AWS Cloud Labs

Portfolio Samples

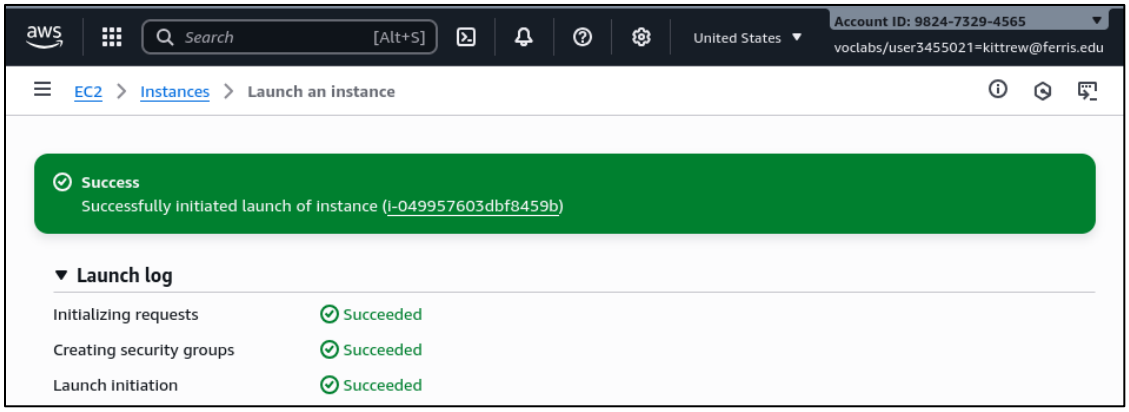
Will Kittredge

TABLE OF CONTENTS

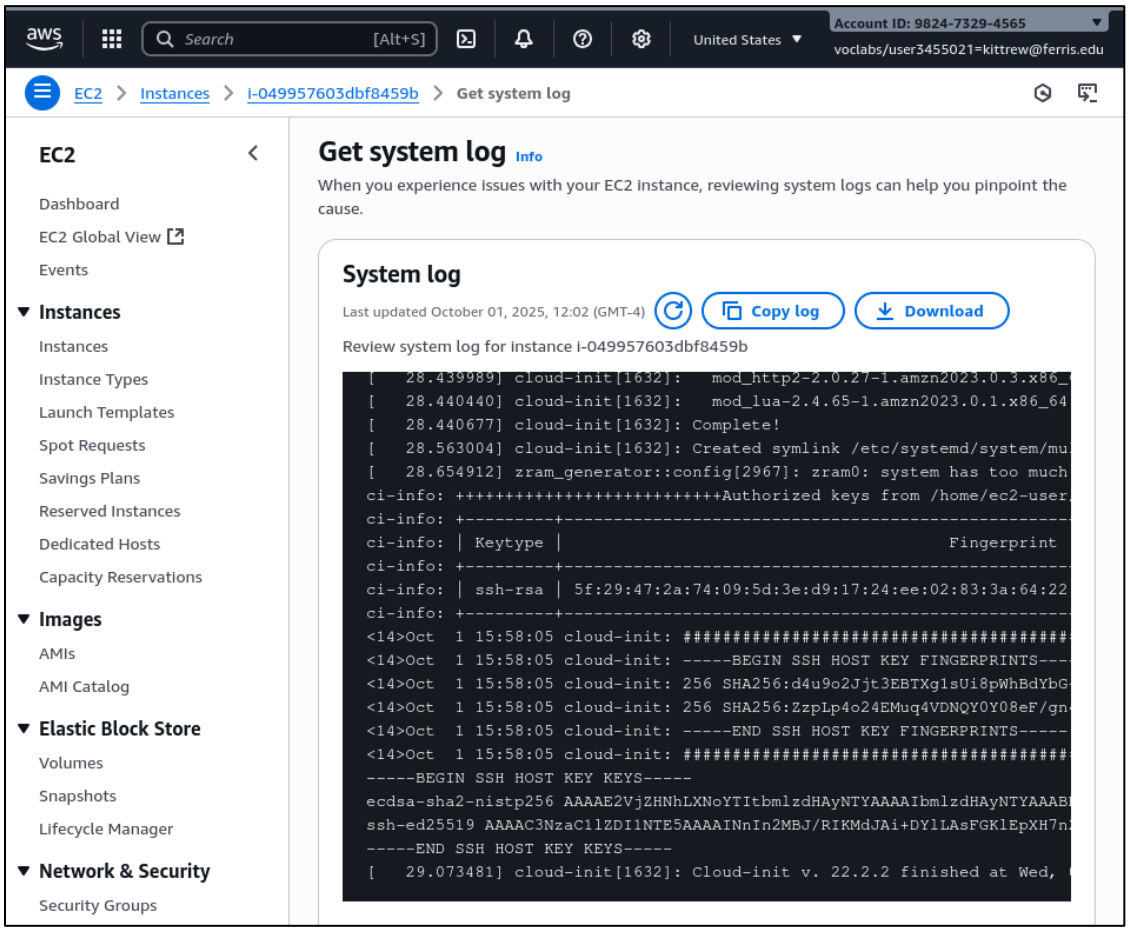
LAB 3: INTRODUCTION TO AMAZON EC2

SCREENSHOTS

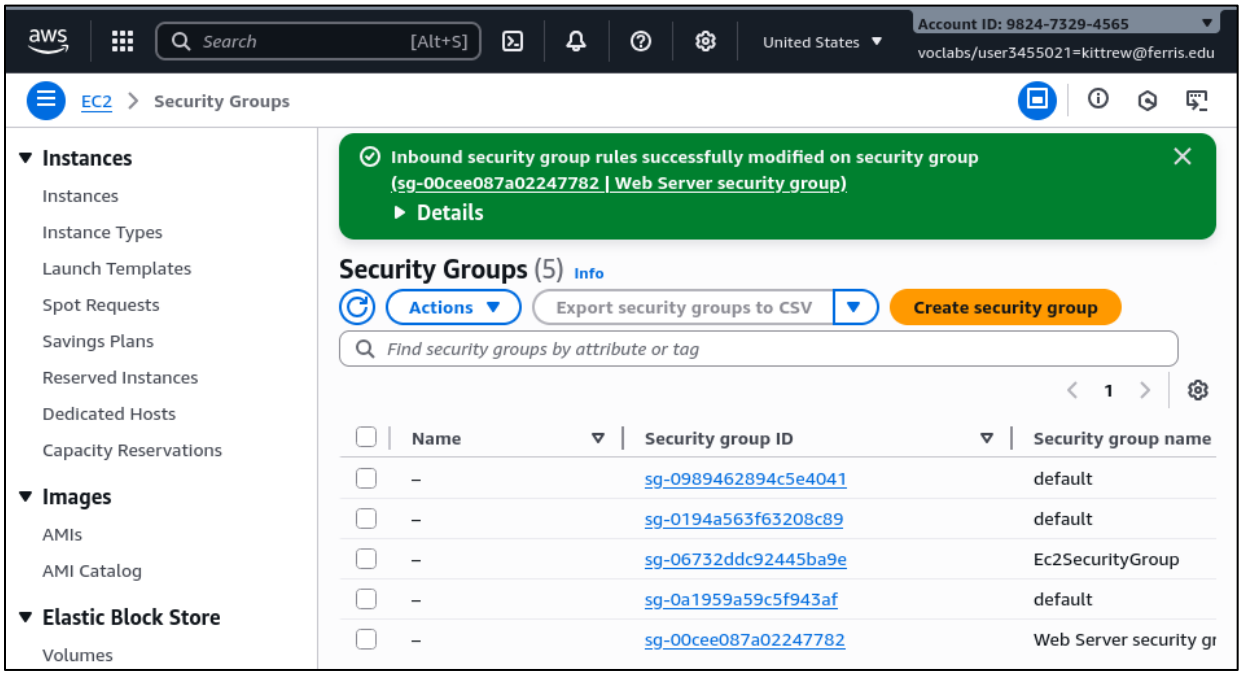
Launched EC2 Instance



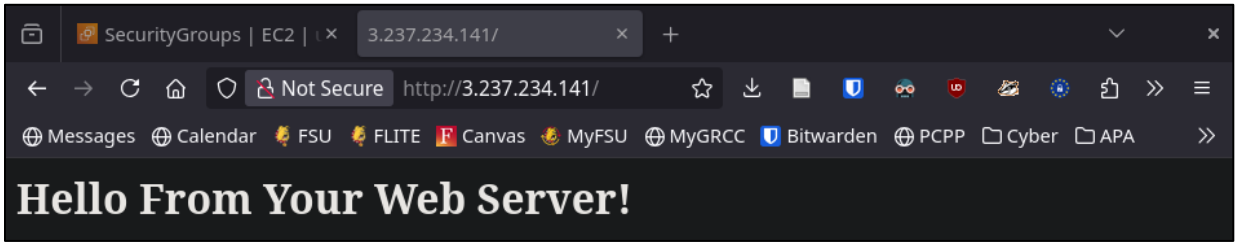
Checked System Log



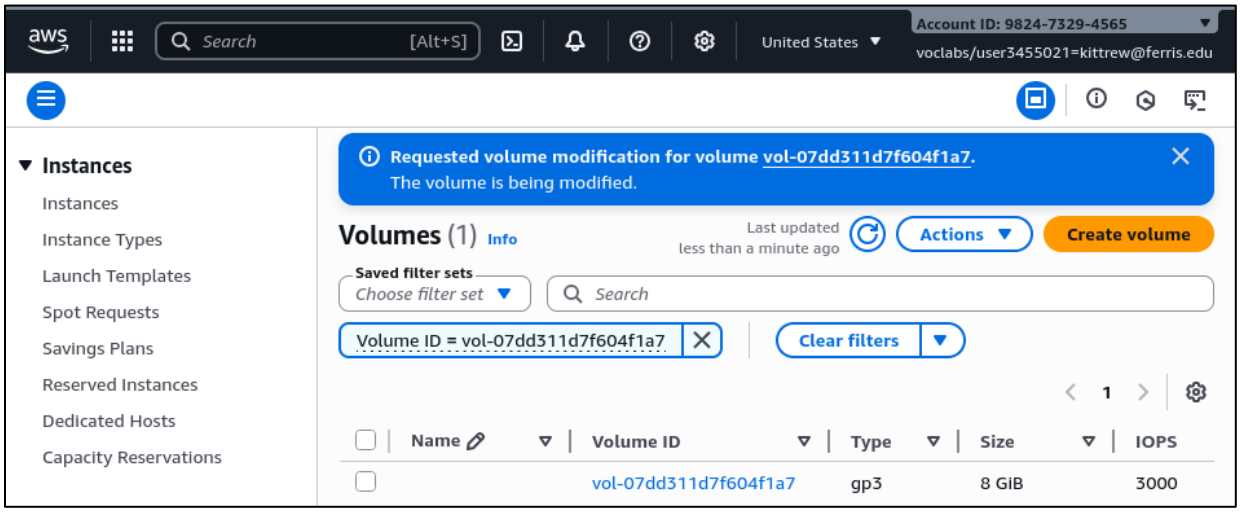
Modified Security Group Rules



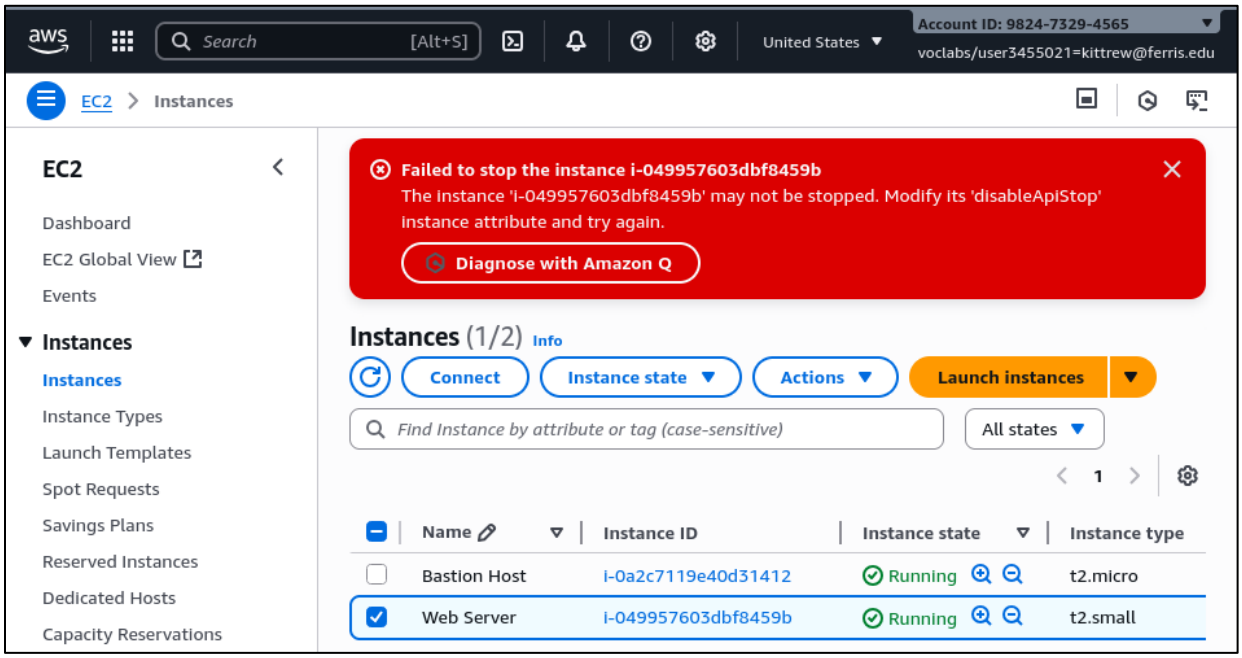
Tested Connection to EC2 Instance



Modified/Resized Volume



Tested Stop Protection



SYNOPSIS

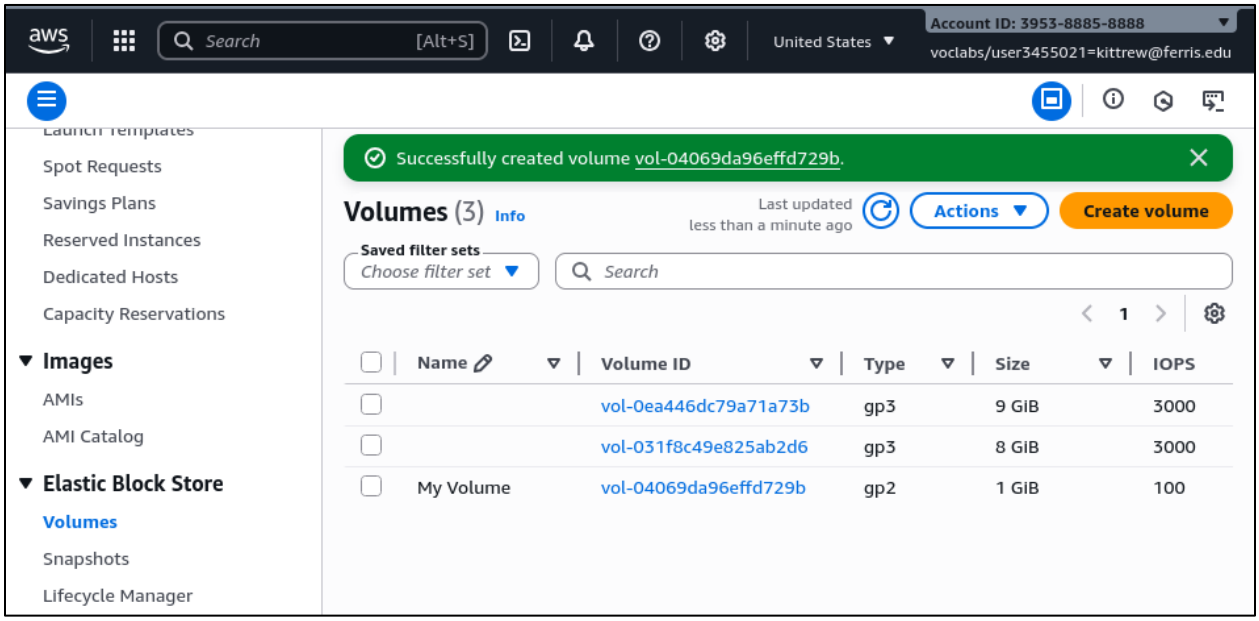
The main purpose of this lab was to provide an introduction to the Amazon Elastic Compute Cloud (EC2) service within the AWS environment. The instructions cover basic (yet fundamental) tasks like launching and monitoring instances, configuring network settings, and modifying resource allocations.

Since we had already done a few other labs that leveraged EC2 instances prior to this one, this was not actually our first time using the service. However, previous labs did not go into nearly as many EC2-specific details compared to this one – any of their EC2-related instructions usually just served as a way to prepare the lab environment for upcoming steps that were more pertinent to lab's focus. This lab, although relatively short and simple, was useful because it put that information into one package for us to familiarize ourselves with. After having completed the lab, I'm confident in my ability to create and deploy simple EC2 virtual machine configurations from the setup wizard. Since the process is conceptually similar to creating a virtual machine instance in other environments that I'm familiar with (e.g., locally on your own computer), it felt relatively easy to get my bearings once I understood Amazon's terminology. When it comes to deploying and monitoring more advanced virtual machine configurations, I think that I still need more practice using EC2 before I become confident in my ability to leverage its features appropriately/effectively.

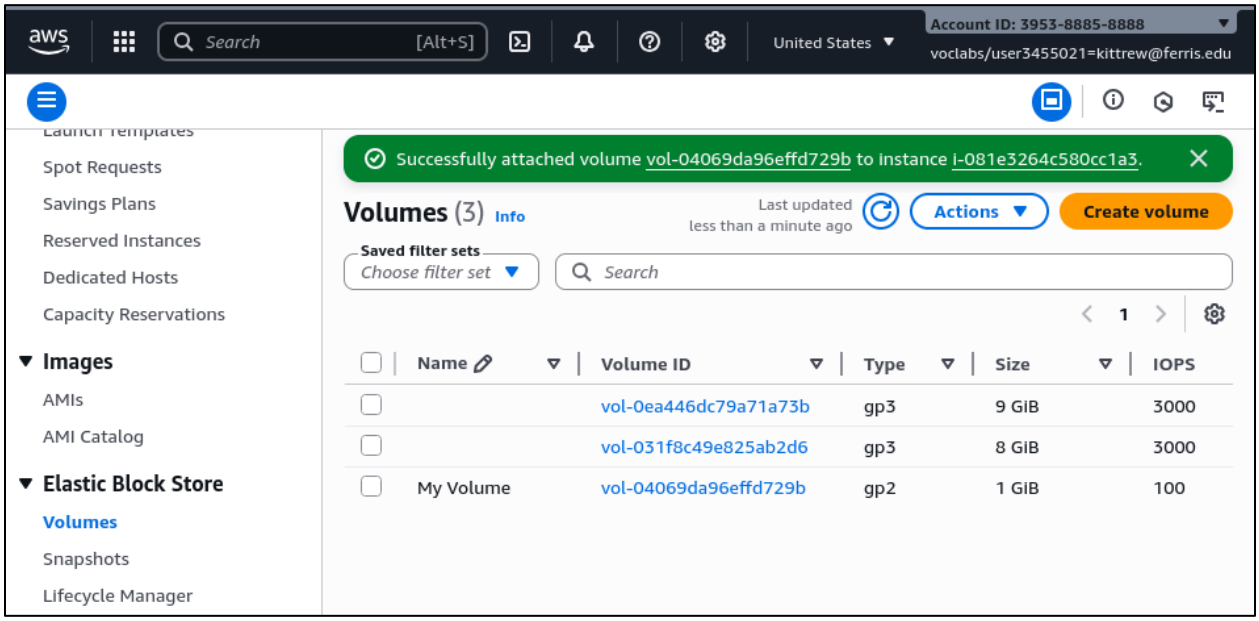
LAB 4: WORKING WITH EBS

SCREENSHOTS

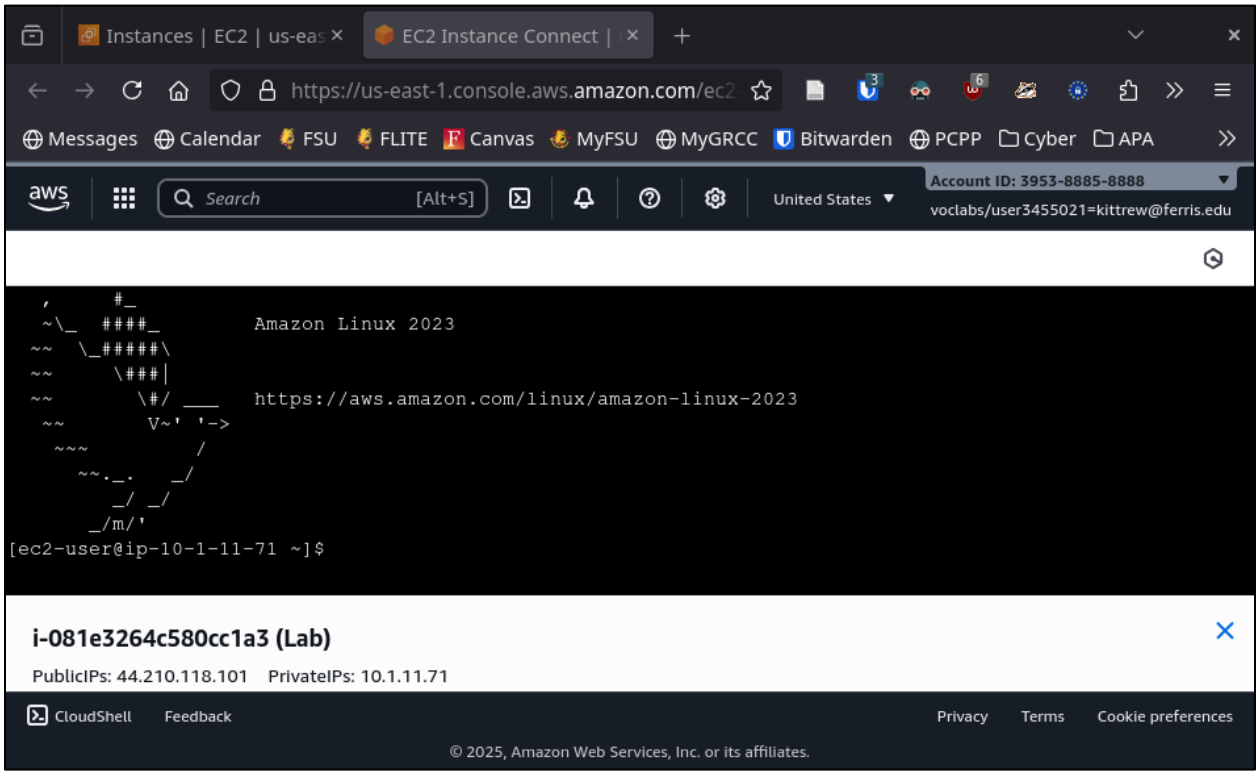
Created New Volume



Attached New Volume



Connected to EC2 Instance



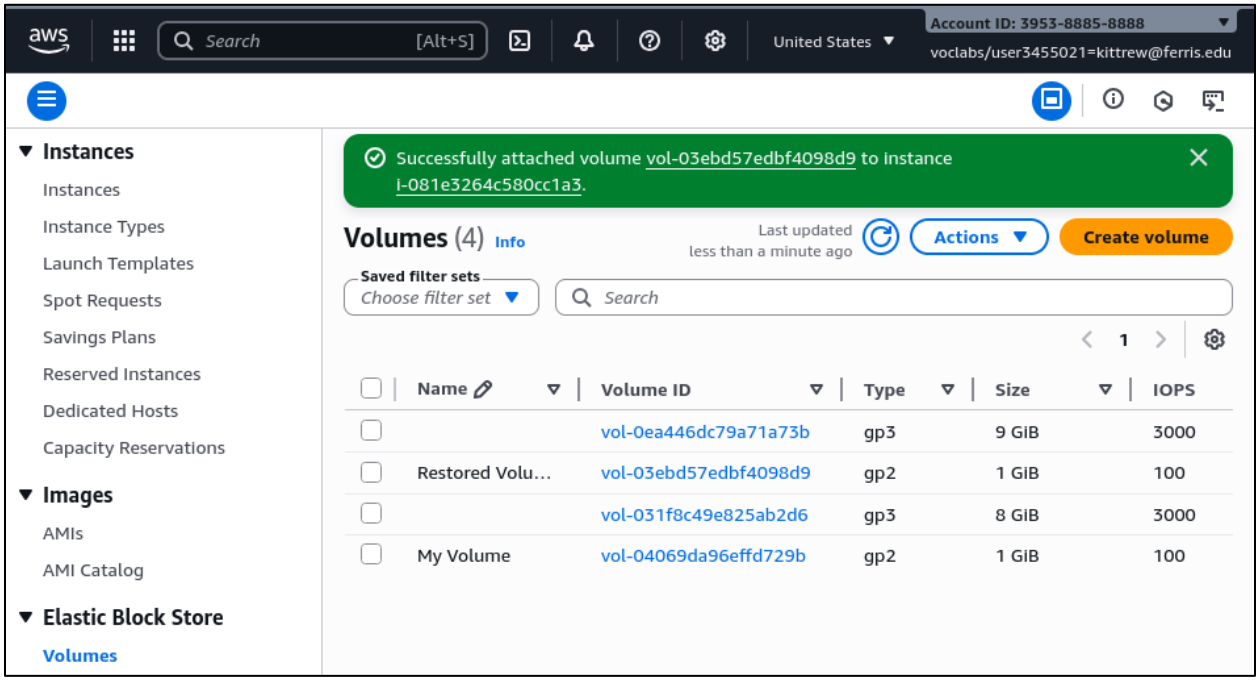
Created Filesystem, Mounted Volume, and Wrote Data

```
[ec2-user@ip-10-1-11-71 ~]$ cat /etc/fstab
#
UUID=de5c5998-22a2-4734-85d8-c8f972ff40e9     /           xfs    defaults,noatime  1   1
UUID=3021-32B7        /boot/efi       vfat    defaults,noatime,uid=0,gid=0,umask=0077,shortname=winnt,x
-systemd.automount 0 2
/dev/sdf   /mnt/data-store ext3 defaults,noatime 1 2
[ec2-user@ip-10-1-11-71 ~]$ df -h
Filesystem      Size  Used Avail Use% Mounted on
devtmpfs        4.0M     0  4.0M   0% /dev
tmpfs           475M     0  475M   0% /dev/shm
tmpfs           190M  440K  190M   1% /run
/dev/xvda1      8.0G  1.6G  6.4G  21% /
tmpfs           475M     0  475M   0% /tmp
/dev/xvda128     10M  1.3M  8.7M  13% /boot/efi
tmpfs            95M     0   95M   0% /run/user/1000
/dev/xvdf       975M   60K  924M   1% /mnt/data-store
[ec2-user@ip-10-1-11-71 ~]$ sudo sh -c "echo some text has been written > /mnt/data-store/file.txt"
[ec2-user@ip-10-1-11-71 ~]$ cat /mnt/data-store/file.txt
some text has been written
[ec2-user@ip-10-1-11-71 ~]$
```

Removed Data (After Snapshot)

```
[ec2-user@ip-10-1-11-71 ~]$ sudo rm /mnt/data-store/file.txt
[ec2-user@ip-10-1-11-71 ~]$ ls /mnt/data-store/
lost+found
[ec2-user@ip-10-1-11-71 ~]$
```

Restored Snapshot to Volume and Attached to Instance



Tested Snapshot

```
[ec2-user@ip-10-1-11-71 ~]$ sudo rm /mnt/data-store/file.txt
[ec2-user@ip-10-1-11-71 ~]$ ls /mnt/data-store/
lost+found
[ec2-user@ip-10-1-11-71 ~]$ sudo mkdir /mnt/data-store2
[ec2-user@ip-10-1-11-71 ~]$ sudo mount /dev/sdg /mnt/data-store2
[ec2-user@ip-10-1-11-71 ~]$ ls /mnt/data-store2
file.txt  lost+found
[ec2-user@ip-10-1-11-71 ~]$
```

SYNOPSIS

This lab served as an introduction to using the Elastic Block Store (EBS) for Amazon EC2 instances. Instructions covered basic tasks such as creating and attaching volumes, making and utilizing snapshots, as well as creating filesystems on the EBS volumes that we made (and mounting them).

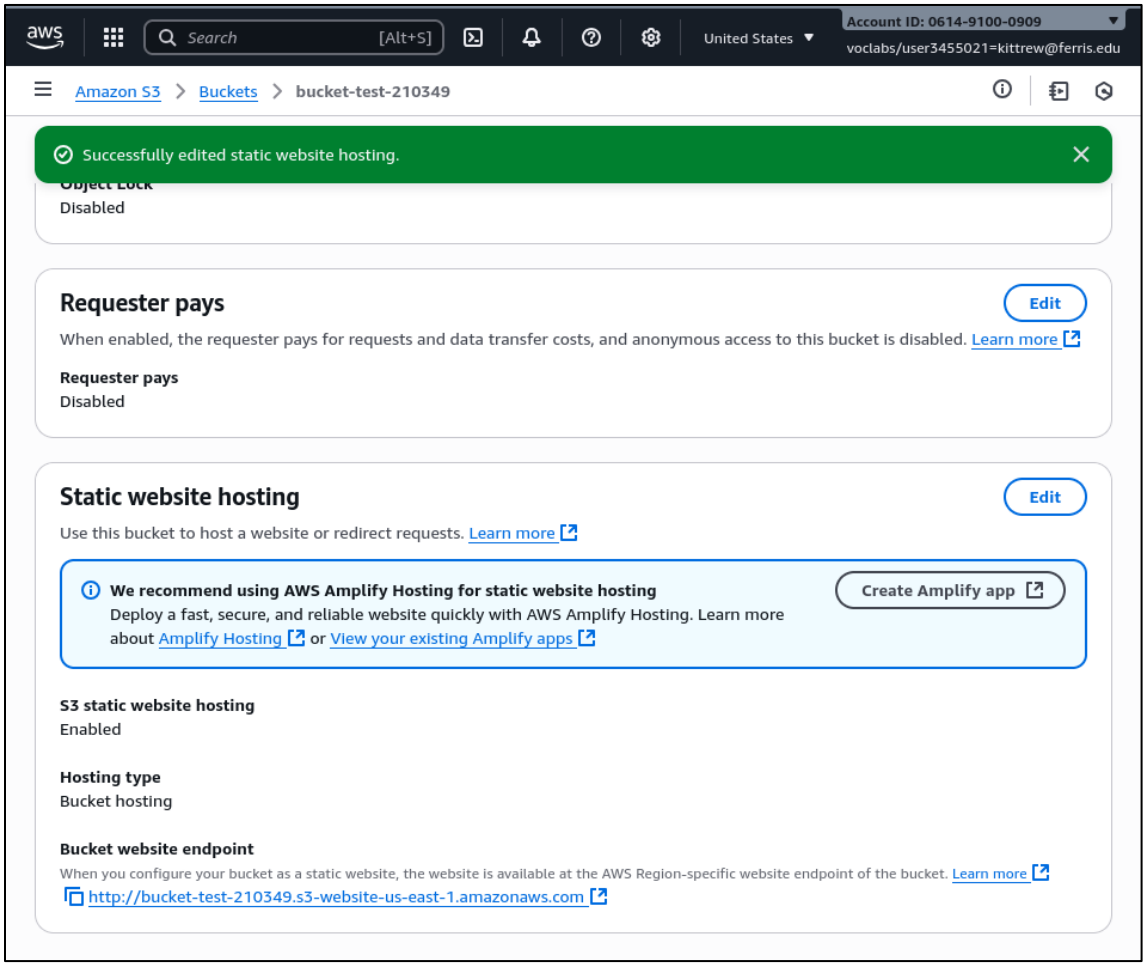
Generally, I found this lab to be relatively simple and straightforward compared to some of the other ones. However, the concepts that it covers are undoubtedly foundational when it comes to managing virtual machines/resources. I would argue that the ability to easily create and deploy snapshots (as well as the wrangling of virtual hardware, such as disks) is one of the primary technical benefits of utilizing virtualization and cloud technology – so it's important that we actually know how to perform those actions in AWS. Like with other concepts we've covered in previous labs (e.g., launching EC2 instances, configuring firewall rules), I found it easy to understand how to manage volumes and snapshots using EBS due to prior experience with other virtual environments.

After having completed the lab, I feel like I have most of the skills that I would need to create a reliable simple environment in AWS – such as moving a homelab with a few test VMs into the cloud. We know how to launch instances from the EC2 lab, how to manage their volumes and snapshots from this lab, how to create the desired networking configuration(s) from the VPC lab, and various supporting concepts from the rest of the labs, assignments, and course content.

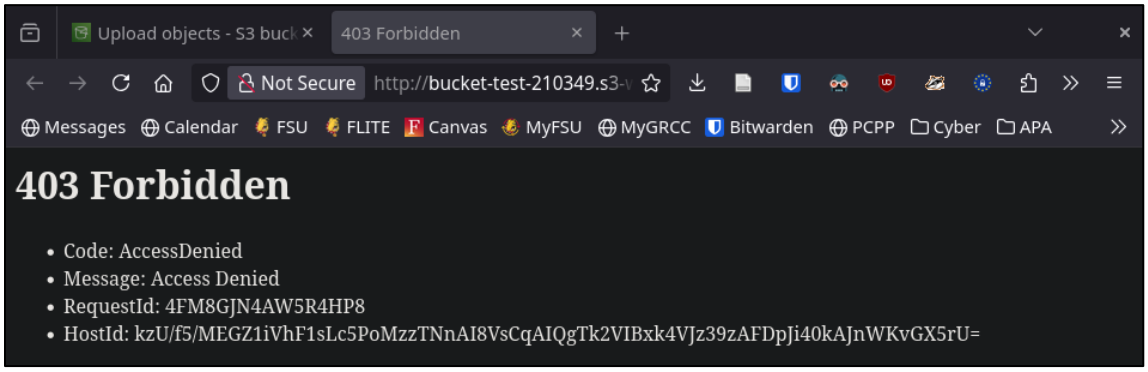
CHALLENGE LAB 4: CREATING A STATIC WEBSITE

SCREENSHOTS

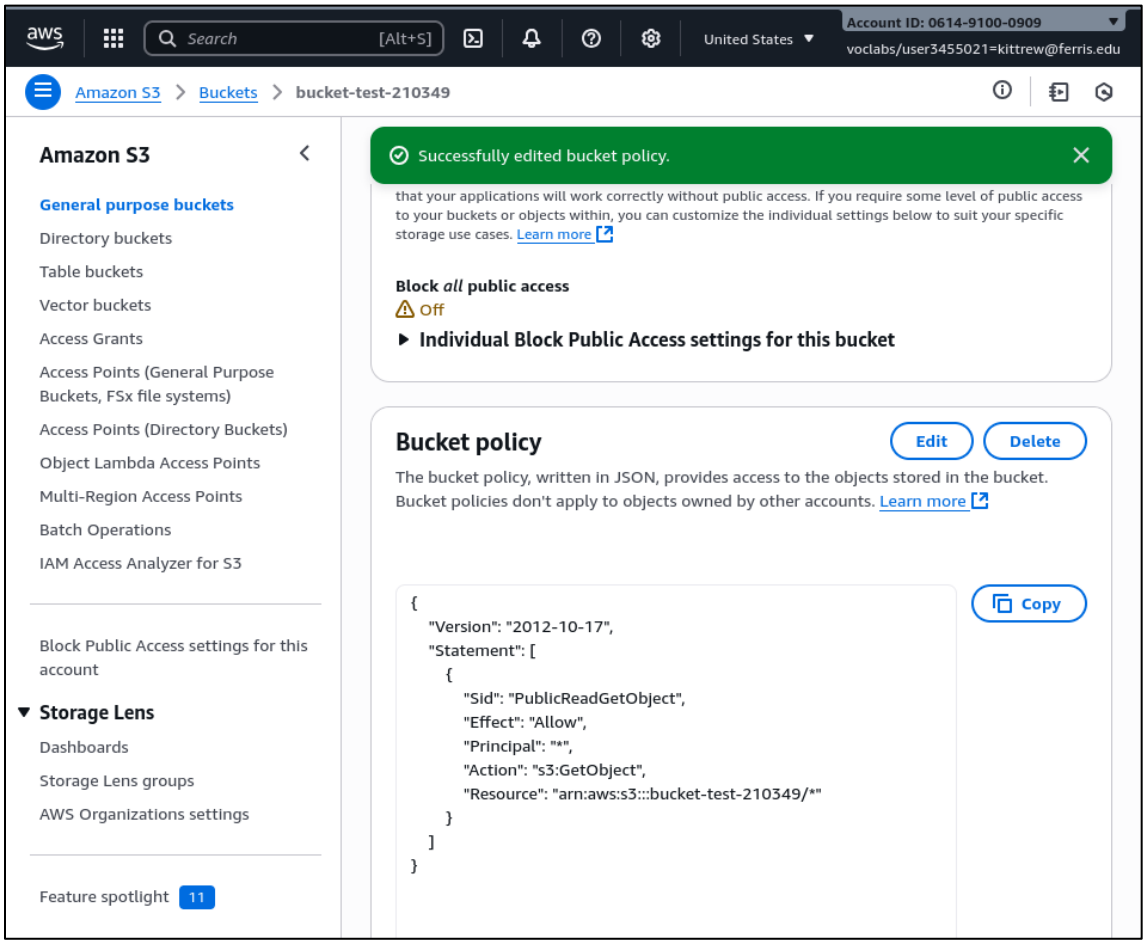
Created Bucket and Enabled Static Website Hosting



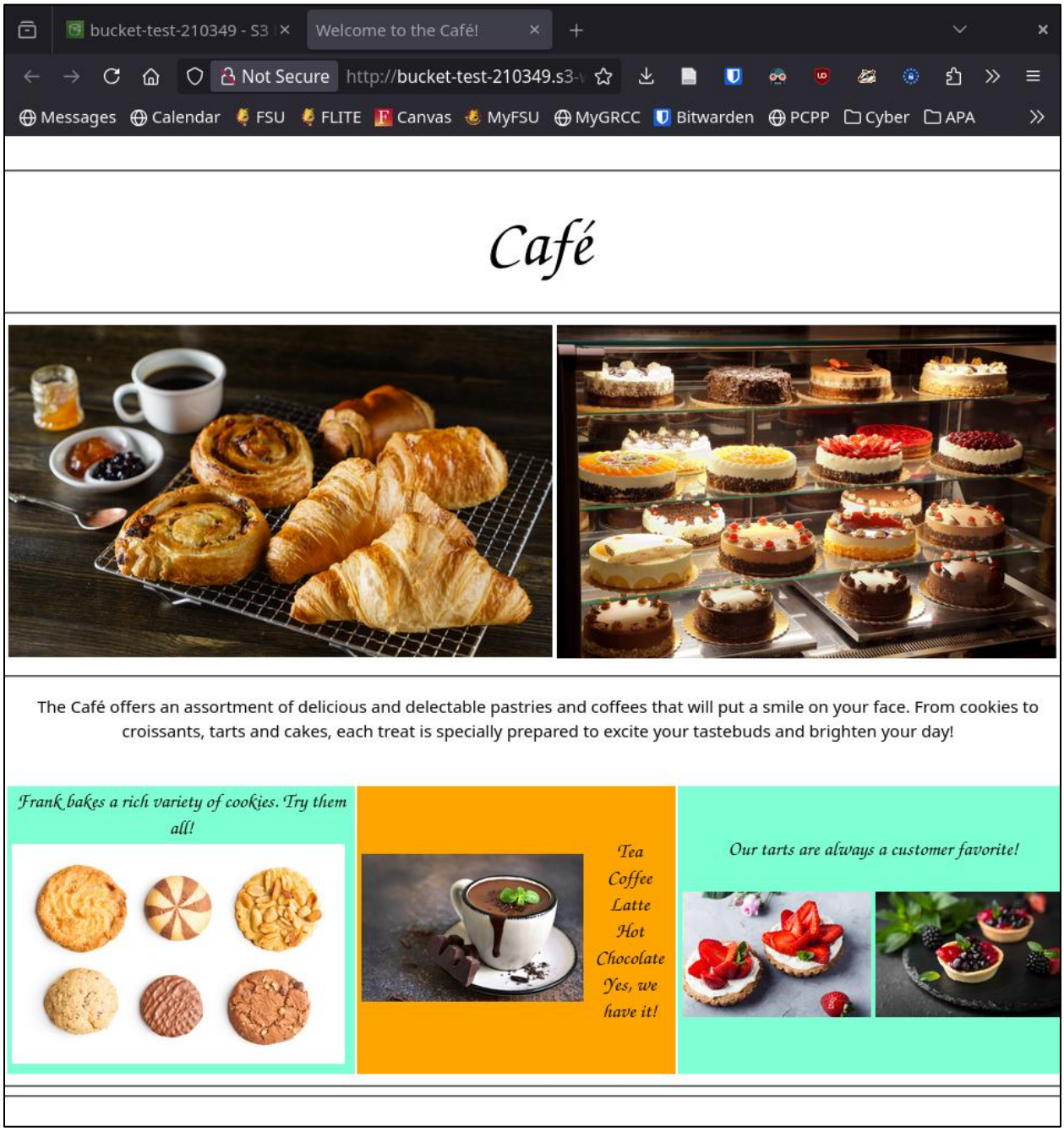
Tested Connection after Uploading Files



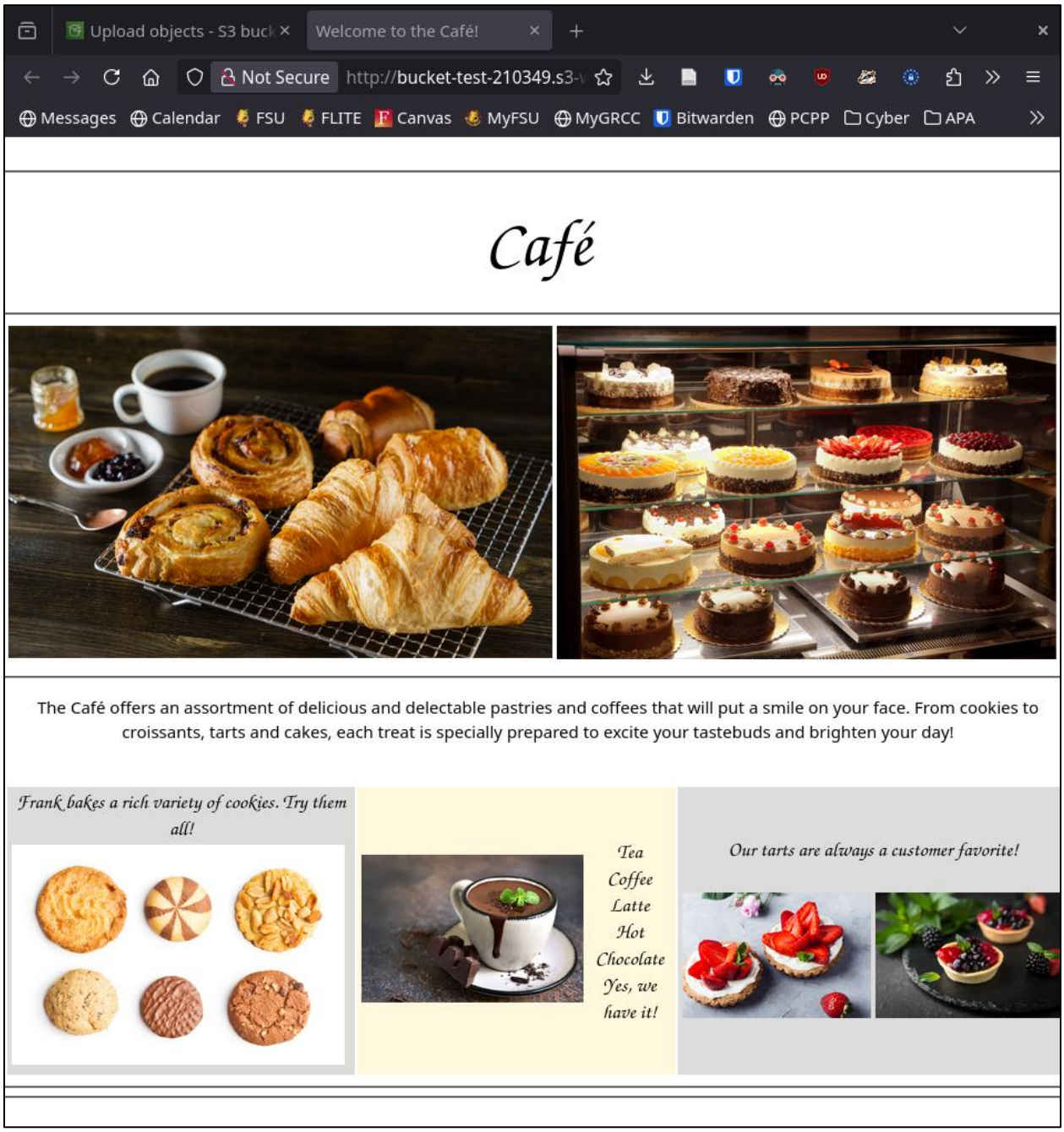
Updated Bucket Policy



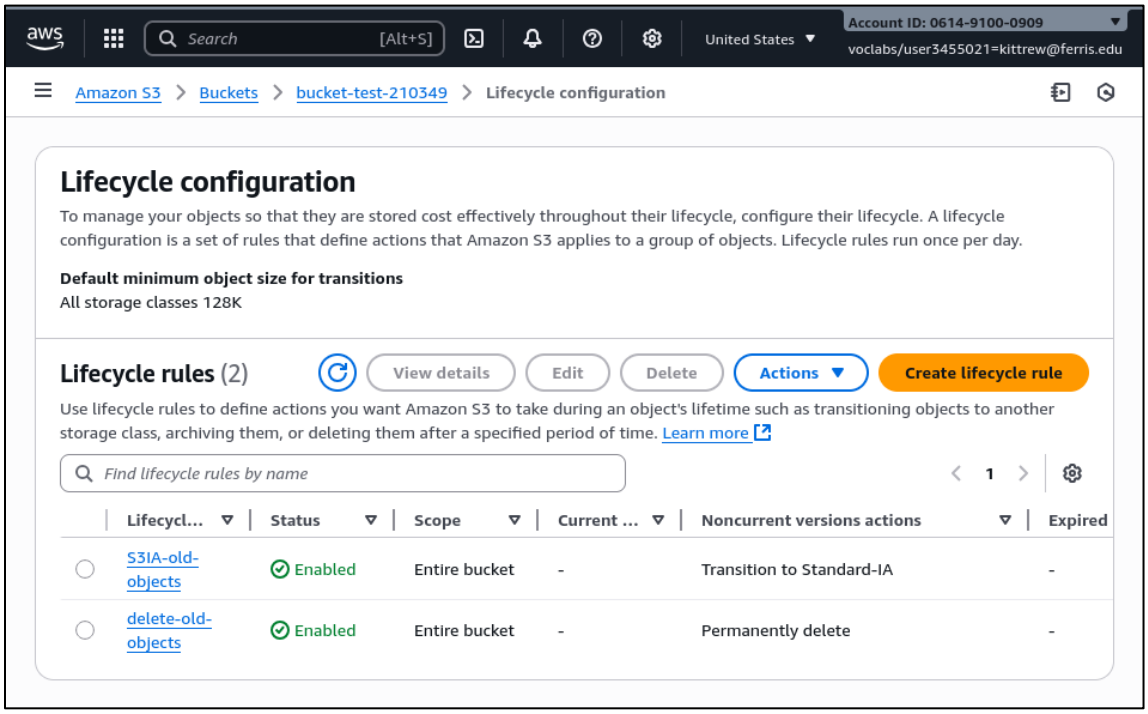
Tested Connection with Updated Policy



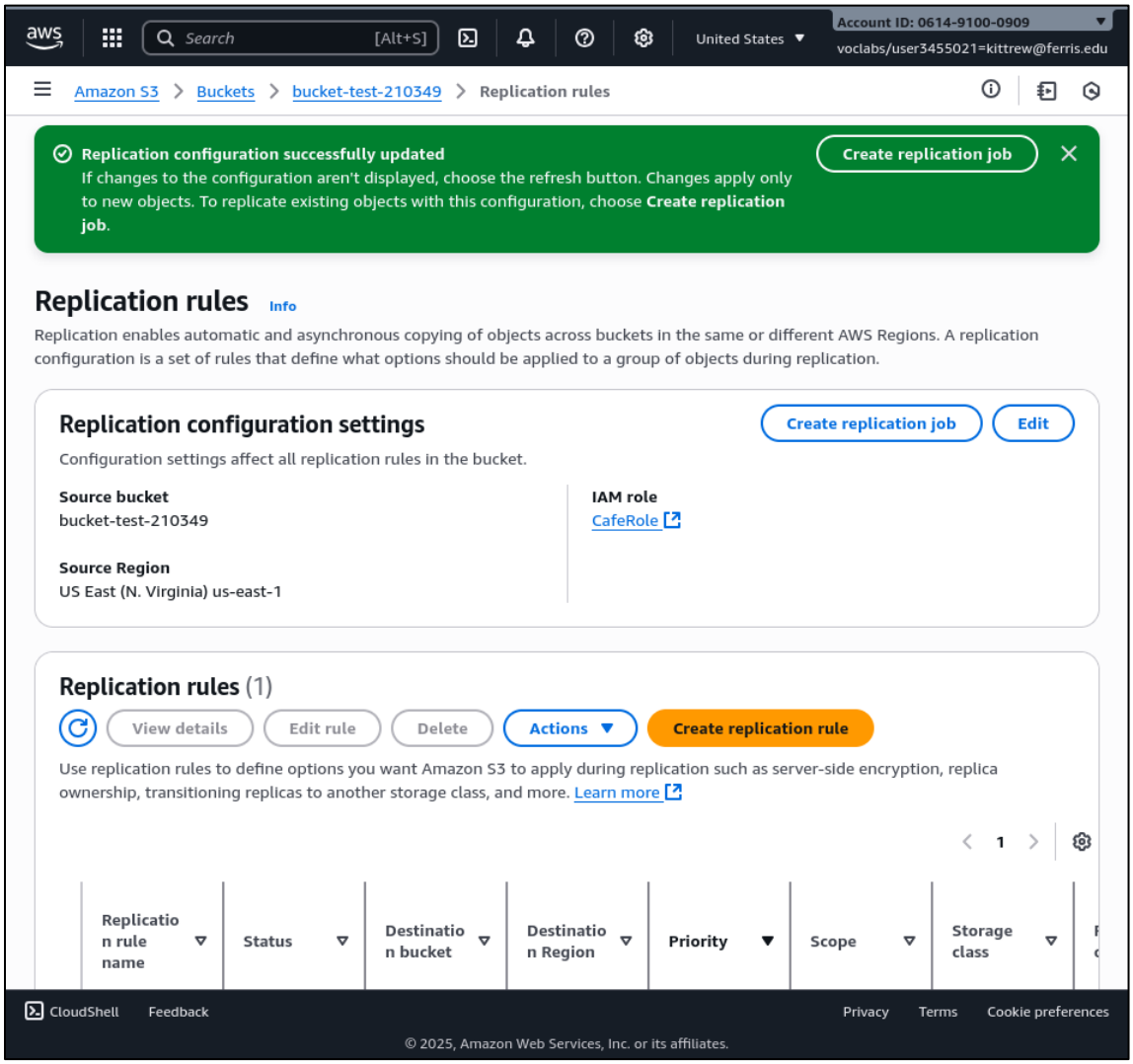
Modified `index.html` *File after Enabling Versioning*



Created Lifecycle Rules



Enabled Cross-Region Replication



SYNOPSIS

This lab was similar to the previous challenge lab we completed where we were tasked with creating a dynamic website. The required files were provided to us (i.e., we did not have to actually structure our own webpage using HTML/CSS), so the challenge was knowing how to properly utilize S3 buckets and their features to create the desired outcome. This primarily involved configuring the bucket correctly, modifying permissions and policies, and enabling versioning.

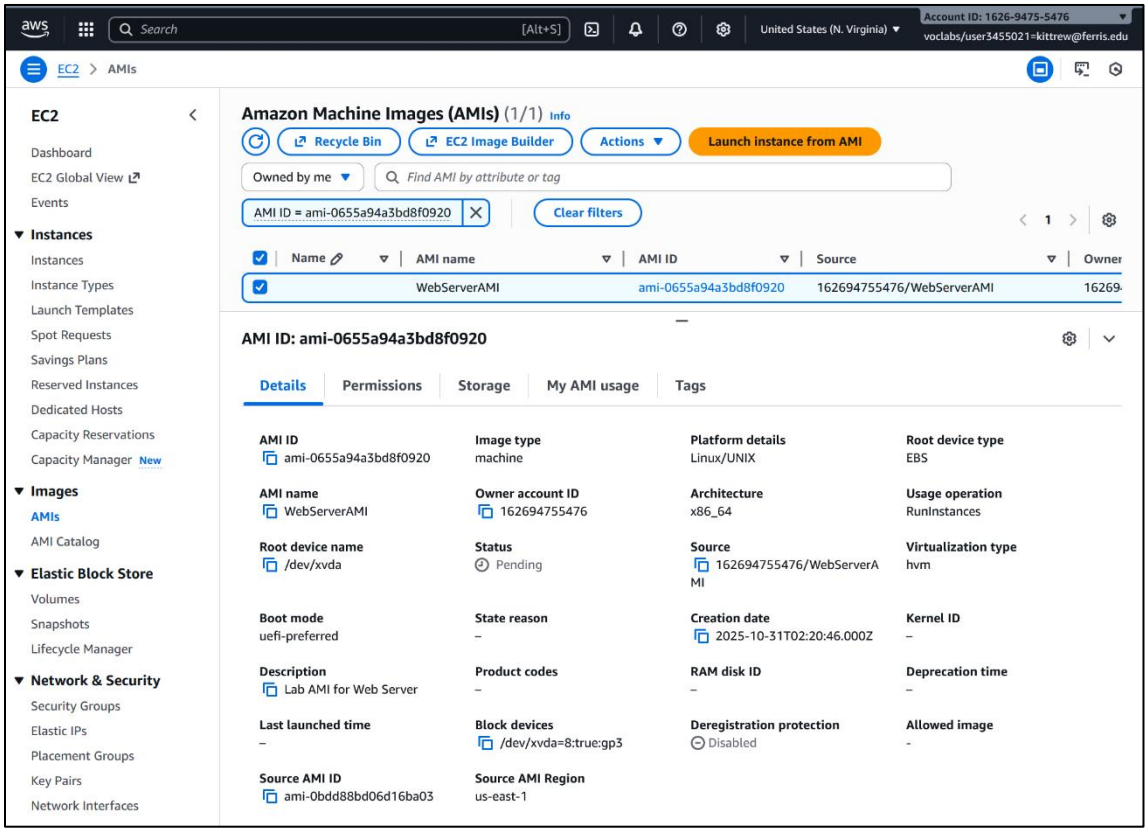
I encountered a few minor issues with this lab, but I was able to progress through the rest of the steps without problems after 10-15 minutes of research and troubleshooting. Creating and applying the bucket policy gave me the most troubles, as I was initially unable to get Amazon to accept the policy I provided. There were also a few quirks that I had to familiarize myself with when it comes to using S3 buckets. In one case, I thought I had completed uploading all of the website files to the bucket I created. I didn't discover until later that file uploads are not automatically initiated after you select a file or folder from your OS with the file picker – you have to scroll to the bottom of the webpage and manually start the upload(s).

After completing the lab, I feel that I could set up a relatively simple static webpage using AWS in a reasonable amount of time and without needing to rely heavily on documentation. The lab content was also applicable to me personally, as I have been slowly chipping away at a personal project that involves creating a static site to host my portfolio and other work that I would like to share publicly.

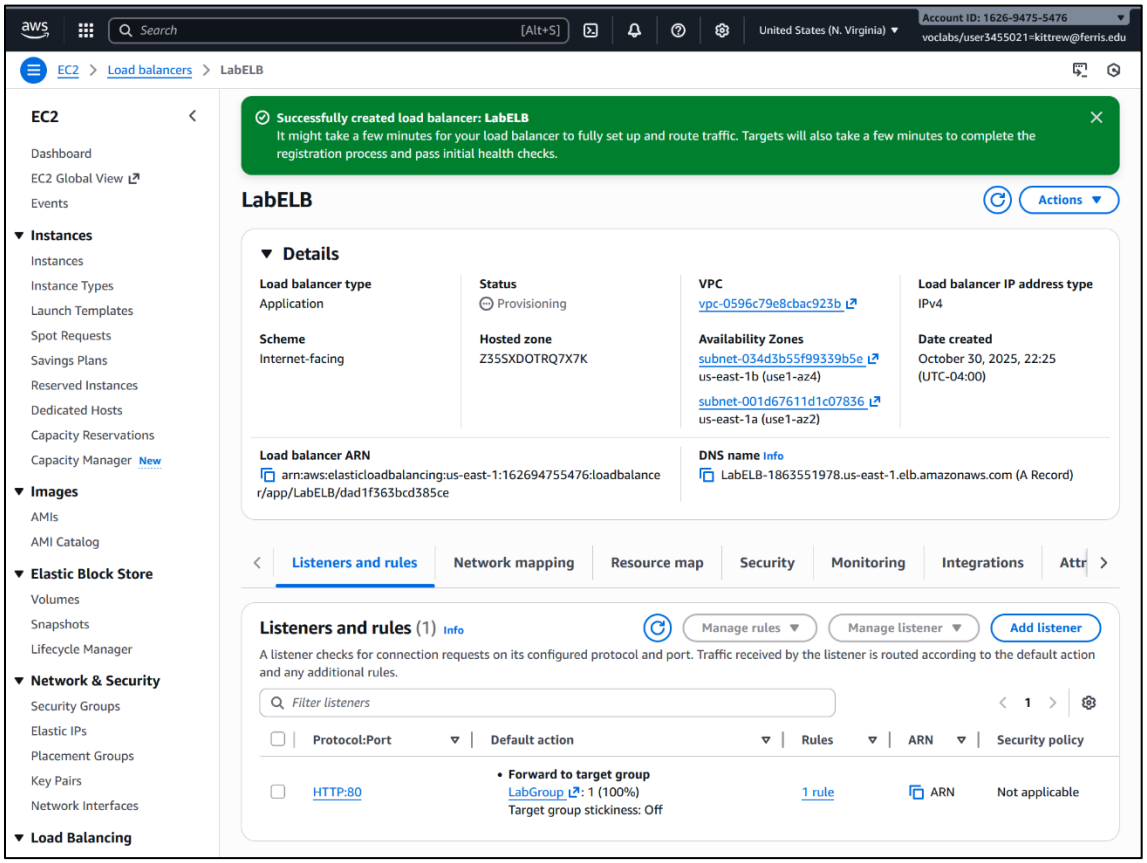
LAB 6: SCALE AND LOAD BALANCE YOUR ARCHITECTURE

SCREENSHOTS

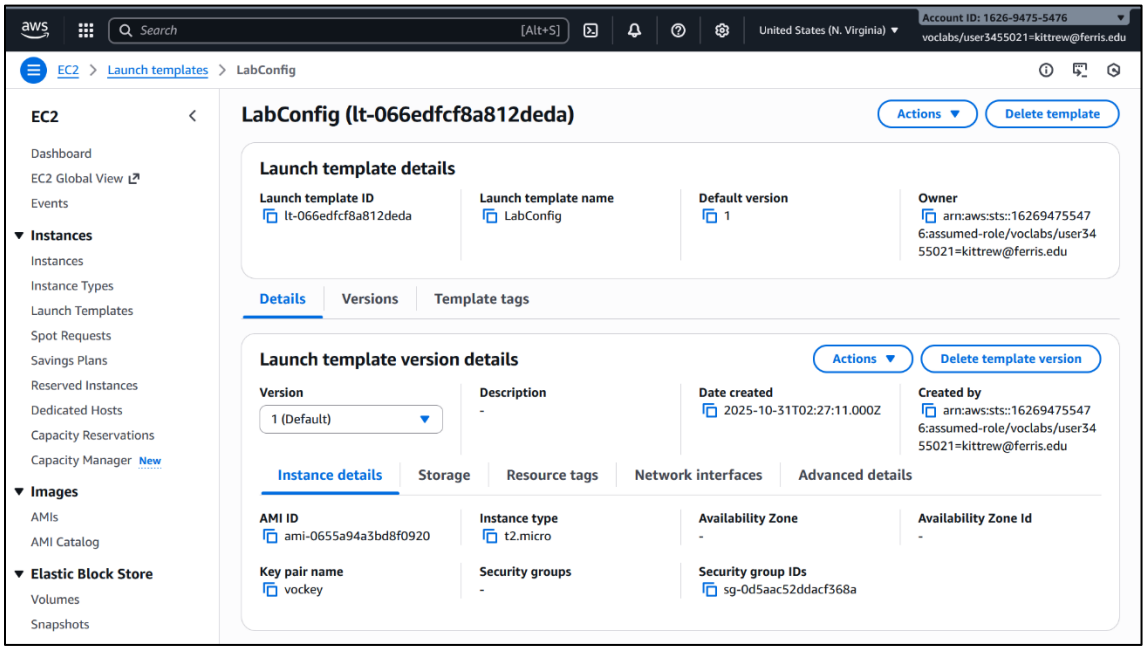
Created AMI for Auto Scaling



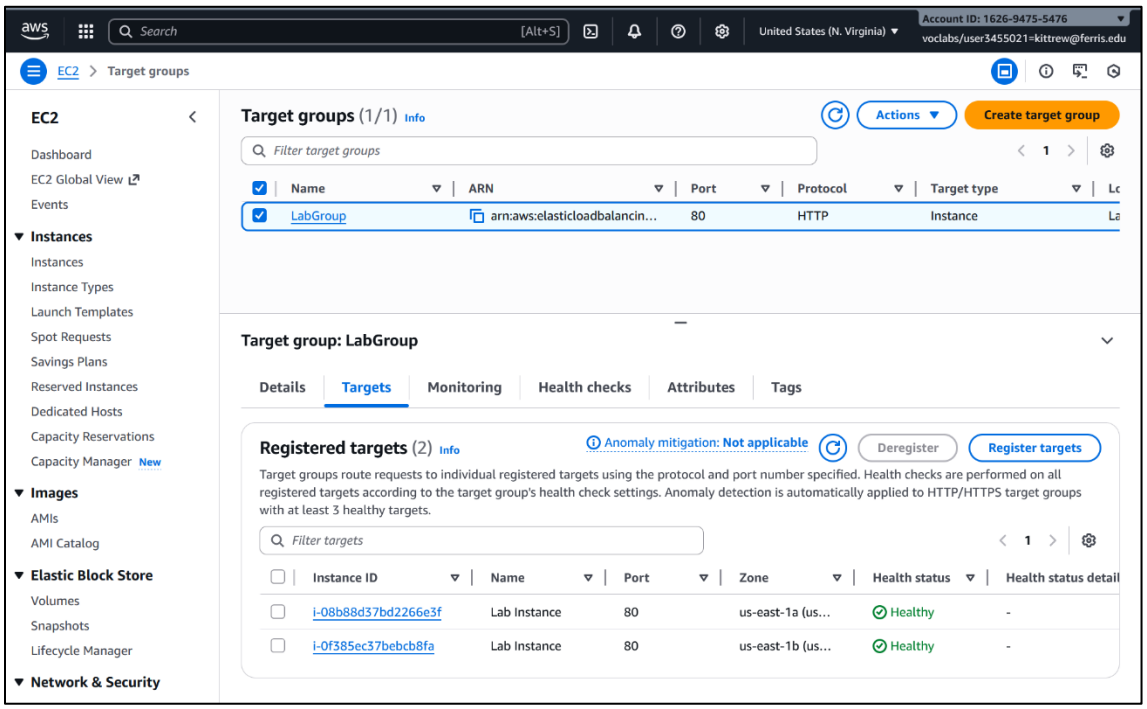
Created Load Balancer



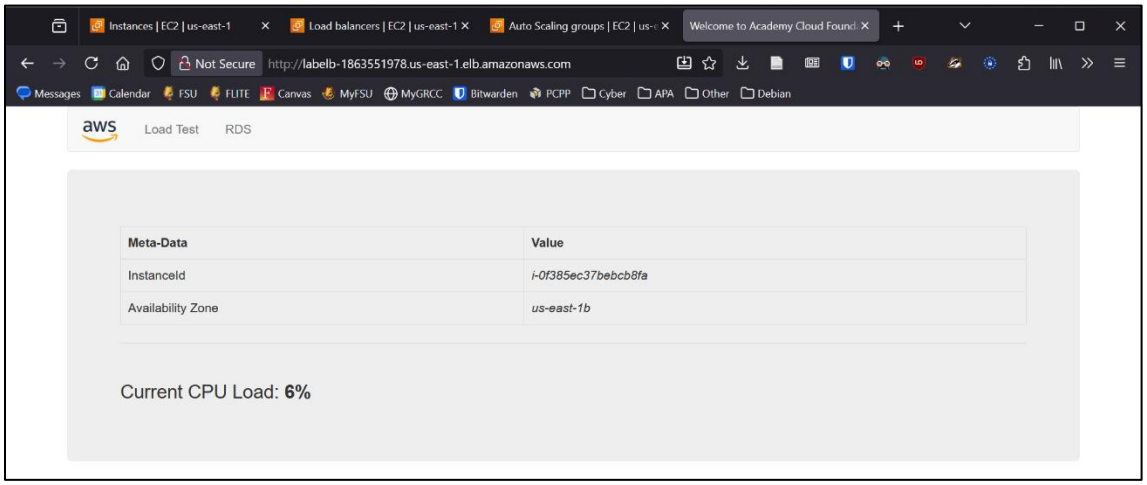
Created Launch Template



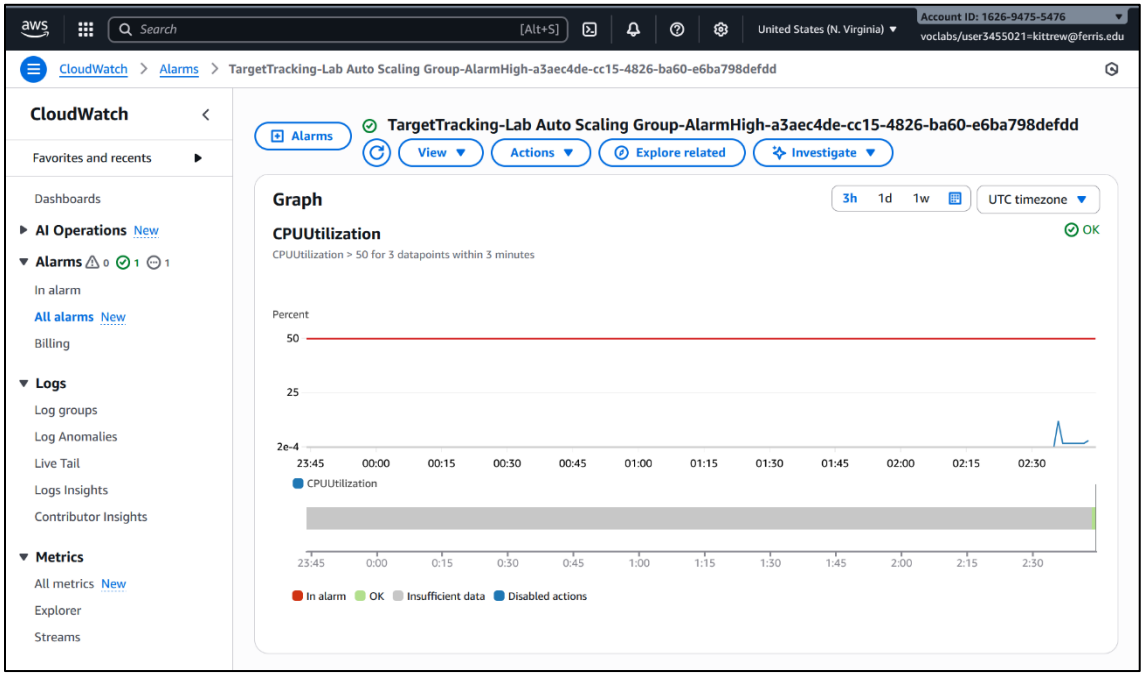
Verified Health of Auto Scaling Instances



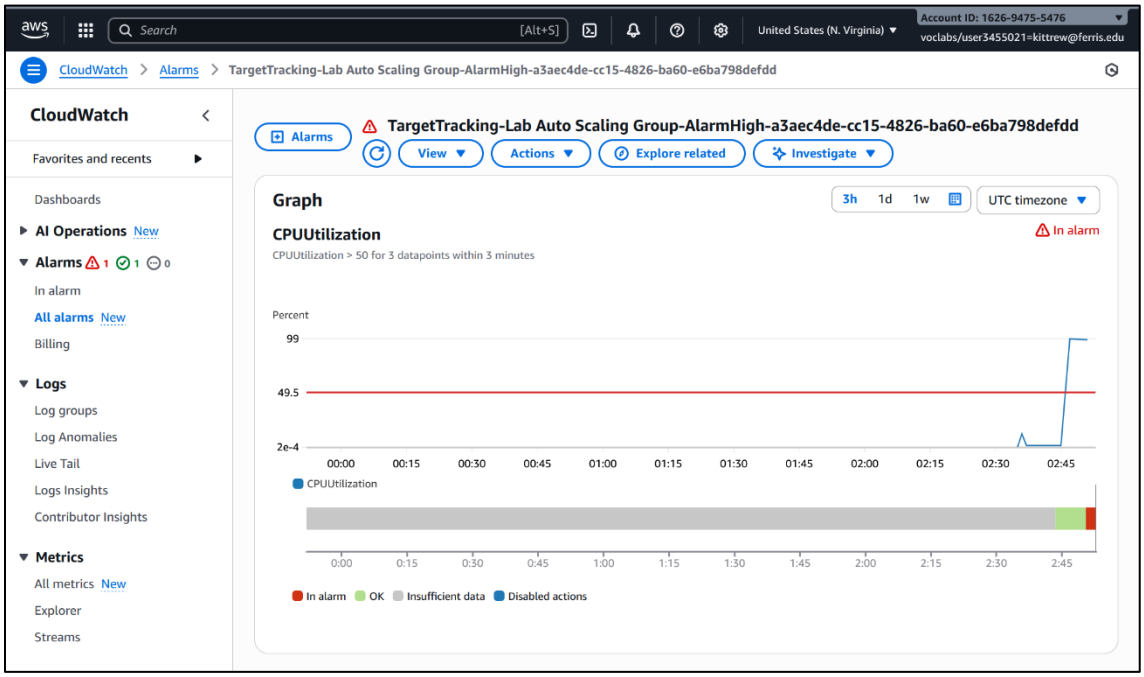
Reached Application



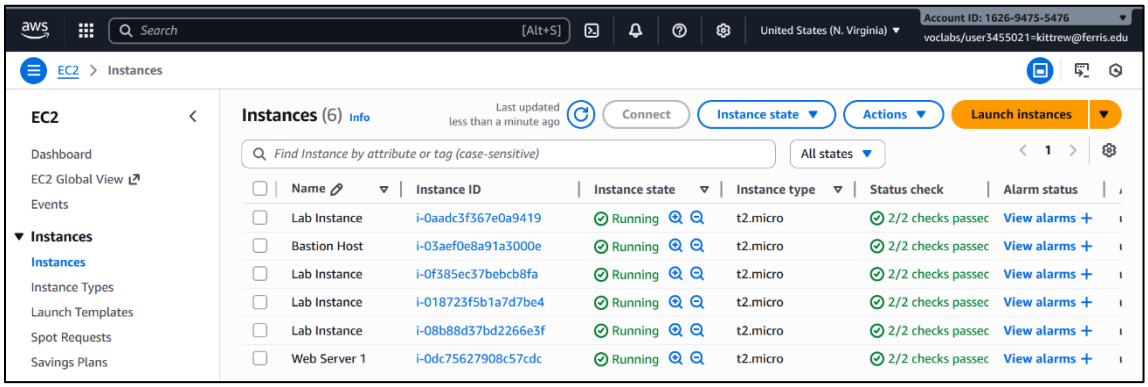
Checked Alarm Status (OK)



Checked Alarm Status (In Alarm)



Observed Automatic Creation of Additional Instances



SYNOPSIS

For this lab, we were tasked with using Elastic Load Balancing and Auto Scaling in order to automatically scale and load balance from one EC2 instance to multiple. The steps primarily involved creating a machine image template, creating and configuring a load balancer, launch template, and auto scaling group, monitoring performance, and observing automatic scaling after a CPU load test.

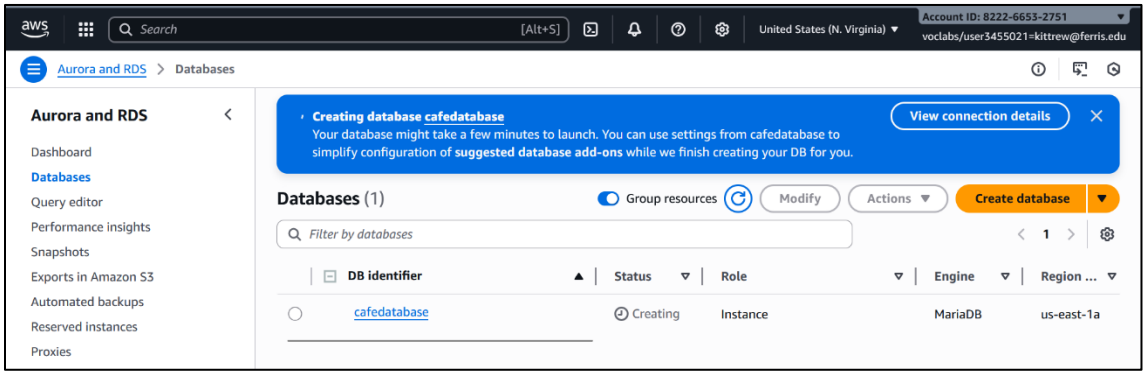
Unfortunately, I ran into an issue when following the launch template and auto scaling group instructions in task 3 where AWS failed to create the auto scaling policy after I finished the setup wizard – it claimed that I had insufficient permissions for some reason. This caused the expected alarms to not appear within CloudWatch, so I had to re-create the auto scaling policy in order to get this portion of the steps to work. I was able to manually edit the auto scaling group so that I could create another policy without needing to delete the entire group and start over. I suspect that this configuration might have been *slightly* wrong due to how long it took CloudWatch to pick up some of the metrics, but it ended up working as intended after a few minutes of waiting for it to respond to my activity (e.g., initiating the CPU load test).

In the absence of any strange permissions issues, I feel confident in my ability to create simple load balancing configurations in AWS with these tools after completing the lab. There are more configurations and setup wizards to complete than I had initially expected, but I found that these were relatively easy to follow once I read the instructions and understood what the purpose of each change that we made was.

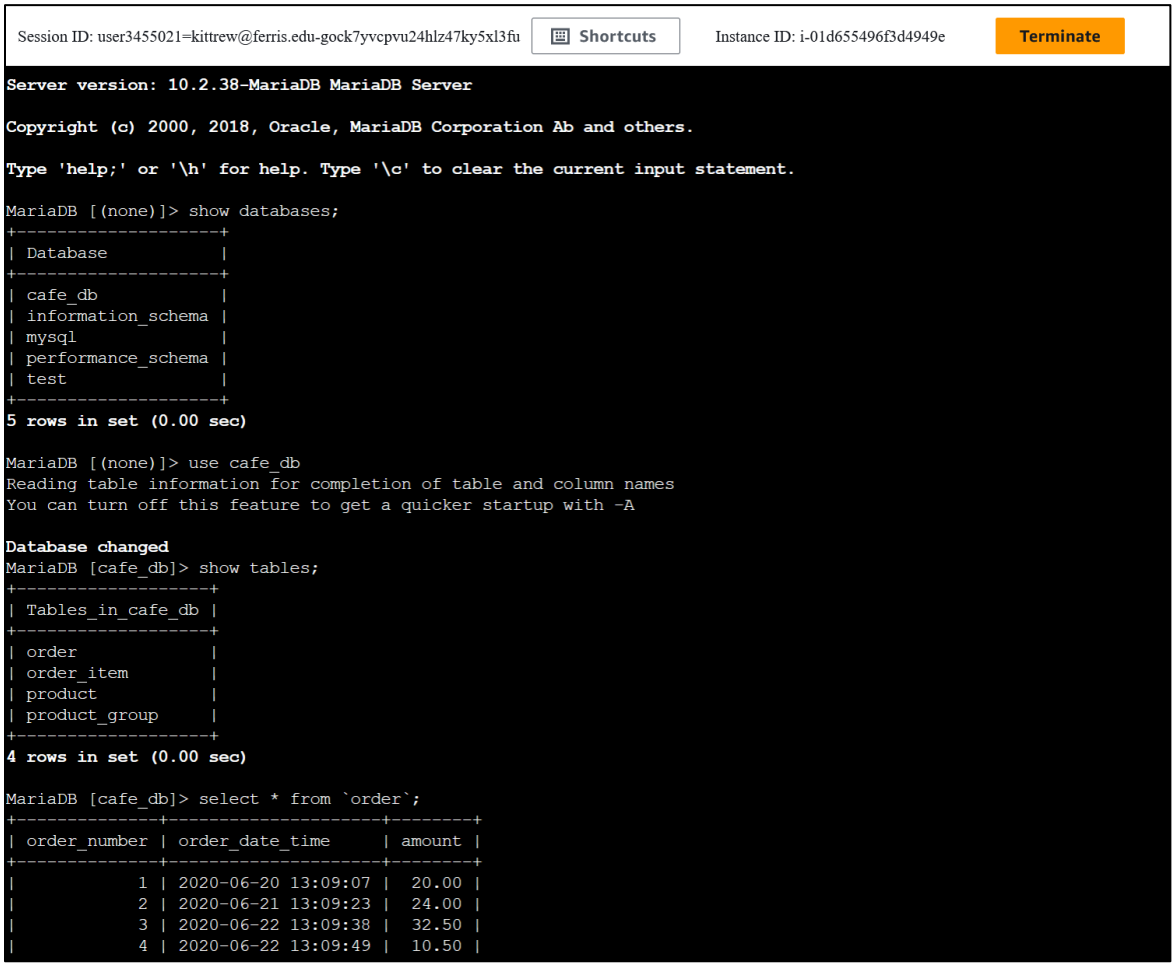
CHALLENGE LAB 6: MIGRATING A DATABASE

SCREENSHOTS

Created Database



Checked Database Content



Dumped Database Content

Session ID: user3455021=kittrew@ferris.edu-gock7yvcpvu24hlz47ky5xl3fu | Shortcuts | Instance ID: i-01d655496f3d4949e | Terminate

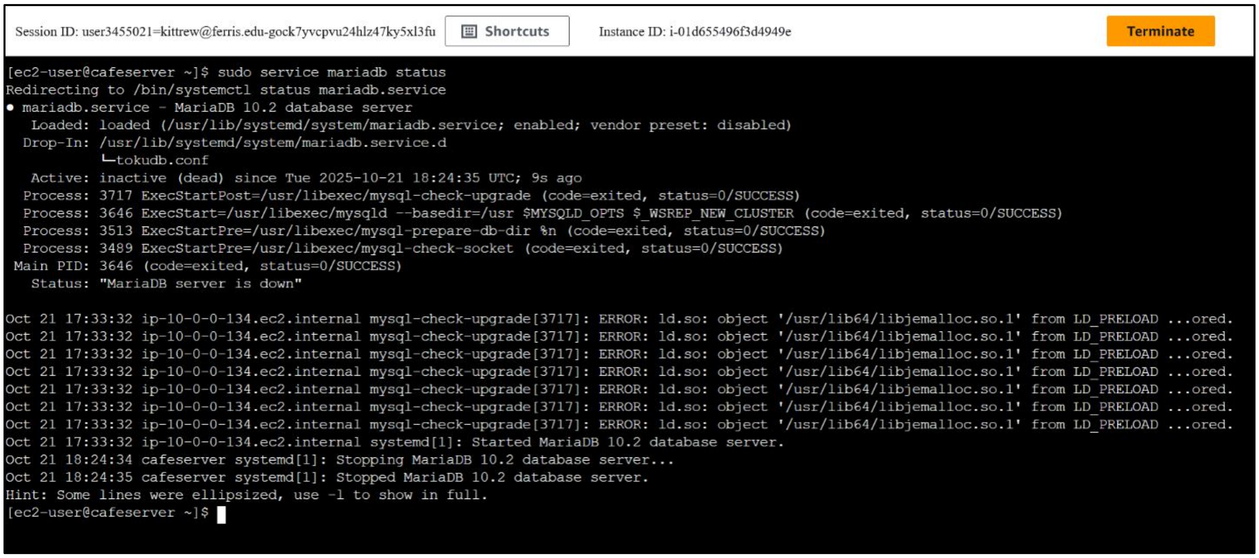
```
[ec2-user@cafeserver ~]$ mysqldump --databases cafe_db -u root -p > CafeDbDump.sql
Enter password:
[ec2-user@cafeserver ~]$ ls
CafeDbDump.sql
[ec2-user@cafeserver ~]$
```

Imported Database Content to RDS

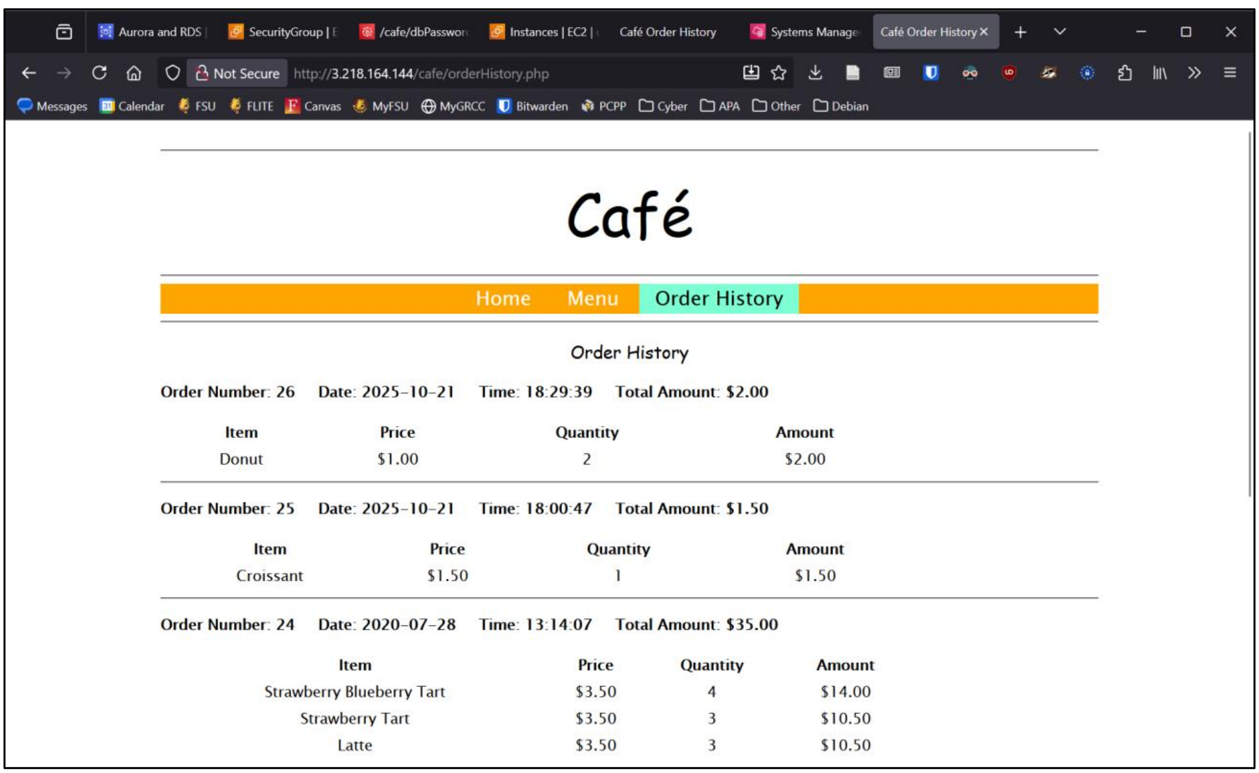
Session ID: user3455021=kittrew@ferris.edu-gock7yvcpvu24hlz47ky5xl3fu | Shortcuts | Instance ID: i-01d655496f3d4949e | Terminate

```
[ec2-user@cafeserver ~]$ mysql -u admin -p --host cafedatabase.cz3drz8rna5u.us-east-1.rds.amazonaws.com
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 45
Server version: 11.4.5-MariaDB-log managed by https://aws.amazon.com/rds/

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]> show databases;
+--------------------+
| Database           |
+--------------------+
|            cafe_db |
| information_schema |
|             innodb |
|              mysql |
| performance_schema |
|                sys |
+--------------------+
6 rows in set (0.00 sec)

MariaDB [(none)]> use cafe_db;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
MariaDB [cafe_db]> show tables;
+-------------------+
| Tables_in_cafe_db |
+-------------------+
|             order |
|        order_item |
|           product |
|     product_group |
+-------------------+
4 rows in set (0.00 sec)

MariaDB [cafe_db]> select * from `order`;
+--------------+---------------------+--------+
| order_number | order_date_time     | amount |
+--------------+---------------------+--------+
|            1 | 2020-06-20 13:09:07 |  20.00 |
|            2 | 2020-06-21 13:09:23 |  24.00 |
|            3 | 2020-06-22 13:09:38 |  32.50 |
|            4 | 2020-06-22 13:09:49 |  10.50 |
|            5 | 2020-06-24 13:10:02 |  42.00 |
|            6 | 2020-06-25 13:10:20 |  14.00 |
|            7 | 2020-06-25 13:10:30 |  35.00 |
|            8 | 2020-06-27 13:10:36 |   6.00 |
|            9 | 2020-06-28 13:10:46 |  18.00 |
|           10 | 2020-07-02 13:10:58 |  18.00 |
|           11 | 2020-07-03 13:11:08 |  19.50 |
|           12 | 2020-07-04 13:11:17 |   9.00 |
```

Stopped Database on EC2 Instance



Tested Functionality



Order number 25 is from the test at the beginning of the lab before the migration, while order number 26 is from the test at the end of the lab.

SYNOPSIS

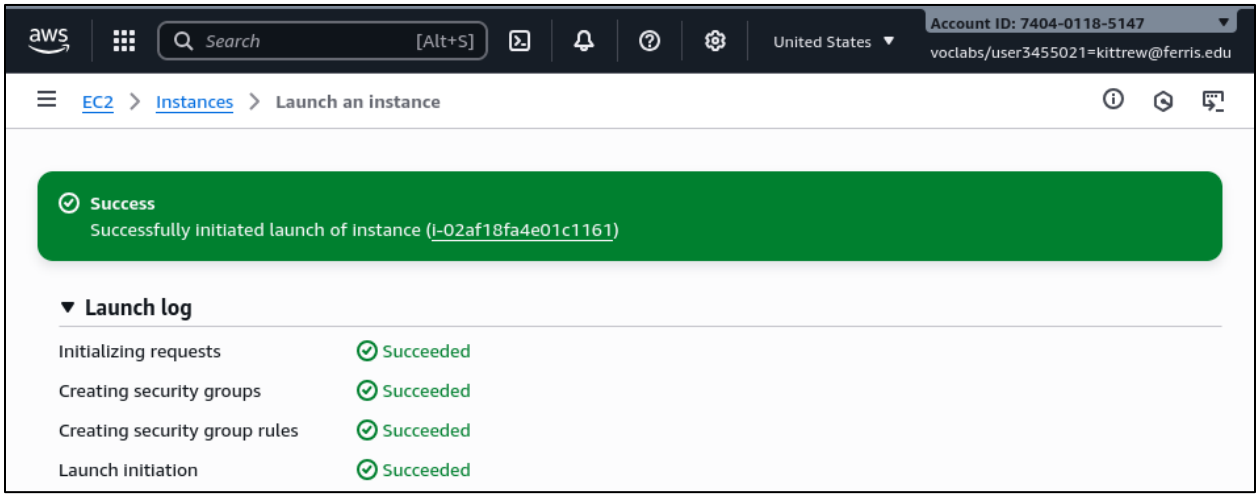
For this challenge lab, we were tasked with migrating from a database hosted on an EC2 instance to Amazon RDS, the service for relational databases in the cloud. The main challenge was in understanding how the initial database configuration worked for the café application, and then knowing which additional steps (i.e., ones not given in the instructions) we would need to complete to switch to RDS and make the café application work with the new configuration.

Although I have some experience with databases, I was admittedly not confident in my abilities at the start of this lab. The database security class was one of the first classes that I completed in the ISI program, and I had not worked with any database technology since then (apart from brief command line interactions like when we show the tables in this lab). Fortunately, I didn't find this to be a problem because most of the technical details were abstracted away with the database creation wizard. I'm becoming better at developing a sense for which configuration options and services might need to be investigated when I encounter problems in AWS, so I didn't find it difficult to get the café application working once I finished the database migration. There were a few minutes at the end of the lab where the menu page initially didn't work, but I quickly discovered that this was because I had forgotten to update the database username and password values in the AWS secrets manager. As soon as I updated these values, the page began working and I was able to successfully submit an order and view it in the history.

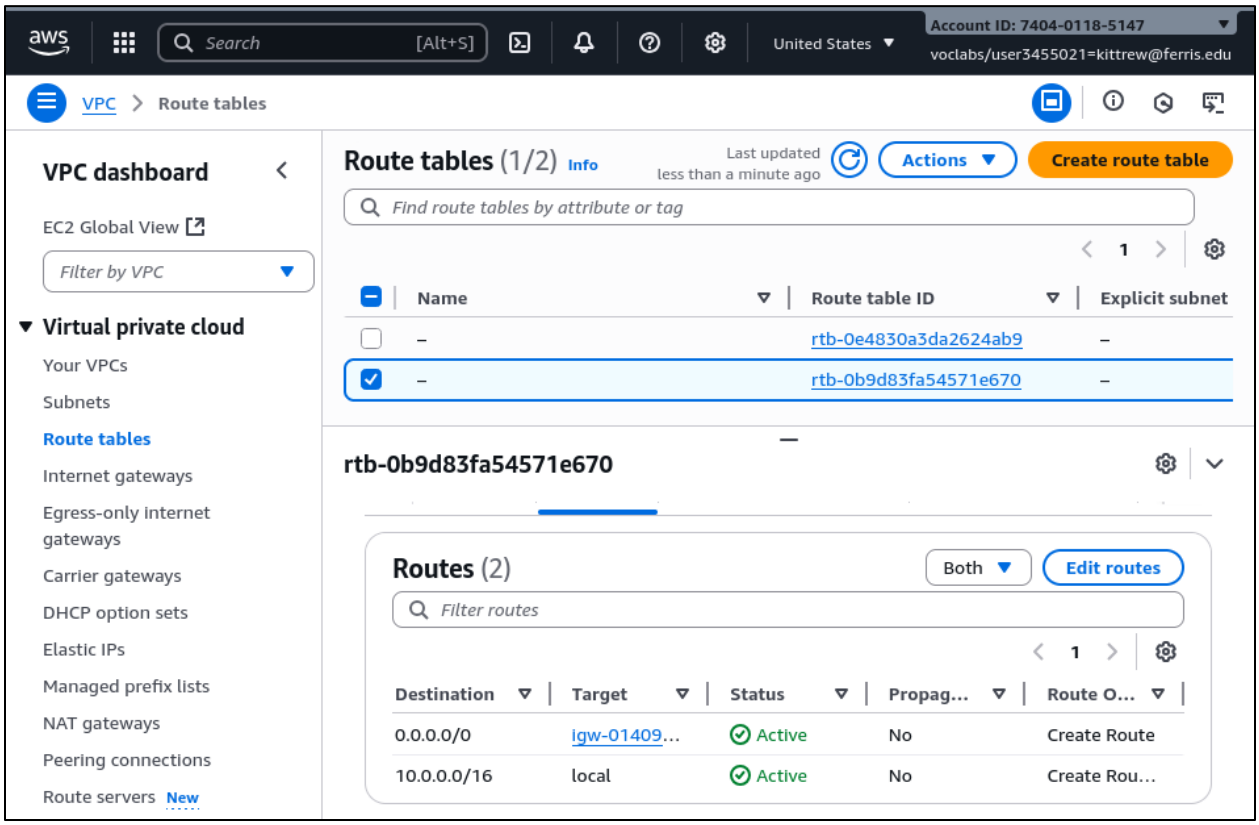
CHALLENGE LAB 7: VPC NETWORKING ENVIRONMENT

SCREENSHOTS

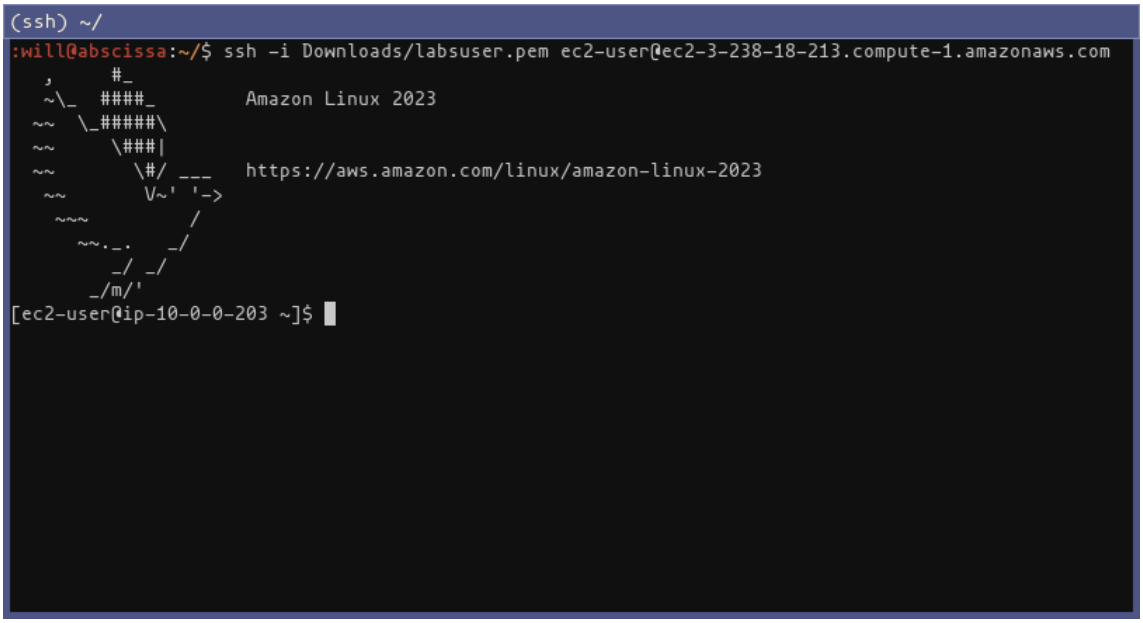
Launched Bastion Host



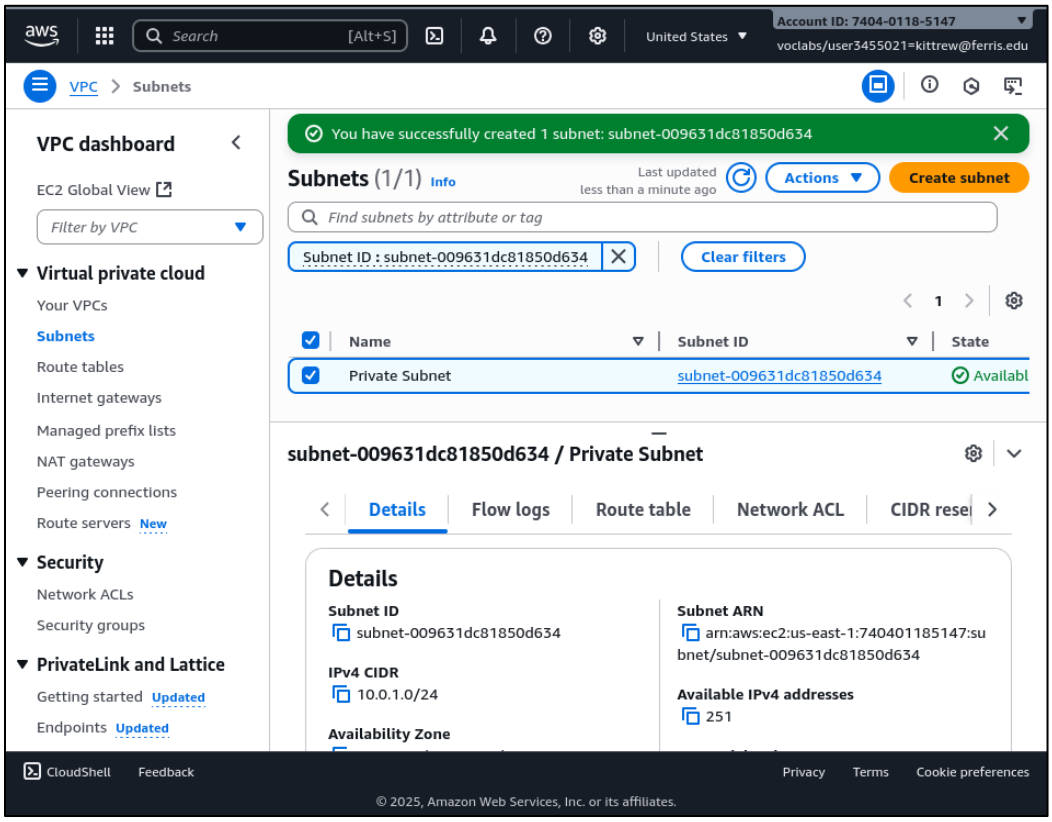
Updated Route Table with Internet Gateway



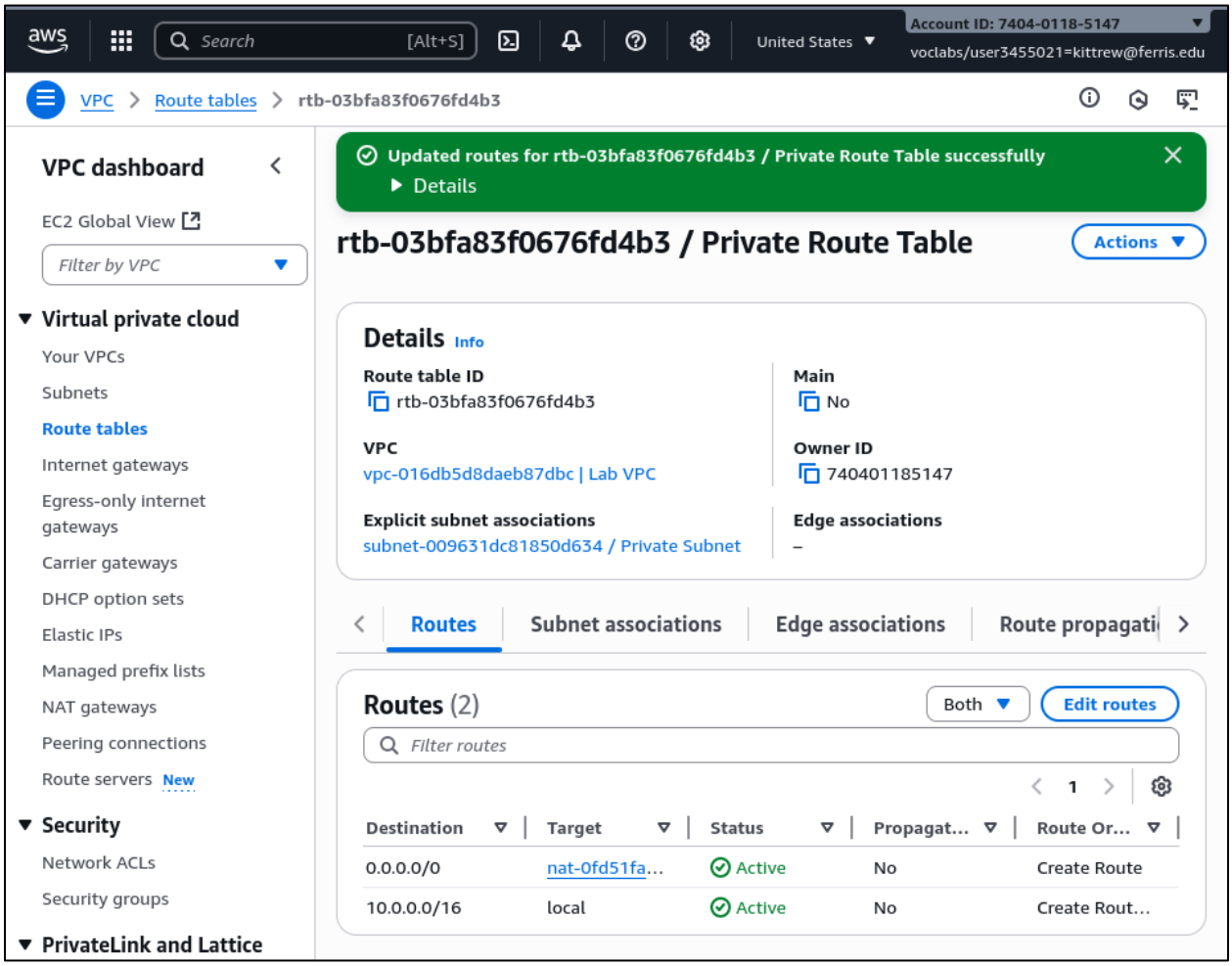
Successfully Connected to Bastion Host



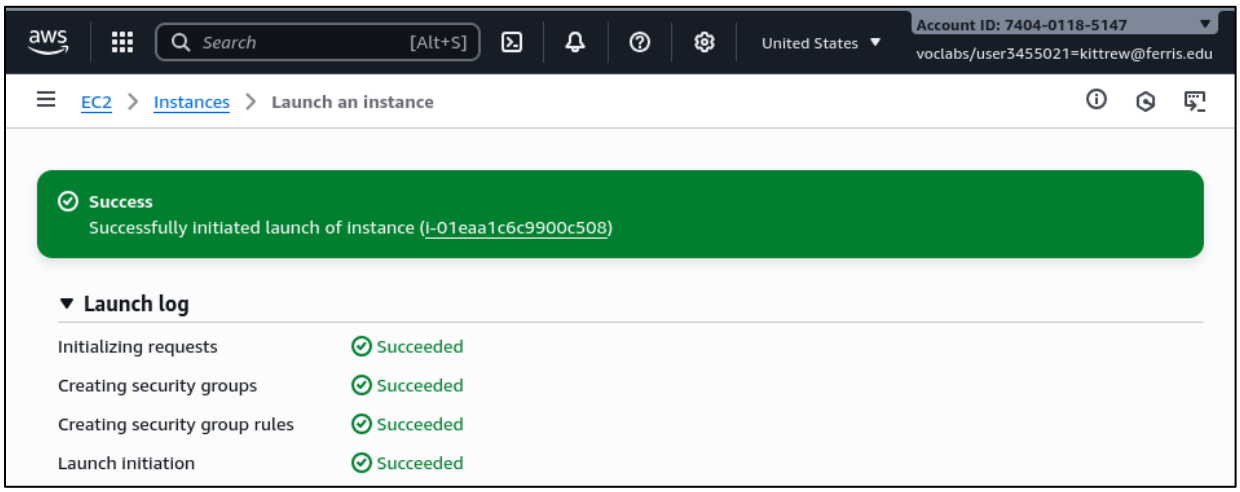
Created Private Subnet



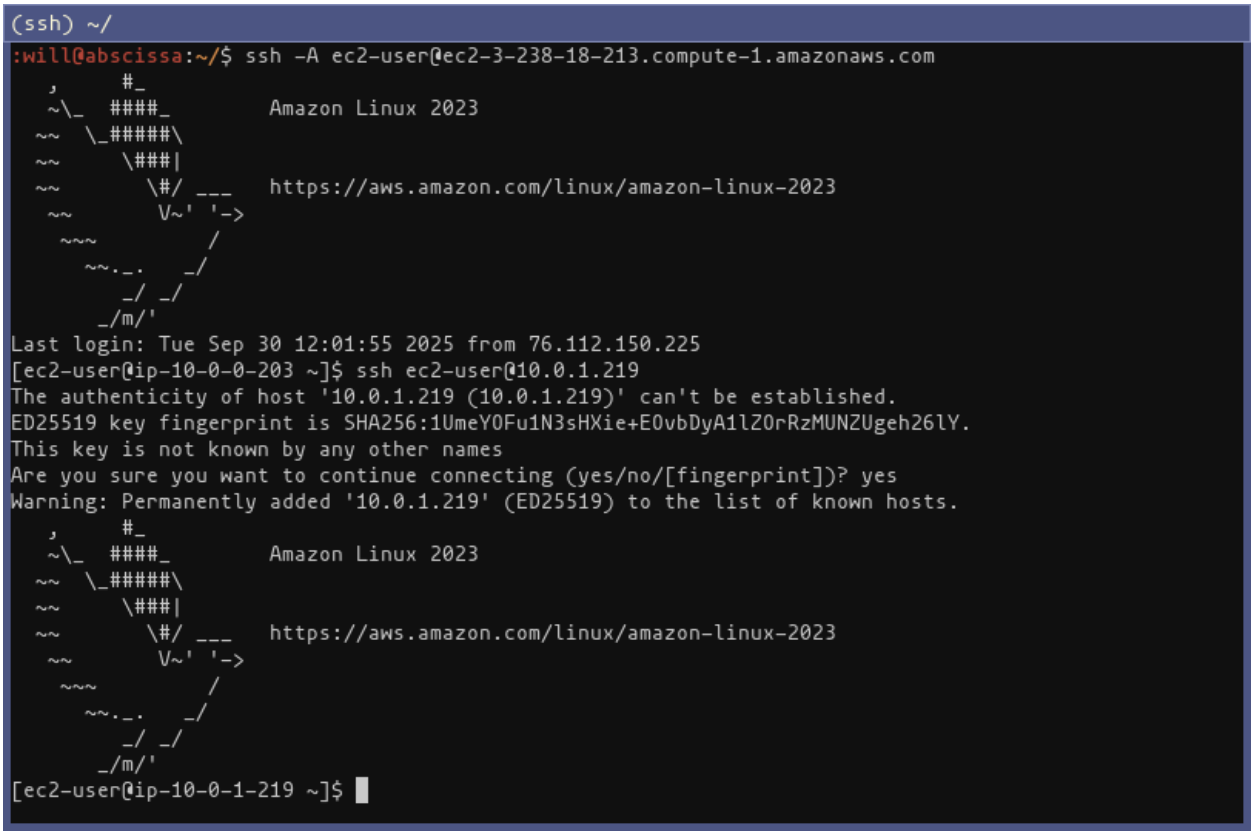
Updated Private Subnet Route Table with NAT Gateway



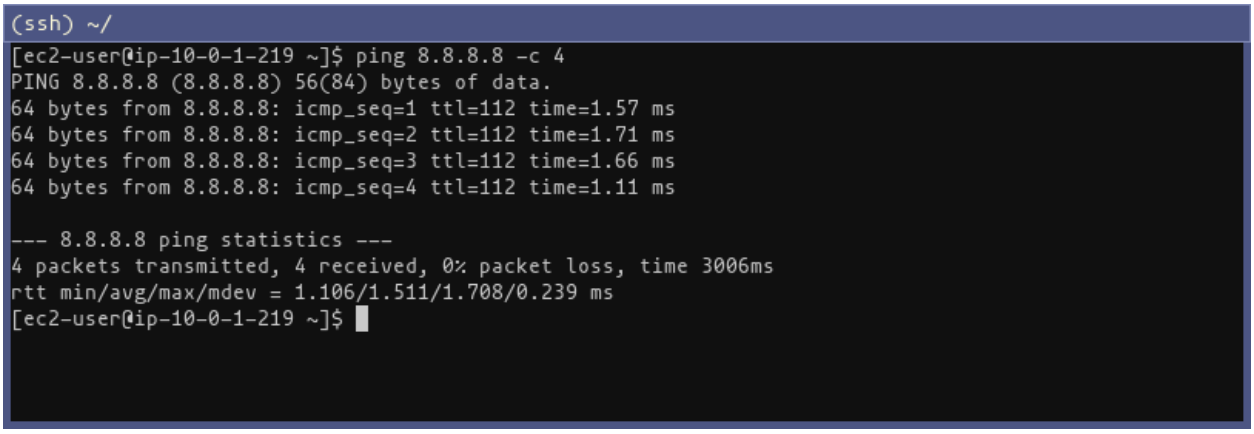
Launched EC2 Instance in Private Subnet



Connected to Host in Private Subnet via SSH Passthrough



Tested Connection to Internet from Private Subnet Host



SYNOPSIS

During this challenge lab, we were tasked with applying our knowledge of the EC2 and VPC services within AWS to create a virtual environment that meets the specifications we were given. Some portions of the lab were guided, while others did not offer complete instructions and required additional research or experimentation.

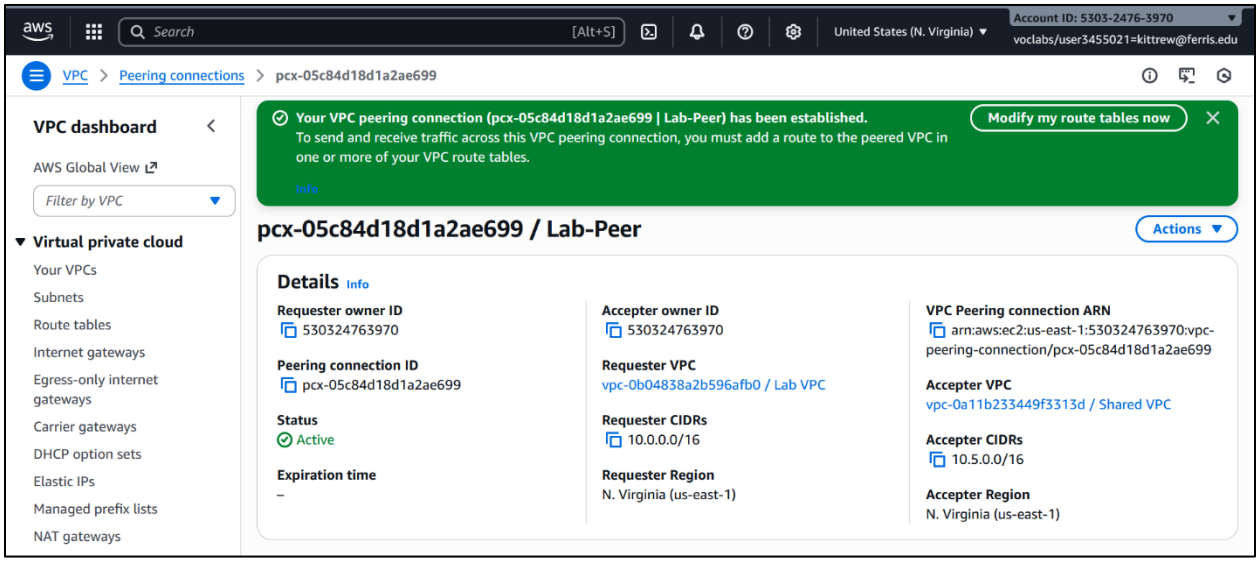
I ran into a few issues, but I think that the lab went well for the most part. Before I was able to use any of the `ssh-add` commands that were in the instructions, I had to run `eval `ssh-agent -s`` first – which would then allow the `ssh-add` command(s) to complete without any error. I also discovered that the `-K` flag the instructions told me to use was incorrect for my version of Linux (Debian 13). After making the SSH connection to a host, I had a minor problem where my `$TERM` was unrecognized, but this could be solved quickly with `export TERM=xterm`. At the end of the lab, I was able to create the network ACL to deny ICMP traffic between the private subnet and the EC2 instance but was unable to get Amazon to apply the settings. I'm not entirely sure what was happening since I think that my method was correct based on their documentation, but I kept receiving permissions errors followed by network connection errors to the AWS webpage itself (maybe something went wrong with my connection?). Had the settings been applied, I think they would have worked correctly.

Overall, I feel more confident in my ability to leverage EC2 and VPC services to create environments as needed without requiring specific instructions. It was nice to get more hands-on practice with using the services, and it was validating to find that I could usually predict roughly what steps were going to come next in the instructions even if I didn't guess every detail correctly.

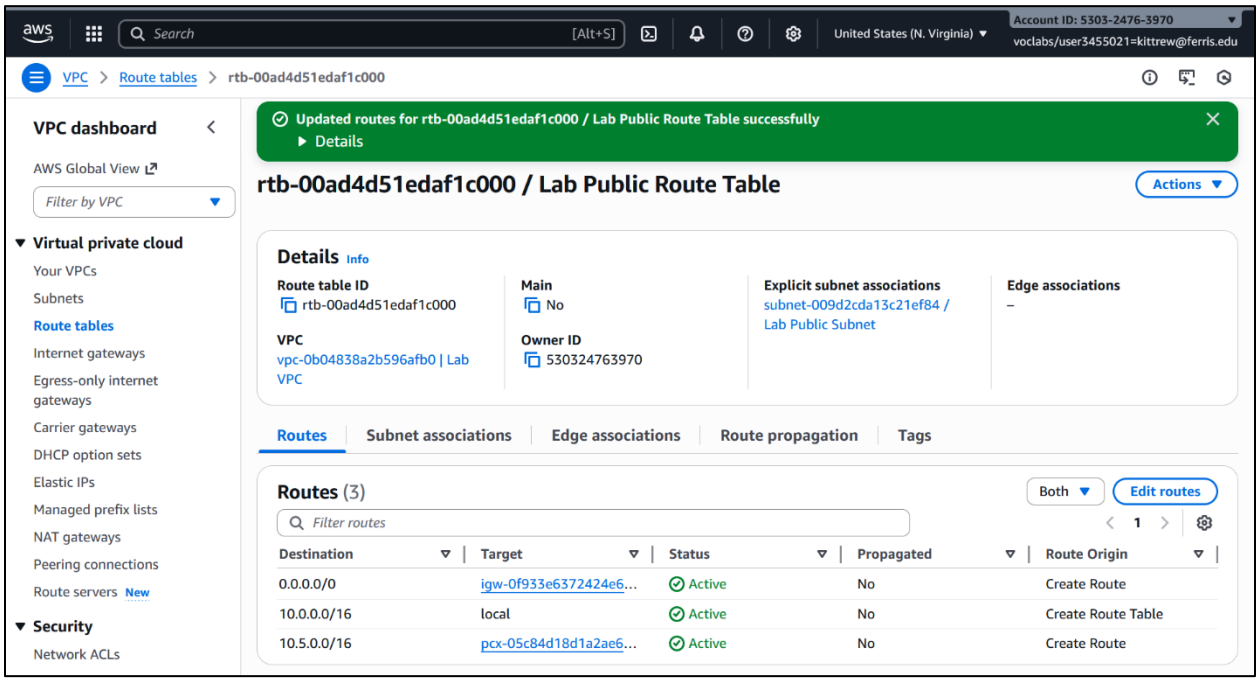
LAB 8: CREATE A VPC PEERING CONNECTION

SCREENSHOTS

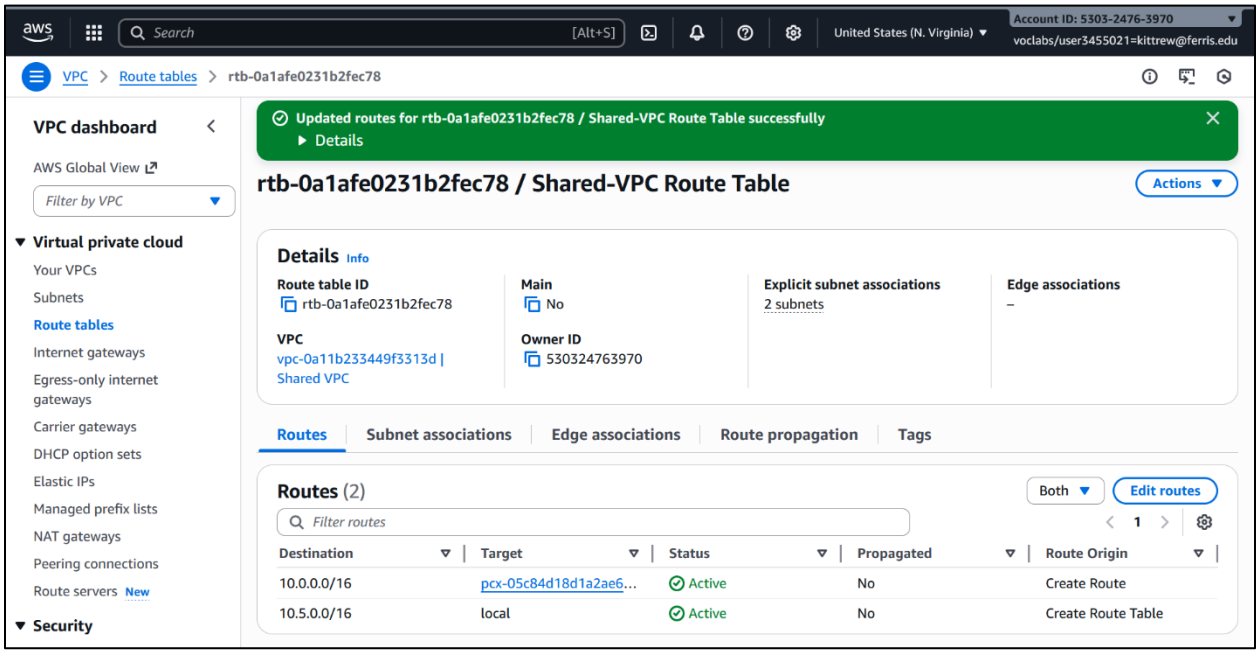
Created and Accepted VPC Peering Connection



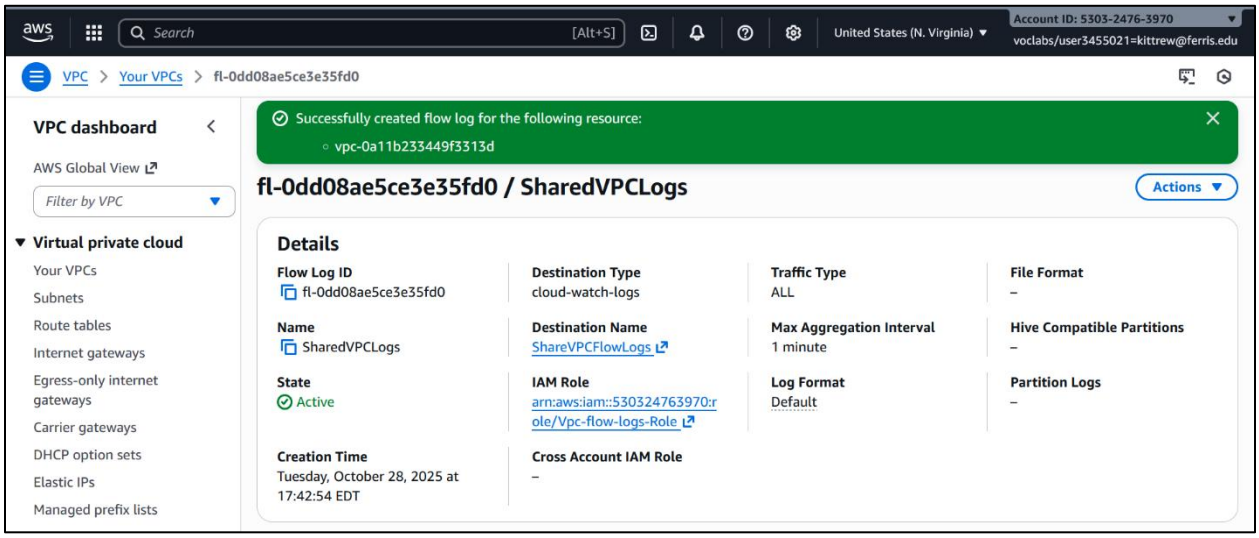
Updated Lab Public Route Table



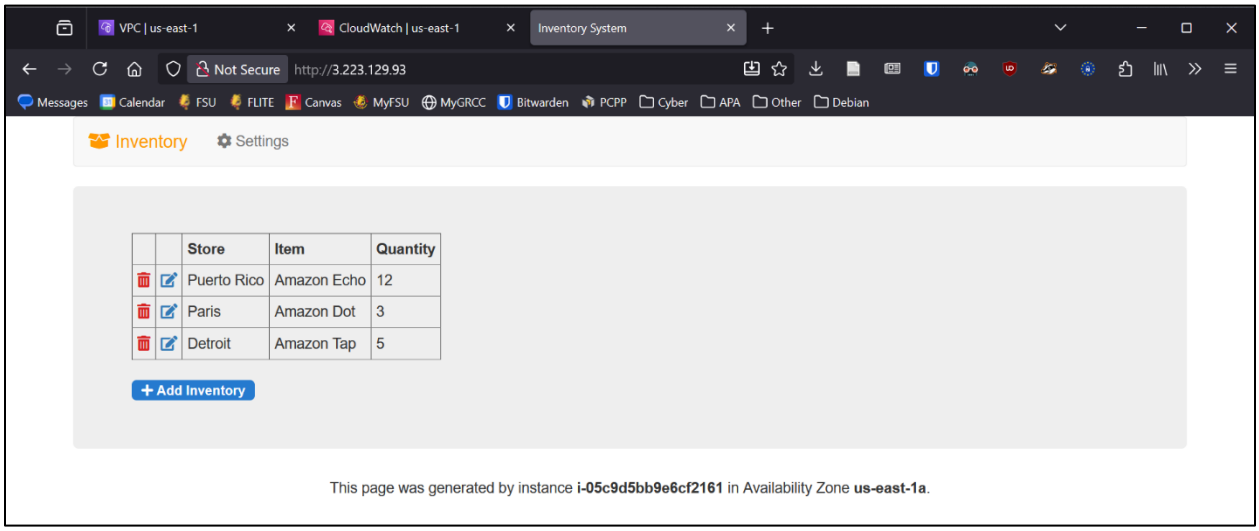
Updated Shared-VPC Route Table



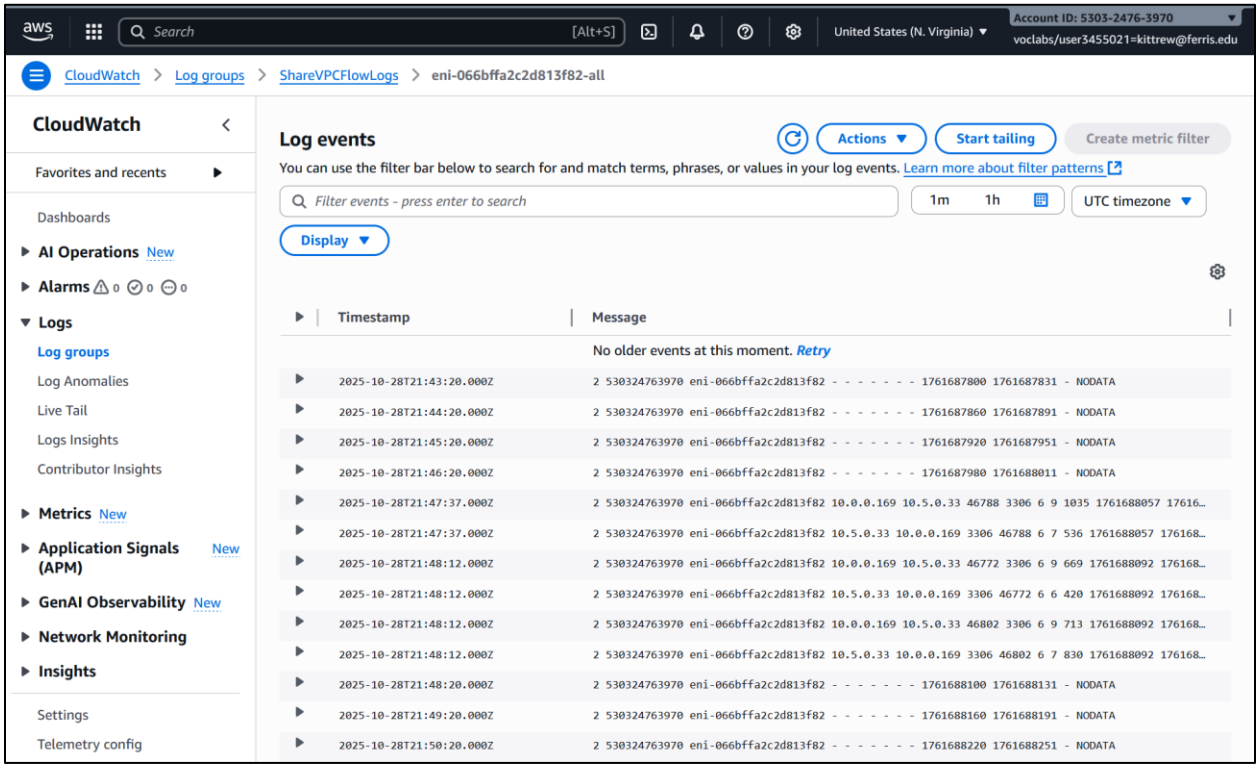
Created VPC Flow Log



Tested VPC Peering Connection



Viewed Flow Logs



SYNOPSIS

In this lab, we created a VPC peering connection between two pre-existing virtual private clouds in our environment. In addition to creating the connection itself, we configured route tables to ensure that traffic is delivered properly between VPCs and enabled logging so that we could have insight into data on the network. At the end of the lab, we tested the configuration and checked the logs to ensure that everything had functioned correctly.

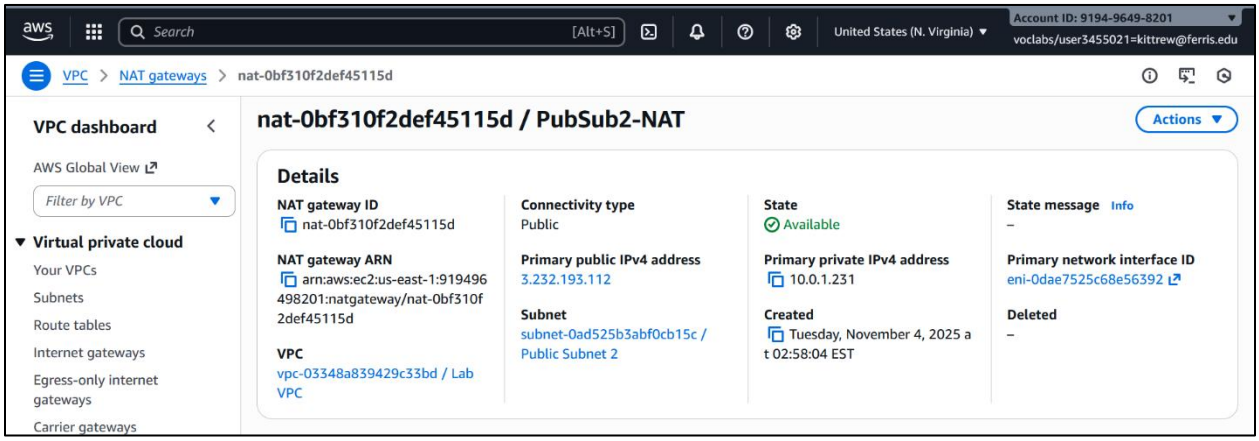
Despite the lab being guided, I don't feel confident in my ability to create configurations that use VPC peering connections in an effective way. I didn't have trouble following any of the steps, but I also don't think I understand what the correct use case/application of VPC peering is. Of course, I know that this feature allows me to connect two VPCs (even between different accounts and regions), but I don't understand why this configuration was beneficial to the environment that we created in our lab – as both VPCs belonged to the same account in the same region. Perhaps I'm reading into it too much and it was only for demonstration purposes, but my understanding is that we could have put the database in a private subnet within a single VPC and then used security controls to achieve effectively the same result.

Otherwise, I feel like I have the foundations to use VPC peering effectively once I develop a better understanding of when it should be used and why it might be desirable over a different configuration.

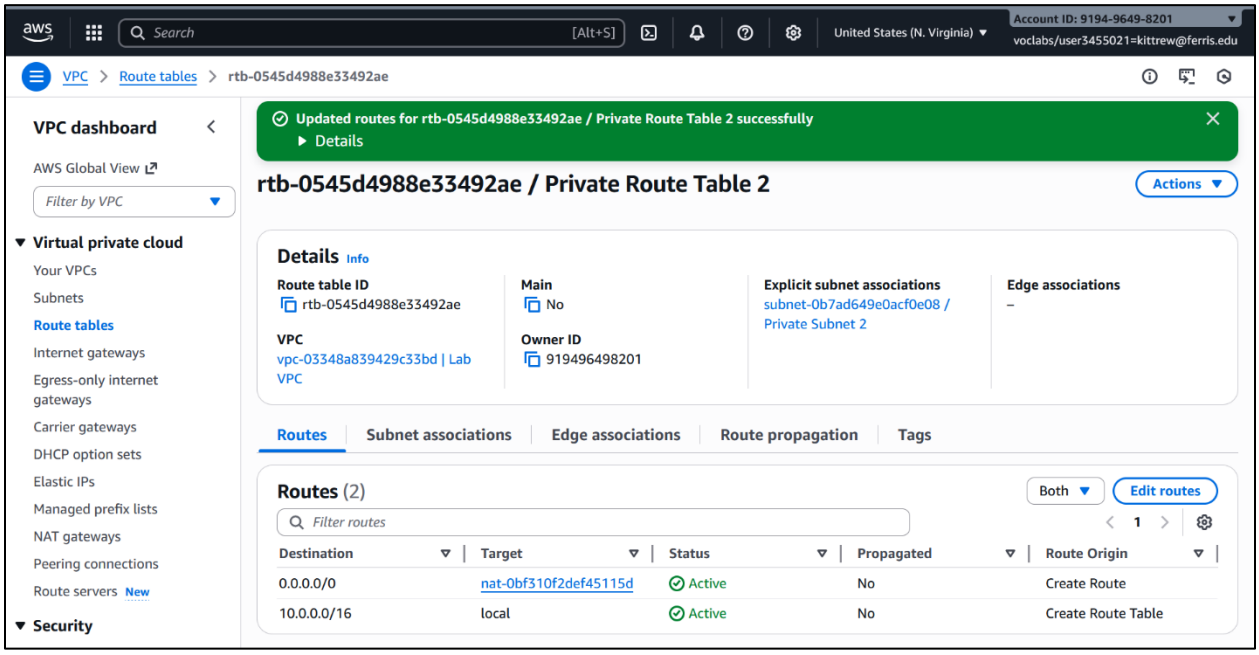
CHALLENGE LAB 10: SCALABLE/AVAILABLE CAFÉ

SCREENSHOTS

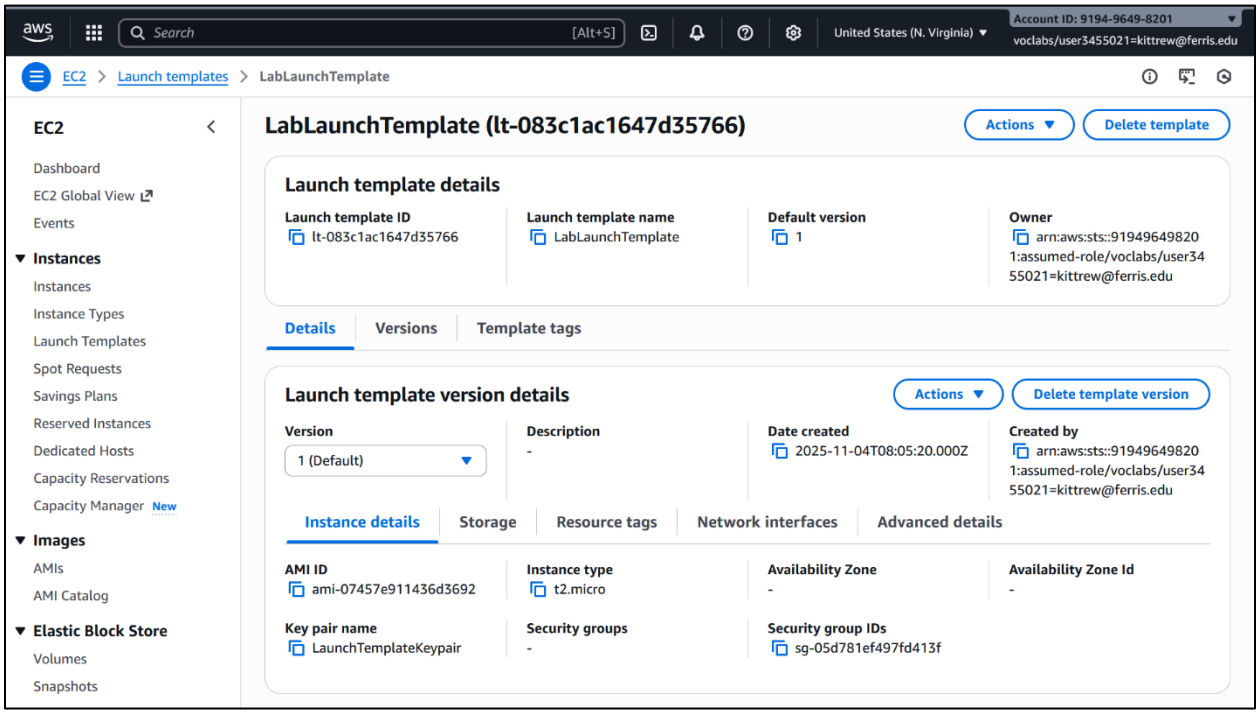
Created NAT Gateway



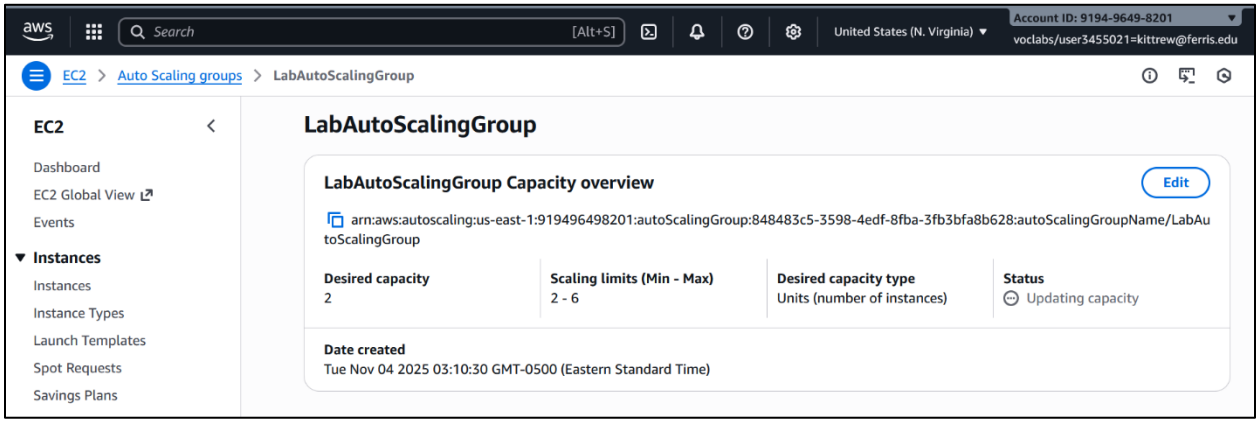
Modified Private Subnet 2 Route Table



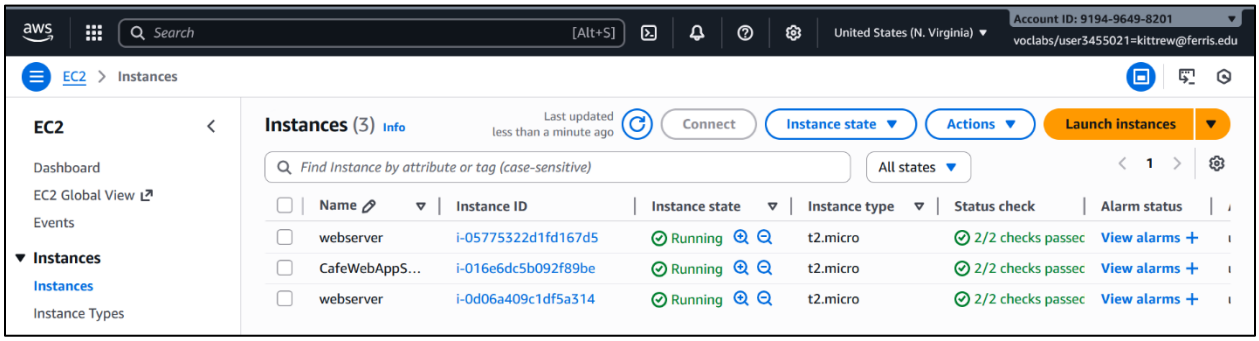
Created Launch Template



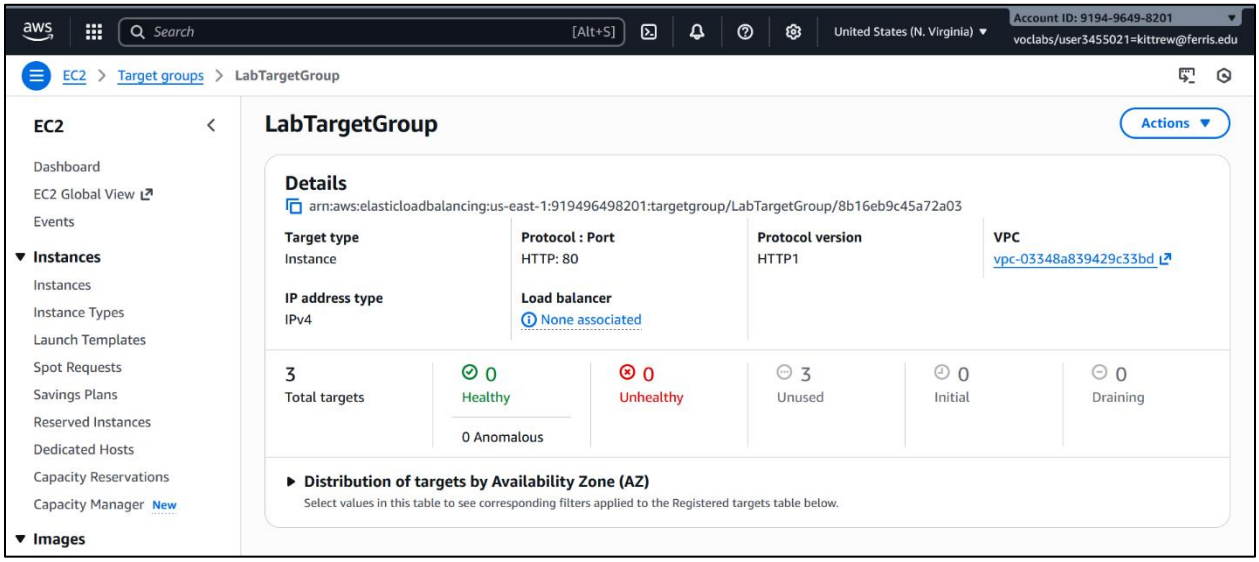
Created Auto Scaling Group



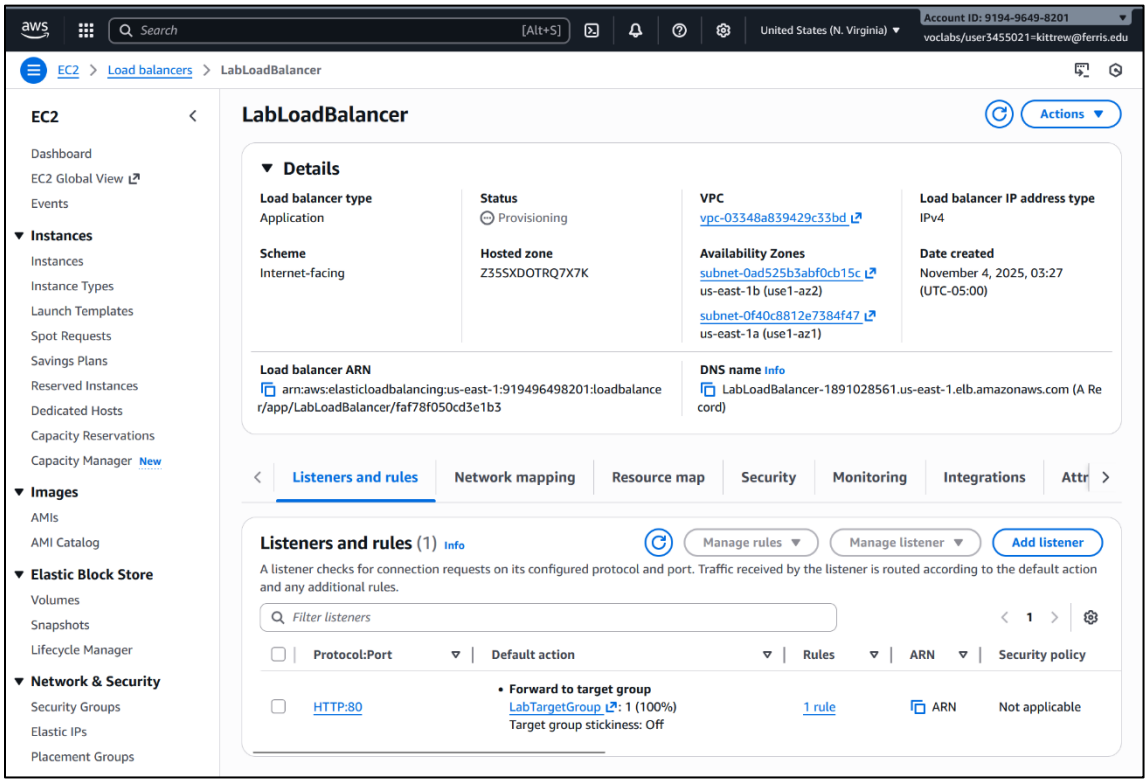
Observed Instance Creation



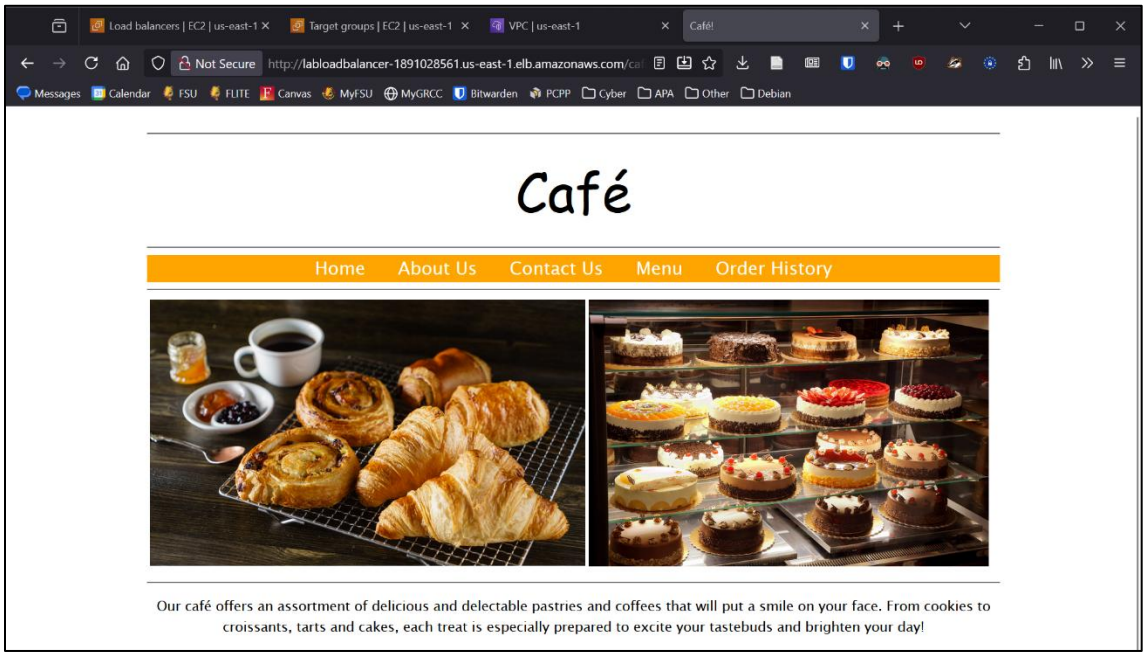
Created Target Group



Created Load Balancer



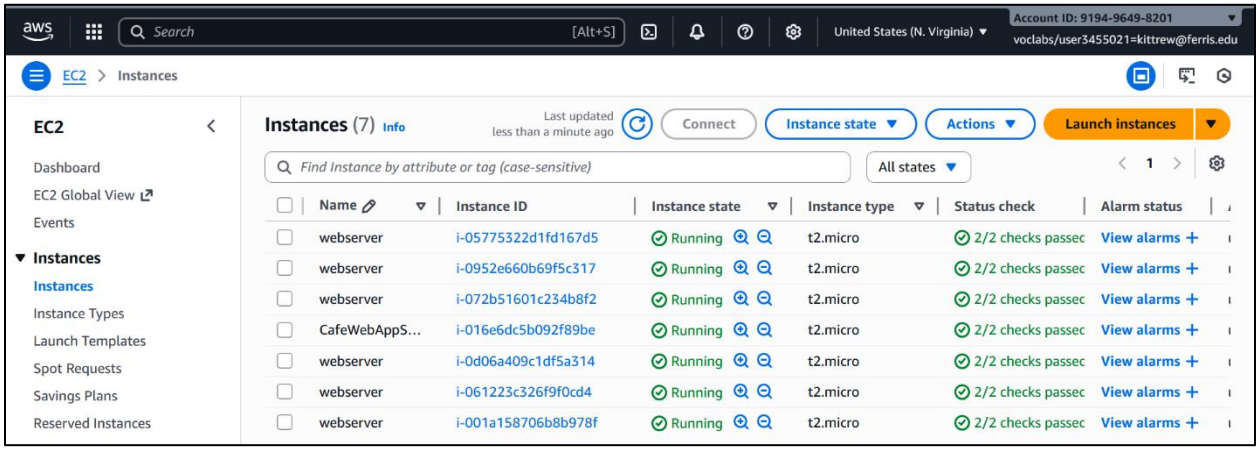
Reached Café Application



Started Stress Test

```
sh-4.2$ stress --cpu 1 --timeout 600
stress: info: [3444] dispatching hogs: 1 cpu, 0 io, 0 vm, 0 hdd
```

Observed Auto Scaling



SYNOPSIS

In this challenge lab, we were tasked with using load balancing and auto scaling to create a scalable and highly available architecture for the café web application. Before we could begin configuring auto scaling, the existing network configuration had to be inspected and updated to facilitate the desired multi-AZ environment. Tasks related to automatic scaling setup were completed afterwards, and a stress test was initiated to confirm that automatic scaling worked.

Most of the lab went smoothly, but I experienced some minor issues towards the end. Like in my previous lab, AWS failed to make the scaling policy after I completed the setup wizard for the auto scaling group. This time, however, policy creation failed silently. I discovered the issue during the final lab task where we observe more EC2 instances being automatically deployed after noticing that nothing had changed about 5 minutes into the CPU stress test. I had to modify the auto scaling group to re-create the automatic scaling policy, which fixed this portion of the issue. The `stress --cpu 1 --timeout 600` command had also completed by this time, which caused the CloudWatch alarm to never be triggered (preventing any automatic scaling). Automatic scaling worked as expected after restarting the stress test and waiting for a few minutes.

I feel more confident that I can use scalability and availability features in AWS with less guidance after completing this lab and troubleshooting the issue that I experienced. With more practice, I would feel comfortable attempting to use scalability and availability features in combination with some of the others that we've covered (e.g., database services).