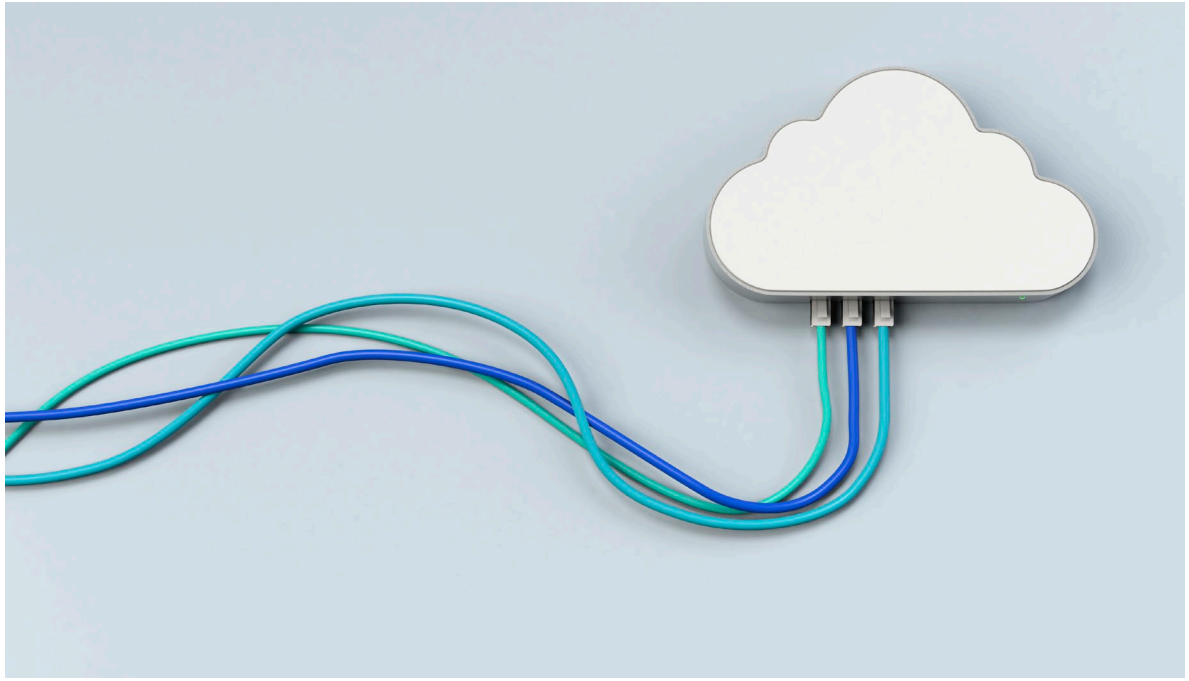
Final Course Project

- NETW211 Introduction to Cloud Computing
- Instructor Professor Risley
- John O’Leary
- February 2023



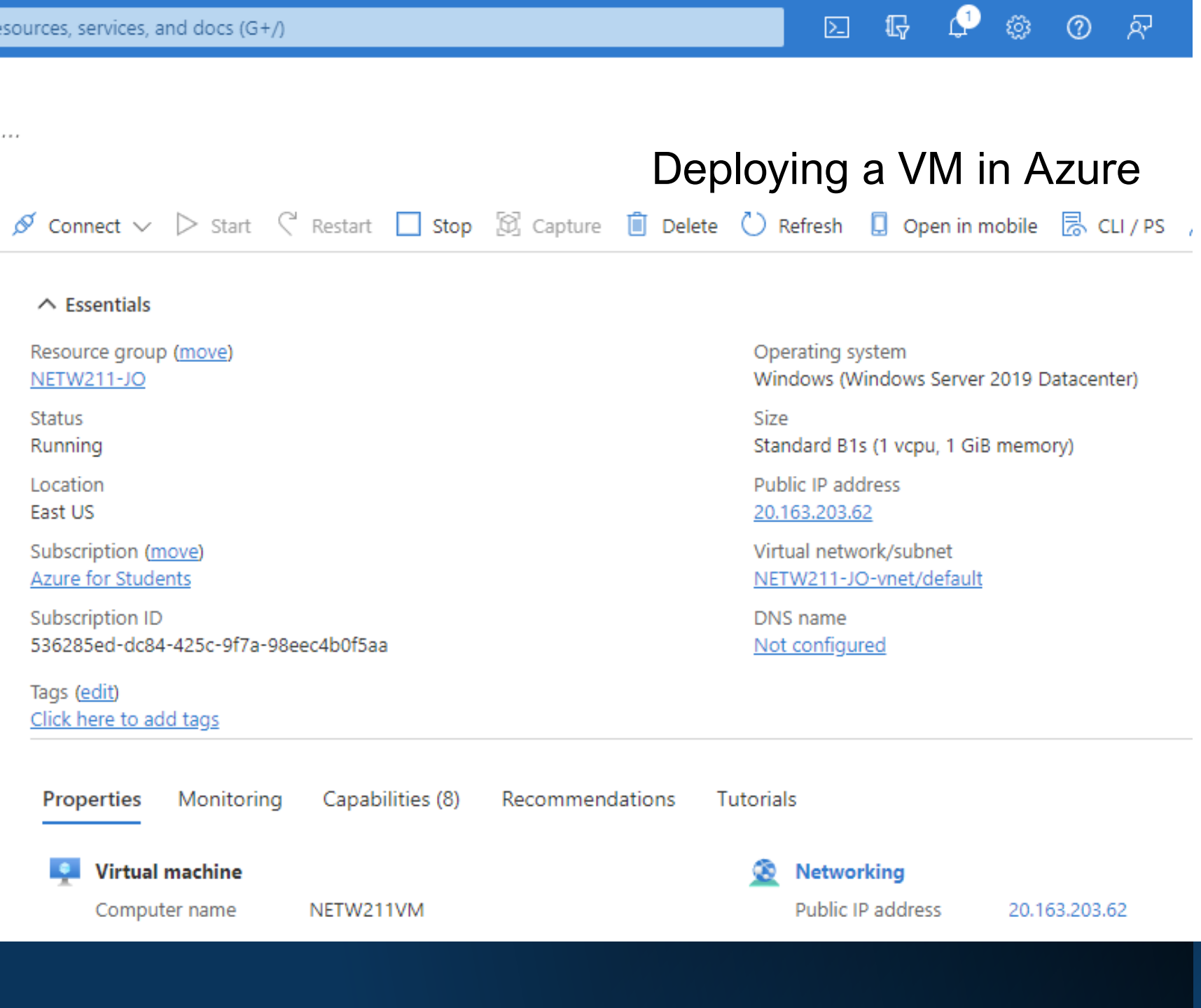
This is a project which includes five modules of stages in developing a cloud compute environment in Microsoft Azure.

Introduction

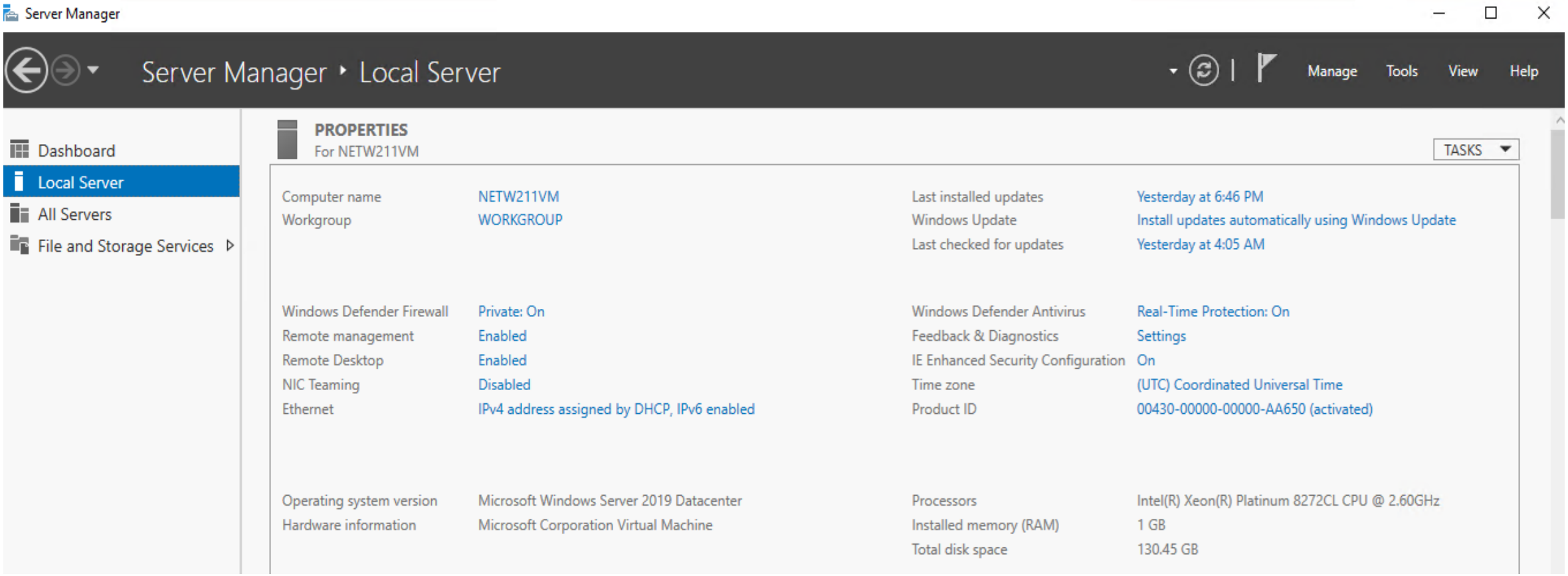
Virtual Machine (VM) Instances

This module includes steps of configuring virtual hardware such as Virtual Machines (VM's), CPU and RAM, and virtualization in the Microsoft Azure cloud environment. It also covers deploying a VM as well as deallocating and deleting the VM. And cloud infrastructure.

Deploying a VM in Azure

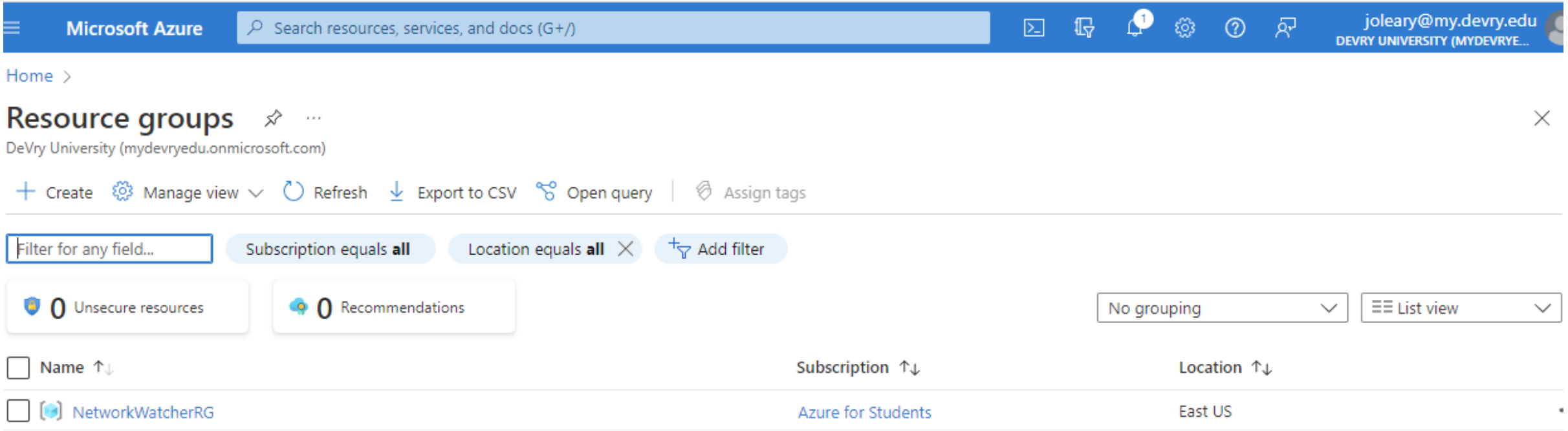


Screenshot of the *NETW211VM* page with information such as the resource group name, subscription, public IP address, etc.



Connecting to the VM

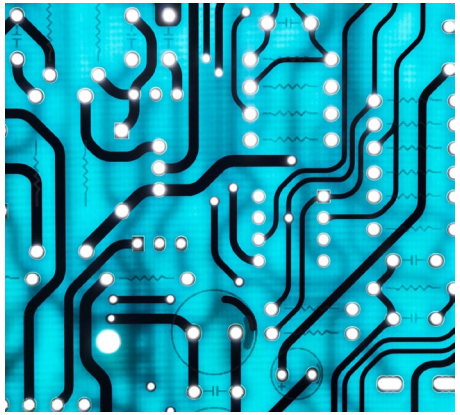
Screenshot of the *PROPERTIES for NETW211VM* page, with the computer name, operating system version, hardware information, etc.



Deleting the VM

Screenshot of the *Resource groups* page, with the *Azure for Students* subscription selection and the "*No resource groups to display*" message.

Azure VNet and Subnets



This module focuses on Virtual Networks in the Cloud environment. It includes lessons on cloud connectivity and identity and access management (IAM). There are also steps of analyzing the effect of cloud infrastructure on network services, such as DHCP, DNS and routing. And creating Virtual Networks and Sub-nets and testing the connectivity.

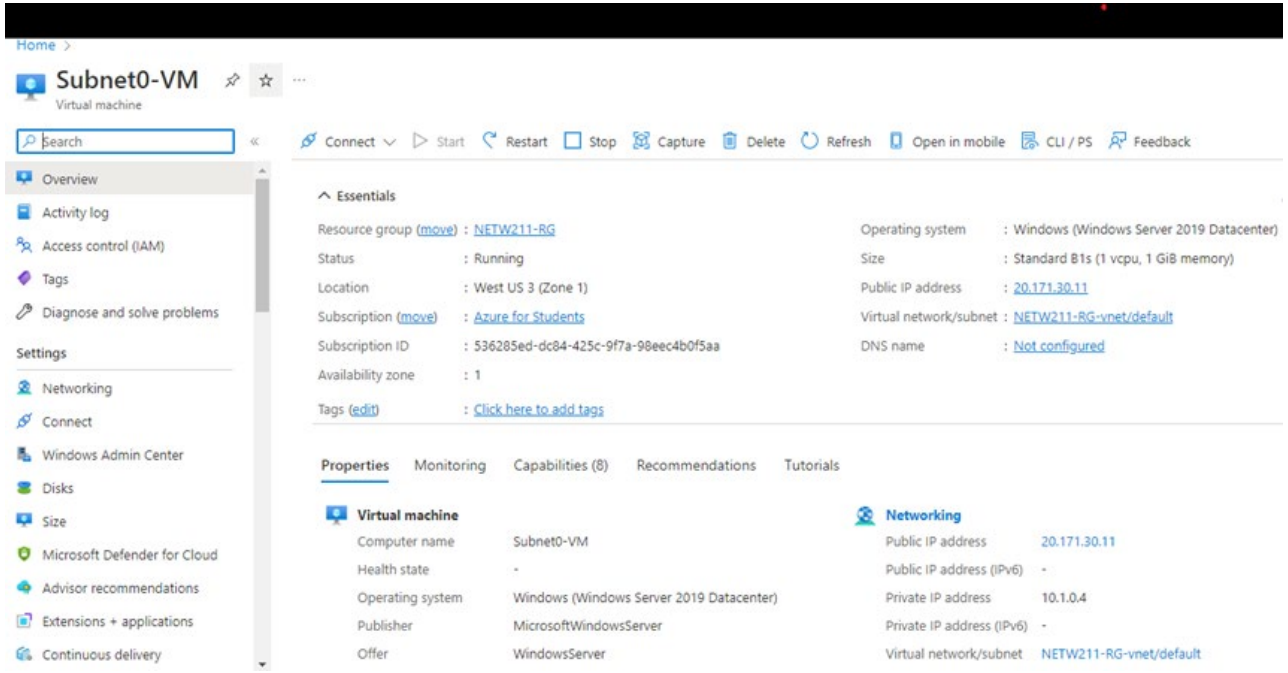
Creating a VNet with Two Subnets

- 1. With a /24 network prefix, how many **usable** IPv4 host addresses are there? [hint: you learned this in NETW191]
- Answer here: 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: First 3 address are reserved in Azure VNet, 3 addresses are used for internal purposes.
- For example:
- VNET: 192.0.0.0/24
- Network Address: 192.168.0.0
- Reserved Address: 192.168.0.1-192.168.0.3
- Broadcast Address: 192.168.0.255

- 1. Microsoft Q&A https://social.msdn.microsoft.com/Forums/en-US/network?forum=WAVirtualMachinesVirtualNetwork (vijisankar Thursday, April 27, 2017)

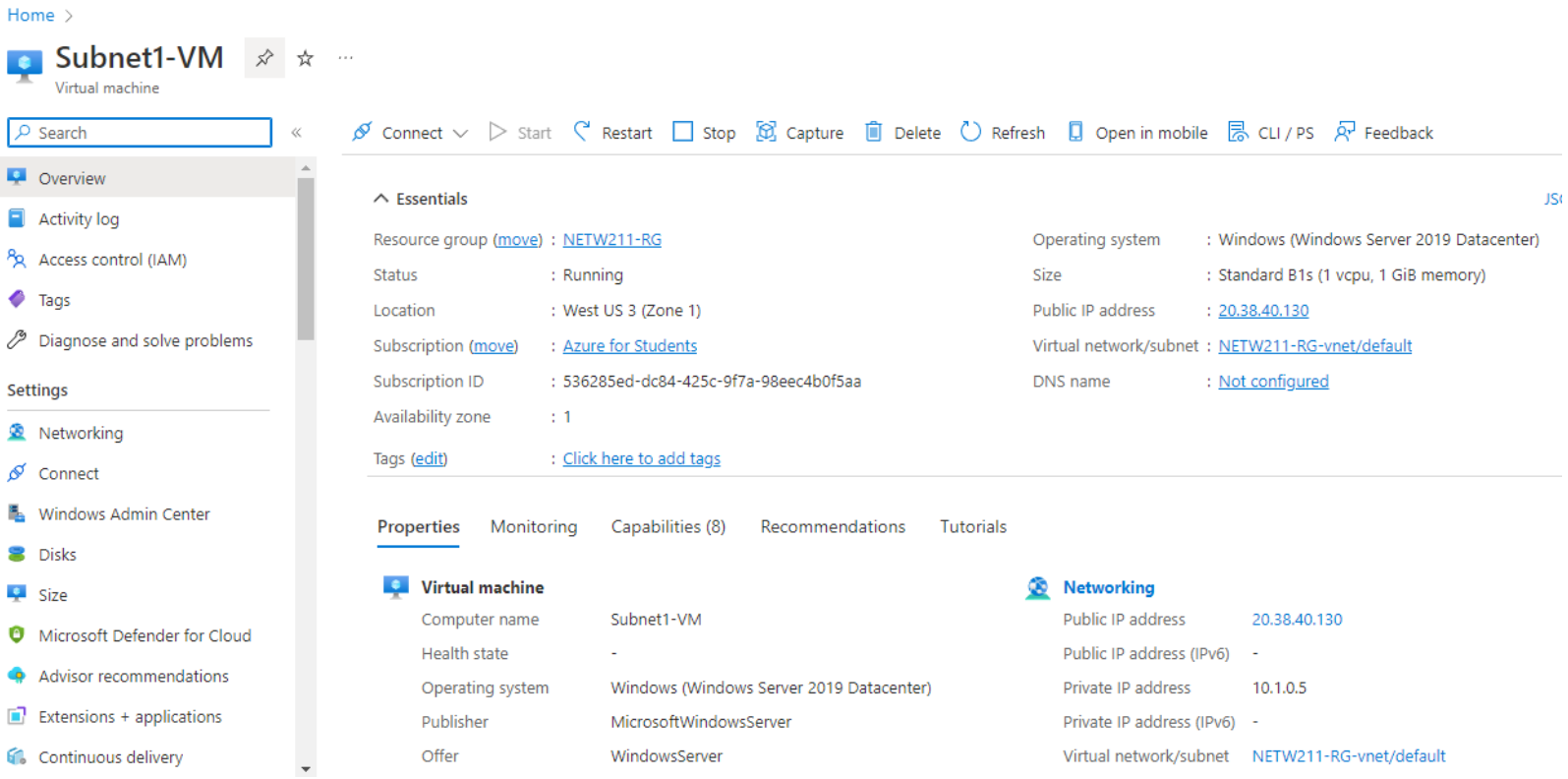
Deploying VMs into Subnets

Properties section of the ***Subnet0-VM*** page, showing the networking and size information of the VM.



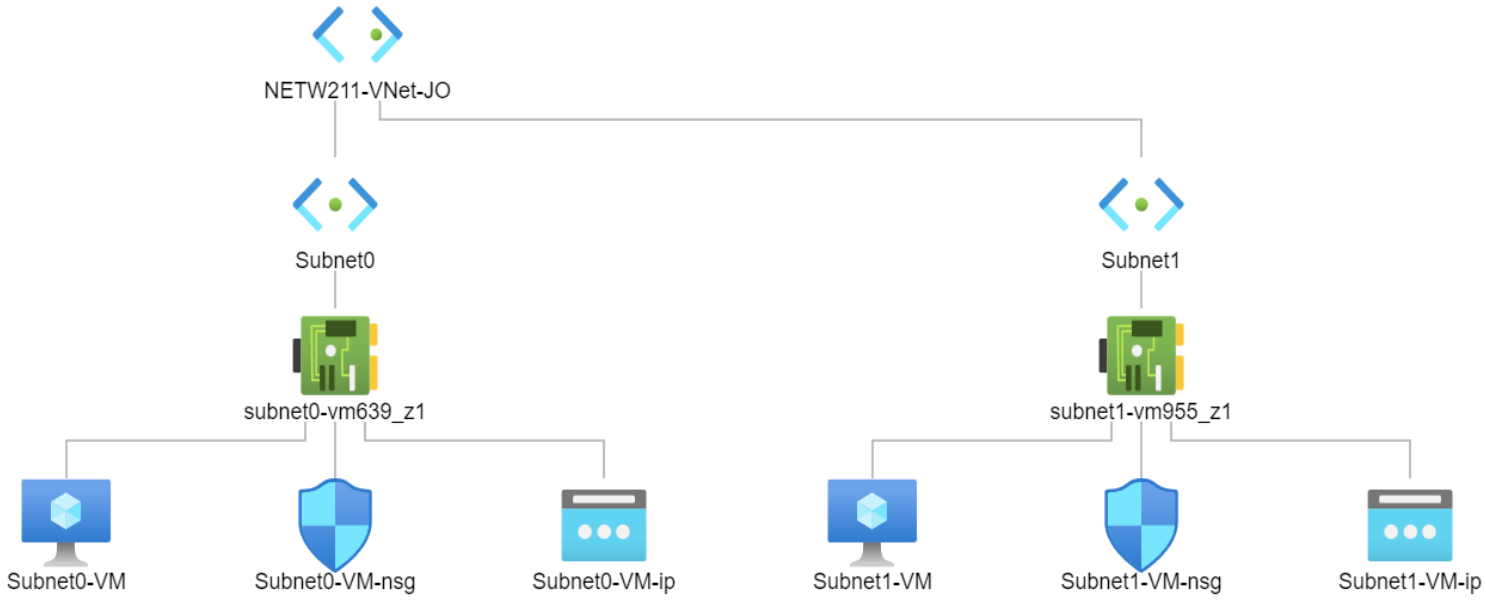
Deploying VMs into Subnets cont'd

Properties section of the ***Subnet1-VM*** page, showing the networking and size information of the VM.



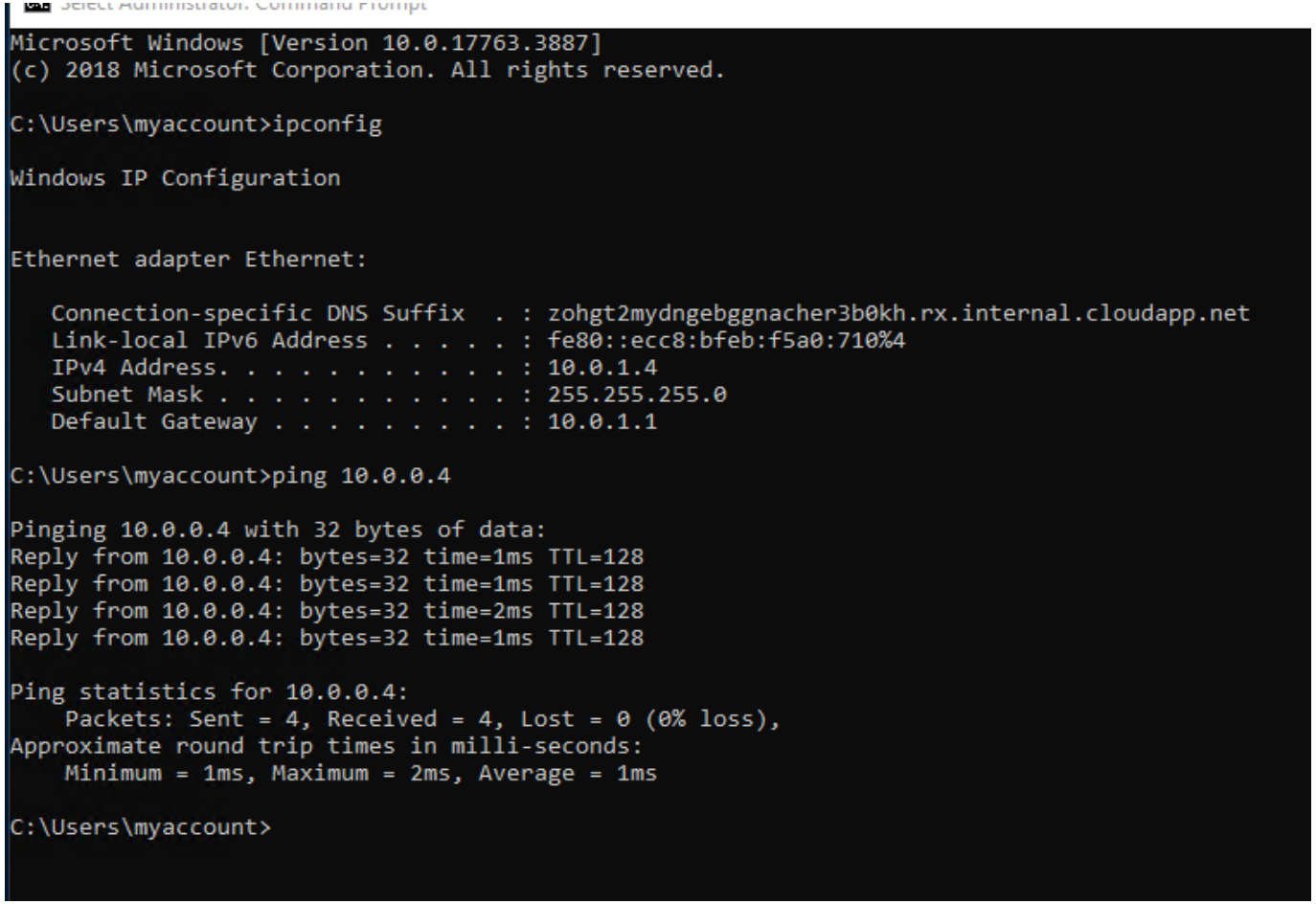
Deploying VMs into Subnets cont'd

Topology diagram of the VNet (*NETW211-VNet-Your Initials*) with two subnets (*Subnet0* and *Subnet1*) and one VM in each subnet (*Subnet0-VM* and *Subnet1-VM*).



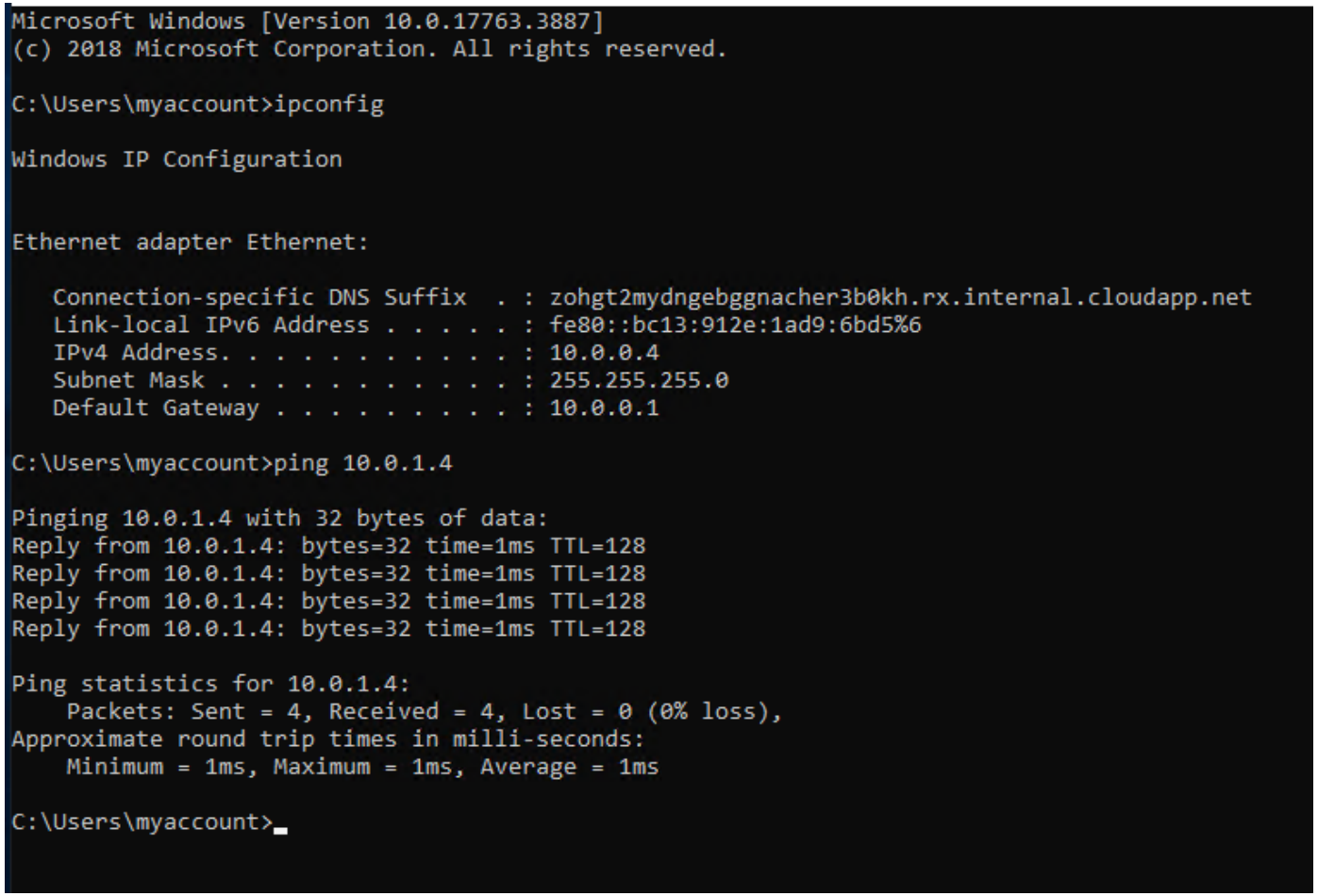
Verifying Connectivity between VMs

ipconfig and ping x.x.x.x results in the command prompt window, including the ***Subnet0****-VM – x.x.x.x – Remote Desktop Connection* window title.



Verifying Connectivity between VMs cont'd

ipconfig and *ping x.x.x.x* results in the command prompt window, including the ***Subnet1****-VM – x.x.x.x – Remote Desktop Connection* window title.

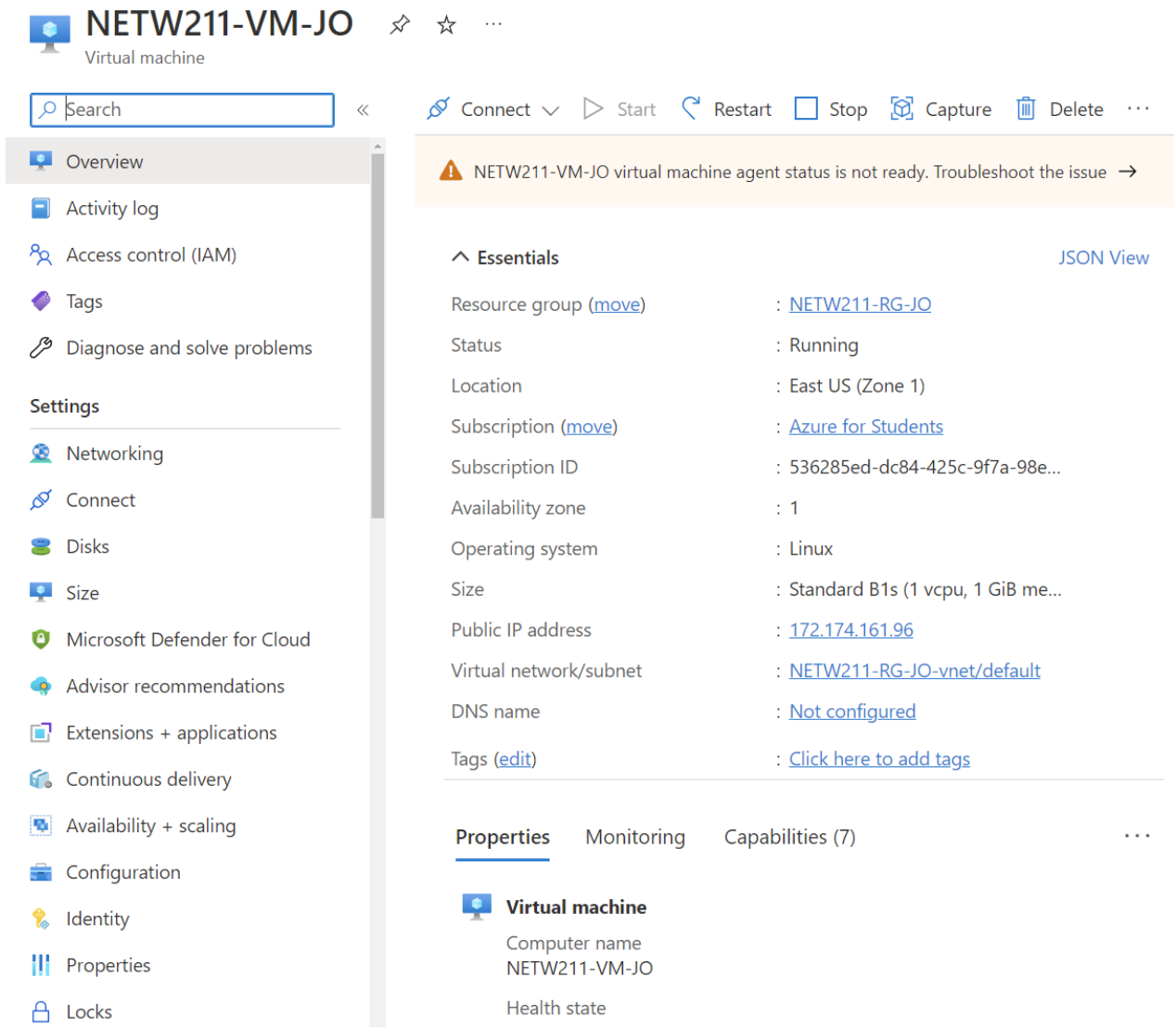


Azure Virtual Machine Security

This module covers cloud security methods and security configurations for resources in the cloud including Virtual Networks and other hardware resources security.

Launching a Virtual Machine

Details of VM instance set up.



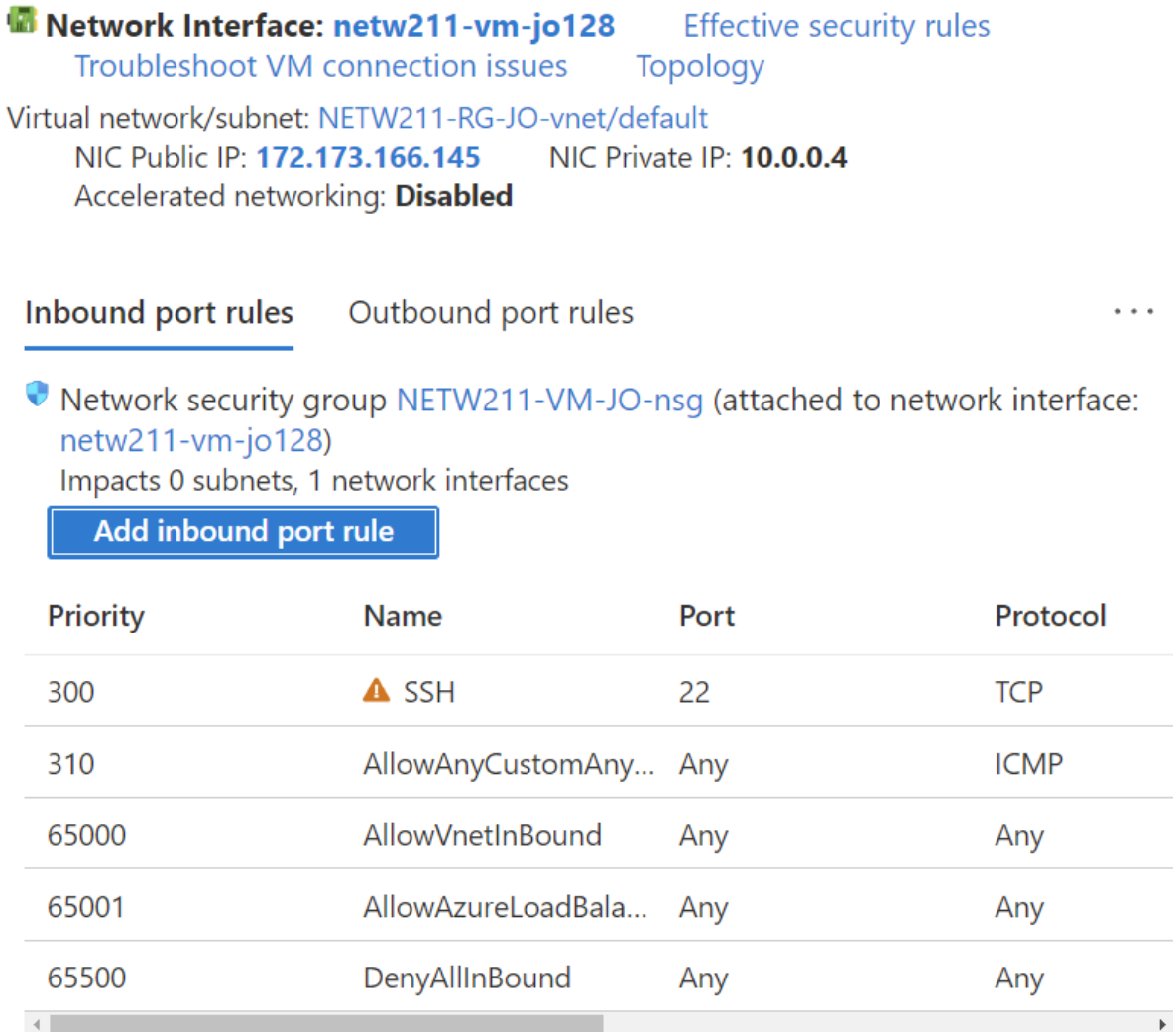
Connecting to the VM via SSH

IPv4 address of the VM in the Azure cloud.

```
C:\Users\jfo84\Downloads>ssh -i NETW211-VM-JO_key.pem azureuser@172.173.166.145
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.15.0-1031-azure x86_64)

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

  System information as of Tue Jan 24 02:24:28 UTC 2023

  System load:  0.0               Processes:             101
  Usage of /:   5.7% of 28.89GB   Users logged in:       0
  Memory usage: 28%               IPv4 address for eth0: 10.0.0.4
  Swap usage:   0%


6 updates can be applied immediately.
4 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

New release '22.04.1 LTS' available.
Run 'do-release-upgrade' to upgrade to it.
```

Configuring an NSG

Inbound port rules section with the newly added *Allow_Ping* rule.



Successful ping result from a local computer to the VM in the Azure cloud.

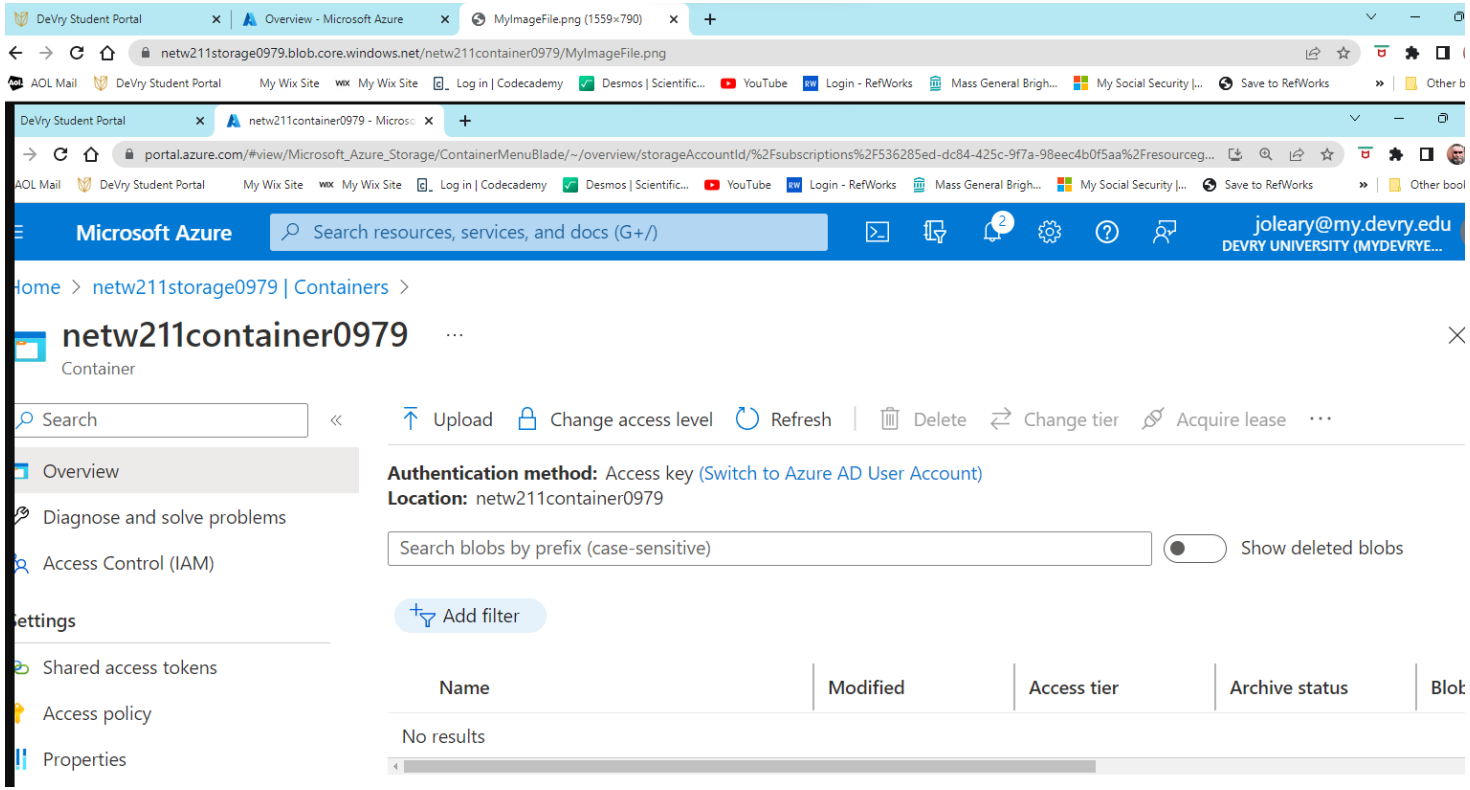
Configuring an NSG cont’d

Cloud Storage

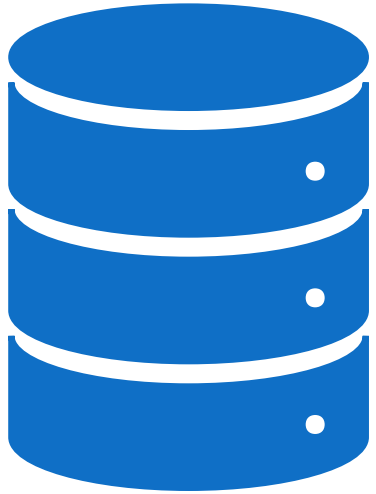
This module includes information about cloud data storage and backup methods including on-premises and cloud storage.
There are sections on object storage, file system storage, and VM-attached storage services in the major Cloud Services Providers.
The module also covers backup methods and redundancy strategies.

Uploading and Accessing a File

Browser window with the image uploaded from your local computer and the URL on top of the window.



Questions



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

Answer here:

Hot tier - An online tier optimized for storing data that is accessed or modified frequently. The hot tier has the highest storage costs, but the lowest access costs.

Cool tier - An online tier optimized for storing data that is infrequently accessed or modified. Data in the cool tier should be stored for a minimum of 30 days. The cool tier has lower storage costs and higher access costs compared to the hot tier.

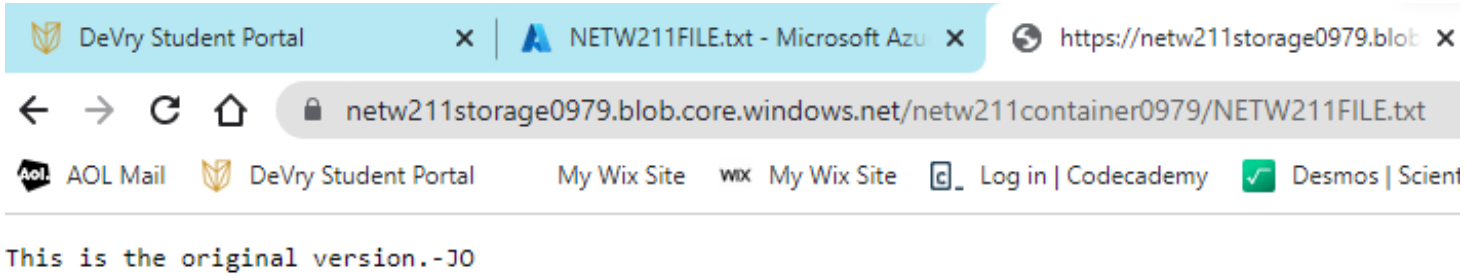
Archive tier - An offline tier optimized for storing data that is rarely accessed, and that has flexible latency requirements, on the order of hours. Data in the archive tier should be stored for a minimum of 180 days.

"Hot" tier is used for every day, frequently accessed data. "Cool" tier stores data that does not get access frequently but needs to be accessible for 30 days or more. The "Archive" tier is used for data that needs long term storage but will never or very rarely need to be accessed. So, data in the archive is stored off-line. But the metadata is kept available for reference and retrieval purposes.

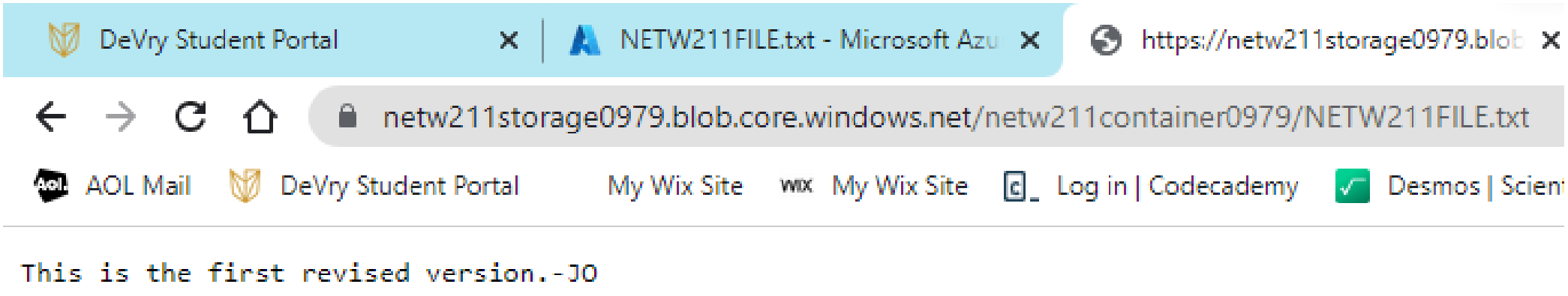
Hot, Cool, and Archive access tiers for blob data, https://docs.microsoft.com/en-us/azure/storage/blobs/access-tiers-overview
Azure Blob Storage Access Tiers, https://cdn2.percipio.com/secure/c/1675348819.223ff5bb614ce0099bfcee2eae6d0f6bcfc358ec/eot/transcripts/c5cdbf64-fb3e-462a-8401-80571701e530/it_cldsaz2020_06_enus.html#section_9

Creating Blob Snapshots

Example snapshot using blob storage in Azure

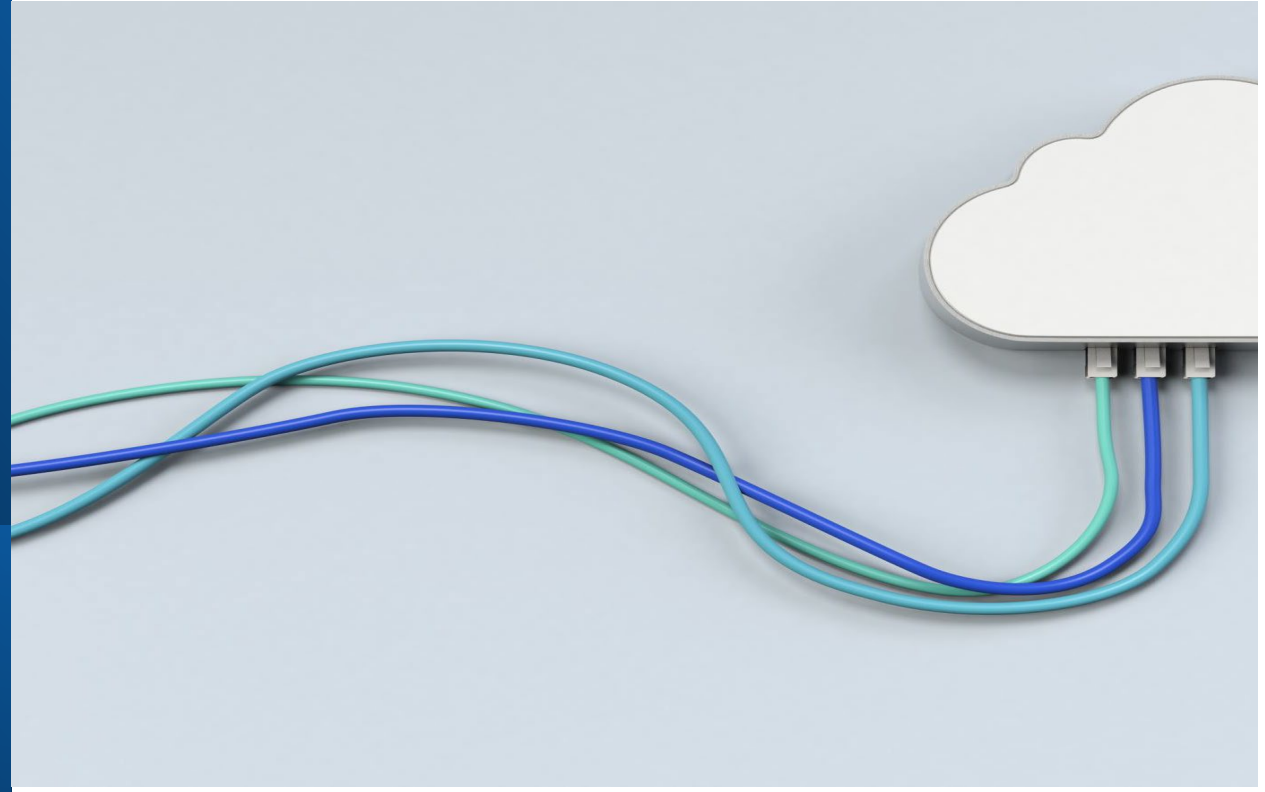


Example of Azure blob versioning.

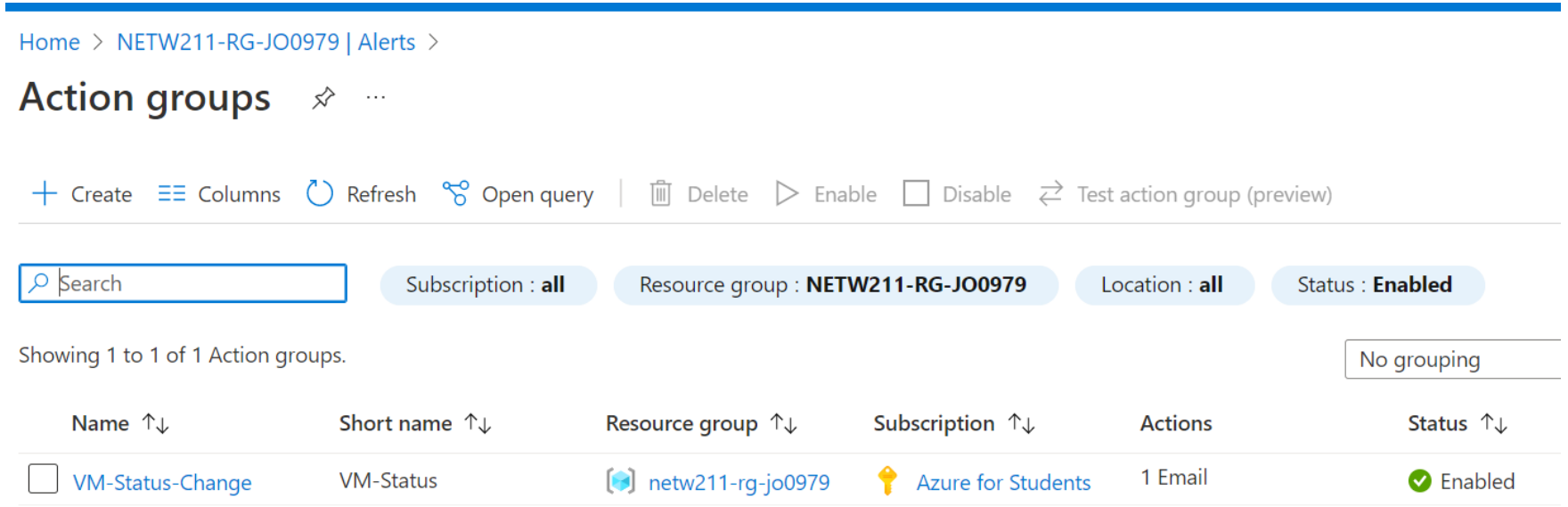


Enabling Blob Versioning

Cloud Monitoring

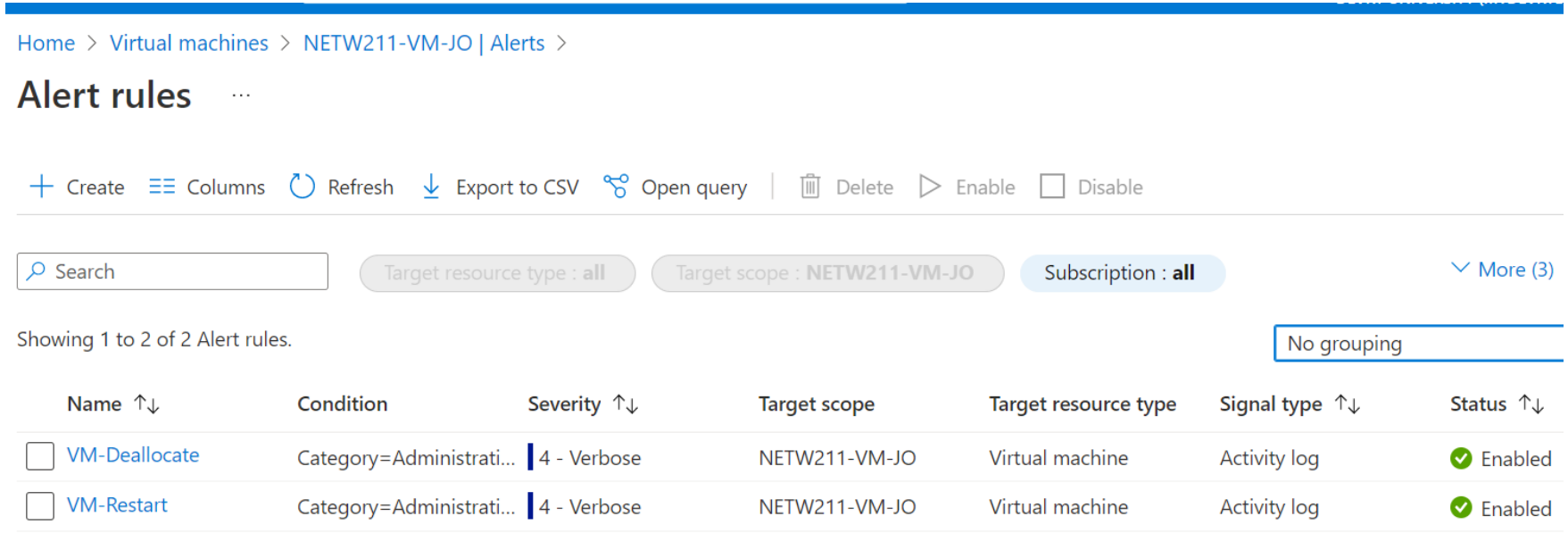


This dodule includes examples of cloud monitoring and automation business continuity planning in the event of a disaster.



- “VM-Status-Change” action group in Azure

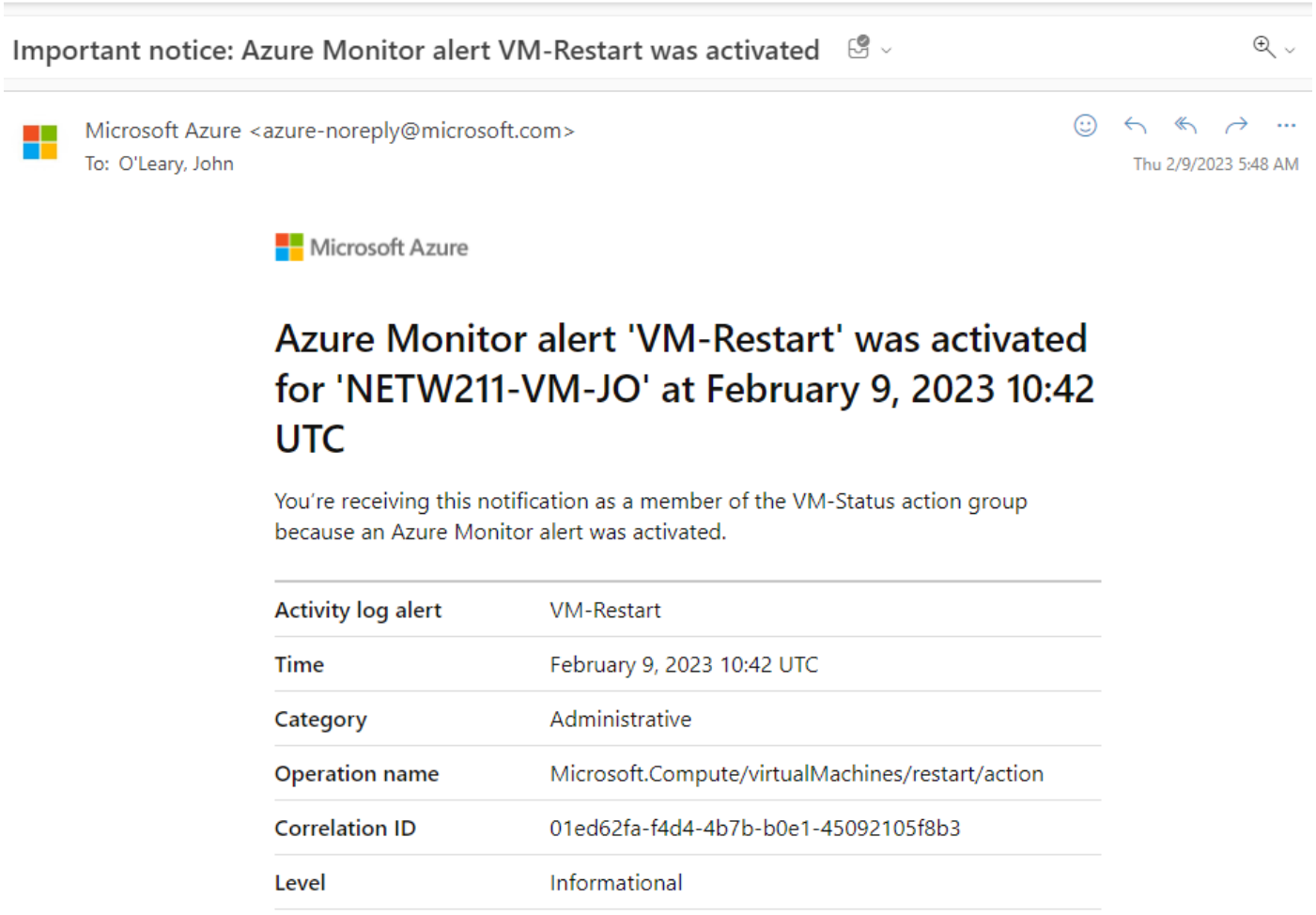
Setting up an Action Group and Notifications



- *Alert rules* window of the *VM-Deallocate* and *VM-Restart* rules.

Setting up Alert Rules

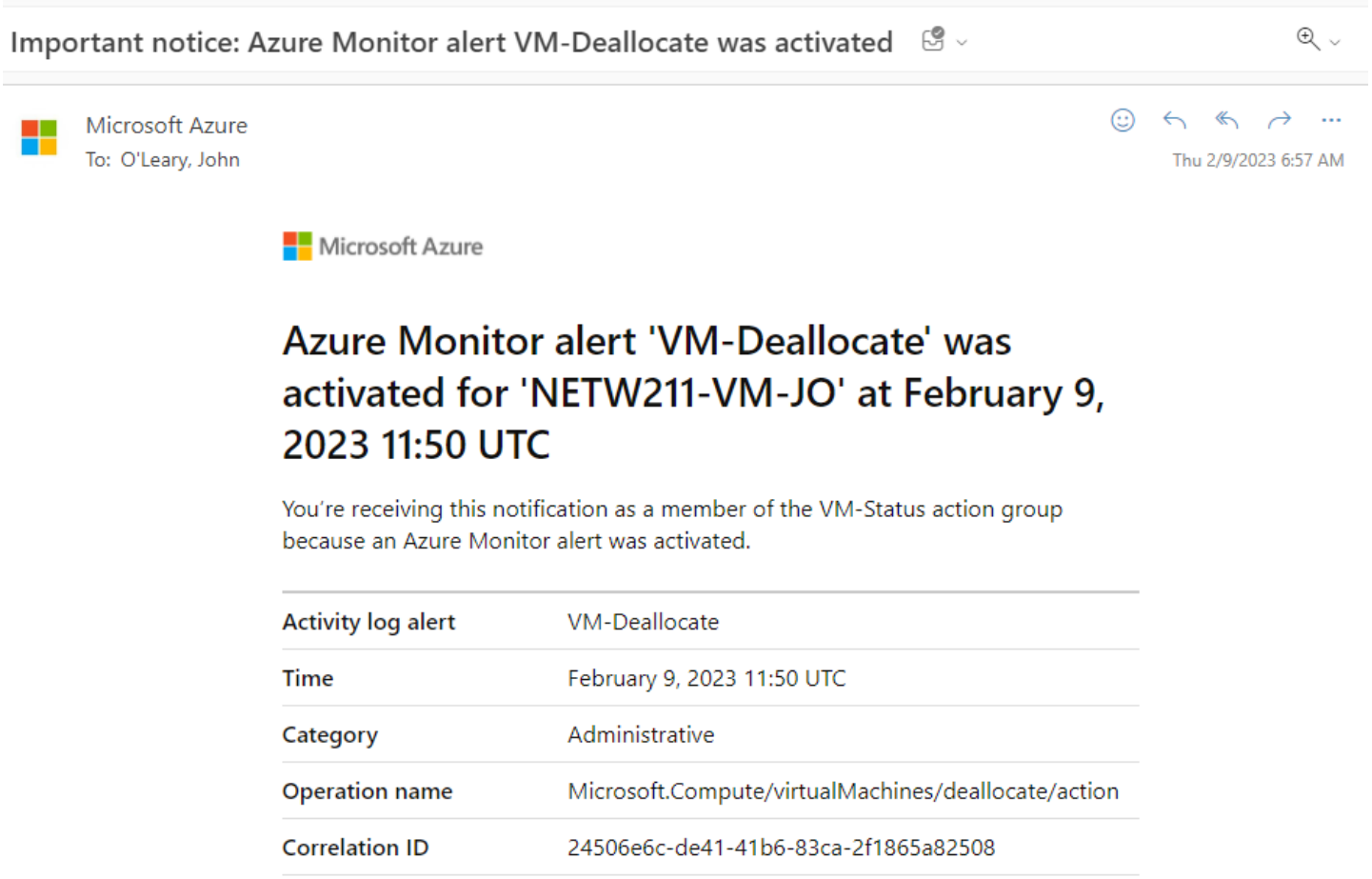
'VM-Restart' was activated email message with the date and time of the alert.



Testing Alerts

Testing Alerts cont’d

- *‘VM-Deallocate’ was activated* email message with the date and time of the alert.



Important notice: Azure Monitor alert VM-Deallocate was activated

Microsoft Azure
To: O'Leary, John

Thu 2/9/2023 6:57 AM

Microsoft Azure

Azure Monitor alert 'VM-Deallocate' was activated for 'NETW211-VM-JO' at February 9, 2023 11:50 UTC

You're receiving this notification as a member of the VM-Status action group because an Azure Monitor alert was activated.

Activity log alert	VM-Deallocate
Time	February 9, 2023 11:50 UTC
Category	Administrative
Operation name	Microsoft.Compute/virtualMachines/deallocate/action
Correlation ID	24506e6c-de41-41b6-83ca-2f1865a82508

Challenges

Some of the challenges I came up against in completing this project include an occasional problem with my laptop or peripherals.

I sometimes had initial difficulty when approaching a new concept until it became more familiar to me.

One other challenge I sometimes encountered is trouble navigating the Azure Cloud Environment.

Career Skills Aquired

- I gained great improvement in my critical thinking skills. Especially because I tend to want to figure things out on my own.
- My knowledge of technology and specifically cloud network technology has increased tremendously.
- I learned the value of joining organizations and developing a professional network of peers to stay relevant in the tech industry.

Conclusion

- In closing I want to say that this class is one of the most valuable and applicable to achieving a successful career in IT and Networking.
- The course was constructive from the Preview Week all the way to the Final Course Project.
- I'd like to thank all of the Professors for contributing their vast knowledge and experience, and I want to specifically thank Professor Risley for instructing the class in a way that very comprehensive, low stress and enjoyable.

References

- Microsoft Q&A https://social.msdn.microsoft.com/Forums/en-US/network?forum=WAVirtualMachinesVirtualNetwork (vijisankar Thursday, April 27, 2017)
- 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://cdn2.percipio.com/secure/c/1675348819.223ff5bb614ce0099bfcee2eae6d0f6bcfc358ec/eot/transcripts/c5cdbf64-fb3e-462a-8401-80571701e530/it_cldsaz2020_06_enus.html#section_9