Microsoft Azure: Infrastructure as a Service (IaaS)

Deploying SQL on Microsoft Azure VMs IaaS

Section 1: Migrating SQL Server Workloads

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Overview

- SQL Server on IaaS vs. PaaS
- Provisioning Microsoft Azure VMs for SQL Server
- Accessing SQL Server with IaaS
- Migrating SQL Server Workloads
- SQL Server IaaS Best Practices
- Summary

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Deploying SQL on Microsoft Azure VMs IaaS

Section 2: SQL Server on IaaS vs PaaS

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SQL Server or Microsoft Azure SQL Database?

	SQL Server (IaaS)	Microsoft Azure SQL Database (PaaS)
Development	Migrate existing apps	Develop new apps
Management	Full control	Managed service
Compatibility	Full SQL Server capabilities	Based on SQL Server technology

Network transport (Tabular Data Stream)

SQL dialect (Transact-SQL)

Data access APIs (ADO.NET, ODBC, JDBC)

Development tools (SQL Server Data Tools)

Management tools (SQL Server Management Studio)

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Which One Fits Your Needs Best?

- IaaS Benefits:
  - Full features of on premise SQL Server and BI:
    - SQL Server Integration Services (SSIS)
    - SQL Server Analysis Services (SSAS)
    - SQL Server Reporting Services (SSRS)
  - Full control over physical administration data files
  - Easier migration path to the cloud for existing code
- PaaS Benefits:
  - Free from physical administration and management
  - Quick provisioning for testing and POC; focus on the code
  - Elasticity with features like Federations (sharding) and Data Sync

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Section 3: Provisioning Microsoft Azure VMs for SQL Server (IaaS)

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SQL Server and Microsoft Azure VM

- Supported SQL Server and Windows Server versions
  - SQL Server 2014
  - SQL Server 2012
  - Windows Server 2008 R2
  - Windows Server 2008/Windows Server 2008 R2 SP1
  - Windows Server 2012
- Supported features
  - All SQL Server features supported except availability group listeners*
- SQL Server provisioning
  - Cloud-first using stock images
  - Bring your own server/Virtual Hard Disk (VHD)
  - Capture cloud images
- SQL Server licensing
  - Pay by the hour or migrate your own license via Software Assurance**

** AlwaysOn Availability Groups supported, but not AG listeners*

*** Microsoft Azure Compute and Storage charges also apply*

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VM Sizes – Basic and Standard Tier

- Each persistent data disk can be up to 1 terabyte (TB)
- Typically, two data disks per available core
- Tiers
  - Basic – no load balancing, auto-scaling or memory intensive models – best for dev/test scenarios – A0 – A4 – not suited for production SQL
  - Standard – full capabilities vs. Basic tier – A0 – A11

VM Size	CPU Cores	Memory	# of Data Disks	SQL Server Edition
A0	Shared	768 MB	1	Express
A1	1	1.75 GB	2	Standard
A2	2	3.5 GB	4	Standard
A3	4	7 GB	8	Standard / Enterprise
A4	8	14 GB	16	Standard / Enterprise
A5	2	14 GB	4	Standard / Enterprise
A6	4	14 GB	16	Standard / Enterprise
A7	8	56GB	16	Standard / Enterprise
A8	8	56GB	16	Standard / Enterprise
A9	16	112GB	16	Standard / Enterprise
A10	8	56GB	16	Standard / Enterprise
A11	16	112GB	16	Standard / Enterprise

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Compute Intensive – A Series VMs

- Hardware designed and optimized for compute and network intensive apps like HPC
- Supported for Windows and Linux
- A8 – A9 Ideal for MPI applications
- A10 – A11 – Ideal for HPC parametric or embarrassingly parallel applications

VM Size	CPU	CPU Cores	Memory	# of Data Disks	# Network Adapters	SQL Server Edition
A8	Intel® Xeon® E5-2670 8 cores @ 2.6 GHz	8	56GB	16	2	Standard / Enterprise
A9	Intel® Xeon® E5-2670 16 cores @ 2.6 GHz	16	112GB	16	2	Standard / Enterprise
A10	Intel® Xeon® E5-2670 8 cores @ 2.6 GHz	8	56GB	16	1	Standard / Enterprise
A11	Intel® Xeon® E5-2670 16 cores @ 2.6 GHz	16	112GB	16	1	Standard / Enterprise

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VM Sizes – D Series Standard Tier

- Compute processers approx. 60% faster than A-Series Standard
- Up to 800GB of local SSD Drive space
- Local Drive is a temporary Drive!!

General Purpose

Name	vCores	Memory (GB)	Local SSD (GB)
D1	1	3.5	50
D2	2	7	100
D3	4	14	200
D4	8	28	400

High Memory

Name	vCores	Memory (GB)	Local SSD (GB)
D11	2	14	100
D12	4	28	200
D13	8	56	400
D14	16	112	800

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Use cases for D-Series VMs

- Workloads that replicate across multiple instances – ex. MongoDB
- High I/O local and temporary cache
- SQL Server 2014 Buffer Pool Extensions
- The CPU cores are 60% faster in D series than A series, so for CPU bound workloads this could result in needing fewer cores to do the same work, and thus reduce cost
- Data intensive type applications – Big Data and BI
- **Remember: The temporary, or D:\ drive on the VMs can lose the data if the physical disk failure occurs. This SSD drive replaces the previously know scratch D:\ drive**

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VM Sizes – G Series

- More memory and Solid State Drive (SSD) drives
- Intel Xeon processor E5 v3 processorUp to 800GB of local SSD Drive space
- Used for applications and parallel processing that require increased computing power

General Purpose

Name	vCores	Memory (GB)	Local SSD (GB)	Persistent Data Disks Max
Standard_G1	2	28	412	4
Standard_G2	4	56	824	8
Standard_G3	8	112	1,649	16
Standard_G4	16	224	3,298	32
Standard_G5	32	448	6,596	64

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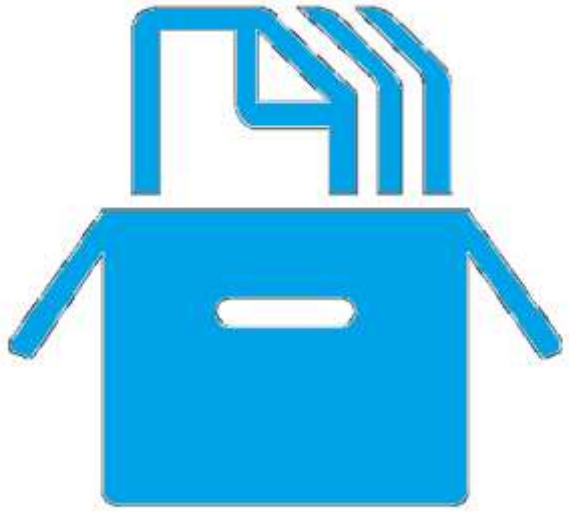
Blob Storage

- Highly available, scalable, and secure file system
- Blobs can be exposed publicly over HTTP
- Continuous geo-replication across data centers
- Used as a backup location for SQL Server database blobs



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Azure Premium Storage *(Preview)*

- Premium storage account can be created via the Azure Preview Portal, Azure PowerShell or the Service Management REST API
- You must first sign up for this Preview service
- Available in Regions West US, East US 2 and West Europe
- Supports on Azure Page Blobs that are used to hold persistent disks
- Only support Locally Redundant Storage (LRS)
- Must use DS-Series disks for VMs
- Cannot be mapped to a custom domain
- Storage analytics not currently supported

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Azure Premium Storage Scalability *(Preview)*

- Three types of Premium Storage disks

Premium Storage Disk Type	P10	P20	P30
Disk size	128 GB	512 GB	1024 GB (1 TB)
IOPS per disk	500	2300	5000
Throughput per disk	100 MB per second	150 MB per second	200 MB per second

- Scalability Targets

Total Account Capacity	Total Bandwidth for a Locally Redundant Storage Account
• Disk capacity: 32 TB • Snapshot capacity: 10 TB	Up to 50 gigabits per second for Inbound + Outbound

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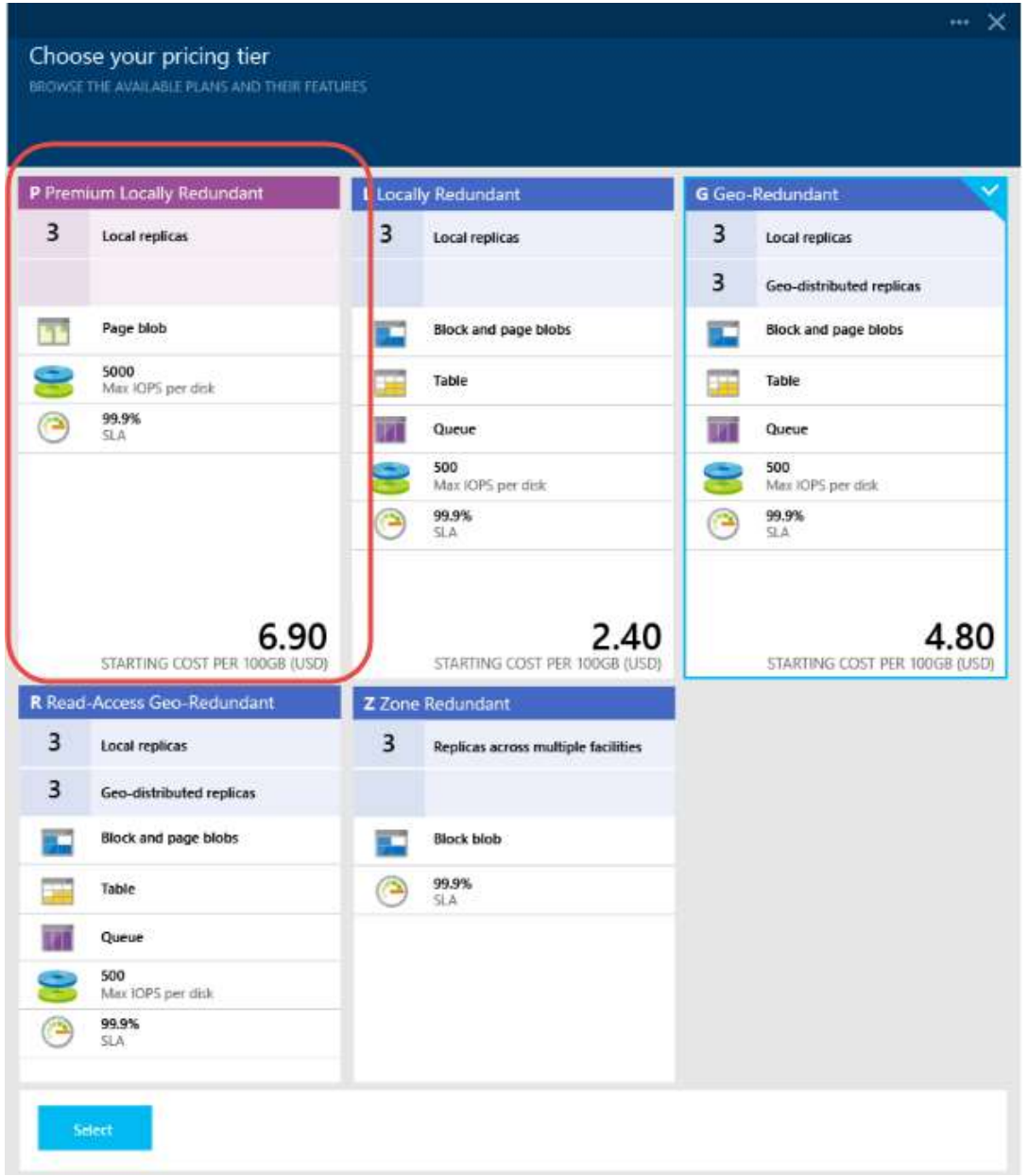
Creating a Premium Storage account *(Preview)*



Persistent Disk Management

Capability	OS Disk	Data Disk
Host Cache Default	ReadWrite	None
Max Capacity	127 GB	1 TB
Imaging Capable	Yes	No
Hot Update	Cache Setting Requires Reboot	Change Cache Without Reboot, Add/Remove Without Reboot

- **C:** = OS Disk (Created by Microsoft Azure or Custom VHD)
- **D:** = Non-Persistent Cache Disk (Created by Microsoft Azure)
- **E:\, F:\, G:\…** = Data Disks (Added through Portal)

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Demo: Provisioning SQL Server with a Stock Image

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Section 5: Custom VHD Provisioning

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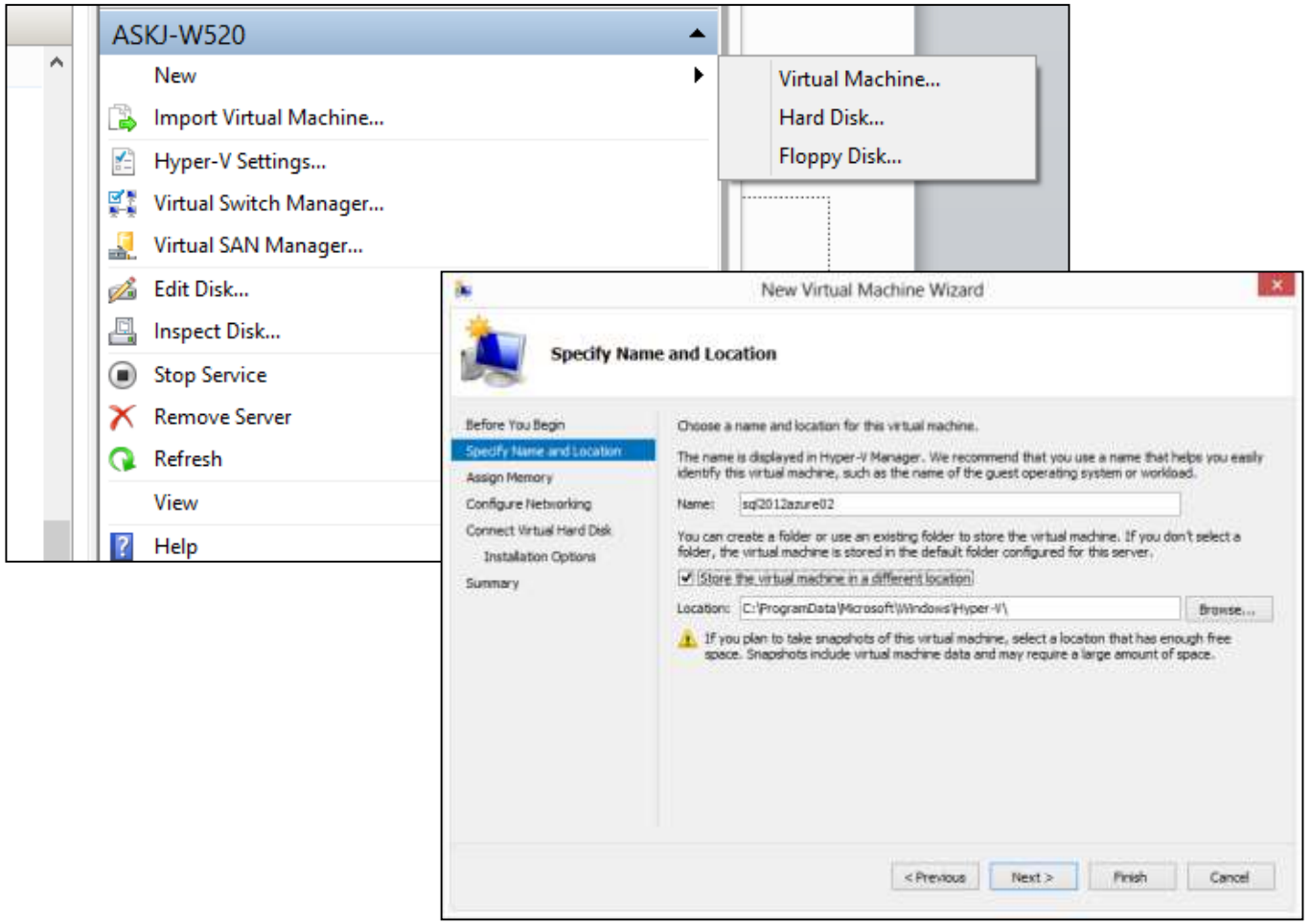
Custom VHD Provisioning

- Create a new VM in Hyper-V using a supported level of Windows Server
  - Windows Server 2008 R2 SP1
  - Windows Server 2012
  - Windows Server 2012 R2



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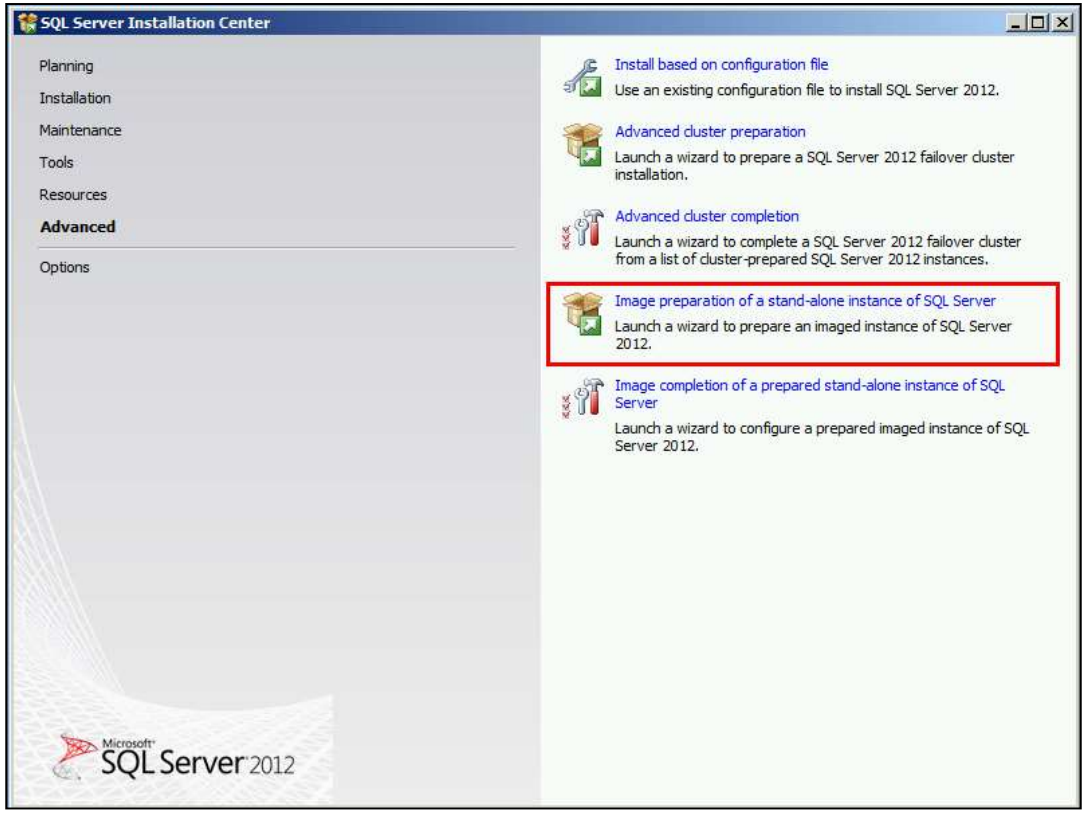
Custom VHD Provisioning (continued)

- Use SQL Server Installation Center to prepare an image of a standalone instance of SQL Server in the new VM



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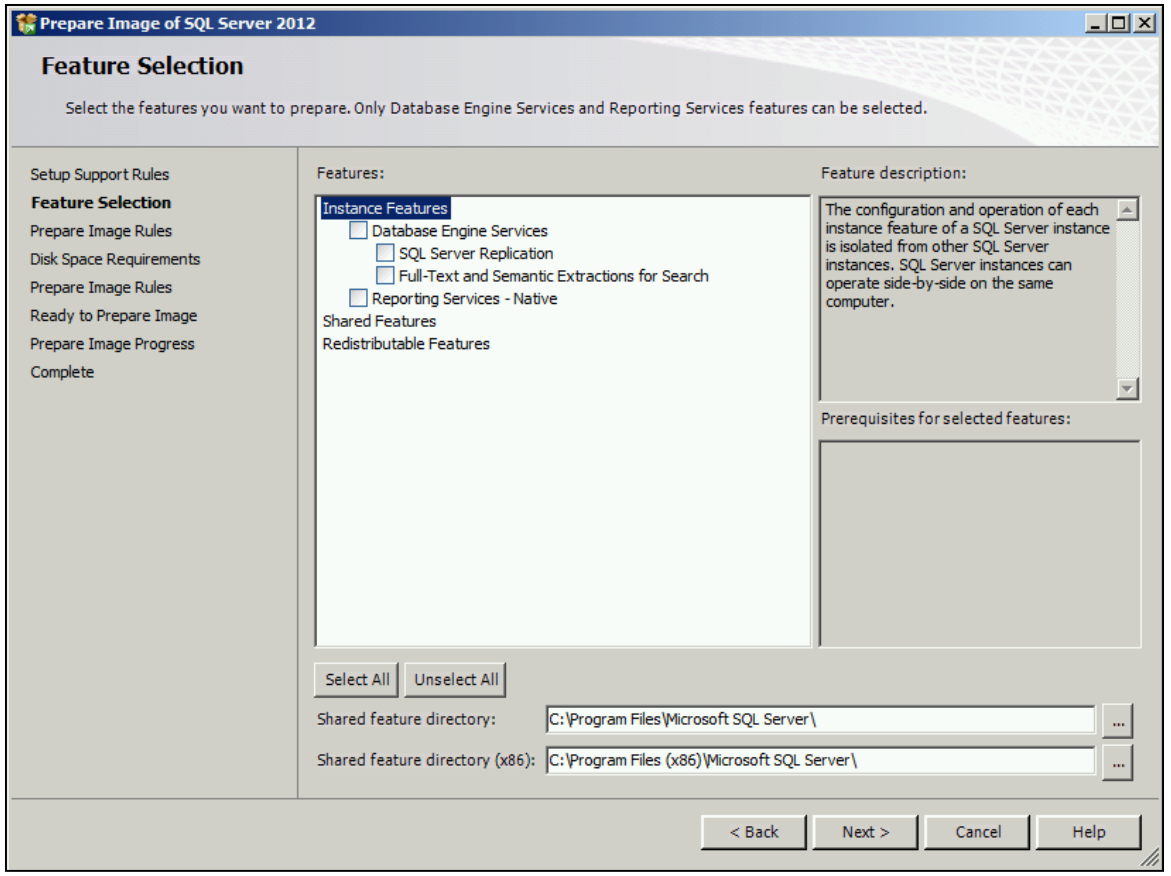
Custom VHD Provisioning (continued)

- Limited features are available for a sysprepped image of SQL Server



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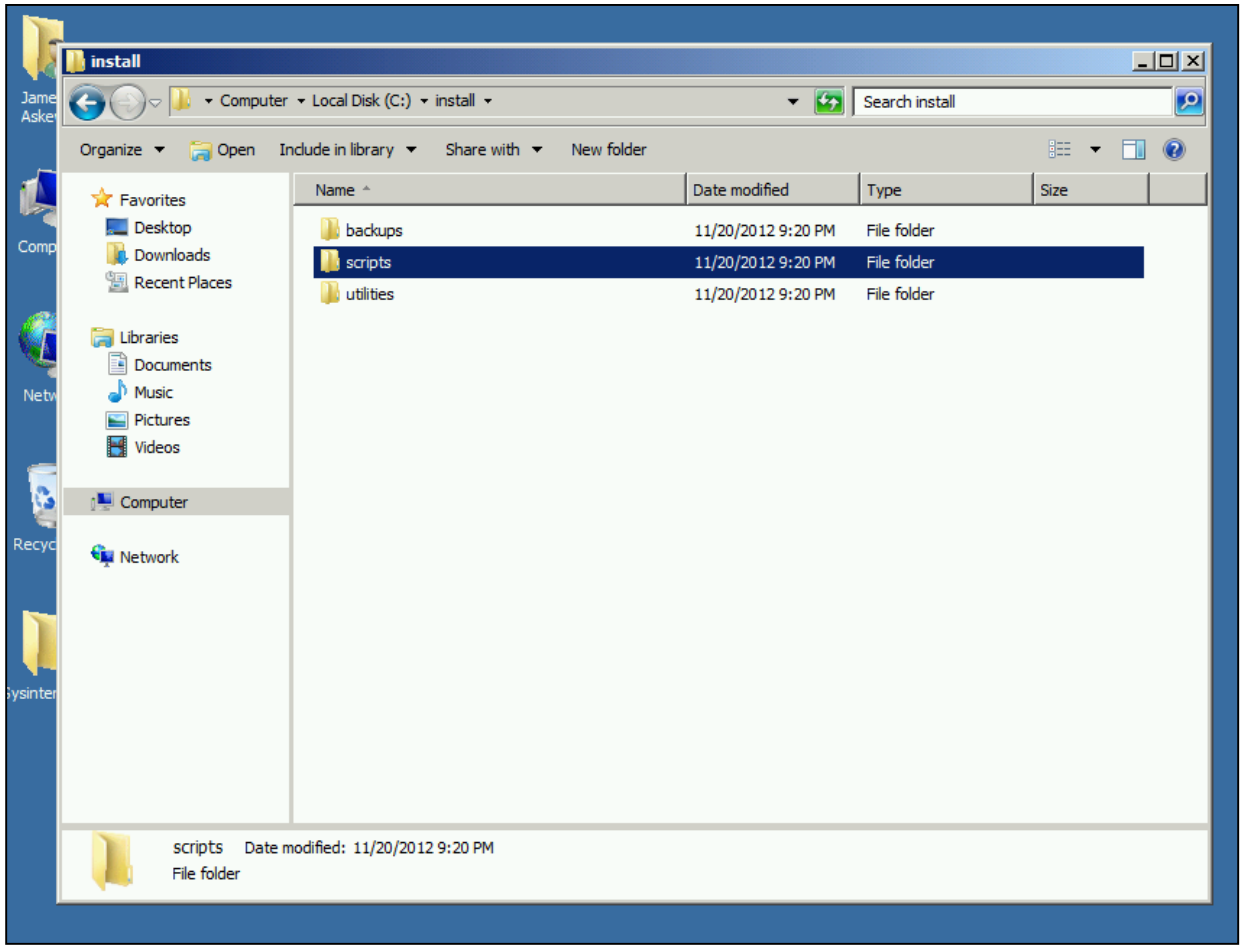
Custom VHD Provisioning (continued)

- Finish customizing VM image:
  - Install software packages
  - Copy installers to disk
  - Copy SQL backups to disk
  - Install ISO mounting software
  - Create local users
  - Any additional customizations



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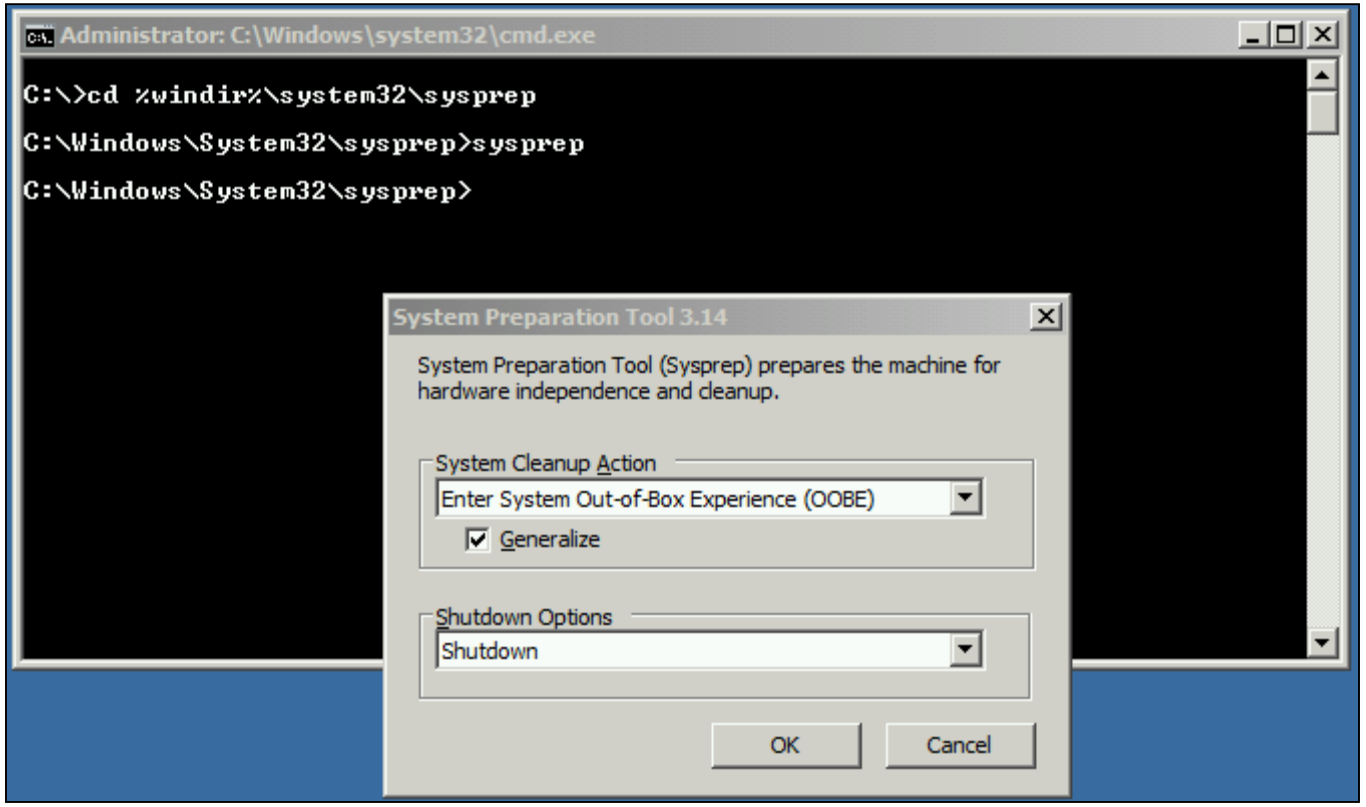
Custom VHD Provisioning (continued)

- Use Windows Sysprep to prepare the image for upload to Microsoft Azure

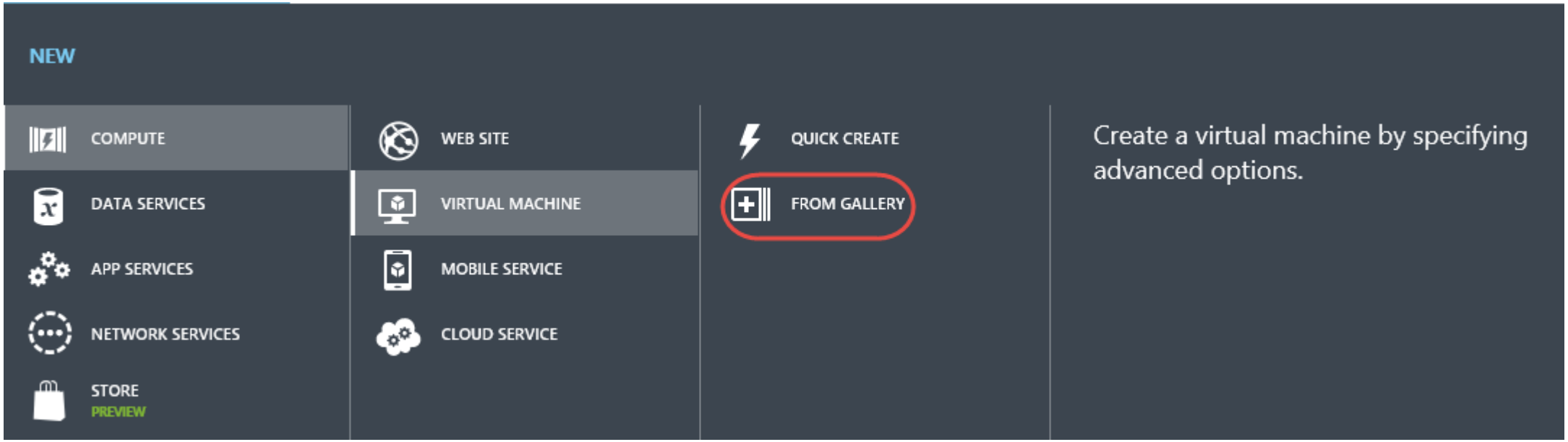


Custom VHD Provisioning (continued)

- Make sure that you have a .vhd format disk, not a .vhdx format. You can use Hyper-V to convert from .vhdx to .vhd
- Open Microsoft Azure PowerShell command prompt
- Add Azure account information by using Add-AzureAccount
- Select the appropriate subscription and storage account
- Use Add-AzureVhd PowerShell cmdlet to upload VHD into storage container
- Call Add-AzureDisk to add uploaded VHD to disk collection

Custom VHD Provisioning (continued)

- Create a new VM from the Gallery



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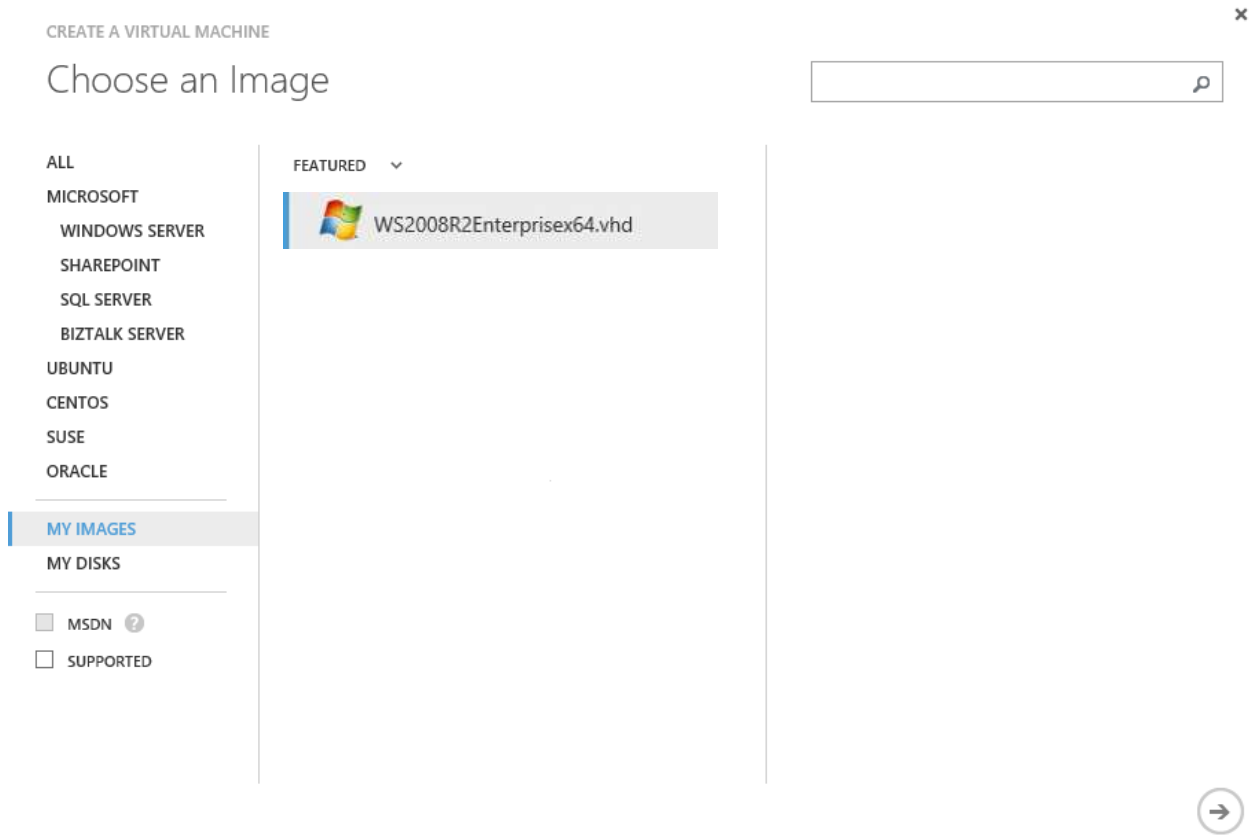
Custom VHD Provisioning (continued)

- Select **My Images** and then select the newly uploaded custom image



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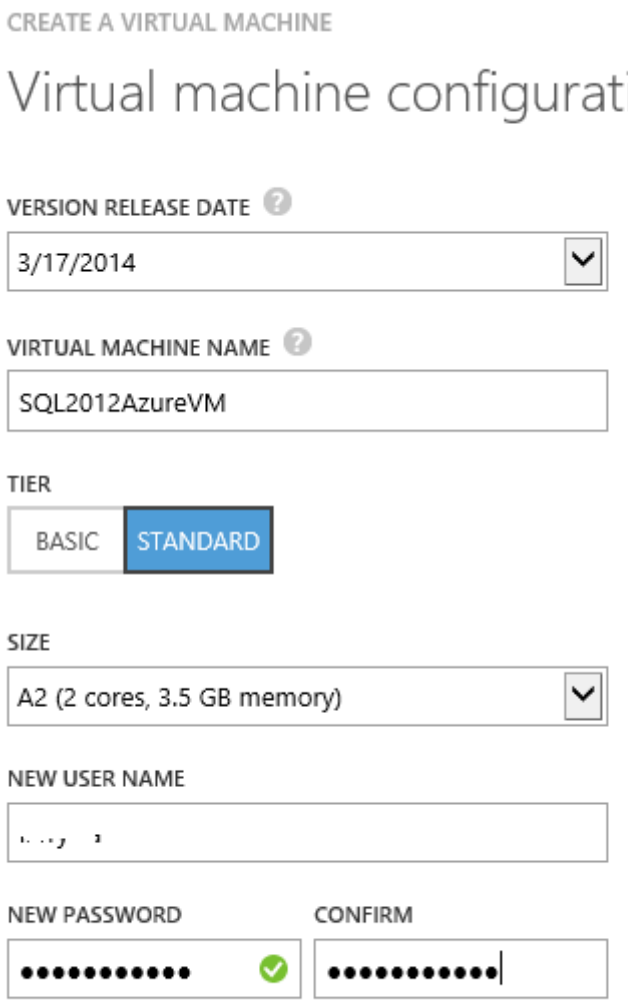
Custom VHD Provisioning (continued)



NOTE

Considerations related to size:

- Medium is the smallest size recommended for production workloads.
- Select Large or Extra Large when using SQL Server Enterprise Edition.
- The size selected limits the number of disks you can configure. (Extra Small <= 1, Small <= 2, Medium <= 4, Large <= 8, Extra Large <= 16)

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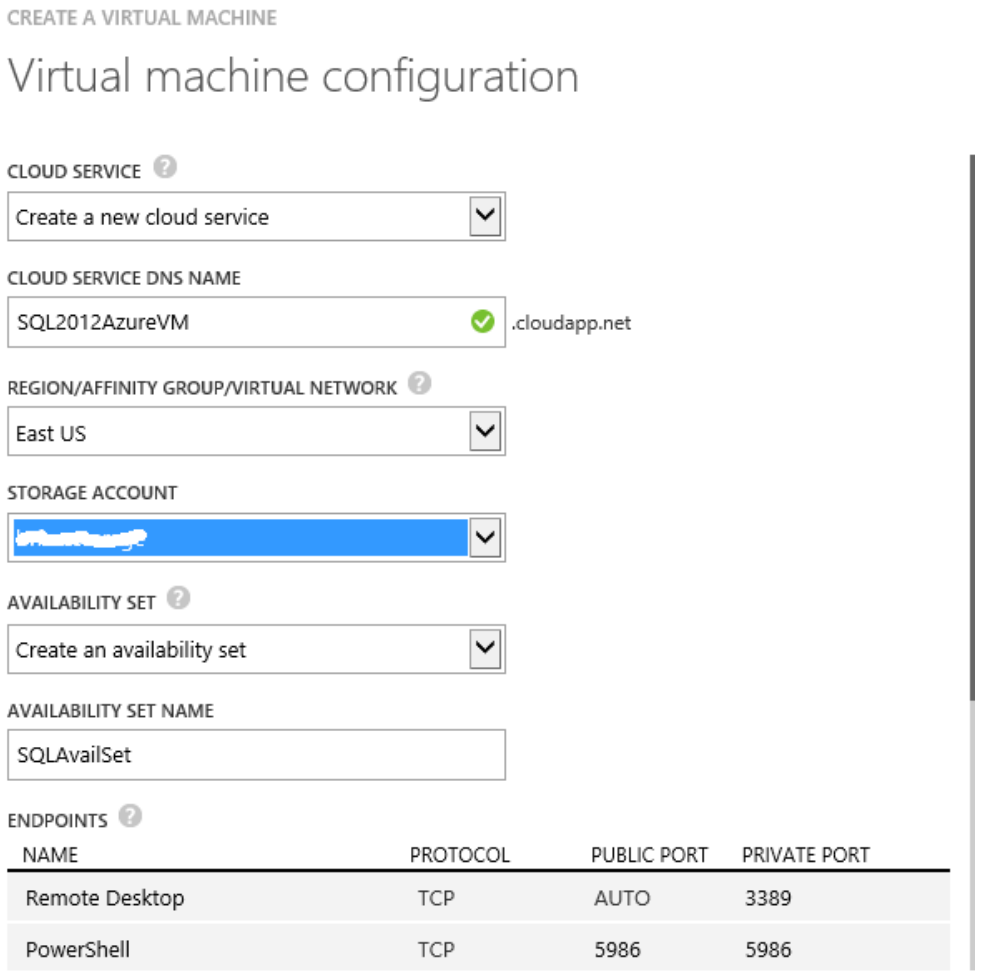
Custom VHD Provisioning (continued)

- Provide Domain Name System (DNS) name, Region, Storage Account and Availability Set



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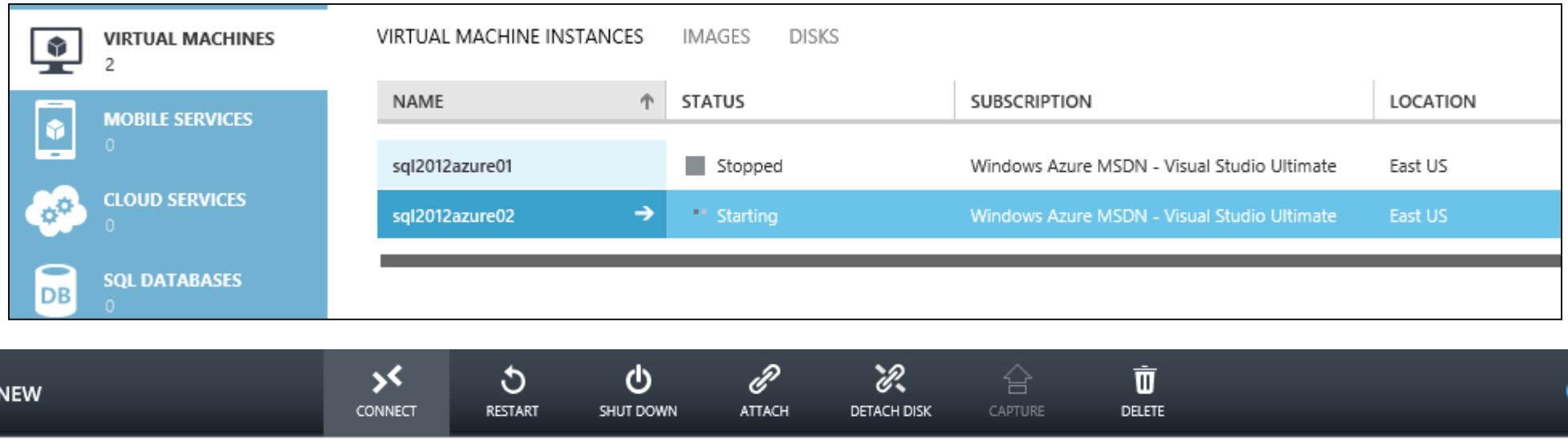
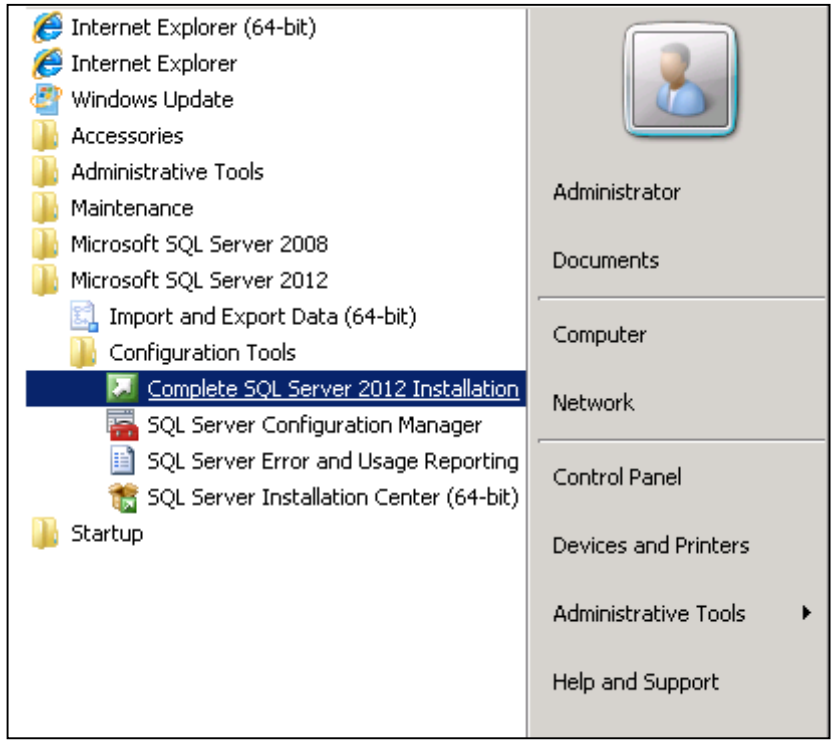
Custom VHD Provisioning (continued)

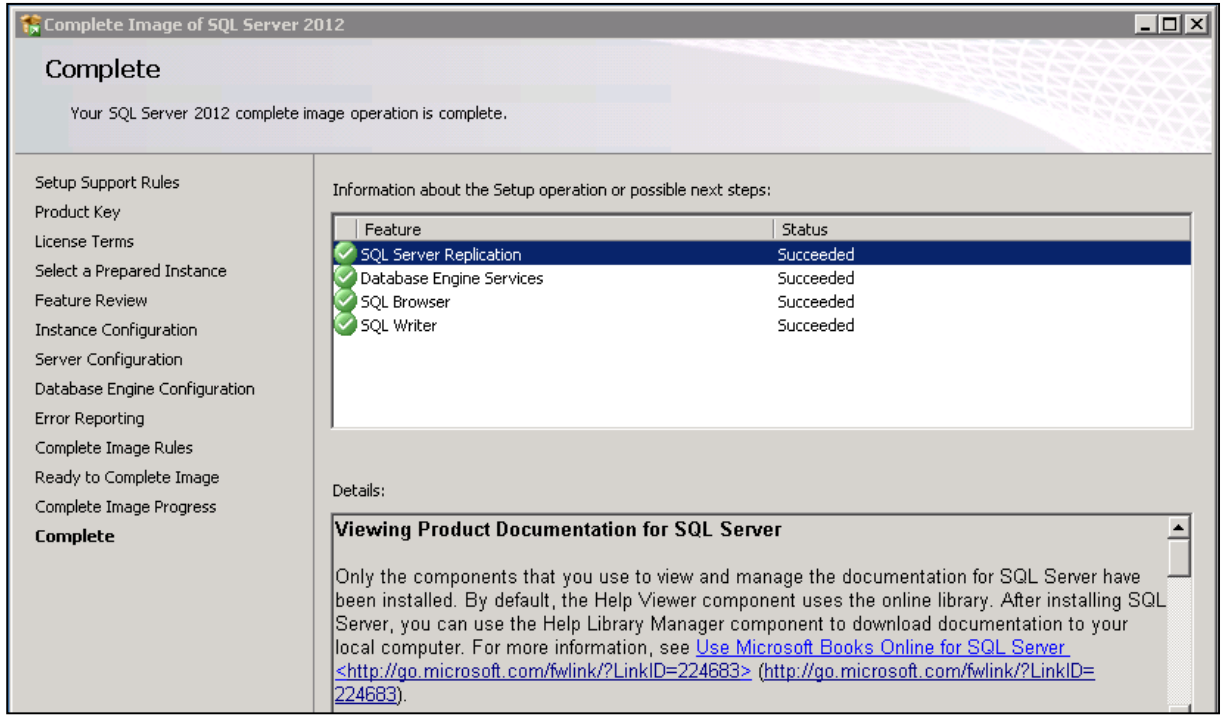
- After provisioning completes, connect to the new Azure VM



Custom VHD Provisioning (continued)

- Complete SQL Server 2012 Prepped Image Installation





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Module 7: Deploying SQL on Microsoft Azure VMs IaaS

Section 6: Accessing SQL Server with IaaS

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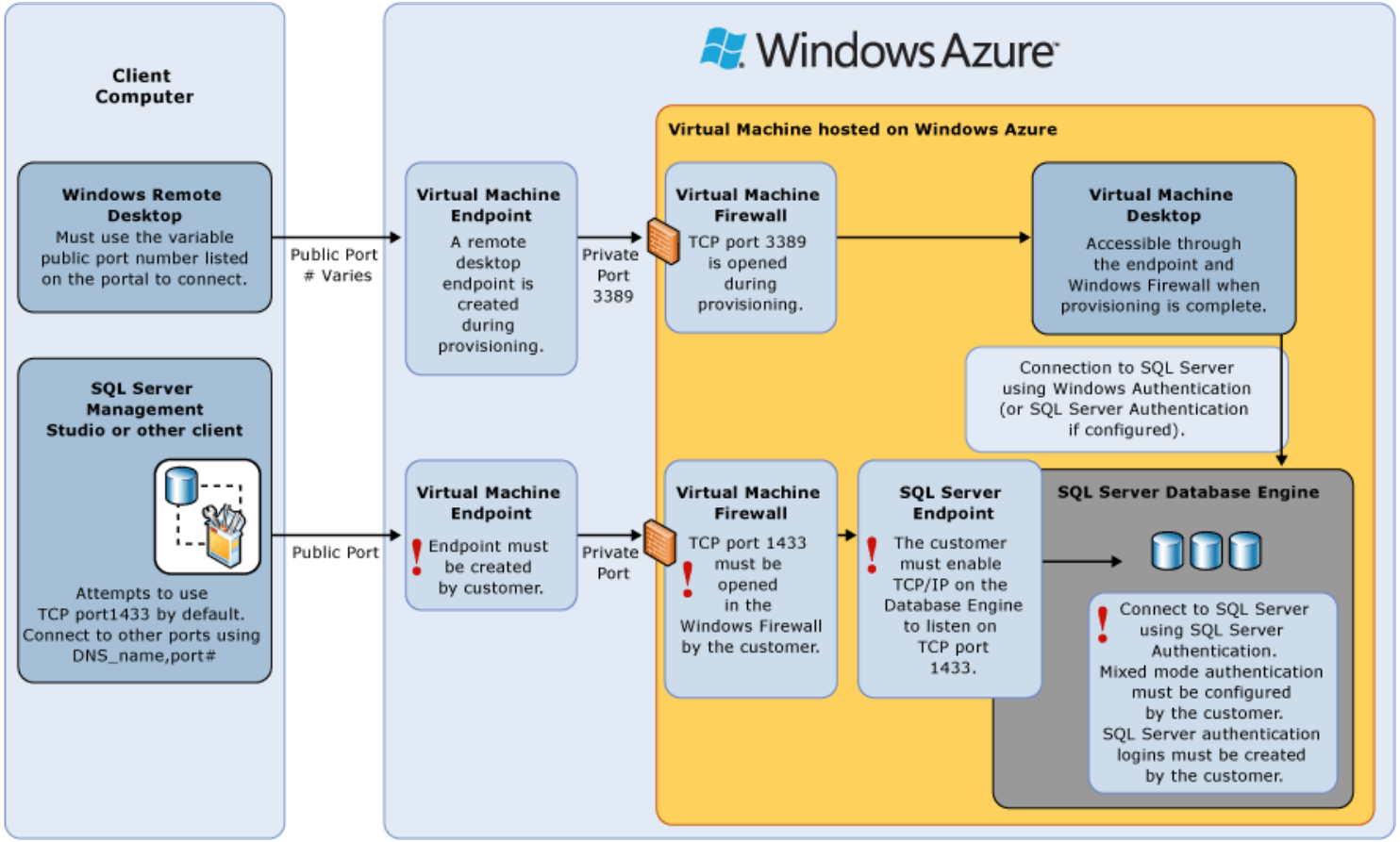
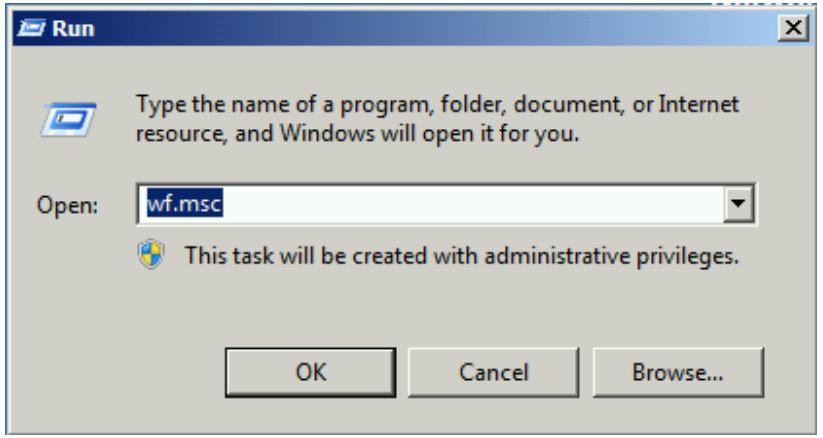
Connectivity Overview

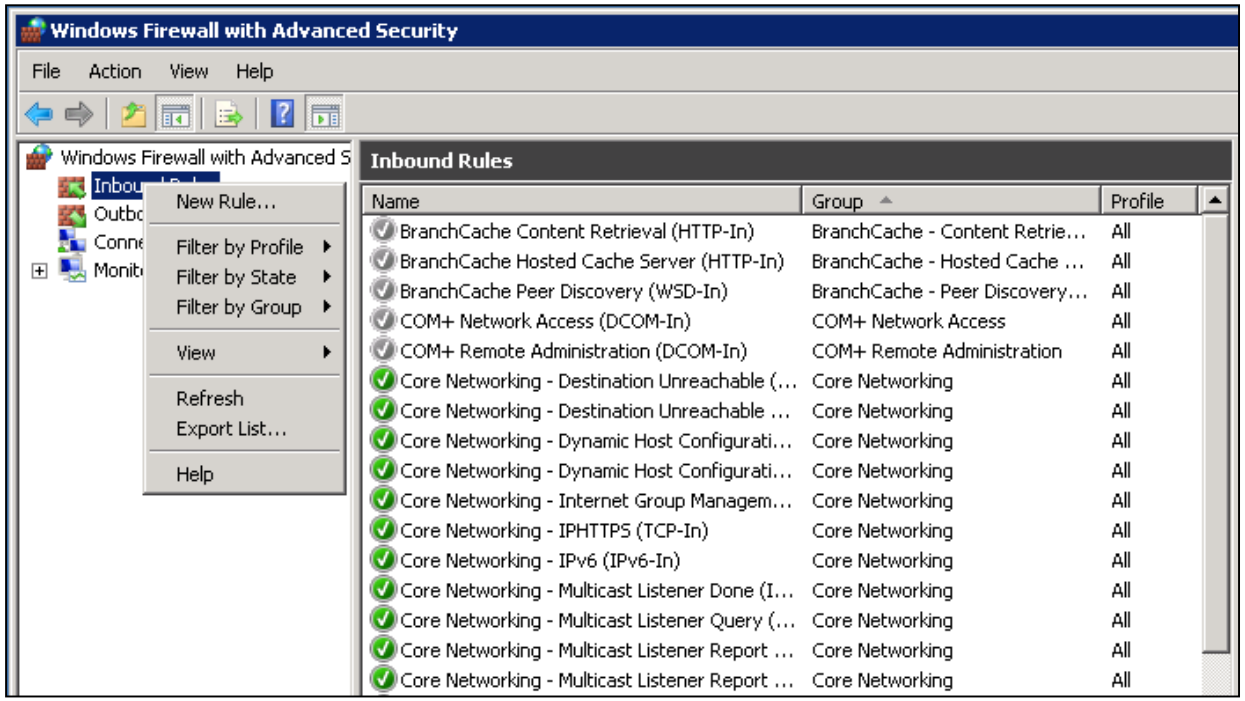
- Port 3389 mapping for Remote Desktop Protocol (RDP) created automatically



Create Firewall Rule in VM

- Create a new rule in the SQL Server VM to allow external access





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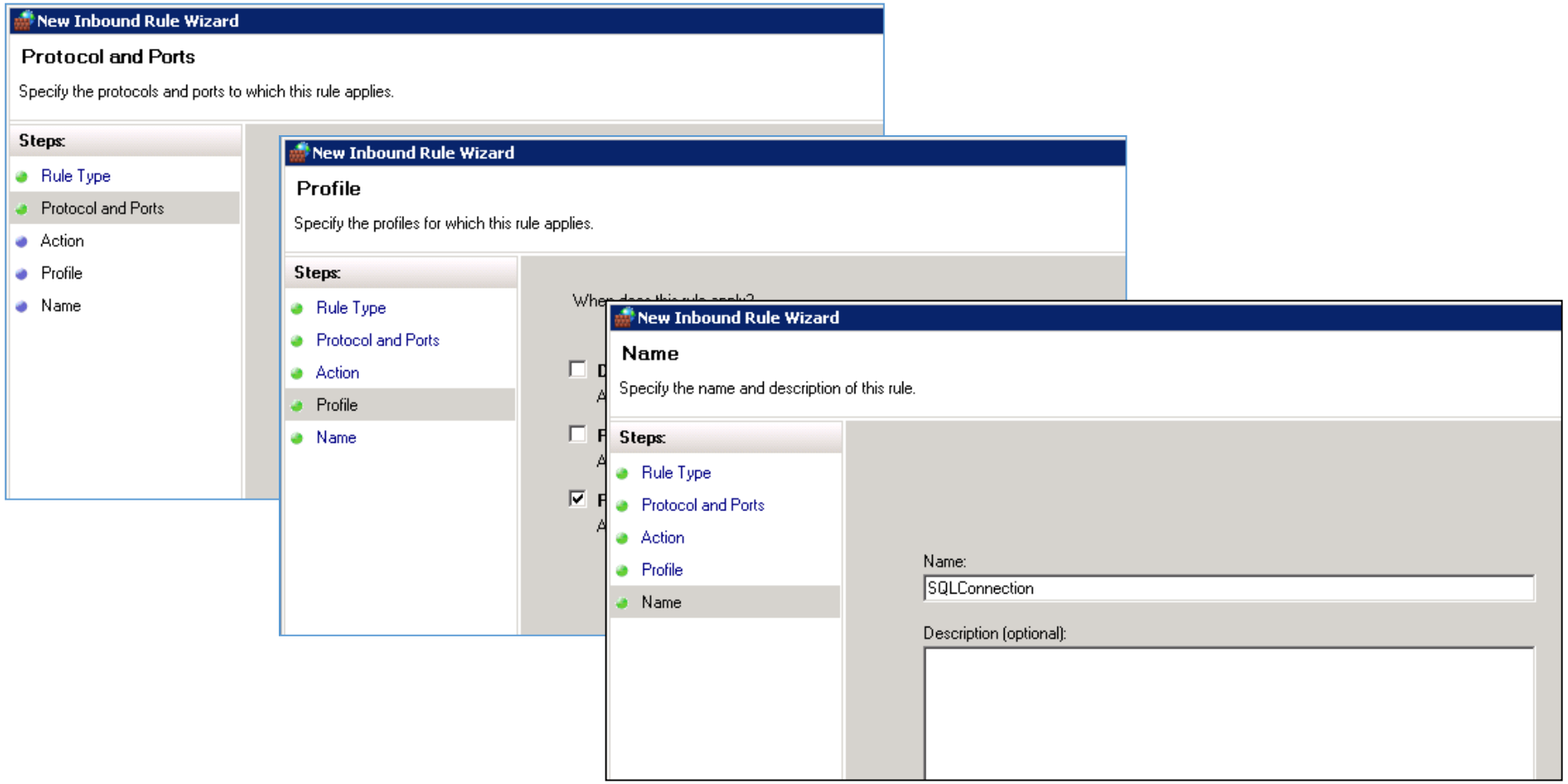
Configure Firewall Rule

- Create a rule to allow inbound access on TCP 1433



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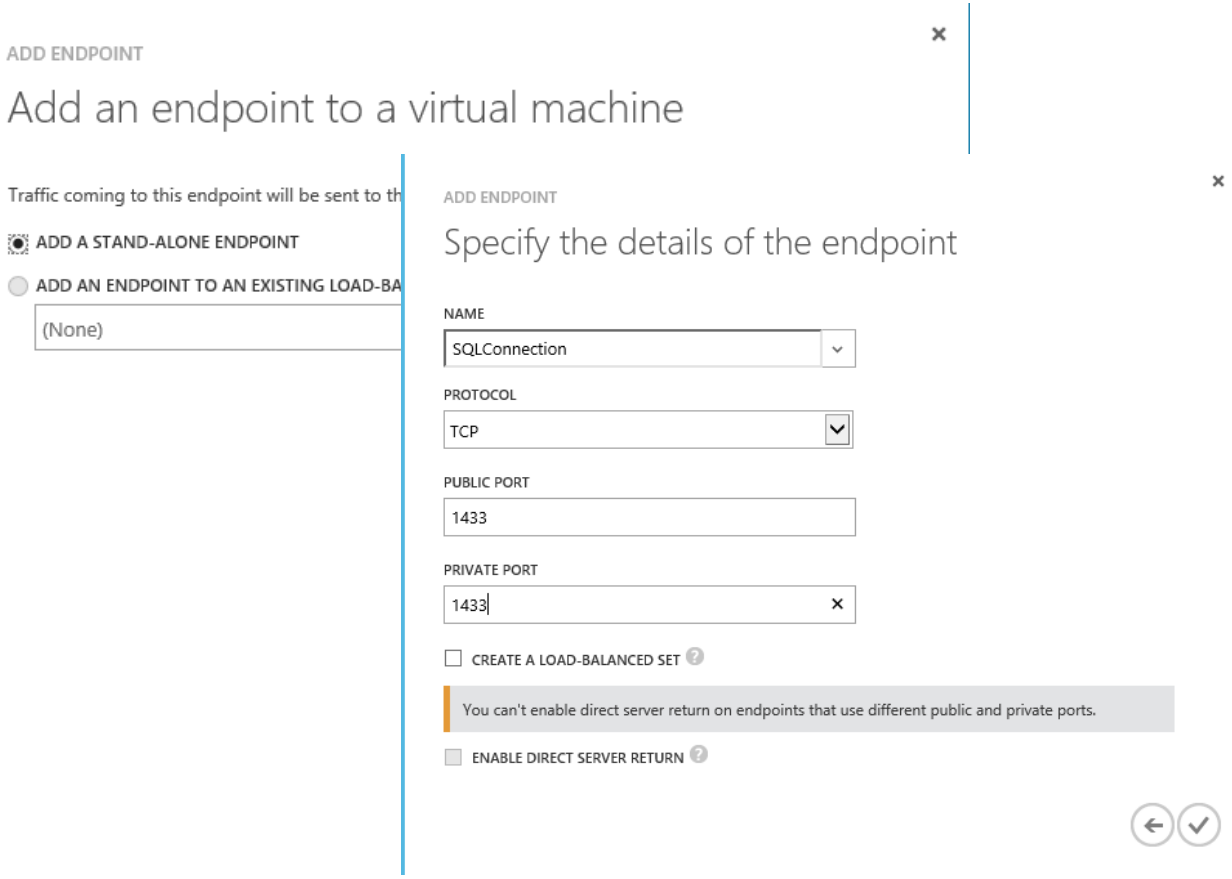
Create a Microsoft Azure Endpoint

- Create a new endpoint for TCP 1433



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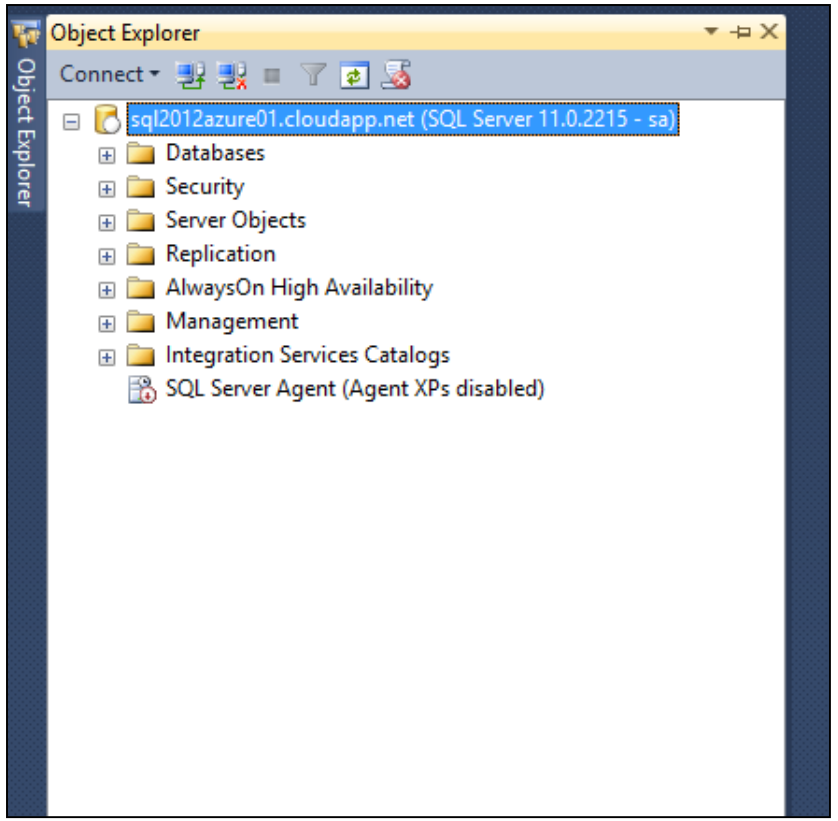
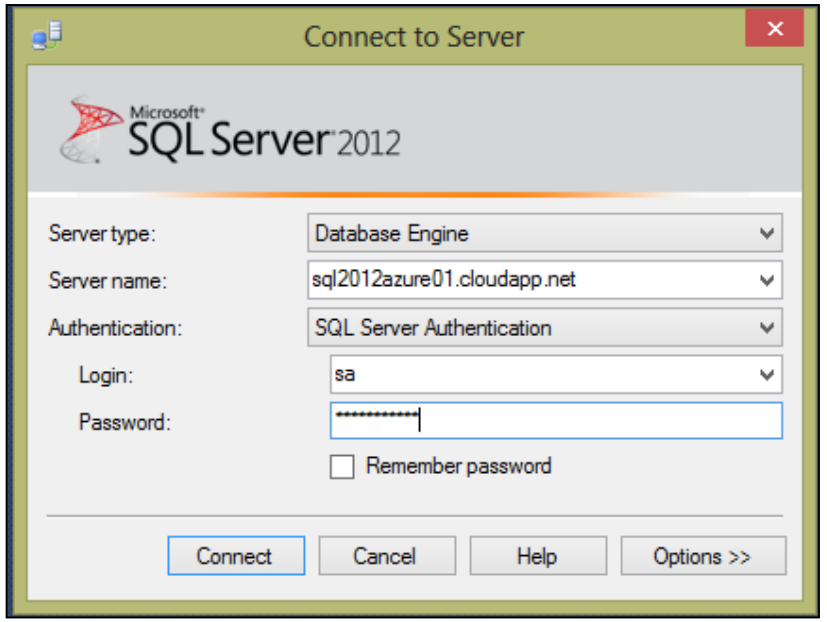
Connecting with SQL Server Management Studio (SSMS)

- Connect using Microsoft Azure VM DNS Name





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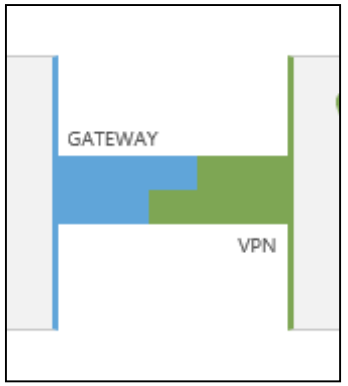
Active Directory Joined Microsoft Azure VMs

- Microsoft Azure VMs can join corporate domains through a site-to-site Virtual Private Network (VPN) connection
  - Create a Virtual Network
  - Create a Gateway
  - Provide information to the Network Admin to configure the VPN device
- Microsoft Azure (web, worker) and IaaS virtual machines use the Microsoft Azure Point-to-Site and Site-To-Site service for joining domains with an VPN connection



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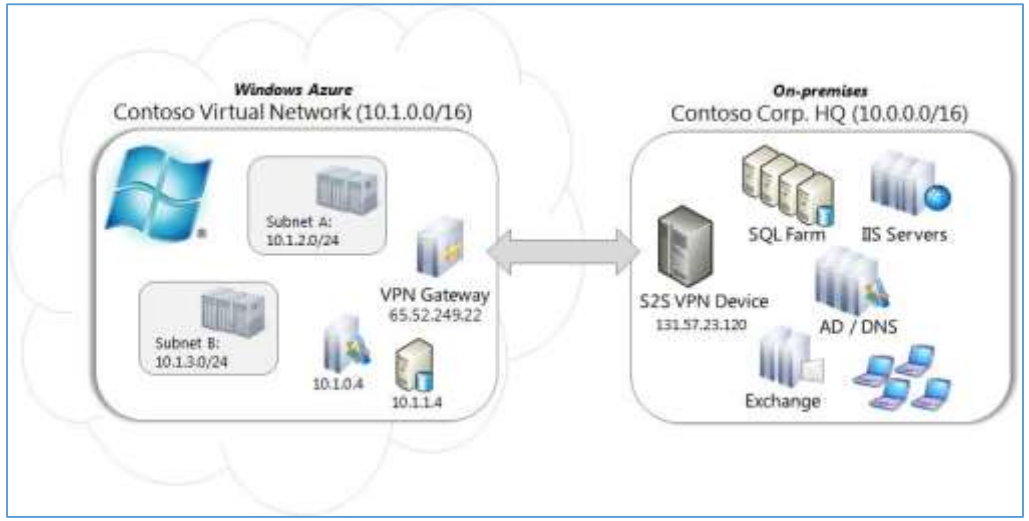
VPN Devices for Site-to-Site Support

- Select Cisco and Juniper VPN devices are tested and supported
  - VPN device must have a public facing IPv4 address
  - VPN device must support IKE 1 and IKE 2
  - Establish IPsec Security Associations in Tunnel mode
  - VPN device must support NAT-T
  - VPN device must support AES 128-bit encryption function, SHA-1 hashing function, and Diffie-Hellman Perfect Forward Secrecy in *Group 2* mode
  - VPN device must fragment packets before encapsulating with the VPN headers



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Demo: Accessing SQL Server with IaaS

Deploying SQL on Microsoft Azure VMs IaaS

Section 7: Migrating SQL Server Workloads

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SQL Data Migration Considerations

- What is the size of the data to be migrated?
- Will the data and applications be all in the cloud or mixed?
- Will all data be migrated or just selected portions? Does the schema need to be moved as-is?
- Can the data be moved offline and be unavailable for a period of time?
- Will the data need to be synchronized with the on-premises database at regular intervals or refreshed?
- Does any of the data need to be converted or transformed?
- Is this a migration of the primary site or a Disaster Recovery site?

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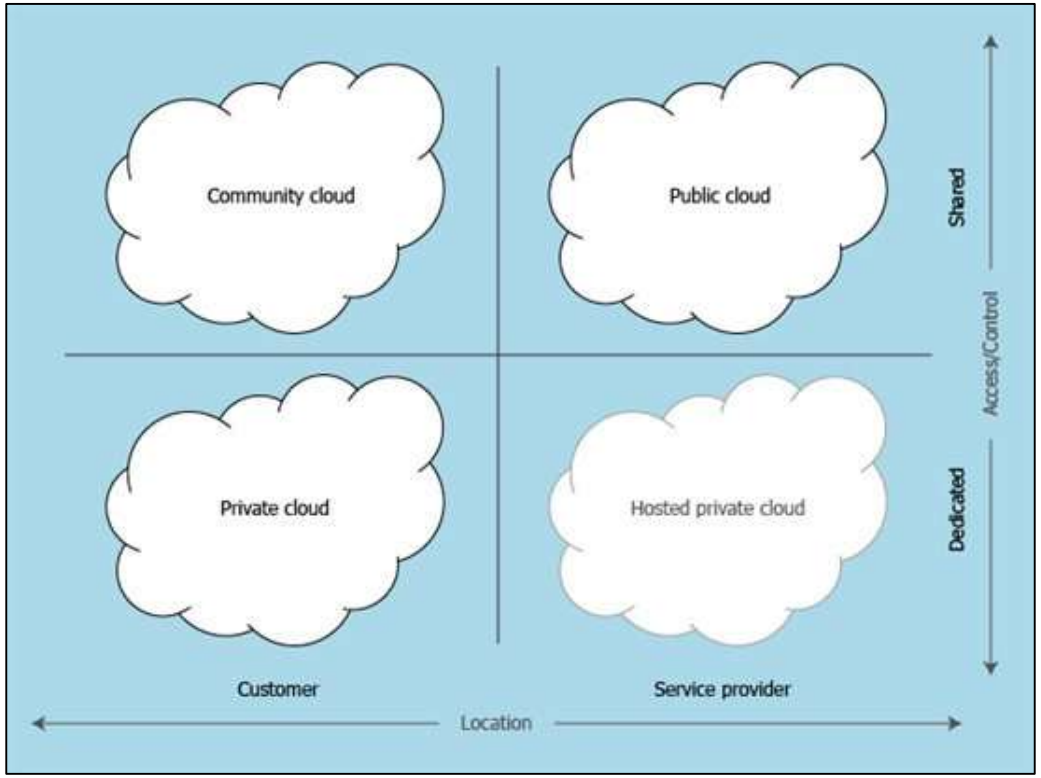
Deployment Models

- Deployment models (shared or dedicated, and whether internally hosted or externally hosted) are defined by the:
  - Ownership and control of architectural design
  - Degree of available customization



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One Time File-based Data Copy

- File based migration using:
  - Backup/Restore
  - Database file detach/attach
  - Bulk Copy Program (BCP)
- Methods for moving files:
  - Copy and paste through RDP Session (for small data sizes)
  - Copy files to intermediary and download (i.e. SkyDrive, ftp service)
  - Save original files into a custom VM or data VHD for upload to Azure with PowerShell using Add-AzureVHD

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Selective Data Movement

- Methods for moving only selected (or potentially all) user data with or without metadata and schema
  - SSIS (used if data must be transformed)
  - Export Data Wizard
  - Transactional Replication
  - Custom T-SQL Script with Linked Server
  - Custom Application (.NET)

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Ongoing Data Replication and DR Sites

- Solutions for ongoing data changes and synchronization to DR sites
  - Transactional Replication
  - Log Shipping
  - Database Mirroring (deprecated in SQL Server 2012)
  - Availability Groups (available in Azure VM—SQL Server 2012 only)
  - Change Data Capture (CDC) and SSIS

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Demo: Moving Data to the Cloud

Deploying SQL on Microsoft Azure VMs IaaS

Section 8: SQL Server IaaS Best Practices

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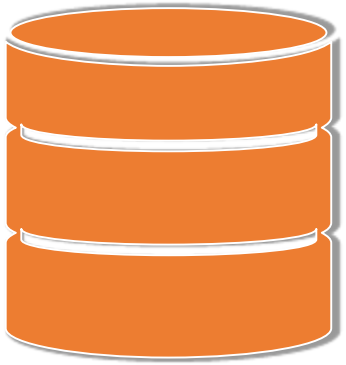
Running SQL Server in a Microsoft Azure VM



- VM Recommendations
  - Use minimum Standard Tier A2
  - For high performance, consider D-Series
- Storage recommendations
  - Use Azure Premium Storage
  - Disable geo-replication on storage account
  - Use attached data disks for data, cache = None
  - Avoid using OS drive for large databases
  - Consider putting database and transaction log files on separate drives
  - DO NOT put **TEMPDB** on the non-persistent cache disk (*D:\) if you are not use a D-Series VM.* Instead use a data disk or the operating system disk drive
  - Only store **TEMPDB** and/or Buffer Pool Extensions on the D drive when using D-Series VMs. D Series uses SSD D drives which can improve performance.
  - Use Storage Spaces (disk striping) to increase effective IOPS
- Database recommendations
  - Consider using database page compression to reduce I/O
  - Enable instant initialization
  - Disable auto-grow/shrink
  - Backup to blob storage
- High availability recommendations
  - Consider latency between primary and replica when choosing sync mode

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High Availability and Disaster Recovery

- AlwaysOn Availabilty Groups (requires DC: Support multiple sites)
- Database mirroring (use certificates)
- Log shipping
- Backup/Restore – Blob Storage Service

Module Summary

- Microsoft has a continuous offering from private to public cloud
- Microsoft Azure now supports IaaS workloads
- SQL Server is fully supported on Microsoft Azure VM
- IaaS is about migration, PaaS is about new development

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