Goodus 기술노트 [40 회]
Recovery Manager(RMAN)

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Breathing Life into Technology

Contents

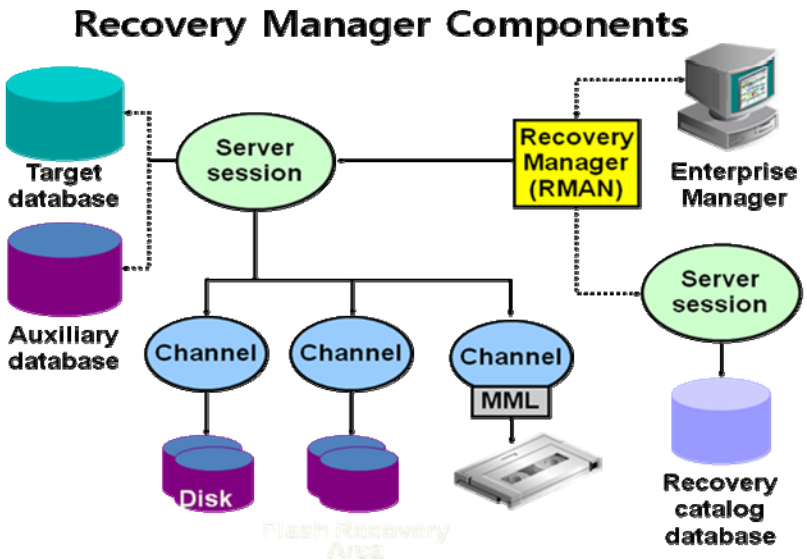
1. Oracle Recovery Manager(RMAN)

1.1. RMAN이란?

recovery manager (RMAN)은 오라클에서 제공하는 backup/recovery solution이다. RMAN을 이용하여 많은 backup vender에서는 solution을 제공하고 있다. oracle도 EM을 통해 RMAN backup을 지원하고 있다.
rman은 oracle datafile, control file, archive file 을 backup할 수 있다. 그러나 online redo log에 대해서는 backup을 하지 못하므로 archive 화하여 backup을 한다. 또 init file이나 password file도 backup을 하지 못한다. 10g에서는 spfile backup이 가능하게 되었다.
archive mode는 물론 no-archive mode에 대해 backup도 가능하다. 하지만 no-archive mode에서의 backup시 target database는 open 상태이면 당연히 안된다.
rman은 catalog를 이용하는 운영방법과 target database의 controlfile을 이용하는 방법이 있으며, 오라클에서는 catalog를 이용하는 방법을 강력히 권고한다. control file을 이용하는 경우 복구가 어려울 수 있으며, resync 등의 작업들이 필요하게 된다
rman은 Incremental Backup을 지원하므로 backup 정책을 유연하게 수립할 수 있다.

만약 다음과 같이 backup 정책을 수립했다고 하면..
일요일에 level 0로 full backup,
월요일에는 level 2로 일요일 backup시점 이후 변동 사항만을 incremental backup,
화요일에는 level 2로 월요일 backup 시점 이후 변동사항만을 incremental backup,
수요일에는 level 1으로 일요일 backup 시점 이후 변동 사항만을 incremental backup,
목요일에는 level 2로 수요일 backup 시점 이후 변동 사항만을 incremental backup.
금요일에는 level 2로 목요일 backup 시점 이후 변동사항만을 incremental backup

만약 토요일에 장애가 발생하면, 일요일, 수요일, 목요일,금요일의 backup을 이용하여 recovery하면 된다. 만약 level 1 incremental backup을 이틀에 한번 정도 할 수 있다면 recovery 시간은 더 단축 할 수 있다.



1.2. RMAN의 특징

- DB 전체, Tablespace 단위,Database files, Archive logs, 그리고 Control files 들을 Backup
  자주 실행되는 operation 들은 script 로 저장하여 간단하게 실행할 수 있다.
- Incremental block level backup 을 할 수 있다.
- 사용되어지지 않은 database block 들은 skip 한다.
- Backup /resotre 시 각 block 에 대한 checksum 을 통해 Corrupted block 을 detection
- Online file 을 backup 할 때, tablespace 를 backup mode 로 할 필요가 없다.
- Backup performance 향상 (Parallelization, less redo log 생성)
- OS 의 open file limit 을 피하기 위해 open file limit 을 지정할 수 있으며, backup 의 사이즈의 limit 을 줄 수 있다. 또한 file 당, second 당 reads 를 지정해서 부하를 조정할 수 있다.
- RMAN 의 메모리 사용
  RMAN 을 사용할 시 주의해야 하는 것은 shared pool 과 large pool 입니다. RMAN 은 몇 개의 Oracle PL/SQL 패키지들을 기존의 PL/SQL 패키지들과 마찬가지로 Shared Pool 에 올려 사용합니다. 이 때 Shared Pool 의 여유 공간이 부족하거나 단편화 현상이 심할 시에는 RMAN 패키지가 실행되지 않을 수가 있습니다. 항상 Shared Pool 내부에 RMAN 의 실행에 충분한 메모리가 존재해야 합니다.

RMAN 의 주요용어와 개념

- Target database
backup,restore,recovery action 이 수행될 대상 데이타베이스 입니다.

- Recovery Catalog
RMAN 에서 사용하는 Information 저장장소입니다.
target database 의 물리적 스키마, datafile 과 archivelog 의 backup sets 과 pieces, backup script 등을 포함하고 있습니다.

- channel
allocation channel 은 target database 의 backup,restore,recover 에 대한 server process 초기화를 합니다. 즉, 이 channel 은 disk 를 포함 기타 OS device 를 지정하게 되며, 이에 따라 parallelization 의 degree 가 결정됩니다.

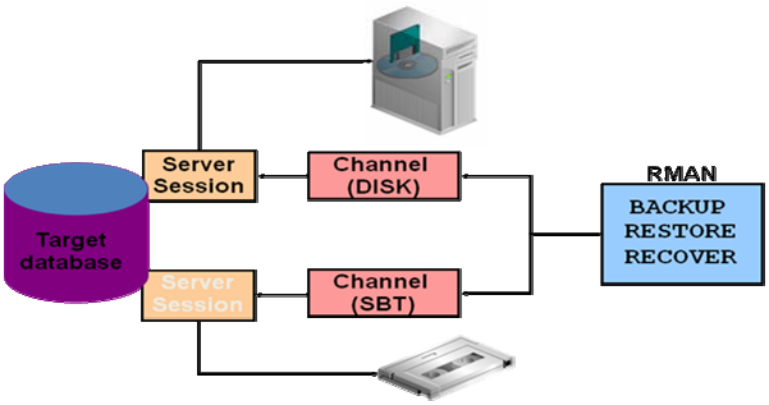
- Backup sets
하나 또는 그 이상의 Datafiles 또는 Archivelogs 를 포함하며,Backup pieces 의 Complate Set 으로, Full 또는 Incremental Backup 으로 구성 됩니다.
Oracle proprietary format 을 사용합니다.

- Backup Pieces
하나의 Backup Set 은 하나 또는 그 이상의 Backup Pieces 로 구성이 되어지며,각 Backup Piece 는 Single Output File 로 O/S 의 File system Size 의 제한을 갖고 있습니다.

1.3. RMAN의 Channel과 Media Management

Oracle RMAN을 이용하여 DataBase백업시 Channel을 할당하여야 한다.
Channel 할당방법은 allocate channel이라는 명령어에 의한 Manual Channel allocation과 Configure 명령어에 의한 Automatic Channel allocation이 있다.

Channel Allocation



Automatic and Manual Channel Allocation

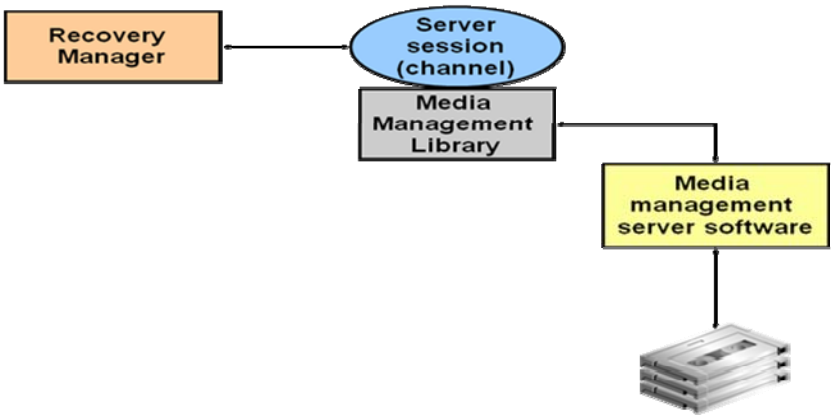
- **Change the default device type for automatic channel allocation:**

```
RMAN> CONFIGURE DEFAULT DEVICE TYPE TO sbt;
```

```
RMAN> RUN {
  2> ALLOCATE CHANNEL c1 DEVICE TYPE disk;
  3> BACKUP DATAFILE '/u01/oradata/user01.dbf';
  4> }
```

■ configure defautl device type to sbt; 에서 sbt 는 tape 장치를 의미한다. 즉 기본적인 default 백업장치를 지정해주는 것이다.

Media Management



RMAN에서 Backup device에 backup을 하기 위해 Media Management Library가 필요하며 media vendor가 제공하는 libraray로 Oracle과의 interface를 제공한다.

1.4. RMAN CONFIGURE COMMAND

Configure automatic channels:

```
RMAN> CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT
'/db01/BACKUP/%U';
```

Implement retention policy by specifying a recovery window:

```
RMAN> CONFIGURE RETENTION POLICY TO RECOVERY
   2> WINDOW OF 7 days;
```

Implement retention policy by specifying redundancy:

```
RMAN> CONFIGURE RETENTION POLICY TO REDUNDANCY 2;
```

- configure channel device type disk format '/db01/backup/%U'; 포멧을 지정해준다. 자동채널 할당 참고 %d : db name , %s : backup set , %p : backup piece, %c : backup copy
- configure retention policy to recovery window of 7 days; 복구를 위한 백업을 유지해주는 기간 설정
- configure retention policy to redundancy 2; default 는 1 이다.
- configure retention policy clear ; retention policy 정보를 clear

Configure duplexed backup sets:

```
RMAN> CONFIGURE DATAFILE BACKUP COPIES FOR
   2> DEVICE TYPE disk TO 2;
```

Configure backup optimization:

```
RMAN> CONFIGURE BACKUP OPTIMIZATION ON;
```

Use the CLEAR option to return to the default value:

```
RMAN> CONFIGURE RETENTION POLICY CLEAR;
RMAN> CONFIGURE CHANNEL DEVICE TYPE sbt CLEAR;
```

- configure datafile backup copies form device type disk to 2;
- 백업의 복사본을 2 개로 만들겠다는 설정명령. Format 에서 %c 가 있어야 중복되지 않으므로 에러가 발생하지 않는다.
- configure backup optimization on ; backup 시 optimize 시킴
- configure retention policy clear; retention policy 를 clear (backup 유지기간 설정을 clear)
- configure channel device type sbt clear ; configure

RMAN 관련한 default configuration

(note 305565.1 Persistent Controlfile configurations for RMAN in 9i and 10g. 참고)

- CONFIGURE RETENTION POLICY TO REDUNDANCY 1;
Backup 보관 주기나 backup본의 갯수를 설정합니다.

- CONFIGURE BACKUP OPTIMIZATION OFF;
이미 backup 된 동일한(checkpoint SCN등) datafile, archived redolog, backup set이 있다면 skip 합니다.

- CONFIGURE DEFAULT DEVICE TYPE TO DISK;
default backup device를 설정합니다.

- CONFIGURE CONTROLFILE AUTOBACKUP OFF;
RMAN의 BACKUP이나 COPY 명령등의 수행후 자동으로 control file backup을 수행합니다.

- CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '%F';
autobackup되는 control file의 기본 format을 변경합니다.

- CONFIGURE DEVICE TYPE DISK PARALLELISM 1;
특정 device에 automatic channel allocation 될때 channel의 갯수를 지정합니다.

- CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1;
DATAFILE, CONTROL FILE의 backup set의 copy본 갯수를 지정합니다.

- CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1;
ARCHIVELOG FILE의 backup set의 copy본 갯수를 지정합니다.

- CONFIGURE MAXSETSIZE TO UNLIMITED;
backupset의 maximum size를 설정합니다.

- CONFIGURE ARCHIVELOG DELETION POLICY TO NONE; (10g only)
flash recovery area의 archived redo log에 대한 삭제 여부를 설정합니다.

- CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/opt/oracle/product/ora10g/dbs/snapcf_db10g.f';
RMAN은 resync시 생성되는 임시 snapshot control file의 이름을 지정한다.

1.5. SHOW 명령어

show all 명령을 하면 모두 보인다. 아래는 특정한 것만 볼 경우 사용을 한다.

- Automatic channel configuration settings
  ```
  SHOW CHANNEL;
  SHOW DEVICE TYPE;
  SHOW DEFAULT DEVICE TYPE;
  ```
- RMAN retention policy configuration settings
  ```
  SHOW RETENTION POLICY;
  ```
- Number of backup copies
  ```
  SHOW DATAFILE BACKUP COPIES;
  ```
- Maximum size for backup sets
  ```
  SHOW MAXSETSIZE;
  ```
- Tablespaces excluded from whole database backups
  ```
  SHOW EXCLUDE;
  ```
- Status of backup optimization
  ```
  SHOW BACKUP OPTIMIZATION;
  ```

1.6. LIST명령어

The LIST Command

List backups of all files in the database:

```
RMAN> LIST BACKUP OF DATABASE;
```

List all backup sets containing the users01.dbf datafile:

```
RMAN> LIST BACKUP OF DATAFILE
   2>   "/db01/ORADATA/u03/users01.dbf";
```

List all copies of datafiles in the SYSTEM tablespace:

```
RMAN> LIST COPY OF TABLESPACE "SYSTEM";
```

- list backup of database; 데이터베이스 백업 정보를 출력한다.
- list backup of datafile ~ : 데이터파일 백업 정보를 출력한다.
- List copy of tablespace " system" : system tablespace 가 copy 명령으로 백업되었는지 확인한다.

1.7. REPORT명령어

The REPORT NEED BACKUP Command

- **Lists all data files requiring a backup**
- **Assumes the most recent backup is used during a restore**
- **Provides three options:**
  - **Incremental** `REPORT NEED BACKUP incremental 3;`
  - **Days** `REPORT NEED BACKUP days 3;`
  - **Redundancy** `REPORT NEED BACKUP redundancy 3;`
- **Without options, takes into account the configured retention policy**

- report need backup incremental 3 ; incremental level 3 일 경우 백업이 필요한지 report
  참고> backup database incremental level 0 이면 전체백업
- report need backup days 3 ;3 일이 지났을 경우 백업이 필요한 것을 report ;
  만약 retention policy 에 의해서 backup 한 것이 기간이 지났을 경우, report 됨.

2. RECOVERY CATALOG

Recovery Catalog 는 RMAN 에 의해 사용되어지며 Recovery Catalog 에 저장되어 있는 정보를 사용하여요청되어진 Backup 과 Resotre 를 실행한다. Rman Backup 에 있어서 Backup & Recovery 를 용이하게 하고 속도를 향상시키고, 동시에 데이터 손실 위험을 감소시키려면 다음 지침을 따라야한다.

1. 대상 데이터베이스에 복구 카탈로그(Recovery Catalog)를 생성하지 마십시요.
2. 별도의 디스크상에 파일을 가진 별개의 DB 를 생성하라.
3. 백업해야 할 DB 가 많다면 모든 대상 DB 의 정보를 담아 둘 별도의 Recovery Catalog DB 를 생성하라.

4. Recovery Catalog 를 백업하라.

catalog 없이 RMAN 을 사용할 때의 단점은 recovery catalog 의 overhead 가 없는 대신, Point-In-Time recovery 를 쉽게 할 수 없다. 또한, control file 손상시에 recovery 할 수 없고, stored script 를 사용할 수 없다.

이에 RMAN 을 사용하기에 앞서 Recovery Catalog 를 사용할지 아니면 Target DataBase 의 Control file 을 사용할지 (NoCatalog)에 대해 결정을 하여야한다. Oracle 은 항상 Recovery Catalog 를 사용하도록 권장한다. Recovery Catalog 를 사용하므로써 Backup 의 performance 를 높일수 있으며 Target Database 의 Controlfile 유실에 대비해서도 Recovery 를 효과적으로 수행할수 있다.

3. RMAN without a Recovery Catalog(Backup & Recovery)

Recovery Catalog 없이 rman 을 사용하여 기본 configure 및 Backup & Recovery 를 진행한다.

```
[busan1 $ rman target / nocatalog              ➔ Recovery Catalog 없이 접속
Recovery Manager: Release 10.2.0.1.0 - Production on Mon Jan 1 23:45:47 2007
Copyright (c) 1982, 2005, Oracle.    All rights reserved.
connected to target database: PROD (DBID=28555911)
using target database control file instead of recovery catalog

RMAN> configure channel device type disk format '/u01/app/oracle/backup/prod_%U';
➔device 에 대한 channel 을 설정한다.
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'/u01/app/oracle/backup/control/%F';
➔controlfile Auto backup channel 설정
RMAN> CONFIGURE BACKUP OPTIMIZATION ON;
➔Backup 최적화 option
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP ON;
➔controlfile Auto Backup 설정
RMAN> configure retention policy to recovery window of 7 days;
➔백업보관주기 설정
RMAN> show all          ➔ 전체 configure 를 보여준다.
RMAN configuration parameters are:
CONFIGURE RETENTION POLICY TO RECOVERY WINDOW OF 7 DAYS;
CONFIGURE BACKUP OPTIMIZATION ON;
CONFIGURE CONTROLFILE AUTOBACKUP ON;
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'/u01/app/oracle/backup/control/%F';
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT     '/u01/app/oracle/backup/prod_%U';

RMAN> backup as compressed backupset database spfile plus archivelog delete input;
➔백업 진행
```

Recovery TEST

```
SQL> !rm /u01/app/oracle/oradata/PROD/disk1/system01.dbf        ➔ Datafile 삭제
SQL> shutdown abort
ORACLE instance shut down.
SQL> startup
ORACLE instance started.
Total System Global Area   264241152 bytes
Fixed Size                   1977976 bytes
Variable Size              104862088 bytes
```

```
Database Buffers              150994944 bytes
Redo Buffers                    6406144 bytes
Database mounted.
ORA-01157: cannot identify/lock data file 1 - see DBWR trace file
ORA-01110: data file 1: '/u01/app/oracle/oradata/PROD/disk1/system01.dbf'      ➔실제 파일이 없으므로 장애유발
[busan1:oracle:/u01]$ rman target / nocatalog
Recovery Manager: Release 10.2.0.1.0 - Production on Sat Jan 27 04:32:05 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
connected to target database: PROD (DBID=24173995, not open)
RMAN> restore datafile 1;
Starting restore at 27-JAN-07
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=285 devtype=DISK
channel ORA_DISK_1: starting datafile backupset restore
channel ORA_DISK_1: specifying datafile(s) to restore from backup set
restoring datafile 00001 to /u01/app/oracle/oradata/PROD/disk1/system01.dbf
channel ORA_DISK_1: reading from backup piece /u01/app/oracle/backup/prod_1ni8hbo2_1_1
channel ORA_DISK_1: restored backup piece 1
piece handle=/u01/app/oracle/backup/prod_1ni8hbo2_1_1 tag=TAG20070127T042433
channel ORA_DISK_1: restore complete, elapsed time: 00:01:46
Finished restore at 27-JAN-07
RMAN> recover datafile 1
Starting recover at 27-JAN-07
using channel ORA_DISK_1
starting media recovery
media recovery complete, elapsed time: 00:00:06

Finished recover at 27-JAN-07
RMAN> alter database open;
database opened

==>DB 가 open 되고 서비스가 정상가동 됨

<참고>
backupset 파일 이름 형식
- Format : 출력 이름의 형식
 - %c : backup piece 의 copy number
 - %p : backup piece number, 1 부터 시작하고 1 씩 증가한다.
 - %s : backup set number, control file 내의 counter, set 이 생성될때 마다 증가한다.
 - %d : database name
 - %n : database name, padded on the right with x char to total length oh 8 char
 - %t : fixed reference time 이후 경과한 시간(초)을 4byte 로 나타낸 값
       %s 와 조합하면 backup set 에 unique name 을 지정할 수 있다.
 - %u : backup set 번호와 생성시간에 대한 단축 표기법, 8 자 이름 지정
 - %U : %u_%p_%c (default)
```

4. RMAN with a Recovery Catalog

4.1. Recovery Catalog Setup

Target DB(PROD)와 Catalog DB(RESP) 초기 TNS Setting

```
===== tnsnames.ora=====(PROD,RESP DB 에 동일하게 setup)
PROD =              ➔ Target DB
  (DESCRIPTION =
```

```
    (ADDRESS = (PROTOCOL = TCP)(HOST = busan1)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = PROD)
    )
  )

RESP =              ➔ Catalog DB
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = busan2)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = RESP)
    )
  )
============================================================
busan1 $ tnsping resp        ➔ target DB 쪽에서 Catalog DB 쪽으로  tnsping TEST(Ok)
TNS Ping Utility for Solaris: Version 10.2.0.1.0 - Production on 01-JAN-2007 22:52:33
Copyright (c) 1997, 2005, Oracle.  All rights reserved.
Used parameter files:
Used TNSNAMES adapter to resolve the alias
Attempting to contact (DESCRIPTION = (ADDRESS = (PROTOCOL = TCP)(HOST = busan2)(PORT = 1521))
(CONNECT_DATA = (SERVER = DEDICATED) (SERVICE_NAME = RESP)))
OK (10 msec)
busan2 $ tnsping PROD        ➔ Catalog DB 쪽에서 Target DB 쪽으로 tnsping TEST (Ok)
TNS Ping Utility for Solaris: Version 10.2.0.1.0 - Production on 01-JAN-2007 22:53:19
Copyright (c) 1997, 2005, Oracle.  All rights reserved.
Used parameter files:
Used TNSNAMES adapter to resolve the alias
Attempting to contact (DESCRIPTION = (ADDRESS = (PROTOCOL = TCP)(HOST = busan1)(PORT = 1521))
(CONNECT_DATA = (SERVER = DEDICATED) (SERVICE_NAME = PROD)))
OK (0 msec)
```

Catalog DB(SID=RESP)에 Tablespace 및 User 생성작업

```
busan2 $ sqlplus '/as sysdba'
SQL*Plus: Release 10.2.0.1.0 - Production on Mon Jan 1 22:36:46 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
Connected to:
Oracle Database 10g Enterprise Edition Release 10.2.0.1.0 - 64bit Production
With the Partitioning and Data Mining options
SQL> create tablespace catalog datafile '/oratest/oradata/RESP/catalog01.dbf' size 50m;
Tablespace created.
SQL> create user rman identified by rman default tablespace catalog;
User created.
SQL> grant recovery_catalog_owner to rman;
Grant succeeded.
SQL> grant connect,resource to rman;
SQL> select instance_name from v$instance;
INSTANCE_NAME
----------------
RESP                ➔Rman catalog DB쪽에 유저를 생성한다.
```

Target DB(PROD)에 Recovery Catalog 생성작업

```
busan1 $ rman target / catalog rman/rman@resp
Recovery Manager: Release 10.2.0.1.0 - Production on Mon Jan 1 22:46:01 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.

connected to target database: PROD (DBID=28555911)
connected to recovery catalog database
RMAN> list incarnation of database;
RMAN-00571: ===========================================================
RMAN-00569: =============== ERROR MESSAGE STACK FOLLOWS ===============
RMAN-00571: ===========================================================
RMAN-03002: failure of list command at 01/01/2007 22:46:35
RMAN-06428: recovery catalog is not installed          ➔아직까지 catalog 가 생성되지 않았음

RMAN> create catalog;
recovery catalog created
RMAN> register database;
database registered in recovery catalog
starting full resync of recovery catalog
full resync complete
RMAN> list incarnation of database;        ➔ DataBase 등록확인

List of Database Incarnations
DB Key  Inc Key DB Name  DB ID            STATUS  Reset SCN  Reset Time
------- ------- -------- ---------------- --- ---------- ----------
1       2       PROD     28555911         CURRENT 1          08-MAR-07oracle    15298 14936  0 Jan16 ?

<note> target database 가 잘못 등록된경우 삭제방법
RESP DB 의 rman 유저로 접속후 package 를 사용하여 삭제
busan2 $ sqlplus rman/rman
SQL*Plus: Release 10.2.0.1.0 - Production on Mon Jan 1 23:15:54 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.

Connected to:
Oracle Database 10g Enterprise Edition Release 10.2.0.1.0 - 64bit Production
With the Partitioning and Data Mining options
SQL> select * from db ;
    DB_KEY      DB_ID HIGH_CONF_RECID LAST_KCCDIVTS HIGH_IC_RECID CURR_DBINC_KEY
---------- ---------- --------------- ------------- ------------- ---------------
         1   28555911                  616717575             1               2
SQL> execute dbms_rcvcat.unregisterdatabase(1,28555911);    ➔잘못등록된 DB 삭제(DB_KEY,DB_ID)
PL/SQL procedure successfully completed.
SQL> select * from db ;
no rows selected
```

4.2. Recovery Catalog를 이용한 Rman Backup(Archive mode)

Recovery Catalog 는 RMAN 의 백업 작업에 대한 메타데이터의 저장소입니다. 쉽게 말해 컨트롤파일에서 RMAN 의 백업과 복구에 관련된 정보들만을 따로 모아 생성시킨 파일과도 같다. 그리고 이 Recovery Catalog 는 대상 데이터

베이스와 'resync' 명령어를 사용하여 해당 정보를 동기화할 수 있습니다. 이러한 이점 때문에 Recovery Catalog 는 복수의 데이터베이스에 대한 백업 및 복구 작업을 중앙 관리하는데 편리한 이점을 가진다. 이와 같은 Recovery Catalog 의 정보 보호를 위해 직접적으로 액세스하는 것은 권장되지 않고. 대신 RC_* 의 뷰를 참조하여 해당 Recovery Catalog 내의 정보를 참조할 수 있다.

Recovery Catalog의 사용을 위해서는 먼저 대상 데이터베이스에 연결한 후, 두번째 NET 연결을 통하여 Recovery Catalog와의 세션을 생성하고, 이 때 Recovery Catalog의 연결은 기존의 RMAN의 연결과는 달리 as sysdba의 권한을 사용하지 않는다. 연결된 후에는 수동으로 대상 데이터베이스와 동기화를 시키거나, 백업 작업의 실행시 자동으로 동기화가 이루어 진다.

Complete Database Backup(full)

```
busan1 $ rman target / catalog rman/rman@resp
Recovery Manager: Release 10.2.0.1.0 - Production on Wed Jan 3 22:04:36 2007
Copyright (c) 1982, 2005, Oracle.    All rights reserved.
connected to target database: PROD (DBID=28555911)
connected to recovery catalog database

RMAN> run {                          ➔ 전체 DB 에 대한 백업을 수행한다.
2>          # backup the complete database to disk
3>          allocate channel    c1 type disk;
4>          backup
5>          full
6>          tag full_db_sunday_night
7>          format '/rman_backup/PROD/db_t%t_s%s_p%p'
8>          (database);
9>          release channel c1;
10>   }
allocated channel: c1
channel c1: sid=144 devtype=DISK

Starting backup at 08-JAN-07
channel c1: starting full datafile backupset
channel c1: specifying datafile(s) in backupset
input datafile fno=00001 name=/oratest/oradata/PROD/system01.dbf
input datafile fno=00002 name=/oratest/oradata/PROD/undotbs01.dbf
input datafile fno=00003 name=/oratest/oradata/PROD/sysaux01.dbf
input datafile fno=00005 name=/oratest/oradata/PROD/catalog01.dbf
input datafile fno=00004 name=/oratest/oradata/PROD/users01.dbf
channel c1: starting piece 1 at 08-JAN-07
channel c1: finished piece 1 at 08-JAN-07
piece handle=/rman_backup/PROD/db_t611286673_s3_p1 tag=FULL_DB_SUNDAY_NIGHT comment=NONE
channel c1: backup set complete, elapsed time: 00:00:55
channel c1: starting full datafile backupset
channel c1: specifying datafile(s) in backupset
including current control file in backupset
channel c1: starting piece 1 at 08-JAN-07
channel c1: finished piece 1 at 08-JAN-07
piece handle=/rman_backup/PROD/db_t611286729_s4_p1 tag=FULL_DB_SUNDAY_NIGHT comment=NONE
channel c1: backup set complete, elapsed time: 00:00:02
Finished backup at 08-JAN-07
```

```
released channel: c1
RMAN> list backupset of database;          ➔백업정보를 확인할수 있다
List of Backup Sets
===================
BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
65      Full    276.27M    DISK        00:00:49     08-JAN-07
        BP Key: 67   Status: AVAILABLE   Compressed: NO   Tag: FULL_DB_SUNDAY_NIGHT
        Piece Name: /rman_backup/PROD/db_t611286673_s3_p1
  List of Datafiles in backup set 65
  File LV Type Ckp SCN    Ckp Time   Name
  ---- -- ---- ---------- --------- ----
  1       Full 435856     08-JAN-07 /oratest/oradata/PROD/system01.dbf
  2       Full 435856     08-JAN-07 /oratest/oradata/PROD/undotbs01.dbf
  3       Full 435856     08-JAN-07 /oratest/oradata/PROD/sysaux01.dbf
  4       Full 435856     08-JAN-07 /oratest/oradata/PROD/users01.dbf
  5       Full 435856     08-JAN-07 /oratest/oradata/PROD/catalog01.dbf
```

Tablespace Backup(Users Tablespace Backup)

```
busan1 $ rman target / catalog rman/rman@resp
Recovery Manager: Release 10.2.0.1.0 - Production on Wed Jan 3 22:04:36 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
connected to target database: PROD (DBID=28555911)
connected to recovery catalog database
RMAN> run {
2>          allocate channel   c1 type disk;
3>          backup
4>          tag tbs_users
5>          format '/rman_backup/PROD/tbs_users_t%t_s%s'
6>          (tablespace users);                ➔ 2 개이상의 tablespace 를 사용하고자한다면
7>          release channel c1;                # (tablespace users,system) 분리해서 입력이가능함
8>  }
allocated channel: c1
channel c1: sid=145 devtype=DISK

Starting backup at 08-JAN-07
channel c1: starting full datafile backupset
channel c1: specifying datafile(s) in backupset
input datafile fno=00004 name=/oratest/oradata/PROD/users01.dbf
channel c1: starting piece 1 at 08-JAN-07
channel c1: finished piece 1 at 08-JAN-07
piece handle=/rman_backup/PROD/tbs_users_t611362619_s5 tag=TBS_USERS comment=NONE
channel c1: backup set complete, elapsed time: 00:00:04
Finished backup at 08-JAN-07

released channel: c1
RMAN> list backupset of tablespace users;          ➔ users 라는 tablespace 백업사항확인
BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
100     Full    88.00K     DISK        00:00:02     08-JAN-07
        BP Key: 102   Status: AVAILABLE   Compressed: NO   Tag: TBS_USERS
        Piece Name: /rman_backup/PROD/tbs_users_t611362619_s5
  List of Datafiles in backup set 100
```

```
File LV Type Ckp SCN       Ckp Time    Name
---- -- ---- ---------- --------- ----
4           Full 473587        08-JAN-07 /oratest/oradata/PROD/users01.dbf
```

Datafile backup

```
busan1 $ rman target / catalog rman/rman@resp
Recovery Manager: Release 10.2.0.1.0 - Production on Wed Jan 3 22:04:36 2007
Copyright (c) 1982, 2005, Oracle.    All rights reserved.
connected to target database: PROD (DBID=28555911)
connected to recovery catalog database

RMAN> run {
2>            allocate channel    c1 type disk;
3>            backup
4>            format '/rman_backup/PROD/df_%d_%u'
5>            (datafile '/oratest/oradata/PROD/sysaux01.dbf');
6>            release channel c1;
7>    }
```

또는 report schema 를 확인후 file number 로도 가능하다.

```
RMAN> report schema
2> ;

Report of database schema

List of Permanent Datafiles
===========================
File Size(MB) Tablespace           RB segs Datafile Name
---- -------- -------------------- ------- ------------------------
1    300      SYSTEM               YES     /oratest/oradata/PROD/system01.dbf
2    200      UNDOTBS1             YES     /oratest/oradata/PROD/undotbs01.dbf
3    120      SYSAUX               NO      /oratest/oradata/PROD/sysaux01.dbf
4    5        USERS                NO      /oratest/oradata/PROD/users01.dbf
5    50       CATALOG              NO      /oratest/oradata/PROD/catalog01.dbf

List of Temporary Files
=======================
File Size(MB) Tablespace           Maxsize(MB) Tempfile Name
---- -------- -------------------- ----------- --------------------
1    20       TEMP                 32767       /oratest/oradata/PROD/temp01.dbf
```

➔아래와 같이 수정도 가능하다

```
run {   allocate channel    c1 type disk;
        backup
        format '/rman_backup/df_%d_%u'
        (datafile 3);                          ➔ datafile 의 번호입력
        release channel c1;
    }

allocated channel: c1
channel c1: sid=145 devtype=DISK
```

```
Starting backup at 08-JAN-07
channel c1: starting full datafile backupset
channel c1: specifying datafile(s) in backupset
input datafile fno=00003 name=/oratest/oradata/PROD/sysaux01.dbf
channel c1: starting piece 1 at 08-JAN-07
channel c1: finished piece 1 at 08-JAN-07
piece handle=/rman_backup/PROD/df_PROD_06i71a4d tag=TAG20070108T230236 comment=NONE
channel c1: backup set complete, elapsed time: 00:00:15
Finished backup at 08-JAN-07

released channel: c1

RMAN> list backupset of datafile 3;
BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
110     Full    84.29M     DISK        00:00:12     08-JAN-07
        BP Key: 112  Status: AVAILABLE  Compressed: NO  Tag: TAG20070108T230236
        Piece Name: /rman_backup/PROD/df_PROD_06i71a4d
  List of Datafiles in backup set 110
  File LV Type Ckp SCN    Ckp Time  Name
  ---- -- ---- ---------- --------- ----
  3       Full 473831     08-JAN-07 /oratest/oradata/PROD/sysaux01.dbf
```

Controlfile Backup

```
busan1 $ rman target / catalog rman/rman@resp
Recovery Manager: Release 10.2.0.1.0 - Production on Wed Jan 3 22:04:36 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
connected to target database: PROD (DBID=28555911)
connected to recovery catalog database
RMAN> run {
2>          allocate channel  c1 type disk;
3>          backup
4>          format '/rman_backup/PROD/cf_t%t_s%s_p%p'
5>          tag cf_monday_night
6>          (current controlfile);
7>          release channel c1;
8> }

allocated channel: c1
channel c1: sid=145 devtype=DISK

Starting backup at 08-JAN-07
channel c1: starting full datafile backupset
channel c1: specifying datafile(s) in backupset
including current control file in backupset
channel c1: starting piece 1 at 08-JAN-07
channel c1: finished piece 1 at 08-JAN-07
piece handle=/rman_backup/PROD/cf_t611363177_s7_p1 tag=CF_MONDAY_NIGHT comment=NONE
channel c1: backup set complete, elapsed time: 00:00:03
Finished backup at 08-JAN-07

released channel: c1
```

모든 archive log backup

```
busan1 $ rman target / catalog rman/rman@resp
Recovery Manager: Release 10.2.0.1.0 - Production on Wed Jan 3 22:04:36 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
connected to target database: PROD (DBID=28555911)
connected to recovery catalog database
RMAN> run {
2> allocate channel  c1 type disk;
3> backup
4> format '/rman_backup/PROD/log_t%t_s%s_p%p'
5> (archivelog all);
6> release channel c1;
7> }

allocated channel: c1
channel c1: sid=145 devtype=DISK

Starting backup at 08-JAN-07
current log archived
channel c1: starting archive log backupset
channel c1: specifying archive log(s) in backup set
input archive log thread=1 sequence=1 recid=1 stamp=611284311
input archive log thread=1 sequence=2 recid=2 stamp=611316069
input archive log thread=1 sequence=3 recid=3 stamp=611349324
input archive log thread=1 sequence=4 recid=4 stamp=611359241
input archive log thread=1 sequence=5 recid=5 stamp=611359291
input archive log thread=1 sequence=6 recid=6 stamp=611359383
input archive log thread=1 sequence=7 recid=7 stamp=611363431
channel c1: starting piece 1 at 08-JAN-07
channel c1: finished piece 1 at 08-JAN-07
piece handle=/rman_backup/PROD/log_t611363438_s8_p1 tag=TAG20070108T231037 comment=NONE
channel c1: backup set complete, elapsed time: 00:00:08
Finished backup at 08-JAN-07

released channel: c1

RMAN> list backupset of archivelog all;
List of Backup Sets
===================
BS Key  Size       Device Type Elapsed Time Completion Time
------- ---------- ----------- ------------ ---------------
146     40.86M     DISK        00:00:04     08-JAN-07
        BP Key: 148  Status: AVAILABLE  Compressed: NO  Tag: TAG20070108T231037
        Piece Name: /rman_backup/PROD/log_t611363438_s8_p1

  List of Archived Logs in backup set 146
  Thrd Seq     Low SCN    Low Time  Next SCN   Next Time
  ---- ------- ---------- --------- ---------- ---------
  1    1       434126     08-JAN-07 434513     08-JAN-07
  1    2       434513     08-JAN-07 448529     08-JAN-07
  1    3       448529     08-JAN-07 462586     08-JAN-07
  1    4       462586     08-JAN-07 467767     08-JAN-07
  1    5       467767     08-JAN-07 468833     08-JAN-07
  1    6       468833     08-JAN-07 470165     08-JAN-07
  1    7       470165     08-JAN-07 474371     08-JAN-07
```

특정 범위의 Sequence Archive log Backup

```
RMAN> run {
2> allocate channel   c1 type disk;
3> backup
4> format '/rman_backup/PROD/log_t%t_s%s_p%p'
5> (archivelog from sequence=1 until sequence=4 thread 1);
6> release channel c1;
7> }

allocated channel: c1
channel c1: sid=145 devtype=DISK

Starting backup at 08-JAN-07
channel c1: starting archive log backupset
channel c1: specifying archive log(s) in backup set
input archive log thread=1 sequence=1 recid=1 stamp=611284311
input archive log thread=1 sequence=2 recid=2 stamp=611316069
input archive log thread=1 sequence=3 recid=3 stamp=611349324
input archive log thread=1 sequence=4 recid=4 stamp=611359241
channel c1: starting piece 1 at 08-JAN-07
channel c1: finished piece 1 at 08-JAN-07
piece handle=/rman_backup/PROD/log_t611363727_s9_p1 tag=TAG20070108T231527 comment=NONE
channel c1: backup set complete, elapsed time: 00:00:08
Finished backup at 08-JAN-07

released channel: c1
```

특정 시간이 경과한 Archive log Backup

```
RMAN> run {
2> allocate channel   c1 type disk;
3> backup
4> format '/rman_backup/PROD/log_t%t_s%s_p%p'
5> (archivelog from time 'sysdate-1' all delete input);
6> release channel c1;
7> }

sysdate-1   :  현재 날짜와 시간보다 1 일전
sysdate-7   :  현재 날짜와 시간보다 7 일전
sysdate- 1/24 : 현재 날짜와 시간보다 1 시간 전
sysdate- 9/24 : 현재 날짜와 시간보다 9 시간 전
sysdate- 5/3600 : 현재 날짜와 시간보다 5 분 전

##Backup 이 완료되면 삭제가 된다. 만일 Backup 이 실패를 한다면 Archivelog 들은 지워지지 않음.
```

Online Redolog 의 Backup

```
RMAN>run {
allocate channel   c1 type disk;
sql "alter system archive log current";
backup
format '/rman_backup/log_t%t_s%s_p%p'
```

```
(archivelog from time 'sysdate-1' all delete input);
release channel c1;
    }
```

Online Redolog 는 백업에 앞서 Archived 되어져야 하므로 위와 같이 sql command 를 이용하여 백업을 진행한다.

4.3. Incremental Backup

Level N incremental Backup 은 가장최근의 N 또는 N 보다 작은 Backup 이후의 변경된 부분만을 Backup 하는 것이다.List Backup Set 을 조회해 보면 Type Column 에는 '**Incr**', LV Column 에는 '**0**'이라고 나타난다.

Level 0 – DataBase Full Backup

```
RMAN> run {
allocate channel   c1 type disk;
backup
incremental level 0                          ➔ DB 전체에 대해 Level 0 로 백업을 받는다.
filesperset 4
format '/rman_backup/PROD/sunday_level0_%t'
(database);
release channel c1;
    }

BS Key   Type LV Size          Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
233      Incr 0   145.04M      DISK            00:00:22       08-JAN-07
         BP Key: 244    Status: AVAILABLE   Compressed: NO   Tag: TAG20070108T233158
         Piece Name: /rman_backup/PROD/sunday_level0_611364719
  List of Datafiles in backup set 233
  File LV Type Ckp SCN      Ckp Time   Name
  ---- -- ---- ---------- --------- ----
  1      0   Incr 474991       08-JAN-07 /oratest/oradata/PROD/system01.dbf
  4      0   Incr 474991       08-JAN-07 /oratest/oradata/PROD/users01.dbf
  5      0   Incr 474991       08-JAN-07 /oratest/oradata/PROD/catalog01.dbf

BS Key   Type LV Size          Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
234      Incr 0   139.35M      DISK            00:00:19       08-JAN-07
         BP Key: 245    Status: AVAILABLE   Compressed: NO   Tag: TAG20070108T233158
         Piece Name: /rman_backup/PROD/sunday_level0_611364745
  List of Datafiles in backup set 234
  File LV Type Ckp SCN      Ckp Time   Name
  ---- -- ---- ---------- --------- ----
  2      0   Incr 475001       08-JAN-07 /oratest/oradata/PROD/undotbs01.dbf
  3      0   Incr 475001       08-JAN-07 /oratest/oradata/PROD/sysaux01.dbf

BS Key   Type LV Size          Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
235      Incr 0   7.08M        DISK            00:00:02       08-JAN-07
         BP Key: 246    Status: AVAILABLE   Compressed: NO   Tag: TAG20070108T233158
         Piece Name: /rman_backup/PROD/sunday_level0_611364771
  Control File Included: Ckp SCN: 475010          Ckp time: 08-JAN-07.
```

만약 다음과 같이 backup 정책을 수립했다고 하면..
일요일에 level 0로 full backup,
월요일에는 level 2로 일요일 backup시점 이후 변동 사항만을 incremental backup,
화요일에는 level 2로 월요일 backup 시점 이후 변동사항만을 incremental backup,
수요일에는 level 1으로 일요일 backup 시점 이후 변동 사항만을 incremental backup,
목요일에는 level 2로 수요일 backup 시점 이후 변동 사항만을 incremental backup.
금요일에는 level 2로 목요일 backup 시점 이후 변동사항만을 incremental backup

만약 토요일에 장애가 발생하면, 일요일, 수요일, 목요일,금요일의 backup을 이용하여 recovery하면 된다. 만약 level 1 incremental backup을 이틀에 한번 정도 할 수 있다면 recovery 시간은 더 단축 할 수 있다.

5. RMAN with Recovery(Datafile,Tablespace)

Datafile Crash or Deleted(DataBase OPEN)

DataBase 가 운영중에 Disk 장애 및 여러가지 이유에서 datafile 이 deleted 되었다면 두가지 방법으로 recovery 가 가능하다.

1. Datafile restore 후 Datafile Recovery
2. Datafile restore 후 Tablespace Recovery

단 system tablespace 에 해당하는 datafile 에 이상이 생겼다면 Database close 후 복구가 진행되어야한다.

DATAFILE RECOVERY

```
busan1 $ sqlplus '/as sysdba'
SQL*Plus: Release 10.2.0.1.0 - Production on Mon Jan 8 23:51:13 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
Connected to:
Oracle Database 10g Enterprise Edition Release 10.2.0.1.0 - 64bit Production
With the Partitioning and Data Mining options
SQL> !rm /oratest/oradata/PROD/users01.dbf                    ➔ 실제 Disk장애를 유발시킨다.
SQL> shutdown immediate
ORA-01116: error in opening database file 4
ORA-01110: data file 4: '/oratest/oradata/PROD/users01.dbf'
ORA-27041: unable to open file
SVR4 Error: 2: No such file or directory
Additional information: 3

##RMAN을 통해서 Recovery를 진행한다.##
RMAN> run {
2> allocate channel c1 type disk;
3> sql "alter tablespace users offline immediate";
4> restore datafile 4;
5> recover datafile 4;
6> sql "alter tablespace users online";
7> release channel c1;
8> }

released channel: ORA_DISK_1
```

```
allocated channel: c1
channel c1: sid=145 devtype=DISK
sql statement: alter tablespace users offline immediate

Starting restore at 08-JAN-07

channel c1: starting datafile backupset restore
channel c1: specifying datafile(s) to restore from backup set
restoring datafile 00004 to /oratest/oradata/PROD/users01.dbf
channel c1: reading from backup piece /rman_backup/PROD/sunday_level0_611364719
channel c1: restored backup piece 1
piece handle=/rman_backup/PROD/sunday_level0_611364719 tag=TAG20070108T233158
channel c1: restore complete, elapsed time: 00:00:02
Finished restore at 08-JAN-07

Starting recover at 08-JAN-07
starting media recovery
media recovery complete, elapsed time: 00:00:04
Finished recover at 08-JAN-07
sql statement: alter tablespace users online          ➔ Datafile이 recovery되었음을 확인할수 있다.
released channel: c1
```

TABLESPACE RECOVERY

```
RMAN> run {
2> allocate channel c1 type disk;
3> sql "alter tablespace users offline immediate";
4> restore tablespace users;
5> recover tablespace users;
6> sql "alter tablespace users online";
7> release channel c1;
8> }
```

Online Redo log file lost(DataBase Closed)

```
RMAN> run {
      allocate channel c1 type disk;
      set until logseq=105 thread=1;
      restore controlfile to       '/oratest/oradata/PROD/control01.ctl';
      replicate controlfile from '/oratest/oradata/PROD/control01.ctl';
      restore database;
      sql "alter database mount";
      recover database;

          sql "alter database open resetlogs";

      release channel c1;
              }
RMAN> reset database;
```

1. **set until** command 는 어떠한 log sequence 까지 recovery 하고 stop 할 것인지를 가리킨다. 이 문장은 datafile 들이 restore 되기 전에 나와야 한다. 그렇지않으면 RMAN 은 지정한 log sequence 보다 앞선 가장

최근의 datafile 들을 restore 하려고 한다.

2. 기본적으로 **restore controlfile** command 에 의하여 init.ora 에 지정되어 있는 control_files 의 위치로 자동적으로 controlfile 들이 restore 된다. 이렇게 하지 않고 특정한 위치를 지정하기 위해서는 **restore controlfile to 'filename'** 이라고 지정하면 된다.
3. 'replicate controlfile'은 init.ora 에 지정되어 있는 위치에 controlfile 을 restore 하지 않고 특정한 위치에 controlfile 을 restore 했을때 이것들을 다시 init.ora 에 지정되어 있는 control_files 의 위치에 controlfile 을 copy 하기 위하여 사용한다.
4. Database 가 resetlogs 로 open 이 되어졌기 때문에 database 의 새로운 incarnation 을 register 해야할 필요가 있다. 이것은 **reset database** command 를 통하여 할 수 있다.

5.1. Rman을 통한 Recovery 시나리오(예제)

SCENARIO 1 : COMPLETE RECOVERY - DATAFILE RECOVERY

1. db open 중에, 해당 tablespace 를 offline
2. datafile 을 restore
3. recover 수행
4. 해당 tablespace online

```
RMAN> report schema;

Report of database schema

List of Permanent Datafiles
===========================
File Size(MB) Tablespace           RB segs Datafile Name
---- -------- -------------------- ------- ------------------------
1    300      SYSTEM               YES     /oracle/oradata/WIPPY/system01.dbf
2    200      UNDOTBS1             YES     /oracle/oradata/WIPPY/undotbs01.dbf
3    210      SYSAUX               NO      /oracle/oradata/WIPPY/sysaux01.dbf
4    5        USERS                NO      /oracle/oradata/WIPPY/users01.dbf
5    20       ORACLE               NO      /oracle/oradata/WIPPY/oracle01.dbf
8    50       RMAN_TS              NO      /oracle/oradata/WIPPY/rman01.dbf

RMAN> run {
    2> sql "alter tablespace oracle offline immediate";
    3> restore datafile 5;
    4> recover datafile 5;
    5> sql "alter tablespace oracle online"; }
```

SCENARIO 2 : COMPLETE RECOVERY - TABLESPACE RECOVERY

1. SCENARIO 1 과 과정은 동일하나, command 가 조금 달라짐.

```
RMAN> run {
    2> sql "alter tablespace oracle offline immediate";
    3> restore tablespace oracle;
    4> recover tablespace oracle;
    5> sql "alter tablespace oracle online"; }
```

!!참고!! 여러개의 backupset 중에 선택해서 restore 할려면??
restore tablespace oracle from tag='태그이름'을 주면 된다.

SCENARIO 3 : COMPLETE RECOVERY - TABLESPACE RECOVERY(새로운 곳에 RESTORE후 RECOVERY)

```
RMAN> run {
    2> sql "alter tablespace oracle offline immediate";
    3> set newname for datafile '/oracle/oradata/WIPPY/control/oracle01.dbf' to '/oracle/oradata/WIPPY/oracle01.dbf';
```

```
    4> restore tablespace oracle;
    5> switch datafile all;
    6> recover tablespace oracle;
    7> sql "alter tablespace oracle online";}

# set newname for '원본 경로' to '이동경로'
# switch datafile all :   Update the control file and recovery catalog
```

SCENARIO 4 : INCOMPLETE RECOVERY - CURRENT ONLINE REDO LOG GROUP의 유실

```
1. alertlog 를 보고 log sequence 를 알아둔다.
RMAN> run {
    2> set until sequence=3 thread=1;
    3> restore database;
    4> recover database;
    5> alter database open resetlogs;}
        executing command: SET until clause

Starting restore at 09-JUL-07
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=156 devtype=DISK

channel ORA_DISK_1: starting datafile backupset restore
channel ORA_DISK_1: specifying datafile(s) to restore from backup set
restoring datafile 00001 to /oracle/oradata/WIPPY/system01.dbf
restoring datafile 00002 to /oracle/oradata/WIPPY/undotbs01.dbf
restoring datafile 00003 to /oracle/oradata/WIPPY/sysaux01.dbf
restoring datafile 00004 to /oracle/oradata/WIPPY/users01.dbf
restoring datafile 00005 to /oracle/oradata/WIPPY/oracle01.dbf
restoring datafile 00008 to /oracle/oradata/WIPPY/rman01.dbf
channel ORA_DISK_1: reading from backup piece /oracle/oradata/backup/full-20070709-34imdbmn_1_1-100-1
channel ORA_DISK_1: restored backup piece 1
piece handle=/oracle/oradata/backup/full-20070709-34imdbmn_1_1-100-1 tag=FULL_BACKUP
channel ORA_DISK_1: restore complete, elapsed time: 00:01:16
Finished restore at 09-JUL-07

Starting recover at 09-JUL-07
using channel ORA_DISK_1

starting media recovery

archive log thread 1 sequence 1 is already on disk as file /oracle/arch/10.2.0/1_1_627485531.dbf
archive log thread 1 sequence 2 is already on disk as file /oracle/arch/10.2.0/1_2_627485531.dbf
archive log filename=/oracle/arch/10.2.0/1_1_627485531.dbf thread=1 sequence=1
archive log filename=/oracle/arch/10.2.0/1_2_627485531.dbf thread=1 sequence=2
media recovery complete, elapsed time: 00:00:06
Finished recover at 09-JUL-07

database opened
new incarnation of database registered in recovery catalog
starting full resync of recovery catalog
full resync complete
```

SCENARIO 5 : INCOMPLETE RECOVERY - CONTROLFILE과 DATAFILE 동시에 유실

```
1. 복구 수행.(nomount 상태)
RMAN> run {
    2> set until sequence=9 thread=1;
    3> restore controlfile;
    4> alter database mount;
    5> restore database;
    6> recover database;
    7> alter database open resetlogs;
    8> }
```

executing command: SET until clause

Starting restore at 09-JUL-07
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=155 devtype=DISK

channel ORA_DISK_1: starting datafile backupset restore
channel ORA_DISK_1: restoring control file
channel ORA_DISK_1: reading from backup piece /oracle/oradata/backup/full-20070709-2pimd5dh_1_1-89-1
channel ORA_DISK_1: restored backup piece 1
piece handle=/oracle/oradata/backup/full-20070709-2pimd5dh_1_1-89-1 tag=FULL_BACKUP
channel ORA_DISK_1: restore complete, elapsed time: 00:00:05
output filename=/oracle/oradata/WIPPY/control/control01.ctl
output filename=/oracle/oradata/WIPPY/control/control02.ctl
output filename=/oracle/oradata/WIPPY/control/control03.ctl
Finished restore at 09-JUL-07

database mounted
released channel: ORA_DISK_1

Starting restore at 09-JUL-07
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=155 devtype=DISK

channel ORA_DISK_1: starting datafile backupset restore
channel ORA_DISK_1: specifying datafile(s) to restore from backup set
restoring datafile 00001 to /oracle/oradata/WIPPY/system01.dbf
restoring datafile 00002 to /oracle/oradata/WIPPY/undotbs01.dbf
restoring datafile 00003 to /oracle/oradata/WIPPY/sysaux01.dbf
restoring datafile 00004 to /oracle/oradata/WIPPY/users01.dbf
restoring datafile 00005 to /oracle/oradata/WIPPY/oracle01.dbf
restoring datafile 00008 to /oracle/oradata/WIPPY/rman01.dbf
channel ORA_DISK_1: reading from backup piece /oracle/oradata/backup/full-20070709-2oimd5bg_1_1-88-1
channel ORA_DISK_1: restored backup piece 1
piece handle=/oracle/oradata/backup/full-20070709-2oimd5bg_1_1-88-1 tag=FULL_BACKUP
channel ORA_DISK_1: restore complete, elapsed time: 00:01:15
Finished restore at 09-JUL-07

Starting recover at 09-JUL-07
using channel ORA_DISK_1

starting media recovery

archive log thread 1 sequence 8 is already on disk as file /oracle/arch/10.2.0/1_8_627475891.dbf
archive log filename=/oracle/arch/10.2.0/1_8_627475891.dbf thread=1 sequence=8
media recovery complete, elapsed time: 00:00:02
Finished recover at 09-JUL-07

database opened
new incarnation of database registered in recovery catalog
starting full resync of recovery catalog
full resync complete

2. backupset file delete
RMAN> delete backupset;
RMAN> delete archivelog all;

SCENARIO 6 : INCOMPLETE RECOVERY - 시간 기반으로 RECOVERY

.bash_profile 에
export NLS_DATE_FORMAT='YYYY-MM-DD HH24:MI:SS'입력 후 쉘다시 적용.

date command 로 현재시간 확인.
2007-07-09 18:23:00 이라고 가정.

oracle 에서 table 삭제.
nomount 상태에서 복구시작.

```
RMAN> run {
    2> set until time='2007-07-09 18:23:00';
    3> restore controlfile;
    4> alter database mount;
    5> restore database;
    6> recover database;
    7> alter database open resetlogs;
    8> }
```

6. Rman Recovery를 이용한 NEW서버에 Restore

rman으로 다른서버에 전체 restore 방법

```
busan1 $ rman target / catalog rman/rman@resp

Recovery Manager: Release 10.2.0.1.0 - Production on Thu Jan 11 14:13:13 2007

Copyright (c) 1982, 2005, Oracle.    All rights reserved.

connected to target database: PROD (DBID=2552232597)
connected to recovery catalog database
RMAN> configure channel device type disk format '/rman_backup/PROD/%d_%s_%p.bak'
RMAN> CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/rman_backup/PROD/snap_control_PROD.f';
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP ON;
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'/rman_backup/PROD/%F.ctl'

RMAN> show all;                                    ➔전체 configure를 확인한다.

RMAN configuration parameters are:
CONFIGURE RETENTION POLICY TO RECOVERY WINDOW OF 1 DAYS;
CONFIGURE BACKUP OPTIMIZATION OFF; # default
CONFIGURE DEFAULT DEVICE TYPE TO DISK; # default
CONFIGURE CONTROLFILE AUTOBACKUP ON;
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '/rman_backup/PROD/%F.ctl';
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     '/rman_backup/PROD/%d_%s_%p.bak';
CONFIGURE MAXSETSIZE TO UNLIMITED; # default
CONFIGURE ENCRYPTION FOR DATABASE OFF; # default
CONFIGURE ENCRYPTION ALGORITHM 'AES128'; # default
CONFIGURE ARCHIVELOG DELETION POLICY TO NONE; # default
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/rman_backup/PROD/snap_control_PROD.f';

RMAN> backup database;

Starting backup at 11-JAN-07
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=154 devtype=DISK
channel ORA_DISK_1: starting full datafile backupset
channel ORA_DISK_1: specifying datafile(s) in backupset
```

input datafile fno=00001 name=/oratest/oradata/PROD/system01.dbf
input datafile fno=00002 name=/oratest/oradata/PROD/undotbs01.dbf
input datafile fno=00003 name=/oratest/oradata/PROD/sysaux01.dbf
input datafile fno=00005 name=/oratest/oradata/PROD/catalog01.dbf
input datafile fno=00004 name=/oratest/oradata/PROD/users01.dbf
channel ORA_DISK_1: starting piece 1 at 11-JAN-07
channel ORA_DISK_1: finished piece 1 at 11-JAN-07
piece handle=/rman_backup/PROD/PROD_20_1.bak tag=TAG20070111T141941 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:45
Finished backup at 11-JAN-07

Starting Control File Autobackup at 11-JAN-07
piece handle=/rman_backup/PROD/c-2552232597-20070111-00.ctl comment=NONE
Finished Control File Autobackup at 11-JAN-07

############사전작업###
Step 1) 새로운 서버로 rman backup, archive 이동
Step 2) $ORACLE_HOME/dbs 에 initPROD.ora 파라미터 위치
Step 3) $ORACLE_HOME/network/admin에 tnsnames.ora 파일에 REPO DB에 접속가능 하도록 설정
Step 4) rman backup의 위치는 원래 백업했던 경로와 같아야 함
archive는 경로를 마음대로 해도 되나 init파라미터에 꼭 설정해야 함
Step 5) datafile을 restore할 곳은 /oratest/oradata/PROD 에서 /oratest/oradata/NEW_PROD로 변경함
즉, init파라미터에서 control_files 파라미터를 /oratest/oradata/NEW_PROD/control01.ctl ~~ 으로 변경해야 함

새로운 서버에서 PROD DB를 nomount 상태로 올림

SQL> startup nomount
ORACLE instance started.

Total System Global Area 353440972 bytes
Fixed Size 451788 bytes
Variable Size 218103808 bytes
Database Buffers 134217728 bytes
Redo Buffers 667648 bytes

Busan2 $ rman target / catalog rman/rman@resp ➔busan2에서 작업을 한다(신규서버)

Recovery Manager: Release 10.2.0.1.0 - Production on Thu Jan 11 14:13:13 2007

connected to target database: PROD (not mounted)
connected to recovery catalog database

RMAN> set dbid=4294045256 ➔ dbid는 실DB의 v$database를 보면 됨

restore하고자 하는 시간을 확인
alert log를 보니.. 296 archive가 있다.
1시 12분 04초에 생겼으니 time based로는 이전까지로 복구해야 한다.
1시 12분 03초로 한다.

Fri Sep 22 01:12:04 2007
ARC1: Evaluating archive log 2 thread 1 sequence 296

```
ARC1: Beginning to archive log 2 thread 1 sequence 296
Creating archive destination LOG_ARCHIVE_DEST_1: '/data/archive/1_296.arc'
Fri Sep 22 01:12:04 2007
Thread 1 advanced to log sequence 297
Current log# 3 seq# 297 mem# 0: /data/oradata/PROD/redo03a.log
```

controlfile을 restore수행 후 DB를 mount상태로 만듦
- 주의! init파라미터에 설정된 경로에 restore가 되니 control_files파라미터를 확인
만약 LOG SEQUENCE NUMBER를 통해서 복구하고자 한다면 아래와 같이 SET UNTIL을 지정한다.

```
SET UNTIL SEQUENCE 276 THREAD 1;
```

참고) LOG SEQUENCE NUMBER를 통해서 복구 하는 방법

```
RMAN> run {
SET UNTIL SEQUENCE 276 THREAD 1;
restore controlfile;
}

RMAN> run {
SET UNTIL TIME "TO_DATE('2007/09/22 01:12:03','YYYY/MM/DD HH24:MI:SS')";
restore controlfile;
}


executing command: SET until clause

Starting restore at 22-SEP-06

allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=12 devtype=DISK
channel ORA_DISK_1: starting datafile backupset restore
channel ORA_DISK_1: restoring controlfile
output filename=/oratest/oradata /NEW_PROD/control01.ctl
channel ORA_DISK_1: restored backup piece 1
piece handle=/backup/RMAN/c-4294045256-20060922-00.ctl tag=null params=NULL
channel ORA_DISK_1: restore complete
replicating controlfile
input filename=/oratest/oradata /NEW_PROD/control01.ctl
output filename=/oratest/oradata /NEW_PROD/control02.ctl
Finished restore at 22-SEP-06

RMAN> alter database mount;

RMAN> run {
SET UNTIL TIME "TO_DATE('2007/09/22 01:12:03','YYYY/MM/DD HH24:MI:SS')";
set newname for datafile '/oratest/oradata /PROD/system01.dbf' to '/oratest/oradata /NEW_PROD/system01.dbf';
set newname for datafile '/oratest/oradata /PROD/undotbs01.dbf' to '/oratest/oradata /NEW_PROD/undotbs01.dbf';
set newname for datafile '/oratest/oradata /PROD/user01.dbf' to '/oratest/oradata /NEW_PROD/users01.dbf';
restore database;
switch datafile all ;
recover database;
sql 'alter database open resetlogs';
}
executing command: SET until clause
executing command: SET NEWNAME
executing command: SET NEWNAME
executing command: SET NEWNAME
```

```
Starting restore at 22-SEP-06

using channel ORA_DISK_1
channel ORA_DISK_1: starting datafile backupset restore
channel ORA_DISK_1: specifying datafile(s) to restore from backup set
restoring datafile 00001 to /oratest/oradata /NEW_PROD/system01.dbf
restoring datafile 00002 to /oratest/oradata /NEW_PROD/undotbs01.dbf
restoring datafile 00003 to /oratest/oradata /NEW_PROD/users01.dbf
channel ORA_DISK_1: restored backup piece 1
piece handle=/rmna_backup/PROD/PROD_13_1.bak tag=TAG20060922T010901 params=NULL
channel ORA_DISK_1: restore complete
Finished restore at 22-SEP-07

Starting recover at 22-SEP-07
using channel ORA_DISK_1

starting media recovery

archive log thread 1 sequence 296 is already on disk as file /data/archive/1_296.arc
archive log filename=/data/archive/1_296.arc thread=1 sequence=296
media recovery complete
Finished recover at 22-SEP-07

sql statement: alter database open resetlogs
```

7. Rman Backup을 위한 Script create

Create or Replace Script

Recovery Catalog 내에 script 형태로 저장이 되어지는 것으로 stored procedure 형태로 불러서 사용할 수 있다.

조회는 RC_STORED_SCRIPT 와 RC_STORED_SCRIPT_LINE 에서 할 수 있다.

```
RMAN> create script backup_db_full {
2> allocate channel c1 type disk;
3> backup
4> full
5> tag full_db_sunday_night
6> format '/rman_backup/PROD/db_t%t_s%s_p%p'
7> (database);
8> release channel c1;
9>         }

created script backup_db_full
```

Execute Script

run 이란 명령어를 통해서 저장된 Script 를 실행한다.

```
RMAN> run{
execute script backup_db_full;
}
executing script: backup_db_full
```

Delete Script

저장된 Script 를 Delete 시킨다.

```
RMAN> run{
delete script backup_db_full;
}
deleted script: backup_db_full
```

OS 상에서 실행이 하는 방법

OS 의 file 형태로 존재하는 Script 를 실행하는 방법

```
busan1 $ cat db_full.rcv
run {
        execute script backup_db_full;
}

busan1 $ rman target / catalog rman/rman@resp @db_full.rcv log full_backup.log
위 script를 쉘파일로 작성한후 OS의 Cron명령어로도 실행가능함.

busan1 $ cat full_backup.log          ➔백업로그로서 완료여부를 확인가능하다.

Recovery Manager: Release 10.2.0.1.0 - Production on Tue Jan 9 00:49:01 2007

Copyright (c) 1982, 2005, Oracle.    All rights reserved.

connected to target database: PROD (DBID=2552232597)
connected to recovery catalog database

RMAN> run {
2>          execute script backup_db_full;
3> }
4>
5>
executing script: backup_db_full
allocated channel: c1
channel c1: sid=143 devtype=DISK
Starting backup at 09-JAN-07
channel c1: starting full datafile backupset
channel c1: specifying datafile(s) in backupset
input datafile fno=00001 name=/oratest/oradata/PROD/system01.dbf
……중략
channel c1: finished piece 1 at 09-JAN-07
piece handle=/rman_backup/PROD/db_t611369398_s19_p1 tag=FULL_DB_SUNDAY_NIGHT comment=NONE
channel c1: backup set complete, elapsed time: 00:00:03
```

```
Finished backup at 09-JAN-07
released channel: c1
Recovery Manager complete.
```

8. Rman Repository의 유지관리

8.1. Removing Obsolete Backupsets

파일이 존재하지 않으면 EXPIRED로 갱신

```
RMAN> allocate channel for maintenance type disk;          ➔channel을 할당한다.
allocated channel: ORA_MAINT_DISK_2
channel ORA_MAINT_DISK_2: sid=139 devtype=DISK

RMAN> crosscheck backup;                    ➔ 불필요한 backup들을 Crosscheck한다.

crosschecked backup piece: found to be 'AVAILABLE'
backup piece handle=/rman_backup/PROD/df_PROD_06i71a4d recid=6 stamp=611362960
crosschecked backup piece: found to be 'AVAILABLE'
backup piece handle=/rman_backup/PROD/cf_t611363177_s7_p1 recid=7 stamp=611363179
crosschecked backup piece: found to be 'AVAILABLE'
중략……
backup piece handle=/rman_backup/PROD/log_t611363727_s9_p1 recid=9 stamp=611363728
crosschecked backup piece: found to be 'AVAILABLE'
crosschecked backup piece: found to be 'AVAILABLE'
backup piece handle=/rman_backup/PROD/db_t611369398_s19_p1 recid=19 stamp=611369400
Crosschecked 14 objects

crosschecked backup piece: found to be 'EXPIRED'
backup piece handle=/rman_backup/PROD/db_t611286673_s3_p1 recid=3 stamp=611286673
crosschecked backup piece: found to be 'EXPIRED'
backup piece handle=/rman_backup/PROD/db_t611286729_s4_p1 recid=4 stamp=611286730
crosschecked backup piece: found to be 'EXPIRED'
backup piece handle=/rman_backup/PROD/tbs_users_t611362619_s5 recid=5 stamp=611362620
Crosschecked 3 objects

RMAN> delete expired backup;          ➔ Expired 된것에 대해서 삭제를 한다.
List of Backup Pieces
BP Key  BS Key  Pc# Cp# Status      Device Type Piece Name
------- ------- --- --- ----------- ----------- ----------
67      65      1   1   EXPIRED     DISK        /rman_backup/PROD/db_t611286673_s3_p1
68      66      1   1   EXPIRED     DISK        /rman_backup/PROD/db_t611286729_s4_p1
102     100     1   1   EXPIRED     DISK        /rman_backup/PROD/tbs_users_t611362619_s5

Do you really want to delete the above objects (enter YES or NO)? yes
deleted backup piece
backup piece handle=/rman_backup/PROD/db_t611286673_s3_p1 recid=3 stamp=611286673
deleted backup piece
backup piece handle=/rman_backup/PROD/db_t611286729_s4_p1 recid=4 stamp=611286730
deleted backup piece
backup piece handle=/rman_backup/PROD/tbs_users_t611362619_s5 recid=5 stamp=611362620
Deleted 3 EXPIRED objects
```

9. RAC환경에서의 RMAN Backup

Setup

양쪽 노드에 remote_login_passwordfile='exclusive' 를 설정한다.(target Database로 접속할 때 internal user로 connect해야 하기 때문에 반드시 setting이 되어 있어야한다.

```
busan1 $ crs_stat -t
Name                 Type                 Target      State       Host
------------------------------------------------------------
ora....g1.inst application       ONLINE      ONLINE      busan1
ora....g2.inst application       ONLINE      ONLINE      busan2
ora.ORA10g.db    application       ONLINE      ONLINE      busan1
ora....N1.lsnr application       ONLINE      ONLINE      busan1
ora.busan1.gsd application       ONLINE      ONLINE      busan1
ora.busan1.ons application       ONLINE      ONLINE      busan1
ora.busan1.vip application       ONLINE      ONLINE      busan1
ora....N2.lsnr application       ONLINE      ONLINE      busan2
ora.busan2.gsd application       ONLINE      ONLINE      busan2
ora.busan2.ons application       ONLINE      ONLINE      busan2
ora.busan2.vip application       ONLINE      ONLINE      busan2

busan1 $ rman target / catalog rman/rman@resp
Recovery Manager: Release 10.2.0.1.0 - Production on Tue Jan 9 19:19:28 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
connected to target database: ORA10G (DBID=3933991550)
connected to recovery catalog database

RMAN> create catalog;                    ➔이미 다른 DB를 위해 rman이 사용중이라면생략
recovery catalog already exists
RMAN> register database;                 ➔ RAC DB를 위해 register한다.

database registered in recovery catalog
starting full resync of recovery catalog
full resync complete

RMAN> CONFIGURE DEVICE TYPE DISK PARALLELISM 2;
몇개의 Channel을 설정할 것인가에 따라 PARALLELISM의 값을 반드시맞춰 주어야 합니다.
이것을 맞춰주지 않으면 Error가 발생하면서 다른 Node의 archive file들을 인식하지 못하게 될수도있음.(실제로
Archived file들은 정상적으로 존재합니다)

new RMAN configuration parameters:
CONFIGURE DEVICE TYPE DISK PARALLELISM 2 BACKUP TYPE TO BACKUPSET;
new RMAN configuration parameters are successfully stored
starting full resync of recovery catalog
full resync complete

RMAN> configure default device type to disk;

new RMAN configuration parameters:
CONFIGURE DEFAULT DEVICE TYPE TO DISK;
new RMAN configuration parameters are successfully stored
starting full resync of recovery catalog
full resync complete

RMAN> configure channel 1 device type disk connect  'SYS/oracle@ORA10g1';   ➔ 각 노드별로 configure를
```

잡아준다.

new RMAN configuration parameters:
CONFIGURE CHANNEL 1 DEVICE TYPE DISK CONNECT 'SYS/oracle@ORA10g1';
new RMAN configuration parameters are successfully stored
starting full resync of recovery catalog
full resync complete

RMAN> configure channel 2 device type disk connect 'SYS/oracle@ORA10g2'; ➔ 각 노드별로 configure를 잡아준다.

new RMAN configuration parameters:
CONFIGURE CHANNEL 2 DEVICE TYPE DISK CONNECT 'SYS/oracle@ORA10g2';
new RMAN configuration parameters are successfully stored
starting full resync of recovery catalog
full resync complete

#####백업실행#####(백업 스크립트에서 channel 할당)#######
RMAN> run {
2> allocate channel node1 type disk connect 'SYS/oracle@ora10g1';
3> allocate channel node2 type disk connect 'SYS/oracle@ora10g2';
4> backup
5> format '/rman_backup/ORA10G/full_db_%t'
6> (database);
7> sql 'alter system archive log current';
8> backup archivelog all delete input;
9> }

allocated channel: node1
channel node1: sid=125 instance=ORA10g1 devtype=DISK

allocated channel: node2
channel node2: sid=129 instance=ORA10g2 devtype=DISK

Starting backup at 2007-01-09 20:53:23
channel node1: starting full datafile backupset
channel node1: specifying datafile(s) in backupset
input datafile fno=00002 name=/dev/vx/rdsk/10gRAC/raw_undotbs1_300m
input datafile fno=00004 name=/dev/vx/rdsk/10gRAC/raw_undotbs2_300m
input datafile fno=00005 name=/dev/vx/rdsk/10gRAC/raw_users_70m
channel node1: starting piece 1 at 2007-01-09 20:53:26
channel node2: starting full datafile backupset
channel node2: specifying datafile(s) in backupset
input datafile fno=00001 name=/dev/vx/rdsk/10gRAC/raw_system_500m
input datafile fno=00003 name=/dev/vx/rdsk/10gRAC/raw_sysaux_500m
channel node2: starting piece 1 at 2007-01-09 20:53:29
channel node1: finished piece 1 at 2007-01-09 20:53:46
piece handle=/rman_backup/ORA10G/full_db_611441606 tag=TAG20070109T205324 comment=NONE
channel node1: backup set complete, elapsed time: 00:00:20
channel node1: starting full datafile backupset
channel node1: specifying datafile(s) in backupset
including current control file in backupset
channel node1: starting piece 1 at 2007-01-09 20:53:58
channel node2: finished piece 1 at 2007-01-09 20:53:58
piece handle=/rman_backup/ORA10G/full_db_611441607 tag=TAG20070109T205324 comment=NONE
channel node2: backup set complete, elapsed time: 00:00:31
channel node1: finished piece 1 at 2007-01-09 20:54:00

```
piece handle=/rman_backup/ORA10G/full_db_611441631 tag=TAG20070109T205324 comment=NONE
channel node1: backup set complete, elapsed time: 00:00:09
Finished backup at 2007-01-09 20:54:00

sql statement: alter system archive log current

Starting backup at 2007-01-09 20:54:22
current log archived
released channel: node1
released channel: node2
```

10. Migration using TTS with RMAN [이기종 Endian[- Linux (Little) ➔ HP-UX (Big) 10G이상]

Target 서버와 Source 서버의 byte order 가 다르면 전송된 데이타를 올바르게 인식할 수 없으므로, 단순 카피 작업으로 Data 파일을 이동하는 것이 불가능하다. Oracle 10g RMAN 유틸리티가 Datafile 을 다른 Byte order 로 변환하는 기능을 지원한다.

```
$ RMAN> convert tablespace users, maints
        2> to platform 'HP-UX (64-bit)'
        3> format='/home/oracle/rman_bkups/%N_%f'
        4> parallelism = 4;
```

```
Starting backup at 14-MAR-04
…
allocated channel: ORA_DISK_5
channel ORA_DISK_5: sid=253 devtype=DISK
channel ORA_DISK_1: starting datafile conversion
input datafile fno=00004 name=/usr/oradata/dw10/dw10/users01.dbf
…
channel ORA_DISK_4: datafile conversion complete, elapsed time: 00:00:01
Finished backup at 14-MAR-04
```

위 과정을 거치면 /home/oracle/rman_bkups 디렉토리에 표준 RMAN 파일 포맷의 파일이 <tablespace_name>_<absolute_datafile_no> 의 파일명으로 생성됩니다. 결국 USERS 테이블스페이스 자체는 전혀 변경되지 않았고, HP-UX 환경을 위한 새로운 파일이 생성되었습니다. 이제 이 파일을 타겟 시스템으로 복사한 뒤 Migration 이 이루어지면 된다.

parallelism = 4
위와 같이 하면 네 개의 RMAN 채널이 생성되어 각각 별도의 데이타파일에 대해 변환 작업을 수행합니다.
하지만 parallelism 이 정말로 효과를 발휘하는 것은, 많은 수의 테이블스페이스를 한꺼번에 변환할 때입니다

서버환경

Source : Linux baekdu 2.6.9-5.EL
Storage : EVA4000
*Target : HP rx6600 (Itanium * 4EA)*
Storage : EVA4000

```
SQL> select username, default_tablespace from dba_users;
USERNAME                       DEFAULT_TABLESPACE
------------------------------ ------------------------------
TSMSYS                         SYSTEM
INSA1                          TS_INSA01                      <==
INSA2                          TS_INSA02                      <==
STRMADMIN                      USERS
REPADMIN                       USERS
ORANGE                         USERS
MDDATA                         USERS
DIP                            USERS
DMSYS                          SYSAUX
DBSNMP                         SYSAUX
WKSYS                          SYSAUX
WK_TEST                        SYSAUX
CTXSYS                         SYSAUX
SYSMAN                         SYSAUX
XDB                            SYSAUX
WKPROXY                        SYSAUX
MGMT_VIEW                      SYSAUX
OLAPSYS                        SYSAUX
ANONYMOUS                      SYSAUX
MDSYS                          SYSAUX
ORDSYS                         SYSAUX
EXFSYS                         SYSAUX
WMSYS                          SYSAUX
ORDPLUGINS                     SYSAUX
SI_INFORMTN_SCHEMA             SYSAUX
OUTLN                          SYSTEM
SYS                            SYSTEM
SYSTEM                         SYSTEM

28 rows selected.
SQL> select tablespace_name, file_name, bytes/1024/1024 from dba_data_files;
TABLESPACE_NAME                FILE_NAME                      BYTES/1024/1024
------------------------------ ------------------------------ ---------------
SYSTEM                         /dev/raw/raw121                            980
UNDOTBS1                       /dev/raw/raw122                            940
SYSAUX                         /dev/raw/raw125                            980
USERS                          /dev/raw/raw126                              5
TS_INSA01                      /dev/raw/raw128                            100   <==
TS_INSA02                      /dev/raw/raw129                            490   <==
TS_INSAIDX                     /dev/raw/raw130                            490   <==
UNDOTBS2                       /dev/raw/raw123                           1999
UNDOTBS3                       /dev/raw/raw124                           1999
UNDOTBS2                       /dev/raw/raw41                            1960
SYSAUX                         /dev/raw/raw331                            990
UNDOTBS3                       /dev/raw/raw332                            990
UNDOTBS1                       /dev/raw/raw333                            990
UNDOTBS3                       /dev/raw/raw334                            990
UNDOTBS3                       /dev/raw/raw335                            990
15 rows selected.
```

Step1) Transportable Tablespace 사용을 위한 Relation Check

```
SQL> exec dbms_tts.transport_set_check('TS_INSA01,TS_INSA02,TS_INSAIDX',TRUE);
PL/SQL procedure successfully completed.
SQL> select * from sys.transport_set_violations;
no rows selected
```

Step2) 해당 Transportable Tablespace를 Read-only mode로 변경한다.

```
SQL> alter tablespace TS_INSA01 read only;
SQL> alter tablespace TS_ INSA02 read only;
SQL> alter tablespace TS_ INSA IDX read only;
```

Step3) rman을 이용한 datafile convert작업

```
[oracle]$ rman target \ catalog rman/rman@resp
Recovery Manager: Release 10.2.0.2.0 - Production on Wed Mar 7 14:45:26 2007
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
connected to target database: JIRI (DBID=2680565210)
connected to recovery catalog database
RMAN> show all;

starting full resync of recovery catalog
full resync complete
RMAN configuration parameters are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 3;
CONFIGURE BACKUP OPTIMIZATION OFF;
CONFIGURE DEFAULT DEVICE TYPE TO DISK;
CONFIGURE CONTROLFILE AUTOBACKUP ON;
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '/db_backup/RMAN/%F';
configuration for DISK channel 3 is ignored
CONFIGURE DEVICE TYPE DISK BACKUP TYPE TO BACKUPSET PARALLELISM 2;
CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1;
CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1;
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT     '/db_backup/RMAN/%d_%s_%c_%p';
CONFIGURE CHANNEL 1 DEVICE TYPE DISK CONNECT '*' FORMAT     '/db_backup/RMAN/ %d_%s_%c_%p';
CONFIGURE CHANNEL 2 DEVICE TYPE DISK CONNECT '*' FORMAT     '/db_backup/RMAN /%d_%s_%c_%p';
CONFIGURE CHANNEL 3 DEVICE TYPE DISK CONNECT '*' FORMAT     '/db_backup/RMAN/ %d_%s_%c_%p';
CONFIGURE MAXSETSIZE TO UNLIMITED;
CONFIGURE ENCRYPTION FOR DATABASE OFF; # default
CONFIGURE ENCRYPTION ALGORITHM 'AES128'; # default
CONFIGURE ARCHIVELOG DELETION POLICY TO NONE; # default
CONFIGURE SNAPSHOT CONTROLFILE NAME TO '/db_backup/RMAN/jiri/snapcf_jiri.f';
```

➔채널 할당작업

```
RMAN> CONFIGURE CHANNEL 1 DEVICE TYPE DISK connect 'sys/oracle@PROD'   format
'/db_backup/RMAN/prod/%U';
CONFIGURE CHANNEL 2 DEVICE TYPE DISK connect 'sys/oracle@PROD'   format '/db_backup/RMAN/prod/%U';
CONFIGURE CHANNEL 3 DEVICE TYPE DISK connect 'sys/oracle@PROD'   format '/db_backup/RMAN/prod/%U';
old RMAN configuration parameters:
CONFIGURE CHANNEL 1 DEVICE TYPE DISK CONNECT '*' FORMAT     '/db_backup/RMAN/prod/%d_%s_%c_%p';
new RMAN configuration parameters:
CONFIGURE CHANNEL 1 DEVICE TYPE DISK CONNECT '*' FORMAT     '/db_backup/RMAN/ prod /%U';
new RMAN configuration parameters are successfully stored
```

starting full resync of recovery catalog
full resync complete

RMAN>
old RMAN configuration parameters:
CONFIGURE CHANNEL 2 DEVICE TYPE DISK CONNECT '*' FORMAT '/db_backup/RMAN/ prod /%d_%s_%c_%p';
new RMAN configuration parameters:
CONFIGURE CHANNEL 2 DEVICE TYPE DISK CONNECT '*' FORMAT '/db_backup/RMAN/ prod /%U';
new RMAN configuration parameters are successfully stored
starting full resync of recovery catalog
full resync complete

RMAN>
old RMAN configuration parameters:
CONFIGURE CHANNEL 3 DEVICE TYPE DISK CONNECT '*' FORMAT '/db_backup/RMAN/ prod /%d_%s_%c_%p';
new RMAN configuration parameters:
CONFIGURE CHANNEL 3 DEVICE TYPE DISK CONNECT '*' FORMAT '/db_backup/RMAN/ prod /%U';
new RMAN configuration parameters are successfully stored
starting full resync of recovery catalog
full resync complete

➔실제 convert 명령어로 rman을 이용한 file convert실행
RMAN> **convert tablespace 'TS_ INSA01 ' to platform 'HP-UX IA (64-bit)'**
db_file_name_convert='/dev/raw/raw128','/hp_data02/INSA01/TS_INSA_01.dbf';

Starting backup at 07-MAR-07
configuration for DISK channel 3 is ignored
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=1067 instance=prod devtype=DISK
allocated channel: ORA_DISK_2
channel ORA_DISK_2: sid=1064 instance=prod devtype=DISK
channel ORA_DISK_1: starting datafile conversion
input datafile fno=00005 name=/dev/raw/raw128
converted datafile=/hp_data02/LPDB01/TS_ INSA _01.dbf
channel ORA_DISK_1: datafile conversion complete, elapsed time: 00:00:25
Finished backup at 07-MAR-07

RMAN> convert tablespace 'TS_ INSA02' to platform 'HP-UX IA (64-bit)'
db_file_name_convert='/dev/raw/raw129','/hp_data04/INSA02/TS_ INSA 02.dbf';

RMAN> convert tablespace 'TS_ INSAIDX' to platform 'HP-UX IA (64-bit)'
db_file_name_convert='/dev/raw/raw130','/hp_data04/ INSA IDX/TS_ INSAIDX01.dbf';

RMAN> exit

Recovery Manager complete.

Step4) 해당 tablespace를 export한다.

% exp \'sys/linkp22 as sysdba\' tablespaces=TS_INSA01,TS_ INSA02,TS_ INSAIDX transport_tablespace=y
file=/hp_data04/INSA/tts_insa.dmp log=/hp_data04/LPDB01/tts_insa_exp.log

SQL> alter tablespace TS_INSA01 read write;
SQL> alter tablespace TS_INSA02 read write;

```
SQL> alter tablespace TS_INSAIDX read write;
```

on 10gR2 on HP (Target)

Step5) target DB 환경구성(user)

```
SQL> create user INSA1 identified by INSA1;
SQL> create user INSA2 identified by INSA2;
SQL> grant connect, resource to insa1;
SQL> grant connect, resource to insa2;
```

Step6) target DB 해당 tablespace Plugging한다.

```
% imp \'sys/oracle as sysdba\' tablespaces=TS_INSA01,TS_INSA02,TS_INSAIDX transport_tablespace=y
file=/data04/INSA/tts_insa.dmp
datafiles=/data04/INSA01/TS_INSA01.dbf,/data04/INSA02/TS_INSA02.dbf,/data04/INSAIDX/TS_INSAIDX01.dbf
log=/data04/INSA/tts_insa_imp.log
```

Step7) 해당 tablespace Read-Write mode로 변경한다.

```
SQL> alter tablespace TS_INSA01 read write;
SQL> alter tablespace TS_INSA02 read write;
SQL> alter tablespace TS_INSAIDX read write;
SQL> alter user INSA1 default tablespace TS_INSA01;
SQL> alter user INSA2 default tablespace TS_INSA02;
```

11. Recovery Catalog Tables & Views

Base tables

NAME	DESCRIPTION
AL	contains archived logs. archived logs are uniquely identified by dbinc_key, recid and stamp.
BCB	contains corrupt block ranges in datafile backups.
BCF	contains control file backups (in backup sets).
BDF	contains all datafile backups (in backup sets).
BP	contains all backup pieces of backup sets.
BRL	contains backup redo logs (in backup sets).
BS	contains all backup sets for all database incarnations.
CCB	contains corrupt block ranges in datafile copies.
CCF	contains control file copies.
CDF	contains all datafile copies.
CKP	records all recovery catalog checkpoints.
DB	contains all target databases that have been registered in this recovery catalog.

DBINC contains all incarnations of the target databases registered in this recovery catalog.
DF contains all datafiles of all database incarnations.
DFATT datafile attributes that change over time.
OFFR stores datafile offline ranges.
ORL contains all redo logfiles for all database incarnations.
RCVER recovery catalog version.
RLH records all redo log history for all threads.
RR contains redo ranges for all database incarnations.
RT redo threads for all database incarnations.
SCR contains 1 row for each stored script.
SCRL contains 1 row for each line of each stored script.
TS contains all tablespaces of all database incarnations.
TSATT tablespace attributes that change over time.

Views

NAME	DESCRIPTION
RC_ARCHIVED_LOG	information about all archivelogs.
RC_BACKUP_CONTROLFILE	backup control files in backup sets.
RC_BACKUP_CORRUPTION	corrupt blocks in datafile backups and copies.
RC_BACKUP_DATAFILE	datafile backups (in backup sets).
RC_BACKUP_PIECE	backup pieces.
RC_BACKUP_REDOLOG	redo log backups (in backup sets).
RC_BACKUP_SET	backup sets.
RC_CHECKPOINT	rc_checkpoint is replaced by rc_resync, but is still used by some tests.
RC_CONTROLFILE_COPY	controlfile copies.
RC_COPY_CORRUPTION	corrupt block ranges in datafile copies for all database incarnations.
RC_DATABASE	information about databases and their current incarnations.
RC_DATABASE_INCARNATION	information about all incarnations registered in recovery catalog.
RC_DATAFILE	information about all datafiles registered in recovery catalog.
RC_DATAFILE_COPY	datafile copies (on disk).
RC_LOG_HISTORY	information about redo log history.
RC_OFFLINE_RANGE	offline ranges for datafiles.
RC_REDO_LOG	information about online redo logs.
RC_REDO_THREAD	information about redo threads.
RC_RESYNC	information about recovery catalog resyncs (checkpoints).
RC_STORED_SCRIPT	stored scripts.
RC_STORED_SCRIPT_LINE	each line of each stored script.
RC_TABLESPACE	information about all tablespaces registered in recovery catalog.

12. 기타 유용한 Script & 명령어 정리

**** FULL BACKUP 하기**

```
-- datafile 두개가 1 나의 file 로 만들기
RUN {
allocate channel   c1 type disk   ;
BACKUP DATABASE format '/rmanbackup/database2_t%t_s%s' filesperset=2;
release channel c1;
}

-- parallel, 2 개 channel
RUN
{
configure device type disk parallelism 2;
allocate channel   c1 type disk maxpiecesize 250m ;
allocate channel   c2 type disk maxpiecesize 250m ;
BACKUP DATABASE format '/rmanbackup/database2_t%t_s%s' filesperset=2;
}
```

**** CONFIGURE 명령어**

```
RMAN> configure device type disk parallelism 1;
RMAN> CONFIGURE CHANNEL DEVICE TYPE DISK MAXPIECESIZE 1G;
RMAN> configure snapshot controlfile name to '/rmanbackup/cf_t%t_s%s_p%p';
RMAN> configure default device type to disk ;
RMAN> configure default device type clear;
```

**** CONTROL FILE BACKUP**

```
run {   allocate channel   c1 type disk;
backup
format '/rmanbackup/cf2_t%t_s%s_p%p'
tag cf_monday_night
(current controlfile);
release channel c1;
}
RMAN> list backupset of controlfile;
```

**** TABLESPACE 단위로 BACKUP**

```
run {
        allocate channel   c1 type disk;
        backup
        tag tbs_users
        format '/rmanbackup/tbs_usersall_t%t_s%s'   filesperset=2
        (tablespace DATA01,DATA02,DATA03,DATA04,DATA05);
        release channel c1;
 }

or

run {
        allocate channel   c1 type disk FORMAT '/rmanbackup/ch1/tbs_t%t_s%s';
        allocate channel   c2 type disk FORMAT '/rmanbackup/ch2/tbs_t%t_s%s';
        backup
        (tablespace DATA01,DATA02,DATA03,DATA04,DATA05 filesperset 2);
        release channel c1;
        release channel c2;
 }

or

run {
```

```
        allocate channel    c1 type disk FORMAT '/rmanbackup/tbs_t%t_s%s'    PARMS ="BLKSIZE=4194304";
        allocate channel    c2 type disk FORMAT '/rmanbackup/tbs_t%t_s%s'    PARMS ="BLKSIZE=4194304";
        backup
        (tablespace DATA01,DATA02,DATA03,DATA04,DATA05 filesperset 2);
        release channel c1;
        release channel c2;
 }

RMAN> list backupset of tablespace DATA01;


run {
  allocate channel d1 type disk;
  backup tablespace "DATA01" filesperset 2
  include current controlfile
  format '/rmanbackup/rman_TBS_%d.%t.%p.%c.bus';
}
```

** 개별 DATAFILE BACKUP

```
run {   allocate channel    c1 type disk;
        backup
        format '/rmanbackup/df_%d_%u'
        (datafile '/opt/oracle/oradata/PROD/disk1/data01_01.dbf2');
        release channel c1;
 }

< Backup 확인 >
RMAN> list backupset of datafile 2;
RMAN> list backupset of datafile '/opt/oracle/oradata/PROD/disk1/data01_01.dbf2'
```

** 개별 DATAFILE BACKUP (FILE COPY)

```
/home/ora920> rman TARGET / RCVCAT rman/rman@rcat

RMAN> run {
        allocate channel    c1 type disk;
        copy datafile 6 to '/rmanbackup/data05_01.dbf';
 }

run {   allocate channel    c1 type disk;
        copy datafile '/opt/oracle/oradata/PROD/disk5/data05_01.dbf' to '/rmanbackup/data05_01.dbf';
 }
```

** INCREMENTAL BACKUP

```
run {
allocate channel d1 type disk;
backup incremental level 0
filesperset 2
format '/rmanbackup/rman_LVL0_%d.%t.%p.%c.bus'
database;
}

run { allocate channel d1 type disk;
backup incremental level 1
filesperset 2
format '/rmanbackup/rman_LVL1_%d.%t.%p.%c.bus'
database;
}

run { allocate channel d1 type disk;
backup incremental level 2
filesperset 2
```

```
format '/rmanbackup/rman_LVL2_%d.%t.%p.%c.bus'
database;
}
```

** ARCHIVE LOG BACKUP

```
alter system switch logfile;

run {
allocate channel d1 type disk
format '/rmanbackup/rman_ARC_%s_%p_%t.bus';
# backup archivelog until time 'sysdate-1/24' delete input;
backup archivelog from time 'sysdate-1/24';
}

-- from time ~ until time
export NLS_DATE_FORMAT='YYYY-MM-DD HH24:MI:SS'
rman target sys/manager@prod catalog rman/rman@resp

        run {
        allocate channel dev1 type disk;
        backup
        (archivelog    from time    '2005-06-22 11:48:00'
                         until time '2005-06-22 11:53:00'
        all
        format '/rmanbackup/%d_%u');
        }

-- logseq 번호로 하고 백업후 dest 에서 삭제까지 해라...

        run {
        allocate channel dev1 type disk;
        backup
        (archivelog low logseq 1 high logseq 20 thread 1
        all delete input
        format '/rmanbackup/%d_%u');
        }

run {
          allocate channel    c1 type disk;
          sql "alter system archive log current";
          backup
          format '/rmanbackup/log_t%t_s%s_p%p'
          (archivelog from time 'sysdate-1' all delete input);
             release channel c1;
    }
```

** RAC ARCHIVE LOG BACKUP

```
RMAN> backup format '/RMAN/BACKUP/al_%t_%s' archivelog all delete input
thread 1;
RMAN> backup archivelog from time 'sysdate-10' until time 'sysdate' thead 1;
RMAN> backup archivelog from logseq 20 until logseq 50 thread 1;
RMAN> backup archivelog from scn 1 until scn 9999;
RMAN> backup archivelog like '/arch/dest%' delete all input thread 1;
RMAN> run {
configure device type disk parallelism 3;
configure default device type to sbt;
configure channel 1 device type sbt connect 'sys/manager@node1'
params 'ENV=(NSR_SERVER=bksvr1)';
configure channel 2 device type sbt connect 'sys/manager@node2'
params 'ENV=(NSR_SERVER=bksvr2)';
backup archivelog all;
```

** OS에서 삭제한 것 CATALOG에 반경하기(CROSSCHECK)

```
# This will give a channel for delete
RMAN> allocate channel for maintenance type disk;

# This will mark the missing pieces as 'EXPIRED'
RMAN> crosscheck backup of database;


RMAN>   crosscheck backup of database;

# Then a delete expired will clean up the repository (from 9i)
RMAN> delete expired backup;

RMAN>   crosscheck backup of database;
```

** RAC(환경)

```
run {
allocate channel node1 type disk connect 'sys/manager@rac1';
allocate channel node2 type disk connect 'sys/manager@rac1';
backup
(database);
sql 'alter system archive log current';
backup
(archivelog like '/u02/app/oracle/admin/V816/arch1/arch%' delete input channel node1)
(archivelog like '/u02/app/oracle/admin/V816/arch2/arch2%' delete input channel node2);
}

RMAN> run {
allocate channel node1 type disk connect 'sys/manager@rac1';
allocate channel node2 type disk connect 'sys/manager@rac2';
restore controlfile;
alter database mount;
restore database;
recover database;
sql 'alter database open resetlogs';
}

run {
allocate channel node_1 type disk connect 'sys/sys_pwd@node_1';
allocate channel node_2 type disk connect 'sys/sys_pwd@node_2';
backup filesperset 1
        (tablespace system, rbs, data1, data2   channel node_1)
        (tablespace temp, reccat, data3, data4 channel node_2);
backup filesperset 20
        (archivelog until time 'SYSDATE' like "/node1/arc/%" delete input channel node_1);
        (archivelog until time 'SYSDATE' like "/node2/arc/%" delete input channel node_2);
}
```

"set autolocate on" : 각 노드로 하여금 자기가 백업받았던 파일들을 restore 하게 하는 명령
이 명령이 없으면, 일부 환경에서는 RMAN 이 위치한 노드에서만
restore 를 시도한다.

```
run {
allocate channel node_1 type disk connect 'sys/sys_pwd@node_1';
allocate channel node_2 type disk connect 'sys/sys_pwd@node_2';
set autolocate on;
restore database;
}
```