



Modernizing SQL Server the Right Way

Post migration activities



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Experience

- +15 Years of experience working on IT
- +10 Years of experience working with SQL Server
- Developer of Open Source tools for SQL Server administration, development and productivity.

Certifications

- MCSE Data Management and Analytics
- MCSA SQL 2016 Database Development
- MCSA SQL 2016 Database Administration
- MCSA SQL 2012/2014

Community

- Regular Author for MSSQLTips.com
- Regular Author for SQLServerCentral.com
- MSSQLTips.com Rookie of the year 2018
- Board member of Guatemala SQL Server User Group
- Owner of SQLGuatemala.com



Improvements since SQL Server 2008

How to justify the investment?

New features comparison from 2008/2008R2 to new versions

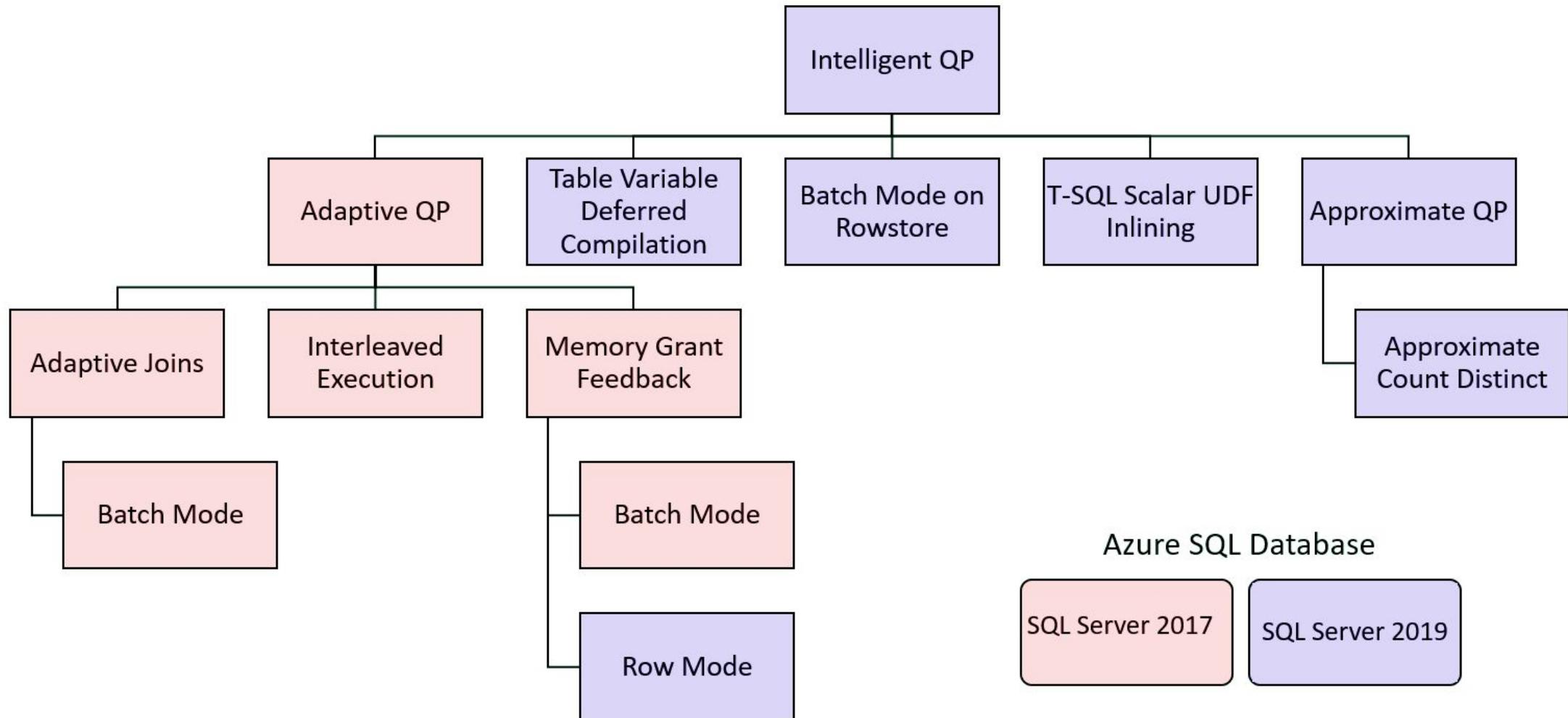
SQL Server 2008/2008 R2
Language-Integrated Query
Transparent Failover (mirroring)*
Log Stream Compression (mirroring)*
Data Compression
FileStream Data
Master Data Services

SQL Server 2017
Support for Linux
Machine Learning Services
Resumable online index rebuild
Smart Backups
Improved Availability Groups
Improved In-Memory OLTP
Improved Security
New and improved DMO's
Improved Query Store
Intelligent Query processing

SQL Server 2019 (so far...)
Data virtualization
Big Data clusters
Machine Learning integration
Language Extensions for Java
Columnstore Index Enhancements
Resumable Online Index Creation
SQL Data Discovery and Classification
Always Encrypted with Secure Enclaves
UTF-8 Support
Enhancement in SQL Graph
Always on Improvements
Improved Intelligent Query Processing

*Will be removed on future product releases

Intelligent Query processing



<https://docs.microsoft.com/en-us/sql/relational-databases/performance/intelligent-query-processing?view=sql-server-2017>

Intelligent Query processing

Check this article for an example on Memory Grant Feedback in SQL Server 2019:

<https://www.mssqltips.com/sqlservertip/5793/sql-server-2019-memory-grant-feedback-example-and-data-collection/>

Not just the SQL Server engine, but your tools...



SQL Server Management Studio 18.1 – A lot of new and improved features (and SQL Server 2019 support)

[Download it here!](#)



Azure Data Studio – Can be used on any operating system and focused on productivity and customization

[Download it here!](#)



Visual Studio 2019 and SSDT – Support for SQL Server 2019

[Download it here!](#)

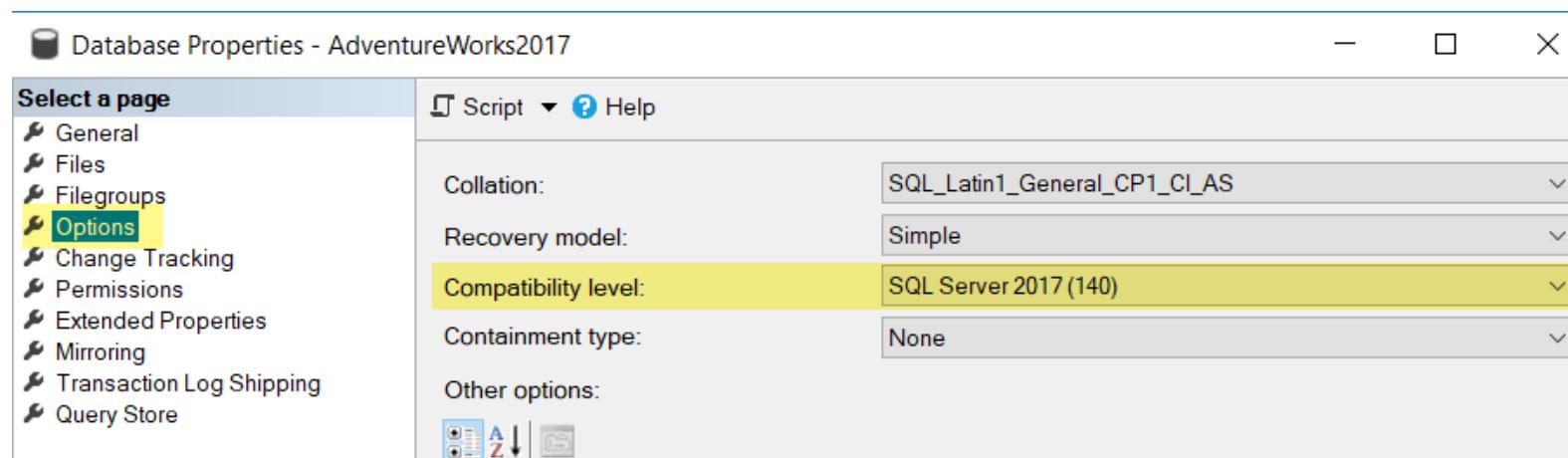


Database Compatibility Certification

What is Database Compatibility level?

A method to maintain backward compatibility at database level into more recent versions of SQL Server

It Does NOT apply for Server level functionalities (**for example DMOs**)



Database Compatibility Level based certification

Stop certifying for any given platform (Cloud, on-prem)!

Stop certifying for a named SQL Server version!

Any certification process should be thought in terms of
"which target database compatibility level am I certifying to?"

Updated public documentation: <http://aka.ms/dbcompat>  PASS

Key Benefits

Simplified application certification on-premise and Azure (e.g. Azure SQL DB MI).

Ability to provide customer a choice of latest SQL Server platform based on certified DB compat level.

Improved risk management by decoupling application upgrade cycles from Database upgrade cycles.

Microsoft stands by DB Compat based certification

Microsoft Database Compatibility Level Protection

Full Functional protection once assessment tools runs clean with no errors.

Query Plan shape protection on comparable hardware.

Maintaining backward compatibility is very important to SQL Server team.

Database Compatibility Level behavior

Database Compatibility Level sets certain database behaviors to be compatible with the specified version of SQL Server.

Compatibility level affects behaviors only for the specified database, not for the entire server.

Product	Compatibility Level Designation	Supported Compatibility Levels
SQL Server 2019	150	150, 140, 130, 120, 110, 100
SQL Server 2017	140	140, 130, 120, 110, 100
Azure SQL Database	130	150, 140, 130, 120, 110, 100
SQL Server 2016	130	130, 120, 110, 100
SQL Server 2014	120	120, 110, 100
SQL Server 2012	110	110, 100, 90
SQL Server 2008 R2	100	100, 90, 80
SQL Server 2008	100	100, 90, 80
SQL Server 2005	90	90, 80
SQL Server 2000	80	80

Functional change protection

Clarifying the caveats

Deprecated = avoid use in new development

- Deprecated functionality introduced in a given SQL Server version is still protected by that compatibility level.

Discontinued = removed from product

- Discontinued functionality introduced in a given SQL Server version is not protected by compatibility level.

Example of removed T-SQL syntax.

- In SQL Server 2012 the `fastfirstrow` hint was removed.

Regardless of the compatibility level, the query below will produce **error 321 (not a recognized table hints option)**:

```
SELECT * FROM HumanResources.Employee WITH (FASTFIRSTROW);
```

-- Instead use:

```
SELECT * FROM HumanResources.Employee OPTION (FAST = <n>);
```

Breaking Changes = behavior changes resulting in different outcome

Protected by Database Compatibility:

```
DECLARE @value datetime = '1900-01-01 00:00:00.003'  
SELECT CAST(@value AS datetime2)
```

- In DB Compat 120 or lower, result is:
1900-01-01 00:00:00.0030000
- Under DB Compat 130, these show improved accuracy by accounting for the fractional milliseconds, resulting in:
1900-01-01 00:00:00.0033333

Not Protected by Database Compatibility:

- The query below works until DB Compat 90, but errors out starting with Database Compatibility 100 (error 241, conversion fail):
`SELECT DATEPART (year, '2007/05-30')`
- Instead use:
`SELECT DATEPART (year, '2007/05/30') or SELECT DATEPART (year, '2007-05-30')`

Check Microsoft Official documentation to see changes across different compatibility levels:

<https://docs.microsoft.com/en-us/sql/t-sql/statements/alter-database-transact-sql-compatibility-level>



Post-Migration

I moved the data, am I done?

SQL Server post migration step is very crucial for reconciling any data accuracy and completeness, as well as uncover performance issues with the workload.

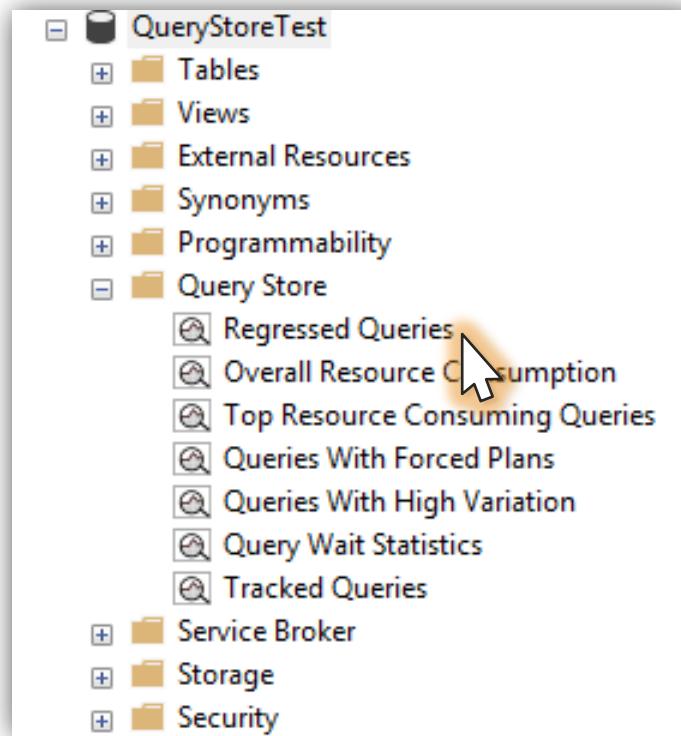
Recommended Upgrade Plan for latest DB Compatibility Level:



Upgrading DB Compat until recently

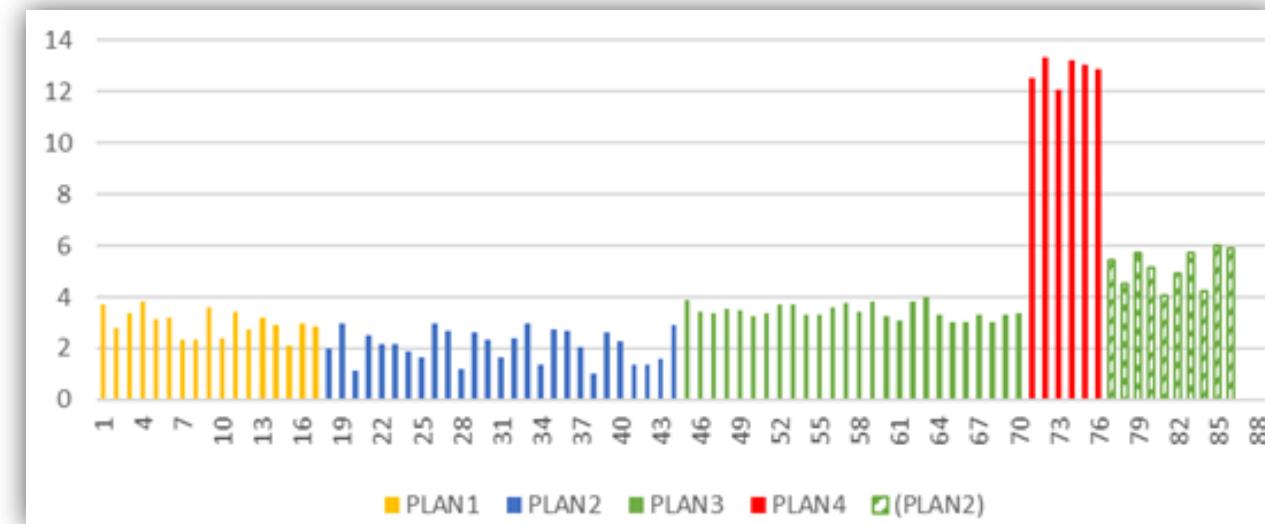
SQL 2016+

Query Store Regressed Queries



SQL 2017+

Automatic Plan Correction



```
-- Enabling Query Store (starting SQL Server 2016)
ALTER DATABASE [YourDatabase] SET QUERY_STORE = ON;
```

```
-- Enabling Automatic tuning (starting SQL Server 2017)
ALTER DATABASE [YourDatabase] SET AUTOMATIC_TUNING ( FORCE_LAST_GOOD_PLAN = ON );
```

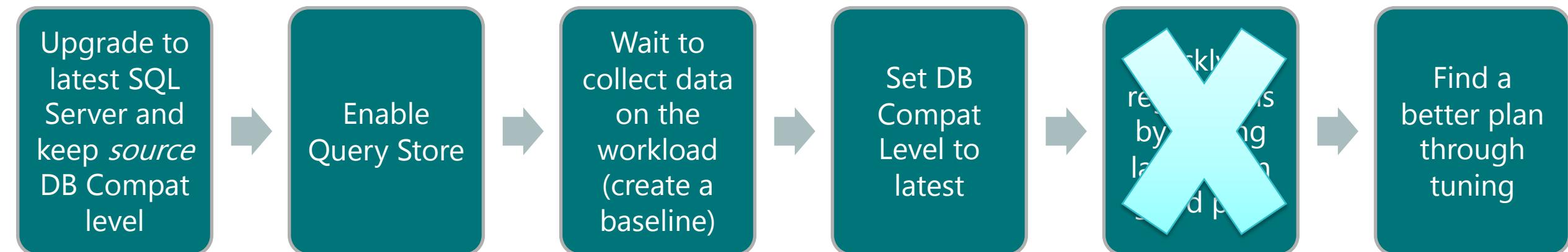
More info about Query Store here:

<https://www.sqlservercentral.com/steps/the-basics-level-1-of-the-stairway-to-query-store>

Query Tuning Assistant (QTA)

1st Priority: to guide users through the documented and recommended DB Compatibility upgrade procedure with ease.

What if instead of choosing between current and last known good plan, we find a 3rd, better plan?

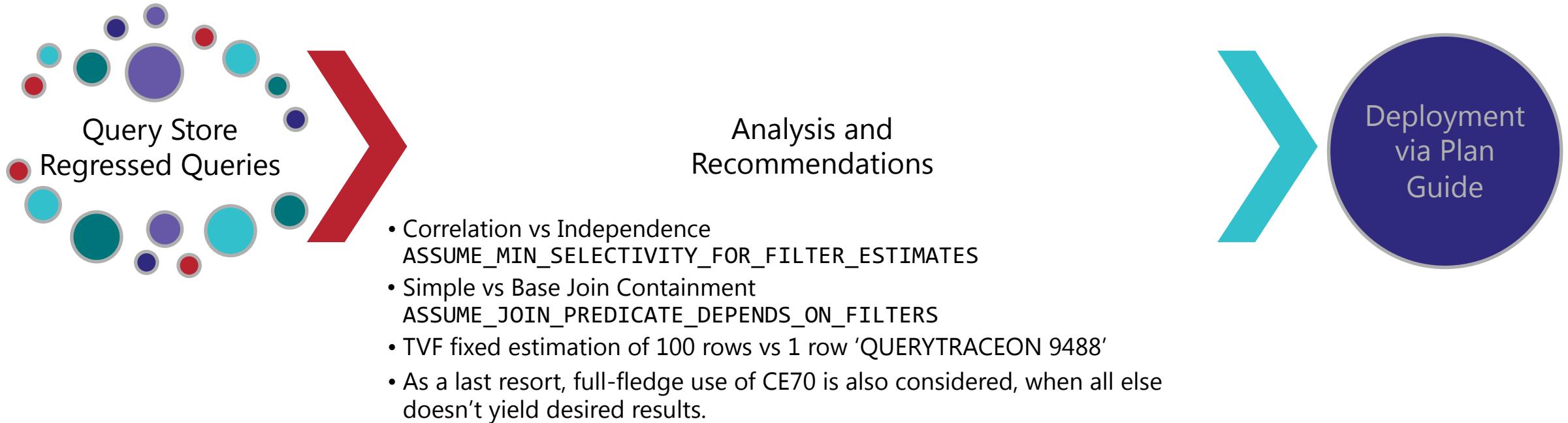


Documented DB Compatibility upgrade process:

<https://docs.microsoft.com/en-us/sql/relational-databases/performance/query-store-usage-scenarios?view=sql-server-2017#CEUpgrade>

Query Tuning Assistant (QTA) Workflow

Available in SSMS v18 and Powershell (preview)



Query Tuning Assistant (QTA)

Official documentation:

<https://docs.microsoft.com/en-us/sql/relational-databases/performance/upgrade-dbcompat-using-qta?view=sql-server-2017>



DEMO

Query Tuning Assistant

Modernization Tools Breakdown

DMA

Readiness assessment: blocking issues breaking changes, behavior changes

Moves schema, data and uncontained objects (like logins) To Azure SQL Database

Backup / Restore to another SQL Server (Keeps source DB Compatibility Level)

New feature recommendation

DEA

A/B Testing

Capture and Replay workload for performance testing and reporting

Also reports on migration blockers because of failed T-SQL syntax

QTA

Upgrade Database Compatibility Model to desired state

Detects workload regressions, and tests CE model variations (subsets)

Provides tangible recommendations for tuning queries without reverting DB compat

Session takeaways

- Start planning for End of Service for SQL Server 2008/R2 and Windows Server 2008/R2 today!
- Review the database migration guide
- Familiarize yourself with the DMA, DEA, Query Store and Query Tuning Assistant
- Leverage Database Compatibility to accelerate modernization

Session resources

<http://aka.ms/sqleosfaq> - End-of-Support FAQ

[Upgrade SQL Server](#)

[Database Migration Guide](#)

[Microsoft Assessment and Planning Toolkit](#)

[Overview of Data Migration Assistant](#)

[DEA 2.1 General Availability: Release Overview – Database Experimentation Assistant](#)

[Post-migration Validation and Optimization Guide](#)

<http://aka.ms/dbcompat> (DB Compatibility Level based upgrades)

Questions?



Thank you!

Want to know more? Having doubts about this presentation?
Visit me at:

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