**Session 17 COMPLETE RECOVERY by RMAN**

**CASE #1 OPEN (HOT) Tablespace recovery  One of the NON-ESSENTIAL files is missing (or corrupted) 🡪 File must Not belong to SYSTEM or UNDOTBS tablespace**

Last login: Mon Apr 11 10:10:36 2022 from 10.31.12.209

[student@oracledb19c ~]$ **su - oracle**

Password:

Last login: Mon Apr 11 10:34:55 EDT 2022 on pts/0

The Oracle base remains unchanged with value /opt/oracle/app/oracle

[oracle@oracledb19c ~]$ **pwd**

/home/oracle

[oracle@oracledb19c ~]$ **cd ARCHIVE**

[oracle@oracledb19c ARCHIVE]$ **ls -l**

total 713120

-rw-r----- 1 oracle dba 2048 Apr8 10:21 arch\_1066817182\_1\_119.log

-rw-r----- 1 oracle dba 184511488 Apr9 06:00 arch\_1066817182\_1\_120.log

-rw-r----- 1 oracle dba 185563136 Apr9 20:25 arch\_1066817182\_1\_121.log

-rw-r----- 1 oracle dba 186449920 Apr1010:09 arch\_1066817182\_1\_122.log

-rw-r----- 1 oracle dba 173700608 Apr1022:12 arch\_1066817182\_1\_123.log

SQL> **sqlplus / as sysdba**

Connected.

SQL> SET PAGESIZE 120

SQL> **select status from v$instance;**

STATUS

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

MOUNTED

* **I forgot to open my DB at the end of Session 16**

SQL> **alter database open;**

Database altered.

**\* Let’s create a table as user Tom, then add some rows – they will be stored in his default tbsp. MINE. \***

SQL> **conn tom/cat**

Connected.

SQL> **CREATE TABLE play (Col1 DATE);**

Table created.

SQL> **host date**

Sat Apr 16 15:04:37 EDT 2022

SQL> **INSERT INTO play VALUES (sysdate -7);**

1 row created.

SQL> **INSERT INTO play VALUES (sysdate -2);**

1 row created.

SQL> **INSERT INTO play VALUES (sysdate);**

1 row created.

SQL> **commit;**

Commit complete.

SQL> **select \* from play;**

COL1

---------

09-APR-22

14-APR-22

16-APR-22

SQL> **conn / as sysdba**

Connected.

SQL> **SELECT GROUP#, SEQUENCE#, STATUS FROM V$LOG;**

GROUP# SEQUENCE# STATUS

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

1 122 INACTIVE

2 123 INACTIVE

3 124 CURRENT

SQL> **SELECT default\_tablespace FROM dba\_users**

**WHERE USERNAME = 'TOM';**

DEFAULT\_TABLESPACE

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

MINE

SQL> **select TS#, NAME from v$tablespace;**

TS# NAME

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

1 SYSAUX

0 SYSTEM

2 UNDOTBS1

4 USERS

3 TEMP

6 MINE

7 JOKE

8 INDX

8 rows selected.

SQL> **SELECT file#, name FROM v$datafile**

**WHERE ts# = 6;**

FILE#

----------

NAME

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

5

/opt/oracle/app/oracle/oradata/STUDENT/mine01.dbf

**\* Let’s mimic Junior DBA error, who removes in Linux the Datafile that belongs to Tbsp MINE. This file is NON-ESSENTIAL, because its Tablespace may be taken offline, unlike the files from tablespaces SYSTEM and UNDOTBS1. That fact and because we are in ARCHIVELOG mode, allow us to perform OPEN (HOT) Recovery. If we have collected ALL archived log files since the LAST FULL Backup of this Tablespace (or its Datafile), then this will be a COMPLETE RECOVERY (No Data Loss)\***

SQL> **host**

[oracle@oracledb19c ARCHIVE]$ **cd /opt/oracle/app/oracle/oradata/STUDENT/**

[oracle@oracledb19c STUDENT]$ **ls -l mine\***

-rw-r----- 1 oracle dba 10493952 Apr 16 15:09 mine01.dbf

[oracle@oracledb19c STUDENT]$ **rm mine01.dbf**

[oracle@oracledb19c STUDENT]$ **ls -l mine\***

ls: cannot access 'mine\*': No such file or directory

[oracle@oracledb19c STUDENT]$ **exit**

exit

**\* We will perform two log switches in order to mimic real life situation, before checking on our table rows \***

SQL> **alter system switch logfile;**

System altered.

SQL> **alter system switch logfile;**

System altered.

SQL> **SELECT GROUP#, SEQUENCE#, STATUS FROM V$LOG;**

GROUP# SEQUENCE# STATUS

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

1 125 ACTIVE

2 126 CURRENT

3 124 ACTIVE

SQL> **select \* from tom.play;**

select \* from tom.play

\*

ERROR at line 1:

ORA-00376: file 5 cannot be read at this time

ORA-01110: data file 5: '/opt/oracle/app/oracle/oradata/STUDENT/mine01.dbf'

**\* Sometimes, your table data stays in the Memory = Buffer Cache, and you can still see it, though the physical file is removed. Then you need to clear the Buffer Cache with**

**> ALTER SYSTEM FLUSH BUFFER CACHE; \***

[oracle@oracledb19c ARCHIVE]$ **rman target /**

Recovery Manager: Release 19.0.0.0.0 - Production on Sat Apr 16 15:16:40 2022

Version 19.3.0.0.0

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connected to target database: STUDENT (DBID=107505563)

RMAN> **list backup of tablespace mine;**

List of Backup Sets

===================

BS Key Type LV Size Device Type Elapsed Time Completion Time

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

18 Incr 0 1.86G DISK 00:00:12 08-APR-22

BP Key: 18 Status: AVAILABLE Compressed: NO Tag: TAG20220408T102124

Piece Name: /home/oracle/BACKUP/full\_0k0qe0t4\_20\_1

List of Datafiles in backup set 18

File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name

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

5 0 Incr 9164178 08-APR-22 NO /opt/oracle/app/oracle/oradata/STUDENT/mine01.dbf

BS Key Type LV Size Device Type Elapsed Time Completion Time

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

21 Incr 0 5.88M DISK 00:00:00 08-APR-22

BP Key: 21 Status: AVAILABLE Compressed: NO Tag: TAG20220408T102822

Piece Name: /home/oracle/BACKUP/full\_0n0qe1a6\_23\_1

List of Datafiles in backup set 21

File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name

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

5 0 Incr 9164548 08-APR-22 NO /opt/oracle/app/oracle/oradata/STUDENT/mine01.dbf

BS Key Type LV Size Device Type Elapsed Time Completion Time

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

25 Incr 1 48.00K DISK 00:00:00 08-APR-22

BP Key: 25 Status: AVAILABLE Compressed: NO Tag: TAG20220408T103103

Piece Name: /home/oracle/BACKUP/full\_0r0qe1f7\_27\_1

List of Datafiles in backup set 25

File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name

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

5 1 Incr 9164685 08-APR-22 NO /opt/oracle/app/oracle/oradata/STUDENT/mine01.dbf

BS Key Type LV Size Device Type Elapsed Time Completion Time

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

31 Full 1.89G DISK 00:00:10 11-APR-22

BP Key: 31 Status: AVAILABLE Compressed: NO Tag: TAG20220411T104010

Piece Name: /home/oracle/BACKUP/full\_110qlv4a\_33\_1

List of Datafiles in backup set 31

File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name

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

5 Full 9425475 11-APR-22 NO /opt/oracle/app/oracle/oradata/STUDENT/mine01.dbf

BS Key Type LV Size Device Type Elapsed Time Completion Time

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

33 Incr 0 1.08G DISK 00:00:07 11-APR-22

BP Key: 33 Status: AVAILABLE Compressed: NO Tag: TAG20220411T104152

Piece Name: /home/oracle/BACKUP/full\_130qlv7g\_35\_1

List of Datafiles in backup set 33

File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name

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

5 0 Incr 9425475 11-APR-22 NO /opt/oracle/app/oracle/oradata/STUDENT/mine01.dbf

**Step One – Place Tablespace OFFLINE and Inspect file for RECOVERY**

RMAN> **alter tablespace MINE offline;**

alter tablespace MINE offline

\*

ERROR at line 1:

ORA-01191: file 5 is already offline - cannot do a normal offline

ORA-01110: data file 5: '/opt/oracle/app/oracle/oradata/STUDENT/mine01.dbf'

**\* If you can not place Tbsp offline in NORMAL mode (default), you need to use IMMEDIATE mode \***

RMAN> **alter tablespace MINE offline immediate;**

Tablespace altered.

RMAN> **SELECT FILE#, ONLINE\_STATUS, ERROR, CHANGE#**

**FROM V$RECOVER\_FILE;**

FILE# ONLINE\_ ERROR CHANGE#

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

5 ONLINE FILE NOT FOUND 0

**Step Two – Restore Missing (or Corrupted) Tablespace in RMAN**

RMAN> **RESTORE TABLESPACE MINE;**

Starting restore at 16-APR-22

using target database control file instead of recovery catalog

allocated channel: ORA\_DISK\_1

channel ORA\_DISK\_1: SID=143 device type=DISK

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 /opt/oracle/app/oracle/oradata/STUDENT/mine01.dbf

channel ORA\_DISK\_1: reading from backup piece /home/oracle/BACKUP/full\_130qlv7g\_35\_1

channel ORA\_DISK\_1: piece handle=/home/oracle/BACKUP/full\_130qlv7g\_35\_1 tag=TAG20220411T104152

channel ORA\_DISK\_1: restored backup piece 1

channel ORA\_DISK\_1: restore complete, elapsed time: 00:00:01

Finished restore at 16-APR-22

**Step Three – Recover Missing ( or Corrupted) Tablespace in RMAN**

RMAN> **RECOVER TABLESPACE MINE;**

Starting recover at 16-APR-22

using channel ORA\_DISK\_1

starting media recovery

archived log for thread 1 with sequence 124 is already on disk as file /home/oracle/ARCHIVE/arch\_1066817182\_1\_124.log

archived log for thread 1 with sequence 125 is already on disk as file /home/oracle/ARCHIVE/arch\_1066817182\_1\_125.log

archived log for thread 1 with sequence 126 is already on disk as file /home/oracle/ARCHIVE/arch\_1066817182\_1\_126.log

archived log file name=/home/oracle/ARCHIVE/arch\_1066817182\_1\_124.log thread=1 sequence=124

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

Finished recover at 16-APR-22

RMAN> **SELECT GROUP#, SEQUENCE#, STATUS FROM V$LOG;**

GROUP# SEQUENCE# STATUS

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

1 125 INACTIVE

2 126 INACTIVE

3 127 CURRENT

**Step Four – Place Tablespace ONLINE**

RMAN> **alter tablespace MINE online;**

Statement processed

**Step Five – Inspect file for RECOVERY an Verify there was NO DATA LOSS**

RMAN> **SELECT \* FROM V$RECOVER\_FILE;**

no rows selected

RMAN> **exit**

Recovery Manager complete.

[oracle@oracledb19c ARCHIVE]$ exit

exit

SQL> **show user**

USER is "SYS"

SQL> **select \* from tom.play;**

COL1

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09-APR-22

14-APR-22

16-APR-22

** Notice that our Table and its rows are back (No Data Loss)**

SQL> **conn tom/cat**

Connected.

SQL> **truncate table play;**

Table truncated.

**CASE #2 CLOSED (COLD) Datafile Recovery**

** One of the ESSENTIAL files is missing (corrupted)**

SQL> **HOST date**

Sat Apr 16 15:21:53 EDT 2022

SQL> **INSERT INTO play VALUES (sysdate+1);**

1 row created.

SQL> **INSERT INTO play VALUES (sysdate + 7);**

1 row created.

SQL> **commit;**

Commit complete.

SQL> **select \* from play;**

COL1

---------

17-APR-22

23-APR-22

SQL> **conn / as sysdba**

Connected.

SQL>

SQL> **SELECT file#, name FROM v$datafile**

**WHERE ts# = 2;**

FILE#

----------

NAME

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

4

/opt/oracle/app/oracle/oradata/DISK3/undotbs01.dbf

SQL> **SELECT GROUP#, SEQUENCE#, STATUS FROM V$LOG;**

GROUP# SEQUENCE# STATUS

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

1 125 INACTIVE

2 126 INACTIVE

3 127 CURRENT

SQL> **alter system switch logfile;**

System altered.

SQL> **alter system checkpoint;**

System altered.

SQL> **SELECT GROUP#, SEQUENCE#, STATUS FROM V$LOG;**

GROUP# SEQUENCE# STATUS

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

1 128 CURRENT

2 126 INACTIVE

3 127 INACTIVE

**\* Let’s mimic Disk Controller error, where Datafile 4 from the UNDOTBS1 tablespace becomes unusable. This is one of TWO ESSENTIAL Datafiles (the other one is from SYSTEM Tablespace) and they can NOT be taken offline. In that case Database will most likely shut down itself and you will need to perform CLOSED COMPLETE RECOVERY. This type Recovery happens while in MOUNT state and NO data loss will occur, because ALL Archive Log files since the LAST FULL Backup of Datafile 4 are available.**

**In the case that just one of these Archive Log files (needed for recovery) is lost or corrupted, you can perform only INCOMPLETE RECOVERY till Point in Time in the Past, when the Redo Log file (of that lost Archive Log file) became current OR till SCN that was saved with the previous Redo Log file (the LAST\_CHANGE#) \***

**Mimicking Disk Controller error involves aborting the database and deleting the essential file, but later we are NOT going to switch to other (good) disk, like the real life situation would require \***

SQL> **shutdown abort;**

ORACLE instance shut down.

SQL> host

[oracle@oracledb19c ARCHIVE]$ **cd /opt/oracle/app/oracle/oradata/DISK3**

[oracle@oracledb19c DISK3]$ **ls -l undo\***

-rw-r----- 1 oracle dba 125837312 Apr 16 15:25 undotbs01.dbf

[oracle@oracledb19c DISK3]$

[oracle@oracledb19c DISK3]$ **rm undotbs01.dbf**

[oracle@oracledb19c DISK3]$ **ls -l undo\***

ls: cannot access 'undo\*': No such file or directory

[oracle@oracledb19c DISK3]$

[oracle@oracledb19c DISK3]$ **rman target /**

Recovery Manager: Release 19.0.0.0.0 - Production on Sat Apr 16 15:27:34 2022

Version 19.3.0.0.0

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connected to target database (not started)

RMAN> **list backup of datafile 4;**

List of Backup Sets

===================

BS Key Type LV Size Device Type Elapsed Time Completion Time

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

18 Incr 0 1.86G DISK 00:00:12 08-APR-22

BP Key: 18 Status: AVAILABLE Compressed: NO Tag: TAG20220408T102124

Piece Name: /home/oracle/BACKUP/full\_0k0qe0t4\_20\_1

List of Datafiles in backup set 18

File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name

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

4 0 Incr 9164178 08-APR-22 NO /opt/oracle/app/oracle/oradata/DISK3/undotbs01.dbf

BS Key Type LV Size Device Type Elapsed Time Completion Time

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

23 Incr 0 1.70M DISK 00:00:00 08-APR-22

BP Key: 23 Status: AVAILABLE Compressed: NO Tag: TAG20220408T102858

Piece Name: /home/oracle/BACKUP/full\_0p0qe1ba\_25\_1

List of Datafiles in backup set 23

File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name

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

4 0 Incr 9164593 08-APR-22 NO /opt/oracle/app/oracle/oradata/DISK3/undotbs01.dbf

BS Key Type LV Size Device Type Elapsed Time Completion Time

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

27 Incr 1 128.00K DISK 00:00:01 08-APR-22

BP Key: 27 Status: AVAILABLE Compressed: NO Tag: TAG20220408T103218

Piece Name: /home/oracle/BACKUP/full\_0t0qe1hi\_29\_1

List of Datafiles in backup set 27

File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name

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

4 1 Incr 9164743 08-APR-22 NO /opt/oracle/app/oracle/oradata/DISK3/undotbs01.dbf

BS Key Type LV Size Device Type Elapsed Time Completion Time

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

31 Full 1.89G DISK 00:00:10 11-APR-22

BP Key: 31 Status: AVAILABLE Compressed: NO Tag: TAG20220411T104010

Piece Name: /home/oracle/BACKUP/full\_110qlv4a\_33\_1

List of Datafiles in backup set 31

File LV Type Ckp SCN Ckp Time Abs Fuz SCN Sparse Name

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

4 Full 9425475 11-APR-22 NO /opt/oracle/app/oracle/oradata/DISK3/undotbs01.dbf

**Step One – Mount Database and Inspect file for RECOVERY**

** you may try to go for OPEN, but it will stop at MOUNT with the famous errors 1157 and 1110**

RMAN> **startup;**

Oracle instance started

database mounted

RMAN-00571: ===========================================================

RMAN-00569: =============== ERROR MESSAGE STACK FOLLOWS ===============

RMAN-00571: ===========================================================

RMAN-03002: failure of startup command at 04/16/2022 15:29:09

ORA-01157: cannot identify/lock data file 4 - see DBWR trace file

ORA-01110: data file 4: '/opt/oracle/app/oracle/oradata/DISK3/undotbs01.dbf'

RMAN> **SELECT FILE#, ONLINE\_STATUS, ERROR, CHANGE#**

**FROM V$RECOVER\_FILE;**

FILE# ONLINE\_ ERROR CHANGE#

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

4 ONLINE FILE NOT FOUND 0

**Step Two – Restore missing Datafile (or whole Tablespace)**

RMAN> **RESTORE DATAFILE 4;**

Starting restore at 16-APR-22

allocated channel: ORA\_DISK\_1

channel ORA\_DISK\_1: SID=137 device type=DISK

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 00004 to /opt/oracle/app/oracle/oradata/DISK3/undotbs01.dbf

channel ORA\_DISK\_1: reading from backup piece /home/oracle/BACKUP/full\_110qlv4a\_33\_1

channel ORA\_DISK\_1: piece handle=/home/oracle/BACKUP/full\_110qlv4a\_33\_1 tag=TAG20220411T104010

channel ORA\_DISK\_1: restored backup piece 1

channel ORA\_DISK\_1: restore complete, elapsed time: 00:00:01

Finished restore at 16-APR-22

**Step Three – Recover missing Datafile (or whole Tablespace)**

RMAN> **RECOVER DATAFILE 4;**

Starting recover at 16-APR-22

using channel ORA\_DISK\_1

starting media recovery

archived log for thread 1 with sequence 124 is already on disk as file /home/oracle/ARCHIVE/arch\_1066817182\_1\_124.log

archived log for thread 1 with sequence 125 is already on disk as file /home/oracle/ARCHIVE/arch\_1066817182\_1\_125.log

archived log for thread 1 with sequence 126 is already on disk as file /home/oracle/ARCHIVE/arch\_1066817182\_1\_126.log

archived log for thread 1 with sequence 127 is already on disk as file /home/oracle/ARCHIVE/arch\_1066817182\_1\_127.log

archived log file name=/home/oracle/ARCHIVE/arch\_1066817182\_1\_124.log thread=1 sequence=124

archived log file name=/home/oracle/ARCHIVE/arch\_1066817182\_1\_125.log thread=1 sequence=125

media recovery complete, elapsed time: 00:00:02

Finished recover at 16-APR-22

**Step Four – Open Database**

RMAN> **alter database open;**

Statement processed

**Step Five – Verify Recovery File and that there is NO DATA LOSS**

RMAN> **SELECT FILE#, ONLINE\_STATUS, ERROR, CHANGE#**

**FROM V$RECOVER\_FILE;**

no rows selected

RMAN> **exit**

Recovery Manager complete.

[oracle@oracledb19c DISK3]$ **exit**

exit

SQL> **conn / as sysdba**

Connected.

SQL> **select status from v$instance;**

STATUS

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

OPEN

SQL> **SELECT \* FROM tom.play;**

COL1

---------

17-APR-22

23-APR-22

SQL> **SELECT GROUP#, SEQUENCE#, STATUS FROM V$LOG;**

GROUP# SEQUENCE# STATUS

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

1 128 INACTIVE

2 129 CURRENT

3 127 INACTIVE

SQL> **exit**

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

Version 19.3.0.0.0

[oracle@oracledb19c ARCHIVE]$ **ls -l**

total 890224

-rw-r----- 1 oracle dba 2048 Apr8 10:21 arch\_1066817182\_1\_119.log

-rw-r----- 1 oracle dba 184511488 Apr9 06:00 arch\_1066817182\_1\_120.log

-rw-r----- 1 oracle dba 185563136 Apr9 20:25 arch\_1066817182\_1\_121.log

-rw-r----- 1 oracle dba 186449920 Apr1010:09 arch\_1066817182\_1\_122.log

-rw-r----- 1 oracle dba 173700608 Apr1022:12 arch\_1066817182\_1\_123.log

-rw-r----- 1 oracle dba 175833600 Apr1615:10 arch\_1066817182\_1\_124.log

-rw-r----- 1 oracle dba 1536 Apr1615:10 arch\_1066817182\_1\_125.log

-rw-r----- 1 oracle dba 1536 Apr1615:14 arch\_1066817182\_1\_126.log

-rw-r----- 1 oracle dba 2382848 Apr1615:24 arch\_1066817182\_1\_127.log

-rw-r----- 1 oracle dba 3121664 Apr1615:31 arch\_1066817182\_1\_128.log

[oracle@oracledb19c ARCHIVE]$ **exit**

logout

[student@oracledb19c ~]$ **exit**

logout