

Exadata 101 -

What You Need to Know!



New York Oracle Users Group - 2011

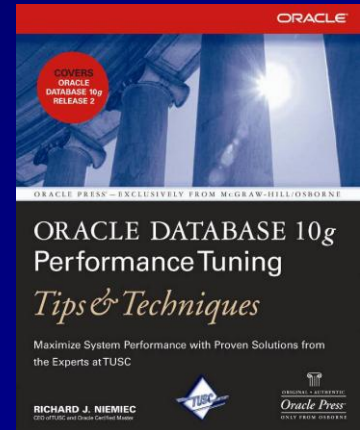


Rich Niemiec, Rolta TUSC

(Thanks: Jim Viscusi, Milton Wan, Damon Grube, Mike Messina, Sri Avantsa, & Shyam Varan Nath + Oracle Learning Library for Examples)



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




Overview



- Terminology & the Basics about Exadata
- Flash Cache
- Storage Index
- Smart Scans
- Hybrid Columnar Compression (HCC)
- Enterprise Manager & Grid Control
- Enterprise Manager Exadata Simulation
- I/O Resource Manager
- Security
- Utilities
- Best Practices
- Summary



Goals ...

- Goals
 - Overview of Exadata - Easy 
- Non-Goals
 - Making you the Expert 





Audience Knowledge

Exadata V1?



10x faster than any Oracle DW

Exadata V2-2?



5x faster than V1⁵



Big Difference... Much Improved!

Exadata Version 1?



Exadata Version

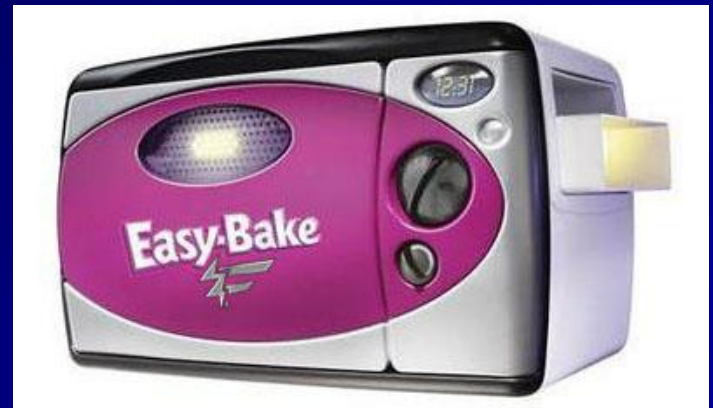




Audience Knowledge

Full RACK?

Half or Quarter





Terminology & The Basics





Some Terms

- SATA Disk (337T) –
Big & Slow – Like a 33 1/3 < 7200 RPM >
- SATA = Serial Advanced Technology Attachment
- SAS Disk (100T) –
Small & Fast – Like a 45 < 15K RPM >
- SAS = Serial Attached SCSI (Small





WHAT is it?

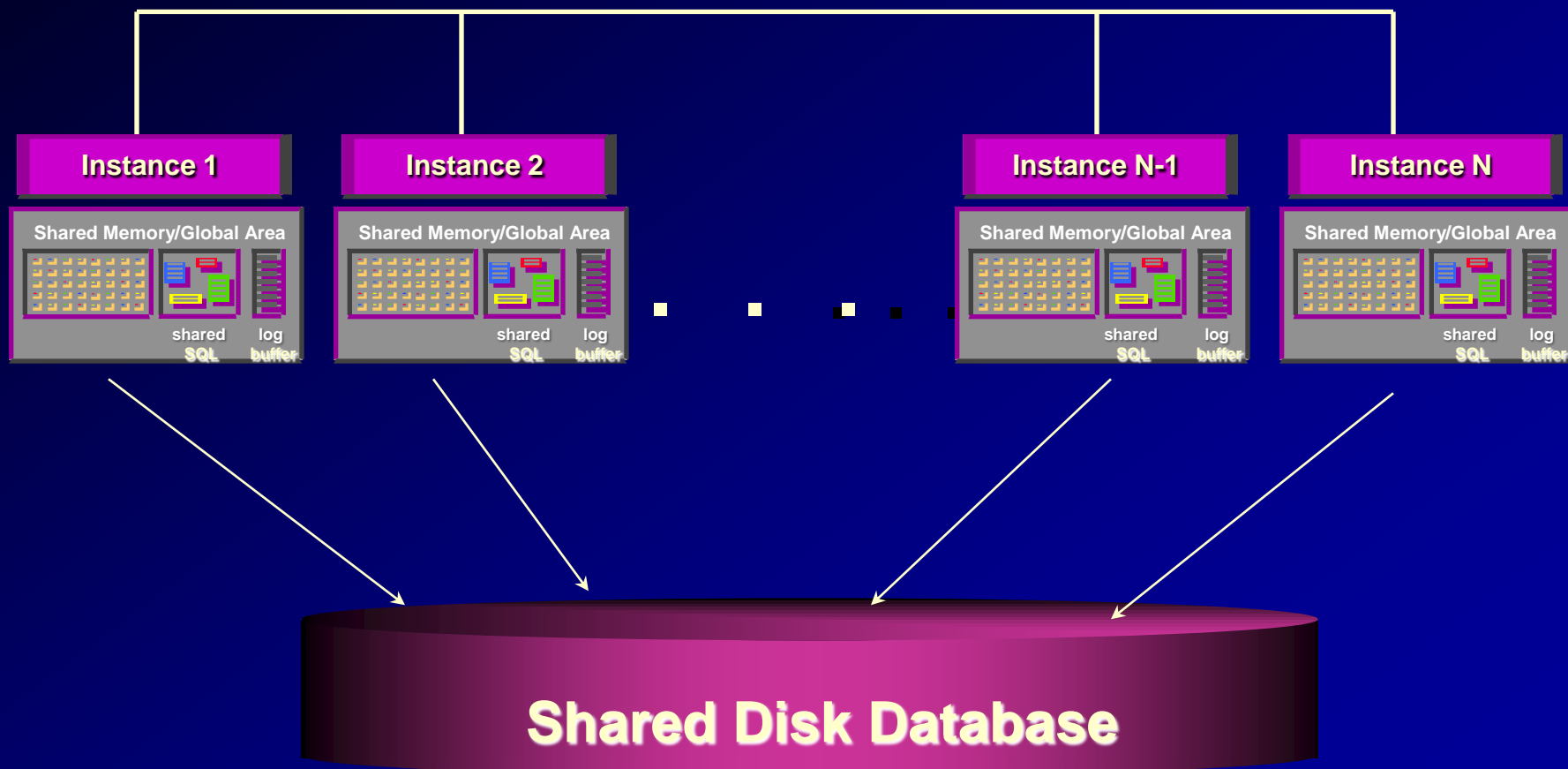


- A prebuilt 8-Node RAC cluster with Super Storage
- All the CPU power you need (64 cores)
- Mega DRAM Server Memory (576G)
- Super-Mega Flash Memory (5.3T)
- Super fast interconnect (40Gb/s)
- 100T of SAS disk (28T useable)
- Database could be MUCH larger with compression!
- If you need it & can afford it – You want it!!



Introduction to RAC - Shared Data Model

Exadata puts it back into One Machine





How BIG is it?

- 64 Cores (16 quad core CPUs) on compute server + 112 cores on storage servers (+ 28 quad core) = **176 cores total-full rack**
- 576G server & 400G of useable server **DRAM (100G/sec)**
- 5.3T of **flash cache (50G/sec)**
- 100T SAS disk (28T useable) – 15K RPM (21G/s; 50K IO/s)

OR

- 336T disk space (100T useable) – **SATA 7.2K RPM**

- SATA = Serial Advanced Technology Attachment

- SAS = Serial Attached SCSI (Serial SCSI)



How FAST can it be?



- ALL Disks Combined:
 - SAS – 21G/s (**50,000 IOPS** = 300 IOPS x 12 disk x 14)
 - SATA – 12 G/s (20,000 IOPS)
- ALL Flash Cache Combined (3.6G/s per cell):
 - 50G/s (**1,000,000 IOPS**); < 20x more random I/O; 2x seq)
- Max Data Bandwidth with Disk + Cache + Compress:
 - 500G/s (10x compression)
- Data Load Rate:



How FAST is it?



Compared to the competition:

- 5 – 100x for Data Warehousing
- 20x faster for OLTP
- Also - Miscellaneous:
 - Hot Swappable **Redundant Power**
 - Each Database Server - Dual Port InfiniBand 40Gb/s card
 - Database Servers have Disk Controller HBA (Host Bus Adapter) has 512M battery backed up cache
 - **Each DB Server has 4 x 1GbE interfaces & ILOM** (Integrated Lights Out Management – Remote power on)



What's Making it FAST?



- Fast Hardware!
- Many CPUs
- Flash Cache
- Lot's of DRAM (Parallel Query in DRAM in 11.2)
- Compression (save 10x-70x)
- Partition Pruning (save 10x-100x)
- Storage Indexes (save 5x-10x)
- Smart Scan (save 4x-10x)
- Turn a 1T search into a 500M search or even

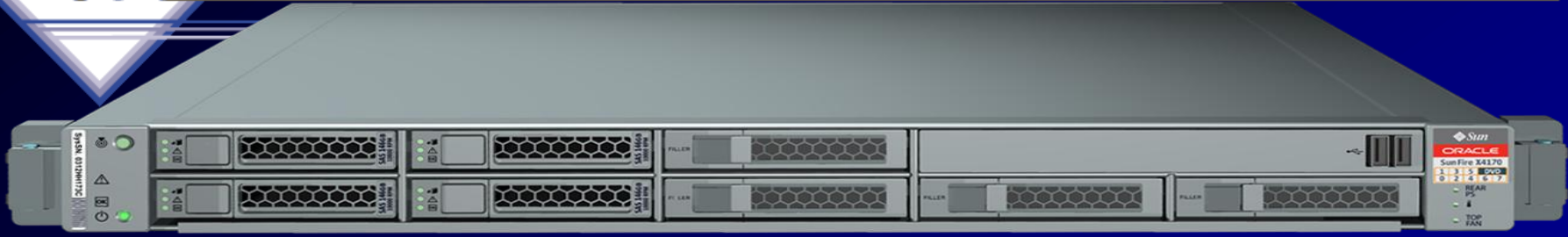


How they got these NUMBERS?

- 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 (146G¹⁶ drives)

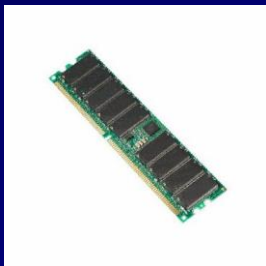


Compute Servers – Like 8 Node RAC!



- 8 compute servers (x4170's)
 - 8 servers x 2 CPU sockets x 4 cores = 64 cores
- 8 compute servers x 72G (18x4G) DRAM = **576G DRAM**
- 4 x 146G drives x 8 = 4.67T (in addition to storage servers)

x8



DRAM
(4G each)





Storage Servers – Full Rack

- 14 Storage Servers (x4275's) with Flash Cache
 - 96G x 4 cards = 394G per storage server of flash cache
 - 24Gx14= **336G of DRAM** (in addition to database servers)
 - 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 SAS**



**12 Disks
Hot Swappable**



**Flash
Cache
(96G each)**



InfiniBand - 40G/s Each way

- 3 InfiniBand Switches x 36 ports = 108 ports
- Leaf and spine switches wired at factory depending on needs and how many Racks you'll have – careful!



36 Ports



Put it all together – Oracle's picture of the Sun Oracle Database Machine

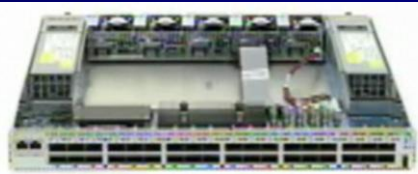


8 Compute Servers

- 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!





One more time...

How they got these NUMBERS?

- 8 **compute** servers (x4170's)
 - 8 servers x 2 CPU sockets x 4 cores = **64 cores**
- 8 compute servers x 72G DRAM = **576G DRAM**
- 3 InfiniBand Switches x 36 ports = **108 ports**
- 14 **Storage** Servers with **112 CPU cores** & Flash Cache
 - 96G x 4 banks = **394G DRAM** 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 1.1TB SATA = **184.8T SATA**



How will the **X2-8** change these ... How they got these NUMBERS?

- 2 compute servers (**7560 CPU** at **2.26 GHz** & **5T SAS**)
 - 2 servers (**x4800's**) x 8 CPU sockets x 8 cores = **128 cores**
- 2 compute servers x 1T DRAM = **2T DRAM**
- 3 InfiniBand Switches x 36 ports = 108 ports
- 14 Storage Servers with 112 CPU cores & Flash Cache
 - 96G x 4 banks = 394G DRAM per storage server
 - 14 storage servers x 394G = 5.376T Flash Cache
 - 12 disks per storage server x 14 servers = 168 disks



Where did all my disk space go?

- Lost Space:
 - 100T SAS = 28T usable
 - 336T SATA = 100T usable
- Apply some compression & get it back:
 - 28T usable x 10 = 280T SAS
 - 100T usable x 10 = 1P SATA





Full Rack or start with 1/2 or 1/4

	<u>Full</u>	<u>Half</u>	<u>Quarter</u>
Compute Servers/cores	8/64	4/32	2/16
Storage Servers/disks*	14/168	7/84	3/36
Storage SAS /IOPs 21.6T	100T	50T	
Storage SATA	336T	168T	72T
Flash IOPs (max)	1,000,000	500,000	225,000
InfiniBand Switches	3	2**	2
Data Load Rates 1T/hr	5T/hr	2.5T/hr	

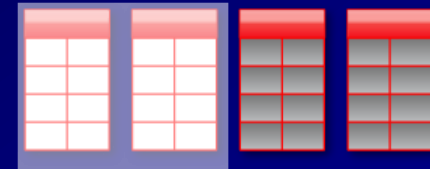
Benefits Multiply*



10 TB of user data
Requires 10 TB of IO



1 TB
with compression



100 GB
with partition pruning



20 GB
with Storage Indexes



5 GB
with Smart Scans



Sub second
On Database
Machine



Data is 10x Smaller, Scans are 2000x faster

**Oracle Slide - Thanks!*



Smart Scans





Smart Scans – 10x savings common

- HARDWARE Scans with **NO Code Change**:
 - Filters based on WHERE clause (predicates)
 - Filters on row / column / join condition
 - Incremental Backup Filtering
- Works with:
 - Uncommitted data
 - Locked rows
 - Chained rows
 - Compressed Data
 - Encrypted Data (11.2)
- You can **SEE** the benefit with Grid Control (OEM)



Smart Scans

- Bloom Filters used for Join Filtering
 - A way to quickly search for matches (simplistic meaning)
 - Saves space & is transparent to the user
 - Makes things faster – hardware level filtering
 - Tests if elements to search for are in a set
 - Many types out there including *Bloomier* filters
 - False positives are possible (rechecks to be perfect – addl. disk)
 - Google BigTable uses Bloom filters to reduce disk lookups



Oracle performance test...

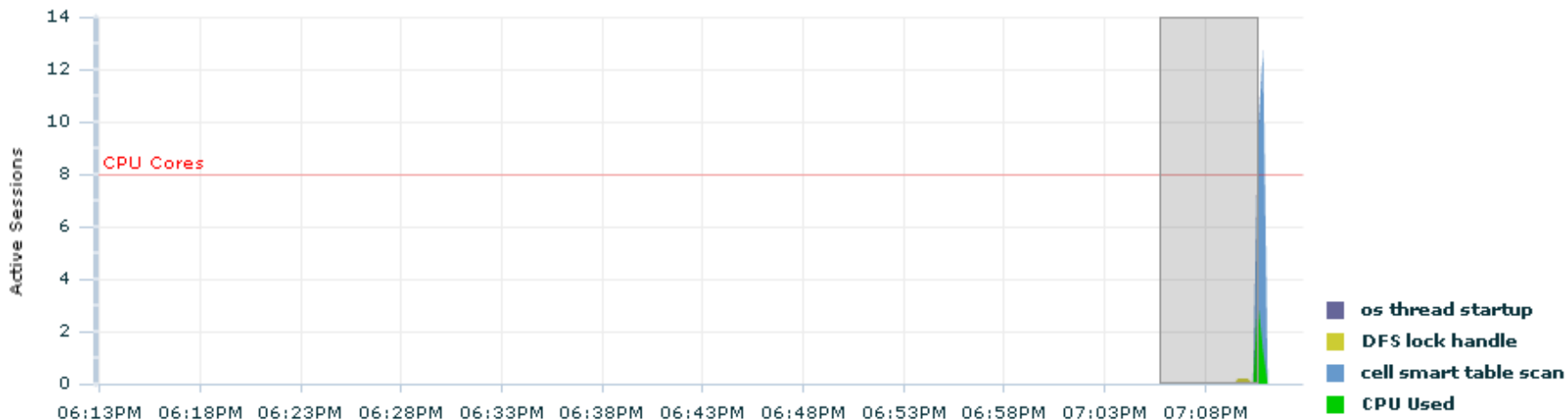
- Without Smart Scan (Push whole table via network)

7:55:11 PM

[Statistics](#) [Activity](#) [Plan](#) [Plan Control](#) [Tuning History](#) [SQL Monitoring](#)

Summary

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



Detail for Selected 5 Minute Interval

Start Time **Nov 17, 2010 7:05:45 PM**

[Run AWR SQL Report](#) [Run ASH Report](#)



The SMART Flash Cache



ALL Flash Cache Combined (3.6G/s per cell): 50G/s (1,000,000 IOPS)
20x more random I/O; 2x more sequential I/O (vs. disk)



Flash Cache – 20x-50x faster than disk

- Caches HOT Data – Does as LAST step!
- PCIe based Flash cards (PCI = Peripheral Component Interconnect express)
- Knows which objects NOT to cache (FTS)
- Can specify WHAT you want to cache
 - **STORAGE (CELL_FLASH_CACHE KEEP)**
 - Table/Partition level with **CREATE** or **ALTER**
- Write through caches is used to accelerate reads – Data written to disk also written to cache for future reads.



Flash Cache

- Caches
 - Hot Data/Index Blocks
 - Control File reads/writes
 - File header reads/writes
- Does NOT cache
 - Mirror copies / Backups / Data Pump
 - Tablespace Formatting
 - Table Scans (rare)

24G x 4 doms = 96G (dom = disk on module – “*solid state*”)

96G x 4 flash cards = 394G per storage server of flash



Flash Cache LRU

- **CELL_FLASH_CACHE** storage clause
 - **DEFAULT** (normal – large I/O's not cached)
 - **KEEP** (use flash cache more aggressive / May not occupy > 80%)
 - **NONE** (flash cache not used)
- **CACHE (NOCACHE) Hint**
 - I/O cached/not-cached in the flash cache
 - *SELECT /*+ CACHE */ ...*
- **EVICT Hint** – Data removed from the flash cache
- ASM rebalance data is evicted from cache when done
- Large I/O (Full Table Scans) on objects with **CELL_FLASH_CACHE** set to **DEFAULT** are not



Using the KEEP cache

```
ALTER TABLE CUSTOMER  
STORAGE (CELL_FLASH_CACHE KEEP);
```

Table Altered.

```
SELECT      TABLE_NAME, TABLESPACE_NAME,  
            CELL_FLASH_CACHE  
FROM        USER_TABLES  
WHERE       TABLE_NAME = 'CUSTOMER';
```

TABLE_NAME	TABLESPACE_NAME	CELL_FL
-----	-----	-----
CUSTOMER	R_TEST	KEEP



How it works...

- DB Request comes to **CELLSRV** (Cell storage server)
- CELLSRV (first time) gets data from disk
 - Data cached based on settings, hints ... etc.
 - Data to WRITE may also be cached after written if it is deemed that it may be needed again.
- CELLSRV (next time) checks:
 - In **Memory Hash Table** that lists what is cached
 - If cached – goes to flash cache
 - In not cached ...may cache based on settings...etc.
- CELLCLI> **list flashcache detail** (allows you to monitor)
- CELLCLI> **list flachcachecontent** where ObjectNumber=62340 detail

(Select DATAOBJ# – from obj\$ where name = 'CUSTOMER'.)



Is it working for me...

```
SELECT      NAME, VALUE
FROM        V$SYSSTAT
WHERE       NAME IN (
            'physical read total IO requests',
            'physical read requests optimized');
```

Name	Value
-----	-----
physical read total IO requests	36240
physical read requests optimized	23954
(this second line (*8192) is flash cache used)	



It IS working ... 4G query

```
SELECT      NAME, VALUE, VALUE*8192 VALUE2
FROM        V$SYSSTAT
WHERE       NAME IN (
            'physical read total IO requests',
            'physical read requests optimized');
```

NAME	VALUE	VALUE2
-----	-----	-----
physical read total IO requests	10,862,844	88,988,418,048
physical read requests optimized	2,805,003	22,978,584,576
run2.....		
physical read total IO requests	11,320,185	92,734,955,520
physical read requests optimized	3,203,224	26,240,811,008
run4.....		
physical read total IO requests	11,993,845	98,253,578,240
physical read requests optimized	3,793,000	31,072,256,000



It IS working ... V\$SQL

```
Select      sql_text, optimized_phy_read_requests,  
            physical_read_requests,  
            io_cell_offload_eligible_bytes  
from        v$sql  
where       sql_text like '%FIND YOUR SQL%'
```

SQL_TEXT	OPTIMIZED_PHY_READ_REQUESTS	PHYSICAL_READ_REQUESTS
----------	-----------------------------	------------------------

IO_CELL_OFFLOAD_ELIGIBLE_BYTES

SELECT....	567790	688309
4.2501E+10		
Run 2.....		
SELECT...	762747	906729
4.9069E+10		
run 4		
SELECT...	1352166	1566537
6.8772E+10		



FYI... NOT DB Flash Cache

- Note: Exadata PCIe card Smart Flash Cache (Exadata hardware PCIe Card Cache stored) is NOT the same as 11gR2 Database Flash Cache (file stored) that can be used with Oracle Enterprise Linux (OEL) and Solaris. In Database Flash Cache, a file can be used as data is aged out of SGA.
- To learn more about the 11gR2 Database Flash Cache, see the initialization parameters `db_flash_cache_size` & `db_flash_cache_size`.



Storage Indexes (11.2)

Table

Index

A	B	C	D
	1		
	3		
	5		
	5		
	8		
	3		

Min B = 1
Max B = 5

Min B = 3
Max B = 8



*** Thanks Oracle for this image*



Storage Index (11.2)

- **10x** is common

- Storage Indexes maintain summary information about the data– *(like Meta Data in a way)*
- A CELL LEVEL (storage) Memory Structure
- Groups things into Min/Max for various columns
- Eliminates I/Os where there is no match
- **Transparent to the user**
- **Done at the hardware level**
- Typically one index for every 1M of disk
- NOT like a B-Tree Index...more like partition elimination to skip data NOT meeting conditions
- 100% done by Oracle – **NO COMMANDS NEEDED!!**



Is it working for me...

```
SELECT      NAME, VALUE
FROM        V$SYSSTAT
WHERE       NAME LIKE ('%storage%');
```

NAME	VALUE
-----	-----
cell physical IO bytes saved by storage index	25604736
(actual savings from Exadata built storage index)	



Check BOTH servers...

```
SELECT      NAME, VALUE
FROM        GV$SYSSTAT
WHERE       NAME LIKE ('%storage%');
```

NAME	VALUE

cell physical IO bytes saved by storage index	19693854720
cell physical IO bytes saved by storage index	0

(actual savings from Exadata built storage index)



Hybrid Columnar Compression (11.2)





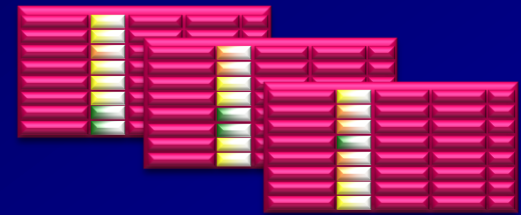
Compression (EHCC) – 4-10x & 30x is common

- 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

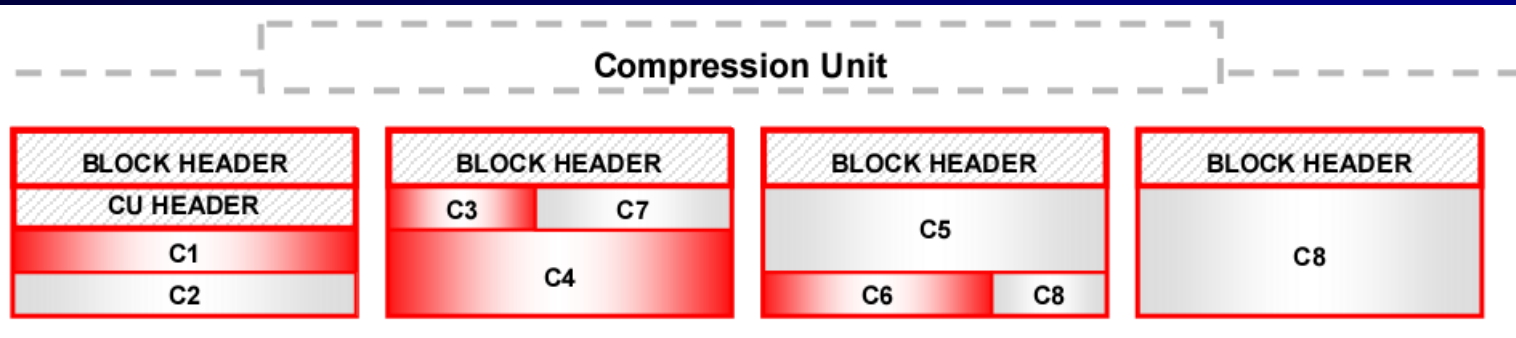
1. Column Data Compressed



(Warehouse)



(Archive)



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

*** 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



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



Enterprise Manager & Grid Control for Exadata



11gR2 Exadata

Page Refreshed Aug 25, 2010 11:44:23 AM PDT

Overview

Total Monitored Oracle Exadata Storage Server Targets 3

Oracle Exadata Storage Server Status



Up(3)

Oracle Exadata Storage Server Alerts

Critical 0
Warning 0
Errors 0

Oracle Exadata Storage Server Policy Violations

Critical 0
Warning 0
Informational 0

Oracle Exadata Storage Server Jobs

Problem Executions (last 7 days) 0
Action Required Executions (last 7 days) 0
Suspended Executions (last 7 days) 0

Target Search

Search All Go

Security Policy Violations

Critical 69
Warning 90
Informational 2
New in Last 24 Hours 55

Recommended Security Patches

Security Recommendations **Unavailable**

My Oracle Support **Credentials Not Set**

Patch Recommendations are not available.
My Oracle Support credentials are required.

Deployments Summary

View Database Installations

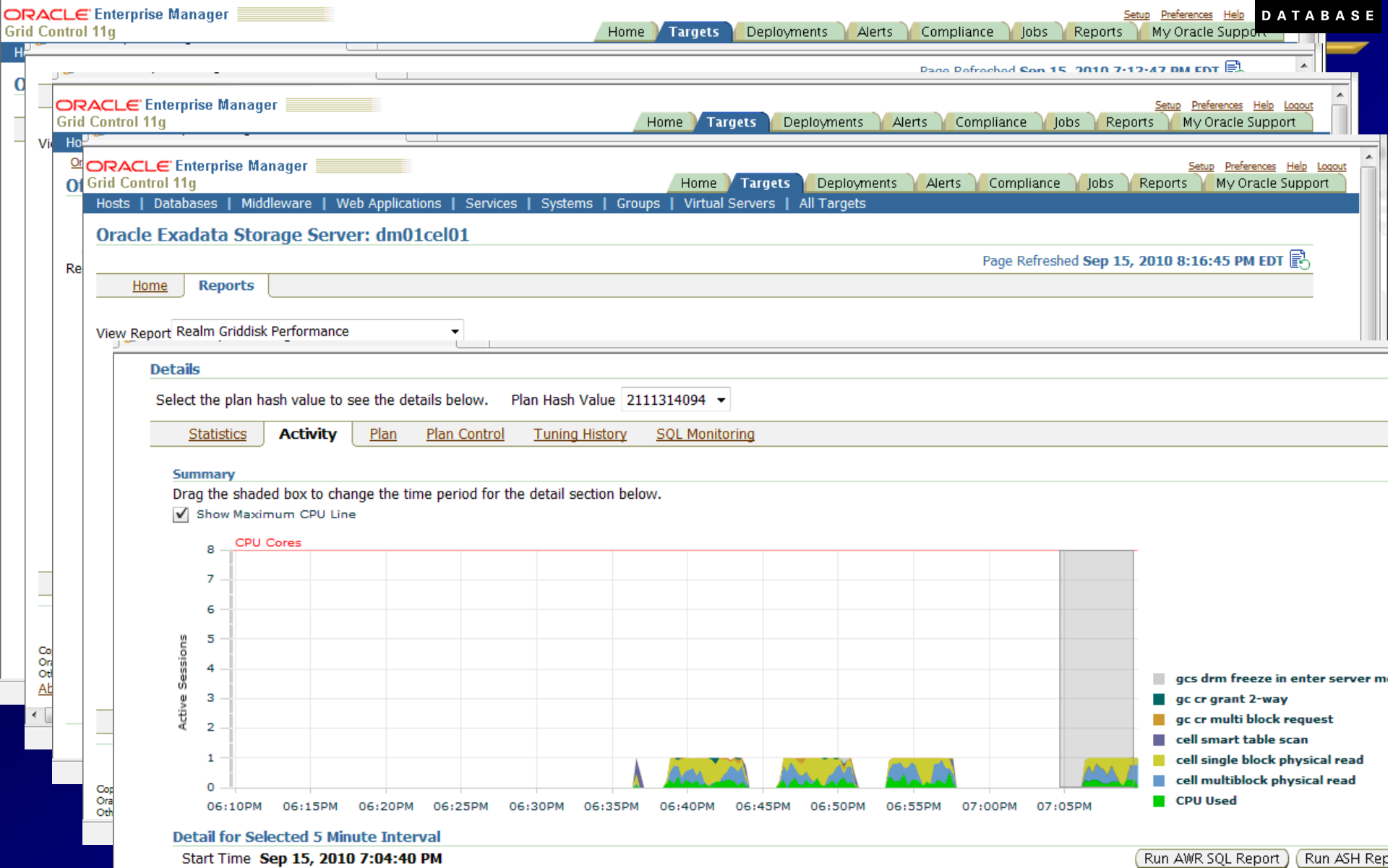
Database Installations	Targets	Installations	Patches Applied
Oracle Database 11g 11.1.0.7.0	2	4	Yes
Oracle Database 11g 11.2.0.2.0	0	1	No

Resource Center

[Enterprise Manager Support Workbench](#)
[Enterprise Manager Command Line Interface](#)
[Enterprise Manager Release Notes](#)

[Oracle Technology Network](#)

11gR2 Exadata



Monitor Targets

(Next slides – Some are coming soon)

ORACLE Enterprise Manager
Grid Control 11g

Setup Preferences Help Logout

Home Targets Deployments Alerts Compliance Jobs Reports My Oracle Support

Page Refreshed Aug 25, 2010 11:44:23 AM PDT

Overview

View Cluster Database

Total Monitored Cluster Database Targets 1

Cluster Database Status

100% Up(1)

Cluster Database Alerts

Critical 3
Warning 0
Errors 1

Cluster Database Policy Violations

Critical 8
Warning 26
Informational 1

Cluster Database Jobs

Problem Executions (last 7 days) 0
Action Required Executions (last 7 days) 0
Suspended Executions (last 7 days) 0

Target Search

Search All Go

Security Policy Violations

Critical 69
Warning 90
Informational 2
New in Last 24 Hours 55

Recommended Security Patches

Security Recommendations **Unavailable**
My Oracle Support [Credentials Not Set](#)
Patch Recommendations are not available.
My Oracle Support credentials are required.

Deployments Summary

View Database Installations

Database Installations	Targets	Installations	Patches Applied
Oracle Database 11g 11.1.0.7.0	2	4	Yes
Oracle Database 11g 11.2.0.2.0	0	1	No

Resource Center

[Enterprise Manager Support Workbench](#)
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[Oracle Technology Network](#)

Home | Targets | Deployments | Alerts | Compliance | Jobs | Reports | My Oracle Support | Setup | Preferences | Help | Logout

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[About Oracle Enterprise Manager](#)



Cluster Home – Shows Alerts... etc.

ORACLE Enterprise Manager

Grid Control 11g

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

[Home](#) [Targets](#) [Deployments](#) [Alerts](#) [Compliance](#) [Jobs](#) [Reports](#) [My Oracle Support](#)

[Hosts](#) | [Databases](#) | [Middleware](#) | [Web Applications](#) | [Services](#) | [Systems](#) | [Groups](#) | [Virtual Servers](#) | [All Targets](#)

System: dscbas_cluster

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[Refresh](#)

[Launch Dashboard](#)

[Home](#)

[Charts](#)

[Administration](#)

[Components](#)

[Topology](#)

General

Owner **SYSMAN**

Problem Jobs **0**

Last 7 days.

Privilege Propagation **Disabled** [?](#)

[Status History](#)



■ Up(17)

Services

Name	Type	Status	Performance Alerts Usage	Alerts Policy Violations
(No data found.)				

Policy Violations

Severity	Current	Last 24 Hours		Distinct Policies Violated
		Cleared	New	
✖	44	0	0	21
⚠	100	0	0	30
ℹ	2	0	0	2
Total	151	0	0	58

[Policy Trend Overview](#)

Alerts

[Alert History](#)

Severity	Current	Last 24 hours
✖	10	0
⚠	17	1
Total	27	1

Blackouts

[Create](#)

Status	Submitted to the Group	Submitted to any Member
Scheduled	0	0
Active	0	0

Security Policy Violations

Severity	Current	Last 24 Hours		Distinct Policies Violated
		Cleared	New	
✖	42	0	0	19
⚠	98	0	0	28
ℹ	4	0	0	4
Total	144	0	0	51

[Security At a Glance](#)

Recommended Security Patches

Security Recommendations **Unavailable**

My Oracle Support [Credentials Not Set](#)

⚠ Patch Recommendations are not available.
My Oracle Support credentials are required.

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Related Links

[Access](#)

[Reports](#)

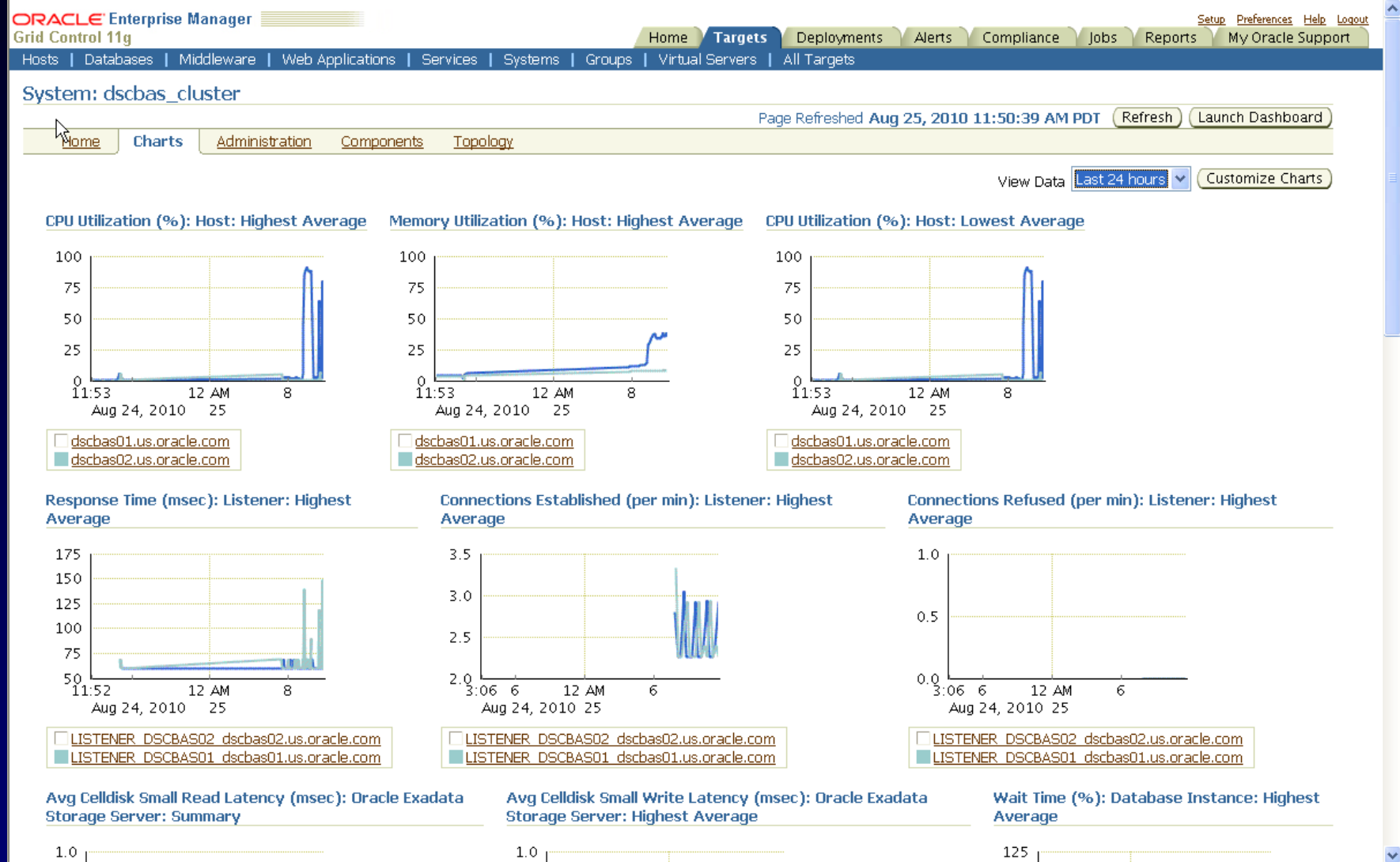
[Configuration Changes](#)

[Target Properties](#)

[Edit System](#)



Cluster Charts – Shows Performance (showing 2 DB Servers on same graph)





Cluster Admin – Shows Issues

ORACLE Enterprise Manager
Grid Control 11g

HomeTargetsDeploymentsAlertsComplianceJobsReportsMy Oracle Support

HostsDatabasesMiddlewareWeb ApplicationsServicesSystemsGroupsVirtual ServersAll Targets

System: dscbas_cluster

Page Refreshed Aug 31, 2010 12:14:32 PM PDTRefreshLaunch Dashboard

HomeChartsAdministrationComponentsTopology

Job Activity

Create JobAdd Middleware HomesGo

Job executions scheduled to start no more than 7 days ago, directly on the target, or on any of its members

Status	Submitted to the System	Submitted to any member
Problems	0	0
Action Required	0	0
Suspended	0	0
Scheduled	0	0
Running	0	0

Deployments Summary

ViewDatabase Installations

Database Installations	Targets	Installations	Patches Applied
Oracle Database 11g 11.1.0.7.0	2	4	Yes

Configuration Searches

Database Feature UsageGo

Database Operations

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Host Operations

Execute Host Command

Listener Operations

StartView ConfigurationStop

HomeChartsAdministrationComponentsTopology

Related Links

AccessReportsConfiguration ChangesTarget PropertiesEdit System

HomeTargetsDeploymentsAlertsComplianceJobsReportsMy Oracle SupportSetupPreferencesHelpLogout



Cluster Topology

ORACLE Enterprise Manager
Grid Control 11g

Home **Targets** Deployments Alerts Compliance Jobs Reports My Oracle Support

Hosts | Databases | Middleware | Web Applications | Services | Systems | Groups | Virtual Servers | All Targets

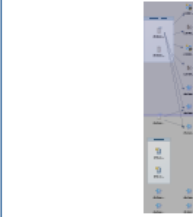
System: dscbas_cluster

Page Refreshed Aug 25, 2010 11:49:50 AM PDT Refresh Launch Dashboard

Home Charts Administration Components **Topology**

View Data Real Time: Manual Refresh

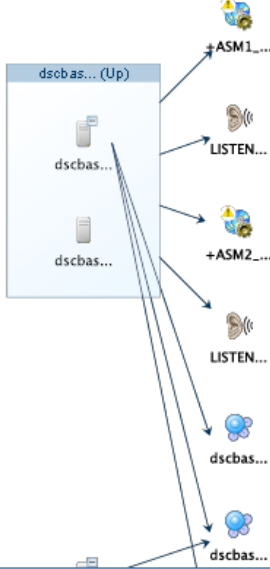
Overview



Selection Details
Nothing Selected

Summary

Components	17	(17)
Alerts	4	6
Policy	64	92
Violations	5	



```
graph TD
    dscbas_1[dscbas... (Up)] --> ASM1[+ASM1...]
    dscbas_1 --> LISTEN_1[LISTEN...]
    dscbas_1 --> ASM2[+ASM2...]
    dscbas_1 --> LISTEN_2[LISTEN...]
    dscbas_1 --> dscbas_2[dscbas...]
    dscbas_1 --> dscbas_3[dscbas...]
```

Legend

Home Charts Administration Components **Topology**

Related Links

Access	Configuration Changes	Edit System
Reports	Target Properties	

Home | **Targets** | Deployments | Alerts | Compliance | Jobs | Reports | My Oracle Support | Setup | Preferences | Help | Logout



Targets – CLUSTER Components

ORACLE Enterprise Manager
Grid Control 11g

Home **Targets** Deployments Alerts Compliance Jobs Reports My Oracle Support

Hosts | Databases | Middleware | Web Applications | Services | Systems | Groups | Virtual Servers | All Targets

System: dscbas_cluster

Page Refreshed Aug 25, 2010 11:49:17 AM PDT [Refresh](#) [Launch Dashboard](#)


Home Charts Administration **Components** Topology

Search

Name	Type	Status	Alerts	Policy Violations	CPU Utilization (%)	CPU Load (5min)	Memory Utilization (%)	Avg Celldisk S	Avg Celldisk S	Respons
+ASM1 dscbas01.us.oracle.com	Automatic Storage Management	↑	0 1	0 1 0						
+ASM2 dscbas02.us.oracle.com	Automatic Storage Management	↑	0 1	0 1 0						
dscbas01.us.oracle.com	Host	↑	0 0	12 0 0	1.64 ✓	2.03 ✓	36.51 ✓			
dscbas01.us.oracle.com:3872	Agent	↑	0 0	0 0 0						
dscbas01s	Oracle Exadata Storage Server	↑	0 0	0 0 0				0	0	
dscbas02.us.oracle.com	Host	↑	0 0	9 0 0	.86 ✓	.14 ✓	8.39 ✓			
dscbas02.us.oracle.com:3872	Agent	↑	0 0	0 0 0						
dscbas02s	Oracle Exadata Storage Server	↑	0 0	0 0 0				0	0	
dscbas03s	Oracle Exadata Storage Server	↑	0 0	0 0 0				0	0	
dscbas_cisco_switch	Cisco Switch	↑	0 0	0 0 0						
dscbas_cluster1	Cluster	↑	1 1	21 0 0						
JimSwitch	Exadata V2 Infiniband Switch	↑	0 0	0 0 0						
LISTENER_DSCBAS01 dscbas01.us.oracle.com	Listener	↑	0 0	2 5 1						
LISTENER_DSCBAS02 dscbas02.us.oracle.com	Listener	↑	0 0	1 5 1						




Hosts

ORACLE® Enterprise Manager  **Global Control 11g**

[Home](#) **[Targets](#)** [Deployments](#) [Alerts](#) [Compliance](#) [Jobs](#) [Reports](#) [My Oracle Support](#)





[Oracle Enterprise Manager](#) [Middleware](#) [Web Applications](#) [Services](#) [Systems](#) [Groups](#) [Virtual Servers](#) [All Targets](#)


Hosts

Page Refreshed Aug 25, 2010 11:48:26 AM PDT 

Search [Go](#) [Advanced Search](#)

[Remove](#) [Configure](#) | [Add](#)

Select	Name 	Status	Alerts	Policy Violations	Compliance Score (%)	CPU Util %	Mem Util %	Total IO/sec
<input checked="" type="radio"/>	dscbas01.us.oracle.com		0 0	12 0 0	69	1.64	35.86	28.83
<input type="radio"/>	dscbas02.us.oracle.com		0 0	9 0 0	69	.86	8.39	15.68
<input type="radio"/>	std3s6.us.oracle.com		1 0	28 0 0	82	3.37	73.67	13.42


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

Related Links

[Customize Table Columns](#) [Execute Host Command](#)

[Home](#) | [Targets](#) | [Deployments](#) | [Alerts](#) | [Compliance](#) | [Jobs](#) | [Reports](#) | [My Oracle Support](#) | [Setup](#) | [Preferences](#) | [Help](#) | [Logout](#)

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[About Oracle Enterprise Manager](#) 



Host: dscbas01.us.oracle.com >

Automatic Storage Management: +ASM1_dscbas01.us.oracle.com

Home Performance Disk Groups Configuration Users

Data Retrieved Aug 25, 2010 11:54:20 AM PDT Refresh

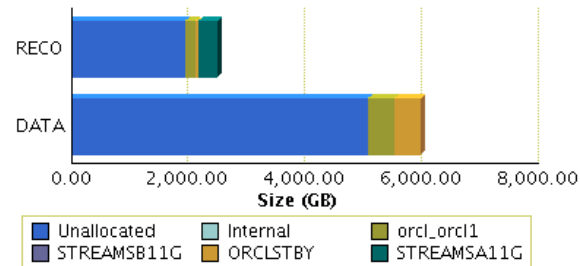
General



Current Status **Up**
 Up Since **Aug 25, 2010 7:12:21 AM PDT**
 Availability (%) **61.84**
 (Last 24 hours)
 Instance Name **+ASM1**
 Version **11.1.0.7.0**
 Host **dscbas01.us.oracle.com**
 Oracle Home **/u01/app/oracle/product/11.1.0/asm_1**

Startup/Shutdown

Disk Group Usage (GB)



Diagnostic Summary

Alert Log **No ORA- errors**
 Active Incidents **0**

Serviced Databases

Name	Disk Groups	Failure Groups	Allocated Space (GB)	Availability	Alerts
orcl_orcl1	DATA, RECO	6 (0 down)	632.06	Up	1 0
STREAMSB11G	RECO	3 (0 down)	0.15	Not Monitored	Not Monitored
ORCLSTBY	DATA, RECO	6 (0 down)	507.56	Not Monitored	Not Monitored
STREAMSA11G	RECO	3 (0 down)	328.84	Not Monitored	Not Monitored

Alerts

Severity	Category	Name	Message	Alert Triggered
Warning	Failure Group Imbalance Status	Disk Size Imbalance (%)	Disk Group RECO has failure groups with disks of different sizes which may lead to suboptimal space usage. Changing the configuration may alleviate this problem.	May 25, 2010 12:16:18 PM

Host Alerts

Severity	Category	Name	Message	Alert Triggered
(No alerts)				

Policy Violations

Storage Servers 1-3 (Exadata Plug-In)

ORACLE Enterprise Manager
Grid Control 11g

Home Targets Deployments Alerts Compliance Jobs Reports My Oracle Support

ORACLE Enterprise Manager
Grid Control 11g

Home Targets Deployments Alerts Compliance Jobs Reports My Oracle Support

Hosts | Databases | Middleware | Web Applications | Services | Systems | Groups | Virtual Servers | All Targets

Oracle Exadata Storage Server: dscbas03s

Page Refreshed Aug 24, 2010 1:48:54 PM PDT [Refresh](#)

Home [Reports](#)

General

Status **Up** [Black Out](#)
Availability (%) **86**
(Last 24 Hours)

CPU Utilization (%)

Memory Utilization (%)

Temperature

Alerts

Metric	Severity	Message	Alert Triggered	Last Value	Last Checked
No Alerts found.					

Configuration

[View Configuration](#) [Configuration History](#) [Saved Configurations](#) [Compare Configuration](#) [Import Configuration](#) [Compare Multiple Configurations](#)

Related Links

[All Metrics](#) [Blackouts](#) [Reports](#) [Metric and Policy Settings](#) [Target Properties](#) [Access](#) [Alert History](#) [Monitoring Configuration](#)

Home [Reports](#)

Home | [Targets](#) | [Deployments](#) | [Alerts](#) | [Compliance](#) | [Jobs](#) | [Reports](#) | [My Oracle Support](#) | [Setup](#) | [Preferences](#) | [Help](#) | [Logout](#)

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Database Instance Monitoring

ORACLE Enterprise Manager
Grid Control 11g

Home Targets Deployments Alerts Compliance Jobs Reports My Oracle Support

Hosts | Databases | Middleware | Web Applications | Services | Systems | Groups | Virtual Servers | All Targets

Cluster: dscbas_cluster1 > Cluster Database: orcl >

Database Instance: orcl_orcl2 Switch Database Instance orcl_orcl2

Home Performance Availability **Server** Schema Data Movement Software and Support

Storage

- Control Files
- Tablespaces
- Temporary Tablespace Groups
- Datafiles
- Rollback Segments
- Redo Log Groups
- Archive Logs
- Disk Groups
- Migrate to ASM
- Make Tablespace Locally Managed

Database Configuration

- Memory Advisors
- Automatic Undo Management
- Initialization Parameters
- View Database Feature Usage

Oracle Scheduler

- Jobs
- Chains
- Schedules
- Programs
- Job Classes
- Windows
- Window Groups
- Global Attributes
- Automated Maintenance Tasks

Statistics Management

- Automatic Workload Repository
- AWR Baselines

Resource Manager

- Getting Started
- Consumer Groups
- Consumer Group Mappings
- Plans
- Settings
- Statistics

Security

- Users
- Roles
- Profiles
- Audit Settings
- Oracle Label Security
- Virtual Private Database
- Application Contexts
- Enterprise User Security
- Database Vault

Query Optimizer

- Manage Optimizer Statistics
- SQL Plan Control
- SQL Tuning Sets

Change Database

- Add Instance
- Delete Instance

Related Links

Access	Advisor Central	Alert History
Alert Log Contents	All Metrics	Apply Patch
Archive/Purge Alert Log	Baseline Metric Thresholds	Blackouts
Deployments	EM SQL History	Execute SQL
Jobs	Metric and Policy Settings	Metric Collection Errors
Monitoring Configuration	Monitor in Memory Access Mode	Reports
Scheduler Central	SQL Worksheet	Target Properties

Cisco Switch & InfiniBand Switch

ORACLE Enterprise Manager

ORACLE Enterprise Manager

ORACLE Enterprise Manager

ORACLE Enterprise Manager

ORACLE Enterprise Manager

Grid Control 11g

Home | Targets | Deployments | Alerts | Compliance | Jobs | Reports | My Oracle Support

Hosts | Databases | Middleware | Web Applications | Services | Systems | Groups | Virtual Servers | All Targets

Exadata V2 Infiniband Switch: JimSwitch >

Metric and Policy Settings

OK

Metric Thresholds Policies

View Metrics with thresholds

Metric	Comparison Operator	Warning Threshold	Critical Threshold	Corrective Actions	Collection Schedule	Details
Aggregate Sensor Condition	=		2	None	Every 1 Minute	Details
Management interface response time	>	75	100	None	Every 1 Minute	Details
Status			Down	None	Every 1 Minute	Details

TIP Empty Thresholds will disable alerts for that metric.

Metric Thresholds Links

Metric Snapshots

Metric Thresholds Policies

Related Links

[Past Apply Operations](#) [Pending Apply Operations](#)

OK

Home | Targets | Deployments | Alerts | Compliance | Jobs | Reports | My Oracle Support | Setup | Preferences | Help | Logout

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Configuration History

ORACLE Enterprise Manager
Grid Control 11g

[Home](#)[Targets](#)[Deployments](#)[Alerts](#)[Compliance](#)[Jobs](#)[Reports](#)[My Oracle Support](#)[Setup](#) [Preferences](#) [Help](#) [Logout](#)[General](#) | [Provisioning](#) | [Patches & Updates](#)

Configuration History

Enterprise Manager automatically collects configuration information for targets such as hosts and databases. Changes to these configurations are recorded and may be viewed from this page.

Page Refreshed Aug 25, 2010 11:59:28 AM PDT

[Search Using SQL](#)Category [Oracle Exadata Storage Server](#)

Changing the category clears any existing results.

Search

Target Name is exactly [dscbas02s](#) Change Discovered after [12/15/02](#)
(Example: 12/15/02)
12 00 AM PM

Target Property Deployment Type Change Discovered before [12/15/02](#)
(Example: 12/15/02)
12 00 AM PM

On Host contains

Member Of contains

Type of Change is [All](#)

[Go](#) [Clear](#)View History Records [Grouped](#)[Save to File](#)

Change Discovered	Target Name	On Host	Category	History Records
Jun 4, 2010 9:00:27 AM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Oracle Cell Configuration	1
May 26, 2010 12:01:58 PM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Cell Celldisk Configuration	12
May 26, 2010 12:01:58 PM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Cell Griddisk Configuration	24
May 21, 2010 1:09:26 PM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Cell Celldisk Configuration	12
May 21, 2010 1:09:26 PM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Cell Griddisk Configuration	24
May 21, 2010 9:39:11 AM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Cell Celldisk Configuration	24
May 21, 2010 9:39:11 AM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Oracle Cell Configuration	1
May 21, 2010 9:39:11 AM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Cell Griddisk Configuration	48
May 21, 2010 9:39:11 AM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Cell LUN Configuration	24
May 21, 2010 9:39:11 AM PDT	dscbas02s	dscbas01.us.oracle.com	Oracle Exadata Storage Server: Cell Physicaldisk Configuration	24

[Home](#) | [Targets](#) | [Deployments](#) | [Alerts](#) | [Compliance](#) | [Jobs](#) | [Reports](#) | [My Oracle Support](#) | [Setup](#) | [Preferences](#) | [Help](#) | [Logout](#)

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[About Oracle Enterprise Manager](#)



Enterprise Manager Exadata Simulation



“11g R1/R2 Best Features” (more on this)



SQL Performance Analyzer 11gR2 - Options

Upgrade
Options

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

Database Instance: si11gr2.myvm.com > Advisor Central > SQL Performance Analyzer

Page Refreshed Oct 9, 2009 12:20:51 PM CDT (Refresh) View Data Real Time: 15 Second Re

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 9i or 10.1](#) Test and analyze the effects of database upgrade from 9i or 10.1 on SQL Tuning Set performance.
- [Upgrade from 10.2 or 11g](#) Test and analyze the effects of database upgrade from 10.2 or 11g on SQL Tuning Set performance.
- [Parameter Change](#) Test and compare an initialization parameter change on SQL Tuning Set performance.
- [Exadata Simulation](#) Simulate the effects of a Exadata Storage Server installation on SQL Tuning Set performance.
- [Guided Workflow](#) Create a SQL Performance Analyzer Task and execute custom experiments using manually created SQL trials.

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 For an explanation of the icons and symbols used in the following table, see the [Icon Key](#)

Related Links

[SQL Tuning Sets](#)

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

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SQL Performance Analyzer 11gR2 – Exadata Simulation

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

Exadata Simulation - Windows Internet Explorer

https://si11gr2.myvm.com:1158/em/console/database/instance/SPIAE:exadata?type=oracle_database&target=si11gr2.myvm.com&event=dload

File Edit View Favorites Tools Help

Links TUSC Homepage TUSC Intranet TUSC Web Email TUSC Time Reporting System Yahoo! MapQuest Maps Travelocity Launch Internet Explorer Browser

Google Search

Exadata Simulation

ORACLE Enterprise Manager 11g
Database Control

Setup Preferences Help Logout
Database

Database Instance: si11gr2.myvm.com > Advisor Central > SQL Performance Analyzer >

Logged in As SYS

Exadata Simulation

Task Information

* Task Name:

* SQL Tuning Set: ⓘ

Description:

Creation Method: **Execute SQLs**

Per-SQL Time Limit: ⓘ

☒ **TIP** Time limit is on elapsed time of test execution of SQL.

Trial Comparison

Comparison Metric: **I/O Interconnect Bytes**

Schedule

Time Zone:

☒ Immediately

☐ Later

Date: ⓘ
(example: Oct 9, 2009)

Time: ☐ AM ☒ PM

Simulating Exadata Storage Server

Exadata Storage provides extremely large I/O bandwidth coupled with a capability to offload SQL processing to Exadata cells. The latter allows Oracle to significantly reduce the volume of data sent through the I/O interconnect while at the same time off-loading CPU resources to the Exadata cells. SQL Performance Analyzer can assess the effectiveness of Exadata SQL offload processing by simulating an Exadata Storage Server installation and measuring the reduction in I/O interconnect bandwidth on your SQL workload. Running this simulation does not require any hardware or configuration changes, and is accomplished as follows:

- A SQL Performance Analyzer Task is created and initial Trial run is performed with Exadata Storage Server simulation disabled.
- A second trial run is performed with Exadata Storage Server simulation enabled.
- A SQL Trial Comparison report is run which compares the two previously described trial runs. The comparison metric is I/O Interconnect Bytes which shows an estimate of the amount of data that would not need to be sent from the Exadata cells to the database server if Exadata storage were used for the examined SQL statements.

Database | Setup | Preferences | Help | Logout

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SQL Performance Analyzer 11gR2 – Exadata Simulation

Job is
running

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

https://sl11gr2.myvm.com:1158/em/console/database/instance/SPIASummary?event=refresh&target=sl11gr2.myvm.com&type=oracle_database&ipMsgID=7569afea

File Edit View Favorites Tools Help

Links TUSC Homepage TUSC Intranet TUSC Web Email TUSC Time Reporting System Yahoo! MapQuest Maps Travelocity Launch Internet Explorer Browser

Google Search

Oracle Enterprise Manager (SYS) - SQL Performance ...

ORACLE Enterprise Manager 11g Database Control

Setup Preferences Help Logout Database

Database Instance: sl11gr2.myvm.com > Advisor Central >

SQL Performance Analyzer

Page Refreshed Oct 9, 2009 8:04:31 PM CDT (Refresh) View Data Real Time: 15 Second Re

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 9i or 10.1](#) Test and analyze the effects of database upgrade from 9i or 10.1 on SQL Tuning Set performance.
- [Upgrade from 10.2 or 11g](#) Test and analyze the effects of database upgrade from 10.2 or 11g on SQL Tuning Set performance.
- [Parameter Change](#) Test and compare an initialization parameter change on SQL Tuning Set performance.
- [Exadata Simulation](#) Simulate the effects of a Exadata Storage Server installation on SQL Tuning Set performance.
- [Guided Workflow](#) Create a SQL Performance Analyzer Task and execute custom experiments using manually created SQL trials.

SQL Performance Analyzer Tasks

Delete View Latest Report

Select Name	Owner	Last Modified	Current Step Name	Type	Status	SQLs Processed	Steps Completed
RJN2	SYS	Oct 9, 2009 8:04:30 PM	INITIAL_SQL_TRIAL	Execute	Processing	5 of 7	1 of 4
RJN1	SYS	Oct 9, 2009 12:37:34 PM	EXEC_114	Compare	Completed		4 of 4

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

Related Links

[SQL Tuning Sets](#)

Database | Setup | Preferences | Help | Logout

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SQL Performance Analyzer 11gR2 – Exadata Simulation



New!
View
PL/SQL

Oracle Enterprise Manager (SYS) - View Job: SYS.RJN2 - Windows Internet Explorer

Database Instance: si11gr2.myvm.com > Scheduler Jobs > View Job: SYS.RJN2

General

Name RJN2
Schema SYS
Enabled FALSE
Description RJN2
Logging Level **No logging (OFF)**
Job Class DEFAULT_JOB_CLASS
Auto Drop FALSE
Restartable FALSE
Destination
Credential Name

Schedule

Repeat **Do Not Repeat**
Start Date

Options

Raise Events **None**
Maximum Run Duration (minutes) **None**
Priority **Medium**
Schedule Limit (minutes) **None**
Maximum Runs **None**
Maximum Failures **None**
Job Weight **1**
Instance Stickiness **TRUE**
For use in RAC. If instance_stickiness is set to TRUE, the Oracle Scheduler will attempt to execute the job on the same instance as the previous run

Command

Command Type **PL/SQL Block**

```
PL/SQL declare sts_name VARCHAR2(30) := 'TOP_SQL_1255109696692'; sts_owner VARCHAR2(30) := 'SYS'; task_name VARCHAR2(30) := 'RJN2'; task_desc VARCHAR2(256) := 'Exadata test'; execution_type VARCHAR2(30) := 'TEST EXECUTE'; persql_timelimit VARCHAR2(30) := '300'; compare_metric VARCHAR2(30) := 'IO_INTERCONNECT_BYTES'; tname VARCHAR2(30) := task_name; ename1 VARCHAR2(30); ename2 VARCHAR2(30); ename3 VARCHAR2(30); edesc VARCHAR2(256); l_status VARCHAR2(30); begin dbms_sqlpa.set_analysis_task_parameter(tname, 'TIME_LIMIT', 'UNLIMITED'); dbms_sqlpa.set_analysis_task_parameter(tname, 'LOCAL_TIME_LIMIT', persql_timelimit); ename1 := dbms_sqlpa.execute_analysis_task(task_name => tname, execution_type => execution_type, execution_name => 'INITIAL_SQL_TRIAL', execution_params => dbms_advisor.arglist('cell_simulation_enabled', 'FALSE'), execution_desc => 'Exadata Storage Server simulation disabled'); select status into l_status from sys.dba_advisor_tasks where task_name = tname and owner = 'SYS'; IF (l_status = 'COMPLETED') THEN ename2 := dbms_sqlpa.execute_analysis_task(task_name => tname, execution_type => execution_type, execution_name => 'SECOND_SQL_TRIAL', execution_params => dbms_advisor.arglist('cell_simulation_enabled', 'TRUE'), execution_desc => 'Exadata Storage Server simulation enabled'); END IF; select status into l_status from sys.dba_advisor_tasks where task_name = tname and owner = 'SYS'; IF (l_status = 'COMPLETED') THEN ename3 := dbms_sqlpa.execute_analysis_task(task_name => tname, execution_type => 'compare performance', execution_params => dbms_advisor.arglist('comparison_metric', compare_metric)); END IF; end;
```

Operation Detail

Select Log ID	Log Date	Operation	Status
469	Oct 9, 2009 8:04:36 PM -05:00	RUN	SUCCEEDED



SQL Performance Analyzer 11gR2 – Exadata Simulation



Click on
Job after
complete

View
Report

SQL Performance Analyzer Task: SYS.RJN2 - Windows Internet Explorer

https://si11gr2.myvm.com:1158/em/console/database/instance/SPIAEdt?SPIATaskOwner=SYS&event=doLoad&SPIATaskName=RJN2&target=si11gr2.myvm.com&type=oracle_database

Oracle Enterprise Manager 11g Database Control

Database Instance: si11gr2.myvm.com > Advisor Central > SQL Performance Analyzer > SQL Performance Analyzer Task: SYS.RJN2

View Latest Report

The SQL Performance Analyzer Task is a container for experimental results of executing a specific SQL Tuning Set under changed environmental conditions and assessing the impact of environmental changes on STS execution performance.

SQL Tuning Set

SQL Trials

A SQL Trial captures the execution performance of the SQL Tuning Set under specific environmental conditions.

SQL Trial Name	Description	Created	SQL Executed	Status
INITIAL_SQL_TRIAL	Exadata Storage Server simulation disabled	10/9/09 8:04 PM	Yes	COMPLETED
SECOND_SQL_TRIAL	Exadata Storage Server simulation enabled	10/9/09 8:04 PM	Yes	COMPLETED

SQL Trial Comparisons

Compare SQL Trials to assess change impact of environmental differences on SQL Tuning Set execution costs.

Trial 1 Name	Trial 2 Name	Compare Metric	Created	Status	Comparison Report
INITIAL_SQL_TRIAL	SECOND_SQL_TRIAL	I/O Interconnect Bytes	10/9/09 8:04 PM	COMPLETED	View Report

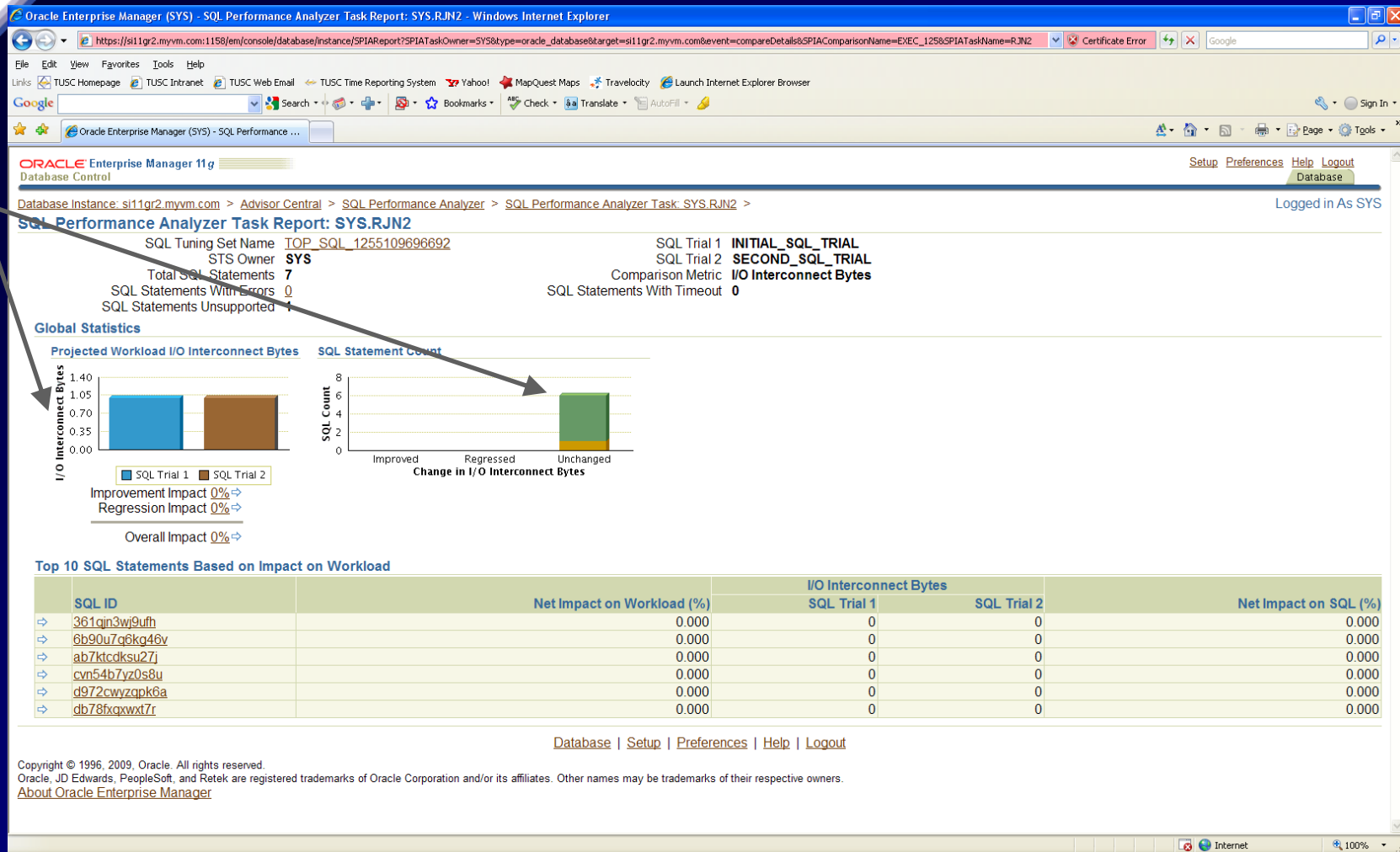
Database | Setup | Preferences | Help | Logout

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SQL Performance Analyzer 11gR2 – Exadata Simulation

Simple
Job so
no
benefit





Resource Management (IORM) (FYI Only)



IORM - I/O Resource Management



- Set I/O resources for different instance
 - Instance A = 50%
 - Instance B = 30%
 - Instance C = 20%
- Further set I/O based on users and tasks
 - Instance A Interactive = 50%
 - Instance A Reporting = 25%
 - Instance A Batch = 15%
 - Instance A ETL = 15%
- Best Solution for **MIXED** workloads & many instances



DBRM – Database Resource Manager

- Enhanced for Exadata
- Allows management of inter and intra DB I/O
- Inter-DB – Managed via IORM & Exadata storage software
- Intra-DB - Managed via Consumer Group
- CPU
- Undo
- DOP (Degree of Parallelism)
- Active Sessions



Grid Control - Resource Manager

ORACLE Enterprise Manager
Grid Control 11g

Home Targets

Hosts | Databases | Middleware | Web Applications | Services | Systems | Groups | Virtual Servers | All

Cluster: dscbas_cluster1 > Cluster Database: orcl >

Database Instance: orcl_orcl2

Home Performance Availability **Server** Schema Data Movement Software and Support

Storage

- Control Files
- Tablespaces
- Temporary Tablespace Groups
- Datafiles
- Rollback Segments
- Redo Log Groups
- Archive Logs
- Disk Groups
- Migrate to ASM
- Make Tablespace Locally Managed

Statistics Management

- Automatic Workload Repository
- AWR Baselines

Query Optimizer

- Manage Optimizer Statistics
- SQL Plan Control
- SQL Tuning Sets

Related Links

- Access
- Alert Log Contents
- Archive/Purge Alert Log
- Deployments
- Jobs
- Monitoring Configuration
- Scheduler Central

Database Configuration

- Memory Advisors
- Automatic Undo Management
- Initialization Parameters
- View Database Feature Usage

Resource Manager

- Getting Started
- Consumer Groups
- Consumer Group Mappings
- Plans
- Settings
- Statistics

Change Database

- Add Instance
- Delete Instance

Advisor Central

- All Metrics
- Baseline Metric Thresholds
- EM SQL History
- Metric and Policy Settings
- Monitor in Memory Access Mode
- SQL Worksheet

Resource Manager

 [Getting Started](#)

 [Consumer Groups](#)

 [Consumer Group Mappings](#)

 [Plans](#)

[Settings](#)

[Statistics](#)

Change Database

 [Add Instance](#)

Security – FYI Only



Oracle Database Security*

ORACLE®
DATABASE 11^g

Built over MANY years...



Oracle Audit Vault

Oracle Database Vault

DB Security Evaluation #19

Transparent Data Encryption

EM Configuration Scanning

Fine Grained Auditing (9i)

Secure application roles

Client Identifier / Identity propagation

Oracle Label Security (2000)

Proxy authentication

Enterprise User Security

Global roles

Virtual Private Database (8i)

Database Encryption API

Strong authentication (PKI, Kerberos, RADIUS)

Native Network Encryption (Oracle7)

Database Auditing

2007+

1977 Government customer

**Oracle Slide - Thanks!*

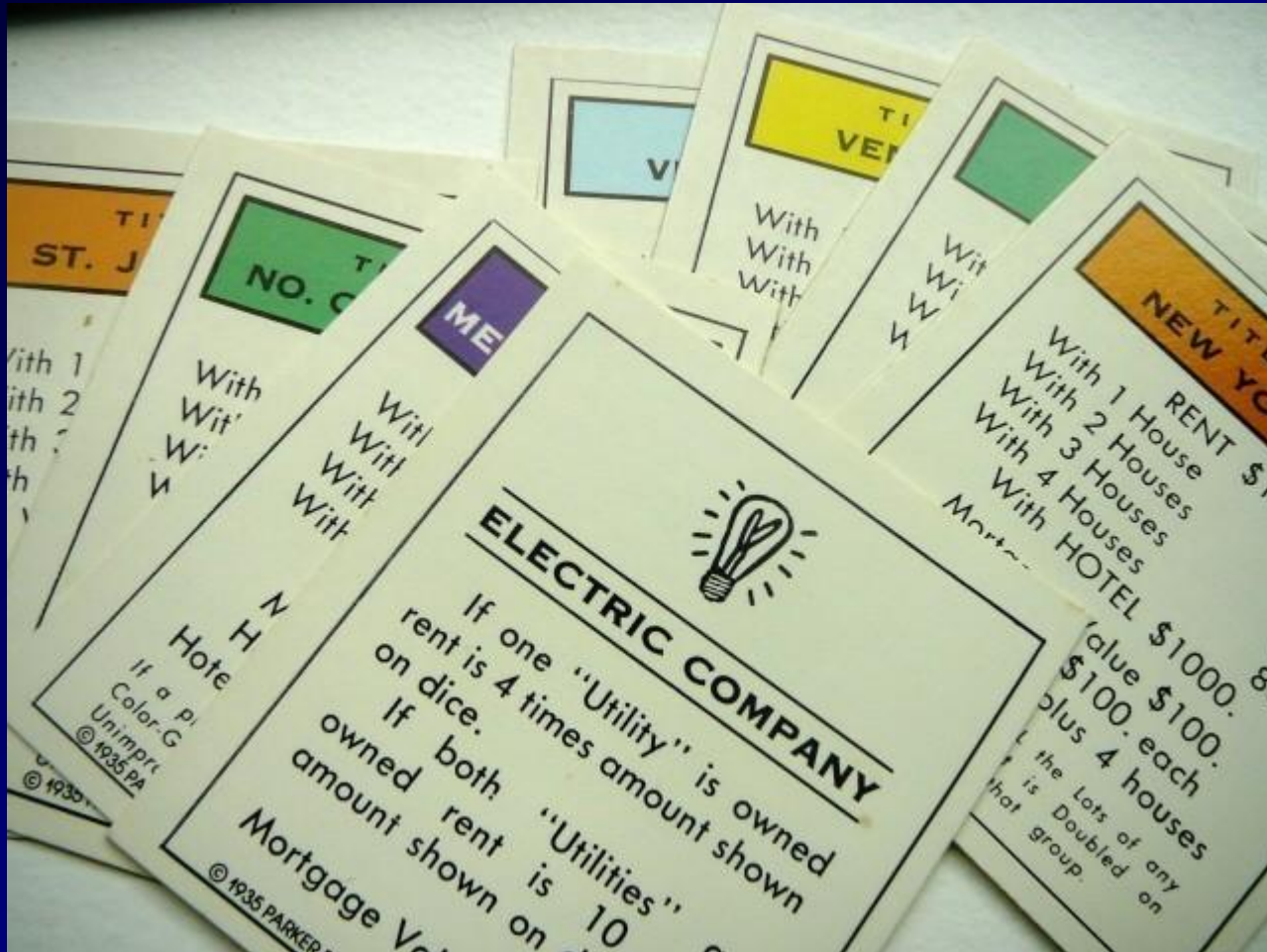


Security

- Audit Vault
- Total Recall / Flashback
- Database Vault
- Label Security
- Advanced Security
- Secure encrypted backup (also available: incremental backup with **Change Tracking File** – much faster)
- Data Masking
- Data Guard
- Failure Groups – (automatic-for storage cell failure)

Utilities - FRI Only...

(Screen Shots - Oracle Learning Library)





Utilities You'll need to Use - FYI

- **CELLCLI** – Cell Command Line Interface (CLI)
- **DCLI** – Run the same command on multiple cells at the same time

From Oracle:

*Oracle Exadata Storage Server includes the DCLI utility on each cell. You can use the **DCLI** utility to execute commands or scripts in parallel across a defined set of cells. The DCLI tool simplifies any operations that must be run across a subset or all cells. Configuration of SSH user equivalency across all cells is an important prerequisite for optimizing the use of DCLI commands. DCLI provides the **-k** option to automate the distribution of SSH private keys into the **AUTHORIZED_KEYS** file.*

- **ADRCI** – Automatic Diagnostic Repository Command line Interface; Quickly get diagnostics reports to send to Oracle

Turn Exadata on...

Sun Fire X4270/X4275 Server CPU Power (TDP Limit) = 80 Watts

Product Serial Number:0937XFG036

CPU : Intel(R) Xeon(R) CPU E5540 @ 2.53GHz

Speed : 2.53 GHz Count : 16

Press F2 to run Setup (CTRL+E on Remote Keyboard)

Press F12 if you want to boot from the network (CTRL+N on Remote Keyboard)

Press F8 for BBS POPUP (CTRL+P on Remote Keyboard)

QPI Operational Speed at : 5.8GT/s

BMC Firmware Revision: 3.0.3.35 r45111

Initializing USB Controllers .. Done.

24568MB OK

USB Device(s): 2 Keyboards, 2 Mice, 1 Hub, 1 Storage Device

Auto-detecting USB Mass Storage Devices ..

Device #01 : Unigen PSA4000 *HiSpeed*

01 USB mass storage devices found and configured.

BMC Responding

Checking NVRAM..

008

008

Checks continue...

```
Starting console mouse services:      [ OK ]
Starting crond:                       [ OK ]
Starting xfs:                         [ OK ]
Starting anacron:                     [ OK ]
Starting atd:                         [ OK ]
Starting exachkcfg:                   [ FAILED ]
Starting HAL daemon:                  [ OK ]
Starting celld:
Starting the RS, CELLSRV, and MS services...
Getting the state of RS services...
    running
Starting CELLSRV services...
The STARTUP of CELLSRV services was not successful. Error: Start Failed
Starting MS services...
The STARTUP of MS services was successful.

[ OK ]

Logging started to /var/log/cellos/validations.log
Run validation biosbootorder - PASSED
Run validation misceachboot - PASSED
Run validation createcell - RDS/IB: connected to 192.168.0.111 version 3.
RDS/IB: connected to 192.168.0.111 version 3.1
```




CELLCLI – Commands

- CellCLI> list cell detail
- CellCLI> list lun
- CellCLI> list physicaldisk
- CellCLI> list flashcache detail
- CellCLI> list celldisk
- CellCLI> calibrate force
- CellCLI> create celldisk all
- CellCLI> create griddisk all harddisk prefix='data'
,size=100g
- CellCLI> create griddisk all harddisk prefix='data'
,size=100g
- CellCLI> list griddisk
- CellCLI> list griddisk attributes name size



Run CELLCLI – Cell Detail

```
[root@sgsas1 ~]# cellcli
CellCLI: Release 11.2.1.2.0 - Production on Fri Nov 06 09:31:15 PST 2009

Copyright (c) 2007, 2009, Oracle. All rights reserved.
Cell Efficiency Ratio: 1

CellCLI> list cell detail
      name:                sgsas1
      bmcType:              IPMI
      cpuCount:             16
      fanCount:             12/12
      fanStatus:            normal
      id:                   f59022f8-969d-4c20-bed0-ed54ba0d2079
      interconnectCount:    3
      interconnect1:        bond0
      iormBoost:            0.0
      ipAddress1:           192.168.214.193/22
      makeModel:            SUN MICROSYSTEMS SUN FIRE X4275 SERVER SAS
      metricHistoryDays:    7
      offloadEfficiency:    1.0
      powerCount:           2/2
      powerStatus:          normal
      status:               online
      temperatureReading:   29.0
      temperatureStatus:    normal
      upTime:               7 days, 9:32
      cellsrvStatus:        running
      msStatus:              running
      rsStatus:              running
```

```
CellCLI> █
```




One Storage Server – 12 Disks + Flash

12 Physical Disks

CellCLI> list lun

0_0	0_0	normal
0_1	0_1	normal
0_2	0_2	normal
0_3	0_3	normal
0_4	0_4	normal
0_5	0_5	normal
0_6	0_6	normal
0_7	0_7	normal
0_8	0_8	normal
0_9	0_9	normal
0_10	0_10	normal
0_11	0_11	normal

16 Flash Modules
4 – flash cards
4 – flash modules ea. card

1_0	1_0	normal
1_1	1_1	normal
1_2	1_2	normal
1_3	1_3	normal
2_0	2_0	normal
2_1	2_1	normal
2_2	2_2	normal
2_3	2_3	normal
4_0	4_0	normal
4_1	4_1	normal
4_2	4_2	normal
4_3	4_3	normal
5_0	5_0	normal
5_1	5_1	normal
5_2	5_2	normal
5_3	5_3	normal

CellCLI> █

CALIBRATE – check performance



**Check
Performance**

```
CellCLI> calibrate force
Calibration will take a few minutes...
Aggregate random read throughput across all hard disk luns: 1597 MBPS
Aggregate random read throughput across all flash disk luns: 4212.28 MBPS
Aggregate random read IOs per second (IOPS) across all hard disk luns: 4930
Aggregate random read IOs per second (IOPS) across all flash disk luns: 149690
Controller read throughput: 1683.11 MBPS
Calibrating hard disks (read only) ...
Lun 0_0 on drive [20:0] random read throughput: 152.93 MBPS, and 421 IOPS
Lun 0_1 on drive [20:1] random read throughput: 156.59 MBPS, and 410 IOPS
Lun 0_10 on drive [20:10] random read throughput: 157.07 MBPS, and 426 IOPS
Lun 0_11 on drive [20:11] random read throughput: 150.99 MBPS, and 408 IOPS
Lun 0_2 on drive [20:2] random read throughput: 151.67 MBPS, and 425 IOPS
Lun 0_3 on drive [20:3] random read throughput: 155.05 MBPS, and 424 IOPS
Lun 0_4 on drive [20:4] random read throughput: 154.51 MBPS, and 425 IOPS
Lun 0_5 on drive [20:5] random read throughput: 152.84 MBPS, and 420 IOPS
Lun 0_6 on drive [20:6] random read throughput: 149.28 MBPS, and 414 IOPS
Lun 0_7 on drive [20:7] random read throughput: 155.20 MBPS, and 427 IOPS
Lun 0_8 on drive [20:8] random read throughput: 154.13 MBPS, and 425 IOPS
Lun 0_9 on drive [20:9] random read throughput: 155.88 MBPS, and 423 IOPS
Calibrating flash disks (read only, note that writes will be significantly slower) ...
Lun 1_0 on drive [[10:0:0:0]] random read throughput: 269.03 MBPS, and 19650 IOPS
Lun 1_1 on drive [[10:0:1:0]] random read throughput: 268.72 MBPS, and 19635 IOPS
Lun 1_2 on drive [[10:0:2:0]] random read throughput: 268.54 MBPS, and 19635 IOPS
Lun 1_3 on drive [[10:0:3:0]] random read throughput: 268.96 MBPS, and 19633 IOPS
Lun 2_0 on drive [[12:0:0:0]] random read throughput: 269.86 MBPS, and 20441 IOPS
Lun 2_1 on drive [[12:0:1:0]] random read throughput: 270.08 MBPS, and 20397 IOPS
Lun 2_2 on drive [[12:0:2:0]] random read throughput: 269.19 MBPS, and 20437 IOPS
Lun 2_3 on drive [[12:0:3:0]] random read throughput: 269.49 MBPS, and 20418 IOPS
Lun 4_0 on drive [[9:0:0:0]] random read throughput: 268.54 MBPS, and 19674 IOPS
Lun 4_1 on drive [[9:0:1:0]] random read throughput: 268.31 MBPS, and 19703 IOPS
Lun 4_2 on drive [[9:0:2:0]] random read throughput: 268.10 MBPS, and 19698 IOPS
Lun 4_3 on drive [[9:0:3:0]] random read throughput: 268.74 MBPS, and 19683 IOPS
Lun 5_0 on drive [[11:0:0:0]] random read throughput: 268.82 MBPS, and 19690 IOPS
Lun 5_1 on drive [[11:0:1:0]] random read throughput: 268.27 MBPS, and 19697 IOPS
Lun 5_2 on drive [[11:0:2:0]] random read throughput: 268.57 MBPS, and 19704 IOPS
Lun 5_3 on drive [[11:0:3:0]] random read throughput: 268.36 MBPS, and 19689 IOPS
CALIBRATE results are within an acceptable range.
```

```
CALIBRATE stress test is now running...
Calibration has finished.
```



Create Celldisks

**We have Celldisks
&
Flash Disks now**

```
CellCLI> create celldisk all
CellDisk CD_00_sgsas1 successfully created
CellDisk CD_01_sgsas1 successfully created
CellDisk CD_02_sgsas1 successfully created
CellDisk CD_03_sgsas1 successfully created
CellDisk CD_04_sgsas1 successfully created
CellDisk CD_05_sgsas1 successfully created
CellDisk CD_06_sgsas1 successfully created
CellDisk CD_07_sgsas1 successfully created
CellDisk CD_08_sgsas1 successfully created
CellDisk CD_09_sgsas1 successfully created
CellDisk CD_10_sgsas1 successfully created
CellDisk CD_11_sgsas1 successfully created
```

```
CellCLI> list celldisk
CD_00_sgsas1      normal
CD_01_sgsas1      normal
CD_02_sgsas1      normal
CD_03_sgsas1      normal
CD_04_sgsas1      normal
CD_05_sgsas1      normal
CD_06_sgsas1      normal
CD_07_sgsas1      normal
CD_08_sgsas1      normal
CD_09_sgsas1      normal
CD_10_sgsas1      normal
CD_11_sgsas1      normal
FD_00_sgsas1      normal
FD_01_sgsas1      normal
FD_02_sgsas1      normal
FD_03_sgsas1      normal
FD_04_sgsas1      normal
FD_05_sgsas1      normal
FD_06_sgsas1      normal
FD_07_sgsas1      normal
FD_08_sgsas1      normal
FD_09_sgsas1      normal
FD_10_sgsas1      normal
FD_11_sgsas1      normal
FD_12_sgsas1      normal
FD_13_sgsas1      normal
FD_14_sgsas1      normal
FD_15_sgsas1      normal
```

```
CellCLI> █
```




Create Griddisks

**Create griddisk
(first 100G – fast part)
DATA**

**Create griddisk
(the rest of the disk)
RECO**

```
CellCLI> create griddisk all harddisk prefix='data',size=100g
GridDisk data_CD_00_sgsas1 successfully created
GridDisk data_CD_01_sgsas1 successfully created
GridDisk data_CD_02_sgsas1 successfully created
GridDisk data_CD_03_sgsas1 successfully created
GridDisk data_CD_04_sgsas1 successfully created
GridDisk data_CD_05_sgsas1 successfully created
GridDisk data_CD_06_sgsas1 successfully created
GridDisk data_CD_07_sgsas1 successfully created
GridDisk data_CD_08_sgsas1 successfully created
GridDisk data_CD_09_sgsas1 successfully created
GridDisk data_CD_10_sgsas1 successfully created
GridDisk data_CD_11_sgsas1 successfully created
```

```
CellCLI> create griddisk all harddisk prefix='fra'
GridDisk fra_CD_00_sgsas1 successfully created
GridDisk fra_CD_01_sgsas1 successfully created
GridDisk fra_CD_02_sgsas1 successfully created
GridDisk fra_CD_03_sgsas1 successfully created
GridDisk fra_CD_04_sgsas1 successfully created
GridDisk fra_CD_05_sgsas1 successfully created
GridDisk fra_CD_06_sgsas1 successfully created
GridDisk fra_CD_07_sgsas1 successfully created
GridDisk fra_CD_08_sgsas1 successfully created
GridDisk fra_CD_09_sgsas1 successfully created
GridDisk fra_CD_10_sgsas1 successfully created
GridDisk fra_CD_11_sgsas1 successfully created
```

```
CellCLI> █
```



Check griddisk size

**First Part
(first 100G)**

**Second 458G
(the rest of the disk)**

```
CellCLI> list griddisk attributes name,size
data_CD_00_sgsas1      100G
data_CD_01_sgsas1      100G
data_CD_02_sgsas1      100G
data_CD_03_sgsas1      100G
data_CD_04_sgsas1      100G
data_CD_05_sgsas1      100G
data_CD_06_sgsas1      100G
data_CD_07_sgsas1      100G
data_CD_08_sgsas1      100G
data_CD_09_sgsas1      100G
data_CD_10_sgsas1      100G
data_CD_11_sgsas1      100G
fra_CD_00_sgsas1       429,234375G
fra_CD_01_sgsas1       429,234375G
fra_CD_02_sgsas1       458,359375G
fra_CD_03_sgsas1       458,359375G
fra_CD_04_sgsas1       458,359375G
fra_CD_05_sgsas1       458,359375G
fra_CD_06_sgsas1       458,359375G
fra_CD_07_sgsas1       458,359375G
fra_CD_08_sgsas1       458,359375G
fra_CD_09_sgsas1       458,359375G
fra_CD_10_sgsas1       458,359375G
fra_CD_11_sgsas1       458,359375G
```

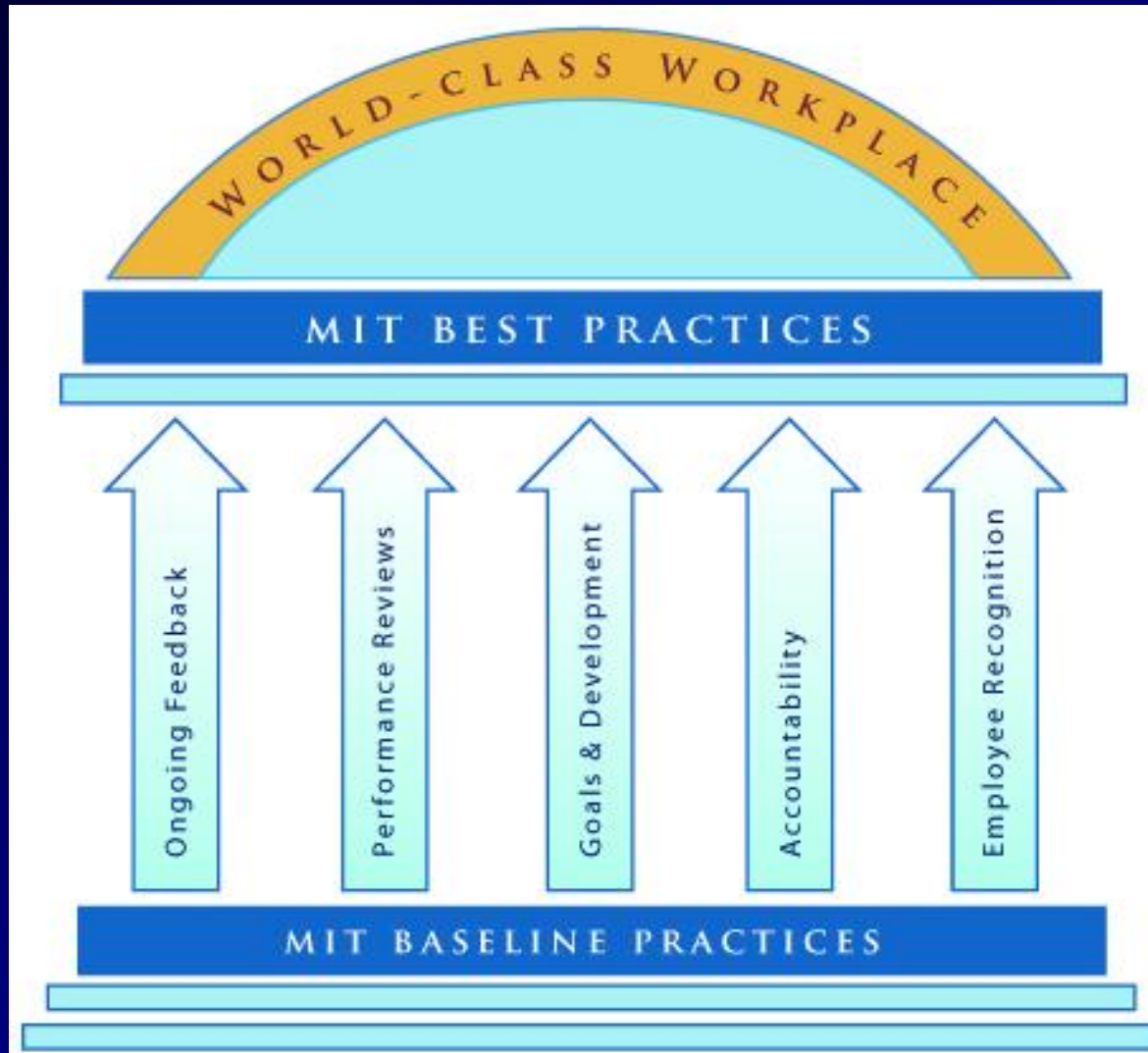


Quick Disk Basics Overview

- Start with a **Physical Disk or LUN** (Logical Unit Number)
- Create a **Cell Disk** on a single LUN
- Create two **Grid Disk slices** on the Cell Disk – One Hot (first – outer ring) & One Cold
- Create **2 ASM Disk Groups** (Hot/Cold – Data/Reco) across many Grid Disks to distribute the I/O across Grid Disks
- Add **mirroring, DG, Flashback; Failure Groups** (auto) ensure mirrored ASM extents are placed on different exadata cells.
- **First 2 cells need 29G SYSTEM Area x 12 disks** (coldest⁹⁰)



Best Practices





MUST haves & DON'T do!

- Must have **Bundle Patch 5** (See **note: 888828.1** for latest)
- Must have **ASM**
- Must have the correct data center **COOLING!**
 - **3 tiles with holes** for full rack (400 CFM/tile) – don't melt it!
- Must have the **correct power needs**
- Must use **Oracle Linux 5.3 (x86_64) & Oracle DB 11.2**
- Must use **RMAN** for backups
- Consider StorageTek SL500 Tape backup
- Use an ASM allocation unit (AU) size of 4M
- Don't add any foreign hardware or – No Support!
- Don't add any foreign BIOS/Firmware – No Support!



Best Practices

- Create ALL celldisk and griddisks
- Use DCLI to run on ALL Storage Servers at once
- Use IORM
- Decide Fast Recovery Area (FRA) & MAA Needs
- Database 11.2.0.1+ (11.2.1.3.1) and ASM 11.2.0.1+
- COMPATIBLE 11.2.0.1+
- Logfile size at 32G (Whoa!)
- LMT (Locally Managed Tablespaces) with at 4M uniform extents
- Move Data with Data Pump (or use INSERT /*+ APPEND */)



It's the Real Deal!!



- Fast Hardware!
- Many CPUs!
- Fast Flash Cache!
- Lot's of DRAM on Database Servers and Storage
- Compression (save 10x-70x)
- Partition Pruning (save 10-100x)
- Storage Indexes (save 5-10x)
- Smart Scan (save 4-10x)
- Turn a 1T search into a 500M search or even 50M



Exadata = Paradigm Shift!



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 500M⁹⁶ people on Facebook



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)



Summary – We Covered...



- Terminology & the Basics about Exadata
- Flash Cache
- Storage Index
- Smart Scans
- Hybrid Columnar Compression (HCC)
- Enterprise Manager & Grid Control
- Enterprise Manager Exadata Simulation
- I/O Resource Manager
- Security
- Utilities
- Best Practices



“We make a Living by what we get; We make a Life by what we give.”

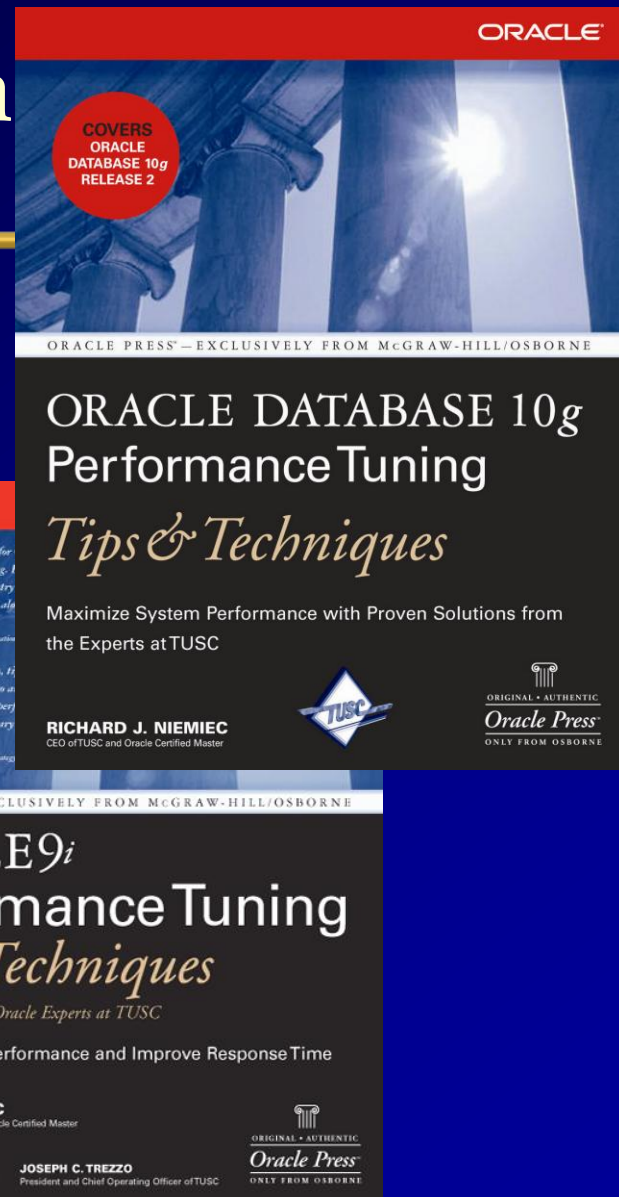




For More Information

- **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

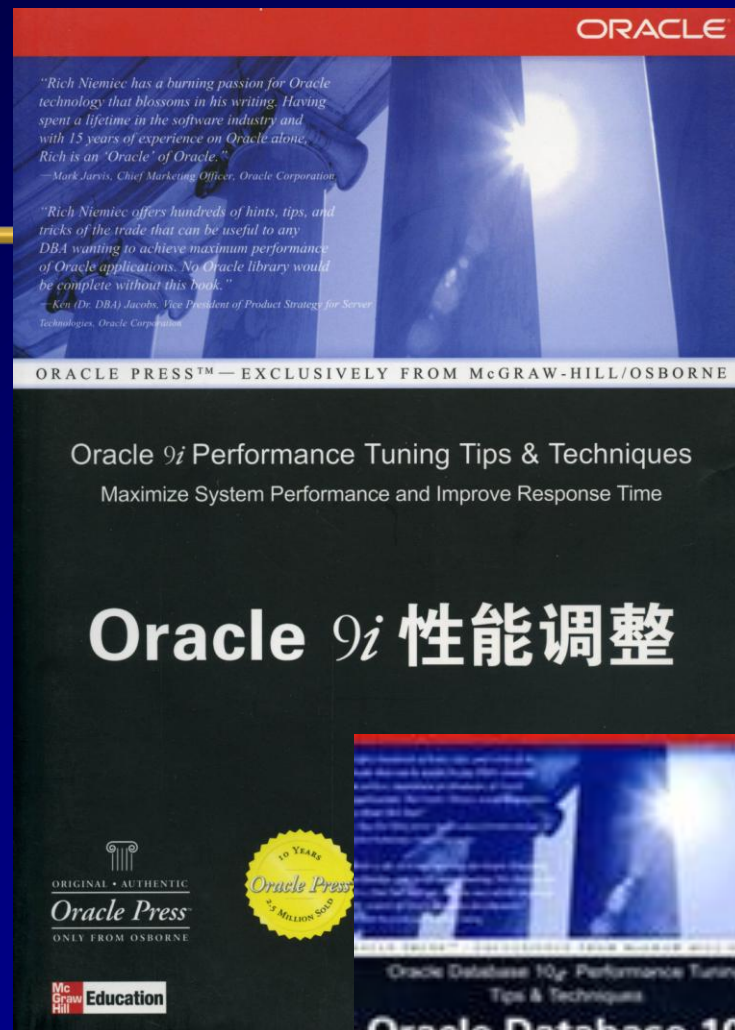




更多信息

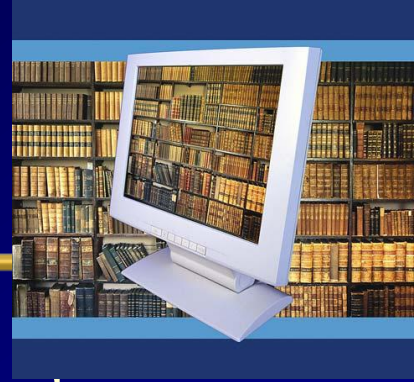
- www.tusc.com
- *Oracle9i Performance Tuning Tips & Techniques; Richard J. Niemiec; Oracle Press (May 2003)*
- *Oracle 10g Tuning (June 11, 2007)*

“成功只访问那些没空追求它的人。”





References



- Exadata V2 – Sun Oracle Database Machine, Oracle
- Oracle Exadata Implementation Workshop, Oracle Corporation, McLean, Virginia - Multiple Exadata sessions
- Oracle Learning Library – multiple sessions/topics
- Oracle 11g R1/R2 Best Features, Rich Niemiec
- Oracle Enterprise Manager Deployment and High Availability Best Practices, Jim Viscusi (Oracle Corporation), Jim Bulloch (Oracle Corporation), Steve Colebrook-Taylor (Barclays Global Investors)
- *Oracle 10g Performance Tuning Tips & Techniques*, Rich Niemiec, Oracle Press McGraw-Hill
- Advanced Compression with Oracle Database 11g Release 2, Oracle Corporation, Steven Lu
- Tech Crunch

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*Won 2 Awards



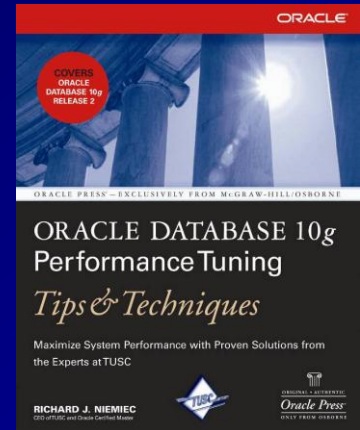
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 - E-Business Suite implementation, R12 upgrades, migration & support
 - Fusion Middleware and Open Systems development
 - Business Intelligence (OBIEE) development
 - Hyperion Financial Performance Management
 - DBA and Database tactical services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



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