

SQL Server 2019 New Features



SQL ARGENTINA PASS



javier.ignacio.villegas@gmail.com



[@javier_vill](https://twitter.com/@javier_vill)



[javiervillegas](https://www.linkedin.com/in/javiervillegas)



sql-javier-villegas.blogspot.com.ar

Javier Villegas

Global DBA Manager at Mediterranean Shipping Company

Involved with the Microsoft SQL Server since early versions

Specialization in SQL Server Administration, Performance Tuning and High Availability

Microsoft MVP Data Platform

MCP and MCTS

Blogger and MSDN Forums contributor

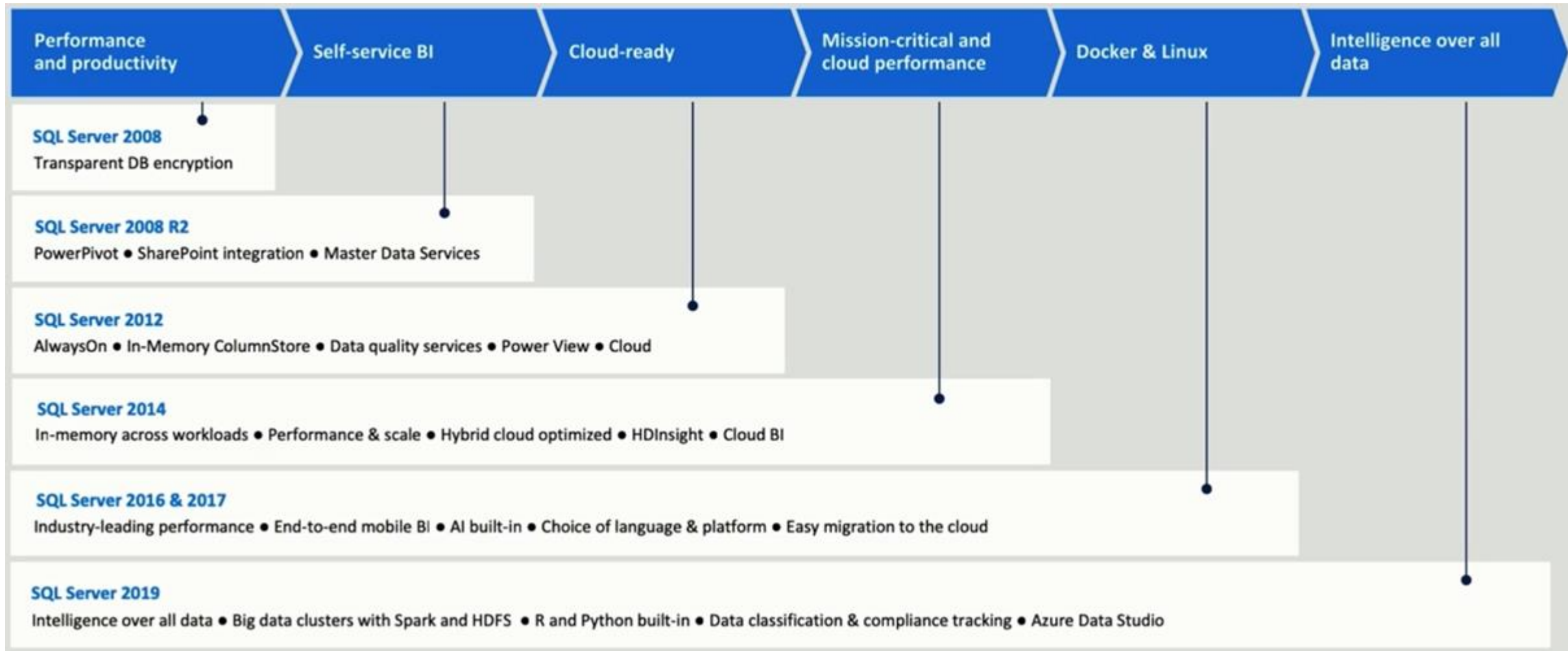
Technical Speaker

NetConf , SQL PASS, 24 HOP, SQL Saturdays and PASS Virtual Groups

GroupBy , DataPlatformGeeks and Azure Global Bootcamp

@sqlargentina

The evolution of SQL Server



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

Azure SQL Database Edge ^{PREVIEW}

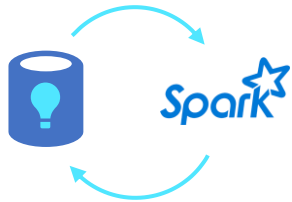
Small-footprint, edge-optimized data engine
with built-in AI



SQL Server 2019

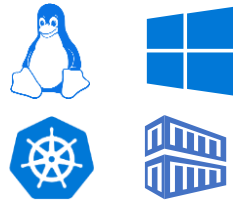
Industry-leading performance and security, with intelligence over all your data

Intelligence over any data



AI and Machine Learning over all data with the power of SQL and Spark

Choice of platform, language and container



T-SQL
Java
C/C++

PHP
Node.js
C#/VB.NET

Python
Ruby

Industry-leading performance and availability

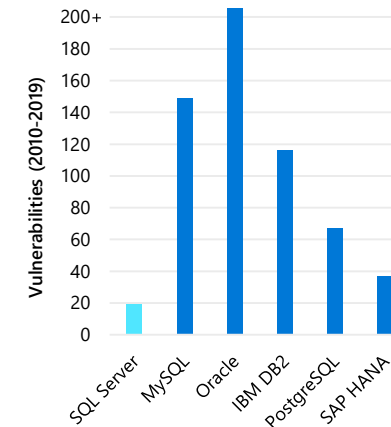


#1 OLTP performance¹

#1 DW performance on 1TB², 3TB³, 10TB⁴, and **30TB**⁵

Intelligent Database

Most secure over the last 9 years⁶



Insights in minutes on any device



The best of Power BI and SQL Server Reporting Services with Power BI Report Server



Edge

In-memory across all workloads



Private cloud

1/10th the cost of Oracle

Most consistent data platform



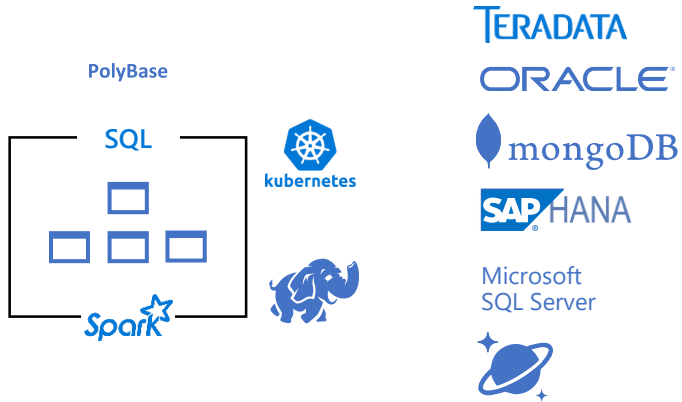
Public cloud

All TPC Claims as 11/3/2019.

¹ <http://www.tpc.org/4081>; ² <http://www.tpc.org/3331>; ³ <http://www.tpc.org/3336>; ⁴ <http://www.tpc.org/3337>; ⁵ <http://www.tpc.org/3345>; ⁶ National Institute of Standards and Technology Comprehensive Vulnerability Database

SQL Server 2019 solves modern data challenges

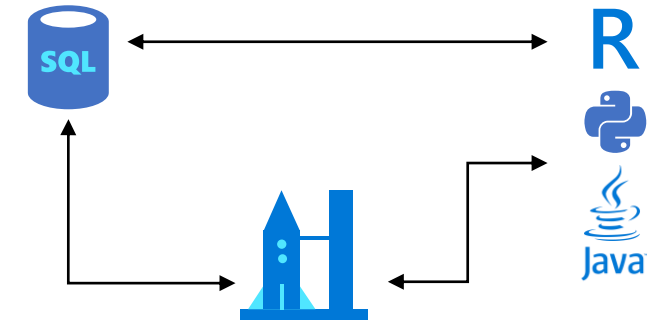
Data virtualization and Big Data Clusters



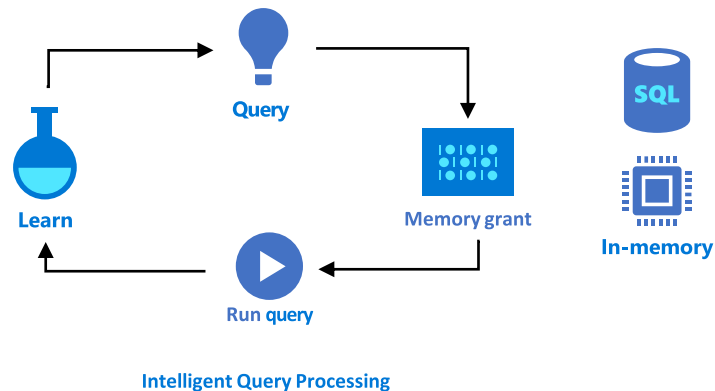
Modern platforms with compatibility



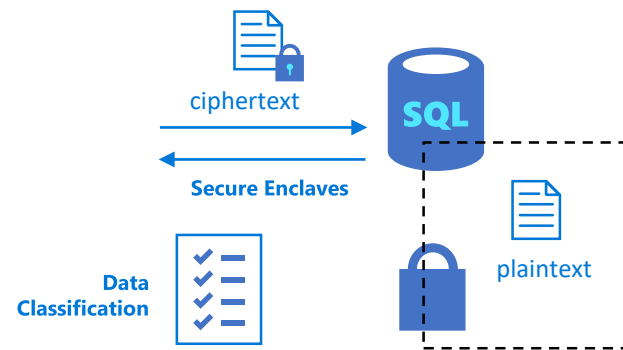
Built-in Machine Learning and extensibility



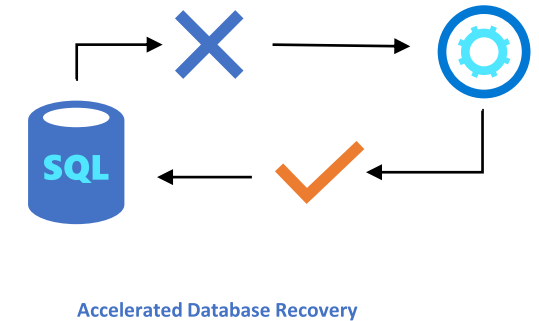
Intelligent performance



Layers of security and compliance

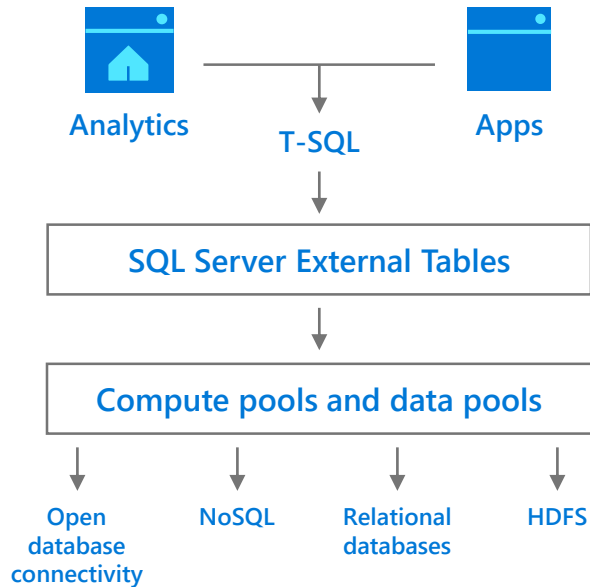


Business critical high availability



SQL Server 2019 big data, analytics, and AI

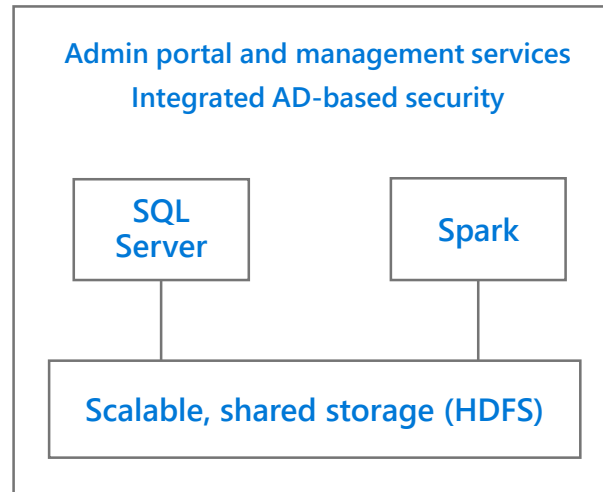
Data virtualization



Combine data from many sources without moving or replicating it

Scale out compute and caching to boost performance

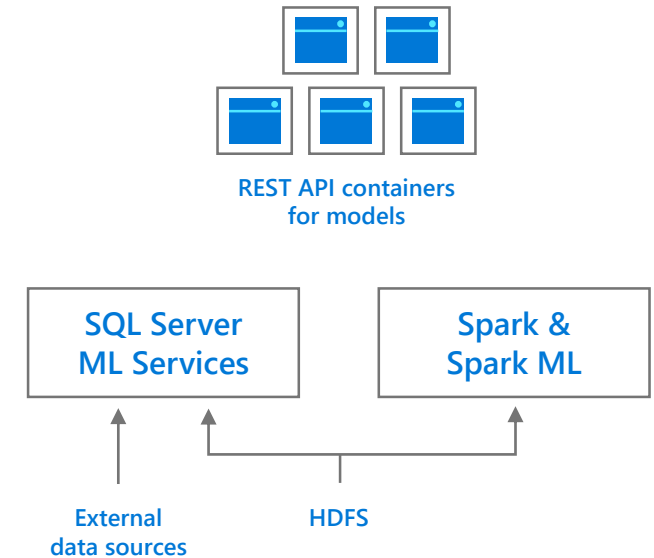
Managed SQL Server, Spark, and data lake



Store high volume data in a data lake and access it easily using either SQL or Spark

Management services, admin portal, and integrated security make it all easy to manage

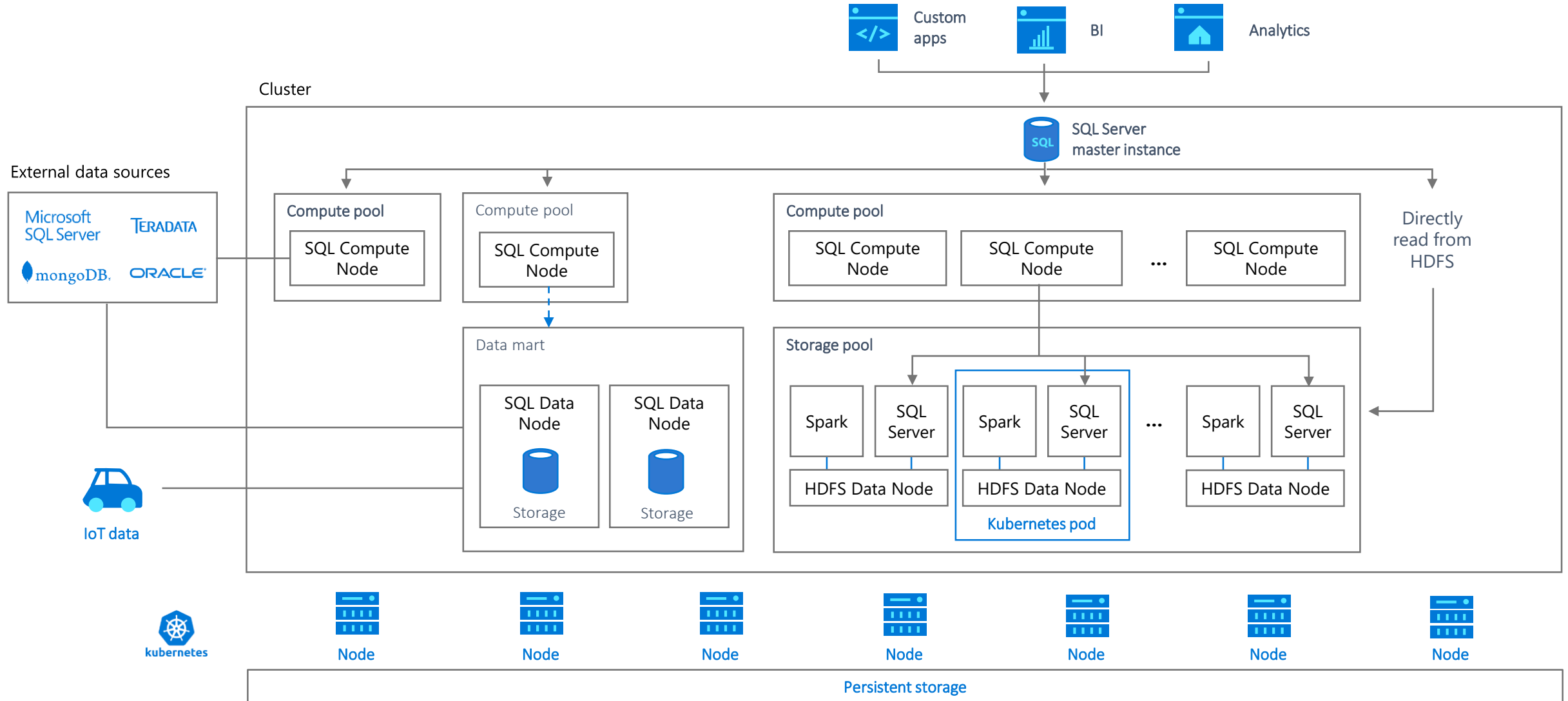
Complete AI platform



Easily feed integrated data from many sources to your model training

Ingest and prep data and then train, store, and operationalize your models all in one system

SQL Server big data clusters



It's built on a strong foundation

Major capabilities of SQL Server 2016 and 2017



Intelligent performance

Query Store

Adaptive Query Processing

Automatic Tuning

Columnstore and In-Memory OLTP

"It Just Runs Faster"



Layers of security

Always Encrypted

Row Level Security

Dynamic Data Masking



Mission critical availability

Clusterless Availability Groups

Distributed Transactions for Availability Groups

Resumable Index Maintenance



Developer experience

JSON

Temporal Tables

Graph Database



Modern platform

Linux and Containers

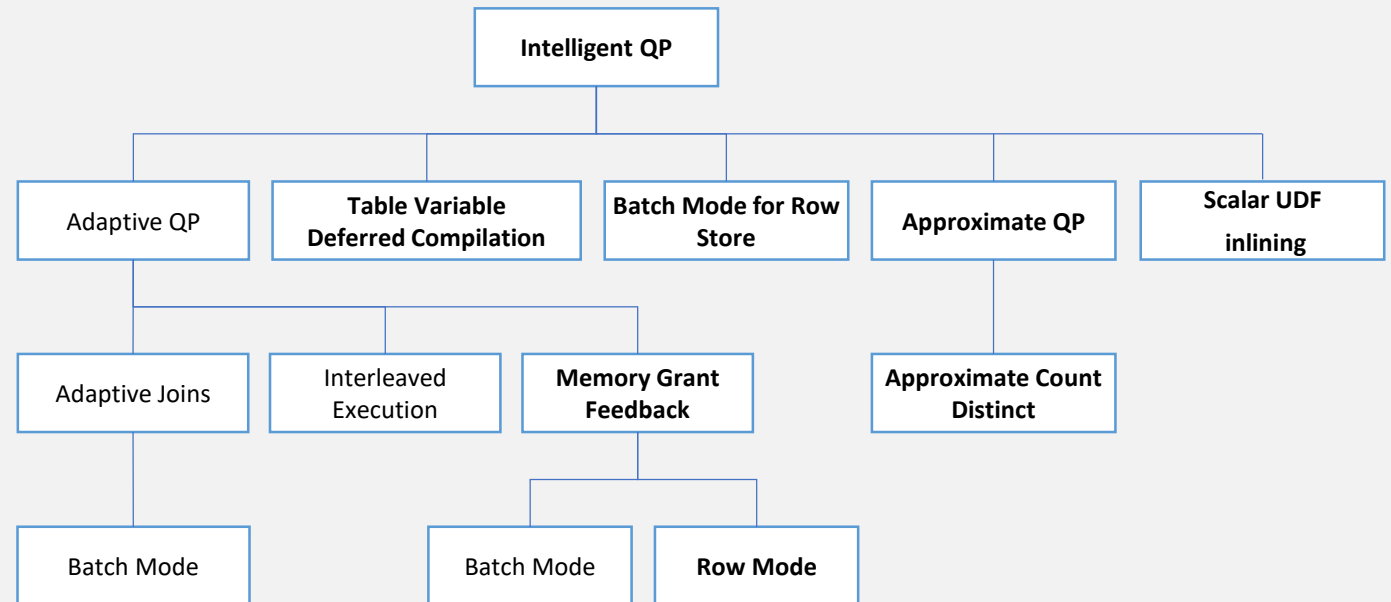
Machine Learning Services with R and Python

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



Bold indicates new and improved features in SQL Server 2019

Industry leading performance



Challenge

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



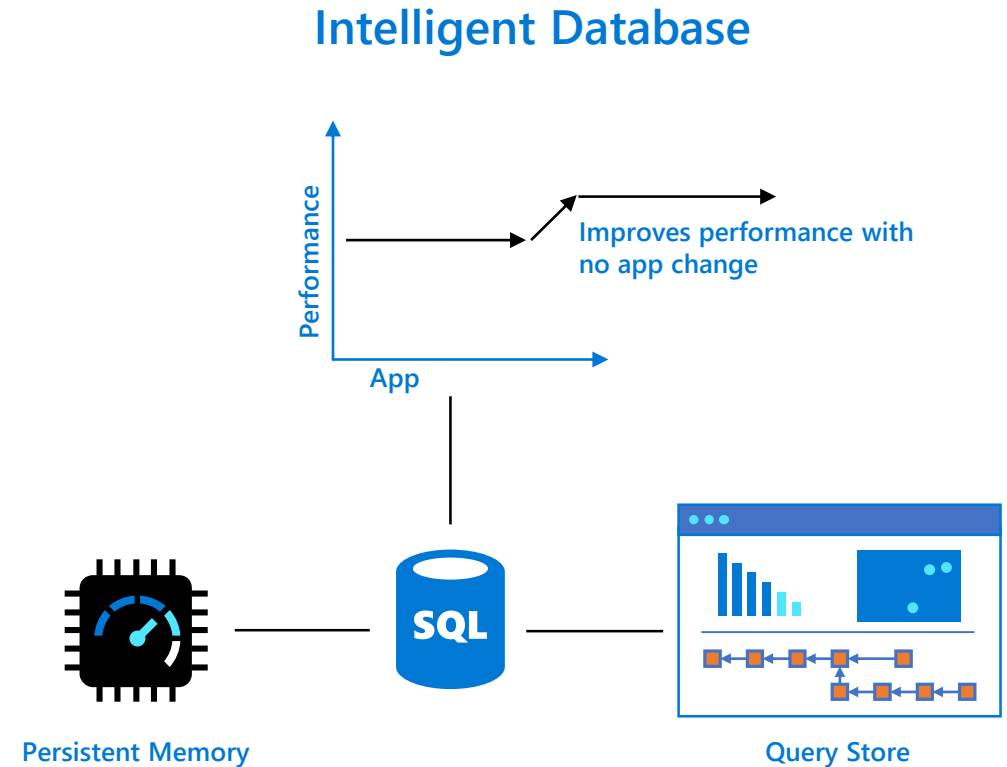
Solution

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 Query Processing improved Banco Itau's query performance by 92% without the need for any code changes

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 Inlining 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

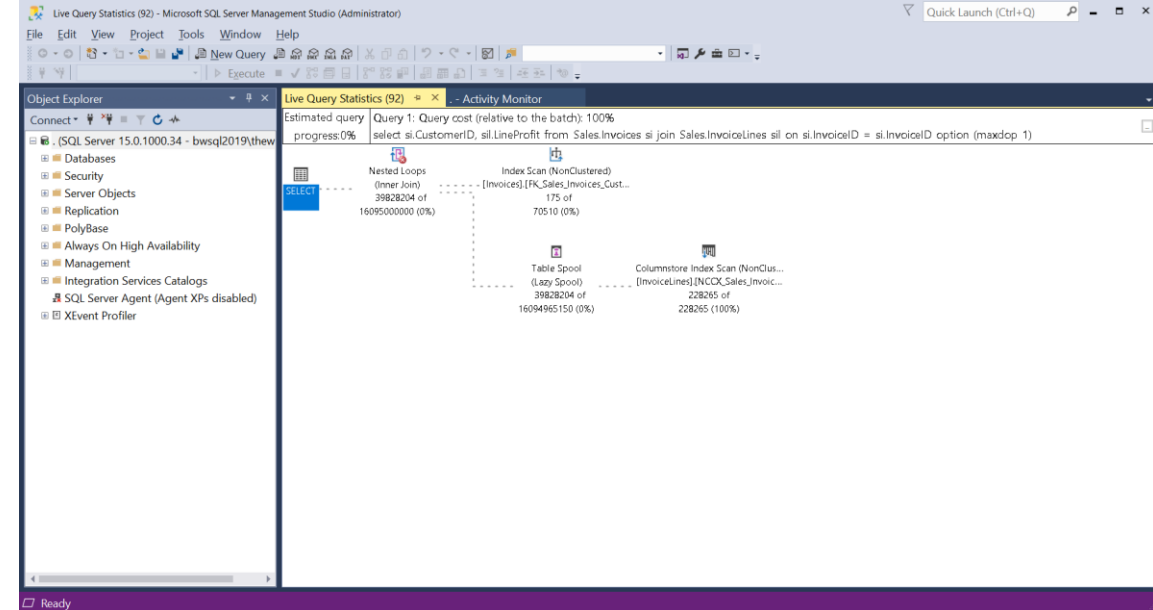
SQL Server 2016 SP1/2017

- Trace flag 7412
- XEvent query_thread_profile

SQL Server 2019

- On by default. No knobs required

dm_exec_query_profiles
dm_exec_query_statistics_xml



DATABASE SCOPED CONFIGURATION

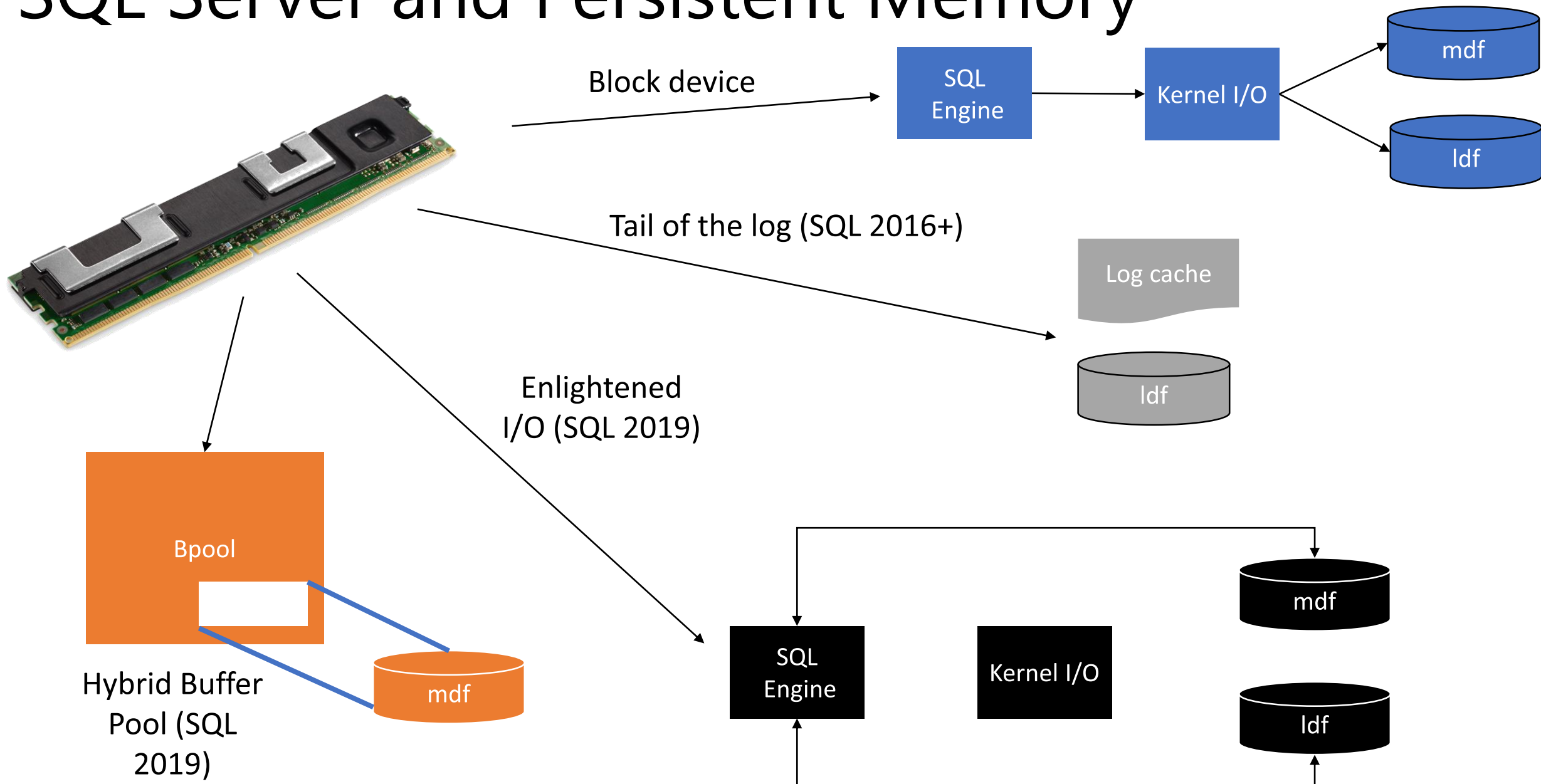
- Enables several database configuration settings at the **individual database** level.
- Available in Azure SQL Database and in SQL Server beginning with SQL Server 2016

```
USE MYDATABASE
```

```
GO
```

```
ALTER DATABASE SCOPED CONFIGURATION SET MAXDOP = 1 ;
```

SQL Server and Persistent Memory



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

Mediterranean Shipping Company

"With the combination of Intelligent Query Processing in SQL Server 2019 as the second generation of Adaptive Query Processing as well as Memory-Optimized TempDB Metadata, we are now able to achieve incredible performance in a more predictable way for all our business-critical processes. We are really happy with SQL Server 2019; key features such as scalar UDF Inlining and Table Variable Deferred Compilation enhance our developers' productivity and empower MSC in providing improved solutions for our customers."

Javier Villegas, Global Database Administrator & Design Coordinator
Mediterranean Shipping Company



MEDITERRANEAN SHIPPING COMPANY

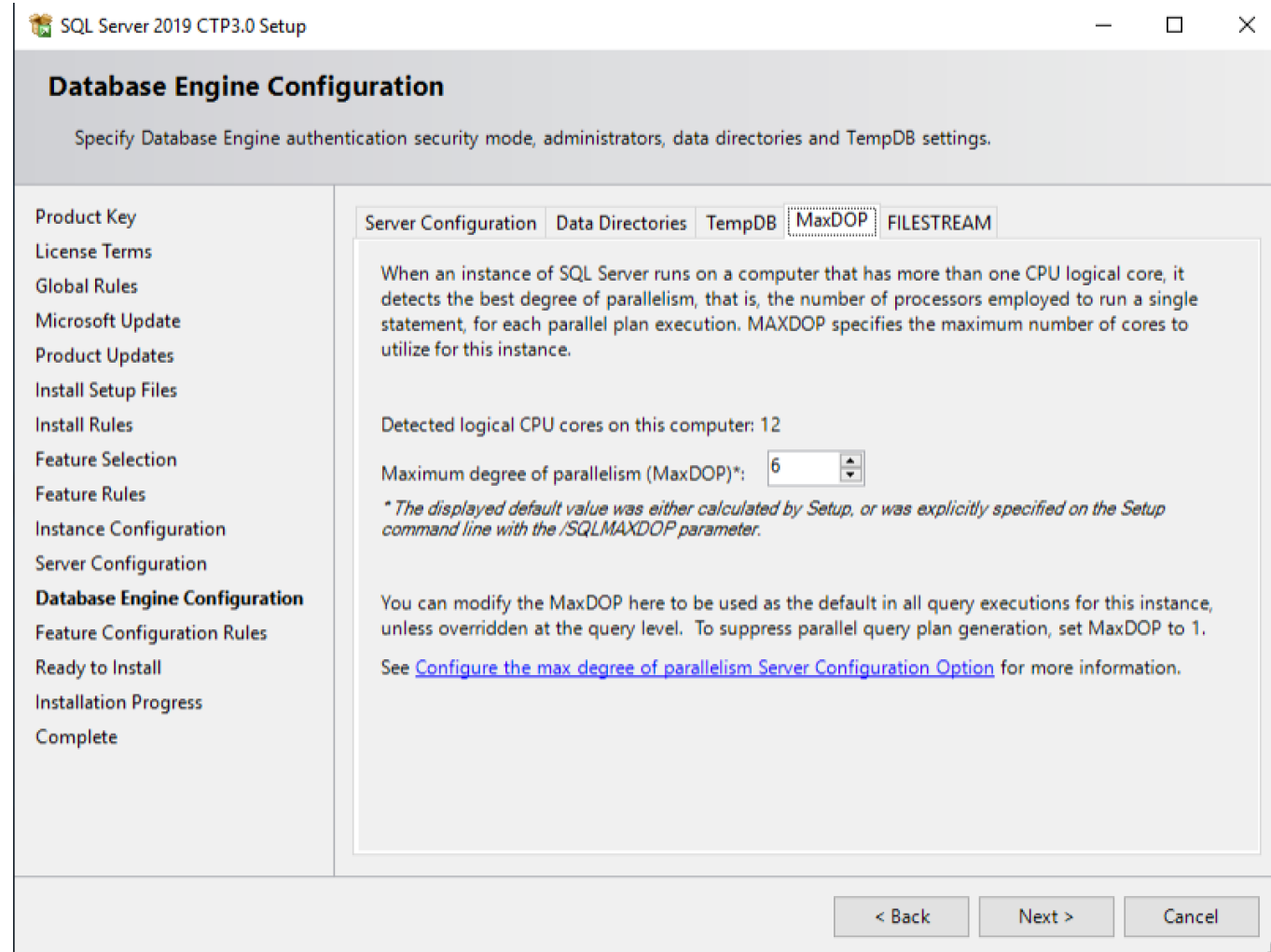


Enhanced Setup Process



Setup

Specify Max Degree of Parallelism during the Setup



SQL Server 2019 CTP3.0 Setup

Database Engine Configuration

Specify Database Engine authentication security mode, administrators, data directories and TempDB settings.

Product Key
License Terms
Global Rules
Microsoft Update
Product Updates
Install Setup Files
Install Rules
Feature Selection
Feature Rules
Instance Configuration
Server Configuration
Database Engine Configuration
Feature Configuration Rules
Ready to Install
Installation Progress
Complete

Server Configuration | Data Directories | TempDB | **MaxDOP** | FILESTREAM

When an instance of SQL Server runs on a computer that has more than one CPU logical core, it detects the best degree of parallelism, that is, the number of processors employed to run a single statement, for each parallel plan execution. MAXDOP specifies the maximum number of cores to utilize for this instance.

Detected logical CPU cores on this computer: 12

Maximum degree of parallelism (MaxDOP)*:

** The displayed default value was either calculated by Setup, or was explicitly specified on the Setup command line with the /SQLMAXDOP parameter.*

You can modify the MaxDOP here to be used as the default in all query executions for this instance, unless overridden at the query level. To suppress parallel query plan generation, set MaxDOP to 1.

See [Configure the max degree of parallelism Server Configuration Option](#) for more information.

< Back Next > Cancel

Setup

Specify Max Server Memory during the Setup

The screenshot shows the 'Database Engine Configuration' window in the SQL Server 2019 CTP3.1 Setup. The window title is 'SQL Server 2019 CTP3.1 Setup'. The main heading is 'Database Engine Configuration', with a subtitle: 'Specify Database Engine authentication security mode, administrators, data directories, TempDB, Max degree of parallelism, Memory limits, and Filestream settings.'

On the left is a navigation pane with the following items: Product Key, License Terms, Global Rules, Product Updates, Install Setup Files, Install Rules, Feature Selection, Feature Rules, Instance Configuration, Server Configuration, **Database Engine Configuration** (highlighted), Feature Configuration Rules, Ready to Install, Installation Progress, and Complete.

The main area has tabs for 'Server Configuration', 'Data Directories', 'TempDB', 'MaxDOP', 'Memory', and 'FILESTREAM'. The 'Memory' tab is selected.

Text in the Memory tab: 'SQL Server can change its memory requirements dynamically based on available system resources. However, in some scenarios you can configure the range of memory (in MB) that is managed by the SQL Server Memory Manager for this instance, by specifying min server memory and/or max server memory.'

Options: ☒ Recommended, ☐ Default.

Fields: 'Min Server Memory (MB):' with two input boxes containing '0'; 'Max Server Memory (MB):' with two input boxes containing '92288' and '2147483647'.

Footnote: '* The displayed recommended values were calculated by Setup based on your system configuration and edition, unless these were explicitly specified in the Setup command line using the /SQLMINMEMORY and /SQLMAXMEMORY parameters.'

Link: 'For more information see: [Server Memory Server Configuration Options](#).'

Checkbox: ☒ Click here to accept the recommended memory configurations for the SQL Server Database Engine.

Buttons at the bottom: '< Back', 'Next >', and 'Cancel'.

SQL Server confidential computing

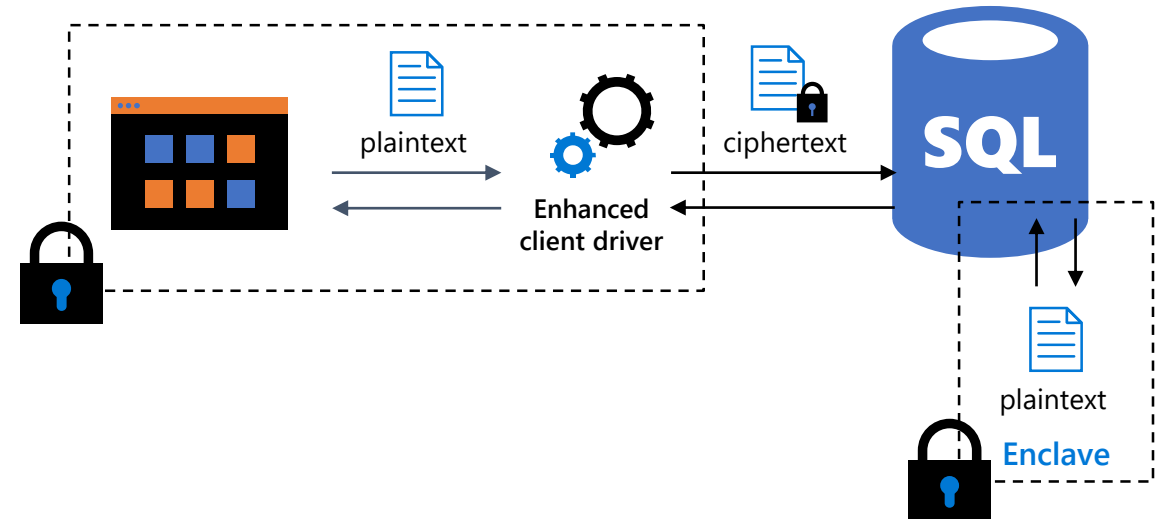
Always Encrypted with secure enclaves

Data Classification and auditing built-in

TDE scan suspend and resume

Simplified certificate management

Always Encrypted with secure enclaves



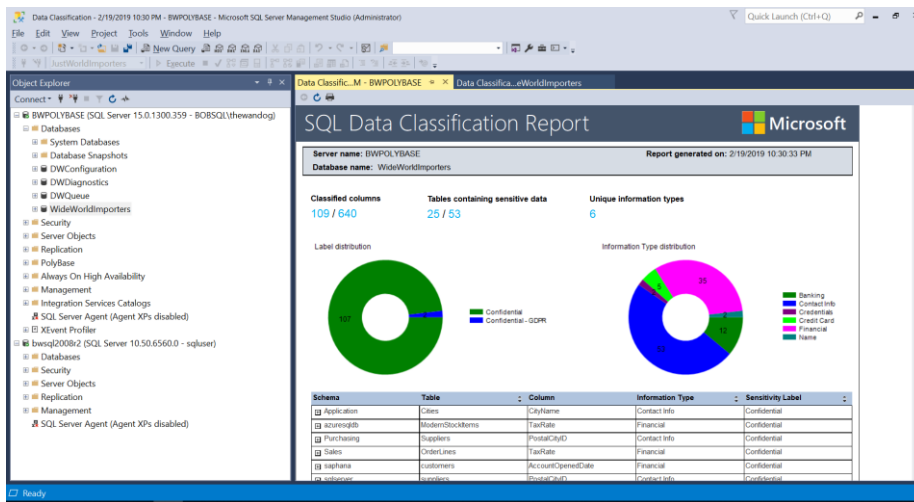
With Secure Enclaves, we can now enforce highly restricted client access without inhibiting real-world data analysis

Data Classification and Auditing

The problem

I need to classify my data in SQL Server and audit access to the classified data

SQL Server 2017



SQL Server 2019 and Azure SQL Database

SQL Server 2019
----->

ADD SENSITIVITY CLASSIFICATION TO
dbo.sales.price, dbo.sales.discount
WITH (LABEL='Highly Confidential',
INFORMATION_TYPE='Financial')

SQL Server Auditing

data_sensitivity_information

Who, what, and when accessed my classified data?

Mission Critical Availability

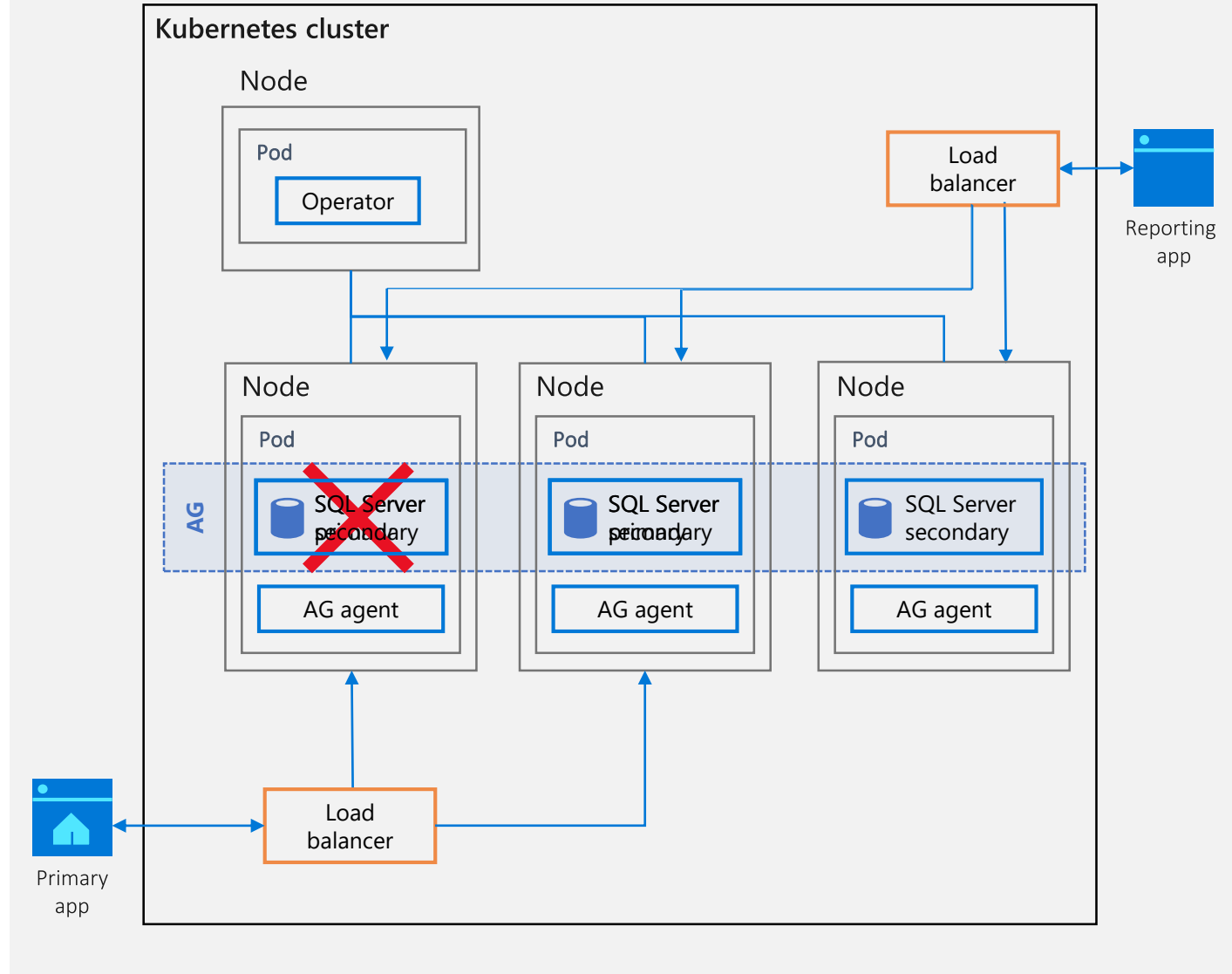


Mission critical availability

Keep SQL Server running

- Resumable online index creation
- Online Clustered Columnstore index creation and rebuild
- Always On availability group enhancements
- Availability groups on Kubernetes
- Accelerated Database Recovery
- ~~AGs for System Databases (Planned)~~

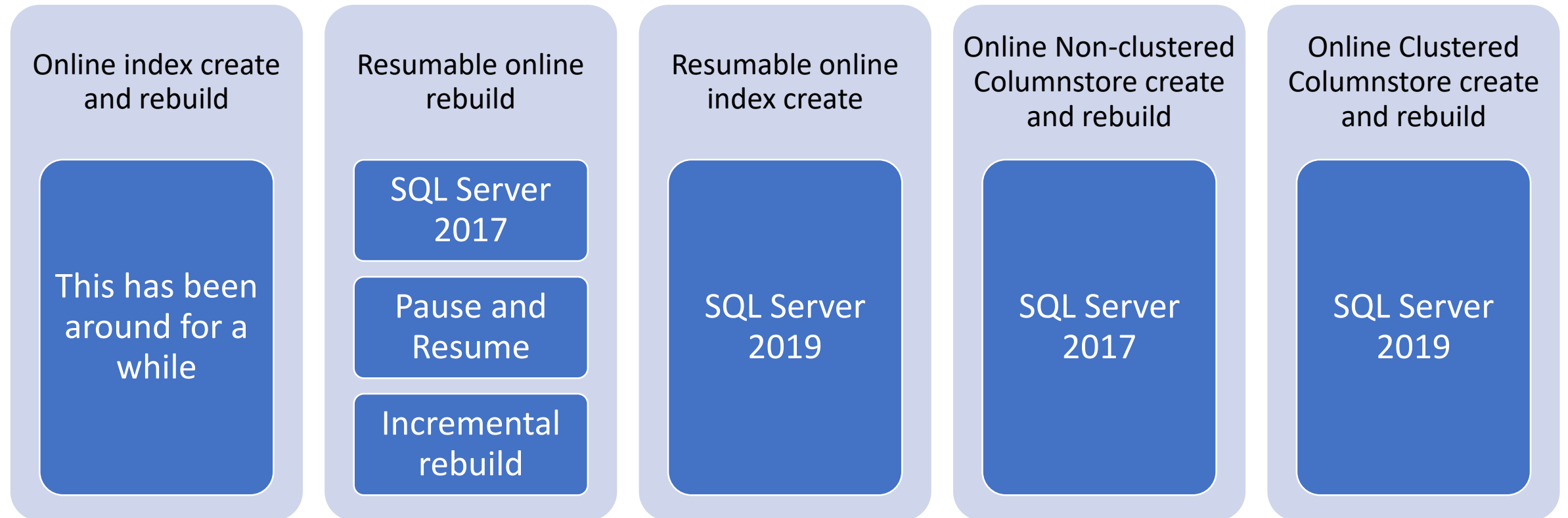
Availability groups on Kubernetes



Using Online Indexing in SQL Server 2019

The problem

Index maintenance causes concurrency problems and application downtime



Always On Availability Group Enhancements

- Always On Availability Groups Turbocharged SQL16
- Database Health Failover Detection SQL16
- DTC and Cross Database Transaction Support SQL17
- *Clusterless* Availability Groups SQL17
- Five sync replicas SQL19
- Primary Replica Connection Redirection SQL19

Clusterless Availability Groups

The problem

I want replica copies of the data but don't want to install clustering software and don't need automatic failover

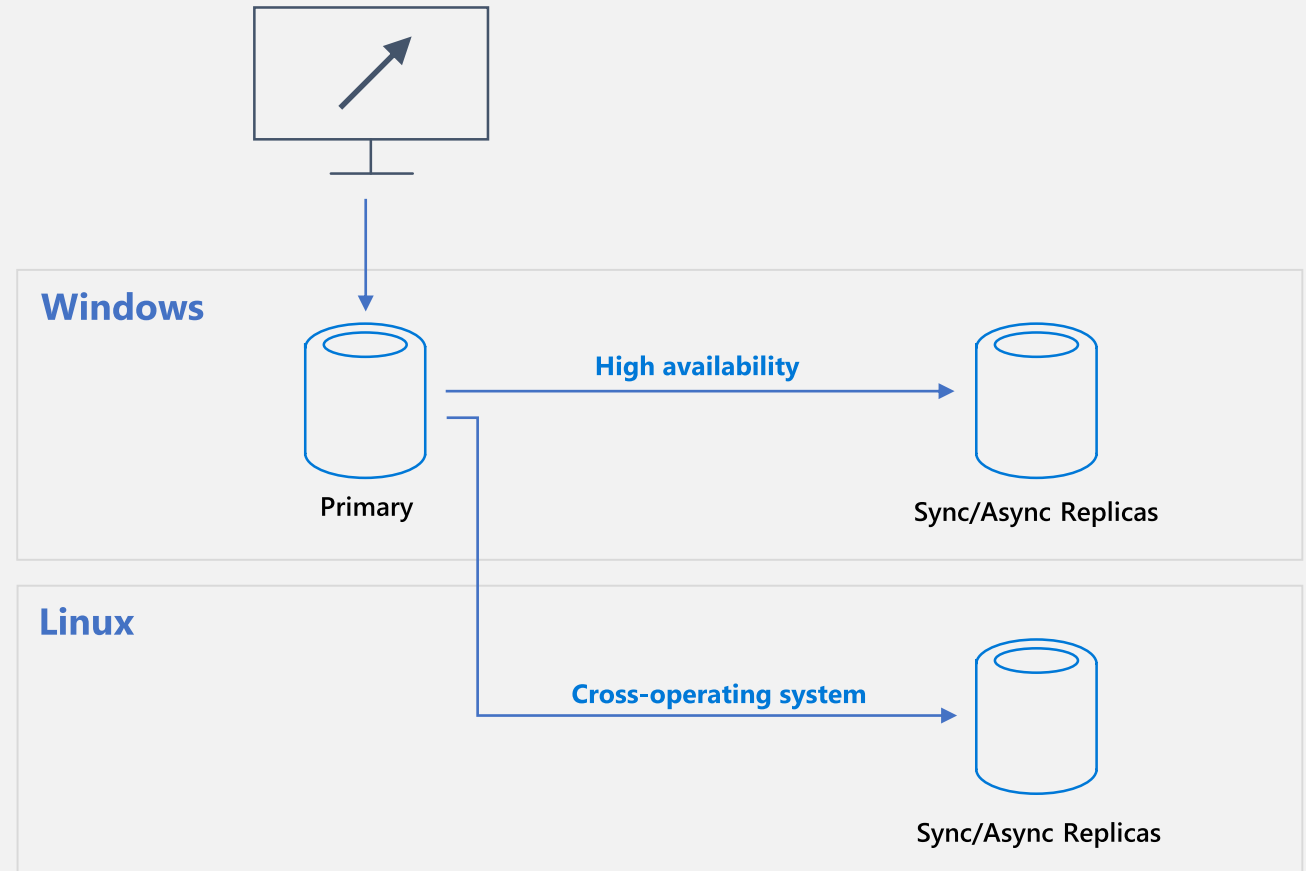
No clustering software required

Replica support built into the Engine

Load balancing of readable secondaries

HA and DR for Linux and Windows

Manual failover



SQL Server is always available



Challenge

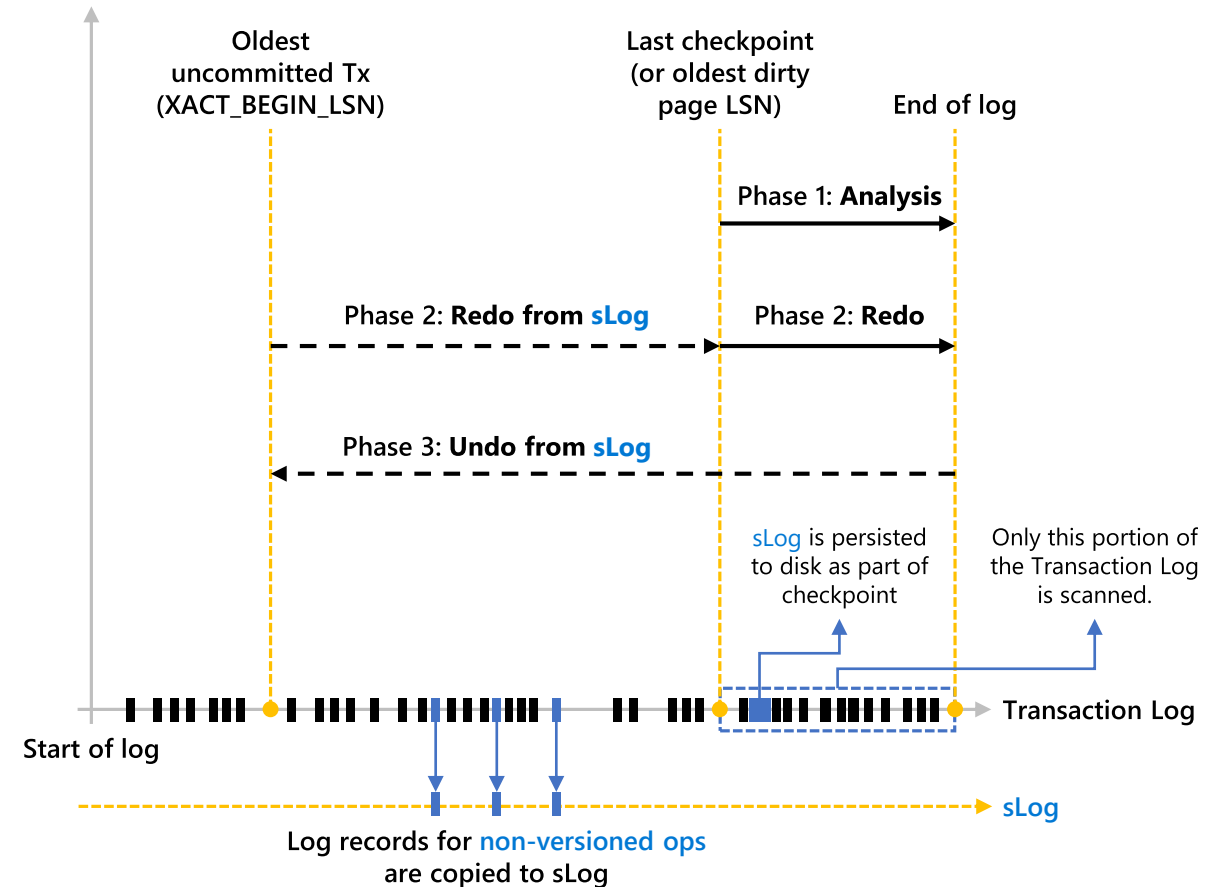
- Log Grows out of Control
- Long rollback blocks applications
- Long Recovery prolongs downtime
- Index operations resource intensive



Solution

- Accelerated Database Recovery (ADR)
- Online Index enhancements
- Availability group enhancements

The New Recovery Process with ADR



We achieve high availability of mission critical data thanks to Accelerated Database Recovery

Accelerated Database Recovery (ADR)



How it works

- Enable/disable as a database option
- Uses a Persisted Version Store (PVS)
- Independent of locking and isolation levels
- Rollback faster than you can react
- Undo recovery faster than you can look it up
- Transaction log truncation not tied to active transactions



Key questions

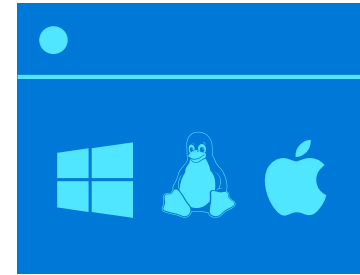
- Does it require more space?
- Will it affect performance?
- Will I still see versions in tempdb?
- How does it work with Always On Availability Groups?



The modern development platform



Speed app development and admin
with new enhancements



Develop on your choice of
language and tooling

Enhance the developer experience

SQL Graph enhancements

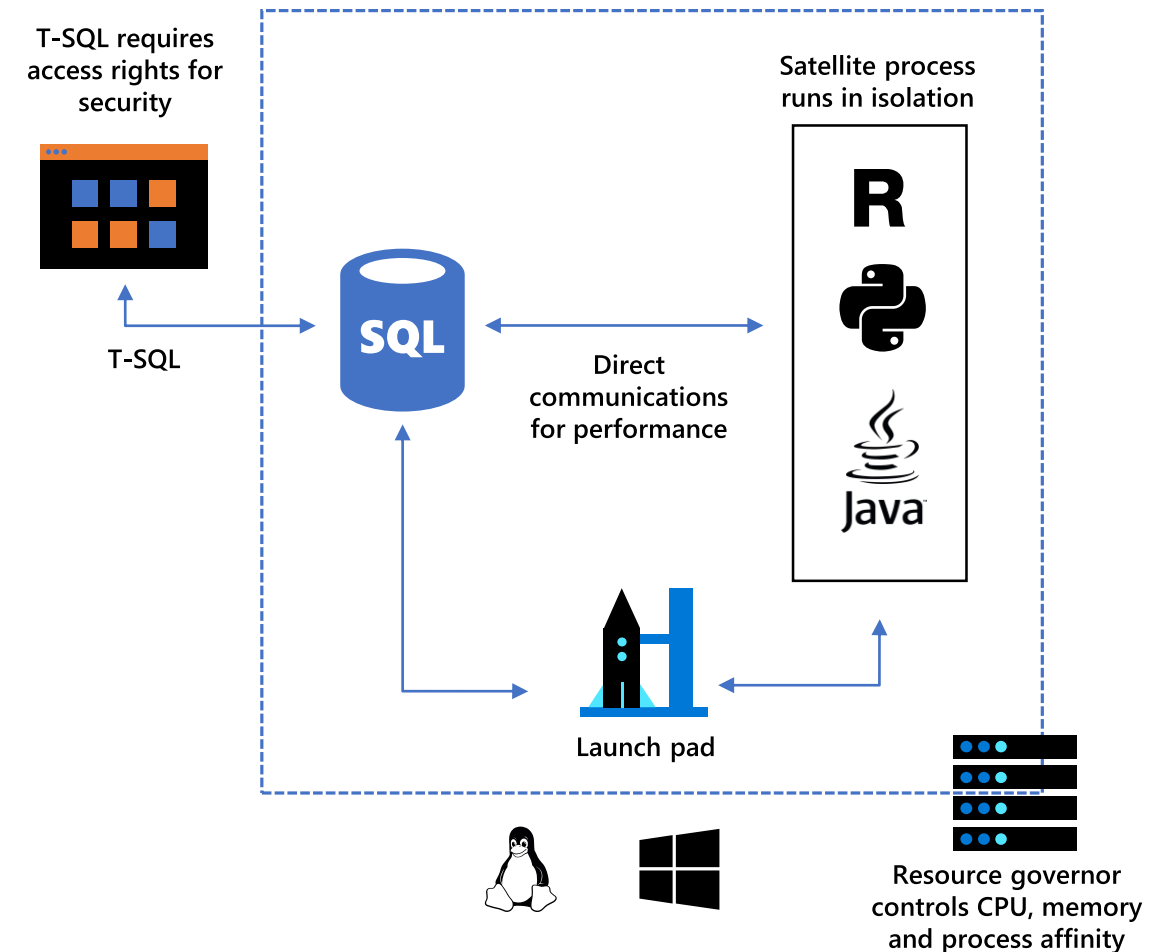
UTF-8 support

Machine Learning Services enhancements

SQL Server Language Extensions and the Extensibility Framework

Security, isolation, and governance built-in

Machine Learning and T-SQL Extensibility



Data science company can mine graph data and carry out machine learning at scale for cancer research

SQL Server on Linux



SQL Server on the platform of your choice

Support for RedHat Enterprise Linux (RHEL), Ubuntu, and SUSE Enterprise Linux (SLES)

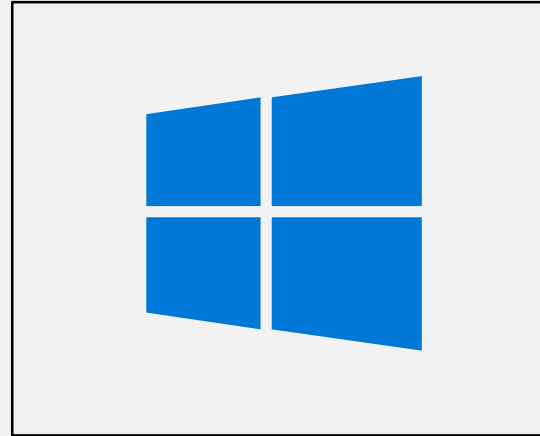
Linux and Windows Docker containers

Windows Server / Windows 10

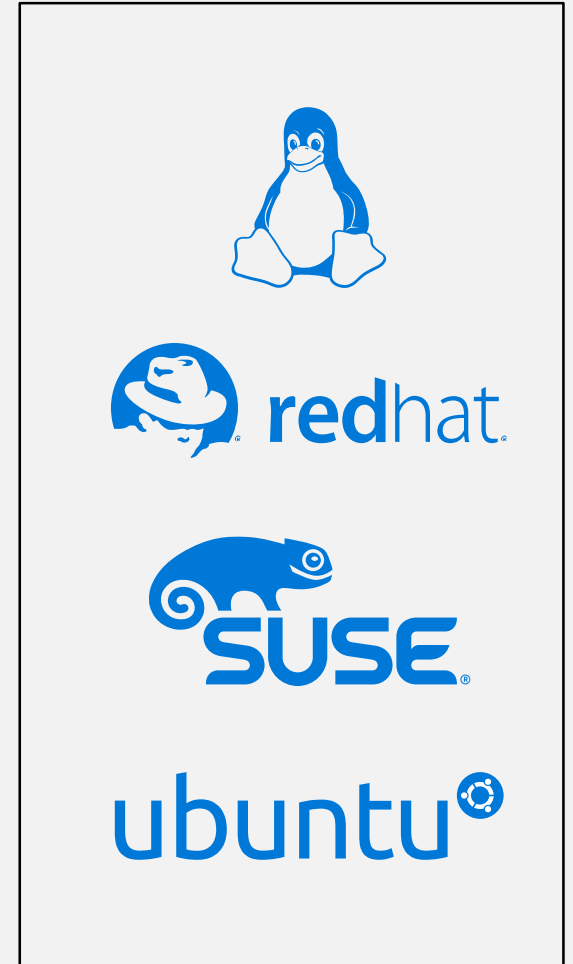
Package-based installation: Yum Install, Apt-Get, and Zypper

Database Compatibility on all Platforms

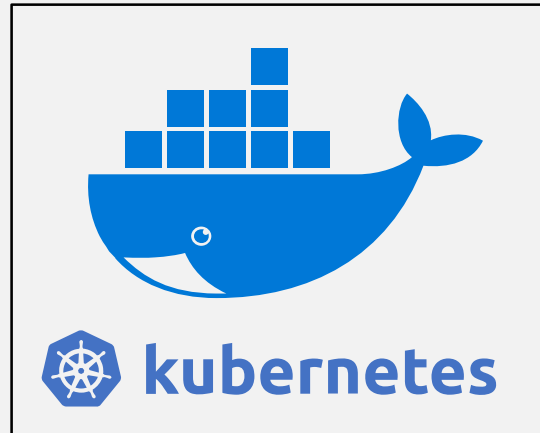
Windows



Linux

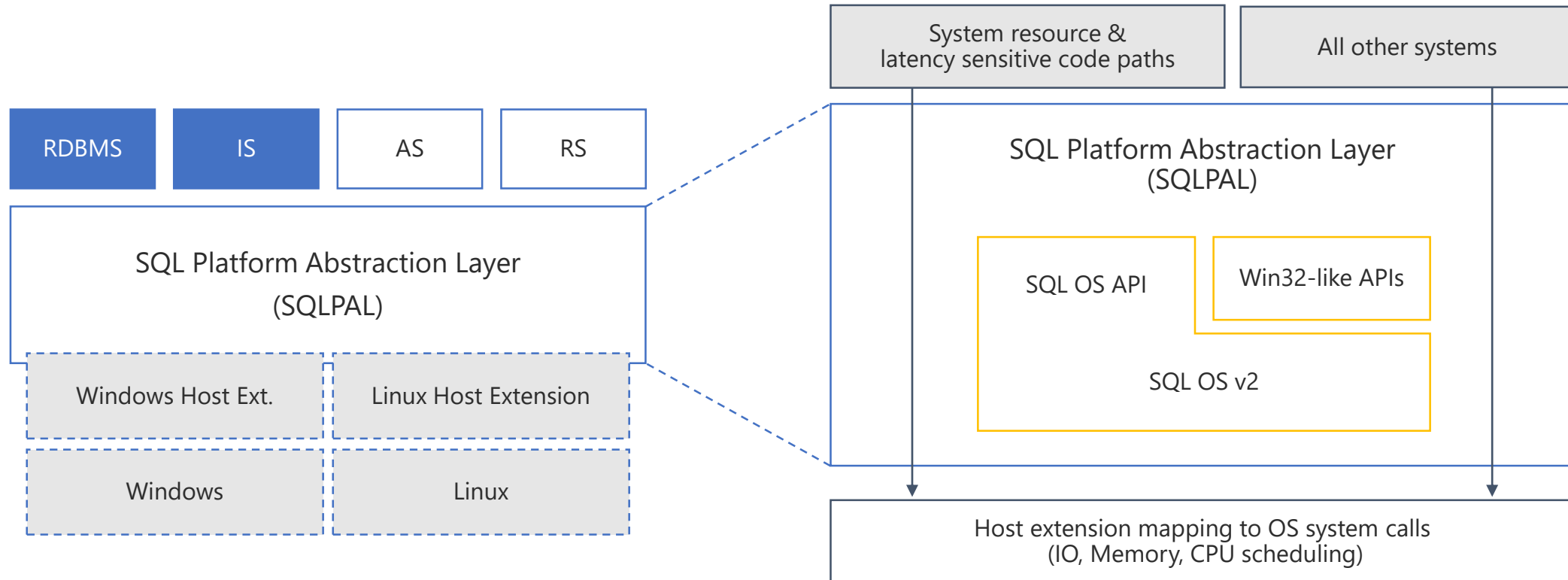


Linux/Windows container



		Windows	Linux
Editions	Developer, Express, Web, Standard, Enterprise	●	●
Services	Database Engine, Integration Services, SQL Server Agent	●	●
	Analysis Services, Reporting Services, MDS, DQS	●	
Mission critical performance and HADR	Maximum number of cores	Unlimited	Unlimited
	Maximum memory utilized per instance	24 TB	12 TB
	Maximum database size	524 PB	524 PB
	Basic OLTP (Basic In-Memory OLTP, Basic operational analytics)	●	●
	Advanced OLTP (Advanced In-Memory OLTP, Advanced operational analytics, adaptive query processing)	●	●
	SQL Server Replication	●	● NEW
	Basic high availability (2-node single database failover, non-readable secondary)	●	●
	Advanced HA (Always On - multi-node, multi-db failover, readable secondaries)	●	●
Security	Basic security (Basic auditing, Row-level security, Data masking, Always Encrypted, Active Directory Authentication)	●	●
	Advanced security (Transparent Data Encryption)	●	●
Data warehousing	PolyBase	●	Planned
	Basic data warehousing/data marts (Basic In-Memory ColumnStore, Partitioning, Compression)	●	●
	Advanced data warehousing (Advanced In-Memory ColumnStore)	●	●
	Advanced data integration (Fuzzy grouping and look ups)	●	●
Tools	Windows ecosystem: Full-fidelity Management & Dev Tool (SSMS & SSDT), command line tools	●	●
	Linux/OSX/Windows ecosystem: Dev tools (VS Code), DB Admin GUI tool, command line tools	●	●
Developer	Programmability (T-SQL, CLR, Data Types, JSON, Graph)	●	●
	Distributed Transactions	●	● NEW
	Machine Learning Services	●	● NEW

The Architecture of SQL Server on Linux



- Light and fast using package managers
 - RHEL: RPM and yum.
 - Ubuntu: Debian and apt-get
 - SUSE: RPM and zypper.
- Dependency management built-in
- Install fast → configure later
- Break up the product into packages
- Offline, unattended, update, rollback, remove



mssql-server

mssql-tools

mssql-server-
fts

mssql-server-
ha

mssql-server-is

["extensibility,
Java, and ML
Services"](#)

Configuring and Updating SQL Server on Linux

Configuration

Updating

Inside the
Engine

ALTER SERVER
CONFIGURATION

sp_configure

Outside the
Engine

Environment
variables during
setup

mssql-conf script
after setup

Package for each
CU and GDR

Packager managers
support update and
rollback

No more service
packs

SQL Server on Linux

Tools and programmability

Windows SQL Server Management Studio (SSMS)

Windows SQL Server Data Tools (SSDT)

3rd party tools continue to work

Existing drivers/frameworks supported



Azure Data Studio

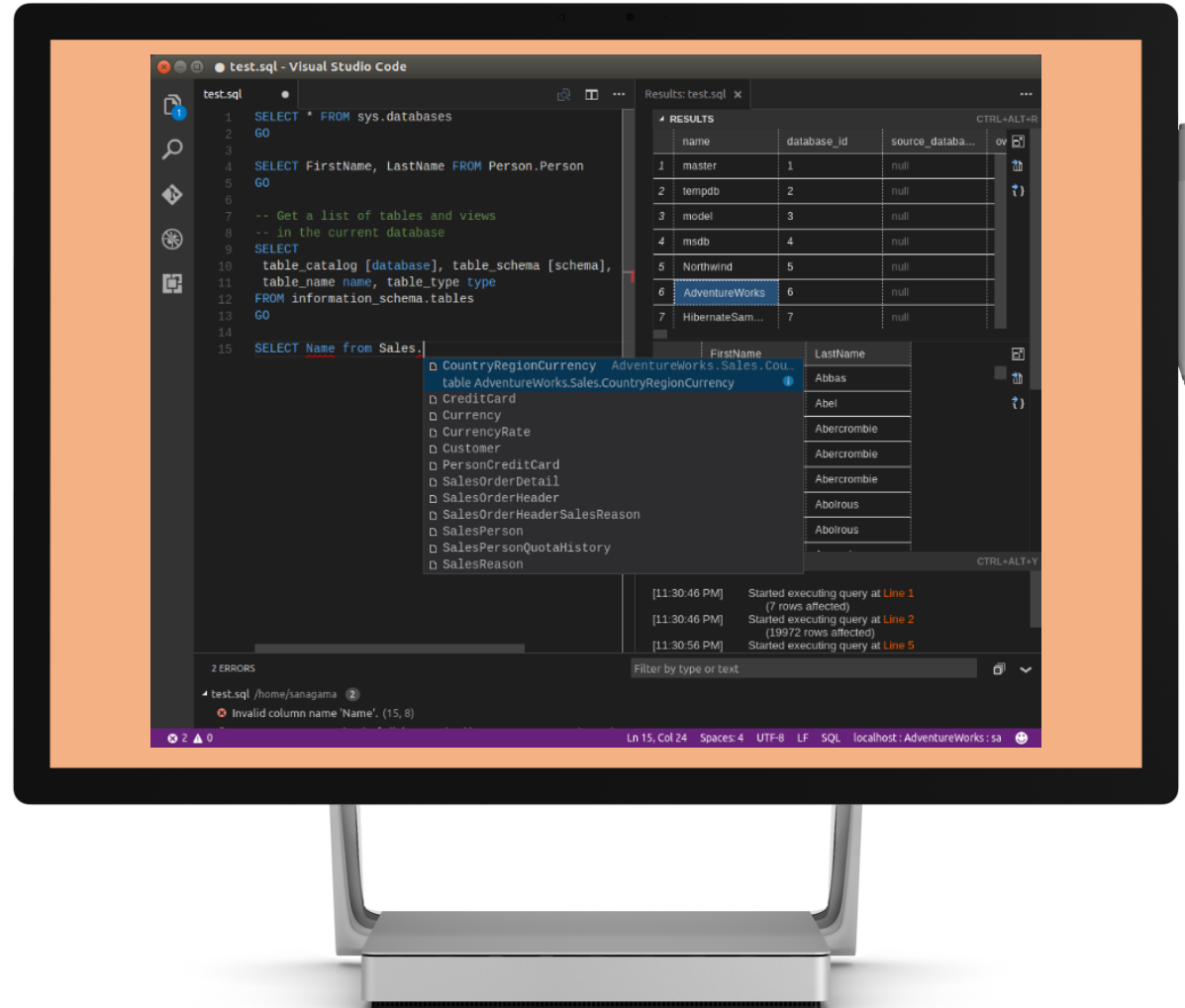
Visual Studio Code mssql extension

Native OS command line tools

- sqlcmd, bcp, sqlpackage

mssql-cli

mssql-scripter



HADR with SQL Server on Linux

Failover Cluster Instance

Pacemaker and Corosync

Single SQL Server instance

SQL resource agent (mssql-server-ha)

Open-source resource agent is available on GitHub Repository¹

Shared Storage

ISCI, NFS, SMB

High Availability Group

CLUSTER_TYPE = EXTERNAL

Auto failover

Pacemaker

SQL resource agent (mssql-server-ha)

3 replicas required

Configuration only replica for metadata

Full AG capabilities

Read-Scale Availability Group

CLUSTER_TYPE=NONE

No clustering required

Manual or forced failover

Sync or async replicas

Read scale routing

Cross-platform

Industry-leading solutions available from HA/DR partners²

1. <https://github.com/Microsoft/mssql-server-ha>

2. <https://docs.microsoft.com/en-us/sql/sql-server/partner-hadr-sql-server?view=sql-server-2017>

SQL Server 2019 and Linux

Closing features gaps for SQL Server on Linux on SQL 2019

- Replication
- Distributed transactions
- Machine Learning

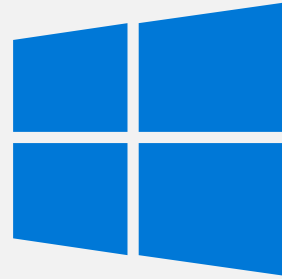
Open LDAP Provider support

The Microsoft Container Registry

SQL Server RedHat Container Images

Always On Availability Groups on Kubernetes

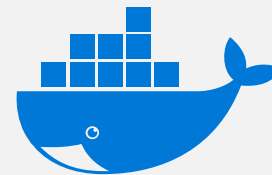
Windows



Linux



Docker containers and Kubernetes



Tuning the SQL Server engine

- Columnstore stats in DBCC CLONEDATABASE
- Estimate compression for Columnstore indexes
- Diagnostics for auto stats blocking
- The #1 voted customer feedback item of all time: String Truncation (1000+ votes)
- Troubleshoot page resource waits with new built-in T-SQL

String or binary data would be truncated

String or binary data would be truncated
in table '%.*ls', column '%.*ls'.
Truncated value: '%.*ls'

```
SELECT page_info.*  
FROM sys.dm_exec_requests AS d  
      CROSS APPLY  
      sys.fn_PageResCracker(d.page_resource) AS r  
      CROSS APPLY sys.dm_db_page_info(r.db_id,  
r.file_id, r.page_id, 'DETAILED')  
      AS page_info;
```

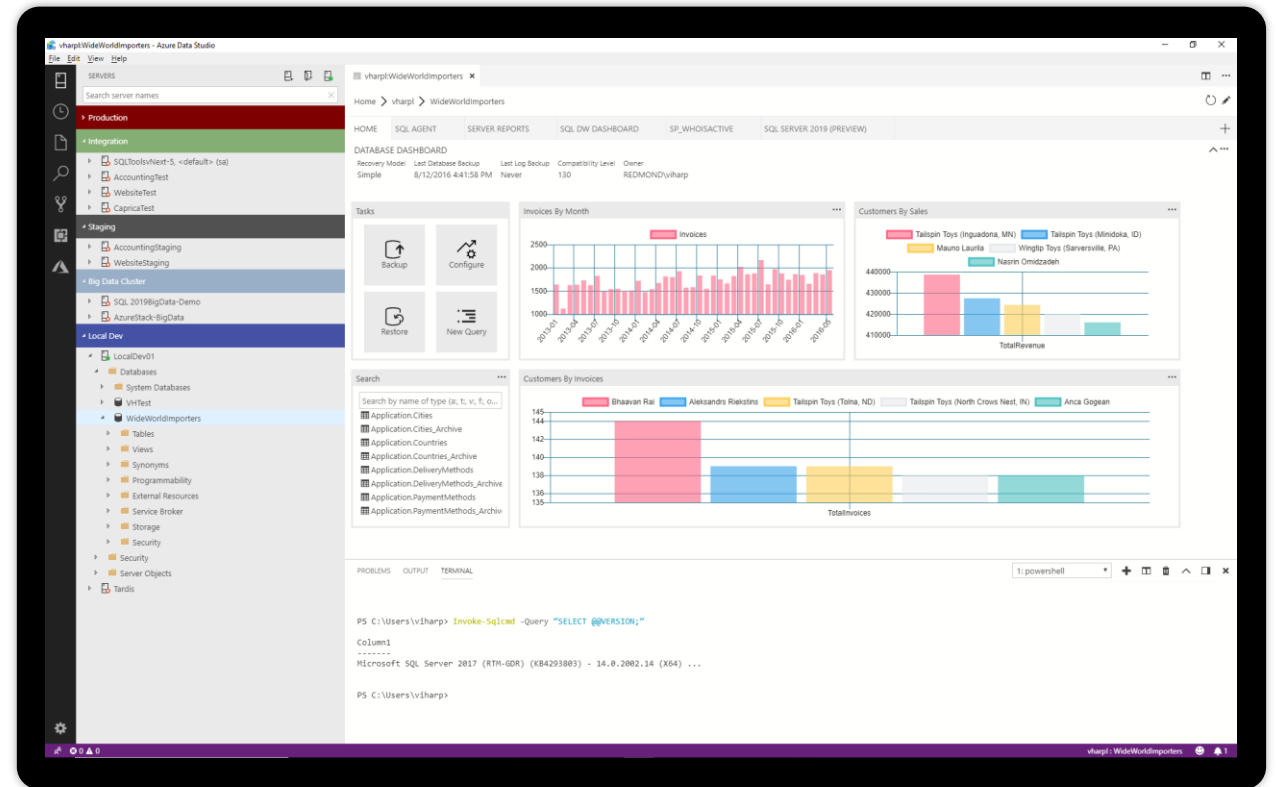
The Azure Data Studio tools experience

Azure Data Studio is a lightweight, open source, cross-platform graphical management tool and code editor

Enable a modern DevOps experience for database developers and DBAs on their platform of choice

Simplify development, configuration, management, monitoring and troubleshooting for SQL databases on-premises and in the cloud

Use **SQL Server Management Studio 18** to access, configure, manage, and administer all SQL Server components





Learn more

Preview SQL Server 2019 now: <https://aka.ms/ss19>

See what's new in SQL Server 2019: <http://docs.microsoft.com/sql/sql-server/what-s-new-in-sql-server-ver15>

SQL SERVER END OF SUPPORT

SQL Server 2008 and 2008 R2 will no longer be supported starting on **July 9, 2019**.

	Current support level	End mainstream	End extended
SQL Server 2014	Currently supporting all versions	July 9, 2019	July 9, 2024
SQL Server 2012	SQL Server 2012 SP2+ is in mainstream support until CY 2017	July 11, 2017	July 12, 2022
 SQL Server 2008 and SQL Server 2008 R2	SQL Server 2008 and 2008 R2 are in extended support which includes security updates, paid support, and requires purchasing non-security hotfix support	July 8, 2014	July 9, 2019
 SQL Server 2005	SQL Server 2005 support ended on April 12, 2016	April 12, 2011	April 12, 2016

Learn more about the SQL Server support lifecycle: support.microsoft.com/lifecycle/

Questions ?



@javier_vill



<https://ar.linkedin.com/in/javiervillegas>



<http://sql-javier-villegas.blogspot.com.ar>

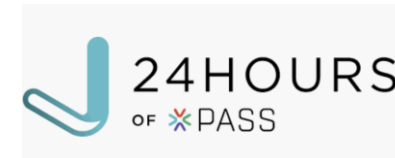


javier.ignacio.villegas@gmail.com

SQL Server 2019 New Features

Thank you!!

Gracias !!



@javier_vill



/javiervillegas