Oracle Database Data Protection

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DBA Day – Data Protection AGENDA

• Data Protection Landscape and backup challenges
• Solving Data Protection with Dell EMC Data Domain
• Boost Backup with RMAN
• Long Term Retention
• Addressing future backup challenges
• Summary
DATA PROTECTION LANDSCAPE AND BACKUP CHALLENGES
By 2018, 70% of business and application owners will have more self-service control over their data protection services, up from 30% today.

Source: 2016 Gartner: Magic Quadrant for Data Center Backup and Recovery
Backup Challenges

- Difficulty meeting backup windows
- Lack of visibility & control of backup

Applications

Backup infrastructure

IT/Backup team

- Lack of control
- Accidental architecture
SOLVING DATA PROTECTION WITH DELL EMC DATA DOMAIN
Dell EMC Data Domain Systems
PROTECTION STORAGE FOR BACKUP AND ARCHIVE DATA

- Reliable access and recovery
- Scale and performance
- Efficient resource utilization
- Seamless integration
Reliability
DATA INVULNERABILITY ARCHITECTURE

End-to-end data verification
- Checksum
- Deduplication, write to disk
- Verify

Self-healing file system
- Cleaning
- Expired data
- Defrag
- Verify

Other
- RAID 6
- NVRAM
- Snapshots

Diagram:
- File System
  - Generate Checksum
  - Verify Data
- Deduplication
- Local Compression
- RAID
  - Verify the file system metadata integrity
  - Verify user data integrity
  - Verify stripe integrity

Flow:
- Re-Checksum and Compare
# Scale and Performance

## Small Enterprise/ROBO – Midsize Enterprise

<table>
<thead>
<tr>
<th></th>
<th>DD2200</th>
<th>DD6300</th>
<th>DD6800</th>
<th>DD9300</th>
<th>DD9800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed (DD Boost)</td>
<td>4.7 TB/hr</td>
<td>24 TB/hr</td>
<td>32 TB/hr</td>
<td>41 TB/hr</td>
<td>68 TB/hr</td>
</tr>
<tr>
<td>Speed (other)</td>
<td>3.8 TB/hr</td>
<td>8.5 TB/hr</td>
<td>14 TB/hr</td>
<td>20 TB/hr</td>
<td>31 TB/hr</td>
</tr>
</tbody>
</table>
| Logical capacity    | 40–860 TB    | 1.8–8.9 PB   | 2.8–14.4 PB\(^1\)  
                      |              |              | 8.4–43.2 PB\(^2\)  
                      |              |              | 7.2–36 PB\(^1\)    
                      |              |              | 21.6–108 PB\(^2\) 
                      |              |              | 10–50 PB\(^1\)     
                      |              |              | 30–150 PB\(^2\)    |
| Usable capacity     | Up to 17.2 TB| Up to 178 TB | Up to 288 TB\(^1\) 
                      |              |              | Up to 720 TB\(^1\) 
                      |              |              | Up to 2.16 PB\(^2\) 
                      |              |              | Up to 1 PB\(^1\)    
                      |              |              | Up to 3 PB\(^2\)    |

1 Total capacity on Active Tier only  
2 Total capacity with DD Cloud Tier software for long-term retention  
3 DD Extended Retention is also available for long-term retention  

## Large Enterprise

- Speed (DD Boost): 5.6 TB/hr (16TB), 11.2 TB/hr (96 TB)  
- Usable capacity: .5 TB – 96 TB, Logical capacity: Up to 4.8 PB  

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[Data Domain Virtual Edition]
DE-DUPE EFFICIENCY
FIXED BLOCK
Almost heaven, West Virginia
Blue Ridge Mountains, Shenandoah River
Life is old there
Older than the trees
Younger than the mountains
Growin' like a breeze
Country Roads, take me home
To the place I belong
West Virginia, mountain momma
Take me home, country roads
All my memories gathered 'round her
Miner's lady, stranger to blue water
Dark and dusty, painted on the sky
Misty taste of moonshine
Teardrops in my eye
Country Roads, take me home
To the place I belong
West Virginia, mountain momma
Take me home, country roads

DE-DUPE EFFICIENCY
FIXED BLOCK
(SMALLER BLOCK SIZE BETTER)
DE-DUPE EFFICIENCY
VARIABLE BLOCK
Almost heaven, West Virginia
Blue Ridge Mountains, Shenandoah River
Life is old there
Older than the trees
Younger than the mountains
Growin' like a breeze
Country Roads, take me home
To the place I belong
West Virginia, mountain momma
Take me home, country roads
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DE-DUPE EFFICIENCY
VARIABLE BLOCK
DATA DOMAIN USES 4K-12K (AVERAGE 8K)
Efficient Resource Utilisation

Without DD Boost

1. ID Segment
2. Unique?
3. Compress
4. Write

Application Server

Enterprise DD Boost

LAN
Efficient Resource Utilisation

- What Gets Distributed?
  - 50% Faster Backups
  - 20 to 40% Lower CPU Utilization
  - 99% Less LAN Bandwidth

With DD Boost

1. ID Segment
2. Unique?
3. Compress
4. Write
Data Domain Replication Efficiency

Production

Database

Oracle Database Server

Copy 1
Copy 2
Catalog

Oracle RMAN
DD Boost Plug-in

Oracle Database Server

Local Data Domain System

Efficient Local backup and Offsite DR

DR Site
Data Domain System

Oracle RMAN
DD Boost Plug-in

Oracle Database Server

Database

WAN
DD BOOST FOR ENTERPRISE APPLICATIONS

NATIVE APPLICATION INTEGRATION, THROUGH WHICH DATA PROTECTION CONTROLLED BY APPLICATION OWNERS

- **Oracle Database** via RMAN
- **SAP** via BR*Tools
- **SAP HANA** via backint
- **IBM DB2** via db2 commands
- **DB2** via SQL Server Mgmt. studio
- **Exchange** via Exchange PowerShell
- **PowerShell** via CLI commands
- **Cloudera** via CLI commands & Hadoop APIs
DD Boost Seamless Integration

DD Boost Supported over SAN

DD Boost Supported over LAN

DD Boost Supported over WAN
DATA DOMAIN – MARKET SHARE (PBBA)

Dell EMC 59.1%

Source: IDC Worldwide Quarterly Purpose Built Backup Appliance Tracker – Q4 2016

Source: Gartner
BOOST BACKUP VIA RMAN
DD BOOST WITH ORACLE RMAN AGENT

- App Owner control of backup using Oracle RMAN
- Faster backup and recovery using native utilities
- Supports IP or Fibre Channel
BOOST BACKUP VIA RMAN DEMO

Get your free Data Domain at

ORACLE INTEGRATION

- Standalone
- RAC configuration
- Data Guard

Oracle Exadata Supported
USING DATA DOMAIN TO CLONE/REFRESH
**ORACLE DD BOOST - BACKUP PERFORMANCE**

Customer Use Case

- Database backup time (existing) --- 25 hours
- Database backup time using DD Boost – 4 hours (5hrs initial)

ACHIEVE HIGHER DE-DUPE

Using Data Domain’s Oracle optimization parameter

Block header changes when
  - Block data changes
  - Multiplexing is enabled

- Oracle multiplexing reduces effectiveness of other deduplication appliances except Data Domain
- Understands Oracle’s backupset data structure
- Result: 30% increase in deduplication
- Highest dedupe rates of any dedupe appliance.

SIMPLE RMAN DD BOOST BACKUP

Minimal changes to RMAN scripts

#Complete DDBOost for RMAN Configuration

CONFIGURE DEFAULT DEVICE TYPE TO SBT_TAPE;
CONFIGURE DEVICE TYPE SBT_TAPE Backup TYPE to BACKUPSET PARALLELISM 8;
CONFIGURE CHANNEL DEVICE TYPE 'SBT_TAPE' PARMS 'BLKSIZE=1048576,
SBT_LIBRARY=/app/oracle/product/12.1.0/dbhome_1/lib/libddobk.so,
ENV=(STORAGE_UNIT=orabackups, BACKUP_HOST=datadomain.emc.com,
ORACLE_HOME=/app/oracle/product/12.1.0/dbhome_1)';

#Authentication one-time only
run
{
ALLOCATE CHANNEL c1 TYPE SBT_TAPE Trace 5 PARMS 'BLKSIZE=1048576,
SBT_LIBRARY=/app/oracle/product/12.1.0/dbhome_1/lib/libddobk.so, ENV=(STORAGE_UNIT=oraclebackups,
BACKUP_HOST=datadomain.emc.com, ORACLE_HOME=/app/oracle/product/12.1.0/dbhome_1)';
send 'set username ddboost password abc123 servername datadomain.emc.com';
RELEASE CHANNEL c1;
}
run {
configure controlfile autobackup on;
set controlfile autobackup format for device type sbt to "CONTROLFILE.%F";
}

allocate channel dd0 type 'sbt_tape'
parms='BLKSIZE=1048576,SBT_LIBRARY=/u01/app/oracle/product/11.2.0/db_1/lib/libddobk.so,ENV=(STORAGE_UNIT=orabackups, BACKUP_HOST=datadomain.emc.com,ORACLE_HOME=/u01/app/oracle/product/11.2.0/db_1);

allocate channel dd1 type 'sbt_tape'
parms='BLKSIZE=1048576,SBT_LIBRARY=/u01/app/oracle/product/11.2.0/db_1/lib/libddobk.so,ENV=(STORAGE_UNIT=orabackups, BACKUP_HOST=datadomain.emc.com, ORACLE_HOME=/u01/app/oracle/product/11.2.0/db_1);

backup fileserset 4 database format '%d_set%s_piece%p_%T_%U';
backup archivelog all format '%d_set%s_piece%p_%T_%U';
release channel dd0;
release channel dd1;
## RMAN Backup Options for Data Domain

<table>
<thead>
<tr>
<th>Application Data</th>
<th>Backup without RMAN compression and Encryption</th>
<th>Backup with <strong>RMAN compression</strong> (disk backup)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Encrypted</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Encrypted with TDE column encryption</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Encrypted with TDE tablespace encryption</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>

**Recommendation:** no RMAN compression and no RMAN encryption
ORACLE TDE TEST RESULT – SMALL DB

#disk uncompressed backup
real   1m15.304s
user   0m3.960s
sys    0m0.299s

#disk compressed backup
real   3m17.607s
user   0m3.699s
sys    0m0.198s

#ddboost uncompressed backup
real   0m35.591s
user   0m3.947s
sys    0m0.237s

- Disk uncompressed backup is 2.1 times longer than DDboost
- Disk compressed backup is 5.6 times longer than DDboost.
## Tuning Summary for Device Type SBT

<table>
<thead>
<tr>
<th>RMAN Parameters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FILESPERSET</td>
<td>Tunable based on customer environment with Oracle Optimization</td>
</tr>
<tr>
<td>Section Size</td>
<td>Break large file to multiple channel</td>
</tr>
<tr>
<td>Number of Channels</td>
<td>As many as the Oracle server can bear</td>
</tr>
<tr>
<td>Backup type</td>
<td>Full and/or cumulative incremental</td>
</tr>
<tr>
<td>Format</td>
<td>%d_set%s_piece%p_%T_%U</td>
</tr>
<tr>
<td>Block Change Tracking</td>
<td>enable</td>
</tr>
<tr>
<td>RMAN Compression</td>
<td>No</td>
</tr>
<tr>
<td>RMAN Encryption</td>
<td>No (Oracle database can be encrypted)</td>
</tr>
</tbody>
</table>
LONG TERM RETENTION
WHAT IS DATA DOMAIN CLOUD TIER?
AUTOMATED LONG TERM RETENTION

- Send only unique data to the Private or Public cloud
- Data lands in the cloud already de-duplicated
- Reduce storage requirements up to 10 – 30x

Automated by Data Domain
DATA DOMAIN CLOUD TIER DATA MOVEMENT EXAMPLE

Data Domain File System - DDXXXX.yourcompany.com

Active Tier

Backup Image 3: A D F G
Backup Image 4: A D G H
Backup Image 5: A D G H I

Cloud Tier

Backup Image 1: A B D E
Backup Image 2: A D E F

S3 Cloud Storage

A B D E F

Day 28 – Next Backup

*14 day movement policy
DATA DOMAIN CLOUD TIER DATA RECALL EXAMPLE

Data Domain File System - DDXXXX.yourcompany.com

Active Tier
- Backup Image 1: A B D E
- Backup Image 4: A D G H
- Backup Image 5: A D G H I

Cloud Tier
- Backup Image 2: A D E F
- Backup Image 3: A D F G

S3 Cloud Storage
- A B D E F G

Blocks B and E recalled from the cloud.

*14 day movement policy
ADDRESSING FUTURE BACKUP CHALLENGES
2010
10TB
2015
40TB
2017
200TB
2020+
1PB??

Challange 1: Database sizes keep growing steadily.

How can your backup architecture keep you protected as your data grows?
BACKUP WITH PROTECTPOINT TECHNOLOGY

Storage-integrated data protection: support VMAX3, VMAX Flash, and XtremIO

1. Application Owner
2. Application Server
3. Catalog
4. Backup

- App owner triggers backup at an application consistent checkpoint
  - RMAN proxy option
  - DB2 snapshot option
  - SQL via SSMS

- Primary storage sends changed blocks directly to Data Domain

- Data Domain uses the changed blocks to create full backups in native format

20X faster backup
No Application Impact
PROTECTPOINT ACCELERATED RESTORES

RESTORE IN FULL OR AT AN OBJECT LEVEL

- Use Array change Block tracking for full restore
- Granular/Object restore carried out by instantly accessing a full backup
  - Either direct from the Data Domain (VMAX3/XtremIO)
  - Or via VMAX3
- Controlled via RMAN
PROTECTPOINT FOR ORACLE

- DBA Control of Backup
  - via Oracle RMAN
- Supports Oracle 11g, 12c
  - Oracle RAC Support
  - OS: Windows, Linux
  - OS: Unix (Solaris, AIX, HP-UX)
  - VMAX³ and XtremIO
  - VMware: RDM Support in guest agent
Evolution of Databases

Pre-computer technologies:
- Printing press
- Dewey decimal system

Magnetic tape
- “flat” (sequential) files

Magnetic Disk

IDMS

ADABAS

System R

Oracle V2

Access

Postgres

MySQL

Network Model
- Defined

Hierarchical model

Indexed-Sequential Access Mechanism (ISAM)

Relational Model

IMS

SQL Server

Sybase

Informix

Ingres

DB2

dBase

DB2

Informix

MySQL

1940-50

1950-60

1960-70

1970-80

1980-90

1990-2000

2000-2010

2010-2020

HBase

Dynamo

MongoDB

Redis

VoltDB

Neo4J

Aerospike

Hana

Riak

Cassandra

Vertica

Hadoop

VoltDB

Hana

Neo4J

Cassandra

Hadoop

Redis

VoltDB

MongoDB

MySQL

Oracle V2

System R

IDMS

Relational Model

Hierarchical model

Indexed-Sequential Access Mechanism (ISAM)
CHALLENGE 2: MODERN DATABASE BACKUP
MARKET ACCELERATION WITH BOOSTFS

BoostFS
Backup SW, NoSQL, Homegrown, P3...... 100+ Solutions

Boost
Application Agent 17 Solutions

Backup SW 9 Solutions
BOOSTFS DEMO
Dell EMC Oracle Backup Solution for Oracle
USING DATA DOMAIN BOOST

• Unsurpassed efficiency
  – Efficiently identify what to backup
    • Use DD Boost to do source side de-dupe
    • Small variable length blocks for highest efficiency
    • Direct backup from Client – No dump and sweep
  – Efficiently & securely send backup data
    • Send unique blocks only using Compression and/or Encryption
  – Efficiently store data
    • Variable Length De-dupe for highest dedupe
    • Data at Rest Encryption
    • Retention Lock to secure backups
    • Expand to Object Storage for Long Term Retention
    • Seamless and automated remote replication for DR

• Controlled via backup software or via native tool
• Industry leading and ready for future