
Tim Chien
Director of Product Management
Oracle Development

Jony Safi
Senior Manager
Oracle Development

Stefan Reiners
DBA
METRO-nom GmBH

October 24, 2018
Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, timing, and pricing of any features or functionality described for Oracle’s products may change and remains at the sole discretion of Oracle Corporation.
Agenda

1. Introduction & Architecture
2. Operational & Monitoring Best Practices
3. METRONOM Case Study
4. Resources & Next Steps
Traditional Backup Solutions Are Not Designed for Database
Treat Databases as Just Files to Periodically Copy

Data Loss Exposure
Lose all data since last backup – no validation

Daily Backup Window
Large performance impact on production

Poor Database Recoverability
Many files are copied but protection state of database is unknown

Many Systems to Manage
Scale by deploying more backup appliances
Zero Data Loss Recovery Appliance

Engineered Data Protection For Complete Recoverability of the Oracle Database

- Reliable & Complete Recovery
- Continually Validates Recovery Status
- Eliminate Long Backup Windows
- End-to-End Data Protection Control & Monitoring
- Archive Backup to Cloud Storage
- Scale-Out Hardware & Storage
Recovery Appliance Architecture

Protected DBs

Delta Push

Changed blocks and Real-Time Redo (no full backups)

Compressed Delta Store

Day 0
Full

Day 1
Incremental

Day N
Virtual Full

Data validation on receipt, copy, restore, periodically

DB Backup Cloud Service

Cloud Archive

Tape Backup

Remote Replica

Copyright © 2018 Oracle and/or its affiliates. All rights reserved.
Agenda

1. Introduction & Architecture
2. Operational & Monitoring Best Practices
3. METRONOM Case Study
4. Resources & Next Steps
MAA Recommendations

• **Do not make any changes to the Recovery Appliance**

• One\(^1\) Recovery Appliance (RA) system per data center\(^2\)

• Backup primary and standby databases to their respective local RA

• No RA replication for any database with a remote standby
  
  • Restore operation can use any RA in any location

---

\(^1\) It can be an interconnected ZDLRA configuration

\(^2\) The definition of a Data Center also includes “fire rooms”
RA Replica: Data Loss Protection from Site Disasters

**BENEFITS**

- Replication to Remote Appliance protects data from disasters or site failures
- Automated restore from Local Appliance or directly from Remote Appliance
Leading North America Healthcare Company

1000+ Protected DBs, 3 Data Centers, Bi-Directional + Hub & Spoke Replication

East Coast DC #1 (1000 DBs)
- PROD
- NON-PROD
- Primary DBs
  - Local RA
- Standalone DBs
  - Local RA
  - Replicated

East Coast DC #2 “Hub” (200 DBs)
- DR
- NON-PROD
- Standby DBs
  - Local RA
  - DB Clone
  - Replicated
- Standalone
  - Local RA
  - Replicated

Midwest DC (50 DBs)
- PROD, NON-PROD
- Standalone
  - Local RA
  - Replicated
  - DB Clone

Replication

Copyright © 2018, Oracle and/or its affiliates. All rights reserved.
NEW: ZDLRA High Availability for Backup & Recovery
Preserve Backup & Recovery Continuity during Planned or Unplanned ZDLRA Outages

- Database backup and redo operations automatically failover to downstream replica appliance.
- ZDL and point-in-time recovery operations from downstream appliance are fully supported.
- Virtual full backups on primary appliance are synchronized to current state when back online.
RA Osaka normally replicates to RA Tokyo – all DBs fully recoverable. When upstream appliance (RA Osaka) is not available, backups and redo are redirected to downstream appliance (RA Tokyo).

• Virtual fulls are created as normal.
• When upstream is back online, downstream appliance backups are transferred.
• Transferred backups are ingested and processed into virtual fulls.
• Normal backups to upstream appliance can be restarted immediately.

Benefits:
• Preserve High Availability during planned or unplanned downtime.
• Database backup & restore/recoverability available from either upstream or downstream appliance.

MAA Presentation and MOS Note 2432144.1 NOW AVAILABLE
Backup Failover to Alternate Appliance

- Incrementals and Redo normally sent to Primary RA
- Alternate RA serves as backup staging area when primary RA is unavailable, then syncs with primary RA afterwards
  - No virtual fulls created on alternate, hence recoverability not supported
  - Space sized for ‘n’ incrementals and archived log backups during primary downtime period
- Benefits:
  - Preserves backup and redo shipment continuity during planned maintenance / upgrades
  - Prevents local Fast Recovery Areas from filling up with archived logs
  - Incremental forever backups continue

“BF_FORWARD” Policy on Alternate RA: STORE_AND_FORWARD = ‘YES’
Global Financial Services Company

8000+ Protected DBs, Global Data Centers, Backup Failover to Alternate Appliance

Each RA in a pod is configured as failover for the other.

- Space is reserved for normal & failover backups

Standardized DB On-Boarding:

- Data Guard or Standalone?
- Failover Config Required?
- DB Size + Change % + Retention -> Reserved Space
- Reserved Space periodically adjusted per space needs
NEW: Zero Data Loss Cross-Platform Database Migration
Simple Database Migration to On-Premise or Cloud@Customer using ZDLRA

- Significant **reduction in downtime** – less than 2 hour read-only downtime, regardless of DB size.

- New automation tool **simplifies** platform migration steps - especially useful for large databases

- Supports **same and cross-endian platform migration activities**
Zero Data Loss Cross-Platform Database Migration
Dramatically Reduce Migration Time – From Hours/Days to Few Hours or Less

Key steps:

- Centralized Recovery Appliance “migration engine” + minimal downtime (short read-only at end)
  - Daily incremental backups -> virtual full backups on Recovery Appliance
  - At destination, restore latest virtual full backup, prior to migration window
    - RESTORE FROM PLATFORM XXX FOREIGN DATAFILE YYY
  - When ready to switchover: At source, take final incremental and metadata tablespace export in read-only
    - RECOVER FROM PLATFORM XXX FOREIGN DATAFILECOPY YYY at destination
    - IMPORT Data Pump export file at destination
  - Destination open in read-only to verify migrated data, then open read-write for business

Day 1:
- Full Backup
- Export
- Import
- Read-only Meta Data

Day 2->N:
- Incremental Backups

Day n:
- Final Incremental
- Read-write
Leading Global Semiconductor Manufacturer

**Business Needs**
- Accelerate Growth
- Drive Operational Excellence
  - Customer Experience
  - Operational Efficiency
- Grow organizational capabilities – optimize innovation
- Address current & planned business growth objectives

**Solution Needs**
- Stability
- Zero Preventable Outages
- Focus on Business Ops
- Increase IT agility, self-service and alignment to business drivers

**Results Achieved**
- Consolidate and standardize
  - Consolidated several database servers
  - Compatible with Exadata
  - Multi-Tenant option
- Reliable, Scalable and High Performing
- Improved the time and cost to build and maintain Analytics platform
- Near zero downtime migration using ZDLRA – RMAN DUPLICATE
- Deliver exceptional service to business users
- Eliminated full backups
- Improved RTO by 4X
- Reduced backup windows by 2X
### NEW: RA System Activity Report in BI Publisher

Tracks Recovery Appliance Activity and Highlights Areas of Action

- Displays information for the following:
  - State of Protected Databases
  - RA Space Utilization
  - State of the Recovery Appliance
  - Tasks & Task History

<table>
<thead>
<tr>
<th>TASK TYPE</th>
<th>TASK PRIORITY</th>
<th>TASK STATE</th>
<th>TASK COUNT</th>
<th>TASK - LAST EXECUTE TIME</th>
<th>TASK - WORK TYPE</th>
<th>TASK - MIN CREATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDEX_BACKUP</td>
<td>100</td>
<td>ORIGURING WAIT</td>
<td>346</td>
<td>11-MAY-2018 19:38:52</td>
<td>Work</td>
<td>11-MAY-2018</td>
</tr>
<tr>
<td>VALIDATE</td>
<td>330</td>
<td>RUNNING</td>
<td>1</td>
<td>11-MAY-2018 19:38:52</td>
<td>Maintenance</td>
<td>11-MAY-2018</td>
</tr>
<tr>
<td>PURGE_DUP</td>
<td>60</td>
<td>RUNNING</td>
<td>6</td>
<td>11-MAY-2018 00:32:54</td>
<td>Work</td>
<td>11-MAY-2018</td>
</tr>
<tr>
<td>INDEX_BACKUP</td>
<td>100</td>
<td>RUNNING</td>
<td>1</td>
<td>16-MAY-2018 07:32:13</td>
<td>Work</td>
<td>16-MAY-2018</td>
</tr>
<tr>
<td>OPT_DF</td>
<td>310</td>
<td>TASK_WAIT</td>
<td>4</td>
<td>Maintenance</td>
<td>12-APR-2018</td>
<td></td>
</tr>
<tr>
<td>PURGE_DF</td>
<td>80</td>
<td>TASK_WAIT</td>
<td>6</td>
<td>Work</td>
<td>16-MAY-2018</td>
<td></td>
</tr>
<tr>
<td>VALIDATE</td>
<td>330</td>
<td>TASK_WAIT</td>
<td>1</td>
<td>Maintenance</td>
<td>12-APR-2018</td>
<td></td>
</tr>
<tr>
<td>PURGE_DUP</td>
<td>60</td>
<td>TASK_WAIT</td>
<td>109</td>
<td>Work</td>
<td>16-MAY-2018</td>
<td></td>
</tr>
<tr>
<td>INDEX_BACKUP</td>
<td>100</td>
<td>TASK_WAIT</td>
<td>25</td>
<td>Work</td>
<td>14-MAY-2018</td>
<td></td>
</tr>
<tr>
<td>CROSSCHECK_DB</td>
<td>350</td>
<td>TASK_WAIT</td>
<td>2</td>
<td>Maintenance</td>
<td>01-MAY-2018</td>
<td></td>
</tr>
</tbody>
</table>
RA System Activity Report: **Healthy?**

- **Items to watch for:** Bad report

<table>
<thead>
<tr>
<th>TASK_TYPE</th>
<th>STATE</th>
<th>CURRENT_COUNT</th>
<th>LAST_EXECUTE_TIME</th>
<th>WORK_TYPE</th>
<th>MIN_CREATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CROSSCHECK_DB</td>
<td>EXECUTABLE</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLAN_DF</td>
<td>EXECUTABLE</td>
<td>498,959</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VALDATE</td>
<td>EXECUTABLE</td>
<td>224</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REBUILD_INDEX</td>
<td>EXECUTABLE</td>
<td>908</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPTIMIZE</td>
<td>EXECUTABLE</td>
<td>224</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPT_DF</td>
<td>EXECUTABLE</td>
<td>98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESTORE_RANDP_REFRESH</td>
<td>EXECUTABLE</td>
<td>203</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB_STATS_REFRESH</td>
<td>EXECUTABLE</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW_INC_FILES</td>
<td>EXECUTABLE</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QTOOLSTR_SHT</td>
<td>EXECUTABLE</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index Backup</td>
<td>EXECUTABLE</td>
<td>179,451</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRT_DEAD</td>
<td>EXECUTABLE</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BACKUP_ARCH</td>
<td>EXECUTABLE</td>
<td>1,072</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNDO</td>
<td>EXECUTABLE</td>
<td>122</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNDO</td>
<td>RUNNING</td>
<td>122</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHECK_FILES</td>
<td>TASK_WAIT</td>
<td>1</td>
<td></td>
<td>Maintenance</td>
<td>04-DEC-2017</td>
</tr>
<tr>
<td>VALDATE</td>
<td>TASK_WAIT</td>
<td>1</td>
<td></td>
<td>Maintenance</td>
<td>04-DEC-2017</td>
</tr>
<tr>
<td>OPTIMIZE</td>
<td>TASK_WAIT</td>
<td>293</td>
<td></td>
<td>Maintenance</td>
<td>04-DEC-2017</td>
</tr>
<tr>
<td>CROSSCHECK_DB</td>
<td>TASK_WAIT</td>
<td>218</td>
<td></td>
<td>Work</td>
<td>04-DEC-2017</td>
</tr>
<tr>
<td>RUNUP_DB</td>
<td>TASK_WAIT</td>
<td>5</td>
<td></td>
<td>Work</td>
<td>04-DEC-2017</td>
</tr>
</tbody>
</table>

Watch for:

- If there are tasks of **WORK TYPE** in **RUNNING** state and created a day earlier then investigate.

- If there are tasks of **MAINTENANCE** or **SBT TYPE** present and their creation time is older than **one week** then it should be investigated.

A **large number of tasks in EXECUTABLE state** for the same **TASK_TYPE**

The same **TASK_TYPE** is increasing in the number of jobs (CURRENT_COUNT) over time.

- A **system with ordering waits older than 1 day**.

- A **system with tasks in STALL_WHEN_WAIT**. This should only be seen if Oracle Support is troubleshooting the system.
RA System Activity Report: Healthy?

The Good:

Minimum creation time for active tasks is within the last 24 hours for work tasks.

Task history state should indicate work is being completed.

Review other sections
Backup Best Practices

• Use Transparent Data Encryption (TDE) instead of RMAN encryption
  – RMAN encryption will prevent ZDLRA from creating Virtual Full Backups (VB$).

• TDE backups will not get compressed on the ZDLRA
  – Encrypted backups don’t get compressed by the storage in general – A sizing exercise must be (re)-conducted when preparing for TDE
    – The incremental forever strategy still applies to TDE backups

• Use RA built-in compression instead of RMAN compression
  – RMAN compression incurs DB CPU utilization & backups are decompressed + recompressed on RA

  – $ rman target <target string> catalog <catalog string>
    backup device type sbt
    cumulative incremental level 1 filesperset 1 section size 64g database
    plus archivelog not backed up
    filesperset 32;
Use Recommended RA Software

• Subscribe to MOS alerts and refer periodically to the following notes:
  – Recovery Appliance Critical Issues MOS note for critical issues alerts
  – Recovery Appliance Supported Versions MOS note for latest software update

• Use Recommended RA Software to avoid known critical issues
  – Number 1 method to avoid problems:  Upgrade to recommended software release
  – Zero Data Loss Recovery Appliance Supported Versions (Doc ID 1927416.1)
  – Zero Data Loss Recovery Appliance Upgrade and Patching (Doc ID 2028931.1)
  – Patches are cumulative and include
    - Bug fixes (Avoid a bug before it happens)
    - Enhancements (New features, optimizations, etc.)

• Coordinate with Platinum Patching
  – Schedule early  & Open Proactive SR
Important things to avoid

1. Don’t ignore incidents: Resolve and understand
2. Don’t neglect the RA: Monitor the system
3. Don’t make modifications to the RA configuration
   i. Zero Data Loss Recovery Appliance - Installing Third-Party Software and Modifying Internal Appliance Software (Doc ID 2014361.1)
4. Don’t take periodic Level 0: Virtual Level 0 requires only one level 0 followed by level 1s
5. Don’t backup to another media: Switching to another media can impact past and future backups made to the RA
4 important things to do

1. **Monitor the RA**
   i. OEM Unified Management Dashboard: Review twice daily and setup alerts and notifications
   ii. Run the System Activity Report daily and monitor trends: 
       *Zero Data Loss Recovery Appliance System Activity Script (Doc ID 2275176.1)*
   iii. Run Exachk Monthly and review findings: 
       *How To update exachk outside ZDLRA Install, Patching and Upgrade (Doc ID 2399688.1)*
   iv. Review Capacity Planning Report Monthly or Bi-Monthly

2. **Use Multi Section**: Set section size to 64GB, this allows for efficient processing in ZDLRA's flash cache
   i. Large datafiles > 16TB will automatically see an increase in section size - section size = sizeof(datafile) / 256
   ii. Small datafiles < 64GB will not have sections
   iii. Forces FILESPERSET to 1

3. **Use the latest libra** (RMAN client sbt library that supports ZDLRA):
   *ZDLRA: Where to download new sbt library (libra.so module) (Doc ID 2219812.1)*

4. **Validate the backup/restore network first**:
   a. Use *Zero Data Loss Recovery Appliance Network Test Throughput script (Doc ID 2022086.1) – requires qperf, supported on specific OSes*
   b. Use *How to measure network performance from RMAN for ZDLRA or Cloud Backups (Doc ID 2371860.1) – uses RMAN’s “NETTEST” option, OS agnostic*
Agenda

1. Introduction & Architecture
2. Operational & Monitoring Best Practices
3. METRONOM Case Study
4. Resources & Next Steps
Agenda

1. Introduction
2. Mission
3. Best Practices
4. Target
5. Summary
Introduction
Introduction

**THE BIGGEST SOFTWARE COMPANY YOU NEVER HEARD ABOUT**

Metronom — Setting the pace in food and technology

- 150,000 Employees
- €37 Billion
- 25 Countries
- 2000 Employees
- IT-Services
- IT-Solutions
Introduction

Team of 13 DBAs
• ~ 2100 Oracle databases
• AIX, Linux, Windows - Servers
• Database features including:
  • RAC
  • Data Guard
  • GoldenGate for Minimal Downtime Maintenance (MDM)
Mission
Mission

- Started POC in 2016
- Replication between two DCs
- Easy Migration
- Go Live April 2017
- Backup of more than 350 productive databases by end of 2017
- Zero Downtime
Best Practices
Easy migration

addzdlra.sh -d testdb -p gold
Best Practices

MAX_RETENTION_WINDOW
• Set it, but not too aggressive

Don’t Submit multiple requests to Delete Databases
• A delete can take a lot of time
• If database delete does not progress for some time, contact Support

Don’t Neglect the RA
• Monitor and adjust the System
• System Activity Report
  • Clarify Findings with Support
Target

• Use ZDLRA to Backup ~900 databases within the next 12 months
• Add more storage to ZDLRA for growth and replication needs
• Implement Minimal Downtime Maintenance patching solution via new RA High Availability for Backup & Recovery procedure (aka Auto-Failover to Replica RA)
• Outsource Backups to Oracle Cloud
RA-based Migration of IBM AIX to ExaCC/OCC

ATTEND OUR MIGRATION SESSION [TRN4033] TOMORROW, 9 AM, MOSCONE WEST 3004
Summary
Summary

- Less time for Backups
- Fast restore and recovery
- Easy Migration due to automated processes
- Scalable for data growth
Thank you for your attention!

Stefan Reiners
Agenda

1. Introduction & Architecture
2. Operational & Monitoring Best Practices
3. METRONOM Case Study
4. Resources & Next Steps
Resources & Next Steps

• Recovery Appliance Product Central
  – www.oracle.com/recoveryappliance

• Recovery Appliance MAA Best Practices Central

• OpenWorld MAA Presentations
  – www.oracle.com/goto/maa -> Presentations

• AskTOM Backup & Recovery Sessions
  – asktom.oracle.com -> Office Hours -> Search for ‘backup’

• Get our business card for follow up questions!