The Best Oracle Database 11g New Features Long Island, NY 2010



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Audience Knowledge / Versions

- Oracle7 Experience ?
- Oracle8*i* Experience ?
- Oracle9*i* Experience ?
- Oracle10g Experience?
- Oracle Database 11g Experience?
- Oracle Database 11g R2 Experience?
- Goals
 - Present NEW features in an EASY way
 - Focus on a few nice features of Oracle11g
- Non-Goals
 - Learn ALL aspects of Oracle11g
 - Learn Tips that will make you money in Las Vegas







Overview

Know the Oracle!

- Start Me Up Using Memory Target, The Buffer Cache & The Result Cache
- Virtual Columns
- Invisible Indexes & Online Index Rebuilds
- DDL Lock Timeout, PL/SQL Expressions/Simple Integer
- Secure Files
- ADDM Enhancements
- SQL Plan Management (SPM) and capturing SQL Plan Baselines
- SQL Performance Analyzer, Access Advisor & Query Repair Advisor
- Exadata Simulation
- Real Application Testing (Database Capture and Replay) & Adding Nodes
- Interval Partitioning & Partition Compression
- Automatic Diagnostic Repository (ADR)
- Auto Sample, Creating Pending Statistics
- Adaptive Cursor Sharing and Bind Peeking
- EM, Grid Control, Security Enhancements & the Future Sizes

Know the Oracle



"I admire risk takers. I like leaders – people who do things before



they become fashionable or popular. I find that kind of integrity inspirational."

LAWRENCE J. ELLISON | Chairman & Chief Executive Officer, 2003

Oracle Firsts – Innovation!

1979 First commercial SQL relational database management system 1983 First 32-bit mode RDBMS 1984 First database with read consistency 1987 First client-server database 1994 First commercial and multilevel secure database evaluations 1995 First 64-bit mode RDBMS 1996 First to break the 30,000 TPC-C barrier 1997 First Web database 1998 First Database - Native Java Support; Breaks 100,000 TPC-C 1998 First Commercial RDBMS ported to Linux 2000 First database with XML 2001 First middle-tier database cache 2001 First RDBMS with <u>Real Application Clusters</u> 2004 First True Grid Database 2005 First FREE Oracle Database (10g Express Edition) 2006 First Oracle Support for LINUX Offering 2007 Oracle 11g Released! **2008 Oracle Exadata Server Announced (Oracle buys BEA)** 2009 Oracle buys Sun – Java; MySQL; Solaris; Hardware; OpenOffice 2010 Oracle announces MySQL Cluster 7.1, Exadata, Exalogic

2007: Version 11g was Released

- The Focus has been Acquisitions and gaining Market Share
- Oracle 11g Database extends an already large lead
 - Easier to Manage the Database Better Grid Control
 - Self Tuning through a variety of tools (Makes 1 person equal 10)
 - Better Security/Encryption & Recoverability via Flashback
 - Better Testing Tools (Real Application Testing)
- Andy Mendelsohn is <u>still</u> the database lead
- Releases of Siebel, PeopleSoft, JDE and Oracle12 Apps.
- New Oracle BI Suite & Acquisition of Hyperion
- Acquisition of BEA, SUN

Oracle gets Sun: Java, MySQL, Solaris, **OpenOffice**, Hardware, Storage Tech

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Oracle to buy Sun Microsystems for \$7.4 billion

Deal comes after IBM abandoned its bid for networking equipment maker

Associated Press

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updated 59 minutes ago

SAN FRANCISCO - Oracle Corp. snapped up computer server and software maker Sun Microsystems Inc. for \$7.4 billion Monday, pouncing on an opportunity that opened up after rival IBM Corp. abandoned an earlier bid to buy one of Silicon Valley's best known - and most troubled - companies.

The deal will end Sun's 27-year history as Silicon Valley's brash independent and give Oracle ownership of the Java programming language, which runs on more than 1 billion devices around the world. Oracle also will take charge of the Selaric operating system, which

Video





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Where are they nam?

New Giant | A look at the two companies Oracle Sun

Database

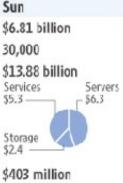
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\$93.79 billion Market Value* 86,500 Employees \$22.43 billion FY08 Revenue Services \$4.6 -**Business** software \$6.2 \$5.52 billion FYC8 Profit Key Products

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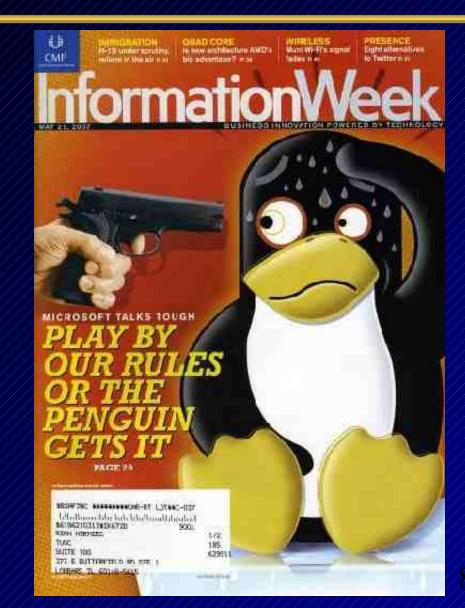
Databases, business software from Siebel, PeopleSoft



Server computers, storage devices, Java and Solaris technology

* As of 4/20/09

Note: Sun's fiscal year ended 6/30/38: Cracle's fiscal year ended 5/31/08 Source: WSJ Market Data Group



Why will Oracle Win in the Future? My Reasons... <u>(Teach your kids Oracle!)</u>

- It's not about the database anymore, now it's about the Applications. When it is about the database, security and high availability are issues where Oracle excels.
- Made acquisitions at the right time in the market
- Oracle has Great Developers who love what they do
- Oracle has Great Sales & Marketing that's maturing
- I believe Oracle will do well with or without Larry down the road, but Larry's creative mind and risk taking is not as easy to replicate in a Fortune 500 CEO. Other CEO's might be too willing to benefit Wall Street first versus benefit Oracle (long term). It would be a loss.

Testing the Future Version Version 11.1.0.6.0 of the Database Version 11.2.0.1.0 of the Database for Release 2 Examples



Oracle Database 11g Release 1: Upgrade Paths

Direct Upgrade Path

Source Database	Target Database
9.2.0.4.0 (or higher)	11.1.x
10.1.0.2.0 (or higher)	11.1.x
10.2.0.1.0 (or higher)	11.1.x

In-Direct Upgrade Path

Source Database	Upgrade Path for Target Database	Target Database
7.3.3.0.0 (or lower)	7.3.4.x> 9.2.0.8	11.1.x
8.0.5.0.0 (or lower)	8.0.6.x> 9.2.0.8	11.1.x
8.1.7.0.0 (or lower)	8.1.7.4> 9.2.0.8	11.1.x
9.0.1.3.0 (or lower)	9.0.1.4> 9.2.0.8	11.1.x

Database Upgrade Assistant (DBUA)

- Command Line Option to Auto Extend System Files
- Express Edition Upgrade to others
- Integration with Oracle Database 11g Preupgrade Tool
- Moving Data Files into ASM, SAN, and Other File Systems
- Oracle Base and Diagnostic Destination Configuration 12

Database Upgrade Assistant (DBUA)

DBUA checks before the upgrade:

- Invalid user accounts or roles
- Invalid data types or invalid objects
- De-supported character sets
- Adequate resources (rollback segments, tablespaces, and free disk space)
- Missing SQL scripts needed for the upgrade
- Listener running (if Oracle Enterprise Manager Database Control upgrade or configuration is requested)
- Oracle Database software linked with Database Vault option. If Database Vault is enabled, Disable Database Vault before upgrade.



DATABASE



\$ sqlplus ***/***

SQL*Plus: Release 11.1.0.6.0 - Production on Tue Oct 30 11:21:04 2007 Copyright (c) 1982, 2007, Oracle. All rights reserved.

Connected to: Oracle Database 11g Enterprise Edition Release 11.1.0.6.0 - Production With the Partitioning, OLAP, Data Mining and **Real Application Testing options**

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Fixed Size	1300352 bytes	Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production
Variable Size	306186368 bytes	PL/SQL Release 11.2.0.1.0 - Production CORE 11.2.0.1.0 Production
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Or... Use 11g EM...





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Or... Use 11g EM...Status...

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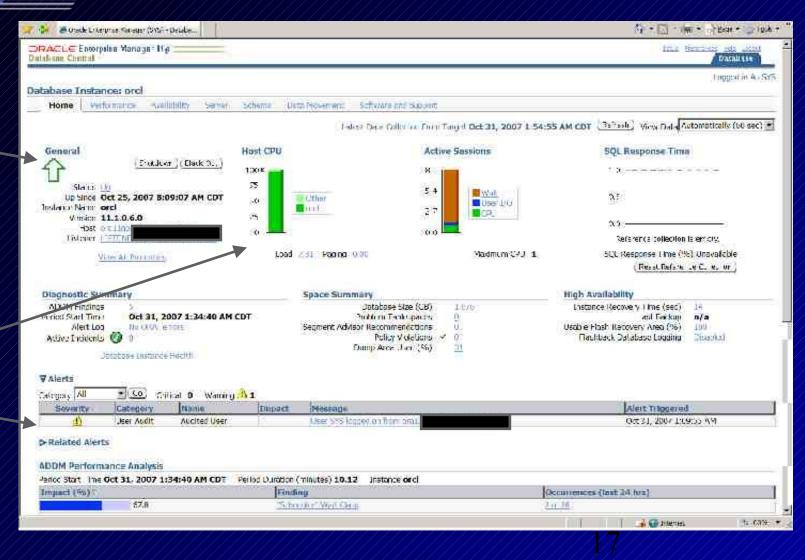
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Database Information - UP! 11gR1

Monitor Database – (UP)

Users are Definitely Using it!

We have – an alert – we logged on as SYS



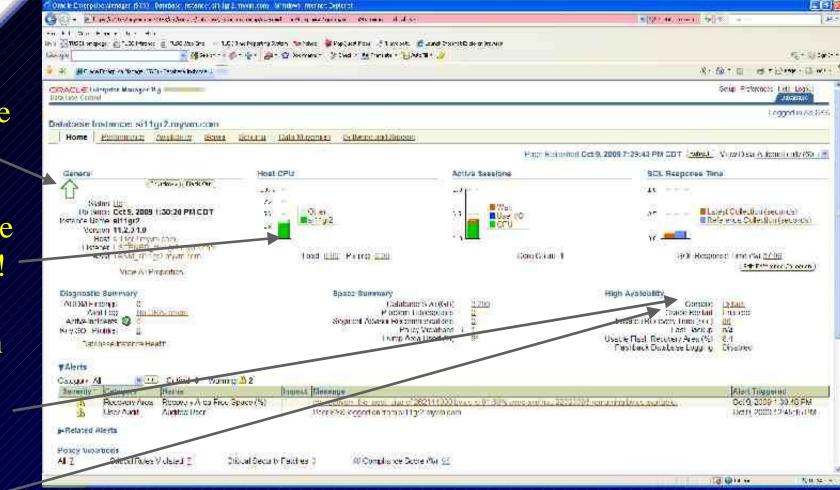
Database Information - UP! 11gR2

Monitor Database (UP)

Users are Using it!

Click on the HA Console

Restart



Enabled (Restart Database, ASM, Listener after restart of Software/Hardware)

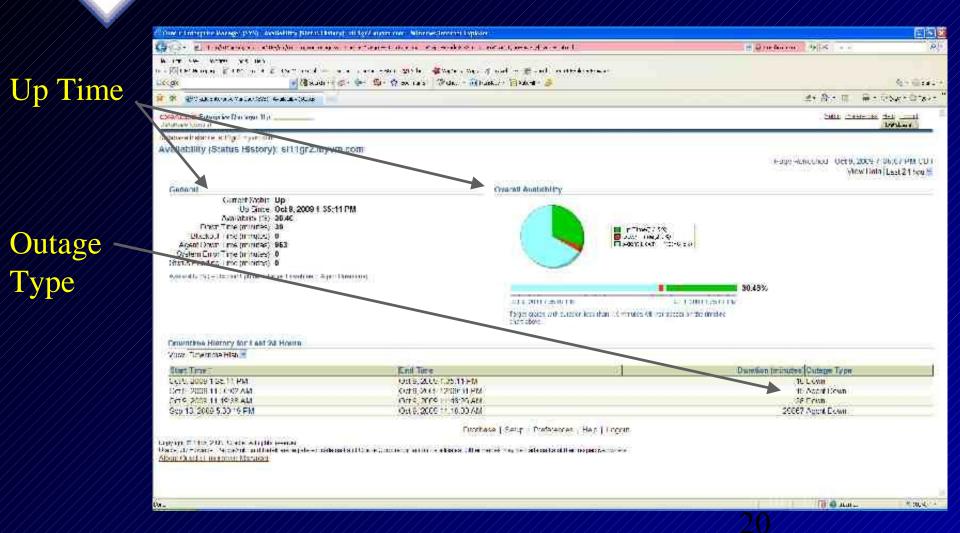
Database Information - UP! High Availability Console - 11gR2

Events that are an issue

Flash Recovery Usage

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Database Information - UP! HA - *Availability* - 11gR2



Database Information - UP! HA *Host* - 11gR2

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Latest Security Evaluation

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Database Information - UP! HA Recovery Settings - 11gR2

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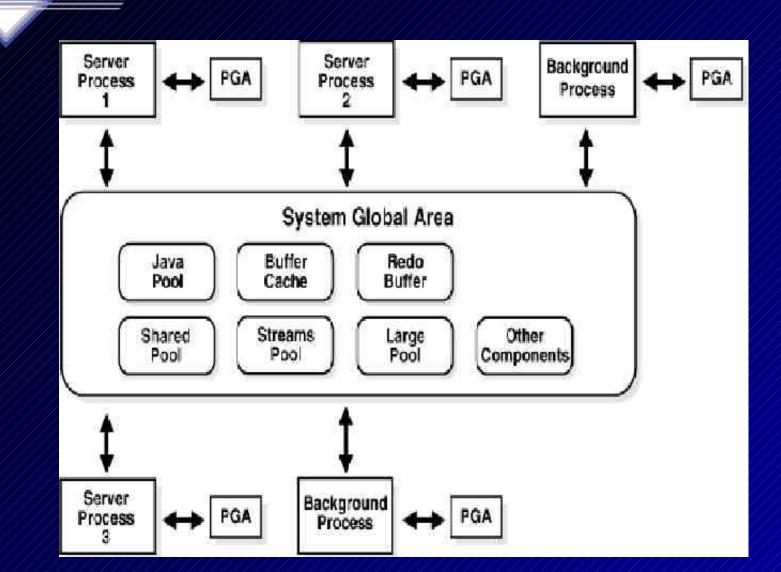




- First there was some Automatic Memory Mgmt 9i
 SGA_MAX_SIZE introduced in 9i Dynamic Memory
 No more Buffers DB_CACHE_SIZE
 Granule sizes introduced _ksm_granule_size
 Then came SGA_TARGET 10g
 Oracle Applications recommends setting this for SGA
 - Set minimums for key values (Data Cache / Shared Pool)
- Now there is MEMORY_TARGET 11g
 SGA + PGA all in one setting; Still set minimums

SGA & PGA will be MEMORY_TARGET





Automatically sized SGA Components that Use SGA_TARGET

<u>Component</u> Fixed SGA Shared Pool Large Pool Java Pool **Buffer** Cache Streams Pool

Initialization Parameter None SHARED POOL LARGE_POOL_SIZE JAVA_POOL_SIZE DB CACHE SIZE STREAMS POOL SIZE

Manually Sized SGA Components that Use SGA_TARGET

<u>Component</u> Log buffer Keep Pool Recycle Pool Block caches Initialization Parameter LOG_BUFFER (pfile only in 10g) DB_KEEP_CACHE_SIZE DB_RECYCLE_CACHE_SIZE DB_nK_CACHE_SIZE

Program Global Area (now in MEMORY TARGET): Aggregate PGA PGA_AGGREGATE_TARGET

Automatic Memory Management (AMM) MEMORY_TARGET in 11g

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sga_max_size sga_target big integer 360M big integer 0

TYPE

SQL> sho parameter memory

NAME

TYPE VALUE

memory_max_target memory_target big integer 360M big integer 360M

/2/8



Moving from SGA_TARGET to: MEMORY_TARGET



SQL> sho parameter target

NAME

memory_max_target memory_target pga_aggregate_target

sga_target

big integer 0 big integer 0 big integer 110M big integer 250M

VALUE

TYPE



Moving from SGA_TARGET to: MEMORY TARGET

ALTER SYSTEM SET MEMORY_MAX_TARGET=360M SCOPE=SPFILE; (shutdown/startup) ALTER SYSTEM SET MEMORY_TARGET=360M SCOPE=SPFILE; ALTER SYSTEM SET SGA_TARGET=0; (or set a minimum) ALTER SYSTEM SET PGA_AGGREGATE_TARGET=0; (or set a minimum)

SQL> sho parameter target

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SQL> sho parameter target

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🟠 • 🔂 - 📾 • 🗗 Bage • 🙆 Tgole • 🔆 🥳 🖉 Onick Enlerprise Manager (SYSTEM) - No. -Memory Advisors Page Portreated October 30, 2007 11:34:30 AH CD1 (Rdreate) (Show SQL) (Rever) (Apply) When Automatic Memory Management is snaked, the database will automatically set the optimal distribution of memory. The distribution of memory will change from time to time to accomolate changes in the workload. Automatic Memory Management Enabled Disable Total Memory Sze 444 MB · Achiou Maximum Merrory Sze 484 MB ··· Cracle Enterprise 4anager (SYSTEM) - Me. 🖓 • 🔄 • 🖮 • 🕞 Bage • 🙆 Tgob • 2 2 Allocation History This diert shows the listory of the components of the Memory. SGA PGA 500 The System Global Area (3GA) is a group of shared memory structures that contains data and control information for one Oracle datakase. The SGA is allocated in memory when an Oracle database instance 400 is starter. \$ 30X E PGA Allocation History B 200 10 ST.A This thart shows the history of the components of the S&A 100 250 2:08 12 PM 18 27 12 PM ŵ 12PM 4 12 Pil -1464 28 Oct 25 2007 25 290 Shared Post Bellie Cathe 100 H 150 Dava Yool area Road 100 SGA PGA 58 Oct 28, 2000 24 10 The System Global area (SGA) is a croup of shared memory structures that contains cata and control information for one Or is started. Allocation History **Current Allocation** This durt shows the history of the components of the SGA. 380 Automatic Shared Nemory Management Snabled NV. 13(015) Total SGA Size (MB) 304 28 Shared Prod (3.9.2%) 8 Stared fool SGA Component Current Allocation (MB) Buffer Came (34.2%) Java Ped Linge Fad Stared Pool 180 Lorge Pool (L.249 Buffer Cache 104 JavaPool 6.999 10. Other (1.305) Lorge Pool -4 14 Java Peol 12 Oct 15, 200 uther 4 SGA PGA Apply changes to SPFILE only

The changes are node to set if the SPF \$2 and the running instance which recurrent that you restart, he catalobse to avoid static parameters.

(Show SQL) (Rever.) (Apply)

\$100% +

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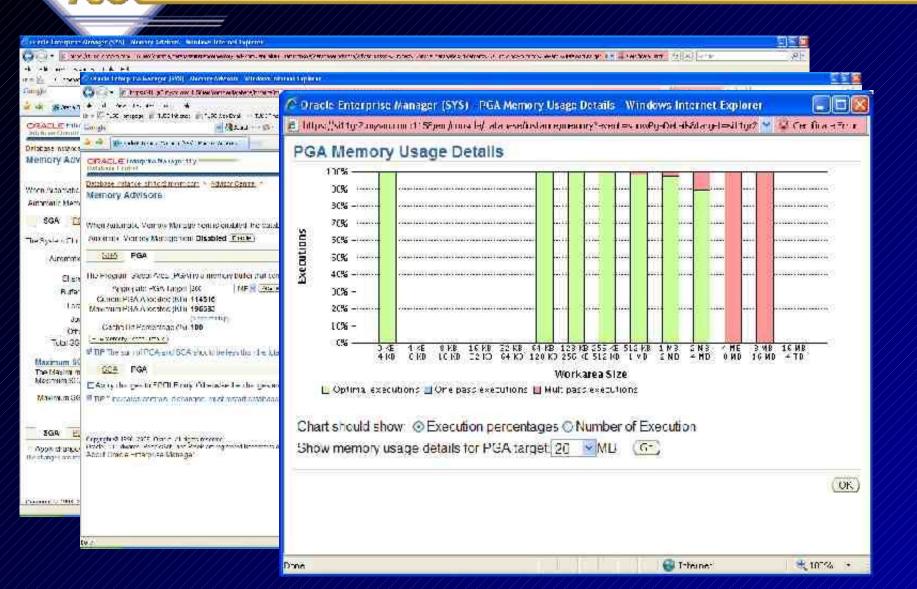
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Consider & 1996, 2007, Credit all mathe reasoned. Onder, 3D Binenish, Respision, and Riek are registered trademarks of Grade Corporation and/on to efficiency. Other memory be bridemarks of their respirative overvise 2006. Children Enformation, Manager.



DATABASE

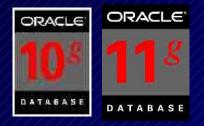
Moving from SGA_TARGET to: Memory Advisor – 11gR2



Buffer Cache & Result Cache



First, A quick review: Flush Buffer Cache



- The new 10g feature allows the flush of the buffer cache. It is NOT intended for production use, but rather for system testing purposes.
- This can help you in your tuning needs or as a band-aid if you have 'free buffer' waits (there are better ways to fix this like writing more often or increasing the DB_CACHE_SIZE)
- Note that any Oracle I/O not done in the SGA counts as a physical I/O. If your system has O/S caching or disk caching, the actual I/O that shows up as physical may indeed be a memory read outside of Oracle.
- To flush the buffer cache perform the following:

SQL> ALTER SYSTEM FLUSH BUFFER_CACHE; 35



select count(*) from tab1;

COUNT(*)

1147

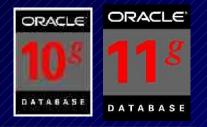
Execution Plan

- 0 SELECT STATEMENT Optimizer=CHOOSE (Cost=4 Card=1)
- 1 0 SORT (AGGREGATE)
- 2 1 TABLE ACCESS (FULL) OF 'TAB1' (TABLE) (Cost=4 Card=1147)

Statistics

- 0 db block gets
- 7 consistent gets
- 6 physical reads

Flush Buffer Cache Example



select count(*) from tab1; (Run it again and the physical reads go away)

COUNT(*)

1147

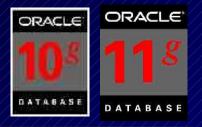
Execution Plan

- 0 SELECT STATEMENT Optimizer=CHOOSE (Cost=4 Card=1)
- 1 0 SORT (AGGREGATE)
- 2 1 TABLE ACCESS (FULL) OF 'TAB1' (TABLE) (Cost=4 Card=1147)

Statistics

- 0 db block gets
- 7 consistent gets
- 0 physical reads

Flush Buffer Cache Example



ALTER SYSTEM FLUSH BUFFER_CACHE;

System altered.

select count(*) from tab1; (Flush the cache and the physical reads are back)

COUNT(*)

1147

Execution Plan

- 0 SELECT STATEMENT Optimizer=CHOOSE (Cost=4 Card=1)
- 1 0 SORT (AGGREGATE)
- 2 1 TABLE ACCESS (FULL) OF 'TAB1' (TABLE) (Cost=4 Card=1147)

Statistics

- 0 db block gets
- 7 consistent gets
- 6 physical reads





ORACLE

- Choose calculations that frequently run
- Choose data that does NOT frequently change
- **RESULT_CACHE** & RELIES_ON clauses
- <u>Takes its memory from the Shared Pool</u>
 - Set with RESULT_CACHE_SIZE
 - RESULT_CACHE_MODE=force (auto/manual)
- DBMS_RESULT_CACHE.FLUSH to clear
- Is NOT passed between RAC/Grid nodes
- Check the docs for other Restrictions & Rules!!



select *

from (select *





- <u>Step 1</u> In Session 1-
- Executed query without hint and it returned an elapsed time of 3.80 seconds (not cached).

- <u>Step 2</u> In Session 2 –
- Executed query without hint and it returned an elapsed time of 3.20 seconds (not cached).





<u>Step 3</u> - In Session 2

Executed query with the RESULT_CACHE hint and it returned an elapsed time of 3.18 seconds (cache it).

Step 4 - In Session 1

Executed query without the RESULT_CACHE hint, but with **RESULT_CACHE_MODE=force** and it returned an elapsed time of 0.86 seconds (cached!!).

Result Cache Example Query From the Oracle Docs



 The <u>RELIES_ON</u> Clause specifies tables or views that the Function Results are dependent on.

-- Package specification CREATE OR REPLACE PACKAGE HR IS

type DeptInfoRec IS RECORD (avgSal NUMBER, numberEmployees NUMBER);

-- Function declaration FUNCTION GetDeptInfo (dept_id NUMBER) RETURN DeptInfoRec RESULT_CACHE;



....

Result Cache Example Query From the Oracle Docs



PACKAGE BODY HR IS

-- Function definition

FUNCTION GetDeptInfo (dept_id NUMBER) RETURN DeptInfoRec RESULT_CACHE RELIES_ON (EMP);

IS

. . .

result DeptInfoRec; BEGIN SELECT AVG(sal), count(*) INTO result FROM EMP WHERE deptno = dept_id; RETURN result;

END;

/ **• • •**

END HR;





The Result Cache – V\$ Views

 V\$RESULT_CACHE_STATISTICS – Displays the amount of memory to help you determine memory currently allocated to the result cache.

Other V\$ views:

- V\$RESULT_CACHE_MEMORY
- V\$RESULT_CACHE_OBJECTS
- V\$RESULT_CACHE_DEPENDENCY

The Result Cache – FYI Only Digging Deeper

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DATABASE

KSPPINM	KSPPSTVL	KSPPDESC
result_cache_auto_execution_threshold	1	result cache auto execution threshold
result_cache_auto_size_threshold result_cache_auto_time_threshold	100 1000	result cache auto max size allowed result cache auto time threshold
_result_cache_block_size	1024	result cache block size
_result_cache_bypass	FALSE	bypass the result cache
_result_cache_hash_buckets	1024	hash bucket count
_result_cache_invalid	0	post-invalidation usage allowance
_result_cache_max_result	100	maximum result size as percent of cache size
_result_cache_remote_expiration	0	<pre>maximum life time (min) for any result using a remote object</pre>
_result_cache_timeout	60	maximum time (sec) $6a$ session

Tuning Tools – FYI Only DBMS_XPLAN



- Use DBMS_XPLAN to query the execution plan
 - Automatically queries the last plan in PLAN_TABLE
 - uses a TABLE() function with another pipelined function
 - Operation text truncation might be a problem
 - Will give additional information after plan
 - Highlight filter vs join conditions, if plan table is current
 - Displays warning message of old version plan table is being used

- In 11g, a procedure for SQL Plan Baselines (we'll cover these later).

DBMS_XPLAN.DISPLAY_SQL_PLAN_BASELINE (

sql_bandle

IN VARCHAR2 := NULL,

plan_name

IN VARCHAR2 := NULL,

format

IN VARCHAR2 := 'TYPICAL') < BASIC'/'ALL'>

RETURN dbms_xplan_type_table;

Tuning Tools – FYI Only DBMS_XPLAN



DBMS XPLAN Example:

Select *

from table (dbms_xplan.display);

PLAN_TABLE_OUTPUT

\ Id	Operation	Name		Rows	V	Bytes	X	Cost	X	Pstart	Pstop
I 0	UPDATE STATEMENT		X	328	X	2296	Ŋ	2	X		
1//1/	UPDATE	JOURNAL_LINE	Ń		X		Ń		X		
X// 2 /	PARTITION RANGE ALL		Ń		X		V		X	/// 1 //	4 /
\ \	TABLE ACCESS FULL	JOURNAL_LINE		328	X	2296	X	2	X	1 /1	41

Note: cpu costing is off, 'PLAN_TABLE' is old version

11 rows selected

The Virtual Column





The Virtual Column

- The value of the virtual column is a derived expression.
 - Can be derived from columns of the same table or from constants
 - Can include SQL or user-defined PL/SQL functions
- Virtual column DATA is NOT PHYSICALLY STORED.
- You CAN NOT explicitly write to a virtual column
- You CAN create a PHYSICAL index (result is functionbased index) or partition on a virtual column <unlike a computed column in SQL Server or other databases>
- If you UPDATE columns of a virtual column and it has an index, then it will be computed on the UPDATE vs. on the SELECT (very important from a tuning standpoint).
- Index Organized and External Tables can NOT have virtual columns.





create table emp_rich (empno number(4), sal number(7,2), yearly_sal generated always as (sal*12), deptno number(2));

Table created.

insert into emp_rich(empno, sal, deptno) select empno, sal, deptno from scott.emp;

14 rows created.



select * from emp_rich;

EMPNO SALYEARLY_SAL DEPTNO

7369	800	9600	20
7499	1600	19200	30
7521	1250	15000	30
7566	2975	35700	20
7654	1250	15000	30
7698	2850	34200	30

ORACLE

DATABASE



The Invisible Index





The Invisible Index

Set an index to VISIBLE or INVISIBLE

- ALTER INDEX idx INVISIBLE;
- ALTER INDEX idx VISIBLE;
- CREATE INDEX... INVISIBLE;
- Great to turn off indexes for a while when you think they're not being used, but BEFORE you drop them.
- Can use INDEX (to override invisibility) or NO_INDEX (to override visibility) hints to override either setting.
- The index IS MAINTAINED during DML
- Great for testing!



create index deptno_invisible_idx on dept_rich(deptno) invisible; Index created.

The Invisible Index

select count(*) from dept_rich where deptno = 30; (doesn't see the index)

COUNT(*) 512 Execution Plan		
Plan hash value: 3024595593		
Id Operation Name	Rows Bytes Cost (%CPU) / Time
0 SELECT STATEMENT 1 SORT AGGREGATE 1* 2 1 TABLE ACCESS FUL	V 1 V 2 V	
		7777777857



select /*+ index(dept_rich_dept_rich_inv_idx) */ count(*) from dept_rich where deptno = 30; (forces the index with hint) COUNT(*) 512 Execution Plan Plan/hash/value:/3699452051 Id / Operation // Name // Rows / Bytes / Cost (%CPU) / Time // 1 SORT AGGREGATE 2 / INDEX RANGE SCAN | DEPT_RICH_INV_IDX / 512 / 1024 /1 (0) / 00:00:01

The Invisible Index



The Invisible Index (set visible)

alter index dept_rich_inv_idx visible; Index altered.

select count(*) from dept_rich where deptno = 30; (it does see the index)

COUNT(*)

/512

Execution/Plan

Plan hash value: 3699452051

/Id /	Operation	Name	R	ows	Bytes /	Cost (%CPU)	Time	
	SELECT STATEMENT			1 X 1 V	2 X 2 X	1 (0)	00:00:01	X
X* 2 X	INDEX RANGE	SCAN	DEPT_RIC	h_in	V_IDX	1 512 1 1	024 /1 (0)	1/00:00



The Invisible Index (set visible)

select /*+ no_index(dept_rich dept_rich_inv_idx) */ count(*)
from dept_rich
where deptno = 30; (forces not using the index with hint)

COUNT(*)

512

Execution Plan

Plan hash value: 3024595593

/ Id / Operation	(Name	Rows Bytes	Cost (%CPU)	Time
0 SELECT STATEMEN 1 SORT AGGREGATE			4 (0)	00:00:01
1* 2 / TABLE ACC	ESS FULL	DEPT_RICH	512 / 1024	458(0)10



The Invisible Index (check it)

alter index dept_rich_inv_idx invisible; Index altered.

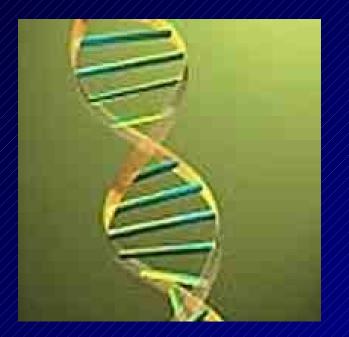
select index_name, visibility
from dba_indexes (or go to USER_INDEXES)
where index_name = 'DEPT_RICH_INV_IDX';

INDEX_NAME VISIBILITY

DEPT_RICH_INV_IDX INVISIBLE



Create & Rebuild Index Online





Create & Rebuild Index Online

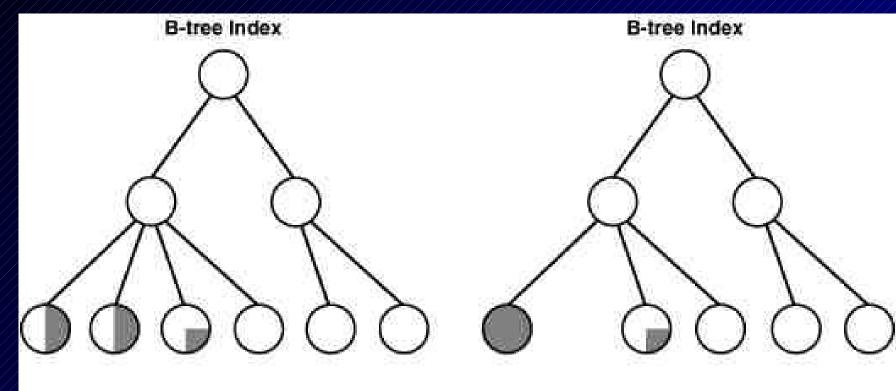
- You can create/rebuild indexes even when doing DML on the base table, but it's better to do during low DML activity.
- **Prior to Oracle 11g**, this required an exclusive lock at the beginning and end of the rebuild. This lock could cause DML delays and performance spike. This lock is no longer required for this operation.
- Rebuild is faster than a DROP and CREATE
- Basic Syntax:

CREATE INDEX index_name ON table (col1,...) ONLINE; Index created.

ALTER INDEX index_name REBUILD ONLINE; Index altered.

Rebuild Index or Coalesce (FYI) Coalesce Example from Oracle Doc.





Before ALTER INDEX vmoore COALESCE;

After ALTER INDEX vmoore COALESCE;



Rebuild Index or Coalesce

<u>Rebuild:</u>

- Quickly move index to another tablespace
- Requires more disk space
- Creates new index tree and shrinks heights
- Change storage/tblspc w/o dropping

<u>Coalesce</u>

- Can't move to another tablespace
- Requires much less space than rebuild
- Coalesces leaf blocks that are in the same branch
- Quickly frees index leaf blocks for use

Nice Developer Tools/Improvements



DDL_LOCK_TIMEOUT PL/SQL Expressions Simple Integer New PL/SQL Packages



The DDL Lock Timeout

- DDL Statements (Create/Alter/Drop) require exclusive locks and thus sometimes fail due to bad timing.
- The parameter DDL_LOCK_TIMEOUT specifies the amount of time (in seconds) the DDL statement will wait for the lock before timing out and failing.
- The default value is 0, the max value is 100000 (27.77 hours).
- Example:

alter session set DDL_LOCK_TIMEOUT = 30

Session altered.





 In Previous Versions needed to retrieve the value of a sequence (CURRVAL / NEXTVAL) by invoking a cursor (explicit or implicit).

<u>In 11g:</u>

- No cursor is needed so the code is more efficient.
- For big jobs Saves MANY cursors



USC



DATABASE

```
OLD Way
DECLARE
V_NEW_VAL NUMBER;
BEGIN
SELECT MY_SEQ.NEXTVAL INTO V_NEW_VAL
FROM DUAL;
END;
```

```
NEW Way
DECLARE
V_NEW_VAL NUMBER;
BEGIN
V_NEW_VAL := MY_SEQ.NEXTVAL;
END;
```



- Oracle added the new SIMPLE_INTEGER data type to be more efficient than PLS_INTEGER since the operations are done directly at the hardware level. There is also a built-in NOT NULL condition for SIMPLE_INTEGER.
- The performance is larger when the PLS_CODE_TYPE='NATIVE' vs. INTERPRETED
- We used a PL/SQL Block to loop through 1 million times incrementing a numeric variable by one. We executed the test for each of these three times.

Results: NUMBER: 1.26s PLS_INTEGER: 0.88s SIMPLE_INTEGER: 0.65s



Additional Enhancements New PL/SQL Packages

- DBMS_AUTO_TASK_ADMIN
- DBMS_COMPARISON
- DBMS_DG
- DBMS_EDITIONS_UTILITIES
- DBMS_HM (Health Monitor)
- DBMS_HPROF
- DBMS_MGD_ID_UTL
- DBMS_NETWORK_ACL_ADMIN
- DBMS_RESCONFIG
- DBMS_RESULT_CACHE

- DBMS_SQLDIAG (SQL Repair)
- DBMS_WORKLOAD_CAPTURE
- DBMS_WORKLOAD_REPLAY
- DBMS_XA
- DBMS_XDBADMIN
- DBMS_XEVENT
- DBMS_XMLDTD
- DBMS_XMLINDEX
- DBMS_XMLTRANSLATIONS
- SDO_RDF
- SDO_RDF_INFERENCE

Additional Enhancements Enhanced PL/SQL Packages

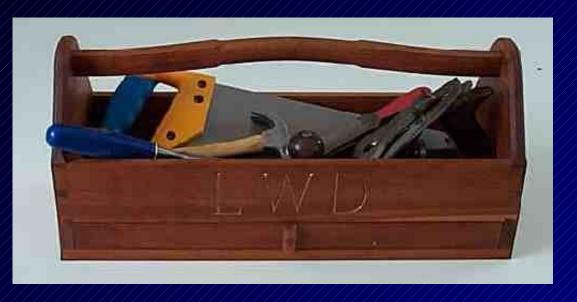


- DBMS_ADVISOR
- DBMS_APPLY_ADM
- DBMS_AQ
- DBMS_AQADM
- DBMS_CAPTURE_ADM
- DBMS_CDC_PUBLISH
- DBMS_CDC_SUBSCRIBE
- DBMS_CQ_NOTIFICATION •
- DBMS_DATA_MINING
- DBMS_DATA_MINING_TR ANSFORM •
- DBMS_DATAPUMP
- DBMS_EXPFIL
- / DBMS_FLASHBACK

- DBMS_HS_PASSTHR OUGH
- DBMS_LOB
- DBMS_LOGSTDBY
- DBMS_MGWADM
- DBMS_MVIEW
- DBMS_PREDICTIVE_ ANALYTICS
 - DBMS_RESOURCE_M ANAGER
 - DBMS_RLMGR
 - DBMS_RULE_ADM
- / DBMS_SCHEDULER /
- DBMS_SERVER_ALE RT
- _ DBMS_SESSION
- DBMS_SPACE

- DBMS_SQL
- DBMS_SQLTUNE
- DBMS_STATS
- DBMS_STREAMS_ ADM
- DBMS_TRACE
- DBMS_UTILITY
- DBMS_WORKLOA
 D_REPOSITORY
- DBMS_XDB
- DBMS_XMLSCHE MA
- DBMS_XPLAN
- UTL_INADDR
- UTL_RECOMP
- UTL_SMTP
- UTL<u>TCP</u>

Nice DBA Tool



Oracle Secure Files

Oracle SecureFiles *High-Performance Large Objects*

High-performance transactional access to large object data –RFID, DICOM medical, CAD, images, 3D spacial –low-latency, high throughput, concurrent access
–space-optimized storage

 Protect your valuable data ... Keep large objects in the database! – transactions

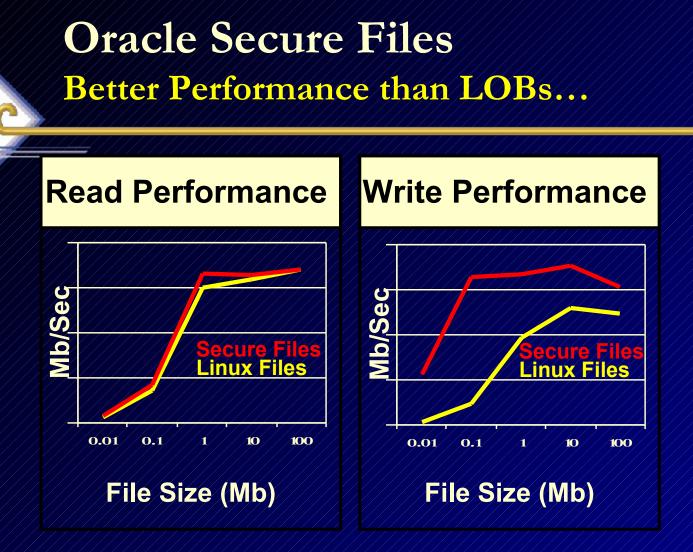
-transparent encryption

-compression and de-duplication

-database-quality security, reliability, and scalability

• Better security, single view and management of data

Superset of LOB interfaces – easy migration



Adding Files using New Disk Space – 2x fast than LOBsAdding Files using Deleted Space – 22x faster than LOBsPL/SQL Reads – 6x Faster than LOBsYour mileage will vary....

ADDM Enhancements (Automatic Database Diagnostic Monitor)





ADDM enhancements

- Global ADDM so that Diagnostics are done across the entire cluster
- Emergency ADDM for use when database is hung
- On any granularity
 - Database Cluster
 - Database Instance
 - Specific Target (such as host, ASM...etc.)
- Over a specified time NOT tied to a pair of snapshots





ADDM Briefly

🛎 Oracle Li Kerpras Sinteger (Sylai - Belaba.

fr + T - ing + of Base + _ igh + DRACLE Enterprise Manager II & true view trees not local Databane Cherral Dataliste Energian in A. Sefa Database Instance: ord Vailo Ind'an South Hitselfer Samani Schenta Lista Novenmu. Schware and Sayoutt Home Takes Date Online Com Tangel Oct 31, 2007 1:54:55 AM COT 🔅 🖅 ski View Date Notomatically (66 sec) 🕷 General Host CPU Active Sassions SQL Response Time Freddown | (Clack 3., 1:304 × 25 Slats M 5.4 Walk. 25 Up Since Oct 25, 2007 8:09:07 AM CDT i ther -0-Use 1/0 Indena Neira ord Hant 🖬 27 CP. Variate 11.1.0.6.0 25 22 -Host of 1100 10 Sec Falcher FTTM Reference collection telemicity. 000 priper 153 beci SUL Response I me (%) Unavailable Madmum C4J 1 Vites Al Purrinties, Resal Refate .e C. e. ur Diagnostic Summary Space Summary **High Availability** ADOM Hindings Cotabase Size (CB) Enstance Recovery Time (sec) IBAU 14 criest Start Time Oct 31, 2007 1:34:40 AM CDT Publish Tanki paces and Davidant n/a 0 Alert Log No.O.O. etcri. Septrent Advisor Recommendations U. Usable Hash Itercovery Area (96) 100 Adive Incidents 🔞 Policy Violations 🗹 00 **Tauhback Database Logding** Disactori Dump Arese Juer (55) 21 Jotobose Instance Health **▼**Alerts . Contrat D Warming A1 Celegray All Category Alert Tilgerred Severity PROVING: Empact Message Oct 31, 2007 1:09:55 AM 1 Jser Audit Alicited User Liser 575 longer.on hor ora-

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Specific Database Instance

We have 5 ADDM Findings

Check them Here

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Top ADDM Findings

Click a Single Timeframe

Let's Check the Hard Parse Issue

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ADDM Briefly

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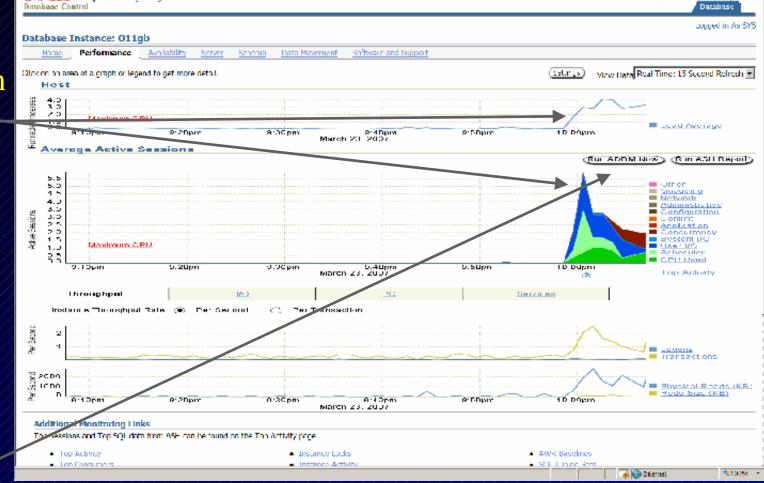


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ADDM - Run NOW!



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Run ADDM NOW!

ADDM - Run NOW!

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ADDM – Run NOW!

Detail on CPU Issue?

Suggested Fixes

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Tide Host Configuration	100
Action – Consider adding more CPUs to the host or adding instances serving the database on other hosts.	
Adixn. Session CPU consumption was throttled by the Oracle Resource Manager. Consider revising the resource plan that was active during the	
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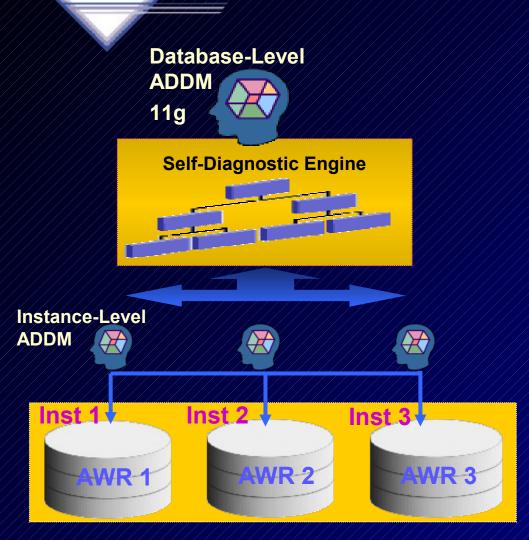


View The Report

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ADDM for **RAC**



- Performance expert in a box
 - Now RAC specialist too!
- Identifies the most "Globally Significant" performance issues for the entire RAC database
- Database-wide and instance-level analysis
- Database-wide analysis of:
 - Global cache interconnect issues
 - Lock manager congestion issues
 - Global resource contention, e.g. IO bandwidth, hot blocks
 - Globally high-load SQL
 - Skew in instance response times
- Allows drill down to instances
- Runs proactively every hour when taking AWR Snapshots (default)



ADDM Considerations:

- CPU Bottlenecks
- Undersized Memory Structures SGA / PGA
- I/O Capacity Issues
- High Load SQL statements
- High Load PL/SQL
- RAC specific issues Global hot block/interconnect
- Application issues such as parsing, locks...etc.
- Concurrency (buffer busy) or hot object issues
- Configuration issues Redo, Archive, Checkpoint.

SQL Tuning Advisors & SQL Plan Management (SPM)

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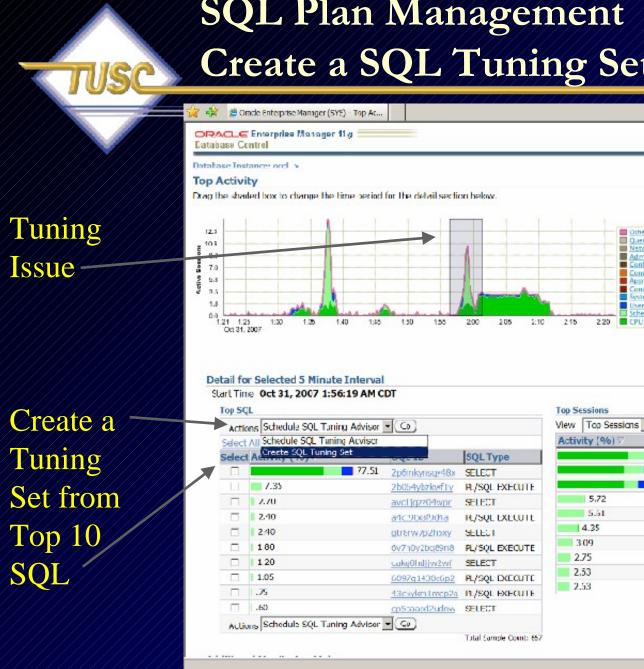
SQL Plan Management

- SQL Plan Management is a mechanism that records/evaluates execution plan of SQL statements (good & bad) over time and builds SQL Plan baselines (replaces stored outlines) of existing plans known to be efficient.
- Events that cause the need for SQL Plan baselines:
 - New version of Oracle (New optimizer version Use capture replay to test effect)
 - Changes to optimizer statistics or data changes
 - Schema, application or metadata changes (use SQL Advisor to get suggestions)
 - System settings changes (Use SQL Replay to find what works)
 - SQL Profile (statistics data skews & correlated columns) creation
- Stored outlines are deprecated (discouraged) in Oracle Database 11g. Oracle highly recommends migrating existing stored outlines to SQL plan baselines. A **SQL Profile contains additional STATISTICS** for this SQL statement for the query optimizer to generate a better execution plan. **An outline/baseline contains HINTS** for this SQL statement for query optimizer to generate a better execution plan.



SQL Plan Management

- **SQL Profile stores STATISTICS** for a SQL statement for the query optimizer to generate a better execution plan.
- A Stored Outline/SQL Plan Baseline contains HINTS for this SQL statement for query optimizer to generate a better execution plan.
- A SQL Plan Baseline should evolve with changes in the system to analyze good/bad plans over time.
- View these in DBA_PLAN_BASELINES
- You can also export a SQL Tuning Set and import it to new system. Capture baselines for Tuning Set with DBMS_SPM (see later slide on entire syntax). Can also use a pack/unpack function to pack/unpack all plans in a system for transporting.



SQL Plan Management **Create a SQL Tuning Set**

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.3 09		140	DBSNMP	emagent@ora		
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SQL Plan Management **Create a SQL Tuning Set**





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		6007q1430c652	MGMT_PAF_AQ.DEQUEUE_REQUEST (g_node_N == ; 1, p_wait =	0	SYSMAN	3338	53.77	15.20	30976	25.00	OE4.SystemPool	
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SQL Plan Management **Create a SQL Tuning Set**



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SQL Plan Management Create a SQL Tuning Set





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SQL Plan Management Create a SQL Tuning Set

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SQL Plan Management Create a SQL Tuning Set





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Setup Preferences Help .og Database Logged in As SYS Refresh ion plan of a particular SQL statement the search string, hou can use the wildcard symbol (%) in a double quoted string. Unpack.) Status Created Last Modified OCT 31, 2007 1:50:10 AM OCT 31, 200/ 1:50:10 AM AULT ENABLED Help Locout er respective ewners. 🔒 😜 internet \$ 100% - SQL Plan Management Capturing Baselines

- Capturing baselines (migrate stored outlines hints)
- Plan history is only tracked for a SQL statement that executes more than once (no ad-hoc queries)
- Automatic Plan Capture:
 OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES
 (set to TRUE the default is FALSE)
- Enable the use of SQL Plan Baselines (could be session level of a tuning set & without the capture):
 OPTIMIZER_USE_SQL_PLAN_BASELINES
 (set to TRUE the default is TRUE) 99

SQL Plan Management Capturing Baselines



DATABASE

DBMS_SPM.LOAD_PLANS_FROM_CURSOR_CACHE (sql_id IN VARCHAR2, plan_hash_value IN NUMBER := NULL, sql_text IN CLOB, fixed IN VARCHAR2 := 'NO', enabled IN VARCHAR2 := 'YES') RETURN PLS_INTEGER;

 Load one or more plans present in the cursor cache for a SQL statement. You can also do this using the plan_handle and sql_text.





118

DBMS_SPM.LOAD_PLANS_FROM_SQLSET (sqlset_name IN VARCHAR2, sqlset_owner IN VARCHAR2 := NULL, basic_filter IN VARCHAR2 := NULL, fixed IN VARCHAR2 := 'NO', enabled IN VARCHAR2 := 'YES' commit_rows IN NUMBER := 1000) RETURN PLS_INTEGER;

- Manually load plans stored in SQL Tuning Sets (STS) into plan baselines.
- Note that plan history is only tracked for a SQL statement that executes more than once (no ad-hoc queries)
 101





• Set the retention to 100 weeks to retain **unused** plans before they are purged (53 is the default). Shown for example, 100 is not recommended, 53 is better since it will include monthly/yearly runs.

begin

dbms_spm.configure('plan_retention_weeks',100); end;

PL/SQL procedure successfully completed.

- You can also purge individual plans with the purge_sql_plan_baseline function.
- You can also query dba_sql_plan_baselines as well as use DBMS_XPLAN.display_sql_plan_baseline to view stored plans.





 Measure and report on performance before and after a change! DBMS_SQLTUNE package.

<u>Great for:</u>

- Database Upgrades
- Application Upgrades
- Hardware Changes
- Database or Schema Changes
- Best for SQL Tuning Especially Batches



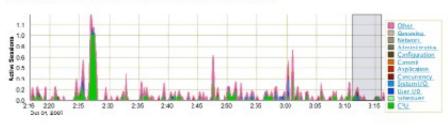
<u>Easy to run – SQL Focus (Test SGA settings):</u>

- Capture SQL
- Transport SQL
- Create a Replay Task
- Set up the environment to Test
- Make any changes to Test (such as SGA/Optimizer)
- Compare before and after performance
- Tune the problems!

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Top Activity

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



Detail for Selected 5 Minute Interval Start Time Oct 31, 2007 3:11:06 AM CDT

Top SOL Top Sessions View Top Sessions -Actions Schedule SQL Tuning Advisor - Go Activity (%) Session ID User Name Program Select A1 Select None 13.38 124 OBSNMP emagent@otal1g Select Activity (%) SQLID **SQL Type** 15.38 114 DBSNMP OMS E 12.50 bgfx0g2]as08u SELECT 12 50 7.69 137 SYSMAN OMS cyc82ddx2x8h5 SELECT 7.69 117 SYS sqlplus@ora11gpr 12.50 74xk3mxtnz14s DELETE 7.69 144 SYSMAN orade@ora11gpn 12.50 г 74aa:bc9654q4 SELECT oracle@orallopo 7.69 515 12.50 5hfurwv38vwfp **SELECT** 7.69 151 3173 wale Quality a 12.50 a8j39gb13lgkr SELECT Click 7.69 orado@ora11gpn E 17.50 53s4'wzvo5c6w **JNKNOWN** 7.69 130 SYSMAN OMS 12.50 2s3ighta120145 UNKNOWN 7.69 144 orade@ora11gpn Total Sample Count: 8 Here Additional Monitoring Links Top Consumers Snapshots Instance Duplicate SQL Instance Activity AWR Baselines Blocking Sessions Search Sessions SQL Turing Sets SOL Performance Analyzer Hand Analysis Search SOL

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SQL Performance Analyzer Guided Workflow



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SQL Performance Analyzer Optimizer Upgrade (10g vs. 11g)



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SQL Performance Analyzer 11gR2 - Options



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Test a Tuning Set that I've used in the past

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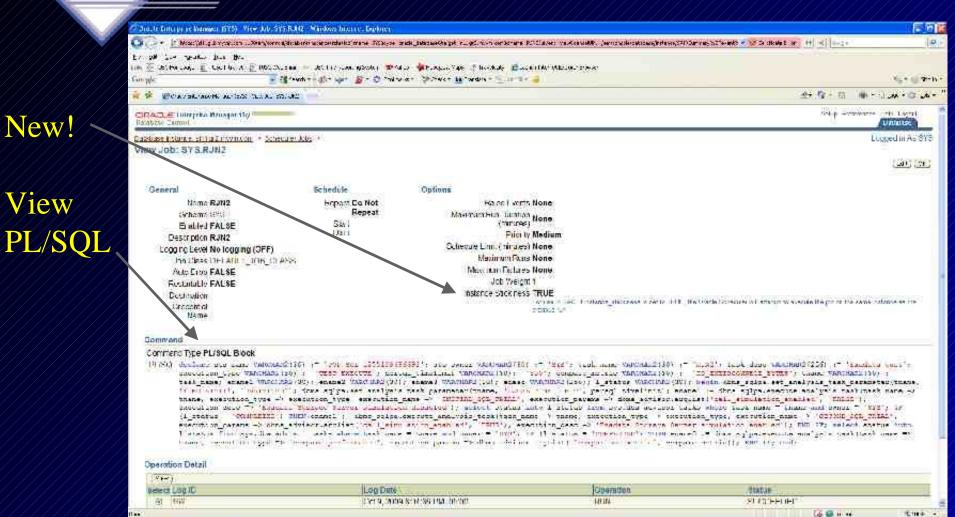
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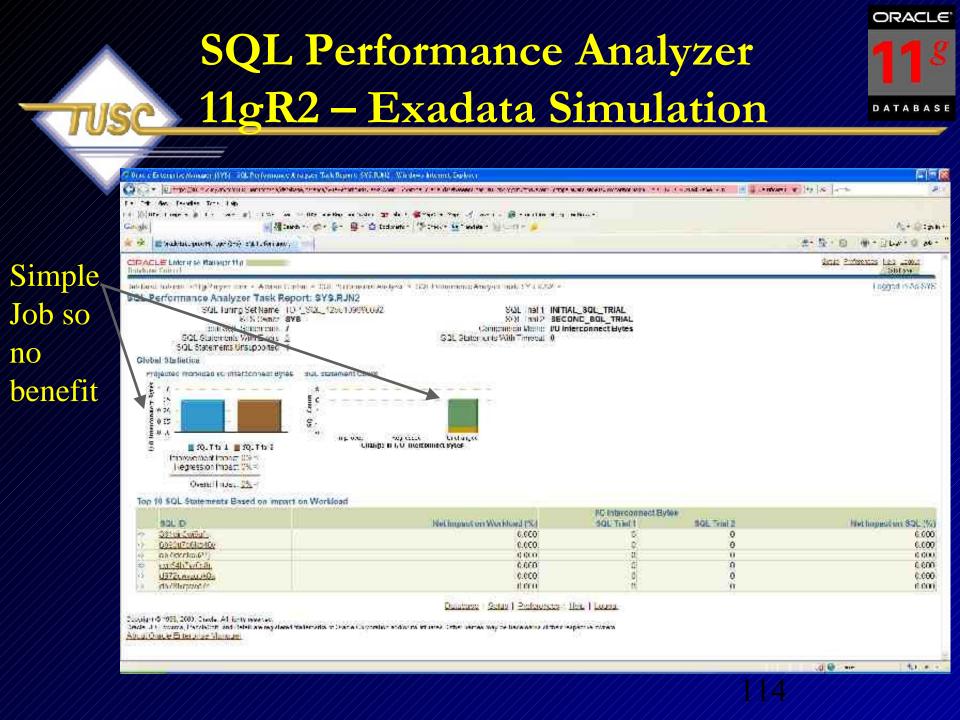


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Exadata = Paradigm Shift!



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Easier way – Oracle's picture of the Sun Oracle Database Machine

8 Compute Server

- /8 x 2 sockets x 4 cores = 64 cores
- 576 GB DRAM

InfiniBand Network

- 40 Gb/sec each directi
- Fault Tolerant



14 Storage Servers

- 14x12=168 Disks
- 100T SAS or
- 336T SATA

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- 5TB+ flash storage!





- 8 compute servers (x4170's)
 - 8 servers x 2 CPU sockets x 4 cores = 64 cores (E5540 2.53 GHz)
- 8 servers x 72G DRAM = 576G DRAM (400G useable)
- 14 Storage Servers total 336G DRAM = 912G Total DRAM
- 3 InfiniBand Switches x 36 ports = 108 ports
- 14 Storage Servers (100-336T) with Flash Cache (5T+)
 - 96G x 4 banks = 394G flash cache per storage server
 - 14 storage servers x 394G = 5.376T Flash Cache
 - -12 disks per storage server x 14 servers = 168 disks
 - 168 disks x 600G SAS = 101T SAS
 - 168 disks x 2T SATA = 336T SATA
 - Additional total storage of 4.672T on Database Servers (146G drives)
- 14 storage servers x 2 quad core E5540 = 112 additional cores

Benefits Multiply*

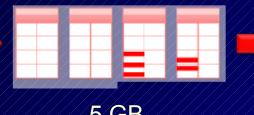
10 TB of user data Requires 10 TB of IO

1 TB with compression

100 GB with partition pruning



20 GB with Storage Indexes



5 GB with Smart Scans

Sub second On Database Machine



Data is 10x Smaller, Scans are 2000x faster

*Oracle Slide -



DATABASE

SQL Advisors



Repair Advisor (next)

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SQL Tuning Advisor	
	Analyze individual SQL statements, and recommond SQL profiles, statistics, indexes, and restructured SQL to SQL performance. View the results of automated execution of SQL Tuning Advisor on observed high- oad SQL.
SQL Repair Advisor	
The SQL Repair Advisor can analyze and x	tentially patch failing SQL statements.
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SQL Failure Analysis	SQL failure analysis is used for non-incident SQL lailures and can be accessed through either SQL Defails or SQL Worksheet. Lick here to go to SQL Worksheet.
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SQL Advisors <u>11gR2 – (same)</u>





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Tuning Advisors

Repair Advisor (next)

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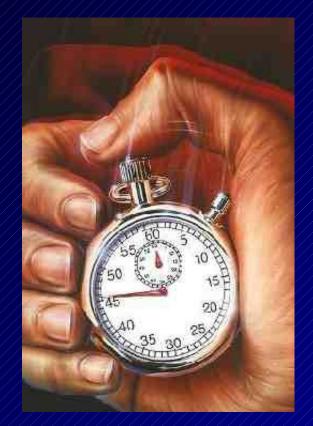
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- The SQL Advisor now combines the functionality of the SQL Tuning Advisor, SQL Access Advisor and the new Partition Advisor.
 - Recommends Partitioning Needs
 - Utilize a previous SQL Tuning Set
 - Take SQL straight from what's currently in the CACHE.
 - Create a hypothetical workload
 - SQL Access Advisor checks Indexes, Partitions or Materialized Views (schema related issues)



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The SQL Repair Advisor



ORA-600



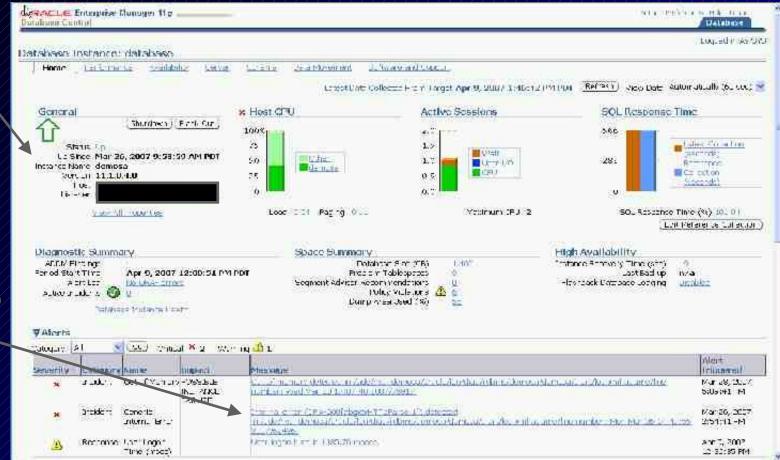
SQL Repair Advisor

- Used to Repair Problem SQL Oracle Errors
- Reloads and recompiles SQL statements to gather diagnostics information to fix.
- Uses the diagnostic information to repair the problem SQL statement (DBMS_SQLDIAG)
- Will fix error going through compilation, execution and trying different routes (could be a slower route for now) to come up with a temporary SQL Patch without error until fixed.

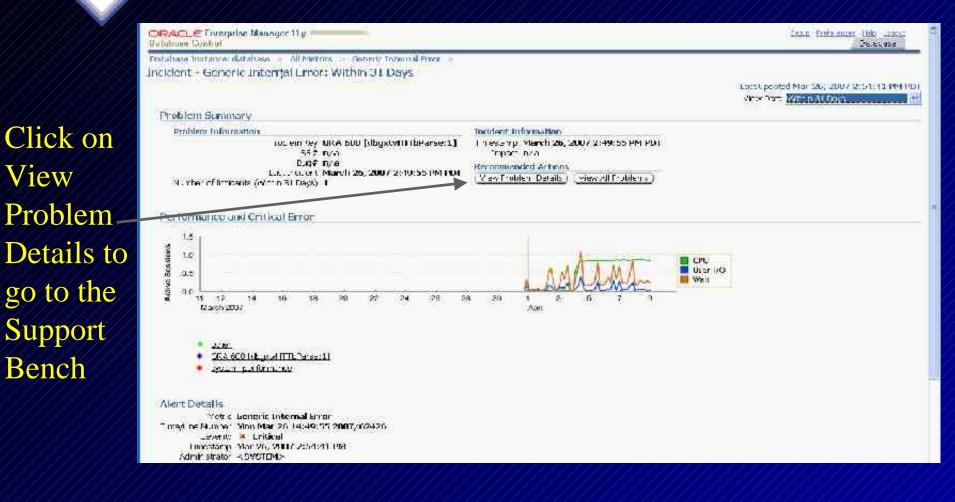
SQL Repair Advisor – Go straight from Alerts

Go to the Database Instance

Click Alert (ORA-600) message text to see details



SQL Repair Advisor – View Problem Details



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Support Workbench - Details

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Results from SQL Repair Advisor

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Note a SQL Patch (FIX for the SQL) has been generated

SQL Repair Advisor Recommendation / Confirmation



Real Application Testing! Database workload capture and replay





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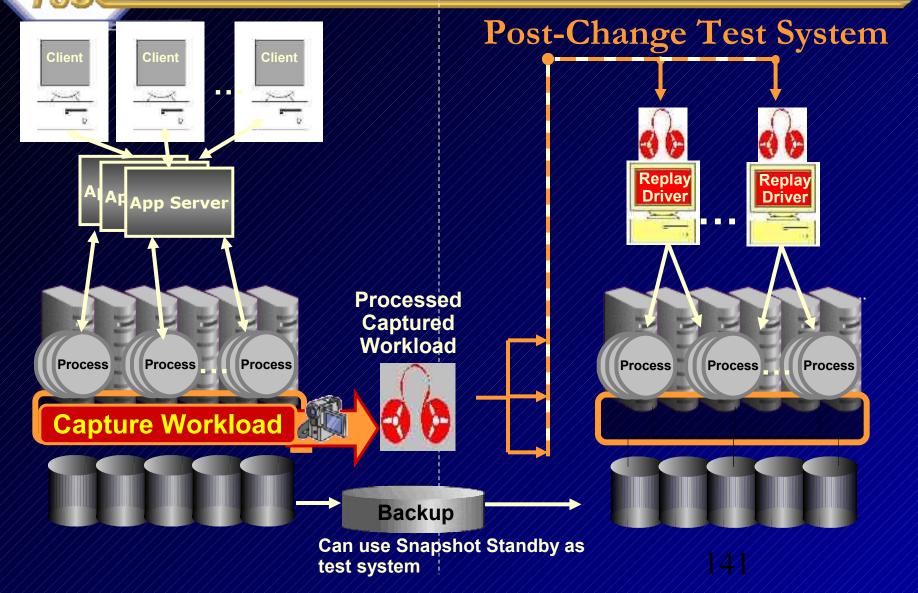


- Used to capture database workload on one system and replay later on a different system. Useful to compare two different systems.
- Could rival LoadRunner in the future (may be more precise!)

<u>Brief Steps:</u>

- Capture workload on a database even from 10gR2
- Restore the database on a test system to the SCN when capture begins
- Perform upgrade and make changes to the test system as needed
- Preprocess the captured workload if it is not preprocessed
- Configure the test system for replay (I don't do this here)
- Replay workload on the restored database (I don't have this in this presentation, but will show some of the screens to do it)
- Great to test upgrade to 11g (Capture 10gR2 then test against 11g)

Pre-Change (could be 9.2.0.8 or 10g Capture) Production System



Database Replay FYI Only – Download to view in detail

Real App Testing:

Database -Replay

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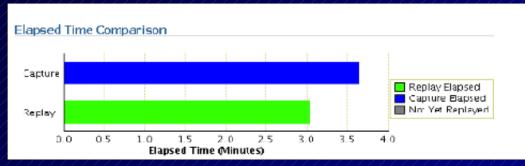


- Exact Concurrency, commits & data divergence minimal
- Unsynchronized Replay
 - Not the same concurrency or commits
 - Data divergence can be large depending on load test performed

ORACLE

DATABASE

- Creates Report
 - Data Divergence
 - Error Divergence
 - Performance Divergence





Partitioning: (FYI Only)



- Tables can be split into many pieces (10g).
- Only a subset of the data is queried
- All of the data COULD be queried
- Leads to enhanced performance of large tables
- Re-orgs & backups can be done on a partition level
- 4 quick examples follow (many many rules for each)
- WHAT'S NEW IN ORACLE 11G

The Rules – See Partitioning Guide

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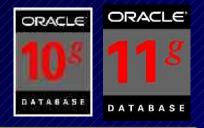
EQ95 *



CREATE TABLE DEPT(DEPTNONUMBER(2),DEPT_NAMEVARCHAR2(30))PARTITION BY RANGE(DEPTNO)(PARTITION D1 VALUESLESS THAN (10) TABLESPACE DEPT1,PARTITION D2 VALUESLESS THAN (20) TABLESPACE DEPT2,PARTITION D3 VALUESLESS THAN (MAXVALUE) TABLESPACEDEPT3);

INSERT INTO DEPT VALUES (1, 'DEPT 1'); INSERT INTO DEPT VALUES (7, 'DEPT 7'); INSERT INTO DEPT VALUES (10, 'DEPT 10'); INSERT INTO DEPT VALUES (15, 'DEPT 15'); INSERT INTO DEPT VALUES (22, 'DEPT 22');

Range Partitioning (8i) (Multi-Column)

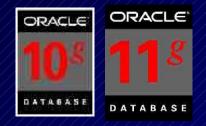


create table cust_sales (acct_no number(5), cust_name char(30), sale_day integer not null, sale_mth integer not null, sale_yr integer not null)

partition by range (sale_yr, sale_mth, sale_day)

(partition cust_sales_q1 values less than (1998, 04, 01) tablespace users1, partition cust_sales_q2 values less than (1998, 07, 01) tablespace users2, partition cust_sales_q3 values less than (1998, 10, 01) tablespace users3, partition cust_sales_q4 values less than (1999, 01, 01) tablespace users4, partition cust_sales_qx values less than (maxvalue, maxvalue, maxvalue) tablespace users4);

Hash Partitioning (8i) (Multi-Column)



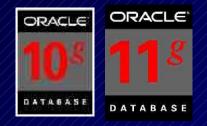
create table cust_sales_hash (acct_no number(5), cust_name char(30), sale_day integer not null, sale_mth integer not null, sale_yr integer not null) partition by hash (acct_no) partitions 4 store in (users1, users2, users3, users4);



Composite Partitioning v (8i)

CREATE TABLE test5 (data item INTEGER, length of item INTEGER, owning dept NUMBER, storage type VARCHAR(30) storage date DATE) / PARTITION BY RANGE (storage date) / SUBPARTITION BY HASH (data item) SUBPARTITIONS 4 STORE IN (data tbs1, data tbs2, data tbs3, data tbs4) (PARTITION q1 1999 VALUES LESS THAN (TO DATE ('01-apr-1999', 'dd-mon-yyyy')), PARTITION q2 1999 VALUÉS LESS THAN (TO DATE ('01-jul-1999', 'dd-mon-yyyy')), PARTITION q3 1999 VALUES LESS THAN (TO DATE ('01-oct-1999', 'dd-mon-yyyy')) (SUBPARTITION q3 1999 s1 TABLESPACE data tbs1, SUBPARTITION q3 1999 s2 TABLESPACE data tbs2), PARTITION q4 1999 VALUES LESS THAN (TO DATE ('01-jan-2000', 'dd-mon-yyyy')) SUBPARTITIONS /8 STORE IN (q4 tbs1, q4 tbs2, q4 tbs3, q4 tbs4, q4/tbs5, q4/tbs6, q4/tbs7, q4/tbs8), //PARTITION q1/2000 VALUES LESS THAN (TO DATE ('01-apr-2000', 'dd-mon-yyyy')));

List Partitioning (Allowed since 9i)



create table dept_part (deptno/number(2), dname varchar2(14), loc // varchar2(13)) partition by list (dname) (partition d1_east values ('BOSTON', 'NEW YORK'), partition d2_west values ('SAN FRANCISCO', 'LOS ANGELES'), partition d3_south values ('ATLANTA', 'DALLAS'), partition d4_north values ('CHICAGO', 'DETROIT'));

Table created.



 This is a helpful addition to range partitioning where Oracle automatically creates a partition when the inserted value exceeds all other partition ranges. 11g also has Ref & Virtual Column Partitioning (not covered here).

There are the following restrictions:

- You can only specify one partitioning key column, and it must be of NUMBER or DATE type.
- Interval partitioning is NOT supported for index-organized tables.
- Interval Partitioning supports composite partitioning:
 - Interval-range *** Interval-hash *** Interval-list
- You can NOT create a domain index on an interval-partitioned table.



CREATE TABLE DEPT_new (DEPTNO NUMBER(2), DEPT_NAME VARCHAR2(30)) PARTITION BY RANGE(DEPTNO) (PARTITION D1 VALUES LESS THAN (10), PARTITION D2 VALUES LESS THAN (20), PARTITION D3 VALUES LESS THAN (30));

Table created.

```
SQL> insert into dept_new values(40, 'test2');
insert into dept_new values(40, 'test2')
*
ERROR at line 1:
```

ORA-14400: inserted partition key does not map to any partition



select segment_name, partition_name
from dba_segments
where segment_name = 'DEPT_NEW';

SEGMENT_NAME

PARTITION_NAME

DEPT_NEW DEPT_NEW DEPT_NEW D1 D2 D3

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DATABAS

CREATE TABLE DEPT_NEW2 (DEPTNO NUMBER(2), DEPT_NAME VARCHAR2(30)) PARTITION BY RANGE(DEPTNO) INTERVAL(10) (PARTITION D1 VALUES LESS THAN (10), PARTITION D2 VALUES LESS THAN (20), PARTITION D3 VALUES LESS THAN (30))

Table created.

SQL> insert into dept_new2 values(40, 'test2'); 1 row created.





insert into dept_new2 values(40,null); insert into dept_new2 values(50,null); insert into dept_new2 values(99,null);

select segment_name, partition_name
from dba_segments
where segment_name = 'DEPT_NEW2'

SEGMENT_NAME PARTITION_NAME

DEPT_NEW2	D1
DEPT_NEW2	D2
DEPT_NEW2	D3
DEPT_NEW2	<u>SYS_P41</u>
DEPT_NEW2	<u>SYS_P42</u>
DEPT_NEW2	<u>SYS_P43</u>

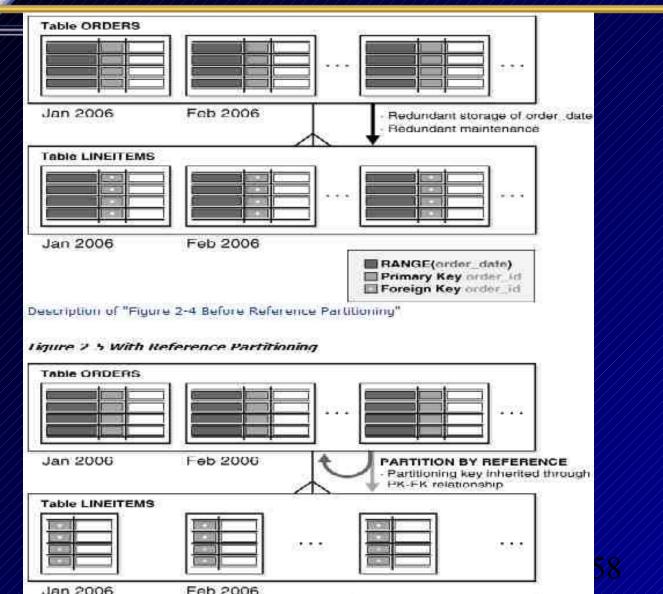
Reference Partitioning – 11g (FYI Only)

- Allows the partitioning of two tables related to one another by referential constraints. The partitioning key is resolved through an existing parent-child relationship, enforced by enabled and active primary key and foreign key constraints.
- Tables with a parent-child relationship can be logically equi-partitioned by inheriting the partitioning key from the parent table without duplicating the key columns. The logical dependency will also automatically cascade partition maintenance operations, thus making application development easier and less error-prone.

Reference Partitioning – 11g (FYI Only)

```
CREATE TABLE orders
( order id
                                                            NOT NULL,
                           CONSTRAINT orders order id nn
             NUMBER (12)
                           CONSTRAINT orders order date nn NOT NULL,
 order date DATE
 order mode VARCHAR2(8),
 customer id NUMBER(6)
                           CONSTRAINT orders customer id nn NOT NULL,
 order status VARCHAR2(2),
  order total NUMBER(8,2),
  sales rep id NUMBER(6),
 promotion id NUMBER(6),
 CONSTRAINT orders order id pk PRIMARY KEY (order id)
PARTITION BY RANGE (order date)
 ( PARTITION p pre 1999 VALUES LESS THAN (TO DATE('01-JAN-2006','dd-MON-yyyy')),
 PARTITION p JAN 1999 VALUES LESS THAN (TO DATE ('01-FEB-2006', 'dd-MON-yyyy'))
3
PARALLEL ;
CREATE TABLE lineitems
( order id
                           CONSTRAINT oitems order id nn
                                                             NOT NULL,
              NUMBER (12)
  line item id NUMBER(3)
                           CONSTRAINT oitems line item id nn NOT NULL,
 product id
                           CONSTRAINT oitems product id nn
             NUMBER (6)
                                                             NOT NULL,
 unit price NUMBER(8)
                           CONSTRAINT oitems unit price nn
                                                             NOT NULL,
             NUMBER(8,2) CONSTRAINT oitems quantity nn
                                                              NOT NULL,
  quantity
  sales amount NUMBER(12,2) CONSTRAINT oitems sales amount nn NOT NULL,
  CONSTRAINT order items orders fk
 FOREIGN KEY (order id) REFERENCES orders (order id)
PARTITION BY REFERENCE (order items orders fk)
PARALLEL ;
```

Reference Partitioning – 11g



Jan 2006



- You can now COMPRESS individual partitions
- Compression as high as 3.5 to 1 is possible
- Compressed Tables now support
 - DML Statements
 - Add and Drop Column
 - Partition level COMPRESS or NOCOMPRESS
- ALTER TABLE... COMPRESS (old compress)
- ALTER TABLE ... NOCOMPRESS
- Table compression now supported for OLTP
- New Advanced Compression Option (chargeable):
 CREATE TABLE *t1* COMPRESS FOR ALL OPERATIONS

Presentation by Shyam Varan Nath – Honey I shrunk the Data Warehouse



CREATE TABLE DEPT_new3 (DEPTNO NUMBER(2), DEPT_NAME VARCHAR2(30)) COMPRESS PARTITION BY RANGE(DEPTNO) interval(10) (PARTITION D1 VALUES LESS THAN (10), LESS THAN (20) NOCOMPRESS, PARTITION D2 VALUES LESS THAN (30)) PARTITION D3 VALUES

Table created.

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insert into dept_new3 values(10,null); 1 row created. insert into dept_new3 values(20,null); 1 row created. insert into dept_new3 values(30,null); 1 row created. insert into dept_new3 values(60,null);

1 row created.

insert into dept_new3 values(90,null);
1 row created.



select table_name, partition_name, compression
from dba_tab_partitions
where table_name = 'DEPT_NEW3';

TABLE_NAME	PARTITION_NAME	COMPRESS
DEPT_NEW3	D1	ENABLED
DEPT_NEW3	D2	DISABLED
DEPT_NEW3	D3	ENABLED
DEPT_NEW3	SYS_P64	ENABLED
DEPT_NEW3	SYS_P65	ENABLED
DEPT_NEW3	SYS_P66	ENABLED

Advanced Compression





Compression History – Timeline (FYI Only)

- Index Compression since 8i
- Table Compression since 9i
 - No Additional License Requirement
 - Only for direct inserts
 - Compression Not Maintained with updates and normal inserts
 - Had to re-org table to re-compress over time.
- 11g Advanced Compression
 - Additional License Requirement
 - Compression Maintained with all DML activity
 - No re-orgs required after initial compression
- 11gR2 Hybrid Columnar Compression (with Exadata)

Advanced Compression (FYI Only)

- The Oracle Advanced Compression option contains the following features:
 - Data Guard Network Compression
 - Data Pump Compression (COMPRESSION=METADATA_ONLY does not require the Advanced Compression option)
 - Multiple RMAN Compression Levels (RMAN DEFAULT COMPRESS does not require the Advanced Compression option)
 - OLTP Table Compression
 - SecureFiles Compression and Deduplication. LZO compression algorithm added. Faster than ZLIB.

Advanced Compression – Test Case (FYI Only)

A test Example – basic CTAS clause:

select mysequence.nextval seq_id, owner, table_name, tablespace_name, cluster_name, iot_name, dbms_random.string('A',10) random_string from dba_tables where 1=2;

Test scenario

- 2 sets of 2 tables, each with a sequence based PK.
- One set with a random data value one without.
- Within a set, one table is compressed and the other is not.
- Run a Standard PL/SQL block, iterating 100 times to load data.
 - Use dbms_random for data for table with random column information.
 - Use 'XXXXXXXXXX' for the second set.

Advanced Compression – Results

Table Sizes and storage

Table Name	Kbytes	Ratio
ACTEST_NORANDOM_COMP	11776	36.11%
ACTEST_NORANDOM_NORMAL	18432	
ACTEST_RANDOM_COMP	14848	/17.14%
ACTEST_RANDOM_NORMAL	17920	

Data Load Time Comparisons

Table Name	Seconds	Ratio
ACTEST_NORANDOM_COMP	22.58	60.03%
ACTEST_NORANDOM_NORMAL	14.11	
ACTEST_RANDOM_COMP	///26.28	21.78%
ACTEST_RANDOM_NORMAL	21.58	

Advanced Compression & OLTP

- Compression is maintained at a block level.
- Maintained through DML operations.
- Compression ratio depends on "RANDOMness" of the data.
- DML Impact depends on "RANDOMness" of the data. Range of 10 to 30%.
 - More visible for bulk operations compared to single row operations.
- Significant Performance gains in selects, primarily due to reduced block scans.
 - Exacts / specifics depend on your compression ratio.
 - Table scans expect upto 50% reduction in block reads.
 - PK based access, impact not noticeable.
- Must evaluate on a case by case basis.



Exadata V1?



EXADATA







5x faster than V1

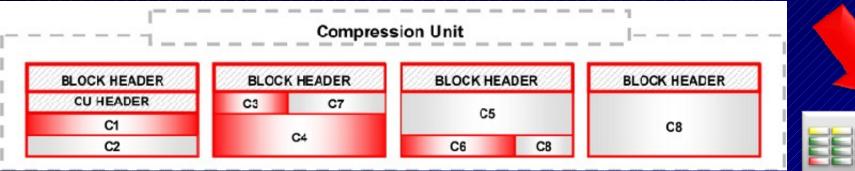
Exadata Hybrid Columnar Compression (EHCC) – 4-10x & 30x is common

- What is it (a HYBRID of column & row storage)?
 - Data organized by column and compressed vs. row
 - Tables organized in Compression Units (CU)-1000 rows?
 - CU's span many blocks (32K)
 - Good for data bulk loaded (not for OLTP single block)
- What's it for?
 - Query Data / DWHS (NOT frequently Updated)
- How much does it compress (old OLTP was 2-3x)?
 10x in a typical data warehouse compression; (*we got 4-11*)
 15x to 70x in archive compression (*cold* data); (*we got 32*)

Hybrid Columnar Compression

1. Column Data Compressed





2. Stored in Compression Units (Better compression when column data stored together) (Warehouse)



** Thanks Oracle for these images

Hybrid Columnar Compression

- Faster Operations: Query runs without decompression
 - Compressed/Processed in FLASH CACHE; lower I/O!
 - Compressed when sent over InfiniBand!
 - Cloned compressed!
 - Backed Up compressed!
 - Scans MUCH less (compressed) data
- Worth Noting:
 - Use standard table compression for OLTP
 - Single block lookup FASTER than other columnar storage
 - Updated rows migrate to normal / lower level compression

Hybrid Columnar Compression

- <u>Fully supported:</u>
 - B-Tree Indexes
 - Bitmap Indexes
 - Text Index
 - Materialized Views
 - Partitioning
 - Parallel Query
 - Data Guard Physical Standby
 - Logical Standby and Streams (FUTURE release)
 - Smart Scans of HCC tables!

Other Oracle Compression

- Data Pump Compression
 Compression = {ALL | DATA_ONLY | NONE}
- RMAN Backup Compression

 Compression Level LOW/HIGH (New in 11.2)
- Secure File Compression
 - LOW/MEDIUM/HIGH (2-3x compression)
 - Deduplication & Encryption
- Normal OLTP Table Compression (since 9.2)
 - 11g now supports INSERT/UPDATE
 - FASTER Algorithm
- Data Guard Redo Transport Compression

Object Maintenance





DATABASE

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Object Maintenance – Reorganize



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- Automatic Optimizer Statistics Collection
- Automatic Segment Advisor
- Automatic SQL Tuning Advisor (DBMS_SQLTUNE)
- Disable/Enable Automated Tasks:

DBMS_AUTO_TASK_ADMIN.DISABLE (ENABLE)

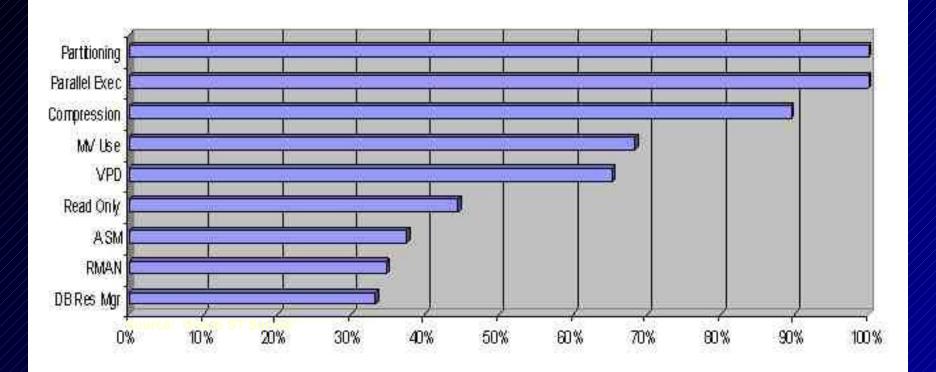
Setting up Maintenance Windows
 DBMS_SCHEDULER.CREATE_WINDOW





- Ability to online redefine tables that have materialized view logs:
 - Tables with materialized view logs can now be redefined online.
 - Materialized view logs are now one of the dependent objects that can be copied to the interim table with the DBMS_REDEFINITION.COPY_TABLE_DEPENDENTS package procedure.
- DBMS_STATS performance has been improved.

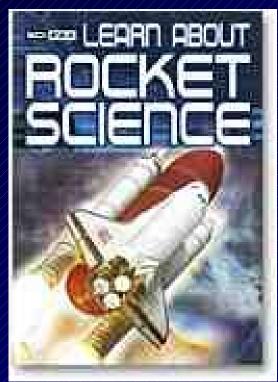
Large-Scale Data Warehouses* *Feature Usage*



* Oracle Survey

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Automatic Diagnostic Repository (ADR)

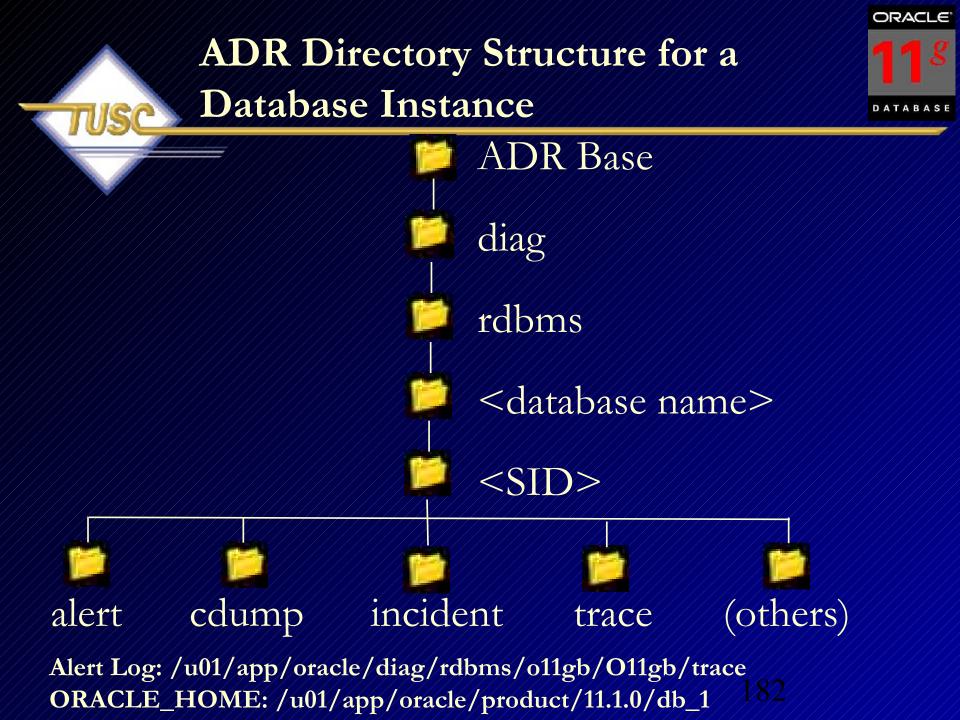


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Automatic Diagnostic Repository (ADR)

- Oracle 11g includes a Fault Diagnosability Infrastructure to prevent, detect, diagnose, resolve issues related to bugs, corruption, etc.
- When a critical error occurs it is assigned an incident number and all diagnostic data tagged with this in ADR.
- ADR is a file based repository outside of the database
- ADR helps detect problems proactively
- ADR helps limit the damage of interruptions
- ADR helps reduce problem diagnostic time
- ADR simplifies Oracle Support / Customer interaction
- The ADR also contains Health Reports, Trace Files, Dump Files, SQL Test Cases and Data Repair Records





DATABASE

ADR – V\$ Diagnostic Info



NAME	VALUE
Diag Enabled	TRUE
ADR Base	/u01/app/oracle
ADR Home	/u01/app/oracle/diag/rdbms/o11gb/011gb
Diag Trace	/u01/app/oracle/diag/rdbms/o11gb/011gb/trace///
Diag Alert	/u01/app/oracle/diag/rdbms/o11gb/011gb/alert
Diag Incident	/u01/app/oracle/diag/rdbms/o11gb/011gb/incident
Diag Cdump	/u01/app/oracle/diag/rdbms/o11gb/O11gb/cdump
Health Monitor	/u01/app/oracle/diag/rdbms/o11gb/011gb/hm
Default Trace File	/u01/app/oracle/diag/rdbms/o11gb/011gb/trace/011gb_ora_16676.trc
Active Problem Count	0
Active Incident Count	0

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ADR – V\$ Diagnostic Info 11R2 – No changes (that I saw)



1* select * from V\$diag_info
SYS@sillgr2> /

INST ID NAME VALUE 1 Diag Enabled TRUE 1 ADR Base /u01/app/oracle /u01/app/oracle/diag/rdbms/sillgr2/sillgr2 1 ADR Home /u@1/app/oracle/diag/rdbms/sillgr2/sillgr2/trace 1 Diag Trace 1 Diag Alert /u01/app/oracle/diag/rdbms/sillgr2/sillgr2/alert 1 Diag Incident /u01/app/oracle/diag/rdbms/sillgr2/sillgr2/incident 1 Diag Cdump /u01/app/oracle/diag/rdbms/sillgr2/sillgr2/cdump 1 Health Monitor /u01/app/oracle/diag/rdbms/sillgr2/sillgr2/hm /u01/app/oracle/diag/rdbms/sillgr2/sillgr2/trace/sillgr2 ora 8978.trc 1 Default Trace File 1 Active Problem Count 2 1 Active Incident Count

11 rows selected.

SYS@sillgr2> SYS@sillgr2> SYS@sillgr2>

Optimizer Statistics & Other Optimizer Advances



Special Thanks: Maria Colgan, Penny Avril & Debbie Migliore

Improved SPEED and Quality Gathering Stats – AUTO-SAMPLING

- <u>Manually gather stats</u>: Impossible to find sample size that works for ALL tables - need COMPUTE
- Especially hard to find a good sample size when the data distribution is very skewed.
- NEW Auto-sampling: "Discovers" the best sample size for every table in your system for you.
 - Get the Quality of a COMPUTE with SPEED of a SAMPLE
 - Oracle' goal is to OBSOLETE the need and use of sampling.
 - Accuracy is comparable to COMPUTE 186



- In 10g, if you gather stats on one partition after a bulk load it causes a full scan of all partitions to gather global table statistics with is extremely time consuming
- In 10g, you have to manual copy statistics to new partition
- In 11g Gather stats for TOUCHED PARTITIONS only!
- Table stats are refreshed WITHOUT scanning the un-touched partitions.

ORACLE



- Currently DBAs are scared to gather stats on a table that is changing for fear of unpredictable execution plans.
- You have to 'FREEZE' critical plans or stats.
- In 11g, gather stats and save as PENDING.
- Verify the new stats won't adversely affect things by checking them with a single user using an alter session or try them out on a different system.
- When everything looks good then, PUBLISH them for all to use!



select dbms_stats.get_prefs('PUBLISH', 'SH', 'CUST') publish from dual;

TRUE

exec dbms_stats.set_table_prefs('SH', 'CUST', 'PUBLISH', 'false'); PL/SQL procedure successfully completed.

select dbms_stats.get_prefs('PUBLISH', 'SH', 'CUST') publish from dual;

FALSE

Manage New Statistics Gather Stats but make them PENDING

select table_name, last_analyzed analyze_time, num_rows, blocks, avg_row_len
from user_tables
where table_name = 'CUST';

TABLE NAME ANALYZE T NUM_ROWS BLOCKS AVG_ROW_LEN

```
execute dbms_stats.gather_table_stats('SH', 'CUST');
PL/SQL procedure successfully completed.
```

```
select table_name, last_analyzed analyze_time, num_rows, blocks, avg_row_len
from user_tables
where table_name = 'CUST';
```

TABLE_NAME ANALYZE_T NUM_ROWS BLOCKS AVG_ROW_LEN

Manage New Statistics **PUBLISH Stats after Testing Complete**

alter session set optimizer_use_pending_statistics = true; (Then run your query – If ready/better – publish the new stats)

exec dbms_stats.publish_pending_stats('SH', 'CUST'); PL/SQL procedure successfully completed.

select table_name, last_analyzed analyze_time, num_rows, blocks, avg_row_len
from user_tables
where table_name = 'CUST';

TABLE_NAME	ANALYZE_T	NUM_ROWS	BLOCKS AVG	_ROW_LEN
CUST	13-0CT-07	55500	1485	180

exec dbms_stats.delete_table_stats('SH', 'CUST'); <to delete>



- Corporate data often has correlations between different columns of a table. For example:
 - A job title is correlated to the salary.
 - The season affects the sold amounts of items such as swim suits sell more in the summer and snow shoes sell more in the winter.
 - The make of a car and color are often used together but are not really correlated well so the filter doesn't reduce the result set.
- Optimizer has to estimate the correct cardinality
 - Will the additional column condition reduce the result set or not? Should it be used.
- Oracle calculates correlated statistics so the optimizer will make great decisions. Single column statistics and histograms are not enough!

Example

CORVETTE	40,000	RED	
CORVETTE	60,000	BLACK	X
CORVETTE	50,000	SILVER	

- Three records selected.
- Single column statistics are accurate

SELECT make, price, color
FROM cars_dot_com
WHERE make = `CORVETTE';

Make	Price	Color
CORVETTE	40,000	RED
CORVETTE	60,000	BLACK
CORVETTE	50,000	SILVER
CADILLAC	90,000	RED
JEEP	35,000	BLACK
JEEP	45,000	SLIVER

Example, cont.

RED

SELECT make, price, color
FROM cars_dot_com
WHERE make = `CORVETTE'
AND COLOR = 'RED`;

One record selected.

40,000

CORVETTE

- No correlated columns
- Additional predicate reduces result set
- Single column statistics are STILL sufficient

Make	Price	Color
CORVETTE	40,000	RED
CORVETTE	60,000	BLACK
CORVETTE	50,000	SILVER
CADILLAC	90,000	RED
JEEP	35,000	BLACK
JEEP	45,000	SLIVER

Example, cont.

CORVETTE	50,000	RED
CORVETTE	50,000	BLACK
CORVETTE	50,000	SLIVER

- Three records selected.
 - Correlated columns
 - Additional predicate <u>has no</u> <u>effect</u>
 - Single column statistics are NOT sufficient
 - Must use '=' and not < or >

SELECT make, price, color
FROM cars_dot_com
WHERE make = `CORVETTE'
AND PRICE = 50000;

Make	Price	Color
CORVETTE	50,000	RED
CORVETTE	50,000	BLACK
CORVETTE	50,000	SILVER
CADILLAC	90,000	RED
JEEP	35,000	BLACK
JEEP	45,000	SLIVER

Manage New Statistics – FYI Only EXTENDED Statistic Group

- Provides a way to collect stats on a group of columns
- Full integration into existing statistics framework

 Automatically maintained with column statistics
 Instantaneous and transparent benefit for any application
- Accurate cardinalities for inter-related columns

 Multiple predicates on the same table are estimated correctly

Manage New Statistics – FYI Only After normal Statistics Creation

select column_name, num_distinct, histogram from user_tab_col_statistics where table_name = 'CUSTOMERS';

COLUMN_NAME	NUM_DISTINCT	HISTOGRAM
CUST_VALID	2	NONE
COUNTRY_ID	19	FREQUENCY
CUST_STATE_PROVINCE	145	NONE
CUST_CITY_ID	620	HEIGHT BALANCED
CUST_CITY	620	NONE
CÚST_LAST_NAME	908	NONE
CUST_FIRST_NAME	1300	NONE
CUST_ID	55500	NONE
•••		
23 rows selected.		

Manage New Statistics – FYI Only Create EXTENDED Statistic Group

- Now lets create the extended statistics group & re-gather statistics on the CUSTOMER table (query user_tab_col_statistics to see new column):
- select dbms_stats.create_extended_stats('SH','CUSTOMERS', '(country_id, cust_state_province)') from dual;
- DBMS_STATS.CREATE_EXTENDED_STATS('SH','CUSTOMERS','(CO

SYS_STUJGVLRVH5USVDU\$XNV4_IR#4

exec dbms_stats.gather_table_stats('SH','CUSTOMERS', method_opt =>
 'for all columns size skewonly');
PL/SQL procedure successfully completed.
 198

Manage New Statistics – FYI Only Now there are Extended Statistics

select column_name, num_distinct, histogram from user_tab_col_statistics where table_name = 'CUSTOMERS';

COLUMN_NAME	NUM_DISTINCT	HISTOGRAM
SYS_STUJGVLRVH5USVDU\$XNV4_IR#4	145	FRÉQUENCY
CUST_VALID	2	FREQUENCY
COUNTRY_ID	19	FREQUENCY
CUST_STATE_PROVINCE	145	FRÉQUENCY
CUST_CITY_ID	62.0	HEIGHT BALANCED
CUST_CITY	620	HEIGHT BALANCED
CUST_LAST_NAME	908	HEIGHT BALANCED
CUST_FIRST_NAME	1300	HEIGHT BALANCED
CUSTID	55500	HEIGHT BALANCED
•••		

Manage New Statistics – FYI Only DROP Extended Statistics

exec dbms_stats.drop_extended_stats('SH', 'CUSTOMERS', '(country_id, cust_state_province)'); PL/SQL procedure successfully completed.

select column_name, num_distinct, histogram
from user_tab_col_statistics where table_name = 'CUSTOMERS';

COLUMN_NAME	NUM_DISTINCT	HISTOGRAM
CUST_VALID	2	NONE
COUNTRY_ID	19	FREQUENCY
CUST_STATE_PROVINCE	145	NONE
CUST_CITY_ID	620	HEIGHT BALANCED
CUST_CITY	620	NONE
CUST_LAST_NAME	908	NONE
CUST_FIRST_NAME	1300	NONE
CUST_ID	55500	NONE
23 rows selected.		



- The optimizer peeks at user-defined bind values during plan selection on the hard parse.
- Initial value of the binds determines the plan for all future binds (hopefully the first peek covers most queries)
- Same execution plan shared regardless of future bind values
- One plan is not always appropriate for all bind values for a given SQL statement
 - Where job= 'PRESIDENT' (use an index only one row)
 - Where job = 'OPERATOR' (don't use an index 90% of the table)
- If Oracle "peeks" and sees the President, it will use the index. Future queries also use the index without peeking after that (bad for the OPERATOR query). 201

Bind Peeking – Pre-11g

- If you need to tune a query that you suspect has issues related to bind peeking, use v\$sql_plan or tkprof output using different values for bind variables and compare execution plans in both cases.
- If you wish to deactivate bind peeking you can set:

alter system set "_OPTIM_PEEK_USER_BINDS"=FALSE;

<u>Note:</u> When running tkprof "explain=username/password" argument should NOT be used. That will cause tkprof to issue an explain plan whose output could differ from the execution plan info inside the raw 10046/sql_trace file.

Consider a Telephone Company...

SELECT Ename, Empno, Job FROM Emp WHERE Job = :B1 Value of B1 = 'OPERATOR';

Empno	Job
6973	OPERATOR
7499	OPERATOR
7521	OPERATOR
8739	PRESIDENT
7788	OPERATOR
7782	OPERATOR
	6973 7499 7521 8739 7788

Ename	Empno	Job
SMITH	6973	OPERATOR
ALLEN	7499	OPERATOR
WARD	7521	OPERATOR
SCOTT	7788	OPERATOR
CLARK	7782	OPERATOR

 If 'OPERATOR' is the bind value at hard parse, most records will be selected. Execution plan will be a full table scan

 If 'PRESIDENT' is the bind value at hard parse, few records will be selected. Execution plan will be an index search

Adaptive Cursor Sharing

Solution:

- In 11g, Oracle uses bind-aware cursor matching.
- Share the plan when binds values are "equivalent"
 - Plans are marked with selectivity range
 - If current bind values fall within range they use the same plan
- Create a new plan if binds are not equivalent
 Generating a new plan with a different selectivity range

Bind Peeking Cursor Sharing (cs) Statistics

select sql_id, peeked, executions, rows_processed, cpu_time from v\$sql_cs_statistics; (using the peeked value on the 2^{nd+} execution)

SQL_ID	P	EXECUTIONS	ROWS	PROCESSED	CPU_TIME
5wfj3qs71nd7m	/¥/	3		1	0/
2rad83pp613m1	/Y/	3		3	0
dr78c03uv97bp	N	1		3	0
dr78c03uv97bp	N	1		3	0
dr78c03uv97bp	/¥/	1		3	0
9qv6tq9ag5b80	/¥/	3		3	0
a2k4qkh681fzx	Y	3		2	0
413zr99jf9h72	N	1		1	0
413zr99jf9h72	N	1		1	0
413zr99jf9h72	Y_	1		<u>N</u>	0
fd69nfzww1mhm	/Y/	6		0	0

Bind Peeking – V\$SQL

select sql_id, executions, is_bind_sensitive, is_bind_aware
from v\$sql;

SQL_ID	EXECUTIONS			
9ugwm6xmvw06u	11	Y	N	
bdfrydpbzw07g	11	/Y/	N	
57pfs5p8xc07w	2.0	N	N	

 is_bind_sensitive – If 'Y', then Oracle is using multiple plans depending on bind variable.

 is_bind_aware – Oracle knows that the different data patterns may result depending on bind value. Oracle switches to a bind-aware cursor and may hard parse the statement.

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Security Enhancements





Security Enhancements

11g is more restrictive

 Password lock time (1), password grace time (7) and password life time (180) all more restrictive; Failed login attempts stays the same (10).

ORACLE

- Passwords will be case sensitive now! (on by default)
- Enhanced hashing algorithm for passwords / DES still available.
- Strong passwords (set via password complexity verification in EM or SQL):
 - Minimum 8 characters
 - At least one letter and one digit
 - Not servername or servername(1-100)
 - Not a common password (i.e. welcome1)
 - Must differ from previous password by 3 characters minimum

Security Enhancements AUDIT_TRAIL=DB (default)



- Audit Trail is ON by default (was off in 10g),
- AUDIT_TRAIL=DB is now the default.
- <u>Things that will be audited by default include:</u>
 - CREATE USER, CREATE SESSION, CREATE ANY TABLLE, CREATE ANY PROCEDURE, CREATE ANY JOB, CREATE EXTERNAL JOB, CREATE ANY LIBRARY, CREATE PUBLIC DB LINK
 - ALTER USER, ALTER ANY TABLE, ALTER ANY PROCEDURE, ALTER PROFILE, ALTER DATABASE, ALTER SYSTEM, AUDIT SYSTEM
 - DROP USER, DROP ANY TABLE, DROP ANY PROCEDURE, DROP PROFILE
 - GRANT ANY PRIVILEGE, GRANT ANY OBJECT PRIVILEGE
 - EXEMPT ACCESS POLICY
 - AUDIT SYSTEM
- Cost of Auditing improved to be 1-2% cost on TPCC benchmark.

All the Rest worth noting...

- SEC_CASE_SENSITIVE_LOGON=FALSE
- CONNECT Role only Create Session (vs. Tbl/View...)
- Consider: _NEW_INITIAL_JOIN_ORDERS=FALSE (CBO more join orders – higher parse times possible)
- GATHER_STATS_JOB on for all DML: DBMS_STATS.LOCK_TABLE_STATS('SH',"T1');
- Auto PROFILES if 3x better; Oracle Always Tuning...
- Statspack STILL works in 11g
- Real Time stats generated for high cpu queries Careful!
- Generate System Stats on migrate: Tune / 11g Parameters

Oracle Database Security Built over MANY years...



Oracle Audit Vault Oracle Database Vault

DB Security Evaluation #19 Transparent Data Encryption EM Configuration Scanning Fine Grained Auditing (9i) Secure application roles **Client Identifier / Identity propagation Oracle Label Security (2000) Proxy authentication Enterprise User Security Global roles** Virtual Private Database (8i) **Database Encryption API** Strong authentication (PKI, Kerberos, RADIUS) Native Network Encryption (Oracle7) **Database Auditing**

Government customer

1977

2007

Other 11gR2 Features

- Grid Plug and Play!!
- Oracle Restart DB, ASM, Listener after restart of software/hardware
- Out of Place Upgrades (zero downtime for patching)
- In Memory Parallel Execution & Auto Degree of Parallelism (DOP)
- Enterprise Manager for Provisioning, Clusterware, GPnP, Restart
- Universal installer (Remove RAC, de-install, downgrades, patches, restarts)
- ASM FS (file system) snapshots 64 images backup/reco/data mining!
- Intelligent data placement on fast tracks
- Flashback Data Archive support for DDL
- Instance caging allocate CPU usage to instances (CPU_COUNT)
- Compare SQL Tuning sets to each other
- Tuning Advisor can use auto DOP, searches historical performance, transport back to 10gR2 or later for testing.
- Virtual Columns can be in PK/FK of reference partition table
- Stored outline migration to SQL Plan Management (SPM)
- Automatic Block Repair

Other 11gR2 Features

- Exadata simulation identify areas that benefit from better I/O interconnect throughput
- Backup to Amazon S3 Simple Storage Solution Using OSB (Oracle Secure Backup Cloud Computing)
- Email notifications on all 11gR2 jobs
- Tablespace Point in Time Recovery
- Runtime only install of Apex
- Table annotations for Result Cache support (whether to use c/s)
- Oracle Spacial supports truck routing data sets to produce directions that include restrictions on truck use roads, weight, height, time of day, conditions.

Oracle Upgrade Case Studies (Thanks Mike Dietrich, Carol Tagliaferri, Roy Swonger: 11g Upgrade Paper – Oracle Germany)

University with about 20,000 users on Sun Solaris

- Moved 10 databases from 9.2.0.8 to 11.1.0.6
- -/Used SQL Tuning Advisor and SQL Performance Analyzer (SPA) to fix 94 queries
- Also moved to RAC, ASM & Data Guard
- -/ 30% more logins and yet Response Time is 50% LOWER!
- International Customer with 400+ databases on IBM AIX & EMC DMX disks
 - Moved from 9.2.0.8 to 11.1.0.6 54% slower
 - Used SPM, SPA, DB Replay to tune things...
 - Changed parameters to 11g 15% improvement
 - Gathered system stats 7% improvement
 - -/Used SPA 18% improvement
 - Turn on SQL Profiling (SPM) 8% improvement
 - /11g is now 11% FASTER than 9.2.0.8
- Data Warehouse customer on RH Linux 64-Bit
 - Moving from 10.2 to 11.1.0.7 with 50 databases each at around 10T
 - Over 200,000 partitions in the database
 - Silent Upgrade of 50 other DWHS's unattended using DBUA silent mode

The Future: 8 Exabytes Look what fits in one 10g Database!

2K – A typewritten page 5M – The complete works of Shakespeare 10M – One minute of high fidelity sound 2T – Information generated on YouTube in one day 10T – 530,000,000 miles of bookshelves at the Library of Congress 20P – All hard-disk drives in 1995 (or your database in 2010) 700P – Data of 700,000 companies with Revenues less than \$200M 1E - Combined Fortune 1000 company databases (average 1P each) 1E –Next 9000 world company databases (average 100T each) 8E - Capacity of ONE Oracle10g Database (CURRENT) 12E to 16E – Info generated before 1999 (memory resident in 64-bit) 16E – Addressable memory with 64-bit (CURRENT) 161E – New information in 2006 (mostly images not stored in DB) 1Z – 1000E (Zettabyte - Grains of sand on beaches -125 Oracle DBs) 100TY - 100T-Yottabytes – Addressable memory 128-bit (FUTURE)



8 Exabytes: Look what fits in one 10g Database!

- All databases of the largest 1,000,000 companies in the world (3E).
- 0r
- All Information generated in the world in 1999 (2E) or
- All Information generated in the world in 2003 (5E) or
- All Email generated in the world in 2006 (6E)
- 0r
- 1 Mount Everest filled with Documents (approx.)

V\$ Views over the years

Version	<u>V\$ Views</u>	<u>X\$ Tables</u>		
6	23	? (35)		
λ	72	126		
8.0	132	200		
8.1	185	271		
9.0	227	352		
9.2	259	394		
10.1.0.2	340 (+31%)	543 (+38%)		
10.2.0.1	396	613218		

Impact Tuning with Oracle

99.8% Less Data Accessed / 96.8% Time Reduction

Option Partitions Partitions / Tuned Parallel Query (20 Proc.) **Function-Based Index Materialized View** Cursor_Sharing Truncate **Driving** Table SGA Sizing 750,000 Query Mix

NOW Oracle will do all of this for you!!!

Before 120 sec - 310M 120 sec - 310M 230 sec 1206 sec - 3G 28 sec 240 sec 510 sec / 8G 900 sec 30 sec 5.1 T / 540 hours

<u>After</u> 0.43 sec - 200k 0.01 sec - 8k **18** sec 7 sec - 8k 3 sec **0.01** sec 0.40 sec / 32k 1 second 0.01 sec 9 G / 23 hours

Benefits Multiply*

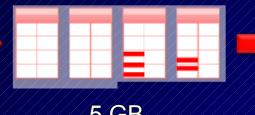
10 TB of user data Requires 10 TB of IO

1 TB with compression

100 GB with partition pruning



20 GB with Storage Indexes



5 GB with Smart Scans

Sub second On Database Machine



Data is 10x Smaller, Scans are 2000x faster

*Oracle Slide -

Easier way – Oracle's picture of Exadata V2 (X2-2)!

8 Compute Servers

- /8 x 2 sockets x 4 cores = 64 cores *
- 576 GB DRAM

InfiniBand Network

- 40 Gb/sec each direction
- Fault Tolerant



14 Storage Servers

- 14x12=168 Disks
- 100T SAS or
- 336T SATA

- 10 M	1.1	ETTTT				-	1000000 T	
	1	65655 I	1	33333				
	2			100000	-			-

- 5TB+ flash storage!



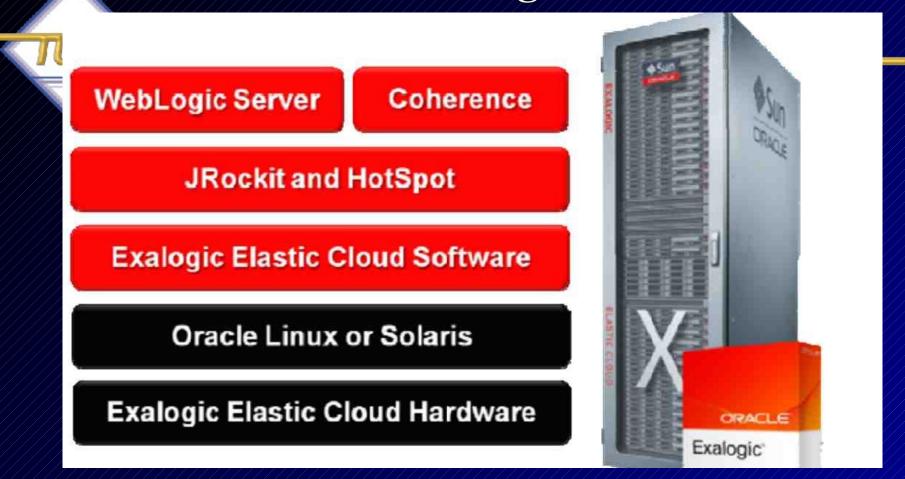
What's Next – Exadata X2-8



- 2 compute servers (7560 CPU at 2.26 GHz & 5T SAS)
 2 servers x 8 CPU sockets x 8 cores = 128 cores
- 2 compute servers x 1T DRAM = **2T DRAM**
- Same storage numbers...

<u>(FUTURE??</u> 8 servers = 512 CPUs & 8T of DRAM) /222

What's Next – Exalogic Elastic Cloud!



- Some points here Leveraging those acquisitions!
 - Coherence is a great product / NEW Linux Unbreakable Enterprise Kernel!
 - / 360 CPUs, 2.8T DRAM, 980G FlashFire SSD, 40T SAS Will help Fusion Apps Smoke!
 - 1M HTTP/sec could fit Facebook on 2 of these even thought there are 500M people on Facebook

Exadata = Paradigm Shift!



Oracle is never caught from behind Oracle's 30th Anniversary in 2007

- Great Sales/Marketing
- Great Database
- Applications Leader
- BI Leader
- Already in the lead
- GAME OVER



A Diverse Team is Oracle's Secret!

"Larry Ellison is the genius behind Oracle, the company, Bob Miner was the genius behind Oracle, the product. The combination of the diverse team Oracle has had over the years is the secret of their success!"

- Rich Niemiec, Select Magazine, 2001



Summary

- Know the Oracle
- Start Me Up Using Memory Target
- The Buffer Cache & The Result Cache
- Virtual Columns
- Invisible Indexes & Online Index Rebuilds
- Creating & Rebuilding Indexes Online
- Secure Files
- DDL Lock Timeout, PL/SQL Expressions/Simple Integer
- ADDM Enhancements
- SQL Plan Management (SPM) and capturing SQL Plan Baselines
- SQL Performance Analyzer, Access Advisor & Query Repair Advisor
- Real Application Testing (Database Capture and Replay)
- Interval Partitioning & Partition Compression
- Automatic Diagnostic Repository (ADR)
- Auto Sample, Creating Pending Statistics
- Adaptive Cursor Sharing and Bind Peeking
- EM, Grid Control, Security Enhancements & the Future Sizes



For More Information

www.tusc.com

- Oracle9i Performance Tuning Tips & Techniques; Richard J. Niemiec; Oracle Press (May 2003)
- Oracle 10g Tuning (June 11, 2007)

ORACLE DATABASE 10g Performance Tuning

COLUMNED THOY RECEIVE THE DANCES.

Tips & Techniques

Maximize System Performance with Proven Solutions from the Experts at 1050

RICHARD J. NIEMIEC

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¶* Oracle Press

ORACLE9[;] Performance Tuning *Tips & Techniques*

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Maximize System Performance and improve Response Time

RICHARD J. NIEWIEC

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

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更多信息

www.tusc.com

- Oracle9i Performance Tuning Tips & Techniques; Richard J. Niemiec; Oracle Press (May 2003)
- Oracle 10g Tuning (June 11, 2007)

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Oracle 9/ Performance Tuning Tips & Techniques Maximize System Performance and Improve Response Time

Oracle 9i 性能调整



Education



Oracle Database 10g 性能调整与优化

at & Oracle Database 15y R2

"成功只访问那些没空追求它的人。

- Henry David Thoreau

"You must BE the change you want to see in the world."

--Mahatma Gandhi



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- www.ioug.org, www.oracle.com, en.wikipedia.org & technet.oracle.com
- Thanks Dan M., Bob T., Brad, Joe, Heidi, Mike K., Debbie, Maria, Linda
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- Dedicated to the memory of Robert Delgado Patton, Stan Yellott, Mark Boston, Bay Manefield, Lax De Haan, Elaine DeMae and Jim Gray

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2010 Oracle Partner of the Year (7 Titans Total)



Prior Years Winner 2002, 2004*, 2007*, 2008 *Won 2 Awards

Rolta TUSC Services



Oracle

- E-Business Suite implementation, R12 upgrades, migration & support
- Fusion Middleware and Open Systems development
- Business Intelligence (OBIEE) development
- Hyperion Financial Performance Management
- DBA and Database tactical services
- Strategic Global Sourcing

• IT Infrastructure

- -/ IT Roadmap Security & Compliance Infrastructure Management
- Enterprise Integration / SOA High Availability and Disaster Planning

Profitability & Cost Management

- Financial Consolidation Budgeting & Forecasting
- Profitability & Risk Analysis Enterprise Performance Management
- Operational, Financial & Management Reporting

Rolta Software Solutions

- iPerspectiveTM rapid data & systems integration
- Geospatial FusionTM spatial integration & visualization
- OneViewTM business & operational intelligence

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www.tusc.com

Dedicated to the Memory of Robert Delgado Patton

Rich's Overview (rich@tusc.com)



- Advisor to Rolta International Board
- Former President of TUSC
 - -/Inc. 500 Company (Fastest Growing 500 Private Companies)
 - /10 Offices in the United States (U.S.); Based in Chicago
 - -/ Oracle Advantage Partner in Tech & Applications
- Former President Rolta TUSC & President Rolta EICT International
- Author (3 Oracle Best Sellers #1 Oracle Tuning Book for a Decade):
 - Oracle Performing Tips & Techniques (Covers Oracle7 & 8i)
 - Oracle9i Performance Tips & Techniques
 - Oracle Database 10g Performance Tips & Techniques
- Former President of the International Oracle Users Group
- Current President of the Midwest Oracle Users Group
- Chicago Entrepreneur Hall of Fame 1998
- E&Y Entrepreneur of the Year & National Hall of Fame 2001
- / IOUG Top Speaker in 1991, 1994, 1997, 2001, 2006, 2007
- MOUG Top Speaker Twelve Times
- National Trio Achiever award 2006
- Oracle Certified Master & Oracle Ace Director
- Purdue Outstanding Electrical & Computer and Engineer 2007



ORACLE DATABASE 10g Performance Tuning







Oracle Database 10g 性能调整与优化 通道Orace Database 15g P2