NWEN243 Project 3 Lab Report Part A

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This lab report documents how I followed the steps laid out in part A of the instructions of the project. NOTE: answers to the questions in the PDF highlighted in red start at page 20.

Preliminary

```java
import java.io.IOException;
import java.net.ServerSocket;
import java.net.Socket;

/**
 * Health Check for the server. Accepts a connection and immediately drops it.
 * Only works on port 5001, which has been selected in the AWS instance
 * security group.
 */
public class MusicGuruHealthCheck {

    //takes 1 argument, port
    public static void main(String[] args) {
        int port = Integer.parseInt(args[0]);
        try (ServerSocket serverSocket = new ServerSocket(port)) {
            while (true) {
                Socket clientSocket = serverSocket.accept();
                clientSocket.close();
            }
        } catch (IOException e) {
            e.printStackTrace();
        }
    }
}
```

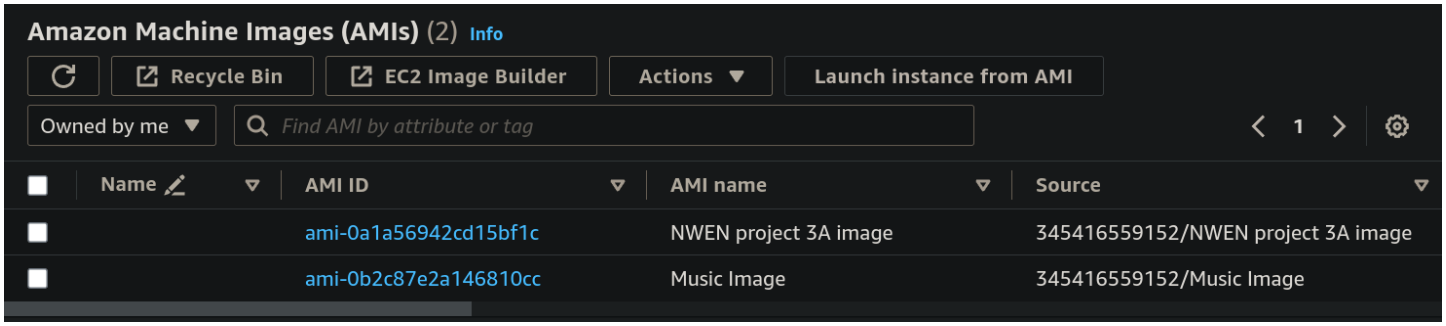
This shows the code I used for the health check server. It constantly loops around accepting and closing socket connections.

```
  GNU nano 6.2
#!/bin/sh
cd /home/ec2-user/
java MusicGuruServer 5000 &
java MusicGuruHealthCheck 5001 &
```

This code shows the run.sh file, edited to start up the health check server when the instance is started. The health check server is situated on port 5001 on my instance.

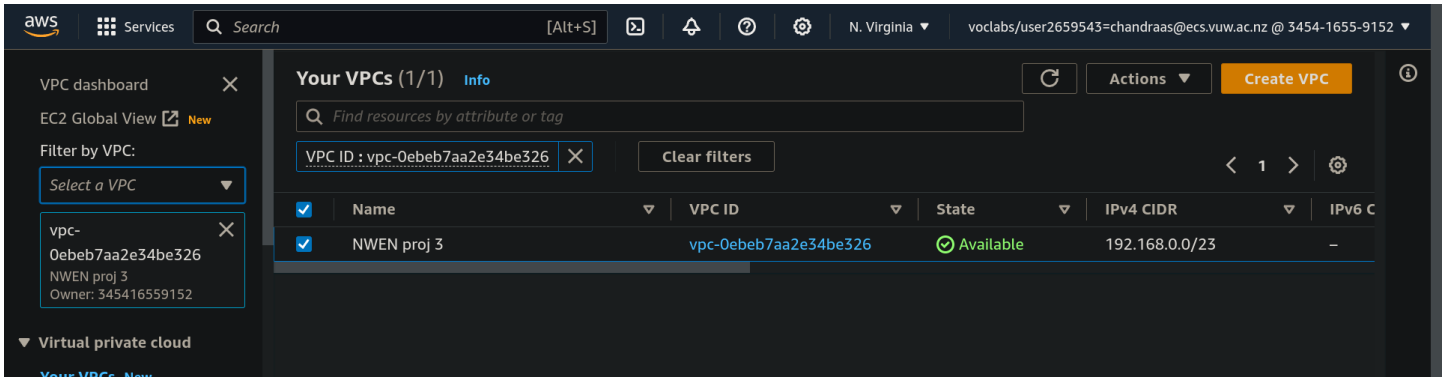
```
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 3$ telnet 5
4.89.229.208 5001
Trying 54.89.229.208...
Connected to 54.89.229.208.
Escape character is '^]'.
Connection closed by foreign host.
```

Here it is showing that the server is healthy. I use telnet to connect to the server and the server automatically closes the connection.



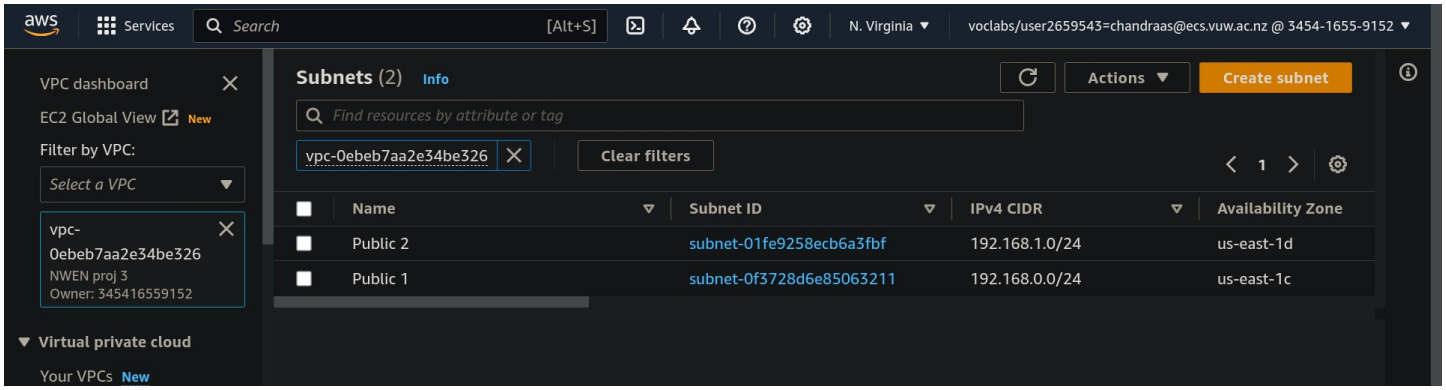
Here is showing the image I’ve created from the updated instance.

Q1-4



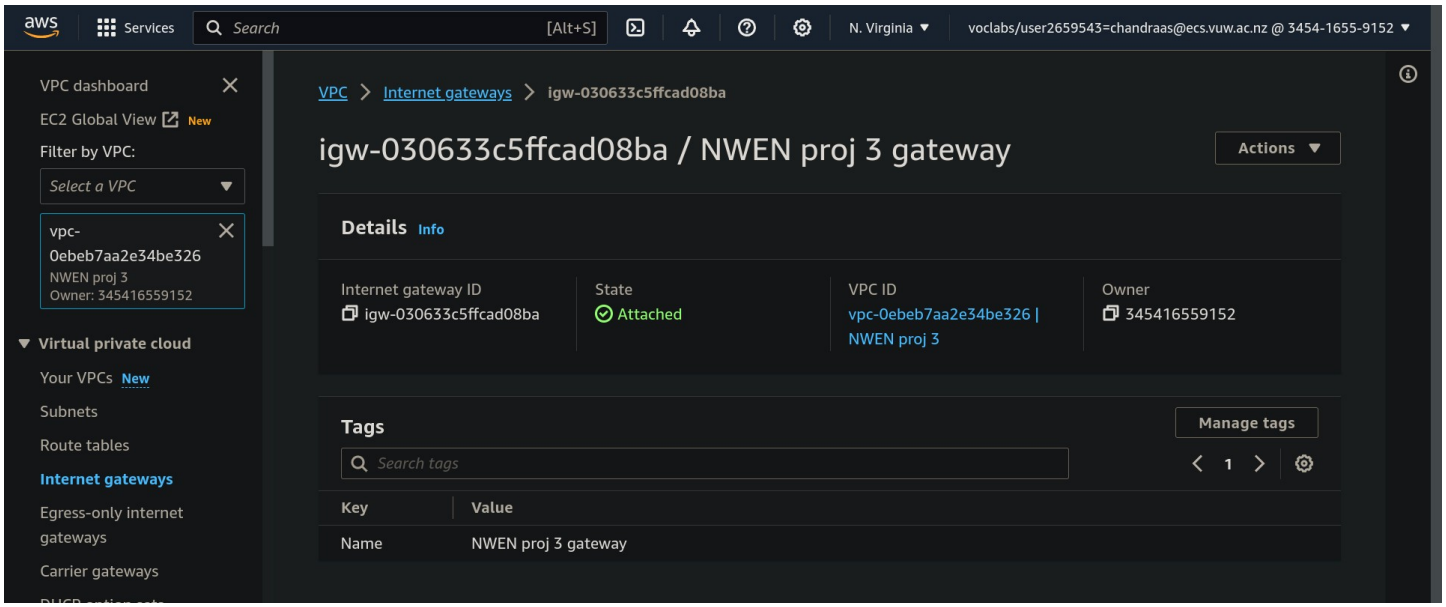
This shows the creation of the VPS alongside the IPv4 CIDR.

Q5-6



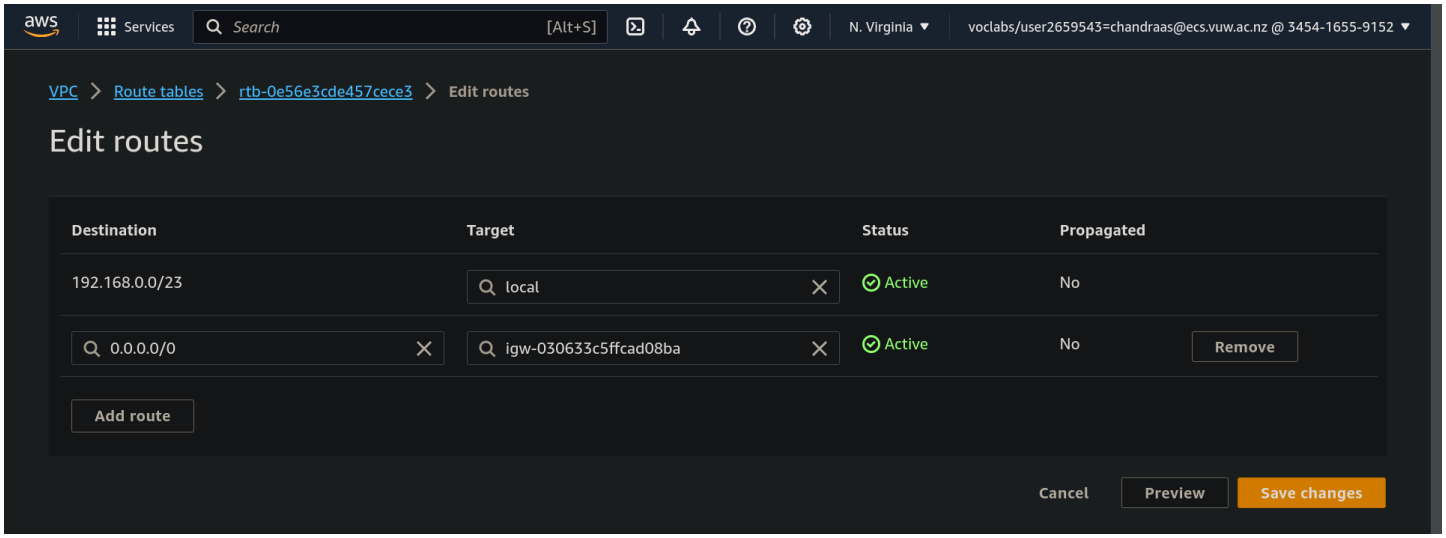
This shows the subnets I created from the VPC, and the different availability zones.

Q7-10



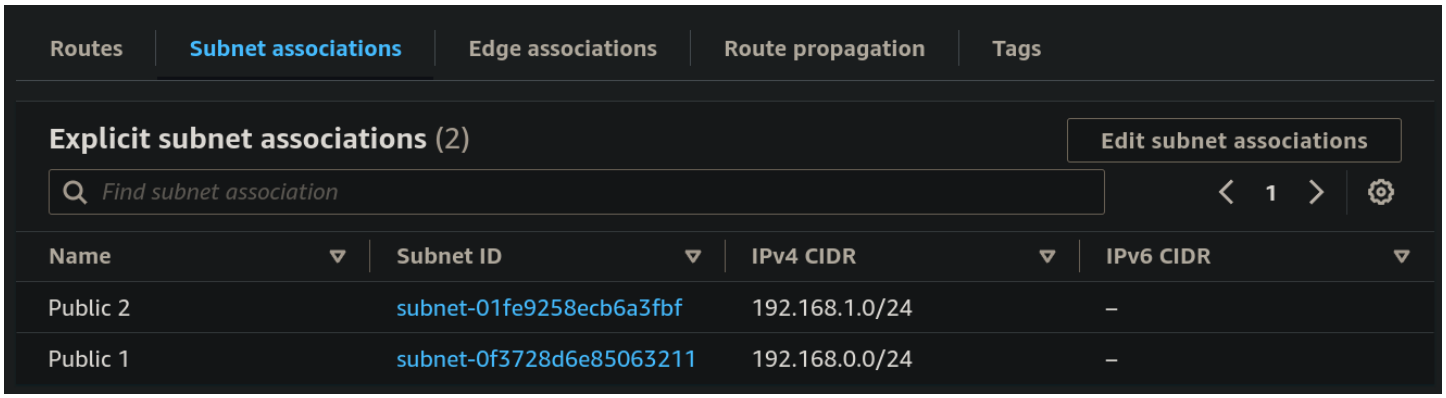
The creation of the Internet Gateway.

Q11-15



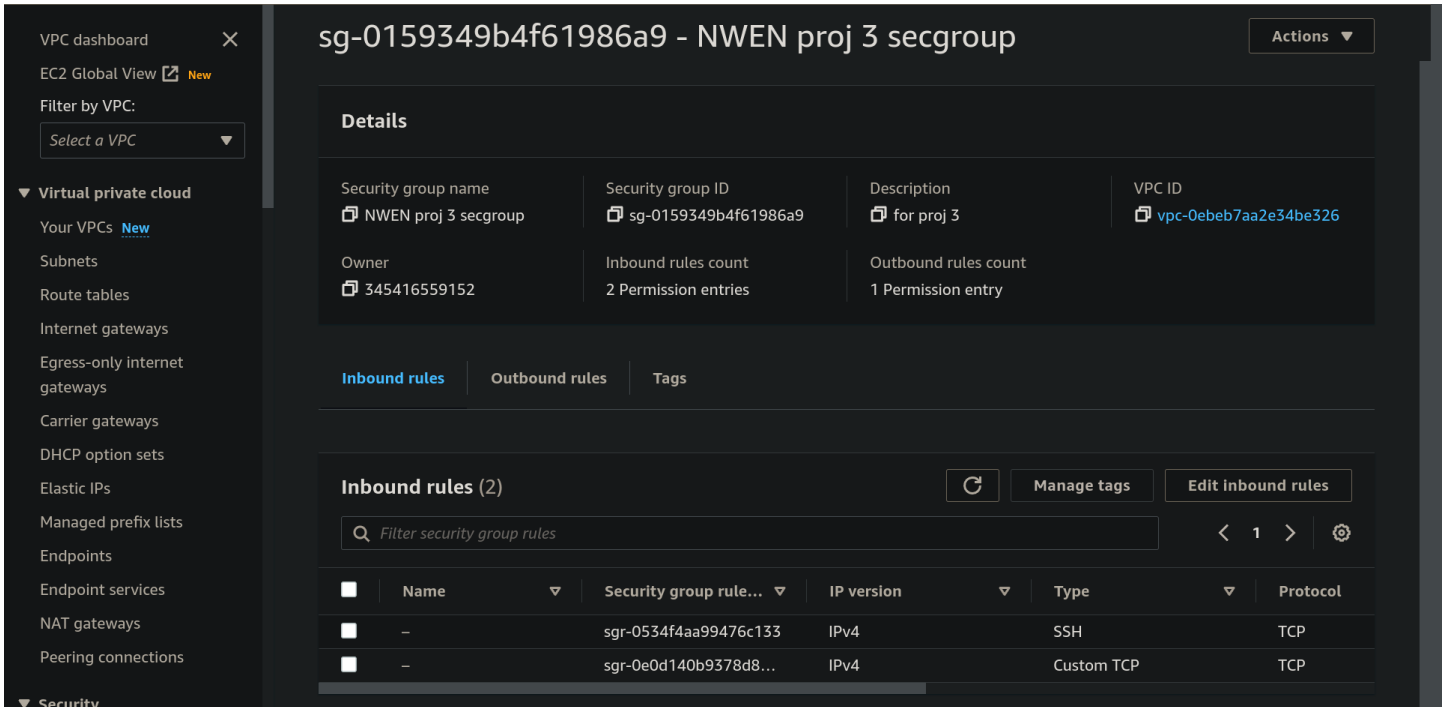
Adding the internet gateway to the routing table of the VPC. The destination is set to 0.0.0.0/23 to allow traffic from everywhere.

Q16-18

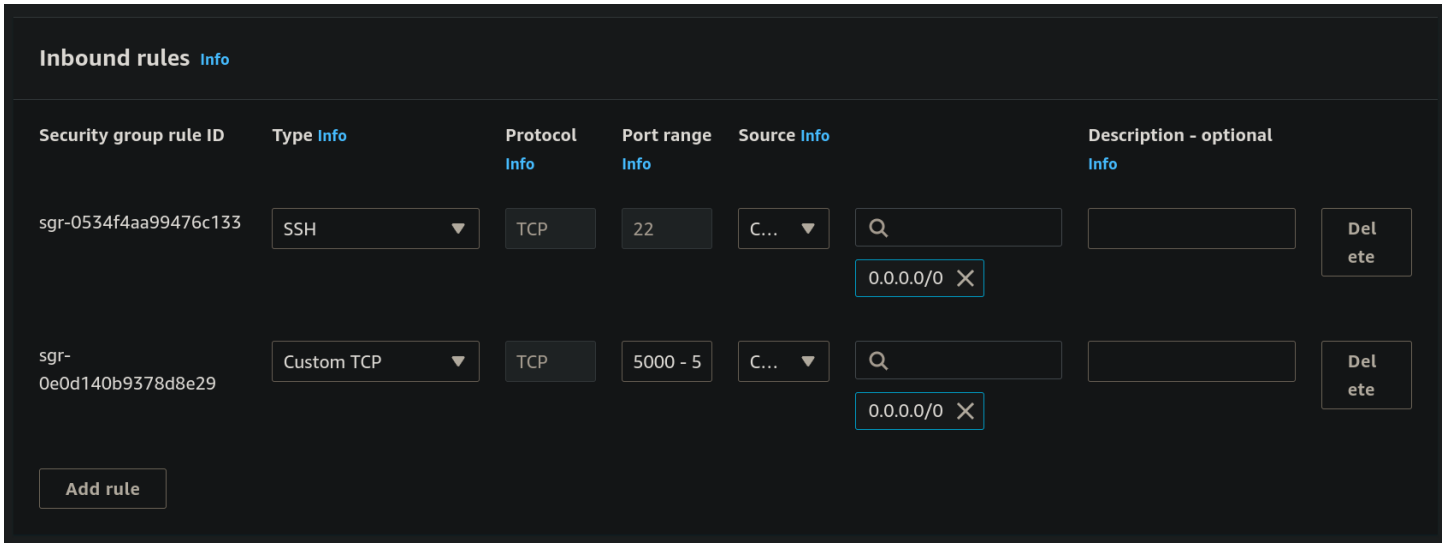


Associating the routing table with the two subnets created earlier.

Q19-24

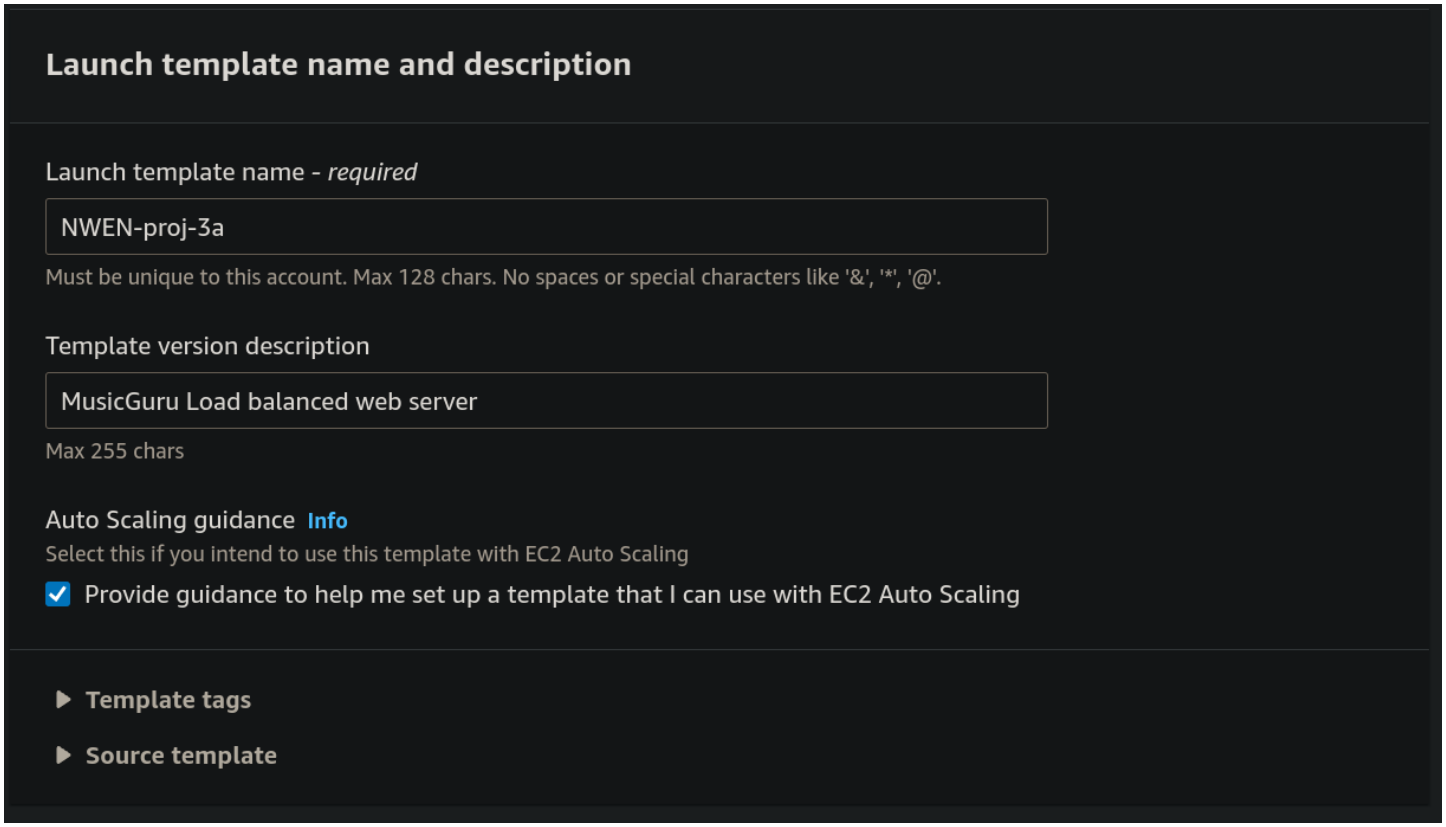


Creation of the custom SSH and TCP groups for the VPC.



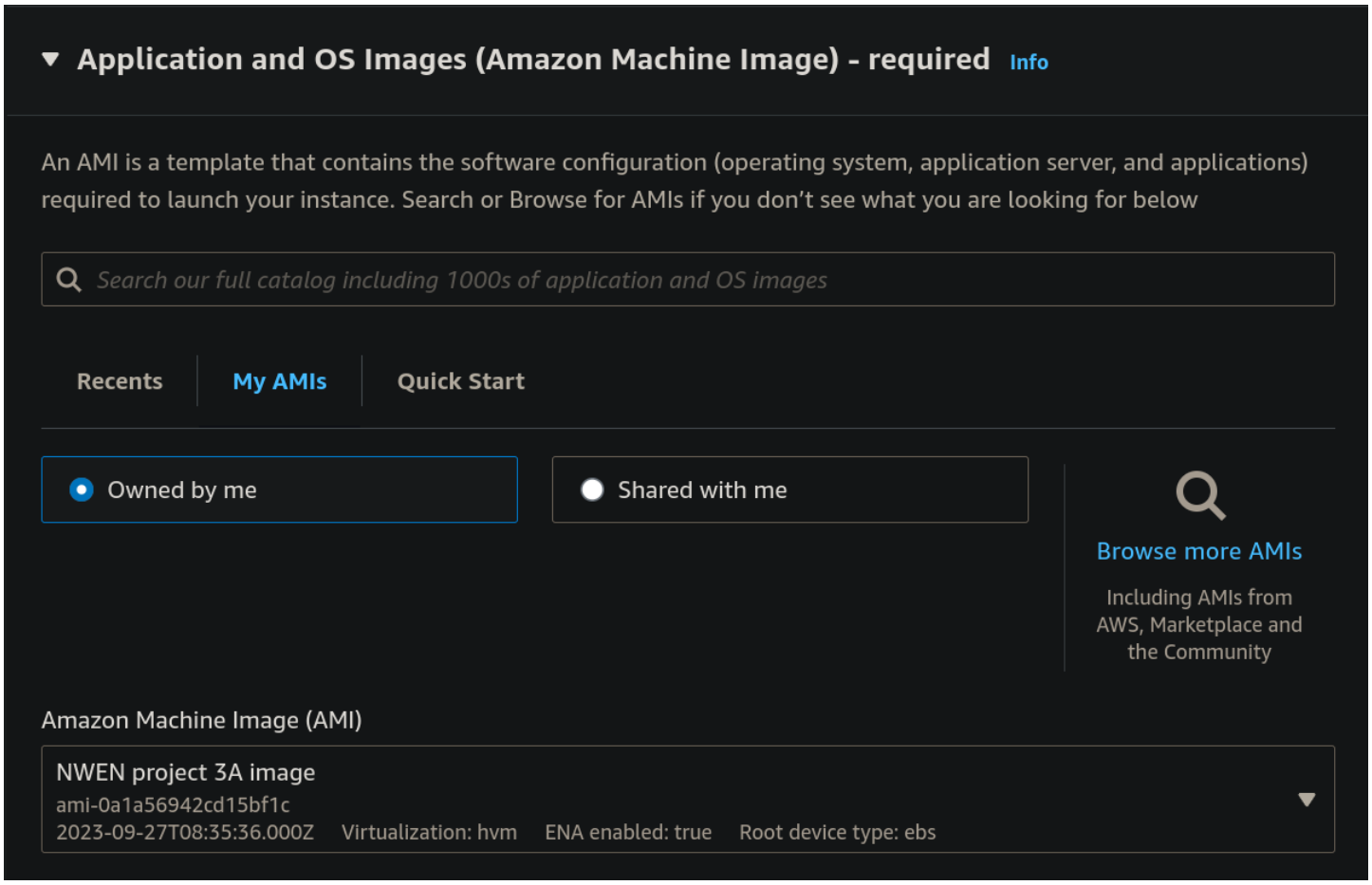
The security groups closer. Both set to accept inbound traffic from all addresses. The custom TCP rule accepts inbound traffic arriving at ports 5000-5001 for the actual MusicGuru server and the health check server.

Q25-28



Creating a template, naming it and clicking the box.

Q29-31

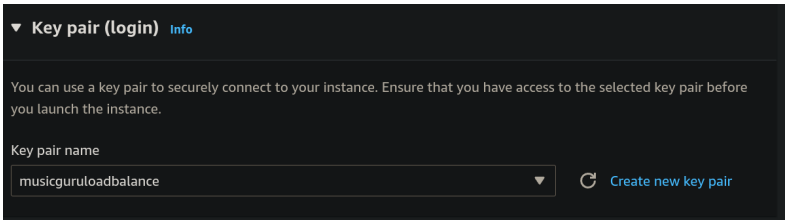


Selecting the image I created.

Q31

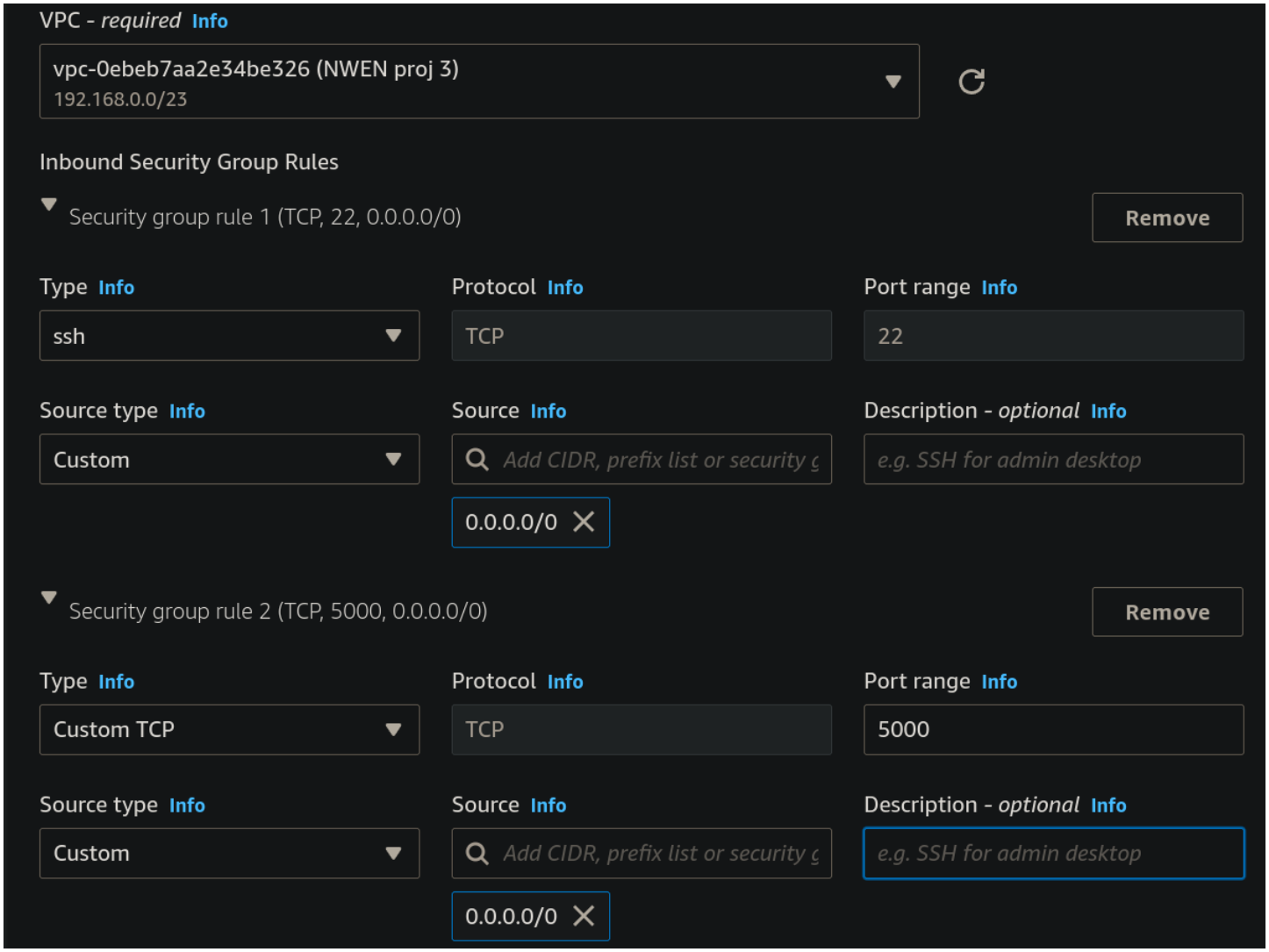
Selecting t2.micro.

Q32



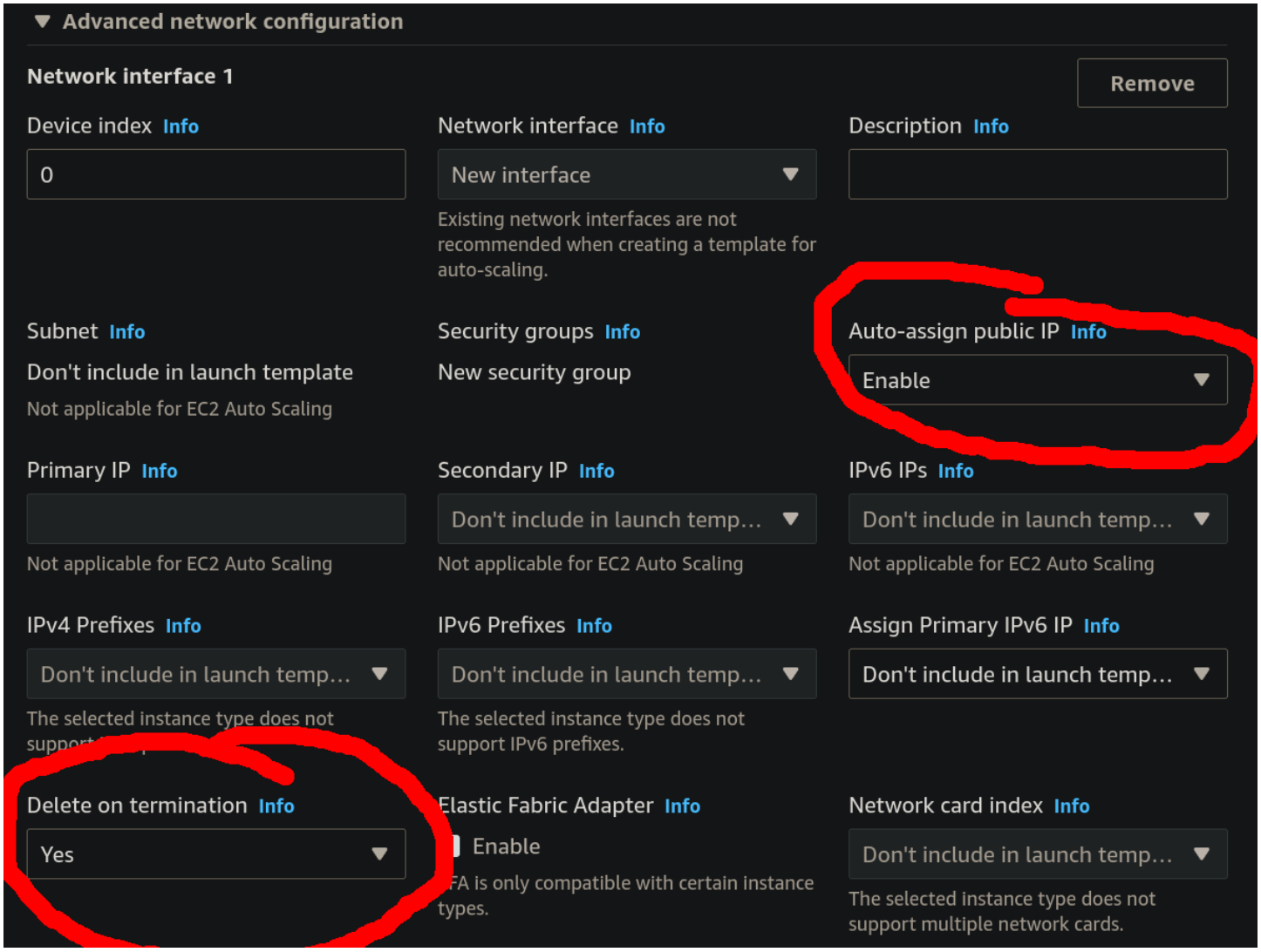
Creating a new key pair.

Q34



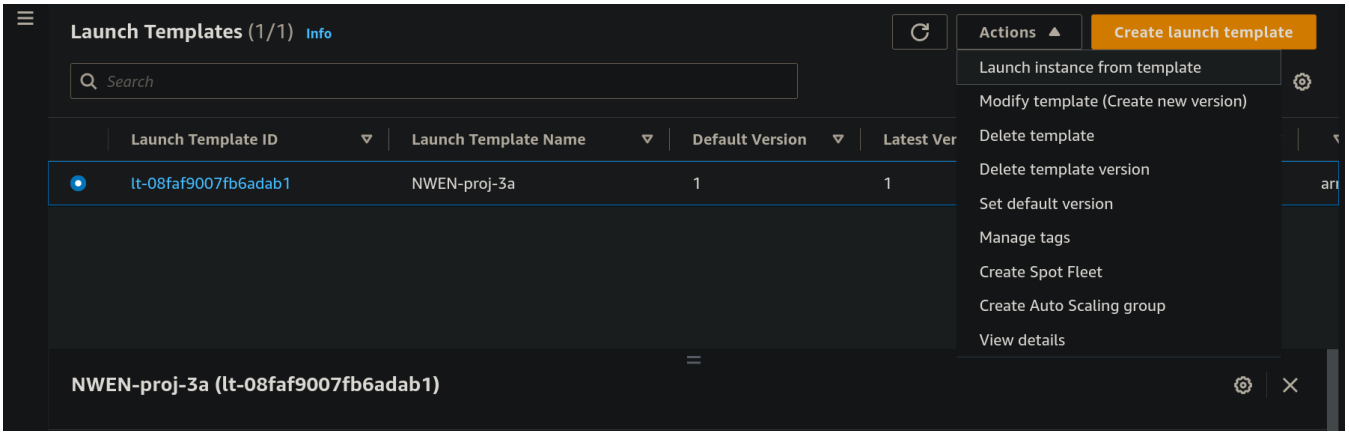
Creating the security groups; one for ssh and the port that my MusicGuru server is using. My VPC is also selected at the top.

Q35-36



Enabling “Auto-assign IP” and “Delete on termination”.

Q38



Launching an instance from the template I created.

Q39

The two instances launched using both subnets.

Q40

us-east-1d	–	44.202.103.135
us-east-1c	–	44.213.101.175

The public IP addresses of the instances.

```
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 3$ ssh -i m
usicguruloadbalance.pem ec2-user@44.213.101.175
Last login: Wed Sep 27 06:58:08 2023 from 151.210.160.8
   ,     #_
   ~\_  ####_        Amazon Linux 2
  ~~  \_#####\
  ~~     \###|       AL2 End of Life is 2025-06-30.
  ~~       \#/ ___
   ~~       V~' '->
    ~~~         /    A newer version of Amazon Linux is available!
      ~~._.   _/
         _/ _/       Amazon Linux 2023, GA and supported until 2028-03-15.
       _/m/'           https://aws.amazon.com/linux/amazon-linux-2023/

[ec2-user@ip-192-168-0-47 ~]$
```

SSH-ing into one of the instances.

```
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 3$ ssh -i m
usicguruloadbalance.pem ec2-user@44.202.103.135
The authenticity of host '44.202.103.135 (44.202.103.135)' can't be established.
ED25519 key fingerprint is SHA256:eKmmkiQq7kI5JWDA+I9nfbbi7TWG2o3KwoBPjTbxmi0.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '44.202.103.135' (ED25519) to the list of known hosts
.
Last login: Wed Sep 27 06:58:08 2023 from 151.210.160.8
   ,     #_
   ~\_  ####_        Amazon Linux 2
  ~~  \_#####\
  ~~     \###|       AL2 End of Life is 2025-06-30.
  ~~       \#/ ___
   ~~       V~' '->
    ~~~         /    A newer version of Amazon Linux is available!
      ~~._.   _/
         _/ _/       Amazon Linux 2023, GA and supported until 2028-03-15.
       _/m/'           https://aws.amazon.com/linux/amazon-linux-2023/

[ec2-user@ip-192-168-1-95 ~]$
```

SSH-ing into the other.

```
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$ java Mus
icGuruClient 44.213.101.175      5000 1963
Range: 1950-2009
Sending year 1963
In 1963 the number 9 song was Blowin' In The Wind by Bob Dylan / Peter Paul & Ma
ry
(192.168.0.47)
```

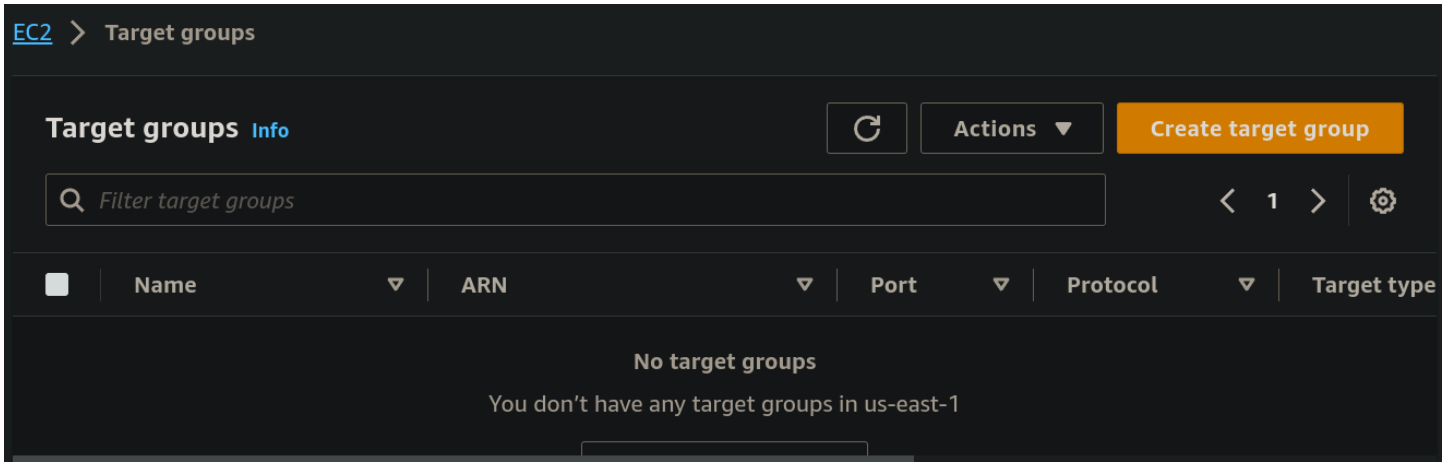
Connecting to the instance via the MusicGuru client for the first instance.

```
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$ java Mus
icGuruClient 44.202.103.135 5000 1963
Range: 1950-2009
Sending year 1963
In 1963 the number 3 song was I Want To Hold Your Hand by Beatles
(192.168.1.95)
```

Connecting to the instance via the MusicGuru client for the second instance.

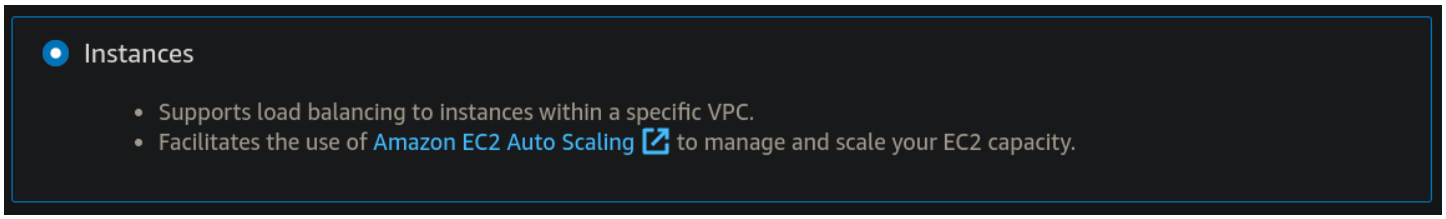
Creating the Load Balancer

Q43

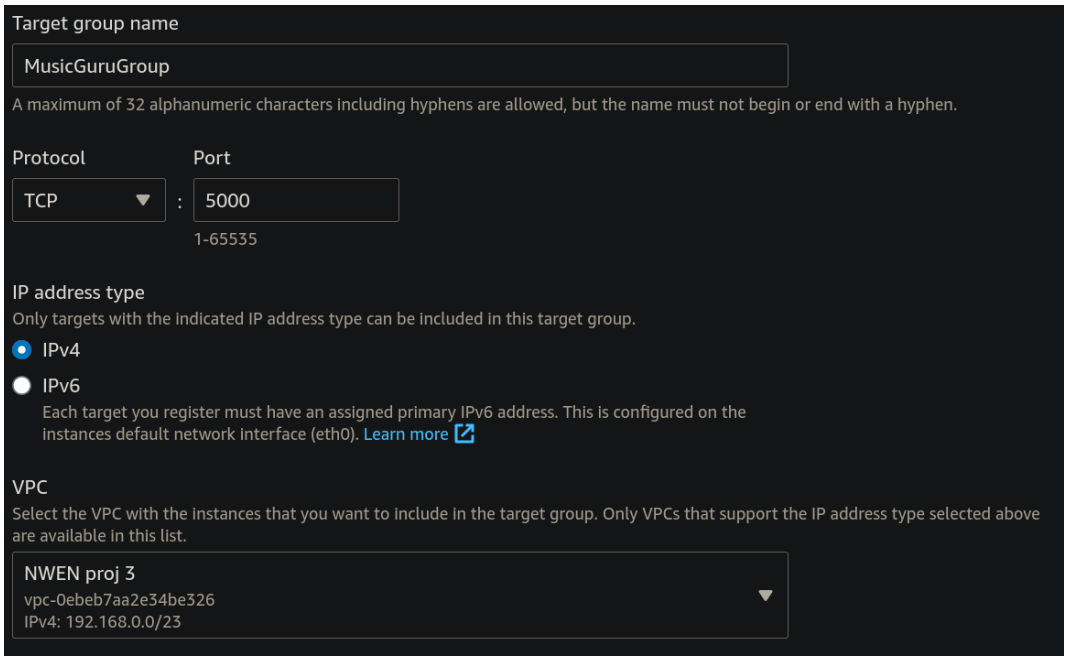


On the "Target Groups" menu.

Q44-45

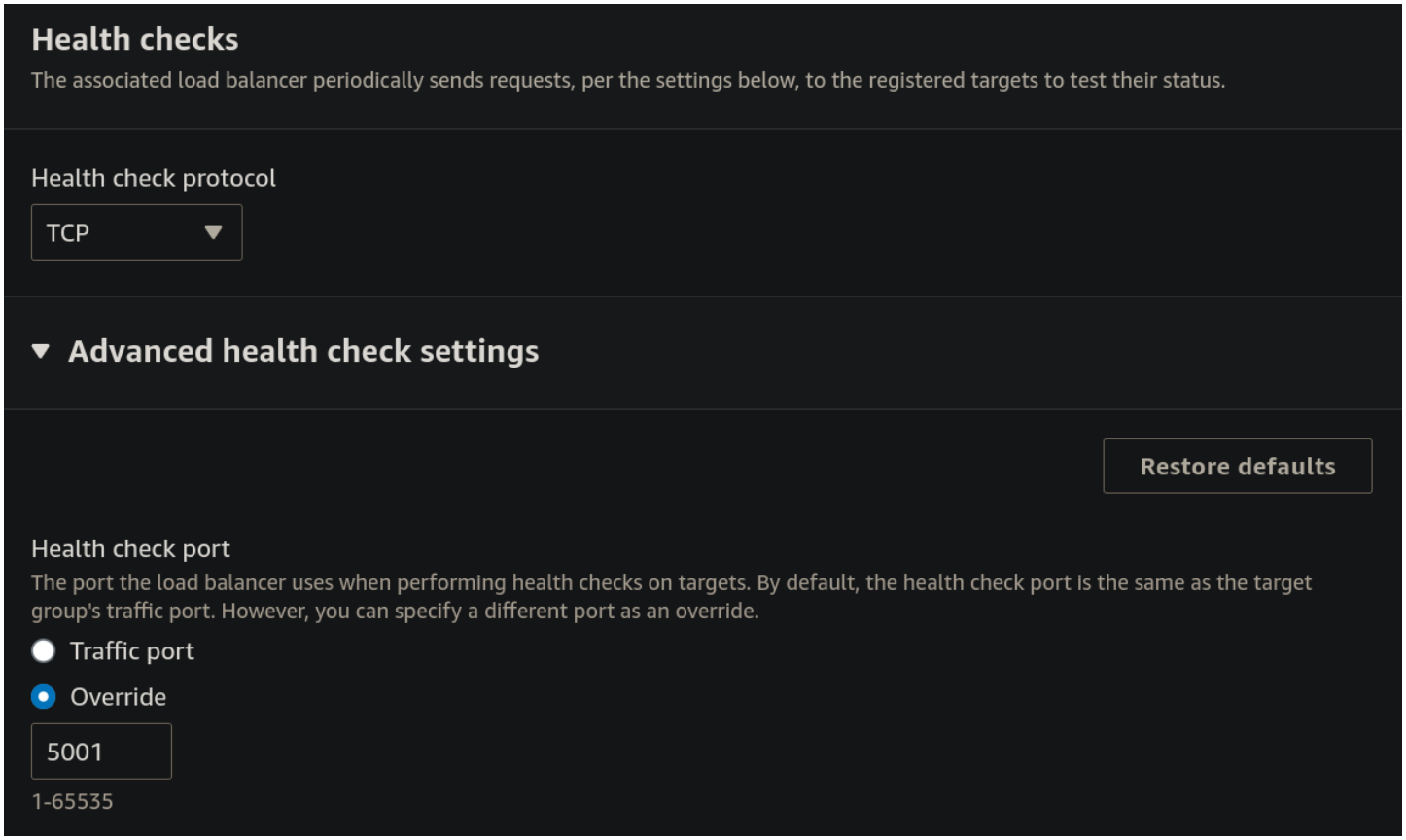


Selecting the default "instances" option.



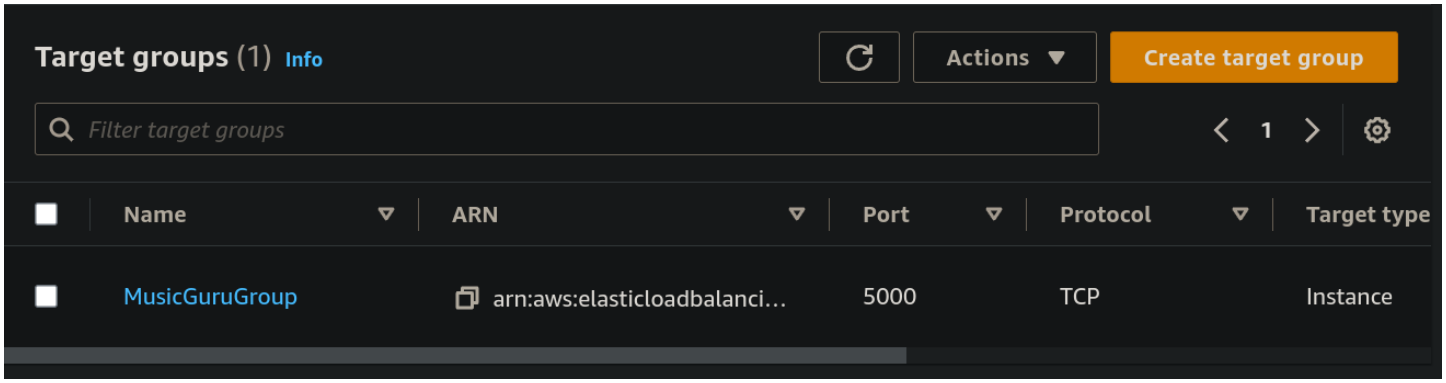
Naming the target group, changing the protocol to TCP and changing the port to 5000 for the server, and selecting the VPC I created.

Q46



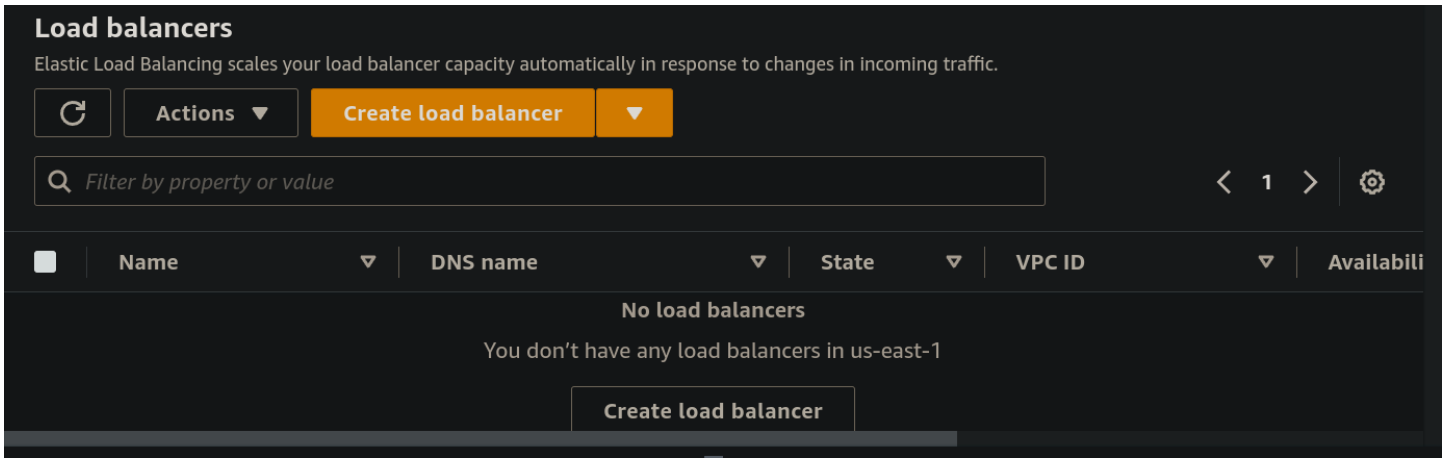
Changing the health check server to TCP protocol and port 5001.

Q48



Target group created.

Q50



Creating the load balancer.

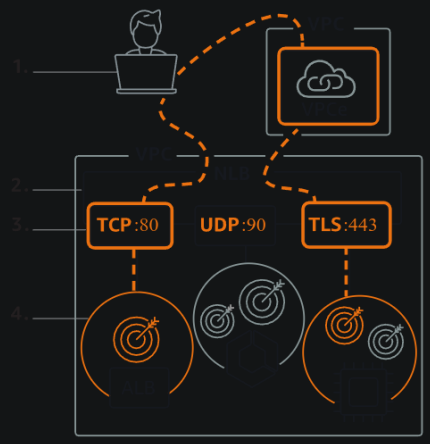
Q51-52

Create Network Load Balancer Info

The Network Load Balancer distributes incoming TCP and UDP traffic across multiple targets such as Amazon EC2 instances, microservices, and containers. When the load balancer receives a connection request, it selects a target based on the protocol and port that are specified in the listener configuration, and the routing rule specified as the default action.

How Elastic Load Balancing works

1. Clients make requests to your application.
2. The load balancer receives the request either directly or through an endpoint for private connectivity (via AWS PrivateLink).
3. The listeners in your load balancer receive requests of matching protocol and port, and route these requests based on the default action that you specify. You can use a TLS listener to offload the work of encryption and decryption to your load balancer.
4. Healthy targets in one or more target groups receive traffic according to the flow hash algorithm.



Creating a Network Load Balancer and reading the dropdown.

Q53

Basic configuration

Load balancer name

Name must be unique within your AWS account and can't be changed after the load balancer is created.

MusicGuruLoadBalancer

A maximum of 32 alphanumeric characters including hyphens are allowed, but the name must not begin or end with a hyphen.

Scheme

Scheme can't be changed after the load balancer is created.

- (•) Internet-facing
  An internet-facing load balancer routes requests from clients over the internet to targets. Requires a public subnet. Learn more
- ( ) Internal
  An internal load balancer routes requests from clients to targets using private IP addresses.

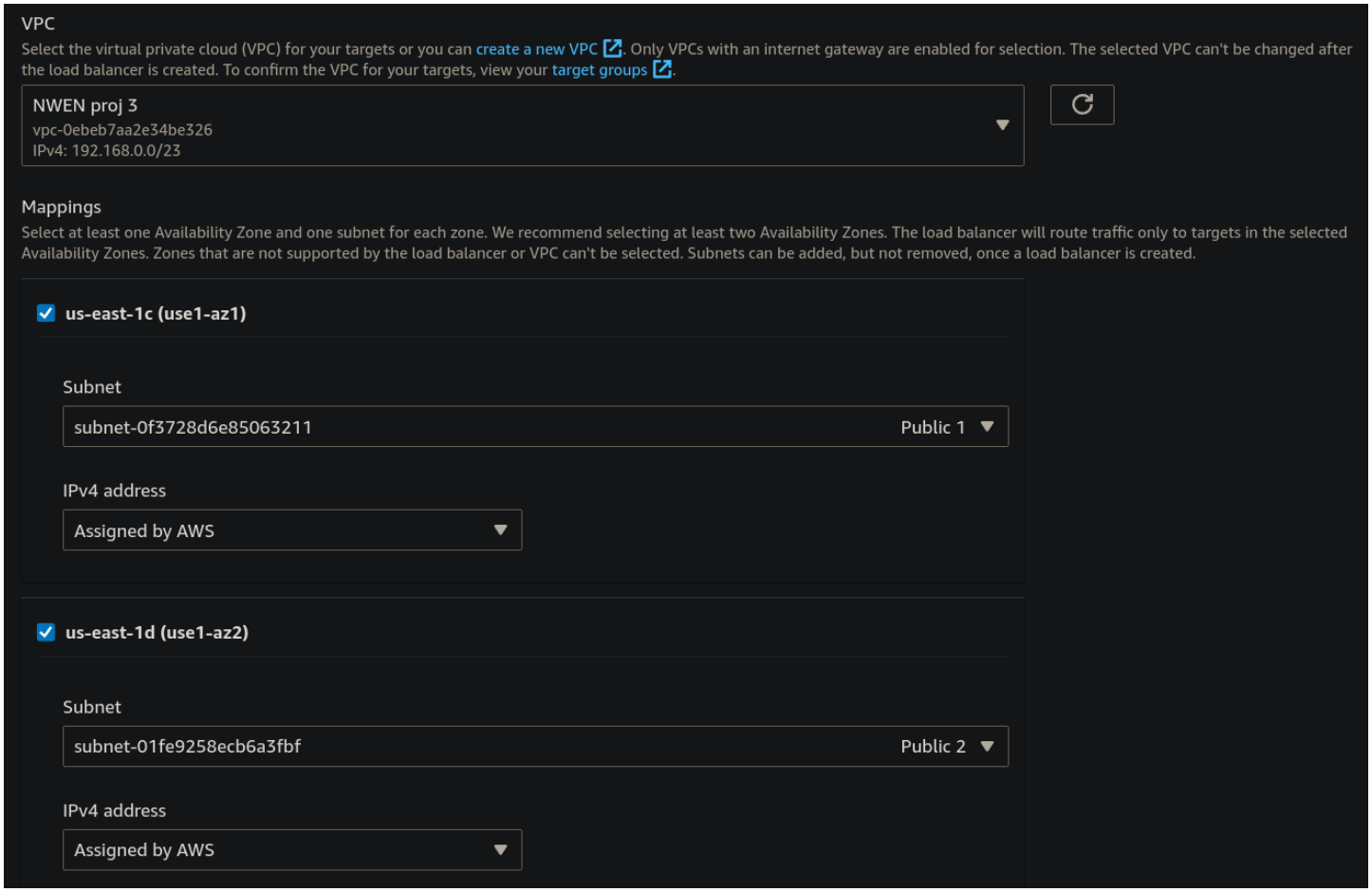
IP address type | Info

Select the type of IP addresses that your subnets use.

- (•) IPv4
  Recommended for internal load balancers.
- ( ) Dualstack
  Includes IPv4 and IPv6 addresses.

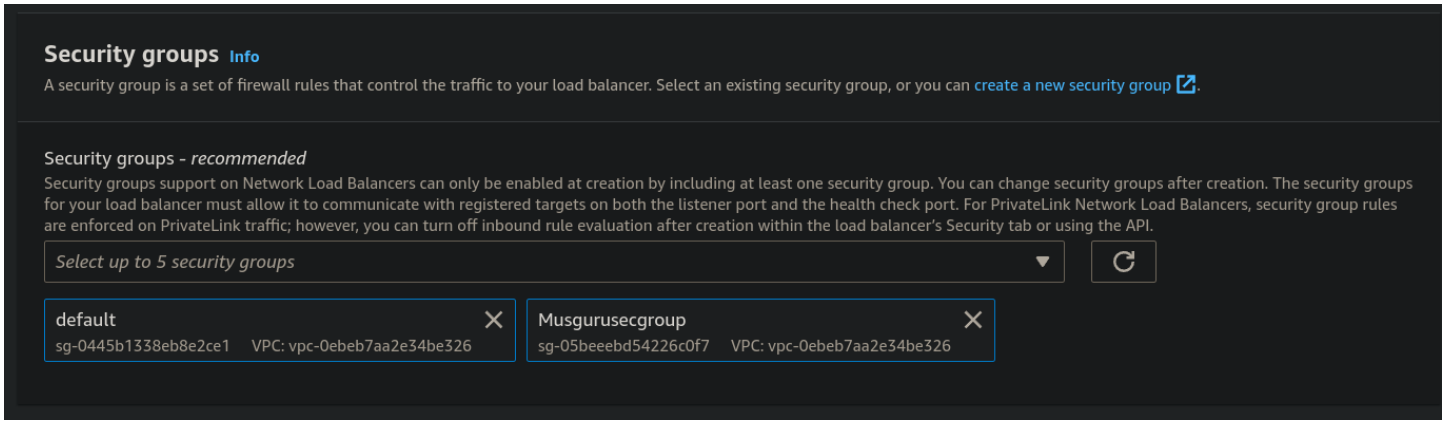
Naming the load balancer and leaving defaults.

Q54



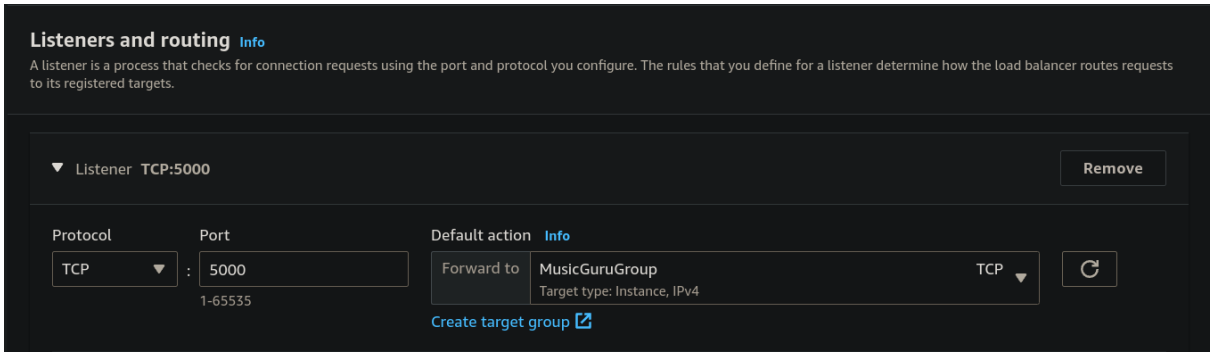
Selecting the Music Guru VPC made and selecting both subnets to map to.

Q55



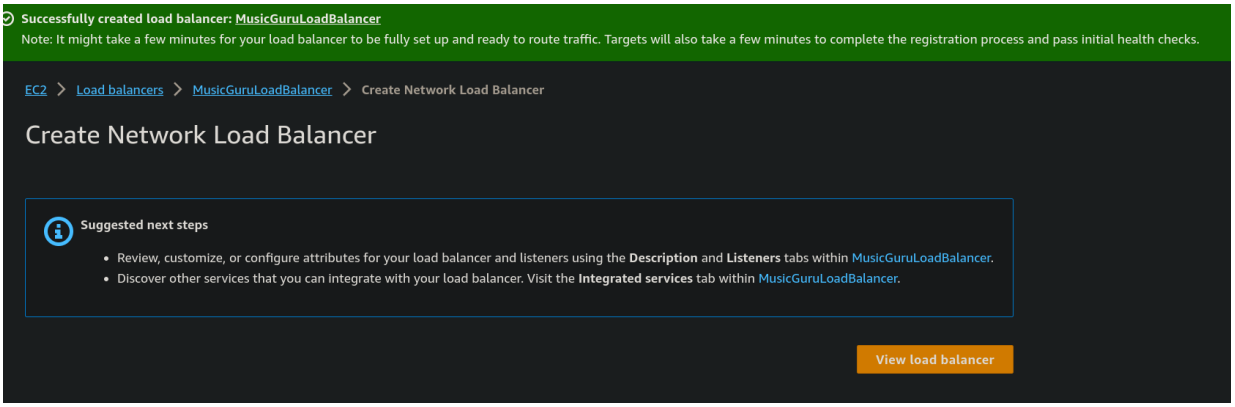
Adding the security group made previously alongside the default one.

Q56



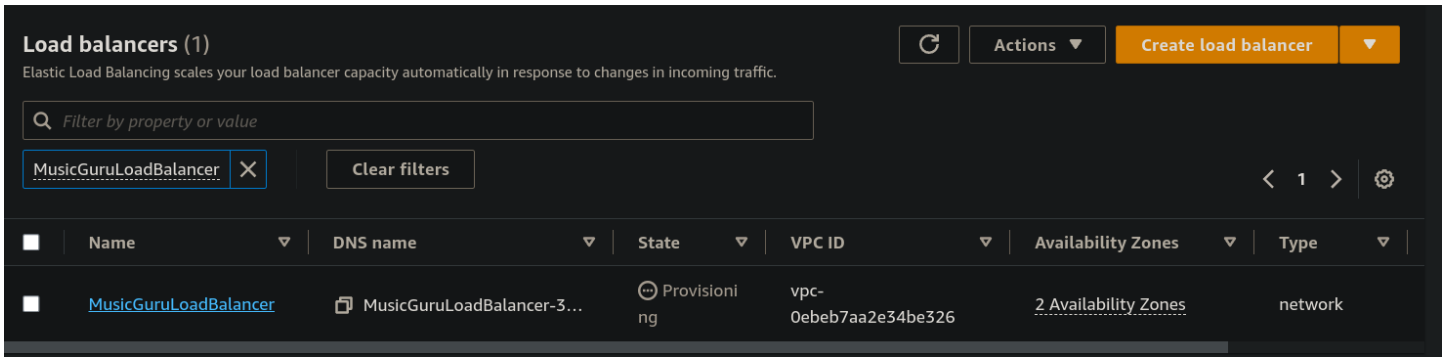
Choosing the target group I created and correcting the port.

Q57



Load balancer created.

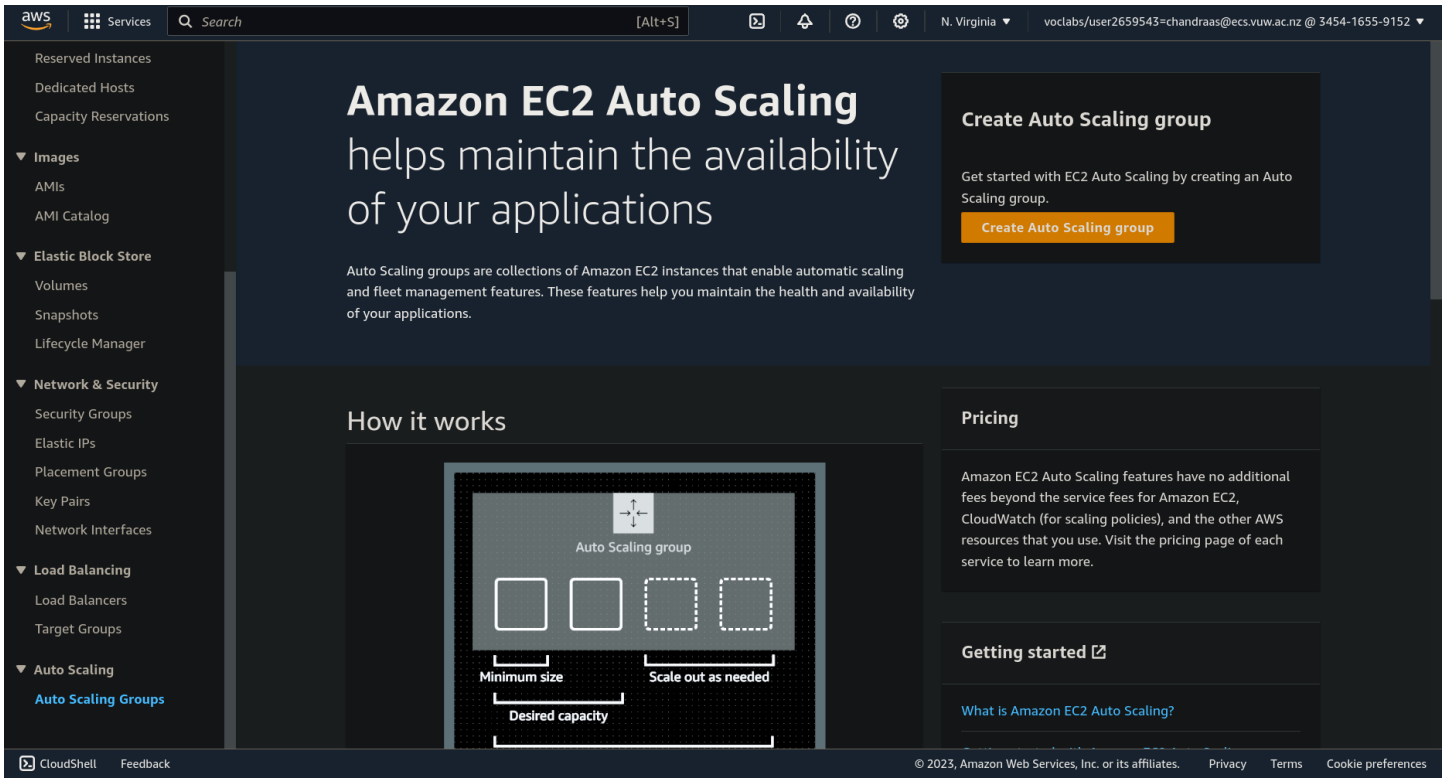
Q58



Viewing load balancer.

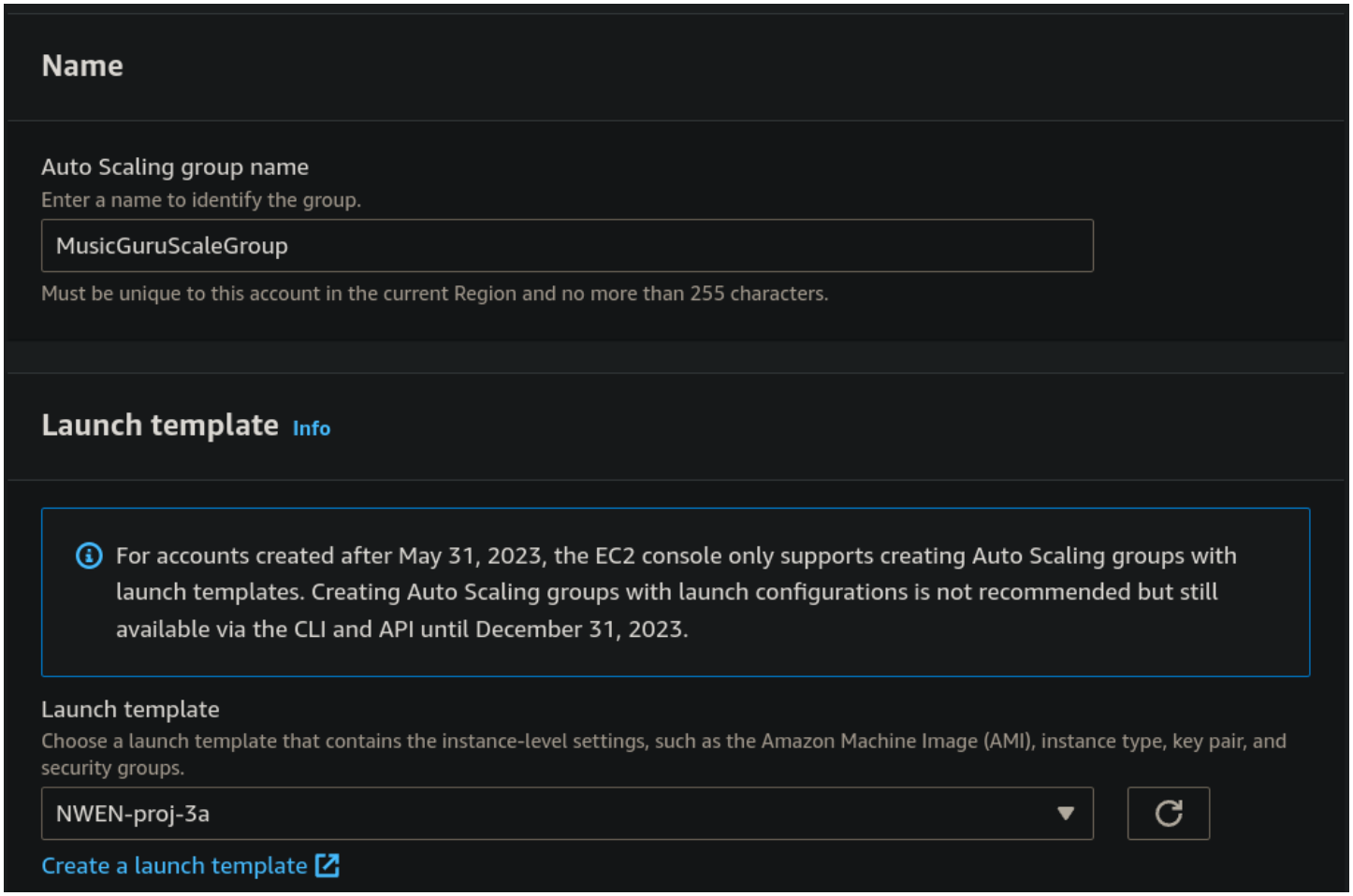
Creating an Autoscaling Group

Q59-61



Viewing the autoscaling group page and reading the information.

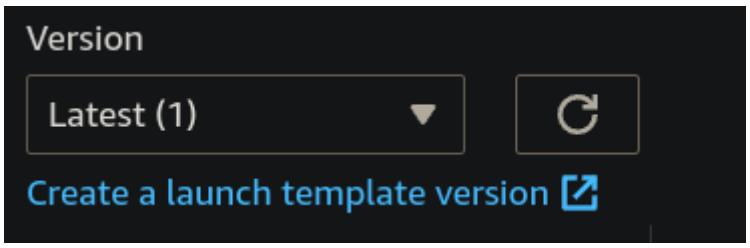
Q62



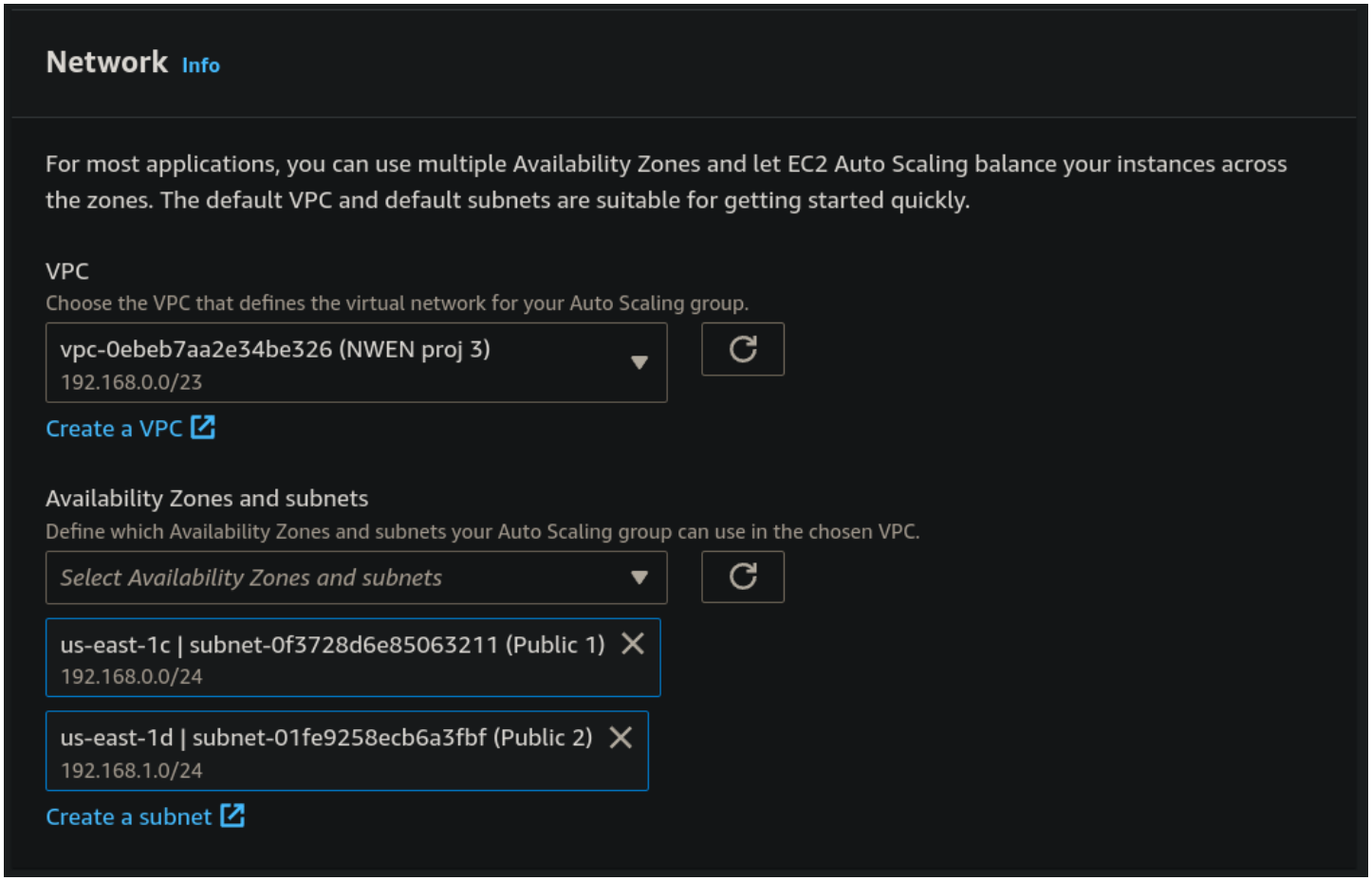
Naming autoscaling group and selecting launch template.

Q63

Choosing the latest version.

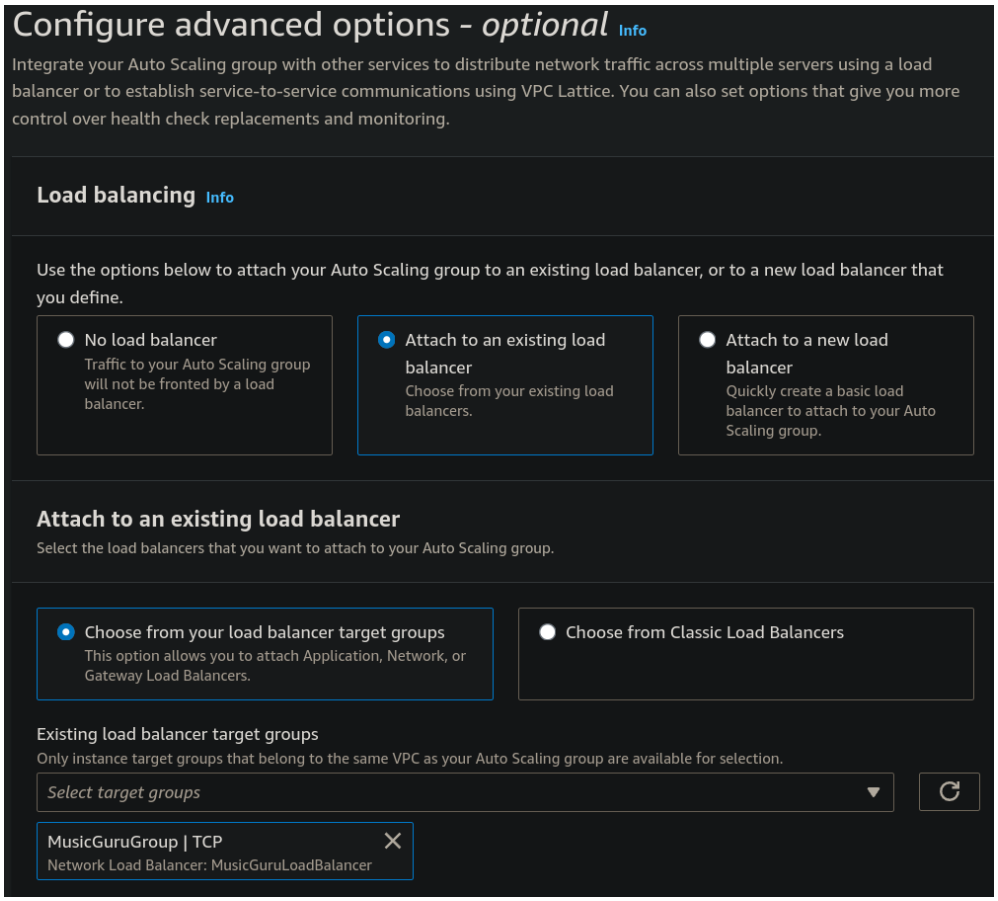


Q64-65



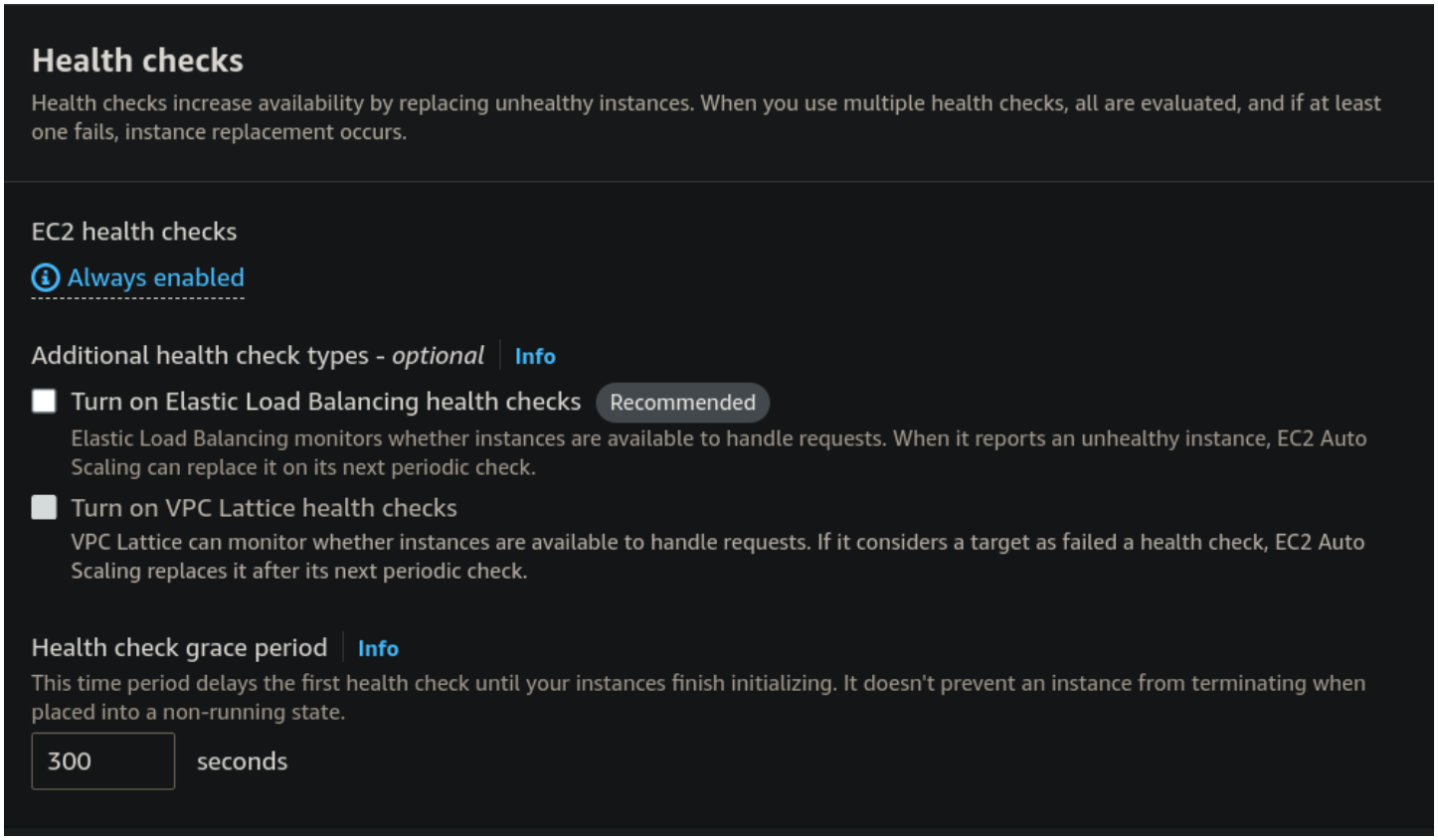
Choosing my VPC and subnets.

66-68



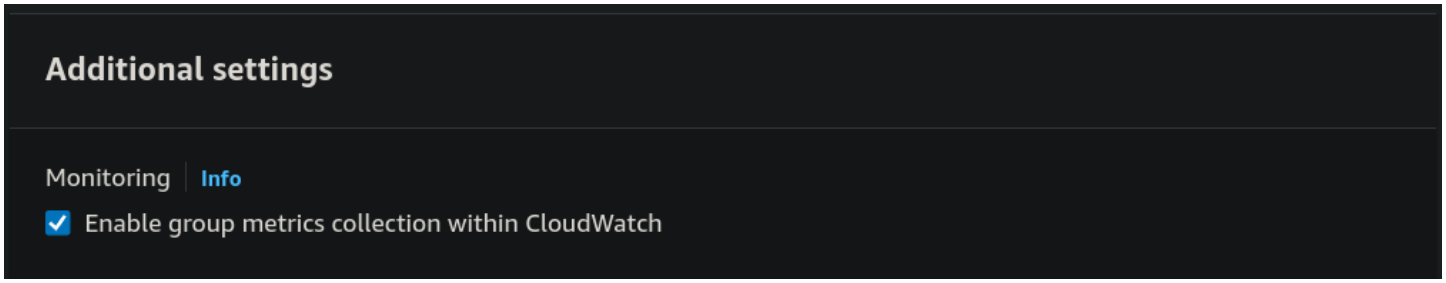
Configure advanced options. Selected “Attach to an existing load balancer” and selected my load balancer target group.

Q69-70



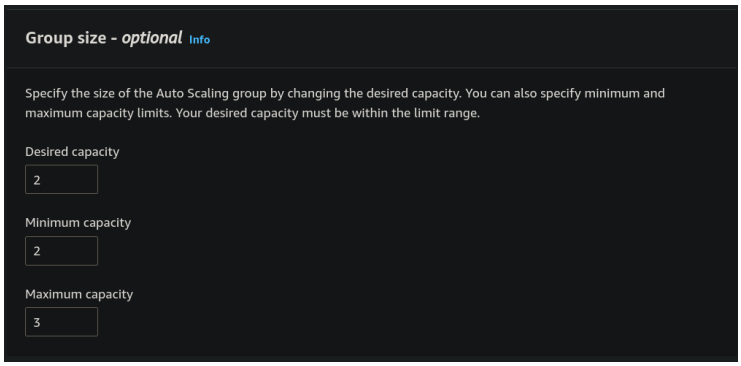
Additional health checks not enabled.

Q71



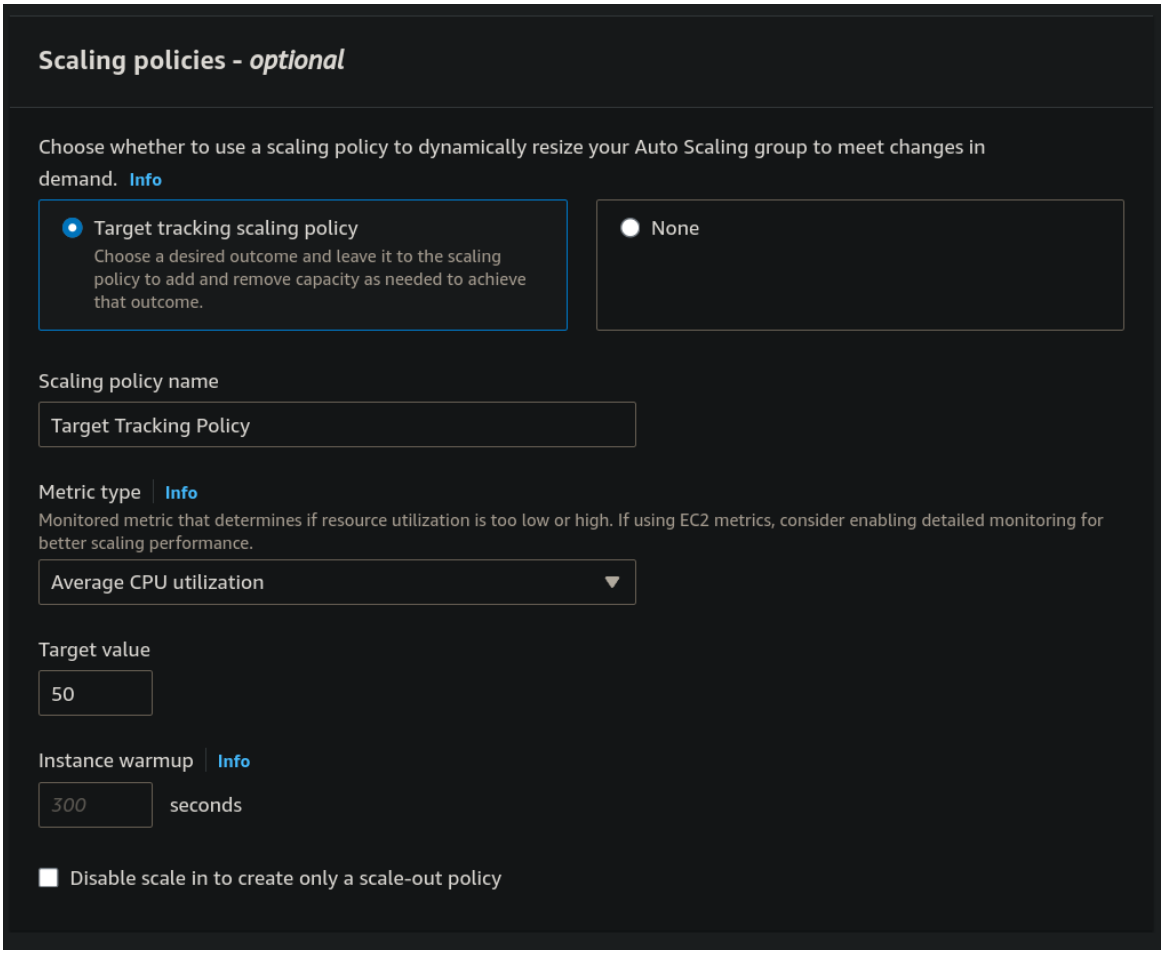
Enabled group metrics collection within CloudWatch.

Q72-73



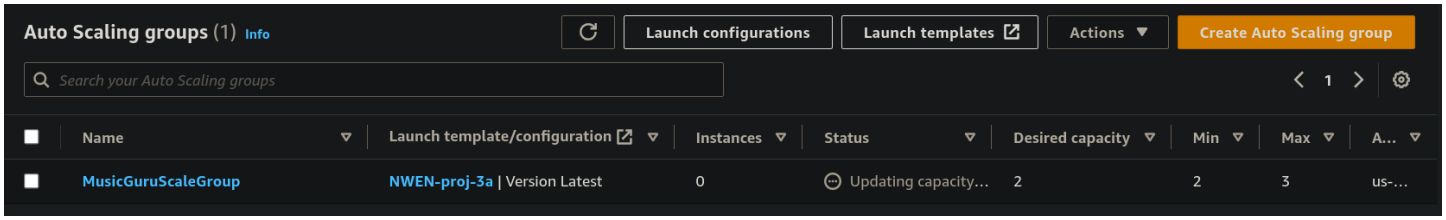
Modified group size to 2 desired, 2 minimum, 3 maximum.

Q74



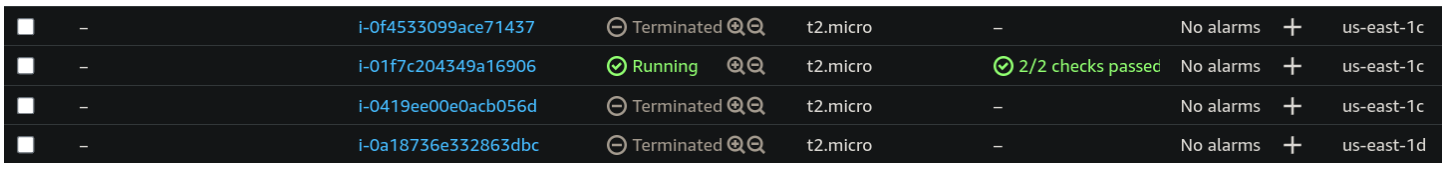
Choosing default scaling policy.

Q75-78



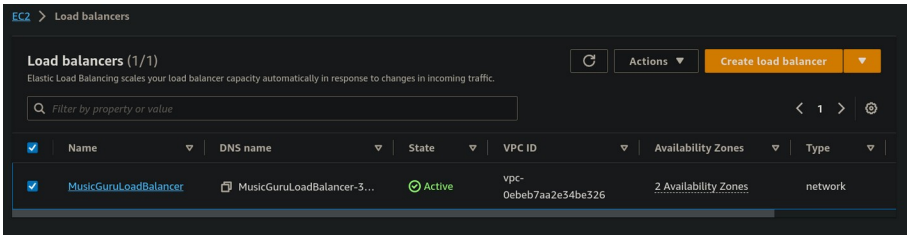
Auto Scaling group created, all other sections skipped through and settings reviewed.

Q79



I have one instance running but a few were instantly terminated.

Q80



Viewing the load balancers pane again.

Q81

Copying the load balancer DNS name.

Q82

```
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$ java Mus
icGuruClient MusicGuruLoadBalancer-fefc11a5a3cc10c2.elb.us-east-1.amazonaws.com
5000 1976
Range: 1950-2009
Sending year 1976
In 1976 the number 2 song was Go Your Own Way by Fleetwood Mac
(192.168.0.186)
```

Works!

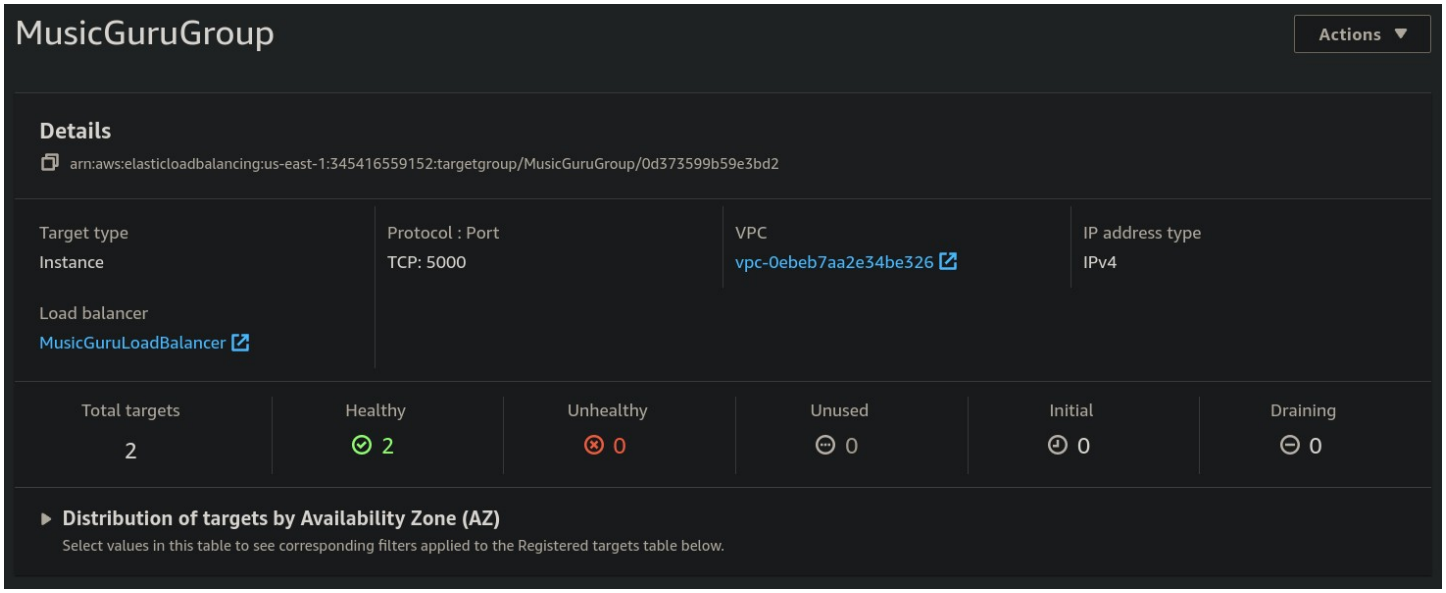
Q83

```
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 3$ ssh -i m
usicguruloadbalance.pem ec2-user@44.199.200.89
Last login: Wed Sep 27 06:58:08 2023 from 151.210.160.8
   ,     #_
   ~\_  ####_        Amazon Linux 2
  ~~  \_#####\
  ~~     \###|       AL2 End of Life is 2025-06-30.
  ~~       \#/ ___
   ~~       V~' '->
    ~~~         /    A newer version of Amazon Linux is available!
      ~~._.   _/
         _/ _/       Amazon Linux 2023, GA and supported until 2028-03-15.
       _/m/'           https://aws.amazon.com/linux/amazon-linux-2023/

[ec2-user@ip-192-168-0-98 ~]$ ls
helloworld.class       MusicGuruHealthCheck.class  SongEntry.class
musicdata.txt          MusicGuruServer.class
MusicGuruClient.class  run.sh
[ec2-user@ip-192-168-0-98 ~]$
```

I ssh-ed into one of the instances using the public IP address. Everything seems good.

Q84



The instances I have are all healthy.

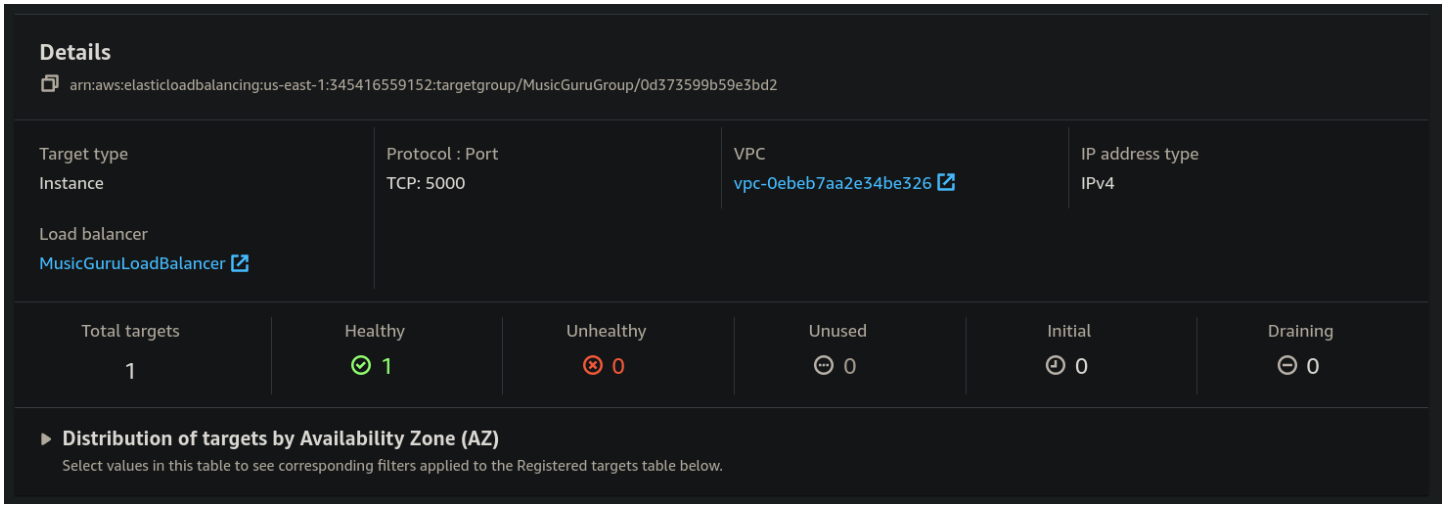
Q85

```
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$ java MusicGuruClient MusicGuruLoadBalancer-fefc11a5a3cc10c2.elb.us-eas
t-1.amazonaws.com 5000 1976
Range: 1950-2009
Sending year 1976
In 1976 the number 4 song was Anarchy in the UK by The Sex Pistols
(192.168.1.154)
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$ java MusicGuruClient MusicGuruLoadBalancer-fefc11a5a3cc10c2.elb.us-eas
t-1.amazonaws.com 5000 1976
Range: 1950-2009
Sending year 1976
In 1976 the number 9 song was The Boys Are Back in Town by Thin Lizzy
(192.168.1.154)
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$ java MusicGuruClient MusicGuruLoadBalancer-fefc11a5a3cc10c2.elb.us-eas
t-1.amazonaws.com 5000 1976
Range: 1950-2009
Sending year 1976
In 1976 the number 3 song was More Than a Feeling by Boston
(192.168.1.154)
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$ java MusicGuruClient MusicGuruLoadBalancer-fefc11a5a3cc10c2.elb.us-eas
t-1.amazonaws.com 5000 1976
Range: 1950-2009
Sending year 1976
In 1976 the number 3 song was More Than a Feeling by Boston
(192.168.0.186)
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$ java MusicGuruClient MusicGuruLoadBalancer-fefc11a5a3cc10c2.elb.us-eas
t-1.amazonaws.com 5000 1976
Range: 1950-2009
Sending year 1976
In 1976 the number 6 song was (Don't Fear) The Reaper by Blue Oyster Cult
(192.168.1.154)
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$ java MusicGuruClient MusicGuruLoadBalancer-fefc11a5a3cc10c2.elb.us-eas
t-1.amazonaws.com 5000 1976
Range: 1950-2009
Sending year 1976
In 1976 the number 9 song was The Boys Are Back in Town by Thin Lizzy
(192.168.1.154)
raashna@raashna-IdeaPad-Flex-5-14ARE05:~/Desktop/uni/NWEN243/project 2$
```

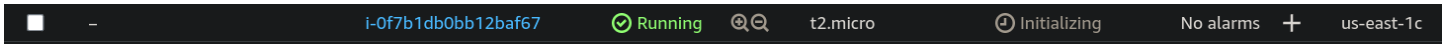
Q1: There doesn’t appear to be any pattern, but the IP address does alternate every 1-3 requests sent.

Q86

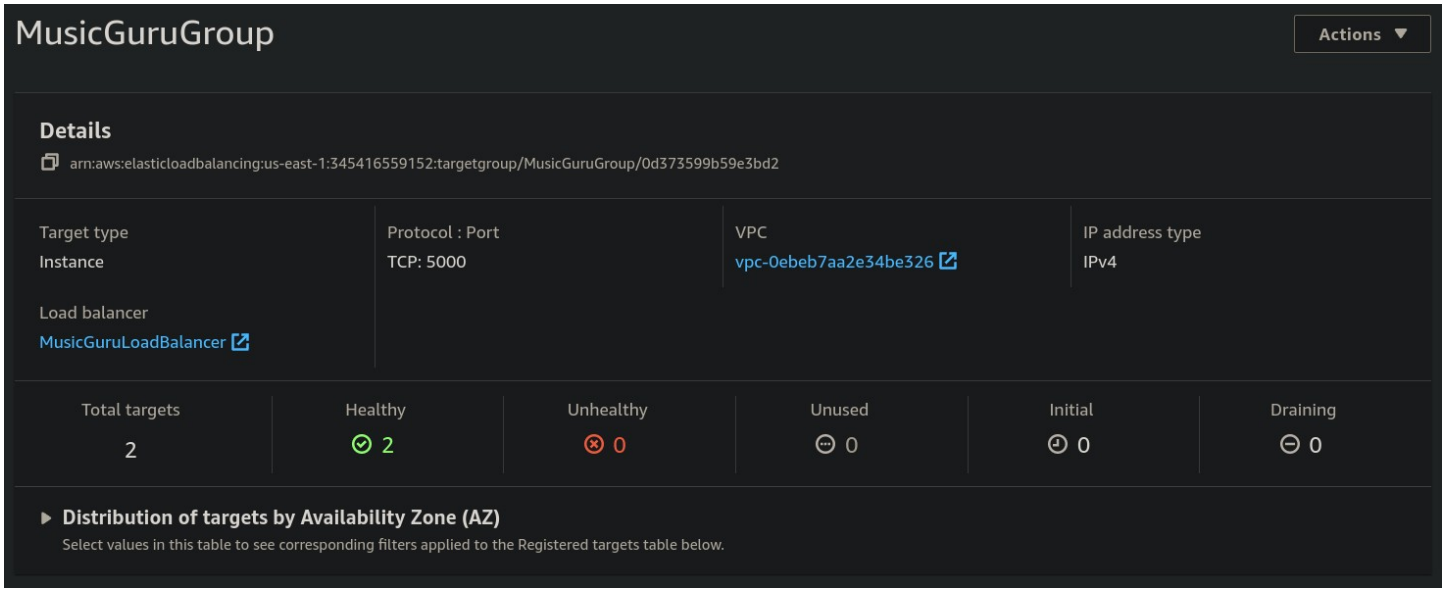
Q2: I terminated this us-east-1c instance here.



The amount of healthy instances went down to one.

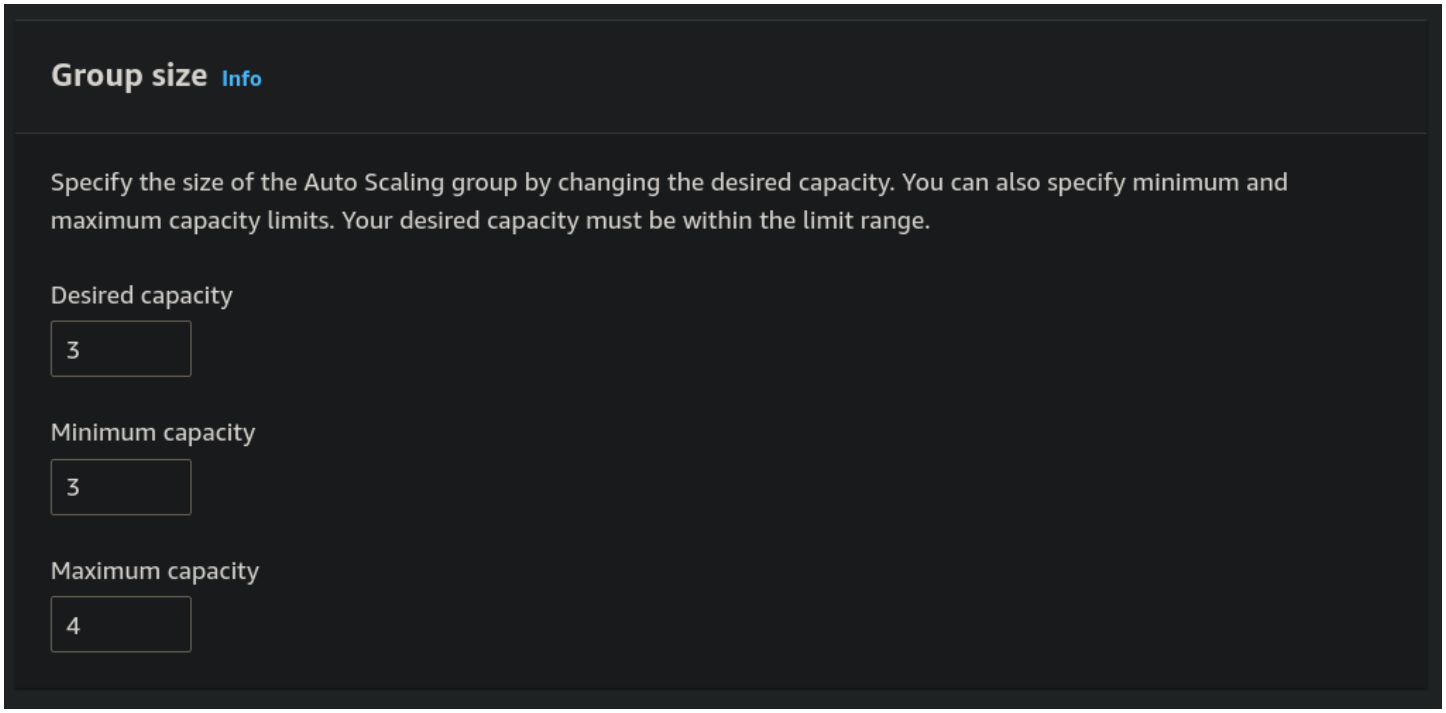


After 5 minutes, this instance was made.



It has now gone back up to 2 healthy instances.

Q87



I scaled them up to have a desired capacity of 3, minimum capacity of 3, and maximum capacity of 4.

The autoscaler keeps creating instances and terminating them.

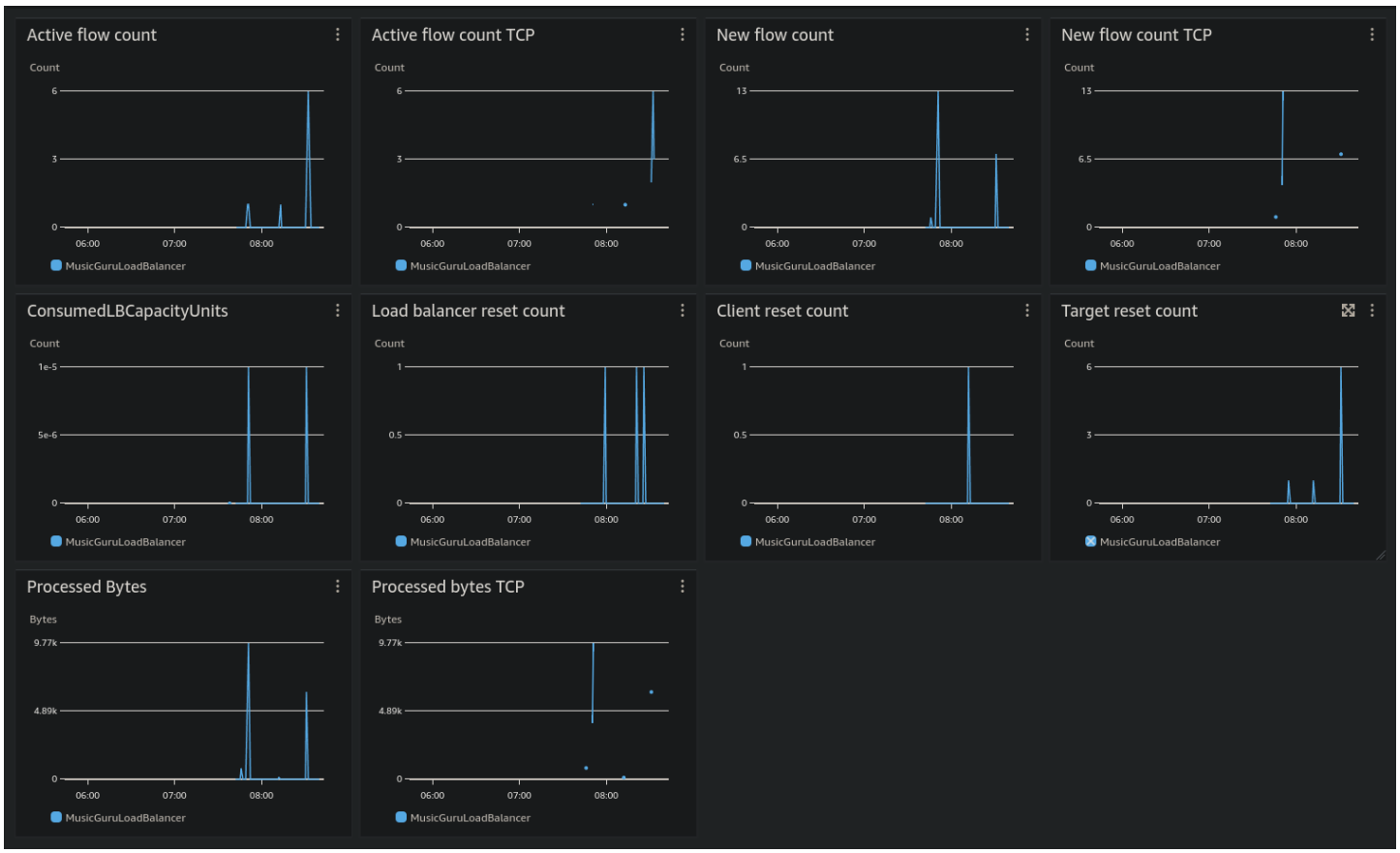
Q3: The auto scaler needs to create an instance that match the requirements of the load balancer, the target group, and the security group, in addition to checking if the requirements for the number of instances are met. This takes time, and the change is not immediate. Moreover, the instances themselves have unique requirements, such as port numbers and cron jobs, and the files we have placed in our template need to be copied over to each instance.

Q88

The “Unhealthy Hosts (Maximum)” and “Unhealthy Hosts (Average)” are both at 0 showing that we’ve never had an unhealthy instance. On “Healthy Hosts (Minimum)” we see the number of instances being created and deleted. Where the line goes from 0 to 2 is the initial creation of our instances via the auto scaling group. The dip seen in the chart and in the “Healthy Hosts (Average)” section is when we terminated one of our instances,

and the autoscaling group immeddiately created another one to reach the minimum capacity of 2.

Q89



The “Active Flow Count” chart shows the number of concurrent connections to the instances in the load balancer. We can see my attempts at connecting to the load balancer’s instances in this chart, both via SSH-ing into the instances via my computer, and through using my MusicGuruClient. The “Active Flow Count (TCP)” chart displays the amount of concurrent connections to the instances in the load balancer, but only the connections via my MusicGuruClient.