Deploying Hybrid Data Guard on Oracle Cloud

GLOC
Great Lakes Oracle Conference

Axxana
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Cloud Standard

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Yossi Nixon

Chief Database Architect - Axxana

Oracle DBA since 1998

Speaker: IOUG, ILOUG, RMOUG, GLOC, KSCOPE, NYOUG

Specializes in Data Guard, RAC, performance tuning

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Deploying Hybrid Data Guard on Oracle Cloud
Introduction
Disaster recovery on the Oracle Cloud
Environment Prerequisites
Deployment Process
Active Data Guard and Far Sync
Risk distance and a solution
Conclusion
Introduction

- Data Guard and Active Data Guard provides
  - **Data** protection - Recovery Point Objective (RPO)
  - Availability - Recovery time objectives (RTO)
- Why to use Data on the cloud?
  - Disaster recovery plan is costly
  - Existing production databases remain on-premises
  - Standby databases can be used for online reporting, test & development
Hybrid DR to the Oracle Cloud

On-Premises (Production)

- Clients
- Applications
- Databases
  - Active Data Guard (encrypted)

Standby Databases on Public Cloud

- Oracle Public Cloud
- Sandbox Test/Dev in the cloud
- Reporting
- Database Cloud Service
- Database Backup Service
- VPN Gateway
**Environment Prerequisites**

- **OS:** Linux, Windows & Solaris X86, **DB:** EE 64Bit 11.2.0.4, 12.1.0.2, 12.2.0.1
- RAC or non-RAC (Note 413484.1 for Data Guard cross-platform compatibility)
- Same Oracle Database version for primary and standby databases

Data transfers from on-premises to Oracle Cloud:

- Public network
- High bandwidth option (Oracle FastConnect)
- Oracle Network Cloud Service – Site to Site VPN or VPN as a Service (VPNaasS)
Deployment Process – Create an Oracle Instance

Create Instance

 Instance
 Provide basic service instance information.

- Instance Name: standby
- Description: 
- Notification Email: yosi.nixon@axxana.com
- Region: No Preference

Service Level: Oracle Database Cloud Service
Metering Frequency: Hourly
Software Release: Oracle Database 12c Release 2
Software Edition: Enterprise Edition
Database Type: Single Instance

Cancel | Next
### Database Configuration

<table>
<thead>
<tr>
<th>Database Configuration</th>
<th>Backup and Recovery Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB Name: stby</td>
<td>Backup Destination: None</td>
</tr>
<tr>
<td>PDB Name: PDB1</td>
<td></td>
</tr>
<tr>
<td>Administration Password: <em>.........</em></td>
<td>Initialize Data From Backup:</td>
</tr>
<tr>
<td>Confirm Password: <em>.........</em></td>
<td>* Create Instance from Existing Backup: No</td>
</tr>
<tr>
<td>Useable Database Storage (GB): 25</td>
<td></td>
</tr>
<tr>
<td>Total Data File Storage (GB): 88.5</td>
<td></td>
</tr>
<tr>
<td>Compute Shape: OC3 - 1.0 OCPU, 7.5 GB RAM</td>
<td></td>
</tr>
<tr>
<td>Use High Performance Storage</td>
<td></td>
</tr>
</tbody>
</table>

**Advanced Settings**

Selecting ‘None’ for Backup Destination may result in no backups for your service instance.
Database Cloud Configured

Oracle Database Cloud Service

Instances Activity SSH Access

Summary

1 Instances
1 OCPUs
7.5 GB Memory
150 GB Storage
1 Public IPs

As of Apr 9, 2018 1:45:29 PM UTC

Instances

Search by instance name or tags

Create Instance

stby

Version: 12.2.0.1
Edition: Enterprise Edition

Created On: Apr 1, 2018 2:37:55 PM UTC

OCPUs: 1
Memory: 7.5 GB
Storage: 150 GB

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Instance Overview

Overview

1 Node

Administration
1 Patches available
0 Snapshots available

Resources

Host Name: stby
Public IP: [redacted]
SID: stby

Instance Overview

1 Nodes
1 OCPUs
7.5 GB Memory
150 GB Storage

Status: Ready
Version: 12.2.0.1
Edition: Enterprise Edition

Connect String: stby:1521/PDB1
Backup Destination: None
Container Name: stby

Character Set: AL32UTF8 - Unicode Universal
National Character Set: AL16UTF16 - Unicode UTF-16
SQL *Net Port: 1521
Timezone: Coordinated Universal Time

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### Access Rules List

You can use access rules to control network access to service components. On this page, you can manage your access rules.

<table>
<thead>
<tr>
<th>Status</th>
<th>Rule Name</th>
<th>Source</th>
<th>Destination</th>
<th>Ports</th>
<th>Protocol</th>
<th>Description</th>
<th>Rule Type</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>🚭</td>
<td>ora_p2_ssh</td>
<td>PUBLIC-INTERNET</td>
<td>DB_1</td>
<td>22</td>
<td>TCP</td>
<td></td>
<td>DEFAULT</td>
<td></td>
</tr>
<tr>
<td>🚭</td>
<td>ora_p2_http</td>
<td>PUBLIC-INTERNET</td>
<td>DB_1</td>
<td>80</td>
<td>TCP</td>
<td></td>
<td>DEFAULT</td>
<td></td>
</tr>
<tr>
<td>🚭</td>
<td>ora_p2_httpssl</td>
<td>PUBLIC-INTERNET</td>
<td>DB_1</td>
<td>443</td>
<td>TCP</td>
<td></td>
<td>DEFAULT</td>
<td></td>
</tr>
<tr>
<td>🚭</td>
<td>ora_p2_dbconsole</td>
<td>PUBLIC-INTERNET</td>
<td>DB_1</td>
<td>1158</td>
<td>TCP</td>
<td></td>
<td>DEFAULT</td>
<td></td>
</tr>
<tr>
<td>🚭</td>
<td>ora_p2_dbexpress</td>
<td>PUBLIC-INTERNET</td>
<td>DB_1</td>
<td>5500</td>
<td>TCP</td>
<td></td>
<td>DEFAULT</td>
<td></td>
</tr>
<tr>
<td>🚭</td>
<td>ora_p2_dblistener</td>
<td>PUBLIC-INTERNET</td>
<td>DB_1</td>
<td>1521</td>
<td>TCP</td>
<td></td>
<td>DEFAULT</td>
<td></td>
</tr>
<tr>
<td>🚭</td>
<td>sys_infra2db_ssh</td>
<td>PAAS-INFRA</td>
<td>DB_1</td>
<td>22</td>
<td>TCP</td>
<td>DO NOT MODIFY. Permit P...</td>
<td>SYSTEM</td>
<td></td>
</tr>
<tr>
<td>🚭</td>
<td>ora_trusted_hosts</td>
<td>127.0.0.1/32</td>
<td>DB_1</td>
<td>1521</td>
<td>TCP</td>
<td>DO NOT MODIFY. A secure...</td>
<td>SYSTEM</td>
<td></td>
</tr>
</tbody>
</table>
Adding new Access Rule

Create Access Rule

- **Rule Name:** DGonPREM
- **Source:** <custom>
- **Destination:** DB_1
- **Destination Port(s):** 1521
- **Protocol:** TCP

This operation may take some time.
On-Premises - Access & prompt-less SSH

- Configure Access
- Configure Name Resolution
- prompt-less SSH:
  - **Oracle Cloud**: Generate the ssh key and copy the file to the On-Premises
    
    ```
    $ ssh-keygen
    $ scp ~/.ssh/id_rsa.pub oracle@<onpremisesIP>:~/.ssh/id_rsa.pub_cloud
    ```

  - **On-Premises**: Copy the generated key to the `authorized_users` file
    
    ```
    $ cat ~/.ssh/id_rsa.pub_cloud >> ~/.ssh/authorized_users
    $ chmod 700 ~/.ssh/authorized_users
    ```
On-Premises – SSH login

Connect to the provisioned cloud instance:

```
$ ssh opc@<cloudip> [-i <key>]
```

Switch to root:

```
[opc@stby ~]$ sudo su -
```
Check the TCP socket sizes on Oracle Cloud & On-Premises:

run as root

```
# /sbin/sysctl -a | egrep net.core.[w,r]mem_max
net.core.wmem_max = 2097152
net.core.rmem_max = 4194304

# /sbin/sysctl -a | egrep net.core.[w,r]mem_max
net.core.wmem_max = 1048576
net.core.rmem_max = 4194304
```

If needed adjust sockets size maximums to 10MB on Oracle Cloud:

```
# sysctl -w net.core.rmem_max=10485760
# sysctl -w net.core.wmem_max=10485760
```
On-premises and cloud machines

- sqlnet.ora

```sql
SQLNET.ENCRYPTION_SERVER = requested
SQLNET.CRYPTO_CHECKSUM_SERVER = requested
SQLNET.CRYPTO_CHECKSUM_TYPES_SERVER = (SHA1)
SQLNET.ENCRYPTION_TYPES_SERVER = (AES256, AES192, AES128)

SQLNET.ENCRYPTION_CLIENT = requested
SQLNET.CRYPTO_CHECKSUM_CLIENT = requested
SQLNET.ENCRYPTION_TYPES_CLIENT = (AES256, AES192, AES128)
```
Patch differences between databases software homes must be:

**Standby-First compatible**, the latest patch on both databases.

```
[oracle@stby ~]$ $ORACLE_HOME/OPatch/opatch lspatches
26569225;
24701882;
26389300;
26272761;
24401351;
26635944;OJVM RELEASE UPDATE: 12.2.0.1.171017 (26635944)
26710464;Database Release Update : 12.2.0.1.171017 (26710464)
```

OPatch succeeded.

**Note 1265700.1 on Data Guard**

**Standby-First patch apply**
On-Premises - Standby Redo Logs

- SRLs – Standby Redo Logs
- ORLs – Online Redo Logs

- SRLs size = largest of ORLs (preferred to be uniform size)

- Number of SRLs = number of ORLs + 1 for each thread (Per Instance)

- SRLs should have same number of threads as ORLs

- Best practice is that SRLs are not duplexed like ORLs
alter system set DB_CREATE_ONLINE_LOG_DEST_1='&DISK_GROUP.';

declare
    log_num number;
    log_size number;
    log_num_standby number;
begin
for j in (select THREAD# i from gv$log group by THREAD#) loop
    select count(*) into log_num from gv$log where THREAD#=j.i;
    select count(*) into log_num_standby from gv$standby_log where THREAD#=j.i;
    select max(BYTES) into log_size from gv$log where THREAD#=j.i;
    for i in 1..(log_num+1-log_num_standby) loop
        execute immediate 'ALTER DATABASE ADD STANDBY LOGFILE THREAD ||j.i ||' SIZE ||log_size;
    end loop;
end loop;
end;
/

SRLs are not duplexed
Number of Threads
Logs Per Tread
Maximum Size of ORLs
Bypass Already Created SRLs
On-Premises: Grid Infrastructure, TDE & Archive mode

- Grid infrastructure / Oracle Restart has become an integral part of the application failover features for Oracle Data Guard
- The installation software for Oracle Grid infrastructure is not present on the cloud service
- Enable Archive Log Mode
- Convert Database to use Transparent Data Encryption
Prepare the Cloud Environment

- Verify Oracle Home and Patches
- Remove the Default Database

```
dbca -silent -deleteDatabase -sourceDB STBY -sysDBAUserName sys -sysDBAPassword <passwd>
```

- Install the Grid Infrastructure (if not already installed)
- Set TCP Socket Buffer Size
- Cloud Oracle Net Encryption Configuration
Setting tnsnames.ora

Configure TNS entries for redo transport – Primary/Standby

```
<primary/standby db_unique_name> =
  (DESCRIPTION =
    (SDU=65536)
    (RECV_BUF_SIZE=10485760)
    (SEND_BUF_SIZE=10485760)
    (ADDRESS = (PROTOCOL = TCP)(HOST = <primary/standby IP address>)(PORT = {<port#>}))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = <primary/standby db_unique_name>)
    )
  )
```
Setting listener.ora

Configure static listeners on the Cloud

```
SID_LIST_LISTENER =
(SID_LIST =
  (SID_DESC =
    (GLOBAL_DBNAME = <Local Instance name>_DGMGRL)
    (ORACLE_HOME = <Local Oracle Home>)
    (SID_NAME = <Local Instance Name>)
  )
)

$ORACLE_HOME/bin/lsnrctl reload <listener name>
```

On 11.2 - a static listener is required for Data Guard Broker
Preparing Auxiliary Database

Create Audit Directory

```bash
mkdir -p /u01/app/oracle/admin/<STANDBY_DBNAME>/adump
```

Create Auxiliary Database, Password File and init.ora

```bash
$ $ORACLE_HOME/bin/orapwd file='$ORACLE_HOME/dbs/orapwd<INSTANCE_NAME>'
password=${passwd} force=y
$ echo "db_name=<primary db_name>" > /tmp/aux.pfile
$ echo "db_unique_name=<standby db_name>" >> /tmp/aux.pfile
$ echo "sga_target=800M" >> /tmp/aux.pfile
```

Start the Auxiliary Instance

```bash
$ export ORACLE_SID=<standby instance name (STBY)>
$ sqlplus "/ as sysdba"
SQL> startup nomount pfile='/tmp/aux.pfile'
ORACLE instance started.
```
Duplicate Database from On-Premises to Cloud

- **Distribute TDE wallets**

  Copy the TDE wallet files from on-premises to the cloud to ENCRYPTION_WALLET_LOCATION directory (defined in sqlnet.ora file)

- **Instantiate, creating standby database using RMAN DUPLICATE**

  RMAN> ... duplicate target database for standby from active database

  spfile

  PARAMETER_VALUE_CONVERT= '<PREMISES DB NAME>', '<CLOUD DB NAME>'

  set db_unique_name='<CLOUD DB NAME>' ...

- **Set these additional parameters**

  alter system set DB_FLASHBACK_RETENTION_TARGET=120 scope=both sid='*';
  alter system set remote_login_passwordfile='exclusive' scope=spfile sid='*';
  alter system set DB_BLOCK_CHECKSUM=FULL; (FULL for inmemory checksum, performance impact)
  alter system set DB_BLOCK_CHECKING=MEDIUM; (FULL if performance allows it)
  alter system set DB_LOST_WRITE_PROTECT=TYPICAL;
  alter system set LOG_BUFFER=256M scope=spfile sid='*';
  alter system set STANDBY_FILE_MANAGEMENT=AUTO;
Register the standby database Oracle Restart

$ srvctl add database -d <standby db_unique_name> -c SINGLE <result of hostname -s> -oh <oracle home> -r physical_standby -s <mount|open>

Configure client Failover
Clients can reconnect to the active primary database after a failure

Configure Data Guard Broker

SQL> alter system set dg_broker_start=FALSE;
SQL> alter system set dg_broker_config_file1=’<PREMISES_FILE_LOC>/<CLOUD DB NAME>/dr1.dat’;
SQL> alter system set dg_broker_config_file2=’<PREMISES_RECOV_LOC>/<CLOUD DB NAME>/dr2.dat’;
SQL> alter system set dg_broker_start=TRUE;
Data Guard Broker Configuration

dgmgrl sys/<passwd>@<PREMISES>

create configuration 'DGconfig' as primary database is <PREMISES> connect identifier is <PREMISES>;

add database <CLOUD> as connect identifier is <CLOUD>;

edit database <PREMISES> set property RedoRoutes='(LOCAL: <CLOUD> ASYNC)';
edit database <CLOUD> set property RedoRoutes='(LOCAL:<PREMISES> ASYNC)';
RedoRoutes - not relevant for 11g

EDIT CONFIGURATION SET PROTECTION MODE AS MaxPerformance;

enable configuration;
Data Guard Health Check

Data Guard specific queries

SQL> select thread#, count(group#) from v$log group by thread#;

SRL >= ORL per Thread

SQL> select distinct bytes from v$log;

Same single value

SQL> select distinct bytes from v$standby_log;

Same single value

SQL> select group#, count(member) from v$logfile where type='STANDBY' group by group#;

one for all groups

SQL> select flashback_on from v$database;

YES

SQL> select force_logging from v$database;

YES

SQL> show parameter checking

remote destinations + threads/instances

SQL> show parameter log_archive_max_processes
Data Guard VALIDATE DATABASE

DGMGRL> validate database stby;

Database Role: Physical standby database
Protection Mode: MaxAvailability
Primary Database: pdb

Ready for Switchover: Yes
Ready for Failover: Yes (Primary Running)
Active Data Guard with Far Sync

RMAN>
CONFIGURE ARCHIVELOG DELETION POLICY TO APPLIED ON ALL STANDBY;

DGMGRL>
EDIT CONFIGURATION SET PROTECTION MODE AS MAXAVALAILABILITY;

Primary

Alternate

Far Sync

ASYNC

SYNC

Standby
SQL > ALTER DATABASE CREATE FAR SYNC INSTANCE
CONTROLFILE AS '/tmp/farsync.ctl';
SQL > create pfile='/tmp/initfs.ora' from spfile;

SQL > ALTER DATABASE ADD STANDBY LOGFILE THREAD 2
SIZE 52428800;
SQL > create spfile from pfile='/tmp/initfs.ora';

DGMGRL> ADD FAR_SYNC fs AS CONNECT IDENTIFIER IS fs;

DGMGRL> EDIT DATABASE pdb SET PROPERTY RedoRoutes = '(LOCAL : fs SYNC ALT = (sdb ASYNC FALLBACK))';

DGMGRL> EDIT DATABASE pdb SET PROPERTY RedoRoutes = '(LOCAL : fs SYNC PRIORITY=1, sdb ASYNC PRIORITY=2 ) )';

Distance Risk

Distance Between Primary and Standby/Far Sync

- Local disaster (=Data Loss)
  - Short

- Increased latency
  - Costly lines
  - Additional Data Center Link Failure Risk (=Data Loss)
  - Long
Axxana – Transparent Layered Protection

Physical Protection
- Multiple Network Connectivity
  - WAN, LAN, Wi-Fi, 4G

Battery Powered

Data Safe
- PhoenixOS Smart DR

Managed by the User

Transparency Managed by Axxana

Far Sync Virtual Machine
Active Data Guard Far Sync with Axxana

Zero Distance SYNC

Recovery over Cellular/1GbE/10GbE

ASYNC over 10GbE

Far Sync/Multiplexed Redo

Protected By Axxana

Primary

Remote Standby
Conclusion

Disaster Recovery on the Oracle Cloud

- Eliminates costs and complexity

Data Guard or Active Data Guard

- Eliminates downtime potential risk

Axxana’s Solution

- True zero data loss in the hybrid cloud
Hybrid DR to Oracle Cloud – [https://www.oracle.com/assets/dr-to-oracle-cloud-2615770.pdf](https://www.oracle.com/assets/dr-to-oracle-cloud-2615770.pdf)


Questions?