



What are we going to do

- Identify the bad query
- Verify the query is bad
- Determine What's wrong
- Solve the query problem



Identify the « bad » query

- Customer reports a query is taking too long
 - Sometimes appears hung
- OS stats (TOP) > Session data shows top query
- AWR, AWR diff, ASH Report
 - Top Timed Events related to CPU and I/O
 - SQL is responsible for most DB time
- TKProf show certain SQL taking too much time
- ADDM found SQL as a main problem
- SQL Tuning Advisor wasn't able to fix a query
- SQL Perf Analyzer shows a query regressed



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Verify the « bad » query

- Use a test script to play with the query
- Use the bind info in the 10046 level 4 or 12

```
var b0 char(8)
exec :b0 := 'test'
```
- Run Query



Verify the « bad » query

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```
var b0 char(8)  
exec :b0 := 'test'
```

- Run Query
- Check trace file



Determine What's Wrong

- Sanity Checks ...
 - Use CBO ?
 - Statistics gathered properly
 - Proper/optimal optimizer mode (all_rows / first_rows_k) ?
 - Appropriate init.ora parameters ?
 - Appropriate / valid hints ?
- Do we know what the desired / good plan is
 - YES : we can analyze what has changed and triage / research
 - NO : we need to either find the cause or find a good plan



Determine What's Wrong

- 2 Approches
 - Triage
 - Query Analysis
- Triage Approach
 - Find a good plan
 - Fix it (quick)
- Query Analysis Approach
 - Find out why it is a bad plan
 - Address the cause
 - Fix the query and many other queries like it



Determine What's Wrong

Triage Approach

- Objectives
 - Quick solution to a problem
 - Not a thorough analysis
 - Some customers want this, others a thorough analysis
 - Inferior to the Query Analysis Approach
- Approach Overview
 - Find a good plan (leverage the CBO to get it)
 - Make a bad plan look like the good one



Determine What's Wrong

Triage Approach

- Finding a good plan
 - Use SQL tuning Advisor (if you can)
 - Get a good testcase
 - Leverage the CBO by tweaking settings to change the plan (SESSION only)
 - FIRST_ROWS_N, ALL_ROWS
 - OPTIMIZER_FEATURES_ENABLE
 - OPTIMIZER_INDEX_COST_ADJ
 - OPTIMIZER_INDEX_CACHING
 - Try dynamic sampling at high levels



Determine What's Wrong

Triage Approach

- Make a Bad Plan look like the Good One
 - Hints (compare hint outlines for clues)

/*+

```
BEGIN_OUTLINE_DATE
IGNORE_OPTIM_EMBEDDED_HINTS('10.2.0.4')
OPTIMIZER_FEATURES_ENABLE('10.2.0.4')
OPT_PARAM('_unnest_subquery' 'false')
OPT_PARAM('_optim_peek_user_binds' 'false')
ALL_ROWS
OUTLINE_LEAF(@"SEL$2")
OUTLINE_LEAF(@"SEL$1")
OUTLINE(@"SEL$2")
OUTLINE(@"SEL$1")
INDEX_RS_ASC(@"SEL$1" "A"@"SEL$1" ("ORD_DATES"."ORDER_ID" "ORD_DATES"."JOBSTEP_SEQ_NO"))
INDEX_RS_ASC(@"SEL$2" "B"@"SEL$2" ("ORD_DATES"."JOB_CD" "ORD_DATES"."COMPLETED_DT"))
END_OUTLINE_DATA
```

*/



Determine What's Wrong

Triage Approach

- Make a Bad Plan look like the Good One
 - Stored Outlines
 - 11g: SQL Plan Management
 - 11g: Use Private statistics



Determine What's Wrong

Query Analysis Approach

Objectives:

- Address the root cause of the problem
- Solve many queries affected
- Obtain a bug fix
- Sacrifice of time will be made to figure this out
- Reconcile:
 - Realistic time to perform min work required to do the job
 - User's performance expectation for given query
 - Amount of work estimated by the CBO
 - Actual execution performance of given query



Determine What's Wrong

Query Analysis Approach

- Approach Overview:
 - Understand the query and related data (foundation)
 - Estimate the minimum work (thus time) required to perform the query
 - Compare to:
 - a) user's expectations
 - b) CBO estimate
 - c) actual performance
 - Identify the gaps between CBO's plan and more optimal plan and work to reduce them



Determine What's Wrong

Query Analysis Approach

- What do we need to know for **diagnosis**?
 - Understand user concern and business requirements
 - How to gather diagnostic information
 - Understand problematic Query
 - Understand data shape and relationships
 - Understand explain plan
 - Understand CBO key concepts
 - Understand and validate atomic CBO computations
 - Understand why the current execution plan was chosen by CBO
 - How to determine if CBO behavior is normal or bogus



Determine What's Wrong

Query Analysis Approach

- What do we need to know for **proposing solutions**?
 - How to identify alternative execution plans promising better performance
 - How to induce and measure performance of alternative plans
 - How to implement a better performing plan
 - Effort and Risk
- What Kinds of Solutions Are Used?
 - Similar to Triage Approach
 - Change Application (Use PL/SQL instead of SQL, etc)
 - SQL (e.g., use MINUS, remove function call in predicate...)
 - Structural: Use NOT NULL, New Index, Materialized Views, Partition