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The Self-Managing Database: Where Technology Meets The Customer
Session Agenda

- Key manageability features
  - Benefits
  - Real World Success Stories
- The Self-Managing Database at Qualcomm
  - Oracle Database 10g Deployment Experience
  - Business Benefits
Why is Manageability Important?

For Customers
- Increase in Size & Complexity
- High Administration Cost
- Unacceptable Failure Cost

For ISV Partners
- Increase in Deployment Complexity
- Increase in Development Cost
- High Support Cost

Do More with Less!
Where DBA’s spend their time

- Create & Configure: 12%
- Install: 6%
- Load Data: 6%
- Software Maintenance: 6%
- Ongoing System Management: 55%

Source: IOUG 2001 DBA Survey
Seamless Out-of-the-Box Experience

- Fast, lightweight install
  - Reduced install time
  - Automated pre- and post-install steps
  - Enhanced silent install for embedded ISVs
- Simplified database creation and configuration
  - Pre-configured database using Database Configuration Assistant (DBCA)
  - Automatic setup of maintenance tasks
- Out of box fully-functional Database Console
- Simplified upgrade
  - Database Upgrade Assistant (DBUA)
  - Automatic Pre- and post- upgrade checks
ISV Talk - CEGEDIM

- **Problem**
  - Install footprint too big
  - Embedding difficult

- **Solution**
  - Smaller install footprint — from 3 CDs down to 1
  - Smaller disk footprint — over 50% reduction
  - New Installer Record Mode for easier packaging and deployment
  - Pre-requisite checking ensures reliable install with high success rate

- **Result**
  - Very quick, easy, and robust install
  - Makes embedded application deployment simpler and more user-friendly
Faster, Easier Data Load

• Oracle Database 10g DataPump
  – 60% faster than Export (single stream)
  – 15X-20X faster than Import (single stream)
  – Automatic Parallelism – multiple streams
  – Re-startable
  – Size estimation on export dumpfiles

• Cross Platform Transportable Tablespaces
Customers Talk – Nextel

ITB Full Database Export

Time (hours)

9i DB Export
10g Data Pump Export

2 - 4 hrs
0.25 hrs
Customers Talk – National Stock Exchange, India

- **Data Import**
  - 9i Import/Export: 20 mins
  - 10g Data Pump Import/Export: 7 mins

- **Data Export**
  - 9i Import/Export: 15 mins
  - 10g Data Pump Import/Export: 7 mins
Ongoing System Management

55% of DBA’s time is spent in ongoing management, monitoring and tuning

1. Performance Diagnosis & Troubleshooting
2. Space & Object Management
3. SQL & Application Tuning
4. System Resource Tuning
5. Backup and Recovery

Source: IOUG 2001 DBA Survey
Oracle Database 10g Solution – Self-Managing Database

- Application & SQL Management
- Storage Management
- System Resource Management
- Backup & Recovery Management
- Space Management
- Database Management

Intelligent Infrastructure

Database Control
Intelligent Infrastructure

- Automatic Workload Repository
  “Data Warehouse” of the Database
- Automatic Maintenance Tasks
  Pre-packaged, resource controlled
- Server-generated Alerts
  Out-of-the-box, Push vs. Pull, Just-in-time
- Advisory Infrastructure
  Integrated, uniformity
Automatic Database Diagnostic Monitor (ADDM)

- Performance expert in a box
- Integrate all managers together
- Automatically provides database-wide performance diagnostic, including RAC
- Real-time results using the Time Model
- Pinpoints root cause and non-problem areas
- Provides Information vs. raw data
- Runs proactively
Customers Talk -

Problem
- Performance slowdown during peak ETL period

Solution
- ADDM automatically identified the bottleneck on the system
- Use EM to drill down to top SQLs in real-time
- Identified that the automatic maintenance job that gather optimizer statistics overlapped with the peak ETL period
- Changed the default maintenance window

Result
- Peak hour processing throughput improved
Automatic Tuning Optimizer

- Automatic capture of high-load SQLs
- Automatic SQL Tuning
  - Learn from past executions
  - Dynamic sampling, partial execution techniques
  - Profile the SQL statement to feedback to optimizer
  - No change to SQL text
Automatic Tuning Optimizer

- Automatic SQL Analysis
  - Optimizer explains decision points
  - Advises on badly written SQL, stale statistics, bad schema

Packaged Apps

Customizable Apps

High-load SQL

Automatic Tuning Optimizer

Auto SQL Analysis

Customizable Apps + SQL Advice

Well-tuned SQL
Automatic Tuning Optimizer

- SQL Access Advisor
  - Advise on access paths
  - Indexes, Materialized Views, Indexes on Materialized Views
  - Consider entire workload
  - Consider Impact on insert/update/delete

Packaged Apps

Customizable Apps

Access Advisor

Customizable Apps +

Indexes & MVs

Well-tuned SQL

High-load SQL
Customers Talk - Oracle Bug DB

• **Problem**
  - Near 100% CPU usage

• **Solution**
  - ADDM automatically identified a high-load SQL which caused performance slowdown every 4 hours
  - SQL Tuning Advisor recommended SQL Profile and index to improve the high-load SQL
  - Use EM to trace the SQL to a job, which DBA identified as “unaccounted for” and disabled it!

• **Result**
  - Consistently at 75% CPU usage
Customers Talk -

• **Problem**
  - Un-optimized queries taking a long time to run
  - Inability to track indexes use

• **Solution - SQL Access Advisor**
  - Recommended Materialized Views and Indexes to be retained
    • Confirmation that they were being used
  - Additional 3 bitmap indexes recommended
    • Working with application vendor to add them
  - Missed Materialized View identified

• **Result**
  - Dramatic Performance Improvement
  - Query taking 2 hours now runs in 10 minutes!
Automatic Shared Memory Tuning

- Automatically resizes with changes in workload
- Maximize usage of available memory
- Helps eliminate out-of-memory errors
- Improve overall performance
- Only 2 memory parameters
Customers Talk - Nextel

- **Problem**
  - Unable to closely monitor memory usage for a large number of databases
  - Over-sized SGA

- **Solution** - Automatic Shared Memory Tuning
  - Tested first on test systems
    - Observed no performance degradation
    - No out of memory errors
  - Now enabled on Production systems
    - Simple, 2-parameter setting
    - Using spfile to preserve settings across shutdowns

- **Result**
  - Ease of management
  - No longer need to over-size the SGA
Proactive Space Management

- Automatically monitor, capture space usage at space allocation time
- Advise and predict space growth trend, fragmentation
- “Just-in-Time” Alerts on space pressure
- Online Segment Shrink
  - Reclaim space from internal fragmentation
  - Improve performance
  - In-place shrinking of tables
  - Wait on DML operations
Single-Command Recovery

- Easy recovery from human errors at all levels
- Database Level
  - **Flashback Database** restores the whole database to time
    - Uses Flashback Logs
- Table Level
  - **Flashback Table** restores rows in a set of tables to time
    - Uses UNDO in database
  - **Flashback Drop** restores a dropped table or a index
    - Recycle bin for DROPs
- Row Level
  - **Flashback Rows** restores rows to time
    - Uses Flashback Query
Automatic Storage Management - Benefits

- **Automates daily storage administration**
  - Automatic I/O tuning
  - Eliminates disk fragmentation
  - Automatically selects allocation policy per Oracle file type

- **Automates storage re-configuration**
  - Automatic data copy on disk add/drop, no reconfiguring volume and re-striping
  - Online migration to new storage hardware
Customers Talk - Nextel

- **Problem**
  - Complex and costly storage solution

- **Solution**
  - Automatic Storage Management (ASM)

- **Result**
  - No manual tuning required
  - Reduced cost of storage solution
  - 4X (1 GB/min to 4 GB/min) increased in IO throughput
Configuration Management

Oracle Inventory
Software Configurations
Hardware Configurations
Install/Clone
Configure
Patch
Secure

View/Search
Compare/Diff
Change Tracking
Reference Configurations

Discover
Enterprise Manager
Analyze
LiveLink
Oracle.com
Product Updates
Patches
Product Configuration

Provision
Customers Talk - Nextel

- **Problem**
  - Managing a large number of systems
  - Repetitive configuration tasks

- **Solution**
  - Enterprise Manager Grid Control

- **Result**
  - Easy, central management of multiple targets
  - Complete software and hardware configuration tracking
  - Automatic Alerting
    - Saves DBA time
  - Patch management
    - Can keep up with the updates
Press Applauds Oracle Database 10g

Oracle Database 10g, the foundation of Oracle Corp.'s long-awaited platform overhaul, emerged from eWEEK Labs' tests with our Analyst's Choice recommendation. Database 10g addresses the needs of organizations pressured to increase uptime while cutting database staff, and it will pique the interest of administrators forced to manage growing collections of unstructured and multimedia data.

http://www.eweek.com/article2/0,1759,1618794,00.asp
“Sophisticated Simplicity.”

-Sean McCown, Infoworld

source: http://www.infoworld.com/article/04/03/19/12TOracle_1.html
The Self-Managing Database at Qualcomm

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CDMA Technologies
Qualcomm
QUALCOMM Reporting Segments
Businesses Aligned, Complementary to CDMA

QUALCOMM CDMA Technologies Group (QCT)
QUALCOMM Technology Licensing (QTL)
QUALCOMM Strategic Initiatives (QSI)

QUALCOMM Internet Services
QUALCOMM Wireless Business Solutions
QUALCOMM Digital Media
Early Participation

- Part of a focused, custom beta program
- Objectives
  - Participate in early development of self-management capabilities
    - Ensure that Qualcomm’s requirements are addressed
  - Provide real-world testing of features
    - Validate them in our environment
  - Early adoption of Oracle Database 10g
    - Realize the benefits of version 10g early
    - Stay ahead of the game
Qualcomm’s Commitment

- Early adoption of Oracle10g
  - At least one production database running on Oracle10g within 3 -6 months of production release
- Resource Commitment
  - Dedicated team to work with Oracle
Environment Overview

- 300 Oracle Databases across Qualcomm
- Platforms: Linux (Red Hat AS 3.0) and Solaris 2.8 (64-bit and 32 bit)
- Database version range from 8.1.7.4 to 10.1.0.3
- 2 applications already production on 10g
  - Centauri
    - Tracks all system event information in real time
    - 4-node RAC cluster
  - Request Tool:
    - IT ticket case management system
    - 7 or 8 applications based on one database
- 8 more applications expected go live on 10g in the next 6 months
Oracle 10g Upgrade Motivation

- Product enhancements in:
  - Install & Configuration
  - Performance Diagnostics & Tuning
  - Space and Memory Management
  - Data Migration
  - Central management: Enterprise Manager Grid Control
Install & Configuration

- Challenges
  - 3 or 4 db installs/upgrade a month
  - Each install 2 - 2.5 hours

- Oracle Database 10g
  - Database install time reduced by half
  - Enterprise-wide Grid Control deployment time reduced from days to a few hours

DBA time for install and configuration down by more than 50%
Installation – Enabling Technologies

- **OUI Enhancements**
  - OUI in prerequisite check mode prior to starting installation to ensure all prerequisites were met (OS versions, patches, etc.)
  - Discovered missing patches that were applied as a result

- **Robust install**
  - No errors encountered
  - User-friendly interface, asked very basic questions

- Significantly faster install compared with earlier versions
Configuration-Enabling Technologies

- **Database configuration Assistant (DBCA)**
  - Guided configuration
  - Can be saved and reused
- **Database Upgrade Assistant (DBUA)**
  - Guided upgrade
  - Reduced chances of errors
- **Enterprise Manager Grid Control**
  - Out of the box setup
  - Significantly easier configuration
Performance Diagnostics & Tuning

- **Automatic Database Diagnostics Monitor (ADDM)**
  - Now the default performance tuning aid
  - Use default settings
    - Collection and analysis every 1 hour
    - 7 days retention of data for analysis
  - Automatically discovered problems and helped quick resolution
  - Noticeable performance improvement
Case Study: Automatic Performance Tuning

- Migration of Centauri Application DB from 8.1.7.4 to Oracle 10g RAC
- Performance degraded after DB upgrade
- The challenges:
  - What is causing performance degradation?
  - How can it be fixed?
ADDM identified the problem...

Automatic Database Diagnostic Monitor (ADDM)

Database Activity

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

Performance Analysis

Task Name: ADDM:296429929_1_455

Database Time (minutes) 136.96  Period Start Time: May 21, 2004 11:00:48 AM  Period Duration (minutes) 29.78

Task Owner: SYS  Average Active Sessions: 4.6

Impact (%): Finding  Recommendation

100% SQL statements consuming significant database time were found.
73% Individual database segments responsible for significant user I/O wait were found.
60% Buffer cache hit rate under 80% causing significant additional I/O.
13% Read and write contention on database blocks was consuming significant database time in the cluster.
38% Contention on buffer cache misses was consuming significant database time.

2 SQL Tuning
2 Segment Tuning
1 DB Configuration
1 Schemas
1 SQL Tuning
...the offending SQL statement. Also, recommended running SQL Tuning Advisor as the solution.
SQL Tuning Advisor immediately identified the missing index...
The recommendation can be implemented by just clicking on the “Implement” button.
Memory Management

- Using **Auto SGA & PGA memory management**
- No performance degradation noticed after upgrade
  - Compared with very well tuned 8i and 9i systems
  - In fact, performance improved slightly!
- **Main benefit: Significant ease of configuration**
  - Just set 2 parameters and you are done!
  - No need to maintain separate parameter files, one for OLTP and other for nightly batch loads
Space Management

- Using **Locally Managed Tablespaces**
  - Automatic Segment Space Management being considered

- **New Segment Advisor**
  - Precise information on data fragmentation
  - Unnecessary reorganizations eliminated

- **New Online Segment Shrink** very useful
  - Considerably easier than Online Redefinition
  - Can be automated
  - Done once every 3 to 4 months
Data Migration

• Transportable Tablespaces
  – Reduce migration time from 3-4 hours to 5 minutes
  – Import/export or schema copy was the only option available in the past
  – Easy to use
Enterprise Manager Grid Control

• Benefits for us
  – Centralized management of hundreds of databases
  – Common interface for various management targets
    • Databases
    • Hosts/OS
    • iAS…etc
  – Easy software configuration and inventory
• Simple, one-time deployment
Overall Business Benefit

- Significant reduction of management costs
- Enhanced administrator productivity
- More efficient use of existing system resources
- Enables us to grow with current resources
Currently in works at Qualcomm

- Additional features being evaluated
  - More self-managing database features
- Grid Control
  - Configuration Management
    - Patch management
  - Non-database targets management
- **Goal:** reduce management costs even more
Next Steps

- **Recommended Parallel Sessions**
  - The Art of Effortless Administration: Oracle Database 10g DBA Best Practices: Tue 12/7/04 3:30 PM - Room 304
  - Oracle Database 10g SQL Optimization: Wed 12/8/04 3:00 PM - Room 304
  - Oracle Database 10g Space and Undo Management: Do's and Don'ts: Thu 12/9/04 1:00 PM - Room 302

- **Related Demos/Exhibits**
  - Database Manageability, Upgrade, DataPump, ASM and Backup and Recovery pods located in Oracle DEMOgrounds

- **See Your Business in Our Software**
  - Visit Oracle Direct in the Oracle DEMOgrounds for a personalized proposal

- **Related Web Sites For More Information**
  - www.oracle.com/technology/products/manageability/database