

The Business Case for SQL Server 2019

Book Authors: What's your favorite new feature of SQL Server 2019?

- **Randolph West:** Accelerated Database Recovery, as well as UTF-8.
- **Melody Zacharias:** Azure Notebooks! I really love them even if they are not technically a 2019 feature.
- **William Assaf:** Tie between Accelerated Database Recovery (ADR) and scalar UDF inlining. Both are going to really going to help a lot of folks.
- **Louis Davidson:** Scalar function inlining. It is a feature that is small, but it shows that Microsoft has really been listening to us and fixing things that will help programmers produce better code.
- **Sven Aelterman:** Biased: expanded cloud offerings. Unbiased: Python integration.
- **Meagan Longoria:** Accelerated database recovery is cool.
- **Joey D'Antoni:** Scalar Function Inlining.



SQL Server Version Velocity

- Starting SQL 2017, no more service packs, CU's only.
 - Within 12 months, 12 CU's for SQL 2017.
 - 17 SQL 2017 CU's in first 24 months
 - SQL 2019 CU2 released Feb 13, 2020
- First public preview of SQL 2019 was only 11 months after SQL 2017 RTM. At that rate we can expect the next public preview of SQL Server 202 n in October!

SQL Server is ready to Upgrade

- Thanks for compatibility levels inside each database, the only valid reasons to delay a SQL Server upgrade these days are vendor application support.
- No technical reasons to buy SQL 2016 over 2017 or 2019.
- Price is the same since 2012.
- Changes are additive – no code breaking.
- Changes to execution plans in SQL 2014 were 95/5.
 - Easier to upgrade past SQL 2014 from <2014 because of the Query Store introduced in SQL 2016

SQL Version Upgrade Timeline

- SQL 2008/2008 R2 are past end of life (July 2019)!
 - Windows Server 2008/2008R2 end of life Jan 2020.
- No longer supported unless you:
 1. Pay lots of money to Microsoft. Srsly.
 2. Migrate your SQL 2008/R2 SQL Server to an Azure VM.
Considerably less money.
- SQL Server 2012 latest SP End of Support is July 2022
- SQL Server 2012 <SP4 no longer supported!
- SQL Server 2014 latest SP End of Support is July 2024

Tools to Assist with Upgrades

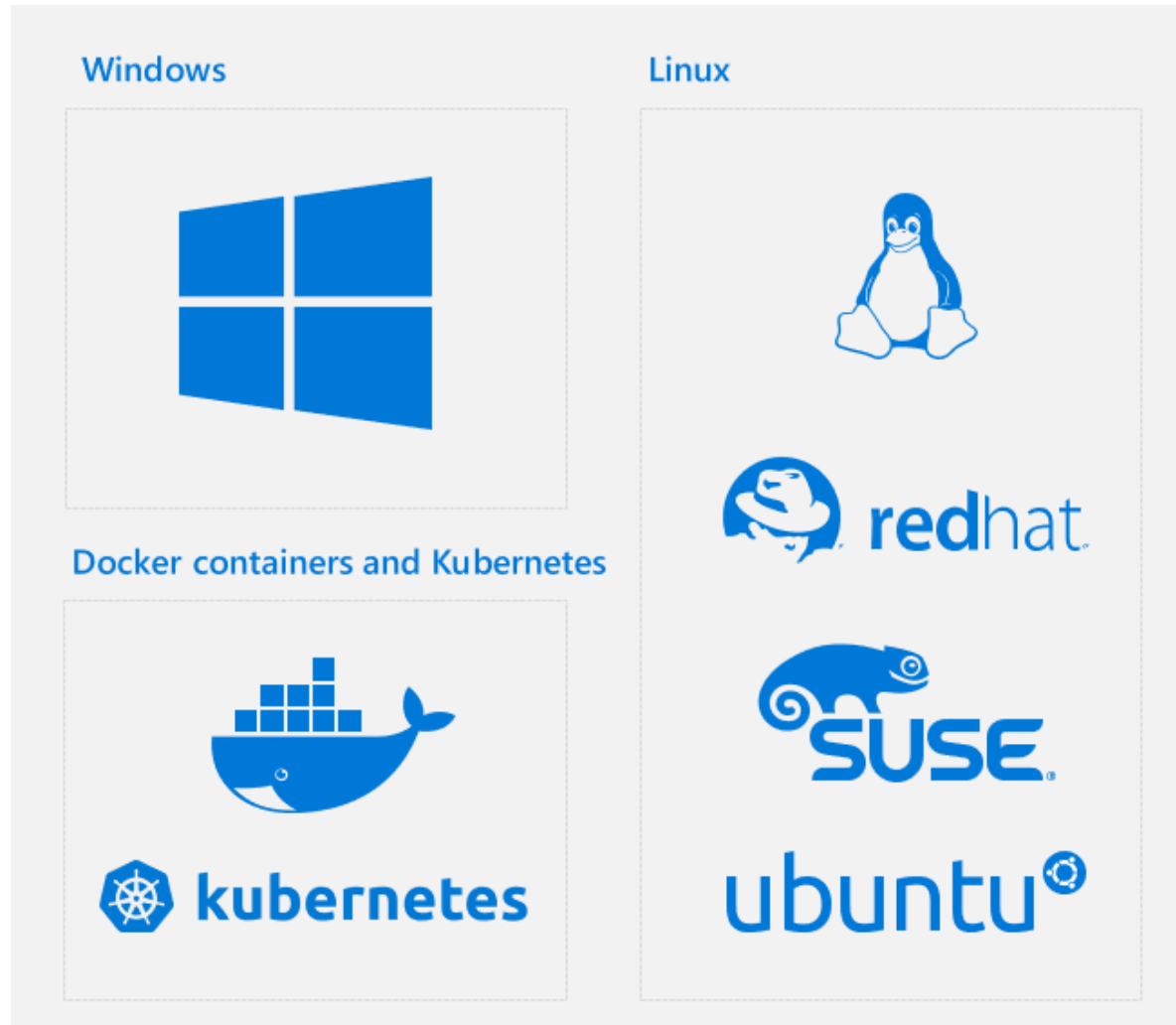
- **Database Migration Assistant (DMA)** – can perform migration to Azure SQL DB for you
- **Database Experimentation Assistant (DEA)** – AB testing for performance on two platforms using Distributed Replay, including on-prem vs Azure, Windows vs Linux.
- **Query Tuning Assistant (QTA)** – AB testing for performance on two compat levels, same hardware
 - Will help with the 2014 Cardinality Estimator change
- **Azure Migrate** – Can upload a .csv for an assessment n Azure to be given estimates on compatibility, expected cost for compute and storage.

<https://azure.microsoft.com/en-us/blog/assess-your-servers-with-a-csv-import-into-azure-migrate/>

IT Leadership: Need to Know Changes for SQL 2019

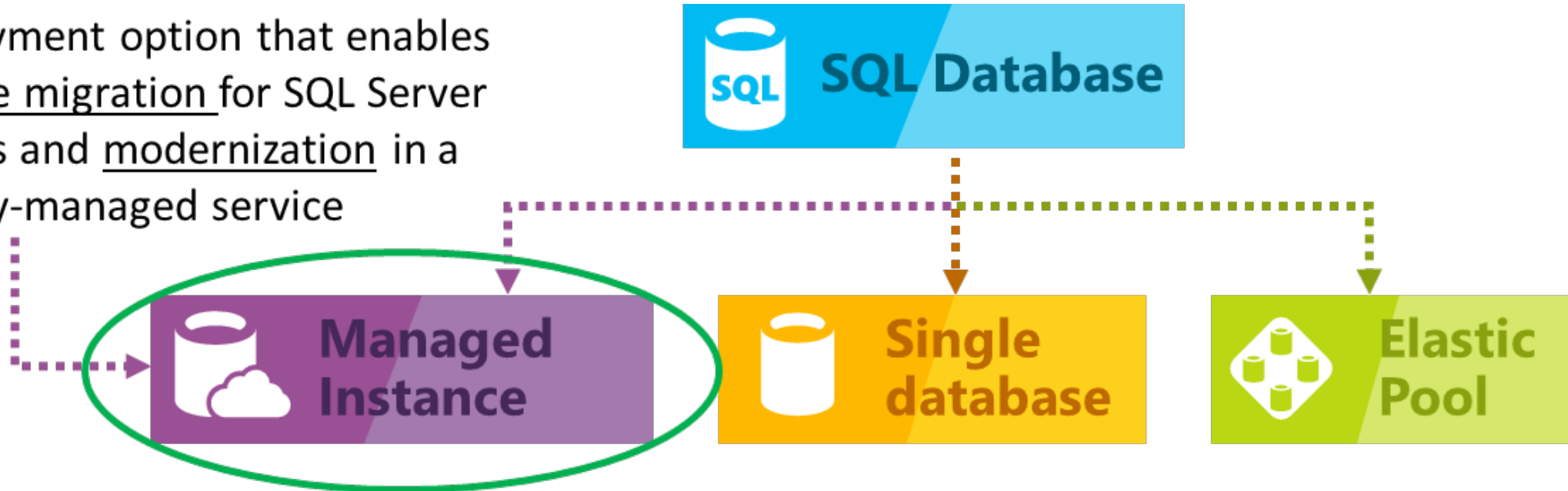
1. v1.0 of Big Data Clusters
2. TDE now Standard Edition!
3. Accelerated Database Recovery (ADR)
4. Major performance improvements, no code changes
5. Quality of Life/efficiency improvements
6. More little things

No Longer Just Windows



No Longer Just Windows

New deployment option that enables friction-free migration for SQL Server workloads and modernization in a fully-managed service



Coming soon with Azure Arc: Run Azure SQL Database on-prem!
Azure Arc: hybrid cloud+on-prem management for Azure

Unlimited Virtualization Benefit

- **Azure Dedicated Hosts** benefit from Unlimited Virtualization
 - Not regular Azure VM's
 - Provides dedicated physical servers in the Azure DC
 - Not colo, the dedicated hosts are Azure standard OEM
 - Bring your on-prem, Enterprise+SA licenses to the host, run unlimited cores of SQL, just like you can on-prem.
- Enterprise Edition only, Windows or Linux

Software Assurance Aids Migration to Azure

- For Azure VM's, use the Azure Hybrid Benefit to apply credits for on-prem licensing with SA for big discounts to SQL on Azure VM's or Azure PaaS SQL offerings.
- You can use your license for **both** your existing on-prem SQL Server and an Azure SQL platform for up to 180 days while you migrate.

SQL Server on Linux



- Red Hat Enterprise (RHEL) preferred, also Ubuntu, SUSE Linux Enterprise
- Support for Active Directory integrated auth
- Linux cluster managers like Pacemaker instead of WSFC
- Almost fully-featured SQL Server on Linux
- New in SQL 2019: Support for replication, MSDTC, CDC

SQL Server on Linux Tooling

- Linux tools: SQL Server “mssql-server”
 - command-line tools Sqlcmd, bcp, drivers and more on Linux

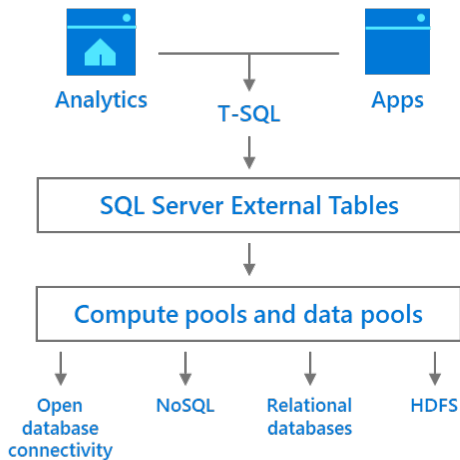
Otherwise, tooling is the same:

- Install **SSMS** on Windows, manage SQL on Linux remotely
- **Azure Data Studio** – lightweight, cross-platform SQL Server management software based Visual Studio Code
- Third party software

Big Data Clusters: SQL Server, Spark, and HDFS in Kubernetes

The entire data lake within SQL Server 2019

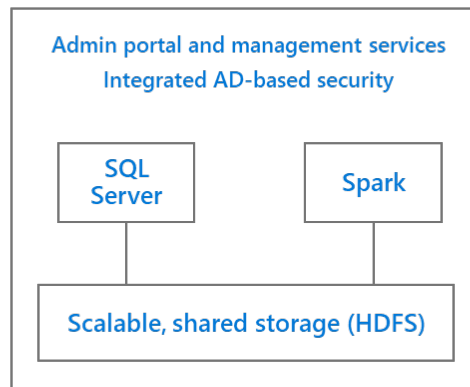
Data virtualization



Combine data from many sources without moving or replicating it

Scale out compute and caching to boost performance

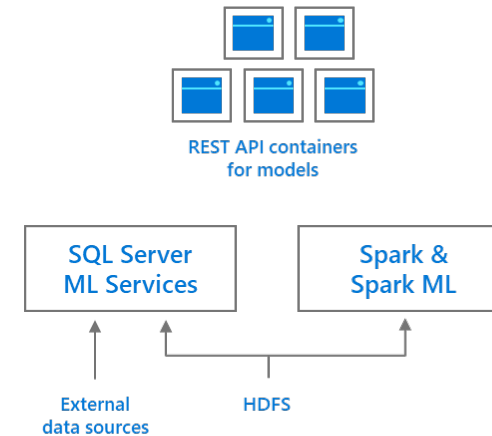
Managed SQL Server, Spark, and data lake



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

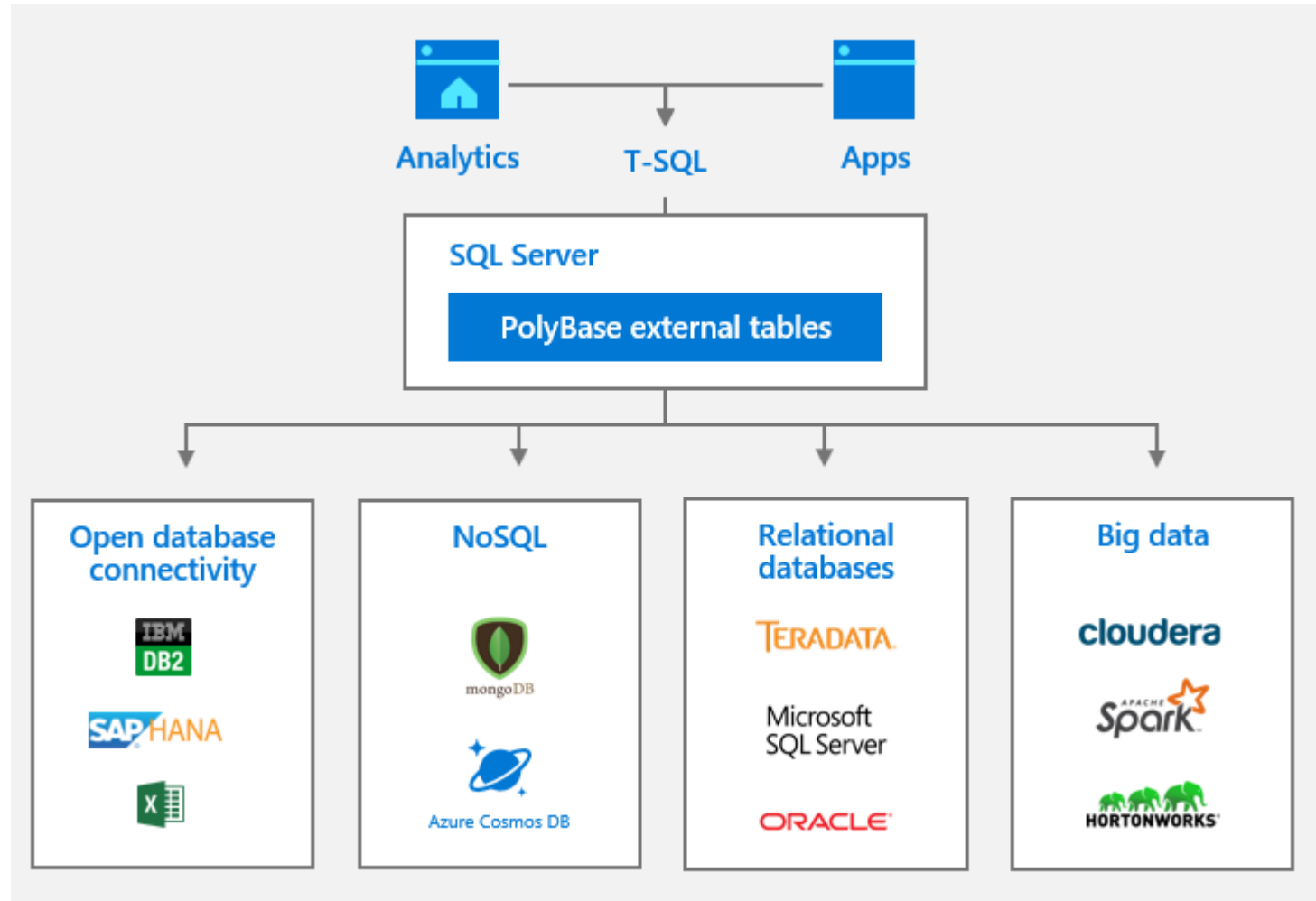
<https://cloudblogs.microsoft.com/sqlserver/2018/09/24/sql-server-2019-preview-combines-sql-server-and-apache-spark-to-create-a-unified-data-platform/>

Big Data Clusters: SQL Server, Spark, and HDFS in Kubernetes

- Big Data Clusters (BDC) is the entire data lake within SQL Server
- All data, both relational and non-relational, queryable with TSQL
- Minimizes data movement, sprawl of skillsets/languages
- Built on Kubernetes, requires some knowledge there to config
- No data movement + scale = no ETL, schema/analysis on read

PolyBase Query Service For External Data

- Query external, non-Microsoft, non-relational data with **PolyBase External Tables** aka “Data Virtualization”
- That’s right, query Oracle or DB2 with Microsoft T-SQL



PolyBase Query Service For External Data

- Superior alternative to Linked Servers, OPENDATASOURCE, or heterogenous replication:
 - External tables allows for clear schema
 - More secure – inside a database, not at instance level
 - ODBC drivers offer scale-out options
 - Optimized for large analytic-scale queries
 - Offers “Push Down” computation for external sources, significantly reducing data transferred
- But does require additional setup.

SQL Server Feature/Edition changes

- Transparent Data Encryption (TDE) is now supported in standard edition in SQL 2019!
 - This is a big deal!
 - TDE is “Encrypt Data at Rest” audit solution feature
- As well as the Extensible Key Management feature that allows 3rd party (Hardware Security Module) HSM vendors including the Azure Key Vault (AKV)
- All hardware caps/limits are the same since SQL 2016

Columnstore Indexing

- Extremely effective for queries on 10+ million rows
- Relatively new (introduced in 2012, limited until 2016)
- Not a B+tree; highly compressed columnar data
- Available in all editions of SQL Server, not just Enterprise
- New in SQL 2019:
 - Improved internals for memory management
 - Improved performance of bulk loading to columnstore

Azure SSIS Lift-and-Shift with Azure IR

- Minimal/no code changes, run SSIS packages in Azure
- Part of Data Factory v2
 - Cloud-based ETL alternative to Boomi, Mulesoft
- Azure Integrated Runtime (IR) instead of a SQL instance on-prem or in an Azure VM

New in Availability Groups in SQL 2019

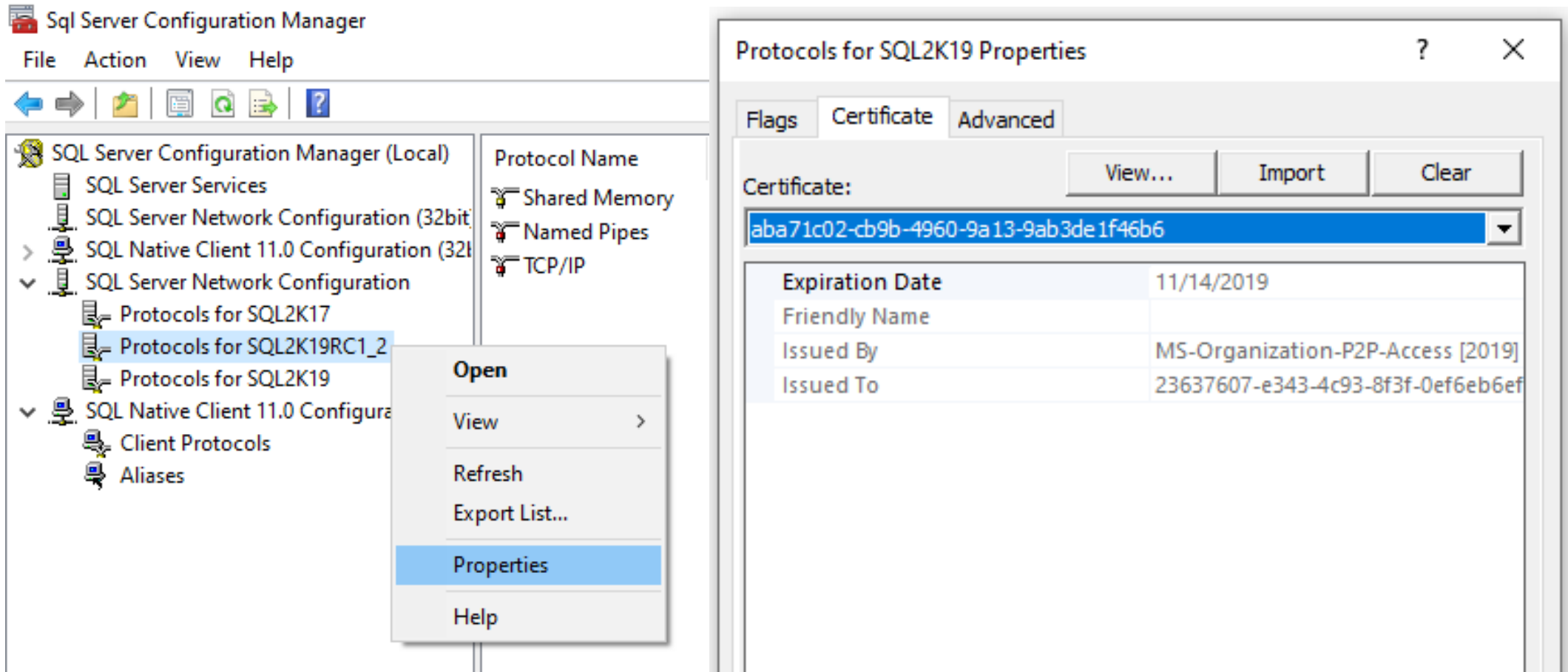
- Now up to 5 synchronous replicas supported
- Availability Groups now supported in Kubernetes
- Not supported in SQL for Windows on Docker (yet)

Software Assurance + Availability Groups

- Software Assurance – Azure VM SQL licensing for up to 2 secondary replicas in your availability groups are now FREE as of Nov 2019
- In case of availability groups, License the cores on the Primary replica, up to three more secondary licenses
- 1 core of Enterprise Edition with SA covers for free:
 - 1 core of HA replica, 1 core of DR replica,
PLUS 1 more DR replica in an Azure VM
 - DR = readable secondary, HA = failover only

Certificate Management inside Configuration Manager

- New in SQL Server 2019: Manage and monitor SSL/TLS certificates
- Deploy certs to instances in a AG or FCI easily



New TSQL Syntax in SQL 2019

- OPTIMIZE_FOR_SEQUENTIAL_KEY
- Reduces PAGELATCH_EX waits on “hot spots” where rapid inserts occur on the last page
- Improves performance up to 30% for *concurrent inserts*
- Add to the definition of each index!
- A sequential key was always superior to a random key, now it's even faster
- toolbox\lab - optimize_for_sequential_key testing.sql
- <https://techcommunity.microsoft.com/t5/SQL-Server/Behind-the-Scenes-on-OPTIMIZE-FOR-SEQUENTIAL-KEY/ba-p/806888>
- <https://support.microsoft.com/en-us/help/4460004/how-to-resolve-last-page-insert-pagelatch-ex-contention-in-sql-server>

Accelerated Database Recovery

- New in SQL Server 2019
 1. Instant rollback of long-running transactions or maintenance operations like index rebuilds
 2. Instant recovery for databases at startup, no more delay after server restart
 3. Can truncate the transaction log around long running transactions, reducing log file size.

Accelerated Database Recovery

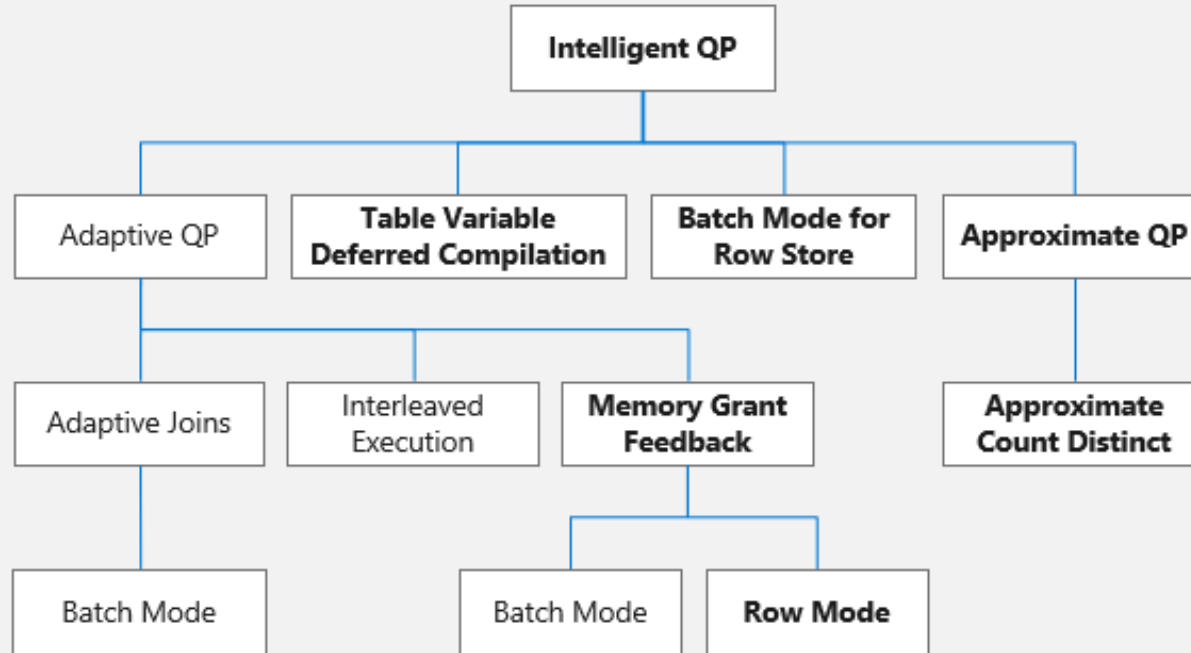
- Works via a persistent Version Store stored directly in the User database, may increase .mdf size by 10%+.
- As a result it is NOT enabled by default

```
ALTER DATABASE whatever SET ACCELERATED_DATABASE_RECOVERY = ON;
```

- Otherwise, it is downright **magical**.
- Supported in Enterprise AND Standard edition.
- Works in ANY compatibility level in SQL 2019!

New Intelligent Query Processing features

The Intelligent Query Processing feature family



Bold indicates new and improved features in SQL Server 2019

<https://cloudblogs.microsoft.com/sqlserver/2018/09/26/sql-server-2019-celebrating-25-years-of-sql-server-database-engine-and-the-path-forward/>

Performance Boost: Batch mode on rowstore

- Batch mode operators work more efficiently for large rowcounts, a major scalability improvement
- On by default in compat 150 (SQL 2019)
- Prior to compat 150, only possible on columnstores. With compat 150, batch mode is another tool for the query optimizer for use on heaps and B-tree indexes.
- New **BATCH_MODE_ON_ROWSTORE** database scoped configuration

Performance Boost: Memory Grant Feedback

- Already had Memory Grant Feedback for batch mode.
- Now supported for row mode.
- More efficient memory estimation and handling
- Prevents spill to disk if memory initially underestimated
- Enterprise edition feature only in SQL 2019 for both row and batch mode.
- On by default in compat 150 (SQL 2019)

Performance Boost: Scalar UDF inlining

Developers now off the hook for some bad habits!

- **Will immediately, dramatically improve performance** where Scalar UDF's are abused, no code changes.
- “Scalar UDF Inlining” automatically transforms inline-able UDFs into relational expressions.
- Prevents UDF's in the SELECT or ON part of queries from exploding query cost with RBAR.

More Specific string truncation error messages

- Introduced in **SQL 2019**. With **SQL 2017 CU12** and **SQL 2016 SP2 CU6** this can be enabled with trace flag 460 (recommended!)

Old:

Msg 2628, Level 16, State 1, Line 10
String or binary data would be truncated.
The statement has been terminated.

New:

```
Msg 2628, Level 16, State 1, Line 37
String or binary data would be truncated in table 'tempdb.dbo.string_truncation_test', column 'chars'.
Truncated value: 'aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaaaaaaaaaaa'.
The statement has been terminated.
```

- Lab - toolbox\lab - string truncation error message improvement in SQL 2019.sql
<https://support.microsoft.com/en-us/help/4468101/optional-replacement-for-string-or-binary-data-would-be-truncated>

New Data Classification Schema

- Before SQL 2019, Data Classification feature used database extended properties to store this data.
- Now, a dedicated schema for this data in SQL 2019.
- Designed to aid auditing, GDPR or CCPA compliance.
- Related to the “SQL Data Discovery and Classification” tool introduced in SSMS 17.5.

<https://docs.microsoft.com/en-us/sql/relational-databases/security/sql-data-discovery-and-classification?view=sql-server-ver15&tabs=t-sql>

- Available in all editions.

HEALTH CHECK



REMEDIATION



MANAGED SQL



The Sparkhound SQL DBA Team

- Knowledge Transfer – We work with your Devs, DBA's, “accidental” DBA's.
- Pros Nearby – Sparkhound's DBA team of FTE's are US-based, CT zone.
- Microsoft & Peer Recognized – Sparkhound DBA team is 100% Microsoft certified, and members have spoken at conferences and user groups.
- Proven Success – For years we have supported servers in US and Europe.
- Dev Background – Experience as former developers provides context.
- The Checklist – Reference for future checks, audit prep, new SQL builds.

Sparkhound Managed SQL

HEALTH CHECK



Interactive Health Check
Windows, SQL, Process

Emphasis on
Knowledge Transfer
What, Why, How

Checklist

Critical
High
Medium
Low

REMEDIATION



Remediation
Planning

Checklist

Maintenance
Window

MANAGED SQL



Proactive Health Checks
Reactive Alerting

Regular Maintenance Windows
Knowledge Transfer
Special Project Assistance
Documentation/Process Improvement
Trending/Analysis

Managed Services

Sparkhound SQL DBA Consulting Services

- Performance Tuning, with App Services team
- Reporting, with our Data Analytics team
- Upgrades/Migrations/Data Conversions
- High Availability/Disaster Recovery solutions
- Pre-audit, encryption, database security
- Maintenance/administration
- Automation/PowerShell
- Azure SQL [IaaS or PaaS] architecture
- Training/**Knowledge Transfer**/skillset updates

SUPPORT YOUR LOCAL STEM INITIATIVES



Digital Courses

Teens learn coding skills

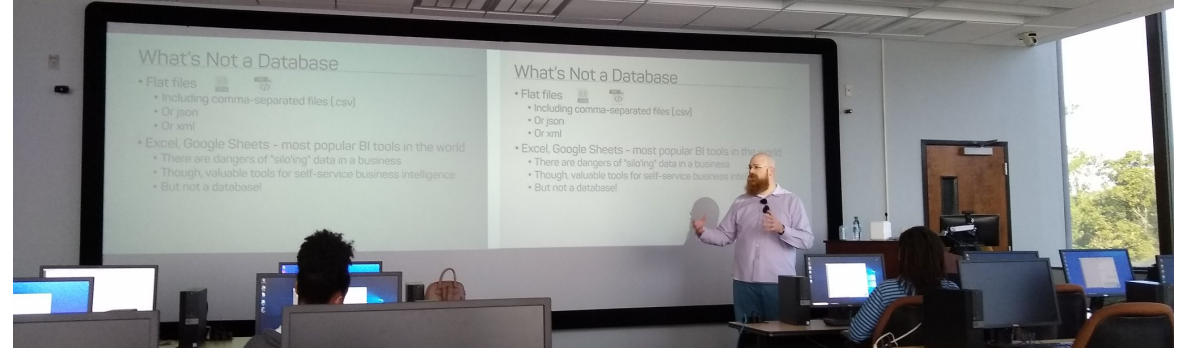
[Learn More >>](#)



Visual Courses

Teens learn photography skills

[Learn More >>](#)



- I encourage you to find, then donate time and money to local STEM education initiatives where you live. Get involved!
- There is almost certainly some nonprofit where you live that needs your enthusiasm and skills to close the achievement gap.

https://www.thewallsproject.org/programs/futures_fund/



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SQL Server 2017 Administration

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Foreword by Patrick LeBlanc, Microsoft

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This presentation, including all source code,
available at my blog:

SQLTact.com