Managing Oracle Exadata with Oracle Enterprise Manager 12c

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Enterprise Technology
Oracle Corporation
(ASEAN)
Oracle Exadata Database Machine

Extreme ROI Platform

- Data Warehousing or Highly Concurrent OLTP
- Massively Parallel Grid Architecture
- Extreme Performance

- Fast Predictable Performance
- Lower Ongoing Costs
- Fastest Time to Value at Lowest Risk

Maximize database performance with automated diagnostics & tuning

Drive down IT operational costs with automated change and configuration mgmt

Automate testing of patches, changes and upgrades while keeping data secure

Using Enterprise Manager 12c Cloud Control!!
Management Challenges

Challenges

- Reduce deployment cost and errors—rapid time to value
- Migrate applications while ensuring business continuity
- Proactively monitor all components
- Maximize availability
- Ensure highest quality of service

Oracle Enterprise Manager Release 12c

- Manages all stages of Exadata lifecycle from deployment to maintenance
- Automates deployment reducing cost and effort
- Mitigates migration risk
- Proactive Monitoring
- Maximizes performance, availability and service quality
Exadata Management

Setup & Monitor
- Discovering Exadata for monitoring
- Monitoring the Database machine

Test
- Consolidate on Exadata
- Validate Application Performance

Manage
- Performance Diagnostics
- Application SQL Tuning

Maintain
- Configuration Compliance
- Patch Automation
Discovering Exadata in Enterprise Manager 12c

- Wizard driven guided discovery now significantly faster (10x) than 11g
- Exadata Storage Cell and the Infiniband network and switches can be discovered out-of-the-box
  - Plug-in based discovery has been deprecated for these targets.
- Install Exadata Add-on for all other targets (viz. KVM, PDU, Cisco Switch)
  - The Add-on is a bundle created using all the plug-ins. It is a collection of jar files.
- Option to Discover New DB Machine or rediscover – Add DB Machine Members
Exadata Monitoring

- Database
- Storage Server
- Infiniband Network
- KVM, PDU, ILOM, CISCO SWITCH
Exadata Management
Integrated View of Hardware and Software

- **Hardware view**
  - Schematic of storage cells, compute nodes and switches
  - Hardware components alerts

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

- **Configuration view**
  - Version summary of all components along with patch recommendations
Storage Cell Management

- Monitoring and administration support:
  - Cell Home page and performance pages
  - Actions supported: Start/stop Cell, verify connectivity, setup SSH

- Automatic discovery of Exadata cells

- Management by Cell Group:
  - All cells used by a database automatically placed in a group
  - Cell Group level administration operations (batch job monitoring)

- Workload Distribution by Databases

- ASM Disk Group Summary

- Incidents

No matching incidents or problems found.
Storage Cell Management – what EM can do

- **Storage Cell monitoring and administration support**
  - Cell Home page and performance pages
  - Actions supported: Start/stop Cell, verify connectivity, setup SSH

- **Automatic discovery of Exadata cells**

- **Management by Cell Group**
  - All cells used by a database automatically placed in a group
  - Cell Group level administration operations - you can issue dcli (distributed cli) commands to a group of cells from EM itself
Storage Cell Management

Select Targets

 Targets displayed below are part of Exadata Grid System. Select the targets on which Administration Operation need to be performed.

Search Targets:

<table>
<thead>
<tr>
<th>Select</th>
<th>Exadata Target Name</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sclb06cell03.us.oracle.com</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sclb06cell02.us.oracle.com</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sclb06cell01.us.oracle.com</td>
<td></td>
</tr>
</tbody>
</table>

Perform Administration  Cancel

I/O Resource Manager (IORM) Settings:

I/O Resource Manager controls how databases utilize the disks and flash cache, based on the settings specified here.

Tip: Oracle recommends the same IORM settings for the group of cells used by the same set of databases. Click on Update All button to change the IORM settings for all cells in this Group.

Status: 2-Active, 1-Inactive, 0-Target Down

Select: Active  Inactive  Update All

Disk Objective: Common objective is not set on all cells

Select:  Update All

Inter-Database Plan:

<table>
<thead>
<tr>
<th>Database Name</th>
<th>Disk Utilization Limit</th>
<th>Disk I/O Allocations</th>
</tr>
</thead>
<tbody>
<tr>
<td>testdb</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>other</td>
<td></td>
<td>80</td>
</tr>
</tbody>
</table>

- Perform Cell Administration tasks
  - Execute Cellcli commands on a set of cells or all cells
- Setup IORM for database targets
Infiniband Network Management

- Infiniband network and switches as EM targets
  - Automatic discovery
- Network home page and performance page
  - Real time and historical
- Topology view of Network with switch and port level details

• Full monitoring
  - Alerts (switch generated and EM generated)
  - Performance metrics
  - Configuration metrics – detect and notify configuration changes/best practice violations
Infiniband Network Management

- Perform Infiniband Administration tasks
  - Enable Port
  - Disable Port
  - Clear Performance counters
  - Clear Error Counters
Common metrics monitored
- Power supply failure
- Fan failure
- Temperature out of range

Specific metrics monitored
- Cisco Switch
  - Configuration change tracking and reporting
  - Unauthorized SNMP access
- Keyboard, Video, Mouse (KVM)
  - Server connected to KVM added/removed, powered on/off
- Measures power consumption used by Exadata components and provides early warning of impending thresholds

- Monitors electric current being used by equipment connected in Exadata rack
Monitor Exadata Database Machine as One
Exadata Service Monitoring

- Service view of Exadata components
- Detailed charts of key performance and usage information
- Service model and topology displaying relationships between components
- Tests can validate service availability from service endpoints
Exadata Aggregate Service

- Exadata Aggregate Service
  - KVM Service
    - Exa KVM System
      - KVM-01
        - FAN FAILURE STATUS

Components
- Metrics
- System
- Service
Exadata Service Dashboards

- Service dashboard for executives and business owners
- Many components reporting up to one Exadata Service

<table>
<thead>
<tr>
<th>Service</th>
<th>Status</th>
<th>Performance</th>
<th>Usage and Business Indicators</th>
<th>Components</th>
<th>Service Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>xchen_DBMachine_Service</td>
<td>![Up]</td>
<td>7578.58 Link Throughput (Gbps)</td>
<td>0.67 Used (GB)</td>
<td>![Up] 13 Up</td>
<td>Last 24 Hours: 100.00%</td>
</tr>
</tbody>
</table>
Exadata Management

**Setup & Monitor**
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**Manage**
- Performance Diagnostics
- Application SQL Tuning

**Maintain**
- Configuration Compliance
- Patch Automation
Deploying Applications on Exadata

- Migrating applications to Exadata can be a very time consuming three step process:
  - Identify which applications to be migrated to Exadata
  - Create test environment on Exadata
  - Validate application performance

- How do we decide what to consolidate?
Use the **Consolidation Planner** (brand-new in EM 12c)

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

- 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

- Gives an idea of what you can consolidate on physical (Exadata or non-Exadata) or on virtual (Oracle VM) servers
After using the Consolidation planner, you have an idea of what to consolidate.

Even then, deploying application to Exadata involves multiple changes:

- O/S migrations
- Storage subsystem changes
- Database upgrades
- Single database instance to RAC

Proper testing required for risk mitigation.
Secure Test System Deployment: Use the Data Masking Pack

- Deploy secure test system by masking sensitive data
- Sensitive data never leaves the database
- Extensible template library and policies for automation
- Sophisticated masking: Condition-based, compound, deterministic
- Integrated masking and cloning
- Leverage masking templates for common data types
- Masking of heterogeneous databases via database gateways
- Command line (EMCLI) support for data masking actions

<table>
<thead>
<tr>
<th>LAST_NAME</th>
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<th>SALARY</th>
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<tr>
<td>MILLER</td>
<td>222–34–1345</td>
<td>40,000</td>
</tr>
</tbody>
</table>

- **NEW in EM 12c:** Data Masking integration with Real Application Testing
- **NEW in EM 12c:** Key-based reversible masking
Validate Application Performance:

Use REAL APPLICATION TESTING (RAT) - DB EE Option

- SQL Performance Analyzer (SPA)
  - SQL unit testing for response time
  - Identify and tune regressed SQL
  - Integrated with SQL Tuning Advisor and SQL Plan Baseline

- Database Replay
  - Load, performance testing for throughput
  - Remediate application concurrency problems
  - Integrated with Oracle Application Testing Suite for comprehensive testing solution

- Seamless integration with Data Masking to preserve data sensitivity compliance
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Use Database Diagnostics and Tuning Packs:

- Oracle Database 11g’s Automatic Performance Diagnostics helps maximize Exadata performance.
- Top-down performance analysis using Automatic Workload Repository.
- Real-time performance analysis with Automatic Database Diagnostic Monitor.
- Resolve performance issues faster with drill-down root-cause analysis.
- Classification tree based on Oracle performance tuning expertise.
- Fully automates database performance diagnostics.
Performance Diagnostics and Tuning

- Automatic SQL Tuning
  - Analyze high-load SQL → tune using SQL Profiles → implement improved SQL plans (optional)
- Comprehensive SQL analyses across 6 dimensions: statistics, SQL profiling, index, alternate plan, parallelization and SQL structure
- SQL Profiles tunes execution plan without changing SQL text
- Enables transparent tuning for packaged applications
Exadata Aware SQL Monitoring

- Real time monitoring of application SQL
- I/O performance graphs with Exadata information
  - Cell offload efficiency
  - Cell smart scan
- Rich metric data
  - CPU
  - I/O requests
  - I/O throughput
  - PGA Usage
  - Temp Usage
• Database Performance page shows Exadata info
• Exadata Database I/O Load graph over time
• I/O Breakdown – I/O MB per second by I/O Function – shows Smart Scan
• Drill down to Exadata System Health / Exadata System Performance from Database Performance page
Storage Cell Performance Triage (determining the priority of treatments based on the severity of the condition)

- Drill down from the Database Performance page
- Provides composite view of all health indicators of a cell or cell group

Helps triage
- Hard Disk I/O Load graph
- Load Imbalance meter over time
- ASM related problems
- Cell software or hardware failures
- Cell configuration issues
- Network related failures
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Root Cause Analysis of Hardware Problems

- Topology View of all Exadata components by
  - Uses
  - Used By
  - System Members
  - DB Machine Software
- Enables out of the box root cause analysis of issues.
Defect Diagnostics

- **Support Workbench**
  - Exadata integrated with Database defect diagnostic framework
  - Support Workbench provides viewing and packaging of incidents
  - Correlated packaging from DB through ASM to Exadata

- **Incident Management**
  - Software and hardware incidents tracked via Incident Console
  - Track, manage and resolve critical incidents
    - Hardware alerts (temperature, cell down, power supply, etc.)
    - Hardware failures come with picture indicating failed part location
    - Best practice violations automatically alerted
Configuration Management:
One of the features of the Lifecycle Management Pack

Automated Configuration Management
• Enforcement of Exadata configurations using Policies
• Detection of configuration drifts and changes
  – From defined golden standards
  – Between storage servers and between database machines
• Detect database targets that do not have required patches
Configuration Management

Compare between Oracle Database Machines
- Gold Image Comparison
- Baseline vs. Current
- Multiple DB Machines
Configuration Management
Storage Cell to Storage Cell

- Ability to compare current configuration vs. saved configurations
  - Within cells
  - Across multiple cells
Automating Database Infrastructure Patching:
Another feature of the Lifecycle Management Pack

Fully Integrated with My Oracle Support

• Proactive advisories, recommendations, and analysis
  – One-off patches, patch set updates, and critical patch updates
• Zero downtime for patching in the case of RAC Rolling patching to cluster nodes
• Integrated patch management & deployment automation
• Patch intelligence and community
• Streamlined conflicts and merge patch process
• Cell patching done through “patchmgr”
OPS Center: OS Patch Management

- Central Repository for iso images
- Unique knowledge base, analysis and how-to-install
- Uses plans, profiles and policy based patch management
- Track and audit change history
- Audit patch and configuration compliance
- Protect RPM by blacklisting
- *Only for use on the Compute Nodes*
OPS Center: Firmware Management

• Automatically downloads required firmware from Oracle
• Run compliance reports to see if the environment is up to date
  – Take action only if it is the Compute Node
• Ops Center uses both Service Processor and OS level APIs to determine disk health
  – Leverages and installs the *hwmgmt* daemon
  – *hwmgmt* sends event information to Ops Center via the Service Processor
Maintain
Fault Diagnostics: ASR (Auto Service Request) Flow

Customer Data Center

- FRU replaced by Field Engineer
- Oracle Field Engineer
- Customer
- Fault occurs

Oracle Support Services

- FRU dispatched by Support Engineer
- Service Request created
- SR routed to Support Engineer
- ASR Service
- Fault telemetry securely transmitted to Oracle
- SR creation email notification to customer
- Product's auto-diagnosis facility sends SNMP trap to ASR Manager

Comprehensive Fault Coverage
- CPU
- Disk controllers
- Disks
- Flash Cards
- Flash modules
- InfiniBand
- Cards
- Memory
- System Board
- Power supplies
- Fans
Change Management:
Another feature of the Lifecycle Management Pack

Capture & compare metadata (dictionary) definitions, track changes in a single db or compare multiple databases, reverse engineer db & schema definitions, capture & version baselines, compare dbs & schemas or baselines, copy db objects with no/full/subset of data, modify objects on multiple dbs, impact analysis

- Manage database changes effectively and efficiently by providing you with the ability to evaluate, plan for, and implement changes.
- Eliminate errors/data loss and down time when making changes through automation, scheduling
- Helps with audit, compliance and management reporting by keeping track of changes through version control.
Oracle Exadata Database Machine

Extreme ROI Platform

- Data Warehousing or Highly Concurrent OLTP
- Massively Parallel Grid Architecture
- Extreme Performance

Fast Predictable Performance

Lower Ongoing Costs

Fastest Time to Value at Lowest Risk

Maximize database performance with automated diagnostics & tuning

Drive down IT operational costs with automated change and configuration mgmt

Automate testing of patches, changes and upgrades while keeping data secure

Enterprise Manager 12c Cloud Control:
Database Diagnostics, Tuning and LifeCycle Management Packs!!
Data Subsetting

What?
• A relationally intact and yet fractional representation of production data for test and development purposes

Why?
• Reduce the storage overhead created by production data copies in various application environments
• Allow developers to perform real world application development by using production-class data
• Very useful in Real Life situations

Subset criteria:
REGION = ‘NORTH AMERICA’
AND FISCAL_YEAR = 2009

Use the TEST DATA MANAGEMENT pack!!
(Brand New in EM12c)
Data Subsetting - High Performance Execution

Production → Export = Writing subset data via DataPump → Import → Test

Datapump Export file

Production → Clone → In-Place subset = Deleting data in the same database → Test

<table>
<thead>
<tr>
<th>Database size</th>
<th>Subset size</th>
<th>Time*</th>
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</thead>
<tbody>
<tr>
<td>Data Pump method</td>
<td>1 Terabyte</td>
<td>200G (20%)</td>
</tr>
<tr>
<td>Clone and delete</td>
<td>1 Terabyte</td>
<td>200G (20%)</td>
</tr>
</tbody>
</table>

*2-nodes Intel Xeon 6-core X5675 Processor w/ 216G memory running OEL 5.5
Data Subsetting: End to End Process

### Production

**HR.EMPLOYEES**

<table>
<thead>
<tr>
<th>NAME</th>
<th>JOB_ID</th>
<th>SALARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGUILAR</td>
<td>SA_MAN</td>
<td>40000</td>
</tr>
<tr>
<td>BENSON</td>
<td>SA_REP</td>
<td>60000</td>
</tr>
</tbody>
</table>

**HR.JOBS**

<table>
<thead>
<tr>
<th>JOB_ID</th>
<th>JOB</th>
<th>Min_SAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA_MAN</td>
<td>Sales Mgr</td>
<td>100000</td>
</tr>
<tr>
<td>SA_REP</td>
<td>Sales Rep</td>
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</tr>
</tbody>
</table>

### Test/Staging

**Extract Data Subset:** 2 methods

**Extract and import Clone and delete**

**Test/Staging**

**HR.EMPLOYEES**

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<tr>
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<th>JOB</th>
<th>Min_SAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA_MAN</td>
<td>Sales Mgr</td>
<td>10000</td>
</tr>
</tbody>
</table>

**Table rule:** Salary < 60,000

**Table rule:** Min_Sal < 20,000
Oracle and the Cloud
Oracle has the Broadest and Most Complete Enterprise CLOUD Services

**Self-Service Application**

- **Infrastructure-as-a-Service (IaaS)**
- **Data(base)-as-a-Service (DBaaS)**
- **Platform-as-a-Service (PaaS)**

**Increasing Enterprise Value**

Cloud Management Pack for DB or Cloud Management Pack for FMW

Pre-Requisites: Database Lifecycle Management Pack and WebLogic Management Pack respectively
Cloud Setup: when using Infrastructure as a Service

EM driven Tasks

Cloud Administrator

1. Provision Bare metal Hypervisor
2. Configure Storage Arrays and network (VLAN)
3. Create Server Pools
4. Define Zones based on functional and operational boundaries
5. Configure Software Library

Self Service Administrator

1. Define allowable VM sizes
2. Assign quotas to Users and Roles
3. Define access boundaries (map roles to zones)
4. Setup Chargeback Plans
5. Make software available for deployment by Self-Service users
Cloud Setup: when using Database as a Service

**EM driven Tasks**

1. Provision Servers and Storage
2. Provision Database Software on single instance servers or RAC
3. Create database server pools
4. Define Zones based on functional and operational boundaries
5. Configure Software Library

**Cloud Administrator**

**Self Service Administrator**

1. Define Deployment Procedures for Database Provisioning
2. Assign quotas to Users and Roles
3. Define access boundaries (map roles to zones)
4. Setup Chargeback Plans and maintenance levels
5. Define a service in Service Catalog for deployment by Self-Service users
Cloud Setup: when using Platform as a Service

EM driven Tasks

Cloud Administrator

1. Provision servers, storage and/or domains for cloud
2. Create Middleware pools using servers or domains
3. Define Zones based on functional and operational boundaries
4. Configure Software Library with required images/Assemblies

Self Service Administrator

1. Define Deployment Procedures for domain or J2EE App Provisioning
2. Assign quotas to Users and Roles
3. Define access boundaries (map roles to zones)
4. Setup Chargeback Plans
5. Define a service in Service Catalog for deployment by Self-Service users
Chargeback Workflow

1. Select Targets for Metering
   - Resource utilization data extracted from Enterprise Manager metric tables

2. Define Charge Plans
   - Define charge items and rates

3. Define Cost Center Hierarchy
   - Manually define or import from LDAP

4. Assign Charge Plans and Cost Centers
   - Determines who gets charged and what for

5. Generate and Distribute Reports
   - Usage and charge information helps users understand their IT costs
## Sample Charge Items

<table>
<thead>
<tr>
<th></th>
<th>Host</th>
<th>VM</th>
<th>Dedicated Database</th>
<th>Shared Database</th>
<th>Dedicated WebLogic</th>
<th>Shared WebLogic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed</strong></td>
<td><strong>Base Charge</strong></td>
<td><strong>Base Charge</strong></td>
<td><strong>Base Charge</strong></td>
<td><strong>Base Charge</strong></td>
<td><strong>Base Charge</strong></td>
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<tr>
<td><strong>Configuration</strong></td>
<td><strong>OS</strong></td>
<td><strong>CPU Count</strong></td>
<td><strong>Edition</strong></td>
<td><strong>Edition</strong></td>
<td><strong>Nodes of Cluster</strong></td>
<td><strong>Version</strong></td>
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<tr>
<td></td>
<td><strong>CPU Count</strong></td>
<td><strong>Allocated Memory</strong></td>
<td><strong>Version</strong></td>
<td><strong>Version</strong></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td><strong>Memory</strong></td>
<td><strong>Allocated Storage</strong></td>
<td><strong>Option</strong></td>
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<tr>
<td></td>
<td></td>
<td><strong>Size</strong></td>
<td><strong>Storage</strong></td>
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<td></td>
<td><strong>Memory</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Usage</strong></td>
<td><strong>CPU Utilization (%)</strong></td>
<td><strong>CPU Utilization (%)</strong></td>
<td><strong>CPU Utilization (%)</strong></td>
<td><strong>DB Time</strong></td>
<td><strong>User Requests</strong></td>
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<td><strong>CPU Requests</strong></td>
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<td></td>
<td><strong>CPU Utilization (%)</strong></td>
<td><strong>Active Sessions</strong></td>
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<td><strong>Memory Usage</strong></td>
<td><strong>Request Execution Time</strong></td>
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<td><strong>User Transactions</strong></td>
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Integration of Metering and Billing
Oracle Enterprise Manager + Oracle Billing and Revenue Management

Cloud Services
- Applications
- Middleware
- Database
- OS
- Virtualization

Usage data collection
Provisioning

Cloud Management
- Oracle Enterprise Manager
  - Configuration Mgmt
  - Lifecycle Management
  - Application Performance Management
  - Application Quality Management
  - Ops Center
    - Physical & Virtual Systems Management

Metered Usage
Balance Control

Cloud Monetization
- Oracle Billing and Revenue Management
  - Pricing/Charging Flexibility
  - Customer Management
  - Complete Billing Operations
  - Value Chain Management
  - Business Intelligence

Bill/Invoice generation and delivery
Oracle Cloud Management: Key Differentiators

- Complete Cloud Lifecycle Management
  - Setup, Deliver, Manage…….

- Broadest and Most Complete Enterprise Services
  - Choice of IaaS, DaaS, PaaS from single Self-Service interface
  - Choice of physical and virtual environments (x86, Sparc)

- Business-Driven, Application-Aware
  - Business-Driven Application Management
  - Integrated Application-to-Disk Management

Cloud Management Overview Whitepaper
Kaleidoscope of Vendors vs. One Red Stack and Management
Cost and Complexity of Integration and Vendor Management

Myriad Management Tools
- SAP Applications
- IBM Middleware
- Oracle Database
- Red Hat Linux
- VMware Virtualization
- HP Hardware
- EMC Storage

Oracle Enterprise Manager
- Applications
- Middleware
- Database
- Operating System
- Virtual Machine
- Servers
- Storage

Complexity of integration, multi-vendor management and implementation costs can be a nightmare!!!

Oracle’s Integrated Cloud Stack and Management reduces risk and has no surprises
<table>
<thead>
<tr>
<th>Company</th>
<th>Benefit</th>
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</thead>
<tbody>
<tr>
<td>Meridian</td>
<td>Saves weeks on application testing time</td>
</tr>
<tr>
<td>Nokia</td>
<td>Saves 80% time and effort for managing Databases</td>
</tr>
<tr>
<td>China Mobile</td>
<td>Ensures seamless user experience for 50,000,000 users</td>
</tr>
<tr>
<td>Colorcon</td>
<td>90% of IT issues addressed before they impact users</td>
</tr>
<tr>
<td>Commonwealth Bank</td>
<td>Drives asset utilization up by 70%</td>
</tr>
<tr>
<td>Cummins</td>
<td>Cuts configuration management effort by 90%</td>
</tr>
<tr>
<td>Telstra</td>
<td>Saves $1.9 million with Oracle Enterprise Manager</td>
</tr>
<tr>
<td>SHM</td>
<td>Saves $170,000 per year with Oracle Enterprise Manager</td>
</tr>
<tr>
<td>City University</td>
<td>Replaces manual tools with automation; saves time by 50%</td>
</tr>
<tr>
<td>Starwood</td>
<td>Reduces Database testing time by 90%</td>
</tr>
<tr>
<td>Bayer</td>
<td>Reduces provisioning effort by 75%</td>
</tr>
<tr>
<td>NetApp</td>
<td>Deploys SOA infrastructure 92% faster</td>
</tr>
<tr>
<td>Cumis</td>
<td>Cuts application testing from weeks to hours</td>
</tr>
<tr>
<td>APL</td>
<td>Reduces critical patching time by 80%</td>
</tr>
<tr>
<td>City of Evanston</td>
<td>Delivers 24/7 uptime with Oracle Enterprise Manager</td>
</tr>
</tbody>
</table>

*Oracle Enterprise Manager: Proven Solution. Trusted by Customers.*
Managing Oracle Exadata with Oracle Enterprise Manager 12c Cloud Control