Microsoft

Introduction to Azure SQL Database

Module 1

Learning Units covered in this Module

- Lesson 1: Basic concepts of Azure SQL Database

- Lesson 2: How to create Azure SQL Database

- Lesson 3: Introduction to Elastic Database Pools

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 SQL Server IaaS and PaaS Solutions

· Describe the difference between the purchase models.

· Describe the service tiers compute and hardware generation of the Azure SQL.

· Describe the difference between Provisioned vs Serverless.

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.
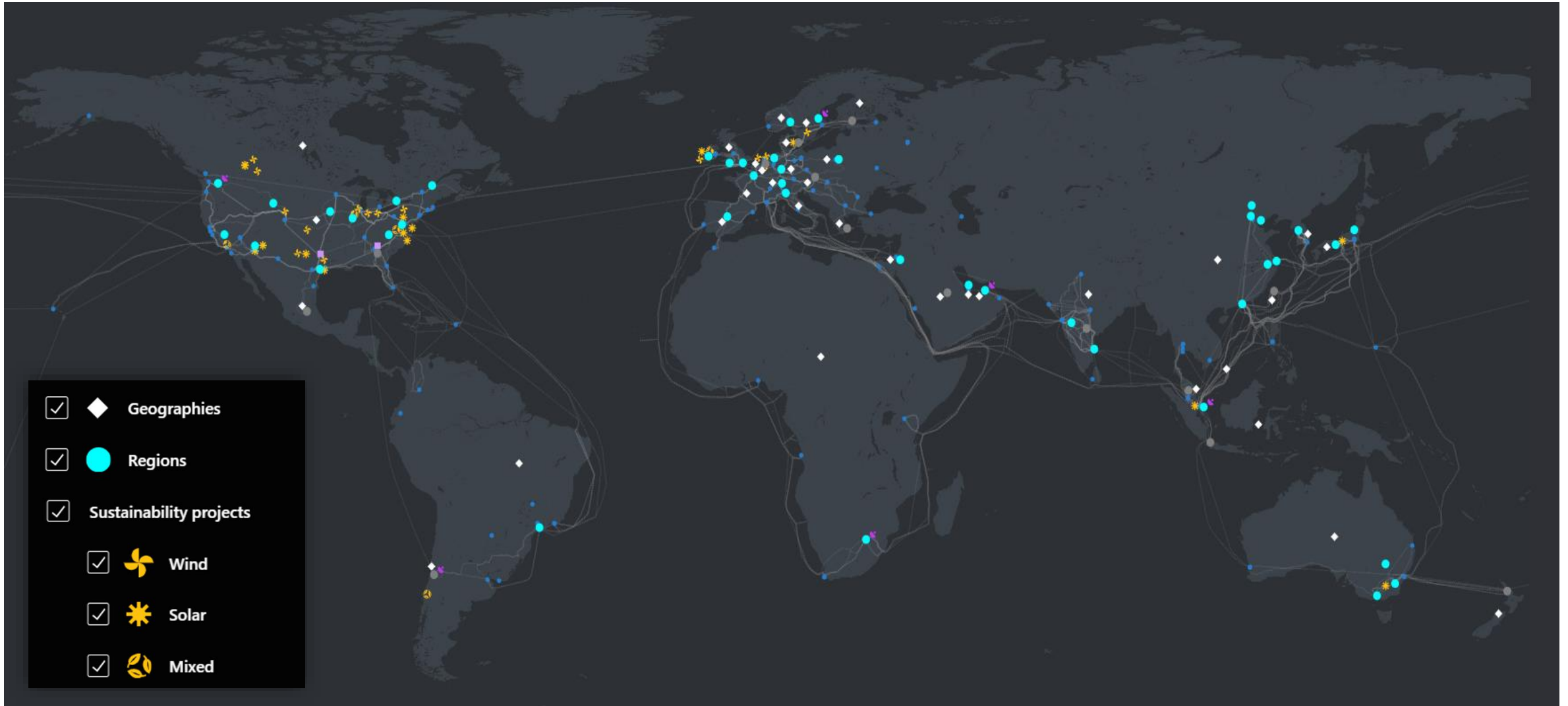
Promote sustainability

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

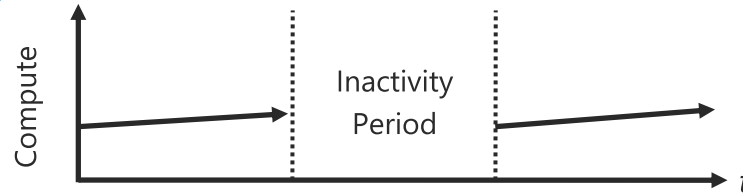Azure Global Regions   Physical security of Azure datacenters   Microsoft Azure Sustainability
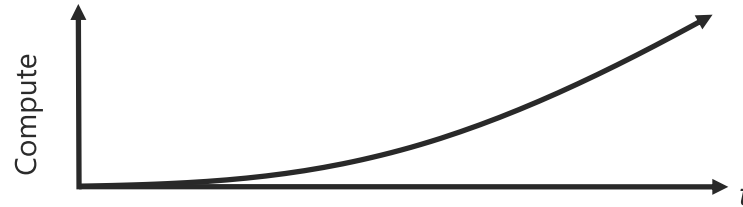
What is Microsoft Azure?

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

[Azure global infrastructure experience (microsoft.com)](https://microsoft.com)
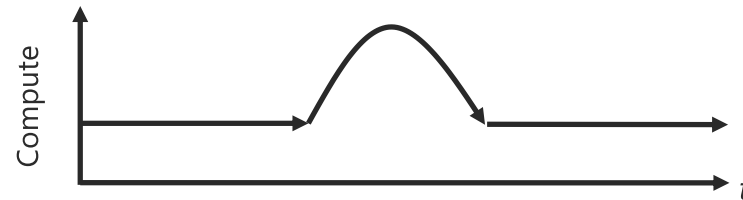
Benefits of Cloud Computing

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.
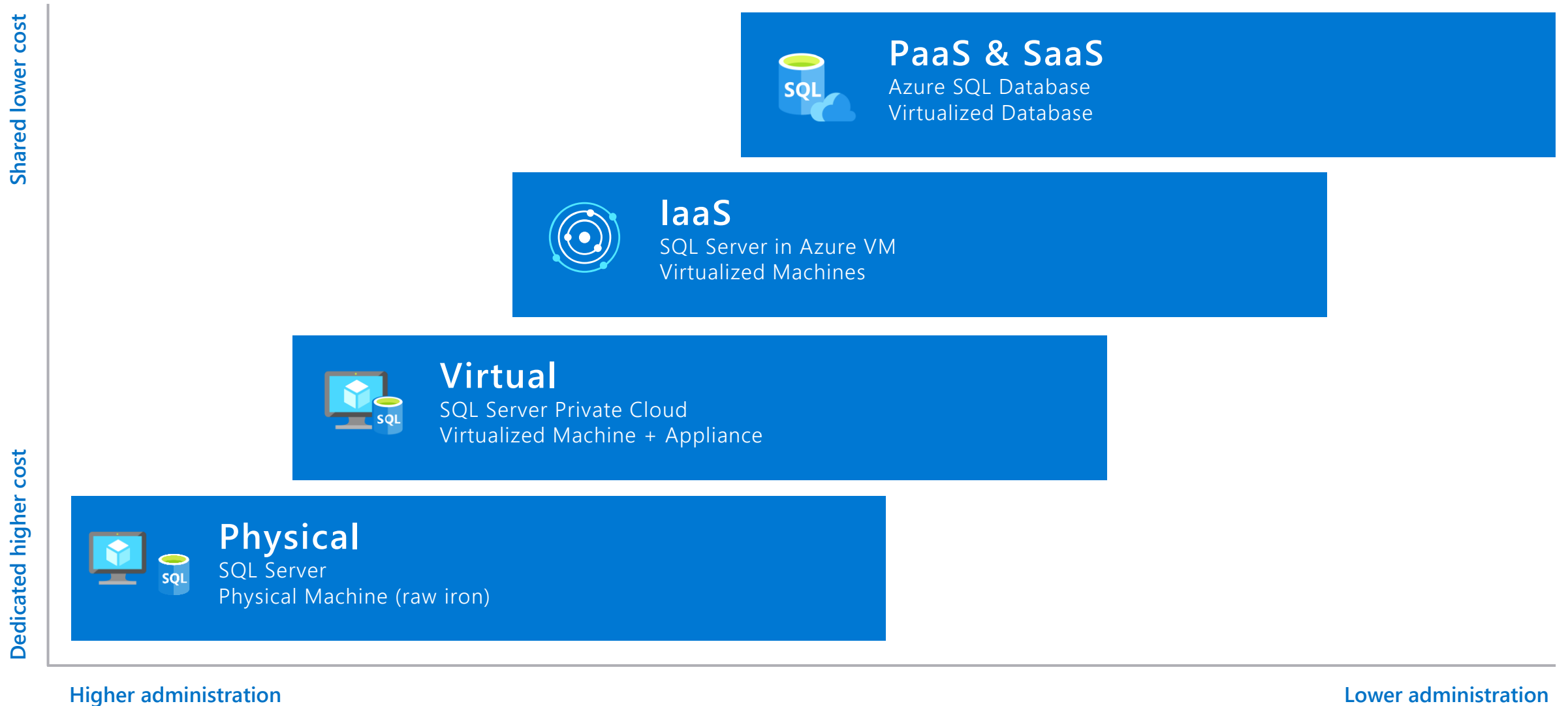
Unpredictable Bursting

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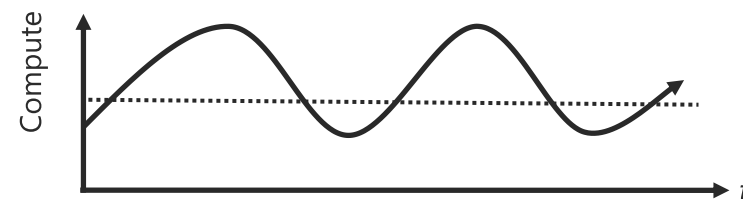
Predictable Bursting

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

Data platform continuum
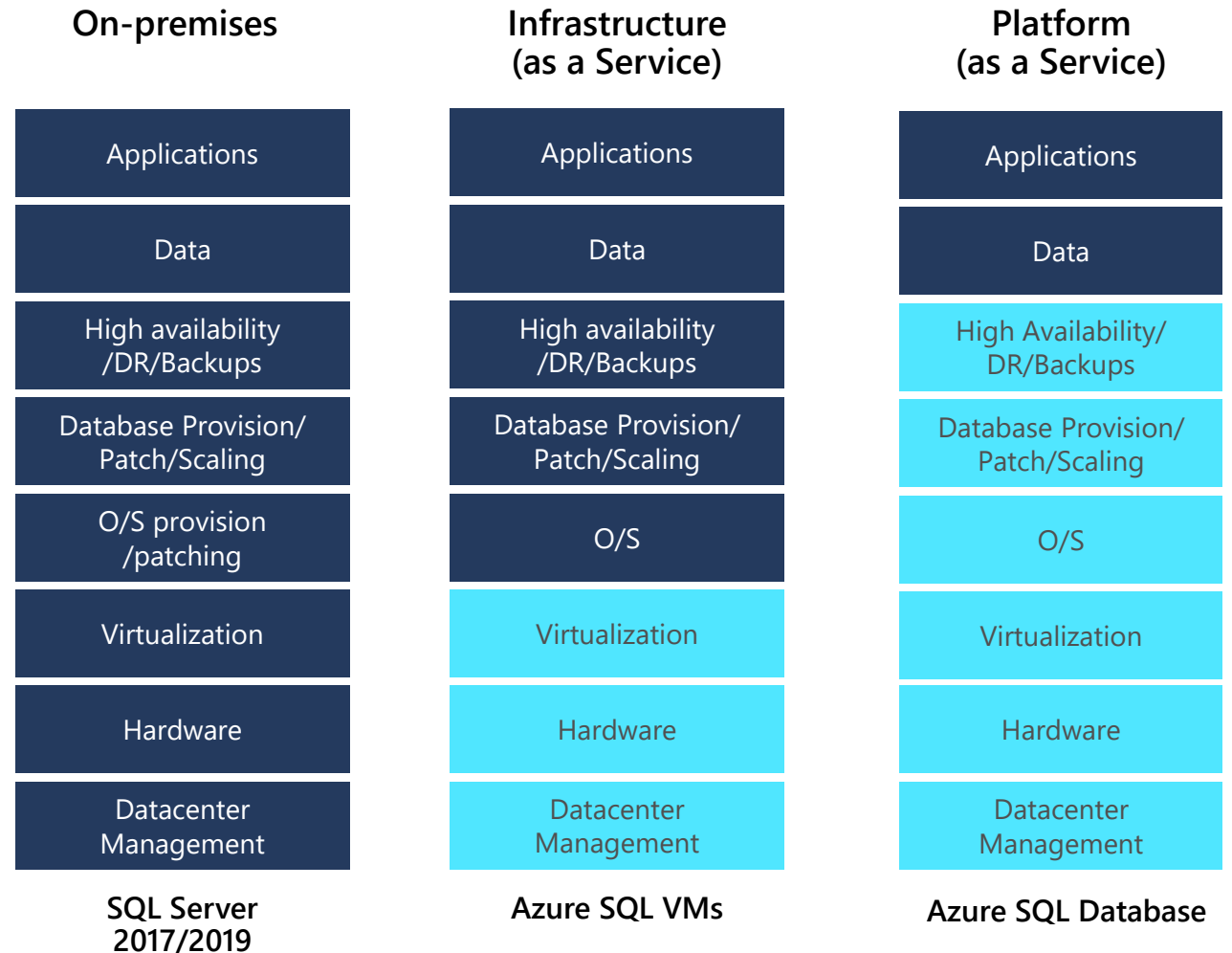
Cloud Hosting Models

| Managed by customer | Managed by Microsoft |

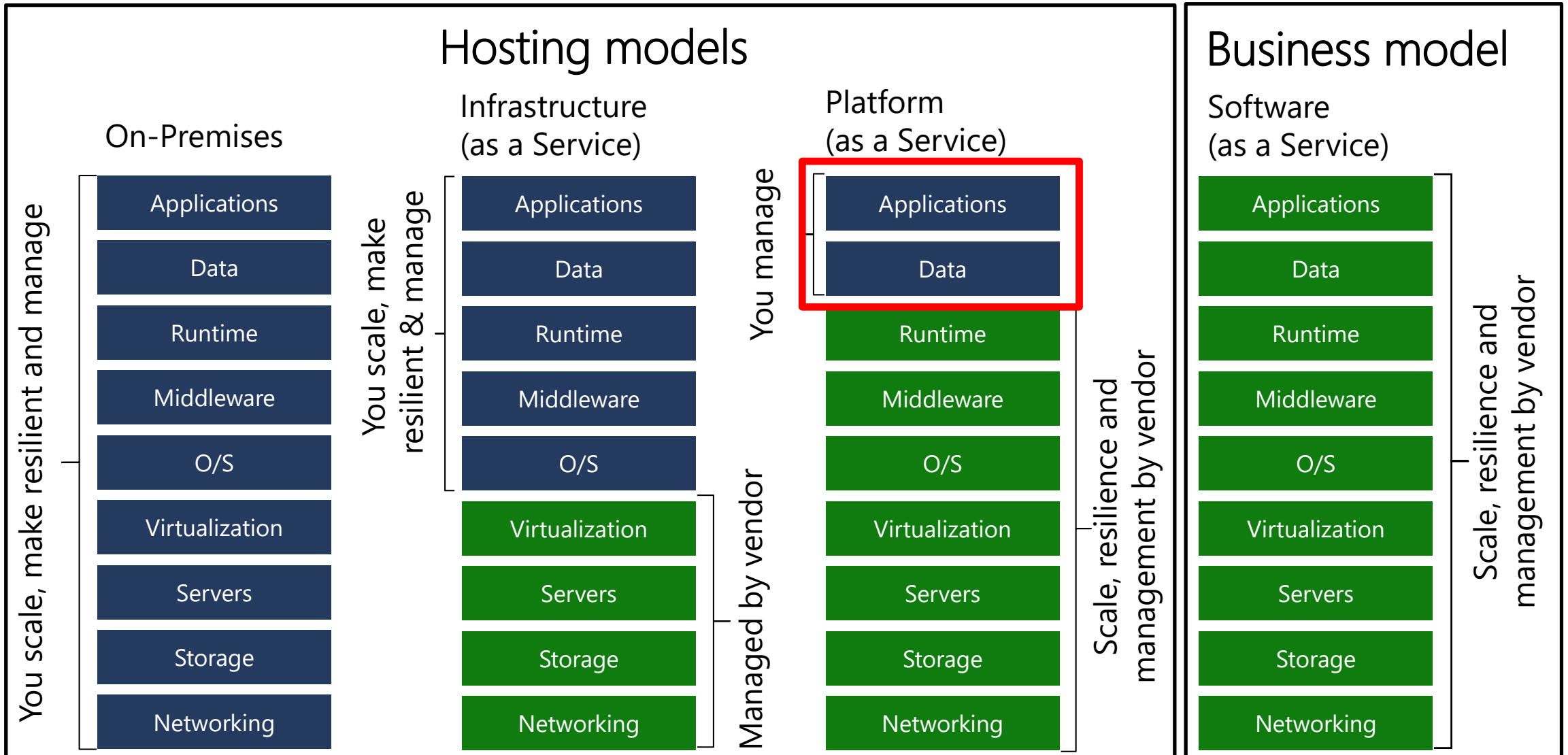**On-premises costs** tend to be driven by hardware and data center management costs

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**

Database as a Service

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 ›

What are my options?

IaaS

PaaS

I want a Virtual Machine	I want a SQL Server	I want a database
Azure manages the hardware	Azure manages the hardware and OS	Azure manages the hardware, OS, and SQL Server
You own the OS and SQL Server	You get a SQL Server, but we help you manage it	Azure gives you predicable performance
You own monitoring and HADR	You need SQL Server feature compatibility and low friction move	Azure provides HADR, monitoring, and intelligence

SQL Server in Azure Virtual Machine

Managed Instance

Single Instance Pool

Azure SQL Database

Single Elastic Pool

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.
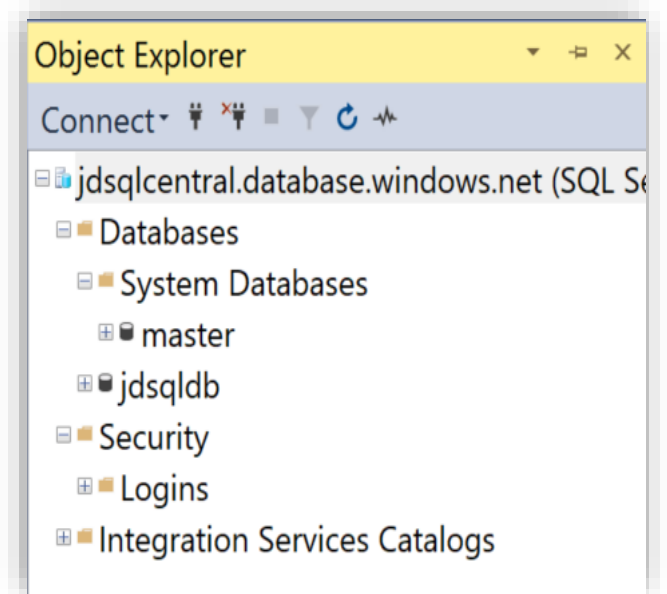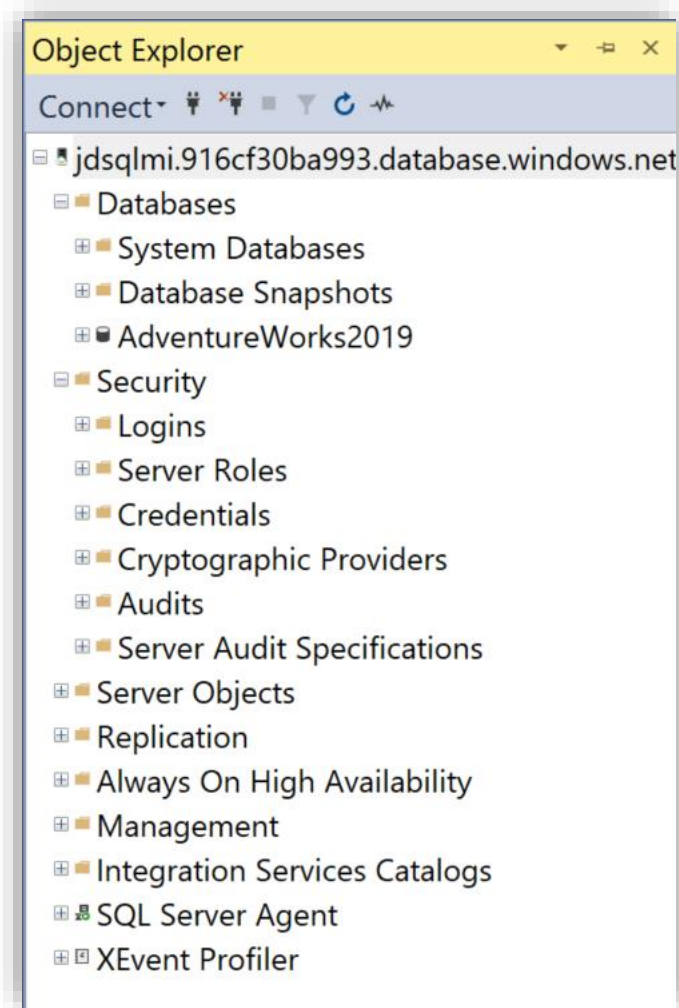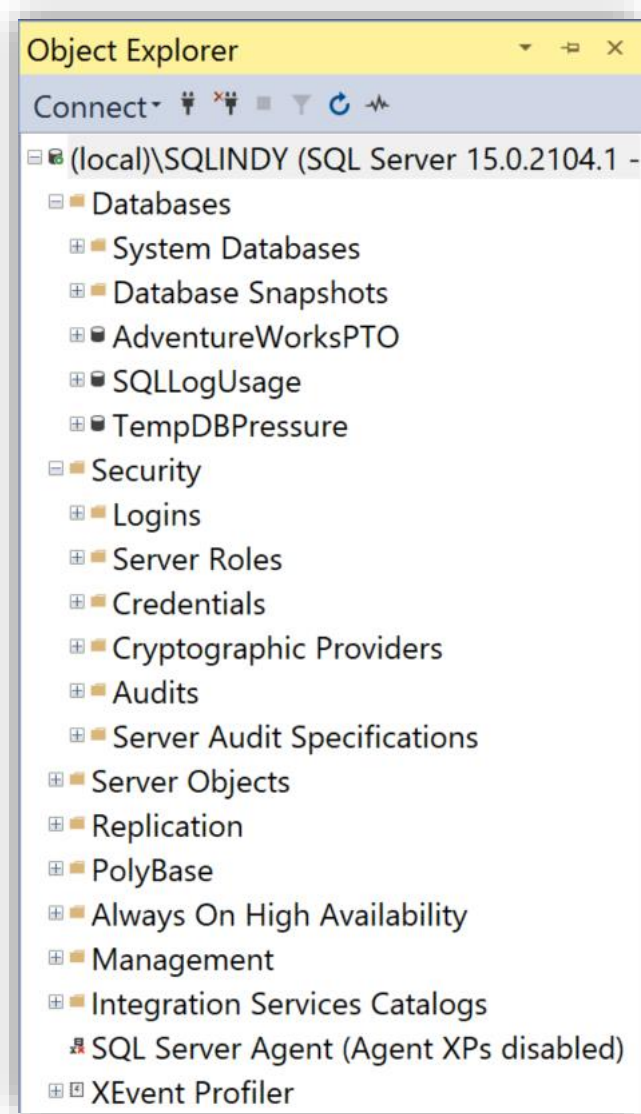
Azure SQL Managed Instance

- 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.

Virtual Machine vs Managed Instance vs Azure SQL Database

Object Explorer — Virtual Machine

```
Object Explorer                          ▼  ⊸  ✕
Connect▾  ⍾  ˣ⍾  ■  ▼  ↻  ⩘
□ ⬚ (local)\SQLINDY (SQL Server 15.0.2104.1 -
  □ ◾ Databases
    ⊞ ◾ System Databases
    ⊞ ◾ Database Snapshots
    ⊞ ◾ AdventureWorksPTO
    ⊞ ◾ SQLLogUsage
    ⊞ ◾ TempDBPressure
  □ ◾ Security
    ⊞ ◾ Logins
    ⊞ ◾ Server Roles
    ⊞ ◾ Credentials
    ⊞ ◾ Cryptographic Providers
    ⊞ ◾ Audits
    ⊞ ◾ Server Audit Specifications
  ⊞ ◾ Server Objects
  ⊞ ◾ Replication
  ⊞ ◾ PolyBase
  ⊞ ◾ Always On High Availability
  ⊞ ◾ Management
  ⊞ ◾ Integration Services Catalogs
    ⚏ SQL Server Agent (Agent XPs disabled)
  ⊞ ▣ XEvent Profiler
```

Object Explorer — Managed Instance

```
Object Explorer                          ▼  ⊸  ✕
Connect▾  ⍾  ˣ⍾  ■  ▼  ↻  ⩘
□ ▪ jdsqlmi.916cf30ba993.database.windows.net
  □ ◾ Databases
    ⊞ ◾ System Databases
    ⊞ ◾ Database Snapshots
    ⊞ ◾ AdventureWorks2019
  □ ◾ Security
    ⊞ ◾ Logins
    ⊞ ◾ Server Roles
    ⊞ ◾ Credentials
    ⊞ ◾ Cryptographic Providers
    ⊞ ◾ Audits
    ⊞ ◾ Server Audit Specifications
  ⊞ ◾ Server Objects
  ⊞ ◾ Replication
  ⊞ ◾ Always On High Availability
  ⊞ ◾ Management
  ⊞ ◾ Integration Services Catalogs
  ⊞ ⚏ SQL Server Agent
  ⊞ ▣ XEvent Profiler
```

Object Explorer — Azure SQL Database

```
Object Explorer                          ▼  ⊸  ✕
Connect▾  ⍾  ˣ⍾  ■  ▼  ↻  ⩘
□ ▫ jdsqlcentral.database.windows.net (SQL Se
  □ ◾ Databases
    □ ◾ System Databases
      ⊞ ◾ master
    ⊞ ◾ jdsqldb
  □ ◾ Security
    ⊞ ◾ Logins
  ⊞ ◾ Integration Services Catalogs
```

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

- SQL Server surface area (vast majority).
- Native virtual network support.
- Fully managed service.

Instance pool*

- Resource sharing between multiple instances to price optimize.
- Simplified performance management for multiple databases.
- Fully managed service.

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

Single database

- Hyperscale storage (up to 100TB).
- Serverless compute.
- Fully managed service.

Elastic pool

- Resource sharing between multiple databases to price optimize.
- Simplified performance management for multiple databases.
- Fully managed service.

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.
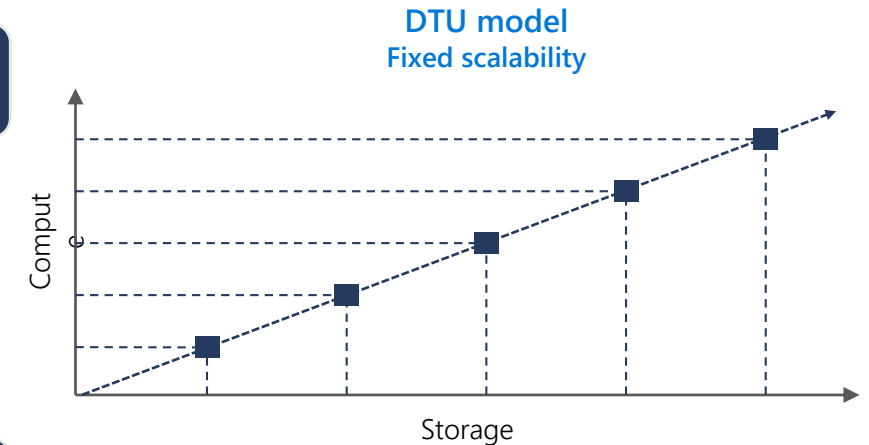
vCore model

- 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
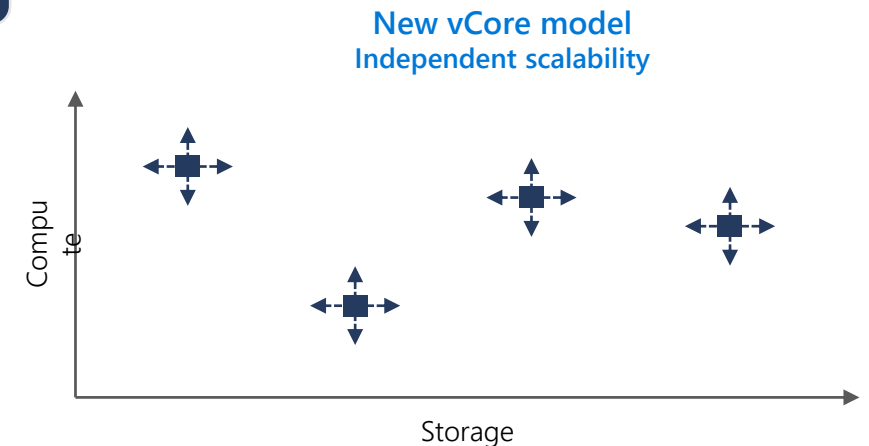
Purchasing models available for Azure SQL Database deployment:

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

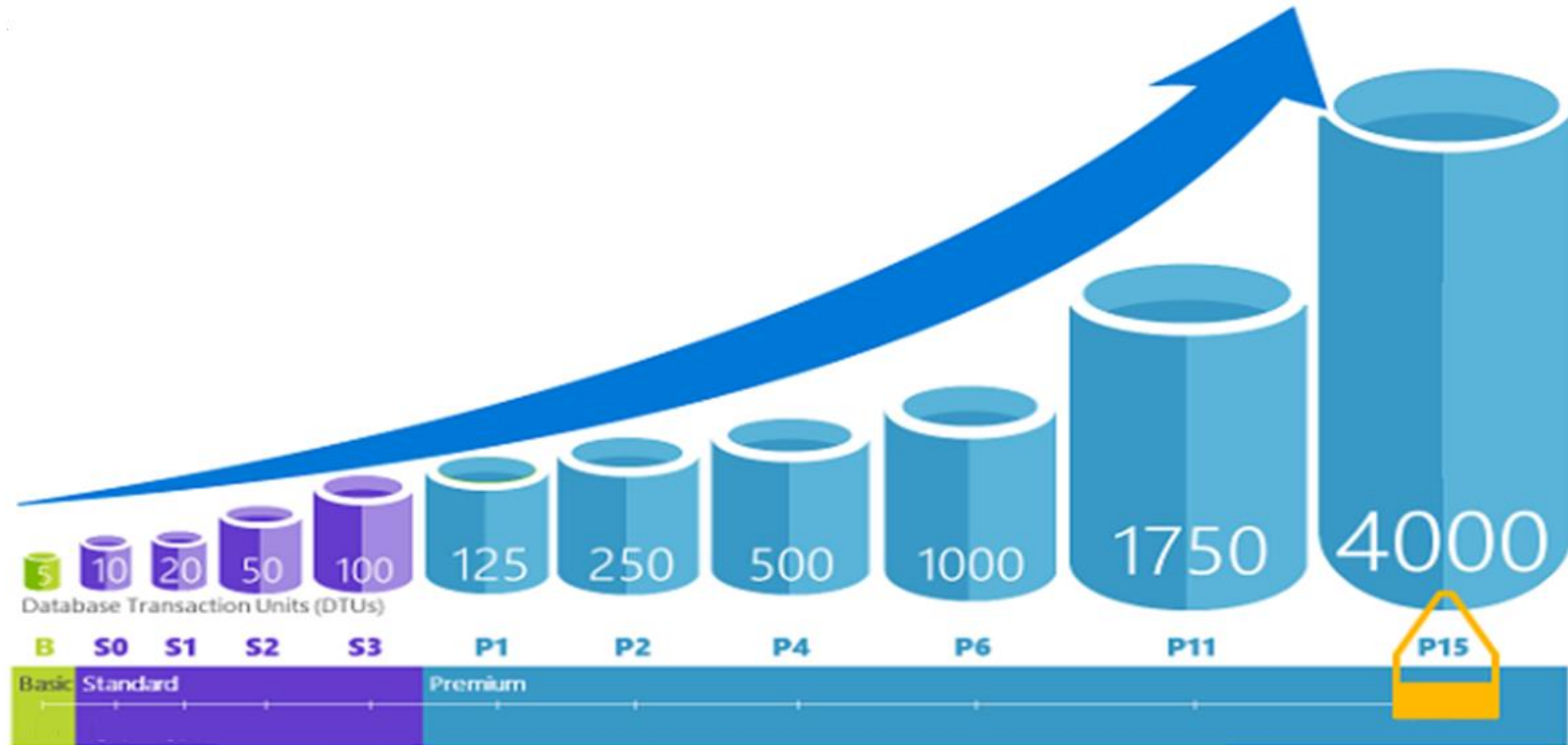# Overview Service Tiers

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

DTU based | **Basic** | **Standard** | **Premium**

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

Managed Instance Service Tiers
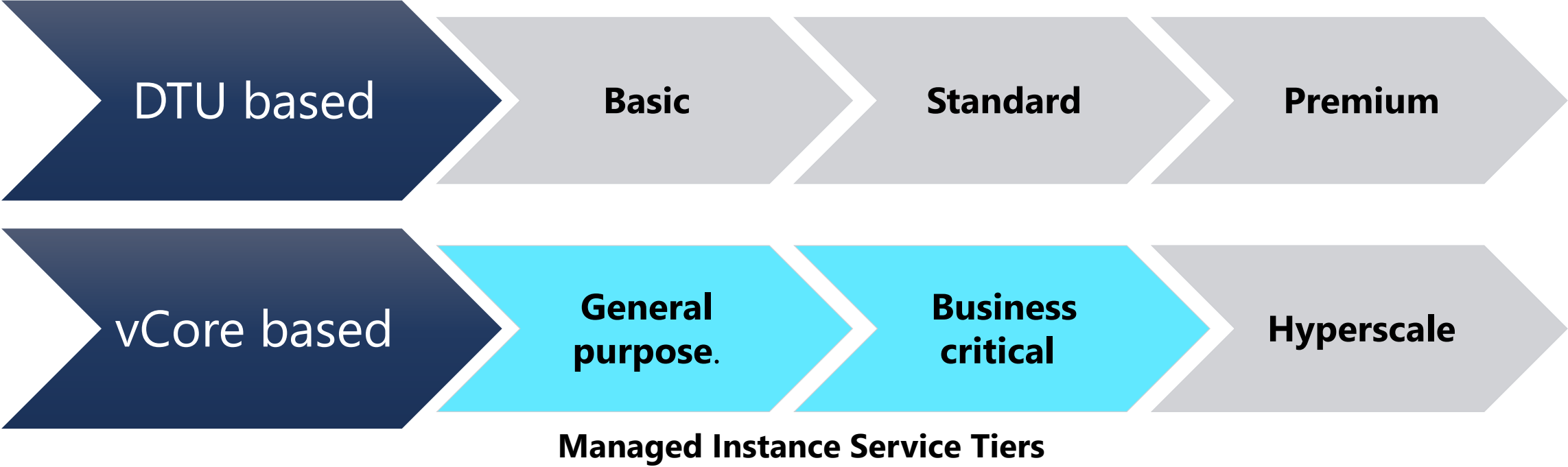
Demonstration

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.

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

$ ← → $$$

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

vCore-based purchasing model: Provisioned compute tier

Simplicity:

- We remain committed to the DTU-based model and the simplicity it offers customers who want a pre-configured solution.

Flexibility:

- The vCore-based model reflects our commitment to customer choice and to simplify the hybrid benefit for customers migrating from on-premises.

Customers pay for:

- Service tier + number of vCores.
- Type and amount of data storage.
- Number of IO.
- Backup storage (RA-GRS).

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

What is Azure SQL Database Hyperscale?

Storage

Scalable new storage architecture

Cloud native
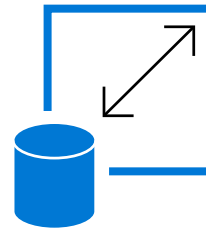
Architected for cloud
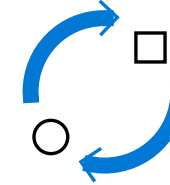
Seamless compatibility

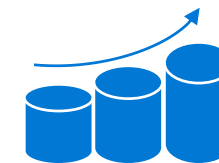Fully compatible with Azure SQL Database

Performance

VLDB operations without VLDB headaches
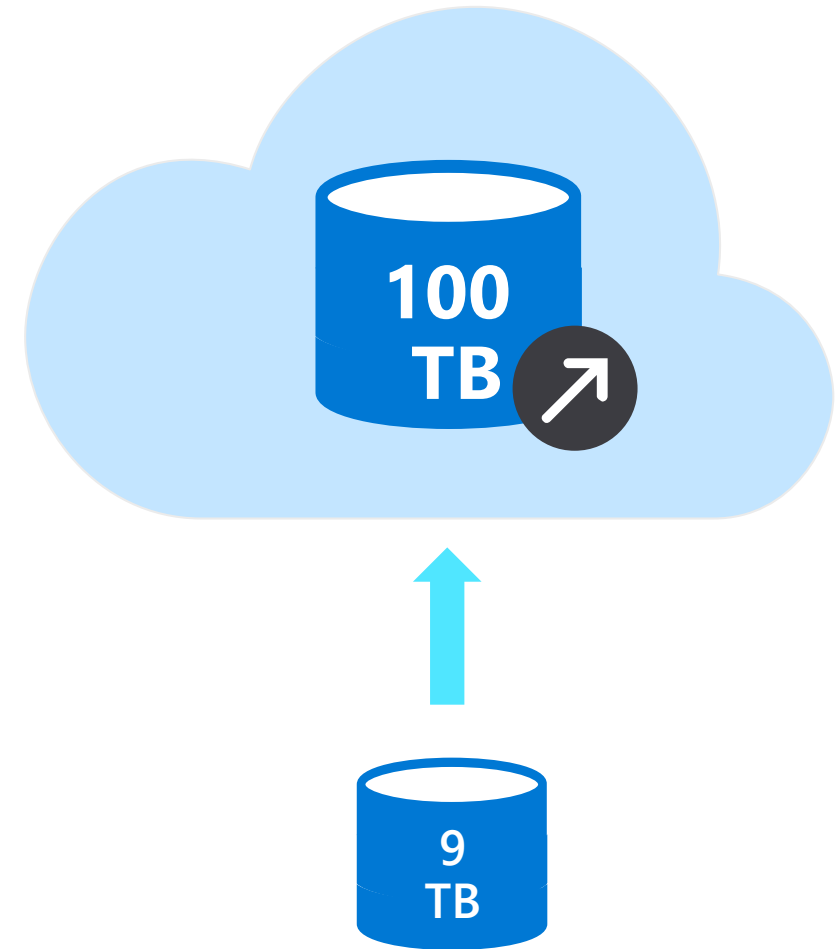
No limits

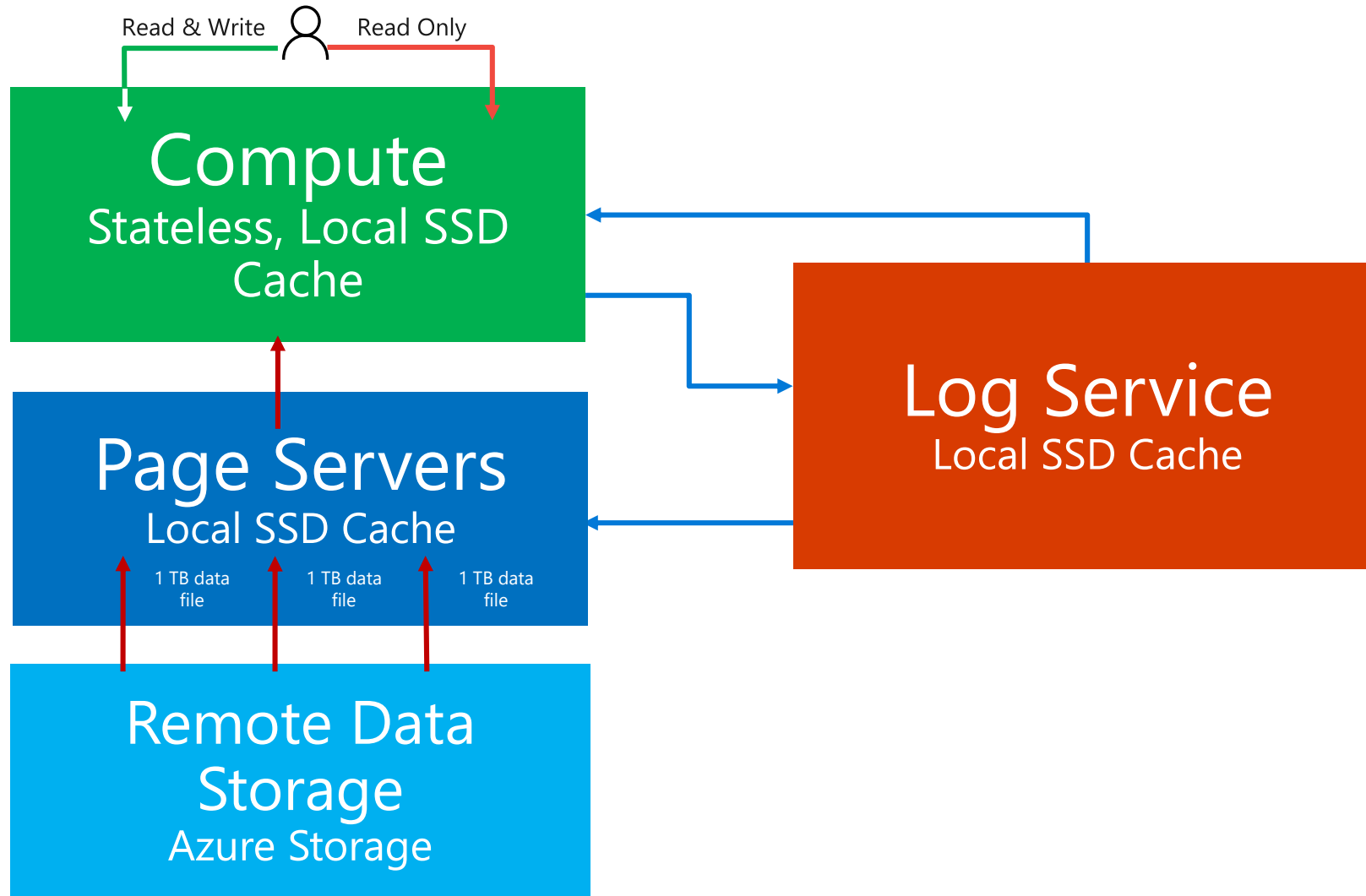Scale compute and storage

Large database

Support for 100TB+

Hyperscale is the foundation for massive app growth

Hyperscale is a new, highly scalable service tier that adapts on-demand to your workload's needs, auto-scaling up to 100TB per database.
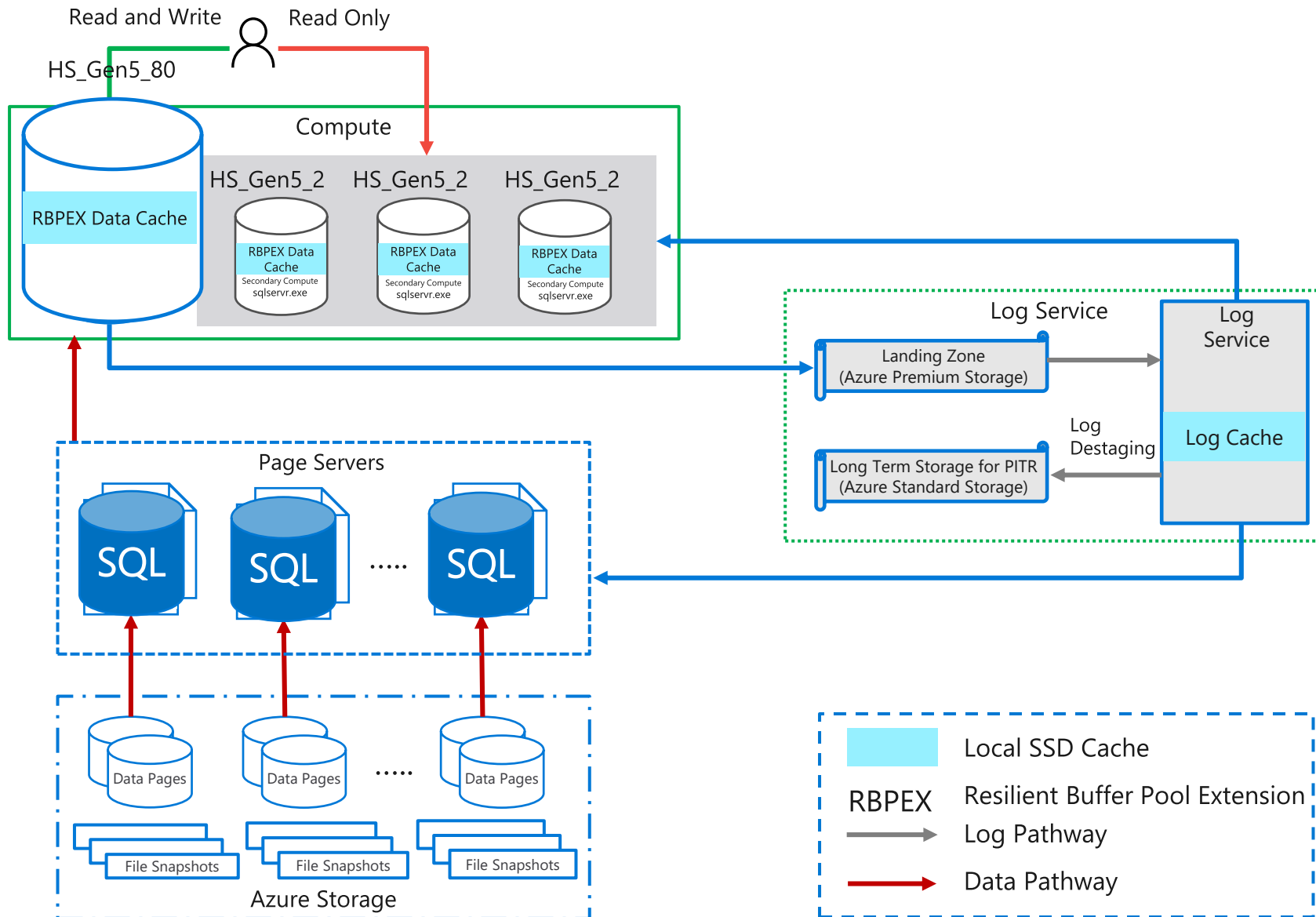
- Storage dynamically adapts to your workloads' needs, auto-scaling up to 100TB.
- Provision one or more additional compute nodes that can serve your read-only workload and use them as a hot-standby, in case of failover.
- Perform operations in constant time, regardless of the size of the data operation.
- Compute and storage resources scale rapidly and independently without sacrificing performance.

100 TB

9 TB

Hyperscale components

Read & Write   Read Only

Compute
Stateless, Local SSD Cache

Log Service
Local SSD Cache

Page Servers
Local SSD Cache

1 TB data file   1 TB data file   1 TB data file

Remote Data Storage
Azure Storage

Hyperscale architecture

Read and Write | Read Only

HS_Gen5_80

Compute

HS_Gen5_2 | HS_Gen5_2 | HS_Gen5_2

RBPEX Data Cache

RBPEX Data Cache
Secondary Compute
sqlservr.exe

Page Servers

SQL ..... SQL

Data Pages

File Snapshots

Azure Storage

Landing Zone (Azure Premium Storage)

Log Service

Log Service

Log Cache

Log Destaging

Long Term Storage for PITR (Azure Standard Storage)

Local SSD Cache

RBPEX Resilient Buffer Pool Extension

→ Log Pathway

→ Data Pathway

Constant time scale up and down.

Offload read-only workload by adding read-scale replicas without data copy – constant time as well.

Low log commit latency - <2.5ms with Premium Storage; < 0.5ms with Ultra SSD (future improvement).

High log generation rate and fast data loading.

Page server instances work independently – infinite scale out.

Adding more page servers as your database grows – pay by usage (start with 5GB with 1GB increments).

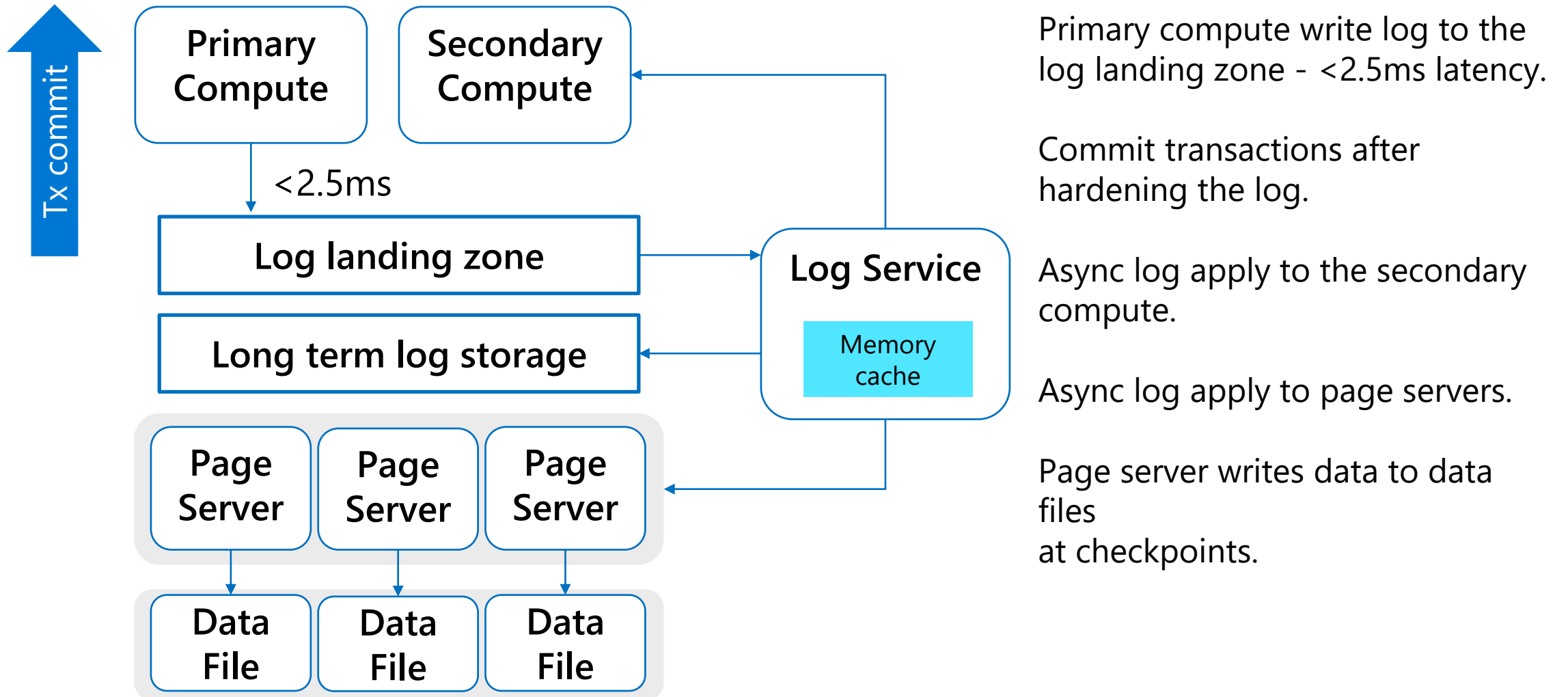Snapshot backup + log offloading – zero impact to compute resource.

Restore database by copying snapshots and log records – constant time point in time restore.

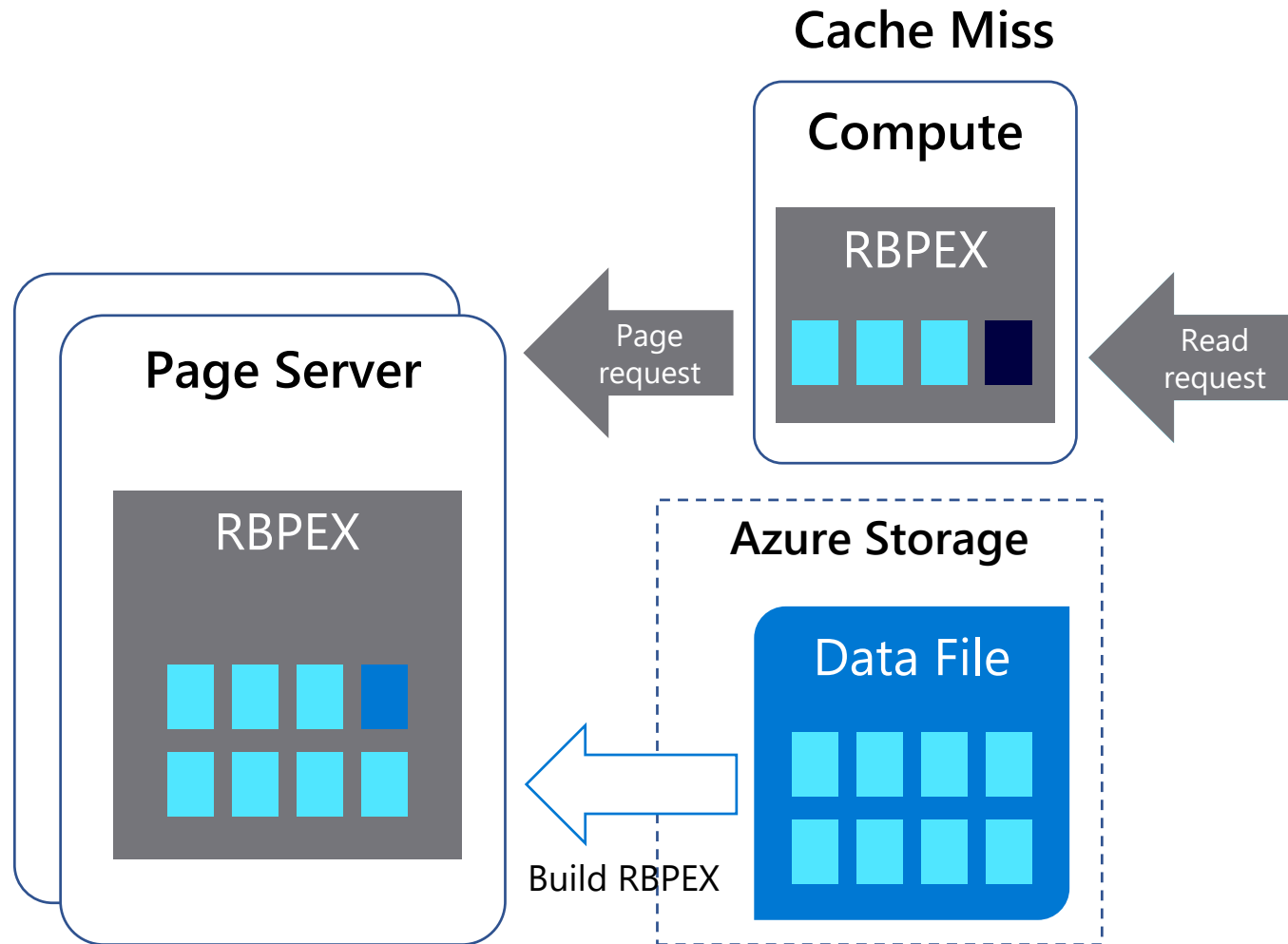Checkpoints also offloaded to page servers.

What is the Hyperscale service tier? - Azure SQL Database | Microsoft Learn

Hyperscale architecture

Read & Write — Read Only

Compute

HS_Gen4_1 — RBPEX Data Cache — Primary Compute sqlservr.exe

HS_Gen4_1 — RBPEX Data Cache — Secondary Compute sqlservr.exe

HS_Gen4_1 — RBPEX Data Cache — Secondary Compute sqlservr.exe

HS_Gen4_1 — RBPEX Data Cache — Secondary Compute sqlservr.exe

Landing Zone (Azure Premium Storage)

Log Service

Log Cache

Log Destaging

Long Term Storage for PITR (Azure Standard Storage)

Log

Page Servers

Covering RBPEX Data Cache — 1 TB data file

Covering RBPEX Data Cache — 1 TB data file

.....

Covering RBPEX Data Cache — 1 TB data file

Azure Storage

Data Pages — File Snapshots

Data Pages — File Snapshots

.....

Data Pages — File Snapshots

Local SSD Cache

RBPEX — Resilient Buffer Pool Extension

Log Pathway

Data Pathway

Write IO

Tx commit

Primary Compute

Secondary Compute

<2.5ms

Log landing zone

Long term log storage

Log Service

Memory cache

Page Server

Page Server

Page Server

Data File

Data File

Data File

Primary compute write log to the log landing zone - <2.5ms latency.

Commit transactions after hardening the log.

Async log apply to the secondary compute.

Async log apply to page servers.

Page server writes data to data files
at checkpoints.

Read IO

Cache Miss

Compute

RBPEX

Page request ← | Read request ←

Page Server

RBPEX

Azure Storage

Data File

Build RBPEX ←

Pre-build RBPEX when page server instance is started.

Two page-server replicas guarantee IO latency.

RBPEX on compute nodes is proportional to # of vCores.

Hit local RBPEX - < 0.5ms.
Hit page server RBPEX - < 2ms.

Optimized for OLTP workload – operating on hot data.

Use Column Store index to optimize HTAP/OLAP workload.

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

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.

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.

Optimize 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

4

1

0

8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00

— Min vcores   — Max vcores   — Vcores used | Vcores billed
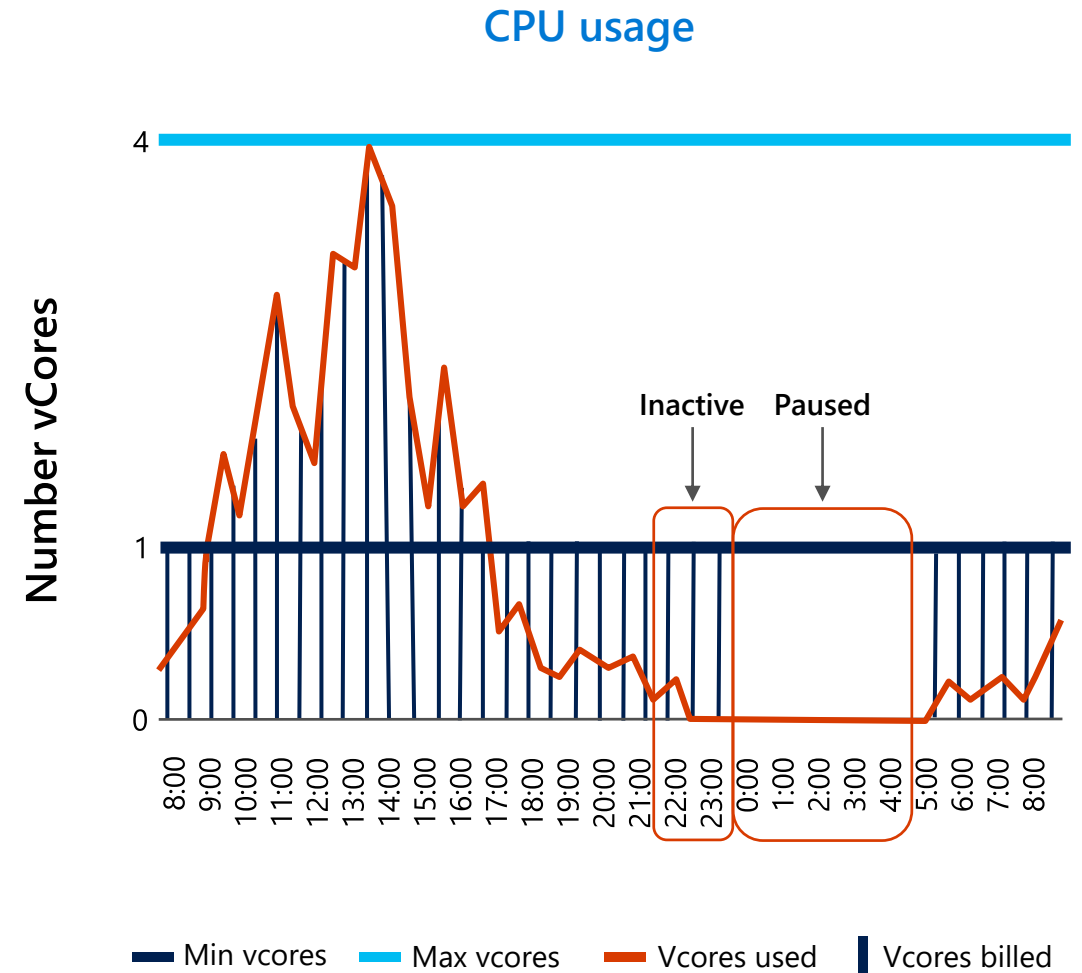
Pay only for what you need

DTUs			vCores		
Basic	**Standard**	**Premium**	**General Purpose**	**Business Critical**	**Hyperscale**
Small databases particularly those in development phases.	General purpose databases with moderate performance requirements.	Mission-critical databases with high performance and high-availability requirements.	Data applications with basic IO and basic availability requirements.	Business critical data applications with fast IO and high availability requirements.	VLDB OLTP and HTAP workloads with highly scalable storage and read-scale requirements.

Elastic scale and performance: Three service tiers within DTU-based model, and two tiers within vCore-based model let you scale up and down based on throughput needs and offer better resource isolation and an improved billing experience.

Business continuity and data protection: A spectrum of business-continuity features across tiers lets you dial up control over data recovery and failover.

Familiar and fully-managed: Near-complete SQL Server compatibility and unprecedented efficiencies as your applications scale with a near-zero maintenance service and a variety of familiar management tools and programmatic APIs.

Identify the right Azure SQL Database SKU for your on-premises database

Database Migration Assistant: (DMA)

- Provides SKU recommendations in a user-friendly output based on performance counters collected from the computer(s) hosting your databases.
- It has several deployment options, including:
  - Single database
  - Elastic pools
  - Managed instance

Identify the right Azure SQL Database SKU for your on-premises database (continued)

This feature provides recommendations related to:

- pricing tier
- compute level
- max data size
- estimated cost per month.

Furthermore, it offers the ability to bulk provision single databases and managed instances in Azure for all recommended databases.

Azure SQL MI SKU Recommendations

We have analyzed 3 databases. For the collection of databases, we have identified the minimum recommended Azure SQL MI 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:		Resource Group:		Region:	West US▾
Instance Name:		Instance Admin Username:		Instance Admin Password:	
VNet Name:		SubNet Name:			

Configure Databases

Provision	Database Name(s)	Pricing Tier	Compute Level	Max Data Size	Est. Cost Per Month
☑	edw_3g, mydb, tpcds1g	General Purpose Gen 5▾	8 VCores \<cost>	Max Data Size: 64 Gb \<cost>	\<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

Demonstration

SQL SKU Assessment Console

Using the Assessment Console to get a recommendation on correct Azure SQL SKU.

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?

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.

A Server is not a machine...

SQL Server > A Machine

SQL Database Server > A TDS* Endpoint
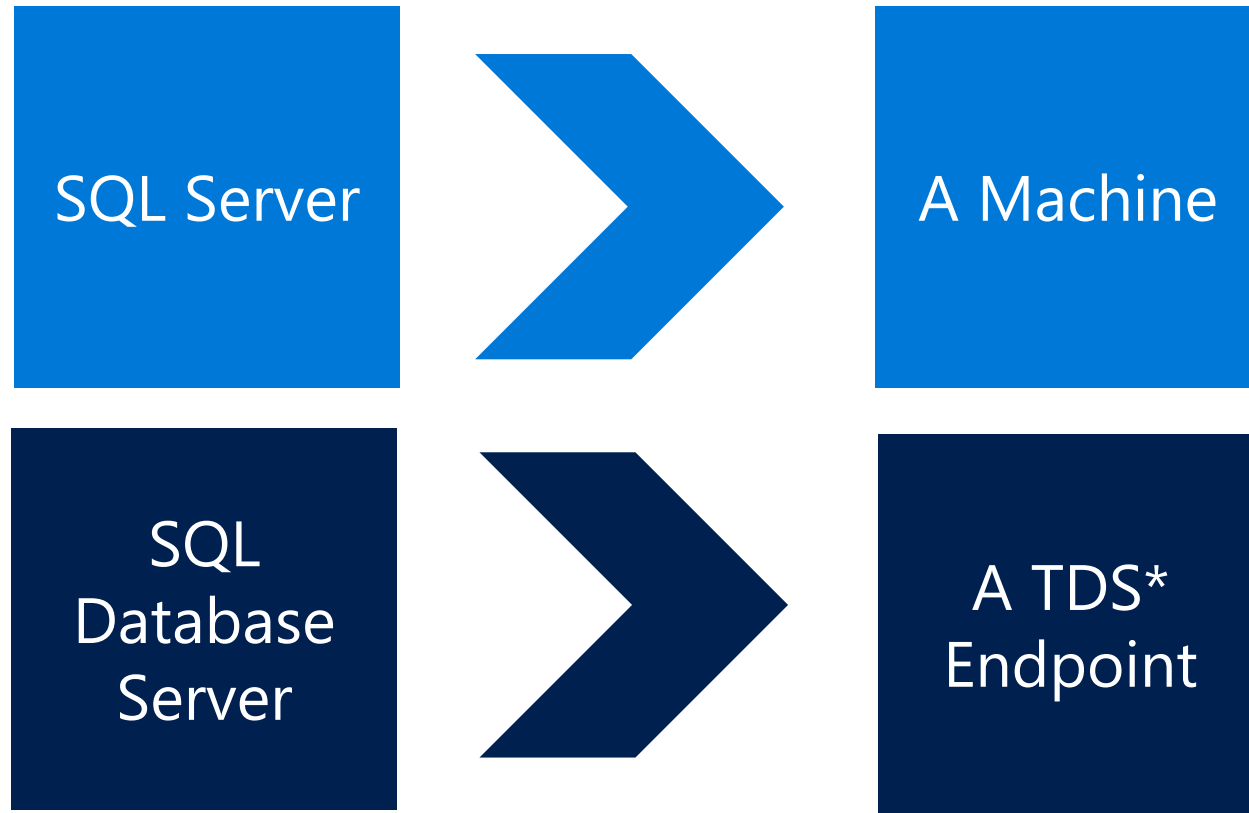
*TDS = Tabular Data Stream

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 *   MCAPS-Hybrid·

Resource group *   (New) AzureSQLDatabaseResourceGroup
                      Create new

Server details

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

Server name *   dbsqlessentials
                                           .database.windows.net

Location *   (US) Central US

Authentication

ℹ Azure Active Directory (Azure AD) is now Microsoft Entra ID. Learn more

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 Microsoft Entra authentication Learn more using an existing Microsoft Entra user, group, or application as Microsoft Entra admin Learn more, or select both SQL and Microsoft Entra authentication.

Authentication method   ○ Use Microsoft Entra-only authentication
                         ● Use both SQL and Microsoft Entra authentication
                         ○ Use SQL authentication

Set Microsoft Entra admin *   **Not Selected**
                              Set admin

Server admin login *   sqlserveradmin

Password *   ••••••••

[Review + create]   [Next : Networking >]

Create SQL database - Portal

Home >

SQL databases 📌 ⋯
Microsoft

+ Create 🕐 Reservations

Create SQL Database ⋯
Microsoft

Database details

Enter required settings for this database, including picking a logical server and configuring the compute and storage resources

Database name * | SalesDB ✓

Server ⓘ | dbsqlessentials (Central US) ▾

Want to use SQL elastic pool? ⓘ   ○ Yes ● No

Workload environment   ○ Development
                       ● Production

ⓘ Default settings provided for Production workloads. Configurations can be modified as needed.

Scale Compute & Storage ➡️

Compute + storage * ⓘ   **General Purpose**
                        Standard-series (Gen5), 2 vCores, 32 GB storage
                        Configure database

Create the database - Code
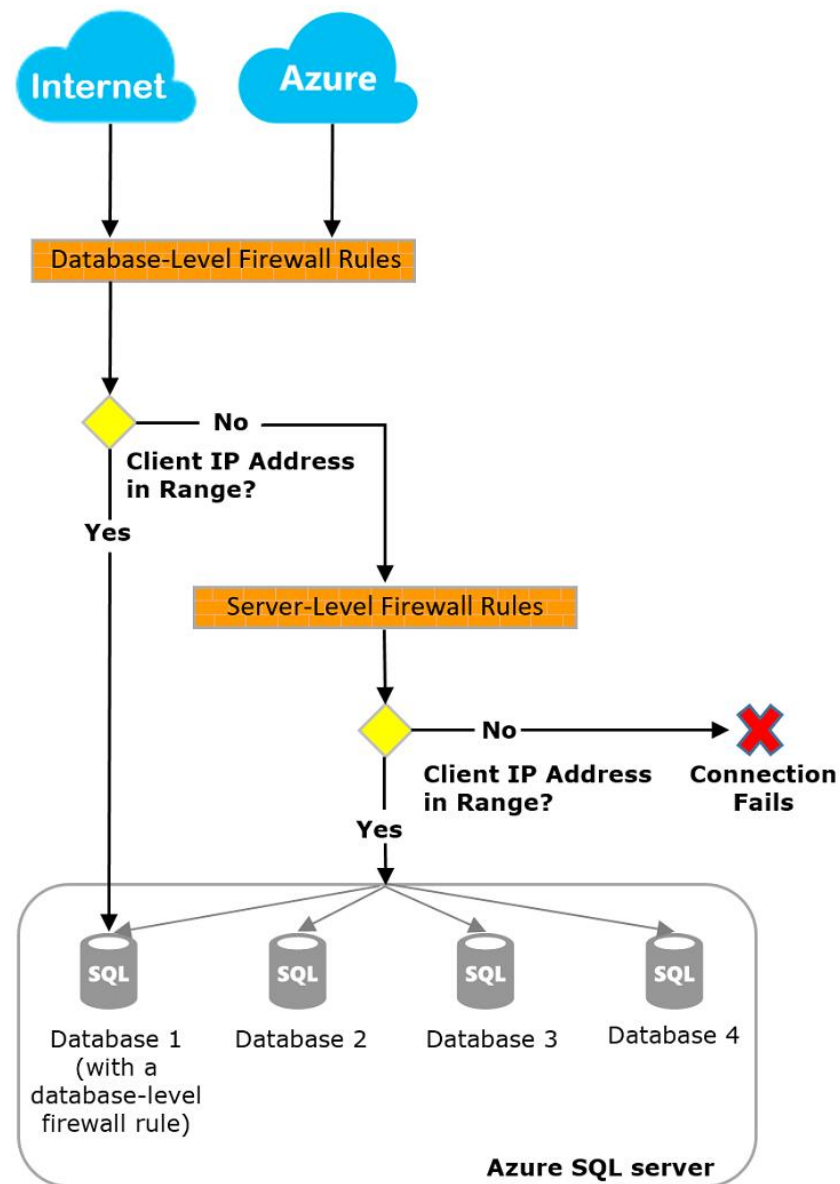
PowerShell:
New-AzSqlDatabase -ResourceGroupName "reurcegroupsqlgsps"
-ServerName "server1" -DatabaseName "database1"
-Edition "Standard" -RequestedServiceObjectiveName "S1"

```
Transact-SQL:
CREATE DATABASE MyFirstAzureSQLDatabase
(MAXSIZE = 500 MB, EDITION = 'standard', SERVICE_OBJECTIVE = 'S1');
```
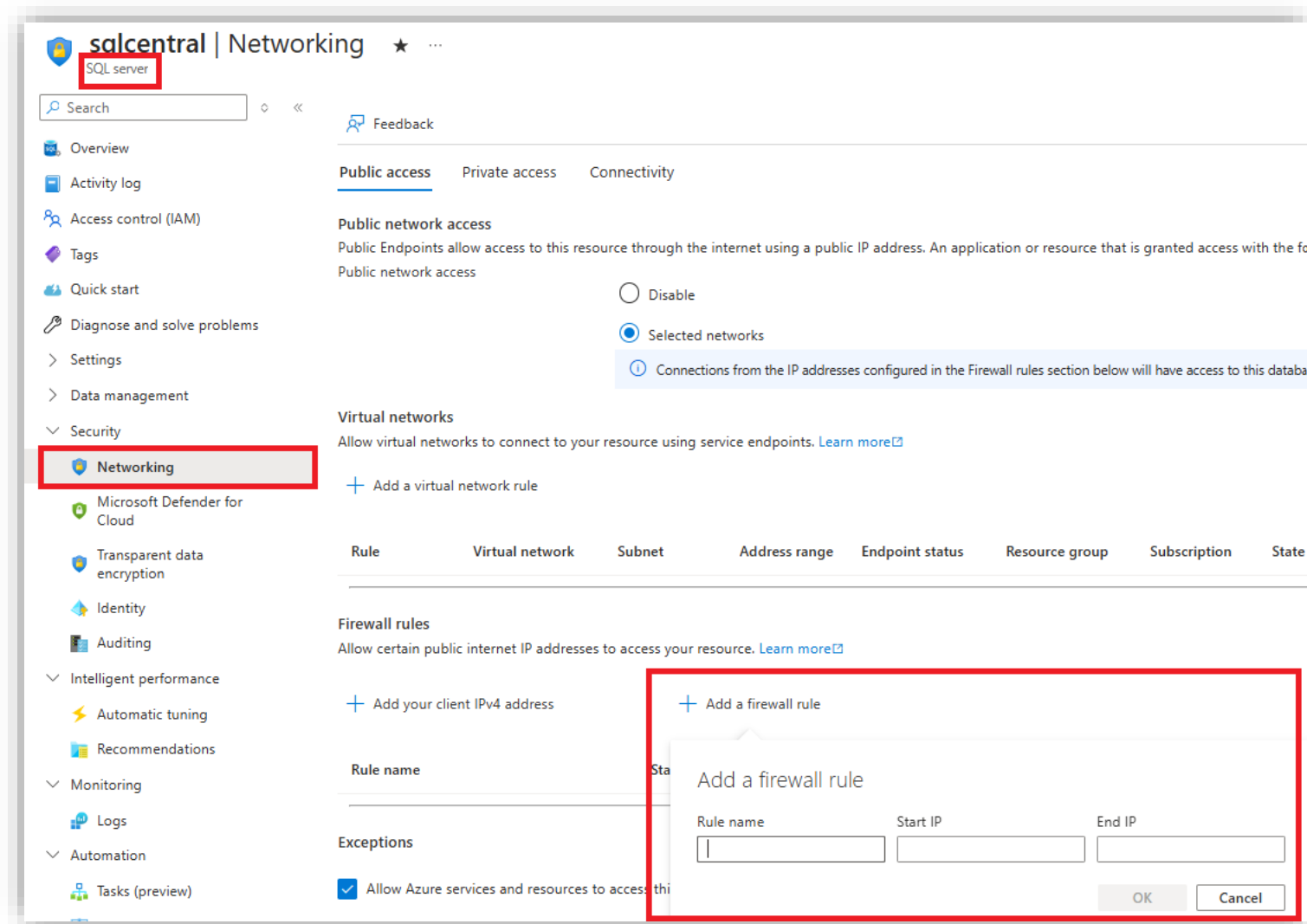
Azure SQL Database Firewall

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

Firewall configuration using portal

By default, Azure blocks all external connections to port 1433.

Enable in the following ways in Azure portal:

- Security -> Networking

Demonstration

Create your first Azure SQL Database

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

Create an Azure SQL Database

- Exercise 1: Create a new SQL Server (logical server).

- Exercise 2: Create firewall rules.

- Exercise 3: Create an Azure SQL. Database (DTU Based).

LAB

Questions?

Knowledge Check

Why do you need to configure the Azure SQL Database Firewall and why is it important?

What options do you need to specify to create an Azure SQL Database?

What is a SQL server (logical server)?

Lesson 3: Introduction to Elastic Database Pools in Azure SQL Database

Objectives

After completing this learning, you will be able to:

- Describe the Azure Elastic Database Pool

What is an Azure SQL elastic pool?

What is an Azure SQL elastic pool?

Managing and scaling multiple databases that have varying and unpredictable usage demands.

A pool is shared by multiple databases to accommodate unpredictable periods of usage by individual databases.

Provisioning resources for the entire pool. It is a cost-effective solution for running multiple data bases with a fixed Budget.

Simply add and remove databases with downtime.

DTU-based Elastic Pool service tiers

	Basic	Standard	Premium
Built for	Light transactional workloads	Medium transactional workloads	Heavy transactional workloads
Available SLA	99.99%		
eDTUs per pool	50-1,600	50-3,000	125-4,000
Max number of databases per pool	100-500	100-500	50-100
Max eDTUS choices per data bases	5	10-3000	25-4,000
Max storage per pool	5-156 GB	4 TB	4 TB
Max storage per database	2 GB	500 GB -1 TB	1 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		
Performance objectives	Transactions per hour	Transactions per minute	Transactions per second

Elastic pool: Storage sizes and compute sizes

vcore-based Elastic Pool service tiers - General Purpose

	Gen5	Fsv2-series
vCores	2 - 80	72
Memory (GB)	10.2 - 408	136
Max number of DBs per pool	100 - 500	500
Storage type	Premium (remote) storage	Premium (remote) storage
Max data size	512 GB – 4 TB	4 TB
Max log size	154 GB – 1229 GB	1 TB
Max tempdb size	64 GB - 384 GB	333 GB
Number of replicas	1	1

Resource limits for elastic pools using the vCore-based purchasing model limits

vcore-based Elastic Pool service tiers - Business Critical

	Gen5	M-series
vCores	4 - 80	128
Memory (GB)	20.4 - 408	3767
Max number of DBs per pool	100	100
Storage type	Local SSD	Local SSD
Max data size	1 TB – 4 TB	4 TB
Max log size	307 GB – 1229 GB	2 TB
Max tempdb size	128 GB - 384 GB	4 TB
Number of replicas	4	4

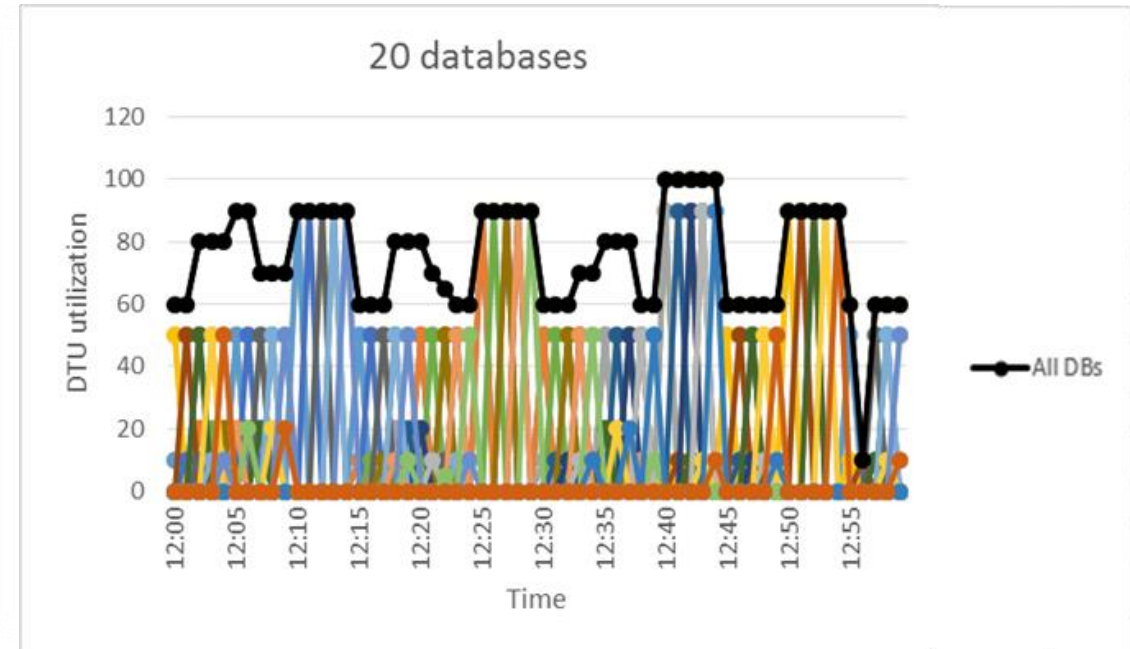Resource limits for elastic pools using the vCore-based purchasing model limits

When to consider a pool?

Assessing database utilization patterns.

There are large differences between peak utilization and average utilization per database.

The peak utilization for each database occurs at different points in time.

eDTUs are shared between many databases.

Rules of Thumb

Minimum number of databases

The sum of the DTUs of performance levels for single databases is more than 1.5x the eDTUs needed for the pool.

Maximum number of concurrently peaking databases

Not more than 2/3 (or 67%) of the databases in the pool should simultaneously peak to their eDTU limit.

DTU utilization per database

A database should be considered for a pool when its peak utilization is about 1.5 times greater than its average utilization.

Maximum number of vCores

The maximum number of vCores that any database in the pool may use, if available based on utilization by other databases in the pool.

Set max vCores per database high enough to handle peaks in database utilization.

The minimum number of vCores

The minimum number of vCores that any database in the pool is guaranteed.

The product of the number of databases in the pool and the minimum vCores per database cannot exceed the vCores per pool.

Max storage per database

The maximum database size set by the user for a database in a pool.

Max database size refers to the maximum size of the data files and _does not include the space used by log files._

DTU

vCore

Impact of changing service tier or rescaling compute size

Create new compute instance for the elastic pool

- A new compute instance for the elastic pool is created with the requested service tier and compute size.
- Regardless, the databases remain online during this step, and connections continue to be directed to the databases in the original compute instance.

Switch routing of connections to new compute instance

- Existing connections to the databases in the original compute instance are dropped.
- Any new connections are established with the databases in the new compute instance. Accelerated Database Recovery can reduce the impact from aborting long running transactions.

No data is lost during any step in the workflow
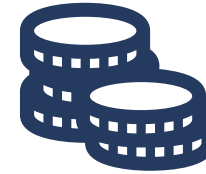
Sizing an Elastic Pool

Cost of under utilization:
When rescaling vCores or eDTUs for an elastic pool, an extra storage cost applies if (1) the storage max size of the pool is supported by the target pool, and (2) the storage max size exceeds the included storage amount of the target pool.

Usage History: Azure DB evaluates historical resource usage.

Billing Size: You are billed for each hour a database exists using the highest service tier + compute size that applied during that hour, regardless of usage or whether the database was active for less than an hour.

Storage Max Size: When downsizing vCores or eDTUs for an elastic pool, the pool used space must be smaller than the maximum allowed size of the target service tier and pool eDTUs.

Change elastic pool storage size

vCore-based purchasing model

- Storage can be provisioned up to the max size limit:
  - For storage in the standard or general-purpose service tiers, increase or decrease size in 10GB increments.
  - For storage in the premium or business critical service tiers, increase or decrease size in 250GB increments.
- The price of storage for an elastic pool is the storage amount multiplied by the storage unit price of the service tier.

DTU-based purchasing model

- The eDTU price for an elastic pool includes a certain amount of storage at no additional cost.
- Extra storage beyond the included amount can be provisioned for an additional cost up to the max size limit in increments of 250 GB up to 1 TB, and then in increments of 256 GB beyond 1 TB.
- The price of extra storage for an elastic pool is the extra storage amount multiplied by the extra storage unit price of the service tier.

Demonstration

Create an Elastic Pool

- Create an Elastic pool using the Azure portal

Questions?

Knowledge Check

What is a SQL Elastic Pool?

When should you consider an elastic pool instead of a single database?

Which tools can help you to size your elastic pool?

Module Summary