



CLO800 - Lab 05:

Cloud Computing options with Virtual Machines

Student Lab Manual

Fall 2026

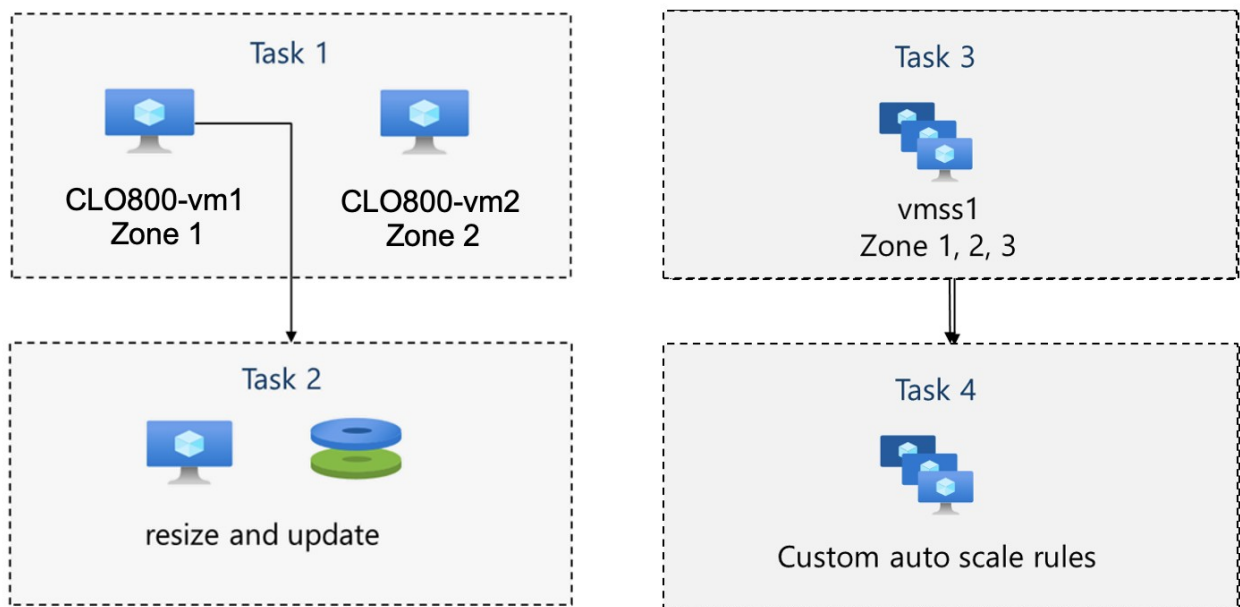
Lab scenario

In this lab, you create and compare virtual machines to virtual machine scale sets. You learn how to create, configure and resize a single virtual machine. You learn how to create a virtual machine scale set and configure autoscaling.

Objectives

In this lab, you will:

- Task 1: Deploy zone-resilient Azure virtual machines by using the Azure portal.
- Task 2: Manage compute and storage scaling for virtual machines.
- Task 3: Create and configure Azure Virtual Machine Scale Sets.
- Task 4: Scale Azure Virtual Machine Scale Sets.
- Task 5: Summary questions & review.



Submission Requirements

Please take a screenshot of your lab progress and results wherever you see this  icon alongside the instructions.

In your lab submission, include all screenshots in the order of each task. Provide a brief explanation of the significance of each screenshot. Compile everything into a single Word or PDF file. Ensure all screenshots are underlined or highlighted as shown in the provided samples. Important: Make sure your `OdI_user` account is included and underlined in all screenshots.

Instructions

Task 1: Deploy zone-resilient Azure virtual machines by using the Azure portal (10 points)

In this task, you will deploy two Azure virtual machines into different availability zones by using the Azure portal. Availability zones offer the highest level of uptime SLA for virtual machines at 99.99%. To achieve this SLA, you must deploy at least two virtual machines across different availability zones.

1. Sign in to the Azure portal - <https://portal.azure.com>.
2. Search for and select **Virtual machines**, on the **Virtual machines** blade, click **+** **Create**, and then select in the drop-down **Azure virtual machine**. Notice your other choices.
3. On the **Basics** tab, in the **Availability zone** drop down menu, place a checkmark next to **Zone 2**. This should select both **Zone 1** and **Zone 2**.

Note: This will deploy two virtual machines in the selected region, one in each zone. You achieve the 99.99% uptime SLA because you have at least two VMs distributed across at least two zones. In the scenario where you might only need one VM, it is a best practice to still deploy the VM to another zone.

4. On the Basics tab, continue completing the configuration:

Setting	Value
Subscription	the name of your Azure subscription
Resource group	<yourName>-clo800-F67-rg
Virtual machine names	<yourName>-clo800-F67-vm1 and <yourName>-clo800-F67-vm2 (After selecting both availability zones, select Edit names under the VM name field.)
Region	East US
Availability options	Availability zone
Availability zone	Zone 1, 2 (read the note about using virtual machine scale sets)
Security type	Standard
Image	Windows Server 2019 Datacenter - x64 Gen2
Azure Spot instance	unchecked
Size	Standard D2s v3
Username	localadmin
Password	Provide a secure password
Public inbound ports	None

Setting	Value
Would you like to use an existing Windows Server license?	Unchecked

5. Click **Next : Disks** • , specify the following settings (leave others with their default values):

Setting	Value
OS disk type	Standard HDD
Delete with VM	checked (default)
Enable Ultra Disk compatibility	Unchecked

6. Click **Next : Networking** • take the defaults but do not provide a load balancer.

Setting	Value
Delete public IP and NIC when VM is deleted	Checked
Load balancing options	None

7. Click **Next : Management** • and specify the following settings (leave others with their default values):

Setting	Value
Patch orchestration options	Azure orchestrated

8. Click **Next : Monitoring** • and specify the following settings (leave others with their default values):

Setting	Value
Boot diagnostics	Disable

9. Click **Next : Advanced** • , take the defaults, then click **Review** ♦ **Create**.

10. After the validation, click **Create**.

Note: Notice as the virtual machine deploys the NIC, disk, and public IP address (if configured) are independently created and managed resources.

11. Wait for the deployment to complete.

Task 2: Manage compute and storage scaling for virtual machines (20 points)

In this task, you will scale a virtual machine by adjusting its size to a different SKU. Azure provides flexibility in VM size selection so that you can adjust a VM for periods of time if it needs more (or less) compute and memory allocated. This concept is extended to disks, where you can modify the performance of the disk, or increase the allocated capacity.

1. On the <yourName>-clo800-F67-vm1 virtual machine, in the Availability + scale blade, select Size.
2. Set the virtual machine size to DS1_v2 and click Resize. When prompted, confirm the change.
3. Note: Choose another size if Standard DS1_v2 is not available. Resizing is also known as vertical scaling, up or down.
4. In the Settings area, select Disks.
5. Under **Data disks** select **+** **Create and attach a new disk**. Configure the settings (leave other settings at their default values).

Setting	Value
Disk name	vm1-disk1
Storage type	Standard HDD
Size (GiB)	32

6. Click **Apply**.
7. After the disk has been created, click **Detach** (if necessary, scroll to the right to view the detach icon), and then click **Apply**.

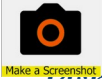
Note: Detaching removes the disk from the VM but keeps it in storage for later use.

8. Search for and select **Disks**. From the list of disks, select the **vm1-disk1** object.
Note: The **Overview** blade also provides performance and usage information for the disk.

9. In the **Settings** blade, select **Size + performance**.
10. Set the storage type to **Standard SSD**, and then click **Save**.
11. Navigate back to the **•yourName• -clo800-F67-vm1** virtual machine and select **Disks**.
12. In the **Data disk** section, select **Attach existing disks**.
13. In the **Disk name** drop-down, select **VM1-DISK1**.
14. Verify the disk is now **Standard SSD**.

15. Select **Apply** to save your changes.

Note: You have now created a virtual machine, scaled the SKU and the data disk size. In the next task we use Virtual Machine Scale Sets to automate the scaling process.



Task 3: Create and configure Azure Virtual Machine Scale Sets (20 points)

In this task, you will deploy an Azure virtual machine scale set across availability zones. VM Scale Sets reduce the administrative overhead of automation by enabling you to configure metrics or conditions that allow the scale set to horizontally scale, scale in or scale out.

1. In the Azure portal, search for and select Virtual machine scale sets and, on the **Virtual machine scale sets** blade, click **➤ Create**.
2. On the **Basics** tab of the **Create a virtual machine scale set** blade, specify the following settings (leave others with their default values) and click **Next : Spot ⌵** :

Setting	Value
Subscription	the name of your Azure subscription
Resource group	<yourName>-clo800-F67-rg
Virtual machine scale set name	<yourName>-vmss1
Region	(US)East US
Availability zone	Zones 1, 2, 3
Orchestration mode	Uniform
Security type	Standard
Image	Windows Server 2019 Datacenter - x64 Gen2
Run with Azure Spot discount	Unchecked
Size	Standard D2s_v3
Username	localadmin
Password	Provide a secure password
Already have a Windows Server license?	Unchecked

3. On the **Spot** tab, accept the defaults and select **Next : Disks ⌵**.
4. On the **Disks** tab, change the **OS disk type** to **Standard HDD** and click **Next: Networking ⌵**.

5. On the **Networking** page, click the **Create virtual network** link below the **Virtual network** textbox and create a new virtual network with the following settings (leave others with their default values). When finished, select **OK**.

Setting	Value
Name	<yourName>-vmss-vnet
Address range	10.82.0.0/20 (change what is there)
Subnet name	subnet0
Subnet range	10.82.0.0/24

6. In the **Networking** tab, click the **Edit network interface** icon to the right of the network interface entry.
7. For **NIC network security group** section, select **Advanced** and then click **Create new** under the **Configure network security group** drop-down list.
8. On the **Create network security group** blade, specify the following settings (leave others with their default values):

Setting	Value
Name	<yourName>-vmss1-nsg

9. Click **Add an inbound rule** and add an inbound security rule with the following settings (leave others with their default values):

Setting	Value
Source	Any
Source port ranges	*
Destination	Any
Service	HTTP
Action	Allow
Priority	1020
Name	allow-http

10. Click **Add** and, back on the **Create network security group** blade, click **OK**.

11. In the **Edit network interface** blade, in the **Public IP address** section, click **Enabled** and click **OK**.
12. In the **Networking** tab, under the **Load balancing** section, specify the following (leave others with their default values).

Setting	Value
Load balancing options	Azure load balancer
Select a load balancer	Create a load balancer

13. On the **Create a load balancer** page, specify the load balancer name and take the defaults. Click **Create** when you are done then **Next : Management** .

Setting	Value
Load balancer name	<yourName>-vmss-lb

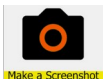
Note: Pause for a minute and review what you done. At this point, you have configured the virtual machine scale set with disks and networking. In the network configuration you have created a network security group and allowed HTTP. You have also created a load balancer with a public IP address.

14. On the **Management** tab, specify the following settings (leave others with their default values):

Setting	Value
Boot diagnostics	Disable

15. Click **Next : Health** . On the **Health** tab, review the default settings without making any changes and click **Next : Advanced** .
16. On the **Advanced** tab, click **Review** + **create**.
17. On the **Review** + **create** tab, ensure that the validation passed and click **Create**.

Note: Wait for the virtual machine scale set deployment to complete. This should take approximately 5 minutes.



Task 4: Scale Azure Virtual Machine Scale Sets (30 points)

In this task, you scale the virtual machine scale set using a custom scale rule.

1. Select **Go to resource** or search for and select the **vmss1** scale set.
2. Choose **Availability** + **Scaling** from the left side menu, then choose **Scaling**.

Scale out rule

1. Select **Custom autoscale**. Then change the **Scale mode** to **Scale based on metric**. And then select **Add a rule**.
2. Let's create a rule that automatically increases the number of VM instances. This rule scales out when the average CPU load is greater than 10% over a 1-minute period. When the rule triggers, the number of VM instances is increased by 1. These values are for demonstration and are not practical in real environments.

Setting	Value
Metric source	Current resource (<yourName>-vmss1)
Metric namespace	Virtual Machine Host
Metric name	Percentage CPU (review your other choices)
Operator	Greater than
Metric threshold to trigger scale action	10
Duration (minutes)	1
Time grain statistic	Average
Operation	Increase count by (review other choices)
Cool down (minutes)	1
Instance count	1

3. Be sure to **Save** your changes.

Scale in rule

1. During evenings or weekends, demand may decrease so it is important to create a scale in rule.
2. Let's create a rule that decreases the number of VM instances in a scale set. The number of instances should decrease when the average CPU load drops below 30% over a 10-minute period. When the rule triggers, the number of VM instances is decreased by 20%.
3. Select **Add a rule**, adjust the settings, then select **Add**.

Setting	Value
Operator	Less than
Threshold	10
Operation	decrease count by
Instance count	1

4. Be sure to **Save** your changes.

Set the instance limits

1. When your autoscale rules are applied, instance limits make sure that you do not scale out beyond the maximum number of instances or scale in beyond the minimum number of instances.
2. **Instance limits** are shown on the **Scaling** page after the rules.

Setting	Value
Minimum	2
Maximum	6
Default	2

3. Be sure to **Save** your changes
4. Run the following PowerShell command in the Cloud Shell prompt to acquire the public IP of the load balancer and generate requests to initiate a scale out and increase the number of VMs running.

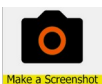
```
$rgName = '<yourName>-clo800-F67-rg'

$lbpipName = '<yourName>-vmss-lb-publicip'

$pip = (Get-AzPublicIpAddress -ResourceGroupName $rgName -Name $lbpipName).IpAddress

while ($true) { Invoke-WebRequest -Uri "http://$pip" }
```

5. On the **•yourName• -vmss1** page, select **Instances**. This is where you would monitor the number of virtual machine instances.



Make a Screenshot

Task 5: Summary Questions & Review (20 points)

Please answer and submit the following questions with your lab report:

1. Describe the main focus of this lab and outline the new skills or concepts you learned during this Azure lab session.
2. What challenges did you encounter during this lab, and how did you overcome them?
3. How do the tasks performed in this lab enhance your understanding of Azure networking?
4. In what ways can you apply the knowledge gained from this lab to real-world scenarios? Please provide specific examples.

To help in your review and comprehension of the lab's key concepts and tasks, please consider the following questions. (submission is optional)

Task 1: Deploy Zone-Resilient Azure Virtual Machines

1. What are the benefits of deploying zone-resilient virtual machines in Azure?
2. Describe the steps you followed to deploy a zone-resilient virtual machine using the Azure portal.
3. How does Azure ensure high availability for zone-resilient virtual machines?

Task 2: Manage Compute and Storage Scaling for Virtual Machines

1. What are the key considerations when scaling compute resources for a virtual machine?
2. Explain how you can manage storage scaling for a virtual machine in Azure.
3. What tools or features in Azure help you monitor and adjust compute and storage resources?

Task 3: Create and Configure Azure Virtual Machine Scale Sets

1. What is an Azure Virtual Machine Scale Set, and why is it useful?
2. Outline the process of creating and configuring a Virtual Machine Scale Set in Azure.
3. How do you ensure that the instances in a scale set are properly configured and updated?

Task 4: Scale Azure Virtual Machine Scale Sets

1. What are the different methods to scale Azure Virtual Machine Scale Sets?
2. Describe a scenario where you would need to scale out versus scale in a Virtual Machine Scale Set.
3. How does Azure handle load balancing and distribution of traffic among instances in a scale set?

Clean your resources

Note: Remember to delete any Azure resources created for this lab after capturing all your information and screenshots. Removing unused resources ensures you will not have unexpected charges and helps you manage your Azure credit for the course. Delete all resource groups except the **Odl-Seneca-lab** default resource group.

These screenshots are just samples. Your screenshots may vary, but they should include similar details underlined.

Task 1:

Microsoft Azure

Search resources, services, and docs (G+/)

Copilot

DEFAULTE DIRECTORY

Home > Virtual machines

Default Directory

+ Create

Switch to classic

Reservations

Manage view

Refresh

Export to CSV

Open query

Assign tags

Start

Restart

Stop

Delete

Filter for any field...

Subscription equals all

Type equals all

Resource group equals all

Location equals all

Add filter

Showing 1 to 2 of 2 records.

No grouping

List view

☐	Name	Subscription	Resource group	Location	Availability zone	Status	Operating system	Size	Public IP address
☐	myName-mst400-f24-vm1	MSDN Platforms Subs...	myName-mst400-f24-...	East US	1	Running	Windows	Standard_D2s_v3	57.151.25.184
☐	myName-mst400-f24-vm2	MSDN Platforms Subs...	myName-mst400-f24-...	East US	2	Running	Windows	Standard_D2s_v3	-

Task 2:

Microsoft Azure

Search resources, services, and docs (G+/)

Copilot

DEFAULTE DIRECTORY

Home > Virtual machines > myName-mst400-f24-vm1

Virtual machines

Default Directory

+ Create

Switch to classic

Filter for any field...

Name

myName-mst400-f24-vm1

myName-mst400-f24-vm2

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Connect

Networking

Settings

Disks

Extensions + applications

Operating system

Configuration

Advisor recommendations

Properties

Locks

Availability + scale

Size

Availability + scaling

myName-mst400-f24-vm1 | Disks

Virtual machine

Search

Refresh

Additional settings

Feedback

Troubleshoot

OS disk

Swap OS disk

Disk name	Storage type	Size (GiB)	Max IOPS	Max throughput (...)
myName-mst400-f24-vm1_Os	Standard HDD LRS	127	500	60

Data disks

Filter by name

Showing 1 of 1 attached data disks

Create and attach a new disk

Attach existing disks

LUN	Disk name	Storage type	Size (GiB)	Max IOPS	Max thr
0	vm1-disk1	Standard SSD LRS	32	500	100

Apply

Discard changes

Task 3:

Microsoft Azure

Search resources, services, and docs (G+)

Copilot

DEFAULT DIRECTORY

Home > CreateVmss-MicrosoftWindowsServer.WindowsServer-2-20240809153417 | Overview >

myName-vmss1

Virtual machine scale set

Search

MoveStartRestartStopHibernateReimageDeleteRefreshFeedback

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Instances

Networking

Settings

Availability + scale

Security

Operations

Monitoring

Automation

Help

Essentials

Resource group (move) : myName-mst400-f24-rg

Status : 2 out of 2 succeeded

Location : East US (Zone 1, 2, 3)

Subscription (move) : MSDN Platforms Subscription

Subscription ID :

Operating system : Windows

Size : Standard_D2s_v3 (2 instances)

Public IP address : 51.8.41.75

Public IP address (IPv6) :

Virtual network/subnet : myName-vmss-vnet/subnet0

Orchestration mode : Uniform

Time created : 8/9/2024, 8:00 PM UTC

Tags (edit) : Add tags

Properties

Monitoring

Capabilities (6)

Recommendations

Tutorials

Virtual machine profile

Operating system : Windows

Capacity reservation group- :

Hibernation : Disabled

Azure Spot

Azure Spot : Disabled

Availability + scaling

Availability zone (edit) : 1, 2, 3

Proximity placement : -

Networking

Public IP address : 51.8.41.75

Public IP address (IPv6) : -

Virtual network/subnet : myName-vmss-vnet/subnet0

Size

Size : Standard_D2s_v3

vCPUs : 2

RAM : 8 GiB

Source image details

Task 4:

Microsoft Azure

Search resources, services, and docs (G+)

Copilot

DEFAULT DIRECTORY (DRKAZEM...)

Home > myName-vmss1

myName-vmss1

Virtual machine scale set

Search

StartRestartStopHibernateReimageDeleteUpgradeRefreshProtection

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Instances

Networking

Network settings

Load balancing

Application security

Search virtual machine instances

Instance	Computer name	Status	Protection policy	Provisioning state	Health state	Latest model
☐ myName-vmss1_12	myname-vm00000C	Running		Succeeded		Yes
☐ myName-vmss1_17	myname-vm00000H	Running		Succeeded		Yes
☐ myName-vmss1_18	myname-vm00000I	Running		Succeeded		Yes

Switch to Bash

RestartManage filesNew sessionEditorWeb previewSettingsHelp

```
PS /home/drkazemi> $rgName = 'myName-mst400-f24-rg'
PS /home/drkazemi> $lbpipName = 'myName-vmss-lb-publicip'
PS /home/drkazemi> $pip = (Get-AzPublicIpAddress -ResourceGroupName $rgName -Name $lbpipName).IpAddress
PS /home/drkazemi> while ($true) { Invoke-WebRequest -Uri "http://$pip" }
```