Microsoft

Introduction to Azure SQL

Module 1

# Learning Units covered in this Module

- Lesson 1: Basic concepts of Azure SQL

- Lesson 2: Create an Azure SQL Database

- Lesson 3: Working with Managed Instances

- Lesson 4: Business Continuity Features

- Lesson 5: Implement Entra ID Security

- Lesson 6: Manage Logins in Azure SQL

Lesson 1: Basic concepts of Azure SQL

Objectives

After completing this learning, you will be able to:

· Describe the basic concept and architecture

· Describe the difference between the purchase models.

· Describe the service tiers compute and hardware generation of the Azure SQL Database.
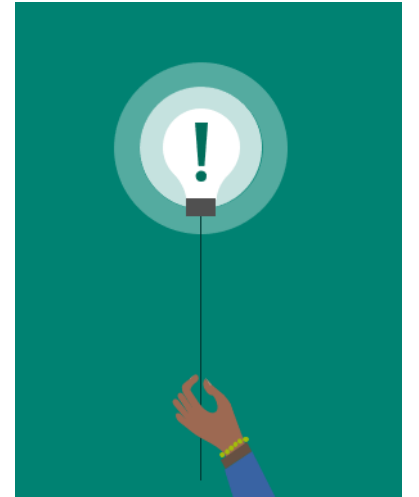
What is Microsoft Azure?

Microsoft Azure is Microsoft's public cloud computing platform

Over 150 countries across 60+ regions worldwide

Windows and Linux

Scale globally

- Reach more locations, faster, with the performance and reliability of a vast global infrastructure.

Safeguard data

- Rely on industry-leading data security in the region and across our network.
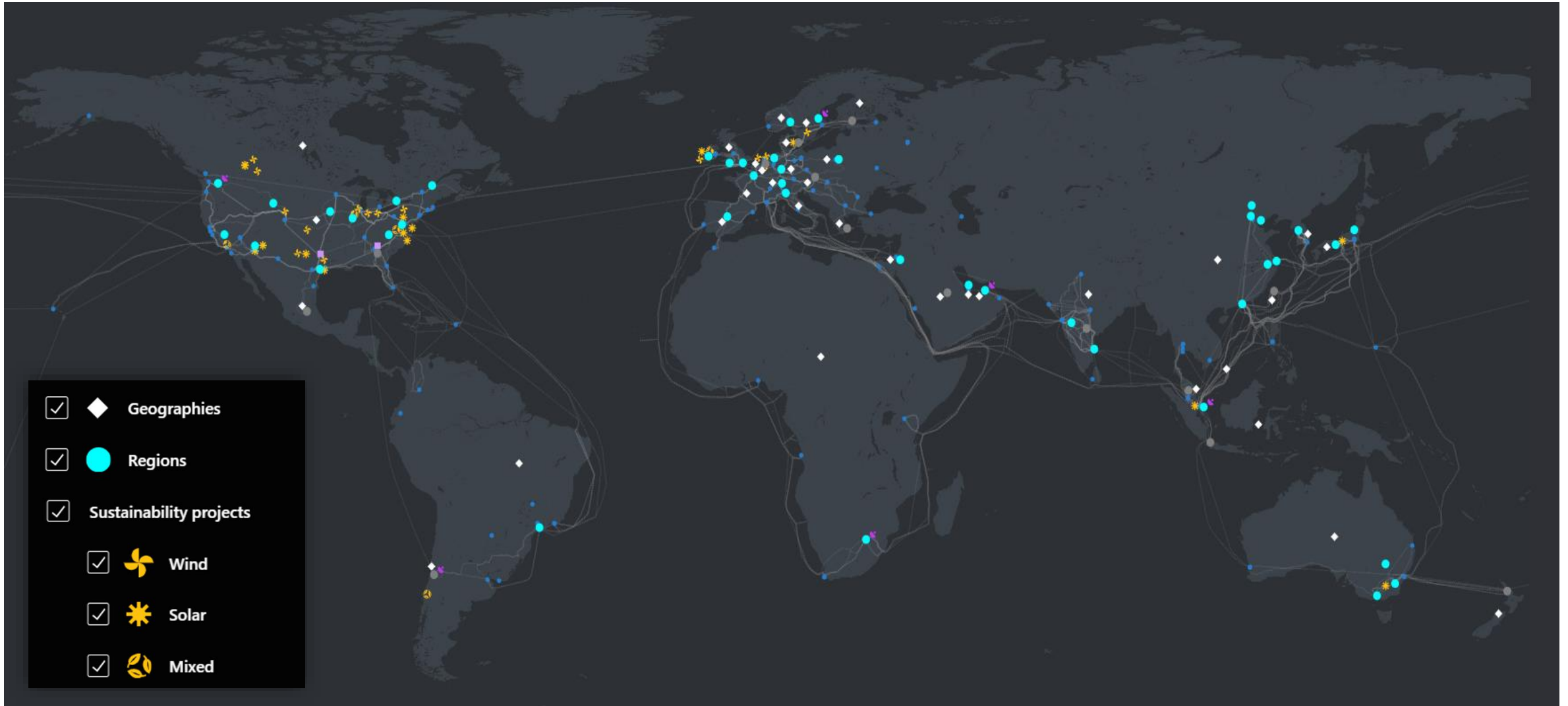
Promote sustainability

- Help build a clean-energy future and accelerate progress toward your sustainability goals.

Azure Global Regions   Physical security of Azure datacenters   Microsoft Azure Sustainability

What is Microsoft Azure?

Legend:
- ☑ ◆ Geographies
- ☑ ● Regions
- ☑ Sustainability projects
  - ☑ Wind
  - ☑ Solar
  - ☑ Mixed

[Azure global infrastructure experience (microsoft.com)](microsoft.com)

Cloud Hosting Models

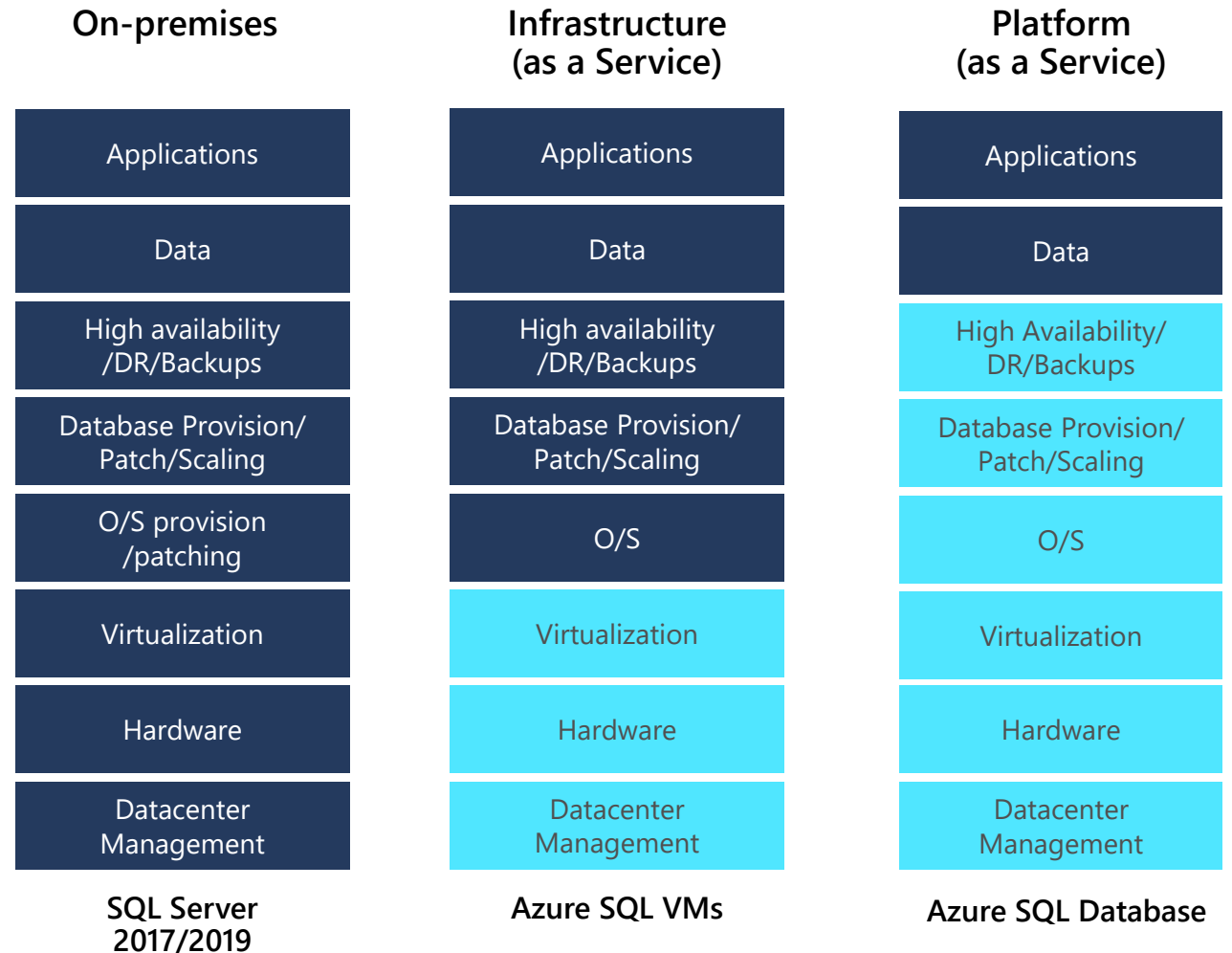| Managed by customer	Managed by Microsoft

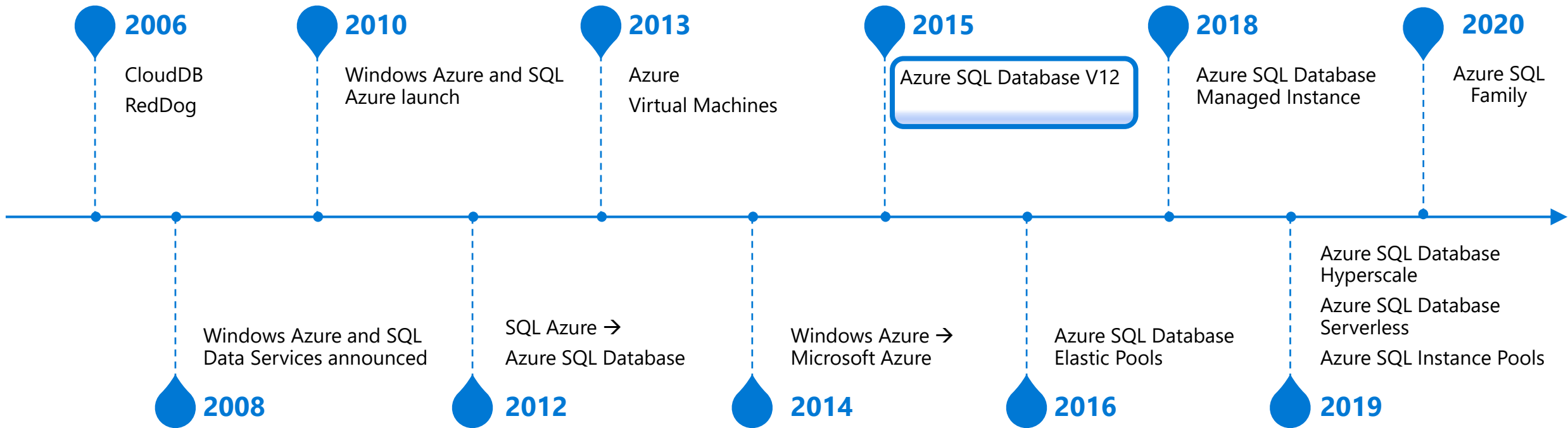**On-premises costs** tend to be driven by hardware and data center management costs

Infrastructure-as-a-Service reduces cost categories related to data center and compute

Platform-as-a-Service off-loads customers' most administrative tasks to Azure, further improving efficiency with machine-learning capabilities for performance and security

- **Managed Instance**: instance-level deployment for lift-shift existing apps to Azure, fully backward compatible

- **Single database**: database-level deployment for new apps

On-premises	Infrastructure (as a Service)	Platform (as a Service)
Applications	Applications	Applications
Data	Data	Data
High availability /DR/Backups	High availability /DR/Backups	High Availability/ DR/Backups
Database Provision/ Patch/Scaling	Database Provision/ Patch/Scaling	Database Provision/ Patch/Scaling
O/S provision /patching	O/S	O/S
Virtualization	Virtualization	Virtualization
Hardware	Hardware	Hardware
Datacenter Management	Datacenter Management	Datacenter Management
SQL Server 2017/2019	**Azure SQL VMs**	**Azure SQL Database**

Azure SQL has come a long way

2006
CloudDB
RedDog

2008
Windows Azure and SQL
Data Services announced

2010
Windows Azure and SQL
Azure launch

2012
SQL Azure →
Azure SQL Database

2013
Azure
Virtual Machines

2014
Windows Azure →
Microsoft Azure

2015
Azure SQL Database V12

2016
Azure SQL Database
Elastic Pools

2018
Azure SQL Database
Managed Instance

2019
Azure SQL Database
Hyperscale
Azure SQL Database
Serverless
Azure SQL Instance Pools

2020
Azure SQL
Family

Azure SQL Family

Explore Azure SQL database services

SQL Server on Azure Virtual Machines

Migrate your SQL workloads to Azure with ease while maintaining complete SQL Server compatibility and operating system-level access

Learn more >

Azure SQL Managed Instance

Modernize your existing SQL Server applications at scale with an intelligent, fully managed service
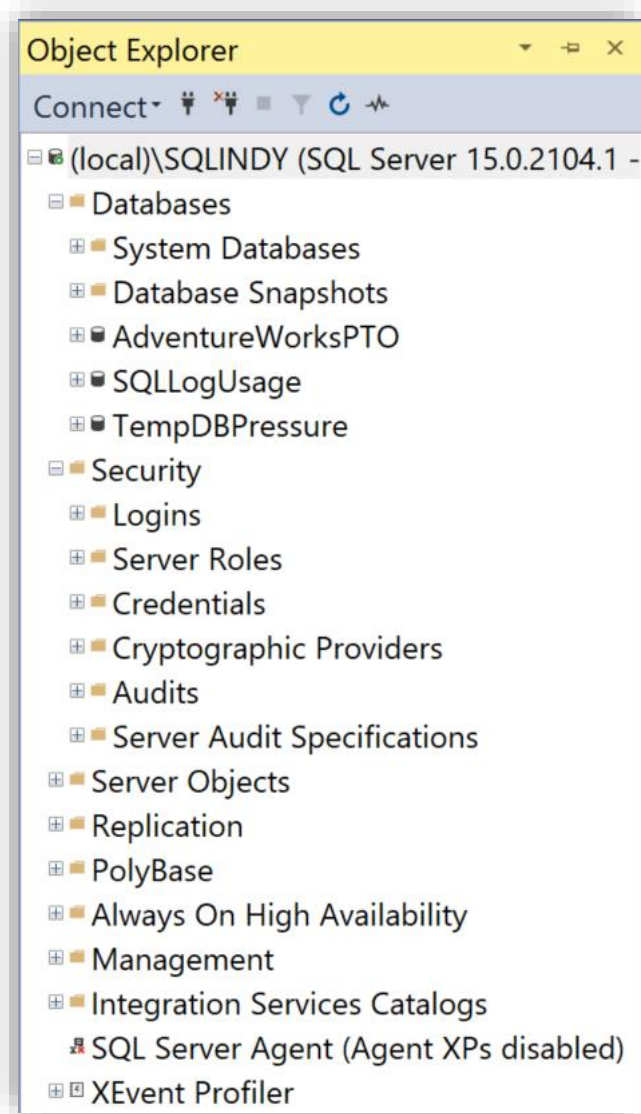
Learn more >

Azure SQL Database

Support modern cloud applications on an intelligent, fully managed service that includes serverless compute

Learn more >

Virtual Machine vs Managed Instance vs Azure SQL Database
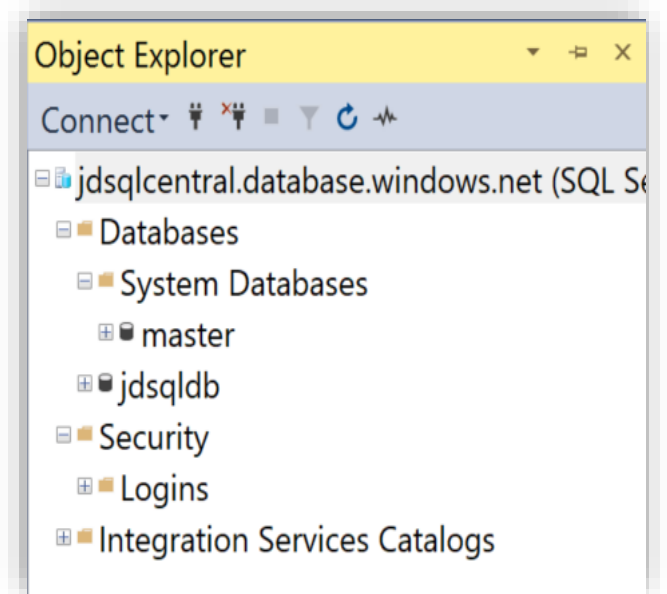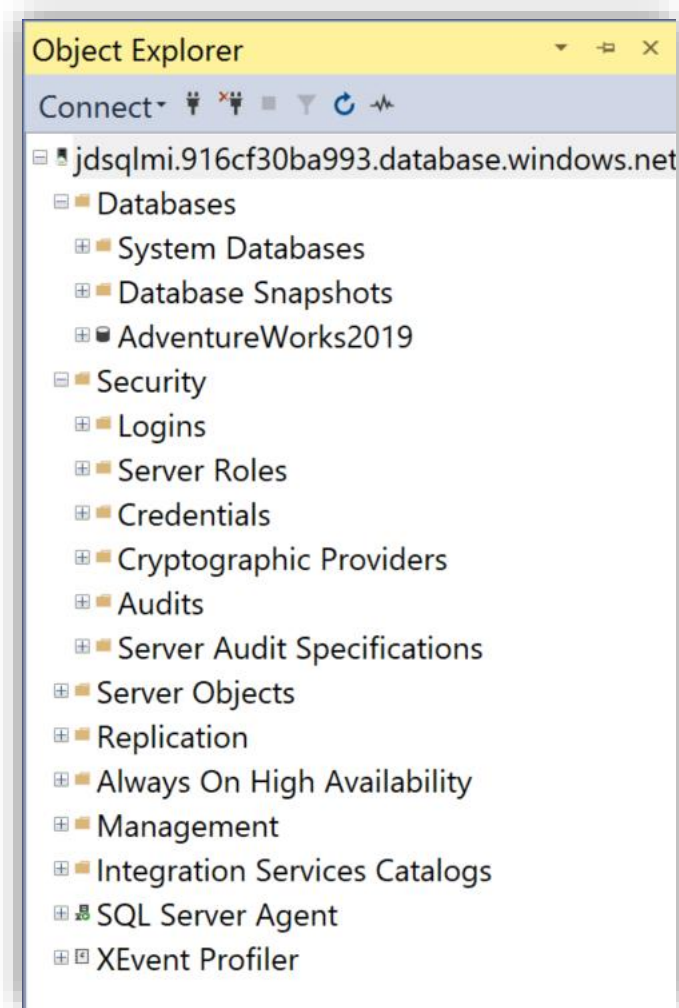
A closer look... Best for

SQL Server in Azure VM

- Existing applications that require fast migration to the cloud with minimal changes or no changes.

- Teams that can configure, fine tune, customize, and manage high availability, disaster recovery, and patching for SQL Server.

- You need a customized environment with full administrative rights.

- SQL Server instances with up to 64 TB of storage. The instance can support as many databases as needed.

Azure SQL Managed Instance

- New applications or existing on-premises applications that want to use the latest stable SQL Server features and that are migrated to the cloud with minimal changes.

- Teams that need built-in high availability, disaster recovery, and upgrade for the database.

- Teams that do not want to manage the underlying operating system and configuration settings.

- Databases of up to 8 TB, or larger databases that can be horizontally or vertically partitioned using a scale-out pattern.

Azure SQL Datababase

- New cloud-designed applications that want to use the latest stable SQL Server features and have time constraints in development and marketing.

- Teams that need built-in high availability, disaster recovery, and upgrade for the database.

- Teams that do not want to manage the underlying operating system and configuration settings.

- Databases of up to 4 TB, or larger databases that can be horizontally or vertically partitioned using a scale-out pattern.

Azure SQL PaaS deployment options

Azure SQL Database

Managed instances
Best for most lift-and-shift migrations to the cloud

Databases
Best for modern cloud applications. Hyperscale and serverless options are available

Single instance	Instance pool*	Single database	Elastic pool
• SQL Server surface area (vast majority). • Native virtual network support. • Fully managed service.	• Resource sharing between multiple instances to price optimize. • Simplified performance management for multiple databases. • Fully managed service.	• Hyperscale storage (up to 100TB). • Serverless compute. • Fully managed service.	• Resource sharing between multiple databases to price optimize. • Simplified performance management for multiple databases. • Fully managed service.

*Instance pool is currently in public preview, more details here

Azure SQL Database Purchasing models and resources

Database Transaction Unit (DTU) model

- Pre-packaged, bundled unit that represents the database power.
- Designed for **predictable performance**, but somewhat inflexible and limited in options.
- DTU sizing offers simplicity of choice.
- Blended measure of CPU, memory, and read-write rates.
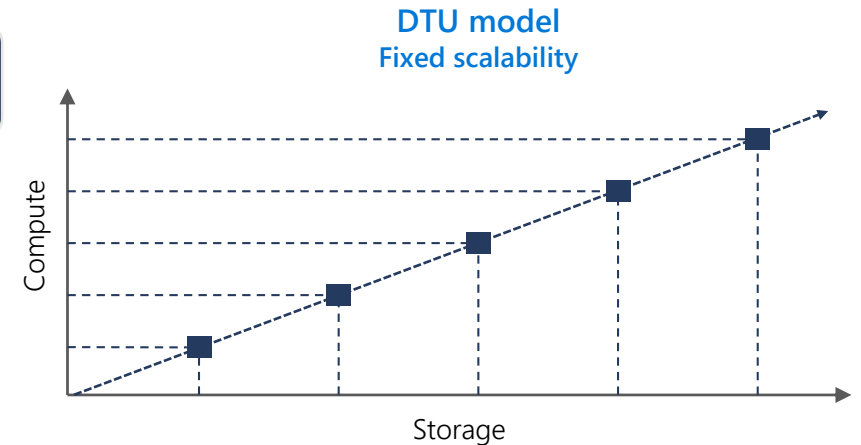
vCore model

- À La carte approach deconstructs the DTU model into separate parts.
- Customers can select compute and storage independently.
- Allows customers to right-size their compute requirements in the cloud.
- vCore sizing offers flexibility of choice.
- Provides a choice between a **provisioned compute tier** and a **serverless compute tier**.

DTU model
Fixed scalability

Compute

Storage

New vCore model
Independent scalability

Compute

Storage
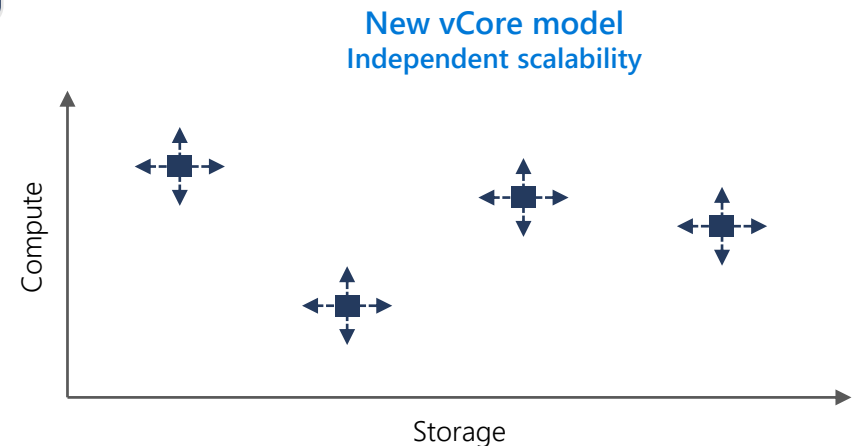
Purchasing models available for Azure SQL Database deployment:

Purchasing model/ Deployment model	DTU based	vCore based
Single Database	✔	✔
Elastic Pool	✔	✔
Managed Instance	✘	✔
Hyperscale service tier (single databases)	✘	✔

Overview Service Tiers

Standard 100DTUs = 1vCore
Premium 125DTUs = 1vCore

DTU based → **Basic** → **Standard** → **Premium**

vCore based → **General purpose.** → **Business critical** → **Hyperscale**

Managed Instance Service Tiers
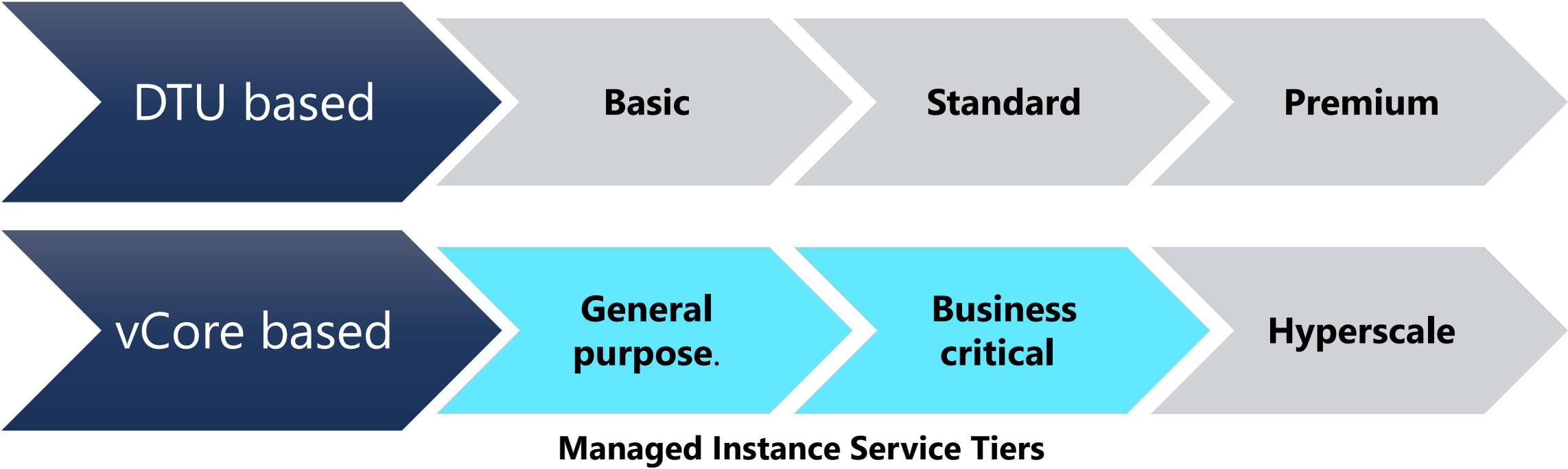
Changing Performance Levels (DTU)

PowerShell

- Set-AzSqlDatabase

REST

- Update database

Azure CLI

- az sql db update

T-SQL

- ALTER DATABASE ... MODIFY (EDITION = ...)

Changing Performance Levels (vCore)

PowerShell

- Set-AzSqlDatabase

REST

- Update database

Azure CLI

- az sql db update

T-SQL

- ALTER DATABASE ... MODIFY (EDITION = ...)

DTU-based model: Service Tiers

	Basic	Standard									Premium					
		S0	S1	S2	S3	S4	S6	S7	S9	S12	P1	P2	P4	P6	P11	P15
Built for	Light transactional workloads	Medium transactional workloads									Heavy transactional workloads					
Available SLA	99.99%															
Database max. size	2 GB	250 GB			1 TB										4 TB	
Point-in-time restore ("oops" recovery)	Any point within 7 days	7-35 days (7 days by default)														
Business continuity	Active geo-replication, up to four readable secondary backups															
Security	Auditing, row-level security, dynamic data masking, Advanced Threat Protection															
Performance objectives	Transactions per hour	Transactions per minute									Transactions per second					
Database transaction units (DTUs)	5	10	20	50	100	200	400	800	1,600	3,000	125	250	500	1,000	1,750	4,000

$ ←——————————————————→ $$$

Resource limits for single databases using the DTU-based purchasing model

Changing Compute Tier and Hardware (vCore)

Service and compute tier

Select from the available tiers based on the needs of your workload. The vCore model provides a wide range of configuration controls and offers Hyperscale and Serverless to automatically scale your database based on your workload needs. Alternately, the DTU model provides set price/performance packages to choose from for easy configuration. Learn more

Service tier   General Purpose (Scalable compute and storage options)   ∨

Compare service tiers ⬈

Compute tier   ⦿ **Provisioned** - Compute resources are pre-allocated. Billed per hour based on
                               vCores configured.

                           ○ **Serverless** - Compute resources are auto-scaled. Billed per second based on
                               vCores used.

Compute Hardware

Select the hardware configuration based on your workload requirements. Availability of compute optimized, memory optimized, and confidential computing hardware depends on the region, service tier, and compute tier.

Hardware Configuration   **Gen5**
                                          up to 80 vCores, up to 408 GB memory
                                          Change configuration

vCore-based purchasing model: Provisioned compute tier

Service tier	General purpose		Business critical		Hyperscale
Best for	Most budget-oriented workloads		Critical business applications with high IO requirements.		VLDB OLTP and HTAP workloads with highly scalable storage and read-scale requirements.
Deployment option	Single / Elastic Pools	Managed Instance	Single / Elastic Pools	Managed Instance	Single
Compute tiers	Gen5: 2 to 80 vCore Fsv2-series*: 72 vCore Serverless: 0.5 to 16 vCore	Gen5: 4 to 80 vCore	Gen5: 2 to 80 vCore M-series*: 128 vCore	Gen5: 4 to 80 vCore	Gen5: 2 to 80 vCore
Storage	Premium remote		Local SSD		Local SSD Cache
	5GB – 4TB per instance	32GB – 16TB per instance	5GB – 4TB per instance	32GB – 16TB per instance	Scale from 5GB to 100TB of storage in 1GB increments
In-Memory	Not supported		Supported		Not supported
Read-write IO	~2ms for all data access		<0.5ms for all data access		<0.5ms for hot data access ~2ms otherwise
Availability	1 replica, no read-scale replicas		3 read replicas, zone-redundant HA	3 replicas, 1 read-scale replica, zone-redundant HA	Primary read/write replica + up to 4 read replicas
Backups	RA-GRS, 7-35 days (7 days by default)		RA-GRS, 7-35 days (7 days by default)		LRS, ZRS, RA-GRS, 7-35 days (7 days by default)

For latest information reference: https://azure.microsoft.com/en-us/pricing/details/sql-database/

* Fsv2-series and M-series are currently in preview.

Choose from hardware generations

	Gen 5	Fsv2-series	M-series	DC-Series
Hardware	Intel E5-2673 v4 (Broadwell) 2.3 GHz processors, fast eNVM SSD vCore=1 LP (hyper-thread)	Intel Xeon Platinum 8168 (SkyLake) processors	Intel Xeon E7-8890 v3 2.5 GHz processors	Intel® XEON E-2288G processors. Featuring Intel Software Guard Extension (Intel SGX))
Performance levels	1 to 80 vCores	72 vCores (1 vCore = 1 hyper-thread)	128 vCores (1 vCore = 1 hyper-thread)	Provision up to 8 vCores (physical)
Memory	5.1 GB per vCore for provisioned compute Up to 24 GB per vCore for serverless compute	1.9 GB per vCore	29 GB per vCore	4.5 GB per vCore
Storage	Up to 4TB remote SSD storage Up to 4TB local SSD storage	Up to 4TB remote SSD storage	Up to 4TB local SSD storage	Up to 4TB remote SSD storage

- Balance performance requirements and price with two hardware generations
- Match your on-premises application behavior
- Fsv2, M, and DC series are Generally available but in limited regions

Provisioned compute and serverless meet different needs

Optimize compute provisioning and billing for your workload

Databases with provisioned compute...

Provision compute resources upfront.

Bill on an hourly basis.

Common scenarios

Workloads with regular and substantial compute utilization.

Multiple databases with bursty usage patterns that can be consolidated into a single server and use *elastic pools* for better price optimization.

Serverless databases...

Scale up or down to meet workload requirements, instead of pre-provisioning.

Bill on a per-second basis.

Common scenarios

Workloads with unpredictable and intermittent usage patterns or performance requirements .

Workloads where the requirements are unknown, and you can delegate compute sizing to the service.

Serverless price to performance with per-second billing

Compute resources scale dynamically up or down based on workload requirements.

Configure minimum and maximum vCores to define the range of available compute capacity.

Use auto-pause delay to define the time period the dataset must be inactive before pausing.

The database is automatically resumed when the next login or other activity occurs.

Pay for compute based on the vCores and memory used per second, with lowest billing based on configured vCore minimum.

When the database is paused, the compute cost is zero and only storage costs are incurred.

CPU usage

Number vCores

Inactive   Paused

— Min vcores   — Max vcores   — Vcores used | Vcores billed

Lesson 2: How to create Azure SQL Database

Objectives

After completing this learning, you will be able to:

- Know which prerequisites are needed before you can create an Azure SQL Database.

- Create your first Azure SQL Database.

Azure SQL Database Server is not a machine...

SQL Server	>	A Machine
Azure SQL Database Server	>	TDS* Endpoint

*TDS = Tabular Data Stream

Server Provisioning

Service head that contains databases

Connect via Fully Qualified Domain Name

Initially contains only a **master** database

Create SQL Database Server
Microsoft

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ | PFE Subscription ⌄

    Resource group * ⓘ | (New) AzureSQLDatabaseRG ⌄
    Create new

Server details

Enter required settings for this server, including providing a name and location.

Server name * | dbsqlessentials ✓
.database.windows.net

Location * | (US) East US ⌄

Authentication

Select your preferred authentication methods for accessing this server. Create a server admin login and password to access your server with SQL authentication, select only Azure AD authentication Learn more ⧉ using an existing Azure AD user, group, or application as Azure AD admin Learn more ⧉ , or select both SQL and Azure AD authentication.

Authentication method | ● Use SQL authentication
⚪ Use only Azure Active Directory (Azure AD) authentication
⚪ Use both SQL and Azure AD authentication

Server admin login * | sqlserveradmin ✓

Password * | •••••••••••••••• ✓

Confirm password * | •••••••••••••••• ✓

Review + create   Next : Networking >

Azure SQL Database Firewall

IP Address-based access control for SQL Database
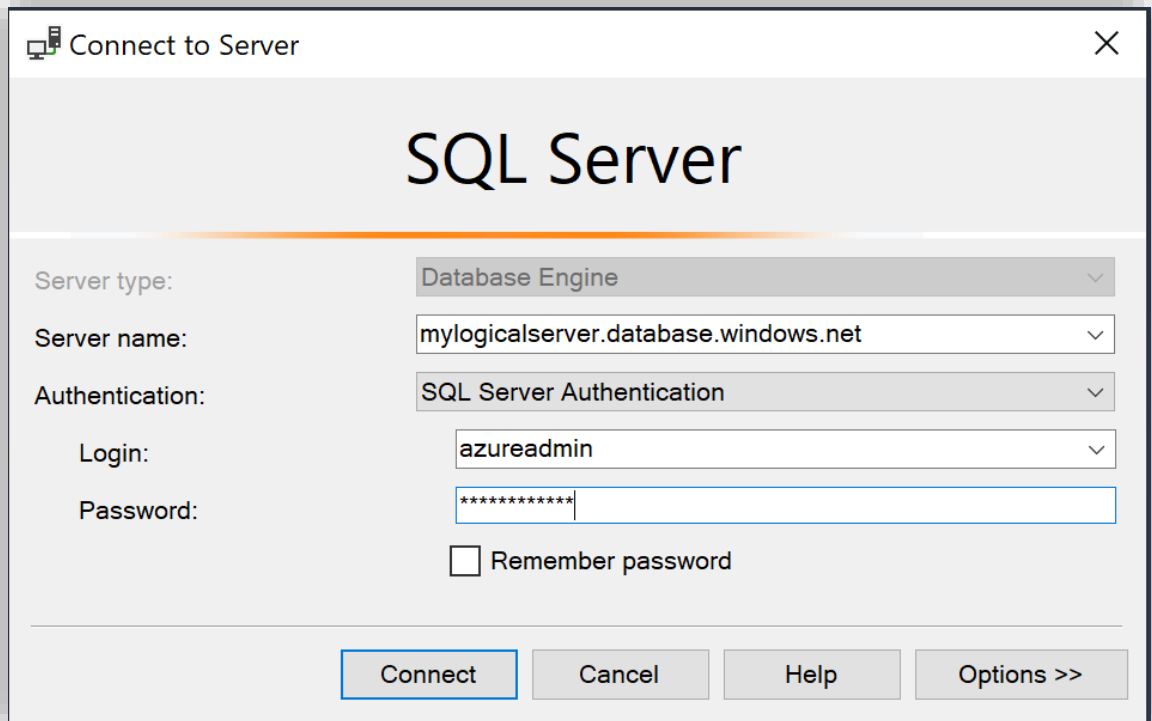
Rules at the server and/or database level

No IP authorized by default, not even Azure itself

SQL Server Management Studio

SQL Server Data Tools

Azure Data Studio

Download the latest version of Azure Data Studio.

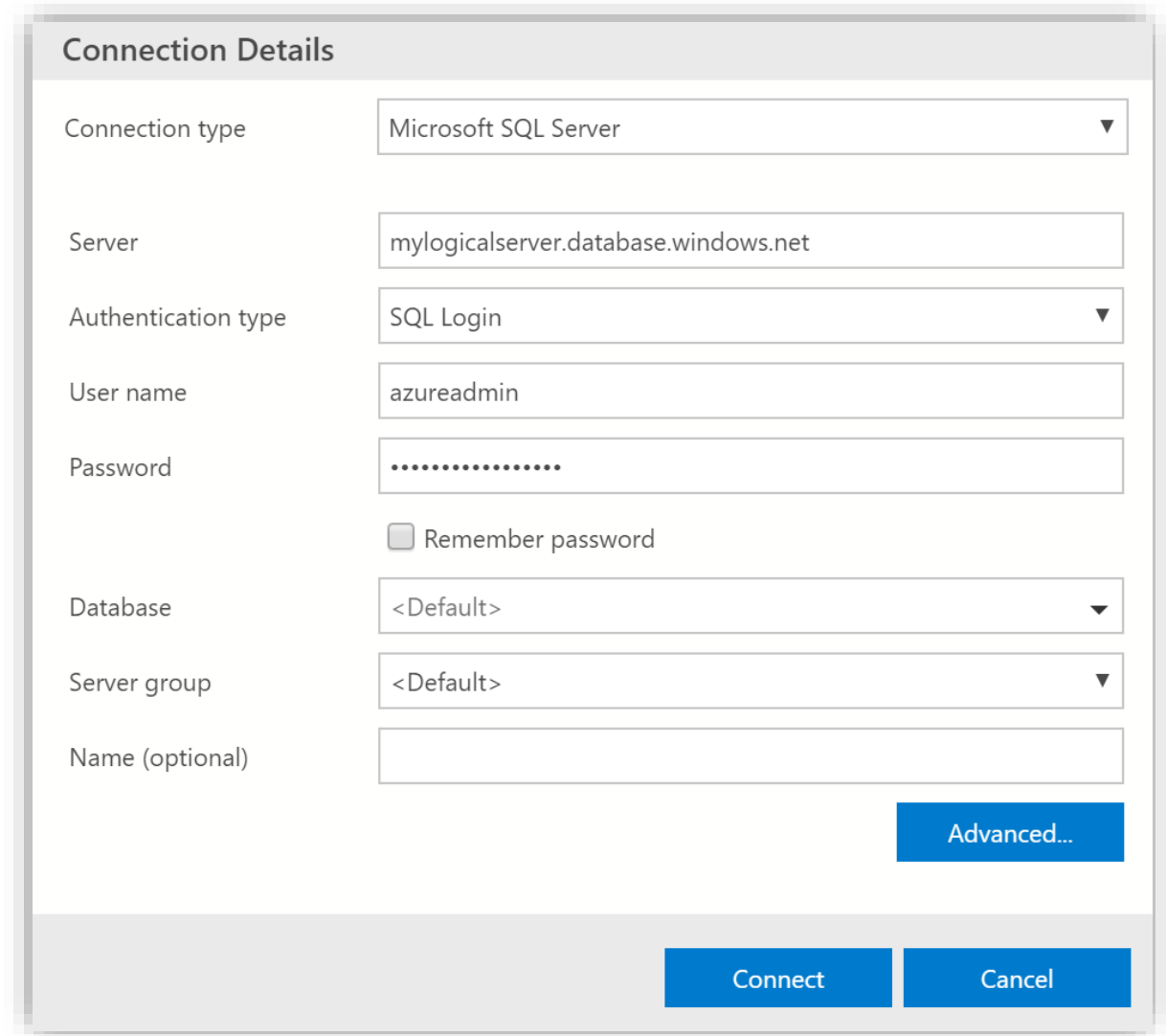Get the fully qualified domain name of your Azure SQL Server.
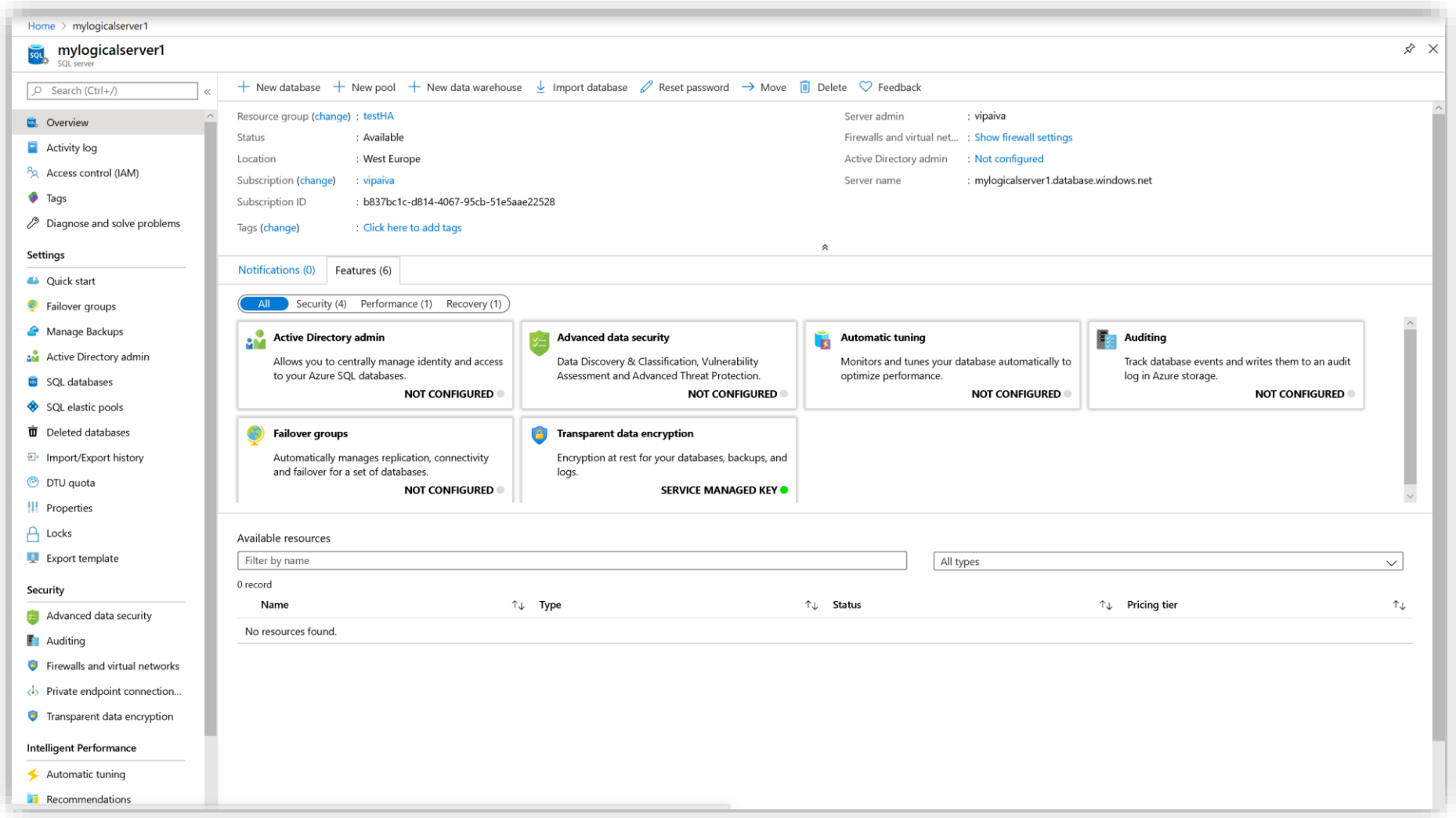
Connect to your SQL Database.

Connection Details

Connection type	Microsoft SQL Server ▾
Server	mylogicalserver.database.windows.net
Authentication type	SQL Login ▾
User name	azureadmin
Password	••••••••••••••
	☐ Remember password
Database	<Default> ▾
Server group	<Default> ▾
Name (optional)	

Advanced...

Connect   Cancel

Azure Portal

Demonstration

Create your first Azure SQL Database

- Create a new server, configure the firewall rules and create an Azure SQL Database (DTU based).

Lesson 3: Working with Managed Instances

Which Azure SQL offering is right for you?

Control	Capabilities

Microsoft Managed

Managed SQL Server as a service

Native restore and log shipping

DTC and Linked Servers

Service Broker and Event Notifications

SQL Agent and Transactional Replication

.NET CLR integration and ML Services

Yes →

Azure SQL Managed Instance

No ↓

Managed SQL database as a service

A database scoped programming model

Yes →

Azure SQL Database

No ↓

Customer Managed

Full control of SQL Server instance

OS level access

SQL Server versions 2008 - 2019

Ful control over upgrades and patching

App and other services colocation

Yes →

SQL Server on Azure VMs

Azure SQL Managed Instance Service Tiers

Service tier

Select from the latest vCore service tiers available for Azure SQL Managed Instance including General Purpose and Business Critical. Learn more ⬀
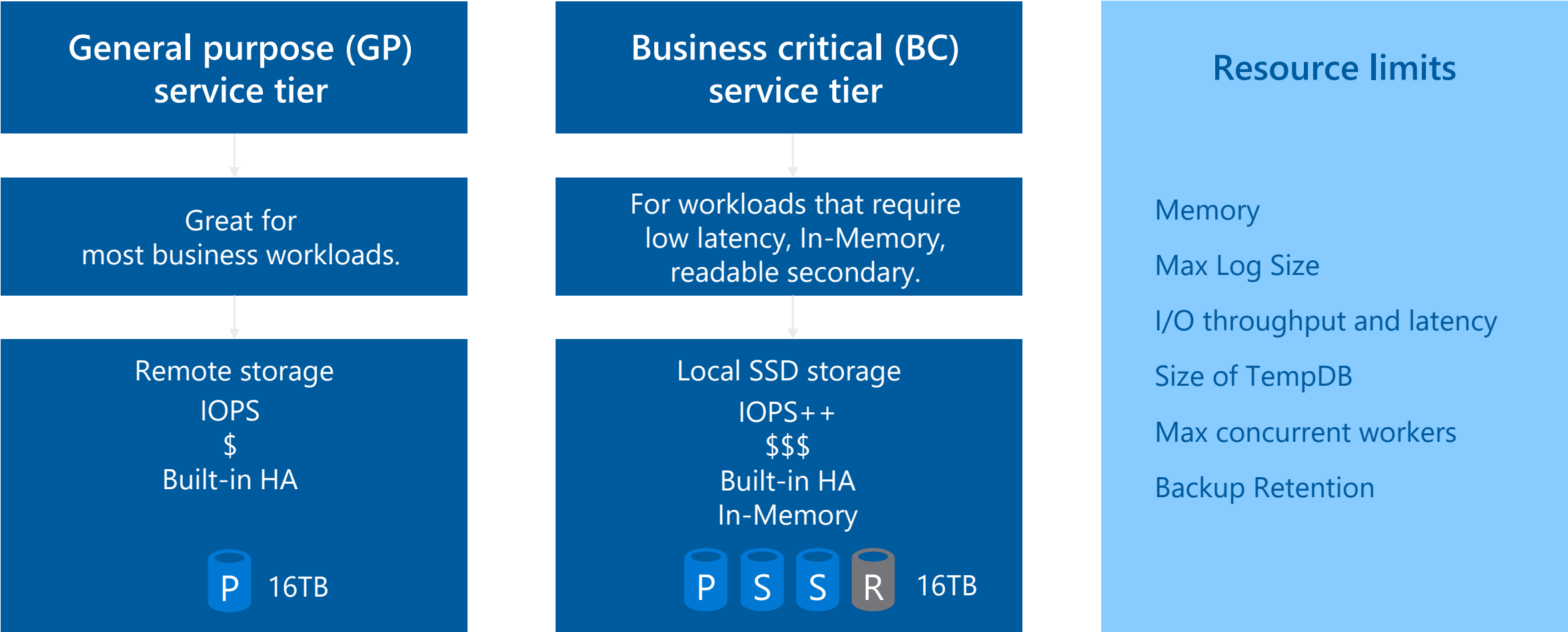
Service tier ⓘ

◉ General Purpose (4-80 vCores, 32 GB-16 TB storage capacity, Fast storage) - for most production workloads

○ Business Critical (4-80 vCores, 32 GB-4 TB storage capacity, Super fast storage) - for IO-intensive and compute-intensive workloads

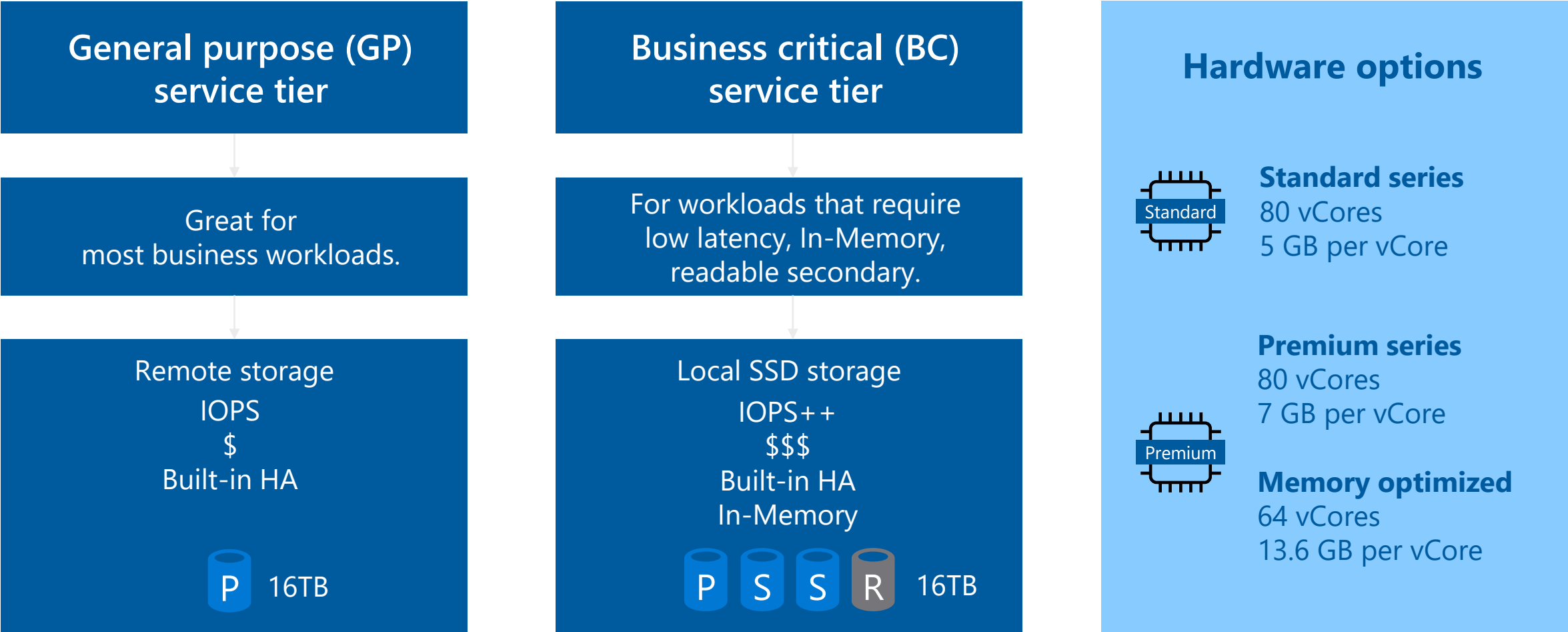Next-gen General Purpose (preview)

(Enabled **Disabled**)

ⓘ Next-gen General Purpose tier is currently in preview. By using this set of preview features, you confirm that you agree that your use of these features is subject to the preview terms in the agreement under which you obtained Microsoft Azure Services. Learn more ⬀

Azure SQL Managed Instance Service Tiers

General purpose (GP) service tier	Business critical (BC) service tier	Resource limits
Great for most business workloads.	For workloads that require low latency, In-Memory, readable secondary.	Memory
		Max Log Size
Remote storage	Local SSD storage	I/O throughput and latency
IOPS	IOPS++	Size of TempDB
$	$$$	Max concurrent workers
Built-in HA	Built-in HA	Backup Retention
	In-Memory	
P 16TB	P S S R 16TB	

Azure SQL Managed Instance Service Tiers

General purpose (GP) service tier

Great for
most business workloads.

Remote storage
IOPS
$
Built-in HA

P 16TB

Business critical (BC) service tier

For workloads that require low latency, In-Memory, readable secondary.

Local SSD storage
IOPS++
$$$
Built-in HA
In-Memory

P S S R 16TB

Hardware options

Standard series
80 vCores
5 GB per vCore

Standard

Premium series
80 vCores
7 GB per vCore

Premium

Memory optimized
64 vCores
13.6 GB per vCore

Next-gen General Purpose (Preview)
Announced March 2024

Select from the latest vCore service tiers available for Azure SQL Managed Instance including General Purpose and Business Critical. Learn more ⬈

Service tier ⓘ

(●) General Purpose (4-80 vCores, 32 GB-16 TB storage capacity, Fast storage) - for most production workloads

(○) Business Critical (4-80 vCores, 32 GB-4 TB storage capacity, Super fast storage) - for IO-intensive and compute-intensive workloads

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Next-gen General Purpose (Preview)
Announced March 2024

Designed for businesses with higher performance requirements while offering the same baseline cost as the General Purpose service tier

Significant upgrades to performance, scalability, and resource flexibility over the General Purpose service tier

Uses managed disks instead of page blobs, which drastically improve storage performance metrics

3 free IOPS for every GB of reserved storage

Support of up to 500 databases per instance, and a max storage size of 32 TB

SQL Managed Instance Hardware Generations

Standard-series (Gen 5)	Premium-series	Premium-series Mem Optimized
• CPU: Intel Broadwell, Skylake and Cascade Lake, 2.3-2.5 GHz	• CPU: **Latest 3rd Gen Intel 8370C (Ice Lake), 2.8 GHz**	• CPU: **Latest 3rd Gen Intel 8370C (Ice Lake), 2.8 GHz**
• vCore range: 4 – 80	• vCore range: 4 – 80	• vCore range: 4 - 64
• Memory / vCore: 5.1 GB	• Memory / vCore: **7 GB**	• Memory / vCore: **13.6 GB**
• Max instance memory: 408 GB	• Max instance memory: **560 GB**	• Max instance memory: **870 GB**

• Max instance storage
  • General Purpose: 16 TB
  • Business Critical: 4 TB
	• Max instance storage
	  • General Purpose: 16 TB
	  • Business Critical: **5.5 TB**
		• Max instance storage
		  • General Purpose: 16 TB
		  • Business Critical: **16 TB**

Deploy, Connect, Configure

Deploy

Choose region, service tier, vCores, and Max Storage
You choose Max Storage for instance based on possible max size
Choose hardware options NEW
Service-aided subnet configuration

Connect

Inside the virtual network with Private IP
Outside using public endpoint/port with NSG

Configure

Configure outside of SQL with the portal or CLI
Change tier, vCores, max storage, maintenance windows NEW
Configure inside SQL with T-SQL or SSMS

What's different?

No OS or file system access
No manual restarts or SQL Server Config Manager
Tempdb managed
Some global trace flags allowed

Evergreen version of SQL

Get rid of perpetual SQL major version upgrades

This is the LAST SQL Server upgrade that you ever perform

Newest / Azure-only features

Leverage latest SQL Server innovation available as "cloud-first"

NEW: Database format alignment with SQL Server 2022

Lesson 4: Business Continuity Features

Objectives

After completing this learning, you will be able to:

- Understand the various business continuity options within Azure SQL Database.

- Understand how to copy and export Azure SQL Databases.

- Understand how to perform a point-in-time restore.

- Understand how to perform a restore of a deleted database.
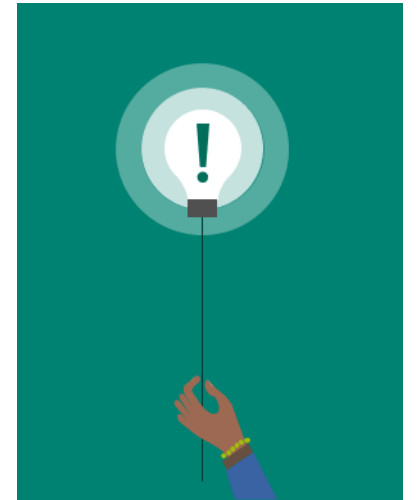
Business Continuity Problem

Mechanisms, Policies and Procedures that enable a business to continue operating in face of disruption.

Customer Error

Customer deleted their data by mistake.

Equipment Failures
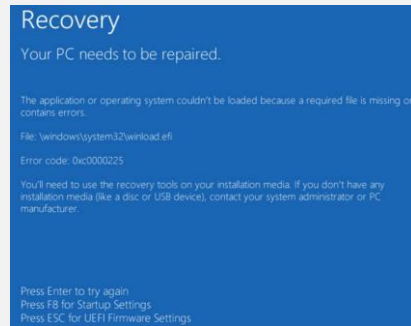
Hardware or other equipment failures

Natural Disasters

Flood, Hurricanes, Tornadoes, Earthquakes

Manmade Disasters

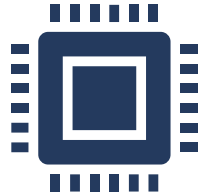Wars or major ecological accidents

Availability vs High Availability vs Disaster Recovery

Availability

Every database comes with core resiliency and availability, that protects it against software or hardware failures.

Industry leading financially backed SLA of 99.99% availability.

High Availability

Continuous availability of the database provided through Zone Redundancy.

Automatic in region recovery from zonal hardware and software failures that's transparent to applications.

Higher SLA of 99.995% availability.

Disaster Recovery

Customer configured database replicas or failover groups

Ability to quickly recover the database from a catastrophic regional failure to provide business continuity.
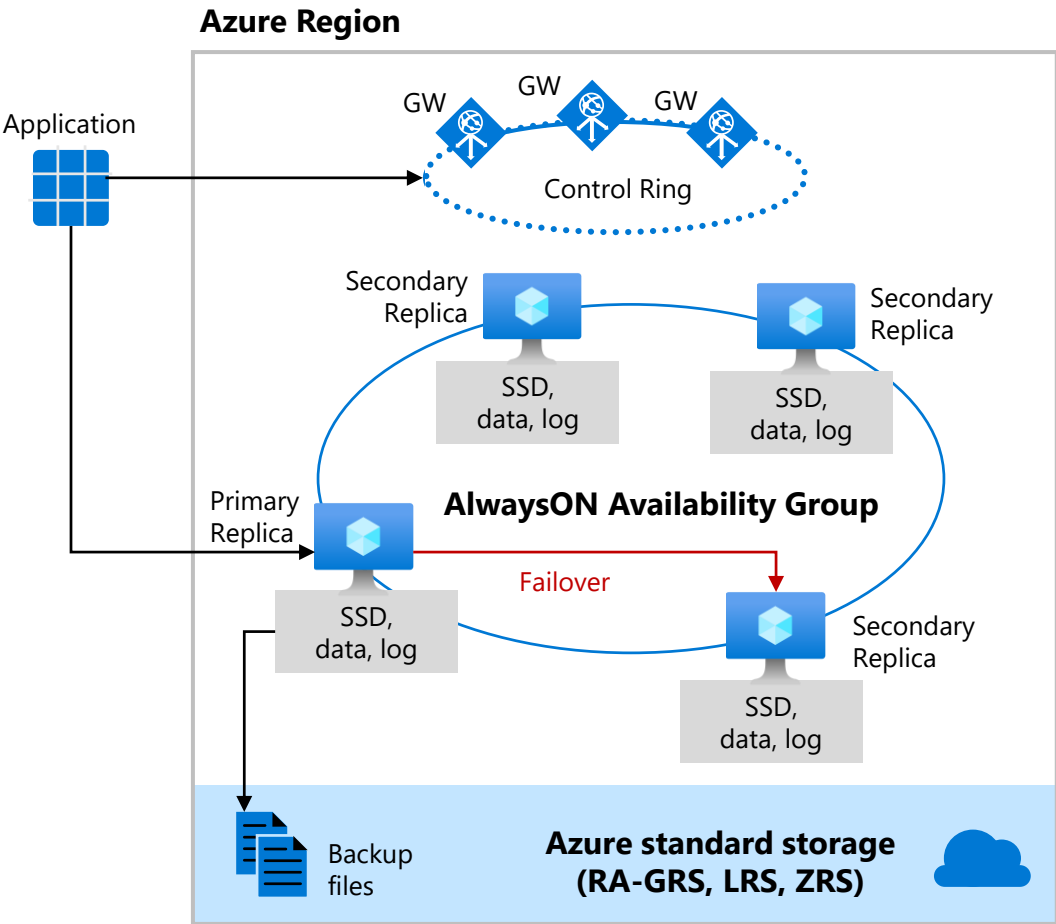
Protect your business by maximizing application availability.

High Availability: General Purpose vs Business Critical

Azure Region

Application

GW GW GW
Control Ring

Primary Replica — Failover →

SSD, tempdb

Nodes with spare capacity

SSD, tempdb

Data and log files

Azure premium storage (LRS) data/log

Backup files

Azure standard storage (RA-GRS, LRS, ZRS)

Basic (DTU), Standard (DTU), General Purpose (vCore)

Azure Region

Application

GW GW GW
Control Ring

Secondary Replica

SSD, data, log

Secondary Replica

SSD, data, log

Primary Replica

AlwaysON Availability Group

SSD, data, log — Failover →

Secondary Replica

SSD, data, log

Backup files

Azure standard storage (RA-GRS, LRS, ZRS)

Premium (DTU) and Business Critical (vCore)

High Availability - General Purpose

Basic (DTU), Standard (DTU), General Purpose (vCore)

Behaves like Failover Cluster Instance

Remote storage provides data redundancy

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

Azure Region

Application

GW   GW   GW

Control Ring

Primary Replica   Failover

Nodes with spare capacity

SSD, tempdb

SSD, tempdb

Data and log files

Azure premium storage (LRS) data/log

Backup files

Azure standard storage (RA-GRS, LRS, ZRS)
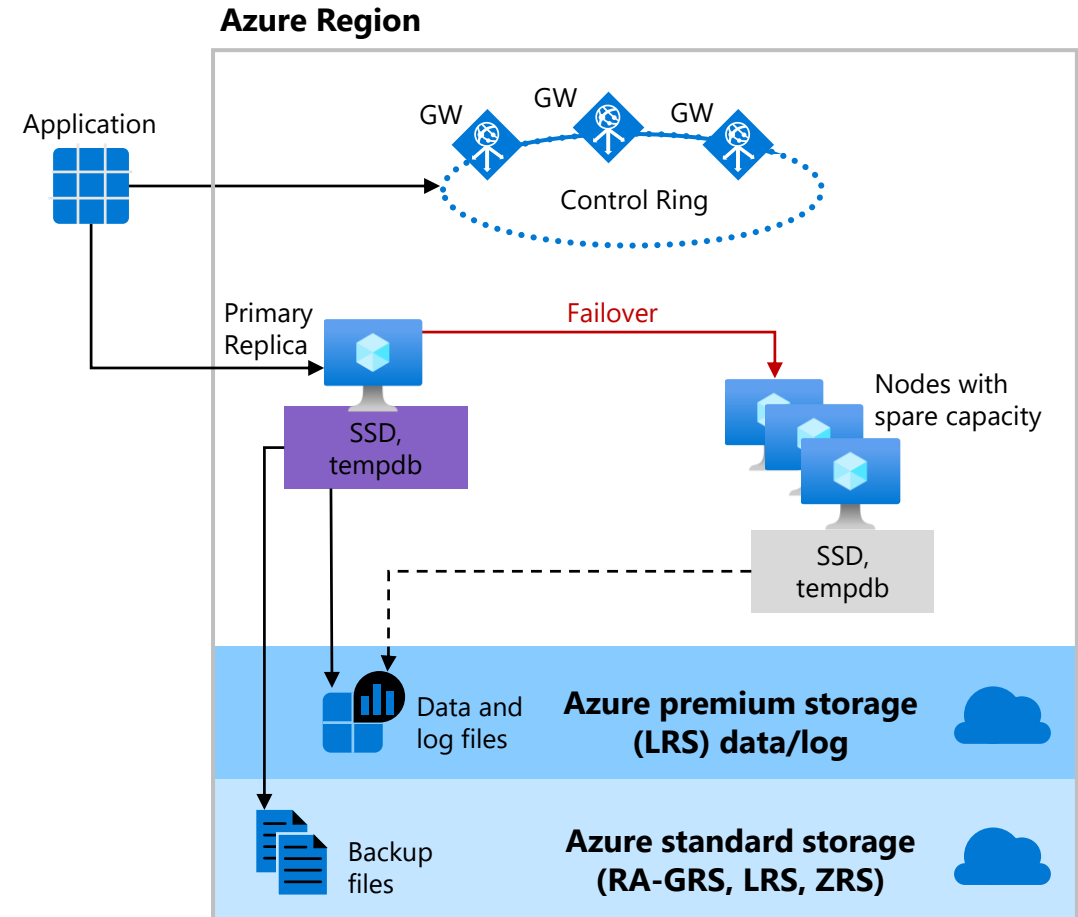
High Availability - Business Critical

Premium (DTU) and Business Critical (vCore)

High availability is implemented using a technology like SQL Server Always On Availability Groups.

High availability is achieved by replicating both compute and storage to additional nodes.

The cluster includes a single primary replica for read-write workloads, and up to three secondary replicas.

The failover is initiated by the Azure Service Fabric.

As an extra benefit, the premium availability model includes Read Scale-Out feature.
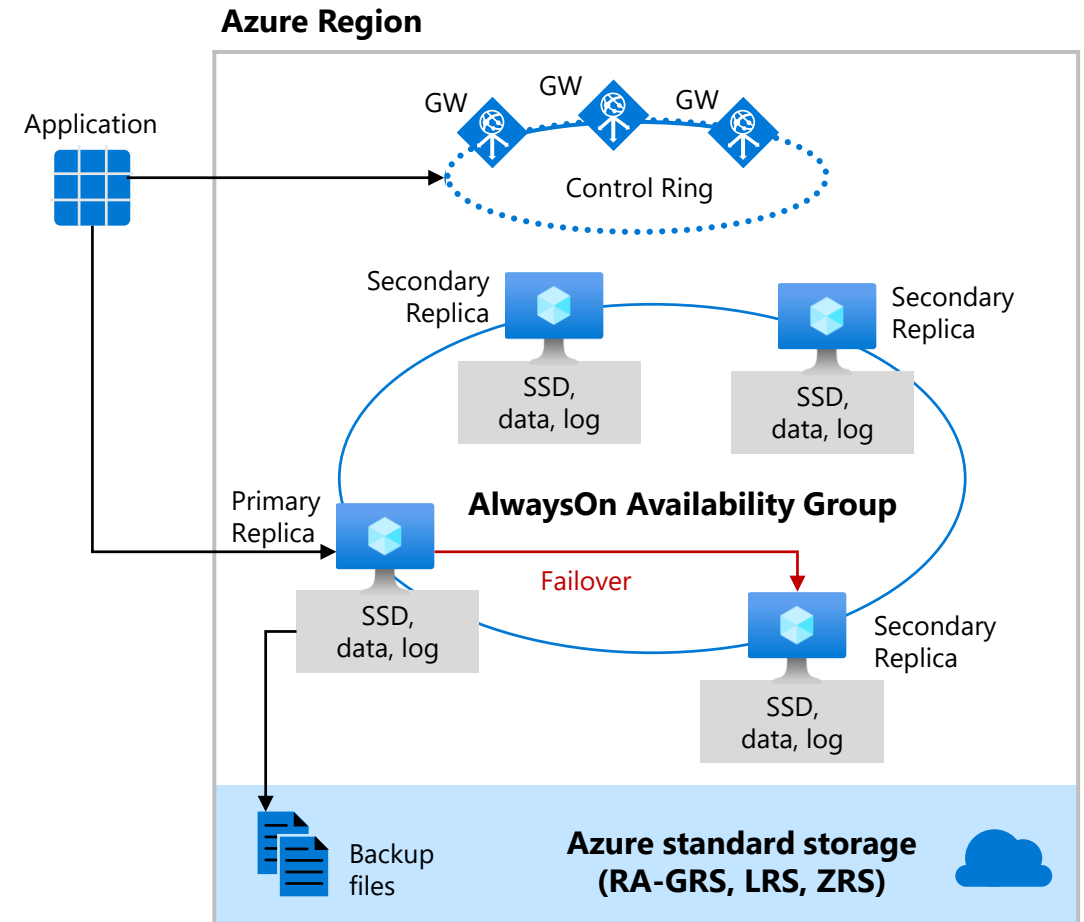
Backup storage redundancy
To enable high durability of backups several ways of replication are offered on instance creation.
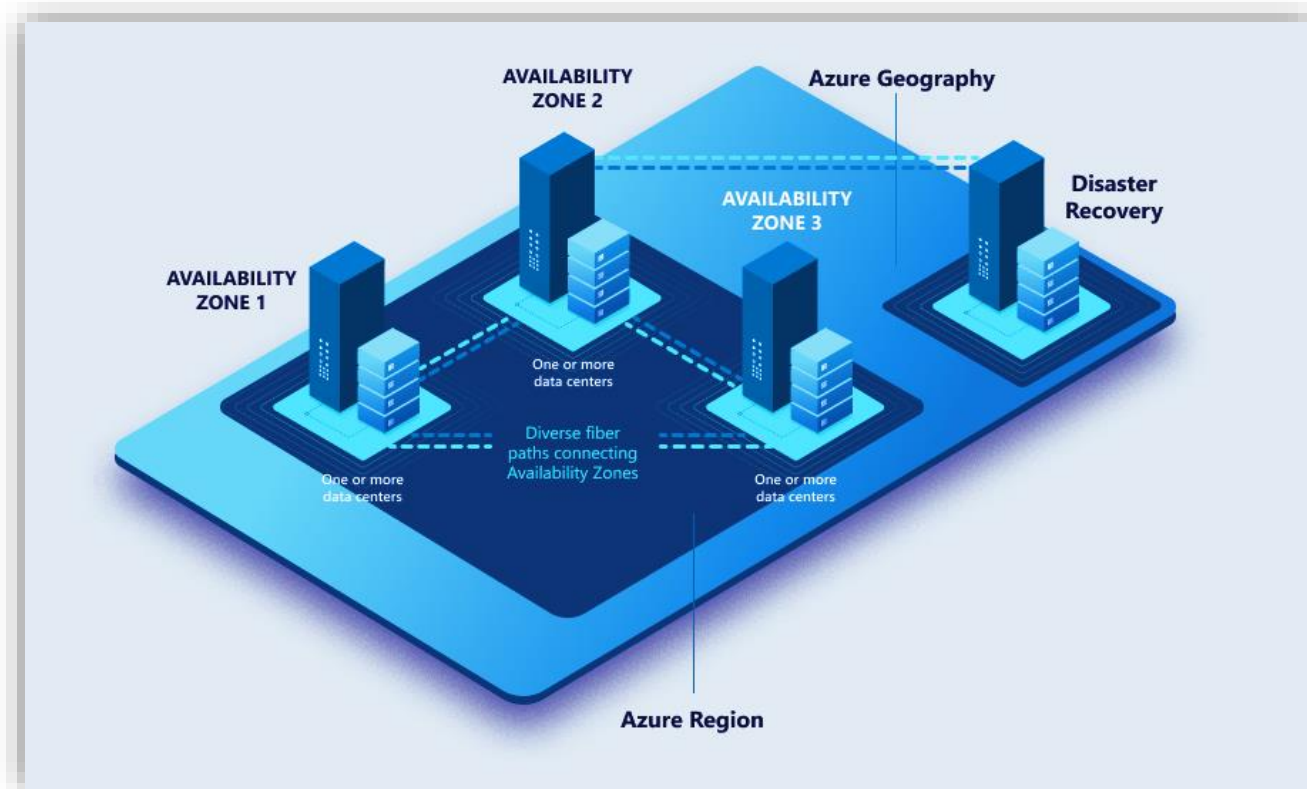
The backups can be all located within

1. LRS: The same building (Local)
2. ZRS: Same region, different buildings (Zone)
3. GRS: Across paired regions (Geo)
4. GZRS: Different buildings AND paired regions (Geo-Zone)

Zone redundant configuration – Premium and Business Critical

By default, the cluster of nodes for the premium availability model is created in the same datacenter.

SQL Database can place different replicas of the Business-Critical database to different availability zones in the same region.

The routing is controlled by Azure Traffic Manager (ATM).

The zone redundant databases have replicas in different datacenters with some distance between them, the increased network latency may impact the performance.

Zone redundant configurations are available in the Premium, Business Critical, General Purpose and Hyperscale Service Tiers.
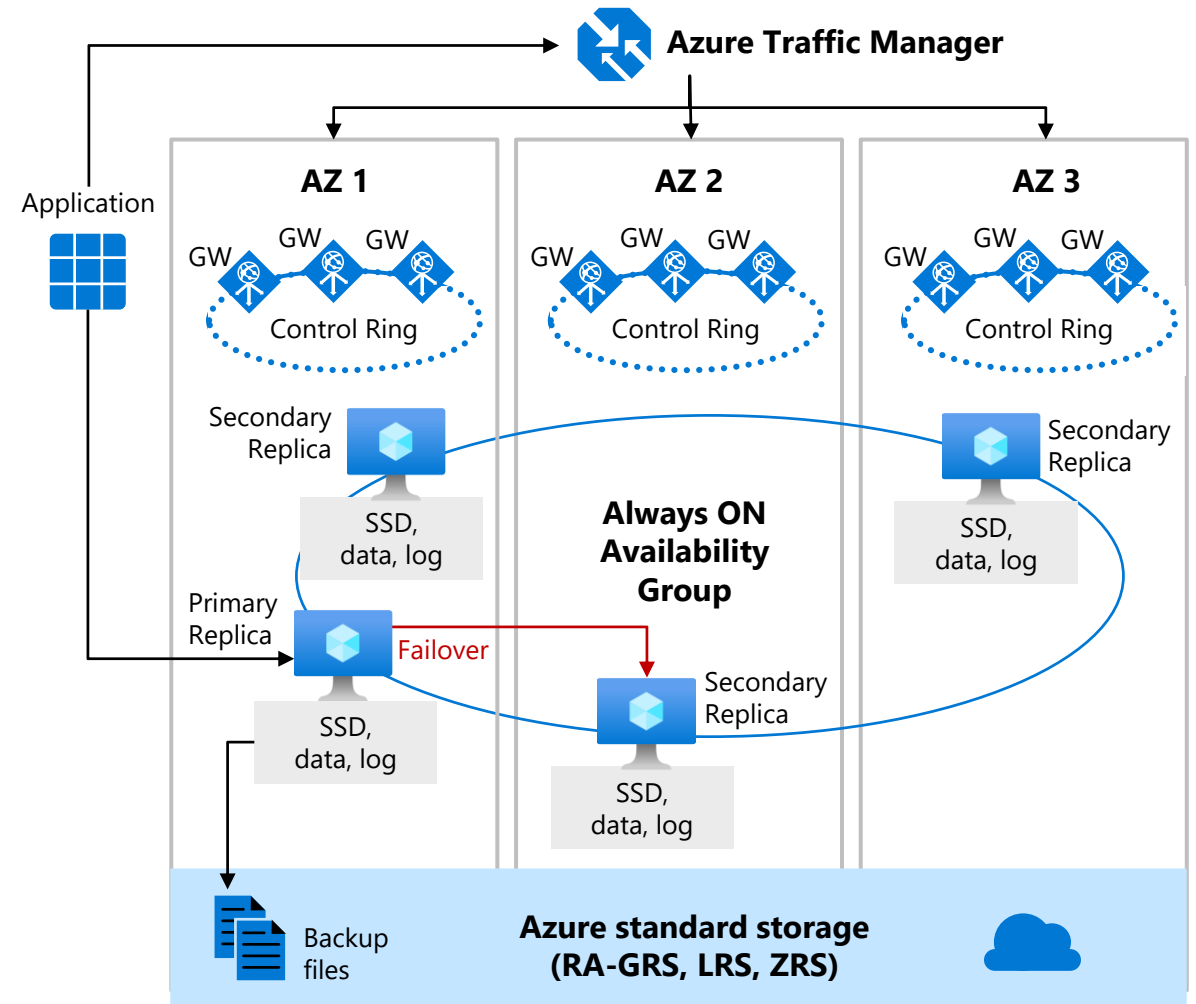
Zone redundant configuration – General Purpose

Zone redundant configurations for the General-Purpose service tier became Generally Available in December 2022. Only available in select regions.

A stateful data layer with the database files (.mdf/.ldf) that are stored in Zone Redundant Storage (ZRS) and are synchronously copied across three physically isolated Azure availability zones.

For zone-redundant serverless and provisioned General-Purpose databases, nodes with spare capacity are readily available in other Availability Zones for failover.

Zone redundancy for the General-Purpose service tier does come with an additional cost that includes charges for the extra resources required to maintain nodes with spare capcity across multiple Availability Zone
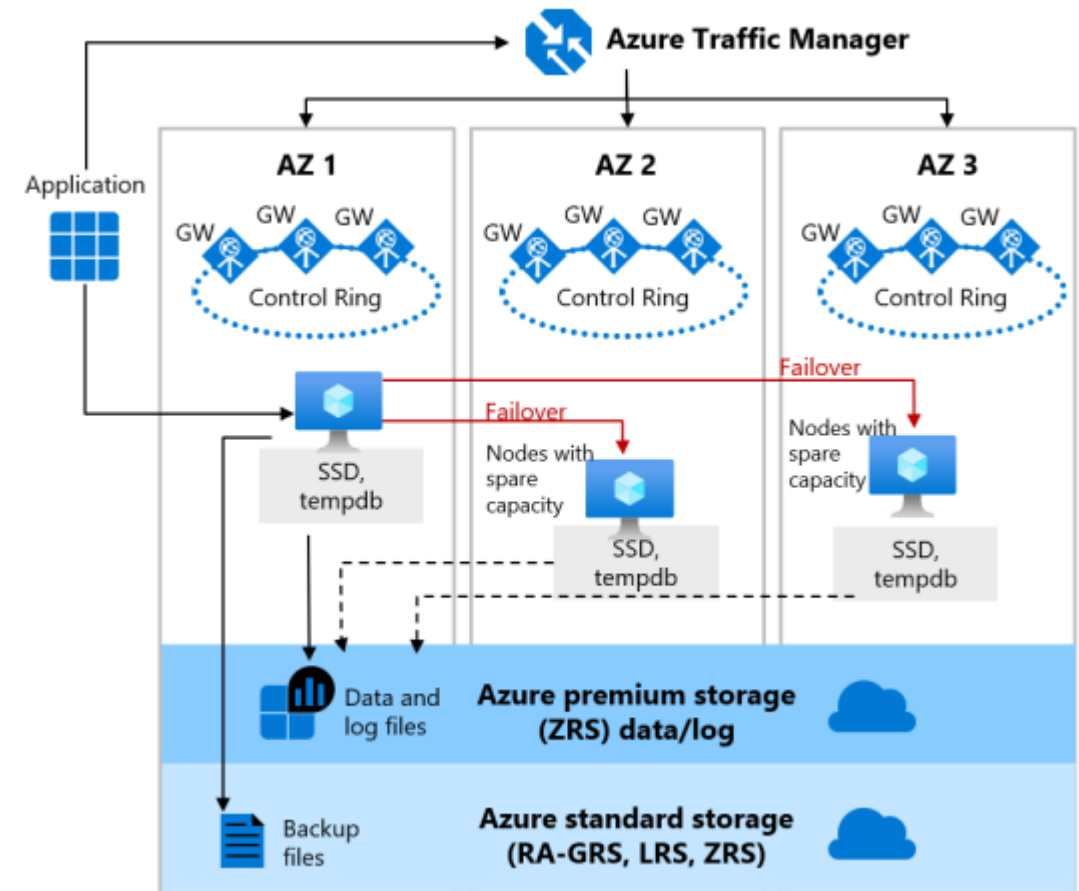
Read Scale-Out

Each database in the Premium and Business Critical service tiers is automatically provisioned with several AlwaysON replicas to support the availability SLA. These replicas are provisioned with the same compute size as the read-write.

Read Scale-Out redirects the read-only client connections to one of the ready-only replicas available instead of sharing the read-write replica.

Effectively isolate the read-only workload from the main read-write workload and doubles the compute capacity of the database or elastic pool at no additional charge.

This is ideal to scale-out for complex analytical workloads without affecting the primary OLTP workload.

Primary endpoint (read-write)

Read-only endpoint

Always On AG

Super-fast SSD

Primary replica

Secondary replica

Secondary replica

Secondary replica
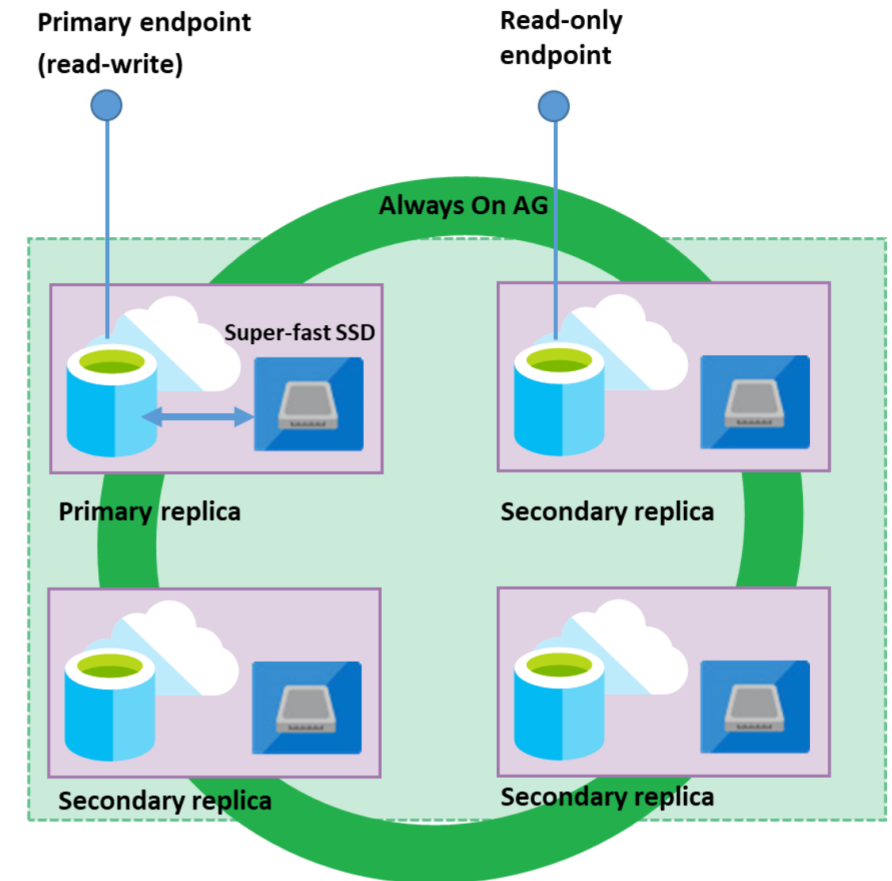
How to use Read Scale-Out?

Default Configuration

- **Enabled** in **Managed Instance** Business Critical tier.
- **Disabled** in **database** placed on **SQL Database server** Premium and Business Critical tiers.

Setup Methods

- **Azure Portal**
  - Settings > Configure > Premium/Business Critical tier > Read scale-out.
- **PowerShell**
  - Set-AzSqlDatabase or
  - New-AzSqlDatabase cmdlets.
- **Azure Resource Manager REST API**
  - Create or
  - Update method

Connection

- Applications will be directed to either the read-write replica or to a read-only replica according to the **ApplicationIntent property** configured in the application's **connection string**.
- Use **ApplicationIntent=ReadOnly**; to connect to the read-only replica.

If your database is geo-replicated, be sure the read scale-out is enabled on both primary and geo-replicated secondary databases.

Backup and restore

Auto backups and Point in Time Restore (PITR)

- Full Database backup once a week
- Differential Backups every 12-24 hours
- Log Backups every 5-10 minutes
- Backup files on Azure storage with RA-GRS replicated
  - Can optionally select LRS or ZRS
- Backup Integrity checks
- Restore to new database
- Long-term retention (up to 10 years) of backups
- Geo-restore of databases if primary region down
- Restore backups of deleted databases

Backups retained for 7/35 days

Time

Now ——————————————→ -7 days

Self-service restore
to a point in time

DB1

DB1
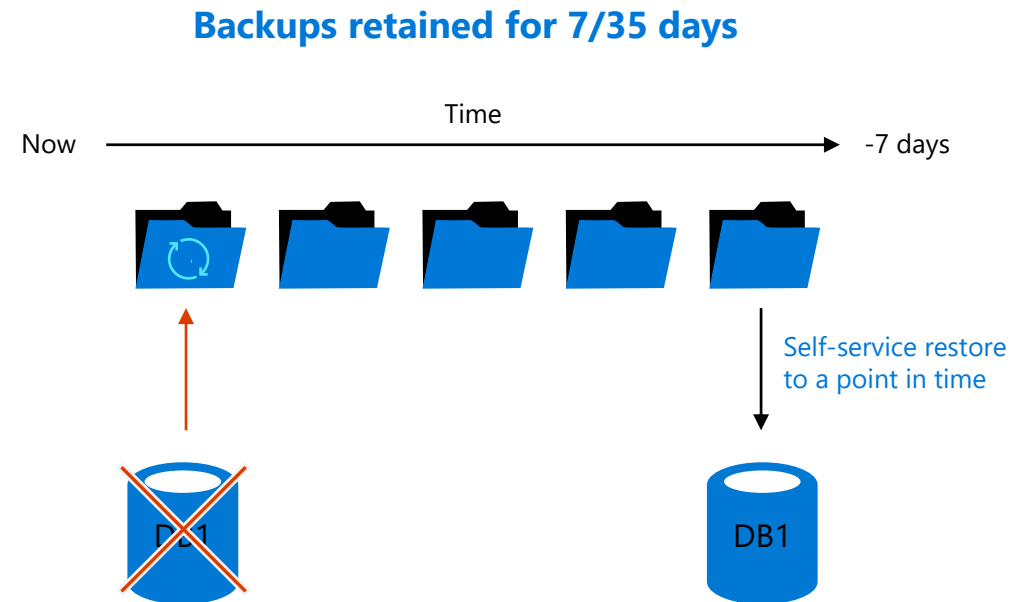
[Automatic, geo-redundant backups - Azure SQL Managed Instance | Microsoft Learn](#)

Setting Backup Policies

Database availability and consistency

Availability	Consistency
• You cannot set OFFLINE and EMERGENCY • RESTRICTED_USER access allowed • Dedicated Admin Connection (DAC) allowed • Accelerated Database Recovery on by default	• Multiple copies of data and backups • Users can execute DBCC CHECKDB (no repair) • Database CHECKSUM on by default • Auto Page Repair when possible • Data integrity error alert monitoring • Backup and restore integrity checks • "lost write" and "stale read" detection • Repair without notification if no impact • Proactive notification to customers

Accelerated Database Recovery (ADR)

- How it works
  - Uses a Persisted Version Store (PVS)
  - Independent of locking and isolation levels
  - Rollback faster than you can react
  - Undo recovery faster than you can look it up
  - Transaction log truncation not tied to active transactions
- Key questions
  - Does it require more space?
  - Will it affect performance?
  - Will I still see versions in tempdb?
  - How does it work with HA?
- Read the paper
- John's video

Demonstration

Enable and disable Read Scale-Out

- Enabling a database with read scale-out.

- Connecting to a Read Scale-Out replica.

- Disabling read scale-out.

Lesson 5: Implement Entra ID Security

Objectives

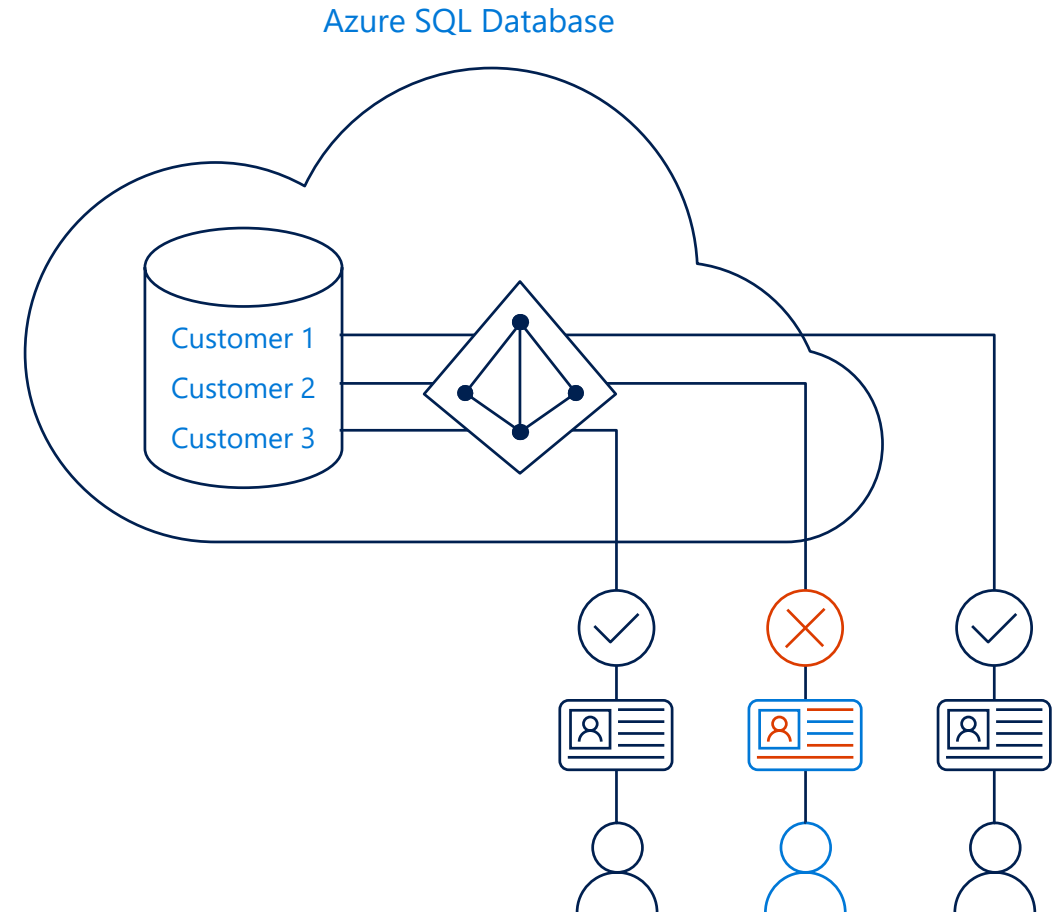After completing this learning, you will be able to:

· Know how to leverage Entra ID security for authenticating connections to an Azure SQL Database.
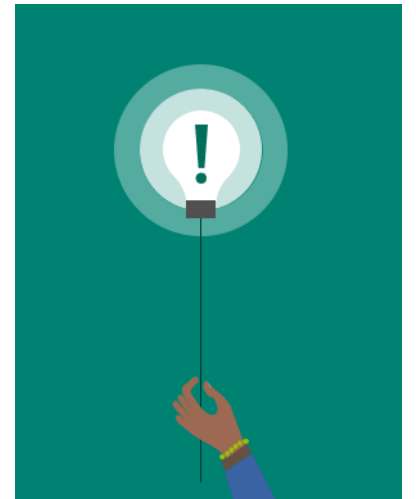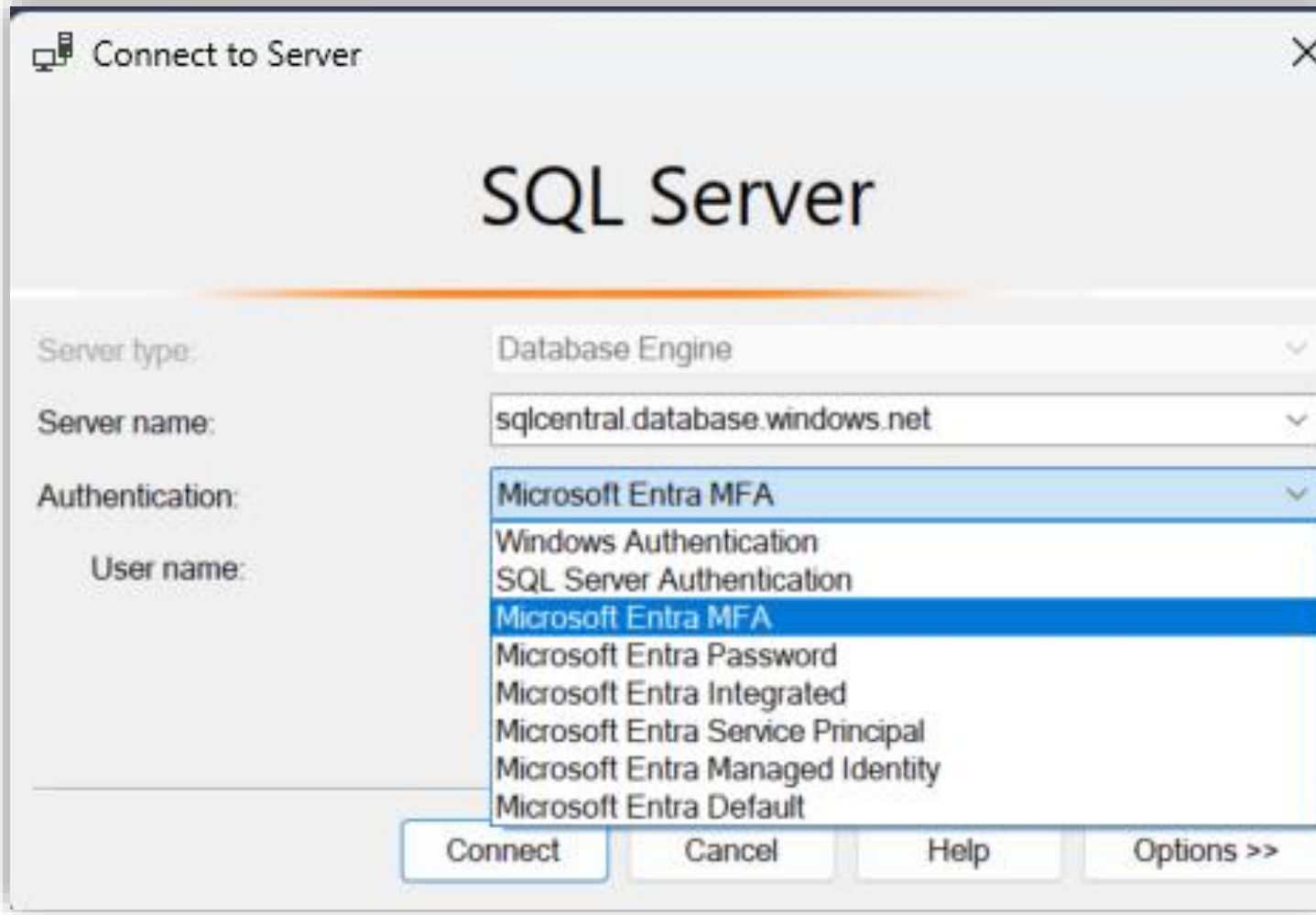
Entra ID Security

Azure Active Directory is now called Entra ID authentication.

Authentication is a mechanism of connecting to Microsoft Azure SQL Database by using identities in Entra ID

Azure SQL Database

Customer 1
Customer 2
Customer 3

Types of Entra ID Authentication

Benefits of Entra Authentication

Centrally manage user permissions.

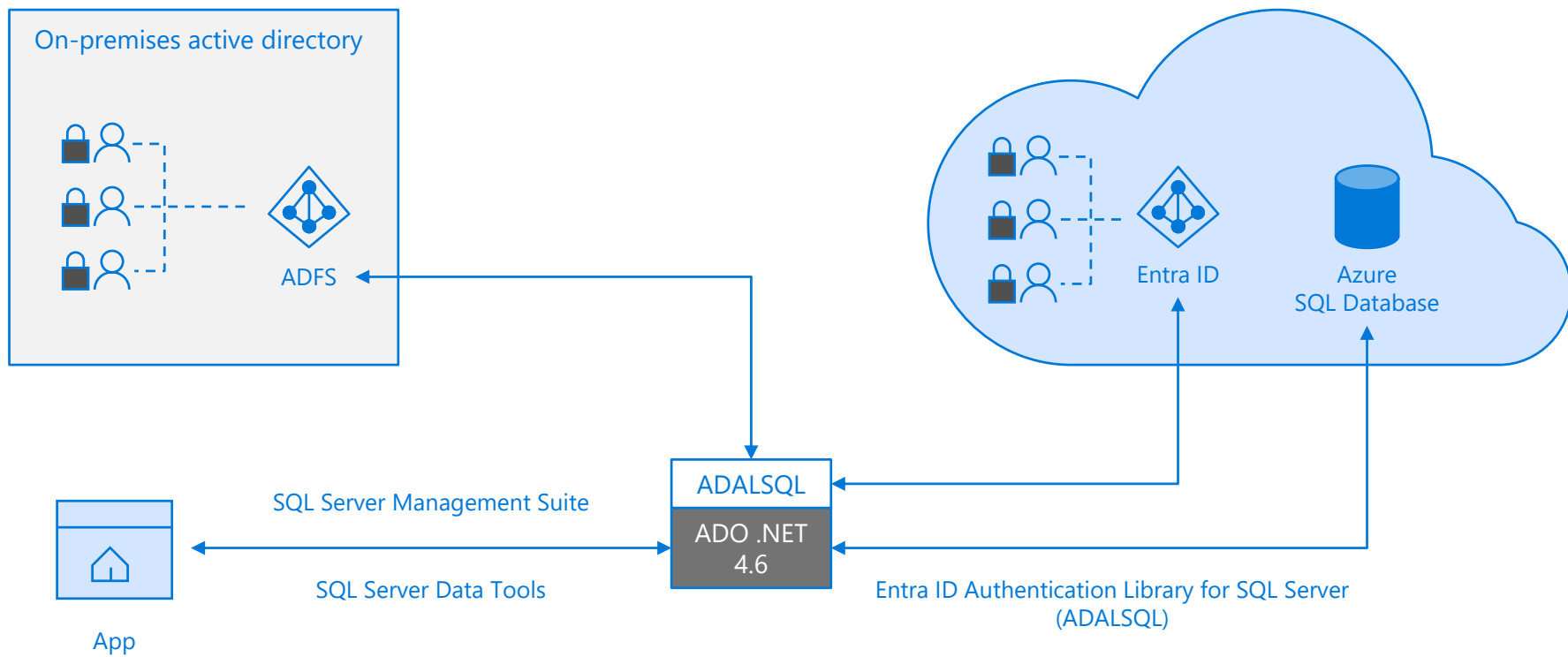Alternative to SQL Server authentication.

Allows password rotation in a single place.

Enables management of database permissions using external Entra ID groups.

Stops password storing by using integrated Windows authentication and other forms of authentication supported by Entra ID.

Trust architecture

Entra ID and Azure SQL Database

On-premises active directory

ADFS

Entra ID

Azure SQL Database

SQL Server Management Suite

ADALSQL

ADO .NET 4.6

SQL Server Data Tools

Entra ID Authentication Library for SQL Server (ADALSQL)

App

Demonstration

Implement Entra ID Authentication

- Connect to Entra ID.
- Connect to Azure SQL DB using SSMS through Entra ID authentication.

Questions?

Knowledge Check

List three benefits of Azure Activity Directory Authentication.

Can we use Windows authentication for Azure SQL Database?

Lesson 6: Manage Logins in Azure SQL Database

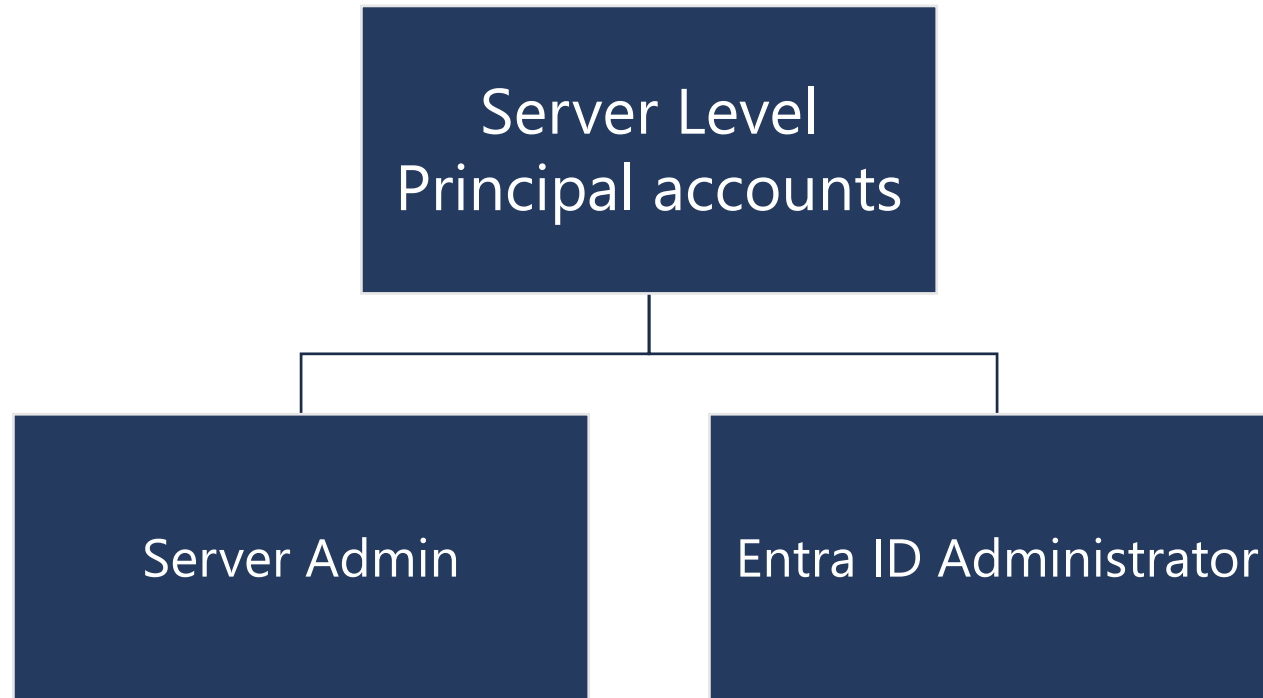# Objectives

After completing this learning, you will be able to:
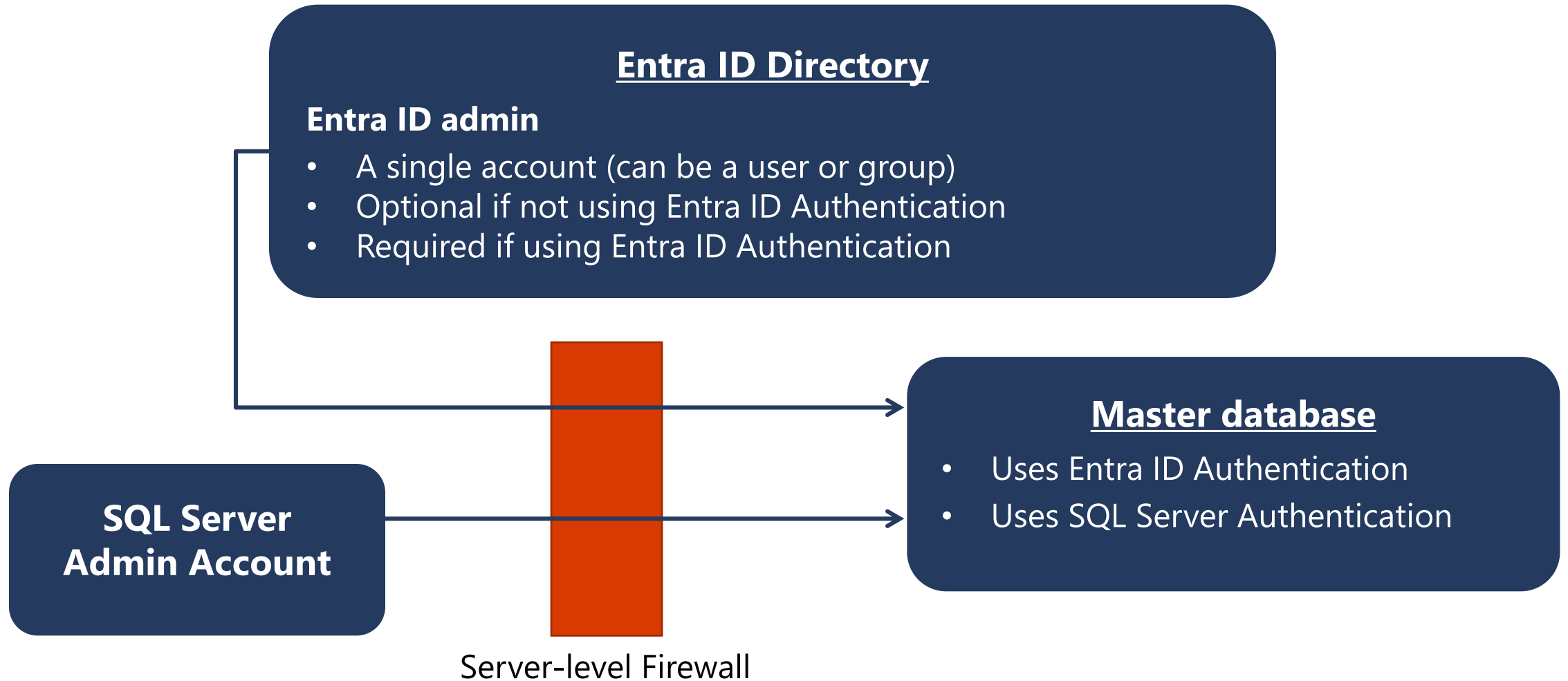
· Manage logins within Azure SQL Database.

Unrestricted Administrative Accounts

Server Level
Principal accounts

Server Admin

Entra ID Administrator

Administrator Access Path

Additional Special Roles

Database Creators

- ALTER ROLE dbmanager* ADD MEMBER Mary;

- ALTER ROLE dbmanager* ADD MEMBER [mike@contoso.com];

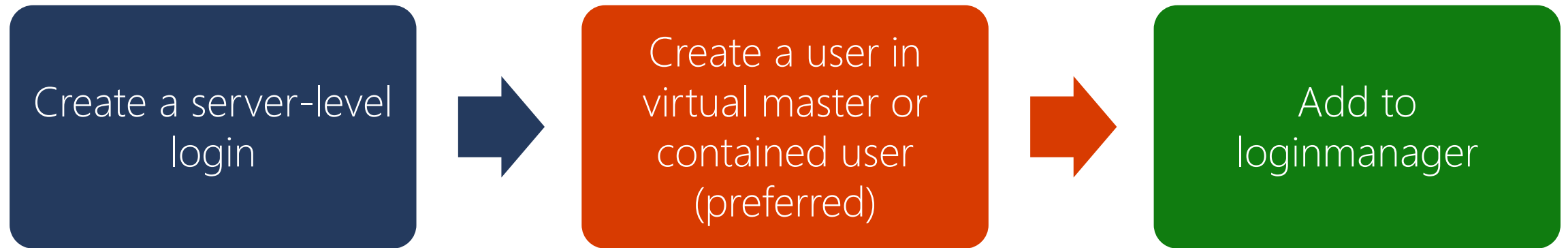Create a server-level login → Create a user in virtual master → Add to dbmanager

*dbmanager is a database role in virtual master database.

Additional Special Roles (continued)

Login Managers

- ALTER ROLE loginmanager* ADD MEMBER Mary;

- ALTER ROLE loginmanager* ADD MEMBER [mike@contoso.com];

Create a server-level login	→	Create a user in virtual master or contained user (preferred)	→	Add to loginmanager

*loginmanager is a database role in virtual master database.

Non-administrator Users

· Generally, non-administrator accounts do not need access to the virtual master database.

· Create contained database users at the database level.

Options:

Entra ID authentication contained database user.	SQL Server authentication contained database user.	SQL Server authentication user based on a SQL Server authentication login.

Groups and Roles

Entra ID authentication

- Put Entra ID users into an Entra ID group.
- Create a contained database user for the group.
- Place one or more database users into a database role.
- Assign permissions to the database role.

SQL Server authentication

- Create contained database users in the database.
- Place one or more database users into a database role.
- Assign permissions to the database role.

Database Roles

The database roles can be the built-in roles such as:

db_owner	db_ddladmin	db_datawriter
db_datareader	db_denydatawriter	db_denydatareader

Naming Requirements

Certain usernames are not allowed for security reasons. You cannot use the following names:

admin

administrator

guest

root

sa

Demonstration

Connect to an Azure SQL DB using SQL Authentication

- Using SQL Login + SQL User.
- Using Contained Database User.

Questions?