Step-By-Step Guide to Create Physical Standby Database Using RMAN Backup and Restore

Switchover, Switchback and Failover operations have been tested using Data Guard Broker.

I have tested these steps with two VirtualBox VMs. Each machine having 7 GB RAM and 2000 MB SGA.

Prerequisites and Assumptions to get started

- You have two servers (VirtualBox VMs) with an Operating System and Oracle installed on them. In this scenario I have already deployed Oracle Database 19c on Oracle Linux 7.9
- On the Primary Site there already exists a Primary Database you want to create your Standby Database for
- The Primary Database is using an SPFILE
- On the Standby Site ORACLE_HOME is installed using the same Oracle Release and Patch Level
- There is Network Connectivity between the Primary and Standby Systems. If you are using the default port 1521, node 1 should be able to communicate to node 2 on 1521 and node 2 should be able communicate to node 1 on 1521. Check network and local firewalls are not blocking the communication.
- Identical directory structure is used for Primary and Standby databases

Environment Information:

OS: Oracle Linux Server 7.9 64-bit

Hostname (Primary): ol7-19-dg1.locadomain

Hostname (Standby): ol7-19-dg2.locadomain

Database Version: 19.3.0.0.0

DB_NAME (Primary and Standby): cdb1

Listener Port (Primary and Standby): 1521

SID/DB_UNIQUE_NAME (Primary): cdb1

Oracle Net Service Name (Primary): cdb1

SID (Standby): cdb1

DB_UNIQUE_NAME/Oracle Net Service Name (Standby): cdb1_stby

The DB_NAME of the Standby database will be the same as that of the Primary database, but it must have a different DB_UNIQUE_NAME value. For this deployment, the Standby database will have the value "cdb1_stby".

Preparing the Primary Database for Standby Database Creation

Check that the primary database is in archivelog mode.

```
SQL> select log_mode from v$database;


LOG_MODE
------------
NOARCHIVELOG
```

If archiving is not enabled, then you must put the primary database in ARCHIVELOG mode and enable automatic archiving. Issue the following SQL statements:

```
SQL> SHUTDOWN IMMEDIATE;
SQL> STARTUP MOUNT;
SQL> ALTER DATABASE ARCHIVELOG;
SQL> ALTER DATABASE OPEN;
```

Determine if FORCE LOGGING is enabled. If it is not enabled, enable FORCE LOGGING mode. This statement may take some time to complete, because it waits for all unlogged direct write I/O to finish. Use SQL*Plus to execute the following commands:

```
SQL> SELECT force_logging FROM v$database;
FORCE_LOGGING
---------------------------------------
NO

SQL> ALTER DATABASE FORCE LOGGING;
Database altered.
```

Configure the Fast Recovery Area:

```
SQL> show parameter db_recovery_file

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
db_recovery_file_dest                string
db_recovery_file_dest_size           big integer 0

SQL> !echo $ORACLE_BASE
/u01/app/oracle

SQL> !mkdir /u01/app/oracle/fast_recovery_area

SQL> ALTER SYSTEM SET db_recovery_file_dest_size='60G';

System altered.

SQL> ALTER SYSTEM SET db_recovery_file_dest='/u01/app/oracle/fast_recovery_area';

System altered.
```

Create standby redo logs on the Primary database (in case of switchovers). Standby redolog is mandatory for real-time apply. The size of standby redo log should be same as that of online redo log and there MUST be one extra sandby group per thread compared to the online redo logs. In my case, the following standby redo logs must be created on both servers.

Check Group# and Size on Primary:

```
SQL> SELECT GROUP#, THREAD#, BYTES, MEMBERS FROM V$LOG;

    GROUP#    THREAD#      BYTES    MEMBERS
---------- ---------- ---------- ----------
         1          1  209715200          1
         2          1  209715200          1
         3          1  209715200          1

SQL>

SQL> alter database add standby logfile thread 1 group 4 size 209715200;

Database altered.
```

SQL> alter database add standby logfile thread 1 group 5 size 209715200;

Database altered.

SQL> alter database add standby logfile thread 1 group 6 size 209715200;

Database altered.

SQL> alter database add standby logfile thread 1 group 7 size 209715200;

Database altered.

SQL>

Set Primary Database Initialization Parameters

On the primary database, you define initialization parameters that control redo transport services while the database is in the primary role.

There are additional parameters you need to add that control the receipt of the redo data and apply services when the primary database is transitioned to the standby role.

*.db_name='cdb1'

*.db_unique_name='cdb1'

*.log_archive_config='dg_config=(cdb1,cdb1_stby)'

*.log_archive_dest_1='LOCATION=USE_DB_RECOVERY_FILE_DEST VALID_FOR=(ALL_LOGFILES,ALL_ROLES) DB_UNIQUE_NAME=cdb1'

*.log_archive_dest_2='SERVICE=cdb1_stby ASYNC VALID_FOR=(ONLINE_LOGFILES,PRIMARY_ROLE) DB_UNIQUE_NAME=cdb1_stby'

*.remote_login_passwordfile='EXCLUSIVE'

*.log_archive_format='%t_%s_%r.arc'

*.FAL_SERVER=cdb1_stby

*.standby_file_management=AUTO

SQL> create pfile from spfile;

File created.

SQL> exit

Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

[oracle@ol7-19-dg1 ~]$

[oracle@ol7-19-dg1 dbs]$ cat initcdb1.ora

cdb1.__data_transfer_cache_size=0

cdb1.__db_cache_size=0

cdb1.__inmemory_ext_roarea=0

cdb1.__inmemory_ext_rwarea=0

cdb1.__java_pool_size=0

cdb1.__large_pool_size=0

cdb1.__oracle_base='/u01/app/oracle'#ORACLE_BASE set from environment

cdb1.__pga_aggregate_target=1073741824

cdb1.__sga_target=2000m

cdb1.__shared_io_pool_size=134217728

cdb1.__shared_pool_size=0

cdb1.__streams_pool_size=0

cdb1.__unified_pga_pool_size=0

*.audit_file_dest='/u01/app/oracle/admin/cdb1/adump'

*.audit_trail='db'

*.compatible='19.0.0'

*.control_files='/u02/oradata/CDB1/control01.ctl','/u02/oradata/CDB1/control02.ctl'

*.db_block_size=8192

*.db_create_file_dest='/u02/oradata'

*.db_name='cdb1'

*.db_unique_name='cdb1'

*.db_recovery_file_dest_size=64424509440

*.db_recovery_file_dest='/u01/app/oracle/fast_recovery_area'

*.diagnostic_dest='/u01/app/oracle'

*.dispatchers='(PROTOCOL=TCP) (SERVICE=cdb1XDB)'

*.enable_pluggable_database=true

*.log_archive_config='dg_config=(cdb1,cdb1_stby)'

*.log_archive_dest_1='LOCATION=USE_DB_RECOVERY_FILE_DEST VALID_FOR=(ALL_LOGFILES,ALL_ROLES) DB_UNIQUE_NAME=cdb1'

*.log_archive_dest_2='SERVICE=cdb1_stby ASYNC VALID_FOR=(ONLINE_LOGFILES,PRIMARY_ROLE) DB_UNIQUE_NAME=cdb1_stby'

*.log_archive_format='%t_%s_%r.arc'

*.nls_language='AMERICAN'

*.nls_territory='AMERICA'

*.open_cursors=300

*.pga_aggregate_target=1024m

*.processes=300

*.remote_login_passwordfile='EXCLUSIVE'

*.sga_target=2000m

*.FAL_SERVER=cdb1_stby

*.standby_file_management=AUTO

*.undo_tablespace='UNDOTBS1'

[oracle@ol7-19-dg1 dbs]$

[oracle@ol7-19-dg1 dbs]$ sqlplus / as sysdba

SQL*Plus: Release 19.0.0.0.0 - Production on Sat Sep 9 05:49:43 2023

Version 19.3.0.0.0

Connected to:

Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

SQL> !cp -p spfilecdb1.ora spfilecdb1.ora.bkp

SQL> shutdown immediate;

Database closed.

Database dismounted.

ORACLE instance shut down.

SQL> create spfile from pfile;

File created.

```
SQL> startup;
ORACLE instance started.

Total System Global Area 3221223152 bytes
Fixed Size                 9139952 bytes
Variable Size            687865856 bytes
Database Buffers        2516582400 bytes
Redo Buffers               7634944 bytes
Database mounted.
Database opened.
SQL>
```

Service Setup

Entries for the Primary and Standby databases are needed in the "$ORACLE_HOME/network/admin/tnsnames.ora" files on both servers. You can create these using the Network Configuration Assistant (netca) utility or manually. The following entries were used during this setup. Notice the use of the SID, rather than the SERVICE_NAME in the entries. This is important, as the broker will need to connect to the databases when they are down, so the services will not be present.

```
CDB1 =
  (DESCRIPTION =
    (ADDRESS_LIST =
      (ADDRESS = (PROTOCOL = TCP)(HOST = ol7-19-dg1.localdomain)(PORT = 1521))
    )
    (CONNECT_DATA =
      (SID = cdb1)
    )
  )

CDB1_STBY =
  (DESCRIPTION =
    (ADDRESS_LIST =
      (ADDRESS = (PROTOCOL = TCP)(HOST = ol7-19-dg2.localdomain)(PORT = 1521))
    )
    (CONNECT_DATA =
      (SID = cdb1)
    )
  )
```

The "$ORACLE_HOME/network/admin/listener.ora" file on the primary server contains the following configuration.

```
LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = ol7-19-dg1.localdomain)(PORT = 1521))
      (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1521))
    )
  )

SID_LIST_LISTENER =
  (SID_LIST =
```

```
  (SID_DESC =
    (GLOBAL_DBNAME = cdb1_DGMGRL)
    (ORACLE_HOME = /u01/app/oracle/product/19.0.0/dbhome_1)
    (SID_NAME = cdb1)
    (ENVS="TNS_ADMIN=/u01/app/oracle/product/19.0.0/dbhome_1/network/admin")
  )
)
```

ADR_BASE_LISTENER = /u01/app/oracle

Copy the network configuration files from primary server to standby server.

```
[oracle@ol7-19-dg1 admin]$ scp *.ora ol7-19-dg2:/u01/app/oracle/product/19.0.0/dbhome_1/network/admin
The authenticity of host 'ol7-19-dg2 (192.168.56.7)' can't be established.
ECDSA key fingerprint is SHA256:qsjlWTTB7lOicJimB3GZM9LDV7PRFaIaSZyr5D4CMBo.
ECDSA key fingerprint is MD5:bf:2d:fd:cd:7e:b7:a9:e6:e3:e7:37:87:53:00:69:3b.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'ol7-19-dg2,192.168.56.7' (ECDSA) to the list of known hosts.
oracle@ol7-19-dg2's password:
listener.ora                                  100%  650   446.6KB/s   00:00
sqlnet.ora                                    100%  195   197.0KB/s   00:00
tnsnames.ora                                  100%  518   578.6KB/s   00:00
[oracle@ol7-19-dg1 admin]$
```

The "$ORACLE_HOME/network/admin/listener.ora" file on the standby server contains the following configuration. Since the broker will need to connect to the database when it is down, we cannot rely on auto-registration with the listener, hence the explicit entry for the database.

```
LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = ol7-19-dg2.localdomain)(PORT = 1521))
      (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1521))
    )
  )

SID_LIST_LISTENER =
  (SID_LIST =
    (SID_DESC =
      (GLOBAL_DBNAME = cdb1_stby_DGMGRL)
      (ORACLE_HOME = /u01/app/oracle/product/19.0.0/dbhome_1)
      (SID_NAME = cdb1)
      (ENVS="TNS_ADMIN=/u01/app/oracle/product/19.0.0/dbhome_1/network/admin")
    )
  )

ADR_BASE_LISTENER = /u01/app/oracle
```

Once the listener.ora changes are in place, restart the listener on both servers.

lsnrctl stop

lsnrctl start

Make sure the SQL*NET connection from primary to standby and vice versa is working.

```
oracle@ol7-19-dg1:~
[oracle@ol7-19-dg1 ~]$ tnsping cdb1

TNS Ping Utility for Linux: Version 19.0.0.0.0 - Production on 09-SEP-2023 07:34:29

Copyright (c) 1997, 2019, Oracle.  All rights reserved.

Used parameter files:
/u01/app/oracle/product/19.0.0/dbhome_1/network/admin/sqlnet.ora


Used TNSNAMES adapter to resolve the alias
Attempting to contact (DESCRIPTION = (ADDRESS_LIST = (ADDRESS = (PROTOCOL = TCP)(HOST = ol7-19-dg1.localdomain)(PORT = 1521))) (CONNECT_DATA = (SID =
db1)))
OK (0 msec)
[oracle@ol7-19-dg1 ~]$ tnsping cdb1_stby

TNS Ping Utility for Linux: Version 19.0.0.0.0 - Production on 09-SEP-2023 07:34:33

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Used parameter files:
/u01/app/oracle/product/19.0.0/dbhome_1/network/admin/sqlnet.ora


Used TNSNAMES adapter to resolve the alias
Attempting to contact (DESCRIPTION = (ADDRESS_LIST = (ADDRESS = (PROTOCOL = TCP)(HOST = ol7-19-dg2.localdomain)(PORT = 1521))) (CONNECT_DATA = (SID =
db1)))
OK (0 msec)
[oracle@ol7-19-dg1 ~]$
```

```
oracle@ol7-19-dg2:/u01/app/oracle/product/19.0.0/dbhome_1/dbs
[oracle@ol7-19-dg2 dbs]$ tnsping cdb1

TNS Ping Utility for Linux: Version 19.0.0.0.0 - Production on 09-SEP-2023 07:34:57

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Used parameter files:
/u01/app/oracle/product/19.0.0/dbhome_1/network/admin/sqlnet.ora


Used TNSNAMES adapter to resolve the alias
Attempting to contact (DESCRIPTION = (ADDRESS_LIST = (ADDRESS = (PROTOCOL = TCP)(HOST = ol7-19-dg1.localdomain)(PORT = 1521))) (CONNECT_DATA = (SID = cdb1)))
OK (0 msec)
[oracle@ol7-19-dg2 dbs]$ tnsping cdb1_stby

TNS Ping Utility for Linux: Version 19.0.0.0.0 - Production on 09-SEP-2023 07:35:05

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Used parameter files:
/u01/app/oracle/product/19.0.0/dbhome_1/network/admin/sqlnet.ora


Used TNSNAMES adapter to resolve the alias
Attempting to contact (DESCRIPTION = (ADDRESS_LIST = (ADDRESS = (PROTOCOL = TCP)(HOST = ol7-19-dg2.localdomain)(PORT = 1521))) (CONNECT_DATA = (SID = cdb1)))
OK (0 msec)
[oracle@ol7-19-dg2 dbs]$
```

Steps for Creating a Physical Standby Database

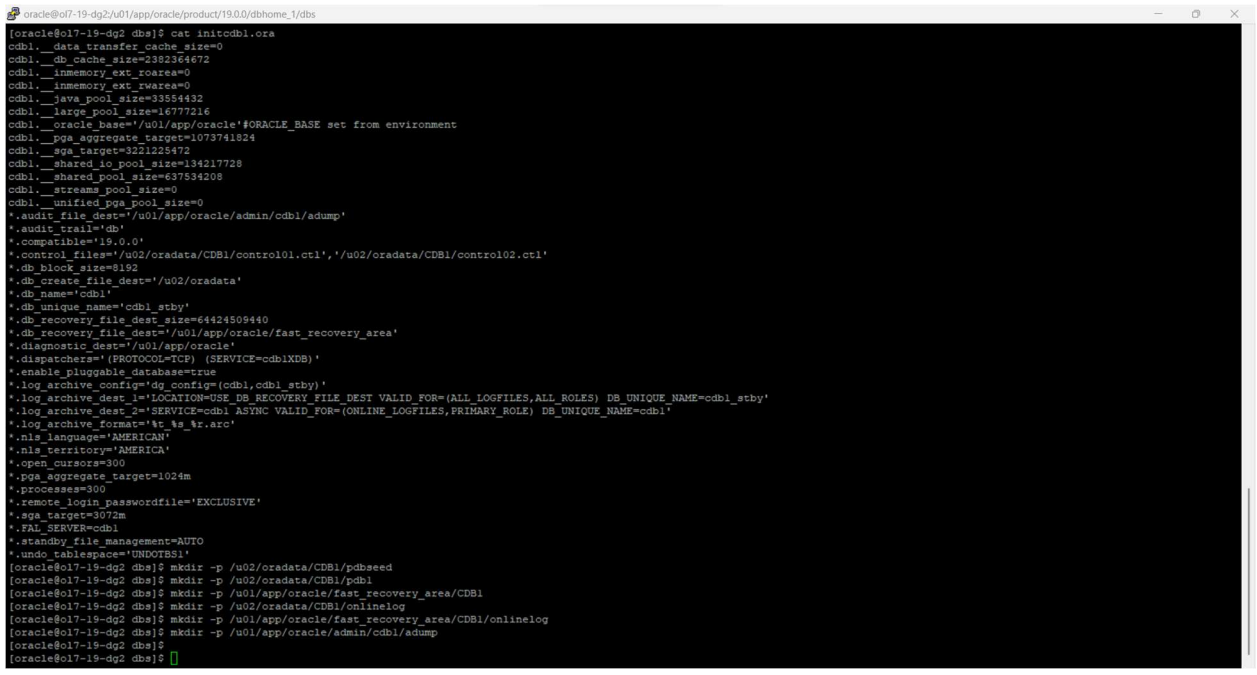
1. Copy the password file and initialization parameter file from Primary database server to Standby database server using scp command.

```
oracle@ol7-19-dg1:/u01/app/oracle/product/19.0.0/dbhome_1/dbs
[oracle@ol7-19-dg1 dbs]$ pwd
/u01/app/oracle/product/19.0.0/dbhome_1/dbs
[oracle@ol7-19-dg1 dbs]$ ls
hc_cdb1.dat  initcdb1.ora  init.ora  lkCDB1  orapwcdb1  snapcf_cdb1.f  spfilecdb1.ora  spfilecdb1.ora.bkp
[oracle@ol7-19-dg1 dbs]$ scp initcdb1.ora orapwcdb1 ol7-19-dg2:/u01/app/oracle/product/19.0.0/dbhome_1/dbs
oracle@ol7-19-dg2's password:
initcdb1.ora                                                                  100% 1521     1.0MB/s   00:00
orapwcdb1                                                                     100% 2048     2.0MB/s   00:00
[oracle@ol7-19-dg1 dbs]$
```

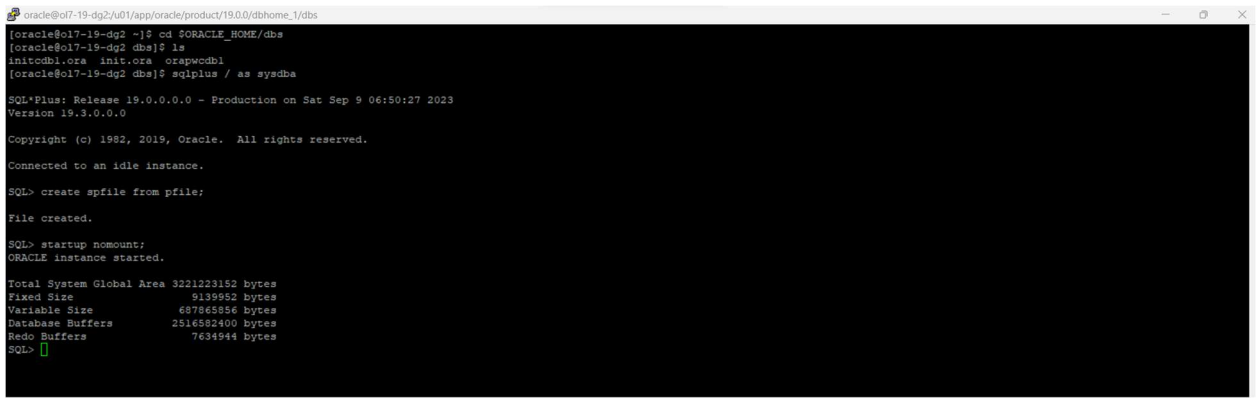
2. Modifying the init<Standby ORACLE_SID>.ora and creating directory structure for the Standby database. Although most of the initialization parameter settings in the parameter file are appropriate for the physical standby database, some modifications must be made. You then create a server parameter file from this parameter file, after it has been modified to contain parameter values appropriate for use at the physical standby database.

   DB_NAME='cdb1'
   DB_UNIQUE_NAME='cdb1_stby'
   LOG_ARCHIVE_CONFIG='DG_CONFIG=(cdb1,cdb1_stby)'
   control_files='/u02/oradata/CDB1/control01.ctl','/u02/oradata/CDB1/control02.ctl'
   LOG_ARCHIVE_FORMAT='%t_%s_%r.arc'
   log_archive_dest_1='LOCATION=USE_DB_RECOVERY_FILE_DEST VALID_FOR=(ALL_LOGFILES,ALL_ROLES)
   DB_UNIQUE_NAME=cdb1_stby'
   log_archive_dest_2='SERVICE=cdb1 ASYNC VALID_FOR=(ONLINE_LOGFILES,PRIMARY_ROLE) DB_UNIQUE_NAME=cdb1'
   REMOTE_LOGIN_PASSWORDFILE=EXCLUSIVE
   STANDBY_FILE_MANAGEMENT=AUTO
   FAL_SERVER=cdb1

   mkdir -p /u02/oradata/CDB1/pdbseed
   mkdir -p /u02/oradata/CDB1/pdb1
   mkdir -p /u01/app/oracle/fast_recovery_area/CDB1
   mkdir -p /u02/oradata/CDB1/onlinelog
   mkdir -p /u01/app/oracle/fast_recovery_area/CDB1/onlinelog
   mkdir -p /u01/app/oracle/admin/cdb1/adump



Startup nomount the auxiliary instance.



3. Backup the Primary database.
   [root@ol7-19-dg1 ~]# mkdir -p /orabackup/cdb1
   [root@ol7-19-dg1 ~]# chown -R oracle:oinstall /orabackup
   [root@ol7-19-dg1 ~]# chmod -R 775 /orabackup

[root@ol7-19-dg1 ~]# su - oracle
Last login: Sat Sep 9 05:55:59 EDT 2023 from gateway on pts/1
[oracle@ol7-19-dg1 ~]$ rman target /

Recovery Manager: Release 19.0.0.0.0 - Production on Sat Sep 9 06:55:56 2023
Version 19.3.0.0.0

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connected to target database: CDB1 (DBID=1120780987)

RMAN> backup as compressed backupset format '/orabackup/cdb1/%U' database plus archivelog;

Starting backup at 09-SEP-23
current log archived
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=43 device type=DISK
channel ORA_DISK_1: starting compressed archived log backup set
channel ORA_DISK_1: specifying archived log(s) in backup set
input archived log thread=1 sequence=7 RECID=1 STAMP=1147067512
input archived log thread=1 sequence=8 RECID=2 STAMP=1147071374
channel ORA_DISK_1: starting piece 1 at 09-SEP-23
channel ORA_DISK_1: finished piece 1 at 09-SEP-23
piece handle=/orabackup/cdb1/0225tqsf_1_1 tag=TAG20230909T065615 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:07
Finished backup at 09-SEP-23

Starting backup at 09-SEP-23
using channel ORA_DISK_1
channel ORA_DISK_1: starting compressed full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00001 name=/u02/oradata/CDB1/system01.dbf

input datafile file number=00003 name=/u02/oradata/CDB1/sysaux01.dbf
input datafile file number=00004 name=/u02/oradata/CDB1/undotbs01.dbf
input datafile file number=00007 name=/u02/oradata/CDB1/users01.dbf
channel ORA_DISK_1: starting piece 1 at 09-SEP-23
channel ORA_DISK_1: finished piece 1 at 09-SEP-23
piece handle=/orabackup/cdb1/0325tqsm_1_1 tag=TAG20230909T065622 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:35
channel ORA_DISK_1: starting compressed full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00010 name=/u02/oradata/CDB1/pdb1/sysaux01.dbf
input datafile file number=00009 name=/u02/oradata/CDB1/pdb1/system01.dbf
input datafile file number=00011 name=/u02/oradata/CDB1/pdb1/undotbs01.dbf
input datafile file number=00012 name=/u02/oradata/CDB1/pdb1/users01.dbf
channel ORA_DISK_1: starting piece 1 at 09-SEP-23
channel ORA_DISK_1: finished piece 1 at 09-SEP-23
piece handle=/orabackup/cdb1/0425tqtq_1_1 tag=TAG20230909T065622 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:15
channel ORA_DISK_1: starting compressed full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00006 name=/u02/oradata/CDB1/pdbseed/sysaux01.dbf
input datafile file number=00005 name=/u02/oradata/CDB1/pdbseed/system01.dbf
input datafile file number=00008 name=/u02/oradata/CDB1/pdbseed/undotbs01.dbf
channel ORA_DISK_1: starting piece 1 at 09-SEP-23
channel ORA_DISK_1: finished piece 1 at 09-SEP-23
piece handle=/orabackup/cdb1/0525tqu9_1_1 tag=TAG20230909T065622 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:15
Finished backup at 09-SEP-23

Starting backup at 09-SEP-23
current log archived
using channel ORA_DISK_1
channel ORA_DISK_1: starting compressed archived log backup set
channel ORA_DISK_1: specifying archived log(s) in backup set
input archived log thread=1 sequence=9 RECID=3 STAMP=1147071448
channel ORA_DISK_1: starting piece 1 at 09-SEP-23
channel ORA_DISK_1: finished piece 1 at 09-SEP-23
piece handle=/orabackup/cdb1/0625tquo_1_1 tag=TAG20230909T065728 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 09-SEP-23

Starting Control File and SPFILE Autobackup at 09-SEP-23
piece handle=/u01/app/oracle/fast_recovery_area/CDB1/autobackup/2023_09_09/o1_mf_s_1147071449_lhrmwspz_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 09-SEP-23

RMAN> backup format '/orabackup/cdb1/SBCF_%U' current controlfile for standby;

Starting backup at 09-SEP-23
using channel ORA_DISK_1
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
including standby control file in backup set
channel ORA_DISK_1: starting piece 1 at 09-SEP-23
channel ORA_DISK_1: finished piece 1 at 09-SEP-23
piece handle=/orabackup/cdb1/SBCF_0825tr39_1_1 tag=TAG20230909T065953 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 09-SEP-23

Starting Control File and SPFILE Autobackup at 09-SEP-23
piece handle=/u01/app/oracle/fast_recovery_area/CDB1/autobackup/2023_09_09/o1_mf_s_1147071595_lhrn1dw0_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 09-SEP-23

RMAN> exit

Recovery Manager complete.
[oracle@ol7-19-dg1 ~]$

4. Create similar backup directory structure and permissions on standby server.
   [root@ol7-19-dg2 ~]# mkdir -p /orabackup/cdb1
   [root@ol7-19-dg2 ~]# chown -R oracle:oinstall /orabackup
   [root@ol7-19-dg2 ~]# chmod -R 775 /orabackup
   [root@ol7-19-dg2 ~]#

5. Make backups available for the standby creation process.

   Copy all the backup pieces created in /orabackup/cdb1 from ol7-19-dg1 to ol7-19-dg2 in

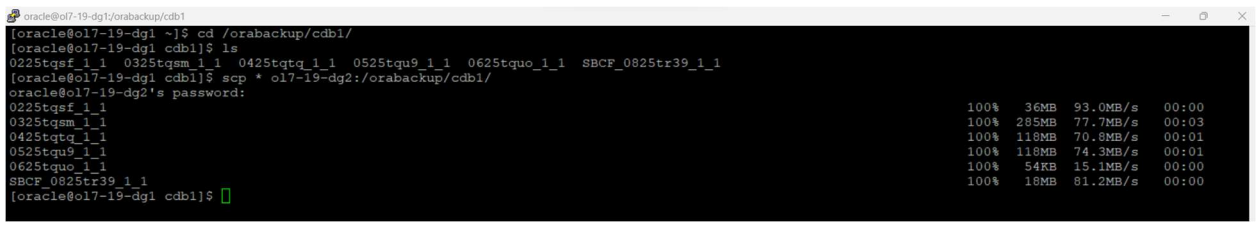
   /orabackup/cdb1.

[oracle@ol7-19-dg1 ~]$ cd /orabackup/cdb1/

[oracle@ol7-19-dg1 cdb1]$ ls

0225tqsf_1_1 0325tqsm_1_1 0425tqtq_1_1 0525tqu9_1_1 0625tquo_1_1 SBCF_0825tr39_1_1

[oracle@ol7-19-dg1 cdb1]$ scp * ol7-19-dg2:/orabackup/cdb1/



6. Do the restore and recover on standby server

[oracle@ol7-19-dg2 ~]$ cd /orabackup/cdb1/

[oracle@ol7-19-dg2 cdb1]$ ls

0225tqsf_1_1 0325tqsm_1_1 0425tqtq_1_1 0525tqu9_1_1 0625tquo_1_1 SBCF_0825tr39_1_1

[oracle@ol7-19-dg2 cdb1]$ rman target /

Recovery Manager: Release 19.0.0.0.0 - Production on Sat Sep 9 07:51:02 2023

Version 19.3.0.0.0

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connected to target database: CDB1 (not mounted)

RMAN> **restore standby controlfile from '/orabackup/cdb1/SBCF_0825tr39_1_1';**

Starting restore at 09-SEP-23

using target database control file instead of recovery catalog

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=38 device type=DISK

channel ORA_DISK_1: restoring control file

channel ORA_DISK_1: restore complete, elapsed time: 00:00:01

output file name=/u02/oradata/CDB1/control01.ctl

output file name=/u02/oradata/CDB1/control02.ctl

Finished restore at 09-SEP-23

RMAN> **sql 'alter database mount standby database';**

sql statement: alter database mount standby database

released channel: ORA_DISK_1

RMAN> **restore database;**

Starting restore at 09-SEP-23

Starting implicit crosscheck backup at 09-SEP-23

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=1 device type=DISK

Crosschecked 7 objects

Finished implicit crosscheck backup at 09-SEP-23

Starting implicit crosscheck copy at 09-SEP-23

using channel ORA_DISK_1

Finished implicit crosscheck copy at 09-SEP-23

searching for all files in the recovery area

cataloging files...

no files cataloged

using channel ORA_DISK_1

channel ORA_DISK_1: starting datafile backup set restore

channel ORA_DISK_1: specifying datafile(s) to restore from backup set

channel ORA_DISK_1: restoring datafile 00001 to /u02/oradata/CDB1/system01.dbf

channel ORA_DISK_1: restoring datafile 00003 to /u02/oradata/CDB1/sysaux01.dbf

channel ORA_DISK_1: restoring datafile 00004 to /u02/oradata/CDB1/undotbs01.dbf

channel ORA_DISK_1: restoring datafile 00007 to /u02/oradata/CDB1/users01.dbf

channel ORA_DISK_1: reading from backup piece /orabackup/cdb1/0325tqsm_1_1

channel ORA_DISK_1: piece handle=/orabackup/cdb1/0325tqsm_1_1 tag=TAG20230909T065622

channel ORA_DISK_1: restored backup piece 1

channel ORA_DISK_1: restore complete, elapsed time: 00:01:05

channel ORA_DISK_1: starting datafile backup set restore

channel ORA_DISK_1: specifying datafile(s) to restore from backup set

channel ORA_DISK_1: restoring datafile 00009 to /u02/oradata/CDB1/pdb1/system01.dbf

channel ORA_DISK_1: restoring datafile 00010 to /u02/oradata/CDB1/pdb1/sysaux01.dbf

channel ORA_DISK_1: restoring datafile 00011 to /u02/oradata/CDB1/pdb1/undotbs01.dbf

channel ORA_DISK_1: restoring datafile 00012 to /u02/oradata/CDB1/pdb1/users01.dbf

channel ORA_DISK_1: reading from backup piece /orabackup/cdb1/0425tqtq_1_1

channel ORA_DISK_1: piece handle=/orabackup/cdb1/0425tqtq_1_1 tag=TAG20230909T065622

channel ORA_DISK_1: restored backup piece 1

channel ORA_DISK_1: restore complete, elapsed time: 00:00:25

channel ORA_DISK_1: starting datafile backup set restore

channel ORA_DISK_1: specifying datafile(s) to restore from backup set

channel ORA_DISK_1: restoring datafile 00005 to /u02/oradata/CDB1/pdbseed/system01.dbf

channel ORA_DISK_1: restoring datafile 00006 to /u02/oradata/CDB1/pdbseed/sysaux01.dbf

channel ORA_DISK_1: restoring datafile 00008 to /u02/oradata/CDB1/pdbseed/undotbs01.dbf

channel ORA_DISK_1: reading from backup piece /orabackup/cdb1/0525tqu9_1_1

channel ORA_DISK_1: piece handle=/orabackup/cdb1/0525tqu9_1_1 tag=TAG20230909T065622

channel ORA_DISK_1: restored backup piece 1

channel ORA_DISK_1: restore complete, elapsed time: 00:00:25

Finished restore at 09-SEP-23

RMAN>

The below command will list all the archivelogs which are backed up and from this list we need to identify the maximum sequence for recovery.

rma[oracle@ol7-19-dg2 ~]$ rman target /

Recovery Manager: Release 19.0.0.0.0 - Production on Sat Sep 9 08:10:00 2023

Version 19.3.0.0.0

connected to target database: CDB1 (DBID=1120780987, not open)

RMAN> **list backup of archivelog all;**

using target database control file instead of recovery catalog

List of Backup Sets

==========

BS Key Size   Device Type Elapsed Time Completion Time

------- ---------- ----------- ------------ ---------------

2   35.52M   DISK   00:00:03   09-SEP-23

        BP Key: 2   Status: AVAILABLE Compressed: YES Tag: TAG20230909T065615

        Piece Name: /orabackup/cdb1/0225tqsf_1_1

  List of Archived Logs in backup set 2

  Thrd Seq   Low SCN   Low Time Next SCN   Next Time

  ---- ------- ---------- --------- ---------- ---------

  1   7   2248712   09-SEP-23 2252704   09-SEP-23

  1   8   2252704   09-SEP-23 2311474   09-SEP-23

BS Key Size   Device Type Elapsed Time Completion Time

------- ---------- ----------- ------------ ---------------

6   53.00K   DISK   00:00:00   09-SEP-23

        BP Key: 6   Status: AVAILABLE Compressed: YES Tag: TAG20230909T065728

        Piece Name: /orabackup/cdb1/0625tquo_1_1

  List of Archived Logs in backup set 6

  Thrd Seq   Low SCN   Low Time Next SCN   Next Time

  ---- ------- ---------- --------- ---------- ---------

  1   9   2311474   09-SEP-23 2311665   09-SEP-23

RMAN> **recover database until sequence 10;**

Starting recover at 09-SEP-23

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=48 device type=DISK

starting media recovery

channel ORA_DISK_1: starting archived log restore to default destination

channel ORA_DISK_1: restoring archived log

archived log thread=1 sequence=9

channel ORA_DISK_1: reading from backup piece /orabackup/cdb1/0625tquo_1_1

channel ORA_DISK_1: piece handle=/orabackup/cdb1/0625tquo_1_1 tag=TAG20230909T065728

channel ORA_DISK_1: restored backup piece 1

channel ORA_DISK_1: restore complete, elapsed time: 00:00:01

archived log file name=/u01/app/oracle/fast_recovery_area/CDB1_STBY/archivelog/2023_09_09/o1_mf_1_9_lhrr55vz_.arc thread=1 sequence=9

channel default: deleting archived log(s)

archived log file name=/u01/app/oracle/fast_recovery_area/CDB1_STBY/archivelog/2023_09_09/o1_mf_1_9_lhrr55vz_.arc RECID=3 STAMP=1147075813

Oracle Error:

ORA-01547: warning: RECOVER succeeded but OPEN RESETLOGS would get error below

ORA-01152: file 1 was not restored from a sufficiently old backup

ORA-01110: data file 1: '/u02/oradata/CDB1/system01.dbf'

media recovery complete, elapsed time: 00:00:00

Finished recover at 09-SEP-23

RMAN> exit

Recovery Manager complete.

[oracle@ol7-19-dg2 ~]$

Note : No need to worry about the errors, you can safely ignore and move to step 7.

Oracle Error:

ORA-01547: warning: RECOVER succeeded but OPEN RESETLOGS would get error below

ORA-01152: file 1 was not restored from a sufficiently old backup

ORA-01110: data file 1: '/u02/oradata/CDB1/system01.dbf'

7. On the Standby database, issue the following command to start Redo Apply:

[oracle@ol7-19-dg2 ~]$ sqlplus / as sysdba

SQL*Plus: Release 19.0.0.0.0 - Production on Sat Sep 9 08:13:47 2023

Version 19.3.0.0.0

Copyright (c) 1982, 2019, Oracle. All rights reserved.

Connected to:

Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

SQL> **alter database recover managed standby database disconnect from session using current logfile;**

Database altered.

SQL>

8. On the primary database, issue a number of ALTER SYSTEM SWITCH LOGFILE statements to archive a number of redo log files.

[oracle@ol7-19-dg1 ~]$ sqlplus / as sysdba

SQL*Plus: Release 19.0.0.0.0 - Production on Sat Sep 9 08:14:42 2023

Version 19.3.0.0.0

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Connected to:

Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

SQL> alter system switch logfile;

System altered.

SQL> /

System altered.

SQL> /

System altered.

SQL> ARCHIVE LOG LIST
Database log mode Archive Mode
Automatic archival Enabled
Archive destination USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence 13
Next log sequence to archive 15
Current log sequence 15
SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0
[oracle@ol7-19-dg1 ~]$

9. On the Standby database, re-query the V$ARCHIVED_LOG view to verify the redo data was received and applied on the standby database.

[oracle@ol7-19-dg2 ~]$ sqlplus / as sysdba

SQL*Plus: Release 19.0.0.0.0 - Production on Sat Sep 9 08:16:57 2023
Version 19.3.0.0.0

Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0

SQL> SELECT SEQUENCE#, FIRST_TIME, NEXT_TIME, APPLIED
2 FROM V$ARCHIVED_LOG
3 ORDER BY SEQUENCE#;

SEQUENCE# FIRST_TIM NEXT_TIME APPLIED
---------- --------- --------- ---------
9 09-SEP-23 09-SEP-23 YES
10 09-SEP-23 09-SEP-23 YES
11 09-SEP-23 09-SEP-23 YES
12 09-SEP-23 09-SEP-23 YES
13 09-SEP-23 09-SEP-23 YES
14 09-SEP-23 09-SEP-23 YES

6 rows selected.

SQL> exit

Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

[oracle@ol7-19-dg2 ~]$

Enable Broker Configuration

At this point we have a primary database and a standby database, so now we need to start using the Data Guard Broker to manage them. Connect to both databases (primary and standby) and issue the following command. This will already be set if you used the PREPARE DATABASE FOR DATA GUARD command.

alter system set dg_broker_start=true;

On the primary server, issue the following command to register the primary server with the broker.

[oracle@ol7-19-dg1 dbs]$ dgmgrl /

DGMGRL for Linux: Release 19.0.0.0.0 - Production on Sat Sep 9 12:48:23 2023

Version 19.3.0.0.0

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Welcome to DGMGRL, type "help" for information.

Connected to "cdb1"

Connected as SYSDG.

DGMGRL> connect sysdg;

Password:

Connected to "cdb1"

Connected as SYSDG.

DGMGRL> create configuration my_dg_config as primary database is cdb1 connect identifier is cdb1;

Configuration "my_dg_config" created with primary database "cdb1"

DGMGRL>

Now add the standby database.

DGMGRL> add database cdb1_stby as connect identifier is cdb1_stby;

Error: ORA-16698: member has a LOG_ARCHIVE_DEST_n parameter with SERVICE attribute set

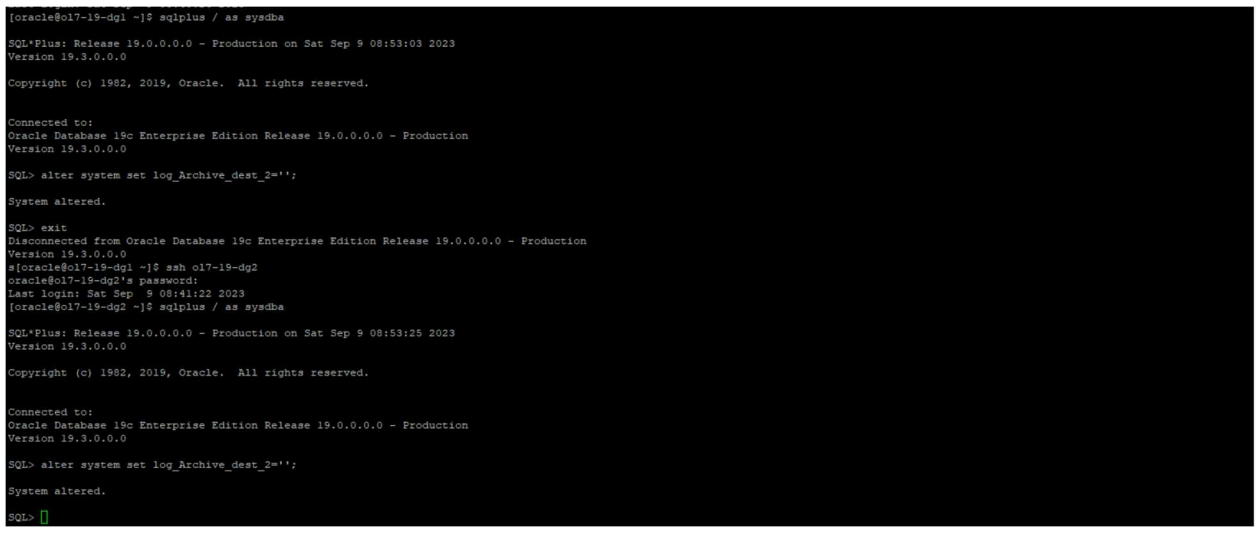
Failed.

In case of above error follow the steps from MOS note Create Configuration Failing with ORA-16698 (Doc ID 1582179.1) to resolve the issue.

Fix for this issue.

alter system set log_archive_dest_2=''; (both Side)

Note: It is good idea to run this command before enabling broker to unset log_archive_dest_2 parameter.



DGMGRL> add database cdb1_stby as connect identifier is cdb1_stby;

Database "cdb1_stby" added

DGMGRL> enable configuration;

Enabled.

The following commands show how to check the configuration and status of the databases from the broker.

DGMGRL> show configuration;

Configuration - my_dg_config

Protection Mode: MaxPerformance

Members:

cdb1 - Primary database

cdb1_stby - Physical standby database

Fast-Start Failover: Disabled

Configuration Status:

SUCCESS (status updated 21 seconds ago)

DGMGRL> show database cdb1;

Database - cdb1

Role: PRIMARY

Intended State: TRANSPORT-ON

Instance(s):

cdb1

Database Status:

SUCCESS

DGMGRL> show database cdb1_stby;

Database - cdb1_stby

Role: PHYSICAL STANDBY

Intended State: APPLY-ON

Transport Lag: 0 seconds (computed 0 seconds ago)

Apply Lag: 0 seconds (computed 0 seconds ago)

Average Apply Rate: 1.00 KByte/s

Real Time Query: ON

Instance(s):

cdb1

Database Status:

SUCCESS

DGMGRL>

Alter the State of a Standby Database (Stop/Start Managed Recovery)

EDIT DATABASE 'cdb1_stby' SET STATE='APPLY-OFF';

EDIT DATABASE 'cdb1_stby' SET STATE='APPLY-ON';

Alter the State of a Primary Database (Stop/Start Redo Transport)

EDIT DATABASE cdb1 SET STATE=TRANSPORT-OFF;

EDIT DATABASE cdb1 SET STATE=TRANSPORT-ON;

Database Switchover

A database can be in one of two mutually exclusive modes (primary or standby). These roles can be altered at runtime without loss of data or resetting of redo logs. This process is known as a Switchover and can be performed using the following commands. Connect to the primary database (cdb1) and switchover to the standby database (cdb1_stby).

[oracle@ol7-19-dg1 ~]$ dgmgrl sys/SysPassword1@cdb1

DGMGRL for Linux: Release 19.0.0.0.0 - Production on Fri Sep 8 18:52:39 2023

Version 19.3.0.0.0

Welcome to DGMGRL, type "help" for information.

Connected to "cdb1"

Connected as SYSDBA.

DGMGRL> switchover to cdb1_stby;

Performing switchover NOW, please wait...

Operation requires a connection to database "cdb1_stby"

Connecting ...

Connected to "cdb1_stby"

Connected as SYSDBA.

New primary database "cdb1_stby" is opening...

Operation requires start up of instance "cdb1" on database "cdb1"

Starting instance "cdb1"...

Connected to an idle instance.

ORACLE instance started.

Connected to "cdb1"

Database mounted.

Database opened.

Connected to "cdb1"

Switchover succeeded, new primary is "cdb1_stby"

DGMGRL>

Let's switch back to the original primary. Connect to the new primary (cdb1_stby) and switchover to the new standby database (cdb1).

DGMGRL> switchover to cdb1;

Performing switchover NOW, please wait...

Operation requires a connection to database "cdb1"

Connecting ...

Connected to "cdb1"

Connected as SYSDBA.

New primary database "cdb1" is opening...

Operation requires start up of instance "cdb1" on database "cdb1_stby"

Starting instance "cdb1"...

Connected to an idle instance.

ORACLE instance started.

Connected to "cdb1_stby"

Database mounted.

Database opened.

Connected to "cdb1_stby"

Switchover succeeded, new primary is "cdb1"

DGMGRL>

Database Failover

If the primary database is not available the standby database can be activated as a primary database using the following statements. Connect to the standby database (cdb1_stby) and failover.

[oracle@ol7-19-dg2 dbs]$ dgmgrl sys/SysPassword1

DGMGRL for Linux: Release 19.0.0.0.0 - Production on Fri Sep 8 18:57:47 2023

Version 19.3.0.0.0

Welcome to DGMGRL, type "help" for information.

Connected to "cdb1_stby"

Connected as SYSDBA.

DGMGRL> failover to cdb1_stby;

Performing failover NOW, please wait...

Failover succeeded, new primary is "cdb1_stby"

DGMGRL>

Known Issue:

If you hit this issue after enabling broker configuration then follow these steps to resolve it.

DGMGRL> show configuration;

Configuration - my_dg_config

  Protection Mode: MaxPerformance

  Members:

cdb1 - Primary database

cdb1_stby - Physical standby database

Warning: ORA-16809: multiple warnings detected for the member

Fast-Start Failover: Disabled

Configuration Status:

WARNING (status updated 52 seconds ago)

DGMGRL> show database cdb1;

Database - cdb1

Role: PRIMARY

Intended State: TRANSPORT-ON

Instance(s):

cdb1

Database Status:

SUCCESS

DGMGRL> show database cdb1_stby;

Database - cdb1_stby

Role: PHYSICAL STANDBY

Intended State: APPLY-ON

Transport Lag: 5 minutes 59 seconds (computed 4 seconds ago)

Apply Lag: 5 minutes 59 seconds (computed 4 seconds ago)

Average Apply Rate: 36.00 KByte/s

Real Time Query: ON

Instance(s):

cdb1

Database Warning(s):

ORA-16853: apply lag has exceeded specified threshold

ORA-16855: transport lag has exceeded specified threshold

ORA-16826: apply service state is inconsistent with the DelayMins property

ORA-16789: standby redo logs configured incorrectly

Database Status:

WARNING

On Primary:

SQL> alter system switch logfile;

System altered.

On Standby:

SQL> select group#, thread#, sequence#, status from v$standby_log;

```
    GROUP#    THREAD#  SEQUENCE# STATUS
---------- ---------- ---------- ----------
         4          1          0 UNASSIGNED
         5          1          0 UNASSIGNED
         6          1          0 UNASSIGNED
         7          1          0 UNASSIGNED
```

```
SQL> select open_mode from v$database;

OPEN_MODE
--------------------
READ ONLY WITH APPLY
```

Something is wrong with standby redo logs.

First, cancel the managed recovery. On Standby database, run below command from dgmgrl:

```
EDIT DATABASE 'cdb1_stby' SET STATE='APPLY-OFF';
```

Shutdown the Standby database and mount it.

Note: Make sure the managed recovery is not started. If you use data guard broker, then mrp is started automatically when you startup mount the Standby database. If managed recovery is started, then cancel the managed recovery from dgmgrl.

```
SQL> select open_mode from v$database;

OPEN_MODE
--------------------
MOUNTED
```

Run these commands on Standby database.

```
SQL> alter system set standby_file_management=manual;

System altered.

SQL> alter database drop logfile group 4;

Database altered.

SQL> alter database drop logfile group 5;

Database altered.

SQL> alter database drop logfile group 6;

Database altered.
```

SQL> alter database drop logfile group 7;

Database altered.

SQL> alter database add standby logfile thread 1 group 4 size 209715200;

Database altered.

SQL> alter database add standby logfile thread 1 group 5 size 209715200;

Database altered.

SQL> SQL> alter database add standby logfile thread 1 group 6 size 209715200;

Database altered.

SQL> alter database add standby logfile thread 1 group 7 size 209715200;

Database altered.

SQL> alter system set standby_file_management=auto;

System altered.

On Primary:

SQL> alter system switch logfile;

System altered.

On Standby:

SQL> select group#, thread#, sequence#, status from v$standby_log;

GROUP#	THREAD#	SEQUENCE#	STATUS
4	1	26	ACTIVE
5	1	0	UNASSIGNED
6	1	0	UNASSIGNED
7	1	0	UNASSIGNED

On Primary once again:

SQL> alter system switch logfile;

System altered.

On Standby:

```
SQL> select group#, thread#, sequence#, status from v$standby_log;

    GROUP#    THREAD#  SEQUENCE# STATUS
---------- ---------- ---------- ----------
         4          1          0 UNASSIGNED
         5          1         27 ACTIVE
         6          1          0 UNASSIGNED
         7          1          0 UNASSIGNED
```

Check the broker status now.

```
DGMGRL> show configuration;

Configuration - my_dg_config

  Protection Mode: MaxPerformance
  Members:
  cdb1      - Primary database
    cdb1_stby - Physical standby database

Fast-Start Failover:  Disabled

Configuration Status:
SUCCESS   (status updated 13 seconds ago)

DGMGRL> show database cdb1;

Database - cdb1

  Role:              PRIMARY
  Intended State:    TRANSPORT-ON
  Instance(s):
    cdb1

Database Status:
SUCCESS

DGMGRL> show database cdb1_stby;

Database - cdb1_stby

  Role:              PHYSICAL STANDBY
  Intended State:    APPLY-ON
  Transport Lag:     0 seconds (computed 1 second ago)
  Apply Lag:         0 seconds (computed 1 second ago)
  Average Apply Rate: 1.00 KByte/s
  Real Time Query:   OFF
  Instance(s):
    cdb1
```

Database Status:

SUCCESS

DGMGRL>

References:

https://docs.oracle.com/en/database/oracle/oracle-database/19/sbydb/index.html#Oracle%C2%AE-Data-Guard

Step By Step Guide To Create Physical Standby Database Using RMAN Backup and Restore (Doc ID 469493.1)

https://oracle-base.com/articles/19c/data-guard-setup-using-broker-19c

Data Guard Physical and Logical Standby - Data Guard Broker Configuration Health Check (Doc ID 1583191.1)