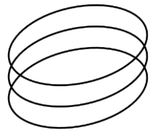
CLOUDMATE
Managed Service Expert



Level 100

Azure SQL database 의 Geo Replica 와 Managed Instance의 Failover group을 통한 CQRS 구현

김정우, 클라우드메이트 2023.03

Azure SQL database의 Geo Replica, 또는 Managed Instance의 Failover group을 통해 RW와 Readonly를 간편하게 구성할 수 있습니다.
WAS에서 Command는 ReadWrite로 요청하고, Query는 Readonly로 요청하여 CQRS 패턴을 구현합니다.

Table of Contents

CLOUDMATE
Managed Service Expert

CLOUDMATE
Managed Service Expert

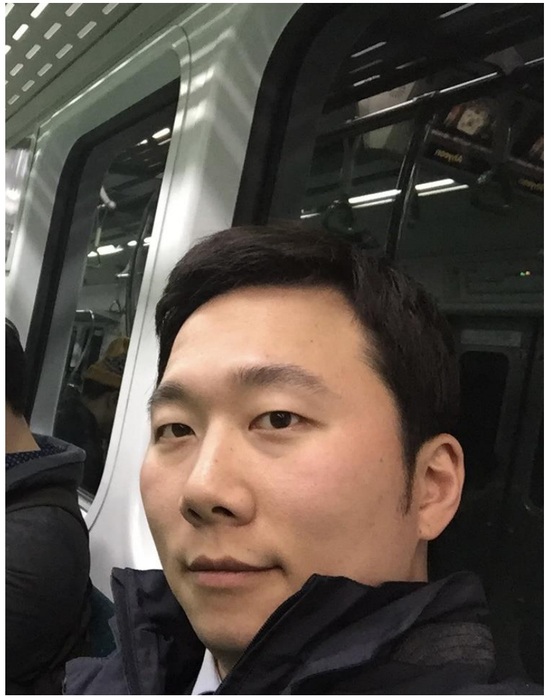
개발자 입니다.

김정우, Jungwoo (Jayden) Kim

rokag3@gmail.com

https://rokag3-gb.github.io/

Live demo 소스코드: https://github.com/rokag3-gb/PASS_Korea_seminar_2023_03



👨‍💻 주로 .NET을 사용하여 웹앱, 서버, 응용앱을 개발하고 그 애플리케이션이 서비스 목적을 달성하는지에 집중하고 있으며, 내부적으로는 Cloud Native 기반의 어플리케이션을 개발하고자 매진하고 있습니다.

2005 ~ 2009: 소규모 SI 회사에서 커리어 시작.
주로 영림원, LG CNS 프로젝트에 투입.
2009 ~ 2020: 모두투어 ERP 개발 및 유지 보수.
2020 ~ 현재: 클라우드메이트 서비스개발팀에서 다양한 애플리케이션 개발.

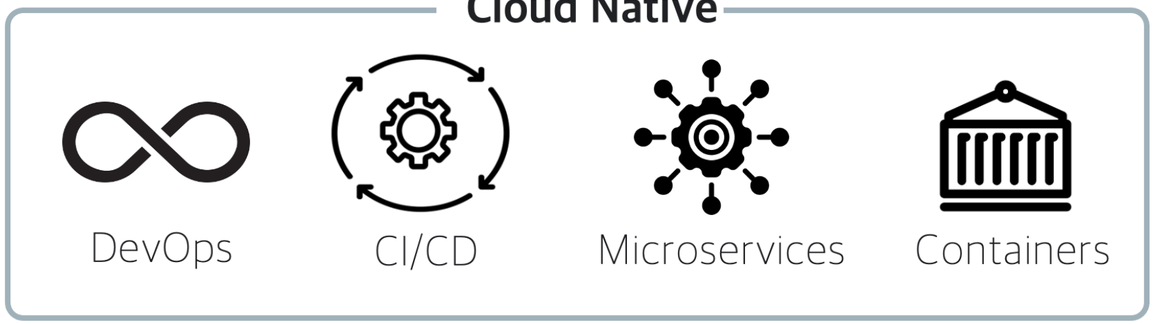
CLOUDMATE, Managed Service Expert

CLOUDMATE
Managed Service Expert

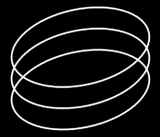
클라우드메이트는 매니지드 서비스 전문 기업(MSP)으로, 고객이 클라우드의 이점을 최대화하여 사용할 수 있도록 하는 **클라우드 네이티브**를 미션으로 가지고 있습니다.

다양한 클라우드 플랫폼 및 솔루션 파트너들과 협력해 고객이 목표로 하는 클라우드 환경을 구축하고 효율적인 운영이 가능하도록 컨설팅하고 있습니다.

비즈니스 모델 개발, 운영 프로세스 변화 등 클라우드에 대한 다양한 고객 니즈를 이해하고 성공적인 클라우드 도입을 위해 컨설팅과 마이그레이션을 수행하며, 이후 안정적인 클라우드 운영을 위한 매니지드 서비스와 교육 및 기술지원 서비스를 제공하고 있습니다.

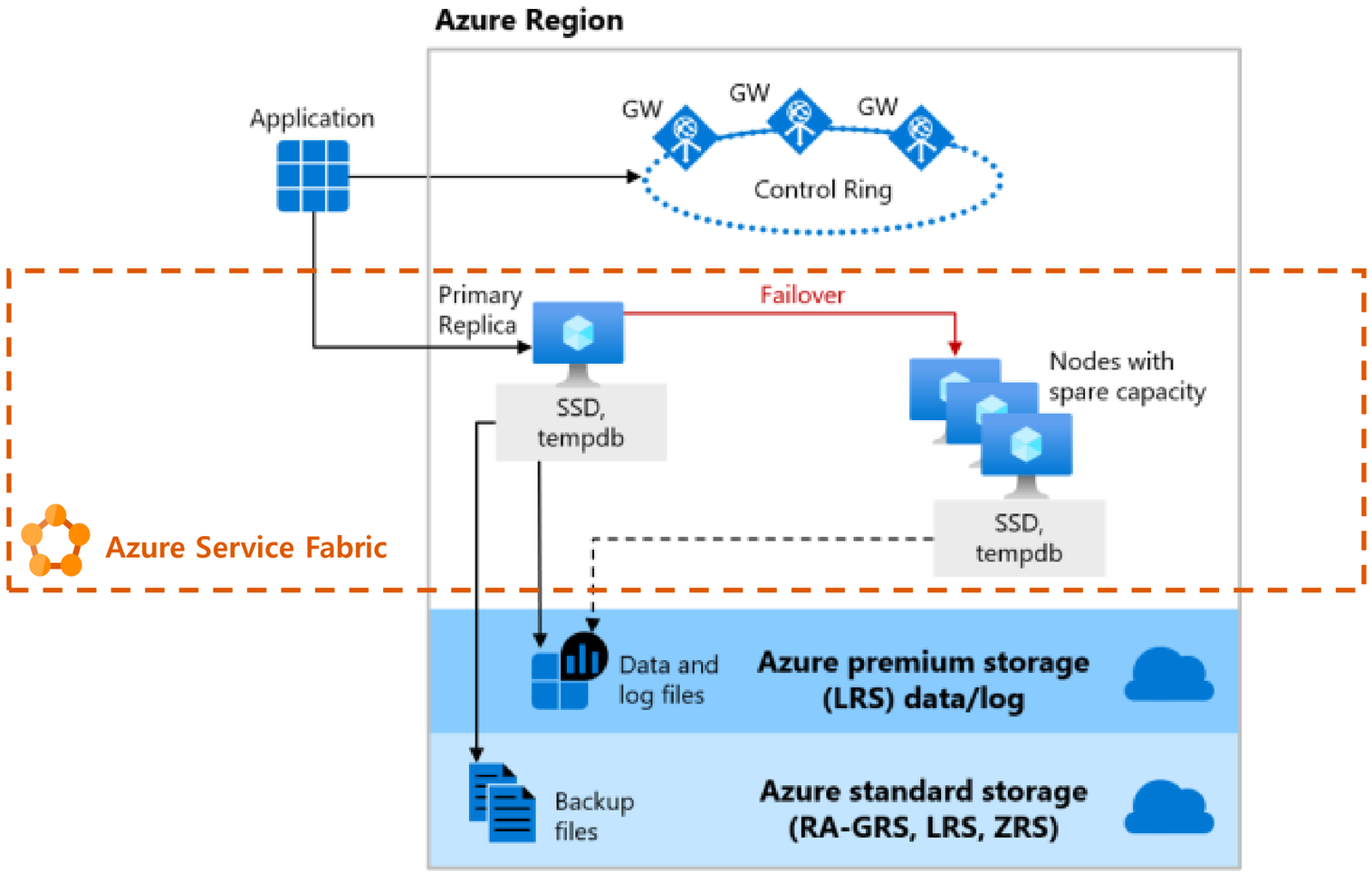


CLOUDMATE
Managed Service Expert

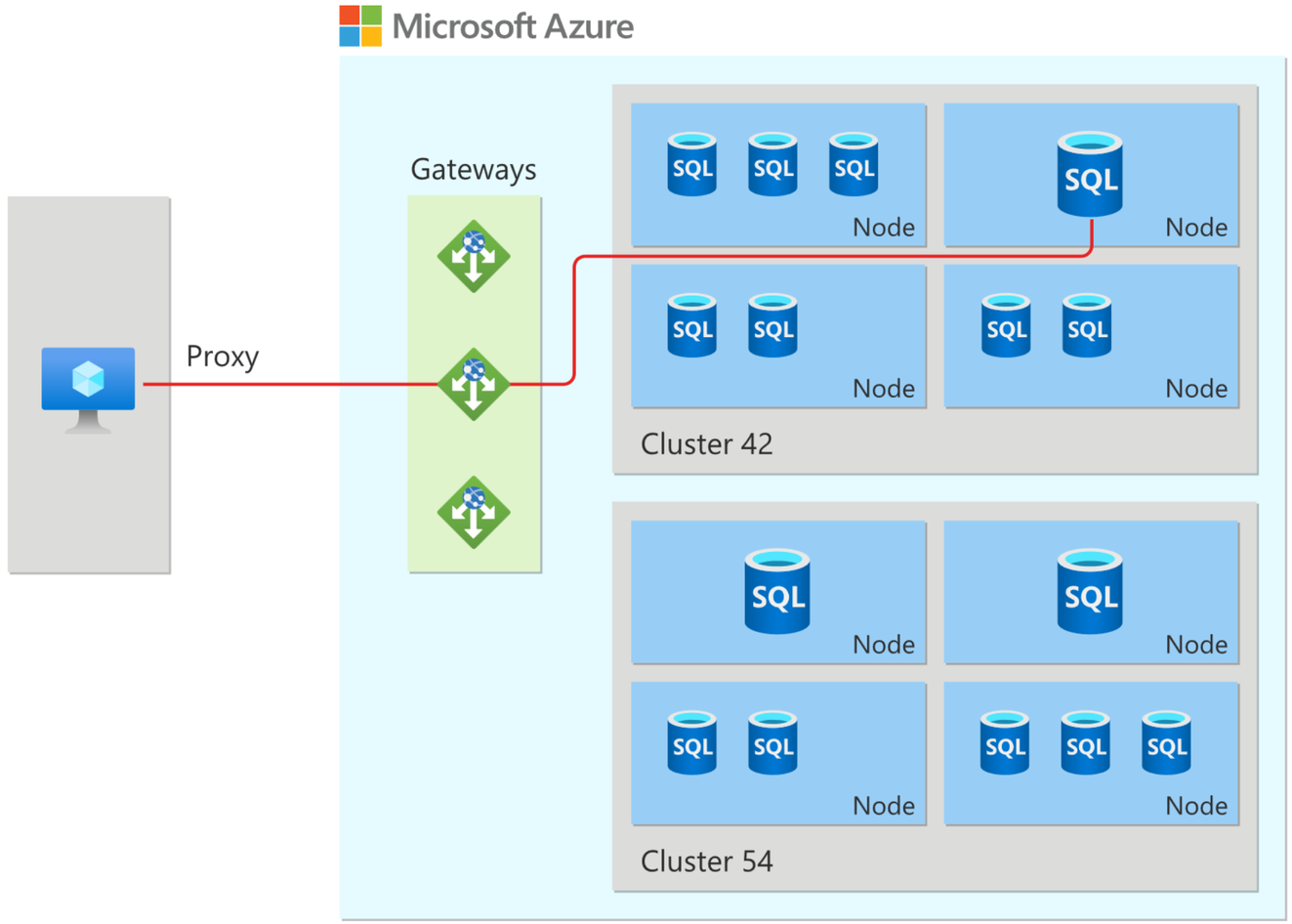


비즈니스 연속성을 위한 Azure SQL Database 및 SQL Managed Instance의 고가용성

Basic, Standard, and General Purpose service tier locally redundant availability



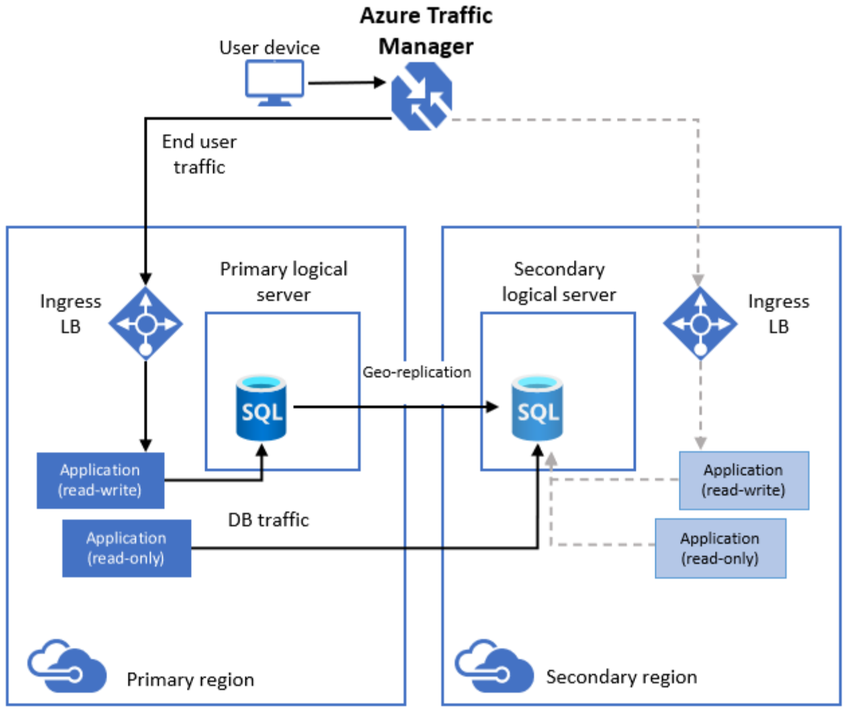
Azure SQL Database connectivity architecture



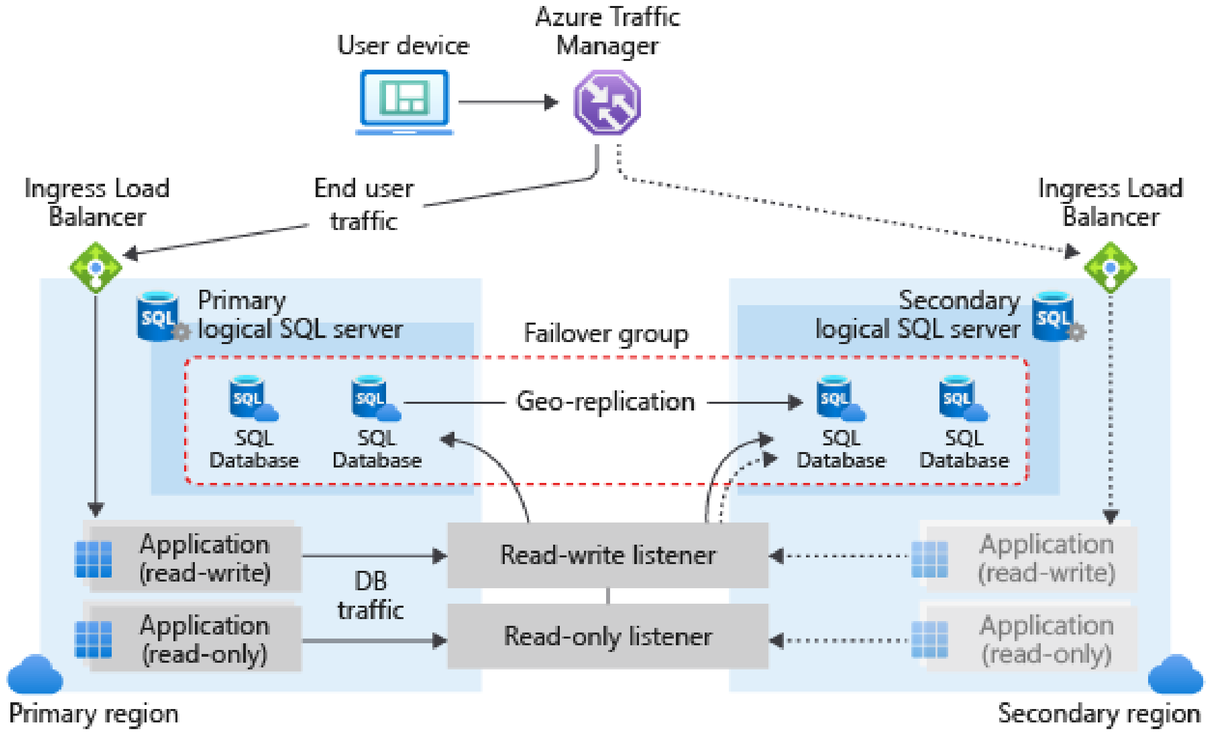
Azure SQL Database Geo Replica vs Failover groups

CLOUDMATE
Managed Service Expert

Geo Replication



Failover Groups



Azure SQL Database Geo Replica vs Failover group

CLOUDMATE
Managed Service Expert

Feature	Geo Replication	Failover Group
Asynchronous Replication	Yes	Yes
Update Connection String After Failover	Yes	No
Multiple Failover groups	No	Yes
Failover multiple databases at once	No	Yes
Secondary replica in the same region	Yes	No
Automatic Failover	No	Yes
Manual Failover		

안바꿔도 됩니다. 좋죠?

Use the read-write listener (primary)

For read-write workloads, use `<fog-name>.database.windows.net` as the server name in the connection string. Connections will be automatically directed to the primary. This name does not change after failover. Note the failover involves updating the DNS record so the client connections are redirected to the new primary only after the client DNS cache is refreshed. The time to live (TTL) of the primary and secondary listener DNS record is 30 seconds.

Source: https://learn.microsoft.com/en-us/azure/azure-sql/database/auto-failover-group-sql-db?view=azuresql&tabs=azure-powershell#using-read-write-listener-for-oltp-workload

Azure SQL Database Geo Replica vs Failover group

CLOUDMATE
Managed Service Expert

고가용성, 자동화된 패치, 자동 성능 조정 기능을 갖춘 완전관리형 RDBMS인 Azure SQL Database는 다음의 서비스 수준 계약(SLA)을 제공합니다.

RTO는 장애 후 서비스를 다시 사용할 수 있게 되는 시간입니다.
RPO는 장애 발생 시 예상되는 최대 데이터 손실입니다.

Recovery Method	Recovery Time Objective	Recovery Point Objective
Geo-Replication	30 sec	5 sec
Auto-Failover Groups	1 hr	5 sec

Service Level Agreement - Azure SQL Database

CLOUDMATE
Managed Service Expert

Additional Definitions:
"**Availability Zone**" is a fault-isolated area within an Azure region, providing redundant power, cooling, and networking.
"**Database**" means any Microsoft Azure SQL Database created in any of the Service tiers and deployed either as a single database or in an Elastic Pool.
"**Zone Redundant Deployment**" is a Database that is deployed across multiple Availability Zones.
"**Primary**" means any Database that has active geo-replication relationship with a Database in other Azure regions. Primary can process read and write requests from the application.
"**Secondary**" means any Database that maintains asynchronous geo-replication relationship with a Primary in another Azure region and can be used as a failover target. Secondary can process read-only requests from applications.
"**Compliant Secondary**" means any Secondary that is created with the same configuration and in the same service tier as the Primary. If the Secondary is created in an elastic pool, it is considered Compliant if both Primary and Secondary are created in elastic pools with matching configurations and with density not exceeding 250 databases for a compliant configuration.

Monthly Uptime Calculation and Service Levels for Azure SQL Database Service
"**Deployment Minutes**" is the total number of minutes that a given Database has been operational in Microsoft Azure during a billing month.
"**Maximum Available Minutes**" is the sum of all Deployment Minutes for a given Microsoft Azure subscription during a billing month.
Downtime: is the total accumulated Deployment Minutes across all Databases in a given Microsoft Azure subscription during which the Database is unavailable. A minute is considered unavailable for a given Database if all continuous attempts by Customer to establish a connection to the Database within the minute fail.
Monthly Uptime Percentage: for a given Database is calculated as Maximum Available Minutes less Downtime divided by Maximum Available Minutes in a billing month for a given Microsoft Azure subscription.
The Monthly Uptime Percentage is calculated using the following formula:

$$\frac{Maximum\ Available\ Minutes - Downtime}{Maximum\ Available\ Minutes} \times 100$$

The following Service Levels and Service Credits are applicable to Customer's use of the General Purpose, Business Critical or Premium tiers of the SQL Database Service configured for Zone Redundant Deployments:

Monthly Uptime Percentage	Service Credit
< 99.995%	10%
< 99%	25%
< 95%	100%

The following Service Levels and Service Credits are applicable to Customer's use of the Hyperscale, Business Critical, Premium or General Purpose, of the SQL Database Service not configured for Zone Redundant Deployments:

Monthly Uptime Percentage	Service Credit
< 99.99%	10%
< 99%	25%
< 95%	100%

The following Service Levels and Service Credits are applicable to Customer's use of the Basic or Standard tiers of the SQL Database

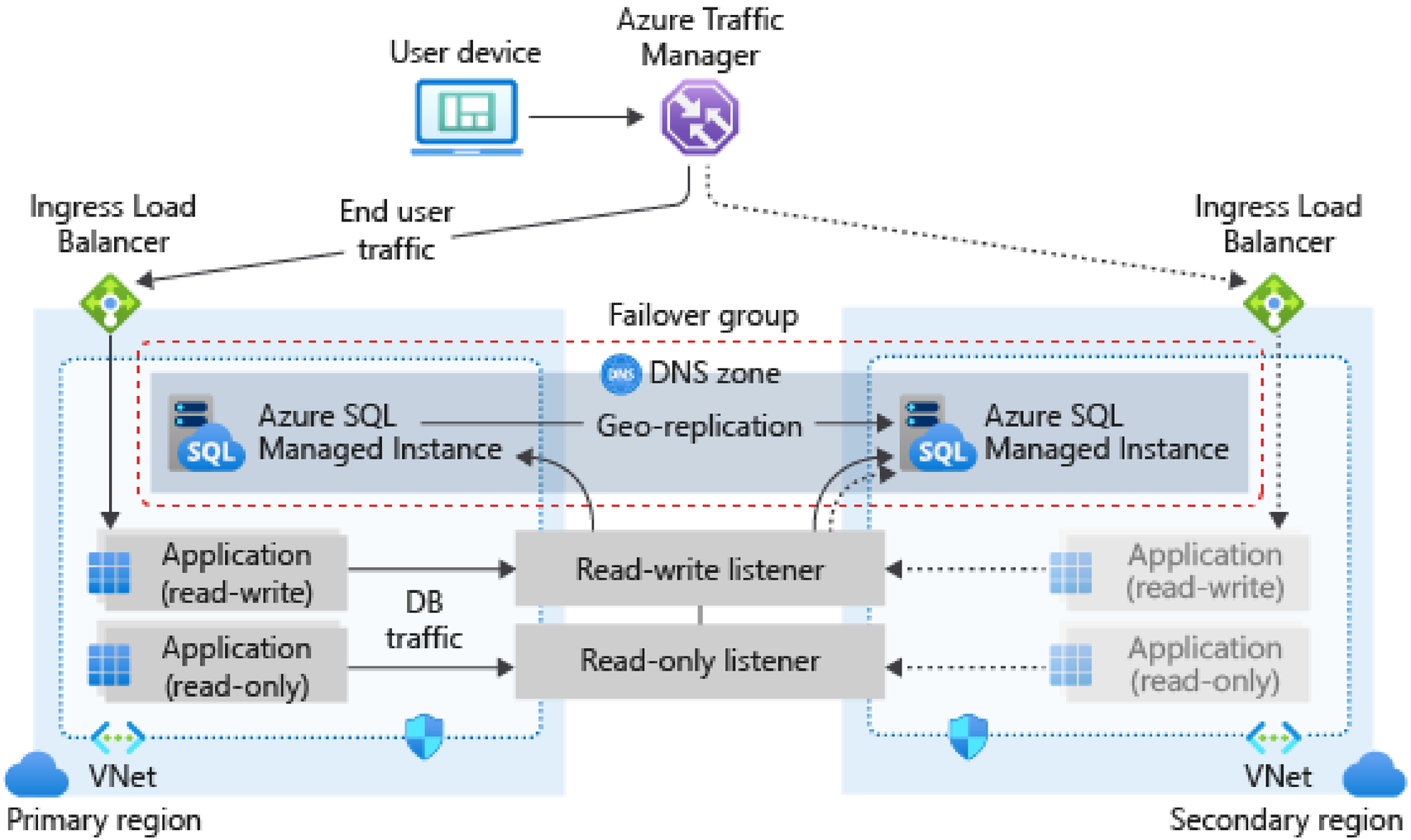
Monthly Uptime Percentage	Service Credit
< 99.99%	10%
< 99%	25%
< 95%	100%

SLA level of 99.99 % uptime/availability results in the following periods of allowed downtime/unavailability:

- **Daily:** 8.6s
- **Weekly:** 1m 0.48s
- **Monthly:** 4m 21s
- **Quarterly:** 13m 2.4s
- **Yearly:** 52m 9.8s

Source: https://uptime.is

Azure SQL Managed Instance Failover group



Service Level Agreement - Azure SQL Managed Instance

CLOUDMATE
Managed Service Expert

Additional Definitions

"**Instance**" means any Microsoft Azure SQL Managed Instance created in any of the Service tiers and deployed as a single instance.

"**Compliant Networking Configuration**" means full set of required configurations of the Microsoft Azure Virtual Network hosting Instance, including Microsoft Azure Network Security Group inbound security rules and mandatory Microsoft Azure User Defined Routes of Microsoft Azure Virtual Network Subnet hosting Instance, allowing uninterrupted flow of the management traffic and allowing data traffic to the dedicated gateway placed in the Microsoft Azure Virtual Network Subnet hosting Instance.

Monthly Uptime Calculation and Service Levels for Azure SQL Managed Instance Service

"**Deployment Minutes**" is the total number of minutes that a given Instance has been operational in Microsoft Azure during a billing month.

"**Maximum Available Minutes**" is the sum of all Deployment Minutes for a given Microsoft Azure subscription during a billing month.

"**Downtime**" is the total accumulated Deployment Minutes across all Instances in a given Microsoft Azure subscription during which the Instance is unavailable. A minute is considered unavailable for a given Instance if all continuous attempts by Customer to establish a connection to the Instance within the minute fail.

"**Monthly Uptime Percentage**" for a given Instance is calculated as Maximum Available Minutes less Downtime divided by Maximum Available Minutes in a billing month for a given Microsoft Azure subscription. Monthly Uptime Percentage is represented by the following formula:

$$\frac{Maximum\ Available\ Minutes - Downtime}{Maximum\ Available\ Minutes} \times 100$$

The following Service Levels and Service Credits are applicable to Customer's use of the Business Critical tier of the SQL Managed Instance Service with Compliant Network Configuration:

Monthly Uptime Percentage	Service Credit
< 99.99%	10%
< 99%	25%
< 95%	100%

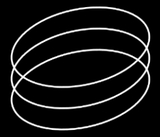
The following Service Levels and Service Credits are applicable to Customer's use of the General Purpose tier of the SQL Managed Instance Service with Compliant Networking Configuration:

Monthly Uptime Percentage	Service Credit
< 99.99%	10%
< 99%	25%
< 95%	100%

SLA level of 99.99 % uptime/availability results in the following periods of allowed downtime/unavailability:

- **Daily:** 8.6s
- **Weekly:** 1m 0.48s
- **Monthly:** 4m 21s
- **Quarterly:** 13m 2.4s
- **Yearly:** 52m 9.8s

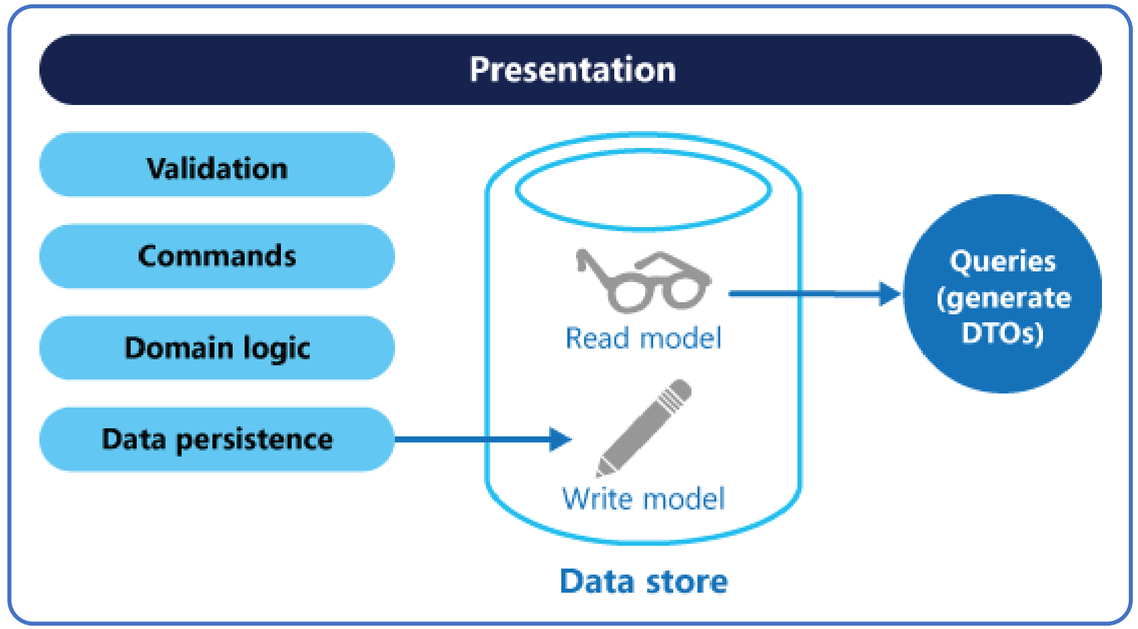
Source: https://uptime.is



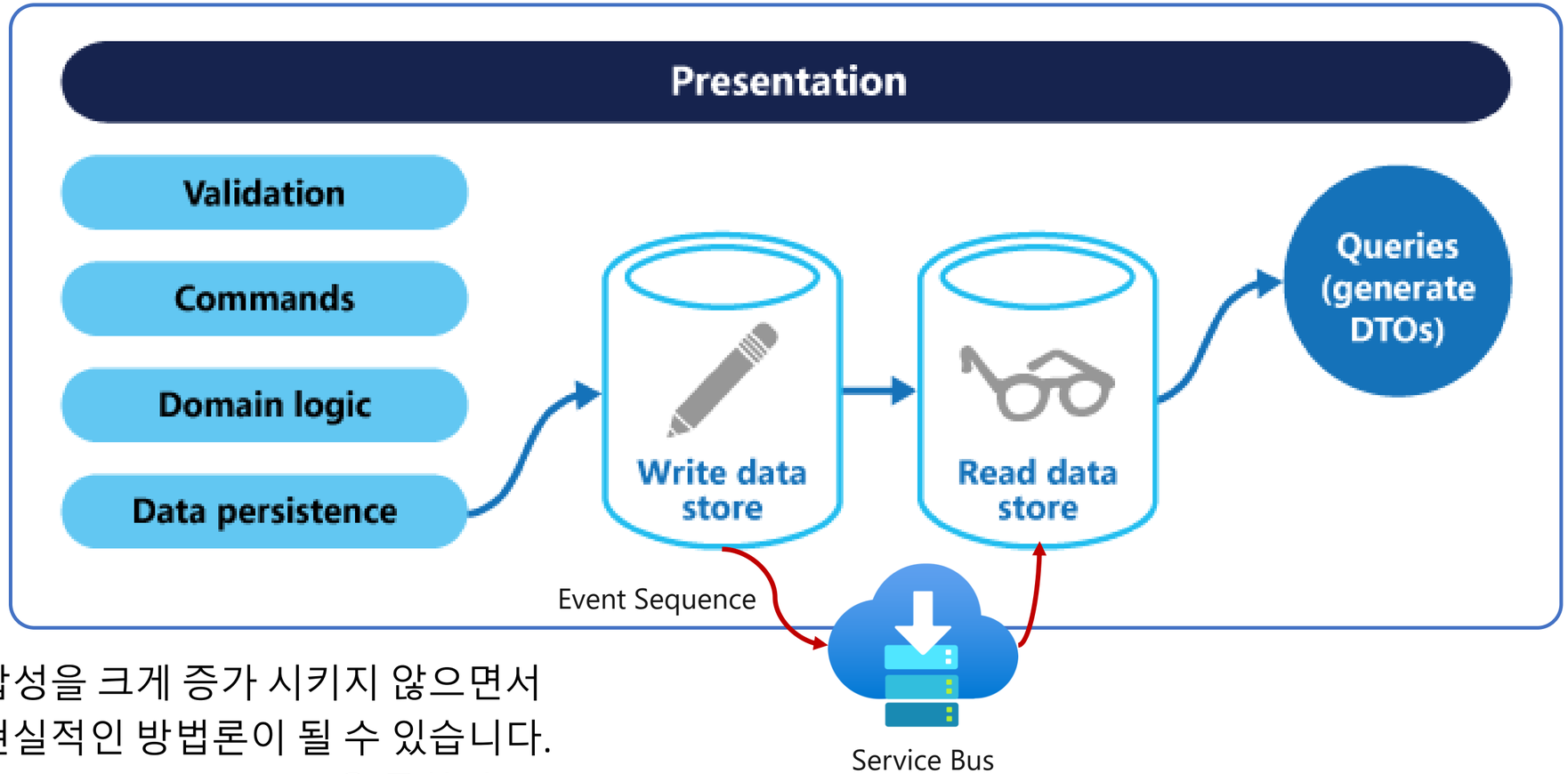
CQRS Pattern

CQRS Pattern

Command and Query Responsibility Segregation: CQRS는 데이터 저장소에 대한 읽기 및 업데이트 작업을 구분하는 패턴인 명령(command)과 쿼리(query)의 책임 분리를 의미합니다.



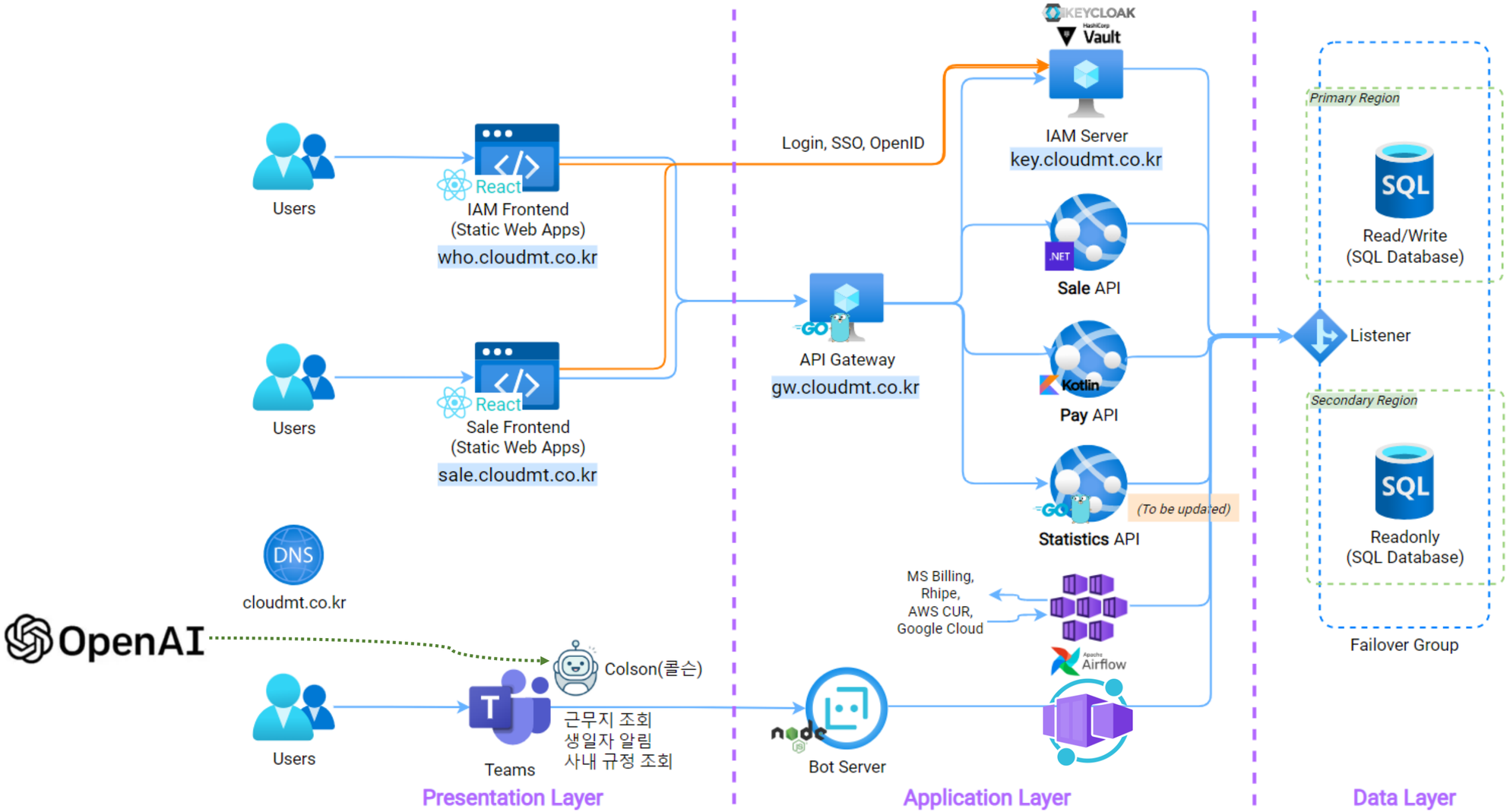
CQRS Pattern -> Event Sourcing Pattern

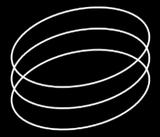


인프라의 복잡성을 크게 증가 시키지 않으면서
효과적이고 현실적인 방법론이 될 수 있습니다.
SQL Server의 Asynchronous commit을 통하여
CQRS pattern의 장점을 극대화할 수 있습니다.

Source: https://learn.microsoft.com/en-us/azure/architecture/patterns/cqrs

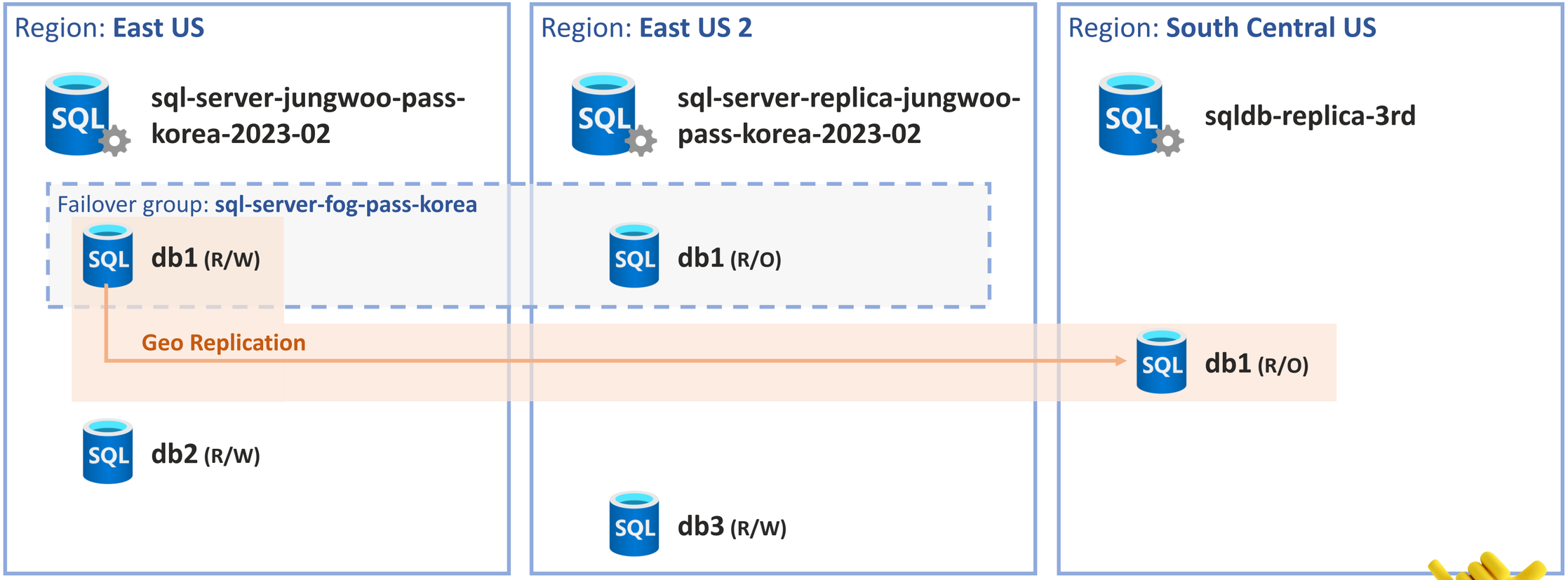
MicroService Architecture Basic Design



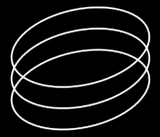


Azure SQL Database의 Geo Replica 및 Failover Group 구성 및 Live demo

Azure SQL Database의 Geo Replica 및 Failover Group 구성

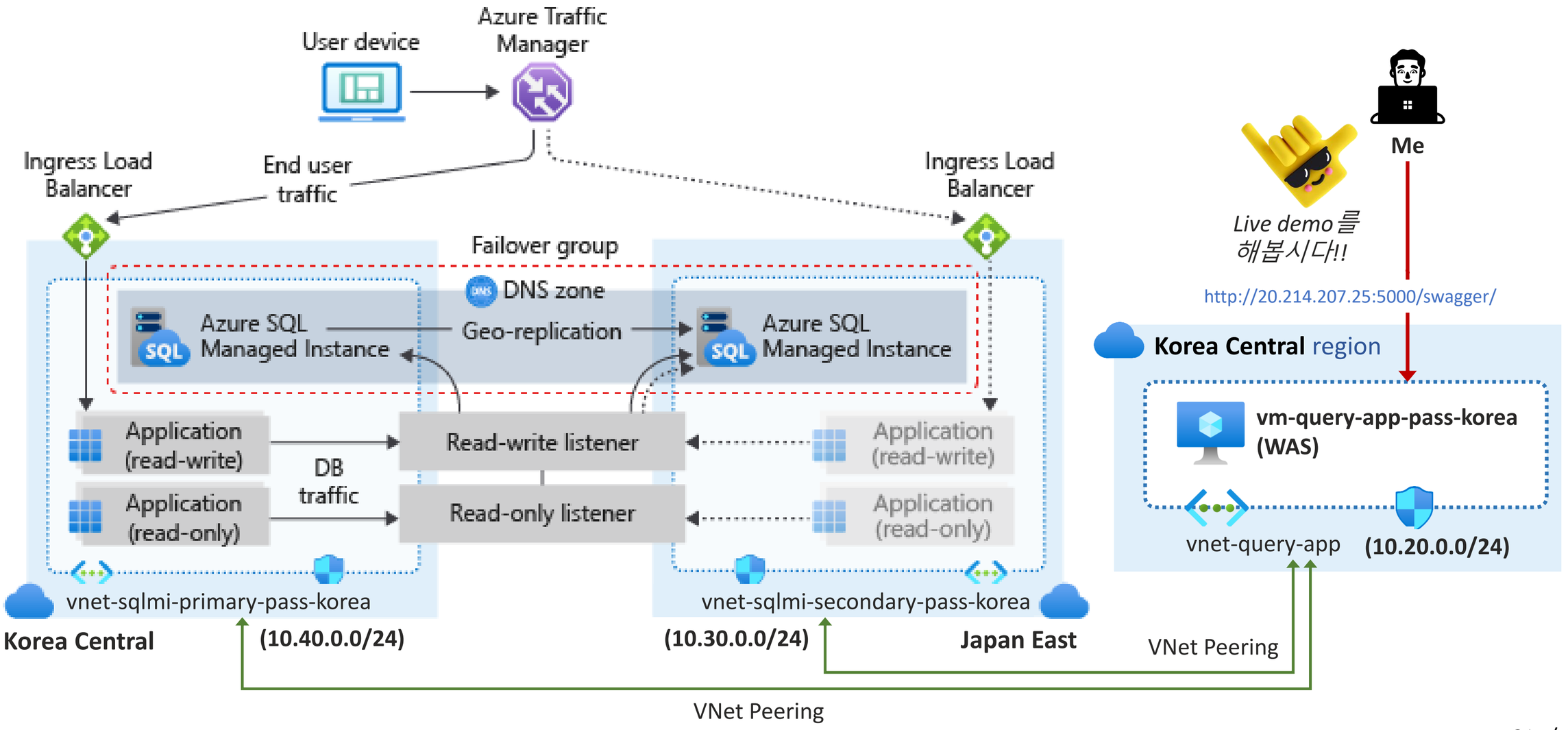


Azure Data Studio 에서 Live demo 를 해봅시다!!



Azure SQL Managed Instance의 Failover Group 구성 및 Live demo

Azure SQL Managed Instance의 Failover Group 구성



Insights

CLOUDMATE
Managed Service Expert

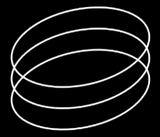
	SQL Database	SQL Managed Instance
Read/Write 또는 Readonly listener 에 접속이	외부망에서도 접속 가능함	MI가 속한 VNet과 통신이 되는 호스트에서만 접속 가능함
Failover 완료 이후 listener DNS 업데이트 여부	TTL 30초. 실제 failover 해보면 수신기 연결이 매끄러움	공식 자료 없음. 최대 5분 이후 DNS 캐시 초기화하면 정상 접속 가능해짐
Multiple Failover groups	가능	불가능

- SQL Managed Instance의 Failover group 생성 과정에서의 시행착오

2개의 인스턴스가 VNet 통신이 가능해야 하며, 그렇지 않으면 다음 에러를 만나게 됩니다.

Failover group creation failed because the primary server's replication traffic cannot reach the secondary server. Please verify that connectivity between the VNets of the primary and secondary managed servers has been established.

https://learn.microsoft.com/en-us/azure/azure-sql/managed-instance/connectivity-architecture-overview?view=azuresql&tabs=current#high-level-connectivity-architecture



Q&A

질문하지마요~

References

CLOUDMATE
Managed Service Expert

- High availability for Azure SQL Database and SQL Managed Instance - https://learn.microsoft.com/en-us/azure/azure-sql/database/high-availability-sla?view=azuresql&tabs=azure-powershell
- Service Level Agreements (SLA) for Online Services - https://www.microsoft.com/licensing/docs/view/Service-Level-Agreements-SLA-for-Online-Services?lang=19&year=2023
- Azure SQL Database and Azure Synapse Analytics connectivity architecture - https://learn.microsoft.com/en-us/azure/azure-sql/database/connectivity-architecture?view=azuresql
- Active geo-replication - https://learn.microsoft.com/ko-kr/azure/azure-sql/database/active-geo-replication-overview?view=azuresql
- **Auto-failover groups overview & best practices (Azure SQL Database)** - https://learn.microsoft.com/en-us/azure/azure-sql/database/auto-failover-group-sql-db?view=azuresql&tabs=azure-powershell
- **Auto-failover groups overview & best practices (Azure SQL Managed Instance)** > DNS Update – https://learn.Microsoft.com/en-us/azure/azure-sql/managed-instance/auto-failover-group-sql-mi?view=azuresql&tabs=azure-powershell#dns-update
- **Connectivity architecture for Azure SQL Managed Instance** - https://learn.microsoft.com/en-us/azure/azure-sql/managed-instance/connectivity-architecture-overview?view=azuresql&tabs=current#high-level-connectivity-architecture
- Azure Storage redundancy - https://learn.microsoft.com/ko-kr/azure/storage/common/storage-redundancy
- Azure SQL Managed Instance connection types - https://learn.microsoft.com/en-us/azure/azure-sql/managed-instance/connection-types-overview?view=azuresql
- Cloud Design Patterns > CQRS pattern - https://learn.microsoft.com/en-us/azure/architecture/patterns/cqrs
- **Azure SQL Stress Tool (Live demo source code repo)** - https://github.com/rokag3-gb/PASS_Korea_seminar_2023_03