DATAGUARD

Oracle Data Guard is a feature used to **create and maintain one or more standby databases**.
It is an **exact copy of the primary database** and keeps them **synchronized using redo logs**.
Data Guard provides:

- ✅ High Availability
- ✅ Disaster Recovery
- ✅ Data Protection

If the **primary server goes down**, the standby can take over and act as the **new primary** (via failover).

🔶 Types of Standby Databases:

1. Physical Standby

- A **block-level copy** of the primary database.
- Uses **redo apply** to stay in sync.
- Can be converted to **Active Data Guard** to allow **read-only** queries while applying redo logs.

2. Logical Standby

- Uses **SQL Apply** (not redo apply).
- Allows **read-write** operations.
- Supports different structures like **materialized views, indexes**, etc.
- Not all data types are supported (e.g., BFILEs, some complex datatypes).

3. Snapshot Standby

- A **temporary read-write version** of a physical standby.
- Used for **testing** purposes.
- Once testing is done, it can be **converted back** to a physical standby, discarding changes.

🔶 Protection Modes:

1. Maximum Protection

- Ensures **zero data loss**.
- Redo must be **written and acknowledged** by at least one standby **before commit completes** on primary.
- If no standby confirms, **primary shuts down** to prevent data loss.

2. Maximum Availability

- Also targets **zero data loss**.
- Redo is sent synchronously, like Maximum Protection.
- However, if the standby is **unreachable**, the primary **continues running** and switches temporarily to **Maximum Performance** mode.

- Once the standby comes back, it **resynchronizes** automatically.

3. Maximum Performance

- **Default mode**.
- Prioritizes **performance** over protection.
- Redo is sent **asynchronously** to the standby.
- There may be **minimal data loss** if the primary fails.

Mode	Data Loss	Primary Stops?	Performance	Use When…
Max Protection	❌ No	✅ Yes	❌ Slower	No data loss allowed
Max Availability	❌ No	❌ No	⚠️ Medium	Balanced safety and uptime
Max Performance	✅ Maybe	❌ No	✅ Fast	Performance is more important

Oracle 19C Dataguard installation using Active Duplicate Method

Primary Ip: 192.168.17.156
Standby IP: 192.168.17.92

Highlevel steps:

1.add hostentries on both sides
2.stopfirewall &disable firewall
3.Enable archivelog & force logging
5.check the redologs and size of the redologs
6.Add standby redologs with same priviouse redos size

7.Modify these parameters
  check db_name and db_unique_name
  set remote archivelog destination for standby & local is in flash_recovery_area.
  Make sure the standby_file_management=auto
  log_archive_config parameter
  remote_login_passwordfile parameter
  Update the fal_server and fal_client parameters

8.configure listener and tnsnames on both servers and check ping
9.create passwd file & pfile
10.copy passwd file &pfile to standby
11.modify pfile and create required directries
12.start standby db with pfile
13. on standby:connect with rman with target & auxiliary instance
14. Run the following duplicate command
15.Connect with sqlplus on standby
16.Dataguard important Queries Check the database status on primary and standby on both servers
17.Start the MRP process on standby database
18.check Status of the MRP process
19.Check if both the primary and standby is in sync

1.Edit the hosts file for both primary and standby server. Add the ip ,hostname entry in hosts file.

Primary Machine hosts file will be like this

```
Last login: Sat Jun 28 14:48:49 2025
[root@node1 ~]# cat /etc/hosts
127.0.0.1   localhost localhost.localdomain localhost4 localhost4.localdomain4
::1         localhost localhost.localdomain localhost6 localhost6.localdomain6
[root@node1 ~]# vi /etc/hosts
[root@node1 ~]# cat /etc/hosts
192.168.17.156  node1.oracle.com node1
192.168.17.90   node2.oracle.com node2

[root@node1 ~]#
```

Standby Machine hosts file will be like this.

```
Last login: Sat Jun 28 14:48:07 2025
[root@node2 ~]# cat /etc/hosts
127.0.0.1   localhost localhost.localdomain localhost4 localhost4.localdomain4
::1         localhost localhost.localdomain localhost6 localhost6.localdomain6
[root@node2 ~]# hostname
node2.oracle.com
[root@node2 ~]# vi /etc/hosts
[root@node2 ~]# cat /etc/hosts
192.168.17.156  node1.oracle.com node1
192.168.17.90   node2.oracle.com node2
[root@node2 ~]#
```

2.Disable the firewall of both primary and standby machine

```
[root@node1 ~]# systemctl stop firewalld
[root@node1 ~]# systemctl disable firewalld
[root@node1 ~]#
```

3.Primary Side Configuration Put the database in archive log mode.

```
SQL> SELECT log_mode FROM v$database;

LOG_MODE
------------
NOARCHIVELOG

SQL> SHUTDOWN IMMEDIATE;
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> STARTUP MOUNT;
ORACLE instance started.

Total System Global Area 1140849904 bytes
Fixed Size                  8895728 bytes
Variable Size             738197504 bytes
Database Buffers          385875968 bytes
Redo Buffers                7880704 bytes
Database mounted.
SQL> ALTER DATABASE ARCHIVELOG;

Database altered.

SQL> ALTER DATABASE OPEN;

Database altered.
```

4. Enable force logging

At least one log file available

```
SQL> alter database force logging;

Database altered.

SQL> alter system switch logfile;

System altered.
```

5.Check the size of online logfile and create same size standby logfile

```
SQL> select GROUP#,THREAD#,SEQUENCE#,bytes/1024/1024,MEMBERS,STATUS from v$log;

    GROUP#    THREAD#  SEQUENCE# BYTES/1024/1024    MEMBERS STATUS
---------- ---------- ---------- --------------- ---------- ----------------
         1          1          7             200          2 CURRENT
         2          1          5             200          2 INACTIVE
         3          1          6             200          2 ACTIVE

SQL> select member from v$logfile;

MEMBER
--------------------------------------------------------------------------------
/u01/app/oracle/oradata/PROD/onlinelog/o1_mf_3_n5wxgzvq_.log
/u01/app/oracle/fast_recovery_area/PROD/onlinelog/o1_mf_3_n5wxh28m_.log
/u01/app/oracle/oradata/PROD/onlinelog/o1_mf_2_n5wxgo4h_.log
/u01/app/oracle/fast_recovery_area/PROD/onlinelog/o1_mf_2_n5wxgslo_.log
/u01/app/oracle/oradata/PROD/onlinelog/o1_mf_1_n5wxgo2p_.log
/u01/app/oracle/fast_recovery_area/PROD/onlinelog/o1_mf_1_n5wxgtgt_.log

6 rows selected.
```

6.create standby redo logs for switchovers and should be adding one extra.

alter database add standby logfile '/u01/app/oracle/oradata/PROD/onlinelog/redo04.log' size 200m;

alter database add standby logfile '/u01/app/oracle/oradata/PROD/onlinelog/redo05.log' size 200m;

alter database add standby logfile '/u01/app/oracle/oradata/PROD/onlinelog/redo06.log' size 200m;

alter database add standby logfile '/u01/app/oracle/oradata/PROD/onlinelog/redo07.log' size 200m;

```
SQL> select member from v$logfile;

MEMBER
--------------------------------------------------------------------------------
/u01/app/oracle/oradata/PROD/onlinelog/o1_mf_3_n5wxgzvq_.log
/u01/app/oracle/fast_recovery_area/PROD/onlinelog/o1_mf_3_n5wxh28m_.log
/u01/app/oracle/oradata/PROD/onlinelog/o1_mf_2_n5wxgo4h_.log
/u01/app/oracle/fast_recovery_area/PROD/onlinelog/o1_mf_2_n5wxgslo_.log
/u01/app/oracle/oradata/PROD/onlinelog/o1_mf_1_n5wxgo2p_.log
/u01/app/oracle/fast_recovery_area/PROD/onlinelog/o1_mf_1_n5wxgtgt_.log
/u01/app/oracle/oradata/PROD/onlinelog/redo04.log
/u01/app/oracle/oradata/PROD/onlinelog/redo05.log
/u01/app/oracle/oradata/PROD/onlinelog/redo06.log
/u01/app/oracle/oradata/PROD/onlinelog/redo07.log
```

SELECT group#, type, member FROM v$logfile WHERE type = 'STANDBY' order by group#;

7.Check DB_NAME & DB_UNIQUE_NAME

```
SQL> show parameter db_name;

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
db_name                              string      prod
SQL> show parameter db_unique_name;

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
db_unique_name                       string      prod
```

8.set remote archivelog destination for standby & local is in flash_recovery_area.

alter system set log_archive_dest_2= 'service=stand async noaffirm reopen=15 valid_for=(all_logfiles,primary_role) db_unique_name=stand';

9. Make sure the STANDBY_FILE_MANAGEMENT parameter is set.

```
SQL> alter system set log_archive_dest_2= 'service=stand async noaffirm reopen=15  valid_for=(all_logfiles,primary_role) db_unique_name=stand';

System altered.

SQL> ALTER SYSTEM SET STANDBY_FILE_MANAGEMENT=AUTO;

System altered.

SQL>
```

10.Listener configuration on primary and standby

```
[oracle@node1 admin]$ cat listener.ora
SID_LIST_LISTENER =
  (SID_LIST =
    (SID_DESC =
      (GLOBAL_DBNAME = prod)
      (ORACLE_HOME = /u01/app/oracle/product/19c/dbhome_1)
      (SID_NAME = prod)
    )
  )

LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = 192.168.17.156)(PORT = 1521))
    )
  )
```

Standby listener

```
[oracle@node2 admin]$ cat listener.ora
SID_LIST_LISTENER =
  (SID_LIST =
    (SID_DESC =
      (GLOBAL_DBNAME = stand)
      (ORACLE_HOME = /u01/app/oracle/product/19c/dbhome)
      (SID_NAME = stand)
    )
  )

LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = 192.168.17.92)(PORT = 1521))
    )
  )
```

TNS FIle on both primary and standby

```
[oracle@node2 admin]$ cat tnsnames.ora
PROD =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = node1.oracle.com)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = prod)
    )
  )
STAND =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = node2.oracle.com)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = stand)
    )
  )
```

stop and Start the listener

lsnrctl stop

lsnrctl start

Crosscheck with tnsping for both stand and primary database.

```
[oracle@node1 admin]$ tnsping stand

TNS Ping Utility for Linux: Version 19.0.0.0.0 - Production on 28-JUN-2025 15:53:49

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

Used parameter files:


Used TNSNAMES adapter to resolve the alias
Attempting to contact (DESCRIPTION = (ADDRESS = (PROTOCOL = TCP)(HOST = 192.168.17.92)(PORT = 1521)) (CONNECT_DATA = (SERVER = DEDICATED) (SERVICE_NAME = stand)))
OK (0 msec)
```

```
[oracle@node2 dbhome]$ tnsping prod

TNS Ping Utility for Linux: Version 19.0.0.0.0 - Production on 28-JUN-2025 15:53:44

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

Used parameter files:


Used TNSNAMES adapter to resolve the alias
Attempting to contact (DESCRIPTION = (ADDRESS = (PROTOCOL = TCP)(HOST = node1.oracle.com)(PORT = 1521)) (CONNECT_DATA = (SERVER = DEDICATED) (SERVICE_NAME = prod)))
OK (10 msec)
```

11.Set the log_archive_config parameter

```
SQL> alter system set log_archive_config='dg_config=(prod,stand)';

System altered.
```

12. set remote_login_passwordfile exclusive.

```
SQL> alter system set remote_login_passwordfile='EXCLUSIVE' scope=spfile;

System altered.
```

13.Update the fal_server and fal_client

```
SQL> alter system set fal_server='stand';

System altered.

SQL> alter system set fal_client='prod';

System altered.
```

14. Create pfile from spfile for the standby database

```
SQL> create pfile from spfile;

File created.
```

15.Move the PFILE,Password file file to standby. Change the name of files as per standby database.

Before moving password better to recreate

```
[oracle@node1 dbhome_1]$ orapwd file=/u01/app/oracle/product/19c/dbhome_1/dbs/orapwprod force=y

Enter password for SYS:
[oracle@node1 dbhome_1]$ cd dbs
[oracle@node1 dbs]$ ll
total 10380
-rw-rw----. 1 oracle oinstall     1544 Jun 28 15:06 hc_prod.dat
-rwxrwxr-x. 1 oracle oinstall     3079 May 14  2015 init.ora
-rw-r--r--. 1 oracle oinstall     1408 Jun 28 16:05 initprod.ora
-rw-r-----. 1 oracle oinstall       24 Jun 27 16:10 lkPROD
-rw-r-----. 1 oracle oinstall     6144 Jun 28 16:13 orapwprod
-rw-r-----. 1 oracle oinstall 10600448 Jun 28 15:26 snapcf_prod.f
-rw-r-----. 1 oracle oinstall     3584 Jun 28 16:03 spfileprod.ora
[oracle@node1 dbs]$
```

```
orapwd file=$ORACLE_HOME/dbs/orapwclone force=y

password for sys: prod@123
```

```
[oracle@node1 dbs]$ scp orapwprod root@192.168.17.92:/u01/app/oracle/product/19c/dbhome/dbs/orapwstand
The authenticity of host '192.168.17.92 (192.168.17.92)' can't be established.
ECDSA key fingerprint is SHA256:TjWtGmZiLMKQcXfrVyKFYId8dlZTM7TMQRSxdjuIt1w.
ECDSA key fingerprint is MD5:52:ad:9d:75:b0:39:20:a0:a3:f5:ff:77:b9:be:cd:ea.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.17.92' (ECDSA) to the list of known hosts.
root@192.168.17.92's password:
orapwprod
[oracle@node1 dbs]$
```

16. copy pfile also to standby

```
[oracle@node1 dbs]$ scp initprod.ora root@192.168.17.92:/u01/app/oracle/product/19c/dbhome/dbs/initstand.ora
root@192.168.17.92's password:
initprod.ora
[oracle@node1 dbs]$
```

17.Standby Configuration Create directory on standby for CDB and PDB datafile also.

mkdir -p /u01/app/oracle/oradata/STAND/
mkdir -p /u01/app/oracle/admin/stand/adump
mkdir -p /u01/app/oracle/fast_recovery_area/stand/

18.Modify pfile in standby. Do changes in standby pfile and add following two parameter as log_file_name_convert and db_file_name_convert

stand.__data_transfer_cache_size=0
stand.__db_cache_size=352321536
stand.__inmemory_ext_roarea=0
stand.__inmemory_ext_rwarea=0
stand.__java_pool_size=16777216
stand.__large_pool_size=16777216
stand.__oracle_base='/u01/app/oracle'#ORACLE_BASE set from environment
stand.__pga_aggregate_target=469762048
stand.__sga_target=671088640
stand.__shared_io_pool_size=33554432
stand.__shared_pool_size=234881024
stand.__streams_pool_size=0

stand.__unified_pga_pool_size=0
*.audit_file_dest='/u01/app/oracle/admin/stand/adump'
*.audit_trail='db'
*.compatible='19.0.0'
*.control_files='/u01/app/oracle/oradata/STAND/controlfile/o1_mf_n5wxgl47_.ctl','/u01/app/oracle/fast_recovery_area/STAND/controlfile/o1_mf_n5wxglg2_.ctl'
*.db_block_size=8192
*.db_create_file_dest='/u01/app/oracle/oradata'
*.db_name='prod'
*.db_unique_name='stand'
*.db_recovery_file_dest='/u01/app/oracle/fast_recovery_area'
*.db_recovery_file_dest_size=8256m
*.diagnostic_dest='/u01/app/oracle'
*.dispatchers='(PROTOCOL=TCP) (SERVICE=standXDB)'
*.db_file_name_convert='/u01/app/oracle/oradata/PROD','//u01/app/oracle/oradata/STAND'
*.log_file_name_convert='/u01/app/oracle/oradata/PROD/','/u01/app/oracle/oradata/STAND/'
*.log_archive_dest_1='location=/u01/archive valid_for=(all_logfiles,all_roles) db_unique_name=stand'
*.log_archive_dest_2='service=prim valid_for=(all_logfiles,primary_role) db_unique_name=prod'
*.fal_client='stand'
*.fal_server='prod'
*.local_listener='(ADDRESS=(PROTOCOL=TCP)(HOST=192.168.17.156)(PORT=1521))'
*.log_archive_config='dg_config=(prod,stand)'
*.log_archive_dest_2='service=stand async noaffirm reopen=15 valid_for=(all_logfiles,primary_role) db_unique_name=stand'
*.memory_target=1081m
*.open_cursors=300
*.processes=300
*.remote_login_passwordfile='EXCLUSIVE'
*.standby_file_management='AUTO'
*.undo_tablespace='UNDOTBS1'

19.Start the database in nomount stage using pfile on standby

```
SQL> startup nomount pfile='/u01/app/oracle/product/19c/dbhome/dbs/initstand.ora';
ORACLE instance started.

Total System Global Area 1140849904 bytes
Fixed Size                  8895728 bytes
Variable Size             738197504 bytes
Database Buffers          385875968 bytes
Redo Buffers                7880704 bytes
SQL>
```

20.on standby:connect with rman with target & auxiliary instance using the following command.

$ rman target sys/orcldb$123@prod auxiliary sys/orcldb$123@stand

```
[oracle@node2 dbs]$ rman target "sys/orcldb\$123"@prod  auxiliary "sys/orcldb\$123"@stand

Recovery Manager: Release 19.0.0.0.0 - Production on Sun Jun 29 09:50:36 2025
Version 19.3.0.0.0

Copyright (c) 1982, 2019, Oracle and/or its affiliates.  All rights reserved.

connected to target database: PROD (DBID=616744746)
connected to auxiliary database: PROD (not mounted)

RMAN>
```

21. Run the following duplicate command, that command will start copying all database on the standby

duplicate target database for standby from active database dorecover nofilenamecheck;

```
RMAN> duplicate target database for standby from active database dorecover nofilenamecheck;

Starting Duplicate Db at 29-JUN-25
using target database control file instead of recovery catalog
allocated channel: ORA_AUX_DISK_1
channel ORA_AUX_DISK_1: SID=39 device type=DISK
current log archived

contents of Memory Script:
{
   backup as copy reuse
   passwordfile auxiliary format  '/u01/app/oracle/product/19c/dbhome/dbs/orapwstand'    ;
}
executing Memory Script

Starting backup at 29-JUN-25
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=82 device type=DISK
```

```
released channel: ORA_DISK_1
released channel: ORA_AUX_DISK_1
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=82 device type=DISK
deleted archived log
archived log file name=/u01/archive1_14_1204906412.dbf RECID=1 STAMP=1205058199
deleted archived log
archived log file name=/u01/archive1_15_1204906412.dbf RECID=2 STAMP=1205058200
deleted archived log
archived log file name=/u01/archive1_16_1204906412.dbf RECID=3 STAMP=1205058201
deleted archived log
archived log file name=/u01/archive1_17_1204906412.dbf RECID=4 STAMP=1205058202
deleted archived log
archived log file name=/u01/archive1_18_1204906412.dbf RECID=5 STAMP=1205058203
Deleted 5 objects

Finished Duplicate Db at 29-JUN-25

RMAN> exit
```

Exit ,Connect with sqlplus on standby

22.Dataguard important Queries Check the database status on primary and standby

select status,instance_name,database_role,protection_mode from v$database,v$instance;

```
select status,instance_name,database_role,protection_mode from v$database,v$instance;
SQL>
STATUS       INSTANCE_NAME    DATABASE_ROLE    PROTECTION_MODE
------------ ---------------- ---------------- --------------------
OPEN         prod             PRIMARY          MAXIMUM PERFORMANCE

SQL>
```

```
SQL> show parameter db_unique_name;

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------
db_unique_name                       string      prod
SQL>
```

On stanby

```
select status,instance_name,database_role,protection_mode from v$database,v$instance;
SQL>
STATUS       INSTANCE_NAME    DATABASE_ROLE    PROTECTION_MODE
------------ ---------------- ---------------- --------------------
MOUNTED      stand            PHYSICAL STANDBY MAXIMUM PERFORMANCE
```

```
SQL> show parameter db_unique_name;

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------
db_unique_name                       string      stand
SQL>
```

23.Start the MRP process on standby database

SQL>ALTER DATABASE RECOVER MANAGED STANDBY DATABASE DISCONNECT FROM SESSION;

Datebase altered

MRP means Managed Recovery Process

🧠 What Does MRP Do?

The MRP process applies archived redo logs that are received from the primary database to the physical standby database.

This keeps the standby database synchronized with the primary.

🔁 Data Guard Flow with MRP:

1. Primary DB generates redo logs.
2. Redo logs are shipped to standby DB via LNS and RFS processes.
3. MRP on the standby picks up those redo logs and applies them to keep the standby current.

⚙ When is MRP Active?

Only on a Physical Standby Database

When the standby is in managed recovery mode:

24.Status of the MRP process

select process,status,client_process,thread#,sequence#,block#,blocks,delay_mins from v$managed_standby;

```
SQL> select PROCESS,STATUS from v$managed_standby where PROCESS='MRP0';

PROCESS   STATUS
--------- ------------
MRP0      APPLYING_LOG
```

```
SQL> DESC v$managed_standby;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------
 PROCESS                                            VARCHAR2(9)
 PID                                                VARCHAR2(24)
 STATUS                                             VARCHAR2(12)
 CLIENT_PROCESS                                     VARCHAR2(8)
 CLIENT_PID                                         VARCHAR2(40)
 CLIENT_DBID                                        VARCHAR2(40)
 GROUP#                                             VARCHAR2(40)
 RESETLOG_ID                                        NUMBER
 THREAD#                                            NUMBER
 SEQUENCE#                                          NUMBER
 BLOCK#                                             NUMBER
 BLOCKS                                             NUMBER
 DELAY_MINS                                         NUMBER
 KNOWN_AGENTS                                       NUMBER
 ACTIVE_AGENTS                                      NUMBER
 CON_ID                                             NUMBER
```

```
SQL> select PROCESS,STATUS,CLIENT_PROCESS,SEQUENCE# from v$managed_standby;

PROCESS   STATUS       CLIENT_P  SEQUENCE#
--------- ------------ -------- ----------
ARCH      CONNECTED    ARCH              0
DGRD      ALLOCATED    N/A               0
DGRD      ALLOCATED    N/A               0
ARCH      CONNECTED    ARCH              0
ARCH      CONNECTED    ARCH              0
ARCH      CONNECTED    ARCH              0
RFS       IDLE         Archival          0
RFS       IDLE         LGWR             19
MRP0      APPLYING_LOG N/A              19

9 rows selected.
```

25.Check if both the primary and standby is in sync

```
SQL> SELECT SEQUENCE#, APPLIED FROM V$ARCHIVED_LOG;

 SEQUENCE# APPLIED
---------- ---------
        14 YES
        15 YES
        16 YES
        17 YES
        18 YES
```

Dataguard physical standby completed success fully