



# Introduction to Azure SQL Database

Module 1



## Learning Units covered in this Module

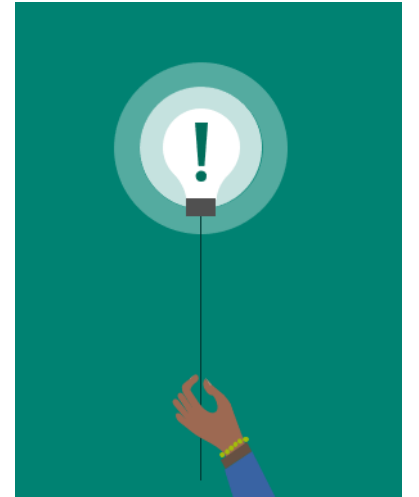
- Lesson 1: Basic concepts of Azure SQL
- Lesson 2: SQL Server IaaS vs PaaS Solutions
- Lesson 3: Azure SQL DB vs Azure SQL MI

# Lesson 1: Basic concepts of Azure SQL Database

# 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/>



# 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

Applications
Data
High availability /DR/Backups
Database Provision/ Patch/Scaling
O/S provision /patching
Virtualization
Hardware
Datacenter Management

SQL Server  
2019/2022

## Infrastructure (as a Service)

Applications
Data
High availability /DR/Backups
Database Provision/ Patch/Scaling
O/S
Virtualization
Hardware
Datacenter Management

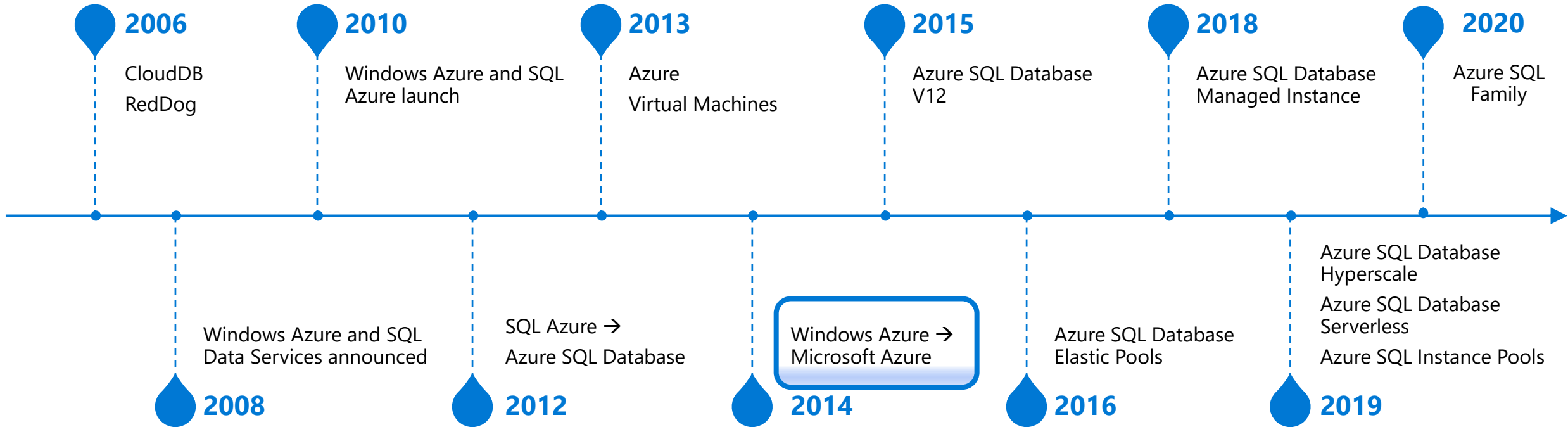
Azure SQL VMs

## Platform (as a Service)

Applications
Data
High Availability/ DR/Backups
Database Provision/ Patch/Scaling
O/S
Virtualization
Hardware
Datacenter Management

Azure SQL Database  
Azure SQL Managed Instance

# Azure SQL has come a long way





# 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 >](#)

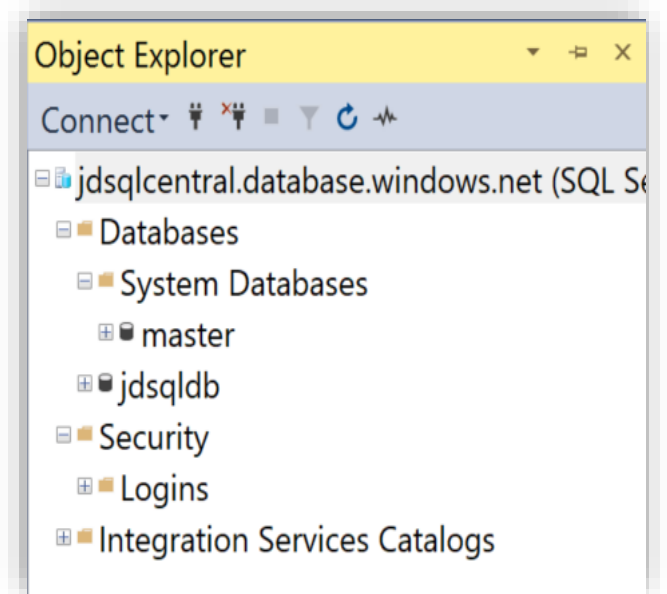
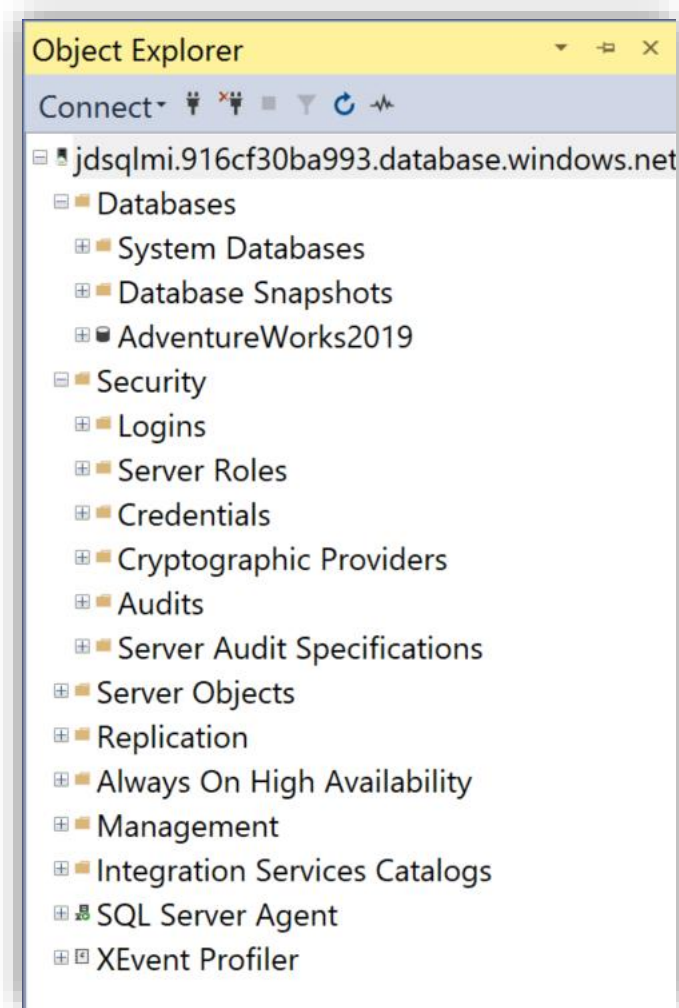
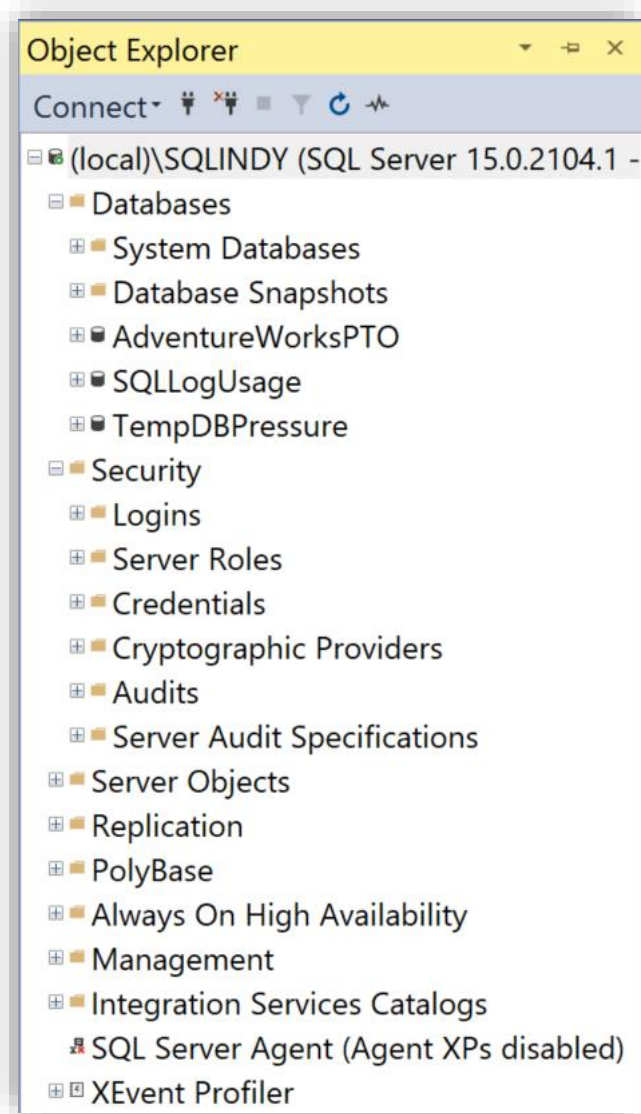


### Azure SQL Database

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



# What are my options?



## I want a Virtual Machine

Azure manages the hardware

You own the OS and SQL Server

You own monitoring and HADR



SQL Server in  
Azure Virtual Machine



## I want a SQL Server

Azure manages the hardware and OS

You get a SQL Server, but we help  
you manage it

You need SQL Server feature  
compatibility and low friction move



Managed Instance  
Single Instance Pool



Azure SQL Database  
Single Elastic Pool

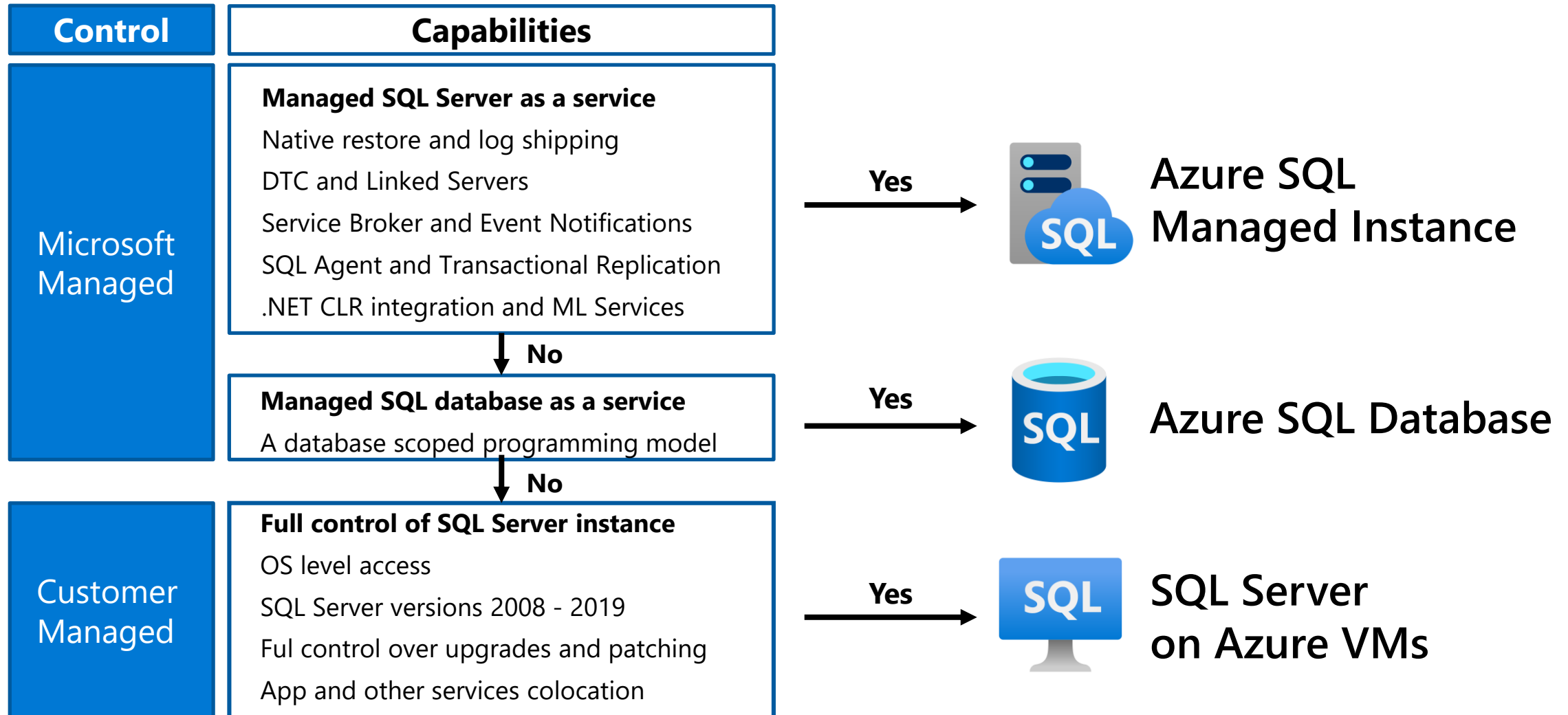
## I want a database

Azure manages the hardware, OS,  
and SQL Server

Azure gives you predictable  
performance

Azure provides HADR, monitoring,  
and intelligence

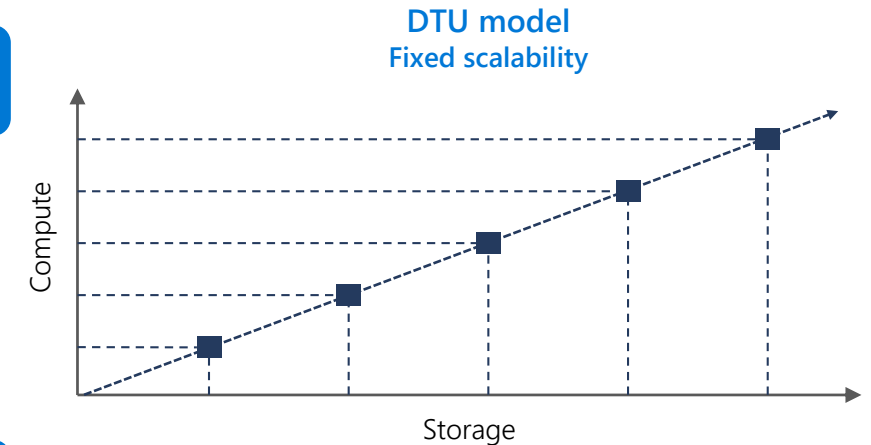
# Which Azure SQL offering is right for you?



# Azure SQL Database Purchasing models and resources

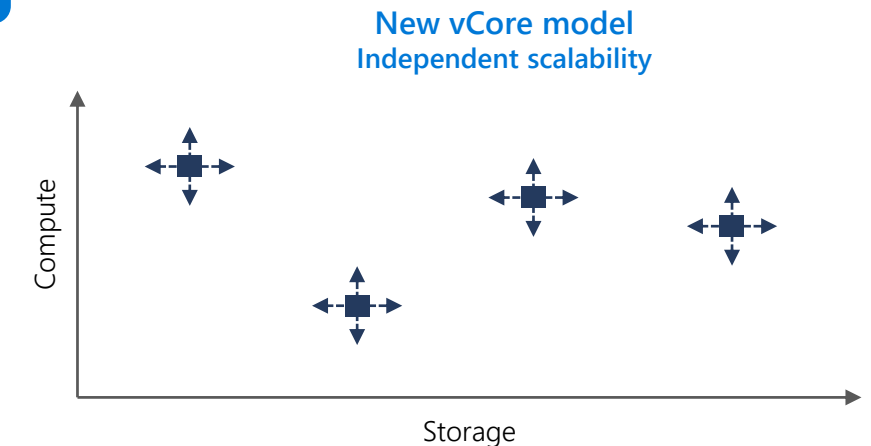
## Database Transaction Unit (DTU) model

- 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

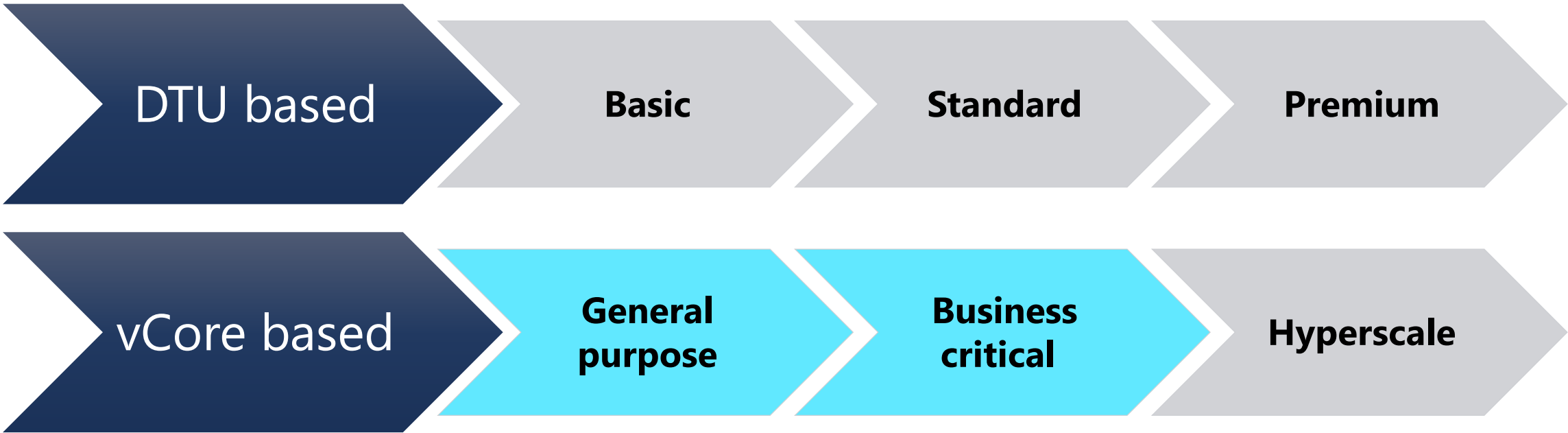
- À La carte approach deconstructs the DTU model into separate parts.
- Customers can select compute and storage independently.
- Allows customers to right-size their compute requirements in the cloud.
- vCore sizing offers flexibility of choice.
- Provides a choice between a **provisioned compute tier**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

# Azure SQL Service Tiers



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

**Azure SQL  
Managed  
Instance**

# 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)

---

**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](#)

# Demonstration

## Overview of Service Tiers available for Azure SQL Database

- Review the different Service Tiers, Compute and Hardware options available while creating an Azure SQL Database.






# 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															
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](#)

# 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.

---

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.

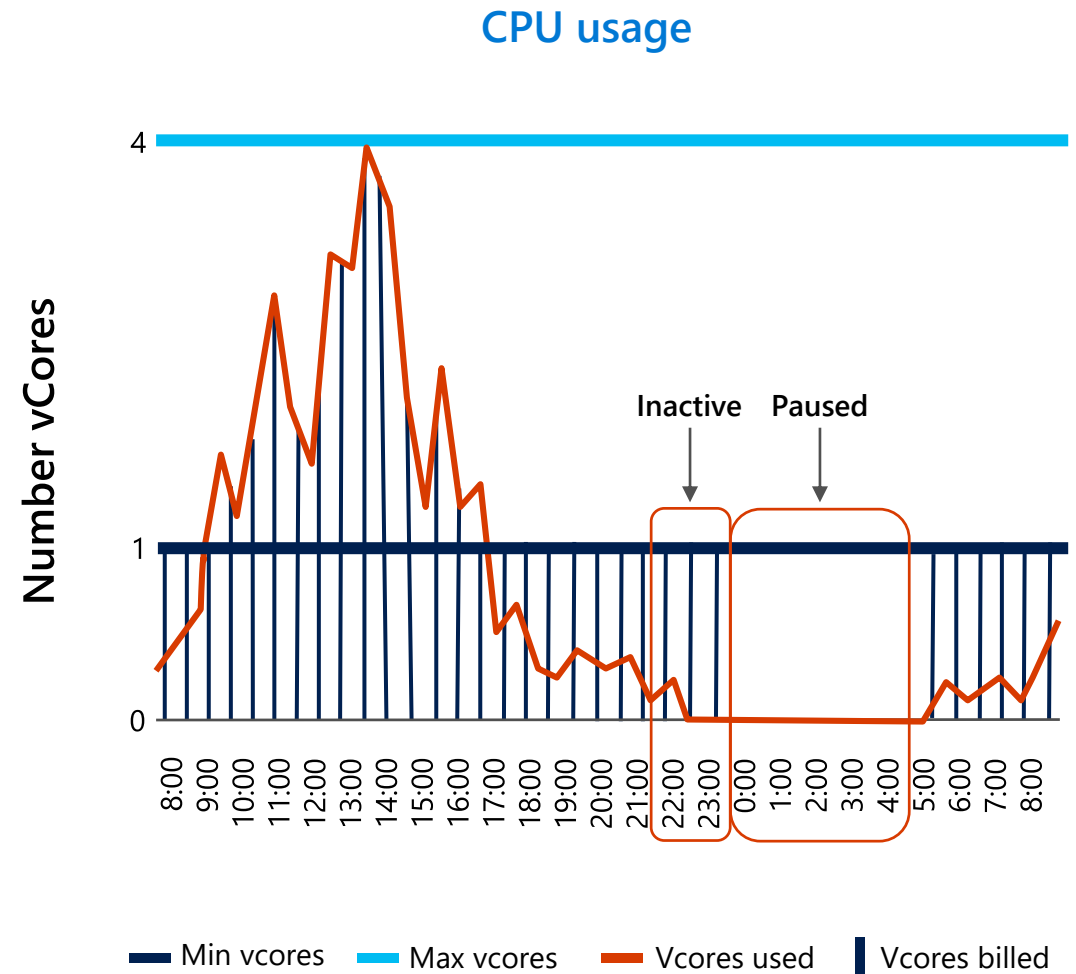
Configure minimum and maximum vCores to define the range of available compute capacity.

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.



# Identify the right Azure SQL Database/MI SKU for your on-premises database (I/II)

## Database Migration Assistant (DMA)

- Single database
- Elastic pools
- Managed instance

### Azure SQL DB SKU Recommendations

We have analyzed 3 databases. For each database, we have identified the minimum recommended Azure SQL DB SKU based off of the performance counters collected from your instances. For more detailed information about the predictions, please refer to one of the text-based output formats.

The sliders below can be used to adjust the compute level and the maximum data size for each database. After configuring the databases and entering the subscription information, click "Generate Provisioning Script" to generate a powershell script that can be used to provision the databases.

#### Subscription information

Subscription Id:	<input type="text"/>	Resource Group:	<input type="text"/>	Server Admin Username:	<input type="text"/>
Region:	<button>West US</button>	Server Name:	<input type="text"/>	Server Admin Password:	<input type="password"/>

#### Configure Databases

Provision	Database Name	Pricing Tier	Compute Level	Max Data Size	Est. Cost Per Month
<input checked="" type="checkbox"/>	edw_3g	<button>Premium</button>	P1 (125 DTU) <cost> <div><div></div></div>	Max Data Size: 40 Gb <cost> <div><div></div></div>	<cost>
<input checked="" type="checkbox"/>	mydb	<button>Premium</button>	P1 (125 DTU) <cost> <div><div></div></div>	Max Data Size: 5 Gb <cost> <div><div></div></div>	<cost>
<input checked="" type="checkbox"/>	tpcds1g	<button>Premium</button>	P1 (125 DTU) <cost> <div><div></div></div>	Max Data Size: 5 Gb <cost> <div><div></div></div>	<cost>
Total Estimated Monthly Cost					<cost>

NOTE: Price refresh failed for region West US. Prices shown are approximate. For the latest price, please consult the Azure Portal or retry with the proper authentication options enabled at a later time.

☐ I already have a SQL Server License (up to 55% savings).

Reset All to Recommended

Generate Provisioning Script

Questions?



# Knowledge Check

What are the differences between IaaS, PaaS, SaaS and where should you position Azure SQL Database?

What are the two purchasing models available?

What are the three vCore-based purchasing models that Azure SQL Database offers?

What are the differences between a provisioned compute tier and a serverless compute tier?

Which are the two deployment options that can use DTU-based or the vCore-based purchasing model?

