

Cloud Computing



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Introduction

In this presentation we will go over technologies that make up cloud computing. We will discuss virtualization and topics relevant to the CompTIA Cloud+ Certification.

Overview

- Virtualization and Cloud Infrastructure
- Cloud Connectivity and IAM
- Securing Cloud Resources
- Cloud Storage
- Cloud Monitoring and Automation

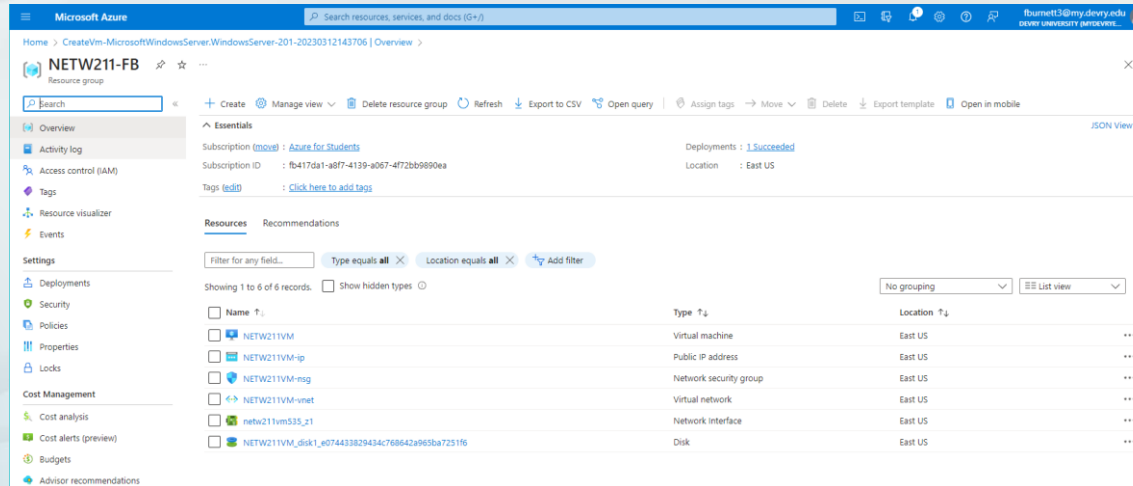


Virtualization and Cloud Infrastructure



Deploying Azure VM

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



The screenshot displays the Microsoft Azure portal interface. The top navigation bar shows the user is logged in as 'fbsamett3@my.denvy.edu'. The main content area is titled 'NETW211-FB' (Resource group). The left sidebar contains navigation links for Overview, Activity log, Access control (IAM), Tags, Resource visualizer, Events, Settings, Deployments, Security, Policies, Properties, Locks, Cost Management, Cost analysis, Cost alerts (preview), Budgets, and Advisor recommendations.

The 'Resources' tab is selected, showing a list of resources. The table below summarizes the resources displayed:

Name	Type	Location
NETW211VM	Virtual machine	East US
NETW211VM-ip	Public IP address	East US
NETW211VM-nsg	Network security group	East US
NETW211VM-vnet	Virtual network	East US
netw211vm535_x1	Network interface	East US
NETW211VM_disk1_e074433829434c768642a963ba7251f6	Disk	East US

Connecting to VM

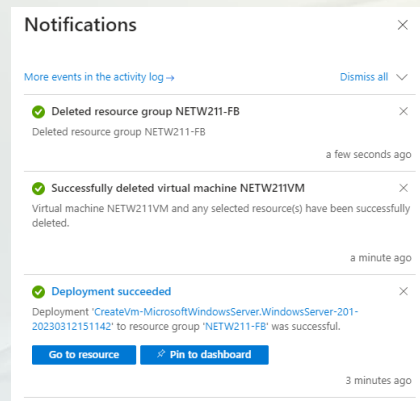
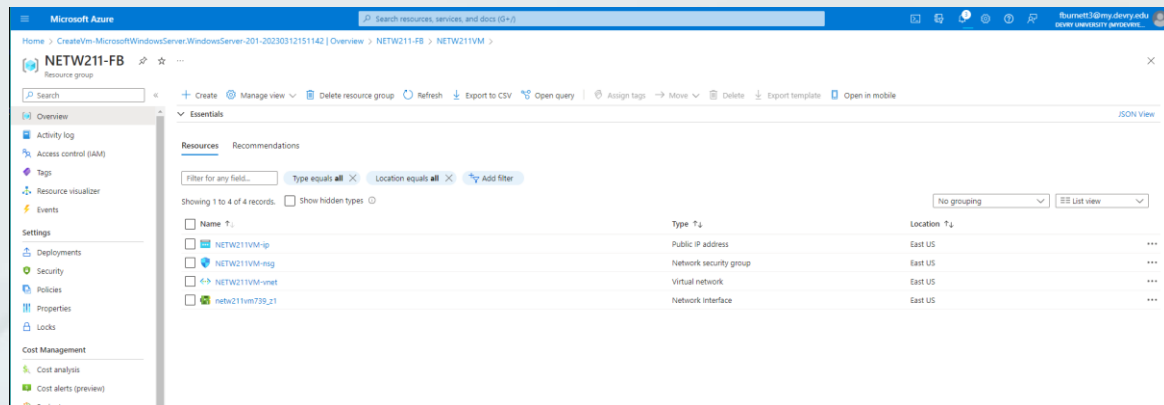
PROPERTIES for *NETW211VM* page, with the computer name, operating system version, hardware information, etc.

The screenshot shows the Windows Server Manager interface. The top navigation bar indicates 'Server Manager > Local Server'. On the left, a sidebar contains 'Dashboard', 'Local Server' (selected), 'All Servers', and 'File and Storage Services'. The main content area is titled 'PROPERTIES For NETW211VM'. It displays various system settings in a grid-like format. The 'Computer name' is NETW211VM, and the 'Workgroup' is WORKGROUP. The 'Operating system version' is Microsoft Windows Server 2019 Datacenter, and the 'Hardware information' is Microsoft Corporation Virtual Machine. Other settings include Windows Defender Firewall (Private: On), Remote management (Enabled), Remote Desktop (Enabled), NIC Teaming (Disabled), Ethernet (IPv4 address assigned by DHCP, IPv6 enabled), Last installed updates (Never), Windows Update (Install updates automatically using Windows Update), Last checked for updates (Never), Windows Defender Antivirus (Real-Time Protection: On), Feedback & Diagnostics (Settings), IE Enhanced Security Configuration (On), Time zone ((UTC) Coordinated Universal Time), Product ID (00430-00000-00000-AA906 (activated)), Processors (Intel(R) Xeon(R) Platinum 8272CL CPU @ 2.60GHz), Installed memory (RAM) (1 GB), and Total disk space (130.45 GB). At the bottom, there is an 'EVENTS' section showing 'All events | 1 total'.

PROPERTIES For NETW211VM			
Computer name	NETW211VM	Last installed updates	Never
Workgroup	WORKGROUP	Windows Update	Install updates automatically using Windows Update
		Last checked for updates	Never
Windows Defender Firewall	Private: On	Windows Defender Antivirus	Real-Time Protection: On
Remote management	Enabled	Feedback & Diagnostics	Settings
Remote Desktop	Enabled	IE Enhanced Security Configuration	On
NIC Teaming	Disabled	Time zone	(UTC) Coordinated Universal Time
Ethernet	IPv4 address assigned by DHCP, IPv6 enabled	Product ID	00430-00000-00000-AA906 (activated)
Operating system version	Microsoft Windows Server 2019 Datacenter	Processors	Intel(R) Xeon(R) Platinum 8272CL CPU @ 2.60GHz
Hardware information	Microsoft Corporation Virtual Machine	Installed memory (RAM)	1 GB
		Total disk space	130.45 GB

EVENTS
All events | 1 total

Deleting VM



Resource groups page, with the Azure for Students subscription selection and the “No resource groups to display” message.



Cloud Connectivity and IAM



Knowledge Check

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

Answer here: 251

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: The first four and last addresses are reserved for Azure.

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>

Deploying VM into Subnets

Properties Monitoring Capabilities (8) Recommendations Tutorials

Virtual machine

Computer name	Subnet0-VM
Health state	-
Operating system	Windows (Windows Server 2019 Datacenter)
Publisher	MicrosoftWindowsServer
Offer	WindowsServer
Plan	2019-datacenter-gensecond
VM generation	V2
VM architecture	x64
Agent status	Ready
Agent version	2.7.41491.1057
Host group	None
Host	-
Proximity placement group	-
Colocation status	N/A
Capacity reservation group	-

Availability + scaling

Availability zone	1
Availability set	-
Scale Set	-

Security type

Security type	Trusted launch
Enable secure boot	Enabled
Enable vTPM	Enabled
Integrity monitoring	Enabled

Networking

Public IP address	20.84.115.119 (Network interface subnet0-vm679_z1)
Public IP address (IPv6)	-
Private IP address	10.0.0.4
Private IP address (IPv6)	-
Virtual network/subnet	NETW211-VNet-FB/Subnet0
DNS name	Configure

Size

Size	Standard B1s
vCPUs	1
RAM	1 GiB

Disk

OS disk	Subnet0-VM_OsDisk_1_e274949489a74c1b99eb5cda4aefe2de
Encryption at host	Disabled
Azure disk encryption	Not enabled
Ephemeral OS disk	N/A
Data disks	0

Auto-shutdown

Auto-shutdown	Not enabled
Scheduled shutdown	-

Azure Spot

Azure Spot	-
Azure Spot eviction policy	-

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



Deploying VM into Subnets cont'd

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

Properties Monitoring Capabilities (8) Recommendations Tutorials

Virtual machine

Computer name	Subnet1-VM
Health state	-
Operating system	Windows (Windows Server 2019 Datacenter)
Publisher	MicrosoftWindowsServer
Offer	WindowsServer
Plan	2019-datacenter-gensecond
VM generation	V2
VM architecture	x64
Agent status	Ready
Agent version	2.7.41491.1057
Host group	None
Host	-
Proximity placement group	-
Colocation status	N/A
Capacity reservation group	-

Availability - scaling

Availability zone	1
Availability set	-
Scale set	-

Security type

Security type	Trusted launch
Enable secure boot	Enabled
Enable vTPM	Enabled
Integrity monitoring	Enabled

Extensions - applications

Extensions	GuestAttestation
------------	------------------

Networking

Public IP address	20.42.83.245 (Network interface subnet1-vm259_x1)
Public IP address (IPv6)	-
Private IP address	10.0.1.4
Private IP address (IPv6)	-
Virtual network/subnet	NETW211-VNet-F8/Subnet1
DNS name	Configure

Size

Size	Standard B1s
vCPUs	1
RAM	1 GiB

Disk

OS disk	Subnet1-VM_OsDisk_1_dea070f0ea4e4d4cfbf909dd423797fe3
Encryption at host	Disabled
Azure disk encryption	Not enabled
Ephemeral OS disk	N/A
Data disks	0

Auto-shutdown

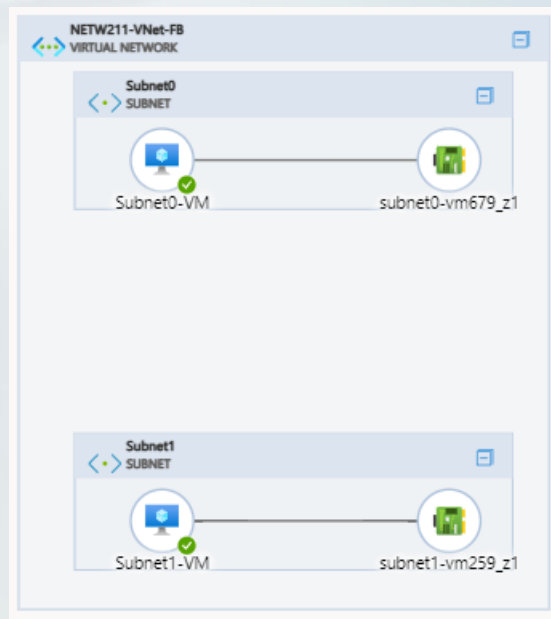
Auto-shutdown	Not enabled
Scheduled shutdown	-

Azure Spot

Azure Spot	-
Azure Spot eviction policy	-

Deploying VM into Subnets cont'd

Topology diagram of your 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

Subnet0-VM – x.x.x.x – Remote Desktop Connection window title.

```
Administrator: Command Prompt

C:\Users\myaccount>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : mjzm5kkipchutmx2fl0zquseh.bx.internal.cloudapp.net
    Link-local IPv6 Address . . . . . : fe80::a9d0:79d5:ff9f:4d0e%6
    IPv4 Address. . . . . : 10.0.1.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.0.1.1

C:\Users\myaccount>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:
Reply from 10.0.0.4: bytes=32 time=1ms TTL=128
Reply from 10.0.0.4: bytes=32 time=1ms TTL=128
Reply from 10.0.0.4: bytes=32 time<1ms TTL=128
Reply from 10.0.0.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Users\myaccount>
```



Verifying Connectivity between VMs cont'd

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.17763.4131]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\myaccount>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : mjzm5kkpzchutmx2f10zquseh.bx.internal.cloudapp.net
    Link-local IPv6 Address . . . . . : fe80::5cd5:b639:f85c:aadc%6
    IPv4 Address. . . . . : 10.0.0.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.0.0.1

C:\Users\myaccount>ping 10.0.1.4

Pinging 10.0.1.4 with 32 bytes of data:
Reply from 10.0.1.4: bytes=32 time<1ms TTL=128
Reply from 10.0.1.4: bytes=32 time=1ms TTL=128
Reply from 10.0.1.4: bytes=32 time=1ms TTL=128
Reply from 10.0.1.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.0.1.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Users\myaccount>
```

***Subnet1-VM – x.x.x.x – Remote
Desktop Connection window title.***



Security Cloud Resources



Launching VM

Properties

Monitoring

Capabilities (?)

Recommendations

Tutorials

Virtual machine

Computer name

Health state

Operating system

Publisher

Offer

Plan

VM generation

VM architecture

Agent status

Agent version

Host group

Host

Proximity placement group

Colocation status

Capacity reservation group

NETW211-VM-FB

-

Linux (ubuntu 20.04)

canonical

0001-com-ubuntu-server-focal

20_04-lts-gen2

V2

x64

Ready

2.9.0.4

None

-

-

N/A

-

Availability - scaling

Availability zone

Availability set

Scale Set

1

-

-

Security type

Security type

Enable secure boot

Enable vTPM

Integrity monitoring

Trusted launch

Enabled

Enabled

Enabled

Networking

Public IP address

Public IP address (IPv6)

Private IP address

Private IP address (IPv6)

Virtual network/subnet

DNS name

20.41.117.28 (Network interface netw211-vm-fb720_21)

-

10.0.0.4

-

NETW211-VM-FB-vnet/default

[Configure](#)

Size

Size

vCPUs

RAM

Standard B1s

1

1 GiB

Disk

OS disk

Encryption at host

Azure disk encryption

Ephemeral OS disk

Data disks

NETW211-VM-FB_OsDisk_1_13f17ee822b649ebb8cd49a2c05ed38e

Disabled

Not enabled

N/A

0

Auto-shutdown

Auto-shutdown

Scheduled shutdown

Not enabled

-

Azure Spot

Azure Spot

Azure Spot eviction policy

-

-

NETW211-VM-Your Initials page, with information such as the resource group name, subscription, public IP address, etc.



Connecting to VM via SSH

azureuser@NETW211-VM-Your Initials
window showing the IPv4 address of the VM
in the Azure cloud.

```
azureuser@NETW211-VM-FB: ~
5.15.0-1034-azure
azureuser@NETW211-VM-FB:~$ cat /etc/os-release
NAME="Ubuntu"
VERSION="20.04.6 LTS (Focal Fossa)"
ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 20.04.6 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@NETW211-VM-FB:~$ ping -c 4
ping: usage error: Destination address required
azureuser@NETW211-VM-FB:~$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000
    link/ether 60:45:bd:44:c0:e4 brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.4/24 brd 10.0.0.255 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::6245:bdf:fe44:c0e4/64 scope link
        valid_lft forever preferred_lft forever
azureuser@NETW211-VM-FB:~$
```


Configuring an NSG

netw211-vm-fb720_z1

IP configuration ⓘ
ipconfig1 (Primary) ▼

🟢 **Network interface: netw211-vm-fb720_z1** [Effective security rules](#) [Troubleshoot VM connection issues](#) [Topology](#) ⓘ

Virtual network/subnet: NETW211-VM-FB-vnet/default NIC Public IP: **20.41.117.28** NIC Private IP: **10.0.0.4** Accelerated networking: **Disabled**

[Inbound port rules](#) [Outbound port rules](#) [Application security groups](#) [Load balancing](#)

🔑 Network security group **NETW211-VM-FB-nsg** (attached to network interface: netw211-vm-fb720_z1)
Impacts 0 subnets, 1 network interfaces

[Add inbound port rule](#)

Priority	Name	Port	Protocol	Source	Destination	Action	
300	⚠️ SSH	22	TCP	Any	Any	🟢 Allow	...
310	Allow_Ping	Any	ICMP	Any	Any	🟢 Allow	...
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	🟢 Allow	...
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	🟢 Allow	...
65500	DenyAllInBound	Any	Any	Any	Any	🔴 Deny	...

Need help?
[Understand Azure load balancing](#) ⓘ
[Quickstart: Create a public load balancer to load balance Virtual Machines](#) ⓘ
[Quickstart: Direct web traffic with Azure Application Gateway](#) ⓘ

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

Configuring an NSG cont'd



successful ping result from your local computer to the VM in the Azure cloud.

```
ca. Command Prompt
Microsoft Windows [Version 10.0.19045.2728]
(c) Microsoft Corporation. All rights reserved.

C:\Users\faith>ping 20.41.117.28

Pinging 20.41.117.28 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 20.41.117.28:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\Users\faith>ping 20.41.117.28

Pinging 20.41.117.28 with 32 bytes of data:
Reply from 20.41.117.28: bytes=32 time=184ms TTL=38
Reply from 20.41.117.28: bytes=32 time=182ms TTL=38
Reply from 20.41.117.28: bytes=32 time=182ms TTL=38
Reply from 20.41.117.28: bytes=32 time=182ms TTL=38

Ping statistics for 20.41.117.28:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 182ms, Maximum = 184ms, Average = 182ms

C:\Users\faith>
```

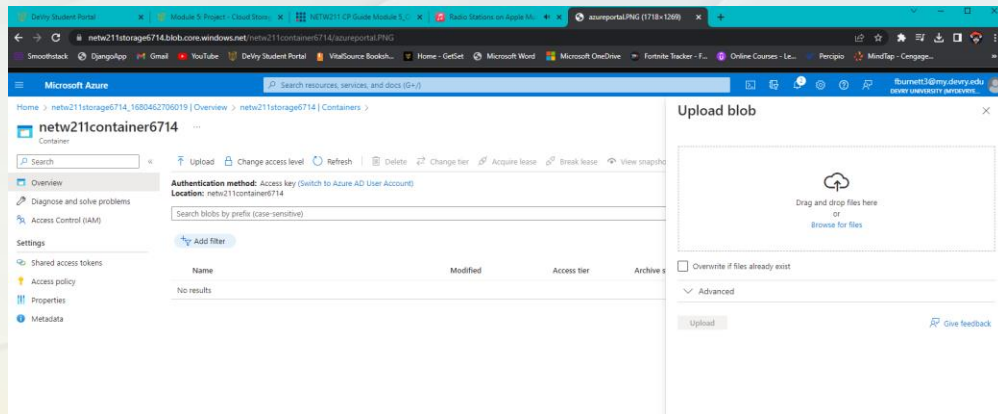




Cloud Storage



Uploading and Accessing a File



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



Knowledge Check

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:

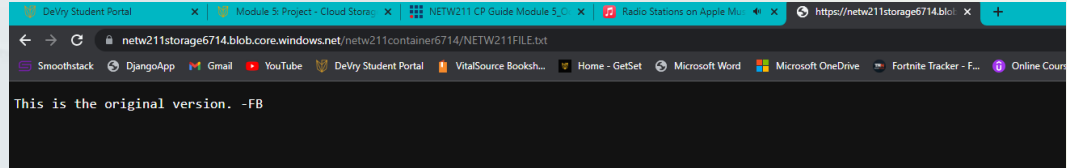
The access tier setting allows you to choose what kind of access tier you want to use. The three types of tiers are hot-storing data that is accessed or changed often, cold-storing data that is not accessed or changed often, and archive-offline option for rarely accessed data.

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

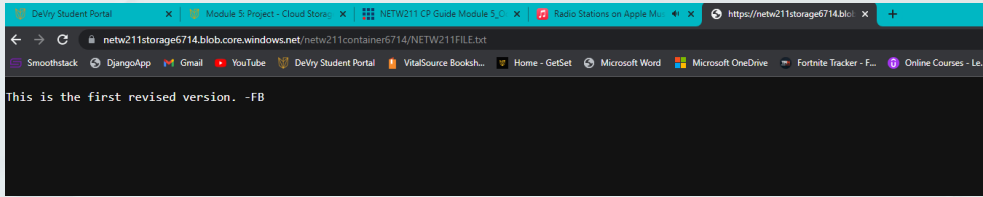
1. Hot, Cool, and Archive access tiers for blob data, <https://docs.microsoft.com/en-us/azure/storage/blobs/access-tiers-overview>
2. Azure Blob Storage Access Tiers, <https://devry.percipio.com/courses/c7ef0333-8560-403f-a004-9c5c843866b0/videos/2658bbe6-ee97-438b-a376-fbb079c3b3a0>

Creating Blob Snapshots

“This is the original version. – Your Initials”
message and the URL on top of the window



Enabling Blob Versioning

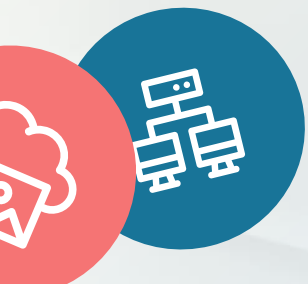


“This is the first revised version. – Your Initials”
message and the URL on top of the window.



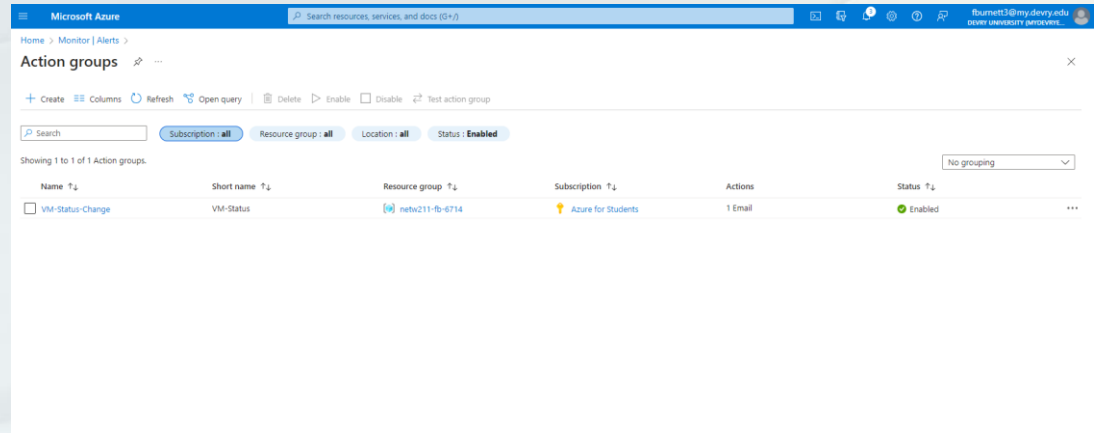


Cloud Monitoring and Automation



Setting up Action Group

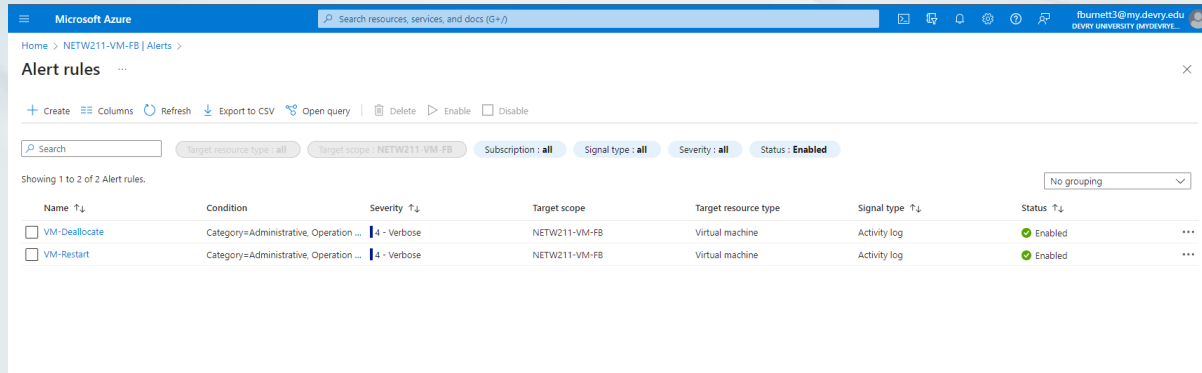
“VM-Status-Change” action group on the *Manage actions* page.



The screenshot shows the Microsoft Azure portal interface for managing action groups. The page title is "Action groups". Below the title, there are filters for "Subscription: all", "Resource group: all", "Location: all", and "Status: Enabled". A table lists the action groups, with one group visible: "VM-Status-Change". The table columns are Name, Short name, Resource group, Subscription, Actions, and Status. The "VM-Status-Change" group is associated with the "netw211-fb-6714" resource group, the "Azure for Students" subscription, and has "1 Email" action and "Enabled" status.

Name	Short name	Resource group	Subscription	Actions	Status
VM-Status-Change	VM-Status	netw211-fb-6714	Azure for Students	1 Email	Enabled

Setting up Alert Rules



The screenshot shows the Microsoft Azure portal interface for managing alert rules. The breadcrumb navigation indicates the path: Home > NETW211-VM-FB | Alerts > Alert rules. The page title is "Alert rules". Below the title, there are action buttons: Create, Columns, Refresh, Export to CSV, Open query, Delete, Enable, and Disable. A search bar is present, and filter buttons are shown for Target resource type (all), Target scope (NETW211-VM-FB), Subscription (all), Signal type (all), Severity (all), and Status (Enabled). A dropdown menu for "No grouping" is also visible. The table below shows two alert rules:

Name	Condition	Severity	Target scope	Target resource type	Signal type	Status	
<input type="checkbox"/> VM-Deallocate	Category=Administrative, Operation ...	4 - Verbose	NETW211-VM-FB	Virtual machine	Activity log	Enabled	...
<input type="checkbox"/> VM-Restart	Category=Administrative, Operation ...	4 - Verbose	NETW211-VM-FB	Virtual machine	Activity log	Enabled	...

Alert rules window showing the VM-Deallocate and VM-Restart rules.



Testing Alerts



Successfully restarted virtual machine



Successfully restarted the virtual machine 'NETW211-VM-FB'.

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

Testing Alerts cont'd



Successfully stopped virtual machine



Successfully stopped the virtual machine 'NETW211-VM-FB'.

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



Challenges

- Subnetting specifically the class system
- Understanding each role in the OSI Model

Skills Learned

- Understanding concepts of networking
- Identify cloud-centric access control techniques
- Access cloud-central security techniques
- Evaluate cloud storage technologies
- Apply common cloud maintenance tools, techniques and services



Thanks!



Do you have any questions?

faithburnett@outlook.com

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