

SQLskills Immersion Event

IEAzure: Azure VMs and Azure SQL Database

Module 1: Azure Overview and the Azure Fabric

Tim Radney

Tim@SQLskills.com



Overview

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

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

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

Platform as a Service (PaaS)

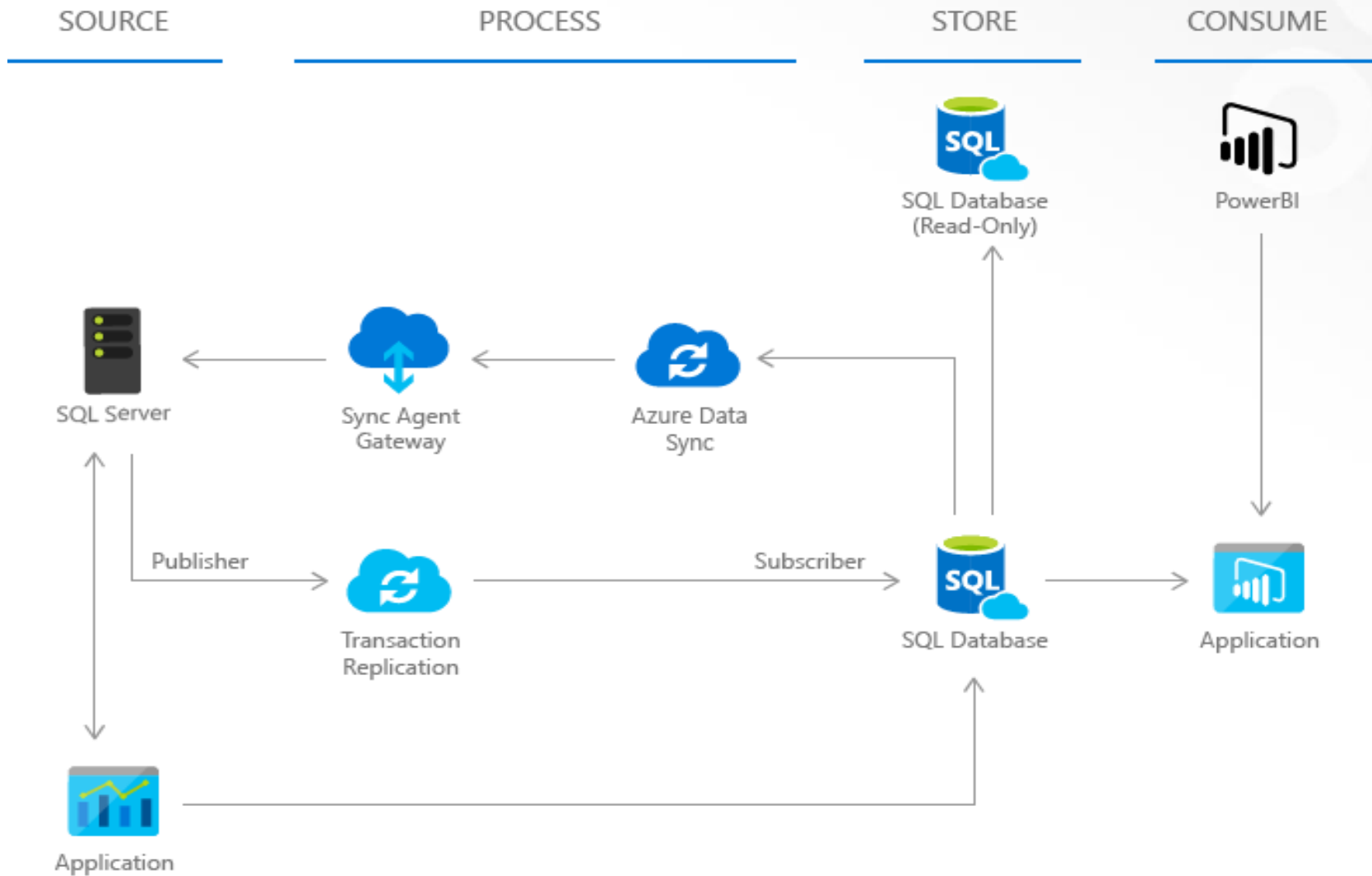
- **Complete modular environment, enable delivery from simple cloud-based apps to sophisticated, enterprise apps**
 - Allows you to focus on applications, not hardware
 - Support for full lifecycle: building, testing, deploying, management
 - Auto-scale to meet demand and save money
 - Integrated health, 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

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 |

Migrate SQL Based Applications



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**

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**

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

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/2IKjwzK>

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



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 99.999999999% (12 9's) | at least 99.9999999999999% (16 9's) | at least 99.9999999999999% (16 9's) |
| Supported storage account types | GPv1, GPv2, Blob | GPv2 | GPv1, GPv2, Blob | GPv1, GPv2, Blob |

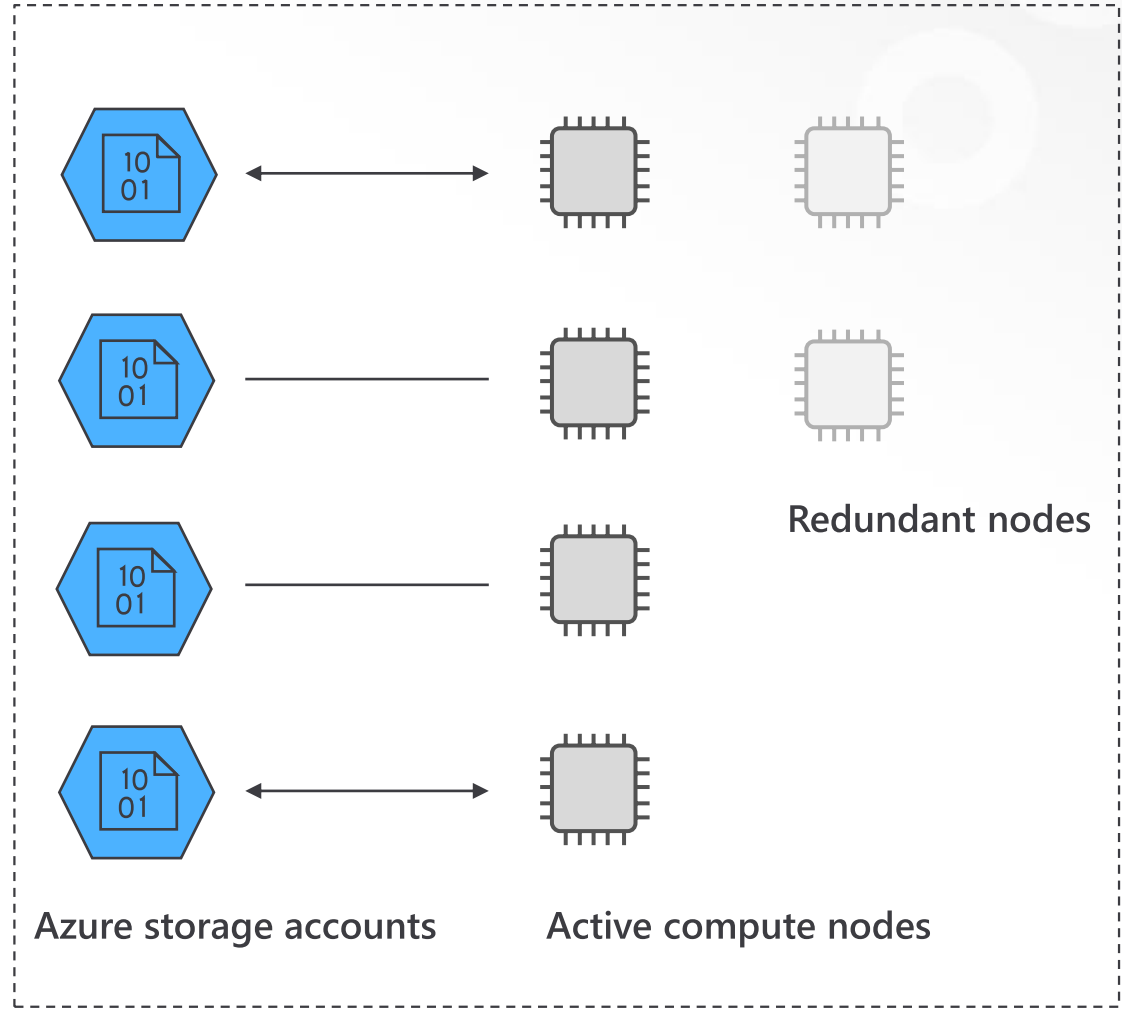
High Availability and Disaster Recovery

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

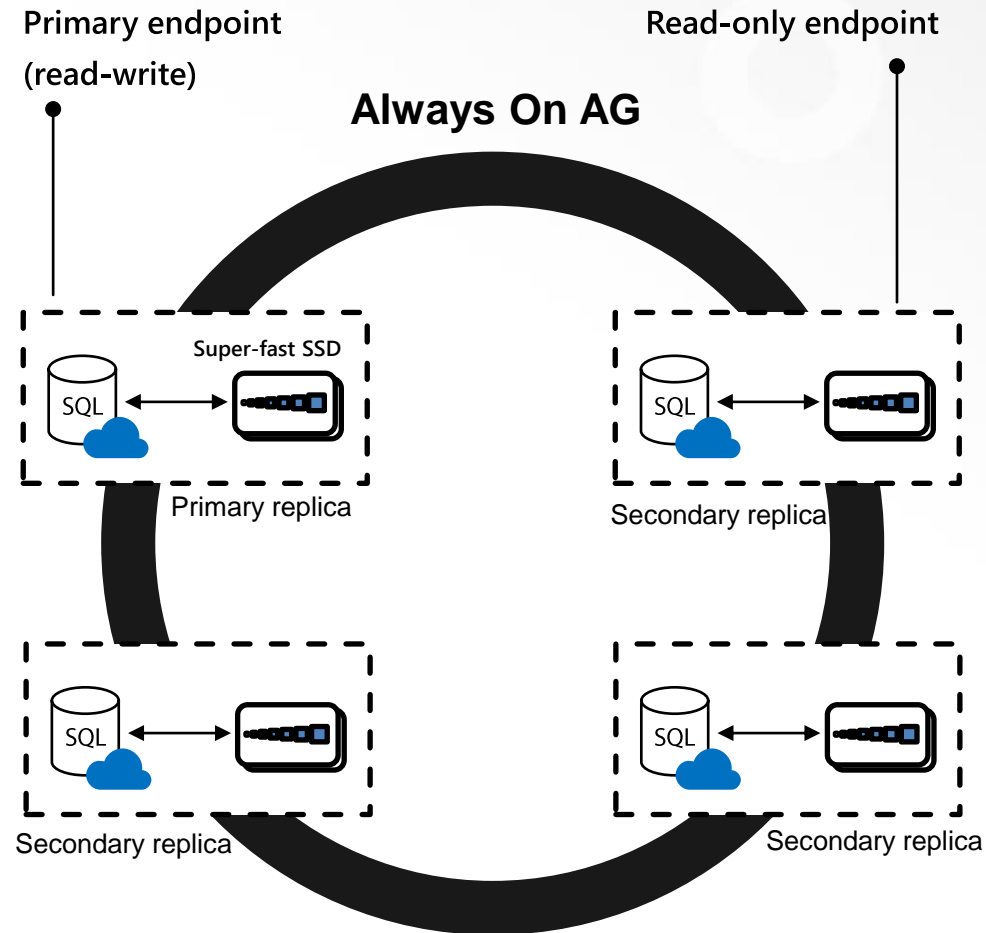
High Availability and Disaster Recovery

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



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



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



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

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

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

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

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

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

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

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

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

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

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

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

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>

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

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

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](#)



Clouddian HyperCloud for Azure

[Learn more](#)



CloudEndure Disaster Recovery - Tier-1

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)**

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>

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

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

Get started

Recently created

Recently created

AI + Machine Learning

Analytics

Blockchain

Compute

Containers

Databases

Developer Tools

DevOps

Identity

Integration

Internet of Things

Media










Mixed Reality

IT & Management Tools

Networking

Software as a Service (SaaS)

Security

-  **Virtual network**
[Quickstart tutorial](#)
-  **Check Point CloudGuard IaaS R80.10 Cluster (preview) (preview)**
[Learn more](#)
-  **Load Balancer**
[Learn more](#)
-  **Application Gateway**
[Learn more](#)
-  **Front Door**
[Learn more](#)
-  **Firewall**
[Learn more](#)
-  **Virtual WAN**
[Learn more](#)
-  **Network security group**
[Quickstart tutorial](#)
-  **ExpressRoute**
[Learn more](#)

Azure Networking

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

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



Azure SQL Managed Instance

[Learn more](#)



SQL Database

[Quickstart tutorial](#)



SQL Data Warehouse

[Quickstart tutorial](#)



SQL Elastic database pool

[Learn more](#)



Azure Database for MariaDB
(preview)

[Learn more](#)



Azure Database for MySQL

[Quickstart tutorial](#)



Azure Database for PostgreSQL

[Quickstart tutorial](#)



Azure Cosmos DB

[Quickstart tutorial](#)



SQL Server 2017 Enterprise Windows
Server 2016

[Learn more](#)



Database as a service for MongoDB

[Learn more](#)

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

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