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Eliminating Low Hanging Fruit

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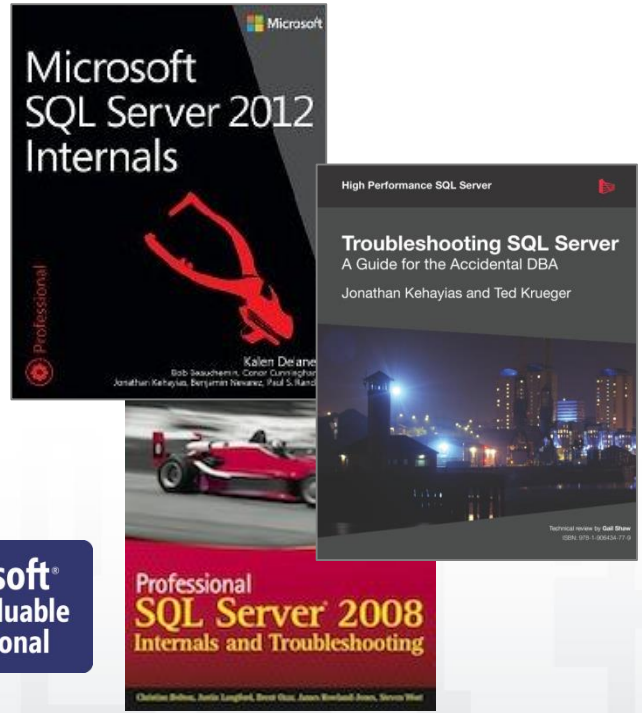

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Overview

- Row-By-Agonizing-Row processing
- Develop and test against realistic scale
- Profile your workload during development
- Use appropriate data types
- Sargability matters

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Row-By-Agonizing-Row Processing

- **Certain constructs force SQL Server into RBAR (row-by-agonizing-row) processing of results**
- **Well known:**
  - WHILE loops
  - Cursors
- **Less well known:**
  - Scalar user defined functions
  - Correlated subqueries

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Cursors and Loops

- **Characteristics**
  - Explicit cursor declaration
  - WHILE loop
  - SqlDataReader in application
- **Problems**
  - Row based processing over Set Based
- **Replace with**
  - Appropriate set based operation
  - Move looping code into SQLCLR or Middle Tier
  - Consume and dispose of SqlDataReader as quickly as possible

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Correlated Sub-Queries

- **Characteristics**
  - Refer to the outer query in the inner query in SELECT statement
  - SELECT Statement used as column value in UPDATE
- **Problems**
  - May cause row-by-row processing to occur
  - Performance decreases exponentially as row count increases
- **Replace with**
  - Table Join
  - Derived Table Join
  - Cross Joined Table Valued Function

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Scalar User Defined Functions

- **Characteristics**
  - Encapsulate common code blocks/business logic in a single call.
  - If columns are passed as parameters it is not inline
- **Problems**
  - Cause row-by-row processing to occur
  - Performance decreases exponentially with data access
- **Replace with**
  - Inline expressions
  - Derived Table Join
  - Cross Joined Inline Table Valued Function

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Develop and Test Against Realistic Scale

- **Development databases often do not contain realistic datasets which can hide/mask potential performance problems**
  - Key Lookups on small data sets may become index scans on larger data sets
  - Missing index impacts may be hidden by data residing in memory for small data sets
  - RBAR problems are often hidden until data sizes scale up
- **Testing a single execution in isolation is not load testing**
  - Testing needs to be performed at scale through load generation to measure accumulated effects
  - Only testing at scale can identify *"death by 1000 cuts"* problems

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Profile Your Workload During Development

- **Learn to use Extended Events (2012+) or SQL Trace to profile your workload during testing**
- **Know the important events to watch for during development**
  - Statement/Batch/RPC completed events
  - SP completed/Module End events – (procedure/trigger/function executions)
  - Execution warnings (sort, hash, missing join predicate)
- **Profiling during development can uncover nasty RBAR issues and performance effecting side effects of trigger executions**
- **Be aware of *"observer overheads"* but not typically a problem with development/test workloads**

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Use Appropriate Data Types

- Understand the storage costs and implications of data types during schema design – especially for keys

Data type	Range	Storage
bigint	-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807	8 Bytes
int	-2,147,483,648 to 2,147,483,647	4 Bytes
smallint	-32,768 to 32,767	2 Bytes
tinyint	0 to 255	1 Byte

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Use Appropriate Data Types (2)

- **Consider precision requirements for dates and times**
  - DATETIME2 = 6, 7, or 8 bytes with nanosecond precision
    - 6 bytes for precisions less than 3
    - 7 bytes for precisions 3 and 4
    - All other precisions require 8 bytes
  - DATETIME = 8 bytes with fractions of second precision
    - Fraction of seconds rounded to .000, .003, or .007 seconds
  - SMALLDATETIME = 4 bytes with minute precision
  - DATE = 3 bytes
- **Don’t store dates or times as CHAR, VARCHAR, NCHAR, or NVARCHAR**

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Sargability Matters

- **A query is sargable (Search ARGument ABLE) if an index seek can be used to speed up the execution of the query**
- **Anti-patterns to sargable expressions include:**
  - Functions in the WHERE clause
  - Implicit/Explicit data type conversions on a column
  - Leading wildcard expressions with LIKE '%<SearchTerm>'
  - Catch all queries and search procedures

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Functions on WHERE Clause Columns

- **Characteristics**
  - Used to change the data stored to match criteria being checked
  - Conversion of data to a different type
- **Problems**
  - Causes Table/Index Scan over Seek
- **Replace with**
  - Appropriate Table Design to support business needs
  - Indexed/Persisted Computed Column
  - Indexed View
  - Other coding paradigm to

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Implicit/Explicit Column Conversions

- **Characteristics**
  - Column data type is of lower precedence than filtering parameter / joining column data type
  - Common in LINQ to SQL/EF and other ORMs
- **Problems**
  - Causes Table/Index Scan over Seek
- **Replace with**
  - Higher precedence column data type
  - Matching data type for filtering parameter

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Catch-All Search Queries

- **Characteristics**
  - Used to search across multiple columns using parameters
  - Not all parameters require input values
  - WHERE clause similar to (@Param1 IS NULL OR Column1 = @Param1)
- **Problems**
  - No optimized execution plan
  - Causes Table/Index Scan over Seek
- **Replace with**
  - Separate search procedures for different parameters passed
  - Parameterized Dynamic SQL

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Review

- Row-By-Agonizing-Row processing
- Develop and test against realistic scale
- Profile your workload during development
- Use appropriate data types
- Sargability matters

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Questions?

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Your evaluation helps organizers build better conferences and helps speakers improve their sessions.

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Thank you!

Our Spring Show Lineup Speaks for Itself!

May 21-24, 2017 in Orlando, Florida

- **40 SQL Sessions, 3 SQL keynotes, and 7 workshops:**
  - 2 workshop on Saturday, May 20
    - *PowerShell for the DBA from 0-60 in a Day* with Ben Miller
    - *SQL Server 2014 and 2016 New Features and Capabilities* with Tim Chapman and David Pless
  - 2 workshops on Sunday, May 21
    - *Performance Troubleshooting using Waits and Latches* with Paul Randal
    - *Azure for the SQL Server DBA* with Tim Radney
  - 3 workshops on Thursday, May 25
    - *Finding and Fixing Performance Problems in SQL Server* with Erin Stellato and Jonathan Kehayias
    - *Advanced SQL Server High Availability* with Brent Ozar
    - *Cortana Intelligence Suite-Microsoft R for Architects* with Buck Woody

Show focuses on versions 2008 and higher with special sessions on new features in SQL 2014 / 2016 plus sessions about Azure and vNext!

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Fantastic evening events interact + meet the speakers get YOUR questions answered!

- **Industry-experts and Microsoft speakers**

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