**RMAN Image copy features of the Oracle 10G**

**Explains the RMAN Image copy feature and incrementally updated backups New in Oracle 10G.**

• Rman is configured with Recovery Catalog.   
• Recovery Catalog Database Name-Orcl   
• Database Name test is taken for demo   
• Database Test is Running in no archive log mode   
• Configured Backup location is 'D:\ORACLE\RMAN\ORA10G'   
• During the first and second run of the backup scripts I made some changes in the Database. Also during the second and the third run I made some changes in the Database.

**Expanded Image Copying Features**: A standard RMAN backup set contains one or more backup pieces, and each of these pieces consists of the data blocks for a particular datafile stored in a special compressed format. When a datafile needs to be restored, therefore, the entire datafile essentially needs to be recreated from the blocks present in the backup piece.

An image copy of a datafile, on the other hand, is much faster to restore because the physical structure of the datafile already exists. Oracle 10g now permit image copies to be created at the database, tablespace, or datafile level through the new RMAN directive **BACKUP AS COPY**. For example, here is a command script to create image copies for all datafiles in the entire database:

RUN {

# Set the default channel configuration. Note the use of the

# %U directive to insure unique file names for the image copies

ALLOCATE CHANNEL dbkp1 DEVICE TYPE DISK FORMAT 'D:\oracle\rman\ora10G\U%';

# Create an image copy of all datafiles in the database

BACKUP AS COPY DATABASE;

}

**Incrementally Updated Backups:** As explained in the previous section, it is now much simpler to create image copy backups of the database. Another new Oracle 10g feature, incrementally updated backups, allows us to apply incremental database changes to the corresponding image copy backup - also known as rolling forward the datafile image copy -- of any datafile in the database. Since image copy backups are much faster to restore in a media recovery situation, this new feature gives us the option to have updated image copies ready for restoration without having to recreate the image copies on a regular basis. To utilize this feature, we will need to use the new BACKUP ... FOR RECOVER OF COPY command to create the incremental level 1 backups to roll forward the changes to the image copy of the datafiles, and use the new RMAN RECOVER COPY OF DATABASE command to apply the incremental backup to the image copies of the datafiles. Note that the TAG directive becomes extremely important to this implementation, as it is used to identify to which image copies the changes are to be rolled forward. Here is a script that illustrates a daily cycle of creation and application of the incrementally updated backups. This would be appropriate for a database that has sufficient disk space for storage of image copies, and has a relatively high need for quick restoration of media:

**Expanded Image Copying Feature**

**Script1**

Rman target backup\_admin/backup\_admin@test catalog rman/rman@orcl

RUN {

# Roll forward any available changes to image copy files

# From the previous set of incremental Level 1 backups

RECOVER COPY OF DATABASE WITH TAG 'cool';

# Create incremental level 1 backup of all datafiles in the database

# For roll-forward application against image copies

BACKUP INCREMENTAL LEVEL 1 FOR RECOVER OF COPY WITH TAG 'cool' DATABASE;

}

*Note: backup\_admin user connect to the target database and Rman user connect to the catalog Operation of the script is explained.*

**First run of Script1:**

* The RECOVER command actually has no effect, because it cannot find any incremental backups with a tag of cool.
* However, the BACKUP command will create a new Incremental Level 0 backup that is labeled with a tag of cool because no backups have been created yet with this tag.

**Second run of Script1:**

* The RECOVER command still will have no effect, because it cannot find any Level 1 incremental backups with a tag of cool.
* The BACKUP command will create its first Incremental Level 1 backup that is labeled with a tag of cool.

**Third and subsequent runs of the Script1:**

* The RECOVER command finds the incremental level 1 image copy backups from the previous night's run tagged as cool, and applies them to the existing datafile image copies.
* The BACKUP command will create the next Incremental Level 1 backup that is labeled with a tag of cool.

**First Run Output**

RMAN> RUN {  
2> # Roll forward any available changes to image copy files  
3> # from the previous set of incremental Level 1 backups  
4> RECOVER  
5> COPY OF DATABASE  
6> WITH TAG 'cool';  
7>  
8> # Create incremental level 1 backup of all datafiles in the database  
9> # for roll-forward application against image copies  
10> BACKUP  
11> INCREMENTAL LEVEL 1  
12> FOR RECOVER OF COPY WITH TAG 'cool'  
13> DATABASE;  
14>};  
  
Starting recover at 13-APR-06  
using channel ORA\_DISK\_1  
no copy of datafile 1 found to recover  
no copy of datafile 2 found to recover  
no copy of datafile 3 found to recover  
no copy of datafile 4 found to recover  
no copy of datafile 5 found to recover  
Finished recover at 13-APR-06  
  
Starting backup at 13-APR-06  
using channel ORA\_DISK\_1  
no parent backup or copy of datafile 1 found  
no parent backup or copy of datafile 3 found  
no parent backup or copy of datafile 5 found  
no parent backup or copy of datafile 2 found  
no parent backup or copy of datafile 4 found  
channel ORA\_DISK\_1: starting datafile copy  
input datafile fno=00001 name=D:\ORACLE\ORADATA\TEST\SYSTEM01.DBF  
output filename=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_55\_P\_1\_T\_587658980 tag=CO  
OL recid=54 stamp=587659007  
channel ORA\_DISK\_1: datafile copy complete, elapsed time: 00:00:35  
channel ORA\_DISK\_1: starting datafile copy  
input datafile fno=00003 name=D:\ORACLE\ORADATA\TEST\SYSAUX01.DBF  
output filename=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_56\_P\_1\_T\_587659015 tag=CO  
OL recid=55 stamp=587659028  
channel ORA\_DISK\_1: datafile copy complete, elapsed time: 00:00:15  
channel ORA\_DISK\_1: starting datafile copy  
input datafile fno=00005 name=D:\ORACLE\ORADATA\TEST\EXAMPLE01.DBF  
output filename=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_57\_P\_1\_T\_587659030 tag=CO  
OL recid=56 stamp=587659036  
channel ORA\_DISK\_1: datafile copy complete, elapsed time: 00:00:07  
channel ORA\_DISK\_1: starting datafile copy  
input datafile fno=00002 name=D:\ORACLE\ORADATA\TEST\UNDOTBS01.DBF  
output filename=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_58\_P\_1\_T\_587659037 tag=CO  
OL recid=57 stamp=587659040  
channel ORA\_DISK\_1: datafile copy complete, elapsed time: 00:00:04  
channel ORA\_DISK\_1: starting datafile copy  
input datafile fno=00004 name=D:\ORACLE\ORADATA\TEST\USERS01.DBF  
output filename=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_59\_P\_1\_T\_587659041 tag=CO  
OL recid=58 stamp=587659041  
channel ORA\_DISK\_1: datafile copy complete, elapsed time: 00:00:01  
channel ORA\_DISK\_1: starting incremental level 1 datafile backupset  
channel ORA\_DISK\_1: specifying datafile(s) in backupset  
including current control file in backupset  
including current SPFILE in backupset  
channel ORA\_DISK\_1: starting piece 1 at 13-APR-06  
channel ORA\_DISK\_1: finished piece 1 at 13-APR-06  
piece handle=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_60\_P\_1\_T\_587659042 tag=TAG20  
060413T143619 comment=NONE  
channel ORA\_DISK\_1: backup set complete, elapsed time: 00:00:03  
Finished backup at 13-APR-06

**Second Run Output**

RMAN> RUN {  
2> # Roll forward any available changes to image copy files  
3> # from the previous set of incremental Level 1 backups  
4> RECOVER  
5> COPY OF DATABASE  
6> WITH TAG 'cool';  
7>  
8> # Create incremental level 1 backup of all datafiles in the database  
9> # for roll-forward application against image copies  
10> BACKUP  
11> INCREMENTAL LEVEL 1  
12> FOR RECOVER OF COPY WITH TAG 'cool'  
13> DATABASE;  
14>};  
  
Starting recover at 13-APR-06  
allocated channel: ORA\_DISK\_1  
channel ORA\_DISK\_1: sid=156 devtype=DISK  
no copy of datafile 1 found to recover  
no copy of datafile 2 found to recover  
no copy of datafile 3 found to recover  
no copy of datafile 4 found to recover  
no copy of datafile 5 found to recover  
Finished recover at 13-APR-06  
  
Starting backup at 13-APR-06  
using channel ORA\_DISK\_1  
channel ORA\_DISK\_1: starting incremental level 1 datafile backupset  
channel ORA\_DISK\_1: specifying datafile(s) in backupset  
input datafile fno=00001 name=D:\ORACLE\ORADATA\TEST\SYSTEM01.DBF  
input datafile fno=00003 name=D:\ORACLE\ORADATA\TEST\SYSAUX01.DBF  
input datafile fno=00005 name=D:\ORACLE\ORADATA\TEST\EXAMPLE01.DBF  
input datafile fno=00002 name=D:\ORACLE\ORADATA\TEST\UNDOTBS01.DBF  
input datafile fno=00004 name=D:\ORACLE\ORADATA\TEST\USERS01.DBF  
channel ORA\_DISK\_1: starting piece 1 at 13-APR-06  
channel ORA\_DISK\_1: finished piece 1 at 13-APR-06  
piece handle=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_61\_P\_1\_T\_587659454 tag=TAG20  
060413T144414 comment=NONE  
channel ORA\_DISK\_1: backup set complete, elapsed time: 00:00:25  
channel ORA\_DISK\_1: starting incremental level 1 datafile backupset  
channel ORA\_DISK\_1: specifying datafile(s) in backupset  
including current control file in backupset  
including current SPFILE in backupset  
channel ORA\_DISK\_1: starting piece 1 at 13-APR-06  
channel ORA\_DISK\_1: finished piece 1 at 13-APR-06  
piece handle=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_62\_P\_1\_T\_587659479 tag=TAG20  
060413T144414 comment=NONE  
channel ORA\_DISK\_1: backup set complete, elapsed time: 00:00:03  
Finished backup at 13-APR-06

**Third Run Output**

RMAN> RUN {  
2> # Roll forward any available changes to image copy files  
3> # from the previous set of incremental Level 1 backups  
4> RECOVER  
5> COPY OF DATABASE  
6> WITH TAG 'cool';  
7>  
8> # Create incremental level 1 backup of all datafiles in the database  
9> # for roll-forward application against image copies  
10> BACKUP  
11> INCREMENTAL LEVEL 1  
12> FOR RECOVER OF COPY WITH TAG 'cool'  
13> DATABASE;  
14> };  
  
Starting recover at 13-APR-06  
allocated channel: ORA\_DISK\_1  
channel ORA\_DISK\_1: sid=156 devtype=DISK  
channel ORA\_DISK\_1: starting incremental datafile backupset restore  
channel ORA\_DISK\_1: specifying datafile copies to recover  
recovering datafile copy fno=00001 name=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_5  
5\_P\_1\_T\_587658980  
recovering datafile copy fno=00002 name=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_5  
8\_P\_1\_T\_587659037  
recovering datafile copy fno=00003 name=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_5  
6\_P\_1\_T\_587659015  
recovering datafile copy fno=00004 name=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_5  
9\_P\_1\_T\_587659041  
recovering datafile copy fno=00005 name=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_5  
7\_P\_1\_T\_587659030  
channel ORA\_DISK\_1: reading from backup piece D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TE  
ST\_S\_61\_P\_1\_T\_587659454  
channel ORA\_DISK\_1: restored backup piece 1  
piece handle=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_61\_P\_1\_T\_587659454 tag=TAG20  
060413T144414  
channel ORA\_DISK\_1: restore complete, elapsed time: 00:00:04  
Finished recover at 13-APR-06  
  
Starting backup at 13-APR-06  
using channel ORA\_DISK\_1  
channel ORA\_DISK\_1: starting incremental level 1 datafile backupset  
channel ORA\_DISK\_1: specifying datafile(s) in backupset  
input datafile fno=00001 name=D:\ORACLE\ORADATA\TEST\SYSTEM01.DBF  
input datafile fno=00003 name=D:\ORACLE\ORADATA\TEST\SYSAUX01.DBF  
input datafile fno=00005 name=D:\ORACLE\ORADATA\TEST\EXAMPLE01.DBF  
input datafile fno=00002 name=D:\ORACLE\ORADATA\TEST\UNDOTBS01.DBF  
input datafile fno=00004 name=D:\ORACLE\ORADATA\TEST\USERS01.DBF  
channel ORA\_DISK\_1: starting piece 1 at 13-APR-06  
channel ORA\_DISK\_1: finished piece 1 at 13-APR-06  
piece handle=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_63\_P\_1\_T\_587659717 tag=TAG20  
060413T144837 comment=NONE  
channel ORA\_DISK\_1: backup set complete, elapsed time: 00:00:25  
channel ORA\_DISK\_1: starting incremental level 1 datafile backupset  
channel ORA\_DISK\_1: specifying datafile(s) in backupset  
including current control file in backupset  
including current SPFILE in backupset  
channel ORA\_DISK\_1: starting piece 1 at 13-APR-06  
channel ORA\_DISK\_1: finished piece 1 at 13-APR-06  
piece handle=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_64\_P\_1\_T\_587659742 tag=TAG20  
060413T144837 comment=NONE  
channel ORA\_DISK\_1: backup set complete, elapsed time: 00:00:03  
Finished backup at 13-APR-06

**Restore operation**

**Spfile Restore**

rman target backup\_admin/backup\_admin@test catalog  rman/rman@orcl

RMAN> run {  
2> restore spfile  to 'd:\spfile';  
3> }  
  
Starting restore at 13-APR-06  
using channel ORA\_DISK\_1  
  
channel ORA\_DISK\_1: starting datafile backupset restore  
channel ORA\_DISK\_1: restoring SPFILE  
output filename=d:\spfile.ora  
channel ORA\_DISK\_1: reading from backup piece D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TE  
ST\_S\_64\_P\_1\_T\_587659742  
channel ORA\_DISK\_1: restored backup piece 1  
piece handle=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_64\_P\_1\_T\_587659742 tag=TAG20  
060413T144837  
channel ORA\_DISK\_1: restore complete, elapsed time: 00:00:03  
Finished restore at 13-APR-06

**Restore Controlfile**

RMAN> run {  
2> restore controlfile;  
3>};  
  
Starting restore at 13-APR-06  
allocated channel: ORA\_DISK\_1  
channel ORA\_DISK\_1: sid=157 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 D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TE  
ST\_S\_64\_P\_1\_T\_587659742  
channel ORA\_DISK\_1: restored backup piece 1  
piece handle=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_64\_P\_1\_T\_587659742 tag=TAG20  
060413T144837  
channel ORA\_DISK\_1: restore complete, elapsed time: 00:00:01  
output filename=D:\ORACLE\ORADATA\TEST\CONTROL01.CTL  
Finished restore at 13-APR-06

**Database Restore**

It will restore the last image copy backup of the Database, which is already been recovered with all incremental backup except the latest one.

RMAN> alter database mount;  
  
database mounted  
released channel: ORA\_DISK\_1  
  
RMAN> run {  
2> restore database;  
3> }  
  
Starting restore at 13-APR-06  
allocated channel: ORA\_DISK\_1  
channel ORA\_DISK\_1: sid=156 devtype=DISK  
  
channel ORA\_DISK\_1: restoring datafile 00001  
input datafile copy recid=63 stamp=587659714 filename=D:\ORACLE\RMAN\ORA10G\BACK  
UP\_DB\_TEST\_S\_55\_P\_1\_T\_587658980  
destination for restore of datafile 00001: D:\ORACLE\ORADATA\TEST\SYSTEM01.DBF  
channel ORA\_DISK\_1: copied datafile copy of datafile 00001  
output filename=D:\ORACLE\ORADATA\TEST\SYSTEM01.DBF recid=64 stamp=587660786  
channel ORA\_DISK\_1: restoring datafile 00002  
input datafile copy recid=60 stamp=587659713 filename=D:\ORACLE\RMAN\ORA10G\BACK  
UP\_DB\_TEST\_S\_58\_P\_1\_T\_587659037  
destination for restore of datafile 00002: D:\ORACLE\ORADATA\TEST\UNDOTBS01.DBF  
channel ORA\_DISK\_1: copied datafile copy of datafile 00002  
output filename=D:\ORACLE\ORADATA\TEST\UNDOTBS01.DBF recid=65 stamp=587660796  
channel ORA\_DISK\_1: restoring datafile 00003  
input datafile copy recid=62 stamp=587659713 filename=D:\ORACLE\RMAN\ORA10G\BACK  
UP\_DB\_TEST\_S\_56\_P\_1\_T\_587659015  
destination for restore of datafile 00003: D:\ORACLE\ORADATA\TEST\SYSAUX01.DBF  
channel ORA\_DISK\_1: copied datafile copy of datafile 00003  
output filename=D:\ORACLE\ORADATA\TEST\SYSAUX01.DBF recid=66 stamp=587660811  
channel ORA\_DISK\_1: restoring datafile 00004  
input datafile copy recid=59 stamp=587659713 filename=D:\ORACLE\RMAN\ORA10G\BACK  
UP\_DB\_TEST\_S\_59\_P\_1\_T\_587659041  
destination for restore of datafile 00004: D:\ORACLE\ORADATA\TEST\USERS01.DBF  
channel ORA\_DISK\_1: copied datafile copy of datafile 00004  
output filename=D:\ORACLE\ORADATA\TEST\USERS01.DBF recid=67 stamp=587660813  
channel ORA\_DISK\_1: restoring datafile 00005  
input datafile copy recid=61 stamp=587659713 filename=D:\ORACLE\RMAN\ORA10G\BACK  
UP\_DB\_TEST\_S\_57\_P\_1\_T\_587659030  
destination for restore of datafile 00005: D:\ORACLE\ORADATA\TEST\EXAMPLE01.DBF  
channel ORA\_DISK\_1: copied datafile copy of datafile 00005  
output filename=D:\ORACLE\ORADATA\TEST\EXAMPLE01.DBF recid=68 stamp=587660819  
Finished restore at 13-APR-06

**Recover the Database**

It will apply the last incremental backup to the Database.

RMAN> recover database;  
  
Starting recover at 13-APR-06  
using channel ORA\_DISK\_1  
channel ORA\_DISK\_1: starting incremental datafile backupset restore  
channel ORA\_DISK\_1: specifying datafile(s) to restore from backup set  
destination for restore of datafile 00001: D:\ORACLE\ORADATA\TEST\SYSTEM01.DBF  
destination for restore of datafile 00002: D:\ORACLE\ORADATA\TEST\UNDOTBS01.DBF  
destination for restore of datafile 00003: D:\ORACLE\ORADATA\TEST\SYSAUX01.DBF  
destination for restore of datafile 00004: D:\ORACLE\ORADATA\TEST\USERS01.DBF  
destination for restore of datafile 00005: D:\ORACLE\ORADATA\TEST\EXAMPLE01.DBF  
channel ORA\_DISK\_1: reading from backup piece D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TE  
ST\_S\_63\_P\_1\_T\_587659717  
channel ORA\_DISK\_1: restored backup piece 1  
piece handle=D:\ORACLE\RMAN\ORA10G\BACKUP\_DB\_TEST\_S\_63\_P\_1\_T\_587659717 tag=TAG20  
060413T144837  
channel ORA\_DISK\_1: restore complete, elapsed time: 00:00:03  
  
starting media recovery  
  
archive log thread 1 sequence 64 is already on disk as file D:\ORACLE\ORADATA\TE  
ST\LOG5.DBF  
archive log filename=D:\ORACLE\ORADATA\TEST\LOG5.DBF thread=1 sequence=64  
media recovery complete, elapsed time: 00:00:01  
Finished recover at 13-APR-06  
  
RMAN> alter database open resetlogs;  
  
database opened  
new incarnation of database registered in recovery catalog  
starting full resync of recovery catalog  
full resync complete