

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.

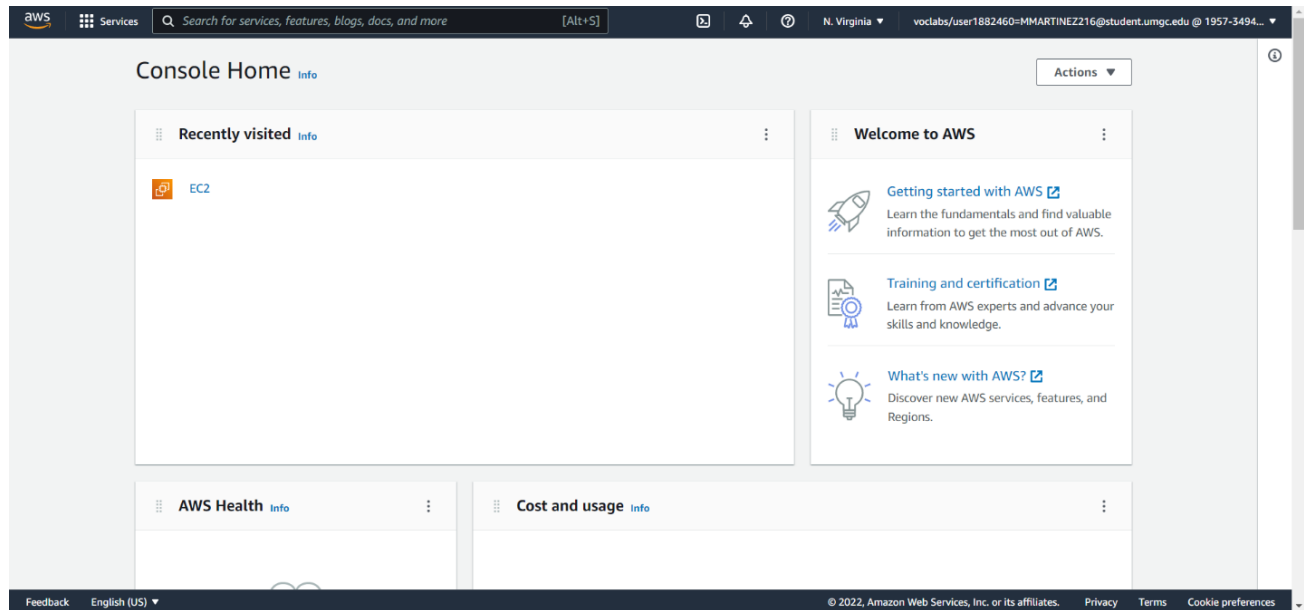


Figure 1: AWS Console Home

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."

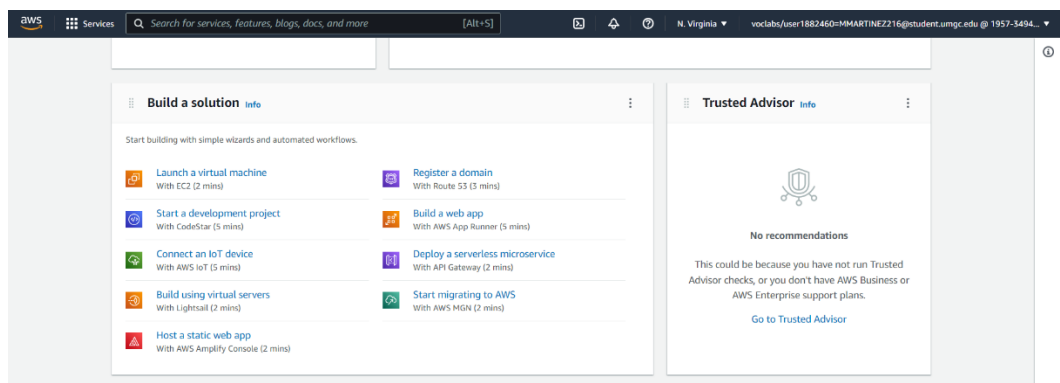


Figure 2: Build a Solution Options

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

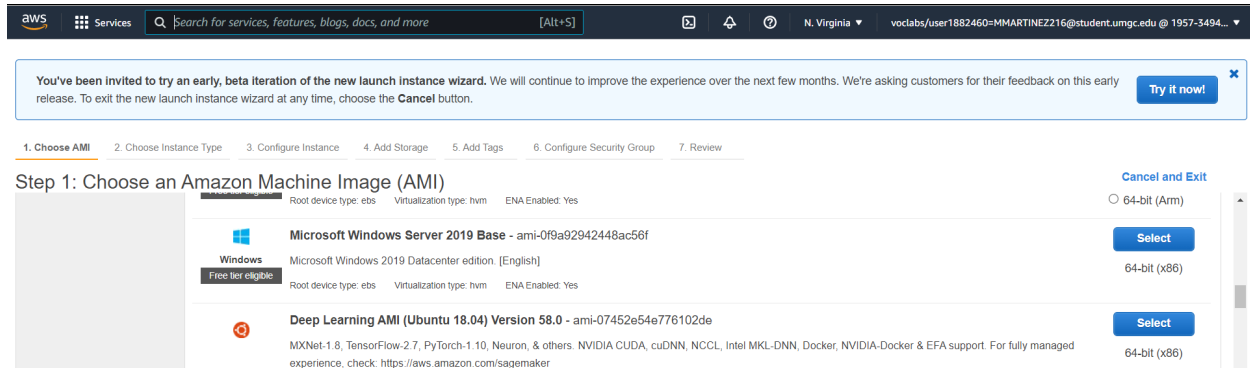


Figure 3: AMI Options

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

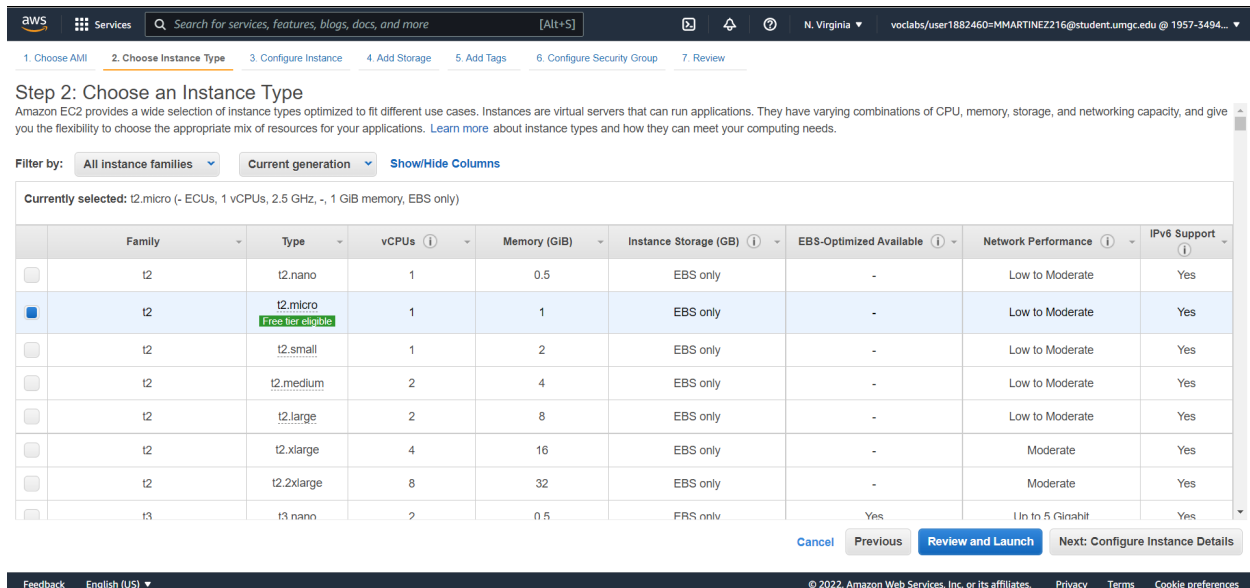


Figure 4: Options for Instance types

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

Step 7: Review Instance Launch

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Instance Type

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	-	1	1	EBS only	-	Low to Moderate

Security Groups

Security group name: launch-wizard-1
Description: launch-wizard-1 created 2022-03-26T19:47:50.484+09:00

Type	Protocol	Port Range	Source	Description
RDP	TCP	3389	0.0.0.0/0	

Instance Details

Storage

Tags

Cancel Previous Launch

Figure 5: Review Instance Settings

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

Step 6: Configure Security Group

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Assign a security group: ☒ Create a new security group ☐ Select an existing security group

Security group name: Windows Server Martinez

Description: launch-wizard-1 created 2022-03-26T19:47:50.496+09:00

Type	Protocol	Port Range	Source	Description
RDP	TCP	3389	My IP 175.223.22.73/32	e.g. SSH for Admin Desktop

Add Rule

Cancel Previous Review and Launch

Figure 6: Edit Security Group Settings

g. Review the settings and select “Launch.”

Step 7: Review Instance Launch

▼ AMI Details [Edit AMI](#)

Microsoft Windows Server 2019 Base - ami-0f9a92942448ac56f
 Microsoft Windows 2019 Datacenter edition. [English]
 Free tier eligible Root Device Type: ebs Virtualization type: hvm

▼ Instance Type [Edit instance type](#)

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	-	1	1	EBS only	-	Low to Moderate

▼ Security Groups [Edit security groups](#)

Security group name Windows Server Martinez
Description launch-wizard-1 created 2022-03-26T19:47:50.496+09:00

Type	Protocol	Port Range	Source	Description
RDP	TCP	3389	175.223.22.73/32	

▶ Instance Details [Edit instance details](#)

[Cancel](#) [Previous](#) [Launch](#)

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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.

Step 7: Review Instance Launch

▼ AMI Details [Edit AMI](#)

Microsoft Windows Server 2019 Base - ami-0f9a92942448ac56f
 Microsoft Windows 2019 Datacenter edition. [English]
 Free tier eligible Root Device Type: ebs Virtualization type: hvm

▼ Instance Type [Edit instance type](#)

Instance Type	ECUs	vCPUs	Memory (GiB)
t2.micro	-	1	1

▼ Security Groups [Edit security groups](#)

Security group name Windows Server Martinez
Description launch-wizard-1 created 2022-03-26T19:47:50.496+09:00

Type	Protocol	Port Range	Source	Description
RDP	TCP	3389	175.223.22.73/32	

▶ Instance Details [Edit instance details](#)

[Cancel](#) [Previous](#) [Launch](#)

Select an existing key pair or create a new key pair

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance. Amazon EC2 supports ED25519 and RSA key pair types.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about removing existing key pairs from a public AMI.

Create a new key pair

Key pair type
☒ RSA ☐ ED25519

Key pair name
 CMT496 Martinez Windows Server

[Download Key Pair](#)

You have to download the **private key file** (*.pem file) before you can continue. **Store it in a secure and accessible location.** You will not be able to download the file again after it's created.

[Cancel](#) [Launch Instances](#)

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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.”

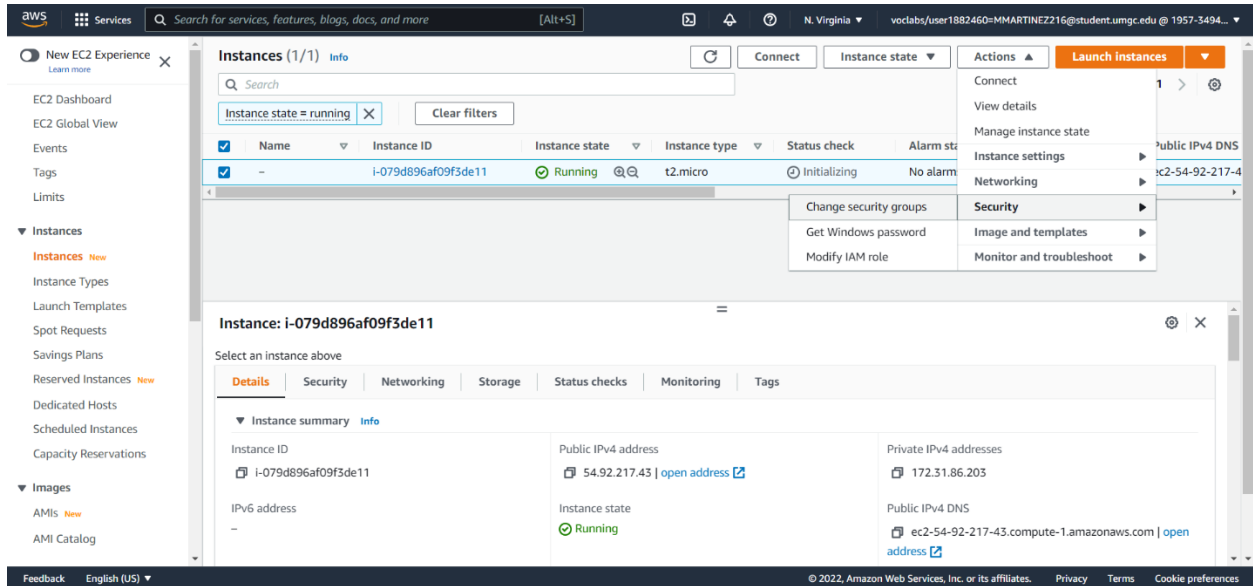


Figure 9: Windows Password link

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

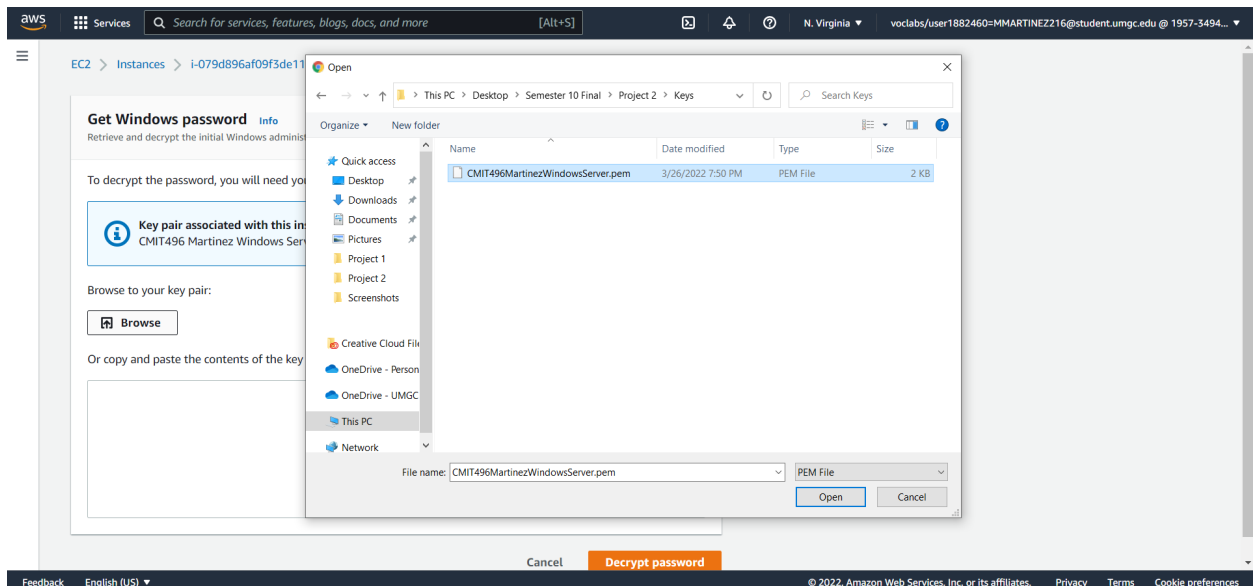


Figure 10: Select the appropriate Key Pair

o. Click on “Decrypt Password.”

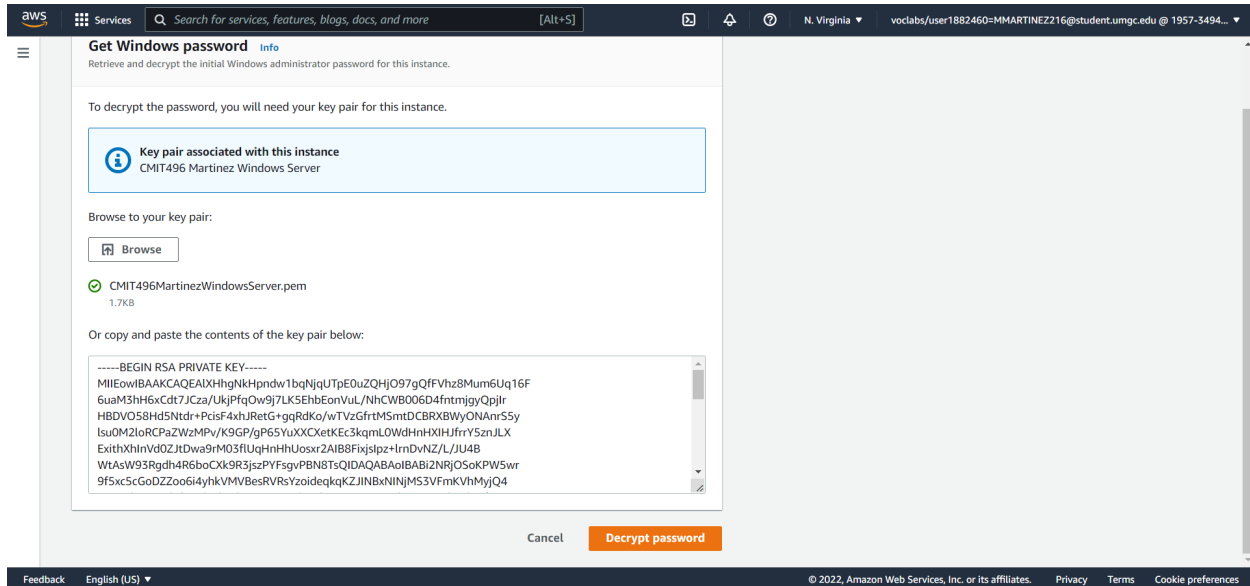


Figure 11: Decrypt the Password

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

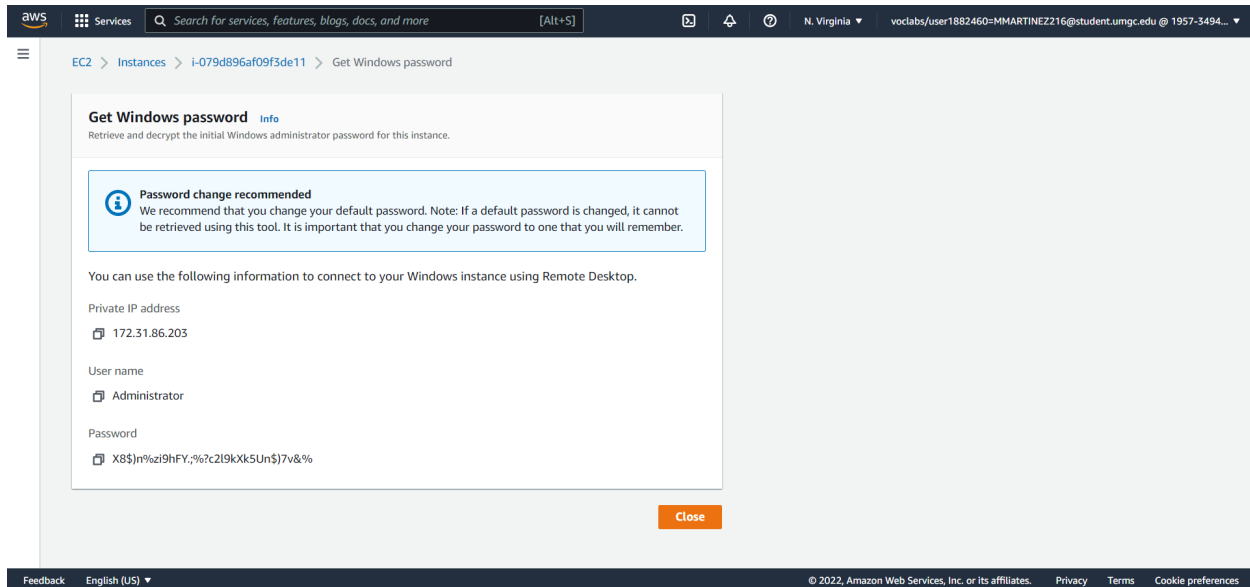


Figure 12: Windows username and password.

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

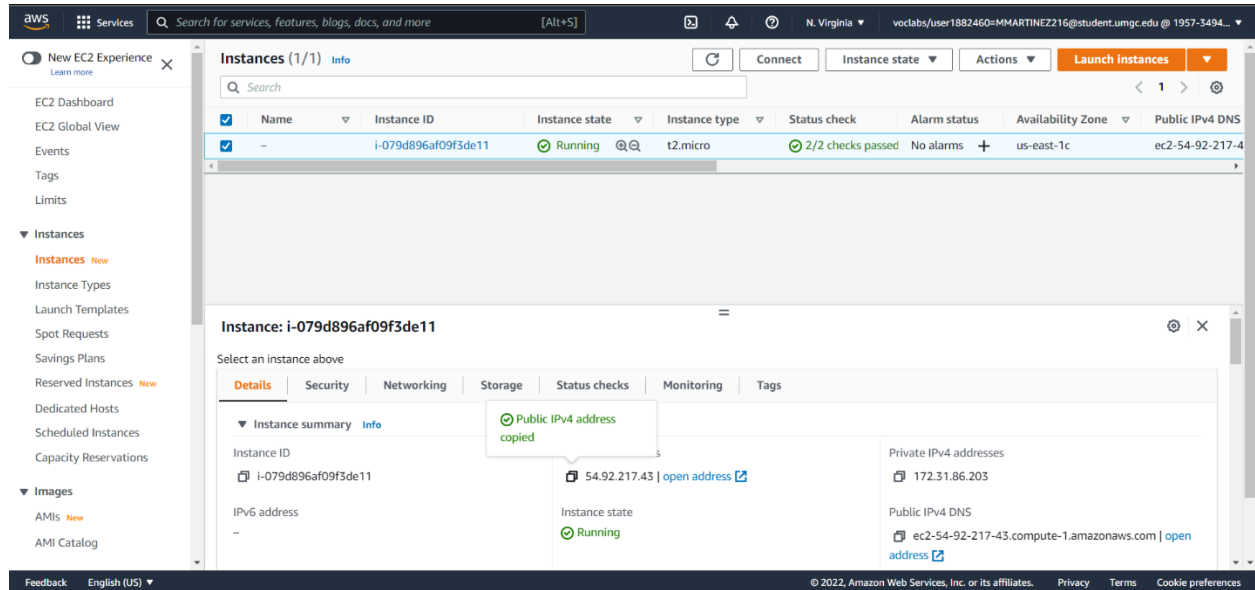


Figure 13: Public IP address

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

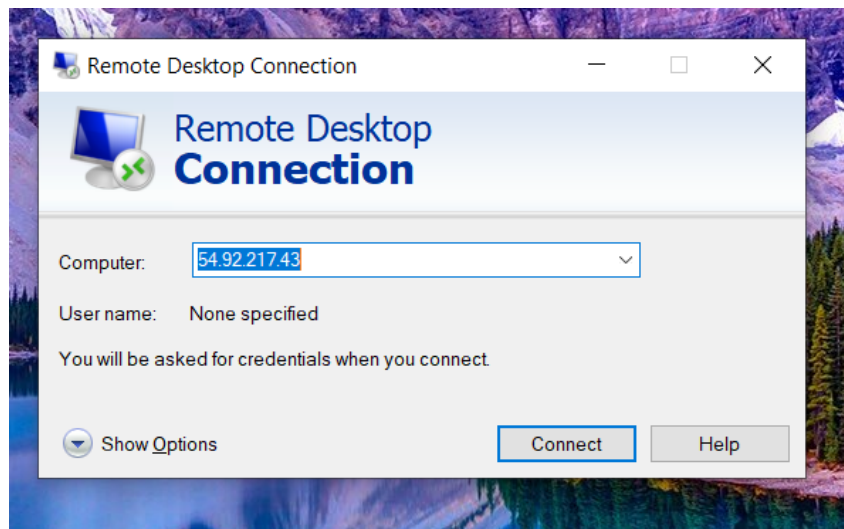


Figure 14: Remote Desktop Connection application

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

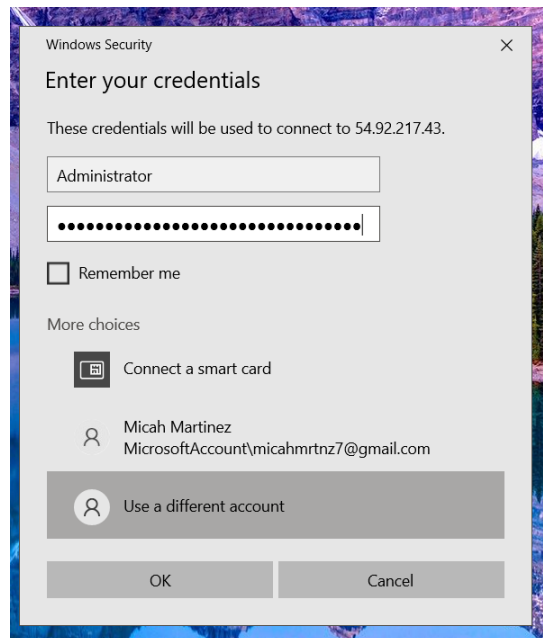


Figure 15: Username and password

- v. Click on “Yes.”

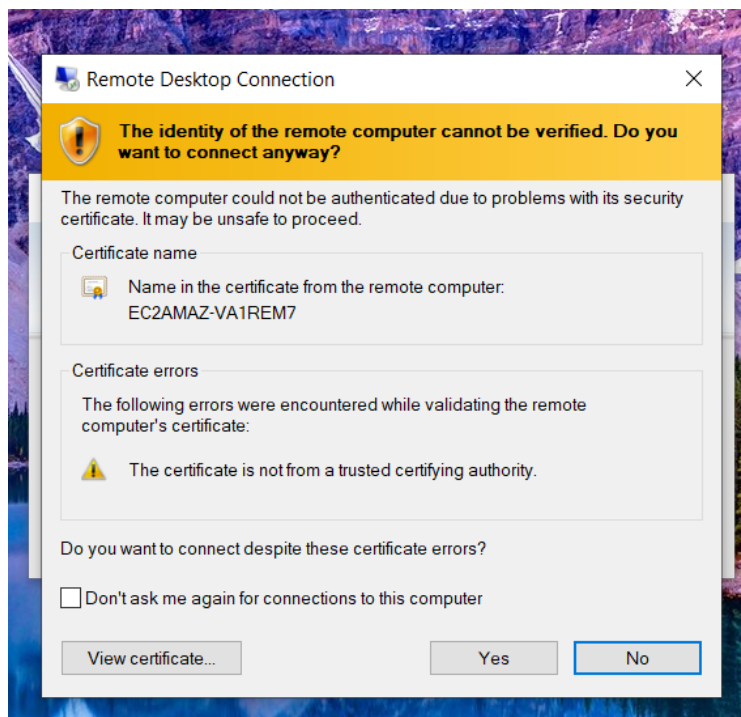


Figure 16: Confirm remote connection

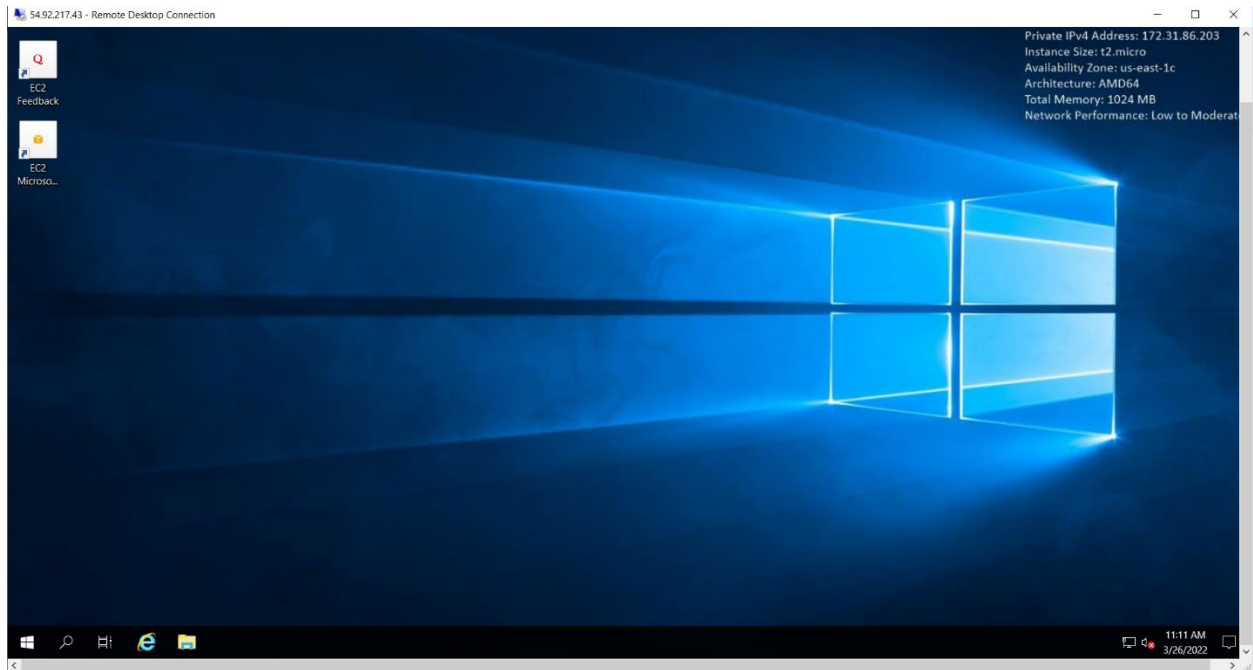
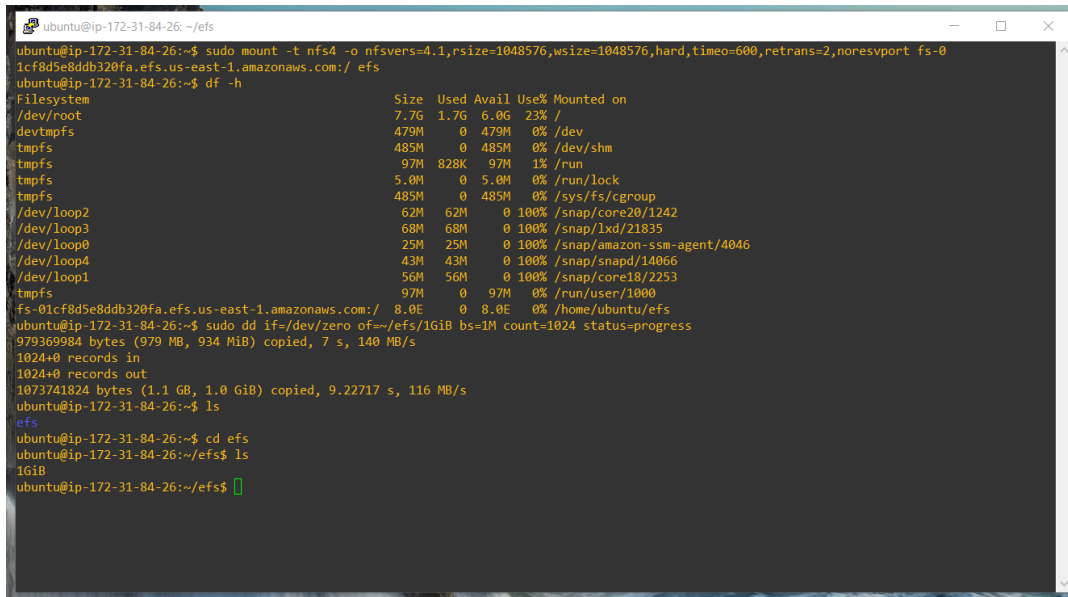


Figure 17: Successful Remote Connection

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.

- 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.



```

ubuntu@ip-172-31-84-26: ~/efs
ubuntu@ip-172-31-84-26:~$ sudo mount -t nfs4 -o nfsvers=4.1,rsize=1048576,wsize=1048576,hard,timeo=600,retrns=2,noresport fs-0
1cf8d5e8ddb320fa.efs.us-east-1.amazonaws.com:/ efs
ubuntu@ip-172-31-84-26:~$ df -h

```

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/root	7.7G	1.7G	6.0G	23%	/
devtmpfs	479M	0	479M	0%	/dev
tmpfs	485M	0	485M	0%	/dev/shm
tmpfs	97M	828K	97M	1%	/run
tmpfs	5.0M	0	5.0M	0%	/run/lock
tmpfs	485M	0	485M	0%	/sys/fs/cgroup
/dev/loop2	62M	62M	0	100%	/snap/core20/1242
/dev/loop3	68M	68M	0	100%	/snap/lxd/21835
/dev/loop0	25M	25M	0	100%	/snap/amazon-ssm-agent/4046
/dev/loop4	43M	43M	0	100%	/snap/snapd/14066
/dev/loop1	56M	56M	0	100%	/snap/core18/2253
tmpfs	97M	0	97M	0%	/run/user/1000
fs-01cf8d5e8ddb320fa.efs.us-east-1.amazonaws.com:/	8.0E	0	8.0E	0%	/home/ubuntu/efs

```

ubuntu@ip-172-31-84-26:~$ sudo dd if=/dev/zero of=/efs/1GiB bs=1M count=1024 status=progress
979369984 bytes (979 MB, 934 MiB) copied, 7 s, 140 MB/s
1024+0 records in
1024+0 records out
1073741824 bytes (1.1 GB, 1.0 GiB) copied, 9.22717 s, 116 MB/s
ubuntu@ip-172-31-84-26:~$ ls
efs
ubuntu@ip-172-31-84-26:~$ cd efs
ubuntu@ip-172-31-84-26:~/efs$ ls
1GiB
ubuntu@ip-172-31-84-26:~/efs$

```

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).

- 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.

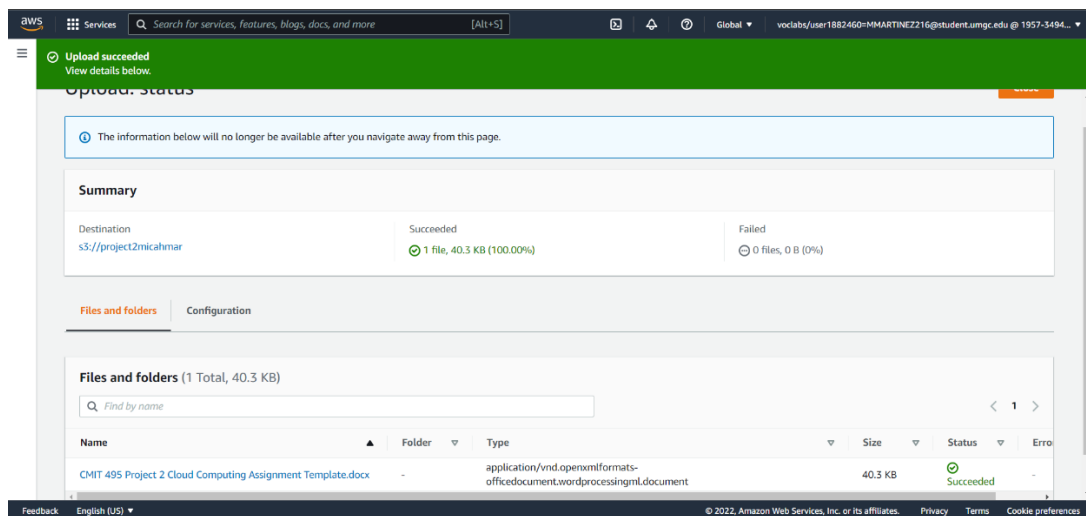


Figure 19: An S3 Bucket with an uploaded file

- 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

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<https://www.computerworld.com/article/3429365/aws-vs-azure-vs-google-whats-the-best-cloud-platform-for-enterprise.html?page=2>
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- Oracle. (2010). *Chapter 14 Managing Network File Systems (Overview)*. Retrieved from Oracle:
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