Oracle Database Backups and Disaster Recovery @ Autodesk

Alan Williams
Database Design Engineer
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- 10+ million people use our professional products to imagine, design, and create a better world.
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Autodesk® Homestyler®

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AutoCAD®

socialcam

Autodesk Tinkerbox™
Agenda

- Background
- Change Drivers
- Where We Were...
- Where We Are…
- Tips For Success
Project Background & Scope

- Tier 1 applications: Siebel CRM, SAP ERP, TIBCO Middleware, Data Warehouse and Data Marts
- Very complex and antiquated environments
  - Multiple vendors, different technologies for different applications
- Costly to support, maintain and troubleshoot
- Project Marshall - enable infrastructure capabilities for the future
- One shot, waterfall style, 24 hour Go-Live
Change Drivers

Increase Reliability
- Oracle Database 11.2
- Standardized hardware configuration

Increase Availability
- Oracle Real Application Clusters
- Oracle Data Guard

Increase Scalability
- Oracle Real Application Clusters
- Commodity Servers

Increase Performance
- Oracle Database 11.2
- Oracle Database Partitioning

Reduce Complexity
- Complete Oracle stack
- Simplified Backup and DR process
Where We Were…

- Complex mix of hardware/software vendors and technologies
  - EMC Storage Replication
  - BCV splits backups
  - NetBackup Tape Management
  - VERITAS Volume Manager
- No database replication

- Various infrastructure standards
  - Server Operating Systems (Solaris & Redhat)
  - Oracle Database 9i – 10g
  - Server hardware (Sun, HP, Dell)
Where We Are…
Disaster Recovery Design

Features

- RAC provides High Availability for Primary
- Data Guard and Flashback Technology protect against:
  - Site and/or storage failures
  - Data corruptions
  - Human error
- Ability to roll back changes within the past ~14 days
- Near real-time ASYNC data replication between peer DCs
- 30 minute maximum lag between standby and primary
- 4 hour RTO, 4 hour RPO
- Significantly faster refreshes of Non-Production environments
- Snapshot standby’s for efficient DR drills or other short tests
- Complete Oracle software technology stack

East Coast DC
- 10 RAC primary databases
- 3 RAC clusters
- 1-4TB sized databases
- 14 day Flashback DB via Fast Recovery Area

West Coast DC
- 10 single instanced physical standbys (non-RAC)
- Daily level 0 backups

ASYNC Data Guard
Redo Apply

MPLS Cloud
## Backup Design

### East Coast DC
- 10 RAC primary databases
- 3 RAC clusters
- 1-4TB sized databases
- 14 day Flashback DB via Fast Recovery Area
- Data Domain (DD) Storage Appliance replicated from West Coast (Read Only)

### West Coast DC
- Single instance physical standby (non-RAC)
- Daily level 0 backups
- Backups used for local refreshes
- Data Domain (DD) Storage Appliance for local backups

### Features
- 3 copies of Production data (4 data sets)
- No tape backups; complete disk based solution
- No incremental backups
- Data Domain deduplication & compression
- 1 – 5 TB sized databases
Alternate Strategies Considered

- **Daily Incremental / Weekly Full Backups**
  - Oracle MAA recommendation
  - Not feasible with Data Domain in order to maximize compression factor

- **Multi-section Backups**
  - Improves backup speed of large databases, especially with BIGFILE tablespaces
  - Not feasible with Data Domain in order to maximize compression factor
RMAN Configuration Parameters

CONFIGURE RETENTION POLICY TO REDUNDANCY 5;
CONFIGURE BACKUP OPTIMIZATION ON;
CONFIGURE DEFAULT DEVICE TYPE TO DISK; # default
CONFIGURE CONTROLFILE AUTOBACKUP ON;
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'/local/oracle/orabackups/OBTMPRD1/%T/%F';

CONFIGURE DEVICE TYPE DISK PARALLELISM 8 BACKUP TYPE TO BACKUPSET;
CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/local/oracle/orabackups/OBTMPRD1/%U';
CONFIGURE MAXSETSIZE TO UNLIMITED; # default
CONFIGURE ENCRYPTION FOR DATABASE OFF; # default
CONFIGURE ENCRYPTION ALGORITHM 'AES128'; # default
CONFIGURE ARCHIVELOG DELETION POLICY TO BACKED UP 1 TIMES TO DISK; # Standby Only
CONFIGURE SNAPSHOT CONTROLFILE NAME TO
'/local/oracle/app/product/db11.2.0.2/dbs/snapcf_OBTMPRD11.f';

** CONFIGURE ARCHIVELOG DELETION POLICY TO APPLIED ON ALL STANDBY; # Primary Only
RMAN Level 0 Backup Script

run {
allocate channel oem_backup_disk1 type disk MAXOPENFILES 1 format 
'/local/oracle/orabackups/<DBNAME>/%T/level0/%U';
allocate channel oem_backup_disk2 type disk MAXOPENFILES 1 format 
'/local/oracle/orabackups/<DBNAME>/%T/level0/%U';

backup FILESPERSET 1 as BACKUPSET tag 'DAILY_LEVL0_DATA' database;
backup FILESPERSET 1 as BACKUPSET tag 'DAILY_LEVL0_ARCH' archivelog all not backed up;
}
run {
allocate channel oem_backup_disk1 type disk MAXOPENFILES 1 format 
'/local/oracle/orabackups/<DBNAME>/%T/level0/%U';

backup FILESPERSET 1 as BACKUPSET tag 'DAILY_LEVL0_CTRL' current controlfile;
}

* Use multiple channels to maximize I/O and network throughput. 8 channels may perform better than 2.
RMAN Archive Log Backup Script

run {
allocate channel oem_backup_disk1 type disk MAXOPENFILES 1 format
'/local/oracle/orabackups/<DBNAME>/%T/level0/%U';
allocate channel oem_backup_disk2 type disk MAXOPENFILES 1 format
'/local/oracle/orabackups/<DBNAME>/%T/level0/%U';

backup FILESPERSET 1 as BACKUPSET tag 'DAILY_LEVL0_ARCH' archivelog all not backed up
until time 'SYSDATE-30';
}

* Use multiple channels to maximize I/O and network throughput. 8 channels may perform better than 2.
Current Backup and Retention Schedule

<table>
<thead>
<tr>
<th>Component</th>
<th>Backup Schedule</th>
<th>Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database</td>
<td>Daily Level 0</td>
<td>7 years</td>
</tr>
<tr>
<td>Archived Logs</td>
<td>Hourly</td>
<td>30 days</td>
</tr>
<tr>
<td>Control Files</td>
<td>Daily</td>
<td>7 years</td>
</tr>
</tbody>
</table>

* Fast Recovery Area (FRA) allows 14 days Flashback Database
Backup Metrics & Performance

- ~400GB per hour backup rate
- 4TB backed up in 10 hours
- 24x Data Domain compression

File System – Usage

File System – Consumption

Standby server CPU consumption

Data Domain Consumption and Usage
RMAN Features Used

- Active Database Duplicate (RMAN/Data Guard feature)
  - Standby databases were created live from hot primary with no initial backup
- Parallelism
  - Improved backup speed, especially useful for VLDBs
Management & Monitoring Tools

<table>
<thead>
<tr>
<th>Management</th>
<th>Monitoring</th>
</tr>
</thead>
</table>
| **Backups** | RMAN Catalog  
Oracle Grid Control 11g  
(evaluating Cloud Control 12c) | NimSoft® |
| **Data Guard Replication** | Oracle Grid Control 11g | NimSoft® |

- Methods to Protect the RMAN catalog
  - Daily incremental and weekly full backups
  - Weekly offsite backups
  - Daily Data Pump exports transferred to a different data center
Data Guard Status in OEM
Data Guard Performance Graph in OEM

Overview

Primary Database Name: PRD1.autodesk.com_us
Data Guard Status: Normal

Test Application
Run the test application to generate a load on the primary database.
Start / Stop

Tip: Click on any of the charts for historical information.

STB1.autodesk.com - Lag Times

Current Transport Lag (seconds) 0.0
Current Apply Lag (seconds) 35.0

STB1.autodesk.com - Apply Rate

Current Apply Rate (KB/sec) 13092
Apply Rate When Active (list 3 logs, KB/sec)

PRD1.autodesk.com_us 1 - Redo Generation Rate

Redo Generation Rate

Current Redo Generation Rate (KB/sec) No data


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SELECT
    'Backup on ' || b.start_time as "Backup Name",
    b.status as "Status",
    TO_CHAR(b.start_time, 'MON DD, YYYY HH12:MI:SS PM') as "Start Time",
    b.time_taken_display as "Time Taken",
    b.input_type as "Type",
    b.output_device_type as "Output Devices",
    b.input_bytes_display as "Input Size",
    b.output_bytes_display as "Output Size",
    b.output_bytes_per_sec_display as "Output Rate (Per Sec)"
FROM
    V$RMAN_BACKUP_JOB_DETAILS b
ORDER BY b.start_time DESC;

<table>
<thead>
<tr>
<th>Backup Name</th>
<th>Status</th>
<th>Start Time</th>
<th>Time Taken</th>
<th>Type</th>
<th>Output Devices</th>
<th>Input Size</th>
<th>Output Size</th>
<th>Output Rate (Per Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backup on 17-SEP-12 COMPLETED SEP 17, 2012 12:27:04 AM 05:40:36</td>
<td>COMPLETED</td>
<td>17-SEP-12 12:27:04 AM 05:40:36</td>
<td>DB FULL</td>
<td>DISK</td>
<td>2.67T</td>
<td>2.61T</td>
<td>133.95M</td>
<td></td>
</tr>
<tr>
<td>Backup on 16-SEP-12 COMPLETED SEP 16, 2012 03:14:13 AM 04:40:51</td>
<td>COMPLETED</td>
<td>16-SEP-12 03:14:13 AM 04:40:51</td>
<td>DB FULL</td>
<td>DISK</td>
<td>2.65T</td>
<td>2.59T</td>
<td>161.27M</td>
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</tr>
<tr>
<td>Backup on 14-SEP-12 COMPLETED SEP 14, 2012 12:01:44 AM 05:39:03</td>
<td>COMPLETED</td>
<td>14-SEP-12 12:01:44 AM 05:39:03</td>
<td>DB FULL</td>
<td>DISK</td>
<td>2.61T</td>
<td>2.55T</td>
<td>131.50M</td>
<td></td>
</tr>
<tr>
<td>Backup on 13-SEP-12 COMPLETED SEP 13, 2012 12:01:47 AM 06:19:12</td>
<td>COMPLETED</td>
<td>13-SEP-12 12:01:47 AM 06:19:12</td>
<td>DB FULL</td>
<td>DISK</td>
<td>2.68T</td>
<td>2.62T</td>
<td>120.78M</td>
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</tr>
<tr>
<td>Backup on 12-SEP-12 COMPLETED SEP 12, 2012 12:03:39 AM 07:25:08</td>
<td>COMPLETED</td>
<td>12-SEP-12 12:03:39 AM 07:25:08</td>
<td>DB FULL</td>
<td>DISK</td>
<td>2.74T</td>
<td>2.68T</td>
<td>105.13M</td>
<td></td>
</tr>
<tr>
<td>Backup on 11-SEP-12 COMPLETED SEP 11, 2012 12:01:39 AM 07:35:04</td>
<td>COMPLETED</td>
<td>11-SEP-12 12:01:39 AM 07:35:04</td>
<td>DB FULL</td>
<td>DISK</td>
<td>2.84T</td>
<td>2.78T</td>
<td>106.81M</td>
<td></td>
</tr>
<tr>
<td>Backup on 10-SEP-12 FAILED SEP 10, 2012 12:01:56 AM 06:17:44</td>
<td>FAILED</td>
<td>SEP 10, 2012 12:01:56 AM 06:17:44</td>
<td>DB FULL</td>
<td>DISK</td>
<td>2.56T</td>
<td>2.50T</td>
<td>115.65M</td>
<td></td>
</tr>
</tbody>
</table>
Improvements Achieved

- Standard Oracle software technology stack
- Standard commodity hardware (HP DL580s)
- Standard Oracle database version across all Tier1 Apps (11.2)
- Standard Operating System (RedHat)
- Simplified technology portfolio

Standards == Simplicity
Tips for Success

- Read the documentation thoroughly, it’s time consuming but **really** worth it
  - High Availability Best Practices [http://goo.gl/6nOmG](http://goo.gl/6nOmG)
  - MOS RMAN Master Note (ID 1116484.1) [http://goo.gl/rUU67](http://goo.gl/rUU67)
  - Backing Up and Recovering VLDBs [http://goo.gl/uvpuq](http://goo.gl/uvpuq)
- Test your backups and DR processes periodically, at least yearly
- Test various failure scenarios and document remediation for each