

Plan Explorer User Guide

WELCOME TO THE PLAN EXPLORER USER GUIDE!

If you have any technical questions, please don't hesitate to contact us:

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Support Forum: <http://forum.sqlsentry.net/>

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1 Welcome

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2 Introduction

INTRODUCTION

SQL Sentry Plan Explorer is a free, lightweight .NET-based tool that builds upon and supplements the capabilities of SSMS for execution plan analysis. In general, the more complex the execution plan, the more useful the tool will be.

Originally, this functionality was planned only for the full version of SQL Sentry v6. However, after using it ourselves for a while and seeing how useful it can be for plan analysis, we decided that anyone that wants it should be able to have it.

As such, Plan Explorer contains almost all plan analysis functionality provided by the full version integrated within the SQL Sentry Console.

Since Plan Explorer is a simple standalone app that doesn't utilize the SQL Sentry database or collector service, it doesn't support historical plan analysis or captured statement integration via SQL Sentry's Top SQL collection. It does, however, support opening .QueryAnalysis files generated by the full version of SQL Sentry. These files can contain actual captured statements, and provide estimated and actual metrics side-by-side for those statements.

3 Plan Explorer Features

PLAN EXPLORER FEATURES

Below are links to the primary features of Plan Explorer. Since the graphical plan diagram in SSMS was used as a starting point for the design of Plan Explorer, some features are compared with the current capabilities of SSMS in order to illustrate the reasoning behind the feature.

General (Section 3.1)

Plan Diagram (Section 3.4.1)

3.1 General

GENERAL

- The “Statements Tree” pane shows a tree list representation of the entire query call stack, including all statements, conditional logic structures, looping structures, nested procedure calls, and dynamic SQL calls. Estimated costs (Total, CPU, and IO), estimated rows, and operation counts are displayed for each statement. Actual costs and rows are shown side-by-side (*Top SQL collection and .QueryAnalysis files only*).
- Significant differences between estimated and actual rows for captured statements are highlighted, making it easy to spot cases where statistics may be stale (*Top SQL collection and .QueryAnalysis files only*).
- The graphical plan diagram (and other tabs) are synchronized with the selected statement, versus trying to show all plans together in a large list. The list can be used to quickly find the highest cost statements. Selecting any statement will show the graphical diagram, top operations list, columns list, and tree list view for that statement’s execution plan.
For actual plans, SSMS lists all plans in a single view with estimated costs in the header for each individual plan. For estimated plans, subtrees are created for each statement and plan. There is no way to quickly sort or find the highest cost statement in either case. Because of this “load everything at once” approach, very large plans can cause significant performance issues for SSMS.
- The graphical query plan and color-coded query text view is synchronized with the statement list.
SSMS has no synchronization between the query text and graphical plan, requiring

manual scrolling.

- Screen and window layout is persisted by default, and can be saved to and loaded from disk. Default horizontal and vertical layout styles are included. Horizontal layout is better for shorter queries with wide plans, and vertical layout better for longer queries.
- Scans and lookups are background highlighted on all views by default if the est row count exceeds 100.
- Tree list view of plan provides a hierarchical view of the plan with estimated costs and other operation details.
- Top Operations view is a sortable list view of all plan operations, sorted descending by total cost by default so you can immediately see the highest cost operations.
SSMS provides no sorting capabilities.
- Columns view shows exactly how data is accessed for each column used by the query, including the associated operation and estimated rows. This view makes it easy to identify bookmark lookups or index scans occurring because indexes are non-covering.
- To inspect or make modifications to an index, the index properties window can be opened by right-clicking any index operation node on the graphical plan, or any grid row on the other tabs. Likewise you can create new indexes via a separate context item. *(Full version only)*
This functionality was available for SQL Server 2000 in Enterprise Manager, but removed from SSMS starting with SQL Server 2005.
- The graphical plan diagram, tree view, top operations, and columns view are synchronized, so an operation selected in one view will be auto-selected on all others.
- Entire plans can be saved to and loaded from file using the .QueryAnalysis format, complete with all statement and plan info.
- Plan TSQL and XML can be saved to file.

3.2 Command Text and Statements Tree Section

COMMAND TEXT

- This section shows an editable version of the query text for the statement or batch being analyzed.
- You can make changes to the query and then, to see how this impacts the execution plan, you can click on the "Estimated Plan" or "Actual Plan" button on the toolbar.
- In either case, you will be asked for the server, database and credentials in order to connect (unless you launched Plan Explorer from within SSMS using our Management Studio **Add-In** (<http://www.sqlsentry.com/plan-explorer/sql-server-query->

view.asp#addin)). To generate the actual plan, the query is run against the server, but the actual query results are not returned to the Plan Explorer UI. By default there is a message box explaining this behavior, but it can be turned off by enabling the Help menu option, "Warn on Actual Plan Execution."

- Generating the actual execution plan by executing the query against the server allows you to collect actual runtime metrics, such as duration, CPU and reads, which you cannot get from an estimated or actual plan on its own.

STATEMENTS TREE

- The Statements Tree represents one of the biggest differences between SQL Sentry Plan Explorer and SSMS. Its function is critical when navigating multi-statement plans. What it shows is a logical breakdown of the entire plan tree, including all control structures, nested procedure calls, and estimated and/or actual metrics for each statement, including operation counts.
- Click on any statement in the grid to be shown the associated plan for that statement only.
- Click on any control structure (IF or WHILE) or EXEC higher up the tree to see a filtered view of the plan starting from that point.
- Sort the statements list and the highest cost trees and statements will immediately bubble up to the top.
- So whether there are 10 or 1,000 statements in the master plan doesn't really matter, it's trivial to find the highest cost individual plans so you can focus your attention on those. Big plans that simply weren't usable before can now be managed with ease.

3.3 General Query and Plan Info Section

GENERAL QUERY & PLAN INFO SECTION

- This section contains two tabs:
 - Text Data
 - Plan XML
- If you loaded an existing execution plan, the T-SQL and plan XML will be auto-generated.
- If you modify the query in the Command Text tab, the query text and XML will be synchronized when you generate a new Estimated or Actual plan from the toolbar.

- Like plans, the T-SQL statements are synchronized with the Statements Tree, meaning that if you select a row on the tree view it will auto-select the associated T-SQL statement and its execution plan, and vice versa.

3.4 Plan Details Section

PLAN DETAILS SECTION

This section contains up to seven tabs:

Plan Diagram (Section 3.4.1)

Plan Tree (Section 3.4.2)

Top Operations (Section 3.4.3)

Query Columns (Section 3.4.4)

Join Diagram (Section 3.4.5)

Parameters (Section 3.4.6)

Expressions (Section 3.4.7)

3.4.1 Plan Diagram

PLAN DIAGRAM

- The Plan Diagram view will certainly be recognized by everyone familiar with SSMS, although you should immediately notice some differences. First, there is color! The cost information is color-scaled so you can quickly see which operations are heaviest, and Lookups and Scans are also highlighted.
- Right-click the diagram and context menus provide access to a variety of other functions. Using the context menus, in addition to scaling by total cost (CPU + I/O), you can also use CPU or I/O separately. This can be very helpful if your hardware is more I/O constrained than CPU constrained, or vice versa. To see which subtrees are most expensive, select the "Cumulative Costs" context item.
- Optimized layout algorithms render plans in a more condensed view than SSMS, so more of the plan fits on the screen without having to zoom out.
In SSMS, each subtree starts one row down from the previous subtree, even if there is sufficient space to display it on the same row. So the more subtrees the taller the plan, and the more scrolling and zooming required to work with it.
- Optimized plan node labels prevent truncation of object names in most cases, and there is an option to disable truncation completely so full object names are always visible.

Object name truncation is a common issue in SSMS, and requires inspecting the tooltip to verify the object name.

- Optimized tooltips prevent wrapping of object names, column names and predicates. *These elements are typically jumbled and wrapped in SSMS, making them difficult to read and process.*
- Estimated costs are displayed above nodes for maximum readability. *SSMS lists costs on the bottom with the other text, so the row it uses will change depending on the operation.*
- Estimated costs label uses color scaling by CPU, IO, or CPU+IO so highest cost operations are instantly obvious, even on larger plans. *SSMS doesn't provide color scaling.*
- Costs are shown to the first decimal place. *SSMS rounds costs to the nearest integer.*
- Connector line width can be scaled by either Rows or Data Size. *SSMS only scales width by rows.*
- "Rows" and "Data Size" are displayed above connector lines. *SSMS doesn't show this information on the diagram, only in tooltips.*
- Connector lines for bookmark (key|rid) lookups, table spools, and function calls show the actual estimated rows or data size, and line width is scaled accordingly. *SSMS always shows a thin line with "1" as the row count for these operations in estimated plans, although it shows the actual rows for actual plans. This behavior is inconsistent and can be deceiving.*
- Cumulative costs can be shown in lieu of per node costs, and when combined with color scaling it's easy to see which subtrees are contributing most to the plan cost. *SSMS supports only per node costs.*
- The mouse scroll wheel can be used for both scrolling up down, and zooming in/out (by holding Ctrl). *The scroll wheel is non-functional for SSMS plan diagrams.*

3.4.2 Plan Tree

PLAN TREE

Plan Tree shows all operations and associated metrics. On the surface it looks similar to a showplan_all, however it's different in several respects:

- You can expand and collapse sections, and sort within levels.

- Additional metrics are shown, such as "Estimated Data Size", as well as "Actual Rows" and "Actual Data Size" for actual plans, side-by-side with the estimates. There are many other plan metrics available by right-clicking any column header and selecting "Column Chooser".
- Significant differences between estimates and actuals are highlighted.
- Possibly problematic operations like scans and bookmark (key / rid) lookups are highlighted.

3.4.3 Top Operations

TOP OPERATIONS

- A simple list of all plan operations, by default ordered by highest estimated cost first.
- Sort by any of the other columns, as well as group by operation type, object, and other criteria.
- Same highlighting as the Plan Tree for potentially problematic operations, and again the "Column Chooser" allows you to add attributes that are not shown by default.

3.4.4 Query Columns

QUERY COLUMNS

- Shows a list of all columns accessed by the query, for whatever reason (sarg, join, output list, sort), along with the table, operation, and index used.
- Columns for related operations are grouped together (indicated by a thick separator bar), with the indexes used and bookmark (key / rid) lookup columns highlighted in orange. This makes it easy to see how indexes can be modified to eliminate lookups.

3.4.5 Join Diagram

JOIN DIAGRAM

- If there are joins present in the query, this tab will be present, showing a visual representation of the joins involved. Similar to the database diagram or Query Designer features within Management Studio - but only showing the columns that actively participate in joins.
- Unlike the join information included in the plan in SSMS, Plan Explorer looks past any views and shows the base tables and base columns, making it quicker to analyze queries that involve, for example, nested views.

3.4.6 Parameters

PARAMETERS

- Shows compiled and runtime parameters referenced in the plan, if any exist (otherwise the tab is not visible).
- For an estimated plan, it will only show the compiled parameter value; for an actual plan, you can compare compiled values with runtime, which can in turn help point out potential parameter sniffing issues.

3.4.7 Expressions

EXPRESSIONS

- If there are any expressions in the plan, Plan Explorer shows a tab to list these (previously expressions were listed only in tooltips).
- You can see the operator type, the shorthand expression name and the expanded version of the expression, as well as any other expressions that reference it or are referenced by it, allowing you to quickly see if you are

4 Using Plan Explorer

4.1 Viewing Query Plans

VIEWING QUERY PLANS

There are multiple ways to view a query plan in Plan Explorer:

- Using the Management Studio **Add-In** (<http://www.sqlsentry.com/plan-explorer/sql-server-query-view.asp#addin>) (a separate install), right-click a plan in SSMS and choose, “View with SQL Sentry Plan Explorer.” This will open the plan(s) in Plan Explorer, providing the correct server/database context for further operations.
- In SSMS, right-click a graphical plan and select “Show Execution Plan XML”, then copy and paste the plan XML into Plan Explorer. It doesn’t matter which pane is active, the clipboard handler is global and will auto-detect plan XML. This makes it quick and easy to move plans from SSMS into Plan Explorer if you’re not using the SSMS add-in.
- Save an execution plan from SSMS to a .sqlplan file, then open the file using the Open toolbar button or File->Open. Raw plan XML files and .QueryAnalysis files are also supported.
- Right-click an existing .sqlplan file and select “Open with -> SQL Sentry Plan Explorer”.
- Drag-and-drop a plan file onto the application.
- Retrieve the estimated or actual plan from T-SQL in the Command Text pane using the “Estimated Plan” or “Actual Plan” button on the toolbar. The connection dialog box will open to connect to a valid SQL Server instance (unless Plan Explorer was launched using the add-in, in which case the connection information will be pre-populated).

4.1.1 RETRIEVING THE ESTIMATED PLAN

Copy and paste, or type raw TSQL into the Text Data pane, then hit F5 or click the “Retrieve Estimated Plan” toolbar button to connect to a server and get the estimated plan.

4.1.2 PLAN DIAGRAM CONTEXT MENUS

Once you have a plan loaded, **right-click anywhere in the diagram area** to access context menus, which control how the graphical plan is displayed. By default, color-scaling and per node costs are enabled.

4.1.3 ACTUAL PLANS

If an **actual plan** is loaded, actual metrics are shown by default. You can quickly toggle the plan diagram back and forth between estimated and actual metrics using the “Show Estimated Plan” toolbar button. This button is only enabled when an actual plan is loaded.

4.2 Generating an Actual Plan

GENERATING AN ACTUAL PLAN

Generating the actual execution plan by executing the query against the server allows you to collect actual runtime metrics, such as duration, CPU and reads, which you cannot get from an estimated or actual plan on its own.

NOTE: You can enable or disable the warning message you get when generating an actual plan using the option “Warn on Actual Plan Execution” in the Help menu.

5 Appendix

5.1 Query Analysis Files

QUERY ANALYSIS FILES

All information shown in the Plan Explorer can be saved to the .QueryAnalysis file format by clicking the Save toolbar button. This proprietary, portable format contains the plan XML along with additional information, including actual statements and actual metrics captured via SQL Sentry's Top SQL trace. This means that DBAs can easily save all estimated and actual data for a query to file for later analysis, or share it with other team members. For example, a DBA using the full version of SQL Sentry can send a .QueryAnalysis file to a developer for tuning, and all the developer needs is the Plan Explorer utility, versus the entire SQL Sentry Console application.

5.2 Exception Reporter

EXCEPTION REPORTER

If you are working in the Plan Explorer and see a small form pop-up unexpectedly, it means we've captured an unhandled exception. If you would, please enter your name and email address along with brief steps to reproduce into the textbox, then submit it – it comes to us via secure web service. If the exception seems to pertain to a particular plan, please also save it to a .QueryAnalysis file and email to support@sqlsentry.net.

5.3 Checking for Updates

CHECKING FOR UPDATES

Plan Explorer can check our servers to ensure you are using the most recent version, and offer to update your software if there is a newer version available. You can do this manually by using Help > Check for Updates, and by default it will also check each time you launch the application. You can disable this automatic check through an option in the Help menu.

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