CON8016: Database as a Service 2.0

Rapid provisioning, richer services, integrated testing and more

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Safe Harbor Statement

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Most enterprises are turning to database as a service (DBaaS) to ensure consolidation, standardization, rapid provisioning, and ongoing management. Oracle offers a comprehensive solution for DBaaS that includes hardware, software, and management tools. In this session, you will learn how Oracle Enterprise Manager 12c can enable DBAs to:

- Jump-start the journey to DBaaS
- Implement a complete service catalog that includes single-instance databases, Oracle Real Application Clusters (Oracle RAC), Oracle Data Guard, full clones, and Snap Clones.
- Leverage provisioning and Oracle Real Application Testing for continuous testing.
- Help manage and monitor your database cloud infrastructure
Program Agenda

1. Current Challenges
2. EM 12c Solution
3. Customer: Energy Transfer
4. Summary
Key Challenges and Solutions

Unmanaged asset sprawl

- 28% have an annual database instance growth of more than 20%
- Less than 50% have consolidated

Configuration Pollution

- Too many versions, patch levels and sizes
- 400 variants out of 1400+ across 3 major releases for a large telecom customer

Slow time to delivery

- Days to Weeks to provision new database services or clone production databases for key projects

Consolidation

Standardization

Automation

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*IDUG Survey, 2013
Consolidation Planning and Testing

Enterprise Manager 12c provides

- Consolidation Planning for physical to virtual, commodity to Engineered Systems and dedicated to multitenant database
- Validation of the database consolidation architecture with Database Consolidation Planner
- Validation of SQL performance and identification of regressions using SQL Performance Analyzer
- Testing of consolidated workload by capturing and replaying real workload using Real Application Testing

Allied Irish Bank (AIB) consolidated its Oracle Database platform with the help of Real Application Testing and 25% less testing resources
Consolidation: DBaaS Architectures

EM12c Supports Database Versions 10gR2 to 12c

Virtual Machines
Dedicated DBs
Dedicated Schema(s)
Pluggable DBs

Share servers
Share servers and OS
Share servers, OS and database
Share servers, OS and database

Increasing Consolidation
# EM12c DBaaS: Unmatched Architectural Choices

<table>
<thead>
<tr>
<th></th>
<th>Virtual Machines</th>
<th>Dedicated DB</th>
<th>Dedicated Schemas</th>
<th>Pluggable DB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consolidation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>Low-Moderate</td>
<td>High</td>
<td>Highest</td>
<td>Highest</td>
</tr>
<tr>
<td><strong>Management</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very complex (VM Sprawl)</td>
<td>Easy</td>
<td>Easy to Involved (based on required resource isolation)</td>
<td>Easy</td>
</tr>
<tr>
<td><strong>Isolation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excellent</td>
<td>Good</td>
<td>Least</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; Onboarding</td>
<td>Easy</td>
<td>Easy</td>
<td>Difficult</td>
<td>Easy</td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suitability</td>
<td>Some (workload dependent)</td>
<td>All</td>
<td>Home grown; requires app validation</td>
<td>All but have to be certified for Database 12c</td>
</tr>
</tbody>
</table>
Consolidation Testing Using SPA

- Validates SQL performance for consolidated database
- SQL workload captured for each database in STS
- SPA validates SQL workload performance in the consolidated environment
- Identifies SQL regressions and helps remediate them
- Works for schema consolidated databases or multitenant databases
- Existing DB11g capability
Consolidation Testing Using Database Replay

Validate consolidation choices with Real Application Testing

- Enables DB consolidation testing
- Allows workload captured on different databases to be replayed concurrently
- Works for schema consolidated databases or pluggable databases

Consolidated Workload Replay
Capacity Planning using Database Replay

- Enables capacity planning by scaling up workload replay
  - **Time-shifting:** Align workload peaks for maximum concurrency
  - **Workload folding:** Split single capture into multiple pieces and replay them concurrently
  - **Schema duplication:** Duplicate and replay workload in each schema concurrently
Enterprise Manager 12c enables

> Single **Service Catalog** with predefined configurations and sizes to minimize variants

> Ongoing Compliance checks to detect violations and mapping to industry standards like STIG and PCI

> Drift management to detect differences across a fleet of databases

> Automated patch management under minimum downtime to bring configurations back to compliance

Telecom Italia has created a single Service Catalog to streamline operations that previously hosted 700 different configurations across 1000+ databases
Service Catalog

Definition

• A collection of *standardized* services available to *selected consumers* for on demand, *self service provisioning*

Benefits

• Establish and enforce effective standardization
• Repeatable and predictable deployment
• Helps identify service costs
• Helps reduce the database management overhead
EM12c DBaaS Service Catalog for Provisioning

Service Definition

Define service tiers to simplify your offerings

Bronze  Silver  Gold

Technical Service

Establish the technical footprint of each service tier

- RAC
- Data Guard
- Backups

Small  Medium  Large

Service Model

Determine the individual services to be provisioned

PDB  Database  Schema

Resource Pools

Align services with resource pools

11.2.0.4  11.2.0.4  12.1.0.1  10.2.0.5  10.2.0.5
# Database Service Levels and Sizes

<table>
<thead>
<tr>
<th>Primary</th>
<th>Standbys</th>
<th>EM12c R4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SI</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>SI</td>
<td>SI</td>
</tr>
<tr>
<td>3</td>
<td>RAC</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>RAC</td>
<td>SI</td>
</tr>
<tr>
<td>5</td>
<td>RAC</td>
<td>RAC</td>
</tr>
<tr>
<td>6</td>
<td>RON</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>RON</td>
<td>RON</td>
</tr>
</tbody>
</table>

SI – Single Instance  
RAC – Real Application Clusters  
RON – RAC One Node

A. Define your own service levels

<table>
<thead>
<tr>
<th></th>
<th>RAC-RAC-SI</th>
<th>RAC-SI</th>
<th>RAC</th>
<th>SI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PLATINUM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GOLD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SILVER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BRONZE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Set your own sizes

<table>
<thead>
<tr>
<th>Size</th>
<th>CPU Core</th>
<th>RAM GB</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>1</td>
<td>6</td>
<td>50 GB</td>
</tr>
<tr>
<td>M</td>
<td>2</td>
<td>12</td>
<td>250 GB</td>
</tr>
<tr>
<td>L</td>
<td>4</td>
<td>24</td>
<td>1,250 GB</td>
</tr>
<tr>
<td>XL</td>
<td>16</td>
<td>48</td>
<td>5 TB</td>
</tr>
</tbody>
</table>
Self Service Software Maintenance

• Process
  – Pools subscribe to DB and GI images
  – New images automatically get deployed to servers in the pool
  – Self Service users or Admin can choose to migrate DBs over to the new home

• Benefits:
  – Out of place patching and upgrade with reduced downtime
  – Subscription based, and at mass scale
  – Flexibility to users to move to new software version on their terms
  – Track compliance across cloud and non-cloud environments

11.2.0.3 DB Home 11.2.0.4 DB Home
11.2.0.3 GI Home 11.2.0.4 GI Home

Image Library
Automation for Database

Enterprise Manager 12c enables

✓ Single click deployment of single instance, RAC, pluggable databases and schemas, optionally with DR setup
✓ Intelligent placement and governance through access control, quota and showback
✓ Instant, storage efficient cloning of databases using Snap Clone
✓ Automation of lifecycle operations like backup, restore, patching, upgrade
✓ RESTFUL APIs for integrating with orchestration services

NAV reduced new database provisioning time from 6-7 days to 18 minutes using Enterprise Manager 12c
Automation for Databases

Service Provisioning incl' REST APIs

Elasticity

Consolidation Planning and Real App Testing

Service Governance: Access Controls, Compliance, Quota, Showback, etc

Ongoing Operations and Performance Management

Database Private Cloud

Dedicated Databases

Schemas

Pluggable Databases

Clones

Runs on any Infrastructure: Physical, Virtual, Engineered Systems
Process Challenges

- 70000 refresh/year
- 2000+ Dev/Test DB
- 3 – 5 TB Typical DB size
- RMAN full clones
- 10 - 20 issues/day
- EMC & NetApp storage

“Database Refresh is a necessary evil!”

- Christian Bilien, Global Head of Database Team
Automation for Database: Optimized Data Refresh

Using Enterprise Manager Snap Clone

- **Features**
  - Rapid and space efficient clones of large databases, from version 10g to 12c
  - Supports ALL storage vendors and configurations (SAN and NAS)
  - Integrated lifecycle management (lineage and association tracking)
  - “Rewind” and “Refresh” capability suited for continuous development and testing

- **Benefits**
  - Agile provisioning (minutes to clone TB sized databases)
  - Over 90% storage savings (KBs of additional space for cloning TB sized database)
  - Reduced administrative overhead for ongoing administration of clones
Data Movement

Production Database

<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>
<td>60,000</td>
</tr>
</tbody>
</table>

Masking & Sub setting

Test Master Database

<table>
<thead>
<tr>
<th>NAME</th>
<th>SSN</th>
<th>SALARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>MILLER</td>
<td>112-23-4567</td>
<td>40,000</td>
</tr>
<tr>
<td>SMITH</td>
<td>111-22-3333</td>
<td>60,000</td>
</tr>
</tbody>
</table>

Data Guard Standby

Prod DB | Backups | Mask / Subset | Test Master | Clones

Refresh

Refresh
DB Clone and Refresh – Admin Flow

- Mask
- Subset
- Update [Patch or Upgrade]
- Change Configuration [SI / RAC]
- Snap Clone
- Use as Test Master

Production Database

Clone / Test Master

Version: 11.2.0.3
Config: 3 Node RAC
Data: RMAN Backup1

Version: 11.2.0.4
Config: Single Instance
Data: RMAN Backup1

RMAN Backup / Data Pump / Storage Snapshot
Self-Service Provisioning
Out-of-box Portal with API support

- Comprehensive support for consolidation
  - Dedicated databases, schema, pluggable
- Automated, intelligent placement
  - workload and configuration
- Complete self-service catalog
  - Governance, quotas, policies, showback
- Flexible cloning architecture
  - Full data cloning by leveraging backups
  - Instant database provisioning using “SnapClone”
- Integrated database lifecycle management
  - Monitoring, backup, patching
- API-driven (RESTful and command line)
## Supported Cloning Options

<table>
<thead>
<tr>
<th>Full Clones</th>
<th>Snap (Thin) Clones</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Database Native</strong> [Storage Agnostic]</td>
<td><strong>Software Solution</strong> [Vendor Agnostic]</td>
</tr>
<tr>
<td>RMAN Restore</td>
<td>ORACLE Solaris ZFS File System</td>
</tr>
<tr>
<td>RMAN Duplicate</td>
<td>CloneDB</td>
</tr>
<tr>
<td>Data Pump</td>
<td></td>
</tr>
<tr>
<td><strong>Hardware Solution</strong> [Vendor Specific]</td>
<td></td>
</tr>
<tr>
<td>NAS</td>
<td>SAN</td>
</tr>
</tbody>
</table>

- Leverage your existing investments
- Cater to both functional and stress testing needs
- Maximize for best performance
Snap Clone on ASM + EMC Storage

- Ability to create ‘live’ thin clones of databases on ASM
- **Live Clone**: NOT snapshot based, but a live clone of DB
- Clone can be within the same or on a different cluster
- EMC VMAX (with Time Finder VPSnap) and VNX storage appliances
- Supported configurations: SI and RAC
- Supported Versions: DB = 10.2.0.5 or higher; GI = 11.2 and higher
Complete APIs for Automation or Integration

- List Zones
  - List Service Templates
  - List Service Instances

- Delete Service
  - Extend reservation

- Request DBs
  - Request PDBs
  - Request Schemas
  - Track request progress

- Service Control (start/stop)
  - Backup
  - Restore
  - Snapshot
  - Get Chargeback info

DBaaS Providers:
- CRUD on Zones / Pools / Service templates / Profiles / Quota / etc
Complete REST API for Automation or Custom Portals

POST: https://example.oracle.com/em/cloud/dbaas/zone/82CF1C28FA20A183C99D138FF8065F19
Authorization: basic ZGVtb3VzZXI6ZGVtb3VzZXI=
Content-Type: application/oracle.com.cloud.common.DbPlatformInstance+json
Accept: application/oracle.com.cloud.common.DbPlatformInstance+json
Body:
{
   "based_on": "/em/cloud/dbaas/dbplatformtemplate/CC3BBB665A6BC6FFE040F00AEF252456",
   "name": "<Request name>",
   "description": "<Request Description>",
   "params": {
      "username": "Master Account username for the DB",
      "password": "Password for the Master Account on the DB"
   }
}
Metering and Showback
Tailored for different use cases and user types

- Showback based on fixed, utilization or configuration
  - Database performance metrics, configuration items, feature-usage
  - Can be extended to leverage other metrics, e.g.: business transactions
- Rollups based on LDAP
- Tailored reporting for different user personas

Chargeback Administrator  Self-Service Portal User  Line of Business User
About EnergyTransfer

Energy Transfer is a Texas-based company that began in 1995 as a small intrastate natural gas pipeline operator and is now one of the largest and most diversified midstream service providers in the country, with over 71,000 miles of natural gas, natural gas liquids (NGLs), refined products, and crude oil pipelines today. The Energy Transfer family of partnerships remains dedicated to providing exceptional service to its customers and attractive returns to its investors.
Who I am

• Houston, TX
• Oracle DBA Technical Team Lead, Energy Transfer
• Tweet @jfruizOracleDBA
• Blog at http://db12c.blogspot.com/
• Blog at http://cloudcontrol12c.blogspot.com/
Agenda

- Infrastructure
- Business Requirements
- Meeting Business Requirements
- Cloud Configuration
- Present and Future Usage
Infrastructure

- Cloud Control 12r4 on Linux
- 220 Host Windows, SunOS and Linux
- 226 Database 9i to 112r4
- PaaS infrastructure on Solaris 11 LDOMs on SPARC T5
- ASM for Database Storage
Business Requirements

• Monthly Refreshes
• Business growth factors
  – 72 refreshes this year for GIS group
• Scarce DBA resources
  • 16 hours per refresh average $90hr ($103K per year)
• Need for repeatable process execution
  – On demand completed with in 8 hours
• Initial EM Cloud Implementation $75K, Yearly cost $13K,
• Business saving per year $79K
Before DBaaS

- Oracle Enterprise 12c Shop
- Manually transfer RMAN /DMP files or central location
- Export / import process
- Use a generic script or OEM to execute RMAN Clone
- Execute the post script provided by GIS group
With DBaaS

• Oracle Enterprise 12c Shop
• Complete standardized deployment process
  – Standard Database naming
  – Using existing RMAN Backups for cloning
• End to End Automation, including transfer & stage of backups in central location
• Self-service portal for DBAs and end users to execute the clone
• Pre/Post scripts for custom modifications
• Email notification to distribution list
• **Benefit**: Faster, repeatable deployment process for DB Clones
DBaaS Testing Process

• Bugs
• Latest patches
• Work closely with DEV and Oracle support
• Automated scripts to update service template via EMCLI
  – Takes backup
  – Transfers to central mounted location
  – Creates new profile
  – Updates existing service template to point to new profile
Database as a Service Setup - I

- **PaaS Zones**
  - Currently, 1 PaaS Zone for GIS Group which maps to one datacenter
  - In future, additional zones to cater to standby environments across other datacenters
  - Comprised of Solaris LDOMs

- **Policy Constraints on each host**
  - CPU usage 80%
  - Memory allocation 95%

- **Pools**
  - Based on QA environment types

<table>
<thead>
<tr>
<th>Pool Name</th>
<th>Owner</th>
<th>PaaS Infrastructure Zone</th>
<th>Member Target Type</th>
<th>Targets</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GISFGTM</td>
<td>SYSMAN</td>
<td>GIS Model Office</td>
<td>Oracle Home</td>
<td>1</td>
<td>Database pool for GISFGTM</td>
</tr>
<tr>
<td>GISPEM</td>
<td>SYSMAN</td>
<td>GIS Model Office</td>
<td>Oracle Home</td>
<td>1</td>
<td>Database pool for GISPEM</td>
</tr>
</tbody>
</table>
Database as a Service Setup - II

• Profiles and service templates
  – Centered around QA environments
  – ASM storage, GI Listener
  – Init parameters
  – Custom post scripts
  – Role

• Chargeback (experimenting)

• Various users for self service access
Self-Service Portal – Usage Flow

1. Delete existing database instance
2. Pick service template based on QA Environment
3. Specify SID name
4. Specify Service name
DBaaS Provision Monitoring

- Monitor provisioning activity
- Views for DBAs and users
- EMCLI verbs to cleanup failed requests in bulk (‘cleanup_dbaas_requests’)
Future for our Private Cloud

• Data Lifecycle Management
• Schema as a service
• Platform as a service
• Implement charge back
• Super charge our Private Cloud via SuperCluster
• Database 12c multitenant
Summary

• Jumpstart your journey to Private DBaaS
• Choice of architecture: VMs, physical, schema, multitenant databases
• Support for various service levels (single instance, HA, DR)
• Consolidation for compute and storage
• Data cloning for performance testing (full clones), and functional testing (Snap Clone)
• Native storage based cloning support; no impact on performance (also supports ZFS filesystem based cloning)