Data on Demand: Advanced Cloning Automation for DBAs

Enterprise Manager

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Session Abstract

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Data is in demand.

As the number of applications grow, DBAs, QA engineers, and developers need copies of their production data on an ongoing basis—quickly and securely. Oracle Enterprise Manager provides two differentiated capabilities to address this surge in demand without affecting on-premises storage.

First, it can lift and shift an on-premises database to Oracle Cloud—eliminating CapEx altogether.

Second, it provides a unique Snap Clone technique that lets users create hundreds of copies of the database with minimal additional storage.

This session covers data cloning and data refresh in general, while highlighting these two capabilities.
Program Agenda

1. Challenges: Data-driven Enterprises
2. Enterprise Manager: Data Cloning & Refresh Solution
3. Snap Clone on Exadata
4. OOCL: Cloning Case Study
5. Hybrid Cloud: Lift –‘n’-Shift

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Data-Driven Organizations

Challenges

Annual Growth of Distinct Oracle Databases

Annual Growth of Data Stored in Oracle Databases

Time Needed to Provision New Databases ( > 1 day)

All the trends call for automated and optimized use of Database platform

Storage Challenges of a Large Financial Institution

- Total Capacity: 50 PB
- Current Year: 67.5 PB
- Y-o-Y growth (20-35%)
- Total Used: 30 PB
- Production: 12 PB
- Non Production: 18 PB
- Annual Oracle Environment Storage Cost: $198 Mil (@$6.6 /GB/year)
- Average no of clones in non-prod per production database: 5 ~ 7
- Non Production Storage costs: $122 Mil

Applications Team: “1300 Apps are utilizing private Cloud”

Database Team: “delivering test data for UAT is the focus for private Cloud this year”
EM: Data Lifecycle Solutions

#1
Snap Clone

#2
Hybrid Cloud

- Leverage resource **optimization** techniques like storage snapshotting to save on CAPEX.

- **‘Lift-&-Shift’** databases from On-premises to Oracle Cloud to eliminate CAPEX.

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# Data Cloning Options [Technology]

## Full Clones
- **Database Native [Storage Agnostic]**
  - RMAN Restore
  - RMAN Duplicate
  - Data Pump

## Snap (Thin) Clones
- **Software Solution [Vendor Agnostic]**
  - ACFS

## Hardware Solution [Vendor Specific]
- NAS
- SAN

- **Leverage your existing investments**
- **Cater to both functional and stress testing needs**
- **Maximize for best performance**

**Use Snap Clone whenever you need >1 clones!**
End to End Automation

Data Cloning & Refresh [Process]
Data Cloning begins from...

TEST MASTER

DATA GUARD

0101010110

RMAN BACKUP

Change Config. (SI/RAC)

Mask, Change Config. (SI/RAC)

Snapshots

SNAP CLONES

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How to Create a ‘Test Master’

- Rapid Creation and management of ‘Test Master’.
- Integrated Masking (Requires Data Masking Pack) and Patching (PSUs)
- Support Active and Passive sources
  - Active: Live instances
  - Passive: RMAN Backup, Data Pump
- Enable request via Self Service portal (PaaS)
Introducing: **Test Master Snapshot**

- **PRODUCTION DATABASE**
- **TEST MASTER**
  - Logical, no physical database

- **RMAN incremental backups /data**
- **RMAN backup of archive logs /archive**

- **Snapshots**
  - Create snap clones from the snapshot’s data & apply archive logs

- **Database 1**
- **Database 2**
- **Database 3**
- **SNAP CLONES**

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DB Snap Clone
- Test Master Snapshots

DEMO
Agile ‘Data Refresh’

Time Travel – Refresh, Rewind across Snapshots

Scheduled or Manual Storage Snapshots or RMAN Backups of the test master database, called Profiles

Test Master

Test master is regularly refreshed with current data from production

• Clones can be created from any profile
• Each user gets a personal read-write database clone

Clones

Private backups

Data Refresh
Data Cloning & Refresh flow

It’s Not Cloudy any more...

- Non Self Service (Admin) flows
- Scheduled Snapshot/RMAN backup creation
- Clone from a library
  - snapshots / backups / Image copies
- Clone from a snapshot or to a point-in-time or SCN
- 1-click Refresh of clones from source
- REST APIs & Emcli verbs
Creating PDBs **Without** Thin Cloning

- Like creating a database from a “template”
- Duplicate “seed” database files to create a new pluggable database
- System actually copies all those seed files to a new location as a starting point
Creating PDBs **With** Thin Cloning

- Like creating a database from a “template”
- Thin clone “seed” database files to create a new pluggable database (no actual copy)
- System uses pointers to all those seed files from a new location as a starting point
- Initially no additional physical storage consumption
- PDB creation happens nearly instantaneously
- Restriction: Thin cloned PDBs cannot be unplugged, only dropped

NewPDB files are thin clones
No additional storage consumptions
Snap Clone on Exadata

**EM12cR5** – Rapid Database Snapshots for Dev/Test

- **Fast space-efficient Snapshot database creation**
  - Create sparse diskgroup on Exadata storage
  - Then create snapshot database or snapshot PDB that reads from base read-only copy of DB and writes to sparse diskgroup

- **Integration with pluggable database enables creation of DB snapshot with Single Click.**

- **All Exadata features work on Snapshots (smart scans, smart flash cache, resource management ...)**
Snap Clone on Exadata

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**Production Database**

- Data Guard
- RMAN clone

**Test Master Database**

- Read only, mounted or closed
- Full copy

**Snapshot Databases**

- Read only or read/write
- Sparse files contain only changed blocks

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EM offers PDB Thin Cloning & beyond...

- **Full Clones**
  - Supported on all platforms

- **Snapshot clones**
  - Source in Read-only if child exists
  - Copy-on-write - Source opened in read-write after clone is created

- **Exadata Sparse clones**
  - File System Agnostic (CloneDB=TRUE)

- **ACFS**
- **ZFSSA / ZS3**
- **Netapp**

- **Configuration mutation from n-Node RAC -> SI**
- **In-line PSU patch application**
- **Integrated Data Masking**
- **Advanced PDB Create options**
  - Max Size.
  - Max Shared Tbsp Size.
  - Logging options.
- **Customization hooks...**
  - Pre-Create Script
  - Post-Create Script
  - Custom Sql Script
Snap Clone @ OOCL

Oracle OpenWorld 2015
Company Background

- Orient Overseas Container Line, Ltd.
  - Founded in 1947
  - Part of Grand Alliance and G6 Alliance operating 300 vessels ranging from 2,992 TEU to 13,208 TEU capacity
  - Fleet of 800,000 containers
  - 320 offices in 70 countries worldwide
  - About $6.5 billion in annual revenue
  - Considered a leader in IT among ocean container carriers
  - IT a competitive advantage
  - Multiple year project to replace core ERP system (IRIS4)
  - Oracle WLS, Coherence, Oracle Exadata, GoldenGate
Business needs: Agile IT

- Enterprise Application
  - IRIS4 – uses multiple multi terabyte (20TB) Oracle databases

- Key Pains and Challenges
  - Time
    - Days or weeks to provision or refresh databases
    - Copying multi-terabyte databases takes time regardless of what technology we use
  - Resources
    - Production size = 20TB, each non-production database size will be 20TB and quickly adding up, increases infrastructure cost
  - Full size production database for development/ testing
    - Cannot make databases with full production data available for development/ testing in time, this leads to untested code and results in production bugs
OOCL: Data Cloning Requirements

- Non Production
  - Production Maintenance
    - Data can be refreshed on demand instead of weekly refresh
  - Development environments
    - Can be integrated with AEP framework (internally developed) to automatically provision full database copy for development
  - UAT (User Acceptance Testing)
    - Multiple UAT environments can be created and on demand to satisfy training needs
  - Production Bug Fixes
    - Testing databases can be provisioned on demand for bug fix testing and validation

- Production
  - Data Analytics
    - Production data can be used on demand and without added storage infrastructure cost
Proof of Concept Testing

- **Background**
  - Oracle Database Enterprise Edition 11.2.0.4, Exadata, Active Data Guard, GoldenGate, Enterprise Manage 12cR4
  - EMC VMAX, VNX, Oracle ZFSSA
  - POC to verify Oracle offering among other vendor offerings like Delphix, Actifio

- **Overall POC process to support this win**
  - Initial discovery process
  - Phase 1: Initial POC was conducted using "Software Solution" using ZFS file system in a Solaris virtual machine
  - Phase 2: Implemented “Hardware Solution” on ZFSSA and Exadata using ADG for replication
  - Phase 3: Upgraded to PS3PG to explore “Data Refresh” capabilities
SnapClone Architectures

**Phase 1 - POC: Software Solution**

- **EMC Storage VNX5300**
- Storage mounted on VM to create zpools
- **Solaris 11 VM for Snap clone**
- **Database – 11.2.0.3**
- **OMS – 12CR4 [PS3PG]**
- **VM – OEL 5.8**
- **Snap Clones using Test Master**
- **Private backups (snapshot s) for SSA user**

**Phase 2 - POC: Hardware Solution**

- **VM Server (Cascade Standby DB)**
- **Data Guard**
- **Exadata (Production)**
- **Exadata (Standby)**
- **ZFS Storage Appliance**
- **Snap Clones using Standby**
- **Private backups (snapshot s) for SSA user**
With Snap Clone

- **Benefits**
  - **Time Saving**
    - Takes minutes instead of days/weeks to provision or refresh environments, providing an agile data platform for development, able to reduce from 1 day turnaround time to about 20 minutes
  - **Storage Savings**
    - Saves storage for copies due to copy on write feature, each 20TB copy now takes about 50GB to 100GB depending on amount of change in the copy
  - **On Demand Refreshes and Self Service**
    - Development environments can be refreshed on demand since the test master is continuously synchronized from production
  - **Ability to Test/Develop with Production Size Data**
    - Quickly create a virtual copy of the production database using the self service portal for testing or development
  - **Rewind & Refresh Feature**
    - All cloned instance can rewind to any time in the past or refresh from a Test Master.
Key Decision Factors

- **Hardware Solution**
  - Seamless integration with exiting infrastructure and Enterprise Manager

- **Test Master Synchronization**
  - More than 3TB of change rate per day in production, other offerings require plenty of network bandwidth and compute power for test master synchronization

- **HCC (Hybrid Columnar Compression)**
  - Other solutions don’t support HCC

- **One Vendor support**
  - Other products require support from Oracle for version support, patches, etc.

- **Cloud Implementation**
  - Our first step in building a full cloud service for OOCL enterprise application

- **Enterprise Manager UI**
  - Developers are already familiar with EM UI and the cloned database can be easily managed and monitored using EM

- **Cost Effective**
  - Can be cost effective compared to other solutions if you already own EM/ ZFSSA

- **Oracle’s Commitment**
  - Based on our experience and interaction with the product teams, Oracle is committed to improving this product
Turbo charging Journey to Cloud
Innovation across 3 Stages of Cloud Adoption & Growth

CONsolidation
Maximize Server Utilization, Streamline Manageability and Drive Down Capital Expenses

Data Cloning
Maximize Data as a Service Performance with Advanced Automation

Hybrid Cloud
Reduce CAPEX, increase Scale through extending to Oracle Cloud
Lift ‘n’ Shift Databases across clouds

Clone Database to Cloud

On-Premises Container Database

Cloud-Based Container Database
Lift ‘n’ Shift Databases across clouds

Clone Database from Cloud

On-Premises Container Database

Cloud-Based Container Database

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Oracle Database Hybrid Cloud
Full portability between on-premises and cloud

On-Premises

Easily move data and workloads.
Configuration and Schema comparison.
Compliance and Drift Management across Clouds.

Unified Management
Enterprise Manager manages both On Premise and Cloud
References

- Enterprise Manager Page on O.com
- Database as a Service Page on OTN
- Snap Clone Page on OTN
- Hybrid Cloud Management Page on OTN
- Cloud Administration Guide (Documentation)

- **MOS Note**: EM12c Recommended Plug-Ins and Patches for DBaaS (1549855.1)
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