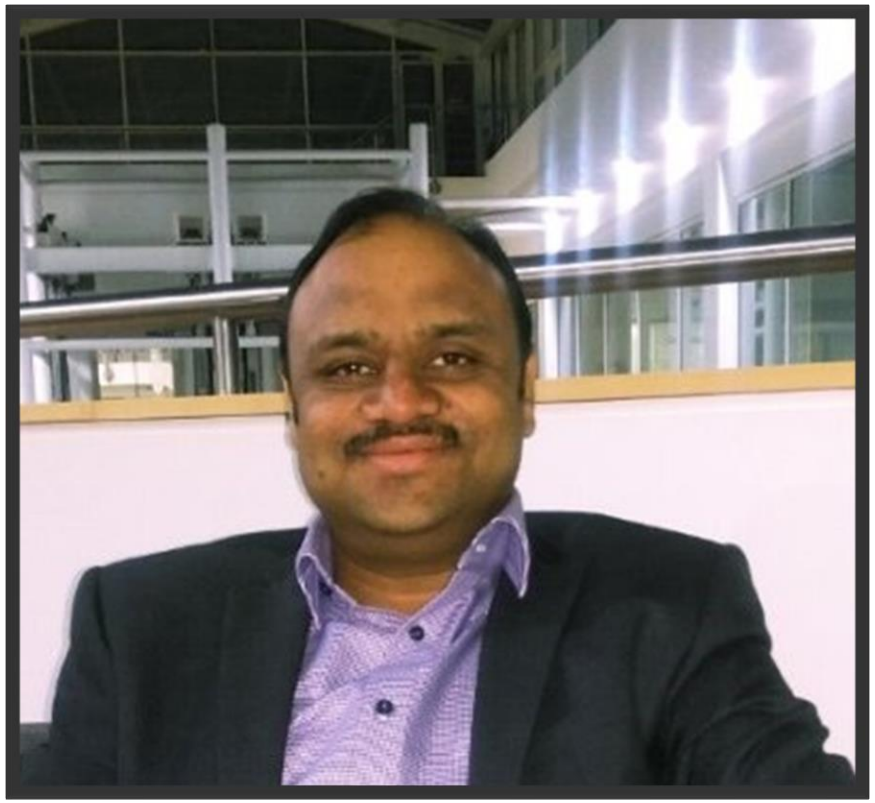
Microsoft Azure

Mastering Azure SQL PaaS

A 100-Minute Journey from Novice to Expert

Azure SQL Database
Azure Managed Instance

Meet the Speakers



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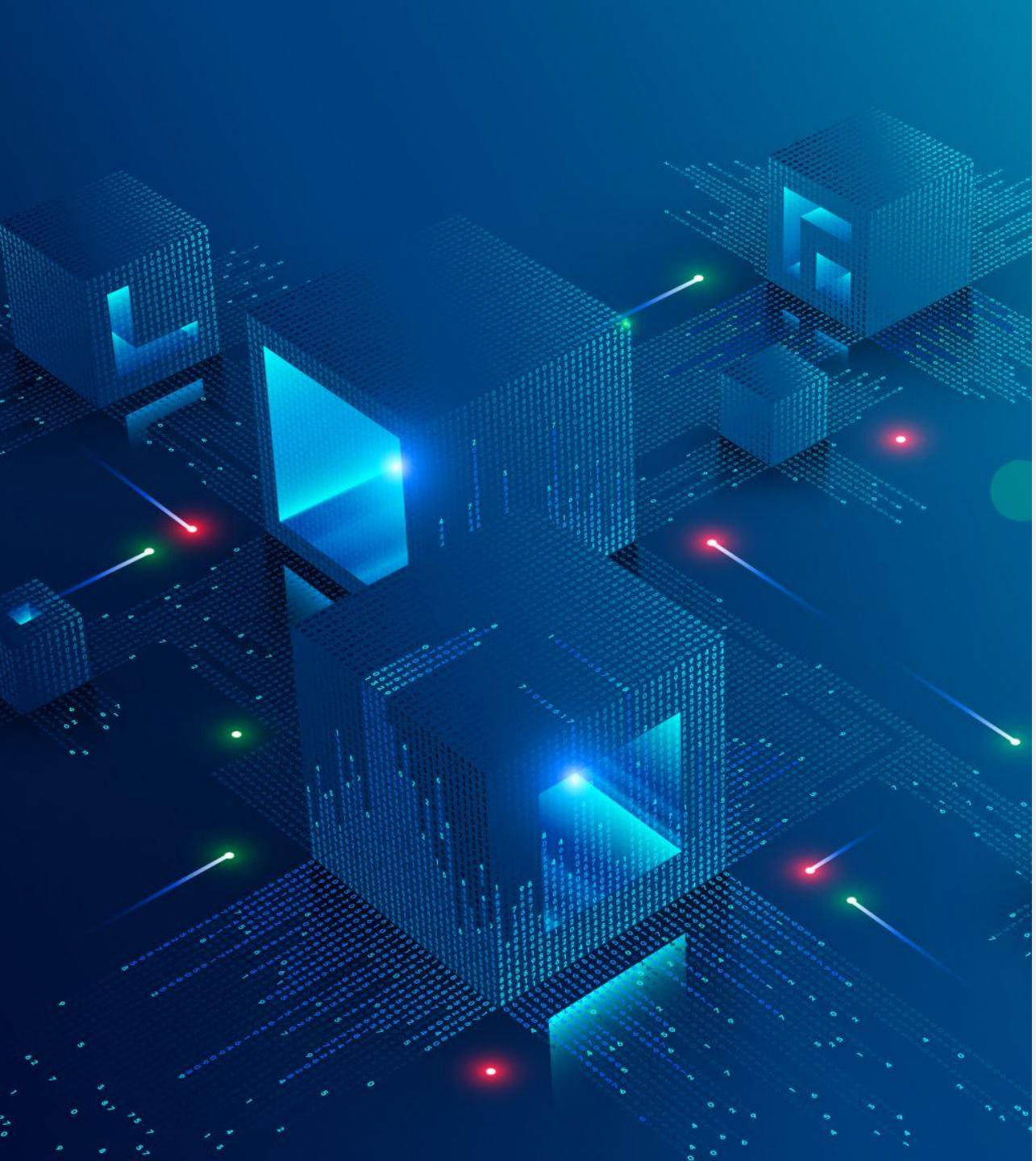


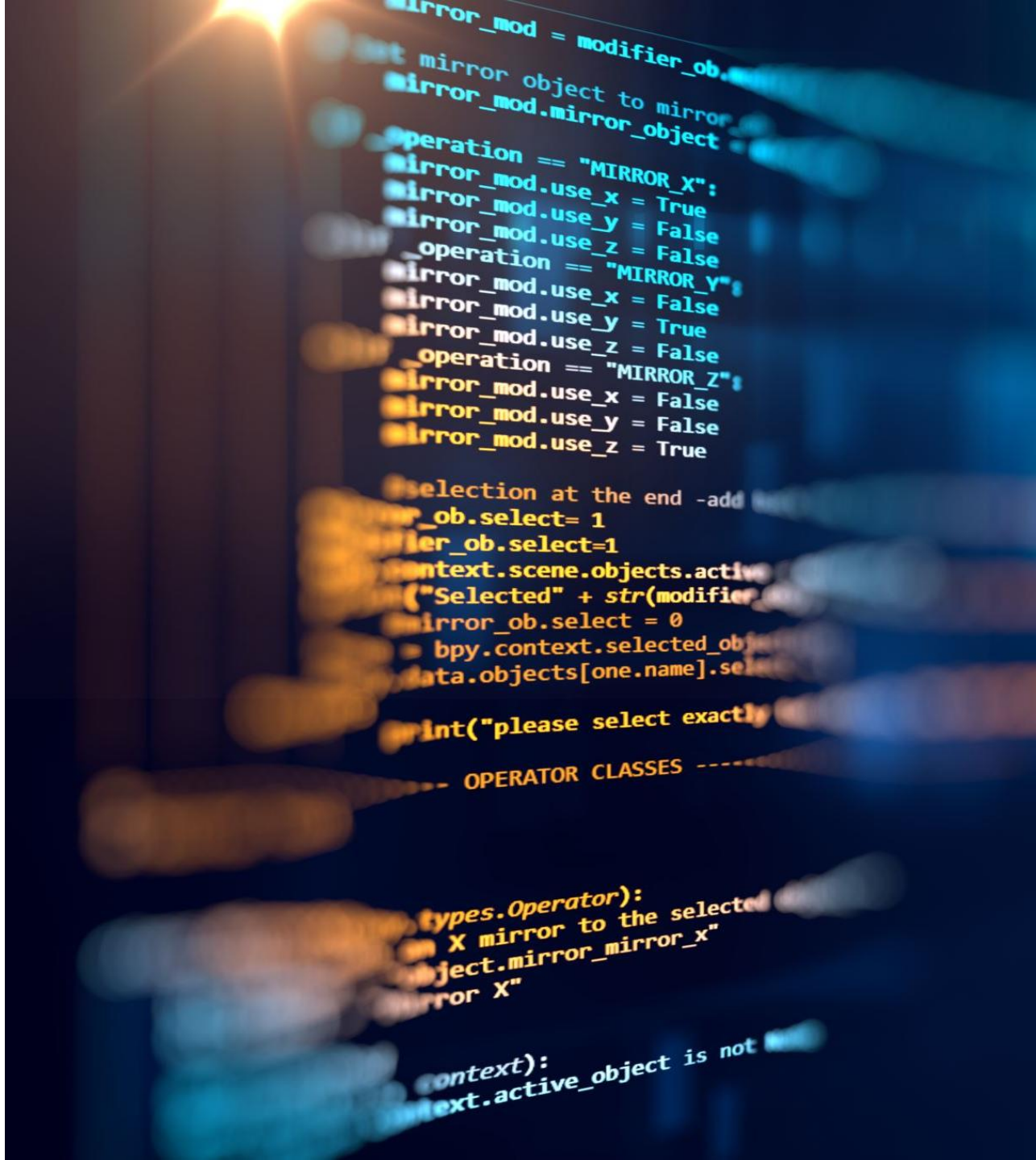
OVERALL AGENDA

- Introduction to SQL PaaS Services on Azure
- Migration to Azure SQL PaaS
- Business Continuity
- Security
- Administration

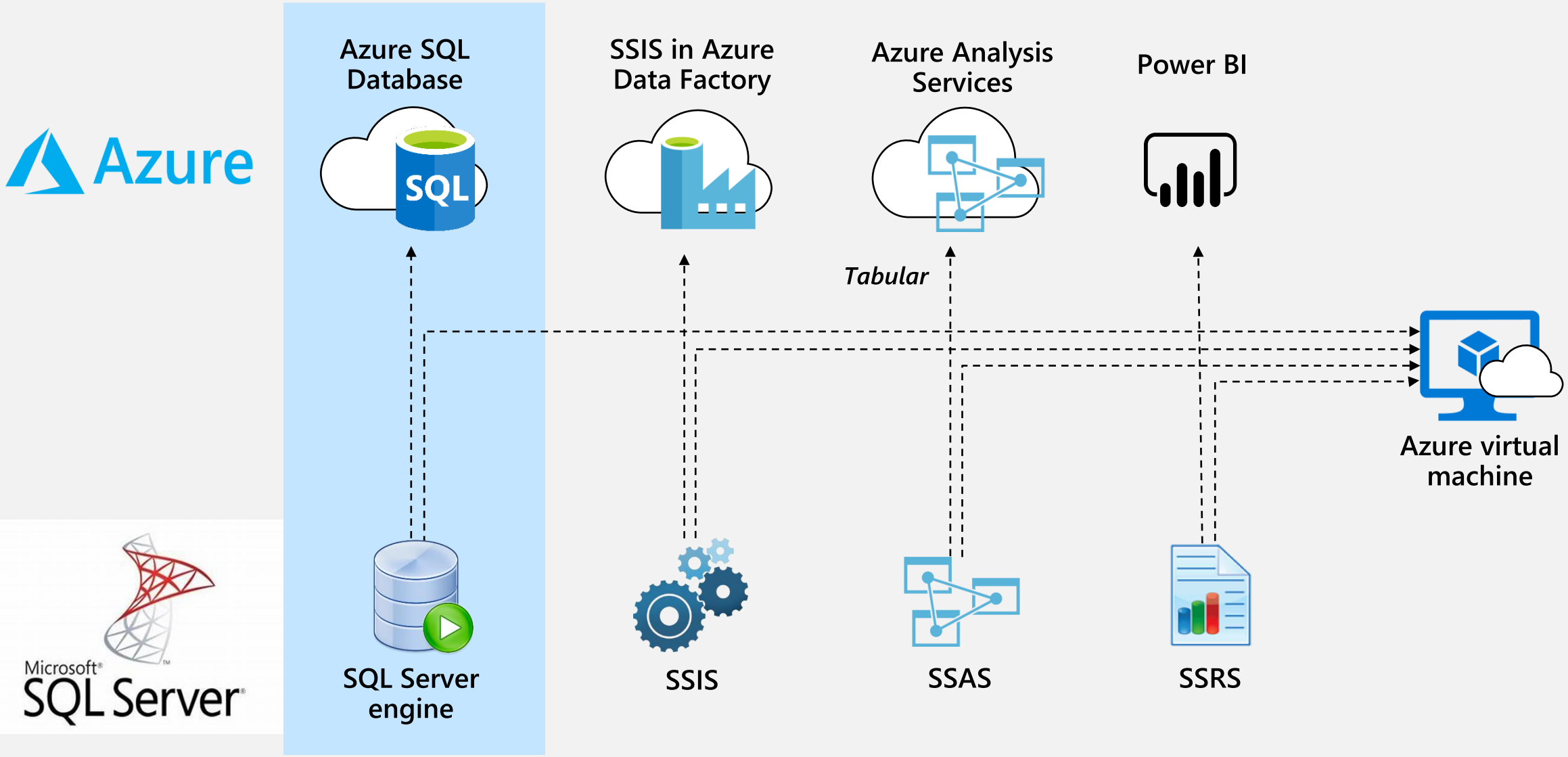

INTRODUCTION TO
AZURE SQL PLATFORM
AS A SERVICE OPTIONS

Agenda/Topics

- Overview
- Azure SQL Managed Instance
- Azure SQL Database
- Deployment Options
- Serverless and Elastic pool options
- Cost optimisation
- Free trial



SQL Server Stack to Azure services



Azure SQL

The family of SQL cloud to edge databases

SQL Server on Azure Virtual Machines

Best for lift and shift and/or workloads requiring OS-level access

Azure SQL Managed Instance

Best for modernizing existing apps

Azure SQL Database

Best for supporting modern cloud apps

Azure SQL Edge

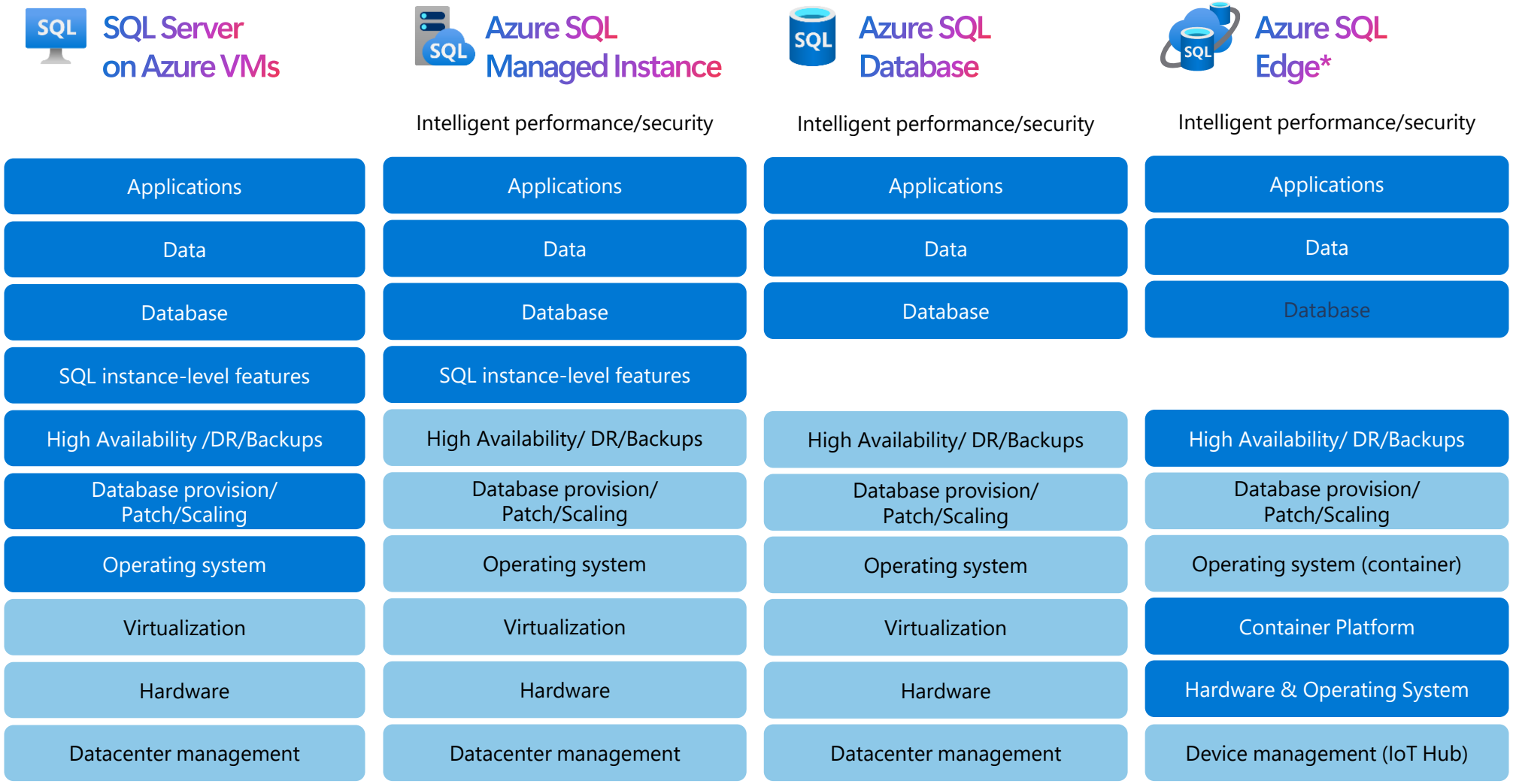
Best for extending apps to IoT edge

Infrastructure-as-a-Service | **Platform-as-a-Service** | **Edge Computing**

Azure SQL enabled by Azure Arc
Run Azure SQL on premises and in multicloud environments

Azure is the cloud that knows SQL Server best

Managed solutions that do more for you



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Azure SQL Managed Instance

Combine the best of SQL Server with the benefits of a fully managed service

- Full SQL Server surface area
- Native VNET integration provides private IP address and full isolation from other tenants without resource sharing
- Always up to date
- Built-in HA with Always-on
- 99.99% SLA out of the box
- Built-in intelligent performance and security

Migrating to Managed Instance means virtually no code changes to your apps

SQL Managed Instance is Azure Arc-enabled

Some scenarios may require a hybrid approach:

Data Latency

Regulations

Distributed Compute

Multicloud

Bring Azure innovation and cloud benefits on-premises, multicloud, and at the edge with Azure Arc-enabled SQL Managed Instance

"I really like the SQL version control, which helps reduce the time that senior administrators must spend upgrading all those different versions."

Kristina Melo, IT Manager, Ferguson Enterprises

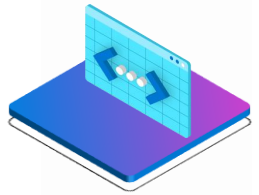
Key Benefits

Always current

Access the latest Azure features and capabilities for on-premises data workloads

Elastic scale

Dynamically scale up or out your data workloads based on capacity



Unified management

Gain a single view of your data across on-premises and cloud environments

Service tiers – Deployment options

General purpose

Most business workloads

Remote storage

IOPS
$
Built-in HA

16TB

Business critical

Workloads that require low latency, fast recovery, and a readable secondary

Local storage

IOPS++
$$$
In-memory

16TB
PREVIEW

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Run Azure SQL on premises and in multicloud environments

Azure is the cloud that knows SQL Server best

Azure SQL Database

Build apps that scale with the pace of your business with managed and intelligent SQL in the cloud

- Fully managed and always on the latest version of SQL
- Hyperscale your most demanding workloads
- Optimize costs with serverless compute that scales automatically
- Build and deliver modern, intelligent apps faster with multi-model capabilities and support for popular languages and frameworks
- Save with the best total cost of ownership

Service tiers – Deployment options

General purpose	Business critical	Hyperscale
Most business workloads	Workloads that require low latency, fast recovery, and a readable secondary	Most business workloads with highly scalable storage and read-scale requirements
Remote storage IOPS $ Serverless* 	Local storage IOPS++ $$$ In-memory 	Local + remote storage IOPS+ $$ Unlimited storage 

Single database

Simplest database scoped model provides resource guarantees.

Best for modern cloud born apps requiring the most management simplicity

Elastic pool

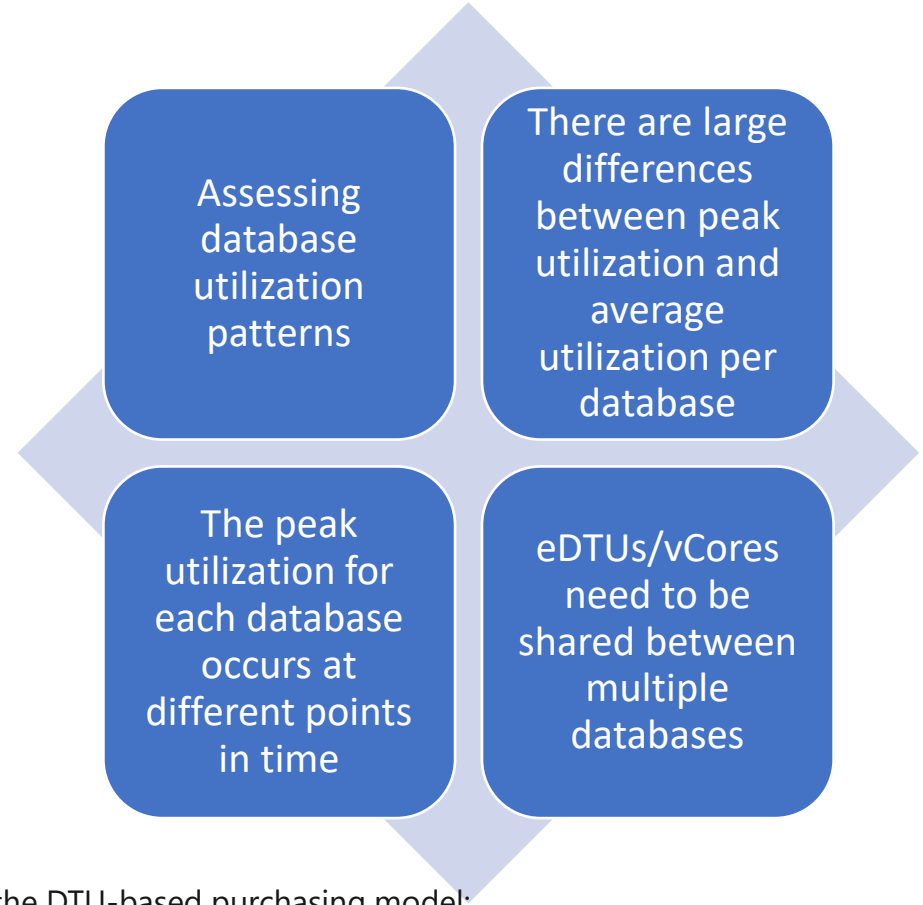
Shared resource model lowers TCO of multi-database environments

Best for multi-tenant SaaS apps requiring database isolation per tenant

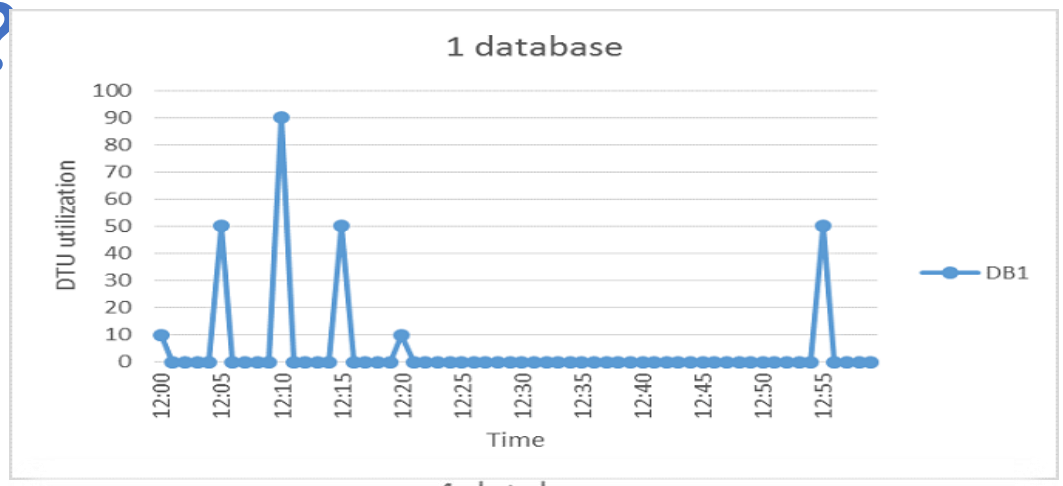
P – Primary replica S – Secondary, read only replica R – Additional, Read only, replica

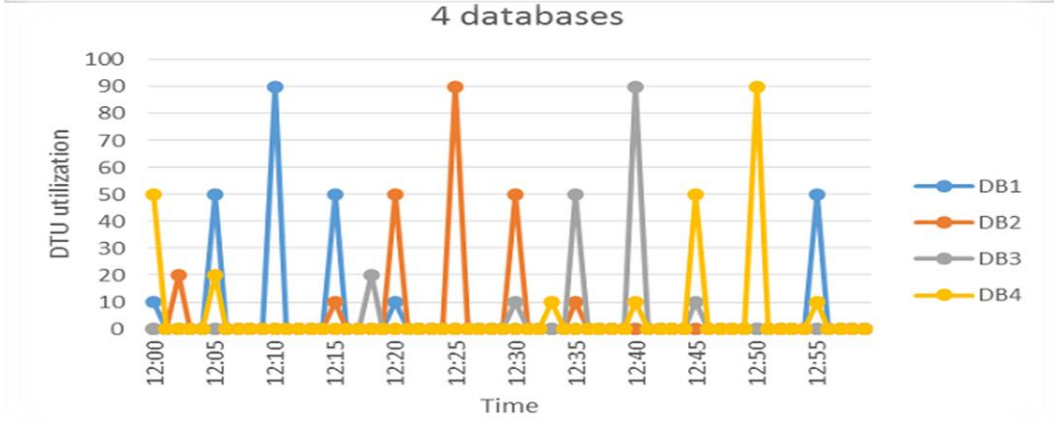
Elastic Pool - When To Consider?

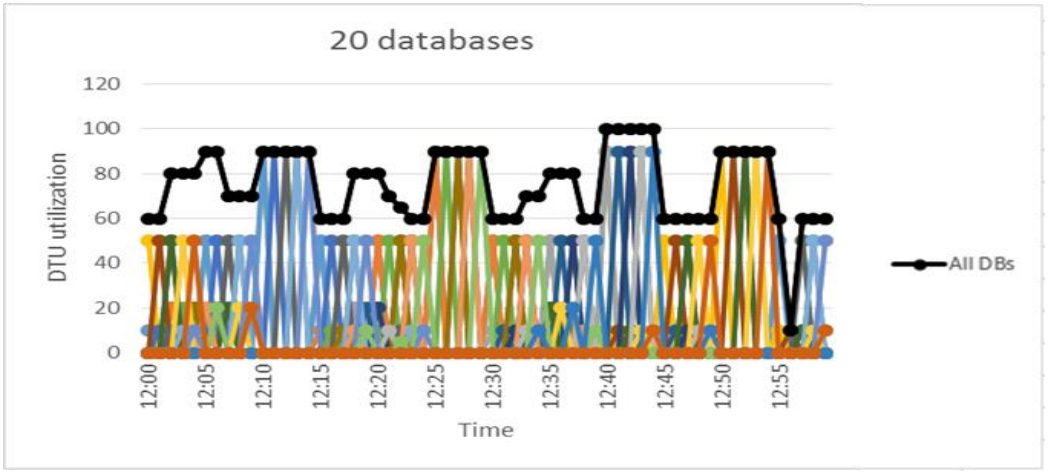
Applies to: Azure SQL Database



1. For the DTU-based purchasing model:
    1. MAX(<*Total number of DBs* × *Average DTU utilization per DB*>, <*Number of concurrently peaking DBs* × *Peak DTU utilization per DB*>)
2. For the vCore-based purchasing model:
    1. MAX(<*Total number of DBs* × *Average vCore utilization per DB*>, <*Number of concurrently peaking DBs* × *Peak vCore utilization per DB*>)







Hyperscale

Applies to: Azure SQL Database

Scale database size up to 100 TB per database

- Scale out the storage and compute resources dynamically beyond the limits of General Purpose or Business Critical service tiers

Rapid Scale Out

- Additional compute nodes to serve read-only workload and use them as a hot-standby in case of failover

Rapid Scale Up

- Compute and storage resources scale rapidly and independently without sacrificing performance
- Similar as scaling up and down between a P6 and a P11, for example, but much faster since this is not a size of data operation

Storage grows automatically as needed

- No defined max size, the database grows as needed
- Billed only for the capacity you use. Storage is dynamically allocated between 40 GB and 100 TB, in 10 GB increments

Near instantaneous database backups regardless of database size

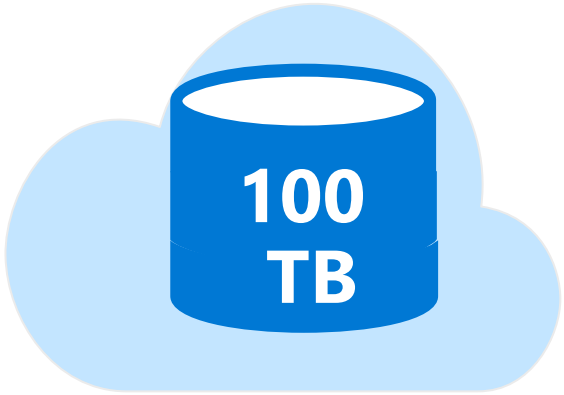
- Based on file snapshots stored in Azure Blob storage

Fast database restores (based on file snapshots) - in minutes rather than hours or days

- Not a size of data operation

Higher overall performance

- Higher transaction log throughput and faster transaction commit times regardless of data volumes



Optimize price to performance with per-second billing

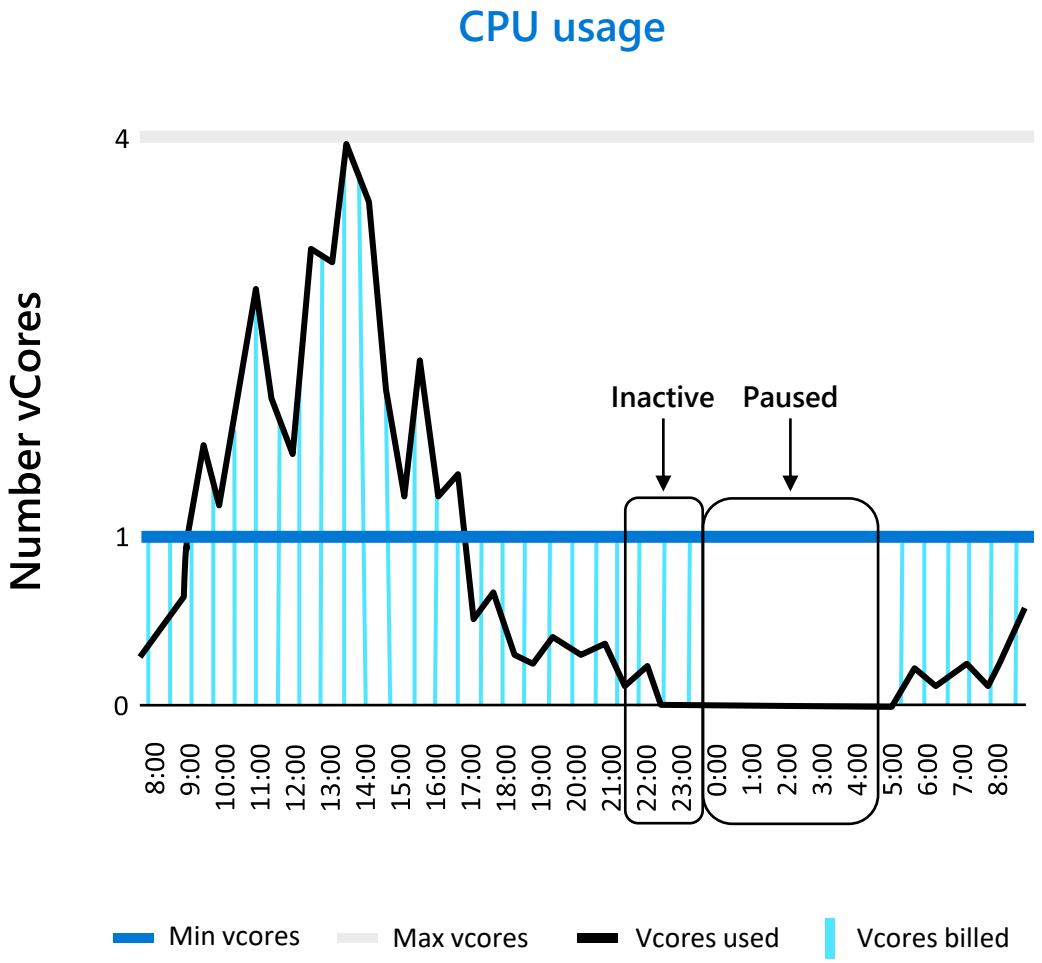
Compute resources scale dynamically up or down based on workload requirements

Configure minimum and maximum vCores to define the range of available compute capacity

Use auto-pause delay to define the time period the dataset must be inactive before pausing

Pay for compute based on the vCores and memory used per second, with lowest billing based on configured vCore minimum

Serverless



Optimize your Azure SQL Costs

Key offers lower your total cost of ownership

Azure Hybrid Benefit

Maximize existing investments in on-premises licenses with discounted rates of up to 55%

Learn more

Reserved Capacity

Prepare resources in advance and save up to 33%. Combine with Azure Hybrid Benefit for savings up to 80%.

Learn more

Dev/Test Pricing

Save up to 55% versus list prices, eligible with active Visual Studio subscriptions.

Learn more

License-Free Standby Replica

Save on licensing costs for a secondary deployment for disaster recovery

Learn about SQL MI

Learn about SQL DB

Learn about SQL VM

Try Azure SQL Database free of charge

Get 100,000 vCore seconds of serverless compute and 32 GB of storage every month!

Azure SQL Database with serverless compute

Flexible compute automatically scales to meet demand.

No time limits

Apply this free offer for the life of your subscription.

Need more? No problem.

Stick with the default auto-pause option or continue usage for additional charges.

What's included:

One Azure SQL Database with serverless compute per Azure Subscription with 100,000 vCore seconds every month.

32 GB data storage +
32 GB backup storage.

Learn More: aka.ms/sqlfreeoffer

Try Azure SQL Managed Instance free of charge

Get 750 vCore hours of serverless compute and 32 GB of storage every month!

More than enough compute

Intel® Xeon® Scalable 2.8 GHz processors provide ample performance for your dev/test or proof of concept requirements.

Use it for 12 months

Use this free offer to support your migration proof of concepts for 12 months.

You're in control

Optimize your monthly available vCore hours by stopping and starting the instance when necessary.

What's included:

Up to two instances per Azure subscription with 4 or 8 vCores of general purpose compute and 750 vCore hours per month.

32 GB data storage +
32 GB backup storage.

Learn More: aka.ms/freesqlMI

Get started today!

Web Pages

Azure SQL family

- SQL Server on Azure Virtual Machines
- Azure SQL Managed Instance
- Azure SQL Database
- Azure SQL Edge

Azure Hybrid Benefit for SQL Server

Azure Database Migration Service

Migration guide

3rd Party Studies

Principled Technologies price-performance report

GigaOm price-performance report

IDC Business Value of Microsoft Azure SQL Database and Azure SQL Managed Instance Workloads

Other Resources - Infographics

Infographic: Azure SQL family

Azure SQL Jumpstart Guide


Questions?

Microsoft Azure

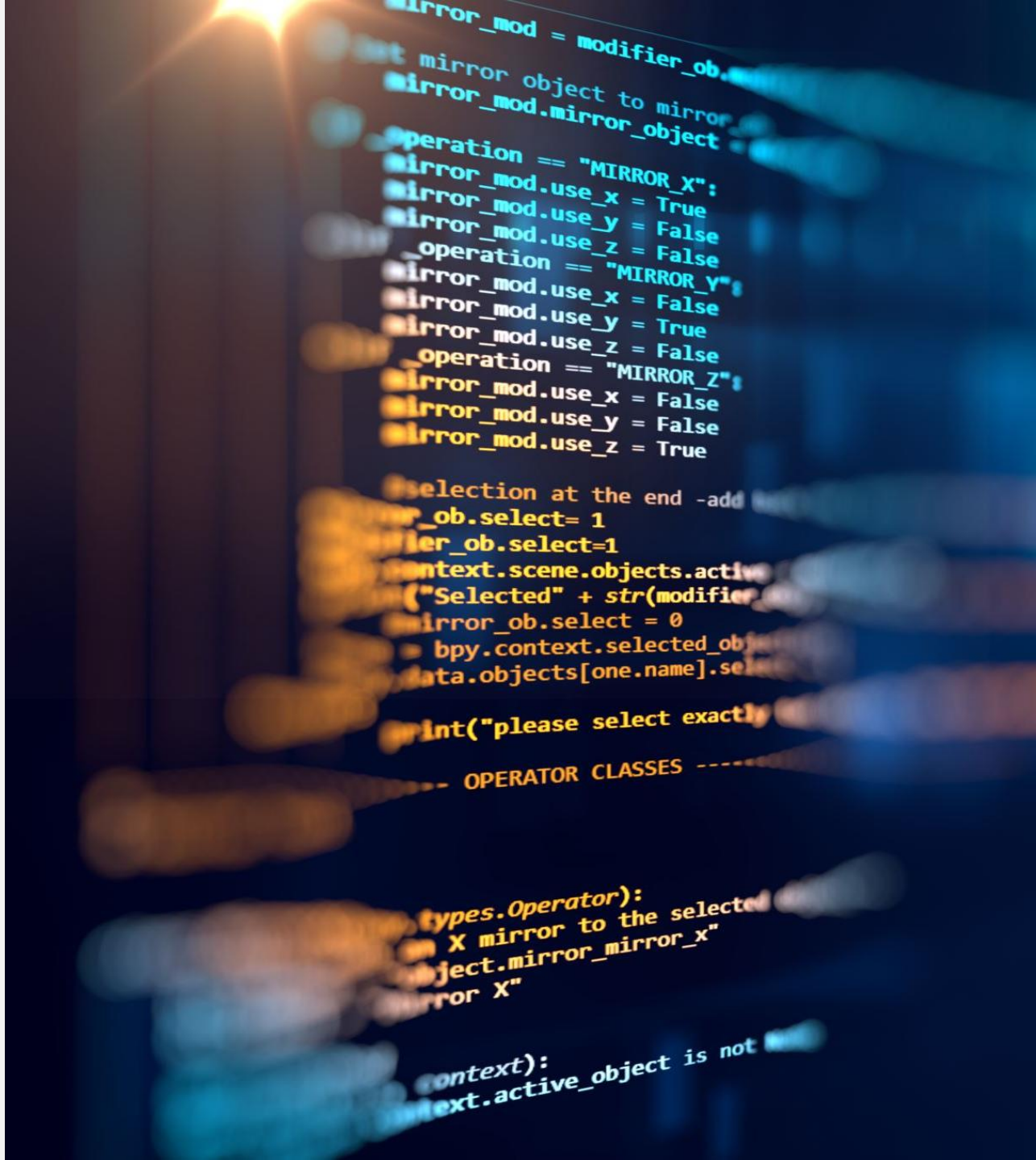
Migration to

Azure SQL PaaS Databases

Azure SQL Database
Azure Managed Instance

Agenda/Topics

- Overview
- Azure Migrate
- Data Migration Assistant (DMA)
- Azure Data Studio Extension
- SQL MI Link
- Other Migration Options



SQL Server Migration Tools - Overview

On-premises

Other clouds

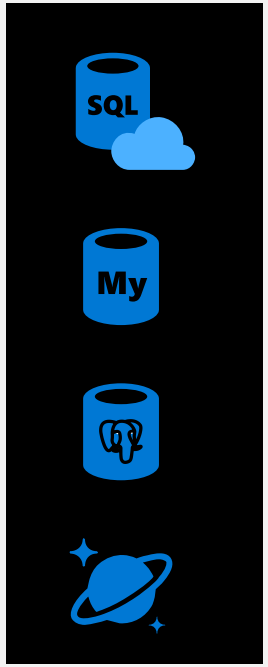
Assessment

- Azure Migrate
- Database Migration Assistant (DMA)
- Database Experimentation Assistant (DEA)
- Data Access Migration Toolkit (DAMT)
- SQL Server Migration Assistant (SSMA)

Migrate

- Database Migration Assistant (DMA)
- Azure Data Studio Extension
- Data Migration Service (DMS)
- Managed Instance link
- Alternative Migration Options
  - Transactional Replication
  - Export/Import BACPAC
  - Bulk Copy
  - Azure Data Factory
  - SQL Data Sync

Microsoft Azure



Azure Migrate: A Central Hub for Datacenter Migration

Applies to: Azure SQL Database, Managed Instance, Azure SQL Virtual Machine

Multiple Scenarios

Migrate Windows and Linux Servers, Databases, Data, Web Applications and Virtual Desktops

Diverse Capabilities

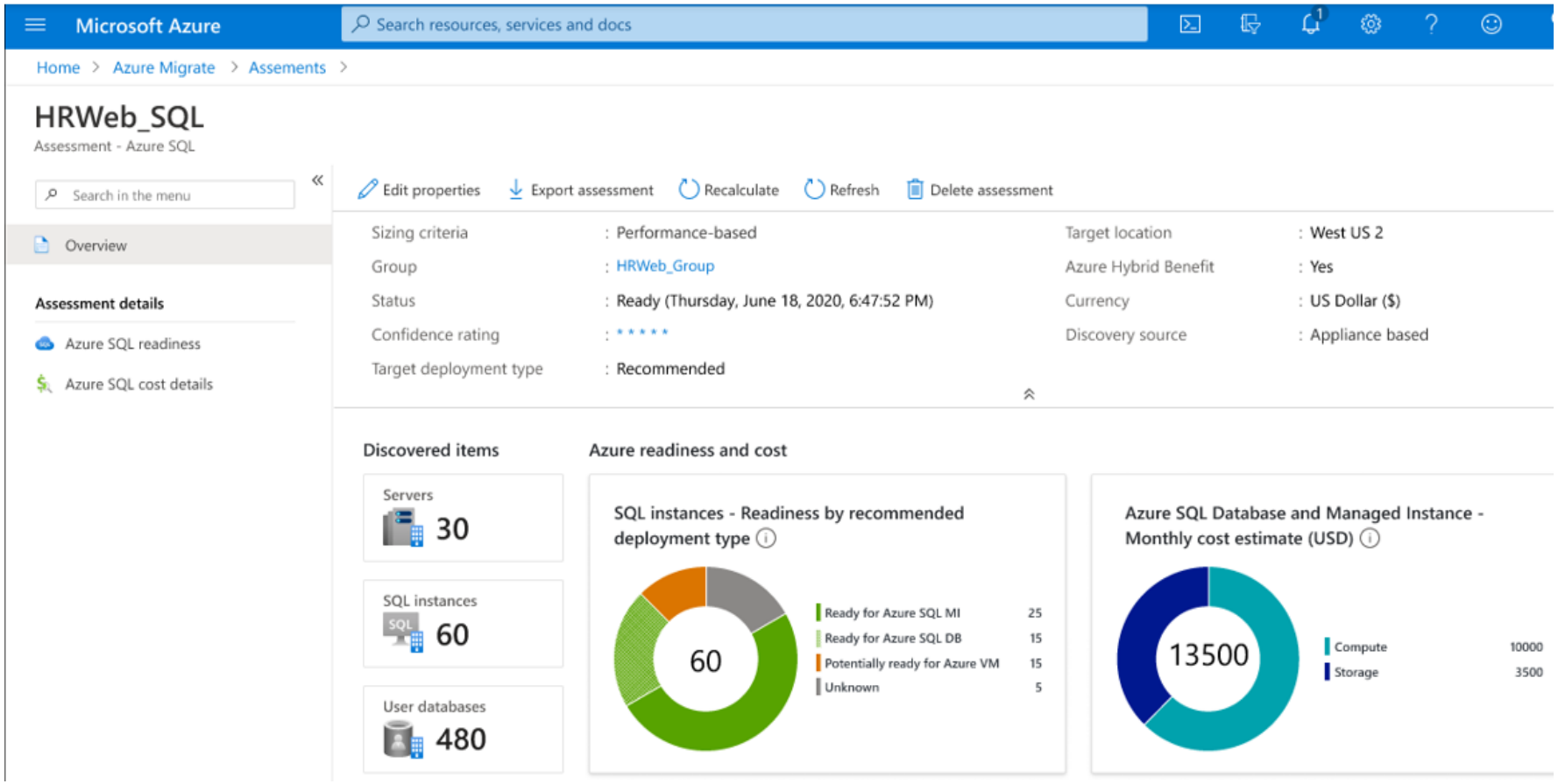
Comprehensive discovery, assessment, and migration capabilities powered by Azure and third-party tools

Centralized Visibility

Centralized migration repository delivering end-to-end tracking and insights

Third Party ISV Tools

Integrates with many third-party ISV tools such as Carbonite, Cloudsphere, UnifyCloud etc.

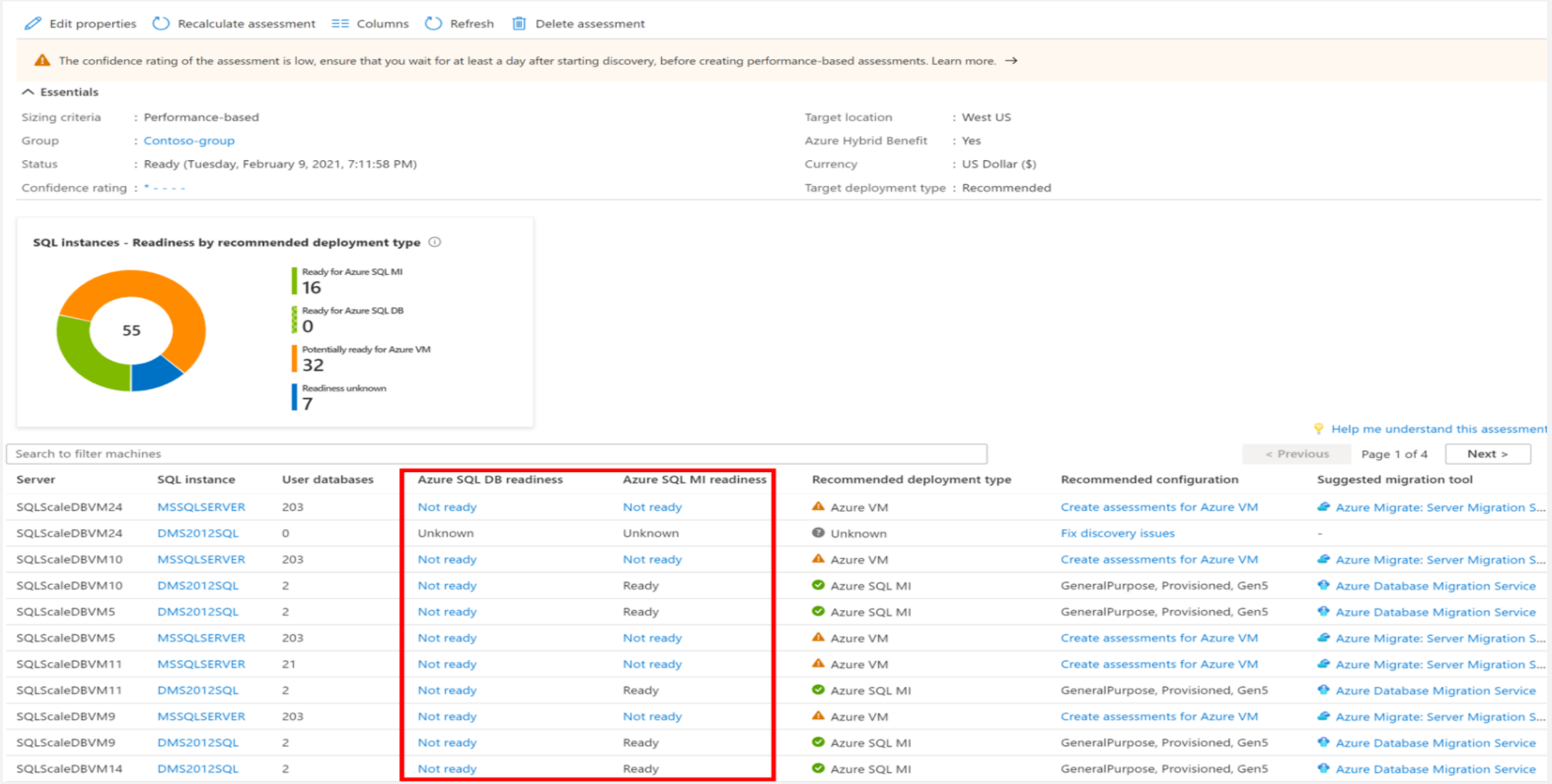


[About Azure Migrate - Azure Migrate | Microsoft Docs]

[Azure Migrate FAQ - Azure Migrate | Microsoft Docs]

Azure Migrate: Reports

Applies to: Azure SQL Database, Managed Instance, Azure SQL Virtual Machine



[Create an Azure SQL assessment - Azure Migrate | Microsoft Docs]

Demonstration

Azure Migrate

Migration Tools: Data Migration Assistant (DMA)

Applies to: Azure SQL Database, Managed Instance, Azure SQL Virtual Machine

Detects compatibility issues that can impact database functionality in your new version of SQL Server or Azure SQL Database

Recommends performance and reliability improvements for your target environment

Allows you to migrate your schema, data, and uncontained objects from your source server to your target server

- The tools does not allow migration to Azure Managed Instance, use Azure Data Studio Extension instead

Upload results to Azure Migrate to view consolidated reports

Can be run graphically or as console app

- Console app required to run SKU assessment

Good for smaller migrations

- For large migrations (in terms of number and size of databases), Microsoft recommends using the Azure Database Migration Service, which can migrate databases at scale

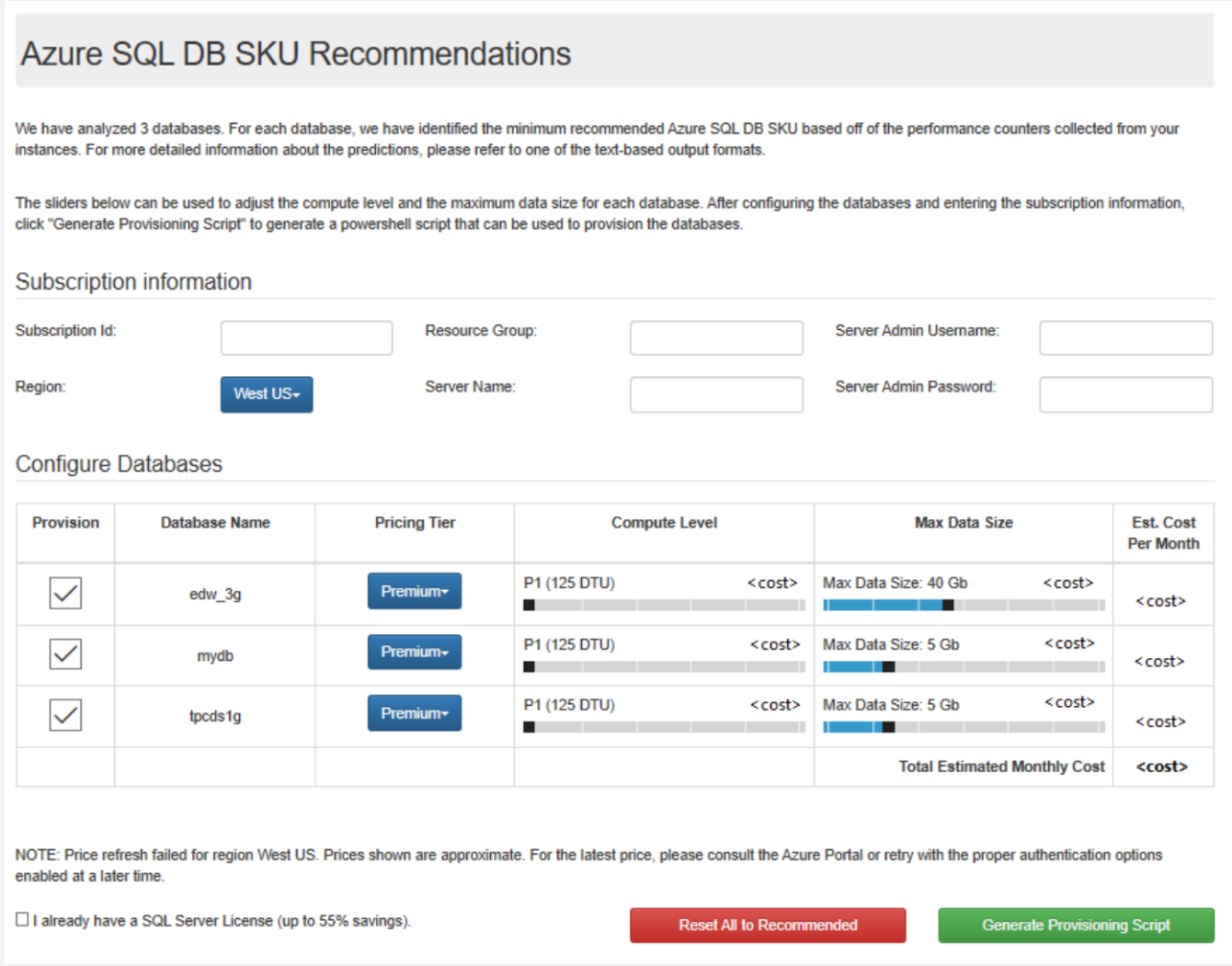
[Perform a SQL Server migration assessment - Data Migration Assistant | Microsoft Docs]

Migration Tools: Data Migration Assistant (DMA)

Applies to: Azure SQL Database, Managed Instance

Get SKU Recommendations with DMA

- Provides SKU recommendations in a user-friendly output based on performance counters collected from the computer(s) hosting your databases
- View details about the reason behind the recommendation and source properties that were analyzed
- It has several deployment options, including:
  - Single database
  - Elastic pools
  - Managed instance
- This feature provides recommendations related to:
  - pricing tier
  - compute level
  - max data size
  - estimated cost per month.



[Get Azure SQL SKU recommendations (Data Migration Assistant)]

[Get right-sized Azure recommendation for your on-premises SQL Server database(s) | Microsoft Docs]

Demonstration

Verify your database for compatibility issues with DMA.

Migration Tools - Azure Data Studio Extension

Applies to: Managed Instance, Azure SQL Virtual Machine

Database Backups must already be available

Includes Assessment of the databases to check for migration blockers

- Revamped assessments which are fast and scalable

Uses self hosted integration runtime to access backups on an on-premise file share and upload them to Azure BLOB storage

Connection to source SQL instance is required to validate the backups files

The backup share should only contain backups that we need in MI, to save on costs since all backups files in the share will be uploaded to the Azure BLOB container

You cannot transfer logins using this method

Minimal downtime with online migrations

[Migrate using Azure Data Studio | Microsoft Docs]

Demonstration

Perform a database Migration to Managed Instance using Azure Data Studio Extension

Link feature in Azure SQL Managed Instance

Use modern Azure services today and migrate when you're ready

Run SQL Server anywhere while immersing in Azure at your own pace.

Offload analytics from a hybrid environment before migrating to the cloud

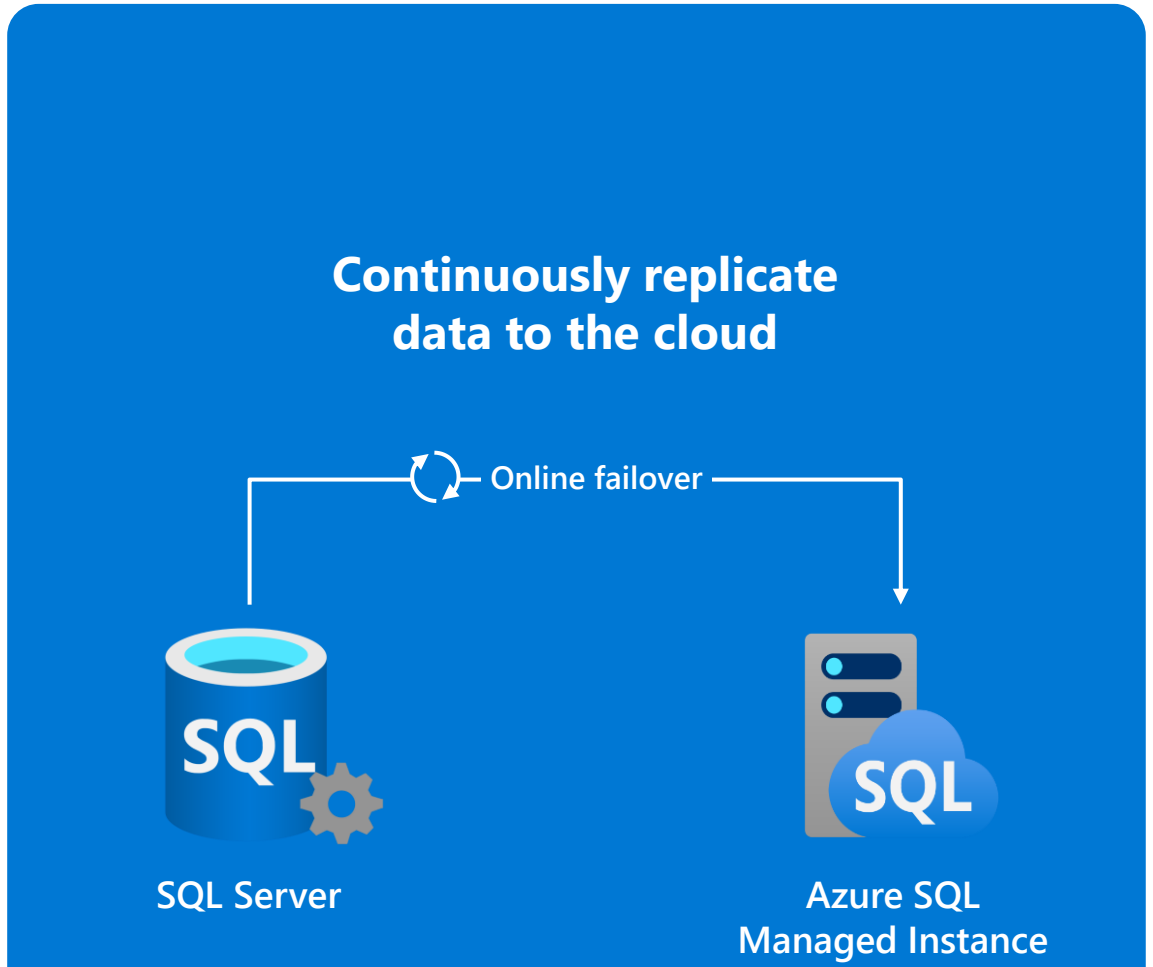
Streamlined, non-disruptive migration experience

Test production workloads on SQL Managed Instance before migrating to the cloud

Two functionalities

- One-way replication (SQL Server 2017 - 2019)
- Disaster recovery (SQL Server 2022) – Manual failover and failback

[The link feature - Azure SQL Managed Instance | Microsoft Docs]



SQL + Apps Migration Factory Details

Rapid migration from on-prem SQL or IaaS to Azure SQL with near-zero code change in data and app tiers

Program Structure

- Eligible engagements executed by Microsoft extended team of architects, engineers and PMs
- Microsoft extended team provides hands on keyboard production migration support
- Rapid, predictable implementation approach designed for **low complexity SQL migrations**

Scope

- Targeting SQL migrations with **near-zero code changes**
- Supported **Migration paths**:
  - On-Premises SQL Server to Azure SQL (IaaS, MI, DB)
  - SQL IaaS to SQL PaaS (MI/DB)
  - [1]AWS SQL Server to Azure SQL (IaaS, MI, DB)
- Migration of dependent **applications supported for lift-and-shift approach only** (Azure VMs or App Service)
- **Customer is responsible for testing of dependencies** (e.g., applications, mapped databases)
-

Benefits

- Virtual resources provided at **zero cost** thru June 2023
- **Speed** - Agile engagement model for skilled capacity
- **Reliability** - Proven approach for migrating SQL to Azure
- Support – on-the-job **knowledge transfer** to enable customer to maximize value of Azure SQL

Program Prerequisites

- **Customer sponsorship secured** with point of contact for providing systems access and unblocking issues as needed to enable the migration
- **Scope of migration ("What to migrate") is confirmed**
  - Source Windows Servers confirmed for migration to Azure IaaS
  - Apps running on WS are approved for lift-and-shift migration
- **Enterprise Landing zone –** Azure connectivity, subscription, identity, security policies
- **Unified contract or CWAA** exists to support hands-on-keyboard work; alternately, can provide screen-sharing support for execution

NOTE: the Microsoft CSU team can support the completion of Enterprise Landing zone setup as needed

Engagement Process

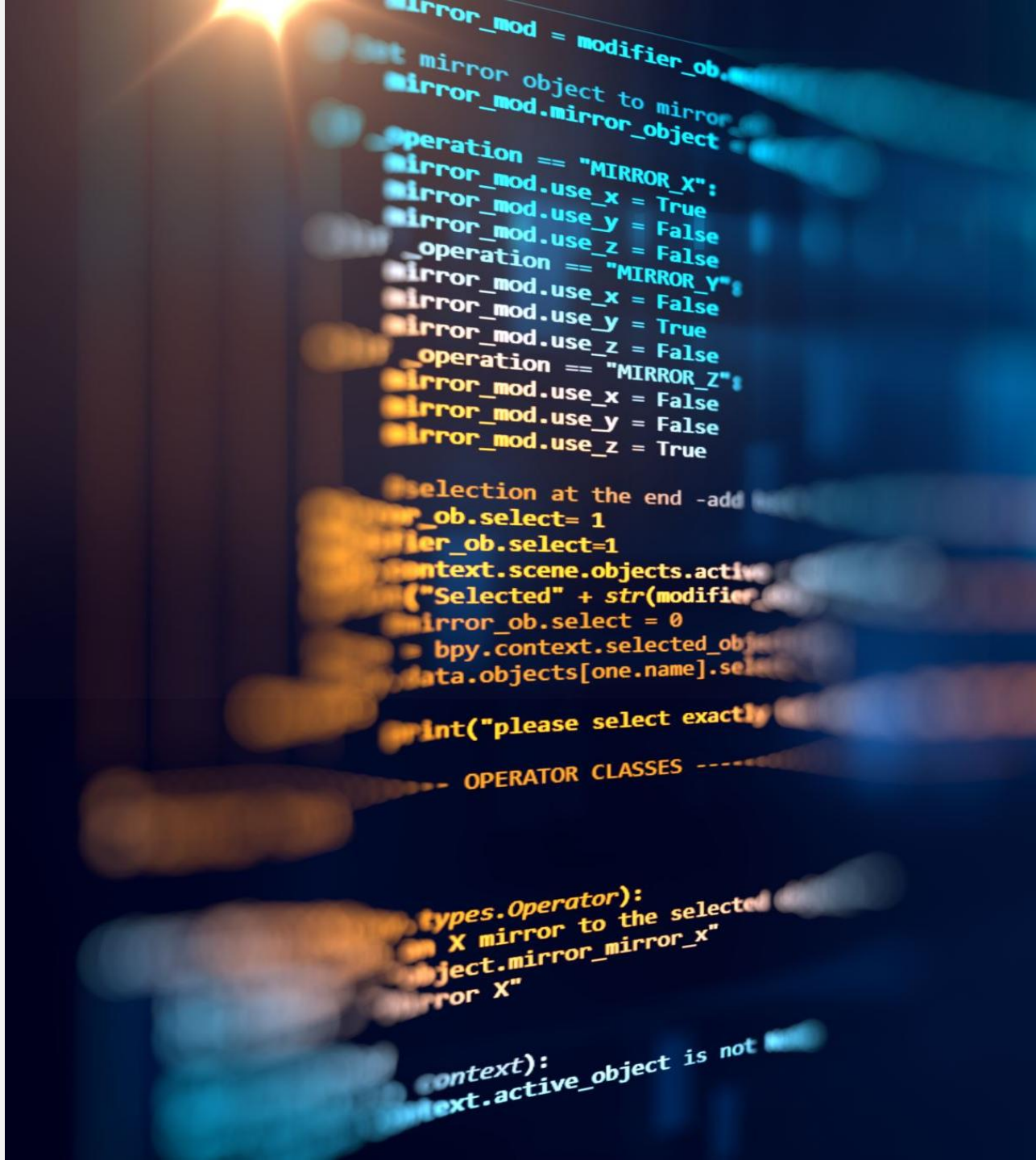
- Submit nomination at www.aka.ms/smf OR check with your Microsoft Account Team for the nomination process


Questions?


BUSINESS CONTINUITY

Agenda/Topics

- Business Continuity Scenarios
  - Scenario 1 - Local hardware or software failures
  - Scenario 2 - Data corruption or accidental data deletion
  - Scenario 3 - Azure datacenter/region outage.



Business Continuity for Azure SQL (PaaS)

- **Availability**
  - Every database comes with core resiliency and availability, that protects it against software or hardware failures.
  - Industry leading financially backed SLA of 99.99% availability.
  - RPO (data loss) = 0
  - RTO (down time) ~ 0

Disaster Recovery

- Ability to quickly recover the database from a catastrophic regional failure to provide business continuity.
- Protect your business by maximizing application availability.
- RPO (data loss) > or = 0
- RTO (downtime) > 0 (seconds or minutes)

High Availability

- Continuous availability of the database provided through Zone Redundancy.
- Automatic in region recovery from zonal hardware and software failures that’s transparent to applications.
- Higher SLA of 99.995% availability.
- RPO (data loss) = 0
- RTO (down time) ~ 0 (sub second or few seconds)

Business Continuity Scenarios

SCENARIO	FEATURES
Local hardware or software failures	Built-in availability architecture
Data corruption or deletion typically caused by an application bug or human error.	Geo-redundant backups Point-in-time restore Restore deleted database Long-term retention (LTR)
Availability zone or data center outage	Implement zone redundancy architecture
Regional Outage	Implement Disaster recovery using : - Geo-restore - Active Geo-replication - Failover groups (recommended)

SCENARIO – 1

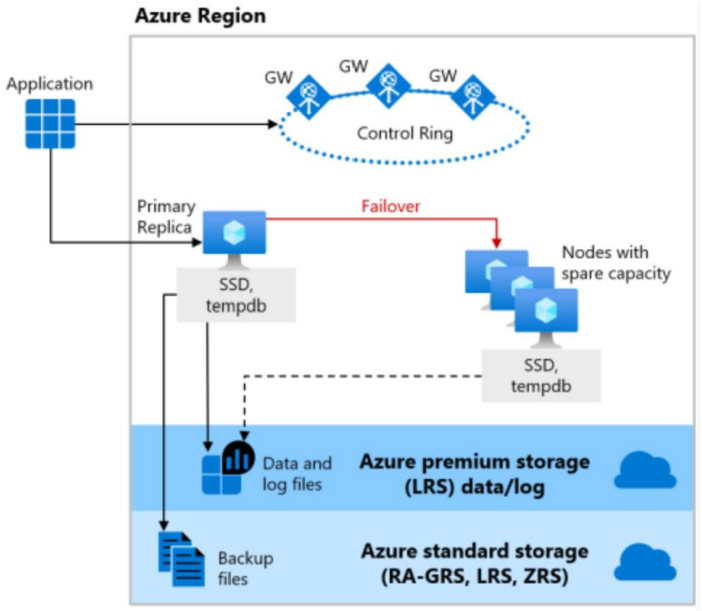
LOCAL HARDWARE OR SOFTWARE FAILURES

- **Built-In High Availability**
  - Ensures quick and automatic recovery from any local hardware and software failures.
  - Designed to never loose committed data in an event of a failure.
  - No downtime required for database upgrades or maintenance.

OnlineSvcsConsolidatedSLA(WW)(English)(March2024)(CR).docx (live.com)

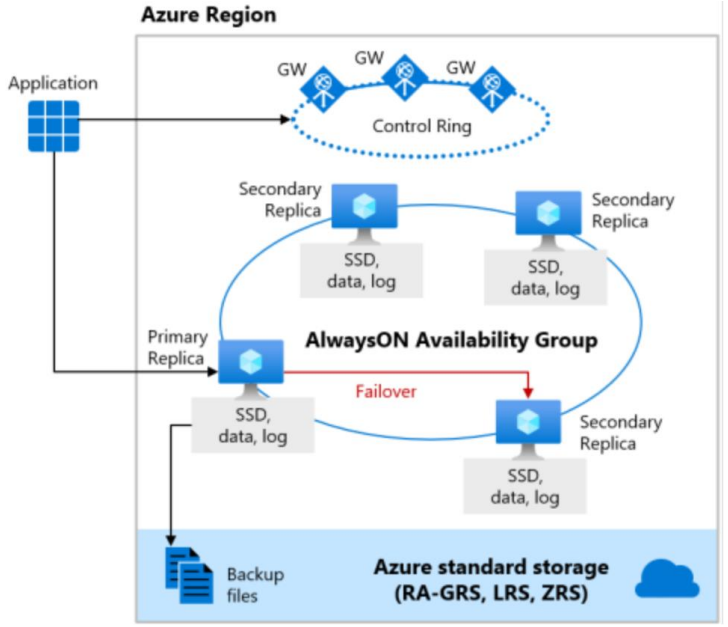
High Availability – Locally Redundant

General Purpose tier



- Architecture based upon separation of compute and storage.
- Targets budget-oriented business applications
- Relies on high availability of the remote storage tier.
- 99.99% availability SLA

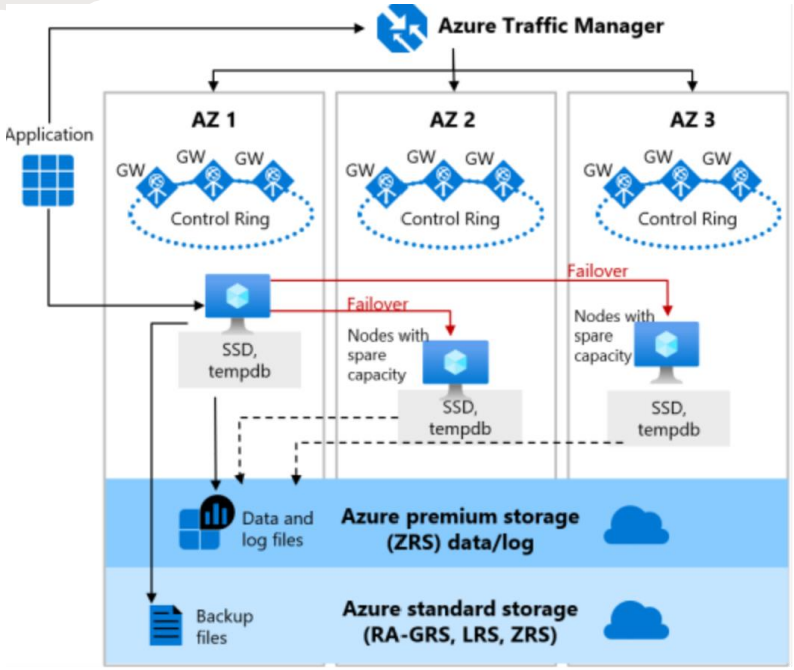
Business Critical tiers



- Architecture based upon all time availability of quorum of database engine nodes.
- Targets mission critical applications.
- 99.99% availability SLA

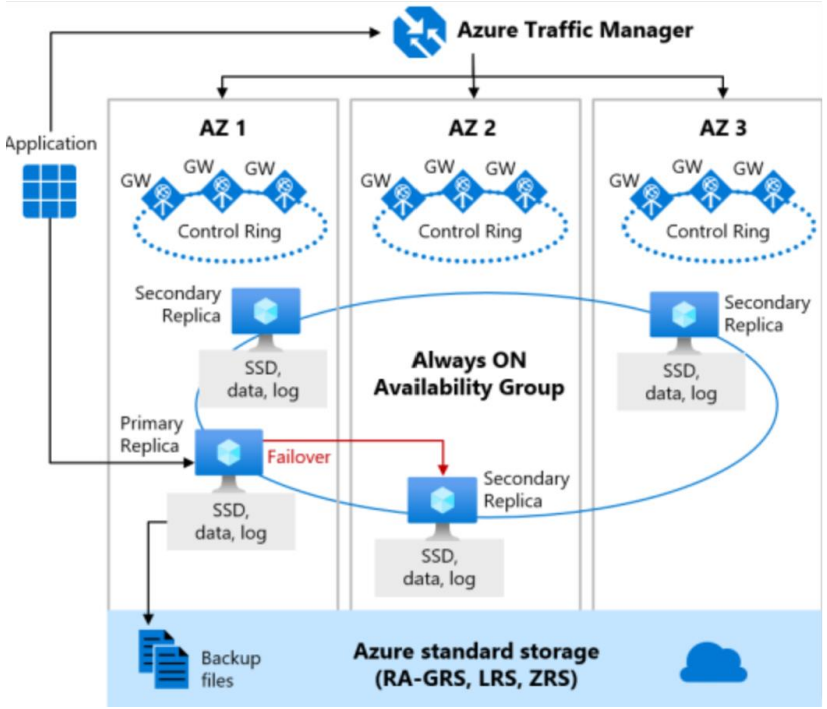
High Availability – Zone Redundant

General Purpose tier



- Utilizes Azure Availability Zones and replicates databases across multiple zones within same Azure region.
- Resilient to a much larger set of failures including catastrophic data center outages.

Premium or Business Critical tiers



- Utilizes Azure Availability Zones and replicas are placed across multiple zones within same Azure region.
- Resilient to a much larger set of failures including catastrophic data center outages.
- Control ring also duplicated across multiple zones. Azure Traffic Manager controls the routing to a specific gateway ring.

SCENARIO – 2

DATA CORRUPTION OR ACCIDENTAL DELETION

- **Point in Time Restore**
  - Restore database to some point in time within the configured retention period up to 35 days.
  - Use Long-term backup retention to keep the backups up to 10 years.
- **Restore a deleted database**
  - Restore deleted database if the server has not been deleted.

DEMO

- **How to configure LTR**
- **Demonstrate PITR**
- **Recover deleted database**

SCENARIO – 3

AZURE DATACENTER / REGION OUTAGE

This is a DR scenario and based upon RPO/RTO requirement following design solutions must be considered –

Recovery Method	RTO	RPO
Geo-restore	12 h	1 h
Manual database failover	30 s	5 s
Auto-failover groups	1 h	5 s

Geo-restore

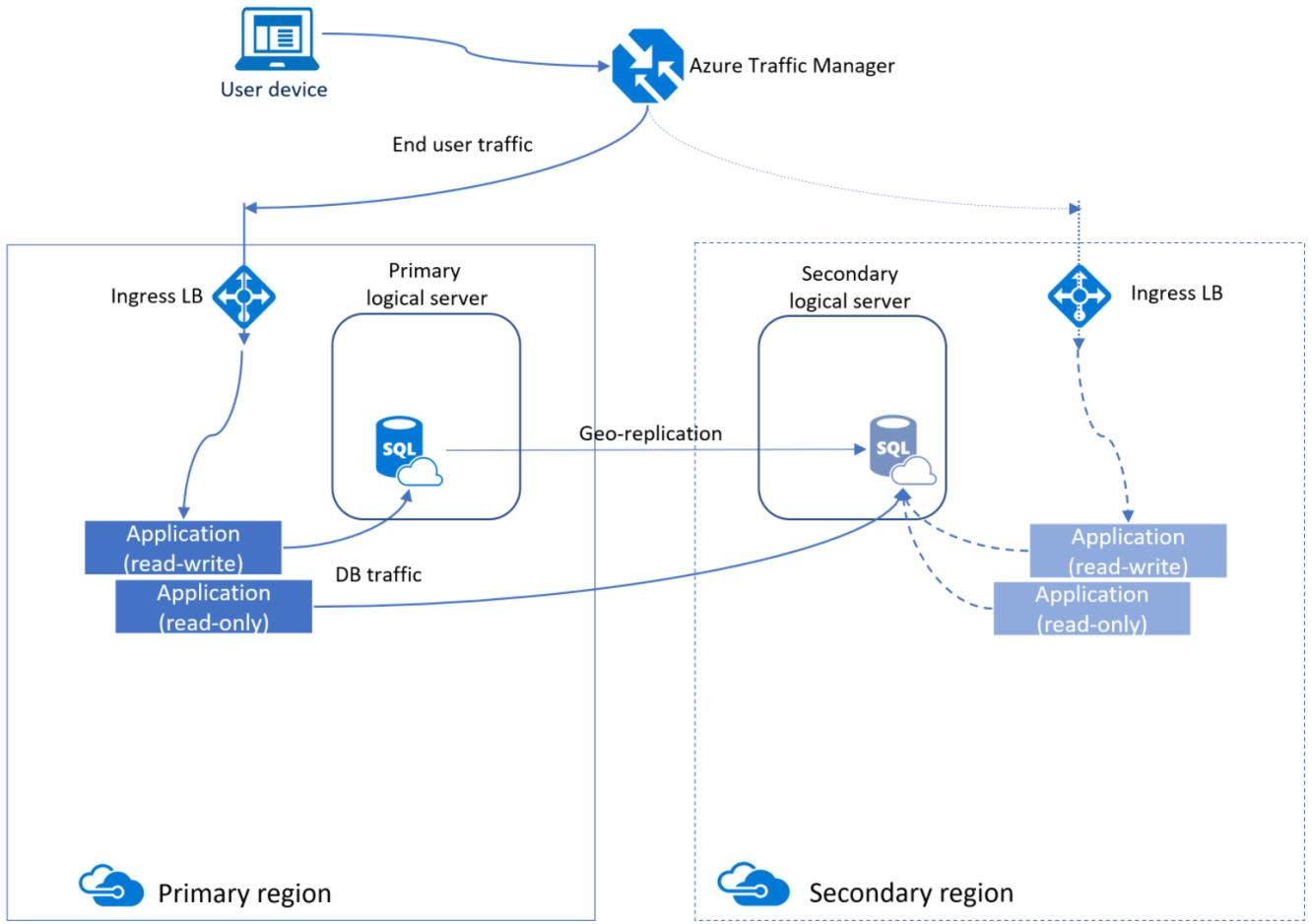
- Create a new database in any Azure region by restoring it from a geo-redundant backup.
- Cheapest DR solution but the RTO is high

SCENARIO – 3

AZURE DATACENTER/ REGION OUTAGE

- **Active geo-replication**

- Create readable replicas and manually failover to any replica in case of a datacenter outage or application upgrade.

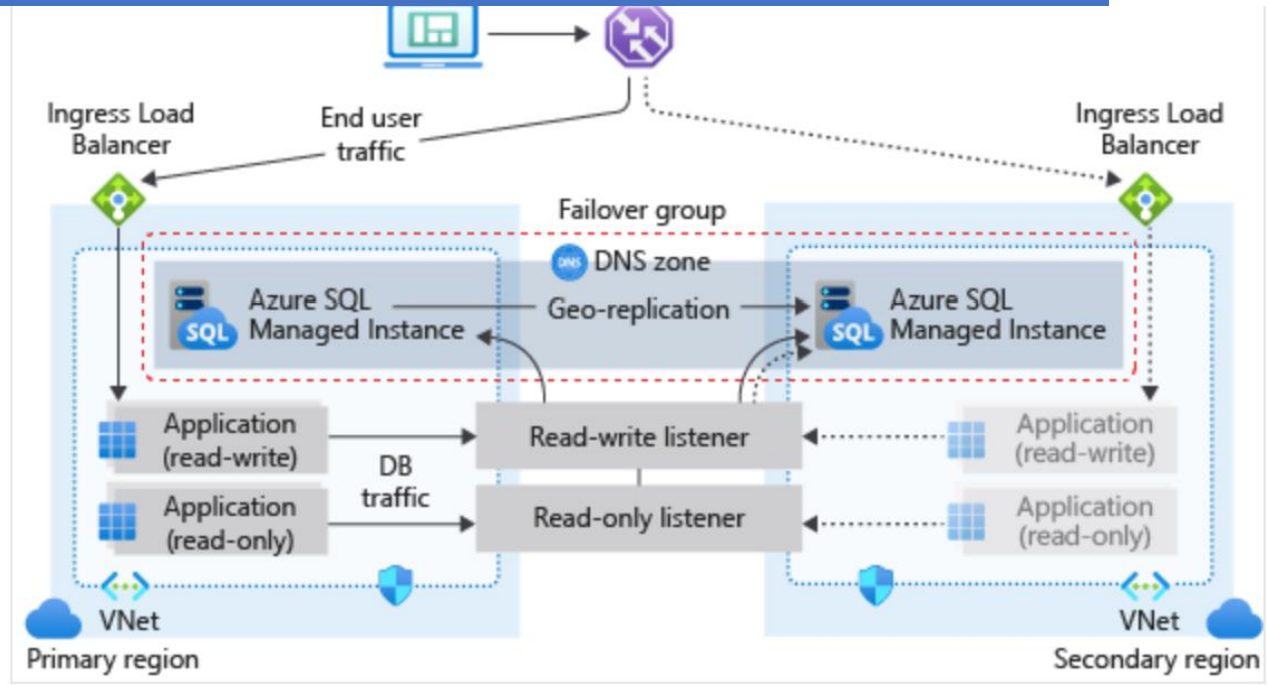


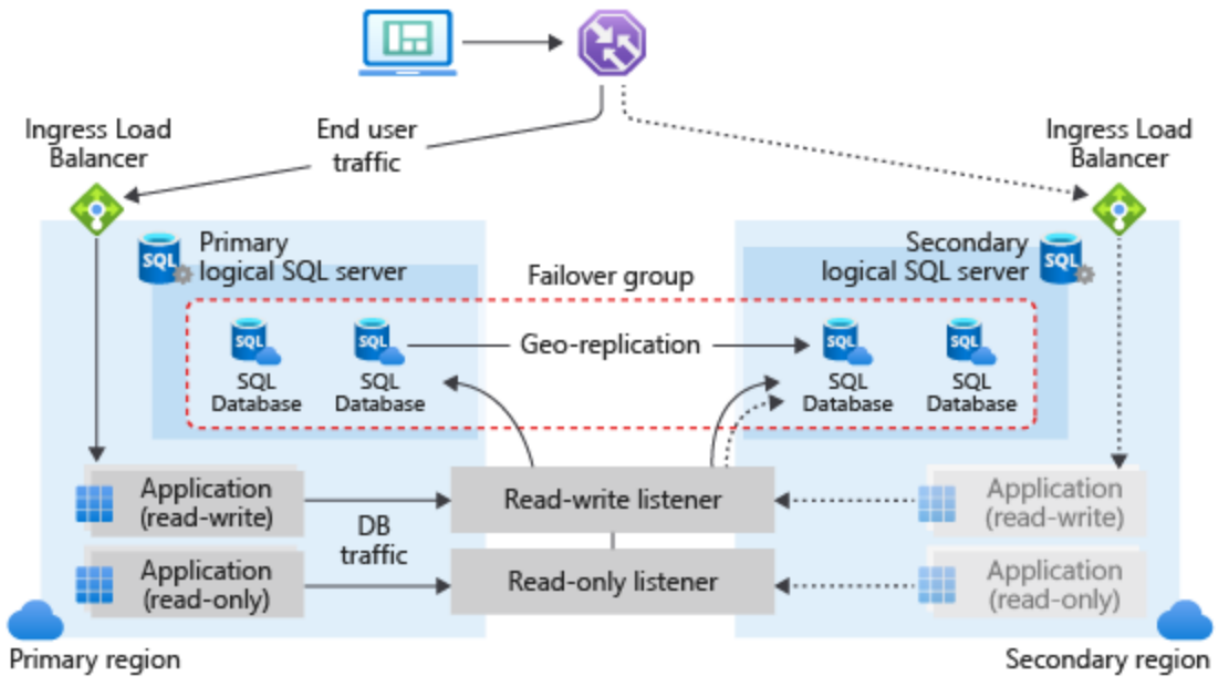
SCENARIO – 3

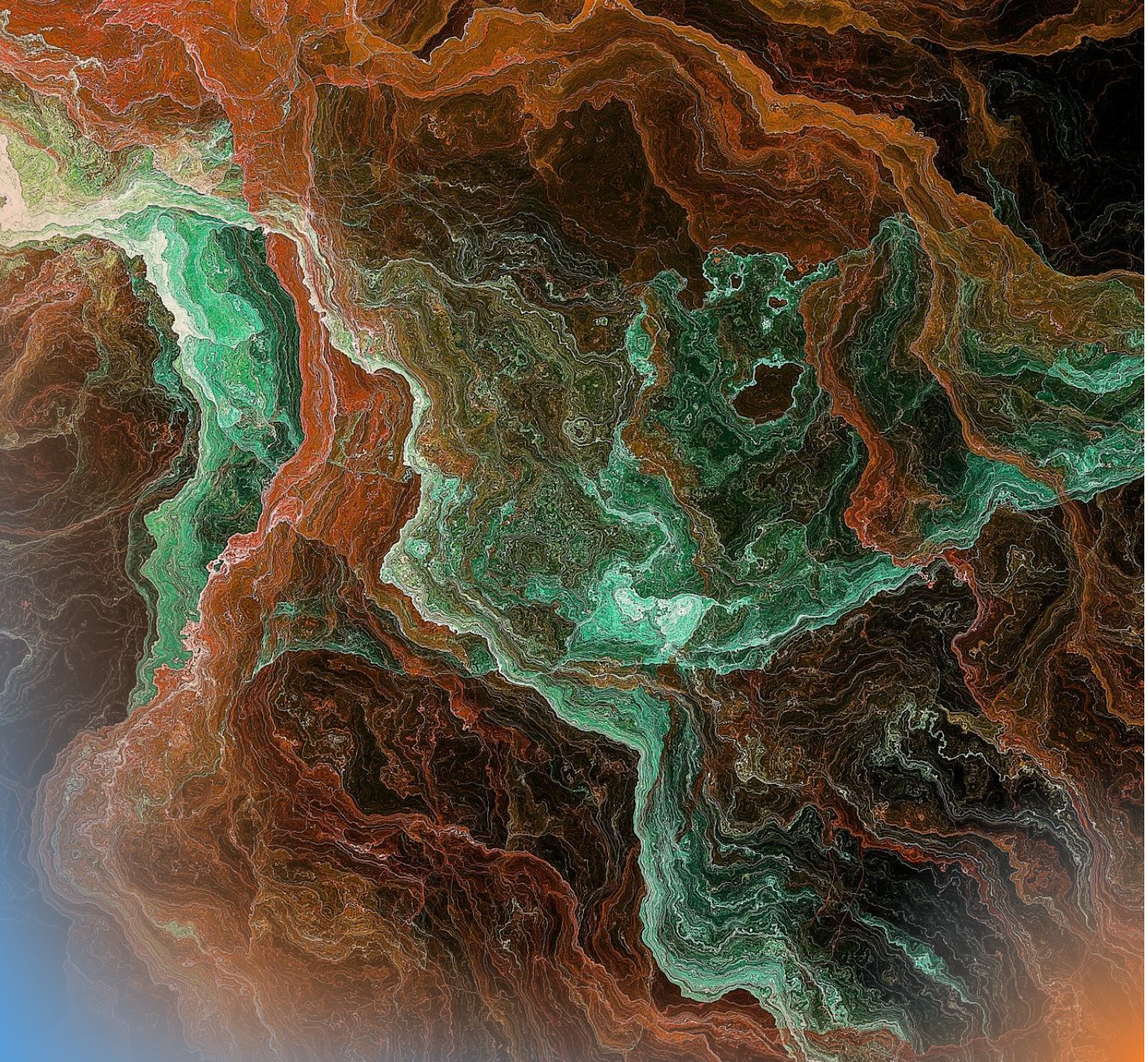
AZURE DATACENTER/ REGION OUTAGE

Auto-failover group

- Allows the application to automatically recover in case of a datacenter outage.







DEMO

- **Active geo-replication**
- **Auto-failover group**


Questions?


INDUSTRY LEADING
SECURITY

IMPORTANT SECURITY CONSIDERATIONS

Security design checkpoints and built-in features to implement them:

- Monitor log, and audit critical security events.
- Identify and tag sensitive data, and track access to it.
- Ensure that databases are configured in accordance with best security practices.
- Protect databases from anomalous activities and potentially harmful attempts to access or exploit them.
- Implement masking techniques to prevent unauthorized viewing of sensitive data
- Encrypt data both in transit and at rest to maintain security.
- Protect sensitive data from unauthorized access by high-privileged and unauthorized users.

INDUSTRY LEADING SECURITY

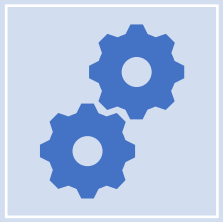
Monitor log, and audit critical security events.

Configure Auditing

Auditing

The auditing feature tracks database events and writes events to an audit log in either Azure storage, Azure log analytics, or to an event hub.

This audit log should then be analyzed and investigated for historical activities to identify potential threats or suspected abuse and security violations.



Demo

Configure Auditing


DEMO

INDUSTRY LEADING SECURITY

Identify and tag sensitive data

Data discover & classification

Data discovery & classification

1

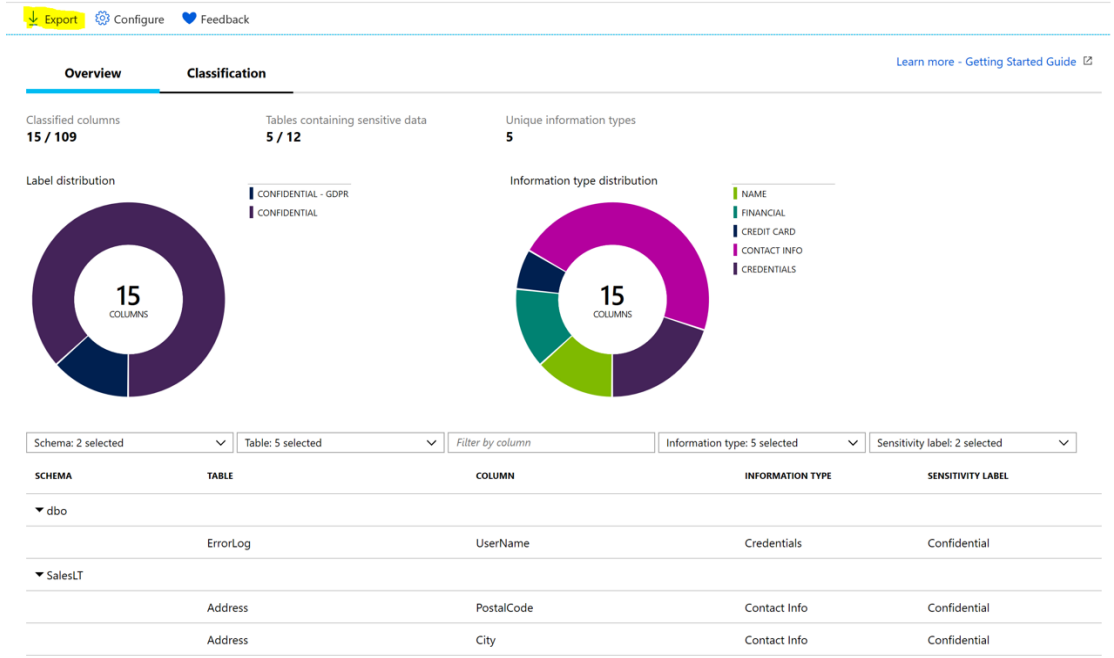
Built-in advanced capabilities for discovering, classifying, labeling & protecting the sensitive data in the databases for e.g. business, financial, healthcare, personally identifiable data (PII) etc.

2

Helps to meet data privacy standards and regulatory compliance requirements.

3

A new field in the **audit log** *data_sensitivity_information* logs the sensitivity classifications (labels) of the actual data that was returned by the query.



d	client_ip	application_name	duration_milliseconds	response_rows	affected_rows	connection_id	data_sensitivity_information
	[redacted]7.125	Microsoft SQL Server Management Studio - Query	1	847	847	C244A066-2271-...	Confidential - GDPR
	[redacted]7.125	Microsoft SQL Server Management Studio - Query	2	32	32	C244A066-2271-...	Confidential
	[redacted]7.125	Microsoft SQL Server Management Studio - Query	41	32	32	A7088FD4-759E-...	Confidential, Confidential - GDPR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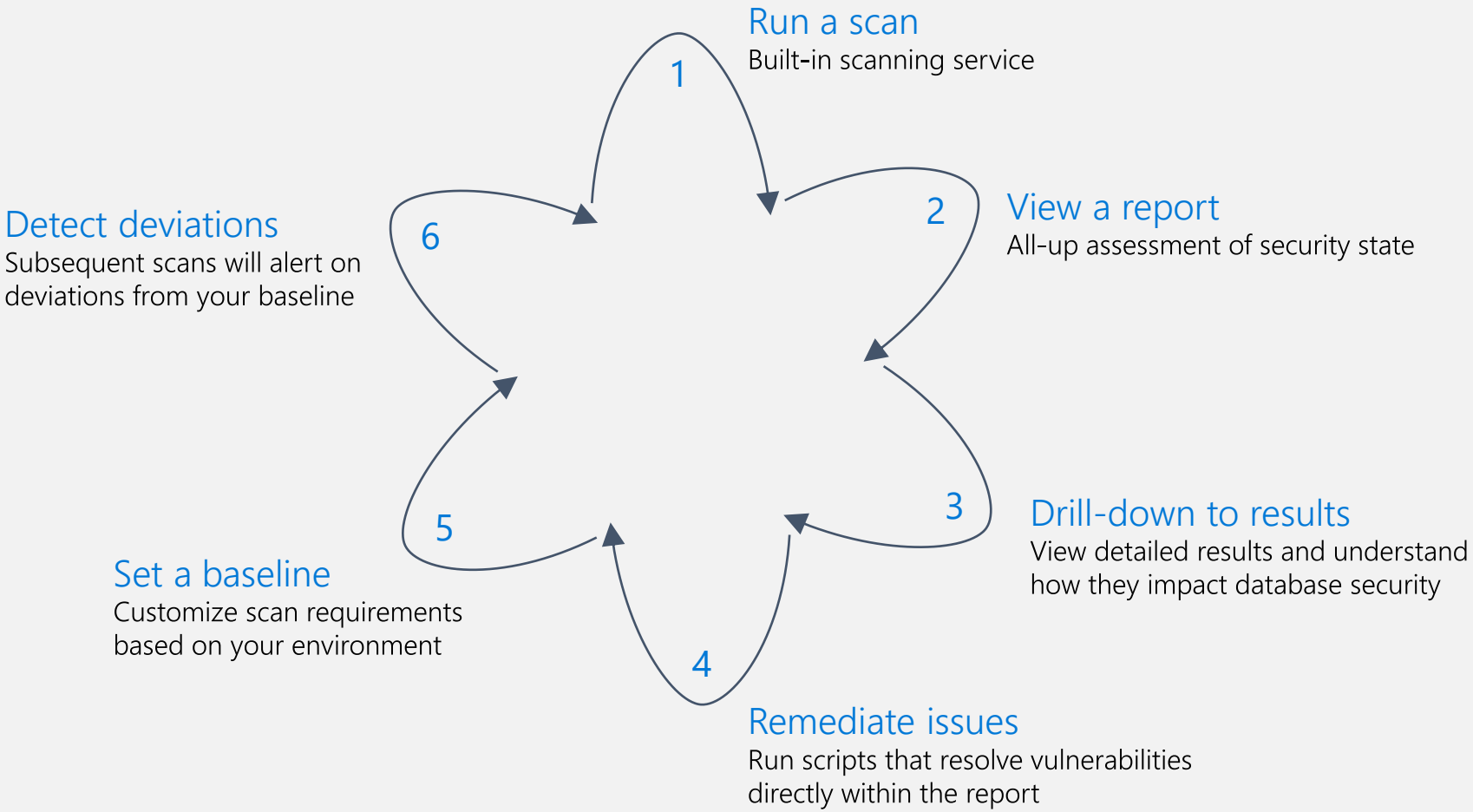
INDUSTRY LEADING SECURITY

Databases are configured in accordance with best security practices

Configure **Vulnerability Assessment**

Vulnerability Assessment

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INDUSTRY LEADING SECURITY

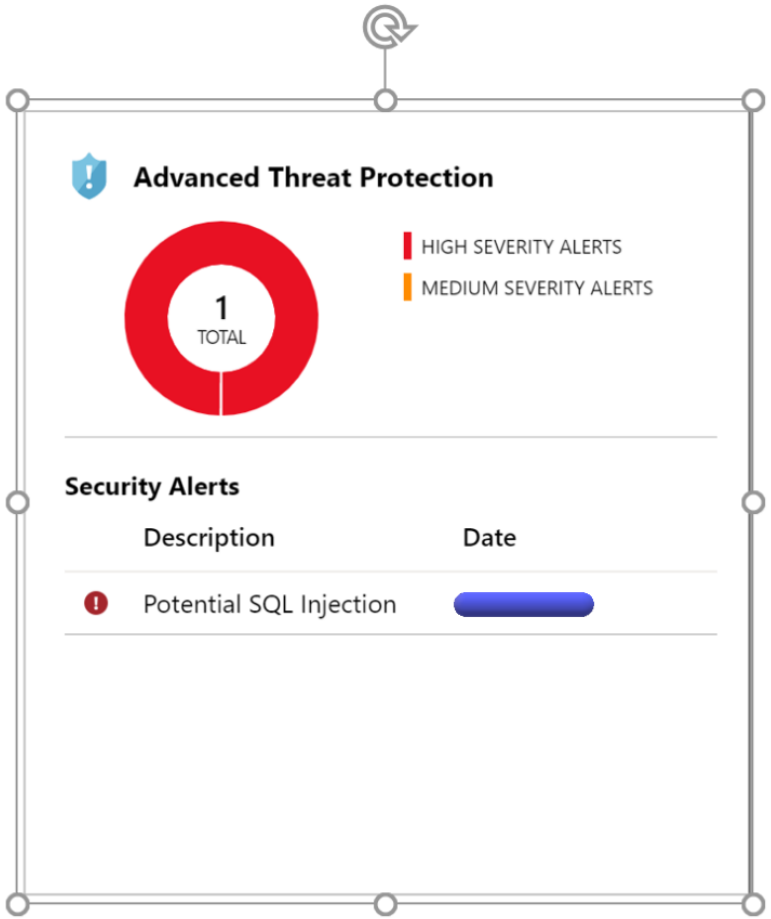
Protect databases from potential harmful activities.

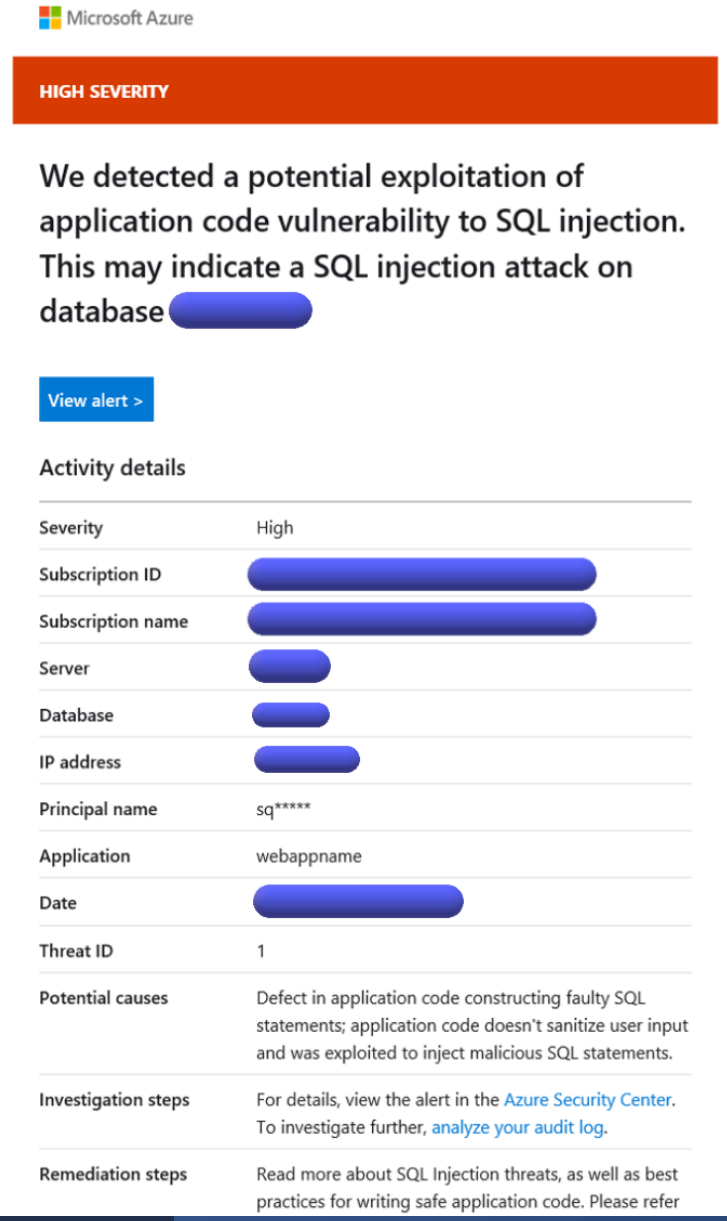
Advanced Threat Protection

Advanced Threat Protection

Threat Detection Alerts

- Vulnerability to SQL injection
- Potential SQL injection
- Access from unusual location
- Access from unusual Azure data center
- Access from unfamiliar principal
- Access from a potentially harmful application
- Brute force SQL credentials





INDUSTRY LEADING SECURITY

Dynamic Data Masking

- Policy based security feature which hides the sensitive data in the result set of the query.
- Dynamic data masking can be configured by the Azure SQL Database admin, server admin, SQL security manager role.
- Users with administrator privileges are always excluded from masking, and see the original data without any mask.

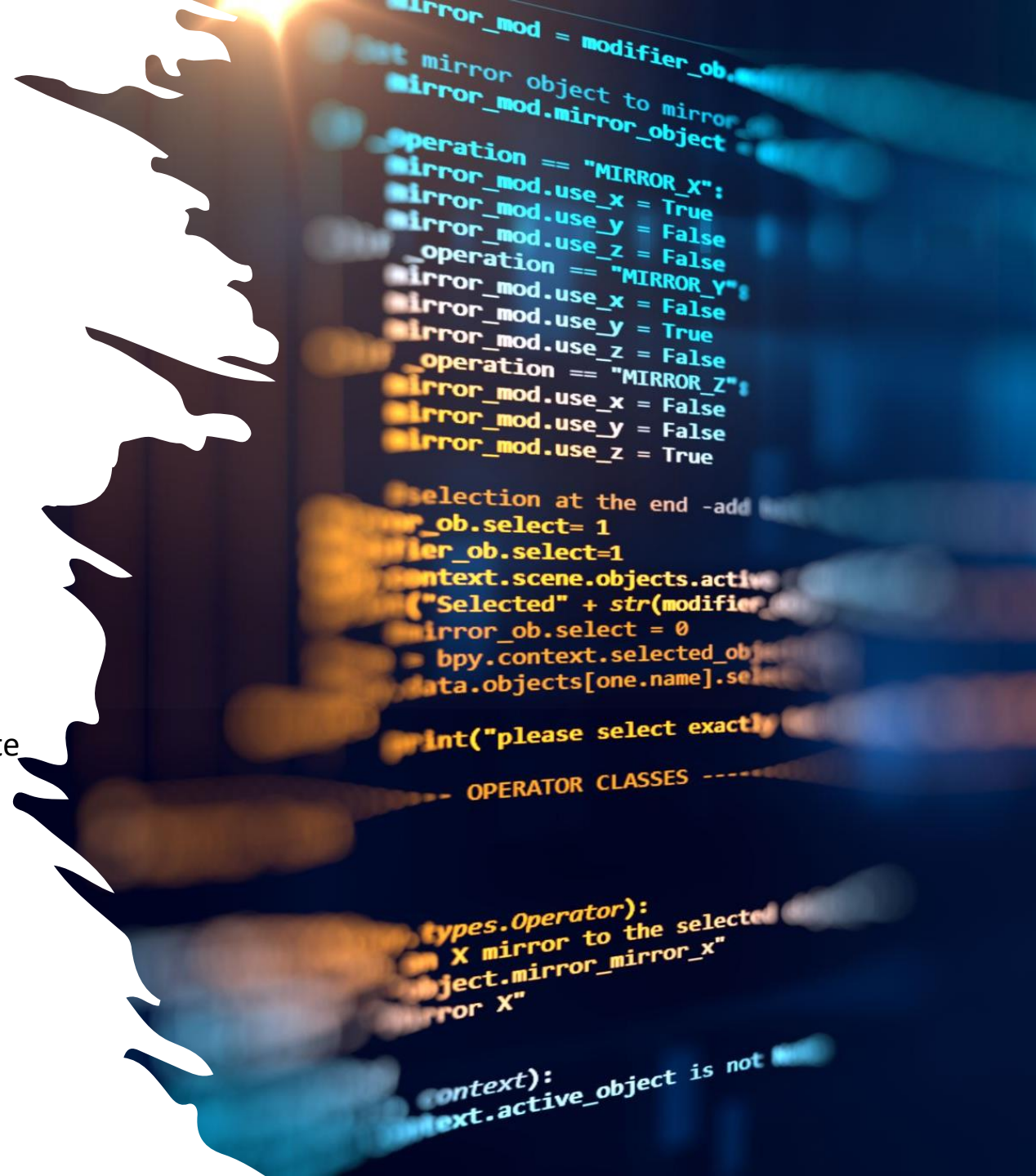
DEMO

- **Demo –**
  - Mask one of the columns from sample database using Azure Portal
  - Create a test user using SSMS and display the masked data

INDUSTRY LEADING SECURITY

Encryptions

- **Encryption-at-rest**
  - Uses TDE (Transparent data encryption)
  - Encrypts entire database using AES encryption algorithm
  - Encryption keys can be managed by Azure or user can bring their own key
- **Encryption-in-transit**
  - SQL Database secures data by encrypting data in motion with Transport Layer Security
  - Best practise is to specify encrypted connection (Encrypt = True) and not trust the server certificate (TrustServerCertificate = False) in applications connection string
  - Evaluate security risk of non-Microsoft drivers if they are not using TLS or using older version of TLS (<1.2)
- **Always Encrypted**
  - Keeps data encrypted while in use
  - Uses two keys CEK and CMK to encrypt the data.
  - Only owner of the data can view the data in plain text.
  - The encryption key is never exposed to Azure SQL database.




DEMO


Questions?


ADMINISTRATION
TASKS

AGENDA

CONFIGURING DATABASE FILE LAYOUT

CONFIGURING TIME ZONE

BACKUP AND RESTORE

MAINTENANCE TASKS

AZURE PLANNED MAINTENANCE

Who manages what ?

DBA Manages :

- Migration Planning and Migration to Azure
- Database designing
- Database level configuration
- Performance tuning
- Database Maintenance
- Monitoring
- Fix application issues like blockages, deadlocks, and broken releases
- Automation
- Cost optimization
- Audit configuration and monitoring

Microsoft Manages:

- Hardware
- Operating system
- SQL installation, configuration and Patches
- Backup and restore
- High availability and disaster recovery
- Scaling
- Auditing

Database File Layout in Azure SQL

- Tempdb files and size depends on Service Tierin Azure SQL Database
- 12 files by default created for Tempdb with initial size 16 MB and autogrowth 256 MB
  Azure SQL Managed Instance
- Path for data and log files cannot be chosen in Azure SQL Managed Instance
- Database files cannot be added/modified in Azure SQL Database
- Files and filegroups can be added in Azure SQL Managed Instance

Azure Premium Disks – SQL MI General Purpose

File IO characteristics - General Purpose tier

Disks Type	P10	P15	P20	P30	P40	P50
Max size	128 GB	256 GB	512 GB	1 TB	2 TB	4 TB
IOPS	500	1100	2300	5000	7500	7500
Throughput (MB/second)	100	125	150	200	250	250

- Local SSD – Temp DB
- Azure Premium Disk – Data & Log files

Performance Test – Link provided

below
100 GB TPCC Database
100 active users

Tools Used
HammerDB for generating TPCC-like workload,
Query Performance Insights library for analyzing performance on Managed Instance.

Test 1
128 GB database file – P10 Disk
Performance of this workload vary between 10K–20K transactions per minute
Wait Type - PAGEIOLATCH

Test 2
540 GB database file – P30 Disk
Performance of this workload vary between 450K–550K transactions per minute

Increasing data files might improve performance on General Purpose Managed Instance tier | by Jovan Popovic | Azure SQLDB Managed Instance | Medium

TempDB configurations for enhanced instance performance tuning

Understanding TempDB and its Impact

What is TempDB?

- System database in SQL Server, crucial for various functions.
- Non-durable storage, minimally logged, regenerated upon server start.

TempDB's Critical Role:

- Essential for SQL Server performance.
- High concurrency, frequent creation and destruction of objects.
- Service may experience contention during heavy usage.

Importance of TempDB Configuration:

- Optimizing TempDB File Count:
  - Increased files improve concurrency and disk bandwidth.
  - Balance needed to avoid performance overheads.
  - Contention unique to each workload.

User Objects :

Temporary tables , Table-Valued function, Temporary stored procedure
Table variables,Index

Database Engine uses:

Intermediate sorting, Spooling, Aggregate ,Cursor operations, Row Versioning

Configuring TempDB Files in Azure SQL Managed Instance:

- Default: 12 data files + 1 log file.
- Add or remove data files as needed.

Configuring Growth Increments:

- Adjustable for TempDB data and log files.
- Uniform increments recommended for optimal performance.
- Initial size of Temp DB Data Files – 16 MB
- Growth Increment - Configurable

Limitations:

- Logical name of tempDB – Configurable but Max 16 characters
- Max files capped at 128.

Adding/Removing Files:

SSMS: Object Explorer → Databases → System Databases → tempdb Properties.

T-SQL: ALTER DATABASE tempdb ADD FILE (NAME = 'file_name');

Time Zone Support

Coordinated Universal Time (UTC) is the recommended time zone for the data tier of newly developed cloud solutions.

Azure SQL Database does not support time zone settings; it always follows UTC.

Azure SQL Managed Instance offers a choice of time zones to meet the needs of existing applications.

The time zone of a managed instance can be set during instance creation only, and the default time zone is UTC.

The time zone of an existing managed instance cannot be changed.

A list of supported time zones is exposed through the sys.time_zone_info system view.

Copy Database

Azure SQL Database

- Copies an Azure SQL Database to another DB on same or different Server
- Creates a transactionally consistent snapshot of the source database as of a point in time the copy request is initiated
- Allows using a different backup storage redundancy and/or compute size within the same or a different service tier
- The logins, users, and permissions in the copied database are managed independently from the source database
- Use Azure portal, PowerShell, Azure CLI or T-SQL

Export Database

Azure SQL Database

Azure SQL Managed Instance

BACPAC Creation:

- Generates a BACPAC file encompassing both schema and data.

Cross-Platform Migration:

- Facilitates seamless database migration across various platforms.

Ensuring Transactional Consistency:

- Vital to halt write activities during export for maintaining transactional integrity.

BACPAC File Size Limitation:

- When exporting to blob storage, BACPAC files must adhere to a maximum size of 200 GB.

Multiple Export Tools:

- Utilize Azure Portal, SSMS, PowerShell, or SQLPackage Utility for exporting BACPAC files.

[Export a database to a BACPAC file - Azure SQL Database & Azure SQL Managed Instance | Microsoft Docs]

Automated Backup

Applies to: Azure SQL Database, Managed Instance

Full Backups every week, Differential backups every 12-24 hours and Transaction Log backups every 5-10 minutes

Storage costs: free up to 100% of the database size, charged per GB beyond that

Backup Redundancy –

Local Redundant (LRS)

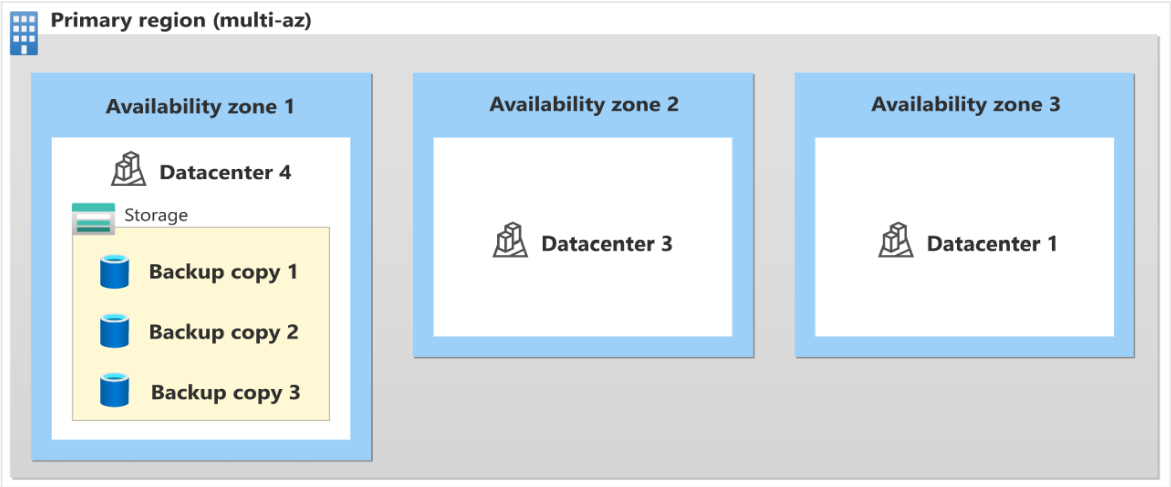
Zone Redundant (ZRS)

Geo Redundant (GRS)

[Automatic, geo-redundant backups - Azure SQL Database & Azure SQL Managed Instance | Microsoft Docs]

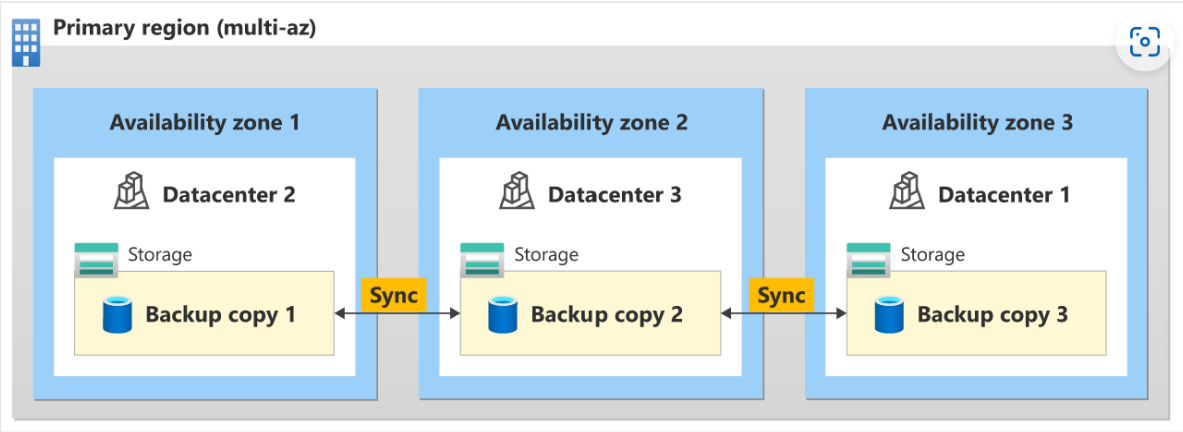
Automated Backups

Locally redundant storage (LRS)



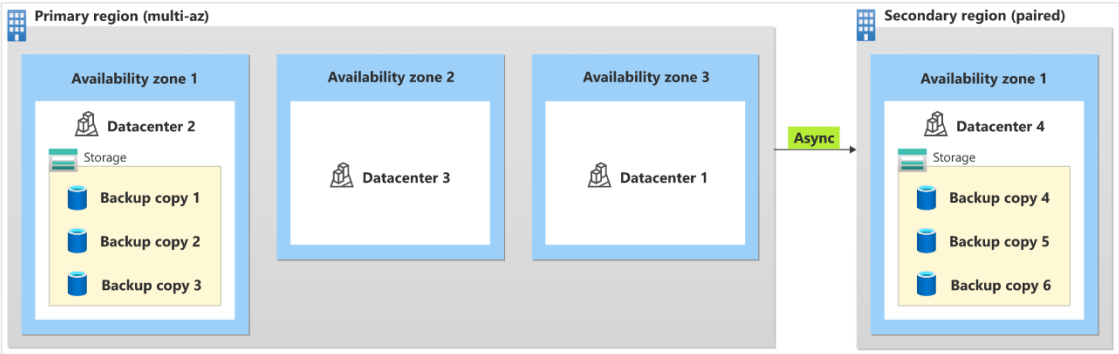
- Synchronously creates three copies within a single physical location in the primary region.
- Cheapest Solution
- Not Resilient to zone/regional outages.

Zone-redundant storage (ZRS)



- Synchronously copies backup across three Azure availability zones in the primary region.

Geo-redundant storage (GRS)



- Synchronously creates three copies within the primary region.
- Three synchronous copies in the paired region asynchronously copied over

Backup Retention

1

Short Term Backup Retention for Point In Time Restore (PITR)

- Default backup retention period is 7 days
- Can be changed up to 35 days for Premium and Business Critical tiers

2

Long Term Backup retention (LTR)

- Only Full backups are retained
- Up to 10 Years

3

You can change the default PITR backup retention period using the Azure portal, PowerShell, or the REST API

Restore - Point In Time Restore (PITR)

The database can be restored to any service tier or performance level

- Creates a new database in the same logical server with a new name
- Point-in-time restore doesn't support cross-server restoration

Database Replacement

- You need to manually rename the original database and then give the restored database the original name using the ALTER DATABASE command in T-SQL.

Data Recovery to recover from a user or application error

- Write and execute the necessary data recovery scripts to extract data from the restored database to the original database.

Restore - Deleted Database

- Restores the database to the point of deletion
- Creates a new database on the server as the original database
- You can choose to failover to the restored database or use scripts to recover data
- If you delete a server or managed instance, all its databases are also deleted and can only be recovered if LTR has been configured

Geo-Restore

Applies to: Azure SQL Database, Managed Instance

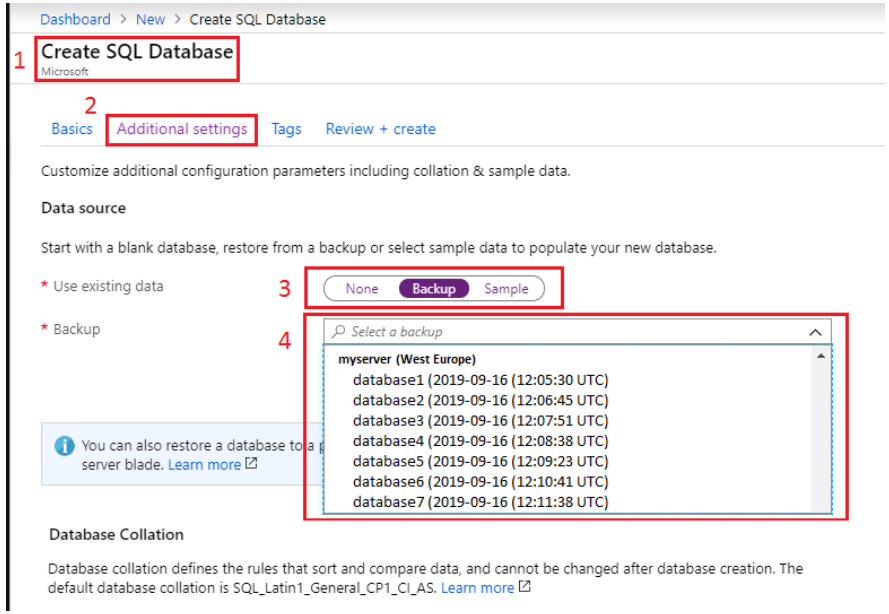
Restores last daily full backup to any Azure region

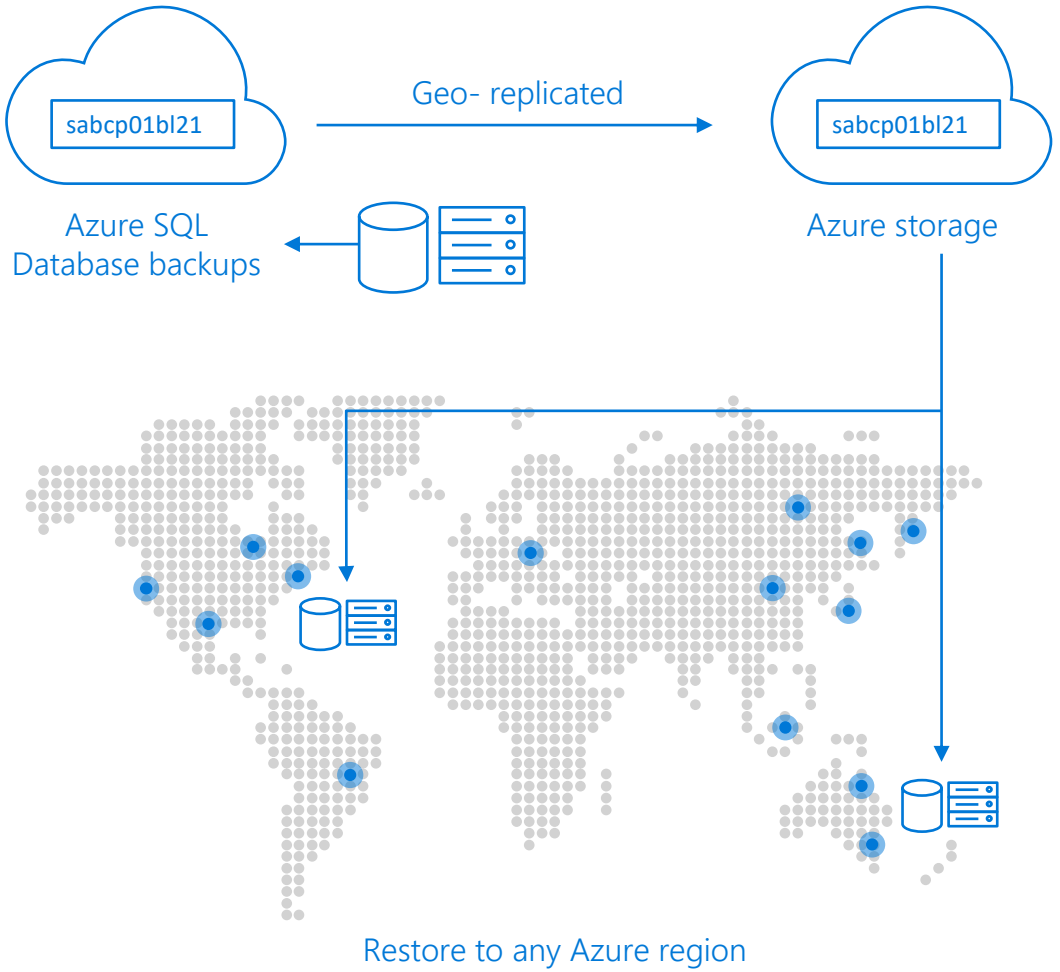
Available only for databases configured with geo-redundant backup storage

Can be performed on SQL databases and MI residing in the same subscription only

RTO≥12h, RPO=1h

Database URL will change after restore





[Automatic, geo-redundant backups - Azure SQL Database & Azure SQL Managed Instance | Microsoft Docs]

Maintenance Tasks

Regular Index maintenance is required as on premises

In built Resource Governance can affect workload performance due to resource contention during maintenance jobs

Provision extra resources for index maintenance activities if running in parallel with your production workloads

In elastic pool, index maintenance on one database can affect performance of other databases in the pool

Index maintenance may increase latency on Read Scale-out or Geo-replication replicas

Regular index maintenance may be required to increase page density in order to stay within the size limit of the pricing tier

When shrinking data files (if must), rebuilding or reorganizing indexes before shrinking files will increase page density

Regular Update statistics is required as on premises

No difference in performance between sequential I/O and random I/O – lesser impact of index fragmentation on performance

Updating statistics is more important than index defragmentation for optimal query plans and performance

Resource cost of updating statistics is much less compared to index rebuild

Support for running DBCC CHECKDB (although its not necessary)

Azure automatically has many checks and balances to check database integrity and automatically fix corruption without data loss

Data Integrity in Azure SQL Database | Azure Blog and Updates | Microsoft Azure

Planned Maintenance

Planned Maintenance Event:

- Continuous updates to Azure SQL Database and Azure SQL Managed Instance services to ensure security, compliance, stability, and performance.
- Utilization of modern service architecture and technologies like hot patching for transparent and non-impactful updates.

Procedure During Planned Maintenance:

- Offline transition of database quorum members one at a time to maintain a responding primary replica.
- For Business Critical and Premium databases, at least one secondary replica remains online to prevent client downtime.
- Reconfiguration process: secondary replica becomes primary for Business Critical and Premium databases; primary replica moves to another stateless compute node for General Purpose, Standard, and Basic databases.

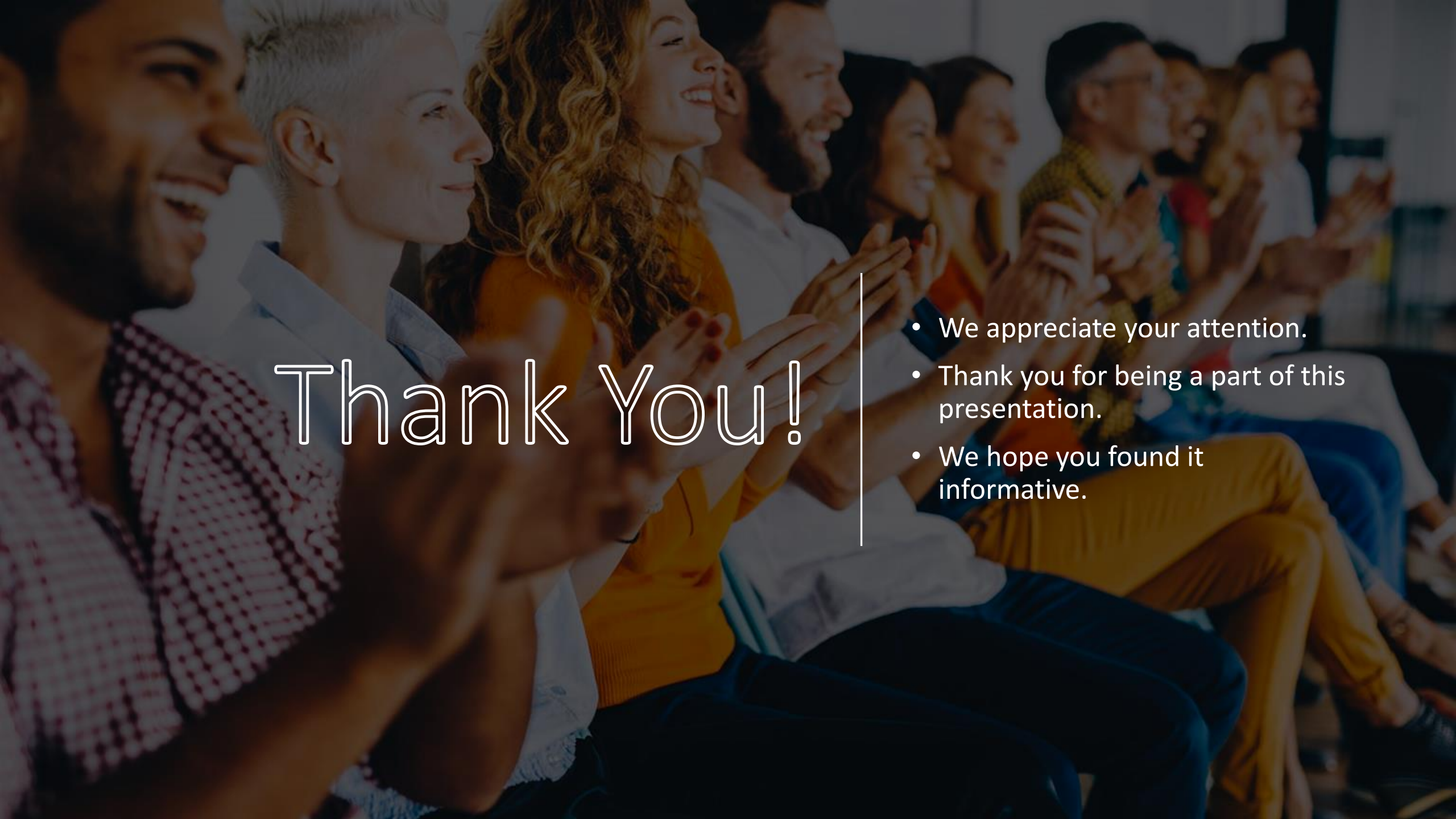
Expectations During Maintenance Event:

- Possibility of single or multiple reconfigurations depending on the initial constellation of primary and secondary replicas.
- Average of 1.7 reconfigurations per event, generally completing within 30 seconds with an average of eight seconds.
- Application reconnection necessary to the new primary replica.
- Potential error 40613 ("Database Unavailable") if connection is attempted during reconfiguration.
- Interruption of long-running queries during reconfiguration, requiring restart.

Maintenance Window

- Allows configuration of maintenance schedule for Azure SQL Database and Azure SQL Managed Instance resources.
- Aims to make impactful maintenance events predictable and less disruptive for your workload.
- Protects from planned impact from upgrades or scheduled maintenance only.
- Does not safeguard against all failover causes, such as hardware failures or cluster load balancing.
- Free of charge and configurable on creation or for existing resources.
- Configurable via Azure portal, PowerShell, CLI, or Azure API.
- By default, Azure SQL maintenance policy blocks most impactful updates during the period 8AM to 5PM local time every day to avoid any disruptions during typical peak business hours.
- You can further adjust the maintenance updates to a time suitable to your Azure SQL resources by choosing from two additional maintenance window slots:
  - Weekday window: 10:00 PM to 6:00 AM local time, Monday - Thursday
  - Weekend window: 10:00 PM to 6:00 AM local time, Friday - Sunday


Questions?



Thank You!

- We appreciate your attention.
- Thank you for being a part of this presentation.
- We hope you found it informative.