



# Introduction to Azure SQL

Module 1



## Learning Units covered in this Module

- Lesson 1: Basic concepts of Azure SQL
- Lesson 2: How to create Azure SQL Database

# 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 140 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

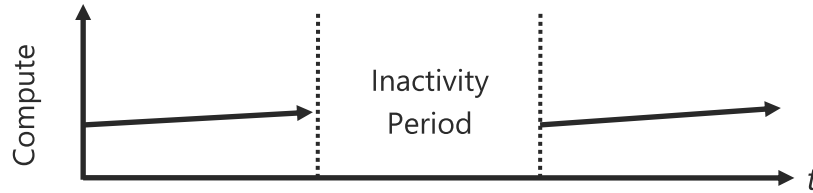
- Help build a clean-energy future and accelerate progress toward your sustainability goals.

# What is Microsoft Azure?

<https://azure.microsoft.com/en-us/global-infrastructure/regions/>

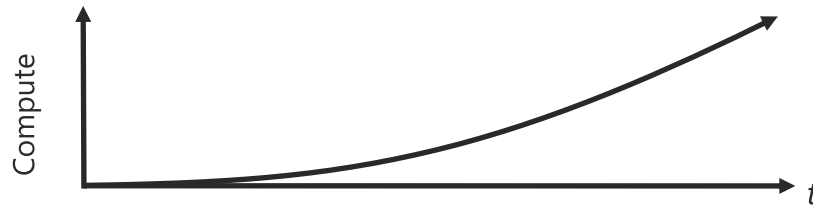


# Benefits of Cloud Computing



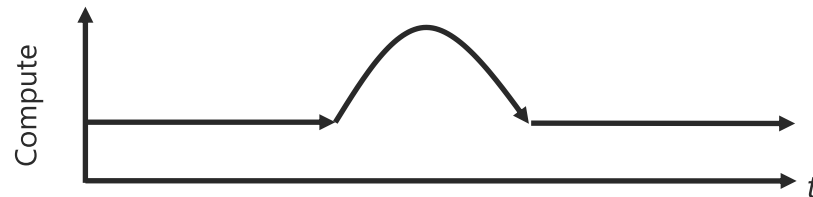
## On and Off

On and off workloads (for example: batch job).  
Over provisioned capacity is wasted.  
Time to market can be cumbersome.



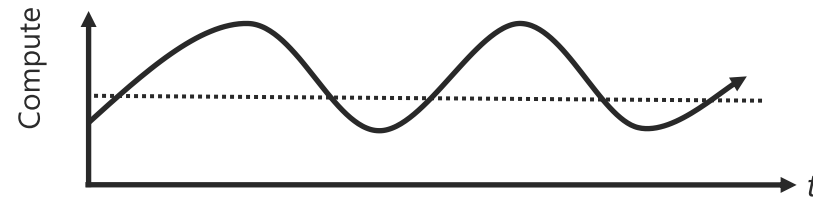
## Growing Fast

Successful services needs to grow/scale.  
Keeping up with growth is a big IT challenge.  
Cannot provision hardware fast enough.



## Unpredictable Bursting

Unexpected/unplanned peak in demand.  
Sudden spike impacts performance.  
Cannot over provision for extreme cases.



## Predictable Bursting

Services with micro seasonality trends.  
Peaks due to periodic increased demand.  
IT complexity and wasted capacity.

# 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

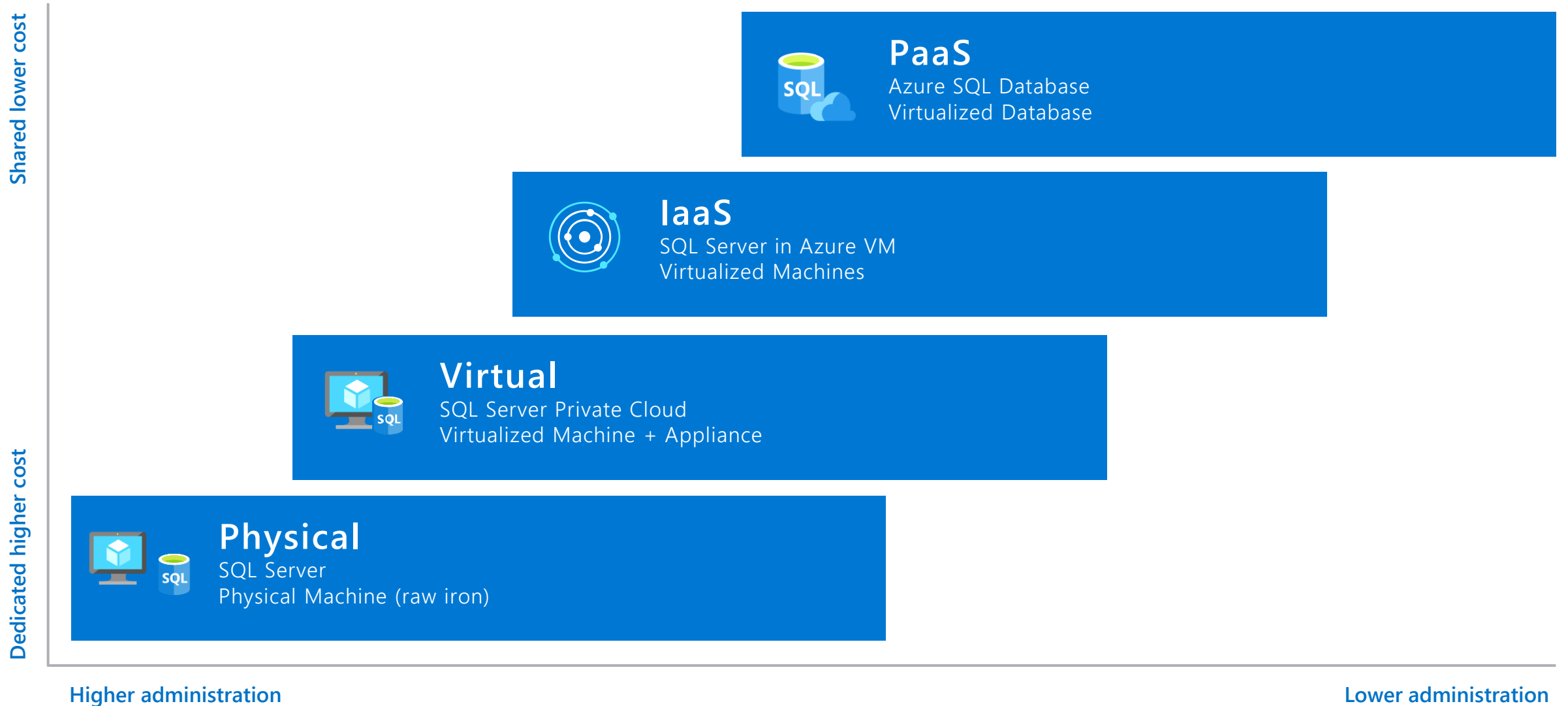
**Platform-as-a-Service** off-loads customers' most administrative tasks to Azure, further improving efficiency with machine-learning capabilities for performance and security

- **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 SQL Managed Instance



# Data platform continuum



# 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 >](#)

# 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.

## 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.

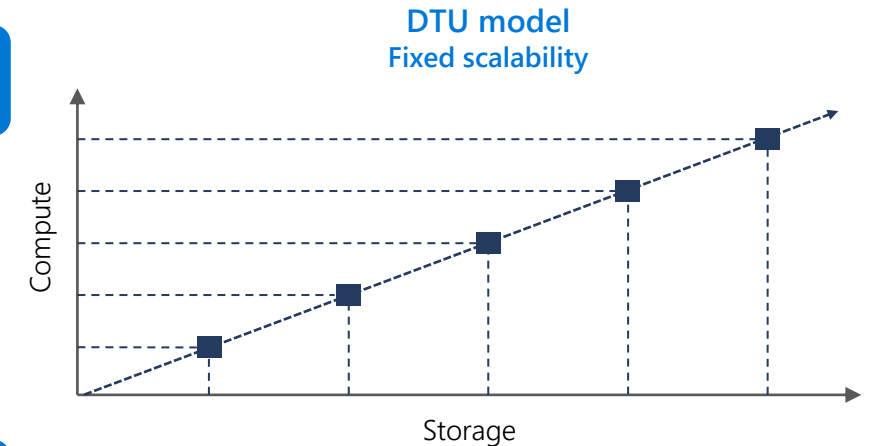
## Azure SQL Database

- 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 Database Purchasing models and resources

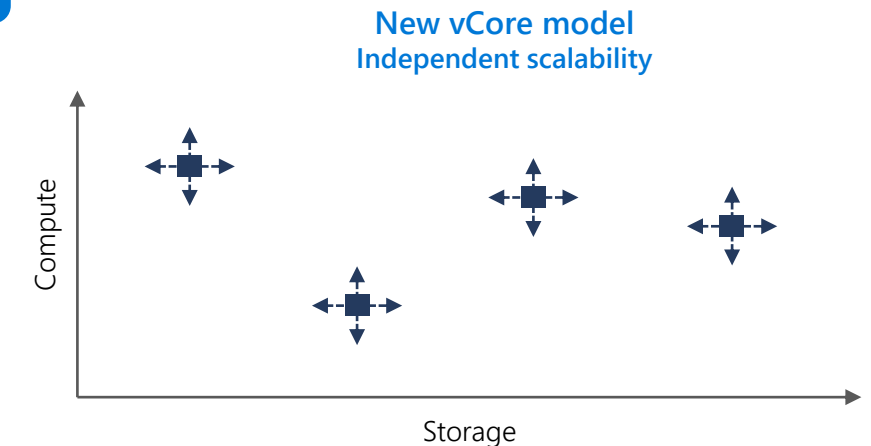
## Database Transaction Unit (DTU) model

- 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

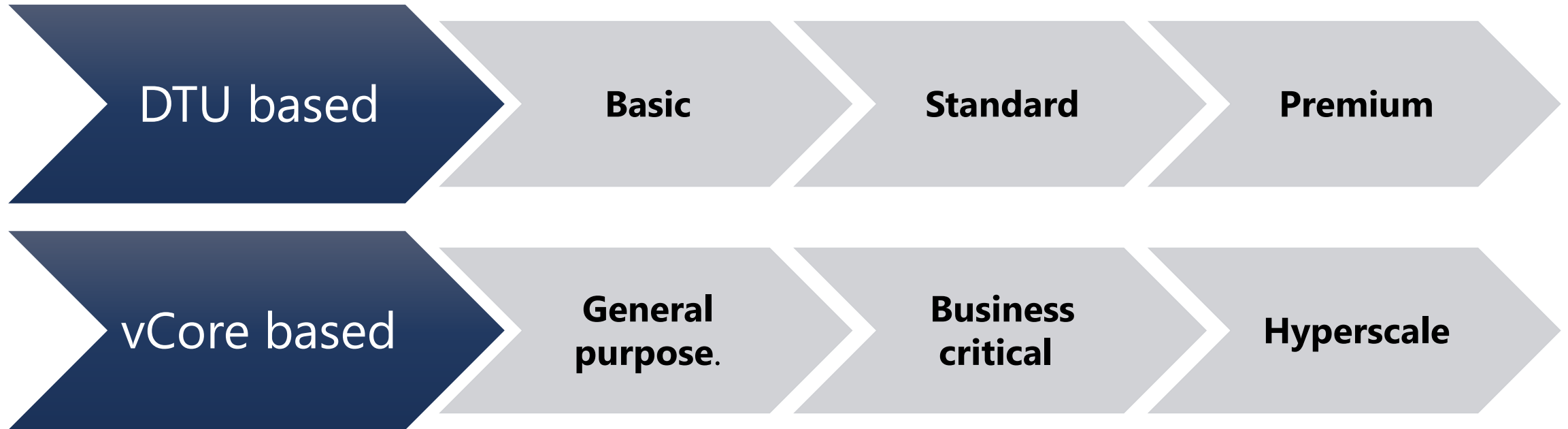
- À La carte approach deconstructs the DTU model into separate parts.
- Customers can select compute and storage independently.
- Allows customers to right-size their compute requirements in the cloud.
- vCore sizing offers flexibility of choice.
- Provides a choice between a **provisioned compute tier**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



## Purchasing models available for Azure SQL Database deployment:

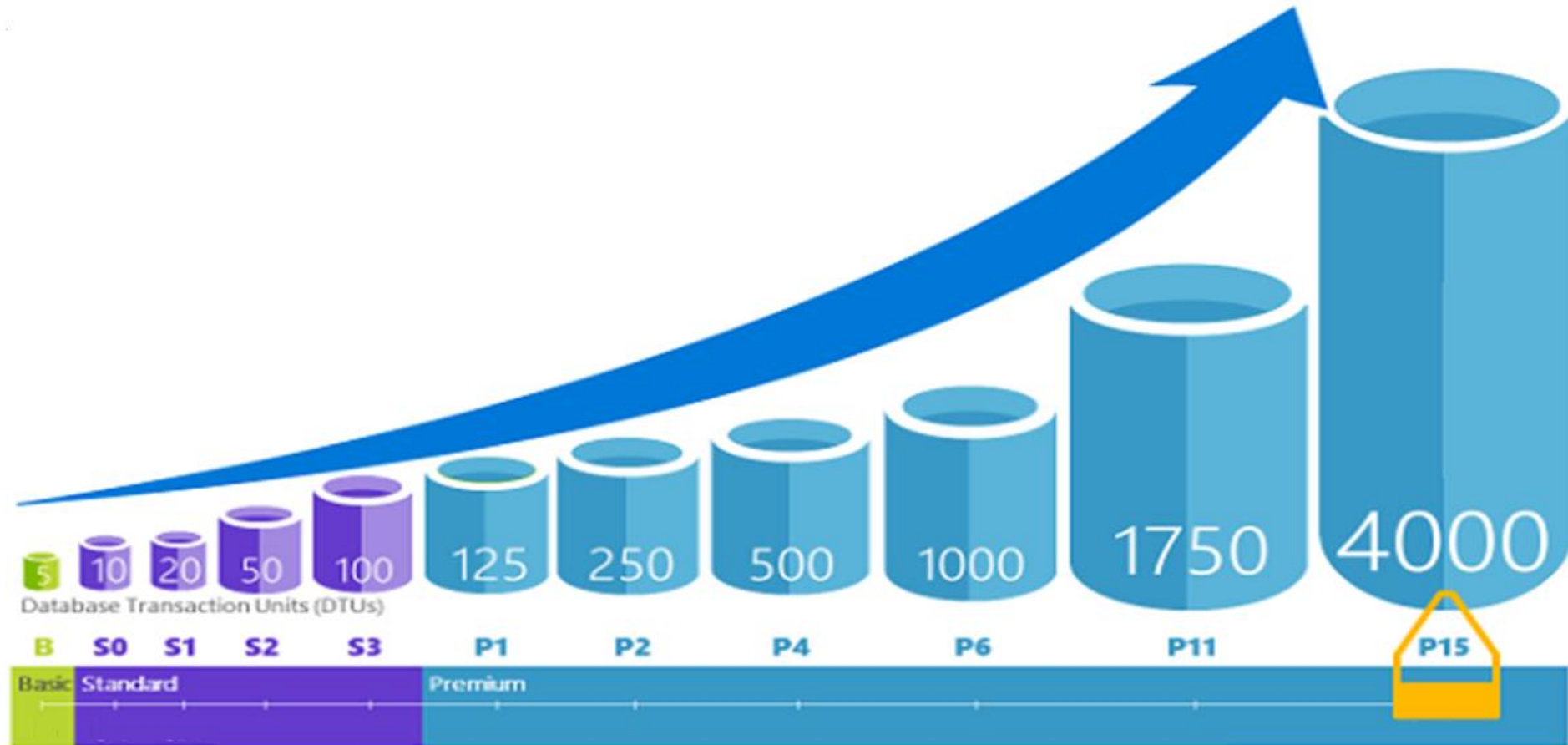
Purchasing model/ Deployment model	DTU based	vCore based
Single Database	✓	✓
Elastic Pool	✓	✓
Managed Instance	✗	✓
Hyperscale service tier (single databases)	✗	✓

# Overview Service Tiers



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

# Database Transaction Units (DTUs)



# 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


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



# Changing Performance Levels (DTU)

## PowerShell

- Set-AzSqlDatabase

## REST

- Update database

## Azure CLI

- az sql db update

## T-SQL

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

**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

DTUs [Compare DTU options](#)

**5 (Basic)**

Data max size (GB)

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**DTU-based purchasing model**

- Basic (For less demanding workloads)
- Standard (For workloads with typical performance requirements)
- Premium (For IO-intensive workloads)

# Changing Performance Levels (vCore)

## PowerShell

- Set-AzSqlDatabase

## REST

- Update database

## Azure CLI

- az sql db update

## T-SQL

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

### 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) ▼

Compute tier

vCore-based purchasing model

General Purpose (Scalable compute and storage options)

Hyperscale (On-demand scalable storage)

Business Critical (High transaction rate and high resiliency)

DTU-based purchasing model

Basic (For less demanding workloads)

Standard (For workloads with typical performance requirements)

Premium (For IO-intensive workloads)

up to 80 vCores, up to 408 GB memory

[Change configuration](#)

Compute Hardware

Select the hardware configuration based on confidential computing hardware depends on

Hardware Configuration

### Save money

Already have a SQL Server License? Save with a license you already own with Azure Hybrid Benefit. Actual savings may vary based on region and performance tier. [Learn more](#)

☐ Yes ☒ No

vCores [Compare vCore options](#)



2

Data max size (GB) ⓘ



32

# 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
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

# vCore-based purchasing model: Serverless compute tier



## On-demand flexible scale

Operate at the true rhythm of your business.

Adapts compute resources to the workload without sacrificing performance.

Automatically pauses and resumes.



## Cost-effective

Pay for performance. Period.

Pay only for compute resources you consume, on a per-second basis.

Further optimize costs with configurable compute thresholds.



Fully managed & intelligent  
Focus on your applications, not your infrastructure

Fully-managed and intelligent database service.

Built-in 99.99% availability.

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Best for unpredictable and intermittent workloads on single databases, such as:



Dev/test



Line of Business



E-commerce

# 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.

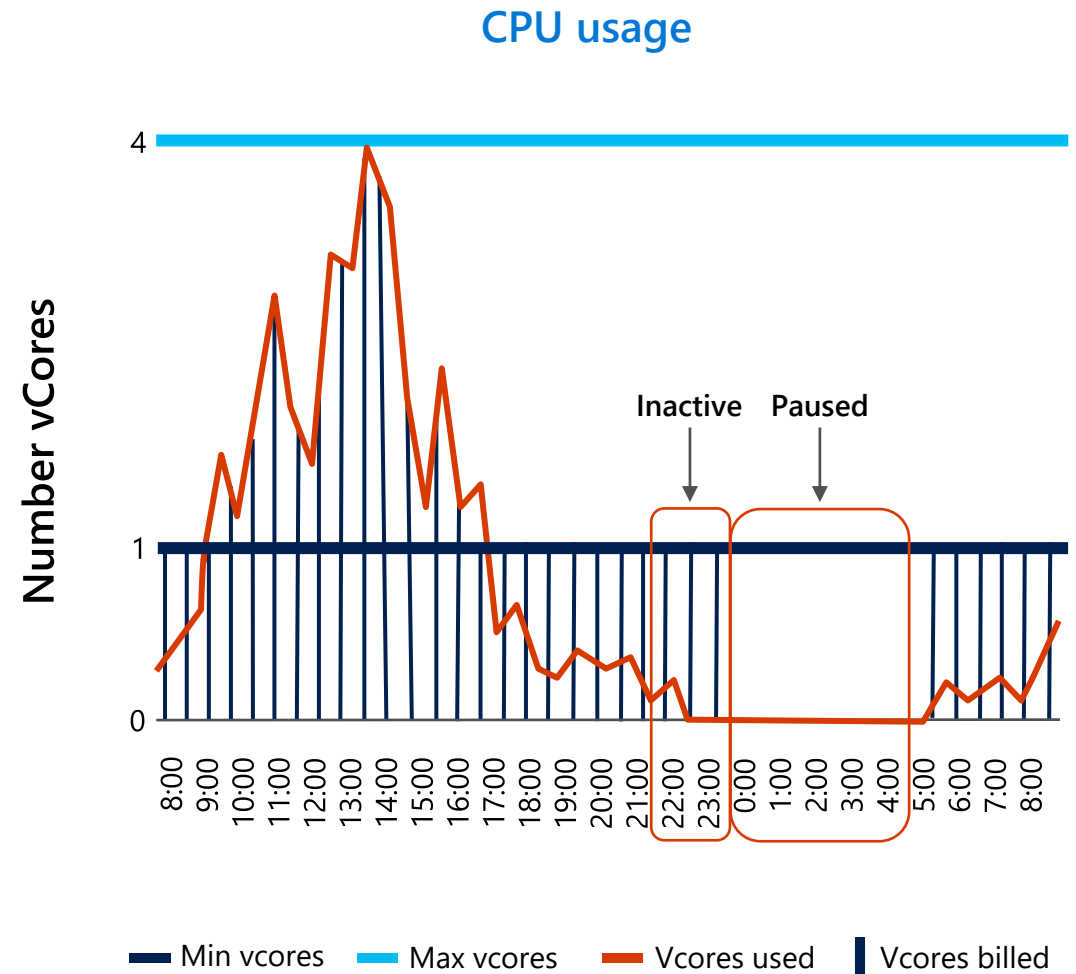
Configure minimum and maximum vCores to define the range of available compute capacity.

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.





## Lesson 2: How to create Azure SQL Database

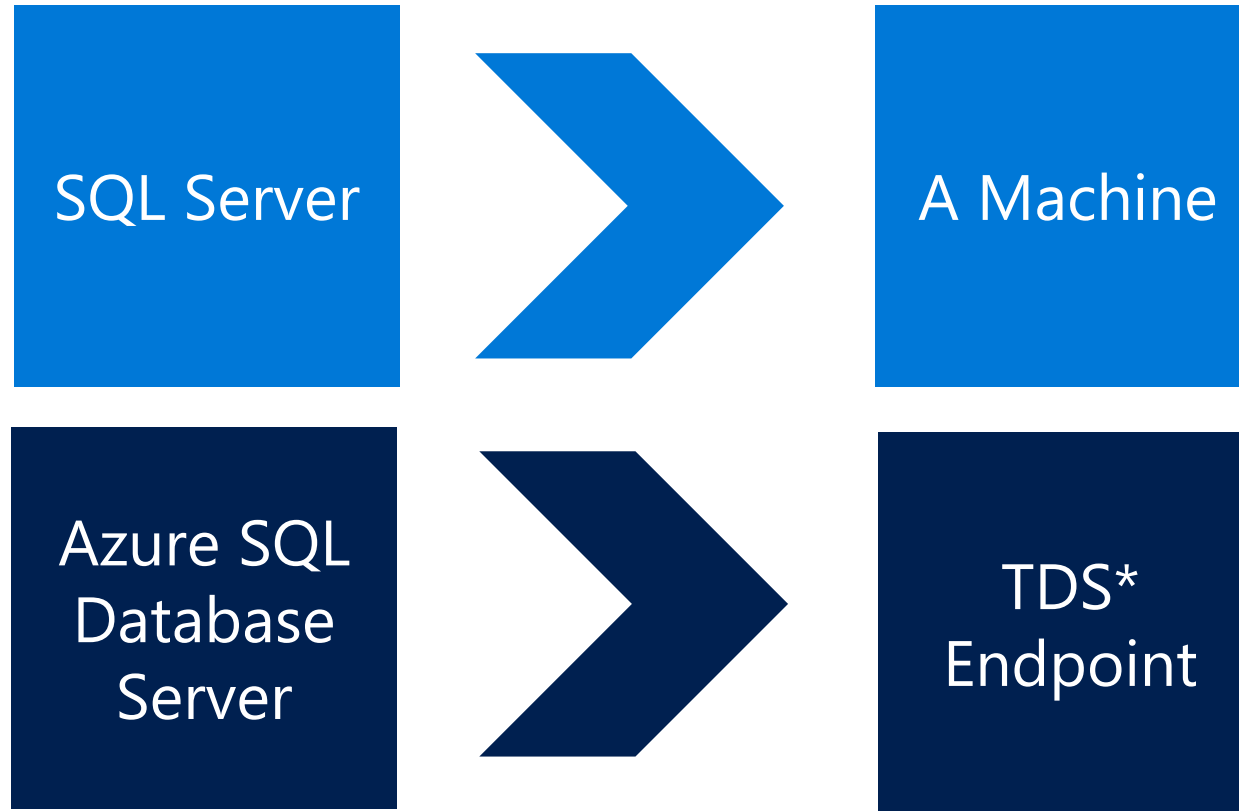
# Objectives

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...



\*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 \* dbssql essentials ✓  
.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

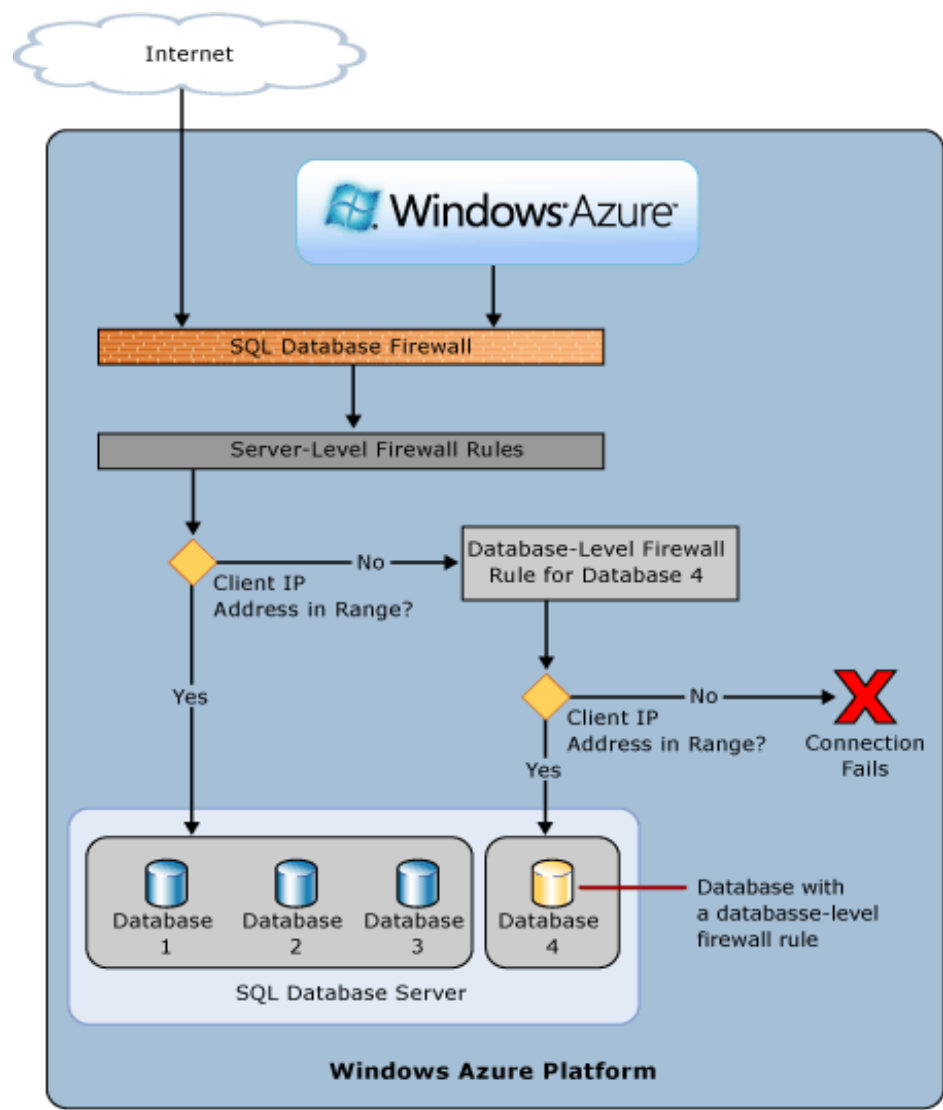
Server admin login \* sqlserveradmin ✓

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

# Demonstration

## Create your first Azure SQL Database

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



Questions?

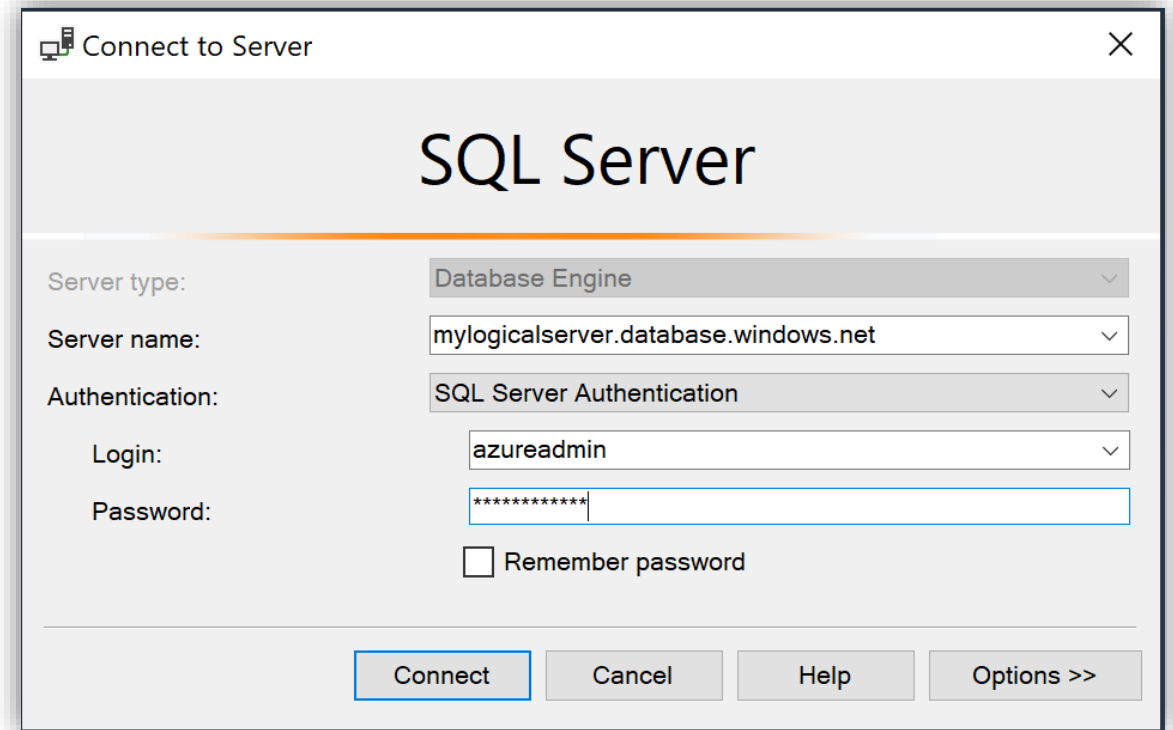


# SQL Server Management Studio

Download  
the latest  
version of  
SSMS.

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

Connect to  
your SQL  
Database.

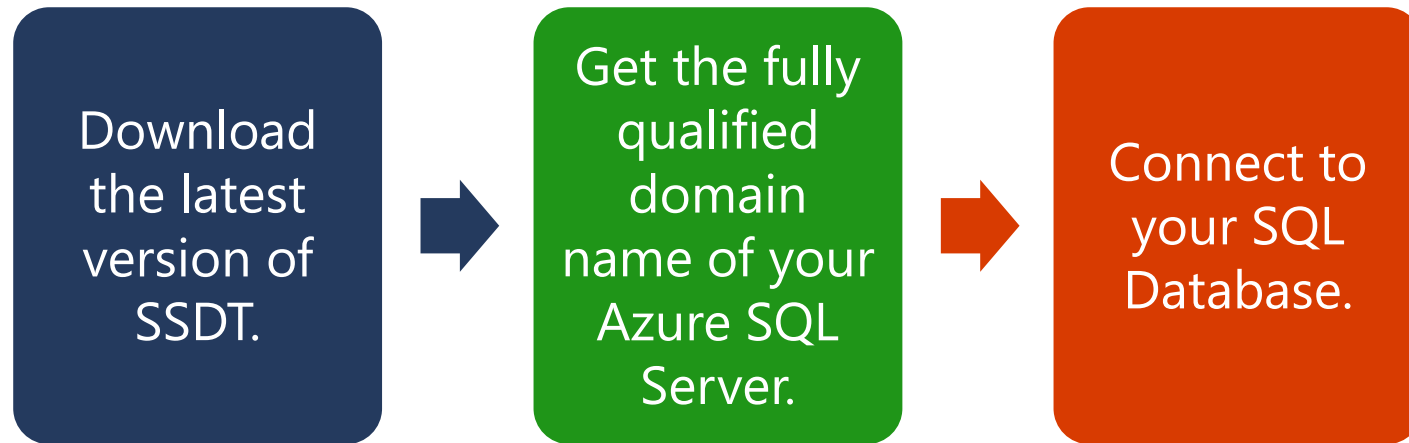


The screenshot shows the 'Connect to Server' dialog box with the following fields and options:

- Server type:** Database Engine (dropdown)
- Server name:** mylogicalserver.database.windows.net (dropdown)
- Authentication:** SQL Server Authentication (dropdown)
- Login:** azureadmin (dropdown)
- Password:** [masked with asterisks]
- ☐ Remember password
- Buttons:** Connect, Cancel, Help, Options >>



# SQL Server Data Tools



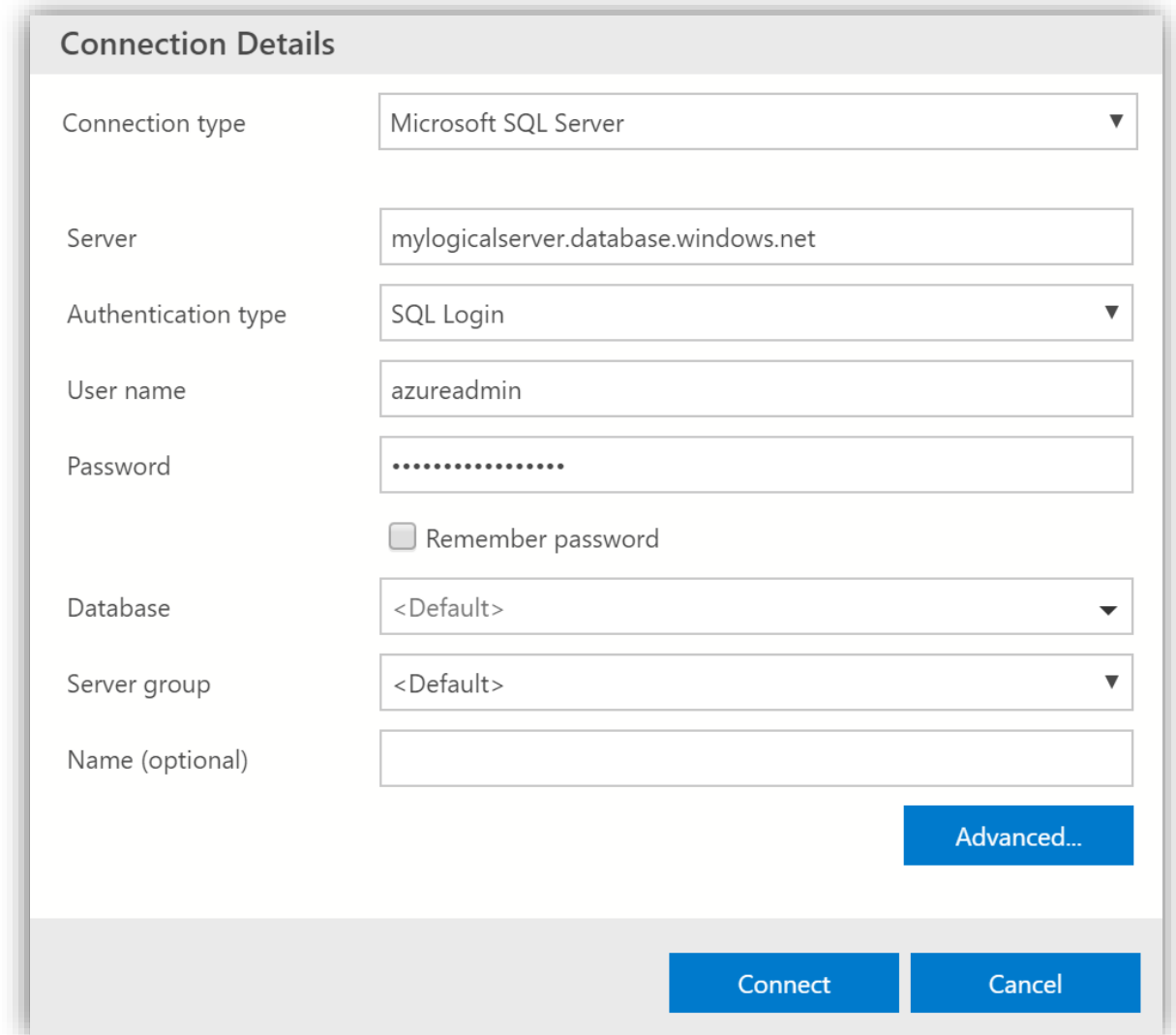
The screenshot shows the 'Connect' dialog box in SQL Server Data Tools. The 'Browse' tab is selected, showing a search bar and a tree view with 'Local', 'Network', and 'Azure' options. Below the tree view, the 'Server Name' field is populated with 'mylogicalserver.database.windows.net'. The 'Authentication' dropdown is set to 'SQL Server Authentication'. The 'User Name' field is populated with 'azureadmin', and the 'Password' field is masked with dots. There is a 'Remember Password' checkbox which is unchecked. The 'Database Name' dropdown is set to '<default>'. At the bottom right, there is a link for 'Advanced...' and two buttons: 'Connect' and 'Cancel'.

# 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.



The screenshot shows the 'Connection Details' dialog box in Azure Data Studio. It contains the following fields and options:

- Connection type:** A dropdown menu set to 'Microsoft SQL Server'.
- Server:** A text box containing 'mylogicalserver.database.windows.net'.
- Authentication type:** A dropdown menu set to 'SQL Login'.
- User name:** A text box containing 'azureadmin'.
- Password:** A text box with masked characters (dots). Below it is a checkbox labeled 'Remember password' which is currently unchecked.
- Database:** A dropdown menu set to '<Default>'.
- Server group:** A dropdown menu set to '<Default>'.
- Name (optional):** An empty text box.

At the bottom right of the dialog, there are three buttons: 'Advanced...' (in a blue box), 'Connect' (in a blue box), and 'Cancel' (in a blue box).

# Azure Portal

