CMIT 495 Current Trends and Projects in Computer Networks and Security

Week 2 – Cloud Computing

1. **Log in to your newly created AWS account and take a screenshot of the AWS Management Console (Dashboard) and paste it below question 1. The screenshot should include the username you created during the setup phase.**

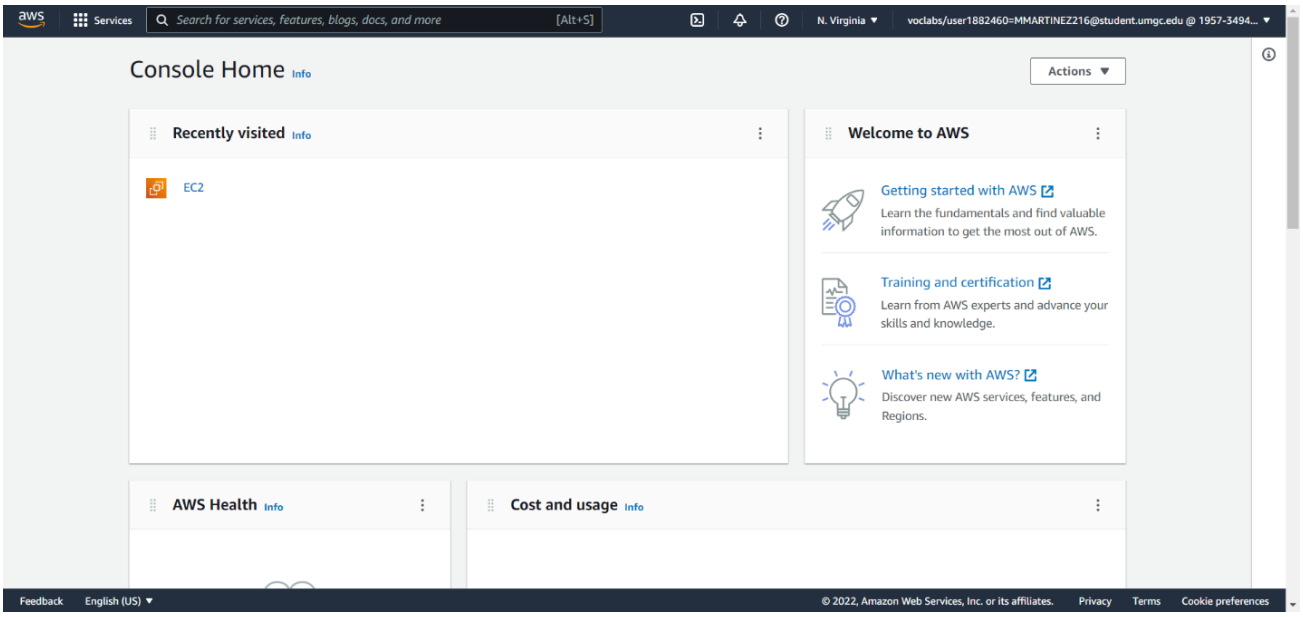

Figure 1: AWS Console Home

2. **Launch a Windows Virtual Machine (VM). Provide a detailed overview of the steps required to install the Microsoft Windows operating system (OS) on the VM. The steps may be listed in the form of bullet points or a summary with complete sentences. Use as much space as required. Finally, take a screenshot of the desktop and paste it with your response below this question.**

   a. Scroll down to "Build a Solution."
   b. Click on "Launch a Virtual Machine."

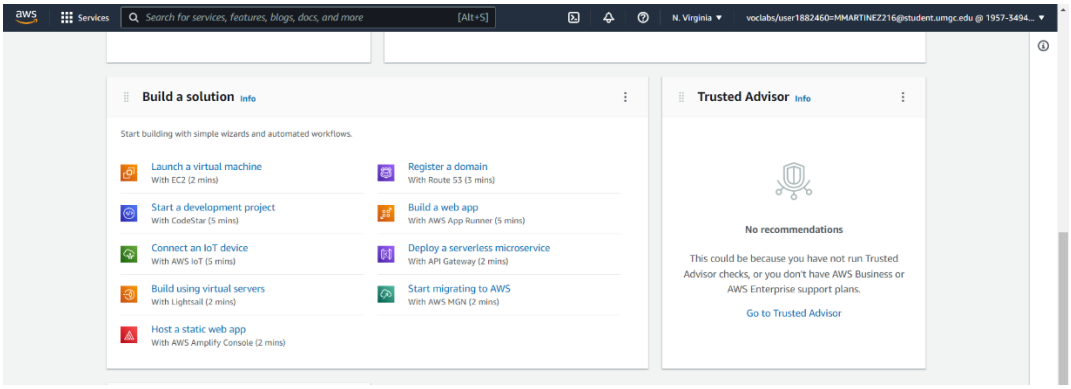

Figure 2: Build a Solution Options

c. Scroll down and select the “Windows Server 2019 Base” Amazon Machine Image (AMI).

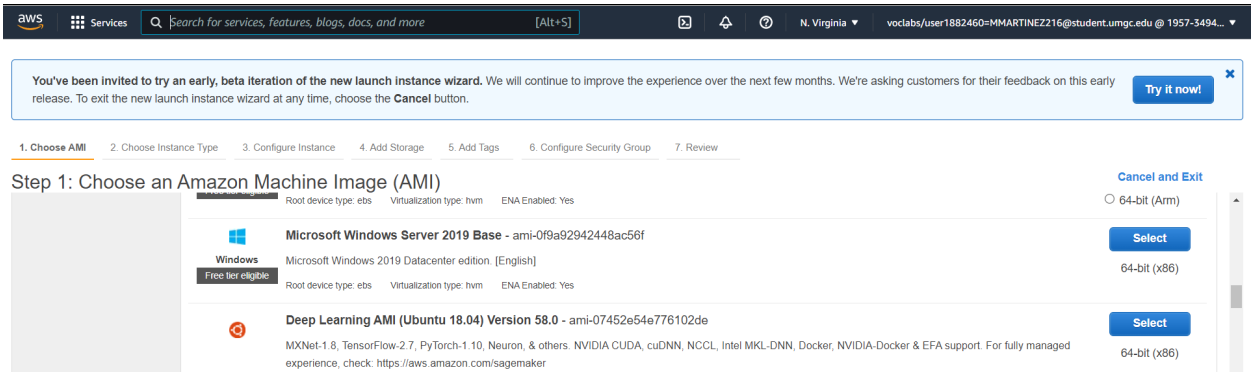

Figure 3: AMI Options

d. Select “t2.micro” or the instance type that fits your needs.

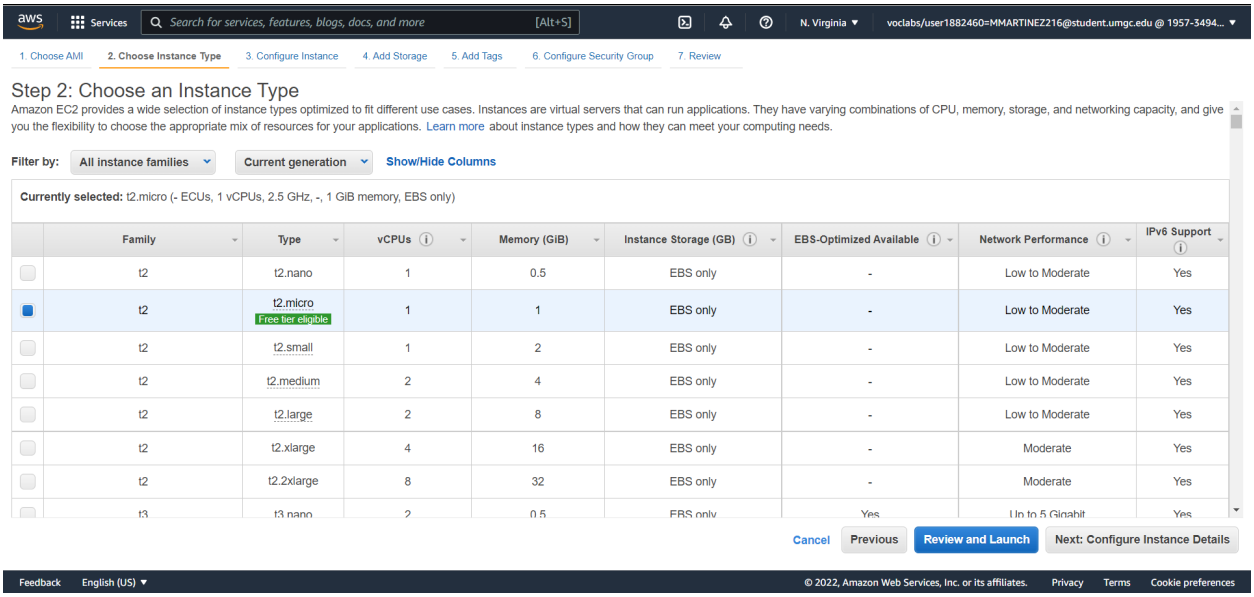

Figure 4: Options for Instance types

e. Click on “Edit Security Groups” to create a new security group or use a previous group.

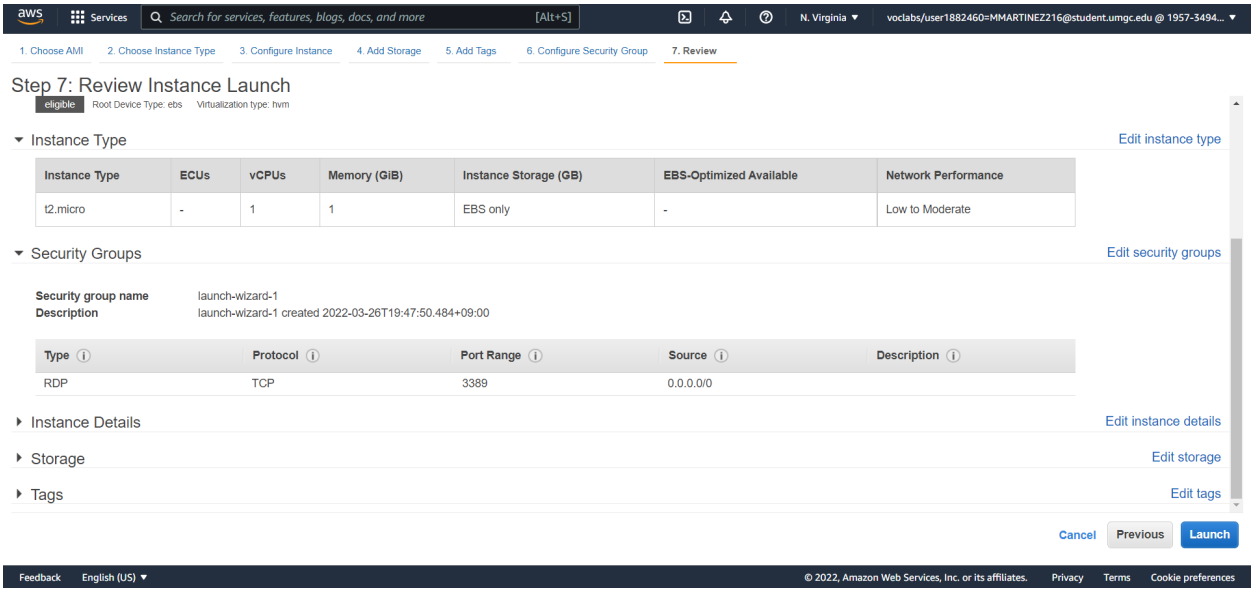

Figure 5: Review Instance Settings

f. Name your security group and ensure to select “My IP” under the “Source” tab.

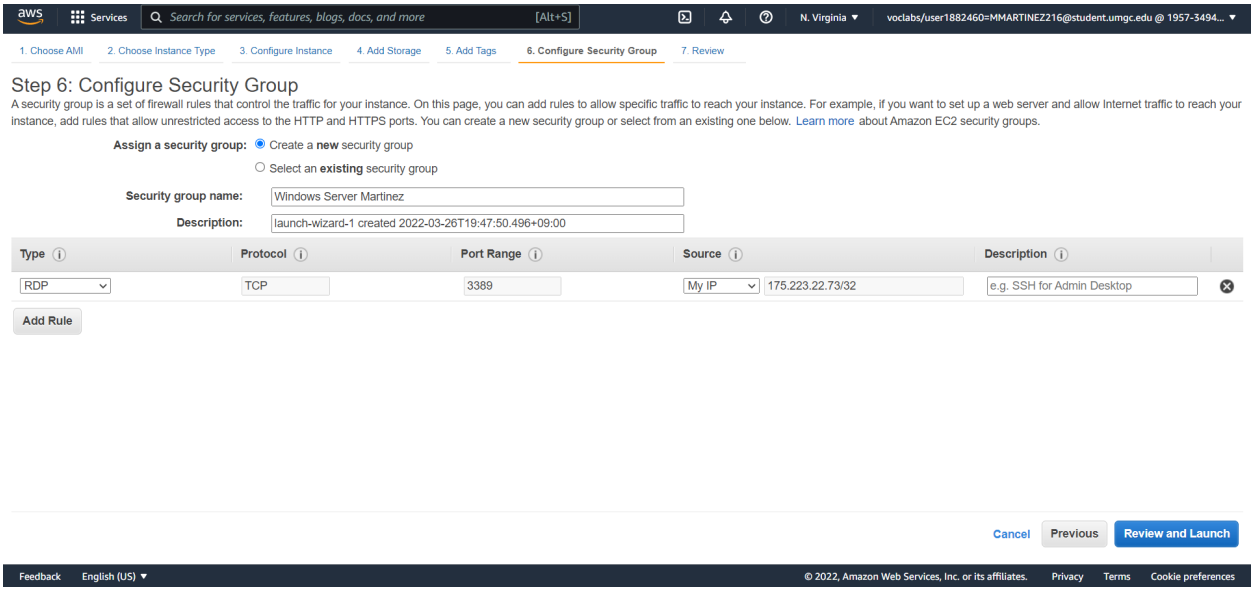

Figure 6: Edit Security Group Settings

g. Review the settings and select “Launch.”

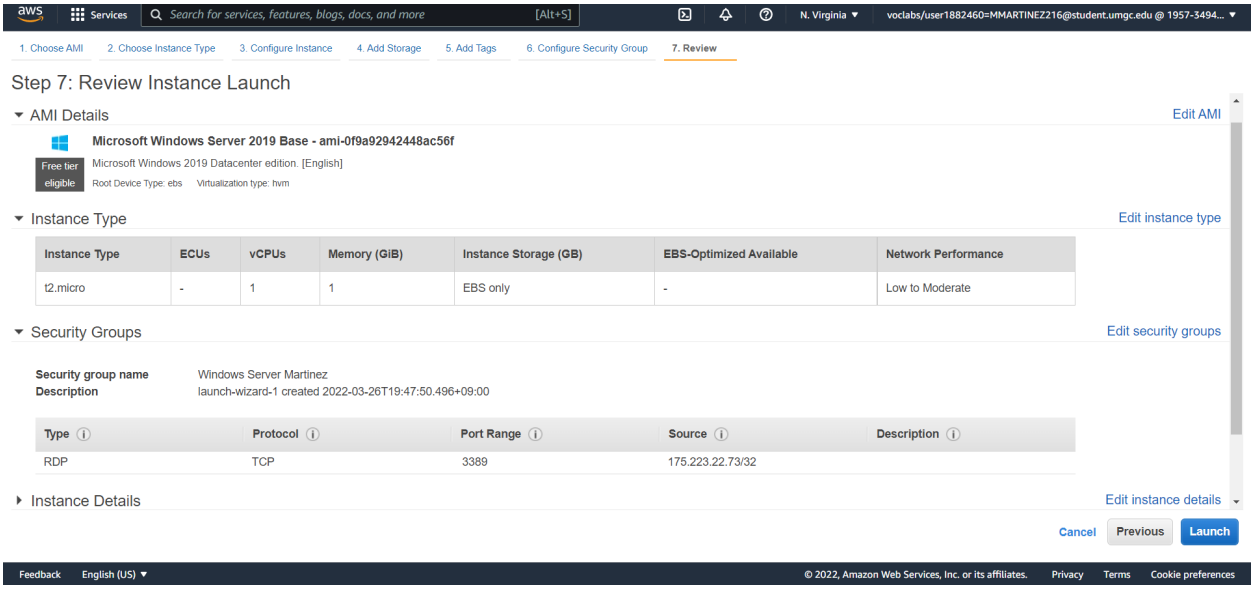

Figure 7: Final review and launch.

h. Create a new Key Pair or use a previous option. Ensure that you have access to the Key Pair once it is downloaded. Key Pairs CAN NOT be downloaded a second time.

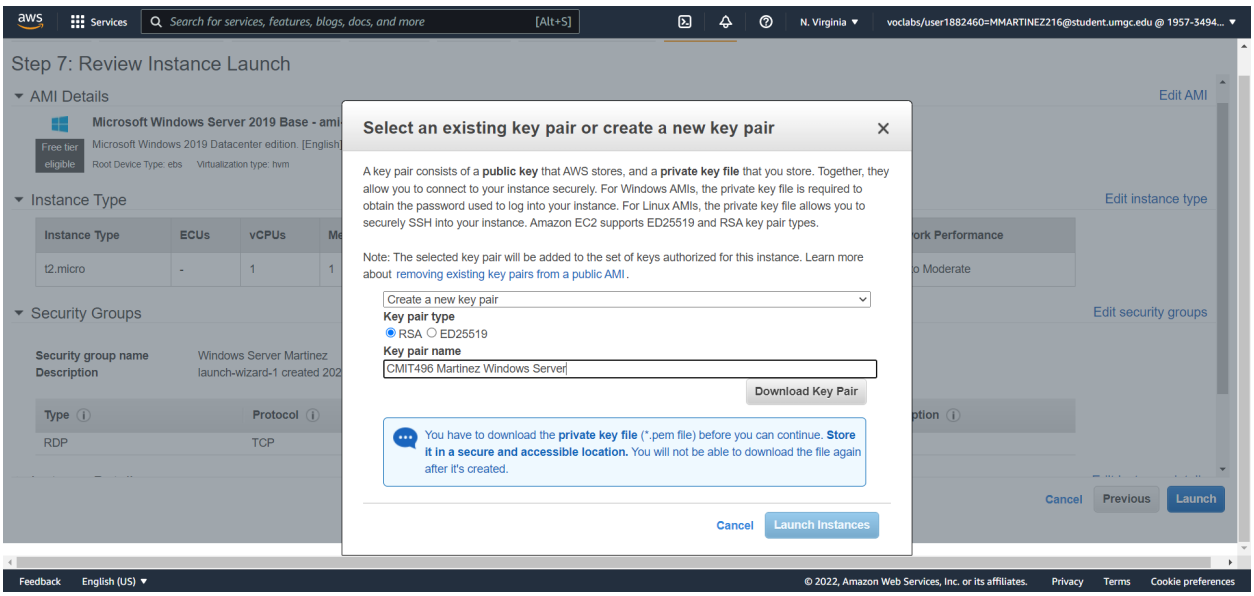

Figure 8: Download the Key Pair

i. Go to the EC2 Dashboard.
j. Click on the “Actions” tab in the top right corner.
k. Scroll down to “Security.”
l. Select “Get Windows Password.”

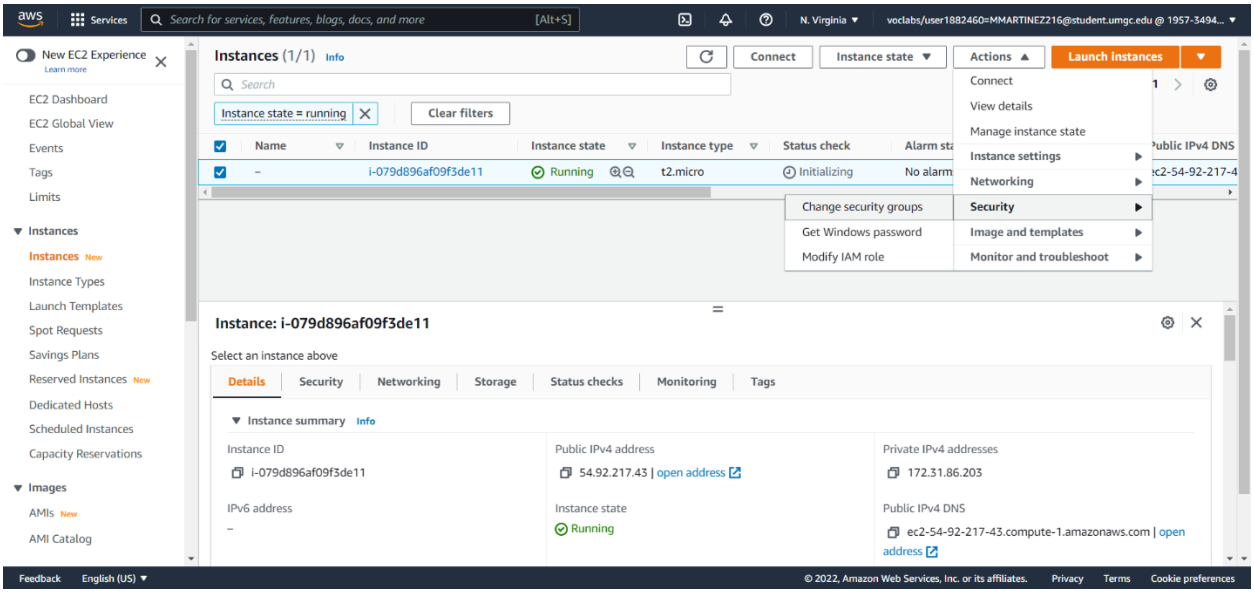

Figure 9: Windows Password link

m. Click “Browse.”
n. Select the appropriate Key Pair.

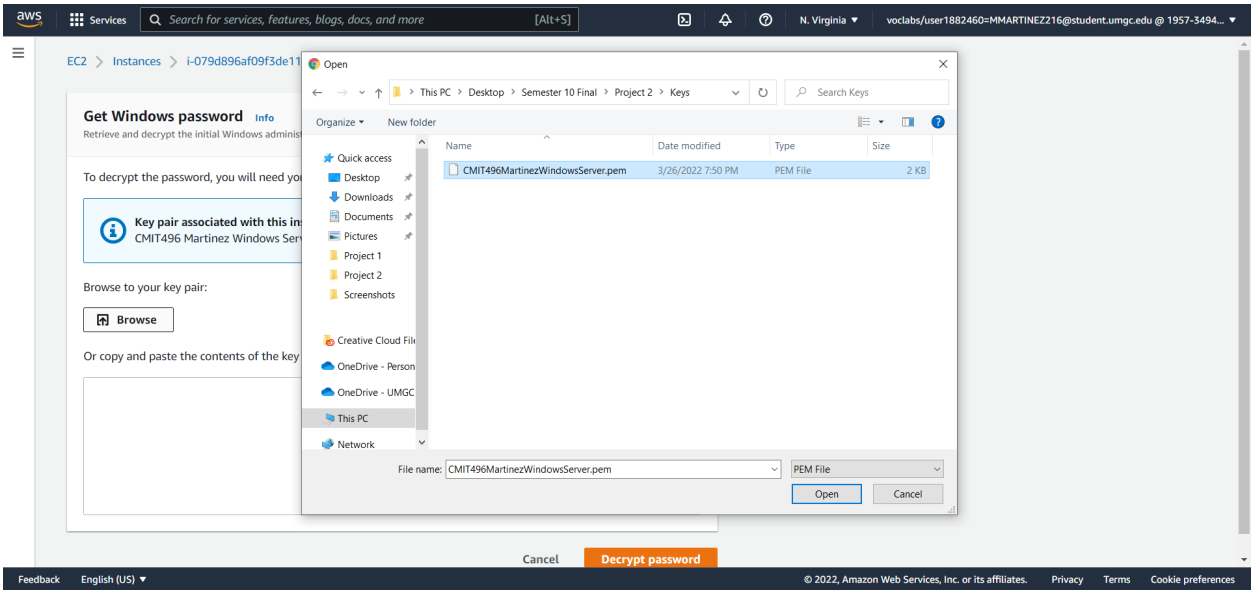

Figure 10: Select the appropriate Key Pair

o. Click on “Decrypt Password.”

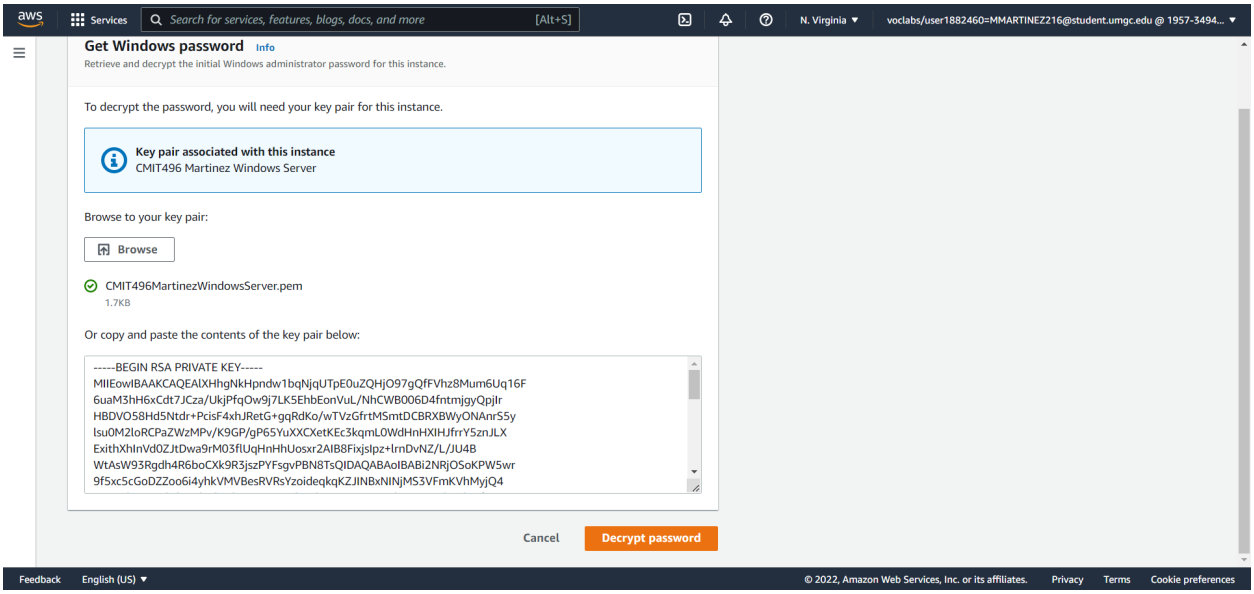

Figure 11: Decrypt the Password

p. Save the Username and Password to an accessible location.

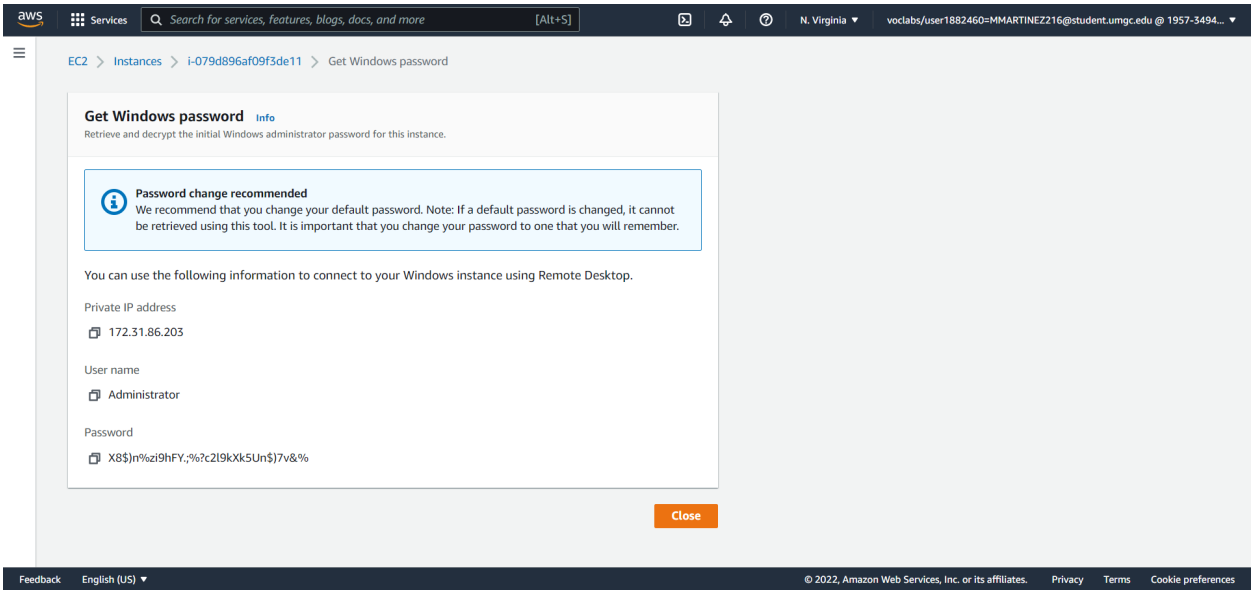

Figure 12: Windows username and password.

q. Return to the EC2 Dashboard and save the Public IP Address.

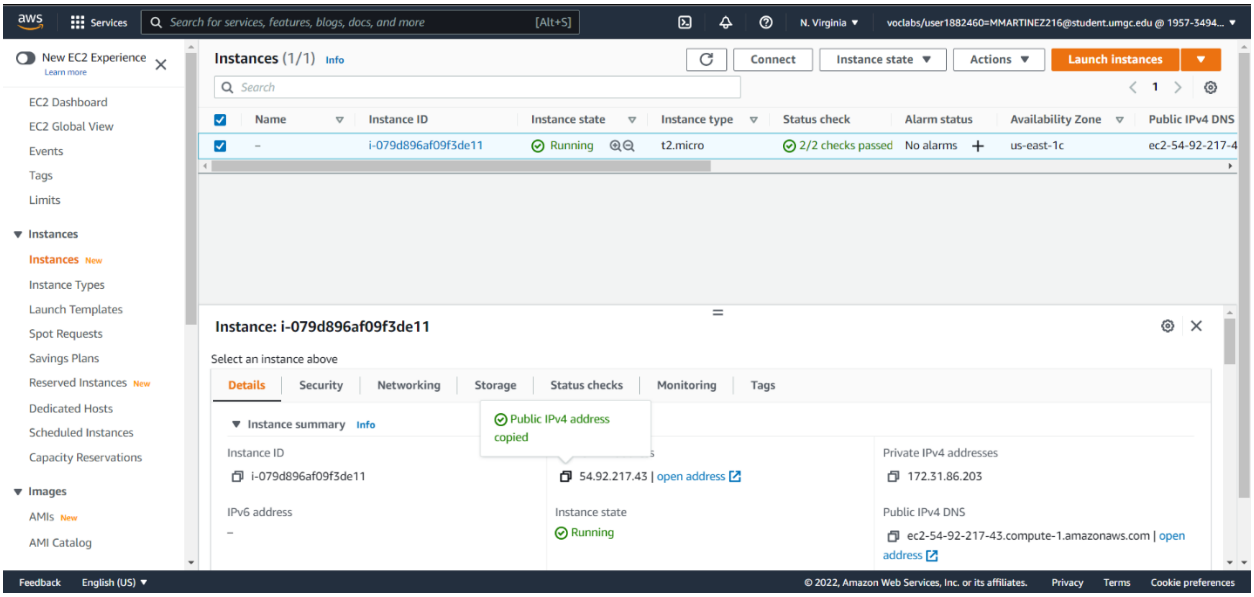

Figure 13: Public IP address

r. Open the “Remote Desktop Connection” application or equivalent.
s. Enter the IP Address from step q and press connect.

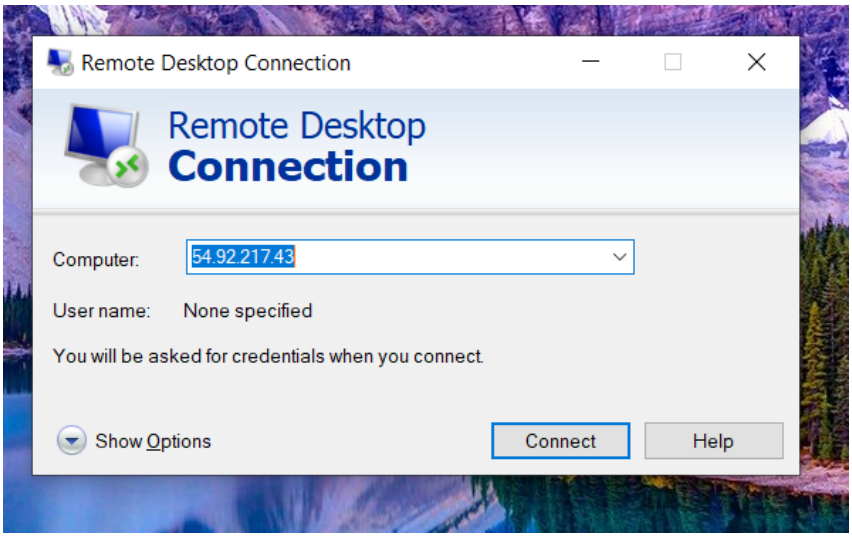

Figure 14: Remote Desktop Connection application

t. Click on “More Options” and select “Use a different account.
u. Enter the username and password from step p.

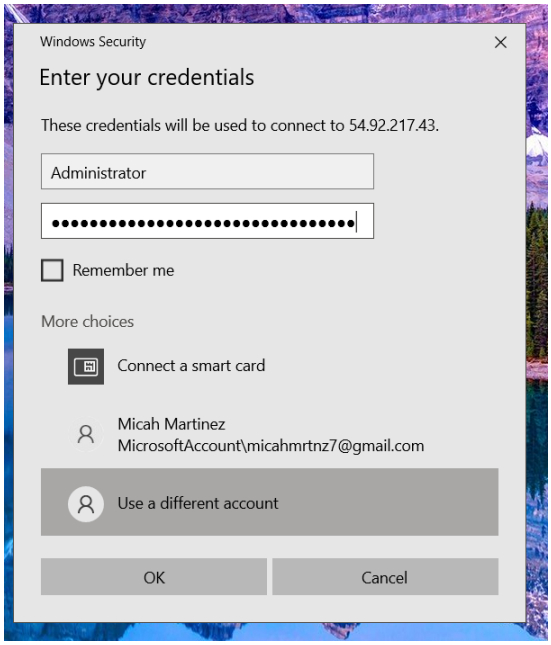

Figure 15: Username and password

v. Click on “Yes.”

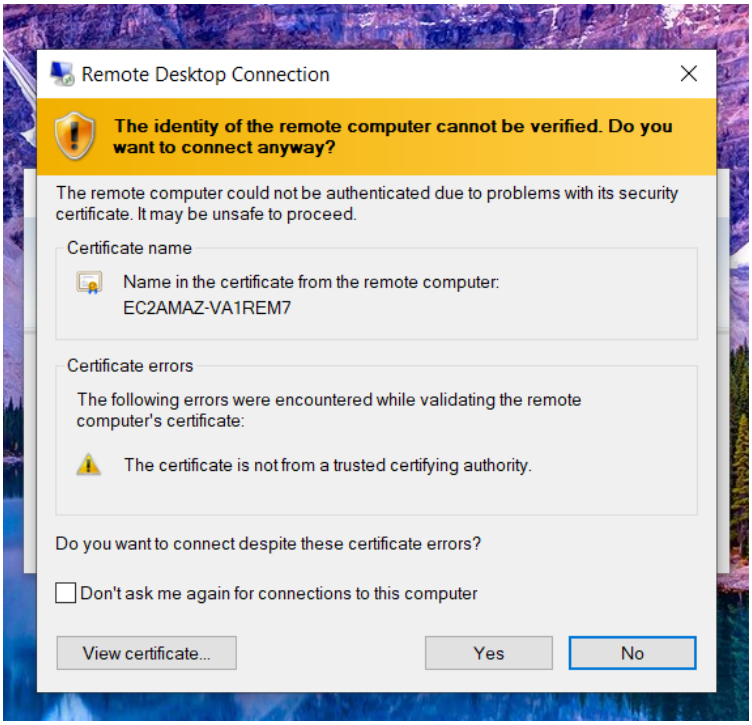

Figure 16: Confirm remote connection

Figure 17: Successful Remote Connection

3. **Using what you learned from Project 1, provision and launch a new AWS EC2 Ubuntu Linux Server and connect to it via the SSH protocol. Note any challenges or opportunities associated with this provisioning.**

   Having provisioned an Ubuntu Linux and a Windows Server, I think most challenges have been eliminated, at least for a basic server. However, I believe many opportunities are available while provisioning new servers, allowing for experimentation with different configurations and capabilities to be explored. Experimenting in this manner can be a great way to fine-tune your AWS Instances for your needs.

4. **Using AWS, *create a network file system* with Amazon Elastic File Systems (EFS) and attach it to the running Ubuntu Server instance. You may use the AWS *web page* for step-by-step instructions and understand how the EFS works. Take a screenshot of the result and embed it below. Specifically, take a screenshot to verify *that your file system has been successfully mounted*, along with the results from *creating a test file in your new file system. This will be done by running a simple dd command to generate a 1GiB file in your new directory.* Finally, describe the value of a network file system.**

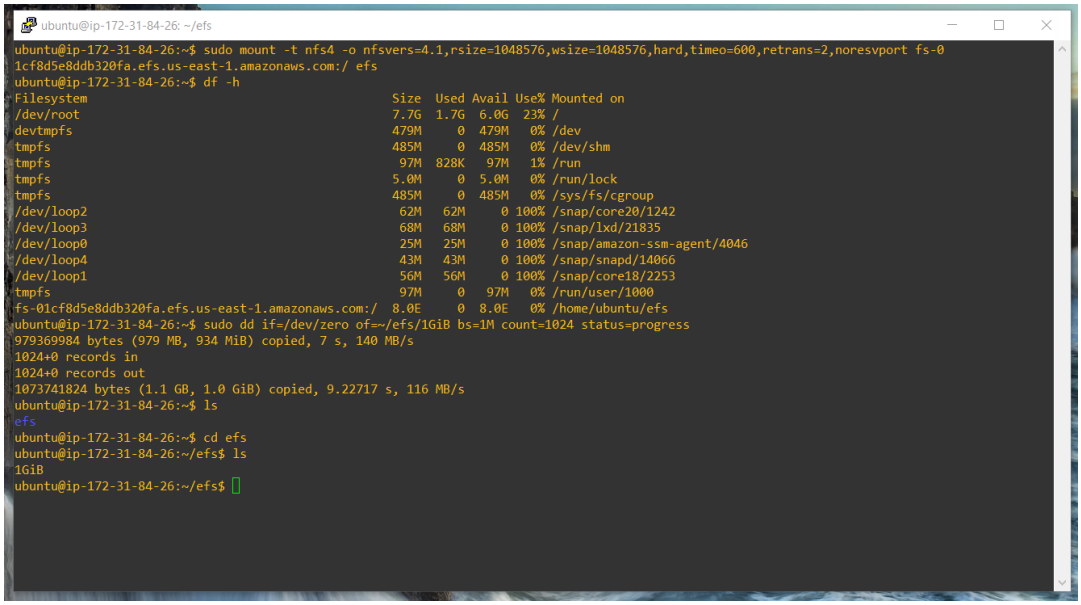

Figure 18: Successful creation and mount of an Amazon EFS with a generated 1GB file

A network file system (NFS) is used for storing files on a network (IBM, 2022). Having an NFS will allow users to access their files and directories from remote locations and even work with those files as if they were on their local computer. Due to recent events, many organizations have begun incorporating work-from-home technologies into their business culture. The NFS will also allow computers that run different operating systems to share and access files with each other, reduce storage costs, and reduce administrative overhead (Oracle, 2010).

5. **Using the AWS platform, create an S3 bucket and upload any file to the S3 bucket. Take a screenshot showing the file was uploaded to the S3 bucket and paste it below. If necessary, use the AWS webpage above for step-by-step instructions.**

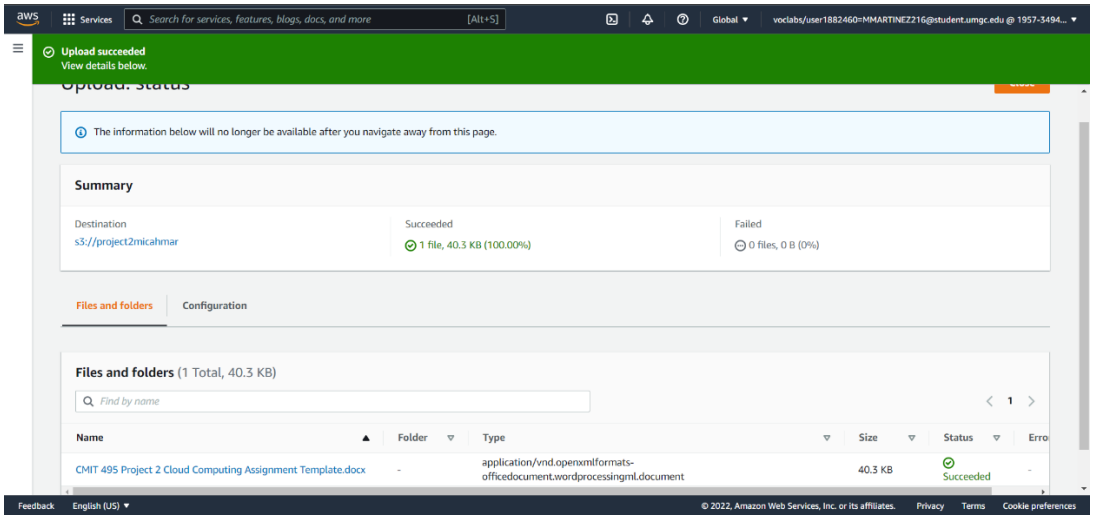

Figure 19: An S3 Bucket with an uploaded file

6. **The CTO will be reviewing this document. You have shown how easy it is to provision a Microsoft OS using the AWS platform. The CTO chose AWS because it offered a free account. She will now expect a recommendation from you on what cloud service to use for the organization's PaaS (e.g., the infrastructure, OS, runtime, etc.) needs. There is no need for a private cloud, so the public option will work just fine. Describe the difference between the Google Cloud platform, Amazon AWS platform, and Microsoft Azure platform. Provide a recommendation for the CTO as to which service provider you would recommend and why. Be explicit and detailed in your recommendation.**

   Of the three major cloud platforms, the Google Cloud Platform (GCP) is well-known for having the most user-friendly interface, lower costs, flexible options, and robust machine learning applications (Veritis, 2021). However, GCP has a reputation for falling short in contract negotiations, discounts, and support for independent software (Carey, 2020).

   Microsoft Azure is an excellent choice for companies that mainly use Microsoft products. When using services like Windows Server, using Azure to migrate to the cloud will allow compatibility and a much easier transition; this is primarily due to Azure relying on large Microsoft-managed datacenters (Veritis, 2021). Unfortunately, Azure has a reputation for periods of downtime, leading to unavailable services (Carey, 2020).

   The provider that I recommend is Amazon Web Services (AWS). AWS has a large selection of cloud services ranging from computing, data management, and networking (Veritis, 2021) and is commonly used as a benchmark for high-quality products by other cloud services. Overall, AWS is one of the oldest cloud service providers, with many quality products, and is available in over 80 regions across the globe.

7. **The CTO approved your comparative analysis between the cloud service providers (i.e. Amazon, Google, and Microsoft). She has decided to proceed with an Amazon Virtual Private Cloud (Amazon VPC). The Amazon VPC enables one to launch AWS resources into a virtual network, which is similar to a traditional network that can be operated in an on-premises data center. Keep in mind that networking, storage, and security associated with a VPC are as important as the overall scalable infrastructure of AWS.**

    a. **To begin, the CEO would like you to provide the network settings needed to provision two (2) subnets for the VPC as shown in the table below:**

Subnet	End-User	CIDR	Network	Broadcast	Mask
A	**Developers**	**146.38.70.105/20**	***146.38.64.0***	***146.38.79.255***	***255.255.240.0***
B	**Marketing**	**172.31.0.0 /16**	***172.31.0.0***	***172.31.255.255***	***255.255.0.0***

    b. **Based on your understanding, list the network address, broadcast address, and subnet mask for subnet A and subnet B in the table above. Perform the necessary calculations and explain how you arrived at your answer.**

Developer's Subnet
Subnet Mask = 11111111.11111111.1111 *0000.00000000* = 255.255.240.0
IP Address = 10010010.00100110.0100 *0110.01101001* = 146.38.70.105
Network Address = 10010010.00100110.0100 *0000.00000000* = 146.38.64.0
Broadcast Address = 10010010.00100110.0100 *1111.11111111* = 146.38.79.255

Marketing Subnet
Subnet Mask = 11111111.11111111. *00000000.00000000* = 255.255.0.0
IP Address = 10101100.00011111. *00000000.00000000* = 172.31.0.0
Network Address = 10101100.00011111. *00000000.00000000* = 172.31.0.0
Broadcast Address = 10101100.00011111. *11111111.11111111* = 172.31.255.255

The first step in finding the network and broadcast addresses for these subnets is to find the subnet mask. Many online resources provide charts (Koishigawa, 2021), or even calculators, showing the subnet mask for every CIDR (Classless Inter-Domain Routing) range. For example, these charts show that the subnet mask for /20 is 255.255.240.0 and the subnet mask for /16 is 255.255.0.0.

Every IPv4 address is made of four binary octets separated by a period. To find the network address, compare the IP address to the subnet mask in binary format. For every "1" in the subnet mask, you do not change the number in the IP address; this works for both network and broadcast addresses. However, for every "0" in the subnet mask, you change the number in the IP address to "0." For example, if the octet in the subnet mask

is “240” and the octet in the IP address is “70”, you would compare “11110000” (subnet) to “01000110” (IP address). Since the last four digits in the subnet mask are “0,” the last four digits in the IP address change to “0,” resulting in “01000000” or “64.”

To find the broadcast address, use the same process as above, except for every “0” in the subnet mask, the IP address changes to “1.” Using the same example as above, “11110000” (subnet) compared to “01000110” (IP address), results in “01001111,” or “79.”

To better help you understand IP addressing, IP subnetting, and IP address summarization, review the following AWS documentation prior to answering the questions in this section:

- **VPCs and subnets**
- **CIDR and Peering for VPC and AWS Control Tower**
- **Subnet CIDR reservations**

Note:

The key benefit of an Amazon VPC (or a virtual private network) is that the internal network devices are not openly accessible via the Internet and can only be accessed from within a secure network. Thus, it keeps the proprietary applications and data protected.

Classless Internet Domain Routing (CIDR) notation: CIDR was introduced as a means to primarily improve address space utilization as a result of the rapid growth of the Internet and growth of the IP routing tables held in the Internet routers. Represented by an IP prefix, CIDR moves away from the traditional IP classes (e.g., Class A, Class B, Class C, etc.). Subnetting a network address space using CCIDR leads to an effective IP address space only for the number of hosts needed without wasting IP addresses.

8. **Please note the following carefully. Confirm that you have stopped and terminated your Microsoft Windows virtual machine, deleted your file system from the Amazon EFS console, deleted the contents of your Amazon S3 bucket, and deleted your Amazon S3 bucket. To confirm, simply type your name below.**

   Micah L. Martinez

References

Carey, S. (2020, January 23). *AWS vs Azure vs Google Cloud: What's the best cloud platform for enterprise?* Retrieved from Computer World: https://www.computerworld.com/article/3429365/aws-vs-azure-vs-google-whats-the-best-cloud-platform-for-enterprise.html?page=2

IBM. (2022, January 5). *Network File System*. Retrieved from IBM: https://www.ibm.com/docs/en/aix/7.1?topic=management-network-file-system

Koishigawa, K. (2021, February 12). *Subnet Cheat Sheet – 24 Subnet Mask, 30, 26, 27, 29, and other IP Address CIDR Network References*. Retrieved from freeCodeCamp: https://www.freecodecamp.org/news/subnet-cheat-sheet-24-subnet-mask-30-26-27-29-and-other-ip-address-cidr-network-references/

Oracle. (2010). *Chapter 14 Managing Network File Systems (Overview)*. Retrieved from Oracle: https://docs.oracle.com/cd/E19683-01/817-0204/6mg168bu8/index.html

Veritis. (2021, April 7). *AWS Vs Azure Vs GCP – The Cloud Platform of Your Choice?* Retrieved from Veritis: https://www.veritis.com/blog/aws-vs-azure-vs-gcp-the-cloud-platform-of-your-choice/#:~:text=AWS%20and%20Azure%20are%20offering,to%20gain%20maximum%20demand%20influx.