Microsoft

ARM Template – Deploy multiple SQL VM and set up Always On

Prepared by

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1 Introduction

This ARM template creates multiple SQL virtual machines on Azure with new or existing virtual network. It also creates network security group, network interfaces and publics IPs and availability set for the VMs. And finally, it creates an internal load balancer.

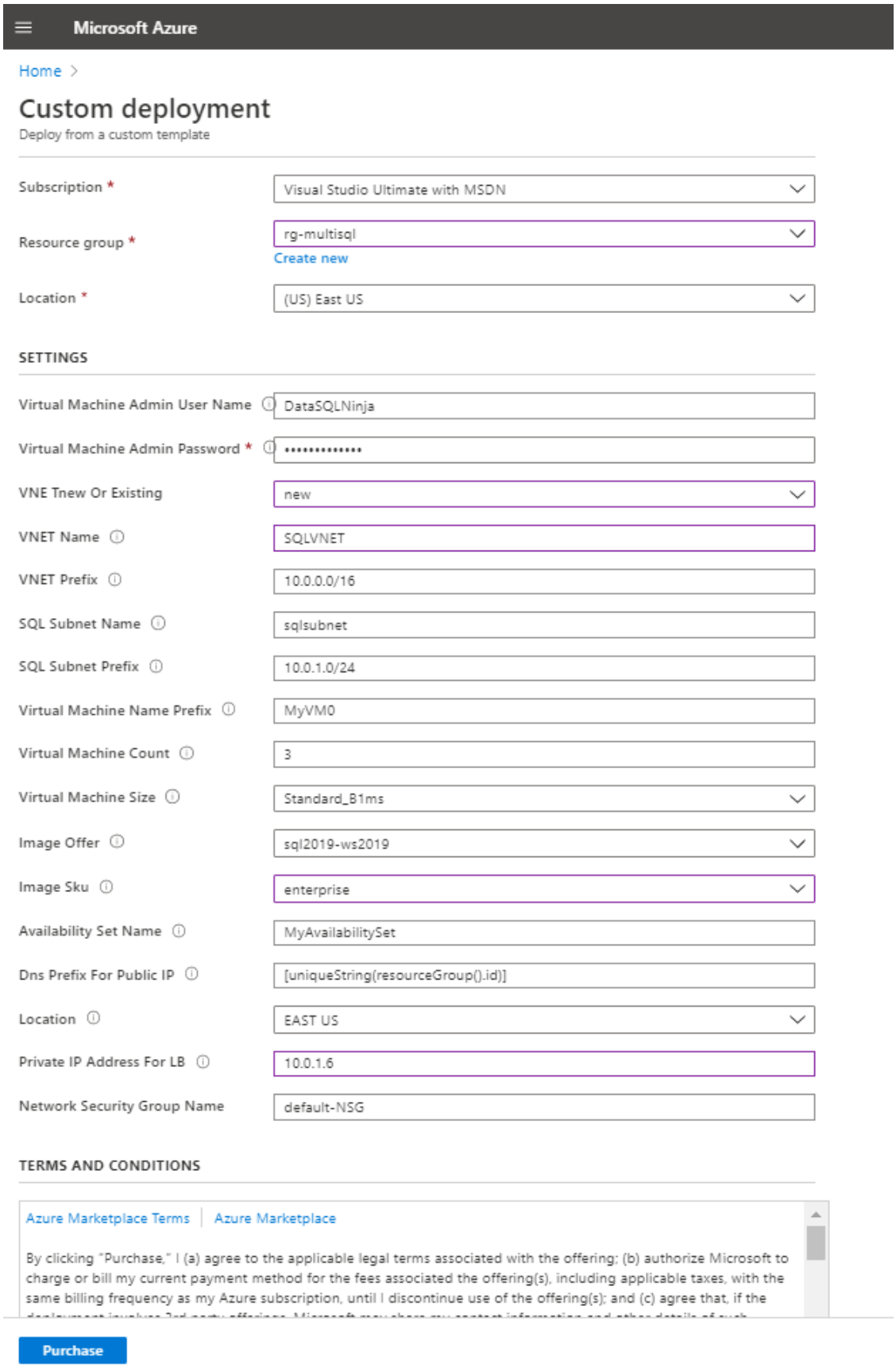
This template can be used independently however, you can use this template along with other available templates for creating Always On availability groups on SQL Server on Azure Virtual Machines.

2 General Guidelines

1. Parameters in this ARM template

You can find all parameter list in the below snapshot. You have the option to

- choose virtual machine's admin username and password.
- Select whether you are going to create a new virtual network, or you already have one where you want to deploy all the VMs.
- Provide virtual network name, VNet prefix (address space), subnet name, subnet prefix.
- virtual machines name's prefix
- number of virtual machines that you want to deploy.
- select a virtual machine size from the drop down.
- select image offer from the drop down, you can find the couple of options in the drop down.
- select image SKU for VMs (dev, standard, enterprise)
- provide availability set name.
- provide a DNS prefix for public IP for all the VMs.
- select location from the dropdown, it gives you the flexibility to deploy your resources in a different location than your resource group.
- provide appropriate IP for load balancer, it must be in the range of subnet IP range, that you provided above.
- provide a suitable name for network security group, you can leave it default as well. However, if you try to run this template twice, you might encounter an issue that duplicate network security group cannot be created.


Microsoft Azure
Home
Custom deployment
Deploy from a custom template
Subscription *
Visual Studio Ultimate with MSDN
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rg-multisql
Create new
Location *
(US) East US
SETTINGS
Virtual Machine Admin User Name
DataSQLNinja
Virtual Machine Admin Password *
VNE Tnew Or Existing
new
VNET Name
SQLVNET
VNET Prefix
10.0.0.0/16
SQL Subnet Name
sqlsubnet
SQL Subnet Prefix
10.0.1.0/24
Virtual Machine Name Prefix
MyVM0
Virtual Machine Count
3
Virtual Machine Size
Standard_B1ms
Image Offer
sql2019-ws2019
Image Sku
enterprise
Availability Set Name
MyAvailabilitySet
Dns Prefix For Public IP
[uniqueString(resourceGroup().id)]
Location
EAST US
Private IP Address For LB
10.0.1.6
Network Security Group Name
default-NSG
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
Purchase

2. **Resources**

   This ARM template reduces lot of manual effort by deploying various resources on Azure without any hassle. When you try to deploy this template, it will ask you to select an existing resource group or create a new one. Based on your selection, this template will start deploying all the resources under that specific resource group.

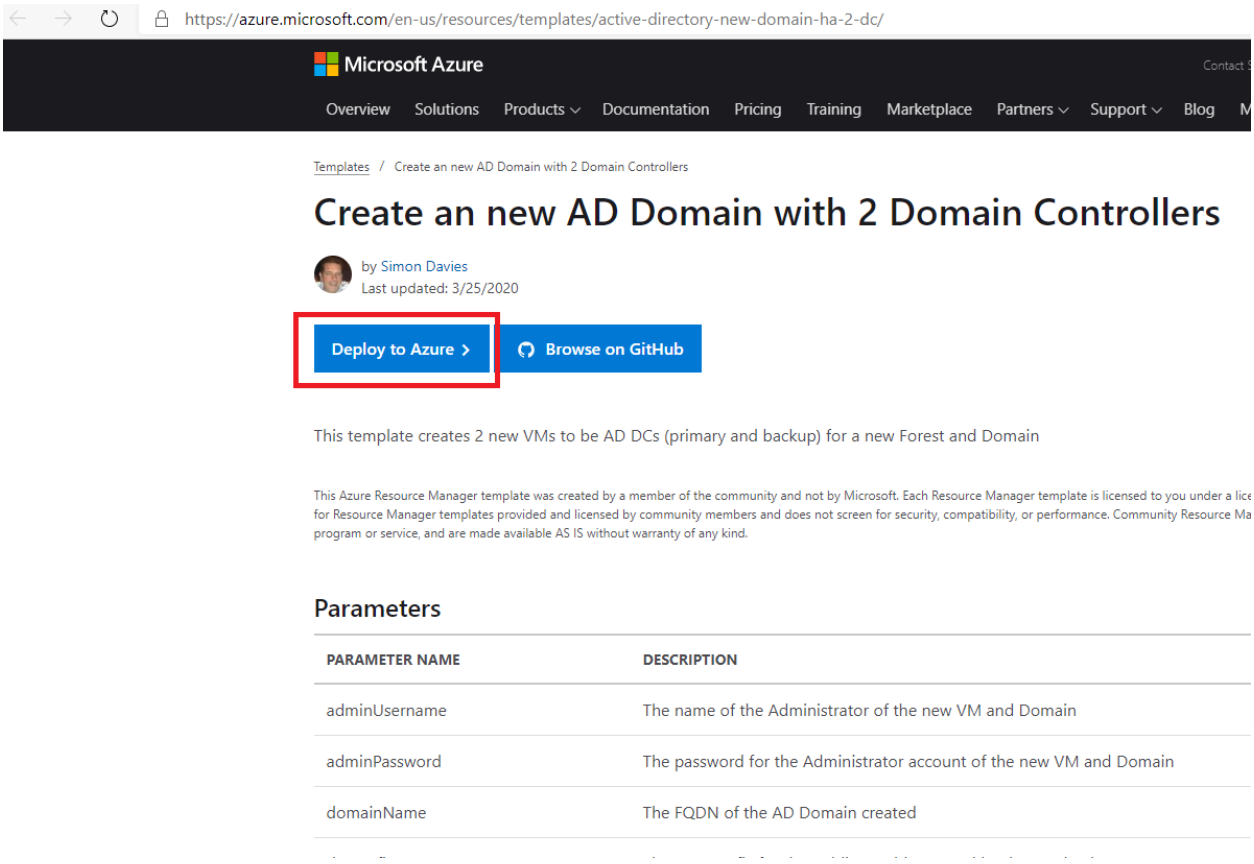
3 SQL Server Always On setup

This template can be used with other existing templates for SQL Server Always On setup. You need to follow below mentioned steps.

3.1 Create a new AD Domain with 2 Domain Controllers

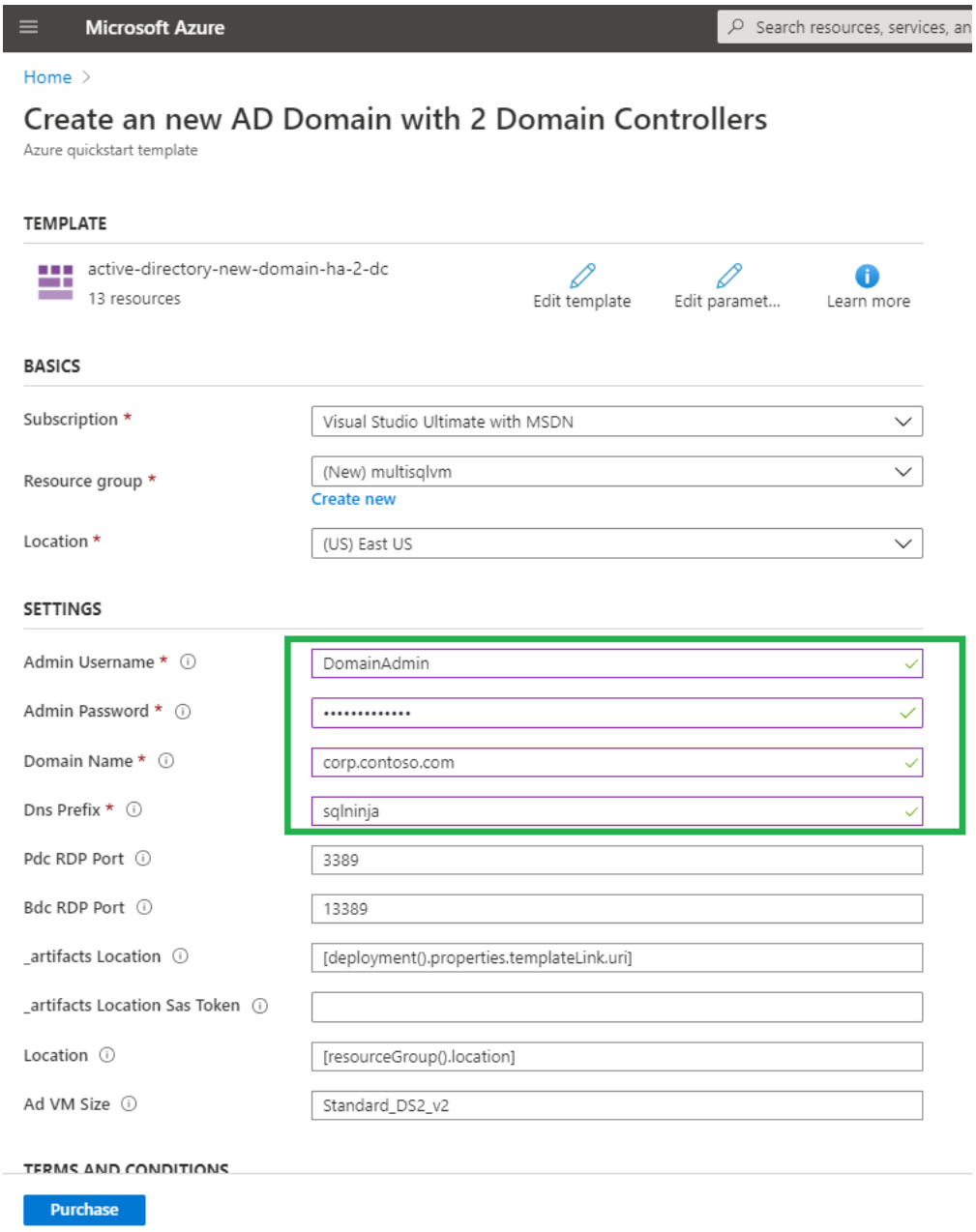
- Click on the below link to navigate to the ARM template to create a new AD domain with 2 domain controllers.

https://azure.microsoft.com/en-us/resources/templates/active-directory-new-domain-ha-2-dc/

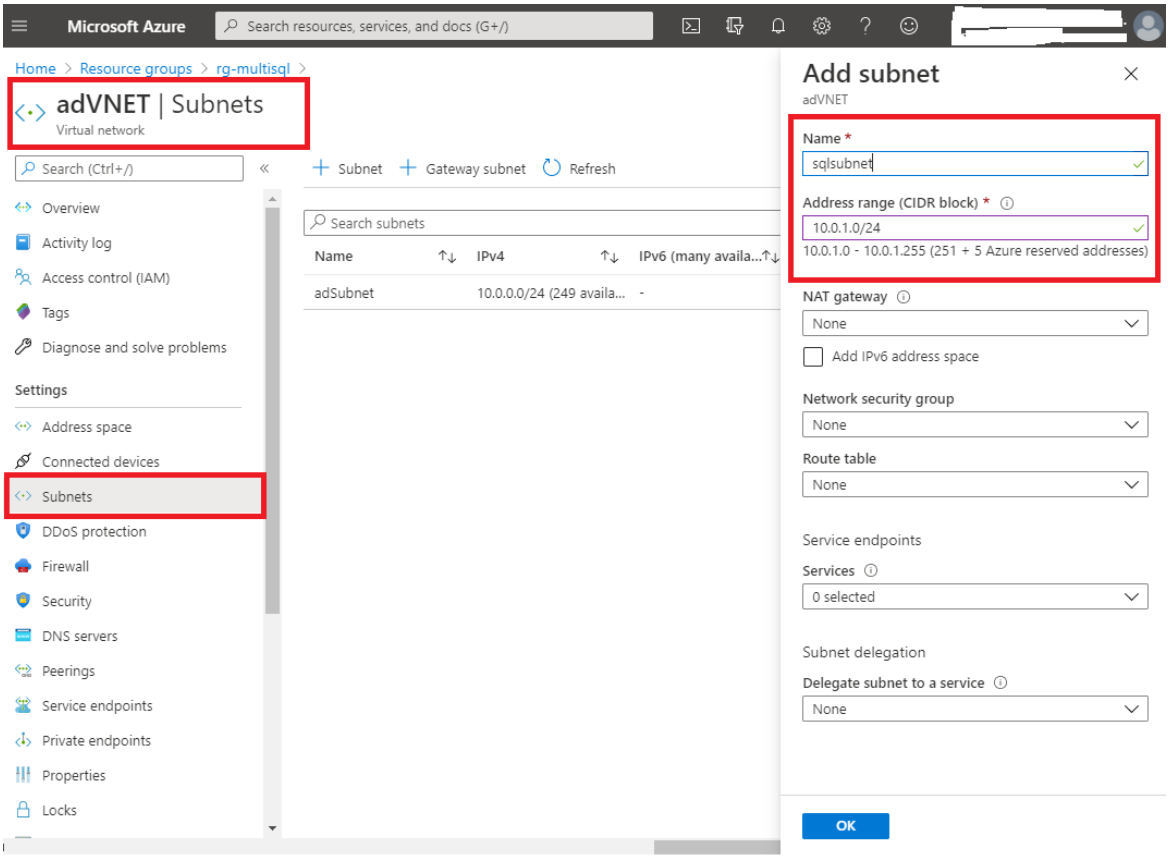


- Click on **Deploy to Azure** and fill in all the required details.
    - Admin Username: **DomainAdmin**
    - Admin Password: **Microsoft01***
    - DomainName: **corp.contoso.com**
    - DNS prefix: **sqlninja**
    - You can leave rest of the fields as it is

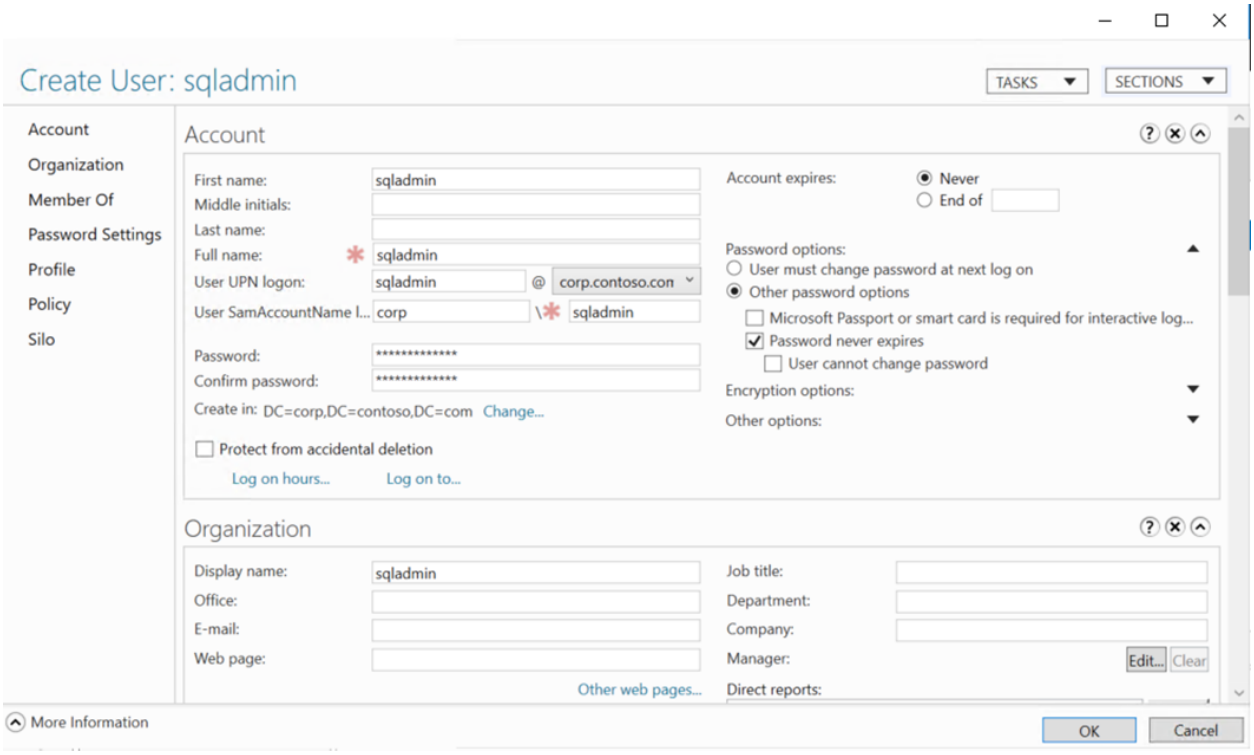
- Click on **Purchase** and the deployment will begin. This will take approximately 30 minutes to complete the deployment.



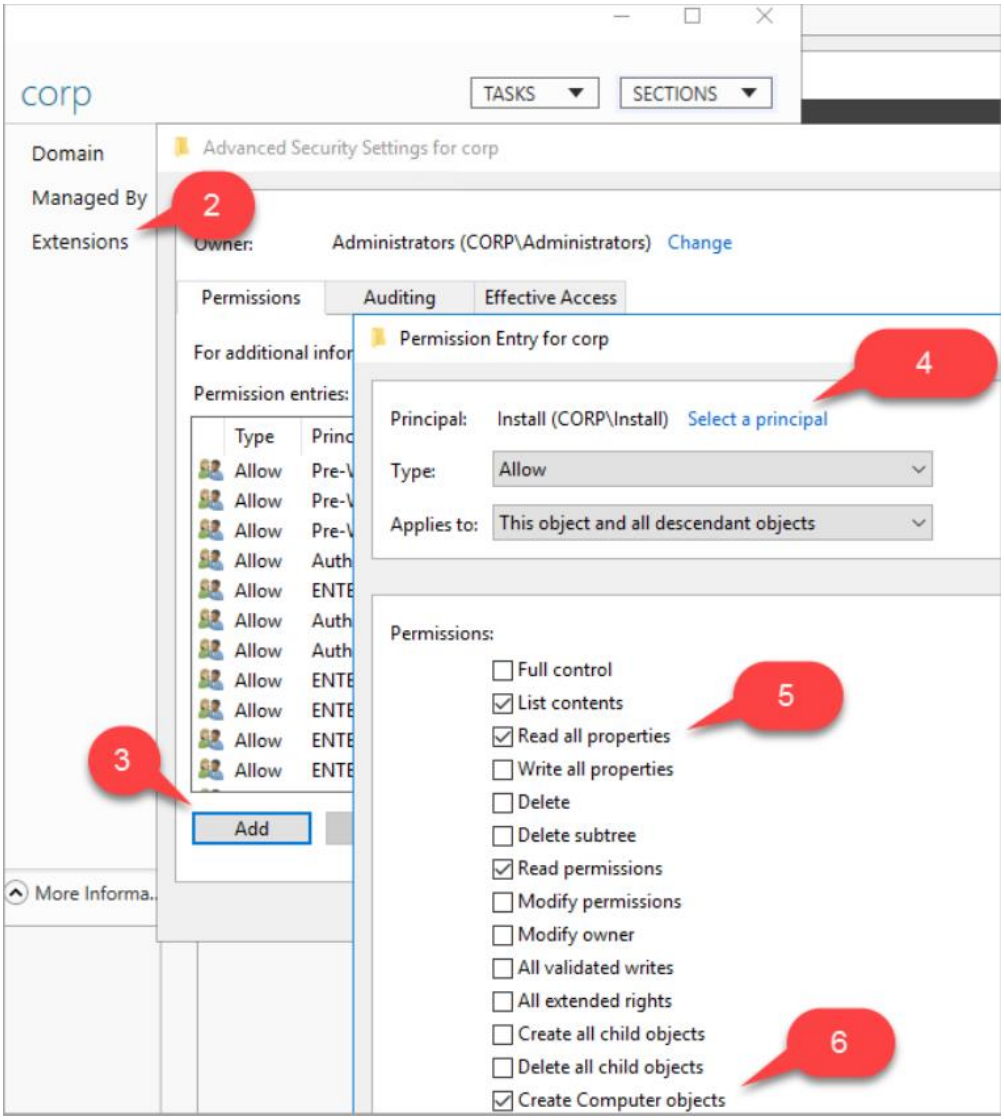
- Go to Azure portal and click on the virtual network **adVNET** and add a subnet, or you can use this template to add a subnet.



- Configure the domain account.
    - Sign into the **adPDC** machine.
    - In Server Manager, select Tools, and then select Active Directory Administrative Center.
    - Select **corp (local)** from the left pane.
    - On the right Tasks pane, select New, and then select User.
    - Fill in the details



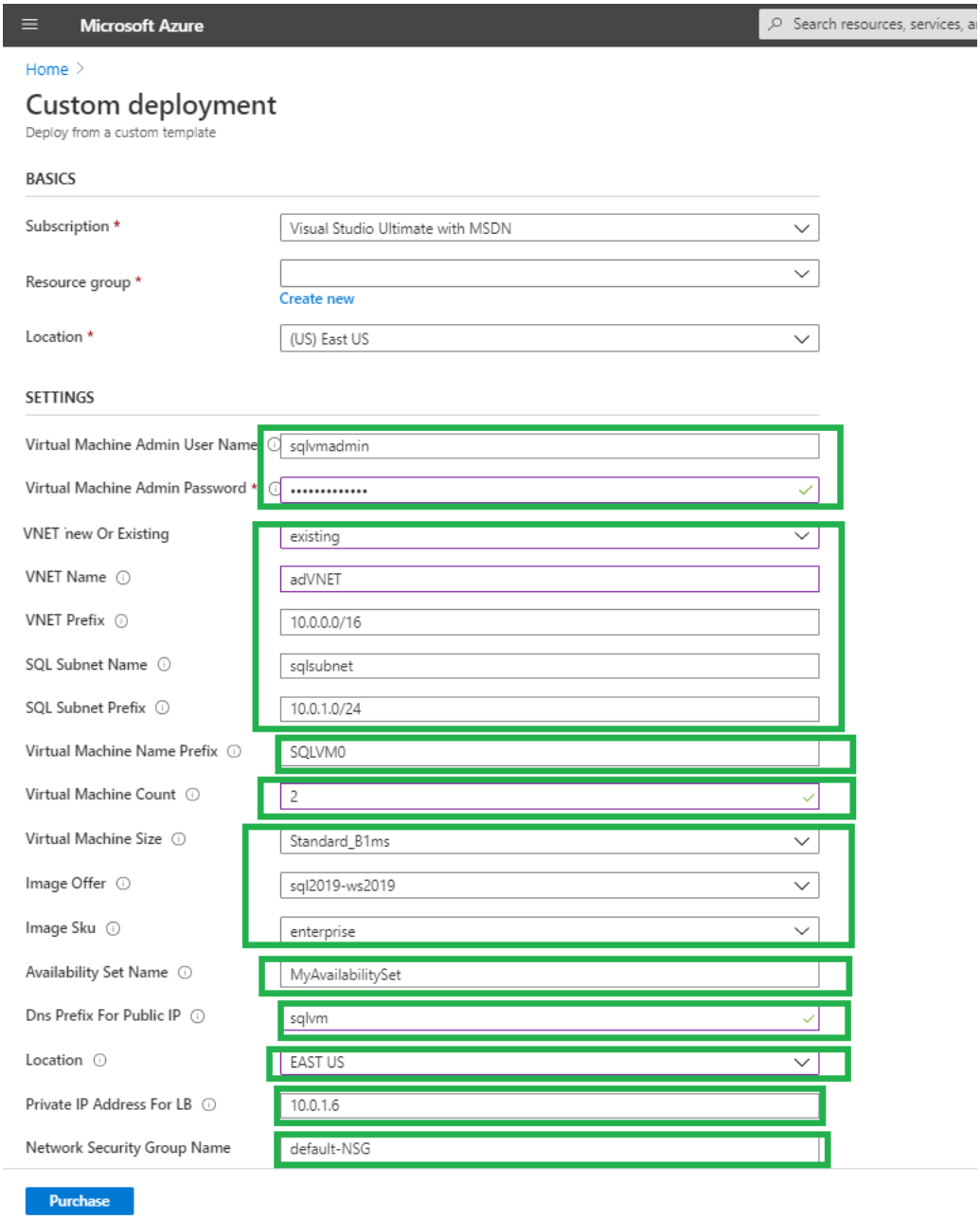
- Grant the required permissions to the sqladmin account
    - In the Active Directory Administrative Center, select corp (local) in the left pane. Then in the right-hand Tasks pane, select Properties.
    - Select Extensions, and then select the Advanced button on the Security tab.
    - In the Advanced Security Settings for corp dialog, select Add.
    - Click Select a principal, search for CORP\sqladmin, and then select OK.
    - Select the Read all properties check box.
    - Select the Create Computer objects check box.
    - Select OK, and then select OK again. Close the corp properties window.



3.2 Deploy multiple SQL Virtual Machines on existing virtual network

- Click on the **Deploy** link and fill in the details.
    - Virtual machine Admin Username: **SQLVMADMIN**
    - Virtual Machine Admin Password: **Microsoft01***
    - VNET new or existing: **existing**
    - VNET Name, VNET Prefix, SQL Subnet Name, SQL Subnet Prefix: Fill in the details of your existing virtual network and corresponding subnet. In this example, virtual network is **adVNET,** address prefix is **10.0.0.0/16**, SQL Subnet name: **SQLSubnet**, SQL Subnet prefix: **10.0.1.0/24**

- Virtual Machine Name prefix: Provide appropriate prefix for your VM names, in this example we are using **SQLVM0**, so the VM names will be SQLVM01, SQLVM02 and so on.
- Virtual Machine count: Number of SQL VMs that you want to deploy, in this example we are going to deploy **2** SQL virtual machines.
- Virtual machine size, Image offer: You can select the values from drop down as per your requirement otherwise, you can leave the default values as it is.
- Image SKU: You have the option to choose from the drop down but leave it at default value. Later steps require the VM's SKU to be enterprise.
- Availability Set Name: **SQLAvailabilitySet**
- DNS prefix for public IP: **sqlvm**
- Location: **EAST US**
- Public IP Address for LB: You need to provide appropriate IP address for load balancer, this IP must fall in the range of SQLSubnet. In this example, we are using **10.0.1.6**
- Network Security Group: **default- NSG**



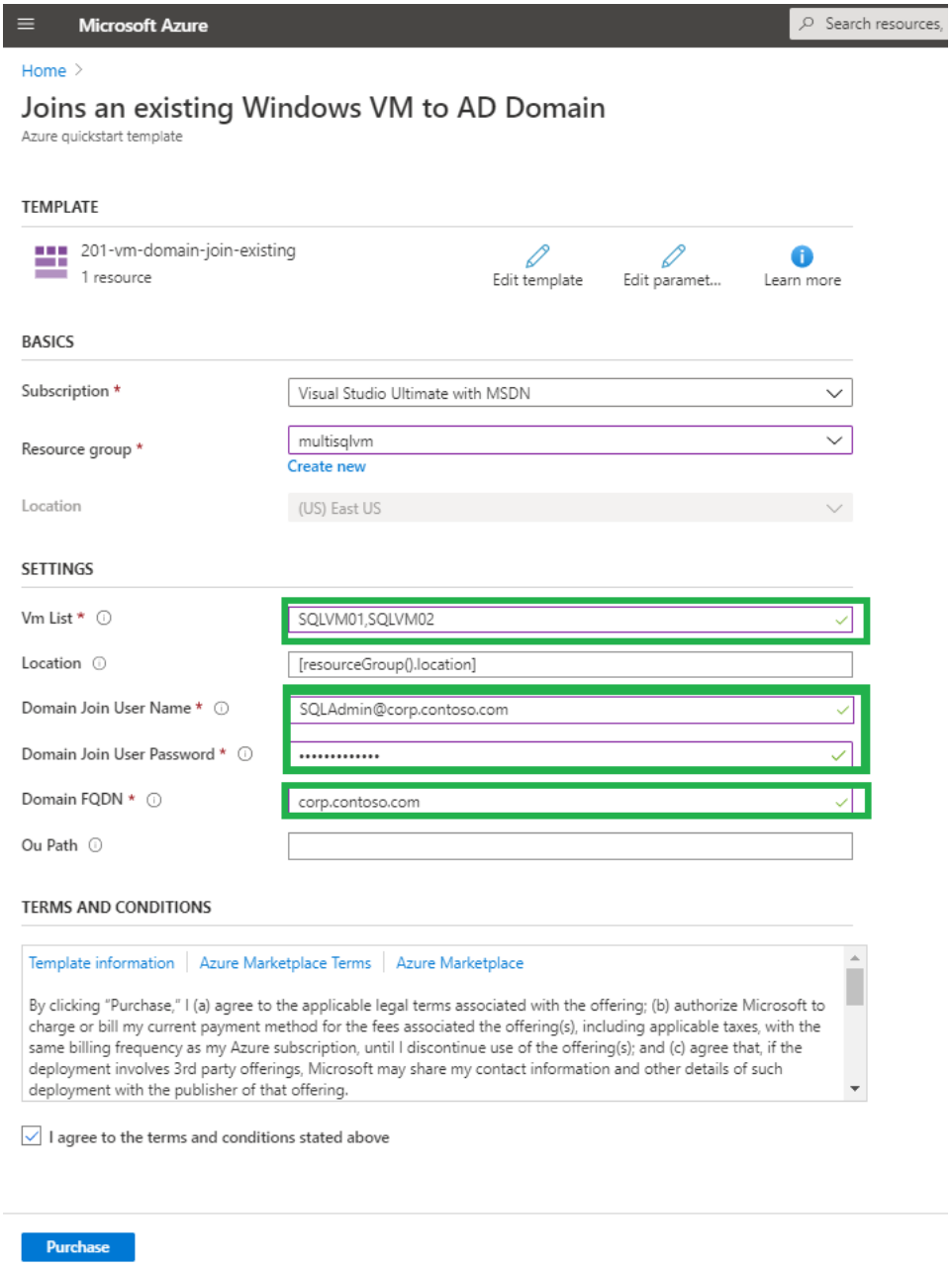
- Login to the SQL virtual machine **SQLVM01** using credentials that you provided while deploying the template. Username: **SQLVM01\ SQLVMADMIN** and Password: **Microsoft01***
- Now you can create your new database on the primary SQL Server. However, you can follow this link if you want to migrate a SQL Server database to SQL Server on this Azure virtual machine.

3.3 Join existing SQL VMs to AD Domain

This template allows you to join an already existing Windows virtual machine into an existing Active Directory Domain. For this template to work you need an existing virtual machine, an AD Domain and a Domain Controller that has communication with this virtual machine and DNS settings that will allow this virtual machine to resolve the Domain DNS name.

- Click on the link below to navigate to the template documentation and then click on **Deploy to Azure** link and fill in the required details.
  https://azure.microsoft.com/en-us/resources/templates/201-vm-domain-join-existing/

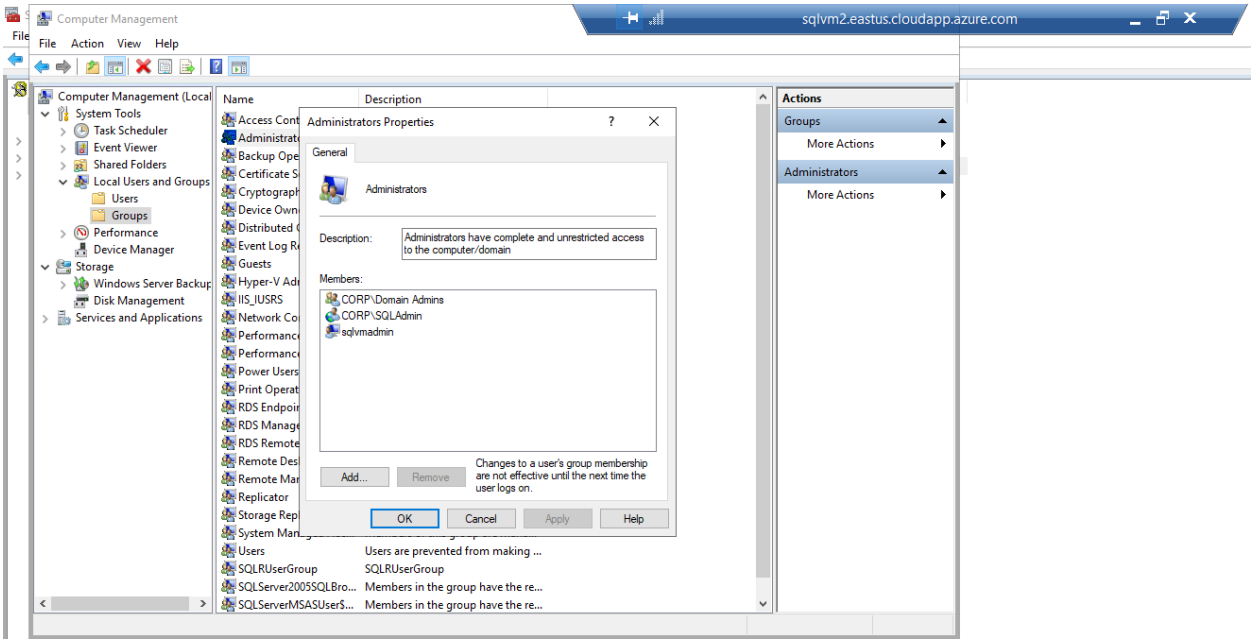
- Fill in the required information to deploy this template on Azure.
  - VM List: Provide list of SQL Virtual machines, use comma **(,)** as separator for multiple VMs. In this example we have two SQL VMs **SQLVM01, SQLVM02**
  - Domain Join Username: **CORP\SQLAdmin**
  - Domain Join User Password: **Microsoft01***
  - Domain FQDN: **corp.contoso.com**



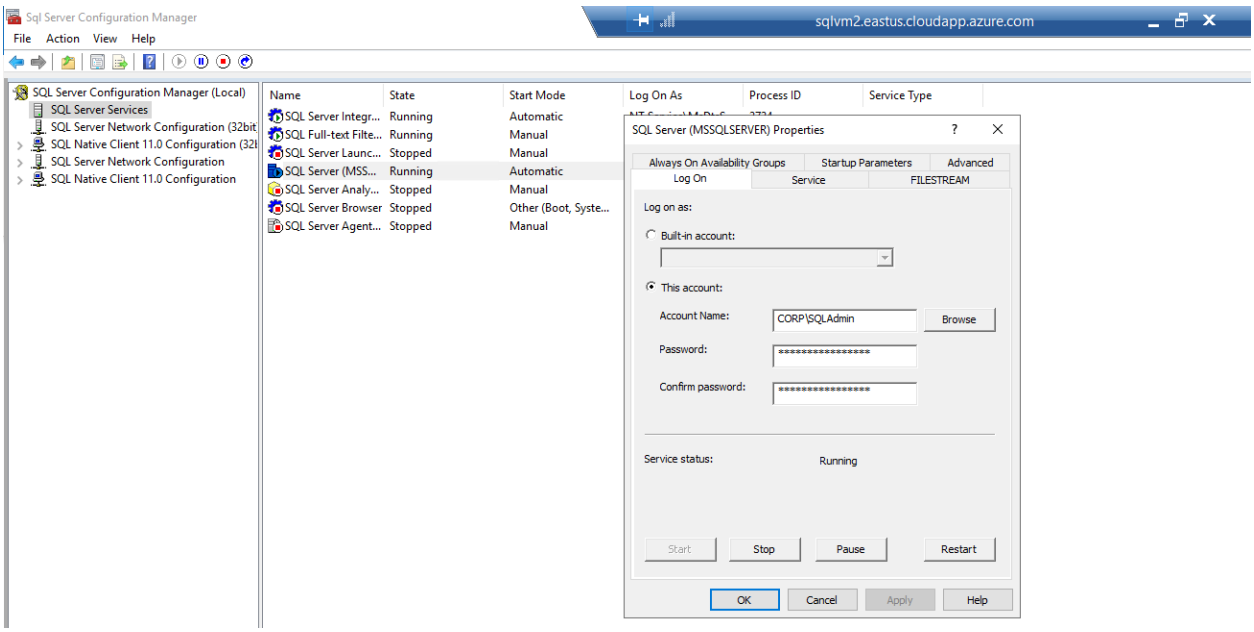
3.4 Additional Settings on SQL VMs

- Add the domain user account **CORP\SQLAdmin** as an administrator on each cluster VM.
    - Wait until the VM is restarted, then launch the RDP file again from the primary domain controller to sign in to any one SQL Server virtual machines by using the **CORP\ SQLAdmin** account.
    - In Server Manager, select Tools, and then select Computer Management.

- In the Computer Management window, expand Local Users and Groups, and then select Groups.
- Double-click the Administrators group.
- In the Administrators Properties dialog, select the Add button.
- Enter the user **CORP\ SQLAdmin** and then select OK.
- Select OK to close the Administrator Properties dialog.
- Repeat the previous steps on other SQL virtual machines.



- Add **CORP\SQLAdmin** user login for SQL Server on both the VMs.
  - Go to the management studio on VM.
  - Connect to SQL Server instance
  - Expand security and right click on Login.
  - Search for **CORP\SQLAdmin** under entire directory
  - Provide sysadmin permission.
- On each SQL Server VM, set the SQL Server service account. Use the accounts that you created when you configured the domain accounts.
  - Open SQL Server Configuration Manager.
  - Right-click the SQL Server service, and then select Properties.
  - Set the account and password.
  - Repeat these steps on the other SQL Server VM.
  - For SQL Server availability groups, each SQL Server VM needs to run as a domain account.



- Grant the required permissions to [NT AUTHORITY\SYSTEM] on each SQL Server instance:
    - ALTER ANY AVAILABILITY GROUP
    - CONNECT SQL
    - VIEW SERVER STATE

      Script:

      GRANT ALTER ANY AVAILABILITY GROUP TO [NT AUTHORITY\SYSTEM]

      GO

      GRANT CONNECT SQL TO [NT AUTHORITY\SYSTEM]

      GO

      GRANT VIEW SERVER STATE TO [NT AUTHORITY\SYSTEM]

      GO

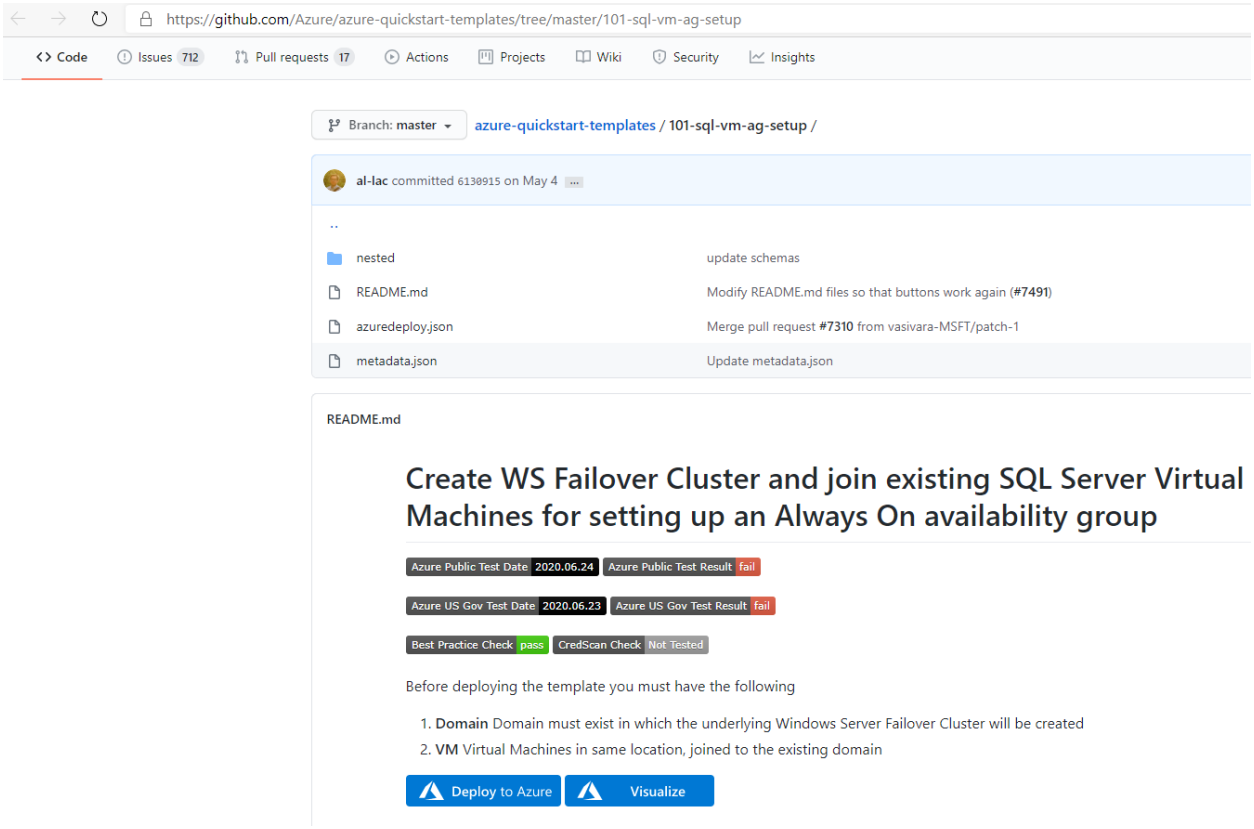
3.5 Create Windows Server Failover Cluster

This deployment will create a WS failover cluster with cloud witness on the provided VMs (in same region) and enable SQL Always ON them. This will enable creating SQL Availability Groups over the created Always ON setup. Following resources will be created

Storage Account to be used as Cloud Witness for failover cluster.

- Resource of type "SqlVirtualMachine" in Microsoft.SqlVirtualMachine resource provider. This corresponds to the existing Virtual Machine.
- Resource of type "SqlVirtualMachineGroup" in Microsoft.SqlVirtualMachine resource provider. This captures details of WS failover cluster setup

https://github.com/Azure/azure-quickstart-templates/tree/master/101-sql-vm-ag-setup



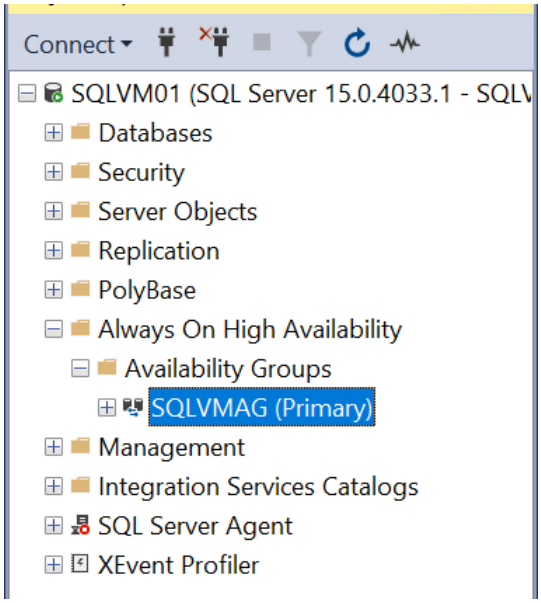
3.6 Create Availability Group manually

- In Object Explorer, connect to the server instance that hosts the primary replica.
- Expand the Always On High Availability node and the Availability Groups node.
- To launch the New Availability Group Wizard, select the New Availability Group Wizard command.
- The first time you run this wizard, an Introduction page appears. To bypass this page in the future, you can click Do not show this page again. After reading this page, click Next.
- On the Specify Availability Group Options page, enter the name of the new availability group in the Availability group name field. This name must be a valid SQL Server

identifier that is unique on the cluster and in your domain. The maximum length for an availability group name is 128 characters.

- Next, specify the cluster type. The possible cluster types depend on the SQL Server version and operating system. Choose **WSFC** from the drop-down list.
- On the Select Databases page, the grid lists user databases on the connected server instance that are eligible to become the availability databases. Select one or more of the listed databases to participate in the new availability group. These databases will initially be the initial primary databases.
- For each listed database, the Size column displays the database size, if known. The Status column indicates whether a given database meets the prerequisites or availability databases. It the prerequisites are not met, a brief status description indicates the reason that the database is ineligible; for example, if it does not use the full recovery model. For more information, click the status description.
- If you change a database to make it eligible, click Refresh to update the databases grid.
- If the database contains a database master key, enter the password for the database master key in the Password column.
- On the Specify Replicas page, specify and configure one or more replicas for the new availability group.
- On the Select Initial Data Synchronization page, choose Join only if you have manually prepared secondary databases on the server instances that will host the secondary replicas otherwise choose Automatic seeding
- The Validation page verifies whether the values you specified in this Wizard meet the requirements of the New Availability Group Wizard. To make a change, click Previous to return to an earlier wizard page to change one or more values. The click Next to return to the Validation page and click Re-run Validation.
- On the Summary page, review your choices for the new availability group. To make a change, click Previous to return to the relevant page. After making the change, click Next to return to the Summary page.

For reference: https://docs.microsoft.com/en-us/sql/database-engine/availability-groups/windows/use-the-availability-group-wizard-sql-server-management-studio



3.7 configure ILB and create listener for an existing Always On availability group on SQL Server VMs in Azure

This deployment will create an AG listener for a SQL Availability Group. This will also setup Load balancer rules corresponding to the Listener. The following resources will be created.

- SQL Availability Group Listener for the provided AG.
- Load balancer rules that will enable Listener to work in Azure.
- Resource of type "AvailabilityGroupListener" in Microsoft.SqlVirtualMachine resource provider.

https://github.com/Azure/azure-quickstart-templates/tree/master/101-sql-vm-aglistener-setup

Parameters:

- Existing failover cluster name: **sqlfc**
- Existing SQL Availability Group: **SQLVMAG**
- Existing VM list: **SQLVM01, SQLVM02**

  Note: You can add a maximum of up to 6 VMs to this field

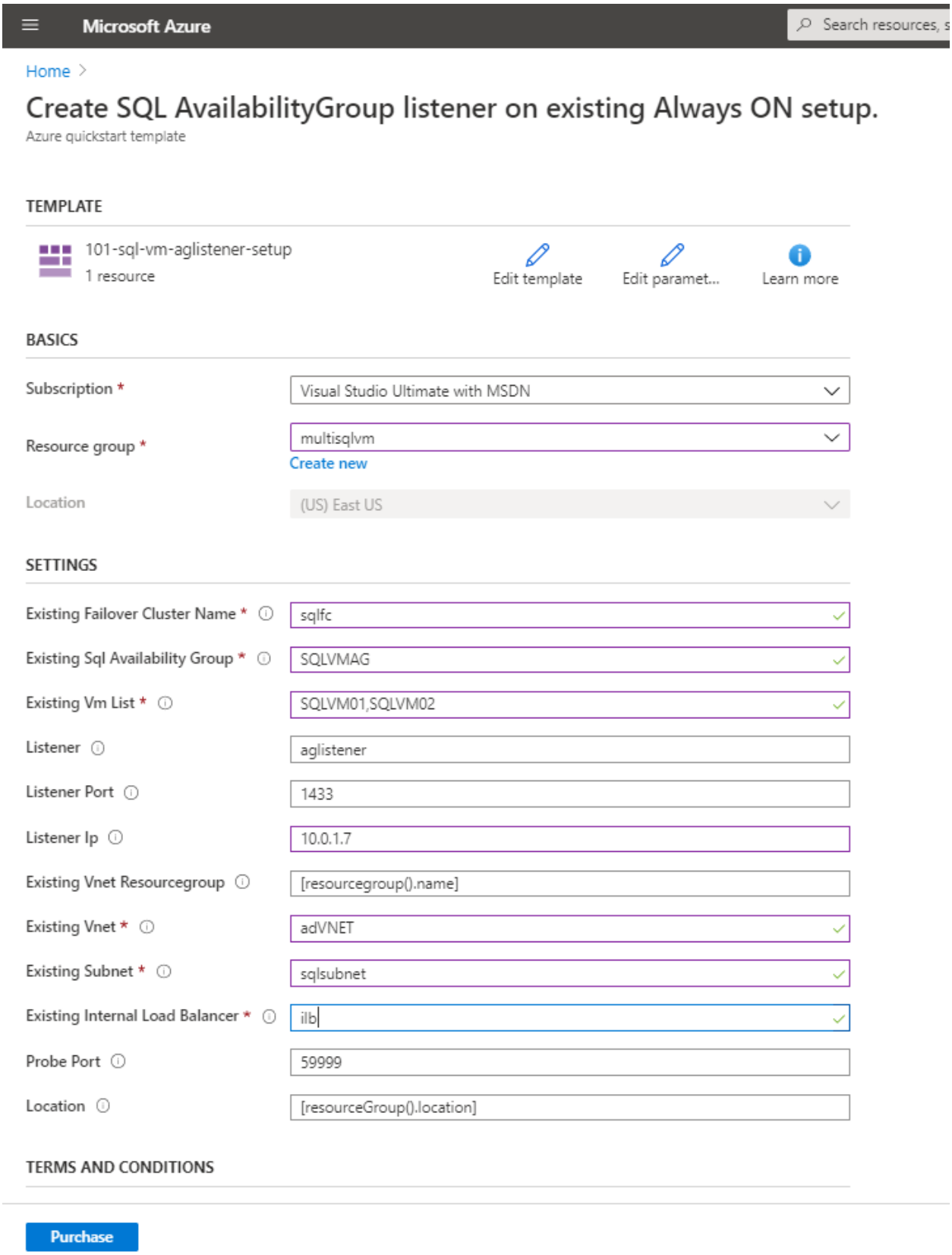
- Listener: **aglistener**

  Note: Maximum character limit for listener is 15

- Listener IP: **10.0.1.7**

Note: When you create one AG listener within an SQL VM Group, you can use an LB IP address. But when you create multiple LB within the SQL VM group, they must choose the available IP address within the LB subnet.

- Existing VNet: **adVNET**
- Existing subnet: **sqlsubnet**
- Existing load balancer: **ilb**


Microsoft Azure
Search resources, s
Home
Create SQL AvailabilityGroup listener on existing Always ON setup.
Azure quickstart template
TEMPLATE
101-sql-vm-aglistener-setup
1 resource
Edit template
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Learn more
BASICS
Subscription *
Visual Studio Ultimate with MSDN
Resource group *
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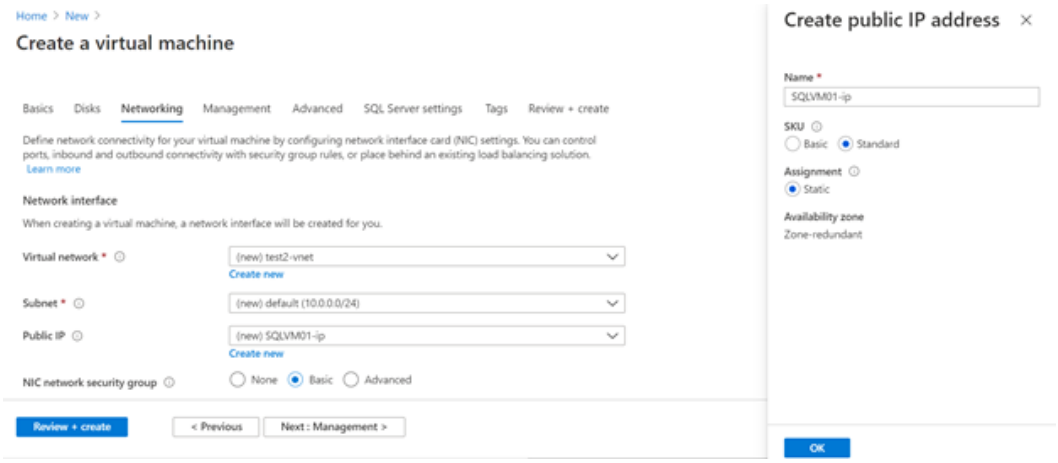
Create new
Location
(US) East US
SETTINGS
Existing Failover Cluster Name *
sqlfc
Existing Sql Availability Group *
SQLVMAG
Existing Vm List *
SQLVM01,SQLVM02
Listener
aglistener
Listener Port
1433
Listener Ip
10.0.1.7
Existing Vnet Resourcegroup
[resourcegroup().name]
Existing Vnet *
adVNET
Existing Subnet *
sqlsubnet
Existing Internal Load Balancer *
ilb
Probe Port
59999
Location
[resourceGroup().location]
TERMS AND CONDITIONS
Purchase

4 Appendices

Configure an availability group for SQL Server on Azure VM (Azure portal - Preview)

It has always been an overhead to create availability group and listener for SQL Server on Azure VM however, now you can configure it on Azure portal directly. You just need to have certain prerequisites before you start creating an availability group for SQL Server on Azure VM.

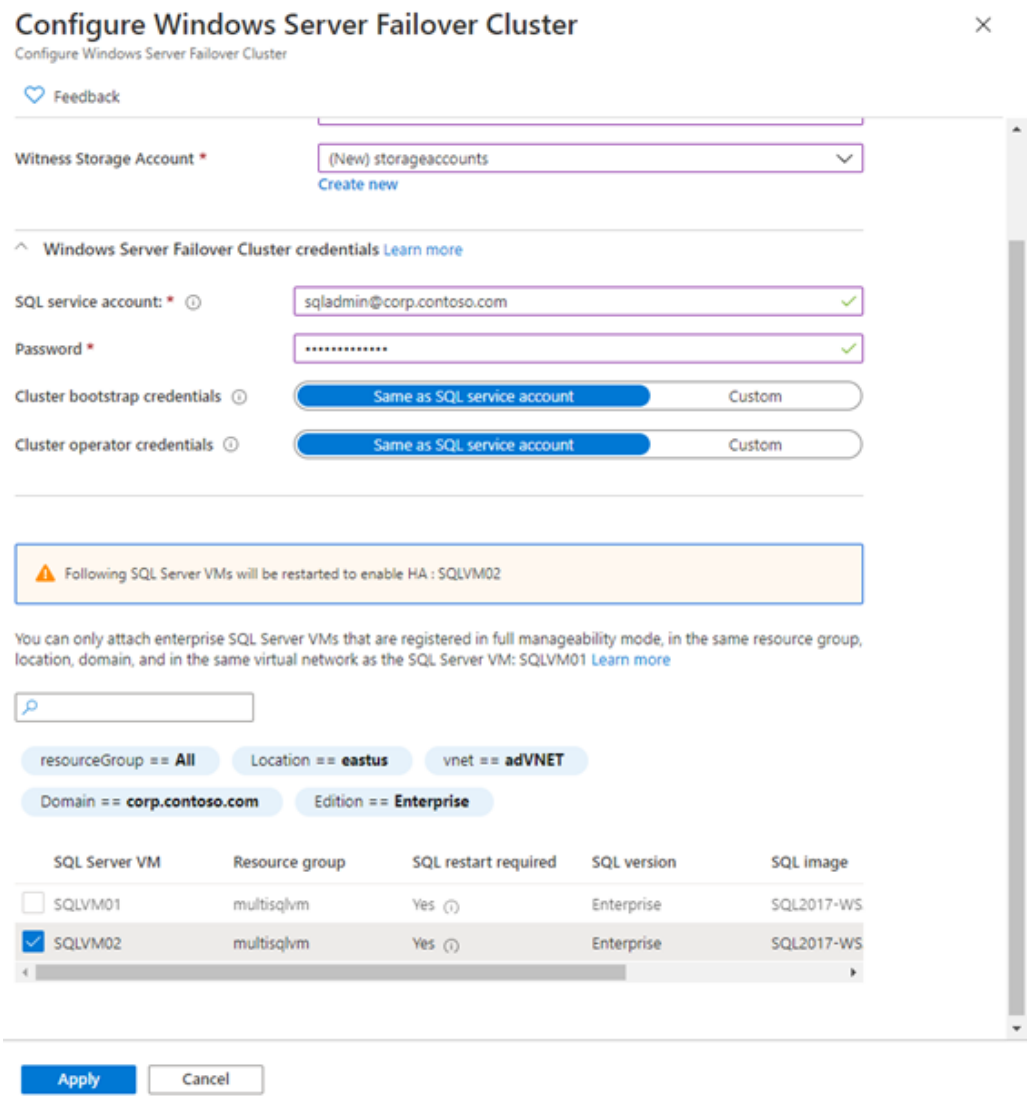
1. You need to have a domain controller in your resource group, if you don't have t already you can create it using the steps mentioned here.
2. Create SQL Server on Azure VM from the portal, however, make sure that you create/use **Standard** public IP address and **Enterprise** edition for SQL Server.



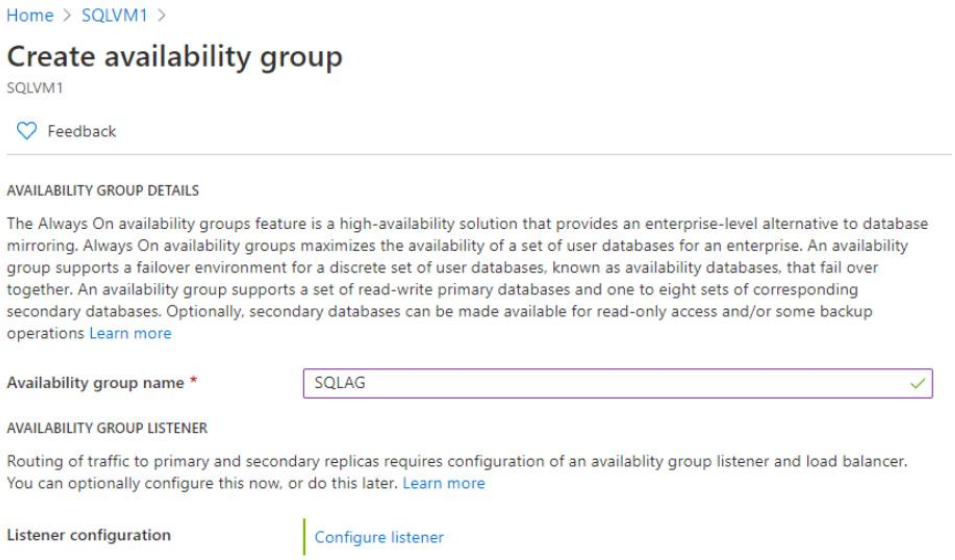
3. Join your VM to the existing domain using the steps mentioned here.
4. Two available (not used by any entity) IP addresses. One is for the internal load balancer. The other is for the availability group listener within the same subnet as the availability group. If you're using an existing load balancer, you only need one available IP address for the availability group listener.
5. Recovery mode for SQL Server must be set to **Full** recovery mode.
6. Add database to the existing SQL Server and take a full backup of the database.

Now that you have all the prerequisites in place, let's try to create availability group and listener from the portal.

1. Go to High Availability tab of SQL Virtual Machine (not the underlying virtual machine) and click on **+New Windows Server Failover Cluster** and provide all the required details



2. Click on Apply after providing all the required details and click on **+New Always On Availability Group**
3. Enter a name for the availability group.
4. Select **Configure listener** to open the **Configure availability group listener** page.



5. Fill out the values, and either use an existing load balancer, or select **Create new** to create a new load balancer. Select **Apply** to save your settings and create your listener and load balancer.
6. Choose **+ Select replica** to open the **Configure availability group replicas** page.
7. Select the virtual machines you want to add to the availability group and choose the availability group settings that best suit your business needs. Select **Apply** to save your settings.
8. Verify your availability group settings and then select **Apply** to create your availability group.

5 Feedback and suggestions

If you have feedback or suggestions for improving this data migration asset, please contact the Data SQL Ninja Engineering Team (datasqlninja@microsoft.com). Thanks for your support!

Note: For additional information about migrating various source databases to Azure, see the Azure Database Migration Guide.