SQL Tuning for Developers 101

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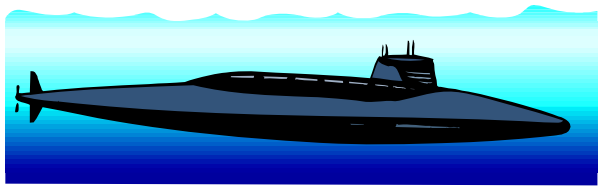

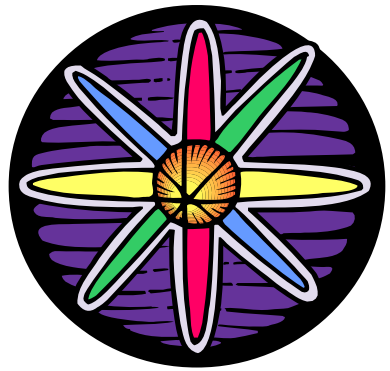

Nuclear Navy 6 years
- Nuclear Chemist/Programmer 10 years
- Kennedy Western University Graduate
- Bachelors Degree Computer Science
- Certified in all Oracle Versions Since 6
- Oracle DBA, author, 16 years

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What We Will Discuss

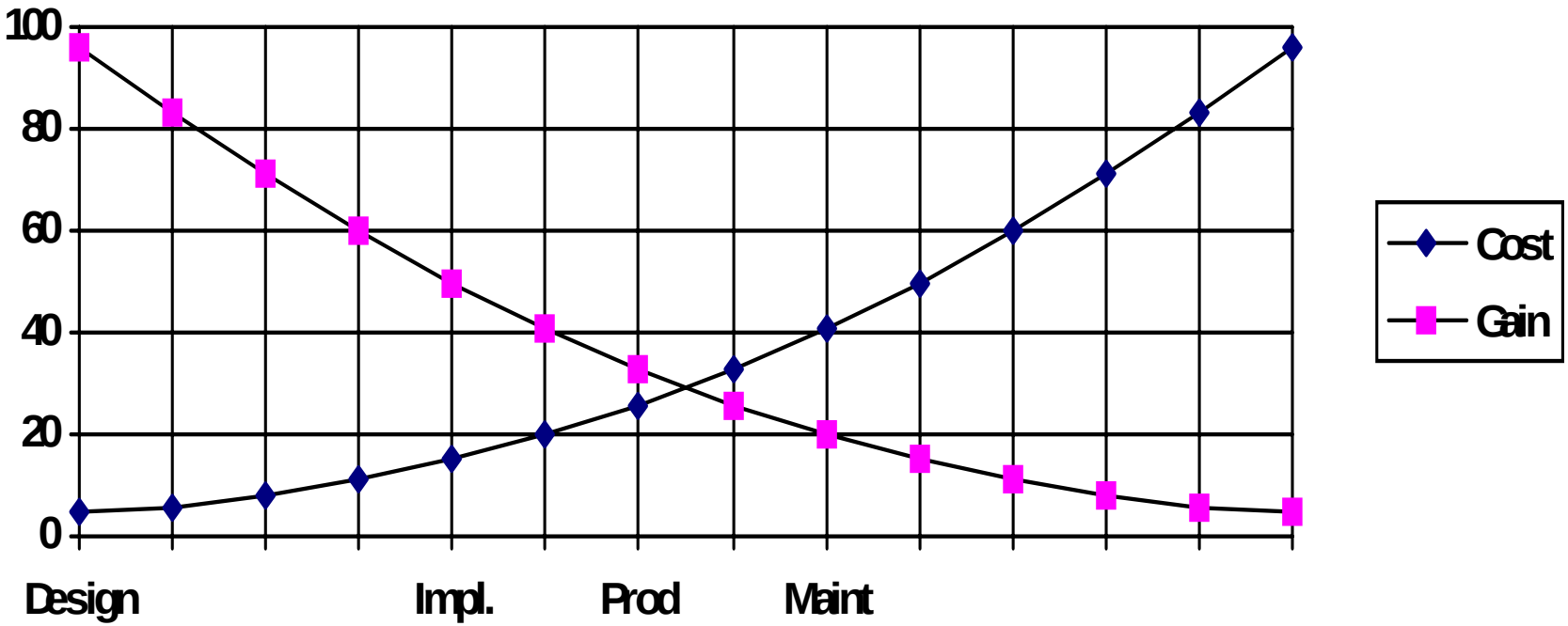
Basic Oracle Tuning Tools

- If you have Oracle you have them
- All developers should be aware of them
- All developers should be able to use them

Why Should Developers Tune?

- DBAs are responsible for tuning…right?
- Wrong! Everyone is!
- Oracle and third party tools make it easy. (Well, almost!)

Why Everyone?



Available Tools

- Explain Plan
- Trace, trcasst and TKPROF
- DBMS_PROFILER
- Events
- Statspack and AWR
- Database/Grid Control

Explain Plan

- Can be used standalone.
- Can be enabled at (SQLPLUS) command line.
- Most tools provide it.
- TKPROF Incorporates it.

Explain Plan Command

- **EXPLAIN PLAN [SET STATEMENT_ID = 'descriptor']**
- **[INTO table]**
- **FOR SQL statement;**
- **Must also have a PLAN_TABLE:**
- **Can use a central one**
- **Each user can run $ORACLE_HOME/rdbms/admin/utlxplan.sql**

Explain Plan Example

```
SQL> explain plan
  2  set statement_id='EXP PLAN EXAMPLE'
  3  for
  4  select t.owner,t.table_name,t.tablespace_name,
  5  i.index_name,i.tablespace_name
  6  from tkp_example t, tkp_example2 i
  7  where
  8  t.table_name=i.table_name and
  9  t.owner not in ('SYS','SYSTEM')
 10*
Explained.
```

Explain Plan Output

```
SQL> column position format 99999999
SQL> column object_name format a12
SQL> column options format a7
SQL> column operation format a15
SQL> select operation, options, object_name, id,  parent_id,
  2  position
  3  from plan_table
  4  where statement_id='EXP PLAN EXAMPLE'
  5* order by id
```

Explain Plan Output

```
OPERATION        OPTIONS  OBJECT_NAME   ID PARENT_ID  POSITION
---------------- -------- ----------- --- --------- ---------
SELECT STATEMENT                        0
MERGE JOIN                              1         0         1
SORT             JOIN                   2         1         1
TABLE ACCESS     FULL     TKP_EXAMPLE2  3         2         1
SORT             JOIN                   4         1         2
TABLE ACCESS     FULL     TKP_EXAMPLE   5         4         1
6 rows selected
```

Explain Plan Formatted

```
SQL> column query_plan format a60
SQL> select lpad(' ',2*level)||operation||' '||object_name query_plan
  2  from plan_table where statement_id is not null
  3  connect by prior id=parent_id
  4  start with id=0;
QUERY_PLAN
------------------------------------------------------------
  SELECT STATEMENT
    MERGE JOIN
      SORT
        TABLE ACCESS TKP_EXAMPLE2
      SORT
        TABLE ACCESS TKP_EXAMPLE
6 rows selected.
```

Plan Table Contents

- Objects
- Actions
- Costs
- Partitions
- Options
- Orders
- Parents
- And much more!

V$SQL_PLAN

- **9i and 10g also have V$SQL_PLAN**
- Contains same information (nearly) as PLAN_TABLE
- However, contains plans for all current SQL in SGA

Command Line Explain Plan

- **SQL> set autotrace on**
- **SQL> set timing on**
- **Autotrace has the options:**
- **OFF**
- **ON**
- **TRACE[ONLY]**
- **EXP[LAIN]**
- **STAT[ISTICS]**

DEMO!

- Let’s look at a demonstration!

Use of TKPROF to Tune Statements

- Must have run SQL with TRACE enabled
- Trace can be enabled at:
  - System
  - Session
- Via:
  - ALTER SYSTEM|SESSION
  - Initialization parameters
  - Special procedures
  - Event settings
- Example:
- **ALTER SESSION SET TIMED_STATISTICS=TRUE;**
- **ALTER SESSION SET SQL_TRACE=TRUE;**

TKPROF and Tracing

- **Tracing Forms, Reports**
- DBMS_SESSION.SET_SQL_TRACE
- TIMED_STATISTICS parameter must still be set manually or via a call using EXECUTE IMMEDIATE on versions prior to Oracle8i
- In Oracle9i:
  - DBMS_SYSTEM.SET_INT_PARAM_IN_SESSION
  - Alters the settings of session alterable parameters.

TKPROF and Tracing

- **Tracing another session**
- DBMS_SYSTEM.
  SET_SQL_TRACE_IN_SESSION
- oradebug program
- Use system events.

Trace Example

- *** SESSION ID:(22.5565) 2005-06-09 13:44:06.977
- APPNAME mod='SQL*Plus' mh=3669949024 act='' ah=4029777240
- =====================
- PARSING IN CURSOR #1 len=32 dep=0 uid=5 oct=42 lid=5 tim=10854727691 hv=3943786303 ad='1cddf17c'
- alter session set sql_trace=true
- END OF STMT
- EXEC #1:c=0,e=102,p=0,cr=0,cu=0,mis=0,r=0,dep=0,og=4,tim=10854718587
- =====================
- PARSING IN CURSOR #1 len=175 dep=0 uid=5 oct=3 lid=5 tim=10856304813 hv=1541441151 ad='1cede18c'
- select a.tablespace_name, b.file_name, a.initial_extent
- from
- test1 a,
- test2 b

Trace Example

- where a.tablespace_name=b.tablespace_name
- order by a.tablespace_name
- END OF STMT
- PARSE #1:c=0,e=2163,p=0,cr=0,cu=0,mis=1,r=0,dep=0,og=4,tim=10856304805
- EXEC #1:c=0,e=85,p=0,cr=0,cu=0,mis=0,r=0,dep=0,og=4,tim=10856310122
- FETCH #1:c=0,e=1039,p=0,cr=6,cu=0,mis=0,r=1,dep=0,og=4,tim=10856311780
- FETCH #1:c=0,e=36,p=0,cr=0,cu=0,mis=0,r=15,dep=0,og=4,tim=10856313026
- FETCH #1:c=0,e=73,p=0,cr=0,cu=0,mis=0,r=4,dep=0,og=4,tim=10856331857
- STAT #1 id=1 cnt=20 pid=0 pos=1 obj=0 op='SORT ORDER BY '
- STAT #1 id=2 cnt=20 pid=1 pos=1 obj=0 op='HASH JOIN '
- STAT #1 id=3 cnt=20 pid=2 pos=1 obj=37981 op='TABLE ACCESS FULL OBJ#(37981) '
- STAT #1 id=4 cnt=20 pid=2 pos=2 obj=37982 op='TABLE ACCESS FULL OBJ#(37982) '

Trace Example

- Good data
- Not very readable
- This is where TKPROF comes in

TKPROF Command

- tkprof tracefile outputfile [explain=] [table=][print=] [insert=] [sys=] [sort=]

- **table=schema.tablename** Use 'schema.tablename' with 'explain=' option.
- **explain=user/password** Connect to ORACLE and issue EXPLAIN PLAN.
- **print=integer** List only the first 'integer' SQL statements.
- aggregate=yes|no
- **insert=filename** List SQL statements and data inside INSERT statements.
- **sys=no** TKPROF does not list SQL statements run as user SYS.
- **record=filename** Record non-recursive statements found in the trace file.
- **waits=yes|no** Record summary for any wait events found in the trace file.
- **sort=option** Set of zero or more of the sort options.

DEMO!

- Let’s look at a demonstration!

DBMS_PROFILER

- Like statspack only for PL/SQL
- Traces each line executed for timings and number of times executed
- Must be built using PROFLOAD.SQL and support tables built with PROFTAB.SQL
- Must explicitly flush data if it is to be retained
- Database and Grid control has interface as do some 3rd party tools

DBMS_PROFILER Contents

- START_PROFILER function
- STOP_PROFILER Function
- FLUSH_DATA Function
- GET_VERSION Procedure
- INTERNAL_VERSION_CHECK Procedure

DBMS_PROFILER Example

```
declare
x integer;
begin
x:=dbms_profiler.start_profiler('Test Profiler');
dbms_revealnet.just_statistics;
x:=dbms_profiler.flush_data;
x:=dbms_profiler.stop_profiler;
end;
/
```

- NOT A CORRECT USAGE! Calls must be inside PL/SQL object to be profiled.

DBMS_PROFILER Example

```
SQL> select runid, run_date, run_total_time,
run_comment from plsql_profiler_runs;

     RUNID RUN_DATE  RUN_TOTAL_TIME RUN_COMMENT
--------- --------- -------------- --------------
         1 05-SEP-99      6.802E+11 Test Profiler
         2 05-SEP-99         533133

SQL> select runid,unit_number,unit_type,unit_owner,
unit_name, unit_timestamp,
  2  total_time from plsql_profiler_units where
runid=2;
```

DBMS_PROFILER Example

```
RUNID UNIT UNIT_TYPE        UN_OWNER    UN_NAME       UNIT_TIME
TOTALTIME
----- ---- -------------- ---------- -----------  --------- ------
---
    2    1 ANONYMOUS BLOCK <anonymous> <anonymous>  00-DECEMB
0
    2    2 PACKAGE BODY    SYS         DBMS_PROFILER 05-SEP-99
0

2 rows selected.


SQL> select runid,unit_number, line#,total_occur, total_time,
min_time, max_time
  2  from plsql_profiler_data where runid=2
```

DBMS_PROFILER Example

```
RUNID UNIT  LINE# TOTAL_OCCUR TOTAL_TIME MIN_TIME  MAX_TIME
----- ---- ------ ----------- ---------- ---------- ----------
    2    1      6           1      20117      20117      20117
    2    1      7           1      37566      37566      37566
    2    2      8           2     125887       4158     121728
    2    2     51           2       7301       2917       4383
    2    2     60           1      19431      19431      19431
    2    2     65           2      15498       6135       9362
    2    2     68           1       2001       2001       2001
    …

17 rows selected.
```

DBMS_PROFILER Example

```
SQL> @test_profiler2
SQL> declare
  2  x integer;
  3  begin
  4  x:=dbms_profiler.start_profiler('Test Profiler2');
  5  dbms_revealnet.just_statistics;  ← We have added calls internally
  6  x:=dbms_profiler.flush_data;
  7  x:=dbms_profiler.stop_profiler;
  8  end;
  9  /

PL/SQL procedure successfully completed.

SQL> select runid, run_date, run_total_time, run_comment from plsql_profiler_runs;
```

DBMS_PROFILER Example

```
RUNID RUN_DATE  RUN_TOTAL_TIME RUN_COMMENT
--------- --------- ------------- --------------------
        1 05-SEP-99      6.802E+11 Test Profiler
        2 05-SEP-99         533133
        3 05-SEP-99      1.393E+09 Test Profiler2
        4 05-SEP-99         522158

SQL> select runid,unit_number,unit_type,unit_owner, unit_name,
unit_timestamp,
  2  total_time from plsql_profiler_units where runid>2;

    RUNID NUMBER TYPE         OWNER  UNIT_NAME       UNIT_TIME
TOTAL_TIME
------ ------- ----------- ------ -------------- --------- -------
---
     3       1 PACKAGE BODY SYS    DBMS_PROFILER   05-SEP-99
0
     3       2 ANONYMOUS BL <anon> <anonymous>     00-DECEMB
0
     3       3 PACKAGE BODY SYSTEM DBMS_REVEALNET  05-SEP-99
0
     4       1 ANONYMOUS BL <anon> <anonymous>     00-DECEMB
0
     4       2 PACKAGE BODY SYS    DBMS_PROFILER   05-SEP-99
```

DBMS_PROFILER Example

```
SQL> select runid,unit_number, line#,total_occur, total_time,
min_time, max_time
  2  from plsql_profiler_data where runid>2;

 RUNID    UNIT     LINE# TOTAL_OCCUR TOTAL_TIME  MIN_TIME  MAX_TIME
------ ------- --------- ----------- ---------- --------- ---------
     3       1         8          12  109762112      3492  98948661
     3       2         5           1    5034924   5034924   5034924
     3       2         6           1      41565     41565     41565
     3       3         7           1     790506    790506    790506
     3       3        16           1   25397557  25397557  25397557
     3       3       773           1   23248826  23248826  23248826
     3       3       774           1      19196     19196     19196
     3       3       946           1     833808    833808    833808
     3       3       949           1       4568      4568      4568
     3       3       951          15   82645188    160706  80156282
     4       2        68           1       1941      1941      1941
 599 rows selected.
```

DBMS_PROFILER Example

RUNID	UNIT	LINE#	TOTAL OCCUR	TOTAL_TIME	MIN_TIME	MAX_TIME
3	3	16	1	25397557	25397557	25397557
3	3	650	1	15901801	15901801	15901801
3	3	773	1	23248826	23248826	23248826
3	3	920	1	870328854	870328854	870328854
3	3	941	5	68741980	272176	67312025
3	3	951	15	82645188	160706	80156282

Finding The problem Line

```
SQL>select source from source$ where obj#=3315 and line=920 /
SOURCE
----------------------------------------------------------
     SELECT SUM(BYTES)/1048576 INTO stat_val
SQL> select line, source from source$ where obj#=3315 and line
between 918 and 923
LINE SOURCE
---- ----------------------------------------------------------
918 BEGIN
919   stat_name := 'TOTAL USED MEG';
920       SELECT SUM(BYTES)/1048576 INTO stat_val
921       FROM dba_extents;
922 INSERT INTO dba_temp VALUES(stat_name,stat_val,26);
923 EXCEPTION

6 rows selected.
```

Controlling DBMS_PROFILER

- By pre-instrumenting procedures, functions and other stored objects, recompiles are avoided
- Use a central debugging package to avoid reinventing the wheel

Profiler Control

```
PROCEDURE profiler_control(
start_stop IN VARCHAR2, run_comm IN VARCHAR2, ret OUT
BOOLEAN) AS
ret_code INTEGER;
BEGIN
 ret_code:=
  dbms_profiler.internal_version_check;
  IF ret_code !=0 THEN
   ret:=FALSE;
  ELSIF start_stop NOT IN ('START','STOP') THEN
   ret:=FALSE;
  ELSIF start_stop = 'START' THEN
   ret_code:=DBMS_PROFILER.START_PROFILER(
    run_comment1=>run_comm);
```

Profiler Control

```
IF ret_code=0 THEN
    ret:=TRUE;
   ELSE
    ret:=FALSE;
   END IF;
  ELSIF start_stop = 'STOP' THEN
   ret_code:=DBMS_PROFILER.FLUSH_DATA;
   ret_code:=DBMS_PROFILER.STOP_PROFILER;
   IF ret_code=0 THEN
    ret:=TRUE;
   ELSE
    ret:=FALSE;
   END IF;
  END IF;
END profiler_control;
```

Using Profiler Control

```
BEGIN
IF RUN_PROFILER THEN
DBA_UTILITIES.PROFILER_CONTROL('START'
,
'JUST_STATISTICS',b_ret);
END IF;
…
IF RUN_PROFILER THEN
DBA_UTILITIES.PROFILER_CONTROL('STOP',
'JUST_STATISTICS',b_ret);
END IF;
END;
```

Example

```
DECLARE
run_profiler boolean;
BEGIN
dba_utilities.run_profiler:=TRUE;
dba_utilities.running_stats(TRUE);
END;
/
```

DBMS_PROFILER Summary

- The DBMS_PROFILER package contains functions that a DBA or developer should use to examine the line-by-line performance of a procedure, function or other stored object
- By simply embedding calls to the DBMS_PROFILER functions into the source code of the object to be monitored a great deal of valuable information about executions and timings for each line of code in the object are gathered.

Using Events

- Allow us to fine tune how Oracle does certain operations.
- To fine tune SQL tracing we can use the 10046 event.

Setting an Event

- Means to tell oracle to generate information in form of a trace file in the context of the event specified.
- Trace file is usually located in USER_DUMP_DEST.
- The resulting trace file provides detailed information about the event traced
- The general format for an event is:

- **EVENT = "<trace class> <event name> <action> <name><trace name><qualifier>"**

Event Types

- 2 types of events:
  - session-events
  - process-events
- Process-events initialized in the parameter file
- Session-events initialized with "ALTER SESSION..." or "ALTER SYSTEM" commands
- Oracle server first checks for session events then for process-events.

Event Classes

- There are 4 traceable event classes:
- Class 1 "Dump something": These events can not be set in the init<SID>.ora but must be set using the ALTER SESSION or the DBMS_SYSYTEM.SET_EV() procedure.
- Class 2 -- "Trap on Error" : Causes oracle to generate an errorstack every time the event occurs.
- Class 3 -- "Change execution path" : Change the execution path for some specific Oracle internal code segment. For example, setting event "10269" prevents SMON from doing free space coalescing.
- Class 4 -- "Trace something": Bbtain traces that are used for, e.g., SQL tuning. I.E. "10046" which causes oracle to trace the SQL access path on each SQL-statement.

Event Arguments

Trace Class	Event Name	Action Key Word	"Name"	Trace Name	Trace Qualifier
Dump Something	immediate	trace	"name"	blockdump redohdr file_hdrs controlf systemstate	level block# level 10 level 10 level 10 level 10
Trap on error	Error number	trace	"name"	Errorstack processstate Heapdump	Forever Off Level n
Change execution path	Even code corresponding to path	trace	"name"	context	Forever or level 10
Trace something	10046	trace	"name"	context	Forever Level n off

Initialization File Event Settings

- The EVENTS commands in an init<SID>.ora file have generally been placed there at the command of Oracle support
- In an Oracle applications instance you may see several events set (as well as several undocumented initialization parameters).
- These alerts turn on advanced levels of tracing and error detection
- The syntax to specify multiple events in the init.ora is:

- **EVENT="<event 1>:<event 2>: <event 3>: <event n>"**

Initialization File Event Settings

- Split events on multiple lines using the continuation "\" backslash character at the end of each :

```
EVENT="<event 1>:\
    <event 2>:\
    <event 3>: \
    <event n>“
```

- For Example:

```
EVENT="\
    10210 trace name context forever, level 10:\
    10211 trace name context forever, level 10:\
    10231 trace name context forever, level 10:\
    10232 trace name context forever, level 10"
```

Initialization File Event Settings

- With almost all EVENT specify them at the session level using the ALTER SESSION command or a call to the DBMS_SYSTEM.SET_EV() procedure
- Will not require an instance bounce for the EVENT to take effect.

Alert Log and Events

- The alert.log should show the events that are in effect, for example:
- **event = 10210 trace name context forever, level 10:10211 trace name context for ever, level 10:10231 trace name context forever, level 10:10232 trace name context forever, level 10**

Setting an Event

- To enable the maximum level of SQL performance monitoring (this works in concert with the SQL trace utility):
- **event = "10046 trace name context forever, level 12"**

Events at the Session Level

- ALTER SESSION command or calls to the DBMS_SYSTEM.SET_EV() procedure. Format for the ALTER SESSION command is:

- **`ALTER SESSION SET EVENTS 'ev_number ev_text level x';`**

- Where:
- Ev_number is the event number
- Ev_text is any required text (usually "trace name context forever")
- x is the required level setting corresponding to the desire action, file or other required data.

Session Example

- **`ALTER SESSION SET EVENTS '10046 trace name context forever level NN'`**
- where NN:
- 1 -- same as a regular trace
- 4 -- also dump bind variables
- 8 -- also dump wait information
- 12 -- dump both bind and wait information

Demo!

- Let’s look at a demonstration!

Seeing What the Optimizer Does

- Event 10053 gives the detail of the various plans considered
- Be very careful with this for large multi-table joins as the report can be quite lengthy!
- The data density, sparse characteristics, index availability, index depth all lead the optimizer to make its decisions
- You can see the running commentary in trace files generated by 10053 event

Using 10053 event

1. Connect to Oracle using SQL*Plus as the appropriate user
2. Issue the following series of commands:

- `SQL> ALTER SESSION SET EVENTS '10053 trace name context forever, level 1';`
- `Session altered.`
- `SQL> EXPLAIN PLAN FOR --SQL STATEMENT--;`
  `Explained.`
- `SQL> exit`

Demo!

- Let’s look at a demonstration!

What Events Are Set In My Session?

```
set serveroutput on size 1000000
 declare
  event_level number;
 begin
  for i in 10000..10999 loop
     sys.dbms_system.read_ev(i,event_level);
     if (event_level > 0) then
        dbms_output.put_line('Event
'||to_char(i)||' set at level '||

to_char(event_level));
     end if;
  end loop;
 end;
 /
```

Demo!

- Let’s look at a demonstration!
- (Feels like I am back in the 60’s…)

Using DBMS_SYSTEM.SET_EV

```
DBMS_SYSTEM.SET_EV(
SI         Binary_integer,
SE         Binary_integer,
EV         Binary_integer,
LE         Binary_integer,
NM  VARCHAR2);
```

- Where:
- SI -- Oracle SID value
- SE -- Oracle Serial number
- EV -- Oracle event to set
- LE -- Event level
- NM -- Name

Using DBMS_SYSTEM.SET_EV

- **For example:**
- **EXECUTE SYS.DBMS_SYSTEM.SET_EV(sid,serial#,10046,level,'');**

Demo!

- One more time!

The DBMS_SYSTEM.READ_EV Procedure

- The DBMS_SYSTEM.READ_EV has the following syntax:
- **DBMS_SYSTEM.READ_EV(**
- **IEVbinary_integer,**
- **OEVbinary_integer);**

- Where:

- IEV -- Oracle event (in value)
- OEV -- Oracle event setting (out value)

- For example:
- **EXECUTE sys.dbms_system.read_ev(i,event_level);**

Are they Supported?

- Oracle support would either say to use or not use DBMS_SYSTEM SET_EV and READ_EV depending on the analyst, day of the week and phase of the moon.
- They are documented in many postings on the Metalink forums.
- In new releases (>9i) the DBMS_SYSTEM package is shipped with the other DBMS packages and is documented in the appropriate manuals.

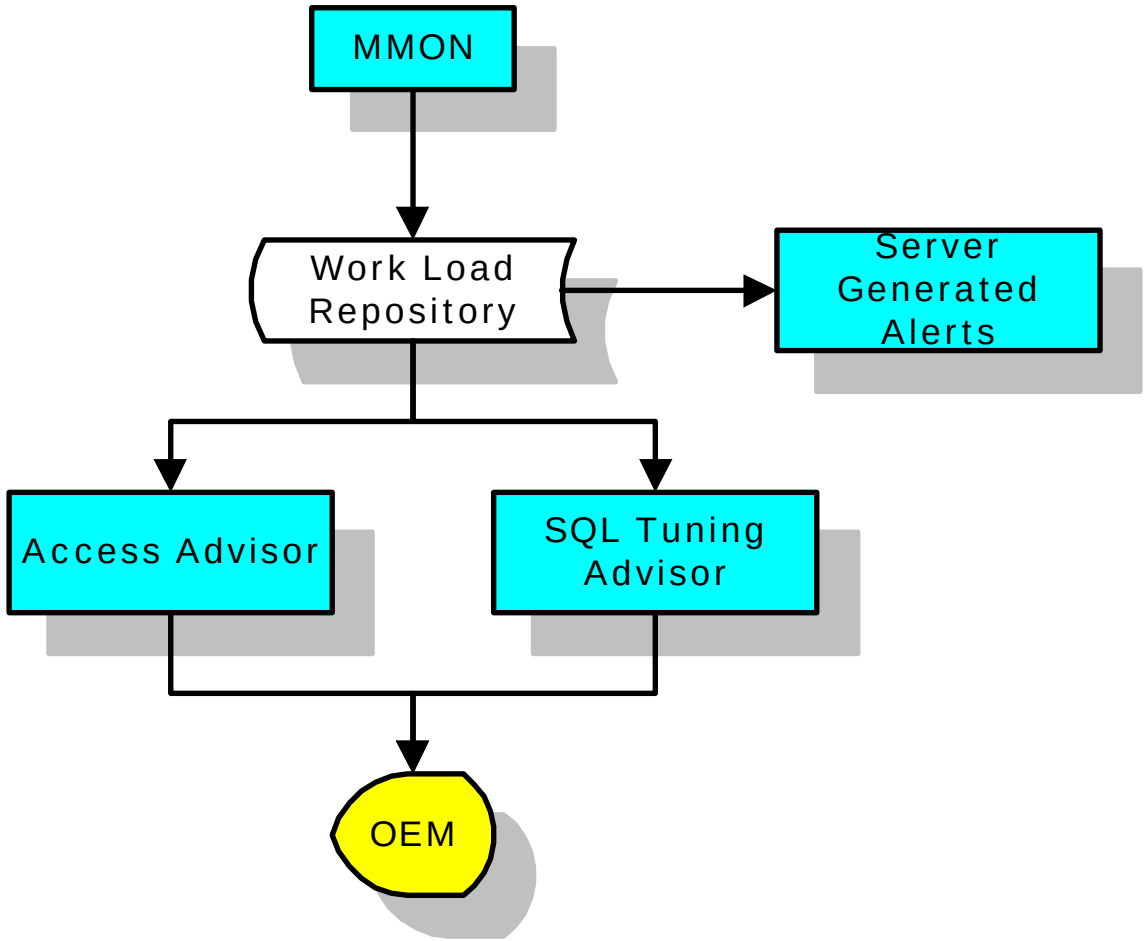
Statspack and AWR

- Statspack was first available in 8.1.7
- New and improved version of the old utlbstat/utlestat scripts
- Statspack improved on that by leaving tables in place an allowing you to collect multiple sets of statistics into them.
- You would then use the provided reports to generate a stastspack report across any two sets of statistics that would give you a delta report on the statistics, details about SQL that was generated and general physical health statistics for the database.

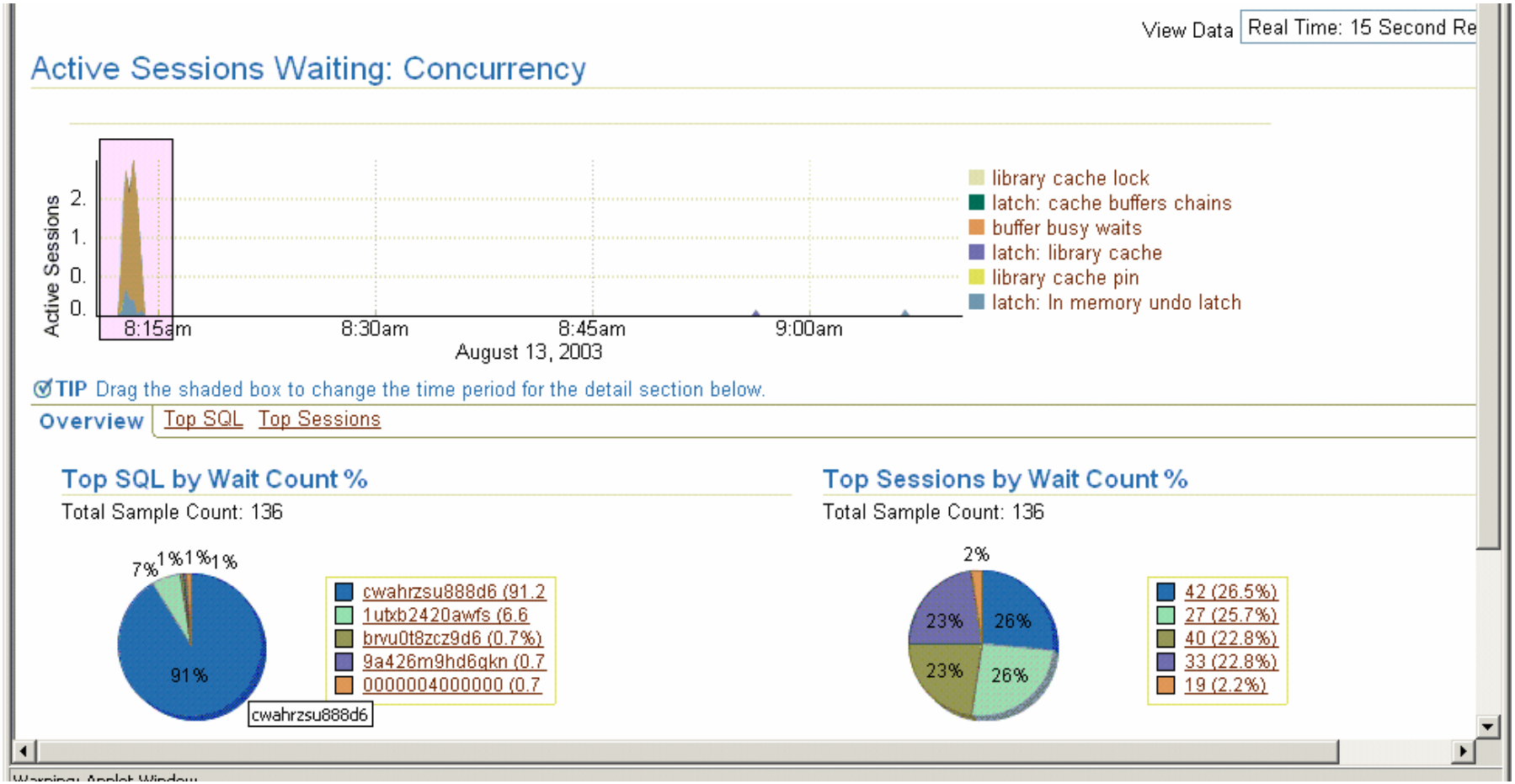
AWR

- In 10g we now have AWR.
- Defaults to a collection interval every 30 minutes
- AWR is like STATSPACK, top SQL is collected every hour, based on your rolling thresholds for high-use SQL.
- AWR collects detailed run-time statistics on the top SQL
- This ensures that AWR collects the most resource intensive SQL.
- Reports can be run against the AWR tables that provide the same type of data a statspack report used to, and, much more.
- AWR takes advantage of the ADDM (Adam)

Automatic Database Diagnostic Monitor



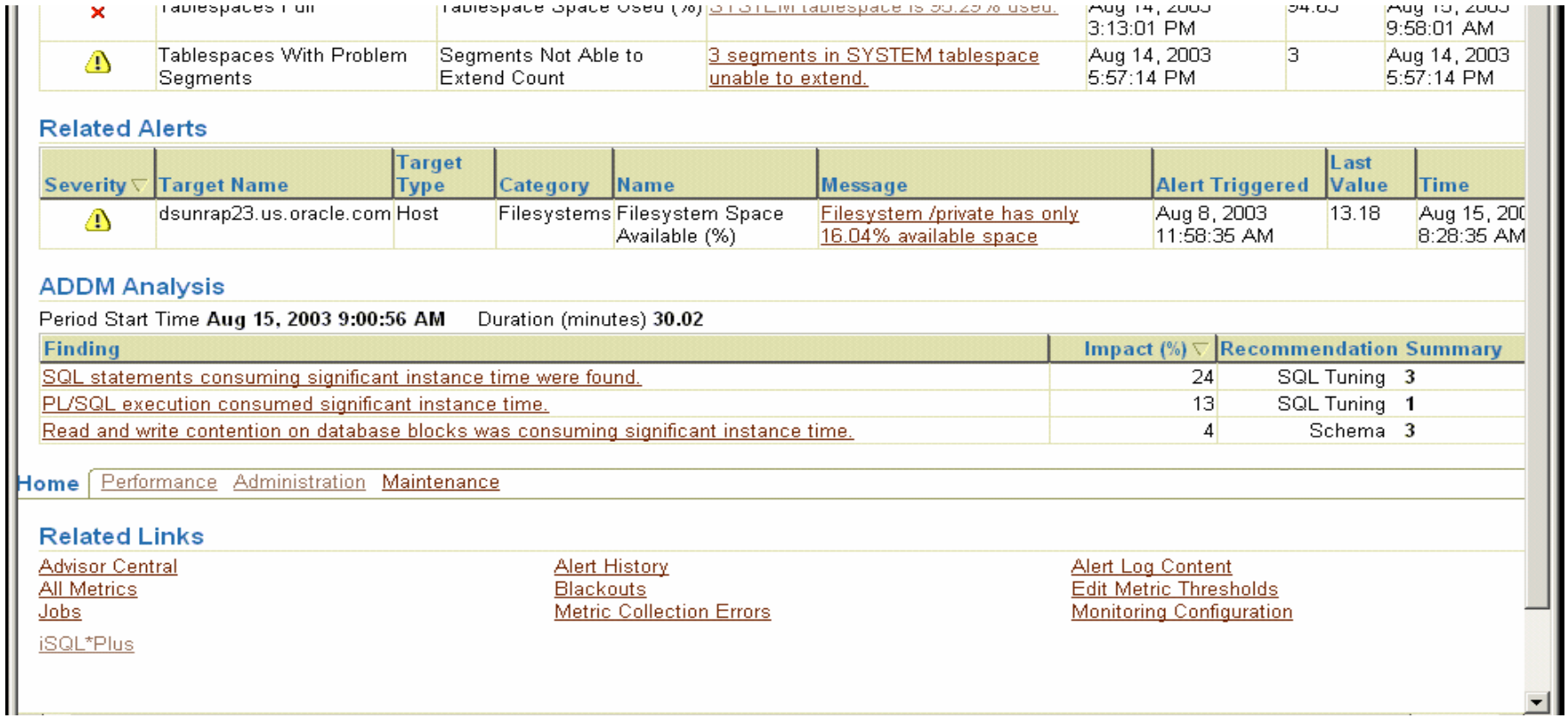
ADDM


View Data
Real Time: 15 Second Re
Active Sessions Waiting: Concurrency
Active Sessions
2.
1.
0.
0.
8:15am
8:30am
8:45am
9:00am
August 13, 2003
library cache lock
latch: cache buffers chains
buffer busy waits
latch: library cache
library cache pin
latch: In memory undo latch
TIP Drag the shaded box to change the time period for the detail section below.
Overview
Top SQL
Top Sessions
Top SQL by Wait Count %
Total Sample Count: 136
7%
1%
1%
1%
91%
cwahrzsu888d6 (91.2
1utxb2420awfs (6.6
brvu0t8zcz9d6 (0.7%)
9a426m9hd6qkn (0.7
0000004000000 (0.7
cwahrzsu888d6
Top Sessions by Wait Count %
Total Sample Count: 136
2%
23%
26%
23%
26%
42 (26.5%)
27 (25.7%)
40 (22.8%)
33 (22.8%)
19 (2.2%)

ADDM


Host: dsunrap23.us.oracle.com
Home
Performance
Targets
Configuration
Page Refreshed Aug 15, 2003 10:06:32
General
Status Up
Boot Time Jul 23 15:06
Time Zone PDT
Availability (%) 100
(Last 24 Hours)
Configuration
Operating System SunOS 5.8 Generic_108528-15 (64-bit)
Hardware Platform Sun Fire V100
IP Address 144.25.32.163
Number of CPUs 1
Memory Size (MB) 2048
Disk Space (GB) 67.47
Job Activity
Scheduled Executions 0
Running Executions 0
Suspended Executions 0
Problem Executions 1
(Last
Advice
Policy Violations 0
Alerts
Metric Name
Severity
Alert Triggered
Value
Last Checked
Filesystem Space Available (%) for /private
Aug 8, 2003 11:58:35 AM
13.17
Aug 15, 2003 8:28:35 AM
Related Links
Alert History
Edit Metric Thresholds
Open Telnet Session
All Metrics
Monitoring Configuration
User-Defined Metrics
Blackouts
Net Services Administration

ADDM



✗	Tablespaces Full	Tablespace Space Used (%)	SYSTEM tablespace is 93.29 % used.	Aug 14, 2003 3:13:01 PM	94.03	Aug 15, 2003 9:58:01 AM
⚠	Tablespaces With Problem Segments	Segments Not Able to Extend Count	3 segments in SYSTEM tablespace unable to extend.	Aug 14, 2003 5:57:14 PM	3	Aug 14, 2003 5:57:14 PM

Related Alerts

Severity	Target Name	Target Type	Category	Name	Message	Alert Triggered	Last Value	Time
⚠	dsunrap23.us.oracle.com	Host	Filesystems	Filesystem Space Available (%)	Filesystem /private has only 16.04% available space	Aug 8, 2003 11:58:35 AM	13.18	Aug 15, 200 8:28:35 AM

ADDM Analysis

Period Start Time **Aug 15, 2003 9:00:56 AM** Duration (minutes) **30.02**

Finding	Impact (%)	Recommendation Summary
SQL statements consuming significant instance time were found.	24	SQL Tuning **3**
PL/SQL execution consumed significant instance time.	13	SQL Tuning **1**
Read and write contention on database blocks was consuming significant instance time.	4	Schema **3**

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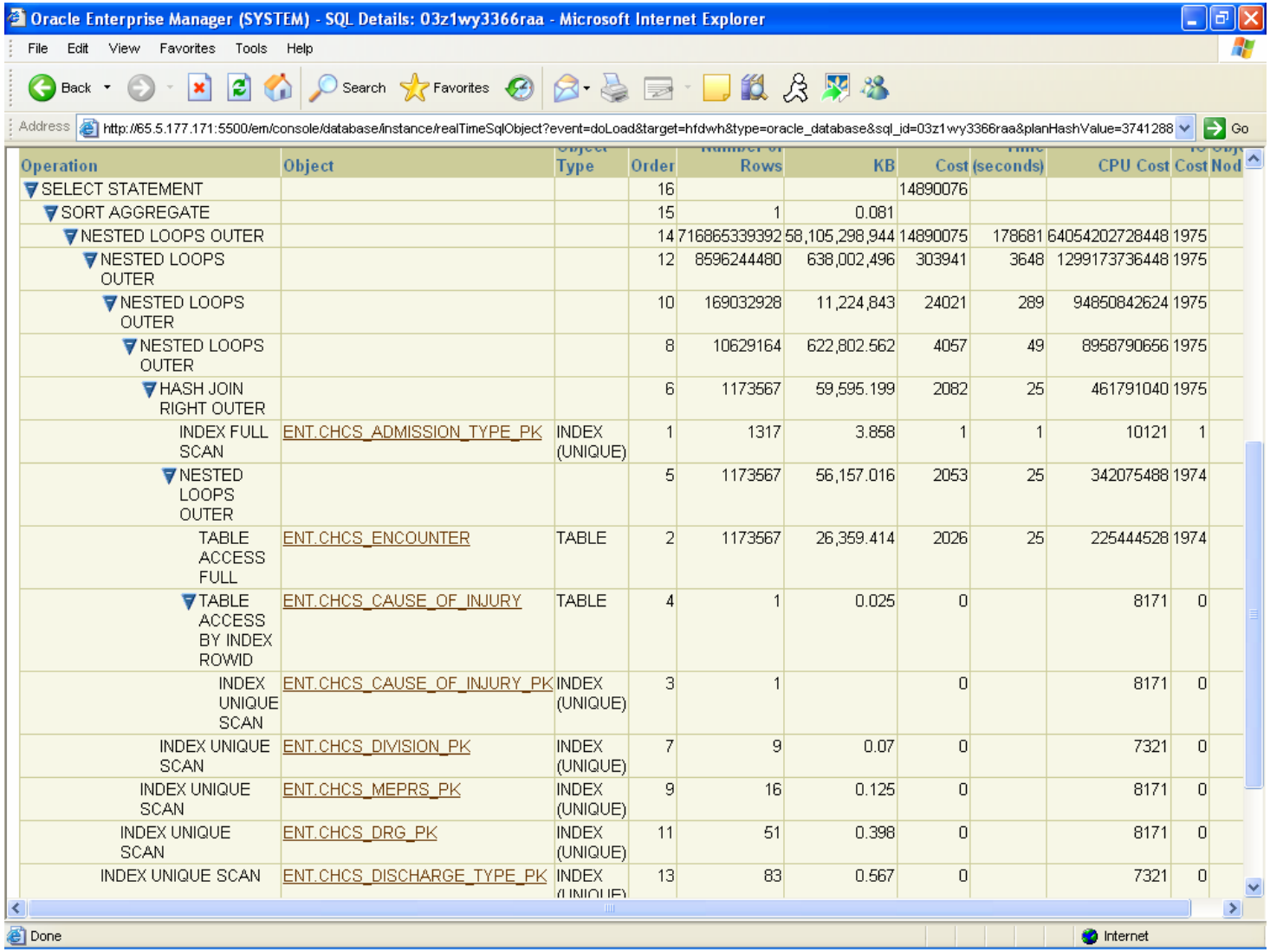
Related Links

Advisor Central
All Metrics
Jobs
iSQL*Plus

Alert History
Blackouts
Metric Collection Errors

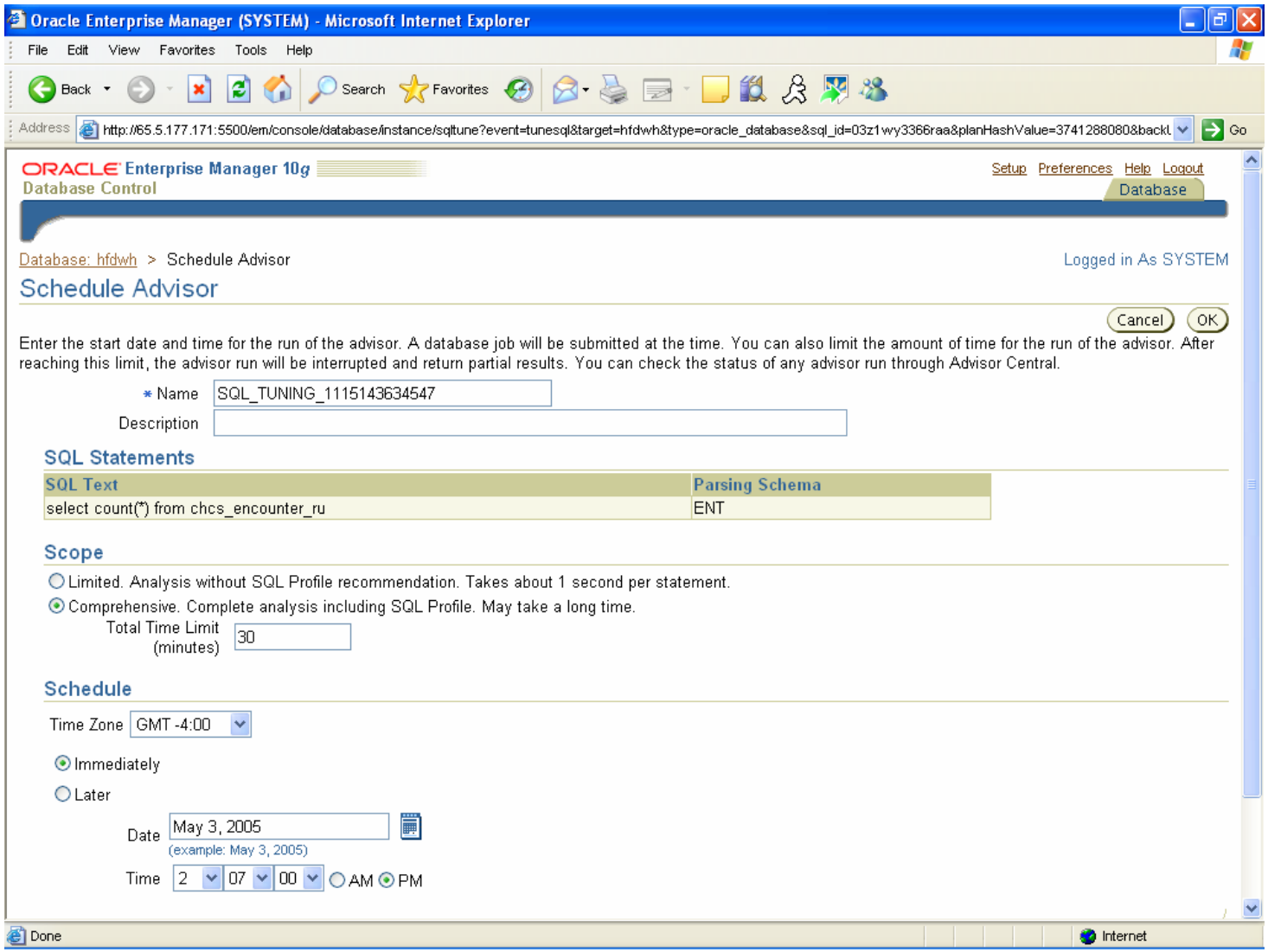
Alert Log Content
Edit Metric Thresholds
Monitoring Configuration

Using 10g Database/Grid Control

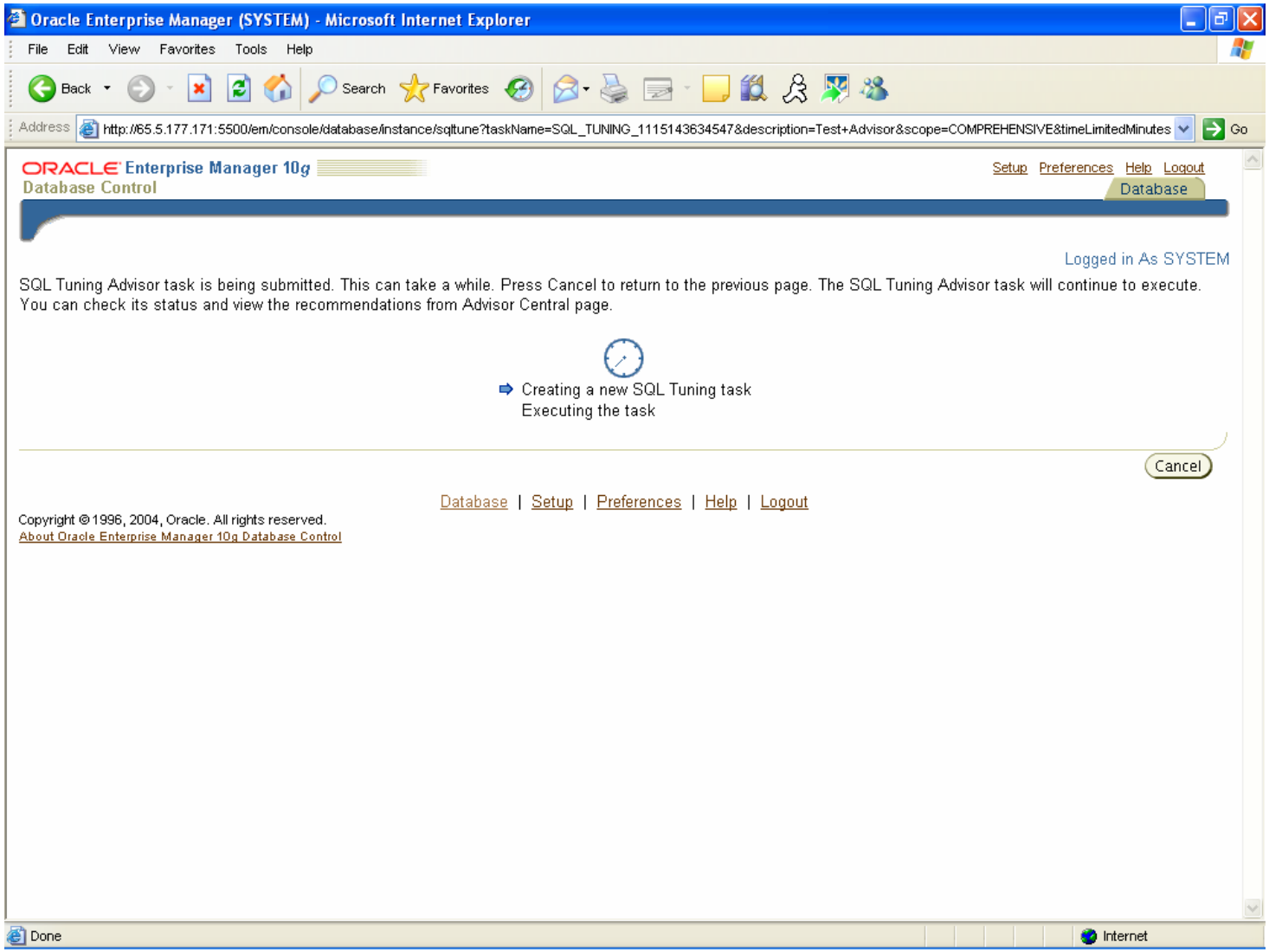


Operation	Object	Type	Order	Rows	KB	Cost	(seconds)	CPU Cost	Cost	Nod
SELECT STATEMENT			16			14890076				
SORT AGGREGATE			15	1	0.081					
NESTED LOOPS OUTER			14	716865339392	58,105,298,944	14890075	178681	64054202728448	1975	
NESTED LOOPS OUTER			12	8596244480	638,002,496	303941	3648	1299173736448	1975	
NESTED LOOPS OUTER			10	169032928	11,224,843	24021	289	94850842624	1975	
NESTED LOOPS OUTER			8	10629164	622,802.562	4057	49	8958790656	1975	
HASH JOIN RIGHT OUTER			6	1173567	59,595.199	2082	25	461791040	1975	
INDEX FULL SCAN	ENT.CHCS_ADMISSION_TYPE_PK	INDEX (UNIQUE)	1	1317	3.858	1	1	10121	1	
NESTED LOOPS OUTER			5	1173567	56,157.016	2053	25	342075488	1974	
TABLE ACCESS FULL	ENT.CHCS_ENCOUNTER	TABLE	2	1173567	26,359.414	2026	25	225444528	1974	
TABLE ACCESS BY INDEX ROWID	ENT.CHCS_CAUSE_OF_INJURY	TABLE	4	1	0.025	0		8171	0	
INDEX UNIQUE SCAN	ENT.CHCS_CAUSE_OF_INJURY_PK	INDEX (UNIQUE)	3	1		0		8171	0	
INDEX UNIQUE SCAN	ENT.CHCS_DIVISION_PK	INDEX (UNIQUE)	7	9	0.07	0		7321	0	
INDEX UNIQUE SCAN	ENT.CHCS_MEPRS_PK	INDEX (UNIQUE)	9	16	0.125	0		8171	0	
INDEX UNIQUE SCAN	ENT.CHCS_DRG_PK	INDEX (UNIQUE)	11	51	0.398	0		8171	0	
INDEX UNIQUE SCAN	ENT.CHCS_DISCHARGE_TYPE_PK	INDEX (UNIQUE)	13	83	0.567	0		7321	0	

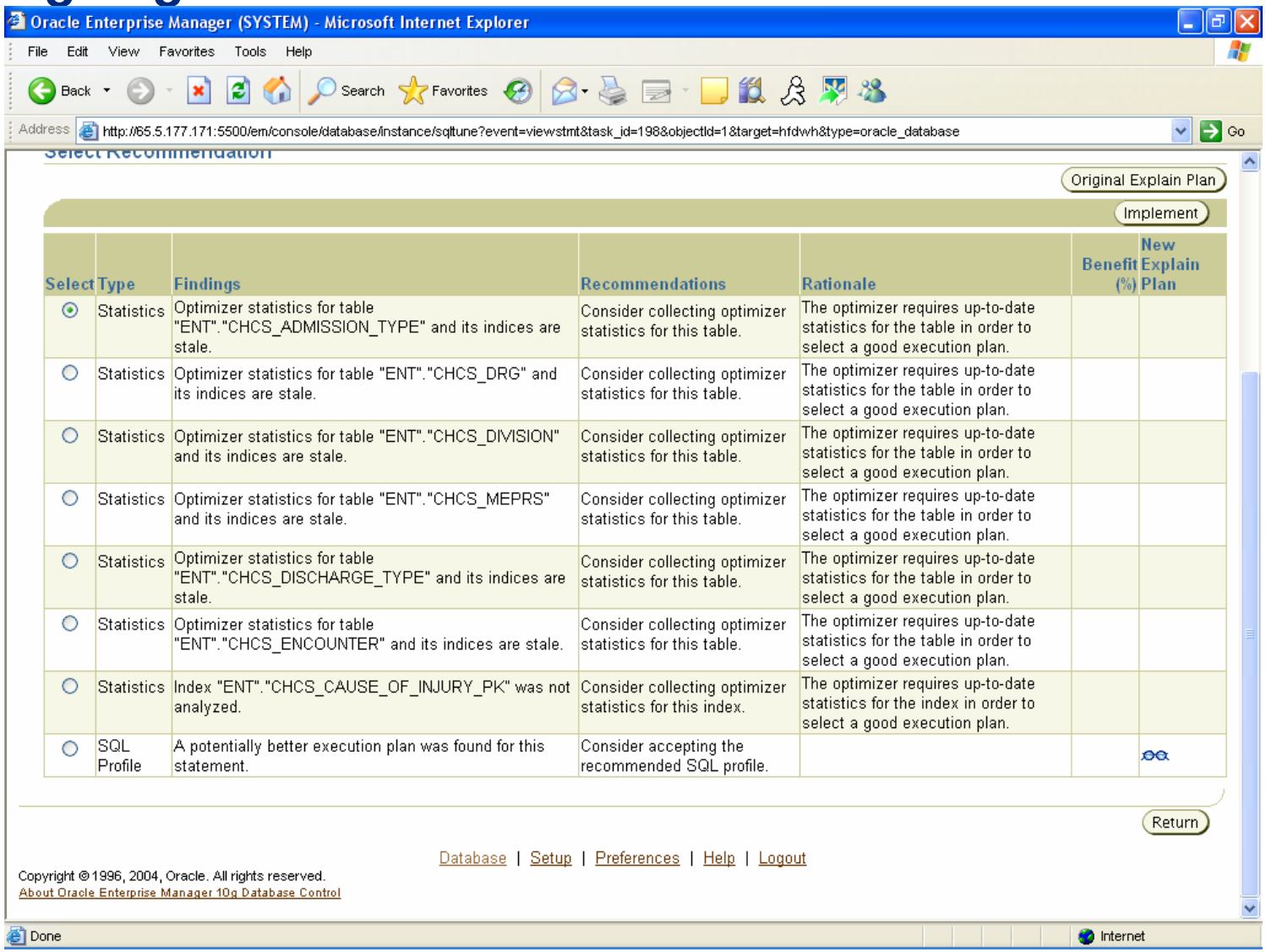
Using 10g Database/Grid Control



Using 10g Database/Grid Control

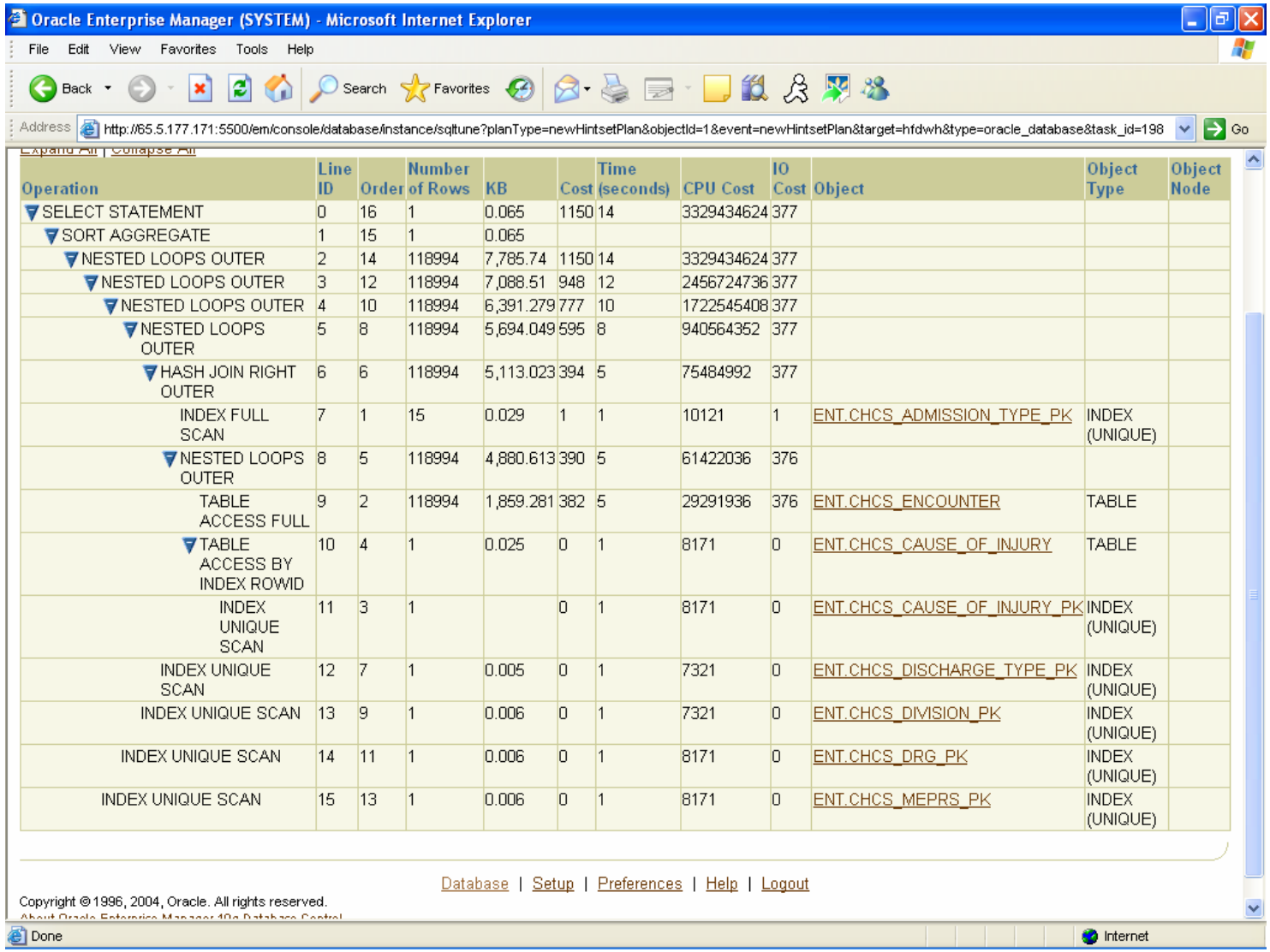


Using 10g Database/Grid Control



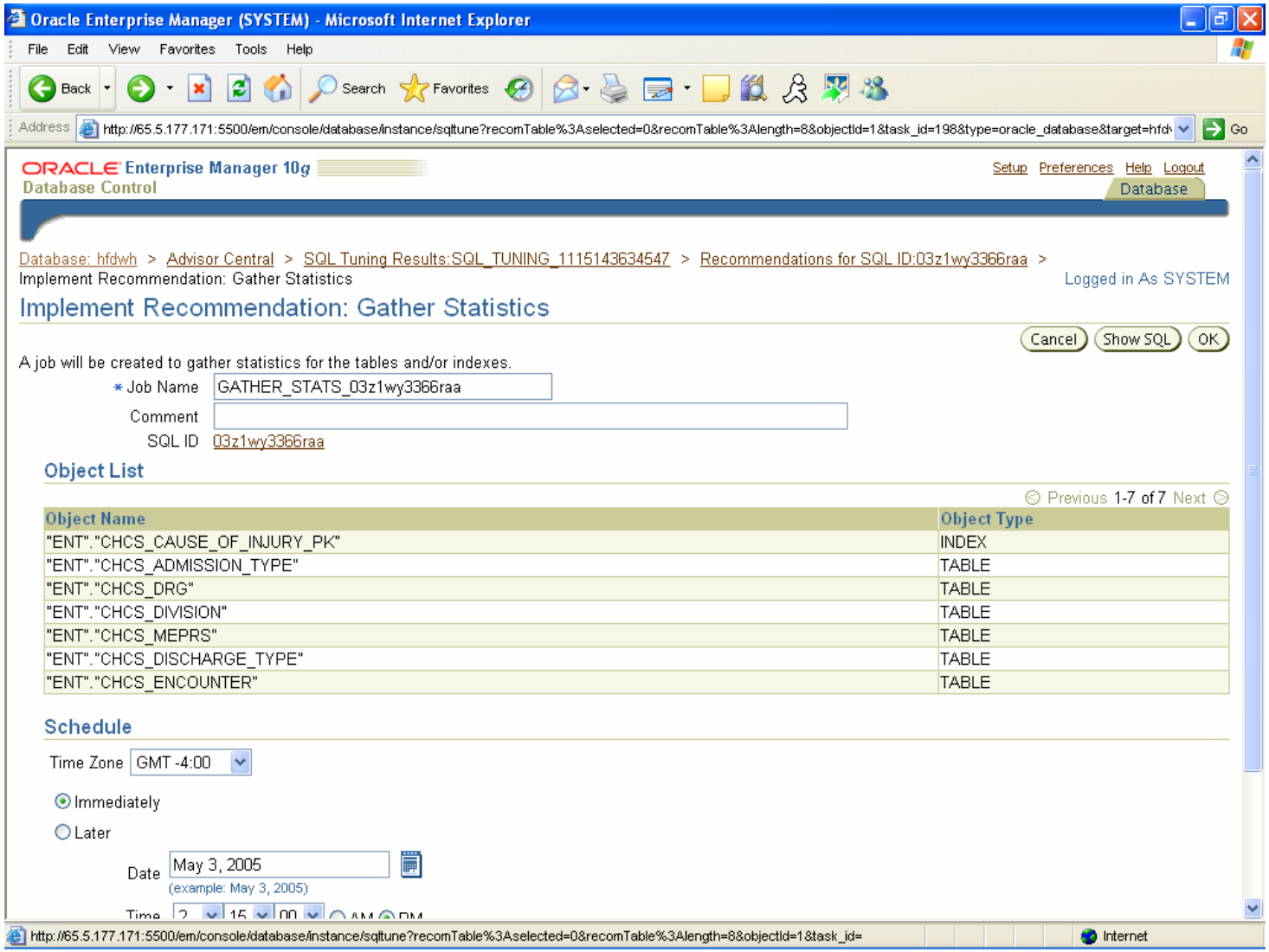
Select	Type	Findings	Recommendations	Rationale	Benefit (%)	New Explain Plan
◉	Statistics	Optimizer statistics for table "ENT"."CHCS_ADMISSION_TYPE" and its indices are stale.	Consider collecting optimizer statistics for this table.	The optimizer requires up-to-date statistics for the table in order to select a good execution plan.		
○	Statistics	Optimizer statistics for table "ENT"."CHCS_DRG" and its indices are stale.	Consider collecting optimizer statistics for this table.	The optimizer requires up-to-date statistics for the table in order to select a good execution plan.		
○	Statistics	Optimizer statistics for table "ENT"."CHCS_DIVISION" and its indices are stale.	Consider collecting optimizer statistics for this table.	The optimizer requires up-to-date statistics for the table in order to select a good execution plan.		
○	Statistics	Optimizer statistics for table "ENT"."CHCS_MEPRS" and its indices are stale.	Consider collecting optimizer statistics for this table.	The optimizer requires up-to-date statistics for the table in order to select a good execution plan.		
○	Statistics	Optimizer statistics for table "ENT"."CHCS_DISCHARGE_TYPE" and its indices are stale.	Consider collecting optimizer statistics for this table.	The optimizer requires up-to-date statistics for the table in order to select a good execution plan.		
○	Statistics	Optimizer statistics for table "ENT"."CHCS_ENCOUNTER" and its indices are stale.	Consider collecting optimizer statistics for this table.	The optimizer requires up-to-date statistics for the table in order to select a good execution plan.		
○	Statistics	Index "ENT"."CHCS_CAUSE_OF_INJURY_PK" was not analyzed.	Consider collecting optimizer statistics for this index.	The optimizer requires up-to-date statistics for the index in order to select a good execution plan.		
○	SQL Profile	A potentially better execution plan was found for this statement.	Consider accepting the recommended SQL profile.			

Using 10g Database/Grid Control

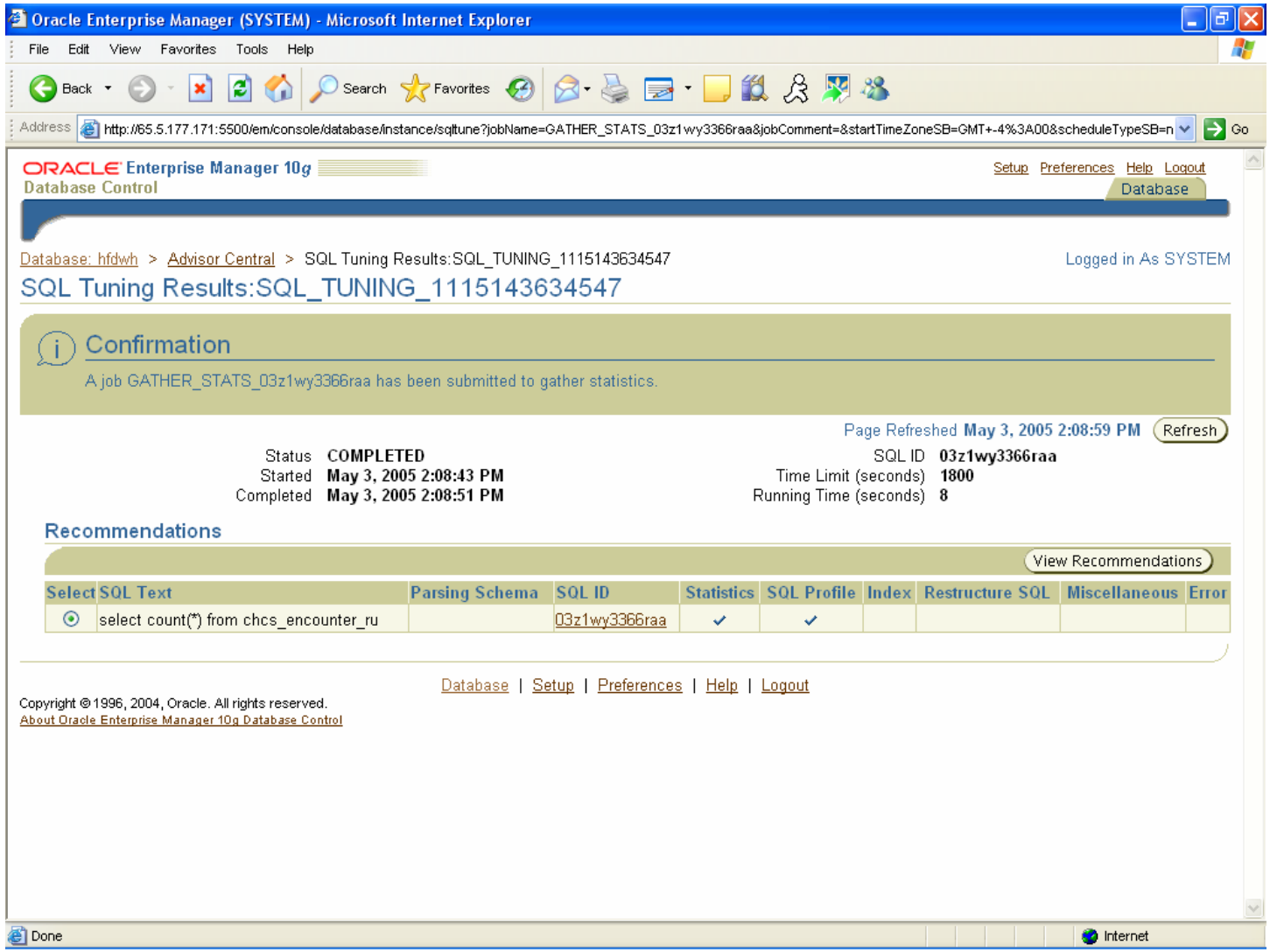


Operation	Line ID	Order	Number of Rows	KB	Cost	Time (seconds)	CPU Cost	IO Cost	Object	Object Type	Object Node
SELECT STATEMENT	0	16	1	0.065	1150	14	3329434624	377			
SORT AGGREGATE	1	15	1	0.065							
NESTED LOOPS OUTER	2	14	118994	7,785.74	1150	14	3329434624	377			
NESTED LOOPS OUTER	3	12	118994	7,088.51	948	12	2456724736	377			
NESTED LOOPS OUTER	4	10	118994	6,391.279	777	10	1722545408	377			
NESTED LOOPS OUTER	5	8	118994	5,694.049	595	8	940564352	377			
HASH JOIN RIGHT OUTER	6	6	118994	5,113.023	394	5	75484992	377			
INDEX FULL SCAN	7	1	15	0.029	1	1	10121	1	ENT.CHCS_ADMISSION_TYPE_PK	INDEX (UNIQUE)	
NESTED LOOPS OUTER	8	5	118994	4,880.613	390	5	61422036	376			
TABLE ACCESS FULL	9	2	118994	1,859.281	382	5	29291936	376	ENT.CHCS_ENCOUNTER	TABLE	
TABLE ACCESS BY INDEX ROWID	10	4	1	0.025	0	1	8171	0	ENT.CHCS_CAUSE_OF_INJURY	TABLE	
INDEX UNIQUE SCAN	11	3	1		0	1	8171	0	ENT.CHCS_CAUSE_OF_INJURY_PK	INDEX (UNIQUE)	
INDEX UNIQUE SCAN	12	7	1	0.005	0	1	7321	0	ENT.CHCS_DISCHARGE_TYPE_PK	INDEX (UNIQUE)	
INDEX UNIQUE SCAN	13	9	1	0.006	0	1	7321	0	ENT.CHCS_DIVISION_PK	INDEX (UNIQUE)	
INDEX UNIQUE SCAN	14	11	1	0.006	0	1	8171	0	ENT.CHCS_DRG_PK	INDEX (UNIQUE)	
INDEX UNIQUE SCAN	15	13	1	0.006	0	1	8171	0	ENT.CHCS_MEPRS_PK	INDEX (UNIQUE)	

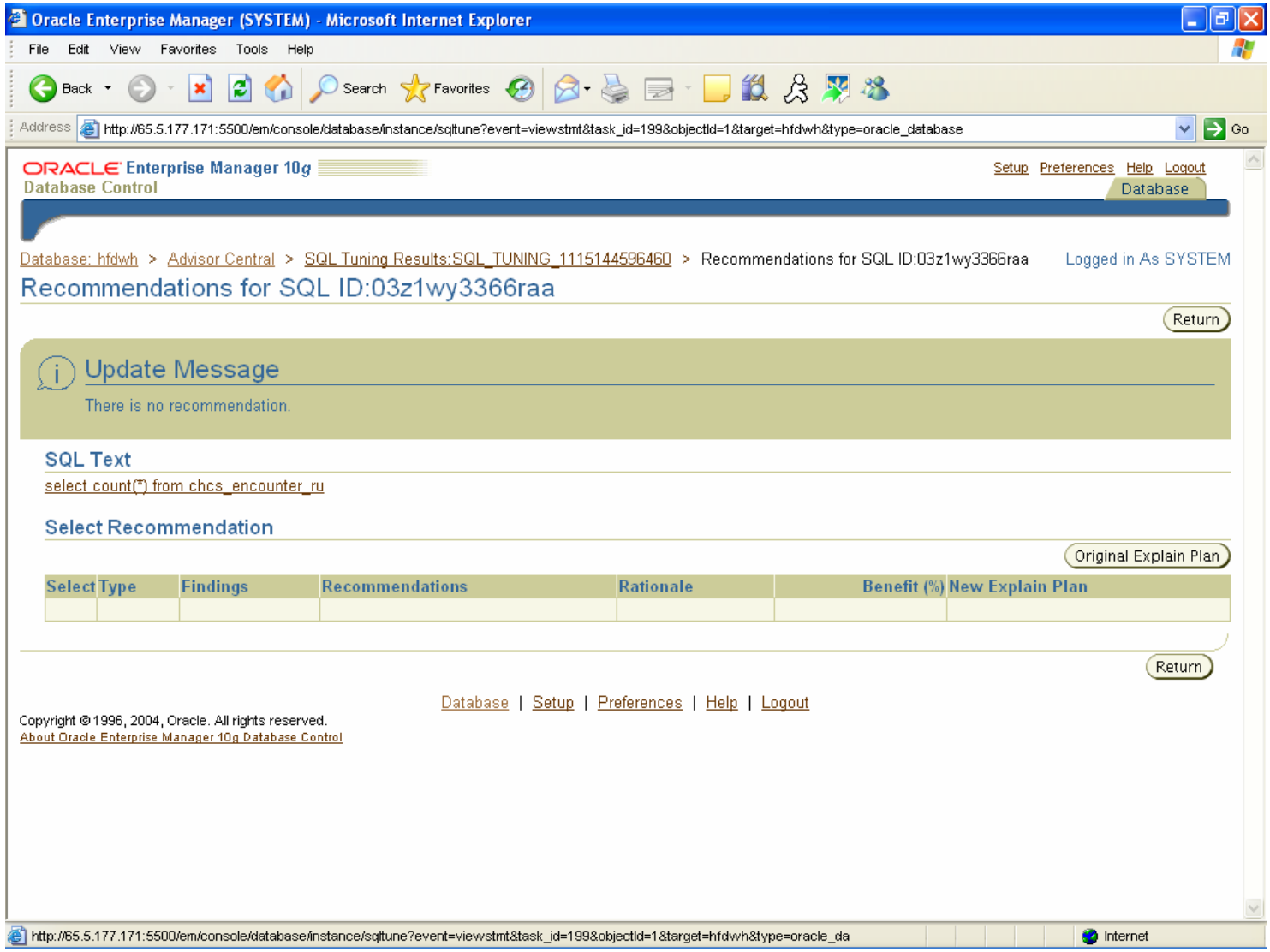
Using 10g Database/Grid Control



Using 10g Database/Grid Control



Using 10g Database/Grid Control



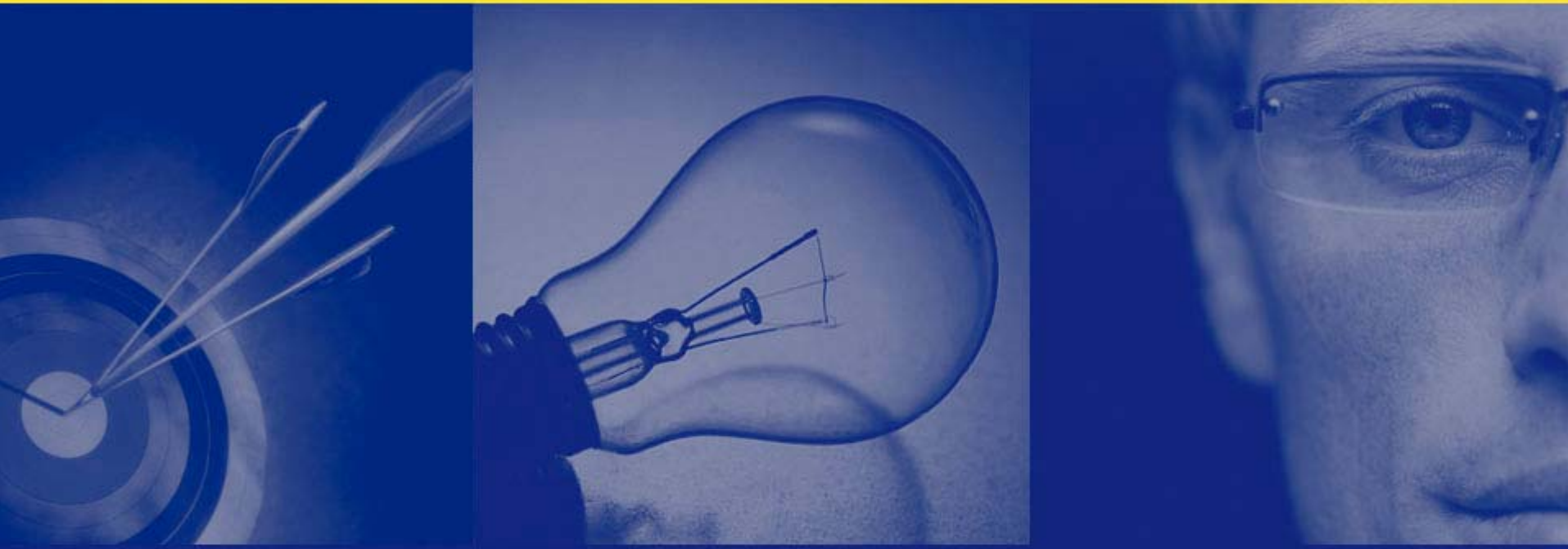
Using 10g Database/Grid Control

- As you can see from previous slide, it says the statement is as tuned as it can get.
- Of course, this will be optimally tuned for the environment in which the SQL Advisor was run, so as long as your development environment is the same as the production, you should be ok.
- However, how you get the SQL profile from development to production is not clear.
- On a second SQL statement taking Oracle suggestions resulted in the statement taking twice as long.
- Caveat Emptor!

In Conclusion

- This paper has tried to show what Oracle provided tuning tools are available to the developer who needs to tune their code to perform optimally.
- We have discussed Explain Plan, tracing and tkprof, use of events and use of statspack and AWR to assist with the tuning of SQL and PL/SQL.
- It is hoped that developers will utilize some of these tools and techniques for tuning code to help provide better code for their applications.

Questions?



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