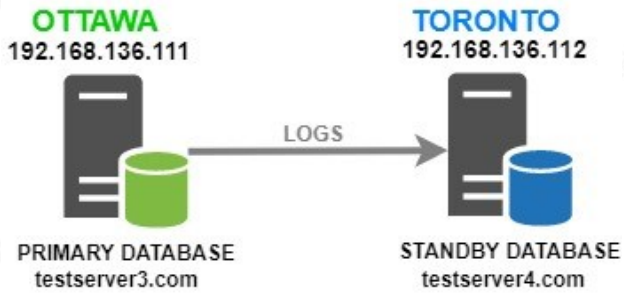
# Dataguard on 12cR2 - Single Instance

**Dataguard configuration on a single instance 12cR2 Database**
**By Kadir Ilker Taysi**

# 1. CONFIGURATION




| | PRIMARY (OTTAWA) | STANDBY (TORONTO) |
|---|---|---|
| IP | 192.168.136.111 | 192.168.136.112 |
| HOSTNAME | testserver3.com | testserver4.com |
| DB NAME | ORCL | ORCL |
| DB UNIQUE NAME | ORCL | ORCLDG |
| DATAFILES PATH | /u01/app/oracle/oradata/ORCL/datafile | /u01/datafiles |
| REDO LOGS PATH | /u01/app/oracle/oradata/ORCL/onlinelog | /u01/logfiles |
| ARCHIVE LOGS | /u01/ARCHIVELOGS | /u01/archives |
| INSTALLATION STATUS | Oracle Software + Database | Oracle Software |
| ORACLE_HOME | /u01/app/oracle/product/12.2.0.1/dbhome | /u01/app/oracle/product/12.2.0.1/dbhome |
| SID | ORCL | ORCLDG |

# 2. PREREQUISITES

### 2.1. Primary database must be in archivelog mode

Put the primary database in archivelog mode if it is not already in that mode.
[PRIMARY]

```
ALTER SYSTEM SET LOG_ARCHIVE_DEST_1='LOCATION=/u01/ARCHIVELOGS';
SHUTDOWN IMMEDIATE;
STARTUP MOUNT;
ALTER DATABASE ARCHIVELOG;
ALTER DATABASE OPEN;
```

### 2.2. Primary Database must be running in force logging mode

[PRIMARY]

```
ALTER DATABASE FORCE LOGGING;
```

# 3. PRIMARY SERVER CONFIGURATION

### 3.1. Standby Redo Logs

If we are planning switchovers, then the standby logs should also be created on the primary database. When the primary becomes a standby, these logs will be used. So, it is a good practice to create them now and let the duplication copies them to the standby.

Have a look at the current config of redo logs:
[PRIMARY]

```
SELECT GROUP#,THREAD#,BYTES/(1024*1024) AS LOGSIZE  FROM V$LOG;

    GROUP#    THREAD#    LOGSIZE
---------- ---------- ----------
         1          1        200
         2          1        200
         3          1        200
```

The standby redo logs should be at least as big as the largest online redo log and there should be one extra group per thread compared the online redo logs. So, to create them:
[PRIMARY]

```
ALTER DATABASE ADD STANDBY LOGFILE ('/u01/app/oracle/oradata/ORCL/onlinelog/standby_redo01.log') SIZE 200M;
ALTER DATABASE ADD STANDBY LOGFILE ('/u01/app/oracle/oradata/ORCL/onlinelog/standby_redo02.log') SIZE 200M;
ALTER DATABASE ADD STANDBY LOGFILE ('/u01/app/oracle/oradata/ORCL/onlinelog/standby_redo03.log') SIZE 200M;
ALTER DATABASE ADD STANDBY LOGFILE ('/u01/app/oracle/oradata/ORCL/onlinelog/standby_redo04.log') SIZE 200M;
```

### 3.2. Network Settings

**tnsnames.ora**
Edit the tnsnames.ora file on the primary database server and add the following lines in the box /u01/app/oracle/product/12.2.0.1/dbhome/network/admin/tnsnames.ora
[PRIMARY]

```
ORCL =
  (DESCRIPTION =
    (ADDRESS_LIST =
      (ADDRESS = (PROTOCOL = TCP)(HOST = 192.168.136.111)(PORT = 1521))
    )
    (CONNECT_DATA =
      (SERVICE_NAME = ORCL)
    )
  )

ORCLDG =
  (DESCRIPTION =
    (ADDRESS_LIST =
      (ADDRESS = (PROTOCOL = TCP)(HOST = 192.168.136.112)(PORT = 1521))
    )
    (CONNECT_DATA =
      (SERVICE_NAME = ORCLDG)
    )
  )
```

**listener.ora**
What we need to do is manually register the database with the listener:

```
LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = testserver3.com)(PORT = 1521))
      (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1521))
    )
  )
```

```
SID_LIST_LISTENER =
  (SID_LIST =
    (SID_DESC =
      (GLOBAL_DBNAME = ORCL)
      (ORACLE_HOME = /u01/app/oracle/product/12.2.0.1/dbhome)
      (SID_NAME = ORCL)
    )
  )

ADR_BASE_LISTENER = /u01/app/oracle
```

### 3.3. Database Parameters

[PRIMARY]

```
ALTER SYSTEM SET LOG_ARCHIVE_CONFIG='DG_CONFIG=(ORCL,ORCLDG)' SID='*' SCOPE=BOTH;

ALTER SYSTEM SET LOG_ARCHIVE_DEST_1='LOCATION=/u01/ARCHIVELOGS VALID_FOR=(ALL_LOGFILES,ALL_ROLES)
DB_UNIQUE_NAME=ORCL' SID='*'  SCOPE=BOTH;

ALTER SYSTEM SET LOG_ARCHIVE_DEST_2='SERVICE=ORCLDG LGWR ASYNC NOAFFIRM max_failure=10
max_connections=5 reopen=180 VALID_FOR=(ONLINE_LOGFILES,PRIMARY_ROLE) DB_UNIQUE_NAME=ORCLDG' SID='*'
SCOPE=BOTH;

ALTER SYSTEM SET LOG_ARCHIVE_DEST_STATE_1=ENABLE SID='*' SCOPE=BOTH;

ALTER SYSTEM SET LOG_ARCHIVE_DEST_STATE_2=ENABLE SID='*' SCOPE=BOTH;

ALTER SYSTEM SET FAL_SERVER='ORCLDG' SID='*' SCOPE=BOTH;

ALTER SYSTEM SET FAL_CLIENT='ORCL' SID='*' SCOPE=BOTH;

ALTER SYSTEM SET LOG_ARCHIVE_MAX_PROCESSES=10 SID='*' SCOPE=BOTH;

ALTER SYSTEM SET LOG_FILE_NAME_CONVERT='/u01/logfiles','/u01/app/oracle/oradata/ORCL/onlinelog'
SID='*' SCOPE=SPFILE;

ALTER SYSTEM SET DB_FILE_NAME_CONVERT= '/u01/datafiles','/u01/app/oracle/oradata/ORCL/datafile'
SID='*' SCOPE=SPFILE;

ALTER SYSTEM SET REMOTE_LOGIN_PASSWORDFILE=EXCLUSIVE SID='*' SCOPE=SPFILE;

ALTER SYSTEM SET STANDBY_FILE_MANAGEMENT=AUTO  SID='*' SCOPE=BOTH;
```

### 3.4. Password File

Copy the password file from primary to standby
[PRIMARY]

```
scp $ORACLE_HOME/dbs/orapwORCL oracle@testserver4.com:/u01/app/oracle/product/12.2.0.1/dbhome/dbs
```

Go to standby server and rename the password file
[STANDBY]

```
cd $ORACLE_HOME/dbs
mv orapwORCL orapwORCLDG
```

### 3.5. FlashBack Database (optional)

If you want to use the flashback database, enable it now on the primary
[PRIMARY]

```
ALTER DATABASE FLASHBACK ON;
```

# 4. STANDBY SERVER CONFIGURATION

### 4.1. Network Settings

**tnsnames.ora**

Create a tnsnames.ora file in the $ORACLE_HOME/network/admin path.

[STANDBY]

```
ORCL =
  (DESCRIPTION =
    (ADDRESS_LIST =
      (ADDRESS = (PROTOCOL = TCP)(HOST = 192.168.136.111)(PORT = 1521))
    )
    (CONNECT_DATA =
      (SERVICE_NAME = ORCL)
    )
  )

ORCLDG =
  (DESCRIPTION =
    (ADDRESS_LIST =
      (ADDRESS = (PROTOCOL = TCP)(HOST = 192.168.136.112)(PORT = 1521))
    )
    (CONNECT_DATA =
      (SERVICE_NAME = ORCLDG)
    )
  )
```

**listener.ora**

Create a listner.ora file in the $ORACLE_HOME/network/admin path.

[STANDBY]

```
 LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = testserver4.com)(PORT = 1521))
      (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1521))
    )
  )

SID_LIST_LISTENER =
  (SID_LIST =
    (SID_DESC =
      (GLOBAL_DBNAME = ORCLDG)
      (ORACLE_HOME = /u01/app/oracle/product/12.2.0.1/dbhome)
      (SID_NAME = ORCLDG)
    )
  )

ADR_BASE_LISTENER = /u01/app/oracle
```

### 4.2. Create paths

[STANDBY]

```
mkdir -p /u01/datafiles
mkdir -p /u01/logfiles
mkdir -p /u01/archives
mkdir -p /u01/controlfiles
mkdir -p /u01/app/oracle/admin/ORCLDG/adump
```

### 4.3. Database Parameters

Create pfile=initORCLDG.ora
[STANDBY]

```
*.audit_trail='db'
*.compatible='12.2.0'
*.db_block_size=8192
*.db_name='ORCL'
*.db_unique_name='ORCLDG'
*.open_cursors=300
*.processes=150
*.remote_login_passwordfile='EXCLUSIVE'
*.standby_file_management='AUTO'
*.undo_tablespace='UNDOTBS1'
*.db_file_name_convert='/u01/app/oracle/oradata/ORCL/datafile','/u01/datafiles'
*.log_file_name_convert='/u01/app/oracle/oradata/ORCL/onlinelog','/u01/logfiles'
*.fal_client='ORCLDG'
*.fal_server='ORCL'
*.log_archive_max_processes=10
*.nls_language='AMERICAN'
*.nls_territory='AMERICA'
*.log_archive_config='DG_CONFIG=(ORCLDG,ORCL)'
*.sga_target=600m
*.standby_file_management='AUTO'
*.pga_aggregate_target=201m
*.audit_file_dest='/u01/app/oracle/admin/ORCLDG/adump'
*.log_archive_dest_state_1='ENABLE'
*.log_archive_dest_state_2='ENABLE'
*.diagnostic_dest='/u01/app/oracle'
*.local_listener='LISTENER_ORCL'
*.control_files='/u01/controlfiles/controlfile.ctl'
*.db_create_file_dest='/u01/datafiles'
*.log_archive_dest_1='LOCATION=/u01/archives VALID_FOR=(ALL_LOGFILES,ALL_ROLES)
DB_UNIQUE_NAME=ORCLDG'
*.log_archive_dest_2='SERVICE=ORCL LGWR ASYNC NOAFFIRM max_failure=10 max_connections=5 reopen=180
VALID_FOR=(ONLINE_LOGFILES,PRIMARY_ROLE) DB_UNIQUE_NAME=ORCL'
```

# 5. RMAN DUPLICATE

### 5.1. Standby -> NOMOUNT

Startup the standby in nomount mode
[STANDBY]

```
startup nomount;
```

### 5.2. Start the duplication

Connect to both databases with RMAN
[STANDBY]

```
rman target sys/sys647381@ORCL auxiliary sys/sys647381@ORCLDG

Recovery Manager: Release 12.2.0.1.0 - Production on Tue Feb 27 21:21:35 2018

Copyright (c) 1982, 2017, Oracle and/or its affiliates.  All rights reserved.

connected to target database: ORCL (DBID=1496966702)
connected to auxiliary database: ORCL (not mounted)
```

[STANDBY] - Watch the **alertlogs** of both primary and standby...

```
duplicate target database for standby from active database;
```

When duplication is over, you can start the never-ending recovery... which is standby recovery.
[STANDBY]

```
alter database recover managed standby database disconnect nodelay;
```

### 5.3. Active Dataguard

**Opening Dataguard in Read-Only mode requires additional license!**

To open in read only mode - This is called Active Dataguard

```
ALTER DATABASE RECOVER MANAGED STANDBY DATABASE CANCEL;
SHUTDOWN IMMEDIATE;
STARTUP MOUNT;
ALTER DATABASE OPEN READ ONLY;
ALTER DATABASE RECOVER MANAGED STANDBY DATABASE DISCONNECT NODELAY;
```

## 6. MONITOR STATUS

**STANDBY PROCESSES CONTROL - LOGS RECEVIED CONTROL**

Monitor current status information of Oracle Database processes related to physical standby databases in the Data Guard environment using V$MANAGED_STANDBY view
[STANDBY]

```
SELECT PROCESS,PID,STATUS,CLIENT_PROCESS,CLIENT_PID,THREAD#,SEQUENCE#,BLOCK#
FROM V$MANAGED_STANDBY;

PROCESS   PID    STATUS       CLIENT_PROCESS       CLIENT_PID   THREAD#  SEQUENCE#     BLOCK#
========= ====== ============ ==================== ============ ======= ========== ==========
DGRD      2324   ALLOCATED    N/A                  N/A                0          0          0
ARCH      2326   CLOSING      ARCH                 2326               1         29       2048
ARCH      2329   CLOSING      ARCH                 2329               1         30          1
ARCH      2331   CONNECTED    ARCH                 2331               0          0          0
ARCH      2333   CONNECTED    ARCH                 2333               0          0          0
ARCH      2335   CONNECTED    ARCH                 2335               0          0          0
ARCH      2338   CONNECTED    ARCH                 2338               0          0          0
ARCH      2340   CONNECTED    ARCH                 2340               0          0          0
ARCH      2342   CONNECTED    ARCH                 2342               0          0          0
ARCH      2344   CONNECTED    ARCH                 2344               0          0          0
ARCH      2346   CONNECTED    ARCH                 2346               0          0          0
DGRD      2348   ALLOCATED    N/A                  N/A                0          0          0
RFS       2356   IDLE         Archival             2369               0          0          0
RFS       2370   IDLE         LGWR                 2391               1         31       6829
RFS       2360   IDLE         UNKNOWN              2379               0          0          0
RFS       2364   IDLE         UNKNOWN              2385               0          0          0
RFS       2362   IDLE         UNKNOWN              2389               0          0          0
RFS       2368   IDLE         UNKNOWN              2383               0          0          0
RFS       2366   IDLE         UNKNOWN              2387               0          0          0
MRP0      2429   APPLYING_LOG N/A                  N/A                1         31       6829
```

**PRIMARY DATABASE LOGS SENT CONTROL**

[PRIMARY]
On the primary server to monitor the status of the replication

```
SELECT
        DEST_NAME,STATUS,DATABASE_MODE,RECOVERY_MODE,PROTECTION_MODE,
        DESTINATION,ARCHIVED_SEQ#,APPLIED_SEQ#,SYNCHRONIZATION_STATUS,GAP_STATUS
FROM
        V$ARCHIVE_DEST_STATUS
WHERE
        STATUS!='INACTIVE';


DEST   STATUS DATABASE_MODE   RECOVERY_MODE  PROTECTION_MOD DESTINATION   EQ#  Q# SYNCHRONIZAT   GAP
------ ------ --------------- -------------- -------------- ------------- ---  -- ------------  ------
DEST_1 VALID  OPEN            IDLE           MAXIMUM PERF   /u01/archives  30   0 CHECK CONFIG
DEST_2 VALID  OPEN_READ-ONLY  MANAGED RTA    MAXIMUM PERF   ORCL           30  29 CHECK CONFIG  NO GAP
```

**GAP CONTROL**

Even if there is a v$archive_gap view for that, IMO the best & most secure way is to check for the latest sequence numbers on both primary and standby servers and then see whether it has been applied...

[PRIMARY]

```
SELECT MAX(SEQUENCE#) FROM V$LOG_HISTORY;

MAX(SEQUENCE#)
------
33
```

[STANDBY]

```
SELECT MAX(SEQUENCE#) FROM V$LOG_HISTORY;

MAX(SEQUENCE#)
------
33
```

[STANDBY]

```
SELECT THREAD# ,SEQUENCE#, NAME, APPLIED FROM
(
    SELECT THREAD# ,SEQUENCE#, NAME, APPLIED, ROW_NUMBER() OVER (ORDER BY SEQUENCE# DESC) SEQORDER
    FROM V$ARCHIVED_LOG
)
WHERE SEQORDER=1


   THREAD#  SEQUENCE# NAME                                     APPLIED
---------- ---------- ---------------------------------------- ---------
         1         33 /u01/ARCHIVELOGS/1_33_969185966.dbf      YES
```

-- OR --

The following query is expected to return no rows if there is no gap - everything is fine...

```
SELECT THREAD#, LOW_SEQUENCE#, HIGH_SEQUENCE# FROM V$ARCHIVE_GAP;
```

## 7. SWITCHOVER & FAILOVER

**Switchover**

Switchover is the reversal of roles between the primary database and one of its standby databases. A switchover guarantees no data loss and is typically done for planned maintenance of the primary system.

In our case to switcover Ottawa onto Toronto:

[OTTAWA]

```
select switchover_status from v$database;

SWITCHOVER_STATUS
--------------------
TO STANDBY
```

We should see "TO STANDBY" in the previous query. If we see "RESOLVABLE GAP" instead, this means that the primary and standby are not in sync. This might be due to a heavy activity on the primary and a network slowness between the servers. We can issue some checkpoints on the primary and see whether the situation improves.

Convert the Primary[OTTAWA] into a standby server
Run the following commands on the current primary [OTTAWA] server

```
alter database commit to switchover to physical standby with session shutdown;
shutdown immediate;
startup nomount;
alter database mount standby database;
```

Convert the Standby[TORONTO] into primary
Run the following commands on the current standby [TORONTO] server

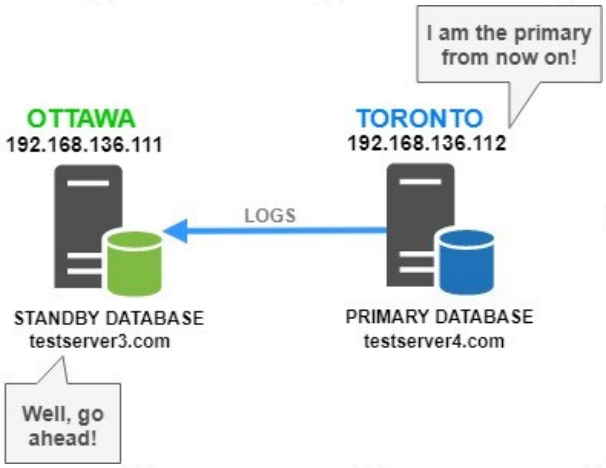
```
alter database commit to switchover to primary;
shutdown immediate;
startup;
```

Check the listeners on both sides and start them if they are shutdown by the switchover command.
On both servers

```
lsnrctl start
```

Start the recovery on the new standby which is [OTTAWA]

```
ALTER DATABASE RECOVER MANAGED STANDBY DATABASE DISCONNECT NODELAY;
```




Monitor the alert logs of the both servers, if for some reason the logs are not shipped, you can submit the following command on the current primary server:

On current primary server

```
alter system set log_archive_dest_state_2='DEFER';
alter system set log_archive_dest_state_2='ENABLE';
```