Microsoft

Introduction to Azure SQL Database

Module 1

Learning Units covered in this Module

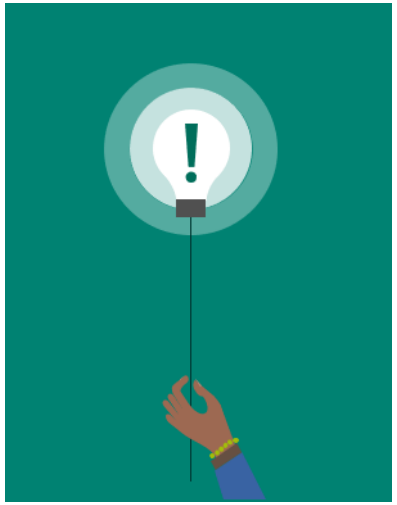
- Lesson 1: Basic concepts of Azure SQL
- Lesson 2: SQL Server IaaS vs PaaS Solutions
- Lesson 3: Azure SQL DB vs Azure SQL MI

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

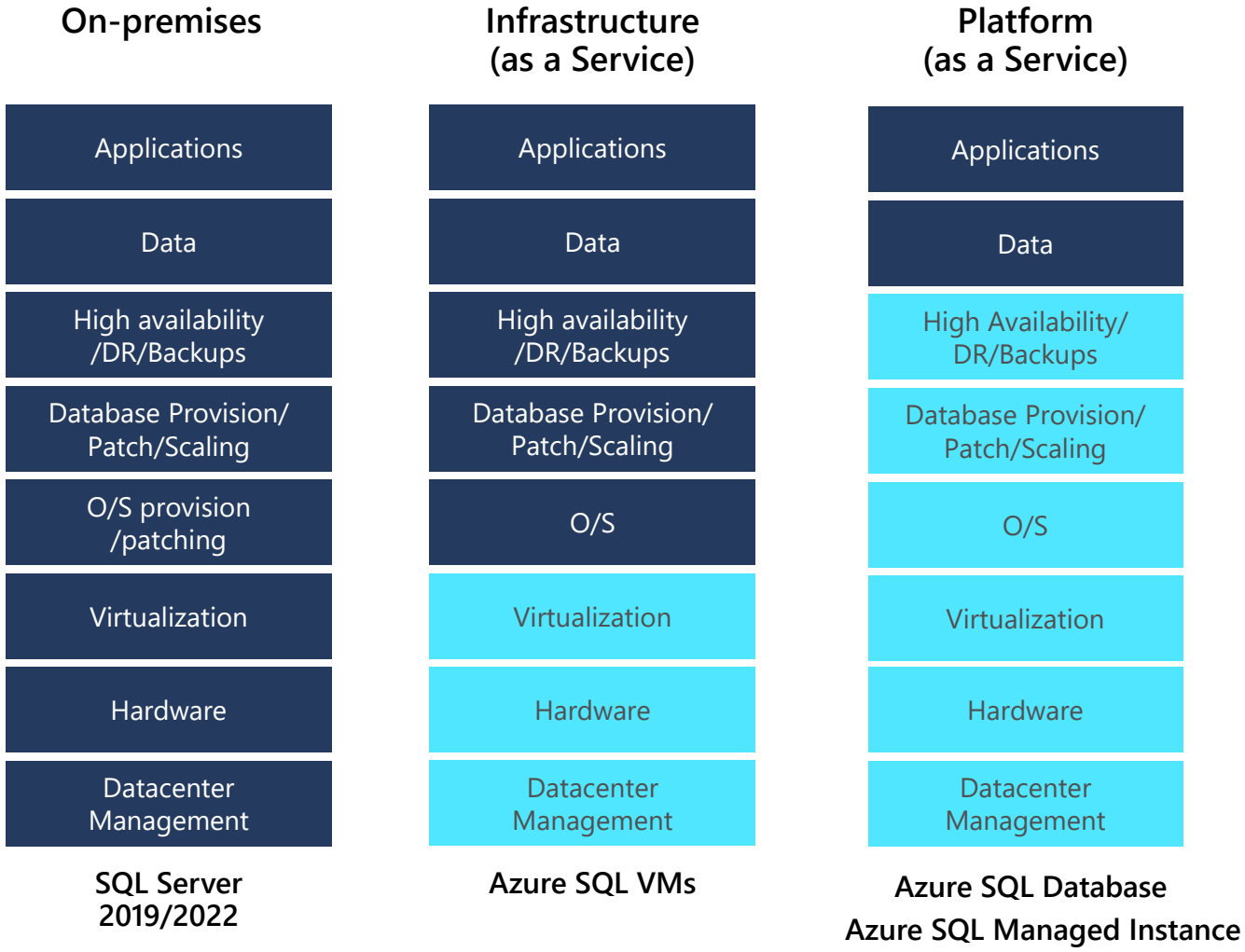
Managed by customer | Managed by Microsoft

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

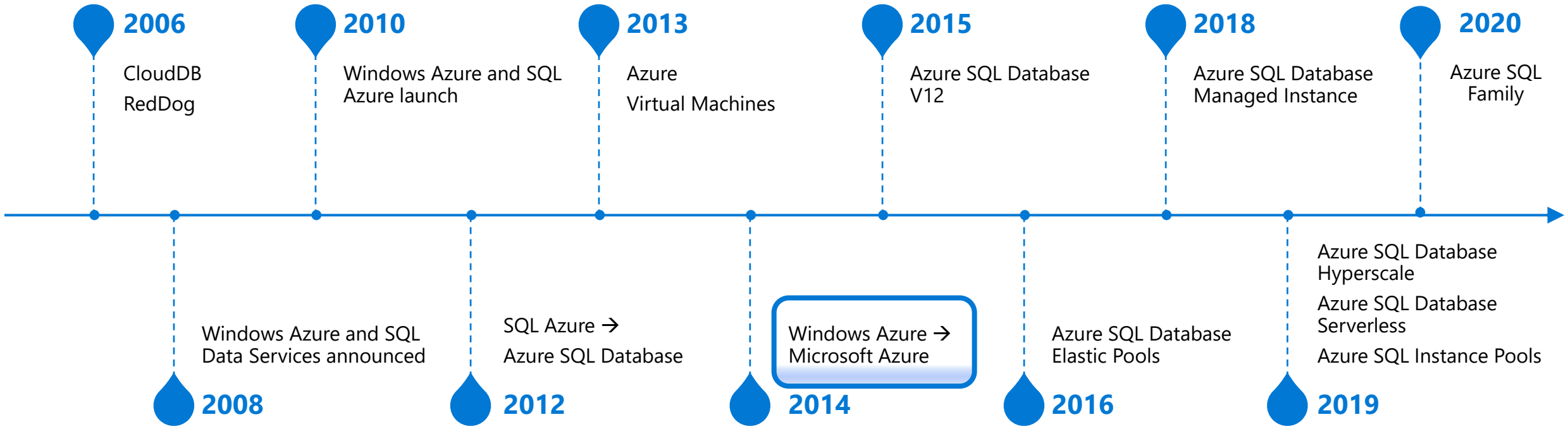
Infrastructure-as-a-Service reduces cost categories related to data center and compute

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



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

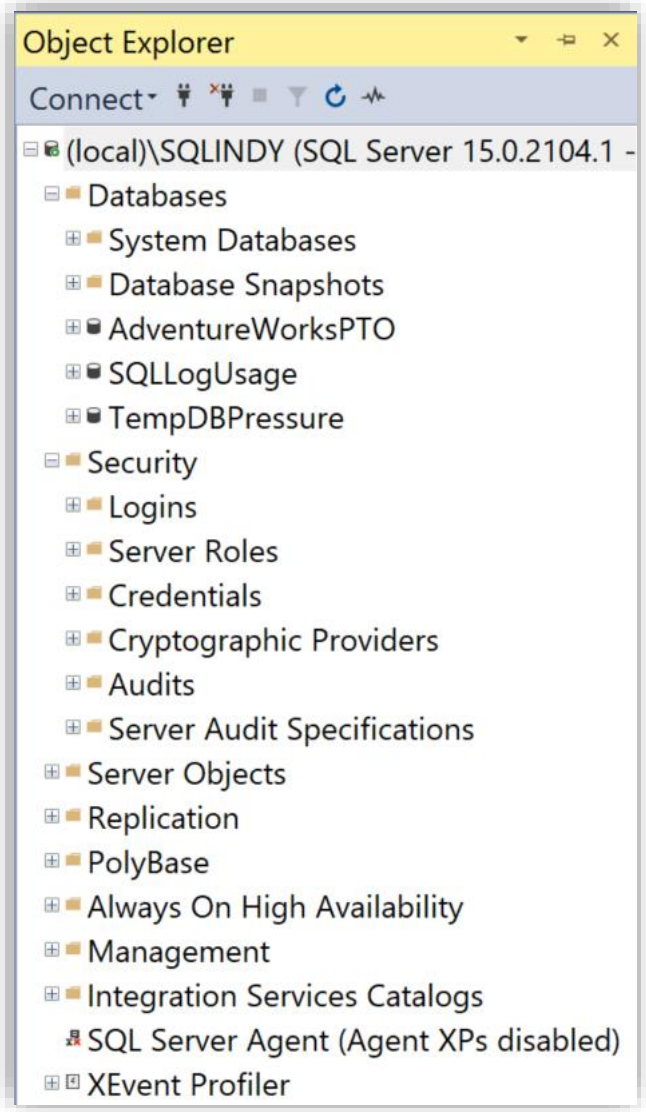
Learn more >

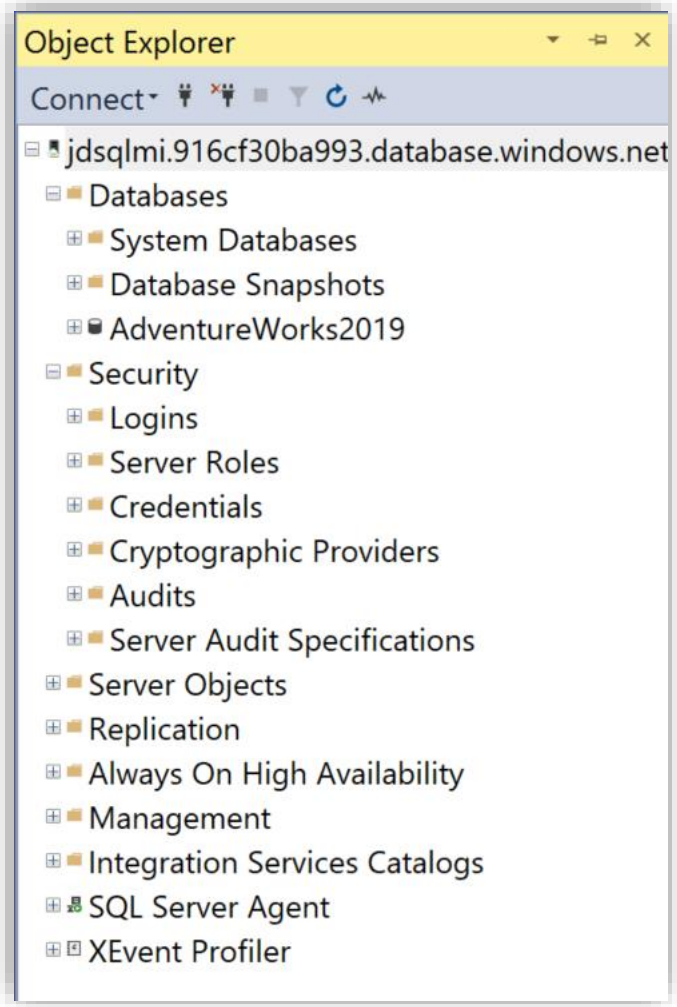
Azure SQL Database

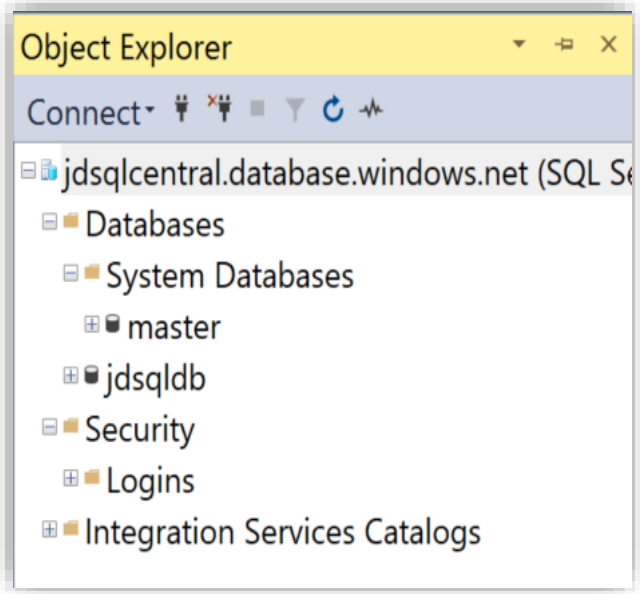
Support modern cloud applications on an intelligent, fully managed service that includes serverless compute

Learn more >

Virtual Machine vs Managed Instance vs Azure SQL Database







What are my options?

IaaS

PaaS

I want a Virtual Machine

- Azure manages the hardware
- You own the OS and SQL Server
- You own monitoring and HADR

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

I want a database

- Azure manages the hardware, OS, and SQL Server
- Azure gives you predicable performance
- Azure provides HADR, monitoring, and intelligence

SQL Server in Azure Virtual Machine

Managed Instance

Single Instance Pool

Azure SQL Database

Single Elastic Pool

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
	No
Microsoft Managed	**Managed SQL database as a service** A database scoped programming model
	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 → Azure SQL Managed Instance

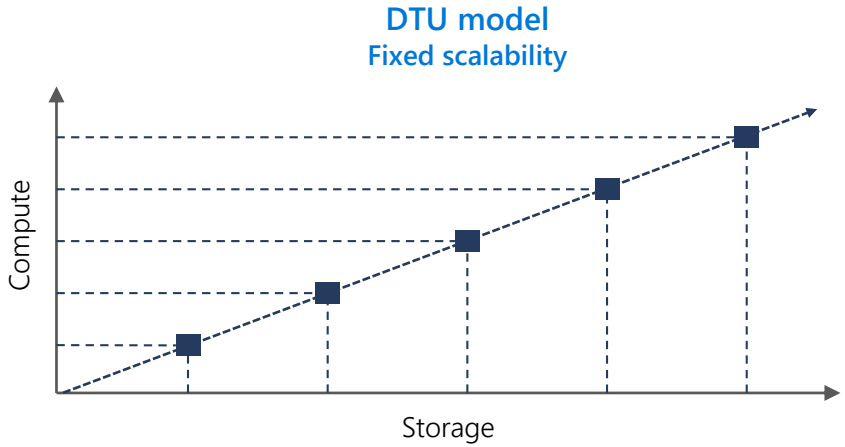
Yes → Azure SQL Database

Yes → SQL Server on Azure VMs

Azure SQL Database Purchasing models and resources

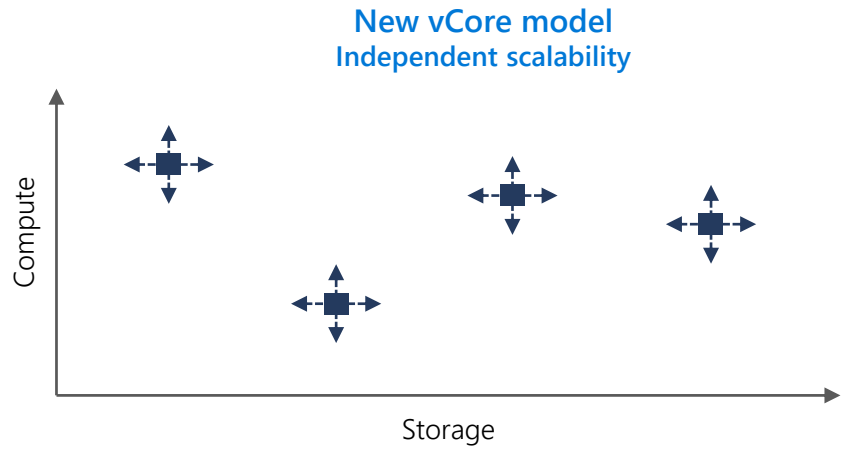
Database Transaction Unit (DTU) model

- 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

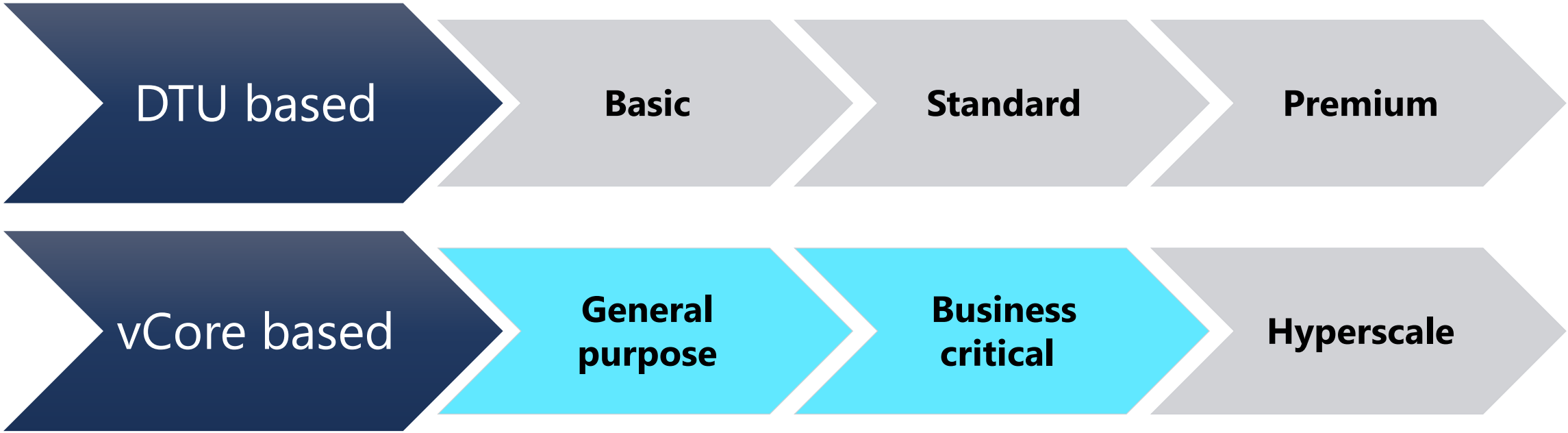
- À La carte approach deconstructs the DTU model into separate parts.
- Customers can select compute and storage independently.
- Allows customers to right-size their compute requirements in the cloud.
- vCore sizing offers flexibility of choice.
- Provides a choice between a **provisioned compute tier**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

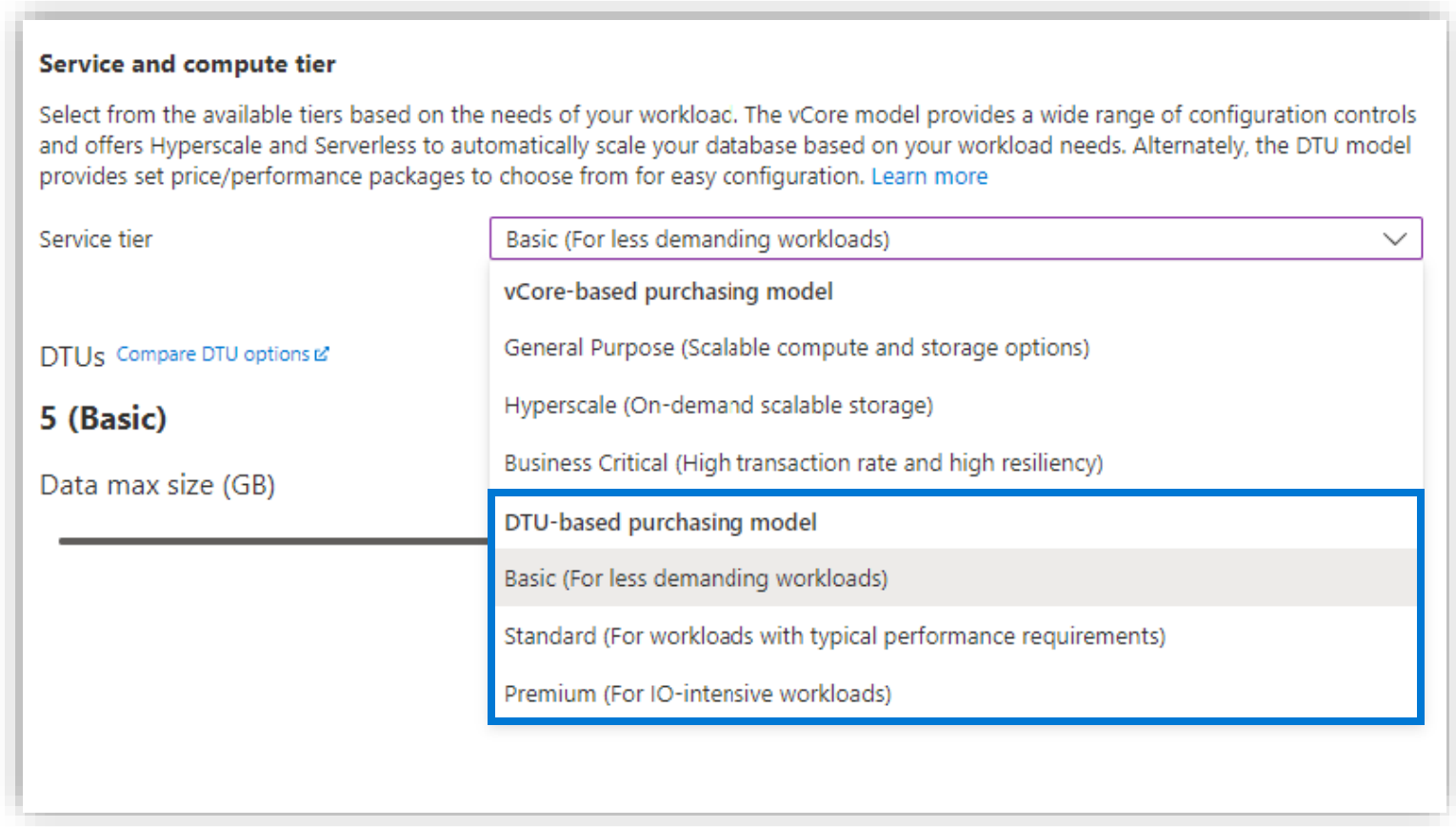
- Update database

Azure CLI

- az sql db update

T-SQL

- ALTER DATABASE … MODIFY (EDITION = …)



Changing Performance Levels (vCore)

PowerShell

- Set-AzSqlDatabase

REST

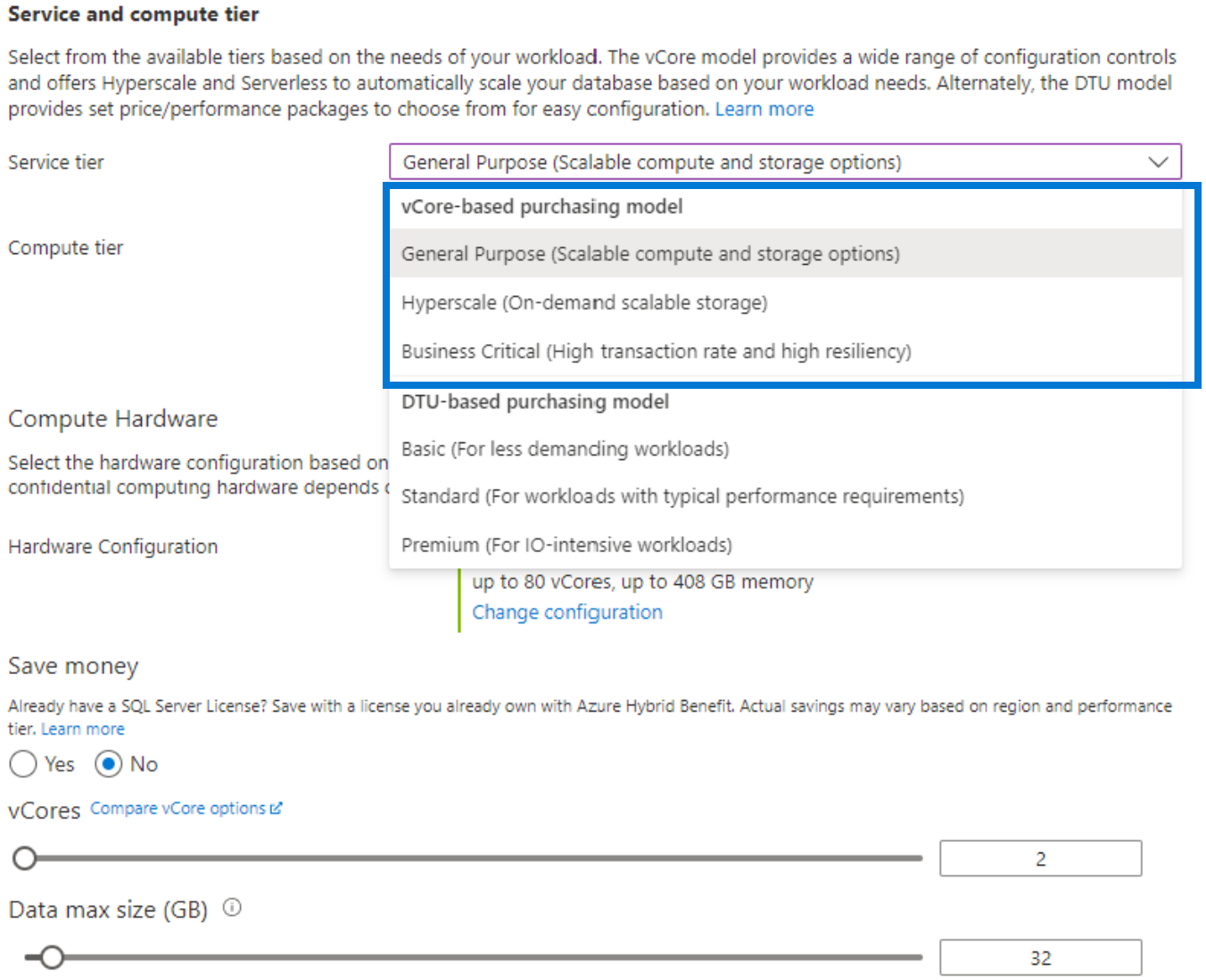
- Update database

Azure CLI

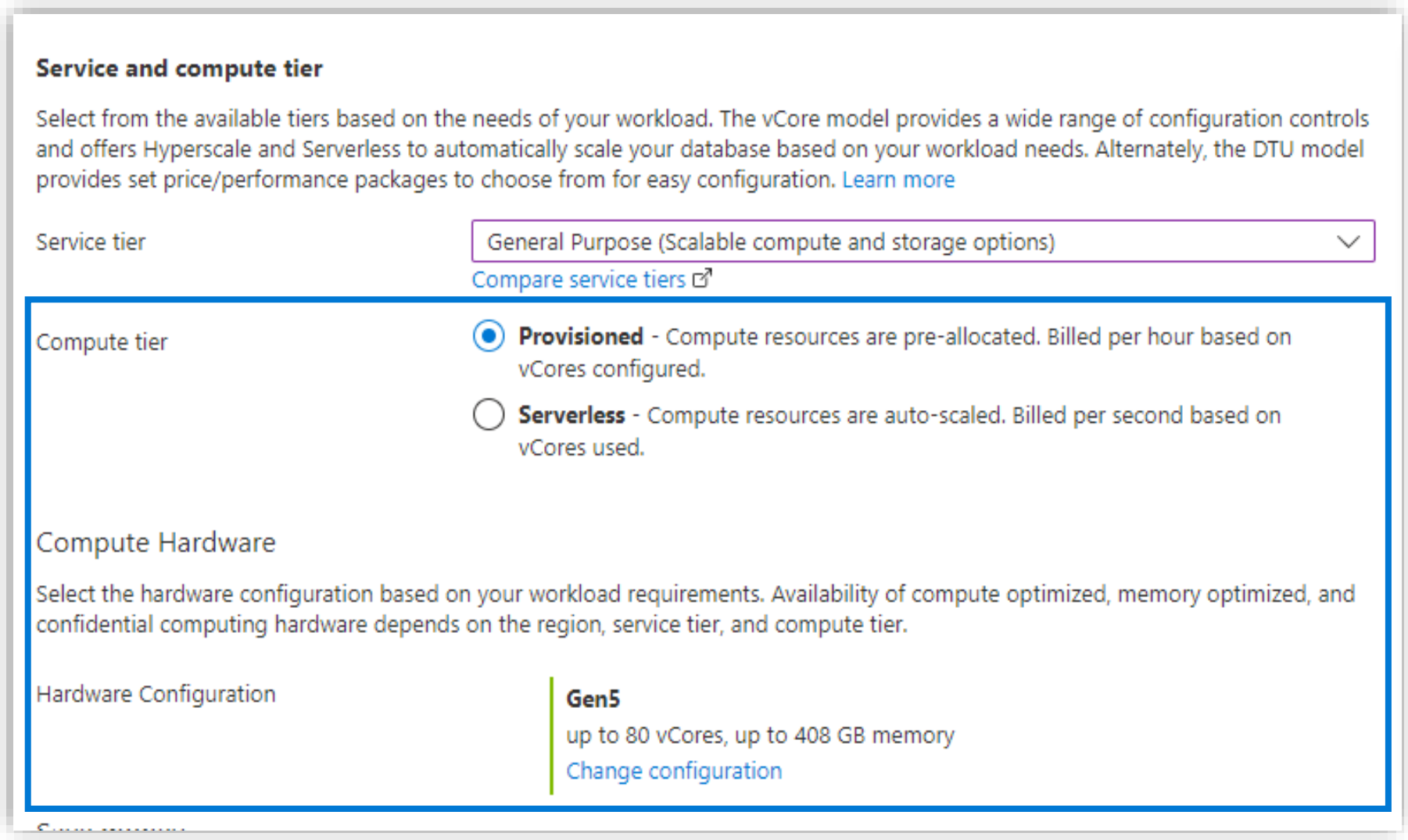
- az sql db update

T-SQL

- ALTER DATABASE … MODIFY (EDITION = …)



Changing Compute Tier and Hardware (vCore)



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	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

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.

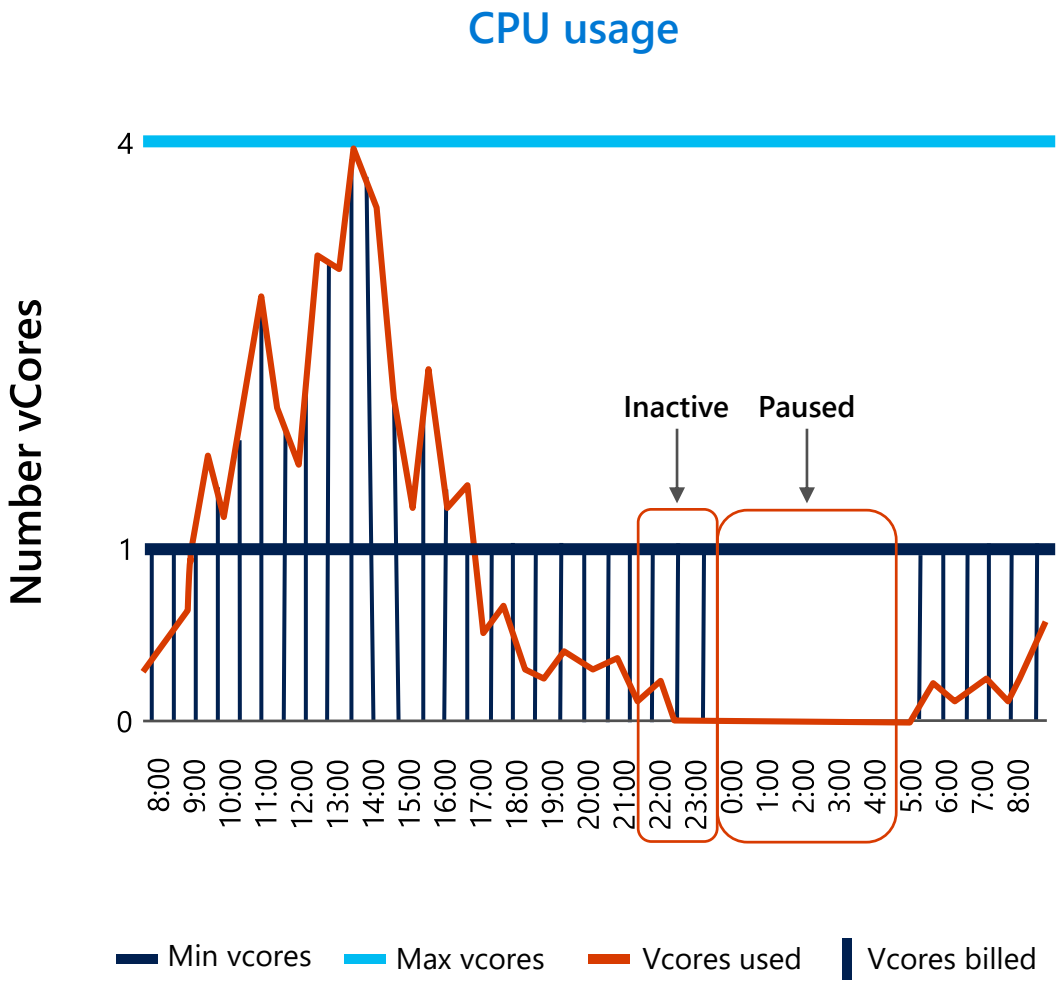
Common scenarios

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

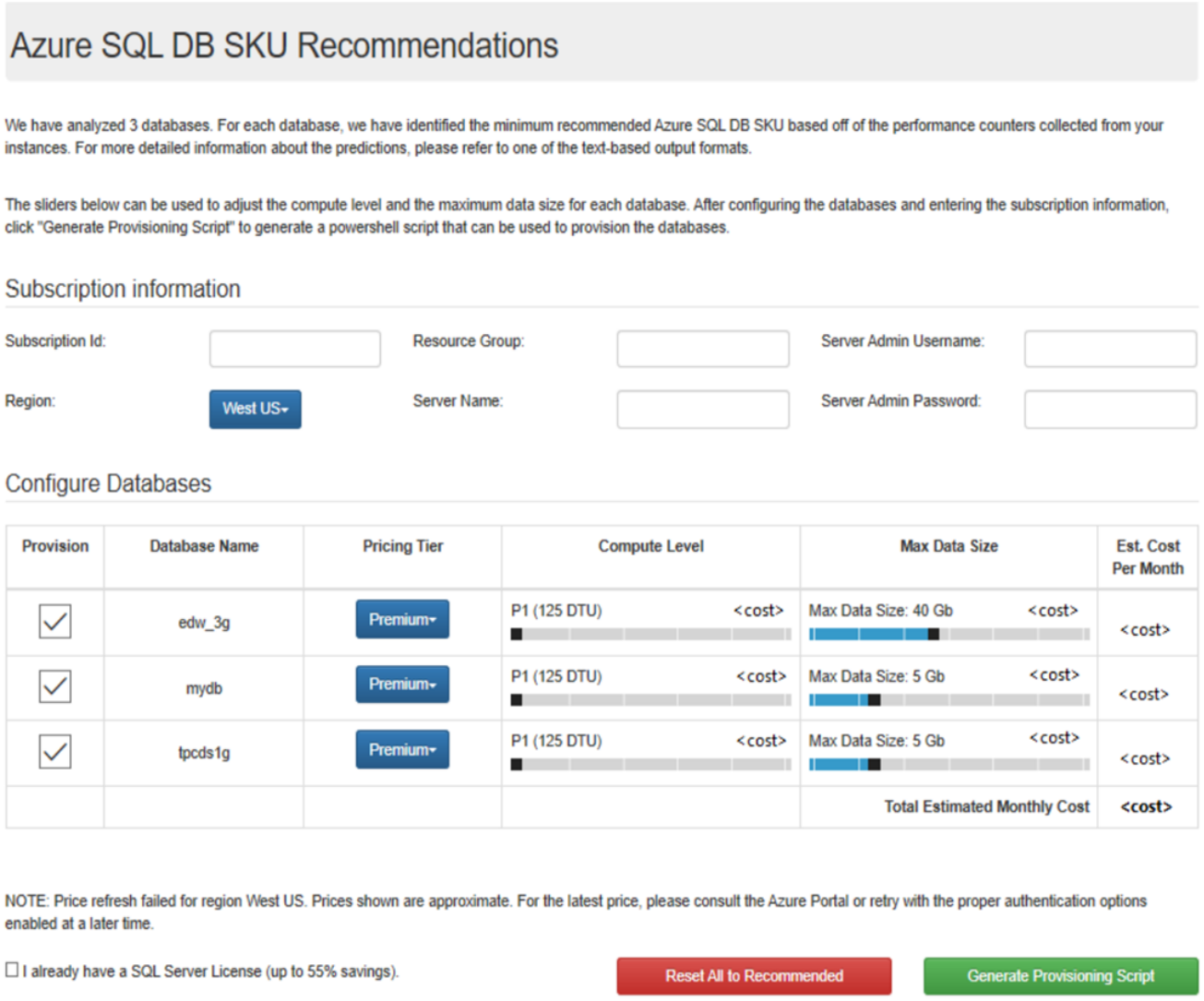
- Compute resources scale dynamically up or down based on workload requirements.
- Configure minimum and maximum vCores to define the range of available compute capacity.
- Use auto-pause delay to define the time period the dataset must be inactive before pausing.
- The database is automatically resumed 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



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?