Enterprise Manager 12c: New Features for Database Management

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Oracle
20% of DBAs admit doing nothing to address performance issues.
Over 50% of DBAs avoid making changes to production because of negatively impacting performance.

90% experienced unplanned downtime resulting from Database changes NOT properly tested.
33% of DBAs handle close to 100 database instances each—with data stores expanding by more than 20% per year
More than 21% will provide a private Database platform as a Cloud service
Deliver Highest Service Quality with Lowest Risk & Effort
Unresponsive Database Problem

• How do I diagnose a slow or hung database?
  – If the database is unresponsive, I can’t even login!

• Should I just bounce the database?
  – All in-flight operations will be aborted
  – All diagnostic information will be lost
  – If I could only know which blocking session to kill!
Real-Time ADDM

- Real-time analysis of hang or slow database systems
- Holistically identify global resource contentions and deadlocks
- Quantified performance impact
- Precise, actionable recommendations
- Supports single instance & RAC

**Real-Time ADDM Results**

<table>
<thead>
<tr>
<th>Priority</th>
<th>Performance Impact</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>100</td>
<td>Unresolved hangs or session wait chains</td>
</tr>
</tbody>
</table>

**Recommendation 1:** Kill the session with ID [1,25,431] (instance number, SID, serial number). The session runs as operating system process 29908.
Real-Time ADDM

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Real-Time ADDM—Architecture

- Makes a lightweight connection without acquiring additional locks and resources, bypassing the SQL layer through the agent
- Also attempts to initiate standard JDBC connection
- Data returned by either connection is analyzed by ADDM
Top Issues Identified by Real-Time ADDM

Resource Constraints
- CPU Bound Hosts
- Memory Paging
- I/O Bound
- Interconnect Bound

Hangs
- Instance Shutting Down
- Top Blocker Analysis
- Memory Pool Flushing
- ASM Unresponsive

Memory Issues
- Library Cache Issues
- Memory Allocation Issues
- Excessive PGA growth

Resource Limits Reached
- Sessions
- Processes

Deadlocks
Comparative Performance Analysis

• Performance yesterday was good, today is terrible, what happen?
  • What changes were made?
  • Is someone running a new batch job?
• RAC instance 1 is running much faster than instance 2, what’s the difference?
  • Is there a workload skew?
  • Did someone make configuration changes?
Compare Period ADDM

• Full ADDM analysis across two AWR snapshot periods
• Detects causes, measure effects, then correlates them
  • Causes: workload changes, configuration changes
  • Effects: regressed SQL, reach resource limits (CPU, I/O, memory, interconnect)
• Makes actionable recommendations along with quantified impact
Compare Period ADDM: Method

- Identify what changed
  - Configuration changes, workload changes

- Quantify performance differences
  - Uses DB Time as basis for measuring performance

- Identify root cause
  - Correlate performance differences with changes

• 30% smaller Buffer cache
• 10% new SQL

• Top SQL increased 45%
• Read I/O up 55%

• Buffer cache reduction caused read I/O increase
Correlation Rules: Symptoms and Causes

Paging
- Physical memory size
- SGA/PGA Target

Hard/Soft Parse Time
- Cursor sharing
- Shared Pool size
- Session cached cursors

SQL Regressions
- Optimizer parameters
- SQL parameters

Temp I/O
- PGA Aggregate Target
Compare Period ADDM: Report

- Reports resource usage for the two periods: CPU, Memory, I/O and Interconnect
- Graphic report shows DB Time over comparison periods
- Reports SQL commonality – how similar was the SQL between two time periods
Active Session History (ASH) Analytics

- Graphical ASH report for advanced analysis
- Select any time period for analysis
- Analyze performance across many dimensions
- Provides visual filtering for recursive drill-downs
- Different visualizations: Stacked chart or Tree Map
- Collaborate with others using Active Reports
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Test Data Management

Challenges

Full production copies for test systems not cost effective

Error-prone, manual process

Producing relationally intact subset is hard but necessary

Cannot use sensitive data in test without obfuscation
Data Discovery and Modeling

• **Application Data Model (ADM)**
  – Scans application schemas to model relationships between tables and columns
  – Extract data relationships from Oracle Applications meta-data
  – Store referential relationships stored in repository
  – Enables test data operations such as data subsetting, masking

• **Sensitive Data Discovery & Data Masking**
  – Pattern-based database scanning
  – Import from pre-built mask templates
  – Pre-built Data Masking templates for Oracle applications
    • Oracle eBusiness Suite
    • Oracle Fusion Applications
Secure Database Testing
Real Application Testing Integration with Data Masking

Capture → Clone → Mask → Test

- DB Replay capture files
- STS
- AWR snapshots

- Clone prod system
- Consistent masking across tables, capture files, STS and AWR snapshots

- Securely replay workload & STS

Production → Stage → Test

<table>
<thead>
<tr>
<th>NAME</th>
<th>SSN</th>
<th>SALARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGUILAR</td>
<td>203-33-3234</td>
<td>40,000</td>
</tr>
<tr>
<td>BENSON</td>
<td>323-22-2943</td>
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</tr>
<tr>
<td>SMITH</td>
<td>111-22-3333</td>
<td>60,000</td>
</tr>
<tr>
<td>MILLER</td>
<td>112-23-4567</td>
<td>40,000</td>
</tr>
</tbody>
</table>
Data Subsetting

- Automatic data extraction rules from ADM
- Estimate subset before execution
- Supports in-place subset and export method
- Subset 100 GB ➔ 20 GB in 12 minutes using export method
Database Upgrade Automation

- **Plan**
  - Detect new DB versions in My Oracle Support
  - Suggest best upgrade path for patch compatibility
  - In-context reference to Upgrade documentation

- **Analyze**
  - Check databases for upgradeability (Space, version, invalid objects, etc)
    - Supported versions are 10.2.0.4, 11.1.0.6, 11.1.0.7

- **Deploy**
  - Mass deploy binaries to all targets and create out-of-place copies
  - Long-running upgrade process can be paused and resumed by the user

- **Switch**
  - Switch instances to new installations
  - Easy switchback if needed
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Exadata Management
Integrated View of Hardware and Software

• Hardware view
  • Schematic of cells, compute nodes & switches
  • Hardware components alerts

• Software/system view
  • Performance, availability, usage by databases, services, clusters
  • Software alerts from db, cluster, ASM
  • Topology view of DB systems/clusters

• Configuration view
  • Version summary of all components along with patch recommendations
Storage Cell Performance

- Composite cell health indicators
- Drill down from database Performance page
  - Helps triage
    - Load imbalance
    - ASM problems
    - Cell configuration issues
    - Cell software or hardware failures
    - Network failures
Storage Cell Management

- Storage Cell monitoring and administration support
  - Cell Home page and performance pages
  - Actions supported: Start/stop Cell, verify connectivity, setup SSH, execute Cellcli on cells
  - Setup IORM for database targets
- Management by Cell Group
  - All cells used by a database automatically placed in a group
  - Cell Group level administration operations (batch job monitoring)
Infiniband Network Monitoring

- Infiniband network and switches as EM targets
- Network home page and performance page – real time and historical
- Network topology view
- Perform admin tasks such as enable/disable port, clear performance/error counters

- Full monitoring
  - Alerts (switch generated and EM generated)
  - Performance metrics
  - Configuration metrics – detect and notify configuration changes/best practice violations
Consolidation Challenges

- Applications have different workload & resource profiles
- Before consolidation, analyze multiple resources
  - CPU
  - Memory
  - Storage
Consolidation Planner

Determines candidates for consolidation

• Identifies under- and over-utilized server
• Works for physical and virtual environments

Benefits

• Maximizes server density
• Minimizes resource contention
• Maintains performance commitment
• Satisfies business, compliance, and technical constraints
Consolidation Planner

- Target resource utilization and configuration data extracted from Enterprise Manager repository
  - CPU, memory, storage, network
  - Over a representative period

- Administrator specifies servers and constraints for workload migration
  - Physical/virtual servers
  - Existing/planned servers
  - Business/technical constraints

- Reports detail how consolidated workloads would perform on target servers
Deliver Highest Service Quality with Lowest Risk & Effort
Database-as-a-Service
Key Features and Benefits

• Self-service paradigm for database deployment and management
• Pre-packaged, pre-configured database configurations
• One-click provisioning and deployment of databases
• On-demand scalability of underlying platform
• Metering and chargeback for IT accountability
• Extreme “agility” for developers, with “enterprise” control for IT
Database-as-a-Service Taxonomy

Cloud
Collection of various zones – Database, OVM…

Database Zones
Logical unit based on configuration, version, etc.

Database Software
Oracle Home
Directories, binaries, executables, programs, scripts, etc. for the Oracle Database

Clusterware
Access to shared storage
**Database-as-a-Service Setup**

**Roles and Responsibilities**

### Cloud Administrator

1. Provision Servers, Storage, and Network
2. Manage Cloud Resources
3. Create Users and Roles
4. Configure Software Library
5. Manage Security and Policies

### Self Service Administrator

1. Provision database software on SI or RAC servers
2. Define Deployment Procedures or Assemblies for database provisioning
3. Define services in Service Catalog for deployment by Self-Service users
4. Assign quotas to Users and Roles
5. Define access control (map roles to zones)
6. Setup Chargeback Plans
Self-Service Provisioning

- Out-of-box console; no additional set up required
  - Supports custom background
- Rich service catalog:
  - Database service
  - OVM Templates and Assemblies
  - Java applications
- Additional capabilities:
  - Backup and Restore VM/Database
  - Basic resource monitoring
  - Chargeback information
  - Quota monitoring
- Cloud APIs
  - RESTful APIs and CLIs ideal for Cloud integrators
Cloud Resource and Request Monitoring

- Manage Cloud Zones and underlying resources (databases, Server Pools, VMs)
  - Track resource flux, tenants, policy violations, etc
  - Drill down into individual resources for deeper monitoring
- Monitor requests and failure rates and identify potential bottlenecks to remediate
Metering and Chargeback

- Resource usage metering & historical usage trends
- Leverages metrics in EM repository
  - >40 DB, host and VM metrics collected
  - Performance metric & Configuration data
- Supports dedicated and shared databases (via services)
- 24 hour collection schedule for metered targets
- Allows administrator to assign charge rates to metered resources
  - Supports fixed, configuration and usage based chargeback
- Reports show usage trends and chargeback costs
### Database Metering and Chargeback Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Metric Type</th>
<th>Aggregation</th>
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<tbody>
<tr>
<td><strong>Dedicated</strong></td>
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<td></td>
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<tr>
<td>Base Charge</td>
<td>Fixed</td>
<td>sum</td>
</tr>
<tr>
<td>Backup Charge</td>
<td>Fixed</td>
<td>sum</td>
</tr>
<tr>
<td>CPU Utilization (SPECint®_rate_base2006)</td>
<td>Usage</td>
<td>avg</td>
</tr>
<tr>
<td>CPU Utilization (%) *</td>
<td>Usage</td>
<td>avg</td>
</tr>
<tr>
<td>Edition</td>
<td>Config</td>
<td>n/a</td>
</tr>
<tr>
<td>Version</td>
<td>Config</td>
<td>avg</td>
</tr>
<tr>
<td>Storage Usage *</td>
<td>Config</td>
<td>avg</td>
</tr>
<tr>
<td>Memory Usage *</td>
<td>Config</td>
<td>avg</td>
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<tr>
<td>Option</td>
<td>Config</td>
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<tr>
<td><strong>Shared (by Service)</strong></td>
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<td></td>
</tr>
<tr>
<td>Base Charge</td>
<td>Fixed</td>
<td>sum</td>
</tr>
<tr>
<td>DB Time</td>
<td>Usage</td>
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<tr>
<td>CPU Time</td>
<td>Usage</td>
<td>sum</td>
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<tr>
<td>CPU Utilization (%)</td>
<td>Usage</td>
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<tr>
<td>CPU Utilization (SPECint®_rate_base2006)</td>
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<tr>
<td>SQL Executes</td>
<td>Usage</td>
<td>sum</td>
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<tr>
<td>User Transactions</td>
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<tr>
<td>Disk Read Bytes (Physical)</td>
<td>Usage</td>
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<tr>
<td>Disk Write Bytes (Physical)</td>
<td>Usage</td>
<td>sum</td>
</tr>
<tr>
<td>Network IO</td>
<td>Usage</td>
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PERFORMANCE
Real-Time ADDM
Compare Period ADDM
ASH Analytics

CHANGE MANAGEMENT
Secure Testing
Data Subsetting
Database Upgrade Automation

ENGINEERED SYSTEMS
Exadata Management
Consolidation Planner

DATABASE CLOUD SERVICES
Database-as-a-Service
Metering and Chargeback
Hardware and Software

Engineered to Work Together