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Lab 2: Finding the Right (Wrong) Queries to Tune

1.6 p1

Afternoon lab setup

In the afternoon lab, you'll have 2 choices:

1. Tune a single query, or
2. Run a load test against your lab SQL Server, then use sp_BlitzCache to figure out which queries to tune, then tune 1

And you can also choose whether or not to use 2019 compatibility level.

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Setting it up

Restart your SQL Server service (clears all stats).

Restore your StackOverflow database (Agent job).

Copy & run the setup script for Lab 2.

By default, it uses 2017 compat level.
If you want to use 2019 compat level, set that.

And if you want to do #2, the load test,
start SQLQueryStress with QueryLab2.json.

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Easier: tuning mqt_Lab2_Level1

At first, it'll take minutes to execute.

Tuned properly, it should run in:

- Under 2 seconds and
- Less than 250,000 logical reads

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Harder: the load test hour version

Stop SQLQueryStress (so your VM goes faster.) You can restart it later if you want to rerun the loads.

20-30 minutes – sp_BlitzCache & query review: run sp_BlitzCache, poke around in the top resource-using queries, look for queries you can tune and make a difference. Tell me which ones you want to tune, and why.

20-30 minutes – tune 1 query: based on the estimated plan from sp_BlitzCache, change the query/indexes, get the new actual plan. Show before & after in Slack like Lab 1.

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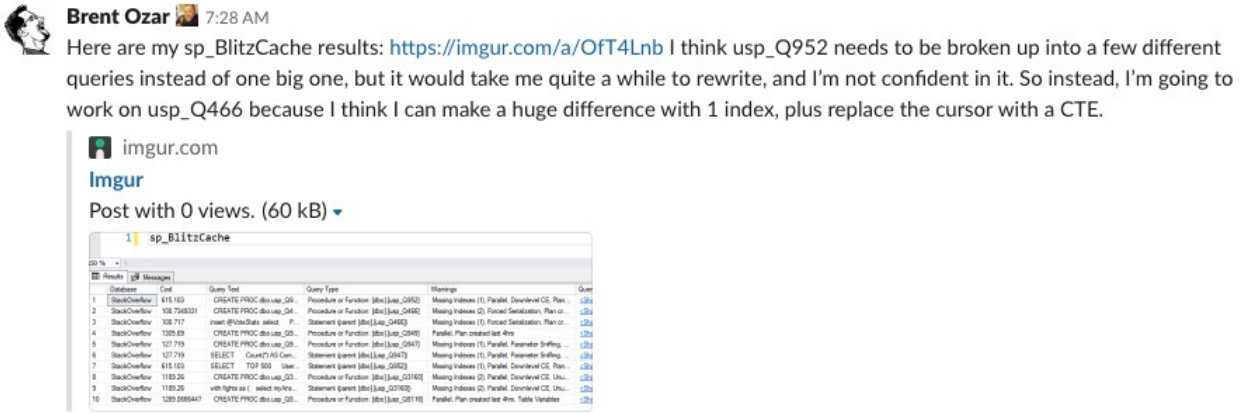
How to turn in your homework

Use Imgur.com to show your sp_BlitzCache results, and what you think you want to do with the queries:



sp_BlitzCache warnings to ignore

In this lab (but not in real life), you can ignore:

Downlevel CE: if you're on SQL Server 2019, but you didn't choose to run in 2019 compat level, you'll get this warning. That's fine.

Plan created in the last 4 hours: because this is a short-running load test.

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If you do the load test version

This lab doesn't have a clear finish line.

My goal isn't to get you to fix all of the T-SQL.

A lot of the modules in Mastering Query Tuning are fun to revisit: I give you a lot of bad T-SQL.

You can also try SQL Server 2019 compatibility: compare the plan before & after, and see which robots fixed which parts of the plan.

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My goals

I want this to be as simple as possible.
I want it all to work on one VM, using off-the-shelf tools that you can use again at home if you want.

I want you to see the moving parts.
I don't want to give you some sealed C# app that you need to recompile or tweak. You're here to performance tune SQL Server, not develop code.

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How I run a workload

SQLQueryStress:

- Open source .NET app that will run 1 query a lot
- https://github.com/ErikEJ/SqlQueryStress

usp_QueryLab2:

- Stored procedure that generates a random number, then based on that number, will call different proc.
- Don't bother tuning this: it only exists to run procs.
- https://BrentOzar.com/go/stresstest

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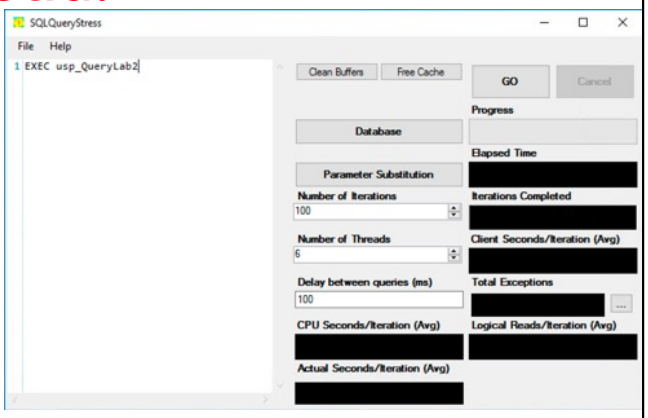
Start your workload.

Open SQLQueryStress

File, Load Settings, Labs\QueryLab2.json

Click Go



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This is a random load test.

It's okay to see SOME errors, but if your test finishes within seconds and "Iterations Completed" = "Total Exceptions", there's a setup problem (like the database is still restoring, or you forgot to run a setup script.)

The test doesn't need to finish: our goal here is just to put a bunch of query plans in your cache over the span of a few minutes.

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Pseudocode

```
DECLARE @Id INT;
SET @Id = (code to build a random #);

IF @Id % 20 = 0 --if it's divisible by 20
   EXEC usp_QueryEvenNumbers;
ELSE IF @Id % 20 = 19  -- remainder is 19
   EXEC usp_QueryOddNumbers;
```

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Examples of modulo (%)

```
DECLARE @Id INT;
SET @Id = 2;
SELECT @Id % 2;
```

100 %

Results | Messages

	(No column name)
1	0

```
DECLARE @Id INT;
SET @Id = 100;
SELECT @Id % 2;
```

100 %

Results | Messages

	(No column name)
1	0

```
DECLARE @Id INT;
SET @Id = 99;
SELECT @Id % 2;
```

100 %

Results | Messages

	(No column name)
1	1

```
DECLARE @Id INT;
SET @Id = 99;
SELECT @Id % 10;
```

100 %

Results | Messages

	(No column name)
1	9

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And we reuse the random ID

```
DECLARE @Id INT;
SET @Id = (code to build a random #);

IF @Id % 20 = 0 --if it's divisible by 20
   EXEC usp_QueryEvenNumbers @Id;
ELSE IF @Id % 20 = 19  -- remainder is 19
   EXEC usp_QueryOddNumbers @Id;
```

Because code usually needs inputs

```
CREATE PROC usp_QueryEvenNumbers @Id INT
AS
SELECT *
FROM dbo.Users u
WHERE OwnerUserId = @Id;
```

Using the random @Id means we search for different records, and we don't keep caching the same one.

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```sql
ALTER PROC dbo.usp_Lab12 WITH RECOMPILE AS
BEGIN
/* Hi! You can ignore this stored procedure.
   This is used to run different random stored procs as part of your class.
   Don't change this in order to "tune" things.
*/
SET NOCOUNT ON

DECLARE @Id1 INT = CAST(RAND() * 10000000 AS INT) + 1;
DECLARE @Id2 INT = CAST(RAND() * 10000000 AS INT) + 1;
DECLARE @Id3 INT = CAST(RAND() * 10000000 AS INT) + 1;

IF @Id1 % 20 = 0
    EXEC dbo.usp_Q3160 @Id1
ELSE IF @Id1 % 20 = 19
    EXEC dbo.usp_Q36660 @Id1
ELSE IF @Id1 % 20 = 18
    EXEC dbo.usp_Q6772 @Id1
ELSE IF @Id1 % 20 = 17
    EXEC dbo.usp_Q6856 @Id1
ELSE IF @Id1 % 20 = 16
```

1.6 p20

```
1  ALTER PROC dbo.usp_Lab12 WITH RECOMPILE AS
2  BEGIN
3  /* Hi! You can ignore this store  cedure.
4     This is used to run diffe  as part of your class.
5     Don't change this in orde
6  */
7  SET NOCOUNT ON
8
9  DECLARE @Id1 INT = CAST(RAND  ;
10 DECLARE @Id2 INT = CAST(RAND  1;
11 DECLARE @Id3 INT = CAST(RAND() * 10000000 AS INT) + 1;
12
13 IF @Id1 % 20 = 0
14     EXEC dbo.usp_Q3160 @Id1
15 ELSE IF @Id1 % 20 = 19
16     EXEC dbo.usp_Q36660 @Id1
17 ELSE IF @Id1 % 20 = 18
18     EXEC dbo.usp_Q6772 @Id1
19 ELSE IF @Id1 % 20 = 17
20     EXEC dbo.usp_Q6856 @Id1
21 ELSE IF @Id1 % 20 = 16
```

RECOMPILE keeps this proc out of your plan cache queries.

1.6 p21

```
ALTER PROC d                                  ILE AS
BEGIN
/* Hi! You                                    cedure.
   This is                                    om stored procs as part of your class.
   Don't ch                                   e" things.
*/
SET NOCOUNT

DECLARE @Id1 IN     AST(RAND() * 10000000 AS INT) + 1;
DECLARE @Id2 INT = CAST(RAND() * 10000000 AS INT) + 1;
DECLARE @Id3 INT = CAST(RAND() * 10000000 AS INT) + 1;

IF @Id1 % 20 = 0
    EXEC dbo.usp_Q3160 @Id1
ELSE IF @Id1 % 20 = 19
    EXEC dbo.usp_Q36660 @Id1
ELSE IF @Id1 % 20 = 18
    EXEC dbo.usp_Q6772 @Id1
ELSE IF @Id1 % 20 = 17
    EXEC dbo.usp_Q6856 @Id1
ELSE IF @Id1 % 20 = 16
```

I use a few different random numbers because some procs join to multiple tables.

1.6 p22

```
1  ALTER PROC dbo.usp_Lab12 WITH RECOMPILE AS
2  BEGIN
3  /* Hi! You can ignore this stored procedure.
4     This is used to run different random stored procs as part of your class.
5     Don't change this in order to "tune" things.
6  */
7  SET NOCOUNT ON
8
9  DECLARE                                  10000000 AS INT) + 1;
10 DECLARE                                  10000000 AS INT) + 1;
11 DECLARE                                  10000000 AS INT) + 1;
12
13 IF @Id1 % 20 = 0
14     EXEC dbo.usp_Q3160 @Id1
15 ELSE IF @Id1 % 20 =
16     EXEC dbo.us
17 ELSE IF @Id1 %
18     EXEC dbo.us
19 ELSE IF @Id1 %
20     EXEC dbo.usp_Q6856 @Id1
21 ELSE IF @Id1 % 20 = 16
```

If @Id1 is evenly divisible by 20...

Then go run this first stored proc.

1.6 p23

```
1  ALTER PROC dbo.usp_Lab12 WITH RECOMPILE AS
2  BEGIN
3  /* Hi! You can ignore this stored procedure.
4     This is used to run different random stored procs as part of your class.
5     Don't change this in order to "tune" things.
6  */
7  SET NOCOUNT ON
8
9  DECLARE @Id1 INT = CAST(RAND() * 10000000 AS INT) + 1;
10 DECLARE @Id2 INT [illegible] AS INT) + 1;
11 DECLARE @Id3 INT [illegible] AS INT) + 1;
12
13 IF @Id1 % 20 = 0
14     EXEC dbo.usp_Q31[illegible] @Id1
15 ELSE IF @Id1 % 20 = 19
16     EXEC dbo.usp_Q36660 @Id1
17 ELSE IF @Id1 % 20 = 18
18     EXEC dbo.usp_Q6[illegible]
19 ELSE IF @Id1 % 20 = [illegible]
20     EXEC dbo.usp_Q6[illegible]
21 ELSE IF @Id1 % 20 = [illegible]
```

If not, is the remainder 19?

Then go run this stored proc.

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```
ALTER PROC dbo.usp_Lab12 WITH RECOMPILE AS
BEGIN
/* Hi! You ca
   This is us                                  ocs as part of your class.
   Don't chan
*/
SET NOCOUNT O

DECLARE @Id1                                   + 1;
DECLARE @Id2 INT = CAST(RAND() * 10000000 AS INT) + 1;
DECLARE @Id3 INT = CAST(RAND() * 10000000 AS INT) + 1;

IF @Id1 % 20 = 0
    EXEC dbo.usp_Q3160 @Id1
ELSE IF @Id1 % 20 = 19
    EXEC dbo.usp_Q36660 @Id1
ELSE IF @Id1 % 20 = 18
    EXEC dbo.usp_Q6772 @Id1
ELSE IF @Id1 % 20 = 17
    EXEC dbo.usp_Q6856 @Id1
ELSE IF @Id1 % 20 = 16
```

You can ignore this proc. (And if you want the class to be more fun, don't look at the proc until you've done your work.)

You'll see a lot of other procs and ad-hoc SQL, though. Those are going to be where the performance gains are.

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