



SQL Server 2022

Parameter Sensitive Plan Optimization

Slide and demos: <https://bit.ly/30eyiwv>



sergio govoni
centro software
S.P.A



BLOG



segovoni.medium.com

GITHUB PROJECTS



github.com/segovoni



AGENDA

- Introduction to Plan Caching mechanisms
- Introduction to Parameter Sensitivity
- SQL Server 2022
 - Parameter Sensitive Plan (PSP) Optimization

Introduction to plan caching mechanisms

Plan Cache internals

- [sys.dm_exec_cached_plans](#)
- There are six different types of plan that could be cached
 - Compiled Plan, Compiled Plan Stub, Parse Tree, Extended Proc, CLR Proc, CLR Function
- For Compiled Plan category we have three types
 - Adhoc, Prepared, Proc
- usecounts gives you a good indication about how many times a particular plan has been used

Ad-hoc Plans

- Ad-hoc plans are the default operation for SQL Server plan caching mechanism
- In order to reuse an ad-hoc plan
 - You have to submit the same query text
 - The environment must be identical, SET options must be identical!
- Every difference will force a recompilation of the query and another plan will be generated for the same logical query

Optimize for Ad-hoc workloads

- Server level option, available since SQL 2008
- Ad-hoc plans are not cached on the first use
 - It only creates a Compiled Plan Stub
- Better memory management
- One more recompilation is necessary
- [sys.dm_exec_cached_plans](#)
 - objtype “Adhoc”, cacheobjtype “Compiled Plan Stub”

Prepared Plans

- When objtype shows “Prepared” means that SQL Server has used parameters in the execution plan
- Auto-parameterization
 - SIMPLE (default) applied to small class of queries
 - FORCED parametrization, database option (since SQL 2005), allows SQL Server to parametrize more queries
- Explicit parameterization
 - Could be done at the application level by “Prepare” method

Prepared Plans

- When SQL Server decides to parameterize, it decides not only what values in your query is able to parameterize, it will also decide what data type the parameter should be
- A shell query (ad-doc) is created for each unique query text
 - Used to find the parameterized query
 - It doesn't contain the full plan

SIMPLE Parametrization

- SQL Server will perform simple parametrization if the plan will be recognized as “Safe”
- Simple parameterization requires simple query!
- A query isn't simple if it contains
 - JOIN
 - Sub-queries
 - SET clause that contains variables (for UPDATES)
 - UNION, INTO, DISTINCT, TOP
 - GROUP BY, HAVING or COMPUTE BY
 - ...

FORCED Parametrization

- When you set the PARAMETERIZATION database option to FORCED, SQL Server will start to parameterizing almost everything
- `sp_get_query_template` returns the parameterized form of a query mimic FORCED parametrization
- Exclusions
 - INSERT.. EXEC
 - Statements into SPs, Triggers, UDFs and cursors
 - Statements running with ANSI_PADDING or ANSI_NULLS set to OFF
 - ...

Demo

Introduction to Parameter Sensitivity

Parameter Sensitivity

→ Parameter sensitivity, also known as Parameter Sniffing, refers to a process whereby SQL Server “sniffs” the current parameter values during compilation or recompilation, and passes it along to the Query Optimizer

Parameter Sensitivity

- Parameter values are sniffed during compilation or recompilation for the following types of batches
 - Stored procedures
 - Queries submitted via `sp_executesql`
 - Prepared queries

Parameter Sensitivity

- A parameter sensitive plan problem happens when the query optimizer generates a query execution plan that's optimal only for a specific parameter value (or set of values)
- Plans that aren't optimal can then cause query performance problems

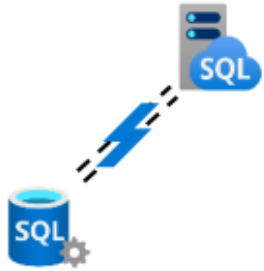
Parameter Sensitivity

- It isn't necessary a bad thing
- It's a bad thing when it's a bad thing
- It's a good thing when it's a good thing 😊, so it depends!
- The problems come when cached plan, with compiled parameters value, is not good enough for current parameters

SQL Server 2022

SQL Server 2022

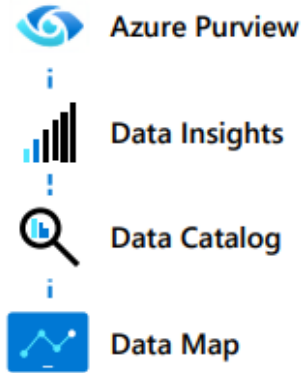
Business continuity
through Azure



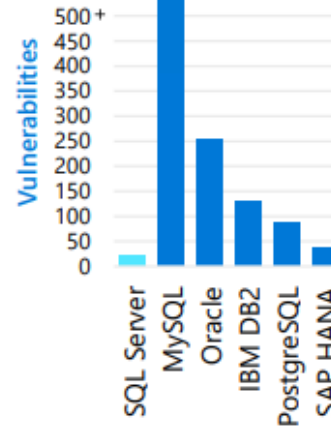
Seamless analytics
over on-prem
operational data



Visibility over your
entire data estate



Most secure over
the last 10 years¹



Industry-leading
performance and
availability



#1 OLTP performance²
#1 DW performance
on 1TB³, 3TB⁴, 10TB⁵,
30TB⁶ and 100TB⁷

All TPC Claims as of 10/06/2021.

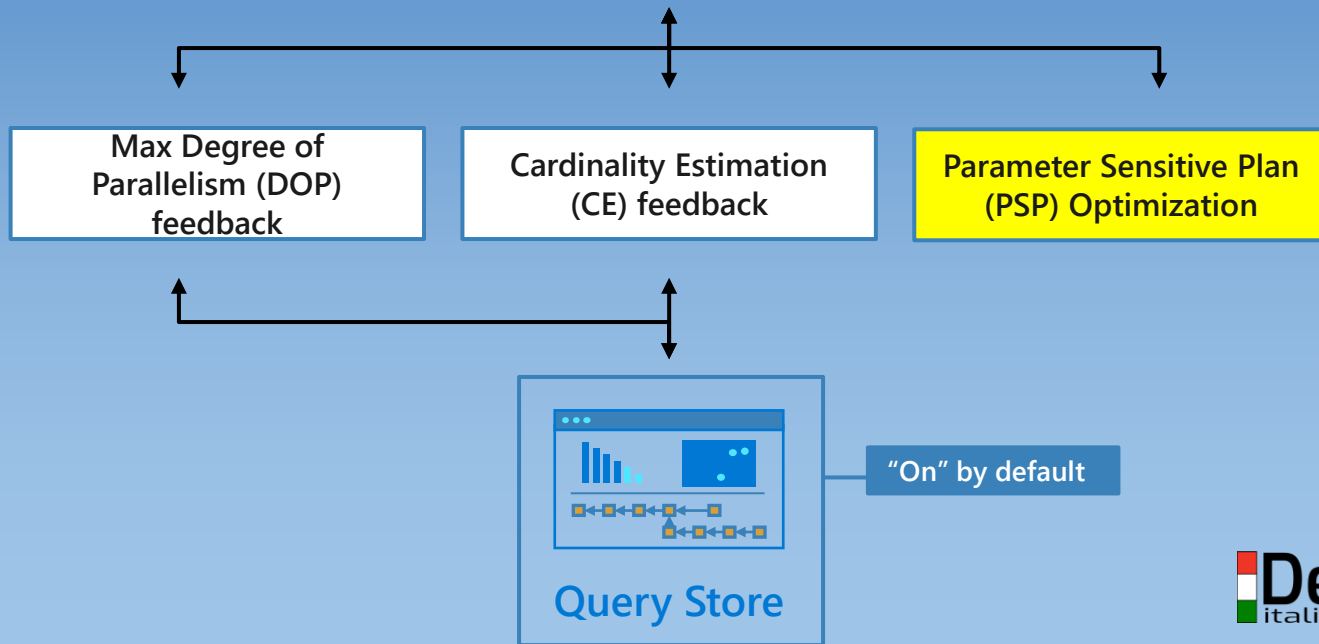
¹ <http://www.tpc.org/4087>; ² <http://www.tpc.org/3374>; ³ <http://www.tpc.org/3380>; ⁴ <http://www.tpc.org/3362>; ⁵ <http://www.tpc.org/3364>; ⁶ National Institute of Standards and Technology Comprehensive Vulnerability Database

SQL Server 2022 Parameter Sensitive Plan

Query Store and Intelligent Query Processing



Intelligent Query Processing (IQP) Next Generation



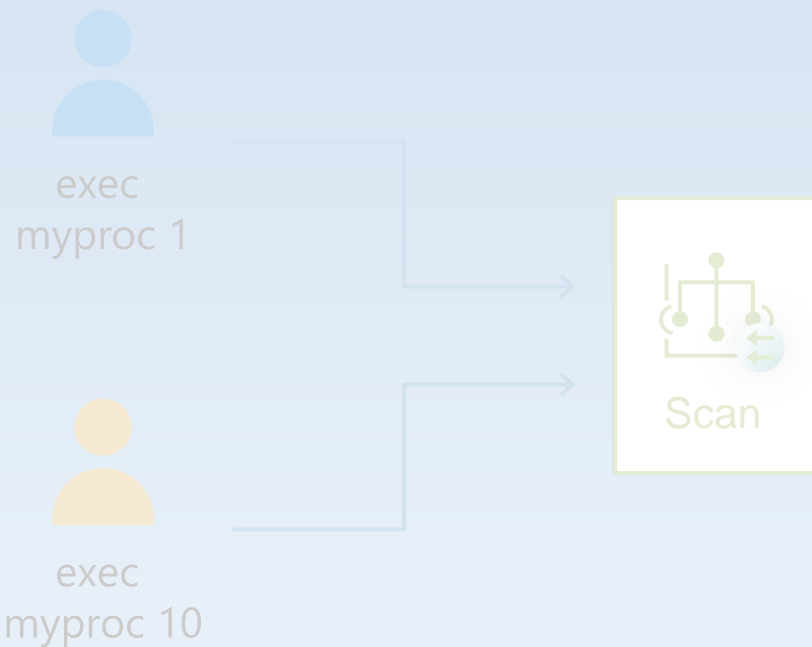
Parameter Sensitive Plan Optimization

- Parameter Sensitive Plan Optimization is one of the new features of SQL Server 2022
- It is part of the family features known as Intelligent Query Processing
- It addressing the scenario where a single cached execution plan for a parameterized query is not optimal for all possible values those parameters can take

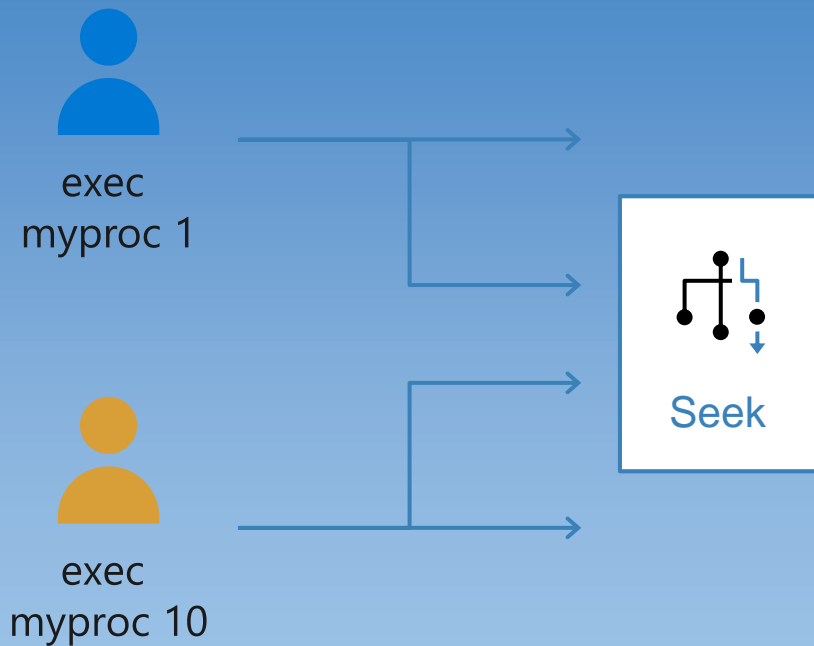
Parameter Sensitive Plan Optimization

- Parameter Sensitive Plan Optimization allows you to keep multiple active execution plans in the plan cache for a single parameterized query
- Each execution plan will be optimized and will host different data sizes depending on the values assumed by the parameters

Before



With PSP optimization



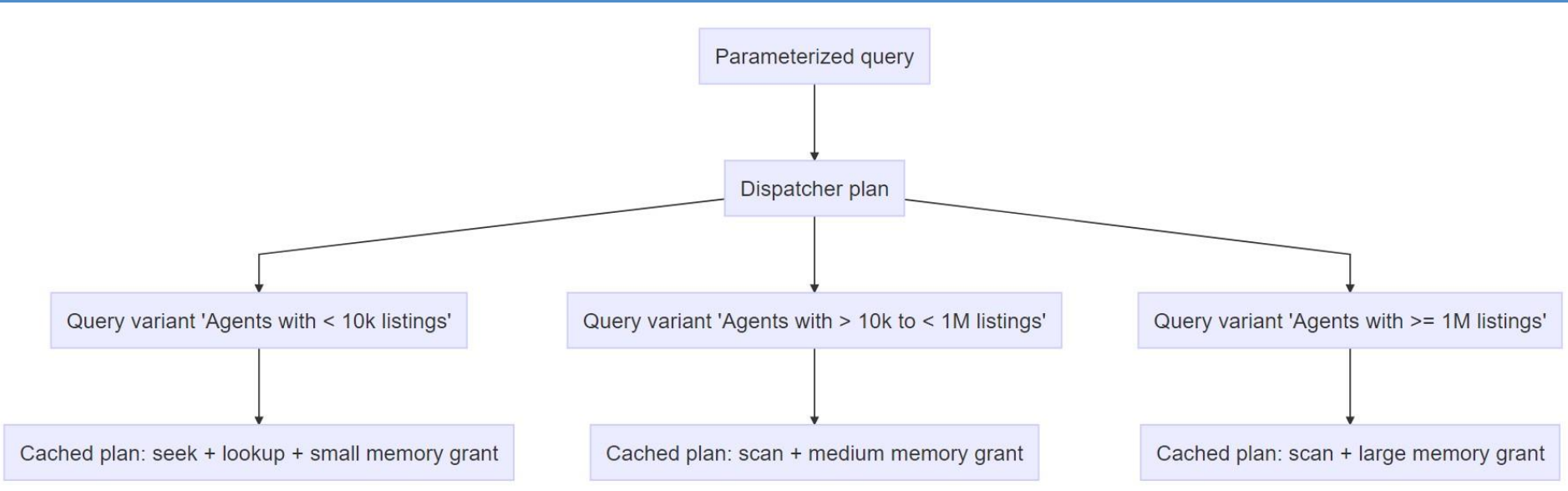
Dispatcher plan

- For execution plans suitable to be optimized with PSP, the initial compilation produces a dispatcher plan that contains the optimization logic
- The dispatcher plan maps to query variants based on the predicates cardinality range boundary values

Dispatcher plan

- Dispatcher plans are automatically updated
- Execution plans linked to query variants are recompiled independently as needed

Dispatcher plan



<https://docs.microsoft.com/en-us/sql/relational-databases/performance/parameter-sensitivity-plan-optimization>

Demo

Resources


- [Intelligent query processing in SQL databases](#)
- [Query Processing improvements in the latest versions of SQL Server](#)
- [Parameters and Execution Plan Reuse](#)
- [Parameter Sensitivity](#)

Resources

- [Queries that have parameter sensitive plan \(PSP\) problems](#)
- [SQL Server 2022 Parameter Sensitive Plan Optimization](#)
- [Session materials](#)

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The screenshot shows the career page of Centro Software. The header includes the company logo and navigation links. The main heading is 'Trova il tuo prossimo lavoro' with a subtext about career opportunities in technology and IT. Below this is a search bar with three input fields: 'Cosa stai cercando?' (containing 'Parole chiave'), 'Dove?' (containing 'Luogo'), and 'Categoria' (containing 'Categorie'). A 'CERCA' button is on the right. The background features a building and a globe with city names like MILANO, PADOVA, and BOLOGNA.

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Alert on

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56 connections work here

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Summary

→ **Parameter Sensitive Plan (PSP) Optimization** allows to keep multiple active execution plans in the plan cache for a single parameterized query solving the famous problem known with the name of **Parameter Sensitivity** or **Parameter Sniffing**



THANK YOU