SQLskills Immersion Event

IEAzure: Azure VMs and Azure SQL Database

Module 1: Azure Overview and the Azure Fabric

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Overview

- What is Azure
- Azure Data Services
- Overall Azure benefits
- Scalability
- Compliance
- High Availability and Disaster Recovery
- Azure First
- Security
- Storage
- Networking
- Management Tools

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What is Microsoft Azure?

A cloud computing platform and infrastructure created by Microsoft, for the building, deploying and managing of applications and services through a global network of Microsoft and partner hosted datacenters

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Infrastructure as a Service (IaaS)

- **Instant computing infrastructure, provisioned and managed over the internet**
  - Quickly scales up and down with demand
  - Helps avoid the complexity of buying and managing your own physical servers and other infrastructure
  - Azure manages the infrastructure, while you purchase, install, configure, and manage your own software, operating systems, middleware, and applications
  - Improved security, scalability, access to Azure 'fabric' benefits such as availability benefits, Azure Marketplace, and other benefits

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Platform as a Service (PaaS)

- **Complete modular environment, enable delivery from simple cloud-based apps to sophisticated, enterprise apps**
  - Allows you to focus on applications, not hardware
  - Support for full lifecycle: building, testing, deploying, management
  - Auto-scale to meet demand and save money
  - Integrated health, monitoring, and load balancing
  - Predictable performance and pricing, pay-as-you-go
  - Secure and compliant for your sensitive data
  - Supports geographically distributed development teams
  - Pre-coded application components built-in:
    - workflow, directory services, security, search, and more

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Azure Data Services (PaaS and IaaS Options)

FIND THE DATABASE PRODUCT THAT YOU NEED

IF YOU WANT...	USE THIS
A globally distributed multi-model database, with support for NoSQL choices, with industry-leading performance and SLAs	Azure Cosmos DB
A fully managed relational database that provisions quickly, scales on the fly, and includes built-in intelligence and security	Azure SQL Database
A fully managed, scalable MySQL relational database with high availability and security built in at no extra cost	Azure Database for MySQL
A fully managed, scalable PostgreSQL relational database with high availability and security built in at no extra cost	Azure Database for PostgreSQL
To host enterprise SQL Server apps in the cloud	SQL Server on Virtual Machines
A fully managed, elastic data warehouse with security at every level of scale at no extra cost	SQL Data Warehouse
Help migrating your databases to the cloud with no application code changes	Azure Database Migration Service
High throughput and consistent low-latency data access to power fast, scalable applications	Azure Cache for Redis
A NoSQL key-value store for rapid development using massive semi-structured datasets	Table Storage
A fully managed, scalable MariaDB relational database with high availability and security built in at no extra cost	Azure Database for MariaDB

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Migrate SQL Based Applications

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Microsoft Azure Benefits

- **Supports many operating systems, frameworks, devices, databases, and languages**
- **Connect on-premises data and applications using hybrid consistency**
- **Leverage Azure Security Center with Azure Monitor to detect and mitigate threats and vulnerabilities**
- **Includes many built-in features for improving manageability and reducing the overhead of routine and pedestrian tasks**

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Microsoft Azure Benefits

- **Quickly build applications using integrated tools**
- **Monitor and manage your environment**
- **Use AI using Cognitive Services and the Bot Framework**
  - Example: https://azure.microsoft.com/en-us/services/cognitive-services/computer-vision/
- **Machine Learning and Power BI**
- **Use any data for insights: ERP, CRM, web, big data, Excel, databases**

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Scalability and Reliability

- **Scale compute up or down as workload demands**
  - May require slight outage
- **99.9 to 99.99% uptime**
  - https://azure.microsoft.com/en-us/support/legal/sla/
  - 99.9% - Single VM
  - 99.95% - Two or more VMs in the same Availability Set
  - 99.99% - Two or more instances deployed across two or more Availability Zones
    - In the same Azure region
  - 99.99% - Azure SQL DB and Managed Instance all tiers
  - 99.9% - Stretch Database
  - 99.995% - Azure SQL Database Business Critical or Premium tiers configured as Zone Redundant Deployments

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Compliance

- **Many certifications**
  - DoD Provisional Authorizations at Impact Levels 5, 4, and 2
  - FIPS 140-2 – US Federal Info Processing Standards
  - HIPPA/HITECH – Health Care
  - ISO 22301, 27001, 27017, 27018
  - PCI DSS – Payment Card industry
  - CJIS – US Criminal Justice Information Services
  - EU Model Clauses
  - *And more..*
- **Azure Trust Center** http://bit.ly/2lKjwzK

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Improved Management Experience

- **Single portal for PaaS/IaaS/SaaS components**
- **Click through to create VMs and databases**
- **Marketplace – single point for provisioning**
- **Growing and maturing experience**
- **Complete PowerShell support**
- **Automation options**
- **Integration support**

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High Availability and Disaster Recovery

Scenario	LRS	ZRS	GRS	RA-GRS
Node unavailability within a data center	Yes	Yes	Yes	Yes
An entire data center (zonal or non-zonal) becomes unavailable	No	Yes	Yes	Yes
A region-wide outage	No	No	Yes	Yes
Read access to your data (in a remote, geo-replicated region) in the event of region-wide unavailability	No	No	No	Yes
Designed to provide _ durability of objects over a given year	at least 99.999999999% (11 9's)	at least 99.9999999999% (12 9's)	at least 99.999999999999999% (16 9's)	at least 99.999999999999999% (16 9's)
Supported storage account types	GPv1, GPv2, Blob	GPv2	GPv1, GPv2, Blob	GPv1, GPv2, Blob

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High Availability and Disaster Recovery

VMs

- **Fault Domain** is a collection of servers that share common resources such as power and network connectivity
- **Availability Set** refers to two or more Virtual Machines deployed across different Fault Domains to avoid a single point of failure
- **Availability Zone** is a fault-isolated area within an Azure region, providing redundant power, cooling, and networking

- **SQL Server on Azure VMs**
  - Availability Groups
  - Mirroring
  - Log shipping
  - Clustering
  - Replication

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High Availability and Disaster Recovery

- **Azure SQL Database**
  - **Standard/general purpose** 99.99% uptime
  - Separation of compute and storage

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High Availability and Disaster Recovery

- **Azure SQL Database**
  - **Premium/business critical** 99.99% uptime
  - Cluster of database engine processes
  - Maintains quorum with minimal impact during maintenance

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High Availability and Disaster Recovery

- **Managed Instance**
  - Business Critical offers Read Scale-Out
  - Free-of-charge read-only node
  - Auto-failover groups
- **Geo-replication**
  - Up to 4 readable secondaries

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Azure First

- **Aug 2014**
  - Preview - Geo-restore
  - Preview - Geo-replication
- **Sept 2014**
  - GA – Azure SQL Database
- **Jan 2015**
  - Preview – Row Level Security
- **Feb 2015**
  - Preview – Dynamic Data Masking
- **Apr 2015**
  - Preview – Transparent Data Encryption
- **May 2015**
  - Preview – Query Store

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Azure First

- **July 2015**
  - Preview – Index Advisor
- **Aug 2015**
  - GA - Row-Level Security
- **Oct 2015**
  - Preview - Query Performance Insight
  - GA - Transparent Data Encryption
  - GA - Dynamic Data Masking
- **Nov 2015**
  - Preview - Always Encrypted
  - Preview - Advance Threat Detection
  - GA - Query Store
  - GA - Geo-replication

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Azure First

- **Jan 2016**
  - GA – Index Advisor
- **Feb 2016**
  - GA - Query Performance Insight
- **Mar 2016**
  - GA - Index Advisor
  - Preview - JSON
- **April 2016**
  - Active geo-replication in all service tiers
- **May 2016**
  - GA – Elastic pools
  - GA - Database Advisor and Performance Dashboard
- **June 2016**
  - GA - SQL Server 2016

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Azure First

- **July 2016**
  - GA – Always Encrypted
- **Dec 2016**
  - Query Store enabled by default
- **May 2017**
  - TDE enabled by default
- **Sept 2017**
  - Preview – SQL Vulnerability Assessment
  - Preview - Intelligent insights
  - GA - Graph support
  - GA - Adaptive query processing

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Azure First

- **Oct 2017**
  - GA – SQL Server 2017
- **April 2018**
  - GA – Read scale-out support
- **Oct 2018**
  - GA – Azure SQL Managed Instance General Purpose
- **Nov 2018**
  - Improvements to the Azure Portal Experience
  - Zone-redundant SQL databases and elastic pools GA: West Europe and South-East Asia
  - Azure SQL Database Managed Instance SKU Recommendation for Database Migration Assistant is now in preview

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Azure First

- **Dec 2018**
  - Azure SQL Database Managed Instance – Business critical service tier now available
    - Designed for mission-critical business apps with high I/O requirements, business critical supports high availability with the highest level of storage and compute redundancy
  - Support for SQL to Azure SQL Managed Instance online migrations
    - Users can now migrate SQL Server databases to Azure SQL Database Managed Instance with minimal downtime
  - Dev/test pricing available for Azure SQL DB Managed Instance

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Azure First

- **Jan 2019**
  - Additional compute levels added to vCore-based Azure SQL databases and elastic pools
    - The range of available compute resources for vCore-based elastic pools and single databases has been expanded within the General Purpose, Business Critical and Hyperscale service tiers.
  - Support for SQL to Azure SQL DB online migrations
    - Users can now migrate SQL Server databases to Azure SQL DB with minimal downtime
- **Feb 2019**
  - Support for Amazon RDS for SQL Server to Azure SQL Database Managed Instance online migrations

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Microsoft Azure Benefits

- **Feb 2019**
  - SQL Server Migration Assistant support for Azure SQL Database Managed Instance
  - DMA support for target readiness assessment for Azure SQL Database Managed Instance
  - Database rename is now supported in Azure SQL Database Managed Instance
- **March 2019**
  - GA – Read scale-out support for Azure SQL Database
- **April 2019**
  - GA – Read scale-out support in Azure SQL Database premium service tier

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Microsoft Azure Benefits

- **May 2019**
  - Azure SQL Database Hyperscale support for single databases
  - Azure SQL Database managed instance SKU recommendation for DMA
  - Azure SQL Database serverless compute tier in preview
  - Time Zone choice for Azure SQL Database managed instance
- **June 2019**
  - Azure SQL Database managed instance now supports larger regional resource limitations
  - GA – 4 vCore Azure SQL Database managed instances on Gen 5
  - Dev/test pricing option for Visual Studio subscribers for MI
  - Changing default backup retention to 7 days for DTU-bases Azure SQL databases
  - Public endpoint for data traffic globally available for MI

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Microsoft Azure Benefits

- **July 2019**
  - Introduction of UTF-8 support for Azure SQL Database
  - Managed Instance enhances security with network traffic containment within Azure cloud
  - Increase of business continuity SLA for Azure SQL Database
- **Aug 2019**
  - Azure SQL Database serverless vCore limit increased to 16
  - GA - SQL data discovery and classification for Azure SQL Database
- **Sept 2019**
  - Instance pools for Azure SQL Database managed instance in preview
  - GA – Auto-failover for manage instances in Azure SQL Database

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Microsoft Azure Benefits

- **Nov 2019**
  - GA - SQL Server 2019
  - GA - Azure SQL Database serverless
  - DMA support for SQL Server 2019
  - BYOK for Azure SQL DB TDE
- **Feb 2020**
  - New Azure SQL Databases default to automatic tuning enabled
- **March 2020**
  - Gen 5 hardware default option
  - TLS 1.2 now enforced on Azure SQL Database MI

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Microsoft Azure Benefits

- **May 2020**
  - Azure SQL Edge now in preview
- **June 2020**
  - BYOK Managed Instance Hyperscale – preview
- **July 2020**
  - New memory optimized and compute optimized hardware options in Azure SQL Database
- **September 2020**
  - Major performance improvements for Azure SQL Managed Instance
    - Enhance log write throughput
  - Machine Learning on Azure SQL Managed Instance - preview

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Microsoft Azure Benefits

- **October 2020**
  - Microsoft Cloud for Healthcare - GA
- **Dec 2020**
  - TDE with customer-managed keys for SQL DB Hyperscale
- **Jan 2021**
  - Confidential computing using Always Encrypted with secure enclaves – preview
- **And so much more….**
  - https://azure.microsoft.com/en-us/updates

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Improved Security

- **Data Protection**
  - SQL Database uses encryption in motion with TLS
  - Data at rest with TDE
    - Bring Your Own Key support
  - Data in use with Always Encrypted
- **Data Discovery & Classification**
- **Access Control**
  - Firewalls
  - SQL and Azure Active Directory Authentication
    - Multi-factor Authentication with AAD

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Improved Security

- **Auditing**
  - Tracks database activities
  - Regulatory compliance
- **Advanced Threat Protection**
  - Detects unusual and potentially harmful access/exploits
- **Vulnerability Assessment**
  - Discover, track, and remediate potential vulnerabilities
- **Full SQLOS Security capabilities**
  - Static Data Masking for Azure SQL Database

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Storage Options

- Storage account - blob, file, table, queue
  Quickstart tutorial
- Azure File Sync
  Quickstart tutorial
- Azure Data Box
  Learn more
- Data Lake Storage Gen1
  Quickstart tutorial
- StorSimple Physical Device Series
  Learn more
- StorSimple Virtual Device Series
  Learn more
- Backup and Site Recovery (OMS)
  Quickstart tutorial
- AltaVault AVA-c4, version 4.4.1
  Learn more
- Cloudian HyperCloud for Azure
  Learn more
- CloudEndure Disaster Recovery - Tier-1

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Storage Options

- **Virtual Machines**
  - Standard – HDD
  - Premium – SSD
  - NVMe SSDs – H-service VMs – temporary local storage only
- **Unmanaged disks**
  - Traditional, you manage, don't allocate too many
- **Managed disks**
  - Creation and management handled for you
  - Specify size and performance tier
- **Scaling – add more disks and stripe (RAID)**

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Storage Options

- **Azure SQL Database**
  - Basic – Standard HDD
  - Standard – HDD
  - Premium – SDD
- **Managed Instance**
  - General Purpose – remote SSD
  - Business Critical – local SSD
- **https://azure.microsoft.com/en-us/services/storage**

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Azure Networking

- **Point-to-Site VPN – (P2S VPN)**
  - Single computer (point) to Azure network (site)
  - Uses certificates
  - Adds flexibility for roaming users
  - Consider Active Directory Certificate Services (AD CS)
- **Site-to-Site VPN – (S2S VPN)**
  - Persistent connection from on-premises to Azure network
  - Requires a static public IP address
- **ExpressRoute**
  - Fastest connection 50Mbps to 100Gbps
  - Limited availability

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Azure Networking

- **Internal networks**
  - VNets – Virtual Networks
    - Can create multiple VNets to isolate environments
    - Can subdivide using Subnets
    - Setup VPNs to allow VNets to communicate
- **Network Security Groups (NSGs)**
    - Enforce and control network traffic rules
    - Similar to a firewall
- **Design and plan first**
    - Before creating VMs or other services, setup your VNet

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Azure Networking

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Demo

A step through the Azure Portal

Management Tools

- **SQL Server Management Studio**
  - On-premises
  - SQL Server on an Azure VM
  - Azure SQL Database
  - Azure SQL DB Managed Instance
- **PowerShell**
  - Same capabilities of SSMS, and more..
- **Azure Data Studio**
  - New product with monthly updates
  - Built-in support for on-premises, Azure SQL DB, Managed Instance, Azure Synapse, and SQL Server 2019

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Demo

A quick walk-through of sample PowerShell scripts

https://docs.microsoft.com/en-us/azure/sql-database/sql-database-powershell-samples

Azure Data Services

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Key Takeaways

- You can run SQL Server in a number of ways in Azure
  - IaaS or PaaS
- Multiple database platforms are available in Azure, not just Microsoft SQL Server
- HA and DR are made much easier in Azure
- Azure first, really is a thing. New development will nearly always come to Azure before on-premises
- You have numerous storage options depending on your platform
- Tools exist for configuring, monitoring, and securing your environment

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Review

- We discussed Azure in general and the many built-in benefits for leveraging Azure
- We had an overview of IaaS and PaaS
- We learned about Azure Data Services and how Azure is scalable
- Azure is secure and compliant
- Networking is much like on-premises, we just need the right people configuring it
- Most enhancements come to Azure first before on-premises for SQL Server
- Various tools exist for working with Azure

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