A bit of background

Joe Webb

- Started in IT in 1993 after receiving a BSEE & MBA from Auburn University
- Founded WebbTech Solutions in 1996
  - Providing consulting, mentoring, & technical training
- Began working with SQL Server in 1996 with version 6.0
- 5-time recipient of the Microsoft MVP Award for SQL Server
- Author of 3 books
- Served 6 years on the Board of Directors for PASS (sqlpass.org)
- Spoken at over 20 conferences in North America & Europe
Agenda

Bottlenecks

• What are they?
• Where are they?
• What causes them?
• What are some common ones?

Identifying bottlenecks

• Performance Monitor
• SQL Profiler
• Server Side Traces
• Dashboard Reports
What are bottlenecks?

- Bot-tle-neck: (bot’ I nek”) (n.) A place or stage in a process at which progress is impeded. ¹
- Bot-tle-neck: (bot’ I nek”) (n.) The delay in transmission of data through the circuits of a computer's microprocessor or over a TCP/IP network. ²
- Bot-tle-neck: (bot’ I nek”) (n.) Anything that is preventing our users from receiving information faster. ³

¹ Dictionary.com
² Webopedia.internet.com
³ Joe’s working definition for this session
Where is the bottleneck?
Where’s the bottleneck?

Client applications

Network Transport and Hardware

Services

Microsoft SQL Server

Microsoft Windows Server

Disk Subsystems
Four Pillars of Performance

- CPU Utilization
- Disk I/O
- Network I/O
- Memory Resources
Causes of bottlenecks

- Inefficient code
- Improper indexing strategy
- Dual use of database
- Poor application design
- Poor database design
- Absence of maintenance plans
- Improper resource distribution
- Using defaults
- Insufficient hardware resources
Tools of the Trade

- Performance Monitor
- SQL Profiler
- Performance Dash Board
- Server Side Traces
• Provides graphical representation for SQL Server and Windows System performance
• Reveals information for Objects, Counters, and Instances
Performance Monitor

- Can select:
  - Computer
  - Performance Object
  - Object Counters
  - Counter Instances
Performance Monitor: Hardware Objects

Memory: Pages / sec
- Rate at which pages are read from or written to disk to resolve hard page faults. Relative values.

Processor: % Processor Time
- The percentage of time that the processor spends to executing threads. Should be < 85% on average.

Physical Disk: Avg Disk Queue Length
- Number of system requests awaiting disk access. A value of more than 2 times the number spindle could indicate disk I/O pressure.
Performance Monitor: O/S Objects

Paging File: % Usage

• Percentage of the operating system page file currently consumed. Should be < 75%.

Processor: % Privileged Time

• Percentage of time the processor is O/S related activities, ie disk I/O. Should be < 33%.
Performance Monitor: SQL Server Objects

SQL Server: SQL Statistics

- SQL Compilations/sec – Compilations required per second. Should be < 100, but can vary according to the usage.
- SQL Re-Compilations/sec – Re- compilations required per second. Should < 10% of compilations.

SQL Server: Buffer Manager

- Buffer Cache Hit Ratio – Percentage of pages located in memory when needed. A well performing system will have a ratio of > 95%.
- Page Life Expectancy – Measure of how long a data page will remain in memory. < 300 seconds is bothersome.
- Lock Requests / sec – Rate of new locks and lock conversions.
- Avg Wait Time – How long a user must wait before a resource like a table may be locked. Should be less than 500 milliseconds.
- Lock Timeouts / sec – Tracks the number of lock requests per second that timed out.
- Number of Deadlocks / second – Measures the number of times per second that a user is selected as the victim of a deadlock. Acceptable values vary, some say < 10.
Performance Monitor: SQL Server Objects

SQL Server: Access Methods

- Full Scans / sec – Measures the number of scans of indexes or tables.
- Page Splits / sec – Rate at which index pages are overflowing.

SQL Server: Databases

- Transactions / sec – Measure of a database’s write activities.

SQL Server: General Statistics

- User Connections – Helps to provide a framework to understand the other counters.
Saving Performance Monitor Counter Logs

- Can view the information in real-time using System Monitor, or
- Save the configuration and create a Counter Log record the data.
• Graphical utility for monitoring SQL Server activities
• Exposes information for Event Classes and Data Columns for immediate viewing or saving
SQL Profiler Uses

- Watch SQL Server activity as it occurs.
- Record events for subsequent analysis.
- Replay traces to simulate workload during stress testing.
- Audit connection activities.
- Overlay Performance Monitor Counter Logs to provide an integrate view of performance.
Creating a New Trace

Select a Trace Template

Opt to save to file or table, depending on needs

Review included Events and Data Columns

Apply Filters to Data Columns to limit extraneous data
## Selecting a Trace Template

<table>
<thead>
<tr>
<th>Template</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_Counts</td>
<td>Captures stored procedure execution behavior over time.</td>
</tr>
<tr>
<td>Standard</td>
<td>Use to monitor general database server activity.</td>
</tr>
<tr>
<td>TSQL</td>
<td>Captures all Transact-SQL statements that are submitted to SQL Server by clients and the time issued. Use to debug client applications.</td>
</tr>
<tr>
<td>TSQL_Duration</td>
<td>Captures all Transact-SQL statements submitted to SQL Server by clients, their execution time (in milliseconds), and groups them by duration. Use to identify slow queries.</td>
</tr>
<tr>
<td>TSQL_Grouped</td>
<td>Captures all Transact-SQL statements submitted to SQL Server and the time they were issued. Groups information by user or client that submitted the statement. Use to investigate queries from a particular client or user.</td>
</tr>
</tbody>
</table>
## Selecting a Trace Template

<table>
<thead>
<tr>
<th>Template</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSQL_SPs</td>
<td>Captures detailed information about all executing stored procedures. Use to analyze the component steps of stored procedures. Add the SP:Recompile event if you suspect that procedures are being recompiled.</td>
</tr>
<tr>
<td>Tuning</td>
<td>Captures information about stored procedures and Transact-SQL batch execution. Use to produce trace output that Database Engine Tuning Advisor can use as a workload to tune databases.</td>
</tr>
<tr>
<td>TSQL_Replay</td>
<td>Captures detailed information about Transact-SQL statements that is required if the trace will be replayed. Use to perform iterative tuning, such as benchmark testing.</td>
</tr>
</tbody>
</table>
SQL Profiler: Trace Events

Error and Warning

- **Missing Column Statistics** – Reveals that statistics that would have helped the optimizer were missing.

Cursors

- **CursorPrepare** – Indicates that a cursor has been prepared for a SQL statement.

TSQL

- **SQL: StatementCompleted** – Indicates that a SQL statement has been completed.
Stored Procedures

- **SP: Recompile** – Indicates that a procedure was recompiled during execution.
- **SP: Completed** – Records that a procedure was executed.
- **SP: StmtCompleted** – Denotes when a statement within a procedure has completed.
Selecting Events and Data Columns

Data Columns
- Object Name
- ApplicationName
- SPID
- CPU
- Reads
- Writes
- TextData
- Duration
- StartTime
- EndTime

Filters
- DatabaseID
- ApplicationName
- Duration
Creating Server Side Traces

- Use SQL Profiler to create the trace and then export it to a T-SQL script
- Use the trace procedures to execute and stop the trace
  - `sp_trace_setstatus @TraceID, 1`
  - `sp_trace_setstatus @TraceID, 0`
- Can schedule to run at various times through the day for benchmarking
Using Performance Dashboard Reports

• Download Dashboard reports from
  http://www.microsoft.com/downloads/details.aspx?familyid=1d3a4a0d-7e0c-4730-8204-e419218c1efc&displaylang=en

• Provides
  – Recent CPU Utilization
  – Current Activity
  – Expensive Queries
    • By CPU
    • Logical Reads/Writes
    • Physical Reads/Writes
    • Duration
Additional Resources

- http://www.simple-talk.com
- http://www.sqlservercentral.com
- http://www.sqlteam.com
- http://www.sqlblog.com
- http://weblogs.sqlteam.com
- Inside SQL Server 2005 series of books
Questions?

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Thank you!