

# Modern SQL Server Features That Make Life Better

# Thank You!

**Thank you!**

- SQL server Meetup Croatia!

# About Me



- Entered IT in Feb 2008
- MCTS SQL Server 2008 Implementation and Maintenance in May 2013
- Database Administrator since 2014
- Blog at <https://leemarkum.com/>
- Currently a Lead Cloud Database Administrator at Upland Software (Views expressed here are my own)
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# Setting Expectations

- The presentation can't go in-depth on any of the features that are covered.
- I am only considering features from the database engine and not SSIS, SSRS, or SSAS.
- There are a lot of features I could have chosen from.

# Agenda

Discuss features in the following categories:

- Performance
- Troubleshooting
- T-SQL
- High Availability/Disaster Recovery

# Modern SQL Server Features That Make Life Better

- How did I decide which SQL Server versions to discuss?
- <https://sqlserverupdates.com/>
- Extended support for SQL Server 2012 ended in July 2022.
- Extended Support for SQL Server 2014 ends in July 2024.

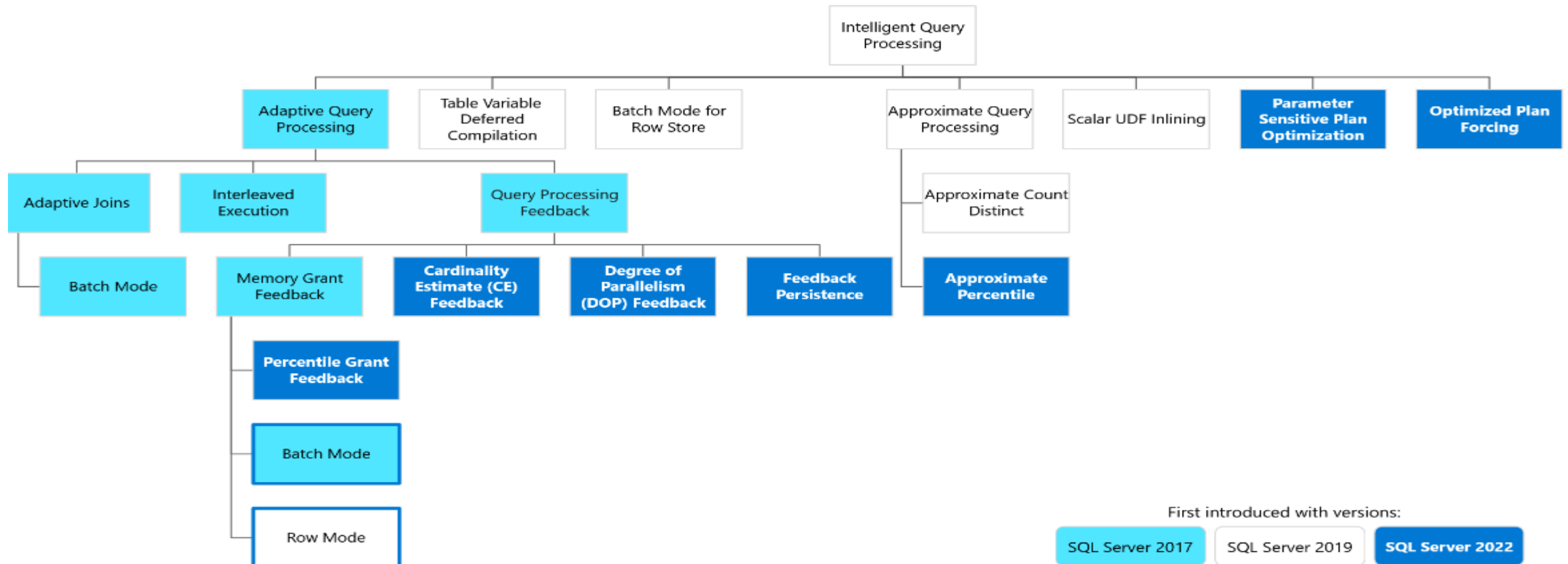
# Modern SQL Server Features That Make Life Better

## Performance Features

# Performance Features

Intelligent Query Processing Picture from MS Learn

<https://bit.ly/3C0Zn1B>





# Performance Features

- Intelligent Query Processing

Includes, but not limited to, features such as:

- Adaptive Joins (SQL Server 2017)
- Interleaved Execution for MSTVFs (SQL Server 2017)
- Memory Grant Feedback – Batch mode (SQL Server 2017)
- Memory Grant Feedback - Row Mode (SQL Server 2019)
- DOP\_Feedback (SQL Server 2022)
- Percentile and persisted memory grant feedback (SQL Server 2022)
- Forced plan optimization – compilation script creation (SQL Server 2022)

# Performance Features

- Memory grant feedback (SQL Server 2017)
  - Can reduce spills to disk by increasing memory grants
  - Can reduce wasted memory by lowering memory grants that are too high
  - Can result in a “zig-zag” result where memory grants are constantly shifting up and down based on parameters passed to the affected query
  - Feedback is lost on SQL Server restart and doesn't occur for plans using RECOMPILE
  - Requires database compatibility level 140 for batch mode and 150 for row mode

# Performance Features

- Persisted and Percentile memory grant feedback (SQL Server 2022)
  - Needs compat level 140 and higher.
  - Needs Query Store enabled and in read-write mode.

# Performance Features

- DOP\_Feedback (SQL Server 2022)
  - Needs compat level 160
  - Needs Query Store enabled and in read/write mode
  - Only verified feedback is persisted.
  - Feedback will be persisted in the sys.query\_store\_plan\_feedback catalog view when we reach a stable degree of parallelism feedback value.

# Performance Features

- CE\_Feedback (SQL Server 2022)

CE feedback identifies model-related assumptions and evaluates whether they're accurate for repeating queries.

Are the data points in two columns, like City and State, related? Old CE - No/ New CE - Yes

CE Feedback reviews actual versus estimated rows to determine if an assumption may be incorrect. If the assumption seems incorrect, then later executions of the same query are tested with different CE assumptions.

If the alternate CE assumptions improve plan quality, the old query plan is replaced with a query plan that uses the appropriate USE HINT query hint that adjusts the estimation model, implemented through the Query Store hint mechanism.

# Performance Features

- Forced plan optimization – compilation script creation (SQL Server 2022)
  - Needs compat level 160
  - Needs Query Store enabled and in read/write mode
  - ALTER DATABASE SCOPED CONFIGURATION SET OPTIMIZED\_PLAN\_FORCING = ON;
  - sys.query\_store\_plan DMV has a bit column for has\_recompile\_script

# Performance Features

- Forced plan optimization – compilation script creation (SQL Server 2022)

Select all queries that have an optimization replay script

```
SELECT q.query_id, t.query_sql_text, p.plan_id,  
TRY_CAST(p.query_plan as XML) as query_plan,  
p.is_forced_plan,  
p.count_compiles  
FROM sys.query_store_plan AS p  
INNER JOIN sys.query_store_query AS q on p.query_id = q.query_id  
INNER JOIN sys.query_store_query_text AS t ON q.query_text_id = t.query_text_id  
WHERE p.has_compile_replay_script = 1;
```

# Performance Features

## Query Store(2016)

- <https://bit.ly/2JGUC5J> (Lee Markum - Overview of Query Store)
  - <https://bit.ly/3Ao8LKF> (Erin Stellato on Query Store - St. Charles SQL Server Meetup channel on YouTube)
- 
- Stores query runtime performance from the perspective of CPU, Duration, logical reads and other metrics
  - Wait Stats information is available in SQL 2017 and above
  - Custom Capture Policies in 2019 to allow better control over what is captured so Query Store performs better.



# Performance Features

## Query Store(2016)

- Is enabled at the database level
- Stores query plans and related performance metrics
- Allows you to detect regression and force “good query plans”

# Performance Features

## Query Store(2016)

- Various reports show performance graphically
- Use TF 7745 to prevent Query store data from writing to disk as part of shutdown or failover process
- Query Store in SQL Server 2022

# Modern SQL Server Features That Make Life Better

## Troubleshooting Features

# Troubleshooting Features

## Verbose Truncation Warnings(2019)

- The dreaded “string or binary data would be truncated” error

Msg 8152, Level 16, State 30, Line 13

String or binary data would be truncated.

The statement has been terminated.

```
CREATE TABLE DemoSQL2019
```

```
(
```

```
  [ID] INT identity(1,1),
```

```
  [NAME] VARCHAR(10),
```

```
)
```

```
INSERT INTO DemoSQL2019 VALUES ('Arizona SQL Server Meetup')
```

```
INSERT INTO DemoSQL2019 VALUES ('Brent Ozar Author')
```

# Troubleshooting Features

## Verbose Truncation Warnings(2019)

- A better error message

Msg 2628, Level 16, State 1, Line 13

String or binary data would be truncated in table  
'TruncateMessageDemo.dbo.DemoSQL2019', column 'NAME'.

Truncated value: 'Arizona SQ'.

- Can be turned on in SQL Server 2017 using trace flag 460.
- Available in compatibility level 150 (SQL Server 2019) by default

# Troubleshooting Features

## Temporal Tables/System-Versioned Tables (2016)

- Composed of a “normal” table and a history table
- Special time range start and time range end columns exist in the history table.
- A temporal table must have a Primary Key

# Troubleshooting Features

## Temporal Tables/System-Versioned Tables (2016)

- Can be a replacement for triggers as a means of tracking changes to tables.
- Can help you answer, what happened to the data and when, making the feature useful for auditing
- Temporal Tables do not track WHO made the modification. But see Aaron Bertrand's solution for that here on MSSQLTips: <https://bit.ly/3672sNH>
- For tracking WHO as well as WHAT, see the new Ledger feature (SQL 2022)

# Modern SQL Server Features That Make Life Better

## T-SQL Enhancements Features



# T-SQL Features

- DROP IF EXISTS(SQL Server 2016SP1)
- CREATE OR ALTER(2016SP1)
- JSON format support(2016)

# T-SQL Features

- ALTER TABLE WITH ONLINE = ON
- Inline specification of CLUSTERED and NONCLUSTERED indexes (2014)
- New string functions (2017) CONCAT\_WS, TRANSLATE, and TRIM, and WITHIN GROUP is now supported for the STRING\_AGG function

# T-SQL Features

## SQL Server 2022 Enhancements:

- Greatest/Least
- Generate\_Series
- Window or STRING\_SPLIT with the enable\_ordinal enhancement enabled
- Create index and resumable constraint enhancements

# Modern SQL Server Features That Make Life Better

High Availability/Disaster Recovery

# High Availability/Disaster Recovery

What is High Availability?

What is Disaster Recovery?



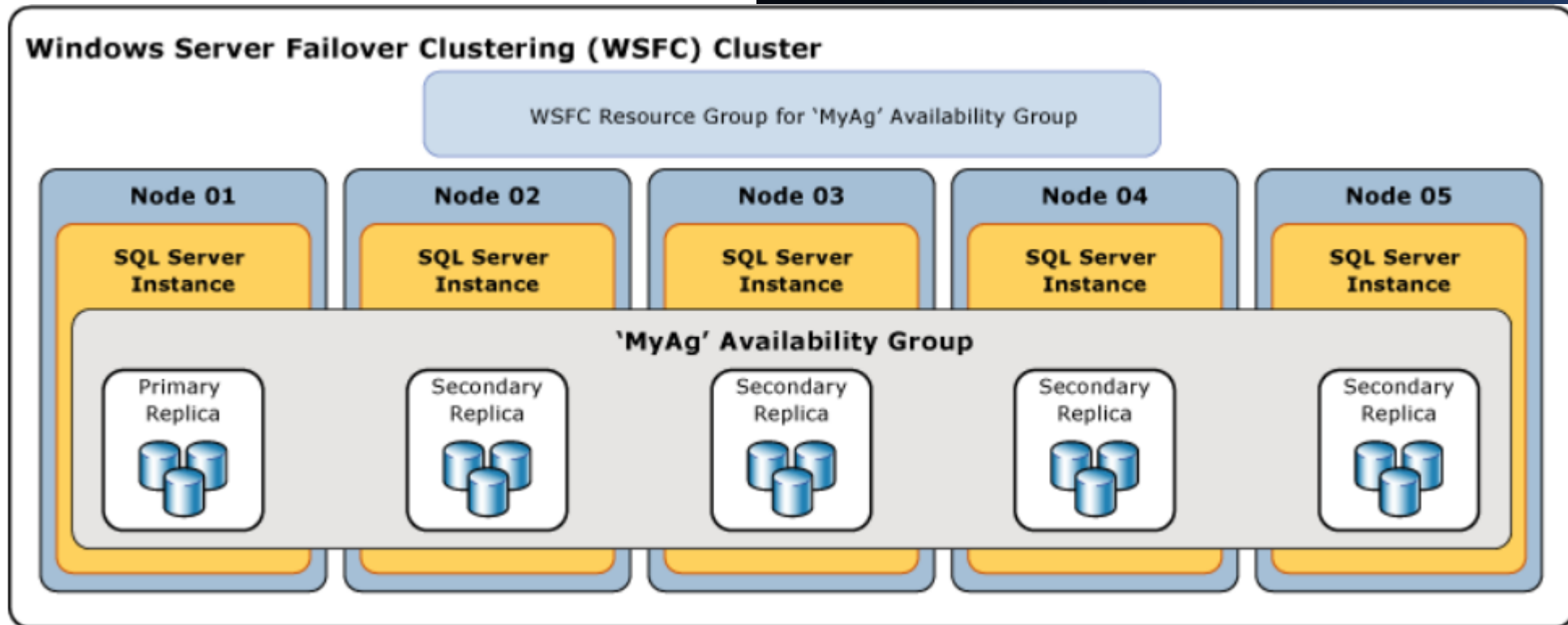
## HA/DR Category

Availability Groups (2012 and Up, but don't try it on 2012)

<https://bit.ly/3xieeks> (MS Docs - What is an AlwaysOn Availability Group)

<https://bit.ly/3dqxrG> (Lee Markum - My Availability Group Database Isn't Synchronizing)

## Modern SQL Server Features That Make Life Better

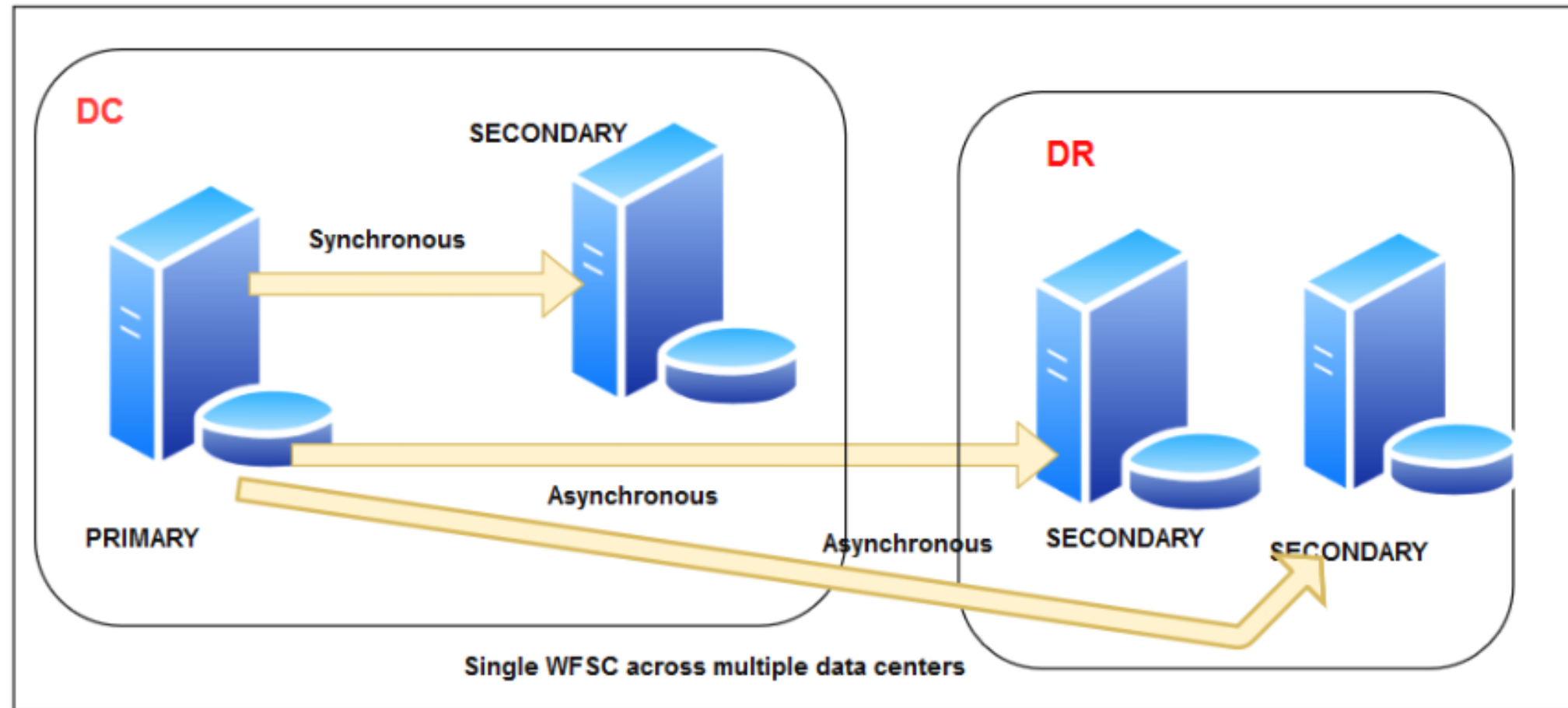


<https://bit.ly/3xieeks>  
MS Docs depiction

# High Availability/Disaster Recovery

Primary Data Center

Disaster Recovery Location



# High Availability/Disaster Recovery

## Summary of Availability Group Positives

- Redundant copies of your SQL Server data
- Automatic failover for a group of databases
- Relatively easy to use for disaster recovery
- Automatic page repair from a secondary
- Readable secondaries by direct connect to a secondary instance name
- Readable secondary using ReadOnly routing feature (AG Listener)
- Manage objects outside the database by contained AGs(SQL 2022)
- Query Store on readable secondaries (SQL 2022)



# Accelerated Database Recovery

## New in SQL Server 2019

<https://www.mssqltips.com/sqlservertip/5971/accelerated-database-recovery-in-sql-server-2019/>

Uses the “persisted version store”

Off by default

Updating Email address to FirstName.LastName@adventure-works.com

	BusinessEntityID	EmailAddressID	EmailAddress	rowguid	ModifiedDate
1	1	1	ken0@adventure-works.com	8A1901E4-671B-431A-871C-EADB2942E9EE	2009-01-07 00:00:00.000
2	2	2	terri0@adventure-works.com	B5FF9EFD-72A2-4F87-830B-F338FDD4D162	2008-01-24 00:00:00.000
3	3	3	roberto0@adventure-works.com	C8A51084-1C03-4C58-A8B3-55854AE7C499	2007-11-04 00:00:00.000
4	4	4	rob0@adventure-works.com	17703ED1-0031-4B4A-AFD2-77487A556B3B	2007-11-28 00:00:00.000
5	5	5	gail0@adventure-works.com	E76D2EA3-08E5-409C-BBE2-5DD1CDF89A3B	2007-12-30 00:00:00.000
6	6	6	jossef0@adventure-works.com	A9C4093A-4F4A-4CAD-BBB4-2C4E920BACCB	2013-12-16 00:00:00.000
7	7	7	dylan0@adventure-works.com	70429DE4-C3BF-4F19-A00A-E976C8017FB3	2009-02-01 00:00:00.000
8	8	8	diane1@adventure-works.com	37F02A87-058D-49F8-A20D-965738B0A71F	2008-12-22 00:00:00.000
9	9	9	gigi0@adventure-works.com	F888A16D-0C33-459E-9D72-D16AE0BB1F43	2009-01-09 00:00:00.000
10	10	10	michael6@adventure-works.com	E0DD366D-433D-4F5A-9347-1A5FE7FBE0A3	2009-04-26 00:00:00.000

# Accelerated Database Recovery

Enhancements in SQL Server 2022

New sp\_configure options:

ADR Cleaner Thread Count – Multi-threaded ADR available in 2022

ADR cleaner retry timeout(min) – Changes the default from 120 in SQL Server 2019 to 15 in 2022.

# Modern SQL Server Features That Make Life Better

How can you discover information about new SQL Server features?

- <https://docs.microsoft.com/en-us/sql/sql-server/what-s-new-in-sql-server-2016?view=sql-server-ver15> (The page has links in the left window of the site to 2016-2019)
- <https://docs.microsoft.com/en-us/previous-versions/sql/> (You guessed it, everything prior to SQL 2016)
- Various MSSQLTIPS articles: <https://www.mssqltips.com/sqlservertip/4574/new-features-in-sql-server-2016-service-pack-1>
- <https://www.mssqltips.com/sqlservertip/5376/tsql-enhancements-in-sql-server-2017/>
- <https://blog.pythian.com/top-10-new-features-of-sql-server-2019/>
- <https://www.sentryone.com/blog/aaronbertrand/fishing-for-features-in-ctps>
- <https://www.sentryone.com/blog/aaronbertrand/more-changes-sql-server>

# Modern SQL Server Features That Make Life Better

## Bonus Material

- In-Memory OLTP(SQL 2014) – This can produce significant improvements for some workloads.
- Backup encryption (2014)
- Always Encrypted (2016)
- Dynamic Data Masking(2016)
- Row Level Security(2016)
- ColumnStore Indexes (2012, but many enhancements since)
- Data Virtualization (2019)

# Modern SQL Server Features That Make Life Better

## Summary

- Performance  
Intelligent Query Processing, Query Store
- Troubleshooting  
Verbose truncation warnings, temporal tables
- T-SQL  
DROP IF EXISTS, CREATE OR ALTER syntax, Inline index creation, greatest/least
- High Availability/Disaster Recovery  
Availability Groups, Contained AGs, Accelerated Database Recovery

# Modern SQL Server Features That Make Life Better

Thank you for attending!

# Modern SQL Server Features That Make Life Better

QUESTIONS?





# Contact Information



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