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TECHNOTE

Multitenent 환경 Backup & Recovery

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1. Overview

Oracle Database 12c 부터 Multitenant Option 을 통해 Pluggable database architecture 를 갖게 되었습니다. 이제는 단일 Container Database 를 생성하고 여기에 여러 Pluggable database 를 연결만하면 기존 Application 을 변경할 필요가 없고 해당 Container Database 에 하나의 메모리를 할당하고 한 세트의 Background process 들만 할당하면 되어 기존 IT 리소스의 활용도를 대폭 높일 수 있습니다. 또한, 여러 Pluggable database 를 새로운 Container Database 에 통합함으로써 확장성을 크게 높일 수 있습니다. CDB, PDB 에 대해서 RMAN 을 통하거나 hot backup(begin/end backup)으로 백업이 가능합니다.

복구는 아래와 같은 다양한 방법들을 제공합니다.

- Instance recovery: CDB level only
- Complete media recovery: CDB, PDB level, tablespace, datafile level
- Incomplete media recovery
 - CDB, PDB level
 - TSPITR root tablespace only(SYSTEM, UNDO, SYSAUX 제외)
- Flashback database
 - CDB, PDB level
- Block recovery: 예전과 동일

2. Multitenent Database Backup

2.1. CDB에서 사용 가능한 기존 Backup 기능

- RMAN의 backup database 명령으로 전체 CDB를 Backup 할 수 있습니다.
- CDB에서 Tablespace, Control file, SPFILE backup은 기존과 동일합니다.
- 단, root container로 접속해서 backup을 수행해야 합니다.
- Incremental Backup과 같이 일반 backup에서의 기능은 모두 사용할 수 있습니다.
- 전체 CDB Recovery가 CDB 내의 PDB를 개별적으로 복원하는 것보다 빠릅니다.

2.2. Root Container backup

- Root container만을 backup하는 RMAN 명령어 BACKUP DATABASE ROOT를 지원합니다.
- 기본적으로 data file만을 backup하며, 옵션으로 archivelog file도 backup할 수 있습니다.
- Control file의 자동 backup을 사용하는 경우 SPFILE 및 Control file에 대한 AUTOBACKUP을 수행합니다.

2.3. PDB에서 사용 가능한 Backup 기능

- Root container에서 RMAN을 사용하여 PDB를 개별적으로 Backup할 수 있습니다.
- PDB 내에서도 SYSDBA 권한을 가진 계정으로 RMAN을 사용하여 Backup할 수 있습니다.
- PDB로 접속할 때 RMAN의 제한 사항
 - Archive log backup, 삭제, 복원에 관련된 non-media recovery
 - Point-In-Time Recovery
 - Tablespace Point-In-Time Recovery
 - Recovery catalog 접속
 - Report/Delete obsolete
 - Configure 명령을 통한 RMAN 설정 변경
 - reset database
 - import catalog
 - register database
 - Data Recovery Advisor
 - RMAN에서의 Flashback 작업
 - Duplicate database
 - Table Recovery

3. Multitenent Database Recovery

3.1. 전체 CDB Recovery

- 일반 복구, Point-In-Time Recovery, Flashback 작업 등 대부분의 non-CDB 가 Recovery 작업과 동일합니다.

3.2. Root Container Recovery

- RMAN 에서 Root container 만을 Recovery 하는 restore database root, recover database root 명령을 지원합니다.
- 단, Oracle 은 전체 CDB Recovery 를 권장합니다.

3.3. PDB Recovery

- Backup 과 마찬가지로 Root container 또는 PDB 내 Recovery 방법을 지원합니다.
- PDB 내에서 Recovery 시 현재 PDB 만을 Recovery 할 수 있고, Root container 에서는 모든 PDB 를 복구할 수 있습니다.

3.4. CDB와 PDB에서 기타 Backup과 Recovery

- Oracle datapump, Flashback 기능을 사용할 수 있습니다.
- Oracle datapump 는 CDB 와 PDB 를 지원하지만, CDB 와 모든 PDB 를 포함한 전역적인 Export/Import 는 지원하지 않습니다.
- 각 PDB 로 접속해서 Export/Import 를 수행해야 합니다.
- Datapump 를 사용해서 CDB 의 PDB 를 다른 CDB 로 옮길 수 있습니다. 단, 현재 Source database 에 common user 가 존재한다면, 이 user 는 Import 시, Target database 에 이 user 를 생성할 수 없습니다. Common user 가 실제로 Export 되었다고 하더라도 새로운 PDB 로 Import 하는 동안 에러가 발생합니다.
- Common user 를 정상적으로 import 하기를 원한다면, Target CDB 에 먼저 이 Common user 를 생성합니다.
- Flashback database 기능은 CDB 와 PDB 를 지원하지만 몇 가지 문제가 있습니다. (Oracle Database Backup and Recovery User's Guide 의 outlier 참조)

4. Multitenent Database Backup & Recovery Practice

4.1. CDB, All pdbs Backup & Recovery

■ CDB 와 모든 PDB Backup

```
[oracle:alice2:ALICE:/oradata/arch]rman target=/  
  
Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 14:37:59 2020  
Version 19.3.0.0.0  
  
Copyright (c) 1982, 2019, Oracle and/or its affiliates. All rights reserved.  
  
connected to target database: ALICE (DBID=2036574689, not open)  
  
RMAN> backup database plus archivelog;  
  
Starting backup at 16-OCT-20  
using target database control file instead of recovery catalog  
allocated channel: ORA_DISK_1  
channel ORA_DISK_1: SID=862 device type=DISK  
channel ORA_DISK_1: starting archived log backup set  
channel ORA_DISK_1: specifying archived log(s) in backup set  
input archived log thread=1 sequence=18 RECID=1 STAMP=1053957603  
input archived log thread=1 sequence=19 RECID=2 STAMP=1053957722  
input archived log thread=1 sequence=20 RECID=3 STAMP=1053957723  
input archived log thread=1 sequence=21 RECID=5 STAMP=1053957724  
input archived log thread=1 sequence=22 RECID=4 STAMP=1053957724  
input archived log thread=1 sequence=23 RECID=6 STAMP=1053959714  
input archived log thread=1 sequence=24 RECID=7 STAMP=1053959739  
channel ORA_DISK_1: starting piece 1 at 16-OCT-20  
channel ORA_DISK_1: finished piece 1 at 16-OCT-20  
piece handle=/oracle/19c/dbs/0cvd49mf_1_1 tag=TAG20201016T143807 comment=NONE  
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01  
Finished backup at 16-OCT-20  
  
Starting backup at 16-OCT-20  
using channel ORA_DISK_1  
channel ORA_DISK_1: starting full datafile backup set  
channel ORA_DISK_1: specifying datafile(s) in backup set  
input datafile file number=00001 name=/oradata/ALICE/system01.dbf  
input datafile file number=00003 name=/oradata/ALICE/sysaux01.dbf
```

```
input datafile file number=00005 name=/oradata/ALICE/undotbs01.dbf
input datafile file number=00007 name=/oradata/ALICE/users01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/19c/dbs/0dvd49mg_1_1 tag=TAG20201016T143808 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:07
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00010 name=/oradata/ALICE/pdb1/undotbs01.dbf
input datafile file number=00008 name=/oradata/ALICE/pdb1/system01.dbf
input datafile file number=00009 name=/oradata/ALICE/pdb1/sysaux01.dbf
input datafile file number=00011 name=/oradata/ALICE/pdb1/users01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/19c/dbs/0evd49mn_1_1 tag=TAG20201016T143808 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00014 name=/oradata/ALICE/pdb2/undotbs01.dbf
input datafile file number=00012 name=/oradata/ALICE/pdb2/system01.dbf
input datafile file number=00013 name=/oradata/ALICE/pdb2/sysaux01.dbf
input datafile file number=00015 name=/oradata/ALICE/pdb2/users01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/19c/dbs/0fvd49mq_1_1 tag=TAG20201016T143808 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00018 name=/oradata/ALICE/pdb3/undotbs01.dbf
input datafile file number=00016 name=/oradata/ALICE/pdb3/system01.dbf
input datafile file number=00017 name=/oradata/ALICE/pdb3/sysaux01.dbf
input datafile file number=00019 name=/oradata/ALICE/pdb3/users01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/19c/dbs/0gvd49mt_1_1 tag=TAG20201016T143808 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00022 name=/oradata/ALICE/pdb4/undotbs01.dbf
input datafile file number=00020 name=/oradata/ALICE/pdb4/system01.dbf
input datafile file number=00021 name=/oradata/ALICE/pdb4/sysaux01.dbf
```



```
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/19c/dbs/0hvd49n0_1_1 tag=TAG20201016T143808 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00006 name=/oradata/ALICE/pdbseed/undotbs01.dbf
input datafile file number=00002 name=/oradata/ALICE/pdbseed/system01.dbf
input datafile file number=00004 name=/oradata/ALICE/pdbseed/sysaux01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/19c/dbs/0ivd49n4_1_1 tag=TAG20201016T143808 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03
Finished backup at 16-OCT-20
```

```
Starting backup at 16-OCT-20
using channel ORA_DISK_1
specification does not match any archived log in the repository
backup cancelled because there are no files to backup
Finished backup at 16-OCT-20
```

```
Starting Control File and SPFILE Autobackup at 16-OCT-20
piece handle=/oracle/19c/dbs/c-2036574689-20201016-01 comment=NONE
Finished Control File and SPFILE Autobackup at 16-OCT-20
```

■ Backup 확인

```
[oracle:alice2:ALICE:/oracle/19c/dbs]ls -alrt
total 2593704
-rw-r--r-- 1 oracle dba      3079 May 14  2015 init.ora
drwxr-xr-x 70 oracle dba      4096 Aug 29 18:50 ..
-rw-r----- 1 oracle dba        24 Oct 15 08:36 lkALICE
-rw-r----- 1 oracle dba     2048 Oct 15 09:17 orapwALICE
-rw-rw---- 1 oracle dba     1544 Oct 16 14:37 hc_ALICE.dat
-rw-r----- 1 oracle dba     3584 Oct 16 14:37 spfileALICE.ora
-rw-r----- 1 oracle dba 112438272 Oct 16 14:38 0cvd49mf_1_1
-rw-r----- 1 oracle dba 842833920 Oct 16 14:38 0dvd49mg_1_1
-rw-r----- 1 oracle dba 277618688 Oct 16 14:38 0evd49mn_1_1
-rw-r----- 1 oracle dba 277159936 Oct 16 14:38 0fvd49mq_1_1
-rw-r----- 1 oracle dba 277594112 Oct 16 14:38 0gvd49mt_1_1
-rw-r----- 1 oracle dba 269074432 Oct 16 14:38 0hvd49n0_1_1
-rw-r----- 1 oracle dba 561618944 Oct 16 14:38 0ivd49n4_1_1
```

```
-rw-r----- 1 oracle dba 18726912 Oct 16 14:38 snapcf_ALICE.f
-rw-r----- 1 oracle dba 18841600 Oct 16 14:38 c-2036574689-20201016-01
```

■ CDB 와 모든 PDB 의 datafile 삭제

```
[oracle:alice2:ALICE:/oradata/ALICE]ls -al
```

```
total 2403876
drwxr-x--- 7 oracle dba 4096 Oct 15 10:44 .
drwxrwxr-x 4 oracle dba 4096 Oct 12 17:21 ..
-rw-r----- 1 oracle dba 18726912 Oct 16 14:45 control01.ctl
-rw-r----- 1 oracle dba 18726912 Oct 16 14:45 control02.ctl
drwxr-x--- 2 oracle dba 4096 Oct 15 09:19 pdb1
drwxr-x--- 2 oracle dba 4096 Oct 15 09:19 pdb2
drwxr-x--- 2 oracle dba 4096 Oct 15 09:19 pdb3
drwxr-x--- 2 oracle dba 4096 Oct 15 10:44 pdb4
drwxr-x--- 2 oracle dba 4096 Oct 15 08:36 pdbseed
-rw-r----- 1 oracle dba 209715712 Oct 16 14:37 redo01.log
-rw-r----- 1 oracle dba 209715712 Oct 16 14:35 redo02.log
-rw-r----- 1 oracle dba 209715712 Oct 16 14:35 redo03.log
-rw-r----- 1 oracle dba 576724992 Oct 16 14:37 sysaux01.dbf
-rw-r----- 1 oracle dba 786440192 Oct 16 14:37 system01.dbf
-rw-r----- 1 oracle dba 20979712 Oct 15 15:19 temp01.dbf
-rw-r----- 1 oracle dba 424681472 Oct 16 14:37 undotbs01.dbf
-rw-r----- 1 oracle dba 5251072 Oct 16 14:37 users01.dbf
```

```
[oracle:alice2:ALICE:/oradata/ALICE]rm -rf *
```

```
[oracle:alice2:ALICE:/oradata/ALICE]ls -al
```

```
total 12
drwxr-x--- 3 oracle dba 4096 Oct 16 14:45 .
drwxrwxr-x 4 oracle dba 4096 Oct 12 17:21 ..
```

■ CDB 와 ALL Pdb's recover

```
[oracle:alice2:ALICE:/home/oracle]ss
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Fri Oct 16 14:47:07 2020
Version 19.3.0.0.0
```

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

Connected to:

```
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0
```

SQL> shut immediate;

ORA-00210: cannot open the specified control file
ORA-00202: control file: '/oradata/ALICE/control01.ctl'
ORA-27041: unable to open file
Linux-x86_64 Error: 2: No such file or directory
Additional information: 3

SQL> shut abort

ORACLE instance shut down.

SQL> startup nomount

ORACLE instance started.

Total System Global Area 1577056040 bytes
Fixed Size 9135912 bytes
Variable Size 503316480 bytes
Database Buffers 1056964608 bytes
Redo Buffers 7639040 bytes

[oracle:alice2:ALICE:/oradata/ALICE]rman target /

Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 14:59:10 2020
Version 19.3.0.0.0

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connected to target database: ALICE (not mounted)

RMAN> restore controlfile from '/oracle/19c/dbs/c-2036574689-20201016-01';

Starting restore at 16-OCT-20
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=743 device type=DISK

channel ORA_DISK_1: restoring control file
channel ORA_DISK_1: restore complete, elapsed time: 00:00:01
output file name=/oradata/ALICE/control01.ctl
output file name=/oradata/ALICE/control02.ctl
Finished restore at 16-OCT-20

```
RMAN> run{  
  alter database mount;  
  restore database;  
  recover database;  
}
```

released channel: ORA_DISK_1

Statement processed

Starting restore at 16-OCT-20

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=743 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 00001 to /oradata/ALICE/system01.dbf

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

channel ORA_DISK_1: restoring datafile 00005 to /oradata/ALICE/undotbs01.dbf

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

channel ORA_DISK_1: reading from backup piece /oracle/19c/dbs/0dvd49mg_1_1

channel ORA_DISK_1: piece handle=/oracle/19c/dbs/0dvd49mg_1_1 tag=TAG20201016T143808

channel ORA_DISK_1: restored backup piece 1

channel ORA_DISK_1: restore complete, elapsed time: 00:00:08

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 00008 to /oradata/ALICE/pdb1/system01.dbf

channel ORA_DISK_1: restoring datafile 00009 to /oradata/ALICE/pdb1/sysaux01.dbf

channel ORA_DISK_1: restoring datafile 00010 to /oradata/ALICE/pdb1/undotbs01.dbf

channel ORA_DISK_1: restoring datafile 00011 to /oradata/ALICE/pdb1/users01.dbf

channel ORA_DISK_1: reading from backup piece /oracle/19c/dbs/0evd49mn_1_1

channel ORA_DISK_1: piece handle=/oracle/19c/dbs/0evd49mn_1_1 tag=TAG20201016T143808

channel ORA_DISK_1: restored backup piece 1

channel ORA_DISK_1: restore complete, elapsed time: 00:00:03

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 00012 to /oradata/ALICE/pdb2/system01.dbf

channel ORA_DISK_1: restoring datafile 00013 to /oradata/ALICE/pdb2/sysaux01.dbf

channel ORA_DISK_1: restoring datafile 00014 to /oradata/ALICE/pdb2/undotbs01.dbf

channel ORA_DISK_1: restoring datafile 00015 to /oradata/ALICE/pdb2/users01.dbf

channel ORA_DISK_1: reading from backup piece /oracle/19c/dbs/0fvd49mq_1_1

```
channel ORA_DISK_1: piece handle=/oracle/19c/dbs/0fvd49mq_1_1 tag=TAG20201016T143808
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:03
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 00016 to /oradata/ALICE/pdb3/system01.dbf
channel ORA_DISK_1: restoring datafile 00017 to /oradata/ALICE/pdb3/sysaux01.dbf
channel ORA_DISK_1: restoring datafile 00018 to /oradata/ALICE/pdb3/undotbs01.dbf
channel ORA_DISK_1: restoring datafile 00019 to /oradata/ALICE/pdb3/users01.dbf
channel ORA_DISK_1: reading from backup piece /oracle/19c/dbs/0gvd49mt_1_1
channel ORA_DISK_1: piece handle=/oracle/19c/dbs/0gvd49mt_1_1 tag=TAG20201016T143808
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:03
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 00020 to /oradata/ALICE/pdb4/system01.dbf
channel ORA_DISK_1: restoring datafile 00021 to /oradata/ALICE/pdb4/sysaux01.dbf
channel ORA_DISK_1: restoring datafile 00022 to /oradata/ALICE/pdb4/undotbs01.dbf
channel ORA_DISK_1: reading from backup piece /oracle/19c/dbs/0hvd49n0_1_1
channel ORA_DISK_1: piece handle=/oracle/19c/dbs/0hvd49n0_1_1 tag=TAG20201016T143808
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:03
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 /oradata/ALICE/pdbseed/system01.dbf
channel ORA_DISK_1: restoring datafile 00004 to /oradata/ALICE/pdbseed/sysaux01.dbf
channel ORA_DISK_1: restoring datafile 00006 to /oradata/ALICE/pdbseed/undotbs01.dbf
channel ORA_DISK_1: reading from backup piece /oracle/19c/dbs/0ivd49n4_1_1
channel ORA_DISK_1: piece handle=/oracle/19c/dbs/0ivd49n4_1_1 tag=TAG20201016T143808
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:03
Finished restore at 16-OCT-20

Starting recover at 16-OCT-20
using channel ORA_DISK_1

starting media recovery

unable to find archived log
archived log thread=1 sequence=25
```

RMAN-00571:

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

RMAN-00571:

=====
RMAN-03002: failure of recover command at 10/16/2020 15:00:52
RMAN-06054: media recovery requesting unknown archived log for thread 1 with sequence 25 and starting SCN of 1589367

RMAN> alter database open resetlogs;

Statement processed

■ Data 확인

[oracle:alice2:ALICE:/oradata/ALICE]sqlplus "/as sysdba"

SQL*Plus: Release 19.0.0.0.0 - Production on Fri Oct 16 15:03:02 2020
Version 19.3.0.0.0

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

SQL> show pdbs

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	PDB1	MOUNTED	
4	PDB2	MOUNTED	
5	PDB3	MOUNTED	
6	PDB4	MOUNTED	

SQL> alter pluggable database all open;

Pluggable database altered.

SQL> show pdbs

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
--------	----------	-----------	------------

```
2 PDB$SEED          READ ONLY NO
3 PDB1              READ WRITE NO
4 PDB2              READ WRITE NO
5 PDB3              READ WRITE NO
6 PDB4              READ WRITE NO
```

```
SQL> alter session set container=pdb1;
```

```
Session altered.
```

```
SQL> select count(*) from alice1.test01;
```

```
COUNT(*)
-----
      1768
```

```
SQL> alter session set container=pdb2;
```

```
Session altered.
```

```
SQL> select count(*) from alice2.test01;
```

```
COUNT(*)
-----
      1199
```

```
SQL> alter session set container=pdb3;
```

```
Session altered.
```

```
SQL> select count(*) from alice3.test01;
```

```
COUNT(*)
-----
      1116
```

4.2. Root Container Backup & Recovery

■ Backup 경로 변경

```
RMAN> CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/snapcf_ALICE.f';
```

```
new RMAN configuration parameters:
```

```
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/snapcf_ALICE.f';
```

```
new RMAN configuration parameters are successfully stored
```

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

using target database control file instead of recovery catalog

old RMAN configuration parameters:

```
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/oracle/backup/%U_%T';
```

new RMAN configuration parameters:

```
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/oracle/backup/cdb/%U_%T';
```

new RMAN configuration parameters are successfully stored

■ Root container Backup

```
[oracle:alice2:ALICE:/oracle/backup]rman target /
```

Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 15:13:34 2020

Version 19.3.0.0.0

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connected to target database: ALICE (DBID=2036574689)

```
RMAN> backup database root;
```

Starting backup at 16-OCT-20

using target database control file instead of recovery catalog

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=254 device type=DISK

channel ORA_DISK_1: starting full datafile backup set

channel ORA_DISK_1: specifying datafile(s) in backup set

```
input datafile file number=00001 name=/oradata/ALICE/system01.dbf
```

```
input datafile file number=00003 name=/oradata/ALICE/sysaux01.dbf
```

```
input datafile file number=00005 name=/oradata/ALICE/undotbs01.dbf
```

```
input datafile file number=00007 name=/oradata/ALICE/users01.dbf
```

channel ORA_DISK_1: starting piece 1 at 16-OCT-20

channel ORA_DISK_1: finished piece 1 at 16-OCT-20

```
piece handle=/oracle/backup/cdb/0ovd4bp3_1_1_20201016 tag=TAG20201016T151339
```

```
comment=NONE
```

channel ORA_DISK_1: backup set complete, elapsed time: 00:00:07

Finished backup at 16-OCT-20

Starting Control File and SPFILE Autobackup at 16-OCT-20

```
piece handle=/oracle/19c/dbs/c-2036574689-20201016-05 comment=NONE
```

Finished Control File and SPFILE Autobackup at 16-OCT-20

■ Backup 확인

```
[oracle:alice2:ALICE:/oracle/backup/cdb]ls -al
```

```
total 896540
drwxr-xr-x 2 oracle dba      4096 Oct 16 15:13 .
drwxr-xr-x 3 oracle dba      4096 Oct 16 15:13 ..
-rw-r----- 1 oracle dba 918044672 Oct 16 15:13 0ovd4bp3_1_1_20201016
```

■ CDB 의 datafile 삭제

```
[oracle:alice2:ALICE:/oradata/ALICE]rm -rf *.dbf *.ctl *.log
```

```
[oracle:alice2:ALICE:/oradata/ALICE]ls -al
```

```
total 28
drwxr-x--- 7 oracle dba 4096 Oct 16 15:19 .
drwxrwxr-x 4 oracle dba 4096 Oct 12 17:21 ..
drwxr-x--- 2 oracle dba 4096 Oct 16 15:01 pdb1
drwxr-x--- 2 oracle dba 4096 Oct 16 15:01 pdb2
drwxr-x--- 2 oracle dba 4096 Oct 16 15:01 pdb3
drwxr-x--- 2 oracle dba 4096 Oct 16 15:01 pdb4
drwxr-x--- 2 oracle dba 4096 Oct 16 15:01 pdbseed
```

■ CDB datafile recover

```
[oracle:alice2:ALICE:/oradata/ALICE]sqlplus "/as sysdba"
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Fri Oct 16 15:20:44 2020
```

```
Version 19.3.0.0.0
```

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

```
Connected to an idle instance.
```

```
SQL> startup nomount;
```

```
ORACLE instance started.
```

```
Total System Global Area 1577056040 bytes
```

```
Fixed Size          9135912 bytes
```

```
Variable Size      503316480 bytes
```

```
Database Buffers  1056964608 bytes
```

```
Redo Buffers      7639040 bytes
```

```
SQL> exit
```

Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0

[oracle:alice2:ALICE:/oradata/ALICE]rman target /

Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 15:21:20 2020
Version 19.3.0.0.0

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connected to target database: ALICE (not mounted)

RMAN> restore controlfile from '/oracle/19c/dbs/c-2036574689-20201016-05';

Starting restore at 16-OCT-20
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=743 device type=DISK

channel ORA_DISK_1: restoring control file
channel ORA_DISK_1: restore complete, elapsed time: 00:00:01
output file name=/oradata/ALICE/control01.ctl
output file name=/oradata/ALICE/control02.ctl
Finished restore at 16-OCT-20

RMAN> run{
alter database mount;
restore database root;
recover database root;
}

released channel: ORA_DISK_1
Statement processed

Starting restore at 16-OCT-20
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=743 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 00001 to /oradata/ALICE/system01.dbf

```

channel ORA_DISK_1: restoring datafile 00003 to /oradata/ALICE/sysaux01.dbf
channel ORA_DISK_1: restoring datafile 00005 to /oradata/ALICE/undotbs01.dbf
channel ORA_DISK_1: restoring datafile 00007 to /oradata/ALICE/users01.dbf
channel ORA_DISK_1: reading from backup piece /oracle/backup/cdb/0ovd4bp3_1_1_20201016
channel ORA_DISK_1: piece handle=/oracle/backup/cdb/0ovd4bp3_1_1_20201016
tag=TAG20201016T151339
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:07
Finished restore at 16-OCT-20

Starting recover at 16-OCT-20
using channel ORA_DISK_1

starting media recovery

unable to find archived log
archived log thread=1 sequence=1
RMAN-00571:
=====
RMAN-00569: ===== ERROR MESSAGE STACK FOLLOWS =====
RMAN-00571:
=====
RMAN-03002: failure of recover command at 10/16/2020 15:24:12
RMAN-06054: media recovery requesting unknown archived log for thread 1 with sequence 1 and
starting SCN of 1607937

RMAN> alter database open resetlogs;
Statement processed

```

4.3. PDB Backup & Recovery

■ Backup 경로 변경

```
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'/oracle/backup/pdb1/%F';
```

new RMAN configuration parameters:

```
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'/oracle/backup/pdb1/%F';
```

new RMAN configuration parameters are successfully stored

```
RMAN> CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/pdb1/snapcf_ALICE.f';
```

old RMAN configuration parameters:

```
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/snapcf_ALICE.f';
```

new RMAN configuration parameters:

```
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/pdb1/snapcf_ALICE.f';
```

new RMAN configuration parameters are successfully stored

```
RMAN> configure channel device type disk format '/oracle/backup/pdb1/%U_%T';
```

old RMAN configuration parameters:

```
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/oracle/backup/cdb/%U_%T';
```

new RMAN configuration parameters:

```
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/oracle/backup/pdb1/%U_%T';
```

new RMAN configuration parameters are successfully stored

■ PDB1 Backup

```
[oracle:alice2:ALICE:/oracle/backup]rman target /
```

Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 15:35:17 2020

Version 19.3.0.0.0

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connected to target database: ALICE (DBID=2036574689)

```
RMAN> backup pluggable database pdb1;
```

Starting backup at 16-OCT-20

using target database control file instead of recovery catalog

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=381 device type=DISK

channel ORA_DISK_1: starting full datafile backup set

channel ORA_DISK_1: specifying datafile(s) in backup set

```
input datafile file number=00010 name=/oradata/ALICE/pdb1/undotbs01.dbf
```

```
input datafile file number=00008 name=/oradata/ALICE/pdb1/system01.dbf
```

```
input datafile file number=00009 name=/oradata/ALICE/pdb1/sysaux01.dbf
```

```
input datafile file number=00011 name=/oradata/ALICE/pdb1/users01.dbf
```

channel ORA_DISK_1: starting piece 1 at 16-OCT-20

channel ORA_DISK_1: finished piece 1 at 16-OCT-20

```
piece handle=/oracle/backup/pdb1/0uvd4d27_1_1_20201016 tag=TAG20201016T153535
```

```
comment=NONE
```

channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03

Finished backup at 16-OCT-20

Starting Control File and SPFILE Autobackup at 16-OCT-20

piece handle=/oracle/backup/pdb1/c-2036574689-20201016-08 comment=NONE

Finished Control File and SPFILE Autobackup at 16-OCT-20

■ Backup 확인

```
[oracle:alice2:ALICE:/oracle/backup/pdb1]ls -al
```

```
total 572596
```

```
drwxr-xr-x 2 oracle dba      4096 Oct 16 15:35 .
```

```
drwxr-xr-x 4 oracle dba      4096 Oct 16 15:33 ..
```

```
-rw-r----- 1 oracle dba 548757504 Oct 16 15:35 0uvd4d27_1_1_20201016
```

```
-rw-r----- 1 oracle dba 18841600 Oct 16 15:35 c-2036574689-20201016-08
```

```
-rw-r----- 1 oracle dba 18726912 Oct 16 15:35 snapcf_ALICE.f
```

■ PDB1 datafile 삭제하여 장애 유발

```
[oracle:alice2:ALICE:/oradata/ALICE]ls -al
```

```
total 2403124
```

```
drwxr-x--- 7 oracle dba      4096 Oct 16 15:24 .
```

```
drwxrwxr-x 4 oracle dba      4096 Oct 12 17:21 ..
```

```
-rw-r----- 1 oracle dba 18726912 Oct 16 15:36 control01.ctl
```

```
-rw-r----- 1 oracle dba 18726912 Oct 16 15:36 control02.ctl
```

```
drwxr-x--- 2 oracle dba      4096 Oct 16 15:01 pdb1
```

```
drwxr-x--- 2 oracle dba      4096 Oct 16 15:01 pdb2
```

```
drwxr-x--- 2 oracle dba      4096 Oct 16 15:01 pdb3
```

```
drwxr-x--- 2 oracle dba      4096 Oct 16 15:01 pdb4
```

```
drwxr-x--- 2 oracle dba      4096 Oct 16 15:01 pdbseed
```

```
-rw-r----- 1 oracle dba 209715712 Oct 16 15:36 redo01.log
```

```
-rw-r----- 1 oracle dba 209715712 Oct 16 15:24 redo02.log
```

```
-rw-r----- 1 oracle dba 209715712 Oct 16 15:24 redo03.log
```

```
-rw-r----- 1 oracle dba 576724992 Oct 16 15:34 sysaux01.dbf
```

```
-rw-r----- 1 oracle dba 786440192 Oct 16 15:30 system01.dbf
```

```
-rw-r----- 1 oracle dba 20979712 Oct 16 15:24 temp01.dbf
```

```
-rw-r----- 1 oracle dba 424681472 Oct 16 15:30 undotbs01.dbf
```

```
-rw-r----- 1 oracle dba 5251072 Oct 16 15:24 users01.dbf
```

```
[oracle:alice2:ALICE:/oradata/ALICE]rm -rf pdb1
```

■ PDB1 recover

```
[oracle:alice2:ALICE:/oradata/ALICE]rman target /
```

Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 15:39:49 2020
Version 19.3.0.0.0

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connected to target database: ALICE (DBID=2036574689)

```
RMAN> run{  
  restore pluggable database pdb1;  
  recover pluggable database pdb1;  
  alter pluggable database pdb1 open;  
}
```

Starting restore at 16-OCT-20

using target database control file instead of recovery catalog

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=506 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 00008 to /oradata/ALICE/pdb1/system01.dbf

channel ORA_DISK_1: restoring datafile 00009 to /oradata/ALICE/pdb1/sysaux01.dbf

channel ORA_DISK_1: restoring datafile 00010 to /oradata/ALICE/pdb1/undotbs01.dbf

channel ORA_DISK_1: restoring datafile 00011 to /oradata/ALICE/pdb1/users01.dbf

channel ORA_DISK_1: reading from backup piece /oracle/backup/pdb1/0uvd4d27_1_1_20201016

channel ORA_DISK_1: piece handle=/oracle/backup/pdb1/0uvd4d27_1_1_20201016

tag=TAG20201016T153535

channel ORA_DISK_1: restored backup piece 1

channel ORA_DISK_1: restore complete, elapsed time: 00:00:03

Finished restore at 16-OCT-20

Starting recover at 16-OCT-20

using channel ORA_DISK_1

starting media recovery

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

Finished recover at 16-OCT-20

Statement processed

■ Data 확인

```
[oracle:alice2:ALICE:/oradata/ALICE]sqlplus "/as sysdba"
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Fri Oct 16 15:40:56 2020
```

```
Version 19.3.0.0.0
```

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

```
Connected to:
```

```
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
```

```
Version 19.3.0.0.0
```

```
SQL> alter session set container=pdb1;
```

```
Session altered.
```

```
SQL> select count(*) from alice1.test01;
```

```
COUNT(*)
```

```
-----
```

```
2286
```

4.4. PDB Tablespace Backup & Recovery

■ Backup 경로 변경

```
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO  
'/oracle/backup/pdb1_tbs/%F';
```

using target database control file instead of recovery catalog

old RMAN configuration parameters:

```
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO  
'/oracle/backup/pdb1/%F';
```

new RMAN configuration parameters:

```
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO  
'/oracle/backup/pdb1_tbs/%F';
```

new RMAN configuration parameters are successfully stored

```
RMAN> CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/pdb1_tbs/snapcf_ALICE.f';
```

old RMAN configuration parameters:

```
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/pdb1/snapcf_ALICE.f';
```

new RMAN configuration parameters:

```
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/pdb1_tbs/napcf_ALICE.f';
```

new RMAN configuration parameters are successfully stored

```
RMAN> configure channel device type disk format '/oracle/backup/pdb1_tbs/%U_%T';
```

old RMAN configuration parameters:

```
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/oracle/backup/pdb1/%U_%T';
```

new RMAN configuration parameters:

```
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/oracle/backup/pdb1_tbs/%U_%T';
```

new RMAN configuration parameters are successfully stored

■ PDB1 Tablespace Backup

```
[oracle:alice2:ALICE:/oracle/backup]rman target /
```

Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 15:45:30 2020

Version 19.3.0.0.0

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connected to target database: ALICE (DBID=2036574689)

```
RMAN> backup tablespace pdb1:system, pdb1:sysaux;
```

Starting backup at 16-OCT-20

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=744 device type=DISK

channel ORA_DISK_1: starting full datafile backup set

channel ORA_DISK_1: specifying datafile(s) in backup set

```
input datafile file number=00008 name=/oradata/ALICE/pdb1/system01.dbf
```

```
input datafile file number=00009 name=/oradata/ALICE/pdb1/sysaux01.dbf
```

channel ORA_DISK_1: starting piece 1 at 16-OCT-20

channel ORA_DISK_1: finished piece 1 at 16-OCT-20

```
piece handle=/oracle/backup/pdb1_tbs/10vd4dns_1_1_20201016 tag=TAG20201016T154708
```

```
comment=NONE
```

channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01

Finished backup at 16-OCT-20

Starting Control File and SPFILE Autobackup at 16-OCT-20

```
piece handle=/oracle/backup/pdb1_tbs/c-2036574689-20201016-09 comment=NONE
```

Finished Control File and SPFILE Autobackup at 16-OCT-20

■ Backup 확인

```
[oracle:alice2:ALICE:/oracle/backup/pdb1_tbs]ls -al
```

```
total 303360
drwxr-xr-x 2 oracle dba      4096 Oct 16 15:47 .
drwxr-xr-x 5 oracle dba      4096 Oct 16 15:44 ..
-rw-r----- 1 oracle dba 273063936 Oct 16 15:47 10vd4dns_1_1_20201016
-rw-r----- 1 oracle dba 18841600 Oct 16 15:47 c-2036574689-20201016-09
-rw-r----- 1 oracle dba 18726912 Oct 16 15:47 snapcf_ALICE.f
```

■ PDB1 일부 datafile 삭제하여 장애 유발

```
[oracle:alice2:ALICE:/oradata/ALICE/pdb1]rm -rf sysaux01.dbf system01.dbf
```

```
[oracle:alice2:ALICE:/oradata/ALICE/pdb1]ls -al
```

```
total 303128
drwxr-x--- 2 oracle dba      4096 Oct 16 15:49 .
drwxr-x--- 7 oracle dba      4096 Oct 16 15:40 ..
-rw-r----- 1 oracle dba 20979712 Oct 16 15:40 temp01.dbf
-rw-r----- 1 oracle dba 304095232 Oct 16 15:45 undotbs01.dbf
-rw-r----- 1 oracle dba 5251072 Oct 16 15:48 users01.dbf
```

■ remove 된 PDB1 datafile recover

```
[oracle:alice2:ALICE:/oradata/ALICE/pdb1]sqlplus "/as sysdba"
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Fri Oct 16 15:40:56 2020
Version 19.3.0.0.0
```

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

```
Connected to:
```

```
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0
```

```
SQL> show pdbs
```

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	PDB1	READ WRITE	NO
4	PDB2	READ WRITE	NO
5	PDB3	READ WRITE	NO
6	PDB4	READ WRITE	NO

```
SQL> alter pluggable database pdb1 close;
```

Pluggable database altered.

```
SQL> show pdbs
```

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	PDB1	MOUNTED	
4	PDB2	READ WRITE	NO
5	PDB3	READ WRITE	NO
6	PDB4	READ WRITE	NO

```
[oracle:alice2:ALICE:/oracle/19c/rdbms/admin]rman target=sys@pdb1
```

Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 16:13:22 2020
Version 19.3.0.0.0

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target database Password:

connected to target database: ALICE:PDB1 (DBID=308595568, not open)

```
RMAN> restore tablespace sysaux;
```

Starting restore at 16-OCT-20

using target database control file instead of recovery catalog

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=382 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 00009 to /oradata/ALICE/pdb1/sysaux01.dbf

channel ORA_DISK_1: reading from backup piece /oracle/backup/pdb1_tbs/10vd4dns_1_1_20201016

channel ORA_DISK_1: piece handle=/oracle/backup/pdb1_tbs/10vd4dns_1_1_20201016

tag=TAG20201016T154708

channel ORA_DISK_1: restored backup piece 1

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

Finished restore at 16-OCT-20

```
RMAN> restore tablespace system;
```

Starting restore at 16-OCT-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 00008 to /oradata/ALICE/pdb1/system01.dbf

channel ORA_DISK_1: reading from backup piece /oracle/backup/pdb1_tbs/10vd4dns_1_1_20201016

channel ORA_DISK_1: piece handle=/oracle/backup/pdb1_tbs/10vd4dns_1_1_20201016

tag=TAG20201016T154708

channel ORA_DISK_1: restored backup piece 1

channel ORA_DISK_1: restore complete, elapsed time: 00:00:03

Finished restore at 16-OCT-20

RMAN> recover tablespace sysaux;

Starting recover at 16-OCT-20

using channel ORA_DISK_1

starting media recovery

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

Finished recover at 16-OCT-20

RMAN> recover tablespace system;

Starting recover at 16-OCT-20

using channel ORA_DISK_1

starting media recovery

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

Finished recover at 16-OCT-20

[oracle:alice2:ALICE:/oracle/19c/dbs/ALL_BACKUP]sqlplus "/as sysdba"

SQL*Plus: Release 19.0.0.0.0 - Production on Fri Oct 16 16:15:10 2020

Version 19.3.0.0.0

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Connected to:

Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

```
SQL> alter pluggable database pdb1 open;
```

Pluggable database altered.

4.5. PDB Datafile Backup & Recovery

■ PDB1 Users 에 해당하는 datafile 11 Backup

```
[oracle:alice2:ALICE:/home/oracle]rman target sys@pdb1
```

Recovery Manager: Release 19.0.0.0.0 - Production on Sat Oct 17 00:34:20 2020

Version 19.3.0.0.0

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target database Password:

connected to target database: ALICE:PDB1 (DBID=308595568)

```
RMAN> backup datafile 11;
```

Starting backup at 17-OCT-20

using target database control file instead of recovery catalog

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=16 device type=DISK

channel ORA_DISK_1: starting full datafile backup set

channel ORA_DISK_1: specifying datafile(s) in backup set

```
input datafile file number=00011 name=/oradata/ALICE/pdb1/users01.dbf
```

channel ORA_DISK_1: starting piece 1 at 17-OCT-20

channel ORA_DISK_1: finished piece 1 at 17-OCT-20

piece handle=/oracle/backup/all_pitr/1ovd5cl3_1_1_20201017 tag=TAG20201017T003443

comment=NONE

channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01

Finished backup at 17-OCT-20

■ Backup 확인

```
[oracle:alice2:ALICE:/oracle/backup/all_pitr]ls -alrt
```

total 3722240

```
drwxr-xr-x 9 oracle dba      4096 Oct 16 23:56 ..
```

```
drwxr-xr-x 2 oracle dba      4096 Oct 17 00:34 .
```

```
-rw-r----- 1 oracle dba    2408448 Oct 17 00:34 1ovd5cl3_1_1_20201017
```

■ datafile 11 번 remove 하는 장애 발생

```
[oracle:alice2:ALICE:/home/oracle]cd /oradata/ALICE/pdb1
```

```
[oracle:alice2:ALICE:/oradata/ALICE/pdb1]ls -al
```

```
total 697880
drwxr-x--- 2 oracle dba      4096 Oct 16 16:19 .
drwxr-x--- 7 oracle dba      4096 Oct 16 15:40 ..
-rw-r----- 1 oracle dba 173023232 Oct 17 00:35 sysaux01.dbf
-rw-r----- 1 oracle dba 230694912 Oct 17 00:34 system01.dbf
-rw-r----- 1 oracle dba  20979712 Oct 16 23:56 temp01.dbf
-rw-r----- 1 oracle dba 304095232 Oct 17 00:35 undotbs01.dbf
-rw-r----- 1 oracle dba   5251072 Oct 17 00:34 users01.dbf
```

```
[oracle:alice2:ALICE:/oradata/ALICE/pdb1]rm -rf users01.dbf
```

■ recover datafile 11

```
[oracle:alice2:ALICE:/oradata/ALICE/pdb1]rman target sys@pdb1
```

```
Recovery Manager: Release 19.0.0.0.0 - Production on Sat Oct 17 00:36:42 2020
Version 19.3.0.0.0
```

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

```
target database Password:
```

```
connected to target database: ALICE:PDB1 (DBID=308595568)
```

```
RMAN> run{
```

```
2> alter database datafile 11 offline;
```

```
3> restore datafile 11;
```

```
4> recover datafile 11;
```

```
5> alter database datafile 11 online;
```

```
6> }
```

```
using target database control file instead of recovery catalog
```

```
Statement processed
```

```
Starting restore at 17-OCT-20
```

```
allocated channel: ORA_DISK_1
```

```
channel ORA_DISK_1: SID=132 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 00011 to /oradata/ALICE/pdb1/users01.dbf
channel ORA_DISK_1: reading from backup piece /oracle/backup/all_pitr/1ovd5cl3_1_1_20201017
channel ORA_DISK_1: piece handle=/oracle/backup/all_pitr/1ovd5cl3_1_1_20201017
tag=TAG20201017T003443
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:01
Finished restore at 17-OCT-20
```

```
Starting recover at 17-OCT-20
using channel ORA_DISK_1
```

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

```
Finished recover at 17-OCT-20
```

```
Statement processed
```

■ Data 확인

```
[oracle:alice2:ALICE:/oradata/ALICE]sqlplus "/as sysdba"
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Sat Oct 17 00:37:56 2020
Version 19.3.0.0.0
```

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

```
Connected to:
```

```
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0
```

```
SQL> show pdbs
```

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	PDB1	READ WRITE	NO
4	PDB2	READ WRITE	NO
5	PDB3	READ WRITE	NO
6	PDB4	READ WRITE	NO

```
SQL> alter session set container=pdb1;
```

Session altered.

```
SQL> select count(*) from alice1.test04;
```

```
COUNT(*)  
-----  
          35
```

⇒ users01.dbf 에 있던 ALICE1.TEST04 table 복구

4.6. PDB Table PITR

■ Backup 경로 변경

```
[oracle:alice2:ALICE:/oracle/backup]rman target /
```

```
Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 22:45:45 2020  
Version 19.3.0.0.0
```

```
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```

```
connected to target database: ALICE (DBID=2036574689)
```

```
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '/oracle/backup/all_pitr/%F';
```

```
using target database control file instead of recovery catalog
```

```
old RMAN configuration parameters:
```

```
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '/oracle/backup/pdb1_tbs/%F';
```

```
new RMAN configuration parameters:
```

```
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '/oracle/backup/all_pitr/%F';
```

```
new RMAN configuration parameters are successfully stored
```

```
RMAN> CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/all_pitr/snapcf_ALICE.f';
```

```
old RMAN configuration parameters:
```

```
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/pdb1_tbs/snapcf_ALICE.f';
```

```
new RMAN configuration parameters:
```

```
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/oracle/backup/all_pitr/snapcf_ALICE.f';
```

```
new RMAN configuration parameters are successfully stored
```

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

old RMAN configuration parameters:

```
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/oracle/backup/pdb1_tbs/%U_%T';
```

new RMAN configuration parameters:

```
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT '/oracle/backup/all_pitr/%U_%T';
```

new RMAN configuration parameters are successfully stored

■ CDB, All PDBs Backup

```
[oracle:alice2:ALICE:/oracle/backup]rman target /
```

Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 22:47:40 2020

Version 19.3.0.0.0

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

connected to target database: ALICE (DBID=2036574689)

```
RMAN> backup database plus archivelog;
```

Starting backup at 16-OCT-20

current log archived

using target database control file instead of recovery catalog

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=259 device type=DISK

channel ORA_DISK_1: starting archived log backup set

channel ORA_DISK_1: specifying archived log(s) in backup set

input archived log thread=1 sequence=1 RECID=8 STAMP=1053971237

input archived log thread=1 sequence=2 RECID=9 STAMP=1053978932

input archived log thread=1 sequence=3 RECID=10 STAMP=1053986423

input archived log thread=1 sequence=4 RECID=11 STAMP=1053986471

input archived log thread=1 sequence=5 RECID=12 STAMP=1053987113

input archived log thread=1 sequence=6 RECID=13 STAMP=1053988448

input archived log thread=1 sequence=7 RECID=14 STAMP=1053988478

input archived log thread=1 sequence=8 RECID=15 STAMP=1053989268

channel ORA_DISK_1: starting piece 1 at 16-OCT-20

channel ORA_DISK_1: finished piece 1 at 16-OCT-20

piece handle=/oracle/backup/all_pitr/1evd56cl_1_1_20201016 tag=TAG20201016T224749 comment=NONE

channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03

channel ORA_DISK_1: starting archived log backup set

channel ORA_DISK_1: specifying archived log(s) in backup set

input archived log thread=1 sequence=18 RECID=1 STAMP=1053957603

input archived log thread=1 sequence=19 RECID=2 STAMP=1053957722


```
input archived log thread=1 sequence=20 RECID=3 STAMP=1053957723
input archived log thread=1 sequence=21 RECID=5 STAMP=1053957724
input archived log thread=1 sequence=22 RECID=4 STAMP=1053957724
input archived log thread=1 sequence=23 RECID=6 STAMP=1053959714
input archived log thread=1 sequence=24 RECID=7 STAMP=1053959739
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/backup/all_pitr/1fvd56co_1_1_20201016 tag=TAG20201016T224749 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 16-OCT-20
```

```
Starting backup at 16-OCT-20
using channel ORA_DISK_1
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00001 name=/oradata/ALICE/system01.dbf
input datafile file number=00003 name=/oradata/ALICE/sysaux01.dbf
input datafile file number=00005 name=/oradata/ALICE/undotbs01.dbf
input datafile file number=00007 name=/oradata/ALICE/users01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/backup/all_pitr/1gvd56cp_1_1_20201016 tag=TAG20201016T224753 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00010 name=/oradata/ALICE/pdb1/undotbs01.dbf
input datafile file number=00008 name=/oradata/ALICE/pdb1/system01.dbf
input datafile file number=00009 name=/oradata/ALICE/pdb1/sysaux01.dbf
input datafile file number=00011 name=/oradata/ALICE/pdb1/users01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/backup/all_pitr/1hvd56cs_1_1_20201016 tag=TAG20201016T224753 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00014 name=/oradata/ALICE/pdb2/undotbs01.dbf
input datafile file number=00012 name=/oradata/ALICE/pdb2/system01.dbf
input datafile file number=00013 name=/oradata/ALICE/pdb2/sysaux01.dbf
input datafile file number=00015 name=/oradata/ALICE/pdb2/users01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
```

```
piece handle=/oracle/backup/all_pitr/1ivd56cu_1_1_20201016 tag=TAG20201016T224753 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00018 name=/oradata/ALICE/pdb3/undotbs01.dbf
input datafile file number=00016 name=/oradata/ALICE/pdb3/system01.dbf
input datafile file number=00017 name=/oradata/ALICE/pdb3/sysaux01.dbf
input datafile file number=00019 name=/oradata/ALICE/pdb3/users01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/backup/all_pitr/1jvd56d1_1_1_20201016 tag=TAG20201016T224753 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00022 name=/oradata/ALICE/pdb4/undotbs01.dbf
input datafile file number=00020 name=/oradata/ALICE/pdb4/system01.dbf
input datafile file number=00021 name=/oradata/ALICE/pdb4/sysaux01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/backup/all_pitr/1kvd56d2_1_1_20201016 tag=TAG20201016T224753 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00006 name=/oradata/ALICE/pdbseed/undotbs01.dbf
input datafile file number=00002 name=/oradata/ALICE/pdbseed/system01.dbf
input datafile file number=00004 name=/oradata/ALICE/pdbseed/sysaux01.dbf
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/backup/all_pitr/1lvd56d5_1_1_20201016 tag=TAG20201016T224753 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:03
Finished backup at 16-OCT-20
```

```
Starting backup at 16-OCT-20
current log archived
using channel ORA_DISK_1
channel ORA_DISK_1: starting archived log backup set
channel ORA_DISK_1: specifying archived log(s) in backup set
input archived log thread=1 sequence=9 RECID=16 STAMP=1053989288
channel ORA_DISK_1: starting piece 1 at 16-OCT-20
channel ORA_DISK_1: finished piece 1 at 16-OCT-20
piece handle=/oracle/backup/all_pitr/1mvd56d8_1_1_20201016 tag=TAG20201016T224808 comment=NONE
```

channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01

Finished backup at 16-OCT-20

Starting Control File and SPFILE Autobackup at 16-OCT-20

piece handle=/oracle/backup/all_pitr/c-2036574689-20201016-0c comment=NONE

Finished Control File and SPFILE Autobackup at 16-OCT-20

■ Backup 확인

```
[oracle:alice2:ALICE:/oracle/backup]cd all_pitr/
```

```
[oracle:alice2:ALICE:/oracle/backup/all_pitr]ls -al
```

```
total 3719888
```

```
drwxr-xr-x 2 oracle dba      4096 Oct 16 22:48 .
```

```
drwxr-xr-x 7 oracle dba      4096 Oct 16 22:45 ..
```

```
-rw-r----- 1 oracle dba 1040081408 Oct 16 22:47 1evd56cl_1_1_20201016
```

```
-rw-r----- 1 oracle dba 112438272 Oct 16 22:47 1fvd56co_1_1_20201016
```

```
-rw-r----- 1 oracle dba 879886336 Oct 16 22:47 1gvd56cp_1_1_20201016
```

```
-rw-r----- 1 oracle dba 298385408 Oct 16 22:47 1hvd56cs_1_1_20201016
```

```
-rw-r----- 1 oracle dba 297730048 Oct 16 22:47 1ivd56cu_1_1_20201016
```

```
-rw-r----- 1 oracle dba 298131456 Oct 16 22:48 1jvd56d1_1_1_20201016
```

```
-rw-r----- 1 oracle dba 282836992 Oct 16 22:48 1kvd56d2_1_1_20201016
```

```
-rw-r----- 1 oracle dba 561618944 Oct 16 22:48 1lvd56d5_1_1_20201016
```

```
-rw-r----- 1 oracle dba 454144 Oct 16 22:48 1mvd56d8_1_1_20201016
```

```
-rw-r----- 1 oracle dba 18841600 Oct 16 22:48 c-2036574689-20201016-0c
```

```
-rw-r----- 1 oracle dba 18726912 Oct 16 22:48 snapcf_ALICE.f
```

■ 검증 Data 생성(New table ALICE1.TEST02 생성, 기존 ALICE1.TEST01 Drop table 장애 발생)

```
[oracle:alice2:ALICE:/oracle/backup/all_pitr]sqlplus "/as sysdba"
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Fri Oct 16 22:49:50 2020
```

```
Version 19.3.0.0.0
```

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

```
Connected to:
```

```
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
```

```
Version 19.3.0.0.0
```

```
SQL> alter session set container=pdb1;
```

```
Session altered.
```

```
SQL> create table alice1.test02(time date, name varchar2(5));
```

Table created.

```
SQL> insert into alice1.test02 values(sysdate, 'rami');
```

1 row created.

```
SQL> commit;
```

Commit complete.

```
SQL> select count(*) from alice1.test02;
```

```
COUNT(*)
```

```
-----
```

```
1
```

```
SQL> drop table alice1.test01;
```

Table dropped.

```
SQL> commit;
```

Commit complete.

```
SQL> select count(*) from alice1.test01;
```

```
select count(*) from alice1.test01
```

```
*
```

```
ERROR at line 1:
```

```
ORA-00942: table or view does not exist
```

■ PITR 을 이용한 recover table (유저가 실수로 DROP 한 ALICE1.TEST01)

```
[oracle:alice2:ALICE:/oracle/backup]rman target /
```

```
Recovery Manager: Release 19.0.0.0.0 - Production on Fri Oct 16 22:47:40 2020
```

```
Version 19.3.0.0.0
```

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

```
connected to target database: ALICE (DBID=2036574689)
```

```
RMAN> recover table 'ALICE1'.TEST01 of pluggable database pdb1
```

```
until time "TO_DATE('2020-10-16 22:45:00', 'YYYY-MM-DD HH24:MI:SS')"
```

```
auxiliary destination '/oracle/backup'
```

```
remap table 'ALICE1'.TEST01:'TEST03';
```

⇒ ALICE1.TEST01 table drop 하기 전 시점으로 table recover 하면서, test01 에서 test03 으로 remap table 하는 명령어

Starting recover at 16-OCT-20

using target database control file instead of recovery catalog

allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=748 device type=DISK

RMAN-05026: warning: presuming following set of tablespaces applies to specified point-in-time

List of tablespaces expected to have UNDO segments

Tablespace SYSTEM

Tablespace PDB1:SYSTEM

Tablespace UNDOTBS1

Tablespace PDB1:UNDOTBS1

Creating automatic instance, with SID='rjrc'

initialization parameters used for automatic instance:

db_name=ALICE

db_unique_name=rjrc_pitr_pdb1_ALICE

compatible=19.0.0

db_block_size=8192

db_files=200

diagnostic_dest=/oracle

_system_trig_enabled=FALSE

sga_target=1504M

processes=200

db_create_file_dest=/oracle/backup

log_archive_dest_1='location=/oracle/backup'

enable_pluggable_database=true

_clone_one_pdb_recovery=true

#No auxiliary parameter file used

starting up automatic instance ALICE

Oracle instance started

Total System Global Area 1577055160 bytes

Fixed Size 9135032 bytes

Variable Size 402653184 bytes
Database Buffers 1157627904 bytes
Redo Buffers 7639040 bytes

Automatic instance created

contents of Memory Script:

```
{  
# set requested point in time  
set until time "TO_DATE('2020-10-16 22:45:00', 'YYYY-MM-DD HH24:MI:SS')";  
# restore the controlfile  
restore clone controlfile;  
  
# mount the controlfile  
sql clone 'alter database mount clone database';  
  
# archive current online log  
sql 'alter system archive log current';  
}
```

executing Memory Script

executing command: SET until clause

Starting restore at 16-OCT-20

allocated channel: ORA_AUX_DISK_1

channel ORA_AUX_DISK_1: SID=129 device type=DISK

channel ORA_AUX_DISK_1: starting datafile backup set restore

channel ORA_AUX_DISK_1: restoring control file

channel ORA_AUX_DISK_1: reading from backup piece /oracle/backup/pdb1_tbs/c-2036574689-20201016-0a

channel ORA_AUX_DISK_1: piece handle=/oracle/backup/pdb1_tbs/c-2036574689-20201016-0a tag=TAG20201016T1

channel ORA_AUX_DISK_1: restored backup piece 1

channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:01

output file name=/oracle/backup/ALICE/controlfile/o1_mf_hrmdyyp3_ctl

Finished restore at 16-OCT-20

sql statement: alter database mount clone database

sql statement: alter system archive log current

contents of Memory Script:

```
{
```

```

# set requested point in time
set until time "TO_DATE('2020-10-16 22:45:00', 'YYYY-MM-DD HH24:MI:SS')";
# set destinations for recovery set and auxiliary set datafiles
set newname for clone datafile 1 to new;
set newname for clone datafile 8 to new;
set newname for clone datafile 5 to new;
set newname for clone datafile 10 to new;
set newname for clone datafile 3 to new;
set newname for clone datafile 9 to new;
set newname for clone tempfile 1 to new;
set newname for clone tempfile 3 to new;
# switch all tempfiles
switch clone tempfile all;
# restore the tablespaces in the recovery set and the auxiliary set
restore clone datafile 1, 8, 5, 10, 3, 9;

switch clone datafile all;
}

```

executing Memory Script

```

executing command: SET until clause
executing command: SET NEWNAME
executing command: SET NEWNAME
executing command: SET NEWNAME
executing command: SET NEWNAME
executing command: SET NEWNAME
executing command: SET NEWNAME
executing command: SET NEWNAME
executing command: SET NEWNAME
executing command: SET NEWNAME

```

```

renamed tempfile 1 to /oracle/backup/ALICE/datafile/o1_mf_temp_%u_.tmp in control file
renamed tempfile 3 to /oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_temp_%u_.tmp
control file

```

```

Starting restore at 16-OCT-20
using channel ORA_AUX_DISK_1

```

```

channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from backup set
channel ORA_AUX_DISK_1: restoring datafile 00001 to /oracle/backup/ALICE/datafile/o1_mf_system_%u_.dbf
channel ORA_AUX_DISK_1: restoring datafile 00005 to /oracle/backup/ALICE/datafile/o1_mf_undotbs1_%u_.dbf

```

channel ORA_AUX_DISK_1: restoring datafile 00003 to /oracle/backup/ALICE/datafile/o1_mf_sysaux_%u_.dbf
channel ORA_AUX_DISK_1: reading from backup piece /oracle/backup/cdb/0ovd4bp3_1_1_20201016
channel ORA_AUX_DISK_1: piece handle=/oracle/backup/cdb/0ovd4bp3_1_1_20201016 tag=TAG20201016T151339
channel ORA_AUX_DISK_1: restored backup piece 1
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:07
channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from backup set
channel ORA_AUX_DISK_1: restoring datafile 00010 to
/oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_undotbs1_%u_.dbf
channel ORA_AUX_DISK_1: reading from backup piece /oracle/backup/pdb1/0uvd4d27_1_1_20201016
channel ORA_AUX_DISK_1: piece handle=/oracle/backup/pdb1/0uvd4d27_1_1_20201016 tag=TAG20201016T153535
channel ORA_AUX_DISK_1: restored backup piece 1
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:03
channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from backup set
channel ORA_AUX_DISK_1: restoring datafile 00008 to
/oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_system_%u_.dbf
channel ORA_AUX_DISK_1: restoring datafile 00009 to
/oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_sysaux_%u_.dbf
channel ORA_AUX_DISK_1: reading from backup piece /oracle/backup/pdb1/10vd4dns_1_1_20201016
channel ORA_AUX_DISK_1: piece handle=/oracle/backup/pdb1/10vd4dns_1_1_20201016 tag=TAG20201016T1547
channel ORA_AUX_DISK_1: restored backup piece 1
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:03
Finished restore at 16-OCT-20

datafile 1 switched to datafile copy

input datafile copy RECID=7 STAMP=1053993218 file name=/oracle/backup/ALICE/datafile/o1_mf_system_hrmdz4q1_

datafile 8 switched to datafile copy

input datafile copy RECID=8 STAMP=1053993218 file

name=/oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_system_hrmdzgx4_.dbf

datafile 5 switched to datafile copy

input datafile copy RECID=9 STAMP=1053993218 file

name=/oracle/backup/ALICE/datafile/o1_mf_undotbs1_hrmdz4q4_.dbf

datafile 10 switched to datafile copy

input datafile copy RECID=10 STAMP=1053993218 file

name=/oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_undotbs1_hrmdzcvw_.dbf

datafile 3 switched to datafile copy

input datafile copy RECID=11 STAMP=1053993218 file name=/oracle/backup/ALICE/datafile/o1_mf_sysaux_hrmdz4q3_

datafile 9 switched to datafile copy

input datafile copy RECID=12 STAMP=1053993218 file

name=/oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_sysaux_hrmdzgx6_.dbf

contents of Memory Script:

```
{
# set requested point in time
set until time "TO_DATE('2020-10-16 22:45:00', 'YYYY-MM-DD HH24:MI:SS')";
# online the datafiles restored or switched
sql clone "alter database datafile 1 online";
sql clone 'PDB1' "alter database datafile 8 online";
sql clone "alter database datafile 5 online";
sql clone 'PDB1' "alter database datafile 10 online";
sql clone "alter database datafile 3 online";
sql clone 'PDB1' "alter database datafile 9 online";
# recover and open database read only
recover clone database tablespace "SYSTEM", "PDB1":"SYSTEM", "UNDOTBS1", "PDB1":"UNDOTBS1", "SYSAUX",
"PDB1":"SYSAUX";
sql clone 'alter database open read only';
}
```

executing Memory Script

executing command: SET until clause

```
sql statement: alter database datafile 1 online
sql statement: alter database datafile 8 online
sql statement: alter database datafile 5 online
sql statement: alter database datafile 10 online
sql statement: alter database datafile 3 online
sql statement: alter database datafile 9 online
```

Starting recover at 16-OCT-20

using channel ORA_AUX_DISK_1

starting media recovery

```
archived log for thread 1 with sequence 1 is already on disk as file /oradata/arch/ALICE_1_1_1053962688.arc
archived log for thread 1 with sequence 2 is already on disk as file /oradata/arch/ALICE_1_2_1053962688.arc
archived log for thread 1 with sequence 3 is already on disk as file /oradata/arch/ALICE_1_3_1053962688.arc
archived log for thread 1 with sequence 4 is already on disk as file /oradata/arch/ALICE_1_4_1053962688.arc
archived log for thread 1 with sequence 5 is already on disk as file /oradata/arch/ALICE_1_5_1053962688.arc
archived log for thread 1 with sequence 6 is already on disk as file /oradata/arch/ALICE_1_6_1053962688.arc
archived log for thread 1 with sequence 7 is already on disk as file /oradata/arch/ALICE_1_7_1053962688.arc
archived log for thread 1 with sequence 8 is already on disk as file /oradata/arch/ALICE_1_8_1053962688.arc
```

```
archived log file name=/oradata/arch/ALICE_1_1_1053962688.arc thread=1 sequence=1
archived log file name=/oradata/arch/ALICE_1_2_1053962688.arc thread=1 sequence=2
archived log file name=/oradata/arch/ALICE_1_3_1053962688.arc thread=1 sequence=3
archived log file name=/oradata/arch/ALICE_1_4_1053962688.arc thread=1 sequence=4
archived log file name=/oradata/arch/ALICE_1_5_1053962688.arc thread=1 sequence=5
archived log file name=/oradata/arch/ALICE_1_6_1053962688.arc thread=1 sequence=6
archived log file name=/oradata/arch/ALICE_1_7_1053962688.arc thread=1 sequence=7
archived log file name=/oradata/arch/ALICE_1_8_1053962688.arc thread=1 sequence=8
media recovery complete, elapsed time: 00:00:11
Finished recover at 16-OCT-20
```

```
sql statement: alter database open read only
```

```
contents of Memory Script:
```

```
{
sql clone 'alter pluggable database PDB1 open read only';
}
```

```
executing Memory Script
```

```
sql statement: alter pluggable database PDB1 open read only
```

```
contents of Memory Script:
```

```
{
  sql clone "create spfile from memory";
  shutdown clone immediate;
  startup clone nomount;
  sql clone "alter system set control_files =
'/oracle/backup/ALICE/controlfile/o1_mf_hrmdyyp3_ctl' comment=
'RMAN set' scope=spfile";
  shutdown clone immediate;
  startup clone nomount;
```

```
# mount database
```

```
sql clone 'alter database mount clone database';
}
```

```
executing Memory Script
```

```
sql statement: create spfile from memory
```

```
database closed
```

```
database dismounted
```

```
Oracle instance shut down
```

connected to auxiliary database (not started)

Oracle instance started

Total System Global Area 1577055160 bytes

Fixed Size 9135032 bytes

Variable Size 402653184 bytes

Database Buffers 1157627904 bytes

Redo Buffers 7639040 bytes

sql statement: alter system set control_files = '/oracle/backup/ALICE/controlfile/o1_mf_hrmdyyp3_.ctl' comment='RMAN set' scope=spfile

Oracle instance shut down

connected to auxiliary database (not started)

Oracle instance started

Total System Global Area 1577055160 bytes

Fixed Size 9135032 bytes

Variable Size 402653184 bytes

Database Buffers 1157627904 bytes

Redo Buffers 7639040 bytes

sql statement: alter database mount clone database

contents of Memory Script:

```
{  
# set requested point in time  
set until time "TO_DATE('2020-10-16 22:45:00', 'YYYY-MM-DD HH24:MI:SS')";  
# set destinations for recovery set and auxiliary set datafiles  
set newname for datafile 11 to new;  
# restore the tablespaces in the recovery set and the auxiliary set  
restore clone datafile 11;  
switch clone datafile all;  
}
```

executing Memory Script

executing command: SET until clause

executing command: SET NEWNAME

Starting restore at 16-OCT-20

allocated channel: ORA_AUX_DISK_1

channel ORA_AUX_DISK_1: SID=211 device type=DISK

channel ORA_AUX_DISK_1: starting datafile backup set restore

channel ORA_AUX_DISK_1: specifying datafile(s) to restore from backup set

channel ORA_AUX_DISK_1: restoring datafile 00011 to

/oracle/backup/RJRC_PITR_PDB1_ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_users_%u_.dbf

channel ORA_AUX_DISK_1: reading from backup piece /oracle/backup/pdb1_tbs/12vd4fhm_1_1_20201016

channel ORA_AUX_DISK_1: piece handle=/oracle/backup/pdb1_tbs/12vd4fhm_1_1_20201016 tag=TAG20201016T1617

channel ORA_AUX_DISK_1: restored backup piece 1

channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:01

Finished restore at 16-OCT-20

datafile 11 switched to datafile copy

input datafile copy RECID=14 STAMP=1053993300 file

name=/oracle/backup/RJRC_PITR_PDB1_ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_users_hrmf237

contents of Memory Script:

{

set requested point in time

set until time "TO_DATE('2020-10-16 22:45:00', 'YYYY-MM-DD HH24:MI:SS');"

online the datafiles restored or switched

sql clone 'PDB1' "alter database datafile 11 online";

recover and open resetlogs

recover clone database tablespace "PDB1":"USERS", "SYSTEM", "PDB1":"SYSTEM", "UNDOTBS1", "PDB1":"UNDOTBS1

"SYSAUX", "PDB1":"SYSAUX" delete archivelog;

alter clone database open resetlogs;

}

executing Memory Script

executing command: SET until clause

sql statement: alter database datafile 11 online

Starting recover at 16-OCT-20

using channel ORA_AUX_DISK_1

starting media recovery

```
archived log for thread 1 with sequence 1 is already on disk as file /oradata/arch/ALICE_1_1_1053962688.arc
archived log for thread 1 with sequence 2 is already on disk as file /oradata/arch/ALICE_1_2_1053962688.arc
archived log for thread 1 with sequence 3 is already on disk as file /oradata/arch/ALICE_1_3_1053962688.arc
archived log for thread 1 with sequence 4 is already on disk as file /oradata/arch/ALICE_1_4_1053962688.arc
archived log for thread 1 with sequence 5 is already on disk as file /oradata/arch/ALICE_1_5_1053962688.arc
archived log for thread 1 with sequence 6 is already on disk as file /oradata/arch/ALICE_1_6_1053962688.arc
archived log for thread 1 with sequence 7 is already on disk as file /oradata/arch/ALICE_1_7_1053962688.arc
archived log for thread 1 with sequence 8 is already on disk as file /oradata/arch/ALICE_1_8_1053962688.arc
archived log file name=/oradata/arch/ALICE_1_1_1053962688.arc thread=1 sequence=1
archived log file name=/oradata/arch/ALICE_1_2_1053962688.arc thread=1 sequence=2
archived log file name=/oradata/arch/ALICE_1_3_1053962688.arc thread=1 sequence=3
archived log file name=/oradata/arch/ALICE_1_4_1053962688.arc thread=1 sequence=4
archived log file name=/oradata/arch/ALICE_1_5_1053962688.arc thread=1 sequence=5
archived log file name=/oradata/arch/ALICE_1_6_1053962688.arc thread=1 sequence=6
archived log file name=/oradata/arch/ALICE_1_7_1053962688.arc thread=1 sequence=7
archived log file name=/oradata/arch/ALICE_1_8_1053962688.arc thread=1 sequence=8
media recovery complete, elapsed time: 00:00:03
Finished recover at 16-OCT-20
```

database opened

contents of Memory Script:

```
{
sql clone 'alter pluggable database PDB1 open';
}
```

executing Memory Script

sql statement: alter pluggable database PDB1 open

contents of Memory Script:

```
{
# create directory for datapump import
sql 'PDB1' "create or replace directory
TSPITR_DIROBJ_DPDIR as "
/oracle/backup";
# create directory for datapump export
sql clone 'PDB1' "create or replace directory
TSPITR_DIROBJ_DPDIR as "
/oracle/backup";
}
```

executing Memory Script

sql statement: create or replace directory TSPITR_DIROBJ_DPDIR as "/oracle/backup"

sql statement: create or replace directory TSPITR_DIROBJ_DPDIR as "/oracle/backup"

Performing export of tables...

EXPDP> Starting "SYS"."TSPITR_EXP_rjrc_qzIE":

EXPDP> Processing object type TABLE_EXPORT/TABLE/TABLE_DATA

EXPDP> Processing object type TABLE_EXPORT/TABLE/STATISTICS/TABLE_STATISTICS

EXPDP> Processing object type TABLE_EXPORT/TABLE/STATISTICS/MARKER

EXPDP> Processing object type TABLE_EXPORT/TABLE/TABLE

EXPDP> .. exported "ALICE1"."TEST01" 413.2 KB 26097 rows

EXPDP> Master table "SYS"."TSPITR_EXP_rjrc_qzIE" successfully loaded/unloaded

EXPDP> *****

EXPDP> Dump file set for SYS.TSPITR_EXP_rjrc_qzIE is:

EXPDP> /oracle/backup/tspitr_rjrc_66837.dmp

EXPDP> Job "SYS"."TSPITR_EXP_rjrc_qzIE" successfully completed at Fri Oct 16 23:55:39 2020 elapsed 0 00:00:19

Export completed

contents of Memory Script:

{

shutdown clone before import

[shutdown clone abort](#)

}

executing Memory Script

Oracle instance shut down

Performing import of tables...

IMPDP> Master table "SYS"."TSPITR_IMP_rjrc_FczF" successfully loaded/unloaded

IMPDP> Starting "SYS"."TSPITR_IMP_rjrc_FczF":

IMPDP> Processing object type TABLE_EXPORT/TABLE/TABLE

IMPDP> Processing object type TABLE_EXPORT/TABLE/TABLE_DATA

IMPDP> .. imported "ALICE1"."TEST03" 413.2 KB 26097 rows

IMPDP> Processing object type TABLE_EXPORT/TABLE/STATISTICS/TABLE_STATISTICS

IMPDP> Processing object type TABLE_EXPORT/TABLE/STATISTICS/MARKER

IMPDP> Job "SYS"."TSPITR_IMP_rjrc_FczF" successfully completed at Fri Oct 16 23:56:10 2020 elapsed 0 00:00:22

Import completed

[Removing automatic instance](#)

[Automatic instance removed](#)

```

auxiliary instance file /oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_temp_hrmf02c1_1
deleted
auxiliary instance file /oracle/backup/ALICE/datafile/o1_mf_temp_hrmdzzvc_tmp deleted
auxiliary instance file /oracle/backup/RJRC_PITR_PDB1_ALICE/onlinelog/o1_mf_3_hrmf2872_log deleted
auxiliary instance file /oracle/backup/RJRC_PITR_PDB1_ALICE/onlinelog/o1_mf_2_hrmf286k_log deleted
auxiliary instance file /oracle/backup/RJRC_PITR_PDB1_ALICE/onlinelog/o1_mf_1_hrmf2864_log deleted
auxiliary instance file
/oracle/backup/RJRC_PITR_PDB1_ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_users_hrmf2372_dbf
deleted
auxiliary instance file /oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_sysaux_hrmdzgx6
deleted
auxiliary instance file /oracle/backup/ALICE/datafile/o1_mf_sysaux_hrmdz4q3_dbf deleted
auxiliary instance file
/oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_undotbs1_hrmdzcvw_dbf deleted
auxiliary instance file /oracle/backup/ALICE/datafile/o1_mf_undotbs1_hrmdz4q4_dbf deleted
auxiliary instance file /oracle/backup/ALICE/B1AB984F55D66781E053532828AC19AC/datafile/o1_mf_system_hrmdzgx4
deleted
auxiliary instance file /oracle/backup/ALICE/datafile/o1_mf_system_hrmdz4q1_dbf deleted
auxiliary instance file /oracle/backup/ALICE/controlfile/o1_mf_hrmdyyp3_ctl deleted
auxiliary instance file tspitr_rjrc_66837.dmp deleted
Finished recover at 16-OCT-20

```

■ **생성한 Table 과 실수로 drop 한 table Data 확인**

[oracle:alice2:ALICE:/oradata/ALICE]sqlplus "/as sysdba"

SQL*Plus: Release 19.0.0.0.0 - Production on Fri Oct 16 23:56:41 2020
Version 19.3.0.0.0

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Connected to:

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

SQL> show pdbs

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	PDB1	READ WRITE	NO
4	PDB2	MOUNTED	
5	PDB3	MOUNTED	

```
SQL> alter session set container=pdb1;
```

```
Session altered.
```

```
SQL> select count(*) from alice1.test02;
```

```
COUNT(*)
```

```
-----
```

```
1
```

⇒ 새로 만든 Table ALICE1.TEST02 그대로 존재

```
SQL> select count(*) from alice1.test03;
```

```
COUNT(*)
```

```
-----
```

```
26097
```

⇒ 유저 실수로 DROP 한 table ALICE1.TEST01 -> ALICE1.TEST03 으로 Recover 완료

4.7. Flashback Container Database & Pluggable database

■ Sample data 생성

```
[oracle:alice2:ALICE:/oradata]sqlplus "/as sysdba"
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Sat Oct 17 01:38:05 2020
```

```
Version 19.3.0.0.0
```

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

```
Connected to:
```

```
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
```

```
Version 19.3.0.0.0
```

```
SQL> create user c##alice identified by alice;
```

```
User created.
```

```
SQL> grant resource, connect, dba to c##alice;
```

```
Grant succeeded.
```



```
SQL> create table c##alice.test01(time date, name varchar2(5));
```

Table created.

```
SQL> insert into c##alice.test01 values(sysdate, 'jsrm');
```

1 row created.

<생략>

```
SQL> commit;
```

Commit complete.

```
SQL> select count(*) from c##alice.test01;
```

```
COUNT(*)
-----
         25
```

```
SQL> alter session set container=pdb1;
```

Session altered.

```
SQL> create table alice1.test05(time date, name varchar2(5));
```

Table created.

```
SQL> insert into alice1.test05 values (sysdate, 'jsrm');
```

1 row created.

<생략>

```
SQL> commit;
```

Commit complete.

```
SQL> select count(*) from alice1.test05;
```

```
COUNT(*)
-----
         43
```

■ Create restore point(CDB)

```
[oracle:alice2:ALICE:/oradata]sqlplus "/as sysdba"
```

SQL*Plus: Release 19.0.0.0.0 - Production on Sat Oct 17 01:31:20 2020

Version 19.3.0.0.0

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

Connected to:

Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

--CDB

```
SQL> create restore point cdb1_before_changes;
```

Restore point created.

--PDB1

```
SQL> alter session set container=pdb1;
```

Session altered.

■ Drop user 및 drop table 장애 발생

```
[oracle:alice2:ALICE:/oradata]sqlplus "/as sysdba"
```

SQL*Plus: Release 19.0.0.0.0 - Production on Sat Oct 17 02:12:18 2020

Version 19.3.0.0.0

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Connected to:

Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

```
SQL> drop user c##alice cascade;
```

User dropped.

```
SQL> alter session set container=pdb1;
```

Session altered.

```
SQL> drop table alice1.test05;
```

Table dropped.

■ Flashback Container Database

```
[oracle:alice2:ALICE:/oradata]sqlplus "/as sysdba"
```

SQL*Plus: Release 19.0.0.0.0 - Production on Sat Oct 17 01:45:21 2020

Version 19.3.0.0.0

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

Connected to:

Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

SQL> shut immediate

Database closed.

Database dismounted.

ORACLE instance shut down.

SQL> startup mount

ORACLE instance started.

Total System Global Area 1577056040 bytes

Fixed Size 9135912 bytes

Variable Size 603979776 bytes

Database Buffers 956301312 bytes

Redo Buffers 7639040 bytes

Database mounted.

SQL> flashback database to restore point cdb1_before_changes;

Flashback complete.

SQL> alter database open resetlogs;

Database altered.

SQL> select count(*) from c##alice.test01;

COUNT(*)

25

==> flashback restore point 이후에 drop user cascade 하였지만 flashback 됨

SQL> alter pluggable database all open;

Pluggable database altered.

SQL> alter session set container=pdb1;

Session altered.

```
SQL> select count(*) from alice1.test05;
```

```
COUNT(*)
-----
         43
```

==> flashback restore point 이후에 table 을 drop 하였지만 flashback 됨

■ Create restore point(PDB1)

```
[oracle:alice2:ALICE:/oradata]sqlplus "/as sysdba"
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Sat Oct 17 02:12:18 2020
Version 19.3.0.0.0
```

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

```
Connected to:
```

```
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0
```

```
SQL> alter session set container=pdb1;
```

Session altered.

```
SQL> create restore point pdb1_before_changes_2 FOR PLUGGABLE DATABASE pdb1;
```

Restore point created.

```
SQL> drop table alice1.test05;
```

Table dropped.

■ Flashback Pluggable Database

```
[oracle:alice2:ALICE:/oradata]sqlplus "/as sysdba"
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Sat Oct 17 02:27:23 2020
Version 19.3.0.0.0
```

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

```
Connected to:
```

Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production

Version 19.3.0.0.0

```
SQL> alter pluggable database pdb1 close;
```

Pluggable database altered.

```
SQL> flashback pluggable database pdb1 to restore point pdb1_before_changes_2;
```

Flashback complete.

```
SQL> alter pluggable database pdb1 open resetlogs;
```

Pluggable database altered.

```
SQL> alter session set container=pdb1;
```

Session altered.

```
SQL> select count(*) from alice1.test05;
```

```
COUNT(*)
```

```
-----
```

```
43
```