

SQL Server: The Intelligent Database



SQL
intersection

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“The purpose of digital technology is to help humans solve human problems.”
- Brad Smith, President, Microsoft

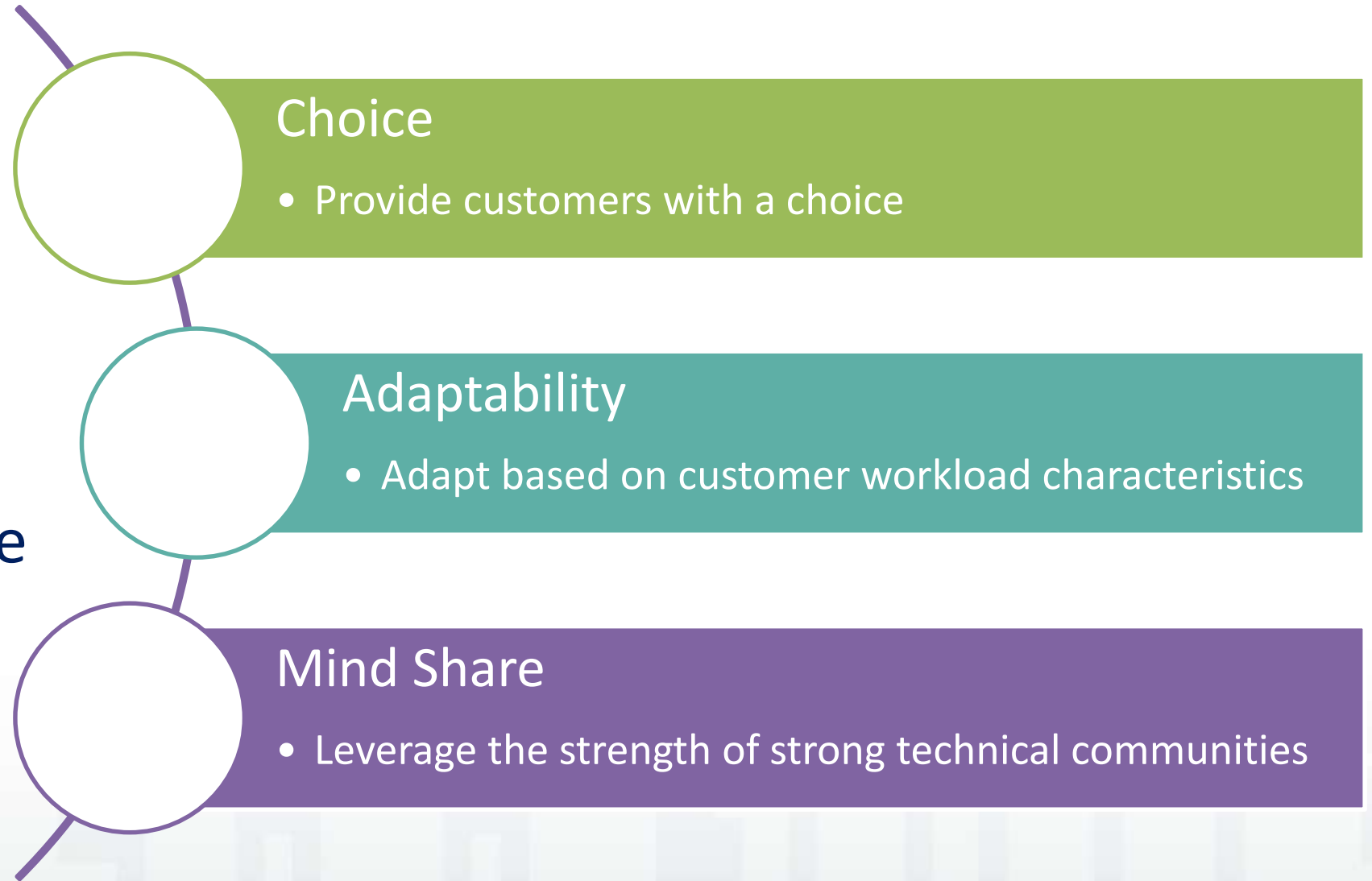
You want to focus on this...



...not this

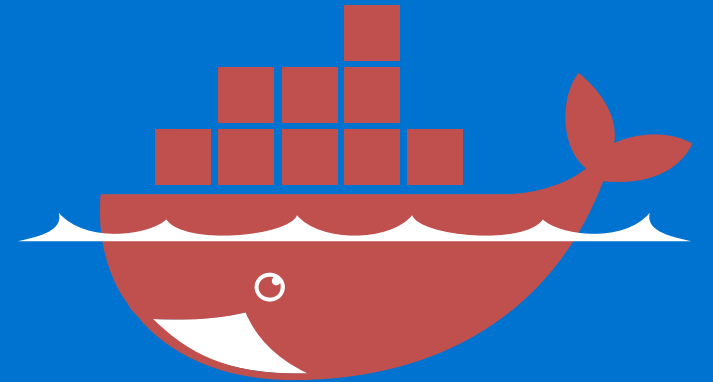
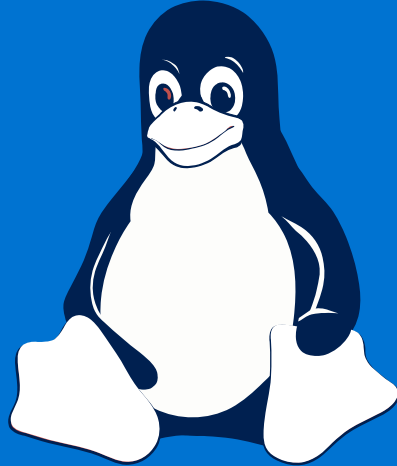
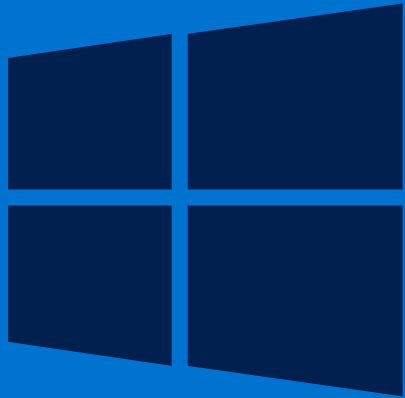


SQL Server 2017 & Azure SQL Database



Choice

SQL Server on the platform of your choice



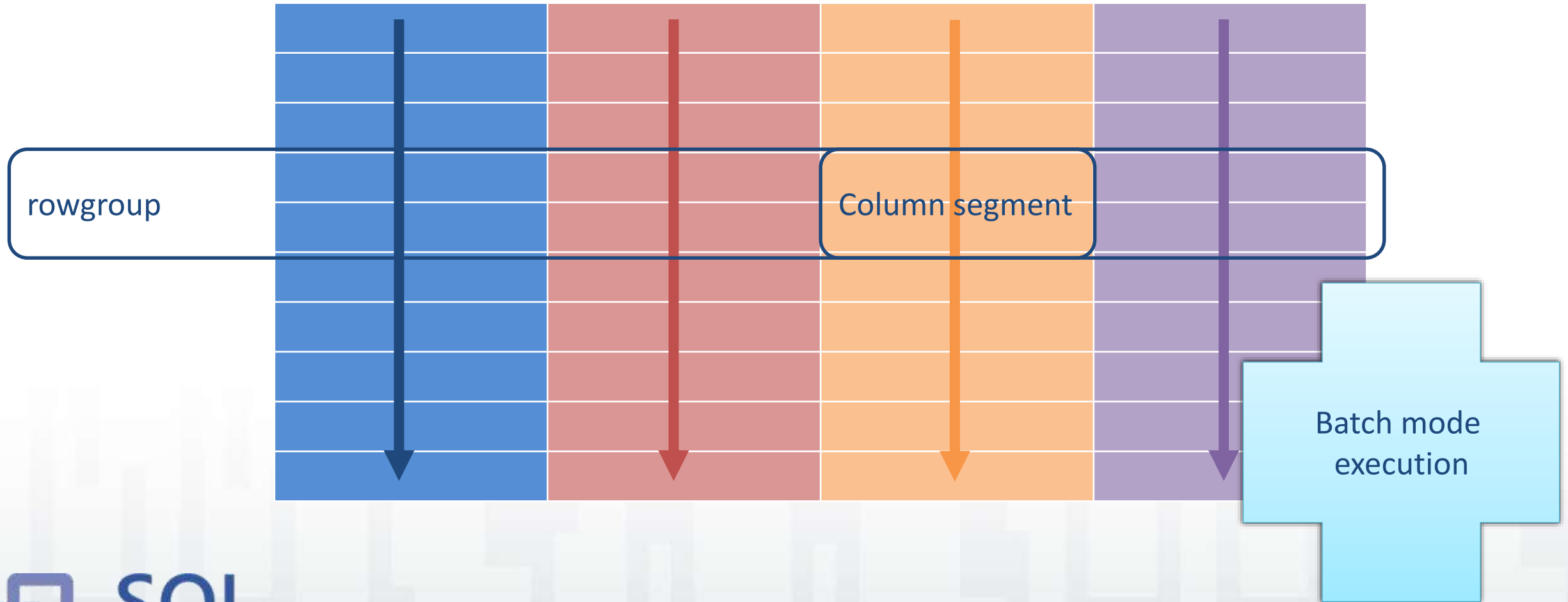
Azure offers options, too

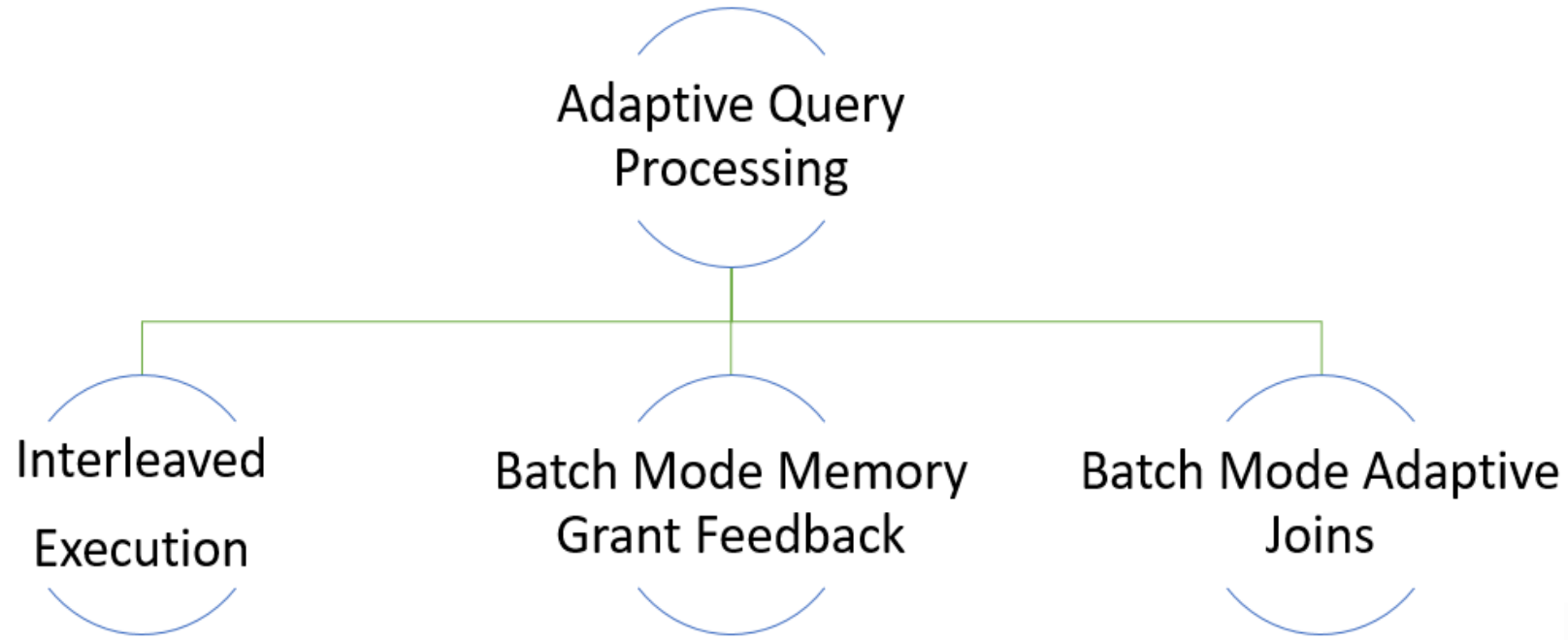


Adaptability

Columnstore

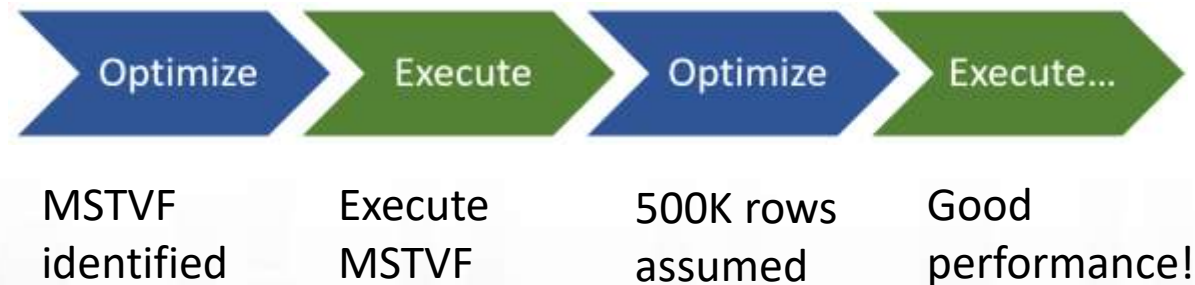
Columnstore





Interleaved execution

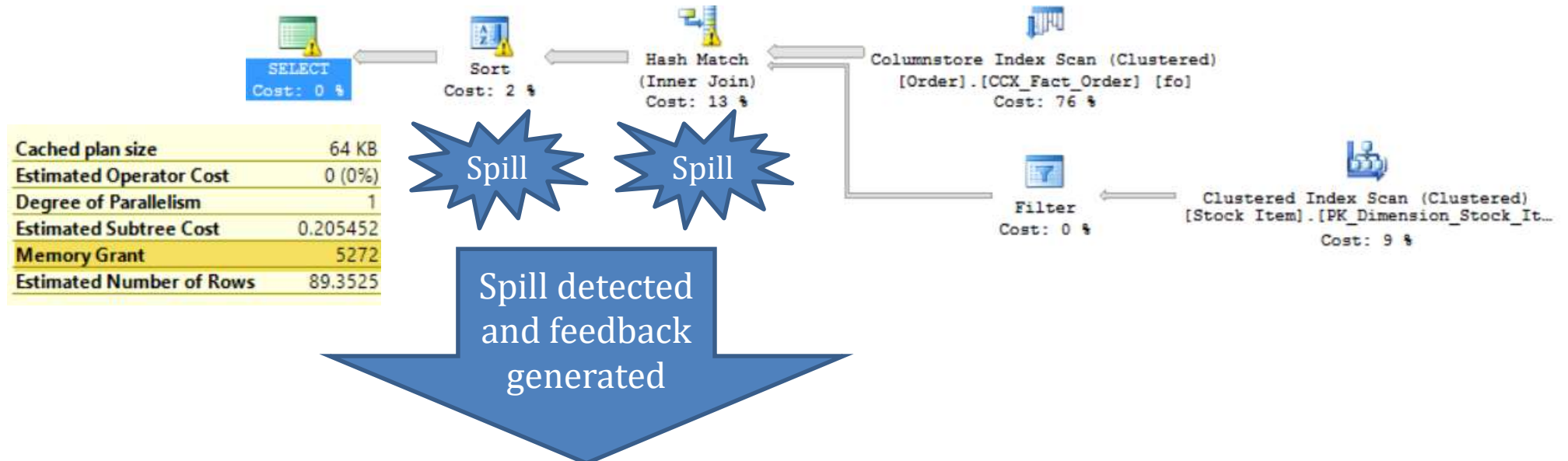
- Statistics tell us how many rows an index will return
- Problem: Table valued functions always estimate 1 or 100
- Solution: interleaved execution
 - Blurring the line between optimization and execution phases



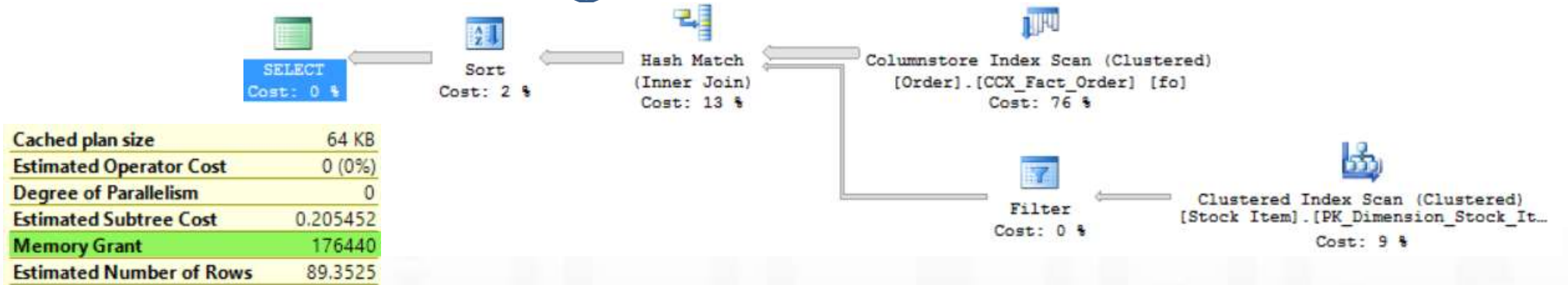
Batch Mode Memory Grant Feedback

- **Execution plans tells us about memory**
 - Minimum amount needed for execution
 - Ideal memory grant size to have all rows fit in memory
- **Too large of a grant? Wasted memory, reduced concurrency**
- **Too small of a grant? Spill to disk**
- **Solution: adaptive memory grants**
 - If granted memory is 2x actual used memory, recalculate memory grant and update cached plan
 - If there's a spill, recalculate the memory grant

Before



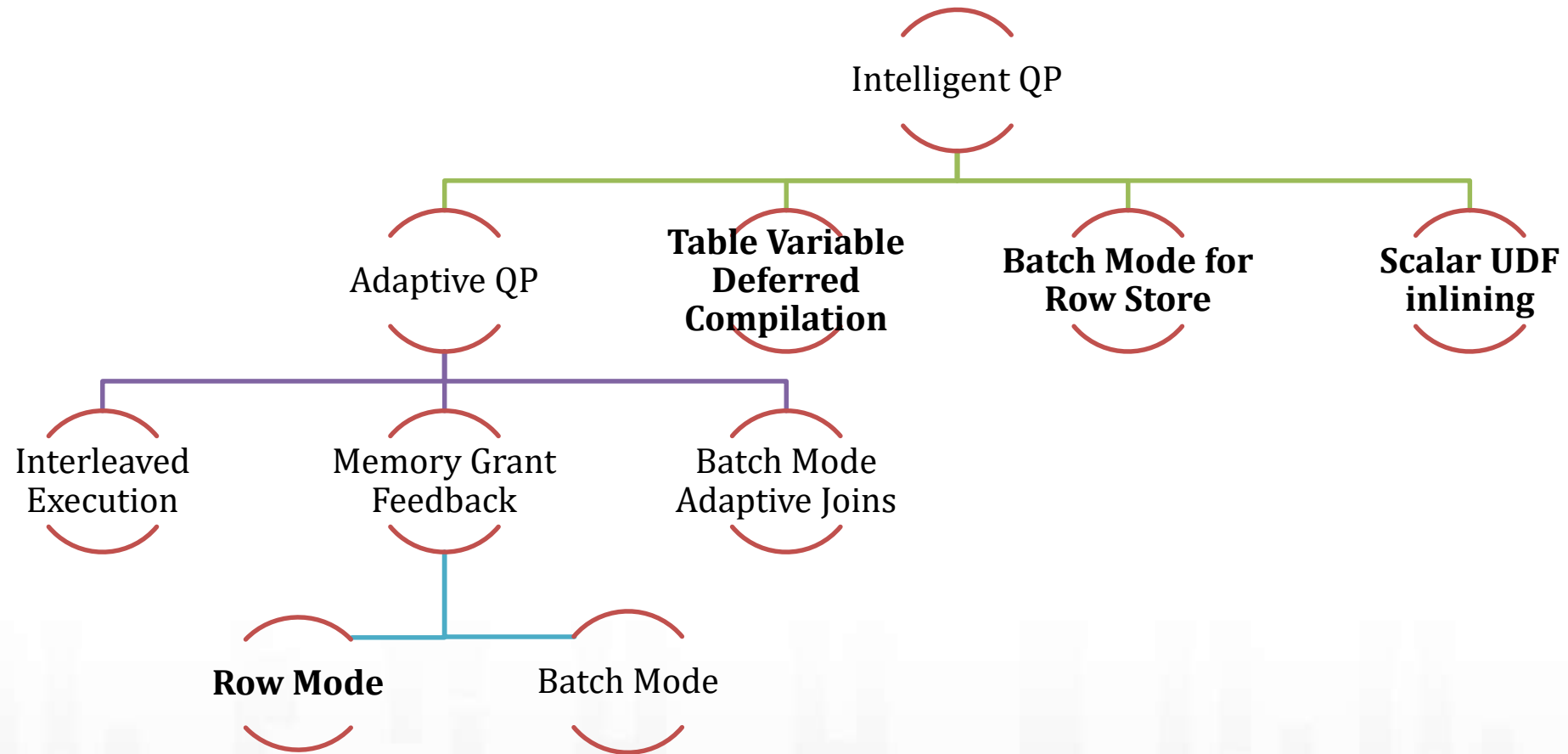
After



Batch Mode Adaptive Joins

- **If cardinality estimates are skewed, we may choose an inappropriate join algorithm**
- **Solution: batch mode adaptive joins**
- **The choice of a hash join or nested loop join is deferred until after the first input is scanned**
 - Is the row count small enough for a nested loop? Do that
 - If the join input exceeds a specific threshold, continue with a hash join

Beyond 2017... Intelligent QP



Query Store

Query Store

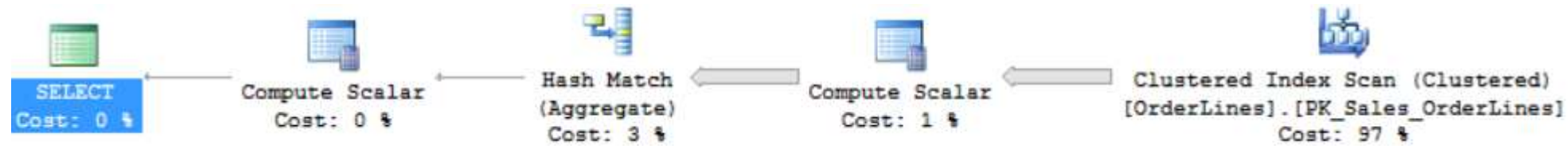
- **Our tool to track query performance, capture runtime statistics, and force plans**
- **Use for**
 - Finding regressed queries
 - Researching top performance killers
 - Monitoring workloads before and after upgrades

What does Query Store show?

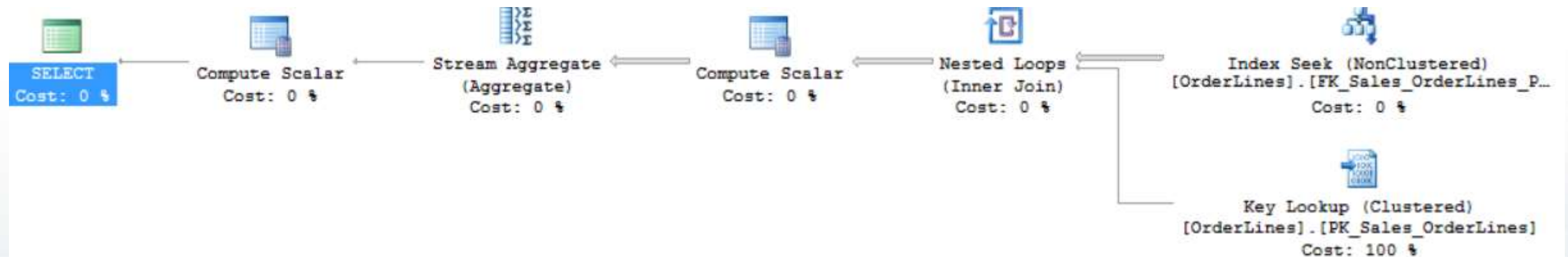


What does Query Store help you find?

Good



Regression



Automatic tuning - plan correction

- **Let SQL Server use a better query plan if regression happens**
- **Force recommendation when**
 - Estimated CPU gain is higher than 10 seconds
 - The number of errors in the new plan is higher than the number of errors in the recommended plan
 - Verify that the forced plan is better than the current one

Demo

Why is my query slow?

Locks

Latches

Buffer
Latches

Buffer IO

Compilation

Transaction
Log IO

Network IO

Parallelism

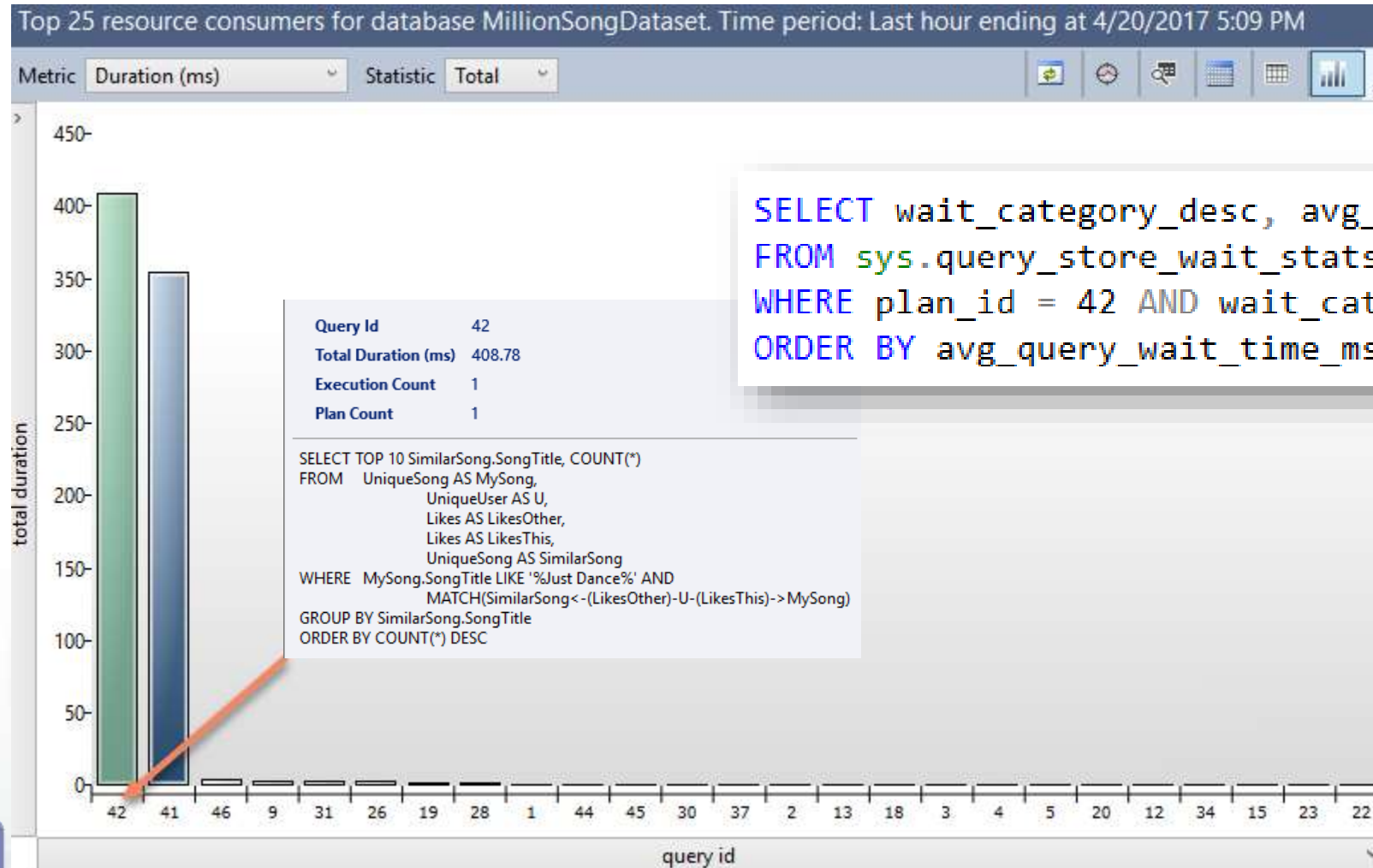
Memory

User Waits

Tracing

Other Disk
IO

Query Store + Wait Statistics

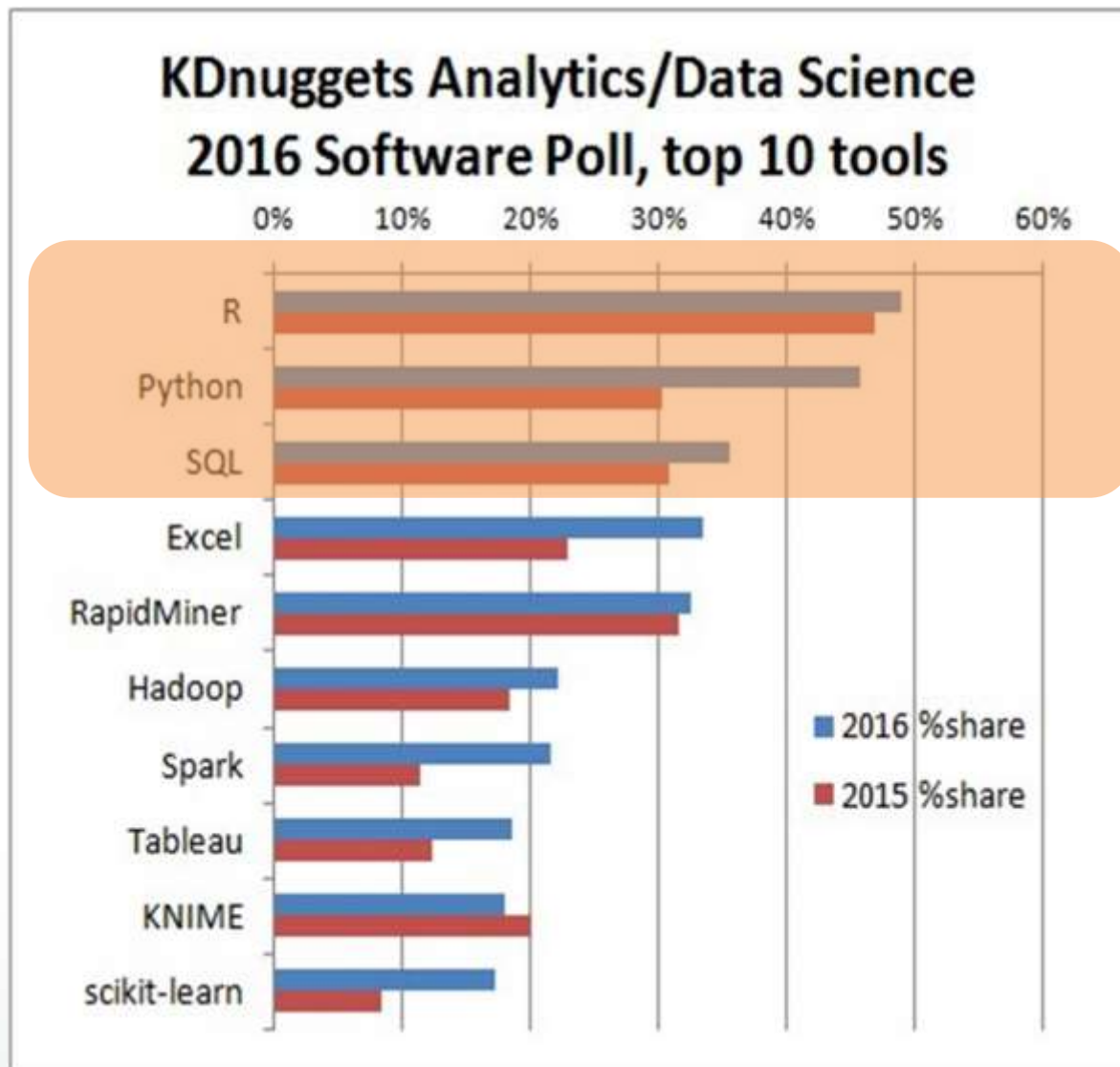


```
SELECT wait_category_desc, avg_query_wait_time_ms
FROM sys.query_store_wait_stats
WHERE plan_id = 42 AND wait_category_desc NOT IN ('Unknown')
ORDER BY avg_query_wait_time_ms DESC;
```

wait_category_desc	avg_query_wait_time_ms
Parallelism	407
Latch	131
Memory	45
Buffer IO	19



Mind Share



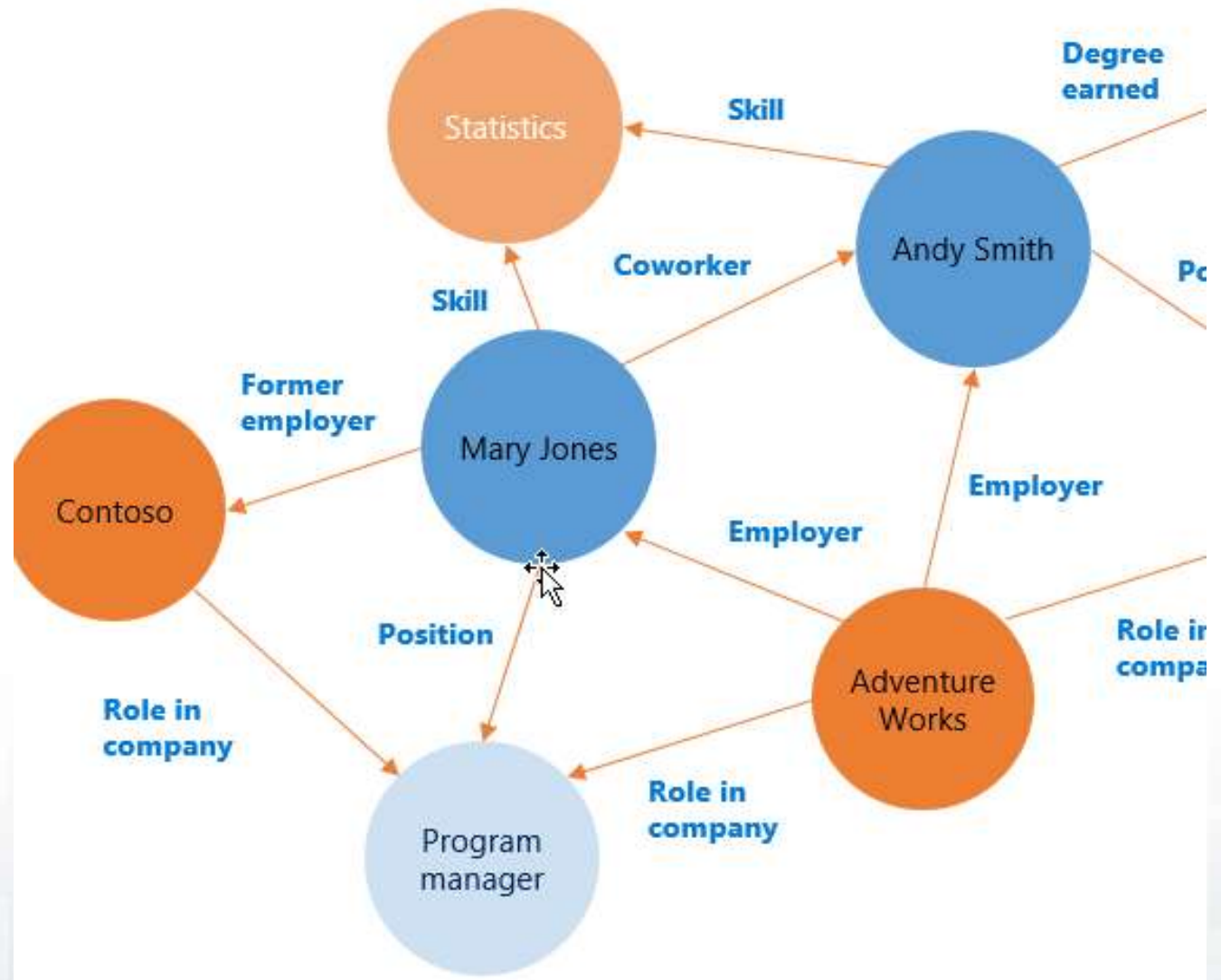
Source: <http://www.kdnuggets.com/2016/06/r-python-top-analytics-data-mining-data-science-software.html>

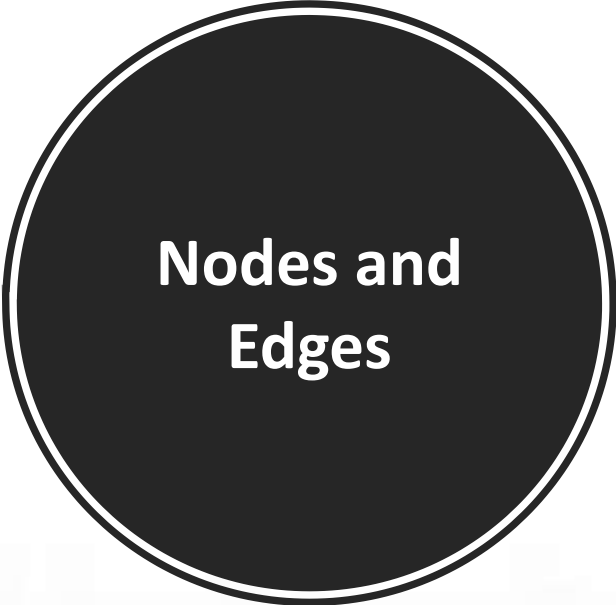
Python

- **SQL Server 2016 introduced SQL Server R Services**
- **SQL Server 2017 now has Machine Learning Services – R and Python**
- **Two options to execute inside SQL Server:**
 - Start from Python and execute remote jobs
 - Start from T-SQL with an embedded Python script
- **Secure and fully governed feature**
 - Supports SQL and integrated authentication
 - Manage resources (CPU & memory etc.)

Graph data

- Native nodes and edge table support
- Query language extension provides multi-hop navigation using join-free pattern matching
- Query across regular SQL tables and graph data
- Interoperability – for example, support for Columnstore indexes





Nodes and Edges

```
CREATE TABLE UniqueUser (UserId VARCHAR(80)) AS NODE;  
GO
```

```
CREATE TABLE Likes (ListenCount BIGINT) AS EDGE;  
GO
```

```
CREATE TABLE UniqueSong (  
    SongId VARCHAR(50)  
    ,SongTitle VARCHAR(500)  
    ,ArtistName VARCHAR(500)  
    ) AS NODE;  
GO
```



MATCH clause

```
-- similar songs
SELECT TOP 10 SimilarSong.SongTitle, COUNT(*)
FROM    UniqueSong AS MySong,
        UniqueUser AS U,
        Likes AS LikesOther,
        Likes AS LikesThis,
        UniqueSong AS SimilarSong
WHERE    MySong.SongTitle LIKE '%Just Dance%' AND
        MATCH(SimilarSong<-(LikesOther)-U-(LikesThis)->MySong)
GROUP BY SimilarSong.SongTitle
ORDER BY COUNT(*) DESC;
```

Stepping outside the box

Cosmos DB

Data models

Document

Graph

Key-Value

Table

Columnar



APIs

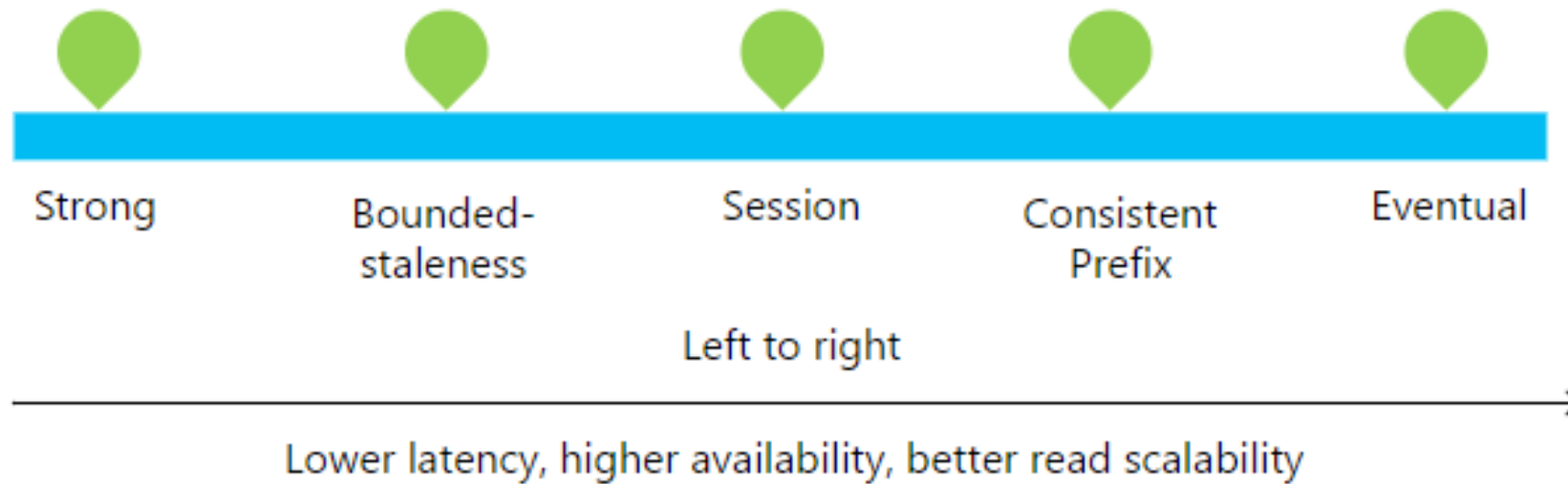
DocumentDB

MongoDB

Table

Graph (Gremlin)

Multiple consistency levels



And with all that, guaranteed performance

- **Schema-agnostic –automatically indexes all the data it ingests without requiring any schema or indexes**
- **Azure Cosmos DB guarantees less than 10-ms latencies on reads and less than 15-ms latencies on (indexed) writes at the 99th percentile**
- **99.99% availability within a single region**

Is CosmosDB going to replace SQL Server?

No!

What's after SQL Server 2017?

Faster Cadence

You can expect that we aren't returning to a slower release cycle

Customer Driven

Our choices will be very influenced by customer drivers both in SQL Server and Azure SQL Database

Cloud Service Influenced

Azure SQL Database service best practices will continue to flow into SQL Server – what we fix in the service, we'll want to port to SQL Server as well

Adaptation

While not every complexity can be addressed, we will look to minimize and mitigate through adaptive mechanisms (feedback loops, sampling, adaptive switches based on runtime conditions)

Focus on this...



...not this



Contact me

Ask questions!

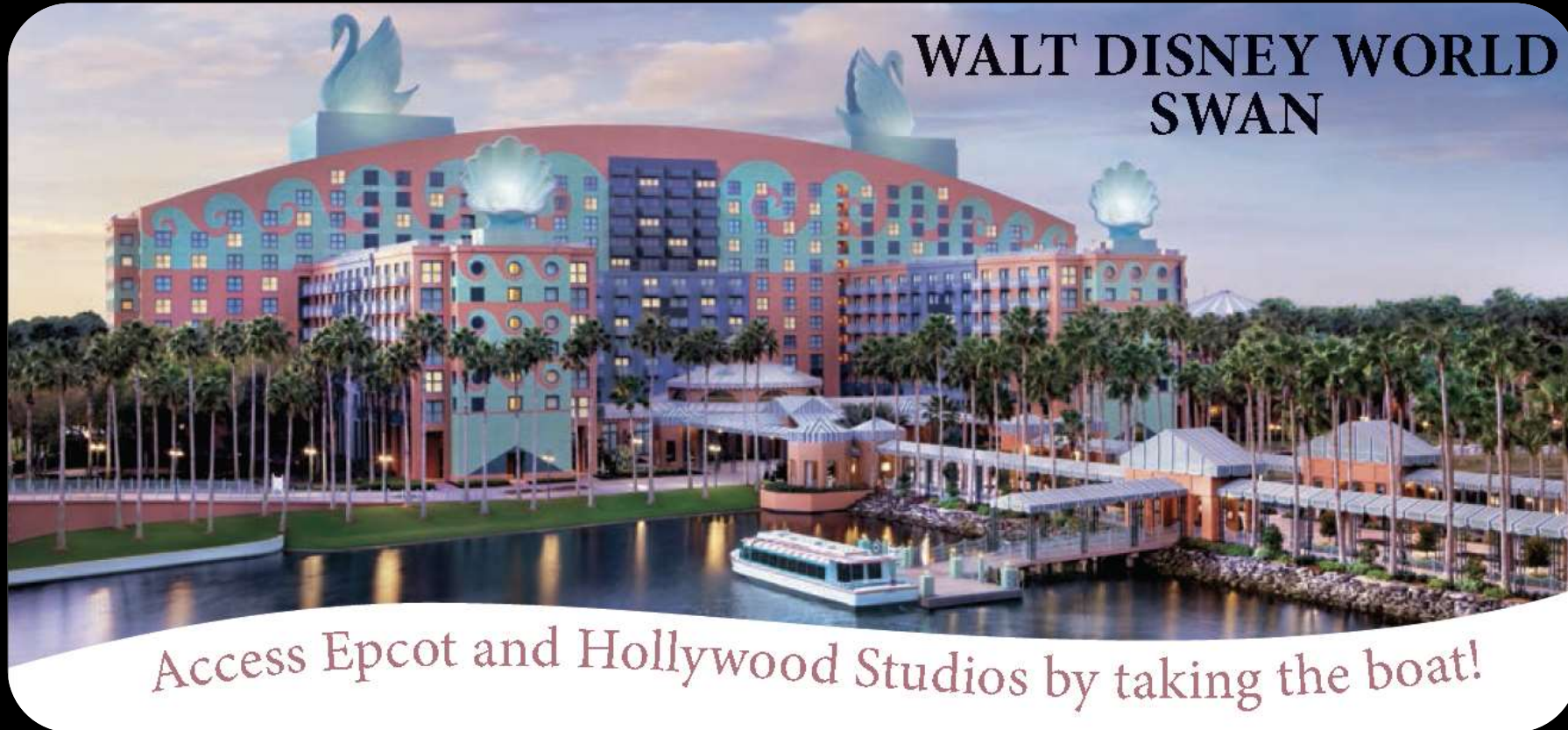
Provide feedback for our product teams!

jes.borland@microsoft.com



Save the Date!

www.SQLintersection.com



2018

Mar 25-28

We're back in Orlando!



Leave the every day behind and enter a world of wonder and enchantment at the Walt Disney World® Resort. Located in the heart of the most magical place on earth, the Walt Disney World Swan and Dolphin Resort provides a truly extraordinary backdrop for our event! Beautiful tropical landscaping, tranquil waterways, and classic art and architecture work together to create a stunning landmark!