

# Options for SQL in Azure

## IaaS and PaaS

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# SINGLE SQL CODE BASE

Eliminate app changes with full SQL Server programming surface

Use familiar SQL Server features in Azure SQL Database

Rapid development cycles with built-in testing across millions of databases

Innovation deployed to Azure first

Industry-leading database engine



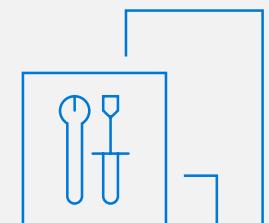
Industry-leading performance



#1 OLTP performance

#1 DW performance

#1 price/performance



# Migrate to the cloud with Azure SQL Database

Breakthrough  
productivity &  
performance



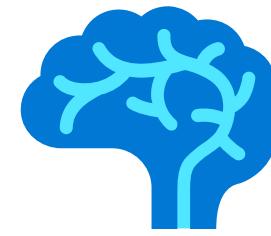
Up to 100 TB of on-demand scalable storage per DB

Industry-leading security



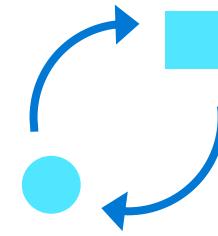
Layers of security and 99.99 percent availability SLA

Built-in intelligence



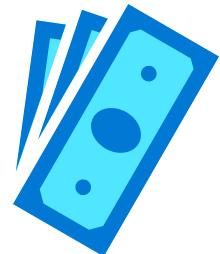
Intelligent performance tuning and intelligent protection

Seamless and compatible



The broadest SQL Server compatibility and VNET support

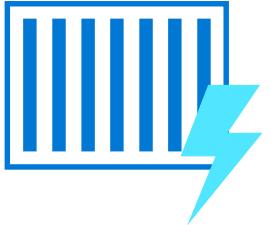
Competitive TCO



Up to 80% savings with Azure Hybrid Benefit and reserved capacity

The best and most economical cloud destination

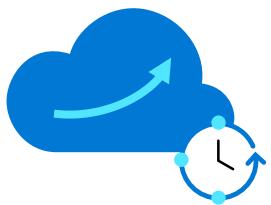
# Breakthrough productivity and performance



**30x**  
faster transactions with in-memory OLTP



**100x**  
performance gains with in-memory analytics

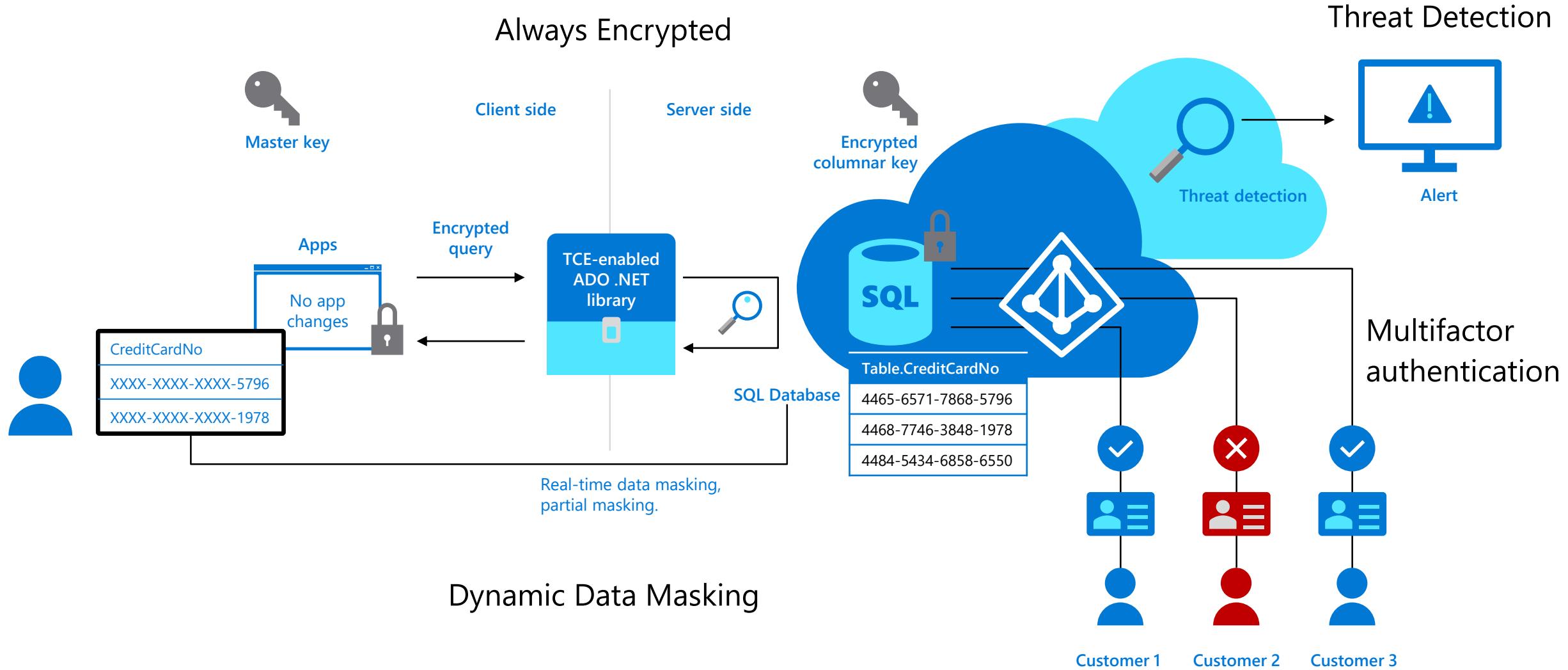


near **100%**  
uptime with dynamic scalability



**100TB +**  
Auto scaling up to 100TB with Hyperscale

# Industry-leading security

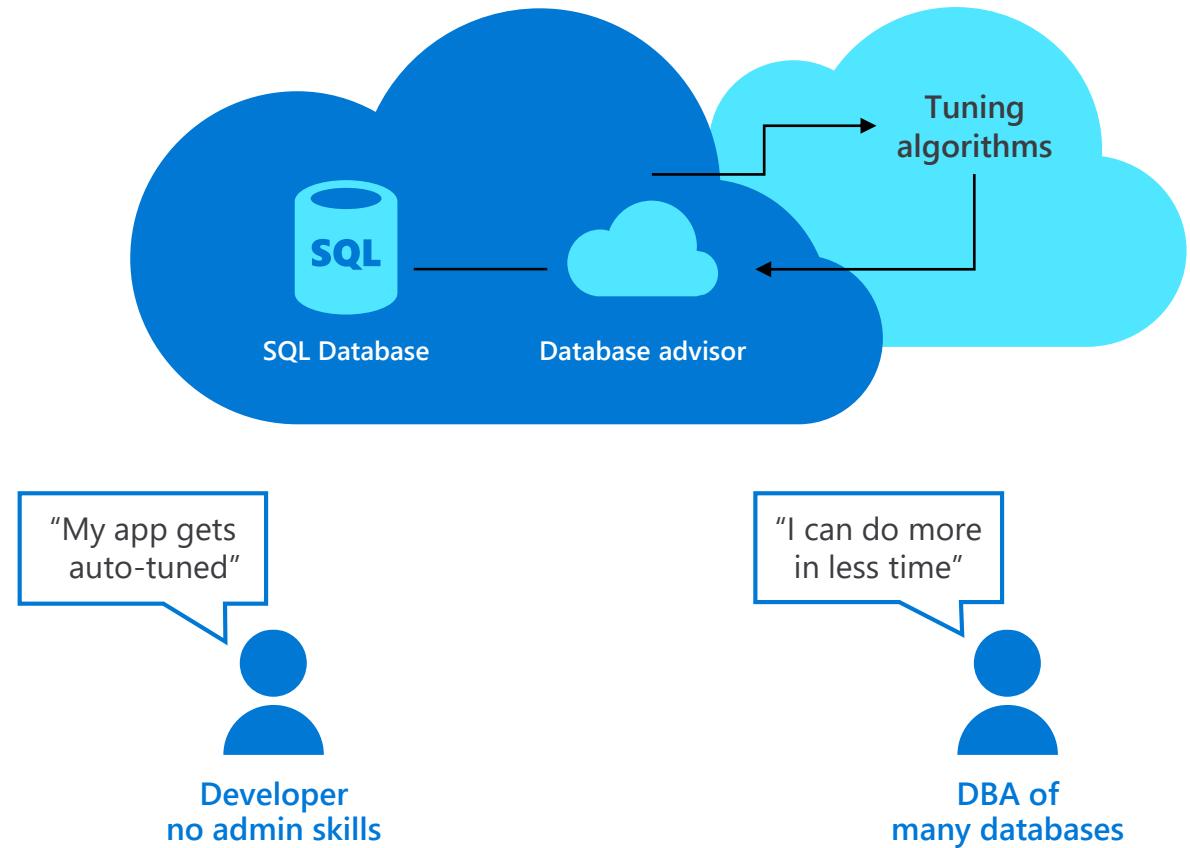


# Built-in intelligence

**Intelligent Performance** learns unique database patterns and automatically tunes for improved performance

## Adaptive query processing

Accelerate parallel queries and improve scaling of frequent queries with Intelligent Query Processing



# Running SQL Server in VMs



# Why SQL Server in an Azure VM?

1

Reduced  
capex/pay-as-  
you-go pricing

2

Fast  
deployment

3

Reduced  
configuration

4

Elastic scale

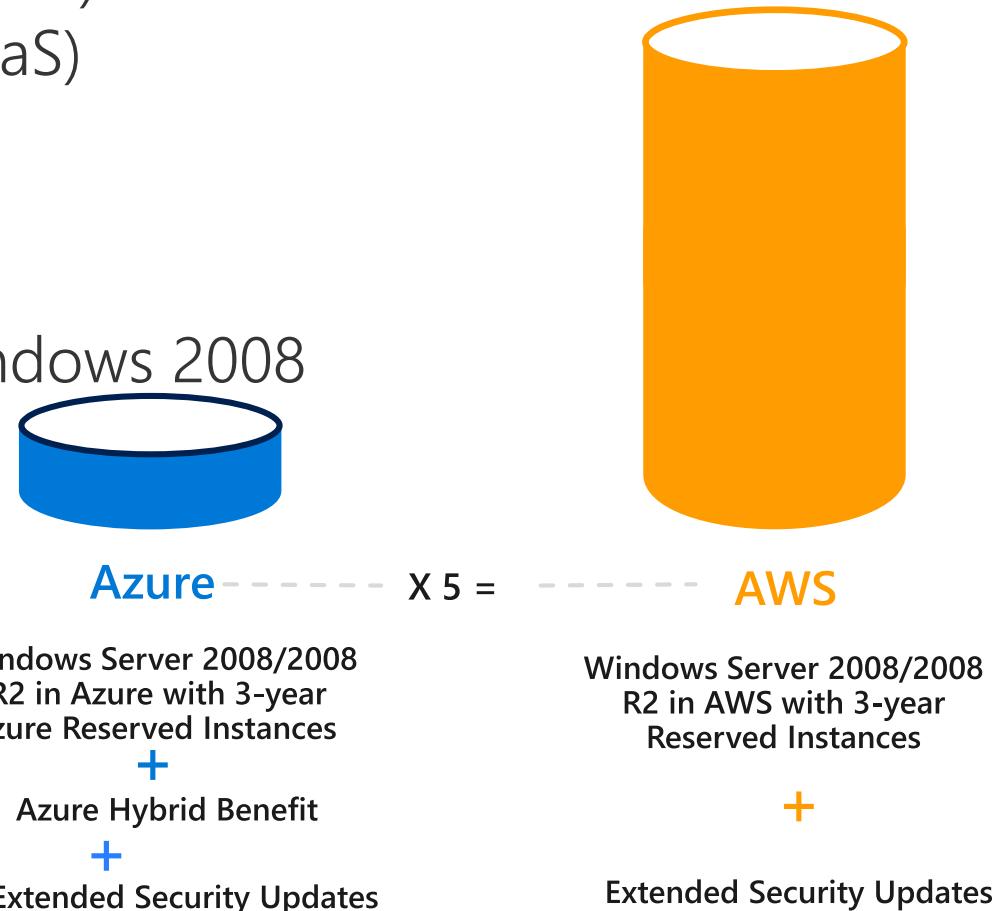


# Azure is the most cost-effective cloud for your SQL Workloads

**Windows Server 2008/2008 R2 in AWS costs 5 times more than in Azure**

- Leverage Azure Hybrid Use Benefits (IaaS & PaaS)
- Leverage Reserved Instance Pricing (IaaS & PaaS)
- Leverage Developer Edition
- Automatic Security Updates
- Configurable Cloud Backup
- Free Extend Security Updates for SQL and Windows 2008

- The cost does not include Software Assurance cost
- Extended Security Updates cost is based on Windows Server Standard open NL ERP pricing in USD. Actual regional pricing and program discounts may apply.
- Sample annual cost comparison of two D2V3 Windows Server VMs. Savings based on two D2V3 VMs in US West 2 region running 744 hours/month for 12 months; reduced compute rate at SUSE Linux Enterprise rate for US west 2. Azure pricing as of 04/24/2018. AWS pricing as of 04/24/2018. Price subject to change
- Actual savings may vary based on location, instance type, or usage
- Extended Security Updates typically costs 75% of the full license price annually

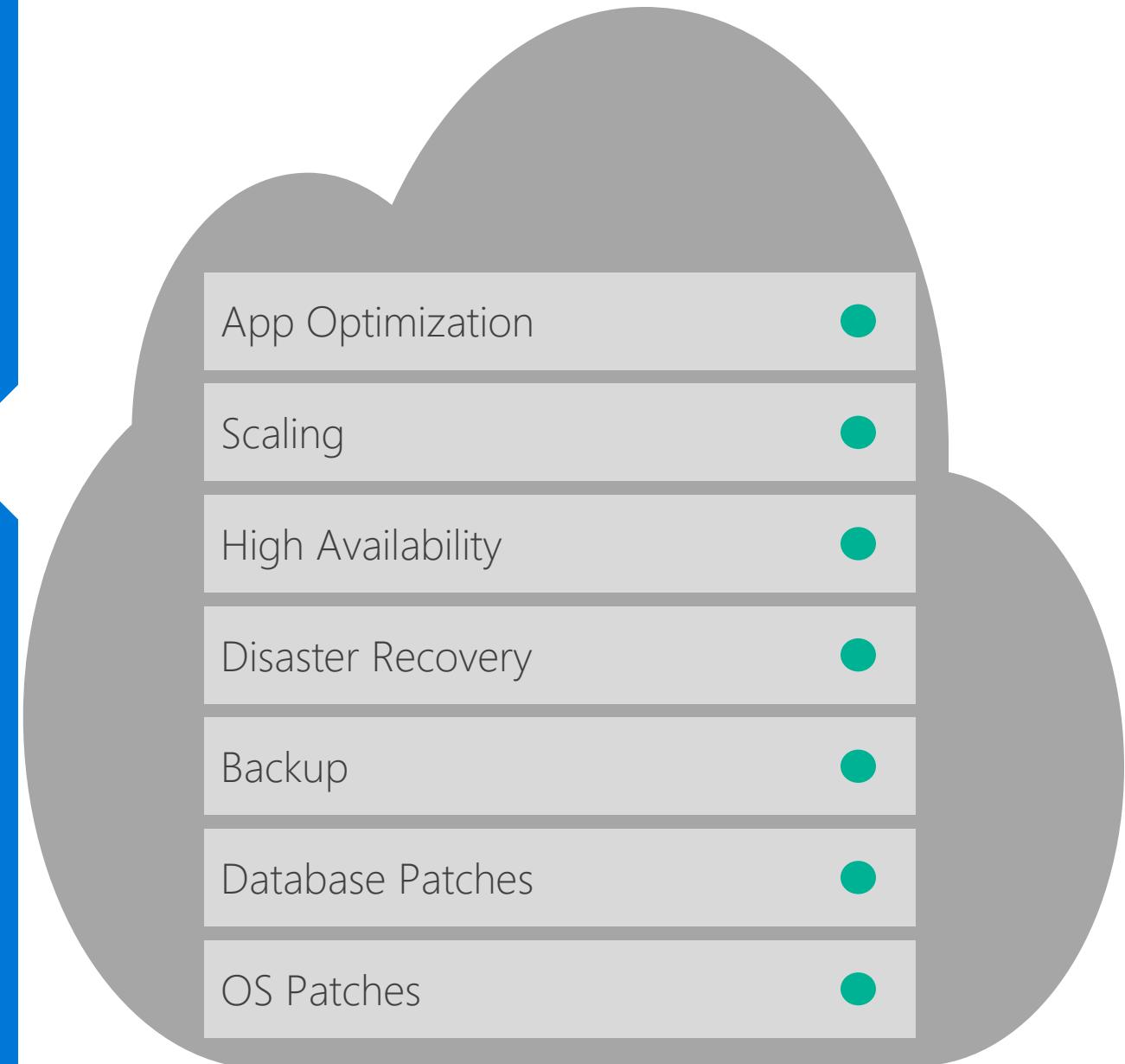


# SQL Database as a Service



# Why PaaS for data stores?

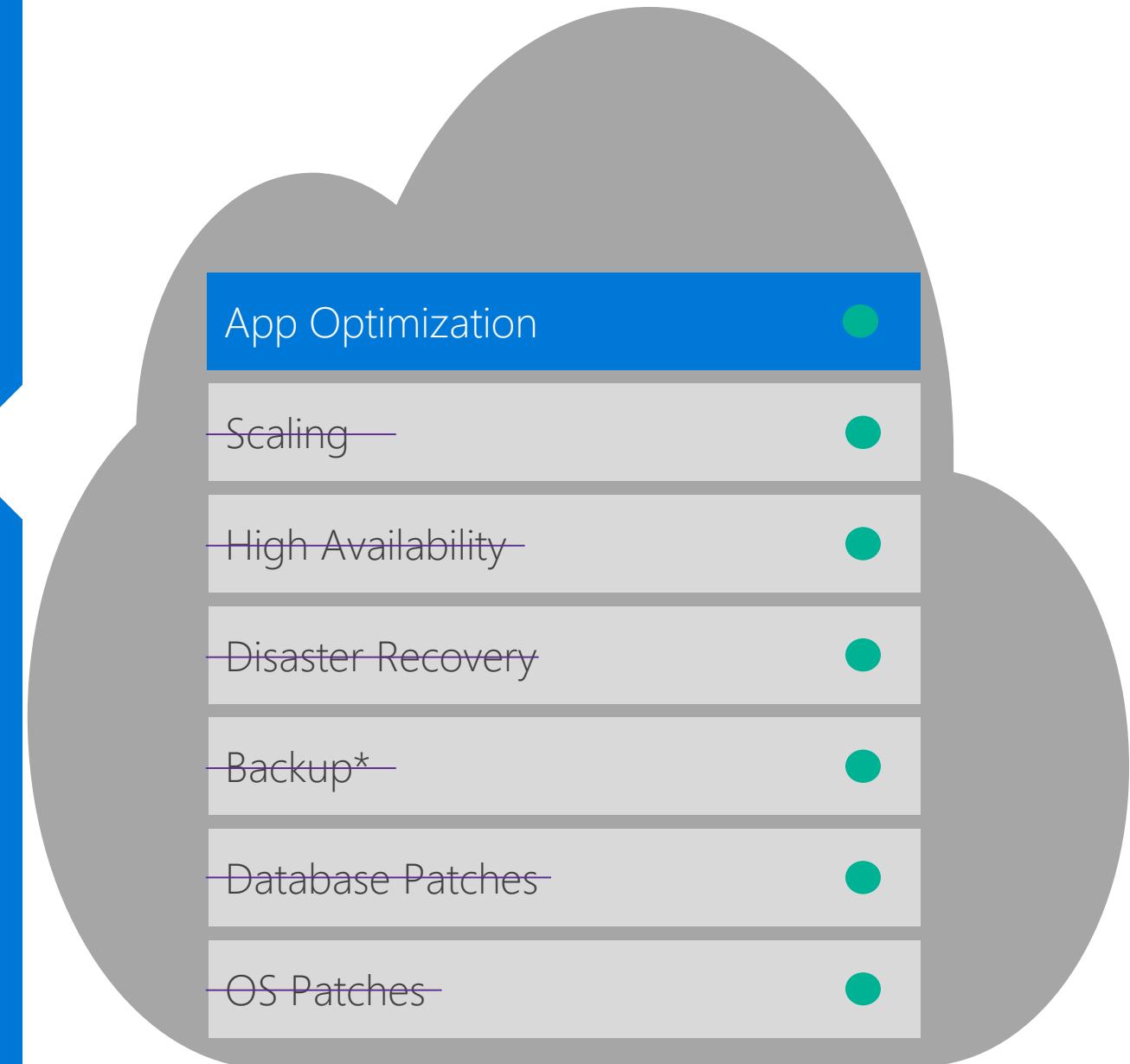
If you host your database in an Azure VM,  
you are responsible for...



# Why PaaS for data stores?

If you use a managed Data Service,  
you are responsible for...

Focus on your app and your business. Achieve a 406% ROI.  
**Let Azure Data Services help you build, scale, and innovate.**

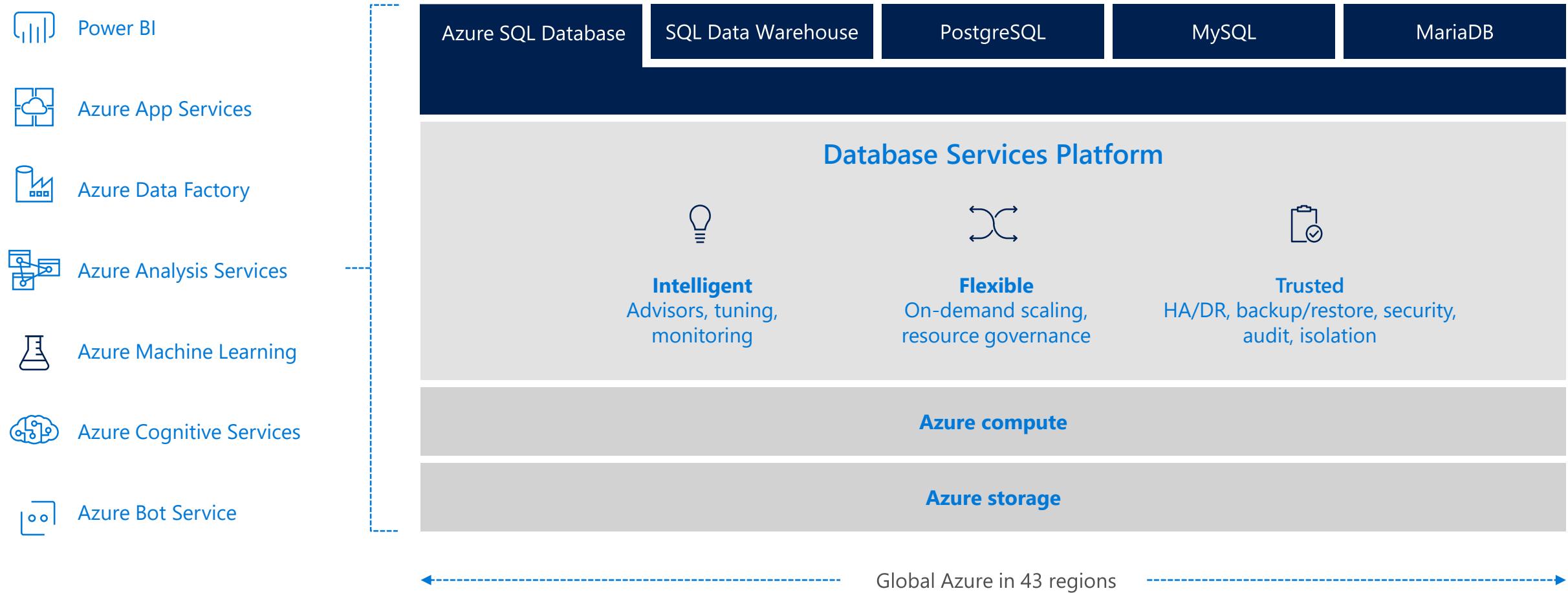


# Focus on your business

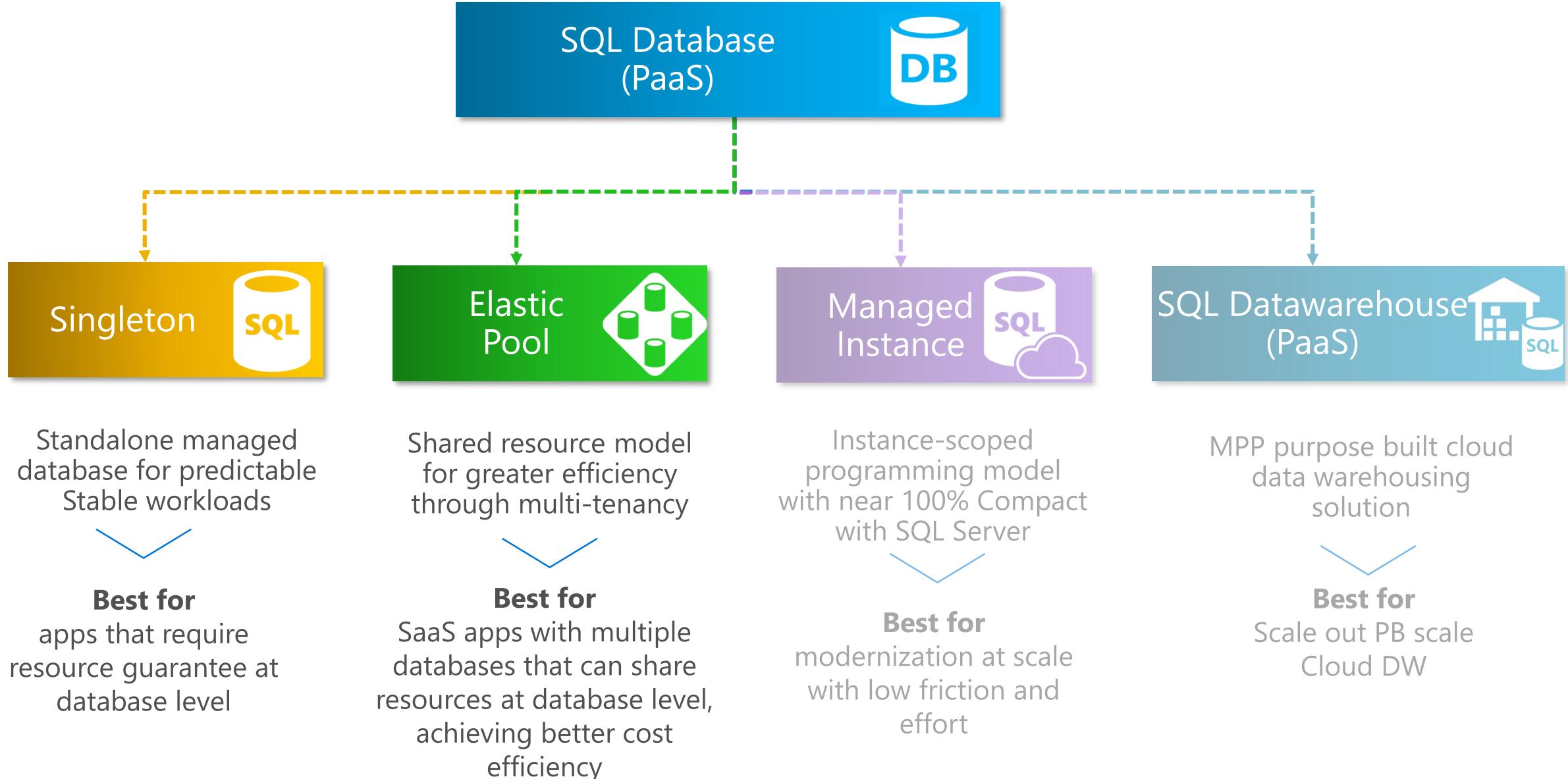
Your work so far	How PaaS helps
Hardware purchasing and management	<b>Built-in</b> scale on-demand
Protect data with backups (with health checks and retention)	<b>Built-in</b> point-in-time restore
High availability implementation	<b>Built-in</b> 99.99% SLA and auto-failover
Disaster recovery implementation	<b>Built-in</b> geo-redundancy and geo-replication
Ensure compliance with standards on your own	<b>Built-in</b> easy to use features
Secure your data from malicious users and mistakes	<b>Built-in</b> easy to use features
Role out updates and upgrades	<b>Built-in</b> updates and upgrades
Monitor, troubleshoot, and manage at scale	<b>Built-in</b> easy to use features
Tune and maintain for predictable performance	<b>Built-in</b> easy to use features

We take care of your database chores

# Azure Relational Database Platform



# What are the SQL Cloud Offerings available?

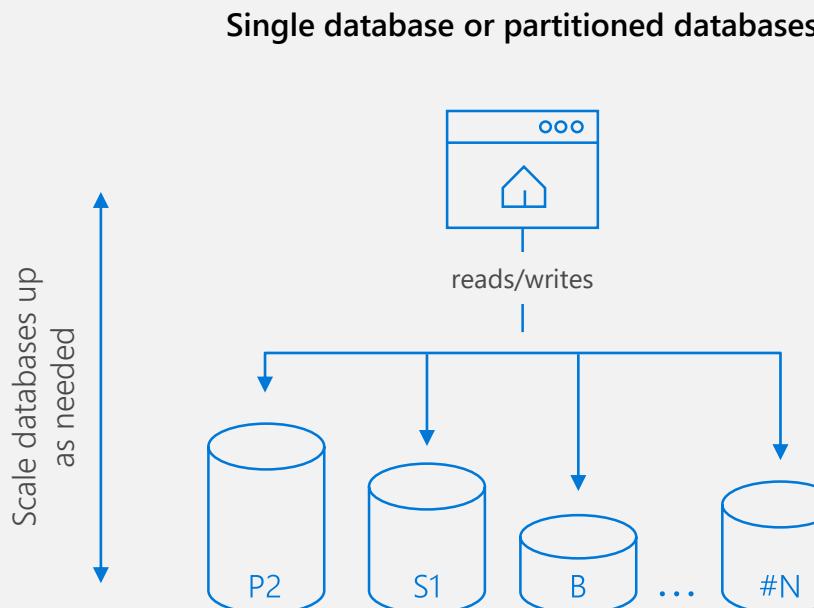


# MANAGING LARGE NUMBERS OF DATABASES

## Predictable workloads

Single databases or partitioned data across multiple databases

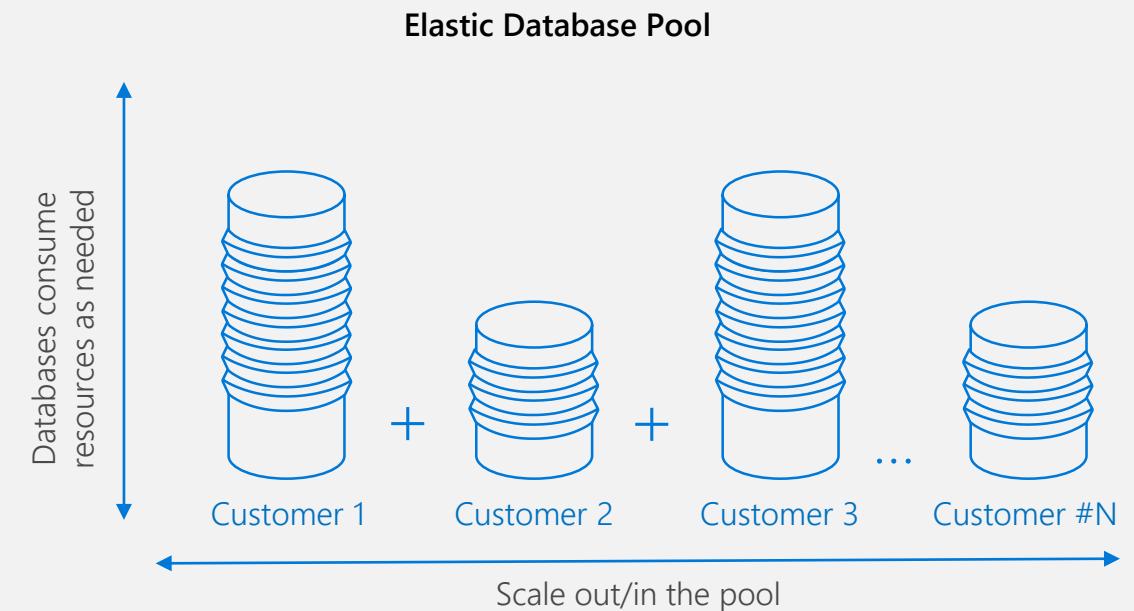
Scale between service tiers and performance levels as capacity needs fluctuate



## Unpredictable workloads

For large numbers of databases with unpredictable performance demands

Pool resources are shared between these databases

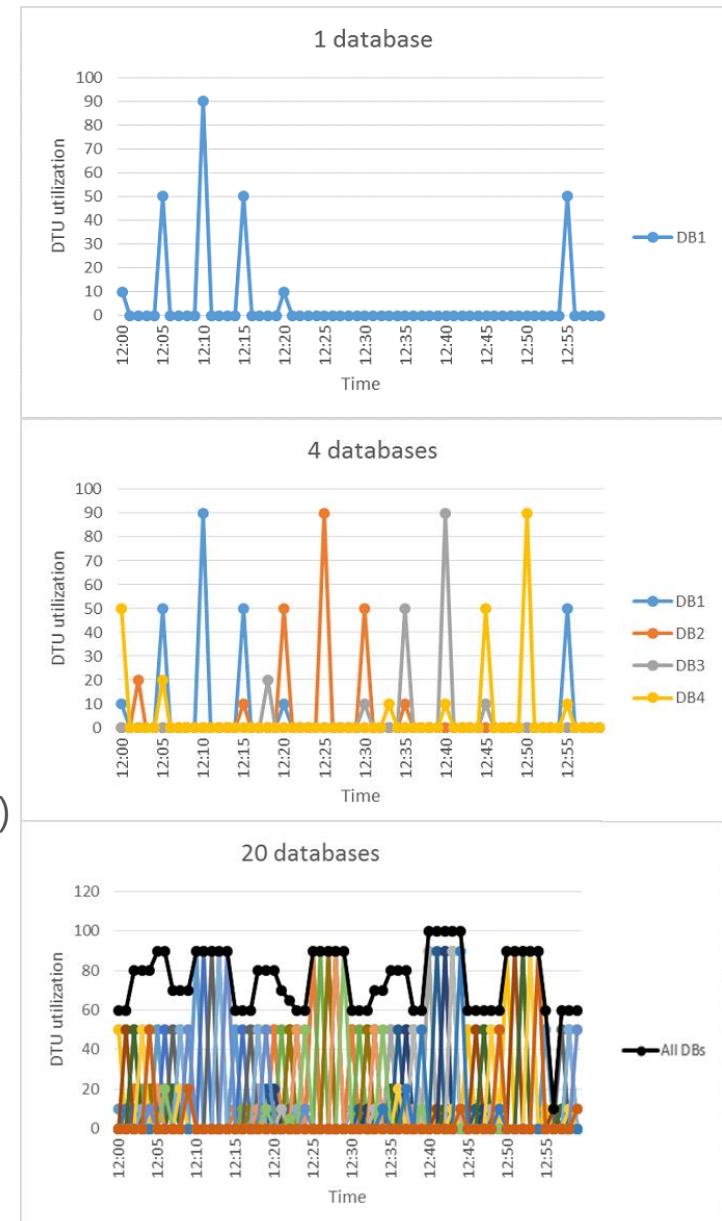


# When to use Elastic vs Singleton DB

- Multiple databases that can share resources
- Large differences between peak and average utilization per DB.
- Peaks occur at different times
- Ensure you meet the minimum #DBs for your pool to be cost effective
  - eDTU price is ~1.5x equivalent DTU price, do the math:
    - Single S0 = 10DTU = \$14.72/mo
    - Single S3 = 100 DTU = \$147/mo
    - Standard Elastic pool w/100 eDTU = \$220/mo ~ 1.5x S3 (Same DTU)
      - Min 2 S3 dbs needed in pool to be cost effective (~33% cheaper)
      - Min 15 S0 dbs needed in pool to be cost effective (~6.6x cheaper)
- Recommendations from Azure Portal
- Can estimate pool size from [calculation](#)

References:

[SQLDB Elastic Pools](#)



# VCORE MODEL

## 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

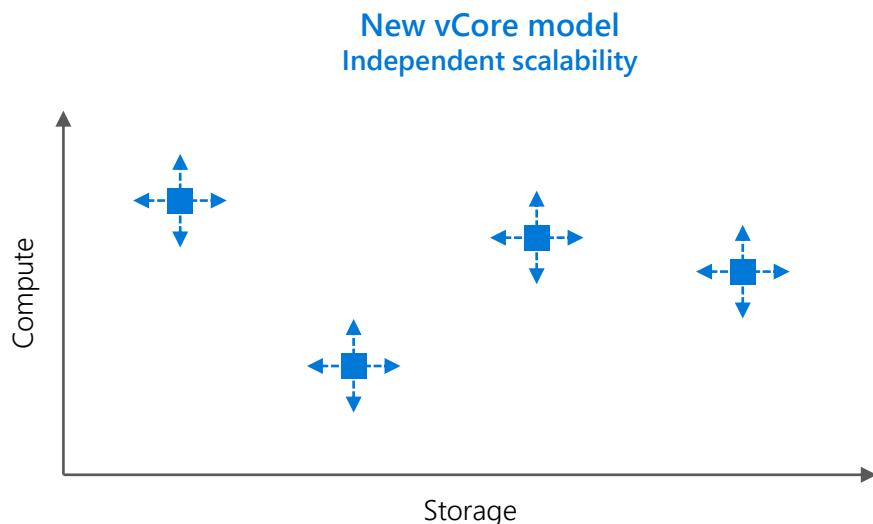
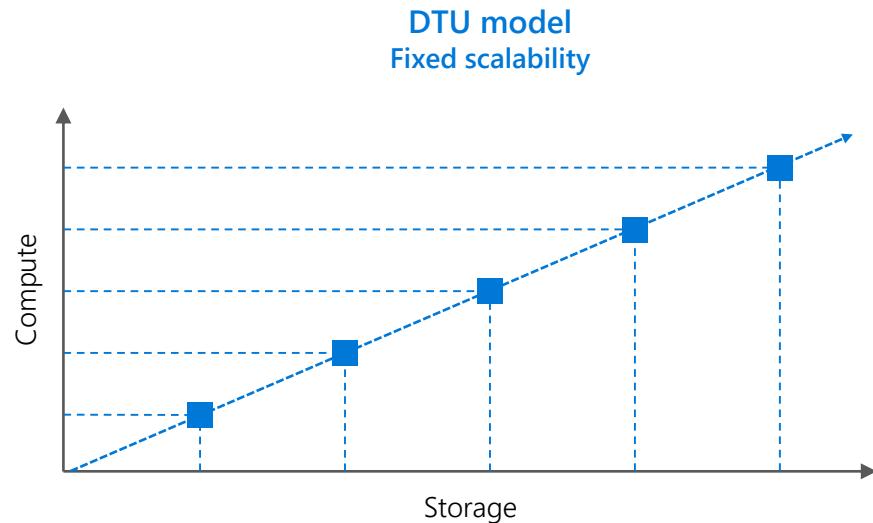
## vCore model

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



# COMMITTED TO CUSTOMER CHOICE

Choice drives our approach to resource management and pricing

## 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)\*

The vCore-based model will exist alongside the DTU-based model and will launch in public preview with no discount

\* Free during preview

\*\* Not supported in Managed Instance preview

\*\*\*Coming soon

	General purpose 	Business critical 		
Best for	Most business workloads. Offers budget-oriented balanced and scalable compute and storage options.	Business applications with high IO requirements. Offers highest resilience to failures using several isolated Always On replicas.		
Compute tiers	Two hardware generations to choose from			
	Single/Elastic Pools	Managed Instance	Single/Elastic Pools	Managed Instance
	1 to 72 vCores	4***, 8-80 vCores	1 to 72 vCores	4***, 8-80 vCores
Storage	Premium remote storage (per instance) 500 – 7000 IOPs		Super-fast local SSD storage (per instance) 5K – <b>200K</b> IOPs	
	Single/Elastic Pools	Managed Instance	Single/Elastic Pools	Managed Instance
	5GB – 4TB	32GB – <b>8TB</b>	5GB – 4TB	32GB – 4TB
Availability	1 replica, no read-scale		3 replicas, 1 read-scale**, zone-redundant HA***	
Backups	RA-GRS, 7-35 days (7 days by default)		RA-GRS, 7-35 days (7 days by default)	

# AZURE HYBRID BENEFIT FOR SQL SERVER

Take an inventory of on-premises licenses to determine potential for conversion

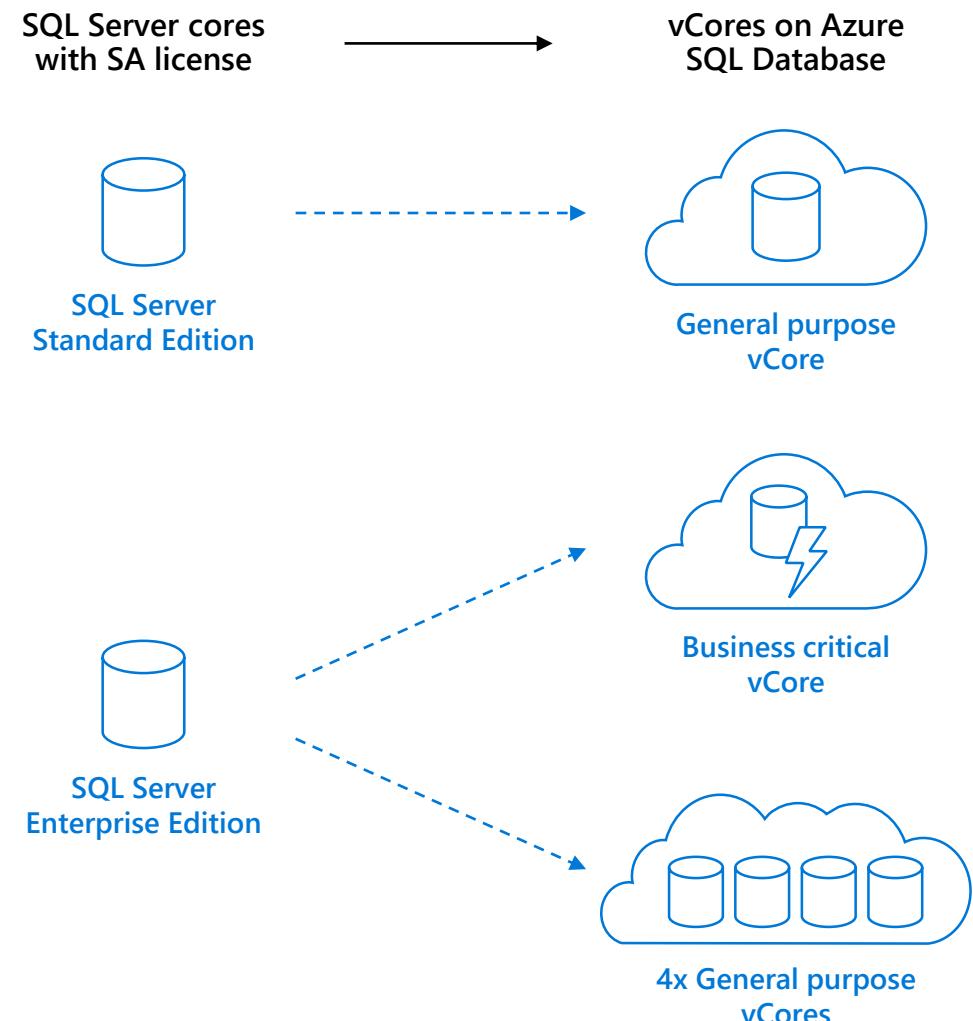
Convert on-premises cores to vCores to maximize value of investments

1 Standard license core = 1 General Purpose core

1 Enterprise license core = 1 Business Critical core

1 Enterprise license core = 4 General Purpose cores  
(virtualization benefit)

## License trade-in values

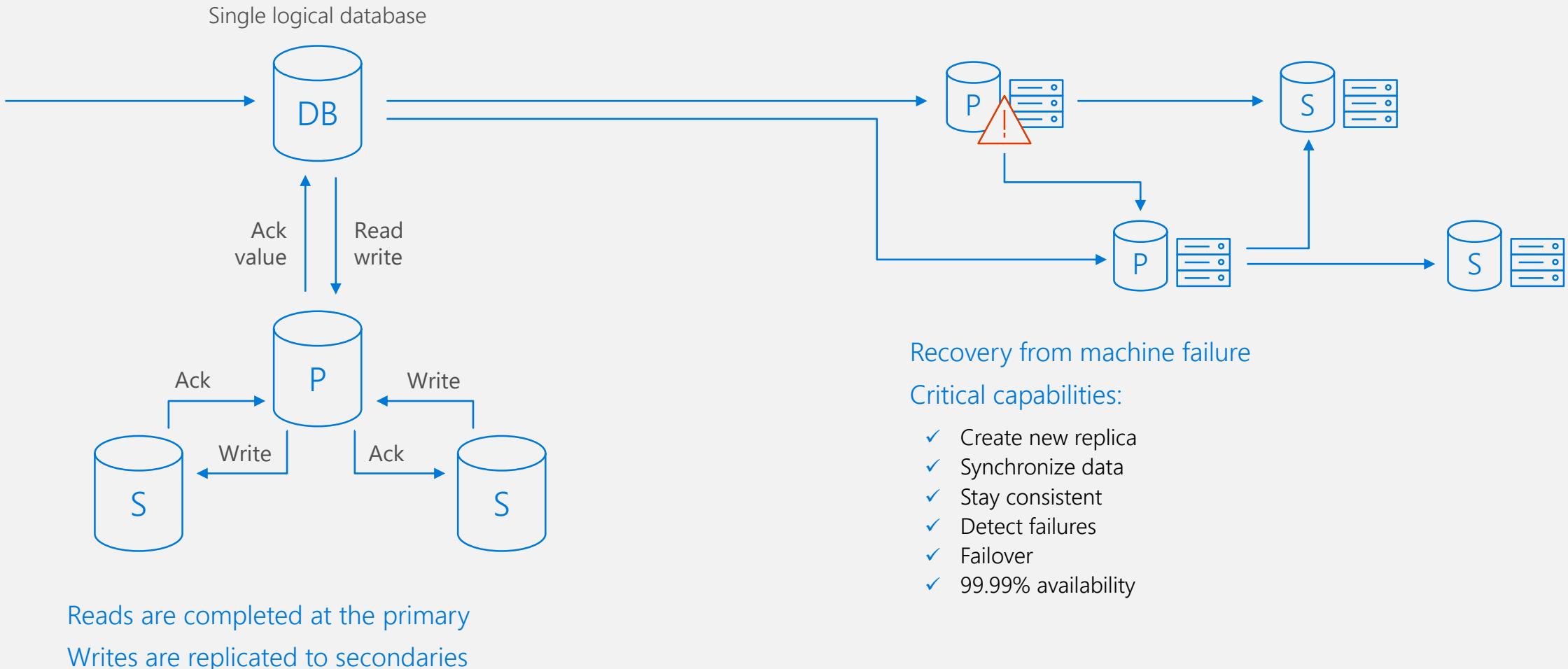


# WHAT IS AZURE SQLDB

Business Continuity &  
Disaster Recovery



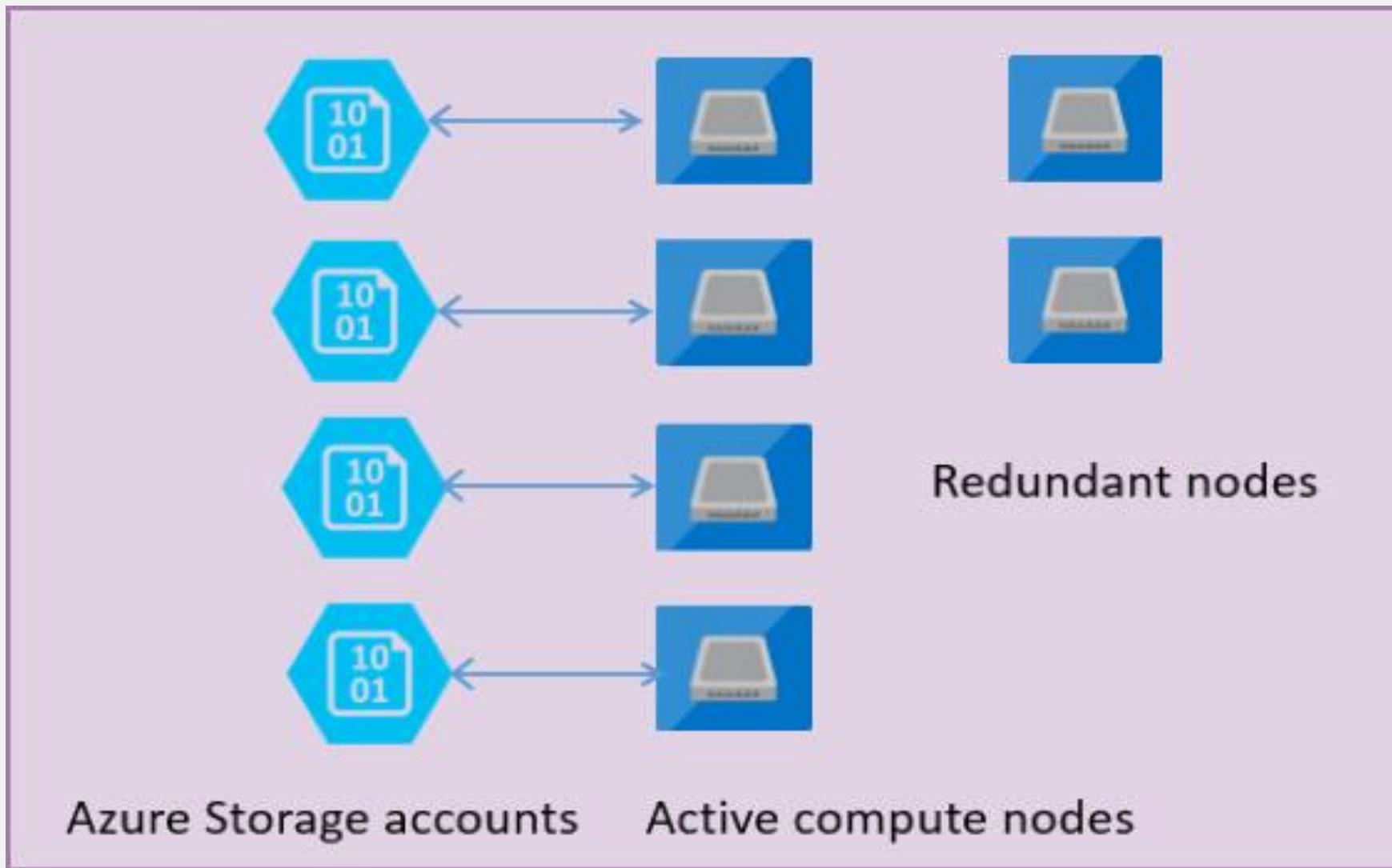
# HIGH-AVAILABILITY PLATFORM



## References:

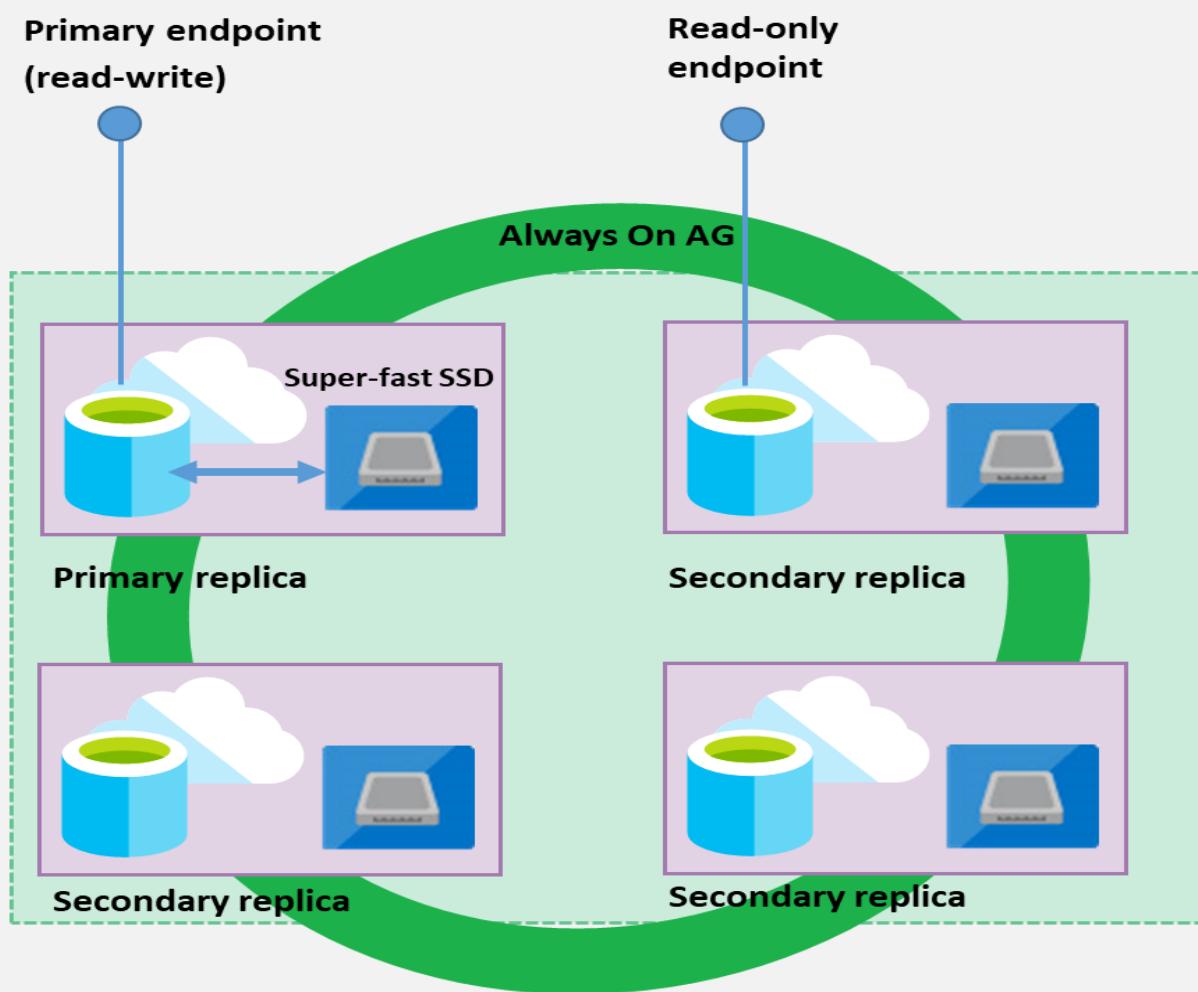
[High Availability](#)

# HIGH-AVAILABILITY PLATFORM: GENERAL PURPOSE



- ✓ Separation of compute and storage layers
- ✓ Replication of data in the storage tier.
- ✓ Failover
- ✓ 99.99% availability

# HIGH-AVAILABILITY PLATFORM: BUSINESS CRITICAL



- ✓ database integrates compute and storage on the single node
- ✓ Replication of data in the storage tier.
- ✓ Failover
- ✓ 99.99% availability
- ✓ Zone redundant configuration (preview)

Business Critical service tier: collocated compute and storage

# POINT-IN-TIME RESTORE

## Automatic backups

Full backups weekly, differential backup every 12 hour,

Transaction log backups every 5-10 minutes

Daily and weekly backups automatically uploaded to geo-redundant Azure Storage

## Self-service restore

Point-in-time up to a second granularity

REST API, PowerShell, or Azure portal

Creates a new database in the same logical server

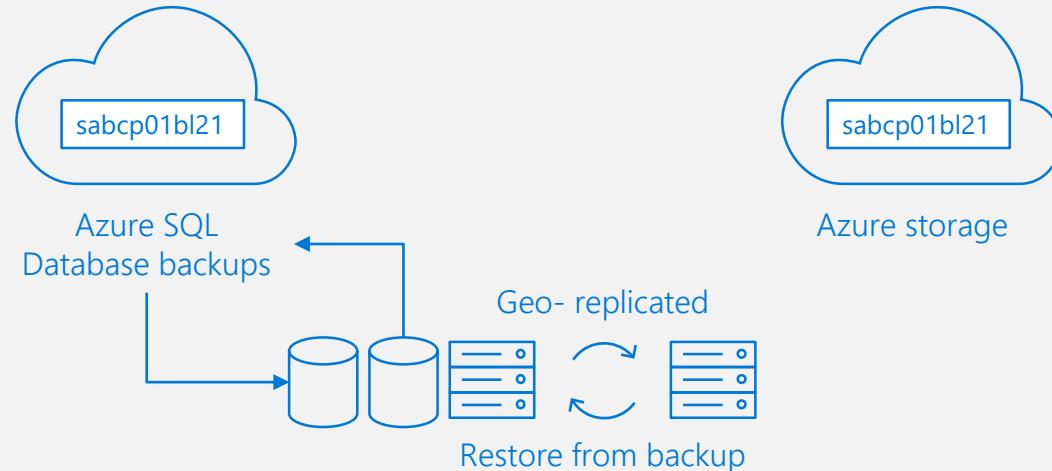
## retention policy

Basic – 7 days

Standard – 35 days

Premium – 35 days

\*No additional cost to retain backups



# GEO-RESTORE PROTECTS FROM DISASTER

Self-service restore API

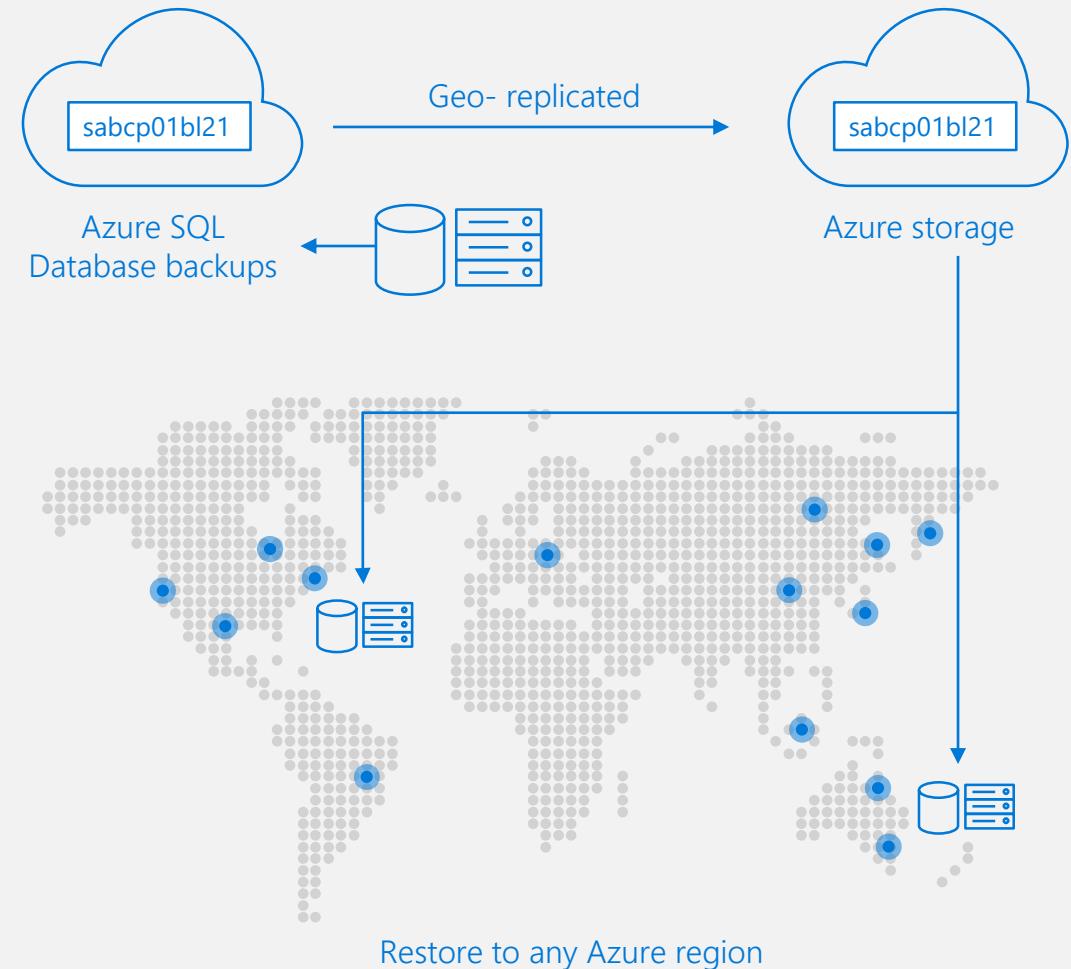
Restores last daily backup to any Azure region

Built on geo-redundant Azure Storage

No extra cost, no capacity guarantee

RTO≥24h, RPO=24h

Database URL will change after restore



# DATABASE RECOVERY

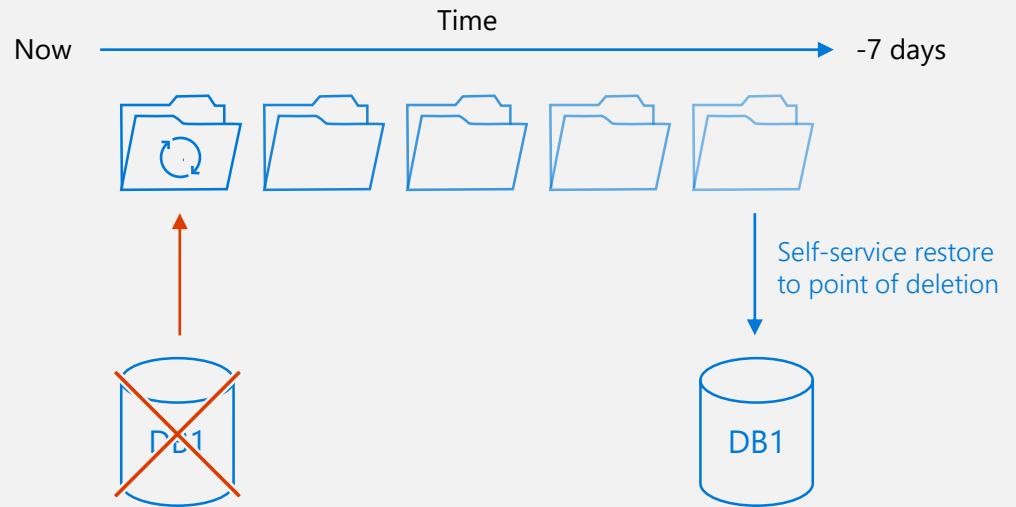
## Restoring a deleted database

Restores the database to the point of deletion  
(earlier backups are deleted)

Creates a new database on the server used by  
the original database

You can choose to failover to the restored database  
or use scripts to recover data

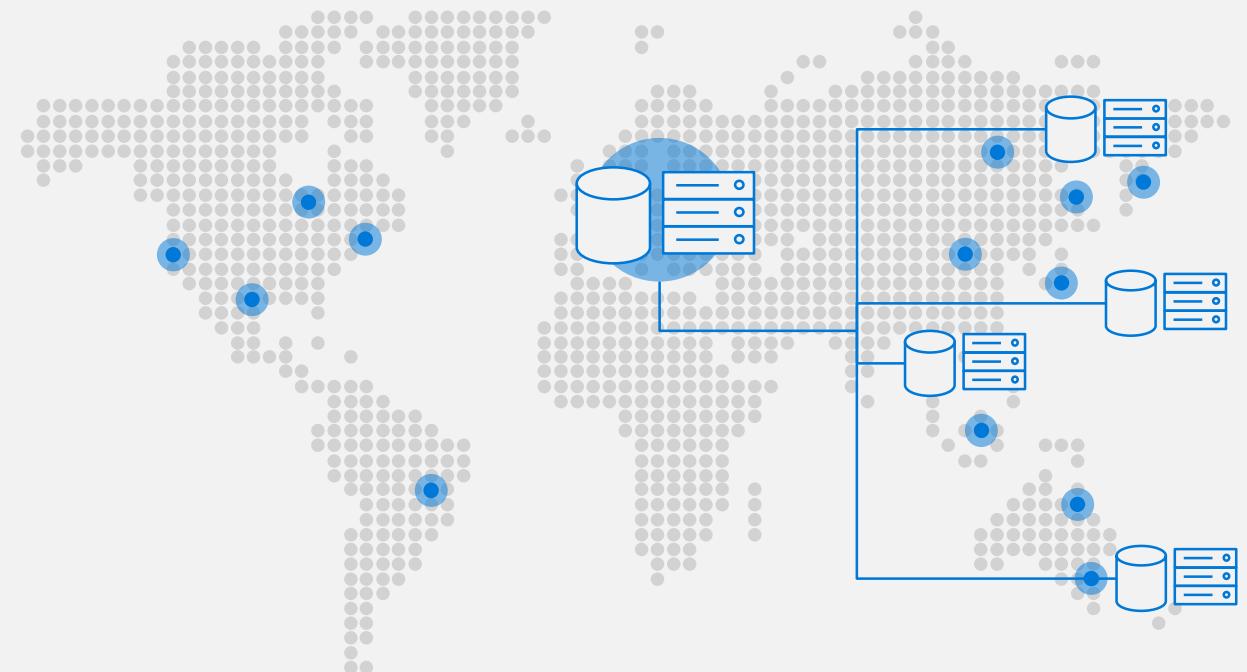
Backups retained for 7/35 days



# ACTIVE GEO-REPLICATION

Mission-critical business continuity on your terms, via programmatic APIs

<b>Service levels</b>	Basic, standard, premium Self service
<b>Readable secondaries</b>	Up to 4
<b>Regions available</b>	Any Azure region
<b>Replication</b>	Automatic, asynchronous
<b>Manageability tools</b>	REST API, PowerShell, or Azure Portal
<b>Recovery time objective (RTO)</b>	<1 hour
<b>Recovery point objective</b>	<5 minutes
<b>Failover</b>	On demand



Up to 4 secondaries

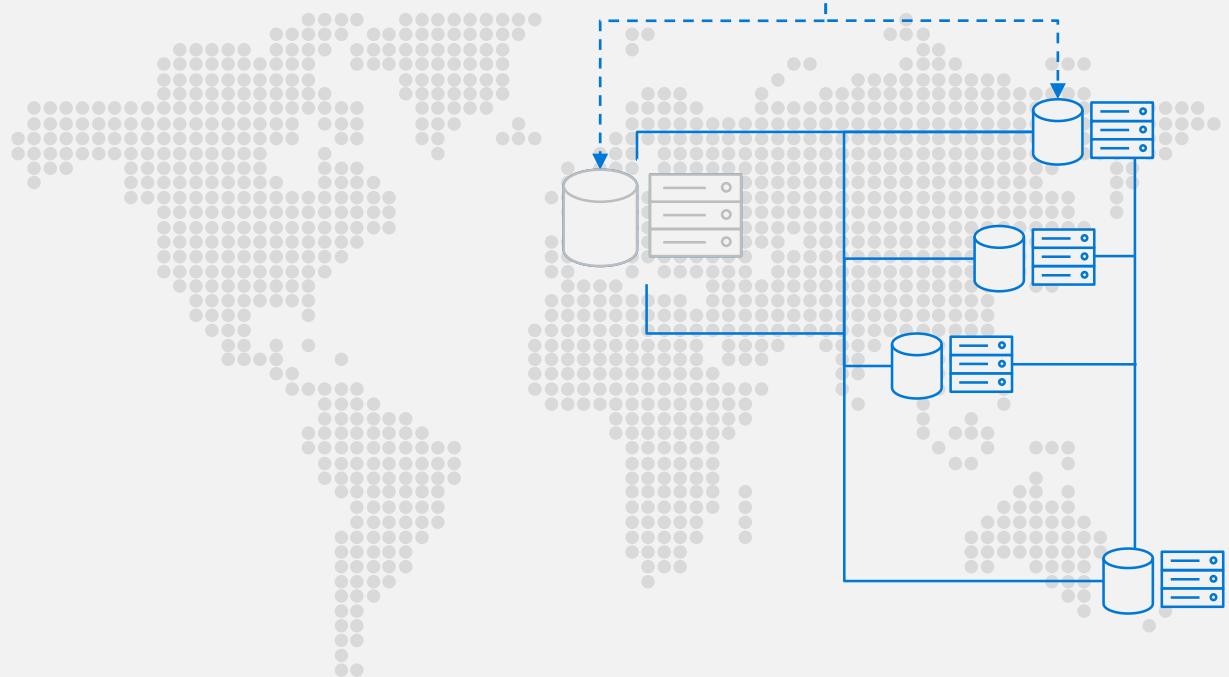
# FAILOVER GROUPS EXTEND GEO-REPLICATION

Enable geo-replication for a group of databases or pools within a server

Automatically or manually failover a group of databases

Supports active-active setup for pools

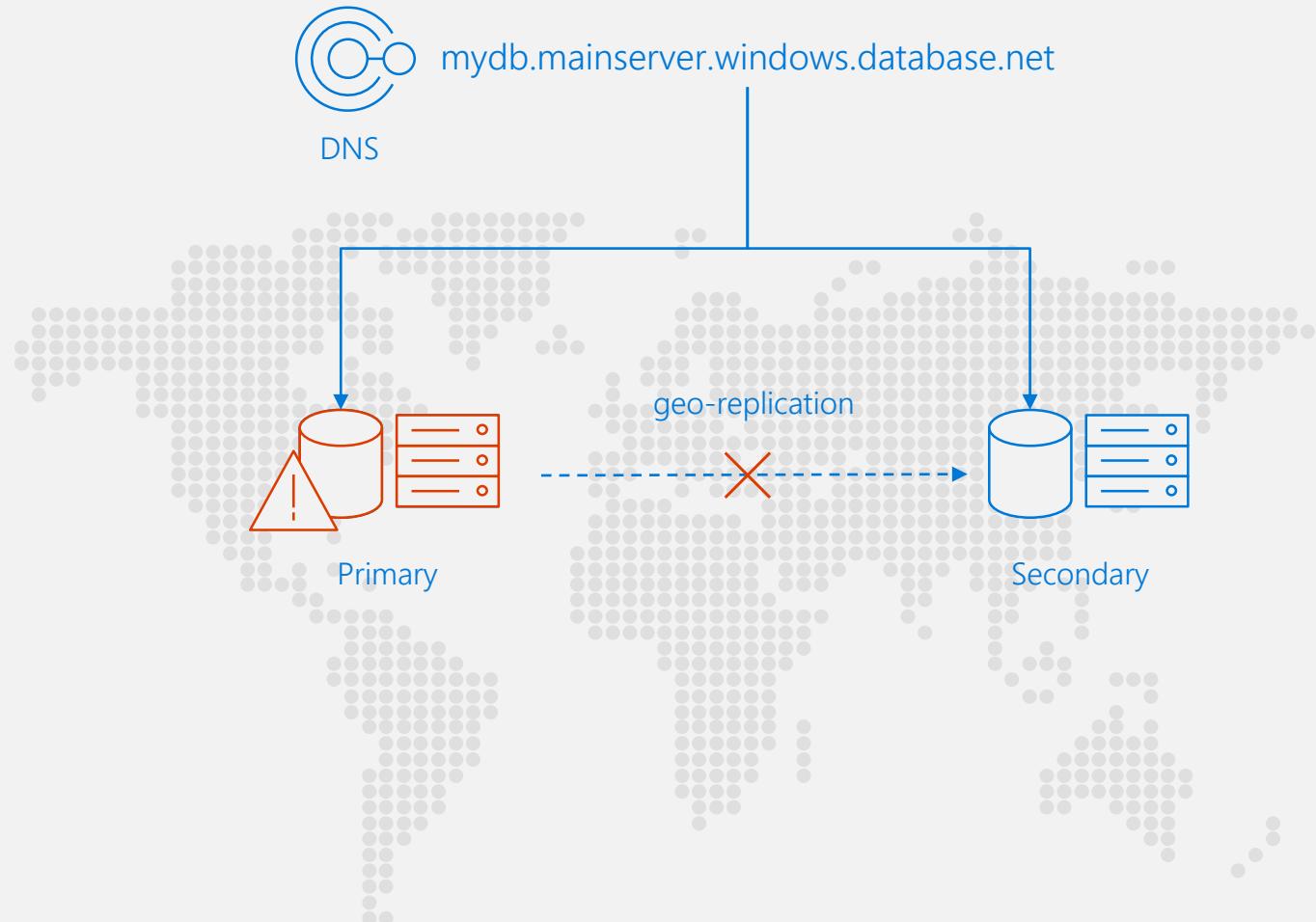
Available for all service tiers



\*Currently in private preview - Microsoft Confidential – Shared Under NDA Only

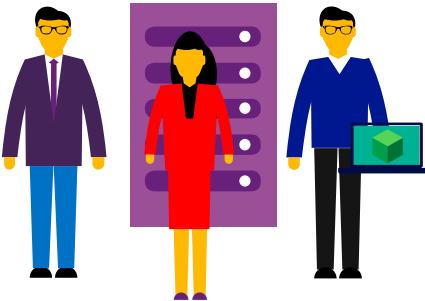
# FAILOVER GROUPS FOR PRIMARY REGION OUTAGE

- Allows cross-region isolation quickly and with minimal data loss
- Automatic DNS swap during failover
- Failover without changing application code or connection strings
- Manually initiated failover or fallback at any time



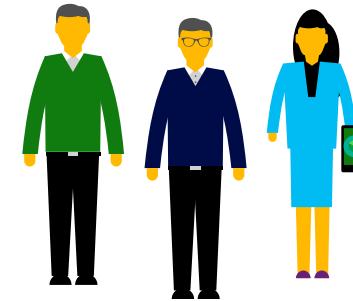
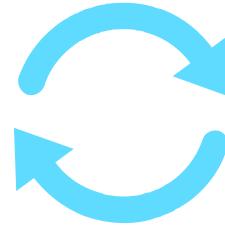
# ROLES AND RESPONSIBILITIES

Microsoft



Azure SQL Database

- Geo-distributed service
- Customer metadata protection and recovery
- Transparent high availability and data protection from local platform failures
- Automatic geo-distributed backups
- Automatic data synchronization of geo-replicated databases
- Platform compliance testing and certification
- Alert of impacted customers about their servers' degradation during regional failures



You

Customer (subscription owner)

- Detecting user errors and initiating point-in-time restore
- Planning, database prioritization, and region selection for disaster recovery
- Initiating geo-restore to selected region
- Initiating failover of geo-replicated databases
- Application disaster recovery drills

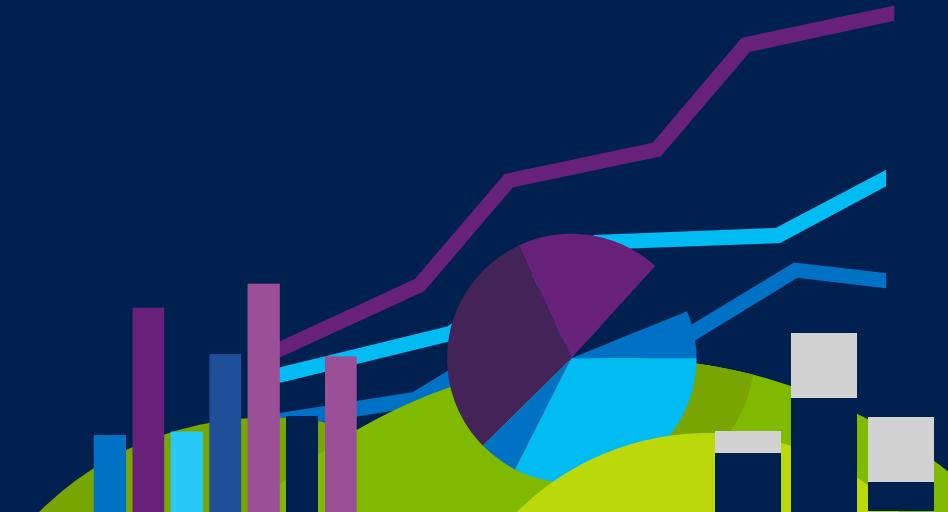
# Business Continuity Options

Capability	Basic	Standard	Premium	General Purpose	Business Critical
Point in Time Restore from backup	Any restore point within seven days	Any restore point within 35 days	Any restore point within 35 days	Any restore point within configured period (up to 35 days)	Any restore point within configured period (up to 35 days)
Geo-restore from geo-replicated backups	ERT < 12 h	ERT < 12 h	ERT < 12 h	ERT < 12 h	ERT < 12 h
	RPO < 1 h	RPO < 1 h	RPO < 1 h	RPO < 1 h	RPO < 1 h
Auto-failover groups	RTO = 1 h	RTO = 1 h	RTO = 1 h	RTO = 1 h	RTO = 1 h
	RPO < 5 s	RPO < 5 s	RPO < 5 s	RPO < 5 s	RPO < 5 s
Manual database failover	ERT = 30 s	ERT = 30 s	ERT = 30 s	ERT = 30 s	ERT = 30 s
	RPO < 5 s	RPO < 5 s	RPO < 5 s	RPO < 5 s	RPO < 5 s

**References:**  
[Business Continuity](#)

# Demo

Intelligent capabilities

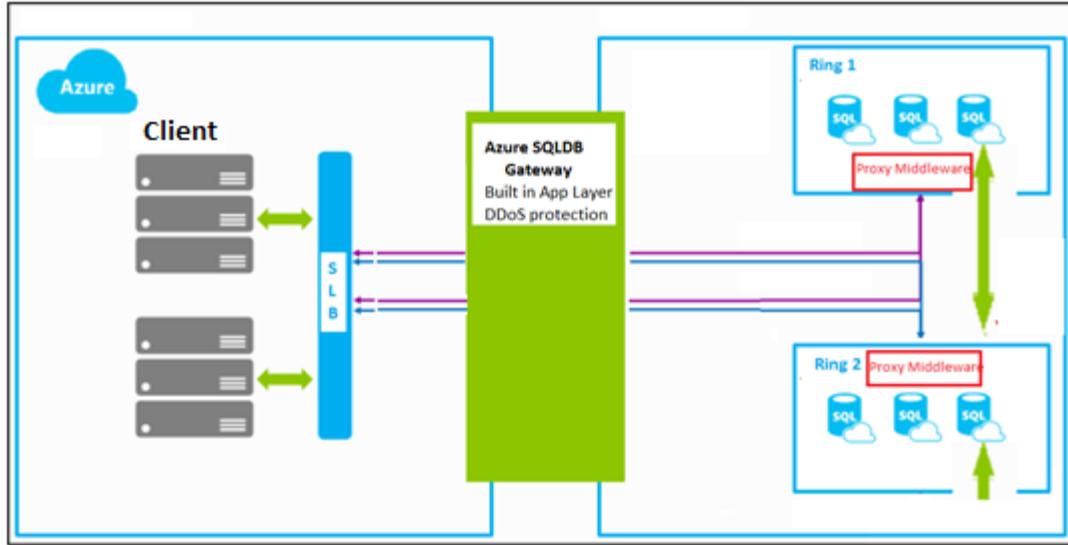


# Security

Securing your data in Azure



# Connectivity Architecture

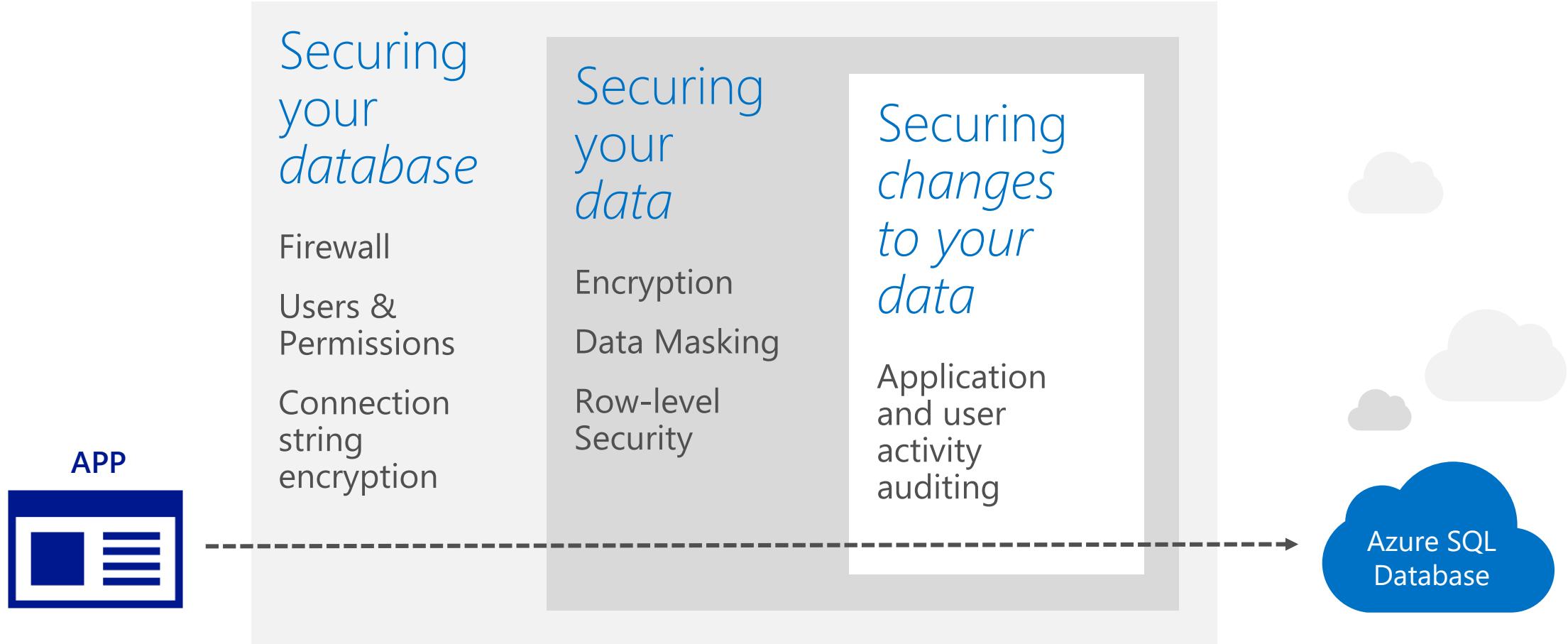


- Connectivity scenarios
  - Outside of Azure
    - » Connection policy of Proxy
    - » All traffic flows thru gateway (Single outbound IP)
    - » Can set to Redirect via [REST API](#) (Multiple outbound IPs)
  - Within Azure
    - » Connection Policy of Redirect
    - » After TCP session establish bypass gateway
- SLB has a Public IP and listens on Port 1433
- Each component has DDoS protection built-in to network and app layer

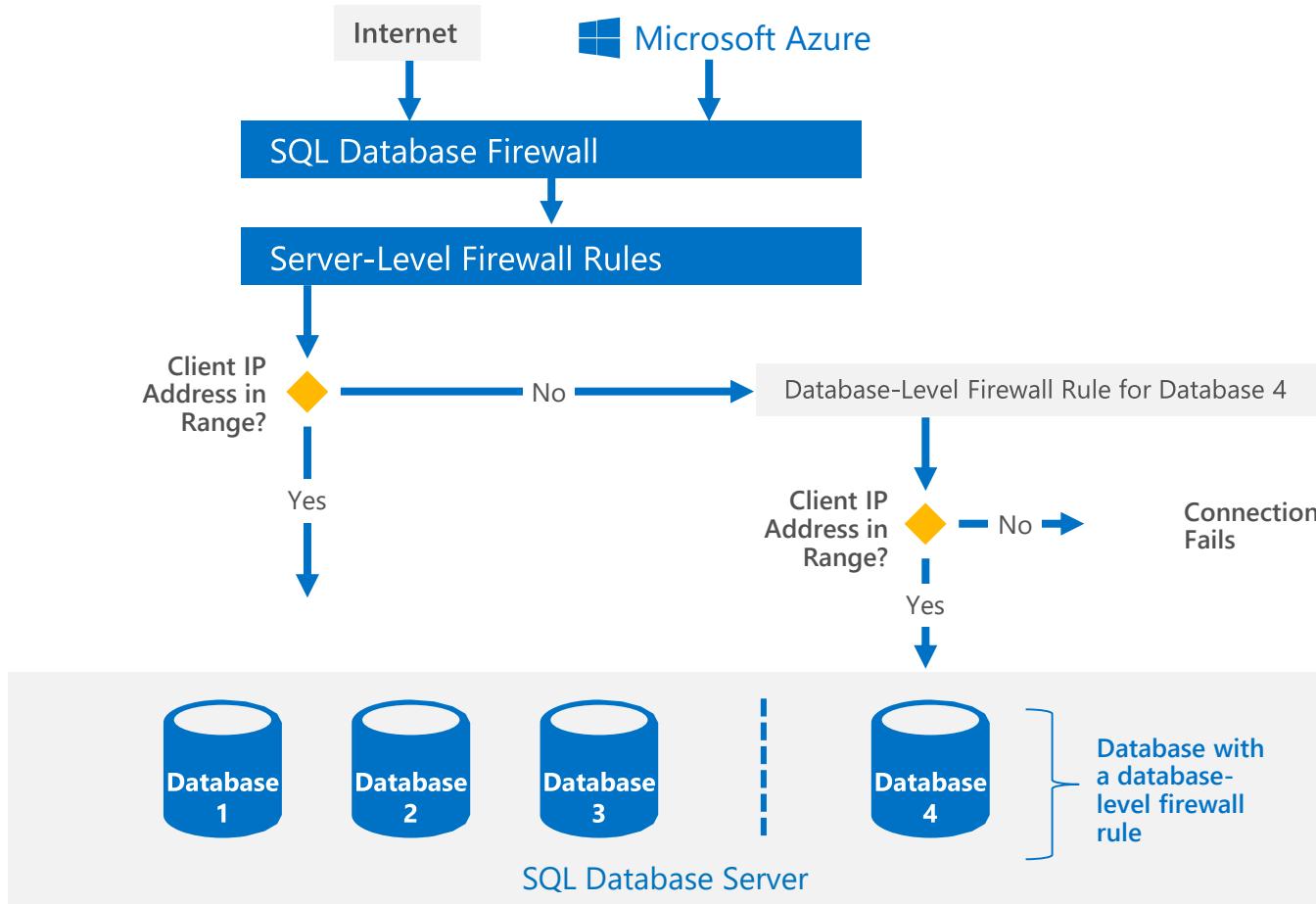
## References:

[Connectivity Architecture](#)

# Layered Approach to Security



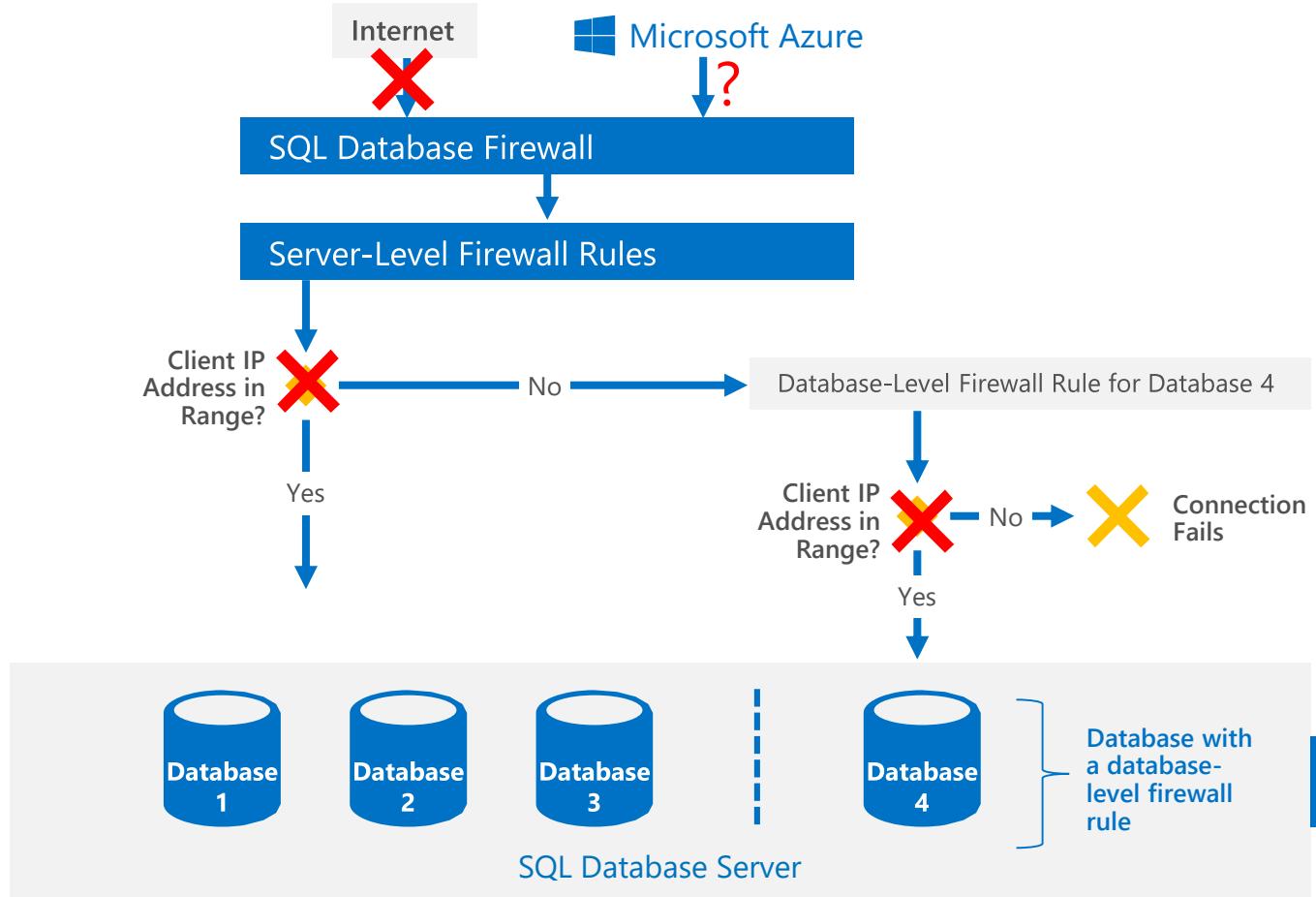
# Securing your database with firewalls



Initially, all access to your Azure SQL Database server is blocked by the firewall.

In order to begin using your Azure SQL Database server, you must go to the Management Portal

# Securing your database via VNET



Allow access only to resources on within a VNET via Service Endpoint

Impact if combined with "Allow all Azure Services":

- Import/Export
- SQL DB Query Editor from browser
- Table Auditing (Use Blob)
- Data Sync



Windows Azure Platform

References:

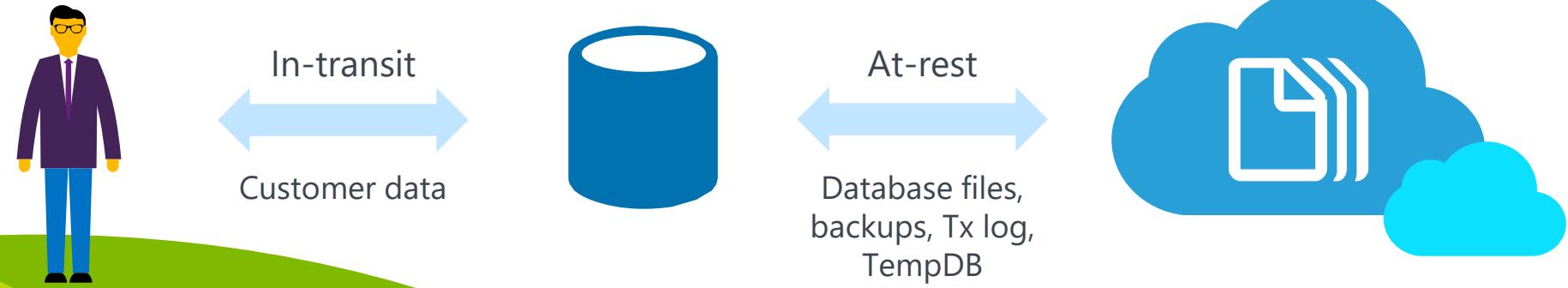
[VNET Service Endpoints](#)

# Azure SQL Database encryption: overview

Encryption type	Type	Customer value
Encryption-in-transit	Transport Layer Security (TLS) from the client to the server	<b>Protects data between client and server against snooping and man-in-the-middle attacks.</b> Azure SQL Database is phasing out Secure Sockets Layer (SSL) 3.0 and TLS 1.0 in favor of TLS 1.2.
Encryption-at-rest	Transparent Data Encryption (TDE) for Azure SQL Database	Protects data on the disk. Key management is done by Azure, which <b>makes it easier to obtain compliance.</b>
Encryption-end-to-end*	Always Encrypted for client-side column encryption	Data is protected end-to-end, but the application is aware of encrypted columns. <b>This is used in the absence of data masking and TDE for compliance-related scenarios.</b>

\*Not available in SQLDW

End-to-end



# Always Encrypted

Protect sensitive data in use from high-privileged yet unauthorized SQL users both on-premises and in the cloud

## Client-side encryption

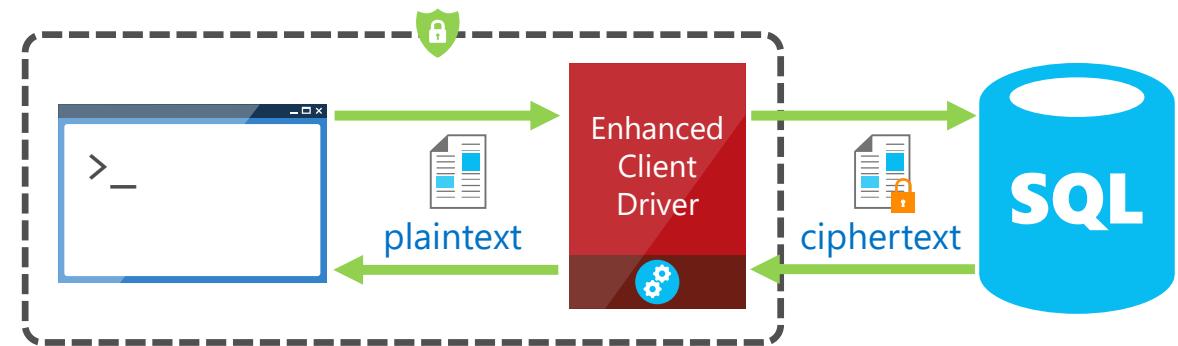
Sensitive data and related encryption keys are never revealed to the database engine

## Encryption transparency

Client driver transparently encrypts query parameters and decrypts encrypted results

## Queries on encrypted data

Support for equality comparison on columns encrypted using deterministic encryption



# Row-level security

Protect data privacy by ensuring the right access across rows

Fine-grained access control over specific rows in database table

Help prevent unauthorized access when multiple users share the same tables, or to implement connection filtering in multitenant applications

Administer via SQL Server Management Studio or SQL Server Data Tools

Enforcement logic inside database and schema bound to table



# Dynamic data masking

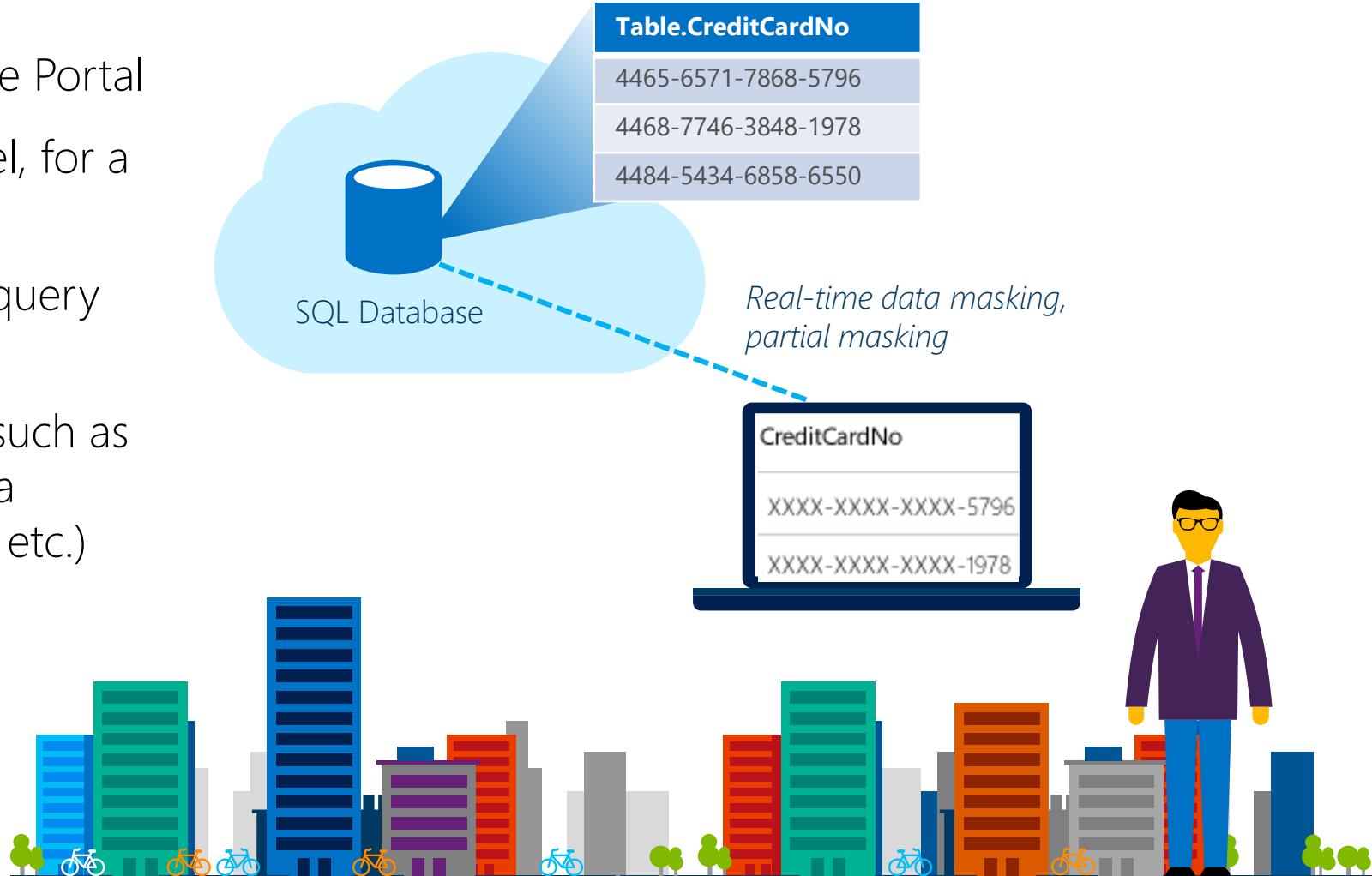
Prevent abuse of sensitive data by hiding it from users

Configuration made easy in new Azure Portal

Policy-driven at table and column level, for a defined set of users

Data masking applied in real-time to query results based on policy

Multiple masking functions available, such as full or partial, for various sensitive data categories (credit card numbers, SSN, etc.)



# Vulnerability Assessment

A one-stop-shop to track and improve your SQL security state

## Get visibility

Discover sensitive data and potential security holes

## Remediate

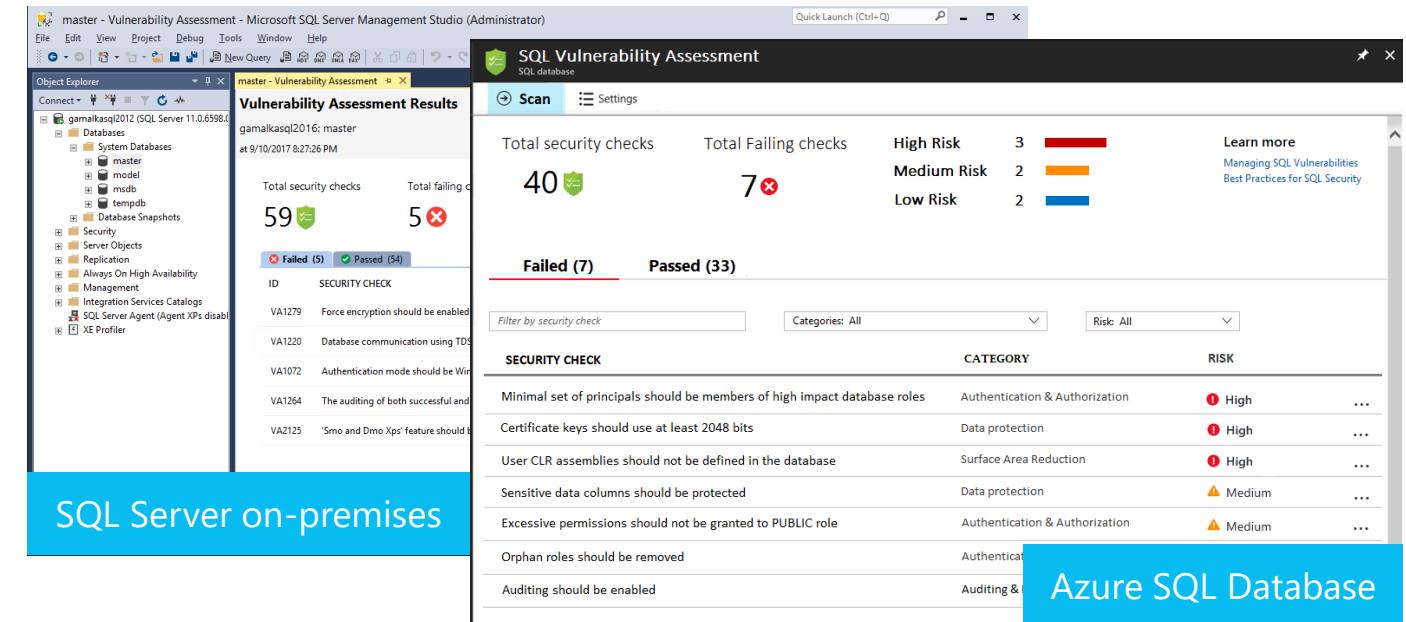
Actionable remediation and security hardening steps

## Customize

Baseline policy tuned to your environment, allowing you to focus on deviations

## Report

Pass internal or external audits to facilitate compliance



Identifies, tracks, and resolves SQL security vulnerabilities



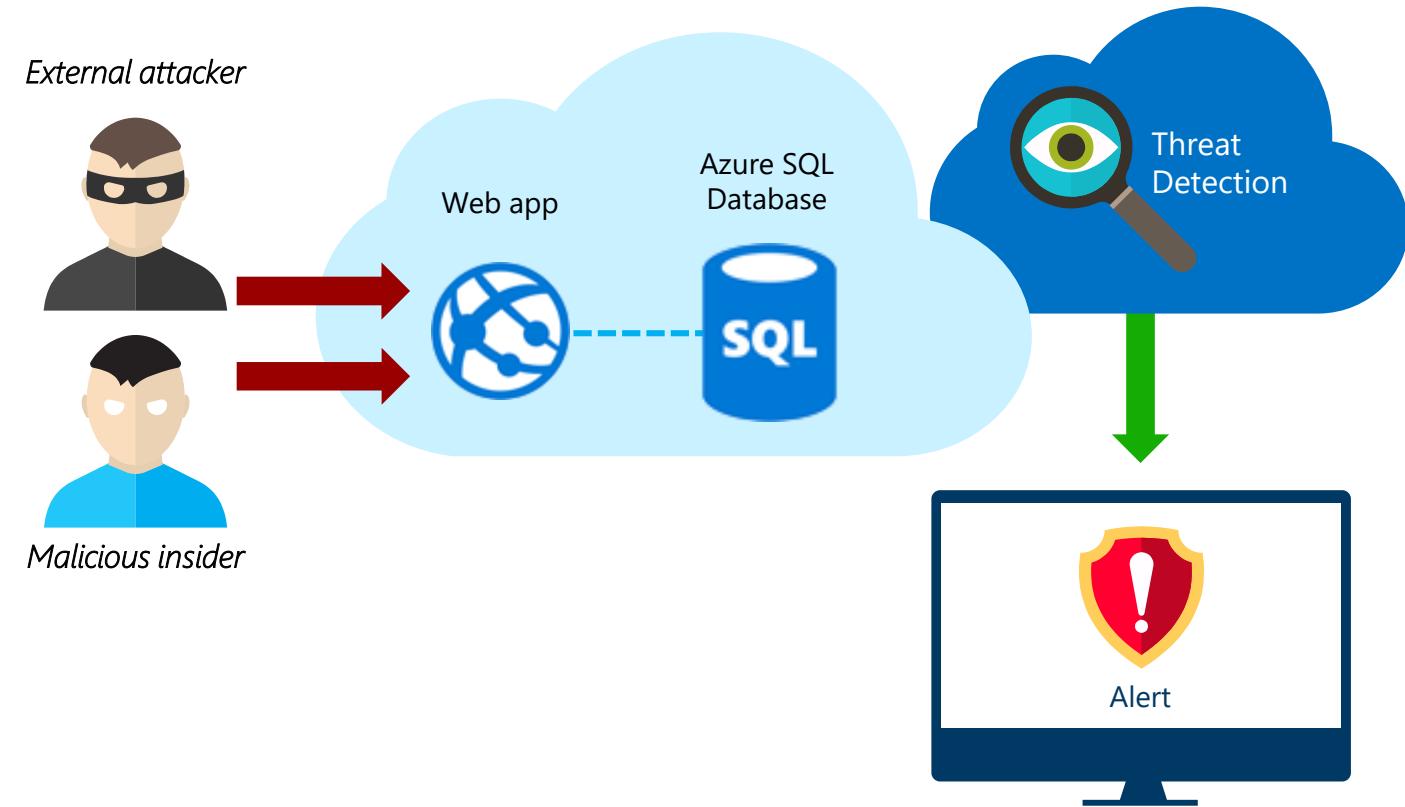
# Threat detection

Detects anomalous database activities that could indicate potential threat

Configure threat detection policy in Azure Portal

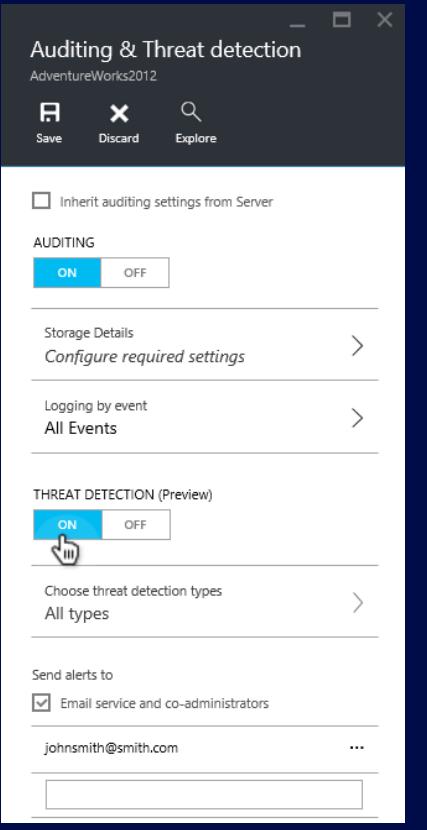
Receive alerts from multiple database-threat detectors that identify anomalous activities

Explore audit log around the time of an event

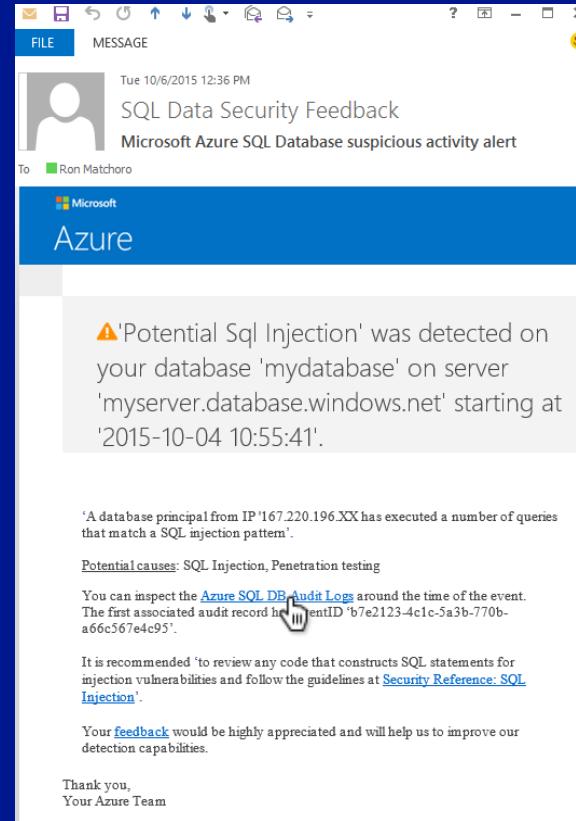


# How it works

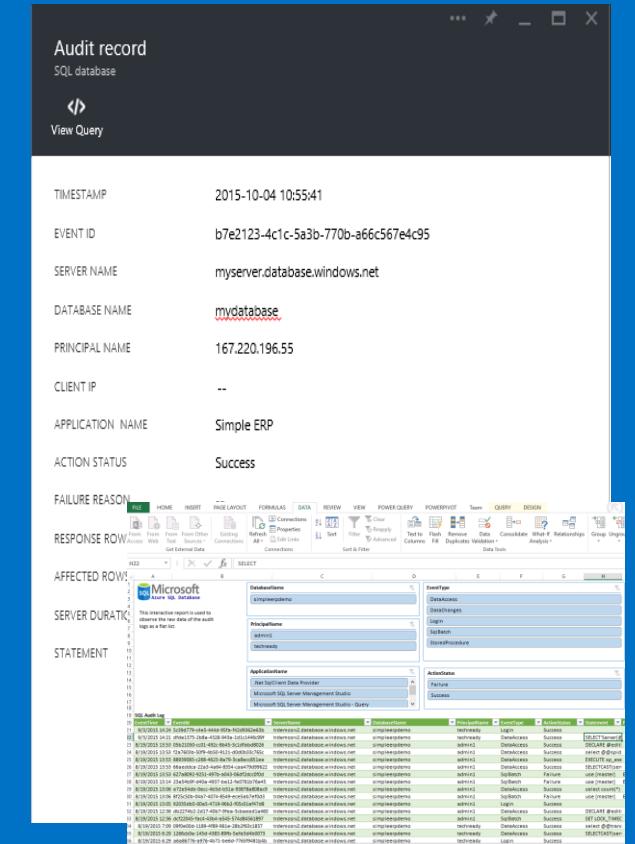
# Set up



## Alert



# Explore



# Auditing

Configurable to track and log database activity

Dashboard views in portal for at-a-glance insights

Pre-defined Power View reports for deep visual analysis on audit log data

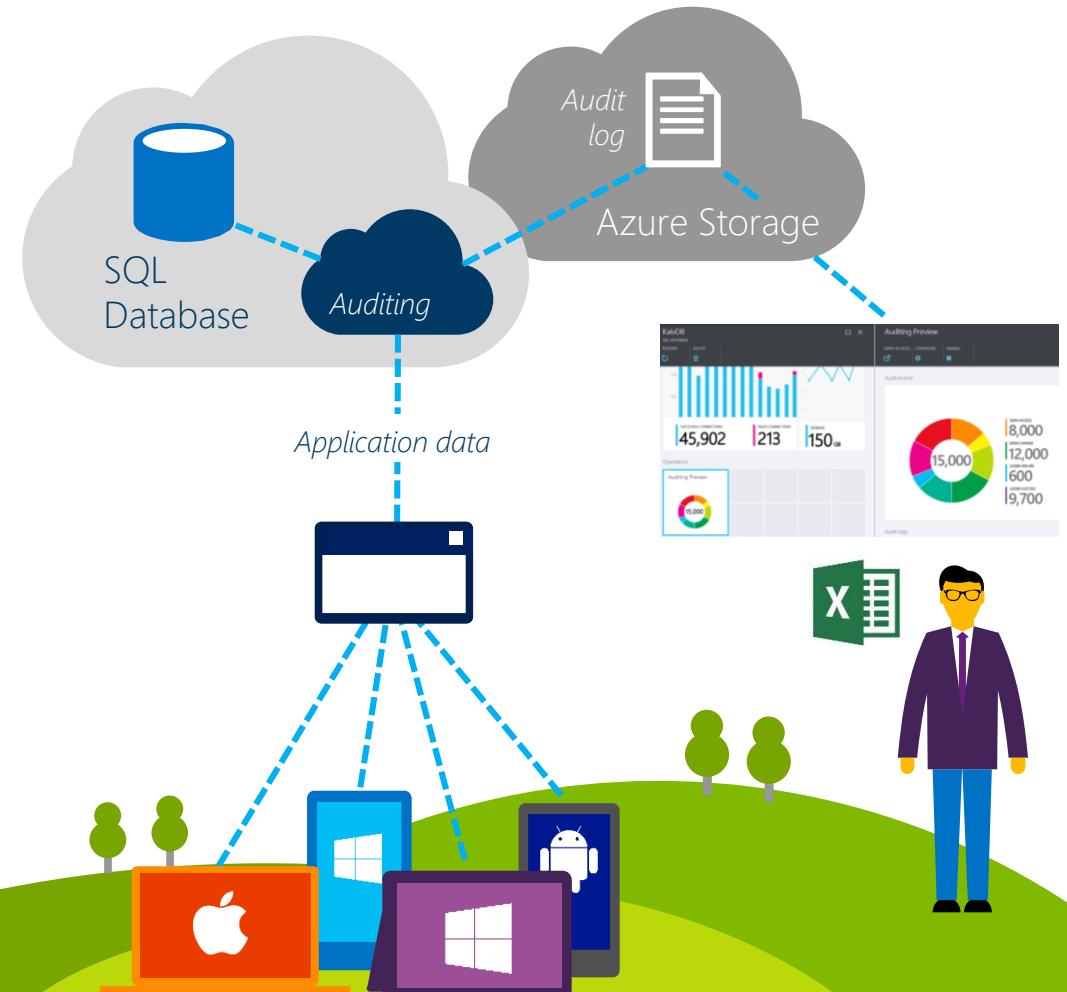
Audit logs reside in your Azure Storage account

Available in Basic, Standard, and Premium

Access via Azure portal



Implement Auditing



# Auditing

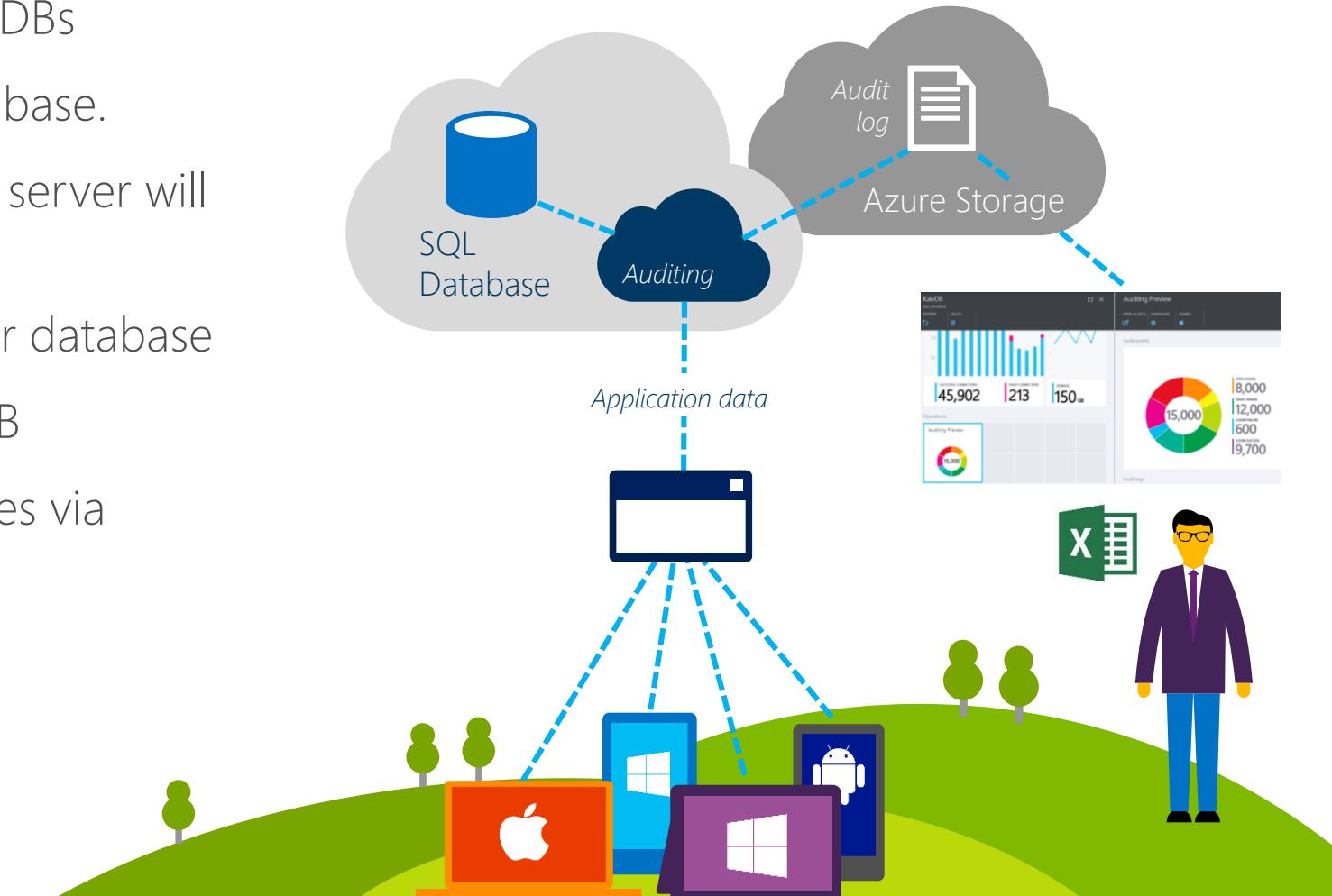
Server policy applies to all existing and new DBs

Server blob auditing also applies to the database.

Enabling blob auditing on the database and server will cause 2x DB audit avoid unless

- Different storage account or retention per database
- Different event types or categories per DB

You can customize event types and categories via PowerShell or RestAPI



Implement Auditing

References: [Auditing](#)

# Customizing Audit Policy

```
Set-AzureRmSqlDatabaseAuditing -State Enabled  
-ResourceGroupName "EastUS2_AzureSQLDB" -ServerName "pankajtsp"  
-StorageAccountName "pankajcsa" -DatabaseName "AdventureWorks2014"  
-AuditAction 'SELECT on Person.Person by public' -RetentionInDays 7
```

## Other Options

```
-AuditActionGroup "BATCH_COMPLETED_GROUP"
```

NOTE: Overwrites and takes precedence over –AuditAction

Ensure running latest Azure PowerShell cmdlets

**Open Issue:** Cannot clear –AuditActionGroup as of 04/09/2018. Will be fixed in next release of PowerShell cmdlets for Azure SQLDB

# Analyzing Auditlogs

You can analyze SQL Audit logs from

- Directly in the Azure Portal
- SSMS v17.x
- TSQL via [sys.fn\\_get\\_audit\\_file](#)
- Azure Storage Explorer
- [PowerBI Template](#)
- Integration with Log Analytics



Implement Auditing

References: [Auditing](#)

# Role Based Access Control (RBAC)

Built-In Role	Purpose	Example
SQL Server Contributor	Manage Logical SQL Servers and Databases. No Access to DB (SQL logins/users) and no access to manage security policies	DBA that needs access Create/Delete servers and databases within subscription or resource group
SQL DB Contributor	Same as above, without access to the logical server	DBA that needs to create databases within an already created Logical Server. Can be scoped to Subscription or resource group
SQL Security manager	Manage policies such as Auditing, Dynamic Data Masking, Masking, Connection, Vulnerability Assessments etc. Does not give access to DB	DBA or information security tasked with setting up Security policies and audit rules.

# Role Based Access Control (RBAC)

## Built-In Role

SQL Server Contributor

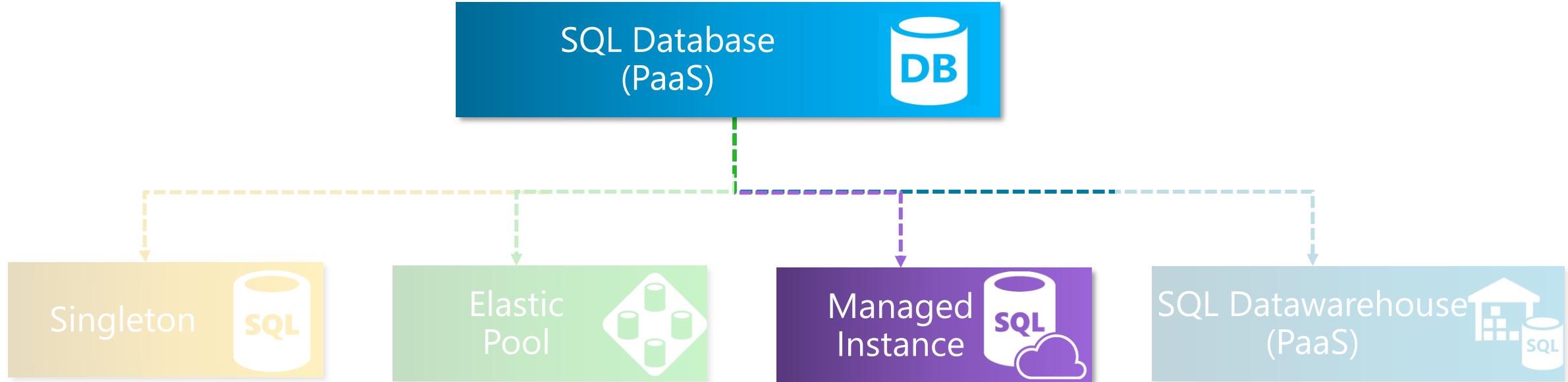
SQL DB Contributor

SQL Security manager

Role <small>i</small>
Monitoring Reader
Owner <small>i</small>
Contributor <small>i</small>
Reader <small>i</small>
Azure Service Deploy Release Management Contributor <small>i</small>
Log Analytics Contributor <small>i</small>
Log Analytics Reader <small>i</small>
masterreader <small>i</small>
Monitoring Contributor <small>i</small>
Monitoring Reader <small>i</small>
Office DevOps <small>i</small>
Resource Policy Contributor (Preview) <small>i</small>
SQL DB Contributor <small>i</small>
SQL Security Manager <small>i</small>
SQL Server Contributor <small>i</small>
User Access Administrator <small>i</small>



# What are the SQL Cloud Offerings available?



# DEDICATED RESOURCES THROUGH CUSTOMER ISOLATION

Easy Lift and Shift with near 100% compat as SQL Server

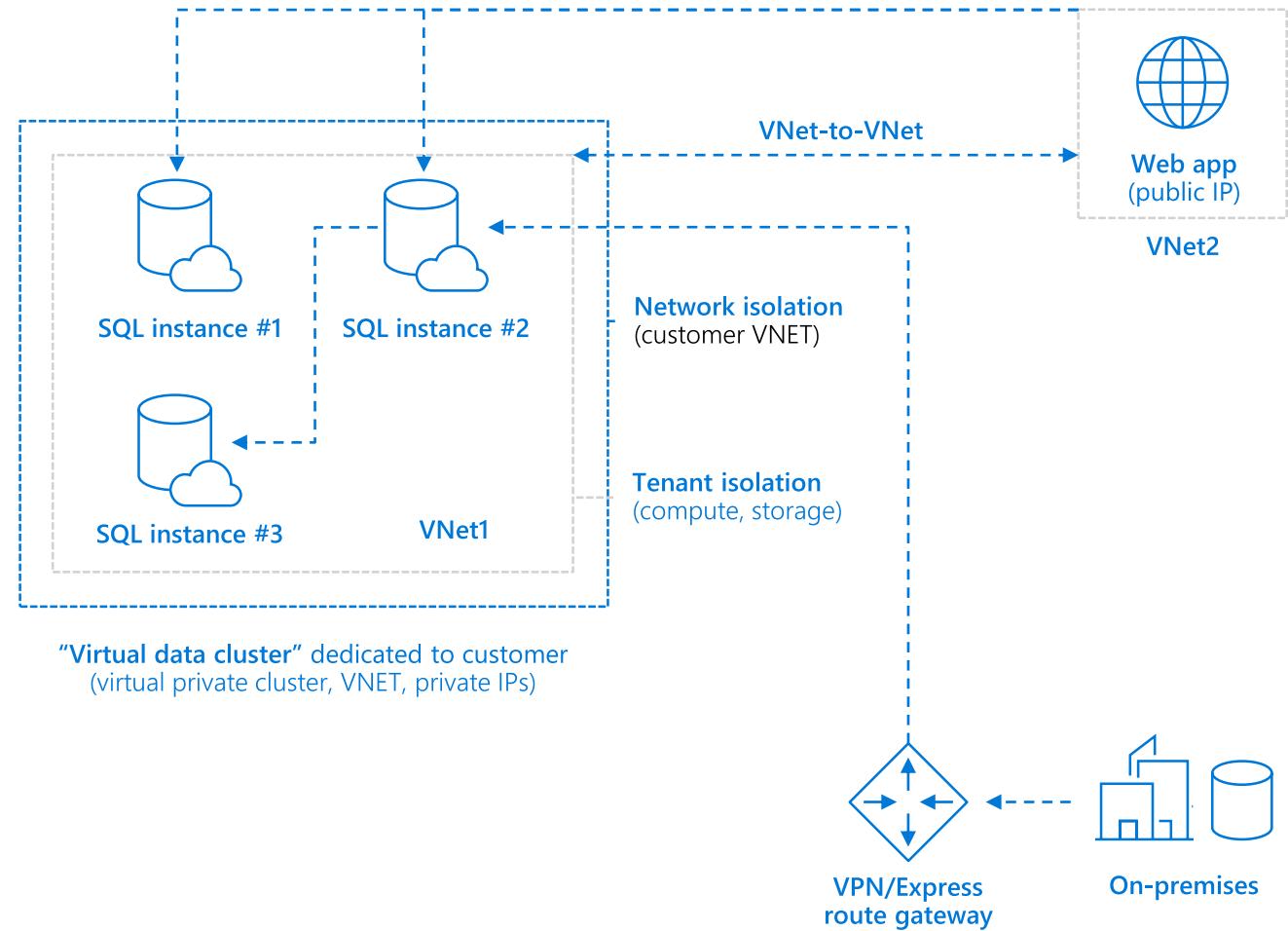
Fully managed PaaS

Enable full isolation from other tenants without resource sharing

Promote secure communication over private IP addresses with native VNET integration

Different business model with easier transparency

## VNET support in SQL Database Managed Instance



### References:

[Managed Instance](#) [SQL Database Features](#)

# CHOOSE THE BEST OPTION FOR YOUR WORKLOADS

Choose compute resources and storage independently

Balance SLA requirements and price with two service tiers

Customers pay for:

- Compute type + vCore
- Type and amount of storage
- Number of IO
- Back-ups

[• Learn more](#)



## Two Managed Instance options

	 GENERAL PURPOSE	 BUSINESS CRITICAL*
Best for	Data applications with basic IO and basic availability requirements	Business critical data applications with fast IO and high availability requirements
Compute tiers	4*, 8-24 vCores (Gen4) 4*, 8-80 vCores (Gen5)	8-32 vCores (Gen4) 8-80 vCores (Gen5)
Storage	Fast remote storage 32GB – 8TB per instance 500 – 7000 IOPs (5-10 ms)	Super-fast local SSD storage 32GB – 4TB per instance 5K – 200K IOPs (1-2 ms)
Availability	1 replica, no read-scale	3 replicas, 1 read-scale

\*Coming soon

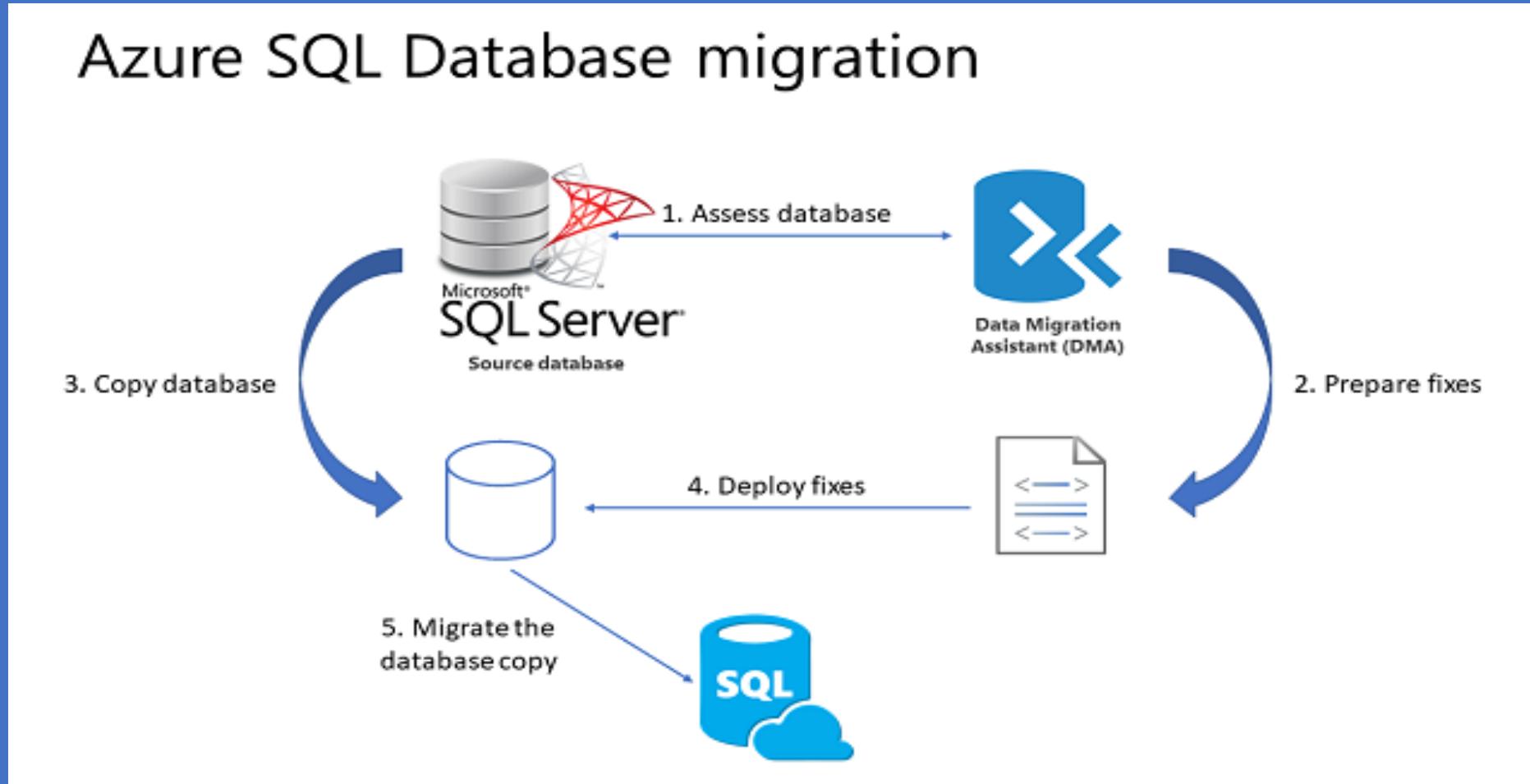
# Demo

SQL MI



# Migration to Azure SQL DB:

Method 1: Migration with Downtime during the migration: DMA or Bacpac

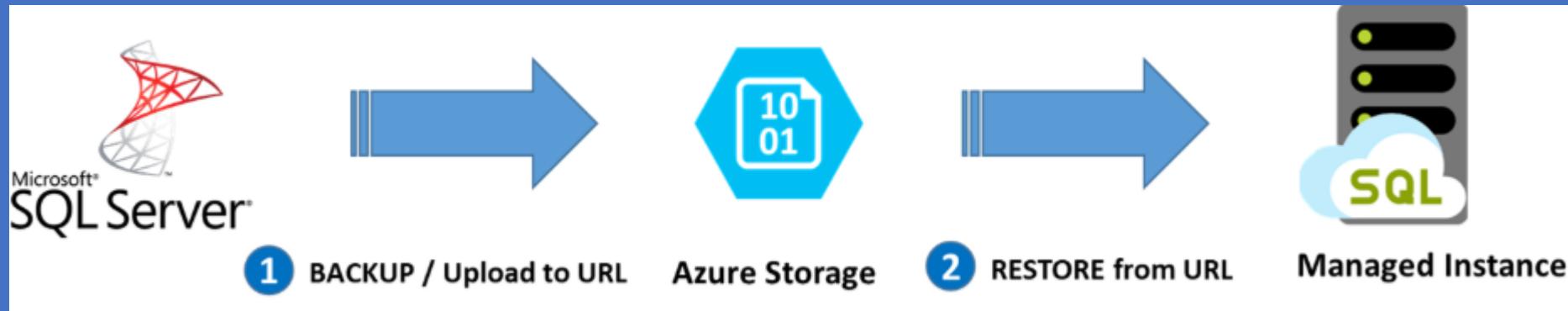


# Migration to Azure SQL MI:

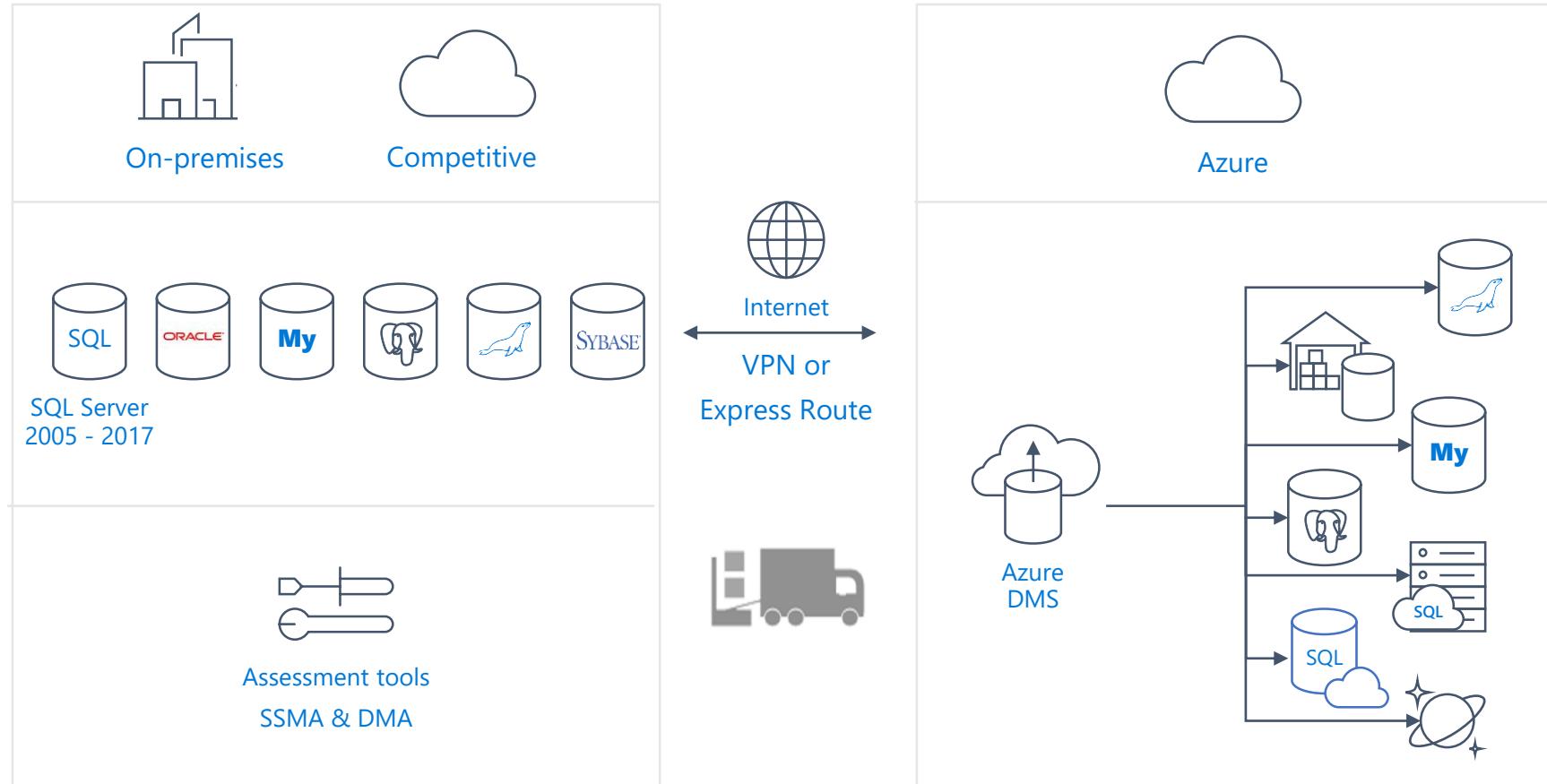
## Azure data Migration Service:

1. Near zero Downtime
2. DMS is the recommended method of migration for your enterprise workloads

## Native Restore from URL:



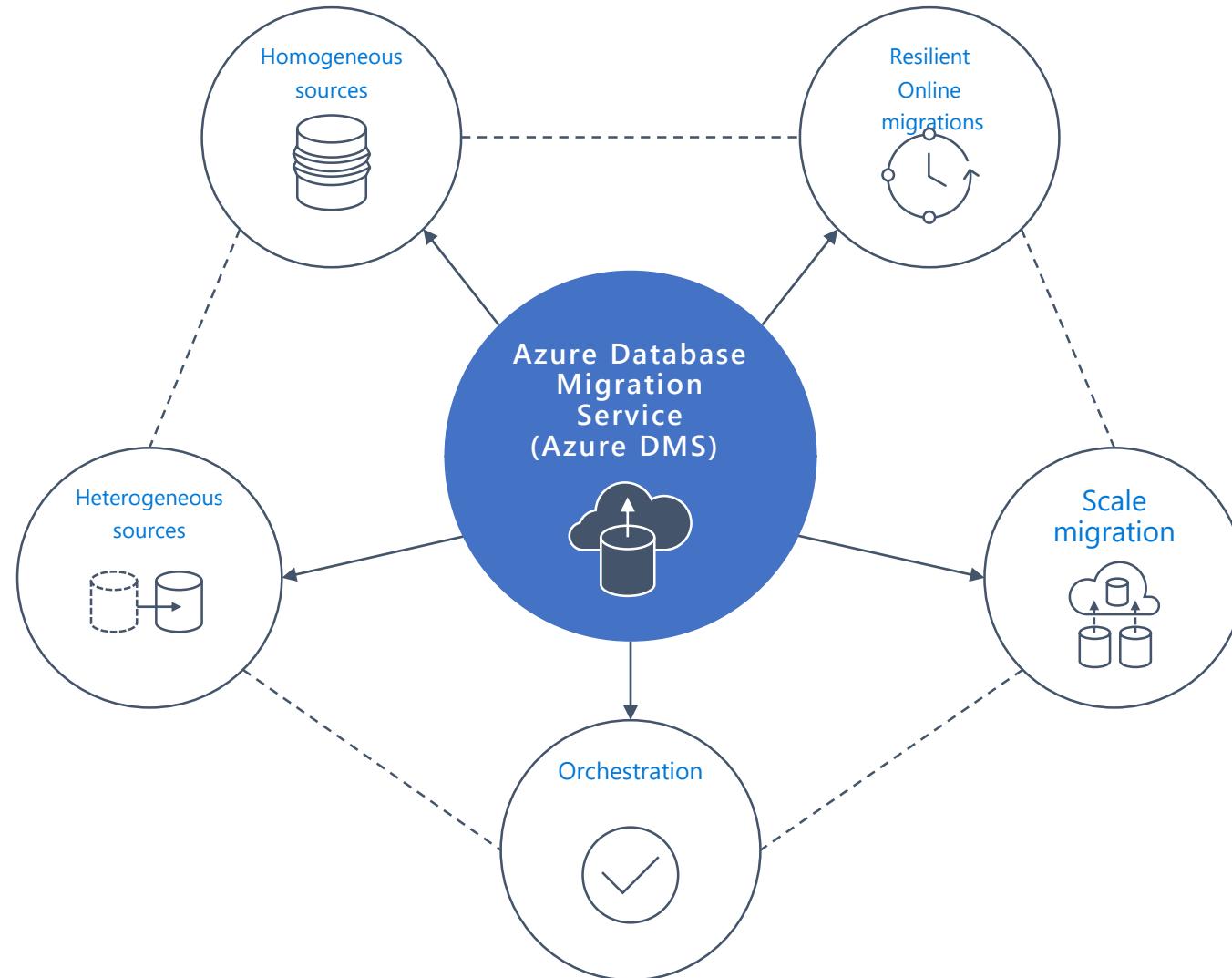
# Migration Tools and DMS Service



Database Migration Guide: <https://datamigration.microsoft.com/>

# Azure Database Migration Service

A seamless, end-to-end solution for moving on-premises SQL server, Oracle, and other relational databases to the cloud



# Tools for your migration journey

## **SQL Server Migration Assistant (SSMA)**

Automates database migration to SQL Server from Microsoft Access, DB2, MySQL, Oracle, and SAP ASE.

## **Data Migration Assistant (DMA)**

Enables upgrade to SQL Server and Azure SQL Database.

## **Azure Hybrid Benefit for SQL Server**

Maximizes current on-premises license investments to facilitate migration.

## **Azure SQL Database Managed Instance**

Facilitates lift and shift migration from on-premises SQL Server to PaaS.



Azure Hybrid  
Benefit for  
SQL Server

Step 1: Data Migration Assistant (DMA)

Step 2: Azure Database Migration Service  
(Azure DMS)

SQL Database  
Managed Instance



Migrating Services:

SSIS:

Lift and shift to SSIS –IR (PaaS).

Provision Azure-SSIS Integration Runtime(IR) in Azure Data Factory and redeploy package.

SSAS:

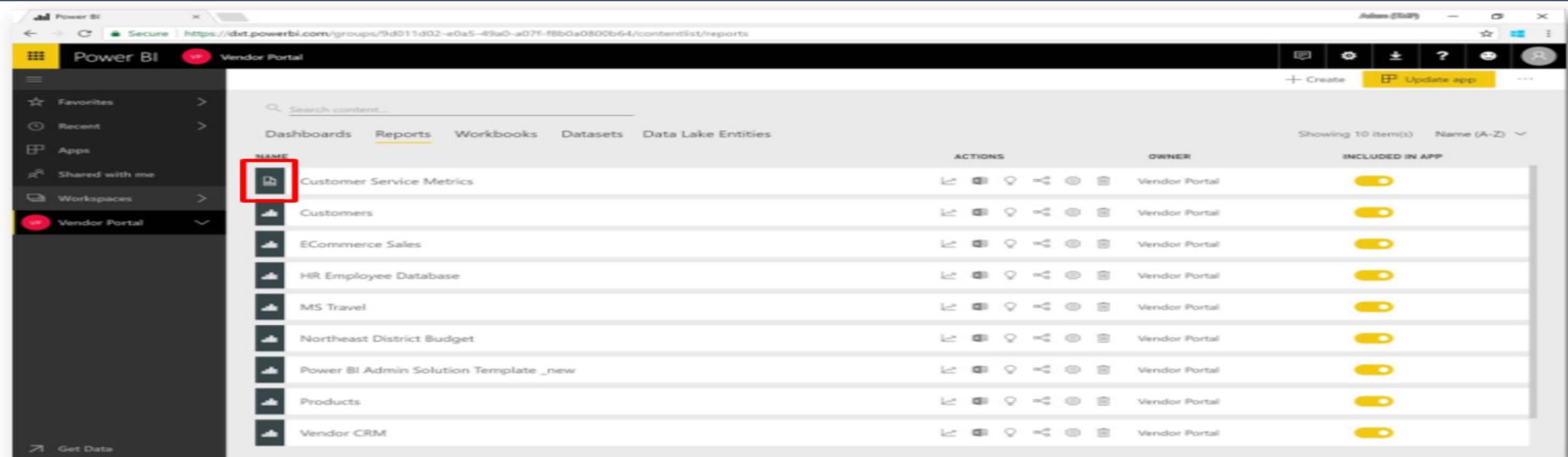
Lift and shift to Azure Analysis service(PaaS).

# Migrating Services:

SSRS:

Option 1: Redesign reports using Power BI.

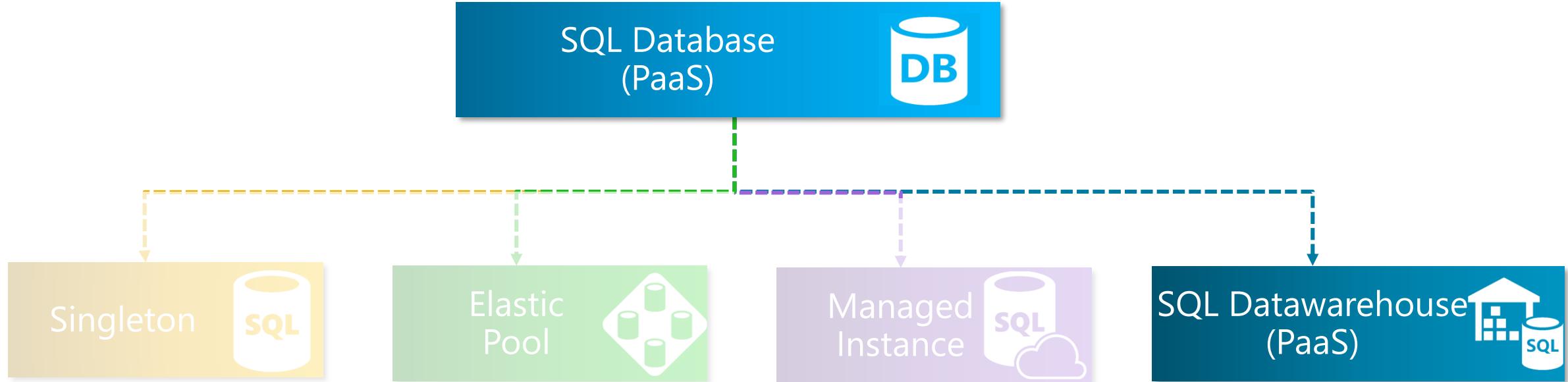
Option 2: Deploy SSRS RDL file to Power BI Premium workspace (Public Preview).



The screenshot shows the Power BI Premium workspace content page. The left sidebar includes 'Favorites', 'Recent', 'Apps', 'Shared with me', 'Workspaces' (with a dropdown for 'Vendor Portal'), and a 'Vendor Portal' section. The main area displays a list of items under 'Reports'. Each item has a preview thumbnail, a name, actions (Edit, Delete, etc.), owner (Vendor Portal), and an 'Included in app' toggle switch. The 'Customer Service Metrics' report is highlighted with a red box around its thumbnail.

NAME	ACTIONS	OWNER	INCLUDED IN APP
Customer Service Metrics	[Edit, Delete, etc.]	Vendor Portal	[Switch]
Customers	[Edit, Delete, etc.]	Vendor Portal	[Switch]
ECommerce Sales	[Edit, Delete, etc.]	Vendor Portal	[Switch]
HR Employee Database	[Edit, Delete, etc.]	Vendor Portal	[Switch]
MS Travel	[Edit, Delete, etc.]	Vendor Portal	[Switch]
Northeast District Budget	[Edit, Delete, etc.]	Vendor Portal	[Switch]
Power BI Admin Solution Template _new	[Edit, Delete, etc.]	Vendor Portal	[Switch]
Products	[Edit, Delete, etc.]	Vendor Portal	[Switch]
Vendor CRM	[Edit, Delete, etc.]	Vendor Portal	[Switch]

# What are the SQL Cloud Offerings available?

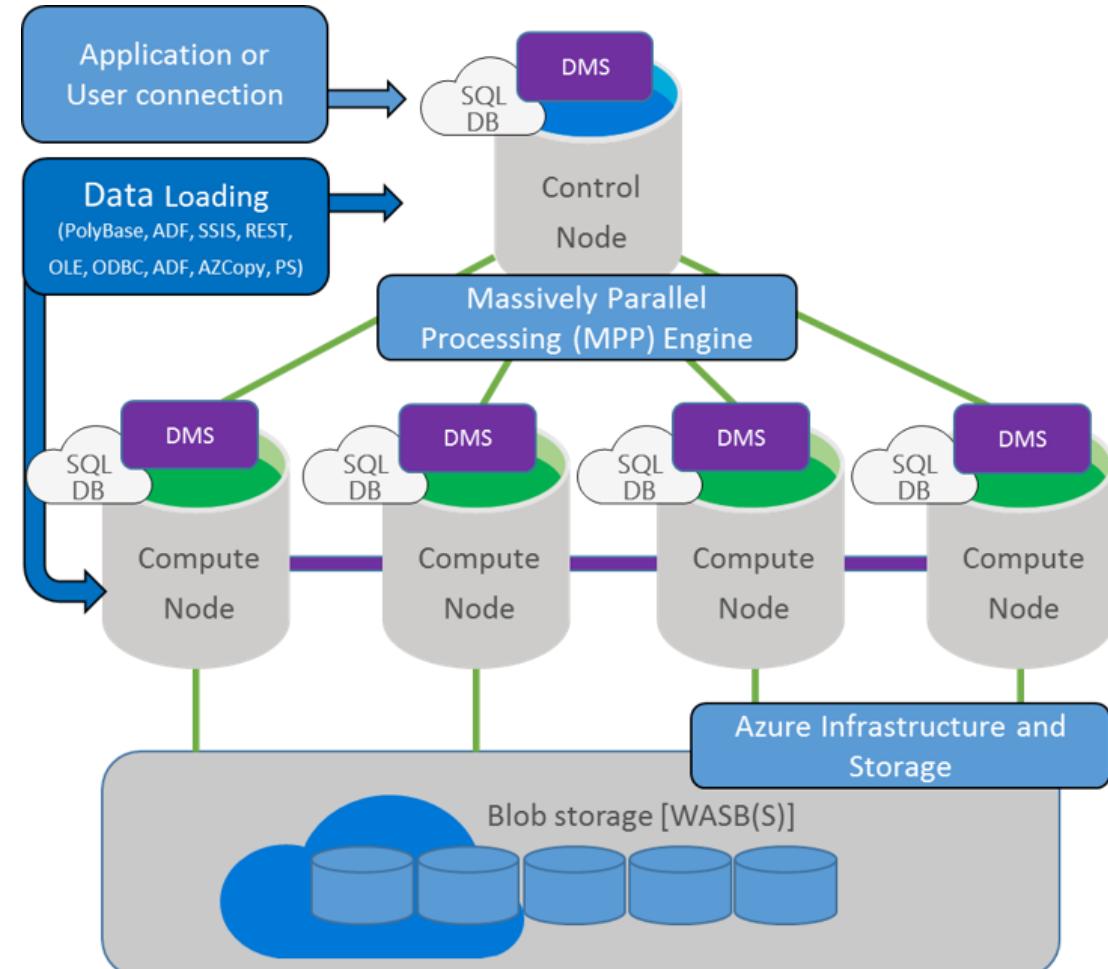


# SQL DW



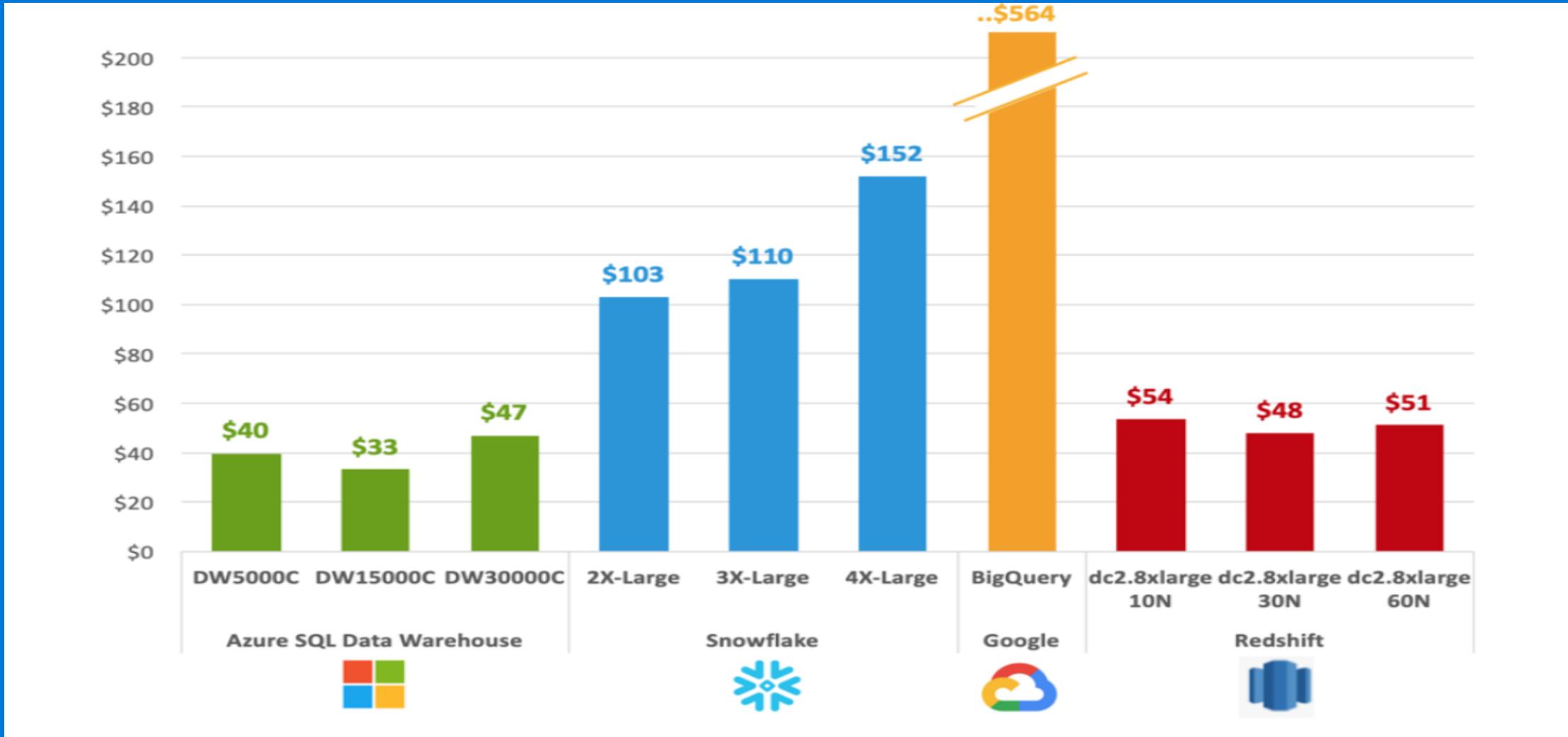
What is it?

- Cloud based MPP database built on SQL Server
- Independent compute and storage
- Pause and resume
- Scale in minutes
- Replicated tables
- Fault tolerate, triple replication, automatic redundant backups
- PolyBase Support
- Distribute data base hash or round robin
- Columnstore indexing
- Integrated analytics
- Provides security and data protection (TDE)
- Third party support and fully Microsoft tooling

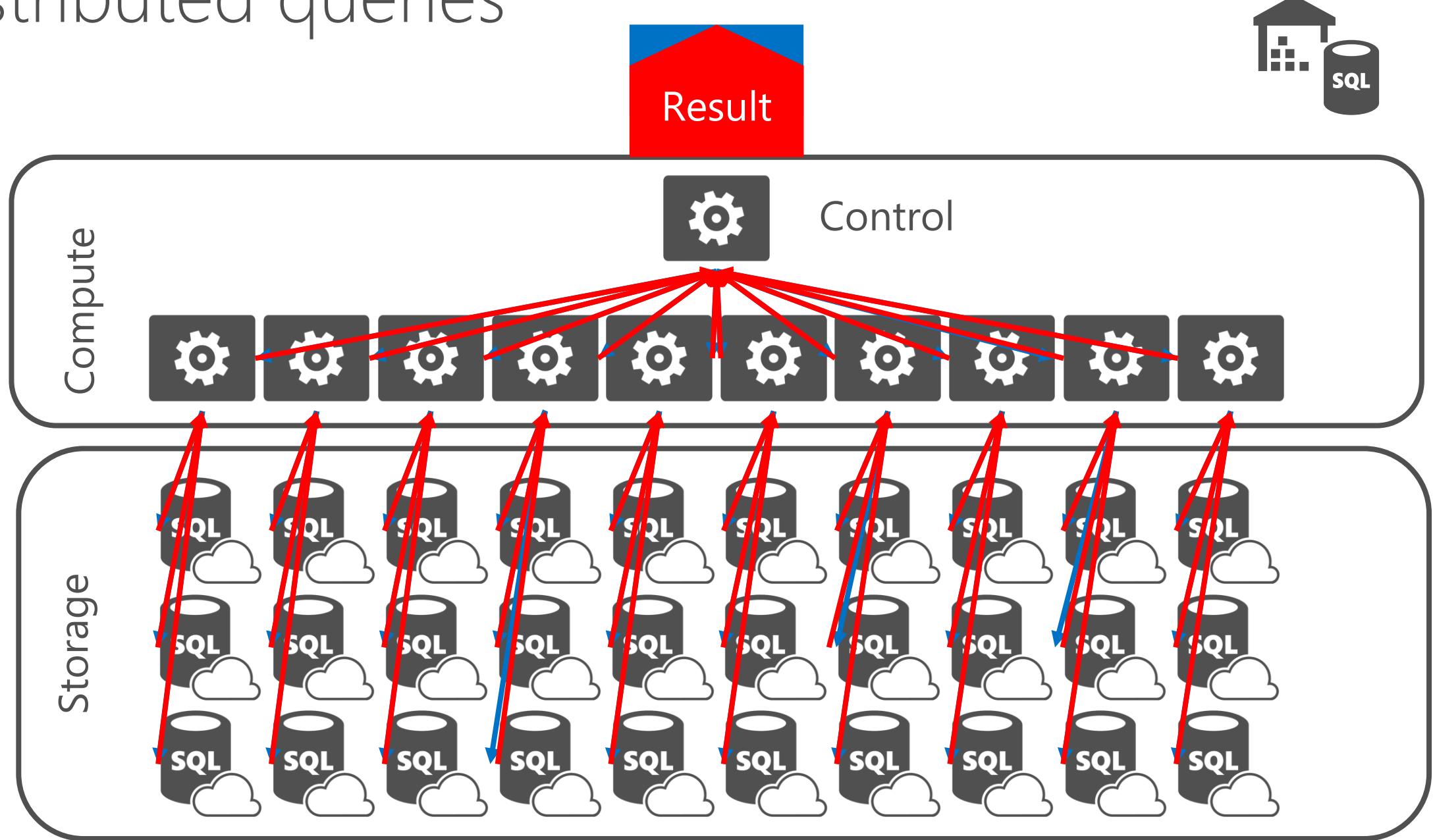


# Industry-leading price performance

Price-Performance @ 30TB (\$ per Query per Hour)



# Distributed queries



# Simple example

```
SELECT COUNT_BIG(*)  
FROM dbo.[FactInternetSales]  
;
```



```
SELECT SUM(*)  
FROM dbo.[FactInternetSales]  
;
```



Control

Compute

```
SELECT COUNT_BIG(*)  
FROM dbo.[FactInternetSales]  
;
```



```
SELECT COUNT_BIG(*)  
FROM dbo.[FactInternetSales]  
;
```



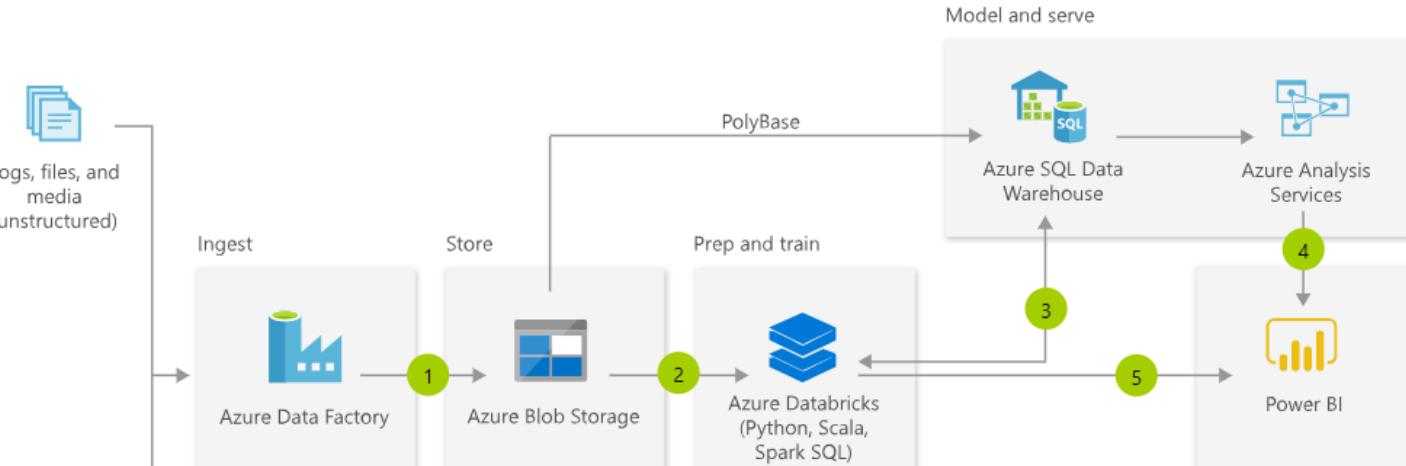
```
SELECT COUNT_BIG(*)  
FROM dbo.[FactInternetSales]  
;
```



```
SELECT COUNT_BIG(*)  
FROM dbo.[FactInternetSales]  
;
```



# Elastic data warehouse as a service with enterprise-class features



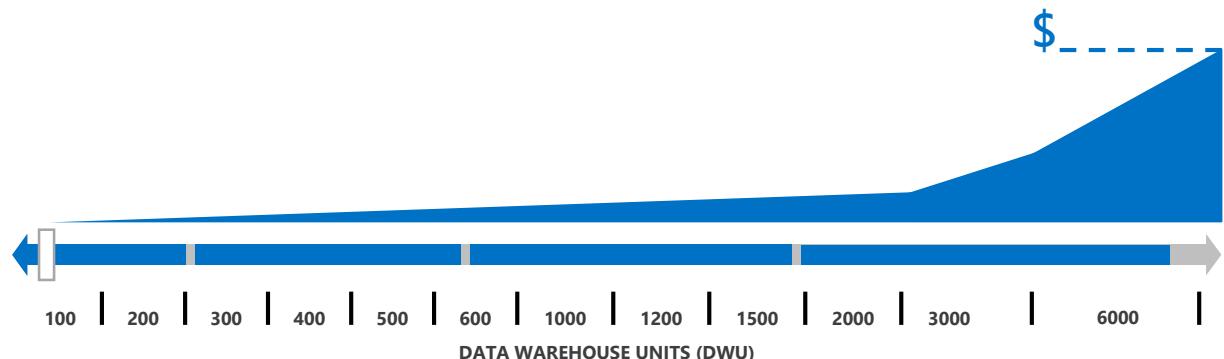
- Petabyte scale with massively parallel processing
- Independent scaling of compute and storage—in seconds
- Transact-SQL queries across relational and non-relational data
- Full enterprise-class SQL Server experience
- Works seamlessly with Power BI, Machine Learning, HDInsight, and Data Factory

# AZURE SQL DATA WAREHOUSE - PERFORMANCE TIERS

## Optimized for elasticity

**Elastic-scale** performance tier provides high performance for regular workloads and analytics

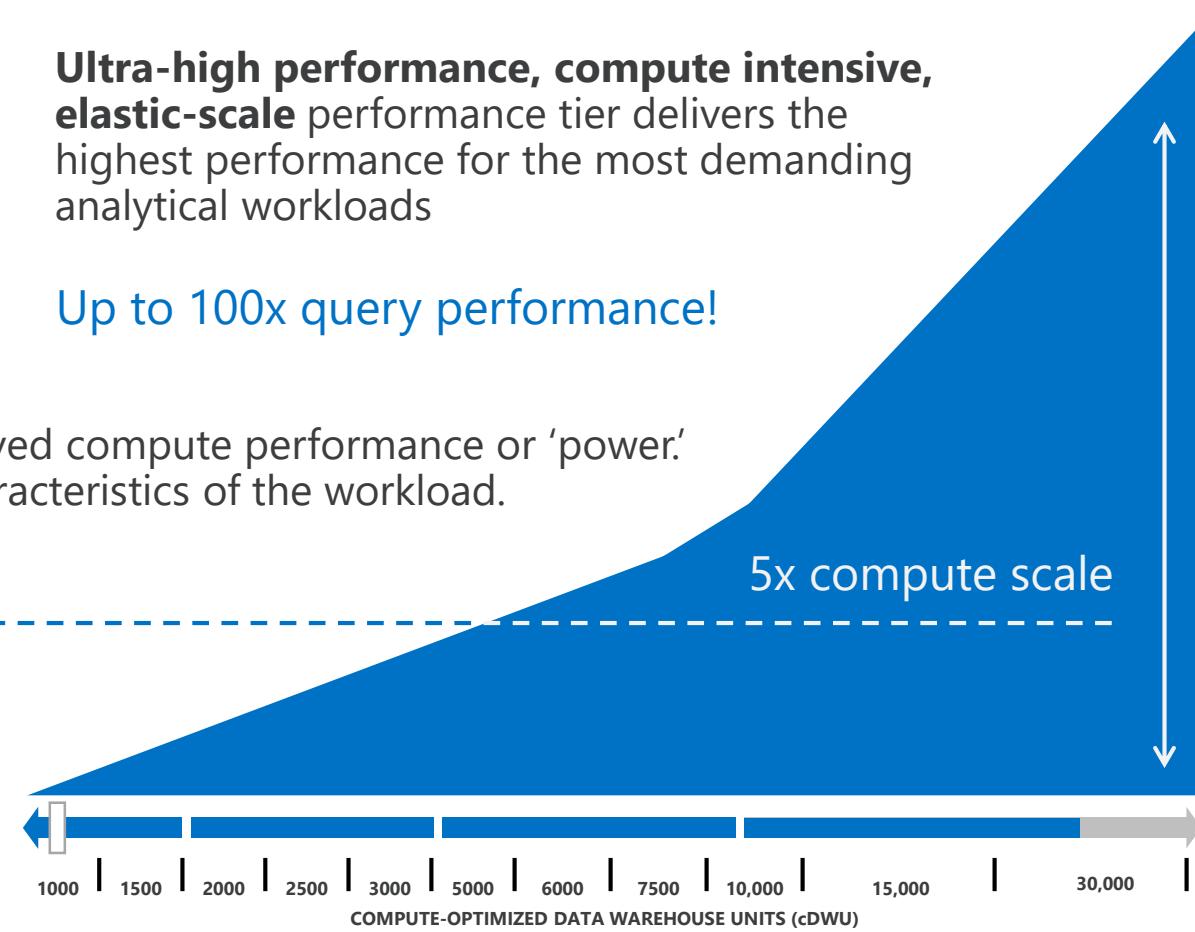
**Data Warehouse Units (DWUs & cDWUs)** are a measure of reserved compute performance or 'power.' A customer's DWU or cDWU needs can vary depending on the characteristics of the workload.



## NEW! Optimized for compute

**Ultra-high performance, compute intensive, elastic-scale** performance tier delivers the highest performance for the most demanding analytical workloads

Up to 100x query performance!

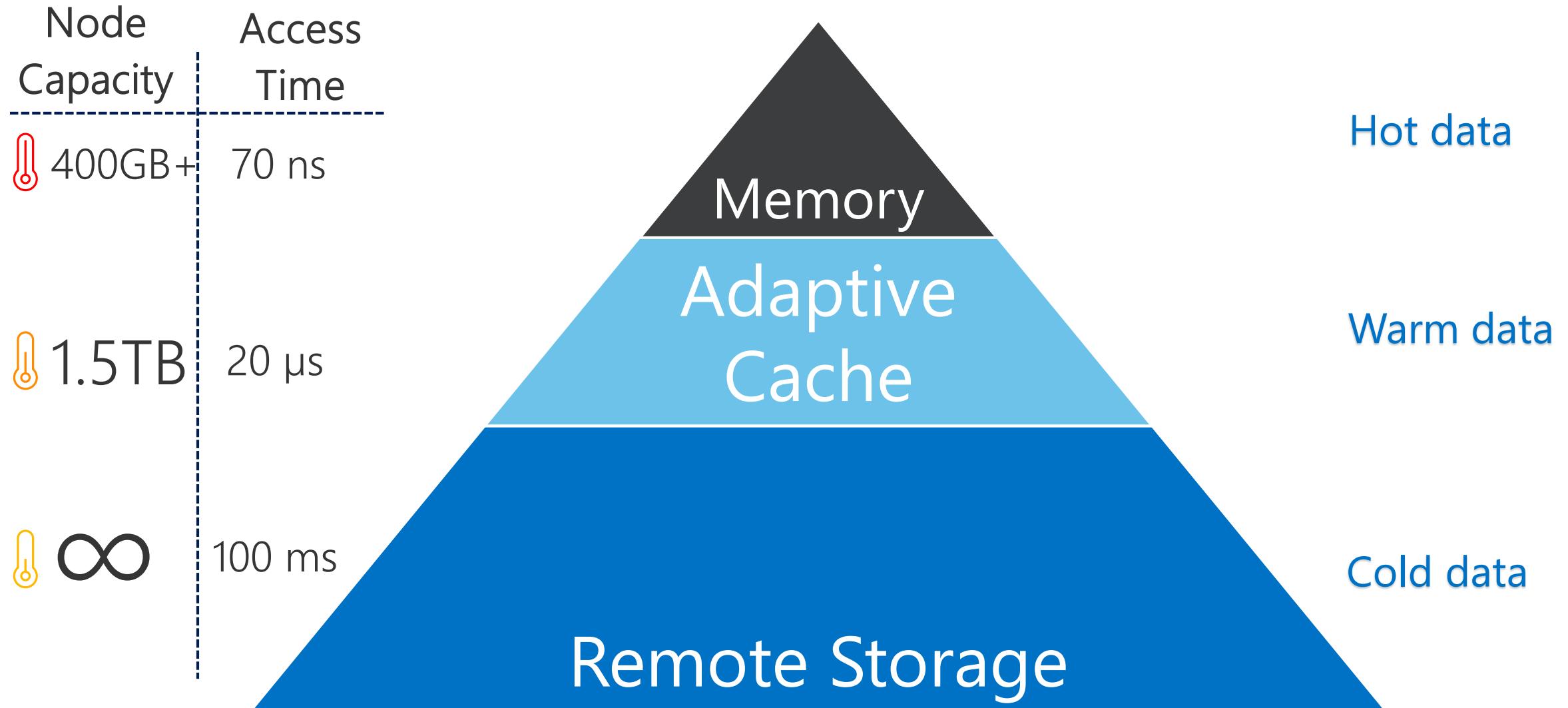


# Sizing the Gen2 Cache

- Working set ~20%
- 1.5TB Gen2 cache per DWU  
500
- EXEC **Sp\_spaceused**
- Same tempdb on both Gen1 and Gen2

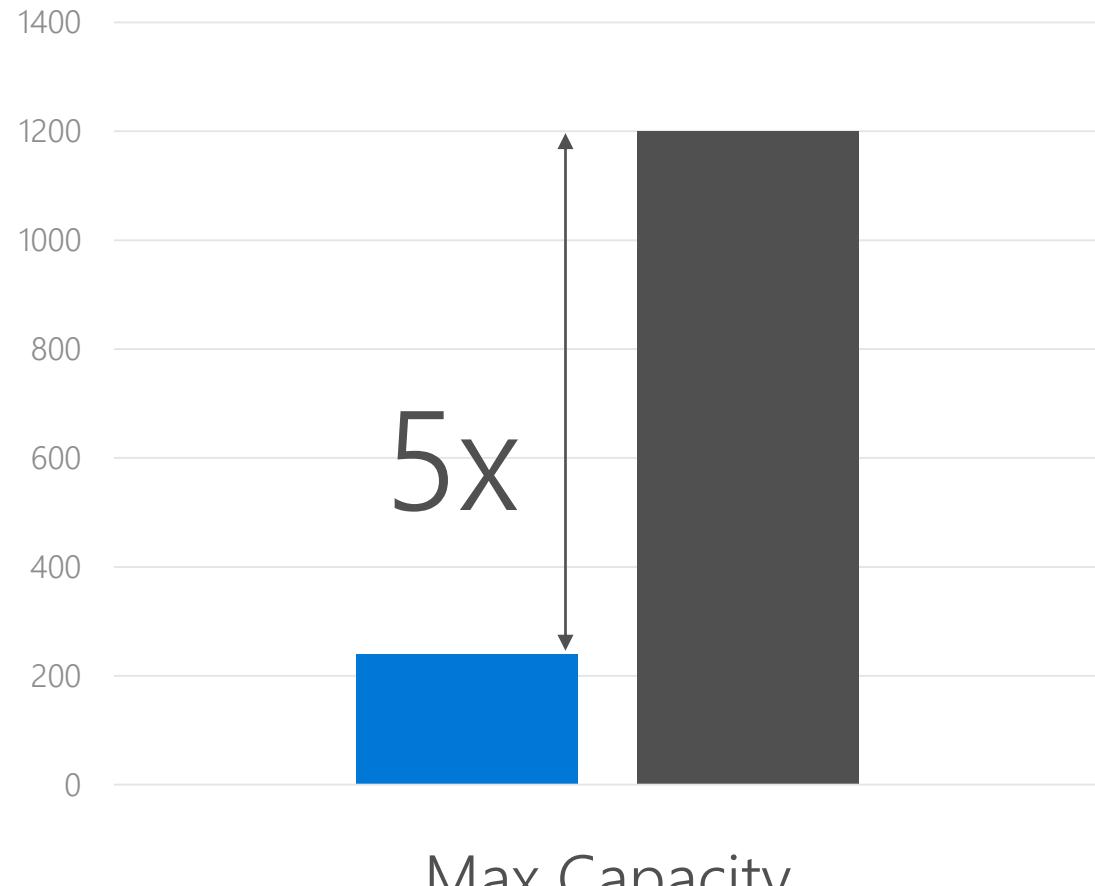
DWU	Memory (GB)	Tempdb (TB)	Gen2 Cache (TB)
1000	720	4	3
1500	1080	5	4.5
2000	1440	7	6
2500	1800	9	7.5
3000	2160	11	9
5000	3600	18	15
6000	4320	22	18
7500	5400	27	22.5
10000	7200	36	30
15000	10800	54	45
30000	21600	108	90

# Automated Tiering of Storage Layers



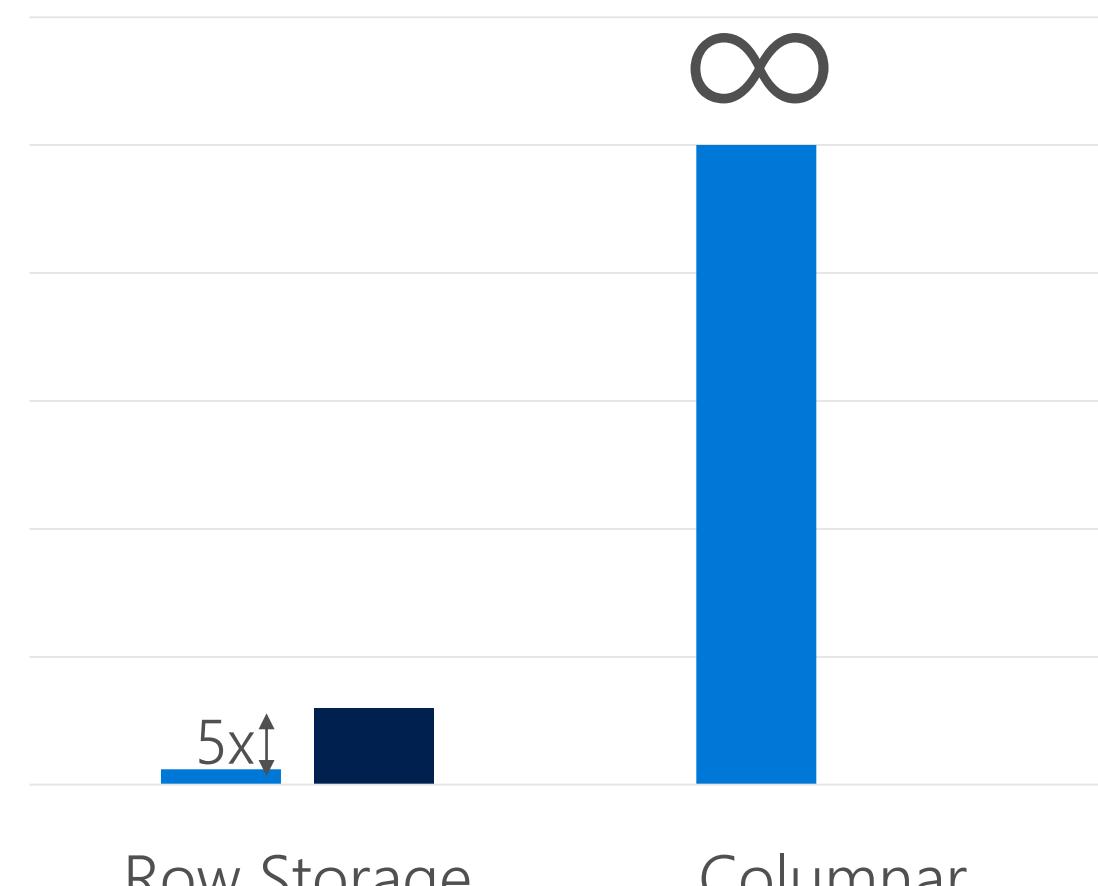
# STORAGE SCALABILITY

Optimized for Elasticity



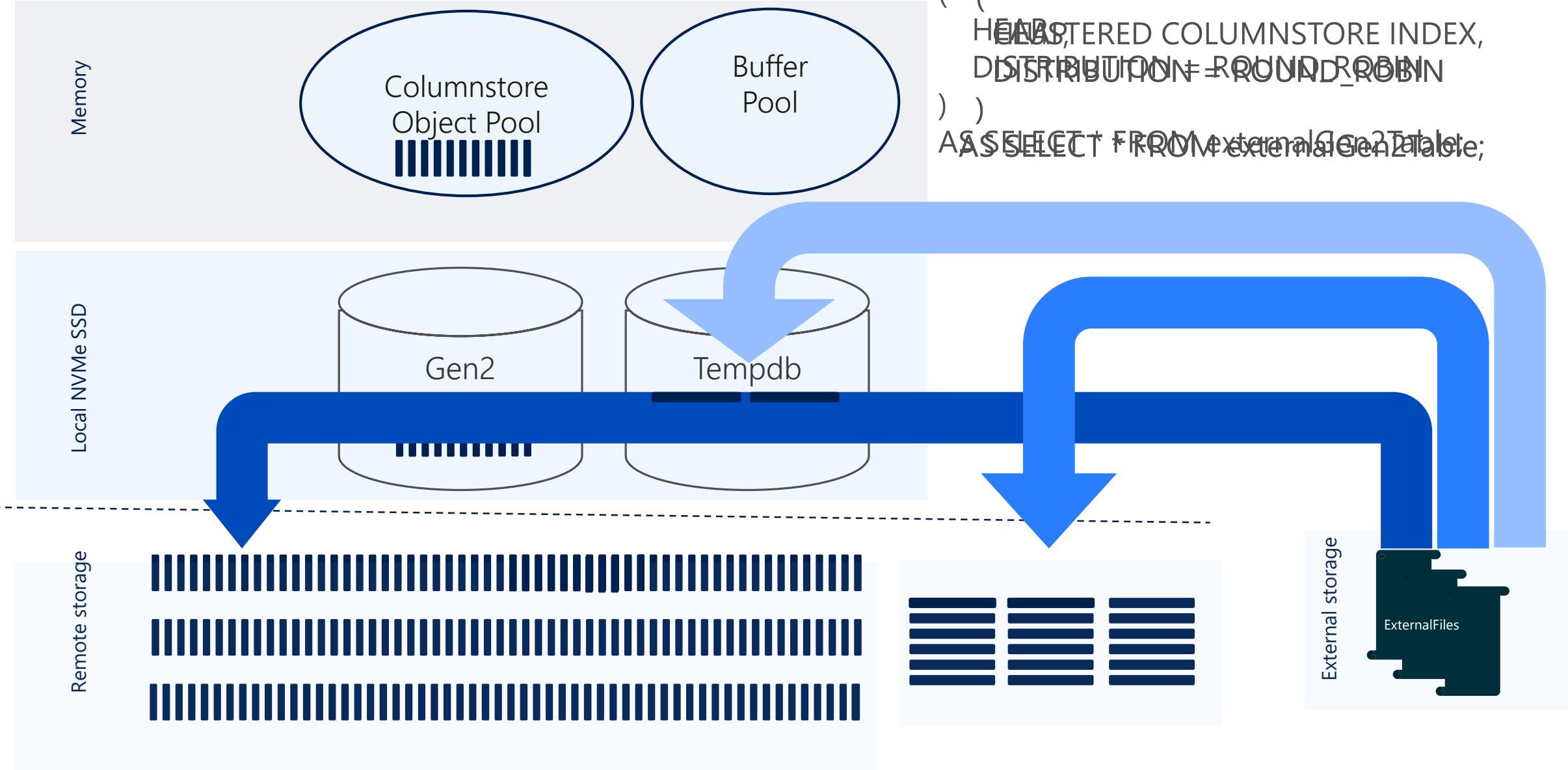
■ Compressed ■ Raw

Optimized for Compute



■ Compressed ■ Raw

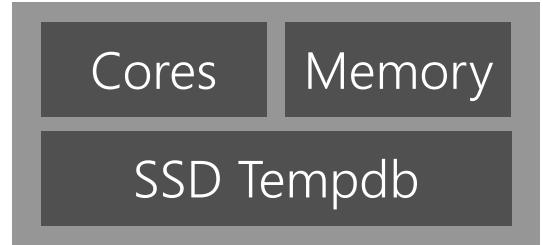
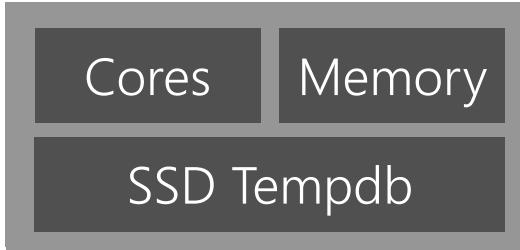
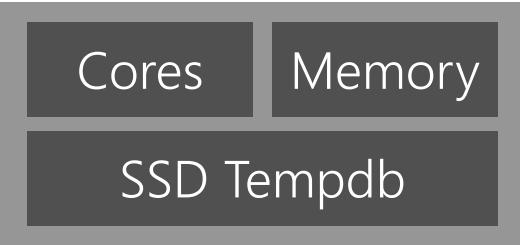
# Loading into Gen2



# OPTIMIZED FOR ELASTICITY

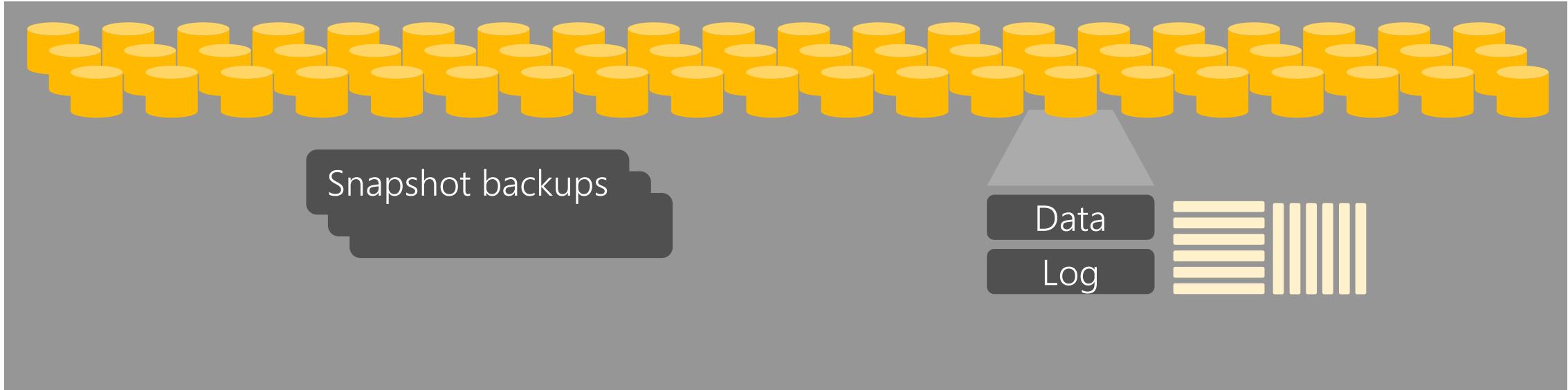


Control



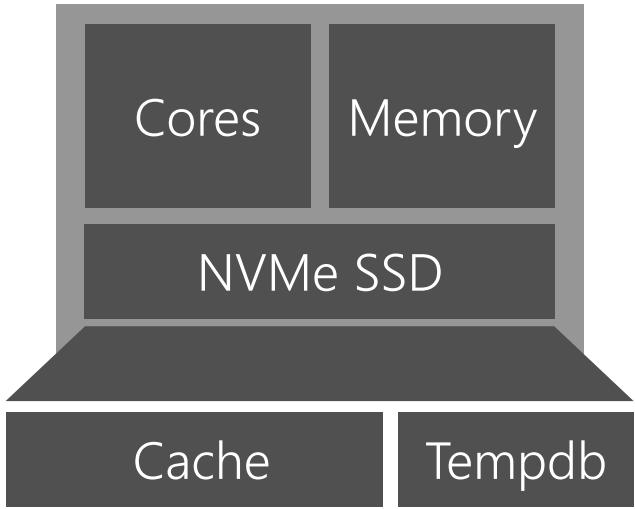
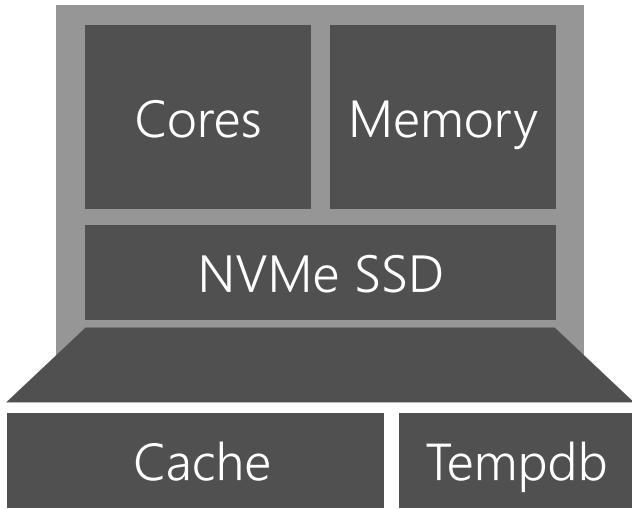
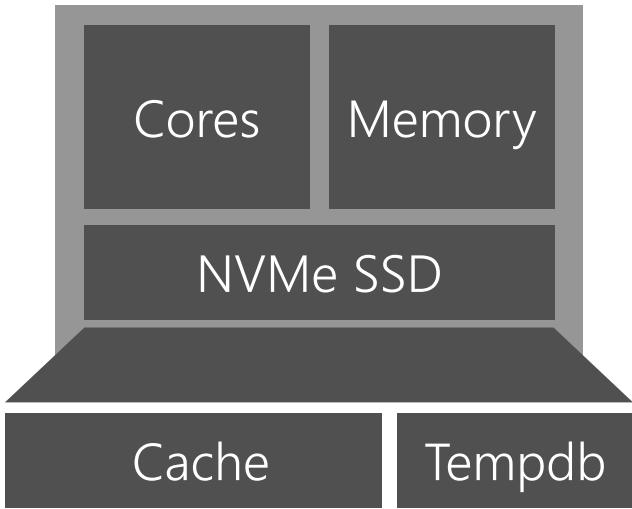
Compute

Remote Storage

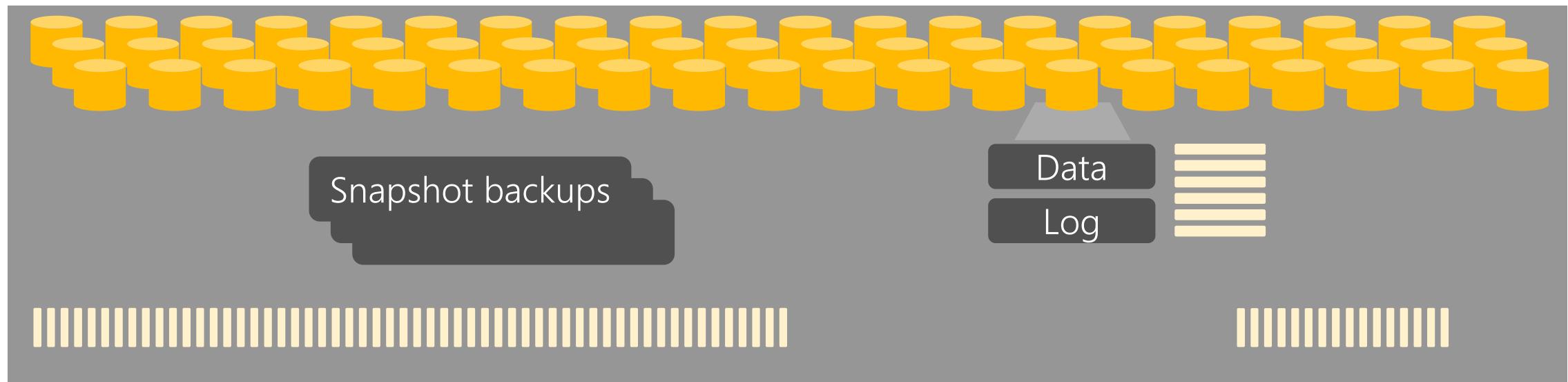


# NEW! OPTIMIZED FOR COMPUTE

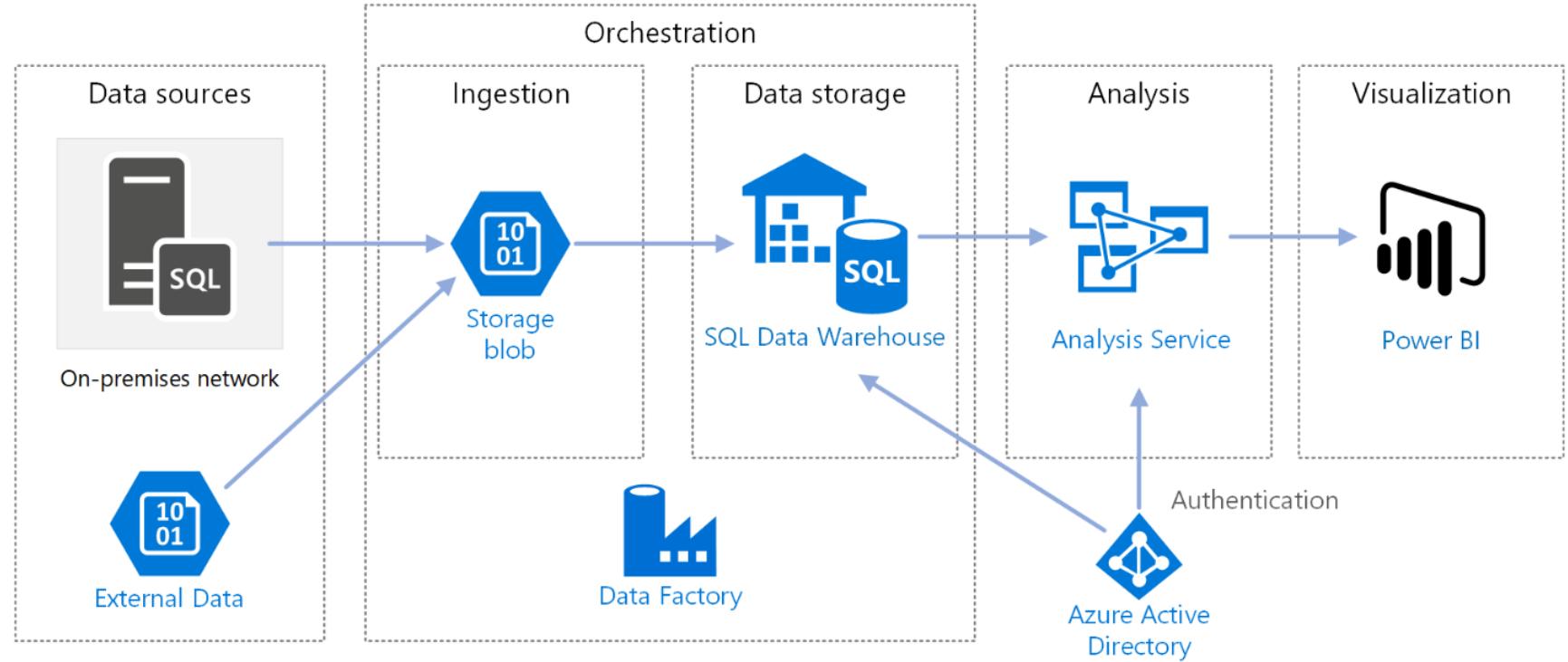
Compute



Remote Storage



# Demo



<https://docs.microsoft.com/en-us/azure/architecture/reference-architectures/data/enterprise-bi-adf>

<http://aka.ms/sqldwE2E>

# Resources-PaaS

- [Get Started with SQL Database](#)
- [AZURE SQL Database Performance Guidance](#)
- [Windows Azure SQL Databases Performance and Elasticity Guide](#)
- [Throttling and Resource Limits](#)
- [Troubleshoot and Optimize Queries with Azure SQL Database](#)
- [Retry Logic for Transient Failures in Windows Azure SQL Database](#)
- [Using the transient application fault block](#)
- [Windows Azure SQL Database Connection Management](#)
- [Troubleshoot connection problems to Azure SQL Database](#)
- [Azure SQL Database](#)
- [Azure SQL Database Transact-SQL Support](#)
- [Using SSDT to migrate SQL DB to Azure](#)
- [SQL Azure FAQ](#)
- [Virtual Academy Training](#)
- [Managing Azure SQL Database using SQL Server Management Studio](#) (**Has link to DMVs**)
- [Maintaining Stats and Indexes in Azure SQLDB](#) (**via Azure Automation**)

SQL DB resource limit:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-resource-limits-logical-server>

Elastic Pool Limit:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-dtu-resource-limits-elastic-pools>

SQLDB Vs SQL Server Vs SQL MI:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-features>

Elastic Pool pricing:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-vcore-resource-limits-elastic-pools>

MI Connectivity Architecture:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-managed-instance-connectivity-architecture>

T-SQL Differences:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-managed-instance-transact-sql-information>

SQL DB Migration:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-cloud-migrate>

SQL MI Migration:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-managed-instance-migrate>

Pricing :

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-service-tiers>

DTU:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-service-tiers-dtu>

Vcore:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-service-tiers-vcore>

Temp dbLog Size :

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-vcore-resource-limits-single-databases>

Recovery Using Backup:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-recovery-using-backups>

Sync database:

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-sync-data>

Elastic Query :

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-elastic-query-overview>

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-elastic-query-getting-started-vertical>

<https://docs.microsoft.com/en-us/azure/sql-database/sql-database-elastic-query-getting-started-vertical>

# Management and Monitoring materials

- Intelligent Insights video: <https://azure.microsoft.com/en-us/resources/videos/azure-friday-get-intelligent-insights-for-improving-azure-sql-database-performance/>
- Azure SQL Analytics solution: <https://docs.microsoft.com/en-us/azure/log-analytics/log-analytics-azure-sql>
- Diagnostic logging and telemetry available: <https://docs.microsoft.com/en-us/azure/sql-database/sql-database-metrics-diag-logging>
- Intelligent Insights concept: <https://docs.microsoft.com/en-us/azure/sql-database/sql-database-intelligent-insights>
- Intelligent Insights details for troubleshooting: <https://docs.microsoft.com/en-us/azure/sql-database/sql-database-intelligent-insights-troubleshoot-performance>
- Log Analytics query language: <https://docs.loganalytics.io/index>
- Automatic tuning video: <https://azure.microsoft.com/en-us/resources/videos/azure-friday-improve-azure-sql-database-performance-with-automatic-tuning/>
- Automatic tuning in Azure: <https://docs.microsoft.com/en-us/azure/sql-database/sql-database-automatic-tuning>
- Automatic tuning technical details: <https://docs.microsoft.com/en-us/sql/relational-databases/automatic-tuning/automatic-tuning>
- Useful Query Store queries: <https://docs.microsoft.com/en-us/sql/relational-databases/performance/monitoring-performance-by-using-the-query-store>