Tuning SQL without the Tuning Pack

John Larkin
JP Morgan Chase
Who am I

- Originally a mainframe COBOL programmer
- DBA for the last 23 years, the last 15 with Oracle.
  - UNIX (Solaris, Aix, Windows, Linux)
- Recently completed a year-long project to split a mid-size datamart into an ETL/staging database and a separate Published database.
- Employed by chemical manufacturers, publishers, retailers as both employee and independent contractor.
- 10g OCA
- Contact – john.x1.larkin@chase.com / john.larkin1@comcast.net
Overview

- SQL does not always perform consistently
  - Performs well in QA
  - sub-optimally in production
- How do we fix it?
  - Money – memory and CPU’s
  - Enterprise Manager Tuning Pack
    » more money - maybe
Scope

– What we will cover
  » Basic concepts and tools.
  » SQL*Plus
  » SQL execution plans
  » Some statistics
  » Hints

– What we will not cover
  » No Enterprise Manager in this presentation.
  » “SET EVENTS 10046”
Execution Plans

- SQL statements are parsed
- correct syntax
- semantic correctness
  » table and column names
  » verify permissions
- Shared_Pool check
  » hard parse - result is a set of query blocks
  » soft parse
    - skips row source generation
    - execution
Execution Plans

- The optimizer, or CBO.
  - `query_rewrite` - query transformer make simpler equivalent forms.
  - Generates potential plans
    » access paths and hints.
  - Estimator calculates cost for each
    » dictionary statistics or estimate.
    » Cost - proportional to resource consumption.
      - CPU consumption
      - disk throughput
      - generates measures for Selectivity and Cardinality.
        percent of rows returned from the row set
        - query predicate
Execution Plans

- Cardinality - number of rows to be processed (estimated) by an operation.
- init.ora parameters
- optimizer_index_cost_adj,
- db_file_multiblock_read_count
- sort_area_size
Execution Plans

– Plan Generator
  » compares costs (relative)
  » chooses the lowest-cost plan.

– Row Source Generator
  » Receives optimal execution plan
  » produces an iterative binary program
    ■ the query plan, with a series of steps
    ■ each step returns a row set
      – used by the next step
      – the last step returns the row set to the application.
  » Row SOURCE - a Row SET returned from a step in the execution plan along with a control structure that can iteratively process the rows.
Execution Plans

» produces a row source tree
  - collection of row sources
    - shows an ordering of tables
    - access method for each table
    - join method for tables when needed
    - data operations – filter / sort / aggregation.

– SQL Execution - the only mandatory step for DML.

» SQL engine executes each row source

» execution plan - read right to left, bottom to top.
  - Start with the right-most entry in the “table” that is the farthest down.
  - Data retrieval starts here.
Getting the PLAN

- Explain Plan syntax or Autotrace in sqlplus.
  - Not perfect

- EXPLAIN plan for <sql statement> set statement_id = 'myplan'
  - does not execute the query
  - Parses
  - submits it for optimization
  - row source generation.
  - stored in sys.plan_table.
  - query plan_table for the execution plan.
Getting the PLAN

- Select * from TABLE(DBMS_XPLAN.Display).
  - named plan
  - child cursors – DBMS_XPLAN.Display_Cursor.
  - for the last statement run in the current session.
  - pull the information for any plan that is still loaded by providing the SQL_ID and optionally the child number.

- Not always the plan you will execute
  - No direct access to the user account
  - separation of duties
  - Execution environment may not look like the job owner
  - data / metadata differences.
  - sort_area_size
  - time of day - batch loads then gather statistics.
  - NLS_DATE_FORMAT could affect index selection.
Getting the PLAN

- set AUTOTRACE TraceOnly
  - execution plan without execution
  - Other options
  - two main choices
    » Don’t execute the sql –
      - like a standard EXPLAIN PLAN
    » run the statement to completion
      - more details about the SQL statement
        - difficult if long running. Isn’t that why we’re here?
        - discuss workarounds later
  - good for getting an execution plan at the start
Getting the PLAN

– subtle difference

– TRACEONLY option
  » Poor wording
    - Assume you only get a trace as output
    - Might assume that it will return quickly
    - Must run to completion - “ONLY” refers to what you will receive from the query.
    - “ONLY” get the trace and plan returned to the screen.
    - the data is what you will not see.
    - No scrolling

– What about what is already running?
  » later
STATISTICALY Speaking:

- Can estimate “Statistics” when costing
- Best to provide accurate statistics 10g
- 10g STATISTICS_LEVEL = TYPICAL default - “GATHER_STATS_JOB”
- Problematic if mid-stream
  - Can leave you with tables that are “empty”
  - Datamart or data warehouse, turned off.
  - Do not mix ANALYZE and the new stats
  - `dbms_stats.gather_table_Stats('SCOTT', 'EMP', estimate_percent => 15);`
STATISTICALLY Speaking:

- Can gather system stats
  - positive or negative - be careful.

- SET EVENTS 10046 - out of scope
  - Provides very good wait based information
  - Trace file in the databases udump directory.
What’s the PLAN?

- AUTOTRACE and Explain Plans
- Execution plan plus statistics and data
  - the first thing that you see.
  - AUTOTRACE is based on the SQL running to completion to obtain a plan and statistics.

- @TRACE_vs_Explain.txt (18)
What’s the PLAN?

- Reading from bottom-right to top-left.
  - Index fast full scan using the PK_Databases index.
  - expect one or two columns in the select list
    » Index Organized Table
      - all of the data is available
      - Sorting adds additional step.

- @Lg_running.txt
What’s the PLAN?

- Grab SQL from v$sql_plan
  - list of active sessions
  - Find session of interest. (username, login time, osuser, event, program - sqlplus / SqlNav, Toad).
  - Get SID and use sys.V_$PX_Session to find the SID for the Query Coordinator.
  - Use this to obtain the SQL and the current execution plan.

- Several more steps - remote objects(db link)
  - significant cost
What’s the PLAN?

– From the 2 row sources
  » data is Hash Join’ed
  » sent parallelly into a buffer sort
  » finishing the “Select” part of the CTAS

– Data loaded into the new table in parallel.

– Missing - list of temporary segments
  » monitor progress of a load.
What’s the Problem?

- Identifying bad plans
  - key indicators that almost always mean trouble
  - Look for the “guaranteed” problems
    » Start with database links
      - need fully qualified object names
      - hidden links in synonyms – ask the developers
  - Run an explain plan
    » if it’s running, compare them
      - Any discrepancies? Track them down.
        - logon triggers, different database, bind peeking.
What’s the Problem?

- Move on to problem determination.
- Looking for database links and nested loops
  - Top 2 trouble makers for me
  - Remote table access problematic for the optimizer
    » appears to treat them as a black box,
    - displays the information in a manner that suggests that.
    - may have problems accessing statistics across the database link or in mating that information with the statistics from the local objects.
  - Nested Loops
    » Tom Kyte despises looping – “Use a SQL statement”
    » The more data you try to push the worse they perform
      - convert Nested Loops to Hashing.
- Sample - 27 hours before it died with a snapshot too old
- @EXPLAIN_Bad_SQL.log
What’s the Problem?

- Nested Loop
  - try to get rid of that by first
  - Use DRIVING_SITE hint.
    » treat the instance where the specified table resides as if it was the site from which the query was submitted.
    » runs the query from that location.
    » pick the row source with the largest amount of returned rows as the driving site.
    » reduce the amount of data pushed through the network
    » ran for more than 24 hours now runs in less than 4.

@Run_Corrected_SQL.log
What’s the Problem?

- database link is hidden within a synonym
  - decompose the synonym into its base format
  - force the driving_site hint
  - often used with views that will not behave
  - Recent results by a colleague
  - Watch the query execute
    » V$session_LONGOPS
      - estimated time to completion
      - early indicator of whether your tuning works
      - Shorter turnaround
      - watch query execute on both sides of the database link.
What’s the Problem?

- use v$sort_usage
  - Sorting - get an idea of where the query is in the overall process.
- parallelize a query
  - optimizer chooses to not parallelize occasionally
  - quicker response, but don’t over do it.
Conclusion

- The Optimizer
  - Very good but does not always get it right.
  - It may need our help
  - Several tools to determine an optimal plan.
  - Hints can help it choose the better plan
  - We can improve performance if we know what to look for.
ERROR Messages

- SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);
- SQL> select max(timestamp) from plan_table;
  02-FEB-10
- SQL> select count(*) from plan_table;
  120
- SQL> delete from plan_table;
Acknowledgements

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References

Oracle

- 11g administrators guide
- 10g Performance and Tuning Guide
More Fun

- Profiles / Outlines
Miscellaneous Ramblings

- Profiles / Outlines
THANK YOU!

Contact information
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