Using SQL Server Query Store & Plan Guides to Fix Problem Queries

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Welcome

Today we're talking about Query Store and Plan Guides in the context of performance. Specifically, how to get SQL to use the plan we want.

My goal is that at the end of the presentation you're clear on when and how to use each option. Using them in some cases takes some effort, but that's just fighting through the syntax and quirks!

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First, What Problem Are We Solving?

Simply: a query would perform better using the existing indexes and statistics if SQL had picked a different plan.

Before you use the techniques I'm showing you today, you have to be able to nudge SQL into using that different (better) plan and that requires understanding quite a bit about how it all works (and we only cover a bit of that).

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One Plan Fits All

Our general approach in SQL is to evaluate a query, generate a plan, cache it, and reuse it for as long as we can (until stats change or the service is restarted) to save on the compilation overhead. When we do that we're hoping that the one plan works well enough for all scenarios.

Often when one size fits all *doesn't work* we resort to recompiling.

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Demo 1 - 2 Different Plans

- This is to show that you its possibly for SQL to generate more than one plan that returns the correct answer
- It's also an illustration of "parameter sniffing" also described as skewed data
- One of these plans will deliver consistent performance
- The other will vary based on the number of matching rows
- It all depends on which plan is in cache!
- And to make it harder, a stats update or an index rebuild can cause a query to recompile and you might get a different plan

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Query Store

- SQL 2016+
- Easy to enable
- It’s a performance data store PLUS the ability to force a plan
- UI only good for some things, sometimes you have to write a query
- The big caveat: you have to had the plan in cache at some point
- Our focus here is on the plan forcing

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Enabling Query Store - Quick Demo

Database Properties - AdventureWorks2017

Select a page

- General
- Files
- Filegroups
- Options
- Change Tracking
- Permissions
- Extended Properties
- Transaction Log Shipping
- Query Store

Script ▾ Help

General	
Operation Mode (Actual)	Read write
Operation Mode (Requested)	**Read write**
Monitoring	
Data Flush Interval (Minutes)	**1**
Statistics Collection Interval	**1 Minute**
Query Store Retention	
Max Plans Per Query	**200**
Max Size (MB)	**1000**
Query Store Capture Mode	**All**
Size Based Cleanup Mode	**Auto**
Stale Query Threshold (Days)	**30**
Wait Statistics Capture Mode	**On**
Query Store Capture Policy	
Execution Count	
Stale Threshold	
Total Compile CPU Time (ms)	
Total Execution CPU Time (ms)	

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Getting The Better Plan Into Cache

You've seen that what the initial parameter value is can matter a lot, you can use that to your advantage:

- With recompile
- Option (recompile)
- Optimize for (requires you to know the value)
- Possibly other hints you add to the query to help shape it

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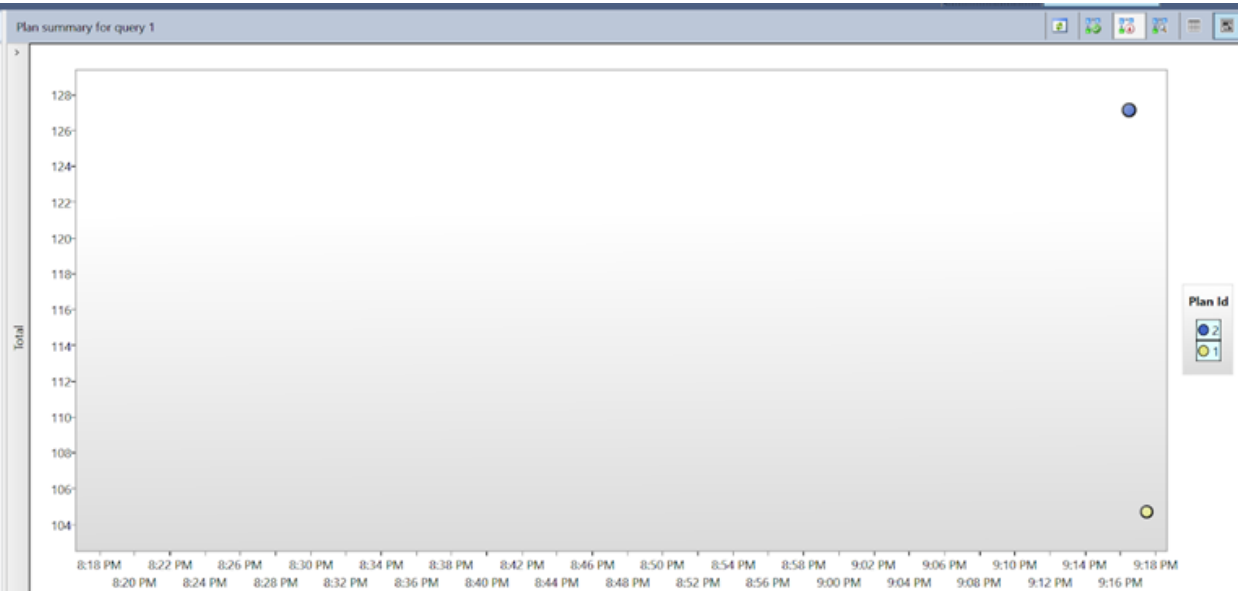
Demo 2: One Proc, Two Plans

Metric: Duration (ms) Statistic: Total

	query id	object id	object name	query sql text	▼ total duration	execution count	plan count
1	1	388196433	get_customersbylastname	(@lastname nvarchar(50))select * from person.pers...	127.14	17	1
2	164	0		select * from person.Person where lastname = 'smi...	97.88	3	1
3	146	0		(@_msparam_0 nvarchar(4000),@_msparam_1 nvar...	47.55	1	1
4	329	0		select * from sys.query_store_query qsq inner join ...	34.68	1	1
5	309	0		select * from sys.query_store_query qsq inner join ...	26.89	1	1
6	145	0		(@_msparam_0 nvarchar(4000))SELECT SCHEMA_N...	26.01	1	1
7	334	0		(@query_id bigint,@plan_id bigint)SELECT p.is_f...	18.67	6	1
8	310	0		select * from sys.query_store_query qsq inner join ...	9.1	2	1
9	332	0		(@interval_end_time datetimeoffset(7),@interval_st...	7.48	2	1
10	320	0		SELECT SCHEMA_NAME(obj.schema_id) AS [Schem...	6.69	1	1
11	319	0		(@_msparam_0 nvarchar(4000))SELECT SCHEMA_N...	4.5	1	1
12	306	0		(@_msparam_0 nvarchar(4000),@_msparam_1 nvar...	3.21	3	1
13	333	0		(@query_id bigint,@interval_end_time datetimeoff...	3.15	6	1
14	328	0		select * from person.Person where lastname = 'qui...	2.61	4	1
15	322	0		SELECT SCHEMA_NAME(xproc.schema_id) AS [Sch...	2.25	1	1
16	316	0		(@_msparam_0 nvarchar(4000),@_msparam_1 nvar...	2.05	1	1
17	318	0		SELECT SCHEMA_NAME(tbl.schema_id) AS [Schem...	1.97	1	1
18	308	0		select * from sys.query_store_query qsq inner join ...	1.67	1	1
19	321	0		SELECT SCHEMA_NAME(s.schema_id) AS [Schema],...	1.51	1	1
20	331	0		(@history_end_time datetimeoffset(7),@history_sta...	1.48	1	1
21	315	0		SELECT u.name AS [Name], u.principal_id AS [ID], I...	1.42	1	1
22	327	0		(@_msparam_0 nvarchar(4000),@_msparam_1 nvar...	1.22	1	1
23	314	0		SELECT tr.name AS [Name], tr.object_id AS [ID], CA...	1.13	1	1
24	324	0		(@_msparam_0 nvarchar(4000),@_msparam_1 nvar...	0.97	6	1
25	307	0		select * from sys.query_store_query qsq	0.76	1	1



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Query Store Limits

Worth repeating - Query Store will only let you force a plan that has been in use at some point. It's up to you to get the plan executed at least once!

Query store can't add hints, remove hints, or let you define the exact plan you want used. If you want those things, you need a plan guide

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Plan Guides

- Allows you to add or remove a query hint, or specify a plan that you provide
- Simple in concept, trickier to implement
- Case and space sensitive, a real pain to work with
- Won’t work in all cases (deletes, temp tables, more)
- Easy to get frustrated, but be patient - you’ll get there

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Two Approaches

- The easy way is to use the built in proc sp_create_plan_guide_from_handle to generate the plan for you
  - This only works in some cases
  - Sometimes you have to provide the offset (see the query in BOL)
- Somewhat harder is to provide the SQL statement to it directly

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Plan Guides - Stored Proc Demo

For the first demo we're going to take our get_customer example and create a plan guide based on the plan in cache. So, just like query store, we need to get the plan into cache first, then we can make sure we keep using it.

Note: A good naming convention will make your life easier!

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Plan Guides - Multi Statement Proc Demo

This shows you what happens if you have a multi statement proc and the stars align.

If the proc has statement that isn't "guideable" then you have to manually create a guide for each one (or one you care about) and provide the offset. I'll include that query with the download.

If the query isn't parameterized, that's a level harder (see Templates)

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Demo - Removing a Hint from a Statement

Sometimes you can’t modify the code (or don’t want to), so you can use a plan guide to add or remove a query hint.

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Summary

- It’s a little overwhelming!
- Main scenarios are you can’t change the code OR you’re seeing the wrong plan in use
- Query Store is easier, go there first, and that means you have to get the plan into cache
- Plan guides do more, but are harder to work with. The space/case sensitive thing will trip you up more than once

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