Transition To Exadata – A Huge Success!

Challenges with traditional infrastructure

• 300TB of storage with over 60% annual growth rate
• Performance challenges
• Cost reduction pressures
• Need to make failover/recovery more robust

Benefits gained with Exadata

• 42x performance gains for reporting & 40% for OLTP
• Reduced storage by 30% using compression
• Consolidated physical servers from 10 to 4
• Reduced direct/indirect chargebacks by 30%
• Significantly improved failover, backup & recovery strategy
Exadata Architecture

**Site 1**
- Production
  - Exadata X2-2 Half Rack
  - High Performance
  - OLTP Database 2TB
  - RTO: 0-4 Hours
  - RPO: Near Zero

**Site 2**
- Standby (DR)
  - Exadata X2-2 Half Rack
  - High Performance
  - OLTP + Data Warehouse
  - RTO: 0-4 Hours
  - RPO: Near Zero

- QA/Development
  - Exadata X2-2 Full Rack
  - High Capacity
  - ZFS Machine with Virtualized Databases

Data Guard
Pre-Exadata Backup Challenges

- Over 60% annual data growth rate
- Business needs growing and becoming more complex
- Expensive software/hardware licenses
- Costly to keep backups on the disk
- Backups hurting database performance
- Complicated recovery with “no-logging”
- Concerns around non-logical DR software
Fundamental Data Protection Strategy

1st Line of Defense
- Flashback: 48 hours
  - data deletion
  - logical corruption
  - user errors

2nd Line of Defense
- Disk Backup: 24 Hours
  - application
  - system

3rd Line of Defense
- Standby Database (DR)
  - Building/site, region
  - HW failure

Last Line of Defense
- Tape: 35 Days
  - Offsite
  - multi-site failures
Flashback

- Oracle Flashback Database
- Primary and Standby Sites

<table>
<thead>
<tr>
<th>Retention Period:</th>
<th>48 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restore Time:</td>
<td>&lt; 1 Hour</td>
</tr>
<tr>
<td>Space Used:</td>
<td>300GB</td>
</tr>
</tbody>
</table>

**Pros**

- Faster recovery
- Data recovery from tables, schema, or entire database
- Roll database back and forth repeatedly within the flashback window for complex data restore

**Cons**

- Same location as production
  - No protection from storage failure
- No protection from physical corruption
Flashback

Disk Backup

Standby Database

Tape Backup

**Disk Backup**

- Exadata Fast Recovery Area
- Incrementally Updated

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Retention Period</td>
<td>24 Hours</td>
</tr>
<tr>
<td>Backup Rate</td>
<td>1.2 TB/hour</td>
</tr>
<tr>
<td>Restore Rate</td>
<td>1 TB/hour</td>
</tr>
<tr>
<td>Type:</td>
<td>RMAN</td>
</tr>
<tr>
<td></td>
<td>Online</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Redundancy</td>
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</tbody>
</table>

**Pros**

- Protect against physical/logical database corruption
- Faster backup and restore
- Minimal overhead to the production database

**Cons**

- Shorter protection window (24 hours)
- Same location as production so no protection from DR or catastrophic storage failure
Standby Database

- Data Guard
- Asynchronous
- No Delay Apply
- 48 Hour Flashback Database setup
- 700 miles between Primary and Standby sites

Pros
- Great for any data recovery when combined with Flashback Database
- Complete data protection if primary site is lost
- Protection from physical corruption
- Can be turned into snapshot standby database temporarily and used for QA/Dev database refreshes through RMAN

Cons
- Resources (another set of servers/storage)
### Tape Backup

|_retention period: 35 Days (Offsite) | Channels: 2-4 | Nodes: 1 | backup rate: 1TB/hour (2 channels) | restore rate: 800GB/hour (2 channels) | rto: 3 Days | type: RMAN | archived redo logs retention: 3 Days on disk | archived redo logs backup: Every 30 minutes |

#### Pros
- Longer term offsite retention than disk and standby
- Media is relatively cheap

#### Cons
- Slower backup and restore than disk
- Media is less reliable
<table>
<thead>
<tr>
<th>Planning a Comprehensive Backup Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Determine disk backup strategy</strong></td>
</tr>
<tr>
<td>• Consider full backups once a week with daily incremental</td>
</tr>
<tr>
<td><strong>Develop tape backup process</strong></td>
</tr>
<tr>
<td>• Implement Oracle suggested RMAN backup strategy as it is great protection against data loss</td>
</tr>
<tr>
<td><strong>Test different restore processes</strong></td>
</tr>
<tr>
<td>• At least annually</td>
</tr>
<tr>
<td><strong>Consolidate tape backup system</strong></td>
</tr>
<tr>
<td>• Should be centrally managed</td>
</tr>
</tbody>
</table>
Implementation Recommendations

Optimal performance

• Configure Exadata backup over InfiniBand for better throughput
• Configure number of channels based on database size and SLAs
• Use one RMAN channel per tape drive for better throughput
• Enable block change tracking for fast RMAN incremental backups

Data protection and disaster recovery

• Backup Archived Log every 30 minutes for better data protection
• Encrypt the data before writing to tape for data security
• Set-up Flashback on both primary and standby databases
• Utilize Data Guard broker

Monitoring

• Use Oracle Enterprise Manager to monitor:
  • Disk backup
  • Tape backup
  • Data Guard
  • Flashback
Summary

- Have clear and well communicated recovery SLAs
- Build your strategy around the business needs
- Revisit a well-documented, multi-level strategy periodically
- Be conservative and prepare for the worst
- Test
- Practice