received message: {'400 Forbidden from country': 'Iran'}
```

30. Create 4th VM Instance (E2-Micro) and Repeat Everything Done in 1st VM Instance

4th VM Instance for Q9 - E2 Micro - Repeat Everything Done in 1st VM Instance

Machine configuration

Series	Description	vCPUs	Memory	Platform
C3	Consistently high performance	4 - 176	8 - 1,408 GB	Intel Sapphire Rapids
C3D	Consistently high performance	4 - 360	8 - 2,880 GB	AMD Genoa
E2	Low cost, day-to-day computing	0.25 - 32	1 - 128 GB	Based on availability
N2	Balanced price & performance	2 - 128	2 - 864 GB	Intel Cascade and Ice Lake
N2D	Balanced price & performance	2 - 224	2 - 896 GB	AMD EPYC
T2A	Scale-out workloads	1 - 48	4 - 192 GB	Ampere Altra Arm
T2D	Scale-out workloads	1 - 60	4 - 240 GB	AMD EPYC Milan
N1	Balanced price & performance	0.25 - 96	0.6 - 624 GB	Intel Skylake

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**

e2-micro (2 vCPU, 1 core, 1 GB memory)

CREATE **CANCEL** **EQUIVALENT CODE**

Automation

Startup script

```
sudo systemctl enable hw44webserver
sudo systemctl start hw44webserver
```

2

You can choose to specify a startup script that will run when your instance boots up or restarts. Startup scripts can be used to install software and updates, and to ensure that services are running within the virtual machine. [Learn more](#)

```
# No need to do this if you did it before
gcloud compute firewall-rules create allow-web-8080 \
--allow=tcp:8080 \
```

```
--target-tags=web-server \
--description="Allow port 8080 access to web servers"
```

```
# This is required
gcloud compute instances add-tags hw4-4 --zone=us-east1-b --tags=web-server
```

```
# Service account
gcloud compute instances set-service-account hw4-4 \
--service-account=bu-ds561-dk98-sa@ds-561.iam.gserviceaccount.com \
--scopes=https://www.googleapis.com/auth/cloud-platform \
--zone=us-east1-b
```

```
base ~/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4 git:(main) ±1 (2.306s)
gcloud compute instances set-service-account hw4-4 \
--service-account=bu-ds561-dk98-sa@ds-561.iam.gserviceaccount.com \
--scopes=https://www.googleapis.com/auth/cloud-platform \
--zone=us-east1-b

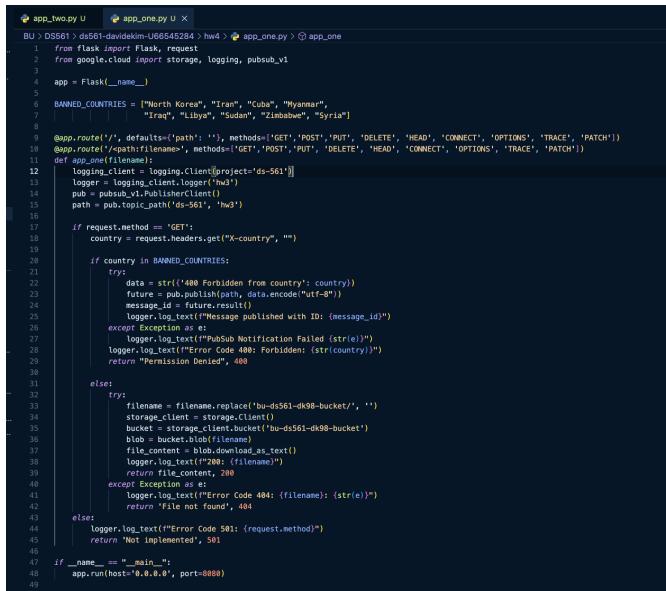
Updated [https://www.googleapis.com/compute/v1/projects/ds-561/zones/us-east1-b/instances/hw4-4].
```

The screenshot shows the 'IP addresses' section of the VPC network settings. A new static IP address is being created with the name 'hw4-4-static-address-external'. The form includes fields for Name, Description, Network Service Tier (set to Premium), IP version (IPv4), Type (Regional), Region (us-east1), and Attached to (hw4-4). Buttons for 'RESERVE' and 'CANCEL' are at the bottom.

Name	IP address	Access type	Region	Type	Version	In use by	Subnetwork	VPC Network	Network Tier
hw4-4-static-address-external	35.237.163.169	External	us-east1	Static	IPv4	VM instance hw4-4 (Zone us-east1-b)			Premium

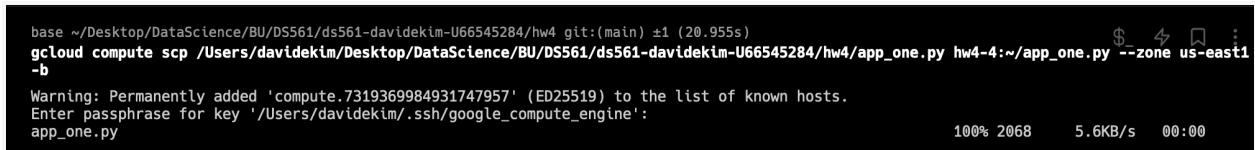
```
sudo apt-get update
sudo apt-get install python3 python3-pip
pip3 install Flask google-cloud-storage google-cloud-pubsub google-cloud-logging
```

```
dk98@hw4-4:~$ sudo apt-get update
sudo apt-get install python3 python3-pip
pip3 install Flask google-cloud-storage google-cloud-pubsub google-cloud-logging
Hit:1 https://deb.debian.org/debian bullseye InRelease
Get:2 https://packages.cloud.google.com/apt google-compute-engine-bullseye-stable InRelease [5146 B]
Get:3 https://packages.cloud.google.com/apt cloud-sdk-bullseye InRelease [6406 B]
Get:4 https://deb.debian.org/debian-security bullseye-security InRelease [48.4 kB]
Get:5 https://deb.debian.org/debian bullseye-updates InRelease [44.1 kB]
Get:6 https://deb.debian.org/debian bullseye-backports InRelease [49.0 kB]
Get:7 https://packages.cloud.google.com/apt google-compute-engine-bullseye-stable/main amd64 Packages [1930 B]
Get:8 https://packages.cloud.google.com/apt cloud-sdk-bullseye/main amd64 Packages [380 kB]
Get:9 https://deb.debian.org/debian-security bullseye-security/main Sources [159 kB]
Get:10 https://deb.debian.org/debian-security bullseye-security/main amd64 Packages [256 kB]
Get:11 https://deb.debian.org/debian-security bullseye-security/main Translation-en [164 kB]
Get:12 https://deb.debian.org/debian bullseye-backports/main Sources.diff/Index [63.3 kB]
Get:13 https://deb.debian.org/debian bullseye-backports/main amd64 Packages.diff/Index [63.3 kB]
Get:14 https://deb.debian.org/debian bullseye-backports/main Sources T-2023-10-12-2014.16-F-2023-10-12-0803.19.pdiff [1508 B]
Get:14 https://deb.debian.org/debian bullseye-backports/main Sources T-2023-10-12-2014.16-F-2023-10-12-0803.19.pdiff [1508 B]
Get:15 https://deb.debian.org/debian bullseye-backports/main amd64 Packages T-2023-10-12-1403.27-F-2023-10-12-1403.27.pdiff [750 B]
Get:15 https://deb.debian.org/debian bullseye-backports/main amd64 Packages T-2023-10-12-1403.27-F-2023-10-12-1403.27.pdiff [750 B]
Fetched 1243 kB in 1s (1146 kB/s)
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Building dependency tree... Done
Reading state information... Done
```



```
app_two.py U app_one.py U
BU > DS561> ds561-davidekim-U66545284 > hw4 > app_one.py > 
1   from flask import Flask, request
2   from google.cloud import storage, logging, pubsub_v1
3
4   app = Flask(__name__)
5
6   BANNED_COUNTRIES = ["North Korea", "Iran", "Cuba", "Myanmar",
7                         "Iraq", "Libya", "Sudan", "Zimbabwe", "Syria"]
8
9   @app.route('/<path>', methods=['GET', 'POST', 'PUT', 'DELETE', 'HEAD', 'CONNECT', 'OPTIONS', 'TRACE', 'PATCH'])
10  @app.route('/<path>filename', methods=['GET', 'POST', 'PUT', 'DELETE', 'HEAD', 'CONNECT', 'OPTIONS', 'TRACE', 'PATCH'])
11  def app_one(path):
12      logging_client = logging.Client(project='ds-561')
13      logger = logging_client.logger('hw4')
14      pub = pubsub_v1.PublisherClient()
15      path = pub.topic_path(ds-561, 'hw4')
16
17      if request.method == 'GET':
18          country = request.headers.get("X-country", "")
19
20          if country in BANNED_COUNTRIES:
21              try:
22                  data = str('400 Forbidden from country: ' + country)
23                  future = pub.publish(data.encode("utf-8"))
24                  message_id = future.result()
25                  logger.log_text(f"Message published with ID: {message_id}")
26              except Exception as e:
27                  logger.log_text("PubSub Notification Failed (str(e))")
28                  logger.log_text("Error Code 400: Forbidden: (str(country))")
29                  return "Permission Denied", 400
30
31          else:
32              try:
33                  filename = path.replace('bu-ds561-dk98-bucket/', '')
34                  storage_client = storage.Client()
35                  bucket = storage_client.bucket('bu-ds561-dk98-bucket')
36                  blob = bucket.blob(filename)
37                  file_content = blob.download_as_text()
38                  logger.log_text(f"200: {filename}")
39                  return file_content, 200
40              except Exception as e:
41                  logger.log_text("Error Code 404: {filename}: {str(e)}")
42                  return "File not found", 404
43
44      else:
45          logger.log_text("Error Code 501: {request.method}")
46          return "Not Implemented", 501
47
48  if __name__ == "__main__":
49      app.run(host="0.0.0.0", port=8888)
```

```
gcloud compute scp
/Users/davidekim/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4/app_one.py
hw4-4:~/app_one.py --zone us-east1-b
```



```
base ~/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4 git:(main) ✘ 1 (20.955s)
gcloud compute scp /Users/davidekim/Desktop/DataScience/BU/DS561/ds561-davidekim-U66545284/hw4/app_one.py hw4-4:~/app_one.py --zone us-east1
-b
Warning: Permanently added 'compute.7319369984931747957' (ED25519) to the list of known hosts.
Enter passphrase for key '/Users/davidekim/.ssh/google_compute_engine':
app_one.py
100% 2068      5.6KB/s   00:00
```

```
sudo apt-get update
sudo apt-get install python3 python3-pip
pip3 install Flask google-cloud-storage google-cloud-pubsub google-cloud-logging
```

```
sudo nano /etc/systemd/system/hw4webserver.service
```

SSH-in-browser

```
GNU nano 5.4
[Unit]
Description=HW4-4 Web Server

[Service]
ExecStart=/usr/bin/python3 app_one.py
Restart=always
User=dk98
WorkingDirectory=/home/davidekim

[Install]
WantedBy=multi-user.target
```

```
[Unit]
Description=HW4 Web Server
```

```
[Service]
ExecStart=/usr/bin/python3 app_one.py
Restart=always
User=dk98
WorkingDirectory=/home/davidekim
```

```
[Install]
WantedBy=multi-user.target
```

```
sudo systemctl enable hw44webserver
```

```
sudo systemctl start hw44webserver
sudo systemctl status hw44webserver
```

```
dk98@hw4-4:~$ sudo systemctl enable hw44webserver
sudo systemctl start hw44webserver
sudo systemctl status hw44webserver
Created symlink /etc/systemd/system/multi-user.target.wants/hw44webserver.service → /etc/systemd/system/hw44webserver.service.
● hw44webserver.service - HW4-4 Web Server
   Loaded: loaded (/etc/systemd/system/hw44webserver.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2023-10-17 21:31:43 UTC; 31ms ago
     Main PID: 71596 (python3)
        Tasks: 1 (limit: 1145)
       Memory: 2.3M
          CPU: 18ms
         CGroup: /system.slice/hw44webserver.service
                  └─71596 /usr/bin/python3 app_one.py

Oct 17 21:31:43 hw4-4 systemd[1]: Started HW4-4 Web Server.
```

31. Stress Test VM4

```
seq 10000 | xargs -I{} -P1000 python3 http-client.py -d 35.237.163.169 -b /bu-ds561-dk98-bucket -w hw2_output -n 100 -i 11000 -p 8080 -f
```

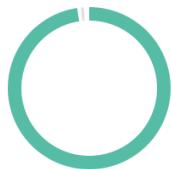
Concurrently up to 10,000 times

```
dk98@hw4-2:/home/davidekim$ seq 100 | xargs -I{} -P100 python3 http-client.py -d 35.237.163.169 -b /bu-ds561-dk98-bucket -w hw2_output -n 100 -i 11000 -p 8080 -f
```

Result: Crashed.

```
    sock.connect(sa)
TimeoutError: [Errno 110] Connection timed out
    sock.connect(sa)
    sock.connect(sa)
TimeoutError: [Errno 110] Connection timed out
TimeoutError: [Errno 110] Connection timed out
    sock.connect(sa)
ConnectionResetError: [Errno 104] Connection reset by peer
    return self._sock.recv_into(b)
ConnectionResetError: [Errno 104] Connection reset by peer
    return self._sock.recv_into(b)
ConnectionResetError: [Errno 104] Connection reset by peer
    return self._sock.recv_into(b)
ConnectionResetError: [Errno 104] Connection reset by peer
```

Credits



\$196.70

Remaining credits

Out of \$200.00

Remaining credits

Instrumentless Credits \$196.70
for Devrel Events
(joeshirey) 291996046

32. Logs

> *	2023-10-18 15:13:24.694	hw4 200: hw2_output/1234.html
> *	2023-10-18 15:13:41.812	hw4 Error Code 404: hw2_output/12345.html: 404 GET https://storage.googleapis.com/download/storage...
> *	2023-10-18 15:14:05.272	hw4 Error Code 501: POST
> *	2023-10-18 15:22:25.716	hw4 Message published with ID: 9520720661705639
> *	2023-10-18 15:22:25.785	hw4 Error Code 400: Forbidden: Syria