SQLskills Immersion Event

IEAzure: Azure VMs and Azure SQL Database

Module 3: Migrating to Azure Virtual Machines

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Overview

- Collecting on-premises data for sizing
- Benchmarking Azure virtual machines
- Choosing the correct size virtual machine
- Migration strategies
- Pros and cons

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Collecting On-Premises Data for Sizing

- **What size virtual machine are you going to need**
- **You need to benchmark your current environment first**
  - CPU
  - Memory
  - Disk IO
  - Storage requirements
- **Physical to virtual concerns**
  - Many physical machines are overpowered by design, you purchase for room to scale up
  - Replacing physical machines are costly, most organizations over scale to support 3-5 years of growth
  - VMs are easier to scale, size more for 12 months to save on operational cost and license

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Collecting On-Premises Data for Sizing

- **Virtual machines are already categorized and optimized for CPU, memory, storage.**
  - General purpose – balanced CPU-to-memory ratio. Ideal for testing and development, small to medium databases, and low to medium traffic web servers
    - B, Dsv3, Dv3, DSv2, Dv2, Av2, DC
  - Memory optimized – high memory-to-CPU ratio. Great for relational database servers, medium to large caches, and in-memory analytics.
    - Esv3, Ev3, M, GS, G, DSv2, Dv2
  - Storage optimized – high disk throughput and IO ideal for Big Data, SQL, NoSQL databases, data warehousing and large transactional databases.
    - Lsv2 and Ls
- **Most SQL Servers fall into DSv2 or Dv2**

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CPU

- **How much CPU do you need?**
  - It depends on current workload
- **You need to capture current CPU workload**
  - Third-party tools
  - DMV scripts
    - Glenn Berry diagnostic queries - http://bit.ly/2rXT0ar
      - CPU utilization history for last 256 minutes
  - Look for average CPU utilization during your peak usage times
- **Capture current CPU specifications and benchmark**
  - CPU-Z
- **Considerations before capturing data**
  - Power plan – are you running in High Performance?

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Memory

- **How much memory (ram) do you need?**
  - It depends on workload and performance requirements
- **You need to capture current memory usage patterns**
  - Page Life Expectancy, Available Mbytes, Max Server Memory configuration
  - Third party tools
  - DMVs, Perfmon, queries

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Storage

- **What are your current IO patterns?**
  - Workloads dictate this
- **Capture current usage patterns**
  - Disk latency – how long is it waiting?
  - Reads/Writes – throughput
  - Current benchmarks
    - CrystalDiskMark
    - Microsoft DiskSpd
- **Storage can easily be a bottleneck**
  - Indexing
  - Faster IO
  - More memory (bufferpool)
- **You may need to tune before migrating**

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General Concerns

- **Physical-to-virtual and virtual-to-virtual concerns**
  - It is easy to over allocate memory on physical machines
  - Memory is somewhat inexpensive
  - Fairly easy to get lots of memory on on-premises VMs
  - Memory is a valuable resource in the Cloud
  - Higher memory = higher core count = more SQL Server license

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Data Collection Tools

- **Free methods**
  - Perfmon counters
  - DMVs
    - http://bit.ly/2rXT0ar
  - Tigertoolbox – SQL Performance Baseline
    - https://bit.ly/2YEkWAd
- **Paid tools**
  - SentryOne
    - https://www.sentryone.com/plan-explorer
- **Importance of baselines**
  - https://sqlperformance.com/2018/05/baselines/importance-of-baselines

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Capturing CPU, memory, and disk benchmarks

Benchmarking Azure Virtual Machines

- **Is collecting baseline/benchmark data different in Azure virtual machines than on-premises?**
  - No, not really
  - You don't have VMware/Hyper-V console access
    - Everything else is mostly the same
- **Capture benchmarks – what the system is capable of**
  - CPU-Z
  - CrystalDiskMark – Microsoft DiskSpd
  - Create a virtual machine to your specifications, run your benchmarks, shutdown and deallocate the virtual machine until your next test or destroy

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Running benchmarks against Azure VMs

Choosing the Correct Size VM

- **You decide on VM by vCPU, memory, disk**
  - vCPU and memory are easy to scale by migrating to a larger VM
  - Larger VM sizes allow for a higher number of data disk
    - More data disk allow you to stripe more disk for more IOPS
    - Modifying disk structures for more IO is much more complex than just moving to a larger VM
- **Lower core count with higher ram sizes exist with memory optimized models**
  - 4 vCPU and 128GB, 8 vCPU and 256GB, 16 vCPU and 432GB are your lowest vCPU and max memory available
- **Pay attention to throughput limits on VM size**
  - It is entirely possible to provision storage with higher IOPS and throughput than the VM limits allow
  - The Importance of Selecting the Proper Azure VM Size - SQLPerformance.com

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Azure Marketplace: sizing various VMs looking at vCPU combinations with memory and data disk, VM limits

Microsoft Database Experimentation Assistant

- DEA is an A/B testing solution for SQL Server upgrades
- Evaluates a version of SQL for a given workload
- Works for SQL Server 2005 and above
- Provides an automated setup for a workload capture and replay of a production database. This uses Distributed Replay and SQL Server-side tracing
- Provides a rich user experience by visualizing data through an analysis report
- Data can be exported to a *.csv file for sharing
- Supports Windows 7, Windows 8, Windows 8.1, Windows 10, Windows Server 2012/2016/2019

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Installing, configuring, and using DEA

Migration Strategies

- **SQL Server backup with Azure Blob storage service**
  - Backup to URL
  - Backup files are available to the VM for easy restore
  - Good for staging a full restore
  - DR
- **Backup and restore**
  - Traditional method for migration
  - Backup local and copy to Azure Blob storage, restore
- **Log shipping**
  - Setup VPN or connectivity to Azure VM
  - Establish log shipping
  - Quick cutover
  - HA/DR

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Migration Strategies

- **Database mirroring**
  - Setup VPN or connectivity to VM
  - Setup mirroring like you normally do
  - Easy failover
  - HA/DR
- **Windows Import/Export Service – ship a hard drive**
  - Used for large migrations
  - Carrier transfer is faster than data speeds available to some organizations
  - Requires planning to sync data changes
- **Availability Group Replica**
  - Extend an on-premises availability group to Azure
  - Extend AD to Azure AD, setup VPN
  - Used for DR for numerous organizations (Hybrid)

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Migration Strategies

- **Database Migration Assistant**
  - UI to assist with backup and restore
- **Detach, copy to Azure blob, attach**
  - Traditional and risky method to detach a database, copy files, and attach
  - This method is not recommended
  - Backup and restore is much safer
- **Physical-to-virtual (P2V), VHD to VHD**
  - Tools exist make an image of a physical machine
  - Migrate an existing VM by migrating the VHD to Azure
- **Transactional replication**
  - Setup a subscriber on an Azure VM, fail over

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Migration strategies from on-premises to an Azure VM

Pros of Azure VMs

- Affordable
- Infrastructure is handled for you
- Compliant
- Secure
- Integrates well
- Hybrid is an option

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Pros of Azure VMs

- Geo-redundant datacenters
- Give up some of your control of the systems
  - Infrastructure roles, servers, storage, network
- High SLAs
  - 99.9% uptime - single instance VM
  - 99.95% uptime - VMs with two or more instances in the same Availability Set
  - 99.99% uptime - VMs with two or more instances in two or more Availability Zones in the same Azure region

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Cons

- **Cost can seem high for larger compute models**
  - Total cost of ownership is likely lower
- **Give up some of your control of the systems**
  - Infrastructure roles, servers, storage, network
- **Latency with hybrid solutions**
- **Fear**

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Key Takeaways

- **Working with Azure virtual machines isn't much different than any other virtual machine**
- **Migrating to Azure VMs is the same process as any other physical-to-virtual migration or VM to VM migration**
- **There are numerous ways of migrating from on-premises to Azure VMs**

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Review

- How to collect on-premises data for sizing
- What benchmarks and how to benchmark Azure virtual machines
- How to choose the correct size virtual machine
- Numerous migration strategies
- Different pros and cons of Azure virtual machines

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