Database Disaster Recovery using only RMAN Backups

Zaffer Khan

12th Apr, 2010

PURPOSE

This paper demonstrates how an Oracle Database can be recovered or reconstructed by using **only** the RMAN Backup files (from Disks) in case of a complete server crash.

CASE STUDY

Every DBA has to ensure that his hours spent in planning and testing the Backup-Recovery Strategy is reliable. Especially that, it should be relied upon when any unexpected scenarios occur. We DBAs, always tend to be at ease when our scheduled backup jobs are performing well and are error-free; followed by couple of satisfactory recovery simulation/testing scenarios.

Nevertheless, there are always scenarios which may be left unanticipated during the Backup-Recovery Testing. One such scenario was haunting me since couple of days. What we are going to see here is the must-have Recovery Test Case that every DBA, who has implemented RMAN Backups, needs to test before relying on his/her Backup-Recovery Strategy.

Let's take an example to elaborate the case and demonstrate how to go about with its resolution.

Let's say, I have a full RMAN Backup including *archivelog* backups maintained on Disks. Let's assume that all the backup files are in recoverable conditions and the RMAN Backups include the following files:

1. RMAN Full Backup files
2. RMAN *Archivelog* files
3. *Controlfile* and SPFILE *autobackup*

And then, let's say "one fine morning" the Production Database Server goes completely offline, due to a major crash and the server requires a complete **rebuild**. The only way to recover the server is to rebuild the entire server, or to have us recover the complete Environment and the Database (from the RMAN Backups) on to another Server.

Here, I will demonstrate how we can recover or reconstruct the Oracle Database by using **only** the RMAN Backups that are made available on Disks.

1

# Database Disaster Recovery using only RMAN Backups

Zaffer Khan
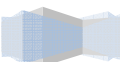
Before we take our case to the RMAN Backups, 2 pre-conditions need to be fulfilled:

1. A Server (the same server or a new one) should be made available in a state where Oracle Product can be installed; i.e., it should be brought online with a functional Operating System and necessary Environment Configurations, same as how it was before the crash.
2. Same version of Oracle Product (including any patch sets) needs to be installed with which the RMAN Backup was taken. This is critical for the recovery to be successful.

For the demonstration, the Operating System used **Microsoft Windows 2003** and the Oracle Database Product used **10g R2 (10.2.0.4) Standard Edition**.

The following steps would outline the procedures for recovering the Database using only RMAN Backup:

1. Create the Oracle Service
2. Create the relevant folder hierarchy under <ORACLE_BASE> directory
3. Restore the SPFILE from *autobackup*, and use the SPFILE to start the instance in NOMOUNT state
4. Restore the *controlfile* from *autobackup,* and MOUNT the database
5. Restore the Database from RMAN backup files
6. Recover the Database from RMAN backup files, and OPEN the database with RESETLOGS
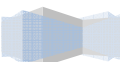
GETTING STARTED

1. Create the Oracle Service

We need to create an Oracle Service using 'oradim' utility, without passing any PFILE information

```
C:\>oradim -new -sid DBTEST -intpwd DBTEST
Instance created.
```

NOTE: 10g onwards, we can directly specify the SPFILE for oracle service creation; thanks to the newly introduced SPFILE option in *oradim* utility.

2. Create the relevant folder hierarchy under <ORACLE_BASE> directory

Now, we need to create the relevant directories for Oracle Database, as follows:

a. Create BDUMP, CDUMP, and UDUMP directories under '*<ORACLE_ BASE>\admin*' directory,

b. Create <DATABASE_NAME> directory under '*<ORACLE_BASE>\oradata*' directory; in our case DBTEST.

3. Restore the SPFILE from *autobackup*, and use the SPFILE to start the instance in NOMOUNT state

Here, we need to connect to the Recovery Manager using the '*rman*' utility, and then start the Recovery process.

First we need to set the Database ID (*DBID*) of the Database. At times, we may or may not know the DBID of the Database. There are 2 ways to find the DBID:

a. If RMAN Backup text logs are maintained, the DBID can be found when the initial connection is made to the target , or

b. If *autobackup* is enabled and has the *autobackup* format set (let's say the format is '**%F**'), then the filename of the *autobackup* has the DBID in it.

In our case, '*c-1106578690-20100408-00*' is the name of the *autobackup* file; so the DBID should be '**1106578690**'.

3

Database Disaster Recovery using only RMAN Backups

Zaffer Khan
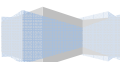
Next, we need to set the *autobackup* location, which will help us identify the location of all the RMAN files. In our case, the RMAN *autobackup* and backup files are located at '*testdb**dbtest*\'.

```
C:\>set oracle_sid=DBTEST

C:\>rman target /

Recovery Manager: Release 10.2.0.1.0 - Production on Thu Apr 8 11:40:10 2010

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

connected to target database (not started)

RMAN> set dbid=1106578690;

executing command: SET DBID

RMAN> startup force nomount;

startup failed: ORA-01078: failure in processing system parameters
LRM-00109: could not open parameter file
'C:\ORACLE\PRODUCT\10.2.0\DB_2\DATABASE\INITDBTEST.ORA'

starting Oracle instance without parameter file for retrieval of spfile
Oracle instance started

Total System Global Area     159383552 bytes

Fixed Size                     1247828 bytes
Variable Size                 58721708 bytes
Database Buffers              92274688 bytes
Redo Buffers                   7139328 bytes

RMAN> SET CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'\\testdb\dbtest\%F';

executing command: SET CONTROLFILE AUTOBACKUP FORMAT
using target database control file instead of recovery catalog
```

NOTE: It is a good practice to generate the text logs whenever your RMAN backup runs and have the command "show all" run before the backup and "list backup" after the backup completes. This ensures that we have information on the complete set of RMAN configurations and a list of all the backups with their details in the text log.

Next, we need to restore the SPFILE from the *autobackup* file and then use it to restart the instance in NOMOUNT state. You can approach this in two ways, as demonstrated below:

a. Restoring the SPFILE from the *autobackup* to a non-default location:

We can restore the SPFILE to a non-default location by using any one of the below 2 methods:

```
RMAN> restore spfile to 'C:\spdbtest01.ora' from autobackup;

Starting restore at 08-APR-10
```
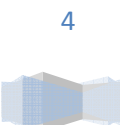
```
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=36 devtype=DISK

channel ORA_DISK_1: looking for autobackup on day: 20100408
channel ORA_DISK_1: autobackup found: \\testdb\dbtest\c-1106578690-20100408-
00
channel ORA_DISK_1: SPFILE restore from autobackup complete
Finished restore at 08-APR-10
```

OR,

```
RMAN> restore spfile to 'C:\spdbtest02.ora' from "\\testdb\dbtest\c-
1106578690-20100408-00";

Starting restore at 08-APR-10
using channel ORA_DISK_1

channel ORA_DISK_1: autobackup found: \\testdb\dbtest\c-1106578690-20100408-
00
channel ORA_DISK_1: SPFILE restore from autobackup complete
Finished restore at 08-APR-10
```

Now, we need to restart the instance in NOMOUNT state using the restored parameter file.

```
RMAN> shutdown immediate
Oracle instance shut down
```

Remember that we have just restored the SPFILE in a non-default location and hence we would require referring a PFILE that should be referencing the SPFILE, so as to start the instance. For this, we need to create a text file, '*init<SID>.ora*', and then mention the path and name of the restored SPFILE in it. In our case, the '*initDBTEST.ora*' would contain only the following statement:

```
SPFILE=C:\spdbtest01.ora
```
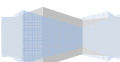
Next, we need to start the instance in NOMOUNT state using the newly created PFILE (referencing the SPFILE).

```
RMAN> startup force pfile='C:\initDBTEST.ora' nomount

Oracle instance started

Total System Global Area    377487360 bytes

Fixed Size                    1249080 bytes
Variable Size               113246408 bytes
Database Buffers            255852544 bytes
Redo Buffers                  7139328 bytes
```

b. <u>Restoring the SPFILE from the *autobackup* to the default location:</u>

We can restore the SPFILE to the default location ("*<ORACLE_HOME>/database*" in Windows) by using any one of the below 2 methods:

```
RMAN> restore spfile from autobackup;

Starting restore at 08-APR-10
using channel ORA_DISK_1

channel ORA_DISK_1: looking for autobackup on day: 20100408
channel ORA_DISK_1: autobackup found: \\testdb\dbtest\c-1106578690-20100408-
00
channel ORA_DISK_1: SPFILE restore from autobackup complete
Finished restore at 08-APR-10
```

OR,

```
RMAN> restore spfile from "\\testdb\dbtest\c-1106578690-20100408-00";

Starting restore at 08-APR-10
using channel ORA_DISK_1

channel ORA_DISK_1: autobackup found: \\testdb\dbtest\c-1106578690-20100408-
00
channel ORA_DISK_1: SPFILE restore from autobackup complete
Finished restore at 08-APR-10
```

The SPFILE has been restored in the DATABASE directory of the default home location. Oracle will now automatically look for an SPFILE in this location when you try to start the instance

```
RMAN> shutdown immediate
Oracle instance shut down
```
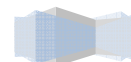
Start the instance in NOMOUNT state. Here, we do not need to reference any PFILE or SPFILE, which makes the task a lot simpler.

```
RMAN> startup force nomount;

Oracle instance started

Total System Global Area    377487360 bytes

Fixed Size                    1249080 bytes
Variable Size               113246408 bytes
Database Buffers            255852544 bytes
Redo Buffers                  7139328 bytes
```

6

4. Restore the *controlfile* from *autobackup*, and MOUNT the database

Once the database is restarted in NOMOUNT state, we need to restore the *controlfiles* so as to restore and recover the database using the RMAN Backups.

Again here, we can restore the *controlfiles* by using any one of the below 2 methods:

```
RMAN> restore controlfile from autobackup;

Starting restore at 08-APR-10
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=156 devtype=DISK

recovery area destination: C:\oracle\flash_recovery_area
database name (or database unique name) used for search: DBTEST
channel ORA_DISK_1: no autobackups found in the recovery area
channel ORA_DISK_1: looking for autobackup on day: 20100408
channel ORA_DISK_1: autobackup found: \\testdb\dbtest\c-1106578690-20100408-00
channel ORA_DISK_1: control file restore from autobackup complete
output filename=C:\ORACLE\ORADATA\DBTEST\CONTROL01.CTL
output filename=C:\ORACLE\ORADATA\DBTEST\CONTROL02.CTL
output filename=C:\ORACLE\ORADATA\DBTEST\CONTROL03.CTL
Finished restore at 08-APR-10
```

OR,

```
RMAN> restore controlfile from "\\testdb\dbtest\c-1106578690-20100408-00";

Starting restore at 08-APR-10
using channel ORA_DISK_1

channel ORA_DISK_1: restoring control file
channel ORA_DISK_1: restore complete, elapsed time: 00:00:10
output filename=C:\ORACLE\ORADATA\DBTEST\CONTROL01.CTL
output filename=C:\ORACLE\ORADATA\DBTEST\CONTROL02.CTL
output filename=C:\ORACLE\ORADATA\DBTEST\CONTROL03.CTL
Finished restore at 08-APR-10
```

5. Restore the Database from RMAN backup files

With the restored *controlfiles*, we are now in a position to restore the Database. We need to mount the Instance first and then restore the database files from the backup.

```
RMAN> alter database mount;

database mounted

RMAN> restore database;

Starting restore at 08-APR-10
Starting implicit crosscheck backup at 08-APR-10
```

Database Disaster Recovery using only RMAN Backups

Zaffer Khan
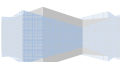
```
allocated channel: ORA_DISK_1
channel ORA_DISK_1: sid=156 devtype=DISK
Crosschecked 4 objects
Finished implicit crosscheck backup at 08-APR-10

Starting implicit crosscheck copy at 08-APR-10
using channel ORA_DISK_1
Finished implicit crosscheck copy at 08-APR-10

searching for all files in the recovery area
cataloging files...
no files cataloged

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 C:\ORACLE\ORADATA\DBTEST\SYSTEM01.DBF
restoring datafile 00002 to C:\ORACLE\ORADATA\DBTEST\UNDOTBS01.DBF
restoring datafile 00003 to C:\ORACLE\ORADATA\DBTEST\SYSAUX01.DBF
restoring datafile 00004 to C:\ORACLE\ORADATA\DBTEST\USERS01.DBF
restoring datafile 00005 to C:\ORACLE\ORADATA\DBTEST\TOOLS01.DBF
restoring datafile 00006 to C:\ORACLE\ORADATA\DBTEST\ORT_TBSP01.DBF
restoring datafile 00007 to C:\ORACLE\ORADATA\DBTEST\OR_TBSP01.DBF
restoring datafile 00008 to C:\ORACLE\ORADATA\DBTEST\OR_TBSP02.DBF
restoring datafile 00009 to C:\ORACLE\ORADATA\DBTEST\OR_TBSP03.DBF
restoring datafile 00010 to C:\ORACLE\ORADATA\DBTEST\OR_TBSP04.DBF
restoring datafile 00011 to C:\ORACLE\ORADATA\DBTEST\ORT_INDX01.DBF
restoring datafile 00012 to C:\ORACLE\ORADATA\DBTEST\ORT_INDX02.DBF
restoring datafile 00013 to C:\ORACLE\ORADATA\DBTEST\OR_INDX01.DBF
restoring datafile 00014 to C:\ORACLE\ORADATA\DBTEST\OR_INDX02.DBF
restoring datafile 00015 to C:\ORACLE\ORADATA\DBTEST\OR_INDX03.DBF
restoring datafile 00016 to C:\ORACLE\ORADATA\DBTEST\OR_TEST01.DBF
restoring datafile 00017 to C:\ORACLE\ORADATA\DBTEST\PY_TBSP01.DBF
restoring datafile 00018 to C:\ORACLE\ORADATA\DBTEST\IT_INDX01.DBF
restoring datafile 00019 to C:\ORACLE\ORADATA\DBTEST\IT_TBSP01.DBF
restoring datafile 00020 to C:\ORACLE\ORADATA\DBTEST\PY_TBSP02.DBF
restoring datafile 00021 to C:\ORACLE\ORADATA\DBTEST\PY_INDX01.DBF
channel ORA_DISK_1: reading from backup piece
\\TESTDB\DBTEST\DBTEST_04LAJPNP_1_1_20100408
channel ORA_DISK_1: restored backup piece 1
piece handle=\\TESTDB\DBTEST\DBTEST_04LAJPNP_1_1_20100408
tag=TAG20100408T110945

channel ORA_DISK_1: restore complete, elapsed time: 00:31:38
Finished restore at 08-APR-10
```
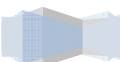
6. Recover the Database from RMAN backup files, and OPEN the database with RESETLOGS

Once restoration of the database is complete, we need to recover the database by applying the *archivelogs* from the backup.

```
RMAN> recover database;

Starting recover at 08-APR-10
using channel ORA_DISK_1

starting media recovery

channel ORA_DISK_1: starting archive log restore to default destination
channel ORA_DISK_1: restoring archive log
archive log thread=1 sequence=32
channel ORA_DISK_1: reading from backup piece
\\TESTDB\DBTEST\DBTEST_05LAJR4F_1_1_20100408
channel ORA_DISK_1: restored backup piece 1
piece handle=\\TESTDB\DBTEST\DBTEST_05LAJR4F_1_1_20100408
tag=TAG20100408T113335

channel ORA_DISK_1: restore complete, elapsed time: 00:00:04
archive log
filename=C:\ORACLE\FLASH_RECOVERY_AREA\DBTEST\ARCHIVELOG\2010_04_08\O1_MF_1_32_
5VVJG77X_.ARC thread=1 sequence=32
channel default: deleting archive log(s)
archive log
filename=C:\ORACLE\FLASH_RECOVERY_AREA\DBTEST\ARCHIVELOG\2010_04_08\O1_MF_1_32_
5VVJG77X_.ARC recid=33 stamp=715790711
unable to find archive log
archive log thread=1 sequence=33
RMAN-00571: ===========================================================
RMAN-00569: =============== ERROR MESSAGE STACK FOLLOWS ===============
RMAN-00571: ===========================================================
RMAN-03002: failure of recover command at 04/08/2010 14:45:21
RMAN-06054: media recovery requesting unknown log: thread 1 seq 33 lowscn
27801294
```

Don't panic when you see the above Error Message. You just need to open the database with RESETLOGS option, as there are no more *archivelogs* to apply.

```
RMAN> alter database open resetlogs;

database opened
```

The Database Disaster Recovery using RMAN is now complete.

NOTE: If it's a Production Database Recovery, take a Full Backup before you make the database available for the end users.