Statspack & AWR Tuning Oracle9i & 10g

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Audience Knowledge

- Oracle8*i* Experience ?
- Oracle9*i* Experience ?
- Oracle9*i* RAC Experience?
- Oracle10^{g} Experience?

- Goals
  - Overview of Tuning Statspack/AWR
  - Focus on a few nice features of Oracle 10^{g}
- Non-Goals
  - Learn ALL aspects of Tuning Oracle

Overview

- Statspack, Tools & Scripts that you can still use
  - Top Waits
  - Load Profile
  - Latch Waits
  - Top SQL
  - Instance Activity
  - File I/O
- The Future OEM & ADDM
- Helpful V$/X$
- Summary

Tuning in General

- Both an Art and a Science
- Exceptions often rule the day…Not a "one size fits all"
- Hardware & Architecture must be right for your application or difficult to succeed.
- Statspack & Enterprise Manager (also 3rd party products) are best for simple tuning and ongoing maintenance.
- V$/X$ are best for drilling deep into problems

- **Enterprise Manager 10g will radically change things.**


Statspack - Still nice;
Some new 10g features

Statspack – Check Regularly

1. **Top 5 wait events**
2. **Load Profile**
3. **Instance Efficiency Hit Ratios**
4. **Wait Events / Wait Event Histograms**
5. **Latch Waits**
6. **Top SQL**
7. **Instance Activity / Time Model Stats / O/S Stats**
8. **File I/O / File Read Histogram / Undo Stats**
9. Memory Allocation
10. Undo

Statspack – Miscellaneous notes

- SQL> @spcreate (system/manager as SYSDBA) <1m
- SQL> alter user PERFSTAT account lock; (also unlock)

- SQL> EXECUTE STATSPACK.MODIFY_STATSPACK_PARAMETER – (i_snap_level=>5, i_buffer_gets_th=>100000, - i_modify_parameter=>'true');

- SQL> execute STATSPACK.SNAP; (do this for start/end) PL/SQL procedure successfully completed.

  (spauto.sql – Setup a snap on the hour every hour)

- SQL> @ORACLE_HOME/rdbms/admin/spreport (also sprepsql)

Statspack – Header Information

DB Name	DB Id	Instance	Inst Num	Release	Cluster	Host
ORA92	968233682	P10	1	9.2.0.4.0	NO	RJN1

	Snap Id	Snap Time	Sessions	Curs/Sess	Comment
Begin Snap:	458	28-Nov-03 00:15:00	814	179.1	
End Snap:	505	28-Nov-03 23:45:00	816	211.4	
Elapsed:		1,410.00 (mins)			

Cache Sizes (end)
~~~~~~~~~~~~~~~~~

Buffer Cache:	32,773M	Std Block Size:	8K
Shared Pool Size:	2,048M	Log Buffer:	1,024K
~~~~~~~~~~~~~~~~~

Statspack – Header Information

DB Name	DB Id	Instance	Inst Num	Release	RAC	Host
ORCL	1050469182	orcl	1	10.1.0.2.0	NO	RJNMOBILE5

	Snap Id	Snap Time	Sessions	Curs/Sess	Comment
Begin Snap:	1	12-Apr-04 11:36:02	14	5.4	
End Snap:	2	12-Apr-04 12:25:32	18	5.6	
Elapsed:		49.50 (mins)			

Cache Sizes (end)
~~~~~~~~~~~~~~~~~

Buffer Cache:	24M	Std Block Size:	8K
Shared Pool Size:	80M	Log Buffer:	256K
~~~~~~~~~~~~~~~~~

Statspack – Header Information

- Ensure that you're running for the right instance.
- Check the start/end times
- Check the cache sizes
  - Could have been changed during the run
  - Last page will tell you more on starting/ending values of initialization parameters

Statspack – Load Profile

Load Profile

	Per Second	Per Transaction
Redo size:	1,409,245.79	36,596.21
Logical reads:	157,472.47	4,089.35
Block changes:	4,061.85	105.48
Physical reads:	5,965.05	154.90
Physical writes:	587.76	15.26
User calls:	5,922.08	153.79
Parses:	92.11	2.39
Hard parses:	0.17	0.00
Sorts:	93.88	2.44
Logons:	0.25	0.01
Executes:	5,686.76	147.68
Transactions:	38.51	

% Blocks changed per Read:	2.58	Recursive Call %:	2.38
Rollback per transaction %:	1.22	Rows per Sort:	114.10

AWR – Load Profile

Report Summary

Cache Sizes

	Begin	End		
Buffer Cache:	10,240M	10,240M	Std Block Size:	8K
Shared Pool Size:	1,264M	1,264M	Log Buffer:	36,744K

Load Profile

	Per Second	Per Transaction
Redo size:	37,741,608.27	5,236,744.44
Logical reads:	239,964.89	33,295.74
Block changes:	137,275.83	19,047.37
Physical reads:	1.84	0.25
Physical writes:	4,708.71	653.35
User calls:	42.00	5.83
Parses:	24.05	3.34
Hard parses:	0.04	0.01
Sorts:	0.34	0.05
Logons:	0.71	0.10
Executes:	31.85	4.42
Transactions:	7.21	

% Blocks changed per Read:	57.21	Recursive Call %:	78.22
Rollback per transaction %:	25.00	Rows per Sort:	153.62

Done

Statspack – Instance Efficiency


```
Instance Efficiency Percentages (Target 100%)
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

            Buffer Nowait %:   99.08       Redo NoWait %:   99.86
            Buffer  Hit   %:   96.39    In-memory Sort %:   99.95
            Library Hit   %:  100.00        Soft Parse %:   99.82
        Execute to Parse %:   98.38         Latch Hit %:   99.64
Parse CPU to Parse Elapsd %:   85.11     % Non-Parse CPU:   99.86
```

Statspack - Instance Efficiency Things to look for…

- Buffer NoWait % of less than 99 percent. This is ratio of hits on a request for a specific buffer where the buffer was immediately available in memory. If the ratio is low, then could be a (hot) block(s) being contended for that should be found in the Buffer Wait Section.

Statspack - Instance Efficiency Things to look for…

- Buffer Hit % of less than 95 percent. This is the ratio of hits on a request for a specific buffer and the buffer was in memory instead of needing to do a physical I/O.
  - When this varies greatly one day to the next, further investigation should be done as to the cause.
  - If you have unselective indexes that are frequently accessed, it will drive your hit ratio higher, which can be misleading indication of good performance.
  - When you effectively tune your SQL and have effective indexes on your entire system, this issue is not encountered as frequently and the hit ratio is a better performance indicator.

Statspack - Instance Efficiency Things to look for…

- Library Hit % of less than 95 percent. A lower library hit ratio usually indicates that SQL is being pushed out of the shared pool early (could be due to a shared pool that is too small).
  - A lower ratio could also indicate that bind variables are not used or some other issue is causing SQL not to be reused (in which case a smaller shared pool may only be a band-aid that will potentially fix a library latch problem which may result).
  - You must fix the problem (use bind variables or CURSOR_SHARING) and then appropriately size the shared pool. I'll discuss this further when we get to latch issues.

Statspack - Instance Efficiency Things to look for…

- In-Memory Sort % of less than 95 percent in OLTP. In an OLTP system, you really don't want to do disk sorts. Setting the PGA_AGGREGATE_TARGET (or SORT_AREA_SIZE) initialization parameter effectively will eliminate this problem.
- Latch Hit % of less than 99 percent is usually a big problem. Finding the specific latch will lead you to solving this issue. More in the Latch Wait section.

AWR - Instance Efficiency

Instance Efficiency Percentages (Target 100%)

Buffer Nowait %:	99.31	Redo NoWait %:	99.99
Buffer Hit %:	100.00	In-memory Sort %:	100.00
Library Hit %:	99.94	Soft Parse %:	99.82
Execute to Parse %:	24.50	Latch Hit %:	94.65
Parse CPU to Parse Elapsd %:	91.87	% Non-Parse CPU:	99.96

Shared Pool Statistics

	Begin	End
Memory Usage %:	68.02	68.20
% SQL with executions>1:	81.94	81.36
% Memory for SQL w/exec>1:	77.24	74.72

Top 5 Timed Events

Event	Waits	Time(s)	Avg Wait(ms)	% Total Call Time	Wait Class
log buffer space	52,521	8,851	169	35.8	Configuration
CPU time		7,636		30.9	
log file sync	7,362	5,122	696	20.7	Commit
buffer busy waits	1,564,508	2,145	1	8.7	Concurrency
log file sequential read	35,171	701	20	2.8	System I/O

Done

What are you Waiting on?

Statspack – Top Wait Events

Top 5 Timed Events

Event	Waits	Time (s)	% Total Ela Time
db file sequential read	399,394,399	2,562,115	52.26
CPU time		960,825	19.60
buffer busy waits	122,302,412	540,757	11.03
PL/SQL lock timer	4,077	243,056	4.96
log file switch (checkpoint incomplete)	188,701	187,648	3.83

Statspack - Top Wait Events Things to look for…

Wait Problem	Potential Fix
Sequential Read	Indicates many index reads – tune the code (especially joins); Faster I/O
Scattered Read	Indicates many full table scans – tune the code; cache small tables; Faster I/O
Free Buffer	Increase the DB_CACHE_SIZE; shorten the checkpoint; tune the code to get less dirty blocks, faster I/O, use multiple DBWR's.
Buffer Busy	Segment Header – Add freelists (if inserts) or freelist groups (esp. RAC). Use ASSM.

Statspack - Top Wait Events Things to look for…

Wait Problem	Potential Fix
Buffer Busy	Data Block – Separate 'hot' data; potentially use reverse key indexes; fix queries to reduce the blocks popularity, use smaller blocks, I/O, Increase initrans and/or maxtrans (this one's debatable) Reduce records per block.
Buffer Busy	Undo Header – Add rollback segments or increase size of segment area (auto undo)
Buffer Busy	Undo block – Commit more (not too much) Larger rollback segments/area. Try to fix the SQL.

Statspack - Top Wait Events Things to look for…

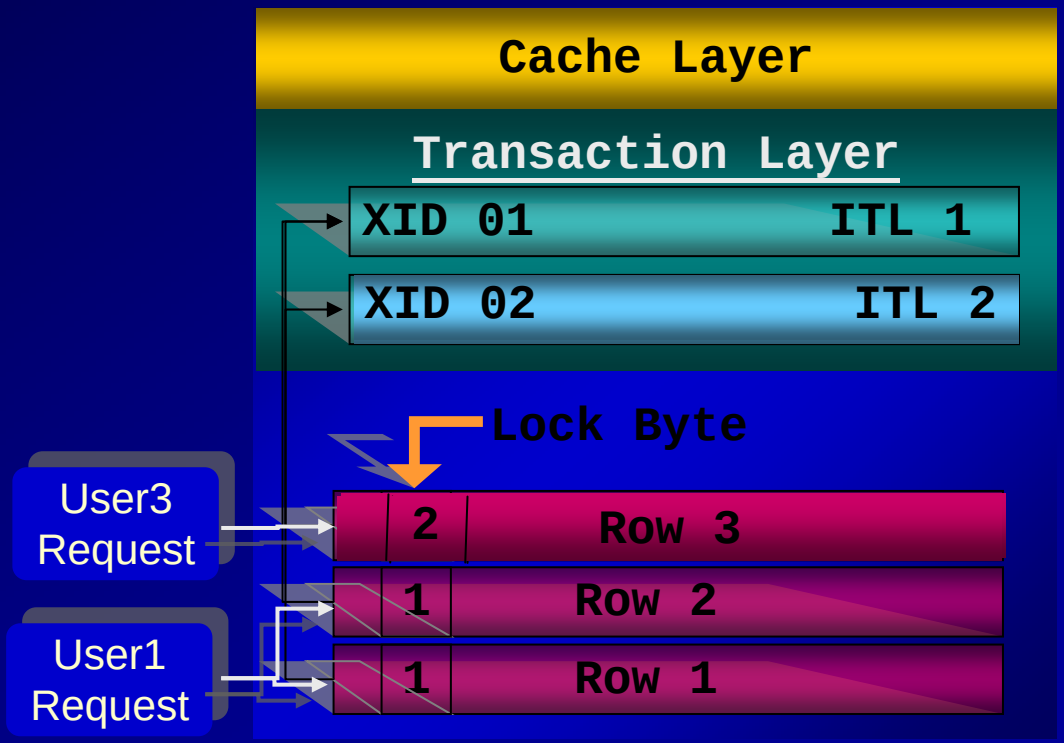
Wait Problem	Potential Fix
Enqueue - ST	Use LMT's or pre-allocate large extents
Enqueue - HW	Pre-allocate extents above HW (high water mark.)
Enqueue – TX	Increase initrans and/or maxtrans (TX4) on (transaction) the table or index. Fix locking issues if TX6. Bitmap (TX4) & Duplicates in Index (TX4).
Enqueue - TM (trans. mgmt.)	Index foreign keys; Check application locking of tables. DML Locks.

Why INITRANS Matter!

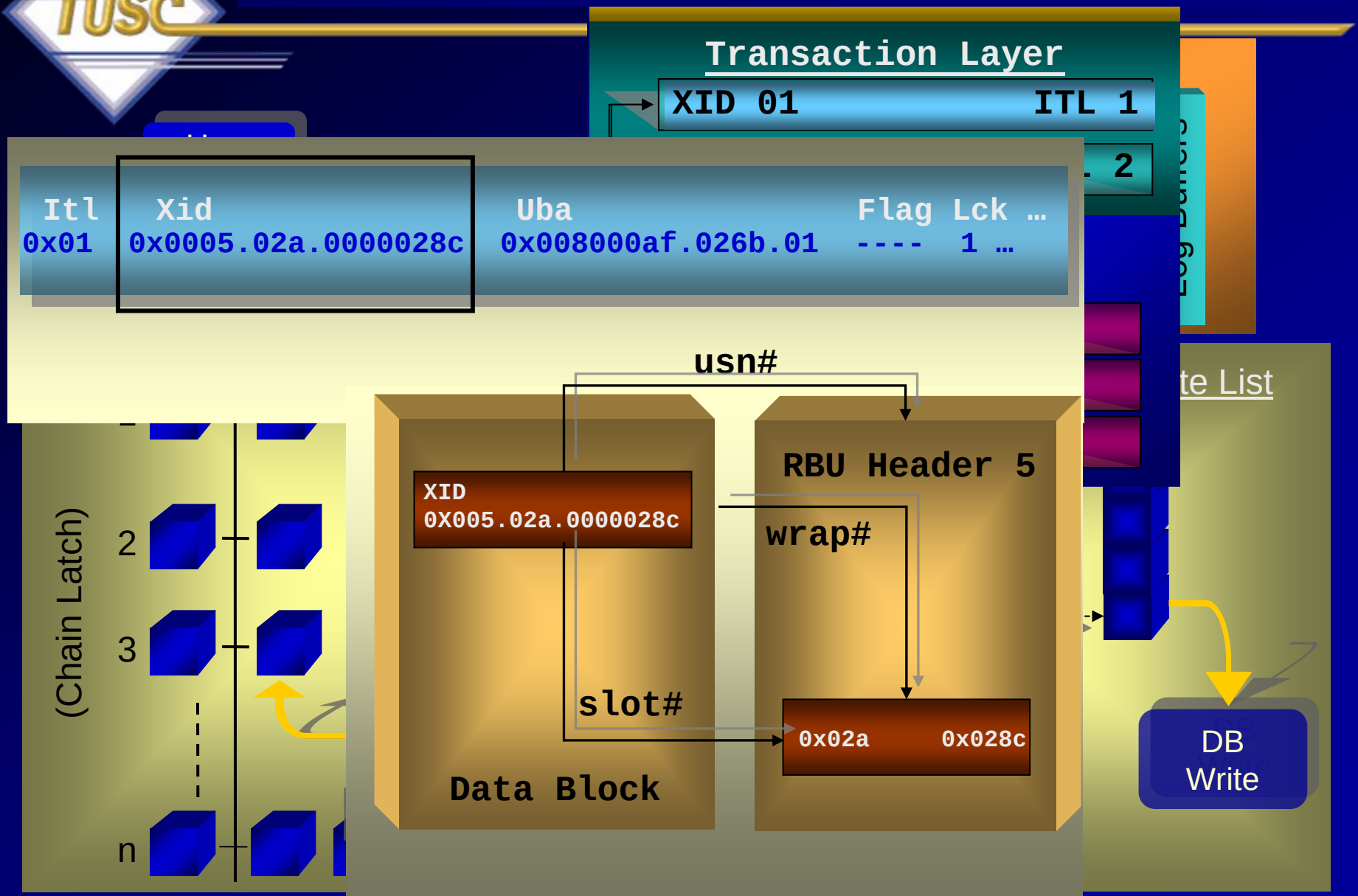
Transactions Moving through Oracle: *ITL & Undo Blocks*

User 1 – Updates Row# 1&2
User 2 updates Row 3

- *User1 updates a row with an insert/update/delete – an ITL is opened and xid tracks it in the data block.*
- *The xid ties to the UNDO header block which ties to the UNDO data block for undo.*
- *If user2 wants to query the row, they create a clone and rollback the transaction going to the undo header and undo block.*
- *If user3 wants to update same row (they wait). If user 3 wants to update different row then they open a second ITL with an xid that maps to an undo header that maps to an undo block.*



Transaction Identifiers



Block Dumps – Top Section / ITL


```
Itl       Xid                  Uba                 Flag Lck       Scn/Fsc
0x01   0x0004.010.00000fba  0x0080003d.08b5.10  ----     4  fsc 0x009d.00000000
0x02   0x0004.016.00000fae  0x008000cc.08af.34  C---     0  scn 0x0000.003deb5b
```

ITL – 2 Interested Transaction Lists

Transaction ID
Undo#.slot#.wrap#
(Undo#,slot#,seq#)

UBA:
File.block(Undo dba).sequence.record
Undo block address where last change is recorded.

Rows Locked:
4 rows deleted for this xid in this block.

AWR – ITL Issues

Segments by ITL Waits

- % of Capture shows % of ITL waits for each top segment compared
- with total ITL waits for all segments captured by the Snapshot

Owner	Tablespace Name	Object Name	Subobject Name	Obj. Type	ITL Waits	% of Capture
				INDEX PARTITION	126	32.06
				INDEX PARTITION	112	28.50
				INDEX PARTITION	66	16.79
				INDEX PARTITION	65	16.54
				INDEX PARTITION	12	3.05

Statspack - Top Wait Events Things to look for…

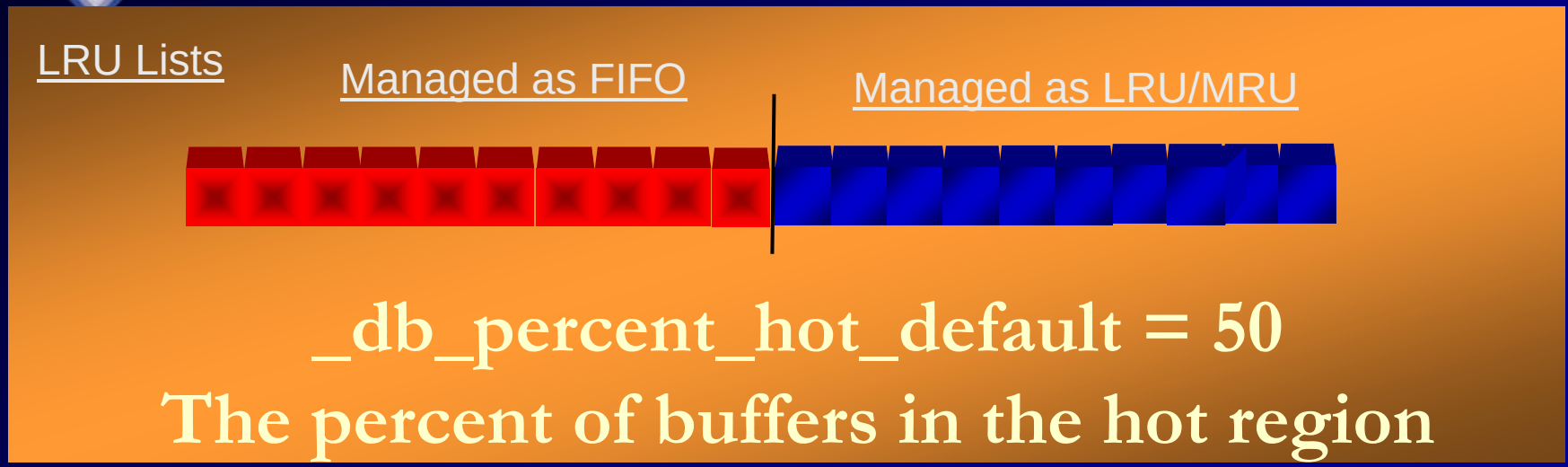
Wait Problem	Potential Fix
Latch Free	Investigate the detail (Covered later)
Log Buffer Space	Increase the Log Buffer; Faster disks for the Redo Logs
Log File Switch	Archive destination slow or full; Add more or larger Redo Logs
Log file sync	Commit more records at a time; Faster Redo Log disks; Raw devices

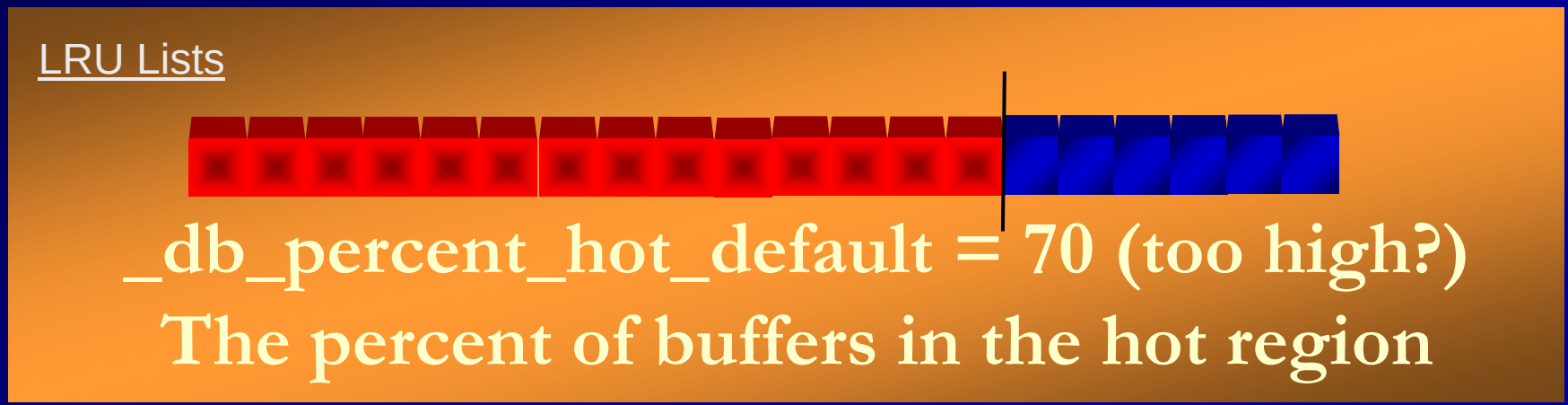
Statspack - Top Wait Events Things to look for…

Wait Problem	Potential Fix
CBC Latches	Cache Buffers Chains Latches – Reduce the length of the hash chain (less copies) by reducing block's popularity. Increase the latches by increasing buffers. Use Oracle SQ generator.
LRU Chain Latch	This latch protects the LRU list when a user needs the latch to scan the LRU chain for a buffer. When a dirty buffer is encountered it is linked to the LRU-W. When adding, moving, or removing a buffer this latch is needed.

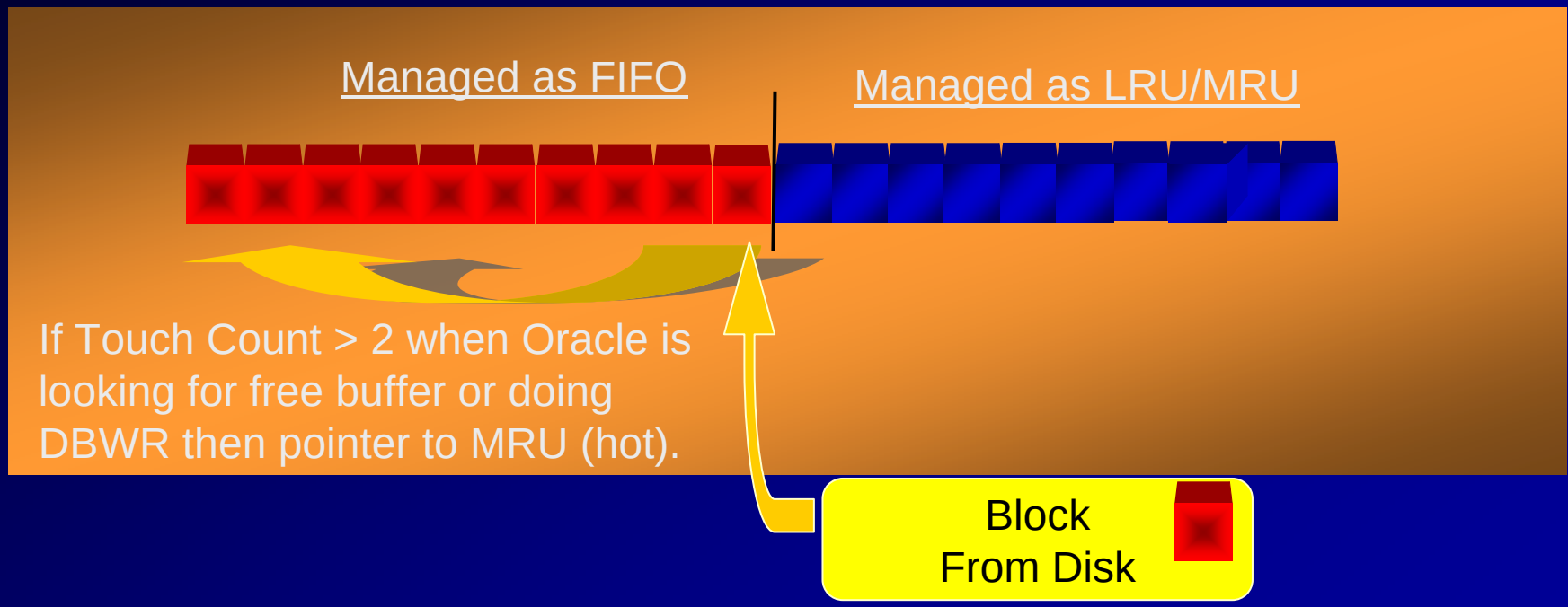
Decoding the Hot/Cold Regions (fyi only)

The percent of buffers in the hot region
A look at pointers in the LRU

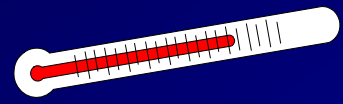




A look at pointers in the LRU



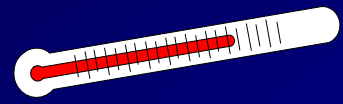
Altering the Hot/Cold LRU
Really advanced tuning!



1. _db_percent_hot_default (50) – The percent of buffers in the hot region.
2. _db_aging_touch_time* (3) – Seconds that must pass to increment touch count again. (Higher - less LRU movement)
3. _db_aging_hot_criteria (2) – Threshold to move a buffer to the MRU (hot) end of LRU chain.
4. _db_aging_stay_count (0) – **Touch count reset to this when moved to MRU (hot) end. Set=0 even if it was 200 previously!
5. _db_aging_cool_count (1) – Touch count reset to this when moved to LRU (cold) end. Set=1 even if it was 200 previously!

*Setting parameter 1 (above) lower, we increase hanging on to older buffers and setting it higher will cause a flush sooner. (*Error in description)*

Altering the Hot/Cold LRU
Really advanced tuning!



6. _db_aging_freeze_cr (FALSE) – Setting this to TRUE will make cr (consistent read) buffers too cold to keep in the cache.
7. _db_percent_hot_keep (0) – Percent of keep buffers considered hot (in hot region). Old LRU algorithm!
8. _db_percent_hot_recycle (0) – Percent of recycle buffers considered hot (in hot region). Old LRU algorithm!

** *If* _db_aging_stay_count => _db_aging_hot_criteria *then touch count is set to ½ it's current count instead of setting it to the* _db_aging_stay_count when moved to the hot end of LRU.

- FTS, FFIS (multi-block) are put on the cold end of the LRU.

Additional LRU's / Faster!!

- LRU Main block replacement list
- LRU-W Old dirty buffers and reco/temp
- LRU-P Ping Buffer list / RAC
- LRU-XO Buffers to be written for drop/truncate
- LRU-XR Buffers to be written for reuse range
- Thread CKPT Thread Checkpoint Queue
- File CKPT File Checkpoint Queue
- Reco CKPT Reco Checkpoint
- LRU-MAIN & LRU-AUX help LRU

Locally Managed Tablespaces- LMT

- Manage space locally using bitmaps
- Benefits
  - no tablespace fragmentation issues
  - better performance handling on large segments
  - lower contention for central resources, e.g., no ST enqueue contention
  - fewer recursive calls
- Implementation
  - specify "EXTENT MANAGEMENT LOCAL" clause during tablespace creation
  - in-place migration

Automatic Segment Space Management (ASSM)

- Automatic intra-object space management
- Benefits –
  - Eliminates Rollback Segment Management
  - simplified administration (**no more FREELISTS, FREELIST GROUPS, PCTUSED**)
  - improved space utilization & concurrency
  - enhanced performance
- Can set undo retention time
  - If set to longest running query time, no more "Snapshot too old"!
- Implementation
  - specify "SEGMENT SPACE MANAGEMENT AUTO" clause during tablespace creation

10g Only – Wait Event Histogram (Breaks down the wait detail)

Wait Event Histogram DB/Inst: ORCL/orcl Snaps: 1-2
-> ordered by event (idle events last)

Event	0 - 1 ms	1 - 4 ms	4 - 8 ms	8 - 16 ms	16 - 32 ms	32+ ms
enq: HW - contention	243	74	73	60	55	197
enq: TX - contention	6	3	0	0	0	61
latch free	657	2	0	0	0	0
latch: In memory undo latch	3	3	1	1	0	0
latch: cache buffers chains	89	7	14	68	1	0
latch: redo allocation	35	56	25	3	0	0

10g– Enqueues Spelled Out

Enqueue activity DB/Inst: ORCL/orcl Snaps: 1-2
-> Enqueue stats gathered prior to 10g should not be compared with 10g data

Enqueue Type (Request Reason)

Requests	Succ Gets	Failed Gets	Waits	Wt Time (s)	Av Wt Time(ms)
HW-Segment High Water Mark					
5,264	5,245	19	552	168	304.96
TX-Transaction					
1,330	1,330	0	61	77	1,255.21
CF-Controlfile Transaction					
4,400	4,298	102	159	43	271.14
CI-Cross-Instance Call Invocation					
460	460	0	4	1	157.75
US-Undo Segment					
1,021	1,021	0	7	0	60.14
FB-Format Block					
3,655	3,655	0	1	0	60.00

Statspack – Top 25

- Tuning the top 25 buffer get and top 25 physical get queries has yielded system performance gains of anywhere from 5 percent to 5000 percent.
- The SQL section of the statspack report tells you which queries to potentially tune first.
- The top 10 of your SQL statements should not be more than 10 percent of your buffer gets or disk reads.

Statspack – Top SQL

```
  Buffer Gets    Executions  Gets per Exec  %Total Time(s)  Time
   (s) Hash Value
--------------- ------------ -------------- ------ ------- --------
    627,226,570          117    5,360,910.9    4.7 9627.09 10367.04
Module: JDBC Thin Client
SELECT * FROM (select d1.tablespace_name, d1.owner, d1.segment_t
ype, d1.segment_name, d1.header_file, d1.extents, d1.bytes, d1.b
locks, d1.max_extents , d1.next_extent from sys.dba_segments d1
where d1.segment_type != 'CACHE'  and  tablespace_name not in (s
elect distinct tablespace_name from sys.dba_rollback_segs)  orde

    409,240,446      175,418        2,332.9    3.1 ####### 59430.83
Module:    ?  @sap10ci (TNS V1-V3)
SELECT "TABNAME" , "VARKEY" , "DATALN" , "VARDATA" FROM "KAPOL"
WHERE "TABNAME" = :A0 AND "VARKEY" LIKE :A1 ORDER BY "TABNAME" ,
 "VARKEY"
```

AWR – Top SQL

SQL ordered by Gets

- Resources reported for PL/SQL code includes the resources used by all SQL statements called by the code.
- Total Buffer Gets: 225,112,503
- Captured SQL account for 99.9% of Total

Buffer Gets	Executions	Gets per Exec	% Total	CPU Time (s)	Elapsed Time (s)	SQL Id	SQL Module	SQL Text
224,907,873	1,680	133,873.73	99.91	7568.17	19515.02			
31,779	6,881	4.62	0.01	2.61	2.61			
21,515	1,688	12.75	0.01	6.18	14.19			
19,827	1,688	11.75	0.01	2.71	10.71			
15,186	1,685	9.01	0.01	4.94	11.82			
13,501	1,685	8.01	0.01	2.84	9.72			
7,867	1	7,867.00	0.00	7.56	23.36			
4,783	1	4,783.00	0.00	0.76	1.09			
3,906	651	6.00	0.00	0.53	0.53			
2,640	646	4.09	0.00	0.62	1.21			

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SQL ordered by Reads

Statspack - Latch Waits

Latch Free – Latches are low-level queueing mechanisms (they're accurately referred to as mutually exclusion mechanisms) used to protect shared memory structures in the System Global Area (SGA).

- Latches are like locks on memory that are very quickly obtained and released.
- Latches are used to prevent concurrent access to a shared memory structure.
- If the latch is not available, a latch free miss is recorded.

Statspack - Latch Waits

Latch Free –

- Most latch problems are related to:
  - The failure to use bind variables (library cache latch)
  - Redo generation issues (redo allocation latch)
  - Buffer cache contention issues (cache buffers lru chain)
  - Hot blocks in the buffer cache (cache buffers chains).
- There are also latch waits related to bugs; check MetaLink for bug reports if you suspect this is the case (oracle.com/support).
- When latch miss ratios are greater than 0.5 percent, you should investigate the issue.

Statspack - Latch Waits

Latch Activity for DB: ORA9I Instance: ora9i Snaps: 1 -2

Latch	Get Requests	Pct Get Miss	Avg Slps /Miss	Wait Time (s)	NoWait Requests	Pct NoWait Miss
KCL freelist latch	4,924	0.0			0	
cache buffer handles	968,992	0.0	0.0		0	
cache buffers chains	761,708,539	0.0	0.4		21,519,841	0.0
cache buffers lru chain	8,111,269	0.1	0.8		19,834,466	0.1
library cache	67,602,665	2.2	2.0		213,590	0.8
redo allocation	12,446,986	0.2	0.0		0	
redo copy	320	0.0			10,335,430	0.1
user lock	1,973	0.3	1.2		0	

Statspack - Latch Waits

Latch Sleep breakdown for DB:
-> ordered by misses desc

Latch Name	Get Requests	Misses	Sleeps	Spin & Sleeps 1->4
library cache	67,602,665	1,474,032	2,935,368	199143/28003 6/582413/412 440/0
cache buffers chains	761,708,539	192,942	83,559	110054/82239 /628/21/0
redo allocation	12,446,986	25,444	1,135	24310/1133/1 /0/0
cache buffers lru chain	8,111,269	6,285	4,933	1378/4881/26 /0/0
process allocation	177	7	7	0/7/0/0/0

- Note that 10g only has “Spin & Sleeps 1-3+”

Statspack - Latch Waits

Latches that are willing to wait try to acquire a latch. If none are available, it will spin and then request the latch again. It will continue to do this up to the _SPIN_COUNT initialization parameter (note that spinning costs CPU).

- If it can't get a latch after spinning up to the _SPIN_COUNT, it will go to sleep. It will wake up after one centisecond (one hundredth of a second). It will do this twice.
- It will then start this process again, spinning up to the _SPIN_COUNT and then sleeping for twice as long (two centiseconds). After doing this again it will double again. So the pattern is 1,1,2,2,4,4 etc. It will do this until it gets the latch
- Every time the latch sleeps, it will creates a latch sleep wait. An example of a "willing to wait" latch is a library cache latch.

Statspack - Latch Waits

Some latches are "not willing to wait." This type of latch does not wait for the latch to become available.

- They immediately time out and retry to obtain the latch.
- A redo copy latch is an example of a "not willing to wait" latch.
- A not willing to wait latch will generate information for the immediate_gets and the immediate_misses columns of the V$LATCH view and also in the statspack report.
- The hit ratio for these latches should also approach 99% and the misses should never fall below 1 percent misses.

Statspack - Latch Waits

- *Gets* - The number of times a willing to wait request for a latch was requested and it was available.
- *Misses* - The number of times a willing to wait request for latch was initially requested but was not available.
- *Sleeps* - The number of a willing to wait request for a latch failed over and over until the spin count was exceeded and the process went to sleep. The number of sleeps may be higher than the misses. Processes may sleep multiple times before obtaining the latch.
- *NoWait Misses* - The number of times immediate (not willing to wait) request for a latch was unsuccessful.

Statspack - Latch Waits Things to look for…

Latch Problem	Potential Fix
Library Cache	Use bind variables; adjust the shared_pool_size
Shared Pool	Use bind variables; adjust the shared_pool_size
Redo allocation	Minimize redo generation and avoid unnecessary commits
Redo copy	Increase the _log_simultaneous_copies
Row cache objects	Increase the Shared Pool

Use Bind Variables / Latch Issues

- If you don't use bind variables in your application code you usually end up with latch contention with the *shared_pool* and *library cache* latches.
- This latch wait time can be reduced by changing just the top couple of executed statements that were using literal SQL instead of bind variables.
- Oracle 8i Release 2 (8.1.6) has an auto-conversion of literals into bind variables… **Oracle9i extends this slightly…**

CURSOR_SHARING=FORCE
(Default is EXACT; 8iR2)

Cursor Sharing - 8.1.6+

If v$sqlarea looks like this:

select empno from rich778 where empno =451572
select empno from rich778 where empno =451573
select empno from rich778 where empno =451574
select empno from rich778 where empno =451575
select empno from rich778 where empno =451576

Use cursor_sharing=force (sqlarea goes to this):

select empno from rich778 where empno =:SYS_B_0

Statspack – Instance Activity Terminology…

Statistic	Description
Session Logical Reads	All reads cached in memory. Includes both consistent gets and also the db block gets.
Consistent Gets	These are the reads of a block that are in the cache. They are NOT to be confused with consistent read (cr) version of a block in the buffer cache (usually the current version is read).
Db block gets	These are block gotten to be changed. MUST be the CURRENT block and not a cr block.
Db block changes	These are the db block gets (above) that were actually changed.
Physical Reads	Blocks not read from the cache. Either from disk, disk cache or O/S cache; there are also physical reads direct which bypass cache using Parallel Query (not in hit ratios).

Statspack – Instance Activity

Statistic	Total	per Second	per Trans
branch node splits	7,162	0.1	0.0
consistent gets	12,931,850,777	152,858.8	3,969.5
current blocks converted for CR	75,709	0.9	0.0
db block changes	343,632,442	4,061.9	105.5
db block gets	390,323,754	4,613.8	119.8
hot buffers moved to head of LRU	197,262,394	2,331.7	60.6
leaf node 90-10 splits	26,429	0.3	0.0
leaf node splits	840,436	9.9	0.3
logons cumulative	21,369	0.3	0.0
physical reads	504,643,275	5,965.1	154.9
physical writes	49,724,268	587.8	15.3
session logical reads	13,322,170,917	157,472.5	4,089.4
sorts (disk)	4,132	0.1	0.0
sorts (memory)	7,938,085	93.8	2.4
sorts (rows)	906,207,041	10,711.7	278.2
table fetch continued row	25,506,365	301.5	7.8
table scans (long tables)	111	0.0	0.0
table scans (short tables)	1,543,085	18.2	0.5

Statspack – Time Model Stats

Time Model System Stats DB/Inst: ORCL/orcl Snaps: 1-2
-> Total Time in Database calls 5560.5s (or 5560475336us)

Statistic	Time (s)	% of DB Time
DB CPU	119.1	2.1
DB time	5,560.5	
Java execution elapsed time	0.1	.0
PL/SQL compilation elapsed time	0.4	.0
PL/SQL execution elapsed time	0.2	.0
background cpu time	16.4	.3
background elapsed time	2,097.6	37.7
connection management call elapsed	1.2	.0
failed parse elapsed time	0.2	.0
hard parse (sharing criteria) elaps	0.0	.0
hard parse elapsed time	13.3	.2
parse time elapsed	14.1	.3
sql execute elapsed time	5,556.3	99.9

Statspack – Time Model Stats

Time Model Statistics

- Total time in database user-calls (DB Time): 24728.7s
- Statistics including the word "background" measure background process time, and so do not contribute to the DB time statistic
- Ordered by % or DB time desc, Statistic name

Statistic Name	Time (s)	% of DB Time
sql execute elapsed time	19,563.36	79.11
DB CPU	7,635.77	30.88
PL/SQL execution elapsed time	9.04	0.04
connection management call elapsed time	5.37	0.02
parse time elapsed	3.94	0.02
hard parse elapsed time	0.37	0.00
hard parse (sharing criteria) elapsed time	0.12	0.00
sequence load elapsed time	0.01	0.00
hard parse (bind mismatch) elapsed time	0.00	0.00
repeated bind elapsed time	0.00	0.00
DB time	24,728.66	
background elapsed time	2,773.25	
background cpu time	1,360.81	

Back to Wait Events Statistics
Back to Top

Wait Class

Done

Statspack – O/S Statistics

OS Statistics DB/Inst: ORCL/orcl Snaps: 1-2

Statistic	Total	per Second
AVG_IN_BYTES	37,371,904	12,583
AVG_OUT_BYTES	1,179,648	397
IN_BYTES	37,371,904	12,583
OUT_BYTES	1,179,648	397
AVG_BUSY_TICKS	24,326	
AVG_IDLE_TICKS	272,598	
AVG_SYS_TICKS	9,483	
AVG_USER_TICKS	14,843	
BUSY_TICKS	24,326	
IDLE_TICKS	272,598	
SYS_TICKS	9,483	
USER_TICKS	14,843	
NUM_CPUS	1	

Statspack – Undo Stats

Undo Segment Stats DB/Inst: ORCL/orcl Snaps: 1-2
-> ordered by Time desc

End Time	Undo Blocks	Num Trans	Max Qry Len (s)	Max Tx Concy	Snap TooOld	OutOf Space	uS/uR/uU/ eS/eR/eU
12-Apr 12:19	31,664	243	818	5	0	0	0/0/0/32/28 0/0
12-Apr 12:09	27,248	357	210	5	0	0	0/0/0/55/57 6/0
12-Apr 11:59	16,403	276	171	5	0	0	0/0/0/28/15 2/0
12-Apr 11:49	3,602	327	0	5	0	0	0/0/0/8/16/ 0
12-Apr 11:39	469	2,946	0	4	0	0	0/0/0/0/0/0

Statspack – File I/O

Tablespace

	Reads	Av Reads/s	Av Rd(ms)	Av Blks/Rd	Writes	Av Writes/s	Buffer Waits	Av Buf Wt(ms)
PSAPSTABI	14,441,749	171	7.9	1.0	521,275	6	1,234,608	6.2
PSAPVBAPD	13,639,443	161	6.2	1.7	10,057	0	2,672,470	4.2
PSAPEDII	11,992,418	142	5.3	1.0	83,757	1	4,115,714	4.4
PSAPEDID	10,617,042	125	8.1	1.0	64,866	1	3,728,009	6.4
PSAPROLL	998,328	12	13.2	1.0	8,321,252	98	285,060	65.7

- **Reads should be below 14ms**

AWR – File I/O

File IO Stats

- ordered by Tablespace, File

Tablespace	Filename	Reads	Av Reads/s	Av Rd (ms)	Av Blks/Rd	Writes	Av Writes/s	Buffer Waits	Av Buf Wt (ms)
		7	0	1.43	1.00	480	1	93	19.68
		6	0	0.00	1.00	34	0	34	16.76
		3	0	0.00	1.00	3	0	0	0.00
	.dbf	7	0	5.71	1.00	4	0	0	0.00
	.dbf	7	0	0.00	1.00	4	0	0	0.00
	.dbf	7	0	0.00	1.00	4	0	0	0.00
	.dbf	7	0	0.00	1.00	4	0	0	0.00
	.dbf	7	0	0.00	1.00	4	0	0	0.00
	.dbf	7	0	2.86	1.00	4	0	0	0.00
	.dbf	7	0	0.00	1.00	4	0	0	0.00
	.dbf	7	0	1.43	1.00	4	0	0	0.00
	.dbf	7	0	2.86	1.00	4	0	0	0.00
	.dbf	7	0	0.00	1.00	4	0	0	0.00
	.dbf	7	0	0.00	1.00	4	0	0	0.00
	.dbf	8	0	0.00	1.00	3	0	0	0.00
	.dbf	8	0	0.00	1.00	3	0	0	0.00
	.dbf	8	0	0.00	1.00	3	0	0	0.00
	.dbf	8	0	0.00	1.00	3	0	0	0.00

Done Internet

Statspack – File Read Histogram

File Read Histogram Stats DB/Inst: ORCL/orcl Snaps: 1-2
->Number of single block reads in each time range
->ordered by Tablespace, File

Tablespace	Filename				
	0 - 4 ms	4 - 8 ms	8 - 16 ms	16 - 32 ms	32+ ms
USERS	C:\ORACLE\ORADATA\ORCL\USERS01.DBF				
	560	2,225	1,452	4,089	8,373
SYSAUX	C:\ORACLE\ORADATA\ORCL\SYSAUX01.DBF				
	123	40	242	357	405
SYSTEM	C:\ORACLE\ORADATA\ORCL\SYSTEM01.DBF				
	100	51	223	207	367

Statspack – Check Regularly

1. Top 5 wait events
2. Load Profile
3. Instance Efficiency Hit Ratios
4. Wait Events / Wait Event Histograms
5. Latch Waits
6. Top SQL
7. Instance Activity / Time Model Stats / O/S Stats
8. File I/O / File Read Histogram / Undo Stats
9. Memory Allocation
10. Undo

Tuning the RAC Cluster Interconnect
Using STATSPACK Reports (FYI Only)

- The STATSPACK report shows statistics ONLY for the node or instance on which it was run.
- Run `statspack.snap` procedure and `spreport.sql` script on each node you want to monitor to compare to other instances.
- Single-instance tuning should be performed before attempting to tune the processes that communicate via the cluster interconnect.

Tuning the RAC Cluster Interconnect
Using STATSPACK Reports (FYI Only)

Top 5 Timed Events

CPU time (processing time) should be the predominant event

Exceeds CPU time, therefore needs investigation.

```
Top 5 Timed Events
~~~~~~~~~~~~~~~~~~
                                                        %  tal
Event                                            Waits    Time (s) El  Time
-------------------------------------------- ---------- ---------- -------
global cache cr request                            820        154   72.50
CPU time                                                       54   25.34
global cache null to x                             478          1     .52
control file sequential read                       600          1     .52
control file parallel write                        141          1     .28

          -------------------------------------------------------------
```

- **Transfer times excessive from other instances in the cluster to this instance.**
- **Could be due to network problems or buffer cache sizing issues.**

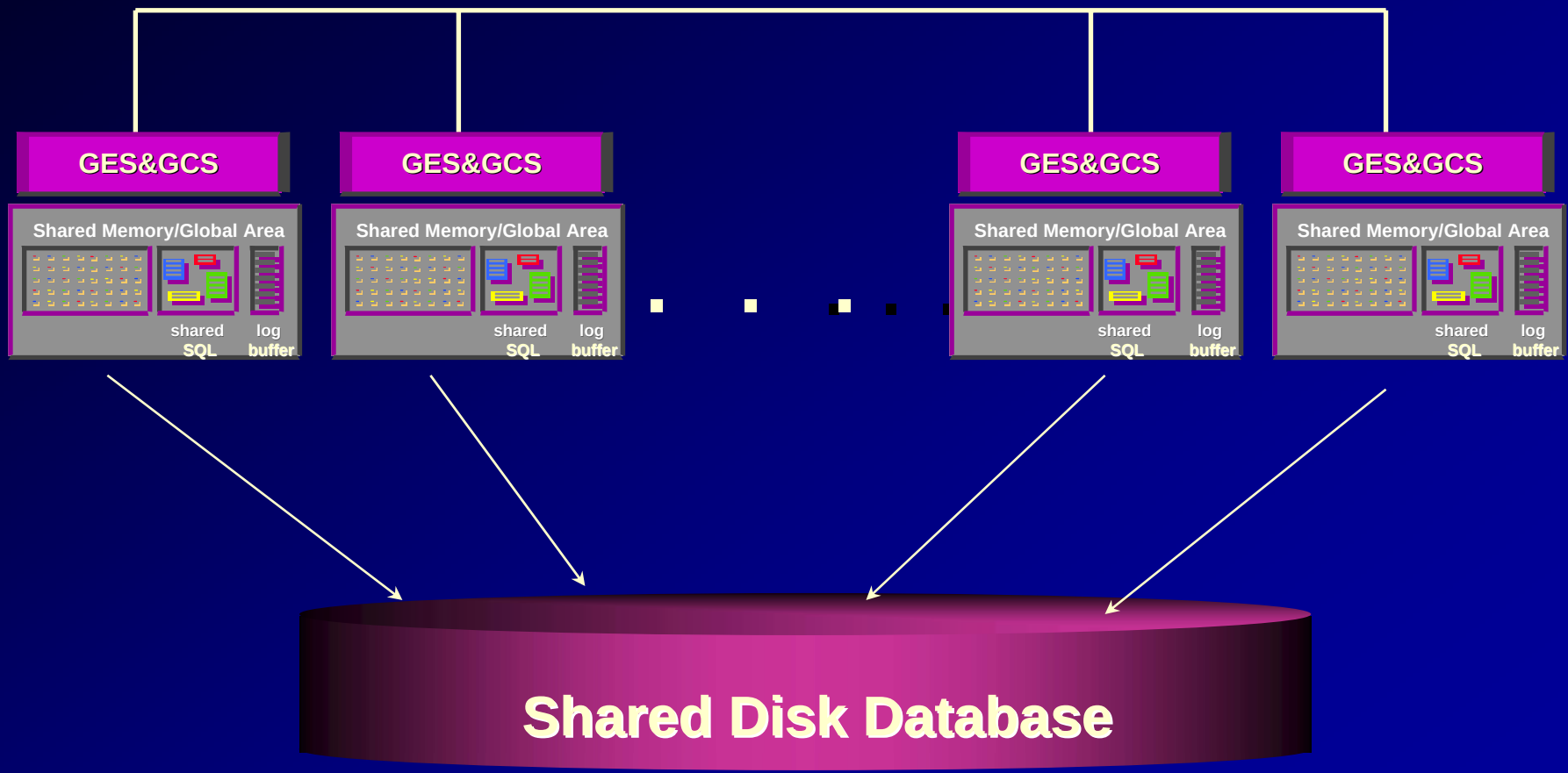
Tuning the RAC Cluster Interconnect
Using STATSPACK Reports (FYI Only)

- Network changes were made
- An index was added
- STATSPACK report now looks like this:

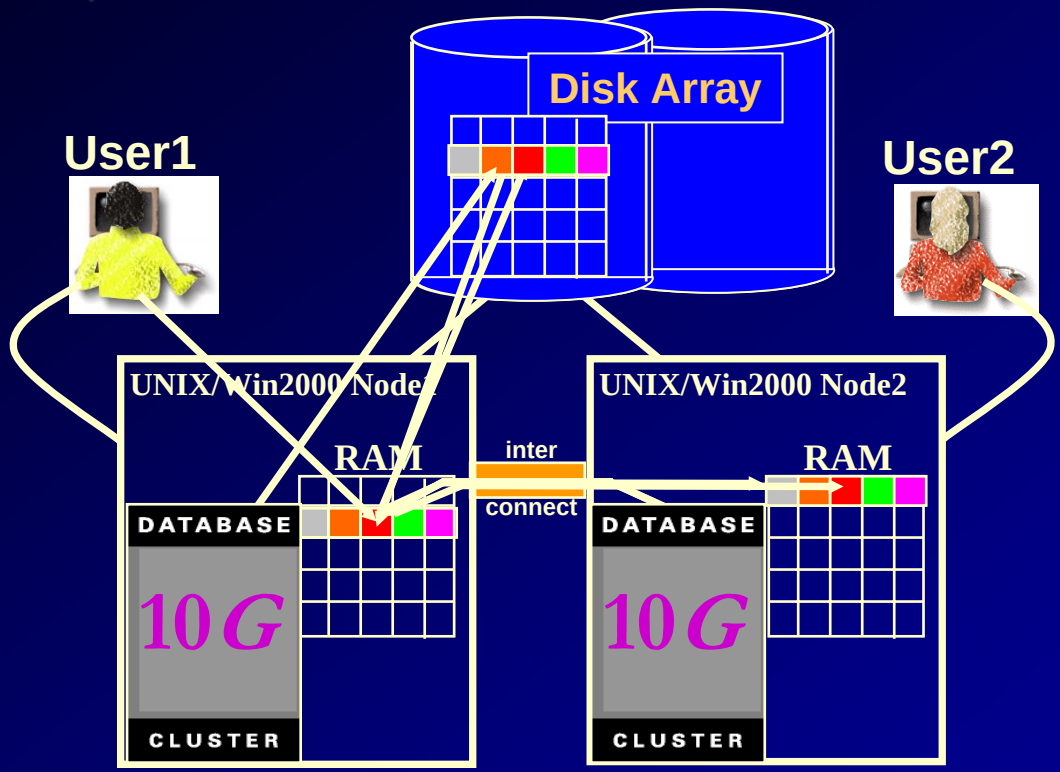
CPU time is now the predominant event

```
Top 5 Timed Events
~~~~~~~~~~~~~~~~~~
                                                                    % Total
Event                                               Waits    Time (s) Ela Time
--------------------------- ------------------------------ ---------- ---------
CPU time                                                            99     64.87
global cache null to x                               1,655          28     18.43
enqueue                                                 46           8      5.12
global cache busy                                      104           7      4.73
DFS lock handle                                         38           2      1.64
```

RAC Architecture
Shared Data Model



Real Applications Clusters - Cache Fusion



1. User1 queries data
2. User2 queries same data - via interconnect with no disc I/O
3. User1 updates a row of data and commits
4. User2 wants to update same block of data – 10g keeps data concurrency via interconnect

Tuning the RAC Cluster Interconnect
Using STATSPACK Reports (FYI)

– Workload characteristics for this instance:

Solved after network and index changes.

```
Cluster Statistics for DB: DB2  Instance: INST1

Global Cache Service - Workload Characteristics
-----------------------------------------------
Ave global cache get time (ms):                      8.2      3.1
Ave global cache convert time (ms):                 16.5      3.2
Ave build time for CR block (ms):                    1.5      0.2
Ave flush time for CR block (ms):                    6.0      0.0
Ave send time for CR block (ms):                     0.9      1.0
Ave time to process CR block request (ms):           8.5      1.3
Ave receive time for CR block (ms):                 18.3     17.2
Ave pin time for current block (ms):                13.7      0.2
Ave flush time for current block (ms):               3.9      0.0
Ave send time for current block (ms):                0.8      0.9
Ave time to process current block request (ms):     18.4      1.1
Ave receive time for current block (ms):            17.4      3.1
Global cache hit ratio:                              2.5      1.7
Ratio of current block defers:                       0.2      0.0
% of messages sent for buffer gets:                  2.2      1.4
% of remote buffer gets:                             1.6      1.1
Ratio of I/O for coherence:                          2.9      8.7
Ratio of local vs remote work:                       0.5      0.6
Ratio of fusion vs physical writes:                  0.0      0.0
```

Tuning the RAC Cluster Interconnect
Using STATSPACK Reports (FYI Only)

- Global Enqueue Services (GES) control the inter-instance locks in Oracle 9i RAC.
- The STATSPACK report contains a special section for these statistics.

```
Global Enqueue Service Statistics
---------------------------------
Ave global lock get time (ms):                          0.9
Ave global lock convert time (ms):                      1.3
Ratio of global lock gets vs global lock releases:      1.1
```

Tuning the RAC Cluster Interconnect
Using STATSPACK Reports (FYI Only)

- Guidelines for GES Statistics:
  - All times should be < 15ms
  - Ratio of global lock gets vs global lock releases should be near 1.0
- High values could indicate possible network or memory problems
- Could also be caused by application locking issues
- May need to review the enqueue section of STATSPACK report for further analysis.

Complete Presentation by Oracle's Rich Niemiec's at:
http://www.oracleracsig.org

Tuning the RAC Cluster Interconnect
Using AWR Reports (FYI Only)

Global Cache Load Profile

	Per Second	Per Transaction
Global Cache blocks received:	0.38	0.05
Global Cache blocks served:	0.26	0.04
GCS/GES messages received:	766.83	106.40
GCS/GES messages sent:	1,278.25	177.36
DBWR Fusion writes:	0.01	0.00
Estd Interconnect traffic (KB)	404.57	

Global Cache Efficiency Percentages (Target local+remote 100%)

Buffer access - local cache %:	100.00
Buffer access - remote cache %:	0.00
Buffer access - disk %:	0.00

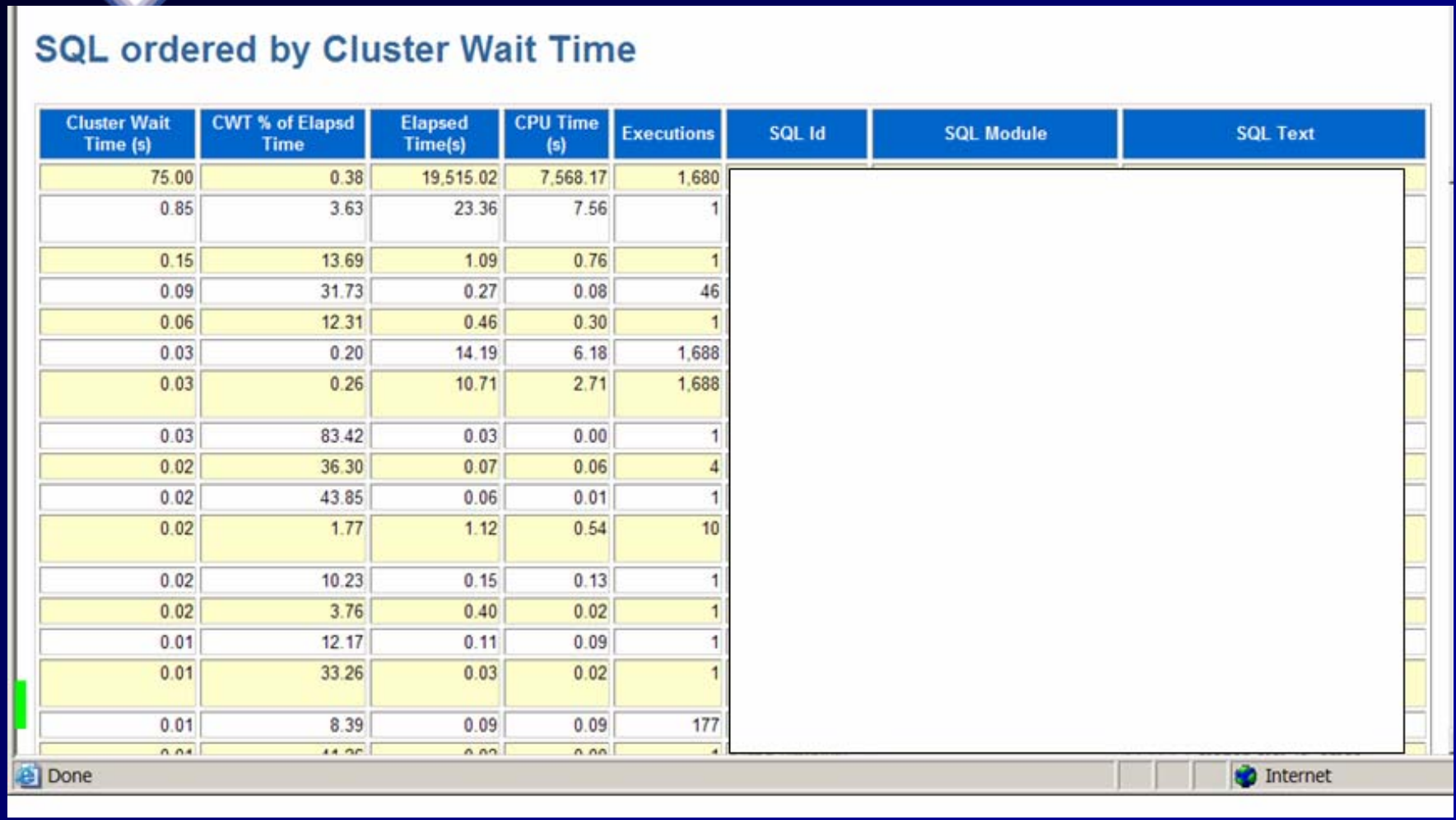
Global Cache and Enqueue Services - Workload Characteristics

Avg global enqueue get time (ms):	1.9
Avg global cache cr block receive time (ms):	1.8
Avg global cache current block receive time (ms):	1.9
Avg global cache cr block build time (ms):	0.0
Avg global cache cr block send time (ms):	0.2
Global cache log flushes for cr blocks served %:	0.0
Avg global cache cr block flush time (ms):	
Avg global cache current block pin time (ms):	0.1

Done

Internet

Tuning the RAC Cluster Interconnect
Using AWR Reports (FYI Only)



SQL ordered by Cluster Wait Time

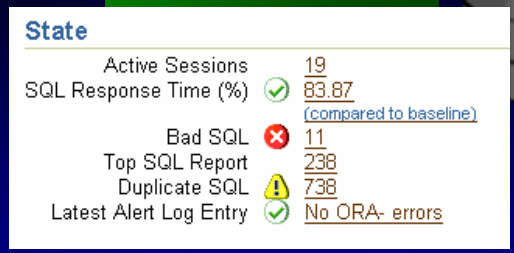
Cluster Wait Time (s)	CWT % of Elapsd Time	Elapsed Time(s)	CPU Time (s)	Executions	SQL Id	SQL Module	SQL Text
75.00	0.38	19,515.02	7,568.17	1,680			
0.85	3.63	23.36	7.56	1			
0.15	13.69	1.09	0.76	1			
0.09	31.73	0.27	0.08	46			
0.06	12.31	0.46	0.30	1			
0.03	0.20	14.19	6.18	1,688			
0.03	0.26	10.71	2.71	1,688			
0.03	83.42	0.03	0.00	1			
0.02	36.30	0.07	0.06	4			
0.02	43.85	0.06	0.01	1			
0.02	1.77	1.12	0.54	10			
0.02	10.23	0.15	0.13	1			
0.02	3.76	0.40	0.02	1			
0.01	12.17	0.11	0.09	1			
0.01	33.26	0.03	0.02	1			
0.01	8.39	0.09	0.09	177			

Done Internet

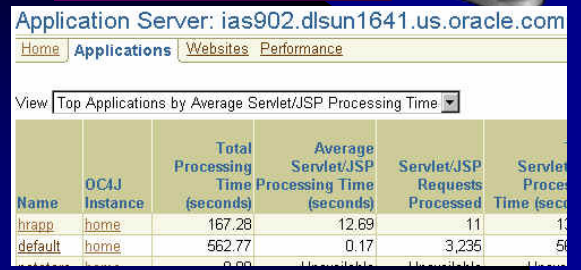
The Future…
Enterprise Manager 10g for the Grid

Host and Hardware

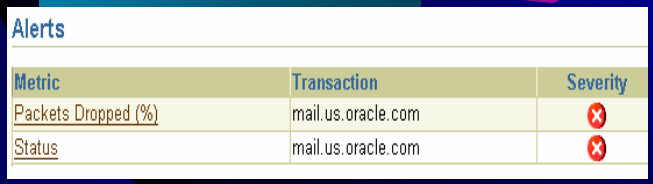
Database



Oracle9iAS



Network and Load Balancer

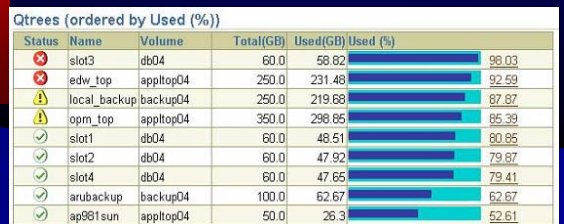


Administration
Monitoring
Provisioning
Security

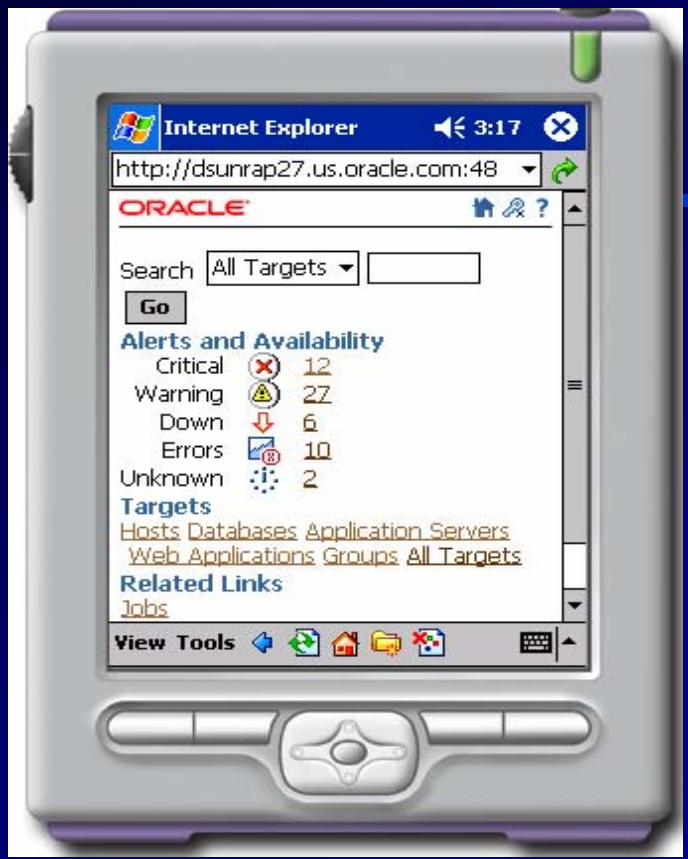
Enterprise Manager

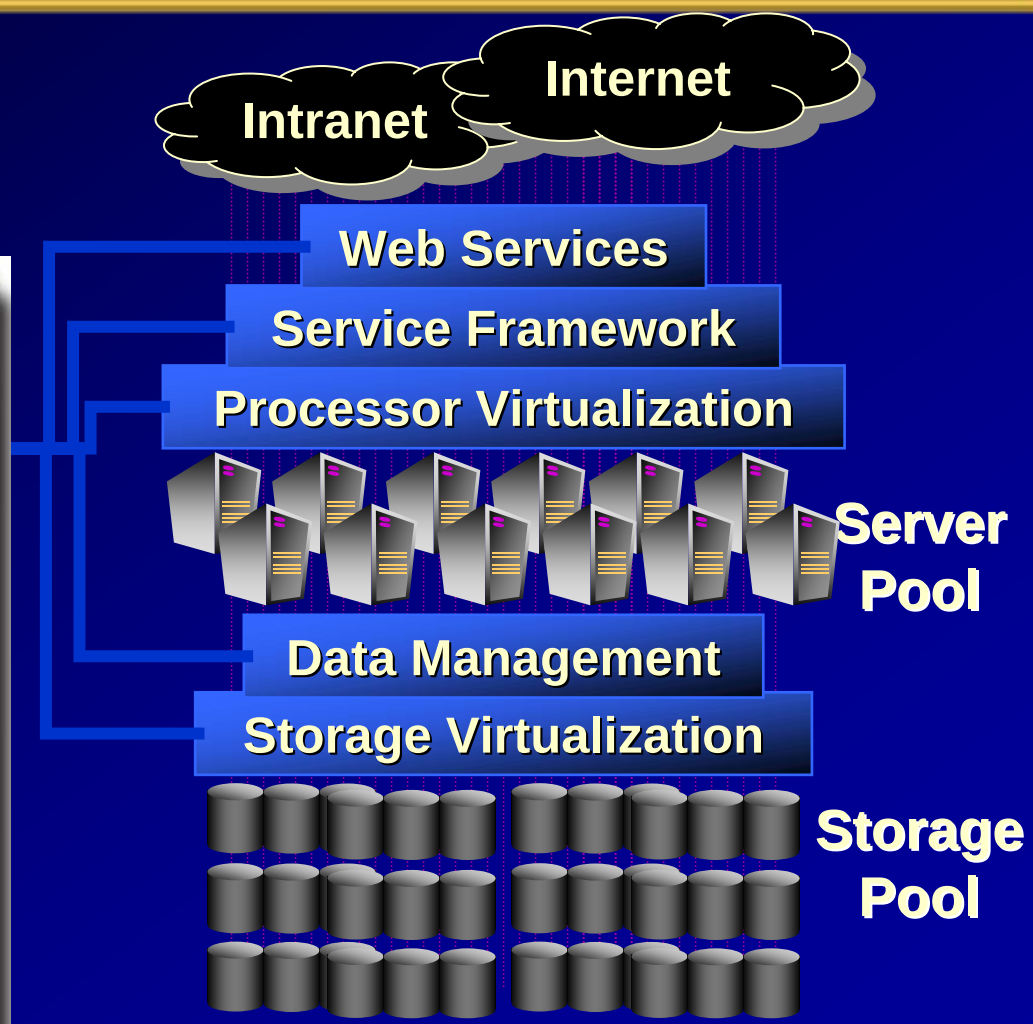
Applications

Storage



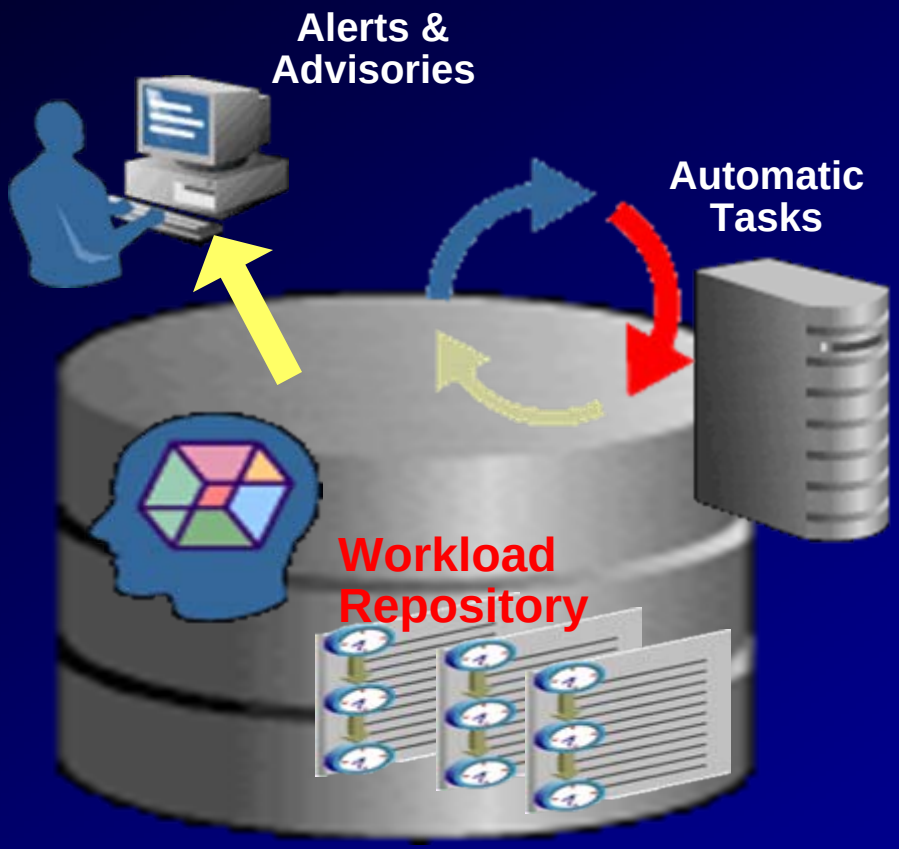
The Future ….
Manage end to end





Oracle 10^{g} Database

Self-Managing Intelligent Infrastructure

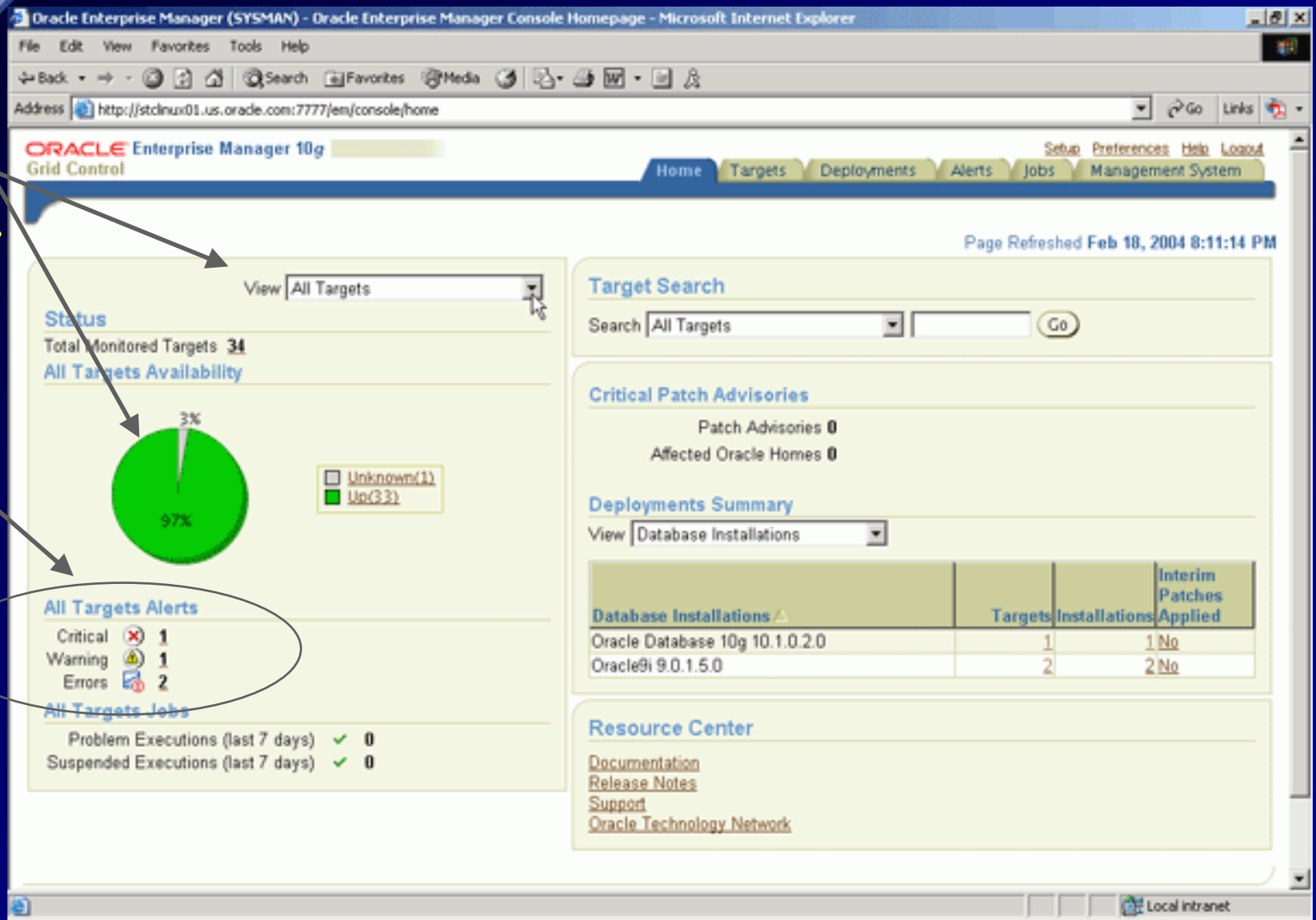


- Aware
  - Self-monitoring
- Proactive
  - Automatic tasks
  - Proactive alerts
- Intelligent
  - Self-diagnosing
  - Self-tuning

Monitor All Targets

Monitor Targets… are they up?

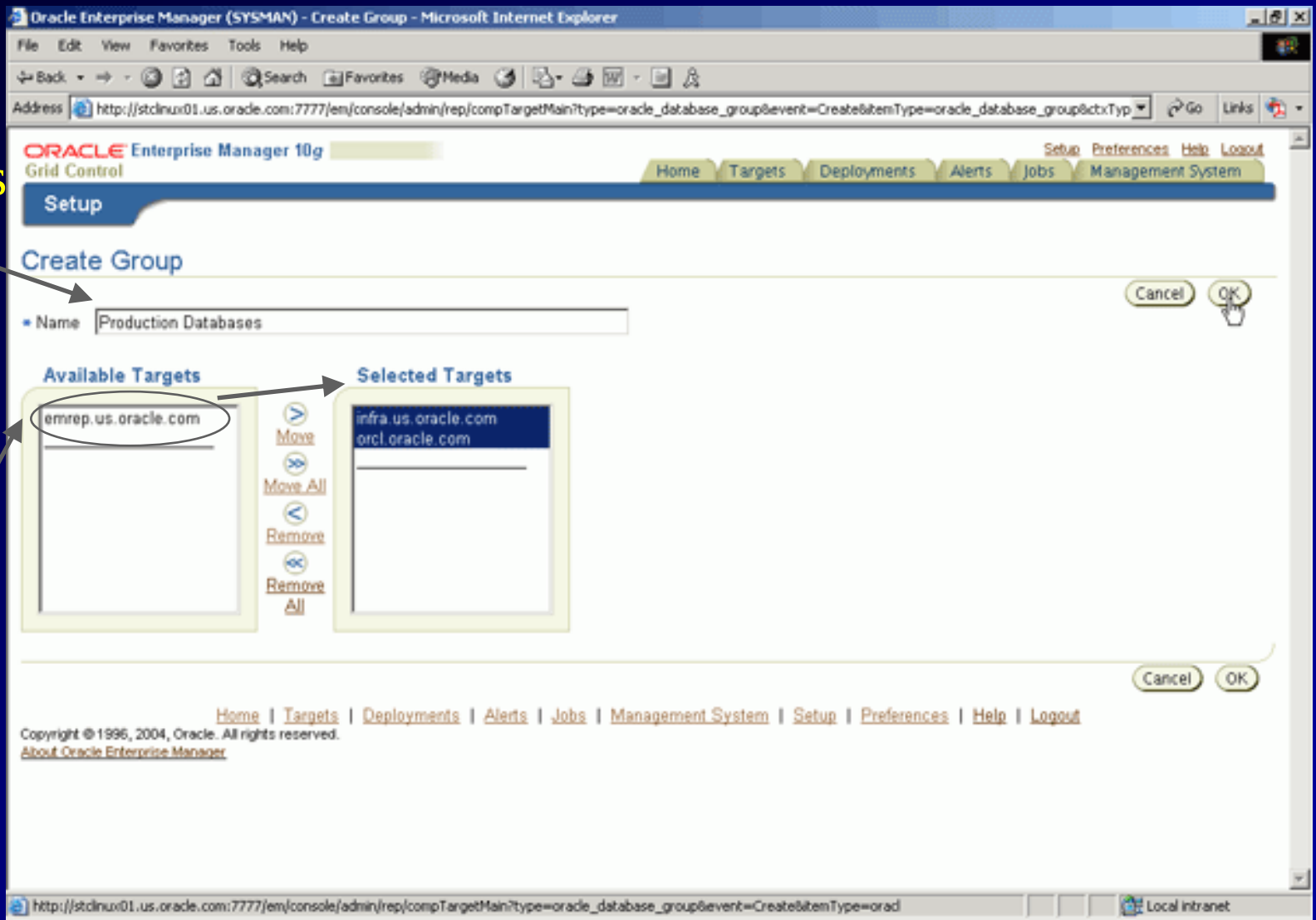
Target Alerts



Database Performance

Create a Prod DB's Group

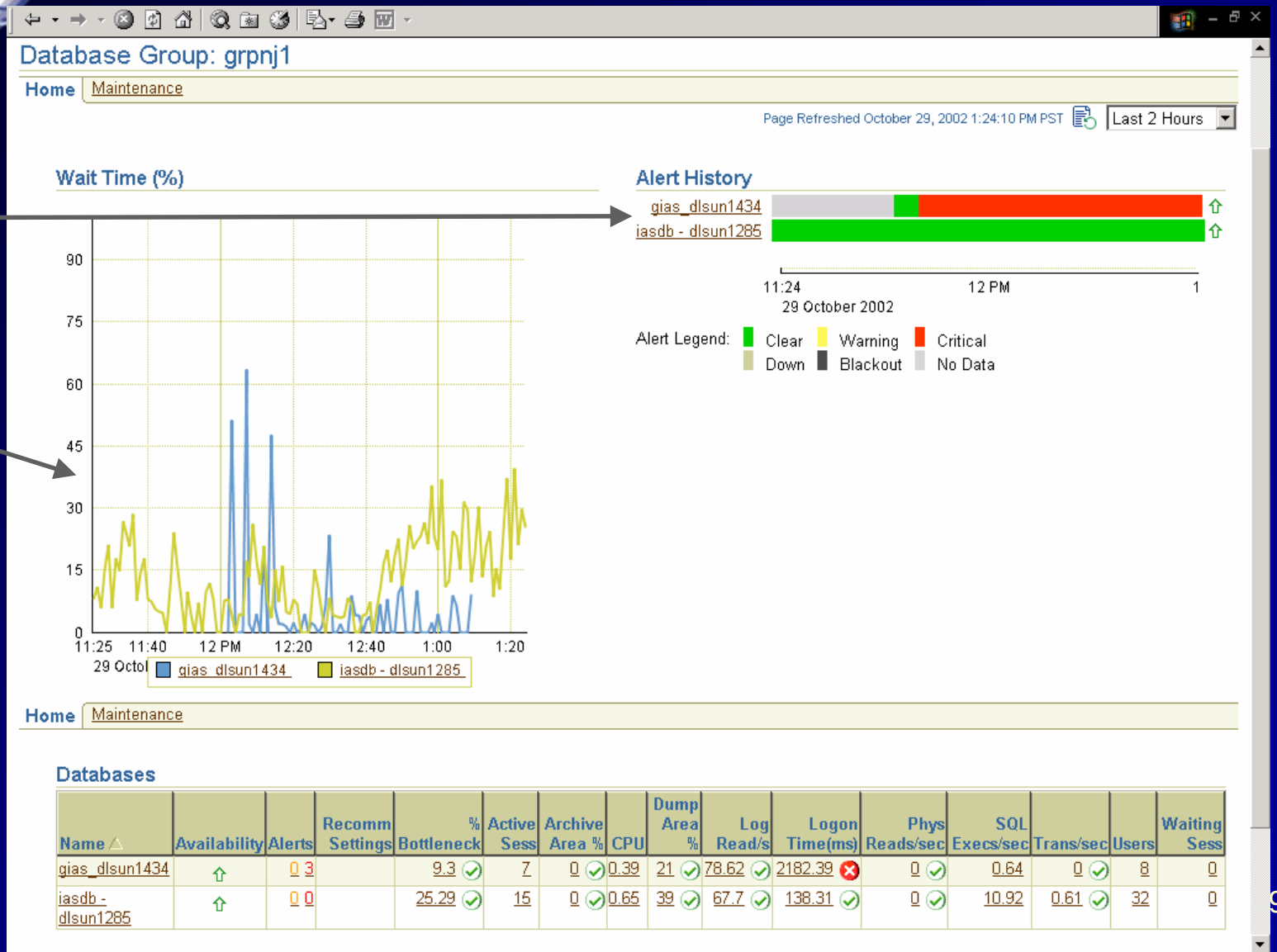
Pick Items for the Group



Database Performance

Alert Issues

Major Waits



Name	Availability	Alerts	Recomm Settings	% Bottleneck	Active Sess	Archive Area %	CPU	Dump Area %	Log Read/s	Logon Time(ms)	Phys Reads/sec	SQL Execs/sec	Trans/sec	Users	Waiting Sess
gias_dlsun1434	⇧	0 3		9.3	7	0	0.39	21	78.62	2182.39	0	0.64	0	8	0
iasdb - dlsun1285	⇧	0 0		25.29	15	0	0.65	39	67.7	138.31	0	10.92	0.61	32	0

Database Performance

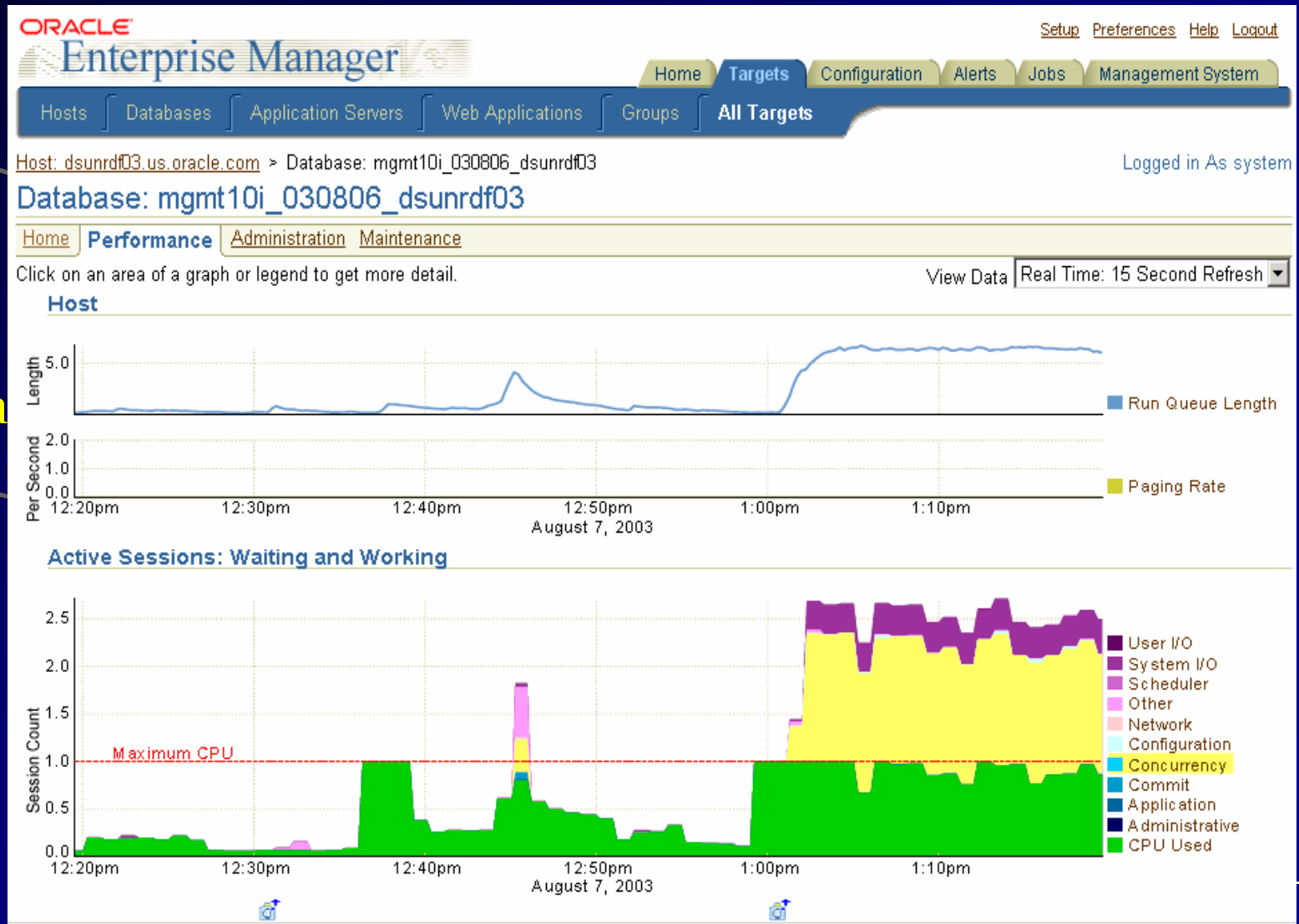
Monitor Database

We have a CPU issue!

Database Performance

Monitor Perform.

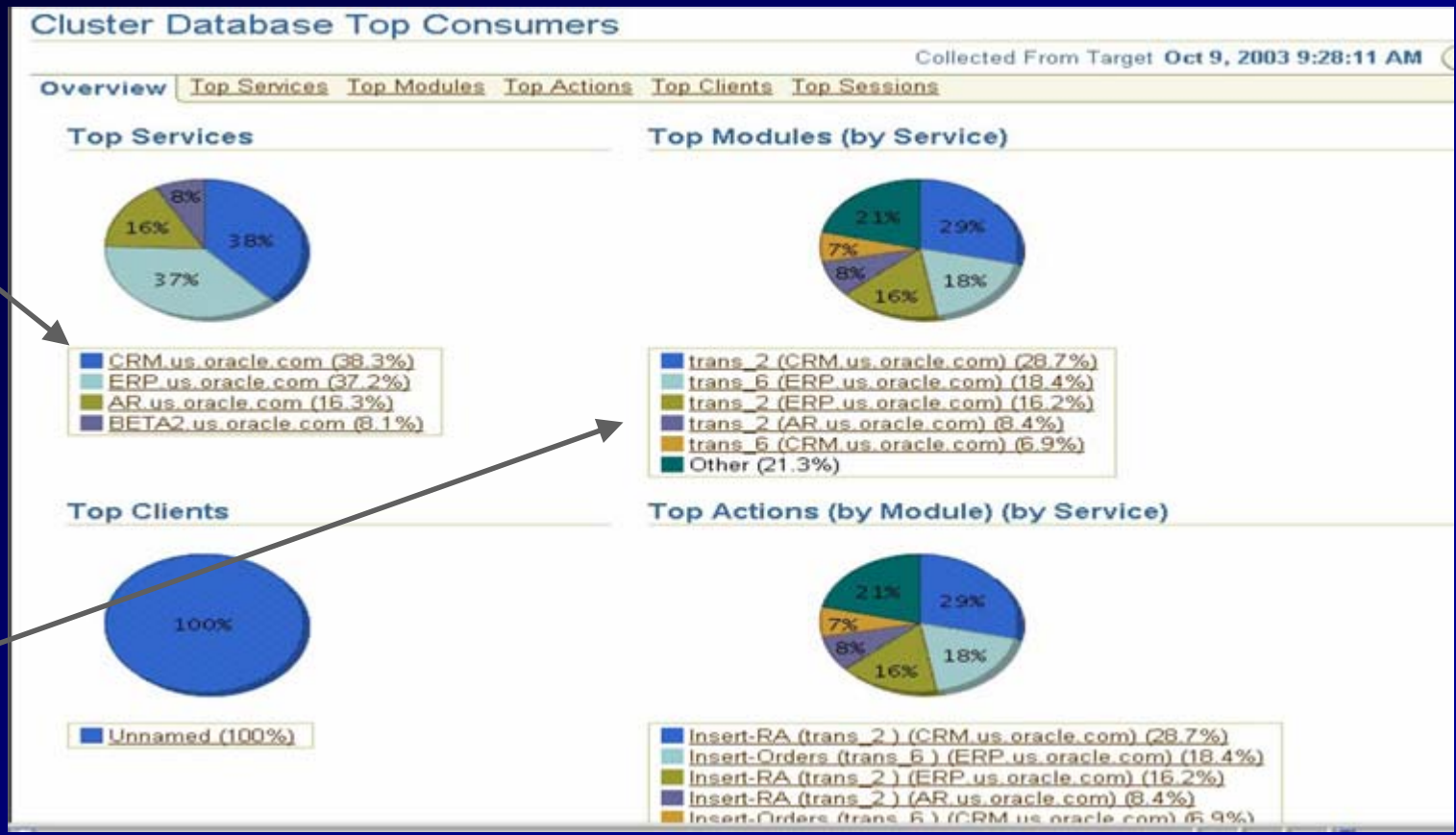
We have a Concurr. issue!



Grid Services - Automatic Workload Management

Top Services

Top Modules



- Complete Presentation by Oracle's Erik Peterson at:
- http://www.oracleracsig.org

10g RAC Enhancements

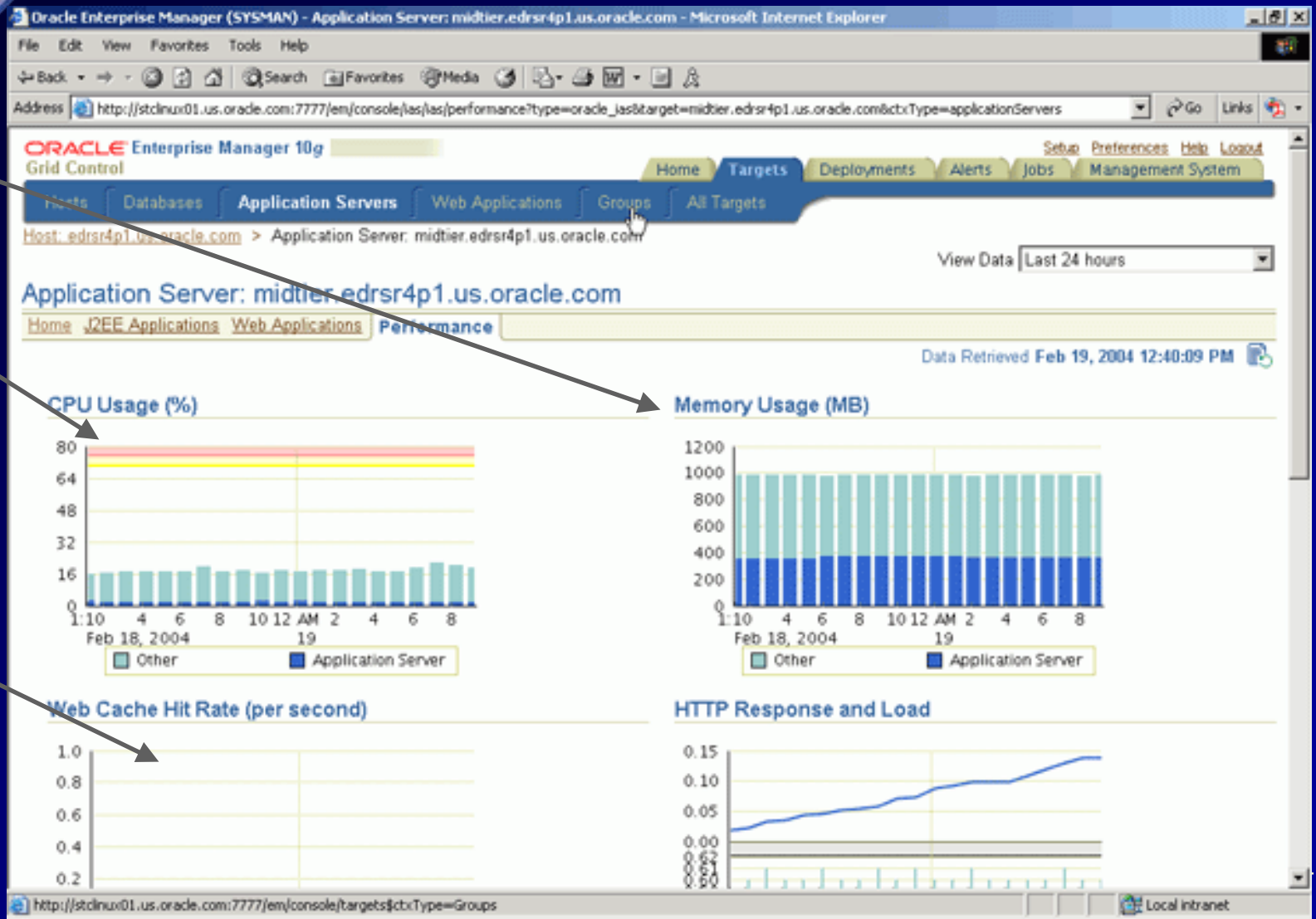
- GRID Control
  - Allows for RAC instance startup, shutdown
  - Allows for RAC instance creation
  - Allows for resource reallocation based on SLAs
  - Allows for automatic provisioning when used with RAC, ASM and Linux

App. Server Performance

Memory

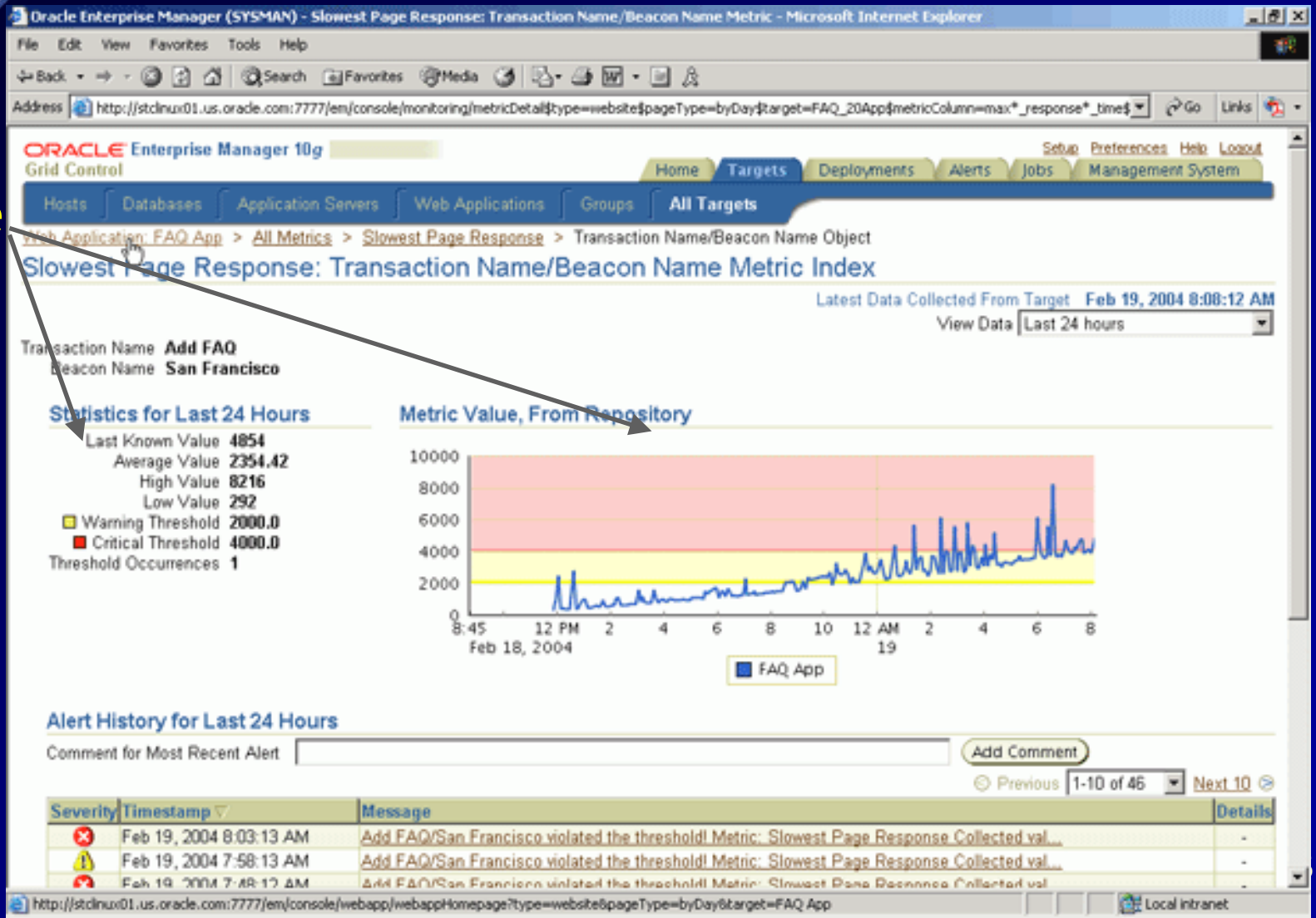
CPU

Web Cache Hits



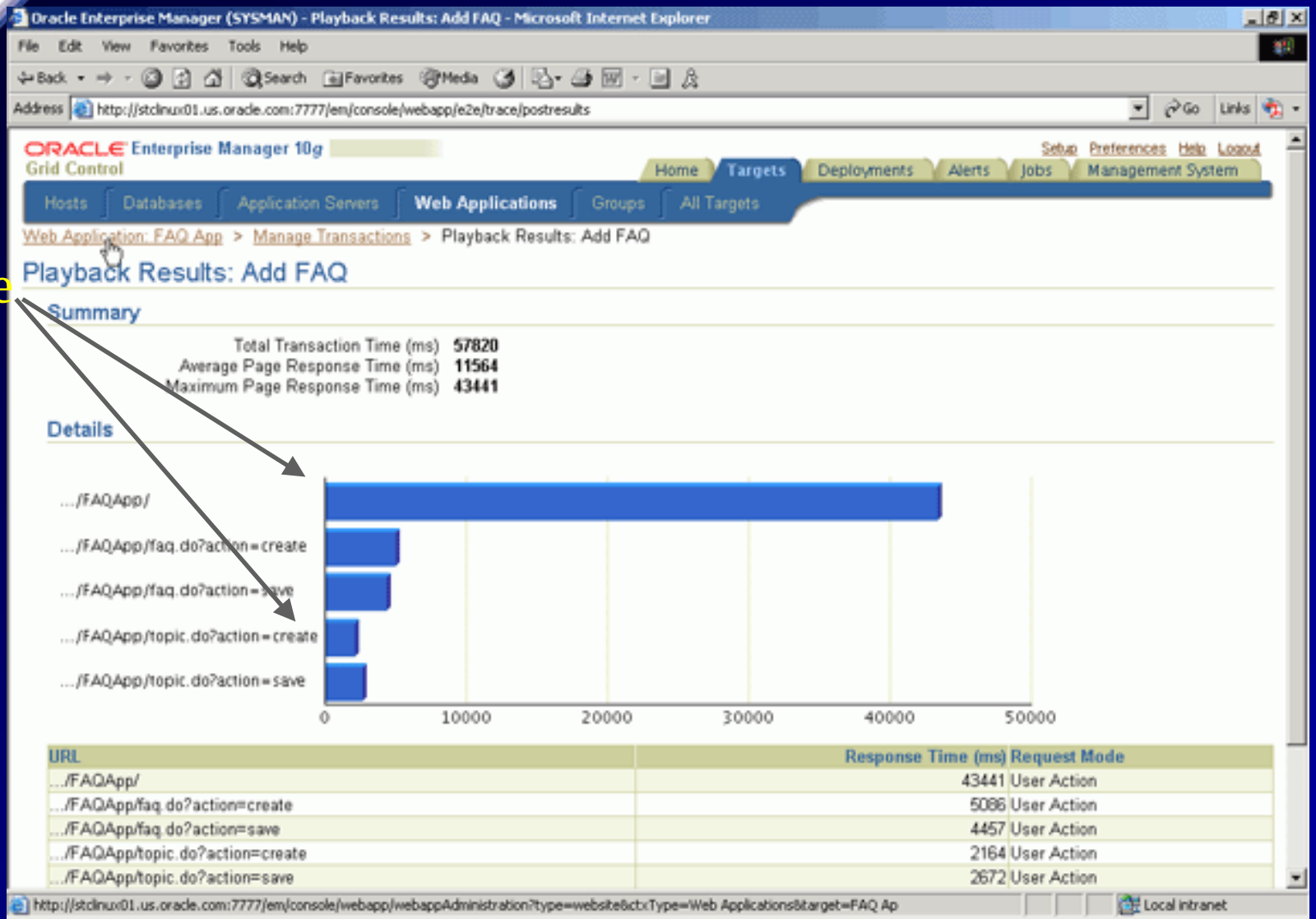
View the Web Application

Page Response Time Detail



URL Response Times

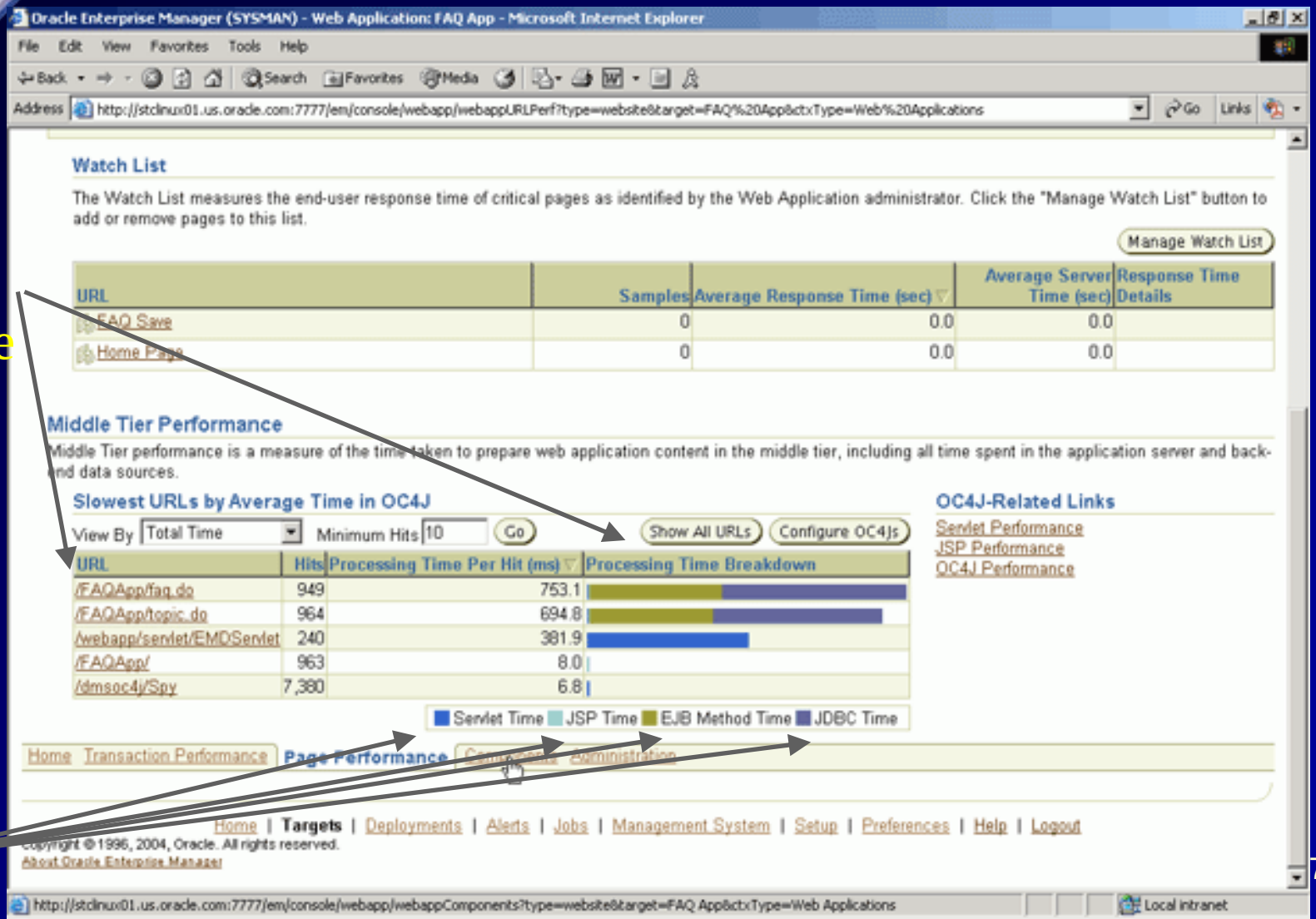
Web Page Response Time all URL's



Middle Tier Performance

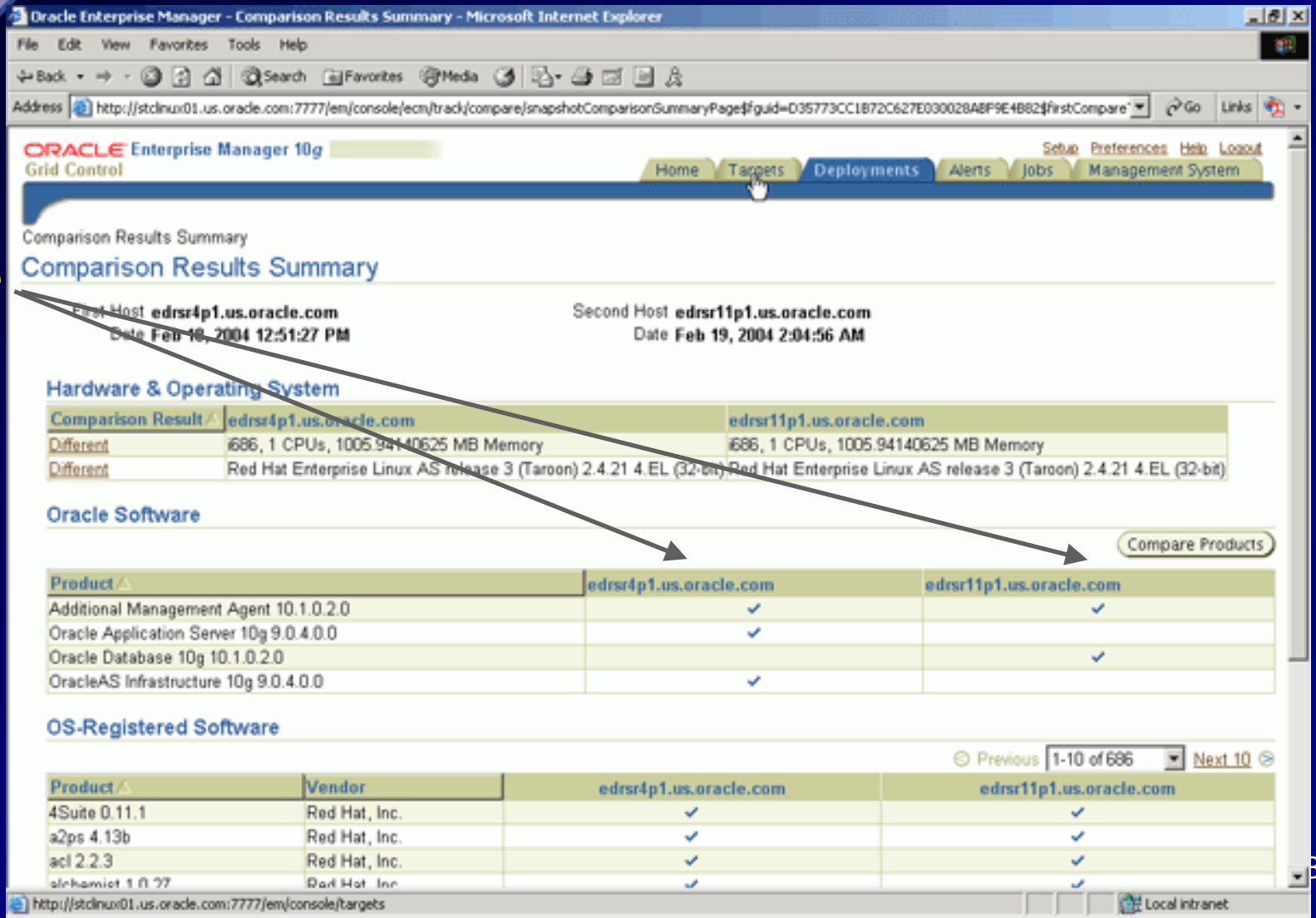
Web Page Detail Response Time all URL's

Splits Time into Parts



Host Performance

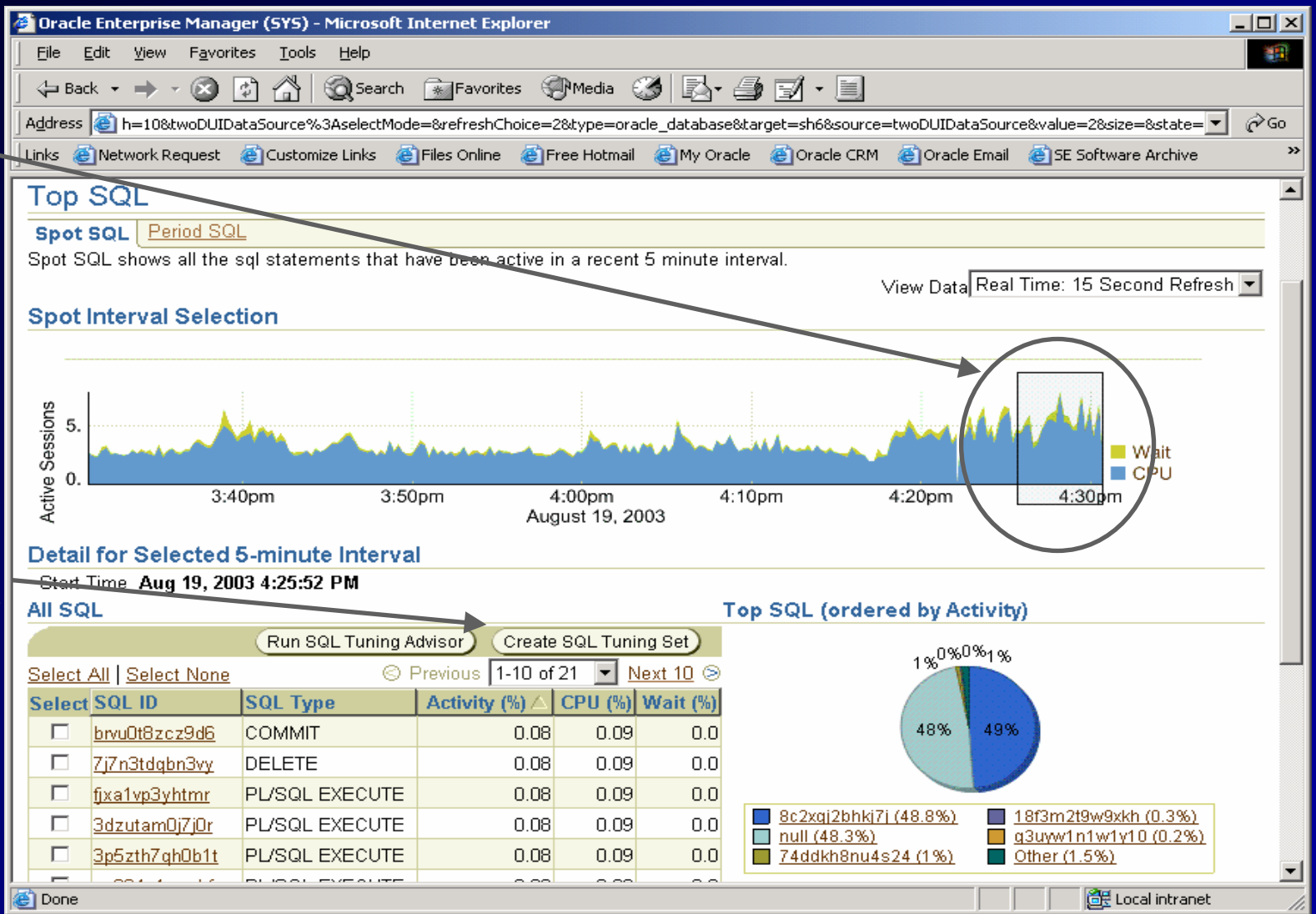
Side by Side Compare



ADDM SQL Tuning Advisor

Drill into Top SQL for worst time period

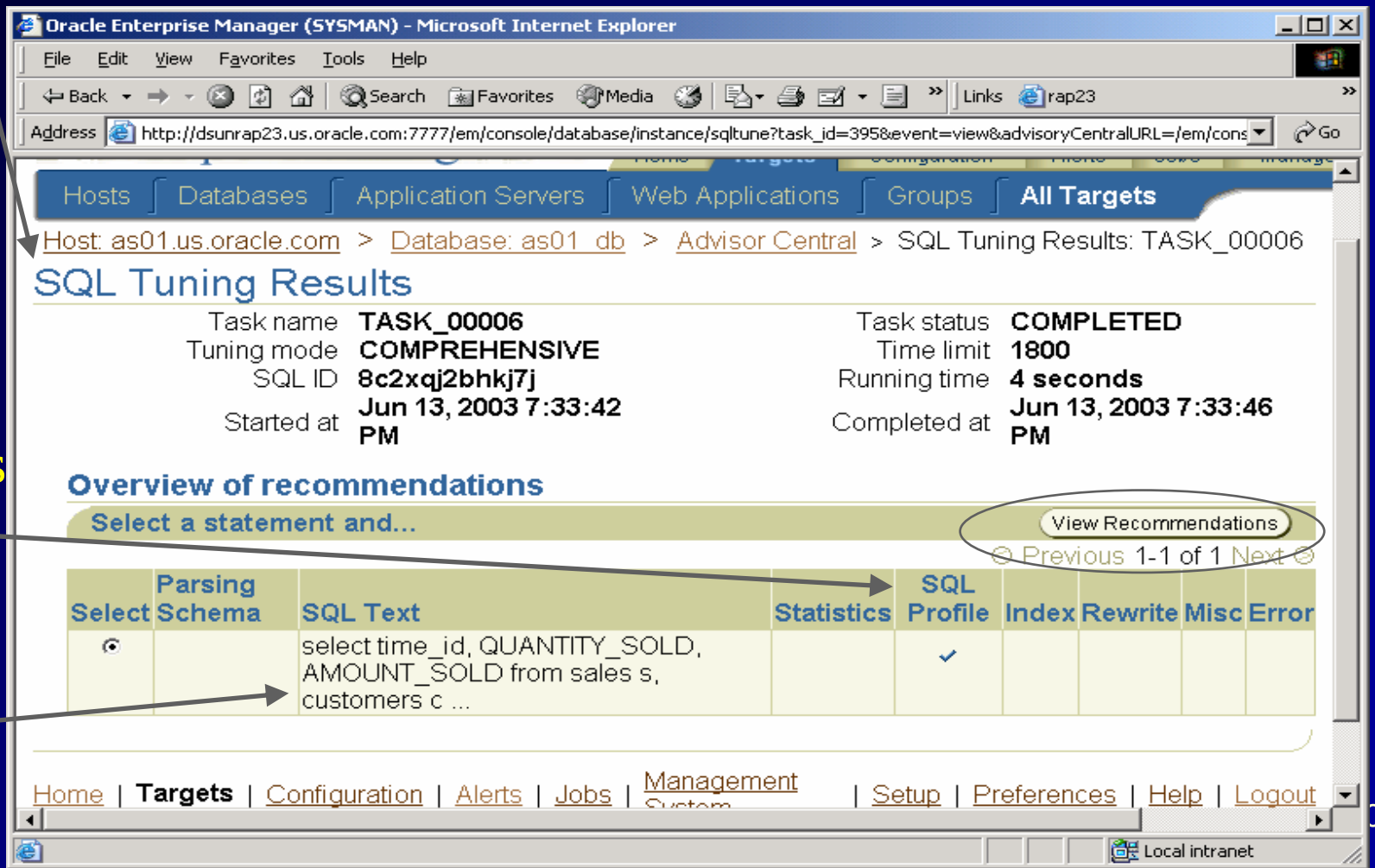
Get Help!



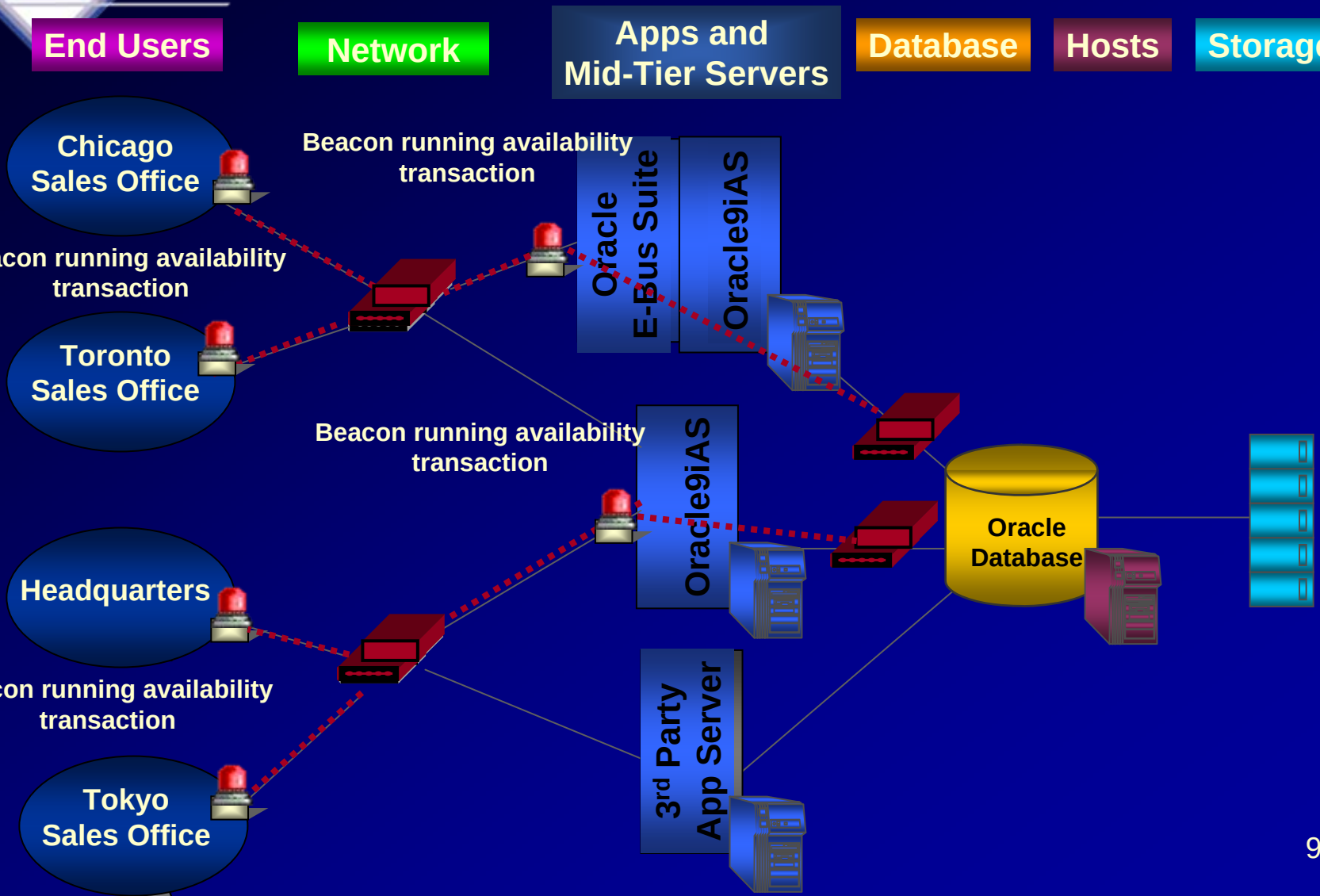
Using SQL Tuning Sets

Tuning Results for this job

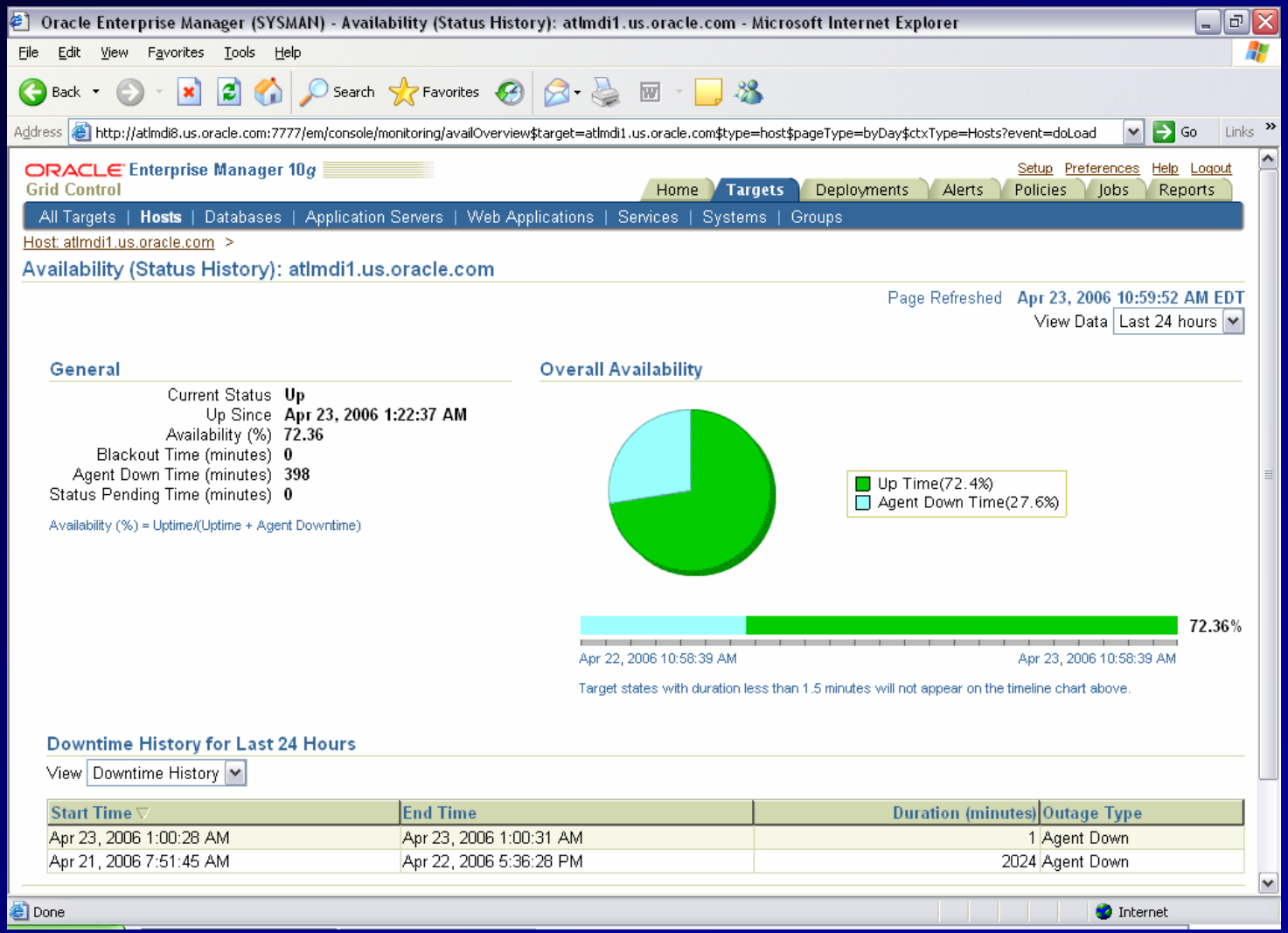
Suggests using a profile For this SQL

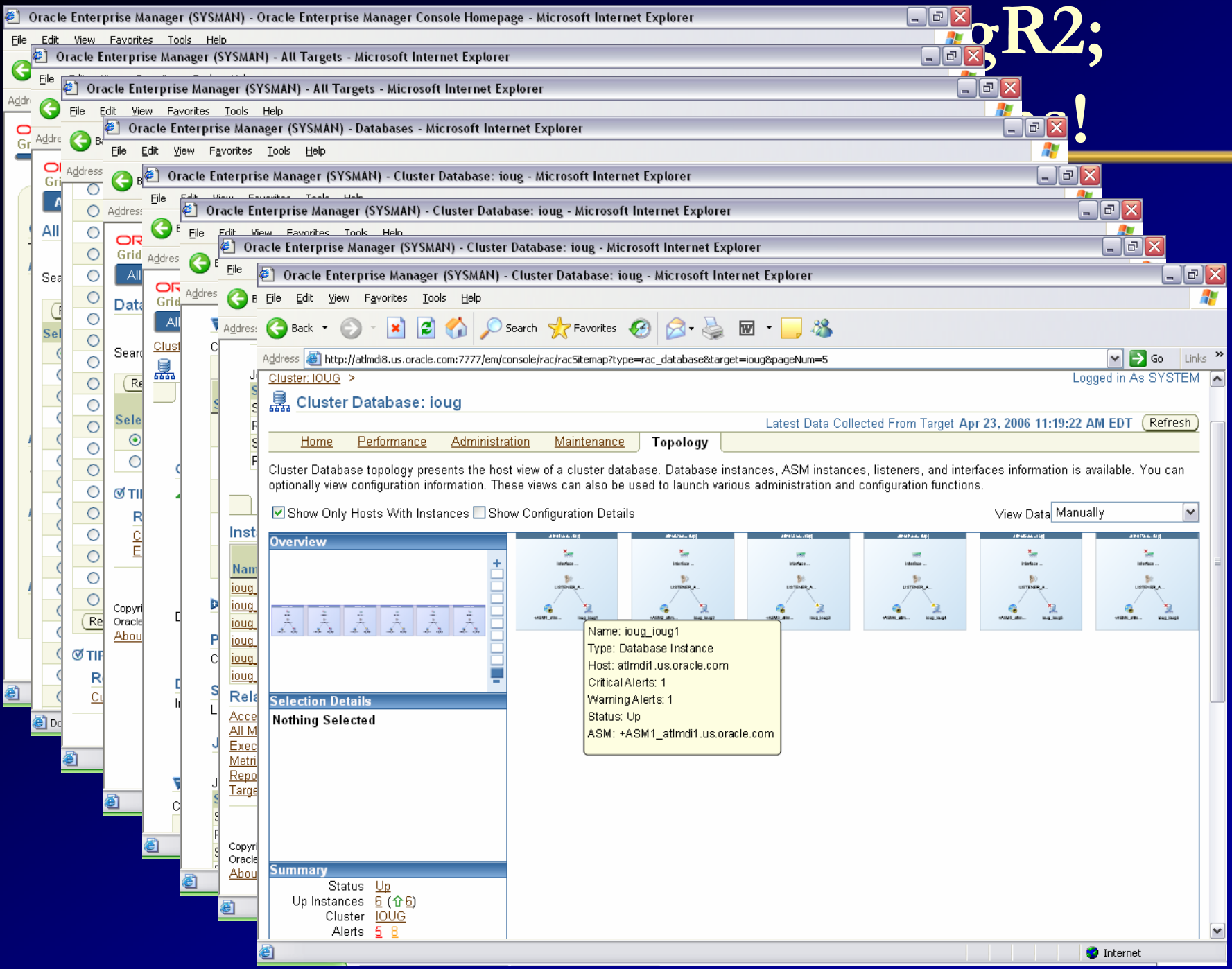


Availability Monitoring Topology

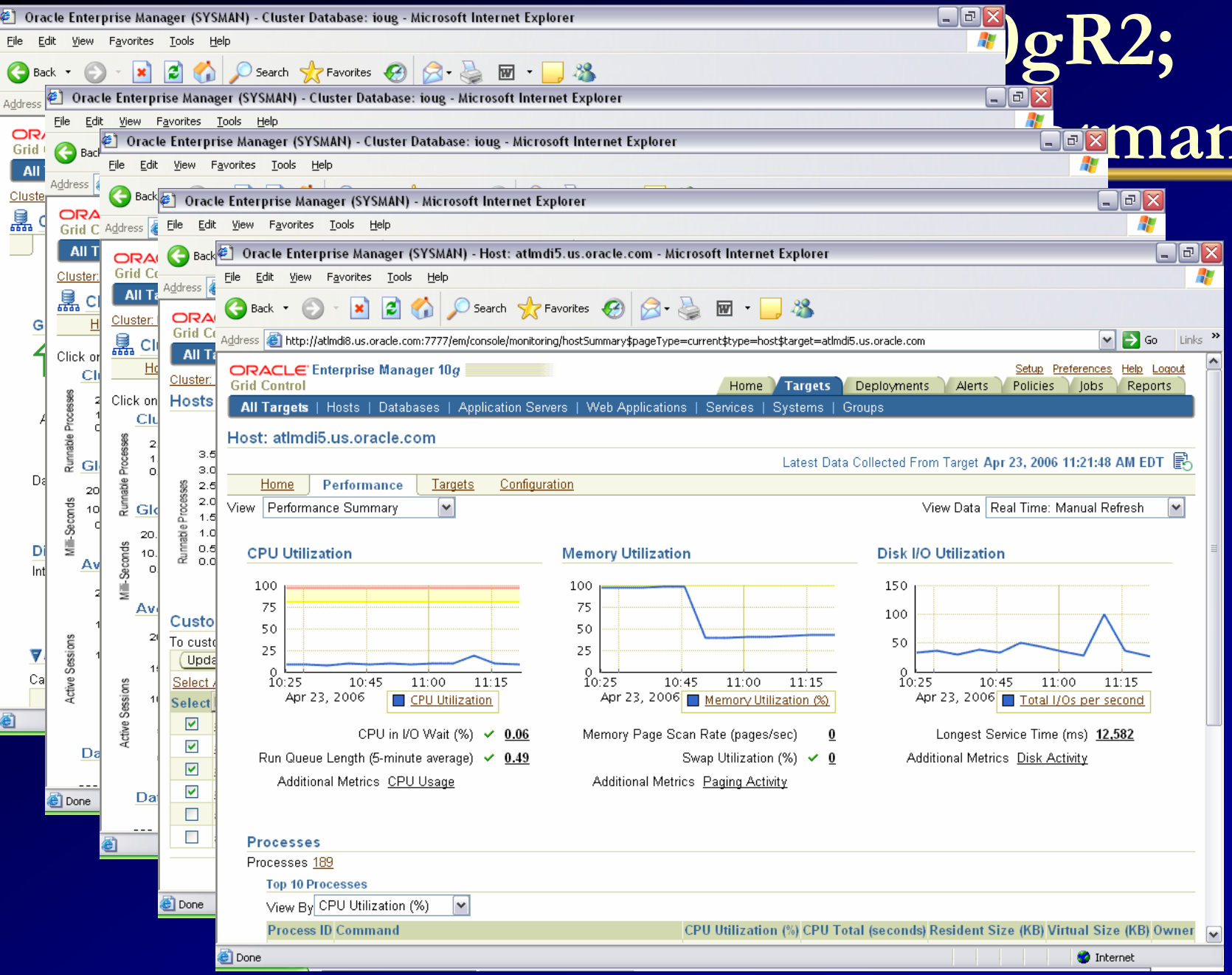


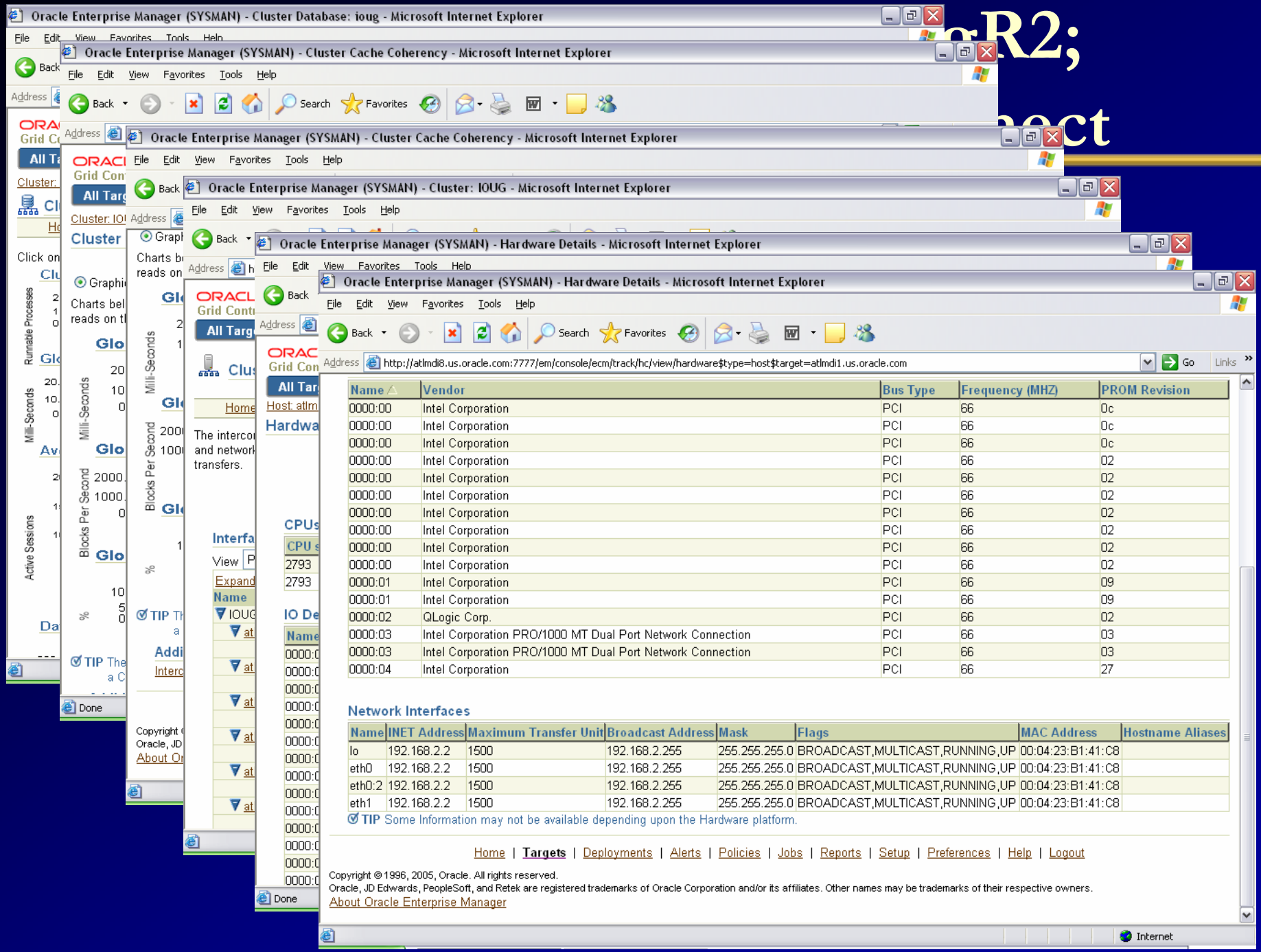
Grid Control – 10gR2; Host Availability & Quick Looks!




Oracle Enterprise Manager (SYSMAN) - Cluster Database: ioug - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://atlmdi8.us.oracle.com:7777/em/console/rac/racSitemap?type=rac_database&target=ioug&pageNum=5
Go Links
Cluster: IOUG >
Logged in As SYSTEM
Cluster Database: ioug
Latest Data Collected From Target Apr 23, 2006 11:19:22 AM EDT
Refresh
Home Performance Administration Maintenance Topology
Cluster Database topology presents the host view of a cluster database. Database instances, ASM instances, listeners, and interfaces information is available. You can optionally view configuration information. These views can also be used to launch various administration and configuration functions.
Show Only Hosts With Instances
Show Configuration Details
View Data Manually
Overview
Selection Details
Nothing Selected
Summary
Status Up
Up Instances 6 (⇧6)
Cluster IOUG
Alerts 5 8
Name: ioug_ioug1
Type: Database Instance
Host: atlmdi1.us.oracle.com
Critical Alerts: 1
Warning Alerts: 1
Status: Up
ASM: +ASM1_atlmdi1.us.oracle.com
Internet

gR2; mance


Oracle Enterprise Manager (SYSMAN) - Cluster Database: ioug - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Host: atlmdi5.us.oracle.com - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://atlmdi8.us.oracle.com:7777/em/console/monitoring/hostSummary$pageType=current$type=host$target=atlmdi5.us.oracle.com
Go Links
ORACLE Enterprise Manager 10g
Grid Control
Setup Preferences Help Logout
Home Targets Deployments Alerts Policies Jobs Reports
All Targets | Hosts | Databases | Application Servers | Web Applications | Services | Systems | Groups
Host: atlmdi5.us.oracle.com
Latest Data Collected From Target Apr 23, 2006 11:21:48 AM EDT
Home Performance Targets Configuration
View Performance Summary
View Data Real Time: Manual Refresh
CPU Utilization
Memory Utilization
Disk I/O Utilization
100 75 50 25 0
150 100 50 0
10:25 10:45 11:00 11:15
Apr 23, 2006
CPU Utilization
Memory Utilization (%)
Total I/Os per second
CPU in I/O Wait (%) 0.06
Run Queue Length (5-minute average) 0.49
Additional Metrics CPU Usage
Memory Page Scan Rate (pages/sec) 0
Swap Utilization (%) 0
Additional Metrics Paging Activity
Longest Service Time (ms) 12,582
Additional Metrics Disk Activity
Processes
Processes 189
Top 10 Processes
View By CPU Utilization (%)
Process ID Command CPU Utilization (%) CPU Total (seconds) Resident Size (KB) Virtual Size (KB) Owner
Done
Internet


Oracle Enterprise Manager (SYSMAN) - Cluster Database: ioug - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Cluster Cache Coherency - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Cluster Cache Coherency - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Cluster: IOUG - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Hardware Details - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Hardware Details - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://atlmdi8.us.oracle.com:7777/em/console/ecm/track/hc/view/hardware$type=host$target=atlmdi1.us.oracle.com
Go Links
Name Vendor Bus Type Frequency (MHZ) PROM Revision
0000:00 Intel Corporation PCI 66 0c
0000:00 Intel Corporation PCI 66 0c
0000:00 Intel Corporation PCI 66 0c
0000:00 Intel Corporation PCI 66 02
0000:00 Intel Corporation PCI 66 02
0000:00 Intel Corporation PCI 66 02
0000:00 Intel Corporation PCI 66 02
0000:00 Intel Corporation PCI 66 02
0000:00 Intel Corporation PCI 66 02
0000:00 Intel Corporation PCI 66 02
0000:01 Intel Corporation PCI 66 09
0000:01 Intel Corporation PCI 66 09
0000:02 QLogic Corp. PCI 66 02
0000:03 Intel Corporation PRO/1000 MT Dual Port Network Connection PCI 66 03
0000:03 Intel Corporation PRO/1000 MT Dual Port Network Connection PCI 66 03
0000:04 Intel Corporation PCI 66 27
Network Interfaces
Name INET Address Maximum Transfer Unit Broadcast Address Mask Flags MAC Address Hostname Aliases
lo 192.168.2.2 1500 192.168.2.255 255.255.255.0 BROADCAST,MULTICAST,RUNNING,UP 00:04:23:B1:41:C8
eth0 192.168.2.2 1500 192.168.2.255 255.255.255.0 BROADCAST,MULTICAST,RUNNING,UP 00:04:23:B1:41:C8
eth0:2 192.168.2.2 1500 192.168.2.255 255.255.255.0 BROADCAST,MULTICAST,RUNNING,UP 00:04:23:B1:41:C8
eth1 192.168.2.2 1500 192.168.2.255 255.255.255.0 BROADCAST,MULTICAST,RUNNING,UP 00:04:23:B1:41:C8
TIP Some Information may not be available depending upon the Hardware platform.
Home | Targets | Deployments | Alerts | Policies | Jobs | Reports | Setup | Preferences | Help | Logout
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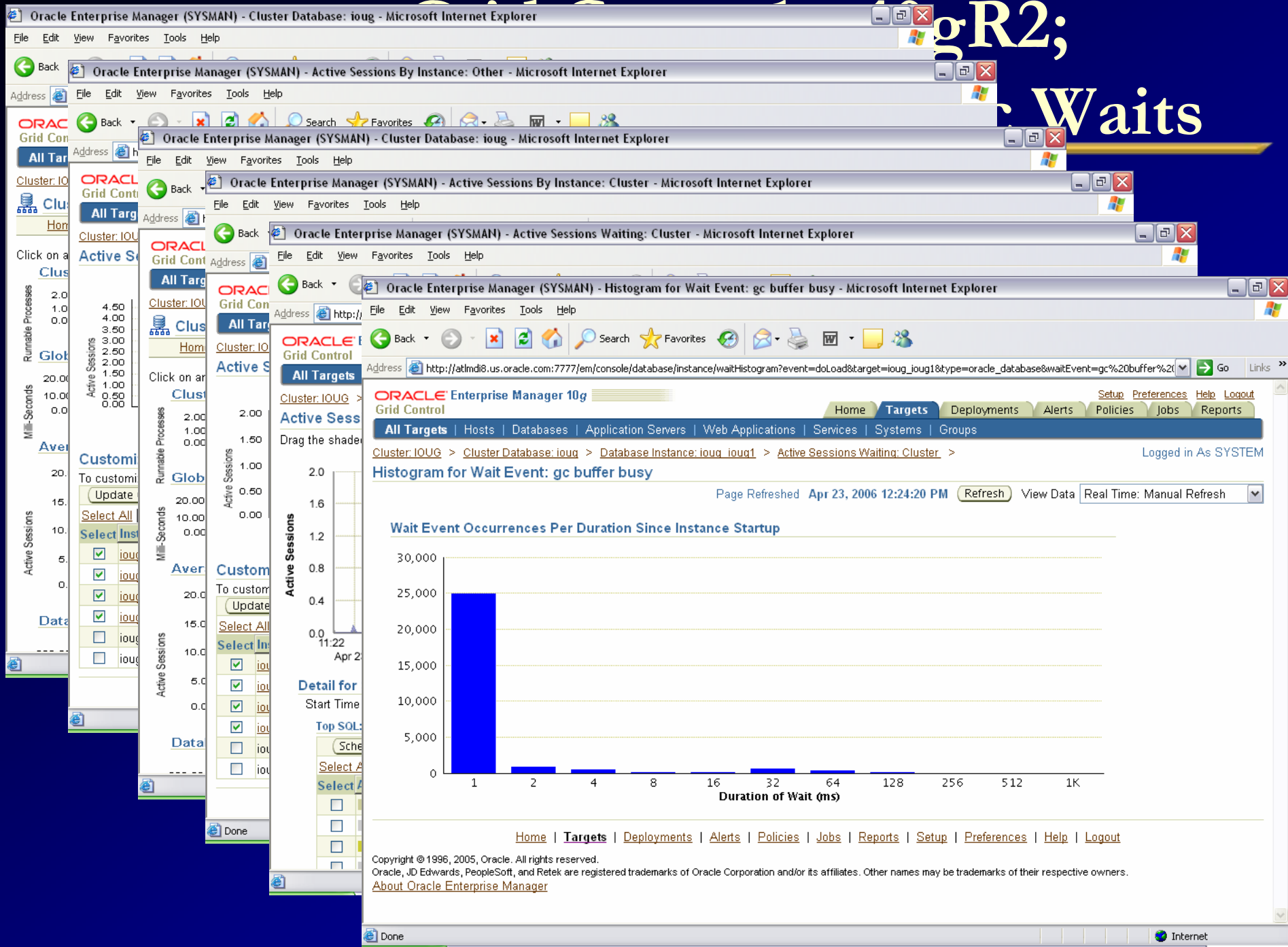
About Oracle Enterprise Manager
Internet

gR2;
Waits


Oracle Enterprise Manager (SYSMAN) - Cluster Database: ioug - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Active Sessions By Instance: Other - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Cluster Database: ioug - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Active Sessions By Instance: Cluster - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Active Sessions Waiting: Cluster - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Histogram for Wait Event: gc buffer busy - Microsoft Internet Explorer
ORACLE Enterprise Manager 10g
Grid Control
Setup Preferences Help Logout
Home Targets Deployments Alerts Policies Jobs Reports
All Targets | Hosts | Databases | Application Servers | Web Applications | Services | Systems | Groups
Cluster: IOUG > Cluster Database: ioug > Database Instance: ioug_ioug1 > Active Sessions Waiting: Cluster >
Logged in As SYSTEM
Histogram for Wait Event: gc buffer busy
Page Refreshed Apr 23, 2006 12:24:20 PM
Refresh
View Data
Real Time: Manual Refresh
Wait Event Occurrences Per Duration Since Instance Startup
30,000
25,000
20,000
15,000
10,000
5,000
0
1
2
4
8
16
32
64
128
256
512
1K
Duration of Wait (ms)
Home | Targets | Deployments | Alerts | Policies | Jobs | Reports | Setup | Preferences | Help | Logout
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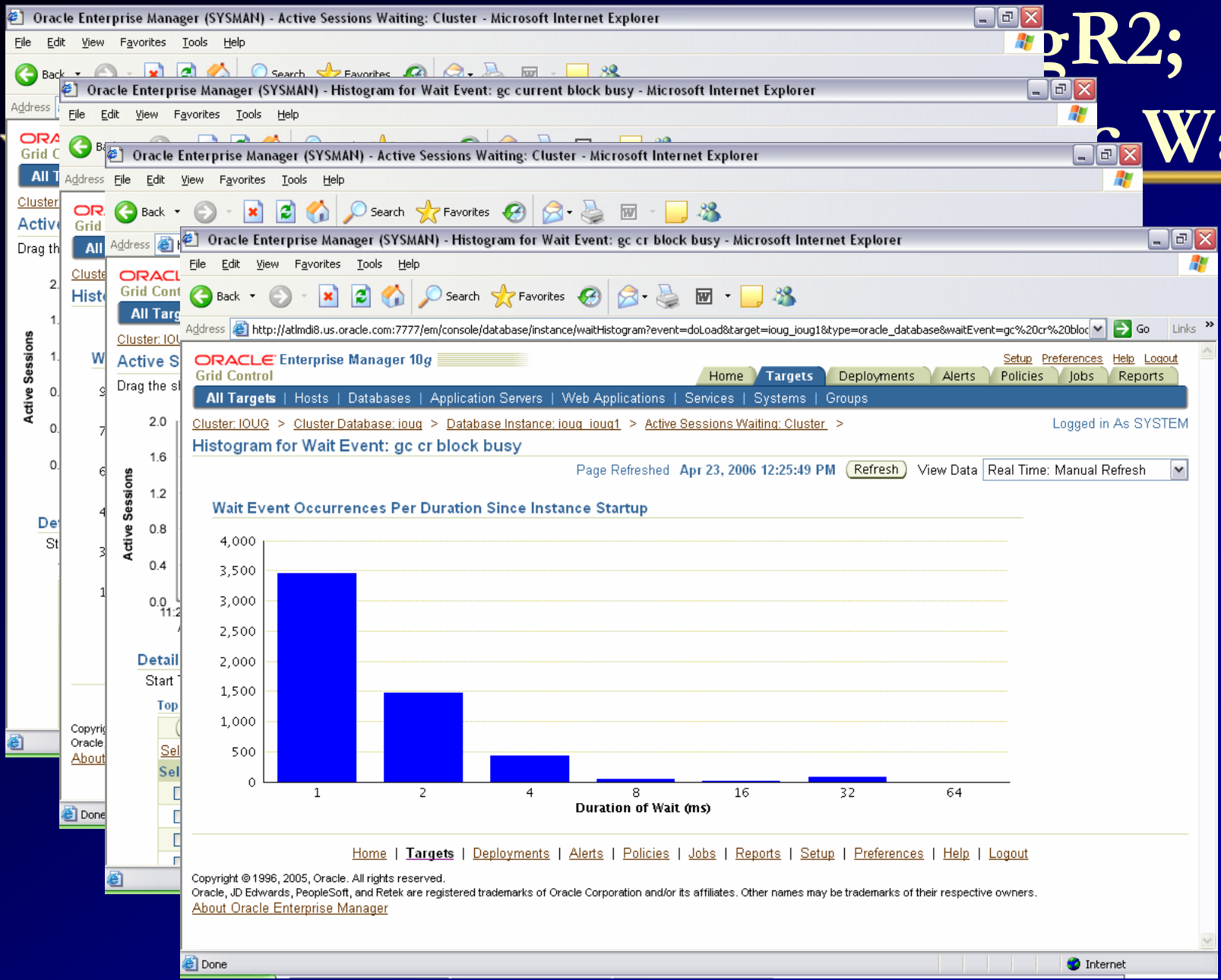
About Oracle Enterprise Manager
Done
Internet

gR2; Waits


Oracle Enterprise Manager (SYSMAN) - Active Sessions Waiting: Cluster - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Histogram for Wait Event: gc current block busy - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Active Sessions Waiting: Cluster - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Histogram for Wait Event: gc cr block busy - Microsoft Internet Explorer
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Cluster: IOUG > Cluster Database: ioug > Database Instance: ioug_ioug1 > Active Sessions Waiting: Cluster >
Logged in As SYSTEM
Histogram for Wait Event: gc cr block busy
Page Refreshed Apr 23, 2006 12:25:49 PM
Refresh
View Data
Real Time: Manual Refresh
Wait Event Occurrences Per Duration Since Instance Startup
Active Sessions
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1
2
4
8
16
32
64
Duration of Wait (ms)
Home | Targets | Deployments | Alerts | Policies | Jobs | Reports | Setup | Preferences | Help | Logout
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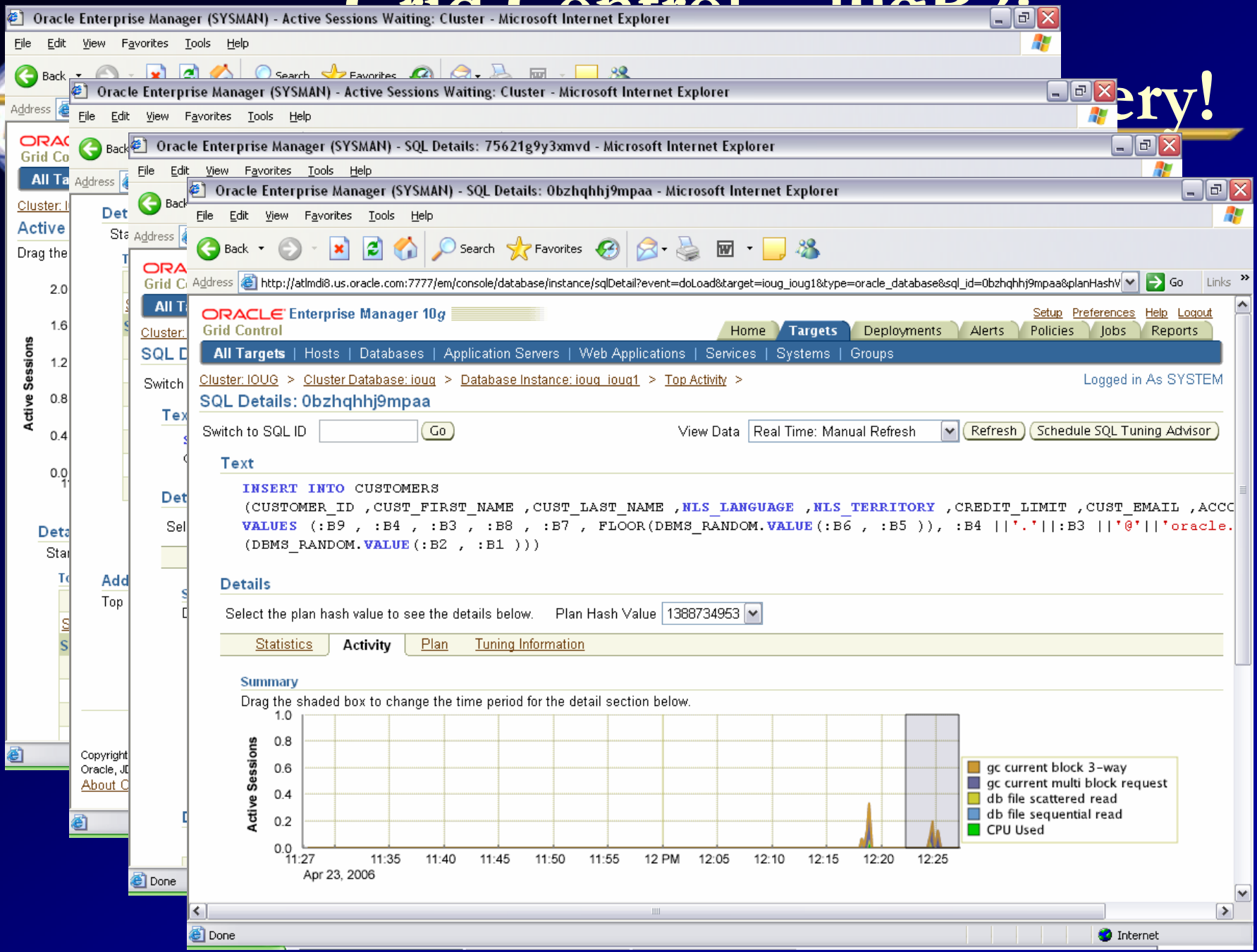
Done
Internet

Grid Control 10gR2: ery!



Oracle Enterprise Manager (SYSMAN) - Active Sessions By Instance: CPU Used - Microsoft Internet Explorer

Oracle Enterprise Manager (SYSMAN) - Active Sessions Working: CPU Used - Microsoft Internet Explorer

Oracle Enterprise Manager (SYSMAN) - Active Sessions Working: CPU Used - Microsoft Internet Explorer

Oracle Enterprise Manager (SYSMAN) - SQL Details: 07p193phmhx3z - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

Address http://atlmdi8.us.oracle.com:7777/em/console/database/instance/sqlDetail?event=doLoad&target=ioug_ioug2&type=oracle_database&sql_id=07p193phmhx3z&planHash

Go Links

ORACLE Enterprise Manager 10g
Grid Control

Setup Preferences Help Logout

Home | Targets | Deployments | Alerts | Policies | Jobs | Reports

All Targets | Hosts | Databases | Application Servers | Web Applications | Services | Systems | Groups

Cluster: IOUG > Cluster Database: ioug > Database Instance: ioug_ioug2 > Top Activity >

Logged in As SYSTEM

SQL Details: 07p193phmhx3z

Switch to SQL ID Go

View Data Real Time: Manual Refresh Refresh

Text

```
BEGIN :1 := orderentry.browseproducts(:2,:3,:4); END;
```

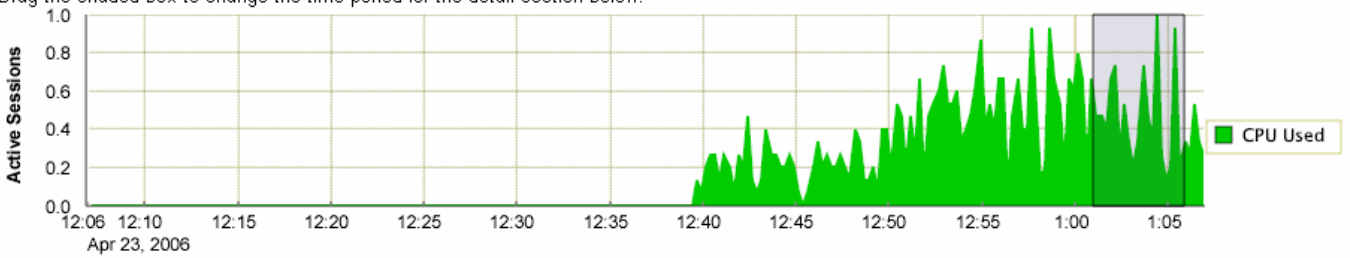
Details

Select the plan hash value to see the details below. Plan Hash Value n/a

Statistics | Activity | Plan | Tuning Information

Summary

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



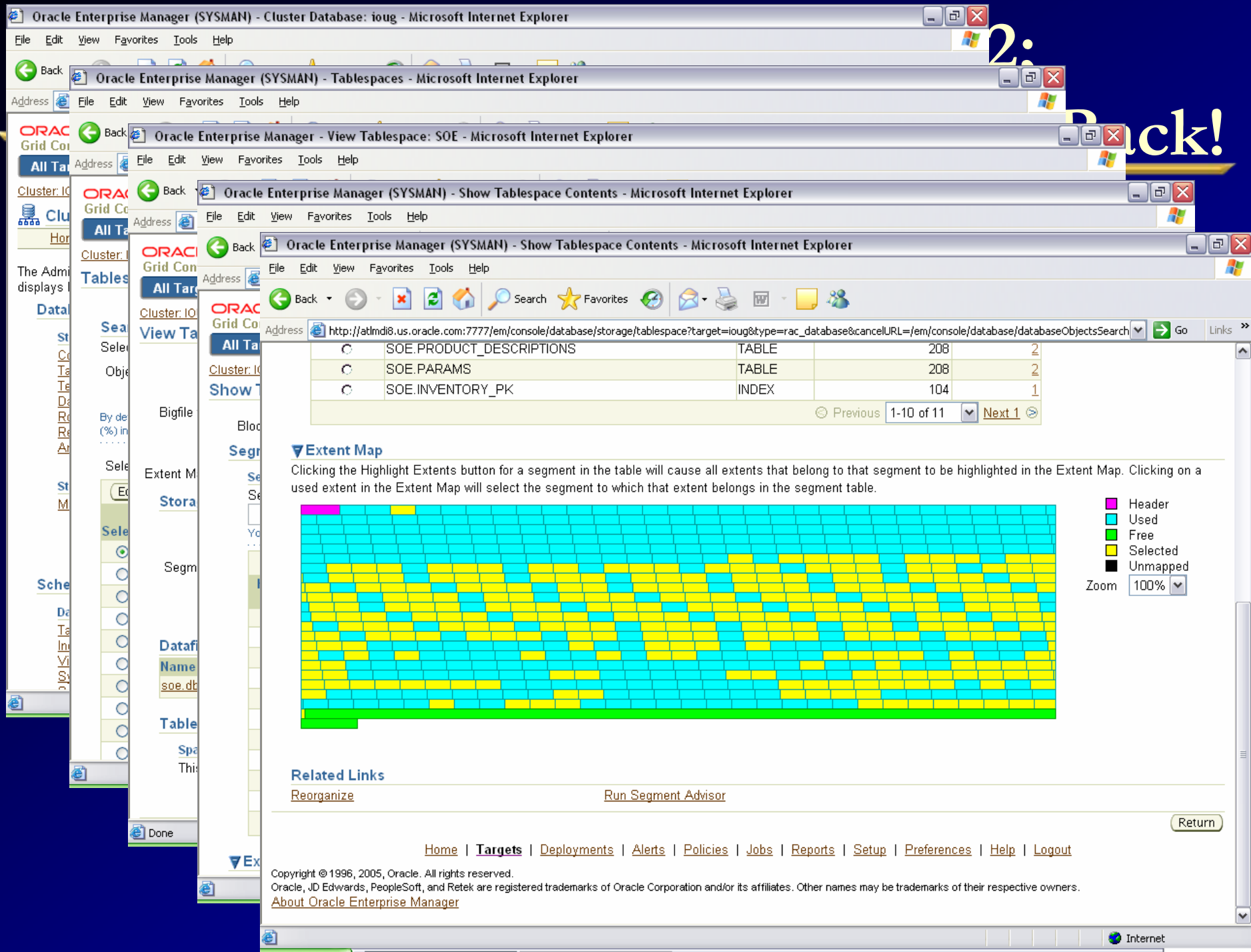
Detail for Selected 5 Minute Interval

Start Time **Apr 23, 2006 1:00:59 PM**

Run ASH Report

Activity (%)	SID	User	Program	Service	Plan Hash Value

Done Internet


Oracle Enterprise Manager (SYSMAN) - Cluster Database: ioug - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Tablespaces - Microsoft Internet Explorer
Oracle Enterprise Manager - View Tablespace: SOE - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Show Tablespace Contents - Microsoft Internet Explorer
Oracle Enterprise Manager (SYSMAN) - Show Tablespace Contents - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://atlmdi8.us.oracle.com:7777/em/console/database/storage/tablespace?target=ioug&type=rac_database&cancelURL=/em/console/database/databaseObjectsSearch
Go Links
SOE.PRODUCT_DESCRIPTIONS TABLE 208 2
SOE.PARAMS TABLE 208 2
SOE.INVENTORY_PK INDEX 104 1
Previous 1-10 of 11 Next 1
Extent Map
Clicking the Highlight Extents button for a segment in the table will cause all extents that belong to that segment to be highlighted in the Extent Map. Clicking on a used extent in the Extent Map will select the segment to which that extent belongs in the segment table.
Header
Used
Free
Selected
Unmapped
Zoom 100%
Related Links
Reorganize
Run Segment Advisor
Return
Home | Targets | Deployments | Alerts | Policies | Jobs | Reports | Setup | Preferences | Help | Logout
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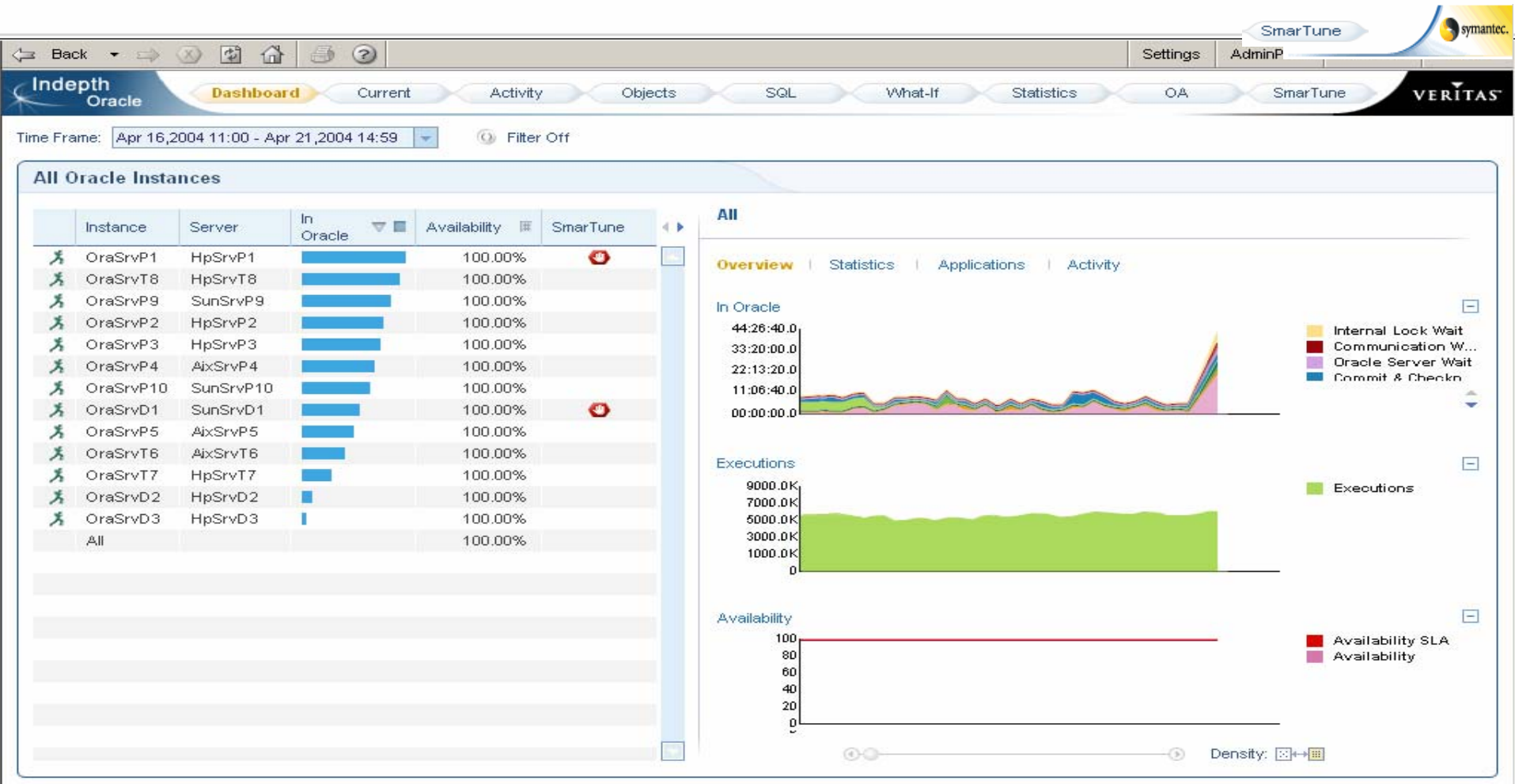
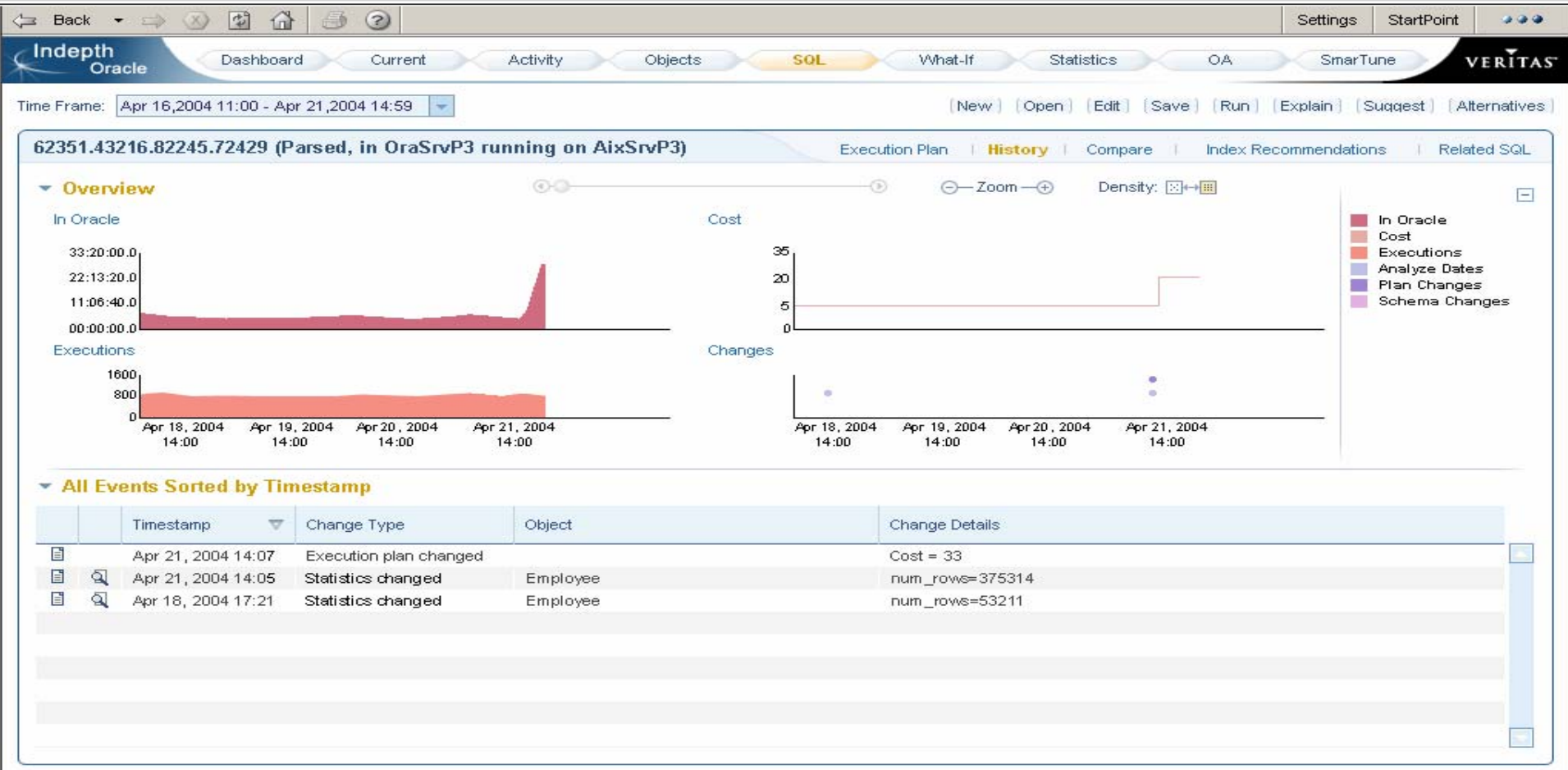
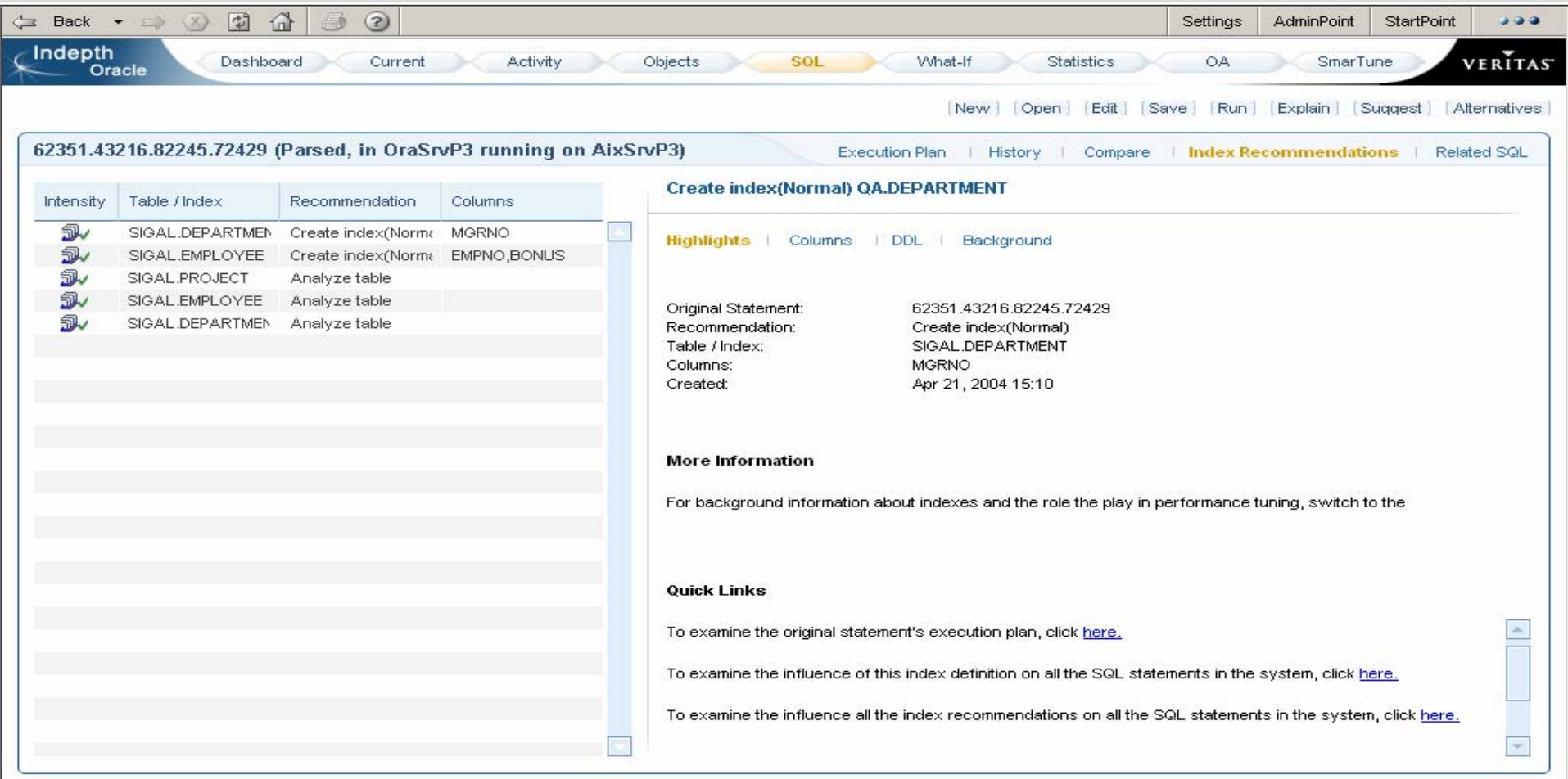
3rd party – Indepth Oracle



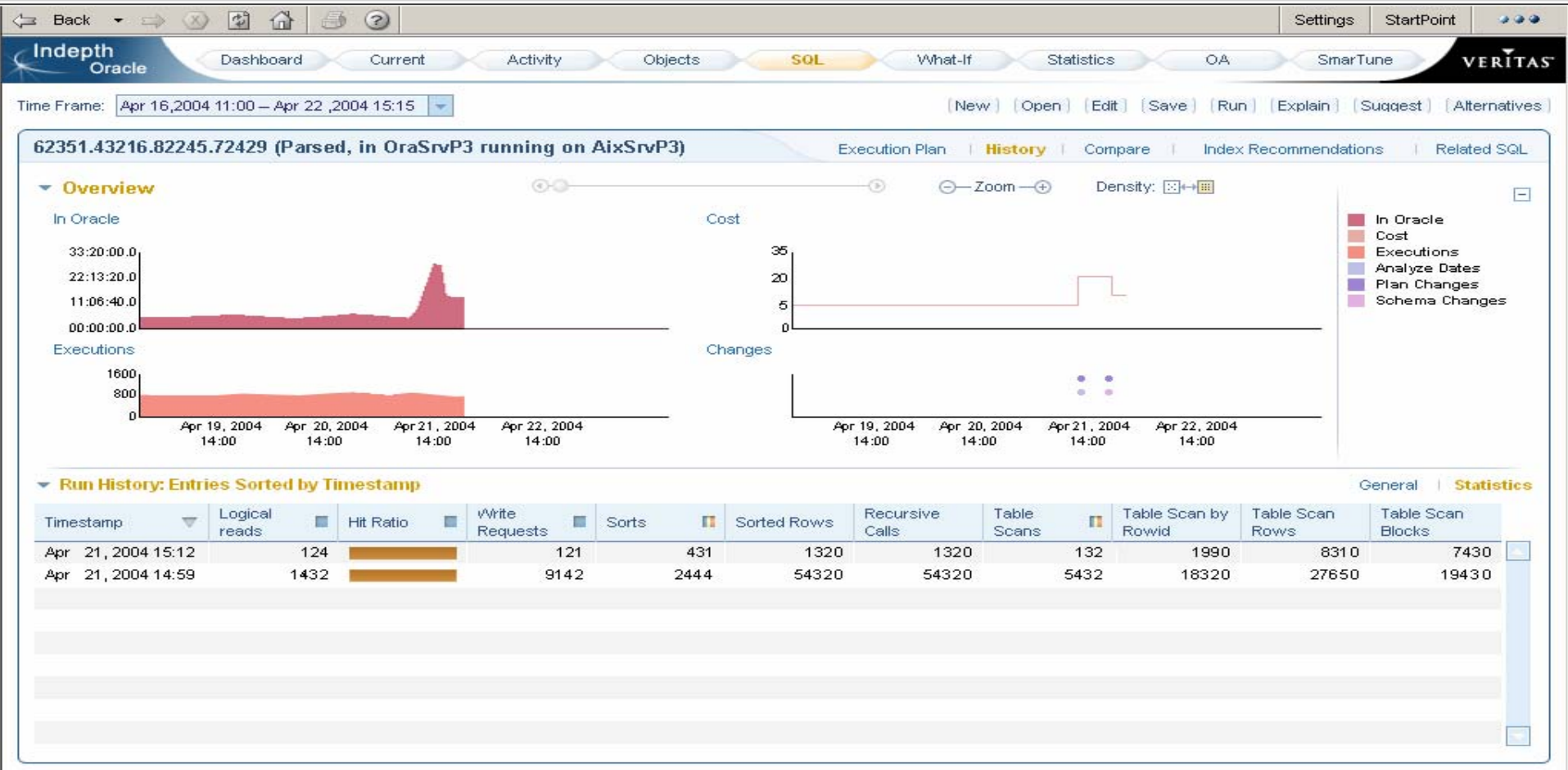
Investigate Reaction To Changes



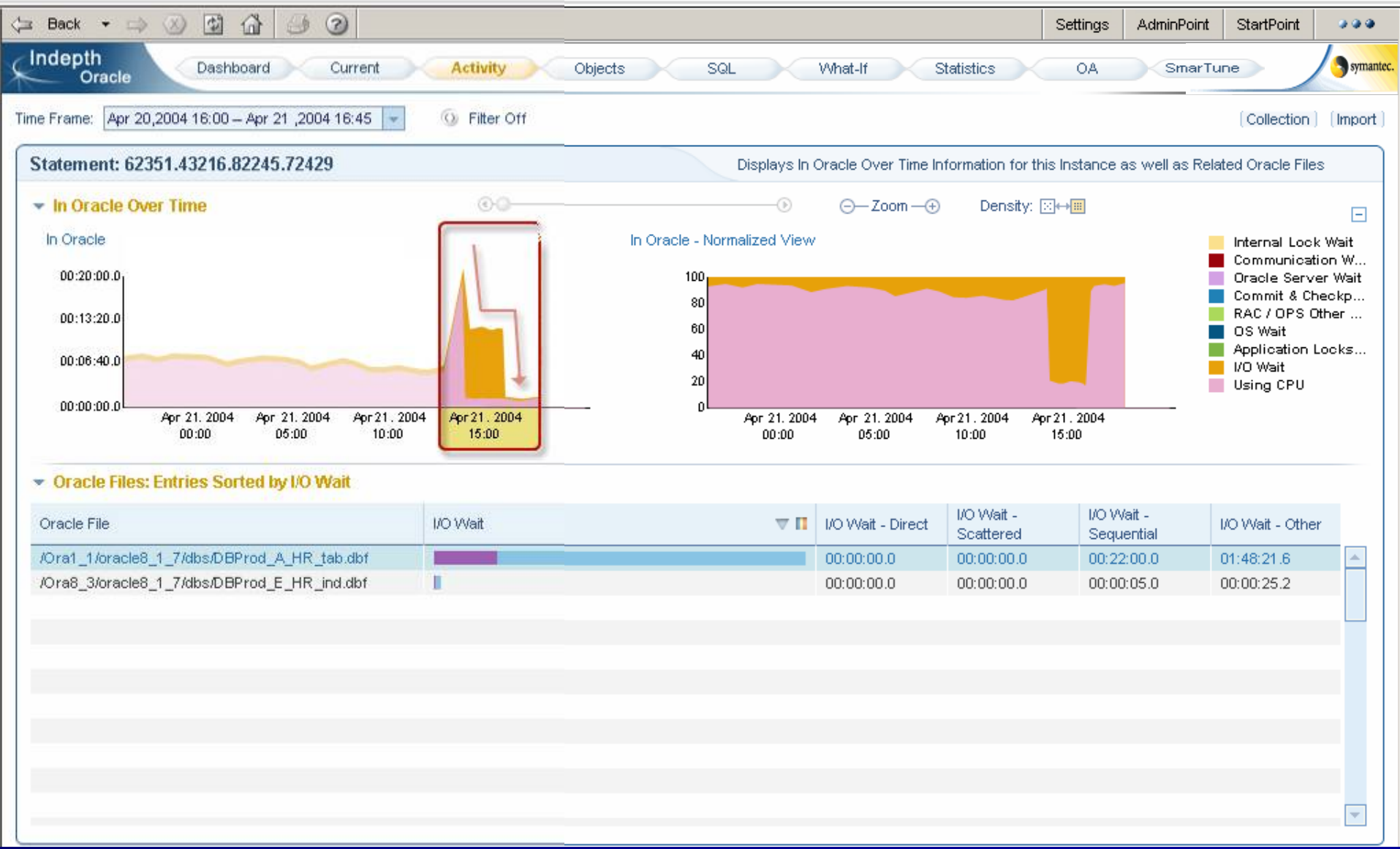
Identify Solutions



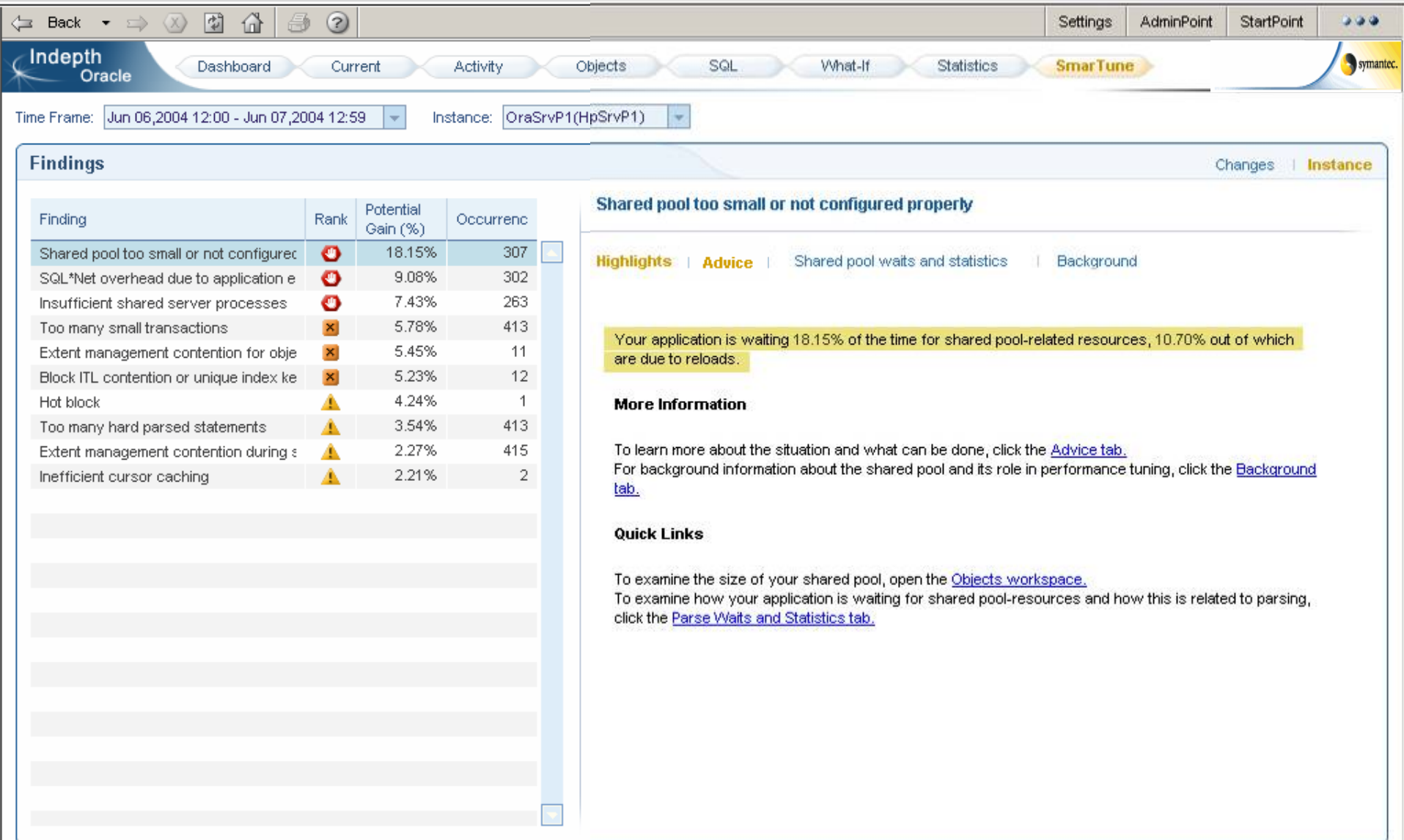
Verify Solution



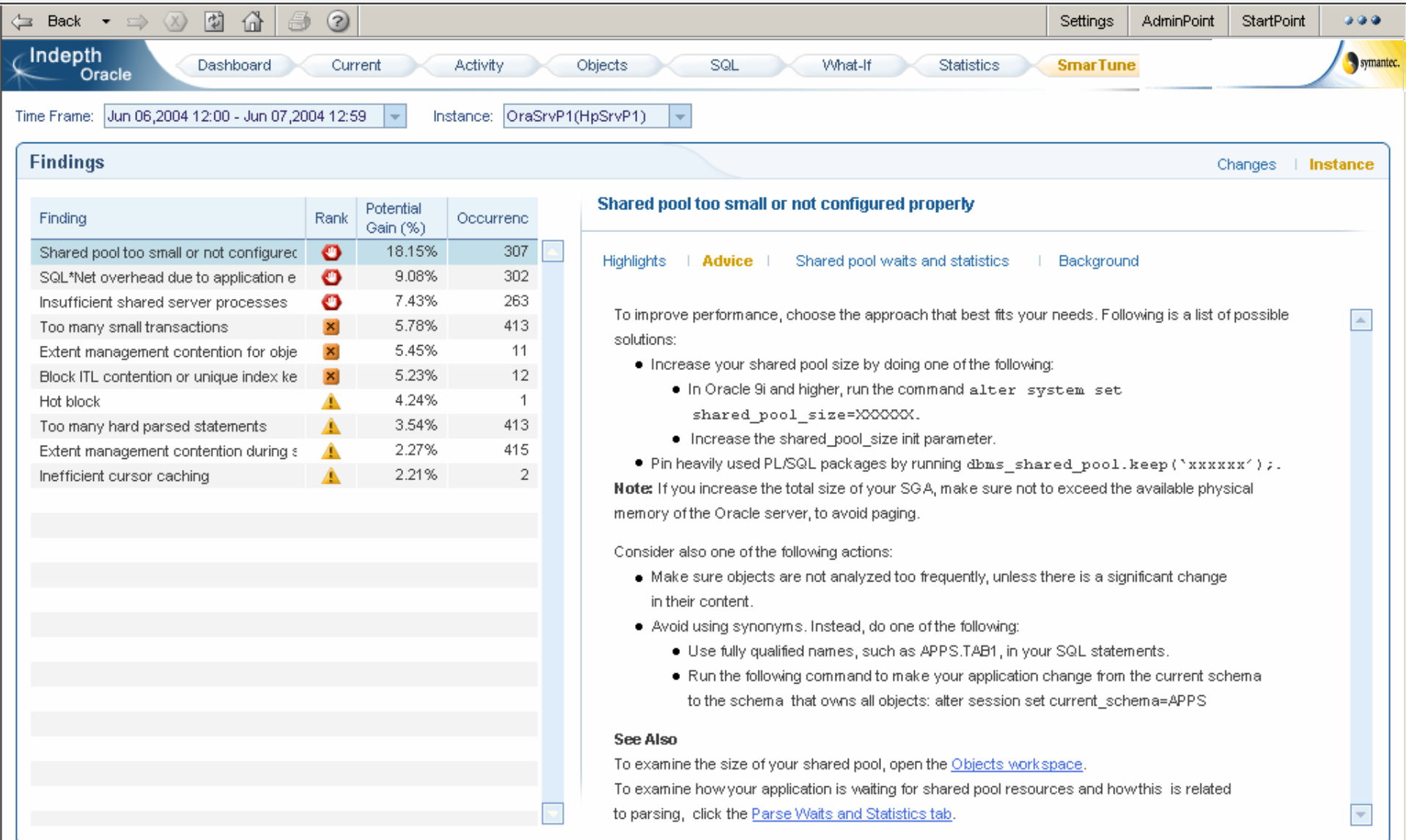
Verify Improvements



Rank Findings

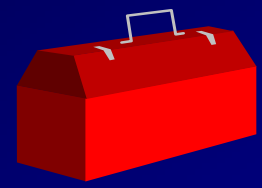


Provide Expert Advice



Helpful V$/X$ Queries (FYI Only)

V$ Views over the years



Version	V$ Views	X$ Tables
6	23	? (35)
7	72	126
8.0	132	200
8.1	185	271
9.0	227	352
9.2	259	394
10.1.02	340 (+31%)	543 (+38%)

Listing of V$ Views


```
select      name
from        v$fixed_table
where       name like 'GV%'
order by    name;

NAME
------------------------------
GV$ACCESS
GV$ACTIVE_INSTANCES
GV$ACTIVE_SESS_POOL_MTH
GV$AQ1
GV$ARCHIVE…
```

Need GV$ - Instance ID

```
select    inst_id, (1 - (sum(decode(name, 'physical reads',value,0)) /
          (sum(decode(name, 'db block gets',value,0)) +
          sum(decode(name, 'consistent gets',value,0))))) * 100 "Hit Ratio"
from      v$sysstat;

INST_ID      Hit Ratio
-----------  ----------------
         1  90.5817699
```

Need GV$ - Instance ID


```
select    inst_id, (1 - (sum(decode(name, 'physical reads',value,0)) /
          (sum(decode(name, 'db block gets',value,0)) +
          sum(decode(name, 'consistent gets',value,0))))) * 100 "Hit Ratio"
from      gv$sysstat
group by inst_id;

INST_ID      Hit Ratio
-----------  ----------------
         1  90.5817699
         2  96.2034537
```

X$ used to create V$

```
select   *
from     v$fixed_view_definition
where    view_name = 'GV$INDEXED_FIXED_COLUMN';
```

VIEW_NAME	VIEW_DEFINITION
gv$indexed_fixed_column	select c.inst_id, kqftanam, kqfcoidx, kqfconam,kqfcoipo from X$kqfco c, X$kqftat where t.indx = c.kqfcotab and kqfcoidx != 0

Listing of X$ Tables

```
select      name
from        v$fixed_table
where       name like 'X%'
order by    name;

NAME
------------------------------
X$ACTIVECKPT
X$BH
X$BUFQM
X$CKPTBUF
X$CLASS_STAT…
```

Listing of X$ Indexes

(419 in 10g; 326 in 9i)


```
select      table_name, index_number, column_name
from        gv$indexed_fixed_column
order by    table_name, index_number, column_name,
            column_position;
```

```
TABLE_NAME                     INDEX_NUMBER COLUMN_NAME
------------------------------ ------------ ------------------------------
X$CLASS_STAT                              1 ADDR
X$CLASS_STAT                              2 INDX
X$DUAL                                    1 ADDR
X$DUAL                                    2 INDX …
```

V$ - System Information


```
SQL> select * from v$version;

BANNER
----------------------------------------------------------------
Oracle Database 10g Enterprise Edition Release 10.1.0.2.0 – Prod
PL/SQL Release 10.1.0.2.0 –Production
CORE 10.1.0.2.0        Production
TNS for 32-bit Windows: Version 10.1.0.2.0 – Production
NLSRTL Version 10.1.0.2.0 – Production
```

V$ - System Information

```
select *
from   v$option;

PARAMETER                      VALUE
------------------------------ ----------
  Partitioning                 TRUE
  Objects                      TRUE
  Real Application Clusters    FALSE
  Advanced Replication         TRUE
  Bit-Mapped Indexes           TRUE
...
```

Great V$ - V$SESSION_WAIT (waiting right now)


```
select event, sum(decode(wait_time,0,1,0)) "Waiting Now",
  sum(decode(wait_time,0,0,1)) "Previous Waits",
  count(*) "Total"
from v$session_wait
group by event
order by count(*);
```

WAIT_TIME = 0 means that it's waiting

WAIT_TIME > 0 means that it previously waited this many ms

Great V$ - V$SESSION_WAIT

EVENT	Waiting Now	Previous Waits	Total
db file sequential read	0	1	1
db file scattered read	2	0	2
latch free	0	1	1
enqueue	2	0	2
SQL*Net message from client	0	254	480

…

V$SESSION_WAIT
Finding Current Specific waits

Buffer Busy Waits or Write Complete Waits Events:

```
SELECT    /*+ ordered */ sid, event, owner, segment_name,
          segment_type,p1,p2,p3
FROM      v$session_wait sw, dba_extents de
WHERE     de.file_id = sw.p1
AND       sw.p2 between de.block_id
          and de.block_id+de.blocks – 1
AND       (event = 'buffer busy waits'
          OR event = 'write complete waits')
AND       p1 IS NOT null
ORDER BY event,sid;
```

V$EVENT_NAME
Finding P1, P2, P3


```
col name for a20
col p1 for a10
col p2 for a10
col p3 for a10
select  event#,name,parameter1 p1,parameter2 p2,parameter3 p3
from   v$event_name
where name in ('buffer busy waits', 'write complete waits')
 EVENT# NAME                 P1         P2         P3
------- -------------------- ---------- ---------- ----------
    143 write complete waits file#      block#
    145 buffer busy waits    file#      block#     id
```

V$ - V$SESSION_WAIT_HISTORY (Last 10 waits for session)

Buffer Busy Waits or Write Complete Waits Events:

```
SELECT    /*+ ordered */ sid, event, owner, segment_name,
          segment_type,p1,p2,p3
FROM      v$session_wait_history sw, dba_extents de
WHERE     de.file_id = sw.p1
AND       sw.p2 between de.block_id
          and de.block_id+de.blocks – 1
AND       (event = 'buffer busy waits'
          OR event = 'write complete waits')
AND       p1 IS NOT null
ORDER BY event,sid;
```

Great V$ - V$SESSION_EVENT (waiting since the session started)


```
select sid, event, total_waits,
  time_waited, event_id
from v$session_event
where time_waited > 0
order by time_waited;
```

SID	EVENT	TOTAL_WAITS	TIME_WAITED
159	process startup	2	1
167	latch: redo allocation	4	1
168	log buffer space	2	3
166	control file single write	5	4

…

V$ - V$SESSION_WAIT_CLASS (session waits by WAIT CLASS)


```
select wait_class, total_waits
from v$system_wait_class;
```

SID	WAIT_CLASS	TOTAL_WAITS
147	Idle	6582
150	Idle	138
153	Application	10
153	Administrative	1
153	Idle	47
153	Network	48
153	User I/O	4
153	System I/O	33

Great V$ - V$SYSTEM_EVENT (waits since the instance started)


```
select sid, event, total_waits,
  time_waited, event_id
from v$system_event
where time_waited > 0
order by time_waited;
```

```
EVENT                          TOTAL_WAITS TIME_WAITED
------------------------------ ----------- -----------
latch: session allocation             5644           1
latch: redo allocation                   4           1
latch: cache buffers chains              4           3
enq: TX - index contention               1           3
direct path write temp                  57           6
row cache lock                           1           7  ...
```

V$ - V$SYSTEM_WAIT_CLASS (system waits by WAIT CLASS)


```
select wait_class, total_waits
from v$system_wait_class;

WAIT_CLASS                       TOTAL_WAITS
-------------------------------- ------------
Other                                  545472
Application                               105
Configuration                              92
Administrative                              1
Concurrency                                30
Commit                                    793
Idle                                   186169
Network                                   385
User I/O                                16017
System I/O                              25478
```

Great V$ - V$OPEN_CURSOR (Added sql_id in 10g)


```
select sid, count(*)
from v$open_cursor
group by sid
having count(*) > 300
order by count(*) desc;
```

```
SID      COUNT(*)
---------- ----------
        11        450
         8        320
         9        301
```

```
select sid, sql_id, count(*)
from v$open_cursor
group by sid, sql_id
order by count(*);
```

```
SID      COUNT(*) SQL_ID
---------- ---------- -------------
        11          2 9tdqgnq7gd5cf
        11          1 a1xgtxssv5rrp
        11          1 attwbvtyu8x5c
```

V$ - Top 10 as % of All

```
select sum(pct_bufgets) percent
from (select rank() over ( order by buffer_gets desc )     as rank_bufgets,
   to_char(100 * ratio_to_report(buffer_gets) over         (), '999.99')
    pct_bufgets
from   v$sqlarea )
where  rank_bufgets < 11;

PERCENT
-----------
     97.07
```

Great V$ - V$SQLAREA or V$SQL

User1:

SQL> conn system/manager

*SQL> create table emp as select * from scott.emp;*

SQL> lock table emp in exclusive mode;

User 2:

SQL> conn system/manager

SQL> lock table emp in exclusive mode;

User 3:

SQL> connect scott/tiger

SQL> lock table emp in

Great V$ - V$SQLAREA or V$SQL

```
select sql_text, users_executing, executions, users_opening
from v$sqlarea
where sql_text like 'lock table emp%';

SQL_TEXT                                 USERS_EXEC  EXEC  USERS_OPEN
---------------------------------------- ----------  ----- ----------
lock table emp in exclusive mode                  1     2           3
```

Great V$ - V$SQLAREA or V$SQL

```
select sql_text, users_executing, executions, users_opening
from v$sql
where sql_text like 'lock table emp%';
```

SQL_TEXT	USERS_EXEC	EXEC	USERS_OPEN
lock table emp in exclusive mode	1	1	2
lock table emp in exclusive mode	0	1	1

V$ - What Users are doing…

```
select   a.sid, a.username, s.sql_text
from     v$session a, v$sqltext s
where a.sql_address     = s.address
and      a.sql_hash_value = s.hash_value
order    by a.username, a.sid, s.piece;

SID  USERNAME        SQL_TEXT
---- ----------------  ---------------------------------
   11  PLSQL_USER    update s_employee set salary = 10000
    9  SYS           select a.sid, a.username, s.sql_text
    9  SYS           from v$session a, v$sqltext
    9  SYS           where a.sql_address  = s.address
   (…partial output listing)
```

Great V$ - V$SEGMENT_STATISTICS


```
select object_name, statistic_name, value
from v$segment_statistics
where value > 100000
order by value;
```

OBJECT_NAME	STATISTIC_NAME	VALUE
ORDERS	space allocated	96551
ORDERS	space allocated	134181
ORDERS	logical reads	140976
ORDER_LINES	db block changes	183600

AWR – Segments by Buffer Busy Waits

Segments by Buffer Busy Waits

- % of Capture shows % of Buffer Busy Waits for each top segment compared
- with total Buffer Busy Waits for all segments captured by the Snapshot

Owner	Tablespace Name	Object Name	Subobject Name	Obj. Type	Buffer Busy Waits	% of Capture
				TABLE PARTITION	1,243,890	89.24
				INDEX PARTITION	39,258	2.82
				INDEX PARTITION	33,780	2.42
				INDEX PARTITION	28,563	2.05
				INDEX PARTITION	26,637	1.91

Back to Segment Statistics
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Segments by Global Cache Buffer Busy

- % of Capture shows % of GC Buffer Busy for each top segment compared
- with GC Buffer Busy for all segments captured by the Snapshot

Owner	Tablespace Name	Object Name	Subobject Name	Obj. Type	GC Buffer Busy	% of Capture
SYS	SYSTEM	UNDO$		TABLE	21	100.00

Back to Segment Statistics

AWR – Segments by Logical Reads

Segments by Logical Reads

- Total Logical Reads: 225,112,503
- Captured Segments account for 90.9% of Total

Owner	Tablespace Name	Object Name	Subobject Name	Obj. Type	Logical Reads	%Total
				INDEX PARTITION	59,714,336	26.53
				INDEX PARTITION	48,936,144	21.74
				INDEX PARTITION	40,319,312	17.91
				INDEX PARTITION	23,612,368	10.49
				INDEX PARTITION	20,381,072	9.05

Back to Segment Statistics
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Segments by Physical Reads

- Total Physical Reads: 1,722
- Captured Segments account for 41.1% of Total

Owner	Tablespace Name	Object Name	Subobject Name	Obj. Type	Physical Reads	%Total
				INDEX PARTITION	275	15.97
				INDEX PARTITION	164	9.52
				INDEX PARTITION	97	5.63

X$ - % of Current Redo Filled


```
SELECT   ROUND((cpodr_bno/lesiz),2)*100||'%'
         PctCurLogFull
FROM     X$kcccp a, X$kccle b
WHERE    a.cpodr_seq = b.leseq;

PCTCURLOGFULL
-------------------------------------
97%
```

X$ - % of Current Redo Filled

```
alter system switch logfile;
 System altered.

SELECT      ROUND((cpodr_bno/lesiz),2)*100||'%'
            PctCurLogFull
FROM        X$kcccp a, X$kccle b
WHERE       a.cpodr_seq = b.leseq;

PCTCURLOGFULL
------------------------------------
0%
```

V$ - V$FILE_HISTOGRAM

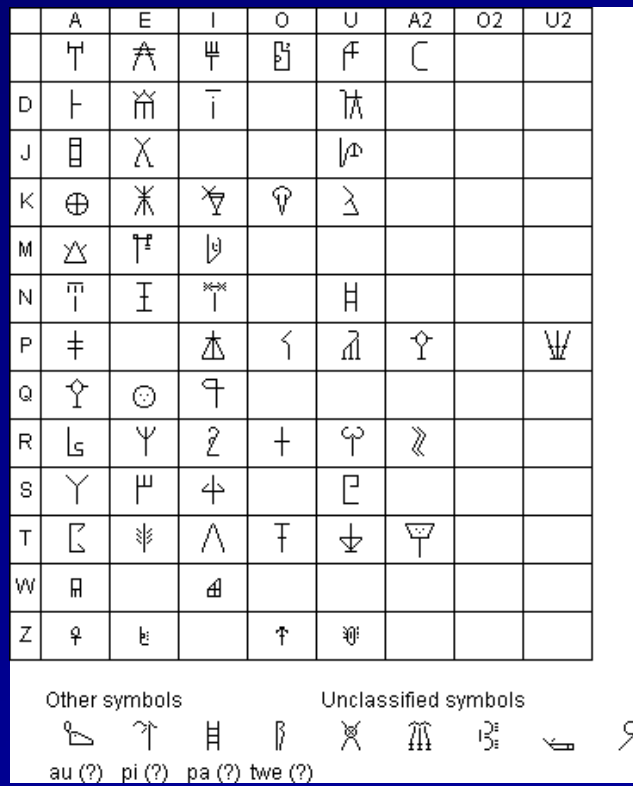
*select * from v$file_histogram;*

```
     FILE# SINGLEBLKRDTIM_MILLI SINGLEBLKRDS
---------- -------------------- ------------
         1                    1          900
         1                    2          120
         1                    4          131
         1                    8          359
         1                   16         1072
         1                   32         1752
...
         2                    1            3
         2                    2            1
         2                    4            2
         2                    8           17
```

Block Dumps (fyi)

Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040		Space	64	40	100	@	@	96	60	140	`	`
1	1	001	SOH (start of heading)	33	21	041	!	!	65	41	101	A	A	97	61	141	a	a
2	2	002	STX (start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX (end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT (end of transmission)	36	24	044	$	$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ (enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK (acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL (bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS (backspace)	40	28	050	(	(	72	48	110	H	H	104	68	150	h	h
9	9	011	TAB (horizontal tab)	41	29	051	)	)	73	49	111	I	I	105	69	151	i	i
10	A	012	LF (NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT (vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF (NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR (carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO (shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI (shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE (data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1 (device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2 (device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3 (device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4 (device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
21	15	025	NAK (negative acknowledge)	53	35	065	5	5	85	55	125	U	U	117	75	165	u	u
22	16	026	SYN (synchronous idle)	54	36	066	6	6	86	56	126	V	V	118	76	166	v	v
23	17	027	ETB (end of trans. block)	55	37	067	7	7	87	57	127	W	W	119	77	167	w	w
24	18	030	CAN (cancel)	56	38	070	8	8	88	58	130	X	X	120	78	170	x	x
25	19	031	EM (end of medium)	57	39	071	9	9	89	59	131	Y	Y	121	79	171	y	y
26	1A	032	SUB (substitute)	58	3A	072	:	:	90	5A	132	Z	Z	122	7A	172	z	z
27	1B	033	ESC (escape)	59	3B	073	;	;	91	5B	133	[	[	123	7B	173	{	{
28	1C	034	FS (file separator)	60	3C	074	<	<	92	5C	134	\	\	124	7C	174			|
29	1D	035	GS (group separator)	61	3D	075	=	=	93	5D	135	]	]	125	7D	175	}	}
30	1E	036	RS (record separator)	62	3E	076	>	>	94	5E	136	^	^	126	7E	176	~	~
31	1F	037	US (unit separator)	63	3F	077	?	?	95	5F	137	_	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com



Last Resort - Block Dumps

```
select  file_id, block_id, blocks
from    dba_extents
where   segment_name = 'EMP'
and     owner = 'SCOTT';

FILE_ID     BLOCK_ID     BLOCKS
----------  -----------  ----------
         1        50465           3
```

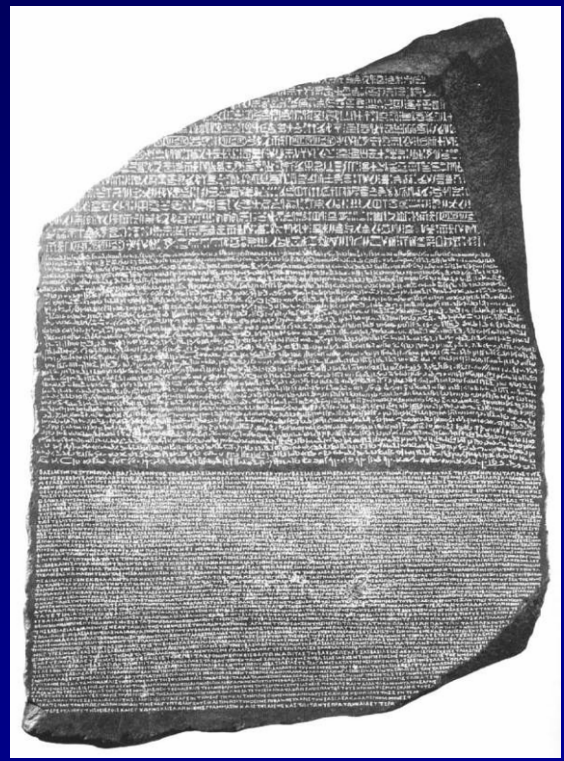
Last Resort - Block Dumps

ALTER SYSTEM DUMP DATAFILE 5 BLOCK 50465
/
ALTER SYSTEM DUMP DATAFILE 5 BLOCK 50466
/
ALTER SYSTEM DUMP DATAFILE 5 BLOCK 50467
/
Or…

ALTER SYSTEM DUMP DATAFILE 5 BLOCK MIN 50465 BLOCK MAX 50467;

(Puts output in user_dump_dest)

Block Dump: Data Section



Last Resort - Block Dumps

```
select  *
from    emp
where   ename = 'MILLER';

EMPNO ENAME   JOB       MGR  HIREDATE  SAL COMM DEPTNO
--------- ---------- --------- --------- ----------------- -------- ---------- ----------
  7934    MILLER    CLERK    7782 23-JAN-82       1300                    10
```

Block Dumps – output from udump

tab 0, row 13, @0x1b0b
tl: 39 fb: --H-FL-- lb: 0x0 cc: 8
col 0: [3] c2 50 23
col 1: [6] 4d 49 4c 4c 45 52
col 2: [5] 43 4c 45 52 4b
col 3: [3] c2 4e 53
col 4: [7] 77 b6 01 17 01 01 01
col 5: [2] c2 0e
col 6: *NULL*
col 7: [2] c1 0b…

Block Dumps – Data Section

DUMP OUTPUT – EMPNO:

col 0: [3] c2 50 23

Hex to Decimal: Col0 = EMPNO = 7934

50 (Hex) = 80 (Decimal) – 1 = 79

23 (Hex) = 35 (Decimal) – 1 = 34

c2: Number in the thousands (c2 is exponent)

Block Dumps – Data Section

DUMP OUTPUT - ENAME:

col 1: [6] 4d 49 4c 4c 45 52

Hex to Character:

Col1 = ENAME = MILLER

4d (Hex) = M (Character)

49 (Hex) = I (Character)

4c (Hex) = L (Character)

4c (Hex) = L (Character)

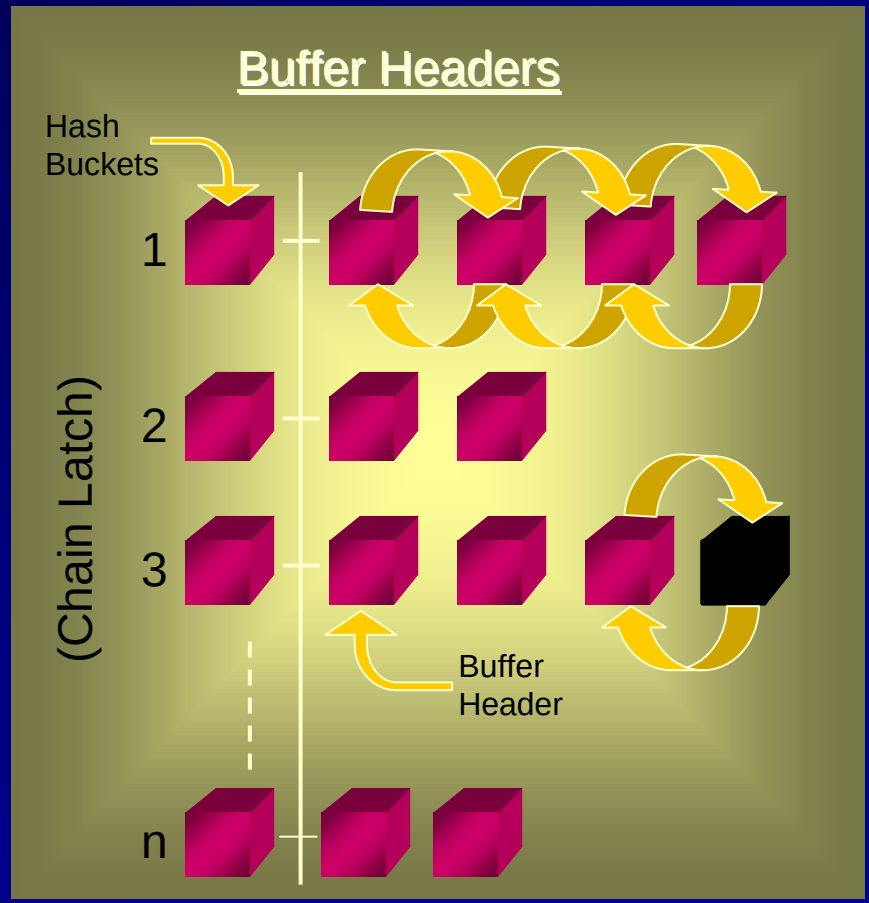
45 (Hex) = E (Character)

52 (Hex) = R (Character)

Transactions Moving through Oracle: *ITL & Undo Blocks*

Working with Hash Buckets And Buffer Headers (not buffers)

- Users asks for a specific data block address.
- This is hashed with a hashing algorithm and placed in the hash bucket that it hashes to.
- It walks the hash chain using the cache buffers chain latch to find the block that it needs (curr or cr).
- There can be many versions of each block



_DB_BLOCK_HASH_BUCKETS and hashing data block addresses

Example: _DB_BLOCK_HASH_BUCKETS
(shouldn't have to change this in Oracle9i or 10g)

- Buffer hash table (x$bh) has all buffer headers for all db_block buffers.
- Buffer header ties to memory base address of the buffer.
- Buckets usually set to Prime(2*db_block_buffers)
- A prime number is often used to avoid hashing anomalies
- Objects dba (class) is hashed to a hash bucket on the hash chain
- Get enough hash buckets (_db_block_hash_buckets)
- Blocks assigned to a hash bucket and onto the hash chain
- Could have multiple blocks hashed to same chain (if both hot-issues)
- Can have multiple versions of a block on same chain
- When block is replaced (based on LRU chain) new block comes in and could be (probably will be) hashed to a different hash chain.

Query all buffer headers (state):

```
col status for a6
select   state,
 decode(state, 0, 'FREE',          /* not currently is use */
               1, 'XCUR',          /* held exclusive by this instance */
               2, 'SCUR',          /* held shared by this instance */
               3, 'CR',            /* only valid for consistent read */
               4, 'READ',          /* is being read from disk */
               5, 'MREC',          /* in media recovery mode */
               6, 'IREC',          /* in instance(crash) recovery mode */
               7, 'WRITE',         /* being written */
               8, 'PIN') status, count(*)   /* pinned */
from  x$bh
group by state;

STATE  STATUS COUNT(*)
------ ------ ----------
     1 XCUR         2001
     3 CR              3
```

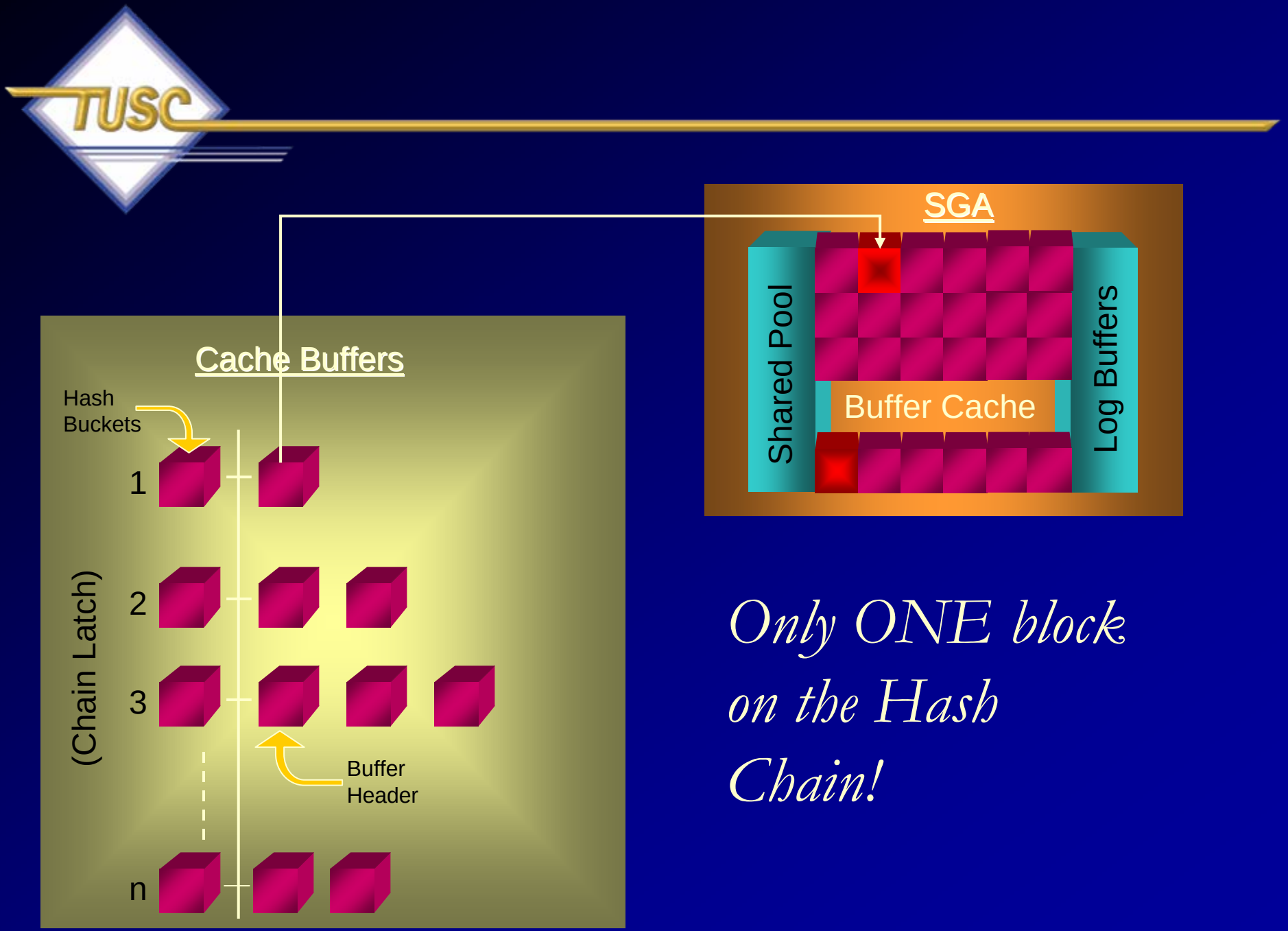
EMP1 is Block#: 56650 (all rows are in this block)

```
select rowid,empno,
       dbms_rowid.rowid_relative_fno(rowid) fileno,
       dbms_rowid.rowid_block_number(rowid) blockno,
       dbms_rowid.rowid_row_number(rowid)   rowno, rownum,
       rpad(to_char(dbms_rowid.rowid_block_number(rowid), 'FM0xxxxxxx') || '.' ||
            to_char(dbms_rowid.rowid_row_number  (rowid), 'FM0xxx'    ) || '.' ||
            to_char(dbms_rowid.rowid_relative_fno(rowid), 'FM0xxx'    ), 18) myrid
from   emp1;
ROWID                  EMPNO     FILENO    BLOCKNO      ROWNO     ROWNUM
------------------ ---------- ---------- ---------- ---------- ----------
MYRID
------------------
AAAM4cAABAAAN1KAAA       7369          1      56650          0          1
0000dd4a.0000.0001

AAAM4cAABAAAN1KAAB       7499          1      56650          1          2
0000dd4a.0001.0001
…
…
AAAM4cAABAAAN1KAAN       7934          1      56650         13         14
0000dd4a.000d.0001


14 rows selected.
```

Let's watch the EMP1 buffer header (So far it's clean and only 1 copy)

```
select    lrba_seq, state, dbarfil, dbablk, tch, flag, hscn_bas,cr_scn_bas,
    decode(bitand(flag,1), 0, 'N', 'Y') dirty,          /* Dirty bit */
    decode(bitand(flag,16), 0, 'N', 'Y') temp,          /* temporary bit */
    decode(bitand(flag,1536), 0, 'N', 'Y') ping, /* ping (to shared or null) bit */
    decode(bitand(flag,16384), 0, 'N', 'Y') stale,      /* stale bit */
    decode(bitand(flag,65536), 0, 'N', 'Y') direct,     /* direct access bit */
    decode(bitand(flag,1048576), 0, 'N', 'Y') new       /* new bit */
from      x$bh
where     dbablk = 56650
order by dbablk;
```

```
  LRBA_SEQ      STATE    DBARFIL     DBABLK        TCH       FLAG   HSCN_BAS
---------- ---------- ---------- ---------- ---------- ---------- ----------
CR_SCN_BAS D T P S D N
---------- - - - - - -
         0          1          1      56650          0   35659776 4294967295
           0 N N N N N N
```



Only ONE block on the Hash Chain!

Let's watch the EMP1 buffer header (Delete a row)

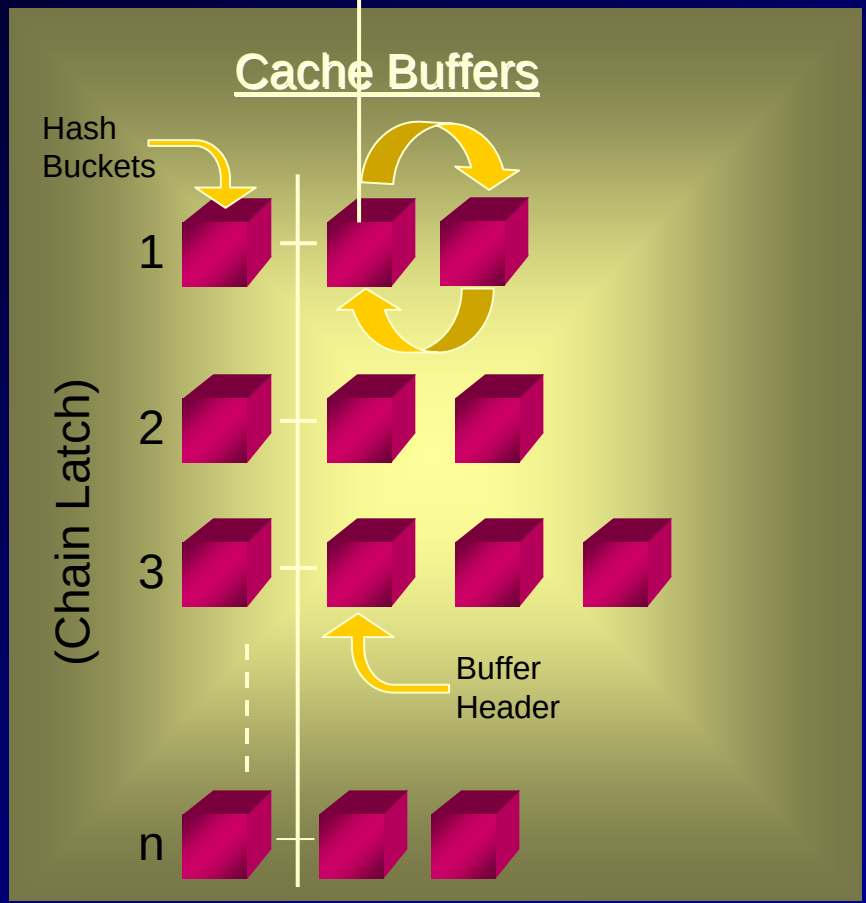
delete from emp1
where comm = 0;

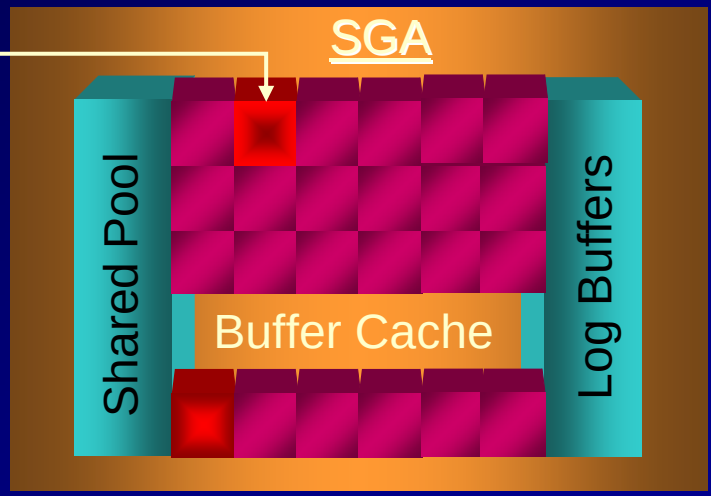
one row deleted.

Let's watch the EMP1 buffer header (Make some changes 2 copies)

```
select    lrba_seq, state, dbarfil, dbablk, tch, flag, hscn_bas,cr_scn_bas,
    decode(bitand(flag,1), 0, 'N', 'Y') dirty,          /* Dirty bit */
    decode(bitand(flag,16), 0, 'N', 'Y') temp,          /* temporary bit */
    decode(bitand(flag,1536), 0, 'N', 'Y') ping, /* ping (to shared or null) bit */
    decode(bitand(flag,16384), 0, 'N', 'Y') stale,      /* stale bit */
    decode(bitand(flag,65536), 0, 'N', 'Y') direct,     /* direct access bit */
    decode(bitand(flag,1048576), 0, 'N', 'Y') new       /* new bit */
from      x$bh
where     dbablk = 56650
order by dbablk;
```

```
  LRBA_SEQ      STATE    DBARFIL     DBABLK        TCH       FLAG   HSCN_BAS
---------- ---------- ---------- ---------- ---------- ---------- ----------
CR_SCN_BAS D T P S D N
---------- - - - - - -
         0          1          1      56650          1       8200 4294967295
         0 N N N N N N

         0          3          1      56650          2     524288          0
   4347881 N N N N N N
```





Hash Chain is now TWO! One is a CR and the other is Current.

V$Transaction now has our record (created when transactions have undo)

```
SELECT t.addr, t.xidusn USN, t.xidslot SLOT, t.xidsqn SQL, t.status,
       t.used_ublk UBLK, t.used_urec UREC, t.log_io LOG,
       t.phy_io PHY, t.cr_get, t.cr_change CR_CHA
FROM   v$transaction t, v$session s
WHERE t.addr = s.taddr;

ADDR             USN        SLOT         SQL STATUS                 UBLK
-------- ---------- ---------- ---------- ---------------- ----------
      UREC         LOG         PHY     CR_GET     CR_CHA
---------- ---------- ---------- ---------- ----------
69E50E5C           5         42         652 ACTIVE                    1
         1          3          0          3          0
```

USN is the Undo Segment Number (rollback segment ID)

SLOT is the slot number in the rollback segment's transaction table.

SQN (Wrap) is the sequence number for the transaction.

USN+SLOT+SQN are the three values that uniquely identifies a transaction XID

Dump the block

Dump the block

Itl	Xid	Uba	Flag	Lck	Scn/Fsc
0x01	0x0005.02a.0000028c	0x008000af.02b6.01	----	1	fsc 0x0029.00000000
0x02	0x0004.016.00000fae	0x008000cc.08af.34	C---	0	scn 0x0000.003deb5b

ITL – 2 Interested Transaction Lists

Committed Transaction

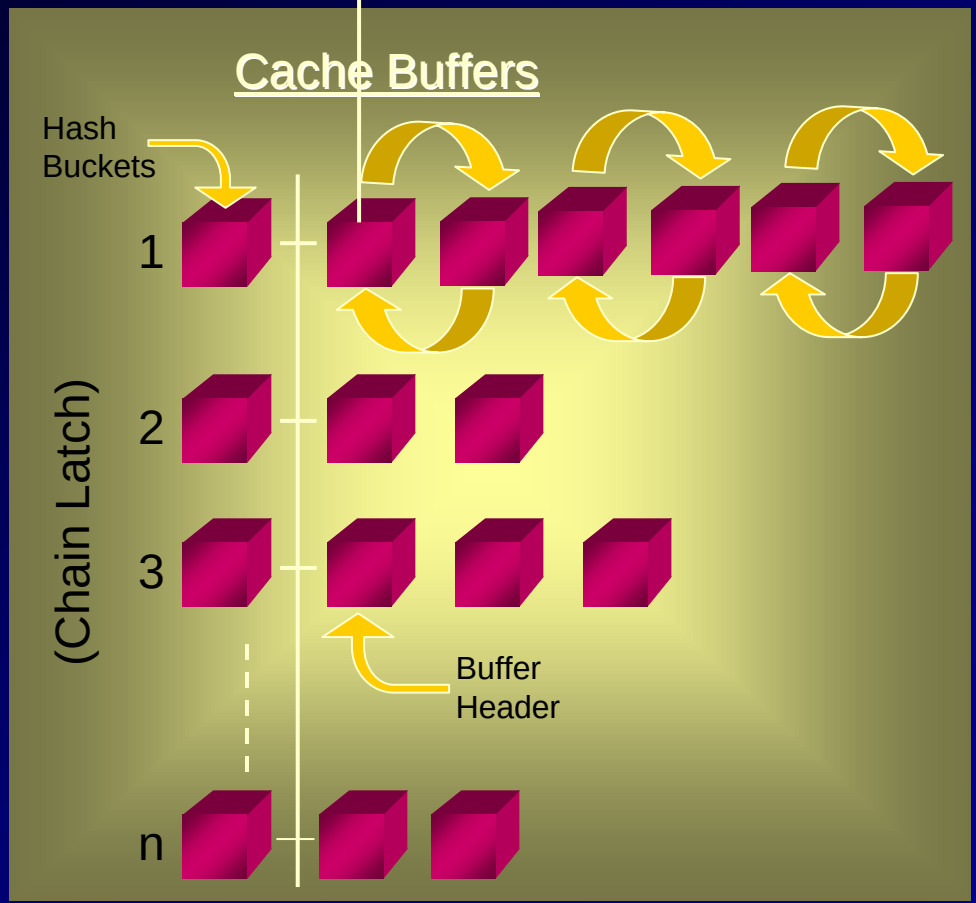
The row I deleted is still locked; fsc is 0x29 = 41 bytes

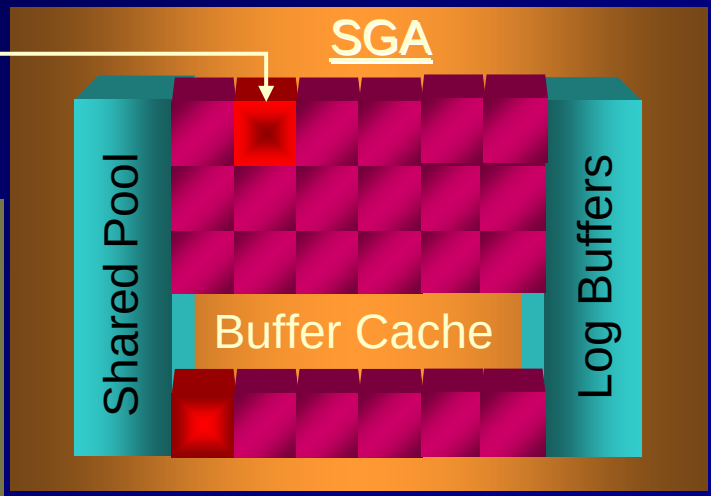
Transaction ID
Undo 5 = 5 (decimal)
Slot 2a = 42 (decimal)
SEQ 28C = 652

UBA:
File.block.sequence.record
Undo block address where last change is recorded.

Insert in 3 other sessions & drive x$bh up to the max of 6 versions of block


```
 LRBA_SEQ      STATE    DBARFIL     DBABLK        TCH        FLAG   HSCN_BAS
---------- ---------- ---------- ---------- ---------- ---------- ----------
CR_SCN_BAS D T P S D N
---------- - - - - - -
         0          3          1      56650          1     524416          0
   4350120 N N N N N N

         0          3          1      56650          1     524416          0
   4350105 N N N N N N

       365          1          1      56650          7   33562633    4350121
         0 Y N N N N N

         0          3          1      56650          1     524416          0
   4350103 N N N N N N

         0          3          1      56650          1     524416          0
   4350089 N N N N N N

         0          3          1      56650          1     524288          0
   4350087 N N N N N N
```





Hash Chain is now SIX long! Five CR and the one Current.

Why only 6 versions of a Block?

```
select      a.ksppinm, b.ksppstvl, b.ksppstdf, a.ksppdesc
from        x$ksppi a, x$ksppcv b
where       a.indx = b.indx
and         substr(ksppinm,1,1) = '_'
and         ksppinm like  '%&1%'
order by    ksppinm;

KSPPINM
--------------------------------------------------------------------------------
KSPPSTVL
--------------------------------------------------------------------------------
KSPPSTDF
---------
KSPPDESC
--------------------------------------------------------------------------------
_db_block_max_cr_dba
6
TRUE
Maximum Allowed Number of CR buffers per dba
```

What happens after we roll everything back – x$bh Still an LRBA:

```
 LRBA_SEQ      STATE    DBARFIL     DBABLK        TCH        FLAG   HSCN_BAS
--------- ---------- ---------- ---------- ---------- ---------- ----------
CR_SCN_BAS D T P S D N
---------- - - - - - -
         0          3          1      56650          1     524416          0
   4350120 N N N N N N

         0          3          1      56650          1     524416          0
   4350105 N N N N N N

       365          1          1      56650         11   35659777    4350702
         0 Y N N N N N

         0          3          1      56650          1     524416          0
   4350103 N N N N N N

         0          3          1      56650          1     524416          0
   4350089 N N N N N N

         0          3          1      56650          1     524288          0
   4350087 N N N N N N

6 rows selected.
```

Let's check V$TRANSACTION & match it up to ITL (no need to dump)

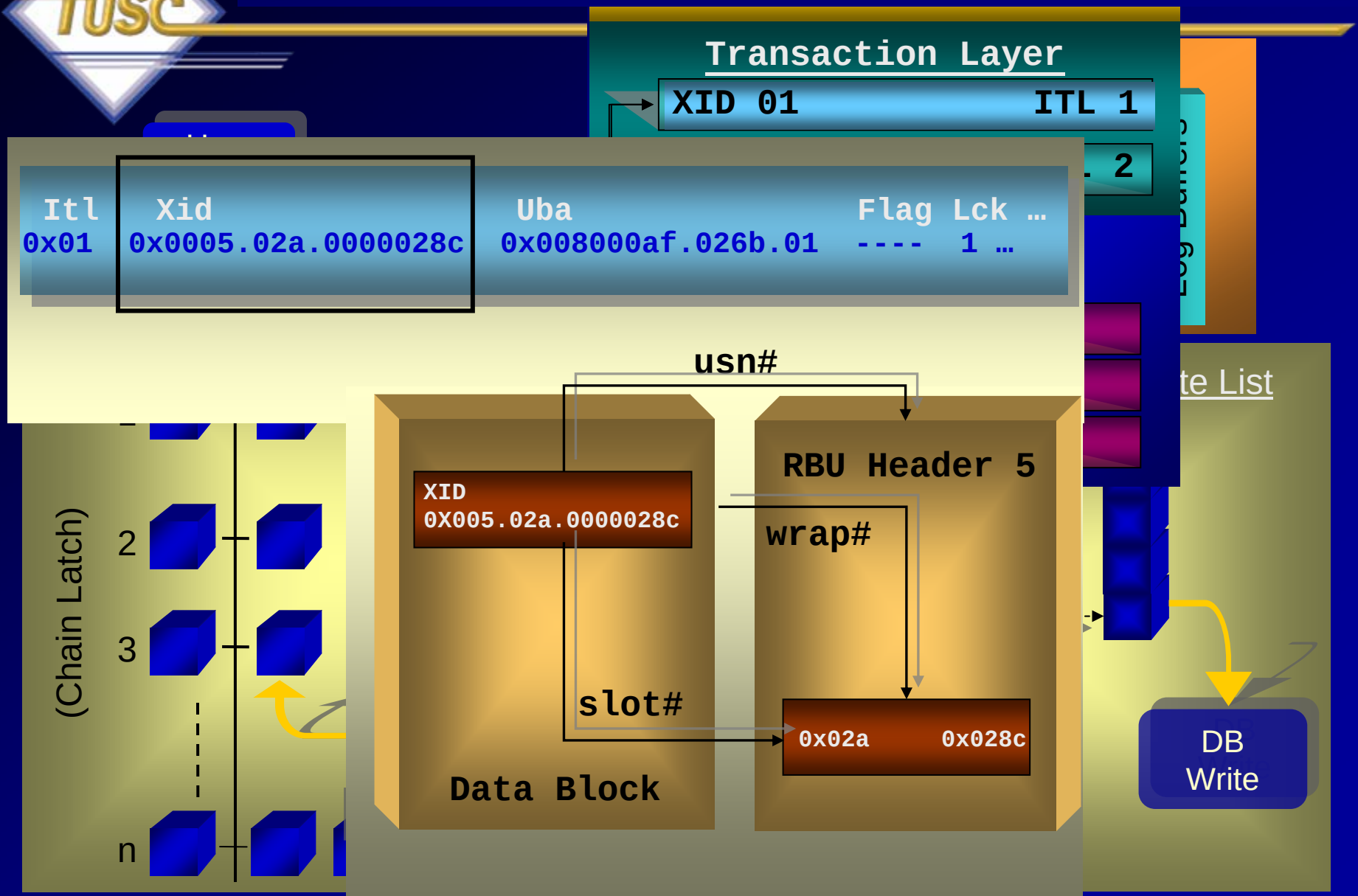
```
select   xidusn, xidslot, xidsqn, ubafil, ubablk, ubasqn, ubarec
from     v$transaction t, v$session s
where    t.ses_addr = s.saddr;
```

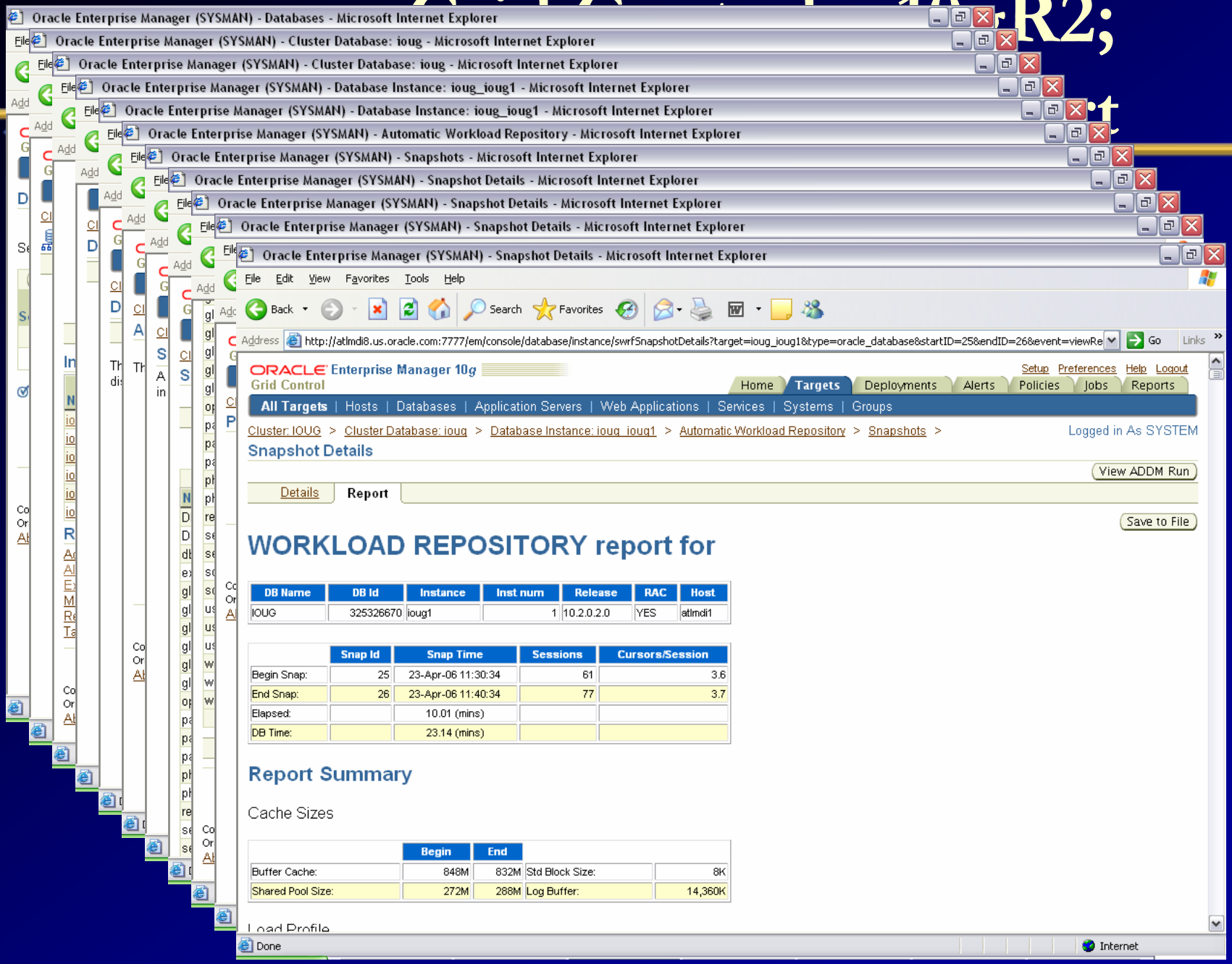
XIDUSN	XIDSLOT	XIDSQN	UBAFIL	UBABLK	UBASQN	UBAREC
4	42	4863	2	851	2718	8
5	14	667	2	1458	713	25

```
4.42.4863 = 4.2a.12ff      2.851.2718.8  = 800353.a9e.8
5.14.667 = 5.e.29b         2.1458.713.25 = 8005b2.2c9.19
```

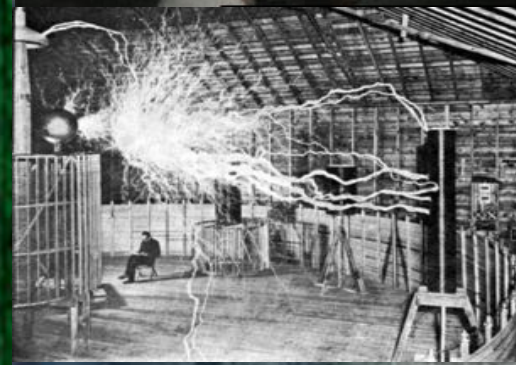
Itl	Xid	Uba	Flag	Lck	Scn/Fsc
0x02	0x0004.02a.000012ff	0x00800353.0a9e.08	----	2	fsc 0x0003.00000000
0x03	0x0005.00e.0000029b	0x008005b2.02c9.19	----	14	fsc 0x0000.00000000

Transaction Identifiers




Oracle Enterprise Manager (SYSMAN) - Snapshot Details - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://atlmdi8.us.oracle.com:7777/em/console/database/instance/swrfSnapshotDetails?target=ioug_ioug1&type=oracle_database&startID=25&endID=26&event=viewRe
Go Links
ORACLE Enterprise Manager 10g
Grid Control
Setup Preferences Help Logout
Home Targets Deployments Alerts Policies Jobs Reports
All Targets | Hosts | Databases | Application Servers | Web Applications | Services | Systems | Groups
Cluster: IOUG > Cluster Database: ioug > Database Instance: ioug_ioug1 > Automatic Workload Repository > Snapshots >
Logged in As SYSTEM
Snapshot Details
View ADDM Run
Details Report
Save to File
WORKLOAD REPOSITORY report for
DB Name DB Id Instance Inst num Release RAC Host
IOUG 325326670 ioug1 1 10.2.0.2.0 YES atlmdi1
Snap Id Snap Time Sessions Cursors/Session
Begin Snap: 25 23-Apr-06 11:30:34 61 3.6
End Snap: 26 23-Apr-06 11:40:34 77 3.7
Elapsed: 10.01 (mins)
DB Time: 23.14 (mins)
Report Summary
Cache Sizes
Begin End
Buffer Cache: 848M 832M Std Block Size: 8K
Shared Pool Size: 272M 288M Log Buffer: 14,360K
Load Profile
Done
Internet

If Time Permits… the Future!



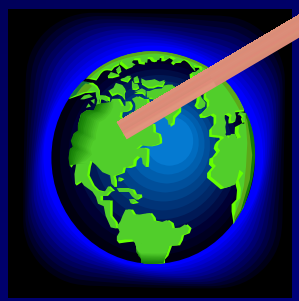
64-Bit advancement of Directly addressable memory

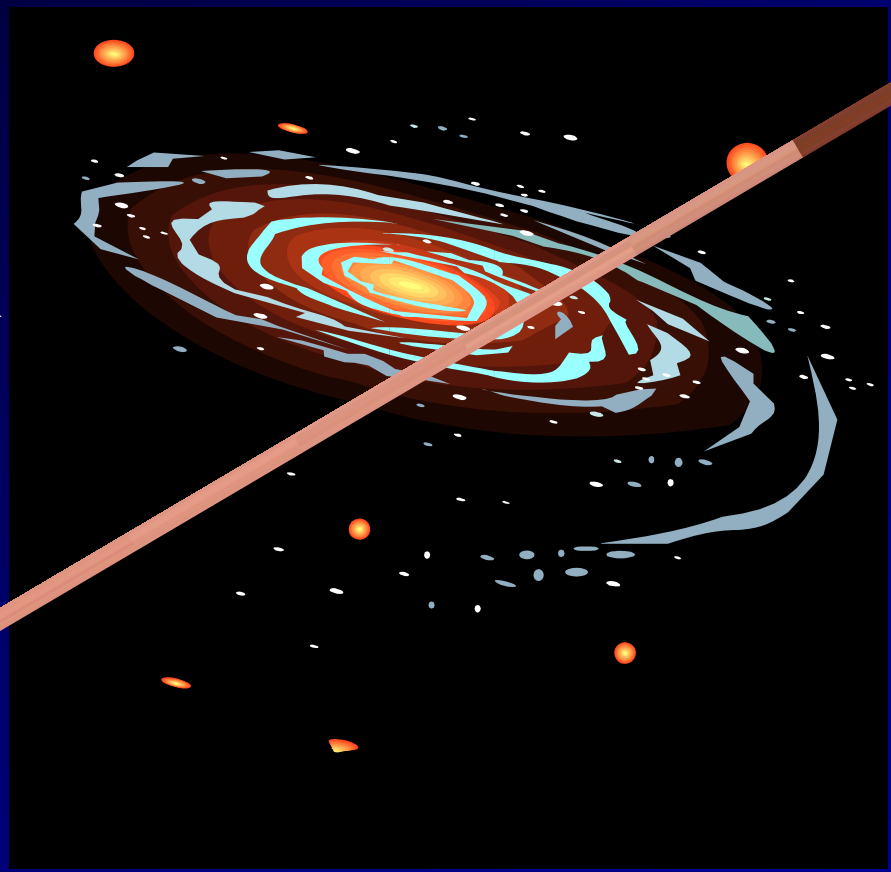
	Address Direct	Indirect/Extended
• 4 Bit:	16	(640)
• 8 Bit:	256	(65,536)
• 16 Bit:	65,536	(1,048,576)
• 32 Bit:	4,294,967,296	
• 64 Bit:	18,446,744,073,709,551,616	

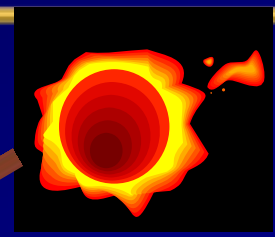
- When the hardware physically implements the theoretical possibilities of 64-Bit, things will dramatically change….
  …moving from 32 bit to 64 bit will be like moving from 4 bit to 32 bit or like moving from 1971 to 2000 overnight.

64bit allows Directly Addressing 16 Exabytes of Memory

Stack single sheets (2K worth of text on each) about 4.8B miles high to get 16E!!







You could stack documents from the Earth so high they would pass Pluto!

Human Brain vs. Computer

Brain

Individual maintains a ~250M capacity

Stores/processes ~ 2G in a lifetime

With over 6.5 Billion people in the world, total memory of world is 1.5P, total processed is 13 Exabytes

Computer

Laptops ~256M in memory capacity

Stores/processes 40G in its lifetime, then buy new one

1.5+ Petabytes can be accessed and managed by one computer with today's technology (internet is 8P)

Human Brain vs. Computer

Brain

10T-1P of operations per second based on retina/neuron synapse speed (Moravec).

Based on Brain power in Watts consumption, the brain performs 100T – 100P operations per second.

Computer

Fastest computer is IBM at 70.2 Teraflops (Blue / Gene L)

Computer is about equal on the low end of the brain and could be 1000 times slower on the high end of brain estimates.

Human Brain vs. Computer

Brain

Problem: We forget a lot of what we see and learn.

Solution: Drugs that improve memory or technology that plugs into the brain.

Problem: Information overload

Solution: Use the computer to aggregate things and use the brain for final decisions.

Computer

Problem: Data Density limits or Superparamagnetic effect (SPE).

Solution: Electron Microscope writing on stainless steel in a vacuum.

Problem: More memory gets farther from the CPU & Limits to CPU speed

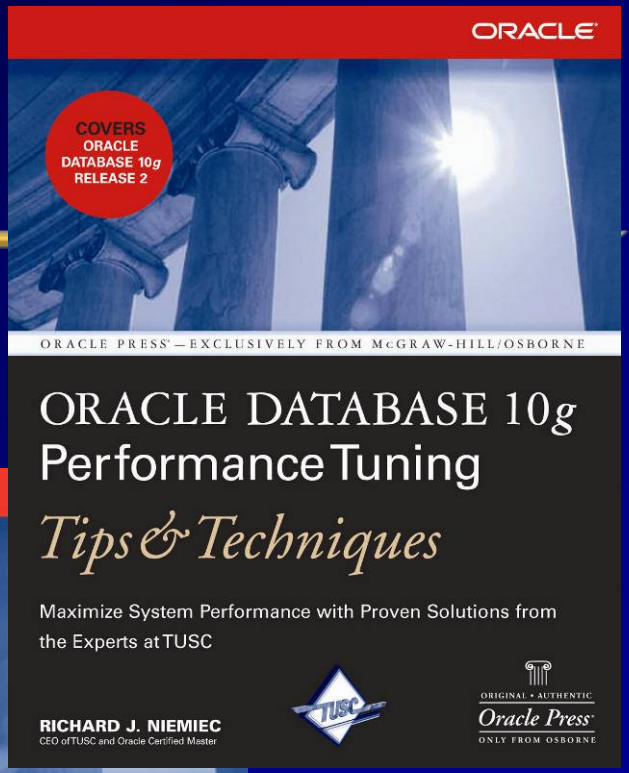
Solution: Chip multiplexing & multi-core CPUs

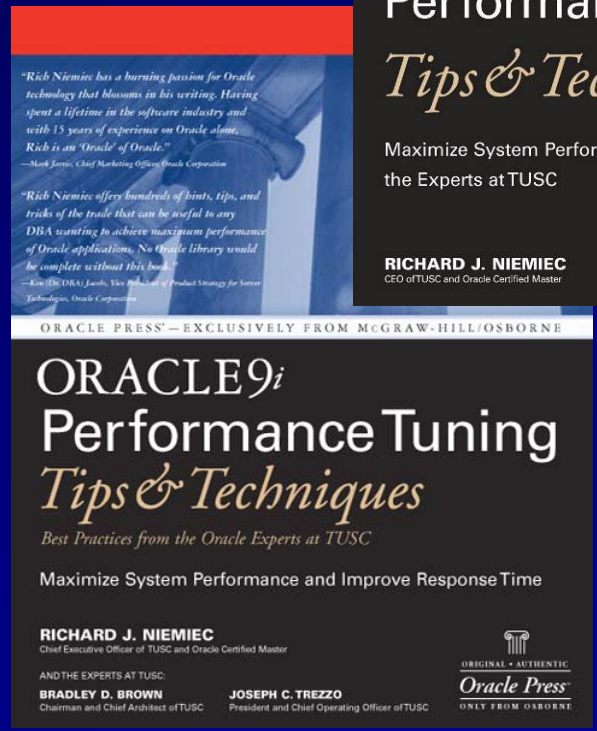
What we covered:

- Statspack, Tools & Scripts that you can still use
  - Top Waits
  - Load Profile
  - Latch Waits
  - Top SQL
  - Instance Activity
  - File I/O
- The Future OEM & ADDM
- Helpful V$/X$
- Summary

For More Information

- www.tusc.com
- *Oracle9i Performance Tuning Tips & Techniques; Richard J. Niemiec; Oracle Press (May 2003)*
- *Oracle 10g Tuning (Early 2007)*





"If you are going through hell, keep going" - Churchill

"The strength of the team is each individual member…the strength of each member is the team."

--Phil Jackson

The Oracle User Groups are part of your team!

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- *The Self-managing Database: Automatic Performance Diagnosis;* Karl Dias & Mark Ramacher, Oracle Corporation
- *EM Grid Control 10g;* otn.oracle.com, Oracle Corporation
- *Oracle Enterprise Manager 10g: Making the Grid a Reality*; Jay Rossiter, Oracle Corporation
- *The Self-Managing Database: Guided Application and SQL Tuning;* Benoit Dageville, Oracle Corporation
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- *Internals of Real Application Cluster*, Madhu Tumma, Credit Suisse First Boston
- *Oracle9i RAC; Real Application Clusters Configuration and Internals,* Mike Ault & Madhu Tumma
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- *Oracle9i Web Development, Bradley D. Brown; Oracle Press*
- *Special thanks to Steve Adams, Mike Ault, Brad Brown, Don Burleson, Kevin Gilpin, Herve Lejeune, Randy Swanson and Joe Trezzo.*
- *Landauer 1986. T.K. Landauer; "How much do people remember? Some estimates of the quantity of information in long-term memory," Cognitive Science ,10 (4) pp. 477-493.*
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- Oracle Database 10*g* New Features, Mike Ault, Daniel Liu, Madhu Tumma, Rampant Technical Press, 2003, www.rampant.cc
- Oracle Database 10*g* - The World's First Self-Managing, Grid-Ready Database Arrives, Kelli Wiseth, Oracle Technology Network, 2003, otn.oracle.com

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- *Internals of Real Application Cluster*, Madhu Tumma, Credit Suisse First Boston
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- Oracle 9i RAC class & instructor's comments
- Oracle 9i Concepts manual
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- *Tips for Tuning Oracle9i RAC on Linux*, Kurt Engeleiter, Van Okamura, Oracle
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- *Oracle RAC and Linux in the real enterprise,* Mark Clark, Director, Merrill Lynch Europe PLC, Global Database Technologies

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