

# The Best Oracle Database 11g New Features

## Long Island, NY 2010



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# Audience Knowledge / Versions

- Oracle7 Experience ?
- Oracle8i Experience ?
- Oracle9i 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!*



TUSC

- 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 **Real Application Clusters**
- 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 still 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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Business / U.S. business

## Oracle to buy Sun Microsystems for \$7.4 billion Deal comes after IBM abandoned its bid for networking equipment maker

**Ap** Associated Press  
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 Solaris operating system, which

### Video



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### New Giant | A look at the two companies

	Oracle	Sun
Market Value*	\$93.79 billion	\$6.81 billion
Employees	86,500	30,000
FY08 Revenue	\$22.43 billion	\$13.88 billion
	<p>Services \$4.6</p> <p>Database \$11.6</p> <p>Business software \$6.2</p>	<p>Services \$5.3</p> <p>Servers \$6.3</p> <p>Storage \$2.4</p>
FY08 Profit	\$5.52 billion	\$403 million
Key Products	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 6/30/08; Oracle's fiscal year ended 5/31/08  
Source: WSJ Market Data Group



**CMF**

**MIGRATION**  
P-53 under scrutiny, where is the air? p. 22

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Is new architecture AMD's big advantage? p. 24

**WIRELESS**  
Will Wi-Fi's signal fade? p. 41

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# InformationWeek

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# Why will Oracle Win in the Future?

## My Reasons... (Teach your kids Oracle!)

The logo for TUSC is a diamond shape with a blue border and a white center. The letters "TUSC" are written in a bold, gold, sans-serif font across the center of the diamond. A horizontal gold line extends from the right side of the diamond across the top of the slide.

TUSC

- 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



TUSC

## 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 Pre-upgrade Tool
- Moving Data Files into ASM, SAN, and Other File Systems
- Oracle Base and Diagnostic Destination Configuration



# 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.

# The New Version – Life is Good!



\$ 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**

SQL> startup  
ORACLE instance started.  
Total System Global Area 422670336 bytes  
Fixed Size 1300352 bytes  
Variable Size 306186368 bytes  
Database Buffers 109051904 bytes  
Redo Buffers 6131712 bytes

Database mounted.  
Database opened.

```
SYS@sillgr2>  
SYS@sillgr2> select * from v$version;  
  
BANNER  
-----  
Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production  
PL/SQL Release 11.2.0.1.0 - Production  
CORE 11.2.0.1.0 Production  
TNS for Linux: Version 11.2.0.1.0 - Production  
NLSRTL Version 11.2.0.1.0 - Production  
  
SYS@sillgr2>  
SYS@sillgr2>  
SYS@sillgr2>  
SYS@sillgr2>
```

# Or... Use 11g EM...

The screenshot displays the Oracle Enterprise Manager 11g Database Control interface. The main window title is "ORACLE Enterprise Manager 11g - Database Control". The "Database instance" is "O11g". The current view is "Startup/Shutdown: Specify Host and Target Database Credentials".

The dialog box prompts the user to "Specify the following credentials in order to change the status of the database:"

**Host Credentials**  
Specify the OS user name and password to login to target database machine.

- Username: root
- Password: \*\*\*\*\*

**Database Credentials**  
Specify the credentials for the target database.  
This is an embedded dialog box. Only the user name and password are visible.

- Username: sys
- Password: \*\*\*\*\*
- Database: O11g
- Connect As: SYSDBA
- Use as Preferred Credential

A note at the bottom of the dialog states: "Do NOT hit the next button to go to database as SYSDBA or SYSOPER. It is better to log on the server of the database."

Buttons at the bottom right: "Cancel" and "OK".

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

ORACLE

11<sup>g</sup>

DATABASE



The screenshot shows the Oracle Enterprise Manager 11g interface. The main window displays the status of a database instance named 'O11qb'. The instance is in a 'Down' state, indicated by a red downward arrow. The status message reads: 'Status: Down Details: There has been a user-initiated shutdown'. The instance details include Host, Port 1521, SID O11qb, and Oracle Home path. Below this, the 'Listener' status is shown as 'Up' with a green upward arrow. However, the 'Agent Connection to Instance' is 'Failed', indicated by a red downward arrow, with the error message 'ORA-01034: ORACLE not available'. The page includes navigation buttons for 'Startup' and 'Perform Recovery', and a 'Related Links' section with links to 'Recovery Settings', 'Monitor in Memory Access Mode', and 'Support Workbench'. The footer contains copyright information for Oracle and links to 'Database' and 'Help'.



# Database Information - UP!

## 11gR1



Monitor Database (UP)

Users are Definitely Using it!

We have an alert – we logged on as SYS

The screenshot shows the Oracle Enterprise Manager 11gR1 interface for the database instance 'orcl'. The page is titled 'Database Instance: orcl' and includes several sections:

- General:** Shows the instance is up since Oct 25, 2007 8:09:07 AM CDT. The version is 11.1.0.6.0. The host is [REDACTED].
- Host CPU:** A bar chart showing CPU usage. The load is 0.31 and the foreground load is 0.00. The maximum CPU is 1.
- Active Sessions:** A bar chart showing the distribution of active sessions by type: Wait (orange), User I/O (blue), and CPU (green).
- SQL Response Time:** A gauge showing the response time, which is currently unavailable.
- Diagnostic Summary:** Shows the last start time as Oct 31, 2007 1:34:40 AM CDT. There are no errors.
- Space Summary:** Shows the database size as 1.0 GB. There are no errors.
- High Availability:** Shows the instance recovery time as 14 seconds. The usable flash recovery area is 100%.
- Alerts:** A table showing one warning alert: 'User Audit: Audited User' with the message 'User SYS logged on from [REDACTED]' triggered on Oct 31, 2007 1:34:40 AM.
- ADDM Performance Analysis:** Shows the period start as Oct 31, 2007 1:34:40 AM CDT and the period duration as 10.12 minutes. The impact is 67.8%.

# 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)

The screenshot shows the Oracle Enterprise Manager 11gR2 web interface. The top navigation bar includes 'Home', 'Performance', 'Availability', 'Security', 'Data Management', and 'Collection and Storage'. The main content area is divided into several sections: 'General' (showing database name 'ORCL', version '11.2.0.3.0', and host '192.168.1.100'), 'Host CPU' (a bar chart showing CPU usage), 'Active Sessions' (a bar chart showing sessions), 'SQL Response Time' (a bar chart showing response times), 'Diagnostic Summary' (a table of diagnostic information), 'Space Summary' (a table of space usage), 'High Availability' (a table of HA status), 'Alerts' (a table of alerts), and 'Policy Violations' (a table of policy violations). The 'High Availability' section is highlighted with a red arrow pointing to the 'HA Console' link. The 'Alerts' section shows a warning alert for 'Recovery Area User Audit'.



# Database Information - UP!

## High Availability Console - 11gR2

Events  
that are an  
issue

Flash  
Recovery  
Usage

The screenshot displays the Oracle High Availability Console for an Oracle Enterprise Manager 11g database. The browser window title is "High Availability Console - Windows Internet Explorer". The address bar shows the URL: [https://el11g2.nyvm.com:1551/ha/console/database/haConsole?event=details&target=el11g2.nyvm.com@oracle\\_database](https://el11g2.nyvm.com:1551/ha/console/database/haConsole?event=details&target=el11g2.nyvm.com@oracle_database). The page content includes:

- Availability Summary:** Status Up, Up Since Oct 9, 2009 1:30:20 PM CDT, Overall Availability 2.102%, Host: el11g2.nyvm.com, ASM Instance: +ASM:el11g2.nyvm.com, MAA Advisor: [Details](#).
- Availability Events:** A table with columns Severity, Message, and Target Time. One event is listed: Severity: Warning, Message: db\_recovery\_file\_dest\_size of 262144000 bytes is 91.00% used and has 2202096 remaining bytes available., Target Time: el11g2 Oct 9, 2009 1:30 PM.
- Backup/Recovery Summary:** Last Backup: N/A, Next Backup: N/A, Instance Recovery Time: 21 sec, Flashback Database: Disabled.
- Flash Recovery Area Usage:** Flash Recovery Area: +FRA01 (220.0 MB). A pie chart shows 21.0 MB Unused and 229.0 MB Used (Non-reclaimable).
- Data Guard Summary:** Oracle Data Guard is not configured or this database.
- Additional Links:** [All Metrics](#), [Metric and Policy Settings](#), [High Availability Operations](#).

At the bottom, there is a footer with copyright information: "Copyright © 1996, 2009, Oracle. All rights reserved. Oracle, JD Edwards, PeopleSoft, and People are registered trademarks of Oracle Corporation and/or its affiliates. Other names may be trademarks of their respective owners. About Oracle Enterprise Manager".

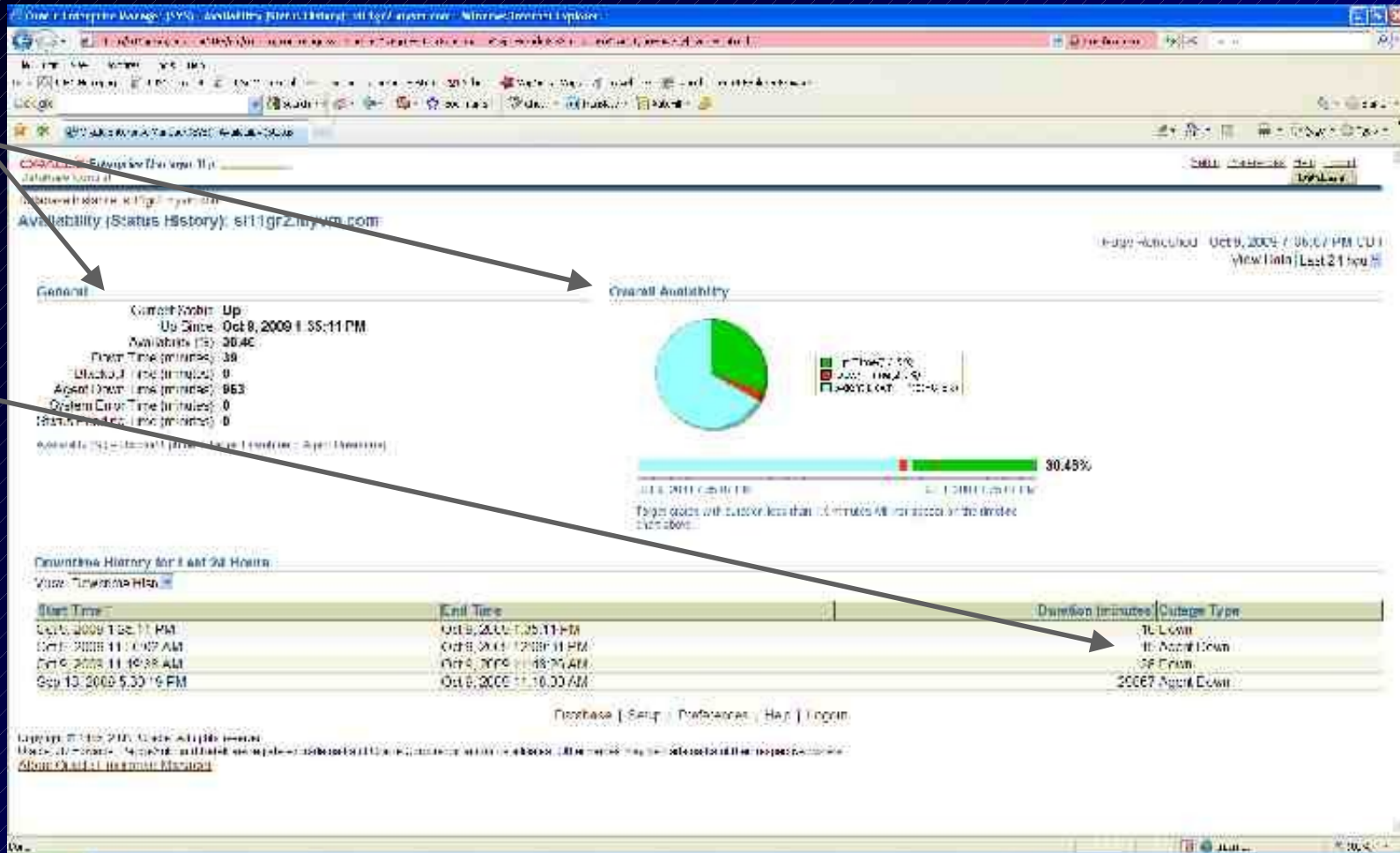


# Database Information - UP!

## HA - Availability - 11gR2

Up Time

Outage Type





# Database Information - UP!

## HA Host - 11gR2

RH 5.2

Latest Security Evaluation

The screenshot displays the Oracle Enterprise Manager console for host: sl11gr2.myvm.com. The interface includes a navigation menu with options like Home, Performance, Administration, Targets, and Configuration. The main content area is divided into several sections:

- General:** Shows the host status as 'Up', last booted on Oct 9, 2009 12:03:07 PM (UTC-05:00), and an availability of 33.29% (last 24 hours). It also lists system details such as Operating System (Red Hat Enterprise Linux Server release 5.2), Hardware Platform (i386), IP Address (192.168.116.11), CPUs (1), Memory Size (1654 MB), Local File Systems (12.42 GB), and Disk Groups Space (3.35 GB).
- Alerts:** A table showing one alert: 'Filesystem Space Available (%) for A01' with a severity of 'Warning' and triggered on Sep 17, 2009 1:47:44 PM.
- Policy Violations:** Shows a current score of 51.0, distinct rates violated of 11.0, and a compliance score of 76%.
- Security:** The last security evaluation was on Oct 9, 2009 1:34:57 PM CDT, with a compliance score of 67%. A link for 'Enterprise Security at a Glance' is provided.
- Critical Patch Advisories for Oracle Homes:** Shows 0 current advisories and notes that Oracle Metalink credentials are not configured.
- Job Activity:** Lists jobs scheduled to start in the next 7 days, with 0 scheduled, 0 running, and 0 suspended executions.



# Database Information - UP!

## HA Recovery Settings - 11gR2

Mean Time to Reco

Warns on *noarch* mode

Flash Reco Area Usage

The screenshot shows the Oracle Enterprise Manager Recovery Settings page. Key sections include:

- Instance Recovery:** A section explaining the Mean Time to Recover (MTTR) target. It includes a slider for 'Current Estimated Mean Time To Recover (seconds)' set to 0, with a 'Minutes' dropdown set to 0.
- Media Recovery:** A section with a warning that the database is currently in ARCHIVELOG mode. It notes that in NOARCHIVELOG mode, only the most recent backup can be used for recovery, and it provides instructions on how to switch to ARCHIVELOG mode.
- Log Archive File Name Format:** A table showing the format for archived redo log files.
 

Number	Archival Destination	Status	Type
1	ORACLE_HOME/BYRD1/ARCHIVELOG	VALID	ARCH
- Flash Recovery:** A section showing the 'Flash Recovery Area Usage' gauge, which is currently at 0%. Below the gauge, it shows 'Non reclaimable Flash Recovery Area (MB) 229' and 'Reclaimable Flash Recovery Area (B) 0'.



# MEMORY\_TARGET & Automatic Memory Management



# Automatic Memory Management (AMM)

## MEMORY\_TARGET in 11g



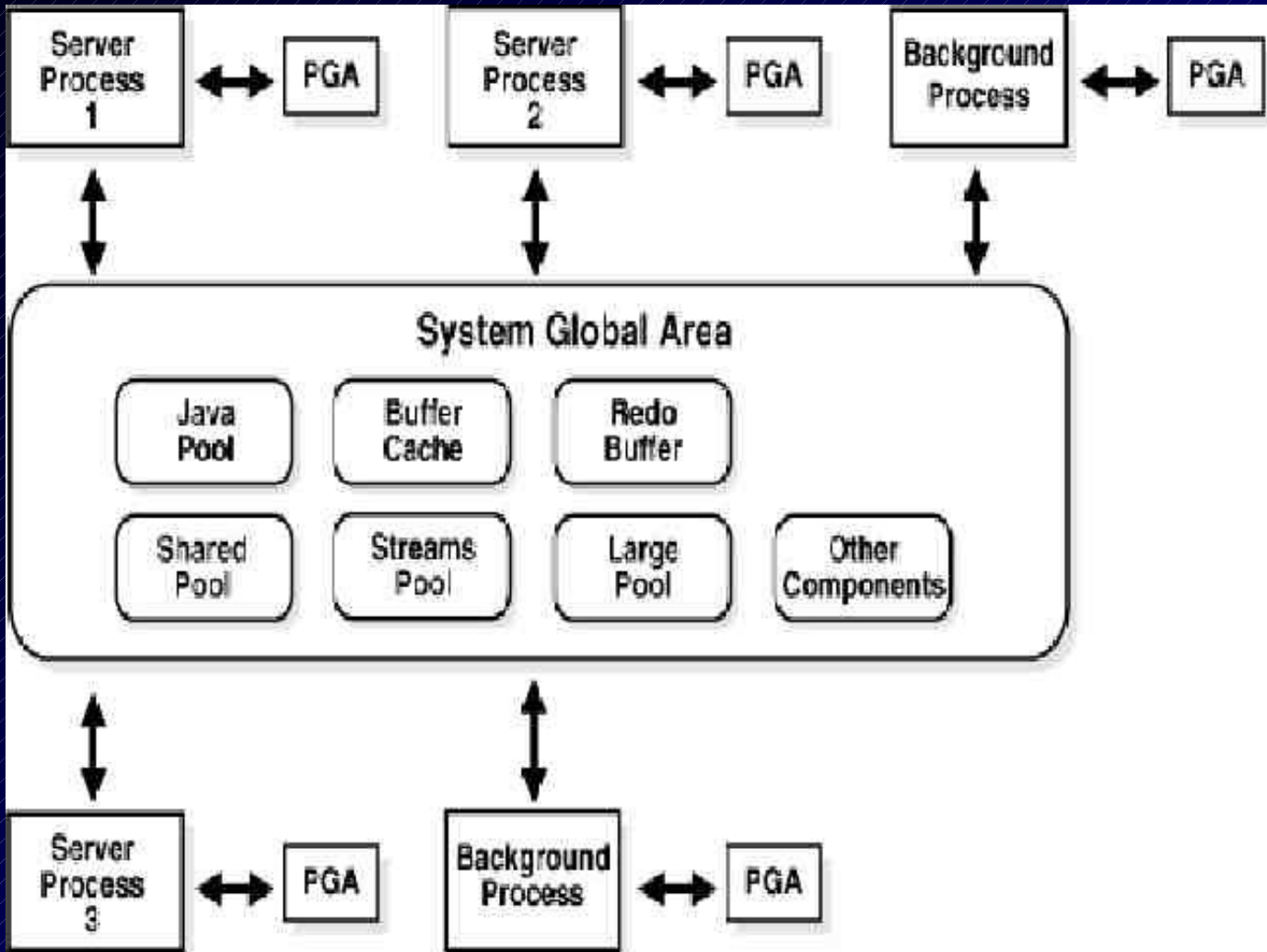
TUSC

- 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>	<u>Initialization Parameter</u>
Fixed SGA	None
Shared Pool	SHARED_POOL
Large Pool	LARGE_POOL_SIZE
Java Pool	JAVA_POOL_SIZE
Buffer Cache	DB_CACHE_SIZE
Streams Pool	STREAMS_POOL_SIZE



## Manually Sized SGA Components that Use SGA\_TARGET

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

### Program Global Area (now in MEMORY\_TARGET):

Aggregate PGA PGA\_AGGREGATE\_TARGET

# Automatic Memory Management (AMM)

## MEMORY\_TARGET in 11g



```
SQL> sho parameter sga_
```

NAME	TYPE	VALUE
sga_max_size	big integer	360M
sga_target	big integer	0

```
SQL> sho parameter memory
```

NAME	TYPE	VALUE
memory_max_target	big integer	360M
memory_target	big integer	360M



# Moving from SGA\_TARGET to: MEMORY\_TARGET



```
SQL> sho parameter target
```

NAME	TYPE	VALUE
memory_max_target	big integer	0
memory_target	big integer	0
pga_aggregate_target	big integer	110M
sga_target	big integer	250M



# 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
```

NAME	TYPE	VALUE
memory_max_target	big integer	360M
memory_target	big integer	360M
pga_aggregate_target	big integer	0
sga_target	big integer	0

# Moving from SGA\_TARGET to: MEMORY\_TARGET (set minimums)



```
ALTER SYSTEM SET SGA_TARGET=200;  
ALTER SYSTEM SET PGA_AGGREGATE_TARGET=100;
```

```
SQL> sho parameter target
```

NAME	TYPE	VALUE
memory_max_target	big integer	360M
memory_target	big integer	360M
pga_aggregate_target	big integer	100M
sga_target	big integer	200M



# Moving from SGA\_TARGET to: MEMORY\_TARGET - EM

Oracle Enterprise Manager (SYSTEM) - Me...

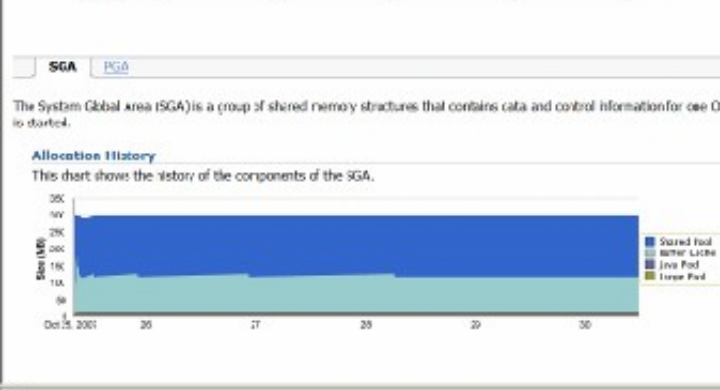
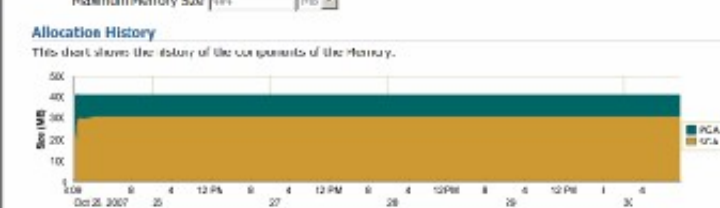
### Memory Advisers

When Automatic Memory Management is enabled, the database will automatically set the optimal distribution of memory. The distribution of memory will change from time to time to accommodate changes in the workload.

Automatic Memory Management: **Enabled** (Disable)

Total Memory Size: 104 MB (Advise)

Maximum Memory Size: 104 MB



Oracle Enterprise Manager (SYSTEM) - Me...

### SGA

The System Global Area (SGA) is a group of shared memory structures that contains data and control information for one Oracle database. The SGA is allocated in memory when an Oracle database instance is started.

### Allocation History

This chart shows the history of the components of the SGA.

### Current Allocation

Automatic Shared Memory Management: **Enabled**  
Total SGA Size (MB) **104**

SGA Component	Current Allocation (MB)
Shared Pool	104
Buffer Cache	104
Large Pool	1
Java Pool	12
Other	1

Apply changes to SPFILE only  
 The changes are made to the SPFILE and the running instance which requires that you restart the database to avoid static parameters.

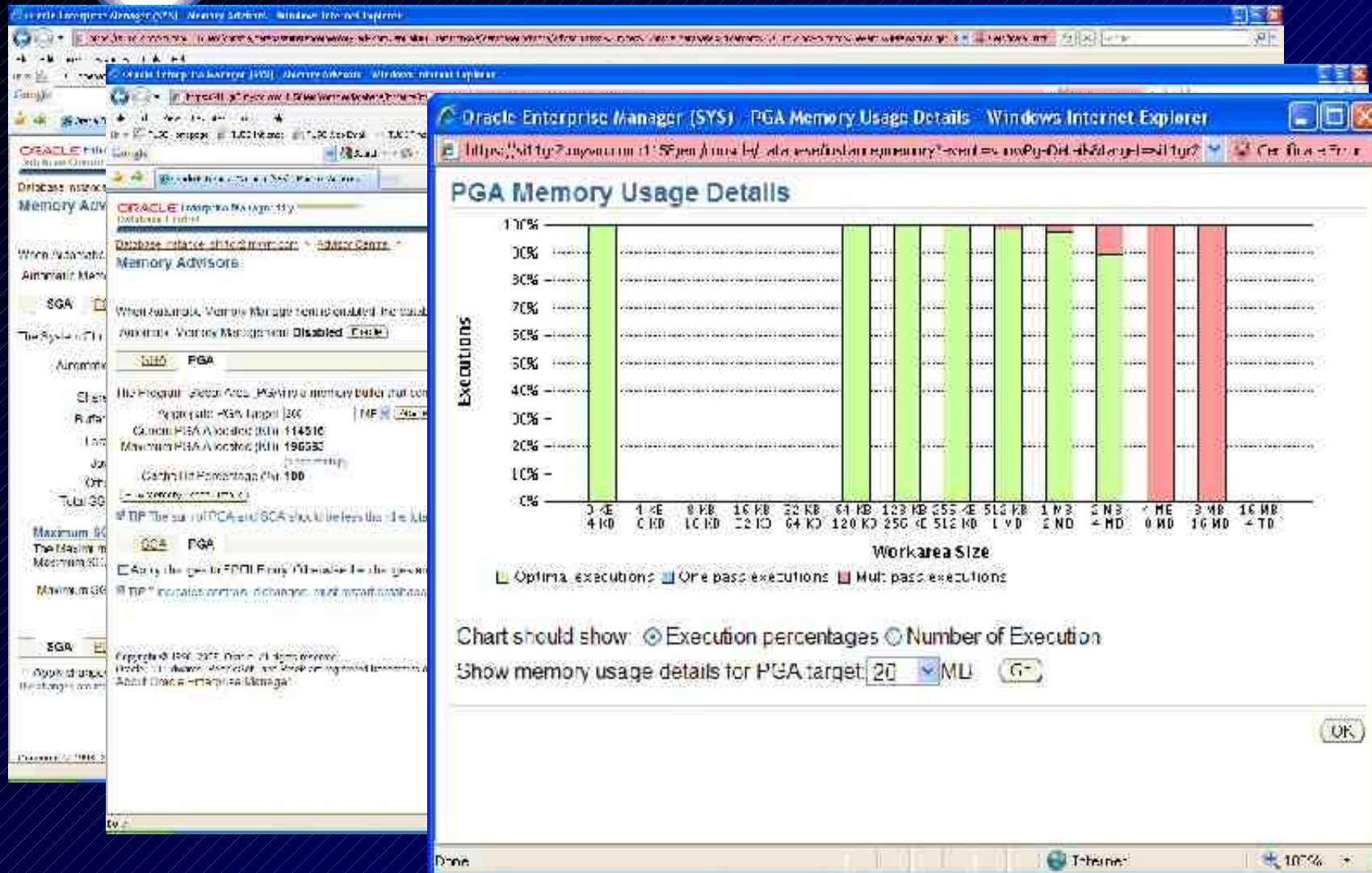
[Database](#) | [Setup](#) | [Performance](#) | [Help](#) | [Logout](#)

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# 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;
```

# Flush Buffer Cache Example



```
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
```



# The Result Cache

- Function Results of queries and query fragments can be cached in memory for **future executions**.
  - Choose calculations that frequently run
  - Choose data that does **NOT** frequently change
- **RESULT\_CACHE** & **RELIES\_ON** clauses
- **Takes its memory from the Shared Pool**
  - 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!!

# Result Cache Performance

## Example Query (1M Row Test)



```
select *
from (select *
      from (select t.country_name, t.city_name,
                  sum(t.salary) a_sum, max(t.salary) a_max
            from emps t
            group by t.country_name, t.city_name)
      order by a_max desc)
where rownum < 2;
```



# Result Cache Example Performance



Step 1 - In Session 1-

Executed query without hint and it returned an elapsed time of 3.80 seconds (**not cached**).

Step 2 - In Session 2 –

Executed query without hint and it returned an elapsed time of 3.20 seconds (**not cached**).

# Result Cache

## Example Performance



### Step 3 - 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 **RELIES\_ON 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;
```

...

```
END HR;
```

# 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



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



# 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\_handle* 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 | Bytes | Cost | Pstart | Pstop |  
-----  
| 0 | UPDATE STATEMENT | | 328 | 2296 | 2 | | |  
| 1 | UPDATE | JOURNAL_LINE | | | | | |  
| 2 | PARTITION RANGE ALL | | | | | 1 | 4 |  
| 3 | TABLE ACCESS FULL | JOURNAL_LINE | 328 | 2296 | 2 | 1 | 4 |  
-----  
-----
```

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 function-based 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.

# The Virtual Column



TUSC

```
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.*



# The Virtual Column

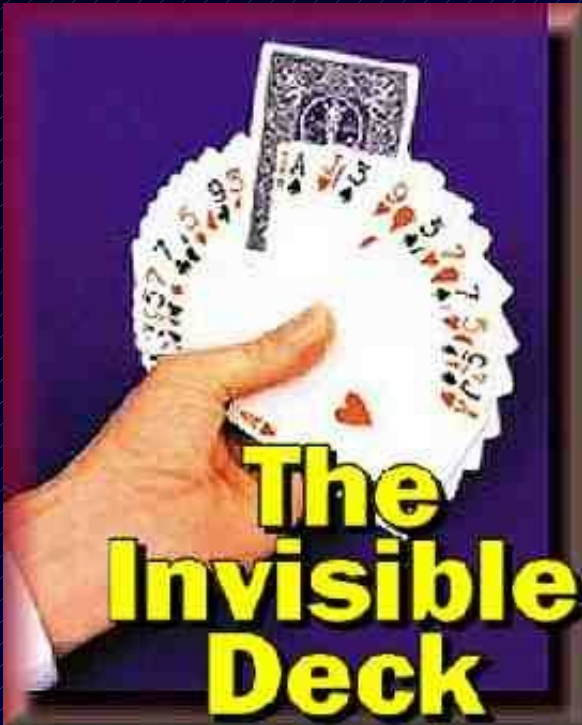
```
select * from emp_rich;
```

EMPNO	SAL	YEARLY_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

...



# The Invisible Index



# The Invisible Index

The logo for TUSC (The University of South Carolina) is a diamond shape with a blue and white gradient, containing the letters 'TUSC' in a gold, serif font. A horizontal gold bar extends from the right side of the diamond across the top of the slide.

TUSC

- 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!



# The Invisible Index

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

```
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	2	4 (0)	00:00:01
1	SORT AGGREGATE		1	2		
* 2	<b>TABLE ACCESS FULL</b>	<b>DEPT_RICH</b>	512	1024	4 (0)	0:00:01



# The Invisible Index

```
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
0	SELECT STATEMENT		1	2	1 (0)	00:00:01
1	SORT AGGREGATE		1	2		
* 2	<b>INDEX RANGE SCAN</b>	<b>DEPT_RICH_INV_IDX</b>	512	1024	1 (0)	00:00:01





# 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	Rows	Bytes	Cost (%CPU)	Time
0	SELECT STATEMENT		1	2	1 (0)	00:00:01
1	SORT AGGREGATE		1	2		
* 2	<b>INDEX RANGE SCAN</b>	<b>DEPT_RICH_INV_IDX</b>	512	1024	1 (0)	00:00:01



# 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 STATEMENT		1	2	4	(0)	00:00:01
1	SORT AGGREGATE		1	2			
* 2	<b>TABLE ACCESS FULL</b>	<b>DEPT_RICH</b>	512	1024	4	(0)	0:00:01



# The Invisible Index (check it)

```
alter index dept_rich_inv_idx invisible;
```

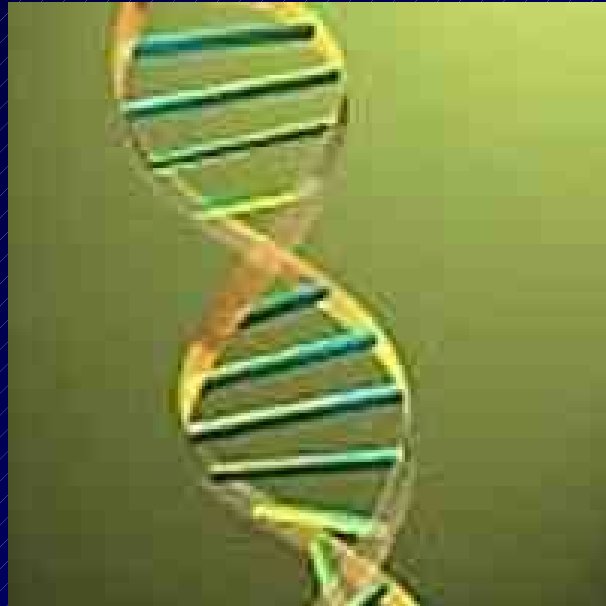
*Index altered.*

```
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;
```

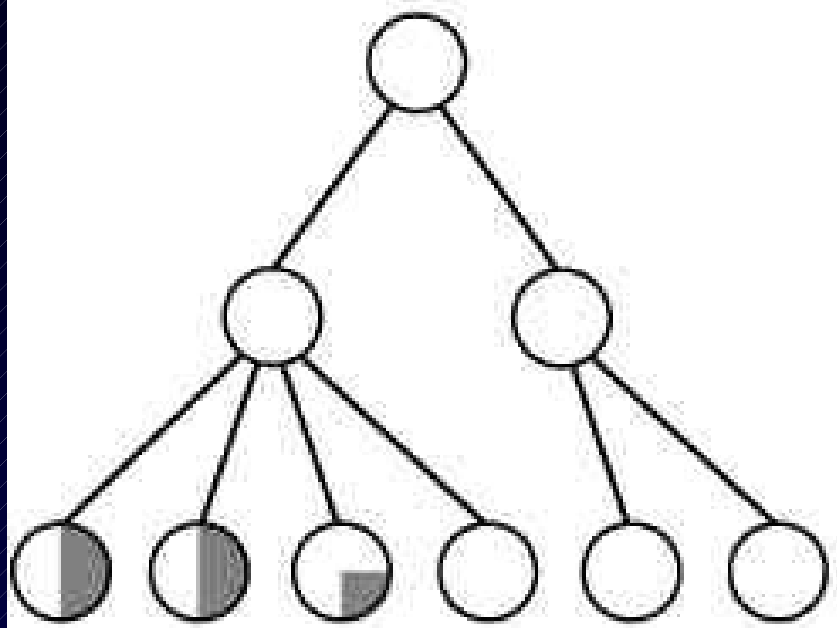
*Index altered.*

# Rebuild Index or Coalesce (FYI)

## Coalesce Example from Oracle Doc.

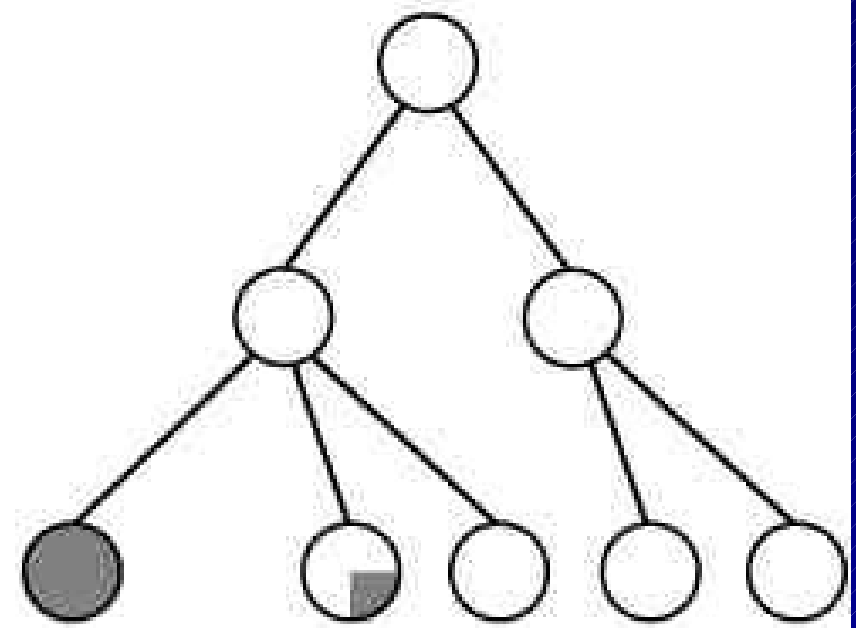


B-tree Index



Before ALTER INDEX vmoore COALESCE;

B-tree Index



After ALTER INDEX vmoore COALESCE;

# Rebuild Index or Coalesce



TUSC

## Rebuild:

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

## Coalesce

- 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

TUSC



**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.*



# Allow Sequences in PL/SQL Expressions



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

In 11g:

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



# Allow Sequences in PL/SQL Expressions

## 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;
```



# Simple Integer Data Type

- 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\_XEVEN
- 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\_TRANSFORM
- DBMS\_DATAPUMP
- DBMS\_EXPFIL
- **DBMS\_FLASHBACK**
- DBMS\_HS\_PASSTHROUGH
- DBMS\_LOB
- DBMS\_LOGSTDBY
- DBMS\_MGWADM
- DBMS\_MVIEW
- DBMS\_PREDICTIVE\_ANALYTICS
- DBMS\_RESOURCE\_MANAGER
- DBMS\_RLMGR
- DBMS\_RULE\_ADM
- DBMS\_SCHEDULER
- DBMS\_SERVER\_ALERT
- **DBMS\_SESSION**
- **DBMS\_SPACE**
- **DBMS\_SQL**
- **DBMS\_SQLTUNE**
- **DBMS\_STATS**
- DBMS\_STREAMS\_ADM
- DBMS\_TRACE
- DBMS\_UTILITY
- DBMS\_WORKLOAD\_REPOSITORY
- DBMS\_XDB
- DBMS\_XMLSCHEMA
- **DBMS\_XPLAN**
- UTL\_INADDR
- UTL\_RECOMP
- UTL\_SMTP
- UTL\_TCP



## 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**

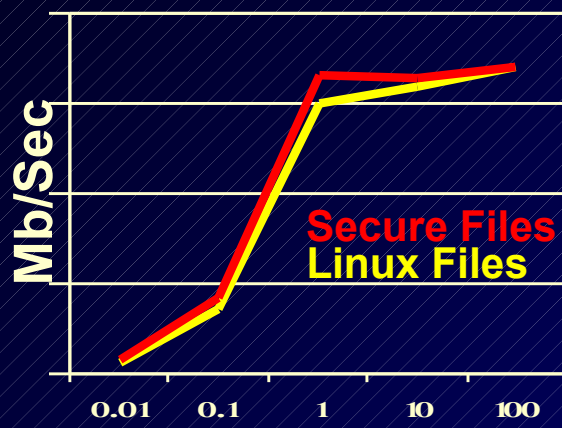


# Oracle Secure Files

## Better Performance than LOBs...

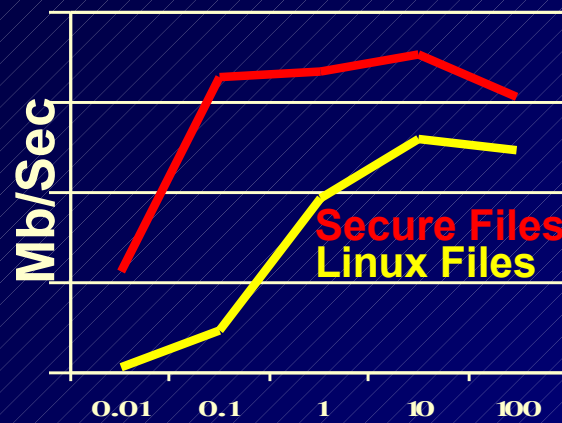
TUSC

### Read Performance



File Size (Mb)

### Write Performance



File Size (Mb)

Adding Files using New Disk Space – **2x faster than LOBs**

Adding Files using Deleted Space – **22x faster than LOBs**

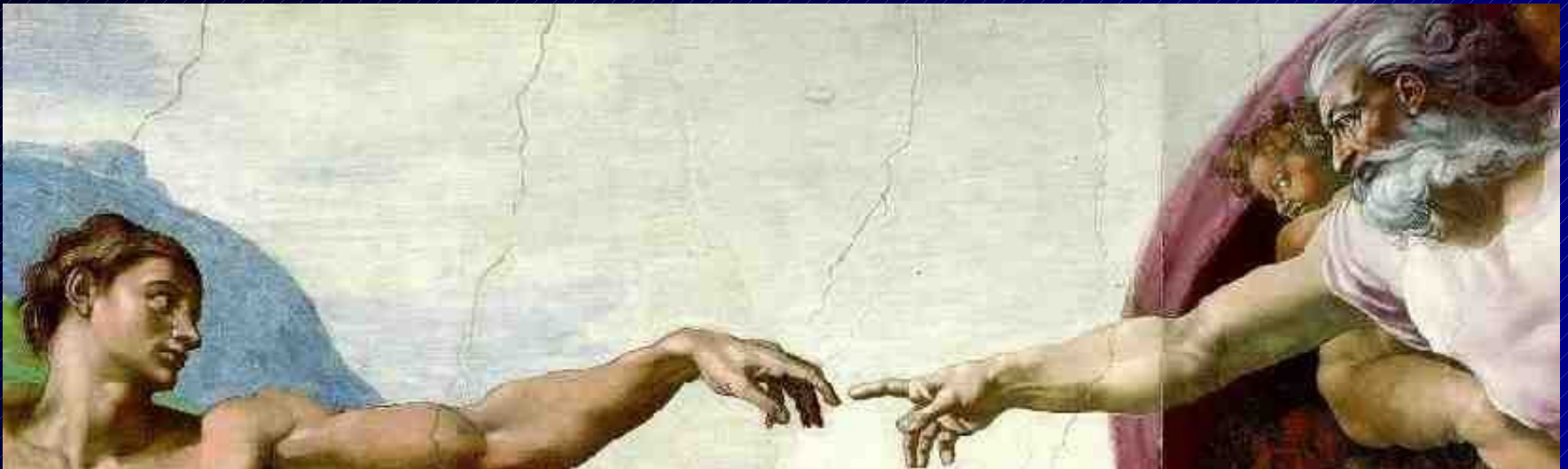
PL/SQL Reads – **6x Faster than LOBs**

*Your mileage will vary....*



# ADDM Enhancements

## (Automatic Database Diagnostic Monitor)



# ADDM enhancements

The logo for TUSC (The University of South Carolina) is a diamond shape with the letters 'TUSC' inside. A horizontal line passes through the diamond, and there are two parallel lines below it.

- 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

Specific Database Instance

We have 5 ADDM Findings

Check them Here

The screenshot displays the Oracle Enterprise Manager interface for a database instance named 'orcl'. The top navigation bar includes 'Home', 'Performance', 'Availability', 'Security', 'Schema', 'Data Movement', and 'Software and Support'. The main content area is divided into several sections:

- General:** Shows instance status (Up since Oct 25, 2007 8:09:07 AM CDT), name (orcl), version (11.1.0.6.0), and host information.
- Host CPU:** A bar chart showing CPU usage, with a total load of 63% and a maximum CPU of 1.
- Active Sessions:** A bar chart showing session counts for Wait, User I/O, and CPU.
- SQL Response Time:** A gauge showing response time, with a note that the reference collection is empty.
- Diagnostic Summary:** Lists ADDM Findings (5), Critical Start Time (Oct 31, 2007 1:34:40 AM CDT), Alert Log (No OMS errors), and Active Instances (0).
- Space Summary:** Provides details on Database Size (100%), Problem Thresholds (0), Segment Advisor Recommendations (0), Policy Violations (0), and Dump Area Usage (21%).
- High Availability:** Shows Instance Recovery Time (14 sec), Redo Backup (n/a), Usable Flash Recovery Area (100%), and Flashback Database Logging (Disabled).
- Alerts:** A table listing alerts, with one warning alert: 'User Audit: Audited User' with a message 'User SYS logged on from ora1[redacted]' triggered on Oct 31, 2007 1:09:55 AM.
- ADDM Performance Analysis:** Shows a period start time of Oct 31, 2007 1:34:40 AM CDT, a duration of 10.12 minutes, and an impact of 67.8. A finding is listed: 'Scheduler: Mail Drop' with 2 occurrences in the last 24 hours.



# ADDM Briefly



Top ADDM Findings

Click a Single Timeframe

Let's Check the Hard Parse Issue

ORACLE Enterprise Manager 11g Database Control

Database Instance: 011gb > Advisor Central > Logged In As SYS

### Automatic Database Diagnostic Monitor (ADDM)

Page Refreshed: Mar 23, 2007 10:00:28 PM CDT [Refresh]

#### Database Activity

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

Zoom

**TIP** For an explanation of the icons and symbols used in this page, see the [Icon Key](#)

#### ADDM Performance Analysis

Task Name: **ADDM:1471326733\_1\_130** Time Range: **Mar 22, 2007 10:47:01 PM to Mar 22, 2007 11:19:01 PM**

Task Owner: **SYS** Average Active Sessions: **0.6** Period Start Time: **Mar 22, 2007 10:00:23 PM CDT** Duration: **60.7** (minutes)

Impact (%)	Finding	Occurrences (last 24 hrs)
30	<a href="#">Hard Parse Due to Parse Errors</a>	1 of 23
10	<a href="#">PL/SQL Execution</a>	1 of 23
9.1	<a href="#">Top Statements by I/O</a>	1 of 23
8.7	<a href="#">Hard Parse Due to Invalidations</a>	1 of 23
8.1	<a href="#">"Scheduler" Wait Class</a>	1 of 23
5.1	<a href="#">I/O Throughput</a>	1 of 23
4.2	<a href="#">PL/SQL Compilation</a>	1 of 23
2	<a href="#">Unusual "Application" Wait Event</a>	1 of 23

Informational findings



# ADDM Briefly



**ORACLE Enterprise Manager 11g**  
Database: Control

Database Instance: O11g | Advisor: Control | Automatic Database Diagnostic Monitor (ADDM): SYS.ADDM:1471326733 | 130

### Performance Finding Details: Hard Parse Due to Parse Errors

Finding: **Hard parsing SQL statements that encountered parse errors was consuming significant database time.** (Finding History)

Impact (Active Sessions): **.19**  
Impact (%): **30**  
Noted Start Time: **Mar 22, 2007 10:00:23 PM CDT**  
Period Duration (minutes): **60.7**  
Filtered: **No** (Filter)

**Recommendations**  
[Show All Details](#) | [Hide All Details](#)

Details	Category	Benefit (%)
Hide	Application Analysts	30

Action: **Investigate application logic to eliminate parse errors.**

#### Findings Path

[Expand All](#) | [Collapse All](#)

Findings	Impact (%)	Additional Information
Hard parsing SQL statements that encountered parse errors was consuming significant database time.	30	
Hard parsing of SQL statements was consuming significant database time.	41.2	
Contention on latches related to the shared pool was consuming significant database time.	6.5	Additional Information
Wait class "Concurrency" was consuming significant database time.	6.5	

Database | Setup | Preferences | Help | Logout

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[About Oracle Enterprise Manager](#)

### Additional Information

Waits for "library cache lock" amounted to 6% of database time.

Done | Internet | 100%

Detailed Info & Findings

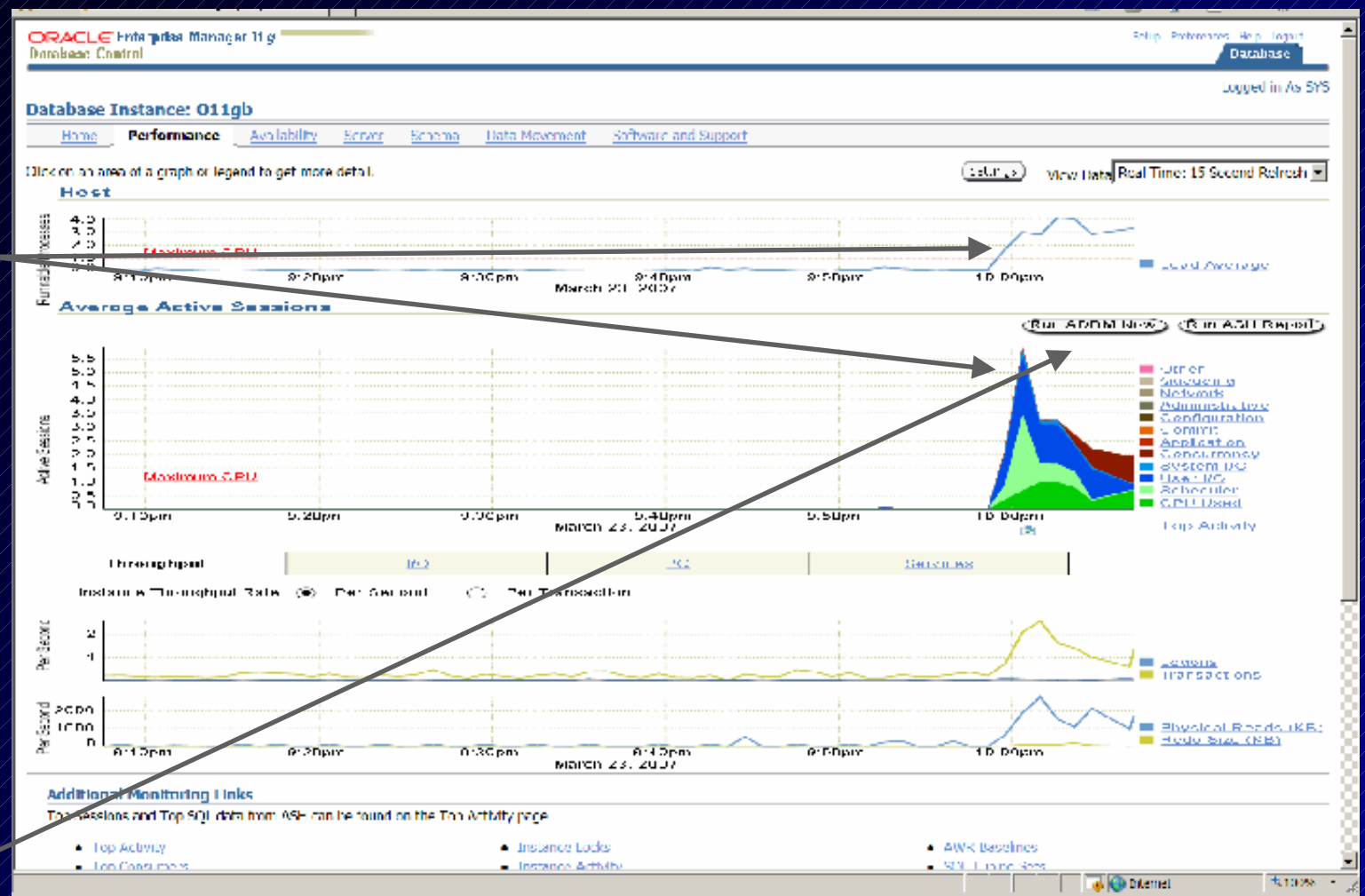
Add'l Info



# ADDM - Run NOW!

A Big Problem Occurs

Run ADDM NOW!



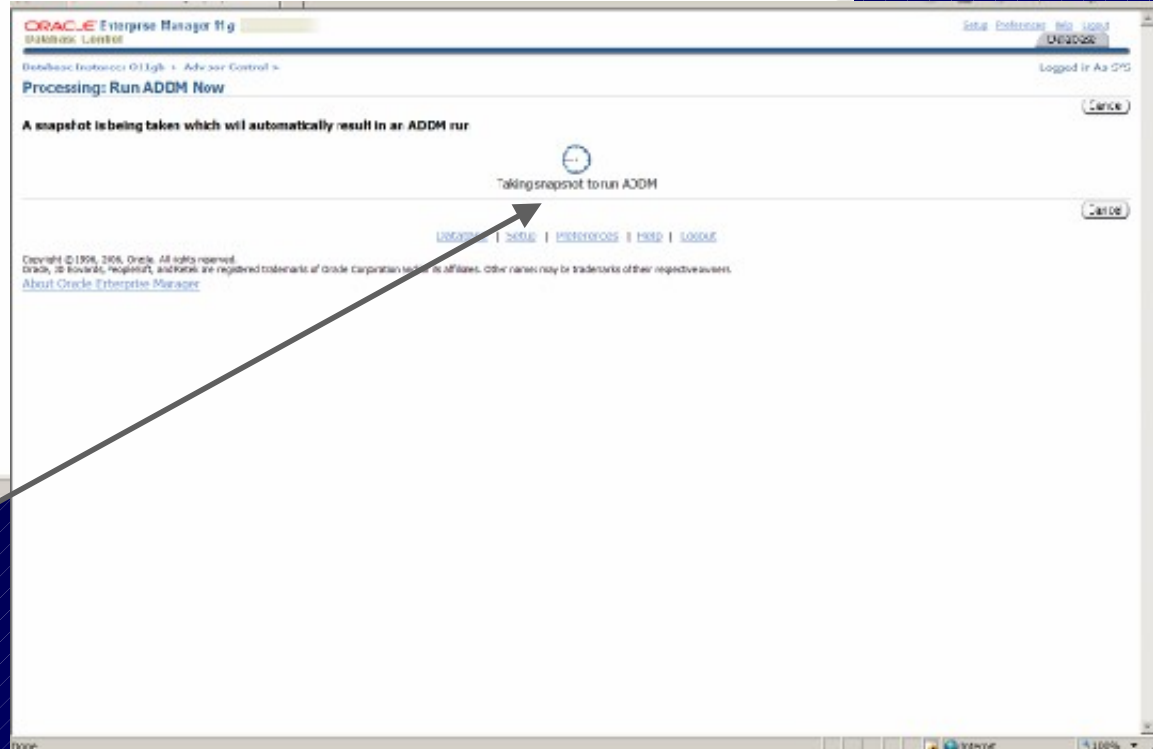


# ADDM - Run NOW!

Are you  
Sure?



Running







# ADDM – Run NOW!

Done.

CPU Issue

ORACLE Enterprise Manager 11g Database Control

Database Instance: O11ub > Advisor Central

Confirmation  
 ADDM has been run successfully

Automatic Database Diagnostic Monitor (ADDM)

Database Activity

ADDM Performance Analysis

Task Name: ADDM:L471326733\_L\_154 (End Time: Mar 23, 2007 10:08:55 PM)

Time Range: Mar 23, 2007 9:50:01 PM to Mar 23, 2007 10:22:01 PM

Task Owner: SYS      Average Active Sessions: 3.5      Period Start Time: Mar 23, 2007 10:00:46 PM CDT

Impact (%)	Finding	Occurrences (last 24 hrs)
100	CPU Usage	1 of 25
36.3	Top SQL by DB Time	3 of 25
23.0	Hard Parse Due to Parse Errors	3 of 25
22.0	"User I/O" wait class	3 of 25
18.3	R/SOL Execution	2 of 25
15.3	"Scheduler" wait class	3 of 25
8.6	Hard Parse Due to Invalidations	2 of 25
7.4	Top Segments by I/O	2 of 25



# ADDM – Run NOW!

Detail on CPU Issue?

Suggested Fixes

ORACLE Enterprise Manager 11g Database Control

Database instance: (11) t1g1 > Actions Center > Automatic Database Diagnostic Monitor (ADDM):SYS.ADDM:11/11/2007 11:15:4 > Logged in As SYS

### Performance Finding Details: CPU Usage

Finding: Host CPU was a bottleneck and the instance was consuming 80% of the host CPU. All wait times will be inflated by wait for CPU. [More...](#) [Show](#)

Impact (Active Sessions): **3.52**  
 Impact (%): **100**  
 Period Start Time: Mar 23, 2007 10:00:46 PM CDT  
 Period Duration (minutes): 8.2  
 Filtered: No [Filter](#)

#### Recommendations

[Expand All Details](#) | [Hide All Details](#)

Details Category	Benefit (%)
Host Configuration	100
Session CPU consumption was throttled by the Oracle Resource Manager. Consider revising the resource plan that was active during the analysis period.	77.8
Application Analysis	4

Additional Information  
 Host CPU consumption for peak 80% (80% resource available for use) is not available from the host OS. While disabling OSWk and Hg, to estimate the impact of this

#### Findings Path

[Expand All](#) | [Collapse All](#)

Findings	Impact (%)	Additional Information
Host CPU was a bottleneck and the instance was consuming 80% of the host CPU. All wait times will be inflated by wait for CPU.	100	<a href="#">Additional information</a>

Database | Setup | Preferences | Help | Logout

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 About Oracle Enterprise Manager

# ADDM – Run NOW!



View  
 The  
 Report

ORACLE Enterprise Manager 11g  
 Database Control

Database Instance: O11gb > Advisor Central > Automatic Database Diagnostic Monitor (ADDM):SYS.ADDM1471326733\_1\_154 > Logged In As SYS

**View Report** Save to File

ADDM Report for Task 'ADDM:1471326733\_1\_154'

-----

**Analysis Period**  
 -----  
 AWR snapshot range from 153 to 154.  
 Time period starts at 23-MAR-07 10:00:46 PM  
 Time period ends at 23-MAR-07 10:08:55 PM

**Analysis Target**  
 -----  
 Database 'O11GB' with DB ID 1471326733.  
 Database version: 11.1.0.3.0.  
 ADDM performed an analysis of instance O11gb, numbered 1 and hosted at  
 orallg [REDACTED]

**Activity During the Analysis Period**  
 -----  
 Total database time was 1721 seconds.  
 The average number of active sessions was 3.32.

**Summary of Findings**  
 -----

Description	Active Sessions percent of Activity	Recommendations
1 CPU Usage	3.32   100	3
2 Top SQL by DB Time	1.3   36.86	2
3 Hard Parse Due to Parse Errors	.9   25.56	1
4 "user i/o" wait class	.81   22.89	0
5 PL/SQL Execution	.65   18.87	2
6 "Scheduler" Wait Class	.54   15.28	0
7 Hard Parse Due to Invalidations	.3   8.6	1
8 Top Segments by I/O	.25   7.44	1
9 Undersized instance memory	.19   5	1

-----

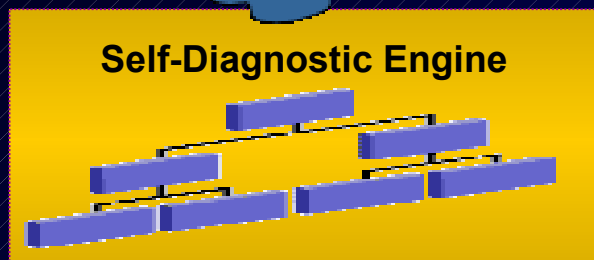
Findings and Recommendations  
 -----

Done Internet 100%



# ADDM for RAC

Database-Level  
ADDM  
11g



Instance-Level  
ADDM



- 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:

The logo for TUSC (The University of South Carolina) is a diamond shape with a blue border and a white center. The letters "TUSC" are written in a gold, serif font across the center of the diamond. A horizontal gold line with a shadow effect passes behind the diamond.

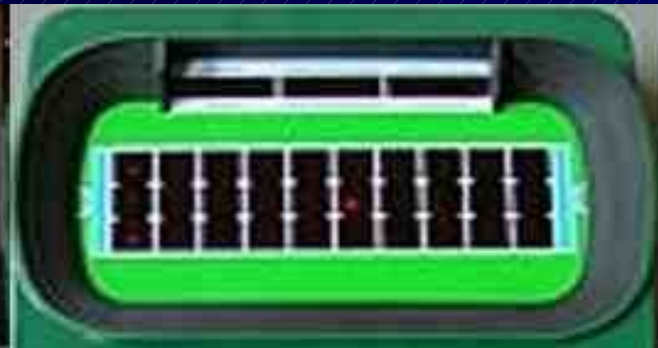
TUSC

- 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)

138	KANSAS	
139	S DIEGO S	
140	BYU	-27
141	RICE	-2
142	TULANE	
143	NAVY	
144	AIR FORCE	-3
145	STANFORD	
146	MTR DAME	-32
147	UTAH STATE	-28





# 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

Tuning Issue

Create a Tuning Set from Top 10 SQL

Oracle Enterprise Manager 11g Database Control

Database Instance: orcl

### 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 1:56:19 AM CDT

#### Top SQL

Activity (%)	SQL ID	SQL Type
77.51	2p6nkysqr48x	SELECT
7.35	2b0s4ybzkwf1y	PL/SQL EXECUTE
7.70	awcljqz6Mwpr	SELECT
2.40	anc9Dxs9Udha	PL/SQL EXECUTE
2.40	qtrbrw/p2hxy	SELECT
1.80	0v7r0y2bq89n8	PL/SQL EXECUTE
1.20	uakj0hdj1w2wf	SELECT
1.05	6092q1+00c0p2	PL/SQL EXECUTE
.75	13caylen1mp2a	PL/SQL EXECUTE
.60	qp5moard2udnw	SELECT

#### Top Sessions

Activity (%)	Session ID	User Name	Program
20.82	120	SYS	sqlplus@ora11g
19.40	121	SYS	sqlplus@ora11g
16.88	117	SYS	sqlplus@ora11g
5.72	137	SYSNAN	ONS
5.51	129	SYSNAN	ONS
4.35	125	DBSNMP	ONS
3.09	140	DBSNMP	emagent@ora11g
2.75	136	SYSNAN	ONS
2.53	130	SYSNAN	ONS
2.53	153	SYSNAN	ONS

Total Sample Count: 657



# Top Activity – 11gR2 (same look)



The screenshot shows the Oracle Enterprise Manager 11gR2 interface. The main heading is "Top Activity" with a sub-heading "Using this shared box to change the time period for the detail section below". Below this is a bar chart showing activity over time. A legend on the right lists various activity types: Other, Waiting, Instance I, Active Session, Configuration, Commit, Application, Instance V, Session I/O, User I/O, and Scheduler. Below the chart is a "Detail for Selected 6 Minute Interval" section. It includes a "Top SQL" table and a "Top Sessions" table.

**Top SQL**

Select Activity (%)	SQL ID	SQL Type
33.33	sgvntfms6sg	PL/SQL (SQL)
33.33	gmvsmgprtp	SQL (PL)
33.33	tsrjpkmsvtdg	SQL (PL)

**Top Sessions**

Activity (%)	Session ID	User Name	Program
90.98	21	SYS	oracle@11gpr2myvm.com (SMCO)
29.27	32	SYS	oracle@11gpr2myvm.com (CJ25)
1.88	12	SYS	oracle@11gpr2myvm.com (CJ25)
1.22	25	SYS	soplus@11gpr2myvm.com (TNS) (V)
1.22	12	SYS	oracle@11gpr2myvm.com (J000)
1.22	11	DBSNMP	OMS
1.22	11	SYS	oracle@11gpr2myvm.com (CJ25)

**Additional Monitoring Links**

- Top Consumers
- Evaluate SQL
- Duplicating Sessions
- Instance Locks
- Instance Activity
- Search Sessions
- AWR Baselines
- SQL Tuning Sets
- SQL Performance Analyzer

# SQL Plan Management

## Create a SQL Tuning Set



Tuning Set Name

Queries

ORACLE Enterprise Manager 11g  
Database Control

Instance: Instance: orcl > SQL Tuning Sets >  
Create SQL Tuning Set

Name:   
Description: Automatically generated by Top SQL

SQL Text

SQL Text	Parsing	Schema
SELECT (select owner    '    department_name segment_name, department_type segment_type, department_id extent_id, initial_size - double_id + 1 block#, block_flag, ...		SYS
BEGIN END; NO (FUNCTION) (IF) = READ*(1, 2, 3); END;		SYSMAN
SELECT * FROM DUAL;		SYSMAN
begin; insert into table table (column col) values ('NUMERIC CHARACTERS = " "'); end;		SYSMAN
SELECT rowid, sql_id, sql_plan_hash_value, sql_text, result_id, resource_usage, module, action, sql_text, DECODE(wait_time, 0, 'N/A', 1), time_waited, service_time, user_id, program_id, ...		DBSNMP
BEGIN END; EXECUTE IMMEDIATE ('ALTER SYSTEM SET STATISTICS_LEVEL = ALL;'); END;		SYSMAN
select value from v\$sesmtd where group_id = 2 and metric_id = 1;		DBSNMP
BEGIN MGMT_BAF_AQ_QUEUE_INFO_QUEUE_STAT(p_queue_id => s1, p_wait => s2, x_sql_text => s3, x_request => s4, x_timestamp => s5); %return_status => r1); END;		SYSMAN
begin; dbms_application_info.set_module(1, 2); dbms_application_info.set_client_info(3); dbms_application_info.set_identifier(4); end;		SYSMAN
/* OracleDBA */ SELECT TO_CHAR(CAST(toal.mtd_time AS TIMESTAMP) AT TIME ZONE 'GMT -YYYY-MM-DD HH:MM:SS.TZD') time, mdu.user_wal_dme_pct, ...		DBSNMP

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# SQL Plan Management Viewing a SQL Tuning Set



Tuning Set Name

Queries & Stats

ORACLE Enterprise Manager 11g  
Database Control  
Database Instance: orcl > SQL Tuning Sets >  
SQL Tuning Set: TOP\_SQL\_1193815473707

Schema: SYS  
Created: 10/31/07 2:25 AM  
Number of Statements: 10  
Description: Automatically generated by Top SQL  
Last Modified: 10/31/07 2:25 AM  
Total DB Time (H:M:S): 0:45:33

SQL Statements

Select	SQL ID	SQL Text	Plan Hash Value	Parsing Schema	Executions	Elapsed Time (seconds)	CPU Time (seconds)	Buffer Gets	Disk Reads	Module
<input type="checkbox"/>	2595aas2ujfww	/*_OracleOEM*/ SELECT TC_CHAR(CAST (nd.nd_time AS ...	3838994914	DBSNMP	252	12.24	9.97	12	1.00	emagent@ora (TNS V1-V3)
<input checked="" type="checkbox"/>	qtr8w7j2h5xy	SELECT sql_id, sql_plan_hash_value, sql_code_seg...	3098115615	DBSNMP	260	18.03	2.78	119	7.00	Realtime Connection
<input checked="" type="checkbox"/>	cahx0hdjw2uf	select value from utysystemtr where group_id = 2 and n...	1216221122	DBSNMP	247	47.62	4.19	4	0.00	Realtime Connection
<input checked="" type="checkbox"/>	2n6mkyregy48x	SELECT de.owner    '   de.segment_name    comment_semo...	1638994723	SYS	18	2198.80	784.59	9948946	1159982.00	sqlplus@ora (TNS V1-V3)
<input checked="" type="checkbox"/>	awc1jgz24twr	SELECT 'x' FROM DUAL	1338734953	SYSMAN	4668	33.95	2.51	0	0.00	OMS
<input checked="" type="checkbox"/>	2b064ybkwfiv	BEGIN EMD_NOTIFICATION_QUEUE_READY; L (:2, :3); END;	0	SYSMAN	1659	35.19	9.78	51685	57.00	OEM.SystemPool
<input checked="" type="checkbox"/>	43c5ykm1mcj2a	begin dhms_application_info.set_module ('1', :1), dhms_application...	0	SYSMAN	5239	11.70	4.76	336	36.00	OMS
<input checked="" type="checkbox"/>	6092q1430c6s2	BEGIN MGMT_PAF_A0.DEQUEUE_REQUEST (s_node_id => :1, p_wait =>...	0	SYSMAN	3338	53.77	15.20	30876	35.00	OEM.SystemPool
<input checked="" type="checkbox"/>	6v2r0y2bq82n8	BEGIN EMDVW.LOG_end_context (MGMT_JOB_ENGINE_MODULE_NAME, :1);...	0	SYSMAN	39648	81.89	53.20	169838	336.00	OEM.SystemPool
<input checked="" type="checkbox"/>	a4c10b290d4a	begin execute immediate 'alter session set NLS_NUMERIC_CHAR...	0	SYSMAN	4668	5.45	5.20	0	0.00	OMS



# SQL Plan Management

## Create a SQL Tuning Set



Run the  
Tuning  
Advisor  
on this  
SQL  
Tuning  
Set (STS)

Run it  
NOW

The screenshot shows the Oracle Enterprise Manager 11g Database Control interface. The page title is "Schedule SQL Tuning Advisor". The breadcrumb navigation is "Database Instances: orcl > Advisor Central > SQL Advisors >". The user is logged in as "As SYS".

The main configuration area is titled "Specify the following parameters to schedule a job to run the SQL Tuning Advisor:". It includes the following fields:

- Name: **SQL\_TUNING\_1193815579422**
- Description: rjn\_test
- SQL Tuning Set: **SYS.TOP\_SQL\_1:93815473707**

Below these fields, the "SQL Tuning Set Description" is "Automatically generated by Tcp SQL" and "SQL Statements Counts" is "10".

The "Scope" section has the following settings:

- Total Time Limit (minutes): 30
- Scope of Analysis:  Comprehensive (This analysis includes SQL Profile recommendation, but may take a long time.)
- Time limit per Statement (minutes): 5

The "Schedule" section has the following settings:

- Time Zone: America/Chicago
- Execution:  Immediately
- Date: Oct 31, 2007
- Time: 2:26:10 AM

At the bottom right, there are "Cancel" and "Submit" buttons. The footer contains copyright information for Oracle and links for "Database", "Setup", "Preferences", "Help", and "Logout".



# SQL Plan Management Create a SQL Tuning Set

Results

Select  
 One query  
 And click  
 View

Oracle Enterprise Manager (SYS) - SQL Tuning

ORACLE Enterprise Manager 11g  
 Database Control

Database Instance: orcl > Adviser Control >  
 SQL Tuning Results: SQL\_TUNING\_1193815570422

Page Refreshed: Oct 31, 2007 2:27:55 AM CDT

Status: **COMPLETED**  
 Started: Oct 31, 2007 2:26:32 AM  
 Completed: Oct 31, 2007 2:27:43 AM

Tuning Set Owner: SYS  
 Tuning Set Name: TOP\_SQL\_1193815473707  
 Time Limit (seconds): 1800  
 Running Time (seconds): 71

Recommendations

View: Incomplete | Refresh

Select SQL Text	Forcing Schema	SQL ID	Statistics	SQL Profile	Index	Restructure SQL	Miscellaneous Error
SELECT * FROM emp; -- design: human.management_name; design: type:emp; type:...	SYS	22c6k9vscv40s	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
BEGIN ENDW_LOG.set_context('Mgmt_JOB_ENGINE.MODULE_NAME',1); Mgmt_JOB_ENGINE.set_context('Mgmt_JOB_ENGINE.MODULE_NAME',1);	SYSMAN	6o70q2la09d0					<input checked="" type="checkbox"/>
BEGIN END_NOTIFICATION_QUEUE_READY(1,2,3); END;	SYSMAN	20664vrv047y					<input checked="" type="checkbox"/>
BEGIN MGMT_PAK_AQ_QUEUE_REQUIREMENT(mode_id => 1, p_wait => 2, p_smb => 4, p_s => 3, x_requested => 1);	SYSMAN	60S/Q1400d0z					<input checked="" type="checkbox"/>
select value from v\$systemic where group_id = 2 and metric_id = 3;	DBSNMP	6ab70c3w2wf					
SELECT * FROM DUAL	SYSMAN	6w10z04wpr					
SELECT event#, sql_id, sql_plan_hash_value, sql_opcode, session_id, session_serial#, module, action...	DBSNMP	qhd0w0d0lncv					<input checked="" type="checkbox"/>
/* OracleDB */ SELECT TO_CHAR(CAST (md.end_time AS TIMESTAMP) AT TIME ZONE 'GMT', ...	DBSNMP	6r56w0d00000					
begin dbms_application_info.set_module(1, 2); dbms_application_info.set_client_info(3); dbms_session...	SYSMAN	630v0v0m0000					<input checked="" type="checkbox"/>
begin execute immediate 'alter session set NLS_NUMERIC_CHARACTERS = ','.'; end;	SYSMAN	64d90a0f0d40					<input checked="" type="checkbox"/>

View: Incomplete | Refresh

Database | Setup | Preferences | Help | Logout

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# SQL Plan Management

## Click on any SQL ID



SQL Text

Waits & Statistics

The screenshot shows the Oracle Enterprise Manager 11g interface for a specific SQL statement. The page is titled "SQL Details: 2p6mkynsqy48x" and is logged in as SYS. The SQL text is displayed as follows:

```
SELECT de.owner || '.' || de.segment_name segment_name, ce.segment_type segment_type, de.extent_id extent#, bh.dbab.k - de.block_id + 1 block#, bh.lru flag,...
```

The "Details" section shows the Plan Hash Value as 1668994723. Below this, there are several tabs: "Statistics", "Activity", "Plan", "Plan Control", and "Timing History". The "Statistics" tab is active, showing a line graph of Active Sessions over time. The "General" section provides information about the SQL statement, including the Module (sqlplus@ora11gprodtest2.tuscil.com (TNS V1 V3)), Action, Parsing Schema (SYS), PL/SQL Source (SYS.DHMS\_MIGAN), SQL Profile (n/a), and SQL Plan Baseline (n/a). The "Activity By Waits" section features a pie chart showing the distribution of waits: Remaining Waits (51.9%), User I/O Waits (11.9%), and CPU (34.1%). The "Activity By Time" section lists various time metrics: Elapsed Time (2,290.00), CPU Time (784.59), and Wait Time (1,514.21). The "Elapsed Time Breakdown" section shows SQL Time (1,200.00), PL/SQL Time (0.00), and Java Time (0.00). The "Other Statistics" section includes Executions that Fetched all Rows (100.00%), Average Persistent Mem (115.49), Average Runtime Mem (114.61), and Serializable Alorts (0). The "Execution Statistics" table provides a summary of the SQL statement's performance:

	Total	Per Execution	Per Row
Executions	18	1	0.07
Elapsed Time (sec)	2,290.80	127.71	6.50
CPU Time (sec)	784.59	43.59	3.24
Buffer Gets	9,948,346	552,719.22	41,111.35
Disc Reads	1,150,302	64,443.44	4,701.71



# SQL Plan Management

## Create a SQL Tuning Set

SQL Profile Will Help 99%

Oracle Enterprise Manager (SYS) - Rooms...

ORACLE Enterprise Manager 11g  
Database Control

Database Instance: orcl > /Advisor Central > SQL Tuning Results: TASK\_179 > Logged In As SYS

**Recommendations for SQL ID: 1gf8p004gdj:cq** Return

Only one recommendation should be implemented.

**SQL Text**  
SELECT /\*+ ordered \*/ de.owner || ',' || de.segment\_name segment\_name, de.segment\_type segment\_type, de.extent\_id extent# , bhd/block# - de.block\_id + 1 block#, ...

**Select Recommendation**  
(Original Explain Plan Annotated)  
(Implement)

Select Type	Findings	Recommendations	Rationale	Benefit New Explain (%) Plan	Compare Explain Explain Plans
<input type="radio"/> Statistics	Optimizer statistics for table "SYS"."LOBFRAG\$" and its indices are stale.	Consider collecting optimizer statistics for this table.	The optimizer requires up-to-date statistics for the table in order to select a good execution plan.		
<input type="radio"/> Statistics	Optimizer statistics for table "SYS"."UE1\$" and its indices are stale.	Consider collecting optimizer statistics for this table.	The optimizer requires up-to-date statistics for the table in order to select a good execution plan.		
<input checked="" type="radio"/> SQL Profile	A potentially better execution plan was found for this statement.	Consider accepting the recommended SQL profile.		99.79 %	etc

Return

[Database](#) | [Setup](#) | [Preferences](#) | [Help](#) | [Logout](#)

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# SQL Plan Management Create a SQL Tuning Set



Compare Before & After

Database (testamanz) > Advisor Central > SQL Tuning Results TASK: 179 > Recommendations for SQLID:sg1lbu004p0cu >

### Compare Explain Plans

Original Explain Plan (Annotated)  
 \* Indicates an adjustment from the original plan by the SQL Tuning Advisor  
 Max Hash Value: 2347322369

Operation	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time	CPU Cost	I/O Cost
SELECT STATEMENT	0				121	1,270	393,855	11,804	15,351,714,281,981	160,630
SORT ORDER BY	-				120	1,270	393,855	11,804	15,351,714,281,981	160,630
NESTED LOOPS	2				119	3,270	353,054	11,804	12,500,098,553,244	108,630
HASH JOIN	3				7	1,708	11		8,647,788	0
NESTED LOOPS	4				5	3,176	0	1	710,600	0
VIEW	5				3	3,013	0	1	355,300	0
SORT AGGREGATE	6				2	1,959				
FIXED TABLE FULL	7	SYS.X\$K\$LLR_CHILDREN	TABLE (FIXED)		1	120,000	0	1	325,300	0
FIXED TABLE FULL	8	SYS.X\$K\$LLR_CHILDREN	TABLE (FIXED)		4	7,670	0	1	355,300	0
FIXED TABLE FULL	9	SYS.X\$SH	TABLE (FIXED)		6	5,738	0	1	355,300	0
VIEW	10	SYS.X\$K\$EXTENTS	VIEW		118	3,114	38,423	1,004	1,122,790,014,976	10,330

New Explain Plan With SQL Profile  
 Max Hash Value: 2138758942

Operation	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time	CPU Cost	I/O Cost
SELECT STATEMENT	0				124	0,262	1,972	24	702,635,712	1,926
SORT ORDER BY	1				123	0,262	1,972	24	702,635,712	1,926
HASH JOIN	2				122	0,262	1,972	24	687,481,920	1,926
HASH JOIN	3				7	1,768	1		8,647,788	0
NESTED LOOPS	4				5	0,176	0	1	715,600	0
VIEW	5				3	0,513	0	1	355,300	0
SORT AGGREGATE	6				2	0,058				
FIXED TABLE FULL	7	SYS.X\$K\$LLR_CHILDREN	TABLE (FIXED)		1	120,000	0	1	325,300	0
FIXED TABLE FULL	8	SYS.X\$K\$LLR_CHILDREN	TABLE (FIXED)		4	7,670	0	1	355,300	0
FIXED TABLE FULL	9	SYS.X\$SH	TABLE (FIXED)		6	5,489	0	1	355,300	0
VIEW	10	SYS.X\$K\$EXTENTS	VIEW		121	18,204	1,972	24	671,246,520	1,926
UNION ALL	11				120					
NESTED LOOPS	12				72	0,222	235	3	14,023,242	234



# SQL Plan Control SQL Profiles stored in the system

SQL Profiles

SQL Plan Baselines

Oracle Enterprise Manager [SYS]  
ORACLE Enterprise Manager 11g  
Database Control  
Database Instance: orcl > Logged in As SYS

SQL Plan Control

SQL Profile | SQL Patch | SQL Plan Baseline

Refresh

A SQL Profile contains additional information (auxiliary statistics) that aids the optimizer to select the optimal execution plan of a particular SQL statement.

Search

SQL Text:  (Go)

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Unpack

Enable | Disable | Drop | Change Category | Pack

Select All | Select None

Select Name	SQL Text	Category	Status	Created	Last Modified
<input type="checkbox"/> SYS_SQLPROF_01457634c08654000	SELECT /*+ ordered */ de.owner    '   ...	DEFAULT	ENABLED	OCT 31, 2007 1:50:10 AM	OCT 31, 2007 1:50:10 AM

TIP The table will display maximum of 2000 rows. Use search criteria to get the desired results.

SQL Profile | SQL Patch | SQL Plan Baseline

Database | Setup | Preferences | Help | Logout

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# 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)



# SQL Plan Management Capturing Baselines



```
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`.



# SQL Plan Management Capturing Baselines



```
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)



# SQL Plan Management Capturing Baselines



- 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.



# SQL Performance Analyzer





# SQL Performance Analyzer

- Measure and report on performance before and after a change! DBMS\_SQLTUNE package.

## Great for:

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





# SQL Performance Analyzer



Easy to run – SQL Focus (Test SGA settings):

- 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!



# SQL Performance Analyzer

Oracle Enterprise Manager (SYS) Top Ac...

### Top Activity

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

View Data: Real Time: 15 Second Refresh

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

#### Top SQL

Actions: Schedule SQL Tuning Advisor Go

Select All | Select None

Select	Activity (%)	SQL ID	SQL Type
<input type="checkbox"/>	12.50	bu(xcQ2)ub08u	SELECT
<input type="checkbox"/>	11.50	oyg8dddqx8hs	SELECT
<input type="checkbox"/>	12.50	74xk3mxfnz14s	DELETE
<input type="checkbox"/>	12.50	74aa3c9854qf	SELECT
<input type="checkbox"/>	12.50	5hfuryv38vwp	SELECT
<input type="checkbox"/>	12.50	a8j3fqb13lqk	SELECT
<input type="checkbox"/>	11.50	33s4wzvo5c6w	UNKNOWN
<input type="checkbox"/>	12.50	2z3urfa130145	UNKNOWN

Total Sample Count: 8

#### Top Sessions

View: Top Sessions

Activity (%)	Session ID	User Name	Program
12.38	129	DBSNMP	emagent@ora11g...
15.38	114	DBSNMP	OMS
7.69	137	SYSMAN	OMS
7.69	117	SYS	sqlplus@ora11g...
7.69	114	SYSMAN	orade@ora11g...
7.69	114	SYS	orade@ora11g...
7.69	151	SYS	orade@ora11g...
7.69	152	SYS	orade@ora11g...
7.69	130	SYSMAN	OMS
7.69	144	SYSMAN	orade@ora11g...

Total Sample Count: 13

#### Additional Monitoring Links

- [Top Consumers](#)
- [Duplicate SQL](#)
- [Blocking Sessions](#)
- [Hand Analysis](#)
- [Instance I/O](#)
- [Instance Activity](#)
- [Search Sessions](#)
- [Search SQL](#)
- [Snapshots](#)
- [AWR Baselines](#)
- [SQL Tuning Sets](#)
- [SQL Performance Analyzer](#)

Click Here



# SQL Performance Analyzer Guided Workflow



ORACLE Enterprise Manager 11g  
Database Control

Database Instance: orcl > Advisor Central > SQL Performance Analyzer > SQL Performance Analyzer Task: SYS.RICH\_TASK1

Task Name: RICH\_TASK1  
Task Owner: SYS  
Task Description: Testing 11g

SQL Tuning Set Name: TOP\_SQL\_1103818776094  
SYS Owner: SYS  
Total SQL Statements: 10  
SQL statements with Errors: 2

Replay Trial 1: SQL\_REPLAY\_1103818776094  
Replay Trial 2: SQL\_REPLAY\_1103818853322  
Comparison Metric: Elapsed Time

**Global Statistics**

Projected Workload Impact Time

SQL Statement Count

Improvement Impact: 83% ↑  
Regression Impact: 0% ↓  
Overall Impact: 83% ↑

**Top 10 SQL Statements Based on Impact on Workload**

SQL ID	Est. Impact on Workload (%)	Elapsed Time	Est. Impact on SQL (%)	% of Workload	Plan
SQL_REPLAY_1103818776094	77.510	41.320	8.813	80.124	95.60 N
SQL_REPLAY_1103818853322	1.020	0.013	0.020	53.094	0.113
SQL_REPLAY_1103818776094	1.030	0.004	0.003	25.000	0.130
SQL_REPLAY_1103818776094	1.000	0.000	0.000	0.000	0.180
SQL_REPLAY_1103818776094	1.000	0.000	0.000	0.000	0.000

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# SQL Performance Analyzer 11gR2 - Options



Upgrade  
 Options

SQL Performance Analyzer allows you to test and analyze the effects of changes on the execution performance of SQL contained in a SQL Tuning Set.

**SQL Performance Analyzer Workflows**

Create and execute SQL Performance Analyzer Task experiments of different types using the following links:

- [Upgrade from 9 or 10.1](#) Test and analyze the effects of database upgrade from 9 or 10.1 on SQL Tuning Set performance.
- [Upgrade from 11.1 or 11g](#) Test and analyze the effects of database upgrade from 11.1 or 11g on SQL Tuning Set performance.
- [Parameter Change](#) Test and compare on initialization parameter change on SQL Tuning Set performance.
- [Parallel Simulation](#) Simulate the effects of parallel storage parameter change on SQL Tuning Set performance.
- [Custom Workflow](#) Create a SQL Performance Analyzer Task and execute custom experiments using manually created SQL Hints.

**SQL Performance Analyzer Tasks**

Select Name	Owner	Last Modified	Current Step Name	Type	Status	SQLs Processed	Steps Completed
No SQL Performance Analyzer Tasks available.							

Tip: Press F1 on an explanation of the icons and symbols used in the following table. See the icon key.

**Related Links**

[SQL Tuning Set](#)

Database | Schema | Performance | Help | Logout

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# SQL Performance Analyzer 11gR2 – Exadata Simulation

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

**Task Information**

Task ID: 10000

SQL Tuning Set: SQL\_TUNING\_SET

SQL Text: SELECT \* FROM emp WHERE emp.dept = 'SALES'

**Total Characteristics**

Connections Used: 100 Interconnect Bytes

**Schedule**

Monday, September 11, 2006

Date: 09/11/2006

Time: 10:00:00 AM

**Simulating Exadata Storage Server**

Exadata Storage Server (Oracle 11gR2) was used to simulate the Exadata Storage Server. The Exadata Storage Server was configured with the following characteristics:

- The Exadata Storage Server was configured with the following characteristics:
- The Exadata Storage Server was configured with the following characteristics:
- The Exadata Storage Server was configured with the following characteristics:

Key Findings:

- The Exadata Storage Server was configured with the following characteristics:
- The Exadata Storage Server was configured with the following characteristics:
- The Exadata Storage Server was configured with the following characteristics:



# SQL Performance Analyzer 11gR2 – Exadata Simulation



Job is running

Oracle Enterprise Manager (11g) - SQL Performance Analyzer - Windows Internet Explorer

Oracle Enterprise Manager 11g  
Database Control

SQL Performance Analyzer

Page Refreshed Oct 9, 2009 0:04:35 PM CDT

SQL Performance Analyzer allows you to test and to analyze the effects of changes on the execution performance of SQL contained in a SQL Tuning Set.

SQL Performance Analyzer Workflows

Create and execute SQL Performance Analyzer Task experiments of different types using the following links:

- [Upgrade from 9 to 10.1](#) Test and analyze the effects of database upgrade from 9 to 10.1 on SQL Tuning Set performance.
- [Upgrade from 10.2 to 11g](#) Test and analyze the effects of database upgrade from 10.2 to 11g on SQL Tuning Set performance.
- [Parameter Change](#) Test and compare the effect of a parameter change on SQL Tuning Set performance.
- [Database Simulation](#) Simulate the effects of a Database Storage Server installation on SQL Tuning Set performance.
- [Driver Workflows](#) Create a SQL Performance Analyzer Task and execute custom experiments using manually created SQL Tsets.

SQL Performance Analyzer Tasks

Task Name	Owner	Last Modified	Current Step Name	Type	Status	SQLs Processed	Steps Completed
EXP	NYS	Oct 4, 2009 8:04:00 PM	INITIAL_SQL_TSET	Baseline	Processing	1 of 1	1 of 1
EXP	SYS	Oct 9, 2009 12:37:31 PM	EXC00114	Compare	Completed	1 of 1	1 of 1

Related Links  
[SQL Tuning Sets](#)

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[About Oracle Enterprise Manager](#)







# SQL Performance Analyzer 11gR2 – Exadata Simulation



Click on  
Job after  
complete  
View  
Report

The screenshot shows the Oracle SQL Performance Analyzer web interface. The main heading is "SQL Performance Analyzer Task: SYS.RJN2". Below this, there are sections for "SQL Tuning Set" and "SQL Trials".

**SQL Trials Table:**

SQL Trial Name	Description	Created	SQL Executed	Status
INITIAL_SQL_TRIAL	Exadata Storage Server simulation disabled	10/09/08:04 PM	Yes	COMPLETED
SECOND_SQL_TRIAL	Exadata Storage Server simulation enabled	10/09/08:04 PM	Yes	COMPLETED

**SQL Trial Comparisons Table:**

Trial 1 Name	Trial 2 Name	Comparison Metric	Created	Status	Comparison Report
INITIAL_SQL_TRIAL	SECOND_SQL_TRIAL	IO in Connected Bytes	10/09/08:04 PM	COMPLETED	...

Navigation links at the bottom include: Database | Setup | Preferences | Help | Logout.



# SQL Performance Analyzer 11gR2 – Exadata Simulation

Simple Job so no benefit

Oracle Enterprise Manager (OEM) - SQL Performance Analyzer Task Report: SYS.RJN2

SQL Tuning Set Name: TUSC\_SQL\_1286109890092  
 SQL Tuning Set Owner: SYS  
 SQL Statements With Errors: 0  
 SQL Statements Unsupported: 0

SQL Hint 1: INITIAL\_SQL\_TRIAL  
 SQL Hint 2: SECOND\_SQL\_TRIAL  
 Component Used: IO Interconnect Bytes  
 SQL Statements With Timeouts: 0

**Global Statistics**

Projected overhead vs. interconnect bytes

Projected overhead: 0.0%  
 Regression model: 0.0%

Overall usage: 2.5%

**SQL Statement Breakdown**

Legend: IO Interconnect Bytes

**Top 10 SQL Statements Based on Impact on Workload**

SQL ID	Net Impact on Workload (%)	IO Interconnect Bytes SQL Trial 1	SQL Trial 2	Net Impact on SQL (%)
SQLTUSC001	0.000	0	0	0.000
SQLTUSC002	0.000	0	0	0.000
SQLTUSC003	0.000	0	0	0.000
SQLTUSC004	0.000	0	0	0.000
SQLTUSC005	0.000	0	0	0.000
SQLTUSC006	0.000	0	0	0.000
SQLTUSC007	0.000	0	0	0.000

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[Annual Oracle Enterprise Database](#)



# Exadata = Paradigm Shift!



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



## 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



- 5TB+ flash storage!





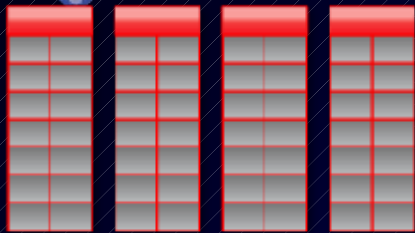
# How they got these NUMBERS?



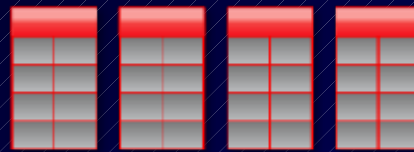
- 8 compute servers (x4170's)
  - 8 servers x 2 CPU sockets x 4 cores = 64 cores (E5540 2.53 GHz)
- 8 servers x 72G DRAM = 576G DRAM (400G useable)
- 14 Storage Servers total 336G DRAM = 912G Total DRAM
- 3 InfiniBand Switches x 36 ports = 108 ports
- 14 Storage Servers (100-336T) with Flash Cache (5T+)
  - 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\*

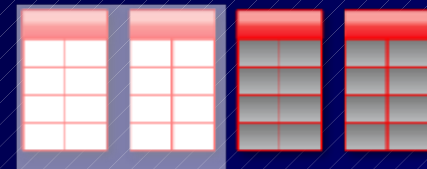
TUSC



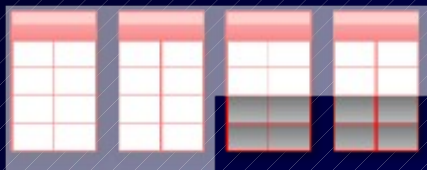
10 TB of user data  
Requires 10 TB of IO



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 -*

# SQL Advisors



Tuning  
Advisors

Repair  
Advisor  
(next)

A screenshot of the Oracle Enterprise Manager 11g web interface. The browser title is 'Oracle Enterprise Manager (SYS) - SQL Ad...'. The page header shows 'ORACLE Enterprise Manager 11g Database Control' and 'Logged in As SYS'. The main content area is titled 'SQL Advisors' and contains three sections: 'SQL Access Advisor', 'SQL Tuning Advisor', and 'SQL Repair Advisor'. Each section has a brief description and a link to more information. The 'SQL Repair Advisor' section is highlighted with a yellow arrow pointing from the text 'Repair Advisor (next)' on the left. The footer contains copyright information for Oracle and a link to 'About Oracle Enterprise Manager'. The browser's status bar at the bottom shows 'Done' and 'Internet'.

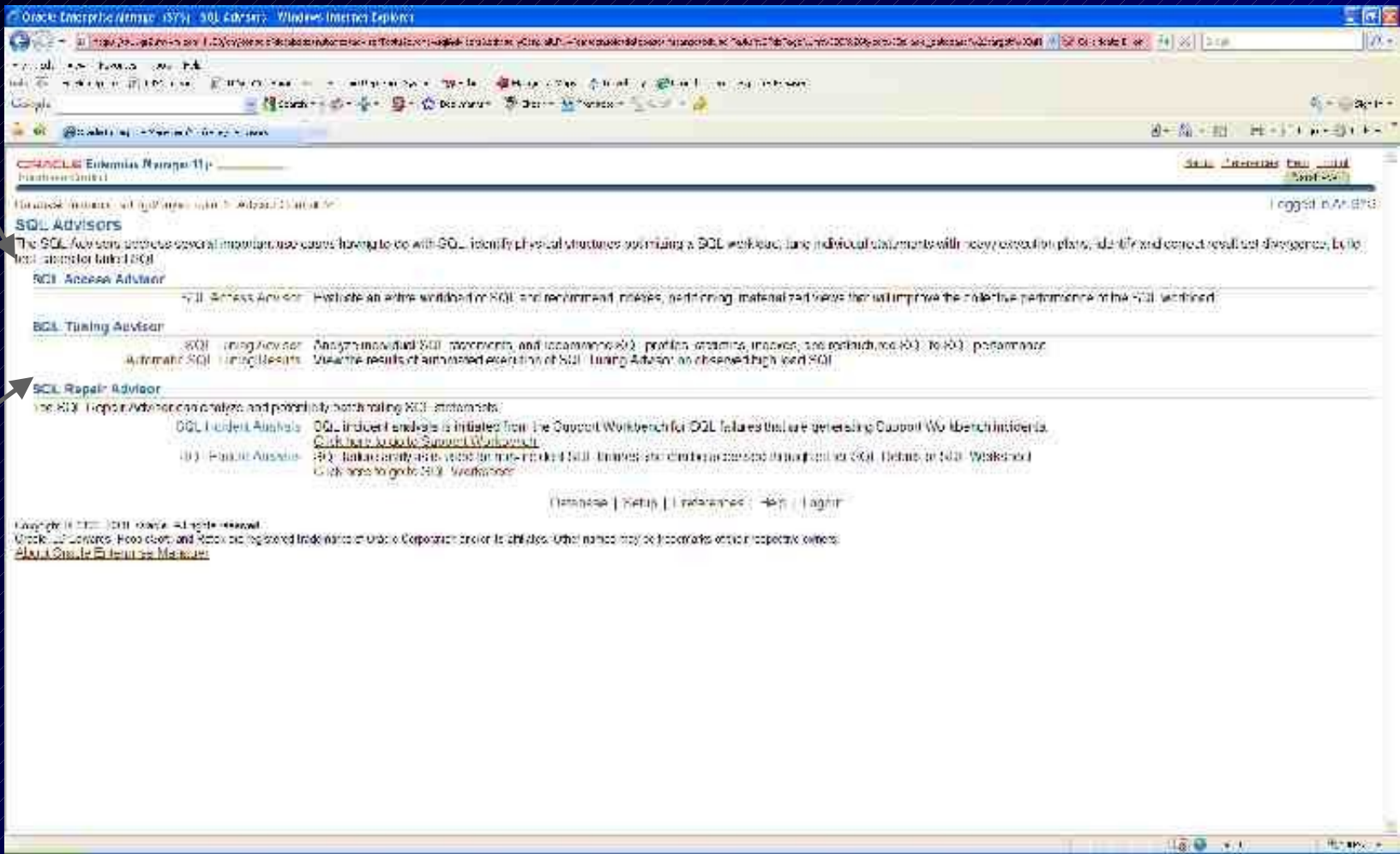
# SQL Advisors

## 11gR2 – (same)



Tuning  
 Advisors

Repair  
 Advisor  
 (next)





# Advisor Central 11gR2 – (different)



Tuning  
Advisors

Repair  
Advisor  
(next)

The screenshot shows the Oracle Enterprise Manager 11gR2 Advisor Central interface. The page title is "ORACLE Enterprise Manager 11g Database Control". The main content area is titled "Advisor Central" and includes a search bar and a table of advisory tasks. The table has columns for "Select Advisory Type", "Name", "Description", "User", "Status", "Start Time", "Duration (seconds)", and "Expires In (days)".

Select Advisory Type	Name	Description	User	Status	Start Time	Duration (seconds)	Expires In (days)
SQL Performance Analyzer	BJHQ	Copydata test	SYS	COMPLETED	Oct 9, 2009 9:04:26 PM	0	UNLIMITED
ADDM	ADDM1792971146_1_65	ADDM auto run snapshots (54, 55), instance 1, database id 1792971146	SYS	COMPLETED	Oct 9, 2009 7:58:28 PM	0	30
ADDM	ADDM1792971146_1_64	ADDM auto run snapshots (52, 53), instance 1, database id 1792971146	SYS	COMPLETED	Oct 9, 2009 7:58:55 PM	0	30
ADDM	ADDM1792971146_1_63	ADDM auto run snapshots (52, 53), instance 1, database id 1792971146	SYS	COMPLETED	Oct 9, 2009 8:00:17 PM	0	30
SQL Repair Advisor	SQL_REPAIR_1792971146_1_62		SYS	COMPLETED	Oct 9, 2009 5:58:17 PM	3	30
ADDM	ADDM1792971146_1_62	ADDM auto run snapshots (50, 52), instance 1, database id 1792971146	SYS	COMPLETED	Oct 9, 2009 5:58:43 PM	0	30
ADDM	ADDM1792971146_1_61	ADDM auto run snapshots (50, 51), instance 1, database id 1792971146	SYS	COMPLETED	Oct 9, 2009 4:00:40 PM	0	30
ADDM	ADDM1792971146_1_60	ADDM auto run snapshots (50, 50), instance 1, database id 1792971146	SYS	COMPLETED	Oct 9, 2009 3:00:27 PM	1	30
ADDM	ADDM1792971146_1_58	ADDM auto run snapshots (57, 58), instance 1, database id	SYS	COMPLETED	Oct 9, 2009 1:00:15 PM	0	30

# Advisor Central - Checkers

## 11gR2 – (different)



Integrity Checks

The screenshot shows the Oracle Advisor Central interface. The 'Checkers' tab is selected, displaying a list of integrity checkers. Below this, the 'Checker Runs' section shows a table of recent runs. Arrows from the 'Integrity Checks' text point to the 'Checkers' and 'Checker Runs' sections.

Checker Name	Run Name	Run	Status	Run Type
DB Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
BI Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
DB Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
BI Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
DB Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
BI Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
DB Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
BI Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
DB Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
BI Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
DB Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
BI Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
DB Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
BI Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
DB Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
BI Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
DB Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full
BI Structure Integrity Check	HW_3_01_301	Resactive	Completed	Full

# Advisor Central - Checkers



## 11gR2 – (different)

Data  
 Block:  
 Integrity  
 Check

Oracle Enterprise Manager (SYS) - Run Data Block Integrity Check - Windows Internet Explorer

Database instance: **si11g2.myvm.com** > **Checkers: Central** > **Run Data Block Integrity Check**

Checks integrity of a data file block

Options  
 Specify the following parameters in order to run this checker.

Parameter	Value	Description
Run Name	<input type="text"/>	The runname parameter is used to identify this run.
Timeout (sec)	<input type="text"/>	The time allocated for this run before its forced to stop.
BLC_DF_NUM	<input type="text"/>	File number
BLC_BL_NUM	<input type="text"/>	Block number

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[About Oracle Enterprise Manager](#)

# SQL Access Advisor NEW Partition Advisor





# SQL Access Advisor & NEW Partition Advisor



- 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)**



# SQL Access Advisor & NEW Partition Advisor

Step One

Use a SQL  
Tuning Set

The screenshot shows the Oracle Enterprise Manager interface for the SQL Access Advisor. The main heading is "SQL Access Advisor: Worldwind Source". Below this, there are instructions: "Select the source of the workload that you want to use for the analysis. The best workload is one that fully represents all the SQL statements that access the underlying tables." There are two radio button options: "Current and Recent SQL activity" and "Use an existing SQL tuning SQL". The second option is selected, and a text box below it contains "SYS.SQLNCEB5Q211838.sql". Below the text box is a section titled "Create a Hypothetical Workload from the Following Schemas and Tables" with a list of schemas and tables, including "SCHEMAS and Tables" and "Tables and Tables". There is an "Add" button next to the list. At the bottom, there is a "Database" section with "select" selected, and a "Filter Options" section. The interface also includes a progress bar at the top with steps: "Workload Source", "Workload Selection Criteria", "Database", and "Advisor".



# SQL Access Advisor & NEW Partition Advisor

Look at  
Partitions

Quick  
Solution

The screenshot shows the Oracle Enterprise Manager 11g interface. The main window is titled "SQL Access Advisor: Recommendation Options" for database "O11g6". It features a progress bar at the top with steps: "Workload Source", "Recommendation Options" (current), "Advisor", and "Review".

**Recommendation Types**  
Select the type of structures to be recommended by the advisor. The advisor performs a global analysis of the SQL workload to help improve schema design. If no recommendation type is selected the advisor will evaluate existing structures only:

- Indexes
- Materialized Views
- Partitioning

**Advisor Mode**  
The advisor can run in one of two modes: Limited or Comprehensive. Limited Mode is meant to help you quickly filter processing the statements with the highest cost, potentially ignoring statements with a cost below a certain threshold. Comprehensive Mode will perform an exhaustive analysis.

- Limited Mode  
Analyze all statements without threshold
- Comprehensive Mode  
Analyze all statements

**Advanced Options:**

At the bottom, there are buttons for "Cancel", "Back", "Step 2 of 4", and "Next". The footer includes copyright information: "Copyright © 1997, 2007, Oracle. All rights reserved. Oracle, E-Books, BooksOnLine, and Blog are registered trademarks of Oracle Corporation and/or its affiliates. Other names may be trademarks of their respective owners. About Oracle Enterprise Manager".



# SQL Access Advisor & NEW Partition Advisor



Step 3  
Schedule  
it.

Run it  
Now!





# SQL Access Advisor & NEW Partition Advisor



Final Review

The screenshot shows the Oracle Enterprise Manager interface for the 'SQL Access Advisor - Review' task. The task is named 'SQLACCESS277452' and is scheduled to run immediately. The 'Options' section is expanded, showing a table of modified options:

Modified Option	Value	Description
<input checked="" type="checkbox"/> SQL Tuning Set	YES (SQL_ACCESS277452_1916_001)	Import workload from SQL Repository
<input checked="" type="checkbox"/> Workload SQL Limit	25	Specifies the number of SQL statements to be analyzed
<input checked="" type="checkbox"/> Workload Source	SQL Tuning Set	The source of SQL statements to be used to create the workload

Navigation buttons at the bottom include 'Cancel', 'Show SQL', 'Back', 'Step 4 of 4', and 'Finish'. The 'Database' menu is visible at the bottom of the page.



# SQL Access Advisor & NEW Partition Advisor

Job Submitted

Job Running Now.

The screenshot shows the Oracle Enterprise Manager interface. At the top, a confirmation message states: "SQL Access Advisor task SQLACC9277452 created successfully." Below this, the "Advisor Central" page is visible, showing a list of advisors. The "Advisor tasks" section contains a table with the following data:

Select	Advisor type	Name	Description	User	Status	Start time	Duration (seconds)	Expires in (days)
<input checked="" type="checkbox"/>	SQL Access Advisor	SQLACC9277452	SQL Access Advisor	SYS	RUNNING	Mar 23, 2007 11:15:08 PM		30
<input type="checkbox"/>	SQL Access Advisor	SQLACC9277452	SQL Access Advisor	SYS	COMPLETED	Mar 21, 2007 11:16:21 PM	21	30



# SQL Access Advisor & NEW Partition Advisor

Oracle Enterprise Manager 11g Database Control

Results for Task: SQLACCESSZ77452

Task Name: SQLACCESSZ77452  
 Status: COMPLETED  
 Admin Mode: LIMITED  
 Scheduler Job: ADF\_SQLACCESSZ77452

Start: May 23, 2007 11:13:08 PM CDT  
 End: May 23, 2007 11:13:21 PM CDT  
 Run Time (SQL tasks): 13  
 Time Limit (seconds): UNLIMITED

Summary | Recommendations | SQL Statements | Update

Overall Worldload Performance

Potential for Improvement

Worldload I/O Cost

Query Execution Time Improvement

Recommendations

Space Requirements (MB): 0.000  
(See the new space requirement)

Hide Recommendation on Action List

Index	Create	0	Drop	0	Retain	1
Materialized View	Create	0	Drop	0	Retain	0
Materialized View Log	Create	0	Drop	0	Retain	0
Partitioned	Tables	0	Indexes	0	Materialized Views	0

SQL Statements

SQL Statements: 21  
Accessed from the original Worldload applied

Hide Statement Counts

Insert	0
Select	25
Update	0
Delete	0
Merge	0
Skipped (Parsing or Privilege Errors)	25

Database | Setup | Preferences | Help | Logout

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 Oracle White Paper 1004006

http://em11g.gridin.fr:1153/em11g/console/database/sqlaccess/sqlaccess/task?id=127369&ent=dev&nav=sqlControlSQL=1&nav=con

Improve I/O

Improve Execution Time



# 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

The screenshot shows the Oracle Enterprise Manager 11g Database Control interface. The main content area is titled 'Database Instance: database'. It includes several performance charts: 'Host CPU' (showing 100% usage), 'Active Sessions' (showing a mix of User, User/DB, and CPU sessions), and 'SQL Response Time' (showing a bar chart with values up to 500). Below these are sections for 'Diagnostic Summary', 'Space Summary', and 'High Availability'. At the bottom, there is an 'Alerts' section with a table of alerts. One alert is highlighted with a yellow background and a red 'X' icon, indicating a critical error. The alert message text is highlighted in blue, and an arrow points from the text 'Click Alert (ORA-600) message text to see details' to this highlighted text.

Severity	Category	Name	Impact	Message	Alert (Timestamp)
Critical	Database	ORA-600: fatal internal error code [10000], [10000], [10000]	High	ORA-600: fatal internal error code [10000], [10000], [10000]	Mar 28, 2007 5:05:41 AM
Critical	Database	ORA-600: fatal internal error code [10000], [10000], [10000]	High	ORA-600: fatal internal error code [10000], [10000], [10000]	Mar 26, 2007 2:51:11 AM
Warning	Database	ORA-600: fatal internal error code [10000], [10000], [10000]	Low	ORA-600: fatal internal error code [10000], [10000], [10000]	Apr 7, 2007 12:52:59 PM

# SQL Repair Advisor – View Problem Details

TUSC

Click on  
View  
Problem  
Details to  
go to the  
Support  
Bench

The screenshot displays the Oracle Enterprise Manager 11g interface. At the top, it shows the database instance 'database' and the incident type 'Generic Internal Error: Within 31 Days'. The 'Problem Summary' section is divided into 'Problem Information' and 'Incident Information'. The 'Problem Information' table lists the error message: 'ORA-600 [dbysvc] [libParse:1] 555: [n/a]'. The 'Incident Information' section shows the timestamp 'March 26, 2007 2:49:55 PM PDT'. Below this, there is a 'Performance and Critical Error' section with a line graph showing resource usage (CPU, User I/O, Wait) over time. The 'Alert Details' section at the bottom provides further context, including the alert name 'Generic Internal Error', its severity 'Critical', and the administrator 'SYSDBA'.

ORACLE Enterprise Manager 11g  
Database Control  
Database Instance: database > All Metrics > Generic Internal Error >  
Incident - Generic Internal Error: Within 31 Days  
Last Updated: Mar 26, 2007 2:51:13 PM PDT  
Alert Name: [Generic Internal Error](#)

**Problem Summary**

Problem Information		Incident Information	
Message	ORA-600 [dbysvc] [libParse:1] 555: [n/a]	Timestamp	March 26, 2007 2:49:55 PM PDT
Error Type	ORA-600 [dbysvc] [libParse:1] 555: [n/a]	Timestamp	March 26, 2007 2:49:55 PM PDT
No. of Incidents (Within 31 Days)	1		

[View Problem Details](#) [View All Problems](#)

**Performance and Critical Error**

**Alert Details**

Alert Name: Generic Internal Error  
Alert Number: Mar 26, 14:49:55 2007/00420  
Severity: Critical  
Timestamp: Mar 26, 2007 2:49:55 PM PDT  
Administrator: SYSDBA



# Support Workbench - Details

Database Instance: database > Support Workbench > Logged in As SYSTEM

Problem Details: ORA 600 [13011] Page Refreshed March 20, 2007 9:05:15 PM PDT [Refresh](#)

---

**Summary**

SR#	--	<a href="#">Edit</a>
Bug#	--	<a href="#">Edit</a>
Active	<b>Yes</b>	
Packaged	<b>No</b>	
Number of Incidents	<b>1</b>	

---

**Last Incident**

Timestamp	<a href="#">March 20, 2007 8:18:05 PM PDT</a>
Incident Source	<b>System Generated</b>
Impact	
Checker's Run	0
Checker Findings	0

---

**Investigate and Resolve**

[Go to Metalink](#) [Quick Package](#)

**Self Service** [Oracle Support](#)

---

**Assess Damage**

[Run Checkers](#)  
[Database Instance Health](#)

---

**Diagnose**

[Alert Log](#)  
[Related Problems Across Topology](#)  
[Diagnostic Dumps for Last Incident](#)  
[Go to Metalink and Research](#)

---

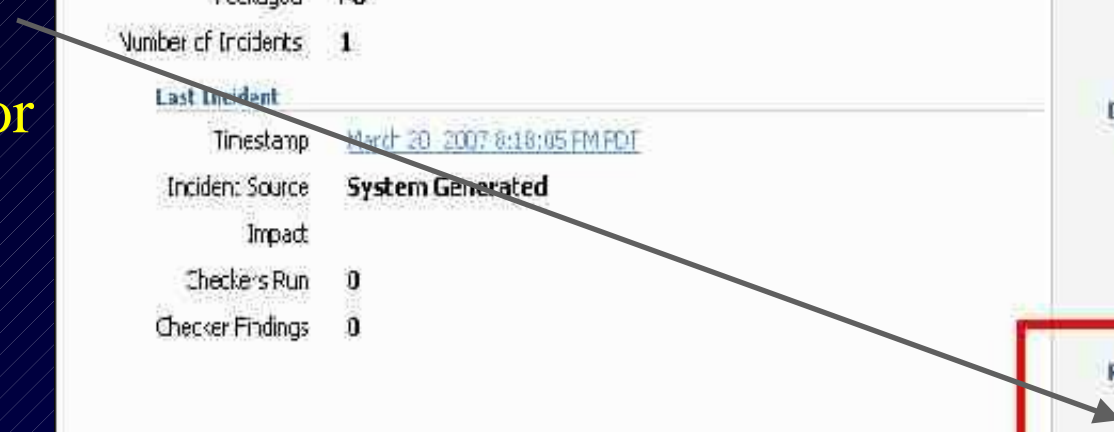
**Resolve**

[SQL Repair Advisor](#)

---

[Incidents](#) [Activity Log](#)

Click on  
SQL  
Repair  
Advisor







# Results from SQL Repair Advisor

SQL Repair Results: SQL\_DIAG\_1171505262358

Page Refreshed Mar 21, 2007 12:45:50 PM PDT

Status: **COMPLETED**  
SQL ID: **9m7mvytcb4d14**  
Time Limit (seconds): **1800**

Started: **Mar 21, 2007 12:45:28 PM PDT**  
Completed: **Mar 21, 2007 12:45:46 PM PDT**  
Running Time (seconds): **18**

**Recommendations**

Select SQL Text	Parsing Schema	SQL ID	SQL Patch
<input type="checkbox"/> delete from : t1 where t1 a = 'a' and rowid <> (select max(rowid) from : t2 where t1 a=t2.a and :1....		9m7mvytcb4d14	<input checked="" type="checkbox"/>

Click on View to Get the Detail finding of the Advisor

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



# SQL Repair Advisor Recommendation / Confirmation

Click on  
Implement  
To accept  
the SQL  
Patch

Repair Recommendations for SQL ID: 9m7mvytcb4d14

[Return](#)

Page Refreshed Mar 21, 2007 12:46:42 PM PDT

Select the desired recommendation and then click on the Implement button to apply the SQL patch, which is a special type of SQL Profile that will repair the SQL statement.

**SQL Text**

```
delete from t1 where t1.a = 'e' and rowid <> (select max(rowid) from t2 where t1.a = t2.a and t1.b = t2.b and t1.d = t2.d)
```

**Findings and Recommendations**

SQL Repair Results: SQL\_DIAG\_1174506262358

**(i) Confirmation**  
The recommended SQL Patch was implemented successfully. Verify results by executing SQL in SQL Worksheet.

[Verify using SQL Worksheet](#) Page Refreshed Mar 21, 2007 12:52:29 PM PDT [Refresh](#)

Status	<b>COMPLETED</b>	Started	<b>Mar 21, 2007 12:45:28 PM PDT</b>
SQL ID	<b>9m7mvytcb4d14</b>	Completed	<b>Mar 21, 2007 12:45:46 PM PDT</b>
Time Limit (seconds)	<b>1800</b>	Running Time (seconds)	<b>18</b>

**Recommendations**

[view](#)

Select SQL Text	Parsing Schema	SQL ID	SQL Patch
delete from t1 where t1.a = 'e' and rowid <> (select max(rowid) from t2 where t1.a = t2.a and t1 ...		9m7mvytcb4d14	✓



# Real Application Testing!

## Database workload capture and replay



# Database workload capture and replay



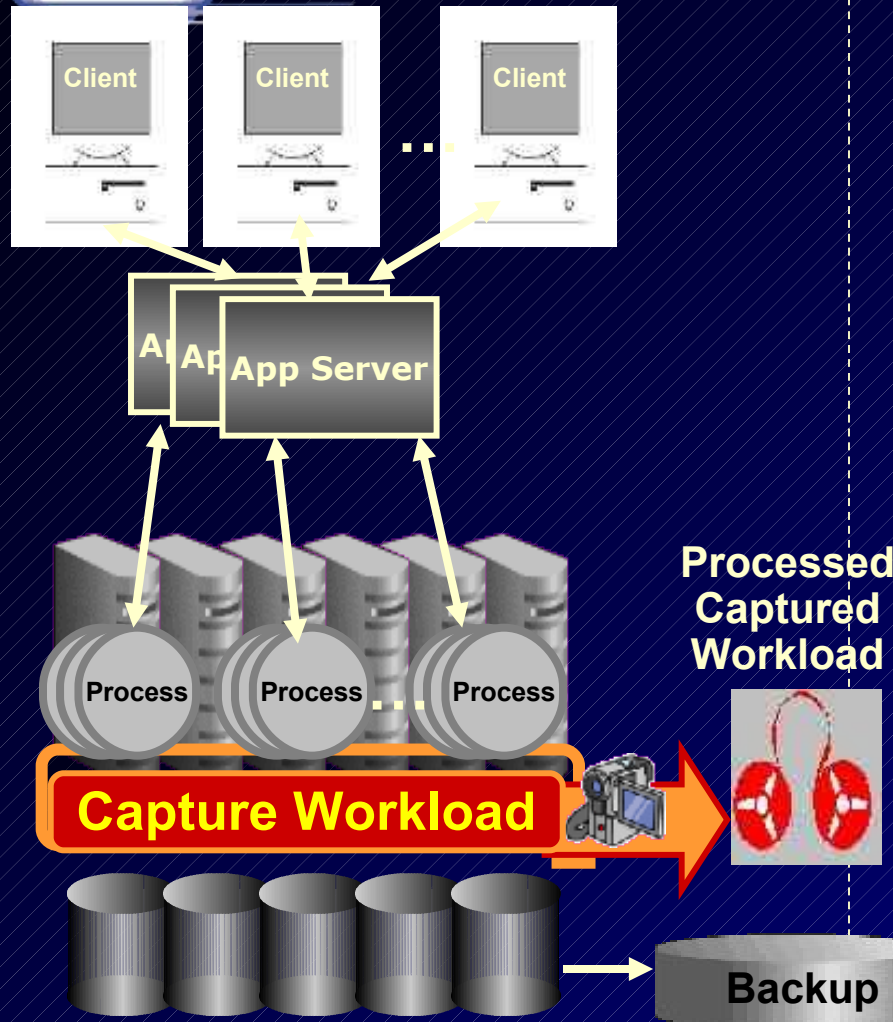
- Used to **capture database workload** on one system and replay later on a different system. Useful to **compare two different systems**.
- Could rival LoadRunner in the future (may be more precise!)

## Brief Steps:

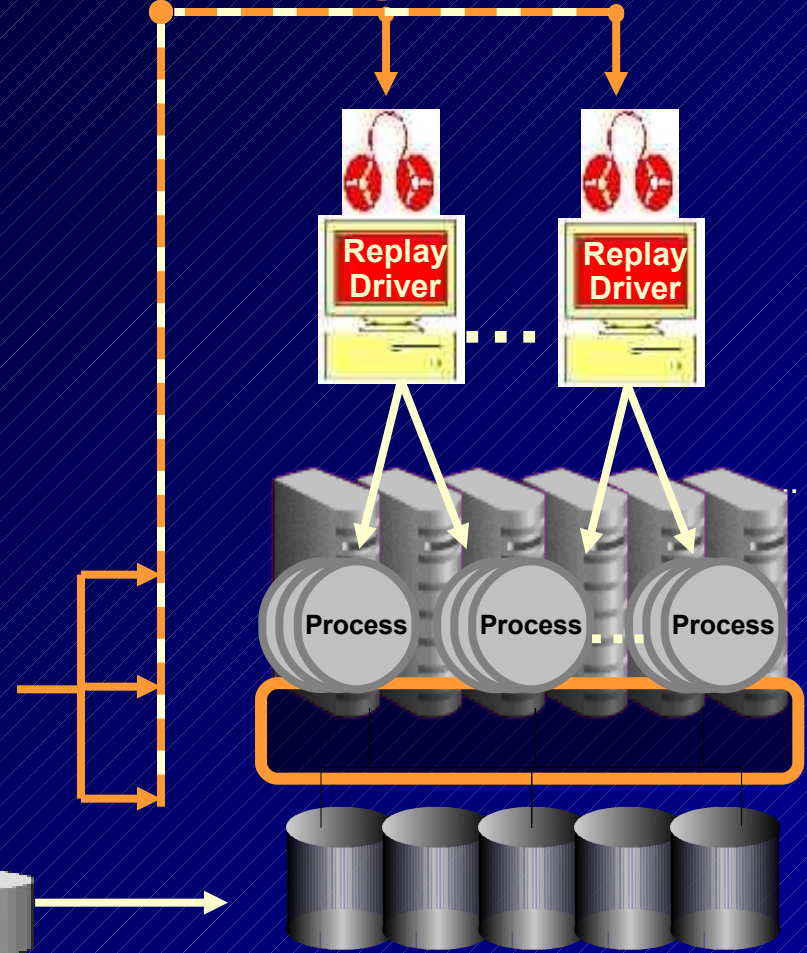
- **Capture** workload on a database even from 10gR2
- **Restore** the database on a **test system** to the SCN when capture begins
- Perform **upgrade** and make changes to the test system as needed
- **Preprocess the captured workload** if it is not preprocessed
- **Configure the test system** for 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



# Post-Change Test System



Can use Snapshot Standby as test system



# Database Replay

## FYI Only – Download to view in detail

Real App  
Testing:

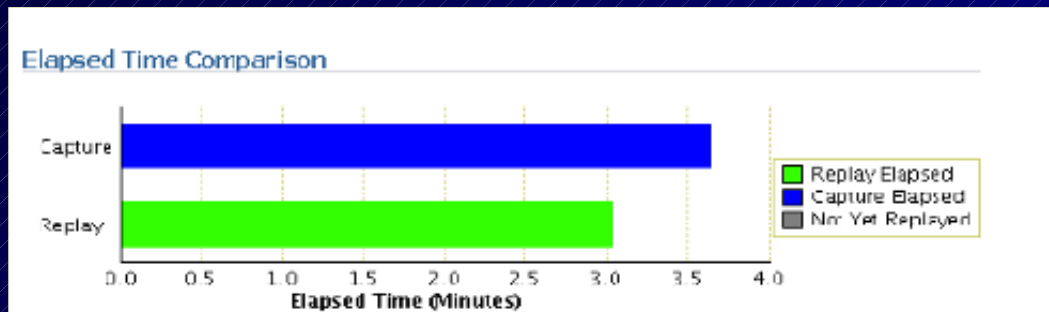
Database  
Replay

The screenshot shows the Oracle Enterprise Manager 11g Database Control interface. The browser title is 'Oracle Enterprise Manager [SYS] - Databa...'. The page header includes 'ORACLE Enterprise Manager 11g Database Control' and 'Logged in As SYS'. The main content area is titled 'Database Instance: orcl' and has several tabs: 'Home', 'Performance', 'Availability', 'Security', 'Settings', 'Data Movement', and 'Software and Support'. The 'Software and Support' tab is active, showing sections for 'Software', 'Support', and 'Related Links'. Under 'Software', there is a 'Real Application Testing' section with links for 'Database Replay' and 'SQL Performance Analyzer'. The 'Support' section includes a link for 'Support Workbench'. The 'Related Links' section contains various links like 'Access', 'Alert Log Contents', 'Blackouts', 'Metric and Policy Settings', 'Monitor in Memory Access Mode', 'SQL Worksheet', 'Advisor Central', 'Alert History', 'Baseline Metric Thresholds', 'Jobs', 'Monitoring Configuration', 'Scheduler Central', and 'User-Defined Metrics'. At the bottom, there is a navigation bar with 'Database | Setup | Preferences | Help | Logout' and a copyright notice: 'Copyright © 1996, 2007, Oracle. All rights reserved. Oracle, JD Edwards, PeopleSoft, and Rotalara are registered trademarks of Oracle Corporation and/or its affiliates. Other names may be trademarks of their respective owners. About Oracle Enterprise Manager'.

# Replay Options...

TUSC

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

J Administering Partitions - Windows Internet Explorer

Table 3-1 ALTER TABLE Maintenance Operations for Table Partitions

Maintenance Operation	Range	Hash	List	Composite: Range/Hash	Composite: Range/List
<a href="#">Adding Partitions</a>	ADD PARTITION	ADD PARTITION	ADD PARTITION	ADD PARTITION MODIFY PARTITION ... ADD SUBPARTITION	ADD PARTITION ... ADD SUBPARTITION
<a href="#">Contracting Partitions</a>	n/a	CONTRACT PARTITION	n/a	MODIFY PARTITION ... CONTRACT SUBPARTITION	n/a
<a href="#">Dropping Partitions</a>	REMOVE PARTITION	n/a	REMOVE PARTITION	REMOVE PARTITION	REMOVE PARTITION ... DROP SUBPARTITION
<a href="#">Exchanging Partitions</a>	EXCHANGE PARTITION	EXCHANGE PARTITION	EXCHANGE PARTITION	EXCHANGE PARTITION EXCHANGE SUBPARTITION	EXCHANGE PARTITION EXCHANGE SUBPARTITION
<a href="#">Merging Partitions</a>	MERGE PARTITIONS	n/a	MERGE PARTITIONS	MERGE PARTITIONS	MERGE PARTITIONS MERGE SUBPARTITIONS
<a href="#">Modifying Default Attributes</a>	MODIFY DEFAULT ATTRIBUTES	MODIFY DEFAULT ATTRIBUTES	MODIFY DEFAULT ATTRIBUTES	MODIFY DEFAULT ATTRIBUTES MODIFY DEFAULT ATTRIBUTES FOR PARTITION	MODIFY DEFAULT ATTRIBUTES MODIFY DEFAULT ATTRIBUTES FOR PARTITION
<a href="#">Modifying Row Attributes of Partitions</a>	MODIFY PARTITION	MODIFY PARTITION	MODIFY PARTITION	MODIFY PARTITION MODIFY SUBPARTITION	MODIFY PARTITION MODIFY SUBPARTITION
<a href="#">Modifying List Partitions: Adding Values</a>	n/a	n/a	MODIFY PARTITION ... ADD VALUES	n/a	MODIFY SUBPARTITION ... ADD VALUES
<a href="#">Modifying List Partitions: Contracting Values</a>	n/a	n/a	MODIFY PARTITION ... CONTRACT VALUES	n/a	MODIFY SUBPARTITION ... CONTRACT VALUES
<a href="#">Modifying a Subpartition Template</a>	n/a	n/a	n/a	SET SUBPARTITION TEMPLATE	SET SUBPARTITION TEMPLATE
<a href="#">Moving Partitions</a>	MOVE PARTITION	MOVE PARTITION	MOVE PARTITION	MOVE SUBPARTITION	MOVE SUBPARTITION

100%



# Range Partitioning (V8)



```
CREATE TABLE DEPT
(DEPTNO          NUMBER(2),
DEPT_NAME       VARCHAR2(30))
PARTITION BY RANGE(DEPTNO)
(PARTITION D1 VALUES LESS THAN (10) TABLESPACE DEPT1,
PARTITION D2 VALUES LESS THAN (20) TABLESPACE DEPT2,
PARTITION D3 VALUES LESS THAN (MAXVALUE) TABLESPACE
DEPT3);
```

```
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,
                    storage_type VARCHAR(30),                    owning_dept NUMBER,
                    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
VALUES 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.*



# Interval Partitioning – 11g

- 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.



# Interval Partitioning – 11g

```
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





# Interval Partitioning – 11g

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

SEGMENT\_NAME

PARTITION\_NAME

-----  
DEPT\_NEW

-----  
D1

DEPT\_NEW

D2

DEPT\_NEW

D3

# Interval Partitioning – 11g

The logo for TUSC (The University of South Carolina) is located in the top left corner. It features the letters 'TUSC' in a stylized, bold font, with a blue and white diamond shape behind the text. A horizontal line with a slight curve passes through the middle of the diamond.

```
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.
```



# Interval Partitioning – 11g

```
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	SYS_P41
DEPT_NEW2	SYS_P42
DEPT_NEW2	SYS_P43



## 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.



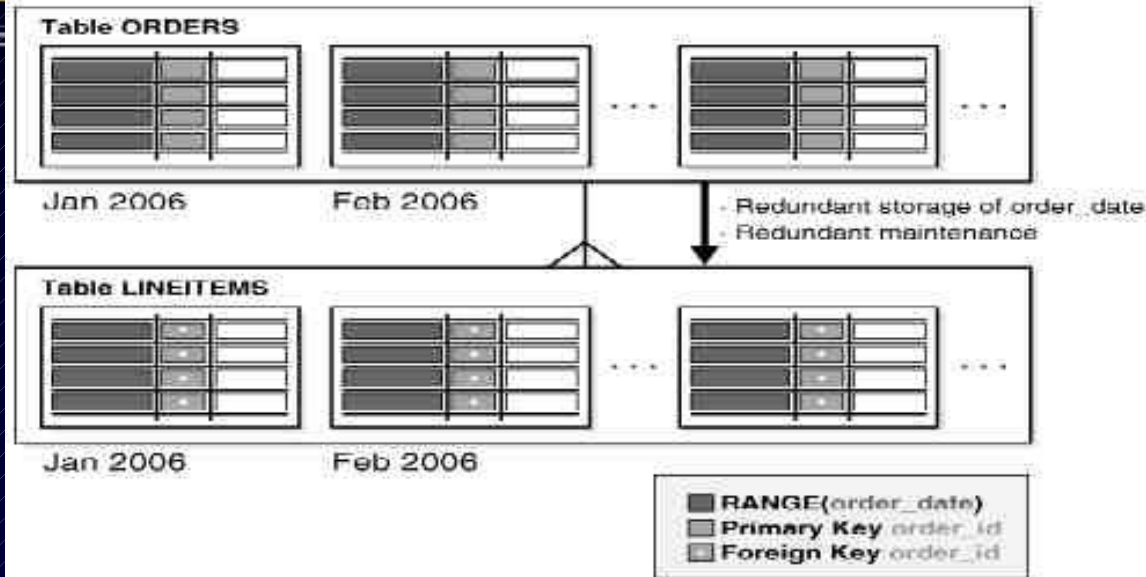
# Reference Partitioning – 11g (FYI Only)

```
CREATE TABLE orders
( order_id      NUMBER(12)      CONSTRAINT orders_order_id_nn      NOT NULL,
  order_date    DATE            CONSTRAINT orders_order_date_nn     NOT NULL,
  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'))
)
PARALLEL ;

CREATE TABLE lineitems
( order_id      NUMBER(12)      CONSTRAINT oitems_order_id_nn      NOT NULL,
  line_item_id  NUMBER(3)       CONSTRAINT oitems_line_item_id_nn  NOT NULL,
  product_id    NUMBER(6)       CONSTRAINT oitems_product_id_nn   NOT NULL,
  unit_price    NUMBER(8)       CONSTRAINT oitems_unit_price_nn   NOT NULL,
  quantity      NUMBER(8,2)    CONSTRAINT oitems_quantity_nn     NOT NULL,
  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 ;
```

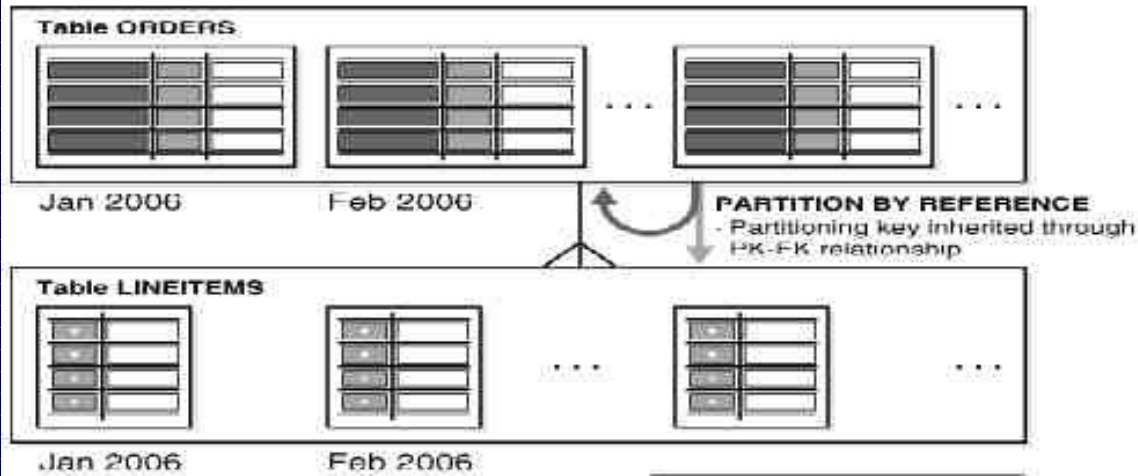


# Reference Partitioning – 11g



Description of "Figure 2-4 Before Reference Partitioning"

*Figure 2-5 With Reference Partitioning*





# Partition Compression

- 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 #1 COMPRESS FOR ALL OPERATIONS

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



# Partition Compression

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

*Table created.*





# Partition Compression

```
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.*



# Partition Compression

```
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

6 rows selected.

# Advanced Compression

TUSC





# 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

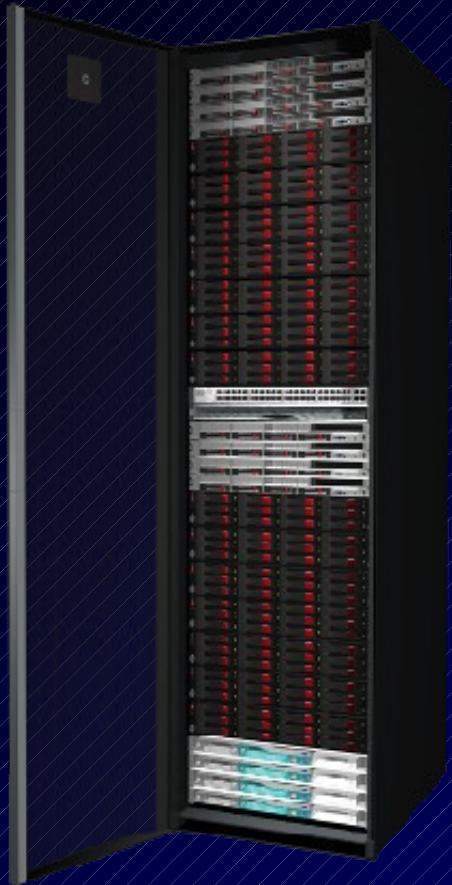
- Compression is **maintained at a block level**.
- Maintained through DML operations.
- Compression ratio depends on “RANDOMness” of the data.
- DML Impact depends on “RANDOMness” of the data.  
Range of 10 to 30%.
  - More visible for bulk operations compared to single row operations.
- **Significant 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.





# Audience Knowledge

Exadata V1?



10x faster than any Oracle DW

Exadata V2? X2-8?



169  
5x faster than V1



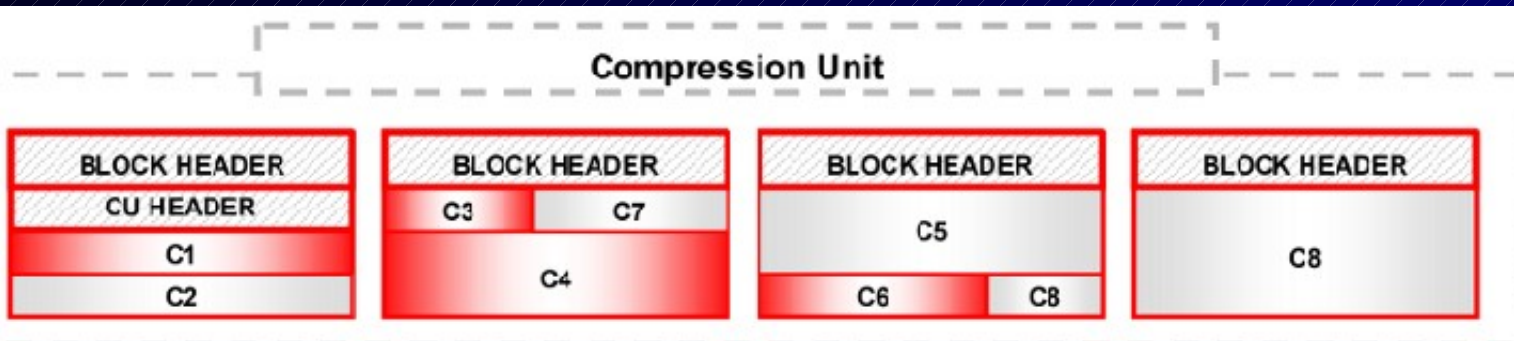
# Exadata Hybrid Columnar Compression (EHCC) – 4-10x & 30x is common

- 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



(Warehouse)

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



(Archive)

\*\* 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

- Fully supported:
  - 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

**View Table: SYSTEM.DEPT\_NEW3**

**General**

Name: **DEPT\_NEW3**  
Schema: **SYSTEM**  
Tablespace: **SYSTEM**  
Organization: **Standard (Heap Organized)**

**Columns**

Name	Data Type	Size	Scale	Nullable	Default Value	Indexed
DEPTNO	NUMBER	2		<input type="checkbox"/>		<input type="checkbox"/>
DEPTNAME	VARCHAR2	30		<input type="checkbox"/>		<input type="checkbox"/>

Indicate a Primary Key column  
 Indicate a Unique Key column

**Constraints**

Name	Table	Type	Columns	Disabled	Deferrable	Initially Deferred	Validate	RCLE	Check Condition	Referenced Schema	Referenced Table	Referenced Column	Referenced Table Column	Cascade on Delete
PK_DEPT	DEPT_NEW3	PRIMARY	DEPTNO											

**Partitions**

Partitioning Method: **Range**  
Partitioning Column: **DEPTNO**  
Number of Partitions: **6**

Partition Definition:

Partition Name	High Value - DEPTNO (NUMBER)	Tablespace
P01	01	SYSTEM
P02	20	SYSTEM
P03	30	SYSTEM
SYS_P03	40	SYSTEM
SYS_P04	50	SYSTEM
SYS_P05	60	SYSTEM

**Options**

Parallel Degree: **Disabled**



# Object Maintenance – Reorganize

Oracle Enterprise Manager - Reorganize Objects: Review

Database Instance: **011gb** Schema Objects: **6** [Launch] [Back] [Stop] [Refresh]

Loaded In As: **SYS**

Job Name: **REORGANIZE\_011GB\_1**  
 Job Schedule: **Run Immediately**

Script

The table summary is a list of the database commands that will be used to reorganize the selected objects. The table is a SQL script that includes functions, procedures, and other (DDL) commands needed during the reorganization. The full script will be created when you approve this job and will be executed by the job to perform the reorganization.

View:  Script Summary  Full Script

```

Target database: 011gb
Script generated at: 23-FAR-2007 12:00
ALTER TABLE 'SYSTEM','DEPT_NEW3' MOVE PARTITION 'D1'
ALTER TABLE 'SYSTEM','DEPT_NEW3' MOVE PARTITION 'D2'
ALTER TABLE 'SYSTEM','DEPT_NEW3' MOVE PARTITION 'D3'
ALTER TABLE 'SYSTEM','DEPT_NEW3' MOVE PARTITION 'SYS_X1'
ALTER TABLE 'SYSTEM','DEPT_NEW3' MOVE PARTITION 'SYS_X2'
ALTER TABLE 'SYSTEM','DEPT_NEW3' MOVE PARTITION 'SYS_X3'
BEGIN DBMS_STATS.GATHER_TABLE_STATS('SYSTEM','DEPT_NEW3',partname=>'D1',estimate_percent=>NULL);
END;
BEGIN DBMS_STATS.GATHER_TABLE_STATS('SYSTEM','DEPT_NEW3',partname=>'D2',estimate_percent=>NULL);
END;
BEGIN DBMS_STATS.GATHER_TABLE_STATS('SYSTEM','DEPT_NEW3',partname=>'D3',estimate_percent=>NULL);
END;
BEGIN DBMS_STATS.GATHER_TABLE_STATS('SYSTEM','DEPT_NEW3',partname=>'SYS_X1',estimate_percent=>NULL);
END;
BEGIN DBMS_STATS.GATHER_TABLE_STATS('SYSTEM','DEPT_NEW3',partname=>'SYS_X2',estimate_percent=>NULL);
END;
BEGIN DBMS_STATS.GATHER_TABLE_STATS('SYSTEM','DEPT_NEW3',partname=>'SYS_X3',estimate_percent=>NULL);
END;
  
```

[Launch] [Back] [Stop] [Refresh]

Database | Home | My Favorites | Help | Logout

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# Automated Maintenance Tasks

The logo for TUSC (The University of South Carolina) is a diamond shape with the letters 'TUSC' inside. It is positioned on the left side of the slide, above a horizontal line that spans the width of the slide.

TUSC

- 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





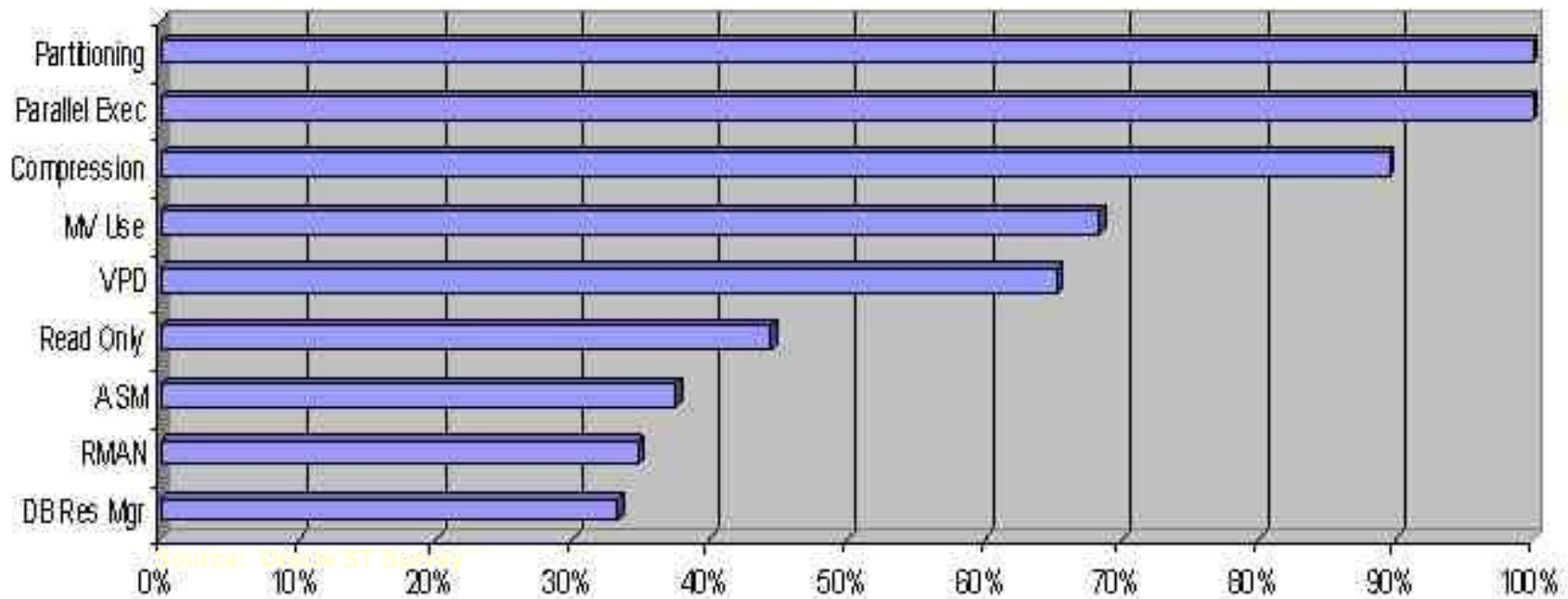
# Additional Enhancements



- 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\*

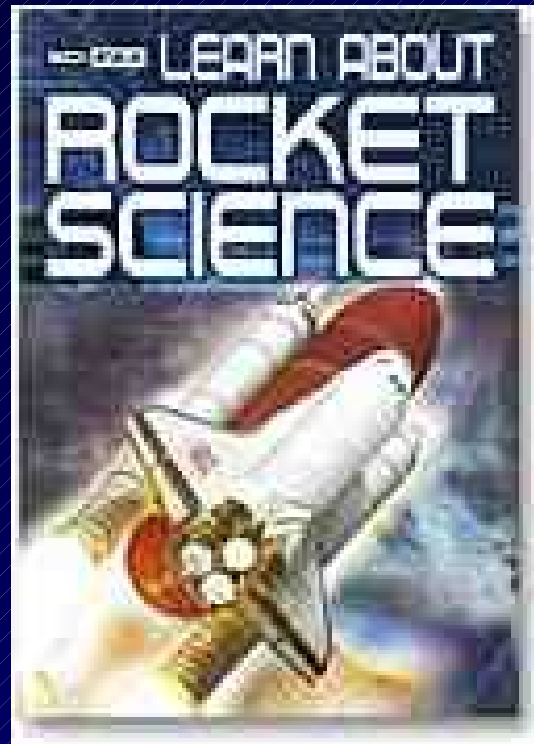
## *Feature Usage*



\* Oracle Survey



# Automatic Diagnostic Repository (ADR)



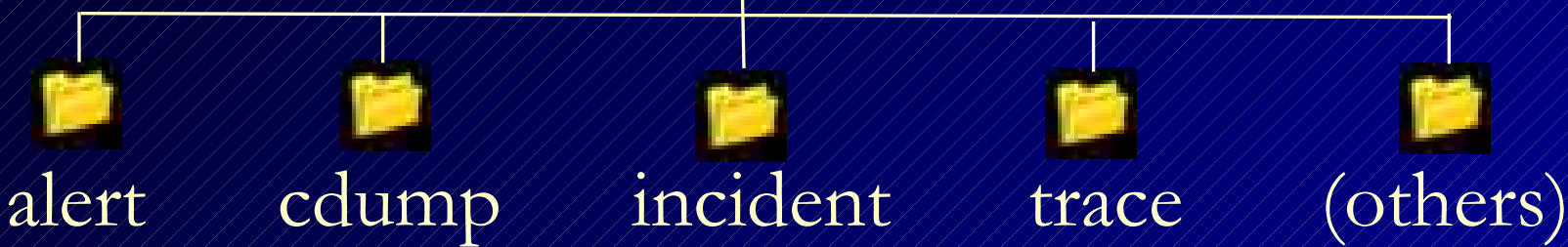
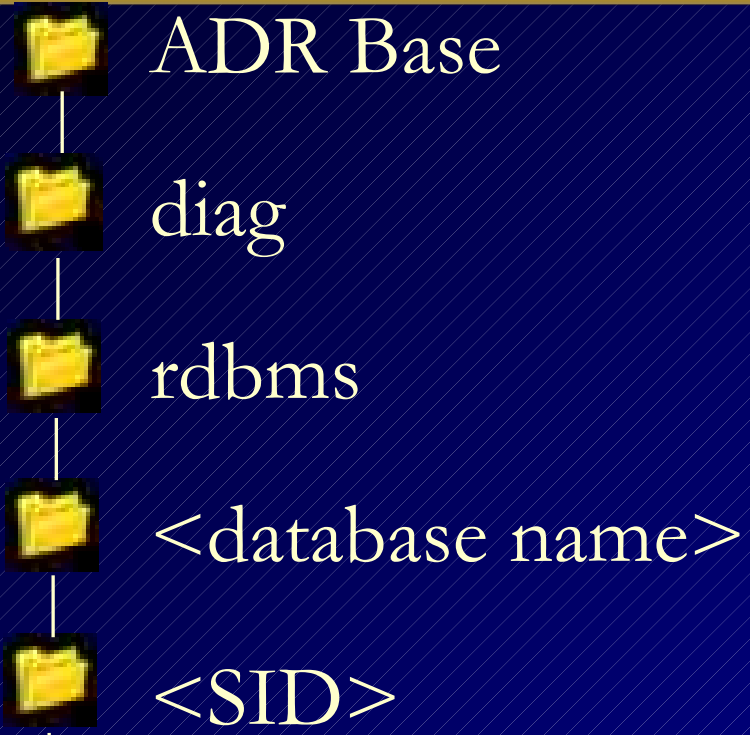
# Automatic Diagnostic Repository (ADR)



- 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



# ADR Directory Structure for a Database Instance



Alert Log: /u01/app/oracle/diag/rdbms/o11gb/O11gb/trace  
ORACLE\_HOME: /u01/app/oracle/product/11.1.0/db\_1 182



# ADR – V\$ Diagnostic Info



```
select name, value
from v$diag_info;
```

NAME	VALUE
-----	-----
Diag Enabled	TRUE
ADR Base	/u01/app/oracle
ADR Home	/u01/app/oracle/diag/rdbms/o11gb/O11gb
Diag Trace	/u01/app/oracle/diag/rdbms/o11gb/O11gb/trace
Diag Alert	/u01/app/oracle/diag/rdbms/o11gb/O11gb/alert
Diag Incident	/u01/app/oracle/diag/rdbms/o11gb/O11gb/incident
Diag Cdump	/u01/app/oracle/diag/rdbms/o11gb/O11gb/cdump
Health Monitor	/u01/app/oracle/diag/rdbms/o11gb/O11gb/hm
Default Trace File	/u01/app/oracle/diag/rdbms/o11gb/O11gb/trace/O11gb_ora_16676.trc
Active Problem Count	0
Active Incident Count	0

11 rows selected.



# 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
1	ADR Home	/u01/app/oracle/diag/rdbms/sillgr2/sillgr2
1	Diag Trace	/u01/app/oracle/diag/rdbms/sillgr2/sillgr2/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
1	Default Trace File	/u01/app/oracle/diag/rdbms/sillgr2/sillgr2/trace/sillgr2_ora_8978.trc
1	Active Problem Count	1
1	Active Incident Count	2

```
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



- Manually gather stats: 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**

# Incremental Statistics Maintenance - Stats by Partition vs. table



- 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 which is extremely time consuming
- In 10g, you have to manually copy statistics to new partition
- In 11g Gather stats for **TOUCHED PARTITIONS** only!
- Table stats are refreshed **WITHOUT** scanning the un-touched partitions.



# Manage New Statistics

## Gather Stats but make **PENDING**



- 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!



# Manage New Statistics

## Gather Stats but make them **PENDING**

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

PUBLISH

-----

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;
```

PUBLISH

-----

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
-----	-----	-----	-----	-----
CUST				

```
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
-----	-----	-----	-----	-----
CUST				



# 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-OCT-07	55500	1485	180

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



# Extended Optimizer Statistics: New Multi-Column Statistics



- 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

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

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



- Three records selected.
- Single column statistics are accurate

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.

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

CORVETTE	40,000	RED
----------	--------	-----



- One record selected.
  - 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.

TUSC

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

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



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

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



# 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
CUST_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.



# 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	FREQUENCY
CUST_VALID	2	FREQUENCY
COUNTRY_ID	19	FREQUENCY
CUST_STATE_PROVINCE	145	FREQUENCY
CUST_CITY_ID	620	HEIGHT BALANCED
CUST_CITY	620	HEIGHT BALANCED
CUST_LAST_NAME	908	HEIGHT BALANCED
CUST_FIRST_NAME	1300	HEIGHT BALANCED
CUST_ID	55500	HEIGHT BALANCED

...

24 rows selected.



# 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.





# Adaptive Cursor Sharing

- 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;
```

Note: 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';
```

Ename	Empno	Job
SMITH	6973	OPERATOR
ALLEN	7499	OPERATOR
WARD	7521	OPERATOR
KING	8739	PRESIDENT
SCOTT	7788	OPERATOR
CLARK	7782	OPERATOR

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 2nd+ execution)
```

SQL_ID	P	EXECUTIONS	ROWS_PROCESSED	CPU_TIME
5wfj3qs71nd7m	Y	3	1	0
2rad83pp613m1	Y	3	3	0
dr78c03uv97bp	N	1	3	0
dr78c03uv97bp	N	1	3	0
dr78c03uv97bp	Y	1	3	0
9qv6tq9ag5b80	Y	3	3	0
a2k4qkh681fzx	Y	3	2	0
413zr99jf9h72	N	1	1	0
413zr99jf9h72	N	1	1	0
413zr99jf9h72	Y	1	1	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	I	I
9ugwm6xmvw06u	11	Y	N
bdfrydpbw07g	11	Y	N
57pfs5p8xc07w	20	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.

# Some 11gR2 Screen Shots

The screenshot displays the Oracle Enterprise Manager (OEM) interface for Automatic Storage Management (ASM). The main content area shows the configuration for a file named **EXAMPLE.261.697814093**. The interface is divided into several sections:

- General:** Displays file details such as Name (+DATA/S111GR2/DATAFILE/EXAMPLE.261.697814093), Type (DATAFILE), Redundancy (UNPROT), Striping (COARSE), Block Size (Bytes) (8192), Blocks (12801), Logical Size (KB) (102408), Creation Date (Sep 17, 2009 1:14:53 PM CDT), and Modification Date (Oct 9, 2009 1:00:00 PM CDT).
- Permissions:** Shows that the file owner is **asmadmin** and the group is **asmadmin**. A note states: "Only the file owner or the ASM administrator can change the permissions of a file. File access control for the diskgroup must be enabled for the permissions to take effect."
- Regions:** Provides options for data placement:
  - Hot
  - Cold
  - Mirror
  - Hot + ColdA tip explains: "If the data is frequently accessed and mostly read-only, put the primary extents in the hot region and mirror extents in the cold region. If the data is frequently accessed and updated, put both primary and mirror extents in the hot region."
- Ownership:** Shows the current owner is **asmadmin**. A note says: "To change the owner of a file, you have to connect as the ASM administrator."
- Group:** Shows the current group is **asmadmin**. A note says: "To change the group of a file, you have to connect as the ASM administrator unless you are the file owner and the owner or a member of the specified group."

At the bottom of the page, there are navigation links: [Database](#), [Setup](#), [Preferences](#), [Help](#), and [Logout](#). The footer contains copyright information: "Copyright © 1996, 2009, Oracle. All rights reserved. Oracle, the Oracle logo and other are registered trademarks of Oracle Corporation and/or its affiliates. Other names may be trademarks of their respective owners. About Oracle | Information | Manage".



# 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).
  - 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.
- Things that will be audited by default include:
  - CREATE USER, CREATE SESSION, CREATE ANY TABLE, 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  
DATABASE 11g

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)

2007

1977

Database Auditing

Government customer





# 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 Spatial 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 Oracle 10g 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)





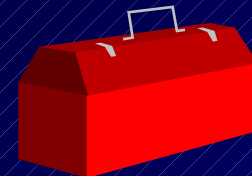
## 8 Exabytes:

# Look what fits in one 10g Database!

- All databases of the largest 1,000,000 companies in the world (3E).
- or*
- 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)
- or*
- 1 Mount Everest filled with Documents (approx.)



# V\$ Views over the years



<u>Version</u>	<u>V\$ Views</u>	<u>X\$ Tables</u>
6	23	? (35)
7	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	613 <sub>218</sub>

# Impact Tuning with Oracle

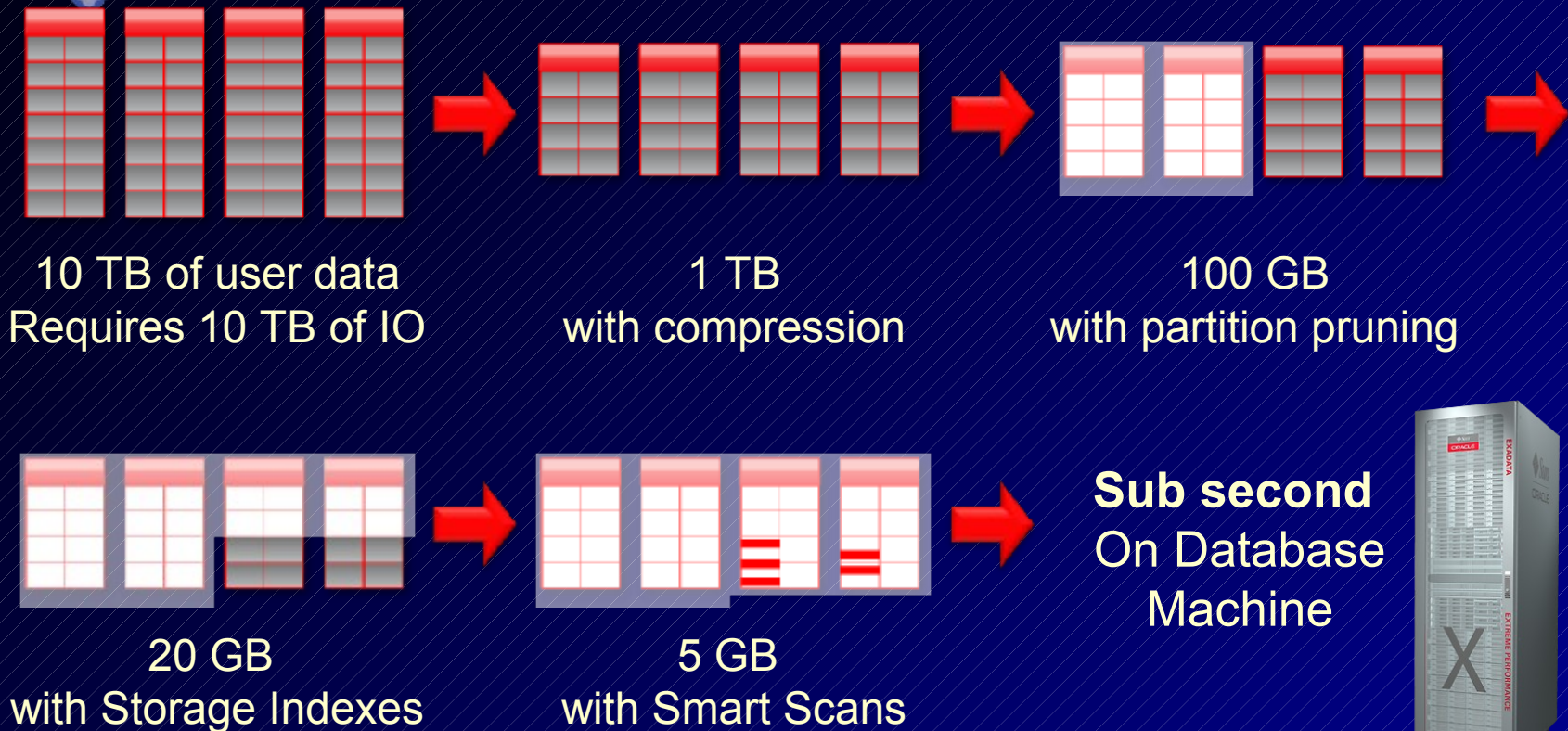


99.8% Less Data Accessed / 96.8% Time Reduction

<u>Option</u>	<u>Before</u>	<u>After</u>
Partitions	120 sec - 310M	0.43 sec - 200k
Partitions / Tuned	120 sec - 310M	0.01 sec - 8k
Parallel Query (20 Proc.)	230 sec	18 sec
Function-Based Index	1206 sec - 3G	7 sec - 8k
Materialized View	28 sec	3 sec
Cursor_Sharing	240 sec	0.01 sec
Truncate	510 sec / 8G	0.40 sec / 32k
Driving Table	900 sec	1 second
SGA Sizing	30 sec	0.01 sec
750,000 Query Mix	5.1 T / 540 hours	9 G / 23 hours

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

# Benefits Multiply\*



**Data is 10x Smaller, Scans are 2000x faster**

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

TUSC



## 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



- 5TB+ flash storage!





# What's Next – Exadata X2-8

## ORACLE EXADATA

Announcing

Oracle Exadata Database Machine X2-8



ORACLE

- 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...**

*(FUTURE?? 8 servers = 512 CPUs & 8T of DRAM)* 222

# What's Next – Exalogic Elastic Cloud!

WebLogic Server

Coherence

JRockit and HotSpot

Exalogic Elastic Cloud Software

Oracle Linux or Solaris

Exalogic Elastic Cloud Hardware



- 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 though there are 500M people on Facebook



# Exadata = Paradigm Shift!





# Oracle is never caught from behind

## Oracle's 30<sup>th</sup> 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!

TUSC

“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

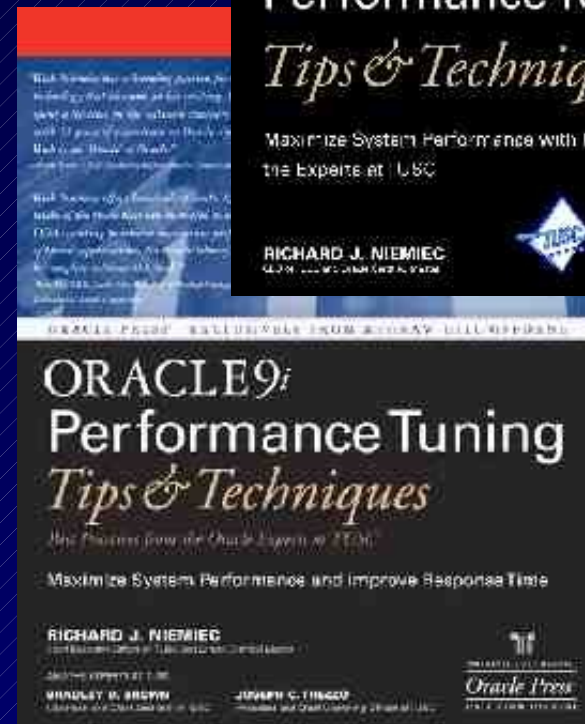
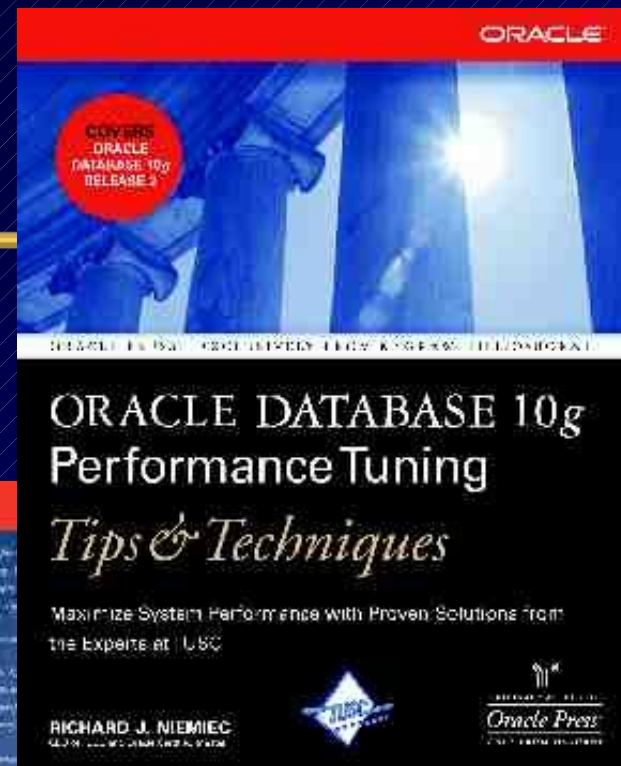
- Know the Oracle
- Start Me Up – Using Memory Target
- The Buffer Cache & The Result Cache
- Virtual Columns
- Invisible Indexes & Online Index Rebuilds
- Creating & Rebuilding Indexes Online
- Secure Files
- DDL Lock Timeout, PL/SQL Expressions/Simple Integer
- ADDM Enhancements
- SQL Plan Management (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](http://www.tusc.com)
- *Oracle9i Performance Tuning Tips & Techniques; Richard J. Niemiec; Oracle Press (May 2003)*
- *Oracle 10g Tuning (June 11, 2007)*



“If you are going through hell, keep going” - Churchill



# 更多信息

- [www.tusc.com](http://www.tusc.com)
- *Oracle9i Performance Tuning Tips & Techniques; Richard J. Niemiec; Oracle Press (May 2003)*
- *Oracle 10g Tuning (June 11, 2007)*



“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*



# References

- [www.tusc.com](http://www.tusc.com), [www.rolta.com](http://www.rolta.com)
- *Oracle10g Performance Tuning Tips & Techniques*; Richard J. Niemiec; Oracle Press
- Database Secure Configuration Initiative: Enhancements with Oracle Database 11g, [www.oracle.com](http://www.oracle.com)
- All Oracle11g Documentation from Oracle Beta Site
- Introduction to Oracle Database 11g, Ken Jacobs
- Oracle Database 11g New Features, Linda Smith
- New Optimizer Features in 11g, Maria Colgan
- [www.ioug.org](http://www.ioug.org), [www.oracle.com](http://www.oracle.com), [en.wikipedia.org](http://en.wikipedia.org) & [technet.oracle.com](http://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 Beaton, Ray Mansfield, Lex De Haan, Elaine DeMoo and Jim Gray**

# Rohta TUSC – *Your* Partner .... Accomplished in Oracle!



**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**
  - iPerspective™ - rapid data & systems integration
  - Geospatial Fusion™ - spatial integration & visualization
  - OneView™ - business & operational intelligence



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## Contact Information

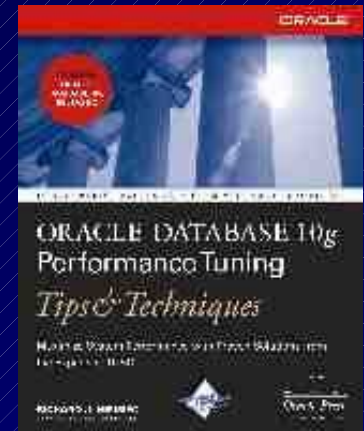
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*Dedicated to the Memory of Robert Delgado Patton*



# 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