Tuning the Oracle Grid
New York 2009
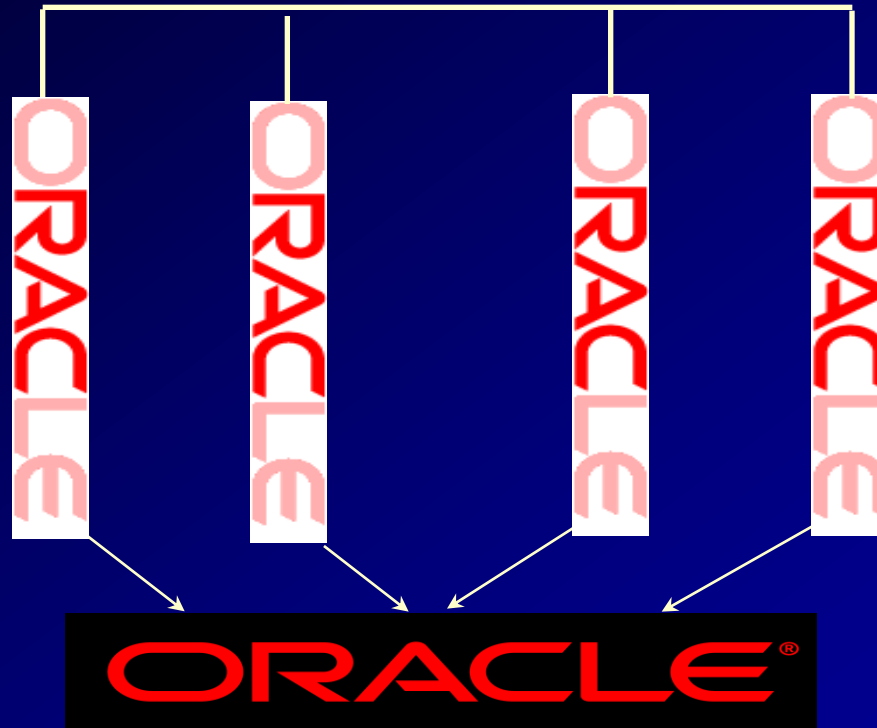
Rich Niemiec, TUSC (www.tusc.com)

Audience Knowledge

- Oracle9*i* Experience ?
- Oracle9*i* RAC Experience?
- Oracle10^g Experience?
- Oracle10^g Grid Control Experience?
- Oracle 11g Experience?

- Goals
  - Overview of Tuning and Oracle 10^g Grid
  - Focus on a few nice grid features of Oracle 10^g
- Non-Goals
  - Learn ALL aspects of Tuning Oracle 10^g
  - Learn how to install/manage RAC/Grid
  - 11g Grid

Overview

- The Basics, Oracle & Market Direction
- RAC, Grid Basics and Scaling it All
- Tuning the Interconnect & using Statspack/AWR
- Grid Control Basics, Multi-Node & Tuning
- Other quick Tips
- Availability thoughts
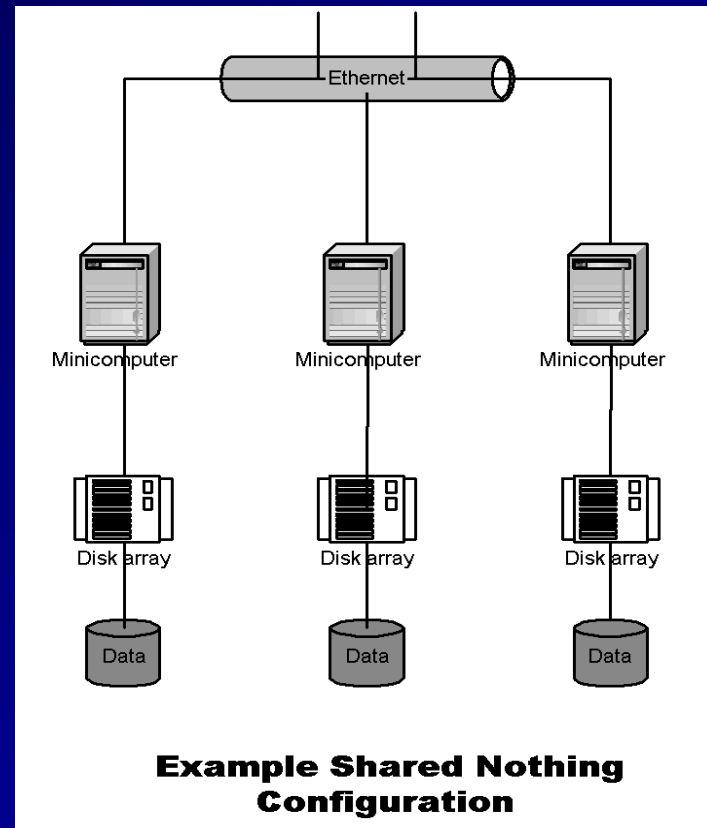- Summary

Tip #1
Know the Basics – OPS and early Clusters

Introduction to RAC

- IBM drove the Shared Nothing Architecture in its cluster solution.
- Others that use this*:
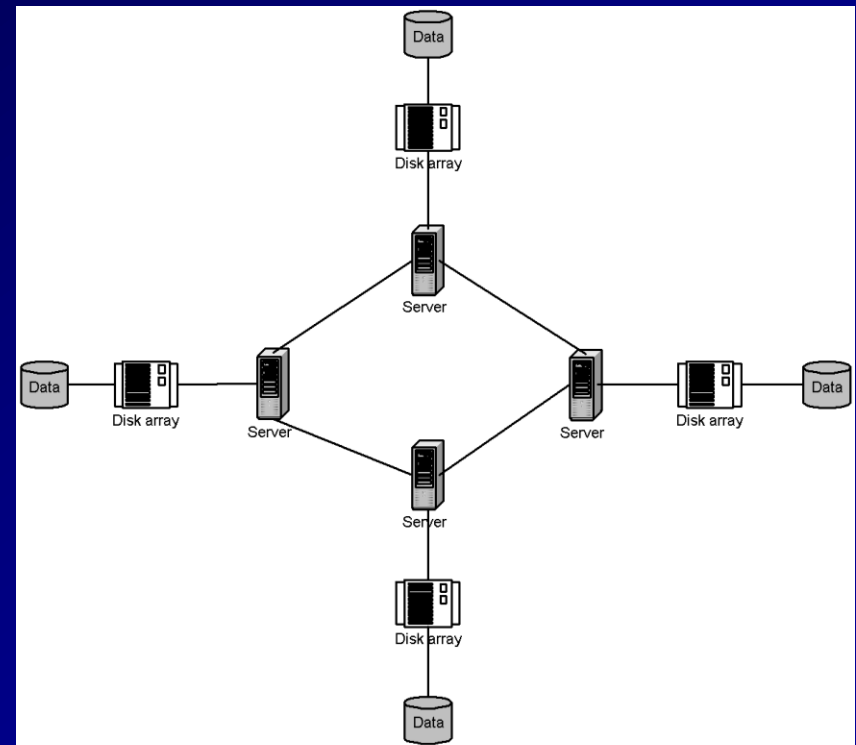 - Teradata
  - Netezza
  - Google

Wikipedia

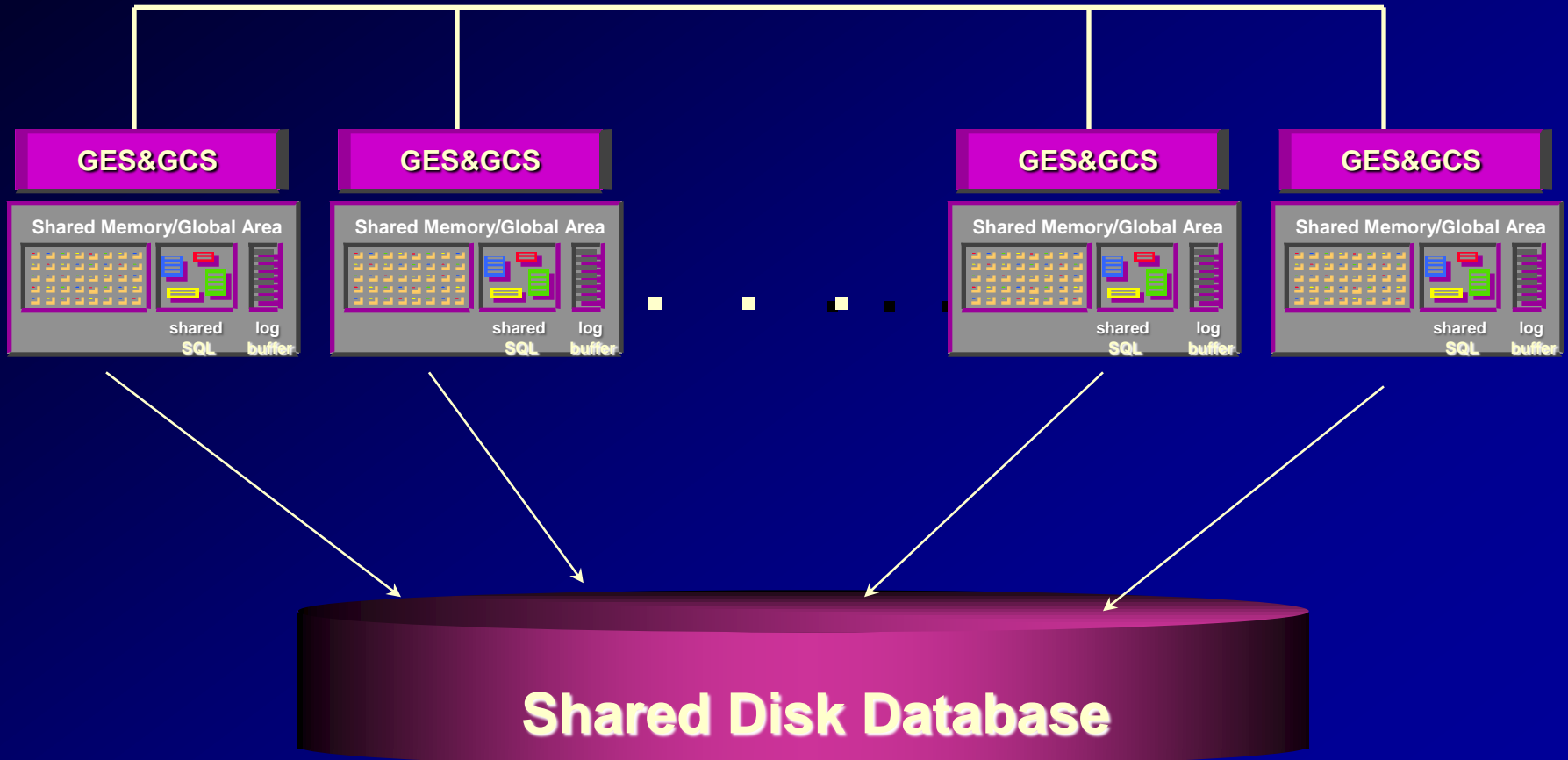**Example Shared Nothing Configuration**

Introduction to RAC

- Federated Databases (Microsoft based Architecture)
- Similar to shared-nothing

MicroSoft Federated Architecture (1)

Introduction to RAC
Shared Data Model

TUSC

GES&GCS	GES&GCS		GES&GCS	GES&GCS
Shared Memory/Global Area	Shared Memory/Global Area		Shared Memory/Global Area	Shared Memory/Global Area
shared SQL · log buffer	shared SQL · log buffer		shared SQL · log buffer	shared SQL · log buffer

Shared Disk Database

Tip #2
Know the Oracle

"I admire risk takers. I like leaders – people who do things before they become fashionable or popular. I find that kind of integrity inspirational."

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

Oracle Firsts – *Innovation!*

1979 First commercial SQL relational database management system
1983 **First 32-bit** **mode RDBMS**
1984 First database with read consistency
1987 **First client-server** **database**
1994 First commercial and multilevel secure database evaluations
1995 **First 64-bit** mode RDBMS
1996 First to break the 30,000 TPC-C barrier
1997 **First Web** database
1998 First Database - Native **Java** Support; Breaks 100,000 TPC-C
1998 First Commercial RDBMS ported to **Linux**
2000 First database with **XML**
2001 First middle-tier database cache
2001 First RDBMS with **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!**

Tip #3
Know the Market Direction – Consolidation!
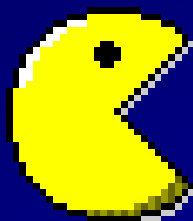
"I think there is a world market for maybe 5 computers."

- Thomas Watson, IBM Chairman '43

How Oracle saved $1B: CONSOLIDATION! & Process

Technology
$200M

People
$50M

Process
$750M
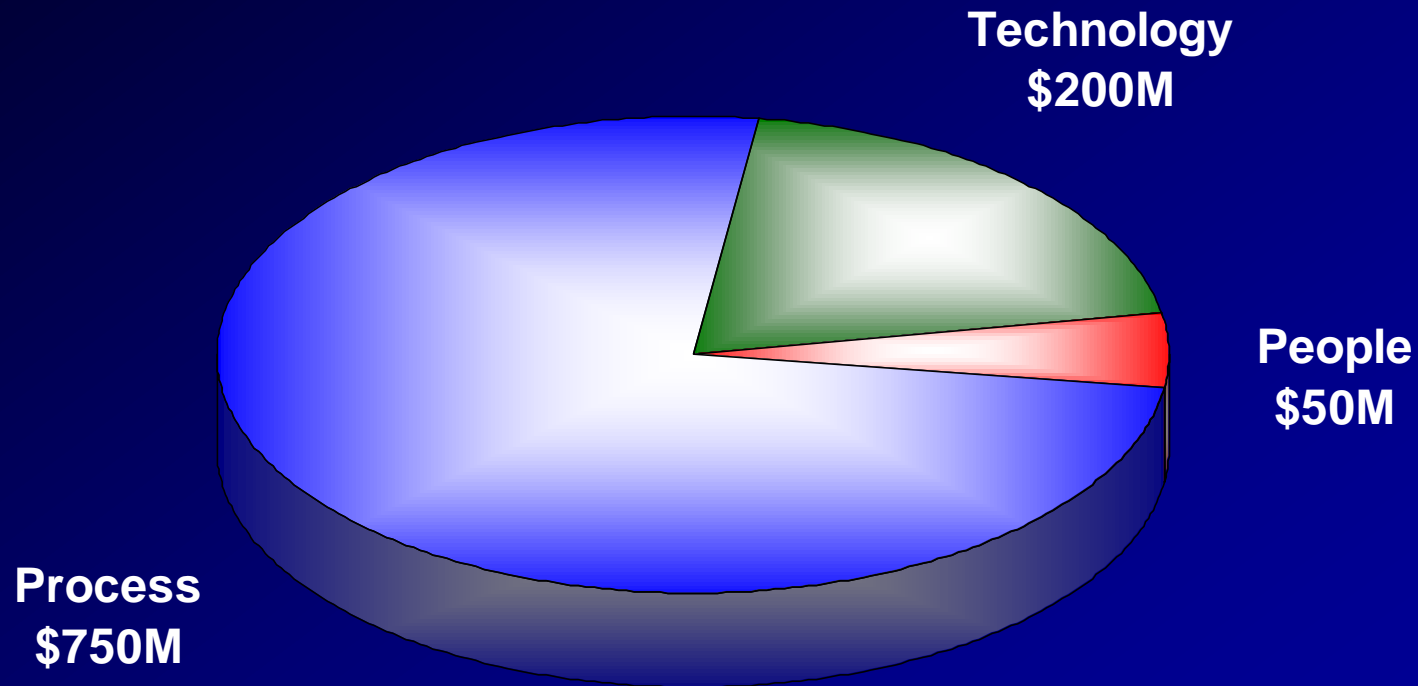
Operating Margin Improvement
Trailing 12 Month Operating Margin Trend

Operating Margin for
most recent quarter:
36.28% (30-NOV-08)

40%

30%

20%

10%

0%

FY 2000   FY 2001   FY 2002   Q103   Q203
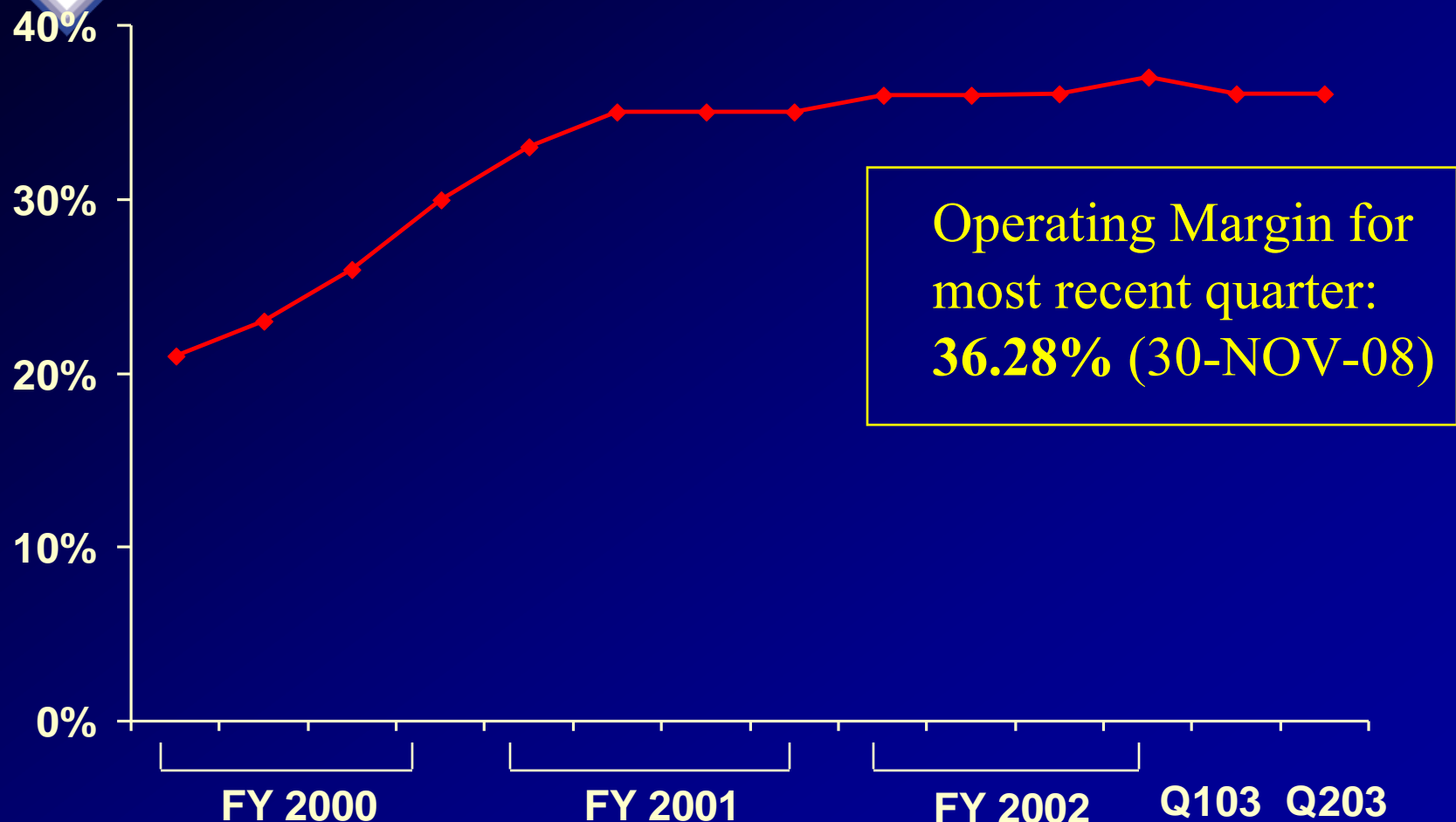
Note: Oracle Corporation - Ending November 2002

I saw this in a Jeff Henley Talk in 2003

TUSC

Trailing 12 Months
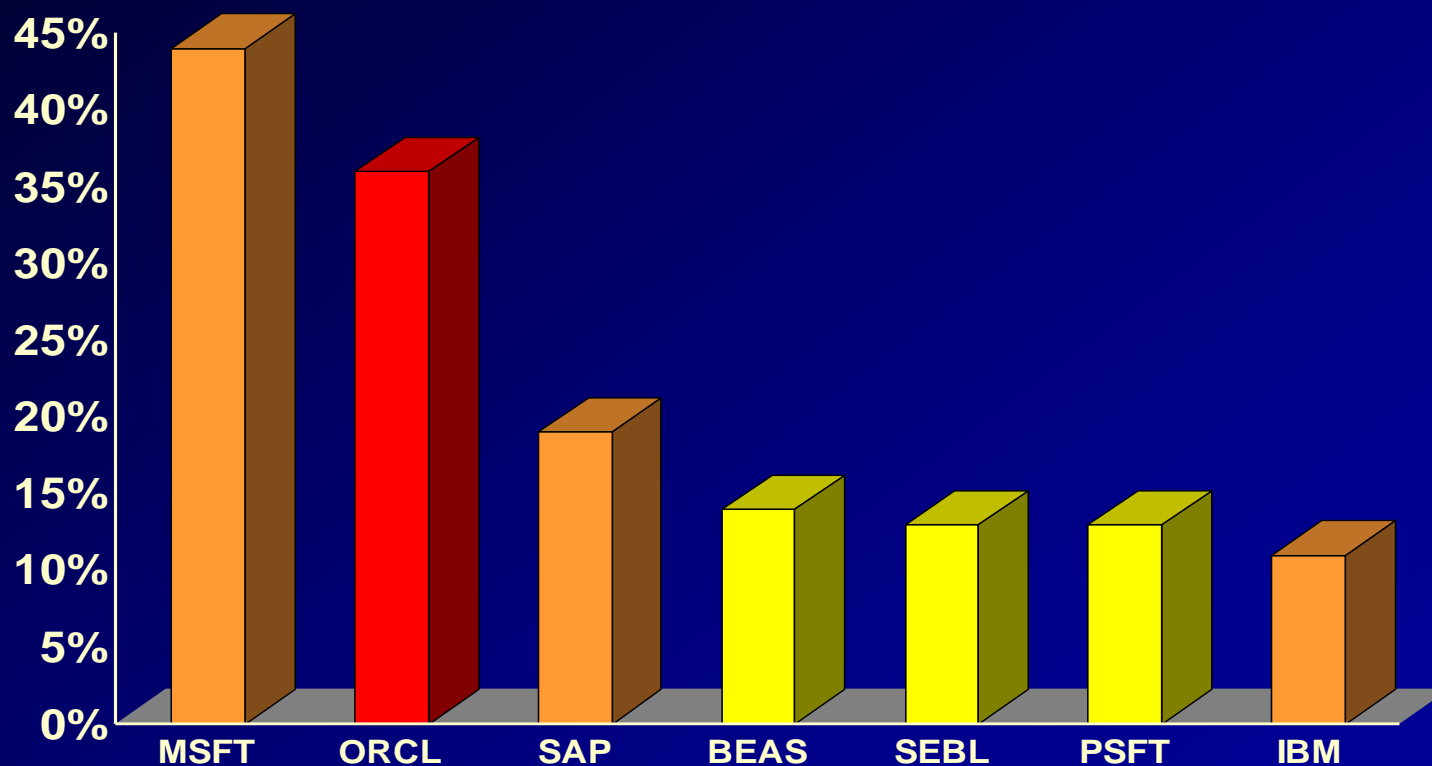
PROJECT **FUSION**
Protect, Extend, Evolve
Your Applications Investment

Future Goal is to do this for Others:

Oracle and PeopleSoft – Better Together

ORACLE

Oracle Agrees to Buy Siebel
→ Vaults Oracle to #1 in Customer Relationship Management
→ Together Oracle and Siebel will be our customers' most valued partner
* Rule 425 Disclosure

JDEDWARDS
you > us

Not to be confused with... Fusion Middleware/**BI Acquisitions:**

oblix | THOR TECHNOLOGIES | OCTETSTRING

Oracle to Acquire Enterprise Performance
Management Leader Hyperion
Learn more >>

Why Linux Helps RAC/Grid?

- Performance via Grid
- Availability via Grid
- Stability via Grid
- Security via Oracle
- Cost Savings via Smaller Servers (Grid)

- Larry says so:
  - Companies start building, supporting and creating once Larry charts a bend in the road.

15

Commercial Linux Database Market 2002

IBM (58%)
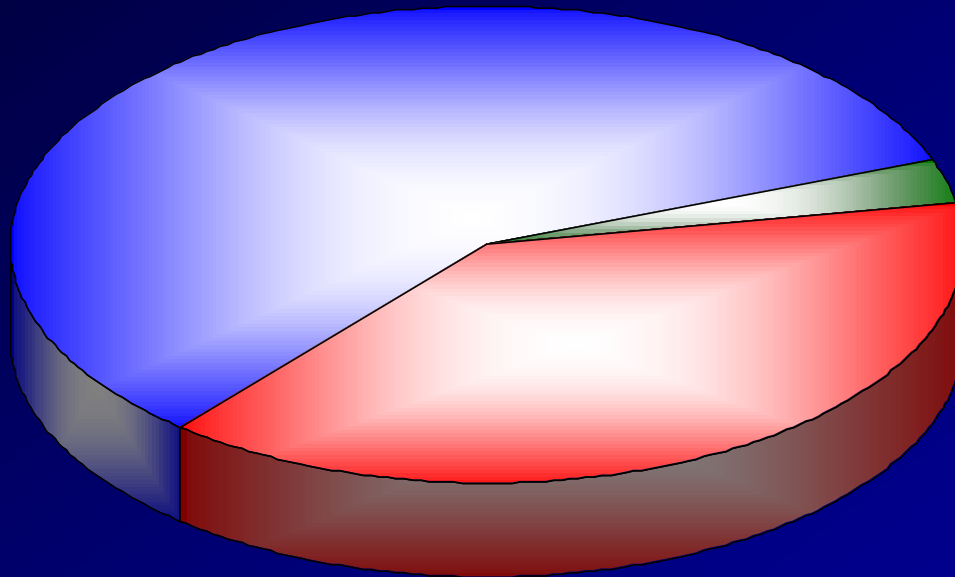
Other (3%)

Oracle (39%)

Source: Gartner, May 2005

Commercial Linux Database Market 2003

IBM (27%)

Other (4%)
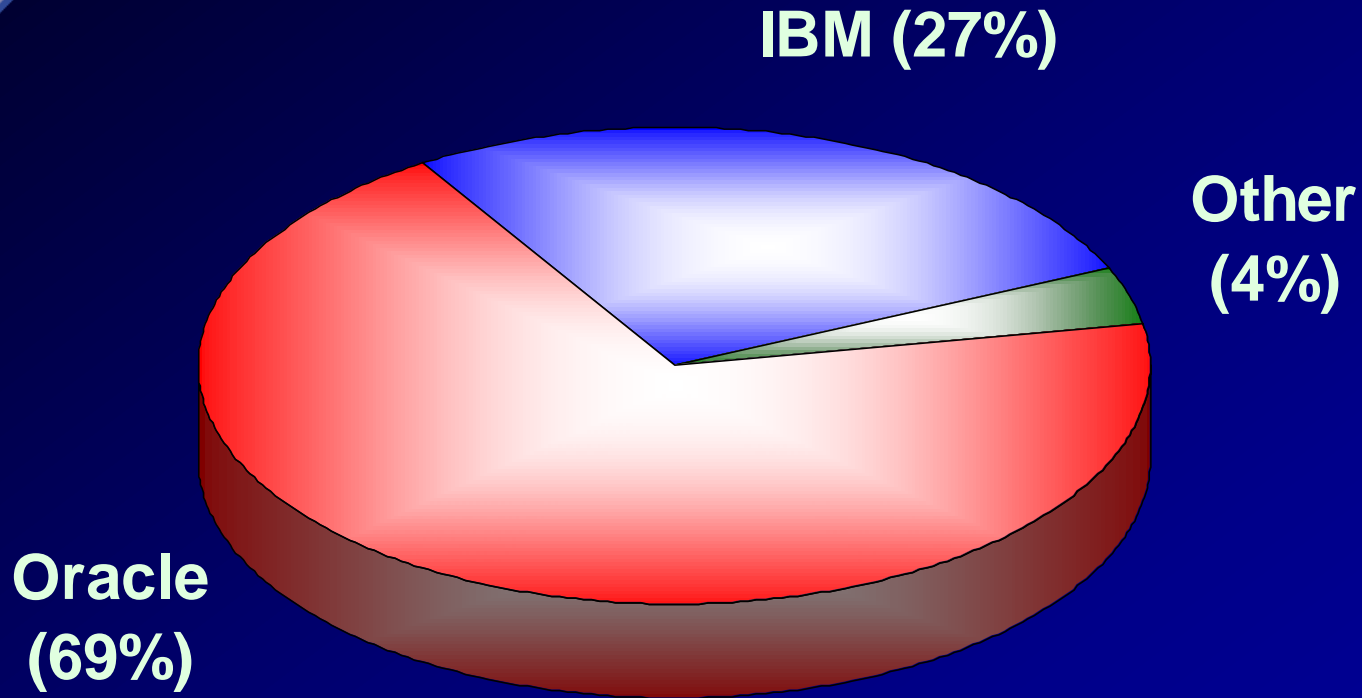
Oracle (69%)

Source: Gartner, May 2005

Commercial Linux Database Market 2004

IBM (16%)

Other (3%)
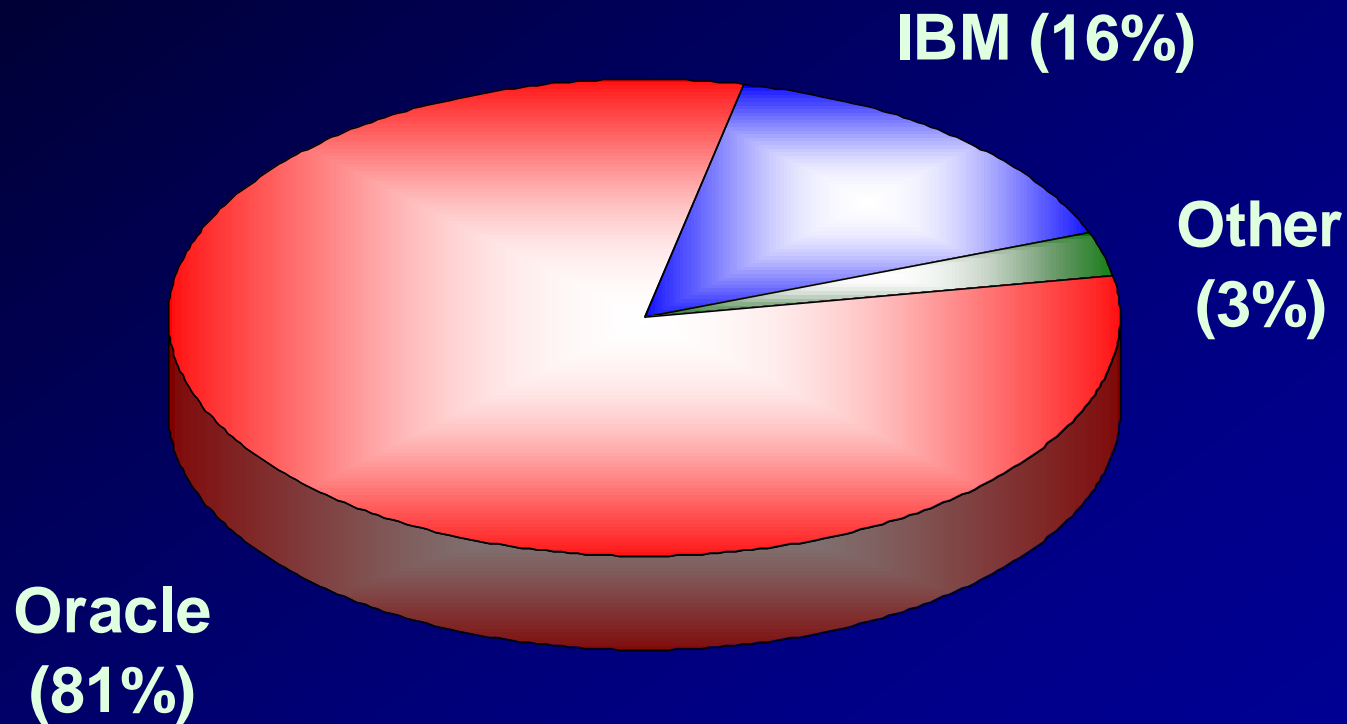
Oracle (81%)

Source: Gartner, May 2005

** Oracle had 82.6% in 2006 (Gartner, June 2007)

Records in Top 10 – TPC-H
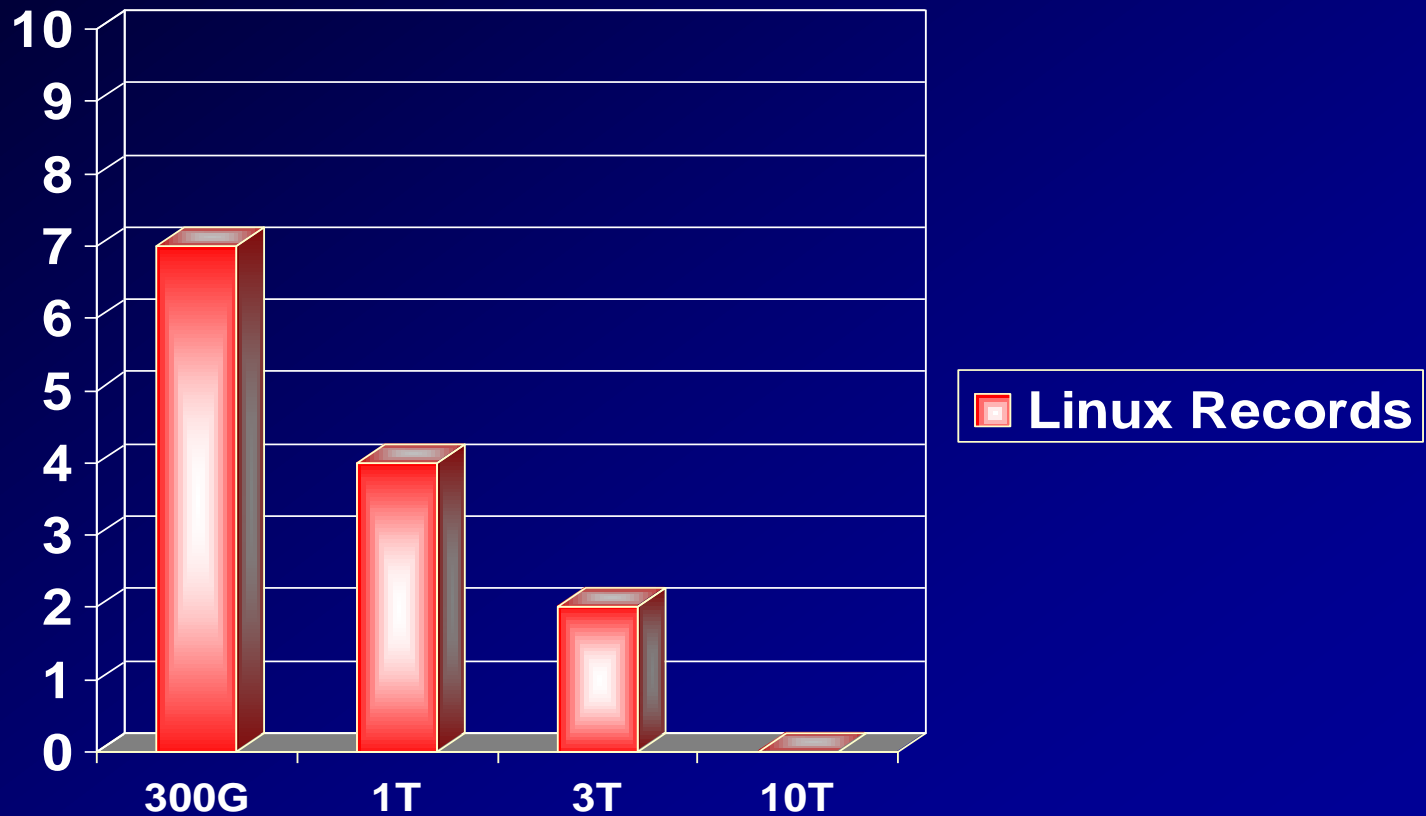
Source: www.tpc.org (As of November 1, 2006)

Records in Top 10 – TPC-H
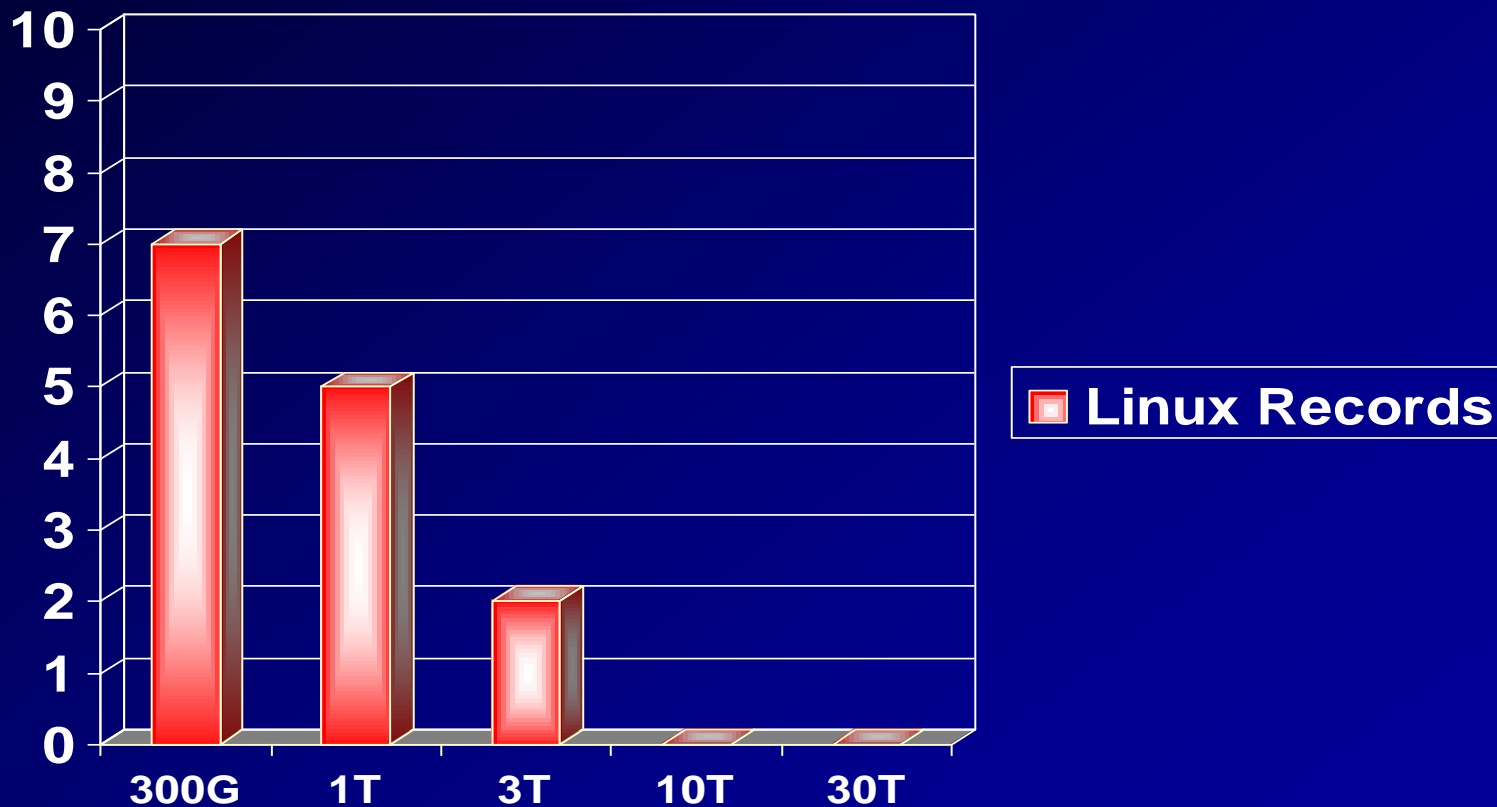
Source: www.tpc.org (As of April 16, 2008)

Tip #4: Grid Basics – Start with RAC

"Forrester estimates that there are more than 1,200 customers who are currently using RAC in production, and this is likely to double in the next 12-18 months..."

- Forrester, Oracle RAC Gains Momentum - 9/15/05

Real Applications Clusters - Cache Fusion

Disk Array

User1

User2

UNIX/Win2000 Node1

UNIX/Win2000 Node2

RAM

RAM

inter

connect

DATABASE

DATABASE

10G

10G

CLUSTER

CLUSTER
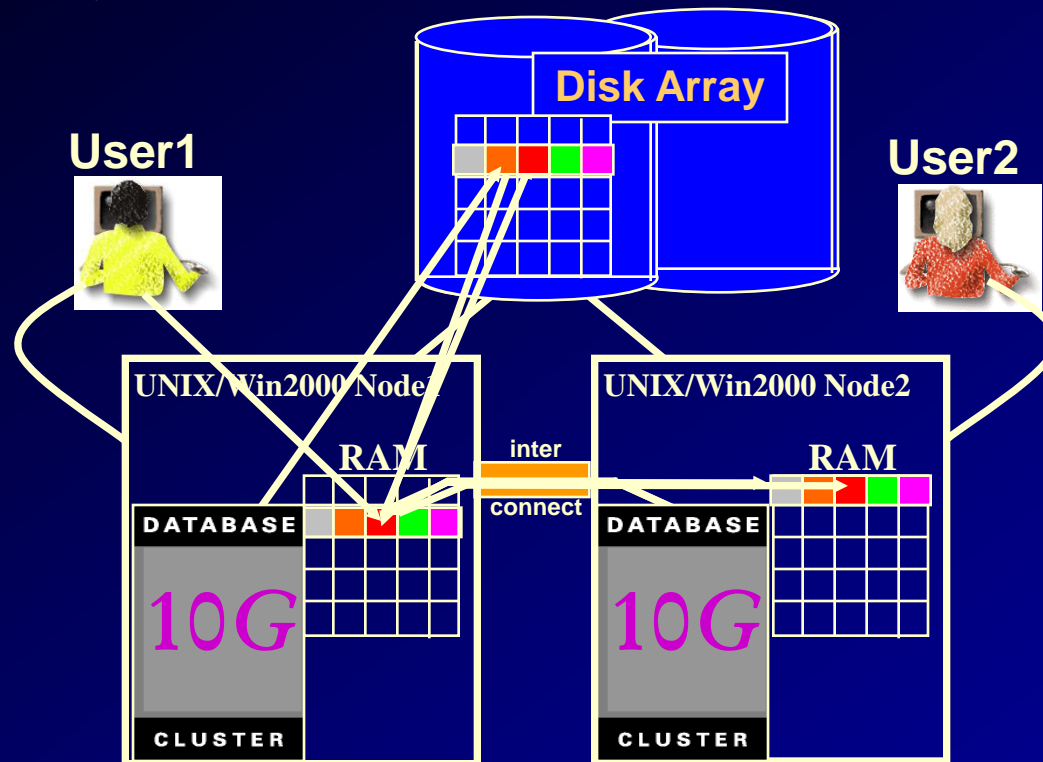
1. User1 queries data

2. User2 queries same data - via interconnect with no disc I/O

3. User1 updates a row of data and commits

4. User2 wants to update same block of data – 10g keeps data concurrency via interconnect

Tip #5: Grid Basics – Scaling it

"The best thing about the Grid is that it is unstoppable."

The Economist
June 2001

Amazon.com Data Warehouse

- 25 TB database
  - 15 TB row data
- 9*i*R2 using one Oracle Cluster File System per storage array
- Services 50,000 complex queries per week
  - 2 to 3 gigabyte (byte, not bit) per second table scan throughput
- Listed in top ten (6th) largest Warehouses in 2005 Winter Survey and only RAC system.
  - In 2003, Amazon was #5 with 13T.
  - Yahoo was #1 in 2005 with 100T of data (triple the #1 of 2003) and they had 385 trillion rows on Oracle!
  - Teradata had 4 of the Top 10 databases in the 2003 survey, yet has zero in the 2005 survey

16 Node RAC Linux Cluster
4 CPUs per Node

8 SAN switches, 32 port each
Switch   Switch   Switch
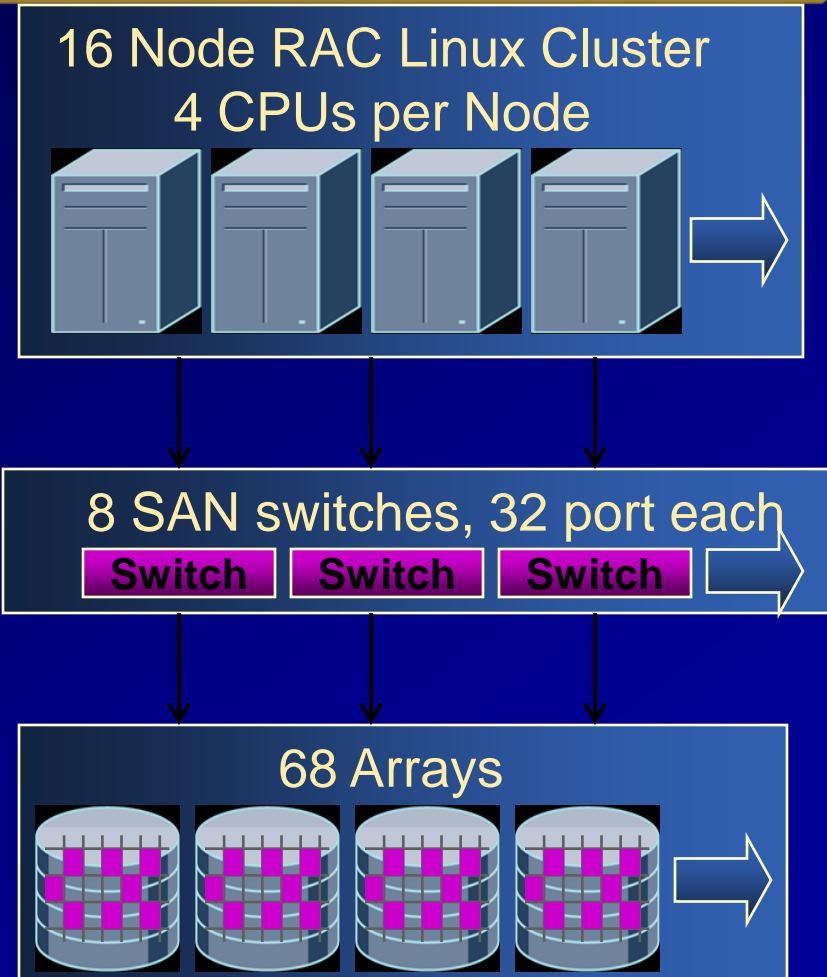
68 Arrays

Issues

- Too many filesystems
  - 68 arrays (2 luns ea.) results in 136 filesystems.
  - To get an even I/O across arrays needed a datafile for every tablespace on each filesystem.
  - Takes over 30 minutes to mount all the filesystems on a host reboot

- Too many datafiles
  - This resulted in thousands of datafiles that caused major management and performance issues

- Not performing to design
  - At first they used no async IO on OCFS 1.0 limited the throughput of cluster to 3 Gbytes of IO per second. Once we got to OCFS 1.0.14 and async I/O the throughput almost doubled to 5 Gbytes per second

Write Caches = Redo Performance

- Write cache
  - A fast array with write caching can do 0.5 ms average writes vs 6 ms for a non cached write
  - Write speed causes issues when writing redo slowing commit.
- Some items that can affect your write times
  - Internal array mirroring
  - They used faster Controllers & mirrored them (doubled IOPS)
- ASM
  - ASM allowed them to use BIGFILE tablespaces which cut datafiles < 100
  - No slow reboots due to mounting

Tip #6
Tune the Interconnect

Normal database Tuning and Monitoring

– Prior to tuning RAC specific operations, each instance should be tuned separately.

- APPLICATION Tuning (Fix the SQL fixes everything)
- DATABASE Tuning (Bad setup = Bad performance)
- OS Tuning (Bad setup = Bad performance)

THEN - You can begin tuning RAC

Tuning the RAC Cluster Interconnect
High GCS Time Per Request

- Problem Indicators:
    - High Transfer Time
    - One node showing excessive transfer time
- Use OS commands to verify cluster interconnects are functioning correctly.
- Contention for blocks: Modify the object to reduce the chances for application contention.
    - Reduce the number of rows per block
    - Adjust the block size to a smaller block size
    - Modify INITRANS and FREELISTS

Tip #7
Use Statspack & AWR to Tune RAC

Statspack/AWR – Check Regularly

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

Tuning the RAC Cluster Interconnect
Using STATSPACK Reports

– The STATSPACK report show statistics ONLY for the node or instance on which it was run.

– Run `statspack.snap` procedure and `spreport.sql` script on each node you want to monitor to compare to other instances.

– In 10g you can still use statspack or you can also use the new AWR Report.

- ## Top 5 Timed Events

CPU time (processing time) should be the predominant event

Exceeds CPU time, therefore needs investigation.

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

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

- Transfer times are excessive from other instances in this cluster to this instance.

- Could be due to network problems or buffer cache sizing issues.

33

Global Cache Load Profile

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

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

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

Global Cache and Enqueue Services - Workload Characteristics

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

Done   Internet

SQL ordered by Cluster Wait Time

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

Done — Internet

Tuning the RAC Cluster Interconnect
Using STATSPACK Reports

– Guidelines for interconnect statistics:

  • All times should be < 15ms

– High values could indicate possible network or memory problems

– Could also be caused by application locking issues

– May need to review the enqueue section of STATSPACK or AWR report for further analysis.

Segments by ITL Waits

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

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

Tip #8
Use Grid Control

Enterprise Manager: Back in Time!
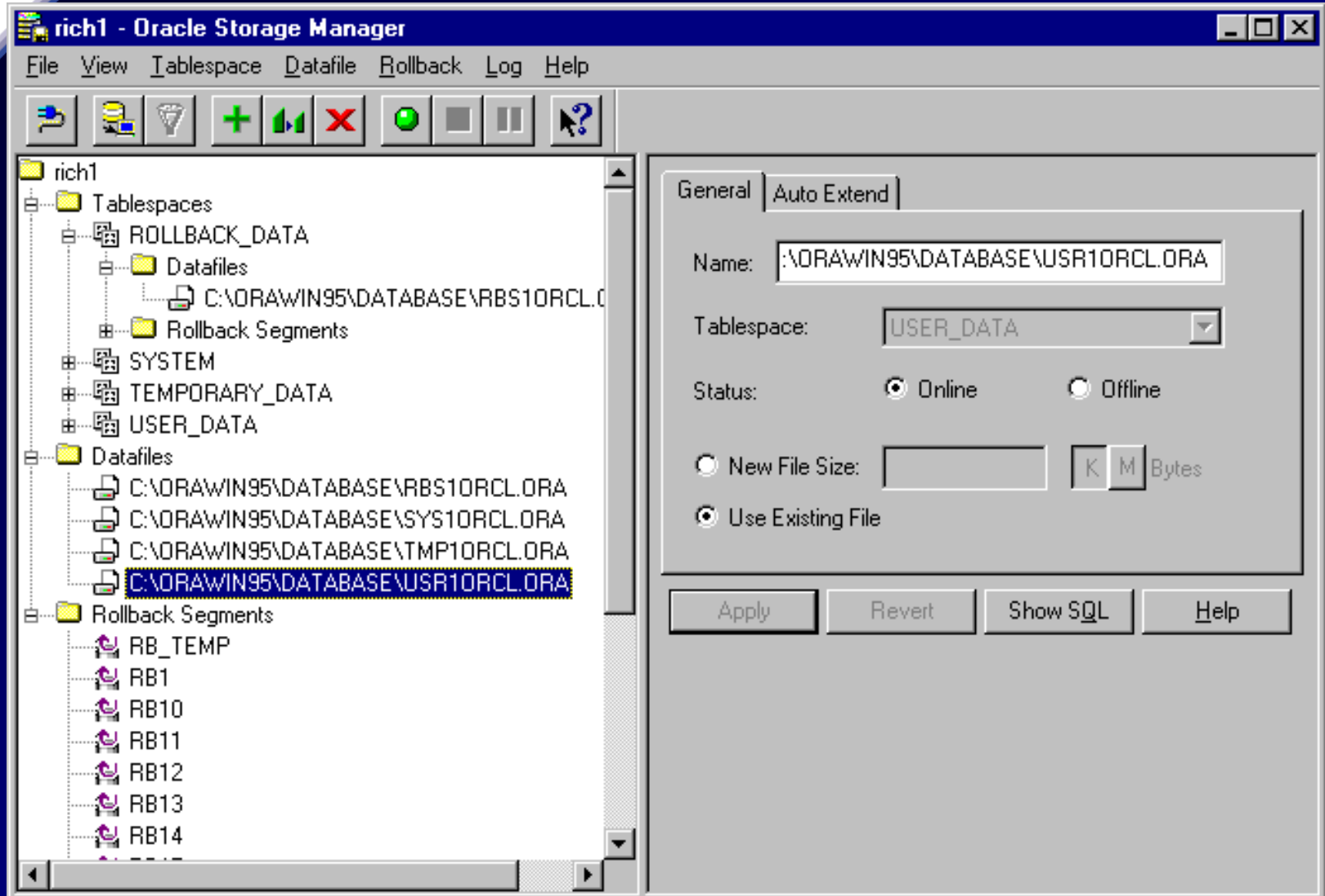
Performance Manager : Back in Time!
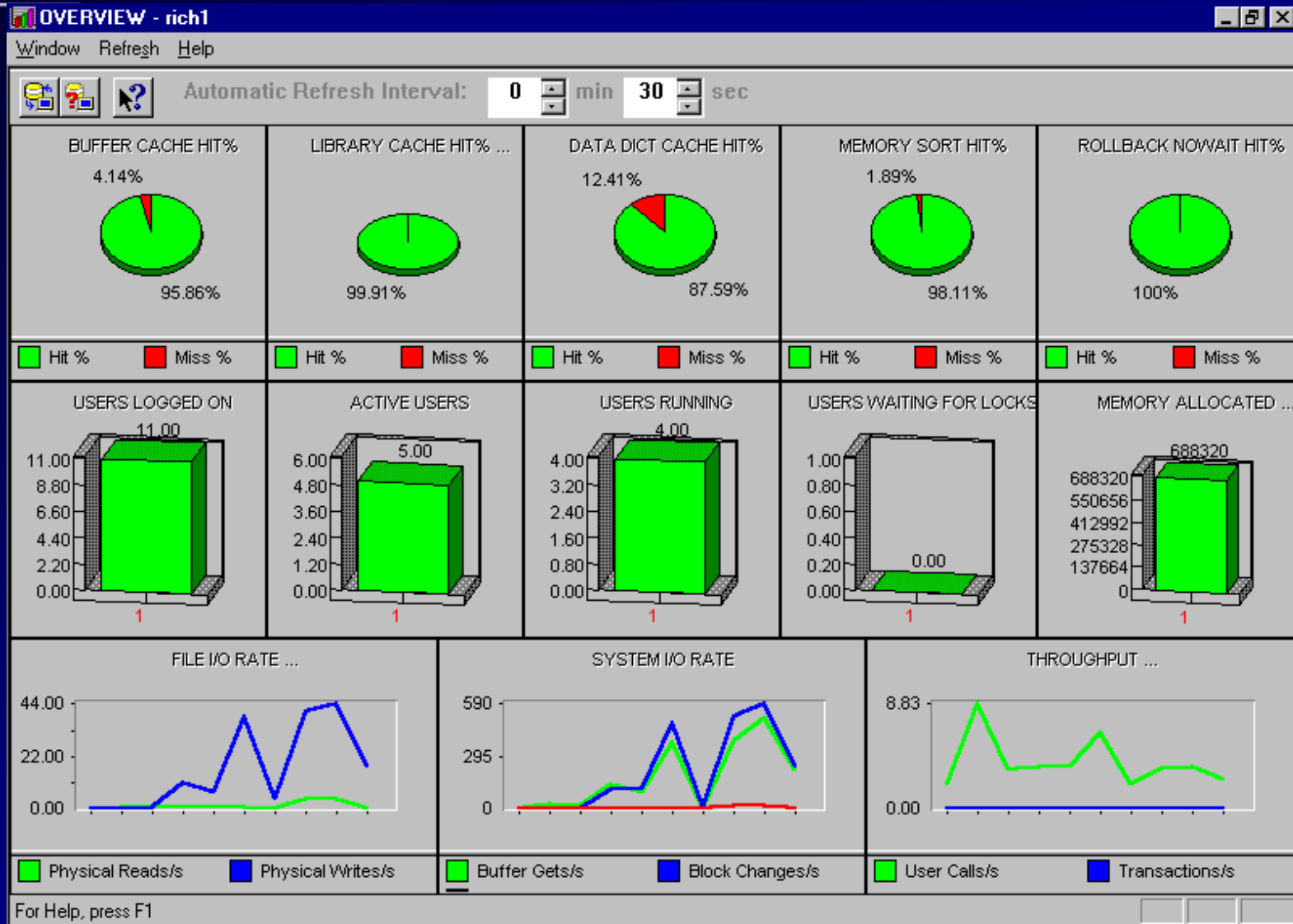
Grid Control 10gR2: Monitor All Targets

Monitor Targets… are they up?

Target Alerts

Grid Control 10gR2: See the Specific Hosts

Click on Targets Tab...

See the Specific HOSTS

Grid Control 10gR2: See the Specific Databases

Still on Targets Tab...

See a Specific Database

Cluster Database

Grid Control 10gR2: View the Topology

One node is UP

One node is DOWN

Grid Control 10gR2:
Look at all Systems

Monitor Systems and their members

Grid Control 10gR2: Click on a Specific System

Click on the PetStore System

Check all changes made and Alerts

Grid Control 10gR2: Specific System – Chart Tab

Click on Charts to see further details

Launch Dashboard (See next slide)

Grid Control 10gR2: Specific System – Dashboard

Dashboard for the PetStore system & Targets

Alerts

Grid Control 10gR2: Specific Groups

Now move to Groups

Many more Changes

Grid Control 10gR2: All Targets – Specific DB

Monitor DB and all core Info.

Click on Policy Trends (See next slide)

Grid Control 10gR2: Specific DB – Policy Trends

Policy Trend Overview shows Violations and Severity
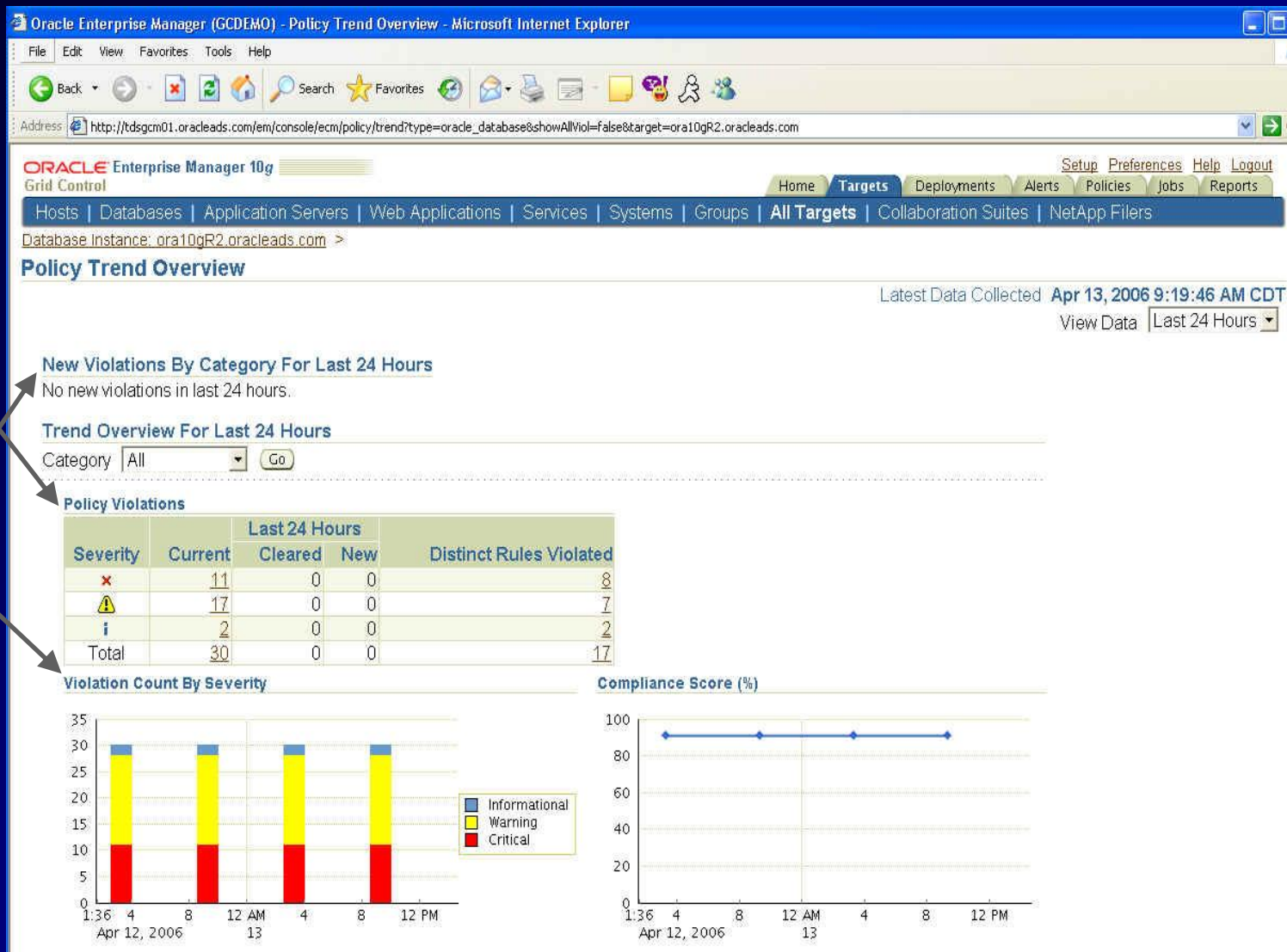
Grid Control 10gR2: Policies – All Violations

Click on Policies Tab & Search Violations

Specific Violation

Grid Control 10gR2: Deployments

Check Deployments and Patches

Check all Installations & Summary of Patches

Tip #9
Use Grid Control for Multi-Node Systems

10g RAC Enhancements

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

Monitor Clusters

Monitor 4-Node IOUG Cluster

Check Alerts & Policy Issues

Monitor Clusters: Interconnect

ORACLE Enterprise Manager 10g
Grid Control

Setup Preferences Help Logout

Home **Targets** Deployments Alerts Policies Jobs Reports

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

Cluster: IOUG

Latest Data Collected From Target **Apr 13, 2006 2:16:38 PM EDT** (Refresh)

Home   Performance   Targets   **Interconnects**   Topology

Check the Inter-connects

The interconnect configuration and internode communication will influence the performance of cluster databases. The tables below show network interfaces on all hosts and network interfaces currently in use by cluster databases. It is important that cluster databases are configured to use a private interconnect for message and block transfers.

View Data [Manually   ▼]

Private Interconnect Transfer Rate (MB/Sec) 0.0788 *
Transfer rate on the private network in the last 5 minutes.

Interfaces by Hosts

View [Private ▼]

Expand All | Collapse All

Name	Type	Subnet	Interface Type	Total I/O Rate (MB/Sec) (Last 5 Minutes)	Total Error Rate (%) (Last 5 Minutes)
▼ IOUG	Cluster				
▼ atlmdi1.us.oracle.com	Host				
eth1	Interface	192.168.1.0	Private	.051 *	0 *
▼ atlmdi2.us.oracle.com	Host				
eth1	Interface	192.168.1.0	Private	.018 *	0 *
▼ atlmdi3.us.oracle.com	Host				
eth1	Interface	192.168.1.0	Private	.026 *	0 *
▼ atlmdi7.us.oracle.com	Host				
eth1	Interface	192.168.1.0	Private	.056 *	0 *

All Nodes listed

Interfaces in Use by Cluster Databases

Expand All | Collapse All

Name	Target Type	Interface Name	Host Name	IP Address	Interface Type	Source	Transfer Rate (MB/Sec) (Last 5 Minutes)
▼ ioug	Cluster Database						
ioug1	Database Instance	eth1	atlmdi1.us.oracle.com	192.168.1.1	Private	Oracle Cluster Repository	.012 *
ioug2	Database Instance	eth1	atlmdi2.us.oracle.com	192.168.1.2	Private	Oracle Cluster Repository	.0035 *
ioug3	Database Instance	eth1	atlmdi3.us.oracle.com	192.168.1.3	Private	Oracle Cluster Repository	.011 *
ioug6	Database Instance	eth1	atlmdi7.us.oracle.com	192.168.1.7	Private	Oracle Cluster Repository	.025 *

TIP The Transfer Rate is the estimated traffic contributed by the instance assuming uniform block size in the database.

TIP * indicates the data that is more than 10 minutes old.

Monitor Clusters: Topology

View the Cluster Topology

Look at the 4 Listeners

Monitor Clusters: Databases

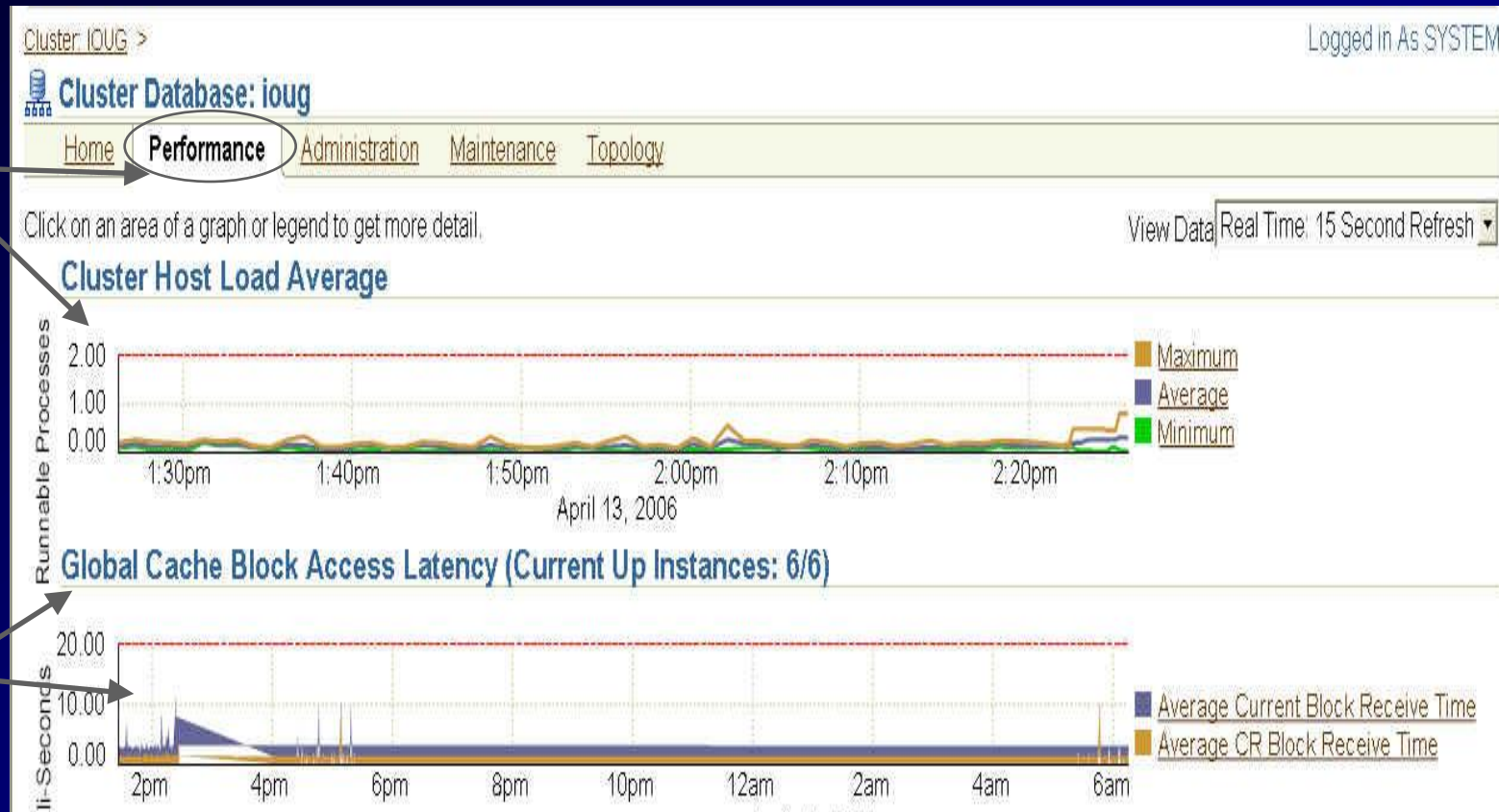Go to the Database Screen for the Cluster

Check CPU, Sessions & Alerts

Monitor Clusters: Global Block Transfers

Check Performance

Check the Transfer of Blocks

Tip #10
Use Grid Control for Tuning Systems

Tune Specific Database

Monitor Specific Database

CPU Issues and User Waits!

62
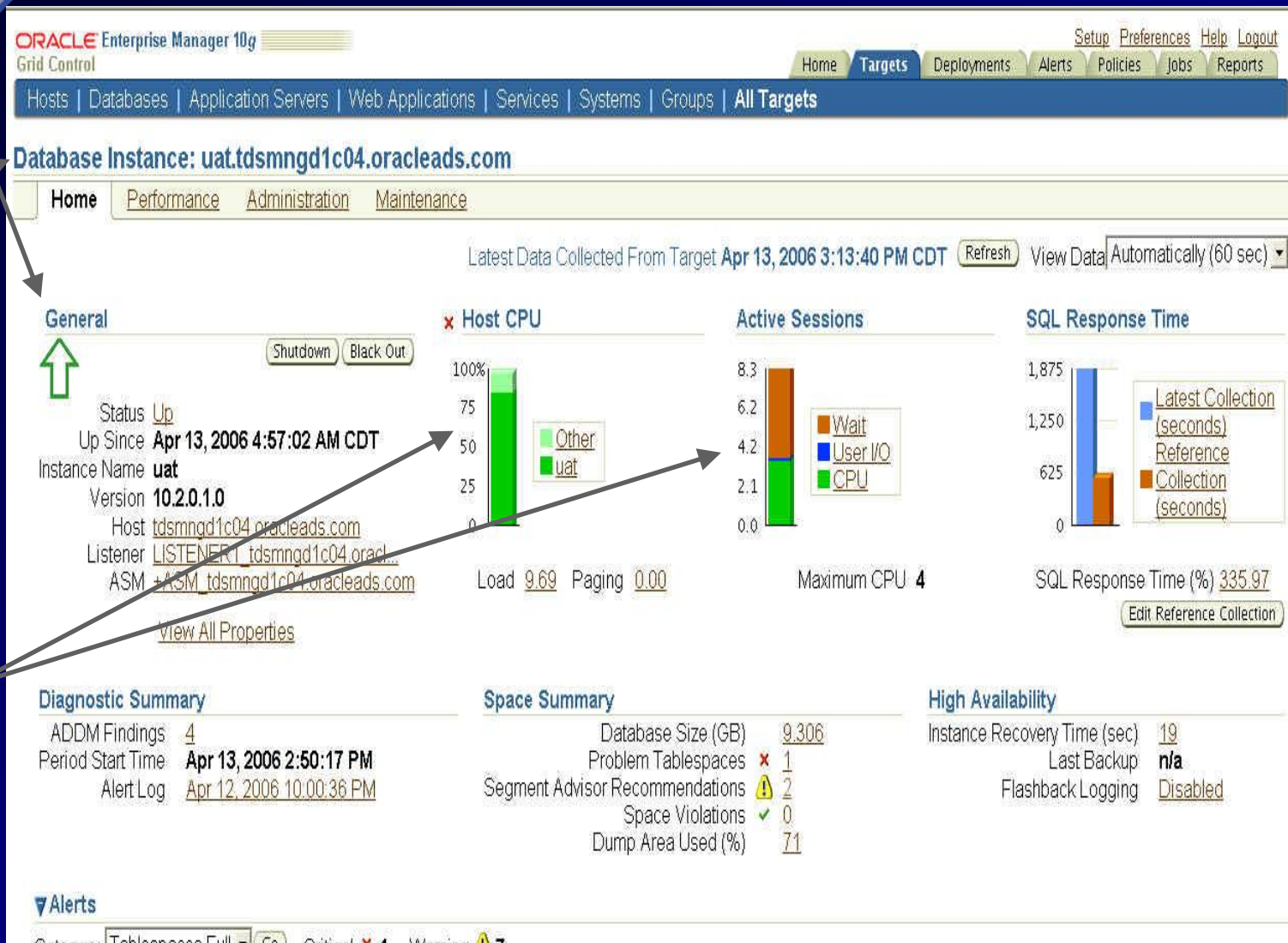
Tune Specific Database (long page continued...)

Alerts

Category Tablespaces Full [Go] Critical ✕ 1 Warning ⚠ 7

Severity	Category	Name	Message	Alert Triggered
✕	Tablespaces Full	Tablespace Space Used (%)	Tablespace USERS3 is 96 percent full	Apr 13, 2006 5:04:28 AM

▶Related Alerts

Performance Analysis

Period Start Time **Apr 13, 2006 2:50:17 PM**   Period Duration (minutes) **10.02**

Impact (%) ▽	Finding	Recommendations
100	Host CPU was a bottleneck and the instance was consuming 88% of the host CPU. All wait times will be inflated by wait for CPU.	**1** Application Analysis **2** SQL Tuning **1** Host Configuration
74.8	SQL statements consuming significant database time were found.	**3** SQL Tuning
21.6	SQL statements were not shared due to the usage of literals. This resulted in additional hard parses which were consuming significant database time.	**1** Application Analysis
21.5	SQL statements were found waiting for row lock waits.	**1** Application Analysis

Policy Violations

Current 11 10 4   Distinct Rules Violated 8 5 4   ⓘ Compliance Score (%) 92   Policy Trend Overview

Security

Last Security Evaluation 🗎 Apr 13, 2006 4:59:42 AM CDT   Compliance Score (%) 90   Enterprise Security At a Glance

Job Activity

Jobs scheduled to start no more than 7 days ago

Scheduled Executions **0**   Running Executions **0**   Suspended Executions ✓ **0**   Problem Executions ✓ **0**

Home	Performance	Administration	Maintenance

Related Links

Access	Advisor Central	Alert History
Alert Log Content	All Metrics	Blackouts
Deployments	Execute SQL	iSQL*Plus
Jobs	Metric and Policy Settings	Metric Baselines
Metric Collection Errors	Monitoring Configuration	Monitor in Memory Access Mode
Reports	Rules Manager	SQL History

Performance Analysis – CPU Issue

Tune Specific Database: Click on Performance

Click on Perf. Tab

CPU & Application Issues
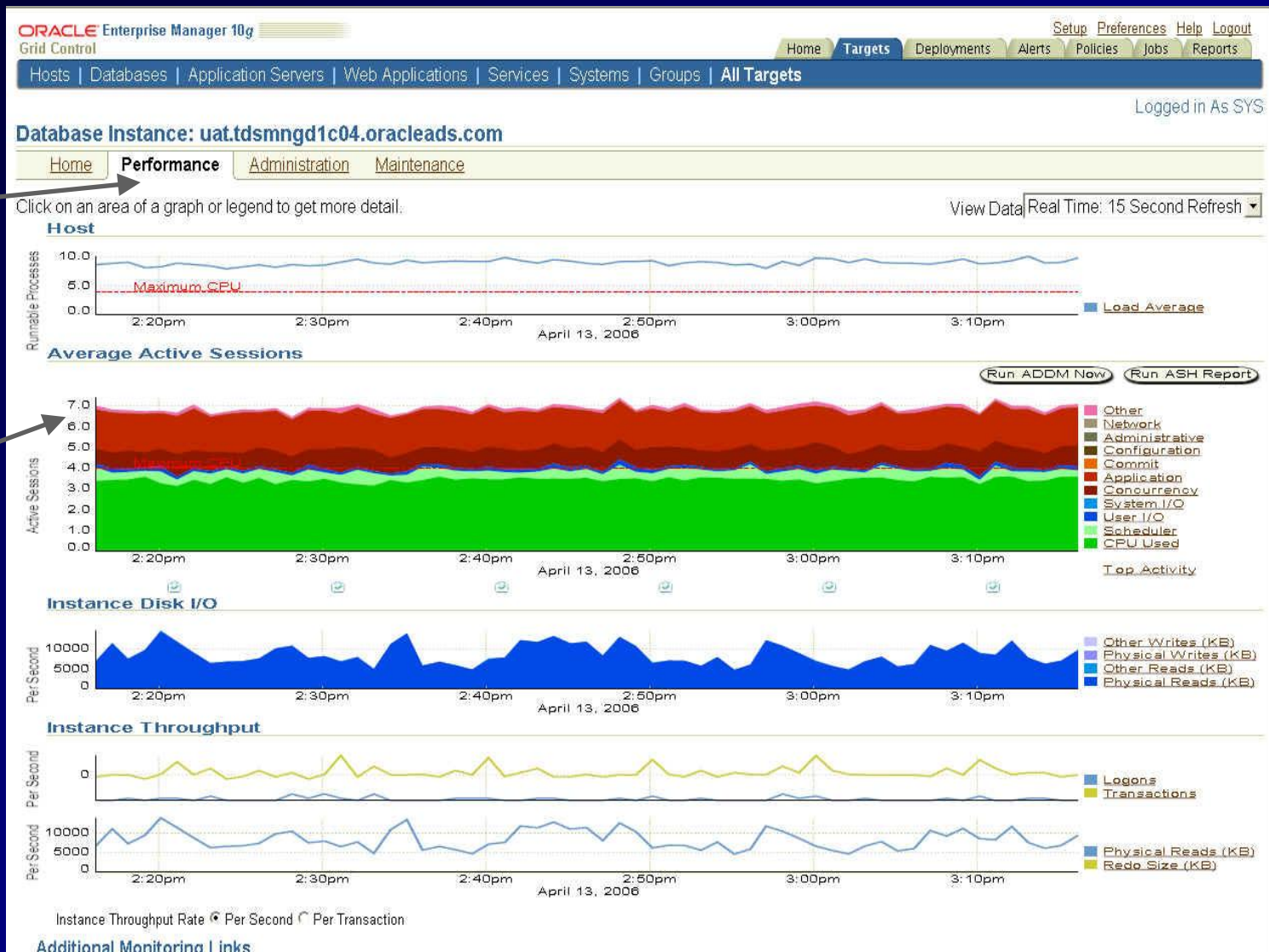
Tune Specific Database: Click on Performance (cont.)

Links to Top SQL

Advisor Central & Other Quick Links
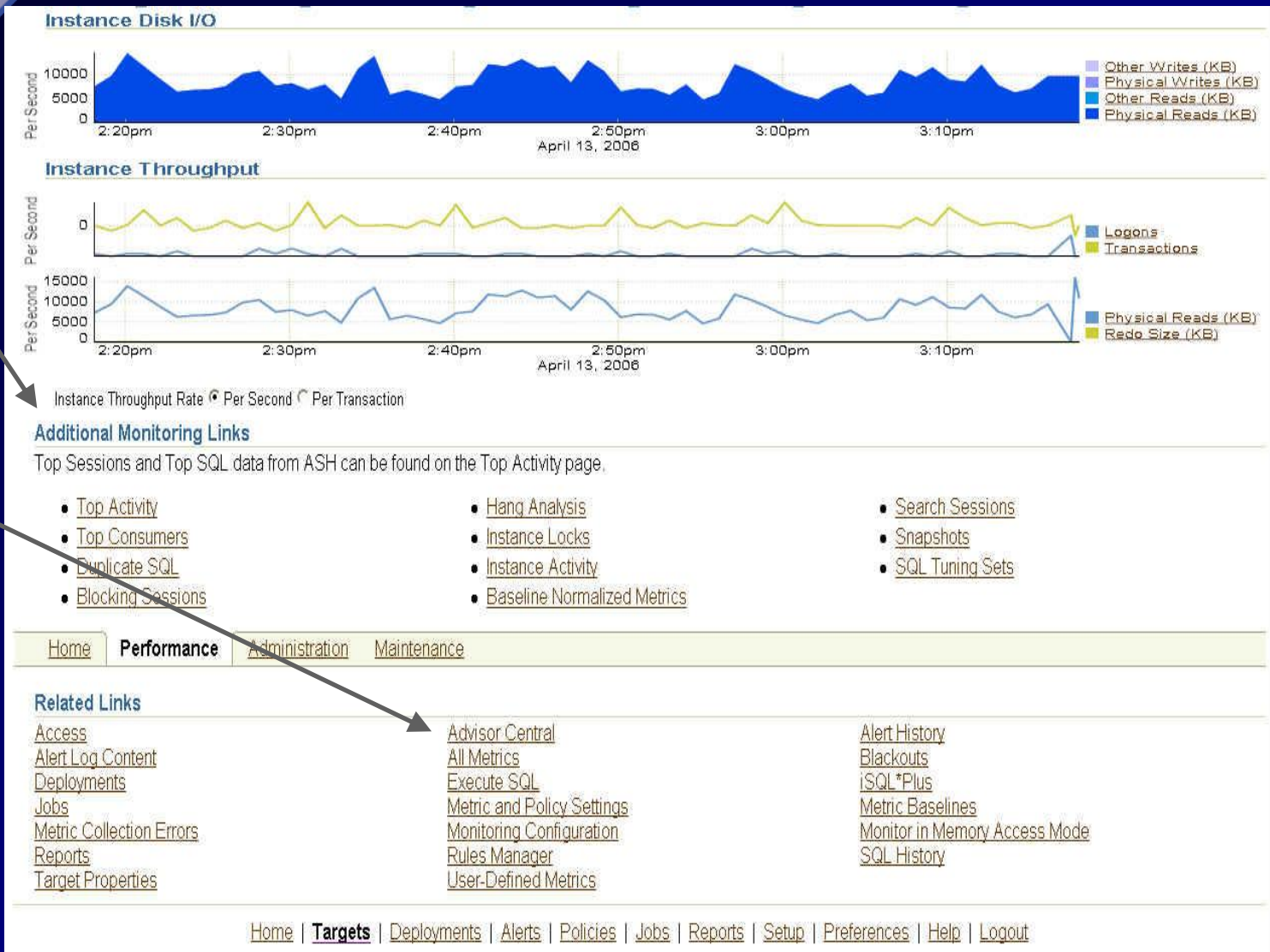
Tune Specific Database: Click on Top Activity

Drill into the Top Resource Hogs.

Worst SQL to Tune!
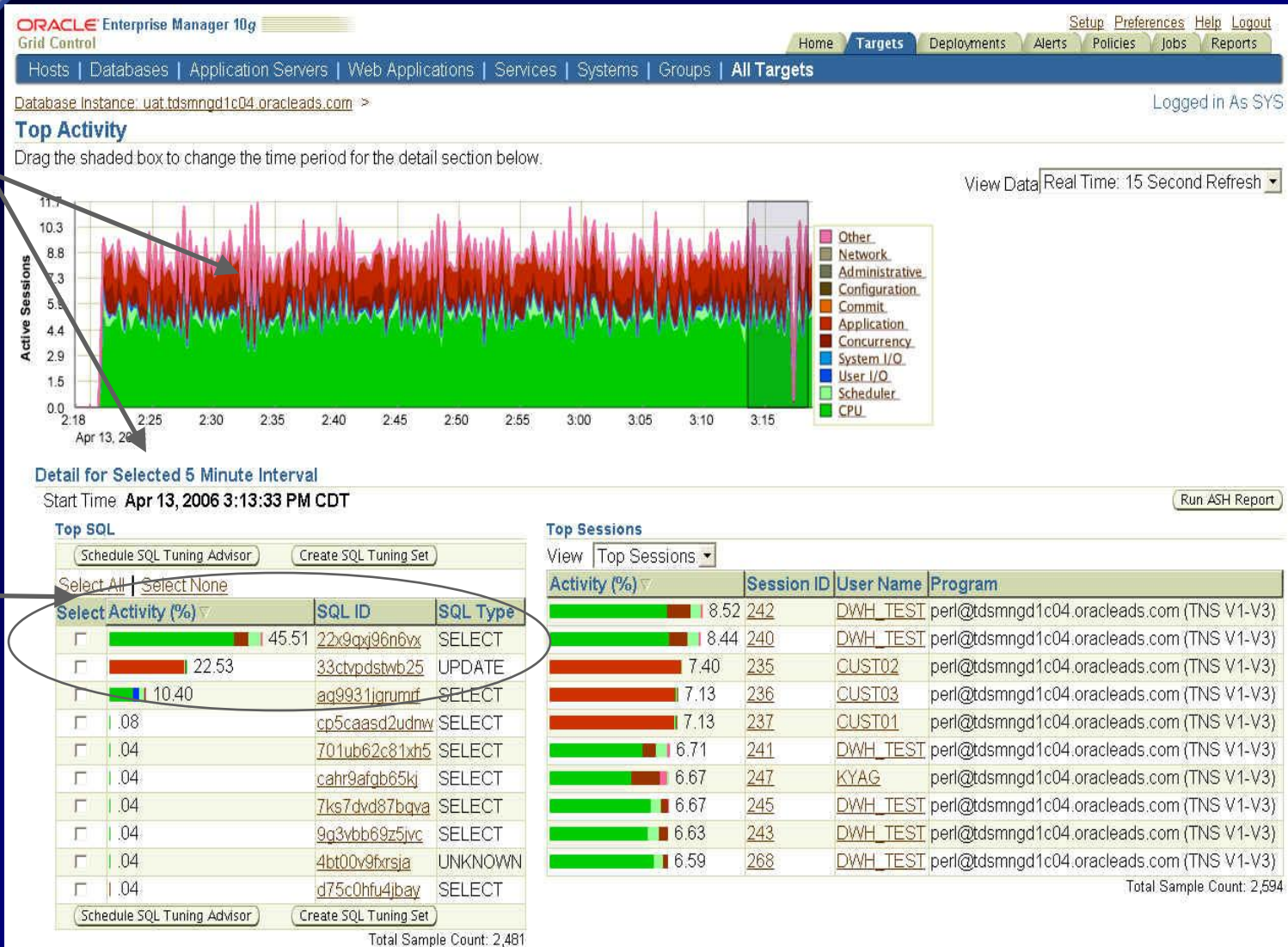
Tune Specific Database: Go To Advisor Central (ADDM)

Pick a problem time.

Analyze Problem; Click Here (next slide)

Tune Specific Database: Run ADDM

Main Finding

Details and Top SQL

Parsing Issue

Tune Specific Database: Advisor: SQL Tuning Set

Run SQL Tuning Set

Results for worst queries

Tune Specific Database: View Recommendations – Query1

Problem Query

Use the Profile: to Help 99%!

Compare Xplan

Tune Specific Database: Compare Explain Plans

Tune Specific Database: View Recommendations – Query2

Second worst SQL to Tune

Fix by collecting statistics Or Rewrite SQL

Tune Specific Database: ADDM Finding/Fix - Parse Issue

Problem: Not using bind variables

Fix for entire database or SQL

ORACLE Enterprise Manager 10g
Grid Control

Setup   Preferences   Help   Logout

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

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

Database Instance: uat.tdsmngd1c04.oracleads.com > Advisor Central > Automatic Database Diagnostic Monitor (ADDM) >

Logged in As SYS

Performance Finding Details

Database Time (minutes)	86.1	Period Start Time	Apr 13, 2006 2:50:17 PM CDT	Period Duration (minutes)	10
Task Owner	SYS	Task Name	ADDM:2598625219_1_10396	Average Active Sessions	8.6

Finding — SQL statements were not shared due to the usage of literals. This resulted in additional hard parses which were consuming significant database time.

Impact (minutes) 18.6

Impact (%) [====] 21.6

Recommendations

Show All Details | Hide All Details

Details	Category	Benefit (%) ▽
▼Hide	Application Analysis	[===] 21.6

Action — Alternatively, you may set the parameter "cursor_sharing" to "force". [Implement]

Action — Investigate application logic for possible use of bind variables instead of literals.

Rationale — At least 1056 SQL statements with PLAN_HASH_VALUE 3191477378 were found to be using literals. Look in V$SQL for examples of such SQL statements.

Findings Path

Expand All | Collapse All

Findings	Impact (%)	Additional Information
▼ SQL statements were not shared due to the usage of literals. This resulted in additional hard parses which were consuming significant database time.	[==] 21.6	
▼ Hard parsing of SQL statements was consuming significant database time.	[==] 21.8	
▼ Contention for latches related to the shared pool was consuming significant database time.	[|] 6.2	Additional Information
Wait class "Concurrency" was consuming significant database time.	[=] 10.8	

Tune Specific Database: Problem Fixed - Nice Improvement

Quick Impact on Host CPU and on Users
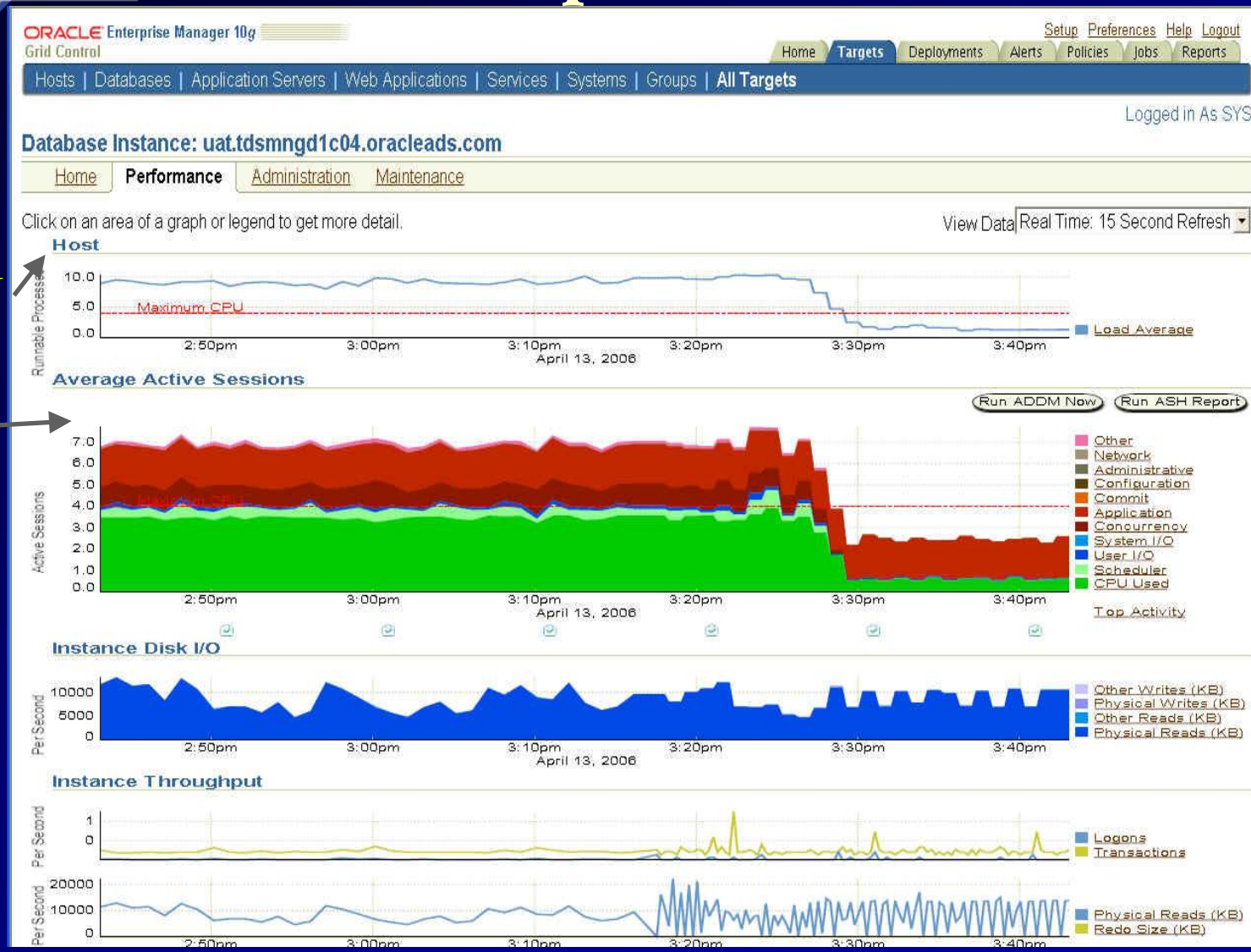
Tune Specific Query: Problem Fixed - Query Improvement

Worst Query1: Shows Huge Benefit

Worst Query2: Example Plan Tree

Tune Specific Query: Problem Fixed – Query Advice Tracked

Query1: Check the Tuning Info.

Tip #11
Where does ASM Fit?

Grid Control – 10gR2; A Look at ASM

Tip #12
Use all parts of Oracle for High Availability Grids

Oracle10g Database - ensures business information is always available

ORACLE 10g DATABASE

TUSC

Unplanned Downtime	**System Failures** →	**Grid Control** *Continuous Availability for all Applications*
	Data Failures & Disasters →	**Data Guard** *Guaranteed Zero Data Loss*
	Human Errors →	**Flashback Everything** *Enable Users to Correct their Mistakes*
Planned Downtime	**System Maintenance** →	**Dynamic Reconfiguration** *Capacity on Demand without Interruption*
	Database Maintenance →	**Online Redefinition** *Adapt to Change Online*
	Storage Failures →	**ASM Mirroring** *Storage Failure Protection*

81

High Availability Spectrum

System Hardware (ECC, Hot Plug & Redundant power, Cooling, PPM's Hot Plug PCI)	Increased Data Availability Mirroring, RAID: Smart Controllers & Storage Subsystems	Fault Recoverability 1st Generation *Individual System Image Clusters,* Cluster Software, Fail over, Shared Resources	Scalable/Parallel, 2nd Generation *Single System Image Clusters,* Fault Tolerance Parallel Databases, Cluster Aware Applications	Wide Area Clusters, Geographic Distribution, Database Replication, Transaction Routing
Single System Configuration		**Local Clusters**		**Distributed Clusters**
Single Site				**Multi-Site**
Systems Management				
Hours-to-Minutes		**Minutes-to-Seconds**		**Seconds-to-0**
88 Hours per year	8 Hours per year	60 Minutes per year	5 Minutes per year	0 Minutes per year
99.0% Normal Commercial Availability	99.9% High Availability	99.99% Fault Resilient Clusters/Fail over	99.999% Fault Tolerant	100.0% Continuous Processing

82

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

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

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

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

- **All databases of the largest 1,000,000 companies in the world (3E).**

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.)

Compelling Technology Statistics!
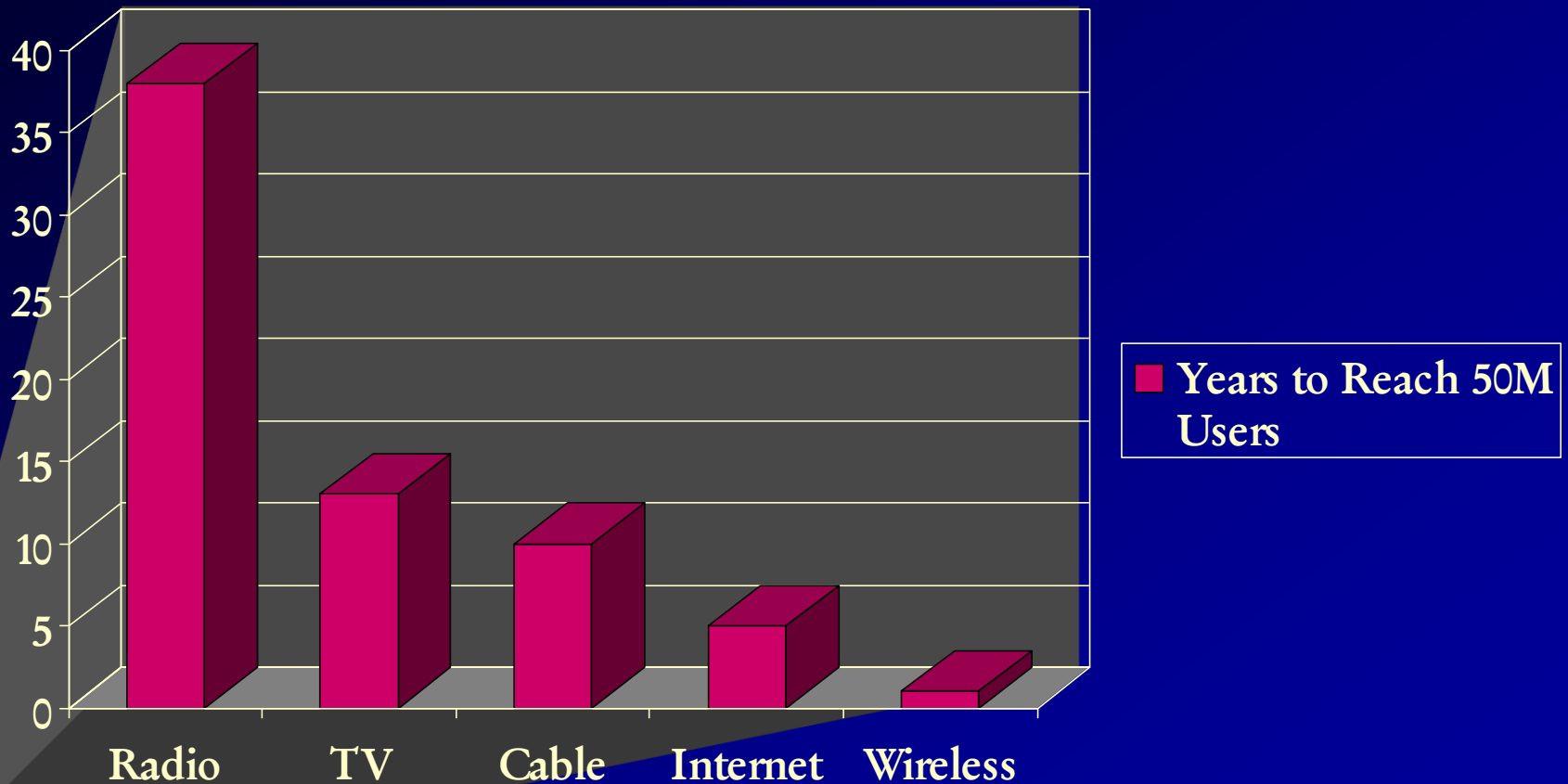
Friedman's 6 Dimensions of Understanding Globalization*

- Politics (Merging)
- Culture (Still disparate)
- Technology (Merging/Merged)
- Finance (Merging/Merged)
- National security (Disparate)
- Ecology (Merging)

Sited from Mark Hasson, PSU, Global Pricing and International Marketing.

Impact Tuning with Oracle

99.8% Less Data Accessed / 96.8% Time Reduction

Option	Before	After
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!!!

V$ Views over the years
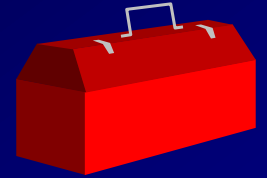
Version	V$ Views	X$ Tables
6	23	? (35)
7	72	126
8.0	132	200
8.1	185	271
9.0	227	352
9.2	259	394
10.1.0.2	340 (+31%)	543 (+38%)
10.2.0.1	396	613
11.1.0.6	484 (+22%)	798 (+30%)

Summary
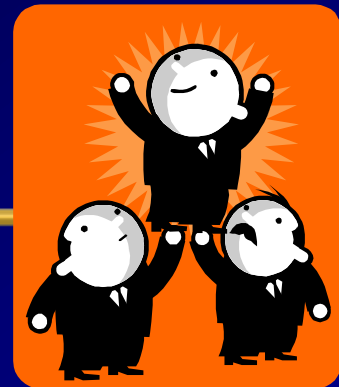
- The Basics, Oracle & Market Direction
- RAC, Grid Basics and Scaling it All
- Tuning the Interconnect & using Statspack/AWR
- Grid Control Basics, Multi-Node & Tuning
- Other quick Tips
- Availability thoughts
- Summary

Thanks for Coming!

Oracle Corporation – 30th Anniversary
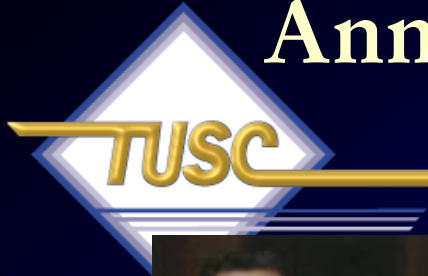
For More Information

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

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

Get good Information:
Your Team extends to Rolta TUSC!

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

--Phil Jackson

Rolta TUSC Services

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  - Full-Life Cycle Development Projects
  - Enterprise Architecture
  - Database Services
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  - Functional & Technical Support
- Training & Mentoring
- Oracle Authorized Reseller

94

References

- *Oracle9i Performance Tuning Tips & Techniques*, Rich Niemiec

- *The Self-managing Database: Automatic Performance Diagnosis;* Karl Dias & Mark Ramacher, Oracle Corporation

- *EM Grid Control 10g;* otn.oracle.com, Oracle Corporation

- *Oracle Enterprise Manager 10g: Making the Grid a Reality*; Jay Rossiter, Oracle Corporation

- *The Self-Managing Database: Guided Application and SQL Tuning;* Benoit Dageville, Oracle Corporation

- *The New Enterprise Manager: End to End Performance*

References

- *Oracle Database 10g Performance Overview*; Hervé Lejeune, Oracle Corporation
- *Oracle 10g; Penny Avril,*, Oracle Corporation
- *Forrester Reports, Inc., TechStrategy Research*, April 2002, Organic IT
- *Internals of Real Application Cluster*, Madhu Tumma, Credit Suisse First Boston
- *Oracle9i RAC; Real Application Clusters Configuration and Internals*, Mike Ault & Madhu Tumma
- *Oracle Tuning Presentation, Oracle Corporation*

References

- www.roltatusc.com, www.tusc.com, www.oracle.com, www.ixora.com, www.laoug.org, www.ioug.org, technet.oracle.com, www.informationweek.com, www.bizjournals.com
- *Oracle PL/SQL Tips and Techniques, Joseph P. Trezzo; Oracle Press*
- *Oracle9i Web Development, Bradley D. Brown; Oracle Press*
- *Using Oracle RAC and ASM to enable scaling on Linux with low cost storage, Grant McAlister, Amazon, 2005*
- *Special thanks to Steve Adams, Mike Ault, Brad Brown, Don Burleson, Kevin Gilpin, Herve Lejeune, Kirk*

References

- Oracle 10g documentation
- Oracle 9i RAC class & instructor's comments
- Oracle 9i Concepts manual
- http://geocities.com/pulliamrick/
- *Tips for Tuning Oracle9i RAC on Linux*, Kurt Engeleiter, Van Okamura, Oracle
- *Leveraging Oracle9i RAC on Intel-based servers to build an "Adaptive Architecture*, Stephen White, Cap Gemini Ernst & Young, Dr Don Mowbray, Oracle, Werner Schueler, Intel
- Oracle 10gR2 New Features & Strategies; Jim Hawkins₉₈

References

- *Running YOUR Applications on Real Application Clusters (RAC); RAC Deployment Best Practices*, Kirk McGowan, Oracle Corporation
- *The Present, The Future but not Science Fiction; Real Application Clusters Development*, Angelo Pruscino, Oracle
- *Creating Business Prosperity in a Challenging Environment, Jeff Henley*
- Oracle Real Application Clusters, Murali Vallath.
- Oracle 10g Real Application Clusters Installation For Intel Linux x86, John Smiley, TUSC (Available on OTN)
- Build Your Own Oracle RAC 10g Cluster on Linux and FireWire, *by Jeffrey Hunter* (Available on OTN)
- **Oracle Database 10g - The World's First Self-Managing, Grid-Ready Database Arrives**, Kelli Wiseth, Oracle

References

- *Real Application Clusters, Real Customers Real Results,* Erik Peterson, Technical Manager, RAC, Oracle Corp.

- *Deploying a Highly Manageable Oracle9i Real Applications Database,* Bill Kehoe, Oracle

- *Getting the most out of your database,* Andy Mendelsohn, SVP Server Technologies, Oracle Corporation

- *Oracle9iAS Clusters: Solutions for Scalability and Availability, Chet Fryjoff, Product Manager, Oracle Corporation*

- *Oracle RAC and Linux in the real enterprise,* Mark

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TUSC Corporate Profile

- "The Oracle Experts" since 1988
  - Oracle Partner of the Year, 2002, 2004, 2007 & 2008
  - Editors Choice – Consultant of the Year 2002 & 2004
  - Authorship, User Groups and Various Awards
  - One of the first 6 Oracle Masters in the World
  - Certified Advantage Partner

Rich's Overview (rich@tusc.com)

- President of TUSC – A Rolta Company:
  - 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
- Author (3 Oracle Best Sellers):
  - 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
- 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 -

(Chapter 2)