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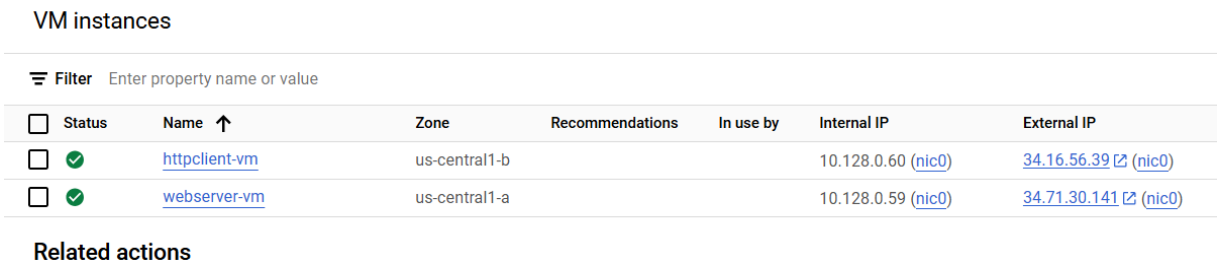
Course: DS 561

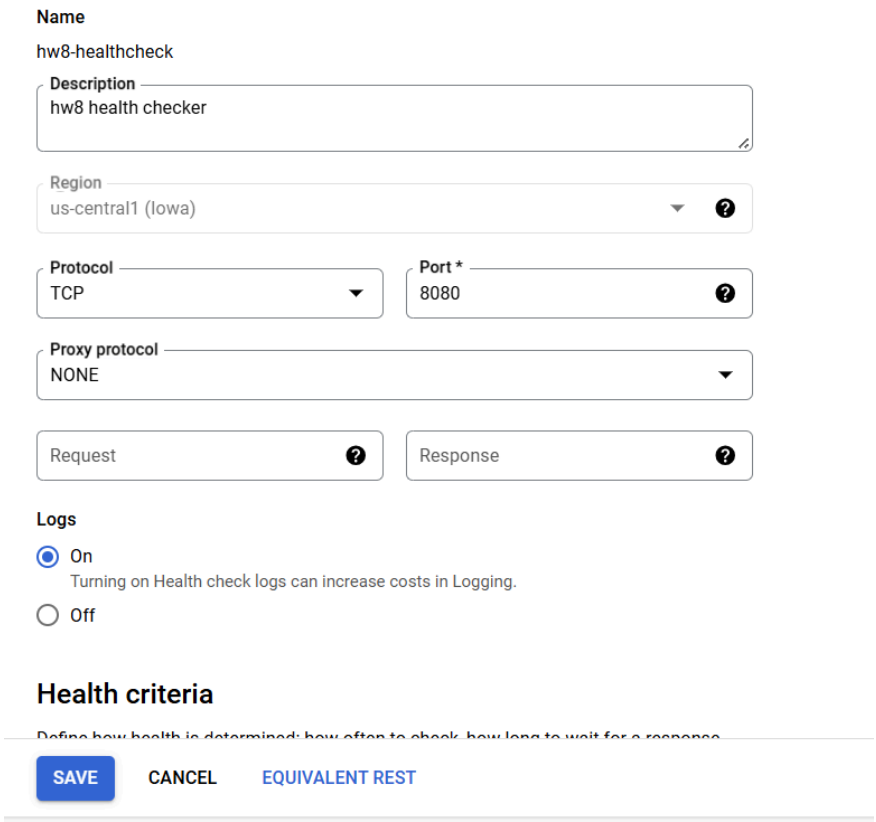
Homework 8

Setup

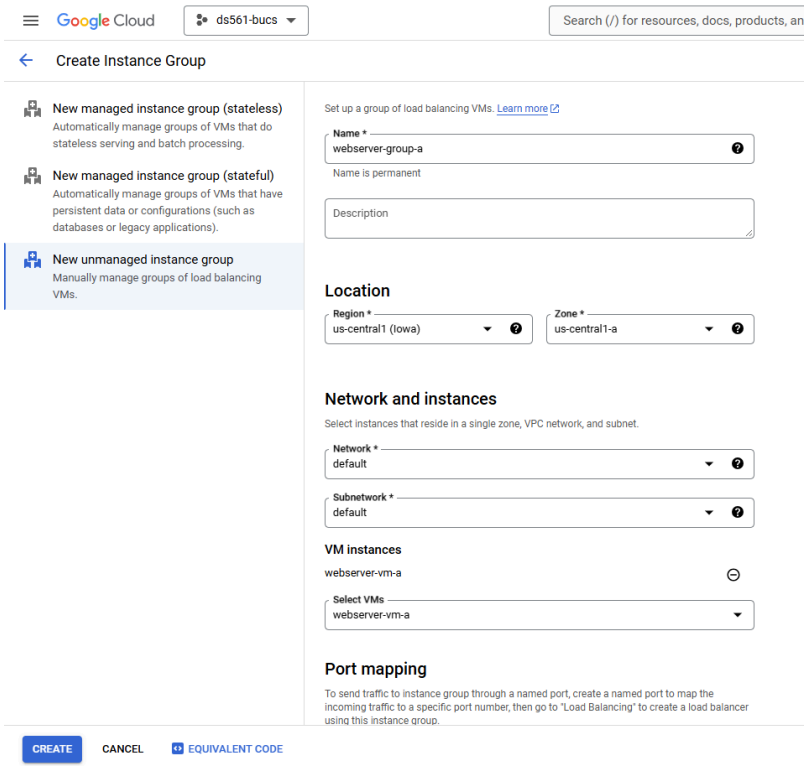
- Create two new VMs along with their startup scripts and permissions
    - gcloud compute instances set-service-account webserver-vm-a --zone=us-central1-a --service-account=844994497823-compute@developer.gserviceaccount.com --scopes=https://www.googleapis.com/auth/cloud-platform
    - gcloud compute instances set-service-account webserver-vm-b --zone=us-central1-b --service-account=844994497823-compute@developer.gserviceaccount.com --scopes=https://www.googleapis.com/auth/cloud-platform
    - #!/bin/bash
      sudo apt-get update
      sudo apt-get install -y python3
      cd /home/jbui/
      source myenv/bin/activate
      pip install google-cloud-storage google-cloud-logging google-cloud-pubsub requests
      chmod +x webserver.py
      nohup python3 webserver.py &

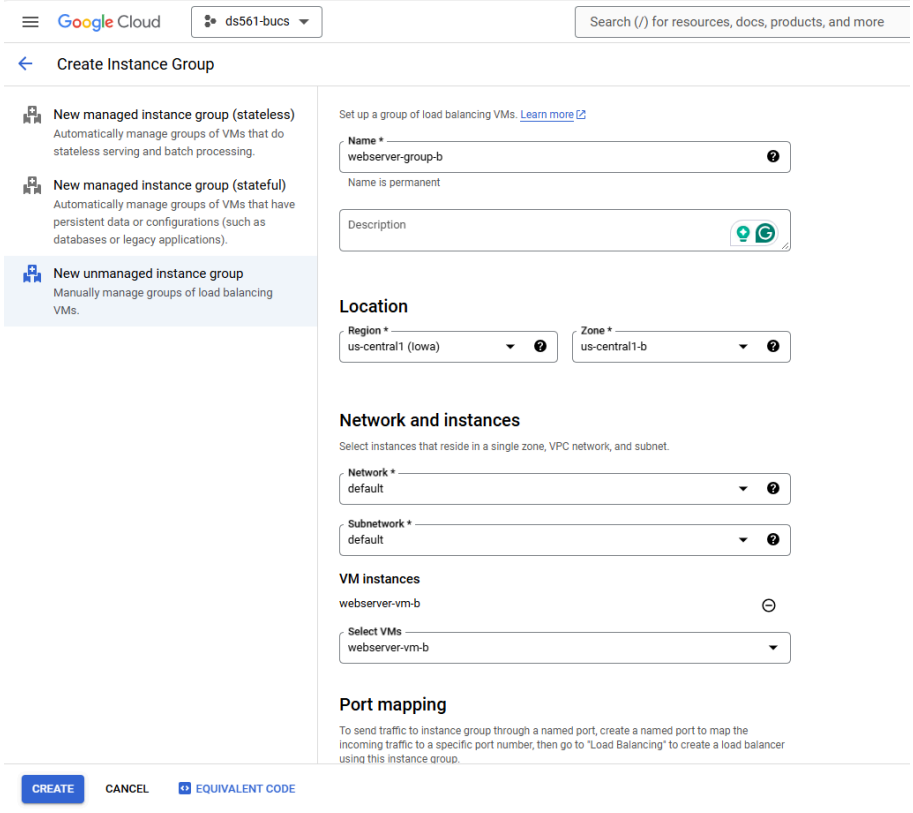


- Create healthchecker



- Create instance group for each VM





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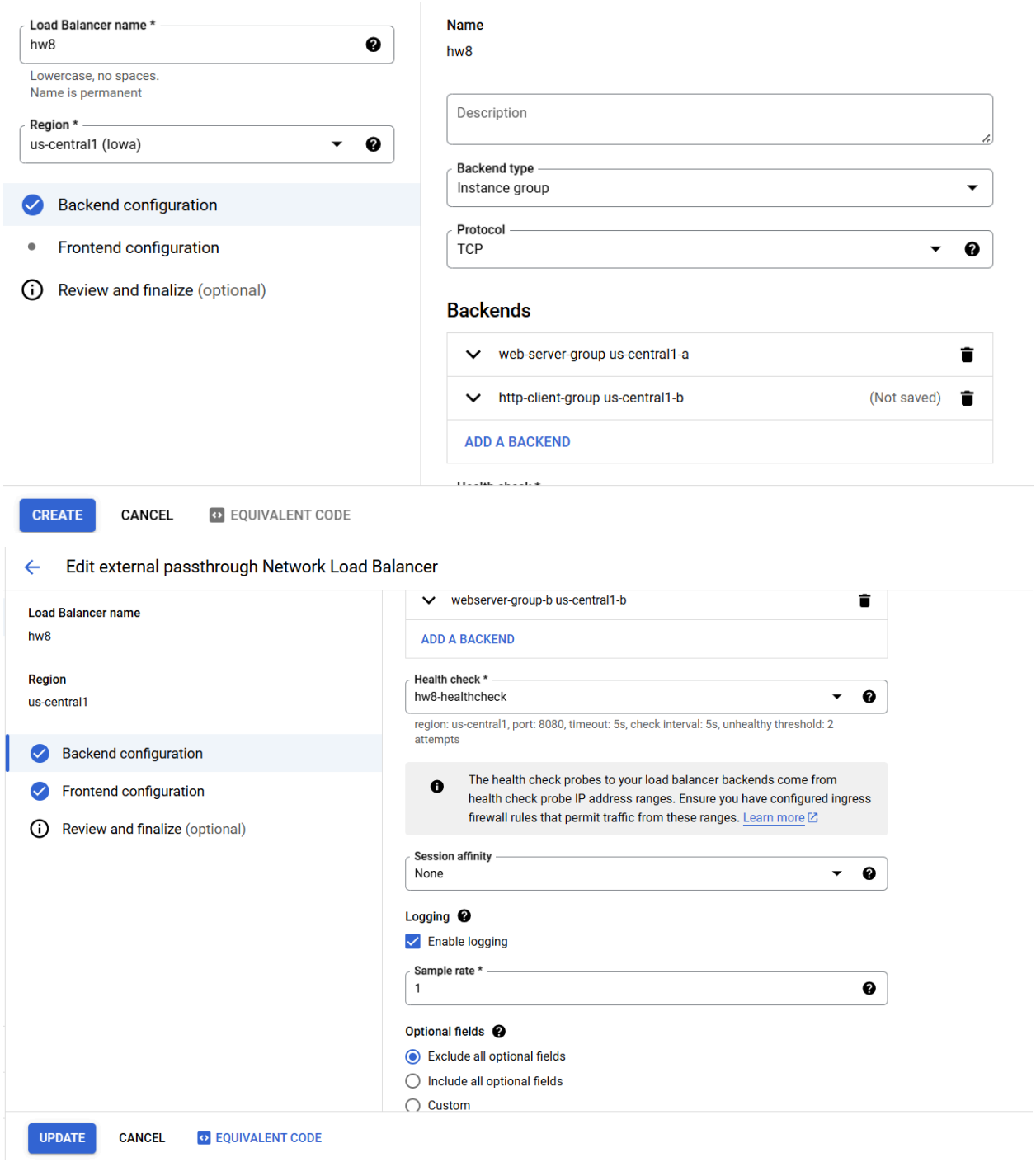
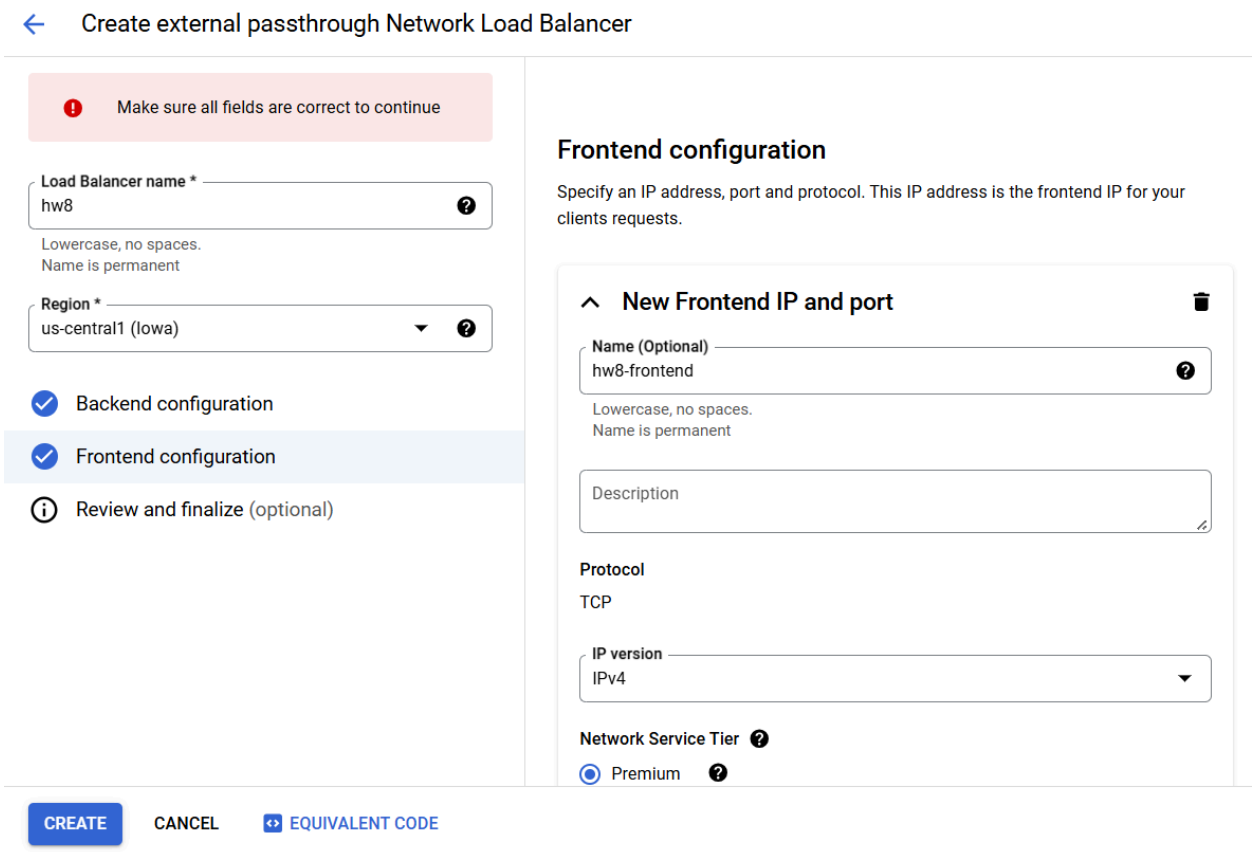
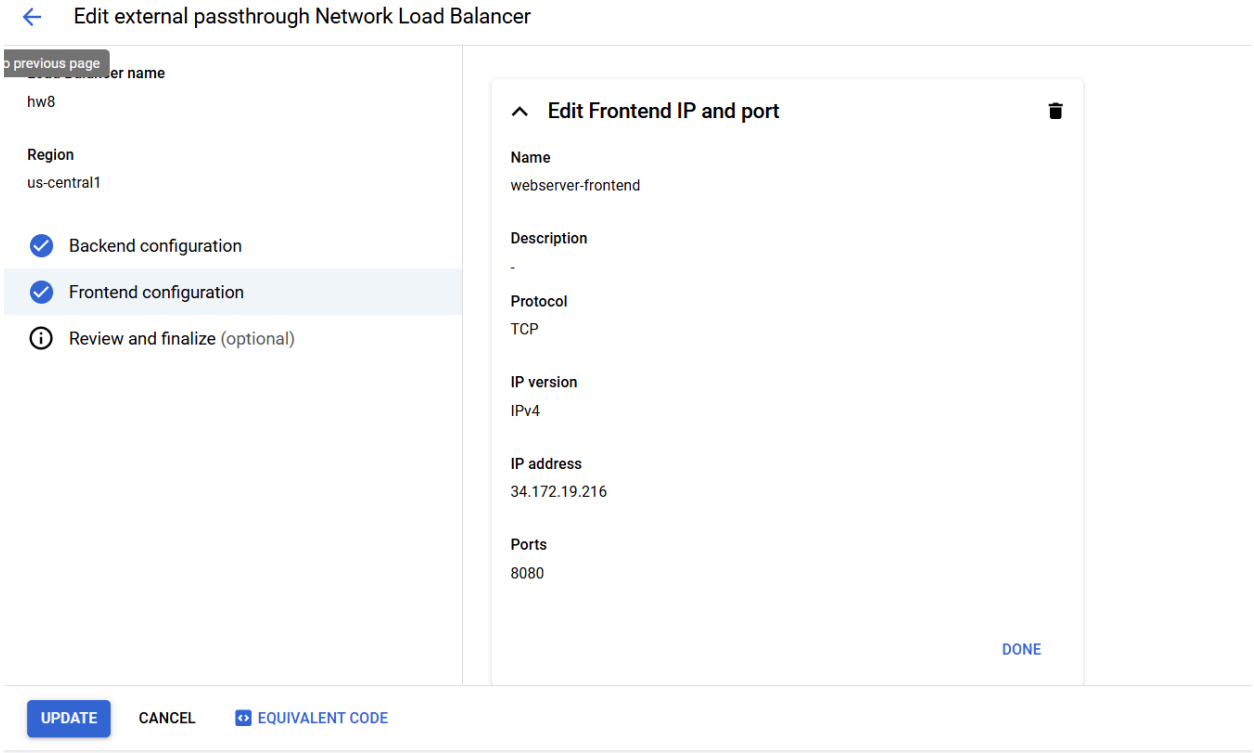
- Create a network load balancer backend with both instance groups each



- Create a network load balancer front end to go to port 80





Code Explanation:

webserver.py

```
from http.server import BaseHTTPRequestHandler, HTTPServer
from google.cloud import storage, logging as cloudLogging, pubsub_v1
import json
import requests

# Google Cloud Logging setup
cloudLoggingClient = cloudLogging.Client()
cloudLogger = cloudLoggingClient.logger("httpServerLog")

# Configuration
bannedCountries = ['North Korea', 'Iran', 'Cuba', 'Myanmar', 'Iraq',
'Libya', 'Sudan', 'Zimbabwe', 'Syria']
projectId = 'ds561-bucs'
topicId = 'banned-country-topic'

def notifyTrackerApp(country):
    publisher = pubsub_v1.PublisherClient()
    topicPath = publisher.topic_path(projectId, topicId)
    messageData = json.dumps({'country': country}).encode('utf-8')
    publisher.publish(topicPath, messageData)

def fetchFileFromBucket(bucketPath):
    bucketName, filePath = bucketPath.split("/", 1)
    bucket = storage.Client().get_bucket(bucketName)
    blob = bucket.blob(filePath)
    if blob.exists():
        return blob.download_as_text()
    return None

def get_zone():
    metadata_url =
"http://metadata.google.internal/computeMetadata/v1/instance/zone"
    headers = {"Metadata-Flavor": "Google"}
    response = requests.get(metadata_url, headers=headers)
    if response.status_code == 200:
        return response.text.split('/')[-1]
    return "unknown"
```

```
class RequestHandler(BaseHTTPRequestHandler):
    def log_message(self, format, *args):
        super().log_message(format, *args)

    def do_GET(self):
        country = self.headers.get('X-Country', 'unknown')
        if country in bannedCountries:
            cloudLogger.log_text("Access denied from banned country: " +
country, severity="ERROR")
            notifyTrackerApp(country)
            self.response_code = 400
            self.send_response(400)
            self.end_headers()
            self.wfile.write(b"Access denied: Request from banned
country")
            return

        try:
            fileContent = fetchFileFromBucket(self.path.strip("/"))
            if fileContent is None:
                cloudLogger.log_text("File " + self.path + " not found",
severity="ERROR")
                self.response_code = 404
                self.send_response(404)
                self.end_headers()
                self.wfile.write(b"File not found")
            else:
                zone = get_zone()
                self.response_code = 200
                self.send_response(200)
                self.send_header("X-Instance-Zone", zone)
                self.end_headers()
                self.wfile.write(fileContent.encode("utf-8"))
        except BrokenPipeError:
            cloudLogger.log_text("The server has timed out!",
severity="ERROR")
            print("The server has timed out!")
        except Exception as e:
            cloudLogger.log_text("Error occurred: " + str(e),
severity="ERROR")
```

```
            self.response_code = 500
            self.send_response(500)
            self.end_headers()

    def handle_unsupported_methods(self):
        cloudLogger.log_text("Unsupported method " + self.command + " was
used for " + self.path, severity="ERROR")
        self.response_code = 501
        self.send_response(501)
        self.end_headers()
        self.wfile.write((self.command + " not
implemented").encode("utf-8"))

    def do_POST(self):
        self.handle_unsupported_methods()

    def do_PUT(self):
        self.handle_unsupported_methods()

    def do_DELETE(self):
        self.handle_unsupported_methods()

    def do_HEAD(self):
        self.handle_unsupported_methods()

    def do_CONNECT(self):
        self.handle_unsupported_methods()

    def do_OPTIONS(self):
        self.handle_unsupported_methods()

    def do_TRACE(self):
        self.handle_unsupported_methods()

    def do_PATCH(self):
        self.handle_unsupported_methods()

def runServer(serverAddress, port):
    server = HTTPServer((serverAddress, port), RequestHandler)
    print(f"Server running on {serverAddress}:{port}...")
```

```
    try:
        server.serve_forever()
    except KeyboardInterrupt:
        print("Server stopped by user.")
    finally:
        server.server_close()
        print("Server has been cleaned up.")

if __name__ == "__main__":
    runServer("0.0.0.0", 8080)
```

- Import google cloud dependencies (storage, logging, pubsub)
- Import request to allow for http requests and retrieval of zone metadata
- Import datetime for logging to keep track of when each request is handled
- Set up logging with cloudLogger and cloudLoggingClient to log events to google cloud
- Keep function fetchFileFromBucket to retrieve a file from google cloud storage
- Implement function get_zone to get the google cloud zone by calling the google metadata server
    - The metadata url is "http://metadata.google.internal/computeMetadata/v1/instance/zone"
    - Each request will include a metadata-flavor header (needed by metadata server)
    - We can then parse the data we get back to indicate which instance zone is handling the request
- Keep do_Get and log_message to continue handling requests based on X-Country header and other requirements from past homework
- Update the try section inside do_Get to get the sone and add it as a response
- Update runserver to initialize the web-server to run until it is closed/ended

Modified section of http-client.py:

```
def make_request(domain, port, country, ip, filename, use_ssl,
ssl_context, follow, verbose, timeout):
    try:
        if verbose:
            print("Requesting ", filename, " from ", domain, port)
```

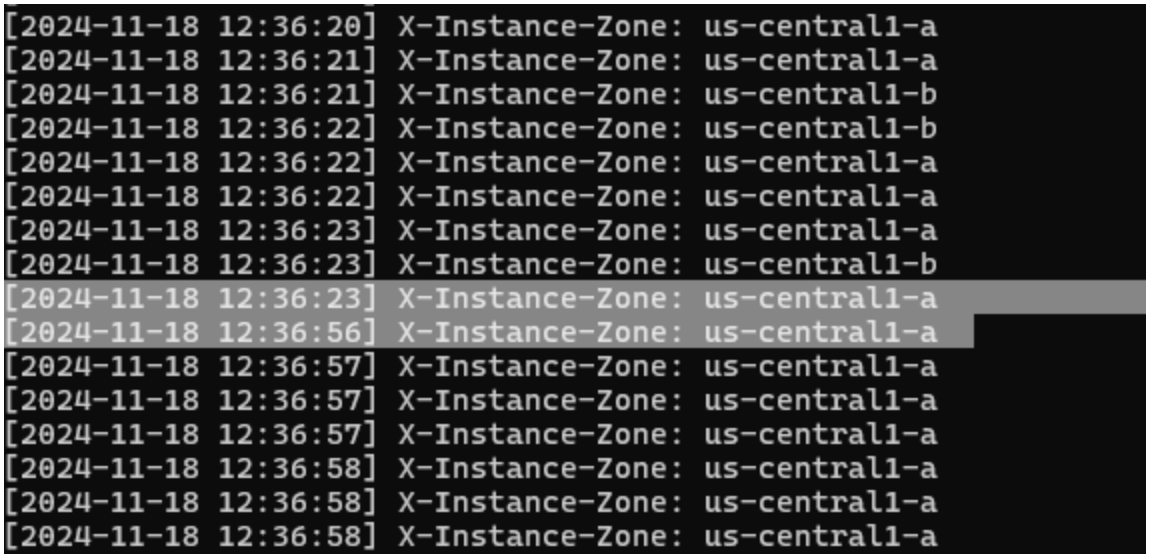
```
        conn = http.client.HTTPSConnection(domain, port,
context=ssl_context, timeout=timeout) if use_ssl else
http.client.HTTPConnection(domain, port, timeout=timeout)
        headers = build_headers(country, ip)
        conn.request("GET", filename, headers=headers)

        res = conn.getresponse()
        data = res.read()

        if verbose:
            print(res.status, res.reason)
            print(data)

        # Print the zone header if it exists
        zone_header = res.getheader("X-Instance-Zone")
        if zone_header:
            current_time = datetime.now().strftime("%Y-%m-%d %H:%M:%S")
            print(f"[{current_time}] X-Instance-Zone:", zone_header)

        if follow:
            location_header = res.getheader('location')
            if location_header is not None:
                filename = urljoin(filename, location_header)
                make_request(domain, port, country, ip, filename, use_ssl,
ssl_context, follow, verbose, timeout)

    # It will take some times to reroute to VM
    except RemoteDisconnected:
        current_time = datetime.now().strftime("%Y-%m-%d %H:%M:%S")
        print(f"[{current_time}] Warning: Remote server disconnected.
Retrying...")
        time.sleep(1)

    except (ConnectionResetError, ConnectionRefusedError, socket.timeout)
as e:
        current_time = datetime.now().strftime("%Y-%m-%d %H:%M:%S")
        print(f"[{current_time}] Connection error: {e}. Retrying...")
        time.sleep(1)
```

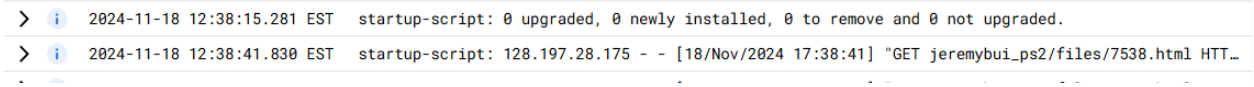
```
    finally:
        conn.close()
def print_zone_ratios():
    global zone_counter
    total_requests = sum(zone_counter.values())
    if total_requests > 0:
        print("\nZone Request Ratios:")
        for zone, count in zone_counter.items():
            ratio = (count / total_requests) * 100
            print(f"{zone}: {ratio:.2f}% ({count} requests)")
    else:
        print("\nNo requests have been processed yet.")
```

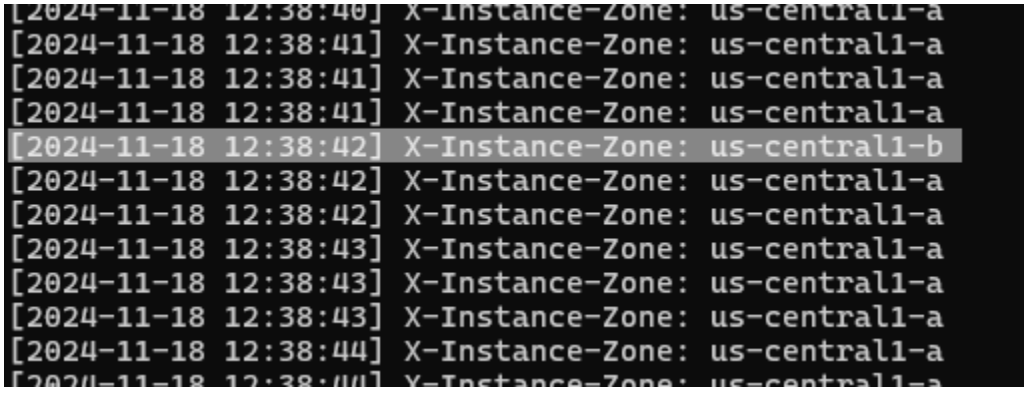
- Retrieve the X-Instance-Zone header from the response and print it with the timestamp to allow us to verify which zone the request is from
- Add a handling where the server may disconnect due to the load balancer being interrupted with a VM shutting down and needing to reroute requests
- Add counter to get ratio of requests by just adding to counter each time a request header is received

Metrics (step 5 and 6)

- Need to run http-client.py with ip from load balancer: python3 http-client.py --domain 34.172.19.216 --port 8080 --bucket jeremybui_ps2 --webdir files --num_requests 1000 --index 10000
- Kill one VM (killed us-central1-b VM) and notice how long it takes to reroute.
- **Step 5 answer: 33 seconds (12:36:56 - 12:36:23)**
    - The VM was killed at 12:36:23 and http-client was modified to buffer while requests could not be served
    - There was a response back from us-central1-a again at 12:36:56 and all of the following requests were from a, showing that requests were rerouted

- 

- Restart the killed VM (us-central1-b) and report how quickly the load balancer notices its presence and starts routing requests to it
- **Step 6 Answer: 27 seconds (13:38:42 - 12:38:15)**
    - Script inside webserver-vm-b successfully started at around 12:38:15
    - Start serving first request inside webserver at 12:38:41
    - Http-client saw response at 12:38:42
- 

- 

- Ratio of requests between zones

```
[2024-11-18 19:41:14] X-Instance-Zone: us-central1-a
[2024-11-18 19:41:14] X-Instance-Zone: us-central1-b
[2024-11-18 19:41:15] X-Instance-Zone: us-central1-b

Zone Request Ratios:
us-central1-b: 46.95% (446 requests)
us-central1-a: 53.05% (504 requests)
```

Cost