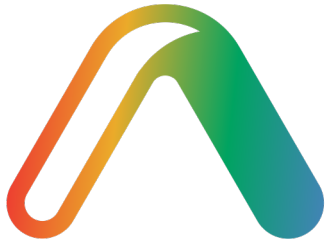

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Architecting for High Availability in Azure SQL

Anthony E. Nocentino

He/him

Principal Field Solution Architecture

Pure Storage

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Thank you!

Level 100

Azure SQL & Our Toolbox To Manage It

Jess Pomfret

Level 200

Azure Arc for the Data Professional

Ben Weissman

Level 100

Control your Cloud Data Deployments - Deploy your Azure Data Solutions with Bicep and Azure DevOps

Rob Sewell

Level 200

What's new with Amazon RDS for SQL Server

Carlos Robles

Level 200

Architecting for High Availability in Azure SQL

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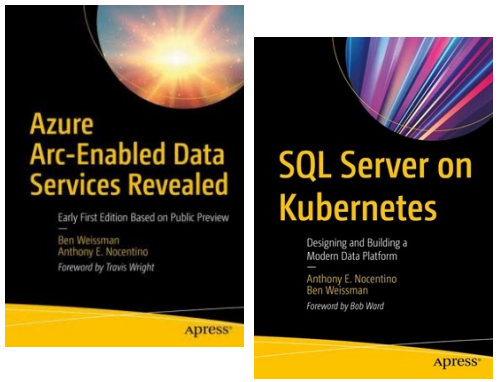

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Agenda

- Azure SQL Services and Service Tiers
- High Availability Architectures
- Disaster Recovery Architectures
- Understanding Application Resiliency

Azure SQL Services

Azure SQL Services

SQL Database – SQL DB

SQL Managed Instance – SQL MI

SQL on Virtual Machines

Azure Infrastructure and Azure SQL

- **Regions** – defines a disaster recovery boundary
- **Paired Regions** – physically adjacent Regions with serialized maintenance
- **Availability Zone** – defines a high availability/fault domain boundary
- **Zone Redundant** – a service that supports Availability Zones
  - Zone Redundant Storage – storage that's synchronously replicated between the three Availability Zones in a Region
  - Locally Redundant Storage – synchronously replicated triple redundant within a datacenter
  - We'll learn about some Zone Redundant Azure SQL Services today

https://docs.microsoft.com/en-us/azure/availability-zones/az-overview
https://docs.microsoft.com/en-us/azure/best-practices-availability-paired-regions

Azure SQL Services High Availability and Disaster Recovery Architectures

Backups!!!

- **Automated Backups**
  - Weekly full, 12-hour differential, 5-10 min log backups
  - Stored in geo-redundant storage (GRS)
  - Can’t schedule and timing is determined by the service and its current workload
- Retention
  - Short term – 7 days, configurable 1-35 days
  - Long term – up to 10 years (week, month, year) and only full backups
- Restore
  - Point in time recovery
  - Geo-restore

Availability Models for SQL DB and SQL MI

- **General Purpose/Standard**
  - Designed for budget-oriented business applications
- **Business Critical/Premium**
  - Designed for performance-sensitive workloads with strict availability requirements

https://docs.microsoft.com/en-us/azure/azure-sql/database/service-tiers-general-purpose-business-critical

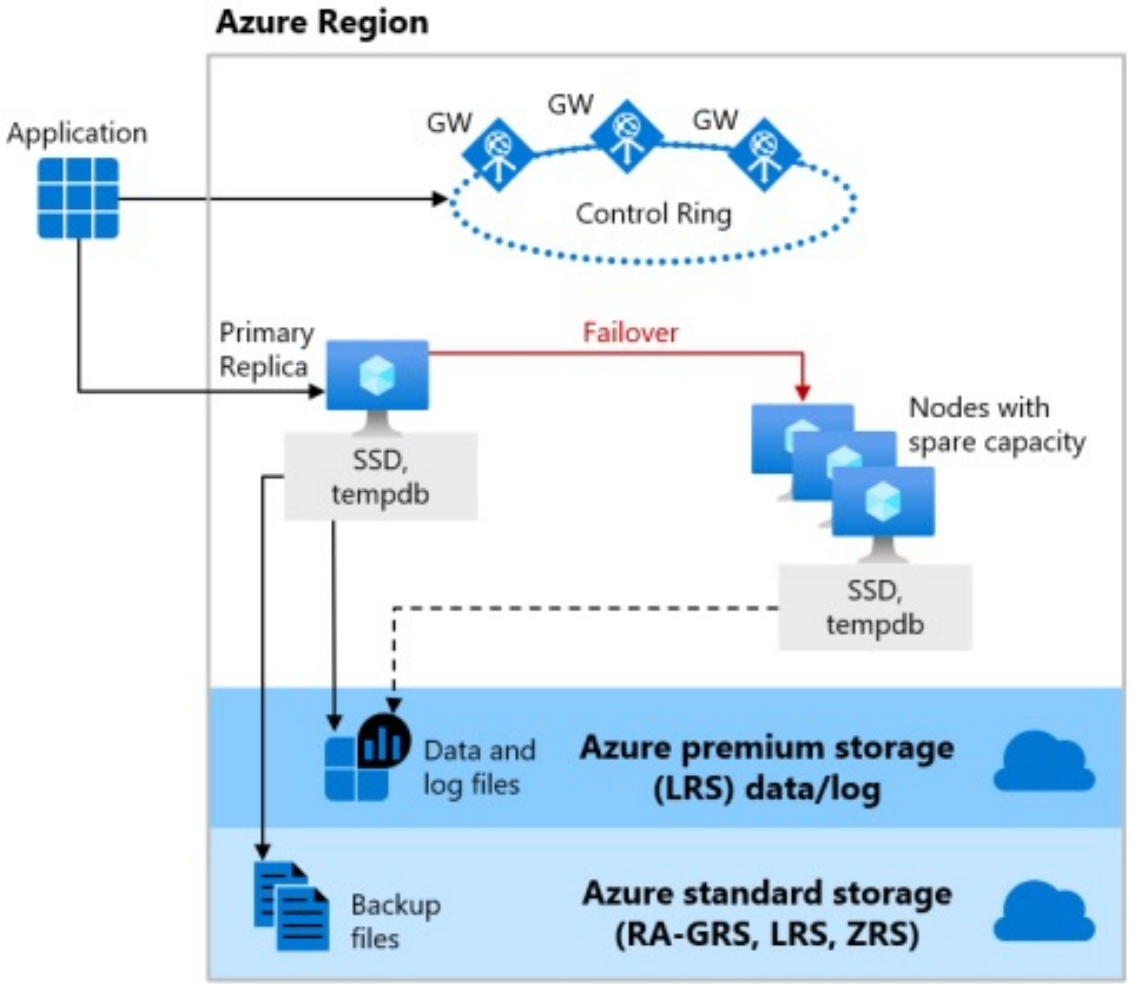
General Purpose/Standard

- Separation of compute and storage
- High availability and reliability are in the remote storage tier
  - Local TempDB, remote data and log files
- Applications that can tolerate some performance degradation during maintenance activities
- Includes **Basic**, **Standard** and **General Purpose** tiers

Business Critical/Premium

- Storage and compute are on the same node
- A cluster of database engine processes
- Availability relies on a quorum of available database engine nodes
- Mission critical applications
  - High IO performance
  - High transaction rate
- Guarantees minimal performance impact to your workload during maintenance activities

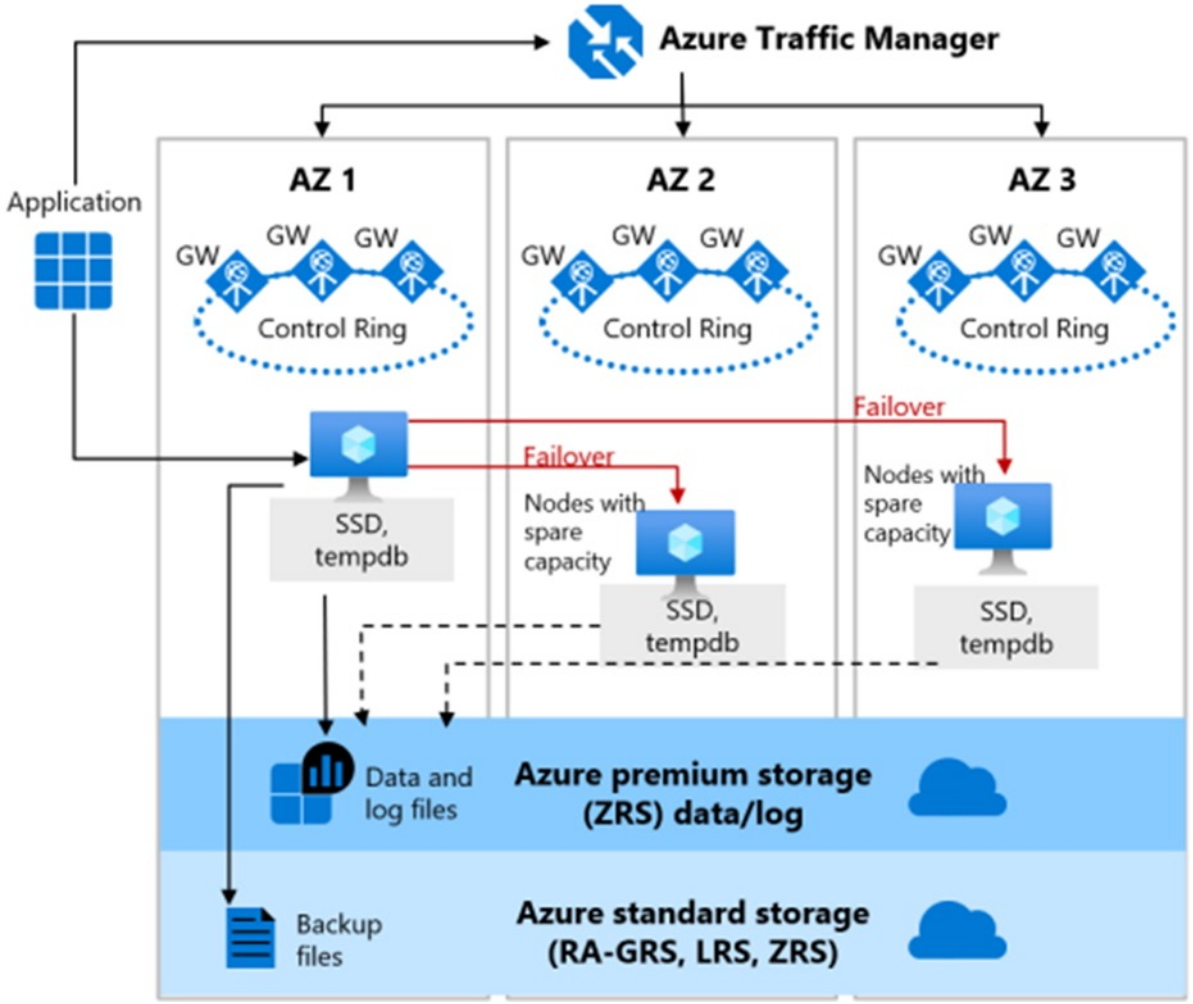
SQL DB/MI – General Purpose/Locally Redundant



- Separation of compute and storage
- Remote Blob Storage – 5-10ms
- 99.99 availability
- Control Ring's Connections Gateways
  - Manages the connections
- Dependent upon having that spare capacity in the Region
- Backups are GRS by default

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

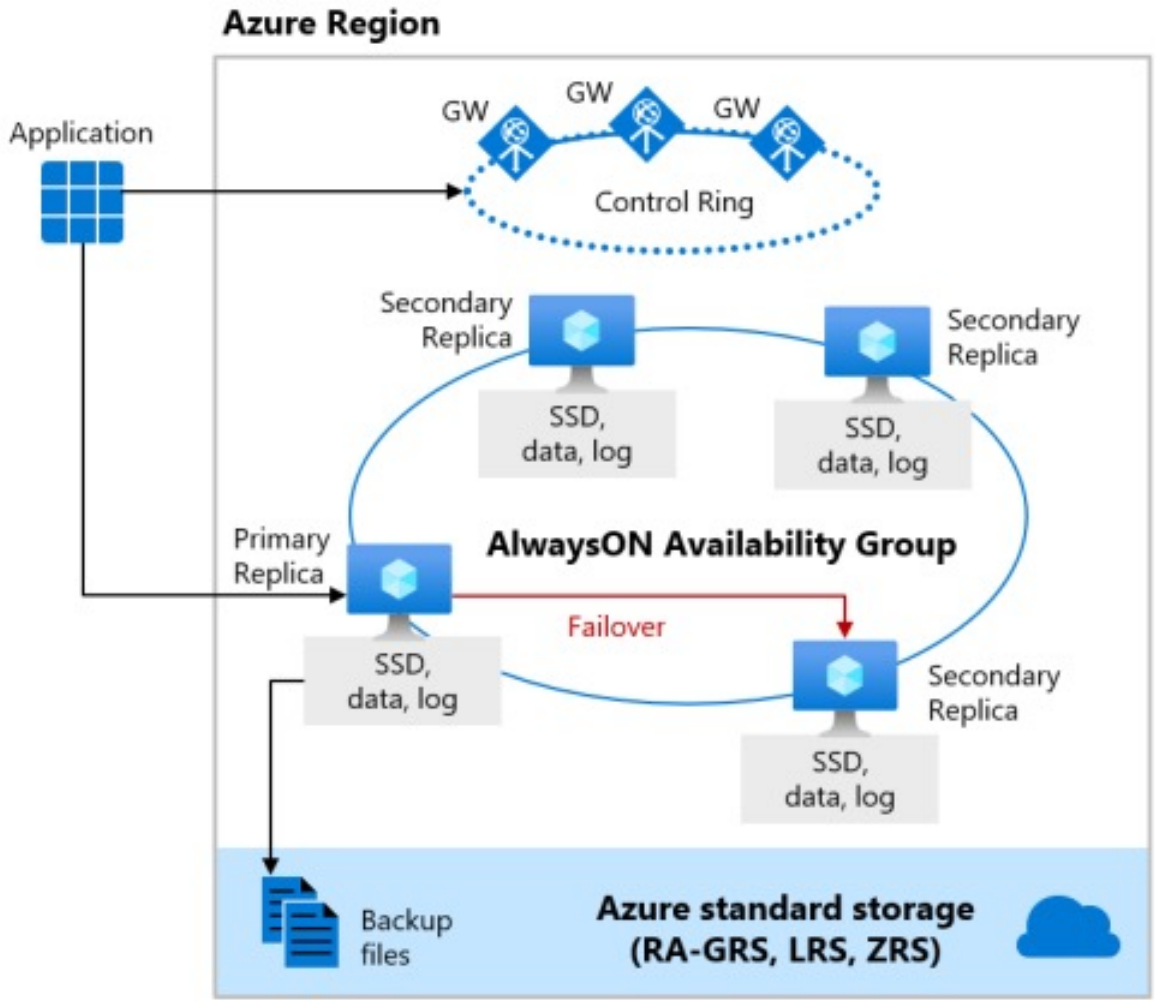
SQL DB - General Purpose/Zone Redundant



- Preview and only SQL DB
- Separation of compute and storage
- Azure Premium ZRS Storage
  - Synchronous storage replication
- Azure Traffic Manager
  - Directs traffic to the Connection Gateways

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

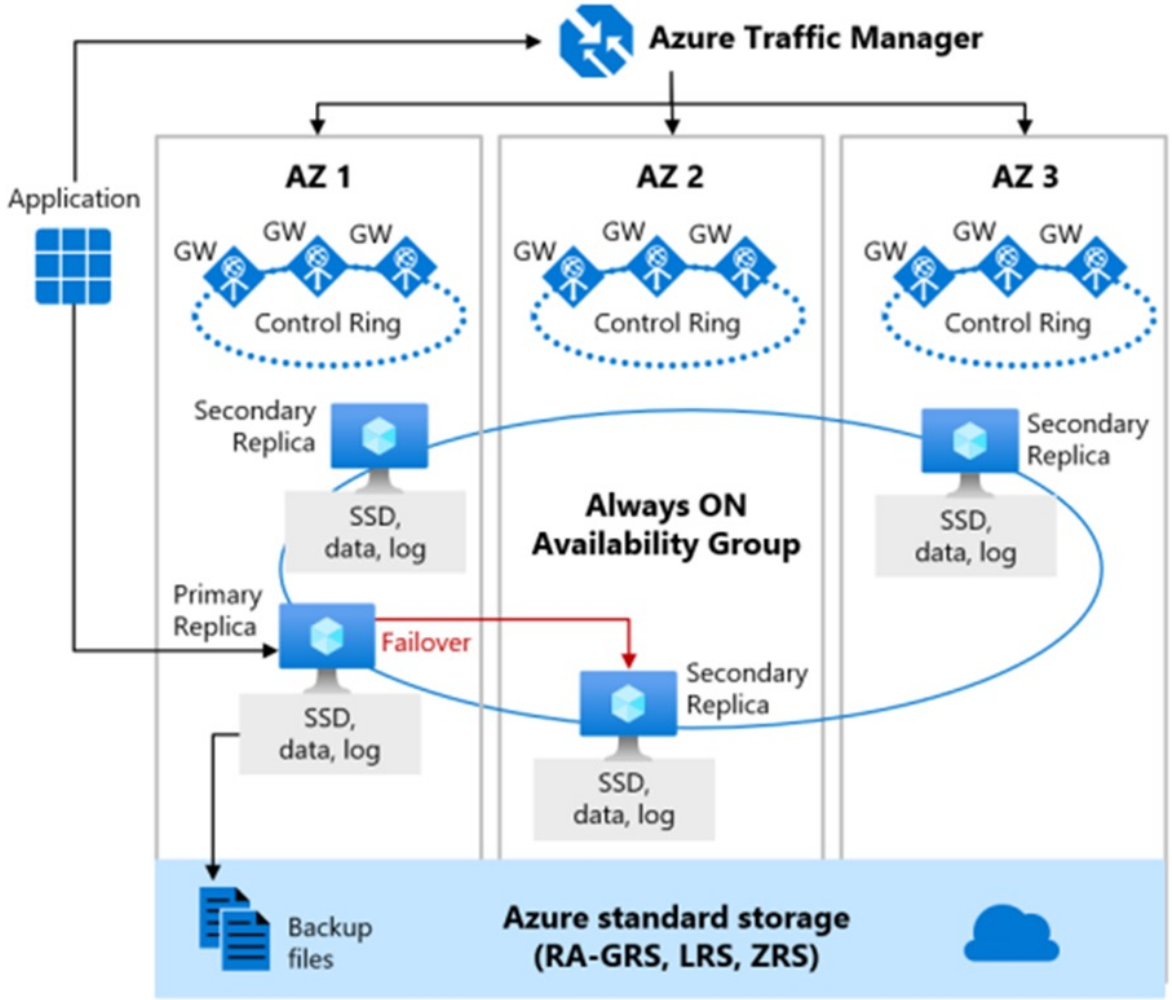
SQL DB/MI – Business Critical/Locally Redundant



- Protects against compute failure within a Region
- Storage is local to the compute
  - 1-2ms
- Availability Groups to replicate
- Readable secondaries
- More expensive, but higher performance
- ADR reduced failover time

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

SQL DB – Business Critical/Zone Redundant



- Only for SQL DB, not SQL MI
- Provides AZ level redundancy
- Availability Groups to replicate
- Azure Traffic Manager is used to send traffic to the Control Ring and Connection Gateways
- But… how do we get Zone redundant SQL MI?

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

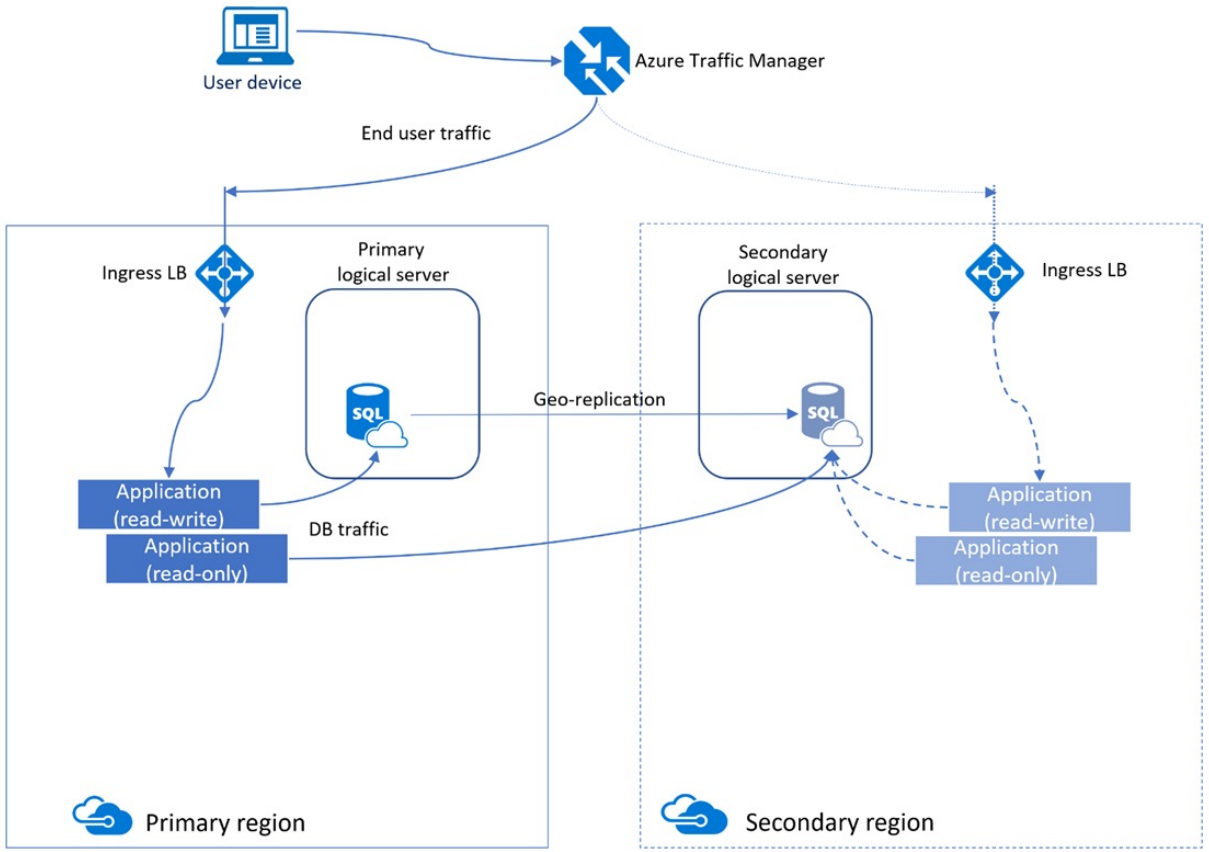
“AZ redundancy is great… but what if a Region fails?”

- Anthony E. Nocentino – PASS Summit 2021

Azure Infrastructure and Azure SQL

- Geo-Replication between Regions
- Auto-Failover Groups

SQL DB – Geo Replication



- Protects against Region failures
- Single database failover
- Only manual failover
- Asynchronous Availability Group to another Region
- Readable secondary
- Requires a connection string change after failover
- It's an entirely separate instance / server

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

Considerations for SQL DB Geo-Replication

- Planned failover can have no data loss
- Unplanned failover can have data loss since it's asynchronous
- Can be used between Subscriptions

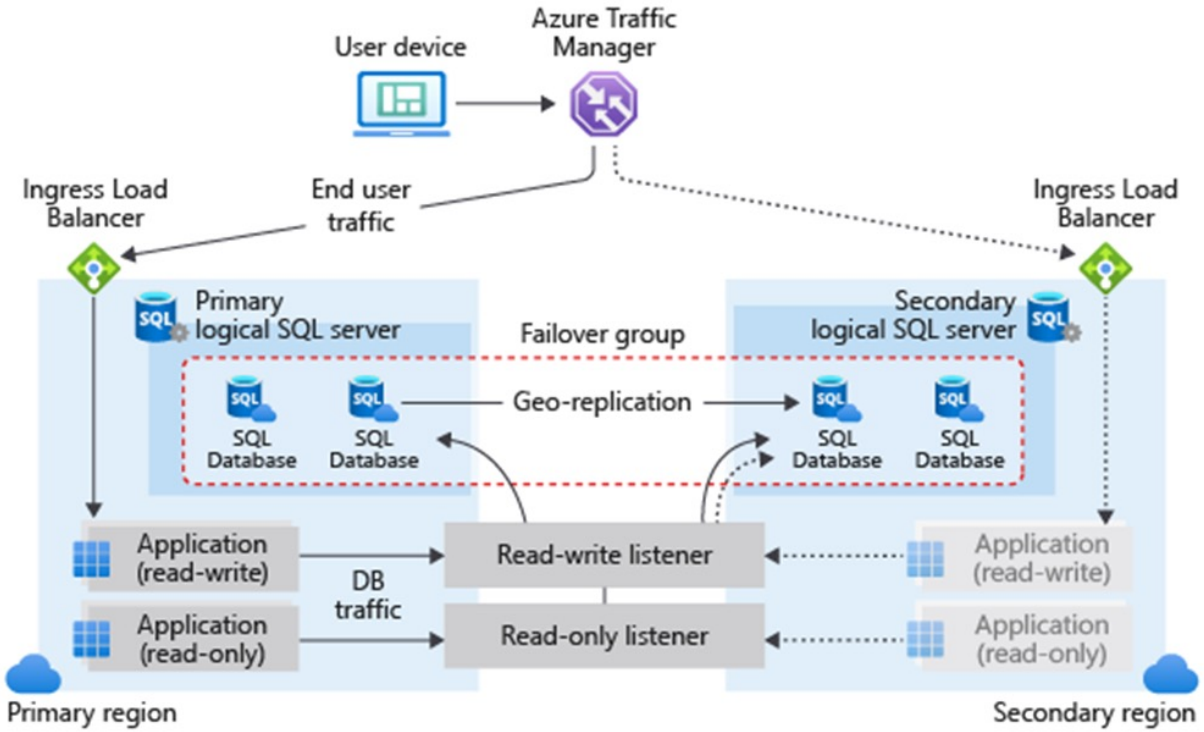
https://docs.microsoft.com/enus/azure/azure-sql/database/active-geo-replication-overview

Auto-Failover Groups – SQL DB and SQL MI

- Protects against the failure of a Region
- No connection string changes
- Readable secondaries
- Two listeners one for RW (Primary) one for RO (Geo-replicated) each with a dedicated DNS name
  - Listener DNS name format depends on the Service

https://docs.microsoft.com/enus/azure/azure-sql/database/auto-failover-group-overview?tabs=azurepowershell

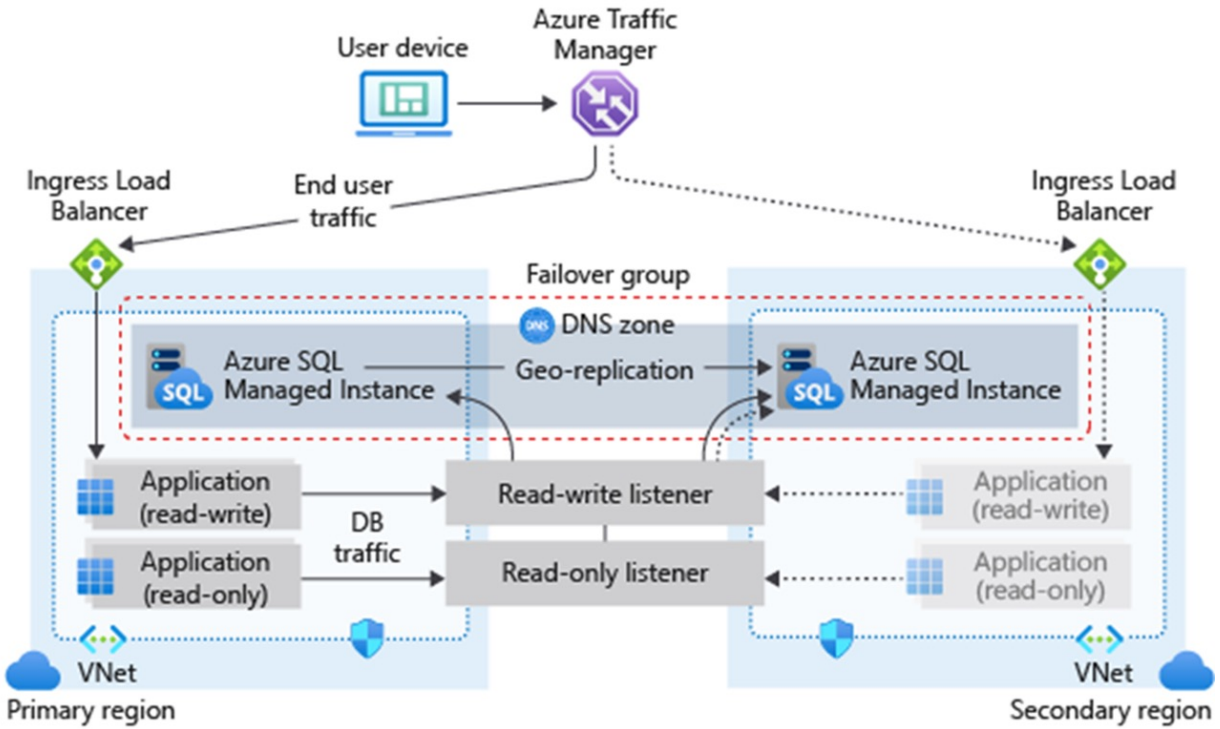
SQL DB – Failover Groups



- Server level enabling groups of databases to failover between Regions
- Asynchronous Availability Group to another Region
- Readable Secondaries

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

SQL MI – Failover Groups



- All user databases on the SQL MI
- VNet connectivity
  - VPN/ExpressRoute
- Use paired Regions for better performance
- Same Service Tier and storage size

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

Considerations for SQL DB and MI - FOGs

- Planned failover can have no data loss
- Unplanned failover can have data loss since it's asynchronous
- Automatic failover is possible based on a defined grace period, defaults to 1 hour
- Uses Azure Traffic Manager to send connections to the logical server or SQL MI
- Can be used between Subscriptions
- It's an entirely separate logical server or instance*

https://techcommunity.microsoft.com/t5/modernization-best-practices-and/azure-sql-managed-instance-sync-agent-jobs-and-logins-in/ba-p/2860495

SQL Server on Azure Virtual Machines

Availability Models for SQL Server on Azure VMs

- Backup and Restore
- Always On Availability Groups
- Always On Failover Cluster Instances
- Log Shipping
- SQL Server Backup and Restore with Azure Blob Storage
- Database Mirroring
- Azure Site Recovery
- HADR Best Practices – NETWORKING!!!!!!!

https://docs.microsoft.com/en-us/azure/azure-sql/virtual-machines/windows/hadr-cluster-best-practices

Backups

- Automated Backup
- Azure Backup for SQL VMs
- Manual Backup - DIY

https://docs.microsoft.com/en-us/azure/azure-sql/virtual-machines/windows/backup-restore

Understanding Application Resiliency

“No one cares about SQL Server being online… what they care about is getting access to the data”

- Anthony E. Nocentino – PASS Summit 2021

Application Access – Types of Errors

- Transient Errors
  - DNS – Time to Live (TTL)
  - Reconfiguration events and **should** last less than 60 seconds
  - Reconfiguration event, retry the connection

- Persistent Errors
  - Errors that will not go away
  - Configuration errors like misspelling a database name

https://docs.microsoft.com/en-us/azure/azure-sql/database/troubleshoot-common-errors-issues

Application Access – Retry Logic

- Use ADO.NET 4.6.2/.NET Framework 4.6.2 - retry logic is built in

- Implement retry logic in code
  - After a delay retry the command
  - After a delay retry the connection

- Use an exponential back-off
  - Start at 5 seconds, double backup up to 60 seconds.
- Code samples available at the link below

https://docs.microsoft.com/en-us/azure/azure-sql/database/troubleshoot-common-connectivity-issues

Demo

Review

- Azure SQL Services and Service Tiers
- High Availability Architectures
- Disaster Recovery Architectures
- Understanding Application Resiliency

Thank you

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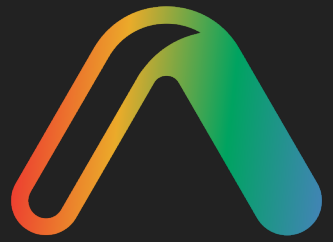

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