



SQL Server Query Tuning

Module 9

Learning Units covered in this Module

- Lesson 1: SARGable Expressions
- Lesson 2: Extended Events

Lesson 1: Sargable Expressions

Objectives

After completing this learning, you will be able to:

- Address SARGability Issues.
- Use computed columns for performance.
- Use constraints for performance.
- Understand parameter sniffing.

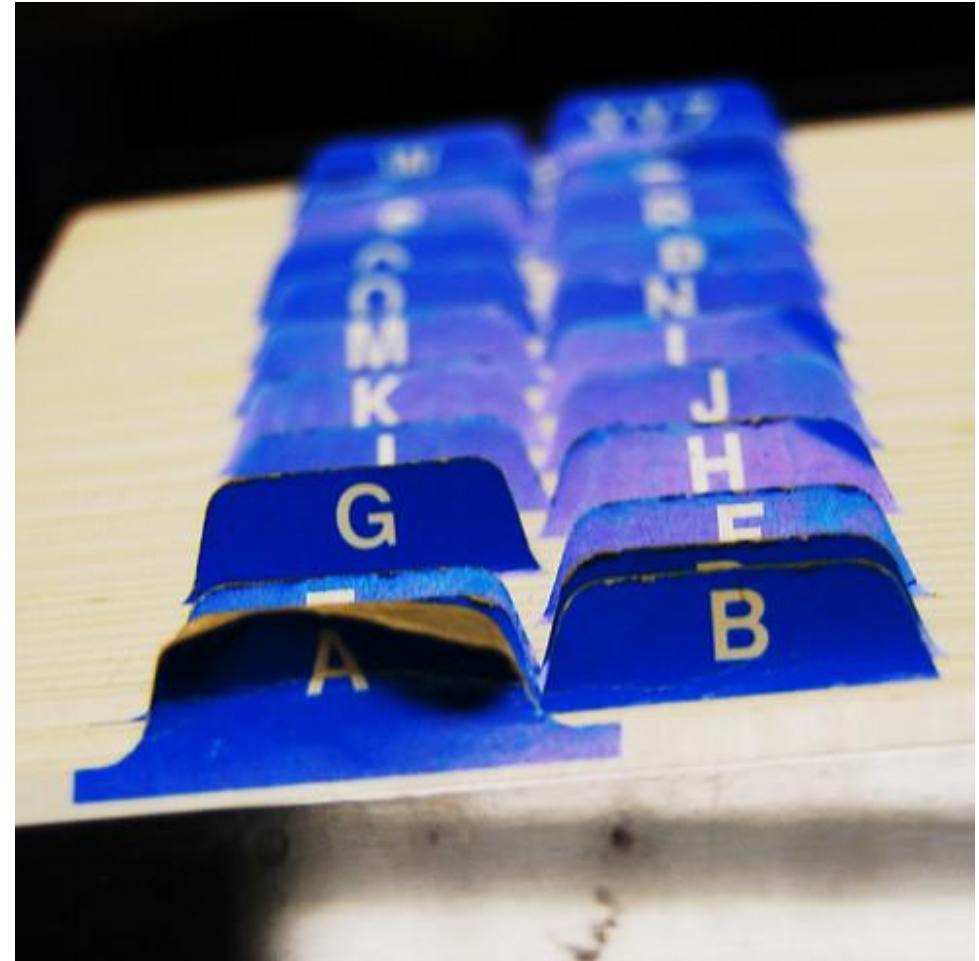


SARGability

What is this?

A SARGable item in a search predicate is able to use an index.

Non-SARGable expressions can significantly slow down queries.



Non-SARGable Expressions

Functions

WHERE ABS(ProductID) = 771

WHERE UPPER(City) = "London"

WHERE UPPER(surname) = "SMITHS"

Calculations / Expressions

WHERE Sales.Price + Sales.Tax > 100

WHERE Sales.Price * (1 + Sales.TaxRate) > 100

Using leading wildcard with LIKE operator

WHERE Employee.FirstName LIKE '%L%' is non-SARGable

WHERE Employee.FirstName LIKE 'L%' is SARGable

Non-SARGable Expressions

Continued

Implicit Conversions

ProductID is defined as **nvarchar(8)**

```
SELECT *  
FROM [dbo].[Product]  
WHERE [ProductID] = 7
```

```
SELECT *  
FROM [dbo].[Product]  
WHERE [ProductID] = N'7'
```

The screenshot shows the SQL Server Enterprise Manager interface. At the top, the 'Execution plan' tab is selected. Below it, the query text is displayed: 'Query 1: Query cost (relative to the batch): 100%
SELECT * FROM [dbo].[Product] WHERE [ProductID]=@1'. The execution plan is shown below the query text. It consists of a single operator: 'Clustered Index Scan (Clustered Index: [Product].[PK_Product_ProductID])'. The cost of this operator is 100% (0.000s). A yellow warning icon is present next to the operator name. A tooltip is displayed over the warning icon, showing the following information:

SELECT	
Cached plan size	40 KB
Estimated Operator Cost	0 (0%)
Degree of Parallelism	1
Estimated Subtree Cost	0.0127253
Estimated Number of Rows	106.371

Statement
SELECT * FROM [dbo].[Product] WHERE [ProductID]=@1

Warnings
Type conversion in expression (CONVERT_IMPLICIT(int, [AdventureWorks2019].[dbo].[Product].[ProductID],0)=CONVERT_IMPLICIT(int, [@1],0)) may affect "SeekPlan" in query plan choice

Using Computed Columns to Improve Performance

Resolving non-SARGable expressions

- Create computed column to Replace calculations / expressions.
- Create an index on computed column.

Selectivity issues for inequalities

- SQL Server assumes 30% selectivity on inequality comparisons.
- Computed column will have more accurate statistics.
- No need to specify computed column.

Using Computed Columns to Improve Performance

Persisted Computed Columns

Specifies that the Database Engine will physically store the computed values in the table.

Marking a computed column as PERSISTED allows an index to be created on a computed column that is deterministic.

```
--Add a new computed column as persisted
ALTER TABLE [dbo].[ProductTest]
ADD stockValue AS (isnull([UnitPrice] * ((1.0) - [UnitPriceDiscount])) *
[StockQty], (0.0))) PERSISTED;

--Create an index on new computed column to improve query performance
CREATE INDEX IX_StockValue ON [dbo].[ProductTest](stockValue);
```

Using Constraints to Improve Performance

Helping Query Optimizer to choose better plans

UNIQUE constraint

- DISTINCT property can be ignored
- Extra columns in ORDER BY may be ignored

CHECK constraint

- CHECK constraints enforce domain integrity by limiting the values that are accepted by one or more columns.

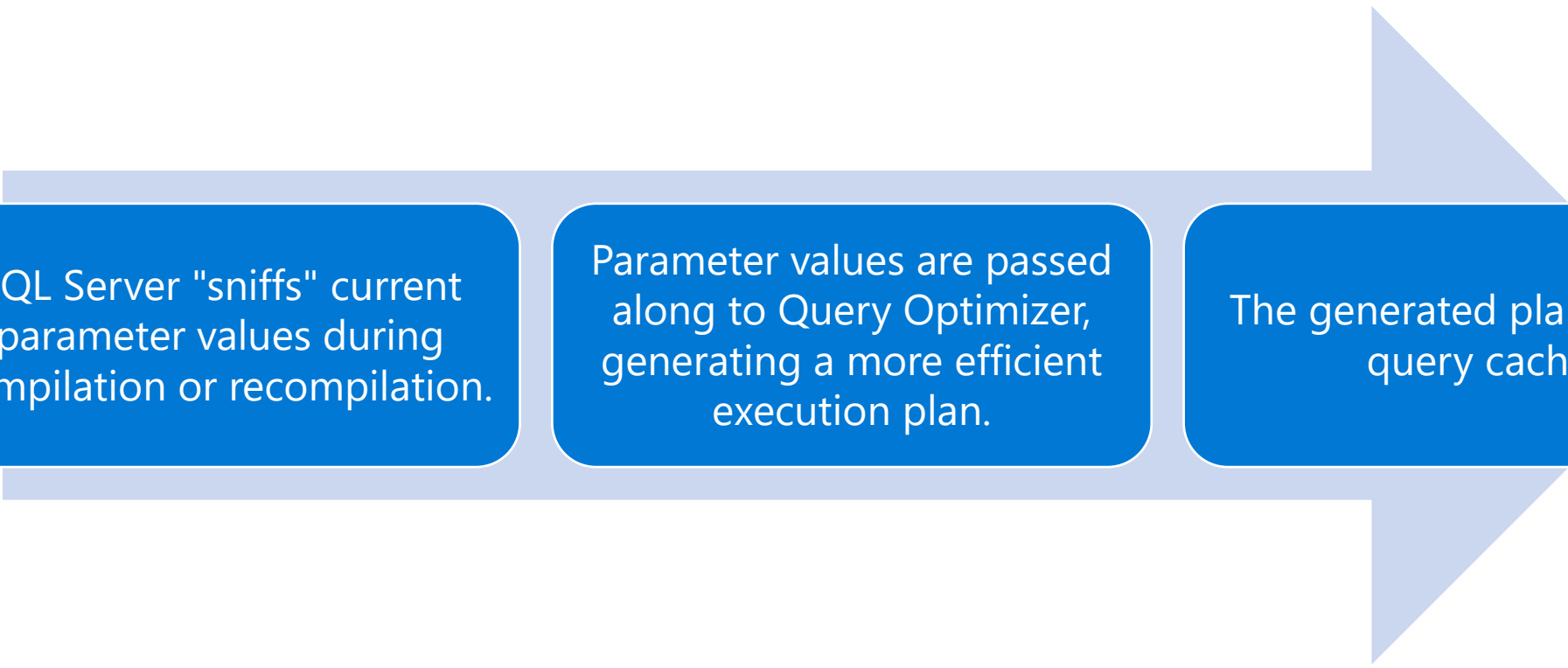
Primary Key

- Special case of UNIQUE constraint

Foreign Key

- Declarative Referential Integrity (DRI)
- Usually faster than triggers
- Allows the query optimizer to identify unnecessary joins

Parameter Sniffing



SQL Server "sniffs" current parameter values during compilation or recompilation.

Parameter values are passed along to Query Optimizer, generating a more efficient execution plan.

The generated plan stays in query cache.

Parameter sniffing can be seen on the following types of batches:

- Stored procedures
- Queries submitted via `sp_executesql`
- Prepared queries

Parameter Sniffing

Mitigation

RECOMPILE

- This workaround trades compilation time and increased CPU for better plan quality.

OPTION (OPTIMIZE FOR...)

- This option requires a good understanding of optimal parameter values and associated plan characteristics.

OPTION (OPTIMIZE FOR UNKNOWN)

- Overrides the actual parameter value and instead use the density vector.

DISABLE_PARAMETER_SNIFFING

- Disables parameter sniffing entirely. This hint name is equivalent to:
 - TRACE FLAG 4136
 - Database Scoped Configuration setting `PARAMETER_SNIFFING = OFF`

KEEPFIXEDPLAN

- This workaround assumes that the good-enough common plan is the one in cache already.

USE PLAN

- Force the plan by explicitly using this query hint by rewriting the query and adding the hint in the query text. Or set a specific plan by using Query Store.

Demonstration

Query Tuning Sargability

Query Tuning using

- Sargability
- Constraints
- Computed Columns



Query Tuning SARGability

- Applying SARGable expression to create better execution plans



Questions?



Knowledge Check

Give two examples of non-SARGable expressions.

Explain three hints we can use to mitigate Parameter Sniffing.

Lesson 2 : Extended Events

Objectives

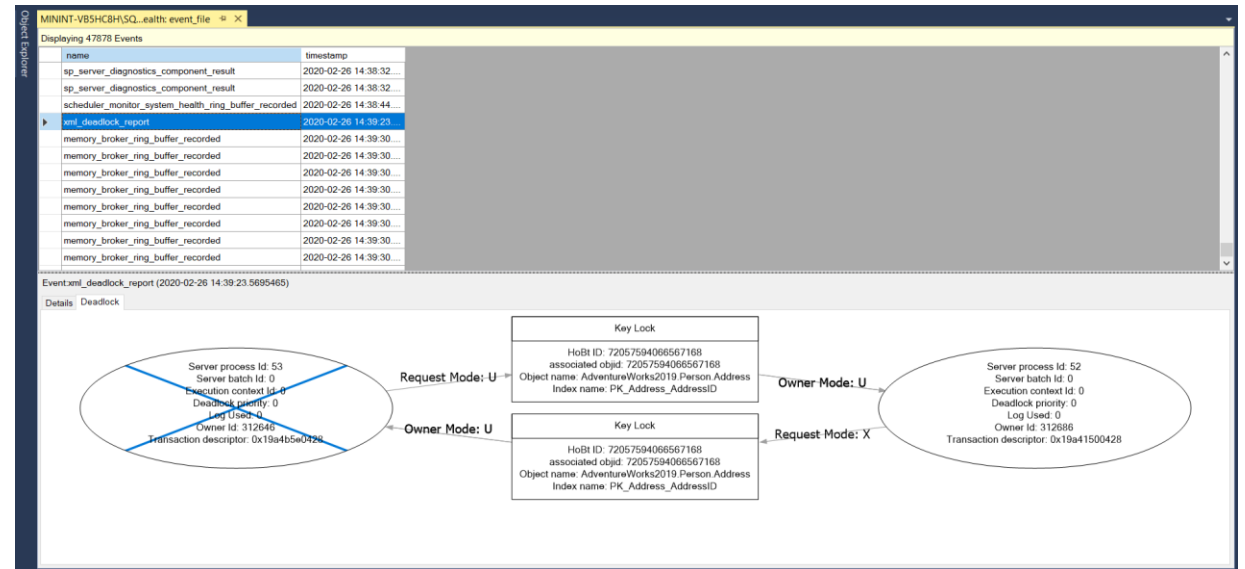
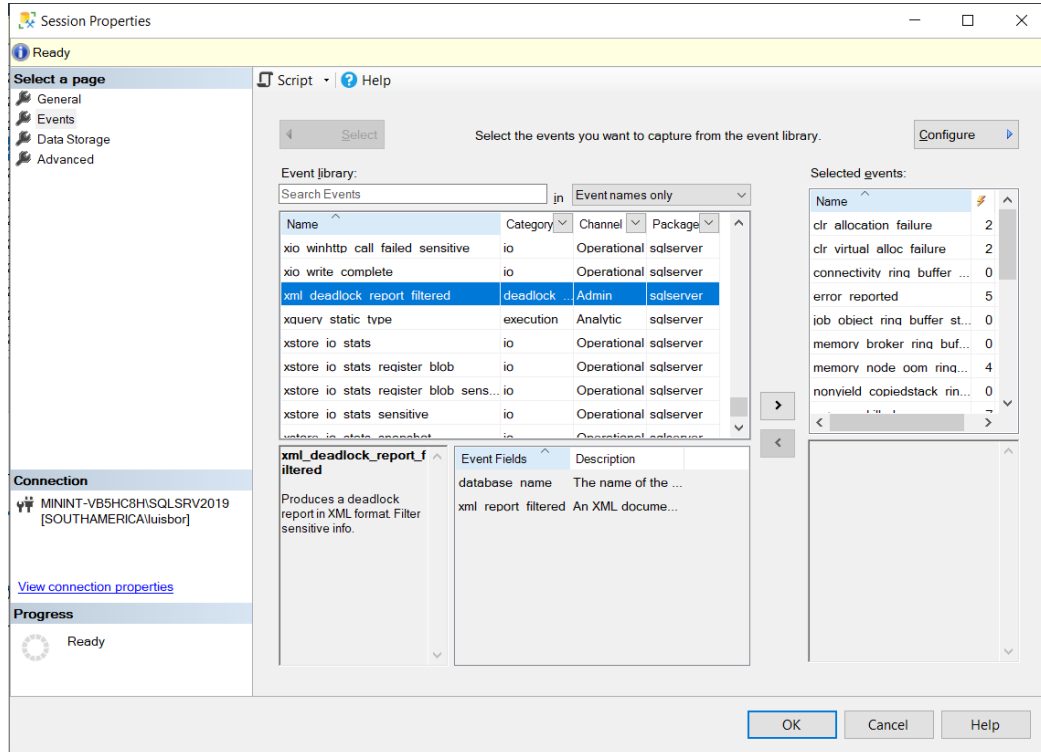
After completing this learning, you will be able to:

- Understand Extended Events objects.
- Create and configure Extended Event Sessions.
- Implement filtering, aggregation, and perform analysis via the UI in SSMS.
- Use Extended Events Profiler (XEProfiler).



Troubleshooting Tools

Extended Events – System Health Session



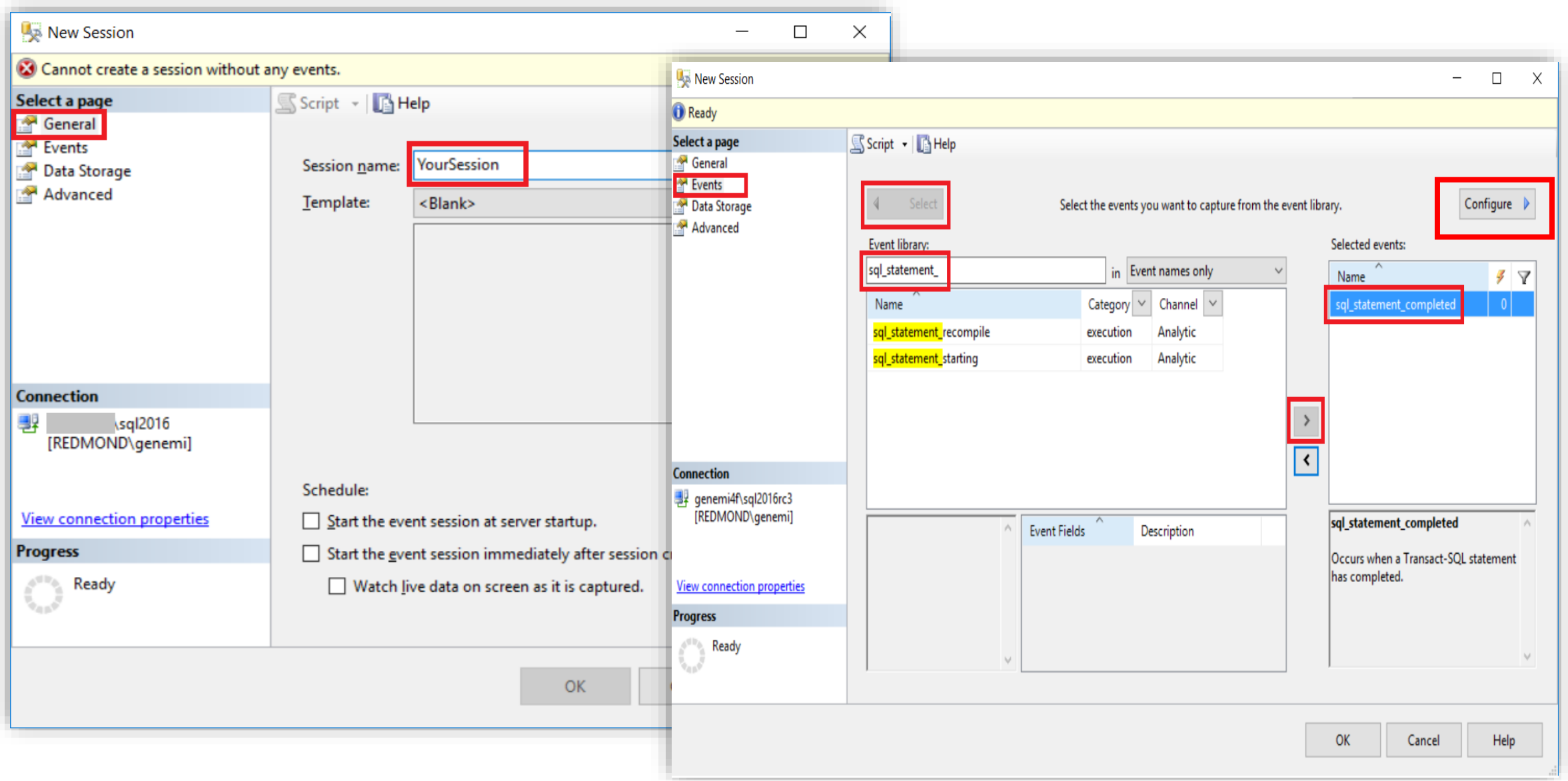
The system_health session is an Extended Events session that is included by default with SQL Server.

This session starts automatically when the SQL Server Database Engine starts and runs without any noticeable performance effects.

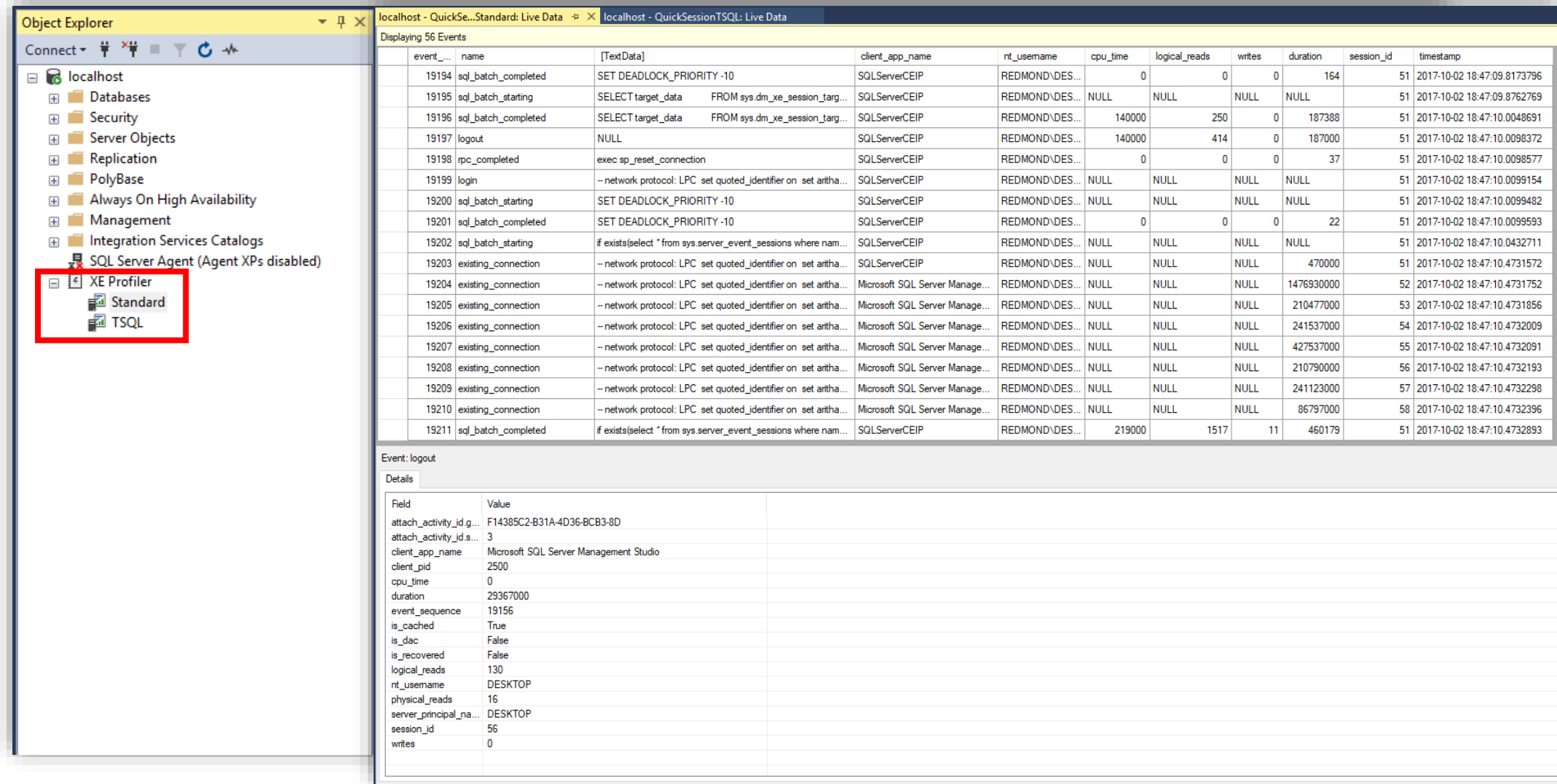
The session collects system data that you can use to help troubleshoot performance issues in the Database Engine.

Never change this session definition – always create your own according to your requirements.

Extended Events in SSMS



Extended Events Profiler



Object Explorer

Connect

localhost

- Databases
- Security
- Server Objects
- Replication
- PolyBase
- Always On High Availability
- Management
- Integration Services Catalogs
- SQL Server Agent (Agent XPs disabled)
- XE Profiler**
 - Standard
 - TSQL

localhost - QuickSe...Standard: Live Data

localhost - QuickSessionTSQL: Live Data

Displaying 56 Events

event...	name	[TextData]	client_app_name	nt_username	cpu_time	logical_reads	writes	duration	session_id	timestamp
19194	sql_batch_completed	SET DEADLOCK_PRIORITY -10	SQLServerCEIP	REDMOND\DES...	0	0	0	164	51	2017-10-02 18:47:09.8173796
19195	sql_batch_starting	SELECT target_data FROM sys.dm_xe_session_targ...	SQLServerCEIP	REDMOND\DES...	NULL	NULL	NULL	NULL	51	2017-10-02 18:47:09.8762769
19196	sql_batch_completed	SELECT target_data FROM sys.dm_xe_session_targ...	SQLServerCEIP	REDMOND\DES...	140000	250	0	187388	51	2017-10-02 18:47:10.0048691
19197	logout	NULL	SQLServerCEIP	REDMOND\DES...	140000	414	0	187000	51	2017-10-02 18:47:10.0098372
19198	rpc_completed	exec sp_reset_connection	SQLServerCEIP	REDMOND\DES...	0	0	0	37	51	2017-10-02 18:47:10.0098577
19199	login	-- network protocol: LPC set quoted_identifier on set aritha...	SQLServerCEIP	REDMOND\DES...	NULL	NULL	NULL	NULL	51	2017-10-02 18:47:10.0099154
19200	sql_batch_starting	SET DEADLOCK_PRIORITY -10	SQLServerCEIP	REDMOND\DES...	NULL	NULL	NULL	NULL	51	2017-10-02 18:47:10.0099482
19201	sql_batch_completed	SET DEADLOCK_PRIORITY -10	SQLServerCEIP	REDMOND\DES...	0	0	0	22	51	2017-10-02 18:47:10.0099593
19202	sql_batch_starting	if exists(select * from sys.server_event_sessions where nam...	SQLServerCEIP	REDMOND\DES...	NULL	NULL	NULL	NULL	51	2017-10-02 18:47:10.0432711
19203	existing_connection	-- network protocol: LPC set quoted_identifier on set aritha...	SQLServerCEIP	REDMOND\DES...	NULL	NULL	NULL	470000	51	2017-10-02 18:47:10.4731572
19204	existing_connection	-- network protocol: LPC set quoted_identifier on set aritha...	Microsoft SQL Server Manage...	REDMOND\DES...	NULL	NULL	NULL	1476930000	52	2017-10-02 18:47:10.4731752
19205	existing_connection	-- network protocol: LPC set quoted_identifier on set aritha...	Microsoft SQL Server Manage...	REDMOND\DES...	NULL	NULL	NULL	210477000	53	2017-10-02 18:47:10.4731856
19206	existing_connection	-- network protocol: LPC set quoted_identifier on set aritha...	Microsoft SQL Server Manage...	REDMOND\DES...	NULL	NULL	NULL	241537000	54	2017-10-02 18:47:10.4732009
19207	existing_connection	-- network protocol: LPC set quoted_identifier on set aritha...	Microsoft SQL Server Manage...	REDMOND\DES...	NULL	NULL	NULL	427537000	55	2017-10-02 18:47:10.4732091
19208	existing_connection	-- network protocol: LPC set quoted_identifier on set aritha...	Microsoft SQL Server Manage...	REDMOND\DES...	NULL	NULL	NULL	210790000	56	2017-10-02 18:47:10.4732193
19209	existing_connection	-- network protocol: LPC set quoted_identifier on set aritha...	Microsoft SQL Server Manage...	REDMOND\DES...	NULL	NULL	NULL	241123000	57	2017-10-02 18:47:10.4732298
19210	existing_connection	-- network protocol: LPC set quoted_identifier on set aritha...	Microsoft SQL Server Manage...	REDMOND\DES...	NULL	NULL	NULL	86797000	58	2017-10-02 18:47:10.4732396
19211	sql_batch_completed	if exists(select * from sys.server_event_sessions where nam...	SQLServerCEIP	REDMOND\DES...	219000	1517	11	460179	51	2017-10-02 18:47:10.4732893

Event: logout

Details

Field	Value
attach_activity_id.g...	F14385C2-B31A-4D36-BCB3-8D
attach_activity_id.s...	3
client_app_name	Microsoft SQL Server Management Studio
client_pid	2500
cpu_time	0
duration	29367000
event_sequence	19156
is_cached	True
is_dac	False
is_recovered	False
logical_reads	130
nt_username	DESKTOP
physical_reads	16
server_principal_na...	DESKTOP
session_id	56
writes	0

Demonstration

SQL Server Management Studio
Extended Events UI

XE Profiler



Extended Events

- Examining Extended Event Functionality



Questions?



Knowledge Check

What are the Extended Event objects?

What is XEProfiler?

When additional data elements capture is need, how can it be configured?

Which channel is disabled by default when creating a session?

