

# Business Continuity During Disaster

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#### **Data Professional**

Microsoft Data Platform MVP. 15 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 Founder of DBA virtual group. Organizer of Boston Data Saturday. Frequent speaker at local and virtual user groups, Data Saturdays and Azure conferences.

#### 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

# 2 16Hr 11Min

Product:		Region:		Date:	
Azure SQL Database ▼		All •		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://status.azure.com/en-us/status/history/

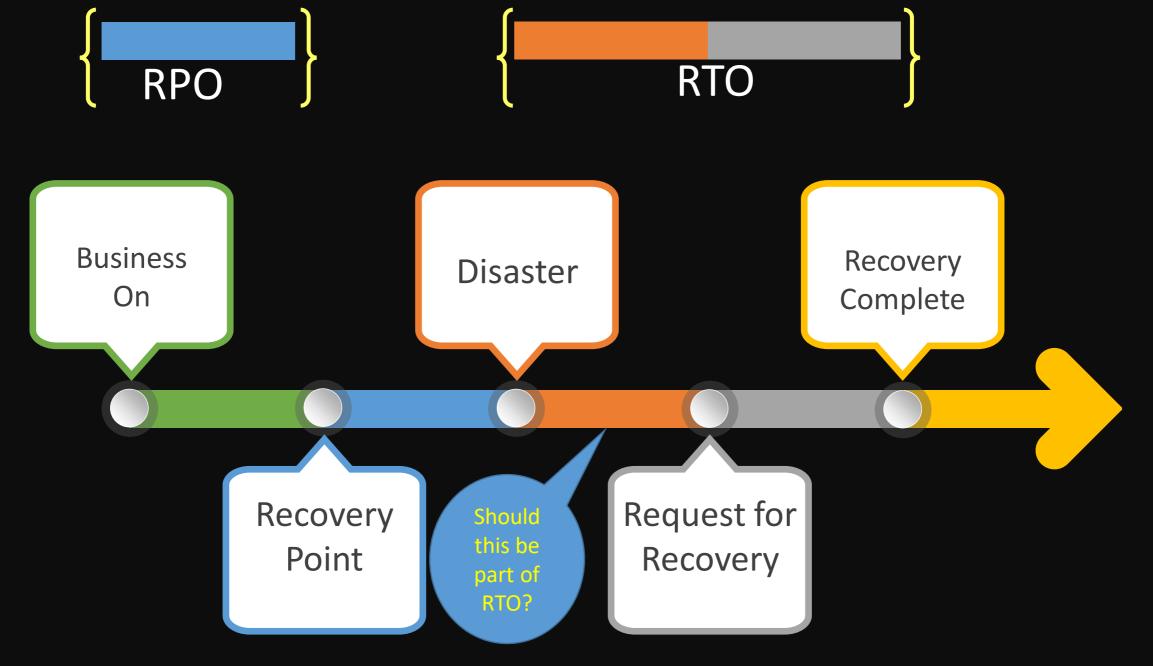
- Between 11:30 UTC and 19:51 UTC on 18 Sep 2020
- Between 09:24 and 11:15 UTC on 01 Jul 2020
- Between 23:00 UTC on 14 Jun 2020 and 01:40 UTC on 15 Jun 2020
- Between 11:57 and 14:20 UTC on 11 Jun 2020
- Between 13:30 and 16:30 UTC on 19 May 2020
- Between 12:41 UTC on 18 May 2020
- Between 17:37 and 21:54 CST on 22 Apr 2020
- Between 09:37 and 13:54 UTC on 22 Apr 2020
- Between approximately 20:30 UTC on 15 Mar 2020 and 00:30 UTC on 16 Mar 2020
- Between 22:00 EST on 24 Jan 2020 and 08:15 EST on 25 Jan 2020

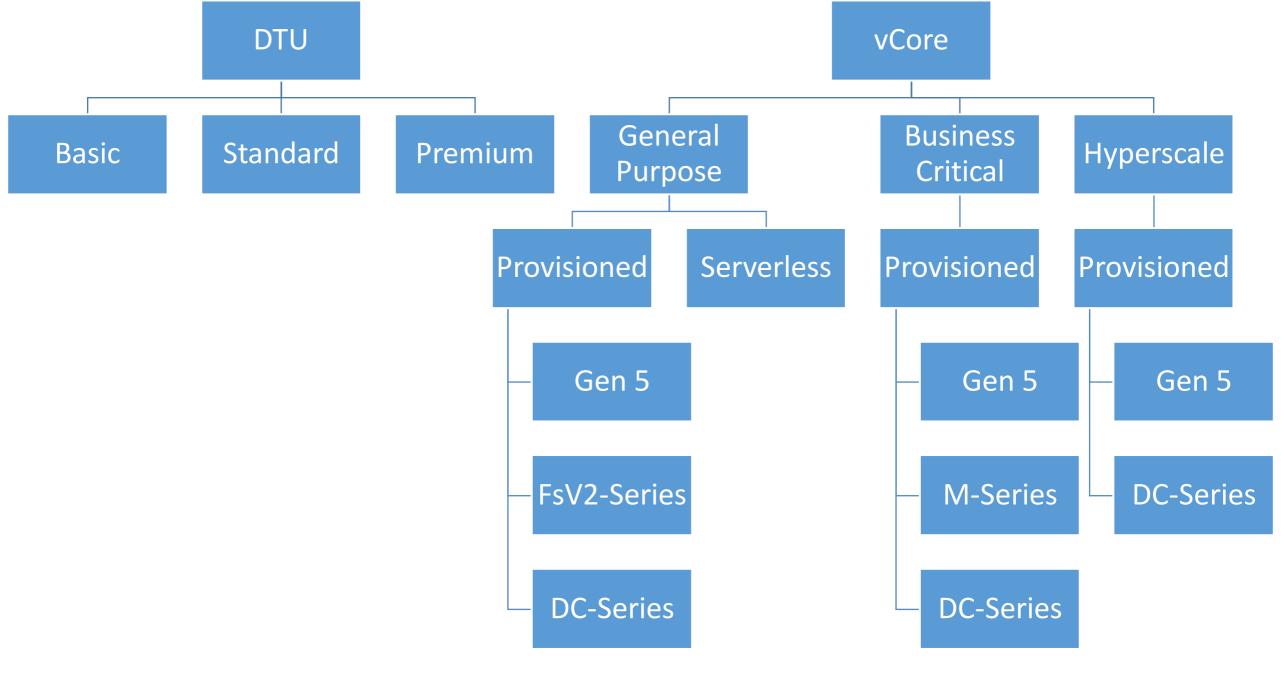
### **Business Continuity**

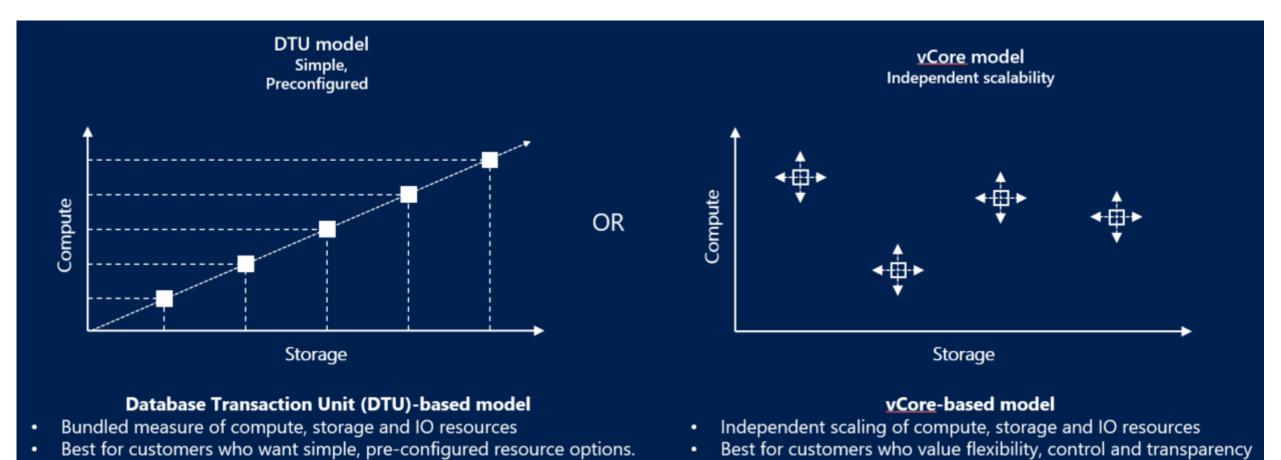
- RTO Recovery Time Objective
- RPO Recovery Point Objective

ERT = ESTIMATED RECOVERY TIME

Max(ERT)=RTO







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

Use with Azure Hybrid Benefit for SQL Server to gain cost savings

Deployment Data Center Zone Region Geography

# Redundancy

Temporal Table

Automated Backup

Built in HA/DR

Zone Redundancy

Active Geo Replication Auto-failover Group



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

# Automated Backup

### Automatic Backup Frequency

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

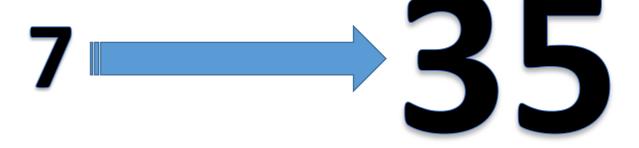
The exact timing of all database backups is determined by the SQL Database or SQL Managed Instance service as it balances the overall system workload. You cannot change the schedule of backup jobs or disable them.

# Automatic Backup Frequency

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

\* Not precise

# PIT Backup Retention



All service tiers except Basic

# Automatic Backup Long Term Retention



Leverage automatic backups



Up to 10 years



Are stored in Readaccess geo-redundant storage (RA-GRS)

# 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

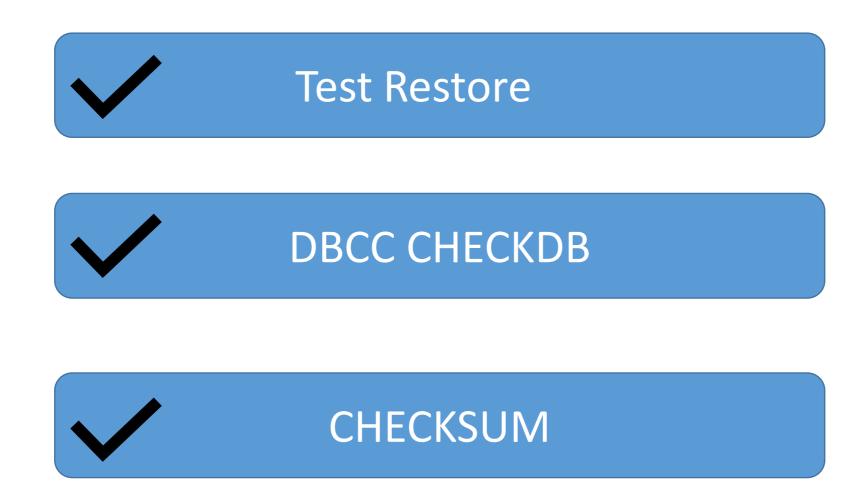
#### Restore

9

- Point-in-time restore of existing database
- Point-in-time restore of deleted database
- Geo-restore Restore a database to another geographic region
- Restore from long-term backup

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

## **Backup Integrity**



## Can We Restore On-Premises?



**Azure Portal** 



Import Export Wizard



SSIS Tool



**Data Tier Application** 



SqlPackage

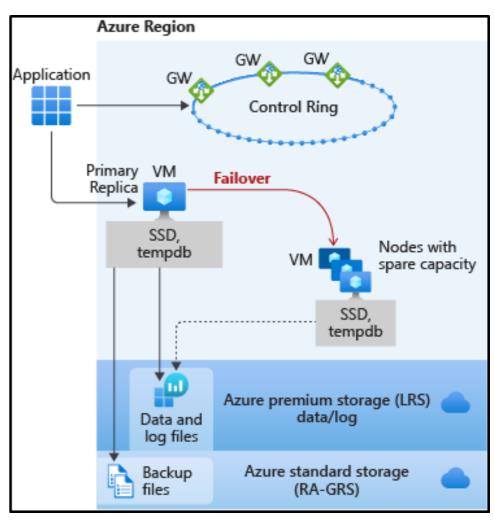


**BCP** 

# Builtin HA/DR

### Basic, Standard, General Purpose

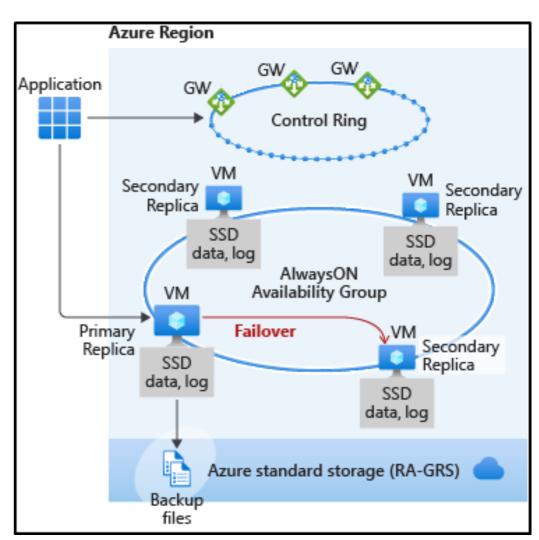
- Behaves like Failover Cluster Instance
- Remote storage provides data redundancy within a datacenter
- Backup files are in a different location with geo-redundancy
- Failover decisions based on SQL and Service Fabric
- Recovery time depends on spare capacity
- Connectivity redirection built-in



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

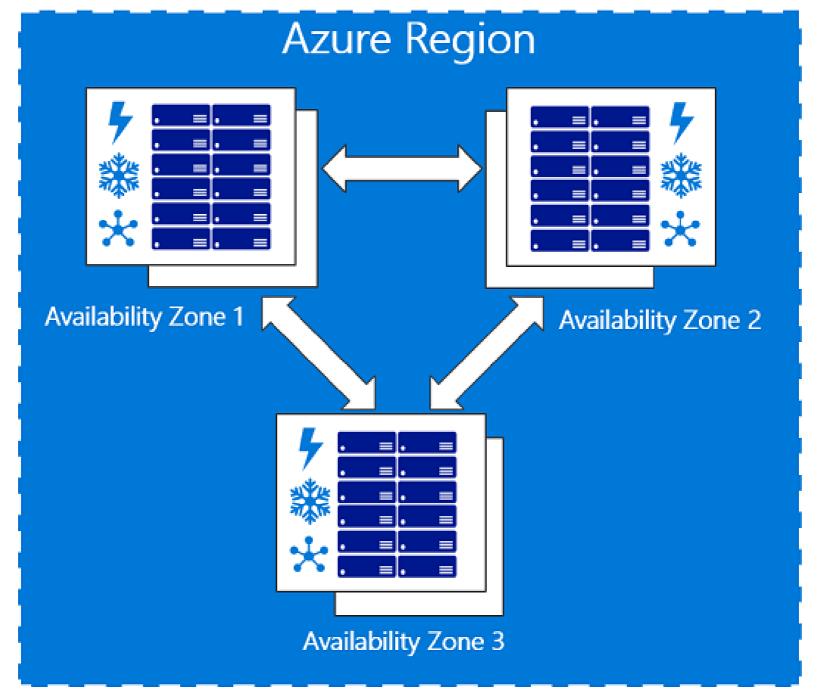
### Premium and Business Critical

- Based on Always On Availability Groups
- 3 secondary replicas automatically created
- 4 replicas kept available
- Backup files in a different location with georedundancy
- 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



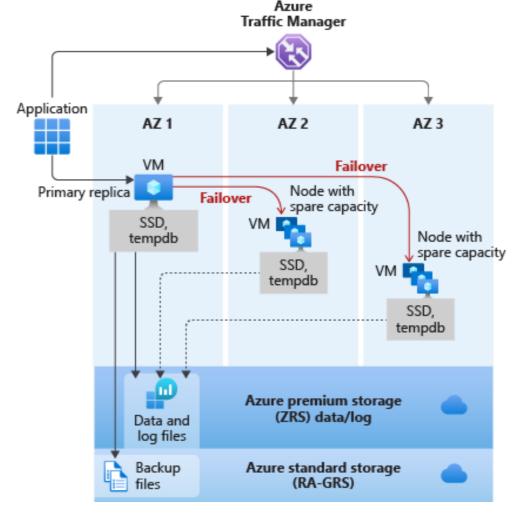
https://docs.microsoft.com/en-us/azure/azure-sql/database/high-availability-sla

# Lone Redundancy



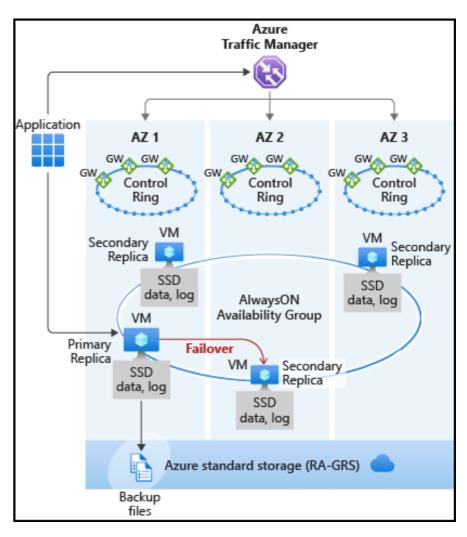
# General Purpose (Public Preview)

- Currently in preview
- 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
- Additional cost



### Premium and Business Critical

- Replicas are automatically created across zones
- Synchronous replication
  - Increased network latency may increase the commit time
- 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

Disable by default

# Service Level Agreement(SLA)

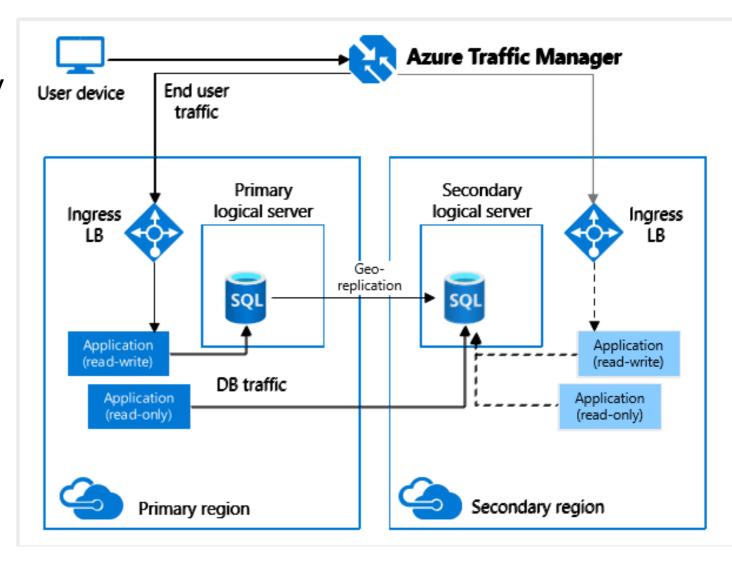
Service Tier	Single Zone SLA	Multiple Zones SLA
Basic, Standard, General Purpose	99.99%	Public Preview
Premium, Business Critical	99.99%	99.995%

**SLA for Azure SQL Database** 



# Active Geo Replication

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



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

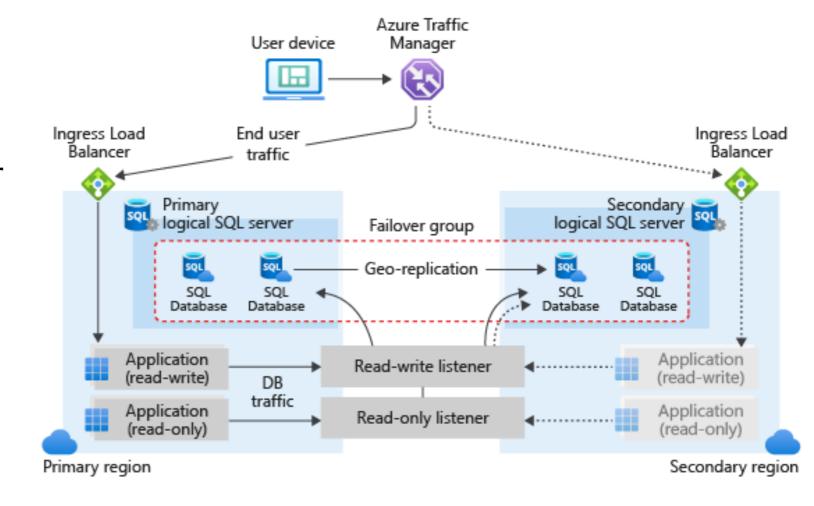


Transaction replicated but not replayed

sp\_wait\_for\_data
base\_copy\_sync

# 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

#### Read/Write listener endpoint

FailoverGroupName.Database.Windows.Net

Read-Only listener endpoint

FailoverGroupName.Secondary.Database.Windows.Net



# **GracePeriodWithDataLossHours**

	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

## Replication Status

```
SELECT
  link guid
  partner server,
  last replication,
  last commit,
  replication lag sec
FROM sys.dm geo replication link status;
```

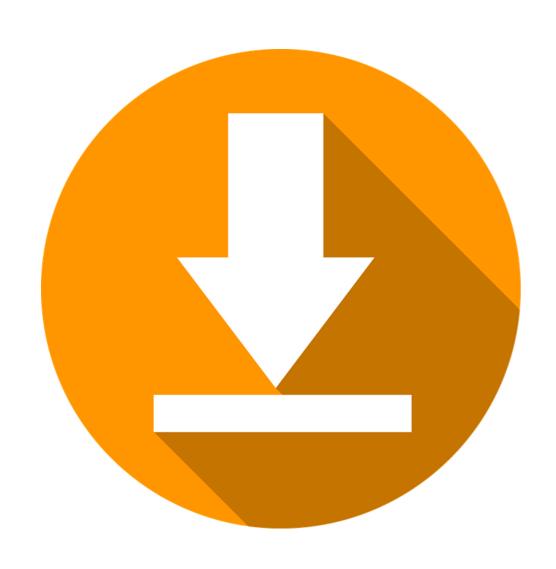
- ✓ RPO and RTO needs
- ✓ Check Azure SQL SLA document
- ✓ How much PIT backup required
- ✓ Do you need LTR backup
- ✓ Do you need to offload read traffic
- ✓ Do you need Zone redundancy
- ✓ Do you need Region redundancy
- ✓ Do you need Auto-failover
- ✓ Is your application ready for failover



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

#### 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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