

Welcome

Predicting Change Outcomes

Leveraging SQL Server Profiler

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SQL Rx

Today's Agenda

- Observations
- Tools for performance tuning SQL Server
- SQL Server Profiler
- SQL Trace Replay
- SQL Trace Replay methodology
- Demo
- Conclusion

Observations from the field

- We're always in a reactive mode
- "If it works pretty well, then push it!"
- Leave performance tuning out of development phase, for a number of reasons
- Requirements definitions are incomplete
- Production/development environments are becoming vastly different
- Substantive testing a thing of the past

Change, and the challenges that we face

- 24-month Microsoft release schedules
- Service Packs
- Hot Fixes
- Maintenance (Corrective, Adaptive, Perfective)
- Upgrades in hardware
- Shrinking development windows
- Shrinking service windows
- Increasingly demanding customers

Tools for performance tuning SQL Server

Dynamic Management Views and Functions, custom scripts

- Flexible
- Much more information now available

Performance Monitor

- Still the top tool for looking at server performance
- Real time or extended logging

Tools for performance tuning SQL Server

Database Tuning Advisor

- New tool for performance tuning
- Initial offering good, will (needs to) get better...

SQL Server Profiler

- Rollover traces, Correlated perfmon counters
- Analysis Services and Integration Services
- Microsoft.SqlServer.Management.Trace and Trace Replay APIs

**These tools are great...but we tend
to use them after the fact**

We need a way to **predict** what our changes will look like before we put them into production.

SQL Server Profiler

An interesting way to leverage an existing tool

SQL Server Profiler

“Microsoft SQL Server Profiler is a graphical user interface to SQL Trace for monitoring an instance of the SQL Server Database Engine or Analysis Services.”

Books Online

Types of traces

- Ad-hoc traces
- Server-side traces
- Pre-defined template traces

SQL Trace Templates

- Ship with SQL Server
- Great starting point for all traces
- Create custom templates

Specifically, SQL Trace Replay

Trace Replay - Allows you to save a trace and then replay it for a much deeper analysis of results.

Why use SQL Trace Replay?

- A method to predict behaviors before rolling them into production
- To compare the same set of work between one database server and another
- Make changes to the database, and then analyze the outcome of those changes
- Easier to use than most load-testing tools, and it comes free with SQL Server.
- Useful for reads, writes, and CPU

Topic has been touched upon, but...

Hotek, M. (2007). Lesson 1: Working with SQL Server Profiler. In Solid Quality Learning, *Microsoft SQL Server 2005 Implementation and Maintenance* (pp. 543-545). Redmond, WA: Microsoft Press

Tells us that SQL trace exists and is used for problem solving, but doesn't explain it or show how to use.

Delaney, K. (2008). Tracing and profiling. In Delaney, K, *Inside Microsoft SQL Server 2005 Query Tuning and Optimization* (pp. 64-69). Redmond, WA: Microsoft Press

Explains, but leaves out methodology and steps.

Ben-Gan, I. (2000). Problem Solving with SQL Profiler. Retrieved 3/16/08 from <http://www.sqlmag.com/Articles/ArticleID/8232/pg/1/1.html>

About as close as I've seen, but not quite.

SQL Trace Templates

Trace Properties

General | Events Selection

Trace name:

Trace provider name:

Trace provider type: version:

Use the template:

Save to file:

Set maximum file size (MB):

Enable file rollover

Server processes trace data

Save to table:

Set maximum rows (in thousands):

Enable trace stop time:

SQL Trace Replay - Events

Trace Properties

General | Events Selection

Review selected events and event columns to trace. To see a complete list, select the "Show all events" and "Show all columns" options.

| Events | Event... | TextD... | Applic... | Login... | Datab... | Client... | HostN... | Serve... | Binary... | SPID | StartTi... |
|--|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-----------|-------------------------------------|-------------------------------------|
| + Cursors | | | | | | | | | | | |
| + Security Audit | | | | | | | | | | | |
| + Sessions | | | | | | | | | | | |
| - Stored Procedures | | | | | | | | | | | |
| <input checked="" type="checkbox"/> RPC Output Parameter | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> RPC:Starting | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| - TSQL | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Exec Prepared SQL | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> Prepare SQL | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> SQL:BatchStarting | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

Sessions
Includes server session event classes.

Show all events
 Show all columns

No data column selected.

Column Filters...
Organize Columns...

Run Cancel Help

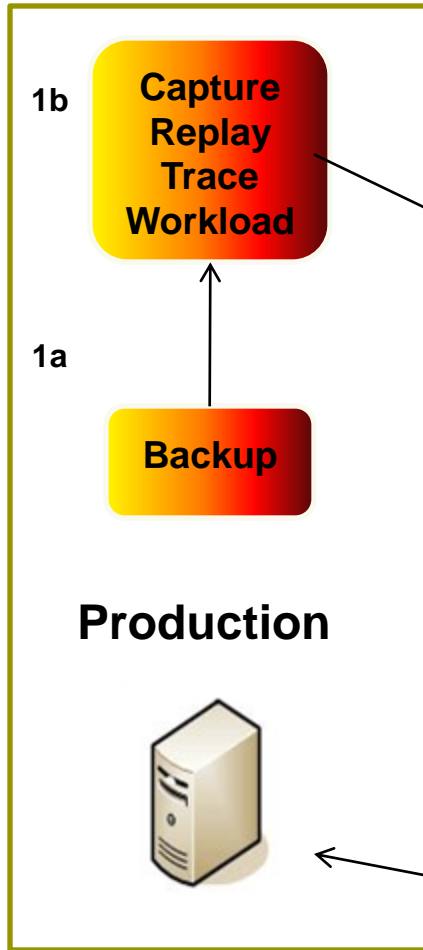
Requirements for Trace Replay

- Identify trace expectations
- Access to two SQL Server instances
- Database backup
- Trace from Production (**Workload**)
- Production Logins
- Test box with changes to implement (service pack, hot fix, patch, DDL, others...)

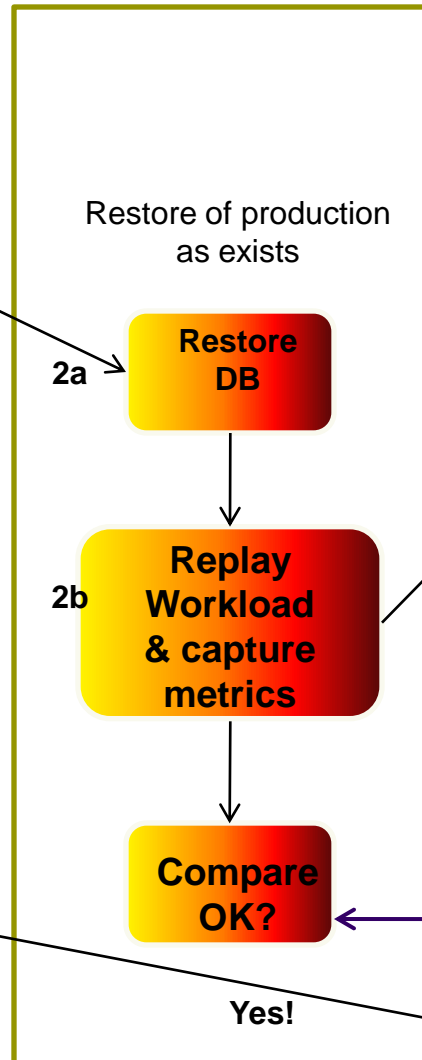
Trace Replay Methodology

“Evaluation Environment”

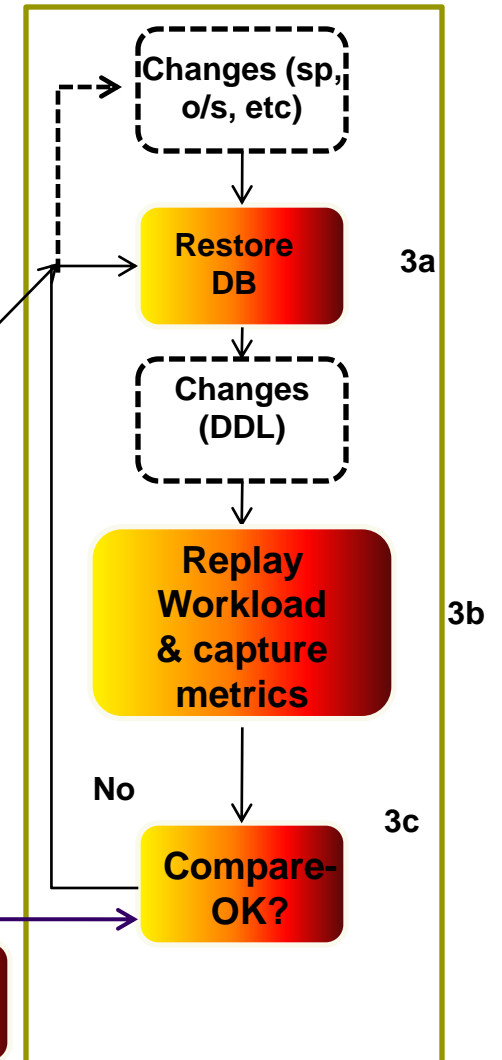
1. “Production Environment”



2. “Test1”



3. “Test2” (proposed)



Demo 1

Sample client results

| | A | B | C |
|----|--------------------------------|--------------------|--------------------|
| 1 | Stored Procedure | SQL2000 sp3 | SQL2000 sp4 |
| 2 | outbound_view | 136,603 | 146,644 |
| 3 | ttm_sm_sp_add_shipment | 4,530 | 1,205,945 |
| 4 | in_view | 9,067 | 9,051 |
| 5 | ttm_import_order_dttma | 5,272 | 5,270 |
| 6 | ttm_wd_shipmentinquireoverview | 152,098 | 746,380 |
| 7 | ttm_sp_import | 3,976 | 2,819 |
| 8 | ttm_sm_sp_add_shipment_init | 108,960 | 415,448 |
| 9 | updtme_move_light | 8,228 | 9,856 |
| 10 | ttm_map_order | 22,191 | 29,590 |
| 11 | ttm_map_stop | 9,568 | 10,464 |
| 12 | ttm_sp_set_orderheader_dttms | 11,558 | 12,391 |
| 13 | it_ordersave | 13,555 | 15,612 |

Demo 2

Comparison with Database-Level Settings

| Name | Size | Type | Date Modified | Attributes |
|---|------------|-------------------------|--------------------|------------|
| Orig Files | | File Folder | 3/17/2008 11:39 AM | |
| Workload2.trc | 180,474 KB | SQL Server Profiler ... | 3/12/2008 4:37 PM | A |
| BaseLineTrace.trc | 116,784 KB | SQL Server Profiler ... | 3/13/2008 6:18 AM | A |
| 90ModeTrace.trc | 116,731 KB | SQL Server Profiler ... | 3/13/2008 9:10 AM | A |
| 90ModeChecksumTrace.trc | 116,732 KB | SQL Server Profiler ... | 3/13/2008 10:28 AM | A |
| 90ModeChecksumBulkLoggedTrace.trc | 116,729 KB | SQL Server Profiler ... | 3/13/2008 7:29 PM | A |
| 90ModeChecksumTraceFullSnapshotIsoLevel.trc | 116,730 KB | SQL Server Profiler ... | 3/14/2008 9:09 AM | A |

```

SELECT SUM(reads), SUM(writes), SUM(cpu)
FROM fn_trace_gettable
      ('C:\SQLRx\Replay\BaseLineTrace.trc', DEFAULT)
GO

```

Trace Replay - Trace Run Comparison

| | Reads | Writes | CPU | | Reads % | Writes % | CPU% |
|---|---------|--------|--------|--|---------|----------|---------|
| All Statements | | | | | | | |
| BaseLineTrace (80) | 1909373 | 684 | 93233 | | | | |
| 90ModeTrace | 1839587 | 570 | 102548 | | -3.65% | -16.67% | 9.99% |
| 90ModeChecksumTrace | 1839664 | 572 | 94222 | | -3.65% | -16.37% | 1.06% |
| 90ModeChecksumBulkLoggedTrace | 1839542 | 664 | 90371 | | -3.66% | -2.92% | -3.07% |
| 90ModeChecksumTraceFullSnapshotIsoLevel | 1839788 | 622 | 100006 | | -3.64% | -9.06% | 7.26% |
| UPDATE | | | | | | | |
| BaseLineTrace (80) | 13055 | 11 | 1267 | | | | |
| 90ModeTrace | 2082 | 12 | 125 | | -84.05% | 9.09% | -90.13% |
| 90ModeChecksumTrace | 2080 | 11 | 171 | | -84.07% | 0.00% | -86.50% |
| 90ModeChecksumBulkLoggedTrace | 2080 | 11 | 233 | | -84.07% | 0.00% | -81.61% |
| 90ModeChecksumTraceFullSnapshotIsoLevel | 2108 | 45 | 187 | | -83.85% | 309.09% | -85.24% |
| INSERT | | | | | | | |
| BaseLineTrace (80) | 1067 | 51 | 125 | | | | |
| 90ModeTrace | 1094 | 55 | 95 | | 2.53% | 7.84% | -24.00% |
| 90ModeChecksumTrace | 1094 | 49 | 62 | | 2.53% | -3.92% | -50.40% |
| 90ModeChecksumBulkLoggedTrace | 1091 | 51 | 95 | | 2.25% | 0.00% | -24.00% |
| 90ModeChecksumTraceFullSnapshotIsoLevel | 1106 | 63 | 79 | | 3.66% | 23.53% | -36.80% |
| DELETE | | | | | | | |
| BaseLineTrace (80) | 77417 | 11 | 1735 | | | | |
| 90ModeTrace | 66558 | 9 | 2064 | | -14.03% | -18.18% | 18.96% |
| 90ModeChecksumTrace | 66568 | 10 | 1877 | | -14.01% | -9.09% | 8.18% |
| 90ModeChecksumBulkLoggedTrace | 66559 | 13 | 1970 | | -14.03% | 18.18% | 13.54% |
| 90ModeChecksumTraceFullSnapshotIsoLevel | 66563 | 10 | 1953 | | -14.02% | -9.09% | 12.56% |

When to use Trace Replay?

- Moving to a new version of SQL Server
- Before applying a new service pack to production
- Upgrading to new hardware
- Moving to a new operating system
- “Bulk” changes, or increases in amount of data
- Index tuning
- Testing changes and examining their interaction with existing code and processes
- Baselines

When not to use Trace Replay?

- The workload must be able to run with relatively few errors
- Many schema changes can break the workload
- Linked Servers make it interesting
- Multiple databases are tough
- Whenever something is in a trace file which cannot be duplicated in another environment
- When a large process cannot be separated into a logical subcomponent.

Conducting a Trace Replay - Notes

- Must start trace immediately after backup
- Database id's must be the same
- Logins must be transferred to dev/test server
- Expect a high utilization rate – dedicate a time slot for trace replay on test server
- Duration counter will produce inconsistent values – recommend not using
- Possibility of multiple iterations
- Experiment with threads and specific spids

Conclusion

- We have challenges, and they must be managed
- SQL Profiler – a powerful tool for predictive tuning
- Specifically, SQL Server Trace Replay
- Steps necessary for successful Trace Replay
- Methodology
- Demos
- Why/when to use SQL Trace Replay?
- Conducting a replay - Notes

Additional Resources

- Contacts:
 - Lee Everest
 - leverest@isi85.com
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 - Blog: www.texastoo.com
 - Lori Brown
 - lorib@isi85.com
- Delaney - *"Inside Microsoft...Query Tuning"*
- SQL Server Magazine

Q & A