HP Data Protector Software

HP Data Protector 6.0 and Oracle 10g RAC configuration best practices

Table of contents

Executive summary

This white paper provides guidance and best practices for performing backup and restore of Oracle 10g Real Application Clusters using HP Data Protector Software.

Since the release of Oracle 9i Real Application Clusters, there has always been uncertainty about what needs to be backed up and how to backup the RAC database. We will try to address these questions throughout this paper.

This paper is not:

- Intended to replace the HP Software Data Protector installation and integration guides with Oracle
- A performance whitepaper on backup and recovery of Oracle Real Application Clusters
- A step-by-step installation and configuration guide

Overview

HP Data Protector Software Oracle integration enables customers to perform online and offline backups of an Oracle database by using the Oracle Recovery Manager and acting as a Media Management Layer. In the past, the integration with an Oracle Real Application Cluster environment was performed using just one of the instances of the cluster.

On the other side, Oracle's Workload Management in a Cluster environment managed the workload distribution, providing optimal performance. With Oracle 10g, the concept of Services was introduced. It enables to group database workloads and distribute them over specific instances.

Integrating HP Software Data Protector with Oracle 10g Real Application Clusters, helps you benefit from using the workload management functionality by distributing the backup and restore load over more than one instance in the cluster.

Target audience

The target audience for this whitepaper are customers, system integrators and solution architects. Basic knowledge of Data Protector and Oracle 10g RAC is advisable to understand this white paper fully.

Review of test configuration

The following hardware configuration was used for the testing:

- 5 HP Integrity Server rx2620 running HP-UX 11.23
- 1 HP StorageWorks EVA5000
- 1 SAN Tape Library MSL5000 with 2 SDLT320 drives
- 2x 1000 Base-T per server

The following software configuration was used for the testing:

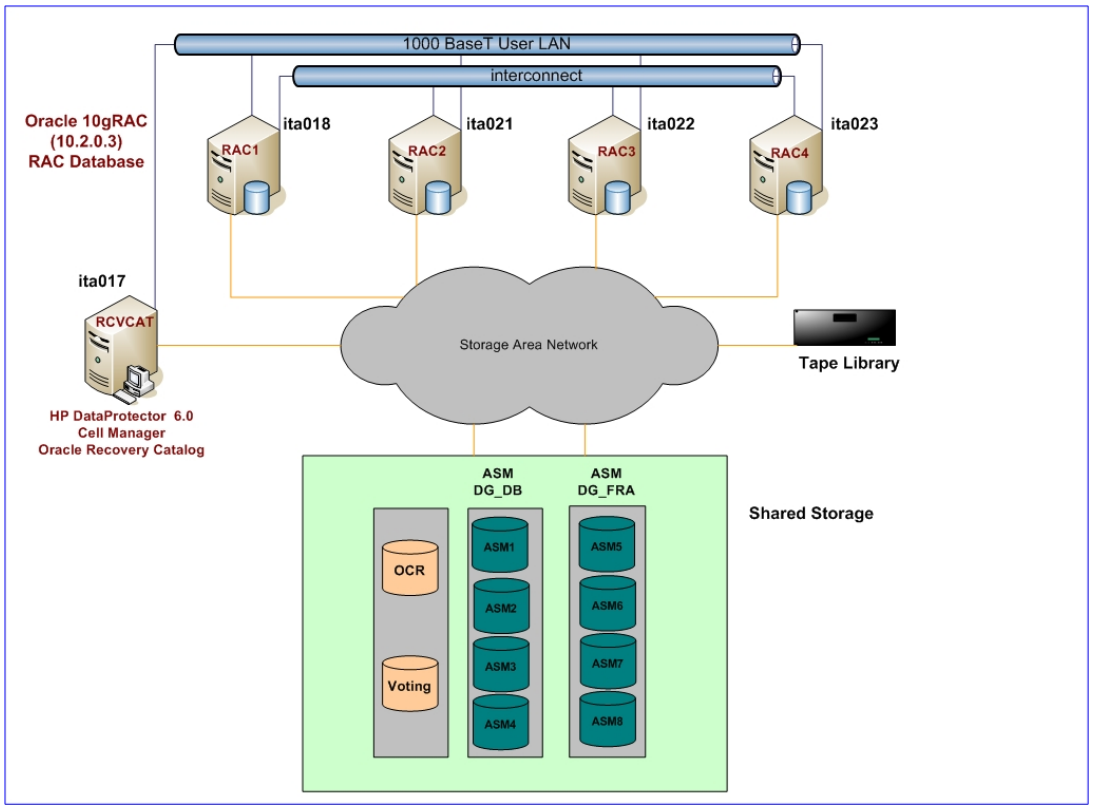
- HP Data Protector 6.0 Cell Manager running on HP-UX
- Oracle 10g RAC version 10.2.0.3 running on 4 nodes using Oracle clusterware
- Oracle 10g version 10.2.0.3 for the Oracle Recovery Catalog (RCVCAT)

The Oracle10g RAC database (RAC) was configured using 2 ASM disk groups:

- Disk Group DG_DB (database): 4 EVA LUN (Vdisk), each with 100 GB
- Disk Group DG_FRA (Flash Recovery Area): 4 EVA LUN (Vdisk), each with 25 GB

The following figure shows the environment described above:

Figure 1. Hardware architecture

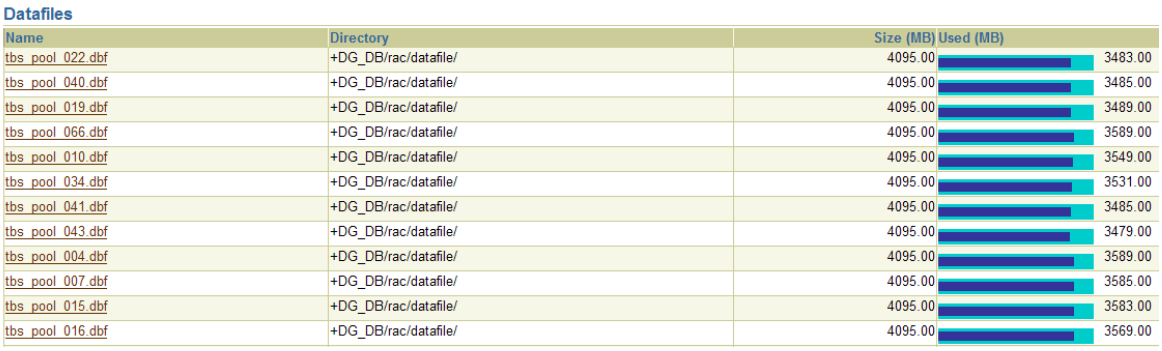


The database had a size of 300GB and was created using the AXWORK suite. This suite created a new tablespace called POOL, with 66 datafiles, each 4095MB in size. The following representation shows the distribution of the datafiles. Note that they are all of equal size:

```
FILE_NAME                                                    MB
---------------------------------------------------- ----------
+DG_DB/rac/datafile/tbs_pool_001.dbf                       4095
+DG_DB/rac/datafile/tbs_pool_002.dbf                       4095
+DG_DB/rac/datafile/tbs_pool_003.dbf                       4095
+DG_DB/rac/datafile/tbs_pool_004.dbf                       4095
+DG_DB/rac/datafile/tbs_pool_005.dbf                       4095
+DG_DB/rac/datafile/tbs_pool_006.dbf                       4095
+DG_DB/rac/datafile/tbs_pool_007.dbf                       4095
+DG_DB/rac/datafile/tbs_pool_008.dbf                       4095

+DG_DB/rac/datafile/tbs_pool_064.dbf                       4095
+DG_DB/rac/datafile/tbs_pool_065.dbf                       4095
+DG_DB/rac/datafile/tbs_pool_066.dbf                       4095
```

The following screenshot shows the graphical display shown by the Oracle Enterprise Manager (Database Console):

Figure 2. Oracle Enterprise Manager: POOL datafiles view



Datafiles

Name	Directory	Size (MB)	Used (MB)
tbs_pool_022.dbf	+DG_DB/rac/datafile/	4095.00	3483.00
tbs_pool_040.dbf	+DG_DB/rac/datafile/	4095.00	3485.00
tbs_pool_019.dbf	+DG_DB/rac/datafile/	4095.00	3489.00
tbs_pool_066.dbf	+DG_DB/rac/datafile/	4095.00	3589.00
tbs_pool_010.dbf	+DG_DB/rac/datafile/	4095.00	3549.00
tbs_pool_034.dbf	+DG_DB/rac/datafile/	4095.00	3531.00
tbs_pool_041.dbf	+DG_DB/rac/datafile/	4095.00	3485.00
tbs_pool_043.dbf	+DG_DB/rac/datafile/	4095.00	3479.00
tbs_pool_004.dbf	+DG_DB/rac/datafile/	4095.00	3589.00
tbs_pool_007.dbf	+DG_DB/rac/datafile/	4095.00	3585.00
tbs_pool_015.dbf	+DG_DB/rac/datafile/	4095.00	3583.00
tbs_pool_016.dbf	+DG_DB/rac/datafile/	4095.00	3569.00

Two extra LUN were allocated on the shared storage for the Oracle Cluster Registry (OCR) and Oracle voting disks.

Below, a list of CRS resources defined in our cluster and their status:

```
oracle@ita018[RAC1]:/opt/oracle/product/CRS/bin$ ./crsstat.sh
HA Resource                                   Target     State
-----------                                   ------     -----
ora.RAC.BACKUP.RAC1.srv                       ONLINE     ONLINE on ita018
ora.RAC.BACKUP.RAC2.srv                       ONLINE     ONLINE on ita021
ora.RAC.BACKUP.RAC3.srv                       ONLINE     ONLINE on ita022
ora.RAC.BACKUP.RAC4.srv                       ONLINE     ONLINE on ita023
ora.RAC.BACKUP.cs                             ONLINE     ONLINE on ita018
ora.RAC.MSL5000.RAC1.srv                      ONLINE     ONLINE on ita018
ora.RAC.MSL5000.RAC2.srv                      ONLINE     ONLINE on ita021
ora.RAC.MSL5000.cs                            ONLINE     ONLINE on ita018
ora.RAC.RAC1.inst                             ONLINE     ONLINE on ita018
ora.RAC.RAC2.inst                             ONLINE     ONLINE on ita021
ora.RAC.RAC3.inst                             ONLINE     ONLINE on ita022
ora.RAC.RAC4.inst                             ONLINE     ONLINE on ita023
ora.RAC.db                                    ONLINE     ONLINE on ita021
ora.ita018.ASM1.asm                           ONLINE     ONLINE on ita018
ora.ita018.LISTENER_ITA018.lsnr               ONLINE     ONLINE on ita018
ora.ita018.gsd                                ONLINE     ONLINE on ita018
ora.ita018.ons                                ONLINE     ONLINE on ita018
ora.ita018.vip                                ONLINE     ONLINE on ita018
ora.ita021.ASM2.asm                           ONLINE     ONLINE on ita021
ora.ita021.LISTENER_ITA021.lsnr               ONLINE     ONLINE on ita021
ora.ita021.gsd                                ONLINE     ONLINE on ita021
ora.ita021.ons                                ONLINE     ONLINE on ita021
ora.ita021.vip                                ONLINE     ONLINE on ita021
ora.ita022.ASM3.asm                           ONLINE     ONLINE on ita022
ora.ita022.LISTENER_ITA022.lsnr               ONLINE     ONLINE on ita022
ora.ita022.gsd                                ONLINE     ONLINE on ita022
ora.ita022.ons                                ONLINE     ONLINE on ita022
ora.ita022.vip                                ONLINE     ONLINE on ita022
ora.ita023.ASM4.asm                           ONLINE     ONLINE on ita023
ora.ita023.LISTENER_ITA023.lsnr               ONLINE     ONLINE on ita023
ora.ita023.gsd                                ONLINE     ONLINE on ita023
ora.ita023.ons                                ONLINE     ONLINE on ita023
ora.ita023.vip                                ONLINE     ONLINE on ita023
```

10gRAC configurations on hp-ux

Starting with Oracle10g RAC, there are different configurations possible for HP-UX; essentially, the customer needs to decide about which clustering solution will be deployed:

- Service Guard Extension for RAC + Oracle Clusterware
- Oracle Clusterware only

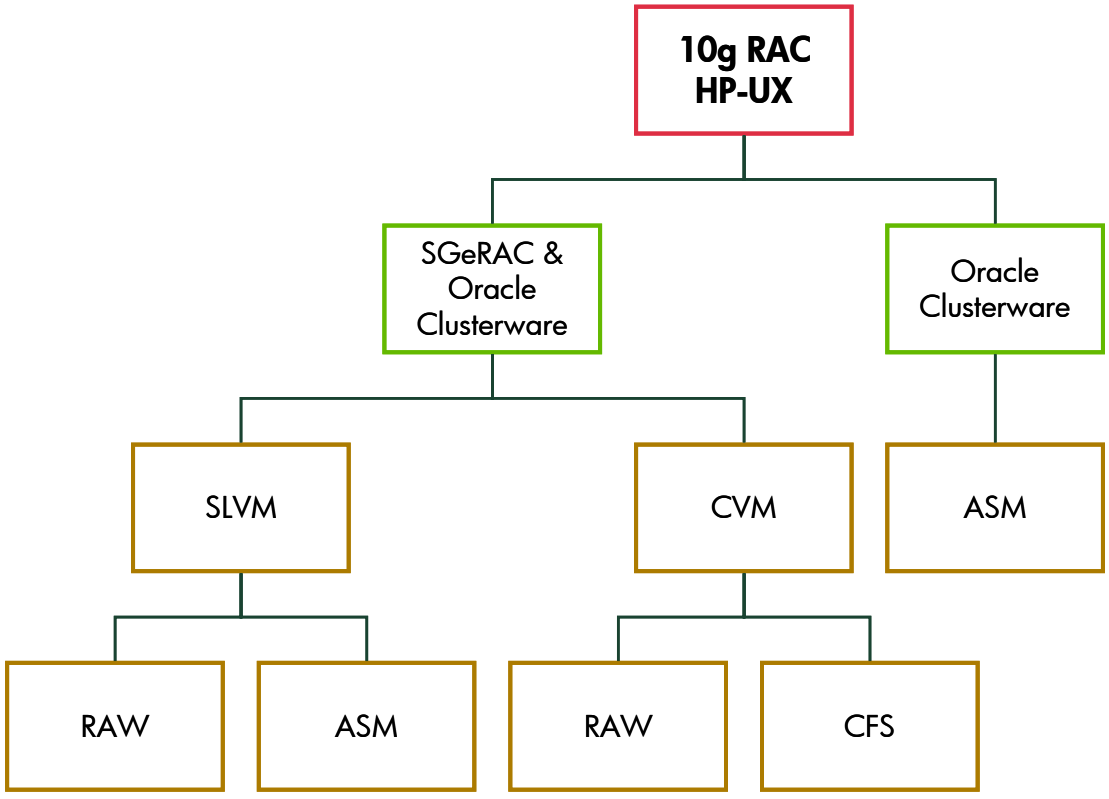
Based on the storage volume manager choice, there are three main alternatives:

- Oracle Automatic Storage Management (ASM)
- HP Cluster File system (CFS)
- RAW devices

Important Note: RAW devices do NOT provide a shared location for storing archive logs (archived logs cannot be located on RAW). In this case, an extra approach has to be addressed to have all archived logs accessible by all RAC instances. This is needed for backup and recovery purposes. Two possible approaches are to:

- Define an archivelog destination local on each node (i.e. /arch1 on RAC1, /arch2 on RAC2) and export it and cross mount it on every system. In case one of the nodes is down, the archivelog directory is also not available.
- Define a shared archivelog destination for all RAC nodes on an NFS share and use a clustering solution as HP Service Guard to guarantee its availability.

Figure 3. Oracle 10gRAC on hp-ux supported configurations



Oracle Virtual IP Address

Since Oracle 10g, clients use a Virtual IP Address (VIP) to connect to the database. The VIP is a static IP which is defined in the Oracle Clusterware installation.

When a RAC node fails, its associated VIP will failover automatically to one of the remaining nodes. The new node hosting the failed VIP will associate a new MAC address for this VIP and will make it known outside.

When clients are not using a VIP for their connections, in case of node failure, they run in a TCP timeout. For availability and failover purposes, we have defined a VIP on each RAC node (ita018-vip, ita021-vip, ita022-vip and ita023-vip). We will use the VIP to configure the integration, thus providing Failover capabilities.

Oracle Services to manage workloads

Applications using an RAC database need to have their workload managed across the entire cluster. For this purpose, Oracle introduced the Workload Management framework. Based on the use of Services, it presents the application using the cluster an interface for managing their load in a very simple way.

Oracle Services allow breaking down workloads in a manageable way, based on Service Level Agreements, High Availability needs, or business needs and route them to the optimal instances assigned. It is recommended to group load with the same service level. Load balancing among the available instances is provided by Oracle Net Services.

When defining a new service, we can specify on which RAC instances the service should run on:

- **Preferred:** service should run on this instance
- **Available:** service should run on this instance if a preferred fails
- **Not Used:** the service should not use this instance

Transparent Application Failover (TAF) enables Oracle Net to failover to a different listener. Based on the TAF method, the services can be defined as:

- **None:**
- **Basic:** connection to failover server will be established at failover time
- **Preconnect:** pre-established connections are allocated to provide faster failover

Oracle Services definition

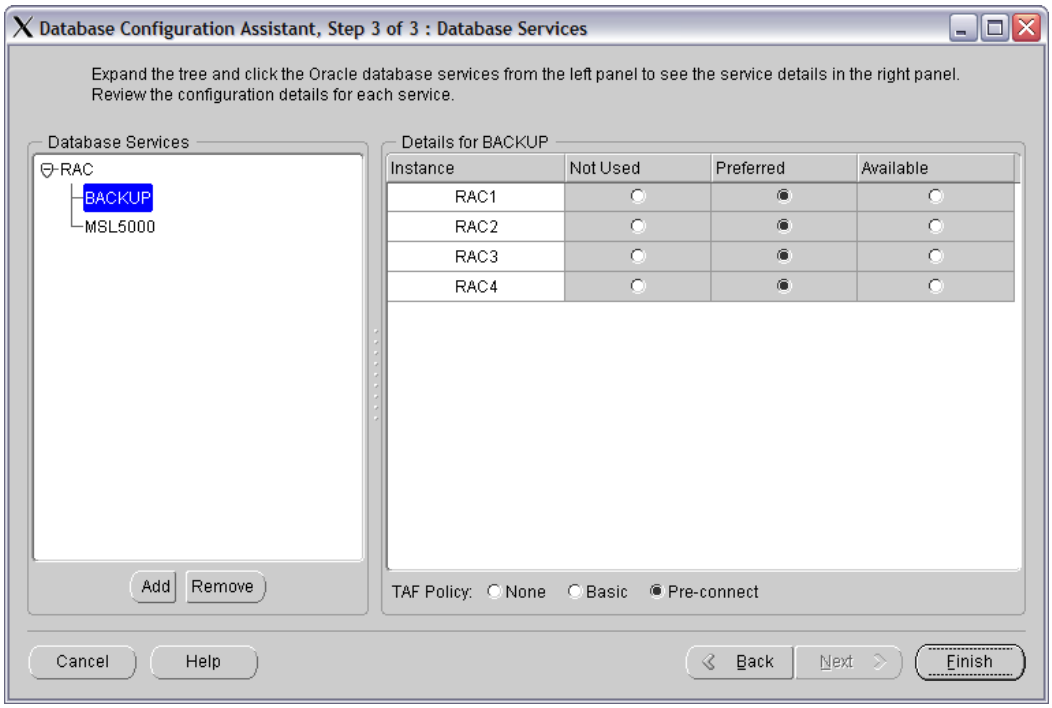
To define a new service, you can use the command line interface, srvctl, or the database configuration assistant, dbca:

```
$ srvctl add service –d RAC –s BACKUP –r RAC1,RAC2,RAC3,RAC4 –P PRECONNECT
```

In the above example, we add a new service called BACKUP in the database RAC. With the option –r we specified the list of preferred instances and the option –P specifies the TAF policy.

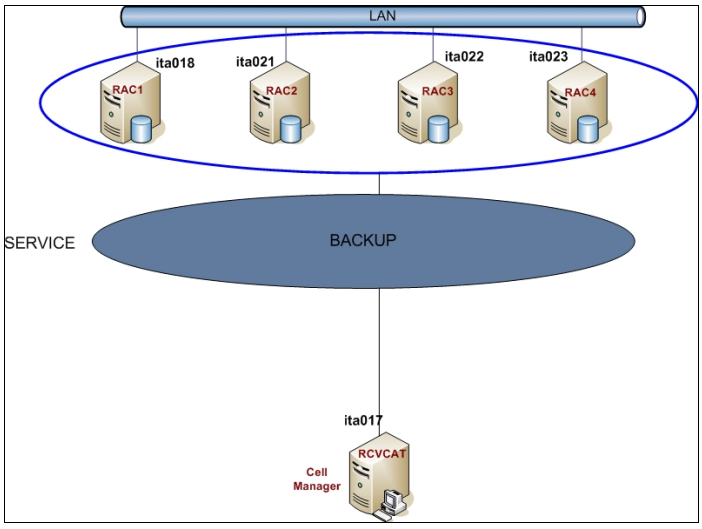
The same can be achieved using the Database Configuration Assistant (dbca) GUI:

Figure 4. Database Configuration Assistant: Database Service BACKUP



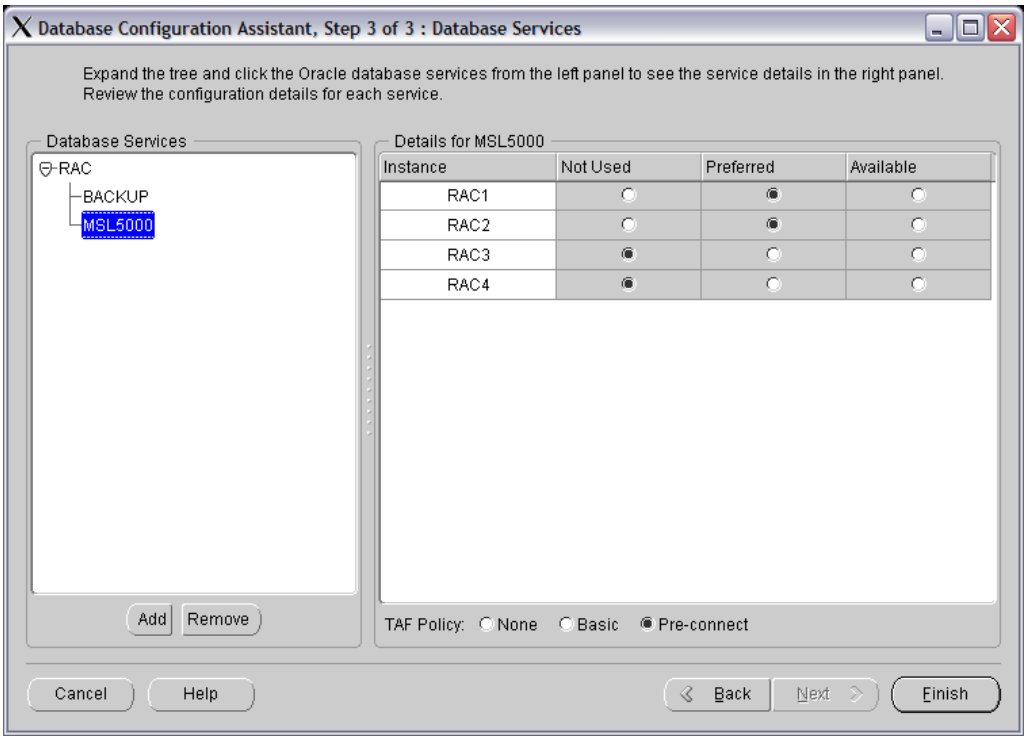
The following figure is a graphical representation of the BACKUP service, which expands over all available instances:

Figure 5. Oracle Service BACKUP



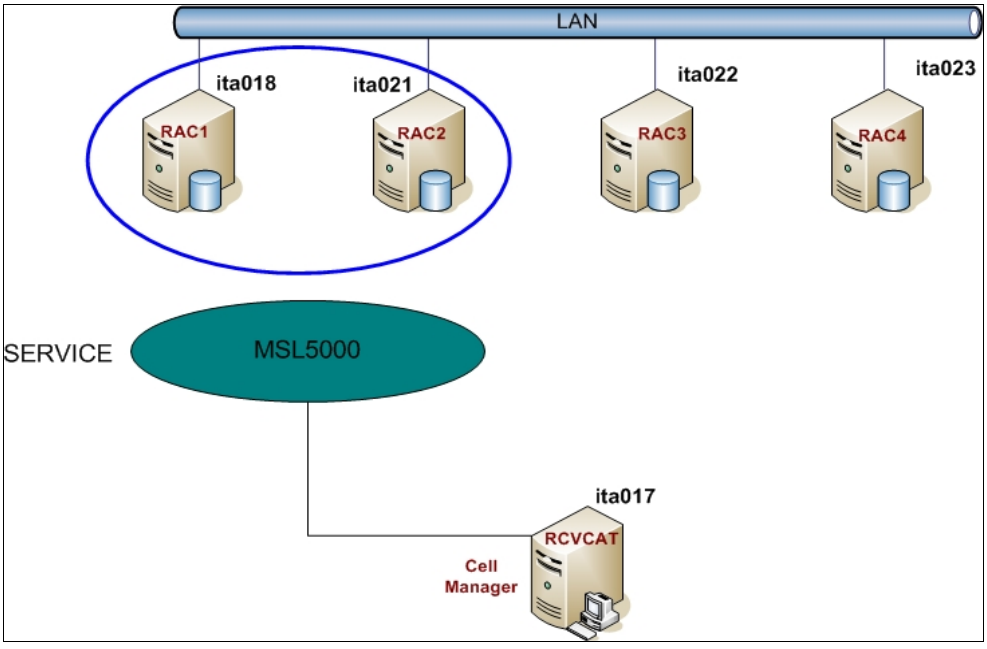
We define also a service called MSL5000, allowed to run on two of the four instances; we set two instances to Preferred and two instances to Not Used.

Figure 6. Database Configuration Assistant: Database Service MSL5000



For the Oracle Service MSL5000, we can see below how only instances RAC1 and RAC2 are available for this service:

Figure 7. Oracle Service MSL5000



The configuration can be verified using the following command:

```
oracle@ita018[RAC1]:/home/oracle$ srvctl status service -d RAC -s BACKUP,MSL5000
Service BACKUP is running on instance(s) RAC1, RAC4, RAC3, RAC2
Service MSL5000 is running on instance(s) RAC1, RAC2
```

Oracle Online Backup Configuration

This section discusses topics such as Backup Session Failover and Backup Load Balancing.

In a large customer environment, hundreds of Oracle Databases are backed up daily. Backup sessions have to run independently from the status of some of the RAC instances. While it is critical to have regular backups for the availability of the data, it is also crucial to backup the archive logs on a daily basis to avoid the archive log destination to fill up

The idea of Session Failover is to be able to have the backup session running although the configured instance is not available. Session failover applies only to the start of the backup session and not to an already running session.

Backup Load Balancing distributes the Backup Load over more than one RAC node. As a result, more than one node will read the datafiles and write the data to tape. This is also valid for a Restore Session.

Configuration Guidelines

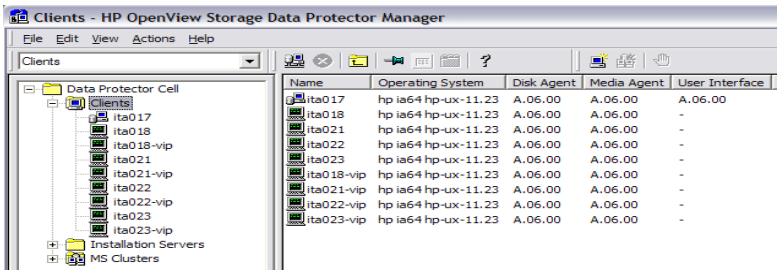
The following is a list of the main tasks needed for the Oracle integration. It is only for reference and does not replace the Data Protector Oracle online integration manual.

1. Install the Data Protector Oracle agent on each and every RAC Node
2. Add a root account has to the Data Protector Admin User group in the Users configuration menu for every RAC Node and every virtual hostname.[1] (1)
3. Add the oracle account to the Data Protector Admin User group in the Users configuration menu for every RAC Node and every virtual hostname.
4. Link the Oracle SBT library (located under $ORACLE_HOME/lib) with the Data Protector SBT library on every node as oracle user. It can be done online (the link process is described in the Data Protector Oracle integration documentation).
5. Verity that the Oracle SQLNET connectivity works between each node and the RMAN recovery catalog
6. Optional: register database RAC in the recovery catalog (this step is done through the Integration). The integration needs a database account with SYSDBA privileges. You can use the Oracle Database built-in SYS account or you may prefer to create a new account (i.e. dp_integration) and grant it SYSDBA (NOTE: the grant has to be done on each node of the cluster).
7. Import the Virtual IP Address (VIP) of every node in the RAC cluster; this will enable us to configure the virtual IP as the client when doing the Integration.

[1] A new enhancement has been developed, which doesn't require the root account but only the oracle account is required. Contact your support organization to receive the needed patch.

The following screenshot shows a list of the available clients in our cell server:

Figure 8. Data Protector Cell Clients



At this point, there are 4 main strategies to configure a backup specification of the Oracle RAC database

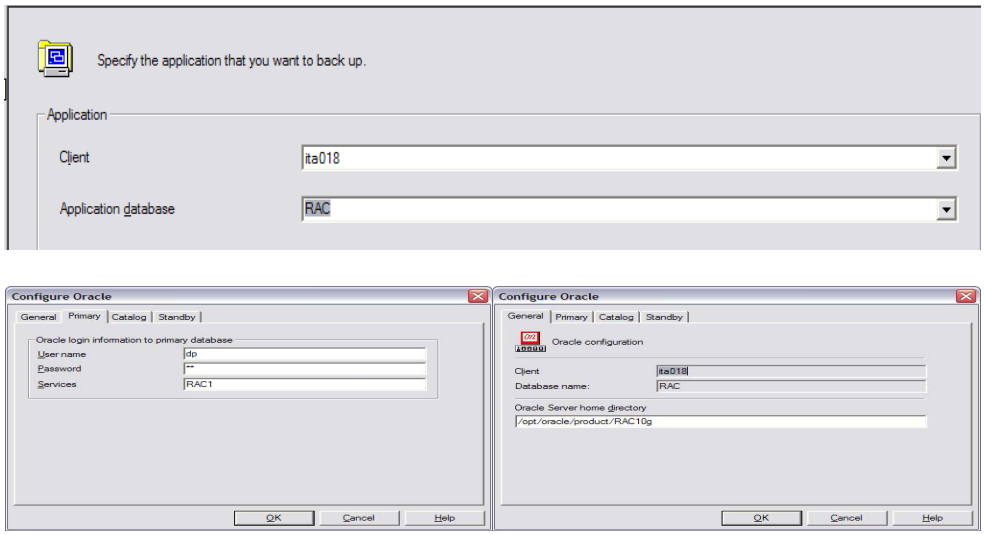
- Configure the backup using the node name and instance, i.e. ita018 and RAC1
- Configure the backup using a VIP and all instances, i.e. ita018-vip and RAC1,RAC2,RAC3,RAC4
- Configure the backup using a VIP and a service name, i.e. ita018-vip and BACKUP
- Configure the backup using a VIP and allocate the channels manually

We perform an Online Backup of the tablespace POOL for all following backups. As it has a large number of datafiles, we can observe how the distribution of datafiles over channels is achieved. The session report for each of these sessions can be found in the Appendix C.

Use the hostname and the Instance name to configure the backup

In this case we use the hostname ita018 as client and the instance name RAC1 to configure the integration. The backup will run exclusively on one node, i.e. ita018. If the instance RAC1 is not available, the backup will fail.

Figure 9. Oracle Integration configuration windows



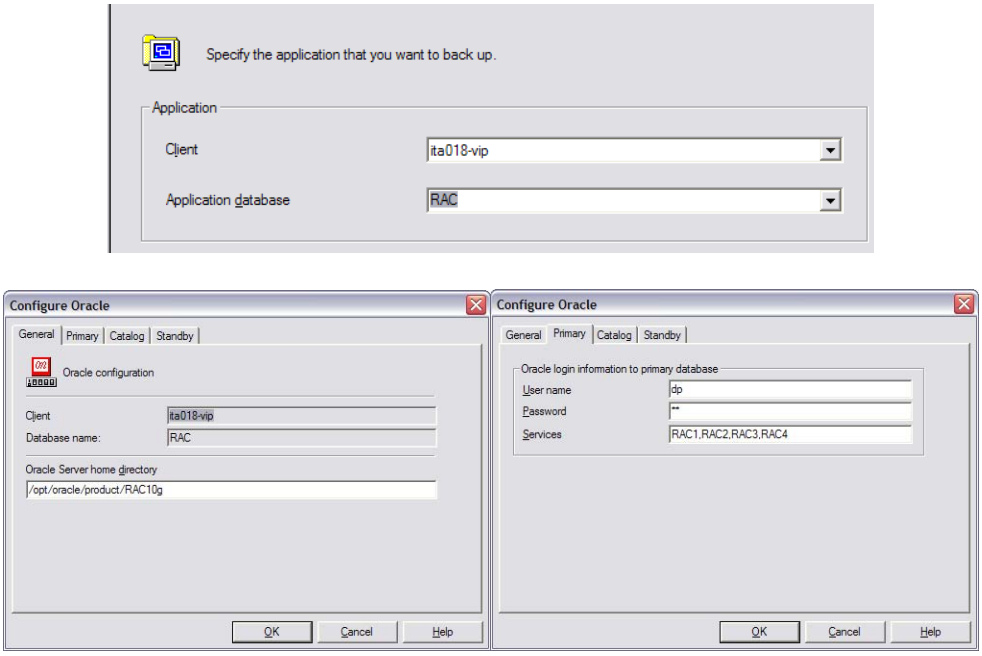
This configuration has the drawback of not providing any failover in case the configured instance is not available. If the session is scheduled and the instance is down, the backup session will fail.

In addition, only one node in the cluster is performing the backup.

Use a VIP and the Instance names to configure the backup

In this case, we need to use a VIP as a client to be able to provide failover. We provide the integration a list with the Instances (RAC1, RAC2, RAC3, and RAC4).

Figure 10. Oracle Integration configuration windows



Note that we configured all available RAC instances names as a service name; this provides no load balancing, but failover in case one instance is available. The Backup will run on just ONE instance, but the session will not fail as long as there is at least one instance of the list running.

First of all, Data Protector verifies the connection to all specified instances and performs the Backup on just one of them; in our case, all channels are allocated on the instance which is local to the VIP configured (in our case RAC1, running on ita018). Refer the Backup Session 2 (Appendix C) for more details.

As shown in the following output, node ita018 is currently listening to VIP ita018-vip:

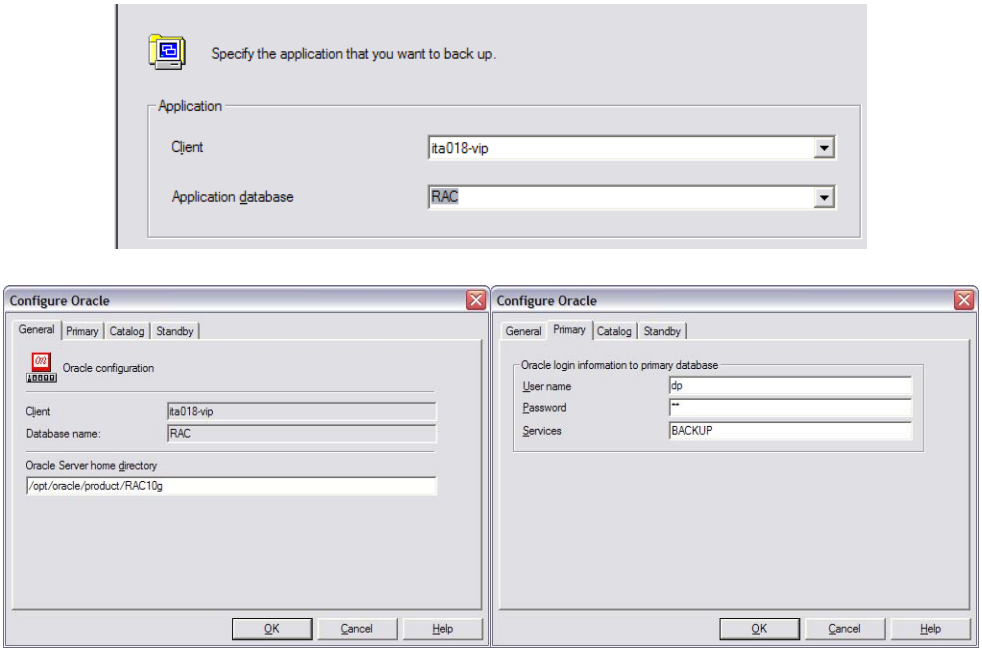
```
root@ita018:/.root# netstat -i
Name      Mtu  Network       Address         Ipkts   Ierrs Opkts   Oerrs Coll
lan1      1500 10.0.0.0      ita018-priv     21210969 0     17790264 0     0
lan0      1500 16.57.72.0    ita018          20450505 0     67265569 0     0
lo0       4136 loopback      localhost       34924594 0     34924590 0     0
lan0:804  1500 16.57.72.0    ita018-vip      118277099 0     325092  0     0
```

Use a VIP and a service name to configure the backup

We have defined two services for backup purposes previously. One of them, Service BACKUP, allocates the channels amongst all four RAC instances. The second one, Service MSL5000, will use only RAC Instances RAC1 and RAC2.

The Oracle integration uses a VIP as a client to guarantee failover.

Figure 11. Oracle Integration configuration windows



Node Affinity awareness: In a RAC environment, some nodes of the cluster have faster access to specific datafiles. RMAN is aware of the node affinity, and will try to assign specific datafiles to the channels of the nodes which have faster access to these datafiles.

In the Appendix C, you can find two session reports using this configuration:

- Backup using service BACKUP (Session 3)
- Backup using service MSL5000 (Session 4)

Use a VIP and allocate the channels to the instances manually

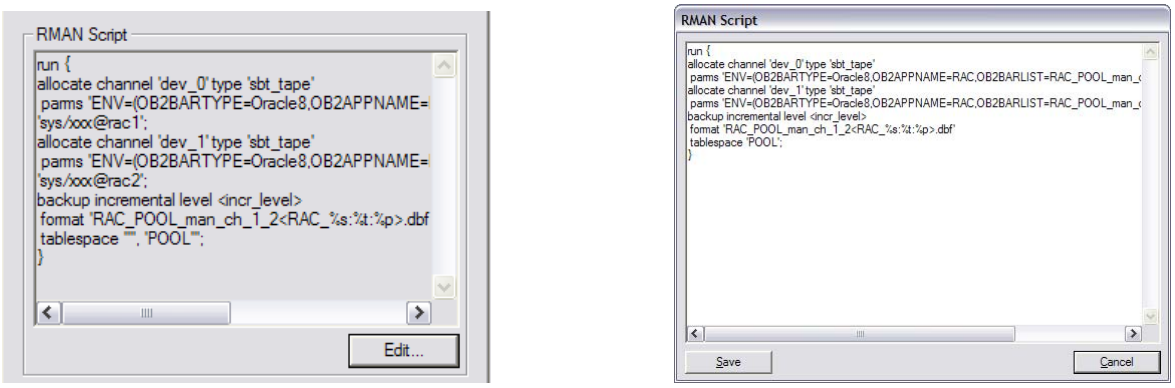
In the above examples, when we define a Service with Load Balancing (for instance BACKUP and MSL5000), we let Oracle take the decision about the number of channels which will be started per configured instance. As it can be seen in some session reports, it could happen that channel distribution is not optimal for the backup (that is, only two of the four instances have channels or one instance gets three out of four channels).

To overcome this situation, channels can also be allocated to specific instances manually. In this case, it is recommended that one channel is allocated per drive device. The optimal situation is to have the same number of drives as instances, thus allocating one channel per instance (each node has a dedicated drive). This approach has a downside: if one of the instances is not available at backup time, the backup session will fail (the channel cannot be allocated on that node).

In our environment, we allocate two channels, one on RAC1 and one on RAC2, writing to two tape drives. To allocate channels manually, we need to edit the RMAN script in the GUI. For this purpose, create a new backup specification; choose the drives for the backup with the right number of channels (tape concurrency), save it and then edit the RMAN script by adding the connection string at the end of the channel specification.

Although the backup specification could also be edited on the cell server, located in $OMNICONFIG/barlists/oracle8, using the GUI is the only supported method to edit a backup script.

Figure 12. Data Protector RMAN script edit window



The complete RMAN script is shown below:

```
run {
allocate channel 'dev_0' type 'sbt_tape'
 parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2)'
connect 'sys/xxx@rac1';
allocate channel 'dev_1' type 'sbt_tape'
 parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2)'
connect 'sys/xxx@rac2';
backup incremental level <incr_level>
 format 'RAC_POOL_man_ch_1_2<RAC_%s:%t:%p>.dbf'
 tablespace 'POOL';
}
```

As it can be seen, two channels will be allocated, one on instance RAC1 and one on instance RAC2. For each of these channels, we have to specify the connection string using the instance name (not a service).

In this scenario, if one of the instances is not available the channel allocation fails and the session will abort.

The backup session report is in the Appendix C under Session 5.

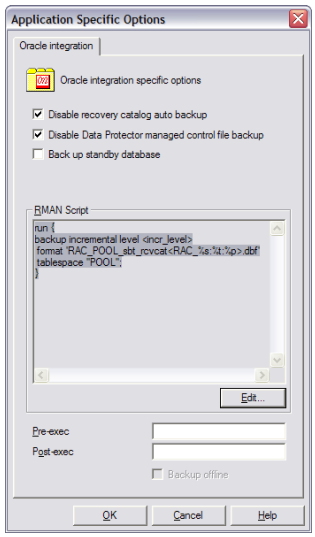
Storing the connection string in the Recovery Catalog

Security concerns may arise when storing the connection string in the backup specification (located in the Cell Manager File system); the channel allocation with the connection string can be defined and stored in the recovery catalog as a configuration parameter.

- Create a backup specification for your database. Once saved, edit it and remove the channel allocation parameters; they will be allocated by RMAN using the Recovery Catalog settings.

```
run {
backup incremental level <incr_level>
 format 'RAC_POOL_sbt_rcvcat<RAC_%s:%t:%p>.dbf'
 tablespace ''POOL'';
}
```

Figure 13. Data Protector RMAN script edit window



- Connect with RMAN to the instance and recovery catalog and specify the channel parallelism we want to use; in our case parallelism 2 (two tapes devices)

```
RMAN> CONFIGURE DEVICE TYPE 'SBT_TAPE' PARALLELISM 2 BACKUP TYPE TO BACKUPSET;
```

- In the recovery catalog, configure the channels with the connection string. We define two SBT channels, 1 connecting to instance RAC1 and 2 connecting to RAC2. For the ENV parameters:
  - OB2BARTYPE = refers to the Oracle integration: Oracle8
  - OB2APPNAME = Database Name (not instance): in our case RAC
  - OB2BARLIST = Name of the backup specification defined in the first step: RAC_POOL_sbt_rcvcat
  - CONNECT connection information for the instance

```
RMAN> CONFIGURE CHANNEL 1 DEVICE TYPE 'SBT_TAPE' PARMS
'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_sbt_rcvcat)' CONNECT
'sys/xxx@RAC1';

RMAN> CONFIGURE CHANNEL 2 DEVICE TYPE 'SBT_TAPE' PARMS
'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL
_sbt_rcvcat)' CONNECT 'sys/xxx@RAC2';
```

Below, the summary of Recovery Catalog saved parameters for the database RAC:

```
RMAN> show all;

RMAN configuration parameters are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
CONFIGURE BACKUP OPTIMIZATION OFF; # default
CONFIGURE DEFAULT DEVICE TYPE TO 'SBT_TAPE';
CONFIGURE CONTROLFILE AUTOBACKUP ON;
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '%F'; # default
```

```
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE SBT_TAPE TO '%F'; #
default
CONFIGURE DEVICE TYPE DISK PARALLELISM 4 BACKUP TYPE TO COMPRESSED BACKUPSET;
CONFIGURE DEVICE TYPE 'SBT_TAPE' PARALLELISM 2 BACKUP TYPE TO BACKUPSET;
CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE SBT_TAPE TO 1; # default
CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE SBT_TAPE TO 1; # default
CONFIGURE CHANNEL DEVICE TYPE DISK FORMAT   '+dg_fra/rac/backup/%U';
CONFIGURE CHANNEL 1 DEVICE TYPE 'SBT_TAPE' PARMS
'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_sbt_rcvcat)' CONNECT
'*';
CONFIGURE CHANNEL 2 DEVICE TYPE 'SBT_TAPE' PARMS
'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_sbt_rcvcat)' CONNECT
'*';
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
'/opt/oracle/product/RAC10g/dbs/snapcf_RAC1.f'; # default
```

As it can be seen, the connection string is hidden.

Backup Configuration Recommendations

Based on the observations during the testing and the results presented through this paper, this is a list of recommendations and best practices to follow when configuring Data Protector 6.0 with Oracle 10g RAC:

Service versus channel allocated manually

The following table summarizes all four alternatives discussed previously:

Configuration	Failover	Load Balancing	Performance
Hostname + Instance	NO	NO	One Instance is used for the backup
VIP + all instances	**YES**	NO	Any available instance is used for the backup
VIP + Service	**YES**	**YES**	Limited control over where channels are allocated. In general, unbalanced
VIP + manual channel	NO	**YES**	One channel on each host. Best results, Best load distribution

The above table suggests using an Oracle Service to configure the integration for better availability. Although the performance will not necessarily be the best, if you need to consider availability and performance, it is the better option.

On the other side, if performance is the key factor for your backups, due to device or time constraints, then allocating the channels manually will provide you the best throughput.

Use Concurrency of 1

In Data Protector the term Concurrency defines the number of channels allocated per tape device. For instance, if we set a concurrency of 2 on one tape drive, we will have 2 RMAN channels writing concurrently onto the tape; thus backup sets are written multiplexed to tape. This is not necessarily the best approach when it comes to restores.

Normally, it shouldn't be necessary to use more than one RMAN channel to stream the Tape Device.

When performing an Oracle restore, RMAN will only read with concurrency ONE from tape (just one channel at a time), independent from the concurrency used during the backup.

The recommendation is to use always concurrency of 1 (one RMAN channel per tape drive)

Set Maxopenfiles to 1

RMAN channel parameter MAXOPENFILES should be set to 1 in case you are using a Disk Array such as XP or EVA where the data is stripped over different physical disks. As a result, we guarantee that every RMAN channel reads just one file at a time (no file multiplexing). Please note this has to be set on each channel manually.

Tape block size should match RMAN output buffer size

The block size of your tape device will determine the I/O size of every write operation. In general, the larger the block size, the faster backup you achieve. On the other hand, the tape block size should match the Oracle write buffer size.

When an RMAN channel reads a datafile, each block is placed into an input buffer. After some block validation checks are performed, it is copied into an output buffer and then sent to the Backup Device.

As documented by Oracle, when setting the parameter MAXOPENFILES < 4, each buffer will be 1MB in size, with a total buffer size of 16MB (per channel), thus 16 Buffers per file. The buffer size used currently, can be verified in the v$BACKUP_ASYNC_IO view.

When writing to the SBT device (TAPE), Oracle allocates also 4 output buffers per channel, each buffer 256Kb, 1MB in total. The size of the write buffers can be adjusted with the BLKSIZE channel parameter.

While the default output buffer size of 256K may be adequate for most environments, it may be worth increasing the RMAN output buffer size and Tape block size to 1MB.

An example of an RMAN script with output buffer size set to 1MB and MAXOPENFILES to 1 is as follows; as channel parameters, they have to be set for every channel.

```
run {
allocate channel 'dev_0' type 'sbt_tape'
parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2)
,BLKSIZE=1048576' connect 'sys/xxx@rac2' maxopenfiles 1;
allocate channel 'dev_1' type 'sbt_tape'
parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2)
,BLKSIZE=1048576' connect 'sys/xxx@rac3' maxopenfiles 1;
backup incremental level <incr_level>
format 'RAC_POOL_man_ch_1_2<RAC_%s:%t:%p>.dbf'
tablespace 'POOL';
}
```

Use Asynchronous I/O if available

Asynchronous I/O on HP-UX is only available when using RAW devices. In other case, consider using the BACKUP_TAPE_IO_SLAVES (default FALSE) Oracle parameter to simulate asynchronous I/O to tape. Synchronous I/O has a performance disadvantage as every server process has perform a task at a time.

Use a Recovery Catalog

Use a recovery catalog to configure the Oracle integration as a centralized store for metadata and scripts. The recovery catalog can also be exported (RMAN user schema) by Data Protector.

For further Backup-tuning recommendations, review the Appendix.

SAN Devices with multipathing using a virtual host

Avoid having data being sent over LAN unnecessarily when working in a SAN environment. In the following two figures, we illustrate two possible scenarios describing SAN backup versus LAN backup in a RAC environment.

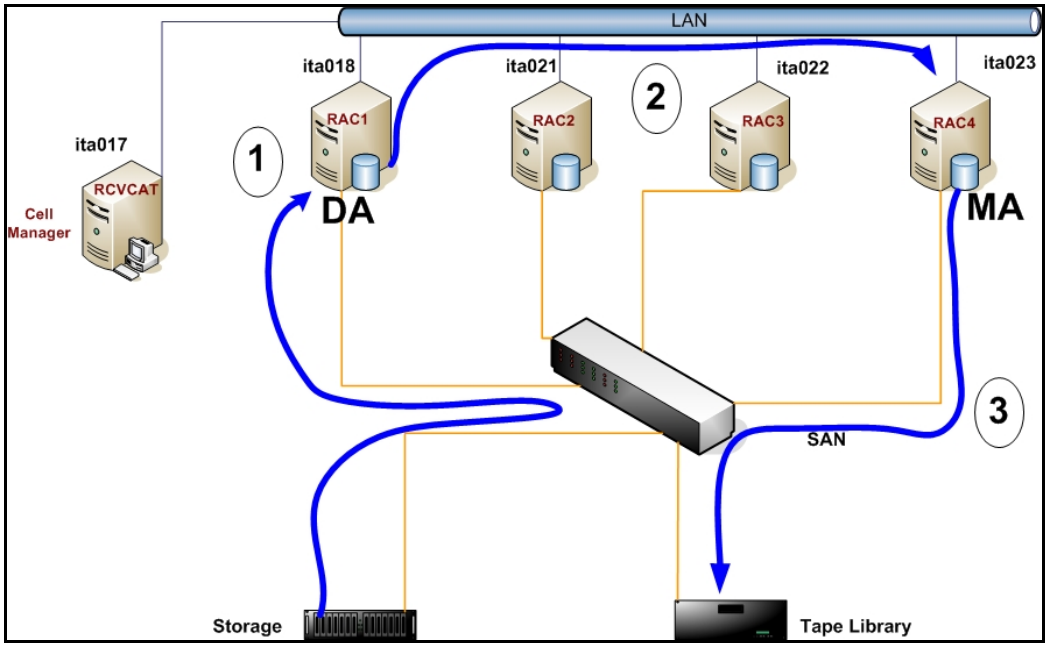
Note
Disk Agent: process which reads data from disk in a backup and writes data to disk in a restore. In an Oracle environment, instead of Disk Agents, Oracle processes are started.
Media Agent: in a backup it writes the backup to disk or tape, in a restore reads the data from tape or disk

Disk Agent and Media Agent are NOT allocated on the same host

1. A Disk Agent (DA) is started on host ita018 which reads data from the shared storage disks.
2. Once the data is on the host, it is sent to host ita023 (via LAN)
3. Ita023 starts a Media Agent (MA) to write the data to the SAN tape.

This is obviously extremely inefficient, as host ita018 should write directly to the SAN device.

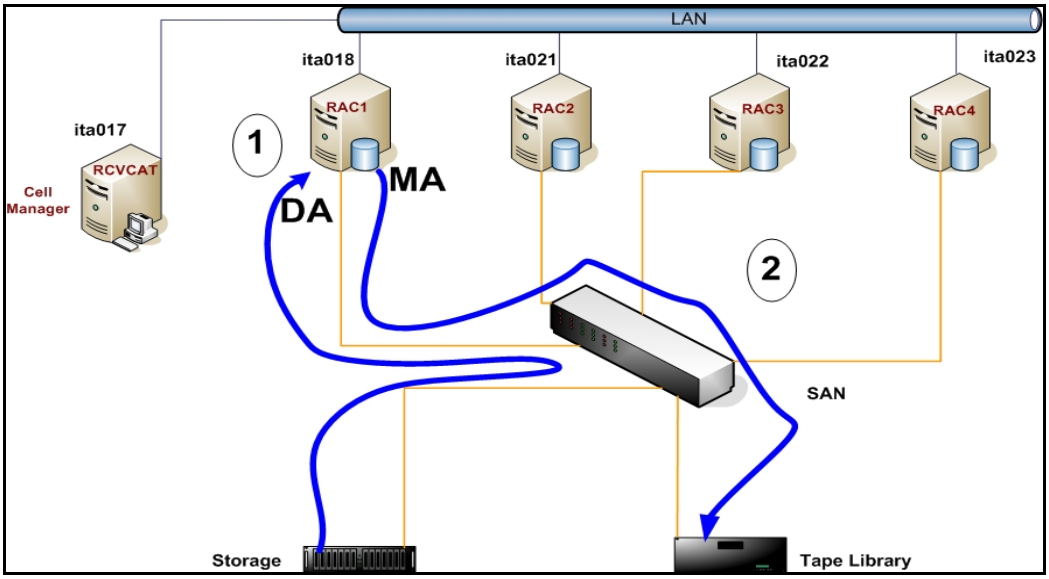
Figure 14. Backup data flow: DA sends data to MA over LAN



Disk Agent and Media Agent are allocated on the same host

1. As in the above example, a Disk Agent (DA) is started on host ita018 to read data from the shared devices.
2. A Media Agent is started on the same host to write the data to the SAN Library. In this setup, the data transfer between DA and MA is done using memory buffers (and not LAN)

Figure 15. Backup data flow: DA and MA exchange data using memory buffers

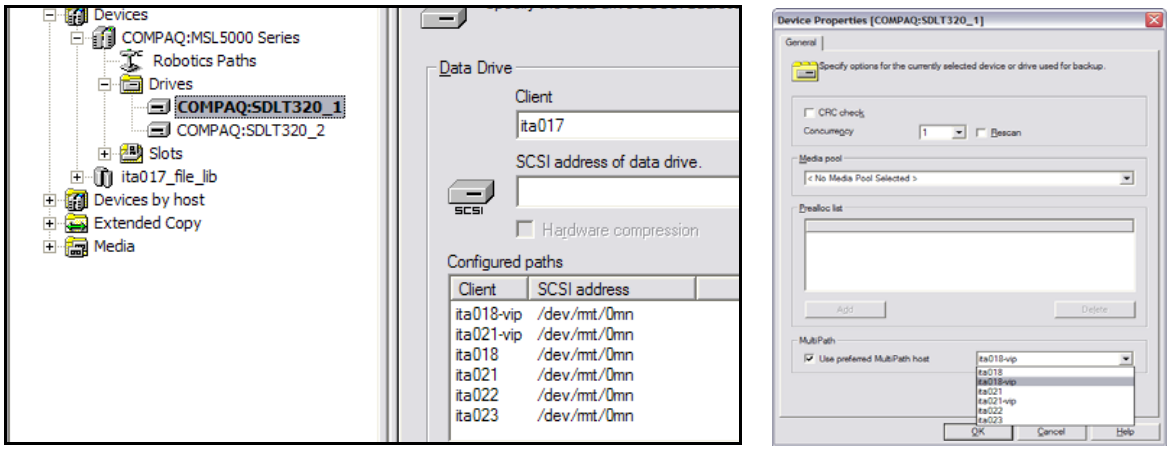


We have the possibility to define an Oracle VIP as client host while configuring SAN devices to be used with a 10g RAC database. As it can be seen in the following screenshot, the Drive SDLT320_1 has a device file on each Cluster member. Moreover, it is also configured with a VIP on Clients ita018 and ita021, thus providing failover capabilities at Tape level. If a tape device is configured for multipath with a virtual hostname (VIP), the SCSI address on each host should be the same.

For each device, we can specify the list of clients which may have access to the device; this is done in the Devices and Media Menu, within the Drive properties page. The configured paths provide multipath access to the tape: if the first path is not available, then the second path will be used and so on. Nevertheless, the first path of the list (if available) will always be used.

As it can be seen in the following figure (left), the drive SDLT320_1 has different configured paths. However, as long as the client address ita018-vip is available, it will be used for the backups, thus starting the Data Protector Media Agent. These are the Tape device global settings.

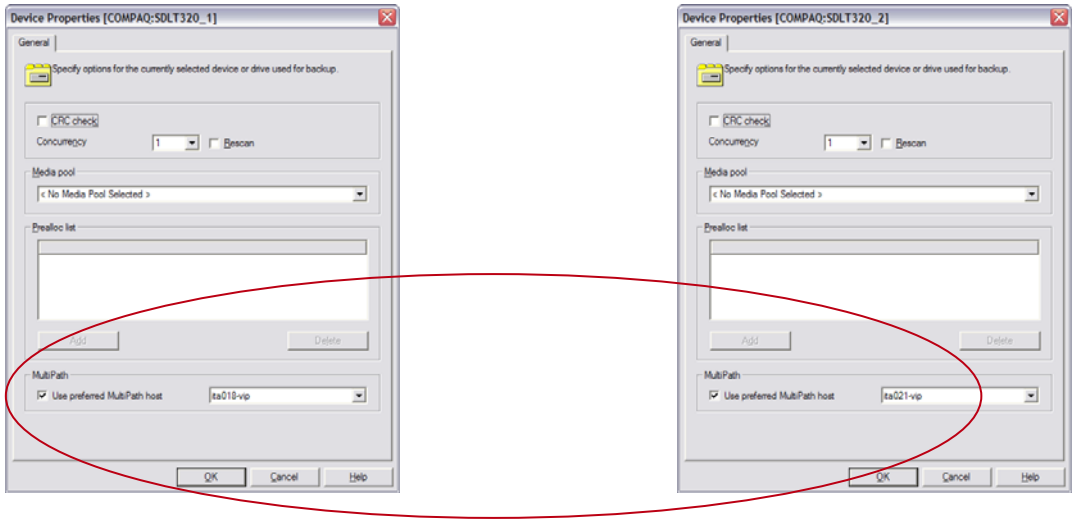
Figure 16. SAN devices configuration



For performance reasons, it is desirable to have the Media Agent started on the same host as the Disk Agent is started. For this purpose, these settings can be overwritten at the Backup specification level (right picture). In this case, we can specify which host should start the Media Agent, thus writing to the tape. This will only influence the current Backup specification.

Assume we allocate two RMAN channels, one on ita018 (RAC1) and one on ita021 (RAC2). We can specify in the backup that the device SDLT320_1 should use the ita018 path and device SDLT320_2 should use the ita021 path. This can be easily achieved in the device properties of the backup specification.

Figure 17. Backup specification: Using preferred Multipath host



Now, if we have a backup specification where two RMAN channels are allocated manually, one on RAC1 and one on RAC2, we can guarantee that:

1. The data read by the Disk Agent on RAC1 will be handed to the Media Agent on RAC1, which will write it to the device SDLT320_1
2. The data read by the Disk Agent on RAC2 will be handed to the Media Agent on RAC2, which will write it to the device SDLT320_2
3. No LAN backup will take place.

File System Backup: Oracle Base and Cluster configuration

After reviewing the online backup configuration of the RAC database, we need to focus on the backup of the Oracle software directories and the cluster configuration files. As these components are not addressed in the Online backup, we need to define an additional File System backup specification.

Important Note:

These files need to be backed up on a regular basis or when there are configuration changes.

Oracle Cluster Registry (OCR)

The Oracle Cluster Registry is a binary file which can be mirrored for redundancy. It holds the entire cluster related information, such as instances names, resources, etc.

The location of the OCR is /var/opt/oracle/ocr.loc:

```
oracle@ita018[RAC1]:/home/oracle$ cat /var/opt/oracle/ocr.loc
ocrconfig_loc=/hpap/rdsk/hpap0
local_only=FALSE
```

Oracle provides an automatic mechanism which performs regular backups of the OCR. The OCR daemons are in charge of these periodic snapshots. It has to be mentioned that these backups are only taken on the OCRMASTER host (as long as it is available).

It can be verified with the following utility:

```
oracle@ita018[RAC1]:/home/oracle$ ocrconfig -showbackup
ita018     2007/09/10 10:43:57     /opt/oracle/product/CRS/cdata/crs
ita018     2007/09/10 06:43:57     /opt/oracle/product/CRS/cdata/crs
ita018     2007/09/10 02:43:56     /opt/oracle/product/CRS/cdata/crs
ita018     2007/09/09 02:43:54     /opt/oracle/product/CRS/cdata/crs
ita018     2007/09/04 14:43:11     /opt/oracle/product/CRS/cdata/crs
```

If we look in the default location of the OCR backups, $ORA_CRS_HOME/cdata/"cluster_name", we see the different backups which are kept:

```
oracle@ita018[RAC1]:/opt/oracle/product/CRS/cdata/crs$ date
Mon Sep 10 14:14:12 METDST 2007
oracle@ita018[RAC1]:/opt/oracle/product/CRS/cdata/crs$ ll -rta
total 109026
drwxrwxr-x   4 oracle     oinstall        96 Jul 20 17:02 ..
-rw-r--r--   1 root       root       8654848 Sep  4 14:43 week.ocr
-rw-r--r--   1 root       root       9433088 Sep  9 02:43 day.ocr
-rw-r--r--   1 root       root       9433088 Sep 10 02:43 day_.ocr
-rw-r--r--   1 root       root       9433088 Sep 10 02:43 backup02.ocr
-rw-r--r--   1 root       root       9433088 Sep 10 06:43 backup01.ocr
drwxrwxr-x   2 oracle     oinstall      1024 Sep 10 10:43 .
-rw-r--r--   1 root       root       9433088 Sep 10 10:43 backup00.ocr
```

These files will be backed when we perform a file system backup of the ORA_CRS_HOME directory.

Oracle Voting Disk

The Oracle Voting Disk is used mainly as a Disk Heartbeat by the Node Monitor to detect "split brain" situations and decide on the node eviction.

There is no automatic mechanism provided by Oracle for backing up the Oracle Voting Disk. As we need to guarantee the recoverability of the Voting Disk in case of loss, at least one backup needs to be performed after the cluster installation and every time the Voting configuration is changed (add/remove of nodes).

The location of the Voting Disk can be queried with this command:

```
oracle@ita018[RAC1]:/home/oracle$ crsctl query  css votedisk
0.     0    /hpap/rdsk/hpap1

located 1 votedisk(s).
```

To perform the backup (online), we use the dd Operating System utility (ocopy for Windows):

```
oracle@ita018[RAC1]:/home/oracle$ dd if=/hpap/rdsk/hpap1 \
of=voting_backup.`date +%Y%m%d_%H:%M:%S` bs=4k
262144+0 records in
262144+0 records out
oracle@ita018[RAC1]:/home/oracle$ ll
-rw-r--r--   1 oracle     oinstall   1073741824 Sep 10 14:44 voting_backup.20070910_14:43:41
```

In our case, the LUN where the Voting Disk is located is 1GB in size. As the dd utility copies the whole disk, remember to delete from the file system old backups of the Voting Disk.

Oracle SPFILE

When using Oracle Automatic Storage Management, the Oracle SPFILE is located on the shared storage and it will be backed up through the RMAN online backup. However, we recommend creating a text copy of it. It can be easily achieved with the following command:

```
SQL> create pfile='$ORACLE_HOME/dbs/init$ORACLE_SID.ora.back' from \
spfile='+DG_DB/rac/spfileRAC.ora'


SQL> HOST mv $ORACLE_HOME/dbs/init$ORACLE_SID.ora.bak \
$ORACLE_HOME/dbs/init$ORACLE_SID.ora.`date +%Y%m%d_%H:%M:%S`


SQL> HOST ls –lrt $ORACLE_HOME/dbs/init$ORACLE_SID.ora*


-rw-r--r--   1 oracle     oinstall      2016 Sep 10 13:07 initRAC1.ora.20070910_13:07:32
```

The second command will add the date and time when the PFILE copy was generated.

ORACLE Directories

The following directories should also be included in the file system backup:

- ORACLE_BASE
- ORACLE_HOME
- ORA_CRS_HOME
- OraInventory
- /var/opt/oracle/*

File system Backup Recommendations

While the Oracle online integration takes care of the backup of datafiles, we have to care with a file system backup of the Oracle Software and configuration files. These are key backups and needed in case we experience a system disaster recovery or need to recover from any system changes / updates.

- Perform a regular backup of the specified files, or at least, every time when files are modified.

Oracle RMAN Restore and Recovery

Oracle Restore Enhancements

Starting with Oracle 10g Release 2, Data Protector includes a series of enhancements to improve restore performance. Additional attributes (SBTBFINFO flags) are now set for each backup file:

- Data Protector Tape device concurrency: This allows more than one RMAN channel to read from the same device
- Backup file sequence: Files should be read in the same sequence they are physically on the media
- Media ID stored in the recovery catalog: This enables oracle processes to optimize restores by avoiding the restore of files in the same tape at the same time.

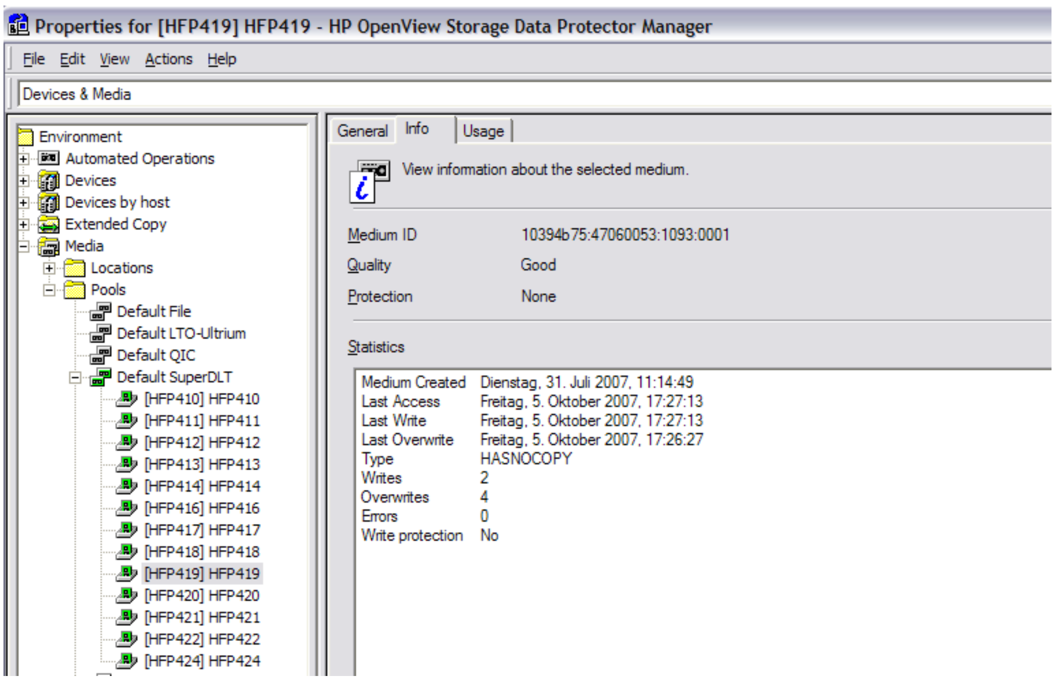
As it can be seen in the following RMAN list command, now the Media ID is stored in the recovery catalog and can be queried:

```
RMAN> list backupset 9266;


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

BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ ---------------
9266    Incr 0  114.01G    SBT_TAPE    00:45:30     2007-10-05
        BP Key: 9270   Status: AVAILABLE  Compressed: NO  Tag: TAG20071005T172549
        Handle: RAC_POOL_man_ch_1_2<RAC_460:635189150:1>.dbf   Media:
10394b75:47060053:1093:0001[[HFP419] HFP419]
  List of Datafiles in backup set 9266
  File LV Type Ckp SCN    Ckp Time   Name
  ---- -- ---- ---------- ---------- ----
  9    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_001.dbf
  11   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_065.dbf
  13   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_002.dbf
  15   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_003.dbf
  17   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_004.dbf
  19   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_006.dbf
  21   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_008.dbf
  23   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_005.dbf
  25   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_007.dbf
  27   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_014.dbf
  29   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_011.dbf
  31   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_013.dbf
  33   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_012.dbf
  35   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_015.dbf
  37   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_009.dbf
  39   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_016.dbf
  41   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_010.dbf
  43   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_031.dbf
  45   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_020.dbf
  47   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_018.dbf
  49   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_023.dbf
  51   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_024.dbf
  53   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_030.dbf
  55   0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_029.dbf
```

```
  57    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_032.dbf
  59    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_022.dbf
  61    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_021.dbf
  63    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_027.dbf
  65    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_017.dbf
  67    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_026.dbf
  69    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_025.dbf
  71    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_028.dbf
  73    0  Incr 32918890   2007-10-05 +DG_DB/rac/datafile/tbs_pool_019.dbf
```

The Media ID matches the Medium ID used by Data Protector on every Tape.

Figure 18. Media Information



If we query the rc_backup_piece view on the recovery catalog (ita017) we obtain the same information:

```
SQL> select BS_KEY,DEVICE_TYPE,HANDLE,MEDIA from rc_backup_piece where BS_KEY='9266';

    BS_KEY DEVICE_TYPE           HANDLE                                       MEDIA
--------------------------------------------------------------------------------
      9266 SBT_TAPE              RAC_POOL_man_ch_1_2<RAC_460:635189150:1>.dbf
10394b75:47060053:1093:0001[[HFP419] HFP419]
```

Oracle RMAN Restore script

While it is possible to edit the RMAN backup script from within the Data Protector GUI, this is not possible for the RMAN restore script.

A new enhancement has been implemented in Data Protector to enable this functionality. A new OMNIRC variable called OB2RMANSAVE needs to be set on the Oracle Server.

When the variable points to a valid location, the restore through the GUI will save the RMAN restore script to the specified location and it will not execute the restore. Once the script has been saved, it can be edited and changed. Afterwards, you can start it from RMAN directly.

```
OB2RMANSAVE=/opt/oracle/
```

Once the script has been saved, it can be edited and changed. Afterwards, you can start it from RMAN directly as shown below:

```
$ rman target / catalog rman/xxx@RCVCAT cmdfile rman_script.rcv
```

Note: as this functionality is not part of the DP 6.0 General Release, you need to contact Data Protector Support to receive the patch which enables it. This enhancement is available for all supported platforms.

Note: After executing the restore, remember to clear the OB2RMANSAVE variable; as long as it is saved, the RMAN restores will not be performed, but only the RMAN script will be saved.

Oracle Restore Configuration

The same way we distribute our backup load over the available instances in the Cluster, it may also be advisable to do it at restore time. However, in this case, the choice of using a Service to configure the restore will not necessarily be the faster option.

As it has been seen for the Backup, if we allocate the channels manually on the instances, we obtain, in general, the best performance results. Therefore, for performance purposes, in a restore scenario, the recommendation is to edit an RMAN restore script.

Consider the following situation: the backup session we want to restore was performed using the Oracle service MSL5000 (Backup session 4). During the backup, two RMAN channels were allocated on RAC2 (ita021).

For the restore however, instead of connecting through a service, we would like to have instances RAC1 and RAC2 running the restore with one channel each.

As described in the above section, we can have Data Protector writing the RMAN Restore script to a local directory, without running the restore. First, decide the number the channels to be used (the same as in the backup, one per tape device is recommended) and include the connection string at the end of the parameter specification (see example below)

Important Note: the OB2BARLIST channel parameter, which points to the backup specification and includes the tape drives and concurrency to be used, should match your needs. If not, edit before the backup specification.

In the example below, we used two instances and two tape drives for the backup; it is recommended to use the same concurrency as in the backup session. The example is performed for the restore and recovery of the POOL tablespace.

For the backup we allocated two channels (RAC1 and RAC2) manually.

```
run {
 allocate channel 'dev_0' type 'sbt_tape'
  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2)' connect sys/xxx@RAC1;
 allocate channel 'dev_1' type 'sbt_tape'
  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2)' connect sys/xxx@RAC2;
 SQL " alter tablespace POOL offline immediate";
 restore tablespace 'POOL';
 recover tablespace 'POOL';
 SQL " alter tablespace POOL online";
 release channel 'dev_0';
 release channel 'dev_1';
 }
```

The restore session report is in the Appendix C under Session 6.

Restore Recommendations Summary

This is a summary of the restore recommendations:

- Edit the RMAN restore script before execution
- Allocate channels manually on the selected instances
- Use the same concurrency as used in the backup
- Assign SAN devices to hosts using the Preferred Multipath host option

Recovery Considerations

When performing a database restore, the level of parallelism is determined by the number of RMAN channels allocated. This is also true when restoring incremental backups. However, when performing media recovery, Oracle will automatically select the optimal level of parallelism.

After we have restored the full backup, RMAN starts with the recovery phase. RMAN will always first apply any suitable incremental backup and once finished, the required archived logs will be used for media recovery.

Parallel recovery is enabled automatically for media recovery using the optimal parallelism degree based on the number of available CPUs in the system. While it is enabled by default, it can be disabled by using the NOPARALLEL clause in the RMAN recover command.

When tuning parallel recovery, standard parallel query tuning recommendations apply. In our environment, the highest recovery performance improvement was achieved by increasing the Oracle parameter PARALLEL_EXECUTION_MESSAGE_SIZE. For more information, review the Media recovery best practices for 10g in the Appendix A.

Although media recovery is done in parallel, it is important to note that media recovery just takes place on ONE RAC instance. As in a backup scenario, we have to guarantee that all archive logs are available from the instance performing the media recovery.

To simulate a recovery scenario, we start an update of the table BENCH_1G in the tablespace POOL. It has 52 Partitions (WEEK column), each partition with 20 million rows (each row is of approximately 200 Bytes)

1. Perform a Full Backup of the POOL tablespace
   From every RAC instance, we issue simultaneously an update of the table, in a way that every instance updates only one table partition; on RAC1, we update the table as follows:

```
SQL> update bench_1g set a07=a07+1 where week=1;

20000000 rows updated.

Elapsed: 00:51:15.95
SQL>
```

Approximately, 130 archive logs per RAC instance were generated during the update.

2. Perform an incremental backup (just for the recovery scenario with incremental backup
3. Perform the restore of the tablespace POOL (as in the previous section)
4. There are different recovery scenarios:
   - Use archived logs generated during the update
   - Use incremental backup taken after the update

Recovery using archived logs

Approximately, 500 archived logs were generated during the table update on all four RAC instances. Media Recovery is performed on the system where the restore/recovery session was started, RAC1 in our case.

In our environment, it took 1hour 50 min to apply all 536 archived logs. In total 23GB redo information.

Using the dynamic view V$RECOVERY_PROGRESS, we can monitor the status of the running recovery. The following representation shows that 62 log files out of 536 have so far been applied at a 14MB/s apply rate.

```
SQL> select TYPE,ITEM,UNITS,SOFAR,TOTAL from v$recovery_progress;

TYPE                                        ITEM                     UNITS               SOFAR      TOTAL
------------------------------------------------------------- ------------------------------- -------
Media Recovery                              Log Files                Files                  62        536
Media Recovery                              Active Apply Rate        KB/sec              14709          0
Media Recovery                              Average Apply Rate       KB/sec              14644          0
Media Recovery                              Redo Applied             Megabytes            2917          0
Media Recovery                              Last Applied Redo        SCN+Time         72219614          0
Media Recovery                              Active Time              Seconds               194          0
Media Recovery                              Apply Time per Log       Seconds                 2          0
Media Recovery                              Checkpoint Time per Log  Seconds                 0          0
Media Recovery                              Elapsed Time             Seconds               204          0

9 rows selected.
```

Recovery using incremental backup

After the table update, we perform an incremental backup instead of using archived logs recovery. The total backup size is 16GB.

Although is an incremental backup, oracle has to read every single block (belonging to the POOL datafiles) in memory to determine if the block has been modified since last backup. For this reason, it can happen that the tape devices are not streaming. This may cause the incremental backup to take longer than the full backup. In our case, it took twice as long as the full backup.

As it can be seen in the restore Session 7, the restore of the incremental backup took only 9 minutes. No Media Recovery is needed as the table update has been recorded in the incremental backup.

Oracle incremental backup with block change tracking enabled.

Starting with Oracle10g, we can enable the block change tracking for incremental backups. Oracle will keep a bitmap of changed blocks in the flash recovery area. When performing an incremental backup, instead of scanning all blocks in the datafiles (as a normal incremental does), only the blocks which are referenced in the bitmap will be read into memory and sent to tape. This functionality has the following advantages:

- Reduces the time of an incremental backup
- Reduces the total load on the system
- Makes incremental backup a valid option
- Provides the same streaming speed as a full backup which enables tape streaming

To enable this functionality, issue the following command:

```
SQL> select status from v$block_change_tracking;

STATUS
----------
DISABLED

SQL> alter database enable block change tracking;

Database altered.

SQL> select status from v$block_change_tracking;

STATUS
----------
ENABLED;

SQL> select FILENAME,bytes from v$block_change_tracking;

FILENAME                                        BYTES
----------------------------------------------  ----------
+DG_DB/rac/changetracking/ctf.351.638031151     23166976
```

The incremental backup with enabled change block tracking took 11 minutes to complete.

Recovery recommendations

- Favor using incremental backups for recovery instead of archived logs
- Enable block change tracking for incremental backups
- Increase the Oracle parameter PARALLEL_EXECUTION_MESSAGE_SIZE for parallel recovery. This parameter determines the buffer size for the message exchanged among parallel processes.
- Use the dynamic view V$RECOVERY_PROGRESS to monitor the recovery progress

Summary

As it has been shown throughout this paper, Data Protector offers several possibilities to perform the configuration in an Oracle10g RAC environment. It is not necessarily a complex task, but limitations and implications need to be understood.

In summary, if ease of configuration and availability are the key premises, using an Oracle Service to configure the integration is the best approach.

If however, due to backup window constraints and backup devices availability, the backup time needs to be minimized, the recommendation is to perform a manual allocation of channels on specific instances.

Independent from the configuration option chosen, Data Protector's Oracle Integration with Oracle RMAN is the ideal choice for protecting your Oracle Database.

Appendix A. Reference documentation

HP

- HP Data Protector Software Documentation and White Papers
- HP 3TB/hour Oracle Online Backup paper

Oracle

- Oracle 10g Backup and Recovery Advanced User's Guide
- Oracle Clusterware and Oracle Real Application Clusters Administration and Deployment Guide
- Tuning Oracle Recovery Manager
- Data Guard Redo Apply and Media Recovery Best Practices
- Oracle Backup and Recovery Papers at OTN
- Metalink Note 237083.1 Using V$BACKUP_ASYNC_IO to monitor RMAN

Tools

- AxWork benchmark Suite

Appendix B. RMAN helpful Scripts

B.1 How to monitor RMAN job progress

```
SELECT SID, SERIAL#, CONTEXT, SOFAR, TOTALWORK,
       ROUND(SOFAR/TOTALWORK*100,2) "%_COMPLETE"
FROM V$SESSION_LONGOPS
WHERE OPNAME LIKE 'RMAN%'
  AND OPNAME NOT LIKE '%aggregate%'
  AND TOTALWORK != 0
  AND SOFAR <> TOTALWORK
/

SQL> @ RMAN_long_ops.sql

       SID    SERIAL#    CONTEXT      SOFAR  TOTALWORK %_COMPLETE
---------- ---------- ---------- ---------- ---------- ----------
      2214        214          1    5065599   17297280      29.29
```

B.2 How to monitor RMAN waits

```
COL type FORMAT a7
COL filename FORMAT a55
COL elapsed_time FORMAT 9999999999
select
TYPE,STATUS,maxopenfiles,FILENAME,BUFFER_SIZE,BUFFER_COUNT,TOTAL_BYTES,ELAPSED_TIME,BYTES,EFFECTIVE_BYTES
_PER_SECOND,IO_COUNT,SHORT_WAITS,LONG_WAITS from v$backup_async_io where type <> 'AGGREGATE' order by
open_time, close_time
/


SQL> @ backup_async_io.sql

TYPE    STATUS      MAXOPENFILES FILENAME                              BUFFER_SIZE BUFFER_COUNT TOTAL_BYTES
ELAPSED_TIME      BYTES EFFECTIVE_BYTES_PER_SECOND   IO_COUNT SHORT_WAITS LONG_WAITS
------- ----------- ------------ ------------------------------------------------------------ ----------- ----
-------- ----------- ------------ ---------- ------------------------- ---------- ----------- ----------
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_001.dbf                      1048576
16  4293918720         8100 4293918720                    53011342       4096           0        564
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_065.dbf                      1048576
16  4293918720         7800 4293918720                    55050240       4096           0        601
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_002.dbf                      1048576
16  4293918720         7900 4293918720                    54353402       4096           0        572
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_003.dbf                      1048576
16  4293918720         8000 4293918720                    53673984       4096           0        537
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_004.dbf                      1048576
16  4293918720         8100 4293918720                    53011342       4096           0        603
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_006.dbf                      1048576
16  4293918720         8200 4293918720                    52364862       4096           0        586
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_008.dbf                      1048576
16  4293918720         8000 4293918720                    53673984       4096           0        571
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_005.dbf                      1048576
16  4293918720         8000 4293918720                    53673984       4096           0        570
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_007.dbf                      1048576
16  4293918720         8200 4293918720                    52364862       4096           0        611
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_014.dbf                      1048576
16  4293918720         8100 4293918720                    53011342       4096           0        619
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_011.dbf                      1048576
16  4293918720         8000 4293918720                    53673984       4096           0        611
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_013.dbf                      1048576
16  4293918720         8100 4293918720                    53011342       4096           0        639
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_012.dbf                      1048576
16  4293918720         8800 4293918720                    48794531       4096           0        593
INPUT   FINISHED                +DG_DB/rac/datafile/tbs_pool_015.dbf                      1048576
16  4293918720         8200 4293918720                    52364862       4096           0        568
INPUT   IN PROGRESS             +DG_DB/rac/datafile/tbs_pool_009.dbf                      1048576
16  4293918720              2314207232                                    2207           0        280
```

B.3 How to monitor RMAN wait states

```
COLUMN EVENT FORMAT a20
COLUMN SECONDS_IN_WAIT FORMAT 999
COLUMN STATE FORMAT a20
COLUMN CLIENT_INFO FORMAT a30

SELECT p.SPID, sw.EVENT, s.SECONDS_IN_WAIT AS SEC_WAIT,
       sw.STATE, s.CLIENT_INFO
FROM V$SESSION_WAIT sw, V$SESSION s, V$PROCESS p
WHERE sw.EVENT LIKE '%sbt%'
       AND s.SID=sw.SID
       AND s.PADDR=p.ADDR
;
SQL> @RMAN_MML_monitor.sql

SPID         EVENT                  SEC_WAIT STATE               CLIENT_INFO
------------ -------------------- ---------- ------------------- ------------------------------
4795         Backup: sbtwrite2             3 WAITED SHORT TIME    rman channel=dev_1
4793         Backup: sbtwrite2             3 WAITING              rman channel=dev_0
```

B.4 How to monitor RMAN channels current speed

In the output below, we can see two RMAN channels running on one instance, each over 70MB/s. In this view, it can also be verified which the current MAXOPENFILES setting is (the value maxopenfiles is only present when type is AGGREGATE)

```
col type format a10;
select TYPE,maxopenfiles,ELAPSED_TIME,EFFECTIVE_BYTES_PER_SECOND from v$backup_async_io where type =
'AGGREGATE' order by open_time, close_time
/


SQL> @backup_aggregate_speed

TYPE       MAXOPENFILES ELAPSED_TIME EFFECTIVE_BYTES_PER_SECOND
---------- ------------ ------------ -------------------------
AGGREGATE             1         8500                  77829012
AGGREGATE             1         8600                  70010737
```

Appendix C. Session Reports

Session 1: Backup using ita018 and RAC1

- Connection to Instance RAC1
- Allocation of two channels on RAC1 (one for each tape drive)

```
[Normal] From: BSM@ita017 "RAC_POOL_RAC1"  Time: 11.10.2007 17:40:40
  OB2BAR application on "ita018" successfully started.

[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 17:40:46
  Starting backup of target database.

  Net service name: RAC1.
  Instance status: OPEN.
  Instance name: RAC1.
  Database DBID = 2216826430.
  Database control file type: CURRENT.
  Database log mode: ARCHIVELOG.


[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 17:40:53
  Starting Oracle Recovery Manager.


Recovery Manager: Release 10.2.0.3.0 - Production on Thu Oct 11 17:40:53 2007

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

RMAN> CONNECT TARGET *
2> CONNECT CATALOG *
3> run {
4> allocate channel 'dev_0' type 'sbt_tape'
5>  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_RAC1,OB2BARHOSTNAME=ita018)'
maxopenfiles 1;
6> allocate channel 'dev_1' type 'sbt_tape'
7>  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_RAC1,OB2BARHOSTNAME=ita018)'
maxopenfiles 1;
8> backup incremental level 0
9>  format 'RAC_POOL_RAC1<RAC_%s:%t:%p>.dbf'
10>  tablespace 'POOL';
11> }
12> EXIT
connected to target database: RAC (DBID=2216826430)

connected to recovery catalog database

allocated channel: dev_0
channel dev_0: sid=2207 instance=RAC1 devtype=SBT_TAPE
channel dev_0: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

allocated channel: dev_1
channel dev_1: sid=2206 instance=RAC1 devtype=SBT_TAPE
channel dev_1: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

Starting backup at 11-OCT-07
channel dev_0: starting incremental level 0 datafile backupset
channel dev_0: specifying datafile(s) in backupset
input datafile fno=00009 name=+DG_DB/rac/datafile/tbs_pool_001.dbf
input datafile fno=00011 name=+DG_DB/rac/datafile/tbs_pool_065.dbf
input datafile fno=00013 name=+DG_DB/rac/datafile/tbs_pool_002.dbf
input datafile fno=00015 name=+DG_DB/rac/datafile/tbs_pool_003.dbf
```

```
input datafile fno=00017 name=+DG_DB/rac/datafile/tbs_pool_004.dbf
input datafile fno=00019 name=+DG_DB/rac/datafile/tbs_pool_006.dbf
input datafile fno=00021 name=+DG_DB/rac/datafile/tbs_pool_008.dbf
input datafile fno=00023 name=+DG_DB/rac/datafile/tbs_pool_005.dbf
input datafile fno=00025 name=+DG_DB/rac/datafile/tbs_pool_007.dbf
input datafile fno=00027 name=+DG_DB/rac/datafile/tbs_pool_014.dbf
input datafile fno=00029 name=+DG_DB/rac/datafile/tbs_pool_011.dbf
input datafile fno=00031 name=+DG_DB/rac/datafile/tbs_pool_013.dbf
input datafile fno=00033 name=+DG_DB/rac/datafile/tbs_pool_012.dbf
input datafile fno=00035 name=+DG_DB/rac/datafile/tbs_pool_015.dbf
input datafile fno=00037 name=+DG_DB/rac/datafile/tbs_pool_009.dbf
input datafile fno=00039 name=+DG_DB/rac/datafile/tbs_pool_016.dbf
input datafile fno=00041 name=+DG_DB/rac/datafile/tbs_pool_010.dbf
input datafile fno=00043 name=+DG_DB/rac/datafile/tbs_pool_031.dbf
input datafile fno=00045 name=+DG_DB/rac/datafile/tbs_pool_020.dbf
input datafile fno=00047 name=+DG_DB/rac/datafile/tbs_pool_018.dbf
input datafile fno=00049 name=+DG_DB/rac/datafile/tbs_pool_023.dbf
input datafile fno=00051 name=+DG_DB/rac/datafile/tbs_pool_024.dbf
input datafile fno=00053 name=+DG_DB/rac/datafile/tbs_pool_030.dbf
input datafile fno=00055 name=+DG_DB/rac/datafile/tbs_pool_029.dbf
input datafile fno=00057 name=+DG_DB/rac/datafile/tbs_pool_032.dbf
input datafile fno=00059 name=+DG_DB/rac/datafile/tbs_pool_022.dbf
input datafile fno=00061 name=+DG_DB/rac/datafile/tbs_pool_021.dbf
input datafile fno=00063 name=+DG_DB/rac/datafile/tbs_pool_027.dbf
input datafile fno=00065 name=+DG_DB/rac/datafile/tbs_pool_017.dbf
input datafile fno=00067 name=+DG_DB/rac/datafile/tbs_pool_026.dbf
input datafile fno=00069 name=+DG_DB/rac/datafile/tbs_pool_025.dbf
input datafile fno=00071 name=+DG_DB/rac/datafile/tbs_pool_028.dbf
input datafile fno=00073 name=+DG_DB/rac/datafile/tbs_pool_019.dbf
channel dev_0: starting piece 1 at 11-OCT-07
channel dev_1: starting incremental level 0 datafile backupset
channel dev_1: specifying datafile(s) in backupset
input datafile fno=00010 name=+DG_DB/rac/datafile/tbs_pool_064.dbf
input datafile fno=00012 name=+DG_DB/rac/datafile/tbs_pool_066.dbf
input datafile fno=00014 name=+DG_DB/rac/datafile/tbs_pool_063.dbf
input datafile fno=00016 name=+DG_DB/rac/datafile/tbs_pool_062.dbf
input datafile fno=00018 name=+DG_DB/rac/datafile/tbs_pool_061.dbf
input datafile fno=00020 name=+DG_DB/rac/datafile/tbs_pool_059.dbf
input datafile fno=00022 name=+DG_DB/rac/datafile/tbs_pool_057.dbf
input datafile fno=00024 name=+DG_DB/rac/datafile/tbs_pool_060.dbf
input datafile fno=00026 name=+DG_DB/rac/datafile/tbs_pool_058.dbf
input datafile fno=00028 name=+DG_DB/rac/datafile/tbs_pool_051.dbf
input datafile fno=00030 name=+DG_DB/rac/datafile/tbs_pool_054.dbf
input datafile fno=00032 name=+DG_DB/rac/datafile/tbs_pool_052.dbf
input datafile fno=00034 name=+DG_DB/rac/datafile/tbs_pool_053.dbf
input datafile fno=00036 name=+DG_DB/rac/datafile/tbs_pool_050.dbf
input datafile fno=00038 name=+DG_DB/rac/datafile/tbs_pool_056.dbf
input datafile fno=00040 name=+DG_DB/rac/datafile/tbs_pool_049.dbf
input datafile fno=00042 name=+DG_DB/rac/datafile/tbs_pool_055.dbf
input datafile fno=00044 name=+DG_DB/rac/datafile/tbs_pool_034.dbf
input datafile fno=00046 name=+DG_DB/rac/datafile/tbs_pool_045.dbf
input datafile fno=00048 name=+DG_DB/rac/datafile/tbs_pool_047.dbf
input datafile fno=00050 name=+DG_DB/rac/datafile/tbs_pool_042.dbf
input datafile fno=00052 name=+DG_DB/rac/datafile/tbs_pool_041.dbf
input datafile fno=00054 name=+DG_DB/rac/datafile/tbs_pool_035.dbf
input datafile fno=00056 name=+DG_DB/rac/datafile/tbs_pool_036.dbf
input datafile fno=00058 name=+DG_DB/rac/datafile/tbs_pool_033.dbf
input datafile fno=00060 name=+DG_DB/rac/datafile/tbs_pool_043.dbf
input datafile fno=00062 name=+DG_DB/rac/datafile/tbs_pool_044.dbf
input datafile fno=00064 name=+DG_DB/rac/datafile/tbs_pool_038.dbf
input datafile fno=00066 name=+DG_DB/rac/datafile/tbs_pool_048.dbf
input datafile fno=00068 name=+DG_DB/rac/datafile/tbs_pool_039.dbf
input datafile fno=00070 name=+DG_DB/rac/datafile/tbs_pool_040.dbf
input datafile fno=00072 name=+DG_DB/rac/datafile/tbs_pool_037.dbf
[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 17:41:07
```

```
  STARTING Media Agent "COMPAQ:SDLT320_1"

input datafile fno=00074 name=+DG_DB/rac/datafile/tbs_pool_046.dbf
channel dev_1: starting piece 1 at 11-OCT-07
[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 17:41:12
  STARTING Media Agent "COMPAQ:SDLT320_2"

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 17:41:12
  By: UMA@ita018@/dev/rac/c20t0d0
  Loading medium from slot 15 to device /dev/rmt/0mn

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 17:41:22
  By: UMA@ita018@/dev/rac/c20t0d0
  Loading medium from slot 16 to device /dev/rmt/1mn

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 17:41:53
  Starting OB2BAR Backup: ita018:RAC_POOL_RAC1<RAC_545:635708462:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 17:42:01
  Starting OB2BAR Backup: ita018:RAC_POOL_RAC1<RAC_544:635708461:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 18:29:02
  Backup Profile:

        Run Time ..... 0:47:01
        Backup Speed ..... 42377,85 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 18:29:03
  Completed OB2BAR Backup: ita018:RAC_POOL_RAC1<RAC_544:635708461:1>.dbf "Oracle8"

channel dev_0: finished piece 1 at 11-OCT-07
piece handle=RAC_POOL_RAC1<RAC_544:635708461:1>.dbf tag=TAG20071011T174100 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_0: backup set complete, elapsed time: 00:48:09
[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 18:29:18
  Backup Profile:

        Run Time ..... 0:47:25
        Backup Speed ..... 42059,50 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 18:29:18
  Completed OB2BAR Backup: ita018:RAC_POOL_RAC1<RAC_545:635708462:1>.dbf "Oracle8"

channel dev_1: finished piece 1 at 11-OCT-07
piece handle=RAC_POOL_RAC1<RAC_545:635708462:1>.dbf tag=TAG20071011T174100 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_1: backup set complete, elapsed time: 00:48:23
Finished backup at 11-OCT-07

Starting Control File and SPFILE Autobackup at 11-OCT-07
[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 18:30:15
  Starting OB2BAR Backup: ita018:c-2216826430-20071011-02 "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 18:30:17
  Backup Profile:

        Run Time ..... 0:00:02
        Backup Speed ..... 9600,00 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 18:30:17
  Completed OB2BAR Backup: ita018:c-2216826430-20071011-02 "Oracle8"

piece handle=c-2216826430-20071011-02 comment=API Version 2.0,MMS Version 65.6.0.0
Finished Control File and SPFILE Autobackup at 11-OCT-07
released channel: dev_0
```

```
released channel: dev_1

Recovery Manager complete.
[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 18:30:34
  Oracle Recovery Manager completed.

[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 18:30:35
  Backup of target database completed.

[Normal] From: BSM@ita017 "RAC_POOL_RAC1"  Time: 11.10.2007 18:30:31
  OB2BAR application on "ita018" disconnected.

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 18:31:30
  /dev/rmt/1mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 18:31:33
  /dev/rmt/0mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 18:31:46
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 16 from device /dev/rmt/1mn

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 18:31:49
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 15 from device /dev/rmt/0mn

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 18:31:59
  COMPLETED Media Agent "COMPAQ:SDLT320_2"

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 18:32:13
  COMPLETED Media Agent "COMPAQ:SDLT320_1"

[Normal] From: BSM@ita017 "RAC_POOL_RAC1"  Time: 11.10.2007 18:32:09

  Backup Statistics:

        Session Queuing Time (hours)      0,00
        ---------------------------------------
        Completed Disk Agents ........       3
        Failed Disk Agents ...........       0
        Aborted Disk Agents ..........       0
        ---------------------------------------
        Disk Agents Total  ...........       3
        =======================================
        Completed Media Agents .......       2
        Failed Media Agents ..........       0
        Aborted Media Agents .........       0
        ---------------------------------------
        Media Agents Total  ..........       2
        =======================================
        Mbytes Total ................. 233898 MB
        Used Media Total .............       2
        Disk Agent Errors Total ......       0


================================================================================
                     Session completed successfully!
================================================================================
```

Session 2: Backup using ita018-vip and RAC1, RAC2, RAC3, RAC4

- Connectivity to all configured instances is verified
- All channels are allocated on instance RAC1

```
[Normal] From: BSM@ita017 "RAC_POOL_RAC1..4"  Time: 11.10.2007 18:41:52
  OB2BAR application on "ita018-vip" successfully started.

[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 18:41:58
  Starting backup of target database.

  Net service name: RAC1.
  Instance status: OPEN.
  Instance name: RAC1.
  Database DBID = 2216826430.
  Database control file type: CURRENT.
  Database log mode: ARCHIVELOG.


  Net service name: RAC4.
  Instance status: OPEN.
  Instance name: RAC4.
  Database DBID = 2216826430.
  Database control file type: CURRENT.
  Database log mode: ARCHIVELOG.


  Net service name: RAC2.
  Instance status: OPEN.
  Instance name: RAC2.
  Database DBID = 2216826430.
  Database control file type: CURRENT.
  Database log mode: ARCHIVELOG.


  Net service name: RAC3.
  Instance status: OPEN.
  Instance name: RAC3.
  Database DBID = 2216826430.
  Database control file type: CURRENT.
  Database log mode: ARCHIVELOG.


[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 18:42:20
  Starting Oracle Recovery Manager.


Recovery Manager: Release 10.2.0.3.0 - Production on Thu Oct 11 18:42:20 2007

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RMAN> CONNECT TARGET *
2> CONNECT CATALOG *
3> run {
4> allocate channel 'dev_0' type 'sbt_tape'
5> parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_RAC1..4,OB2BARHOSTNAME=ita018-vip)'
maxopenfiles 1;
6> allocate channel 'dev_1' type 'sbt_tape'
7> parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_RAC1..4,OB2BARHOSTNAME=ita018-vip)'
maxopenfiles 1;
8> backup incremental level 0
9> format 'RAC_POOL_RAC1..4<RAC_%s:%t:%p>.dbf'
10> tablespace 'POOL';
```

```
11> }
12> EXIT
connected to target database: RAC (DBID=2216826430)

connected to recovery catalog database

allocated channel: dev_0
channel dev_0: sid=2230 instance=RAC1 devtype=SBT_TAPE
channel dev_0: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

allocated channel: dev_1
channel dev_1: sid=2204 instance=RAC1 devtype=SBT_TAPE
channel dev_1: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

Starting backup at 11-OCT-07
channel dev_0: starting incremental level 0 datafile backupset
channel dev_0: specifying datafile(s) in backupset
input datafile fno=00009 name=+DG_DB/rac/datafile/tbs_pool_001.dbf
input datafile fno=00011 name=+DG_DB/rac/datafile/tbs_pool_065.dbf
input datafile fno=00013 name=+DG_DB/rac/datafile/tbs_pool_002.dbf
input datafile fno=00015 name=+DG_DB/rac/datafile/tbs_pool_003.dbf
input datafile fno=00017 name=+DG_DB/rac/datafile/tbs_pool_004.dbf
input datafile fno=00019 name=+DG_DB/rac/datafile/tbs_pool_006.dbf
input datafile fno=00021 name=+DG_DB/rac/datafile/tbs_pool_008.dbf
input datafile fno=00023 name=+DG_DB/rac/datafile/tbs_pool_005.dbf
input datafile fno=00025 name=+DG_DB/rac/datafile/tbs_pool_007.dbf
input datafile fno=00027 name=+DG_DB/rac/datafile/tbs_pool_014.dbf
input datafile fno=00029 name=+DG_DB/rac/datafile/tbs_pool_011.dbf
input datafile fno=00031 name=+DG_DB/rac/datafile/tbs_pool_013.dbf
input datafile fno=00033 name=+DG_DB/rac/datafile/tbs_pool_012.dbf
input datafile fno=00035 name=+DG_DB/rac/datafile/tbs_pool_015.dbf
input datafile fno=00037 name=+DG_DB/rac/datafile/tbs_pool_009.dbf
input datafile fno=00039 name=+DG_DB/rac/datafile/tbs_pool_016.dbf
input datafile fno=00041 name=+DG_DB/rac/datafile/tbs_pool_010.dbf
input datafile fno=00043 name=+DG_DB/rac/datafile/tbs_pool_031.dbf
input datafile fno=00045 name=+DG_DB/rac/datafile/tbs_pool_020.dbf
input datafile fno=00047 name=+DG_DB/rac/datafile/tbs_pool_018.dbf
input datafile fno=00049 name=+DG_DB/rac/datafile/tbs_pool_023.dbf
input datafile fno=00051 name=+DG_DB/rac/datafile/tbs_pool_024.dbf
input datafile fno=00053 name=+DG_DB/rac/datafile/tbs_pool_030.dbf
input datafile fno=00055 name=+DG_DB/rac/datafile/tbs_pool_029.dbf
input datafile fno=00057 name=+DG_DB/rac/datafile/tbs_pool_032.dbf
input datafile fno=00059 name=+DG_DB/rac/datafile/tbs_pool_022.dbf
input datafile fno=00061 name=+DG_DB/rac/datafile/tbs_pool_021.dbf
input datafile fno=00063 name=+DG_DB/rac/datafile/tbs_pool_027.dbf
input datafile fno=00065 name=+DG_DB/rac/datafile/tbs_pool_017.dbf
input datafile fno=00067 name=+DG_DB/rac/datafile/tbs_pool_026.dbf
input datafile fno=00069 name=+DG_DB/rac/datafile/tbs_pool_025.dbf
input datafile fno=00071 name=+DG_DB/rac/datafile/tbs_pool_028.dbf
input datafile fno=00073 name=+DG_DB/rac/datafile/tbs_pool_019.dbf
channel dev_0: starting piece 1 at 11-OCT-07
channel dev_1: starting incremental level 0 datafile backupset
channel dev_1: specifying datafile(s) in backupset
input datafile fno=00010 name=+DG_DB/rac/datafile/tbs_pool_064.dbf
input datafile fno=00012 name=+DG_DB/rac/datafile/tbs_pool_066.dbf
input datafile fno=00014 name=+DG_DB/rac/datafile/tbs_pool_063.dbf
input datafile fno=00016 name=+DG_DB/rac/datafile/tbs_pool_062.dbf
input datafile fno=00018 name=+DG_DB/rac/datafile/tbs_pool_061.dbf
input datafile fno=00020 name=+DG_DB/rac/datafile/tbs_pool_059.dbf
input datafile fno=00022 name=+DG_DB/rac/datafile/tbs_pool_057.dbf
input datafile fno=00024 name=+DG_DB/rac/datafile/tbs_pool_060.dbf
input datafile fno=00026 name=+DG_DB/rac/datafile/tbs_pool_058.dbf
input datafile fno=00028 name=+DG_DB/rac/datafile/tbs_pool_051.dbf
input datafile fno=00030 name=+DG_DB/rac/datafile/tbs_pool_054.dbf
input datafile fno=00032 name=+DG_DB/rac/datafile/tbs_pool_052.dbf
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input datafile fno=00034 name=+DG_DB/rac/datafile/tbs_pool_053.dbf
input datafile fno=00036 name=+DG_DB/rac/datafile/tbs_pool_050.dbf
input datafile fno=00038 name=+DG_DB/rac/datafile/tbs_pool_056.dbf
input datafile fno=00040 name=+DG_DB/rac/datafile/tbs_pool_049.dbf
input datafile fno=00042 name=+DG_DB/rac/datafile/tbs_pool_055.dbf
input datafile fno=00044 name=+DG_DB/rac/datafile/tbs_pool_034.dbf
input datafile fno=00046 name=+DG_DB/rac/datafile/tbs_pool_045.dbf
input datafile fno=00048 name=+DG_DB/rac/datafile/tbs_pool_047.dbf
input datafile fno=00050 name=+DG_DB/rac/datafile/tbs_pool_042.dbf
input datafile fno=00052 name=+DG_DB/rac/datafile/tbs_pool_041.dbf
input datafile fno=00054 name=+DG_DB/rac/datafile/tbs_pool_035.dbf
input datafile fno=00056 name=+DG_DB/rac/datafile/tbs_pool_036.dbf
input datafile fno=00058 name=+DG_DB/rac/datafile/tbs_pool_033.dbf
input datafile fno=00060 name=+DG_DB/rac/datafile/tbs_pool_043.dbf
input datafile fno=00062 name=+DG_DB/rac/datafile/tbs_pool_044.dbf
input datafile fno=00064 name=+DG_DB/rac/datafile/tbs_pool_038.dbf
input datafile fno=00066 name=+DG_DB/rac/datafile/tbs_pool_048.dbf
input datafile fno=00068 name=+DG_DB/rac/datafile/tbs_pool_039.dbf
input datafile fno=00070 name=+DG_DB/rac/datafile/tbs_pool_040.dbf
input datafile fno=00072 name=+DG_DB/rac/datafile/tbs_pool_037.dbf
input datafile fno=00074 name=+DG_DB/rac/datafile/tbs_pool_046.dbf
channel dev_1: starting piece 1 at 11-OCT-07
[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 18:42:32
  STARTING Media Agent "COMPAQ:SDLT320_1"

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 18:42:37
  By: UMA@ita018@/dev/rac/c20t0d0
  Loading medium from slot 24 to device /dev/rmt/0mn

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 18:42:37
  STARTING Media Agent "COMPAQ:SDLT320_2"

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 18:42:47
  By: UMA@ita018@/dev/rac/c20t0d0
  Loading medium from slot 18 to device /dev/rmt/1mn

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 18:43:07
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_RAC1..4<RAC_547:635712145:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 18:43:18
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_RAC1..4<RAC_548:635712145:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 19:30:01
  Backup Profile:

        Run Time ..... 0:46:54
        Backup Speed ..... 42483,26 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 19:30:01
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_RAC1..4<RAC_547:635712145:1>.dbf "Oracle8"

channel dev_0: finished piece 1 at 11-OCT-07
piece handle=RAC_POOL_RAC1..4<RAC_547:635712145:1>.dbf tag=TAG20071011T184224 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_0: backup set complete, elapsed time: 00:47:39
[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 19:30:06
  Backup Profile:

        Run Time ..... 0:46:48
        Backup Speed ..... 42613,70 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 19:30:06
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_RAC1..4<RAC_548:635712145:1>.dbf "Oracle8"

channel dev_1: finished piece 1 at 11-OCT-07
```

```
piece handle=RAC_POOL_RAC1..4<RAC_548:635712145:1>.dbf tag=TAG20071011T184224 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_1: backup set complete, elapsed time: 00:47:42
Finished backup at 11-OCT-07

Starting Control File and SPFILE Autobackup at 11-OCT-07
[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 19:30:56
  Starting OB2BAR Backup: ita018-vip:c-2216826430-20071011-03 "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 19:30:58
  Backup Profile:

        Run Time ........... 0:00:02
        Backup Speed ....... 9600,00 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 11.10.2007 19:30:59
  Completed OB2BAR Backup: ita018-vip:c-2216826430-20071011-03 "Oracle8"

piece handle=c-2216826430-20071011-03 comment=API Version 2.0,MMS Version 65.6.0.0
Finished Control File and SPFILE Autobackup at 11-OCT-07
released channel: dev_0
released channel: dev_1

Recovery Manager complete.
[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 19:31:15
  Oracle Recovery Manager completed.

[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 19:31:15
  Backup of target database completed.

[Normal] From: BSM@ita017 "RAC_POOL_RAC1..4"  Time: 11.10.2007 19:31:11
  OB2BAR application on "ita018-vip" disconnected.

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 19:31:49
  /dev/rmt/1mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 19:32:05
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 18 from device /dev/rmt/1mn

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_2"  Time: 11.10.2007 19:32:17
  COMPLETED Media Agent "COMPAQ:SDLT320_2"

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 19:32:24
  /dev/rmt/0mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 19:32:39
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 24 from device /dev/rmt/0mn

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 19:32:53
  COMPLETED Media Agent "COMPAQ:SDLT320_1"

[Normal] From: BSM@ita017 "RAC_POOL_RAC1..4"  Time: 11.10.2007 19:32:49

  Backup Statistics:

        Session Queuing Time (hours)      0,00
        ---------------------------------------
        Completed Disk Agents ........       3
        Failed Disk Agents ...........       0
        Aborted Disk Agents ..........       0
        ---------------------------------------
```

```
        Disk Agents Total  ...........       3
        ========================================
        Completed Media Agents .......       2
        Failed Media Agents ..........       0
        Aborted Media Agents .........       0
        ----------------------------------------
        Media Agents Total  ..........       2
        ========================================
        Mbytes Total ................. 233898 MB
        Used Media Total .............       2
        Disk Agent Errors Total ......       0


================================================================================
                    Session completed successfully!
================================================================================
```

Session 3: Backup using ita018-vip and service BACKUP

- Two channels are allocated on RAC2 and two on RAC3

```
[Normal] From: BSM@ita017 "RAC_POOL_BACKUP"  Time: 11.10.2007 20:15:57
  OB2BAR application on "ita018-vip" successfully started.

[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 20:16:03
  Starting backup of target database.

  Net service name: BACKUP.
  Instance status: OPEN.
  Instance name: RAC3.
  Database DBID = 2216826430.
  Database control file type: CURRENT.
  Database log mode: ARCHIVELOG.


[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 20:16:09
  Starting Oracle Recovery Manager.


Recovery Manager: Release 10.2.0.3.0 - Production on Thu Oct 11 20:16:09 2007

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RMAN> CONNECT TARGET *
2> CONNECT CATALOG *
3> run {
4> allocate channel 'dev_0' type 'sbt_tape'
5> parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_BACKUP,OB2BARHOSTNAME=ita018-vip)'
maxopenfiles 1;
6> allocate channel 'dev_1' type 'sbt_tape'
7> parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_BACKUP,OB2BARHOSTNAME=ita018-vip)'
maxopenfiles 1;
8> allocate channel 'dev_2' type 'sbt_tape'
9> parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_BACKUP,OB2BARHOSTNAME=ita018-vip)'
maxopenfiles 1;
10> allocate channel 'dev_3' type 'sbt_tape'
11> parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_BACKUP,OB2BARHOSTNAME=ita018-vip)'
maxopenfiles 1;
12> backup incremental level 0
13> format 'RAC_POOL_BACKUP<RAC_%s:%t:%p>.dbf'
14> tablespace 'POOL';
15> }
16> EXIT
connected to target database: RAC (DBID=2216826430)

connected to recovery catalog database

allocated channel: dev_0
channel dev_0: sid=2235 instance=RAC2 devtype=SBT_TAPE
channel dev_0: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

allocated channel: dev_1
channel dev_1: sid=2216 instance=RAC2 devtype=SBT_TAPE
channel dev_1: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

allocated channel: dev_2
channel dev_2: sid=2220 instance=RAC3 devtype=SBT_TAPE
channel dev_2: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

allocated channel: dev_3
channel dev_3: sid=2219 instance=RAC3 devtype=SBT_TAPE
```

```
channel dev_3: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

Starting backup at 11-OCT-07
channel dev_0: starting incremental level 0 datafile backupset
channel dev_0: specifying datafile(s) in backupset
input datafile fno=00009 name=+DG_DB/rac/datafile/tbs_pool_001.dbf
input datafile fno=00013 name=+DG_DB/rac/datafile/tbs_pool_002.dbf
input datafile fno=00017 name=+DG_DB/rac/datafile/tbs_pool_004.dbf
input datafile fno=00021 name=+DG_DB/rac/datafile/tbs_pool_008.dbf
input datafile fno=00025 name=+DG_DB/rac/datafile/tbs_pool_007.dbf
input datafile fno=00029 name=+DG_DB/rac/datafile/tbs_pool_011.dbf
input datafile fno=00033 name=+DG_DB/rac/datafile/tbs_pool_012.dbf
input datafile fno=00037 name=+DG_DB/rac/datafile/tbs_pool_009.dbf
input datafile fno=00041 name=+DG_DB/rac/datafile/tbs_pool_010.dbf
input datafile fno=00045 name=+DG_DB/rac/datafile/tbs_pool_020.dbf
input datafile fno=00049 name=+DG_DB/rac/datafile/tbs_pool_023.dbf
input datafile fno=00053 name=+DG_DB/rac/datafile/tbs_pool_030.dbf
input datafile fno=00057 name=+DG_DB/rac/datafile/tbs_pool_032.dbf
input datafile fno=00061 name=+DG_DB/rac/datafile/tbs_pool_021.dbf
input datafile fno=00065 name=+DG_DB/rac/datafile/tbs_pool_017.dbf
input datafile fno=00069 name=+DG_DB/rac/datafile/tbs_pool_025.dbf
input datafile fno=00073 name=+DG_DB/rac/datafile/tbs_pool_019.dbf
channel dev_0: starting piece 1 at 11-OCT-07
channel dev_1: starting incremental level 0 datafile backupset
channel dev_1: specifying datafile(s) in backupset
input datafile fno=00010 name=+DG_DB/rac/datafile/tbs_pool_064.dbf
input datafile fno=00014 name=+DG_DB/rac/datafile/tbs_pool_063.dbf
input datafile fno=00018 name=+DG_DB/rac/datafile/tbs_pool_061.dbf
input datafile fno=00022 name=+DG_DB/rac/datafile/tbs_pool_057.dbf
input datafile fno=00026 name=+DG_DB/rac/datafile/tbs_pool_058.dbf
input datafile fno=00030 name=+DG_DB/rac/datafile/tbs_pool_054.dbf
input datafile fno=00034 name=+DG_DB/rac/datafile/tbs_pool_053.dbf
input datafile fno=00038 name=+DG_DB/rac/datafile/tbs_pool_056.dbf
input datafile fno=00042 name=+DG_DB/rac/datafile/tbs_pool_055.dbf
input datafile fno=00046 name=+DG_DB/rac/datafile/tbs_pool_045.dbf
input datafile fno=00050 name=+DG_DB/rac/datafile/tbs_pool_042.dbf
input datafile fno=00054 name=+DG_DB/rac/datafile/tbs_pool_035.dbf
input datafile fno=00058 name=+DG_DB/rac/datafile/tbs_pool_033.dbf
input datafile fno=00062 name=+DG_DB/rac/datafile/tbs_pool_044.dbf
input datafile fno=00066 name=+DG_DB/rac/datafile/tbs_pool_048.dbf
input datafile fno=00070 name=+DG_DB/rac/datafile/tbs_pool_040.dbf
input datafile fno=00074 name=+DG_DB/rac/datafile/tbs_pool_046.dbf
channel dev_1: starting piece 1 at 11-OCT-07
channel dev_2: starting incremental level 0 datafile backupset
channel dev_2: specifying datafile(s) in backupset
[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 11.10.2007 20:16:22
  STARTING Media Agent "COMPAQ:SDLT320_2"

input datafile fno=00011 name=+DG_DB/rac/datafile/tbs_pool_065.dbf
[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 20:16:23
  STARTING Media Agent "COMPAQ:SDLT320_1"

input datafile fno=00015 name=+DG_DB/rac/datafile/tbs_pool_003.dbf
input datafile fno=00019 name=+DG_DB/rac/datafile/tbs_pool_006.dbf
input datafile fno=00023 name=+DG_DB/rac/datafile/tbs_pool_005.dbf
input datafile fno=00027 name=+DG_DB/rac/datafile/tbs_pool_014.dbf
[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 20:16:28
  By: UMA@ita018@/dev/rac/c20t0d0
  Loading medium from slot 22 to device /dev/rmt/0mn

input datafile fno=00031 name=+DG_DB/rac/datafile/tbs_pool_013.dbf
[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 11.10.2007 20:16:23
  By: UMA@ita018@/dev/rac/c20t0d0
  Loading medium from slot 23 to device /dev/rmt/1mn
```

```
input datafile fno=00035 name=+DG_DB/rac/datafile/tbs_pool_015.dbf
input datafile fno=00039 name=+DG_DB/rac/datafile/tbs_pool_016.dbf
input datafile fno=00043 name=+DG_DB/rac/datafile/tbs_pool_031.dbf
input datafile fno=00047 name=+DG_DB/rac/datafile/tbs_pool_018.dbf
input datafile fno=00051 name=+DG_DB/rac/datafile/tbs_pool_024.dbf
input datafile fno=00055 name=+DG_DB/rac/datafile/tbs_pool_029.dbf
input datafile fno=00059 name=+DG_DB/rac/datafile/tbs_pool_022.dbf
input datafile fno=00063 name=+DG_DB/rac/datafile/tbs_pool_027.dbf
input datafile fno=00067 name=+DG_DB/rac/datafile/tbs_pool_026.dbf
input datafile fno=00071 name=+DG_DB/rac/datafile/tbs_pool_028.dbf
channel dev_2: starting piece 1 at 11-OCT-07
channel dev_3: starting incremental level 0 datafile backupset
channel dev_3: specifying datafile(s) in backupset
input datafile fno=00012 name=+DG_DB/rac/datafile/tbs_pool_066.dbf
input datafile fno=00016 name=+DG_DB/rac/datafile/tbs_pool_062.dbf
input datafile fno=00020 name=+DG_DB/rac/datafile/tbs_pool_059.dbf
input datafile fno=00024 name=+DG_DB/rac/datafile/tbs_pool_060.dbf
input datafile fno=00028 name=+DG_DB/rac/datafile/tbs_pool_051.dbf
input datafile fno=00032 name=+DG_DB/rac/datafile/tbs_pool_052.dbf
input datafile fno=00036 name=+DG_DB/rac/datafile/tbs_pool_050.dbf
input datafile fno=00040 name=+DG_DB/rac/datafile/tbs_pool_049.dbf
input datafile fno=00044 name=+DG_DB/rac/datafile/tbs_pool_034.dbf
input datafile fno=00048 name=+DG_DB/rac/datafile/tbs_pool_047.dbf
input datafile fno=00052 name=+DG_DB/rac/datafile/tbs_pool_041.dbf
input datafile fno=00056 name=+DG_DB/rac/datafile/tbs_pool_036.dbf
input datafile fno=00060 name=+DG_DB/rac/datafile/tbs_pool_043.dbf
input datafile fno=00064 name=+DG_DB/rac/datafile/tbs_pool_038.dbf
input datafile fno=00068 name=+DG_DB/rac/datafile/tbs_pool_039.dbf
input datafile fno=00072 name=+DG_DB/rac/datafile/tbs_pool_037.dbf
channel dev_3: starting piece 1 at 11-OCT-07
[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 11.10.2007 20:16:51
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_BACKUP<RAC_550:635717772:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 11.10.2007 20:17:02
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_BACKUP<RAC_551:635717772:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 11.10.2007 21:04:49
  Backup Profile:

        Run Time ..... 0:47:47
        Backup Speed ..... 21504,27 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 11.10.2007 21:04:49
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_BACKUP<RAC_551:635717772:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita022 "RAC"  Time: 11.10.2007 21:04:50
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_BACKUP<RAC_552:635717773:1>.dbf "Oracle8"

channel dev_1: finished piece 1 at 11-OCT-07
piece handle=RAC_POOL_BACKUP<RAC_551:635717772:1>.dbf tag=TAG20071011T201615 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_1: backup set complete, elapsed time: 00:48:46
[Normal] From: OB2BAR_Oracle8@ita022 "RAC"  Time: 11.10.2007 21:27:19
  Backup Profile:

        Run Time ..... 0:22:29
        Backup Speed ..... 42993,39 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita022 "RAC"  Time: 11.10.2007 21:27:19
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_BACKUP<RAC_552:635717773:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita022 "RAC"  Time: 11.10.2007 21:27:19
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_BACKUP<RAC_553:635717774:1>.dbf "Oracle8"

channel dev_2: finished piece 1 at 11-OCT-07
```

```
piece handle=RAC_POOL_BACKUP<RAC_552:635717773:1>.dbf tag=TAG20071011T201615 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_2: backup set complete, elapsed time: 01:11:16
[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 11.10.2007 21:47:32
  Backup Profile:

        Run Time ..... 1:30:41
        Backup Speed ..... 11312,23 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 11.10.2007 21:47:32
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_BACKUP<RAC_550:635717772:1>.dbf "Oracle8"

channel dev_0: finished piece 1 at 11-OCT-07
piece handle=RAC_POOL_BACKUP<RAC_550:635717772:1>.dbf tag=TAG20071011T201615 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_0: backup set complete, elapsed time: 01:31:24
[Normal] From: OB2BAR_Oracle8@ita022 "RAC"  Time: 11.10.2007 21:49:57
  Backup Profile:

        Run Time ..... 0:22:38
        Backup Speed ..... 42714,86 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita022 "RAC"  Time: 11.10.2007 21:49:57
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_BACKUP<RAC_553:635717774:1>.dbf "Oracle8"

channel dev_3: finished piece 1 at 11-OCT-07
piece handle=RAC_POOL_BACKUP<RAC_553:635717774:1>.dbf tag=TAG20071011T201615 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_3: backup set complete, elapsed time: 01:33:48
Finished backup at 11-OCT-07

Starting Control File and SPFILE Autobackup at 11-OCT-07
[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 11.10.2007 21:50:51
  Starting OB2BAR Backup: ita018-vip:c-2216826430-20071011-04 "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 11.10.2007 21:50:54
  Backup Profile:

        Run Time ..... 0:00:04
        Backup Speed ..... 4800,00 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 11.10.2007 21:50:54
  Completed OB2BAR Backup: ita018-vip:c-2216826430-20071011-04 "Oracle8"

piece handle=c-2216826430-20071011-04 comment=API Version 2.0,MMS Version 65.6.0.0
Finished Control File and SPFILE Autobackup at 11-OCT-07
released channel: dev_0
released channel: dev_1
released channel: dev_2
released channel: dev_3

Recovery Manager complete.
[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 21:51:15
  Oracle Recovery Manager completed.

[Normal] From: ob2rman@ita018 "RAC"  Time: 10/11/07 21:51:15
  Backup of target database completed.

[Normal] From: BSM@ita017 "RAC_POOL_BACKUP"  Time: 11.10.2007 21:51:11
  OB2BAR application on "ita018-vip" disconnected.

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 21:51:40
  /dev/rmt/0mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 21:51:56
```

```
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 22 from device /dev/rmt/0mn

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 11.10.2007 21:52:08
  COMPLETED Media Agent "COMPAQ:SDLT320_1"

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 11.10.2007 21:52:45
  /dev/rmt/1mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 11.10.2007 21:53:01
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 23 from device /dev/rmt/1mn

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 11.10.2007 21:53:13
  COMPLETED Media Agent "COMPAQ:SDLT320_2"

[Normal] From: BSM@ita017 "RAC_POOL_BACKUP"  Time: 11.10.2007 21:53:14

  Backup Statistics:

        Session Queuing Time (hours)      0,00
        ---------------------------------------
        Completed Disk Agents ........       5
        Failed Disk Agents ...........       0
        Aborted Disk Agents ..........       0
        ---------------------------------------
        Disk Agents Total  ...........       5
        =======================================
        Completed Media Agents .......       2
        Failed Media Agents ..........       0
        Aborted Media Agents .........       0
        ---------------------------------------
        Media Agents Total  ..........       2
        =======================================
        Mbytes Total ................. 233898 MB
        Used Media Total .............       2
        Disk Agent Errors Total ......       0
```

Session 4: Backup using ita018-vip and service MSL5000

- Two channels allocated on RAC2 and none on RAC1

```
[Normal] From: BSM@ita017 "RAC_POOL_MSL5000"  Time: 19.10.2007 09:21:34
  OB2BAR application on "ita018-vip" successfully started.

[Normal] From: ob2rman@ita018 "RAC"  Time: 10/19/07 09:21:36
  Starting backup of target database.

  Net service name: MSL5000.
  Instance status: OPEN.
  Instance name: RAC1.
  Database DBID = 2216826430.
  Database control file type: CURRENT.
  Database log mode: ARCHIVELOG.


[Normal] From: ob2rman@ita018 "RAC"  Time: 10/19/07 09:21:42
  Starting Oracle Recovery Manager.


Recovery Manager: Release 10.2.0.3.0 - Production on Fri Oct 19 09:21:42 2007

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RMAN> CONNECT TARGET *
2> CONNECT CATALOG *
3> run {
4> allocate channel 'dev_0' type 'sbt_tape'
5> parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_MSL5000) ,BLKSIZE=1048576'
maxopenfiles 1;
6> allocate channel 'dev_1' type 'sbt_tape'
7> parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_MSL5000) ,BLKSIZE=1048576'
maxopenfiles 1;
8> backup incremental level 0
9> format 'RAC_POOL_MSL5000<RAC_%s:%t:%p>.dbf'
10> tablespace 'POOL';
11> }
12> EXIT
connected to target database: RAC (DBID=2216826430)

connected to recovery catalog database

allocated channel: dev_0
channel dev_0: sid=2203 instance=RAC2 devtype=SBT_TAPE
channel dev_0: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

allocated channel: dev_1
channel dev_1: sid=2212 instance=RAC2 devtype=SBT_TAPE
channel dev_1: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

Starting backup at 19-OCT-07
channel dev_0: starting incremental level 0 datafile backupset
channel dev_0: specifying datafile(s) in backupset
input datafile fno=00009 name=+DG_DB/rac/datafile/tbs_pool_001.dbf
input datafile fno=00011 name=+DG_DB/rac/datafile/tbs_pool_065.dbf
input datafile fno=00013 name=+DG_DB/rac/datafile/tbs_pool_002.dbf
input datafile fno=00015 name=+DG_DB/rac/datafile/tbs_pool_003.dbf
input datafile fno=00017 name=+DG_DB/rac/datafile/tbs_pool_004.dbf
input datafile fno=00019 name=+DG_DB/rac/datafile/tbs_pool_006.dbf
input datafile fno=00021 name=+DG_DB/rac/datafile/tbs_pool_008.dbf
input datafile fno=00023 name=+DG_DB/rac/datafile/tbs_pool_005.dbf
input datafile fno=00025 name=+DG_DB/rac/datafile/tbs_pool_007.dbf
```

```
input datafile fno=00027 name=+DG_DB/rac/datafile/tbs_pool_014.dbf
input datafile fno=00029 name=+DG_DB/rac/datafile/tbs_pool_011.dbf
input datafile fno=00031 name=+DG_DB/rac/datafile/tbs_pool_013.dbf
input datafile fno=00033 name=+DG_DB/rac/datafile/tbs_pool_012.dbf
input datafile fno=00035 name=+DG_DB/rac/datafile/tbs_pool_015.dbf
input datafile fno=00037 name=+DG_DB/rac/datafile/tbs_pool_009.dbf
input datafile fno=00039 name=+DG_DB/rac/datafile/tbs_pool_016.dbf
input datafile fno=00041 name=+DG_DB/rac/datafile/tbs_pool_010.dbf
input datafile fno=00043 name=+DG_DB/rac/datafile/tbs_pool_031.dbf
input datafile fno=00045 name=+DG_DB/rac/datafile/tbs_pool_020.dbf
input datafile fno=00047 name=+DG_DB/rac/datafile/tbs_pool_018.dbf
input datafile fno=00049 name=+DG_DB/rac/datafile/tbs_pool_023.dbf
input datafile fno=00051 name=+DG_DB/rac/datafile/tbs_pool_024.dbf
input datafile fno=00053 name=+DG_DB/rac/datafile/tbs_pool_030.dbf
input datafile fno=00055 name=+DG_DB/rac/datafile/tbs_pool_029.dbf
input datafile fno=00057 name=+DG_DB/rac/datafile/tbs_pool_032.dbf
input datafile fno=00059 name=+DG_DB/rac/datafile/tbs_pool_022.dbf
input datafile fno=00061 name=+DG_DB/rac/datafile/tbs_pool_021.dbf
input datafile fno=00063 name=+DG_DB/rac/datafile/tbs_pool_027.dbf
input datafile fno=00065 name=+DG_DB/rac/datafile/tbs_pool_017.dbf
input datafile fno=00067 name=+DG_DB/rac/datafile/tbs_pool_026.dbf
input datafile fno=00069 name=+DG_DB/rac/datafile/tbs_pool_025.dbf
input datafile fno=00071 name=+DG_DB/rac/datafile/tbs_pool_028.dbf
input datafile fno=00073 name=+DG_DB/rac/datafile/tbs_pool_019.dbf
channel dev_0: starting piece 1 at 19-OCT-07
channel dev_1: starting incremental level 0 datafile backupset
channel dev_1: specifying datafile(s) in backupset
input datafile fno=00010 name=+DG_DB/rac/datafile/tbs_pool_064.dbf
input datafile fno=00012 name=+DG_DB/rac/datafile/tbs_pool_066.dbf
input datafile fno=00014 name=+DG_DB/rac/datafile/tbs_pool_063.dbf
input datafile fno=00016 name=+DG_DB/rac/datafile/tbs_pool_062.dbf
input datafile fno=00018 name=+DG_DB/rac/datafile/tbs_pool_061.dbf
input datafile fno=00020 name=+DG_DB/rac/datafile/tbs_pool_059.dbf
input datafile fno=00022 name=+DG_DB/rac/datafile/tbs_pool_057.dbf
input datafile fno=00024 name=+DG_DB/rac/datafile/tbs_pool_060.dbf
input datafile fno=00026 name=+DG_DB/rac/datafile/tbs_pool_058.dbf
input datafile fno=00028 name=+DG_DB/rac/datafile/tbs_pool_051.dbf
input datafile fno=00030 name=+DG_DB/rac/datafile/tbs_pool_054.dbf
input datafile fno=00032 name=+DG_DB/rac/datafile/tbs_pool_052.dbf
input datafile fno=00034 name=+DG_DB/rac/datafile/tbs_pool_053.dbf
input datafile fno=00036 name=+DG_DB/rac/datafile/tbs_pool_050.dbf
input datafile fno=00038 name=+DG_DB/rac/datafile/tbs_pool_056.dbf
input datafile fno=00040 name=+DG_DB/rac/datafile/tbs_pool_049.dbf
input datafile fno=00042 name=+DG_DB/rac/datafile/tbs_pool_055.dbf
input datafile fno=00044 name=+DG_DB/rac/datafile/tbs_pool_034.dbf
input datafile fno=00046 name=+DG_DB/rac/datafile/tbs_pool_045.dbf
input datafile fno=00048 name=+DG_DB/rac/datafile/tbs_pool_047.dbf
input datafile fno=00050 name=+DG_DB/rac/datafile/tbs_pool_042.dbf
input datafile fno=00052 name=+DG_DB/rac/datafile/tbs_pool_041.dbf
input datafile fno=00054 name=+DG_DB/rac/datafile/tbs_pool_035.dbf
input datafile fno=00056 name=+DG_DB/rac/datafile/tbs_pool_036.dbf
input datafile fno=00058 name=+DG_DB/rac/datafile/tbs_pool_033.dbf
input datafile fno=00060 name=+DG_DB/rac/datafile/tbs_pool_043.dbf
input datafile fno=00062 name=+DG_DB/rac/datafile/tbs_pool_044.dbf
input datafile fno=00064 name=+DG_DB/rac/datafile/tbs_pool_038.dbf
input datafile fno=00066 name=+DG_DB/rac/datafile/tbs_pool_048.dbf
input datafile fno=00068 name=+DG_DB/rac/datafile/tbs_pool_039.dbf
input datafile fno=00070 name=+DG_DB/rac/datafile/tbs_pool_040.dbf
input datafile fno=00072 name=+DG_DB/rac/datafile/tbs_pool_037.dbf
input datafile fno=00074 name=+DG_DB/rac/datafile/tbs_pool_046.dbf
channel dev_1: starting piece 1 at 19-OCT-07
[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 19.10.2007 09:21:53
  STARTING Media Agent "COMPAQ:SDLT320_1"

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 19.10.2007 09:21:58
```

```
  By: UMA@ita018@/dev/rac/c20t0d0
  Loading medium from slot 25 to device /dev/rmt/0mn

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 19.10.2007 09:21:57
  STARTING Media Agent "COMPAQ:SDLT320_2"

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 19.10.2007 09:22:07
  By: UMA@ita018@/dev/rac/c20t0d0
  Loading medium from slot 12 to device /dev/rmt/1mn

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 19.10.2007 09:22:26
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_MSL5000<RAC_602:636369706:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 19.10.2007 09:22:37
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_MSL5000<RAC_603:636369706:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 19.10.2007 10:08:12
  Backup Profile:

        Run Time ..... 0:45:35
        Backup Speed ..... 43751,20 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 19.10.2007 10:08:12
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_MSL5000<RAC_603:636369706:1>.dbf "Oracle8"

channel dev_1: finished piece 1 at 19-OCT-07
piece handle=RAC_POOL_MSL5000<RAC_603:636369706:1>.dbf tag=TAG20071019T092146 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_1: backup set complete, elapsed time: 00:46:29
[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 19.10.2007 10:09:24
  Backup Profile:

        Run Time ..... 0:46:58
        Backup Speed ..... 42422,96 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 19.10.2007 10:09:24
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_MSL5000<RAC_602:636369706:1>.dbf "Oracle8"

channel dev_0: finished piece 1 at 19-OCT-07
piece handle=RAC_POOL_MSL5000<RAC_602:636369706:1>.dbf tag=TAG20071019T092146 comment=API Version 2.0,MMS
Version 65.6.0.0
channel dev_0: backup set complete, elapsed time: 00:47:44
Finished backup at 19-OCT-07

Starting Control File and SPFILE Autobackup at 19-OCT-07
[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 19.10.2007 10:10:20
  Starting OB2BAR Backup: ita018-vip:c-2216826430-20071019-00 "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 19.10.2007 10:10:22
  Backup Profile:

        Run Time ..... 0:00:02
        Backup Speed ..... 9728,00 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 19.10.2007 10:10:22
  Completed OB2BAR Backup: ita018-vip:c-2216826430-20071019-00 "Oracle8"

piece handle=c-2216826430-20071019-00 comment=API Version 2.0,MMS Version 65.6.0.0
Finished Control File and SPFILE Autobackup at 19-OCT-07
released channel: dev_0
released channel: dev_1

Recovery Manager complete.
[Normal] From: ob2rman@ita018 "RAC"  Time: 10/19/07 10:10:40
  Oracle Recovery Manager completed.
```

```
[Normal] From: ob2rman@ita018 "RAC"  Time: 10/19/07 10:10:41
  Backup of target database completed.

[Normal] From: BSM@ita017 "RAC_POOL_MSL5000"  Time: 19.10.2007 10:10:41
  OB2BAR application on "ita018-vip" disconnected.

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 19.10.2007 10:11:29
  /dev/rmt/1mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 19.10.2007 10:11:45
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 12 from device /dev/rmt/1mn

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 19.10.2007 10:11:57
  COMPLETED Media Agent "COMPAQ:SDLT320_2"

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 19.10.2007 10:12:22
  /dev/rmt/0mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 19.10.2007 10:12:38
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 25 from device /dev/rmt/0mn

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 19.10.2007 10:12:51
  COMPLETED Media Agent "COMPAQ:SDLT320_1"

[Normal] From: BSM@ita017 "RAC_POOL_MSL5000"  Time: 19.10.2007 10:12:52

  Backup Statistics:

        Session Queuing Time (hours)      0,00
        ---------------------------------------
        Completed Disk Agents ........       3
        Failed Disk Agents ...........       0
        Aborted Disk Agents ..........       0
        ---------------------------------------
        Disk Agents Total  ...........       3
        =======================================
        Completed Media Agents .......       2
        Failed Media Agents ..........       0
        Aborted Media Agents .........       0
        ---------------------------------------
        Media Agents Total  ..........       2
        =======================================
        Mbytes Total ................. 233898 MB
        Used Media Total .............       2
        Disk Agent Errors Total ......       0


================================================================================
                      Session completed successfully!
================================================================================
```

Session 5: Backup allocating channels manually on RAC1 and RAC2

```
[Normal] From: BSM@ita017 "RAC_POOL_man_ch_1_2"  Time: 05.10.2007 17:25:33
  OB2BAR application on "ita018-vip" successfully started.

[Normal] From: ob2rman@ita018 "RAC"  Time: 10/05/07 17:25:39
  Starting backup of target database.

  Net service name: MSL5000.
  Instance status: OPEN.
  Instance name: RAC2.
  Database DBID = 2216826430.
  Database control file type: CURRENT.
  Database log mode: ARCHIVELOG.


[Normal] From: ob2rman@ita018 "RAC"  Time: 10/05/07 17:25:45
  Starting Oracle Recovery Manager.


Recovery Manager: Release 10.2.0.3.0 - Production on Fri Oct 5 17:25:45 2007

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RMAN> CONNECT TARGET *
2> CONNECT CATALOG *
3> run {
4> allocate channel 'dev_0' type 'sbt_tape'
5>  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2,OB2BARHOSTNAME=ita018-
vip)' connect * maxopenfiles 1;
6> allocate channel 'dev_1' type 'sbt_tape'
7>  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2,OB2BARHOSTNAME=ita018-
vip)' connect * maxopenfiles 1;
8> backup incremental level 0
9>  format 'RAC_POOL_man_ch_1_2<RAC_%s:%t:%p>.dbf'
10>  tablespace 'POOL';
11> }
12> EXIT
connected to target database: RAC (DBID=2216826430)

connected to recovery catalog database

allocated channel: dev_0
channel dev_0: sid=2221 instance=RAC1 devtype=SBT_TAPE
channel dev_0: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

allocated channel: dev_1
channel dev_1: sid=2209 instance=RAC2 devtype=SBT_TAPE
channel dev_1: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

Starting backup at 05-OCT-07
channel dev_0: starting incremental level 0 datafile backupset
channel dev_0: specifying datafile(s) in backupset
input datafile fno=00009 name=+DG_DB/rac/datafile/tbs_pool_001.dbf
input datafile fno=00011 name=+DG_DB/rac/datafile/tbs_pool_065.dbf
input datafile fno=00013 name=+DG_DB/rac/datafile/tbs_pool_002.dbf
input datafile fno=00015 name=+DG_DB/rac/datafile/tbs_pool_003.dbf
input datafile fno=00017 name=+DG_DB/rac/datafile/tbs_pool_004.dbf
input datafile fno=00019 name=+DG_DB/rac/datafile/tbs_pool_006.dbf
input datafile fno=00021 name=+DG_DB/rac/datafile/tbs_pool_008.dbf
input datafile fno=00023 name=+DG_DB/rac/datafile/tbs_pool_005.dbf
input datafile fno=00025 name=+DG_DB/rac/datafile/tbs_pool_007.dbf
input datafile fno=00027 name=+DG_DB/rac/datafile/tbs_pool_014.dbf
```

```
input datafile fno=00029 name=+DG_DB/rac/datafile/tbs_pool_011.dbf
input datafile fno=00031 name=+DG_DB/rac/datafile/tbs_pool_013.dbf
input datafile fno=00033 name=+DG_DB/rac/datafile/tbs_pool_012.dbf
input datafile fno=00035 name=+DG_DB/rac/datafile/tbs_pool_015.dbf
input datafile fno=00037 name=+DG_DB/rac/datafile/tbs_pool_009.dbf
input datafile fno=00039 name=+DG_DB/rac/datafile/tbs_pool_016.dbf
input datafile fno=00041 name=+DG_DB/rac/datafile/tbs_pool_010.dbf
input datafile fno=00043 name=+DG_DB/rac/datafile/tbs_pool_031.dbf
input datafile fno=00045 name=+DG_DB/rac/datafile/tbs_pool_020.dbf
input datafile fno=00047 name=+DG_DB/rac/datafile/tbs_pool_018.dbf
input datafile fno=00049 name=+DG_DB/rac/datafile/tbs_pool_023.dbf
input datafile fno=00051 name=+DG_DB/rac/datafile/tbs_pool_024.dbf
input datafile fno=00053 name=+DG_DB/rac/datafile/tbs_pool_030.dbf
input datafile fno=00055 name=+DG_DB/rac/datafile/tbs_pool_029.dbf
input datafile fno=00057 name=+DG_DB/rac/datafile/tbs_pool_032.dbf
input datafile fno=00059 name=+DG_DB/rac/datafile/tbs_pool_022.dbf
input datafile fno=00061 name=+DG_DB/rac/datafile/tbs_pool_021.dbf
input datafile fno=00063 name=+DG_DB/rac/datafile/tbs_pool_027.dbf
input datafile fno=00065 name=+DG_DB/rac/datafile/tbs_pool_017.dbf
input datafile fno=00067 name=+DG_DB/rac/datafile/tbs_pool_026.dbf
input datafile fno=00069 name=+DG_DB/rac/datafile/tbs_pool_025.dbf
input datafile fno=00071 name=+DG_DB/rac/datafile/tbs_pool_028.dbf
input datafile fno=00073 name=+DG_DB/rac/datafile/tbs_pool_019.dbf
channel dev_0: starting piece 1 at 05-OCT-07
channel dev_1: starting incremental level 0 datafile backupset
channel dev_1: specifying datafile(s) in backupset
input datafile fno=00010 name=+DG_DB/rac/datafile/tbs_pool_064.dbf
input datafile fno=00012 name=+DG_DB/rac/datafile/tbs_pool_066.dbf
input datafile fno=00014 name=+DG_DB/rac/datafile/tbs_pool_063.dbf
input datafile fno=00016 name=+DG_DB/rac/datafile/tbs_pool_062.dbf
input datafile fno=00018 name=+DG_DB/rac/datafile/tbs_pool_061.dbf
input datafile fno=00020 name=+DG_DB/rac/datafile/tbs_pool_059.dbf
input datafile fno=00022 name=+DG_DB/rac/datafile/tbs_pool_057.dbf
input datafile fno=00024 name=+DG_DB/rac/datafile/tbs_pool_060.dbf
input datafile fno=00026 name=+DG_DB/rac/datafile/tbs_pool_058.dbf
input datafile fno=00028 name=+DG_DB/rac/datafile/tbs_pool_051.dbf
input datafile fno=00030 name=+DG_DB/rac/datafile/tbs_pool_054.dbf
input datafile fno=00032 name=+DG_DB/rac/datafile/tbs_pool_052.dbf
input datafile fno=00034 name=+DG_DB/rac/datafile/tbs_pool_053.dbf
input datafile fno=00036 name=+DG_DB/rac/datafile/tbs_pool_050.dbf
input datafile fno=00038 name=+DG_DB/rac/datafile/tbs_pool_056.dbf
input datafile fno=00040 name=+DG_DB/rac/datafile/tbs_pool_049.dbf
input datafile fno=00042 name=+DG_DB/rac/datafile/tbs_pool_055.dbf
input datafile fno=00044 name=+DG_DB/rac/datafile/tbs_pool_034.dbf
input datafile fno=00046 name=+DG_DB/rac/datafile/tbs_pool_045.dbf
input datafile fno=00048 name=+DG_DB/rac/datafile/tbs_pool_047.dbf
input datafile fno=00050 name=+DG_DB/rac/datafile/tbs_pool_042.dbf
input datafile fno=00052 name=+DG_DB/rac/datafile/tbs_pool_041.dbf
input datafile fno=00054 name=+DG_DB/rac/datafile/tbs_pool_035.dbf
input datafile fno=00056 name=+DG_DB/rac/datafile/tbs_pool_036.dbf
input datafile fno=00058 name=+DG_DB/rac/datafile/tbs_pool_033.dbf
input datafile fno=00060 name=+DG_DB/rac/datafile/tbs_pool_043.dbf
input datafile fno=00062 name=+DG_DB/rac/datafile/tbs_pool_044.dbf
input datafile fno=00064 name=+DG_DB/rac/datafile/tbs_pool_038.dbf
input datafile fno=00066 name=+DG_DB/rac/datafile/tbs_pool_048.dbf
input datafile fno=00068 name=+DG_DB/rac/datafile/tbs_pool_039.dbf
input datafile fno=00070 name=+DG_DB/rac/datafile/tbs_pool_040.dbf
input datafile fno=00072 name=+DG_DB/rac/datafile/tbs_pool_037.dbf
input datafile fno=00074 name=+DG_DB/rac/datafile/tbs_pool_046.dbf
channel dev_1: starting piece 1 at 05-OCT-07
[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 05.10.2007 17:25:56
  STARTING Media Agent "COMPAQ:SDLT320_1"

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 05.10.2007 17:26:01
  By: UMA@ita018@/dev/rac/c20t0d0
```

```
  Loading medium from slot 22 to device /dev/rmt/0mn

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 05.10.2007 17:25:57
  STARTING Media Agent "COMPAQ:SDLT320_2"

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 05.10.2007 17:26:07
  By: UMA@ita018@/dev/rac/c20t0d0
  Loading medium from slot 6 to device /dev/rmt/1mn

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 05.10.2007 17:26:31
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_man_ch_1_2<RAC_460:635189150:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 05.10.2007 17:26:37
  Starting OB2BAR Backup: ita018-vip:RAC_POOL_man_ch_1_2<RAC_461:635189146:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 05.10.2007 18:11:12
  Backup Profile:

        Run Time ..... 0:44:35
        Backup Speed ..... 44732,44 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita021 "RAC"  Time: 05.10.2007 18:11:12
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_man_ch_1_2<RAC_461:635189146:1>.dbf "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 05.10.2007 18:11:20
  Backup Profile:

        Run Time ..... 0:44:49
        Backup Speed ..... 44458,13 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 05.10.2007 18:11:20
  Completed OB2BAR Backup: ita018-vip:RAC_POOL_man_ch_1_2<RAC_460:635189150:1>.dbf "Oracle8"

channel dev_0: finished piece 1 at 05-OCT-07
piece handle=RAC_POOL_man_ch_1_2<RAC_460:635189150:1>.dbf tag=TAG20071005T172549 comment=API Version
2.0,MMS Version 65.6.0.0
channel dev_0: backup set complete, elapsed time: 00:45:32
channel dev_1: finished piece 1 at 05-OCT-07
piece handle=RAC_POOL_man_ch_1_2<RAC_461:635189146:1>.dbf tag=TAG20071005T172549 comment=API Version
2.0,MMS Version 65.6.0.0
channel dev_1: backup set complete, elapsed time: 00:45:31
Finished backup at 05-OCT-07

Starting Control File and SPFILE Autobackup at 05-OCT-07
[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 05.10.2007 18:12:11
  Starting OB2BAR Backup: ita018-vip:c-2216826430-20071005-02 "Oracle8"

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 05.10.2007 18:12:13
  Backup Profile:

        Run Time ..... 0:00:02
        Backup Speed ..... 9472,00 (KB/s)

[Normal] From: OB2BAR_Oracle8@ita018 "RAC"  Time: 05.10.2007 18:12:13
  Completed OB2BAR Backup: ita018-vip:c-2216826430-20071005-02 "Oracle8"

piece handle=c-2216826430-20071005-02 comment=API Version 2.0,MMS Version 65.6.0.0
Finished Control File and SPFILE Autobackup at 05-OCT-07
released channel: dev_0
released channel: dev_1

Recovery Manager complete.
[Normal] From: ob2rman@ita018 "RAC"  Time: 10/05/07 18:12:29
  Oracle Recovery Manager completed.
```

```
[Normal] From: ob2rman@ita018 "RAC"  Time: 10/05/07 18:12:30
  Backup of target database completed.

[Normal] From: BSM@ita017 "RAC_POOL_man_ch_1_2"  Time: 05.10.2007 18:12:27
  OB2BAR application on "ita018-vip" disconnected.

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 05.10.2007 18:13:23
  /dev/rmt/1mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 05.10.2007 18:13:30
  /dev/rmt/0mn
  Medium header verification completed, 0 errors found

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 05.10.2007 18:13:39
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 6 from device /dev/rmt/1mn

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 05.10.2007 18:13:46
  By: UMA@ita018@/dev/rac/c20t0d0
  Unloading medium to slot 22 from device /dev/rmt/0mn

[Normal] From: BMA@ita021 "COMPAQ:SDLT320_2"  Time: 05.10.2007 18:13:52
  COMPLETED Media Agent "COMPAQ:SDLT320_2"

[Normal] From: BMA@ita018 "COMPAQ:SDLT320_1"  Time: 05.10.2007 18:14:09
  COMPLETED Media Agent "COMPAQ:SDLT320_1"

[Normal] From: BSM@ita017 "RAC_POOL_man_ch_1_2"  Time: 05.10.2007 18:14:06

  Backup Statistics:

        Session Queuing Time (hours)      0,00
        ---------------------------------------
        Completed Disk Agents ........       3
        Failed Disk Agents ...........       0
        Aborted Disk Agents ..........       0
        ---------------------------------------
        Disk Agents Total  ...........       3
        =======================================
        Completed Media Agents .......       2
        Failed Media Agents ..........       0
        Aborted Media Agents .........       0
        ---------------------------------------
        Media Agents Total  ..........       2
        =======================================
        Mbytes Total ................. 233898 MB
        Used Media Total .............       2
        Disk Agent Errors Total ......       0
```

Session 6: Restore allocating channels manually on RAC1 and RAC2

- Manually created RMAN script
- Channels allocated on RAC1 and RAC2 using the connection string sys/xxx@<ORACLE_SID>
- Tablespace POOL offline
- Restore
- Recovery

```
oracle@ita018[RAC1]:/opt/oracle$ rman target sys/sys@MSL5000 catalog rman/rman@rcvcat cmdfile
restore_RAC_POOL_2ch.rcv

Recovery Manager: Release 10.2.0.3.0 - Production on Tue Oct 9 13:35:51 2007

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connected to target database: RAC (DBID=2216826430)
connected to recovery catalog database

RMAN> run {
2> allocate channel 'dev_0' type 'sbt_tape'
3>  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2)' connect *;
4> allocate channel 'dev_1' type 'sbt_tape'
5>  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2)' connect *;
6> SQL " alter tablespace POOL offline immediate";
7> restore tablespace 'POOL';
8> recover tablespace 'POOL';
9> SQL " alter tablespace POOL online";
10> release channel 'dev_0';
11> release channel 'dev_1';
12> }
13>
14>
allocated channel: dev_0
channel dev_0: sid=2209 instance=RAC1 devtype=SBT_TAPE
channel dev_0: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

allocated channel: dev_1
channel dev_1: sid=2222 instance=RAC2 devtype=SBT_TAPE
channel dev_1: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

sql statement:  alter tablespace POOL offline immediate

Starting restore at 2007-10-09

channel dev_0: starting datafile backupset restore
channel dev_0: specifying datafile(s) to restore from backup set
restoring datafile 00010 to +DG_DB/rac/datafile/tbs_pool_064.dbf
restoring datafile 00012 to +DG_DB/rac/datafile/tbs_pool_066.dbf
restoring datafile 00014 to +DG_DB/rac/datafile/tbs_pool_063.dbf
restoring datafile 00016 to +DG_DB/rac/datafile/tbs_pool_062.dbf
restoring datafile 00018 to +DG_DB/rac/datafile/tbs_pool_061.dbf
restoring datafile 00020 to +DG_DB/rac/datafile/tbs_pool_059.dbf
restoring datafile 00022 to +DG_DB/rac/datafile/tbs_pool_057.dbf
restoring datafile 00024 to +DG_DB/rac/datafile/tbs_pool_060.dbf
restoring datafile 00026 to +DG_DB/rac/datafile/tbs_pool_058.dbf
restoring datafile 00028 to +DG_DB/rac/datafile/tbs_pool_051.dbf
restoring datafile 00030 to +DG_DB/rac/datafile/tbs_pool_054.dbf
restoring datafile 00032 to +DG_DB/rac/datafile/tbs_pool_052.dbf
restoring datafile 00034 to +DG_DB/rac/datafile/tbs_pool_053.dbf
restoring datafile 00036 to +DG_DB/rac/datafile/tbs_pool_050.dbf
restoring datafile 00038 to +DG_DB/rac/datafile/tbs_pool_056.dbf
restoring datafile 00040 to +DG_DB/rac/datafile/tbs_pool_049.dbf
```

```
restoring datafile 00042 to +DG_DB/rac/datafile/tbs_pool_055.dbf
restoring datafile 00044 to +DG_DB/rac/datafile/tbs_pool_034.dbf
restoring datafile 00046 to +DG_DB/rac/datafile/tbs_pool_045.dbf
restoring datafile 00048 to +DG_DB/rac/datafile/tbs_pool_047.dbf
restoring datafile 00050 to +DG_DB/rac/datafile/tbs_pool_042.dbf
restoring datafile 00052 to +DG_DB/rac/datafile/tbs_pool_041.dbf
restoring datafile 00054 to +DG_DB/rac/datafile/tbs_pool_035.dbf
restoring datafile 00056 to +DG_DB/rac/datafile/tbs_pool_036.dbf
restoring datafile 00058 to +DG_DB/rac/datafile/tbs_pool_033.dbf
restoring datafile 00060 to +DG_DB/rac/datafile/tbs_pool_043.dbf
restoring datafile 00062 to +DG_DB/rac/datafile/tbs_pool_044.dbf
restoring datafile 00064 to +DG_DB/rac/datafile/tbs_pool_038.dbf
restoring datafile 00066 to +DG_DB/rac/datafile/tbs_pool_048.dbf
restoring datafile 00068 to +DG_DB/rac/datafile/tbs_pool_039.dbf
restoring datafile 00070 to +DG_DB/rac/datafile/tbs_pool_040.dbf
restoring datafile 00072 to +DG_DB/rac/datafile/tbs_pool_037.dbf
restoring datafile 00074 to +DG_DB/rac/datafile/tbs_pool_046.dbf
channel dev_0: reading from backup piece RAC_POOL_man_ch_1_2<RAC_496:635442810:1>.dbf
channel dev_1: starting datafile backupset restore
channel dev_1: specifying datafile(s) to restore from backup set
restoring datafile 00009 to +DG_DB/rac/datafile/tbs_pool_001.dbf
restoring datafile 00011 to +DG_DB/rac/datafile/tbs_pool_065.dbf
restoring datafile 00013 to +DG_DB/rac/datafile/tbs_pool_002.dbf
restoring datafile 00015 to +DG_DB/rac/datafile/tbs_pool_003.dbf
restoring datafile 00017 to +DG_DB/rac/datafile/tbs_pool_004.dbf
restoring datafile 00019 to +DG_DB/rac/datafile/tbs_pool_006.dbf
restoring datafile 00021 to +DG_DB/rac/datafile/tbs_pool_008.dbf
restoring datafile 00023 to +DG_DB/rac/datafile/tbs_pool_005.dbf
restoring datafile 00025 to +DG_DB/rac/datafile/tbs_pool_007.dbf
restoring datafile 00027 to +DG_DB/rac/datafile/tbs_pool_014.dbf
restoring datafile 00029 to +DG_DB/rac/datafile/tbs_pool_011.dbf
restoring datafile 00031 to +DG_DB/rac/datafile/tbs_pool_013.dbf
restoring datafile 00033 to +DG_DB/rac/datafile/tbs_pool_012.dbf
restoring datafile 00035 to +DG_DB/rac/datafile/tbs_pool_015.dbf
restoring datafile 00037 to +DG_DB/rac/datafile/tbs_pool_009.dbf
restoring datafile 00039 to +DG_DB/rac/datafile/tbs_pool_016.dbf
restoring datafile 00041 to +DG_DB/rac/datafile/tbs_pool_010.dbf
restoring datafile 00043 to +DG_DB/rac/datafile/tbs_pool_031.dbf
restoring datafile 00045 to +DG_DB/rac/datafile/tbs_pool_020.dbf
restoring datafile 00047 to +DG_DB/rac/datafile/tbs_pool_018.dbf
restoring datafile 00049 to +DG_DB/rac/datafile/tbs_pool_023.dbf
restoring datafile 00051 to +DG_DB/rac/datafile/tbs_pool_024.dbf
restoring datafile 00053 to +DG_DB/rac/datafile/tbs_pool_030.dbf
restoring datafile 00055 to +DG_DB/rac/datafile/tbs_pool_029.dbf
restoring datafile 00057 to +DG_DB/rac/datafile/tbs_pool_032.dbf
restoring datafile 00059 to +DG_DB/rac/datafile/tbs_pool_022.dbf
restoring datafile 00061 to +DG_DB/rac/datafile/tbs_pool_021.dbf
restoring datafile 00063 to +DG_DB/rac/datafile/tbs_pool_027.dbf
restoring datafile 00065 to +DG_DB/rac/datafile/tbs_pool_017.dbf
restoring datafile 00067 to +DG_DB/rac/datafile/tbs_pool_026.dbf
restoring datafile 00069 to +DG_DB/rac/datafile/tbs_pool_025.dbf
restoring datafile 00071 to +DG_DB/rac/datafile/tbs_pool_028.dbf
restoring datafile 00073 to +DG_DB/rac/datafile/tbs_pool_019.dbf
channel dev_1: reading from backup piece RAC_POOL_man_ch_1_2<RAC_495:635442814:1>.dbf
channel dev_1: restored backup piece 1
piece handle=RAC_POOL_man_ch_1_2<RAC_495:635442814:1>.dbf tag=TAG20071008T155328
channel dev_1: restore complete, elapsed time: 00:56:12
channel dev_0: restored backup piece 1
piece handle=RAC_POOL_man_ch_1_2<RAC_496:635442810:1>.dbf tag=TAG20071008T155328
channel dev_0: restore complete, elapsed time: 00:59:47
Finished restore at 2007-10-09

Starting recover at 2007-10-09

starting media recovery
```

```
archive log thread 1 sequence 1091 is already on disk as file +DG_FRA/rac/1_1091_628844420.dbf
archive log thread 1 sequence 1092 is already on disk as file +DG_FRA/rac/1_1092_628844420.dbf
archive log thread 1 sequence 1093 is already on disk as file +DG_FRA/rac/1_1093_628844420.dbf
archive log thread 1 sequence 1094 is already on disk as file +DG_FRA/rac/1_1094_628844420.dbf
archive log thread 1 sequence 1095 is already on disk as file +DG_FRA/rac/1_1095_628844420.dbf
archive log thread 2 sequence 442 is already on disk as file +DG_FRA/rac/2_442_628844420.dbf
archive log thread 2 sequence 443 is already on disk as file +DG_FRA/rac/2_443_628844420.dbf
archive log thread 3 sequence 429 is already on disk as file +DG_FRA/rac/3_429_628844420.dbf
archive log thread 3 sequence 430 is already on disk as file +DG_FRA/rac/3_430_628844420.dbf
archive log thread 4 sequence 434 is already on disk as file +DG_FRA/rac/4_434_628844420.dbf
archive log thread 4 sequence 435 is already on disk as file +DG_FRA/rac/4_435_628844420.dbf
archive log thread 4 sequence 436 is already on disk as file +DG_FRA/rac/4_436_628844420.dbf
archive log thread 4 sequence 437 is already on disk as file +DG_FRA/rac/4_437_628844420.dbf
archive log thread 4 sequence 438 is already on disk as file +DG_FRA/rac/4_438_628844420.dbf
archive log filename=+DG_FRA/rac/1_1091_628844420.dbf thread=1 sequence=1091
archive log filename=+DG_FRA/rac/2_442_628844420.dbf thread=2 sequence=442
archive log filename=+DG_FRA/rac/3_429_628844420.dbf thread=3 sequence=429
archive log filename=+DG_FRA/rac/4_434_628844420.dbf thread=4 sequence=434
archive log filename=+DG_FRA/rac/1_1092_628844420.dbf thread=1 sequence=1092
archive log filename=+DG_FRA/rac/4_435_628844420.dbf thread=4 sequence=435
archive log filename=+DG_FRA/rac/1_1093_628844420.dbf thread=1 sequence=1093
archive log filename=+DG_FRA/rac/1_1094_628844420.dbf thread=1 sequence=1094
archive log filename=+DG_FRA/rac/4_436_628844420.dbf thread=4 sequence=436
archive log filename=+DG_FRA/rac/4_437_628844420.dbf thread=4 sequence=437
media recovery complete, elapsed time: 00:00:20
Finished recover at 2007-10-09

sql statement:  alter tablespace POOL online

released channel: dev_0

released channel: dev_1

Recovery Manager complete.
```

Session 7: Restore and Recovery using an incremental backup

```
RMAN> run {
2> allocate channel 'dev_0' type 'sbt_tape'
3>  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2
)' connect *;
4> allocate channel 'dev_1' type 'sbt_tape'
5>  parms 'ENV=(OB2BARTYPE=Oracle8,OB2APPNAME=RAC,OB2BARLIST=RAC_POOL_man_ch_1_2
)' connect *;
6> SQL " alter tablespace POOL offline immediate";
7> restore tablespace 'POOL';
8> recover tablespace 'POOL';
9> SQL " alter tablespace POOL online";
10> release channel 'dev_0';
11> release channel 'dev_1';
12> }
13>
14>
allocated channel: dev_0
channel dev_0: sid=2221 instance=RAC1 devtype=SBT_TAPE
channel dev_0: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

allocated channel: dev_1
channel dev_1: sid=2207 instance=RAC2 devtype=SBT_TAPE
channel dev_1: Data Protector A.06.00/PHSS_35908/PHSS_35909/DPSOL_00261/DPLNX_

sql statement:  alter tablespace POOL offline immediate

Starting restore at 2007-11-07

channel dev_0: starting datafile backupset restore
channel dev_0: specifying datafile(s) to restore from backup set
restoring datafile 00010 to +DG_DB/rac/datafile/tbs_pool_064.dbf
restoring datafile 00012 to +DG_DB/rac/datafile/tbs_pool_066.dbf
restoring datafile 00014 to +DG_DB/rac/datafile/tbs_pool_063.dbf
restoring datafile 00016 to +DG_DB/rac/datafile/tbs_pool_062.dbf
restoring datafile 00018 to +DG_DB/rac/datafile/tbs_pool_061.dbf
restoring datafile 00020 to +DG_DB/rac/datafile/tbs_pool_059.dbf
restoring datafile 00022 to +DG_DB/rac/datafile/tbs_pool_060.dbf
restoring datafile 00024 to +DG_DB/rac/datafile/tbs_pool_057.dbf
restoring datafile 00026 to +DG_DB/rac/datafile/tbs_pool_058.dbf
restoring datafile 00028 to +DG_DB/rac/datafile/tbs_pool_056.dbf
restoring datafile 00030 to +DG_DB/rac/datafile/tbs_pool_054.dbf
restoring datafile 00032 to +DG_DB/rac/datafile/tbs_pool_051.dbf
restoring datafile 00034 to +DG_DB/rac/datafile/tbs_pool_050.dbf
restoring datafile 00036 to +DG_DB/rac/datafile/tbs_pool_049.dbf
restoring datafile 00038 to +DG_DB/rac/datafile/tbs_pool_053.dbf
restoring datafile 00040 to +DG_DB/rac/datafile/tbs_pool_055.dbf
restoring datafile 00042 to +DG_DB/rac/datafile/tbs_pool_052.dbf
restoring datafile 00044 to +DG_DB/rac/datafile/tbs_pool_040.dbf
restoring datafile 00046 to +DG_DB/rac/datafile/tbs_pool_038.dbf
restoring datafile 00048 to +DG_DB/rac/datafile/tbs_pool_043.dbf
restoring datafile 00050 to +DG_DB/rac/datafile/tbs_pool_042.dbf
restoring datafile 00052 to +DG_DB/rac/datafile/tbs_pool_037.dbf
restoring datafile 00054 to +DG_DB/rac/datafile/tbs_pool_035.dbf
restoring datafile 00056 to +DG_DB/rac/datafile/tbs_pool_045.dbf
restoring datafile 00058 to +DG_DB/rac/datafile/tbs_pool_034.dbf
restoring datafile 00060 to +DG_DB/rac/datafile/tbs_pool_048.dbf
restoring datafile 00062 to +DG_DB/rac/datafile/tbs_pool_036.dbf
restoring datafile 00064 to +DG_DB/rac/datafile/tbs_pool_044.dbf
restoring datafile 00066 to +DG_DB/rac/datafile/tbs_pool_047.dbf
restoring datafile 00068 to +DG_DB/rac/datafile/tbs_pool_046.dbf
restoring datafile 00070 to +DG_DB/rac/datafile/tbs_pool_039.dbf
```

```
restoring datafile 00072 to +DG_DB/rac/datafile/tbs_pool_041.dbf
restoring datafile 00074 to +DG_DB/rac/datafile/tbs_pool_033.dbf
channel dev_0: reading from backup piece RAC_POOL_man_ch_1_2<RAC_702:637941358:1>.dbf
channel dev_1: starting datafile backupset restore
channel dev_1: specifying datafile(s) to restore from backup set
restoring datafile 00009 to +DG_DB/rac/datafile/tbs_pool_001.dbf
restoring datafile 00011 to +DG_DB/rac/datafile/tbs_pool_065.dbf
restoring datafile 00013 to +DG_DB/rac/datafile/tbs_pool_002.dbf
restoring datafile 00015 to +DG_DB/rac/datafile/tbs_pool_003.dbf
restoring datafile 00017 to +DG_DB/rac/datafile/tbs_pool_004.dbf
restoring datafile 00019 to +DG_DB/rac/datafile/tbs_pool_006.dbf
restoring datafile 00021 to +DG_DB/rac/datafile/tbs_pool_005.dbf
restoring datafile 00023 to +DG_DB/rac/datafile/tbs_pool_008.dbf
restoring datafile 00025 to +DG_DB/rac/datafile/tbs_pool_007.dbf
restoring datafile 00027 to +DG_DB/rac/datafile/tbs_pool_009.dbf
restoring datafile 00029 to +DG_DB/rac/datafile/tbs_pool_011.dbf
restoring datafile 00031 to +DG_DB/rac/datafile/tbs_pool_014.dbf
restoring datafile 00033 to +DG_DB/rac/datafile/tbs_pool_015.dbf
restoring datafile 00035 to +DG_DB/rac/datafile/tbs_pool_016.dbf
restoring datafile 00037 to +DG_DB/rac/datafile/tbs_pool_012.dbf
restoring datafile 00039 to +DG_DB/rac/datafile/tbs_pool_010.dbf
restoring datafile 00041 to +DG_DB/rac/datafile/tbs_pool_013.dbf
restoring datafile 00043 to +DG_DB/rac/datafile/tbs_pool_025.dbf
restoring datafile 00045 to +DG_DB/rac/datafile/tbs_pool_027.dbf
restoring datafile 00047 to +DG_DB/rac/datafile/tbs_pool_022.dbf
restoring datafile 00049 to +DG_DB/rac/datafile/tbs_pool_023.dbf
restoring datafile 00051 to +DG_DB/rac/datafile/tbs_pool_028.dbf
restoring datafile 00053 to +DG_DB/rac/datafile/tbs_pool_030.dbf
restoring datafile 00055 to +DG_DB/rac/datafile/tbs_pool_020.dbf
restoring datafile 00057 to +DG_DB/rac/datafile/tbs_pool_031.dbf
restoring datafile 00059 to +DG_DB/rac/datafile/tbs_pool_017.dbf
restoring datafile 00061 to +DG_DB/rac/datafile/tbs_pool_029.dbf
restoring datafile 00063 to +DG_DB/rac/datafile/tbs_pool_021.dbf
restoring datafile 00065 to +DG_DB/rac/datafile/tbs_pool_018.dbf
restoring datafile 00067 to +DG_DB/rac/datafile/tbs_pool_019.dbf
restoring datafile 00069 to +DG_DB/rac/datafile/tbs_pool_026.dbf
restoring datafile 00071 to +DG_DB/rac/datafile/tbs_pool_024.dbf
restoring datafile 00073 to +DG_DB/rac/datafile/tbs_pool_032.dbf
channel dev_1: reading from backup piece RAC_POOL_man_ch_1_2<RAC_701:637941357:1>.dbf
channel dev_0: restored backup piece 1
piece handle=RAC_POOL_man_ch_1_2<RAC_702:637941358:1>.dbf tag=TAG20071106T135556
channel dev_0: restore complete, elapsed time: 00:58:41
channel dev_1: restored backup piece 1
piece handle=RAC_POOL_man_ch_1_2<RAC_701:637941357:1>.dbf tag=TAG20071106T135556
channel dev_1: restore complete, elapsed time: 01:01:47
Finished restore at 2007-11-07

Starting recover at 2007-11-07
channel dev_0: starting incremental datafile backupset restore
channel dev_0: specifying datafile(s) to restore from backup set
destination for restore of datafile 00009: +DG_DB/rac/datafile/tbs_pool_001.dbf
destination for restore of datafile 00011: +DG_DB/rac/datafile/tbs_pool_065.dbf
destination for restore of datafile 00013: +DG_DB/rac/datafile/tbs_pool_002.dbf
destination for restore of datafile 00015: +DG_DB/rac/datafile/tbs_pool_003.dbf
destination for restore of datafile 00017: +DG_DB/rac/datafile/tbs_pool_004.dbf
destination for restore of datafile 00019: +DG_DB/rac/datafile/tbs_pool_006.dbf
destination for restore of datafile 00021: +DG_DB/rac/datafile/tbs_pool_005.dbf
destination for restore of datafile 00023: +DG_DB/rac/datafile/tbs_pool_008.dbf
destination for restore of datafile 00025: +DG_DB/rac/datafile/tbs_pool_007.dbf
destination for restore of datafile 00027: +DG_DB/rac/datafile/tbs_pool_009.dbf
destination for restore of datafile 00029: +DG_DB/rac/datafile/tbs_pool_011.dbf
destination for restore of datafile 00031: +DG_DB/rac/datafile/tbs_pool_014.dbf
destination for restore of datafile 00033: +DG_DB/rac/datafile/tbs_pool_015.dbf
destination for restore of datafile 00035: +DG_DB/rac/datafile/tbs_pool_016.dbf
destination for restore of datafile 00037: +DG_DB/rac/datafile/tbs_pool_012.dbf
```

```
destination for restore of datafile 00039: +DG_DB/rac/datafile/tbs_pool_010.dbf
destination for restore of datafile 00041: +DG_DB/rac/datafile/tbs_pool_013.dbf
destination for restore of datafile 00043: +DG_DB/rac/datafile/tbs_pool_025.dbf
destination for restore of datafile 00045: +DG_DB/rac/datafile/tbs_pool_027.dbf
destination for restore of datafile 00047: +DG_DB/rac/datafile/tbs_pool_022.dbf
destination for restore of datafile 00049: +DG_DB/rac/datafile/tbs_pool_023.dbf
destination for restore of datafile 00051: +DG_DB/rac/datafile/tbs_pool_028.dbf
destination for restore of datafile 00053: +DG_DB/rac/datafile/tbs_pool_030.dbf
destination for restore of datafile 00055: +DG_DB/rac/datafile/tbs_pool_020.dbf
destination for restore of datafile 00057: +DG_DB/rac/datafile/tbs_pool_031.dbf
destination for restore of datafile 00059: +DG_DB/rac/datafile/tbs_pool_017.dbf
destination for restore of datafile 00061: +DG_DB/rac/datafile/tbs_pool_029.dbf
destination for restore of datafile 00063: +DG_DB/rac/datafile/tbs_pool_021.dbf
destination for restore of datafile 00065: +DG_DB/rac/datafile/tbs_pool_018.dbf
destination for restore of datafile 00067: +DG_DB/rac/datafile/tbs_pool_019.dbf
destination for restore of datafile 00069: +DG_DB/rac/datafile/tbs_pool_026.dbf
destination for restore of datafile 00071: +DG_DB/rac/datafile/tbs_pool_024.dbf
destination for restore of datafile 00073: +DG_DB/rac/datafile/tbs_pool_032.dbf
channel dev_0: reading from backup piece RAC_POOL_man_ch_1_2<RAC_704:638014021:1>.dbf
channel dev_1: starting incremental datafile backupset restore
channel dev_1: specifying datafile(s) to restore from backup set
destination for restore of datafile 00010: +DG_DB/rac/datafile/tbs_pool_064.dbf
destination for restore of datafile 00012: +DG_DB/rac/datafile/tbs_pool_066.dbf
destination for restore of datafile 00014: +DG_DB/rac/datafile/tbs_pool_063.dbf
destination for restore of datafile 00016: +DG_DB/rac/datafile/tbs_pool_062.dbf
destination for restore of datafile 00018: +DG_DB/rac/datafile/tbs_pool_061.dbf
destination for restore of datafile 00020: +DG_DB/rac/datafile/tbs_pool_059.dbf
destination for restore of datafile 00022: +DG_DB/rac/datafile/tbs_pool_060.dbf
destination for restore of datafile 00024: +DG_DB/rac/datafile/tbs_pool_057.dbf
destination for restore of datafile 00026: +DG_DB/rac/datafile/tbs_pool_058.dbf
destination for restore of datafile 00028: +DG_DB/rac/datafile/tbs_pool_056.dbf
destination for restore of datafile 00030: +DG_DB/rac/datafile/tbs_pool_054.dbf
destination for restore of datafile 00032: +DG_DB/rac/datafile/tbs_pool_051.dbf
destination for restore of datafile 00034: +DG_DB/rac/datafile/tbs_pool_050.dbf
destination for restore of datafile 00036: +DG_DB/rac/datafile/tbs_pool_049.dbf
destination for restore of datafile 00038: +DG_DB/rac/datafile/tbs_pool_053.dbf
destination for restore of datafile 00040: +DG_DB/rac/datafile/tbs_pool_055.dbf
destination for restore of datafile 00042: +DG_DB/rac/datafile/tbs_pool_052.dbf
destination for restore of datafile 00044: +DG_DB/rac/datafile/tbs_pool_040.dbf
destination for restore of datafile 00046: +DG_DB/rac/datafile/tbs_pool_038.dbf
destination for restore of datafile 00048: +DG_DB/rac/datafile/tbs_pool_043.dbf
destination for restore of datafile 00050: +DG_DB/rac/datafile/tbs_pool_042.dbf
destination for restore of datafile 00052: +DG_DB/rac/datafile/tbs_pool_037.dbf
destination for restore of datafile 00054: +DG_DB/rac/datafile/tbs_pool_035.dbf
destination for restore of datafile 00056: +DG_DB/rac/datafile/tbs_pool_045.dbf
destination for restore of datafile 00058: +DG_DB/rac/datafile/tbs_pool_034.dbf
destination for restore of datafile 00060: +DG_DB/rac/datafile/tbs_pool_048.dbf
destination for restore of datafile 00062: +DG_DB/rac/datafile/tbs_pool_036.dbf
destination for restore of datafile 00064: +DG_DB/rac/datafile/tbs_pool_044.dbf
destination for restore of datafile 00066: +DG_DB/rac/datafile/tbs_pool_047.dbf
destination for restore of datafile 00068: +DG_DB/rac/datafile/tbs_pool_046.dbf
destination for restore of datafile 00070: +DG_DB/rac/datafile/tbs_pool_039.dbf
destination for restore of datafile 00072: +DG_DB/rac/datafile/tbs_pool_041.dbf
destination for restore of datafile 00074: +DG_DB/rac/datafile/tbs_pool_033.dbf
channel dev_1: reading from backup piece RAC_POOL_man_ch_1_2<RAC_705:638014021:1>.dbf
channel dev_0: restored backup piece 1
piece handle=RAC_POOL_man_ch_1_2<RAC_704:638014021:1>.dbf tag=TAG20071107T100659
channel dev_0: restore complete, elapsed time: 00:04:35
channel dev_1: restored backup piece 1
piece handle=RAC_POOL_man_ch_1_2<RAC_705:638014021:1>.dbf tag=TAG20071107T100659
channel dev_1: restore complete, elapsed time: 00:09:01

starting media recovery
media recovery complete, elapsed time: 00:00:07
```

```
Finished recover at 2007-11-07

sql statement:  alter tablespace POOL online

released channel: dev_0

released channel: dev_1

Recovery Manager complete.
oracle@ita018[RAC1]:/opt/oracle$
```

For more information

- HP Data Protector Software
  http://www.hp.com/go/dataprotector

4AA1-7160ENW, December 2007