Microsoft Cloud Workshop

Building a resilient IaaS architecture
Hands-on lab step-by-step
June 2018

Contents

Building a resilient IaaS architecture hands-on lab step-by-step

Abstract and learning objectives

In this hands-on lab, you will deploy a pre-configured IaaS environment and then redesign and update it to account for resiliency and in general high availability. Throughout the hands-on lab you will use various configuration options and services to help build a resilient architecture.

At the end of this workshop, you will be better able to design and use the following services:

- The use of availability sets

- The use of Managed Disks

- Design principles when provisioning storage to VMs

- Effective employment of Azure Backup to provide point-in-time recovery

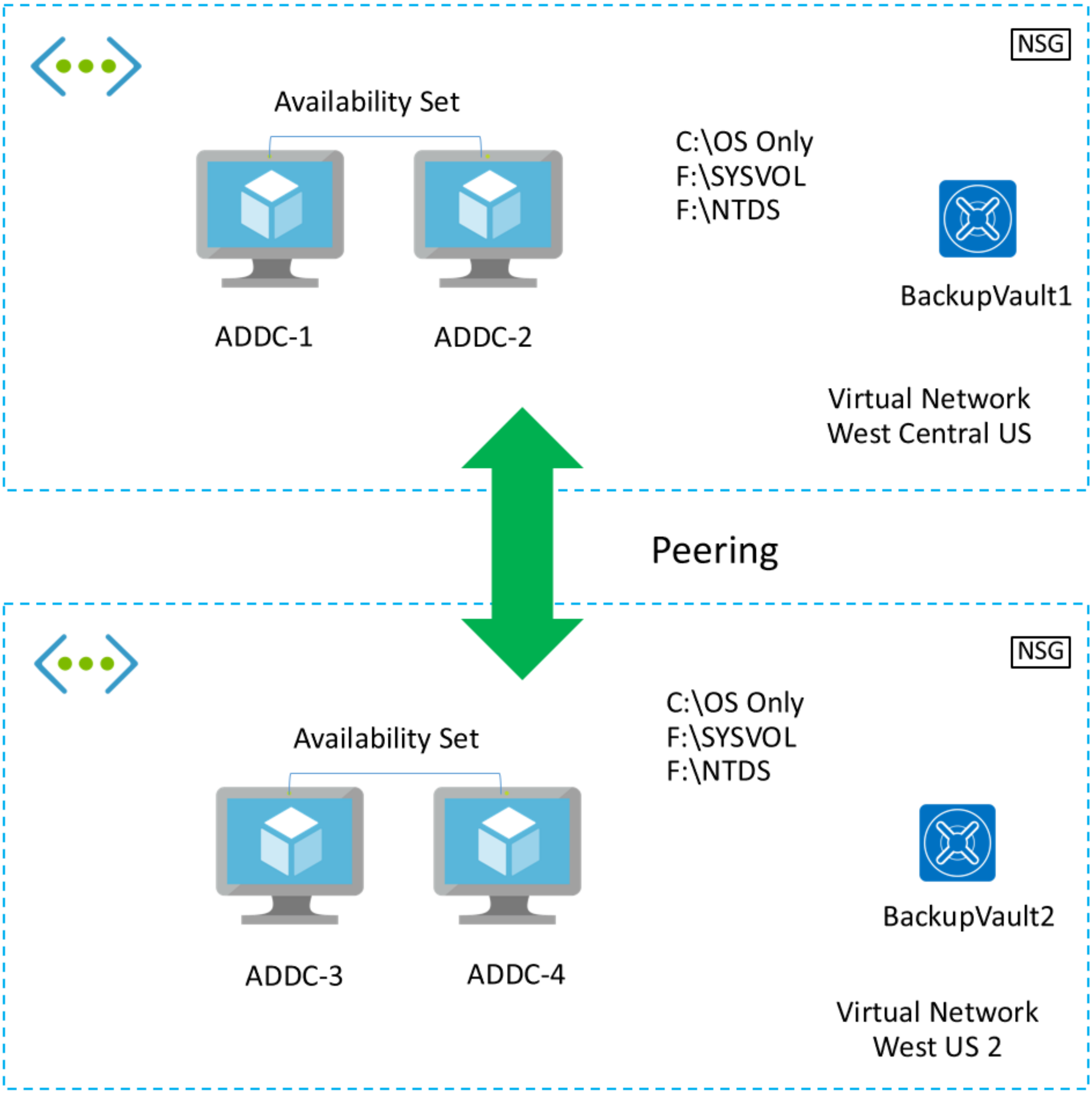
- SQL Server Always On Availability Groups

Overview

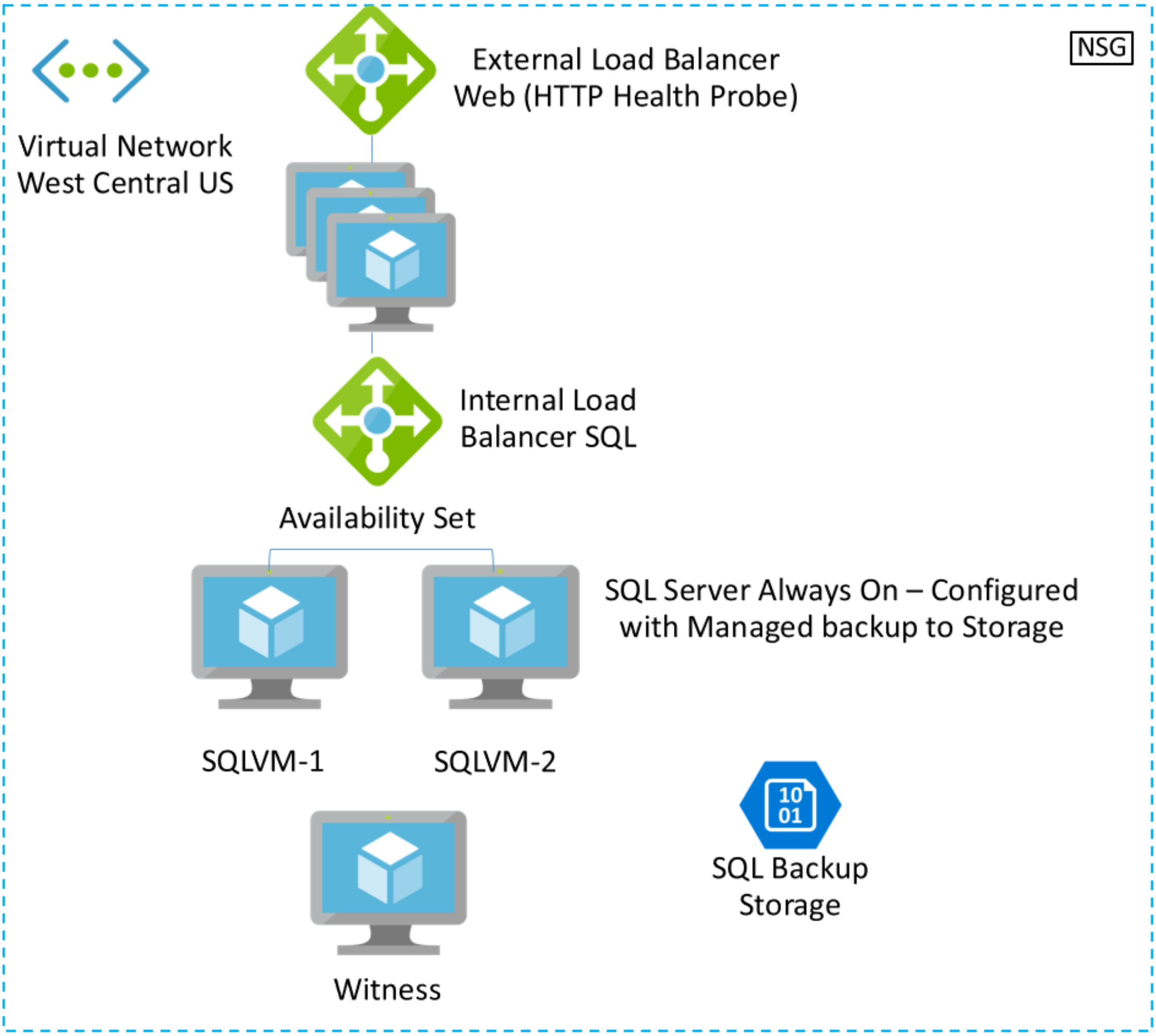
Contoso has asked you to deploy their infrastructure in a resilient manner to insure their infrastructure will be available for their users and gain an SLA from Microsoft.

Solution architecture

Highly resilient deployment of Active Directory Domain Controllers in Azure.



Deployment of a web app using scale sets, and a highly available SQL Always On deployment.



Requirements

1. Microsoft Azure Subscription

2. Virtual Machine Built during this hands-on lab or local machine with the following:

   a. Visual Studio 2017 Community or Enterprise Edition

   b. Latest Azure PowerShell Cmdlets

   c. https://azure.microsoft.com/en-us/downloads/

   d. Ensure you reboot after installing the SDK or Azure PowerShell will not work correctly

Help references

Description	Links

Authoring ARM Templates	https://azure.microsoft.com/en-us/documentation/articles/resource-group-authoring-templates/
Virtual Machine Scale Set Samples	https://github.com/gbowerman/azure-myriad
Azure Quick Start Templates	https://github.com/Azure/azure-quickstart-templates
Network Security Groups	https://azure.microsoft.com/en-us/documentation/articles/virtual-networks-nsg/
Managed Disks	https://azure.microsoft.com/en-us/services/managed-disks
Always-On Availability Groups	https://docs.microsoft.com/en-us/sql/database-engine/availability-groups/windows/overview-of-always-on-availability-groups-sql-server?view=sql-server-2017
SQL Server Managed Backup to Azure	https://docs.microsoft.com/en-us/sql/relational-databases/backup-restore/sql-server-managed-backup-to-microsoft-azure?view=sql-server-2017
Virtual Network Peering	https://docs.microsoft.com/en-us/azure/virtual-network/virtual-network-peering-overview
Azure Backup	https://azure.microsoft.com/en-us/services/backup/

Exercise 1: Prepare connectivity between regions

Duration: 30 minutes

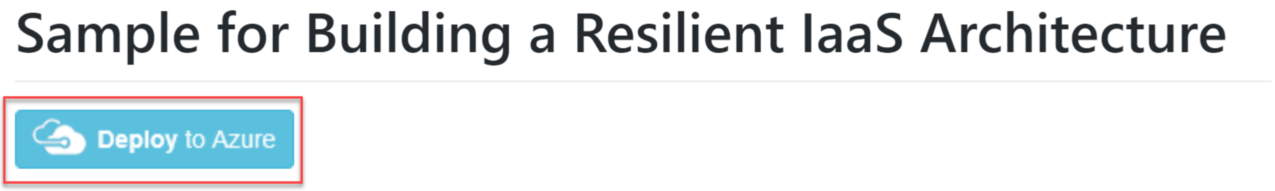
Contoso is planning to deploy infrastructure in multiple regions in Azure to provide infrastructure closer to their employees in each region as well as the ability to provide additional resiliency in the future for certain workloads. In this exercise, you will configure connectivity between the two regions.

Task 1: Deploy the lab environment

1. Login to the Azure portal (https://portal.azure.com) with the credentials that you want to deploy the lab environment to

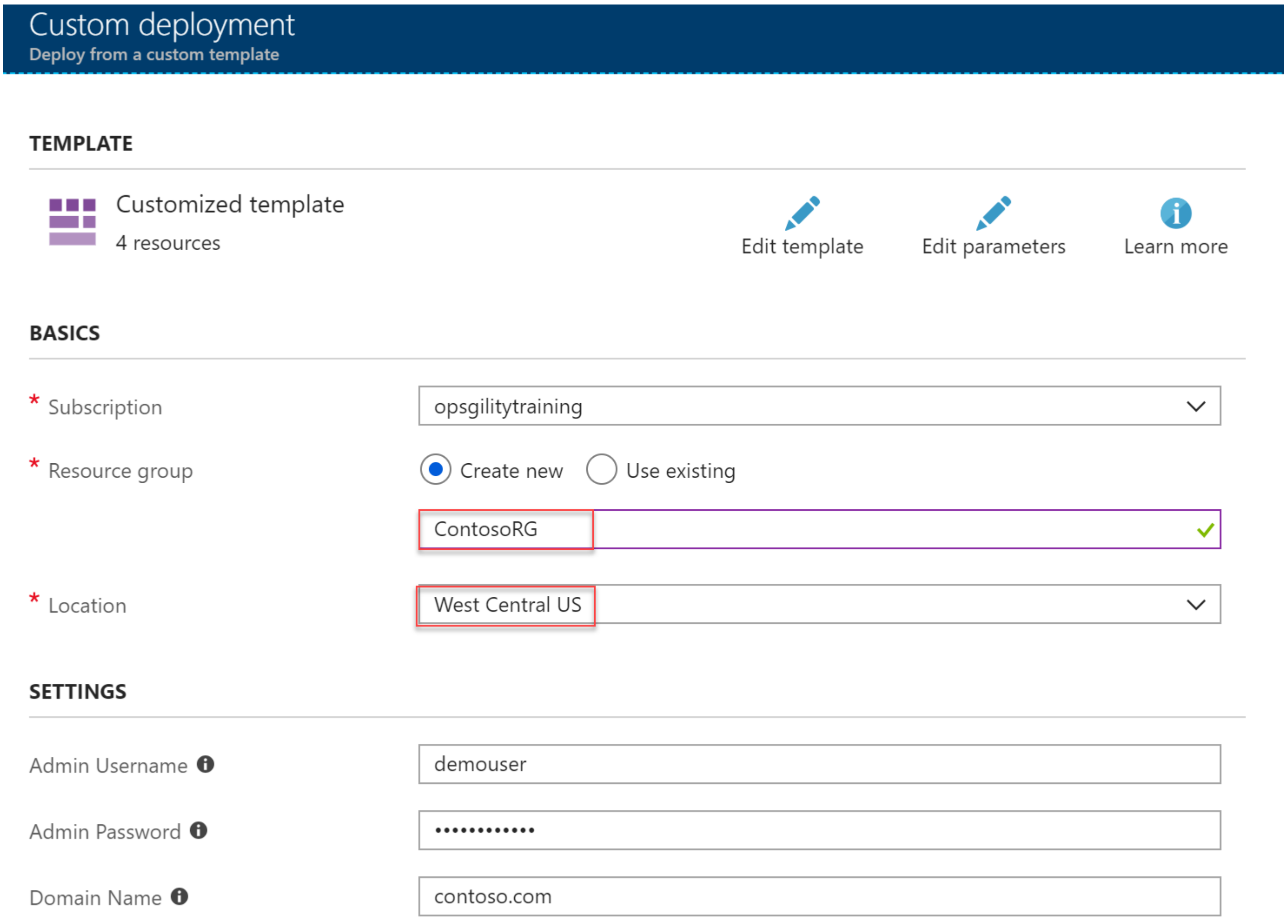
2. In a separate tab, navigate to: https://github.com/opsgility/cw-building-resilient-iaas-architecture

3. Click the button **Deploy to Azure**



Sample for Building a Resilient IaaS Architecture

4. Specify the Resource group name as **ContosoRG** and the region as **West Central US**, **check the two check boxes** on the page and click **Purchase**



Custom deployment
Deploy from a custom template

TEMPLATE

Customized template
4 resources

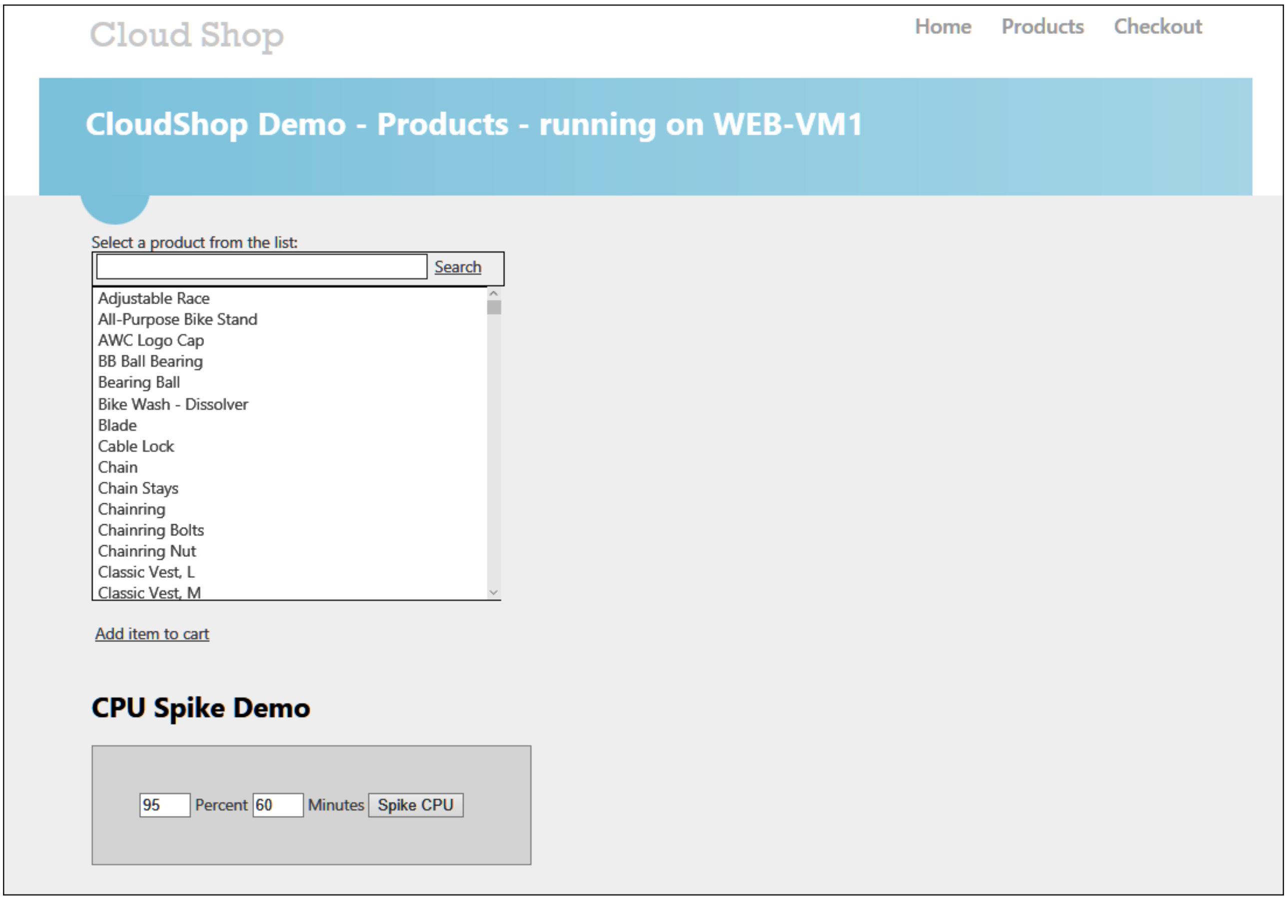
BASICS

* Subscription	opsgilitytraining
* Resource group	● Create new ○ Use existing
	ContosoRG ✓
* Location	West Central US

SETTINGS

Admin Username	demouser
Admin Password	••••••••••••
Domain Name	contoso.com

5. Once the deployment is successful, validate the deployment by opening the **CloudShopWeb** virtual machine and navigating your browser to its public IP address



CloudShop Demo - Products - running on WEB-VM1

Select a product from the list:

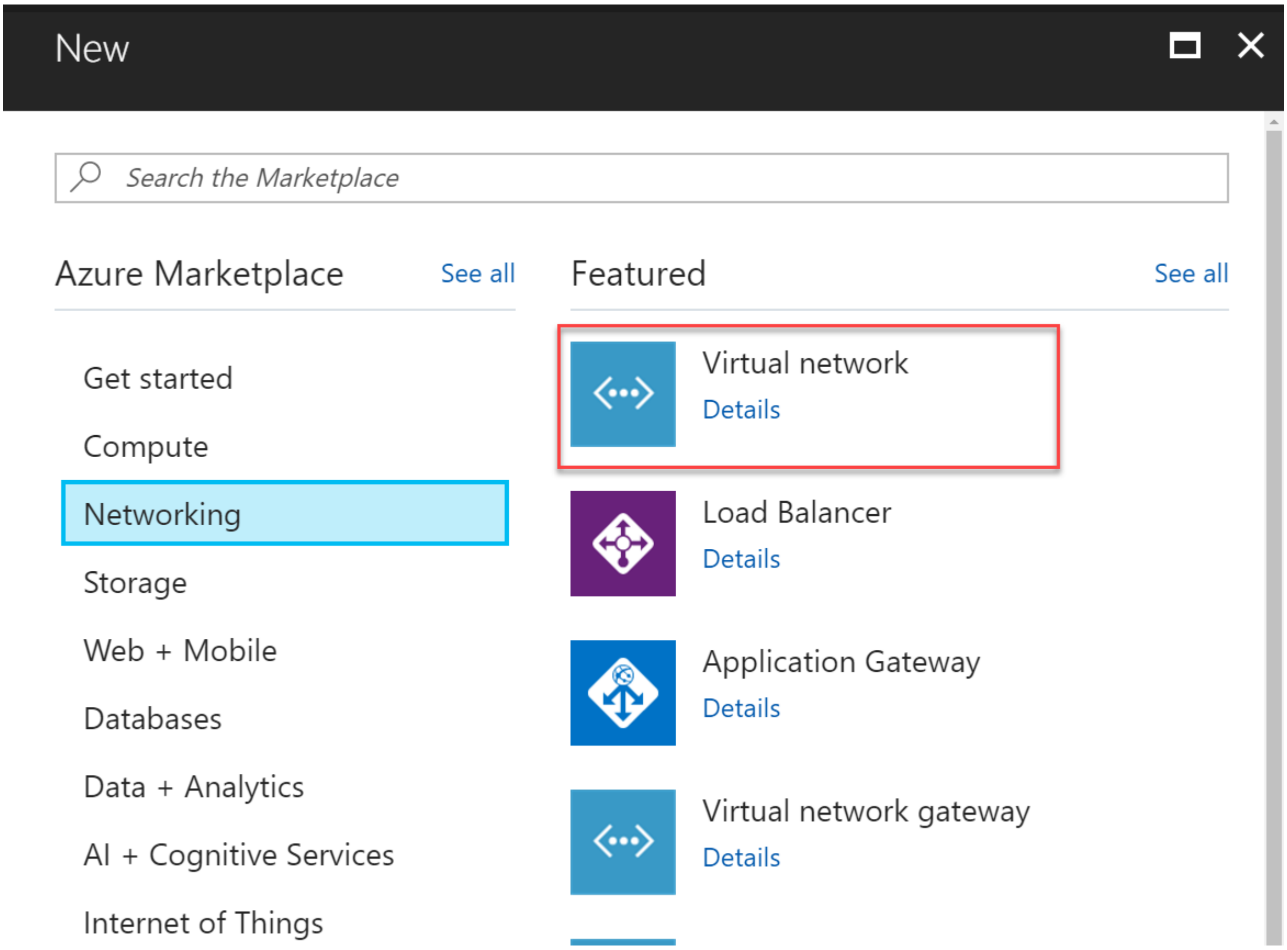
Adjustable Race
All-Purpose Bike Stand
AWC Logo Cap
BB Ball Bearing
Bearing Ball
Bike Wash - Dissolver
Blade
Cable Lock
Chain
Chain Stays
Chainring
Chainring Bolts
Chainring Nut
Classic Vest, L
Classic Vest, M

CPU Spike Demo

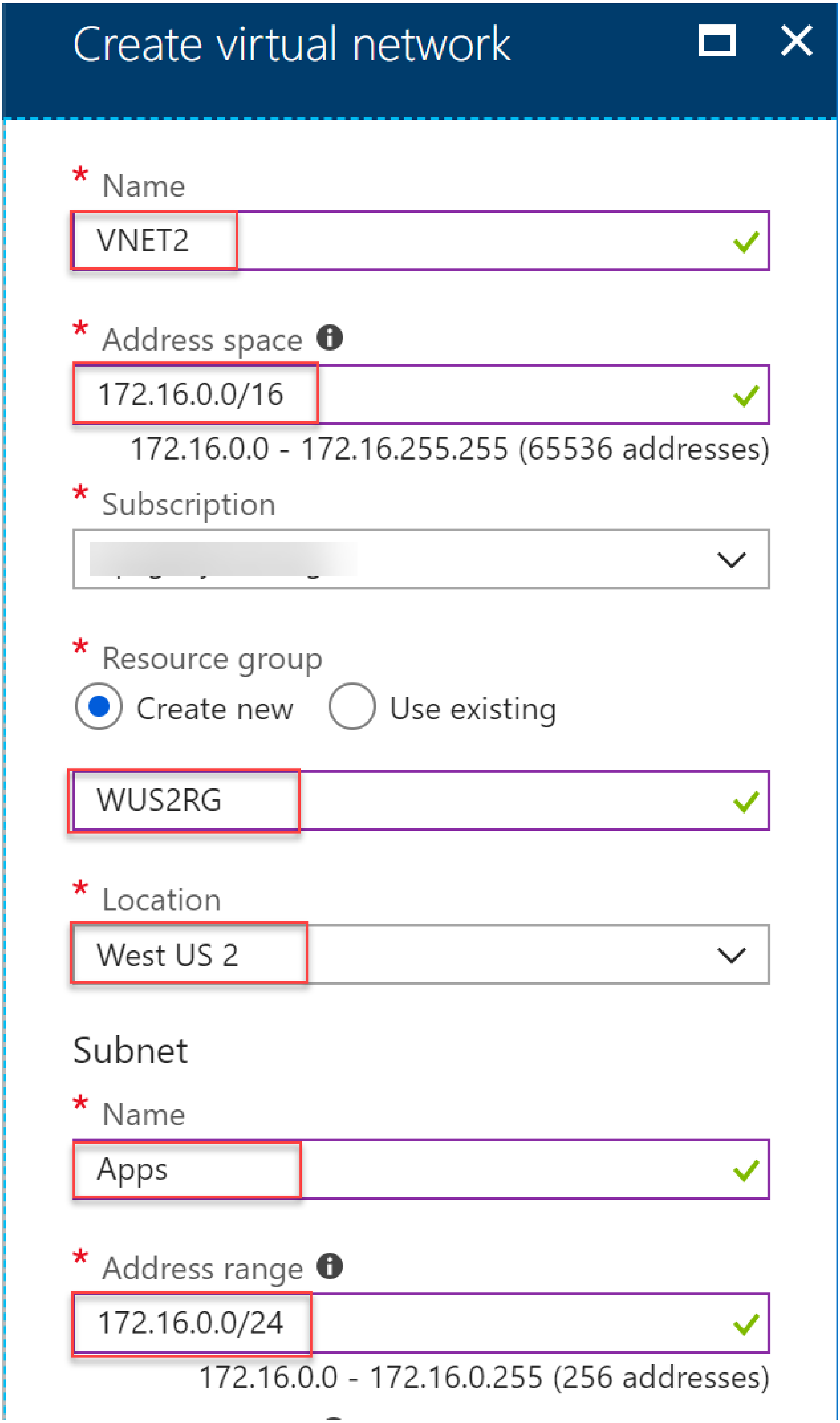
95 Percent 60 Minutes

Task 2: Create a VNET in the second region

1. Browse to the Azure portal and authenticate at https://portal.azure.com/
2. In the left pane, click **+ Create Resource**
3. In the **New** blade, select **Networking > Virtual Network**



4. For the **Create virtual network** settings, enter the following information:
   - Name: **VNET2**
   - Address space: **172.16.0.0/16**
   - Subnet name: **Apps**
   - Subnet address range: **172.16.0.0/24**
   - Subscription: **Choose your subscription**
   - Resource group: **Create new -- WUS2RG**
   - Location: **West US 2**
   - Pin to dashboard: **Check the checkbox**
   - Click the **Create** button to continue



Create virtual network

* Name

VNET2 ✓

* Address space

172.16.0.0/16 ✓

172.16.0.0 - 172.16.255.255 (65536 addresses)

* Subscription

* Resource group

● Create new ○ Use existing

WUS2RG ✓

* Location

West US 2

Subnet

* Name

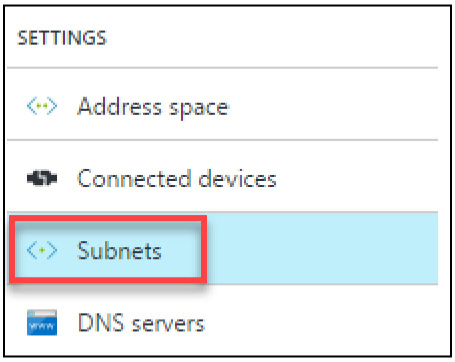
Apps ✓

* Address range

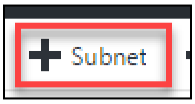
172.16.0.0/24 ✓

172.16.0.0 - 172.16.0.255 (256 addresses)

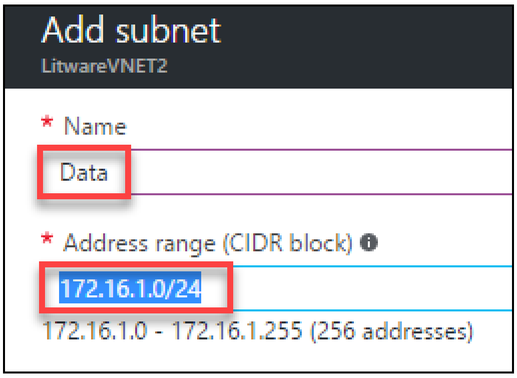
5. Once the deployment is complete, add two more subnets to the virtual network. To do this, select the **Subnets >** icon in the **Settings** area.



6. Click the **+ Subnet** option, and enter the following settings:



   - Name: **Data**
   - Address range (CIDR block): **172.16.1.0/24**
   - Click the **OK** button to add this subnet:



Add subnet

LitwareVNET2

* Name

Data

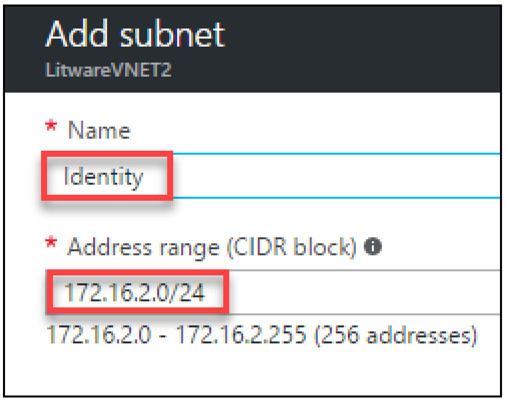
* Address range (CIDR block)

172.16.1.0/24

172.16.1.0 - 172.16.1.255 (256 addresses)

7. Once the subnet is created successfully, repeat the above step for an **Identity** subnet with the following settings:

   - Name: **Identity**
   - Address range (CIDR block): **172.16.2.0/24**
   - Click the **OK** button to add this subnet:



Add subnet

LitwareVNET2

* Name

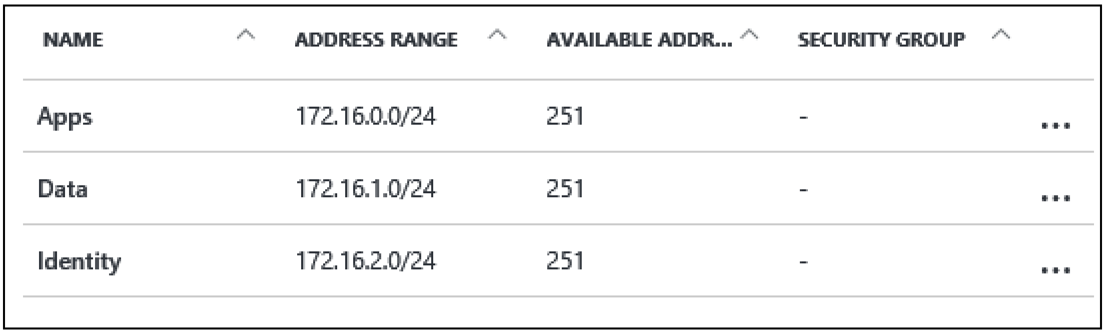
Identity

* Address range (CIDR block)

172.16.2.0/24

172.16.2.0 - 172.16.2.255 (256 addresses)

8. The subnets will look like this once complete:

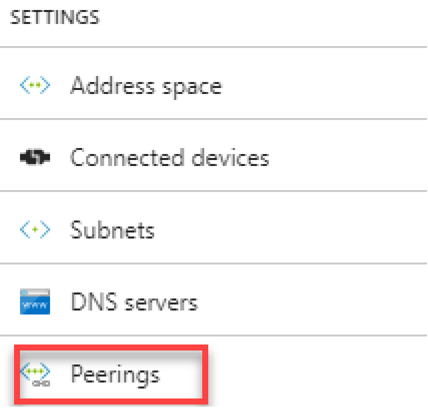


NAME	ADDRESS RANGE	AVAILABLE ADDR...	SECURITY GROUP	
Apps	172.16.0.0/24	251	-	...
Data	172.16.1.0/24	251	-	...
Identity	172.16.2.0/24	251	-	...

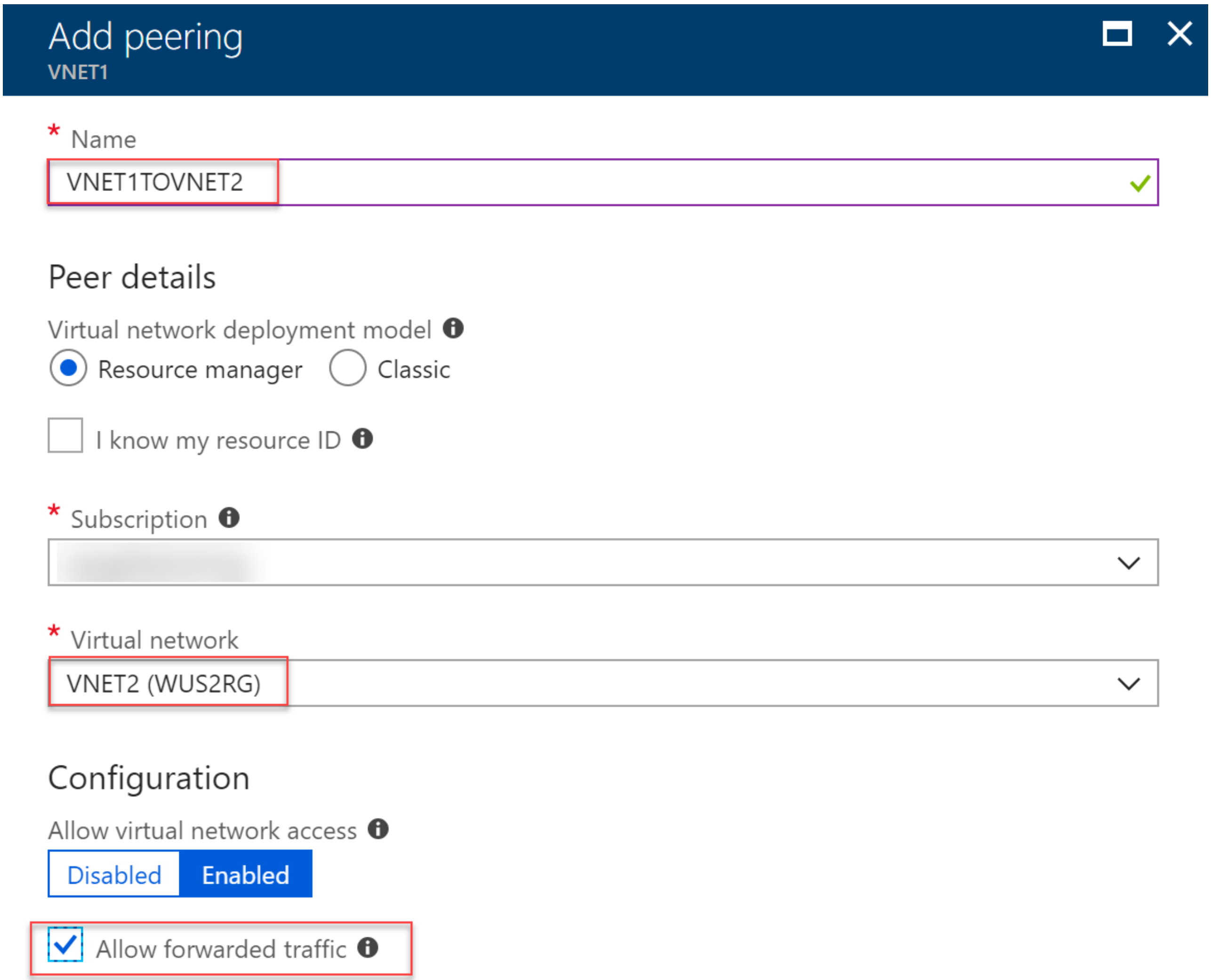
Task 3: Configure VNET Peering between region

1. Open the first virtual network (VNET1) by clicking **All Services -> Virtual networks** and clicking the name

2. Click on **Peerings** and click **+Add**



3. Name the peering, **VNET1TOVNET2** and change the Virtual network dropdown to **VNET2** click **Allow forwarded traffic,** and then click **OK**



Add peering
VNET1

* Name
VNET1TOVNET2

Peer details

Virtual network deployment model
● Resource manager ○ Classic

□ I know my resource ID

* Subscription

* Virtual network
VNET2 (WUS2RG)

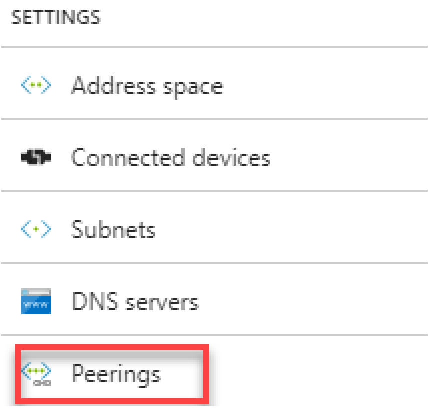
Configuration

Allow virtual network access
Disabled **Enabled**

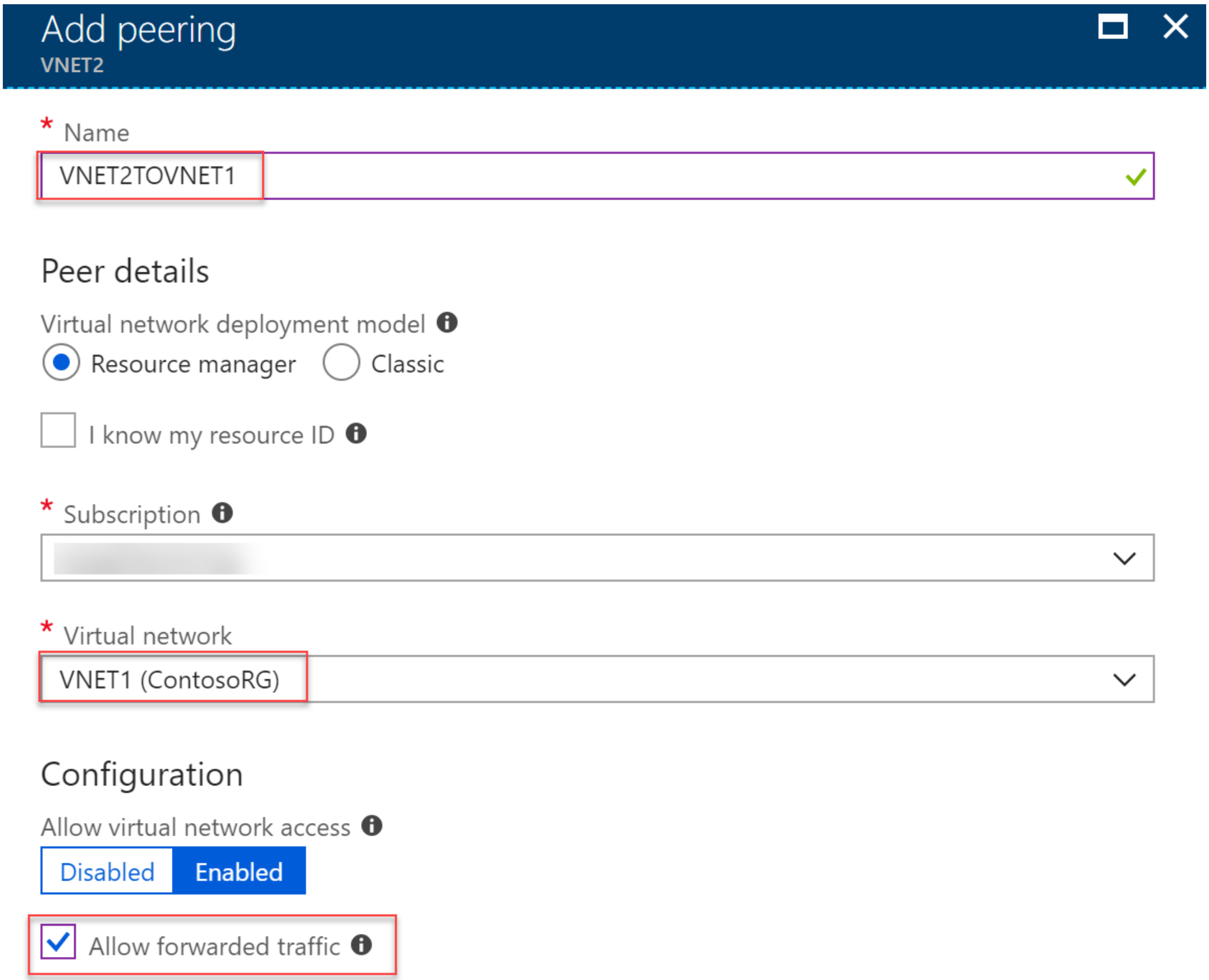
☑ Allow forwarded traffic

4. Open the second virtual network (LitewareVNET2) by clicking **All Services -> Virtual networks** and clicking the name

5. Click on **Peerings** and click **+Add**



6. Name the peering, **VNET2TOVNET1** and change the Virtual network dropdown to **VNET1** click **Allow forwarded traffic,** and then click **OK**



Add peering
VNET2

* Name
VNET2TOVNET1

Peer details

Virtual network deployment model
● Resource manager ○ Classic

□ I know my resource ID

* Subscription

* Virtual network
VNET1 (ContosoRG)

Configuration

Allow virtual network access
Disabled **Enabled**

☑ Allow forwarded traffic

Exercise 2: Build the DCs in for resiliency

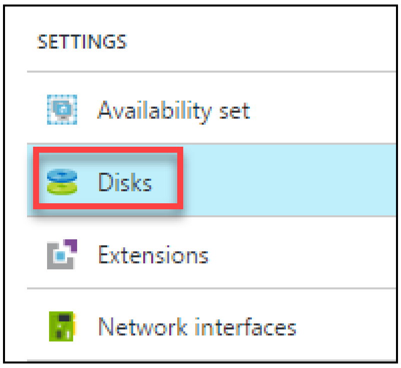
Duration: 30 minutes

In this exercise, you will deploy Windows Server Active Directory configured for resiliency using Azure Managed Disks and Availability Sets in the primary region. You will then deploy additional domain controllers in a second region for future expansion of the Azure footprint.

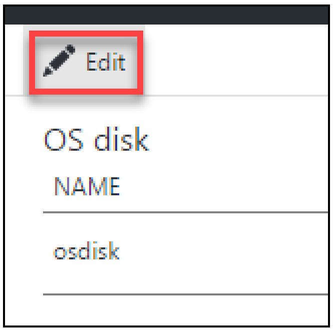
Task 1: Create Resilient Active Directory Deployment

In this task, you will change the disk cache settings on the existing domain controller **Read Only** to avoid corruption of Active Directory database.

1. Select **Virtual machines** in the left menu pane of the Azure portal
2. Click on **ADVM**, and in the **Settings** area, select **Disks**

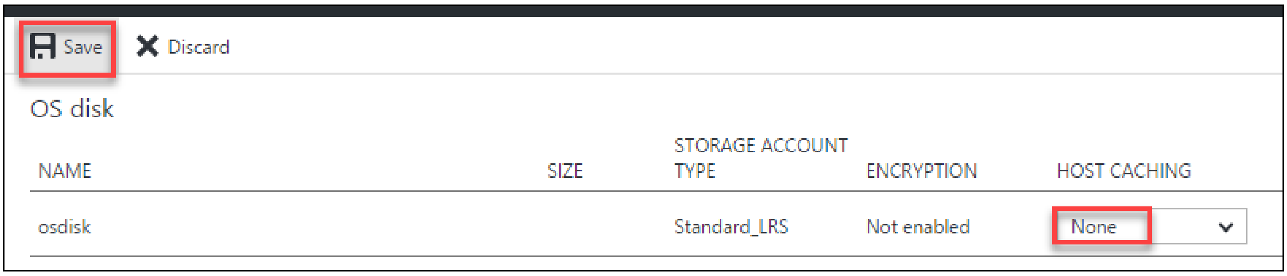


3. On the Disks blade, click **Edit**



NAME
osdisk

4. Change the **Host caching** from **Read/Write** to **None** via the drop-down option, and click the **Save** icon

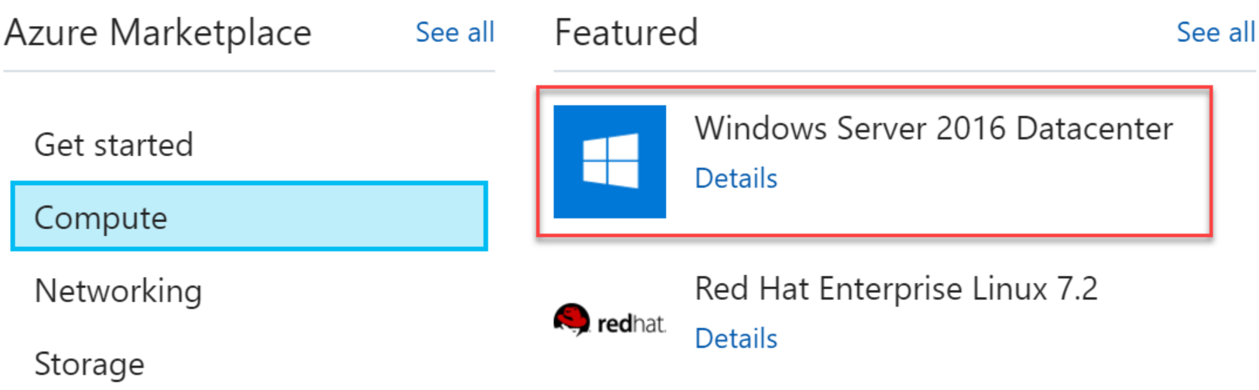


NAME	SIZE	STORAGE ACCOUNT TYPE	ENCRYPTION	HOST CACHING
osdisk		Standard_LRS	Not enabled	None

Note: In production, we would not want to have any OS drives that do not have read/write cache enabled. This machine will be decommissioned, but first, we want to make sure the AD Database and SYSVOL will not be corrupted during our updates.

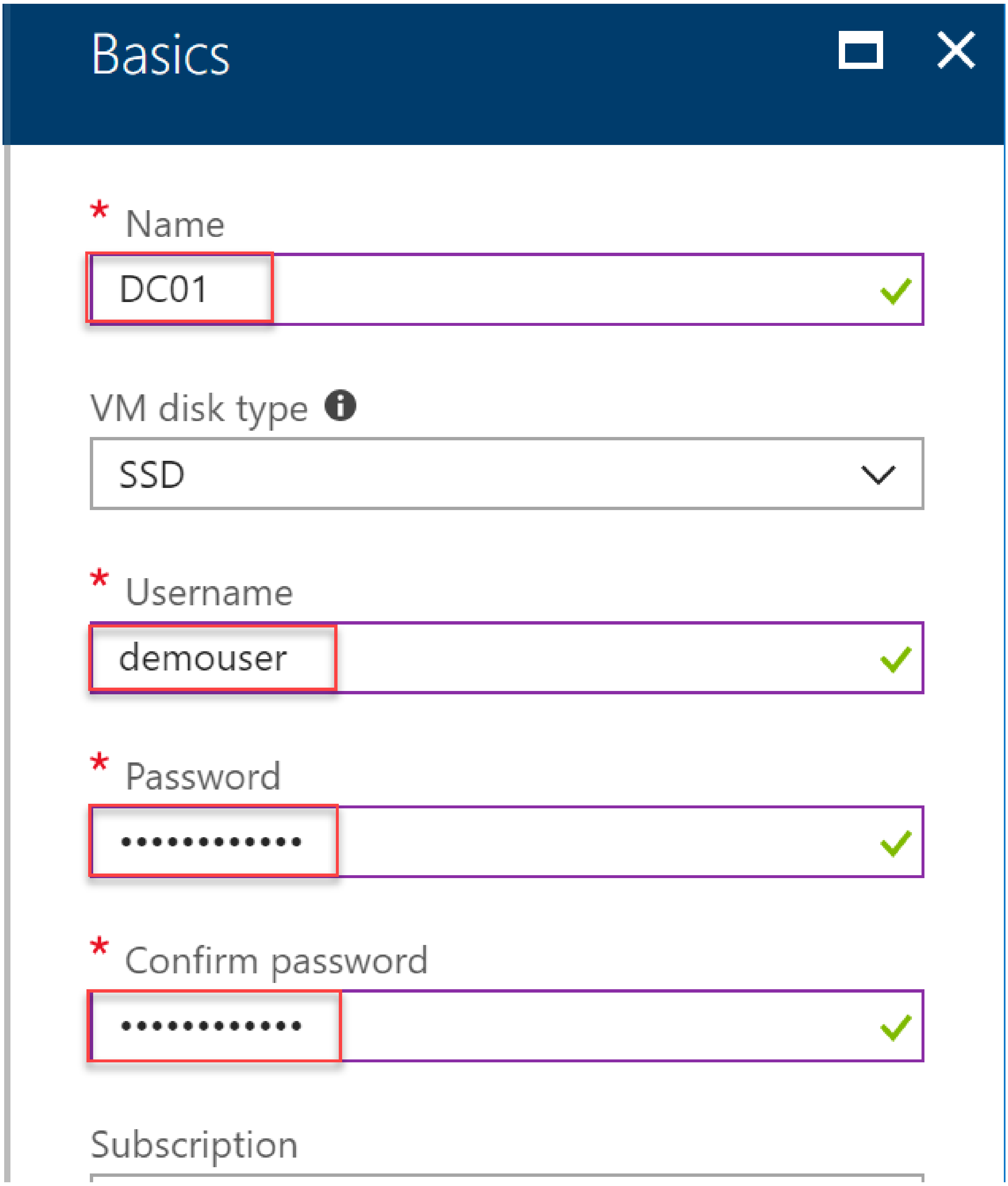
5. In the left pane, click **+ Create Resource**

6. In the **New** blade, select **Compute > Windows Server 2016**



7. In the **Create virtual machine** blade, enter the **Basics** information:

- Name: **DC01**
- VM disk type: **SSD**
- Username: **demouser**
- Password: **demo@pass123**
- Confirm password: **demo@pass123**
- Subscription: **Select your subscription**
- Resource group: **Create New - ADRG**
- Location: **West Central US**
- Click the **OK** button to continue



Basics

* Name
DC01 ✓

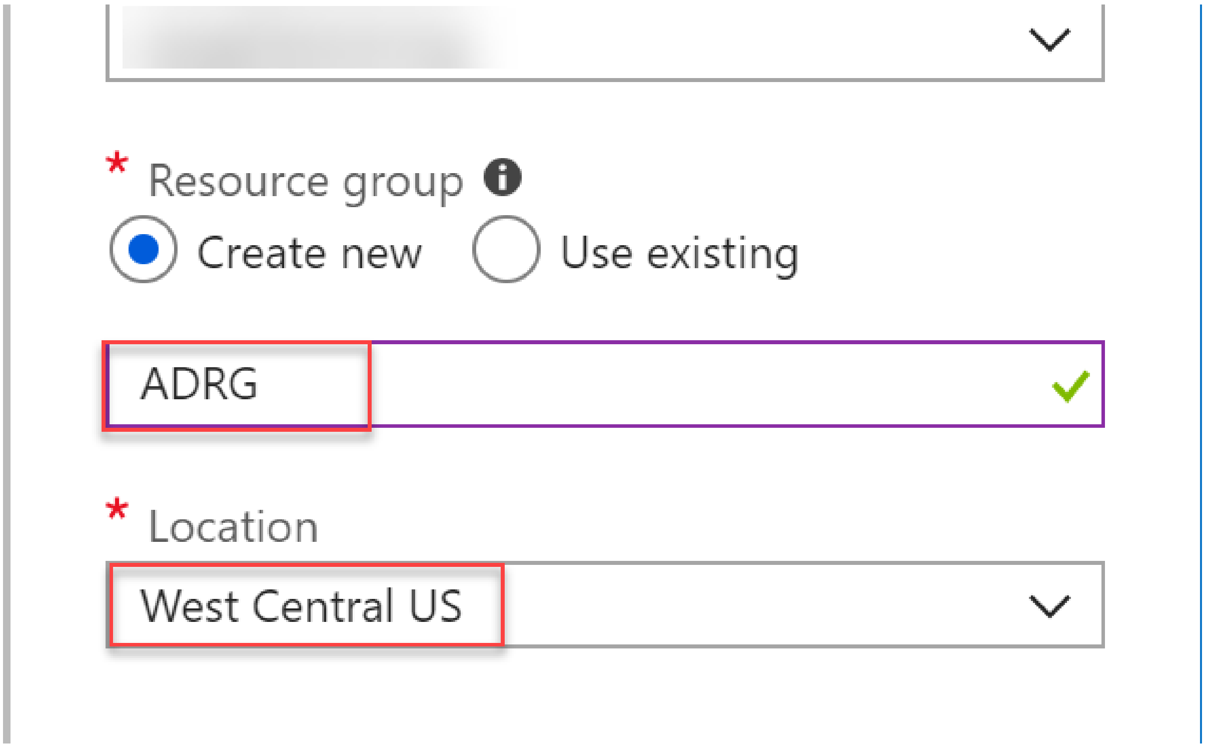
VM disk type
SSD

* Username
demouser ✓

* Password
•••••••••••• ✓

* Confirm password
•••••••••••• ✓

Subscription



* Resource group

● Create new ○ Use existing

ADRG

* Location

West Central US

8. For the **Size**, select **DS1_V2**. You may have to select the **View All** option if it is not one of the recommended sizes.

9. In the **Settings** options, choose the following configuration:

    - Storage Use Managed Disks: **Yes**
    - Virtual Network: **Click the name to choose VNET1**
    - Subnet: **Choose Identity as the subnet**
    - Availability set: **Create new, ADAV**
    - Auto-shutdown: **Off**
    - Guest OS Diagnostics: **Enabled**
    - Backup: **Enabled**
    - Recovery Services Vault: **Create New -> BackupVault**
    - Resource Group: **BackupVaultRG**
    - Leave all other settings: **Default**
    - Then, click the **OK** button to continue to the **Summary**

    > **Note**: Backup with a Domain Controller is a supported scenario. Care should be taken on restore. For more information see the following: https://docs.microsoft.com/en-us/azure/backup/backup-azure-arm-restore-vms#backup-for-restored-vms

    There will be a final validation and when this is passed, click the **Create** button to complete the deployment.

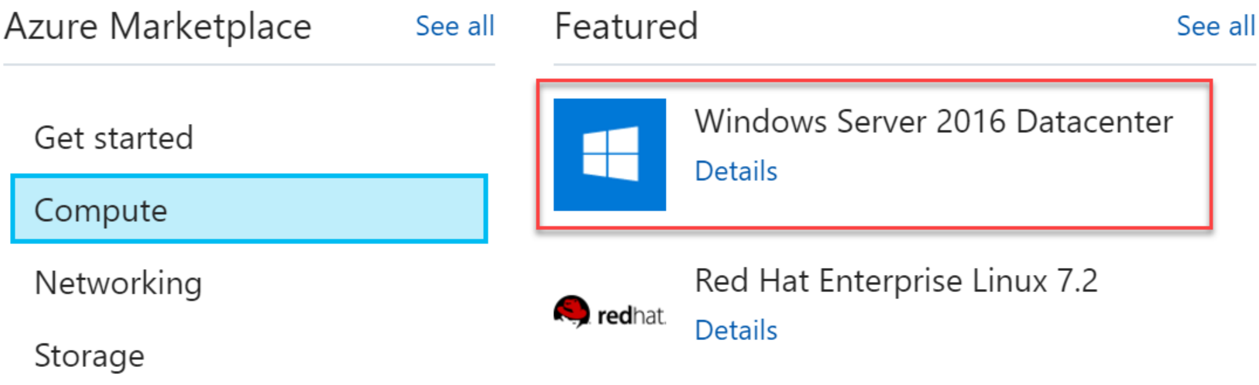
10. Give the deployment a few minutes to build the Availability Set resource. Then, repeat those steps to create **DC02**, as that will be another Domain Controller making sure to place it in the **ADAV** availability set and the existing **BackupVault**.

Task 2: Create the Active Directory deployment in the second region

In this task, you will deploy Active Directory in the second region, so identity is available for new workloads.

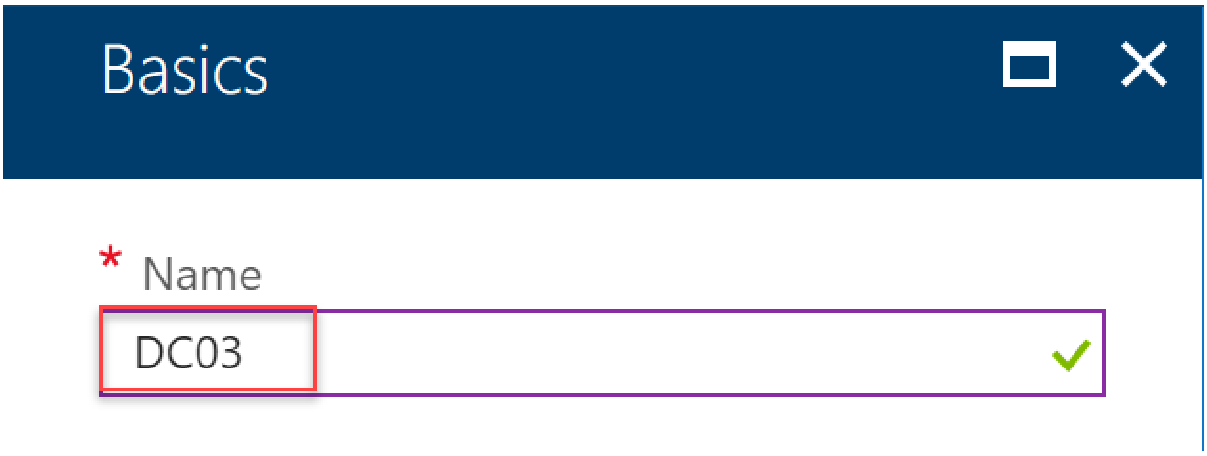
1. In the left pane, click **+ Create Resource**

2. In the **New** blade, select **Virtual Machines > Windows Server 2016 Datacenter**



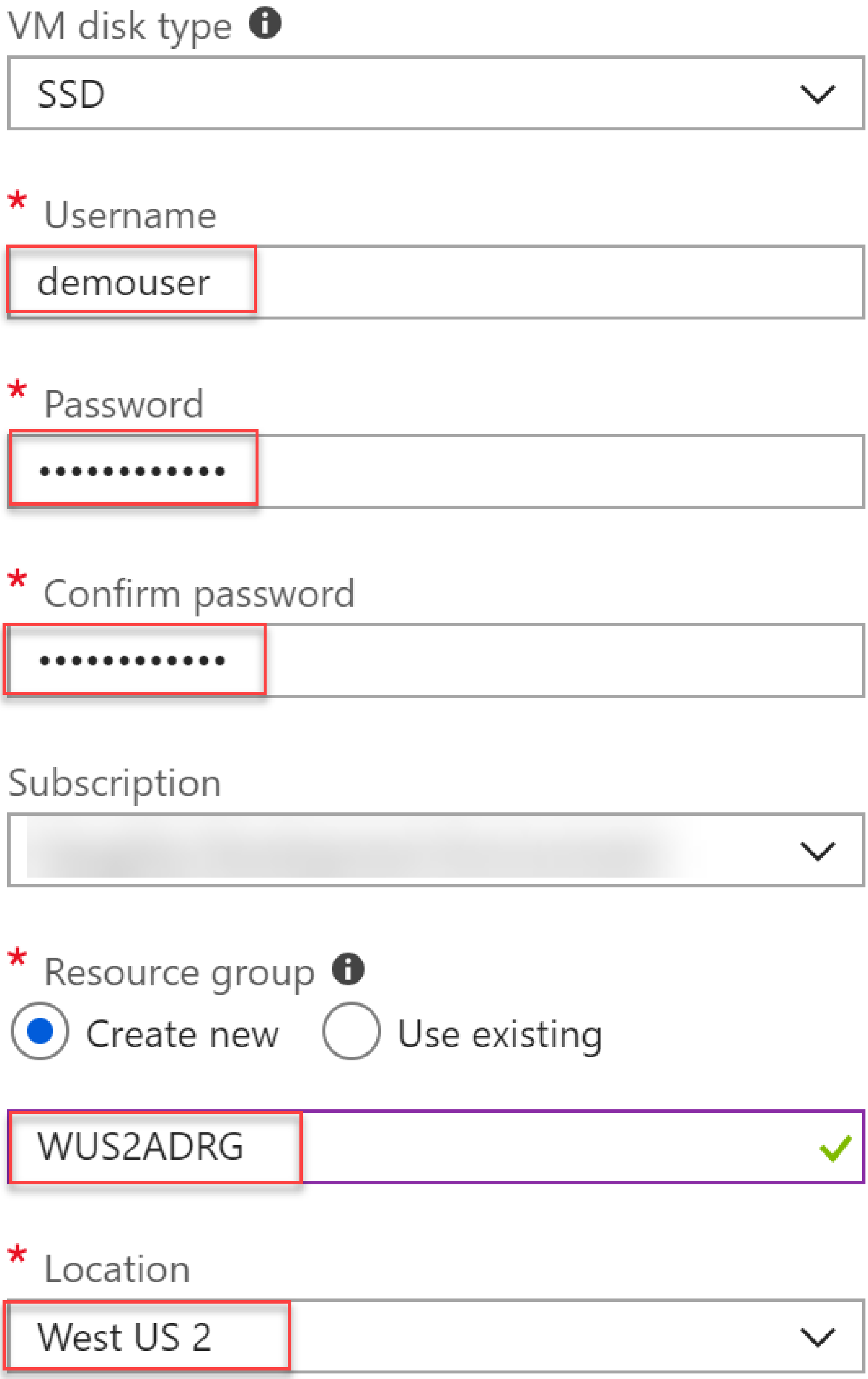
3. In the **Create virtual machine** blade, enter the **Basics** information:

   - Name: **DC03**
   - VM disk type: **SSD**
   - Username: **demouser**
   - Password: **demo@pass123**
   - Confirm password: **demo@pass123**
   - Subscription: **Select your subscription**
   - Resource group: **WUS2ADRG**
   - Location: **West US 2**
   - Click the **OK** button to continue



* Name

DC03



VM disk type: SSD

* Username: demouser

* Password: ••••••••••••

* Confirm password: ••••••••••••

Subscription:

* Resource group: ● Create new ○ Use existing

WUS2ADRG ✓

* Location: West US 2

4. For the **Size**, select **Standard DS1 V2**. You may have to select the **View All** option if it is not one of the recommended sizes.

5. Click the **Select** button to continue to **Settings**

6. In the **Settings** options, choose the following configuration:

    - Storage Use Managed Disks: **Yes**

- Virtual Network: **Click the name to choose VNET2**
- Subnet: **Choose Identity as the subnet**
- Availability set: **Create new, ADAV2**
- Auto-shutdown: **Off**
- Guest OS Diagnostics: **Enabled**
- Backup: **Enabled**
- Recovery Services Vault: **Create New -> BackupVault2**
- Resource Group: **Create New -> BackupVault2RG**
- Leave all other settings: **Default**
- Then, click the **OK** button to continue to the **Summary**

7. There will be a final validation. When this is passed, click the **Create** button to complete the deployment.

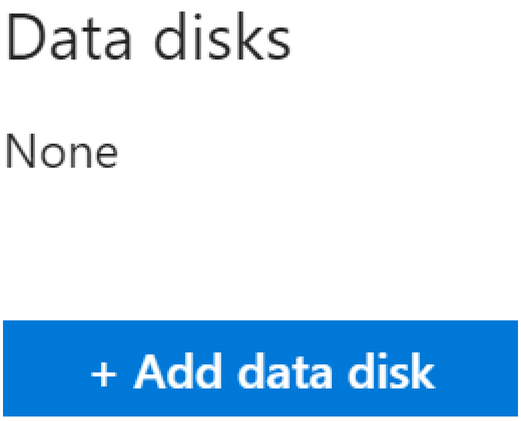
8. Give the deployment a few minutes to build the Availability Set resource. Then, repeat those steps to create **DC04**, as that will be another Domain Controller making sure to place it in the **ADAV2** availability set and the existing **BackupVault2**.

Task 3: Add data disks to Active Directory domain controllers (both regions)

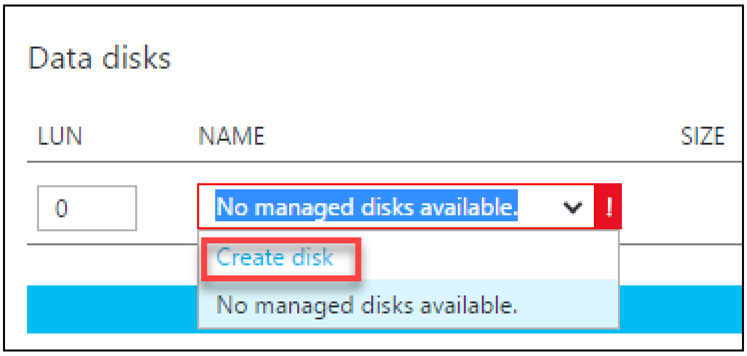
1. Open **DC01** from the Azure portal

2. In the **Settings** blade, select **Disks**

3. Click on **Add data disk**



4. On the settings for the **Data disk menu**, click on the drop-down menu under **Name**, and click **Create Disk**



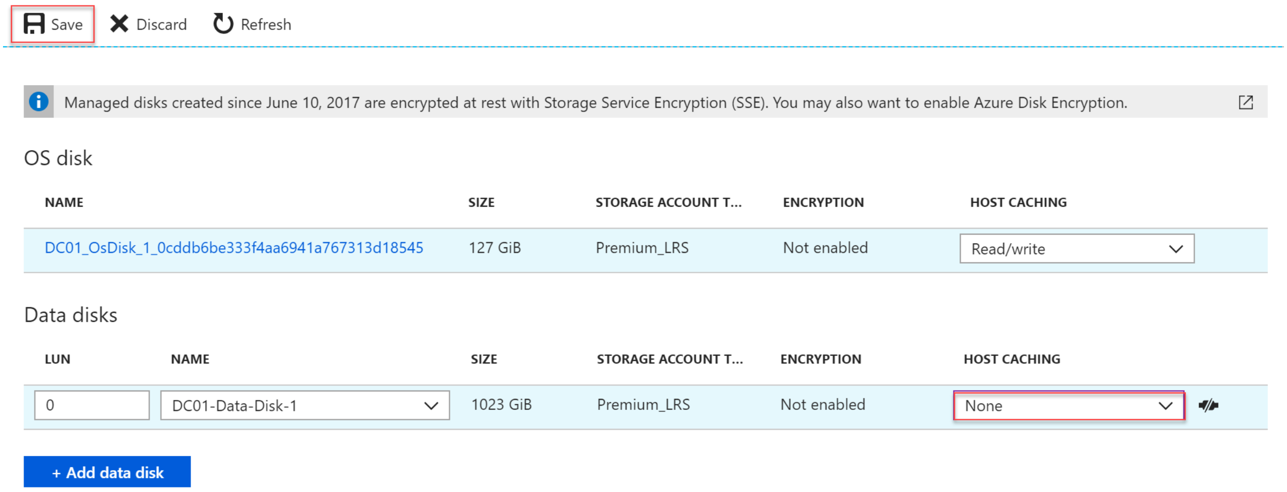
Data disks

LUN	NAME	SIZE
0	No managed disks available.	

5. On the Create managed disk blade, enter the following, and click **Create**:

   - Name: **DC01-Data-Disk-1**
   - Resource group: **Use existing / ADRG**
   - Account Type: **Premium (SSD)**
   - Source Type: **None (empty disk)**
   - Size: **32**

6. Once the disk is created, the portal will move back to the **Disks** blade. Locate the new disk under **Data Disks**, change the **HOST CACHING** to **None**, and click **Save**.



Managed disks created since June 10, 2017 are encrypted at rest with Storage Service Encryption (SSE). You may also want to enable Azure Disk Encryption.

OS disk

NAME	SIZE	STORAGE ACCOUNT T...	ENCRYPTION	HOST CACHING
DC01_OsDisk_1_0cddb6be333f4aa6941a767313d18545	127 GiB	Premium_LRS	Not enabled	Read/write

Data disks

LUN	NAME	SIZE	STORAGE ACCOUNT T...	ENCRYPTION	HOST CACHING
0	DC01-Data-Disk-1	1023 GiB	Premium_LRS	Not enabled	None

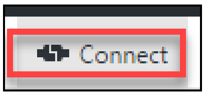
7. Perform these same steps for **DC02** naming the disk **DC02-Data-Disk-1**. Also, make sure the Host caching is set to **None**.

8. Perform Steps 1-4 for **DC03** and **DC04** naming the disks **DC03-Data-Disk-1** and **DC04-Data-Disk1** respectively. Make sure to set the Host caching to **None**.

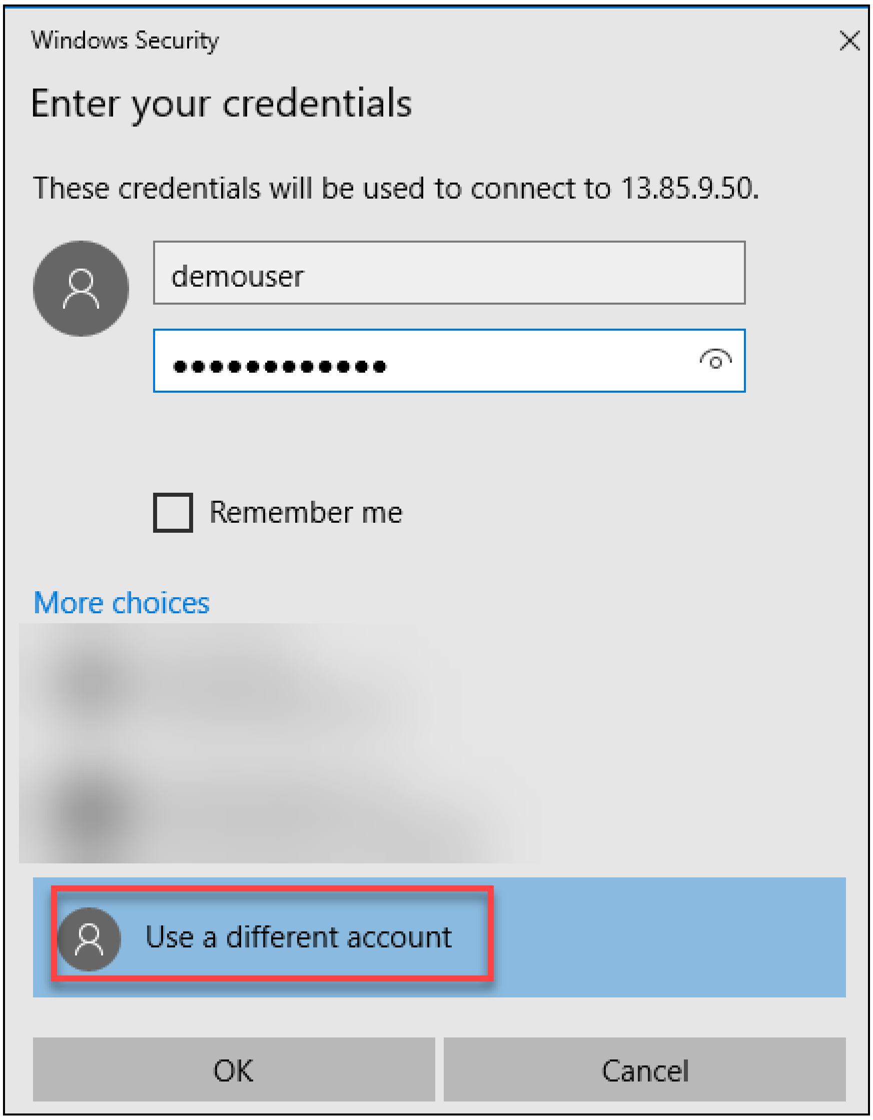
Task 4: Format data disks on DCs and configure DNS settings across connection

1. Click on **DC01** on the Azure dashboard

2. Click the **Connect** icon on the menu bar to RDP into the server



3. Login to the VM with **demouser** and password created during deployment



Windows Security

Enter your credentials

These credentials will be used to connect to 13.85.9.50.

demouser

•••••••••••••

□ Remember me

More choices

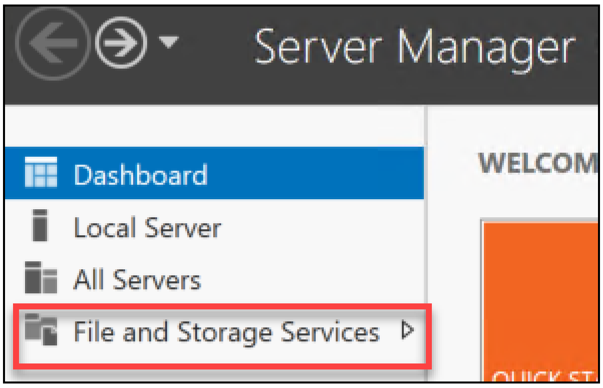
Use a different account

OK Cancel

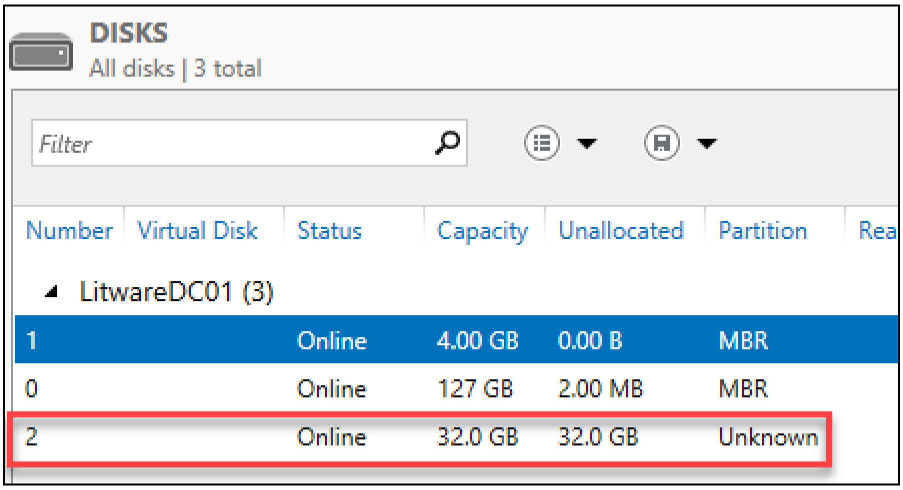
> **Note**: You might have to click "Use a different account," depending on which OS you are connecting from to put in the demouser credentials.

4. Click **Yes** to continue to connect to DC01

5. Once the logged in, click on **File and Storage Services** in **Server Manager**



6. Click on **Disks**, and let the data load. You should now see an **Unknown** partition disk in the list.



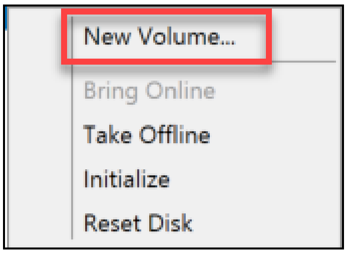
DISKS

All disks | 3 total

Filter

Number	Virtual Disk	Status	Capacity	Unallocated	Partition	Rea
LitwareDC01 (3)						
1		Online	4.00 GB	0.00 B	MBR	
0		Online	127 GB	2.00 MB	MBR	
2		Online	32.0 GB	32.0 GB	Unknown	

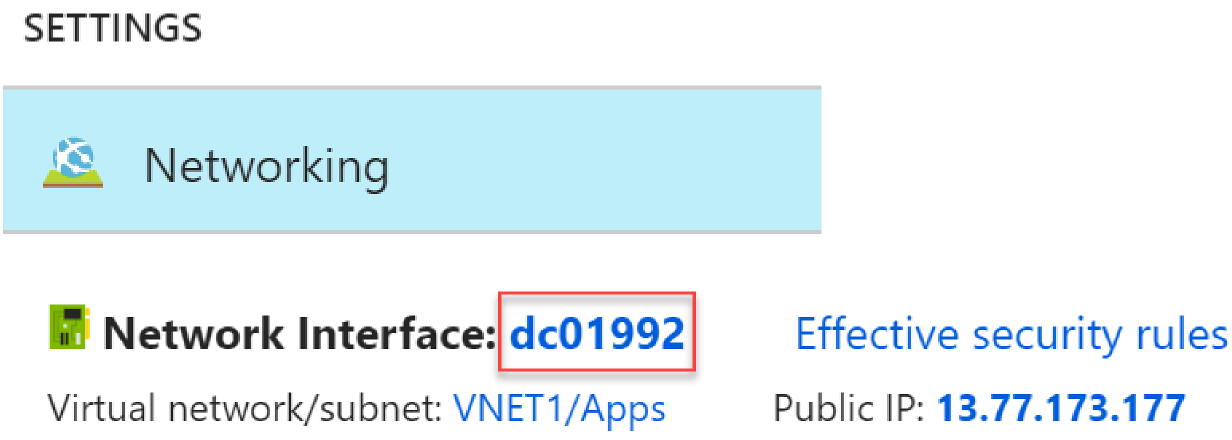
7. Right-click on this disk and choose **New Volume...** from the context menu options



8. Follow the prompts in the **New Volume Wizard** to format this disk, as the **F:** drive for the domain controller

9. Perform these same steps for the remaining 3 DCs (**DC02**, **DC03**, and **DC04**)

10. Go back to the Azure portal dashboard and click on **DC01**. Next, click on **Networking** followed by the name of the NIC.

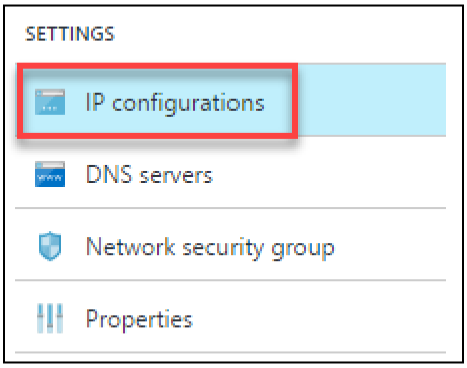


Network Interface: dc01992

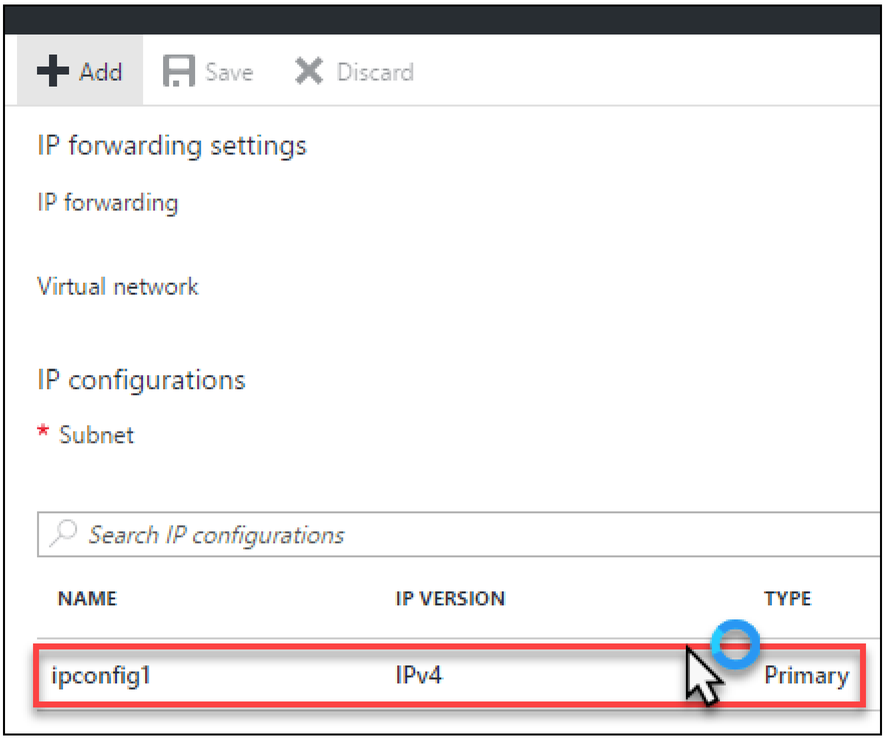
Virtual network/subnet: VNET1/Apps

Public IP: 13.77.173.177

11. Select the **IP configurations**



12. Click the IP Configuration named **ipconfig1**



NAME	IP VERSION	TYPE
ipconfig1	IPv4	Primary

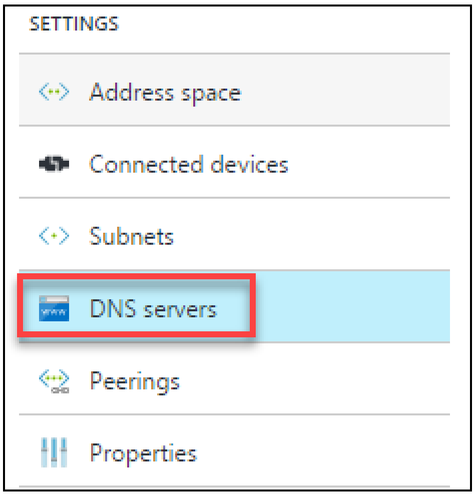
13. On the **ipconfig1** blade, change the **Private IP address settings** to **Static.** Leave all the other settings at their defaults and click the **Save** icon.

14. Once Azure notifies the network interface change is saved, repeat these steps on the remaining 3 DCs (**DC02**, **DC03**, and **DC04**)

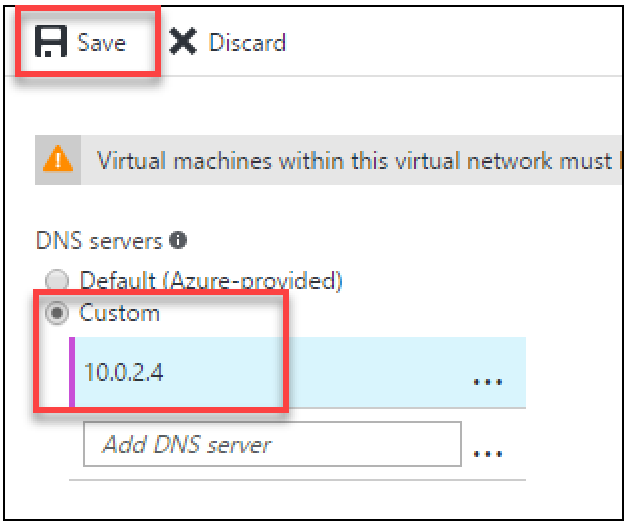
> **Note**: Static IP for DC02 should be 10.0.2.6. DC03 should be 172.16.2.4 and DC04 should be 172.16.2.5.

15. In the Azure portal, click **More Services >** and in the filter, type in **Virtual Networks**. Select **VNET2** from the list.

16. In the **Settings** area, select **DNS Servers**



17. Change **DNS servers** to **Custom**, and provide the address of **10.0.2.4** in the **Primary DNS server** box. Click the **Save** icon to commit the changes.



Virtual machines within this virtual network must

DNS servers

○ Default (Azure-provided)
● Custom

10.0.2.4

Add DNS server

18. At this point, restart **DC03** and **DC04**, so they can get their new DNS Settings

> **Note**: DC01 and DC02 received the correct DNS settings from the VNET DNS configured prior to their deployment, as the Customer DNS was set before the hands-on lab for that VNET. DC03 and DC04 must be rebooted to receive the updated DNS settings from their virtual network.

19. While these two DCs are rebooting, RDP into **ADVM**, and run the following PowerShell command:

```
Set-DnsServerPrimaryZone -Name contoso.com -DynamicUpdate
NonsecureAndSecure
```

> **Note**: This would not be done in a production environment, but for purposes of our hands-on lab, we need to perform this step for the SQL Cluster in the coming tasks.

20. After the PowerShell command runs, Sign Out of **ADDC**

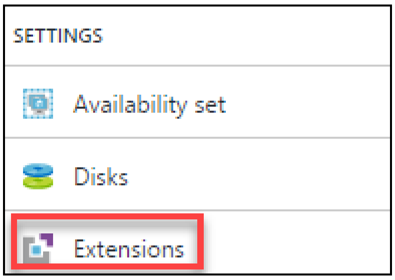
Task 5: Promote DCs as additional domain controllers

1. Login to **LABVM** created before the hands-on lab or the machine where you have downloaded the exercise files

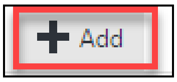
2. Browse to the Azure portal and authenticate at https://portal.azure.com/

3. Click on **DC01** on the Azure dashboard

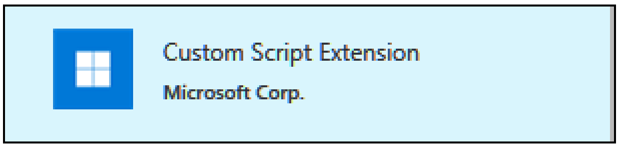
4. In the **Settings** area, click **Extensions**



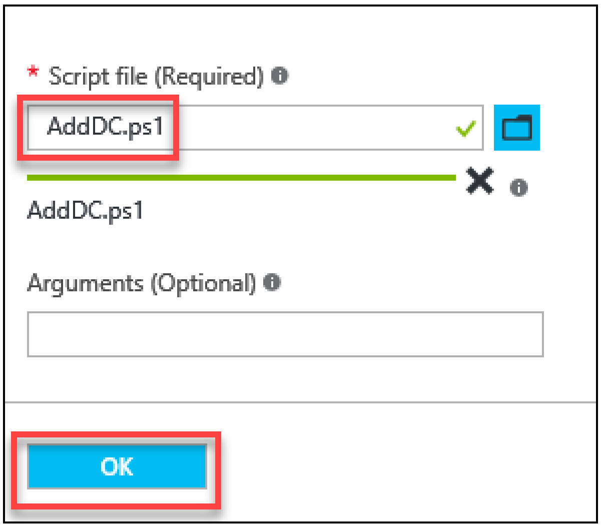
5. Click the **+ Add** icon



6. Choose **Custom Script Extension** by Microsoft Corp., and click the **Create** button to continue



7. Browse to the **C:\HOL** folder and select the **AddDC.ps1** script by clicking the folder icon for **Script file (Required)**. Then, click the **OK** button to continue.



* Script file (Required)

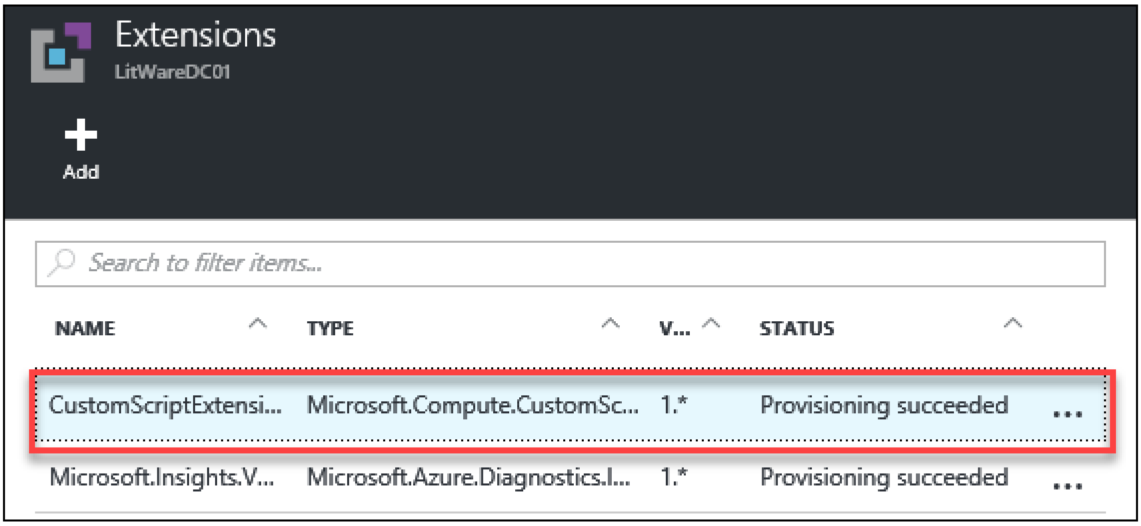
AddDC.ps1

AddDC.ps1

Arguments (Optional)

8. This script will run the commands to add this DC to the domain as an additional DC in the contoso.com domain. Repeat these steps for **DC02**, **DC03**, and **DC04**.

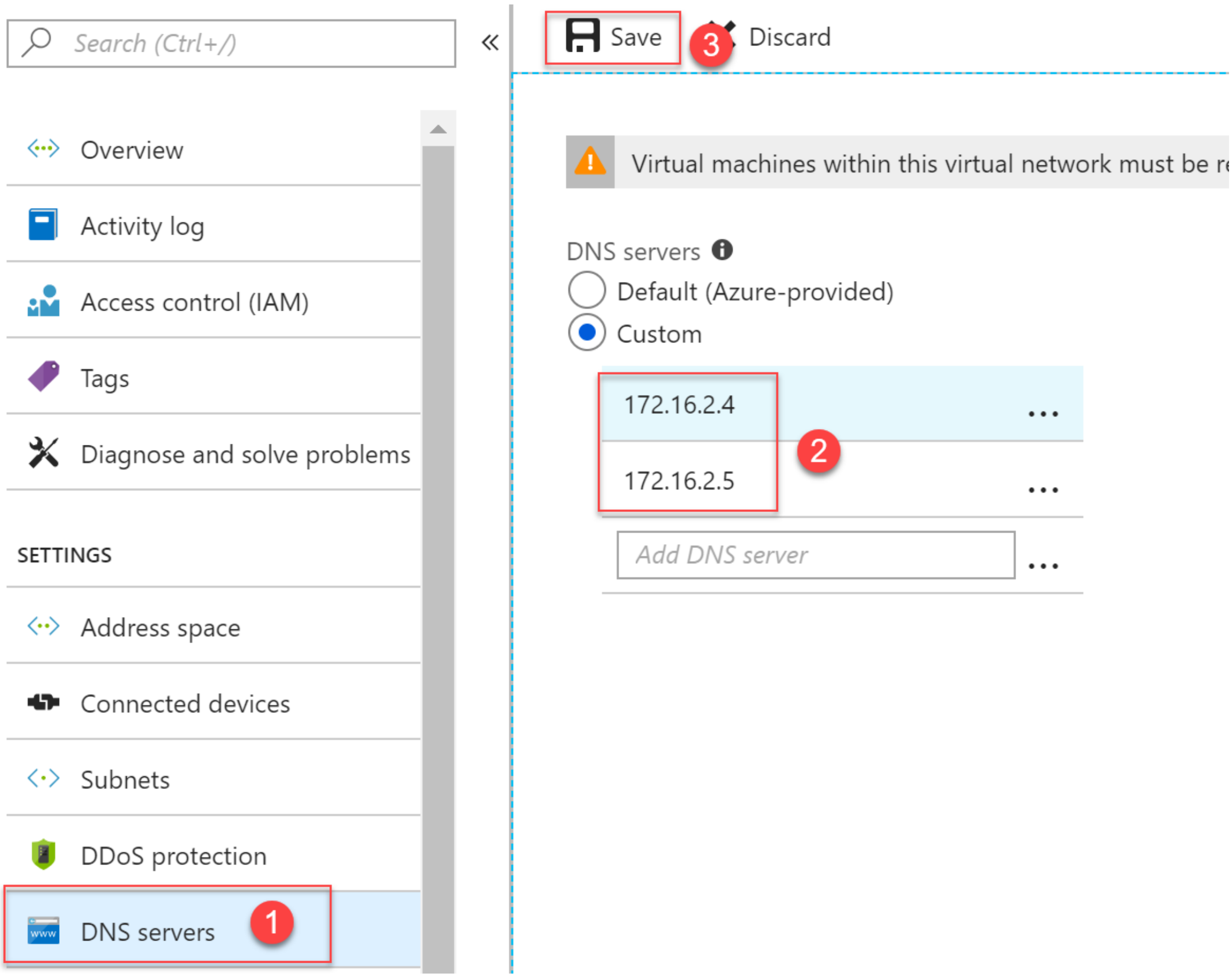
9. Once this succeeds, you will see a **Provisioning succeeded** message under **Extensions** for all four domain controllers



NAME	TYPE	V...	STATUS	
CustomScriptExtensi...	Microsoft.Compute.CustomSc...	1.*	Provisioning succeeded	...
Microsoft.Insights.V...	Microsoft.Azure.Diagnostics.I...	1.*	Provisioning succeeded	...

> **Note**: While this a live production environment, there would need to be some additional steps to clean up Region 1 and to configure DNS, Sites and Services, Subnets, etc. Please refer to documentation on running Active Directory Virtualized or in Azure for details. ADDC should be demoted gracefully, and if required, a new DC can be added to the ADAVSet and data disk attached for F:\.

10. Open the settings for VNET2 in the Azure portal. Under DNS servers, add the two new domain controller IP addresses and click **Save**



DNS servers
○ Default (Azure-provided)
● Custom

172.16.2.4
172.16.2.5

Summary

In this exercise, you will deploy Windows Server Active Directory configured for resiliency using Azure Managed Disks and Availability Sets in the primary and the failover region.

Exercise 3: Build web tier and SQL for resiliency

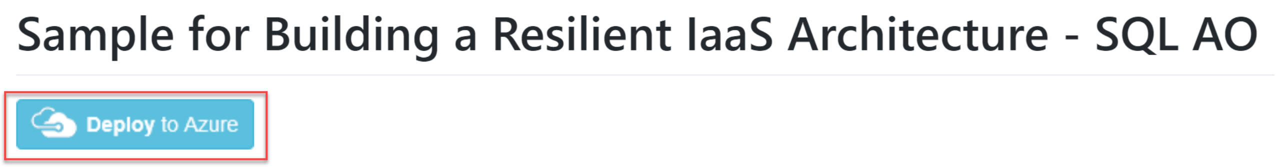
Duration: 60 minutes

In this exercise, you will deploy resilient web servers using VM scale sets and a SQL Always-On Cluster for resiliency at the data tier.

Task 1: Deploy SQL Always-On Cluster

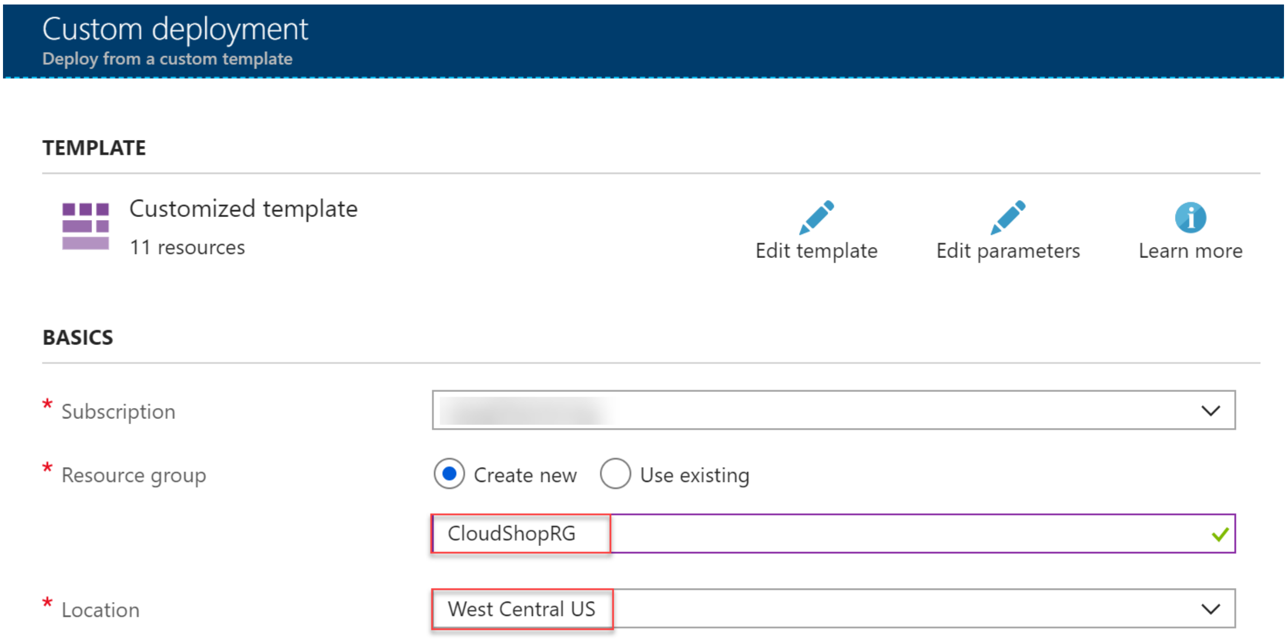
In this task, you will deploy a SQL Always-On cluster using an ARM template that deploys to your existing Virtual Network and Active Directory infrastructure.

1. Navigate to https://github.com/opsgility/cw-building-resilient-iaas-architecture-sql and click the **Deploy to Azure Button**



Sample for Building a Resilient IaaS Architecture - SQL AO

2. Specify the resource group name as **CloudShopRG** and ensure the region is set to **West Central US**



Custom deployment
Deploy from a custom template

TEMPLATE

Customized template
11 resources

BASICS

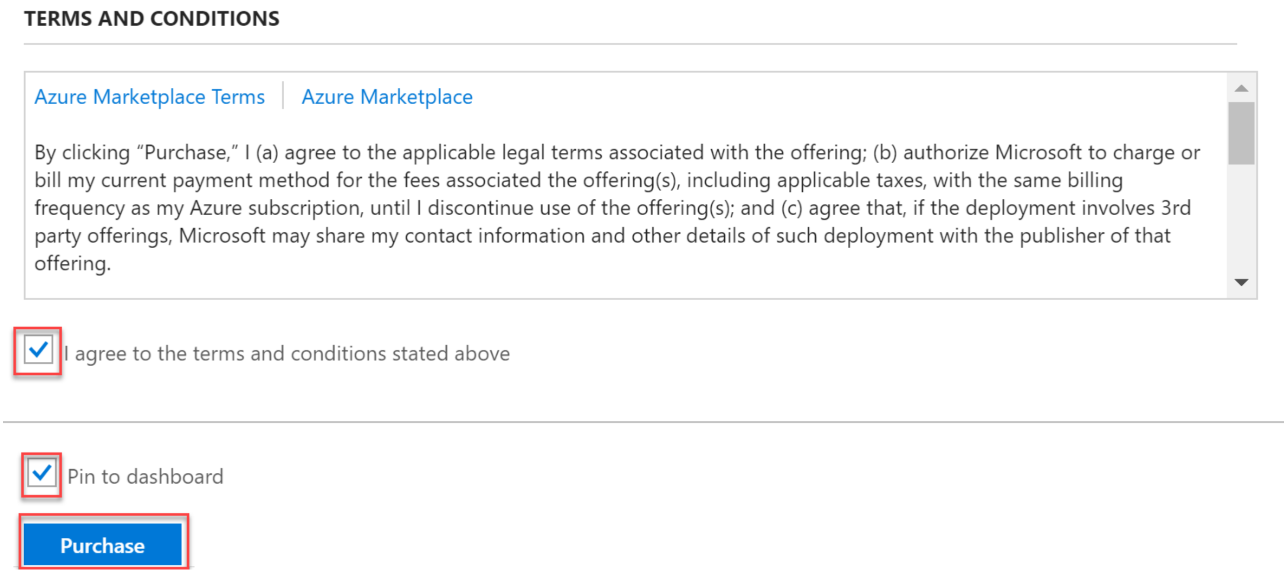
* Subscription

* Resource group ● Create new ○ Use existing

CloudShopRG

* Location West Central US

3. Check the two checkboxes for agreeing to terms and conditions and Pin to Dashboard and click Purchase to start the deployment



TERMS AND CONDITIONS

Azure Marketplace Terms | Azure Marketplace

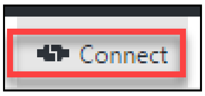
By clicking “Purchase,” I (a) agree to the applicable legal terms associated with the offering; (b) authorize Microsoft to charge or bill my current payment method for the fees associated the offering(s), including applicable taxes, with the same billing frequency as my Azure subscription, until I discontinue use of the offering(s); and (c) agree that, if the deployment involves 3rd party offerings, Microsoft may share my contact information and other details of such deployment with the publisher of that offering.

☑ I agree to the terms and conditions stated above

☑ Pin to dashboard

4. Wait until the template deployment is complete before continuing

5. Open a remote desktop connection to the **SQLVM-1** virtual machine you created in the previous task, and login using the **contoso\demouser** account with the password demo@pass123

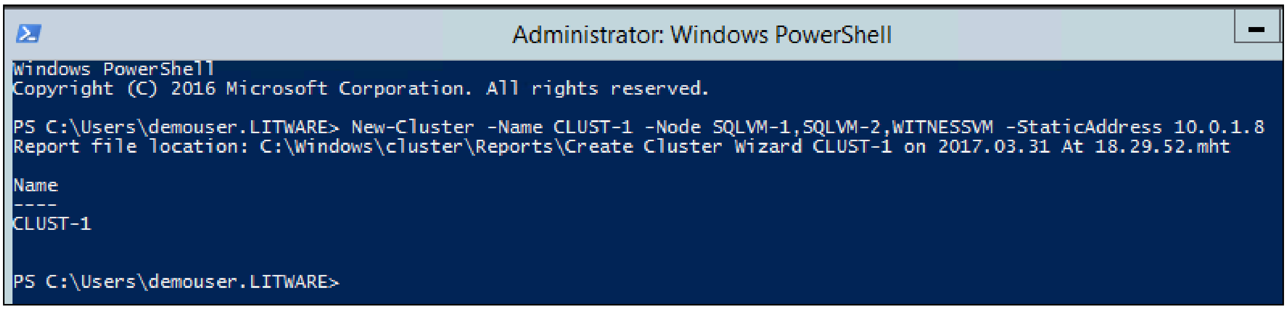


6. Once connected, open the Windows Explorer, check to make sure the F:\ Drive is present, and the Database was restored to the F:\Data directory

7. Next, run this command from **SQLVM-1** to create a Cluster for the SQL Always-On Group. **Start > PowerShell > Enter**, and execute the following commands:

```
   New-Cluster -Name CLUST-1 -Node SQLVM-1,SQLVM-2,WITNESSVM -
StaticAddress 10.0.1.8
```

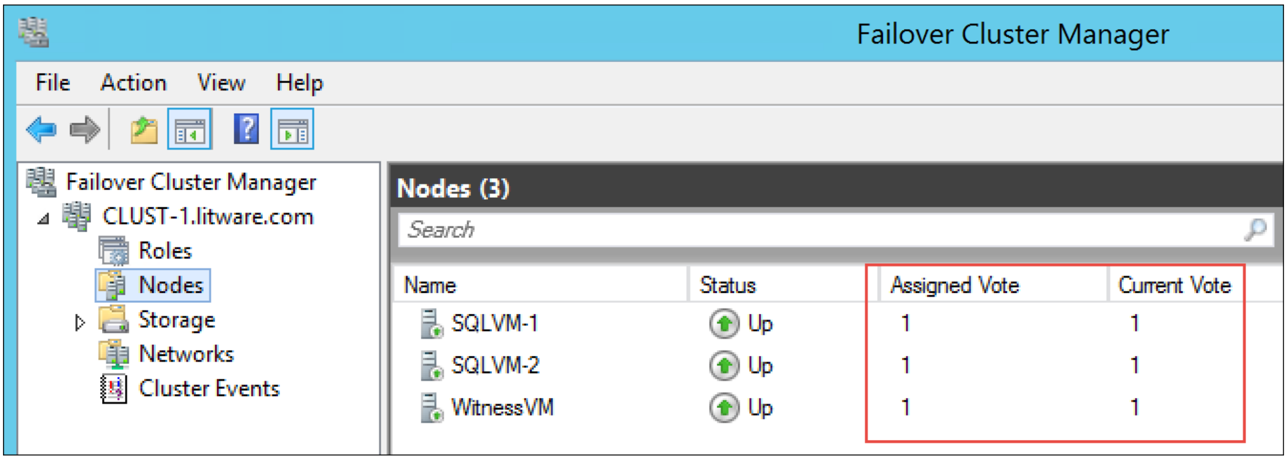
8. This will create a three-node cluster with a static IP address. It is also possible to use a wizard for this task, but the resulting cluster will require additional configuration to set the static IP address to be viable in Azure. This is due to the way Azure DHCP distributes IP addresses causing the cluster to receive the same IP address as the node it is executing on resulting in a duplicate IP address and failure of the cluster service.



```
Windows PowerShell
Copyright (C) 2016 Microsoft Corporation. All rights reserved.

PS C:\Users\demouser.LITWARE> New-Cluster -Name CLUST-1 -Node SQLVM-1,SQLVM-2,WITNESSVM -StaticAddress 10.0.1.8
Report file location: C:\Windows\cluster\Reports\Create Cluster Wizard CLUST-1 on 2017.03.31 At 18.29.52.mht

Name
----
CLUST-1


PS C:\Users\demouser.LITWARE>
```

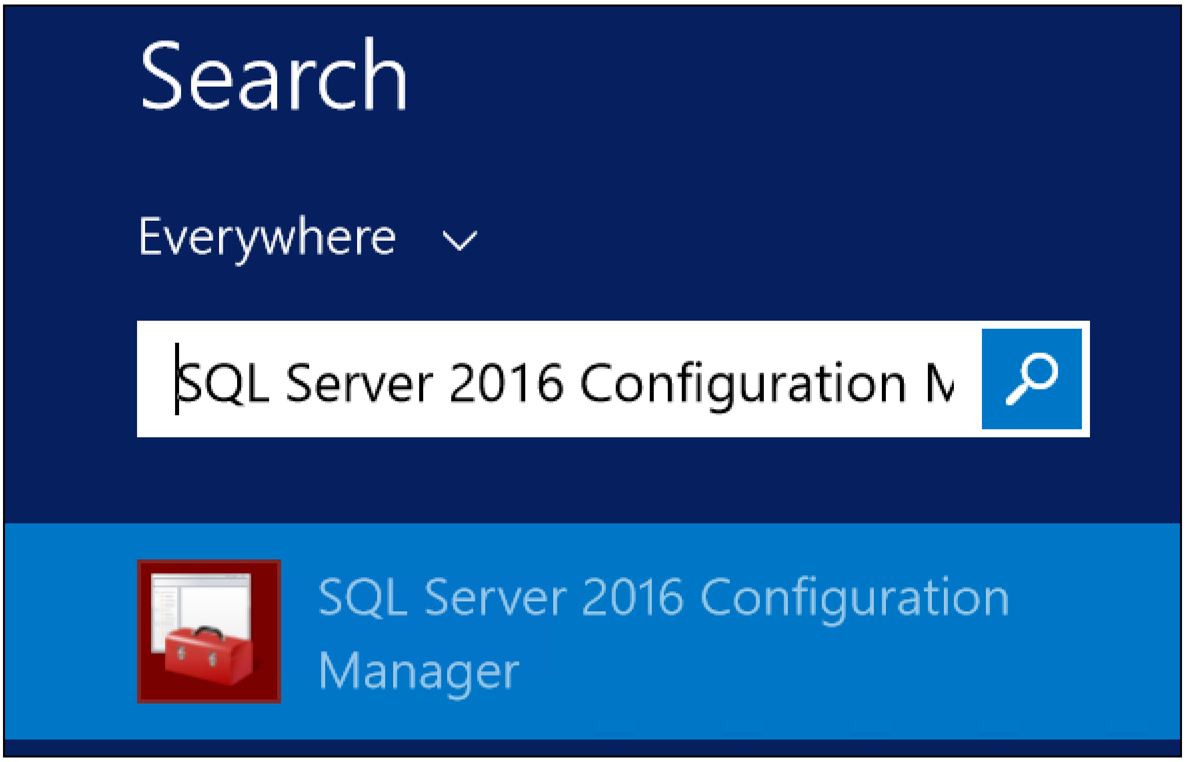
9. Once the PowerShell command has completed, open the **Failover Cluster Manager**, expand the **CLUS-1** cluster, select Nodes, validate all nodes are online and Assigned Vote and Current Vote are listed

as "1" for all nodes of the cluster

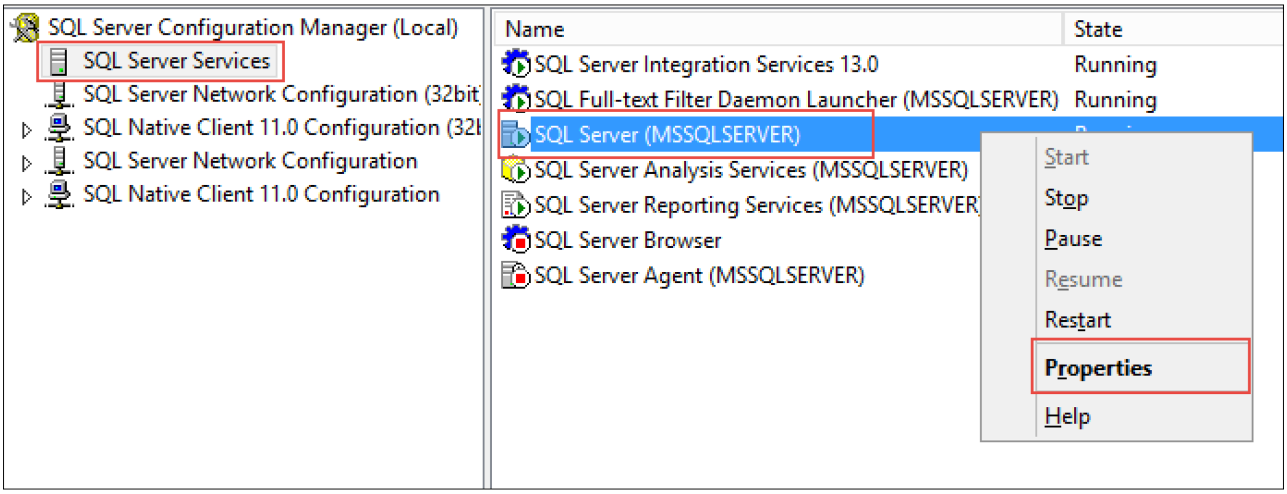


Name	Status	Assigned Vote	Current Vote
SQLVM-1	Up	1	1
SQLVM-2	Up	1	1
WitnessVM	Up	1	1

10. Launch **SQL Server 2016 Configuration Manager** on **SQLVM-1**

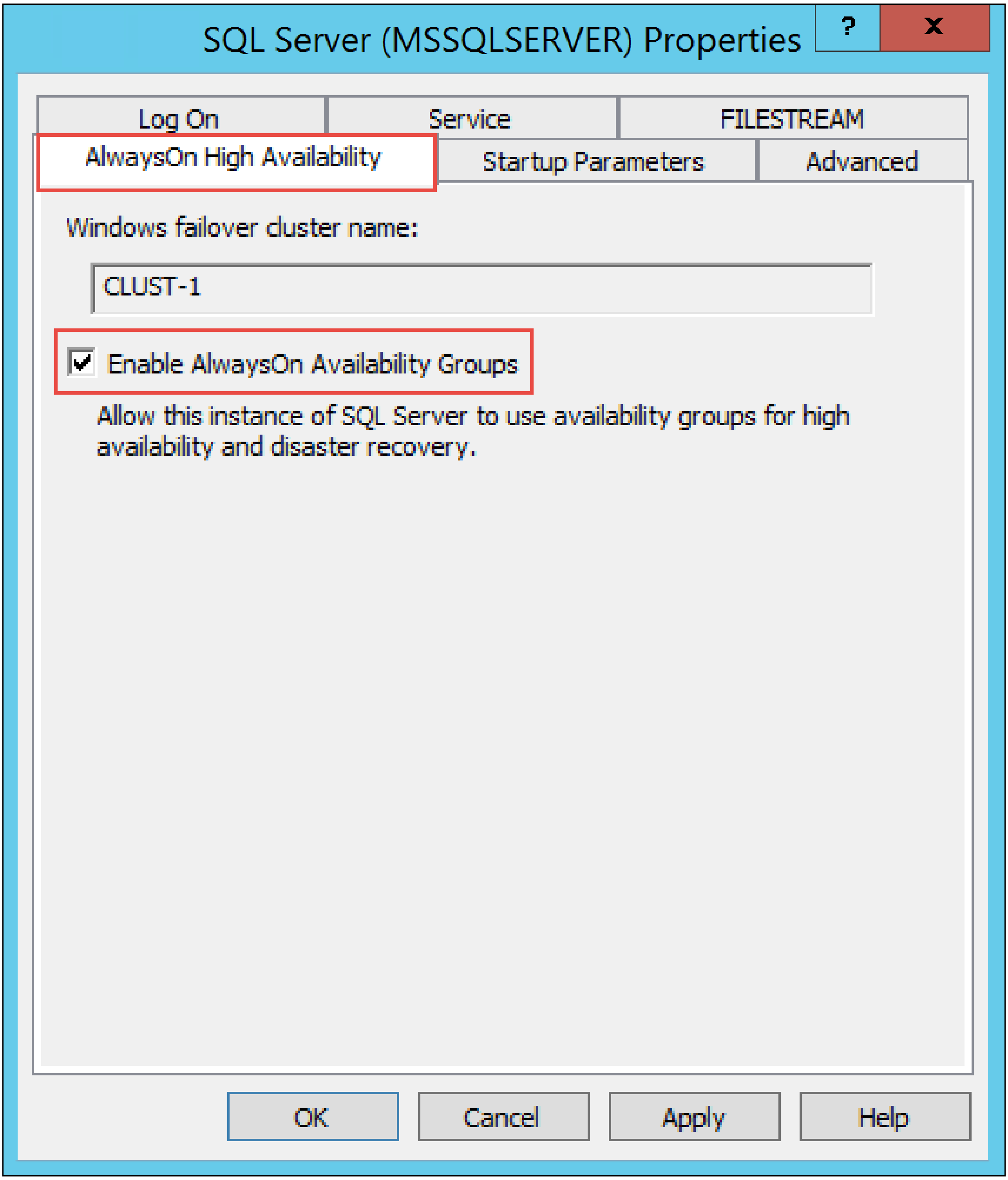

Search
Everywhere
SQL Server 2016 Configuration M
SQL Server 2016 Configuration Manager

11. Click **SQL Server Services**, right-click **SQL Server (MSSQLSERVER)**, and select **Properties**


SQL Server Configuration Manager (Local)
SQL Server Services
SQL Server Network Configuration (32bit
SQL Native Client 11.0 Configuration (32I
SQL Server Network Configuration
SQL Native Client 11.0 Configuration
Start
Stop
Pause
Resume
Restart
Properties
Help

Name	State
SQL Server Integration Services 13.0	Running
SQL Full-text Filter Daemon Launcher (MSSQLSERVER)	Running
SQL Server (MSSQLSERVER)	
SQL Server Analysis Services (MSSQLSERVER)	
SQL Server Reporting Services (MSSQLSERVER	
SQL Server Browser	
SQL Server Agent (MSSQLSERVER)	

12. Select the **AlwaysOn High Availability** tab, check the box for **Enable AlwaysOn Availability Groups**, click **Apply**, and click **OK** on the message that changes will not take effect until after the server is restarted



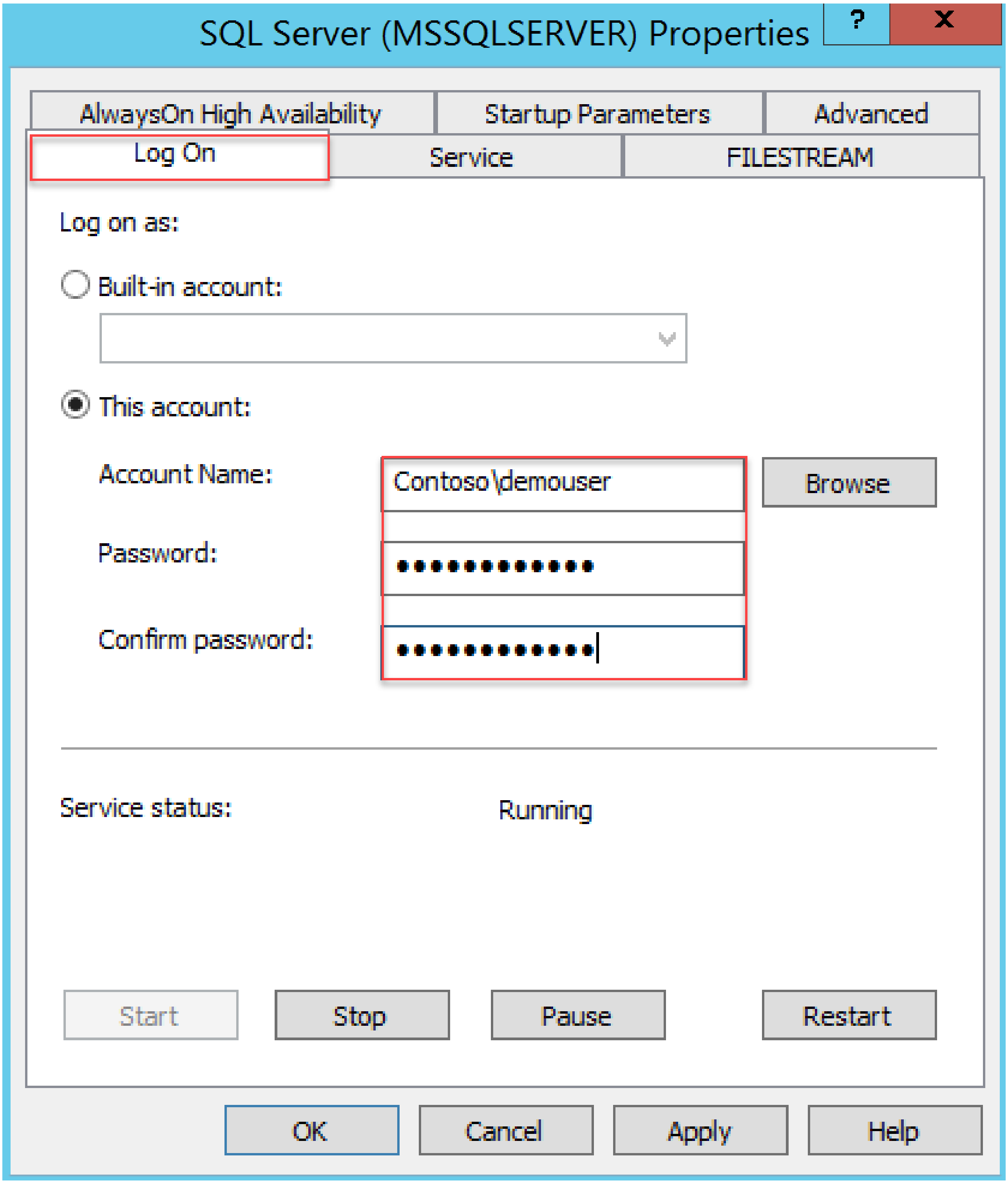
Windows failover cluster name:

CLUST-1

☑ Enable AlwaysOn Availability Groups

Allow this instance of SQL Server to use availability groups for high availability and disaster recovery.

13. On the **Log On** tab, change the service account to **contoso\demouser** using **demo@pass123** for the password. Click **OK** to accept the changes, and click **Yes** to confirm the restart of the server.



Log on as:

○ Built-in account:

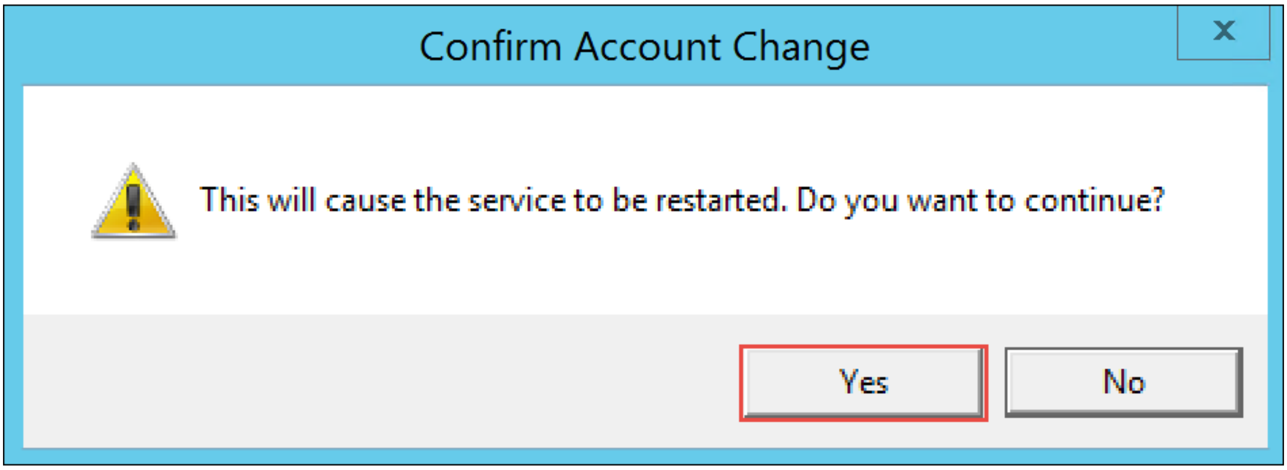
● This account:

Account Name: Contoso\demouser

Password: ●●●●●●●●●●●●

Confirm password: ●●●●●●●●●●●●

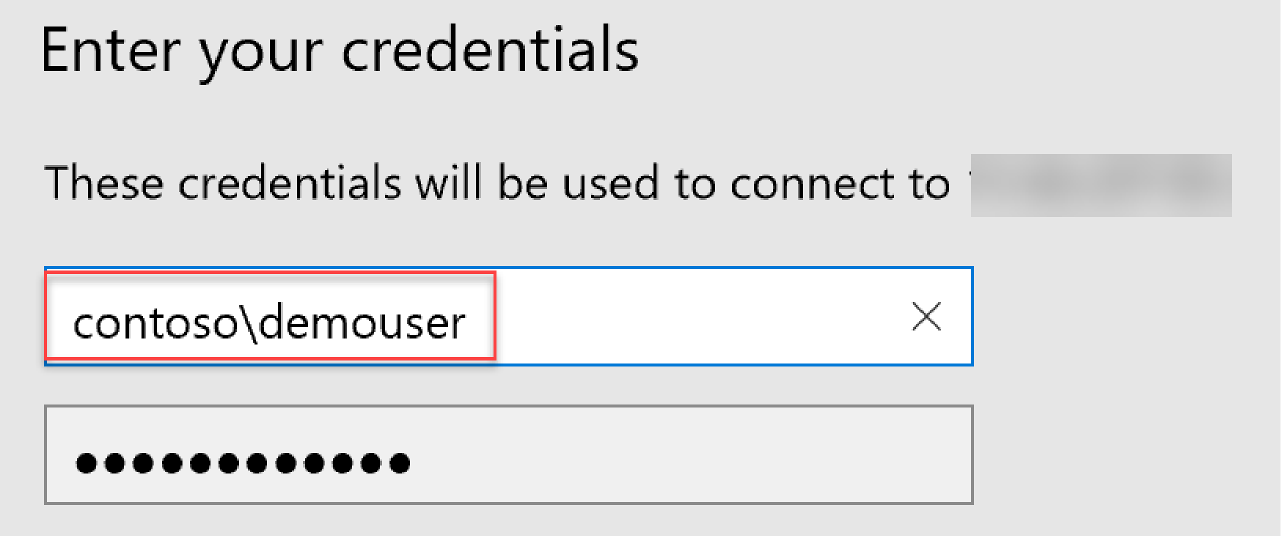
Service status: Running



This will cause the service to be restarted. Do you want to continue?

14. Minimize the RDP Window for **SQLVM-1**

15. From the Azure portal, locate **SQLVM-2**, and click **Connect.** Make sure to Sign On using the **contoso\demouser** domain account.



Enter your credentials

These credentials will be used to connect to [redacted]

contoso\demouser

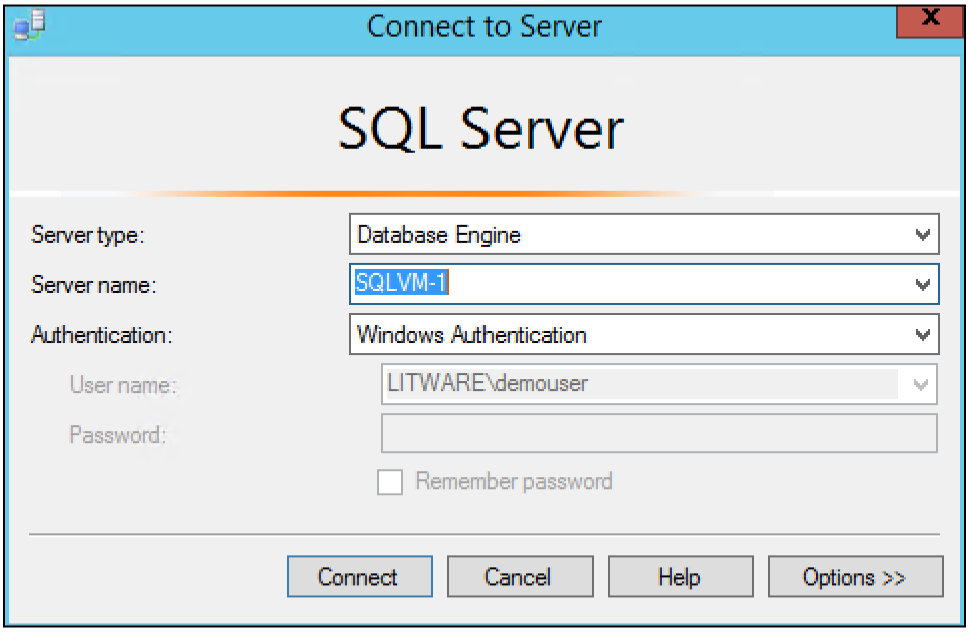
●●●●●●●●●●●●

16. From the RPD Session on **SQLVM-2**, repeat steps to configure **AlwaysOn High Availability** and **Log On** using SQL 2016 Configuration Manager

17. Move back to RDP session with **SQLVM-1**

18. Launch **SQL Server 2016 Management Studio**, and connect to the local instance of SQL Server

19. Click **Connect** to login to SQL Server



Connect to Server

SQL Server

Server type: Database Engine

Server name: SQLVM-1

Authentication: Windows Authentication

User name: LITWARE\demouser

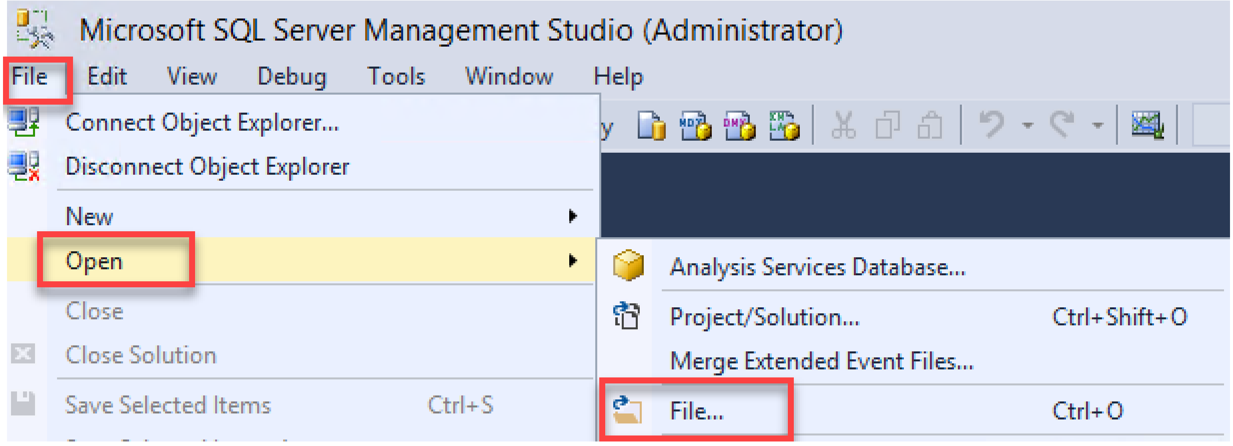
Password:

□ Remember password

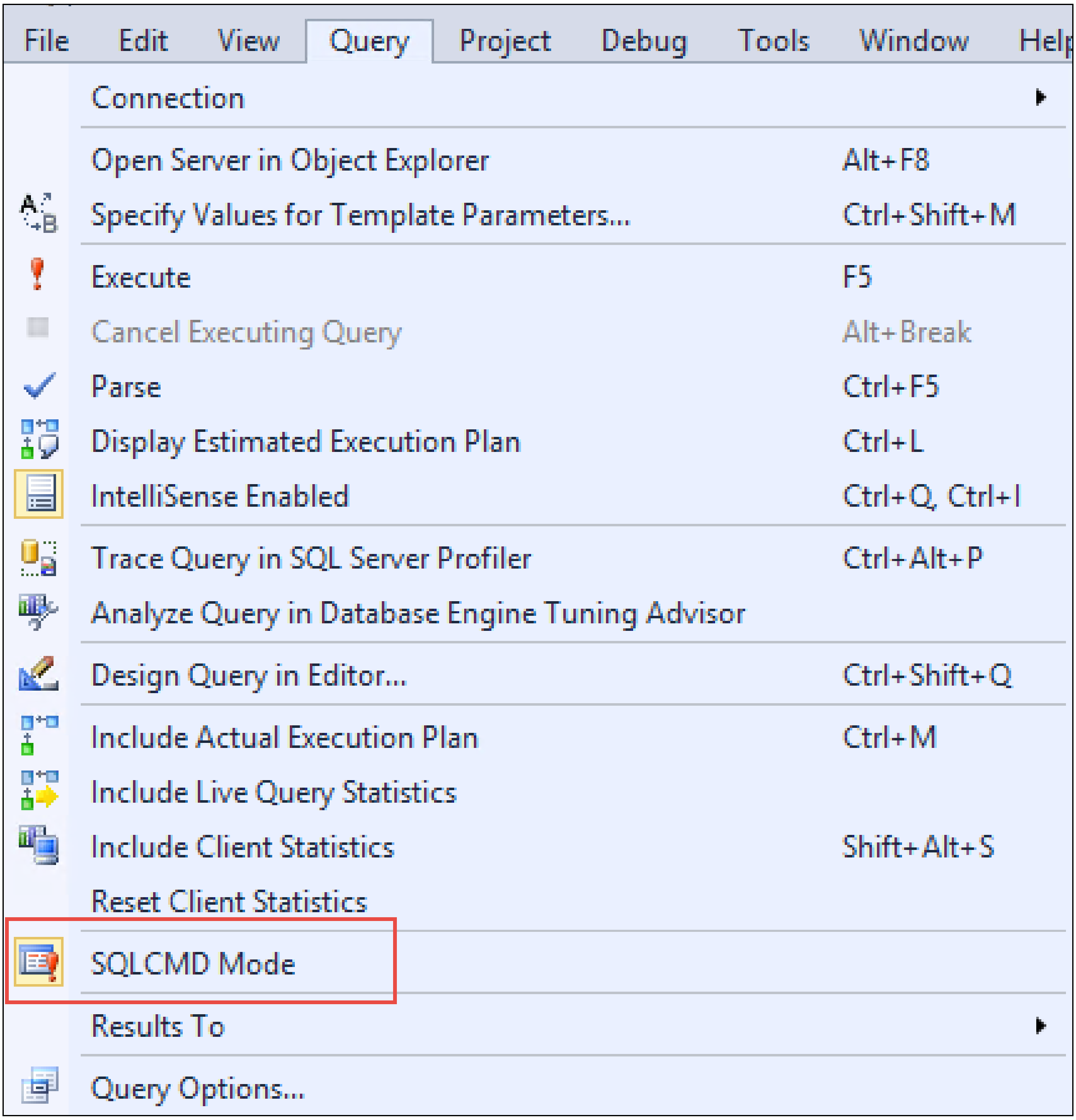
> **Note**: Availability Groups require that the databases be in full recovery mode and that an initial backup has been taken. If you deployed via the ARM template this will be done for you.

20. Minimize your **SQLVM-1** RDP Session and then Copy from your **LABVM** the file **C:\HOL\CreateAGRegion1.sql** and then back on **SQLVM-1** paste it into the **C:\SQDATA** directory

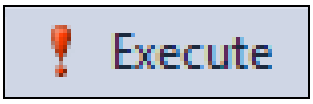
21. Within SQL Server Management Studio, open the **C:\SQDATA\CreateAGRegion1.sql** file


Microsoft SQL Server Management Studio (Administrator)
File
Edit
View
Debug
Tools
Window
Help
Connect Object Explorer...
Disconnect Object Explorer
New
Open
Close
Close Solution
Save Selected Items Ctrl+S
Analysis Services Database...
Project/Solution... Ctrl+Shift+O
Merge Extended Event Files...
File... Ctrl+O

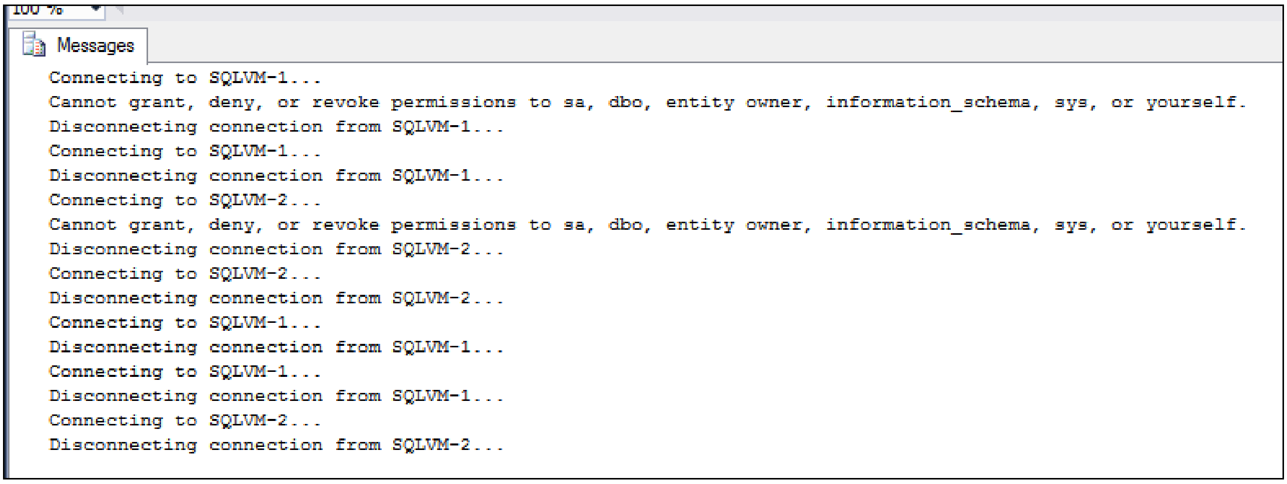
22. Select the **Query** menu and click **SQLCMD Mode**


File
Edit
View
Query
Project
Debug
Tools
Window
Help
Connection
Open Server in Object Explorer Alt+F8
Specify Values for Template Parameters... Ctrl+Shift+M
Execute F5
Cancel Executing Query Alt+Break
Parse Ctrl+F5
Display Estimated Execution Plan Ctrl+L
IntelliSense Enabled Ctrl+Q, Ctrl+I
Trace Query in SQL Server Profiler Ctrl+Alt+P
Analyze Query in Database Engine Tuning Advisor
Design Query in Editor... Ctrl+Shift+Q
Include Actual Execution Plan Ctrl+M
Include Live Query Statistics
Include Client Statistics Shift+Alt+S
Reset Client Statistics
SQLCMD Mode
Results To
Query Options...

23. Click the **Execute** button to configure the Availability Group

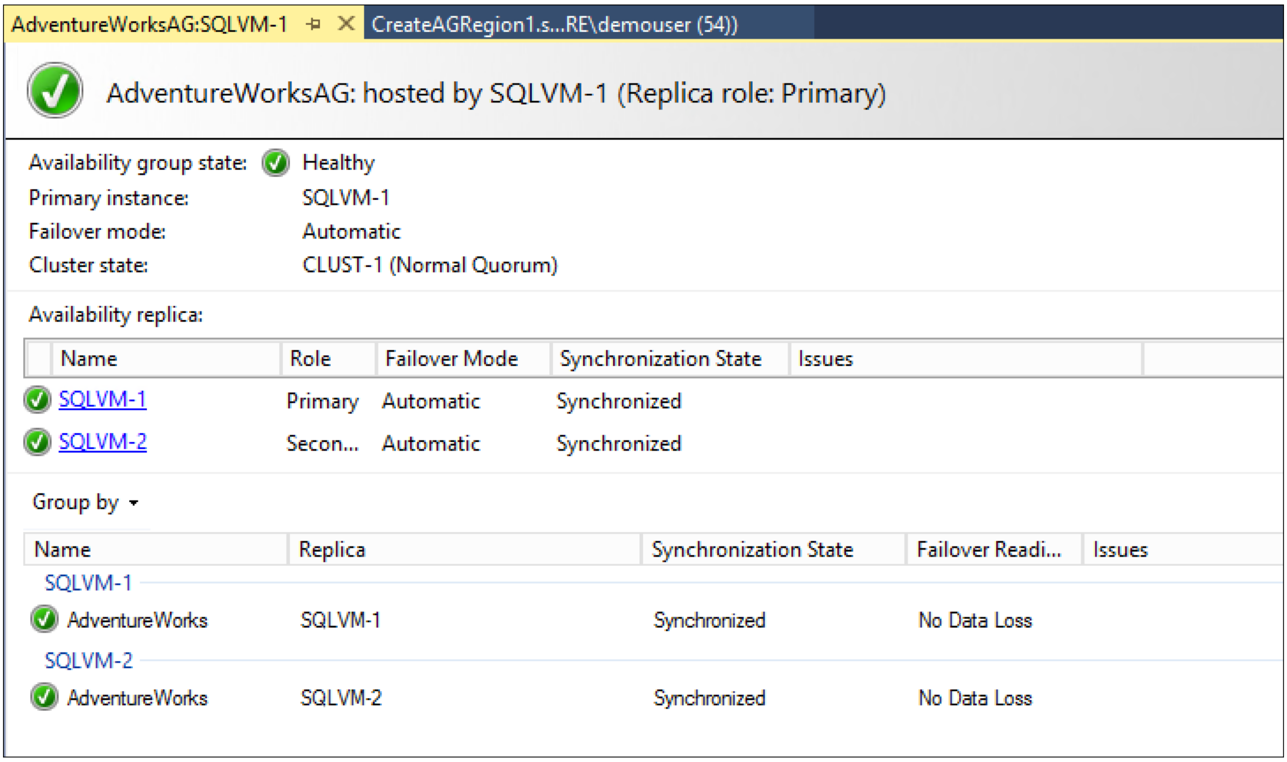


> **Note**: Some security messages are expected. This script was generated by the SQL Server New Availability Group Wizard and modified to support AUTOMATIC_SEEDING. Automatic seeding makes initializing replicas much easier, and the speed of the process is increased significantly. For more details on automatic seeding and performance improvements please refer to SQLCAT's blog: https://blogs.msdn.microsoft.com/sqlcat/2016/06/28/sqlsweet16-episode-2-availability-groups-automatic-seeding-2/.



```
Connecting to SQLVM-1...
Cannot grant, deny, or revoke permissions to sa, dbo, entity owner, information_schema, sys, or yourself.
Disconnecting connection from SQLVM-1...
Connecting to SQLVM-1...
Disconnecting connection from SQLVM-1...
Connecting to SQLVM-2...
Cannot grant, deny, or revoke permissions to sa, dbo, entity owner, information_schema, sys, or yourself.
Disconnecting connection from SQLVM-2...
Connecting to SQLVM-2...
Disconnecting connection from SQLVM-2...
Connecting to SQLVM-1...
Disconnecting connection from SQLVM-1...
Connecting to SQLVM-1...
Disconnecting connection from SQLVM-1...
Connecting to SQLVM-2...
Disconnecting connection from SQLVM-2...
```

24. Expand **AlwaysOn High Availability -> Availability Groups**, right-click **AdventureWorksAG** (Primary), and choose **Show Dashboard**. Your dashboard should look like this:



AdventureWorksAG: hosted by SQLVM-1 (Replica role: Primary)

Availability group state: ✓ Healthy
Primary instance: SQLVM-1
Failover mode: Automatic
Cluster state: CLUST-1 (Normal Quorum)

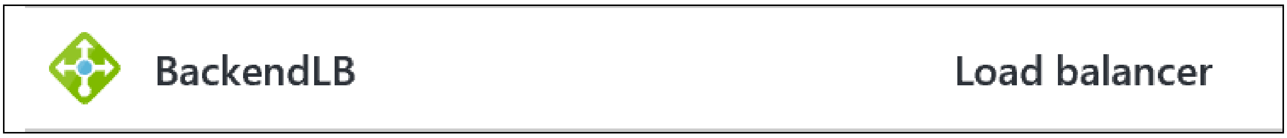
Availability replica:

	Name	Role	Failover Mode	Synchronization State	Issues
✓	SQLVM-1	Primary	Automatic	Synchronized	
✓	SQLVM-2	Secon...	Automatic	Synchronized	

Group by ▾

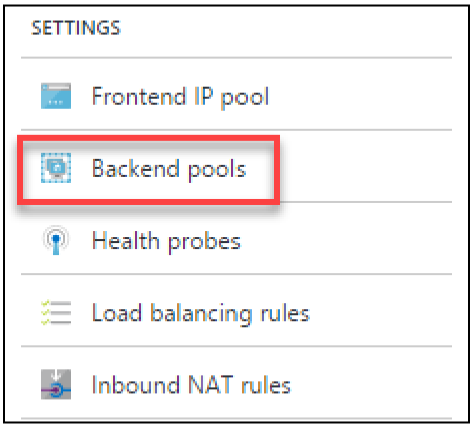
Name	Replica	Synchronization State	Failover Readi...	Issues
SQLVM-1				
✓ AdventureWorks	SQLVM-1	Synchronized	No Data Loss	
SQLVM-2				
✓ AdventureWorks	SQLVM-2	Synchronized	No Data Loss	

25. On the Azure portal, open the settings of the **BackendLB** load balancer in the **contosoSQLRG** resource group

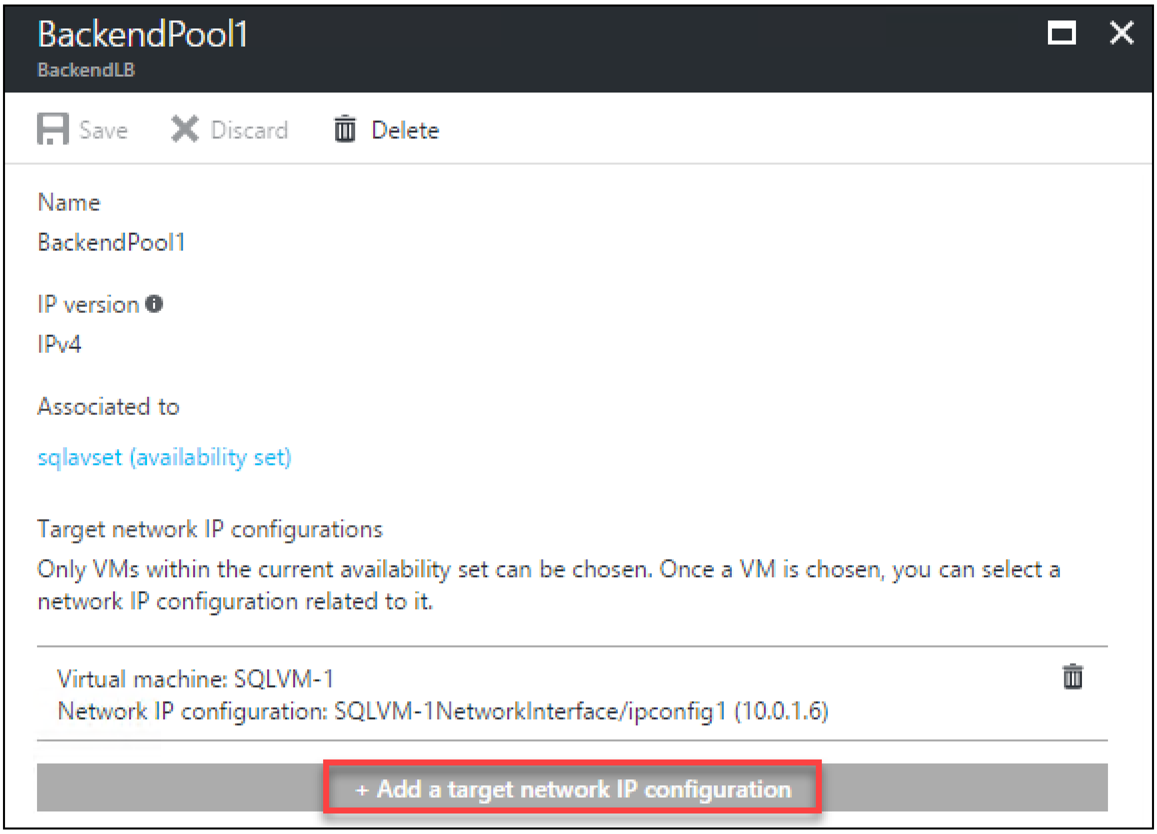


BackendLB Load balancer

26. Click on **Backend pools**



27. Click **BackendPool1** which will open a window showing **SQLVM-1**. Click the **Add a target network IP configuration**.



Name
BackendPool1

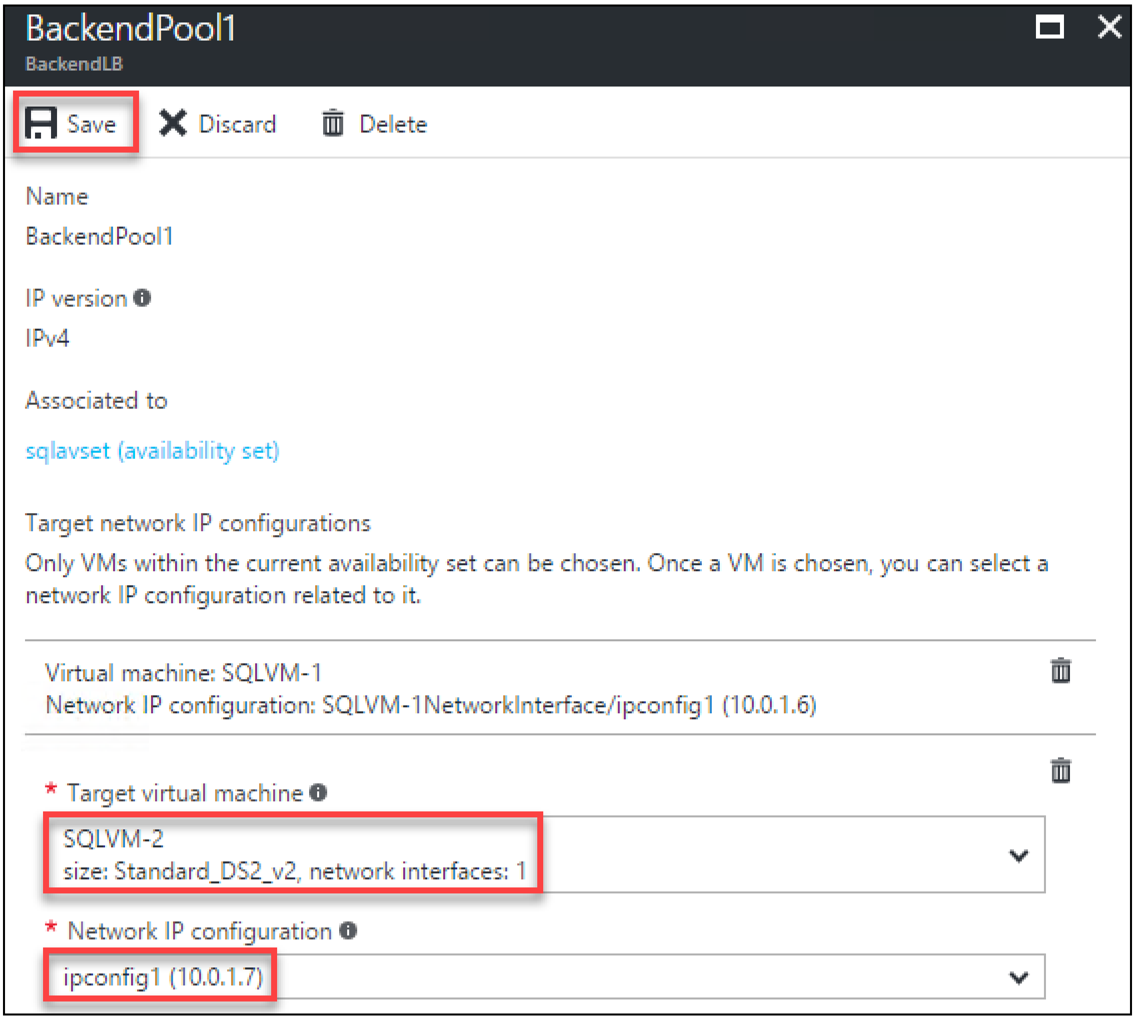
IP version
IPv4

Associated to
sqlavset (availability set)

Target network IP configurations
Only VMs within the current availability set can be chosen. Once a VM is chosen, you can select a network IP configuration related to it.

Virtual machine: SQLVM-1
Network IP configuration: SQLVM-1NetworkInterface/ipconfig1 (10.0.1.6)

28. From the List for Target Virtual Machine select the **SQLVM-2** and the Network IP Configuration **ipconfig1 (10.0.1.7)**



BackendPool1
BackendLB

Name
BackendPool1

IP version
IPv4

Associated to

sqlavset (availability set)

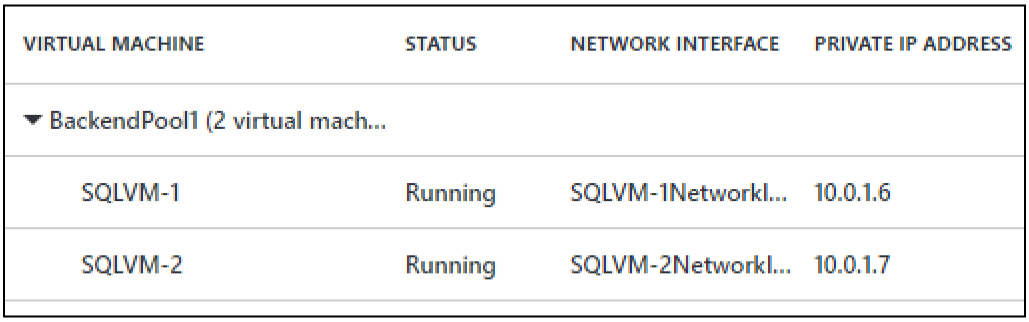
Target network IP configurations
Only VMs within the current availability set can be chosen. Once a VM is chosen, you can select a network IP configuration related to it.

Virtual machine: SQLVM-1
Network IP configuration: SQLVM-1NetworkInterface/ipconfig1 (10.0.1.6)

* Target virtual machine
SQLVM-2
size: Standard_DS2_v2, network interfaces: 1

* Network IP configuration
ipconfig1 (10.0.1.7)

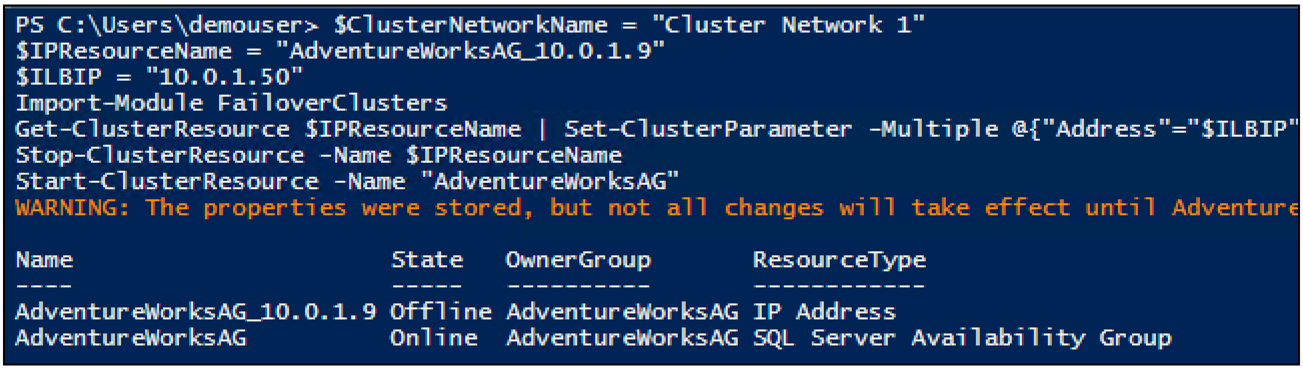
29. Click the **Save** to add **SQLVM-2** to the **BackendPool1**



VIRTUAL MACHINE	STATUS	NETWORK INTERFACE	PRIVATE IP ADDRESS
▼ BackendPool1 (2 virtual mach...			
SQLVM-1	Running	SQLVM-1Networkl...	10.0.1.6
SQLVM-2	Running	SQLVM-2Networkl...	10.0.1.7

30. Go back to **SQLVM-1** and open an **Administrative PowerShell_ISE** session. Execute the following PowerShell to configure your cluster for the probe port.

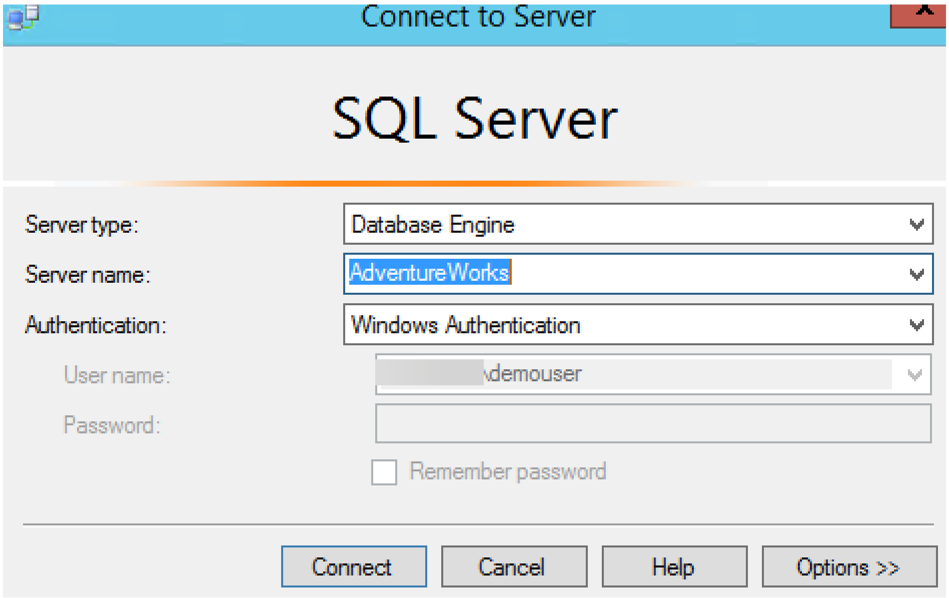
```
$ClusterNetworkName = "Cluster Network 1"
$IPResourceName = "AdventureWorksAG_10.0.1.9"
$ILBIP = "10.0.1.50"
Import-Module FailoverClusters
Get-ClusterResource $IPResourceName | Set-ClusterParameter -Multiple
@{"Address"="$ILBIP";"ProbePort"="59999";"SubnetMask"="255.255.255.255
";"Network"="$ClusterNetworkName";"EnableDhcp"=0}
Stop-ClusterResource -Name $IPResourceName
Start-ClusterResource -Name "AdventureWorksAG"
```



```
PS C:\Users\demouser> $ClusterNetworkName = "Cluster Network 1"
$IPResourceName = "AdventureWorksAG_10.0.1.9"
$ILBIP = "10.0.1.50"
Import-Module FailoverClusters
Get-ClusterResource $IPResourceName | Set-ClusterParameter -Multiple @{"Address"="$ILBIP"
Stop-ClusterResource -Name $IPResourceName
Start-ClusterResource -Name "AdventureWorksAG"
WARNING: The properties were stored, but not all changes will take effect until Adventure

Name                       State   OwnerGroup       ResourceType
----                       -----   ----------       ------------
AdventureWorksAG_10.0.1.9 Offline AdventureWorksAG IP Address
AdventureWorksAG          Online  AdventureWorksAG SQL Server Availability Group
```

31. Connect to **SQLVM-02** and launch **SQL Server Management Studio**

32. Open a Server connection to the **AdventureWorks** listener endpoint to verify connectivity. The listener is like entering a SQL Server's Name, but this is the AOG.



Connect to Server

SQL Server

Server type: Database Engine

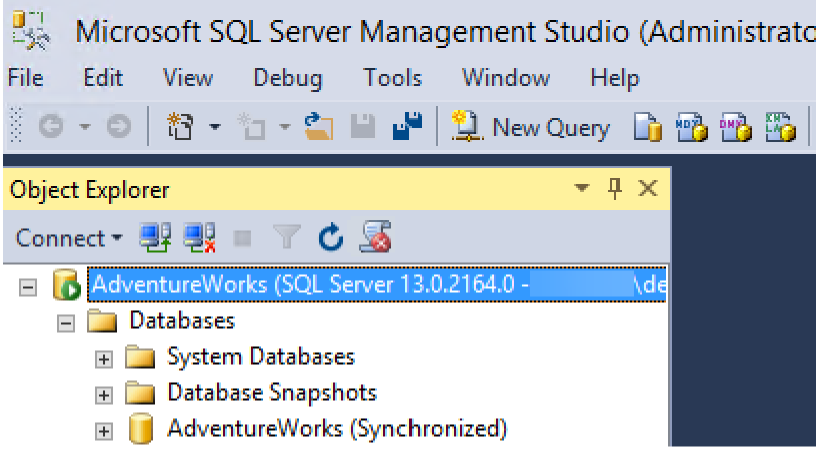
Server name: AdventureWorks

Authentication: Windows Authentication

User name: [redacted]\demouser

Password:

□ Remember password



Microsoft SQL Server Management Studio (Administrato

AdventureWorks (SQL Server 13.0.2164.0 - [redacted]\de
Databases
System Databases
Database Snapshots
AdventureWorks (Synchronized)

33. After successfully connecting to the AOG listener, disconnect from both SQLVM-1 and SQLVM-2 by using Sign Out from the RDP windows

Task 2: Convert the SQL deployment to Managed Disks

In this task, you will convert the disks of the SQL deployment to managed disks. This task could be automated as part of the template deployment; however, it is important to understand how to migrate existing infrastructure to managed disks.

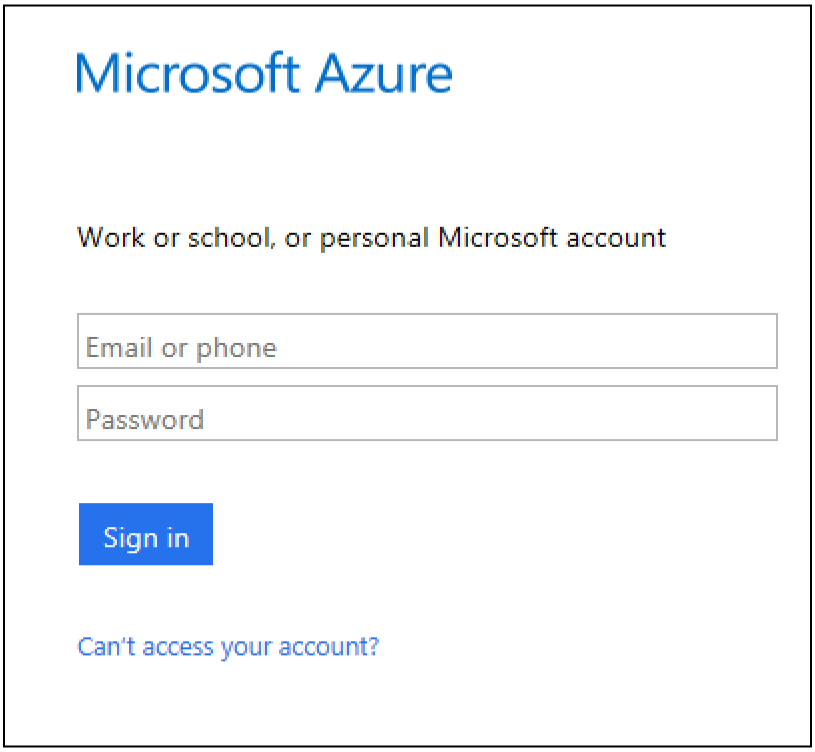
1. On LABVM open the PowerShell ISE Tool

Note: In the next few steps, you will use PowerShell to migrate the disks for the SQL Unfractured to Managed Disks.

2. In the execution pane, login to Azure using the Login-AzureRmAccount, and press Enter

   Login-AzureRmAccount

3. At the Azure login screen, enter your Account and Password


Microsoft Azure
Work or school, or personal Microsoft account
Email or phone
Password
Sign in
Can't access your account?

4. Once logged in, make sure to set your subscription that is the default for this hands-on lab

```
Get-AzureRMSubscription
Select-AzureRmSubscription -SubscriptionName ???your subscription
name???
```

5. Once this is completed, run the following command to verify your VMs for the hands-on lab are present.

```
Get-AzureRMVM -ResourceGroupName contosoCloudShopRG
```

6. Now, move to the scripting pane of the PowerShell ISE tool. Paste this code into the window.

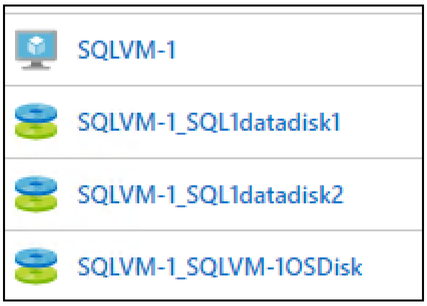
```
<#
    The following code converts the existing availability to
aligned/managed and then converts the disks to managed as well.
    Note: The PlatformFaultDomainCount is set to 2 - this is because
```

```
the region currently only supports two managed fault domains
#>

$rgName = 'contosoCloudShopRG'

$avSetName = 'SQLAVSet'

$avSet = Get-AzureRmAvailabilitySet -ResourceGroupName $rgName -Name
$avSetName

$avSet.PlatformFaultDomainCount = 2

Update-AzureRmAvailabilitySet -AvailabilitySet $avSet -Sku Aligned

foreach($vmInfo in $avSet.VirtualMachinesReferences)
{
    $vm = Get-AzureRmVM -ResourceGroupName $rgName | Where-Object
{$_.Id -eq $vmInfo.id}

    Stop-AzureRmVM -ResourceGroupName $rgName -Name $vm.Name -Force

    ConvertTo-AzureRmVMManagedDisk -ResourceGroupName $rgName -VMName
$vm.Name
}
```

7. Next, click the **Play** button in PowerShell_ISE. This will deallocate all the machines in the Availability Set SQLAVSET and migrate them to a Managed AVSET and the disk to Managed Disks.

   > **Note**: This process will take about 10-15 minutes to complete and be careful not to stop the process.

8. Open the Azure portal and browse to the **CloudShopRG** Resource Group. Notice now, the machines are using Managed Disks, and the disk objects now appear.



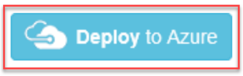
SQLVM-1
SQLVM-1_SQL1datadisk1
SQLVM-1_SQL1datadisk2
SQLVM-1_SQLVM-1OSDisk

Task 3: Build a scalable and resilient web tier

In this task, you will deploy a VM scale set that can automatically scale up or down based on the CPU criteria. The application the scale set deploys points to the new SQL AlwaysOn availability group created previously.

1. Navigate to https://github.com/opsgility/cw-building-resilient-iaas-architecture-ss and click the **Deploy to Azure Button**

Sample for Building a Resilient IaaS Architecture - ScaleSet



2. Specify the existing resource group **CloudShopRG** and set the **Instance Count to 2**

> **Note**: The instance count is the initial number of servers deployed. The number can change based on the auto scale rules set in the ARM template.

3. Agree to the terms, check **Pin to dashboard** and click **Purchase**

4. While the scale set is deploying, open the ARM template you just deployed by navigating to: https://github.com/opsgility/cw-building-resilient-iaas-architecture-ss/blob/master/azure-deploy.json. Review the auto scale settings in the autoscalewad resource to understand how the default auto scale settings are configured.

Summary

In this exercise, you deployed resilient web servers behind a load balancer, and a SQL Always-On Availability Group for database resiliency.

Exercise 4: Configure SQL Server Managed Backup

Duration: 15 minutes

In this exercise, you will configure SQL Server Managed Backup to back up to an Azure Storage Account.

Task 1: Create an Azure Storage Account

In this task, you will add a 3rd node to the SQL Always-On deployment in a second region that you can then failover with Azure Site Recovery in the event of a failure in the primary region.

1. From the lab virtual machine, execute the following PowerShell ISE commands to create a new storage account and generate the tSQL needed to configure managed backup for the AdventureWorks database

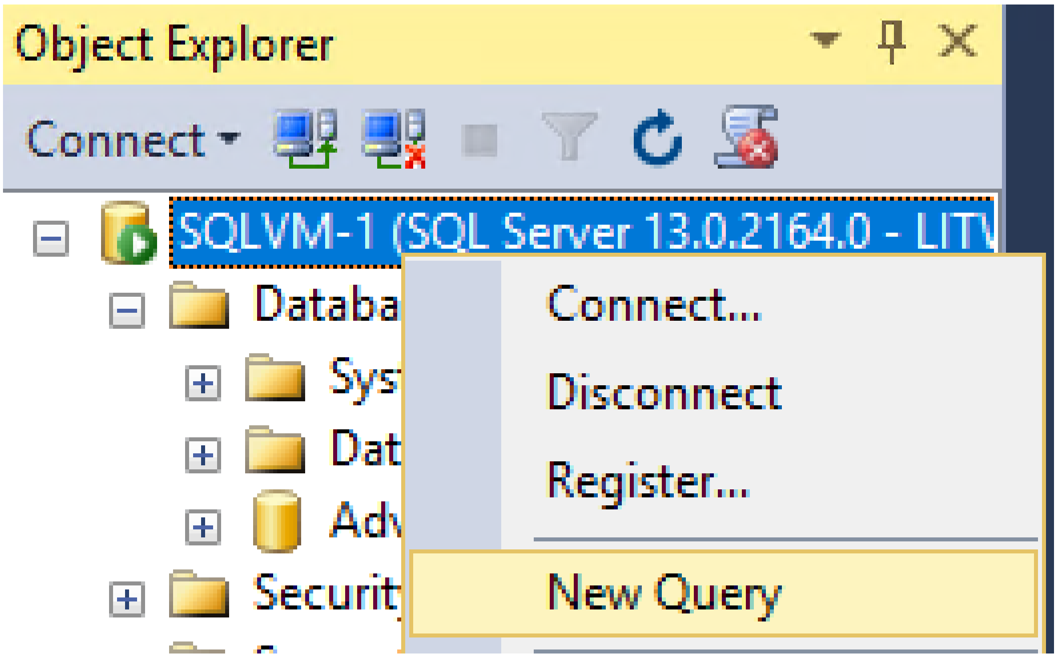
```
$storageAcctName = "[unique storage account name]"

$resourceGroupName = "contosoCloudShopRG"
$containerName= "backups"
$location = "West Central US"
$storageSkuName = "Standard_LRS"


"Creating Storage Account $storageAcctName"
$sa = New-AzureRmStorageAccount -ResourceGroupName $resourceGroupName
`
                                -Name $storageAcctName `
                                -Location $location `
                                -SkuName $storageSkuName


$storageKey = (Get-AzureRmStorageAccountKey -Name $storageAcctName -
ResourceGroupName $resourceGroupName )[0].Value
$context = New-AzureStorageContext -StorageAccountName
$storageAcctName -StorageAccountKey $storageKey


Write-Host "Creating New Storage Container  $containerName"
New-AzureStorageContainer -name $containerName -permission container -
context $context


$fullSasToken = New-AzureStorageContainerSASToken -Name $containerName
-Permission rwdl -FullUri -Context $context
$containerUrl = $fullSasToken.Substring(0,$fullSasToken.IndexOf("?"))
$sasToken = $fullSasToken.Substring($fullSasToken.IndexOf("?")+1)


$enableManagedBackupScript = @"
--------------------
---BEGIN TSQL Script
--------------------
CREATE CREDENTIAL [$containerUrl]
WITH IDENTITY = 'Shared Access Signature',
     SECRET = '$sasToken'

GO

EXEC msdb.managed_backup.sp_backup_config_basic
 @enable_backup = 1,
 @database_name = 'AdventureWorks',
 @container_url = '$containerUrl',
 @retention_days = 30

 --------------------
 ---END TSQL Script
 --------------------
"@


write-host $enableManagedBackupScript
```

2. Execute the code using PowerShell ISE. Make sure you change the **$storageAcctName = "[unique storage account name]"** field to a unique storage account name across Azure prior to execution. Make sure you save the code generated between the **Begin TSQL Script and End TSQL Script** in your PowerShell ISE output after execution into a notepad file. This code creates an identity using a Shared Access Signature (SAS) to a container in the storage account and configures managed backup when executed.

Task 2: Configure managed backup in SQL Server

1. Connect to **SQLVM-1** using remote desktop and launch SQL Server Management Studio

2. Right click on **SQLVM-1**, and click **New Query**

3. Paste in the following code and click **Execute** to enable SQL Server Agent extended stored procedures. Refresh SQL Server Management Studio and if SQL Server Agent is stopped right click on it and click Start.

   ```
   EXEC sp_configure 'show advanced options', 1
   GO
   RECONFIGURE
   GO
   EXEC sp_configure 'Agent XPs', 1
   GO
   RECONFIGURE
   GO
   ```

4. Paste the code copied to notepad (the code that creates the new SQL identity with a Shared Access Signature) in the previous task into the query window replacing the existing code and click **Execute**

5. Paste the code into the query window replacing the existing code and click **Execute** to create a custom backup schedule

   ```
   USE msdb;
   GO
   EXEC managed_backup.sp_backup_config_schedule
        @database_name =  'AdventureWorks'
       ,@scheduling_option = 'Custom'
       ,@full_backup_freq_type = 'Weekly'
       ,@days_of_week = 'Monday'
       ,@backup_begin_time =  '17:30'
       ,@backup_duration = '02:00'
   ```

```
    ,@log_backup_freq = '00:05'
GO
```

6. Execute the following tSQL in the query window to generate a backup on-demand. You can also specify Log for @type

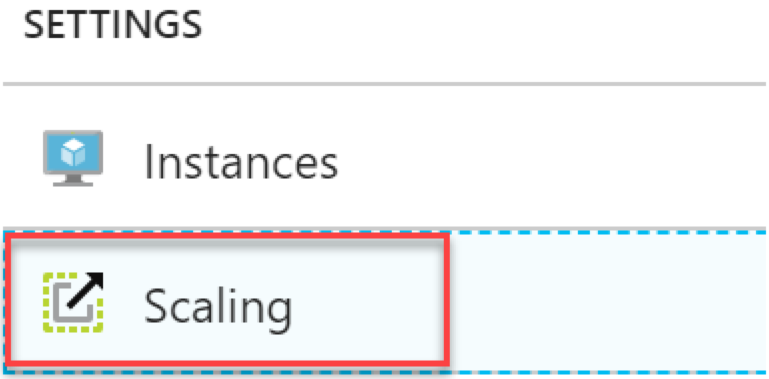
```
EXEC msdb.managed_backup.sp_backup_on_demand
@database_name  = 'AdventureWorks',
@type ='Database'
```

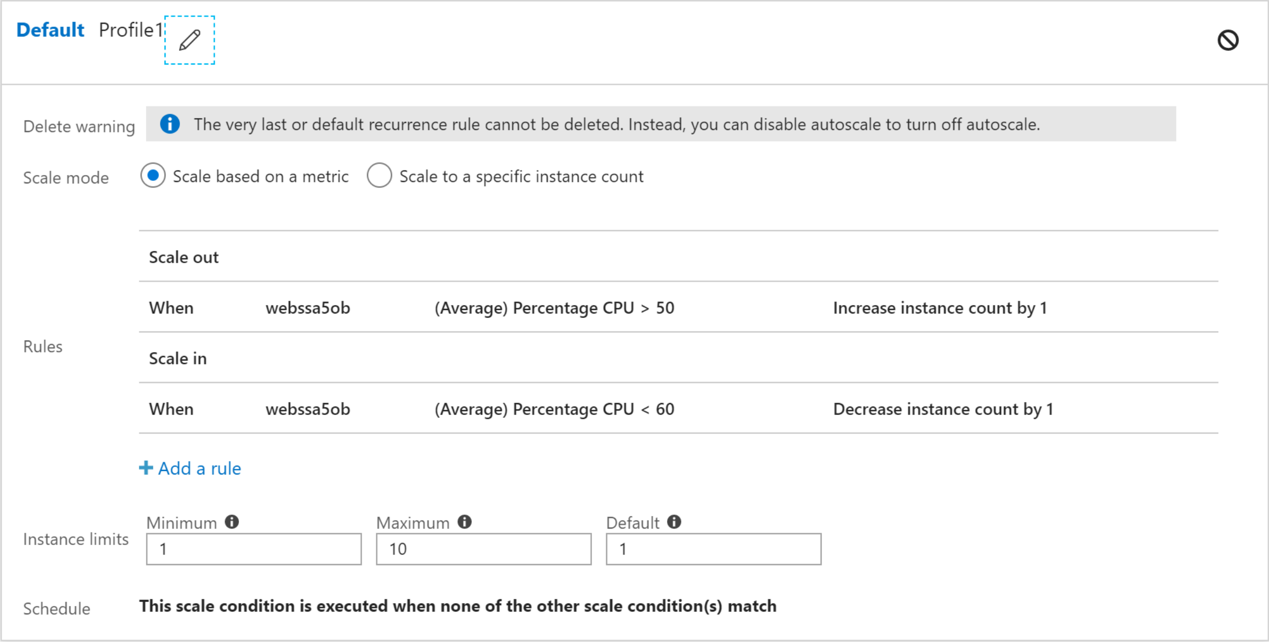
Exercise 5: Validate resiliency

Task 1: Validate resiliency for the CloudShop application

1. In the Azure portal, open the **CloudShopRG** resource group. Click the VM scale set created in the previous task.

2. Click the Scaling menu item to review the auto scale settings that were deployed with the ARM template





Delete warning: The very last or default recurrence rule cannot be deleted. Instead, you can disable autoscale to turn off autoscale.

Scale mode: ● Scale based on a metric ○ Scale to a specific instance count

Rules

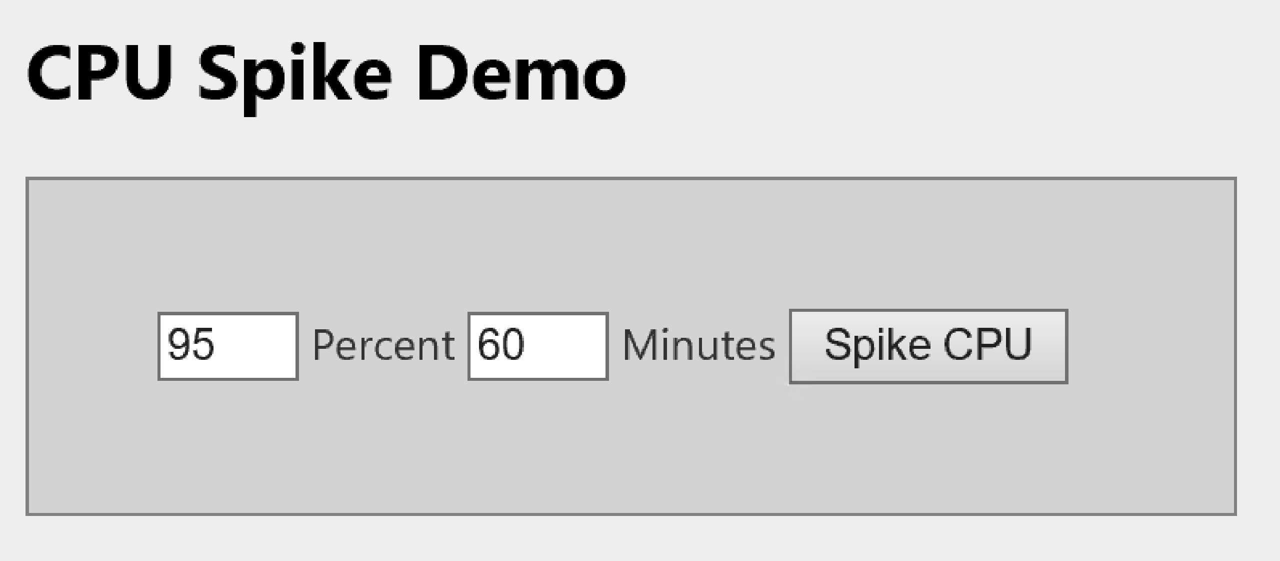
Scale out			
When	webssa5ob	(Average) Percentage CPU > 50	Increase instance count by 1
Scale in			
When	webssa5ob	(Average) Percentage CPU < 60	Decrease instance count by 1

Instance limits: Minimum 1, Maximum 10, Default 1

Schedule: This scale condition is executed when none of the other scale condition(s) match

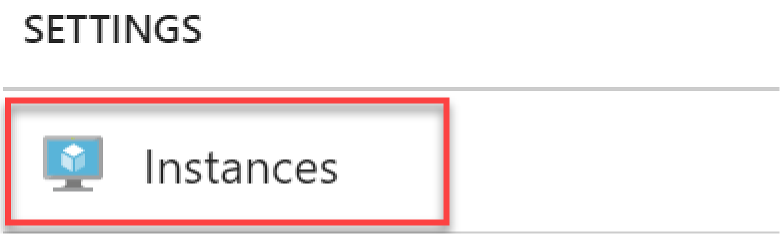
3. Click the **Overview** tab and copy the public IP address to the clipboard, and navigate to it in a different browser tab

4. After the application is loaded, click the Spike CPU button to simulate an auto scale event

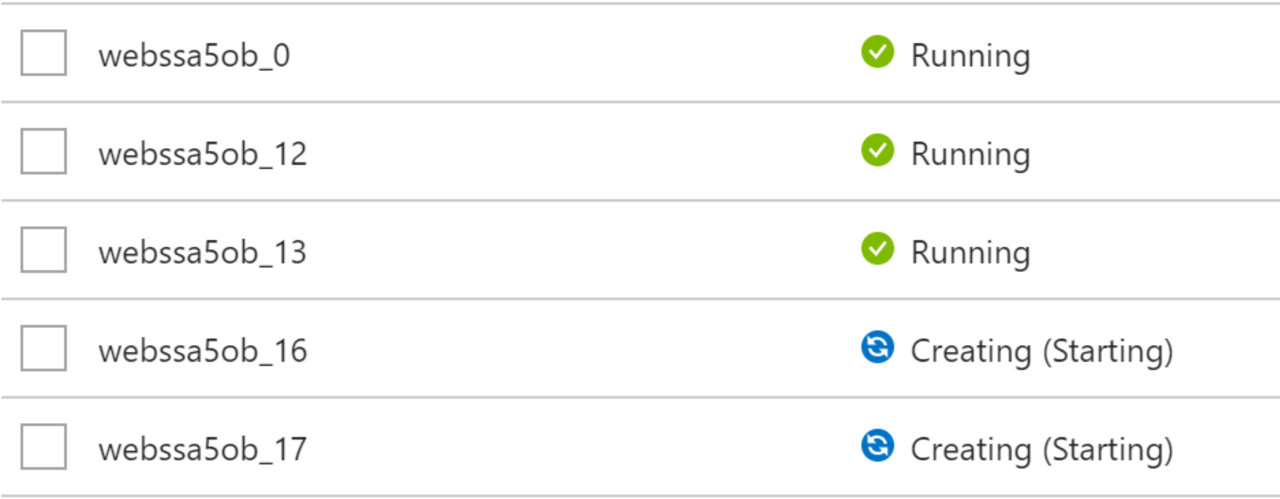


CPU Spike Demo

5. After 15-20 minutes, click the instances button to validate that additional instances were added in response to the CPU spike



You will see something like the following after a while with new instances starting.



□	webssa5ob_0	✓ Running
□	webssa5ob_12	✓ Running
□	webssa5ob_13	✓ Running
□	webssa5ob_16	Creating (Starting)
□	webssa5ob_17	Creating (Starting)

Task 2: Validate SQL Always On

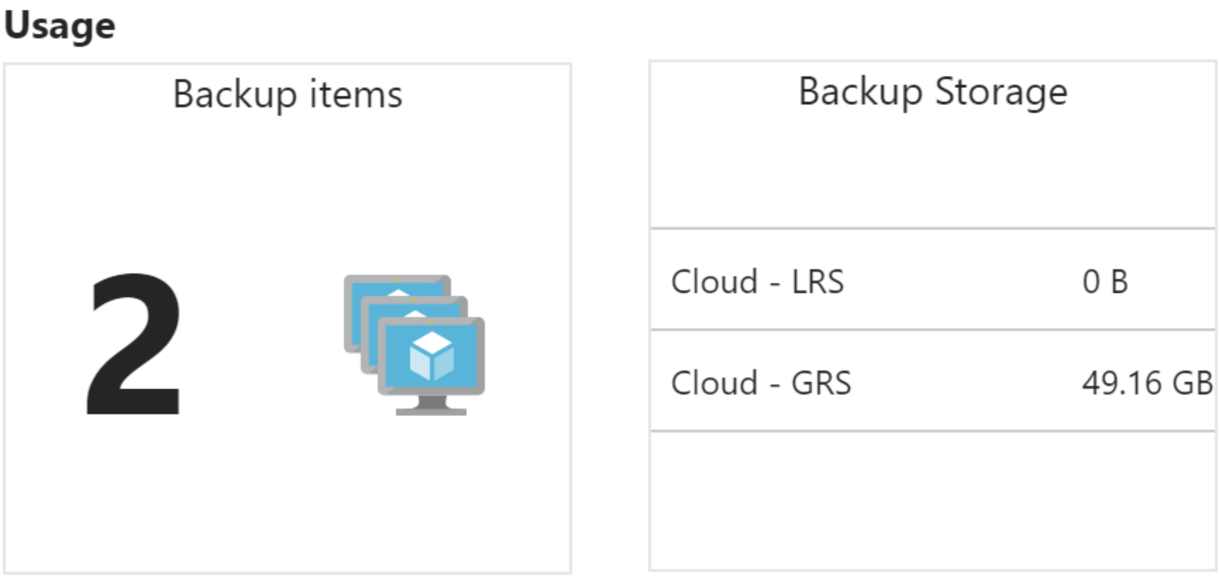
1. Within the Azure portal, click on Virtual Machines and open **SQLVM-1.** Click **Stop** at the top of the blade to shut the virtual machine off.

2. After the VM is deallocated, refresh the CloudShop application in your browser. If the page loads with data in the dropdown list SQL has successfully failed over the primary node to the secondary. You can login to the secondary vm (SQLVM-2) and connect via SQL Server Management Studio to confirm.

Task 3: Validate backups are taken

1. In the Azure portal, click All Services and search for Recovery Vault. Click the link and you should see the two recovery vaults created as part of the deployment of the Active Directory domain controllers.

2. Open each vault and validate that a backup of the VM has occurred



Usage

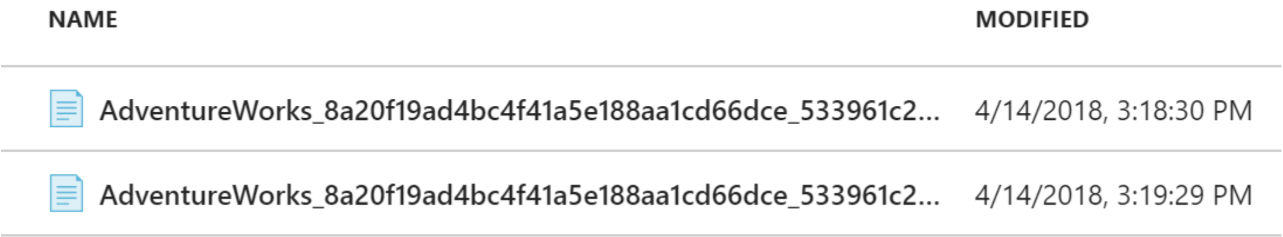
Backup items

2

Backup Storage

Cloud - LRS	0 B
Cloud - GRS	49.16 GB

3. To validate the SQL Server backup, open the Storage Account created earlier in the Azure portal and click **Blobs** -> and then **backups**. If the backup has already completed, you will see the backup file in the container.



NAME	MODIFIED
AdventureWorks_8a20f19ad4bc4f41a5e188aa1cd66dce_533961c2...	4/14/2018, 3:18:30 PM
AdventureWorks_8a20f19ad4bc4f41a5e188aa1cd66dce_533961c2...	4/14/2018, 3:19:29 PM

After the hands-on lab

Task 1: Delete the resource groups created

1. Within the Azure portal, click Resource Groups on the left navigation

2. Delete each of the resource groups created in this lab by clicking them followed by clicking the Delete Resource Group button. You will need to confirm the name of the resource group to delete.

You should follow all steps provided *after* attending the hands-on lab.