Azure SQL Managed Instance
Lessons learned from the trenches

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What is in it for me?

• Introduction to Azure SQL Database Managed Instance (MI)
  • main features
  • difference between SQL versions

• Learn how to troubleshoot MI issues:
  • tips on how to monitor it, resolve performance problems
  • find documentation, initial troubleshooting steps
What is Managed Instance (MI)

• **Recent PaaS offering:**
  - near 100% compatibility with SQL Server Enterprise Edition
  - native virtual network (VNet)

• **PaaS capabilities with reduced management overhead**
  - automatic patching and version updates
  - managed backup
  - high-availability

• **Fully managed service with minimal design changes**
  - envisioned as preferred platform for SQL Server on-premises / IaaS customers looking to migrate their applications to cloud
What is Managed Instance (MI)

A flavor of SQL DB designed to enable easy migration to fully managed PaaS, for almost any application!

**Easy lift and shift**
- Fully-fledged SQL instance with nearly 100% compat with on-prem

**Fully managed PaaS**
- Built on the same PaaS service infrastructure
- All PaaS features

**Full isolation and security**
- Native VNET implementation
- Private IP addresses

**New business model**
- Competitive
- Transparent
- Frictionless
Key Differences in usage scenarios between SQL Server Offerings in Azure

**Azure SQL Database**
- Simplified database-centric programming model
- Potential to scale out without hitting hard ceiling
- Predictable performance

**Managed Instance**
- Customers can lift and shift their on-premises SQL Servers to a MI
- Complete isolation of instances with native VNET support
- PaaS benefits
- Built-in HA

**SQL IaaS VM**
- Customization of OS or SQL Server
- Specific requirements to run third-party applications on the same VM as SQL Server
- Support for VLDB (above 8TB)
- Support for older versions of SQL Server
Key Features of MI

<table>
<thead>
<tr>
<th>PaaS Benefits</th>
<th>Management</th>
<th>Business Continuity</th>
<th>Security and Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• No management overhead for managing underlying infrastructure</td>
<td>• Azure Resource Manager (ARM) API for automating service provisioning and scaling</td>
<td>• Built in high availability</td>
<td></td>
</tr>
<tr>
<td>• “Relatively quick” provisioning and service scaling</td>
<td>• Azure portal functionality for manual service provisioning and scaling</td>
<td>• 99.99% uptime SLA</td>
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<tr>
<td>• Automated patching and version upgrade</td>
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<td>• Data protected with automated backups</td>
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<td></td>
<td>• Point in time restore capabilities *</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Isolated environment (VNet integration, single-tenant service, dedicated compute and storage)</td>
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<tr>
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<td></td>
<td>• Azure AD authentication, single sign-on support</td>
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<td></td>
<td></td>
<td></td>
<td>• SQL auditing and threat detection</td>
</tr>
</tbody>
</table>
Target Customer Audience for MI

- Customers looking to migrate applications from on-premises or IaaS VMs, self-built or ISV provided, with as low migration efforts as possible
vCore-Based Service Tiers for GP MI

- Allows independently choose compute and storage
- Removes guesswork of DTUs
- 2 hardware generations (Gen4 and Gen5)

**Gen4**
- Intel E5-2673 v3 (Haswell) 2.4 GHz processors
- Locally-attached SSD
- 8, 16, 24 vCores options
- 1 vCore = 1 physical core
- 7GB of RAM per vCore

**Gen5**
- Intel E5-2673 v4 (Broadwell) 2.3 GHz processors
- Locally-attached fast NVMe SSD
- 8, 16, 24, 32, 40, 64, 80 vCores options
- 1 vCore = 1 logical core, hyper-threaded
- 5.5GB of RAM per vCore
- Guaranteed accelerated networking
MI Service Tiers

General Purpose (GP)
- For majority of business apps with typical performance and HA requirements
- High-performance Azure Premium storage (up to 8 TB)
- Max storage per DB – **8 TB**
- Up to 100 databases / instance
- Independent selection of storage and compute
- Number of vCores: 8, 16, 24 for Gen 4 or 8, 16, 24, 32, 40 for Gen 5
- Multiple data files per database

Business Critical (BC)
- Designed for business applications with highest performance and HA requirements (fast failover)
- Comes with super-fast SSD storage (up to 1 TB on Gen 4 and up to 4 TB on Gen 5)
- Max storage per DB – **4 TB** (for 32-80 vCores in Gen 5)
- Up to 100 databases / instance
- Independent selection of storage and compute
- Number of vCores: 8, 16, 24, 32 for Gen 4 or 8, 16, 24, 32, 40, 64, 80 for Gen 5
- Multiple data files per database
- In-Memory OLTP
- 1 additional read-only replica
MI provides additional security isolation from other tenants in the Azure cloud. It includes:

• Dedicated underlying compute and storage

• SQL endpoint is exposed only through a private IP address on a VNet

• Connectivity from on-premises environment using Azure Express Route or VPN Gateway
Requirements and Planning for MI VNet

Dedicated subnet inside VNet with the following requirements:

• **No other cloud services**, except MI, allowed in subnet

• **Must not have NSGs** associated with MI subnet

• The subnet must have a User Route Table (UDR) with 0.0.0.0/0 Next Hop Internet as the **only route assigned to it**

• Subnet **must not have any Service endpoints** (storage or SQL) associated to it
Scripted Deployment

```powershell
$scriptUrlBase = 'https://raw.githubusercontent.com/Microsoft/sql-server-samples/master/samples/manage/azure-sql-db-managed-instance/attach-jumpbox'

$parameters = @{
  subscriptionId = 'de8382bc-f9ac-48ef-a92b-8bfe1cc345b7'
  resourceGroupName = 'ManagedInstance'
  virtualNetworkName = 'vnet-midemo'
  administratorLogin = 'smcadmin'
  administratorLoginPassword = '<password>'
}

Invoke-Command -ScriptBlock ([Scriptblock]::Create({iwr ($scriptUrlBase + '/attachJumpbox.ps1?t=' + [DateTime]::Now.Ticks)).Content})) -ArgumentList $parameters, $scriptUrlBase
```
Authentication and Authorization in MI

**Authorization**
- MI has the same authorization capabilities (through DB role memberships and object-level permissions) as SQL Server

**Authentication**
- MI supports 2 types of authentication:
  - SQL Authentication, which uses a username and password
  - Azure Active Directory Authentication, which uses identities managed by Azure Active Directory and is supported for managed and integrated domains (contained users only)
Key Differences between SQL Server on-premises and MI

- High-availability is built in and pre-configured in MI
- Automated backups
- MI does not allow access to the file system
- MI supports Azure AD authentication
- MI automatically manages filegroup (called XTP) for databases containing In-Memory OLTP objects
Key Differences between MI and Azure SQL DB

**MI does not support:**
- Automatic index tuning
- BACPAC file export
- Geo-restore
- Geo-replication (available only in private preview)
- SQL Data Sync
- TDE with BYOK
- Elastic Pools

**Azure SQL DB does not support:**
- User-initiated backups
- Change Data Capture
- Common language runtime (CLR)
- Cross-database queries and transactions
- Database mail
- Distributed partition views
- Event notifications
- Multiple filegroups
- Linked servers
- OPENDATASOURCE, OPENQUERY, OPENROWSET
- Resource Governor
- Service Broker
- SQL Server Agent
- SQL Server Profiler
- Most system SPs
What else is missing in MI?

MI does not support:
- Database Mirroring
- Extended Stored Procedures
- Management Data Warehouse
- Windows Authentication
- AlwaysOn Availability Groups

Will be added later this year:
- Support for local time. Only UTC is supported now
- Instance collation is fixed now
- Azure native monitoring capabilities (Azure Monitor and OMS support)

Could be added post-GA:
- Filestream and FileTable Support
- Cross-instance distributed transactions
- Stretch Database Support
- Polybase
DB File Layout in MI Considerations

1. Additional Files and Filegroups Are allowed
2. Adding Files to Filegroup is allowed only via ALTER DATABASE statement
3. You cannot choose path for data and log files
4. Multiple files (14) automatically created for TempDB with initial size 16 MB and autogrowth 256 MB. Custom TempDB configuration will be supported soon.
Additional Considerations for Disk Storage Limit in GP MI

1. Every GP MI has up to **35 TB** of internal storage

2. GP MI uses pre-defined sizes of azure disks (**128GB, 256GB, 512GB**, etc.) for every file so every file is placed on a single disk with the smallest size that is enough to fit the file with the current file size.

3. As a result, **you cannot have > 280 files** on the GP MI because 280 files placed on the smallest 128GB disks will reach 35TB limit.

Simpler DB Administration in MI

Many SQL DBA functions are not required:

- OS / SQL Server installation and patching
- Managing backups
- High availability configuration
Migration to MI

Data Migration Service (DMS)
- Create an instance of DMS in different subnet
  - Make sure that ports 53, 443, 445, 9354, 12000 are open
- Create a BLOB container and retrieve its SAS URI
- Create a migration project in DMS
- Run and monitor migration

Backup and Restore
- Create Azure storage account for hosting native SQL Server backup files
- Get SAS token for container where backup is stored
- Create credential in SQL MI using container’s URL and SAS key
- Restore database from URL using T-SQL
Scalability Options for MI

Vertical: scale up or scale down
Change service tiers to provide a larger resource allocation for the entire managed instance

Horizontal: scale out or scale in
Similar to Elastic Pool, add or remove databases and manage performance using resource governor
MI Pricing

- Prices in Public Preview was 50% of GA prices.
- For ex., now for SQL MI GP 8vCores is $800+/month

### Gen 4

Gen 4 CPUs are based on Intel E5-2673 v3 (Haswell) 2.4 GHz processors. In Gen 4, 1 vCore = 1 physical CPU

<table>
<thead>
<tr>
<th>vCORE</th>
<th>MEMORY (GB)</th>
<th>INCLUDED STORAGE</th>
<th>LICENSE INCLUDED PRICE</th>
<th>AZURE HYBRID BENEFIT</th>
<th>PRICE (% SAVINGS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>50</td>
<td>First 32 GB/month</td>
<td>$1.0087/hour</td>
<td>$0.6088/hour</td>
<td>(-40%)</td>
</tr>
<tr>
<td>16</td>
<td>112</td>
<td>First 32 GB/month</td>
<td>$2.0173/hour</td>
<td>$1.2176/hour</td>
<td>(-40%)</td>
</tr>
<tr>
<td>24</td>
<td>157</td>
<td>First 32 GB/month</td>
<td>$3.0259/hour</td>
<td>$1.8263/hour</td>
<td>(-40%)</td>
</tr>
</tbody>
</table>

*Managed Instance is in public preview. Prices reflect preview rates.

### Gen 5

Gen 5 logical CPUs are based on Intel E5-2673 v4 (Broadwell) 2.3 GHz processors. In Gen 5, 1 vCore = 1 hyper thread

<table>
<thead>
<tr>
<th>vCORE</th>
<th>MEMORY (GB)</th>
<th>INCLUDED STORAGE</th>
<th>LICENSE INCLUDED PRICE</th>
<th>AZURE HYBRID BENEFIT</th>
<th>PRICE (% SAVINGS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>44</td>
<td>First 32 GB/month</td>
<td>$1.0087/hour</td>
<td>$0.6088/hour</td>
<td>(-40%)</td>
</tr>
<tr>
<td>16</td>
<td>88</td>
<td>First 32 GB/month</td>
<td>$2.0173/hour</td>
<td>$1.2176/hour</td>
<td>(-40%)</td>
</tr>
<tr>
<td>24</td>
<td>132</td>
<td>First 32 GB/month</td>
<td>$3.0259/hour</td>
<td>$1.8263/hour</td>
<td>(-40%)</td>
</tr>
<tr>
<td>32</td>
<td>176</td>
<td>First 32 GB/month</td>
<td>$4.0345/hour</td>
<td>$2.4351/hour</td>
<td>(-40%)</td>
</tr>
<tr>
<td>40</td>
<td>264</td>
<td>First 32 GB/month</td>
<td>$5.0431/hour</td>
<td>$3.0431/hour</td>
<td>(-40%)</td>
</tr>
<tr>
<td>64</td>
<td>352</td>
<td>First 32 GB/month</td>
<td>$8.069/hour</td>
<td>$4.8701/hour</td>
<td>(-40%)</td>
</tr>
<tr>
<td>80</td>
<td>396</td>
<td>First 32 GB/month</td>
<td>$10.09/hour</td>
<td>$6.087/hour</td>
<td>(-40%)</td>
</tr>
</tbody>
</table>

### Storage

<table>
<thead>
<tr>
<th>STORAGE</th>
<th>PREVIEW PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 32 GB/month</td>
<td>Included</td>
</tr>
<tr>
<td>Additional storage**</td>
<td>$0.0575/GB</td>
</tr>
<tr>
<td>Backup** GB/month</td>
<td>$0.05</td>
</tr>
</tbody>
</table>

*Storage is available in increments of 22 GB up to 8 TB.

### I/Os

<table>
<thead>
<tr>
<th>I/O RATE</th>
<th>PREVIEW PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 1 million requests**</td>
<td>$0.10</td>
</tr>
</tbody>
</table>

*Limited-time promotion. I/Os will not be charged until December 31, 2018. Backup storage will not be charged until December 31, 2018.
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  • main features
  • difference between SQL versions

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  • find documentation, initial troubleshooting steps
Questions
Configure a VNet for Azure SQL Database Managed Instance

Create an Azure SQL Database Managed Instance

Change size of Azure SQL Managed Instance using PowerShell

Replication with SQL Database Managed Instance

Sending emails in Azure SQL Managed Instance
Additional Resources - 2

Point-In-Time Restore in MI

File Storage in MI

Storage performance best practices and considerations for Azure SQL DB MI

Cross-instance point-in-time restore in Azure SQL Database Managed Instance

HA Differences in GP and BC