Business Continuity During Disaster

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SQL

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Data Professional

Microsoft Data Platform MVP. 14 Years working with Microsoft Data Platform. Microsoft and MongoDB certified. Worked in ecommerce, healthcare and finance industry.

Giving Back

Board member NESQL user group and PASS DBA virtual group. Organizer of Boston SQL Saturday. Frequent speaker at local and virtual user groups, SQL Saturdays, PASS Summit and Azure events.

When Not Working

Running – 1x26.2 and 30+x 13.1, Learning US history. Shuttling 3 kids.

Between 13:19 UTC on 10 Jan 2019 and approximately 05:30 UTC on 11 Jan 2019

∑ 16Hr 11Min

Product:

Azure SQL Database ▼

Region:

All ▼

Date:

Most recent ▼

January 2019

1/10   **Storage and Dependent Services - UK South**

Summary of impact: Between 13:19 UTC on 10 Jan 2019 and approximately 05:30 UTC on 11 Jan 2019, a subset of customers leveraging Storage in UK South may have experienced intermittent service availability issues. Other resources with dependencies on the affected Storage scale unit may have also experienced impact related to this event.

Preliminary root cause: Engineers determined that a number of factors, initially related to a software error, caused several nodes on a single storage scale unit to become temporarily unreachable. This, along with the increase in load on the scale unit caused by the initial issue, resulted in impact to customers with Storage resources located on this scale unit.
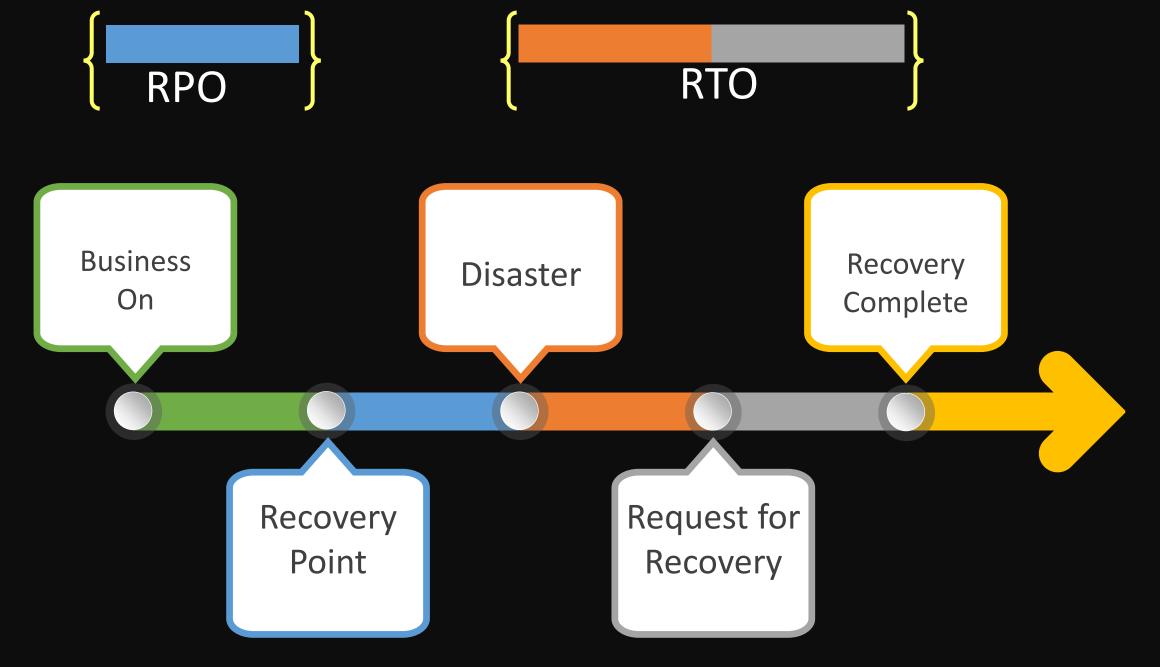
Mitigation: To recover the nodes, the Azure team undertook a sequence of structured mitigation steps, including:
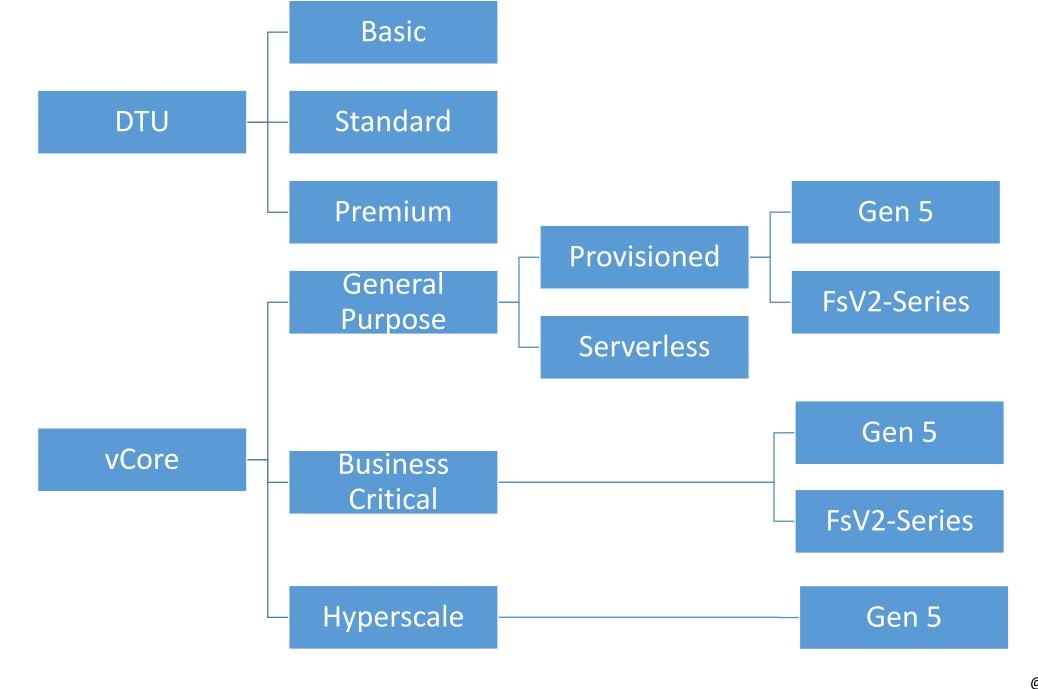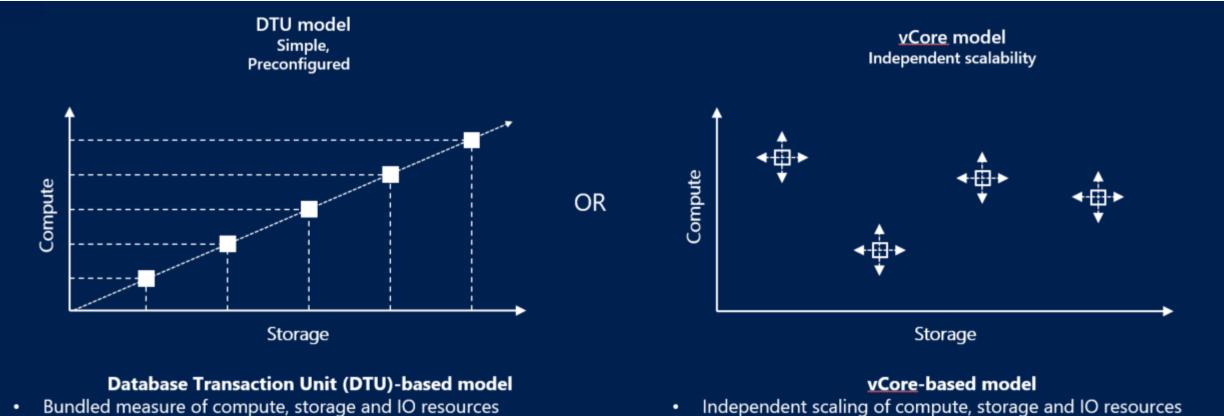
https://intoosu.oregonstate.edu/file/whyjpg

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Business Continuity

- RTO Recovery Time Objective
- RPO Recovery Point Objective

ERT = ESTIMATED RECOVERY TIME

Max(ERT)=RTO

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DTU model
Simple,
Preconfigured

OR

vCore model
Independent scalability

Database Transaction Unit (DTU)-based model
• Bundled measure of compute, storage and IO resources
• Best for customers who want simple, pre-configured resource options.

vCore-based model
• Independent scaling of compute, storage and IO resources
• Best for customers who value flexibility, control and transparency
• Use with Azure Hybrid Benefit for SQL Server to gain cost savings

https://docs.microsoft.com/en-us/azure/azure-sql/database/purchasing-models

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Temporal Table

Automated Backup

Built in HA/DR

Zone Redundancy

Active Geo Replication

Auto-failover Group

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Business Continuity

Recovery method	RTO	RPO
Geo-restore from geo-replicated backups	12 h	1 h
Auto-failover groups	1 h	5 s
Manual database failover	30 s	5 s

https://docs.microsoft.com/en-us/azure/azure-sql/database/business-continuity-high-availability-disaster-recover-hadr-overview#recover-a-database-to-the-existing-server

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Automated Backup

Automatic Backup Frequency

- Lose control of precise RPO
- Frequency based on the performance level and amount of database activity

Full database backups are created weekly, differential database backups are generally created every 12 hours, and transaction log backups are generally created every 5 - 10 minutes
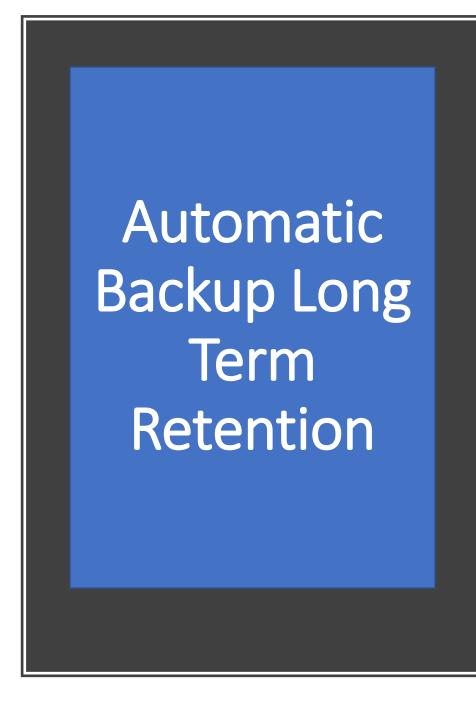
Automatic Backup Frequency

FULL	WEEKLY
DIFFERENTIAL	* 12-24 HOURS
TRANSACTION LOG	* 5~10 MINUTES

* Not precise

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PIT Backup Retention

7 ⟶ 35

All service tiers except Basic

Automatic Backup Long Term Retention

Leverage automatic backups

Up to 10 years

Are stored in Read-access geo-redundant storage (RA-GRS)

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Automatic Backup Long Term Retention

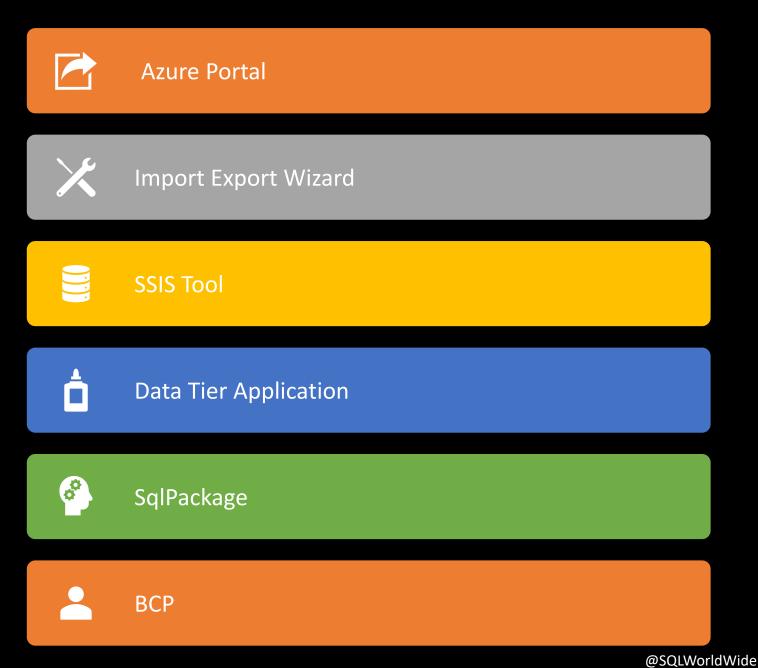| W	M	Y	Week Of Year
0	0	5	3
0	3	0	
12	0	0	
6	12	10	16

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Restore

- A new database on the same logical server
- On the same logical server recovered to the deletion time for a deleted database
- In any region recovered to the point of the most recent daily backups in RA-GRS

- Cannot overwrite an existing database during restore
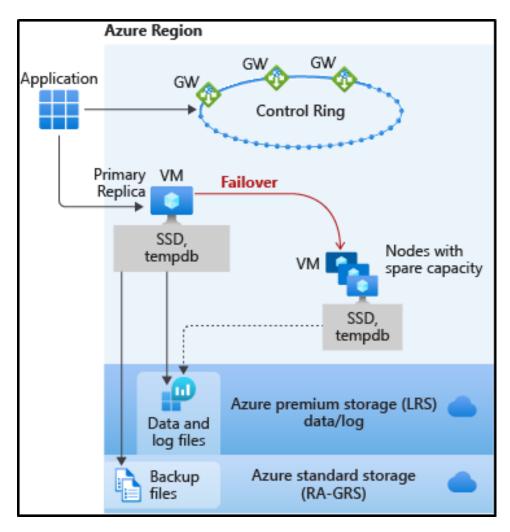- If you delete a SQL Server instance you cannot restore a database

Can We Restore On-Premise?

- Azure Portal
- Import Export Wizard
- SSIS Tool
- Data Tier Application
- SqlPackage
- BCP

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Built in HA/DR

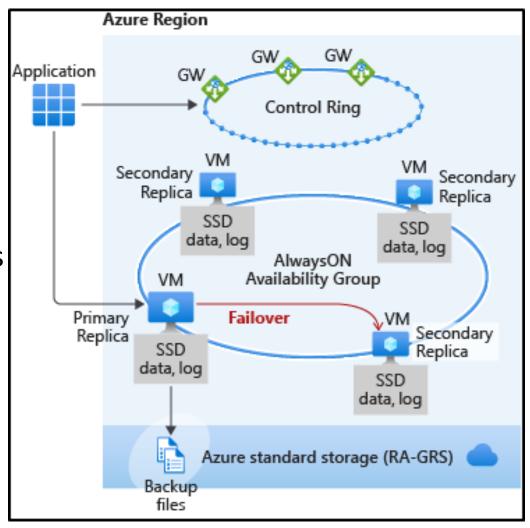# Basic, Standard, General Purpose

- Behaves like Failover Cluster Instance
- Remote storage provides data redundancy within a datacenter
- Backup files are in a different location with geo-redundancy
- Failover decisions based on SQL and Service Fabric
- Recovery time depends on spare capacity
- Connectivity redirection built-in

https://docs.microsoft.com/en-us/azure/azure-sql/database/high-availability-sla
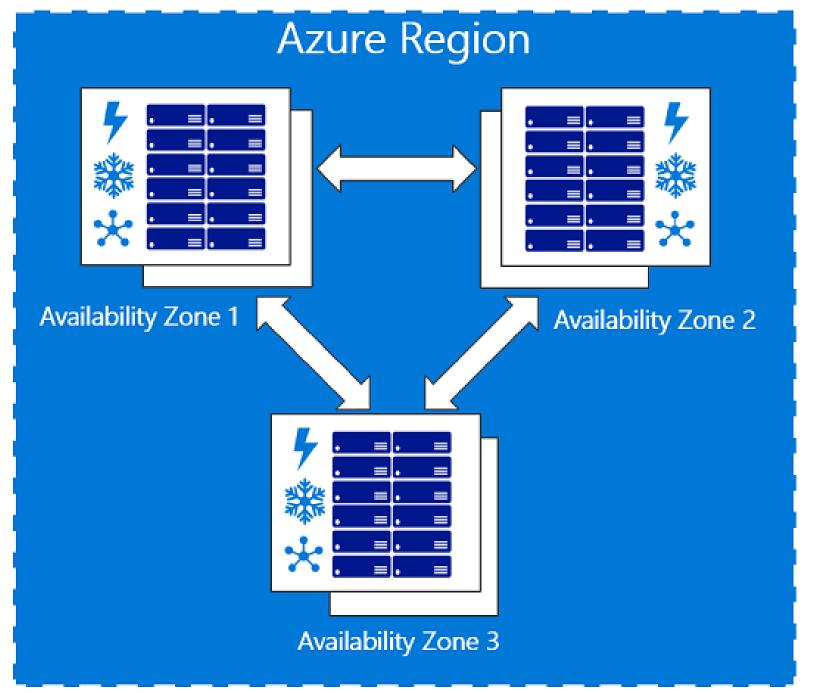
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Premium and Business Critical

- Based on Always On Availability Groups

- 3 secondary replicas automatically created

- Four replicas kept available

- Backup files in a different location with geo-redundancy

- At least one secondary must sync for commits

- Automatic failover based on SQL and Service Fabric

- Recovery time extremely fast

- Connectivity redirection built-in
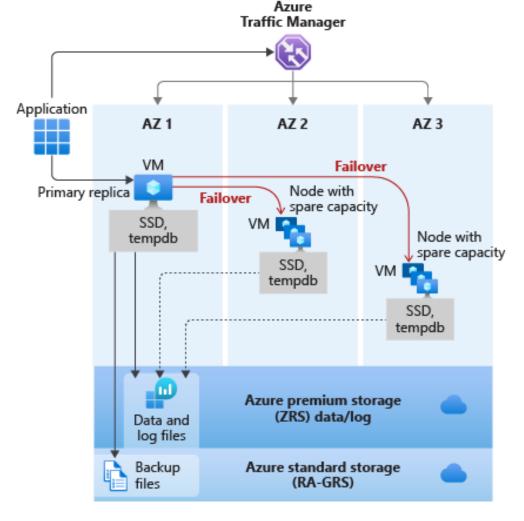
- Read Scale-Out from one of the replicas

https://docs.microsoft.com/en-us/azure/azure-sql/database/high-availability-sla

Zone Redundancy

Azure Region

Availability Zone 1

Availability Zone 2

Availability Zone 3

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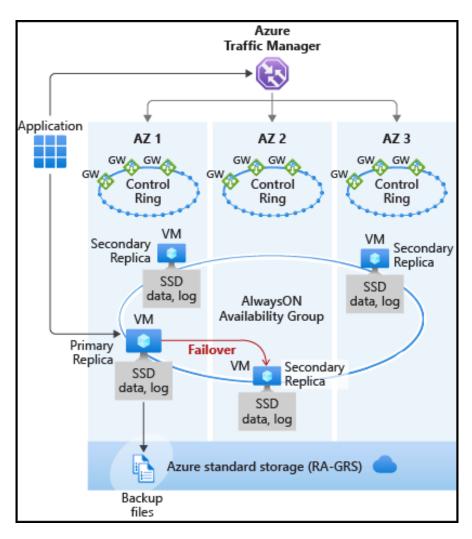https://docs.microsoft.com/en-us/azure/availability-zones/az-overview

General Purpose (Preview)

- Currently in preview for SQL Database
- Remote storage is zone redundant
- Guaranteed compute capacity in other Availability Zones
- Database resilient to zonal outage
- Only available with Gen5 compute hardware
- Disable by default

https://docs.microsoft.com/en-us/azure/azure-sql/database/high-availability-sla

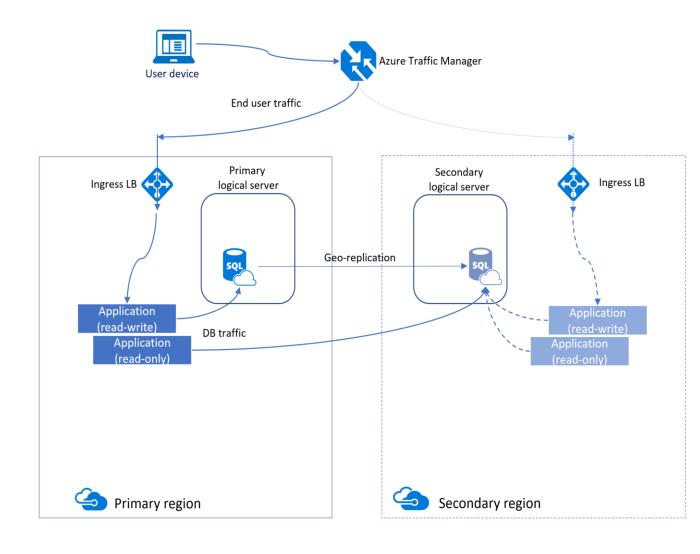@SQLWorldWide

Premium and Business Critical

- Replicas are automatically created across zones
- Synchronous replication
  - <mark>Increased network latency may increase the commit time</mark>
- Database resilient to zonal outage
- Free for Business Critical & Premium
- Only available with Gen5 compute hardware

https://docs.microsoft.com/en-us/azure/azure-sql/database/high-availability-sla

Active Geo Replication

- Leverages the Always On availability group technology
- Asynchronously replicate committed transactions
- Up to four secondaries are supported in the same of different region
- Secondaries can be used for read-only traffic
- Guaranteed to never have partial transaction (Using Snapshot Isolation)

All service tiers other than hyperscale

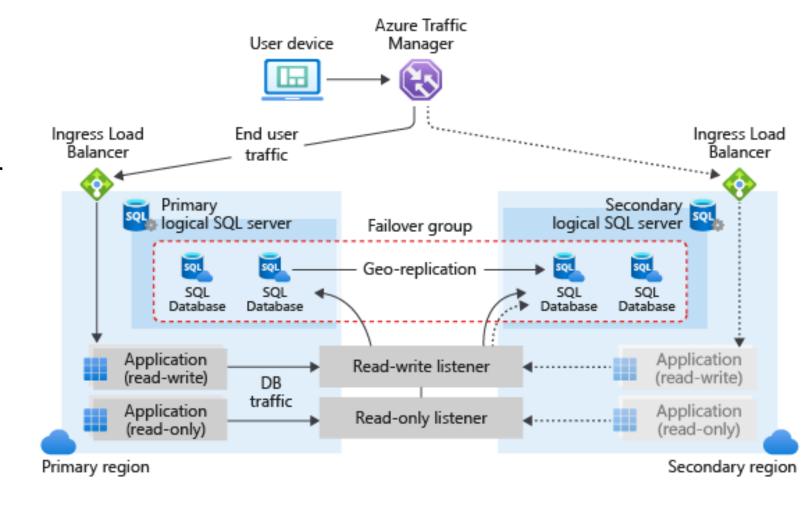https://docs.microsoft.com/en-us/azure/azure-sql/database/active-geo-replication-overview

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Transaction replicated but not replayed

sp_wait_for_database_copy_sync

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Auto-failover Groups

- Only one secondary server or instance in a different region
- Secondaries can be used for read-only traffic
- Listener end-points that remain unchanged during failovers
- By default, configured with an automatic failover policy
- By default, the failover of the read-only listener is disabled

All service tiers other than hyperscale

https://docs.microsoft.com/en-us/azure/azure-sql/database/auto-failover-group-overview?tabs=azure-powershell

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Read/Write listener endpoint

FailoverGroupName.Database.Windows.Net

Read-Only listener endpoint

FailoverGroupName.Secondary.Database.Windows.Net

	Geo-replication	Auto-failover groups
Automatic failover	No	Yes
Fail over multiple databases simultaneously	No	Yes
Update connection string after failover	Yes	No
Managed instance supported	No	Yes
Can be in same region as primary	Yes	No
Multiple replicas	Yes	No
Supports read-scale	Yes	Yes

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Replication Status

```
SELECT
    link_guid ,
    partner_server ,
    last_replication ,
    replication_lag_sec
FROM sys.dm_geo_replication_link_status;
```

- Automated Backup
- Built in HA/DR
- Active Geo-Replication
- Auto-Failover Group
- Read Scale-Out

https://www.invotide.com/demo

Resource

- Designing globally available services using Azure SQL Database
- Overview of business continuity with Azure SQL Database
- High-availability and Azure SQL Database
- Automated backups - Azure SQL Database
- Long-term retention - Azure SQL Database
- Creating and using active geo-replication
- Use read-only replicas to load-balance read-only query workloads
- What are Availability Zones in Azure?
- Configure active geo-replication for Azure SQL Database in the Azure portal and initiate failover
- Use auto-failover groups to enable transparent and coordinated failover of multiple databases
- Accelerated Database Recovery in Azure SQL
- Features comparison: Azure SQL Database and Azure SQL Managed Instance

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