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NETW 211

Final Project

December 18, 2022

Introduction

Topics Covered

Hardware virtualization	Cloud infrastructure
Cloud security	Cloud storage
Cloud migration	Capacity planning
Cloud computing platforms and services	Performance monitoring

Agenda

Agenda

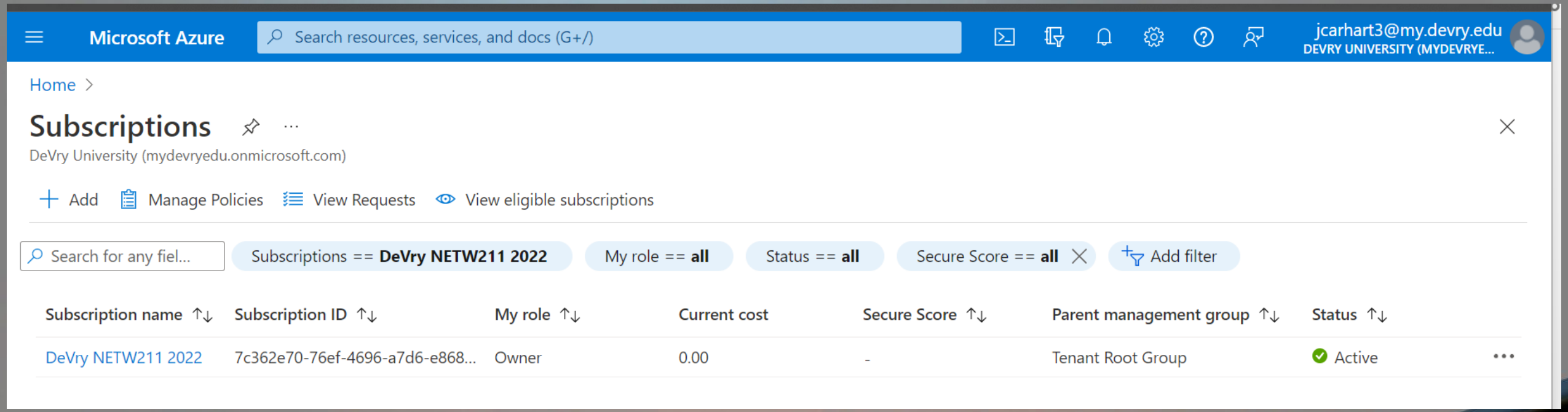
1. Cloud Computing
2. Virtualization of Networking
3. Network Services on a Cloud Platform
4. Identify Cloud-Centric Access Control Techniques
5. Assess Cloud-Centric Security Techniques
6. Evaluate Cloud Storage Technologies
7. Common Cloud Maintenance Tools, Techniques, and Services

Module 1

Cloud Computing:

Azure account creation

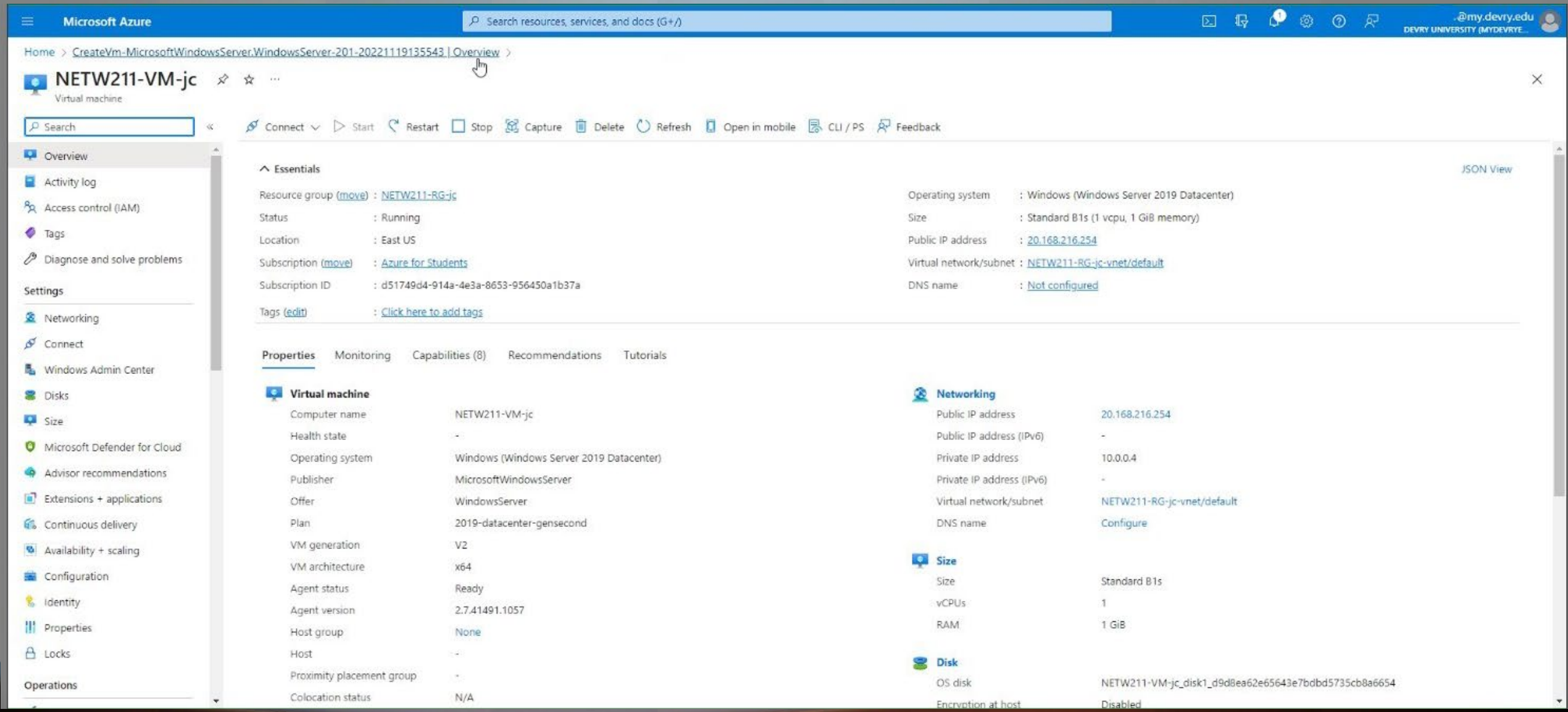
Creating Azure Account



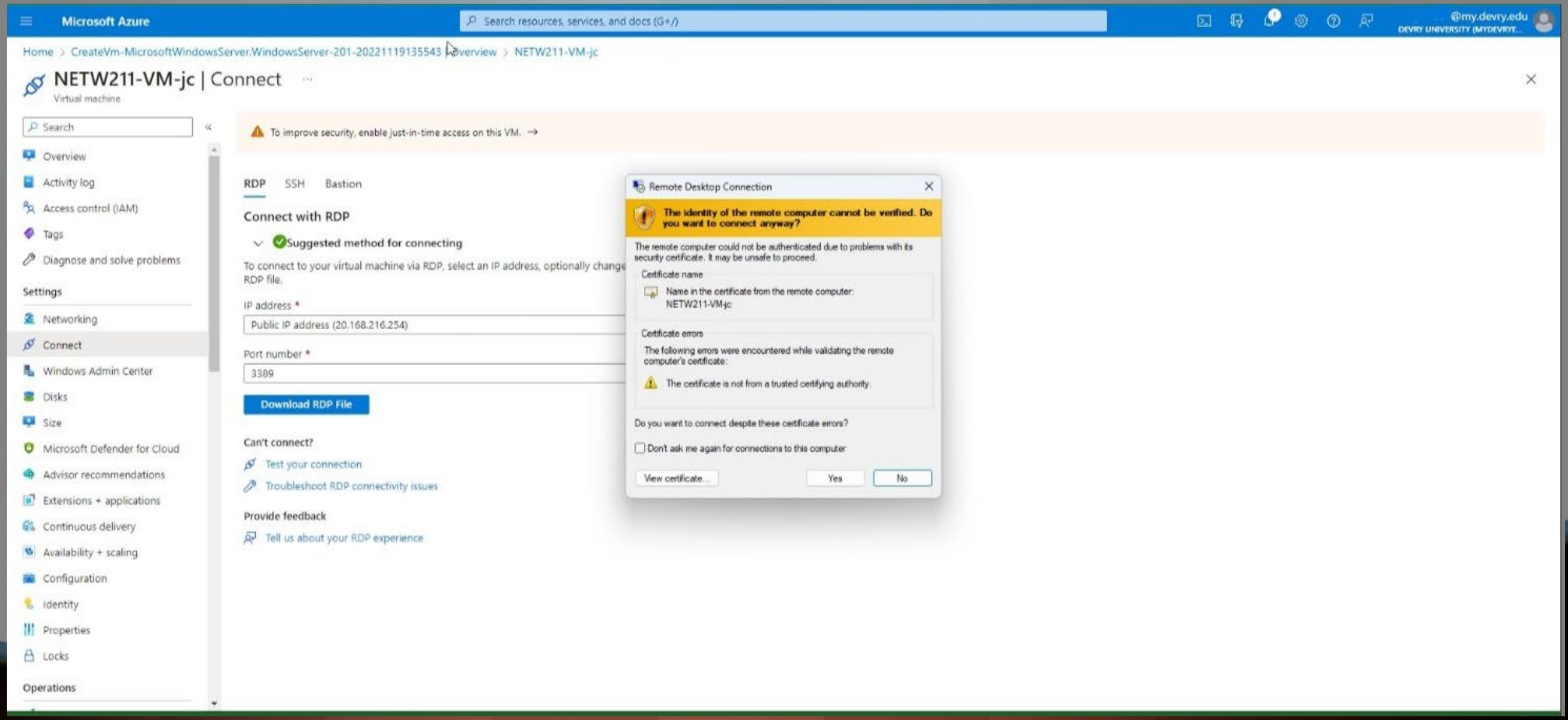
Module 2

Virtualization of Networking: Virtual Machine Instances

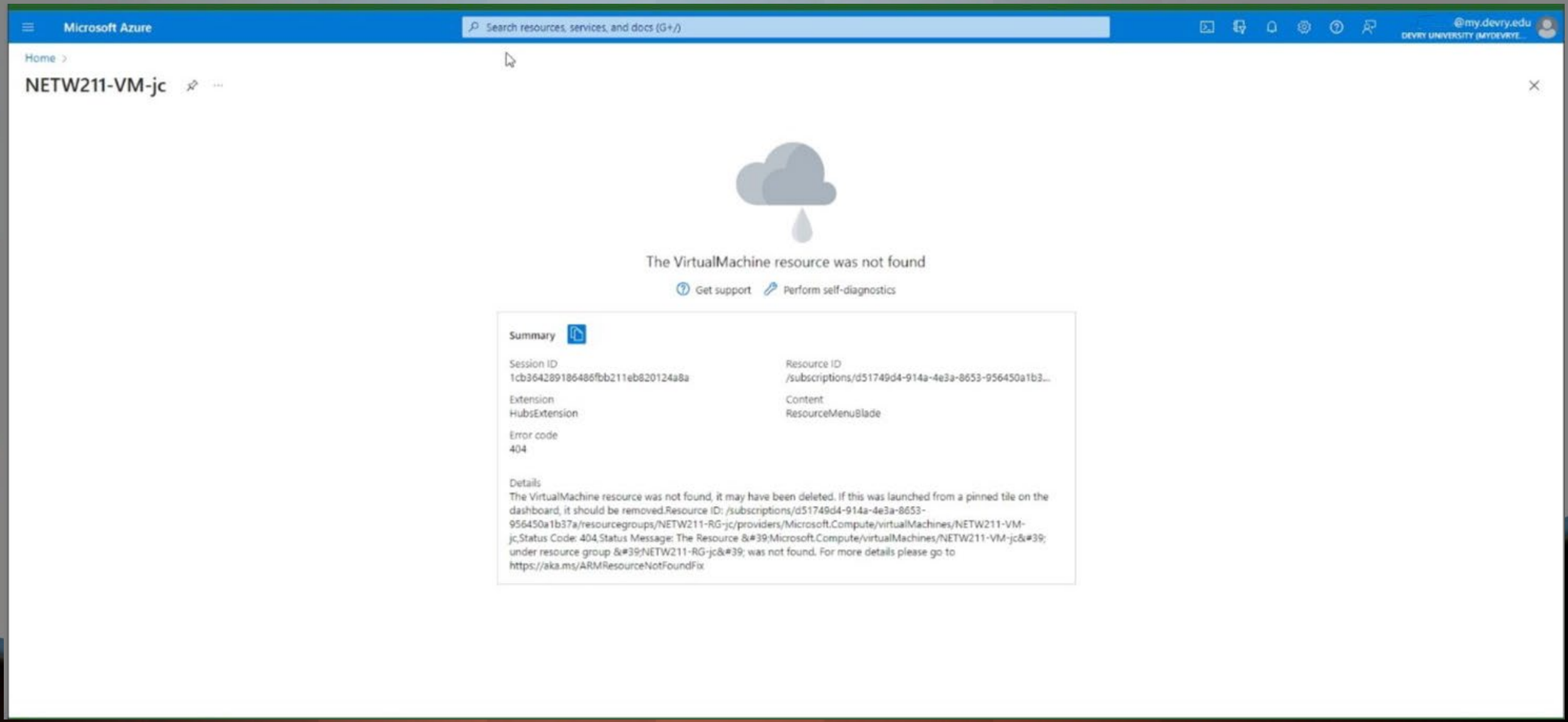
Deploying a VM in Azure



Connecting to the VM



Deleting a VM



Module 3

Network Services on a Cloud Platform:

Azure VNet and Subnets

Creating a VNet with Two Subnets

1. With a /24 network prefix, how many **usable** IPv4 host addresses are there? [hint: you learned this in NETW191]

Answer here:

The formula is: 2^n -2 2^8 -2 = 254

2. Given the answer above, why is the number of available IP addresses for Subnet0 (10.0.0.0/24) or Subnet1 (10.0.1.0/24) shown as 251? [hint: where did the missing addresses go?]

Answer here:

Azure reserves the first 4 and the last IP address including the network address, the default gateway, the network broadcast, and 2 for mapping the DNS IPs to the VNet space.

Network:	**10.0.1.0**
Default Gateway:	**10.0.1.1**
Reserved to map the DNS IPs to the VNet space:	**10.0.1.2, 10.0.1.3**
Network broadcasting address;	**10.0.1.255**

Creating a VNet with Two Subnets (cont.)

References (here are two examples to get your research started):

1. IP Subnet Calculator, https://www.calculator.net/ip-subnet-calculator.html

2. Azure Virtual Network frequently asked questions, https://docs.microsoft.com/en-us/azure/virtual-network/virtual-networks-faq

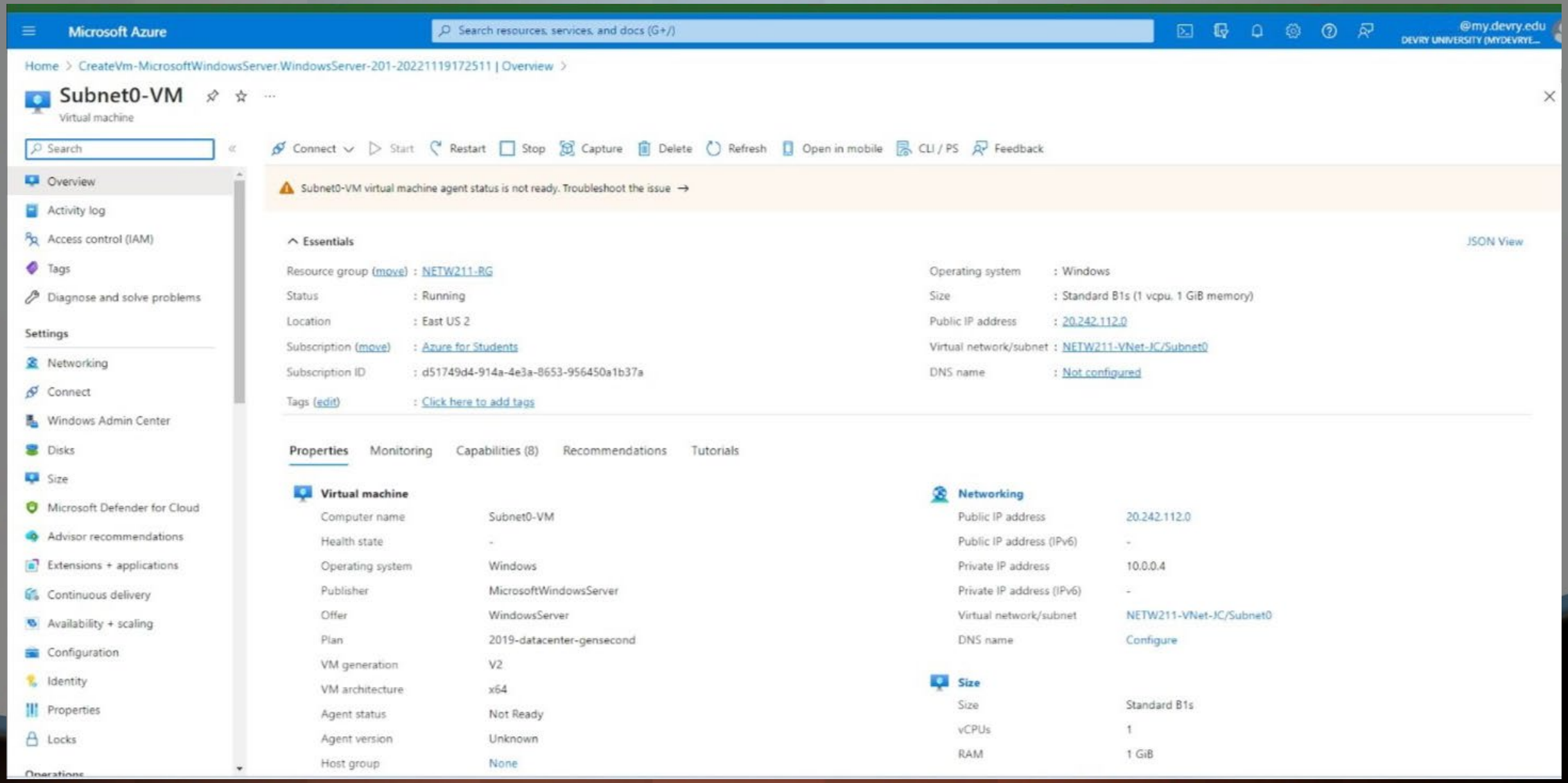
3. **Subnet Cheat Sheet – 24 Subnet Mask, 30, 26, 27, 29, and other IP Address CIDR Network References**

https://www.freecodecamp.org/news/subnet-cheat-sheet-24-subnet-mask-30-26-27-29-and-other-ip-address-cidr-network-references/

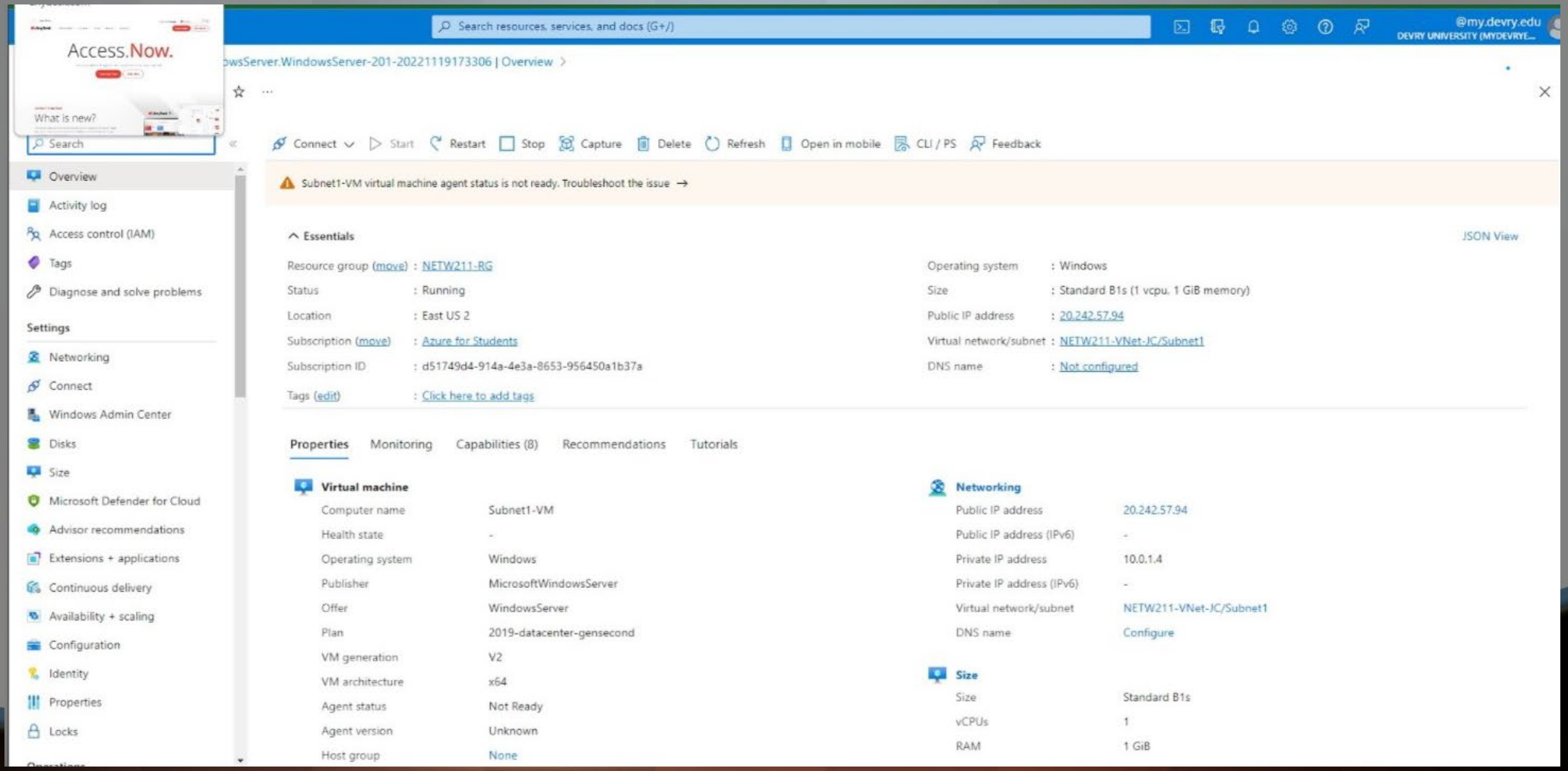
4. **Private IP addresses**

https://learn.microsoft.com/en-us/azure/virtual-network/ip-services/private-ip-addresses

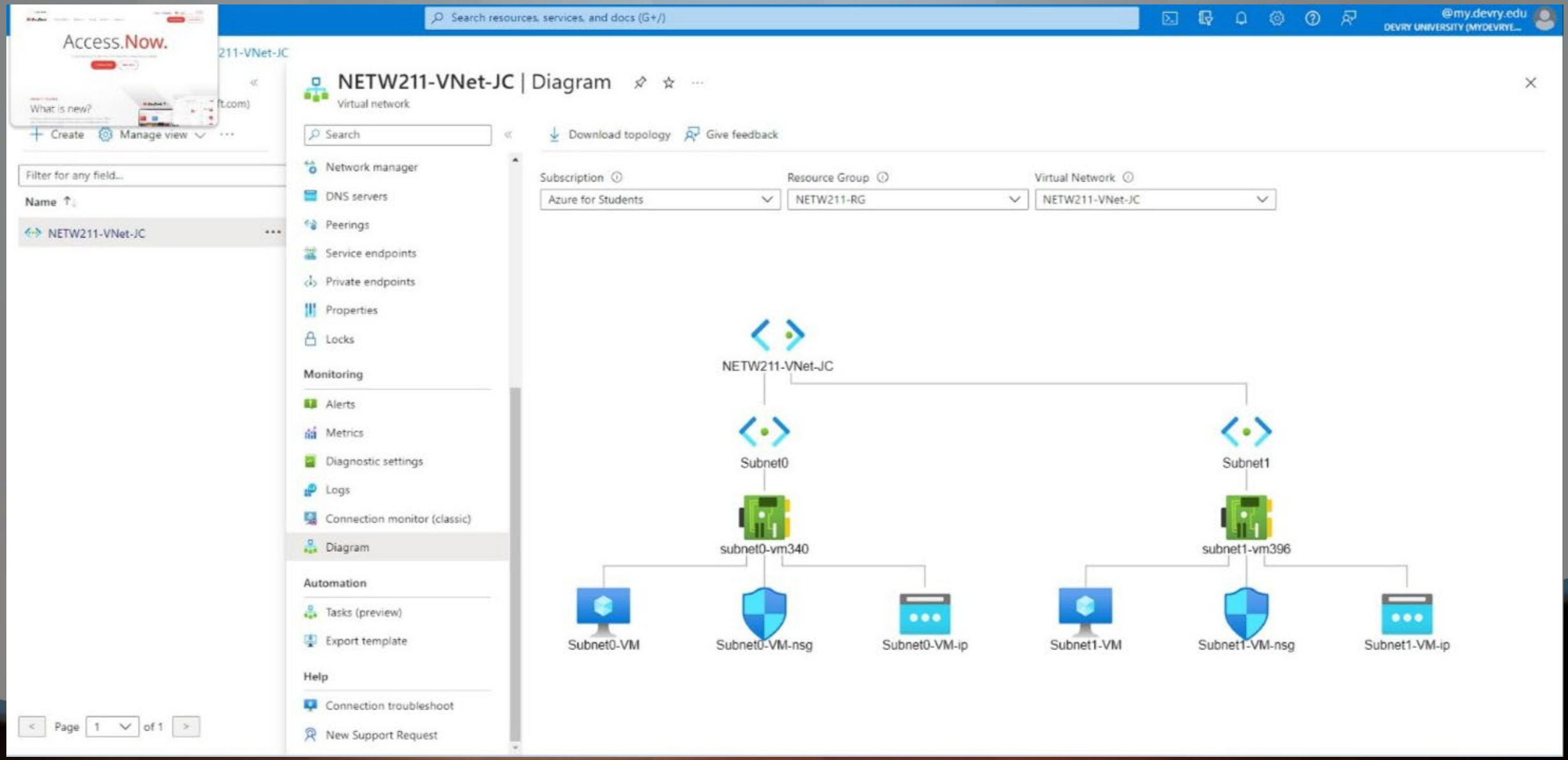
Deploying VMs into Subnets



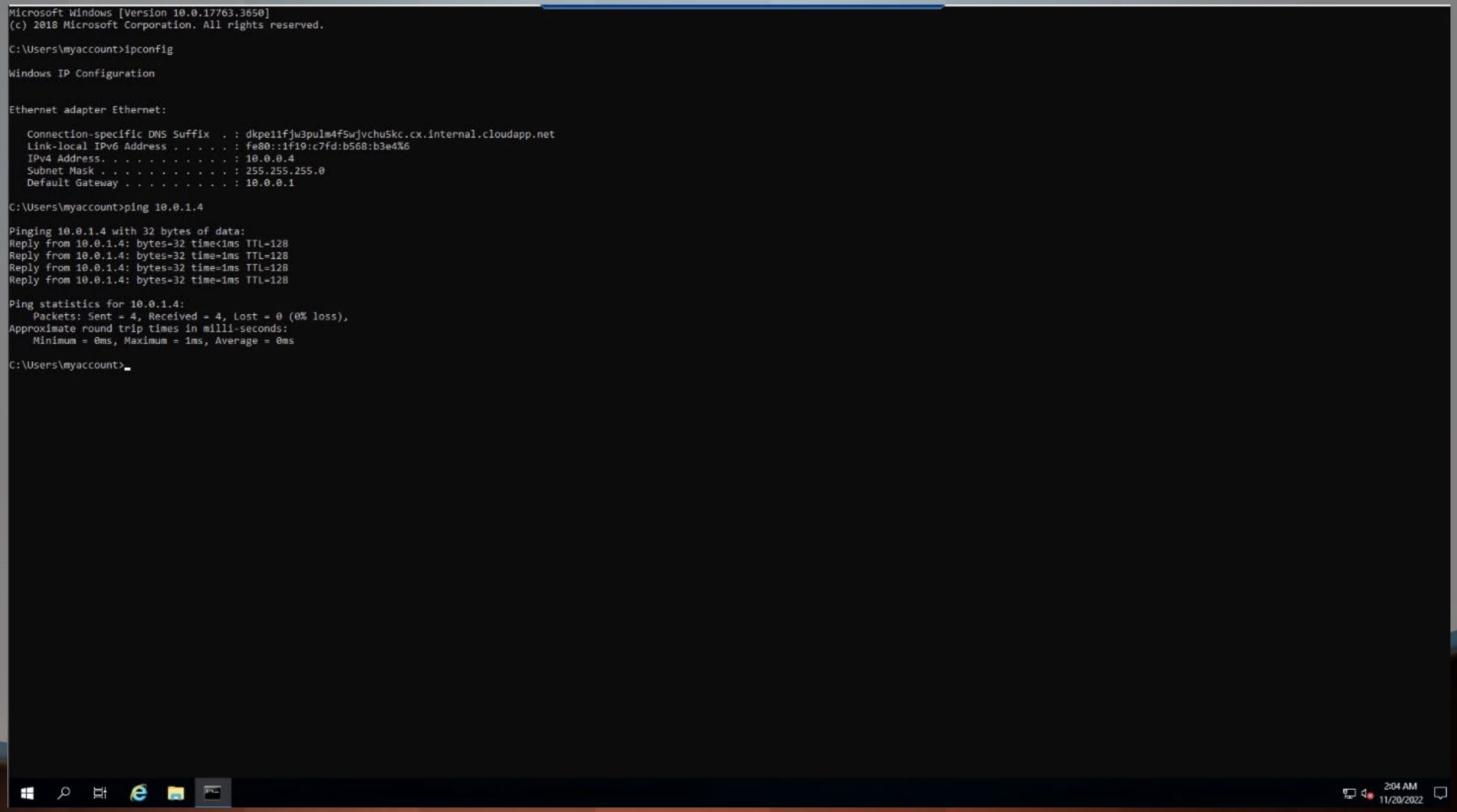
Deploying VMs into Subnets (cont.)



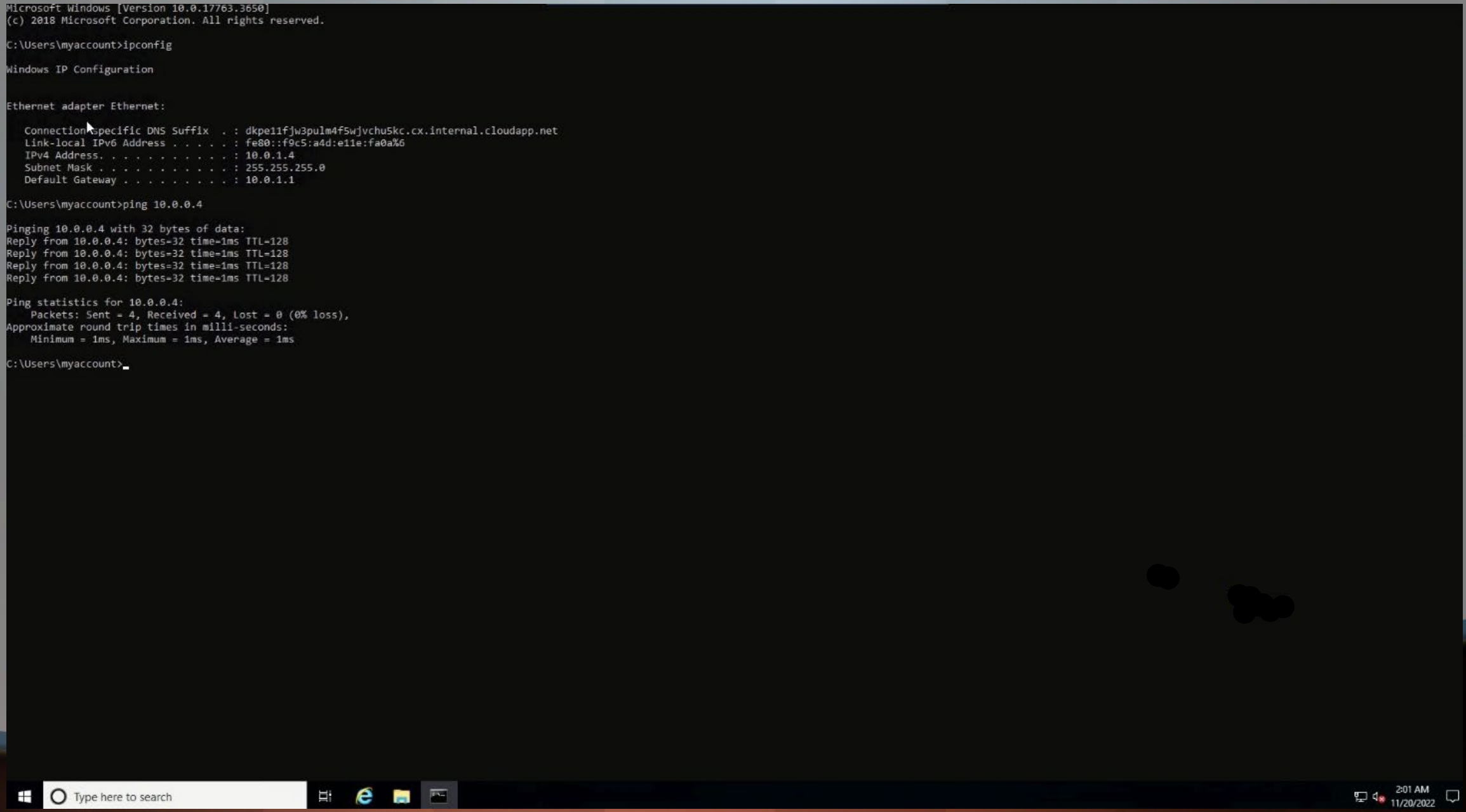
Deploying VMs into Subnets (cont.)



Verifying Connectivity between VMs



Verifying Connectivity between VMs (cont.)

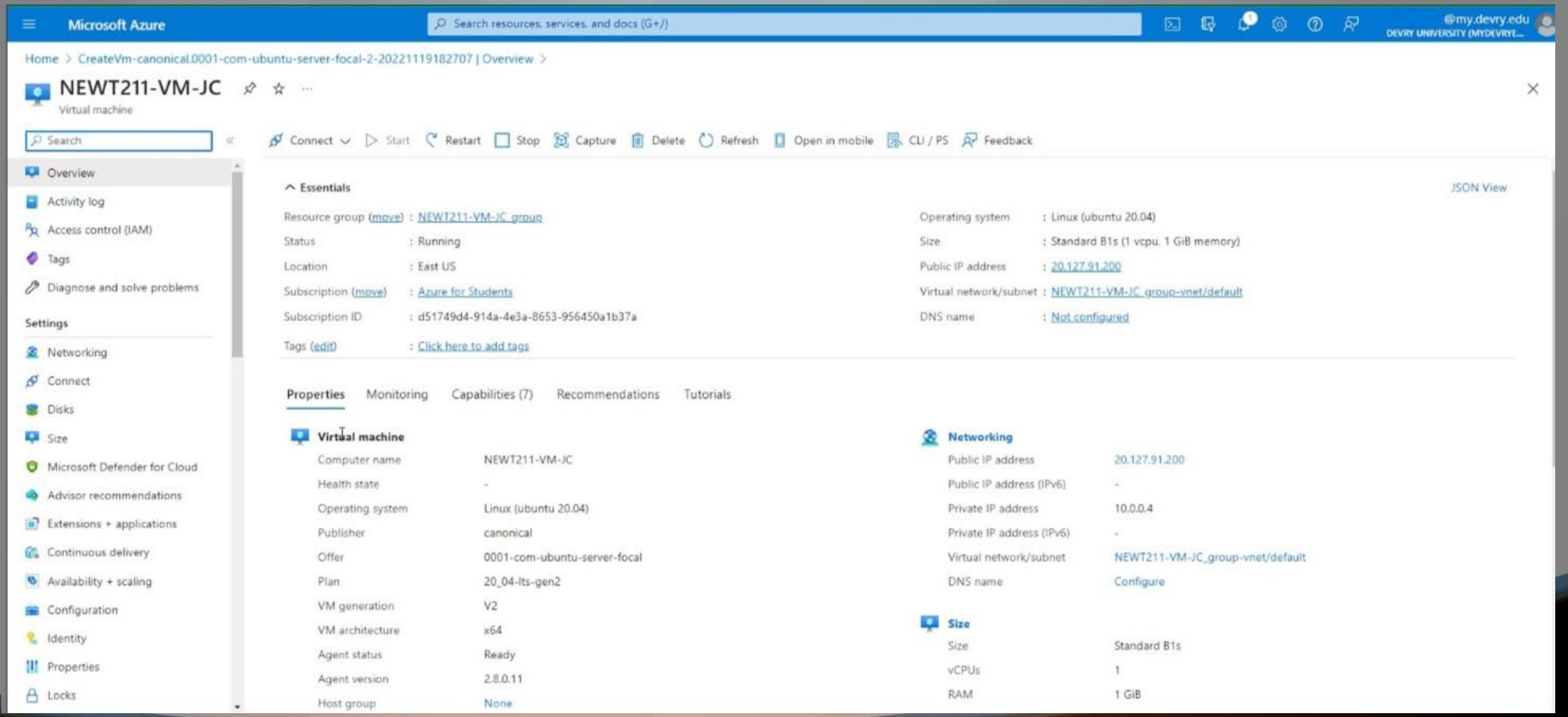


Module 4

Identify Cloud-Centric Access Control Techniques:

Azure VM Security

Launching a VM



Connecting to the VM via SSH

```
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.15.0-1023-azure x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Sun Nov 20 02:40:34 UTC 2022

  System load:  0.0               Processes:             100
  Usage of /:   5.1% of 28.89GB   Users logged in:       0
  Memory usage: 30%               IPv4 address for eth0: 10.0.0.4
  Swap usage:   0%

0 updates can be applied immediately.



The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

azureuser@NEWT211-VM-JC:~$ uname -r
5.15.0-1023-azure
azureuser@NEWT211-VM-JC:~$ cat /etc/os-release
NAME="Ubuntu"
VERSION="20.04.5 LTS (Focal Fossa)"
ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 20.04.5 LTS"
VERSION_ID="20.04"
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
VERSION_CODENAME=focal
UBUNTU_CODENAME=focal
azureuser@NEWT211-VM-JC:~$ ping -c 4 www.facebook.com
PING star-mini.c10r.facebook.com (31.13.66.35) 56(84) bytes of data.
64 bytes from edge-star-mini-shv-01-iad3.facebook.com (31.13.66.35): icmp_seq=1 ttl=54 time=1.40 ms
64 bytes from edge-star-mini-shv-01-iad3.facebook.com (31.13.66.35): icmp_seq=2 ttl=54 time=1.55 ms
64 bytes from edge-star-mini-shv-01-iad3.facebook.com (31.13.66.35): icmp_seq=3 ttl=54 time=1.51 ms
64 bytes from edge-star-mini-shv-01-iad3.facebook.com (31.13.66.35): icmp_seq=4 ttl=54 time=1.56 ms

--- star-mini.c10r.facebook.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3005ms
```

Configuring an NSG

```
Microsoft Windows [Version 10.0.22621.819]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Maine Loc>ping 20.127.91.200

Pinging 20.127.91.200 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 20.127.91.200:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\Users\Maine Loc>ping 20.127.91.200

Pinging 20.127.91.200 with 32 bytes of data:
Reply from 20.127.91.200: bytes=32 time=83ms TTL=43
Reply from 20.127.91.200: bytes=32 time=76ms TTL=43
Reply from 20.127.91.200: bytes=32 time=75ms TTL=43
Reply from 20.127.91.200: bytes=32 time=77ms TTL=43

Ping statistics for 20.127.91.200:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 75ms, Maximum = 83ms, Average = 77ms

C:\Users\Maine Loc>
```

Configuring an NSG (cont.)

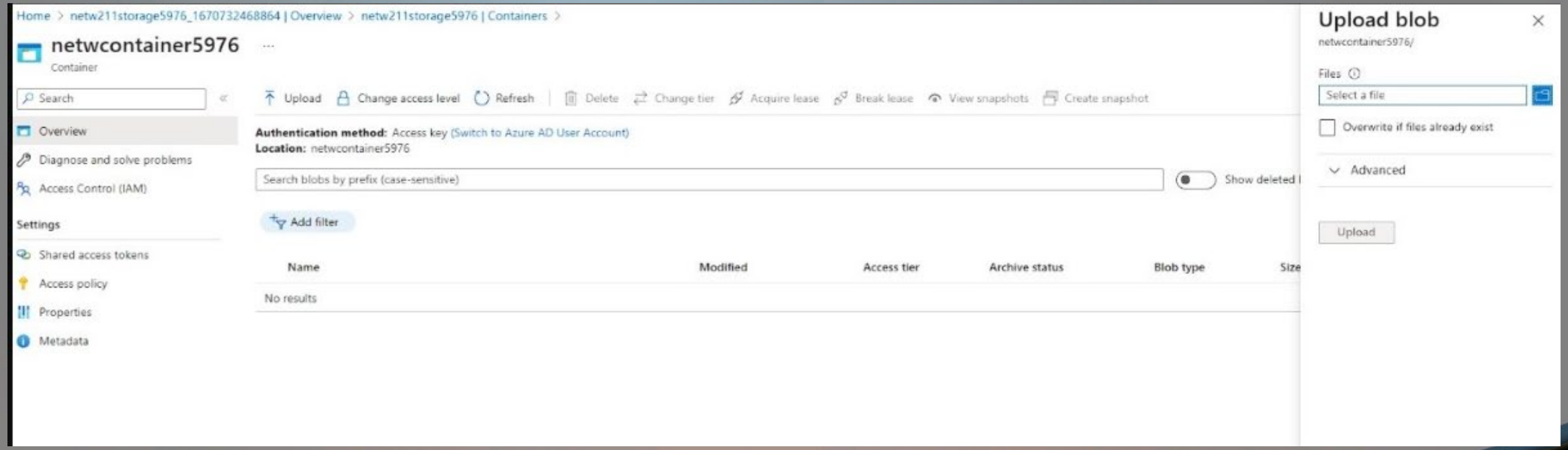
```
Microsoft Windows [Version 10.0.22621.819]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Maine Loc>ping 20.127.91.200

Pinging 20.127.91.200 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 20.127.91.200:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\Users\Maine Loc>ping 20.127.91.200

Pinging 20.127.91.200 with 32 bytes of data:
Reply from 20.127.91.200: bytes=32 time=83ms TTL=43
Reply from 20.127.91.200: bytes=32 time=76ms TTL=43
Reply from 20.127.91.200: bytes=32 time=75ms TTL=43
Reply from 20.127.91.200: bytes=32 time=77ms TTL=43

Ping statistics for 20.127.91.200:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 75ms, Maximum = 83ms, Average = 77ms

C:\Users\Maine Loc>
```

Module 5

Assess Cloud-Centric Security Techniques:

Cloud Storage

Uploading and Accessing a File



Question

What does the *access tier* setting do? What are the Azure blob storage access tiers?

[hint: in the Azure portal, on the *Upload blob* page, under *Advanced*, click the ? circle above the *Access tier* box.]

Answer here:

Depending on how it is utilized, the access tier setting enables you to store blob data in the most affordable way while letting users access it right away.

The levels of Azure blob access are:

An online storage layer designed for frequently accessed or updated data is called a "hot tier." The hot tier has the least expensive access fees but the most expensive storage expenses.

An online storage layer designed for data that is viewed or changed seldom is called the "cool tier." Data in the cool tier needs to be kept for at least 30 days. In contrast to the hot tier, the cool tier has greater access prices and lower storage expenses.

The archive layer is an offline storage level that is designed to store data with a flexible latency requirement of a few hours and that is rarely accessed. A minimum of 180 days should be allowed for the storage of data in the archive tier.

References (here are two examples to get your research started):

1. Hot, Cool, and Archive access tiers for blob data, https://docs.microsoft.com/en-us/azure/storage/blobs/access-tiers-overview
2. Azure Blob Storage Access Tiers, https://devry.percipio.com/courses/c7ef0333-8560-403f-a004-9c5c843866b0/videos/2658bbe6-ee97-438b-a376-fbb079c3b3a0
3. https://learn.microsoft.com/en-us/azure/storage/blobs/access-tiers-overview
4. http://learn.microsoft.com/en-us/azure/storage/blobs/storage-blobs-overview

Creating Blob Snapshots

```
This is the original version. -JX
```

Enabling Blob Versioning

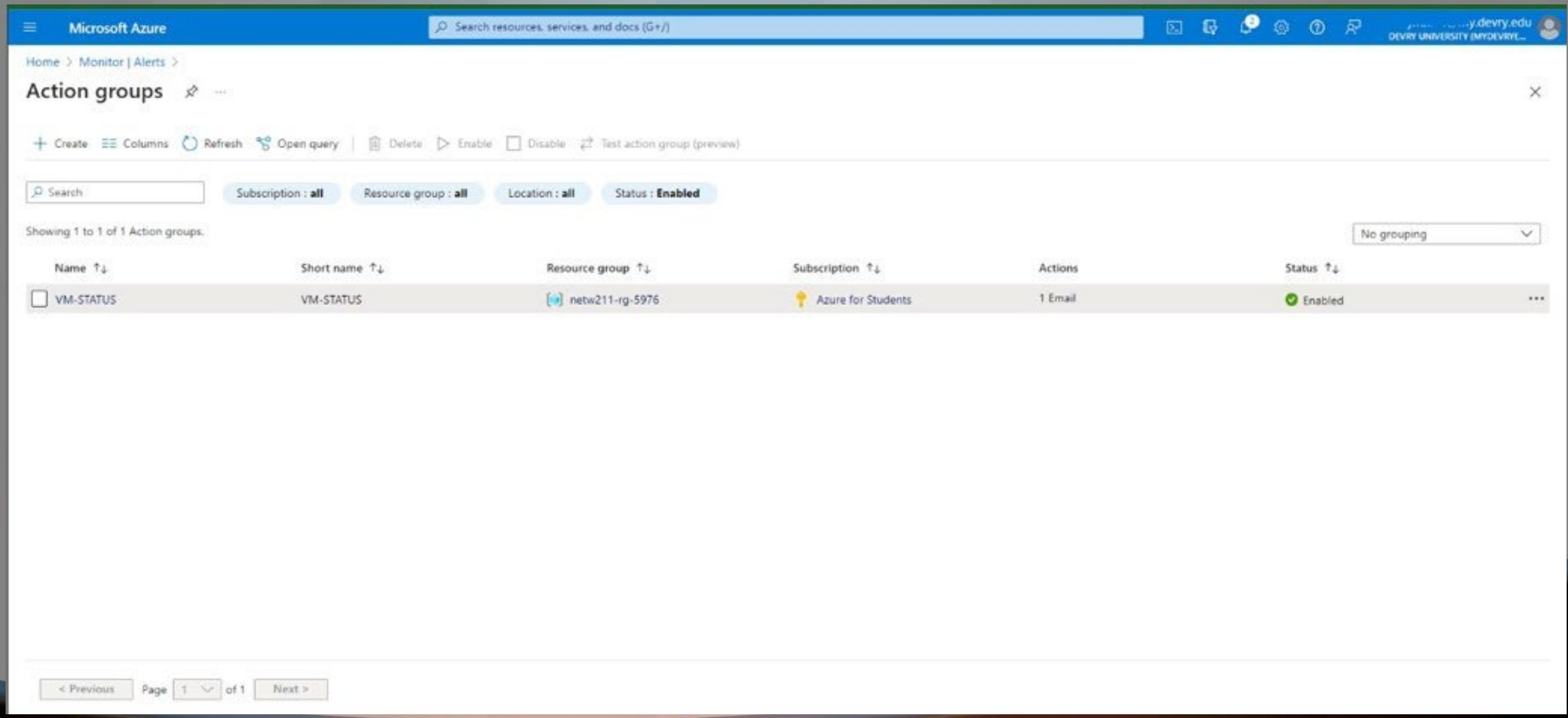
This is the first revised version. -JC

Module 6

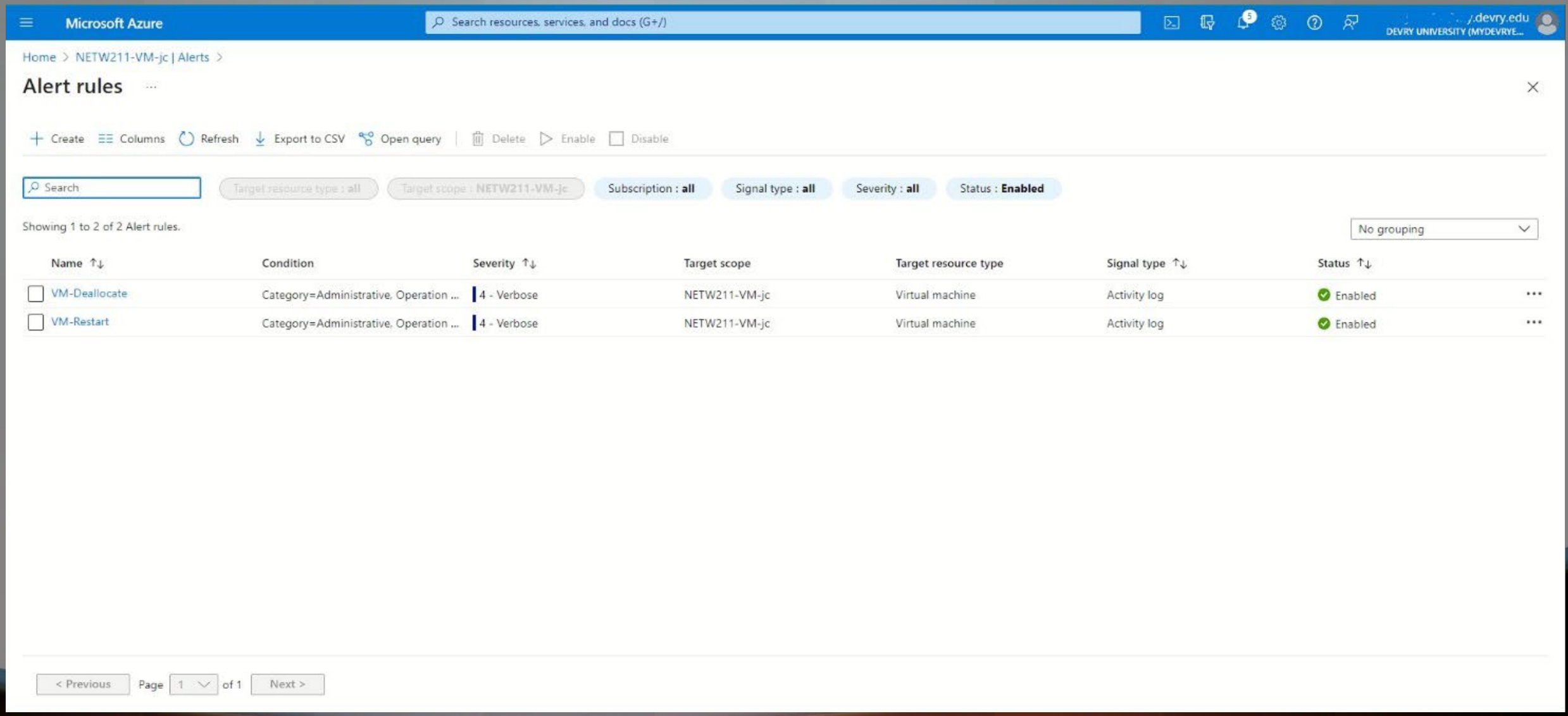
Evaluate Cloud Storage Technologies:

Cloud Monitoring

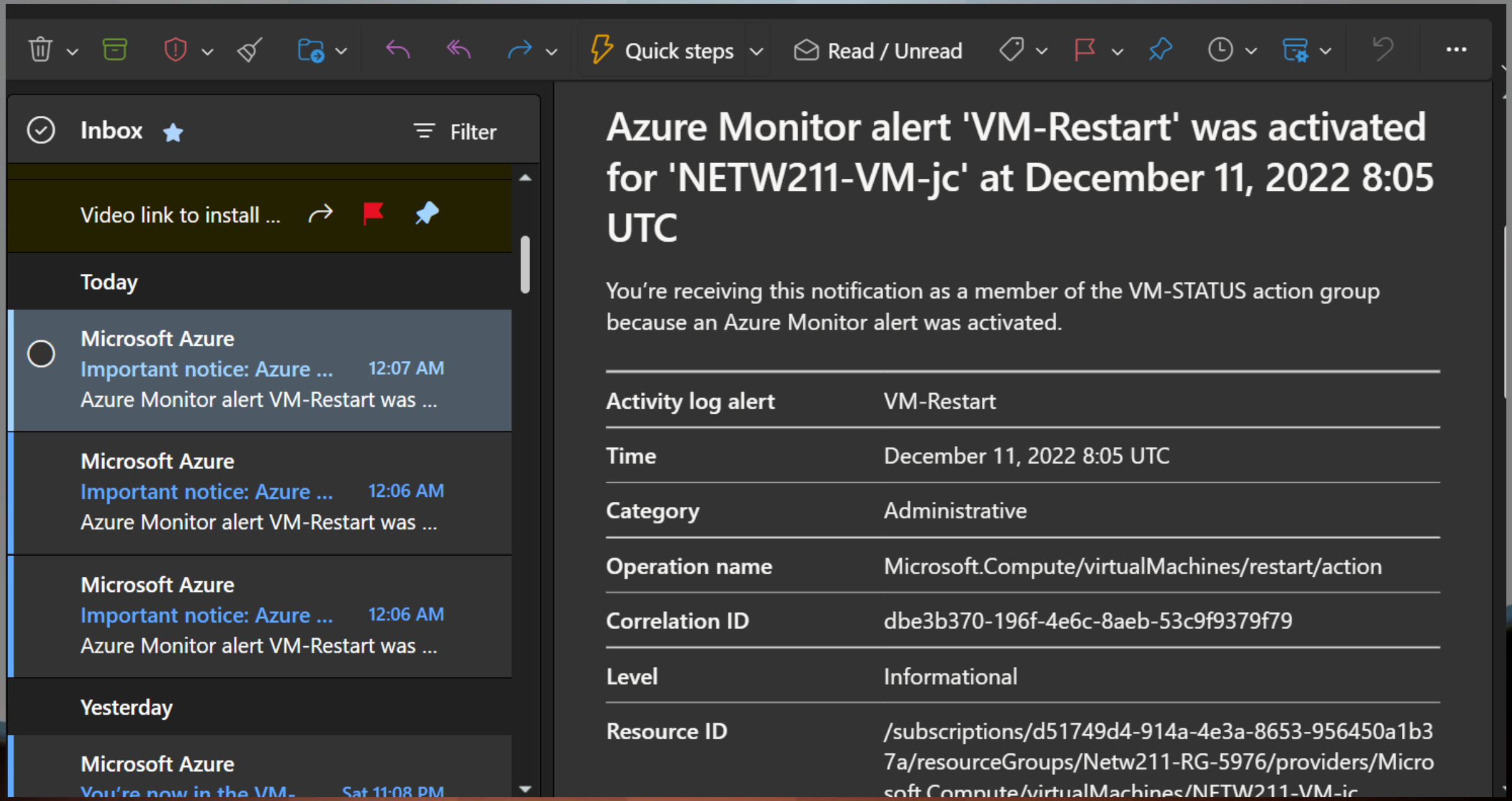
Setting up an Action Group and Notifications



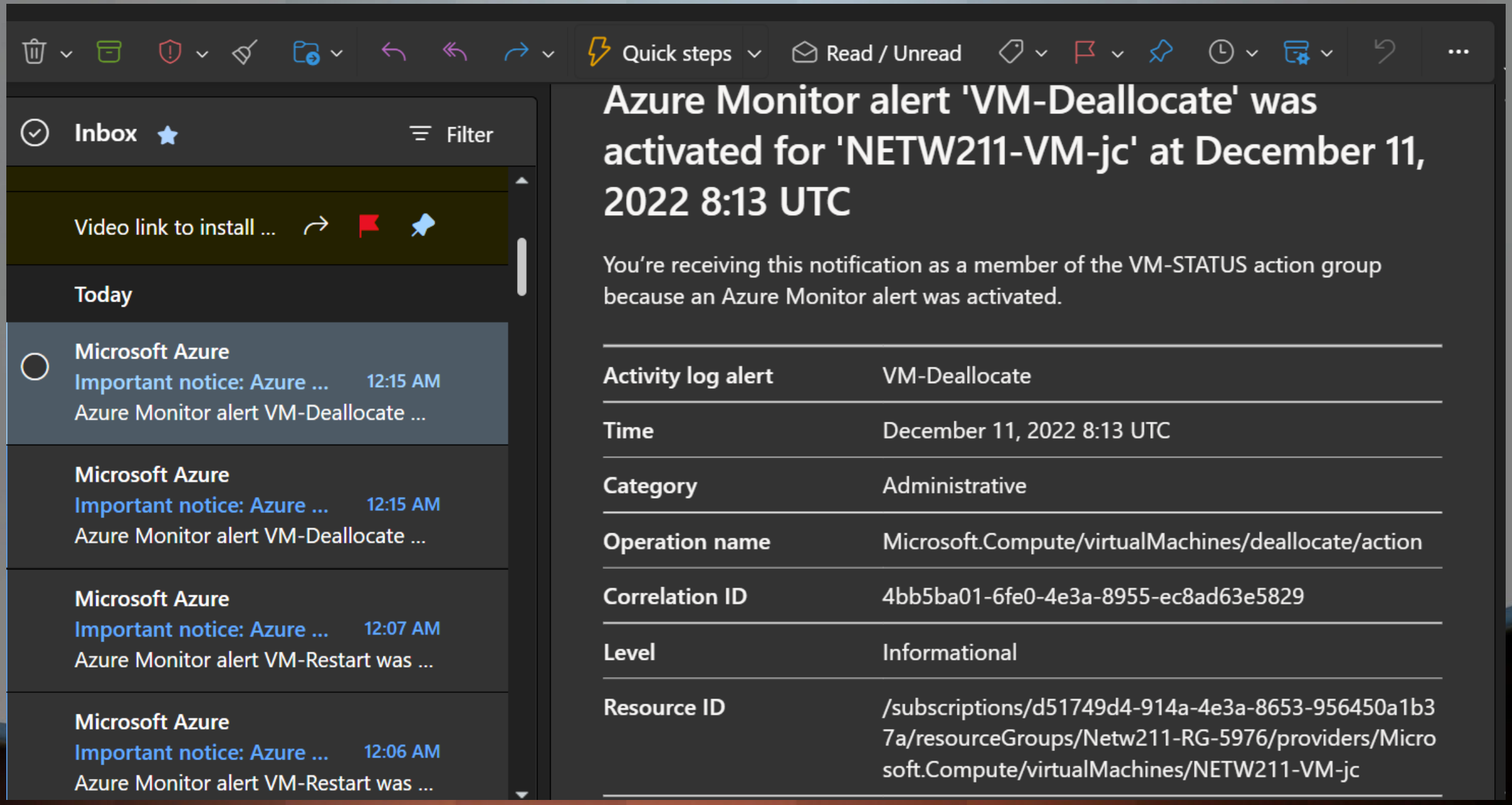
Setting up Alert Rules



Testing Alerts



Testing Alerts (cont.)



Module 7

Common Cloud Maintenance Tools, Techniques, and Services

Challenges

Challenges

Challenges	Solutions
Unable to connect to my Microsoft Azure subscription for free student services in spite of continued help from my professors and MS tech support	As a last resort, I worked with another student to use a remote desktop app to connect to his Azure account to complete my assignments

Career Skills

Career Skills

Career Skills

- Perseverance
- Patience
- Problem Solving
- Communication
- Analytical Thinking
- Research
- Resourcefulness
- Overcoming Obstacles

Conclusion

Conclusion

Lessons learned:

- Understand cloud computing
- Assess cloud-centric security techniques
- Explain the virtualization of networking
- Evaluate cloud storage technologies
- Examine network services on a cloud platform
- Apply common cloud maintenance tools, techniques, and services
- Identify cloud-centric access control techniques
- Explore the evolving job market in the digitized world
- Produce a network on a cloud platform

References

References

IP Subnet Calculator:
https://www.calculator.net/ip-subnet-calculator.html

Azure Virtual Network FAQs:
https://docs.microsoft.com/en-us/azure/virtual-network/virtual-networks-faq

IP Address CIDR Network References:
https://www.freecodecamp.org/news/subnet-cheat-sheet-24-subnet-mask-30-26-27-29-and-other-ip-address-cidr-network-references/

Private IP addresses:
https://learn.microsoft.com/en-us/azure/virtual-network/ip-services/private-ip-addresses

References (cont.)

Hot, Cool, and Archive access tiers for blob data:
https://docs.microsoft.com/en-us/azure/storage/blobs/access-tiers-overview

Azure Blob Storage Access Tiers:
https://devry.percipio.com/courses/c7ef0333-8560-403f-a004-9c5c843866b0/videos/2658bbe6-ee97-438b-a376-fbb079c3b3a0

Microsoft/Learn:
https://learn.microsoft.com/en-us/azure/storage/blobs/access-tiers-overview

http://learn.microsoft.com/en-us/azure/storage/blobs/storage-blobs-overview