RMAN (Recovery Manager)

RMAN 이란 오라클 데이터베이스의 백업 복구를 위한 유틸리티이다. 백업의 상황들을 recovery catalog에 등록하여 여러 백업의 중앙 관리가 가능하다. 파일보다 작은 oracle block level로 백업, 복원, 복구가 가능하여 백업 시간을 단축할 수 있다. RMAN 백업 대상으로는 **컨트롤 파일, 데이터 파일, 아카이브 로그 파일**이 있다. 온라인 리두 로그파일과 temp 파일은 RMAN 백업 대상이 아니다.

- **backup set (backup as backupset)**
  블록 레벨로 백업을 진행한다. 오라클의 RMAN으로 생성 및 복원이 가능하다. RMAN으로 백업 진행 시 유일하게 tape device에 저장할 수 있는 유형이다.
  - 장점 : 사용된 데이터 블록만 백업한다. (incremental backup) 백업 시간과 용량을 효과적으로 쓸 수 있다. block corruption 검사가 가능하다.
  - 단점 : 오직 RMAN에서만 가능하고 OS command 로 진행할 수 없다.

- **image copy**
  디스크에 생성된 데이터 파일을 COPY 한다. User Managed Backup에서 수행했던 백업과 동일한 형식으로 진행한다. backup as copy라는 명령어로 생성된 이미지 카피만 RMAN으로 복원할 수 있다.
  - 장점 : OS 명령어로 복원하는 방법을 사용할 수 있다.
  - 단점 : tape device 에 쓰기가 불가하다. 사용하지 않은 빈 블럭도 백업에 포함된다. block corruption 검사가 불가능하다.

초기설정 / Fast Recovery Area 설정

FRA 크기 설정

* FRA란, Backup&Recovery, flashback database 목적으로 활용되는 디스크 영역이다. FRA에 저장된 정보는 설정된 정책 및 필요에 따라 자동 보관 또는 삭제된다. 사용하기 위해서는 필수적으로 사전에 **크기와 위치**가 설정되어야 한다.

```
SYS@PROD1>show parameter db_recovery_file_dest

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


SYS@PROD1>alter system set db_recovery_file_dest_size=2G;
System altered.


SYS@PROD1>show parameter db_recovery_file_dest

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
db_recovery_file_dest                string
db_recovery_file_dest_size           big integer 2G
```

FRA 경로 설정

```
[oracle@edydr1p1 ~]$ mkdir fast_recovery_area
[oracle@edydr1p1 ~]$ ls
afiedt.buf  backup     Desktop    fast_recovery_area  oradiag_oracle  solns
Videos      arch1      bea             Documents  labs      Pictures
Templates   arch2      control_re.sql  Downloads  Music     Public      utl_dir


SYS@PROD1>alter system set db_recovery_file_dest='/home/oracle/fast_recovery_area';

System altered.


SYS@PROD1>show parameter db_recovery_file_dest

NAME                                 TYPE     VALUE
------------------------------------ ----------- ------------------------------
db_recovery_file_dest                string   /home/oracle/fast_recovery_area
db_recovery_file_dest_size           big integer 2G
```

default configure 변경

```
[oracle@edydr1p1 backup]$ mkdir rman
[oracle@edydr1p1 backup]$ ls
arch  PROD1  rman

[oracle@edydr1p1 ~]$ rman target /
```

* RMAN의 설정값 전체 조회

```
RMAN> show all;

RMAN configuration parameters for database with db_unique_name PROD1 are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
CONFIGURE BACKUP OPTIMIZATION OFF; # default
CONFIGURE DEFAULT DEVICE TYPE TO DISK; # default
CONFIGURE CONTROLFILE AUTOBACKUP OFF; # default
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '%F'; # default
CONFIGURE DEVICE TYPE DISK PARALLELISM 1 BACKUP TYPE TO BACKUPSET; # default
CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE MAXSETSIZE TO UNLIMITED; # default
CONFIGURE ENCRYPTION FOR DATABASE OFF; # default
CONFIGURE ENCRYPTION ALGORITHM 'AES128'; # default
CONFIGURE COMPRESSION ALGORITHM 'BASIC' AS OF RELEASE 'DEFAULT' OPTIMIZE FOR LOAD TRUE ; #
default
CONFIGURE RMAN OUTPUT TO KEEP FOR 7 DAYS; # default
CONFIGURE ARCHIVELOG DELETION POLICY TO NONE; # default
CONFIGURE SNAPSHOT CONTROLFILE NAME TO
'/u01/app/oracle/product/12.1.0/dbhome_1/dbs/snapcf_PROD1.f'; # default
```

* 백업을 수행할 device 설정

```
RMAN> configure default device type to disk;

new RMAN configuration parameters:
CONFIGURE DEFAULT DEVICE TYPE TO DISK;
new RMAN configuration parameters are successfully stored
```

* 백업을 저장 경로 형식 설정 (%U : 16진수, %T : YYYYMMDD)

```
RMAN> configure channel device type disk format'/home/oracle/backup/rman/%U_%T';
```

* 백업 수행 시 control file auto backup 설정

```
RMAN> configure controlfile autobackup on;

* control file 저장 포맷 명시 (%F : DBID)
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'/home/oracle/backup/rman/%F';


RMAN> show all;

RMAN configuration parameters for database with db_unique_name PROD1 are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
CONFIGURE BACKUP OPTIMIZATION OFF; # default
CONFIGURE DEFAULT DEVICE TYPE TO DISK;
CONFIGURE CONTROLFILE AUTOBACKUP ON;
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'/home/oracle/backup/rman/%F';
CONFIGURE DEVICE TYPE DISK PARALLELISM 1 BACKUP TYPE TO BACKUPSET; # default
CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/home/oracle/backup/rman/%U_%T';
CONFIGURE MAXSETSIZE TO UNLIMITED; # default
CONFIGURE ENCRYPTION FOR DATABASE OFF; # default
CONFIGURE ENCRYPTION ALGORITHM 'AES128'; # default
CONFIGURE COMPRESSION ALGORITHM 'BASIC' AS OF RELEASE 'DEFAULT' OPTIMIZE FOR LOAD TRUE ; #
default
CONFIGURE RMAN OUTPUT TO KEEP FOR 7 DAYS; # default
CONFIGURE ARCHIVELOG DELETION POLICY TO NONE; # default
CONFIGURE SNAPSHOT CONTROLFILE NAME TO
'/u01/app/oracle/product/12.1.0/dbhome_1/dbs/snapcf_PROD1.f'; # default
```

case 1. Backupset

RMAN에 접속한다. target DB가 open 또는 mount 상태에서 수행한다.

```
[oracle@edydr1p1 ~]$ rman target/
```

DB의 데이터 파일 정보

```
RMAN> report schema;

using target database control file instead of recovery catalog
Report of database schema for database with db_unique_name PROD1

List of Permanent Datafiles
===========================
File Size(MB) Tablespace           RB segs Datafile Name
---- -------- -------------------- ------- ------------------------
1    800      SYSTEM               YES     /u01/app/oracle/oradata/PROD1/system01.dbf
3    650      SYSAUX               NO      /u01/app/oracle/oradata/PROD1/sysaux01.dbf
4    80       UNDOTBS1             YES     /u01/app/oracle/oradata/PROD1/undotbs01.dbf
5    1280     EXAMPLE              NO      /u01/app/oracle/oradata/PROD1/example01.dbf
6    5        USERS                NO      /u01/app/oracle/oradata/PROD1/users01.dbf

List of Temporary Files
=======================
File Size(MB) Tablespace           Maxsize(MB) Tempfile Name
---- -------- -------------------- ----------- --------------------
1    60       TEMP                 32767       /u01/app/oracle/oradata/PROD1/temp01.dbf
```

백업이 필요한 데이터 파일 정보

```
RMAN> report need backup;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
Report of files with less than 1 redundant backups
File #bkps Name
---- ----- -----------------------------------------------------
1    0     /u01/app/oracle/oradata/PROD1/system01.dbf
3    0     /u01/app/oracle/oradata/PROD1/sysaux01.dbf
4    0     /u01/app/oracle/oradata/PROD1/undotbs01.dbf
5    0     /u01/app/oracle/oradata/PROD1/example01.dbf
6    0     /u01/app/oracle/oradata/PROD1/users01.dbf
```

백업수행

```
RMAN> backup database;

Starting backup at 03-JUL-20
...
input datafile file number=00005 name=/u01/app/oracle/oradata/PROD1/example01.dbf
input datafile file number=00001 name=/u01/app/oracle/oradata/PROD1/system01.dbf
input datafile file number=00003 name=/u01/app/oracle/oradata/PROD1/sysaux01.dbf
input datafile file number=00004 name=/u01/app/oracle/oradata/PROD1/undotbs01.dbf
input datafile file number=00006 name=/u01/app/oracle/oradata/PROD1/users01.dbf
...
Finished Control File and SPFILE Autobackup at 03-JUL-20
```

backupset 방식으로 백업한 파일들의 정보 표시

```
RMAN> list backup;

List of Backup Sets
===================

BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
1       Full    1.24G      DISK        00:00:59     03-JUL-20
        BP Key: 1   Status: AVAILABLE  Compressed: NO  Tag: TAG20200703T133419
        Piece Name: /home/oracle/backup/rman/01v4cm6s_1_1_20200703
  List of Datafiles in backup set 1
  File LV Type Ckp SCN    Ckp Time  Name
  ---- -- ---- ---------- --------- ----
  1       Full 2445300    03-JUL-20 /u01/app/oracle/oradata/PROD1/system01.dbf
  3       Full 2445300    03-JUL-20 /u01/app/oracle/oradata/PROD1/sysaux01.dbf
  4       Full 2445300    03-JUL-20 /u01/app/oracle/oradata/PROD1/undotbs01.dbf
  5       Full 2445300    03-JUL-20 /u01/app/oracle/oradata/PROD1/example01.dbf
  6       Full 2445300    03-JUL-20 /u01/app/oracle/oradata/PROD1/users01.dbf

BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
2       Full    9.73M      DISK        00:00:00     03-JUL-20
        BP Key: 2   Status: AVAILABLE  Compressed: NO  Tag: TAG20200703T133526
        Piece Name: /home/oracle/backup/rman/c-2264598720-20200703-00
  SPFILE Included: Modification time: 03-JUL-20
  SPFILE db_unique_name: PROD1
  Control File Included: Ckp SCN: 2445344      Ckp time: 03-JUL-20
```

백업이 잘 진행됐는지 확인

```
[oracle@edydr1p1 rman]$ ls
01v4cm6s_1_1_20200703  c-2264598720-20200703-00
```

case 2. image copy

잠깐! channel 이란?

데이터와 백업 장치와의 데이터 전송 경로 (disk channel, tape channel)
채널 프로세스란, 실제 백업과 복구 담당 프로세스이다. channel 할당 시 backup & recovery 수행이 가능하다.
recovery시 channel은 필수이며, backup 시에는 channel이 필수는 아니다.

copy 방식으로 백업

```
[oracle@edydr1p1 ~]$ mkdir -p backup/rman/copy
[oracle@edydr1p1 ~]$ rman target/

RMAN> run{
2> allocate channel c1 type disk format '/home/oracle/backup/rman/copy/%U';
3> backup as copy database;
4> }

using target database control file instead of recovery catalog
allocated channel: c1
channel c1: SID=51 device type=DISK

Starting backup at 03-JUL-20
channel c1: starting datafile copy
input datafile file number=00005 name=/u01/app/oracle/oradata/PROD1/example01.dbf
output file ...
channel c1: datafile copy complete, elapsed time: 00:00:45
channel c1: starting datafile copy
...
Starting Control File and SPFILE Autobackup at 03-JUL-20
released channel: c1
```

copy 방식으로 백업한 파일들의 정보 표시

```
RMAN> list datafilecopy all;

List of Datafile Copies
=======================

Key     File S Completion Time Ckp SCN    Ckp Time
------- ---- - --------------- ---------- ---------------
4       1    A 03-JUL-20       2446729    03-JUL-20
        Name: /home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSTEM_FNO-1_04v4cnke
        Tag: TAG20200703T135753

5       3    A 03-JUL-20       2447967    03-JUL-20
        Name: /home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSAUX_FNO-3_05v4cnls
        Tag: TAG20200703T135753

6       4    A 03-JUL-20       2447988    03-JUL-20
        Name: /home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-UNDOTBS1_FNO-4_06v4cnmv
        Tag: TAG20200703T135753

3       5    A 03-JUL-20       2446711    03-JUL-20
        Name: /home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-EXAMPLE_FNO-5_03v4cnj1
        Tag: TAG20200703T135753

7       6    A 03-JUL-20       2448016    03-JUL-20
        Name: /home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-USERS_FNO-6_07v4cnn7
        Tag: TAG20200703T135753
```

아카이브 파일 확인

```
RMAN> list archivelog all;
```

OS 레벨에서 백업본 확인

```
[oracle@edydr1p1 copy]$ ls -lhS

total 2.8G
-rw-r----- 1 oracle oinstall 1.3G Jul  3 13:58 data_D-PROD1_I-2264598720_TS-EXAMPLE_FNO-5_03v4cnj1
-rw-r----- 1 oracle oinstall 801M Jul  3 13:59 data_D-PROD1_I-2264598720_TS-SYSTEM_FNO-1_04v4cnke
-rw-r----- 1 oracle oinstall 651M Jul  3 13:59 data_D-PROD1_I-2264598720_TS-SYSAUX_FNO-3_05v4cnls
-rw-r----- 1 oracle oinstall  81M Jul  3 14:00 data_D-PROD1_I-2264598720_TS-UNDOTBS1_FNO-4_06v4cnmv
-rw-r----- 1 oracle oinstall 5.1M Jul  3 14:00 data_D-PROD1_I-2264598720_TS-USERS_FNO-6_07v4cnn7
```

테이블 추가 후 아카이빙

```
SYS@PROD1>create table scott.test(id number);
Table created.

SYS@PROD1>insert into scott.test values(1);
1 row created.

SYS@PROD1>commit;
Commit complete.

SYS@PROD1>alter system switch logfile;
System altered.

SYS@PROD1>/
System altered.

SYS@PROD1>/
System altered.
```

데이터파일 삭제 후 체크포인트

```
SYS@PROD1>! rm /u01/app/oracle/oradata/PROD1/*.dbf

SYS@PROD1>alter system checkpoint;
System altered.
```

HR 계정에 접속하려고 했더니 오류가 발생했다. 강제로 shutdown 한 후 다시 mount 한다.

```
SYS@PROD1>conn hr/hr
ERROR:
ORA-02002: error while writing to audit trail
ORA-01116: error in opening database file 1
ORA-01110: data file 1: '/u01/app/oracle/oradata/PROD1/system01.dbf'
ORA-27041: unable to open file
Linux-x86_64 Error: 2: No such file or directory
……
SYS@PROD1>shutdown abort
ORACLE instance shut down.

SYS@PROD1>startup mount
ORACLE instance started.
```

잠깐!! DB가 shutdown 상태에서는 RMAN을 실행시킬 수 없다.

```
[oracle@edydr1p1 ~]$ rman target/
Recovery Manager: Release 12.1.0.2.0 - Production on Fri Jul 3 14:15:14 2020
Copyright (c) 1982, 2014, Oracle and/or its affiliates.  All rights reserved.
connected to target database (not started)
```

현재 장애 상황 조회

```
RMAN> list failure;

using target database control file instead of recovery catalog
Database Role: PRIMARY

List of Database Failures
=========================

Failure ID Priority Status    Time Detected Summary
---------- -------- --------- ------------- -------
1342       CRITICAL OPEN      03-JUL-20     System datafile 1:
'/u01/app/oracle/oradata/PROD1/system01.dbf' is missing
1145       CRITICAL OPEN      25-JUN-20     System datafile 1:
'/u01/app/oracle/oradata/PROD1/system01.dbf' needs media recovery
22         HIGH     OPEN      03-JUL-20     One or more non-system datafiles are missing
442        HIGH     OPEN      25-JUN-20     One or more non-system datafiles need media
recovery
```

현재 장애 상황 자세히 조회

```
RMAN> list failure 22 detail;

Database Role: PRIMARY

List of Database Failures
=========================

Failure ID Priority Status    Time Detected Summary
---------- -------- --------- ------------- -------
22         HIGH     OPEN      03-JUL-20     One or more non-system datafiles are missing
  Impact: See impact for individual child failures
  List of child failures for parent failure ID 22
  Failure ID Priority Status    Time Detected Summary
  ---------- -------- --------- ------------- -------
  1366       HIGH     OPEN      03-JUL-20     Datafile 6:
'/u01/app/oracle/oradata/PROD1/users01.dbf' is missing
    Impact: Some objects in tablespace USERS might be unavailable
  1360       HIGH     OPEN      03-JUL-20     Datafile 5:
'/u01/app/oracle/oradata/PROD1/example01.dbf' is missing
    Impact: Some objects in tablespace EXAMPLE might be unavailable
  1354       HIGH     OPEN      03-JUL-20     Datafile 4:
'/u01/app/oracle/oradata/PROD1/undotbs01.dbf' is missing
    Impact: Some objects in tablespace UNDOTBS1 might be unavailable
  1348       HIGH     OPEN      03-JUL-20     Datafile 3:
'/u01/app/oracle/oradata/PROD1/sysaux01.dbf' is missing
    Impact: Some objects in tablespace SYSAUX might be unavailable
```

DB를 mount 상태로 올린다.

```
RMAN> shutdown abort
RMAN> startup mount
```

복원에 필요한 파일들 확인

```
RMAN> restore database preview summary;

Starting restore at 03-JUL-20
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=22 device type=DISK

List of Datafile Copies
=======================

Key     File S Completion Time Ckp SCN    Ckp Time
------- ---- - --------------- ---------- ---------------
4       1    A 03-JUL-20       2446729    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSTEM_FNO-1_04v4cnke
        Tag: TAG20200703T135753

5       3    A 03-JUL-20       2447967    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSAUX_FNO-3_05v4cnls
        Tag: TAG20200703T135753

6       4    A 03-JUL-20       2447988    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-UNDOTBS1_FNO-4_06v4cnmv
        Tag: TAG20200703T135753

3       5    A 03-JUL-20       2446711    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-EXAMPLE_FNO-5_03v4cnj1
        Tag: TAG20200703T135753

7       6    A 03-JUL-20       2448016    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-USERS_FNO-6_07v4cnn7
        Tag: TAG20200703T135753

using channel ORA_DISK_1

List of Archived Log Copies for database with db_unique_name PROD1
=====================================================================

Key     Thrd Seq     S Low Time
------- ---- ------- - ---------
74      1    1       A 25-JUN-20
        Name: /home/oracle/arch1/arch_1_1_1044007843.arc

75      1    2       A 03-JUL-20
        Name: /home/oracle/arch1/arch_1_2_1044007843.arc

76      1    3       A 03-JUL-20
        Name: /home/oracle/arch1/arch_1_3_1044007843.arc

77      1    4       A 03-JUL-20
        Name: /home/oracle/arch1/arch_1_4_1044007843.arc

RMAN-05119: recovery can not be done to a consistent state.
Media recovery start SCN is 2446711
Recovery must be done beyond SCN 2448016 to clear datafile fuzziness
Finished restore at 03-JUL-20
```

Restore & Recovery

```
RMAN> restore database;

Starting restore at 03-JUL-20
using channel ORA_DISK_1

channel ORA_DISK_1: restoring datafile 00001
input datafile copy RECID=4 STAMP=1044799154 file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSTEM_FNO-1_04v4cnke
destination for restore of datafile 00001: /u01/app/oracle/oradata/PROD1/system01.dbf
channel ORA_DISK_1: copied datafile copy of datafile 00001
output file name=/u01/app/oracle/oradata/PROD1/system01.dbf RECID=0 STAMP=0
channel ORA_DISK_1: restoring datafile 00003
input datafile copy RECID=5 STAMP=1044799196 file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSAUX_FNO-3_05v4cnls
destination for restore of datafile 00003: /u01/app/oracle/oradata/PROD1/sysaux01.dbf
channel ORA_DISK_1: copied datafile copy of datafile 00003
output file name=/u01/app/oracle/oradata/PROD1/sysaux01.dbf RECID=0 STAMP=0
channel ORA_DISK_1: restoring datafile 00004
input datafile copy RECID=6 STAMP=1044799206 file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-UNDOTBS1_FNO-4_06v4cnmv
destination for restore of datafile 00004: /u01/app/oracle/oradata/PROD1/undotbs01.dbf
channel ORA_DISK_1: copied datafile copy of datafile 00004
output file name=/u01/app/oracle/oradata/PROD1/undotbs01.dbf RECID=0 STAMP=0
channel ORA_DISK_1: restoring datafile 00005
input datafile copy RECID=3 STAMP=1044799114 file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-EXAMPLE_FNO-5_03v4cnj1
destination for restore of datafile 00005: /u01/app/oracle/oradata/PROD1/example01.dbf
channel ORA_DISK_1: copied datafile copy of datafile 00005
output file name=/u01/app/oracle/oradata/PROD1/example01.dbf RECID=0 STAMP=0
channel ORA_DISK_1: restoring datafile 00006
input datafile copy RECID=7 STAMP=1044799208 file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-USERS_FNO-6_07v4cnn7
destination for restore of datafile 00006: /u01/app/oracle/oradata/PROD1/users01.dbf
channel ORA_DISK_1: copied datafile copy of datafile 00006
output file name=/u01/app/oracle/oradata/PROD1/users01.dbf RECID=0 STAMP=0
Finished restore at 03-JUL-20


RMAN> recover database;

Starting recover at 03-JUL-20
using channel ORA_DISK_1

starting media recovery

archived log for thread 1 with sequence 1 is already on disk as file
/home/oracle/arch1/arch_1_1_1044007843.arc
archived log for thread 1 with sequence 2 is already on disk as file
/home/oracle/arch1/arch_1_2_1044007843.arc
archived log for thread 1 with sequence 3 is already on disk as file
/home/oracle/arch1/arch_1_3_1044007843.arc
archived log for thread 1 with sequence 4 is already on disk as file
/home/oracle/arch1/arch_1_4_1044007843.arc
archived log file name=/home/oracle/arch1/arch_1_1_1044007843.arc thread=1 sequence=1
archived log file name=/home/oracle/arch1/arch_1_2_1044007843.arc thread=1 sequence=2
media recovery complete, elapsed time: 00:00:01
Finished recover at 03-JUL-20
```

DB 오픈 후 데이터가 살아있는지 확인

```
RMAN> alter database open;

SYS@PROD1>conn hr/hr
Connected.

HR@PROD1>select * from scott.test;
1 row selected.
```

(더 이상 사용하지 않는) image copy로 백업한 파일들을 삭제한다.

```
RMAN> delete datafilecopy all;

released channel: ORA_DISK_1
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=22 device type=DISK
List of Datafile Copies
=======================

Key     File S Completion Time Ckp SCN    Ckp Time
------- ---- - --------------- ---------- ---------------
4       1    A 03-JUL-20       2446729    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSTEM_FNO-1_04v4cnke
        Tag: TAG20200703T135753

5       3    A 03-JUL-20       2447967    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSAUX_FNO-3_05v4cnls
        Tag: TAG20200703T135753

6       4    A 03-JUL-20       2447988    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-UNDOTBS1_FNO-4_06v4cnmv
        Tag: TAG20200703T135753

3       5    A 03-JUL-20       2446711    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-EXAMPLE_FNO-5_03v4cnj1
        Tag: TAG20200703T135753

7       6    A 03-JUL-20       2448016    03-JUL-20
        Name:
/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-USERS_FNO-6_07v4cnn7
        Tag: TAG20200703T135753


Do you really want to delete the above objects (enter YES or NO)? yes
deleted datafile copy
datafile copy file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSTEM_FNO-1_04v4cnke
RECID=4 STAMP=1044799154
deleted datafile copy
datafile copy file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-SYSAUX_FNO-3_05v4cnls
RECID=5 STAMP=1044799196
deleted datafile copy
datafile copy file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-UNDOTBS1_FNO-4_06v4cnmv
RECID=6 STAMP=1044799206
deleted datafile copy
datafile copy file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-EXAMPLE_FNO-5_03v4cnj1
RECID=3 STAMP=1044799114
deleted datafile copy
datafile copy file
name=/home/oracle/backup/rman/copy/data_D-PROD1_I-2264598720_TS-USERS_FNO-6_07v4cnn7
RECID=7 STAMP=1044799208
Deleted 5 objects


RMAN> list datafilecopy all;
specification does not match any datafile copy in the repository
```

case 3. incremental backup_변경 및 추가된 데이터만 백업

이전에 했던 backupset 파일을 지운다.

```
RMAN> delete backupset;

using channel ORA_DISK_1

List of Backup Pieces
BP Key  BS Key  Pc# Cp# Status      Device Type Piece Name
------- ------- --- --- ----------- ----------- ----------
1       1       1   1   AVAILABLE   DISK        /home/oracle/backup/rman/01v4cm6s_1_1_20200703
2       2       1   1   AVAILABLE   DISK        /home/oracle/backup/rman/c-2264598720-20200703-00
3       3       1   1   AVAILABLE   DISK        /home/oracle/backup/rman/c-2264598720-20200703-01

Do you really want to delete the above objects (enter YES or NO)? yes
deleted backup piece
backup piece handle=/home/oracle/backup/rman/01v4cm6s_1_1_20200703 RECID=1 STAMP=1044797662
deleted backup piece
backup piece handle=/home/oracle/backup/rman/c-2264598720-20200703-00 RECID=2 STAMP=1044797726
deleted backup piece
backup piece handle=/home/oracle/backup/rman/c-2264598720-20200703-01 RECID=3 STAMP=1044799209
Deleted 3 objects
```

백업에 필요한 파일을 조회

```
RMAN> report need backup;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
Report of files with less than 1 redundant backups
File #bkps Name
---- ----- -----------------------------------------------------
1    0     /u01/app/oracle/oradata/PROD1/system01.dbf
3    0     /u01/app/oracle/oradata/PROD1/sysaux01.dbf
4    0     /u01/app/oracle/oradata/PROD1/undotbs01.dbf
5    0     /u01/app/oracle/oradata/PROD1/example01.dbf
6    0     /u01/app/oracle/oradata/PROD1/users01.dbf
```

Incremental FULL Backup 을 한다.

```
RMAN> run{
2> allocate channel c1 type disk;
3> allocate channel c2 type disk;
4> backup incremental level 0 database;
5> }

released channel: ORA_DISK_1
allocated channel: c1
channel c1: SID=22 device type=DISK

allocated channel: c2
channel c2: SID=50 device type=DISK

channel c1: starting incremental level 0 datafile backup set
channel c1: specifying datafile(s) in backup set
input datafile file number=00005 name=/u01/app/oracle/oradata/PROD1/example01.dbf
...
input datafile file number=00006 name=/u01/app/oracle/oradata/PROD1/users01.dbf
…
```

* 잠깐!! Incremental Backup
  - Level 0 : Full Backup
  - Level 1 : 마지막 incremental Backup 이후 변경된 block 만 Backup 수행

변경사항 작업

```
SYS@PROD1>update hr.employees
  2  set salary = salary * 1.1
  3  where department_id = 20;

2 rows updated.

SYS@PROD1>commit;
Commit complete.

SYS@PROD1>create table hr.inc_emp
  2  as
  3  select *
  4  from hr.employees;

Table created.

SYS@PROD1>select count(*)
  2  from hr.inc_emp;

  COUNT(*)
----------
       107

1 row selected.

SYS@PROD1>delete hr.inc_emp
  2  where department_id = 50;

45 rows deleted.

SYS@PROD1>commit;
Commit complete.
```

Incremental LEVLE 1 Backup 을 한다.

```
RMAN> run{
2> allocate channel c1 type disk;
3> backup incremental level 1 database;
4> }

allocated channel: c1
channel c1: SID=22 device type=DISK

Starting backup at 03-JUL-20
channel c1: starting incremental level 1 datafile backup set
channel c1: specifying datafile(s) in backup set
input datafile file number=00005 name=/u01/app/oracle/oradata/PROD1/example01.dbf
...
Finished backup at 03-JUL-20
...
released channel: c1
```

users datafile 손실

```
SYS@PROD1>update hr.employees
  2  set salary = salary * 1.1
  3  where department_id = 20;

2 rows updated.


SYS@PROD1>commit;
Commit complete.


SYS@PROD1>create table hr.inc_emp
  2  as
  3  select *
  4  from hr.employees;

Table created.


SYS@PROD1>select count(*)
  2  from hr.inc_emp;

  COUNT(*)
----------
       107

1 row selected.


SYS@PROD1>delete hr.inc_emp
  2  where department_id = 50;

45 rows deleted.


SYS@PROD1>commit;
Commit complete.

SYS@PROD1>alter system switch logfile;
System altered.

SYS@PROD1>/
System altered.

SYS@PROD1>/
System altered.

SYS@PROD1>/
System altered.

SYS@PROD1>! rm -f /u01/app/oracle/oradata/PROD1/users01.dbf
```

손실된 파일 확인

```
RMAN> list failure;

Database Role: PRIMARY

List of Database Failures
=========================

Failure ID Priority Status    Time Detected Summary
---------- -------- --------- ------------- -------
22         HIGH     OPEN      03-JUL-20     One or more non-system datafiles are missing
442        HIGH     OPEN      25-JUN-20     One or more non-system datafiles need media recovery


RMAN> list failure 2 detail;

Impact: See impact for individual child failures
List of child failures for parent failure ID 2
Failure ID Priority Status Time Detected Summary
---------- -------- --------- ------------- ------- 1526 HIGH OPEN 25-JUN-20 Datafile 6:
'/u01/app/oracle/oradata/PROD1/users01.dbf' is missing
Impact: Some objects in tablespace USERS might be unavailable
```

해당 테이블 스페이스를 오프라인으로 변경 후 복구작업을 한다.

```
RMAN> alter tablespace users offline immediate;
Statement processed
```

* 이때 테이블에 변경을 가하면 다음과 같은 오류가 뜬다.

```
SYS@PROD1>update hr.inc_emp
2 set salary = 10000;
ORA-00376: file 6 cannot be read at this time
ORA-01110: data file 6: '/u01/app/oracle/oradata/PROD1/users01.dbf'

RMAN> restore tablespace users;

Starting restore at 03-JUL-20
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=22 device type=DISK
...
Finished restore at 03-JUL-20

RMAN> recover tablespace users;

Starting recover at 03-JUL-20
...
Finished recover at 03-JUL-20


RMAN> alter tablespace users online;
Statement processed
```

* 정상적으로 조회가 된다.

```
SYS@PROD1>select count(*) from hr.inc_emp;

  COUNT(*)
----------
        62

1 row selected.
```

case 4. multisection backup_큰 파일을 여러 프로세스가 동시에 백업셋 생성

multisection backup 수행

```
RMAN> backup as compressed backupset
2> section size 100M
3> tablespace example;

RMAN> list backup;

List of Backup Sets
===================
...
    List of Backup Pieces for backup set 10 Copy #1
    BP Key  Pc# Status      Piece Name
    ------- --- ----------- ----------
    10      1   AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_1_1_20200703
    11      2   AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_2_1_20200703
    12      3   AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_3_1_20200703
    13      4   AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_4_1_20200703
    14      5   AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_5_1_20200703
    15      6   AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_6_1_20200703
    16      7   AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_7_1_20200703
    17      8   AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_8_1_20200703
    18      9   AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_9_1_20200703
    19      10  AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_10_1_20200703
    20      11  AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_11_1_20200703
    21      12  AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_12_1_20200703
    22      13  AVAILABLE   /home/oracle/backup/rman/0fv4ctc4_13_1_20200703

BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
11      Full    9.73M      DISK        00:00:01     03-JUL-20
        BP Key: 23   Status: AVAILABLE  Compressed: NO  Tag: TAG20200703T153710
        Piece Name: /home/oracle/backup/rman/c-2264598720-20200703-05
  SPFILE Included: Modification time: 03-JUL-20
  SPFILE db_unique_name: PROD1
  Control File Included: Ckp SCN: 2653174      Ckp time: 03-JUL-20
```

case 5. 사용자가 backup 파일을 삭제했을 때

백업을 수행한다.

```
RMAN> report schema;
RMAN> backup datafile 6;
RMAN> list backup of tablespace users;
RMAN> crosscheck backupset;

using channel ORA_DISK_1
crosschecked backup piece: found to be 'AVAILABLE'
backup piece
handle=/home/oracle/fast_recovery_area/PROD1/backupset/2020_07_03/o1_mf_nnnd0_TAG202
00703T150150_hhxlghhs_.bkp RECID=4 STAMP=1044802911
crosschecked backup piece: found to be 'AVAILABLE'
backup piece
handle=/home/oracle/fast_recovery_area/PROD1/backupset/2020_07_03/o1_mf_nnnd0_TAG202
00703T150150_hhxlghj3_.bkp RECID=5 STAMP=1044802911
crosschecked backup piece: found to be 'AVAILABLE'
backup piece handle=/home/oracle/backup/rman/c-2264598720-20200703-02 RECID=6
STAMP=1044802936

Crosschecked 22 objects
```

backup file을 사용자가 임의로 삭제

```
SYS@PROD1>! rm /home/oracle/backup/rman/c-2264598720-20200703-02
```

백업 상태를 디스크 또는 테이프 등의 media와 비교하여 확인한다 (crosscheck)

```
RMAN> crosscheck backupset;

using channel ORA_DISK_1
crosschecked backup piece: found to be 'AVAILABLE'
backup piece
handle=/home/oracle/fast_recovery_area/PROD1/backupset/2020_07_03/o1_mf_nnnd0_TAG202
00703T150150_hhxlghhs_.bkp RECID=4 STAMP=1044802911
crosschecked backup piece: found to be 'AVAILABLE'
backup piece
handle=/home/oracle/fast_recovery_area/PROD1/backupset/2020_07_03/o1_mf_nnnd0_TAG202
00703T150150_hhxlghj3_.bkp RECID=5 STAMP=1044802911
crosschecked backup piece: found to be 'EXPIRED'
backup piece handle=/home/oracle/backup/rman/c-2264598720-20200703-02 RECID=6
STAMP=1044802936
crosschecked backup piece: found to be 'AVAILABLE'
backup piece ...
Crosschecked 22 objects
```

```
RMAN> list expired backupset;

List of Backup Sets
===================

BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
6       Full    9.73M      DISK        00:00:00     03-JUL-20
        BP Key: 6   Status: EXPIRED  Compressed: NO  Tag: TAG20200703T150216
        Piece Name: /home/oracle/backup/rman/c-2264598720-20200703-02
  SPFILE Included: Modification time: 03-JUL-20
  SPFILE db_unique_name: PROD1
  Control File Included: Ckp SCN: 2651227      Ckp time: 03-JUL-20


RMAN> delete expired backupset;

using channel ORA_DISK_1

List of Backup Pieces
BP Key  BS Key  Pc# Cp# Status      Device Type Piece Name
------- ------- --- --- ----------- ----------- ----------
6       6       1   1   EXPIRED     DISK
/home/oracle/backup/rman/c-2264598720-20200703-02

Do you really want to delete the above objects (enter YES or NO)? y
deleted backup piece
backup piece handle=/home/oracle/backup/rman/c-2264598720-20200703-02 RECID=6
STAMP=1044802936
Deleted 1 EXPIRED objects


RMAN> list expired backupset;
specification does not match any backup in the repository
```

case 6. delete backup

---

backupset 삭제

* backupset, image copy 리스트를 모두 보여준다.

```
RMAN> list backup;
```

* backupset 으로 백업한 파일을 지운다.

```
RMAN> delete backupset;

using channel ORA_DISK_1

List of Backup Pieces
BP Key  BS Key  Pc# Cp# Status      Device Type Piece Name
------- ------- --- --- ----------- ----------- ----------
4       4       1   1   AVAILABLE   DISK
/home/oracle/fast_recovery_area/PROD1/backupset/2020_07_03/o1_mf_nnnd0_TAG20200703T150150_h
hxlghhs_.bkp
5       5       1   1   AVAILABLE   DISK
/home/oracle/fast_recovery_area/PROD1/backupset/2020_07_03/o1_mf_nnnd0_TAG20200703T150150_h
hxlghj3_.bkp
7       7       1   1   AVAILABLE   DISK
/home/oracle/fast_recovery_area/PROD1/backupset/2020_07_03/o1_mf_nnnd1_TAG20200703T151219_h
hxm2450_.bkp
...
Do you really want to delete the above objects (enter YES or NO)? yes
deleted backup piece
backup piece
handle=/home/oracle/fast_recovery_area/PROD1/backupset/2020_07_03/o1_mf_nnnd0_TAG20200703T1
50150_hhxlghhs_.bkp RECID=4 STAMP=1044802911
deleted backup piece
...

RMAN> list backup;
specification does not match any backup in the repository
```

case 7. RMAN backup recovery advisor 1

백업을 수행한다.

```
RMAN> backup database;
```

OS 레벨에서 system01.dbf 파일을 강제로 삭제한다.

```
SYS@PROD1>! rm /u01/app/oracle/oradata/PROD1/system01.dbf

SYS@PROD1>shutdown abort
ORACLE instance shut down.
SYS@PROD1>startup force
ORACLE instance started.

Total System Global Area 1241513984 bytes
Fixed Size             2923872 bytes
Variable Size              452985504 bytes
Database Buffers     771751936 bytes
Redo Buffers          13852672 bytes
Database mounted.
ORA-01157: cannot identify/lock data file 1 - see DBWR trace file
ORA-01110: data file 1: '/u01/app/oracle/oradata/PROD1/system01.dbf'
```

failure 파일을 확인한다.

```
[oracle@edydr1p1 ~]$ rman target/

RMAN> startup mount
database is already started


RMAN> list failure;
using target database control file instead of recovery catalog
Database Role: PRIMARY

List of Database Failures
=========================

Failure ID Priority Status    Time Detected Summary
---------- -------- --------- ------------- -------
2022       CRITICAL OPEN      03-JUL-20     System datafile 1:
'/u01/app/oracle/oradata/PROD1/system01.dbf' is missing
1628       HIGH     OPEN      03-JUL-20     Tablespace 4: 'USERS' is offline


RMAN> list failure 2022 detail;
Database Role: PRIMARY

List of Database Failures
=========================

Failure ID Priority Status    Time Detected Summary
---------- -------- --------- ------------- -------
2022       CRITICAL OPEN      03-JUL-20     System datafile 1:
'/u01/app/oracle/oradata/PROD1/system01.dbf' is missing
  Impact: Database cannot be opened
```

adivisor 를 이용한 복구

```
RMAN> advise failure;

Database Role: PRIMARY

List of Database Failures
=========================

Failure ID Priority Status    Time Detected Summary
---------- -------- --------- ------------- -------
2022       CRITICAL OPEN      03-JUL-20     System datafile 1:
'/u01/app/oracle/oradata/PROD1/system01.dbf' is missing
  Impact: Database cannot be opened

...

Optional Manual Actions
=======================
1. If file /u01/app/oracle/oradata/PROD1/system01.dbf was unintentionally renamed or moved,
restore it

Automated Repair Options
========================
Option Repair Description
------ ------------------
1      Restore and recover datafile 1
  Strategy: The repair includes complete media recovery with no data loss
  Repair script: /u01/app/oracle/diag/rdbms/prod1/PROD1/hm/reco_287713945.hm


RMAN> repair failure preview;

Strategy: The repair includes complete media recovery with no data loss
Repair script: /u01/app/oracle/diag/rdbms/prod1/PROD1/hm/reco_287713945.hm

contents of repair script:
   # restore and recover datafile
   restore ( datafile 1 );
   recover datafile 1;
   sql 'alter database datafile 1 online';


RMAN> repair failure;

Strategy: The repair includes complete media recovery with no data loss
Repair script: /u01/app/oracle/diag/rdbms/prod1/PROD1/hm/reco_287713945.hm

contents of repair script:
   # restore and recover datafile
   restore ( datafile 1 );
   recover datafile 1;
   sql 'alter database datafile 1 online';

Do you really want to execute the above repair (enter YES or NO)? yes
executing repair script
...
channel ORA_DISK_1: specifying datafile(s) to restore from backup set
channel ORA_DISK_1: restoring datafile 00001 to /u01/app/oracle/oradata/PROD1/system01.dbf
...
repair failure complete

SYS@PROD1>alter database open;
Database altered.
```

case 8. RMAN backup recovery advisor 2

insa 테이블 스페이스를 만든 후 백업

```
SYS@PROD1>create tablespace insa
  2  datafile '/u01/app/oracle/oradata/PROD1/insa.dbf'
  3  size 10M
  4  extent management local uniform size 1M
  5  segment space management auto;

Tablespace created.


[oracle@edydr1p1 ~]$ rman target/

RMAN> report need backup;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
Report of files with less than 1 redundant backups
File #bkps Name
---- ----- -----------------------------------------------------
2    0     /u01/app/oracle/oradata/PROD1/insa.dbf


RMAN> backup tablespace insa format '/home/oracle/backup/rman/%U_%T';
```

테이블에 변경사항 작업 후 제거

```
SYS@PROD1>create table scott.insa_table
  2  tablespace insa
  3  as
  4  select *
  5  from hr.employees;

Table created.


SYS@PROD1>select count(*)
  2  from scott.insa_table;

  COUNT(*)
----------
       107

1 row selected.


SYS@PROD1>alter system switch logfile;
System altered.

SYS@PROD1>/
System altered.

(… 3번 연속)
```

```
SYS@PROD1>! rm /u01/app/oracle/oradata/PROD1/insa.dbf

SYS@PROD1>conn / as sysdba
Connected.

SYS@PROD1>alter system flush buffer_cache;
System altered.

SYS@PROD1>select * from scott.insa_table;
select * from scott.insa_table
                    *
ERROR at line 1:
ORA-01116: error in opening database file 2
ORA-01110: data file 2: '/u01/app/oracle/oradata/PROD1/insa.dbf'
ORA-27041: unable to open file
Linux-x86_64 Error: 2: No such file or directory
Additional information: 3
```

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```
[oracle@edydr1p1 ~]$ rman target/

RMAN> list failure;

Database Role: PRIMARY

List of Database Failures
=========================

Failure ID Priority Status    Time Detected Summary
---------- -------- --------- ------------- -------
22         HIGH     OPEN      03-JUL-20     One or more non-system datafiles are
missing

RMAN> list failure 22 detail;

Database Role: PRIMARY

List of Database Failures
=========================

Failure ID Priority Status    Time Detected Summary
---------- -------- --------- ------------- -------
22         HIGH     OPEN      03-JUL-20     One or more non-system datafiles are
missing
  Impact: See impact for individual child failures
  List of child failures for parent failure ID 22
  Failure ID Priority Status    Time Detected Summary
  ---------- -------- --------- ------------- -------
  2130       HIGH     OPEN      03-JUL-20     Datafile 2:
'/u01/app/oracle/oradata/PROD1/insa.dbf' is missing
    Impact: Some objects in tablespace INSA might be unavailable

RMAN> advise failure;

Database Role: PRIMARY

List of Database Failures
=========================

Failure ID Priority Status    Time Detected Summary
---------- -------- --------- ------------- -------
22         HIGH     OPEN      03-JUL-20     One or more non-system datafiles are
missing
  Impact: See impact for individual child failures
  List of child failures for parent failure ID 22
  Failure ID Priority Status    Time Detected Summary
  ---------- -------- --------- ------------- -------
  2130       HIGH     OPEN      03-JUL-20     Datafile 2:
'/u01/app/oracle/oradata/PROD1/insa.dbf' is missing
    Impact: Some objects in tablespace INSA might be unavailable

analyzing automatic repair options; this may take some time
using channel ORA_DISK_1
analyzing automatic repair options complete

Mandatory Manual Actions
========================
no manual actions available

Optional Manual Actions
```

```
=======================
1. If file /u01/app/oracle/oradata/PROD1/insa.dbf was unintentionally renamed or
moved, restore it

Automated Repair Options
=======================
Option Repair Description
------ ------------------
1      Restore and recover datafile 2
  Strategy: The repair includes complete media recovery with no data loss
  Repair script: /u01/app/oracle/diag/rdbms/prod1/PROD1/hm/reco_2170133795.hm

RMAN> repair failure preview;

Strategy: The repair includes complete media recovery with no data loss
Repair script: /u01/app/oracle/diag/rdbms/prod1/PROD1/hm/reco_2170133795.hm

contents of repair script:
   # restore and recover datafile
   sql 'alter database datafile 2 offline';
   restore ( datafile 2 );
   recover datafile 2;
   sql 'alter database datafile 2 online';

RMAN> repair failure;

Strategy: The repair includes complete media recovery with no data loss
Repair script: /u01/app/oracle/diag/rdbms/prod1/PROD1/hm/reco_2170133795.hm

contents of repair script:
   # restore and recover datafile
   sql 'alter database datafile 2 offline';
   restore ( datafile 2 );
   recover datafile 2;
   sql 'alter database datafile 2 online';

Do you really want to execute the above repair (enter YES or NO)? yes
executing repair script

sql statement: alter database datafile 2 offline

Starting restore at 03-JUL-20
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 00002 to
/u01/app/oracle/oradata/PROD1/insa.dbf
channel ORA_DISK_1: reading from backup piece
/home/oracle/backup/rman/11v4d48l_1_1_20200703
channel ORA_DISK_1: piece handle=/home/oracle/backup/rman/11v4d48l_1_1_20200703
tag=TAG20200703T173412
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:01
Finished restore at 03-JUL-20

Starting recover at 03-JUL-20
using channel ORA_DISK_1

starting media recovery
```

```
archived log for thread 1 with sequence 11 is already on disk as file
/home/oracle/arch1/arch_1_11_1044007843.arc
archived log for thread 1 with sequence 12 is already on disk as file
/home/oracle/arch1/arch_1_12_1044007843.arc
archived log for thread 1 with sequence 13 is already on disk as file
/home/oracle/arch1/arch_1_13_1044007843.arc
archived log for thread 1 with sequence 14 is already on disk as file
/home/oracle/arch1/arch_1_14_1044007843.arc
archived log for thread 1 with sequence 15 is already on disk as file
/home/oracle/arch1/arch_1_15_1044007843.arc
archived log file name=/home/oracle/arch1/arch_1_11_1044007843.arc thread=1
sequence=11
archived log file name=/home/oracle/arch1/arch_1_12_1044007843.arc thread=1
sequence=12
archived log file name=/home/oracle/arch1/arch_1_13_1044007843.arc thread=1
sequence=13
media recovery complete, elapsed time: 00:00:00
Finished recover at 03-JUL-20

sql statement: alter database datafile 2 online
repair failure complete


SYS@PROD1>select count(*) from scott.insa_table;

  COUNT(*)
----------
       107

1 row selected.


SYS@PROD1>drop tablespace insa including contents and datafiles;
Tablespace dropped.
```