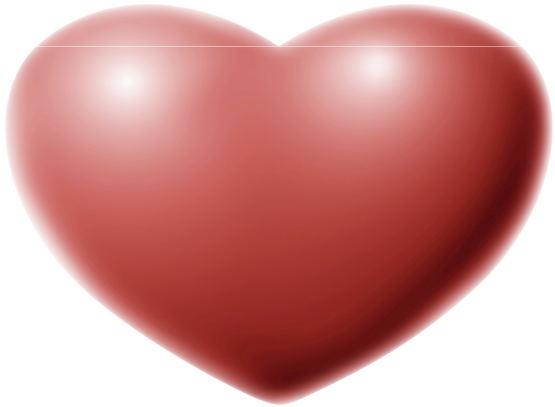
Oracle Performance for Developers

And the DBA's That Love Them!



by Kerry Osborne

- an oldish Oracle guy

whoami

I added this slide because everyone else had one!

Started working with Oracle in 1983
Primarily a developer for the first 5-6 years
Became a consultant around 1987
…

Never worked directly for Oracle
Not certified in anything
But I have attended the Hotsos Symposium 4 years in a row!

It's the Code, Stupid!

"*Let me blurt out the punch line of this article in one sentence. The main performance problem in the huge majority of database applications is bad SQL code*."

Joe Celko - *It's the Code Stupid!*
Information Management Magazine, June 2005

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Why is there so much bad code?

And the Survey Says:

Lack of Education – No. 1 Answer

Why is there so much bad code?

- My Education was Definitely Lacking!
- Most developers have a decent understanding of SQL
- But most have a significant blind spot:
  - They don’t really know very much about the database
- Also there hasn’t been a really good certification program
  - OCP is OK, but not great
  - OCP is primarily aimed at DBAs

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Why is there so much bad code?

- By Comparison Plumbers in Texas Require Apprenticeship
  - Master Plumber – 8,000 hours + testing
  - Journeyman Plumber – 8,000 hours
  - Certified Drain Cleaner – 4,000 hours

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Why is there so much bad code?

Just One More Reminder: This guy needed 4 years as an apprentice to get his Master Plumbers Certification! For a profession that can be summed up as “&!*% runs down hill”.

Why is there so much bad code?

SQL is a set language

- Very different from a procedural language
  - Reasonable to expect pretty linear response
  - If your doing 10 records/min you can do 600/hour

- Also very different from an object oriented type language

"*If we politely request an object to do something for us instead of brutally calling its procedures directly, this is called message passing, even if no actual 'message' is transmitted. The joy here is that many different kinds of objects may understand the same message, which leads to the notion of polymorphism. For example, we can ask many different kinds of documents to Print themselves, and they each respond appropriately.*"

- Unknown Java Evangelist

Why is there so much bad code?

SQL is a very very very high level language

- Actually it's closer to a software spec than a program
  - Basically only the result is defined (I'm stretching here)
  - But many many implementation decisions are left to the DB
    - the most import input is the statistics
    - lots of optimizer parameters as well
      - 194 in 10.2.0.3 on linux
      - 270 in 11.1.0.7 on linux

  - It can be like giving instructions to my kids

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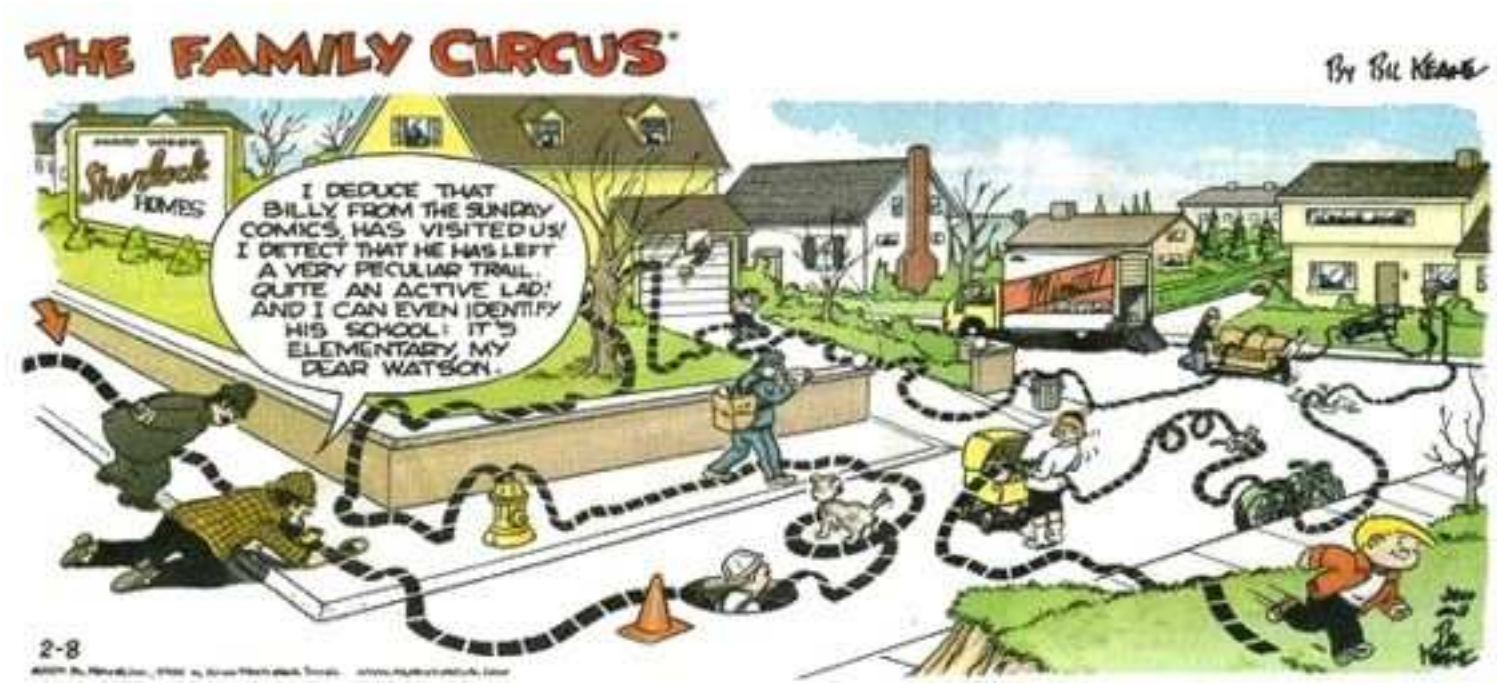
Why is there so much bad code?



Why is there so much bad code?

My Original Top Ten List Things NOT to Do

1. Hire Developers that Don't Know ~~SQL~~ --- Oracle
2. Write a Meta-Layer (hide the database from the developers)
3. Don't use connection pooling
4. Leave Autocommit On
5. Hinder the CBO (Bad Stats, Bad Histograms, Bad Hints, …)
6. Use an Unpopular Language/Tool
7. Don't Use the Tools You Already Own
8. Throw Hardware At It
9. Don't Worry About Concurrency (What Me Worry)
10. Do Everything One Row at a Time

Why is there so much bad code?

Some Things I left out of my original list:

1. Not Using Bind Variables (yes Virginia, it's still a problem)
2. Not Closing Cursors (ditto) – it's a memory leak
3. Doing Unnecessary Work (200,000 execs a day – no rows)
4. Not Using Constraints (or worse, not believing that they work)
5. Not Instrumenting Your Code
6. Over-Instrumenting Your Code

Why is there so much bad code?

Oracle is NOT a Persistent Data Store!

- Well it is, but that's only a small part or what it is
  - It's an engine (it has it's own jvm, and pl/sql)
  - It performs some types of operations blazingly fast
    - sorting, filtering, joining … for example
  - It's basically a big, sophisticated disk cache

Please don't think of it as a place to save everything if you have to reboot the app server!

Why is there so much bad code?

The development environment doesn't match production

- Lot's of issues come into play here
  - Stats mainly (these can be set to match Production)
  - But also the myriad optimizer parameters

A close corollary to this is lack of access to production

- Developers are quite often not even aware of the differences

DBAs are from Venus, Developers are from Mars

1. Lack of a Common Language
2. Most Companies are Organized Wrong
3. DBAs Often Don’t Respect Developers
4. Developers Often Resent DBAs

I would like to buy a Dam-burgen!

DBAs are from Venus, Developers are from Mars

Emailing instead of talking

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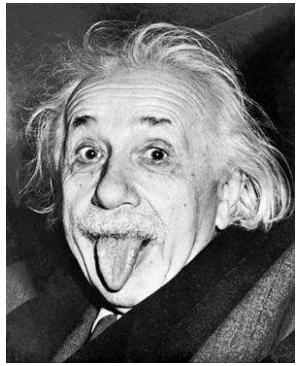
DBAs are from Venus, Developers are from Mars

Typical DBA Characteristics

- Cranky
- More Experienced
- Goal is to Keep Anything Really Bad from Happening
- Basically Pessimistic (envisions the catastrophes)



Typical Developer Characteristics

- Creative
- Less Experienced
- Goal is to Complete the Unified Field Theory
- Basically Optimistic (envisions the possibilities)

Can't We All Just Get Along

- DBAs stay up all night resolving performance problems
  (even though they weren't consulted on the design)

- This experience leads to DBAs start resenting developers

- DBAs attack Developers for lack of expertise
  (even though they have no idea what they were attempting)

- Developers begin to feel mistreated and resent DBAs

- Developers begin to write bad code on purpose
  (just to keep the DBAs up at night)

- DBAs now have a real reason to abuse the Developers

- Repeat (at least until you can find a new job)

Seek First to Understand, then to be Understood

DBAs

- Learn to write a Java program
- Try to understand the data that you're responsible for
- Volunteer to participate in code reviews
- Give appropriate production access to your key developers *
- Be willing to teach developers what you know

Developers

- Learn as much as you can about Oracle
- Focus on SQL and the optimizer *
- Volunteer to help diagnose performance problems
- Instrument your code
- Be willing to teach DBAs what you know

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Tools Every Oracle Developer Should Know

Explain Plan
DBMS_XPLAN
VSQL, VSQLAREA, V$SQL_PLAN
AUTOTRACE
Trace Files
Statspack/AWR
Basic Wait Events – Reads, SQL*Net, Log File Sync, CPU
DBMS_STATS

Explain Plan - Lies

Your probably familiar with this:

```
SQL> explain plan for select …
SQL> select * from table(dbms_xplan.display('plan_table','','ALL'));
```

I hardly ever use it, because EXPLAIN PLAN LIES!

- **It tells you what it thinks the optimizer might do …**
- **It's basically a different code path**
- **Google for "Explain Plan Lies" for more info**

… and unless Burleson has recently written something with that title recently you should find something I wrote!

DBMS_XPLAN

Try this instead:

SQL> select * from table(dbms_xplan.display_cursor('&sql_id','&child_no','typical'));

```
-------------------------------------------------------------------------------------------------------------
| Id  | Operation              | Name                   | Rows  | Bytes | Cost (%CPU)| Time     | Pstart| Pstop |
-------------------------------------------------------------------------------------------------------------
|   0 | UPDATE STATEMENT       |                        |       |       |    82 (100)|          |       |       |
|   1 |  UPDATE                | SEARCH_FCC_CDR_EVENT   |       |       |            |          |       |       |
|   2 |   PARTITION RANGE ALL  |                        |     1 |    94 |    81   (0)| 00:00:01 |     1 |    40 |
|   3 |    PARTITION HASH SINGLE|                       |     1 |    94 |    81   (0)| 00:00:01 |     4 |     4 |
|*  4 |     INDEX RANGE SCAN   | PK_SEARCH_FCC_CDR_EVENT |     1 |    94 |    81   (0)| 00:00:01 |       |       |
-------------------------------------------------------------------------------------------------------------


Predicate Information (identified by operation id):
---------------------------------------------------

   4 - access("EVENT_ID"='172.21.21.104cf829d:11f8c3306e2:-c18')
```

DBMS_XPLAN

3 Display Functions:

Display – plan table
Display_Cursor – shared pool
Display_AWR – AWR tables

Options:

ALLSTATS *
IOSTATS
MEMSTATS
OUTLINE
PEEKED_BINDS *

See Rob van Wijk's blog for a very detailed set of examples
http://rwijk.blogspot.com/2008/03/dbmsxplandisplaycursor.html

And the Oracle Documentation
http://download.oracle.com/docs/cd/B19306_01/appdev.102/b14258/d_xplan.htm#i999189

DBMS_XPLAN - Options

allstats –

select /*+ gather_plan_statistics */ blah,blah,blah …
select * from table(dbms_xplan.display_cursor('&sql_id','&child_no','allstats'));

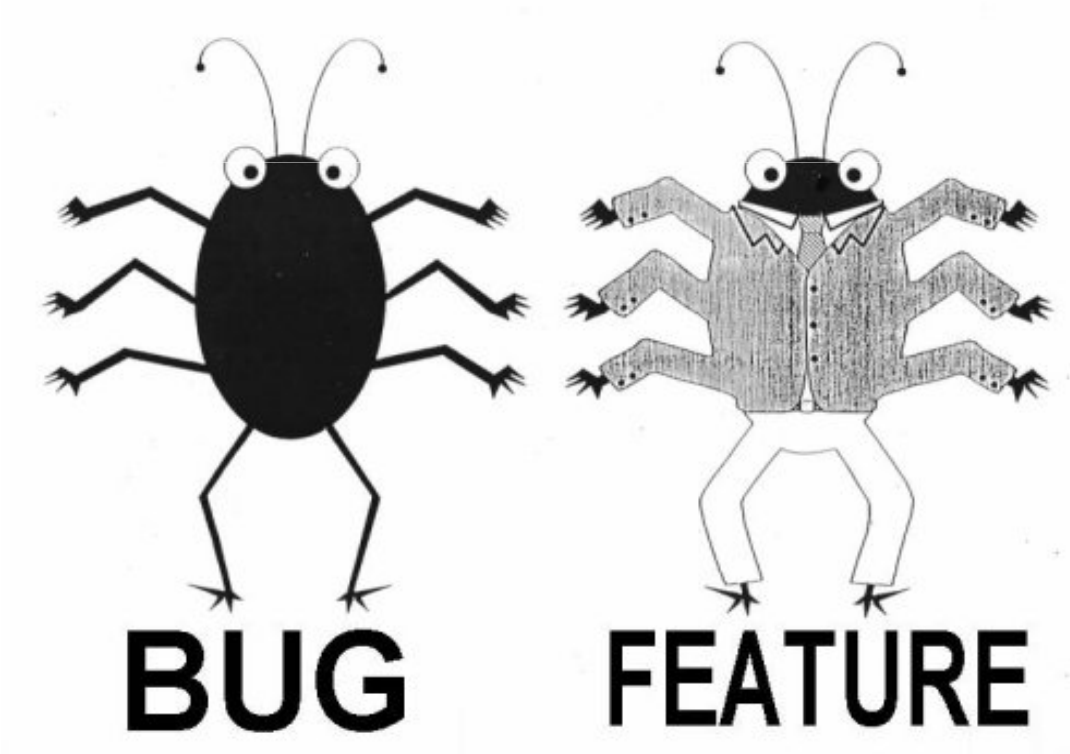
```
-----------------------------------------------------------------------------------------------------------------
| Id  | Operation                           | Name                | Starts | E-Rows | A-Rows |   A-Time   | Buffers |
-----------------------------------------------------------------------------------------------------------------
|*  1 |  COUNT STOPKEY                      |                     |      1 |        |      1 |00:00:00.01 |      44 |
|   2 |   PARTITION RANGE ALL               |                     |      1 |      1 |      1 |00:00:00.01 |      44 |
|   3 |    PARTITION HASH ALL               |                     |     10 |      1 |      1 |00:00:00.01 |      44 |
|   4 |     TABLE ACCESS BY LOCAL INDEX ROWID| DODA_TABLE          |     37 |      1 |      1 |00:00:00.01 |      44 |
|*  5 |      INDEX RANGE SCAN               | DODA_TABLE_IDX1     |     37 |   3403K|      1 |00:00:00.01 |      43 |
-----------------------------------------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   1 - filter(ROWNUM<2)
   5 - access("COL1">SYSDATE@!)
```

peeked_binds –

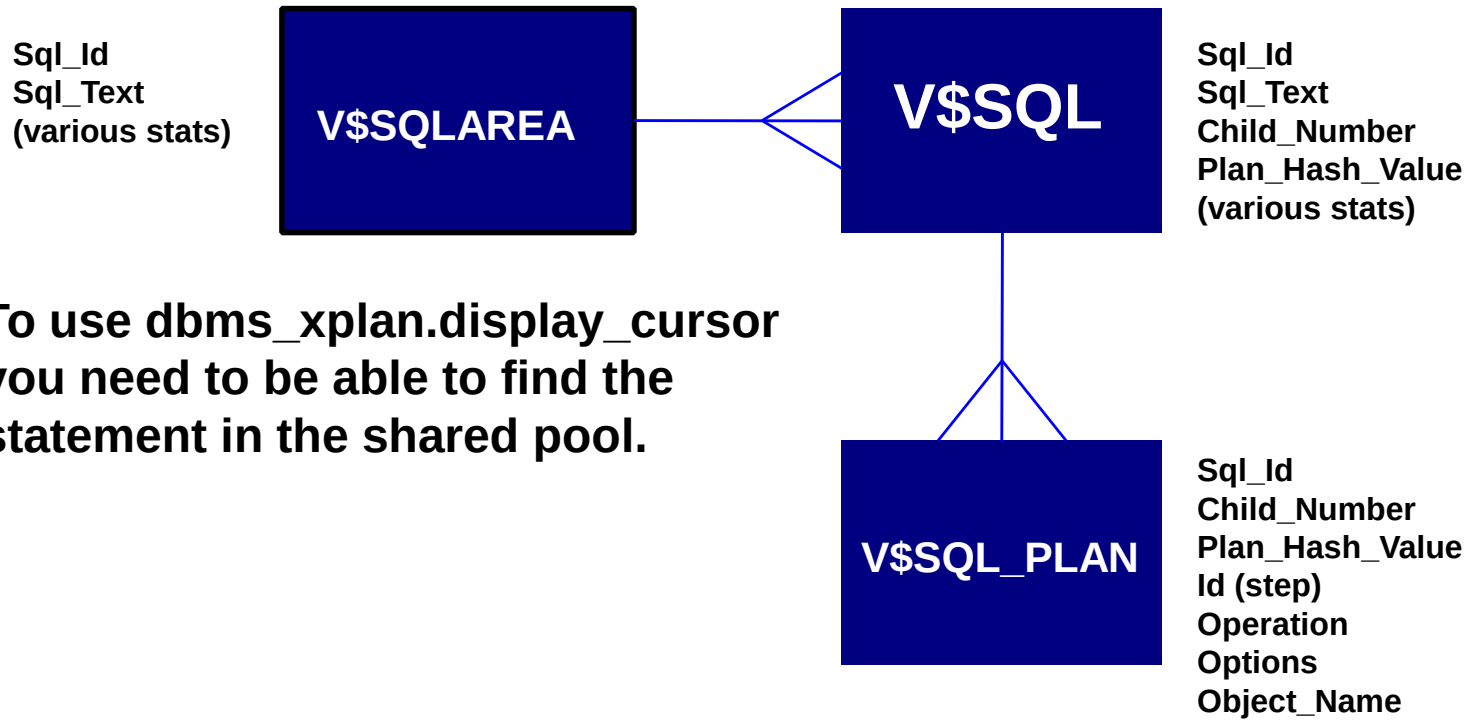
```
Peeked Binds (identified by position):
--------------------------------------

   1 - :1 (VARCHAR2(30), CSID=31): '17-Apr-2008 00:00:00'
   2 - :2 (VARCHAR2(30), CSID=31): 'dd-MON-yyyy HH24:MI:ss'
   3 - :3 (VARCHAR2(30), CSID=31): '18-Apr-2008 23:59:59'
```

Digression – Bind Variable Peeking

Drives Me Nuts!



Shared Pool Layout (V$SQL…)



To use dbms_xplan.display_cursor you need to be able to find the statement in the shared pool.

Note: prior to 10g hash_value used as key (no sql_id)

Finding Statements in the Shared Pool

```
SQL> !cat find_sql.sql
select sql_id, child_number, plan_hash_value plan_hash, executions execs,
(elapsed_time/1000000)/decode(nvl(executions,0),0,1,executions) avg_etime,
disk_reads/decode(nvl(executions,0),0,1,executions) avg_pio,
buffer_gets/decode(nvl(executions,0),0,1,executions) avg_lio,
sql_text
from v$sql s
where upper(sql_text) like upper(nvl('&sql_text',sql_text))
and sql_text not like '%from v$sql where sql_text like nvl(%'
and sql_id like nvl('&sql_id',sql_id)
order by 1, 2, 3
/


SQL> @find_sql
Enter value for sql_text: %skew%
Enter value for sql_id:

SQL_ID         CHILD  PLAN_HASH  EXECS  AVG_ETIME      AVG_LIO SQL_TEXT
------------- ------ ---------- ------ ---------- ------------ ------------------------------------------------
0qa98gcnnza7h      0  568322376      5      13.09      142,646 select avg(pk_col) from kso.skew where col1 > 0
0qa98gcnnza7h      1 3723858078      1       9.80    2,626,102 select avg(pk_col) from kso.skew where col1 > 0
```

Finding Statements in the Shared Pool

```
SQL> !cat dplan.sql
set lines 150
select * from table(dbms_xplan.display_cursor('&sql_id','&child_no','typical'))
/

SQL> @dplan
Enter value for sql_id: 0qa98gcnnza7h
Enter value for child_no: 0

PLAN_TABLE_OUTPUT
------------------------------------------------------------------------------------------------------------------------
    --------------------------------
SQL_ID  0qa98gcnnza7h, child number 0
-------------------------------------
select avg(pk_col) from kso.skew where col1 > 0

Plan hash value: 568322376

-----------------------------------------------------------------------------
| Id  | Operation          | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-----------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |      |       |       | 31719 (100)|          |
|   1 |  SORT AGGREGATE    |      |     1 |    11 |            |          |
|*  2 |   TABLE ACCESS FULL| SKEW |    32M|   335M| 31719  (37)| 00:00:43 |
-----------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   2 - filter("COL1">0)
```

XPLAN - Access

What You Need:

SELECT ON V_$SQL
SELECT ON V_$SQL_PLAN
SELECT ON V_$SQL_PLAN_STATISTICS_ALL

Or

SELECT ANY DICTIONARY

Autotrace

```
SQL> set autotrace traceonly
SQL> @avgskew

Execution Plan
----------------------------------------------------------
Plan hash value: 568322376

--------------------------------------------------------------------------------
| Id  | Operation          | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |      |     1 |    11 | 31719  (37)| 00:00:43 |
|   1 |  SORT AGGREGATE    |      |     1 |    11 |            |          |
|*  2 |   TABLE ACCESS FULL| SKEW |    32M|   335M| 31719  (37)| 00:00:43 |
--------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   2 - filter("COL1">0)

Statistics
----------------------------------------------------------
          0  recursive calls
          0  db block gets
     173731  consistent gets
     109968  physical reads
          0  redo size
        433  bytes sent via SQL*Net to client
        396  bytes received via SQL*Net from client
          2  SQL*Net roundtrips to/from client
          0  sorts (memory)
          0  sorts (disk)
          1  rows processed
```

Autotrace

SQL*Plus command
- useful for quick and dirty look at interactive SQL

set autotrace statistics – statistics section is useful
set autotrace traceonly – suppresses query output

Unfortunately – it uses Explain Plan!

My Conclusion: – not overly useful, but it's easy and I do use it

Tom Kyte. *Autotrace*
http://asktom.oracle.com/tkyte/article1/autotrace.html

Autotrace – Uses Explain Plan

```
SQL> @flush_pool

System altered.

SQL> @find_sql
Enter value for sql_text: %skew%
Enter value for sql_id:

no rows selected

SQL> set autotrace traceonly
SQL> @avgskew

Execution Plan
----------------------------------------------------------
Plan hash value: 568322376

--------------------------------------------------------------------------------
| Id  | Operation          | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |      |     1 |    11 | 31719  (37)| 00:00:43 |
|   1 |  SORT AGGREGATE    |      |     1 |    11 |            |          |
|*  2 |   TABLE ACCESS FULL| SKEW |    32M|   335M| 31719  (37)| 00:00:43 |
--------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   2 - filter("COL1">0)

Statistics
----------------------------------------------------------
Bla, bla, bla ….
```

Autotrace – Uses Explain Plan

```
SQL> set autotrace off
SQL> @find_sql
Enter value for sql_text: %skew%
Enter value for sql_id:

SQL_ID         CHILD  PLAN_HASH  EXECS     AVG_ETIME  AVG_LIO SQL_TEXT
------------- ------ ---------- ------ ------------- -------- ------------------------------------------------
0qa98gcnnza7h      0  568322376      1         15.96  173,787 select avg(pk_col) from kso.skew where col1 > 0

2u7v8088nxqxr      0  568322376      1           .01       44 EXPLAIN PLAN SET STATEMENT_ID='PLUS2897584' FOR se
                                                               lect avg(pk_col) from kso.skew where col1 > 0


SQL> /
Enter value for sql_text: %dbms_xplan.display%
Enter value for sql_id:

SQL_ID         CHILD  PLAN_HASH  EXECS     AVG_ETIME  AVG_LIO SQL_TEXT
------------- ------ ---------- ------ ------------- -------- ------------------------------------------------
3s1hh8cvfan6w      0 2137789089      1           .12    1,991 SELECT PLAN_TABLE_OUTPUT FROM TABLE(DBMS_XPLAN.DIS
                                                               PLAY('PLAN_TABLE', :1))
```

As you can see, the shared pool now has an explain plan statement and a dbms_xplan.display call.

Autotrace - Access

What You Need:

SELECT ON V_$SQL
SELECT ON V_$SQL_PLAN

Or

SELECT ANY DICTIONARY

And

PLUSTRACE

Trace Files

10046 - Extended Trace Files
10053 - CBO Choices

Cary Millsap & Jeff Holt. ***Optimizing Oracle Performance***
O'Reilly, 2003.

Pete Finnigan. ***How to Set Trace…***
http://www.petefinnigan.com/ramblings/how_to_set_trace.htm

Wolfgang Breitling. ***A Look under the Hood of CBO: The 10053 Event***
http://www.centrexcc.com/A%20Look%20under%20the%20Hood%20of%20CBO%20-%20the%2010053%20Event.pdf

Tom Kyte. ***Use the 10053 Event to Trace CBO Choices***
http://asktom.oracle.com/pls/asktom/f?p=100:11:0::::P11_QUESTION_ID:63445044804318

Trace Files - 10046

```
/opt/oracle/admin/LAB102/udump/lab102_ora_4207.trc
Oracle Database 10g Enterprise Edition Release 10.2.0.1.0 - Production
ORACLE_HOME = /opt/oracle/product/db/10.2.0/db1
System name:    Linux
Node name:      homer
Release:        2.6.9-34.ELhugemem
Version:        #1 SMP Fri Feb 24 17:04:34 EST 2006
Machine:        i686
Instance name: LAB102
Redo thread mounted by this instance: 1
Oracle process number: 20
Unix process pid: 4207, image: oracle@homer (TNS V1-V3)

*** ACTION NAME:() 2007-08-16 13:48:14.571
*** MODULE NAME:(SQL*Plus) 2007-08-16 13:48:14.571
*** SERVICE NAME:(SYS$USERS) 2007-08-16 13:48:14.571
*** SESSION ID:(143.189) 2007-08-16 13:48:14.571
=====================
PARSING IN CURSOR #7 len=68 dep=0 uid=61 oct=42 lid=61 tim=1159462982979740 hv=740818757 ad='30663e48'
alter session set events '10046 trace name context forever, level 8'
END OF STMT
EXEC #7:c=0,e=269,p=0,cr=0,cu=0,mis=0,r=0,dep=0,og=1,tim=1159462982979717
WAIT #7: nam='SQL*Net message to client' ela= 7 driver id=1650815232 #bytes=1 p3=0 obj#=-1 tim=1159462982980778
WAIT #7: nam='SQL*Net message from client' ela= 119 driver id=1650815232 #bytes=1 p3=0 obj#=-1 tim=1159462982981008
=====================
PARSING IN CURSOR #8 len=44 dep=0 uid=61 oct=3 lid=61 tim=1159463023994427 hv=761757617 ad='54738434'
select avg(col1) from skew
where rownum < 10
END OF STMT
PARSE #8:c=4000,e=3904,p=0,cr=0,cu=0,mis=1,r=0,dep=0,og=1,tim=1159463023994411
EXEC #8:c=0,e=185,p=0,cr=0,cu=0,mis=0,r=0,dep=0,og=1,tim=1159463023994844
WAIT #8: nam='SQL*Net message to client' ela= 9 driver id=1650815232 #bytes=1 p3=0 obj#=53707 tim=1159463023994980
WAIT #8: nam='db file scattered read' ela= 218 file#=4 block#=21900 blocks=5 obj#=53707 tim=1159463023995544
FETCH #8:c=0,e=665,p=5,cr=4,cu=0,mis=0,r=1,dep=0,og=1,tim=1159463023995732
WAIT #8: nam='SQL*Net message from client' ela= 157 driver id=1650815232 #bytes=1 p3=0 obj#=53707 tim=1159463023996048
FETCH #8:c=0,e=7,p=0,cr=0,cu=0,mis=0,r=0,dep=0,og=0,tim=1159463023996183
WAIT #8: nam='SQL*Net message to client' ela= 7 driver id=1650815232 #bytes=1 p3=0 obj#=53707 tim=1159463023996312
WAIT #8: nam='SQL*Net message from client' ela= 298 driver id=1650815232 #bytes=1 p3=0 obj#=53707 tim=1159463023996669
XCTEND rlbk=0, rd_only=1
STAT #8 id=1 cnt=1 pid=0 pos=1 obj=0 op='SORT AGGREGATE (cr=4 pr=5 pw=0 time=736 us)'
STAT #8 id=2 cnt=9 pid=1 pos=1 obj=0 op='COUNT STOPKEY (cr=4 pr=5 pw=0 time=846 us)'
STAT #8 id=3 cnt=9 pid=2 pos=1 obj=53707 op='TABLE ACCESS FULL SKEW (cr=4 pr=5 pw=0 time=639 us)'
WAIT #0: nam='log file sync' ela= 680 buffer#=4862 p2=0 p3=0 obj#=53707 tim=1159463039852003
```

Trace Files - 10053

Outlines Options Considered by the Oprimizer

But also…

- **Lists all optimizer parameters (split by default/altered)**
- **Lists all object stats (including partition / composite)**
- **List all values of peeked bind variables**
- **Lists the actual query being executed (unnesting, etc…)**
- **Lists single table access options for each table**
- **Lists all calculations**
- **Finally shows plan it came up with including outline**

Trace Files - 10053

```
***************************************
BASE STATISTICAL INFORMATION
***********************
Table Stats::
  Table: SKEW  Alias: SKEW
    #Rows: 32000004  #Blks:  180074  AvgRowLen:  31.00
Index Stats::
  Index: COL3_INDEX  Col#: 4
    LVLS: 2  #LB: 84881  #DK: 1000001  LB/K: 1.00  DB/K: 31.00  CLUF: 31999920.00
  Index: SKEW_COL1  Col#: 2

...

***************************************
SINGLE TABLE ACCESS PATH
  Column (#2): COL1(NUMBER)
    AvgLen: 5.00 NDV: 895516 Nulls: 0 Density: 1.6792e-06 Min: 1 Max: 1000000
    Histogram: HtBal  #Bkts: 254  UncompBkts: 254  EndPtVals: 230
  Table: SKEW  Alias: SKEW
    Card: Original: 32000004  Rounded: 32000004  Computed: 32000004.00  Non Adjusted: 32000004.00
  Access Path: TableScan
    Cost:  31718.67  Resp: 31718.67  Degree: 0
      Cost_io: 20027.00  Cost_cpu: 8322387067
      Resp_io: 20027.00  Resp_cpu: 8322387067
  Access Path: index (RangeScan)
    Index: SKEW_COL1
    resc_io: 28901466.00  resc_cpu: 217660057141
    ix_sel: 1  ix_sel_with_filters: 1
    Cost: 29207244.77  Resp: 29207244.77  Degree: 1


...

*********************************
Number of join permutations tried: 1
*********************************
Final - All Rows Plan:  Best join order: 1
  Cost: 31718.6688  Degree: 1  Card: 32000004.0000  Bytes: 352000044
```

Trace Files – Access

What You Need:

An o/s account on the db server
Access to the user_dump_dest directory*
Access to v$parameter to find the udump directory
Access to v$session if tracing a remote session

And

Have to be in DBA group
unless _public_trace_files=true

* Jared Still. *A Novel Use for Oracle External Tables*
http://www.dbazine.com/oracle/or-articles/still1

Trace Files – Access

_public_trace_files=true

sets .trc files created in udump to 644 (rw-r--r--)
sets .trc files created in bdump to 644 (rw-r--r--)
does not change alert log permissions
does not change adump file permissions
does require a bounce of the instance

Note: **10046 trace files do not contain clear text passwords. They may, however, contain hashed value of password if trace on at level 12 (binds) for a dba session when it is setting a password .**

Statspack / AWR

Provides a lot of data

Very useful despite the aggregation of data

Snapshots collected once per hour by default (OK)

Retention is 7 days by default (not long enough)

Can report between any two snapshots

(but not across a bounce)

- **AWR / Statspack -** basically the same thing (except for the licensing fee)

Statspack / AWR

Contains Basic Workload Information
transactions, parses, db time, etc…

Contains a profile of how the database spent it's time
also known as a wait event profile

Contains most expensive SQL (along with %)
by Etime, CPU , Gets, Reads, Execs

(and so much more)

Statspack / AWR

```
WORKLOAD REPOSITORY report for

DB Name         DB Id    Instance     Inst Num Release     RAC Host
------------ ----------- ------------ -------- ----------- --- ------------
XXX           3484184718 XXX1                1 10.2.0.3.0  YES xx-xxxx

             Snap Id      Snap Time      Sessions Curs/Sess
           --------- ------------------- -------- ---------
Begin Snap:     10081 01-May-08 11:00:09       245      57.8
  End Snap:     10082 01-May-08 12:00:29       215      56.9
   Elapsed:               60.33 (mins)
   DB Time:               60.12 (mins)

Cache Sizes
~~~~~~~~~~~                       Begin        End
                             ---------- ----------
               Buffer Cache:       944M     1,104M  Std Block Size:         8K
           Shared Pool Size:     1,440M     1,280M      Log Buffer:    14,352K

Load Profile
~~~~~~~~~~~~                            Per Second       Per Transaction
                                   ---------------       ---------------
                  Redo size:             45,573.66              6,151.79
              Logical reads:              7,166.25                967.34
              Block changes:                247.94                 33.47
             Physical reads:                186.44                 25.17
            Physical writes:                 40.93                  5.52
                 User calls:                 62.09                  8.38
                     Parses:                 28.05                  3.79
                Hard parses:                 10.90                  1.47
                      Sorts:                 53.18                  7.18
                     Logons:                  0.46                  0.06
                   Executes:                 35.54                  4.80
                Transactions:                  7.41
 % Blocks changed per Read:    3.46    Recursive Call %:    76.32
 Rollback per transaction %:   15.44       Rows per Sort:    20.44
```

Statspack / AWR

```
Instance Efficiency Percentages (Target 100%)
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
            Buffer Nowait %:   99.94       Redo NoWait %:   99.92
            Buffer  Hit   %:   97.40    In-memory Sort %:  100.00
            Library Hit   %:   87.03        Soft Parse %:   61.13
         Execute to Parse %:   21.07         Latch Hit %:   99.93
Parse CPU to Parse Elapsd %:   63.65     % Non-Parse CPU:   79.10

 Shared Pool Statistics        Begin    End
                              ------  ------
             Memory Usage %:   66.76   54.22
    % SQL with executions>1:    8.34   22.47
  % Memory for SQL w/exec>1:   15.15   47.83

Top 5 Timed Events                                         Avg %Total
~~~~~~~~~~~~~~~~~~                                        wait   Call
Event                                 Waits    Time (s)   (ms)   Time Wait Class
------------------------------ ------------ ----------- ------ ------ ----------
db file sequential read            655,969       2,769      4   76.8   User I/O
CPU time                                             516          14.3
gc current block 2-way             364,108         115      0    3.2    Cluster
gc cr grant 2-way                  395,360          70      0    1.9    Cluster
library cache lock                 207,165          49      0    1.3 Concurrenc
```

Statspack / AWR

```
SQL ordered by Elapsed Time       DB/Inst: PRORAC/prorac1  Snaps: 10081-10082
...

  Elapsed      CPU                  Elap per  % Total
  Time (s)   Time (s)  Executions   Exec (s)  DB Time    SQL Id
---------- ---------- ------------ ---------- ------- -------------
       409         15           16       25.5    11.3 fahcqt234ft6f
SELECT blah, blah1, balh3 …

       387         13           16       24.2    10.7 932qp5mmkj5rr
SELECT blah, blah2, blah3 …

…

SQL ordered by Gets               DB/Inst: PRORAC/prorac1  Snaps: 10081-10082
...
                                Gets              CPU     Elapsed
  Buffer Gets   Executions    per Exec   %Total Time (s)  Time (s)    SQL Id
-------------- ------------ ------------ ------ -------- --------- -------------
     3,984,767       18,544        214.9   15.4    11.15     11.15 9ungu4m6h9t7p
Module: is_domDecisionSupport@as-seebeyond06 (TNS V1-V3)
SELECT username AS table_schem FROM all_users ORDER BY table_schem

       546,482           27     20,240.1    2.1     8.63      8.70 ach580jj1zsfx
SELECT COUNT(*) from Bob_Loblaw …
```

Statspack / AWR

Query the underlying tables directly

```
SQL> @awr_plan_stats
Enter value for sql_id: 0qa98gcnnza7h

SQL_ID        PLAN_HASH_VALUE        EXECS          ETIME    AVG_ETIME        AVG_LIO
------------- --------------- ------------ -------------- ------------ --------------
0qa98gcnnza7h       568322376            5           39.7        7.943      104,443.0
0qa98gcnnza7h      3723858078            1           82.4       82.435   15,286,176.0


SQL> @awr_plan_change
Enter value for sql_id: 0qa98gcnnza7h

   SNAP_ID BEGIN_INTERVAL        SQL_ID  PLAN_HASH_VALUE  EXECS    AVG_ETIME        AVG_LIO
---------- --------------- ------------- --------------- ------ ------------ --------------
     21519 06-MAR-09 03.00 0qa98gcnnza7h       568322376      2         .118          511.0
     21623 10-MAR-09 11.33 0qa98gcnnza7h      3723858078      1       82.435   15,286,176.0
     21624 10-MAR-09 11.35 0qa98gcnnza7h       568322376      3       13.160      173,731.0
```

***Read Dave's paper.**

Statspack / AWR

```
SQL> !cat unstable_plans.sql
select * from (
select sql_id, sum(execs), min(avg_etime) min_etime, max(avg_etime) max_etime,
stddev_etime/min(avg_etime) norm_stddev
from (
select sql_id, plan_hash_value, execs, avg_etime,
stddev(avg_etime) over (partition by sql_id) stddev_etime
from (
select sql_id, plan_hash_value,
sum(nvl(executions_delta,0)) execs,
(sum(elapsed_time_delta)/decode(sum(nvl(executions_delta,0)),0,1,sum(executions_delta))/1000000)
avg_etime
-- sum((buffer_gets_delta/decode(nvl(buffer_gets_delta,0),0,1,executions_delta))) avg_lio
from DBA_HIST_SQLSTAT S, DBA_HIST_SNAPSHOT SS
where ss.snap_id = S.snap_id
and ss.instance_number = S.instance_number
and executions_delta > 0
and elapsed_time_delta > 0
and s.snap_id >= nvl('&earliest_snap_id',0)
and s.snap_id <= nvl('&last_snap_id',9999999)
group by sql_id, plan_hash_value))
group by sql_id, stddev_etime
)
where norm_stddev > nvl(to_number('&min_stddev'),2)
and max_etime > nvl(to_number('&min_etime'),.1)
order by norm_stddev;
```

Statspack / AWR

```
SQL> @unstable_plans
Enter value for min_stddev:
Enter value for min_etime:

SQL_ID        SUM(EXECS)   MIN_ETIME   MAX_ETIME   NORM_STDDEV
------------- ---------- ----------- ----------- -------------
c5by9gdw3814r         14         .03         .12        2.1274
848dyu9288c3h         16         .02         .16        2.1309
2am60vd2kw8ux         11         .05         .22        2.4976
frxg53fac2n8j          5         .03         .30        4.2479
0qa98gcnnza7h         62       25.58      314.34        7.9833
g0jvz8csyrtcf          2         .09        1.19        8.2304
2cn0kc8u4b81w        545         .02         .42       12.8022
9wt62290ah0f7          6         .01         .47       38.5857
d8mayxqw0wnpv       1373         .01         .85       48.3874
```

Kerry Osborne. ***Unstable Plans (Plan Instability)***
http://kerryosborne.oracle-guy.com/2008/10/unstable-plans/

AWR - Access

What You Need:

SELECT ANY DICTIONARY
EXECUTE ON DBMS_WORKLOAD_REPOSITORY
access to $ORACLE_HOME/rdbms/admin/awrrpt.sql

Or

A friendly DBA who will run the report for you

Basic Wait Events

You should know a few of them:

CPU – not really a wait event
db file sequential read
db file scattered read
log file sync
SQL*Net message to client
SQL*Net message from client
direct path read
…

- **Read *Optimizing Oracle Performance***

Wait Events That Everyone Should Know
http://oracle-guy.com/papers/Oracle%20Wait%20Events%20That%20Everyone%20Should%20Know.ppt

DBMS_STATS

You should know the capabilities of this package:

gather_table_stats
gather_schema_stats
method_opt (for all columns)
set_table_stats
set_column_stats
set_index_stats
restore_table_stats
restore_schema_stats

***Read Karen's paper.**
***Read the Oracle docs on DBMS_STATS**

References

Tom Kyte. Pretty much everything he has ever written

Jonathan Lewis. *Cost-Based Oracle Fundamentals*
Apress, 2006.

Cary Millsap & Jeff Holt. *Optimizing Oracle Performance*
O'Reilly, 2003.

Karen Morton. *Managing Statistics for Optimal Query Performance*
http://method-r.com/downloads/doc_download/11-managing-statistics-for-optimal-query-performance-karen-morton

Kerry Osborne. *Explain Plan Lies*
http://kerryosborne.oracle-guy.com/2008/10/explain-plan-lies/

Questions / Contact Information

Questions?

Contact Information : Kerry Osborne

kerry.osborne@enkitec.com
kerryosborne.oracle-guy.com
www.enkitec.com