Microsoft

# DP-300
# Administering Microsoft Azure SQL Solutions

# Course Outline

- Introduction to Azure Database Administration
- Plan and implement data platform resources
- Implement a secure environment
- Monitor and optimize operational resources
- Optimize query performance
- Automate database tasks
- Plan and implement a high availability and disaster recovery environment

Microsoft

# Introduction to Azure Database Administration

Introduction to Azure Data Platform

# Objectives

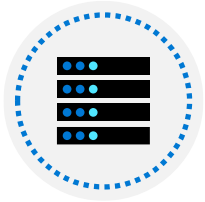
- Understand the role of Azure Database Administrator as it fits in with other data platform roles
- Describe the key differences between the SQL Server-based database options in Azure
- Describe main features available on Azure SQL offerings

# Prerequisites:

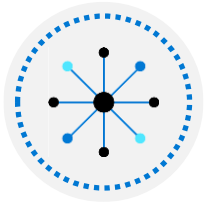
Students attending this course or taking this exam should have a solid understanding of the principals of SQL Server Database Administration, and a beginner level knowledge of the Azure Data Platform options, including Azure SQL Database, Azure SQL Managed Instance, and SQL Server on Azure Virtual Machines.

# Prepare to Maintain SQL Databases on Azure

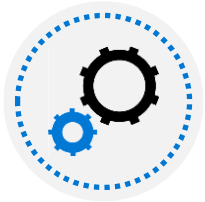
# Objectives



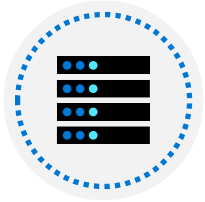
Describe Microsoft Intelligent Data Platform roles



Understand SQL Server in an Azure virtual machine



Design Azure SQL Database for cloud-native applications



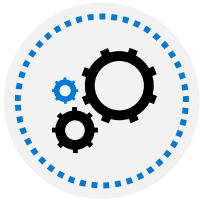
Explore Azure SQL Managed Instance

# Azure Database Administrator

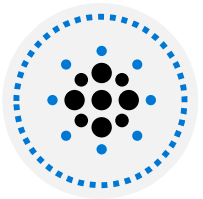
**Azure Database Administrator:**

The Azure Database Administrator implements and manages the operational aspects of cloud-native and hybrid data platform solutions built on Microsoft Azure data services and Microsoft SQL Server

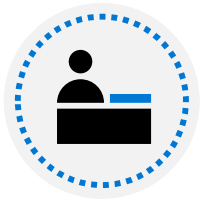
# Other Azure Data Platform Roles



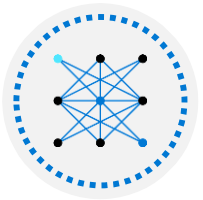
Azure Data Engineer



Azure Data Scientist

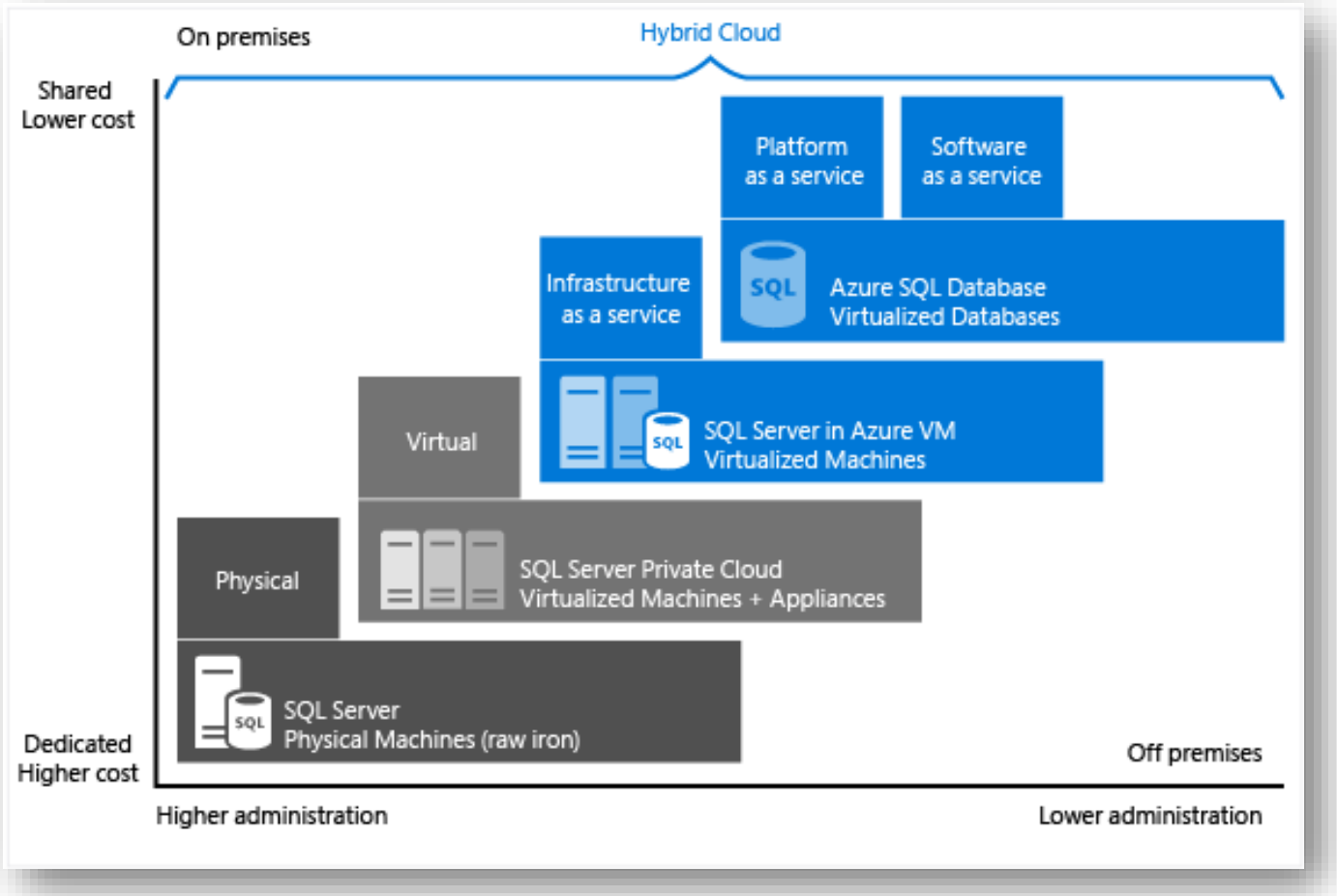


Azure Data Analyst



Azure Artificial Intelligence Engineer

# Azure SQL platform



# SQL Server on Azure Virtual Machine

# SQL Server on Azure Virtual Machine

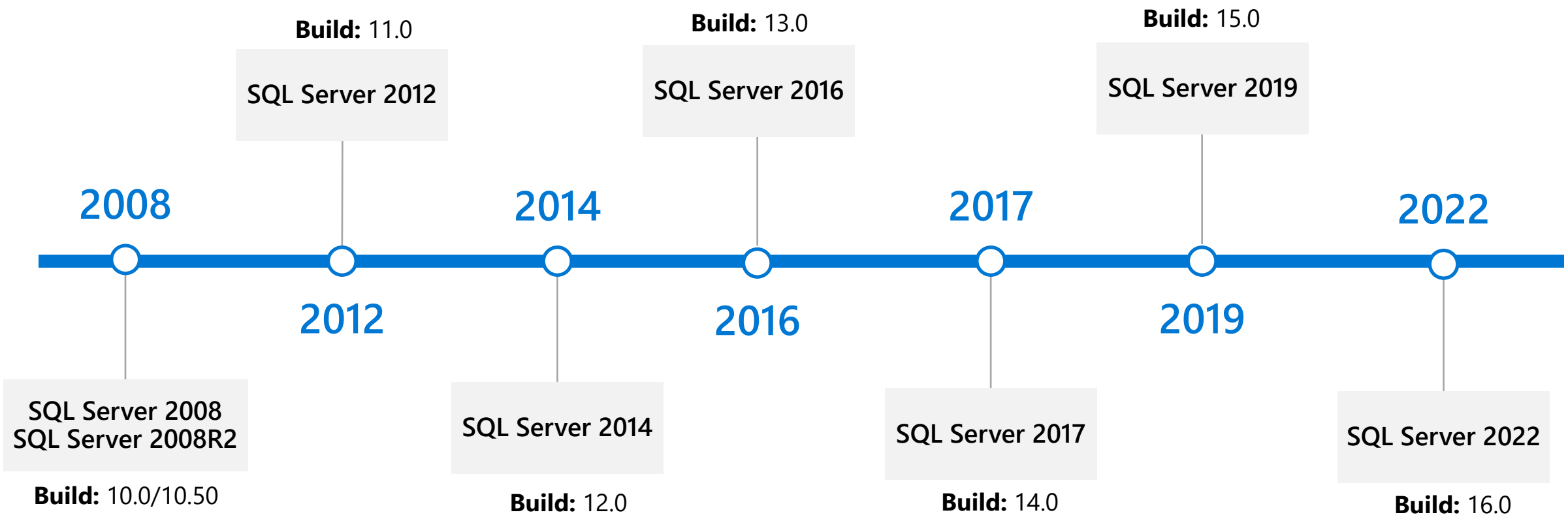
Gives you a wide range of computing power and RAM

Provides flexibility for applications that may have dependency on specific versions of SQL Server

**Allows you to run additional SQL Server services like** :

- Analysis Services
- Reporting Services
- Machine Learning Services
- Integration Services alongside database engine

# SQL Server versions available



# Backup solutions

In recent releases of SQL Server, Microsoft has introduced several features to support running SQL Server in an Azure virtual machine.

## Automated Backup

Allows you to schedule regular backups for all databases on a SQL Server VM

## Azure Backup

Complete enterprise backup solution that automatically handles your backups across your infrastructure

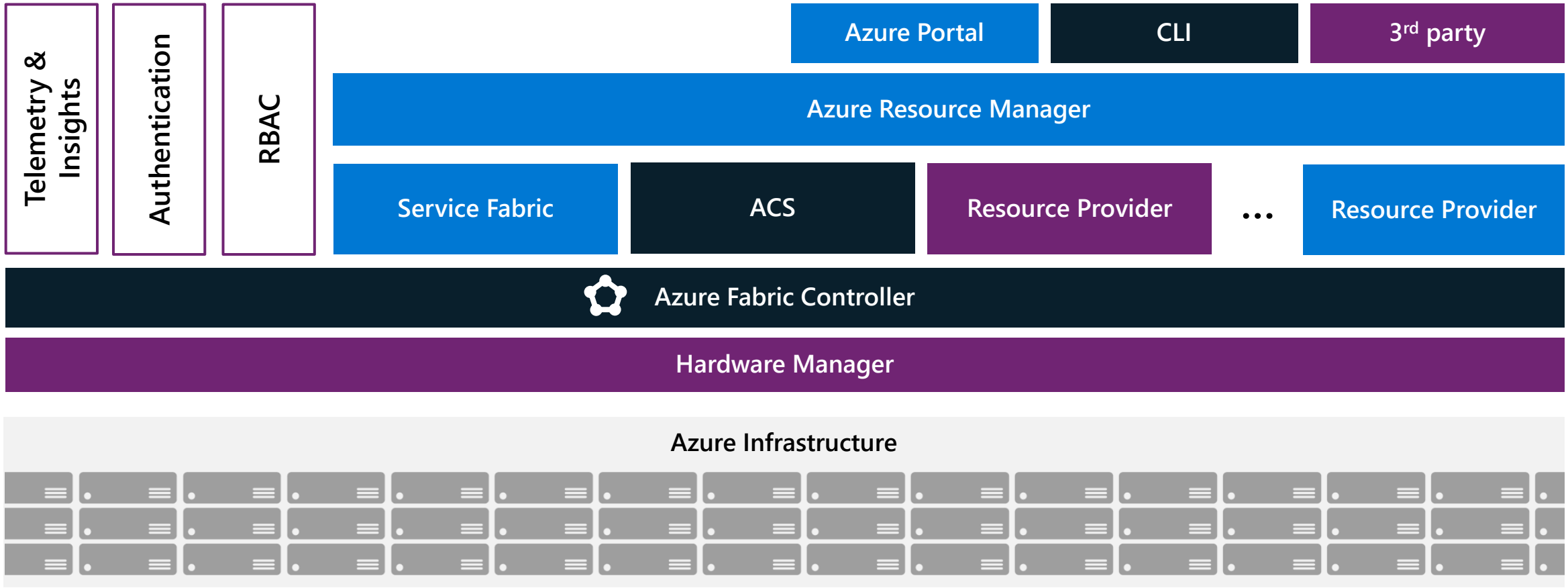
## Back up to URL

Allows you to use standard backup syntax to back up your databases to Azure Blob Storage service

# Deployment options

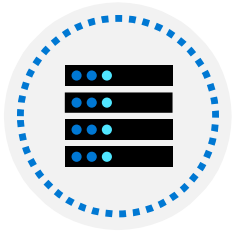
| Azure Resource Manager (ARM) | PowerShell / Azure CLI | Azure Bicep |
| --- | --- | --- |
| Azure Resource Manager templates are a declarative deployment that describes the desired structure and state of the resources to be deployed | Uses an imperative procedural model - to explicitly specify the process to be executed | Azure Bicep is a declarative language that allows you to deploy Azure resources |

# Azure Resource Manager templates



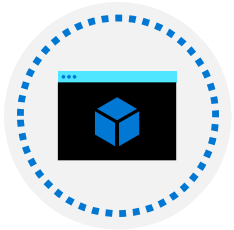
# Azure storage

**The Azure Storage platform provides several storage services to store files, tables, blobs, queues and VM disks**



**SQL Server uses two types of Azure storage:**

- Managed Disks
- Blob Storage



**Heavy workloads typically use Premium SSD or Ultra Disk for database and transaction log files. Use Standard storage for your database backups**

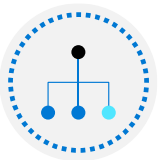
# Azure infrastructure availability options

The Azure platform is built to be fault-tolerant

High availability is built into the platform at power, network, and compute layers

Default availability for a single Azure VM with premium managed disk is 99.9%

You can build further HA and DR solutions using SQL Server features like Always On Availability Group



To deploy Availability Groups in Azure, you need to deploy VMs into an Availability Zone or Availability Sets

# Azure SQL Platform

# Azure SQL platform as a service offerings

| **Azure SQL Database** | Azure SQL Managed Instance |
| --- | --- |
| Use an evergreen version of SQL Server binaries | |
| PaaS offerings allow customers to get more scalability and other benefits from cloud deployments | |

# Azure SQL Database

# Azure SQL Database

Azure SQL Database is a service offering aimed at new application development

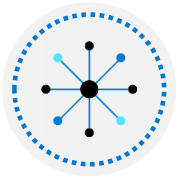
## Deployment options

- Single Database
- Elastic Pools
- Hyperscale
- Serverless

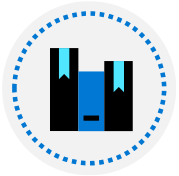
## Azure SQL Database purchasing models

- **Database Transaction Unit (DTU)**
  - Basic
  - Standard
  - Premium
- **vCore**
  - General Purpose
  - Hyperscale
  - Business Critical

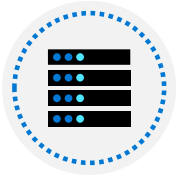
# Single database deployment



Simplest approach to deploying Azure SQL Database



Each database has its own full set of resources



All databases are isolated from each other and are portable

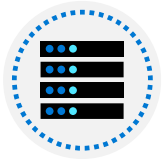
Service level and costs are configured at the individual database level

# Elastic Pools

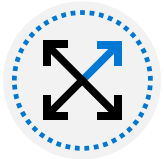
Designed for multi-tenant applications where each tenant has its own databases, or data is shared across databases

Allows you to pay one price for multiple databases that can be managed together on a single logical server

Can significantly reduce costs by configuring min/max DTU or vCore settings on a per database level to balance resource usage within an elastic pool

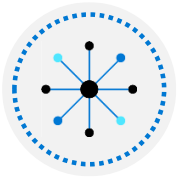


Best suited for databases that have similar performance requirements and non-concurrent spikes in utilization



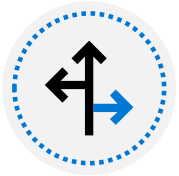
Single databases can be added or removed from the elastic pool with brief downtime. Rescaling a pool has minimal downtime

# Scaling Elastic Pools



Resources in an elastic pool can be shared across all the databases in the pool

You can assign storage and compute resources to each of the databases in the pool or set default values across the pool



Scaling up and down will incur a small amount of downtime, and a brief interruption in the connections

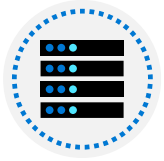
Available in DTU-based purchasing model or the vCore-based purchasing model

# Hyperscale

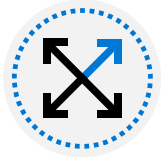
Supports up to 100 TB of database size

Nearly instantaneous backups using snapshot technologies

Fast database restores



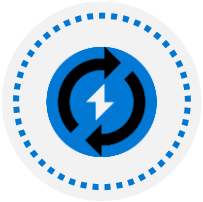
Higher overall throughput because of distributed log writes



Horizontal scaling model

# Compute tier offerings

**Provisioned** - provides a specific amount of compute resources



**Serverless** - auto-scales compute resources based on workload

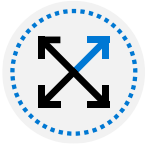
# Serverless

Requires a logical server

Like an auto-pause for Azure SQL Database

First connection to a paused database will receive an error, then the database service resumes

More expensive per minute than normal SQL Database, but can be much cheaper for databases that are largely idle like development and testing workloads



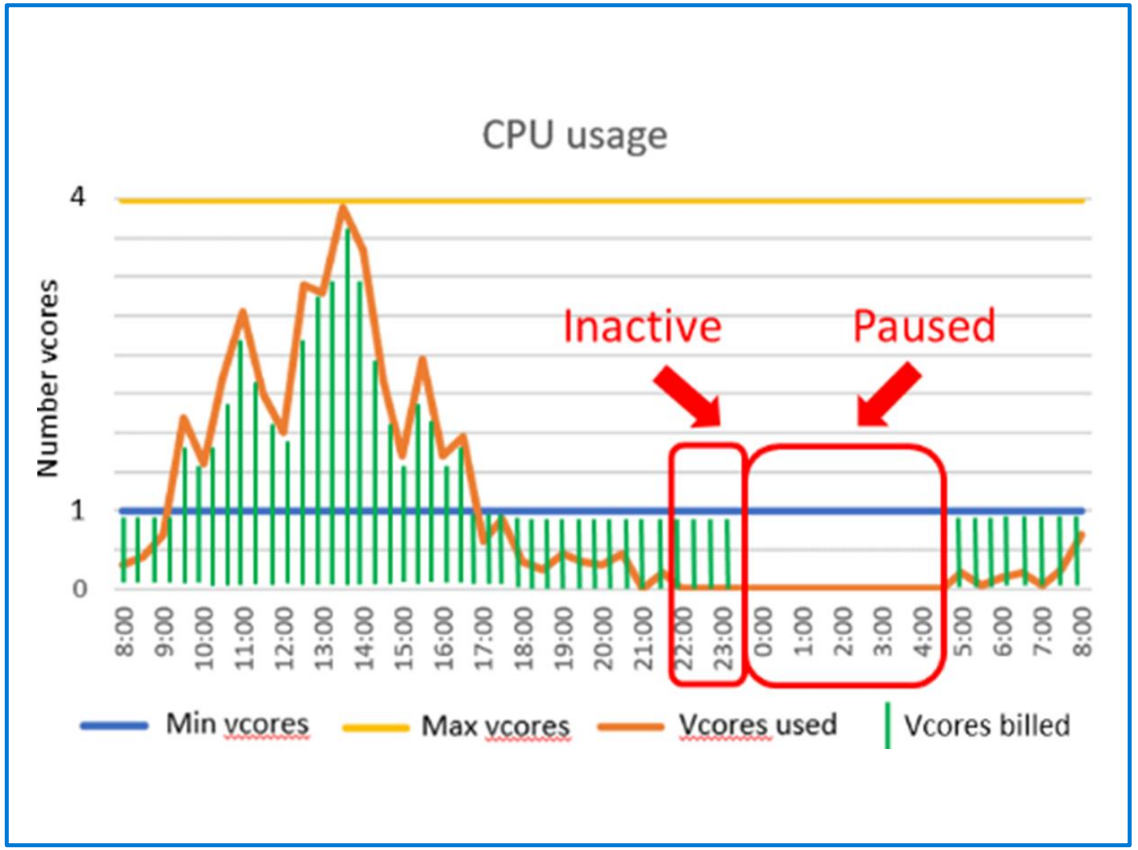
Allows for auto-scale as workloads increase by increasing the number of vCores allocated to the database

# Azure SQL Database – Serverless

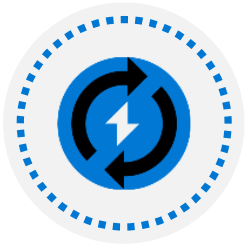
- Allows you to spend less for databases that do not need to be running 24x7
- Best suited for irregular workloads
- Only available in vCore model

## Serverless incompatibility:

- Geo-replication
- Long-term backup retention
- A job database in elastic jobs
- The sync database in SQL Data Sync



# Azure SQL Database backups and restore



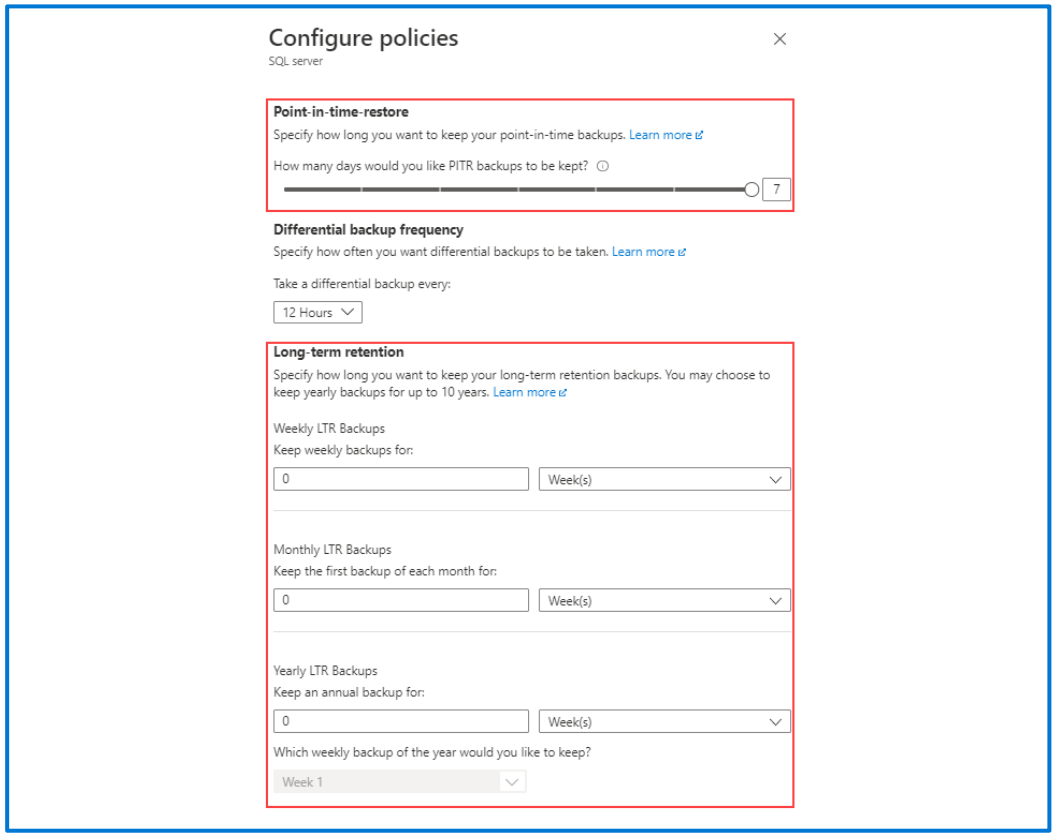
Backups are performed automatically by the service

Backups are stored in geo-redundant storage accounts


Backup retention is **7** days by default, up to **35** days

# Long-term retention (LTR)

- LTR allows you to restore an old version of the database by using the Azure portal, Azure CLI, or Azure PowerShell
- Read-access geo-redundant storage



# Elastic Jobs (preview) & Elastic Query (preview)

## Elastic Jobs

You can create and schedule elastic jobs that could be periodically executed against one or many Azure SQL databases to run Transact-SQL (T-SQL) queries and perform maintenance tasks.

## Elastic Query

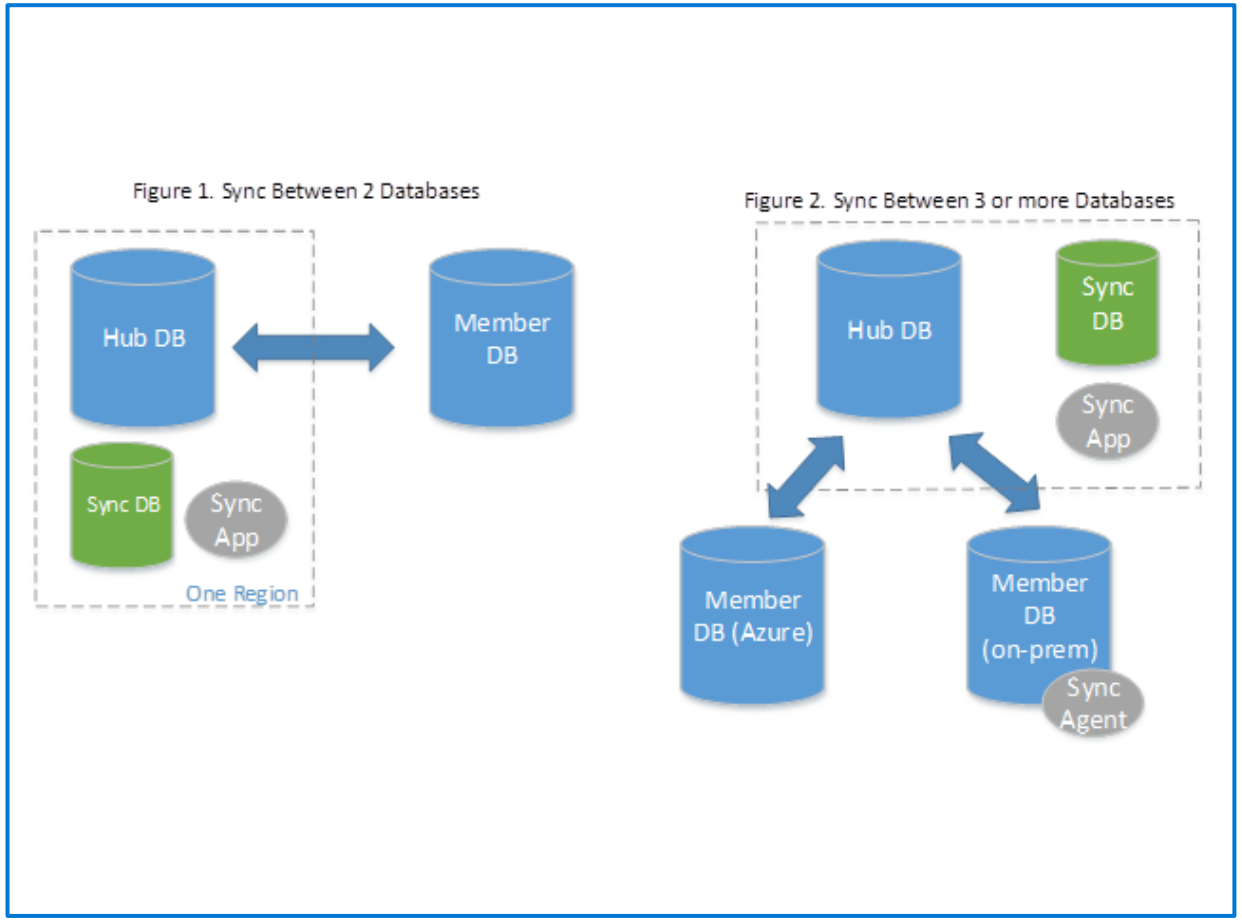
- Allows you to run T-SQL queries that bridge multiple databases in SQL Database
- Increases portability for migration
- Partitioning strategies:
  - Vertical partitioning
  - Horizontal partitioning

# SQL Data Sync

- Bi-directionally and incrementally synchronize data
- Good option for offloading intensive workloads in production
- Tracks changes using insert, update, and delete triggers

## Scenarios

- Hybrid Data Synchronization
- Distributed Applications
- Globally Distributed Applications



# SQL Data Sync vs. Transactional Replication

| | SQL Data Sync | Transactional Replication |
|---|---|---|
| **Advantages** | • Active-active support<br>• Bi-directional between on-premises and Azure SQL Database | • Lower latency<br>• Transactional consistency<br>• Reuse existing topology after migration<br>• Azure SQL Managed Instance support |
| **Disadvantages** | • No transactional consistency<br>• Higher performance impact | • Can't publish from Azure SQL Database<br>• High maintenance cost |

# Azure SQL Managed Instance

# Azure SQL Managed Instance

Managed Instance is a PaaS offering that offers 99% of the functionality of SQL Server

Includes SQL Server Agent, Service Broker, and Common Language Runtime options

Allows for cross database queries

The Azure platform manages backups, patching, and high availability, embedded auditing, security and performance tools

# Hybrid licensing for PaaS services

**Both Azure SQL Database and Managed Instance support the hybrid licensing benefit:**

## Enterprise Edition

Each core entitles you to 8 cores of General Purpose, or 1 core of Business Critical

## Standard Edition

Each core of entitles you to 1 core of General Purpose

# Azure SQL Managed Instance service offerings

## General purpose

- Uses Azure Premium storage
- Supports up to 16 TB of data
- Designed for applications with typical performance and I/O latency requirements

## Business critical

- Supports readable secondary replicas of your database
- Direct attached storage (lower latency)
- Supports up to 4 TB of data

Azure SQL Database and Managed Instance have similar high availability architectures, which guarantee 99.99% percent uptime

# Network connectivity architecture

Azure SQL Managed Instance is deployed within its own subnet in a virtual network

The Managed Instance service has a publicly accessible name, but is primarily accessible over a private IP address

Customers have to opt-in to having an open public IP endpoint

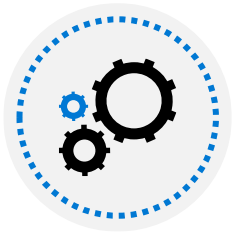
Azure platform does connect securely into managed instance to provide management activity

# Backup and restore

Backups are taken automatically

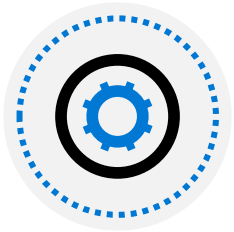
Can take an on-demand copy-only backup to Azure Blob Storage

# Automatic Tuning



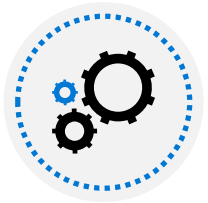
**Provides the following features:**

- Query Store/Query Performance Insight
- Identifying Expensive Queries
- Force Last Good Execution Plan
- Adding Indexes
- Removing Unused Indexes

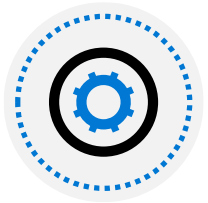


**All these features can be configured at the service level**

# Machine Learning Services



**Provides machine learning operations within your relational database structure, by using Python and R packages**



**Provides high-performance capabilities:**

- Train machine learning models based on either sampled dataset or population dataset
- Reduce complexity in security and compliance
- Deploy machine learning models using T-SQL stored procedures
- Use of open-source libraries like scikit-learn, PyTorch, and TensorFlow.

```
-- Enable Machine Learning Services feature
EXEC sp_configure 'external scripts enabled', 1;
RECONFIGURE WITH OVERRIDE;
```

# Summary

**Prepare to maintain SQL databases on Azure:**

- Understand the other Azure Data Platform roles
- Overview of the Azure service
- Understand Azure SQL Database service offerings
- Learn about the benefits of IaaS and PaaS database services