Oracle Database (& Applications)
Disaster Recovery in the Cloud

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By 2021, 50% of organizations will augment or replace their current backup application with another solution, compared to what they deployed at the beginning of 2017.

By 2022, 20% of storage systems will be self-protecting, obviating the need for backup applications, up from less than 5% today.

By 2020, 30% of large enterprises will leverage snapshots and backup for more than just operational recovery (e.g., disaster recovery, test/development, DevOps, etc.), up from less than 15% at the beginning of 2017.

By 2020, 30% of organizations will have replaced traditional backup applications with storage- or HCIS-native functions for the majority backup workloads, up from 15% today.

By 2020, the number of enterprises using the cloud as a backup target will double, up from 10% at the beginning of 2017.

By 2021, over 50% of organizations will supplant backup with archiving for long-term data detention, up from 30% in 2017.

By 2019, despite increasing effectiveness of countermeasures, successful ransomware attacks will double in frequency year over year, up from 2 to 3 million in 2016.
Why DR in Cloud?

- Align Cloud Strategy
- No need to setup a duplicate data center, that sits idle.
- Respond quickly to disaster using cloud orchestration and automation tools.
- Need to pay for only the data and resources you consume.
- Full blown DR solutions available to small, medium and large businesses.
- No dependency on legacy software & tape, infrastructure, drives, etc.
- Geographic redundancy
- Long-term retention and multiple tiers of storage to manage cost.
- Create copies of production workloads for dev/test, reporting, analytics and other business processes — all in the cloud.
- Ability to more frequently – and remotely – test DR function in order to validate the ability to recover after a failure at the primary site.
- Significantly decrease recovery time objectives (RTO) and recovery point objectives (RPO).
Two-Tier Backup Infrastructure

- **Performance tier:**
  - Disk backup targets have replaced tape almost completely.
  - As large-capacity solid-state drives (SSDs) become more cost-effective, they will increase their role in the performance tier of the backup target infrastructure.
  - Especially true when the backup target is used for instant recovery.

- **Archive tier or long-term retention tier:**
  - Both disk and enterprise tape libraries will likely coexist for the foreseeable future, especially in large backup environments where backup data exceeds 1PB.
  - In smaller environments, enterprises will gradually remove the tape footprint to simplify operational complexity.
  - Cloud object storage is being positioned by cloud providers as tape replacement.
Cloud Backup & DR Considerations

- Cloud Backup may replace offsite backup solutions
  - Cost – Storage, Egress, Ingress
  - Security
  - Speed
  - RPO & RTO

- Supported Solutions
  - Mostly VMWare, Hyper-V
  - Mostly Linux, Windows
  - Oracle VM Hypervisor?

- Oracle Licensing

- Public vs Hosted Private Clouds

Legacy Tools Can Backup to Cloud

1. De-duplicated backup to Commvault Media Agent (Standard De-duplication Building block design). Short term recovery points are retained on-premise to deliver fast, local-based restores.

2. De-duplicated assisted copy to S3 bucket (DASH Copy) over direct Internet, IPsec VPN tunnel and/or Direct Connect. Recovery points in S3 become an independent, discrete 2nd copy of the data. No gateway/ specialist hardware required (all software-driven).

3. VM Restore & Convert into new EC2 instances, or Application out-of-place restores (ie. SQL, MySQL, Exchange, File) to existing instances. Destination MA can be powered off when not in-use for cost savings.
Modern Tools

Veeam Cloud Connect: Cloud Backup Made Easy

The most efficient way to get backups offsite to a service provider

Veeam® delivers powerful and reliable features and functionality to help you avoid the risk of catastrophic data loss. With Veeam Cloud Connect, you get:

- **Hosted offsite backups:** Get your physical and virtual backups offsite to a hosted cloud repository through a secure SSL connection with no additional Veeam licensing required.
- **Complete visibility and control:** Access and recover data in hosted backup repositories directly from the backup console; track cloud repository consumption and receive reminders for hosted storage renewals.
- **A modern backup architecture:** Leverage Veeam’s modern backup technology, including Backup Copy jobs with Built-in WAN Acceleration, forever incremental backups, GFS (grandfather-father-son) retention policies and more—all built into one product.
- **End-to-end encryption:** Rest easy by encrypting all data at source (before it leaves your network perimeter), in flight and at rest, without negatively impacting the data reduction ratios of built-in compression and WAN Acceleration.

**Veeam Cloud Connect licensing:** Veeam Cloud Connect backup and replication is included within Veeam Availability Suite™, Veeam Backup & Replication™, Veeam Backup Essentials™, and Veeam Agent for Microsoft Windows for all end users at no additional charge and with no additional licensing required. However, you will need to acquire a subscription to the appropriate computer and/or storage resources from a service provider of your choice in order to use it.

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**Oracle Database Replication, Offsite Backup, & Recovery**

Oracle Databases are run in 98% of the Fortune 500 and form the backbone of many critical applications and business operations. Should Oracle Database availability become impacted due to a disaster, human error or logical failure business productivity may be greatly interrupted, data potentially lost, corporate image tarnished and share price potentially devalued. As such, developing a plan to minimize impact of Oracle database downtime with minimal RTO and RPO is important for any organization that leverages this technology.

**Challenges of Protecting Oracle Database Servers**

The protection of Oracle Database Servers is therefore critical to any organization size and their protection made ever more challenging by large amounts of data change being written on a constant basis inside large databases sometimes terabytes in size. Many different BC/DR technologies can be used to protect Oracle Database Servers, common examples being storage based replication, log shipping or database mirroring software. Each of these different technologies introduces the following risks to the recovery of Oracle Database Servers:

- Multiple solutions require separate skill sets relying on the knowledge of individuals to recover Oracle Database Servers also introducing complexity.
- Log shipping and database mirroring software require DBAs to manage and maintain protection in addition being present to manage a disaster recovery plan.

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**The 3-2-1 Rule**

The 3-2-1 rule states that you need to keep three copies of your data, stored on at least two types of media, with one copy being offsite. Getting backups offsite can be challenging due to limited bandwidth, expanding data volumes and a lack of resources required to build or maintain a true offsite backup repository.

With Veeam Cloud Connect, you can master the 3-2-1 rule without dumping money and resources into a second site or adding bandwidth—just leverage cloud backup repository services from a Veeam Cloud & Service Provider and take advantage of Veeam’s Built-in WAN Acceleration technology and so much more.
There are more...

Disaster Recovery for Oracle Database Applications

- **OS & Third-Party Software Licenses** — In order for most disaster recovery solutions to provide robust protection and recovery of Oracle Database, you need to purchase duplicate operating system (OS), Oracle Database, and third-party software licenses to run your Oracle Database in your standby site.

  With CloudEndure Disaster Recovery, you don’t need to purchase duplicate OS or third-party software licenses. Your Oracle Database and all other server data are kept in real-time sync in a dormant “staging area” that is not running any licensed OS or application. In the event of a disaster or drill, your OS (such as Oracle Linux) will be launched on-demand in the target cloud, and you only pay for what you use during the disaster period. In other words, you get robust...
AWS Direct Connect

AWS Direct Connect makes it easy to establish a dedicated network connection from your premises to AWS. Using AWS Direct Connect, you can establish private connectivity between AWS and your datacenter, office, or colocation environment, which in many cases can reduce your network costs, increase bandwidth throughput, and provide a more consistent network experience than Internet-based connections.

AWS Direct Connect lets you establish a dedicated network connection between your network and one of the AWS Direct Connect locations. Using industry standard 802.1q VLANs, this dedicated connection can be partitioned into multiple virtual interfaces. This allows you to use the same connection to access public resources such as objects stored in Amazon S3 using public IP address space, and private resources such as Amazon EC2 instances running within an Amazon Virtual Private Cloud (VPC) using private IP space, while maintaining network separation between the public and private environments. Virtual interfaces can be reconfigured at any time to meet your changing needs.
**Figure 3: Cloud-Based DR Primary Business Drivers**

Q. What are your primary business drivers for implementing or wanting to implement a cloud-based disaster-recovery solution? [Select up to three]
Oracle Database Backup Cloud Service (PaaS)
Low-Cost Offsite Cloud Storage for Oracle Database Backups
Oracle Database Backup Cloud Service

- A secure, scalable, reliable, and on-demand Oracle public cloud storage solution for storing Oracle Database backups
- Offsite Storage
- Easy to deploy
- End-to-end security
- On-demand storage
- Continuous Access
- Provision Test/Dev environments on Oracle Cloud using backup (DR?)
- Database versions: 10.2, 11g, 12c (EE and SE)
Installation & Configuration

- Download the Oracle Database Cloud Backup Module from OTN
- Extract opc_install.jar
- Run the installer
  - `java -jar opc_install.jar -serviceName myService -identityDomain myDomain -opcId 'myAccount@myCompany.com' -opcPass 'myPassword' -walletDir /home/oracle/OPC/wallet -libDir /home/oracle/OPC/lib`
- Setup transparent encryption of backups using Oracle wallet (recommended) or by using a password (not recommended, but simple)
  - `SET ENCRYPTION ON IDENTIFIED BY password ONLY;`
  - `CONFIGURE COMPRESSION ALGORITHM ‘BASIC’;`
- Specify Cloud location in RMAN backup
  - `CONFIGURE CHANNEL DEVICE TYPE sbt PARMS='SBT_LIBRARY=/orclhome/lib/libopc.so, SBT_PARMS=(OPC_PFILE=/orclhome/dbs/opct1.ora)';`
<table>
<thead>
<tr>
<th>File Name</th>
<th>Location</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>libopc.so</td>
<td>User specified library location.</td>
<td>SBT library which enables backup to Oracle Cloud which does REST calls to the cloud</td>
</tr>
<tr>
<td>opc&lt;SID&gt;.ora</td>
<td>$ORACLE_HOME/dbs</td>
<td>Configuration information stored – like REST endpoint, wallet information, custom container etc.</td>
</tr>
<tr>
<td>cwallet.sso</td>
<td>User specified wallet location</td>
<td>Oracle wallet which securely stores backup service credentials. This is used implicitly to authenticate against Oracle cloud during RMAN backups and restore operations.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Database / Features</th>
<th>Supported Versions / Options</th>
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</thead>
<tbody>
<tr>
<td>Oracle Database – Enterprise Edition*</td>
<td>10.2.0.5, 11.1, 11.2, 12c (64 bits)</td>
</tr>
<tr>
<td>Oracle Database – SE/SE1/SE2*</td>
<td>10.2.0.5, 11.1.0.7, 11.2.0.3, and versions 11.2.0.4 and above</td>
</tr>
<tr>
<td>Platforms (64 bits)</td>
<td>Linux, Solaris, SPARC, Windows, HP-UX, AIX, zLinux</td>
</tr>
<tr>
<td>RMAN Compression (Included)</td>
<td>HIGH, MEDIUM, BASIC, LOW (depends on DB version)</td>
</tr>
<tr>
<td>RMAN Encryption (Included)</td>
<td>Password, TDE, Dual-mode</td>
</tr>
</tbody>
</table>
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>';
    ```
End-To-End Flow

$ 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/BA387934/00000001
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

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<thead>
<tr>
<th>Database Type</th>
<th>1st Copy</th>
<th>2nd Copy</th>
<th>3rd Copy</th>
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</thead>
<tbody>
<tr>
<td>Non-Critical</td>
<td></td>
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<tr>
<td>Important</td>
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<td></td>
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<tr>
<td>Mission Critical</td>
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* For Large Database, choose Oracle Fast Connect

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**Essential (free) Tools for DBA**
Thank you!

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