Azure Data Services

- Azure SQL DB & Cosmos DB

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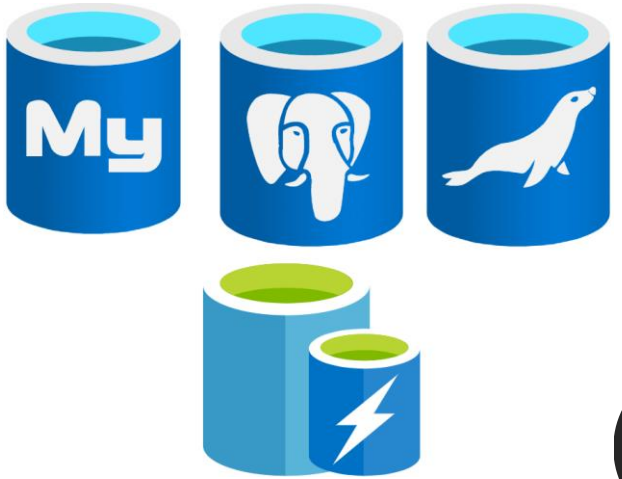
Agenda

- Types of Data
- Database Services in Azure
- Azure SQL DB Deployment options
- Azure SQL Database
- Azure Cosmos Database
- Demos
- Q&A



Types of Data

Structured data

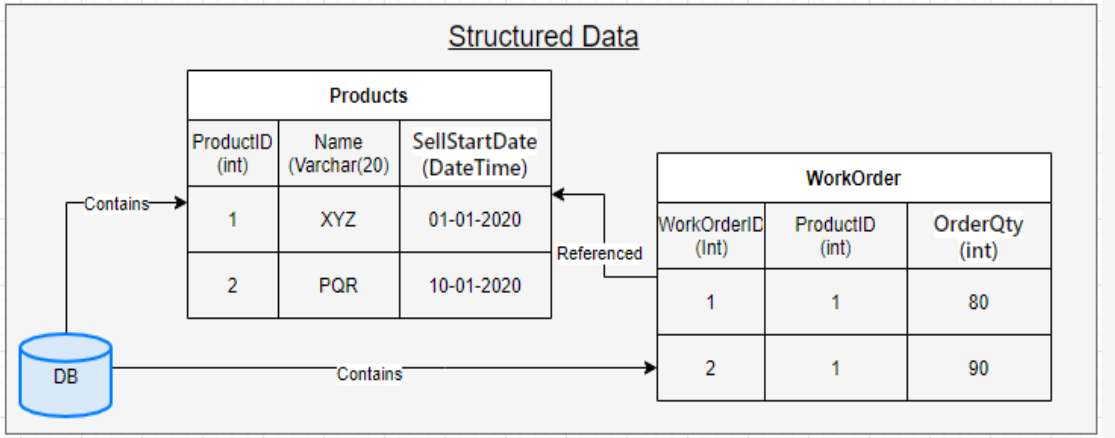
- Stick to schema
- Restriction on data to hold
- Stored in table with rows & columns
- Each row identified by Key
- Related Data between tables identified by Reference Key and also called "Relational data"

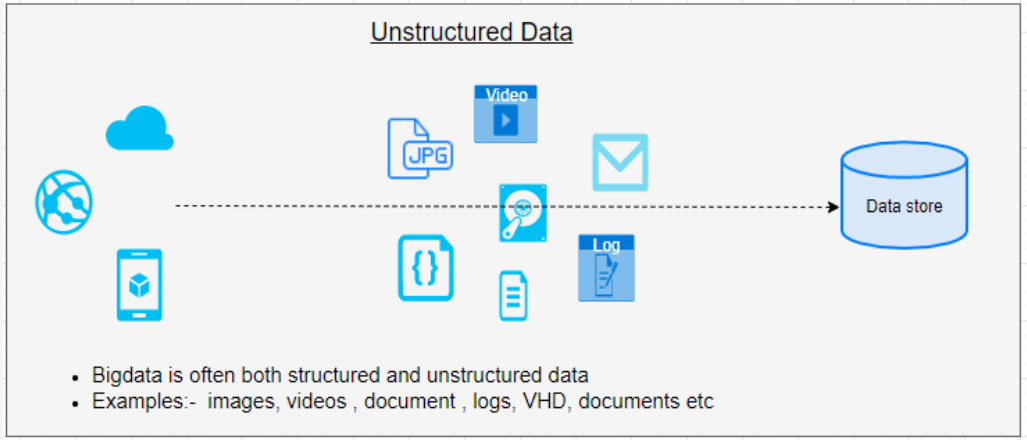
Unstructured data

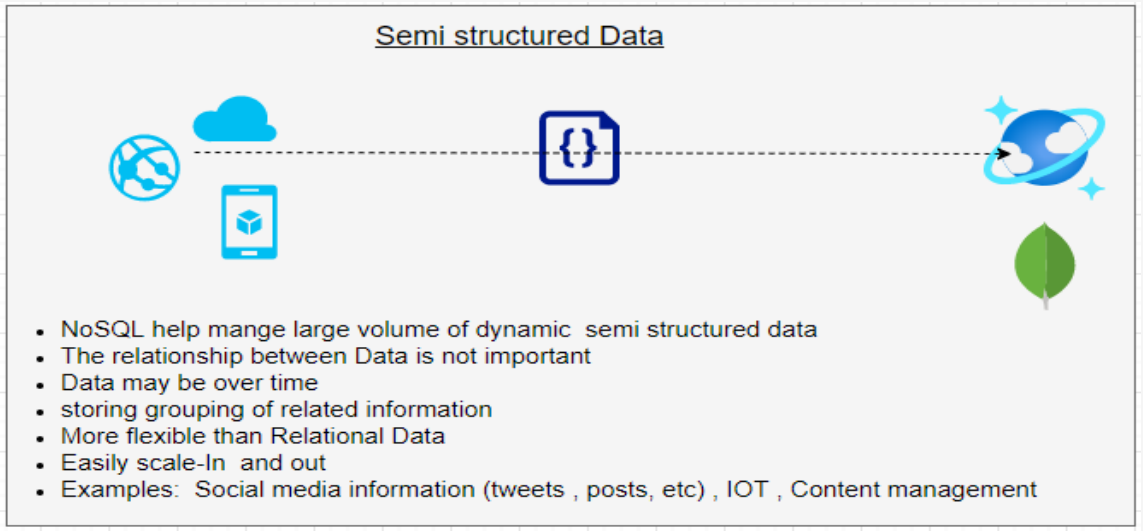
- Data is not Organized
- No restrictions on data to hold

Semi structured data

- not completely structured but somewhat organized
- Uses keys \tags to organize data
- represent in JSON document \ Key value pair
- Referred as NoSQL or Non-relational Data







Database services in Azure

Database Service	Use Case
SQL Server on Virtual Machines	Lift and Shift existing On-Premises SQL workloads to Azure to maintain complete SQL Server compatibility and operating system-level access
Azure SQL Managed Instance	Migrate existing SQL workloads to Azure complete SQL Server compatibility, Intelligent , scalable with all the benefits of a fully managed platform as a service
Azure SQL Database	Build modern cloud applications with up-to-date relational database service with serverless compute, hyperscale storage, high availability with SLA 99.995% and AI-powered and automated features to optimize performance, threat detection and durability
Azure Cosmos DB	Build applications with guaranteed low latency and high availability with SLA 99.999% anywhere, at any scale, or migrate Cassandra, MongoDB, and other NoSQL workloads to the cloud
Azure Cache for Redis	Build fast and scalable applications with an open-source-compatible in-memory data store to cache database query results ,static content and session state distributed way by using cache aside pattern
Azure Database for MySQL	Deliver high availability with SLA up to 99.99% and elastic scaling to open-source mobile and web apps with a managed community MySQL database service, or migrate existing MySQL workloads to the cloud
Azure Database for PostgreSQL	Build scalable, secure, and fully managed enterprise-ready apps on open-source PostgreSQL, scale out single-node PostgreSQL with high performance and availability up to 99.99% , or migrate existing PostgreSQL and Oracle workloads to the cloud
Azure Database for MariaDB	Deliver high availability with SLA up to 99.99% and elastic scaling to open-source mobile and web apps with a managed community MariaDB database service or migrate existing MariaDB Workloads
Azure Database Migration Service	This is DB migration tool which simplify , automate database migration to azure.

Reference: https://azure.microsoft.com/en-us/product-categories/databases/

Azure SQL

Relational Database-as-a- service

Azure SQL includes a range of products for hosting relational databases within Azure.

Deployment Options for Azure SQL

1. Azure SQL virtual machines
2. Azure SQL managed instances
3. Azure SQL Databases

What are the Primary Use case

- Build Applications with back end data repository
- Commonly used in Microsoft environments
- If need a fully managed SQL Database back-end

SQL Virtual Machine

- Full Administrative control over the sqlserver
- Best for initial migrations (Lift & shift)to cloud with OS level access
- Expansive SQL Server and OS version Support
- Automated Manageability features for SQL Server

SQL Managed Instances

- Intelligent, scalable cloud database service with all the benefits of a fully managed and platform as a service.
- Native Virtual network support
- Fully Managed service
- Enables frictionless migration for SQL workloads

Features

- Provide Latest stable SQL Server engine
- Managed automated backups
- Database monitoring and metrics
- Automatic software patching
- Multiple data files per database
- single log file per database
- SSIS is part of Azure Data factory PaaS

Pricing Model

support V-Core purchasing model (allow to change CPU, memory and Storage based on workload needs)

- **Gen 4** - Logical core based on Intel® E5-2673 v3 (Haswell), SSD , Physical cores , 7 GB Ram per core , Compute between 8-24 cores
- **Gen 5** - Logical cores based on Intel® E5-2673 v4 (Broadwell) 2.3 GHz. SSD , hyper threaded logical cores , 7 GB Ram per core , Compute between 8-24 cores

Azure SQL

Relational Database-as-a- service

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Deployment Options for Azure SQL

1. Azure SQL virtual machines
2. Azure SQL managed instances
3. Azure SQL Databases

SQL Databases

- Best suitable for modern cloud application
- Hyper scale storage up to 100 TB
- Server less Compute

Types of Resources

Single Database

- Hyper scale storage up to 100 TB
- Serverless compute
- Easy Management

Elastic Pool

- Cost effective solution for cost optimization
- Resource sharing between multiple database
- Simplified performance solution

Database Server

used to manage group of single database and elastic pools

- Access management
- Backup Management
- Business Continuity Management

Features for Azure SQL Database

- Uses Latest stable version of Microsoft SQL
- SQL elastic pools –economic resource sharing
- Serverless compute and Hyperscale storage
- Layers of protection , Intelligent threat protection
- Built-in AI for automatic performance tuning
- High Availability with SLA up to 99.995 %
- Failover Groups
- Geo-Replications
- Firewalls and virtual network support
- Dynamic data masking
- Transparent Data encryption at server
- Synch Groups
- Azure Search
- Create New Database or Migrate Existing Database using Microsoft Data Migration Service tool.

Azure SQL :Pricing

DTU Pricing

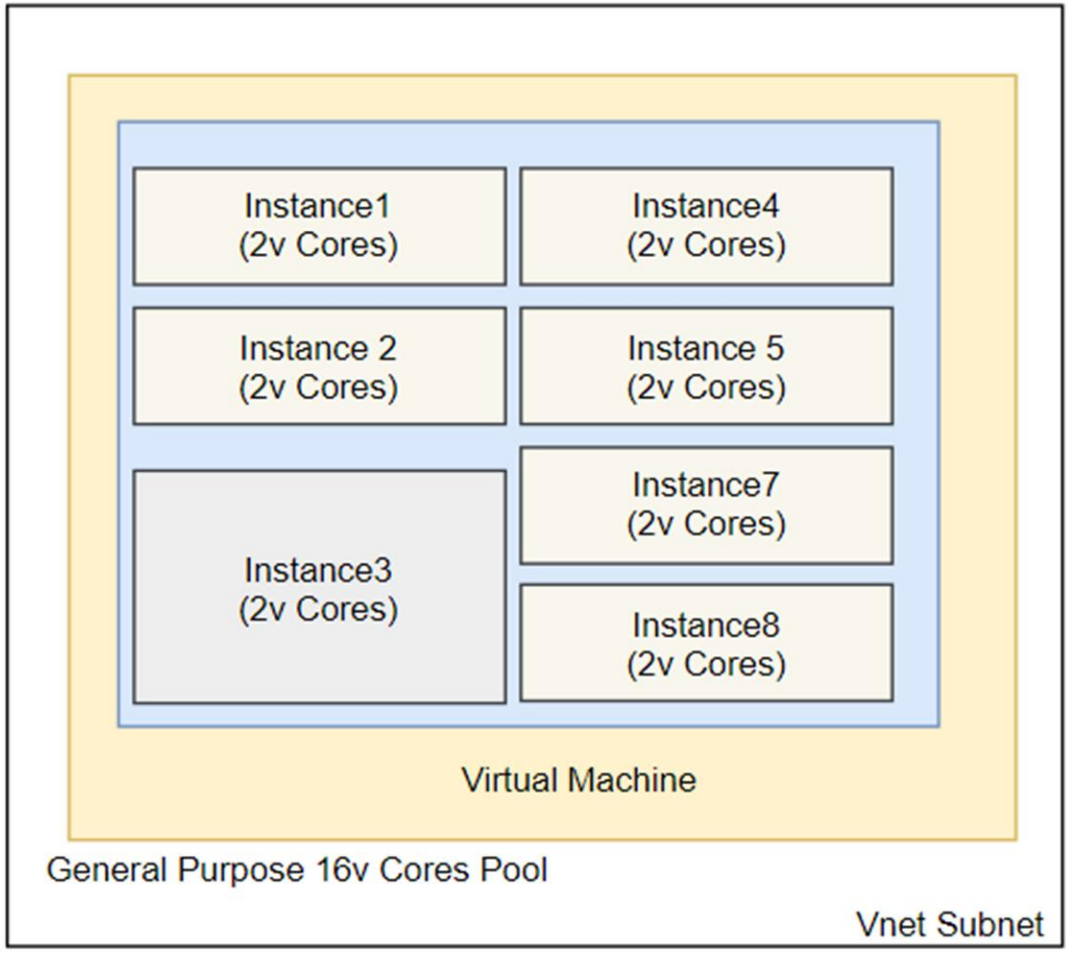
Pricing	CPU	IOPS	Latency	Storage	Backups	Use case
Basic	Low	5 DTU	5ms read 10ms read	DB <2 GB per pool <156 DB	7 days	Small database with single concurrent user
Standard	Low-High	10-100 DTU		DB <1 TB per pool <4 TB	35 days	Best for cloud apps with multiple operations
Premium	Med-High	100-800 DTU	2ms read 2ms read	DB <4 TB per pool < 4 TB		High transaction volumes Large no of users

vCore-based pricing

Pricing	Storage	Latency	Backups	Backups
General purpose	5 GB – 4 TB	5 -10 ms	7–35day backup 1 replica	Default option for most
Business Critical	5 GB – 4 TB	1-2 ms	7–35day backup 3 replicas , 1 read-scale backup	Business with I/O requirements
Hyperscale	Up to 100 TB	Flexible –fast storage	Near-instant backups and fast restores	Most workload and high scalable storage and fast restores

Reference: Service tiers - DTU-based purchase model - Azure SQL Database

SQL MI - Instance Pool



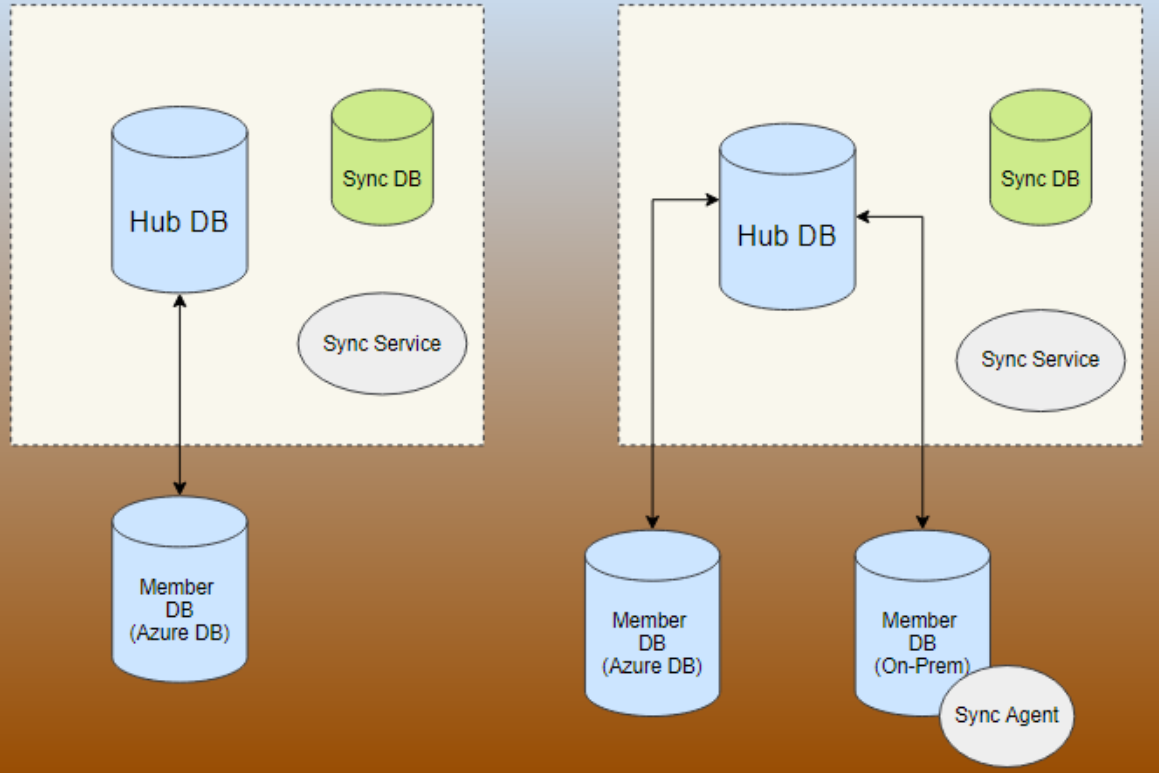
1 Instance pool

- Instance pools is a new managed instance option for cost-effective way to migrate smaller instances to the cloud at scale,
- Reduce extra work of consolidating less compute-intensive workloads.
- Allow scaling compute and storage independently.
- Customers pay for compute associated with the pool resource measured in cores, and storage associated with every instance measured in gigabytes
- the first 32 GB are free of charge for every instance

Key Benefits

1. Ability to host 2-vCore instances. **Only for instances in the instance pools*.
2. Predictable and fast instance deployment
3. Minimal IP address collections

Sync Groups In Azure SQL



A sync group is a group of databases that you want to synchronize.

- Data Sync service built on Azure SQLDB
- it uses a hub and spoke topology to synchronize data
- Hub Database Should be an Azure SQL Database.
- The member databases can be either databases in Azure SQL Database or in instances of SQL Server.
- Sync Metadata Database contains the metadata and log for Data Sync and

  The Sync Metadata Database should be Azure SQL Database located in the same region as the Hub Database. it should be not be deleted while sync group or sync agent exists

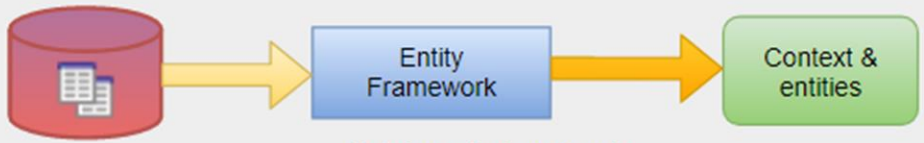
Use Cases

- Hybrid Data Synchronization
- Distributed Application
- Globally Distributed Application

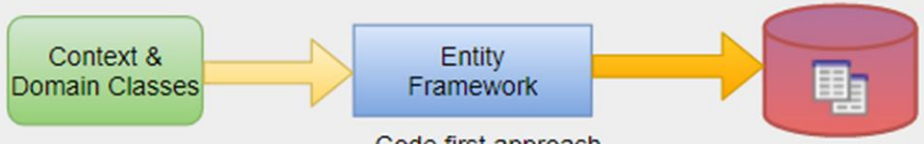
Entity Framework Core

- Unified ORM framework for all kind of data bases
- Supported for all kind of .NET applications.
- Simplifies building Data layers quickly regardless of databases.

Entity Framework Core



Database first approach



Code first approach

- Entity Framework Core is the version of Entity Framework after EF 6.x.
- Open-source, lightweight, extensible and a cross-platform version of Entity Framework data access technology.
- An Object/Relational Mapping (O/RM) framework.
- EF Core is used with .NET Core applications. , it can also be used with standard .NET 4.5+ framework based applications.

- Database first approach : Generate Data access classed from existing Database
- Code first approach : Write entities and add migration and update Database using coded Entities.

- Microsoft.EntityFrameworkCore
- Microsoft.EntityFrameworkCore.Design

Entity framework Core uses Provider model to access many different databases

- SQLServer - Microsoft.EntityFrameworkCore.SqlServer
- MySQL - MySql.Data.EntityFrameworkCore
- PostgreSQL - Npgsql.EntityFrameworkCore.PostgreSQL
- SQLite - Microsoft.EntityFrameworkCore.SQLite
- SQLCompact - EntityFrameworkCore.SqlServerCompact40
- In-memory - Microsoft.EntityFrameworkCore.InMemory
- Cosmos - Microsoft.EntityFrameworkCore.Cosmos

Demo

Azure SQL Workloads

Demo

Access Azure SQL Workloads using Entity Framework Core Packages

Cosmos DB

- Globally Distributed database
- Supports schema-less data
- Highly responsive with constantly changing data
- Multi model & multi master
- Designed for massive scale out
- Suitable for No SQL data
- Integration with Azure Function
- Azure Cognitive Search
- Serverless model without resource planning in advance
- Enterprise-grade security
- Encrypted at rest & transit
- Automatic Indexing

Cosmos DB API Options & Consistency levels

- SQL (Core)
- Cassandra
- MongoDB
- Gremlin
- Table

Consistency	Details
Strong	Guaranteed write operation only committed and visible on the primary after it has been committed and confirmed by all replicas.
Bounded Staleness	Allows to configure how stale docs can be within replicas; staleness means the quantity or version count a replica document can be behind a primary document.
Session	Guarantees that all read and write operations are consistent within a user session.
Consistent Prefix	Guarantees read changes in the order that matches the sequence of the corresponding writes.
Eventual	Offers looser consistency and commits and write operations against the primary immediately. Replica transactions are asynchronously handled and will eventually be consistent with the primary.

Cosmos DB :Pricing

- Operation of Cosmos DB measures in Request Unit (RU) and billed per hour
- Storage billed in GB by SSD . Two backup copies are free & additional copies are charged in GB of data stored.

- There are mainly two types of pricing model
  - ❖ Provisioned Throughput
    - ❖ Standard
      - Guaranteed low latency and high availability with SLA 99.9999 %
      - Single digit milliseconds reads and writes
      - ideal for large & Critical workloads
      - starting minimum 400 RU/sec
    - ❖ Autoscale
      -No need to manually manage capacity of large & critical workloads (Additional feature over standard throughput)
      - Custom throughput limit starting 4000 RU/sec
  - ❖ Serverless
    - Eliminates over-provision the database infrastructure
- Save up to 65% of billing cost with reserved capacity
- Save up to 70% of billing cost with TCO

Reference: RU -based on Pricing model - Azure Cosmos DB

Cosmos DB Capacity calculator

Cosmos DB :Tools

Cosmos DB Emulator

- Emulates the Azure Cosmos DB service to develop and test application locally with out Azure Subscription
- Can provide docker support as well
- Supports same functionality as the azure cosmos DB
  - Provisioning database, containers , scaling containers , querying data , execute stored procedures , triggers

Limitations :-

- only support SQL API client only and not support other mode
- emulator doesn't support multi-region replication
- Limitations on Scaling RU/sec

Cosmos DB Data Migration tool

- Open-source project to migrate documents to cosmos DB
- used to migrate documents(local \storage account etc.) to Cosmos DB Emulator and Azure Cosmos DB Service

- Also, Integration with VS code and Visual studio.

Demo

No SQL workloads using Cosmos DB

Demo

Cosmos Emulator and Migration tool to Cosmos

Demo

Accessing Cosmos DB data using Cosmos DB using Entity framework core

Demo

Accessing Cosmos DB data using Cosmos DB using Microsoft.Azure.Cosmos

Third-Party Managed Databases in Azure

- Azure Database for MySQL
- Azure Database for PostgreSQL
- Azure Database for MariaDB

Managed Database Options

- Build-in high availability with SLA up to 99.99%
- Auto-scaling
- Encrypt at rest and in –transit
- Automatic backups with 35 days retention period
- Pay as you go
- High predictable performance

Demo

Third party Managed Database workloads

Demo

Third party Managed Database workloads using Entity framework core