MUG

Azure SQL a fondo

SQL ARGENTINA

msc

javier.ignacio.villegas@gmail.com

@javier_vill

javiervillegas

sql-javier-villegas.blogspot.com.ar

Javier Villegas

IT Director – DBA and BI Services at MSC

Working with the SQL Server for more than 25 years

Microsoft MVP Data Platform

Microsoft Certified Trainer

Azure Data Community Board of Advisors

Technical Speaker

SQL PASS, 24 HOP, SQL Saturdays , PASS Marathon , PASS Virtual Groups, vOpen, Microsoft AI+ Tour, Data Saturdays, Azure Global Bootcamp , GroupBy , PowerBI Summit and DataPlatformGeeks

MVP Microsoft® Most Valuable Professional

Microsoft Certified Trainer Microsoft MCT Trainer 2020 - 2021

Microsoft Certified Azure Database Administrator Associate

Microsoft Certified Azure Data Fundamentals

AZURE EN EL BAR

SQL ARGENTINA

@azureenelbar
@sqlargentina

Encuesta

https://forms.office.com/r/U8FYRfdWQ2

@javier_vill

javiervillegas

MUG

Get Started

Azure Subscription

https://azure.microsoft.com/en-us/free

SQL Server Management Studio & Azure Data Studio

https://aka.ms/ssms

Sample Databases

https://docs.microsoft.com/en-us/sql/samples/sql-samples-where-are

Get Started

Azure Storage Explorer

https://azure.microsoft.com/en-us/features/storage-explorer/

SQL Server Migration Assistant

https://aka.ms/ssma

Data Migration Assistant

https://aka.ms/dma

Database Experimentation Assistant

https://docs.microsoft.com/en-us/sql/dea/database-experimentation-assistant-overview?view=sql-server-ver15

Agenda

- Introduccion a Azure SQL
  - SQL Server en Azure Virtual Machines (VMs)
  - Azure SQL Database
  - Azure SQL Managed Instance
- Casos de Uso
- Performance
- Migracion

Azure SQL

Azure SQL

A unified SQL portfolio built on the industry-leading SQL Server engine

SQL Server on Azure Virtual Machines

Best for re-hosting and apps requiring OS-level access and control

Automated manageability features and OS-level access

Azure SQL Managed Instance

Best for modernizing existing apps

Offers high compatibility with SQL Server and native VNET support

Azure SQL Database

Best for building new apps in the cloud

Pre-provisioned or serverless compute and Hyperscale storage to meet demanding workload requirements

Infrastructure as a Service

Platform as a Service

SQL is everywhere

SQL Server 2019

Best for modernizing your databases in your private cloud

SQL on Linux

Best for a compatible SQL running on Linux

SQL in containers

Best for portable, consistent, and easy to patch SQL

SQL on Kubernetes

Best for database containers at scale with built-in HA

SQL virtual machines

Best for migrations and applications requiring OS-level access

SQL managed instances

Best for most lift-and-shift migrations to the cloud. Instance pool options are available

SQL databases

Best for modern cloud applications. Elastic pools, Hyperscale and Serverless options are available

SQL Edge

Best for data and machine learning applications on IOT Edge

IAAS vs PAAS

SQL Server in Azure VM

- It’s a VM!
- Management of OS and SQL Server
- Select Version, OS, Edition
- Single VM availability SLA: 99.9%
  (<43 min downtime p/month)

  Multi-VM availability SLA: 99.95%
  (<21 min downtime p/month)

Azure SQL Database Managed Instance*

- Migrate Fleet of Databases
- Security Isolation with Azure VNet
- Application Surface Compatibility
  SQL Agent, Profiler
  Cross DB querying, CLR, Replication,
  CDC, Service Broker
- Database sizes up to 35TB
- Minimize Migration Downtime
- All Azure SQL Database features

Azure SQL Database

- Fully managed Database
- Active Learning and Optimization
- End to End Integration
- Intelligent Data Protection & Security
- Application & Data Modernization
- Up to 4 TB single Databases
  > using Elastic Scale
- Geo-DR
- Database availability SLA: 99.99%

IaaS vs PaaS

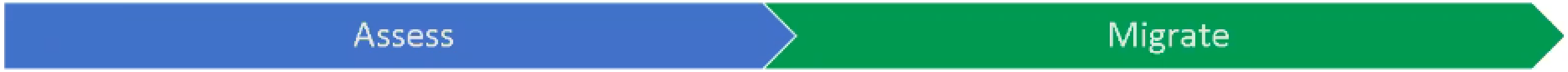
- Business continuity
- High availability
- Automated backups
- Long term backup retention
- Geo-replication

- Scale
- Advanced security
- Version-less
- Built-in monitoring
- Built-in intelligence

Focus on your business...

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

Migration Tools & Services



Data Migration Assistant

Rich assessments at scale

Feature recommendations

Schema conversions

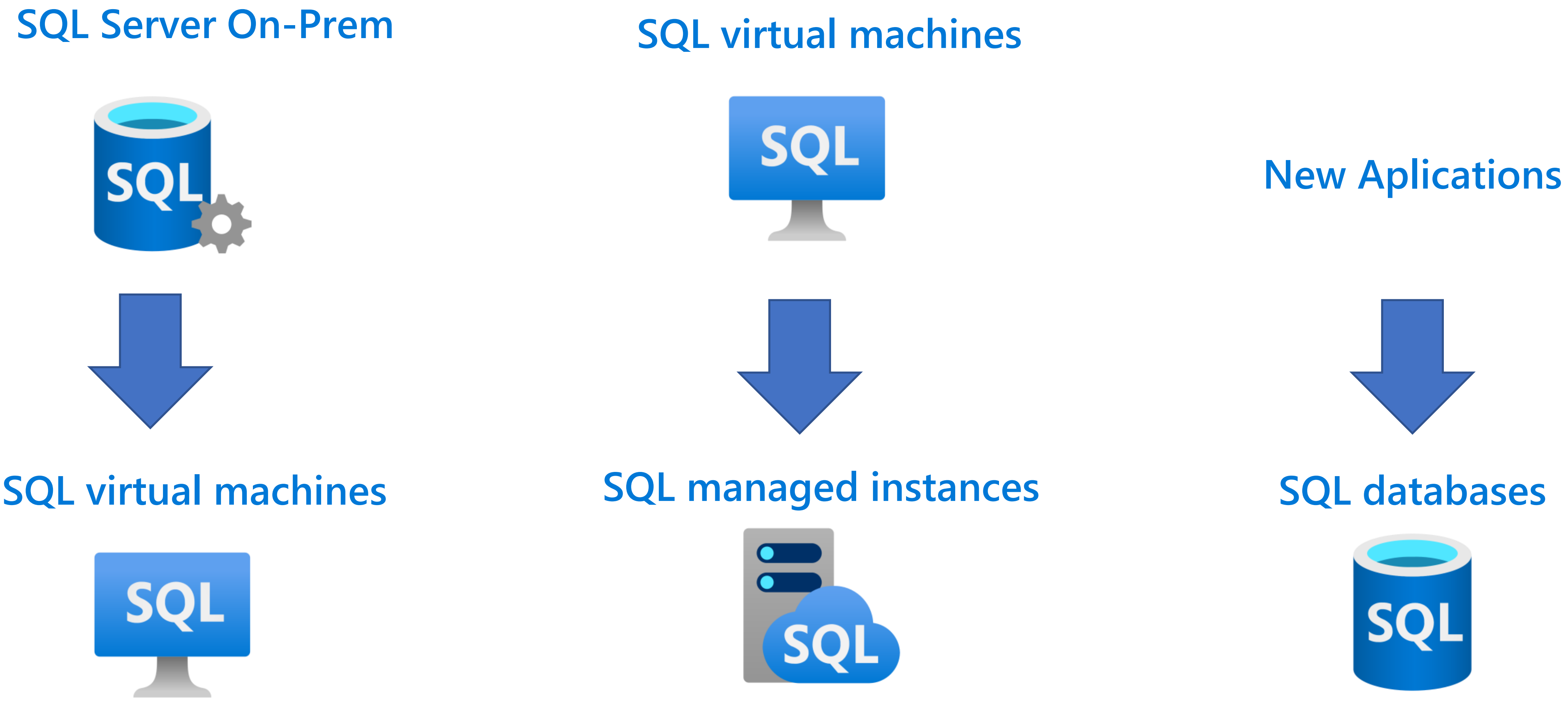
Azure Database Migration Service

MS and non-MS source support

Built for scale and reliability

Built with enterprise security and privacy

Migration Options



SQL Server On-Prem

SQL virtual machines

SQL virtual machines

SQL managed instances

New Aplications

SQL databases

SQL Server on Azure Virtual Machines

Deployment Choices

Marketplace pre-installed SQL Server on Windows or Linux
Install your own SQL Server
Lift and Shift with Azure Migrate (Azure Site Recovery)

Resource Provider

Unlock Licensing and Edition Flexibility
Automated Backups and Security Updates
Manage VMs through Azure SQL in portal

Sizes and Storage Performance

Memory or Storage optimized sizes for best performance
Data and log on Premium Storage Managed Disks
Azure Blob Read Caching for data disks

Tempdb on local SSD
Ultra disks for extremely low latency needs

Networking and Security

Virtual Networks to integrate with on-premises
Advanced Data Security services (Preview)

HADR

Azure VM built-in HA
Azure Storage built-in DR
Azure Backup and Automated backups to Azure Blob Storage
File-Snapshot Backups

Failover Cluster Instance with Azure Premium File Share
Always On Availability Groups with Cloud Witness
Hybrid Availability Group Secondary replicas
HADR on RedHat Linux with Pacemaker and fencing

SQL Server on Azure Virtual Machines

SQL Server on Azure Virtual Machines

Best practices for SQL Server on Azure VMs

VM size: Performance best practices for SQL Server on Azure VMs

Storage: Performance best practices for SQL Server on Azure VMs

Performance best practices for SQL Server in Azure Virtual Machines (Github)

SQL Server on Azure VM documentation

Use Cases (SQL Server on Azure VMs)

Lift and Shift

Easy Migration Path

Compatibility

Azure SQL

SQL Server on Azure Virtual Machines

Azure SQL a fondo

Dia 2

Azure SQL

What is Azure SQL ?

Migrate to Azure SQL

Azure SQL managed instance eases cloud migration

Customer challenge

I want to migrate to the cloud, remove management overhead, but I need instance-scoped features (Service Broker, SQL Server Agent, CLR…)

Solution

Managed instance combines leading security features with SQL Server compatibility and business model designed for on-premises customers

Key features

Single instance or instance pool

SQL Server surface area (vast majority)

Native virtual network support

Fully managed service

On-premise identities enabled with Azure AD and AD Connect

Azure differentiators

Near zero downtime migration using log shipping

Fully managed business continuity with failover groups

Projected return on investment of 212 percent over three years[1]

The best of SQL Server with the benefits of a managed service

Azure SQL Database is built for modern cloud apps

Customer challenge

I want to build modern apps, potentially multi-tenanted, with the highest uptime and predictable performance

Solution

Azure SQL Database is a highly scalable cloud database service with built-in high availability and machine learning

Key features

Single database or elastic pool

Hyperscale storage (100TB+)

Serverless compute

Fully managed service

Private link support

High availability with AZ isolation

Azure differentiators

Industry highest availability SLA of 99.995%

Industry only business continuity SLA with 5 second RPO and 30 second RTO

Price-performance leader for mission-critical workloads while costing up to 86 percent less than AWS RDS (GigaOm)

Azure SQL MI or DB?

Azure SQL managed instance

Single instance

SQL Server surface area (vast majority)

Native virtual network support

Fully managed service

Instance pool

Pre-provision compute resources for migration

Enables cost-efficient migration.

Ability to host smaller instances (2Vcore)

Currently in public preview

Azure SQL Database

Single database

Hyperscale storage (up to 100TB)

Serverless compute

Fully managed service

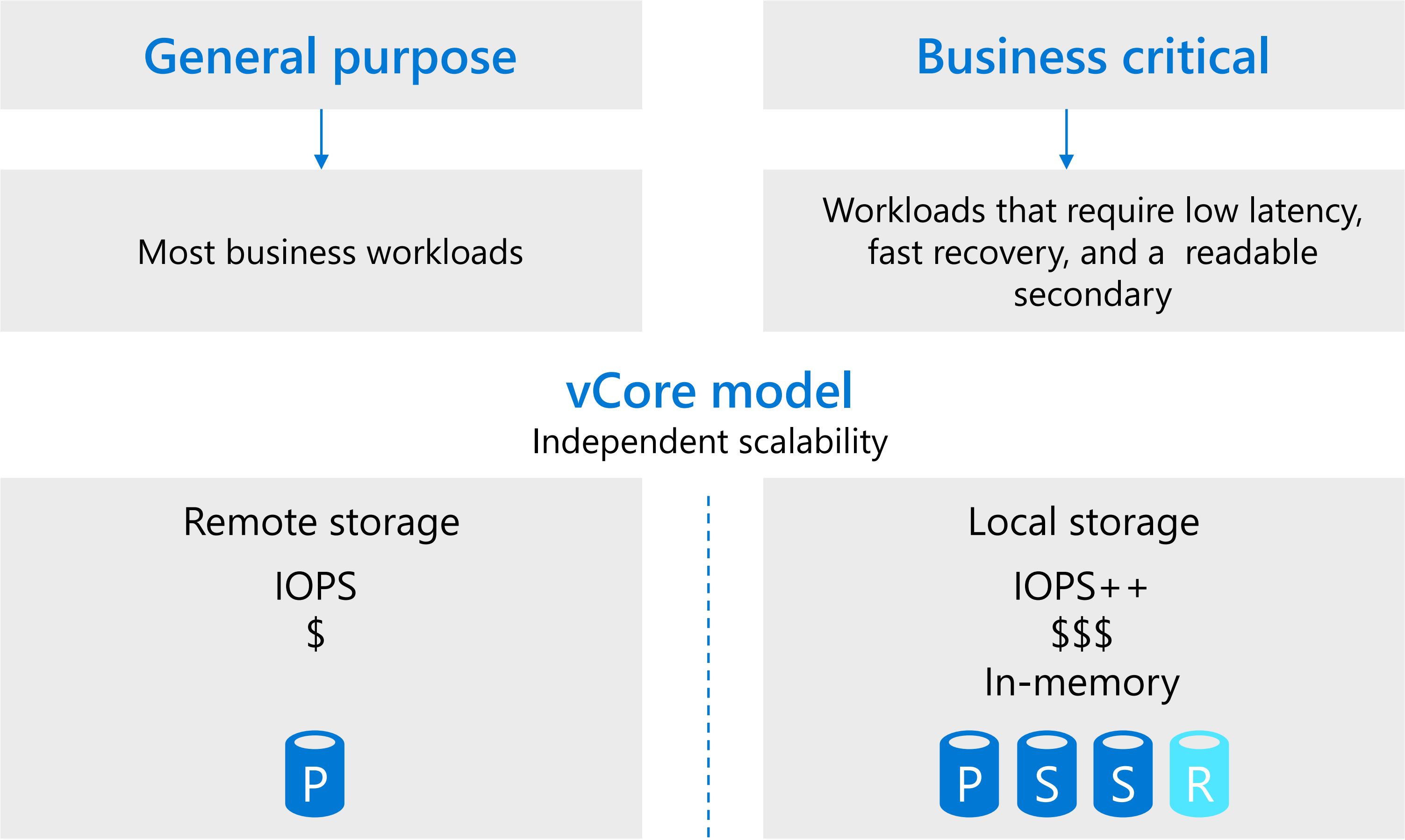
Elastic pool

Resource sharing between multiple databases to price optimize

Simplified performance management for multiple databases

Fully managed service

Service tiers – Managed Instance



General purpose

Most business workloads

Business critical

Workloads that require low latency, fast recovery, and a readable secondary

vCore model

Independent scalability

Remote storage

IOPS

$

P

Local storage

IOPS++

$$$

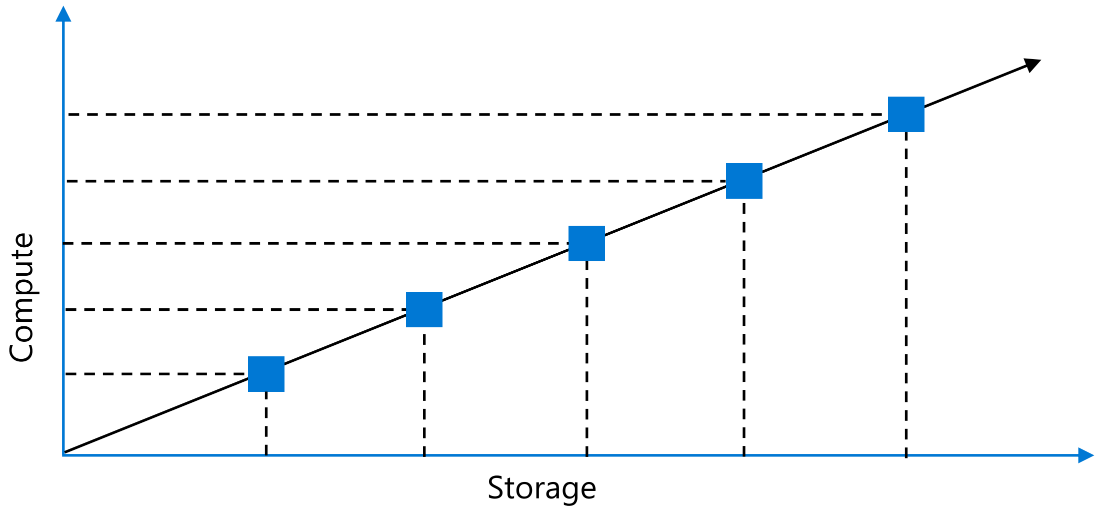
In-memory

P S S R

Purchasing models - Single Database

DTU model

Simple, preconfigured



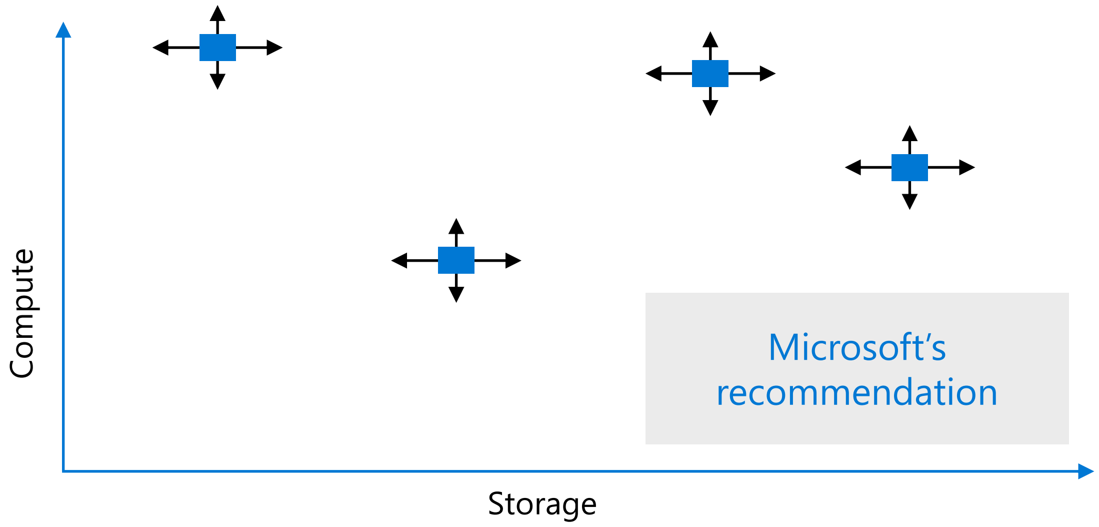
Pre-packaged, bundled unit that represents the database power

Designed for predictable performance, but somewhat inflexible and limited in options

DTU sizing offers simplicity of choice

vCore model

Independent scalability

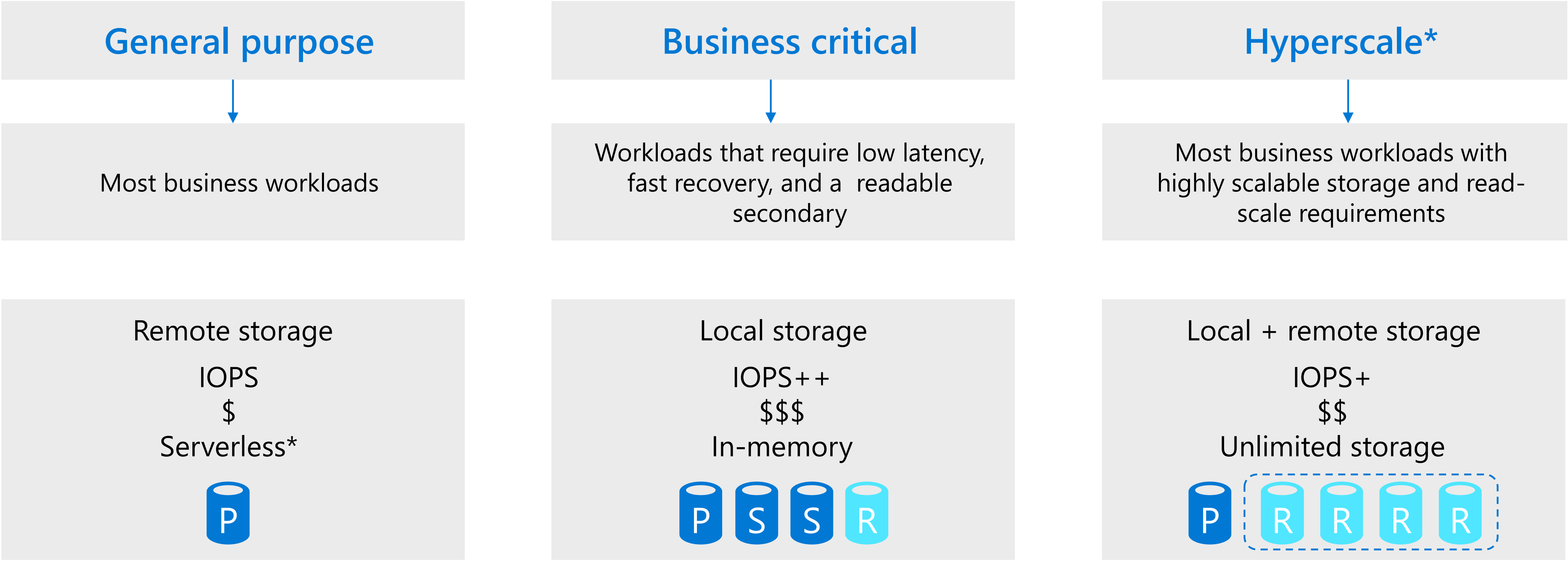


Microsoft's recommendation

This model allows you to independently choose compute and storage resources. It also allows you to use Azure Hybrid Benefit for SQL Server to gain cost savings.

Best for customers who value flexibility, control and transparency

Service tiers – SQL Database



General purpose	Business critical	Hyperscale*
Most business workloads	Workloads that require low latency, fast recovery, and a readable secondary	Most business workloads with highly scalable storage and read-scale requirements
Remote storage	Local storage	Local + remote storage
IOPS	IOPS++	IOPS+
$	$$$	$$
Serverless*	In-memory	Unlimited storage
P	P S S R	P R R R R

*Not in managed instance

Hardware

GEN 5

Gen5

80 vCore limit

Up to 4 TB of local storage

Accelerated Networking is guaranteed

FUTURE

Future

Future hardware generations

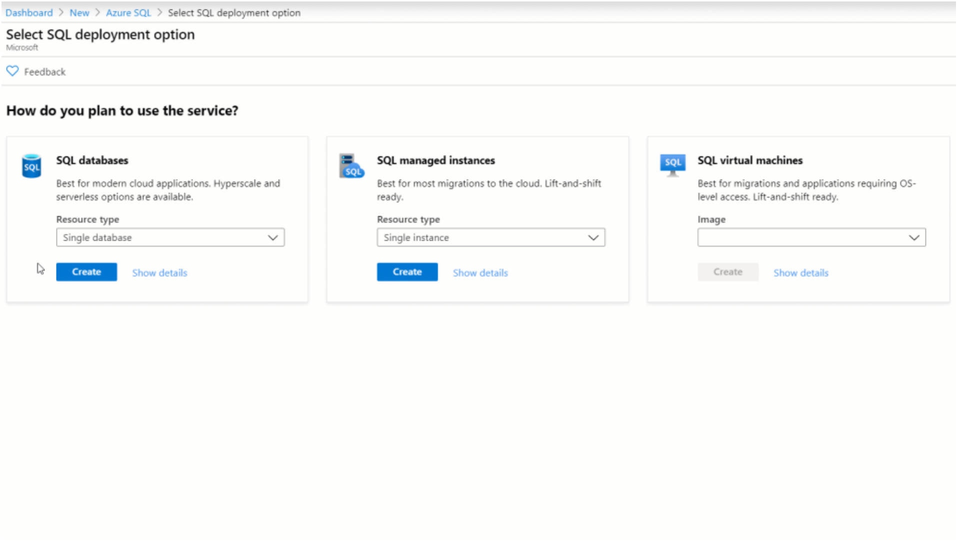
M-series (memory optimized)

- 128 vCores (hyperthreaded)
- 3.8 TB memory
- Business critical (preview)

Fsv2-series (compute optimized)

- 72 vCores (hyperthreaded)
- 3.4 GHz sustained turbo clock speed
- General purpose (preview)

Interfaces for Azure SQL



Select SQL deployment option

Microsoft

How do you plan to use the service?

SQL databases

Best for modern cloud applications. Hyperscale and serverless options are available.

Resource type: Single database

SQL managed instances

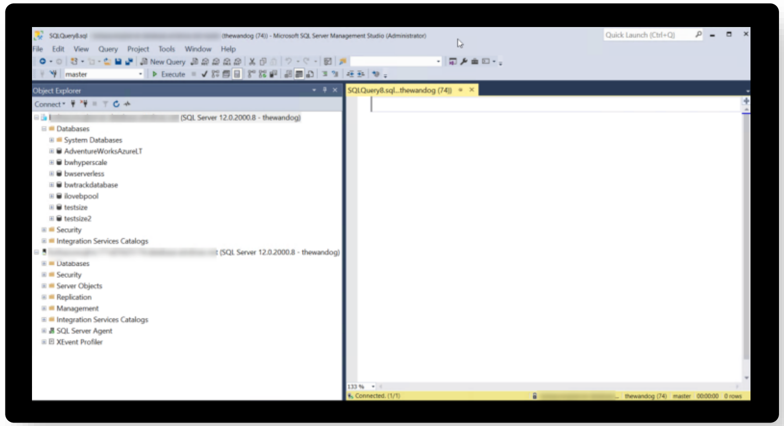
Best for most migrations to the cloud. Lift-and-shift ready.

Resource type: Single instance

SQL virtual machines

Best for migrations and applications requiring OS-level access. Lift-and-shift ready.

Image:

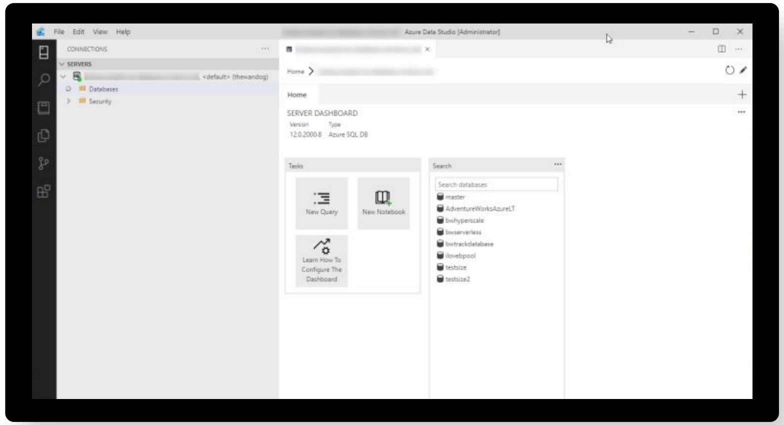


SQLQuery8.sql [redacted] (thewandog (74)) - Microsoft SQL Server Management Studio (Administrator)

master

```
[redacted] (SQL Server 12.0.2000.8 - thewandog)
  Databases
    System Databases
    AdventureWorksAzureLT
    bwhyperscale
    bwserverless
    bwtrackdatabase
    ilovebpool
    testsize
    testsize2
  Security
  Integration Services Catalogs
[redacted] (SQL Server 12.0.2000.8 - thewandog)
  Databases
  Security
  Server Objects
  Replication
  Management
  Integration Services Catalogs
  SQL Server Agent
  XEvent Profiler
```

Connected. (1/1) [redacted] thewandog (74) master 00:00:00 0 rows



[redacted] <default> (thewandog)

- Databases
- Security

SERVER DASHBOARD

Version	Type
12.0.2000.8	Azure SQL DB

- master
- AdventureWorksAzureLT
- bwhyperscale
- bwserverless
- bwtrackdatabase
- ilovebpool
- testsize
- testsize2

T-SQL

Powershell

az cli

REST API

sqlcmd

bcp

Summary

- ✓ Azure SQL has evolved into **the world’s database**
- ✓ **Azure SQL includes** Virtual machine, Managed Instance, and Database
- ✓ **SQL Server on Azure Virtual Machines** is best for 100% lift and shift
- ✓ **Azure SQL Managed Instances:** Database engine instance + power of PaaS
- ✓ **Azure SQL Database** for modern cloud apps providing you the most PaaS capabilities

Azure SQL

Managed Instance and Azure SQL Database

Azure SQL a fondo

Dia 3

What is a Managed Instance

Azure SQL Database Managed Instance is a new capability of Azure SQL Database, providing near 100% compatibility with SQL Server on-premises, providing a native virtual network (VNet) implementation that addresses common security concerns, and a business model favorable for on-premises SQL Server customers. Managed Instance allows existing SQL Server customers to lift and shift their on-premises applications to the cloud with minimal application and database changes. At the same time, Managed Instance preserves all PaaS capabilities (automatic patching and version updates, backup, high-availability), that drastically reduces management overhead and TCO.

Easy migration: nearly 100% like SQL Server

Data migration

- Native backup/restore
- Log shipping (DMS)

Security

- TDE
- SQL Audit
- Row level security
- Always Encrypted

Programmability

- Global temp tables
- Cross-database queries and transactions
- Linked servers
- CLR modules

Operational

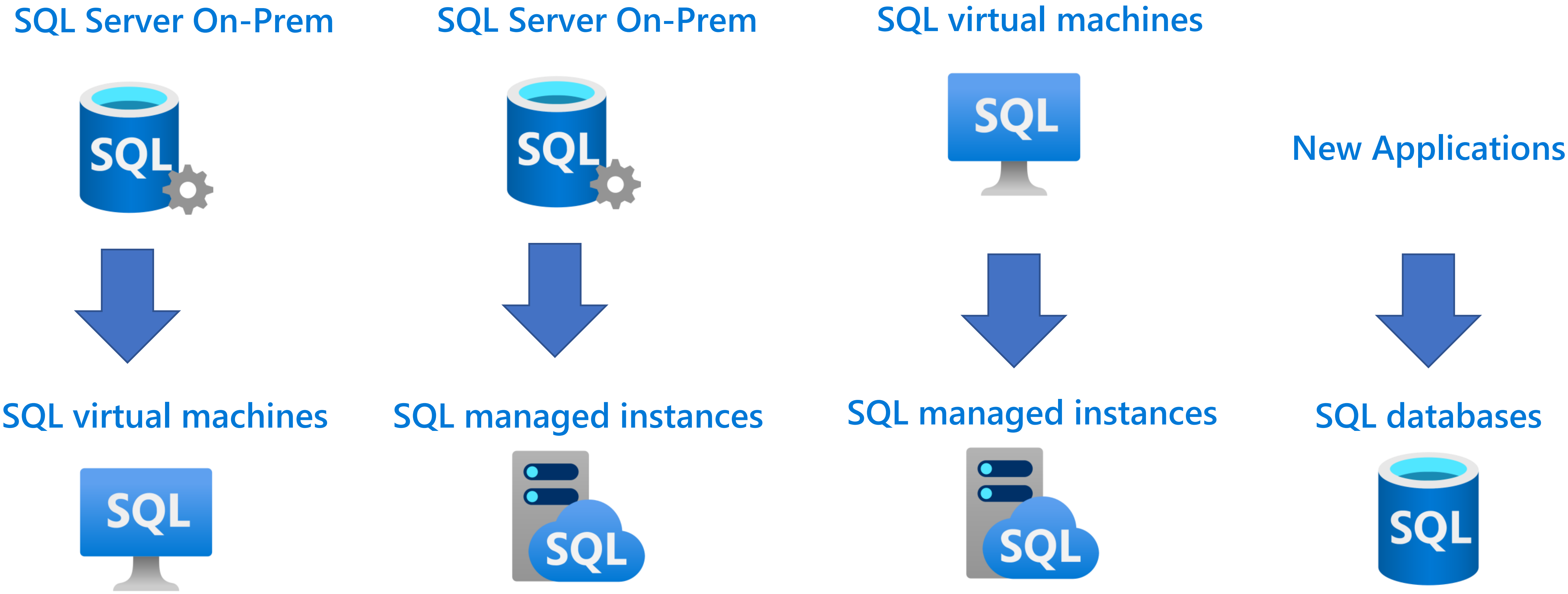
- DMVs & XEvents
- Query Store
- SQL Agent
- DB Mail (external SMTP)

Scenario enablers

- Service Broker
- Change Data Capture
- Transactional Replication

Supports compatibility modes (SQL Server 2005+)

Migration Options



SQL Server On-Prem

SQL virtual machines

SQL Server On-Prem

SQL managed instances

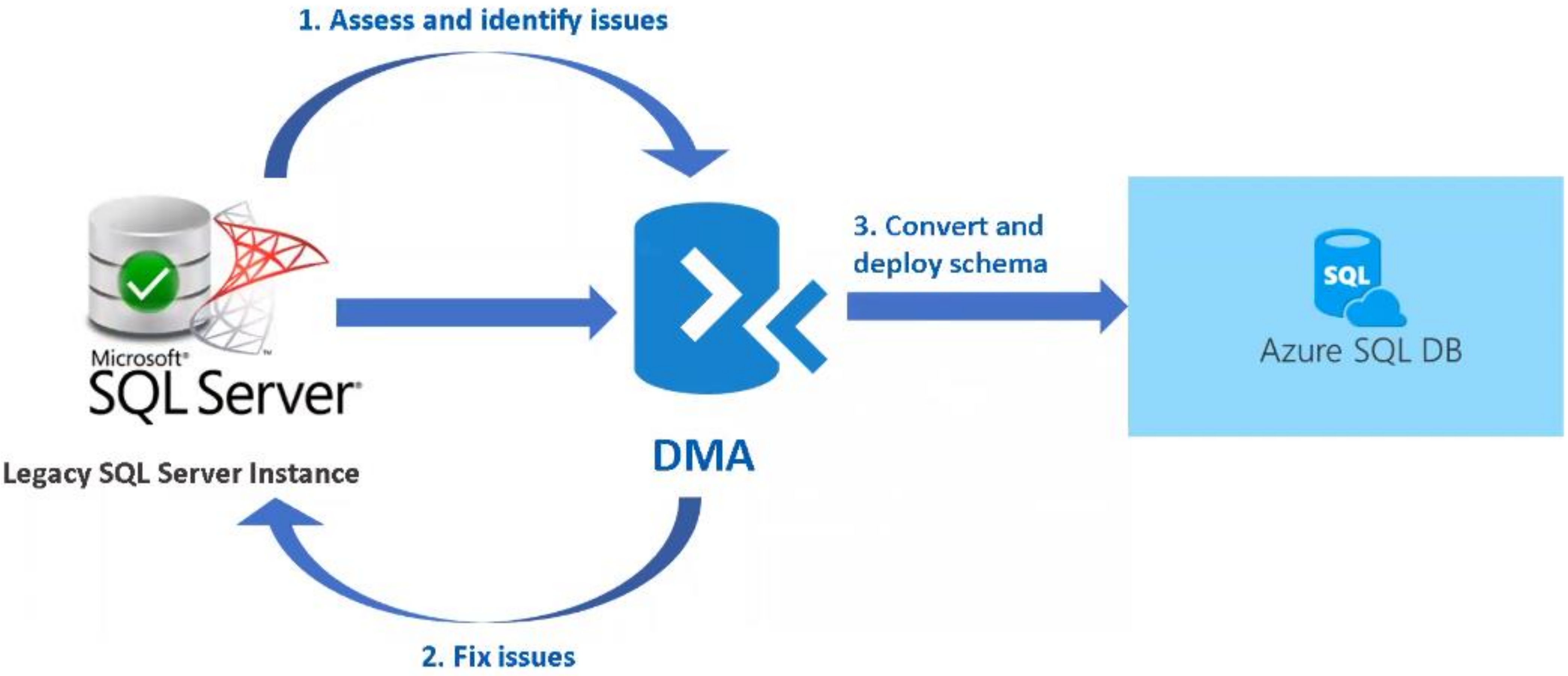
SQL virtual machines

SQL managed instances

New Applications

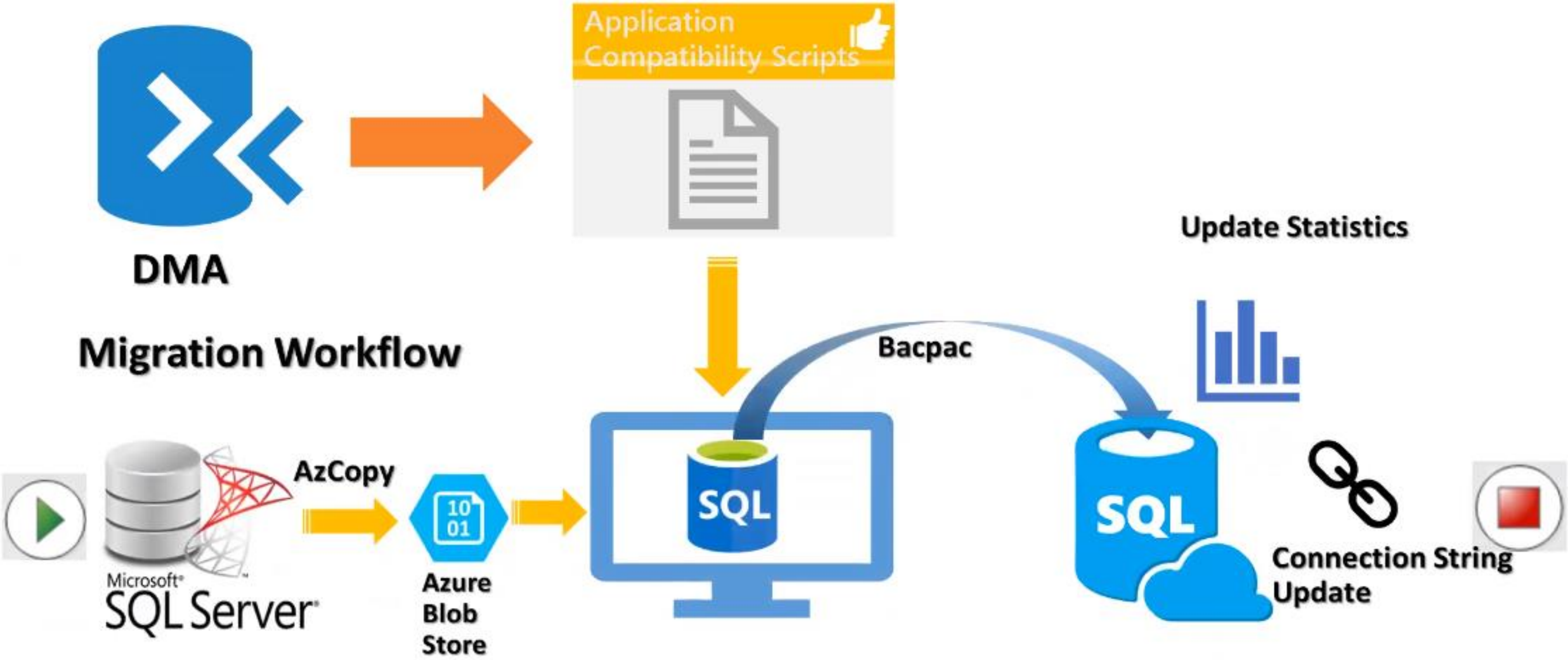
SQL databases

Assess and Convert


1. Assess and identify issues
Microsoft
SQL Server
Legacy SQL Server Instance
DMA
3. Convert and deploy schema
SQL
Azure SQL DB
2. Fix issues

Migration Workflow

Pre-Migration Tasks



DMA

Application Compatibility Scripts

Migration Workflow

Microsoft SQL Server

AzCopy

Azure Blob Store

SQL

Bacpac

SQL

Update Statistics

Connection String Update

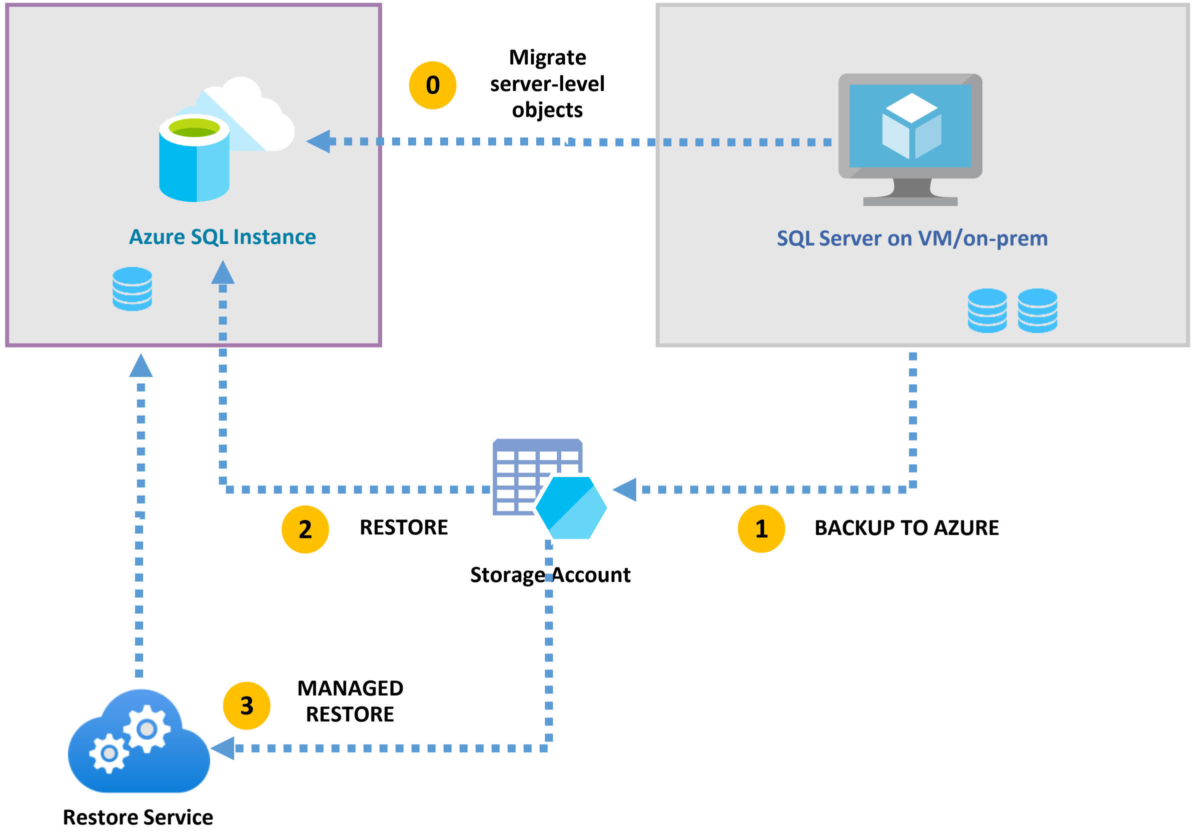
Easy Database Migration

Offline

- Native backup/restore
- BACKUP WITH CHECKSUM

Online

- Data Migration Service
- Replication
- Log shipping



SSAS / SSIS / SSRS

Will **not be installed** side-by-side with Managed Instance

Recommendation: **move to PaaS model**

SQL Server Analysis Service - SSAS

For Tabular Model

Migrate your OLAP models to Azure Analysis Services

Azure Analysis Services

… or run these services in Azure virtual machines

SQL Server Integration Service - SSIS

Migrate your SSIS packages to new SSIS on Azure Data Factory

… or run these services in Azure virtual machines

SQL Server Reporting Service - SSRS

Migrate your reports to Power BI

… or run these services in Azure virtual machines

Use Cases (Managed Instance)

Platform as a Service

Lift and Shift

Easy Migration Path

Compatibility

Autopilot

Use Cases (Azure SQL Database)

Modern Applications

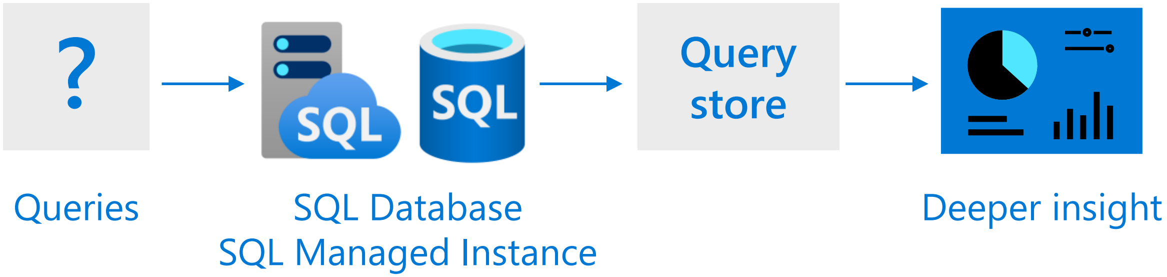
Autopilot

DEMO

Migration

Monitoring and Troubleshooting Performance

- Azure Monitor Metrics, Alerts, and Logs
- Dynamic Management Views
- Extended Events
- Lightweight Query Profiling on by default
- Query Plan Debugging with SET statements
- Query Store on by default
- Performance Visualizations in portal



Dynamic Management Views

Azure SQL Managed Instance

- All SQL Server DMVs available
- sys.server_resource_stats

You will need these

- sys.dm_io_virtual_file_stats
- sys.dm_os_performance_counters
- sys.dm_instance_resource_governance
- sys.dm_user_db_resource_governance

Azure SQL Database

- Common SQL Server DMVs available
- sys.dm_db_resource_stats
- sys.elastic_pool_resource_stats

Geek out

- sys.dm_user_db_resource_governance_internal
- sys.dm_resource_governor_resource_pools_history_ex
- sys.dm_resource_governor_workload_groups_history_ex

Extended events with Azure SQL

Azure SQL Database

- Most common events and actions
- File (Azure Blob Storage), ring_buffer, and counter targets

Azure SQL Managed Instance

- All events, targets, and actions supported
- File targets to Azure Blob Storage
- Azure MI supports all SQL Server events plus Azure specific events

Intelligent Performance

- Query Store (2016)
- Automatic Tuning (2017)
- Adaptive Query Processing (AQP) (2017)
- Intelligent Query Processing (IQP) (2019)
- Columnstore and In-Memory OLTP
- Tempdb Metadata – "It just runs faster" (2019)

Industry leading performance

⚠

Challenge

DBA’s spend most of their time tuning database performance, leading to high operational costs

✓

Solution

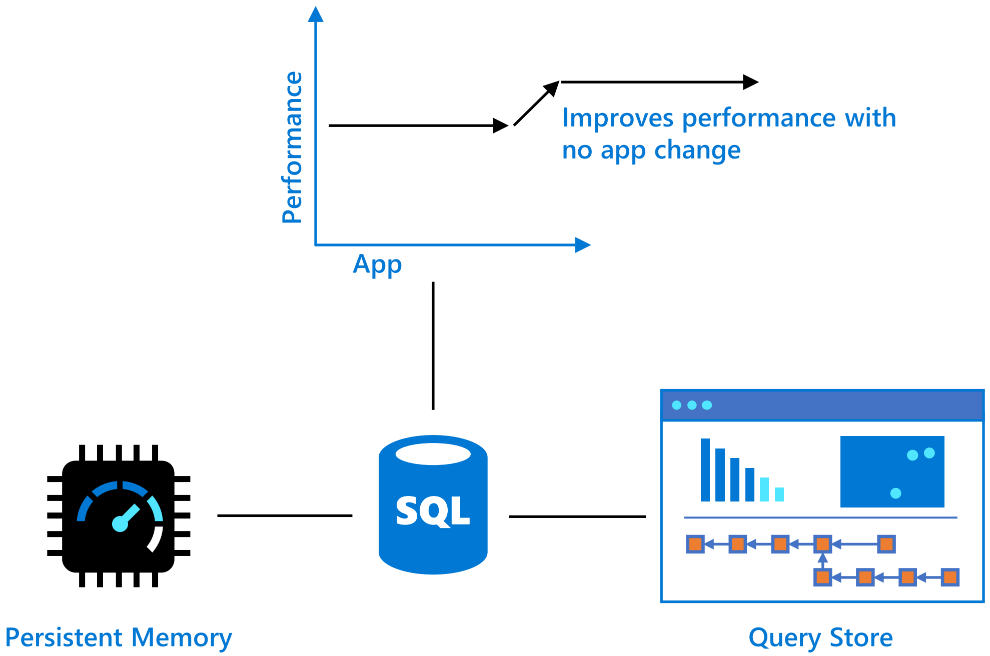
Automation with Intelligent Database capabilities while providing mission critical performance

Gain performance with no app changes with Intelligent Query Processing

Performance insights anytime anywhere with Query Store and lightweight query profiling

Accelerate I/O performance with Persistent Memory

Intelligent Database



Query Store

The SQL Server Query Store feature provides you with insight on query plan choice and performance.

It simplifies performance troubleshooting by helping you quickly find performance differences caused by query plan changes.

Query Store automatically captures a history of queries, plans, and runtime statistics, and retains these for your review.

It separates data by time windows so you can see database usage patterns and understand when query plan changes happened on the server.

Query Store

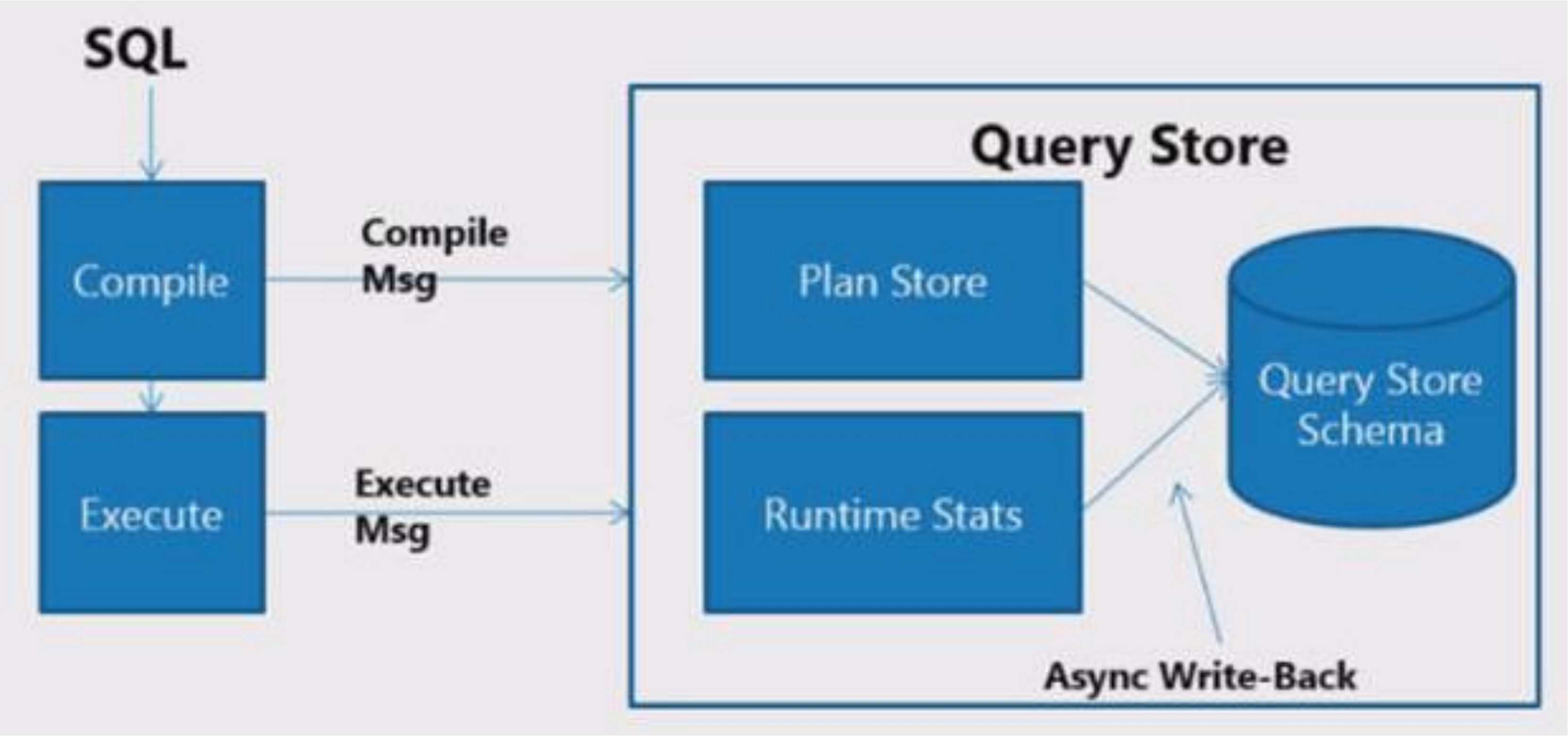
Execution plans for any specific query in SQL Server typically evolve over time due to several different reasons such as statistics changes, schema changes, creation/deletion of indexes, etc.

The procedure cache (where cached query plans are stored) only stores the latest execution plan. Plans also get evicted from the plan cache due to memory pressure. As a result, query performance regressions caused by execution plan changes can be non-trivial and time consuming to resolve.

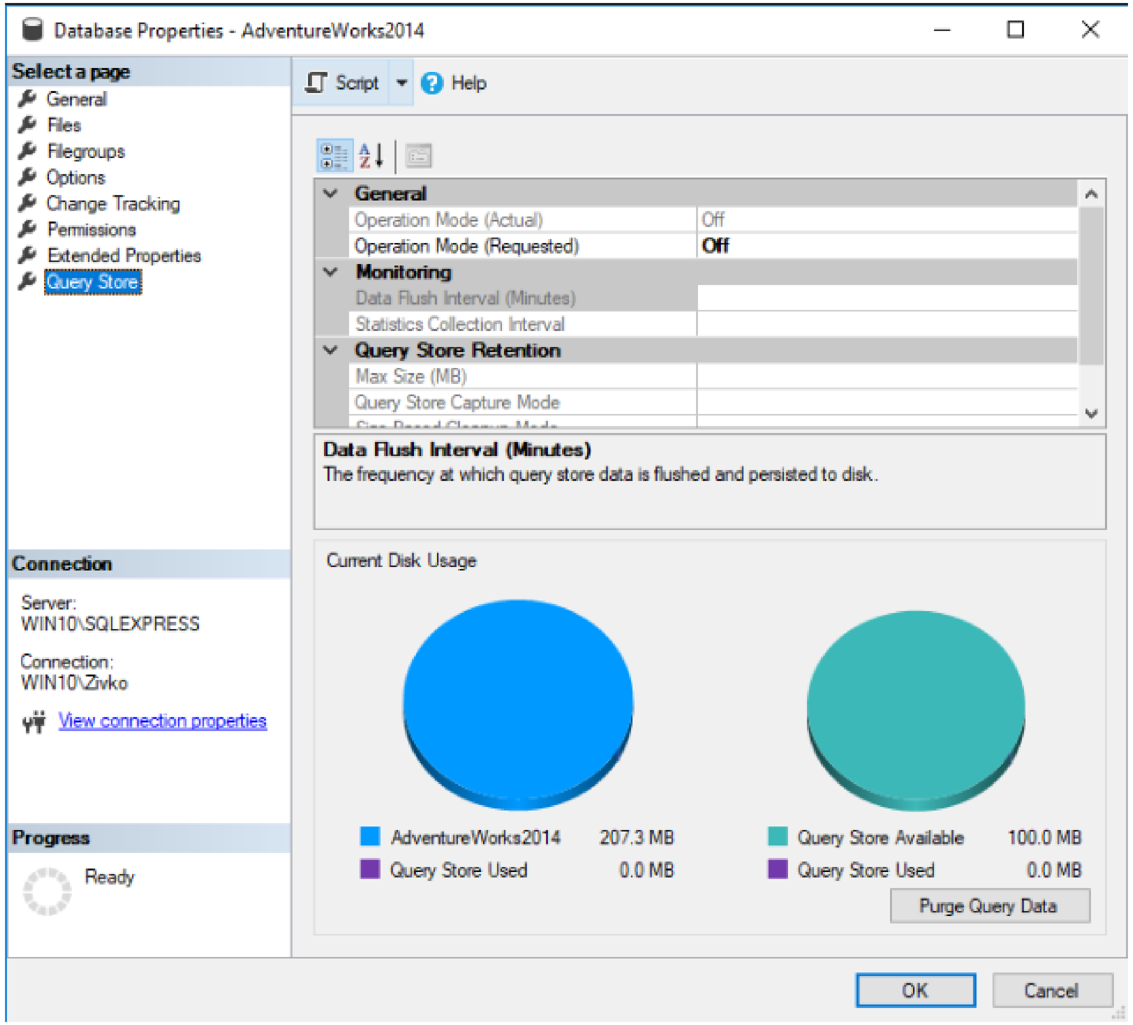
Since the query store retains multiple execution plans per query, it can enforce policies to direct the query processor to use a specific execution plan for a query. This is referred to as plan forcing.

Plan forcing can resolve a query performance regression caused by a plan change in a very short period.

Query Store


SQL
Compile
Execute
Compile Msg
Execute Msg
Query Store
Plan Store
Runtime Stats
Query Store Schema
Async Write-Back

Query Store



General

Operation Mode (Actual)	Off
Operation Mode (Requested)	Off

Monitoring

Data Flush Interval (Minutes)	
Statistics Collection Interval	

Query Store Retention

Max Size (MB)	
Query Store Capture Mode	

Data Flush Interval (Minutes)
The frequency at which query store data is flushed and persisted to disk.

Current Disk Usage

AdventureWorks2014	207.3 MB	Query Store Available	100.0 MB
Query Store Used	0.0 MB	Query Store Used	0.0 MB

Server:
WIN10\SQLEXPRESS

Connection:
WIN10\Zivko

View connection properties

Ready

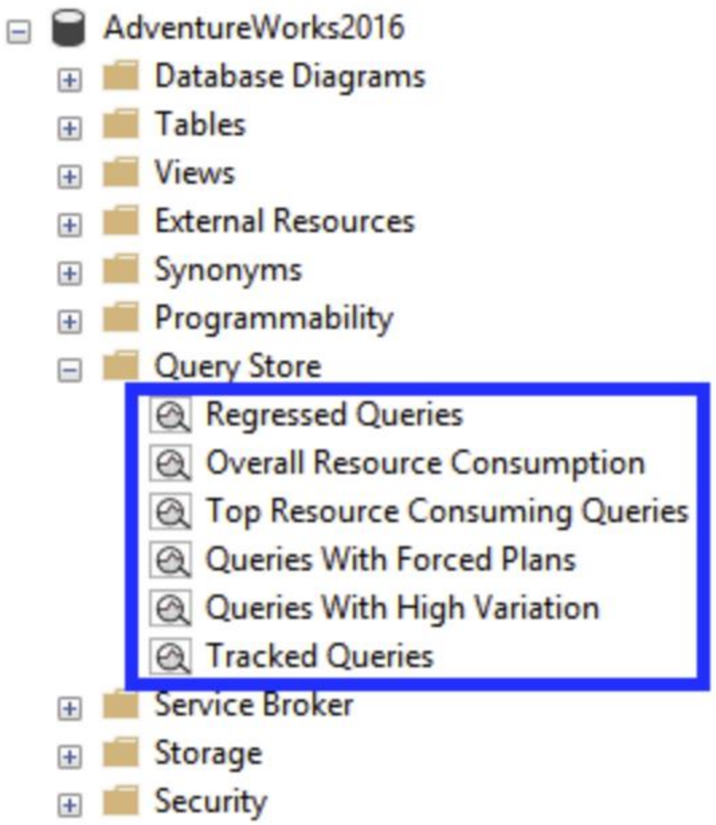
Common scenarios for using Query Store

- Quickly find and fix a plan performance regression by forcing the previous query plan. Fix queries that have recently regressed in performance due to execution plan changes.
- Determine the number of times a query was executed in a given time window, assisting a DBA in troubleshooting performance resource problems.
- Identify top *n* queries (by execution time, memory consumption, etc.) in the past *x* hours.
- Audit the history of query plans for a given query.
- Analyze the resource (CPU, I/O, and Memory) usage patterns for a particular database.
- Identify top n queries that are waiting on resources.
- Understand wait nature for a particular query or plan.

The query store contains three stores:

- a **plan store** for persisting the execution plan information.
- a **runtime stats store** for persisting the execution statistics information.
- a **wait stats store** for persisting wait statistics information.

Query Store



- AdventureWorks2016
  - Database Diagrams
  - Tables
  - Views
  - External Resources
  - Synonyms
  - Programmability
  - Query Store
    - Regressed Queries
    - Overall Resource Consumption
    - Top Resource Consuming Queries
    - Queries With Forced Plans
    - Queries With High Variation
    - Tracked Queries
  - Service Broker
  - Storage
  - Security

ALTER DATABASE <DB Name> SET QUERY_STORE = ON;

EXEC **sp_query_store_force_plan** @query_id = 48, @plan_id = 49;

EXEC **sp_query_store_unforce_plan** @query_id = 48, @plan_id = 49;

Best Practices with Query Store

- Keep Query Store adjusted to your workload
- Verify Query Store is collecting query data continuously
- Set the optimal query capture mode
- Keep the most relevant data in Query Store
- Avoid using non-parameterized queries
- Avoid a DROP and CREATE pattern when maintaining containing objects for the queries
- Check the status of Forced Plans regularly
- Avoid renaming databases if you have queries with Forced Plans
- Use trace flags on mission critical servers to improve recovery from disaster

https://docs.microsoft.com/en-us/sql/relational-databases/performance/best-practice-with-the-query-store?view=sql-server-2017

Automatic Query Tuning

Automatic tuning is a database feature that provides insight into potential query performance problems, recommend solutions, and automatically fix identified problems.

Automatic tuning in SQL Server 2017 notifies you whenever a potential performance issue is detected, and lets you apply corrective actions, or lets the Database Engine automatically fix performance problems.

Automatic tuning in SQL Server 2017 enables you to identify and fix performance issues caused by **SQL plan choice regressions**.

Automatic tuning in Azure SQL Database creates necessary indexes and drops unused indexes.

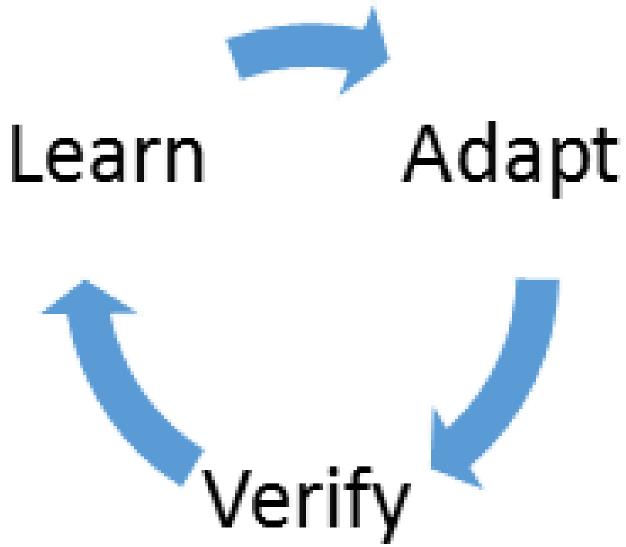
Automatic Query Tuning

Database Engine monitors the queries that are executed on the database and automatically improves performance of the workload. Database Engine has a built-in intelligence mechanism that can automatically tune and improve performance of your queries by dynamically adapting the database to your workload. There are two automatic tuning features that are available:

- **Automatic plan correction** (available in SQL Server 2017 and Azure SQL Database) that identifies problematic query execution plans and fixes SQL plan performance problems.
- **Automatic index management** (available only in Azure SQL Database) that identifies indexes that should be added in your database, and indexes that should be removed.

How does automatic tuning works?

Automatic tuning is a continuous monitoring and analysis process that constantly learns about the characteristic of your workload and identify potential issues and improvements.



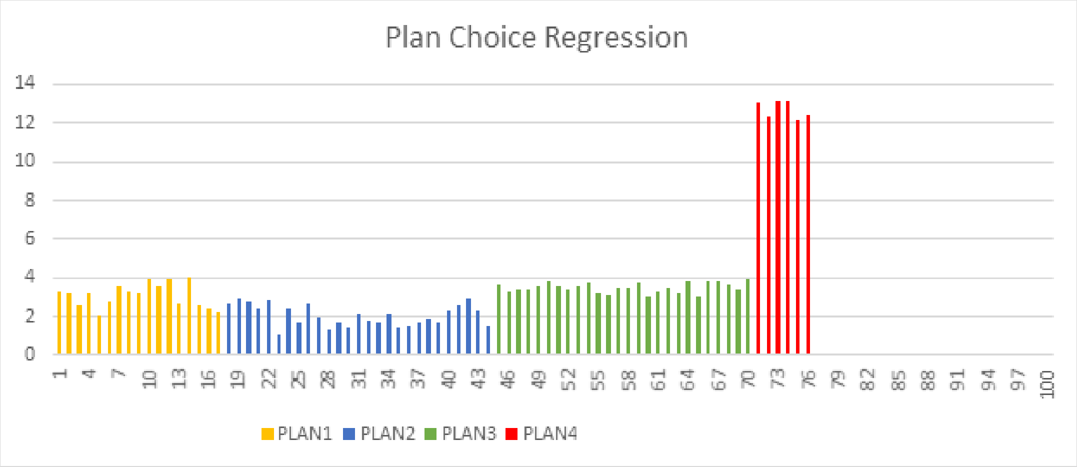
Learn

Adapt

Verify

What is SQL plan choice regression?

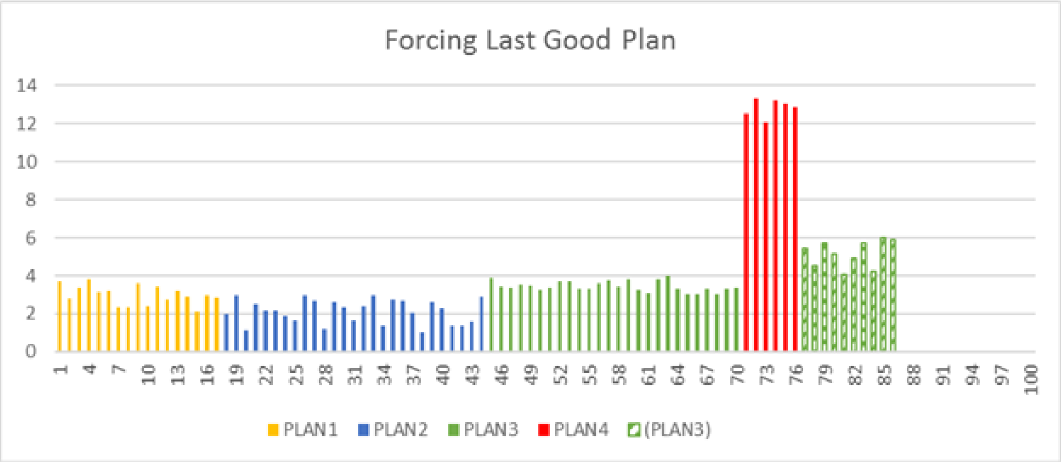
SQL Server Database Engine may use different SQL plans to execute the Transact-SQL queries. Query plans depend on the statistics, indexes, and other factors. The optimal plan that should be used to execute some Transact-SQL query might be changed over time. In some cases, the new plan might not be better than the previous one, and the new plan might cause a performance regression



Whenever you notice the plan choice regression, you should find some previous good plan and force it instead of the current one using **sp_query_store_force_plan** procedure. Database Engine in SQL Server 2017 provides information about regressed plans and recommended corrective actions. Additionally, Database Engine enables you to fully automate this process and let Database Engine fix any problem found related to the plan changes.

Automatic plan choice correction

Database Engine can automatically switch to the last known good plan whenever the plan choice regression is de

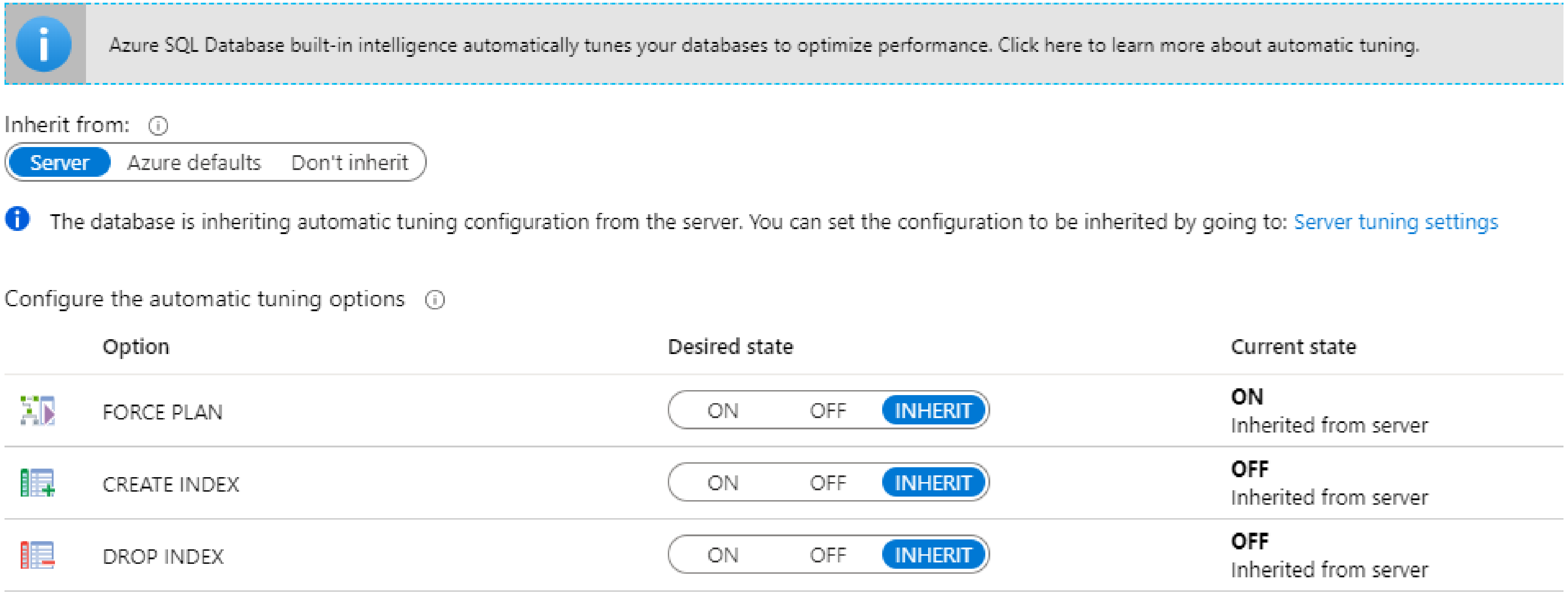


Database Engine automatically detects any potential plan choice regression including the plan that should be used instead of the wrong plan. When the Database Engine applies the last known good plan, it automatically monitors the performance of the forced plan. If the forced plan is not better than the regressed plan, the new plan will be unforced and the Database Engine will compile a new plan. If Database Engine verifies that the forced plan is better than regressed one, the forced plan will be retained until a recompile (for example, on next statistics or schema change) if it is better than the regressed plan.

Note: Any plans auto forced do not persit on a restart of the SQL Server instance.

Automatic index management

Azure SQL Database can perform automatic index tuning. Over time, the database will learn about existing workloads and provide recommendations on adding or removing indexes in order to provide better performance. Like forcing improved query plans, the database can be configured to allow for automatic index creation or removal depending on existing index performance



Azure SQL Database built-in intelligence automatically tunes your databases to optimize performance. Click here to learn more about automatic tuning.

Inherit from: ⓘ

[✓ Server] Azure defaults Don't inherit

The database is inheriting automatic tuning configuration from the server. You can set the configuration to be inherited by going to: Server tuning settings

Configure the automatic tuning options ⓘ

Option	Desired state	Current state
FORCE PLAN	ON OFF [✓ INHERIT]	**ON** Inherited from server
CREATE INDEX	ON OFF [✓ INHERIT]	**OFF** Inherited from server
DROP INDEX	ON OFF [✓ INHERIT]	**OFF** Inherited from server

Automatic index management

- When enabled, the Performance Recommendations blade will identify indexes that can be created or dropped depending on query performance.
- This feature is not available for on-premises databases and only available for Azure SQL Database.
- Creating new indexes can consume resources, and the timing of the index creations is critical to ensure no negative impact is felt on your workloads.
- Azure SQL Database will monitor windows of time to implement new indexes to avoid causing performance issues. If resources are needed for existing workloads and potentially not available to create an index, the tuning action is postponed until such time as resources are available.
- If a newly created index does not result in an increase in query performance, it will be dropped quickly. This monitoring process will validate that any actions taken only helps performance and does not degrade it. If an index is dropped and query performance noticeably degrades, the recently dropped index will be recreated automatically.

Adaptive Query Processing

- Before SQL Server 2017, the behavior of the SQL Server query-processing engine was to analyze the query first, create the plan and then execute it.

- If the plan was somehow not appropriate, the query-processing engine was not able to change it while executing the query or even after it.

- Sometimes the query execution plans made by SQL Server are not appropriate.

Adaptive Query Processing

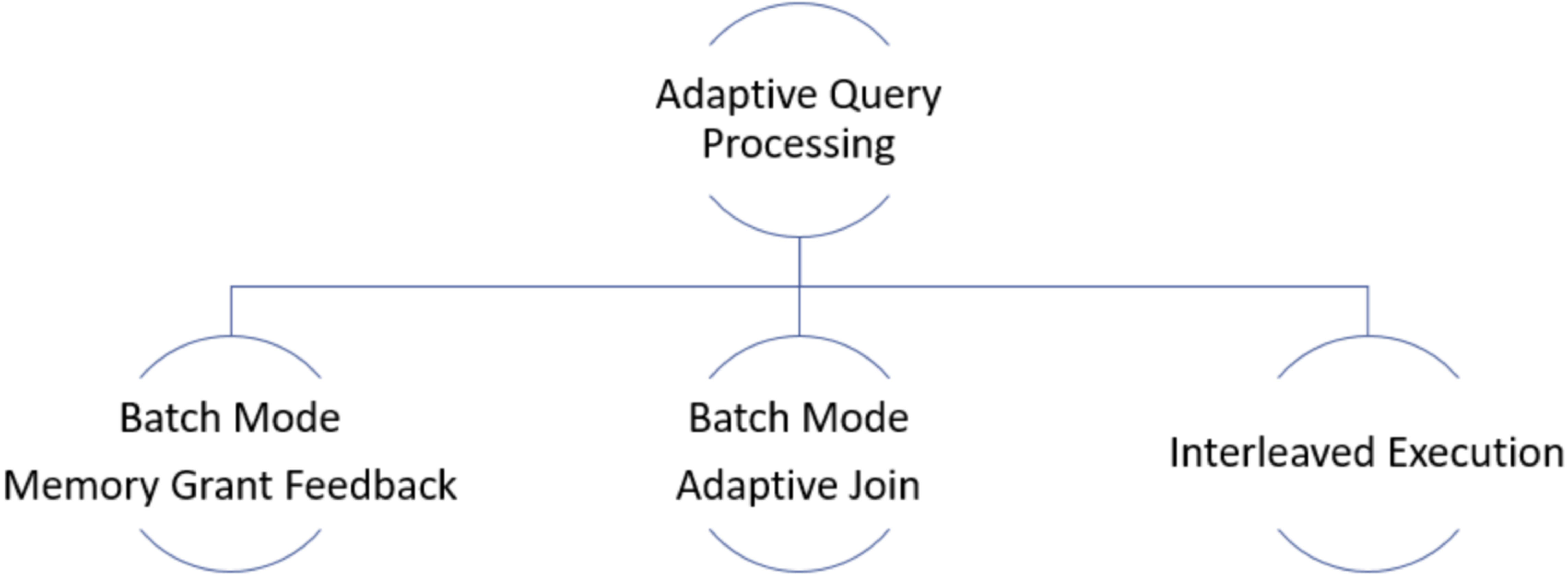
There are number of reasons behind poorly designed execution plan.

- Lack of appropriate indexes
- Outdated statistics
- In-appropriate query execution plans cached with outdated values are stored
- Poorly written codes

There are two ways to fix these problems.

- Provide more relevant and accurate information about the query
- re-write the code so that it may perform in a better way.

Adaptive Query Processing



Adaptive Query Processing

Batch Mode Memory Grant Feedback

Batch Mode Adaptive Join

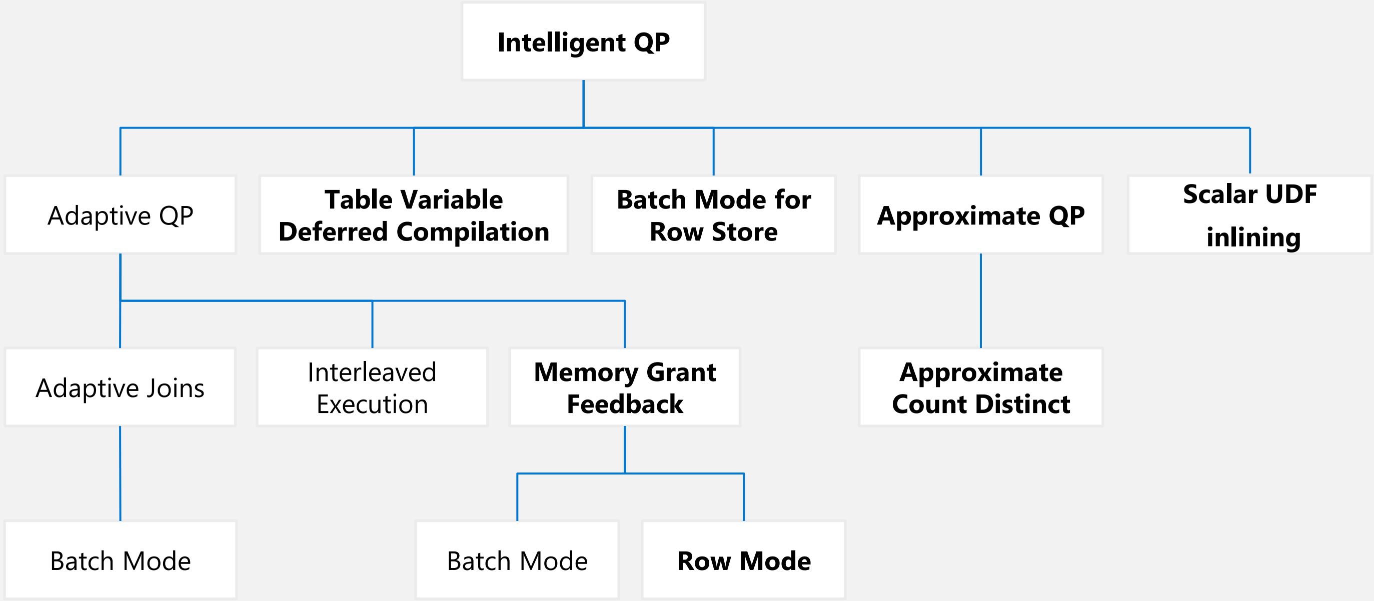
Interleaved Execution

Mission critical performance

The intelligent database

- Intelligent Query Processing
- Gain performance insights anytime and anywhere with Lightweight Query Profiling
- Accelerating I/O performance with Persistent Memory
- Hybrid Buffer Pool
- Tempdb: It Just Runs Faster

The Intelligent Query Processing feature family



Intelligent QP

Adaptive QP

Table Variable Deferred Compilation

Batch Mode for Row Store

Approximate QP

Scalar UDF inlining

Adaptive Joins

Interleaved Execution

Memory Grant Feedback

Approximate Count Distinct

Batch Mode

Batch Mode

Row Mode

Bold indicates new and improved features in SQL Server 2019

Intelligent Query Processing

dbcompat to enable

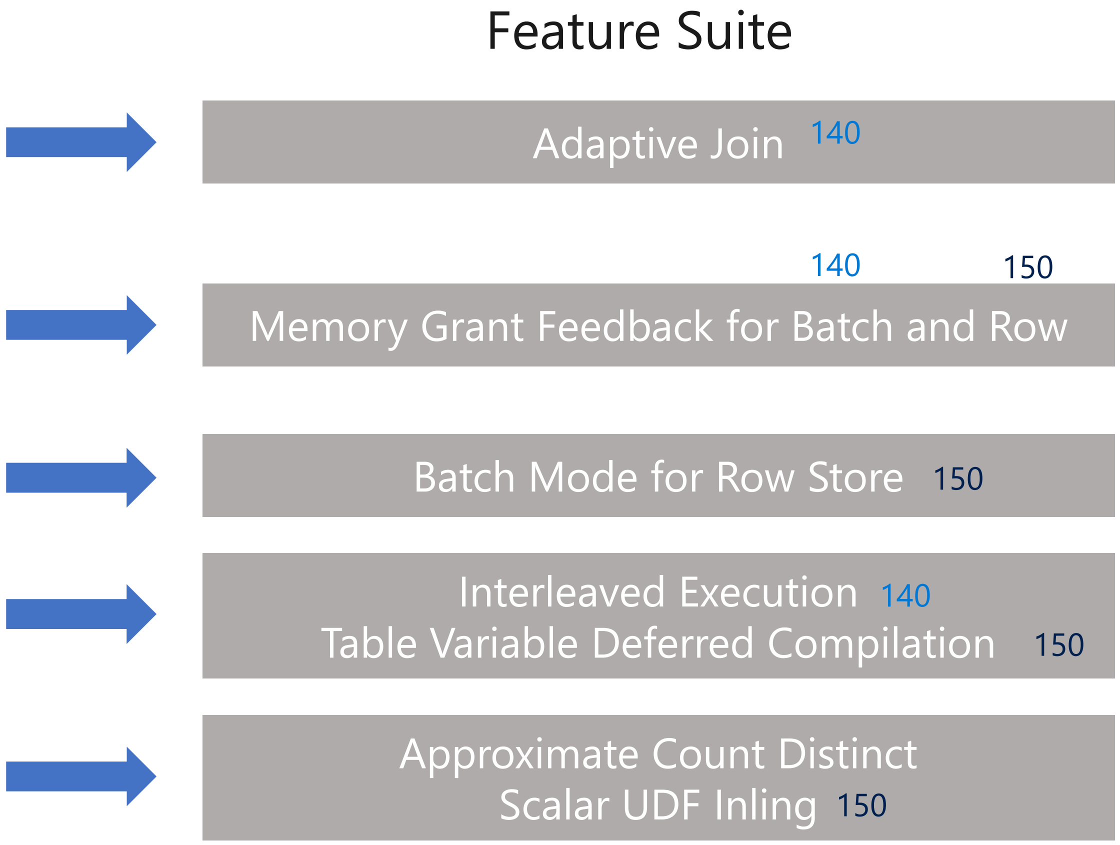
140	SQL Server 2017
150	SQL Server 2019

The problem

Build a query processor to work and adapt to any type of workload with no application changes required

The Solution(s)

- Build intelligent, adaptable operators
- Modify query plans in cache based on previous execution
- Expand batch mode
- Execution data drives downstream compilation
- Smarter query processing



Feature Suite

Adaptive Join 140

140 150
Memory Grant Feedback for Batch and Row

Batch Mode for Row Store 150

Interleaved Execution 140
Table Variable Deferred Compilation 150

Approximate Count Distinct
Scalar UDF Inling 150

Lightweight Query Profiling

The problem

I want to see the details of a query plan at the operator level for any **active** executing query

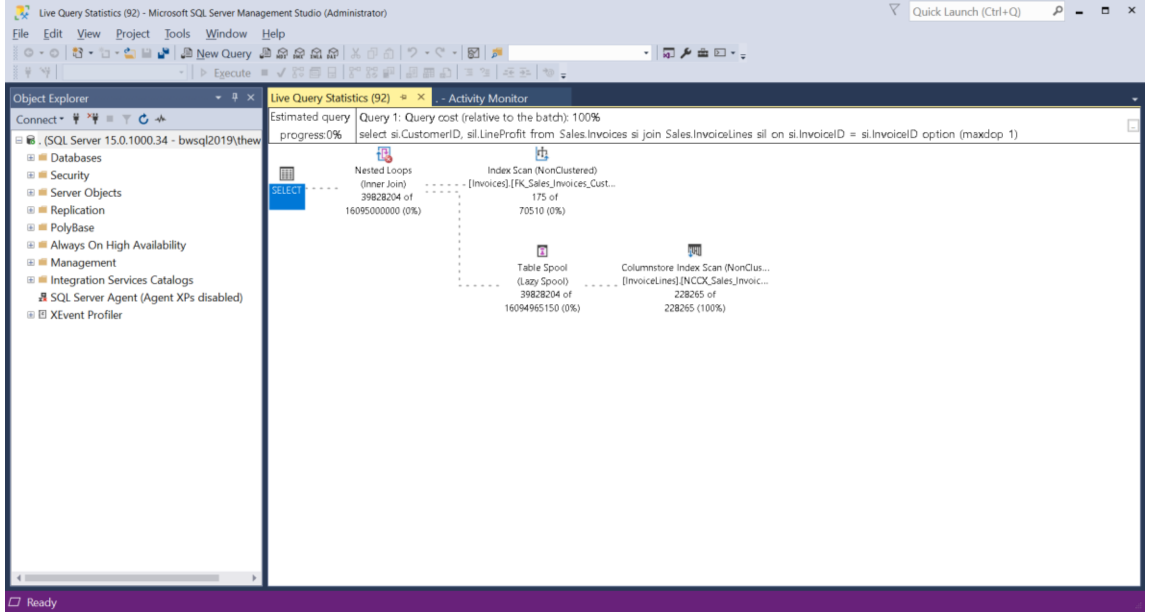
dm_exec_query_profiles
dm_exec_query_statistics_xml

SQL Server 2016 SP1/2017

- Trace flag 7412
- XEvent query_thread_profile

SQL Server 2019

- On by default. No knobs required



Live Query Statistics (92) - Microsoft SQL Server Management Studio (Administrator)

Estimated query progress:0%

Query 1: Query cost (relative to the batch): 100%

```
select si.CustomerID, sil.LineProfit from Sales.Invoices si join Sales.InvoiceLines sil on si.InvoiceID = si.InvoiceID option (maxdop 1)
```

Tempdb Just Runs Faster

The problem(s)

High multi-user rates of tempdb usage can lead to latency due to….

allocation page latch waits – Multiple users needing to allocate pages for temp tables

system table page latch waits – High rates of create/drop require system table modifications

The Solution

- Create multiple files to partition allocation pages
- SQL Server 2016+ creates multiple tempdb files during setup
- Start with 8 and add by 4 until concurrency alleviated
- But…what about system tables?

The SQL 2019 Solution

- Key tempdb system tables become SCHEMA_ONLY memory optimized tables
- Latch and lock free
- Turn on with ALTER SERVER CONFIGURATION
- This is NOT user data just metadata so memory requirements small

DATABASE SCOPED CONFIGURATION

- Enables several database configuration settings at the **individual database** level.
- Available in Azure SQL Database and in SQL Server beginning with SQL Server 2016

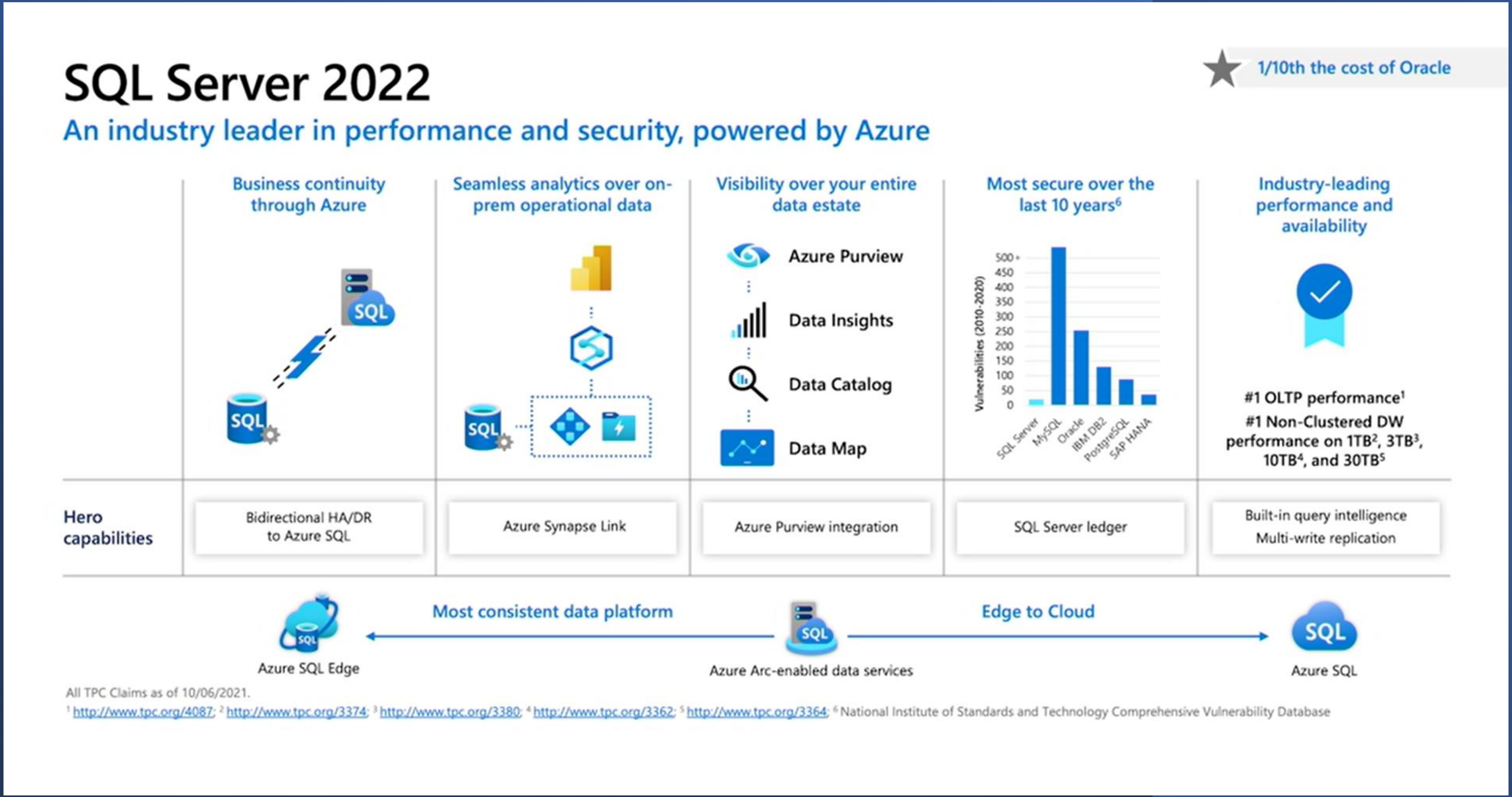
```
USE MYDATABASE
GO
ALTER DATABASE SCOPED CONFIGURATION SET MAXDOP = 1 ;
```

https://docs.microsoft.com/en-us/sql/t-sql/statements/alter-database-scoped-configuration-transact-sql?view=sql-server-ver15

DEMO

Performance features

Hybrid data services
Announcing
SQL Server 2022



SQL Server 2022

An industry leader in performance and security, powered by Azure

★ 1/10th the cost of Oracle

	Business continuity through Azure	Seamless analytics over on-prem operational data	Visibility over your entire data estate	Most secure over the last 10 years[6]	Industry-leading performance and availability
			Azure Purview Data Insights Data Catalog Data Map		#1 OLTP performance[1] #1 Non-Clustered DW performance on 1TB[2], 3TB[3], 10TB[4], and 30TB[5]
Hero capabilities	Bidirectional HA/DR to Azure SQL	Azure Synapse Link	Azure Purview integration	SQL Server ledger	Built-in query intelligence Multi-write replication

Most consistent data platform

Edge to Cloud

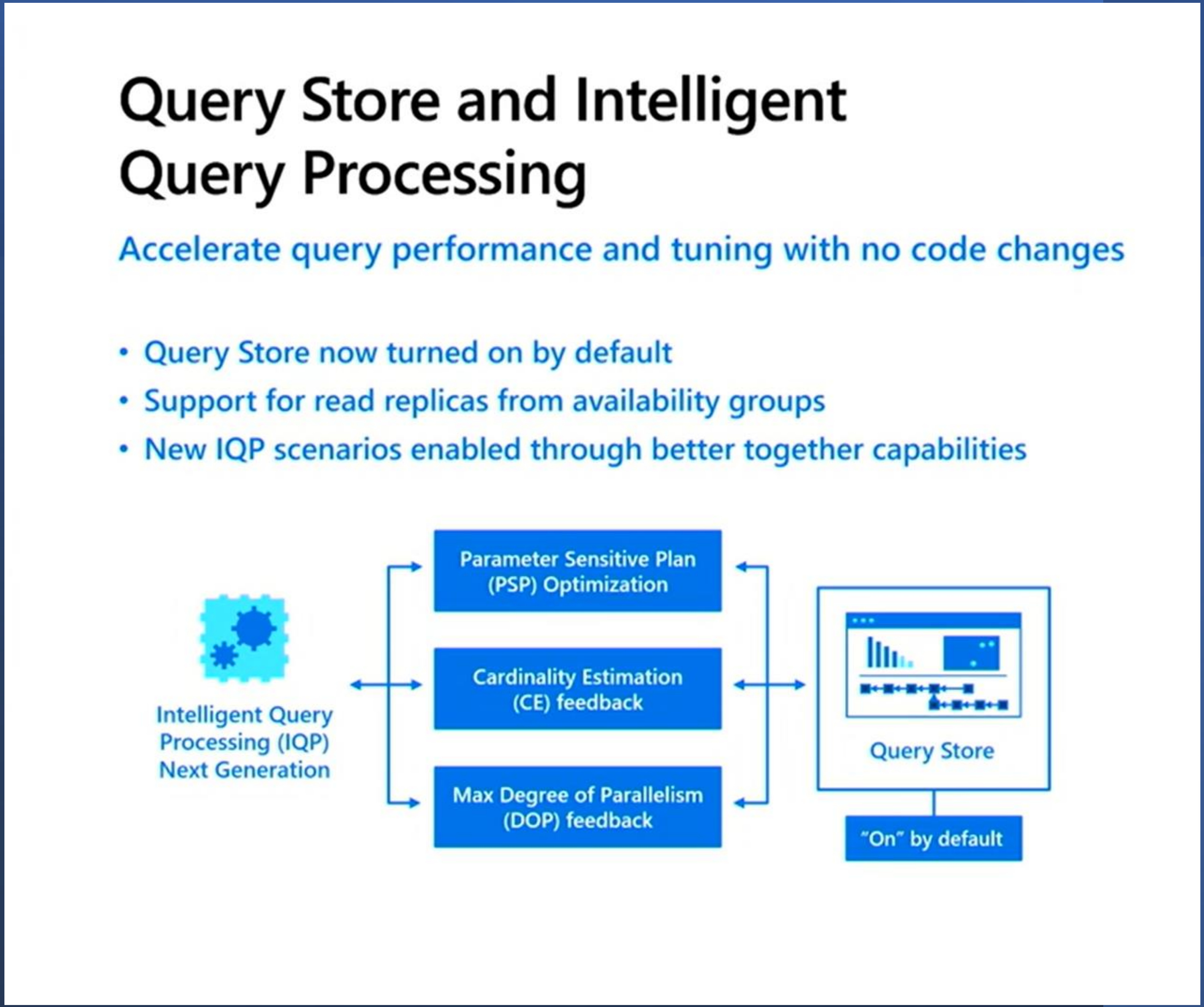
Azure SQL Edge

Azure Arc-enabled data services

Azure SQL

All TPC Claims as of 10/06/2021.

[1] http://www.tpc.org/4087; [2] http://www.tpc.org/3374; [3] http://www.tpc.org/3380; [4] http://www.tpc.org/3362; [5] http://www.tpc.org/3364; [6] National Institute of Standards and Technology Comprehensive Vulnerability Database



Query Store and Intelligent Query Processing

Accelerate query performance and tuning with no code changes

- Query Store now turned on by default
- Support for read replicas from availability groups
- New IQP scenarios enabled through better together capabilities

Intelligent Query Processing (IQP) Next Generation

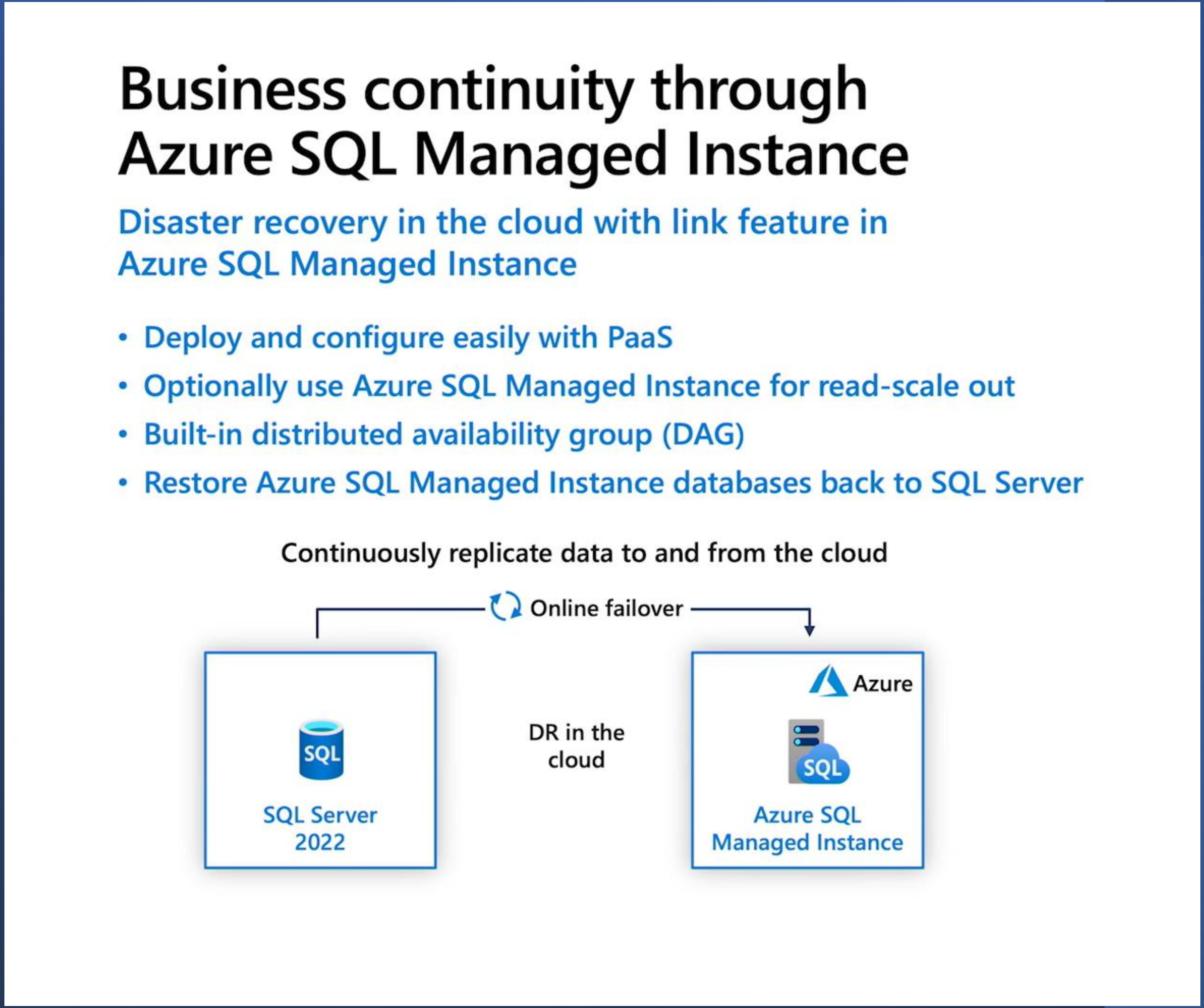
Parameter Sensitive Plan (PSP) Optimization

Cardinality Estimation (CE) feedback

Max Degree of Parallelism (DOP) feedback

Query Store

"On" by default



Business continuity through Azure SQL Managed Instance

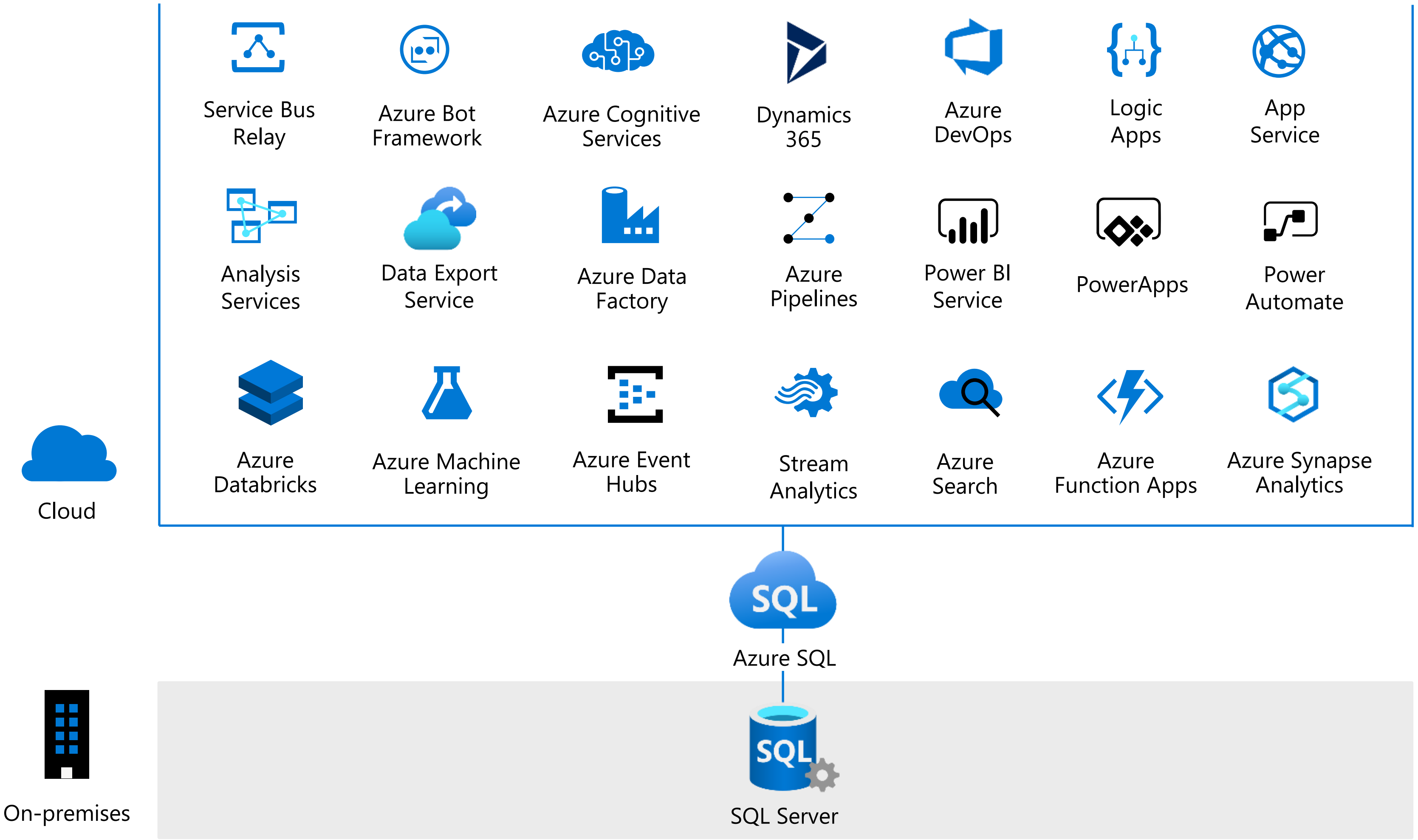
Disaster recovery in the cloud with link feature in Azure SQL Managed Instance

- Deploy and configure easily with PaaS
- Optionally use Azure SQL Managed Instance for read-scale out
- Built-in distributed availability group (DAG)
- Restore Azure SQL Managed Instance databases back to SQL Server

Continuously replicate data to and from the cloud

Building modern apps with Azure SQL

- IoT
- Analytics
- Streaming
- Visualizations
- Automation
- Notification
- Alerting
- Web/Mobile



Service Bus Relay

Azure Bot Framework

Azure Cognitive Services

Dynamics 365

Azure DevOps

Logic Apps

App Service

Analysis Services

Data Export Service

Azure Data Factory

Azure Pipelines

Power BI Service

PowerApps

Power Automate

Azure Databricks

Azure Machine Learning

Azure Event Hubs

Stream Analytics

Azure Search

Azure Function Apps

Azure Synapse Analytics

Cloud

Azure SQL

On-premises

SQL Server

Keep Learning

Azure SQL fundamentals - Learn

QR: **https://cutt.ly/ngnX9ob**

Azure SQL a fondo

javier_vill

javiervillegas

sql-javier-villegas.blogspot.com.ar

javier.ignacio.villegas@gmail.com

MUG

THANK YOU!!

GRACIAS!!

PASS SQL ARGENTINA

GroupBy

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Azure COMMUNITY CONFERENCE

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PASS MARATHON

24HOURS OF PASS

PASS GLOBAL SPANISH VIRTUAL CHAPTER

SQL SATURDAY LA

PASS SQLSATURDAY AUCKLAND

PASS SQLSATURDAY ALBANY | JULY 25 2020

PASS SQLSATURDAY SALVADOR | 17 OCT 2020

PASS SQLSATURDAY LOS ANGELES | JUN 13 2020

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SFSSUG South Florida SQL Server User Group

Microsoft Reactor

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#1000 PASS SQLSATURDAY OREGON | OCT 24 2020

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Michiana PASS

Microsoft TRAINING TECH DAYS Una apuesta al talento colombiano

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It's SQL FRIDAY

GLOBAL AI COMMUNITY ON VIRTUAL TOUR

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Microsoft Data and AI South Florida Data - Artificial Intelligence - Internet of Things

COVID-19 JULY 2020 IN SUPPORT OF unicef 2020 TWENTY LIGHTUP VIRTUAL CONFERENCE 09:00 AM EST | 01:00 PM GMT | 06:30 PM IST 24 Hours of Microsoft Technologies Learning & Fund Raising Event To Fight COVID-19