



Banishing Slow Queries with Intelligent Query Processing

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Found in Kentucky, USA

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Denny Cherry & Associates



Certified IT professionals to help achieve IT goals

Clients ranging from small business to Fortune 10 corporations

Help save on costs while improving IT reliability and solving challenges





<https://bit.ly/mypresentationfiles>



AGENDA



01

What is IQP?

02

Challenges

03

**Table
Deferred
Compilation**

04

**Parameter
Sensitive
Plans**

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**Degree of
Parallelism
Feedback**

06

Demos

What is IQP?

Challenges

Table Deferred Compilation

Parameter Sensitive Plans

Degree of Parallelism Feedback

Demos





Prince

Artist Formerly Known As

Adaptive Query
Processing

A silhouette of a person walking a tightrope between two rock formations. The person is holding a long pole for balance. The background is a blue sky with white clouds. The scene is framed by dark rock formations on the left and right sides.

CHALLENGES



CHALLENGE ACCEPTED!



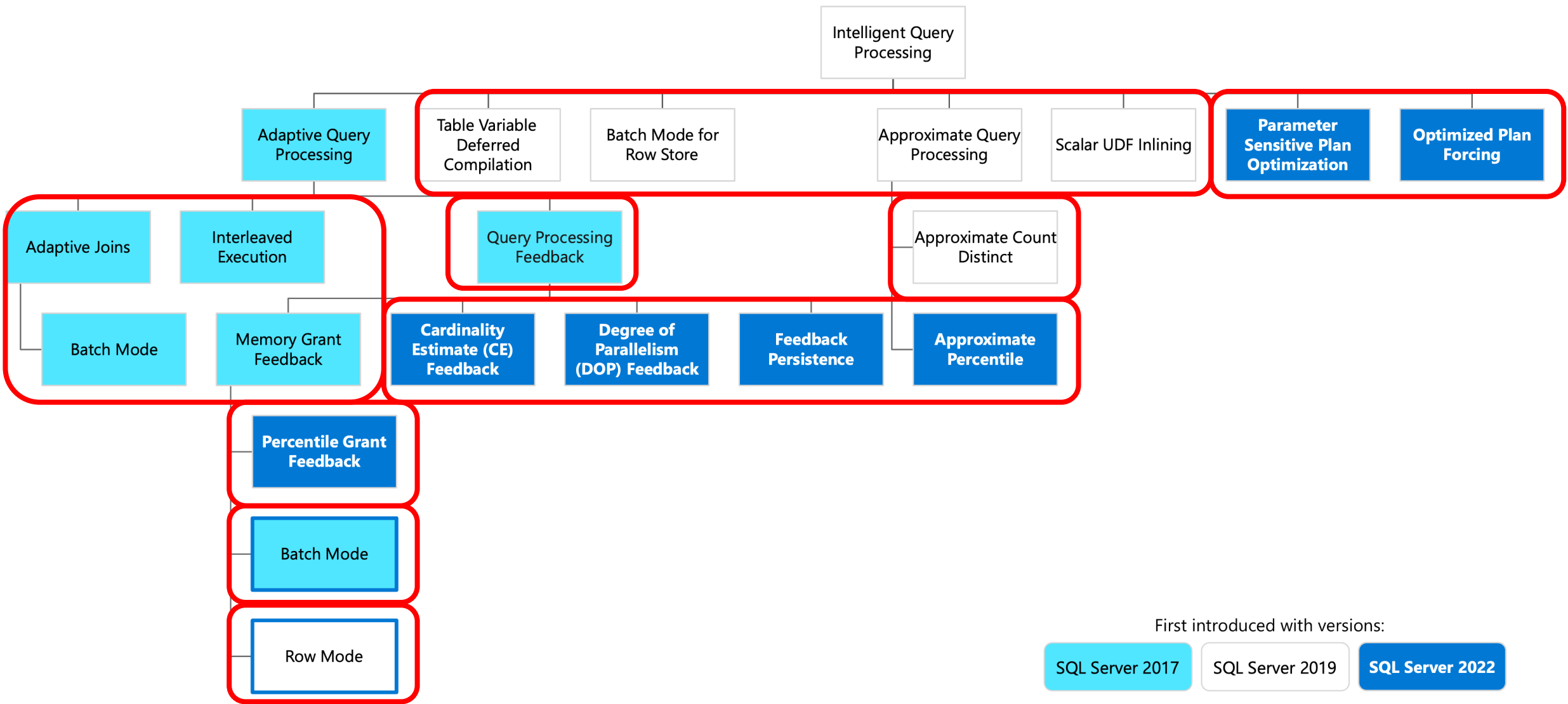
Lightweight Query Profiling

Provides framework for performance improvements

< SQL Server 2019 = Opted In

Query Store utilized in most cases

SQL Server 2022 IQP





COMPATIBILITY LEVEL



Query Inflight - 2016 SP1 or higher

sys.dm_exec_query_statistics_xml(sessionID)

Query Completion - 2019+

sys.dm_exec_query_plan_stats(plan_handle)

LAST_QUERY_PLAN_STATS





Table Variable Deferred Compilation

Table Variables Issues



Estimated Subtree Cost	0.000000
Number of Executions	1
Estimated Number of Executions	1
Estimated Number of Rows to be Read	1
Estimated Number of Rows Per Execution	1
Estimated Row Size	15 B
Actual Rebinds	0
Actual Rewinds	0
Ordered	False
Node ID	4

Object

[@table] [a]

Output List

@table.objectid

Table Variable Deferred Compilation



< SQL Server 2019 = 1 row fixed estimate

Too many rows = bad execution plan

Temporary Table vs Table Variable

Table Variable Deferred Compilation



Compilation is shifted to first actual execution of a statement

Utilizes actual cardinality vs wild guess

Mimics temporary table behavior



Parameter Sensitive Plan

Parameter Sensitive Plan



Helps solve parameter sniffing issues

Parameter sniffing issues is not bad; it's working as designed

Only works on equality predicates

Cardinality values are divided into three predicate "buckets" via Dispatcher.

Parameter Sensitive Plan



Uses High, Medium, Low predicate boundary values

Child queries are then compiled and executed generating query variants. They have their own execution plan in Query Store.

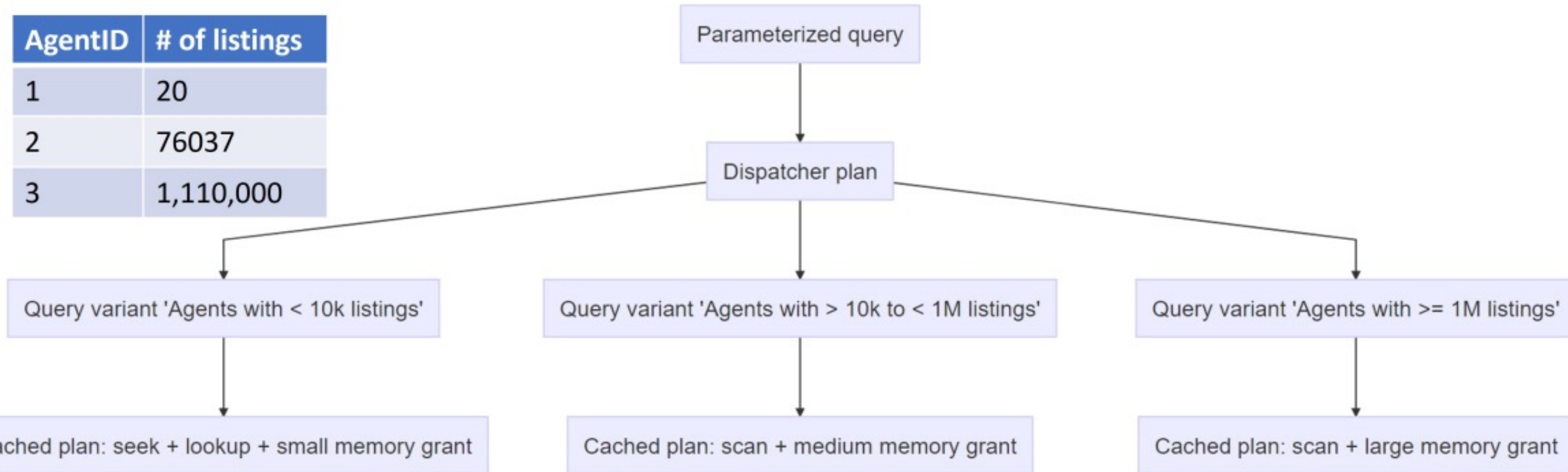
Dispatcher plans are recompiled after large data distribution changes

Variant plans will recompile independently

Parameter Sensitive Plan



AgentID	# of listings
1	20
2	76037
3	1,110,000



Sys.query_store_plan

Sys.query_store_query_variant



Degree of Parallelism Feedback

DOP Feedback



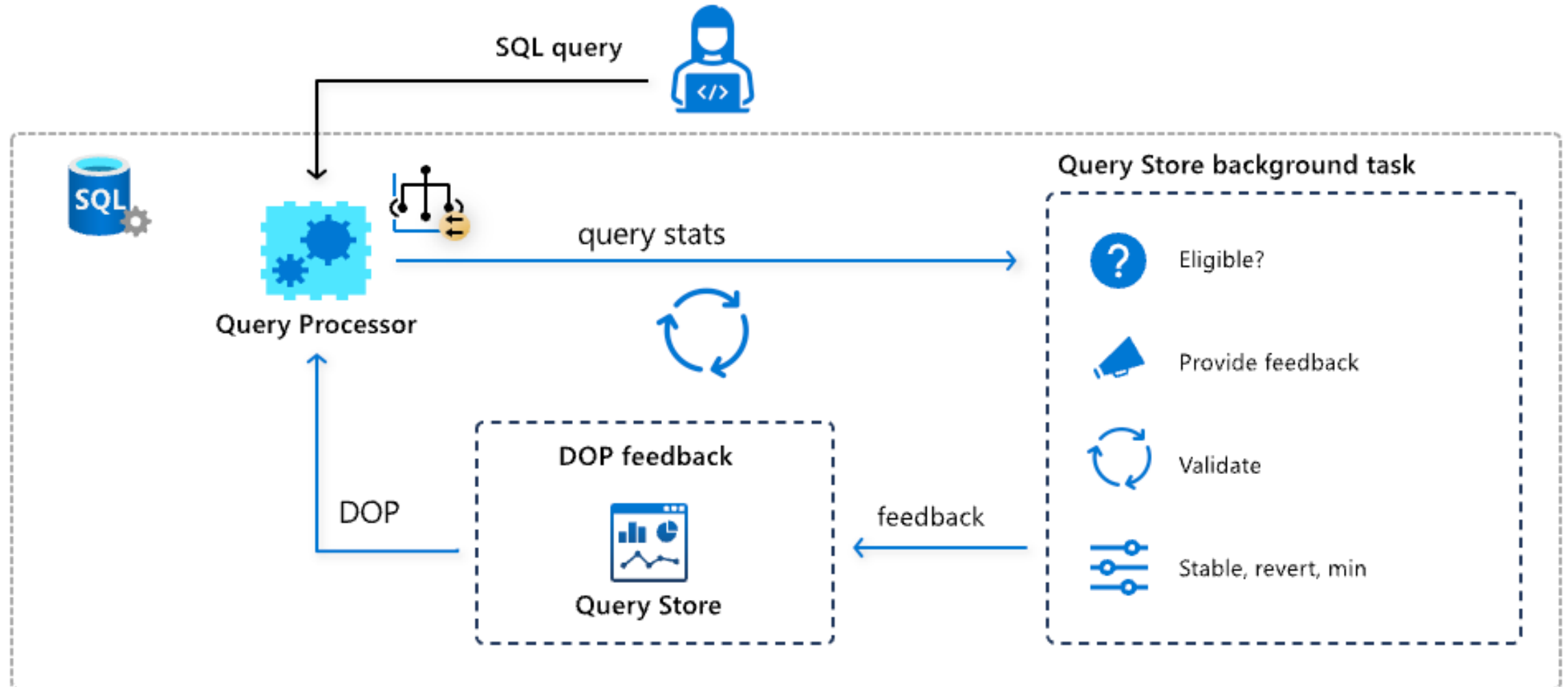
Uses elapsed time and waits to identify inefficient parallelism for repeating queries

Query store is required

Plan regression = last known good DOP

Honors Plan forcing

DOP Feedback Architecture



DOP Feedback



Won't rotate up unless reverting

DOP of 2 is the minimum value

Query Hints will be the new ceiling limit if > 2

DOP Feedback is Replica aware

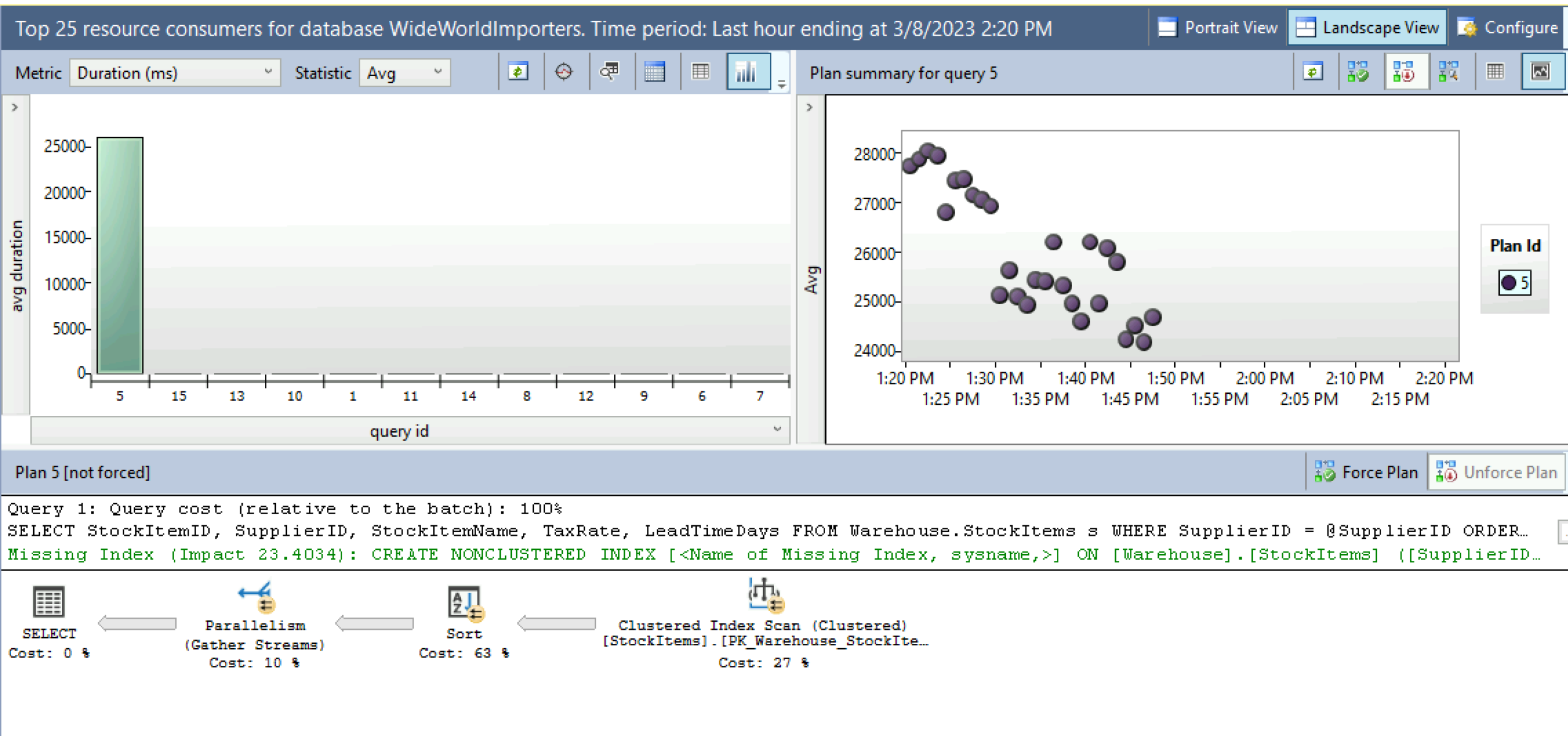


DEMO

Displaying 16 Events

	name	timestamp	feedback_dop	query_dop
▶	dop_feedback_eligible_query	2023-03-08 13:16:55.7877502	NULL	16
	dop_feedback_provided	2023-03-08 13:23:30.4246819	12	16
	dop_feedback_validation	2023-03-08 13:23:58.8934144	12	NULL
	dop_feedback_validation	2023-03-08 13:24:26.7528532	12	NULL
	dop_feedback_validation	2023-03-08 13:28:58.6556280	12	NULL
	dop_feedback_provided	2023-03-08 13:29:26.7178994	8	12
	dop_feedback_validation	2023-03-08 13:29:52.5435216	8	NULL
	dop_feedback_validation	2023-03-08 13:31:34.9902149	8	NULL
	dop_feedback_validation	2023-03-08 13:35:47.0307650	8	NULL
	dop_feedback_provided	2023-03-08 13:36:13.8242589	6	8
	dop_feedback_validation	2023-03-08 13:36:39.4556774	6	NULL
	dop_feedback_validation	2023-03-08 13:38:20.4270055	6	NULL
	dop_feedback_validation	2023-03-08 13:42:35.0200419	6	NULL
	dop_feedback_provided	2023-03-08 13:42:59.9480367	4	6
	dop_feedback_validation	2023-03-08 13:43:24.4562714	4	NULL
	dop_feedback_validation	2023-03-08 13:45:04.2911374	4	NULL

Duration



CPU Time



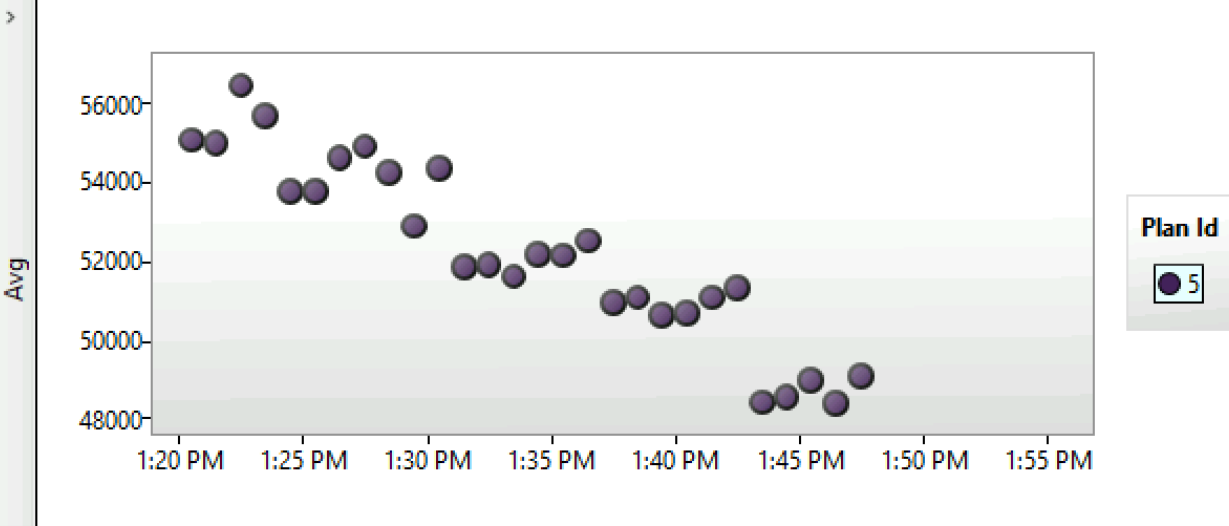
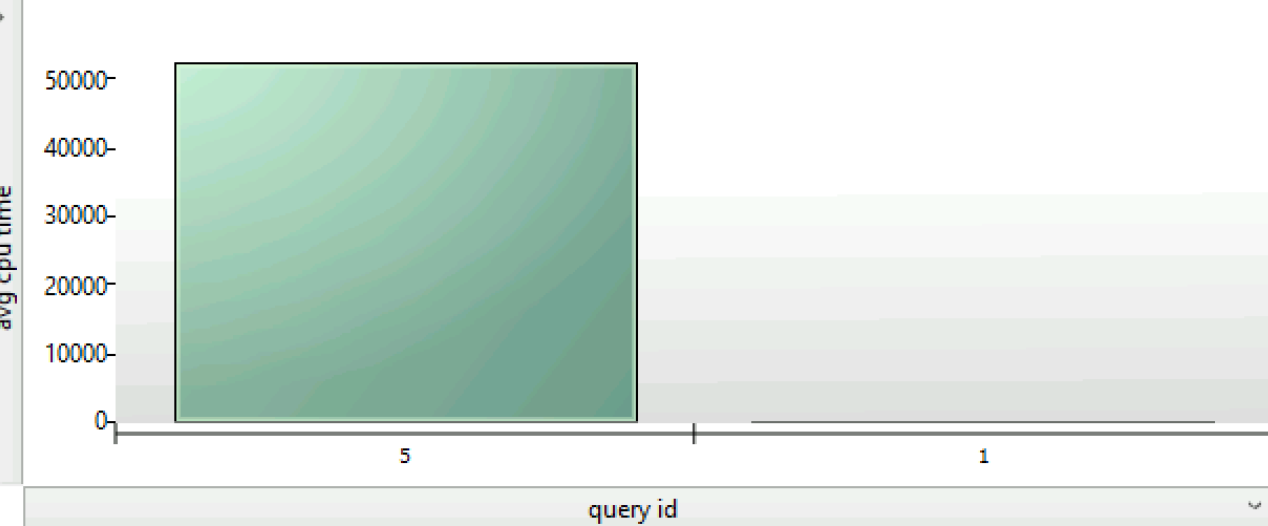
Top 25 resource consumers for database WideWorldImporters. Time period: 3/8/2023 1:19 PM - 3/8/2023 1:55 PM

Portrait View Landscape View Configure

Metric CPU Time (ms) Statistic Avg



Plan summary for query 5



Plan Id
5

Plan 5 [not forced] Force Plan Unforce Plan

Query 1: Query cost (relative to the batch): 100%
SELECT StockItemID, SupplierID, StockItemName, TaxRate, LeadTimeDays FROM Warehouse.StockItems s WHERE SupplierID = @SupplierID ORDER BY StockItemName
Missing Index (Impact 23.4034): CREATE NONCLUSTERED INDEX [<Name of Missing Index, sysname,>] ON [Warehouse].[StockItems] ([SupplierID]) INCLUDE...



Feature Availability



Feature

Enterprise

Standard

Table Variable Deferred
Compilation

Yes

Yes

Parameter Sensitive Plan

Yes

Yes

Degrees of Parallelism Feedback*

Yes

No

Summary



Performance Game Changer

Increased flexibility

Minimal Intrusion

Compatibility Levels are Important



BYE BYE BAD ANTI-PATTERNS!!

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Slides

Feedback always appreciated!!!

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