IaaS

Concurrency

Considerations before beginning

A bad query is always worth tuning

Deployment model

- Service Management – classic (old)
- Resource Manager
  - Deploy, manage, monitor all related services together
  - Consistent deployment – for example, Dev to QA and QA to Prod
  - Reference: Resource Manager Overview https://azure.microsoft.com/en-us/documentation/articles/resource-group-overview/
- Reference: Understanding Resource Manager deployment and classic deployment https://azure.microsoft.com/en-us/documentation/articles/resource-manager-deployment-model/

Region

- Are the services you want available in the region you want?
- Reference: Services by region https://azure.microsoft.com/en-us/regions/#services

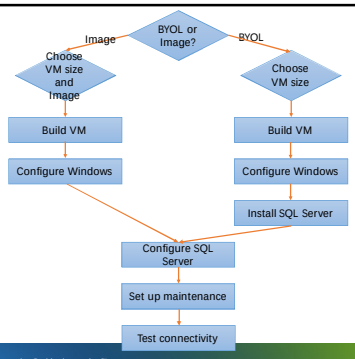
VM size

- Understand what you need for your workload
- Minimums for SQL Server
  - Standard - DS2
    - 2 cores
    - 7 GB RAM
    - 4 disks @ 6400 max IOPS
  - Enterprise - DS3
    - 4 cores
    - 14 GB RAM
    - 8 disks @ 12,800 max IOPS
- Reference: Sizes for virtual machines: https://azure.microsoft.com/en-us/documentation/articles/virtual-machines-size-specs/
- Reference: Virtual Machines Pricing: https://azure.microsoft.com/en-us/pricing/details/virtual-machines/

Storage

- VM size determines max number & speed of disks, regular vs premium storage
- Starts with C: and D:
  - D: is temporary and Microsoft warns to never store anything you want to keep on it!
- You can and should add more disks and stripe them – we'll talk about that later
  - When you do that, you're paying for additional storage

Workflow



BYOL

Bring Your Own Licensing

Build the VM

- Reference: Performance best practices for SQL Server in Azure Virtual Machines https://azure.microsoft.com/en-us/documentation/articles/virtual-machines-sql-server-performance-best-practices/
  - VM size
  - Storage
  - Disks
  - I/O
  - Back up to blob storage

You will have to enter

- VM Name
- Size
- Storage account
- Virtual Network

Demo

PowerShell

- Open New-AzureRmVM.ps1
- Resource: Create and configure a Windows Virtual Machine with Resource Manager and Azure PowerShell https://azure.microsoft.com/en-us/documentation/articles/virtual-machines-ps-create-preconfigure-windows-resource-manager-vms/

Prep Windows

- Check power setting
- Enable Perform volume maintenance tasks, Lock pages in memory (maybe!)
- Join to domain

Create and attach storage

- Attach from Portal or PowerShell
- Stripe or pool in File & Storage Systems
- Add in Disk Management

Install SQL Server

- Mount media, follow your normal checklist
  - You have a setup checklist, right?!
- You choose what features and services are installed
- You control service accounts
- You can specify data directories

Images

Build the VM

- Follow the same best practices

You will have to select

- Name
- Size
- Storage Account
- Virtual Network
- Connectivity
- Port
- Authentication mode
- Auto patching
- Auto backups

Demo

PowerShell

- Same script, different image

Windows and SQL Server are installed

- SQL Server features installed
- Service account used
- Data directories
  - What if you wanted something different?

Prep Windows

- Check power setting
- Enable Perform volume maintenance tasks, Lock pages in memory (maybe!)
- Join to domain

Comparing storage using diskspd

- BYOL – I added two SSD and mirrored

```
Total IO
thread |       bytes     |     I/Os     |    MB/s   |  I/O per s |  AvgLat  | LatStdDev |  file
------------------------------------------------------------------------------------------------------
     0 |        55853056 |         6818 |     26.61 |    3406.65 |    1.172 |     4.202 | d:\diskspd\io.dat (20GB)
     1 |        98484224 |        12022 |     46.93 |    6006.86 |    0.665 |     3.216 | d:\diskspd\io.dat (20GB)
     2 |        59940864 |         7317 |     28.56 |    3655.98 |    1.092 |     4.075 | d:\diskspd\io.dat (20GB)
     3 |        56385536 |         6883 |     26.87 |    3439.13 |    1.162 |     4.194 | d:\diskspd\io.dat (20GB)
------------------------------------------------------------------------------------------------------
total:       270663680 |        33040 |    128.97 |   16508.61 |    0.968 |     3.847
```

- Image – I selected IOPS and let Azure handle set-up

```
Total IO
thread |       bytes     |     I/Os     |    MB/s   |  I/O per s |  AvgLat  | LatStdDev |  file
------------------------------------------------------------------------------------------------------
     0 |        57376768 |         7004 |     27.32 |    3497.04 |    1.143 |     4.077 | d:\diskspd\io.dat (20GB)
     1 |        95035392 |        11601 |     45.25 |    5792.29 |    0.690 |     3.196 | d:\diskspd\io.dat (20GB)
     2 |        57196544 |         6982 |     27.23 |    3486.06 |    1.147 |     4.043 | d:\diskspd\io.dat (20GB)
     3 |        59023360 |         7205 |     28.10 |    3597.40 |    1.112 |     3.998 | d:\diskspd\io.dat (20GB)
------------------------------------------------------------------------------------------------------
total:       268632064 |        32792 |    127.91 |   16372.80 |    0.977 |     3.768
```

Both

Build servers frequently?

- Configure Azure Resource Manager Templates
  - Use JSON

Configure SQL Server

- Use your checklist!
- Mine includes:
  - Configure tempdb & model
  - Set MAXDOP & cost threshold for parallelism
  - Configure max & min memory
  - Add startup trace flags
  - Configure Database Mail
  - Set up Alerts for important errors
  - Set up and schedule maintenance

Yes, you still need to do maintenance!

- Backups
  - BYOL
    - Recommend backup to Azure blob storage
  - SQL Server Images does allow you to set auto-backups
    - Uses SQL Server Managed Backup in the background
    - Backs up to Azure blob storage
- CHECKDB
- Indexes/Statistics

Tools for maintenance

- Maintenance Plans
- T-SQL scripts
- 3rd party tools

Connectivity

- Connect applications to the new server
  - In the same vnet? Specify server name and integrated security in the connection string.
  - Over the internet?
    - Open TCP ports in Windows Firewall
    - Configure SQL Server to listen on TCP
    - Configure mixed mode authentication
    - Configure a Network Security Group inbound rule for port 1433
    - Configure DNS name
    - Verity connectivity
- Resource: Connect to a SQL Server Virtual Machine on Azure (Resource Manager) https://azure.microsoft.com/en-us/documentation/articles/virtual-machines-sql-server-connectivity-resource-manager/

Set up HA/DR

- Azure options like Availability Sets only protect the Windows VM
- No HA or DR for your databases!

HA/DR options

HA	Azure VMs – same region
Availability Groups	Yes
Database Mirroring	Yes
Failover Cluster Instances	Yes – with caveats

DR	Hybrid – On-prem to Azure	Azure VMs – same region	Azure VMs – span regions
Availability Groups	Yes	Yes	Yes
Database Mirroring	Yes	Yes	Yes
Backup/restore	Yes	Yes	Yes
Log shipping	Yes	Yes	Yes

Availability Groups

- All servers in the AG have to be in the same resource group
- You have to create a WSFC and set a static IP address
- In order to have a listener, you have to create an Internal Load Balancer to create a load-balanced endpoint
- Resource: 3 Keys to Configuring Azure Virtual Machines for Use in SQL Server Availability Groups http://www.concurrency.com/blog/w/3-keys-to-configuring-azure-virtual-machines-for-u

Failover Cluster Instances

- Azure doesn't support shared storage
- Option 1: use SIOS DataKeeper, a 3rd party utility
  - Uses synchronous data replication between two storage volumes
- Option 2: remote iSCSI Target shared block storage via ExpressRoute

Moving data into the database

- No easy button
- Back up and restore a database
- Create an SSIS package to move the schema and/or data
- Export and import a Data-tier Application (DACPAC)

Changing VM size

FAQ

- Can I upgrade or downgrade?
  - Yes!
- Is it an online operation?
  - Yes!
- How long does it take?
  - It depends
- How?
  - Portal
  - PowerShell

PowerShell

- Open Change Azure vm size.ps1

Stopping the VM

When do you get charged?

- "If the status says "Stopped (Deallocated)," you're not being billed. If it says "Stopped Allocated," you're still being billed for allocated virtual cores (not the software license itself)."
- "To ensure you're not being billed, always stop virtual machines from the management portal. You can also stop the VM through Powershell by calling ShutdownRoleOperation with "PostShutdownAction" equal to "StoppedDeallocated". If you shut down a VM from inside (using Windows power options) or through PowerShell by calling ShutdownRoleOperation with "PostShutdownAction" equal to "Stopped"."
- https://azure.microsoft.com/en-us/pricing/details/virtual-machines/

BYOL or Image?

- Which will be more cost-effective?
  - This is a question I can't answer!
- How much control do you want over SQL Server setup?
  - Hint: PowerShell helps a lot!