Microsoft

Introduction to Azure Data Services

Speaker Name

Microsoft Intelligent Data Platform

Power AI innovation, no matter where your data resides

Databases | Analytics | AI | Governance

Azure SQL DB

Azure Cosmos DB

Azure for PostgreSQL

MySQL

Microsoft Fabric

Azure Databricks

Azure AI

Microsoft Purview

snowflake

mongoDB.

ORACLE

Redis

+many more

Azure SQL

Key Features of Azure SQL Offerings

SQL Server on Azure VM

Key features

SQL Server and OS server access

Expansive SQL and OS version support

File stream, DTC, and Simple Recovery model available

Automated manageability features for SQL Server

Automatic security patching

Point in time restore with Azure Backup

Azure SQL Managed Instance

Key features

Available as single instance or instance pool

SQL Server surface area (vast majority)

Native virtual network support

Fully managed service

On-premise identities enabled on cloud instances, through integration with Entra ID and AD Connect

Azure SQL Database

Key features

Single database or elastic pool

Hyperscale storage (128TB+)

Serverless compute

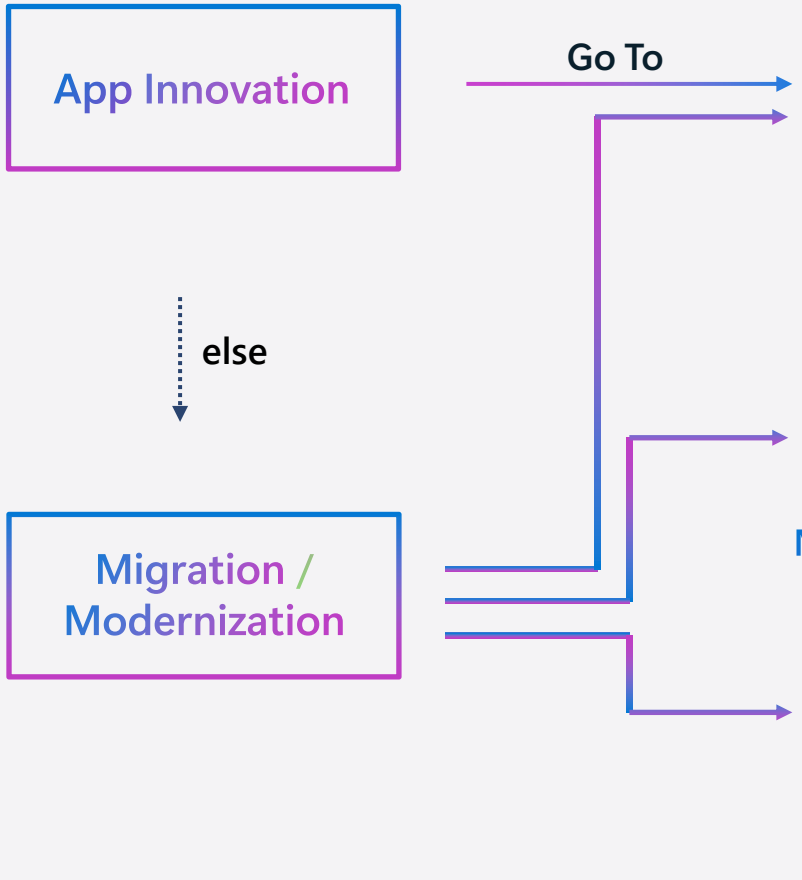
Fully managed service

Private link

High availability with AZ isolation

Business continuity at scale

Choosing the right Azure SQL Target



- Rapid scalability
- Resource pooling for multi-tenant SaaS
- Serverless compute
- 100TB+ storage
- Auto-Pause to save costs
- Cost at par with open-source options

- Instance model
- Native vNet support
- Maximize License & SA investments
- On-Premises SQL Server compatibility
- Near real-time data replication from on-premises to the cloud?

- OS level access
- Capabilities at the VM level?
- SSRS/SSAS
- SQL Server versions 2012 - 2022?
- Maximize License & SA investments

Benefits of PaaS

- Lower administrative burden
- No End of Support hassles
- Fully managed and up to date
- Dynamic resource scaling
- Built-in high availability and automatic backups
- Multi-model capabilities
- **AI Ready**

Benefits of IaaS

- Maintain OS-level control
- Easy lift-and-shift eliminates app refactoring
- Faster path to the cloud
- **AI Ready.** SQL Server 2025

* Use Azure Arc to enable the same services in your datacenter or on the cloud of your choice, when a hybrid or multi-cloud approach is required

Comparing Azure SQL options

	 SQL Server on Azure VMs	 Azure SQL Managed Instance	 Azure SQL Database
Deployment	• Choose Azure VM compute and storage sizes • Portal or CLI gallery images • Full SQL Server Setup • Bring your own image or self-install from Volume Licensing Center with active SA • Images with full SQL Server or Database only setup	• Dedicated instance or instance pools • vCore based compute • Portal or CLI instance deployment • Native VNet integration	• Provisioned and Serverless compute options • Multi-tenancy with elastic pools • Hyperscale for 128TB+ databases • Portal or CLI database deployment
	• Automated backups • Automated security updates • Manual patching and version upgrades • Dynamic VM sizing • Backup and Restore with Azure Blob Storage • Full SQL Server Engine features • Full access to OS	• Automated and user-initiated backups • Point-in-time Restore • Automated patching and upgrades • Dynamic scaling • Full Dynamic Management Views • Extended Events • Query Store • Database Mail • Resource Governor • SQL Server Agent • Azure Resource Health	• System-initiated automatic backups • Long-term backup retention • Create new database based on point-in-time restore • Automated patching and version upgrades • Dynamic scaling • Auto-scale with serverless • Azure Resource Health • Subset of Dynamic Management Views • Extended Events • Query Store
Security	• Integrated Security Authentication with domain joined VM, Entra ID authentication • Full SQL Server Engine Security Features • Azure Threat Protection and vulnerability assessments • Azure Security Center and Policies for infrastructure	• Entra ID Authentication • Transparent Data Encryption (TDE) with BYOK • Always Encrypted • SQL Server Audit • Row Level Security and Dynamic Data Masking • Advanced Threat Protection • Windows authentication	• Entra ID Authentication • Transparent Data Encryption (TDE) with BYOK • Always Encrypted • SQL Server Audit • Row Level Security and Dynamic Data Masking • Advanced Threat Protection • Ledger
Business Continuity	• Full Always On Availability Groups (AG) • Always On Failover Cluster Instance • SQL Server replication • Change Data Capture • Log Shipping • Database Snapshots • Accelerated Database Recovery • Tempdb Optimized Metadata	• Built in Azure HA/DR • Built-in readable secondary using geo-replication • Auto Failover Groups • SQL Server Replication • Change Data Capture • Accelerated Database Recovery on by default • Link feature	• Built in Azure HA/DR • Built-in readable secondary using geo-replication • Availability Zones • Active geo-replication • SQL Data Sync • Accelerated Database Recovery on by default

*This comparison is intended as a guide and subject to change without notice. SQL Server on Azure VM feature availability may be limited to specific SQL Server versions. For detailed comparisons, please see our documentation at aka.ms/AzureSQL_documentation

Comparing Azure SQL options (continued)

	 SQL Server on Azure VMs	 Azure SQL Managed Instance	 Azure SQL Database
Performance	• Automatic Plan Correction • Full SQL Server Engine Performance Features • Azure Blob cache • High performance ultra disks	• Intelligent Query Processing • Columnstore Indexes • Memory Optimized Tables • Automatic Plan Correction	• Intelligent Query Processing • Columnstore Indexes • Memory Optimized Tables • Automated Tuning including Indexes and Plan Correction
Programmability	• All major programming languages • Server-level collations • UTF-8 • T-SQL JSON integration • Graph database • Common Language Runtime • Native cross database queries • PolyBase external tables with Hadoop • New PolyBase connectors • Java language extension • Distributed transactions • FileStream • Full T-SQL surface area	• All major programming languages • Server-level collations • UTF-8 • T-SQL JSON integration • Graph database • Common Language Runtime • Native cross database queries • Distributed transactions • Linked Servers • Service broker	• All major programming languages • Database-level collations • UTF-8 • T-SQL JSON integration • Graph database
Networking	• Public Endpoint with Network Security Group (NSG) • Private Endpoint with Native Azure Vnet	• Public Endpoint with Network Security Group (NSG) • Private Endpoint with Native Azure Vnet	• IP Firewall for Public Endpoint • Virtual Network Firewall within Azure • Private Endpoint with PrivateLink (preview)
Analytics and BI	• SQL Server Integration Services (SSIS) • SQL Server Reporting Services (SSRS) • SQL Server Analysis Services (SSAS) • Machine Learning Server (standalone) • Machine Learning Services and language extensions • Full-text and semantic extractions for search	• Machine Learning Services with R and Python **Compatible with:** • Azure Data Factory SSIS integration runtime • Migrate SSRS to Power BI paginated reports • Azure Analysis Services	**Compatible with:** • Azure Data Factory SSIS integration runtime • Migrate SSRS to Power BI paginated reports • Azure Analysis Services
Storage limits	**Instances up to 256 TB**	**Instance up to 16 TB**	**Databases up to 4 TB (100 TB with Hyperscale)**
SLA	**SLA varies based on tier level. Max 99.99% HA SLA when distributed between AZ**	**99.99% availability SLA at instance level**	**Up to 99.995% availability SLA at database level**

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New!

Enhanced capacity and performance for Hyperscale

Higher storage capacity: Generally Available for Hyperscale single databases

100 TB → 128 TB

Higher maximum transaction log rates for Hyperscale databases and elastic pools: Limited preview

100 MiB / sec → 150 MiB / sec

aka.ms/HSEnhancements

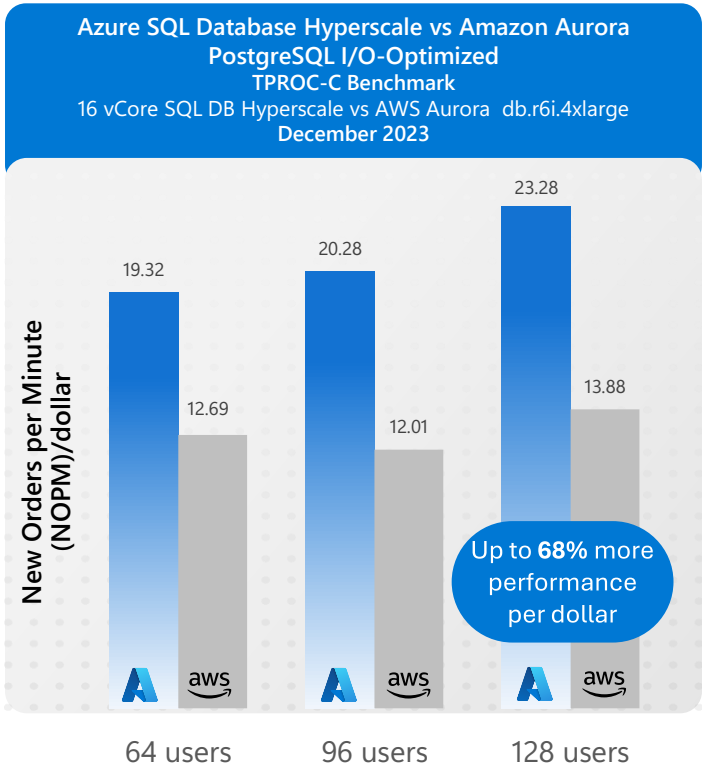
Azure SQL Database Hyperscale outperforms

Build new, highly scalable cloud applications with the performance and security of Azure SQL *for the price of commercial open-source databases*

Principled Technologies published a study where they tested throughput performance between Azure SQL Database Hyperscale and Amazon Aurora PostgreSQL.

SQL Database Hyperscale emerged as the price-performance leader for mission-critical workloads, delivering up to 68 percent more performance per dollar than Amazon Aurora PostgreSQL.[1]

Blog: https://devblogs.microsoft.com/azure-sql/build-highly-scalable-ai-ready-applications-on-azure-sql-database-hyperscale/



Database performance per dollar comparison.
Higher is better.

Price-performance claims based on data from a study commissioned by Microsoft and conducted by Principled Technologies in December 2023. The study compared performance and price performance between a 16 vCore and 32 vCore Azure SQL Database using premium-series hardware on the Hyperscale service tier and the db.r6i.4xlarge and db.r6i.8xlarge offerings for Amazon Web Services Aurora PostgreSQL I/O-Optimized (AWS Aurora). Benchmark data is taken from a Principled Technologies report which used the HammerDB TPROC-C benchmark. The TPROC-C workload is derived from the TPC-C Benchmark and results were obtained with the HammerDB TPROC-C workload . The HammerDB TPROC-C workload is derived from the TPC-C benchmark and is not comparable to published TPC-C Benchmark results, as this implementation does not comply with all requirements of the TPC Benchmark. Price-performance is calculated by Principled Technologies as the cost of running the cloud platform continuously divided by new orders per minute throughput, based upon the standard. Prices are based on publicly available US pricing in East US 1 for Azure SQL Database and US East for AWS Aurora as of December 2023. Performance and price-performance results are based upon the configurations detailed in the Principled Technologies report. Actual results and prices may vary based on configuration and region.

aka.ms/SQL_DB_Hyperscale_benchmark

Hyperscale is the only **license-free** PaaS offering in the #AzureSQL family!

Azure SQL DB Hyperscale serverless

Automatic scaling of compute and memory; log throughput independent of compute

Auto-scaling independence of the primary replica, high availability replicas, and named replicas

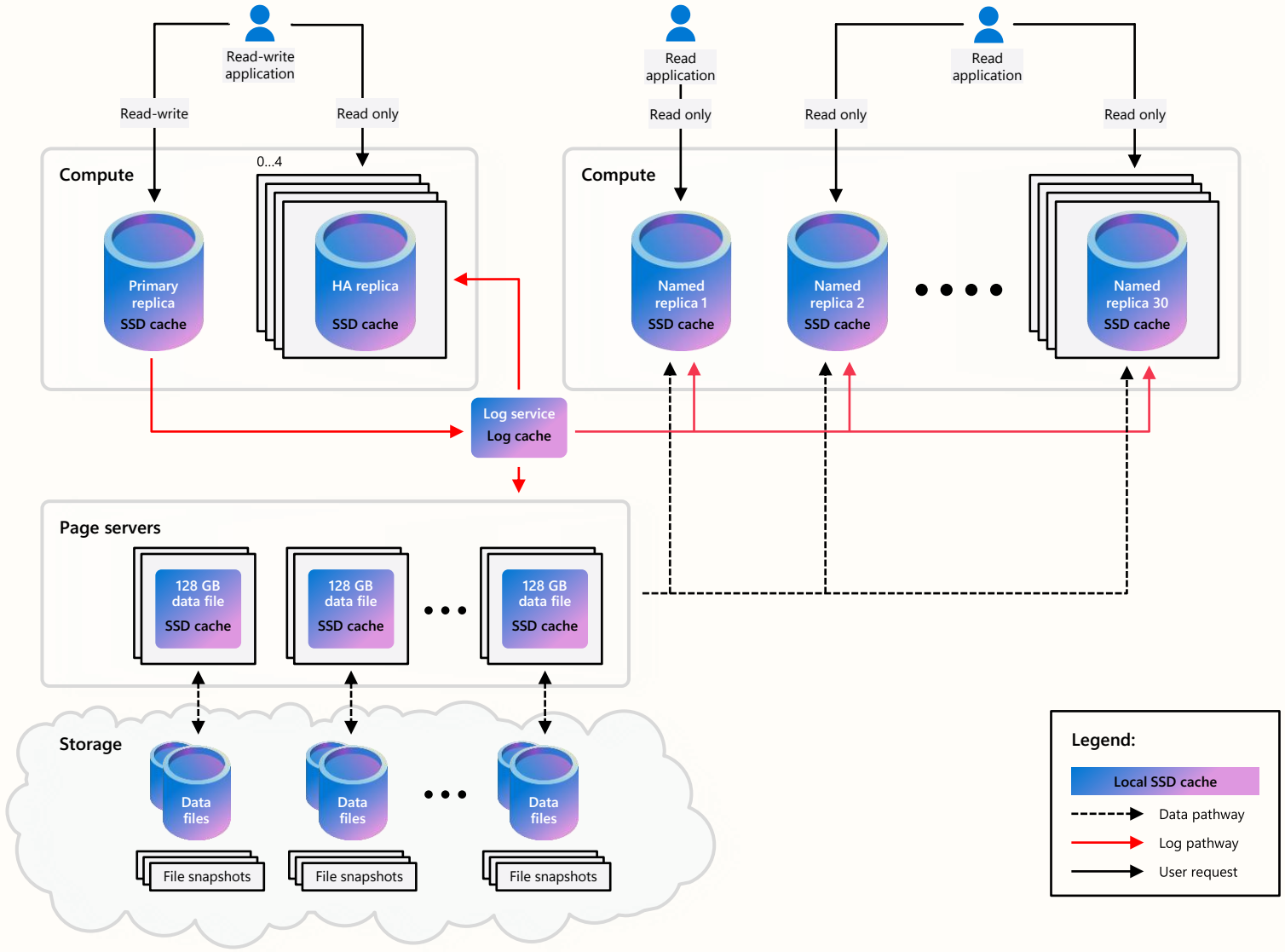
Automatic scaling of database storage up to 100 TB

Auto-scaling independence of CPU and memory to match workload demand

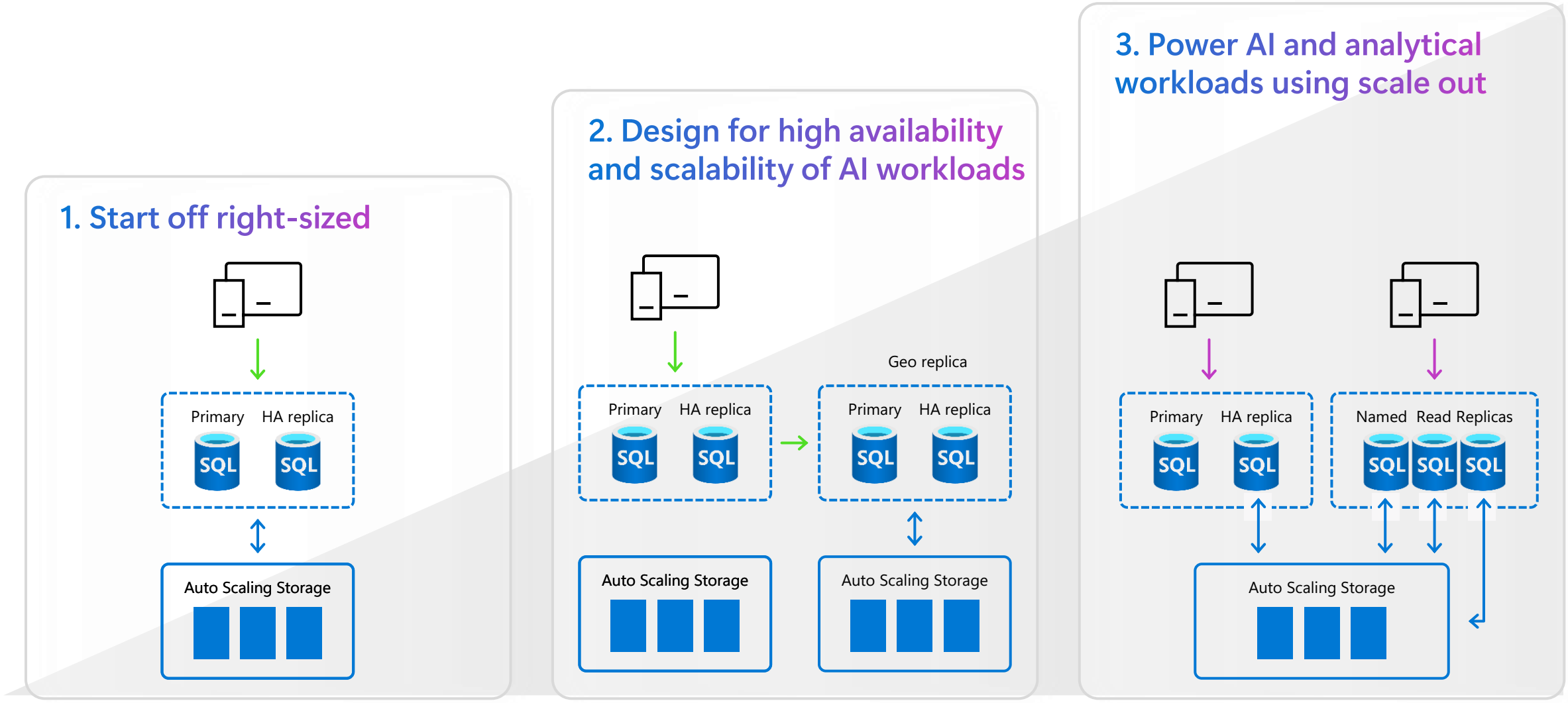
Per-Second Billing of used resources

Built-for-the cloud architecture enables near-limitless growth potential

Distributed, scale-out and resilient

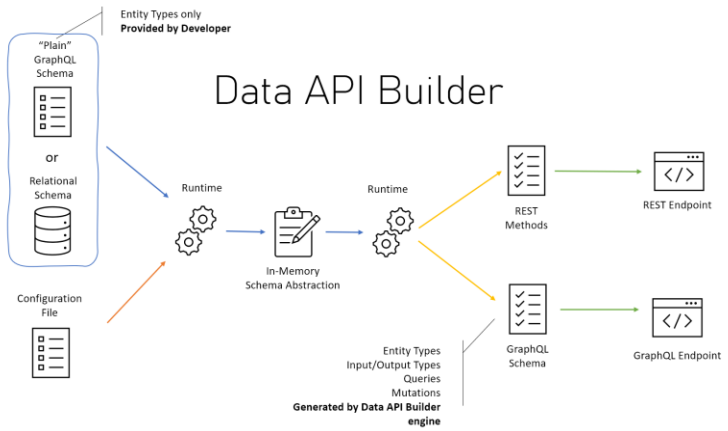


Build and Modernize AI Apps on a flexible & scalable foundation from 10GB-128TB

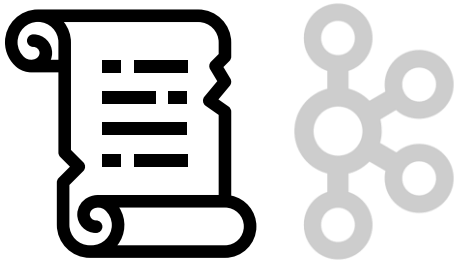


Updated to be Developer Friendly

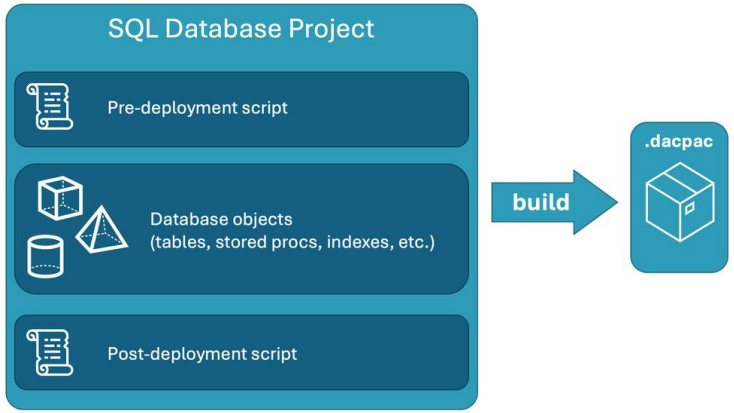
Database Access via APIs (REST/GraphQL)



JSON Data Type/ Streaming changes to EventHub/Kafka



SQL Server DevOps (CI/CD) with SQL Projects



Data Security Support for Zero Trust Architecture – Ledger (immutable storage), Always Encrypted, EntraID Authentication, monitored by Defender and Purview

Demo

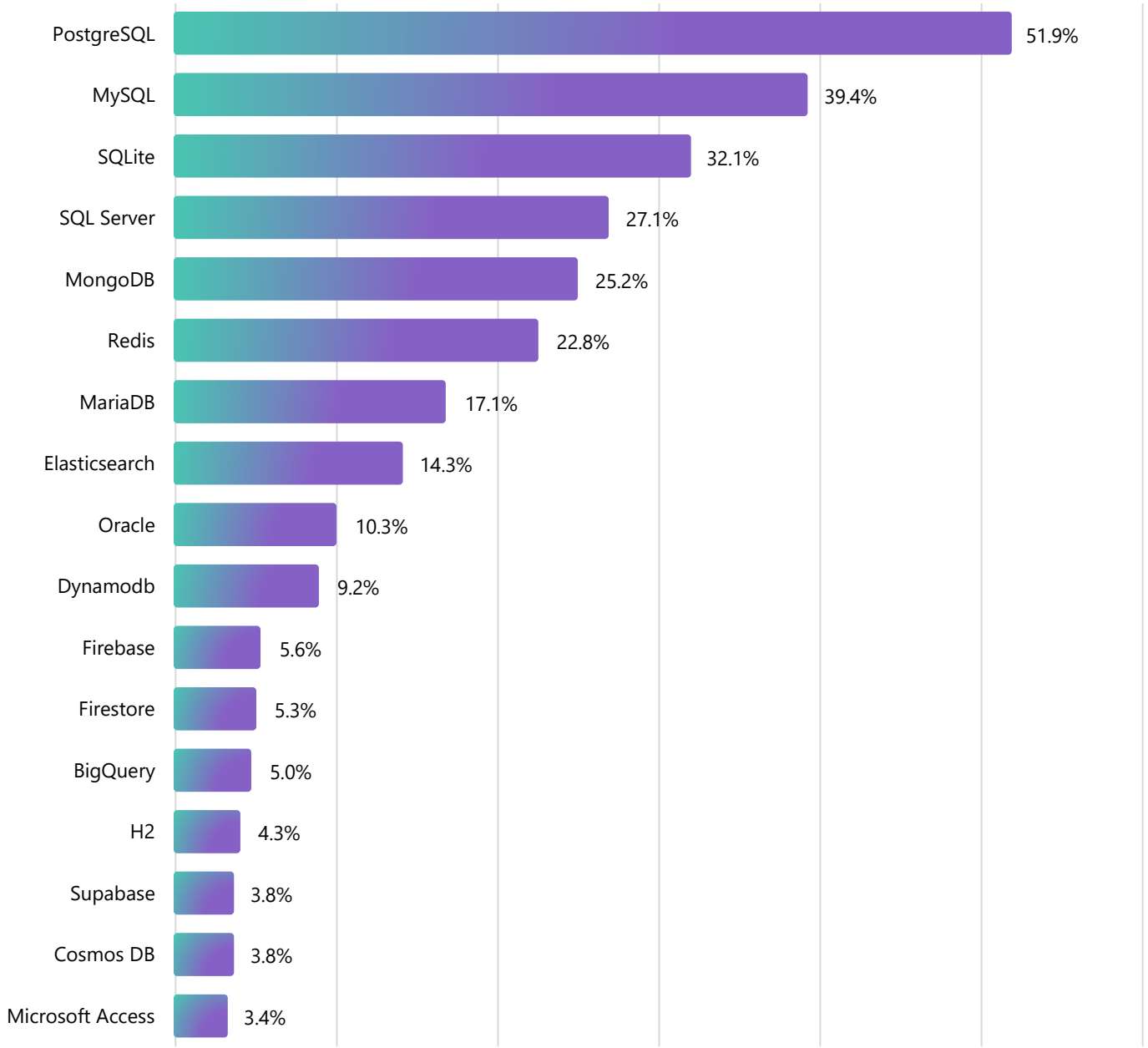
Azure Database for PostgreSQL

Postgres is the most popular database for professional developers

PostgreSQL extended lead 2024

*Which **database environments** have you done extensive development work in over the past year, and which do you want to work in over the next year? (If you both worked with the database and want to continue to do so, please check both boxes in that row.)*

Source:
Stack Overflow Developer Survey 2024



Azure Database for PostgreSQL is Enterprise Ready Today

Entra ID

Private Endpoints

Virtual Networks

Data Encryption

Azure Defender

Availability Zones

Geo DR

Performance

Azure Policy

Azure Advisor

UBS

accenture

BOEING

pwc

American Airlines

FedEx

tomtom

Swiss Re

BMW

Unique to Azure

Industry leading AI for building intelligent applications

[1.5, -0.4, ..., 20.2]

Native Vectors

Azure AI Integrated

Copilot Powered

All Community Supported Postgres Versions

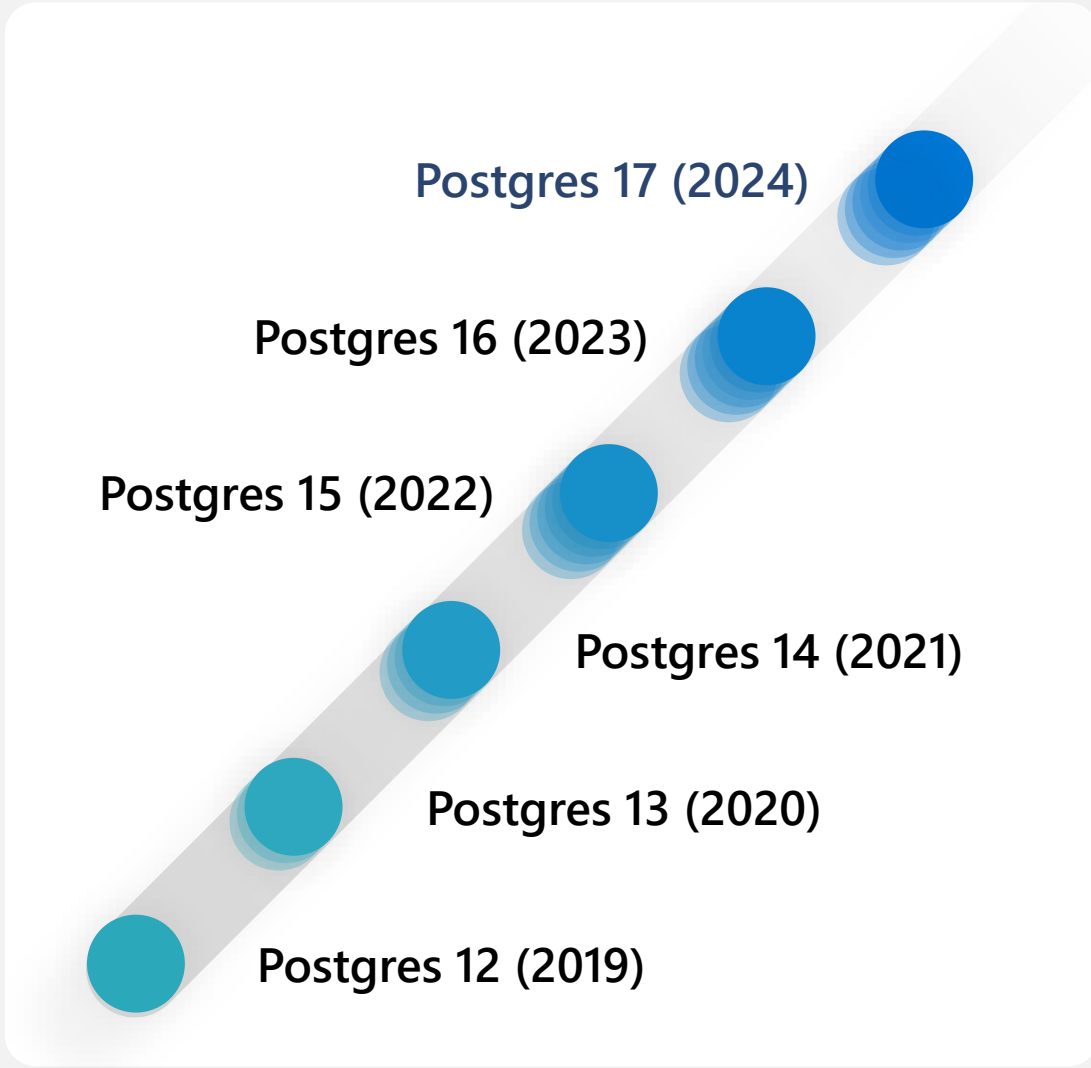
Major versions available **with weeks** of community GA

Minor versions **maintained automatically**

Upgrade in-place in minutes

Key performance features

- **More efficient Vacuum Process**
- **Streaming IO improvements**
- **Query processing improvements**
- **Insights into Memory Usage via EXPLAIN**
- **Enhanced JSON Functions**
- **Dynamic Logical Replication**



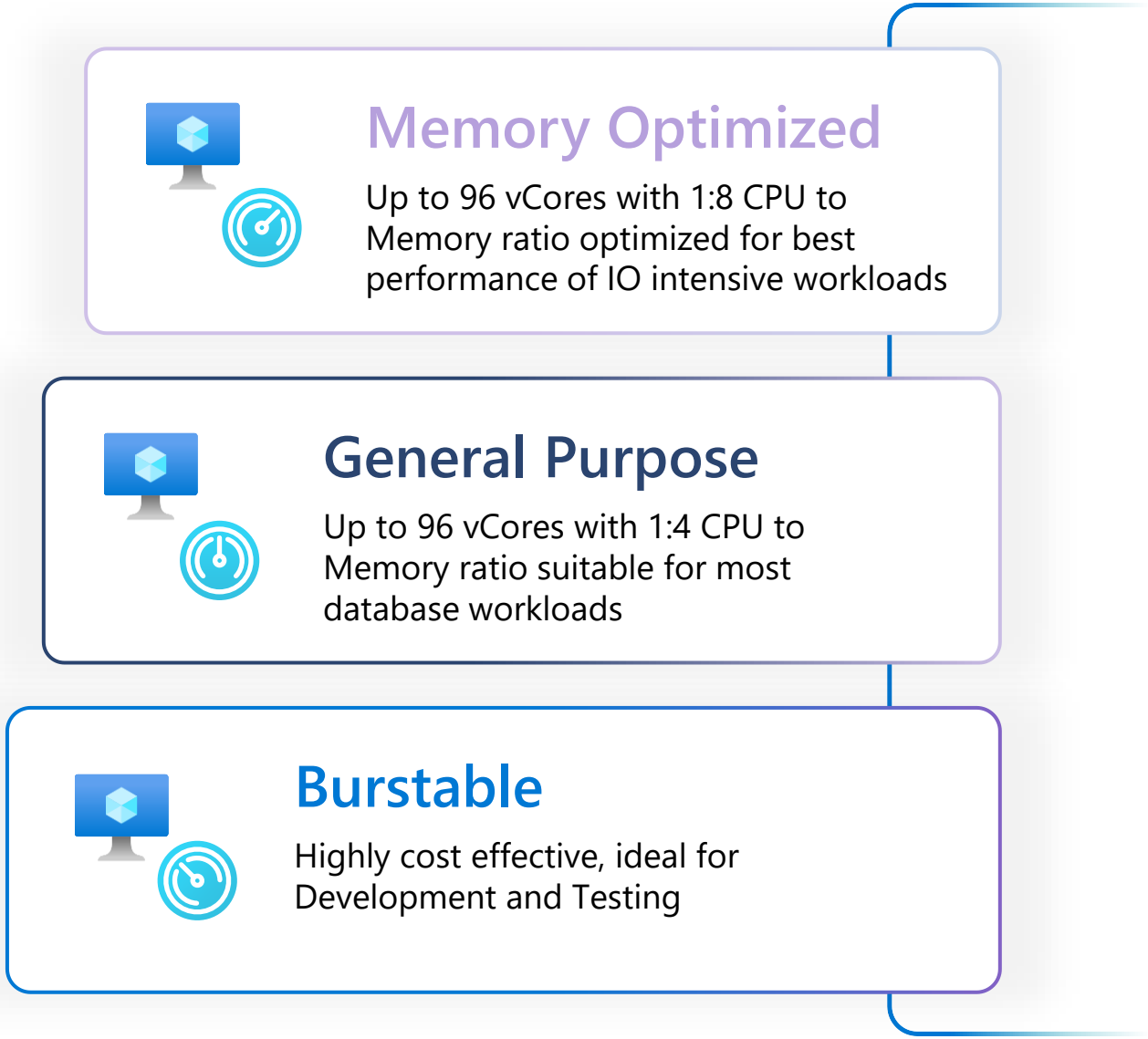
Workload Optimized Compute SKU's

Cost optimized for different workloads

Each switch between any SKU in minutes

Stop/Start during inactive periods

Reserved Capacity



Broad support for common Postgres extensions

60+ Postgres extensions supported

Enables developers to **extend the functionality of Postgres** beyond core capabilities

Microsoft **automatically maintains** extensions versions

address_standardizer
address_standardizer_data_us
amcheck
azure_ai
azure_local_ai (Preview)
azure_storage
bloom
btree_gin
btree_gist
citext
cube
dblink
dict_int
dict_xsyn
earthdistance
fuzzystrmatch
hstore
hypopg
intagg
intarray
isn
lo
login_hook
ltree
orafce
pageinspect
pgaudit
pg_buffercache
pg_cron
pgcrypto
pg_failover_slots (Preview)
pg_freespacemap
pg_hint_plan
pglogical
pg_partman
pg_prewarm
pg_repack
pgrouting
pgrowlocks
pg_squeeze
pg_stat_statements
pgstattuple
pg_trgm
pg_visibility
plpgsql
plv8
postgis
postgis_raster
postgis_sfcgal
postgis_tiger_geocoder
postgis_topology
postgres_fdw
semver
session_variable
sslinfo
tablefunc
tds_fdw
timescaledb
tsm_system_rows
tsm_system_time
unaccent
uuid-ossp
vector

Extensive Monitoring

Rich metrics and logs provide observability into the entire database workload

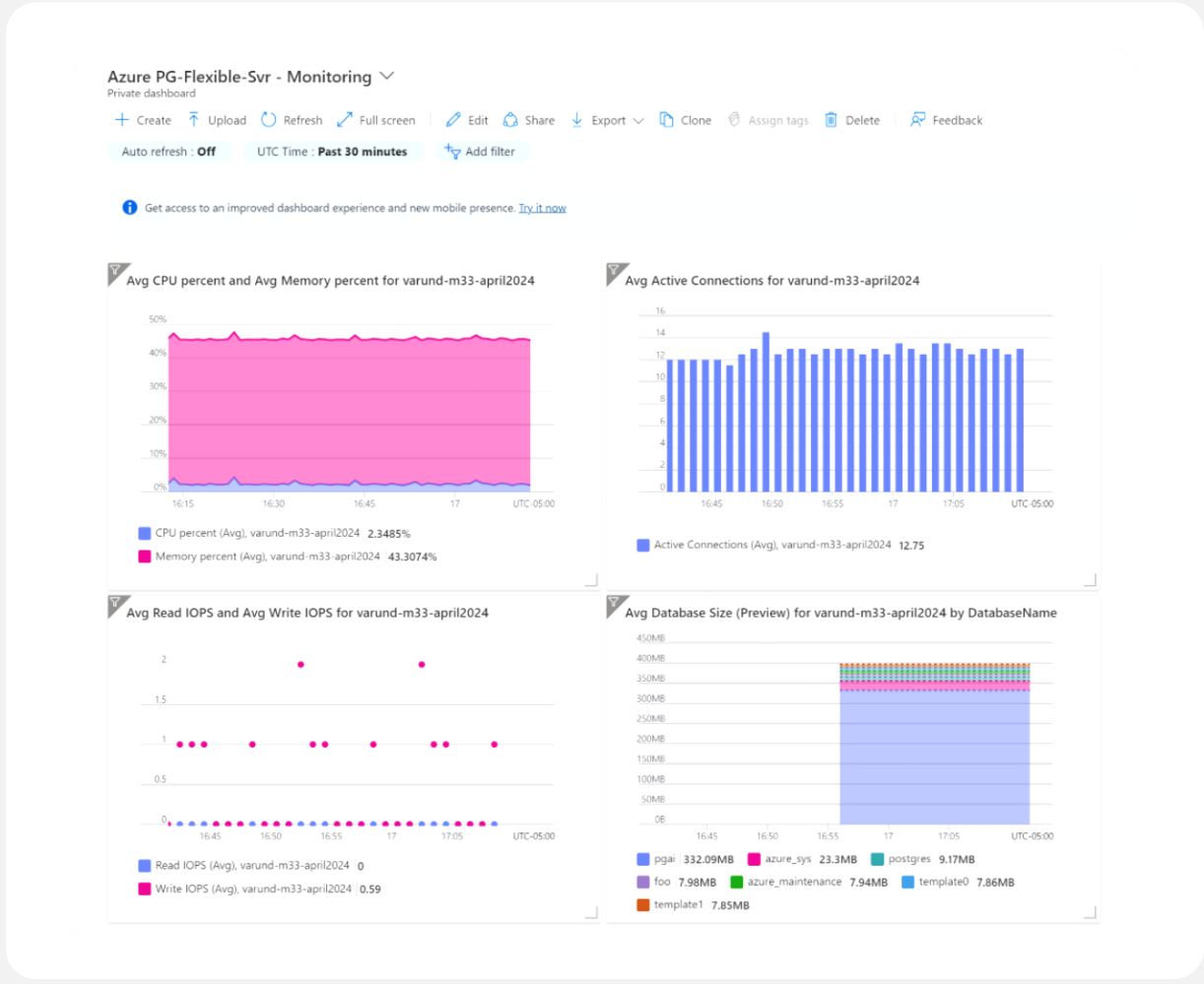
Access to detailed metrics and logs

Quickly **diagnose performance** issues

Make informed scaling decisions

Set up alerts and auto-scaling for quick responses

Visualize data using the Portal, Power BI, Grafana, or Log Analytics



Integrated with Azure Advisor

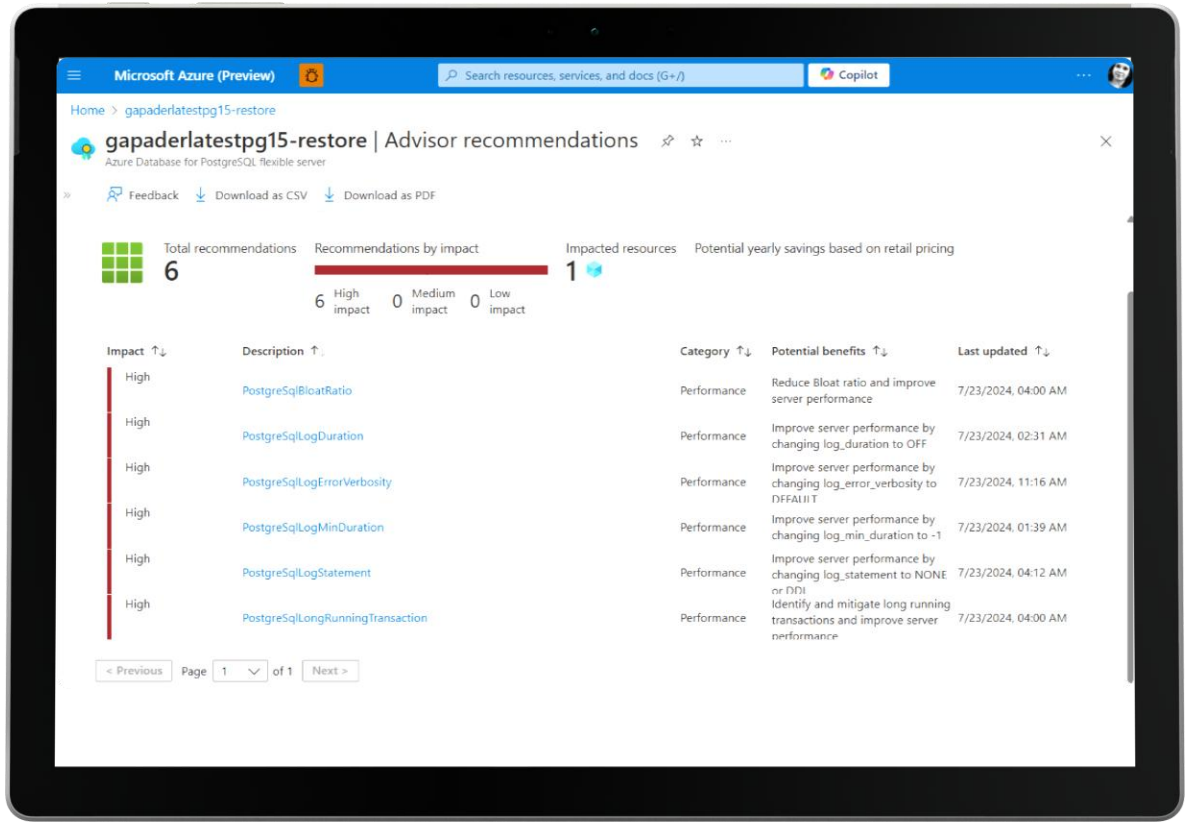
Built-in recommendations for workload optimization

Unique to Azure

Azure Advisor supports over 16 recommendations for optimizing workloads on Azure Database for PostgreSQL

Performance optimizations are based on actual usage history to prioritize highest impact

Recommendations include optimizations for **logging**, **disk space**, and **memory usage** amongst others



Easy to build with a fully-managed service on Azure

Automatic updates

Azure ensures your data is available and automatically updates your database, freeing you to focus on your application

Modern apps built with Azure Kubernetes Service (AKS)

Engage cloud native developers with the flexibility of AKS and extensibility of PostgreSQL

Scale in seconds

Scale your compute or storage resources independently to meet your application's needs

Enable real-time operational analytics apps

Converge transactional and analytics data stores

Built-in compliance and security

Automatically leverage enterprise grade security and compliance; proactively receive security alerts with Advanced Threat Protection

Build geospatial enabled Apps

Leverage PostGIS, the world's most popular OS geospatial solution to deliver location-aware experiences

Azure IP Advantage

Rest assured that you have best-in-industry uncapped defense and indemnification coverage

Combine time series and relational data

Power just-in-time decision-making for event driven applications

Using community PostgreSQL, and not a fork. No vendor lock-in.

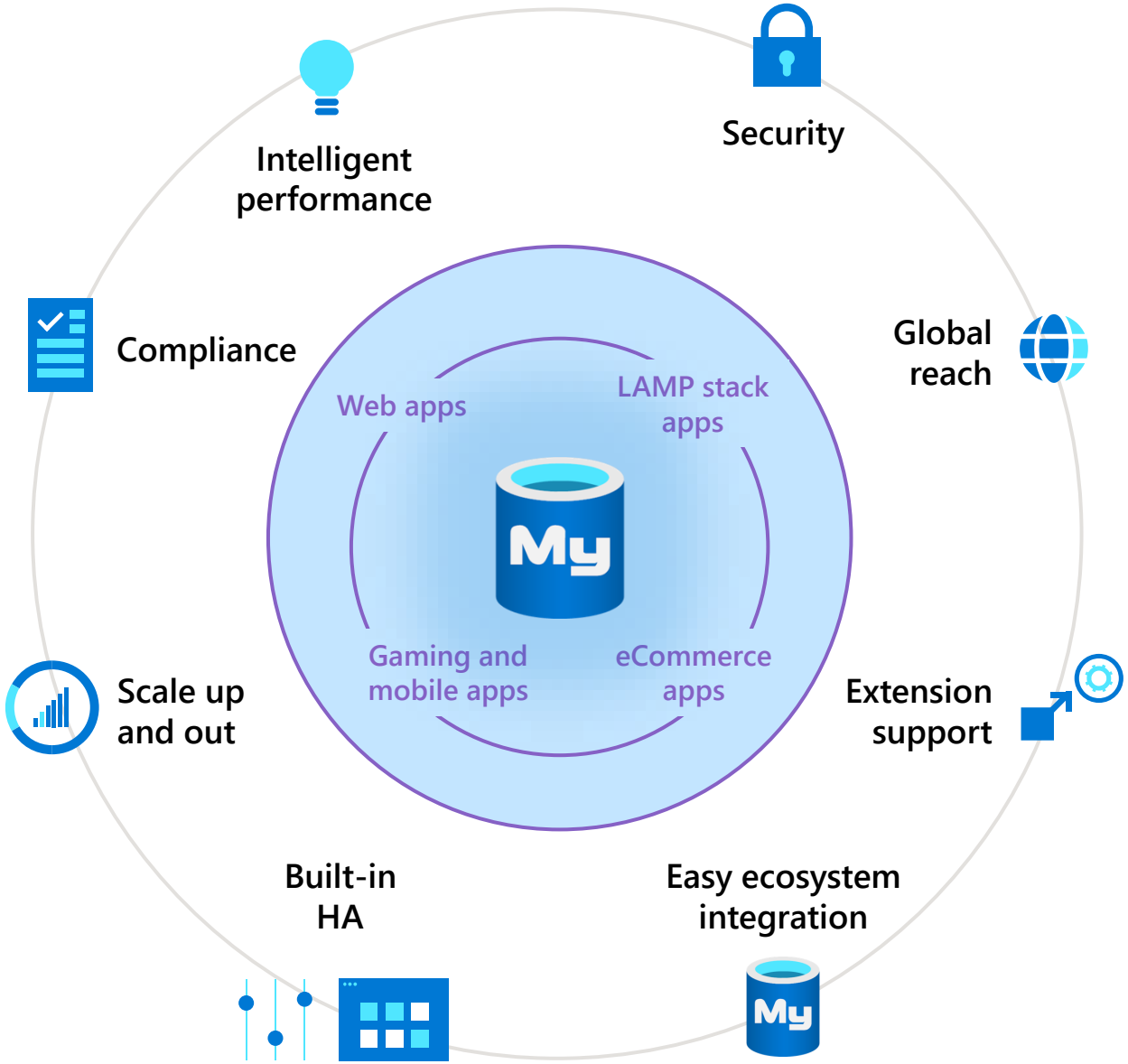
Demo

Azure Database for MySQL

Microsoft

Azure Database for MySQL

Build cost effective apps with a fully-managed database that enables granular control and flexibility so you can easily set it up, operate, and scale.



Powered by MySQL Community Edition

Microsoft

Build limitless, trusted AI-ready apps with Azure Database for MySQL

Intelligent

Integrate with **Azure OpenAI** and **Azure AI Search**

Deploy Applications in Azure App Services and Azure Kubernetes Services

Analyze and Visualize your data using Power BI

Automate with GitHub Actions, Terraform

Limitless

Up to 2.26x better throughput at 55% lower latency compared to AWS and GCP

Auto-scaling storage and IOPs up to 80K

Scale up to 96 vCores, 672 GiB Memory

Scale-out with up to 10 read replicas

Trusted

TDE at rest and in motion using customer managed keys

Microsoft Entra ID authentication and full network isolation

Superior compliance with most comprehensive coverage of any cloud

Zone resilient and cross-region high availability with built-in backups

Performance tiers

Compute Tier	Burstable	General Purpose	Business Critical
Target Workloads	Best for workloads that don't continuously need the full CPU. Example: An office check-in/out application, which only needs CPU bursts during business hours.	Best for most business workloads that require balanced compute and memory with scalable I/O throughput. Example: Hosting web and mobile apps and other enterprise applications.	Best for high-performance tier 1 database workloads that require in-memory performance and low disk latency for faster transaction processing and higher concurrency. Example: Processing real-time data and high-performance transactional or analytical apps.
VM series	B-series	Ddsv4-series	Edsv4/v5-series
vCores	1, 2, 4, 8, 12,16, 20	2, 4, 8, 16, 32, 48, 64	2, 4, 8, 16, 32, 48, 64
Memory per vCore	Variable	4 GiB	8 GiB**
Storage size	20 GiB to 16 TiB	20 GiB to 16 TiB	20 GiB to 32 TiB (64TiB – on demand)
Max IOPS	5000	20000	80000

Azure Cosmos DB

Lunch break till 12:35

Azure Cosmos DB: Choosing RU or vCore

Once you decide if RU or vCore is better for your workloads, you have options based on your API of choice

RU is a good choice if your workloads need:

- Higher scale & availability
- High-concurrency low-latency requests
- Instant request-based autoscale
- Active/Active regions (multi-region write)
- In-database vector indexing (coming in 2024)
- Unlimited scale-out over small shards

If RU is best for you, choose between native Cosmos DB and OSS API options

Recommended

- Best of Cosmos DB: Azure Cosmos DB for NoSQL
- MongoDB familiarity: Cosmos DB for MongoDB (RU) ★
- Cassandra familiarity: Cosmos DB for Cassandra

vCore is a good choice if your workloads need:

- Higher compatibility and Migration
- Richer queries with complex aggregations
- Familiar node + vCore-based scaling
- Geo-DR with readable secondaries
- In-database vector Indexing (available now)
- Scale-up on large shards before scale-out

If vCore is best for you, choose between OSS options based on your preferred API

- MongoDB familiarity: Cosmos DB for MongoDB (vCore) ★
- Cassandra familiarity: Managed Instance for Cassandra
- PostgreSQL familiarity: Cosmos DB for PostgreSQL

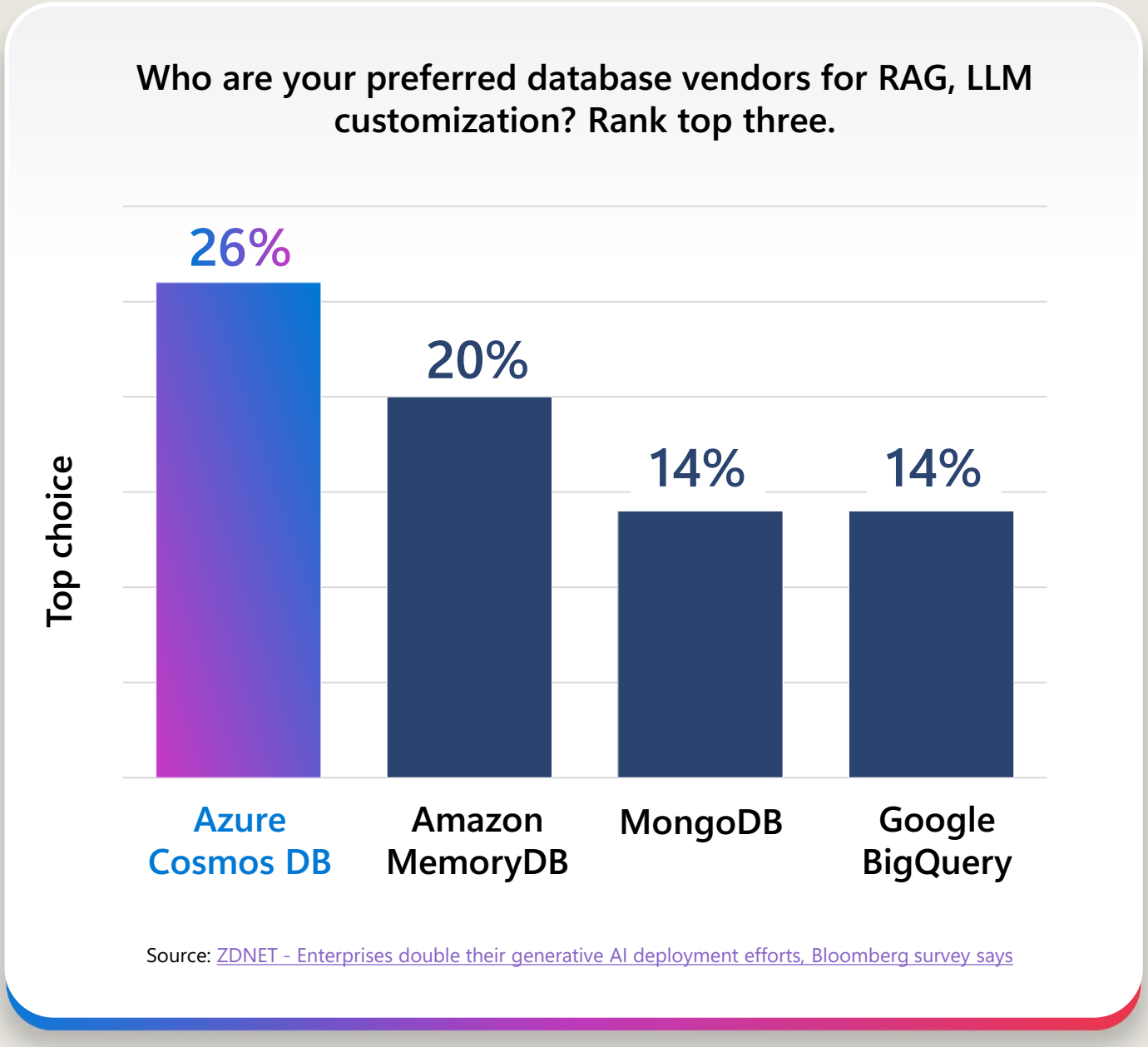
Bloomberg survey

Azure Cosmos DB is the preferred database for AI apps

A recent Bloomberg survey of CIOs* found that Azure Cosmos DB is the preferred database for LLM and RAG generative AI workloads. This is due to features that are tailor-made for building intelligent apps like:

- Ability to store and query vectors within Azure Cosmos DB with **high-performance vector indexing powered by DiskANN**
- **Dynamic scaling** that allows partitions and regions to scale independently
- Industry-leading **SLA-backed 99.999** percent availability for NoSQL data

Source: 60% of Enterprise Chief Information Officers Report Plans to Increase Spending on AI Inferencing Workloads with Microsoft



Source: ZDNET - Enterprises double their generative AI deployment efforts, Bloomberg survey says

Build scalable apps

- Fuel NoSQL and MongoDB apps with **high-performance**, distributed computing over **massive volumes** of NoSQL and vector data
- Start small and pay for only what you use with serverless computing or enhanced and unlimited **dynamic autoscale**
- Develop and test your applications and run small production workloads with the Azure **Cosmos DB free tier**
- Azure Cosmos DB offers a comprehensive suite of **SLAs** for both low **latency** and high **availability**

AI use cases with Azure Cosmos DB

Operational + Vector Database

Keeping operational and vector data together in the same database to reduce complexity and cost

- MongoDB vCore based Copilot
- AI Travel Assistant

Retrieval Augmented Generation (RAG)

RAG (Retrieval Augmented Generation) Apps to personalize GenAI experiences

- Build your own Copilot
- Claims processing AI agent

Conversational History

Conversational History, Multi-Agent Memory to optimize application responses and to enable auditing

- Storing Chat History in Azure CosmosDB

Semantic Caching, AI Graphs

Semantic Caching to reduce latency and cost of GenAI experiences

- AI Travel Assistant
- OmniRAG and Cosmos AI Graphs

AI Agents

AI Agents and multi-agent solutions with Memory

- Agentic AI in Retail
- Agentic AI Travel Assistant

Secure and available

- Stay compliant with enterprise-grade, multilayer security across all your data and apps
- Get industry-leading SLA-backed 99.999 percent availability for NoSQL data
- Easily recover and restore critical data with flexible options for continuous backup and point-in-time restore