



NZOUG Masterclass Series

Aspects of 10g Tuning

SAGE Computing Services
Customised Oracle Training Workshops
and Consulting
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Agenda

- Performance enhancements in 10g
- Recommendations on gathering statistics
- System Statistics
- Identifying the problem
- The Automatic Workload Repository
- Identifying high resource SQL
- Resolving SQL problems
- Bind variables
- SQL Tuning Advisor
- SQL Access Advisor
- Using wait events – Tuning I/O
- Common tuning problems – examples
- Using ADDM

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Approach

- Identify tuning goals
- Investigate problem
- Consider alternative solutions
- Implement chosen solution
- Test against goals

3

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Performance Enhancements in 10g

4

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Rule Based Optimiser Obsolete

- OPTIMIZER_MODE
 - ALL_ROWS
Throughput
 - FIRST_ROWS
Response
 - FIRST_ROWS_N
Response + I hate full scans

5

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Statistics Gathering

- Number of INSERT, UPDATE, and DELETE operations recorded
- SELECT * FROM DBA_TAB_MODIFICATIONS
- Automatic statistics gathered on STALE objects
 - Tables and indexes
 - Job Name = GATHER_STATS_JOB
 - Program =
DBMS_STATS.GATHER_DATABASE_STATS_JOB_PROC
 - Schedule = MAINTENANCE_WINDOW_GROUP
 - Nights and weekend
- Can be disabled using EXECUTE
DBMS_SCHEDULER.DISABLE('GATHER_STATS_JOB');

6

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Statistics Management

- Statistics history
- Stored by default for a period of 31 days
- If statistics_level is TYPICAL or ALL they are purged automatically
 - DBA_OPTSTAT_OPERATIONS
 - USER_TAB_STATS_HISTORY
 - DBMS_STATS.ALTER_STATS_HISTORY_RETENTION
 - DBMS_STATS.PURGE_STATS
 - DBMS_STATS.RESTORE
 - DBMS_STATS.GET_STATS_HISTORY_AVAILABILITY

7

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Statistics Management

- Ability to lock statistics
 - DBMS_STATS.LOCK_SCHEMA_STATS
 - DBMS_STATS.LOCK_TABLE_STATS
- Statistics can be unlocked
 - DBMS_STATS.UNLOCK_SCHEMA_STATS
 - DBMS_STATS.UNLOCK_TABLE_STATS
- Dynamic sampling
 - For very dynamic data or missing statistics
 - OPTIMIZER_DYNAMIC_SAMPLING
 - > DYNAMIC_SAMPLING(tablealias level)
 - Levels 0 to 10

8

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Gathering Statistics

- Check that statistics are up to date on all objects
- Create histograms on skewed columns
- NO_INVALIDATE
- GATHER_FIXED_OBJECTS_STATS
- Keep multiple sets of statistics
- METHOD_OPT parameter

FOR COLUMNS col1,col2 SIZE n	
FOR ALL COLUMNS SIZE n	
FOR ALL INDEXED COLUMNS SIZE n	
integer	Number of histogram buckets
REPEAT	already have histograms
AUTO	data distribution and workload
SKEWONLY	data distribution

9

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Manually Setting Stats

- DBMS_STATS.SET_TABLE_STATS
- Set table, column or index stats manually
- Regathering will overwrite
- Freezing fixes stats – won't respond to changes
- Use only for jobs where data is very volatile and a fixed result gives good results
- ** But if its all working fine – why change the statistics **

10

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Trcess

- End to end tracing
- trcssess used to consolidate a number of trace files


```
trcssess  output=output_file
          session=session_id      e.g. 152.3 This is the SID and
                                   SERIAL# from v$session
          clientid=client_id
          service=service_name
          action=action_name
          module=module_name
          trace_files              the * wildcard can be used
```
- DBMS_MONITOR package can be used to gather statistics for a specific Client ID, Service or service, module and action
- DBMS_APPLICATION_INFO package can be used to set the module and action from within an application

11

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New Hints

- Specify index with name or column
 - > INDEX(org (org_id name))
- Use nested loop with a specific index
 - > USE_NL_WITH_INDEX (alias (indexname))
- Name a query block
 - > QB_NAME (q1).
- Do not perform query transformation
 - > NO_QUERY_TRANSFORMATION
- Perform index skip scan
 - > INDEX_SS

12

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Other

- ✦ Global temporary table SYS.PLAN_TABLE\$
- ✦ Private outlines
- ✦ Fast DUAL access
- ✦ New tuning tools
- ✦ New costing model
 - ✦ CPU + IO
 - ✦ Uses MBRC system parameter for full scans
 - ✦ Statistics with or without workload

13

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Cost Model

- ✦ Prior to Oracle 9i
 - ✦ Number of I/Os
 - ✦ Estimates of index blocks in memory
 - ✦ OPTIMIZER_INDEX_CACHING
 - ✦ Estimates of cost of index scan
 - ✦ OPTIMIZER_INDEX_COST_ADJ
- ✦ Oracle 9i
 - ✦ I/O plus CPU costing if system statistics gathered
- ✦ Oracle 10g
 - ✦ CPU and I/O
 - ✦ System statistics or defaults

14

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Gathering System Statistics

- ✦ Workload statistics
 - ✦ CPUSPEEDNW, IOSEEKTIME, IOTFRSPEED
- ✦ Noworkload statistics
 - ✦ SREADTIME, MREADTIME, CPUSPEED, MBRC, SLAVETHR
- ✦ Optimiser uses workload statistics if available
- ✦ SYS.AUX_STATS\$
- ✦ Gather at times of representative workload
 - ✦ Daytime OLTP set
 - ✦ Nighttime batch / reporting set
- ✦ Import as required

15

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Gathering System Statistics

- ✦ DBMS_STATS.CREATE_STAT_TABLE ('SYS','OLTP_SYSSTAT','STAT_TS');
- ✦ DBMS_STATS.GATHER_SYSTEM_STATS (gathering_mode => 'INTERVAL', interval => 2, stattab => 'OLTP_SYSSTAT', statid => 'OLTP');
- ✦ DBMS_STATS.DELETE_SYSTEM_STATS;
- ✦ DBMS_STATS.IMPORT_SYSTEM_STATS (stattab => 'OLTP_SYSSTAT', statid => 'OLTP', statown => 'SYS');

16

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Identifying the problem

17

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Identifying the Problem

- ✦ User information



Something is wrong with the HR application

18

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Identifying the Problem

Advanced user information

Something is wrong with the payroll run, its taking much longer than normal

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Identifying the Problem

Possible problems

- Application issues - Contention
- High resource SQL – This is always the most likely
- Database configuration
- OS configuration

Tools

- Wait events
- the V\$ tables
- Tracing
- Dictionary tables
- Enterprise Manager

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Identifying the Problem

When does it happen

- Current session
- At specific times
- All the time

What is the scope of the problem

- Single user
- Particular time/job
- Overall performance

Has anything changed

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Trace 10046

Turn tracing on for the system (performance overhead) or session

Identify location of user_dump_dest

Check max_dump_file_size

```
BEGIN
dbms_monitor.session_trace_enable(session_id=>130,
serial_num=>708, waits=>TRUE, binds=>TRUE);
END;
```

```
ALTER system set events
'10046 trace name context forever, level 12'
```

trcsess output=all_traces.trc service=ora10g *.trc

tkprof all_traces.trc all_traces.prf sort=execpu, prscpu, fchcpu

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all_trace.prf - Notepad

ERROR: release 9.0.1.5.1 - Production on Mon May 23 18:11:37 2005

(c) copyright 2001 oracle Corporation. All rights reserved.

Trace file: c:\udump\all_trace.trc

Sort options: prscpu, fchcpu, execpu

=====

count = number of times OCI procedure was executed
cpu = cpu time in seconds executing
elapsed = elapsed time in seconds executing
disk = number of physical reads of buffers from disk
query = number of buffers gotten for consistent read
current = number of buffers gotten in current mode (usually for update)
rows = number of rows processed by the fetch or execute call

=====

SELECT COUNT(*) COMMENTS
FROM
BOOKINGS_LARGE B WHERE B.RESOURCE_CODE = '181'

call	count	cpu	elapsed	disk	query	current	rows
Parse	2	0.00	0.00	0	0	0	0
Execute	21	0.29	0.29	24862	1177098	0	0
Fetch	21	133.15	230.21	24862	1177098	0	21
total	44	133.64	230.21	24862	1177098	0	21

misses in library cache during parse: 1
misses in library cache during execute: 1
optimizer goal: FIRST_ROWS
Parsing user id: 73 (recursive depth: 1)

Rows Row Source Operation

1 SORT AGGREGATE (cr=>75098 pr=>11724 pw=>0 time=>11570799 us)

533654 TABLE ACCESS FULL BOOKINGS_LARGE (cr=>75098 pr=>11724 pw=>0 time=>12296770 us)

Elapsed times include waiting on following events:

Event waited on	Times	Max. wait	Total waited
db file sequential read	1819	0.13	2.97
db file scattered read	626	0.20	2.72

=====

High Resource SQL

V\$SQL has buffer gets and physical reads for statements in the SGA

V\$SQL_PLAN has plans for statements in the SGA

Use V\$SQLSTATS (10g Rel 2)

- Row for unique combinations of SQL statement and optimizer plan (SQL_ID and PLAN_HASH_VALUE)
- Retained longer than V\$SQL
- Does not include SQL PROFILE or OUTLINE

dba_hist_sqlstat and dba_hist_sqltext have buffer gets and physical reads for past statement

dba_hist_sql_plan has plans for past statement

dba_hist_optimizer_env

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AWR Data for High Resource SQL

Look for high buffer gets

```
SELECT s.snap_id, s.sql_id, s.buffer_gets_total, s.executions_total,
       s.buffer_gets_total/NULLIF(executions_total,0) reads, t.sql_text
FROM   dba_hist_sqlstat s, dba_hist_sqltext t
WHERE  t.sql_id = s.sql_id
AND    buffer_gets_total/NULLIF(executions_total,0) > 1000000
```

SNAP_ID	SQL_ID	BUFFER_GETS_TOTAL	EXECUTIONS_TOTAL	READS
824	3a0a04m3gduuq	4979957	1	4979957

```
SQL_TEXT
-----
insert into bookings_large
select booking_seq.nextval, mod(event2_seq.nextval,100000)+201,
resource_code, chargeable, made_by, quantity,
cost, status, comments
from bookings_large
```

AWR Data for High Resource SQL

Find execution path

```
SELECT lpad(to_char(id),level) ID, parent_id PT,
       decode(id,0,'Cost: '||cost,object_name) OB,
       operation OP, rpad(options,30)|| rpad(access_predicates,30)||
       rpad(filter_predicates,30) OT,
       to_number(decode(id,0,null,position)) PS, cardinality CD
FROM   dba_hist_sql_plan
CONNECT BY prior id = parent_id
AND    sql_id = '&sql_id'
START WITH
       parent_id is null
AND    sql_id = '&sql_id';
```

Id	Par	Object	Operation	Options	Pos	Rows
0		Cost: 1322	INSERT STATEMENT			
1	0		SEQUENCE		1	
2	1	BOOKINGS_LARGE TABLE ACCESS	FULL		1	810770

Problems with a Current Session

Find waiting sessions

```
SELECT sid, serial#, username, event,
       blocking_session, seconds_in_wait, sql_id
FROM   v$session
WHERE  state = 'WAITING'
AND    wait_class != 'Idle'
```

SID	SERIAL#	USERNAME	EVENT	BLOCKING_SESSION	SECONDS_IN_WAIT	SQL_ID
161	573	TRAIN	enq: TX - row lock contention	130	1207	g3xry817zpwk3

Problems with a Current Session

Find the SQL the session is running

```
SELECT sql_text
FROM   v$sql
WHERE  sql_id = 'g3xry817zpwk3'
```

```
SQL_TEXT
-----
UPDATE events set start_date = start_date+1 WHERE event_no = :b1
```

We can find the SQL the blocker is running but it may not be the blocking statement

Find Bind Variables

```
SELECT value_string
FROM   v$sql_bind_capture
WHERE  sql_id = 'g3xry817zpwk3'
```

VALUE_STRING
100

Bind capture is disabled when STATISTICS_LEVEL = BASIC

Session Problems

Currently waiting

- V\$SESSION
- V\$SESSION_WAIT

Current sessions

- V\$SESSION_WAIT_CLASS
- V\$SESS_TIME_MODEL

Recent sessions

- V\$SESSION_WAIT_HISTORY
- V\$ACTIVE_SESSION_HISTORY

Past sessions

- DBA_HIST_ACTIVE_SESSION_HISTORY

Current Session Problems

🔍 If there is no current wait check the session's wait classes

```
SELECT wait_class_id, wait_class#, wait_class,
       total_waits, time_waited
FROM v$session_wait_class
WHERE sid=161
```

WAIT_CLASS_ID	WAIT_CLASS#	WAIT_CLASS	TOTAL_WAITS	TIME_WAITED
4217450380	1	Application	210	62654
3386400367	5	Commit	3	0
2723168908	6	Idle	25	545088
2000153315	7	Network	31	0
1740759767	8	User I/O	11	10

Locking problem

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Problems with a Current Session – Example 2

🔍 Find waiting sessions

```
SELECT sid, serial# , username, event,
       blocking_session, seconds_in_wait, sql_id
FROM v$session
WHERE state = 'WAITING'
AND wait_class != 'Idle'
```

SID	SERIAL#	USERNAME	EVENT	BLOCKING_SESSION	SECONDS_IN_WAIT	SQL_ID
130	708	TRAIN2	db file scattered read		0	3a0e04m9gduq

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Current Session Problems

🔍 Is this a one off event or a pattern

```
SELECT wait_class_id, wait_class#, wait_class,
       total_waits, time_waited
FROM v$session_wait_class
WHERE sid=130
```

WAIT_CLASS#	WAIT_CLASS	TOTAL_WAITS	TIME_WAITED
0	Other	309	670
1	Application	318	74379
2	Configuration	1213	9735
4	Concurrency	31	0
5	Commit	495	325
6	Idle	605	71174
7	Network	694	4
8	User I/O	21278	15526
9	System I/O	3099	4013

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Current Session Problems

🔍 Last 10 waits

```
SELECT event#, event, wait_time, wait_count
FROM v$session_wait_history
WHERE sid = 130
```

EVENT#	EVENT	WAIT_TIME	WAIT_COUNT
294	db file sequential read	1	1
586	SQL*Net message to client	0	1
590	SQL*Net message from client	6	1
586	SQL*Net message to client	0	1
590	SQL*Net message from client	2	1
586	SQL*Net message to client	0	1
590	SQL*Net message from client	0	1
586	SQL*Net message to client	0	1
294	db file sequential read	0	1
294	db file sequential read	0	1

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Recent Session Problems

🔍 Active session history

```
SELECT sample_time, event, wait_time, time_waited
FROM v$active_session_history
WHERE session_id = 130
AND session_serial# = 708
ORDER BY sample_time
```

SAMPLE_TIME	EVENT	WAIT_TIME	TIME_WAITED
21-MAY-05 08.35.46.570 AM	control file sequential read	0	24076
21-MAY-05 08.35.47.601 AM	db file scattered read	117906	0
21-MAY-05 08.35.48.632 AM	db file scattered read	117734	0
21-MAY-05 08.35.49.663 AM	log file switch completion	0	278636
21-MAY-05 08.35.50.694 AM	db file sequential read	169	0
21-MAY-05 08.35.51.725 AM	db file scattered read	0	21938
21-MAY-05 08.35.52.757 AM	db file scattered read	0	71240
21-MAY-05 08.35.53.788 AM	db file sequential read	0	14740
21-MAY-05 08.35.54.819 AM	db file sequential read	186	0
21-MAY-05 08.35.55.850 AM	db file sequential read	0	140
21-MAY-05 08.36.26.785 AM	db file scattered read	0	8894
21-MAY-05 08.36.27.816 AM	db file scattered read	0	5867
21-MAY-05 08.36.28.848 AM	db file scattered read	0	45020

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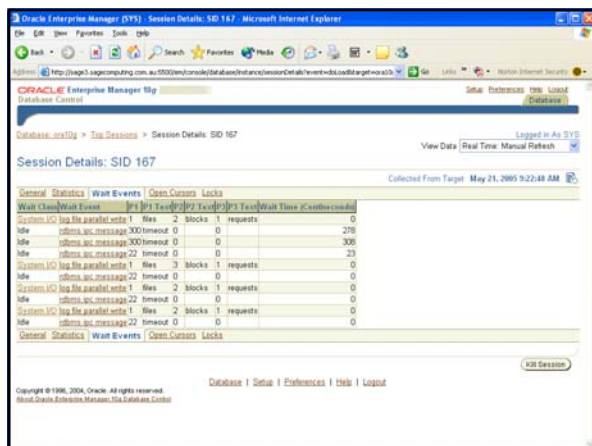
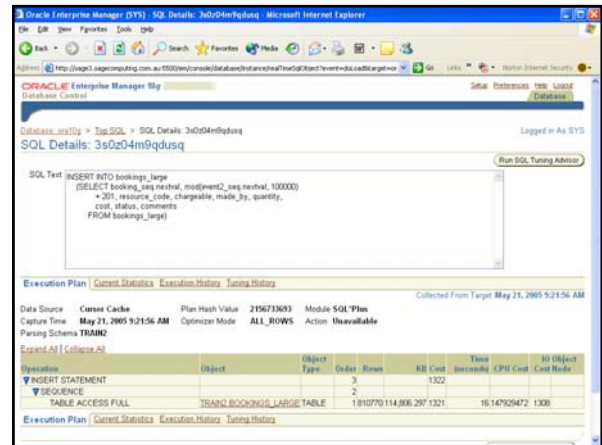
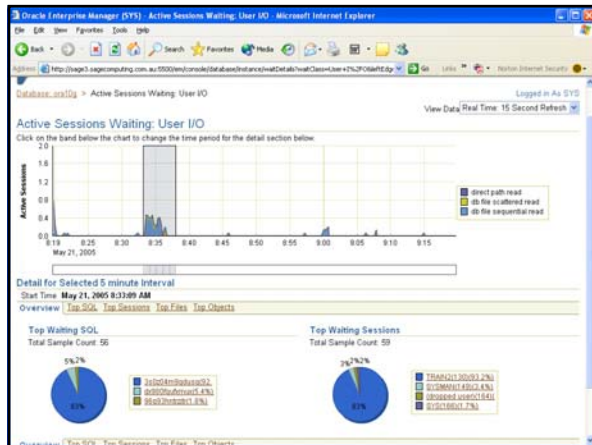
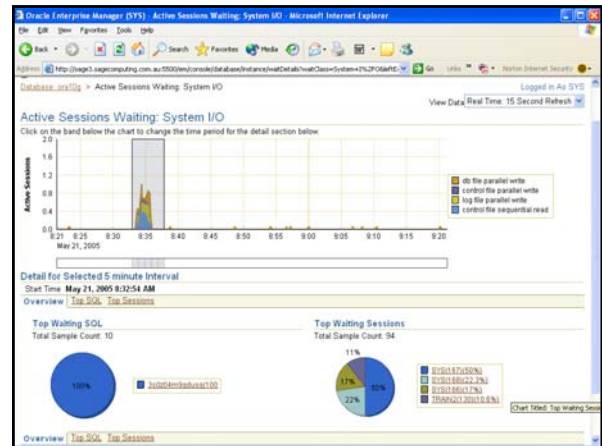
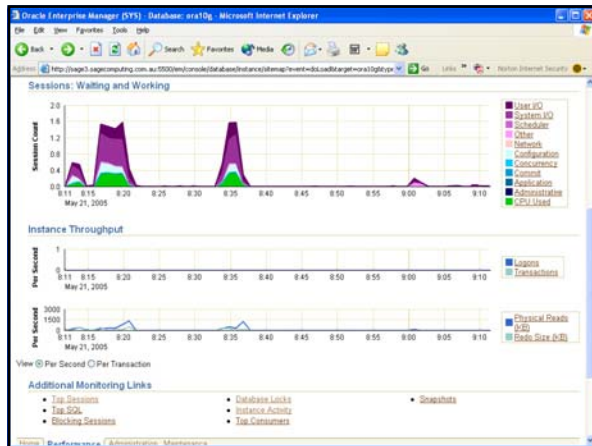
Current Session Problems


🔍 Find where the session has spent its time

```
SELECT stat_name, value
FROM v$ess_time_model
WHERE sid=130
```

STAT_NAME	VALUE
DB time	1258404159
DB CPU	167882212
background elapsed time	0
background cpu time	0
sequence load elapsed time	80535063
parse time elapsed	15047886
hard parse elapsed time	8505043
sql execute elapsed time	1228185596
connection management call elapsed time	2375
failed parse elapsed time	174792
failed parse (out of shared memory) elapsed time	0
hard parse (sharing criteria) elapsed time	27209
hard parse (bind mismatch) elapsed time	411
PL/SQL execution elapsed time	996463
inbound PL/SQL rpc elapsed time	0
PL/SQL compilation elapsed time	359383
Java execution elapsed time	0

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Fix the Problem

- 🔥 Kill one of the sessions
- 🔧 Fix the application problem
- 🔍 Identify and fix the high resource SQL


42
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Overall Performance Problems - Sources

- Alert log
- Wait events
- Oracle 10g gathers comprehensive statistics
 - Active session history
 - Time model
 - Metrics
 - OS statistics

43
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Wait Events

- Look for system wait classes


```

SELECT  wait_class_id, wait_class#, wait_class,
        total_waits, time_waited
FROM    v$system_wait_class

```

WAIT_CLASS_ID	WAIT_CLASS#	WAIT_CLASS	TOTAL_WAITS	TIME_WAITED
1893977003	0	Other	6238	444427
4217450380	1	Application	26661	826816
3290255840	2	Configuration	2096	12605
3875070507	4	Concurrency	136	186
3386400367	5	Commit	8151	1930
2723168908	6	Idle	683331	197711587
2000153315	7	Network	205150	70
1740759767	8	User I/O	69290	57267
4108307767	9	System I/O	134573	57583

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Wait Events

- Look for system wait events - Application


```

SELECT  e.event, e.total_waits, e.total_timeouts,
        e.time_waited, average_wait
FROM    v$system_event e, v$event_name n
WHERE   n.event_id = e.event_id
AND     n.wait_class# = 1 -- Application

```

EVENT	TOTAL_WAITS	TOTAL_TIMEOUTS	TIME_WAITED	AVERAGE_WAIT
enq: RO - fast object reuse	33	0	11	0
enq: TX - row lock contention	2690	2686	826242	307
SQL*Net break/reset to client	24110	0	566	0

45
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Wait Events

- Look for system wait events – User I/O


```

SELECT  e.event, e.total_waits, e.total_timeouts,
        e.time_waited, average_wait
FROM    v$system_event e, v$event_name n
WHERE   n.event_id = e.event_id
AND     n.wait_class# = 8 -- User I/O

```

EVENT	TOTAL_WAITS	TOTAL_TIMEOUTS	TIME_WAITED	AVERAGE_WAIT
local write wait	7	0	0	0
read by other session	1	0	1	1
db file sequential read	58691	0	47970	1
db file scattered read	7424	0	8271	1
db file single write	151	0	14	0
db file parallel read	1	0	3	3
direct path read	1474	0	925	1
direct path read temp	102	0	25	0
direct path write	1473	0	160	0
direct path write temp	168	0	2	0

46
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Wait Events

- Look for system wait events – System I/O


```

SELECT  e.event, e.total_waits, e.total_timeouts,
        e.time_waited, average_wait
FROM    v$system_event e, v$event_name n
WHERE   n.event_id = e.event_id
AND     n.wait_class# = 9 -- System I/O

```

EVENT	TOTAL_WAITS	TOTAL_TIMEOUTS	TIME_WAITED	AVERAGE_WAIT
ksfd: async disk IO	288	0	15	0
control file sequential read	19938	0	21111	2
control file single write	714	0	128	0
control file parallel write	26960	0	10292	0
recovery read	6	0	0	0
log file sequential read	378	0	350	1
log file single write	375	0	40	0
log file parallel write	51020	0	17352	0
db file parallel write	42478	0	8626	0

47
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Wait Events

- Look for distribution of wait times
- One event with a long wait time could skew the results

```

SELECT  wait_time_milli, wait_count
FROM    v$event_histogram
WHERE   event = 'enq: TX - row lock contention'

```

WAIT_TIME_MILLI	WAIT_COUNT
1	0
2	0
4	0
8	0
16	0
32	0
64	0
128	2
256	2
512	0
1024	0
2048	1
4096	2685

48
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Wait Events

Look for distribution of wait times

```
SELECT wait_time_milli, wait_count
FROM v$event_histogram
WHERE event = 'db file sequential read'
```

WAIT_TIME_MILLI	WAIT_COUNT
1	28683
2	1120
4	3017
8	6987
16	10667
32	5671
64	1933
128	391
256	197
512	28
1024	1

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Time Model

- Records where the database is spending time
- DB Time is overall database activity time
- ADDM's goal is to minimise this
- Look for high parse time as proportion of SQL execution time

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Time Model

Find where the system has spent its time

```
SELECT stat_name, value
FROM v$sys_time_model
```

STAT_NAME	VALUE
DB time	1.030528x10
DB CPU	526468001
background elapsed time	5488728225
background cpu time	49628001
sequence load elapsed time	80675372
parse time elapsed	71315840
hard parse elapsed time	60198409
sql execute elapsed time	1.02118x10
connection management call elapsed time	1395986
failed parse elapsed time	302227
failed parse (out of shared memory) elapsed time	0
hard parse (sharing criteria) elapsed time	591387
hard parse (bind mismatch) elapsed time	294519
PL/SQL execution elapsed time	103156155
inbound PL/SQL rpc elapsed time	0
PL/SQL compilation elapsed time	8411615
Java execution elapsed time	1037473

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Metrics

- Calculated at intervals
- V\$SYSMETRIC
- V\$EVENTMETRIC
- V\$WAITCLASSMETRIC
- V\$FILEMETRIC
- V\$METRICNAME

52 www.sagecomputing.com.au

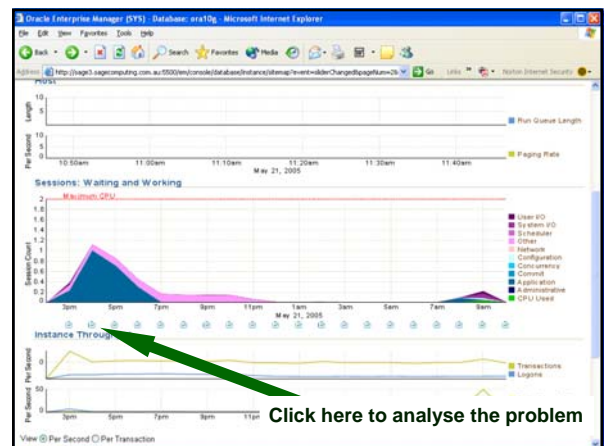
Metrics


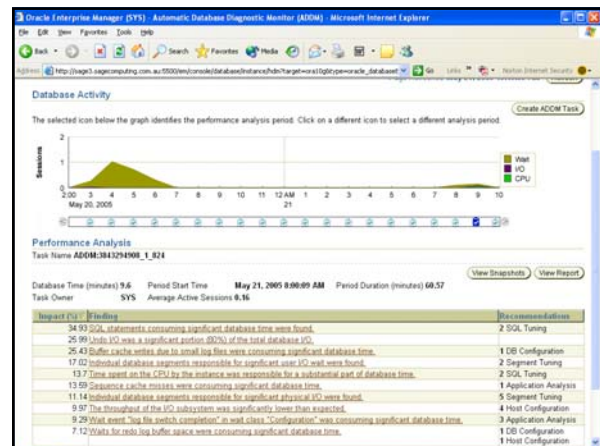
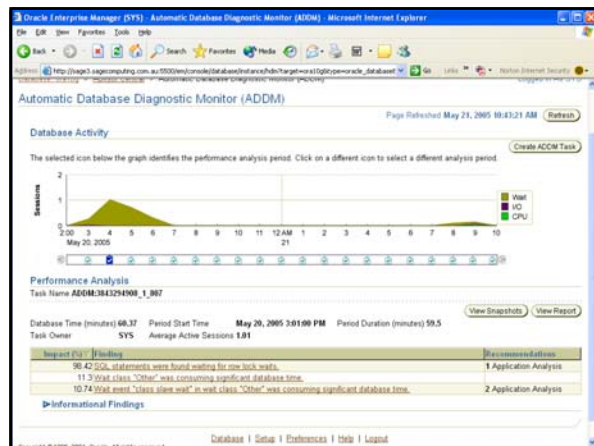
Shows traditional hit ratios

```
SELECT metric_name, AVG(value), metric_unit
FROM v$sysmetric
WHERE metric_unit LIKE '%%' ESCAPE '\'
GROUP BY metric_name, metric_unit
```

METRIC_NAME	AVG(VALUE)	METRIC_UNIT
User Limit %	0	% Sessions/License_Limit
PGA Cache Hit %	99	% Bytes/TotalBytes
Process Limit %	22	% Processes/Limit
Session Limit %	21	% Sessions/Limit
Soft Parse Ratio	75	% SoftParses/TotalParses
User Calls Ratio	25	% UserCalls/AllCalls
Memory Sorts Ratio	100	% MemSort/(MemSort + DiskSort)
Shared Pool Free %	12	% Free/Total
Row Cache Hit Ratio	100	% Hits/Gets
Row Cache Miss Ratio	0	% Misses/Gets
Buffer Cache Hit Ratio	100	% (LogRead + PhysRead)/LogRead
Cursor Cache Hit Ratio	0	% CursorCacheHit/SoftParse
Database CPU Time Ratio	84.5	% Cpu/DB_Time
Library Cache Hit Ratio	99	% Hits/Pins
User Commits Percentage	100	% (UserCommit/TotalUserTxn)
Database Wait Time Ratio	31	% Wait/DB_Time
Host CPU Utilization (%)	1	% Busy/(Idle+Busy)
Library Cache Miss Ratio	0	% Misses/Gets
Redo Allocation Hit Ratio	100	% (#redo - RedoSpaceReq)/#redo
User Rollbacks Percentage	0	% (UserRollback/TotalUserTxn)
Rescues Without Parse Ratio	95	% (Rescue/Parse/TotalParse)

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The Automatic Workload Repository (AWR)

57

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AWR

- ◆ Persistent storage of system statistics
 - ◆ Active session history
 - ◆ V\$tables
 - ◆ Plans
 - ◆ Automatic Database Diagnostic Monitor results
- ◆ Gathered in memory and flushed to disk by MMON
- ◆ Purged every 7 days
- ◆ Snapshots can be preserved
- ◆ Check that AWR collection is not causing library cache waits

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- ▶ **DBMS_WORKLOAD_REPOSITORY**
- ▶ **Create an AWR snapshot**
`dbms_workload_repository.create_snapshot`
- ▶ **Produce a report using two snapshots**
`dbms_workload_repository.awr_report_html`
`dbms_workload_repository.awr_report_text`
`$ORACLE_HOME/rdbms/admin/awrrpt.sql`
- ▶ **Create a baseline**
`dbms_workload_repository.create_baseline`



DBA_HIST.....

DBA_HIST_DATABASE_INSTANCE	DBA_HIST_BUFFER_POOL_STAT
DBA_HIST_SNAPSHOT	DBA_HIST ROWCACHE SUMMARY
DBA_HIST_SNAP_ERROR	DBA_HIST_SGA
DBA_HIST_BASELINE	DBA_HIST_SGASTAT
DBA_HIST_WF_CONTROL	DBA_HIST_PGASTAT
DBA_HIST_DATAFILE	DBA_HIST_RESOURCE_LIMIT
DBA_HIST_FILESTATXS	DBA_HIST_SHARED_POOL_ADVICE
DBA_HIST_TEMPFILE	DBA_HIST_SQL_WORKAREA_HSTGRM
DBA_HIST_TEMPSTATXS	DBA_HIST_PGA_TARGET_ADVICE
DBA_HIST_SQLSTAT	DBA_HIST_INSTANCE_RECOVERY
DBA_HIST_SQLTEXT	DBA_HIST_JAVA_POOL_ADVICE
DBA_HIST_SQL_SUMMARY	DBA_HIST_THREAD
DBA_HIST_SQL_PLAN	DBA_HIST_STAT_NAME
DBA_HIST_SQLBIND	DBA_HIST_SYSTSTAT
DBA_HIST_OPTIMIZER_ENV	DBA_HIST_SYS_TIME_MODEL
DBA_HIST_EVENT_NAME	DBA_HIST_OSTAT_NAME
DBA_HIST_SYSTEM_EVENT	DBA_HIST_OSTAT
DBA_HIST_BG_EVENT_SUMMARY	DBA_HIST_PARAMETER_NAME
DBA_HIST_WAITSTAT	DBA_HIST_PARAMETER
DBA_HIST_ENQUEUE_STAT	DBA_HIST_UNDOSTAT
DBA_HIST_LATCH_NAME	DBA_HIST_SEG_STAT
DBA_HIST_LATCH	DBA_HIST_SEG_STAT_OBJ
DBA_HIST_LATCH_CHILDREN	DBA_HIST_METRIC_NAME
DBA_HIST_LATCH_PARENT	DBA_HIST_SYSMETRIC HISTORY
DBA_HIST_LATCH_MISSES SUMMARY	DBA_HIST_SYSMETRIC SUMMARY
DBA_HIST_LIBRARY_CACHE	DBA_HIST_SESSIONTIME HISTORY
DBA_HIST_DBCACHE_ADVICE	DBA_HIST_SQLAREA_DEPENDENCY

60

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AWR Tables

WRH\$.... Tables

History of statistics

e.g. WRH\$_SQLSTAT_BL

WRI\$..... Tables

Advice/recommendation tables

e.g. WRI\$_ADV_RECOMMENDATIONS

WRM\$..... Tables

Snapshot / baseline tables

e.g. WRM\$_SNAPSHOT

61

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Oracle Enterprise Manager (SYS) Automatic Workload Repository (AWR) - Microsoft Internet Explorer

Database: orcl10g - Automatic Workload Repository

The Automatic Workload Repository is used for storing database statistics that are used for performance tuning.

General

- Snapshot Retention (days): 7
- Snapshot Interval (minutes): 60
- Collection Level: TYPICAL
- Next Snapshot Capture Time: May 21, 2005 1:00:23 PM

Manage Snapshots and Preserved Snapshot Sets

Snapshots: 24

Preserved Snapshot Sets: 1

Latest Snapshot Time: May 21, 2005 12:00:23 PM

Earliest Snapshot Time: May 20, 2005 12:53:41 PM

Oracle Enterprise Manager (SYS) Snapshots - Microsoft Internet Explorer

Select Beginning Snapshot

Go To Time: 5/21/05 12:00 PM

Create

Select ID	Snapshot Time	Collection Level	Write to Preserved Snapshot Set
004	May 20, 2005 12:53:41 PM	TYPICAL	
005	May 20, 2005 2:00:26 PM	TYPICAL	
006	May 20, 2005 3:01:00 PM	TYPICAL	
007	May 20, 2005 4:00:29 PM	TYPICAL	
008	May 20, 2005 5:01:03 PM	TYPICAL	
009	May 20, 2005 6:00:34 PM	TYPICAL	
010	May 20, 2005 7:00:06 PM	TYPICAL	
011	May 20, 2005 8:00:39 PM	TYPICAL	
012	May 20, 2005 9:00:12 PM	TYPICAL	
013	May 20, 2005 10:00:45 PM	TYPICAL	
014	May 20, 2005 11:00:18 PM	TYPICAL	
015	May 21, 2005 12:00:51 AM	TYPICAL	
016	May 21, 2005 1:00:23 AM	TYPICAL	
017	May 21, 2005 2:00:56 AM	TYPICAL	
018	May 21, 2005 3:00:26 AM	TYPICAL	
019	May 21, 2005 4:01:01 AM	TYPICAL	
020	May 21, 2005 5:00:32 AM	TYPICAL	
021	May 21, 2005 6:01:06 AM	TYPICAL	
022	May 21, 2005 7:00:37 AM	TYPICAL	
023	May 21, 2005 8:00:09 AM	TYPICAL	

Oracle Enterprise Manager (SYS) Snapshot Details - Microsoft Internet Explorer

Snapshot Details

Beginning Snapshot ID: 865

Beginning Snapshot Capture Time: May 20, 2005 2:00:26 PM

Ending Snapshot ID: 866

Ending Snapshot Capture Time: May 20, 2005 3:01:00 PM

Name	Value	Per Second	Per Transaction
DB CPU (seconds)	0.00	0.00	0.00
DB time (seconds)	14539.39	4.00	12.13
db block changes	274561.00	75.61	228.96
enqueue count	69279.00	19.08	57.78
global cache or block receive time (seconds)	0.00	0.00	0.00
global cache or blocks received	0.00	0.00	0.00
global cache current block receive time (seconds)	0.00	0.00	0.00
global cache current blocks received	0.00	0.00	0.00
global cache get time (seconds)	0.00	0.00	0.00
global cache gets	0.00	0.00	0.00
opened cursors cumulative	20087.00	5.53	16.74
parse count (hard)	22513.00	6.20	18.76
parse time cpu (seconds)	4.46	0.00	0.00
parse time elapsed (seconds)	13.31	0.00	0.01
physical reads	24522.00	6.75	20.45
physical writes	7594.00	2.09	6.33
redo size (KB)	35945.39	9.87	29.90
session cursor cache hits	0.00	0.00	0.00
session logical reads	1300246.00	369.75	1089.45

Oracle Enterprise Manager (SYS) Snapshot Details - Microsoft Internet Explorer

WORKLOAD REPOSITORY report for

Database: orcl10g

Instance: 1013.0.2.0

Snapshot ID: 865

Snapshot Time: May 20, 2005 2:00:26 PM

Carouse/Session: 28

Carouse/Session: 14.5

Report Summary

Cache Sizes (end)

Cache Name	Size	Unit
Buffer Cache	2048 MB	Block Size
Shared Pool Size	80M	Log Buffer

Load Profile

	Per Second	Per Transaction
Redo size	10,108.04	30.613.08
Logical reads	369.67	1,089.45
Block changes	75.60	228.96
Physical reads	6.75	20.45
Physical writes	2.09	6.33
User calls	2.03	6.37

Oracle Enterprise Manager (SYS) Automatic Database Diagnostic Monitor (ADDM) - Microsoft Internet Explorer

Automatic Database Diagnostic Monitor (ADDM)

Database Activity

The selected icon below the graph identifies the performance analysis period. Click on a different icon to select a different analysis period.

Performance Analysis

Task Name: ADDM384329400_1_866

Task Owner: SYS

Average Active Sessions: 8.27

Database Time (minutes): 16.11

Period Start Time: May 20, 2005 2:00:26 PM

Period Duration (minutes): 60.53

Impact (s)	Findings	Recommended actions
62.32	SQL statements were found waiting for row lock waits.	1 Application Analysis
38.75	Wait class "Other" was consuming significant database time.	2 Application Analysis
36.74	Wait event "classmate wait" in test class "Other" was consuming significant database time.	1 SQL Tuning
6.08	SQL statements consuming significant database time were found.	5 Segment Tuning
4.43	Individual database segments responsible for significant physical I/O were found.	1 I/O Configuration
3.96	The buffer cache was undersized causing significant additional read I/O.	1 SQL Tuning
3.27	The throughput of the I/O subsystem was significantly lower than expected.	2 Host Configuration



AWR

- ◆ Save snapshots for standard work profiles
- ◆ Use as a source for ADDM
- ◆ Use as a baseline
- ◆ Compare timelines
- ◆ Create a SQL Tuning set from a range of snapshots

67

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Resolving SQL Problems

68

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Tune the SQL – First steps

- ◆ Are statistics up to date?
- ◆ Are histograms gathered on skewed data?
- ◆ Are system statistics collected?
- ◆ Are the initialisation parameters appropriate
- ◆ Use trace 10053

69

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Tune the SQL – Second steps

- ◆ Use SQL Tuning Advisor
- ◆ Use SQL Access Advisor
- ◆ Consider rewriting the statement
- ◆ Consider hints
- ◆ Consider new indexes
- ◆ Run the statement overnight
- ◆ Consider materialised views
- ◆ Consider partitioning

70

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Automatic SQL Tuning

- ◆ SQL Tuning Advisor
- ◆ Optimiser runs in tuning mode
- ◆ Takes more time to decide
- ◆ Uses dynamic sampling
- ◆ Uses partial execution
- ◆ Uses past execution
- ◆ Source can be:
 - ◆ Top SQL
 - ◆ Statement
 - ◆ SQL Tuning Set
 - ◆ Snapshot
 - ◆ Preserved snapshot set

71

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Automatic Tuning Optimiser

- ◆ Statistics
 - ◆ Recommendations to gather
 - ◆ Implement these and rerun
 - ◆ Create auxiliary statistics
- ◆ SQL Profiles
 - ◆ Store auxiliary statistics
 - ◆ Verify and correct estimates
 - ◆ Complex predicates
 - ◆ Skewed join data
 - ◆ Sparse join data
 - ◆ Custom optimiser mode
 - ◆ Not run in limited mode
 - ◆ Rerun when significant data changes

72

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Automatic Tuning Optimiser

- Access path
 - Indexes
 - Only for this statement
- SQL Structure
 - Changes to code
 - Datatype mismatches
 - UNION/UNION ALL
 - Modified columns

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Outlines v SQL Profile

Outline	SQL Profile
From Oracle 8i	From Oracle 10g
Stored as a set of hints	Stored as supplementary optimiser information
Plan will be static	Plan may change
Will not apply to different literals unless CURSOR_SHARING=SIMILAR or FORCE on creation and use	Applies to different literals if force_match=>TRUE

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Outlines v SQL Profile

Outline

SQL Profile

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SQL Profiles

- Automatic Tuning Optimiser
- Uses execution history
- Uses partial execution
- Store auxiliary statistics
- Store optimizer settings
- Verify and correct estimates
 - Complex predicates
 - Skewed join data
 - Sparse join data
- Rerun when significant data changes
- Use SQLTUNE_CATEGORY to test

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Oracle Enterprise Manager (SYS) - Active Sessions Waiting: User SYS - Microsoft Internet Explorer

Database Instance: ora10g@sagecomputing.com.au - Address Central - SQL Tuning Results STATEMENT1

Recommendations for SQL ID: a9c0bpyzw67n

Only one recommendation should be implemented.

SQL Text

```
SELECT count(*) FROM organisations o, events_large e, bookings_large b, resources r WHERE o.org_id = e.org_id AND e.event_no = b.event_no AND b.resource_code = r.code AND r.name = 'Juni'
```

Select Recommendation

Select Type	Findings	Recommendations	Benefits	How Explain
SQL Profile	A potentially better execution plan was found for this statement.	Consider accepting the recommended SQL profile.	93.72%	Original Explain Plan

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Oracle Enterprise Manager (SYS) - Active Sessions Waiting: User SYS - Microsoft Internet Explorer

Database Instance: ora10g@sagecomputing.com.au - Address Central - SQL Tuning Results STATEMENT1

Recommendations for SQL ID: a9c0bpyzw67n - New Explain Plan

New Explain Plan With SQL Profile

The following is the new explain plan for the SQL statement being tuned. The cost has been adjusted by the SQL Tuning Advisor to reflect the recommendation.

Original Explain Plan

Indicates an adjustment from the original plan by the SQL Tuning Advisor. The following is the original explain plan for the SQL statement being tuned.

Operation	Plan ID	Object	Object Type	Order	Rows	Cost	Size
SELECT STATEMENT	0				11	1	0.00
TABLE ACCESS	1	ORGANISATIONS	TABLE		10	1	0.00
TABLE ACCESS	2	EVENTS_LARGE	TABLE		9	15	1.01
TABLE ACCESS	3	BOOKINGS_LARGE	TABLE		6	132	7.96
TABLE ACCESS	4	RESOURCES	TABLE		3	5	0.21
TABLE ACCESS	5	EVENTS_LARGE	TABLE		1	1	0.02
TABLE ACCESS	6	BOOKINGS_LARGE	TABLE		24084	705	301
TABLE ACCESS	7	RESOURCES	TABLE		5	58	1.01
TABLE ACCESS	8	EVENTS_LARGE	TABLE		5	42484	705
TABLE ACCESS	9	BOOKINGS_LARGE	TABLE		76751689	106	720

Oracle Enterprise Manager (SYS) - Active Sessions Waiting: User SYS - Microsoft Internet Explorer

Database Instance: ora10g@sagecomputing.com.au - Address Central - SQL Tuning Results STATEMENT1

SQL Tuning Results: STATEMENT1

The recommended SQL Profile was created successfully.

Status: COMPLETED
Time Limit (seconds): 1800
Started: 3/18/2006 14:33:38
Completed: 3/18/2006 14:33:51
Running Time (seconds): 13

Recommendations

Select SQL Text	Plan	SQL ID	Profile	Index	Recommendations	How Explain
SELECT count(*) FROM organisations o, events_large e, bookings_large b, resources r WHERE o.org_id = e.org_id AND e.event_no = b.event_no AND b.resource_code = r.code AND r.name = 'Juni'		a9c0bpyzw67n	SQL_PROFILE	INDEX	✓	Original Explain Plan

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What Does the SQL Profile Do

SELECT rec_id, type
FROM dba_advisor_recommendations
WHERE task_name = 'STATEMENT1';

working.txt - Notepad

```
REC_ID TYPE
1 SQL_PROFILE
```

82

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What Does the SQL Profile Do

SELECT rec_id, message, attr1
FROM dba_advisor_rationale
WHERE task_name = 'STATEMENT1';

working.txt - Notepad

```
1
this attribute adjusts optimizer estimates.
OPT_ESTIMATE('o' 'sel$1', 'o' 'sel$1', 'e' 'sel$1', 'b' 'sel$1'),
SCALE_ROWS=0.0006673178999

1
this attribute adjusts optimizer estimates.
OPT_ESTIMATE('e' 'sel$1', 'o' 'sel$1', 'e' 'sel$1', 'b' 'sel$1'),
SCALE_ROWS=0.0003210737756

1
this attribute adjusts optimizer estimates.
OPT_ESTIMATE('e' 'sel$1', 'o' 'sel$1', 'e' 'sel$1', 'b' 'sel$1'),
SCALE_ROWS=0.0006673178999
```

83

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Oracle Enterprise Manager (SYS) - Active Sessions Waiting: User SYS - Microsoft Internet Explorer

Database Instance: ora10g@sagecomputing.com.au - Address Central - SQL Details: a9c0bpyzw67n

SQL Details: a9c0bpyzw67n

Switch to SQL ID: [a9c0bpyzw67n] View Data [Real Time] Manual Refresh [Refresh] Schedule SQL Tuning Advisor [Schedule]

Text

```
SELECT count(*) FROM organisations o, events_large e, bookings_large b, resources r WHERE o.org_id = e.org_id AND e.event_no = b.event_no AND b.resource_code = r.code AND r.name = 'Juni'
```

Details

Select the plan hash value to see the details below. Plan Hash Value: 347537846

Statistics Activity Plan Tuning Information

SQL Profiles and Outlines

A SQL Profile contains additional statistics of this SQL statement for the query optimizer to generate a better execution plan. An outline contains hints for this SQL statement for the query optimizer to generate a better execution plan.

Select Name	Type	Category	Status	Created
SQL_PROFILE	SQL Profile	DEFAULT	ENABLED	3/17/2006 14:34:31

SQL Tuning History

The following SQL tuning tasks provide the recommendations to tune this SQL statement.


Advisor Task Name	Advisor Task Owner	Task Completion
STATEMENT1	SYS	3/17/2006 14:33:51

84

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Identify the SQL Profile

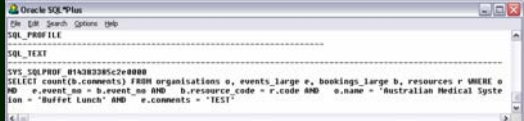
```
SELECT name, signature, sql_text, status, force_matching
FROM dba_sql_profiles
```



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Check the Profile is Used

```
SELECT sql_profile, sql_text
FROM v$sql
WHERE sql_profile is not null
```




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How a SQL Profile Works

- Calculates Signature for statement
- Strips spaces
- Converts to upper case

```
SELECT *
FROM sql$
```

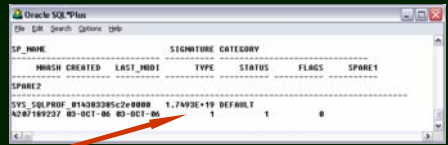


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How a SQL Profile Works

- Profile attributes contain optimiser information

```
SELECT *
FROM sqlprof$
```

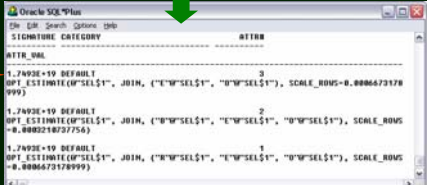


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How a SQL Profile Works

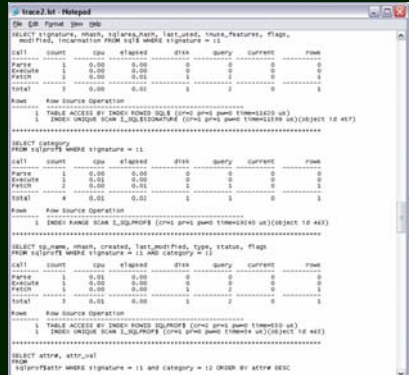
- Profile attributes contain optimiser information

```
SELECT *
FROM sqlprof$sattr
```



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Formatted Trace File



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SQL Profile - Example

- Both of these statements use the same profile

```
SELECT sql_text, sql_id, sql_profile, exact_matching_signature,
force_matching_signature
FROM v$sql WHERE upper(sql_text) like '%BOOKINGS%'
```

SQL_ID	SQL_PROFILE	EXACT_MATCHING_SIGNATURE
40000000000000000000000000000000	SQLPROF_01A383D5C2E8000	1.7493E+19

91

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Handling Literals

- Use force_match to make literals behave like bind variables

```
BEGIN
dbms_sqltune.accept_sql_profile(task_name=>'STATEMENT1',
force_match=>TRUE);
END;
```

SP_NAME	SIGNATURE	CATEGORY
SQLPROF_01A383D5C2E8000	1.7493E+19	DEFAULT

92

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Handling Literals

- Both of these statements use the same profile

```
SELECT sql_text, sql_id, sql_profile, exact_matching_signature,
force_matching_signature
FROM v$sql WHERE upper(sql_text) like '%BOOKINGS%'
```

SQL_ID	SQL_PROFILE	EXACT_MATCHING_SIGNATURE
40000000000000000000000000000000	SQLPROF_01A383D5C2E8000	1.7493E+19

93

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SQL Profiles - Categories

- Accept profile in a category to test
DBMS_SQLTUNE.ACCEPT_SQL_PROFILE (
task_name => 'Task_Name',
category => 'TEST_CATEGORY')
- Set the category for your session
ALTER SESSION SET
SQLTUNE_CATEGORY='TEST_CATEGORY'
- Test the code
- Reset the category
DBMS_SQLTUNE.ALTER_SQL_PROFILE (
name => 'SQL_Profile_Name',
attribute_name => 'category', value => 'DEFAULT');

94

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SQL Profiles – Export/Impart

- Use staging table
dbms_sqltune.create_stgtab_sqlprof(
table_name=>'PROFILE_TEMP');
- Add profile to staging table
dbms_sqltune.pack_stgtab_sqlprof (
profile_name => 'PROFILE1',
staging_table_name => 'PROFILE_TEMP');
- Data pump
dbms_sqltune.unpack_stgtab_sqlprof(
staging_table_name => 'PROFILE_TEMP',
,REPLACE=>TRUE);

95

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SQL Access Advisor

- Source can be:
 - Top SQL
 - SQL Tuning Set
 - Defined SQL
 - Schemas and/or tables
- Filter by
 - Users
 - Tables
 - Top resource users
 - Module IDs
 - Actions

96

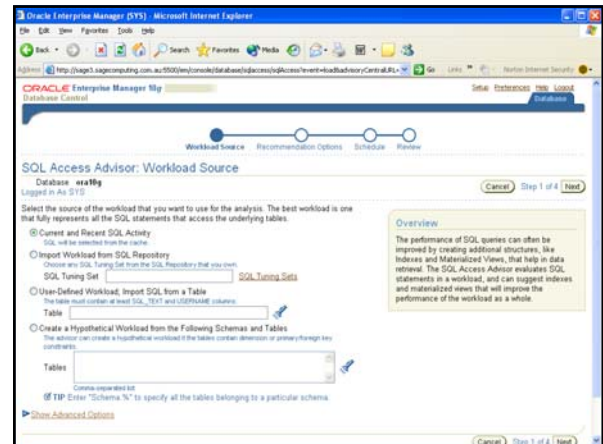
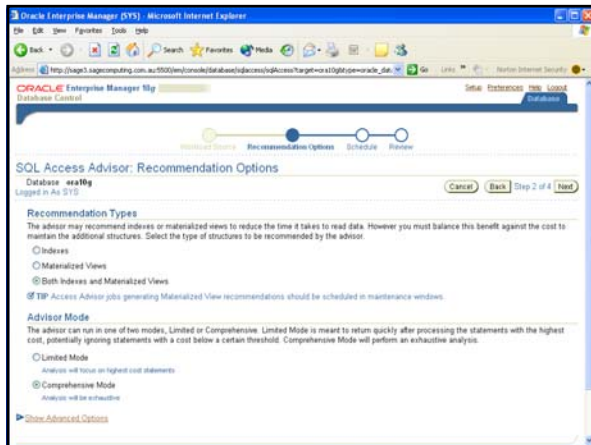
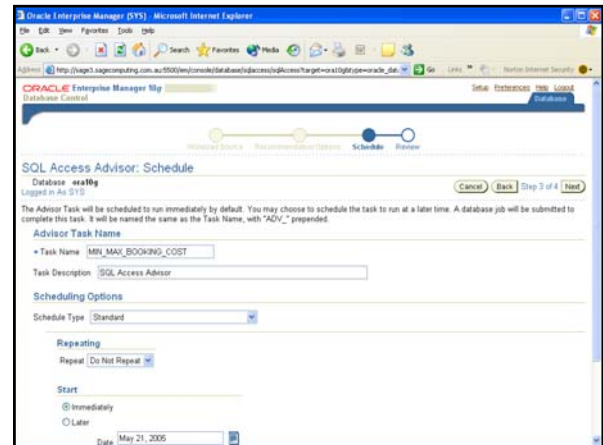
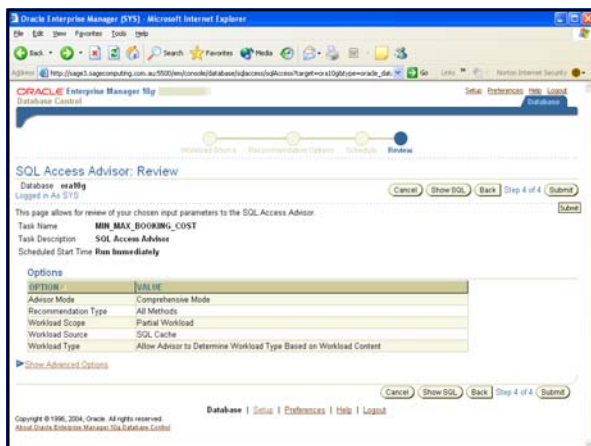
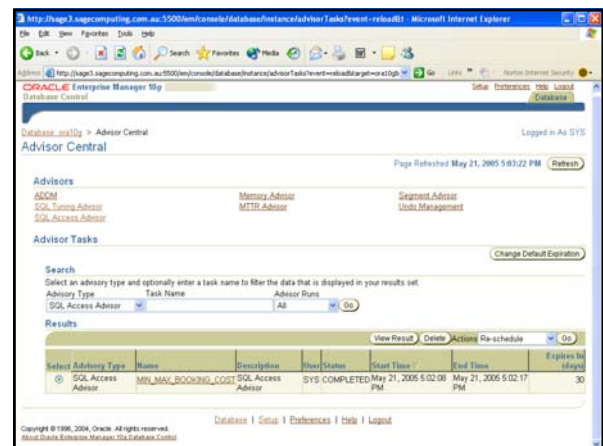
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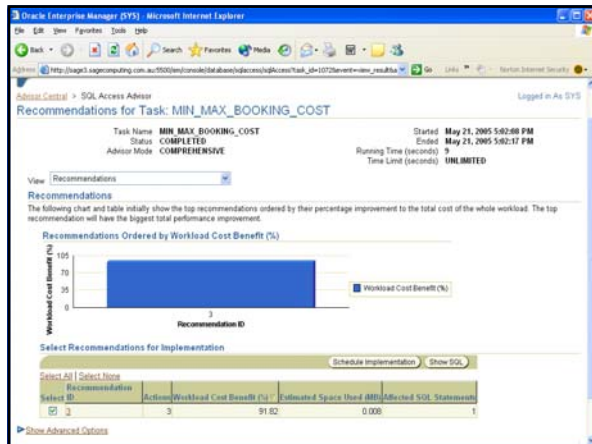


SQL Access Advisor

- Options
- Define workload type
- Include dropping indexes
- Indexes
- Materialised views
- Both
- Limited
- Comprehensive

97
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Oracle Enterprise Manager (SYS) - Microsoft Internet Explorer

Address Central > SQL Access Advisor

Recommendation: 3

The Actions table lists the actions of the selected recommendation. You may change the values of any of the editable fields. If you edit any name, dependent names, which are shown as readonly, will be updated accordingly. If the Tablespace field is left blank the default tablespace of the schema will be used. When you click OK, the SQL script is modified, but it is not actually executed until you select 'Schedule Implementation' on the Recommendations page.

Cancel OK

Actions

Action	Object Name	Index (Object Table)	Schema	Tablespace
CREATE MATERIALIZED VIEW LOG		TRANC_BOOKINGS_LARGE	TRANC	
CREATE MATERIALIZED VIEW	"MVS_0400000"		"SYS"	
GATHER TABLE STATISTICS	"MVS_0400000"		"SYS"	

SQL Affected by Recommendation

Statement ID	Statement	Workload Cost Benefit (%)	Original Cost	New Cost	SQL Cost Benefit (%)	Execution Count
1	SELECT max(cost), min(cost), avg(cost) FROM bookings_large	91.82	1099	3	99.82	1

Cancel OK

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Database | Setup | Preferences | Help | Logout

Wait Events

105

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Wait Event Classes

```
SELECT distinct wait_class#, wait_class
FROM v$event_name
ORDER BY wait_class#
```

↓

WAIT_CLASS#	WAIT_CLASS
0	Other
1	Application
2	Configuration
3	Administrative
4	Concurrency
5	Commit
6	Idle
7	Network
8	User I/O
9	System I/O
10	Scheduler
11	Cluster

106

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Wait Event Classes

- Application
- Configuration
- Administrative
- Concurrency
- Commit
- Idle
- Network
- User I/O
- System I/O
- Scheduler
- Cluster
- Other

Includes locking problems
Database configuration problems
Caused by database administration
Contention for buffers and latches
log file synchronisation
Waiting for something to do
Network delays
Disk read / write waits by users, SMON and MMON
Disk read/ write waits by background process except SMON and MMON
Resource manager waits
RAC waits
Other insignificant waits

107

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What Class is Causing Waits

```
SELECT wait_class_id, wait_class#, wait_class,
total_waits, time_waited
FROM v$system_wait_class
```

↓

WAIT_CLASS_ID	WAIT_CLASS#	WAIT_CLASS	TOTAL_WAITS	TIME_WAITED
1893977003	0	Other	2000	52528
4217450380	1	Application	320	10
3290255840	2	Configuration	111	523
3875070507	4	Concurrency	765	3655
3386400367	5	Commit	527	385
2723168908	6	Idle	555098	11965178
2000153315	7	Network	526262	89
1740759767	8	User I/O	97884	120198
4108307767	9	System I/O	8699	6811

108

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User I/O Events

```

SELECT name
FROM v$event_name
WHERE wait_class# = 8

```

NAME

local write wait
buffer read retry
read by other session
db file sequential read
db file scattered read
db file single write
db file parallel read
direct path read
direct path read temp
direct path write
direct path write temp
NFILE read

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What Events are Causing User I/O Waits

System wait events – User I/O

```

SELECT e.event, e.total_waits, e.total_timeouts,
       e.time_waited, average_wait
FROM v$system_event e, v$event_name n
WHERE n.event_id = e.event_id
AND n.wait_class# = 8 – User I/O

```

EVENT	TOTAL_WAITS	TOTAL_TIMEOUTS	TIME_WAITED	AVERAGE_WAIT
read by other session	45432	0	40824	1
db file sequential read	49525	0	74044	1
db file scattered read	3311	0	5610	2
db file single write	8	0	3	0
db file parallel read	1	0	1	1
direct path read	92	0	34	0
direct path read temp	6	0	0	0
direct path write	108	0	4	0
direct path write temp	35	0	0	0

User I/O Class

- db file sequential read
 - Single block IO
 - May be index access
- db file scattered read
 - Multi block IO
 - Table full scan or index fast full scan
 - Sort operation
- db file single write
 - Writing file headers
- BFILE read
 - Waiting for read of external bfile
- Direct path read and direct path read temp
 - Sort operations written to disk
 - Parallel slaves

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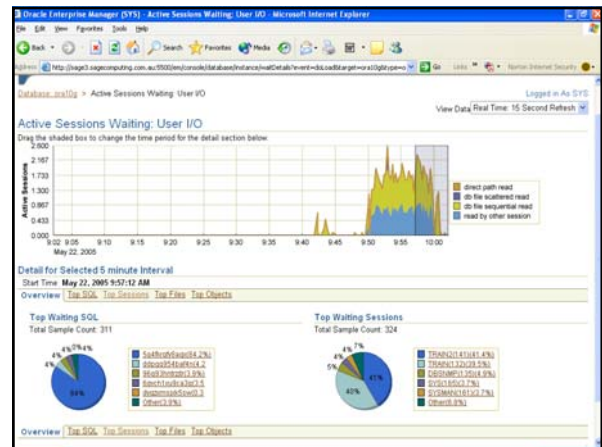
What Objects are Causing Sequential reads

```

SELECT object_name, current_obj#, current_file#,
       current_block#, wait_time, time_waited
FROM v$active_session_history h, dba_objects o
WHERE session_id = 141
AND session_serial# = 2
AND o.object_id = h.current_obj#
AND event = 'db file sequential read'

```

OBJECT_NAME	CURRENT_OBJ#	CURRENT_FILE#	CURRENT_BLOCK#	WAIT_TIME	TIME_WAITED
BK_LO_EVINFO	54674	8	16442	0	2440
BK_LO_EVINFO	54674	8	16374	0	180
BOOKINGS_LARGE	54577	8	9645	0	20874
BOOKINGS_LARGE	54577	8	8904	0	63567
BOOKINGS_LARGE	54577	8	12850	0	6029
BOOKINGS_LARGE	54577	8	4011	0	13001
BK_LO_EVINFO	54674	8	16265	0	14899
BK_LO_EVINFO	54674	8	16229	0	173
BK_LO_EVINFO	54674	8	16216	0	14479



Oracle Enterprise Manager (SYS) - SQL Details: 3f78x2va84 - Microsoft Internet Explorer

SQL Text: `SELECT count(comments)
FROM bookings_large
WHERE resource_code = 31`

Execution Plan | Current Statistics | Execution History | Tuning History

Collected From Target May 22, 2005 6:10:11 PM

Data Source: Cerner Cache Plan Hash Value: 406132515 Module: SQL*Plus
Capture Time: May 22, 2005 6:10:11 PM Optimizer Mode: FIRST_ROWS Action: Unavailable
Parsing Schema: TRAIN2

Expand All | Collapse All

Operation	Object	Object Type	Index Name	KB Cost	Time (seconds)	CPU Cost	IO Cost	Object Cost
SELECT STATEMENT				4	422			
TABLE ACCESS BY INDEX ROWID	TRAIN2 BOOKINGS_LARGE	TABLE		3	1	0.014		
INDEX RANGE SCAN	TRAIN2_BK_RES2	INDEX		210117	138	318	422	31816176
				1	170117	26		1220306

Execution Plan | Current Statistics | Execution History | Tuning History

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Oracle Enterprise Manager (SYS) - SQL Details: 5g4fkgfy8agx - Microsoft Internet Explorer

SQL Text: `SELECT event_no, cost
FROM train2 bookings_large
WHERE event_no = 10000`

Execution Plan | Current Statistics | Execution History | Tuning History

Collected From Target May 22, 2005 10:01:00 AM

Data Source: Cerner Cache Plan Hash Value: 42182496 Module: SQL*Plus
Capture Time: May 22, 2005 10:01:00 AM Optimizer Mode: FIRST_ROWS Action: Unavailable
Parsing Schema: TRAIN2

Expand All | Collapse All

Operation	Object	Object Type	Index Name	KB Cost	Time (seconds)	CPU Cost	IO Cost	Object Cost
SELECT STATEMENT				3	1209481			
TABLE ACCESS BY INDEX ROWID	TRAIN2 BOOKINGS_LARGE	TABLE		2120940	10,108,906	1209481		74691000110144
INDEX RANGE SCAN	TRAIN2_BK_EV750	INDEX		1120940	2917		17	219395376

Execution Plan | Current Statistics | Execution History | Tuning History

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Oracle Enterprise Manager (SYS) - Session Details: SID 141 - Microsoft Internet Explorer

Session Details: SID 141

General | Statistics | Wait Events | Open Cursors | Links

Page Refreshed May 22, 2005 10:03:33 AM

Serial Number: 2
Current Status: INACTIVE
Wait Event: idle
OS Server Process ID: 3864
OS User Name: TRAIN2
Resource Consumer Group: 0

Application Information
Program: sqlplus.exe
Module: SQL*Plus
Command: UNDO=0

Client Information
OS Client Process ID: 31723176
OS User Name: SAGE3 sage
Terminal: SAGE3
Host: WORKGROUP\SAGE3

General | Statistics | Wait Events | Open Cursors | Links

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Oracle Enterprise Manager (SYS) - Active Sessions Waiting: User I/O - Microsoft Internet Explorer

Active Sessions Waiting: User I/O

View Data Real Time: 15 Second Refresh

Drag the shaded box to change the time period for the detail section below

Detail for Selected 5 minute Interval
Start Time: May 22, 2005 9:54:18 AM

Overview | Top SQL | Top Sessions | Top Files | Top Objects

Top Wait Events per Object

Object Number	Wait Event	Activity (%)
54572	db file sequential read	31.96
54572	read by other session	34.56
54624	db file sequential read	9.40
54624	read by other session	8.25
0	db file sequential read	1.15
13	db file sequential read	96
10	db file sequential read	56
10	db file sequential read	19

Overview | Top SQL | Top Sessions | Top Files | Top Objects

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Oracle Enterprise Manager (SYS) - Histogram for Wait Event: db file sequential read - Microsoft Internet Explorer

Histogram for Wait Event: db file sequential read

View Data Real Time: Manual Refresh

Page Refreshed May 22, 2005 10:26:50 AM

Wait Event Occurrences Per Duration

Duration of Wait (milliseconds)

Occurrences

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Oracle Enterprise Manager - Table General: TRAIN2 BOOKINGS_LARGE - Microsoft Internet Explorer

Edit Table: TRAIN2 BOOKINGS_LARGE

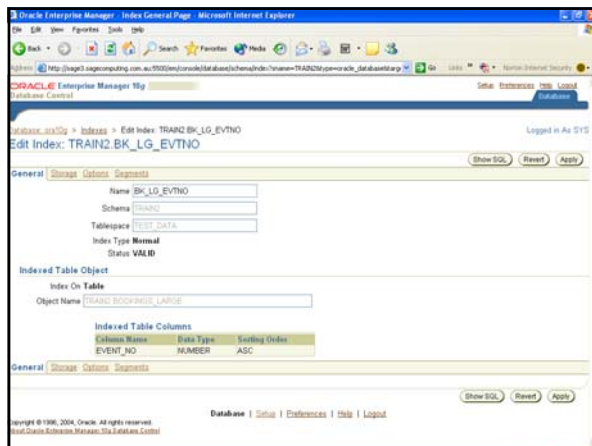
General | Constraints | Segments | Storage | Options | Statistics

Name: BOOKINGS_LARGE
Schema: TRAIN2
Tablespace: TEST_DATA
Organization: Standard, Heap Organized
Number of Indexes: 3

Columns

Select Name	Basic Type	Size	Scale	Not Null	Default Value
BOOKING_NO	NUMBER	9		<input checked="" type="checkbox"/>	
EVENT_NO	NUMBER	6		<input checked="" type="checkbox"/>	
RESOURCE_CODE	VARCHAR2	4		<input checked="" type="checkbox"/>	
CHARGEABLE	VARCHAR2	1		<input type="checkbox"/>	
MADE_BY	VARCHAR2	15		<input type="checkbox"/>	
QUANTITY	NUMBER	4		<input type="checkbox"/>	
COST	NUMBER	9		<input type="checkbox"/>	
STATUS	VARCHAR2	1		<input type="checkbox"/>	

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Tuning – Sequential Reads

- Abnormally high wait level may be an index that should not be used
 - For table access
 - For nested loop join
- Check
 - Statistics on the index are current
 - Optimizer mode is not FIRST_ROWS
 - Column has a histogram if data is skewed
 - There is not an old SQL*Profile
 - Bind peeking
- If all this is OK – tune the SQL

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Example – Scattered Reads

```

DECLARE
v_1 VARCHAR2(4) := 'VCR1';
v_2 NUMBER;
BEGIN
  SELECT count(b.comments)
  INTO v_2
  FROM bookings_large b
  WHERE b.resource_code = v_1;

  v_1 := 'PC1';

  FOR counter IN 1..20 LOOP
    SELECT count(b.comments)
    INTO v_2
    FROM bookings_large b
    WHERE b.resource_code = v_1;
  END LOOP;
END;

```

Skewed data + Histogram

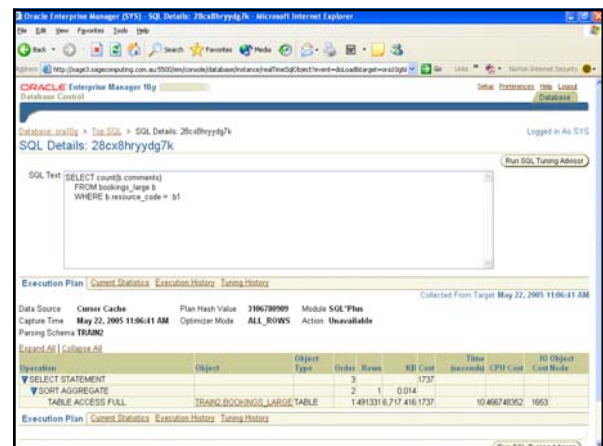
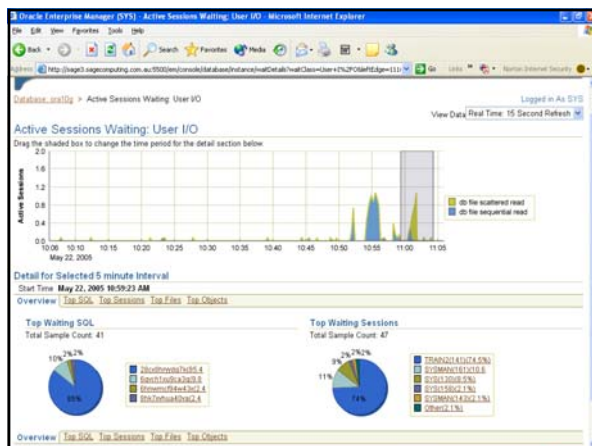
SELECT resource_code, COUNT(*)
FROM bookings_large
GROUP BY resource_code

RESOURCE_CODE	COUNT(*)
BRIG	297763
BRIN	148879
CONF	99255
FLPC	99252
LMCH	148881
PC1	9629
TAP1	49626
VCR1	489252
VCR2	99255

SELECT endpoint_number, endpoint_value
FROM user_histograms
WHERE table_name = 'BOOKINGS_LARGE'
AND column_name = 'RESOURCE_CODE'

ENDPOINT_NUMBER	ENDPOINT_VALUE
1198	3.4436E+35
1760	3.4436E+35
2124	3.4949E+35
2456	3.6501E+35
3040	3.9620E+35
3079	4.1675E+35
3279	4.3748E+35
5173	4.4790E+35
5554	4.4790E+35

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Oracle Enterprise Manager (SYS) - Session Details: SID 141 - Microsoft Internet Explorer

Database: ora10g > Top Sessions > Session Details: SID 141

Session Details: SID 141

Page Refreshed: May 22, 2005 11:06:54 AM

General	Statistics	Wait Events	Open Cursors	Locks
Serial Number: 2				
Current Status: INACTIVE				
Wait Event: SQL*				
OS Server Process ID: 3808				
OS User Name: TRUNK				
Resource Consumer Group: 0				
Application Information				
Program: sqlplus.exe	Client Information			
Module: SQL*Plus	OS Client Process ID: 3172306			
Command: UNKNOWN	OS User Name: SAGE3			
	Terminal: WORKGROUP\SAGE3			
	Host: WORKGROUP\SAGE3			

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Oracle Enterprise Manager (SYS) - Session Details: SID 141 - Microsoft Internet Explorer

Database: ora10g > Top Sessions > Session Details: SID 141

Session Details: SID 141

Page Refreshed: May 22, 2005 11:06:54 AM

General	Statistics	Wait Events	Open Cursors	Locks
Serial Number: 2				
Current Status: INACTIVE				
Wait Event: SQL*				
OS Server Process ID: 3808				
OS User Name: TRUNK				
Resource Consumer Group: 0				
Application Information				
Program: sqlplus.exe	Client Information			
Module: SQL*Plus	OS Client Process ID: 3172306			
Command: UNKNOWN	OS User Name: SAGE3			
	Terminal: WORKGROUP\SAGE3			
	Host: WORKGROUP\SAGE3			

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Tuning – Scattered Reads

- Abnormally high levels may be a full scan of large table
- Check
 - Statistics on the table and indexes are current
 - System statistics are gathered
 - Column has a histogram if data is skewed
 - There is not an old SQL*Profile
 - Bind peeking
- If all this is OK – tune the SQL

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Bind Peeking

- Values of bind variable inspected on hard parse
- Subsequent executions use the same plan
- If selective value first, subsequent executions may use inappropriate index
- If non selective value first, subsequent executions may full scan
- Set `_optim_peek_user_binds` to FALSE

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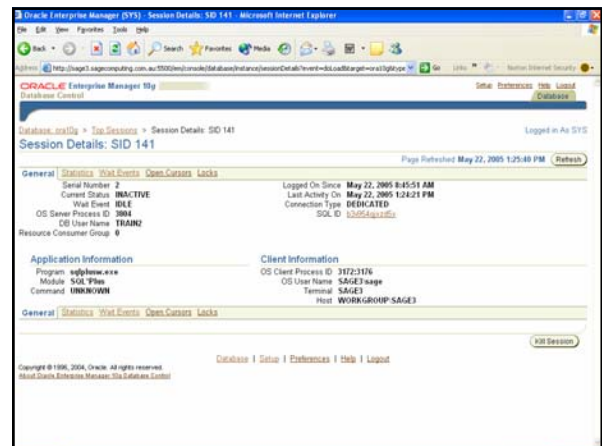
Tuning – I/O

- Minimise I/O
- Distribute I/O
- Tune sorts
- Tune buffer cache
- Use KEEP buffer pool for
 - small scans on commonly used tables
 - tables with sequential reads and commonly used data
- Use RECYCLE buffer pool for
 - random access to large tables

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Common Tuning Problems - examples

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The screenshot shows the Oracle Enterprise Manager 11g interface. The top navigation bar includes links for Home, Job, View, Reports, Tools, and Help. The main content area is titled "Performance Finding Details" and shows a warning icon. The finding is titled "The PGA was inadequately sized, causing additional I/O to temporary tablespaces to consume significant database time." The finding details include a score of 4.0, a severity of Warning, and a message to increase the size of the PGA by setting the value of parameter "pga_aggregate_target" to 41 MB. The Recommendations section shows a table with one recommendation: "Increase the size of the PGA by setting the value of parameter 'pga_aggregate_target' to 41 MB." The Findings Path section shows a table with one finding: "The PGA was inadequately sized, causing additional I/O to temporary tablespaces to consume significant database time." The table has columns for Finding, Impact (%), and Additional Information.

Oracle Enterprise Manager 11g

Database Control

Performance Finding Details

Logged In As SYS

Database Time [warning] 5.27 Annual Start Time May 21, 2005 3:00:56 PM Period Duration (findings) 59.43

Task Owner SYS Task Name AEDM:3843249081_1_831 Average Active Sessions 6.09

Finding

The PGA was inadequately sized, causing additional I/O to temporary tablespaces to consume significant database time.

Impact (findings) 4.0%
Impact (%) 4.0

Recommendations

Show All Details | Hide All Details

Result Category	Severity (%)
Warning: DB Configuration	3.00

Message Increase the size of the PGA by setting the value of parameter "pga_aggregate_target" to 41 MB. [Impartment](#)

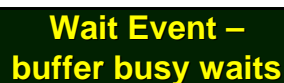
Findings Path

Expand All | Collapse All

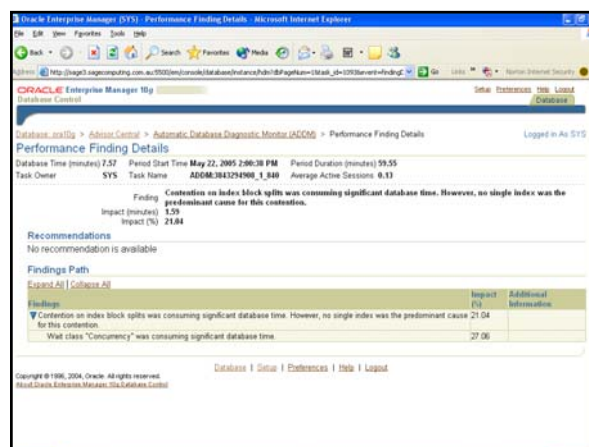
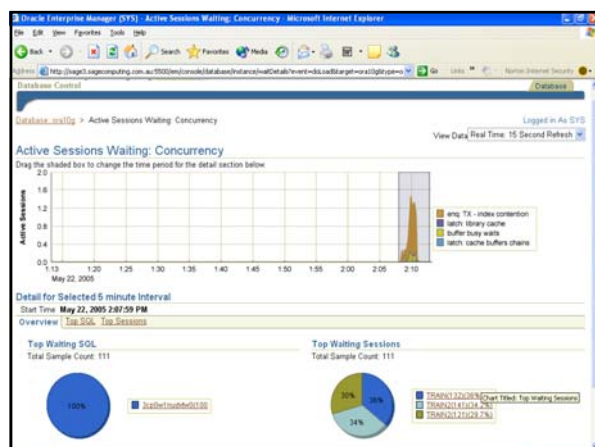
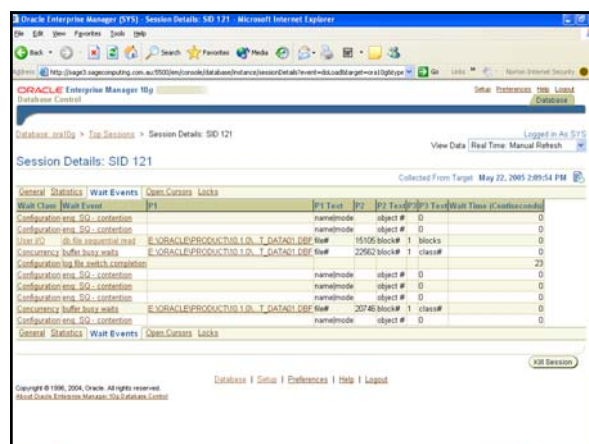
Finding	Impact (%)	Additional Information
<input checked="" type="checkbox"/> The PGA was inadequately sized, causing additional I/O to temporary tablespaces to consume significant database time. What class "User I/O" was consuming significant database time.	4.0	91.56

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Most Recent Database Status: The Database Control

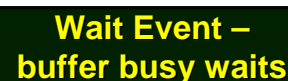
Database 1 Status 1 Performance 1 Info 1 Logout



- 139



OBJECT_NAME	CURRENT_OBJ#	CURRENT_FILES	CURRENT_BLOCKS	WAIT_TIME	TIME_WAITED
BK_LG_EVNTNO	54674	8	14477	0	391
BK_LG_EVNTNO	54674	8	15194	17	0
BK_LG_EVNTNO	54674	8	15294	1	0
BK_LG_EVNTNO	54674	8	22947	0	281891
BK_LG_EVNTNO	54674	8	16774	30	0
BK_RES2	54692	8	20465	0	1022386
BK_RES2	54692	8	21655	0	961881
BK_RES2	54692	8	21655	0	961218
BK_RES2	54692	8	21741	0	4755933
BK_RES2	54692	8	20636	0	475356
BOOKINGS_LARGE	54577	8	20636	3	0
BOOKINGS_LARGE	54577	8	20746	0	1027986
BOOKINGS_LARGE	54577	8	20844	44	0
BOOKLG_PK	54578	8	19995	0	2697311
BOOKLG_PK	54578	8	19995	0	269694



- 144



Wait Event – log buffer space

- ✦ Wait to write to the log buffer
- ✦ I/O to the log file is not keeping up with write requests to the buffer
- ✦ Move log files to faster drives
- ✦ Increase log buffer

145

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The screenshot shows the Oracle Enterprise Manager (SYS) Performance Finding Details page. The finding is titled 'Wait for redo log buffer space were consuming significant database time.' The impact is 0.68 minutes and 1.12%. The recommendations section suggests increasing the size of the redo log buffer by setting the parameter 'log_buffer' to 8 M. The findings path shows the finding is under 'Configuration'.

The screenshot shows the Oracle Enterprise Manager (SYS) View Report page in Microsoft Internet Explorer. The report displays FINDING 10: 7.1% impact (41 seconds). The finding description states: 'Waits for redo log buffer space were consuming significant database time.' The recommendations section includes two recommendations: 1. DB Configuration, 7.1% benefit (41 seconds) and 2. Host Configuration, 7.1% benefit (41 seconds). The symptoms section states: 'Wait class "Configuration" was consuming significant database time. (18% impact [106 seconds])'.



Wait Event – log file sync

- ✦ Wait class = Commit
- ✦ Write redo information from log buffer to redo log files
- ✦ On user commit
- ✦ Reduce commit frequency
- ✦ Move redo log files to faster disk

148

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Wait Event – log file parallel write

- ✦ Wait class = System I/O
- ✦ LGWR waiting to write to redo log files
- ✦ May occur in conjunction with log file sync
- ✦ Move redo log files to faster disk
- ✦ Don't overdo number of redo group members
- ✦ Reduce amount of redo
 - ✦ No logging
 - ✦ Global temporary tables

149

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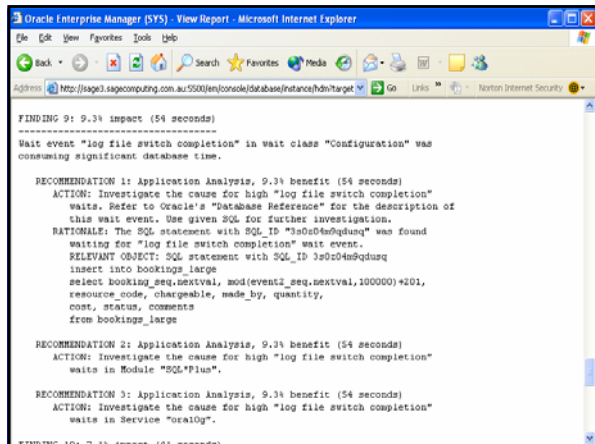


Wait Event – log file switch

- ✦ (archiving needed)
 - ✦ Required redo not finished being archived
 - ✦ Check alert log
 - ✦ Increase archiver processes
- ✦ (checkpoint incomplete)
 - ✦ Required log needed to complete checkpoint
 - ✦ Check sufficient redo log files
- ✦ (clearing log file)
 - ✦ Required logfile waiting to be cleared
- ✦ (completion)
 - ✦ Normal log file switch not complete

150

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Wait Event – library cache latch waits

- Library cache latch taken to add new statement
- Reduce hard parsing
- Use bind variables
- Use cursor_sharing = SIMILAR
- Consider increasing the SGA

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Wait Event – free buffer wait

- DBWR not keeping up
- Look at wait events for DBWR
- Optimise I/O
- Buffer cache too big
- Buffer cache too small

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Background Processes

```
SELECT program, serial#, sid
FROM v$session
WHERE program like 'ORACLE.EXE%'
```

PROGRAM	SERIAL#	SID
ORACLE.EXE (q002)	2208	128
ORACLE.EXE (MMNL)	1	156
ORACLE.EXE (MMON)	1	158
ORACLE.EXE (QMON)	3	160
ORACLE.EXE (CJQ0)	1	163
ORACLE.EXE (RRCO)	1	164
ORACLE.EXE (SMON)	1	165
ORACLE.EXE (CPEP)	1	166
ORACLE.EXE (LGWR)	1	167
ORACLE.EXE (DBW0)	1	168
ORACLE.EXE (MRMAN)	1	169
ORACLE.EXE (SPCK)	1	170

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Background Process – Wait Events

```
SELECT event, wait_time, time_waited
FROM v$active_session_history
WHERE session_id = 168
AND session_serial# = 1
```

EVENT	WAIT_TIME	TIME_WAITED
rdms ipc message	3078109	0
db file parallel write	0	1074
rdms ipc message	3077900	0
rdms ipc message	3077814	0
db file parallel write	0	68898
db file parallel write	0	2664
db file parallel write	0	62162
rdms ipc message	3077741	0
rdms ipc message	3077854	0
db file parallel write	0	5607
db file parallel write	0	166
db file parallel write	1596	0
db file parallel write	0	161
control file sequential read	222	0
control file sequential read	0	20607
control file sequential read	0	46275
control file sequential read	0	20818

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Using ADDM

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ADDM

- Automatic Database Diagnostic Monitor
- Performs self diagnosis
- Run for each AWR snapshot (hourly)
- Aim is to reduce DB time
- Identify bottlenecks
- Make recommendations
 - Impact
 - Benefit
 - Action and rationale

STATISTICS_LEVEL TYPICAL or ALL

157

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ADDM

- Hot objects
- High resource SQL / PL/SQL / Java
- Memory structures
- I/O Performance
- Log files / archiving / checkpoints
- Contention
- RAC issues
- Documents wait classes not causing problems

158

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ADDM Recommendations

- Tune the SQL
- Application changes
 - Use of bind variables
 - Sequence caching
- Schema changes
 - Partitioning
- Configuration
 - Changes to init parameters
 - Changes to file sizes
- Hardware changes

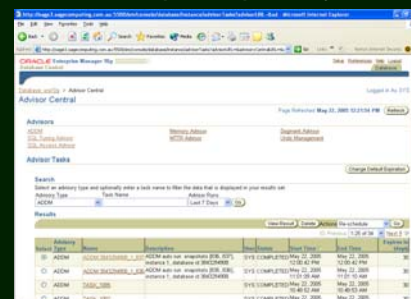
159

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Accessed through Enterprise Manager

- View ADDM output for up to 7 days



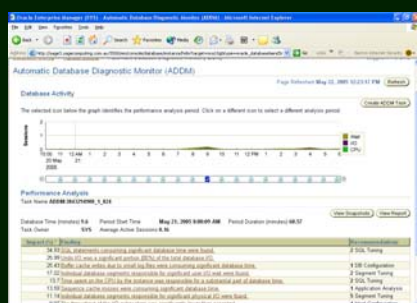
160

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Accessed through Enterprise Manager

- View ADDM output for a snapshot



161

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ADDM Analysis

- Perform analysis between two snapshots
 - No shutdown between snapshots
- Run from Enterprise Manager
- Run using
 - @\$ORACLE_HOME/rdbms/admin/addmrpt.sql
- Run using DBMS_ADVISOR
- Produces report
 - Text
 - HTML
- Results in the following views
 - DBA_ADVISOR_TASKS
 - DBA_ADVISOR_LOG
 - DBA_ADVISOR_RECOMMENDATIONS
 - DBA_ADVISOR_FINDINGS

162

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DBA_ADVISOR_FINDINGS

Top 10 findings

```
SELECT type, message
FROM (SELECT type, message, count(*) num
      FROM dba_advisor_findings
      GROUP BY type, message
      ORDER BY num desc)
WHERE rownum < 10
```

TYPE	MESSAGE
SYNOPSIS	Wait class "User I/O" was consuming significant database time.
INFORMATION	There was no significant database activity to run the ADOX.
PROBLEM	SQL statements consuming significant database time were found.
PROBLEM	Wait event "class slave wait" in wait class "Other" was consuming significant database time.
PROBLEM	Wait class "Other" was consuming significant database time.
PROBLEM	PL/SQL execution consumed significant database time.
PROBLEM	The throughput of the I/O subsystem was significantly lower than expected.
PROBLEM	Individual database segments responsible for significant user I/O wait were found.
PROBLEM	Time spent on the CPU by the instance was responsible for a substantial part of database

Database Control
Advisor Central
Logged in As SYS
Page Refreshed May 24, 2006 9:25:20 AM
Refresh

Advisors

Advisor	Memory Advisor	Segment Advisor
ADOX		
SQL Tuning Advisor		
SQL Access Advisor		

Advisor Tasks

Search

Select an advisory type and optionally enter a task name to filter the data that is displayed in your results set.

Advisory Type: All Types Task Name: Last Run: Go

Results

Advisory	Name	Description	Next Status	Start Time	End Time	Expires In (Days)
ADOX	ADOX_3043254000_1_001	ADOX auto run snapshot (000, 001), SYS	COMPLETED	May 24, 2006 8:00:29 AM	May 24, 2006 8:00:29 AM	30
SQL Tuning Advisor	SQL_TUNING_111671332812		SYS COMPLETED	May 22, 2006 11:08:51 AM	May 22, 2006 11:08:53 AM	26
SQL Access Advisor	SQL_ACCESS_111671332812	SQL Access Advisor	SYS COMPLETED	May 21, 2006 5:02:08 PM	May 21, 2006 5:02:17 PM	27

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Thank You For Your Attention

Any Questions?

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