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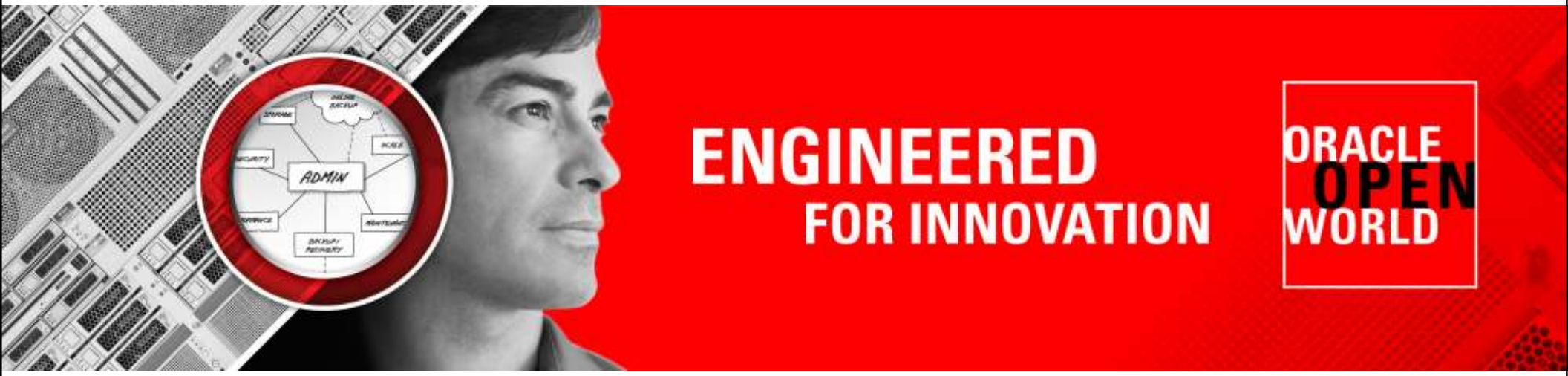


ORACLE

Five things you *probably* didn't know about SQL

Thomas Kyte
http://asktom.oracle.com/

ask Tom ORACLE

Who am I

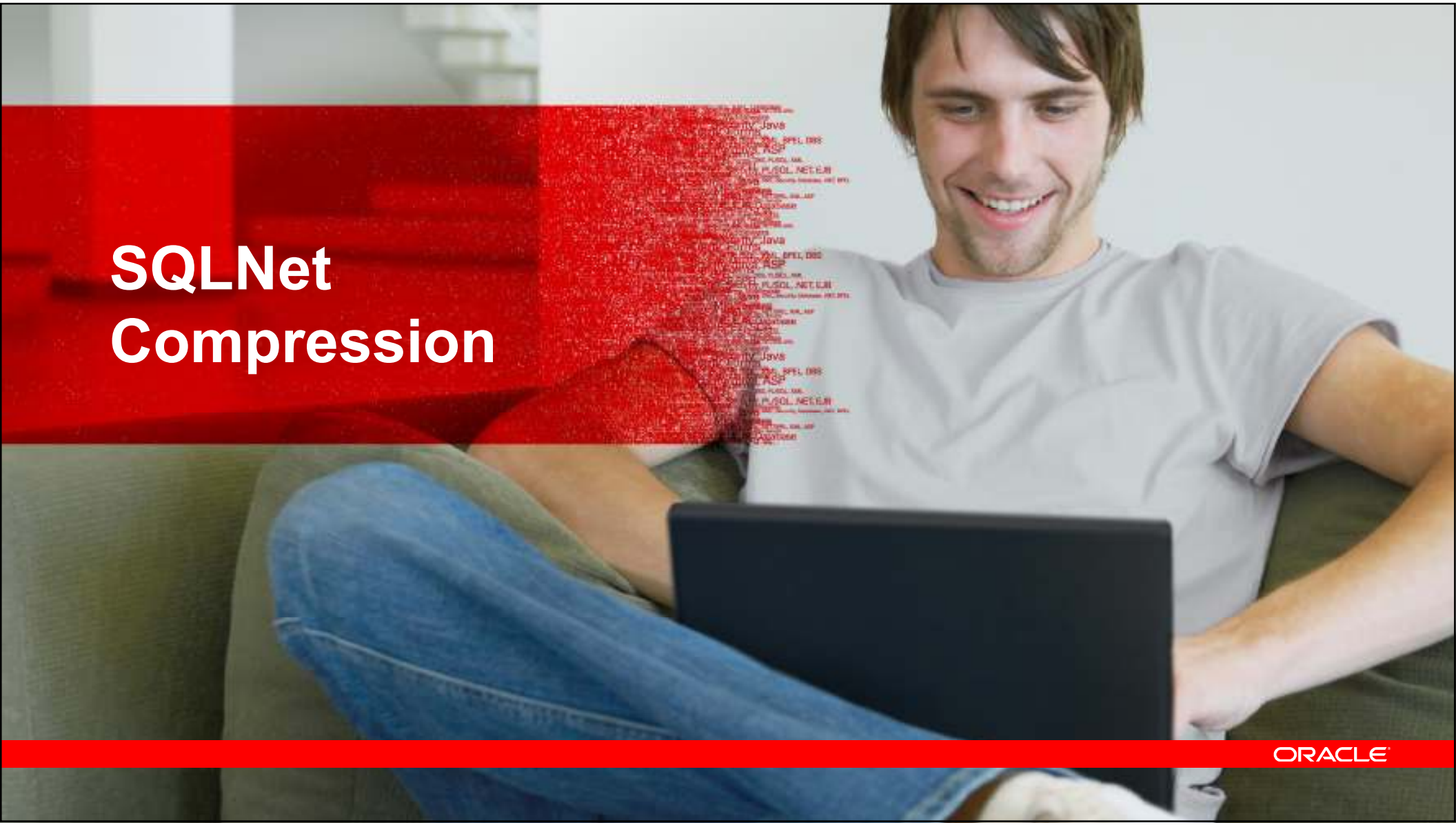
- Been with Oracle since 1993
- User of Oracle since 1987
- The “Tom” behind AskTom in Oracle Magazine

  www.oracle.com/oramag
- Expert Oracle Database Architecture
- Effective Oracle by Design
- Expert One on One Oracle
- Beginning Oracle

Five things you probably didn't know about SQL

- SQLNet Compression
- NULLS and Indexes and Cardinality
- You are being watched!
- Scalar Subquery Caching
- Calling statement level non-deterministic functions

SQLNet Compression



SQLNet Compression

- How you retrieve the data matters
- Not all result sets are the same – even if they have the same data

SQLNet Compression

```
ops$tkyte%ORA11GR2> create table t
  2  as
  3  select *
  4    from all_objects;
Table created.

ops$tkyte%ORA11GR2> begin
  2          dbms_stats.gather_table_stats( user, 'T' );
  3  end;
  4  /
PL/SQL procedure successfully completed.
```

SQLNet Compression

```
ops$tkyte%ORA11GR2> set arraysize 15

ops$tkyte%ORA11GR2> set autotrace traceonly statistics
```

SQLNet Compression

```
ops$tkyte%ORA11GR2> select * from t;
72228 rows selected.


Statistics
----------------------------------------------------------
       5794  consistent gets
    8015033  bytes sent via SQL*Net to client
      53385  bytes received via SQL*Net from client
       4817  SQL*Net roundtrips to/from client
      72228  rows processed
```

SQLNet Compression

```
ops$tkyte%ORA11GR2> select * from t order by timestamp;
72228 rows selected.


Statistics
----------------------------------------------------------
       1031  consistent gets
    3427630  bytes sent via SQL*Net to client
      53385  bytes received via SQL*Net from client
       4817  SQL*Net roundtrips to/from client
      72228  rows processed
```

SQLNet Compression

```
ops$tkyte%ORA11GR2> select * from t order by timestamp,
object_type, owner;
72228 rows selected.


Statistics
----------------------------------------------------------
       1031  consistent gets
    3280011  bytes sent via SQL*Net to client
      53385  bytes received via SQL*Net from client
       4817  SQL*Net roundtrips to/from client
      72228  rows processed
```

SQLNet Compression

```
ops$tkyte%ORA11GR2> set arraysize 100
ops$tkyte%ORA11GR2> set autotrace traceonly statistics
```

SQLNet Compression

```
ops$tkyte%ORA11GR2> select * from t;
72228 rows selected.


Statistics
----------------------------------------------------------
       1842  consistent gets
    7482943  bytes sent via SQL*Net to client
       8362  bytes received via SQL*Net from client
        724  SQL*Net roundtrips to/from client
      72228  rows processed
```

SQLNet Compression

```
ops$tkyte%ORA11GR2> select * from t order by timestamp;
72228 rows selected.


Statistics
----------------------------------------------------------
       1031  consistent gets
    2907819  bytes sent via SQL*Net to client
       8362  bytes received via SQL*Net from client
        724  SQL*Net roundtrips to/from client
      72228  rows processed
```

SQLNet Compression

```
ops$tkyte%ORA11GR2> select * from t order by timestamp,
object_type, owner;
72228 rows selected.


Statistics
----------------------------------------------------------
       1031  consistent gets
    2760200  bytes sent via SQL*Net to client
       8362  bytes received via SQL*Net from client
        724  SQL*Net roundtrips to/from client
      72228  rows processed
```

SQLNet Compression

	No Order 15	Some Order 15	Very Ordered 15	No Order 100	Some Order 100	Very Ordered 100
Bytes Sent	8.01 m	3.42 m	3.28 m	7.48 m	2.90 m	2.76 m
% of original	100%	43%	41%	93%	36%	34%
Consistent Gets	5832	1033	1033	1741	1033	1033

```
ops$tkyte%ORA11GR2> select round(1033*8/1024,2) from dual;

ROUND(1033*8/1024,2)
--------------------
                8.07
```

SQLNet Compression

	No Order 1000	Some Order 1000	Very Ordered 1000	No Order 100	Some Order 100	Very Ordered 100
Bytes Sent	7.39 m	2.82 m	2.67 m	7.48 m	2.90 m	2.76 m
% of original	92%	35%	33%	93%	36%	34%
Consistent Gets	1105	1033	1033	1741	1033	1033

```
ops$tkyte%ORA11GR2> select round(1033*8/1024,2) from dual;

ROUND(1033*8/1024,2)
--------------------
                8.07
```

NULLS and Indexes and Cardinality

“Wrong cardinality = Wrong Plan”

NULLs and Cardinality

```
ops$tkyte%ORA11GR2> create table t
  2  pctfree 20
  3  as
  4  select a.*,
  5         case when mod(rownum,100) <= 50
  6              then last_ddl_time
  7          end end_date
  8    from all_objects a;

Table created.
```

NULLs and Cardinality

```
ops$tkyte%ORA11GR2> create index t_idx
  2                      on t(end_date);

Index created.
```

NULLs and Cardinality

```
ops$tkyte%ORA11GR2> select count(*)
  2    from t
  3   where end_date
  4   between to_date('01-sep-2010', 'dd-mon-yyyy')
  5       and to_date('30-sep-2010', 'dd-mon-yyyy');

  COUNT(*)
----------
     36267
```

NULLs and Cardinality

```
ops$tkyte%ORA11GR2> begin
  2      dbms_stats.gather_table_stats(user, 'T');
  3  end;
  4  /

PL/SQL procedure successfully completed.
```

NULLs and Cardinality

```
ops$tkyte%ORA11GR2> select count(*),
  2           count(distinct end_date),
  3           count(end_date),
  4           min(end_date),
  5           max(end_date)
  6     from t;

  CNT         CNTD         CNT2         MIN         MAX
----------- ----------- ----------- --------- ---------
      72228         703       36850 01-OCT-02 30-SEP-11
```

NULLs and Cardinality

```
ops$tkyte%ORA11GR2> set autotrace traceonly explain
ops$tkyte%ORA11GR2> select *
  2    from t
  3   where end_date
  4         between to_date( '01-sep-2010', 'dd-mon-yyyy' )
  5             and to_date( '30-sep-2010', 'dd-mon-yyyy' );

Execution Plan
----------------------------------------------------------
Plan hash value: 1601196873
```

NULLs and Cardinality

```
-------------------------------------------------------------------------
| Id  | Operation          | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |      | 36024 |  3588K|   339   (1)| 00:00:05 |
|*  1 |  TABLE ACCESS FULL| T    | 36024 |  3588K|   339   (1)| 00:00:05 |
-------------------------------------------------------------------------

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

   1 - filter("END_DATE"<=TO_DATE(' 2010-09-30 00:00:00', 'syyyy-mm-dd
              hh24:mi:ss') AND "END_DATE">=TO_DATE(' 2010-09-01 00:00:00',
              'syyyy-mm-dd hh24:mi:ss'))
```

NULLs and Cardinality

```
ops$tkyte%ORA11GR2> update t
  2     set end_date =
  3           to_date( '01-jan-9999','dd-mon-yyyy' )
  4    where end_date is null;

35378 rows updated.

ops$tkyte%ORA11GR2> commit;

Commit complete.
```

NULLs and Cardinality

```
ops$tkyte%ORA11GR2> begin
  2    dbms_stats.gather_table_stats(user, 'T');
  3 end;
  4 /

PL/SQL procedure successfully completed.
```

NULLs and Cardinality

```
ops$tkyte%ORA11GR2> select *
  2    from t
  3   where end_date
  4 between to_date('01-sep-2010', 'dd-mon-yyyy')
  5     and to_date('30-sep-2010', 'dd-mon-yyyy');

Execution Plan
----------------------------------------------------------
Plan hash value: 470836197
```

NULLs and Cardinality

```
-------------------------------------------------------------------------------
| Id  | Operation                    | Name  | Rows  | Bytes | Cost (%CPU)|
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT             |       |   175 | 18375 |    10   (0)|
|   1 |  TABLE ACCESS BY INDEX ROWID| T     |   175 | 18375 |    10   (0)|
|*  2 |   INDEX RANGE SCAN           | T_IDX |   175 |       |     2   (0)|
-------------------------------------------------------------------------------


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

   1 - filter("END_DATE"<=TO_DATE(' 2010-09-30 00:00:00', 'syyyy-mm-dd
              hh24:mi:ss') AND "END_DATE">=TO_DATE(' 2010-09-01 00:00:00',
              'syyyy-mm-dd hh24:mi:ss'))
```

“Wrong cardinality = Wrong Plan”

Nulls and Indexes

- There is a pervasive myth that indexes and NULLs are like matter and anti-matter
- There is the thought that “where column is null” cannot use an index
- There is a thought that NULLs are not indexed
- None of that is true…

NULLs and Indexes

```
ops$tkyte%ORA11GR2> create table t
  2  as
  3  select a.*,
  4         case when mod(rownum,100) > 1
  5              then object_type
  6          end otype
  7    from all_objects a;

Table created.
```

NULLs and Indexes

```
ops$tkyte%ORA11GR2> select count(*) from t where
otype is null;

  COUNT(*)
----------
      1445
```

NULLs and Indexes

```
ops$tkyte%ORA11GR2> begin
  2    dbms_stats.gather_table_stats( user, 'T' );
  3  end;
  4  /

PL/SQL procedure successfully completed.
```

NULLs and Indexes

```
ops$tkyte%ORA11GR2> create index t_idx
                         on t(otype,owner);

Index created.
```

NULLs and Indexes

```
ops$tkyte%ORA11GR2> set autotrace traceonly explain
ops$tkyte%ORA11GR2> select * from t where otype is null;

Execution Plan
----------------------------------------------------------
Plan hash value: 470836197
```

NULLs and Indexes

```
-------------------------------------------------------------------------------
| Id  | Operation                    | Name  | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT             |       |  1445 |   149K|    96   (0)| 00:00:02 |
|   1 |  TABLE ACCESS BY INDEX ROWID| T     |  1445 |   149K|    96   (0)| 00:00:02 |
|*  2 |   INDEX RANGE SCAN           | T_IDX |  1445 |       |     7   (0)| 00:00:01 |
-------------------------------------------------------------------------------

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

   2 - access("OTYPE" IS NULL)
```

NULLs and Indexes

```
ops$tkyte%ORA11GR2> drop index t_idx;

Index dropped.

ops$tkyte%ORA11GR2> create index t_idx
                              on t(otype,0);

Index created.
```

NULLs and Indexes

```
-------------------------------------------------------------------------------
| Id  | Operation                    | Name   | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT             |        |  1445 |   149K|     96   (0)| 00:00:02 |
|   1 |  TABLE ACCESS BY INDEX ROWID| T      |  1445 |   149K|     96   (0)| 00:00:02 |
|*  2 |   INDEX RANGE SCAN           | T_IDX  |  1445 |       |      7   (0)| 00:00:01 |
-------------------------------------------------------------------------------

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

   2 - access("OTYPE" IS NULL)
```

Nulls and Indexes

- What is true is that entirely NULL key entries are not made in B*Tree indexes
- Therefore, an index on just OTYPE cannot be used to find NULLs
- But – what about B*Tree cluster indexes and Bitmap indexes?


You are being
WATCHED!
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You are being WATCHED!

- 9i and before – V$ tables
- 10g – ASH and AWR are obvious
- But there is more
  - We watch what you ask for and change how statistics are gathered based on that.

You are being WATCHED!

```
ops$tkyte%ORA11GR2> create table t
  2  as
  3  select a.*,
  4         case when rownum < 500
  5              then 1
  6              else 99
  7          end some_status
  8    from all_objects a
  9  /
Table created.
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> begin
  2      dbms_stats.gather_table_stats(user,'T');
  3  end;
  4  /

PL/SQL procedure successfully completed.
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> select histogram
  2    from user_tab_cols
  3   where table_name = 'T'
  4     and column_name = 'SOME_STATUS';

HISTOGRAM
---------------
NONE
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> create index t_idx
                         on t(some_status);

Index created.
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> set autotrace traceonly explain
ops$tkyte%ORA11GR2> select * from t where some_status = 1;

Execution Plan
----------------------------------------------------------
Plan hash value: 1601196873

-------------------------------------------------------------------------------
| Id  | Operation          | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |      | 36115 |  3526K|   300   (1)| 00:00:04 |
|*  1 |  TABLE ACCESS FULL| T    | 36115 |  3526K|   300   (1)| 00:00:04 |
-------------------------------------------------------------------------------
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> select * from t where some_status = 99;

Execution Plan
----------------------------------------------------------
Plan hash value: 1601196873

-------------------------------------------------------------------------------
| Id  | Operation          | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |      | 36115 |  3526K|   300   (1)| 00:00:04 |
|*  1 |  TABLE ACCESS FULL| T    | 36115 |  3526K|   300   (1)| 00:00:04 |
-------------------------------------------------------------------------------
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> begin
  2    dbms_stats.gather_table_stats( user, 'T' );
  3  end;
  4  /

PL/SQL procedure successfully completed.
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> select histogram
  2    from user_tab_cols
  3   where table_name = 'T'
  4     and column_name = 'SOME_STATUS';

HISTOGRAM
---------------
FREQUENCY
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> select * from t where some_status = 1;

Execution Plan
----------------------------------------------------------
Plan hash value: 470836197

-------------------------------------------------------------------------------
| Id  | Operation                    | Name  | Rows  | Bytes | Cost (%CPU)| Time
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT             |       |   539 | 53900 |    10   (0)| 00:00
|   1 |  TABLE ACCESS BY INDEX ROWID| T     |   539 | 53900 |    10   (0)| 00:00
|*  2 |   INDEX RANGE SCAN           | T_IDX |   539 |       |     2   (0)| 00:00
-------------------------------------------------------------------------------
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> select * from t where some_status = 99;

Execution Plan
----------------------------------------------------------
Plan hash value: 1601196873

-------------------------------------------------------------------------------
| Id  | Operation          | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |      | 71683 |  7000K|   300   (1)| 00:00:04 |
|*  1 |  TABLE ACCESS FULL| T    | 71683 |  7000K|   300   (1)| 00:00:04 |
-------------------------------------------------------------------------------
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> select *
  2    from
  3  (
  4  select *
  5    from sys.col_usage$
  6   where obj# = (select object_id
  7                   from dba_objects
  8                  where object_name = 'T'
  9                    and owner = 'OPS$TKYTE' )
 10  )
 11   unpivot (value for x in
 12     ( EQUALITY_PREDS, EQUIJOIN_PREDS, NONEQUIJOIN_PREDS,
 13       RANGE_PREDS, LIKE_PREDS, NULL_PREDS ) )
 14  /
```

You are being WATCHED!

OBJ#	INTCOL#	TIMESTAMP	X	VALUE
98040	16	30-SEP-11	EQUALITY_PREDS	1
98040	16	30-SEP-11	EQUIJOIN_PREDS	0
98040	16	30-SEP-11	NONEQUIJOIN_PREDS	0
98040	16	30-SEP-11	RANGE_PREDS	0
98040	16	30-SEP-11	LIKE_PREDS	0
98040	16	30-SEP-11	NULL_PREDS	0

6 rows selected.

You are being WATCHED!

```
ops$tkyte%ORA11GR2> select * from t where
some_status > 100;

no rows selected

ops$tkyte%ORA11GR2> begin
  2    dbms_stats.gather_table_stats( user, 'T' );
  3  end;
  4  /
PL/SQL procedure successfully completed.
```

You are being WATCHED!

```
 OBJ#     INTCOL# TIMESTAMP X                      VALUE
---------- ---------- --------- ------------------ ----------
     98040         16 30-SEP-11 EQUALITY_PREDS              2
     98040         16 30-SEP-11 EQUIJOIN_PREDS              0
     98040         16 30-SEP-11 NONEQUIJOIN_PREDS           0
     98040         16 30-SEP-11 RANGE_PREDS                 1
     98040         16 30-SEP-11 LIKE_PREDS                  0
     98040         16 30-SEP-11 NULL_PREDS                  0

6 rows selected.
```

You are being WATCHED!

- You can ‘seed’ column stats pre-emptively
- Adds more “watching”
- Suggests possible extended statistics as well

You are being WATCHED!

```
ops$tkyte%ORA11GR2> begin
  2    dbms_stats.seed_col_usage( null, null, 10 );
  3  end;
  4  /

PL/SQL procedure successfully completed.
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> select *
  2    from t
  3   where owner = 'SYS'
  4     and object_type = 'DIMENSION';

no rows selected
```

You are being WATCHED!

```
ops$tkyte%ORA11GR2> select dbms_stats.report_col_usage( user, 'T' )
  2    from dual;

DBMS_STATS.REPORT_COL_USAGE(USER,'T')
------------------------------------------------------------------------------
LEGEND:
.......

EQ          : Used in single table EQuality predicate
RANGE       : Used in single table RANGE predicate
LIKE        : Used in single table LIKE predicate
NULL        : Used in single table is (not) NULL predicate
EQ_JOIN     : Used in EQuality JOIN predicate
NONEQ_JOIN  : Used in NON EQuality JOIN predicate
FILTER      : Used in single table FILTER predicate
JOIN        : Used in JOIN predicate
GROUP_BY    : Used in GROUP BY expression
```

You are being WATCHED!

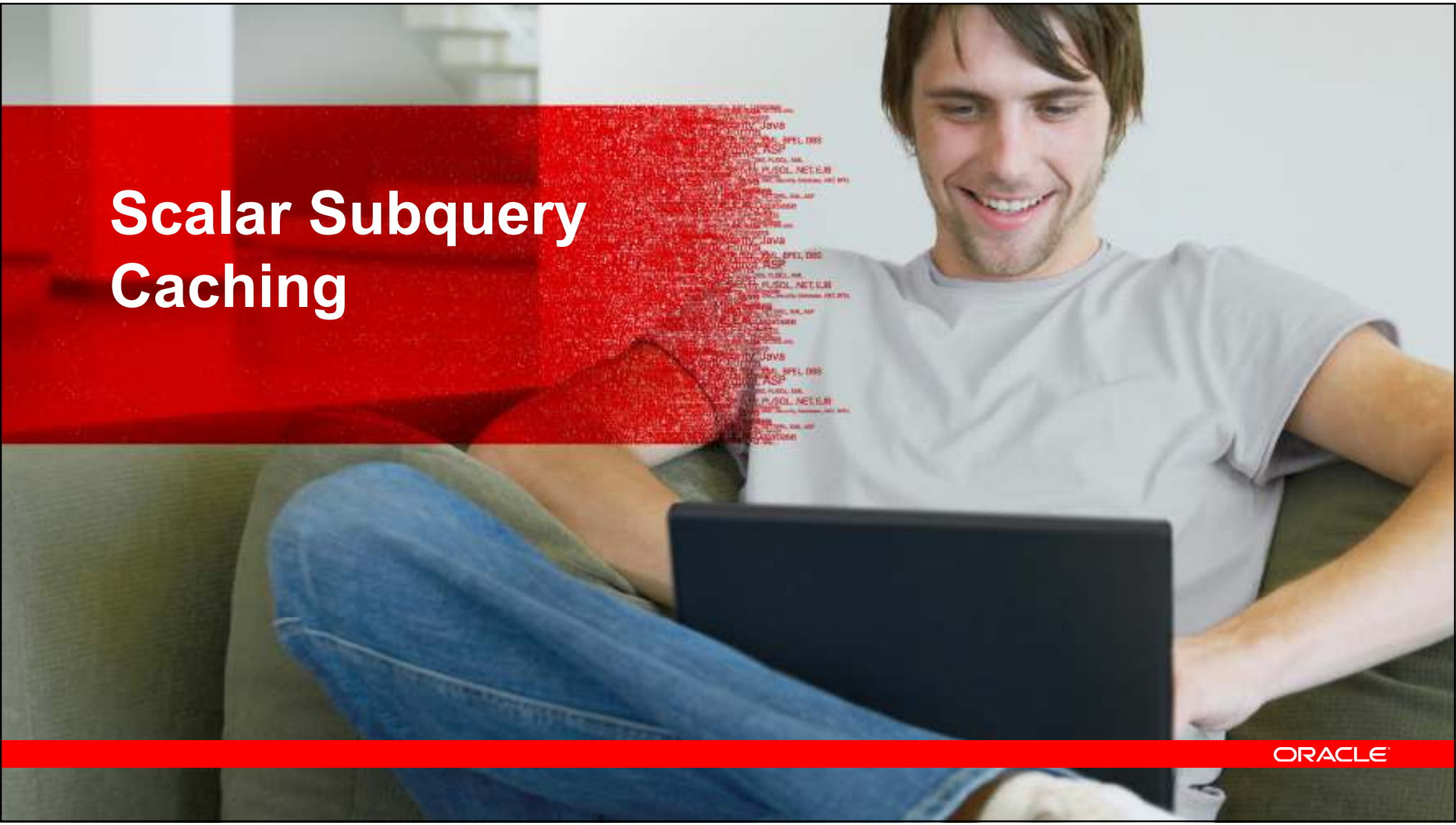
```
ops$tkyte%ORA11GR2> select dbms_stats.report_col_usage( user, 'T' )
  2    from dual;

...

COLUMN USAGE REPORT FOR OPS$TKYTE.T
.....................................

1. OBJECT_TYPE                          : EQ
2. OWNER                                : EQ
3. SOME_STATUS                          : EQ RANGE
4. (OWNER, OBJECT_TYPE)                 : FILTER
###############################################################################
```

Scalar Subquery Caching



Scalar Subquery Caching

- A scalar subquery is a query that returns zero or one rows and a single column
- Can be used anywhere an expression can be used
- Is executed conceptually once for each row it is processed against
- For example:

Scalar Subquery Caching

```
Select dname, (select count(*)
                 from emp
                where emp.deptno = dept.deptno)
  from dept;
```

Is a lot like….

Scalar Subquery Caching

```
Begin
      for x in (select dname, deptno from dept)
      loop
            select count(*) into cnt
              from emp
             where deptno = X.DEPTNO;

            dbms_output.put_line
            ( x.dname || ' ' || x.cnt );
      end loop;
End;
```

Scalar Subquery Caching

- Conceptually it is like that…
- In reality there is caching going on
- Up to 255 entries can be saved
- Only for the duration of the query! Not across queries

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> create table t
  2  as
  3  select *
  4    from all_objects;

Table created.
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> begin
  2    dbms_stats.gather_table_stats( user,'T' );
  3  end;
  4  /

PL/SQL procedure successfully completed.
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> create or replace
                    function f( x in varchar2 )
  2  return number
  3  as
  4  begin
  5      dbms_application_info.set_client_info
  6      ( to_number(userenv('client_info'))+1 );
  7
  8      return length(x);
  9  end;
 10  /
Function created.
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> variable startcpu number;
ops$tkyte%ORA11GR2> begin
  2       dbms_application_info.set_client_info(0);
  3       :startcpu := dbms_utility.get_cpu_time;
  4   end;
  5   /

PL/SQL procedure successfully completed.
```

This is run before every subsequent query…

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> select owner, f(owner) from t;

72233 rows selected.

ops$tkyte%ORA11GR2> select userenv('client_info') ci,
  2          dbms_utility.get_cpu_time-:startcpu cpu
  3     from dual;

CI                      CPU
---------- ----------
72233                   115
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> select owner,
                    (select f(owner) from dual) from t;
72233 rows selected.

ops$tkyte%ORA11GR2> select userenv('client_info') ci,
  2          dbms_utility.get_cpu_time-:startcpu cpu
  3     from dual;

CI                    CPU
---------- ----------
69                    25
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> create or replace
                    function f( x in varchar2 )
  2  return number
  3  DETERMINISTIC
  4  as
…
 10  end;
 11  /

Function created.
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> select owner, f(owner) from t;

72233 rows selected.

ops$tkyte%ORA11GR2> select userenv('client_info') ci,
  2          dbms_utility.get_cpu_time-:startcpu cpu
  3     from dual;

CI                      CPU
---------- ----------
8278                    74
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> create or replace
                    function f( x in varchar2 )
  2  return number
  3  RESULT_CACHE
  4  as
  5  begin
…
 10  end;
 11  /
Function created.
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> select owner, f(owner) from t;

72233 rows selected.

ops$tkyte%ORA11GR2> select userenv('client_info') ci,
  2         dbms_utility.get_cpu_time-:startcpu cpu
  3    from dual;

CI                    CPU
---------- ----------
35                    60
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> select owner, f(owner) from t;

72233 rows selected.

ops$tkyte%ORA11GR2> select userenv('client_info') ci,
  2          dbms_utility.get_cpu_time-:startcpu cpu
  3    from dual;

CI                    CPU
---------- ----------
0                     62
```

Scalar Subquery Caching

```
ops$tkyte%ORA11GR2> select owner,
                    (select f(owner) from dual) from t;
72233 rows selected.

ops$tkyte%ORA11GR2> select userenv('client_info') ci,
  2          dbms_utility.get_cpu_time-:startcpu cpu
  3     from dual;

CI                    CPU
---------- ----------
0                     22
```

Scalar Subquery Caching

How many times will g('scott') be invoked?

```
Select * from T where owner = g('scott');
```

It depends of course…

Scalar Subquery Caching

Now How many times will g('scott') be invoked?

```
Select * from T where owner =
(select g('scott') from dual);
```

It won't depend this time…

Statement Level *non*-Deterministic Functions

Statement level non-deterministic functions

- What is a deterministic function?
- What is a statement level deterministic function?
- Why do we care?

Statement level non-deterministic functions

```
ops$tkyte%ORA11GR2> create table t
  2  as
  3  select *
  4    from all_users
  5   where rownum <= 5;

Table created.
```

Statement level non-deterministic functions

```
ops$tkyte%ORA11GR2> create or replace function f
  2  return number
  3  as
  4      pragma autonomous_transaction;
  5      l_cnt  number;
  6  begin
  7      select count(*) into l_cnt from t;
  8
  9      insert into t (username, user_id, created )
 10      values ( 'hello', 123, sysdate );
 11      commit;
 12
 13      return l_cnt;
 14  end;
 15  /
```

Statement level non-deterministic functions

```
ops$tkyte%ORA11GR2> select count(*) over () cnt1,
  2           (select count(*) from t) cnt2,
  3           f() cnt3,
  4           (select f() from dual) cnt4
  5     from t;
```

Statement level non-deterministic functions

```
ops$tkyte%ORA11GR2> select count(*) over () cnt1,
  2          (select count(*) from t) cnt2,
  3          f() cnt3,
  4          (select f() from dual) cnt4
  5     from t;

      CNT1       CNT2       CNT3       CNT4
---------- ---------- ---------- ----------
         5          5          5          6
         5          5          7          6
         5          5          8          6
         5          5          9          6
         5          5         10          6
```

Statement level non-deterministic functions

```
ops$tkyte%ORA11GR2> create or replace
                    function f(p_scn in number)
  2  return number
  3  as
  4      pragma autonomous_transaction;
  5      l_cnt  number;
  6  begin
  7      select count(*) into l_cnt from t
  8          as of scn p_scn;
  9
 10      insert into t (username, user_id, created )
 11      values ( 'hello', 123, sysdate );
 12      commit;
 13
 14      return l_cnt;
 15  end;
 16  /
```

Statement level non-deterministic functions

```
ops$tkyte%ORA11GR2> variable scn number
ops$tkyte%ORA11GR2> exec :scn :=
                    dbms_flashback.get_system_change_number

PL/SQL procedure successfully completed.
```

Statement level non-deterministic functions

```
ops$tkyte%ORA11GR2> select count(*) over () cnt1,
  2          (select count(*) from t) cnt2,
  3          f(:scn) cnt3,
  4          (select f(:scn) from dual) cnt4
  5     from t;

      CNT1       CNT2       CNT3       CNT4
---------- ---------- ---------- ----------
         5          5          5          5
         5          5          5          5
         5          5          5          5
         5          5          5          5
         5          5          5          5
```

Statement level non-deterministic functions

```
ops$tkyte%ORA11GR2> insert into t
(username, user_id, created ) values
( 'x', 1, sysdate );

1 row created.

ops$tkyte%ORA11GR2> exec :scn :=
                dbms_flashback.get_system_change_number

PL/SQL procedure successfully completed.
```

Statement level non-deterministic functions

```
ops$tkyte%ORA11GR2> select count(*) over () cnt1,
  2          (select count(*) from t) cnt2,
  3          f(:scn) cnt3,
  4          (select f(:scn) from dual) cnt4
  5     from t;

      CNT1       CNT2       CNT3       CNT4
---------- ---------- ---------- ----------
         6          6          5          5
         6          6          5          5
         6          6          5          5
         6          6          5          5
         6          6          5          5
         6          6          5          5
6 rows selected.
```

Five things you probably didn't know about SQL

- SQLNet Compression
- NULLS and Indexes and Cardinality
- You are being watched!
- Scalar Subquery Caching
- Calling statement level non-deterministic functions

Q&A

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