# The Roadmap to Better Performance: Reading Query Plans

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# Abstract

Whether you're a DBA or a developer, you probably know that when you submit a query to SQL Server it generates a plan – a map if you will – that determines how it will get the data you've requested. But if you're not familiar with how to read that map, then how do you know how to create a faster route to the data? How can you tune a query?

If you've been lost when looking at plans before, then sign up for this session where we will cover the basics of query plans. We'll step through how to capture them, discuss the essential information to review in a plan, and highlight a couple patterns to look for when tuning queries. As usual, expect lots of demos to highlight key points, and "plan" to walk away with new methods to use when reviewing query plans in SQL Server. Level: 200



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# Overview

- How to capture and view a query plan
- Essential information in a plan
- Query plan patterns


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# Query Plan Review

- **For every query submitted to SQL Server, the optimizer creates an execution plan (aka query plan)**
- **The plan tells you how the query was executed…how the optimizer decided to retrieve the results**
  - What tables and/or indexes were accessed
  - Whether scans or seeks were performed
  - What operators (aka iterators) were used
  - The estimated cost of each operation
  - How many rows were expected
  - …and more


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# What the Query Plan Does Not Include

- **Query duration**
  - Use SET STATISTICS TIME
- **IO information**
  - The number of IOs
  - Whether the data had to be read from disk
  - Use SET STATISTICS IO
- **Lock information**
- **Wait statistics**
- **The actual cost**
- **…and more**

- **You cannot use query plans in isolation to tune queries**
  - You need multiple tools


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# Finding a Query Plan

- **The majority of plans are stored in cache**
  - We won't worry about exceptions today
- **This means that the plan cache can be queried**
- **The plan retrieved from cache is the *estimated* plan**
  - sys.dm_exec_query_plan or sys.dm_exec_cached_plans
  - SET SHOWPLAN_XML
  - Graphical Showplan
- **The *actual plan* can only be retrieved when you execute the query**
  - SET STATISTICS XML
  - Graphical Showplan
  - Trace or Extended Events…these are not recommended


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# Demo

## Capturing Query Plans

# Estimated vs. Actual

- **The plan that's stored in cache is the one that has been used**
- **When you retrieve the plan from cache, you only see estimates (number of rows, number of executions)**
- **When you capture the "actual" query plan, it's the same as the plan that exists in cache but it *also includes* actuals (actual number of rows, actual number of executions)**
  - Useful to see if there is disparity between the estimates and actuals
  - If so, then you need to figure out why the differences exist
    - This goes back to **statistics**…we're not getting into this today ☺

- **"An actual plan is absolutely identical to an estimated plan…with the addition of the actual values…it's the estimated plan with what really happened."**


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# Essential Information in a Plan

- **Tables and/or indexes were accessed**
- **Type of access (seek, scan)**
- **Operators (aka iterators)**
- **Estimates**
  - Cost
  - Rows
- **Arrow width**
  - How much data is being retrieved?
- **Missing indexes**

- **Note: there is *a lot more* information in a plan than we can discuss in this session**


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# Demo

## Finding Information in Query Plans

# Where Do You Start With a Plan?

- There is no one answer
- You have to practice reading and understanding plans to determine where you can improve a query
- This takes time
- It's a science and an art…just like indexing


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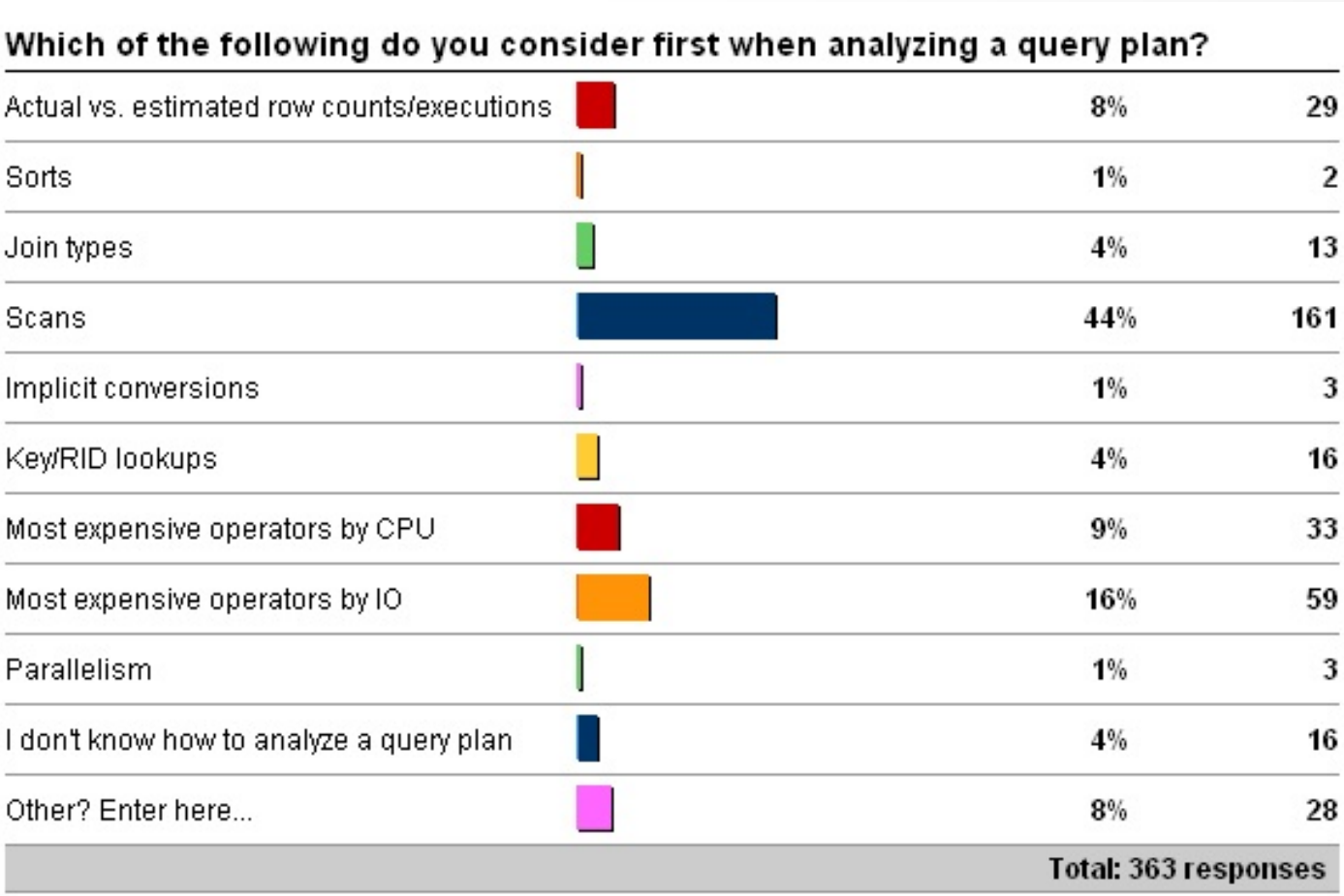
# Where Do You Start With a Plan?



**Which of the following do you consider first when analyzing a query plan?**

| | | |
|---|---|---|
| Actual vs. estimated row counts/executions | 8% | 29 |
| Sorts | 1% | 2 |
| Join types | 4% | 13 |
| Scans | 44% | 161 |
| Implicit conversions | 1% | 3 |
| Key/RID lookups | 4% | 16 |
| Most expensive operators by CPU | 9% | 33 |
| Most expensive operators by IO | 16% | 59 |
| Parallelism | 1% | 3 |
| I don't know how to analyze a query plan | 4% | 16 |
| Other? Enter here... | 8% | 28 |
| | Total: 363 responses | |

http://www.sqlskills.com/blogs/paul/query-plan-analysis-first-steps/



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# Demo

Patterns in Query Plans

# Resources

- **Whitepaper:**
  - *Statistics Used by the Query Optimizer in Microsoft SQL Server 2008*
    - http://msdn.microsoft.com/en-us/library/dd535534.aspx
- **Books:**
  - Microsoft® SQL Server® 2008 Internals (Chapter 8)
- **Blogs**
  - Craig Freedman's SQL Blog (not updated recently but very good!):
    - http://blogs.msdn.com/b/craigfr/
  - Conor Cunningham Blog(s):
    - http://blogs.msdn.com/b/conor_cunningham_msft/
    - http://www.sqlskills.com/blogs/conor/
  - Paul White's Blog (http://sqlblog.com/blogs/paul_white/)
  - Benjamin Nevarez (http://www.benjaminnevarez.com/)

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# Questions?