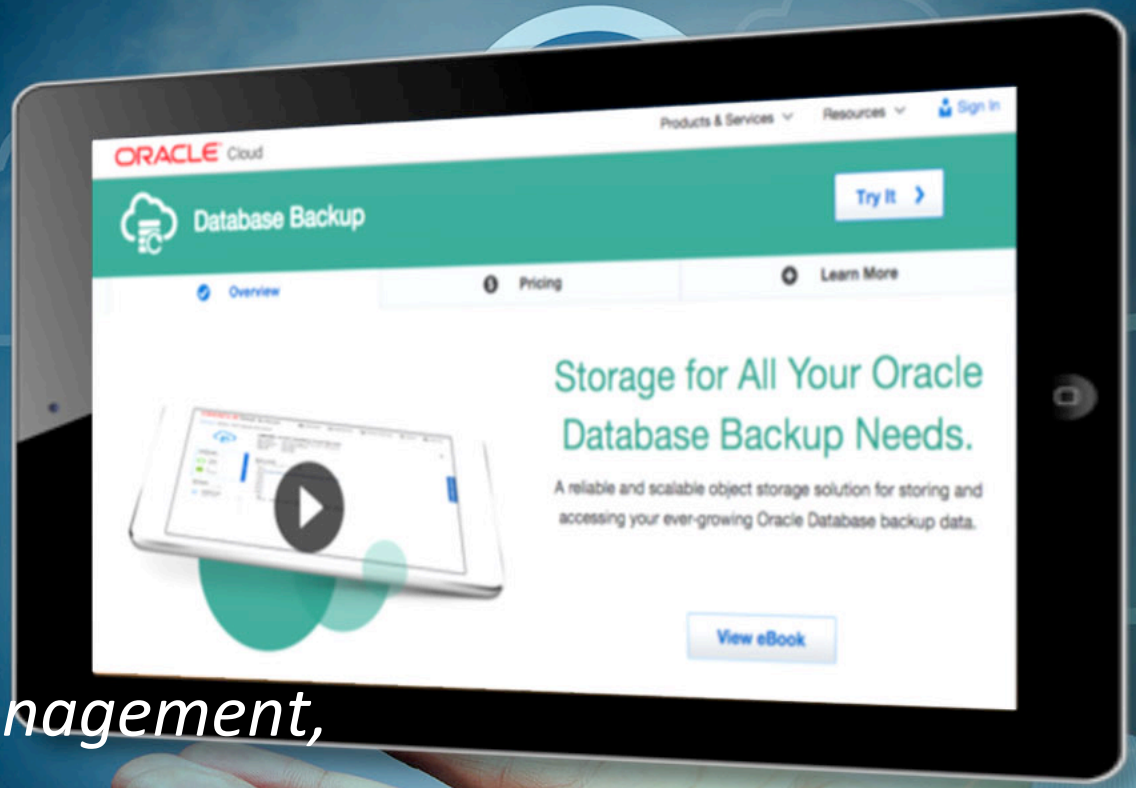
Oracle Database Backup Cloud Service



Sridhar Ranganathan
High Availability Product Management, Oracle

ORACLE

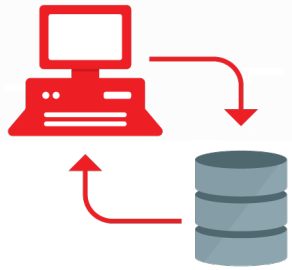
Safe Harbor Statement

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, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

Traditional Database Backup Best Practices

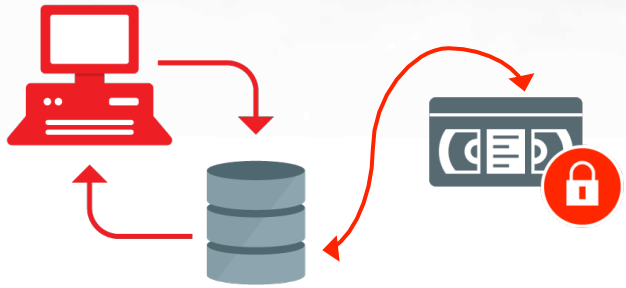
Local FRA Backups

- Local disk backups
- Short term retention
  - Example: 7 days
- Quickest RTO
  - Image copy
  - Backup Sets



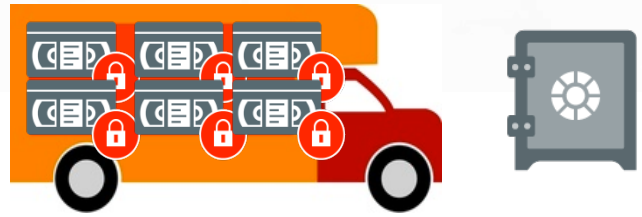
On-site Tiered Storage

- Storage tier based on data value & retention requirements
  - Disk-to-Disk (Example: 30 days)
  - Disk-to-Tape (Example: 90 days)
  - Disk-to-Disk-to-Tape (Example: 7-30-90 days)



Off-site Storage

- Tapes physically shipped to offsite (Tape Vaulting)
- Long term retention & Archiving (Example: 5 yrs)
- Compliance, Regulatory & DR purposes



Challenges with Backup Infrastructure

On-Demand Capacity Growth

With explosive data growth, storage capacity planning for the long term retention is a challenge

High Cost

Incurs capital expenditure to procure, higher operation cost to manage onsite & offsite storage infrastructure

No DR / Tape Infrastructure

Not everyone has tape infrastructure or remote (DR) site for taking backups and to store offsite

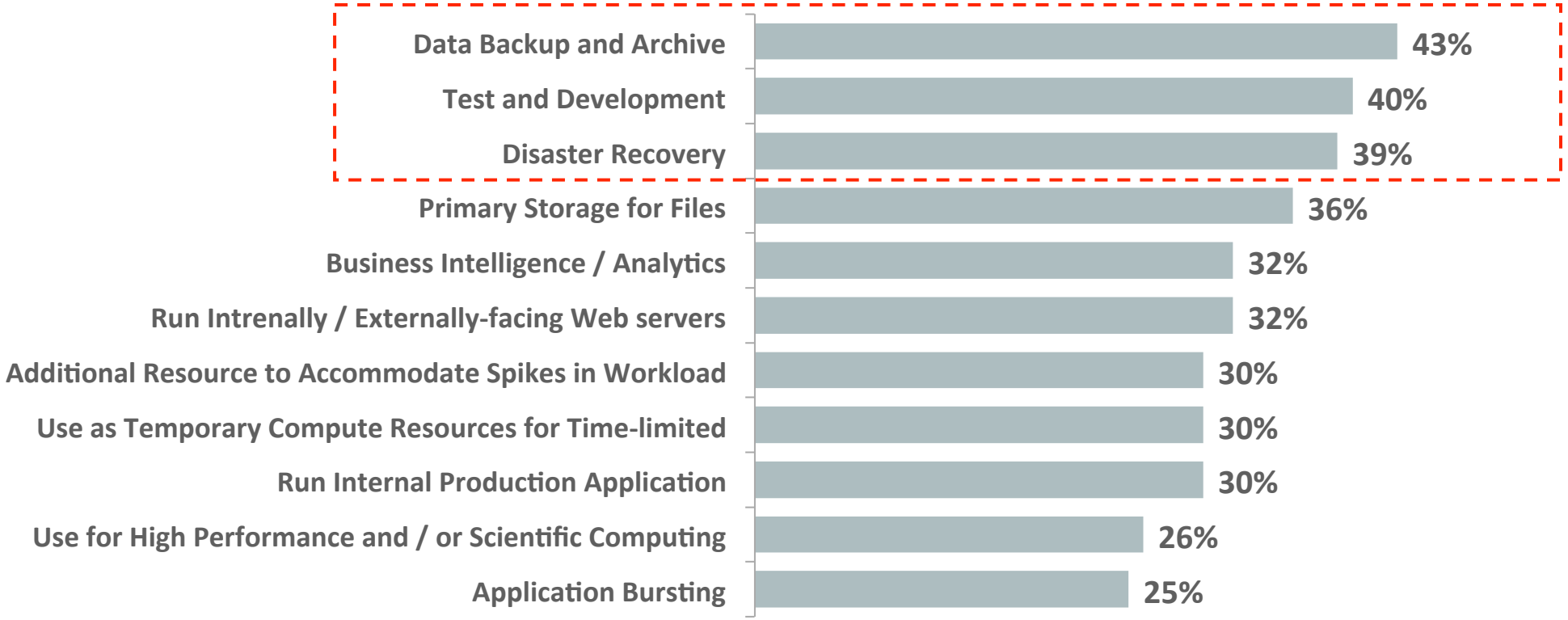
Accessibility Issues

With Tape-vaulting, offsite data is not immediately accessible which increases RTO

Cloud Storage Provides a Great Alternative!

Cloud Infrastructure for Backup & Archive – Top Preference

For which of the following purposes does / did your organization use cloud infrastructure services? (Percent of respondents, N = 256, multiple responses accepted)



Source: Enterprise Strategy Group, 2014

Topics

1. Oracle Database Backup Cloud Service Overview
2. Use Cases
3. Oracle Database Cloud Service Integration
4. Choosing Backup Strategy & Best Practices
5. Summary
6. Q&A

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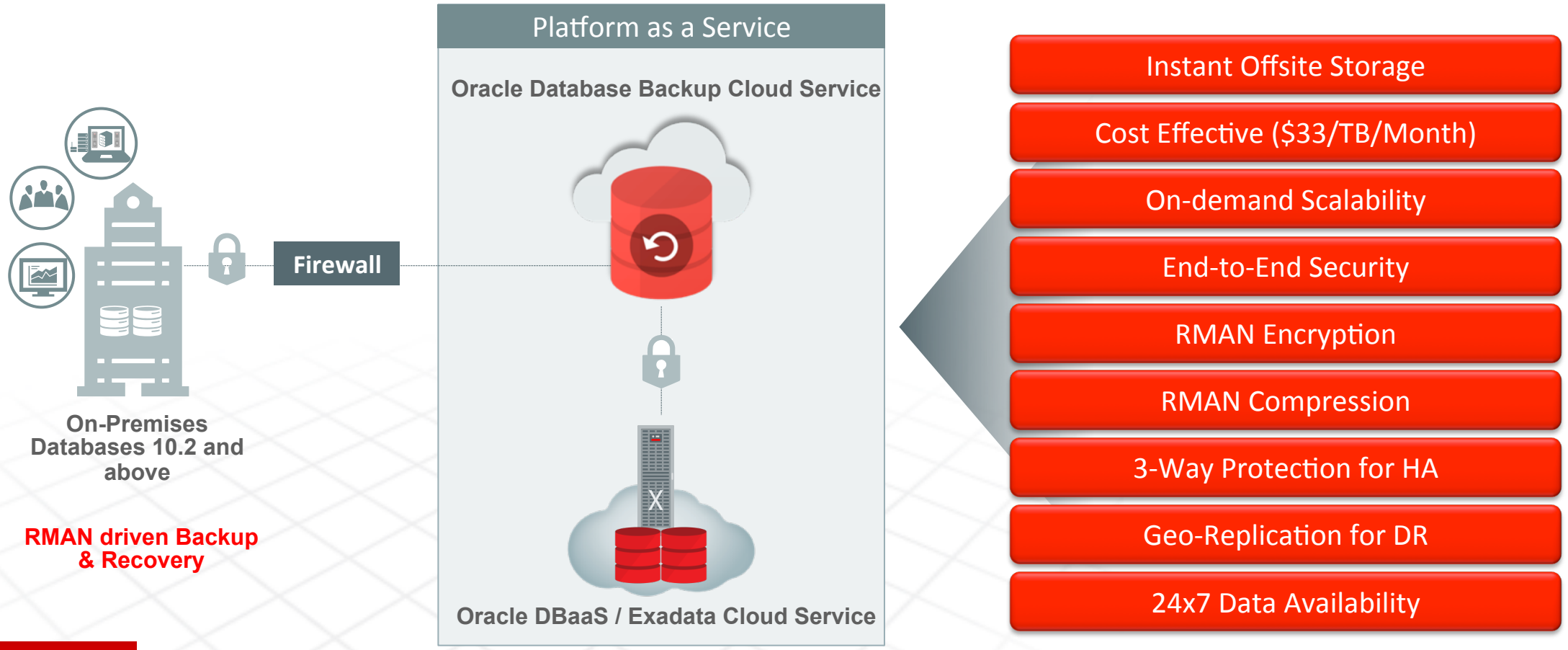
Oracle Database Backup Cloud Service (PaaS)

Low-Cost Offsite Cloud Storage for Oracle Database Backups



Backup Service: For your On-Premises Database Backups

Simple 4-Step Process

1 Cloud Subscription

- **Metered / Non-Metered**
- Storage Capacity
- Identity Domain
- Service Name
- User ID/Password
- Geo-Replication

2 Install RMAN Module

- Download Installer from OTN
- Run Installer on the DB Server

3 Configure RMAN

- Tape (SBT) Interface
- Encryption
- Compression
- Parallelism

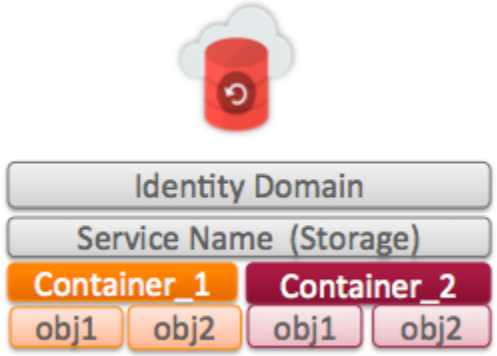
4 Perform Backup & Recovery

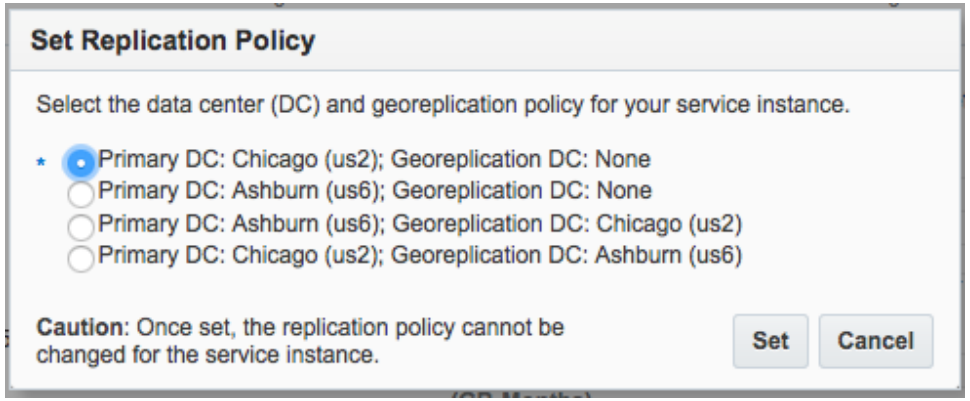
- Schedule full & Incremental backups
- Restore & Recovery on-demand

Cloud Side Operations

1

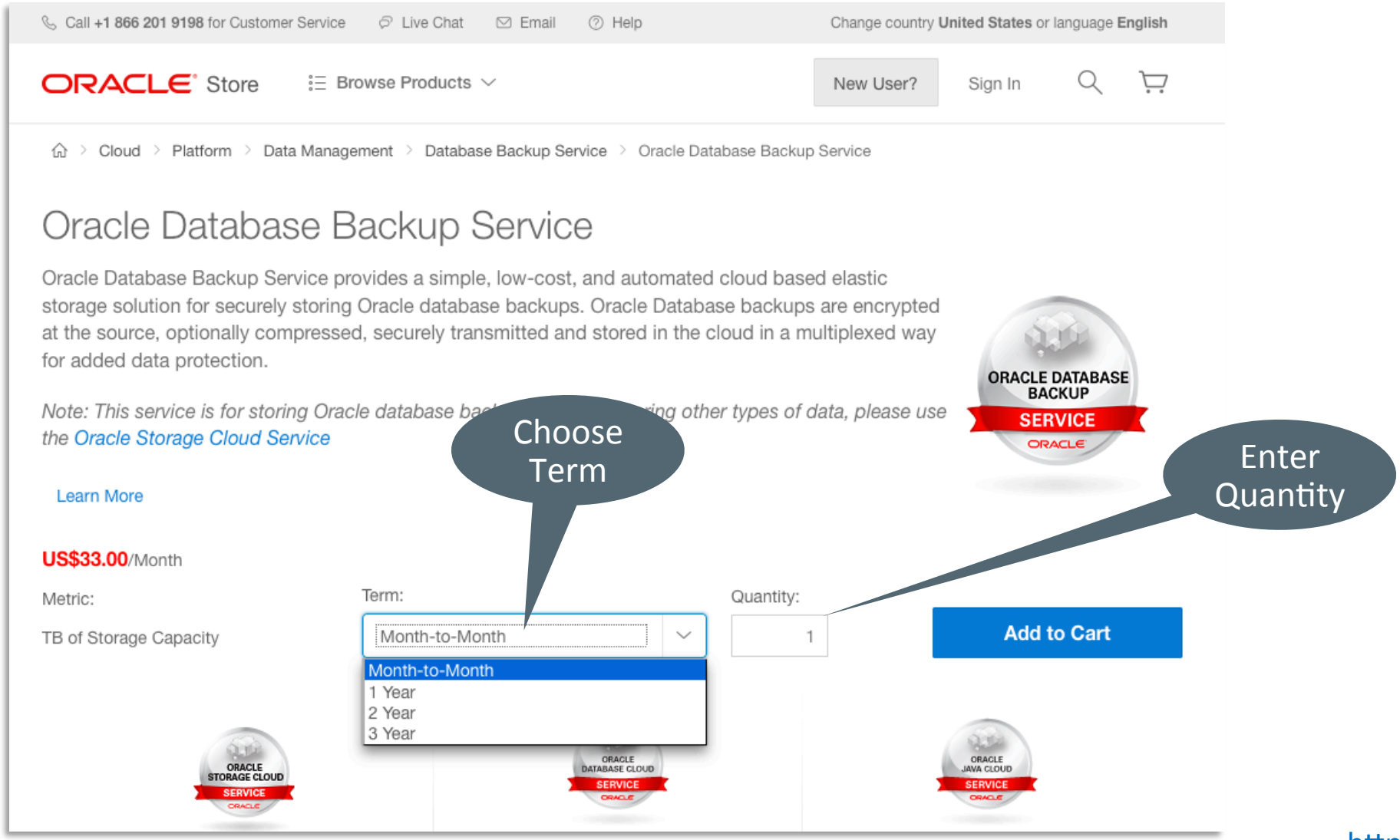
- Subscribe for Database Backup Cloud Service
- REST Endpoint & Authentication
  - Identity Domain, Service Name, User ID, Password
- Choose Geo-Replication
- Create Container
  - Auto-created (or) User pre-created
- Only SSL (HTTPS) access is allowed
- RMAN backup pieces are stored under the container as objects
- Stored in 3-way in the chosen datacenter
- Replicated to another datacenter within the same region if Geo-Replication* is chosen





Example: Subscribe for Database Backup Cloud Service

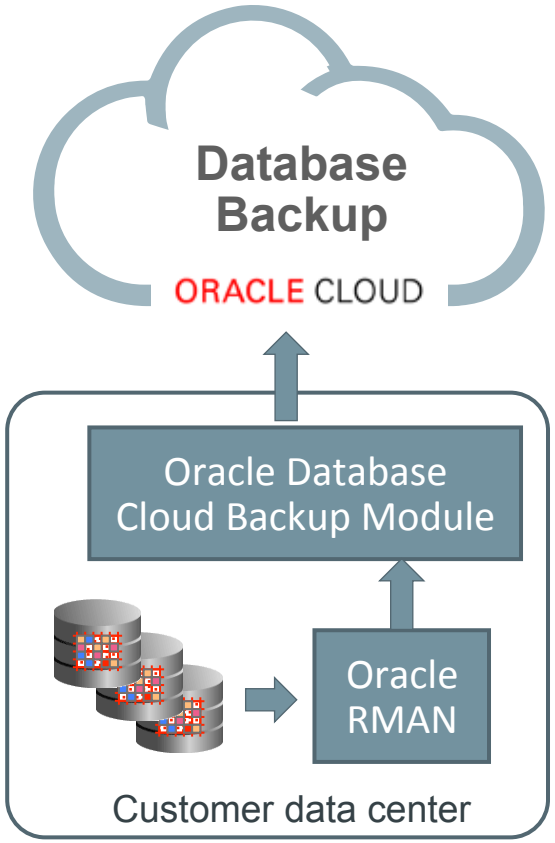
1



https://shop.oracle.com/

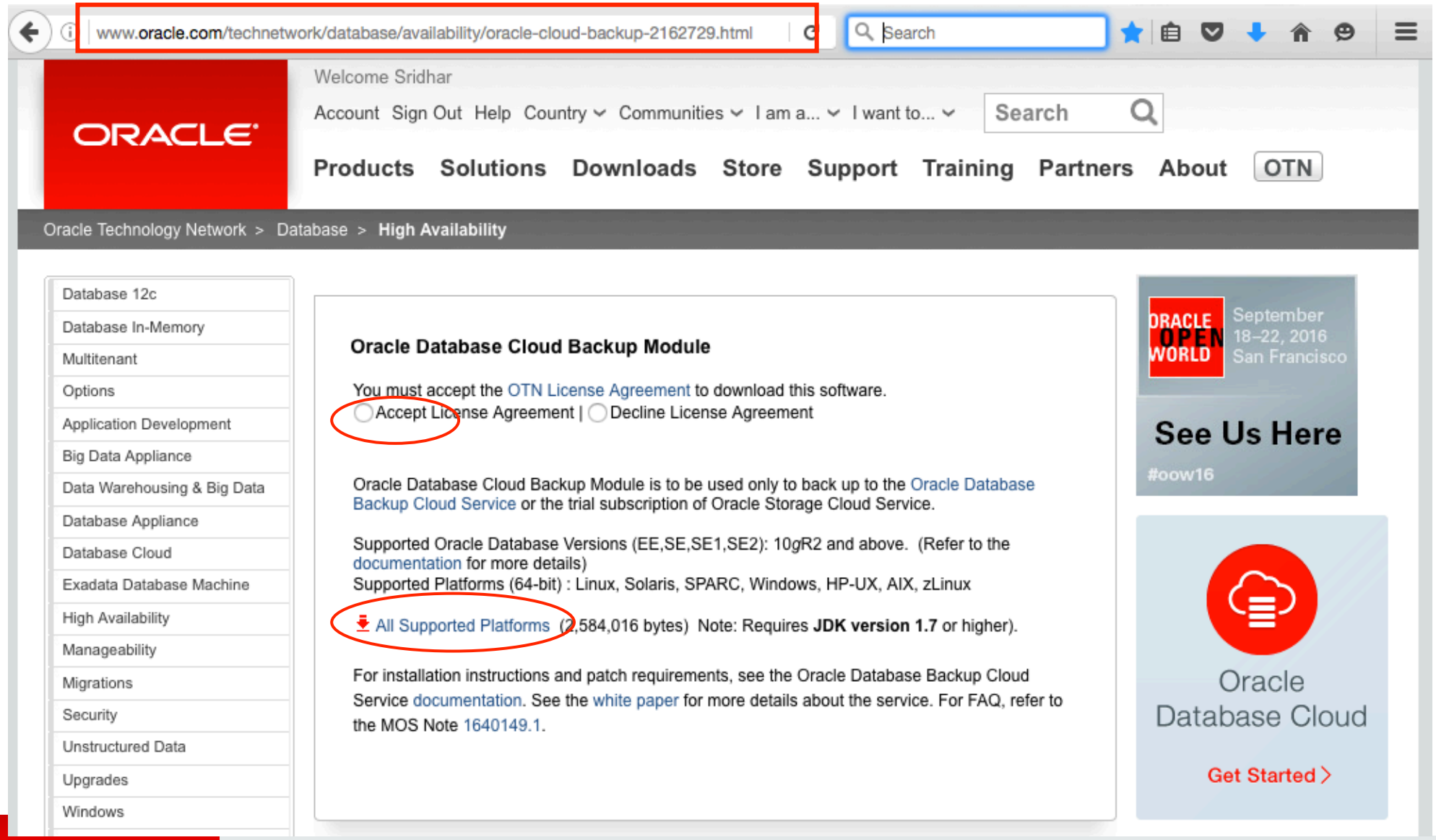
On-Premises: Client Side Operations

- Download Oracle Database Cloud Backup Installer from OTN and run it
  - Installs platform specific SBT module, configures wallet and OPC parameter file
- Configure RMAN environment and perform backups
- RMAN streams backup data to the cloud via RMAN cloud library module using SBT interface (*libopc.so*) via REST calls
- Backup pieces are chunked into 100MB objects and shipped to the cloud
  - Uses REST end point
  - Each chunk is stored as an object under container
  - Failed transmissions are retried automatically by RMAN
- Manifest (metadata) file is created for every backup piece
  - Default container name (created by the RMAN module)
  - "oracle-data-[first 8 chars of service & domain]



Example: Download Oracle Database Cloud Backup Module

2



Example: Run the Installer

2

HybridDR_Commands — oracle@HCDR2:~ — ssh — 145×35

```
[oracle@localhost OPC] unzip opc_installer.zip

[oracle@localhost OPC] ls opc*
  opc_install.jar  opc_readme.txt

[oracle@localhost OPC]$ java -jar opc_install.jar -serviceName myService –identityDomain
  myDomain -opcid sridhar.ranganathan@oracle.com -opcPass 'myPassword' -libDir /home/oracle/
  OPC/lib -walletDir /home/oracle/OPC/wallet
Oracle Database Cloud Backup Module Install Tool, build 2016-07-12
Oracle Database Cloud Backup Module credentials are valid.
Oracle Database Cloud Backup Module wallet created in directory /home/oracle/OPC/wallet.
Oracle Database Cloud Backup Module initialization file /u01/products/db/12.1/dbs/opcodbs.ora
  created.
Downloading Oracle Database Cloud Backup Module Software Library from file opc_linux64.zip.
Downloaded 23169388 bytes in 152 seconds. Transfer rate was 152430 bytes/second.
Download complete.
```

Files Configured During Installation

File Name	Location	Purpose
libopc.so	User specified library location.	SBT library which enables backup to Oracle Cloud which does REST calls to the cloud
opc<SID>.ora	$ORACLE_HOME/dbs	Configuration information stored – like REST endpoint, wallet information, custom container etc.
cwallet.sso	User specified wallet location	Oracle wallet which securely stores backup service credentials. This is used implicitly to authenticate against Oracle cloud during RMAN backups and restore operations.

Note: Installation can be repeated to get latest module, update the password etc.

3

RMAN Compression and Encryption

- RMAN Compression
  - **Optional**
    - 10g: BASIC
    - 11g and above: HIGH, BASIC, MEDIUM,LOW
  - MEDIUM recommended
  - No ACO licensing required

```
CONFIGURE COMPRESSION ALGORITHM 'MEDIUM';
BACKUP AS COMPRESSED BACKUPSET DATABASE PLUS ARCHIVELOG;
```

- RMAN Encryption
  - **Mandatory**
  - Password, Transparent Data Encryption (TDE), Dual-Mode
  - No ASO licensing required
  - Keys are kept local (not in the storage cloud)
  - If TDE is used (preferred), then simply use SET ENCRYPTION ON before backups and restores
  - For password encryption:

```
SET ENCRYPTION ON IDENTIFIED BY '<password>' ONLY;
```

  - Before doing restore,

```
SET DECRYPTION IDENTIFIED BY '<password>';
```

Example: RMAN Configuration

3

HybridDR_Commands — oracle@HCDR2:~ — ssh — 145×35

```
$ rman target /
Recovery Manager: Release 12.1.0.1.0 - Production on Sun Aug 14 09:41:08 2016
Copyright (c) 1982, 2013, Oracle and/or its affiliates.  All rights reserved.
connected to target database: odbs (DBID=2636081010, open)

RMAN>CONFIGURE CHANNEL DEVICE TYPE 'SBT_TAPE' PARMS  'SBT_LIBRARY=/home/oracle/
  OPC/lib/ libopc.so, ENV=(OPC_PFILE=/u01/products/db/12.1/dbs/opcodbs.ora)';

RMAN> CONFIGURE COMPRESSION ALGORITHM 'MEDIUM';

RMAN> CONFIGURE CONTROLFILE AUTOBACKUP ON;

RMAN> CONFIGURE DEVICE TYPE 'SBT_TAPE' PARALLELISM 8 BACKUP TYPE TO BACKUPSET;

RMAN> SHOW ALL;
```

Example: Perform RMAN Backups

4

HybridDR_Commands — oracle@HCDR2:~ — ssh — 145×35

```
RMAN> SET ENCRYPTION ON IDENTIFIED BY 'abc123' ONLY;
executing command: SET encryption

RMAN> BACKUP DEVICE TYPE SBT AS COMPRESSED BACKUPSET DATABASE PLUS ARCHIVELOG FORMAT '%d_%U';

Starting backup at 14-AUG-16
current log archived
released channel: ORA_DISK_1
released channel: ORA_DISK_2
released channel: ORA_DISK_3
released channel: ORA_DISK_4
released channel: ORA_DISK_5
released channel: ORA_DISK_6
released channel: ORA_DISK_7
released channel: ORA_DISK_8
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=42 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: Oracle Database Backup Service Library VER=3.15.1.16
```

Example: Perform RMAN Restore & Recovery

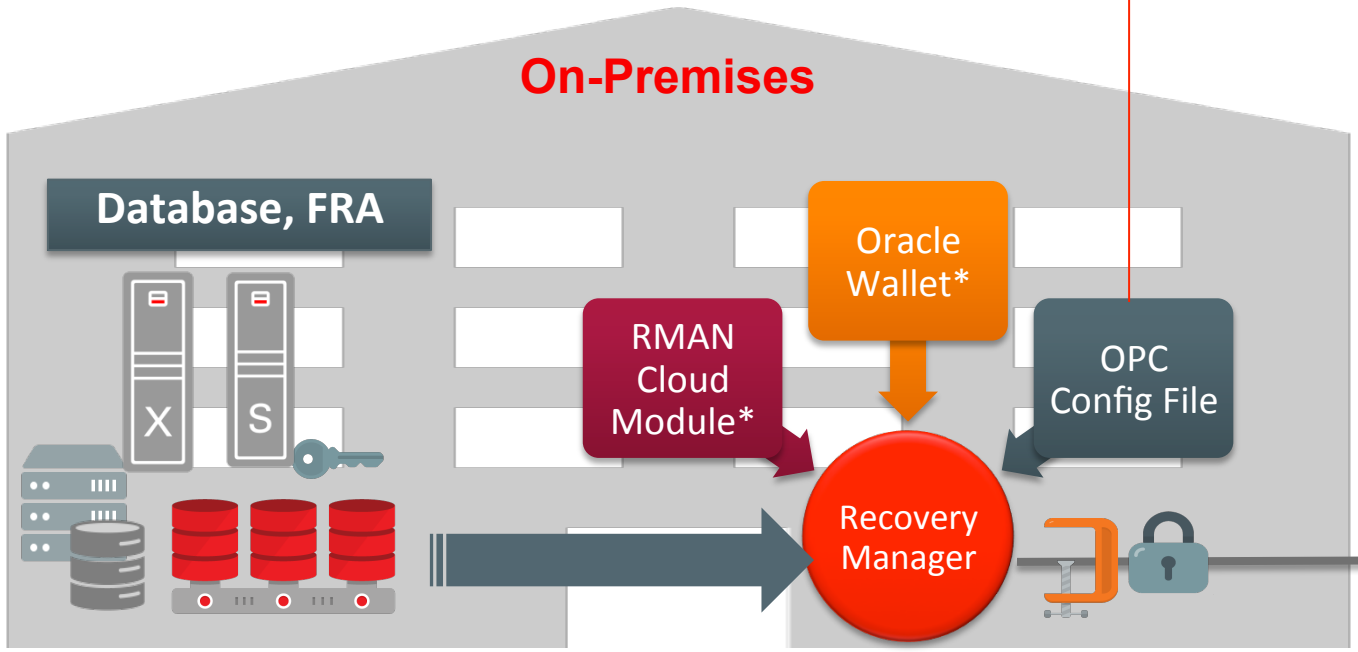
4

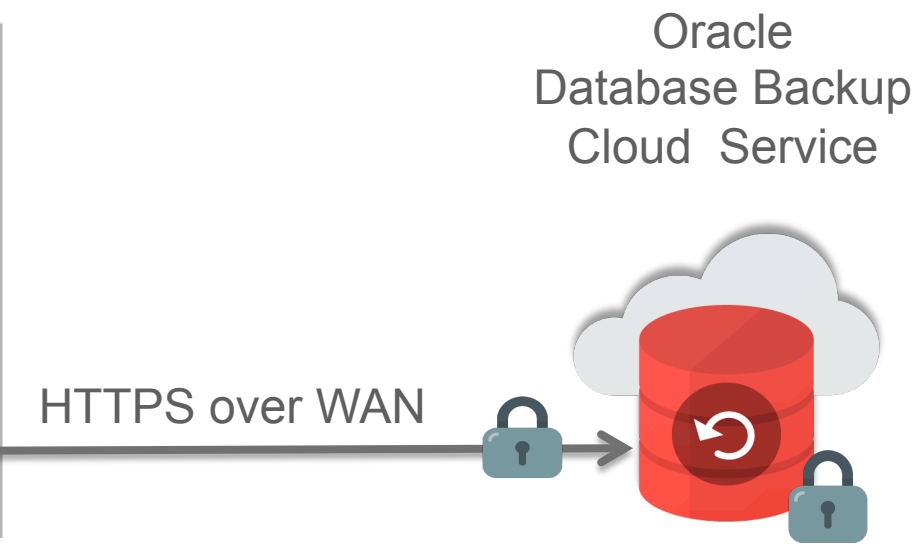
HybridDR_Commands — oracle@HCDR2:~ — ssh — 145×35

```
RMAN> SET DECRYPTION IDENTIFIED BY 'abc123';

executing command: SET decryption
using target database control file instead of recovery catalog

RMAN> RESTORE DATABASE;

Starting restore at 13-SEP-15
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=22 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: Oracle Database Backup Service Library VER=3.15.1.16
allocated channel: ORA_SBT_TAPE_2
channel ORA_SBT_TAPE_2: SID=19 device type=SBT_TAPE
…
RMAN> RECOVER DATABASE;
```

End-To-End Flow

```
opc_host=https://odbs_dom. storage.oraclecloud.com/
odbs_svc-odbs_dom
opc_wallet='location=file:/abc/opcwlt'
opc_container='myContainer'
```






```
$ rman target /
RMAN> CONFIGURE CHANNEL DEVICE TYPE SBT PARMS='SBT_LIBRARY=
/opc/libopc.so' , SBT_PARMS=(OPC_PFILE=/opc/opcSID.ora)';
RMAN> CONFIGURE DEVICE TYPE SBT PARALLELISM 8;
RMAN> SET ENCRYPTION ON IDENTIFIED BY "mypwd" ONLY;
RMAN> BACKUP AS COMPRESSED BACKUPSET DATABASE PLUS ARCHIVELOG;
```

```
https://
odbs_dom.storage.oraclecloud
.com/v1/odbs_svc-odbs_dom/
myContainer/H8djkj86/
BA387934/0000001
```

RMAN Operations Supported with Cloud Backups

All Typical Tape (SBT) Operations

Database (Backupset)	Backups From Fast Recovery Area	Restore from Cloud	Maintenance
• BACKUPSET Backups • Full Database • Selected Tablespace(s) • Selected Data Files • Incremental – Differential • Incremental – Cumulative • Compressed • Encrypted	• Image Copies • Archived logs • Compressed • Encrypted backup sets	• Full Database • Tablespace • Datafile • Table Recovery (12c) • Block Recovery	• Retention Period • Crosscheck • Obsolete • Delete Obsolete • Delete Backups

Support Matrix (On-Premises)

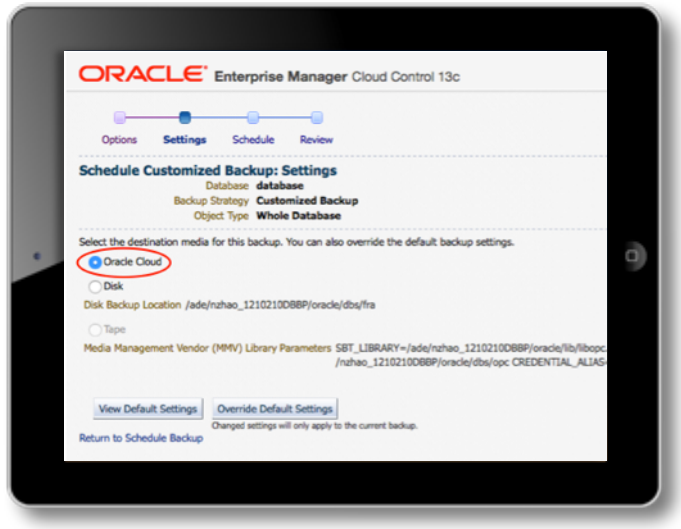
Database / Features	Supported Versions / Options
Oracle Database – Enterprise Edition*	10.2.0.5, 11.1,11.2, 12c (64 bits)
Oracle Database – SE/SE1/SE2*	10.2.0.5, 11.1.0.7, 11.2.0.3, and versions 11.2.0.4 and above
Platforms (64 bits)	Linux, Solaris, SPARC, Windows, HP-UX, AIX, zLinux
RMAN Compression (Included)	HIGH, MEDIUM, BASIC, LOW (depends on DB version)
RMAN Encryption (Included)	Password, TDE, Dual-mode

* Older Database versions no longer supported by Oracle are in deprecated mode

UI Management for Backup & Recovery

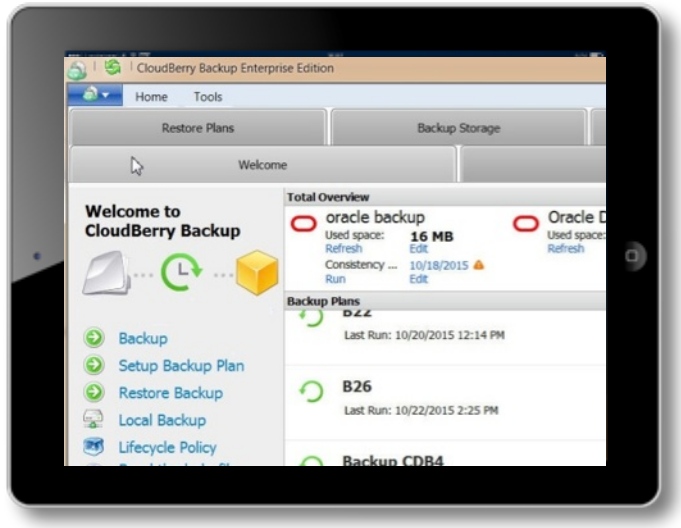
Enterprise Manager 13c

- Oracle Cloud as a backup destination
- Configure, schedule, B&R



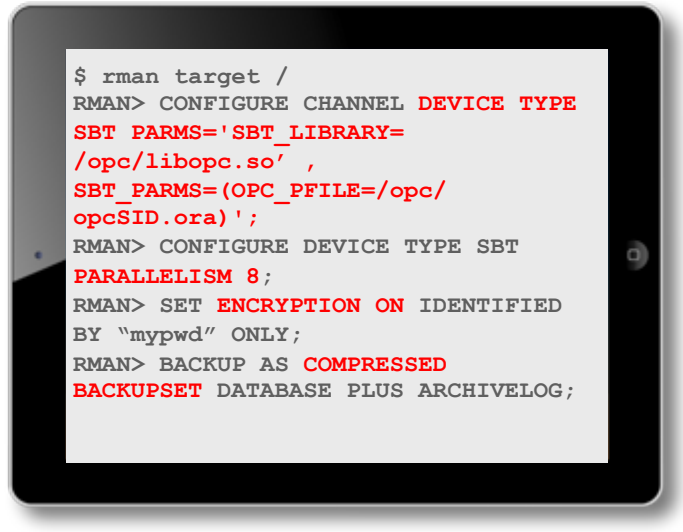
Cloudberry Lab

- Simple UI to perform backup & recovery operations



RMAN CLI

- Perform complex operations via scripting



3rd Party Application Support : VERITAS COMMVAULT

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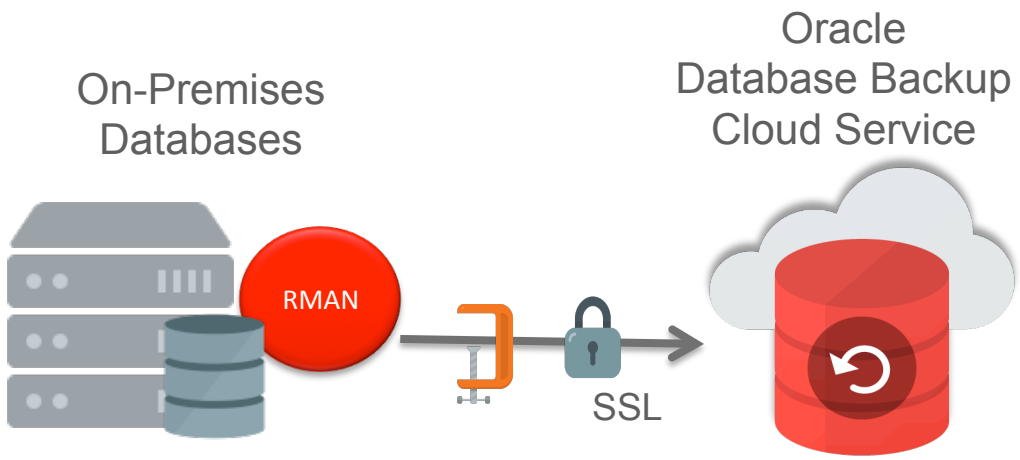
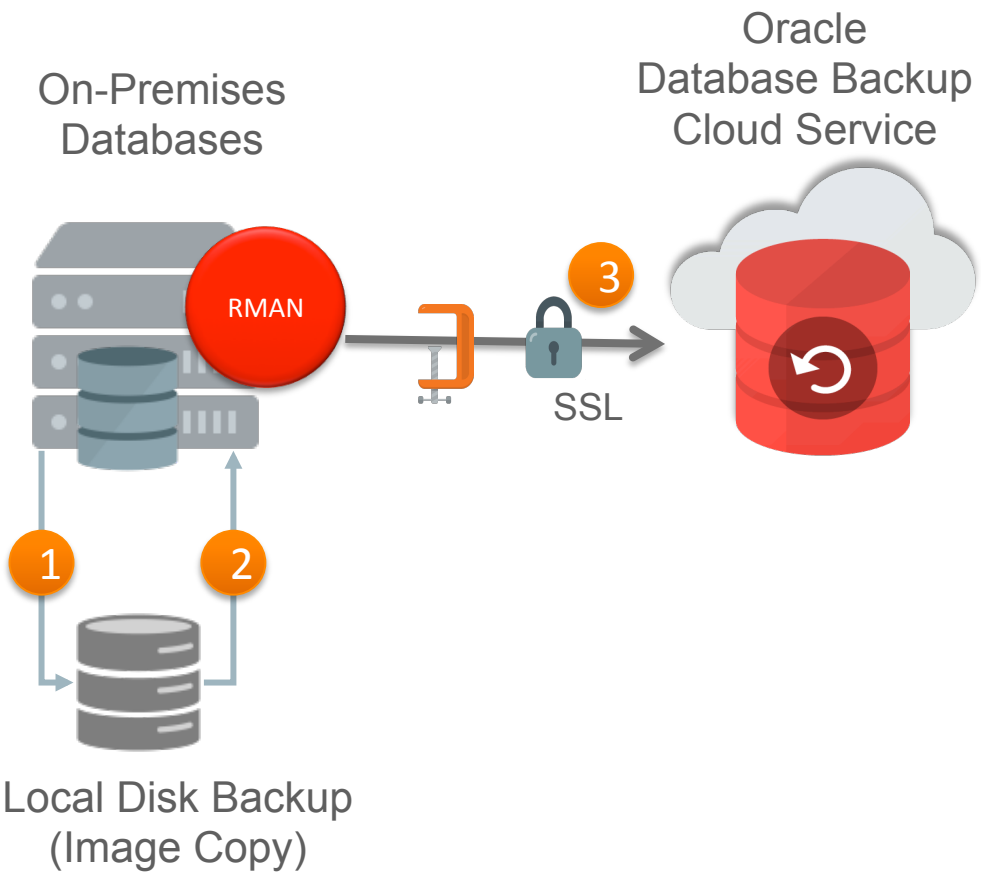
Use Case: Non-Critical Database Backups

- **Scenario**
  - A number of non-critical databases (Test/dev)
  - Database Server connected to internet (directly or via Proxy)
  - Retention requirement : 6 months - 5 years
  - RTO : Hours to Days
  - Data Loss Exposure: As of last backup
- **Solution**
  - Directly backup databases + archived logs to Oracle Cloud over public network
  - Weekly full + Daily Incremental strategy
  - Perform frequent Archived logs backup to reduce data loss exposure



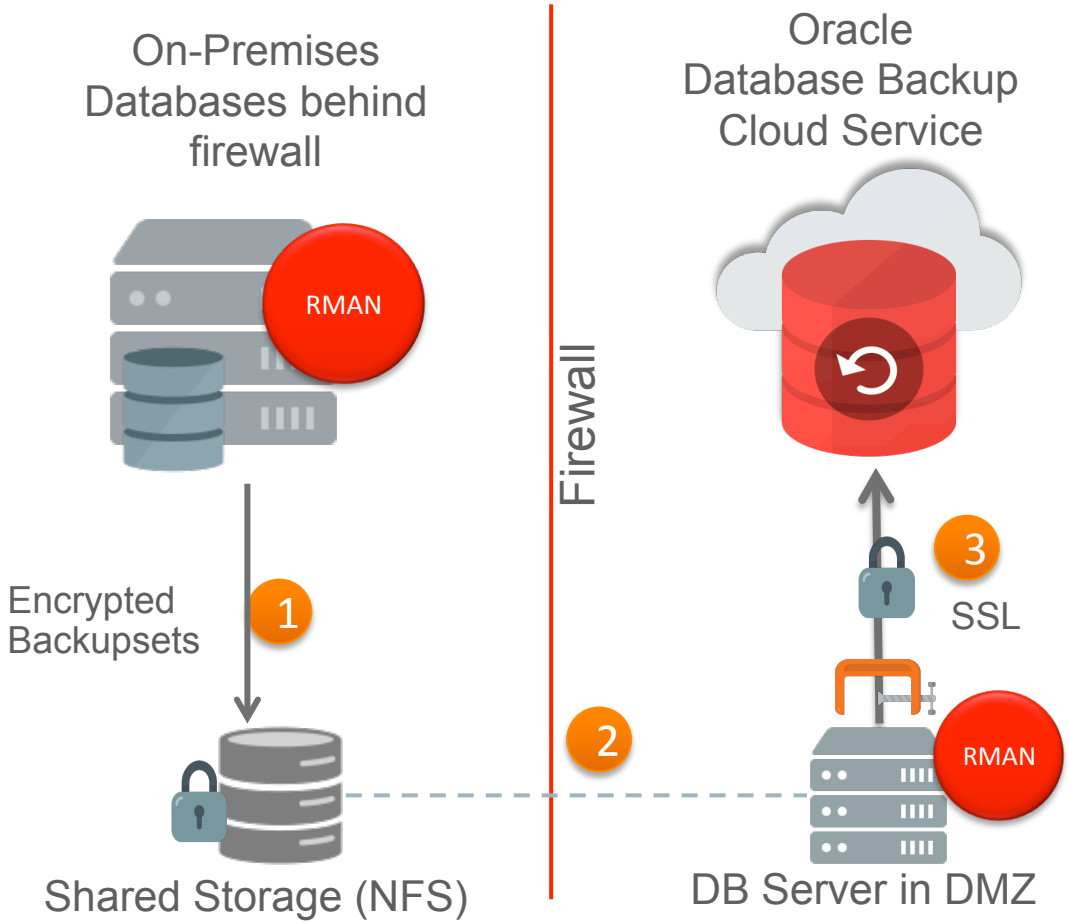
Use Case: Business Critical Database Backups

- **Scenario**
  - A number of business critical production databases
  - Wants to store recent backups on local disk and older backups in the cloud for long term retention
  - Database server is connected to the internet
  - Retention
    - Local disk: 1 month, Cloud: 1-5 years
- **Solution**
  1. Do RMAN image copy backups to local disk
  2. Backup those image copies to the cloud using RMAN from the same DB server



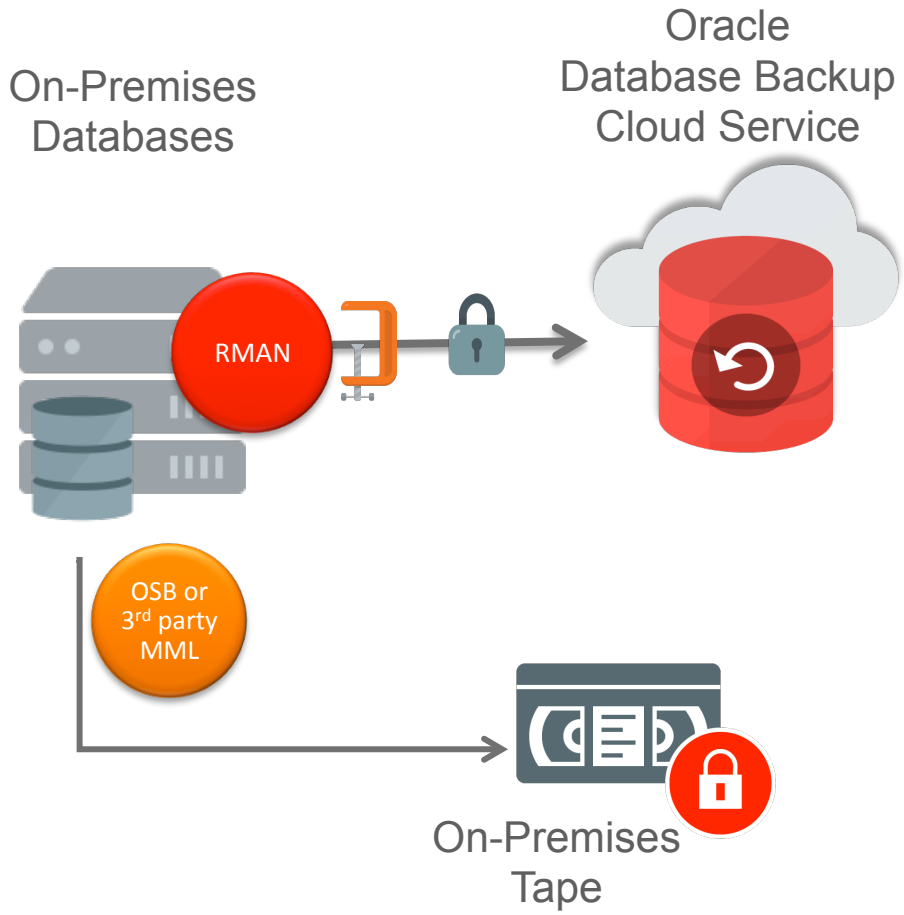
Use Case: DB Server Not Connected to Internet

- **Scenario**
  - A number of business critical databases
  - Wants to store recent backups on local disk and older backups in the cloud for long term retention
  - Database Server is **NOT** connected to the internet
  - Retention
    - Local disk: 1 month, Cloud: 1-5 years
- **Solution**
  1. Perform encrypted BACKUPSET backups to a shared disk (NFS)
  2. Start a database instance in a server that is connected to the internet
  3. Backup encrypted RMAN backups to cloud



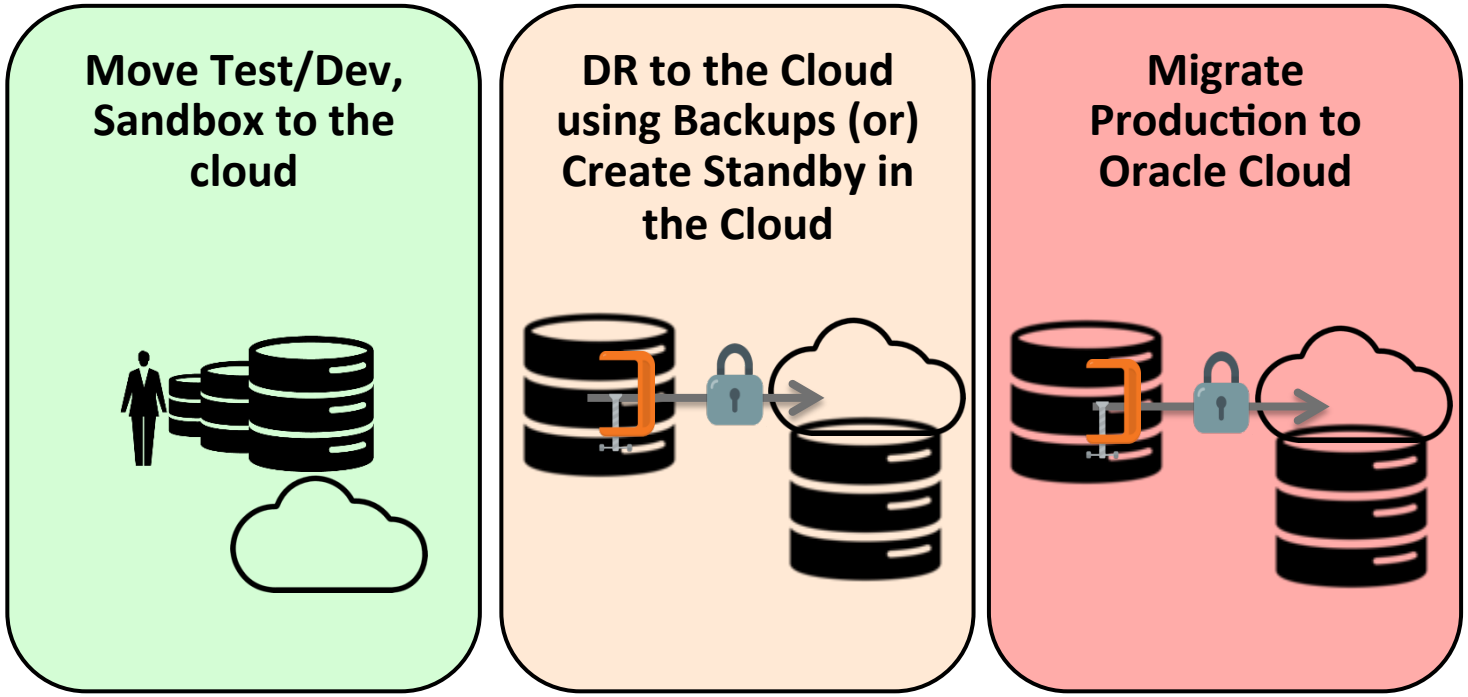
Use Case: Customers already having Tape Backups

- **Scenario**
  - Already has Tape infrastructure & tape software and want to continue to use that for local copies
  - Cloud for offsite storage for long term backup retention
  - Since RMAN uses Tape interface for cloud backups, wondering if cloud backups work along-side of Tape backups
- **Solution**
  - Do not change the existing RMAN Tape configuration
  - Use RMAN Tags (Backup Name) to differentiate cloud & tape backups
  - Backup to Tape and then to cloud(using ALLOCATE CHANNEL option)
    - Cannot simultaneously backup to tape & cloud in a single command



Oracle Database Backup Cloud Service

Additional Use Cases



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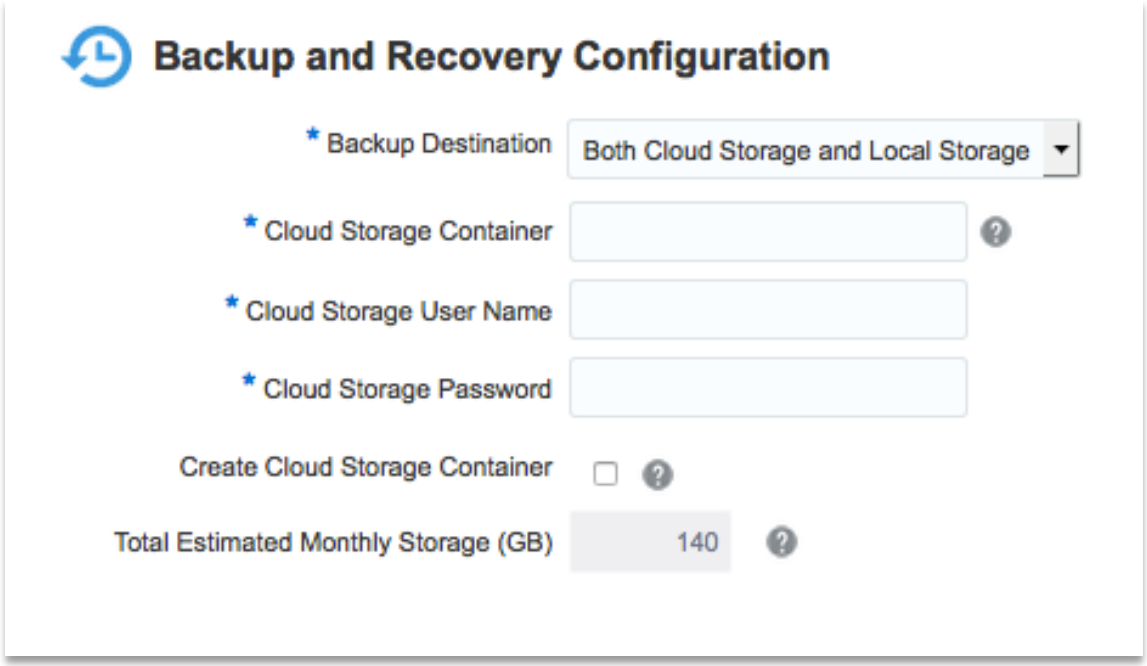
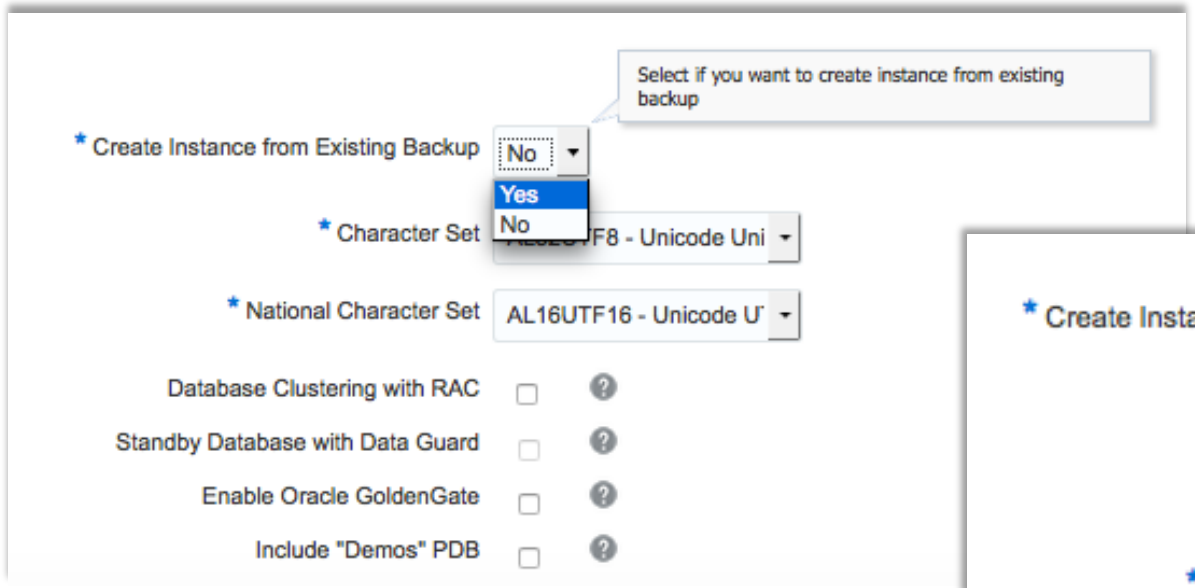
Backup Configuration in Database Cloud Service

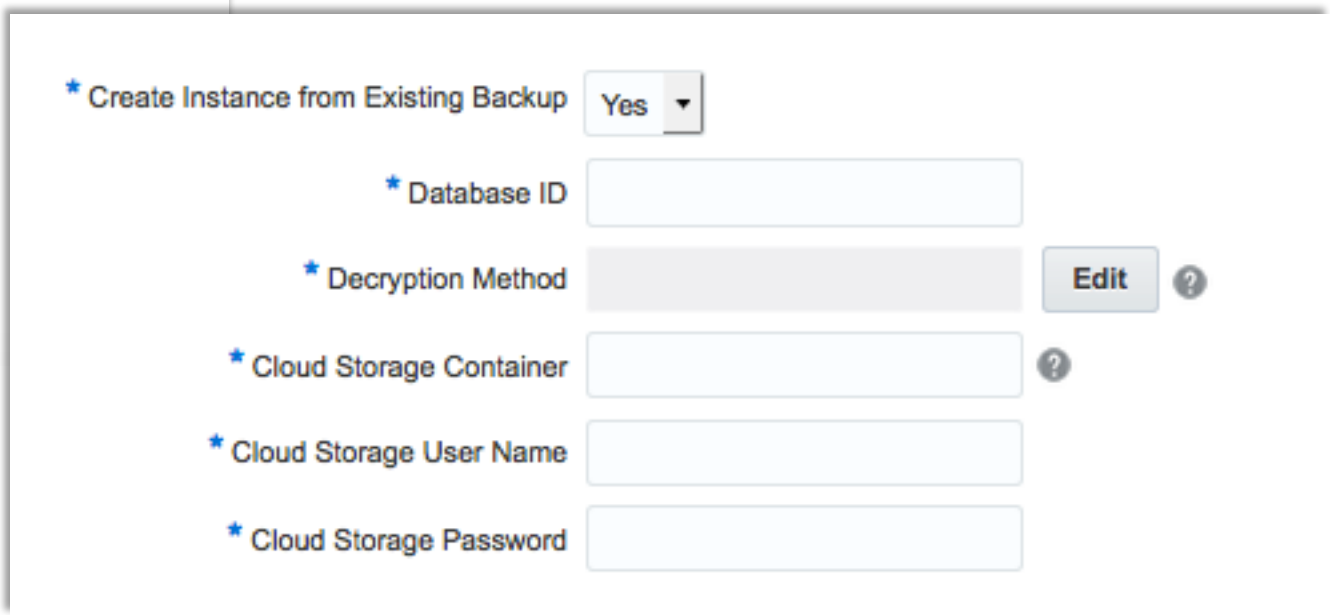
- At Provision Time: Configure Cloud Storage backups for DBCS / ExaCS
  - Cloud & Local Storage (DBCS Only)
    - Local backups for 7 days (Image Copy)
    - Cloud Storage 30 days
  - Cloud Only (DBCS / ExaCS)
    - Cloud Storage for 30 days (Backupset)
- Automated backups done every day
- On-Demand UI/CLI based backup & recovery
  - Recovery: Specific backup / Full / PIT
- Weekly automated RESTORE VALIDATE



Instantiate Database in the Cloud using Backups

Based on On-Premises (or) Cloud Database Backups





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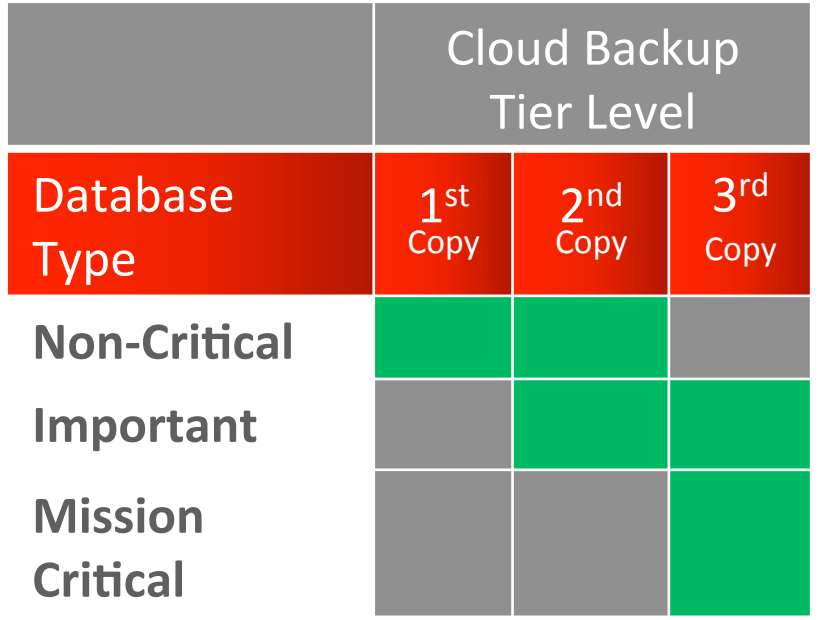
Choosing the Right Backup Strategy for your Databases

Typical Candidates for Cloud Backup

- Database sizes up to low-mid single digit TB
- Relaxed Recovery Time objective
- Direct from database or from disk backups for business-critical databases
- Additional copy of backup data in the cloud

Not Suitable for Cloud Backups

- Very large databases with many TBs of data*
- Strict downtime requirements
- Predictable recovery time requirement*
- Mission-critical databases with cloud backup as the only backup



* For Large Database, choose Oracle Fast Connect

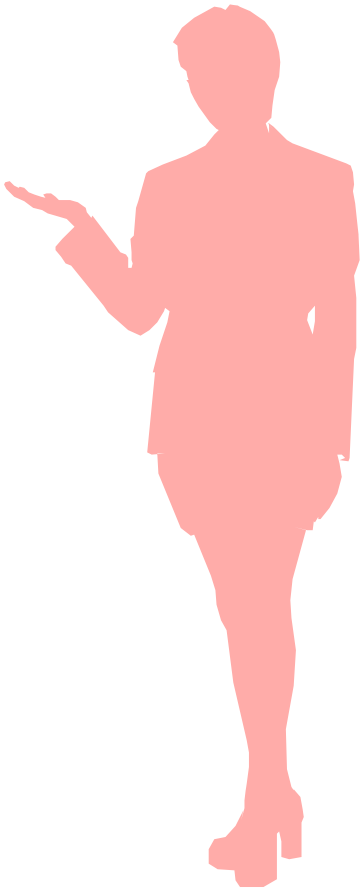
Backup Performance Over WAN

Usual Best Practices to Optimize Data Transfer

- Use RMAN compression (HIGH, MEDIUM, LOW, BASIC)
- Increase PARALLELISM (until you reach maximum network throughput)
- Use MULTISECTION backups
- Refer to MOS Note 2078576.1 for performance investigation
- If public network throughput is not sufficient
  - Oracle Fast Connect (Standard, Partner Edition, MPLS)

Best Practices

- ✓ Choose cloud storage as appropriate storage tier based on RTO/RPO
- ✓ Perform traditional weekly full and daily incremental backups
- ✓ Use Recovery Catalog for long-term retention
- ✓ You may schedule backing up archived logs frequently to reduce RPO
- ✓ Run Installer once in few months to pick up latest RMAN SBT module
- ✓ Run Installer with new credentials after changing Oracle Cloud password
- ✓ Use Global Namespace to access REST endpoint
- ✓ Copy opc<SID>.ora file to other SIDs if same ORACLE_HOME is used by multiple databases
- ✓ Configure CONTROLFILE AUTOBACKUP ON



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Why Backup to Oracle Cloud?

Low Cost

End-to-End Security

Availability

Single Vendor Support On-premises to Cloud

Instantaneously Provisioned

Customer Managed Keys

Scalability / Elastic Storage

Familiar Backup & Recovery Interface

Extending Backups to HA/DR

All in the Cloud (or) On-Premises to Cloud

Using Backups

- RMAN backup to Database Backup Cloud Service
- Longer recovery time and potential data loss depending on the size and the last backup

Using Standby

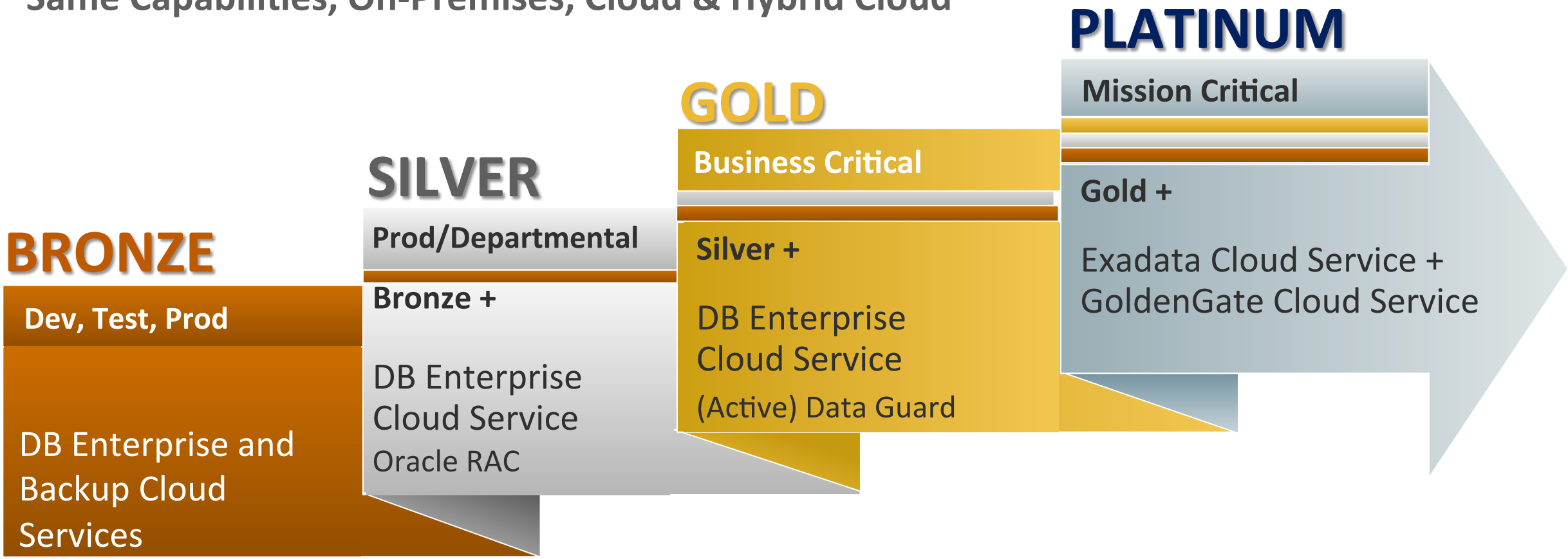
- Real-time replicated data using Data Guard
- Faster failover and low to near-zero data loss

Using Active Standby

- Real-time replicated data using Active Data Guard with read-only capabilities (or) Active-Active multi-master using GoldenGate
- Faster failover and low to near-zero data loss
- Better return on investment with standby used for load balancing, read-only workloads, reporting.

Database High Availability on Oracle Cloud

Same Capabilities, On-Premises, Cloud & Hybrid Cloud



http://www.oracle.com/technetwork/database/availability/maa-reference-architectures-2244929.pdf

Reference

- https://cloud.oracle.com/database_backup
  - Documents under Learn More tab
- Technical White Paper (OTN)
- Data Sheet
- Cloud Documentation (docs.oracle.com/cloud)
- MOS Note 1640149.1 (FAQ)

Example: Sign-up for a Trial

https://cloud.oracle.com/database_backup