



Hardware and Software
Engineered to Work Together

Oracle Database 12c: Backup and Recovery Workshop

Activity Guide

D78850GC20

Edition 2.0 | March 2015 | D90710

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This book was published using: *Oracle Tutor*

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Course Practice Environment: Security Credentials

Chapter I

Course Practice Environment: Security Credentials

For OS usernames and passwords, see the following:

- If you are attending a classroom-based or live virtual class, ask your instructor or LVC producer for OS credential information.
- If you are using a self-study format, refer to the communication that you received from Oracle University for this course.

For product-specific credentials used in this course, see the following table:

Product-Specific Credentials		
Product/Application	Username	Password
Enterprise Manager Database Express	SYS	oracle_4U
Enterprise Manager Cloud Control	SYSMAN	oracle_4U
Database (orcl and rcat)	SYS	oracle_4U
Database (orcl and rcat)	SYSTEM	oracle_4U

Practices for Lesson 1: Introduction

Chapter 1

Practices for Lesson 1: Overview

Practices Overview

In this practice, you will explore the environment you will use during the course practices.

Practice 1-1: Exploring the Course Environment

Overview

In this optional practice, you explore some elements of the practice environment. Throughout the following practices, more elements will be introduced and you will change this configuration.

Assumptions

The student has a machine with a Linux operating system. Preinstalled are:

- Oracle Database 12c (12.1) with three active database instances:
- `orcl` (your main database)
- `rcat` (for your RMAN catalog)
- `emrep` (for Oracle Enterprise Manager Cloud Control)
- Oracle Enterprise Manager Cloud Control

Staged software includes:

- Oracle Secure Backup

Tasks

1. Log in to the machine as the `oracle` user with the password that you have been provided.
2. Open a terminal window by double-clicking the Terminal icon, or by right-clicking the mouse button and selecting Open.
3. There should be three instances running: `emrep`, `orcl`, and `rcat`. You can confirm this by using the `pgrep -lf pmon` command, which displays the process monitor (`pmon`) background process with its instance name.

```
$ pgrep -lf pmon
12852 ora_pmon_emrep
22184 ora_pmon_orcl
23853 ora_pmon_rcat
$
```

4. Because there are several instances in your environment, you need to set environment variables pointing to the correct instance. You can use `oraenv` to set your environment variables. Set the environment to the `orcl` instance.

```
$ . oraenv
ORACLE_SID = [oracle] ? orcl
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1 is
/u01/app/oracle
$
```

5. Confirm that the listener is listening for each of the three instances. (You will see additional XDB instances.)

```
$ lsnrctl status
LSNRCTL for Linux: Version 12.1.0.2.0 - Production on 02-DEC-
2014 12:15:39

Copyright (c) 1991, 2014, Oracle. All rights reserved.

Connecting to
(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP)(HOST=edp1.us.oracle.com)(PORT=1521)))
STATUS of the LISTENER
-----
Alias                      LISTENER
Version                    TNSLSNR for Linux: Version 12.1.0.2.0
- Production
Start Date                 02-DEC-2014 03:11:15
Uptime                     0 days 9 hr. 4 min. 26 sec
Trace Level                off
Security                   ON: Local OS Authentication
SNMP                       OFF
Listener Parameter File    /u01/app/oracle/product/12.1.0/dbhome_1/network/admin/listener.o
ra
Listener Log File          /u01/app/oracle/diag/tnslsnr/EDP1/listener/alert/log.xml
Listening Endpoints Summary...

(DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=edp1.us.oracle.com)(PORT=1521)))
(DESCRIPTION=(ADDRESS=(PROTOCOL=ipc)(KEY=EXTPROC1521)))

(DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=edp1.us.oracle.com)(PORT=5501))(Presentation=HTTP)(Session=RAW))

(DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=edp1.us.oracle.com)(PORT=5500))(Presentation=HTTP)(Session=RAW))
Services Summary...
Service "emrep" has 1 instance(s).
  Instance "emrep", status READY, has 1 handler(s) for this
service...
Service "emrepXDB" has 1 instance(s).
  Instance "emrep", status READY, has 1 handler(s) for this
service...
Service "orcl" has 1 instance(s).
```

```
Instance "orcl", status READY, has 1 handler(s) for this
service...
Service "orclXDB" has 1 instance(s).
Instance "orcl", status READY, has 1 handler(s) for this
service...
Service "rcat" has 1 instance(s).
Instance "rcat", status READY, has 1 handler(s) for this
service...
Service "rcatXDB" has 1 instance(s).
Instance "rcat", status READY, has 1 handler(s) for this
service...
The command completed successfully
$
```

6. Confirm that the ORCL database is in NOARCHIVELOG mode. There are different ways to do this. In this practice, you will query the V\$DATABASE view.

- a. Log in to SQL*Plus with the SYSDBA privilege.

```
$ sqlplus / as sysdba
SQL*Plus: Release 12.1.0.2.0 Production on Tue Dec 2 12:21:48
2014

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Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 -
64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real
Application Testing options

SQL>
```

Note: To avoid filling the activity guide with unnecessary output, the SQL*Plus banner will not be repeated in the practices that follow.

- b. Query the LOG_MODE column and other columns of interest in the V\$DATABASE view.

```
SQL> SELECT name, log_mode, db_unique_name FROM v$database;

NAME      LOG_MODE      DB_UNIQUE_NAME
-----
ORCL      NOARCHIVELOG orcl
SQL>
```

- c. Confirm your understanding of how you are currently logged in to SQL*Plus.

```
SQL> SELECT user FROM dual;
```

```
USER
```

```
-----
```

```
SYS
```

```
SQL>
```

Note: When you execute `sqlplus / as sysdba`, you are using OS security credentials and are logged in as the `SYS` user.

- d. Optionally: If you want to test your logon with Oracle Net Services, use the service name (`@orcl` in this example):

```
SQL> exit
$ sqlplus sys@orcl as sysdba
.
.
.
Enter password: <<<not displayed
Connected.
SQL>
```

- e. Exit SQL*Plus.

```
SQL> exit
Disconnected from Oracle Database 12c Enterprise Edition Release
12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real
Application Testing options
$
```

Note: To avoid filling the activity guide with unnecessary output, the SQL*Plus banner will not be repeated in the practices that follow.

Practices for Lesson 2: Getting Started

Chapter 2

Practices for Lesson 2: Overview

Practices Overview

In these practices, you perform a database backup, create a test case to be used in a recovery operation, and perform a database recovery.

Practice 2-1: Backing Up in NOARCHIVELOG Mode

Overview

In this mandatory practice, you invoke the RMAN client and perform a database backup with default settings. The backup will be used in a later practice to perform recovery (after an intentionally introduced “disaster”).

Assumptions

You start in a terminal window, in which the environment variables are pointing to the ORCL instance. (Revisit the previous practice if you are not sure how to set the environment variables by using oraenv.)

Tasks

1. Logged in to a terminal window as the oracle OS user, invoke the RMAN client with the SYSBACKUP role. Note that both double and single quotation marks are needed.

```
$ rman target ''/ as sysbackup''  
Recovery Manager: Release 12.1.0.2.0 - Production on Wed Dec 3  
12:11:26 2014  
Copyright (c) 1982, 2014, Oracle and/or its affiliates. All  
rights reserved.  
connected to target database: ORCL (DBID=1393010434)  
RMAN>
```

Note: To avoid filling the activity guide with unnecessary output, the RMAN banner will not be repeated in the practices that follow.

2. Confirm that the ORCL database is in NOARCHIVELOG mode.

```
RMAN> SELECT NAME, DBID, LOG_MODE FROM V$DATABASE;  
  
using target database control file instead of recovery catalog  
NAME          DBID  LOG_MODE  
-----  
ORCL        1393010434  NOARCHIVELOG  
RMAN>
```

3. Display the default username with which you logged in.

```
RMAN> SELECT USER FROM DUAL;  
  
USER  
-----  
SYSBACKUP  
  
RMAN>
```

Note: You logged in with the SYSBACKUP privilege (that connects you as the SYSBACKUP user), which is very similar to the SYSDBA privilege, except that it does not include the

SELECT privileges for user-content tables. By default, SYSDBA can see the content of user tables, but SYSBACKUP cannot. (Both can query the data dictionary and dynamic views.)

- View the default parameters that will be used for your database backup. You will change some of them in later practices.

```
RMAN> show all;

RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
CONFIGURE BACKUP OPTIMIZATION OFF; # default
CONFIGURE DEFAULT DEVICE TYPE TO DISK; # default
CONFIGURE CONTROLFILE AUTOBACKUP OFF; # default
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'%F'; # default
CONFIGURE DEVICE TYPE DISK PARALLELISM 1 BACKUP TYPE TO
BACKUPSET; # default
CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1; # default
CONFIGURE MAXSETSIZE TO UNLIMITED; # default
CONFIGURE ENCRYPTION FOR DATABASE OFF; # default
CONFIGURE ENCRYPTION ALGORITHM 'AES128'; # default
CONFIGURE COMPRESSION ALGORITHM 'BASIC' AS OF RELEASE 'DEFAULT'
OPTIMIZE FOR LOAD TRUE ; # default
CONFIGURE RMAN OUTPUT TO KEEP FOR 7 DAYS; # default
CONFIGURE ARCHIVELOG DELETION POLICY TO NONE; # default
CONFIGURE SNAPSHOT CONTROLFILE NAME TO
'/u01/app/oracle/product/12.1.0/dbhome_1/dbs/snapcf_orcl.f'; # default

RMAN>
```

- Perform a backup of the ORCL database by using the BACKUP DATABASE command.
Expect to get an error.

```
RMAN> BACKUP DATABASE;
Starting backup at 03-DEC-14
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=272 device type=DISK
RMAN-00571:
=====
RMAN-00569: ===== ERROR MESSAGE STACK FOLLOWS
=====
RMAN-00571:
=====
```

```
RMAN-03002: failure of backup command at 12/03/2014 12:18:53
RMAN-06149: cannot BACKUP DATABASE in NOARCHIVELOG mode
RMAN>
```

6. Change the state of the database so that you can take a backup of the database in NOARCHIVELOG mode.
 - a. The database must be placed in the MOUNT state to create a consistent backup. This practice shows the use of RMAN, but you could use other tools as well, such as SQL*Plus. (*Continue in your RMAN terminal session.*)

```
RMAN> shutdown immediate;

database closed
database dismounted
Oracle instance shut down

RMAN> startup mount;

connected to target database (not started)
Oracle instance started
database mounted

Total System Global Area      536870912 bytes
Fixed Size                      2926472 bytes
Variable Size                   281020536 bytes
Database Buffers                247463936 bytes
Redo Buffers                     5459968 bytes
RMAN>
```

- b. Perform your database backup. There should be no errors.

```
RMAN> backup database;
Starting backup at 03-DEC-14
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=12 device type=DISK
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00005
name=/u01/app/oracle/oradata/orcl/example01.dbf
input datafile file number=00001
name=/u01/app/oracle/oradata/orcl/system01.dbf
input datafile file number=00003
name=/u01/app/oracle/oradata/orcl/sysaux01.dbf
input datafile file number=00004
name=/u01/app/oracle/oradata/orcl/undotbs01.dbf
input datafile file number=00006
name=/u01/app/oracle/oradata/orcl/users01.dbf
```

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```

channel ORA_DISK_1: starting piece 1 at 03-DEC-14
channel ORA_DISK_1: finished piece 1 at 03-DEC-14
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_03/o1_mf_nnndf_TAG20141203T123300_b7y0qx14_.bkp
tag=TAG20141203T123300 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:45
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
including current control file in backup set
including current SPFILE in backup set
channel ORA_DISK_1: starting piece 1 at 03-DEC-14
channel ORA_DISK_1: finished piece 1 at 03-DEC-14
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_03/o1_mf_ncsnf_TAG20141203T123300_b7y0sf6v_.bkp
tag=TAG20141203T123300 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 03-DEC-14
RMAN>

```

Question: How many backup sets are shown in the output? How long did it take to create the backups?

Possible answer: In this example, two backup sets are created. It took a total of 46 seconds elapsed time to create both backups.

- Open the database.

```

RMAN> ALTER DATABASE OPEN;
Statement processed
RMAN>

```

- List your backups.

```

RMAN> list backup;

List of Backup Sets
=====

BS Key  Type LV Size      Device Type Elapsed Time Completion Time
-----  --  --  -----
1       Full   1.31G     DISK          00:00:29   03-DEC-14
          BP Key: 1    Status: AVAILABLE  Compressed: NO   Tag:
TAG20141203T123300
          Piece Name:
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_03/o1_
mf_nnndf_TAG20141203T123300_b7y0qx14_.bkp
          List of Datafiles in backup set 1

```

```

File LV Type Ckp SCN      Ckp Time   Name
----- ----- -----
 1       Full 1810014    03-DEC-14
/u01/app/oracle/oradata/orcl/system01.dbf
 3       Full 1810014    03-DEC-14
/u01/app/oracle/oradata/orcl/sysaux01.dbf
 4       Full 1810014    03-DEC-14
/u01/app/oracle/oradata/orcl/undotbs01.dbf
 5       Full 1810014    03-DEC-14
/u01/app/oracle/oradata/orcl/example01.dbf
 6       Full 1810014    03-DEC-14
/u01/app/oracle/oradata/orcl/users01.dbf

BS Key  Type LV Size      Device Type Elapsed Time Completion Time
----- -----
 2       Full   9.64M      DISK          00:00:03   03-DEC-14
          BP Key: 2   Status: AVAILABLE  Compressed: NO   Tag:
TAG20141203T123300
          Piece Name:
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_03/o1_
mf_ncsnf_TAG20141203T123300_b7y0sf6v_.bkp
          SPFILE Included: Modification time: 03-DEC-14
          SPFILE db_unique_name: ORCL
          Control File Included: Ckp SCN: 1810014           Ckp time: 03-DEC-
14

RMAN>

```

Question: Which objects are in the backup sets as shown in the output in the code box?

Possible answer: The first backup set contains data file backups. The second backup set contains the control file and SPFILE backups.

9. Use the `DELETE OBSOLETE` command to determine whether you can save space by removing duplicates. Then exit the RMAN client.

```

RMAN> delete obsolete;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
using channel ORA_DISK_1
no obsolete backups found
RMAN> exit
Recovery Manager complete.
$
```

Practice 2-2: Creating a Test Case for Recovery

Overview

In this practice, you create your first test case, which is a new tablespace, user, and a table.

Assumptions

You completed practice 2-1 (and have a backup of your closed database in NOARCHIVELOG mode).

The \$LABS environment variable points to the /home/oracle/labs training directory (which is your course home directory). Unless indicated otherwise, start all practices in this directory.

Tasks

1. In the \$LABS directory is a Linux file that executes a test case. Navigate into your course home directory and review the `setup_02_02.sh` file by using the `cat` command. (*Best Practice Tip:* In later practices, it is also recommended to first review a script file before executing it.)

```
$ cd $LABS
$ cat setup_02_02.sh
#!/bin/sh
# -- DISCLAIMER:
# -- This script is provided for educational purposes only. It is
# -- NOT supported by Oracle World Wide Technical Support.
# -- The script has been tested and appears to work as intended.
# -- You should always run new scripts on a test instance initially.
#
# configure the environment
. $LABS/set_db.sh

# This script creates the BAR22 user, the BAR22TBS tablespace
# and BARCOPY table. The table is populated
# and a backup is made.
#

sqlplus -S /nolog > /tmp/setup.log 2>&1 <<EOF
connect / as sysdba

-- CLEANUP from previous run
DROP USER bar22 CASCADE;
```

```
DROP TABLESPACE bar22tbs INCLUDING CONTENTS AND DATAFILES;

-- Create tablespace
CREATE TABLESPACE bar22tbs
DATAFILE '/u01/backup/orcl/bar22tbs01.dbf' SIZE 10M REUSE
SEGMENT SPACE MANAGEMENT MANUAL;

-- Create user
CREATE USER BAR22 IDENTIFIED BY oracle_4U
DEFAULT TABLESPACE bar22tbs
QUOTA UNLIMITED ON bar22tbs;

GRANT CREATE SESSION TO BAR22;

-- create table and populate
-- be sure table is at least 2 blocks long
CREATE TABLE BAR22.barcopy
TABLESPACE bar22tbs
AS SELECT * FROM HR.EMPLOYEES;

INSERT INTO BAR22.BARCOPY
SELECT * FROM BAR22.BARCOPY;

INSERT INTO BAR22.BARCOPY
SELECT * FROM BAR22.BARCOPY;

EOF

# Switch logfile
sqlplus / as sysdba >> /tmp/setup.log 2>&1 <<EOF

ALTER SYSTEM SWITCH Logfile;
alter system checkpoint;
exit;
EOF
echo "Setup complete." >> /tmp/setup.log
exit
$
```

2. Note the location and name of the data file and that the script executes the `set_db.sh` file. Review this file as well.

```
$ cat set_db.sh
ORACLE_SID=orcl
```

```
ORAENV_ASK='NO'  
. oraenv >/dev/null  
ORAENV_ASK=''  
  
$
```

Question: What do these two files do together?

Possible answer: `set_db.sh` uses `oraenv` to set the environment variables for the ORCL instance.

`setup_02_02.sh` first attempts to drop a user and tablespace (if they exist from previous tests). Then it creates the BAR22 user, BAR22TBS tablespace, and the BARCOPY table. The BARCOPY table is filled with rows from the HR.EMPLOYEES table.

After that, SYSDBA switches log files and executes a checkpoint.

Question: Where is the data file for the tablespace located?

Possible answer: In the file system

3. You can either perform these tasks by entering the commands or as is recommended for now, execute the `setup_02_02.sh` file in the terminal window as the default oracle OS user.

```
$ ./setup_02_02.sh  
$
```

4. The output is redirected to the `/tmp/setup.log` file. You can review the output while the script is executing. (*Space lines have been removed to reduce the output*).

```
$ cat /tmp/setup.log  
DROP USER bar22 CASCADE  
*  
ERROR at line 1:  
ORA-01918: user 'BAR22' does not exist  
  
DROP TABLESPACE bar22tbs INCLUDING CONTENTS AND DATAFILES  
*  
ERROR at line 1:  
ORA-00959: tablespace 'BAR22TBS' does not exist  
  
Tablespace created.  
User created.  
Grant succeeded.  
Table created.  
107 rows created.  
214 rows created.  
  
SQL*Plus: Release 12.1.0.2.0 Production on Thu Dec 4 07:28:42  
2014
```

```
Copyright (c) 1982, 2014, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 -  
64bit Production
```

```
With the Partitioning, OLAP, Advanced Analytics and Real  
Application Testing options
```

```
SQL> SQL>
```

```
System altered.
```

```
SQL>
```

```
System altered.
```

```
SQL> Disconnected from Oracle Database 12c Enterprise Edition  
Release 12.1.0.2.0 - 64bit Production
```

```
With the Partitioning, OLAP, Advanced Analytics and Real  
Application Testing options
```

```
Setup complete.
```

```
$
```

Question: Do the first two error messages signal a problem with your setup?

Possible answer: No. They occur when a user and tablespace do not exist (possibly from a previous execution of the script). It is important that the object creation (*marked in green*) is executed without errors.

5. Optionally, log in to SQL*Plus as SYSDBA and review the new table.

```
$ sqlplus / as sysdba

SQL> SELECT * FROM BAR22.BARCOPY;
.
.
EMPLOYEE_ID FIRST_NAME           LAST_NAME
-----          -----
EMAIL          PHONE_NUMBER        HIRE_DATE   JOB_ID
SALARY
-----          -----          -----
COMMISSION_PCT MANAGER_ID        DEPARTMENT_ID
-----          -----
206  William          Gietz
WGIETZ          515.123.8181      07-JUN-02
AC_ACCOUNT      8300
                 205            110
```

```
428 rows selected.
```

```
SQL>
```

Note: Only the last row of the BARCOPY table and the number of rows selected are displayed in the code box. (The total should be **428**; the last row could be different.)

6. Optionally, to list the archive log mode, execute the archive log list command in SQL*Plus.

```
SQL> archive log list
Database log mode           No Archive Mode
Automatic archival          Disabled
Archive destination          USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence   16
Current log sequence         18
SQL>
```

Note: Your sequence numbers may be different.

7. Crash the ORCL database by using the **SHUTDOWN ABORT** command. Then exit from SQL*Plus.

```
SQL> shutdown abort
ORACLE instance shut down.
SQL> exit
$
```

8. Optionally, list your pmon processes. ora_pmon_orcl should not appear in the list.

```
$ pgrep -lf pmon
12852 ora_pmon_emrep
23853 ora_pmon_rcat
$
```

9. Optionally, log in to SQL*Plus as SYSDBA, attempt to query your test table, and exit.

```
$ sqlplus / as sysdba
...
Connected to an idle instance.
SQL> SELECT * FROM BAR22.BARCOPY;
SELECT * FROM BAR22.BARCOPY
*
ERROR at line 1:
ORA-01034: ORACLE not available
Process ID: 0
Session ID: 0 Serial number: 0
SQL> exit
$
```

If you attempt to query your test file in the idle instance, the ORA-01034 error is displayed.

10. **Create an issue.** If you want to create a test case for instance recovery, then all you need to do is to execute step 11, because instance recovery happens automatically on startup (after a shutdown abort). This practice creates a test case for media recovery. Simulate a failure by removing the /u01/backup/orcl/bar22tbs01.dbf file.

```
$ rm /u01/backup/orcl/bar22tbs01.dbf  
$
```

11. Attempt to start the ORCL database. Logged in to SQL*Plus as SYSDBA, enter startup. You should again see the ORA-01110 error. Exit from SQL*Plus.

```
...  
Connected to an idle instance  
SQL> startup  
ORACLE instance started.  
  
Total System Global Area  536870912 bytes  
Fixed Size                  2926472 bytes  
Variable Size                281020536 bytes  
Database Buffers            247463936 bytes  
Redo Buffers                 5459968 bytes  
Database mounted.  
ORA-01157: cannot identify/lock data file 2 - see DBWR trace  
file  
ORA-01110: data file 2: '/u01/backup/orcl/bar22tbs01.dbf'  
SQL> exit  
$
```

Practice 2-3: Recovering in NOARCHIVELOG Mode

Overview

In this practice, you use the RMAN client to recover your ORCL database.

Assumptions

You have a terminal window open with the environment variables pointing to the ORCL database instance. This practice has optional steps for learning purposes.

Tasks

1. Because the ORCL database is in NOARCHIVELOG mode, you know that you need to first mount the instance.
 - a. Log in to RMAN.

```
$ rman target ''/ as sysbackup''  
...  
connected to target database: ORCL (DBID=1393010434, not open)  
RMAN>
```

- b. Optionally, list your backups.

```
RMAN> list backup;  
using target database control file instead of recovery catalog  
  
List of Backup Sets  
=====  
BS Key  Type LV Size    Device Type Elapsed Time Completion Time  
-----  ---- - - -----  
1       Full   1.31G    DISK          00:00:29      03-DEC-14  
        BP Key: 1   Status: AVAILABLE  Compressed: NO   Tag:  
TAG20141203T123300  
        Piece Name:  
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_03/o1_  
mf_nnndf_TAG20141203T123300_b7y0qx14_.bkp  
        List of Datafiles in backup set 1  
        File LV Type Ckp SCN    Ckp Time  Name  
        -----  
        1       Full 1810014  03-DEC-14  
/u01/app/oracle/oradata/orcl/system01.dbf  
        3       Full 1810014  03-DEC-14  
/u01/app/oracle/oradata/orcl/sysaux01.dbf  
        4       Full 1810014  03-DEC-14  
/u01/app/oracle/oradata/orcl/undotbs01.dbf  
        5       Full 1810014  03-DEC-14  
/u01/app/oracle/oradata/orcl/example01.dbf
```

```

6      Full 1810014  03-DEC-14
/u01/app/oracle/oradata/orcl/users01.dbf

BS Key  Type LV Size     Device Type Elapsed Time Completion Time
-----
2      Full   9.64M     DISK            00:00:03   03-DEC-14
      BP Key: 2    Status: AVAILABLE  Compressed: NO  Tag:
TAG20141203T123300
      Piece Name:
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_03/o1_
mf_ncsnf_TAG20141203T123300_b7y0sf6v_.bkp
      SPFILE Included: Modification time: 03-DEC-14
      SPFILE db_unique_name: ORCL
      Control File Included: Ckp SCN: 1810014          Ckp time: 03-DEC-
14

RMAN>

```

Note: There is no data file for your test case because it was created after your backup.

2. Attempt to recover the database by using the RECOVER DATABASE command. Expect an error. Then exit RMAN.

```

RMAN> recover database;
Starting recover at 04-DEC-14
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=12 device type=DISK
RMAN-00571:
=====
RMAN-00569: ===== ERROR MESSAGE STACK FOLLOWS
=====
RMAN-00571:
=====
RMAN-03002: failure of recover command at 12/04/2014 08:23:18
RMAN-06094: datafile 2 must be restored
RMAN> exit
Recovery Manager complete.
$ 

```

Note the error about your missing data file. A complete recovery in NOARCHIVELOG mode is only possible if all the changes since the last backup are contained in the online redo logs. In “real life,” this is highly unlikely. You have two possible recovery paths:

- 1) Drop the missing tablespace or
- 2) Recover the entire database to the time of the last backup

The following steps show you option 1:

- a. In a terminal window pointing to the ORCL instance, log in to SQL*Plus as SYSDBA. Set the bar22tbs01.dbf file to OFFLINE FOR DROP and open the database.

```
SQL> ALTER DATABASE DATAFILE '/u01/backup/orcl/bar22tbs01.dbf'
OFFLINE FOR DROP;
Database altered.

SQL> ALTER DATABASE OPEN;
Database altered.

SQL>
```

- b. Drop the BAR22TBS tablespace definition.

```
SQL> DROP TABLESPACE BAR22TBS INCLUDING CONTENTS AND DATAFILES;
Tablespace dropped.
```

- c. Now your ORCL database is open, users can access it, but you “lost” the BAR22TBS tablespace (for training purposes).
- d. Optionally (if you have extra time), list the data file names and tablespace names by using the DBA_DATA_FILES view.

```
SQL> col file_name format a44
SQL> col tablespace_name format a10
SQL> select file_name, tablespace_name from dba_data_files;

FILE_NAME                                TABLESPACE
-----                                     -----
/u01/app/oracle/oradata/orcl/system01.dbf    SYSTEM
/u01/app/oracle/oradata/orcl/sysaux01.dbf    SYSAUX
/u01/app/oracle/oradata/orcl/example01.dbf   EXAMPLE
/u01/app/oracle/oradata/orcl/users01.dbf     USERS
/u01/app/oracle/oradata/orcl/undotbs01.dbf   UNDOTBS1
SQL>
```

- e. To clean up this test case, drop the BAR22 user and then exit SQL*Plus.

```
SQL> DROP USER bar22 CASCADE;
User dropped.

SQL> exit
$
```

Practices for Lesson 3: Configuring for Recoverability

Chapter 3

Practices for Lesson 3: Overview

Practices Overview

In these practices, you multiplex the control files, configure the fast recovery area, configure redo log files, and configure the database for ARCHIVELOG mode.

In these practices, you configure the default backup destination, set the RMAN display data and time format, configure control file autobackup, configure the backup retention policy, and configure a device for backup.

Practice 3-1: Configuring the Default Backup Destination and ARCHIVELOG Mode

Overview

In this practice, you determine the default backup destination setting, set the DB_RECOVERY_FILE_DEST_SIZE initialization parameter, and verify that the default location is being used.

Next, you enable ARCHIVELOG mode and restart the ORCL database instance.

Assumptions

You have a terminal window open with the environment variables set for the ORCL database instance. Use \$LABS as your working directory. Unless otherwise indicated, always work from that directory.

Tasks

1. The DB_RECOVERY_FILE_DEST parameter specifies the default location for the Fast Recovery Area. View the parameter value by logging in to SQL*Plus and using the show parameter command.

```
$ sqlplus / as sysdba

SQL> show parameter db_recovery_file_dest

NAME                           TYPE        VALUE
-----
db_recovery_file_dest          string      /u01/app/oracle/fast_recovery_
                                         area
db_recovery_file_dest_size    big integer 4560M
SQL>
```

Note: These (or similar) values are expected for your training environment. If you had need to change the FRA size, you could do it with the ALTER SYSTEM SET db_recovery_file_dest_size = nn command.

2. Place the ORCL database in archive log mode. Several tools are available to change the log mode for a database. SQL*Plus is shown in the solution.
 - a. Place the ORCL database in MOUNT mode.

```
SQL> SHUTDOWN IMMEDIATE
Database closed.
Database dismounted.
ORACLE instance shut down.

SQL> STARTUP MOUNT
```

```

ORACLE instance started.
Total System Global Area  536870912 bytes
Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers             247463936 bytes
Redo Buffers                 5459968 bytes
Database mounted.
SQL>

```

- b. Execute the ALTER DATABASE ARCHIVELOG command.

```

SQL> ALTER DATABASE ARCHIVELOG;
Database altered.
SQL>

```

- c. Open the database, list the archive logs, and then exit SQL*Plus.

```

SQL> ALTER DATABASE OPEN;
Database altered.
SQL> archive log list
Database log mode           Archive Mode
Automatic archival          Enabled
Archive destination          USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence   18
Next log sequence to archive 20
Current log sequence        20
SQL> exit
$ 

```

Note: The database is now in ARCHIVELOG mode. After a mode change like this, it is best practice to perform a backup of the entire database.

3. In a terminal window (which is pointing to ORCL), log in to the RMAN client and execute the BACKUP DATABASE command, and then exit RMAN.

```

$ rman target ''/ as sysbackup''
connected to target database: ORCL (DBID=1393010434)

RMAN> BACKUP DATABASE;
Starting backup at 05-DEC-14
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=34 device type=DISK
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00005
name=/u01/app/oracle/oradata/orcl/example01.dbf

```

```
input datafile file number=00001
name=/u01/app/oracle/oradata/orcl/system01.dbf
input datafile file number=00003
name=/u01/app/oracle/oradata/orcl/sysaux01.dbf
input datafile file number=00004
name=/u01/app/oracle/oradata/orcl/undotbs01.dbf
input datafile file number=00006
name=/u01/app/oracle/oradata/orcl/users01.dbf
channel ORA_DISK_1: starting piece 1 at 05-DEC-14
channel ORA_DISK_1: finished piece 1 at 05-DEC-14
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_05/o1_mf_nnndf_TAG20141205T120952_b8384lhs_.bkp
tag=TAG20141205T120952 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:25
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
including current control file in backup set
including current SPFILE in backup set
channel ORA_DISK_1: starting piece 1 at 05-DEC-14
channel ORA_DISK_1: finished piece 1 at 05-DEC-14
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_05/o1_mf_ncsnf_TAG20141205T120952_b8385cno_.bkp
tag=TAG20141205T120952 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 05-DEC-14
RMAN> exit
```

Note that the dates do not include the time (just the date).

Practice 3-2: Setting the Date and Time Format for RMAN

Overview

In this practice, you set the date/time format that RMAN uses for displaying timestamps. The default date format does not include the time of day information. In this workshop, you will be performing several backups and recoveries in the same day and in some cases will need to determine which backup to use.

Assumptions

You completed the previous practice.

You have two terminal windows open, each with the environment variables set for the ORCL database instance. Use \$LABS as your working directory. Unless otherwise indicated, always work from that directory.

Tasks

1. Set the NLS_LANG and NLS_DATE_FORMAT variables such that RMAN includes time information in any timestamp values.

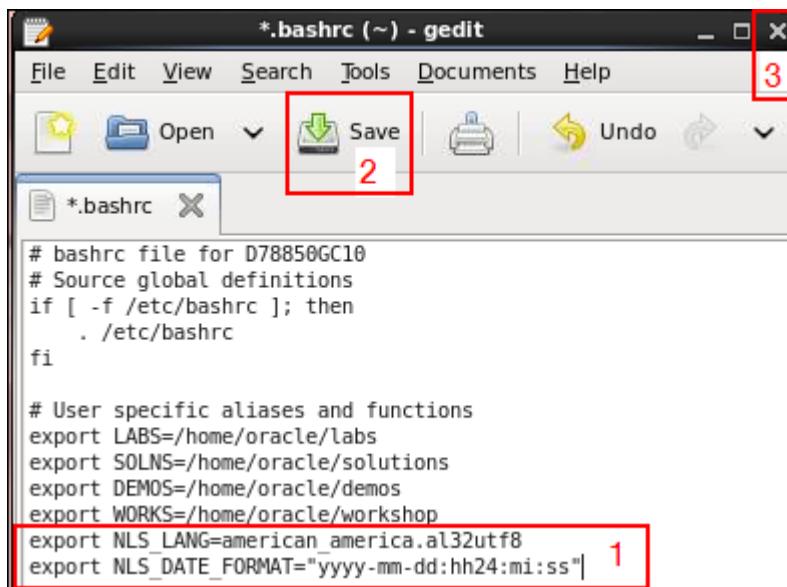
Use the editor of your choice (`vi`, `gedit`) and add the following two lines to the end of the `~oracle/.bashrc` file:

```
export NLS_LANG=american_america.al32utf8  
export NLS_DATE_FORMAT="yyyy-mm-dd:hh24:mi:ss"
```

- a. In a terminal window, invoke your editor. The solution uses the `gedit` editor.

```
$ gedit ~oracle/.bashrc
```

- b. Copy and paste by using the mouse buttons and icons in the editor, then save your changes and close the `gedit` window.



Note: If you are not copying and pasting the variables, then double-check that the `NLS_LANG` value is written correctly: with... a (letter "I", not digit '1').

- c. View the modified file by using the `cat` command.

```
$ cat ~oracle/.bashrc
# bashrc file for D78850GC10
# Source global definitions
if [ -f /etc/bashrc ]; then
    . /etc/bashrc
fi

# User specific aliases and functions
export LABS=/home/oracle/labs
export SOLNS=/home/oracle/solutions
export DEMOS=/home/oracle/demos
export WORKS=/home/oracle/workshop
export NLS_LANG=american_america.al32utf8
export NLS_DATE_FORMAT="yyyy-mm-dd:hh24:mi:ss"
$
```

- d. **Exit out of all your terminal windows.** This ensures that when you create new ones, these settings will be in effect.
2. Open a new terminal window, and verify the settings by starting RMAN and listing the backups in the recovery catalog or from the control file.
- a. Set up the environment for the `orcl` database and log in to RMAN.

```
$ . oraenv
ORACLE_SID = [oracle] ? orcl
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1 is
/u01/app/oracle
$ rman target ''/ as sysbackup'
RMAN>
```

- b. List the backups, and note the timestamp format. The output shows the most recent backups.

```
RMAN> list backup;
.
.
.
BS Key  Type LV Size      Device Type Elapsed Time Completion
Time
-----
-----
3       Full   1.34G      DISK          00:00:10      2014-12-
05:12:10:03
          BP Key: 3    Status: AVAILABLE  Compressed: NO   Tag:
TAG20141205T120952
          Piece Name:
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_05/o1_
mf_nnndf_TAG20141205T120952_b83841hs_.bkp
```

```

List of Datafiles in backup set 3
File LV Type Ckp SCN      Ckp Time           Name
-----
1       Full 2084587    2014-12-05:12:09:53 /u01/app/oracle/oradata/orcl/system01.dbf
3       Full 2084587    2014-12-05:12:09:53 /u01/app/oracle/oradata/orcl/sysaux01.dbf
4       Full 2084587    2014-12-05:12:09:53 /u01/app/oracle/oradata/orcl/undotbs01.dbf
5       Full 2084587    2014-12-05:12:09:53 /u01/app/oracle/oradata/orcl/example01.dbf
6       Full 2084587    2014-12-05:12:09:53 /u01/app/oracle/oradata/orcl/users01.dbf

BS Key  Type LV Size      Device Type Elapsed Time Completion
Time
-----
4       Full   9.64M      DISK          00:00:02    2014-12-
05:12:10:20
          BP Key: 4     Status: AVAILABLE  Compressed: NO   Tag:
TAG20141205T120952
          Piece Name:
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_05/o1_
mf_ncsnf_TAG20141205T120952_b8385cno_.bkp
          SPFILE Included: Modification time: 2014-12-05:12:07:39
          SPFILE db_unique_name: ORCL
          Control File Included: Ckp SCN: 2084595      Ckp time: 2014-
12-05:12:10:18
RMAN>

```

3. **Job Tip:** Because the output of the RMAN commands can be quite long, consider using the RMAN SPOOL LOG TO <file> command to direct the output to your specified file.
 - a. Optionally, enter SPOOL LOG TO /tmp/test.log in your RMAN window.
 - b. Repeat the previous LIST BACKUP command.
 - c. Note that the output is **not** displayed in your window. In a second terminal window, enter cat /tmp/test.log to view the output.

Practice 3-3: Configuring RMAN Settings

Overview

In this practice, you configure or confirm RMAN settings for the following tasks:

- To back up the control file and server parameter file (SPFILE) each time RMAN takes a backup of anything in the `orcl` database
- To ensure that one redundant backup is kept

Then you perform a tablespace backup to verify these settings.

Assumptions

You completed the previous practice.

You have two terminal windows open, each with the environment variables set for the `ORCL` database instance. Use `$LABS` as your working directory.

Tasks

1. Logged in to an RMAN session as `SYSBACKUP`, check whether control file autobackup is enabled.

See step 2a in the previous practice, if you want to review the login.

```
RMAN> show controlfile autobackup;

RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE CONTROLFILE AUTOBACKUP OFF; # default

RMAN>
```

Note: Autobackup is not enabled.

2. Enable control file autobackup.

```
RMAN> configure controlfile autobackup on;

new RMAN configuration parameters:
CONFIGURE CONTROLFILE AUTOBACKUP ON;
new RMAN configuration parameters are successfully stored

RMAN>
```

Note: The control file and SPFILE will be automatically backed up.

3. View the current retention policy setting.

```
RMAN> show retention policy;
RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
RMAN>
```

4. If your redundancy is 1, go to the next step.
 - a. If your redundancy has another value, change it to ensure that one copy of each file is backed up.

```
RMAN> configure retention policy to redundancy 1;

old RMAN configuration parameters:
CONFIGURE RETENTION POLICY TO NONE;
new RMAN configuration parameters:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1;
new RMAN configuration parameters are successfully stored

RMAN>
```

- b. Check the retention policy setting again.

```
RMAN> show retention policy;

RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1;
RMAN>
```

5. Delete obsolete backups from prior practices by using the DELETE OBSOLETE command.

```
RMAN> DELETE OBSOLETE;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=270 device type=DISK
Deleting the following obsolete backups and copies:
Type          Key      Completion Time    Filename/Handle
-----        -----
---  
Backup Set      1        2014-12-03:12:33:43
    Backup Piece   1        2014-12-03:12:33:43
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_03/o1_
mf_nnndf_TAG20141203T123300_b7y0qx14_.bkp
Backup Set      2        2014-12-03:12:33:49
    Backup Piece   2        2014-12-03:12:33:49
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_03/o1_
mf_ncsnf_TAG20141203T123300_b7y0sf6v_.bkp

Do you really want to delete the above objects (enter YES or
NO)? y
deleted backup piece
```

```
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_03/o1_mf_nnndf_TAG20141203T123300_b7y0qx14_.bkp  RECID=1
STAMP=865341180
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_03/o1_mf_ncsnf_TAG20141203T123300_b7y0sf6v_.bkp  RECID=2
STAMP=865341229
Deleted 2 objects
RMAN>
```

6. Review the schema to see which data file contains the USERS tablespace.

```
RMAN> REPORT SCHEMA;
Report of database schema for database with db_unique_name ORCL

List of Permanent Datafiles
=====
File  Size(MB)  Tablespace          RB  segs  Datafile Name
----  -----  -----
1     810      SYSTEM            YES
/u01/app/oracle/oradata/orcl/system01.dbf
3     760      SYSAUX           NO
/u01/app/oracle/oradata/orcl/sysaux01.dbf
4     150      UNDOTBS1         YES
/u01/app/oracle/oradata/orcl/undotbs01.dbf
5    1243      EXAMPLE           NO
/u01/app/oracle/oradata/orcl/example01.dbf
6      5      USERS             NO
/u01/app/oracle/oradata/orcl/users01.dbf

List of Temporary Files
=====
File  Size(MB)  Tablespace          Maxsize(MB) Tempfile Name
----  -----  -----
1     197      TEMP              32767
/u01/app/oracle/oradata/orcl/temp01.dbf
RMAN>
```

Note:

- If you are not connected to the recovery catalog, the RB segs column contains *** as a value. It contains the YES and NO values when you are connected to the recovery catalog.
- The USERS tablespace is file number 6 in this example. Your USERS tablespace might have a different file number. You can back up the tablespace either as data file or as tablespace. The solution shows the tablespace backup.

7. Back up the USERS tablespace.

```
RMAN> backup tablespace users;
Starting backup at 2014-12-05:12:44:02
using channel ORA_DISK_1
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00006
name=/u01/app/oracle/oradata/orcl/users01.dbf
channel ORA_DISK_1: starting piece 1 at 2014-12-05:12:44:02
channel ORA_DISK_1: finished piece 1 at 2014-12-05:12:44:03
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_05/o1_mf_nnndf_TAG20141205T124402_b83b4lc4_.bkp
tag=TAG20141205T124402 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 2014-12-05:12:44:03

Starting Control File and SPFILE Autobackup at 2014-12-
05:12:44:03
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_05/o1_mf_s_865514643_b83b4n9r_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 2014-12-
05:12:44:06
RMAN>
```

In the RMAN output, note:

- Your data file number for the USERS tablespace (6 in this example)
- Autobackup is enabled for the control file and SPFILE

8. Exit RMAN.

```
RMAN> exit
$
```

Practice 3-4: Configuring Control Files

Overview

In this practice, you multiplex your control files to reduce the chances of failure or data loss. You use the following tools:

- Enterprise Manager Database Express 12 (EM Express) to view the existing control files (as SYSDBA)
- SQL*Plus and an editor to update the CONTROL_FILES parameter in the initialization parameter file (as SYSDBA)

Assumptions

You completed the previous practice and have two terminal windows open (each pointing to the ORCL instance).

Tasks

Your overall task is to verify that you have at least two control files, each on a different disk to ensure redundancy. This practice also introduces you to different tools for learning purposes.

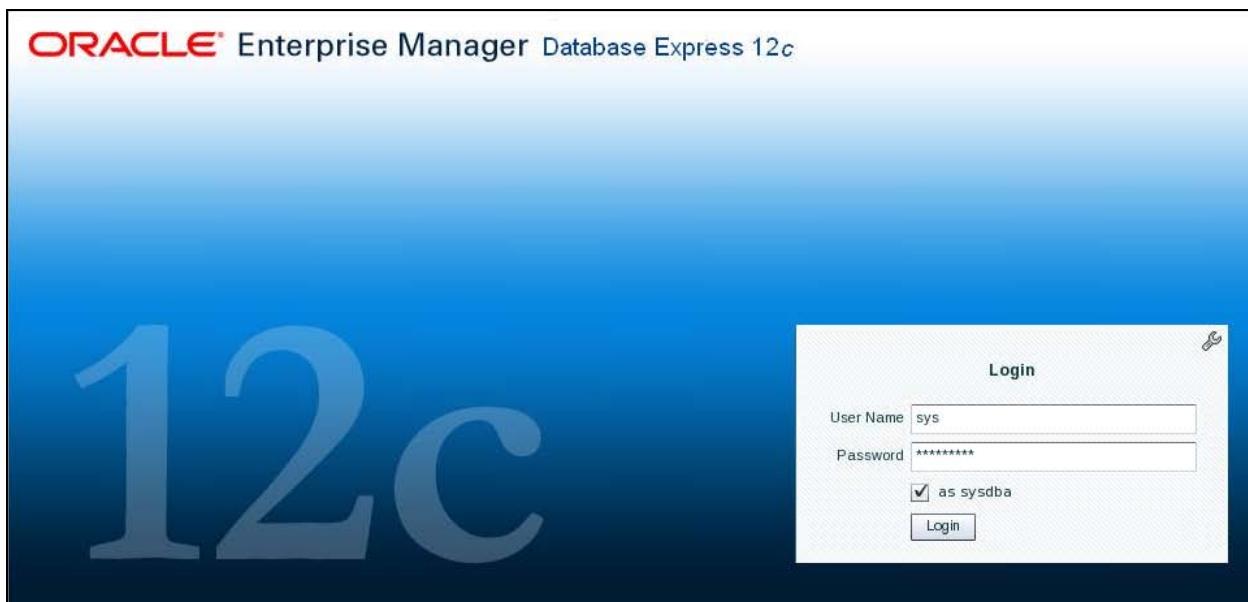
1. Using a browser, launch EM Express for your ORCL database by entering `http://<hostname>:5500/em` as the URL.

Note: EM Express is only available if the database is open. (Cloud Control, which you explore in a later practice, is available regardless of the state of the target database.)

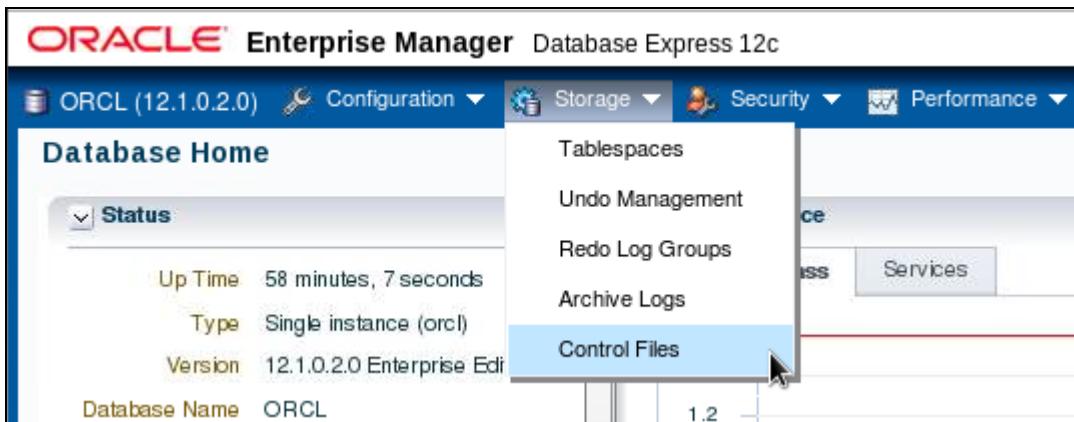
If you are unsure about your hostname, you can query it in a terminal window.

```
$ hostname --long
edpl.us.oracle.com
$
```

- a. Log in as the SYS user, using the SYSDBA role.



2. Expand the **Storage** menu and select **Control Files**.



3. View information on the Control Files page and answer the questions that follow.

The screenshot shows the 'Control Files' page in Oracle Enterprise Manager. The left panel displays 'Control File Information' with details like Type: Current, Creation Date: Tue Dec 2, 2014 5:34:58 AM, Sequence Number: 3039, Last Change Number: 2086780, and Date Last Modified: Fri Dec 5, 2014 12:46:17 PM. The right panel shows 'Control File Sections' with a table of record counts for various types. Below these are sections for 'List of Control Files' and 'List of Redo Log Groups'. The 'List of Control Files' table is highlighted with a red border, showing two entries: control02.ctl and control01.ctl, both located in /u01/app/oracle/fast_recover... and created on Nov 28, 2014, with sizes of 10MB each.

Type	Total Record Count
Filename	2,298
Database Blo...	8,384
Foreign Archi...	1,002
Restore Point	2,083
Guaranteed R...	2,048
Proxy Copy	246
Flashback Log	2,048
Backup Piece	209
Datafile Copy	200
Ckpt Progress	11
Auxiliary Dat...	128
Rman Configu...	50
Datafile	100

Question 1: On the Control Files: General page, how many control files do you have?

Answer: 2

Question 2: Are they located in different directories?

Answer: Yes

4. When you are finished reviewing the information available, click **Logout** (top-right).

5. Optionally, log in to SQL*Plus as the SYSDBA user and list the control file names.

```
SQL> show parameter control_files

NAME          TYPE        VALUE
-----
control_files  string     /u01/app/oracle/oradata/orcl/control
                      01.ctl, /u01/app/oracle/fast_recover
                      y_area/orcl/control02.ctl

SQL>
```

Practice 3-5: Recovery Settings in Cloud Control

Overview

In this practice, you confirm and configure settings to reduce the chances of failure or data loss. This practice also has the aim to introduce you to different tools that are available for backup and recovery.

Assumptions

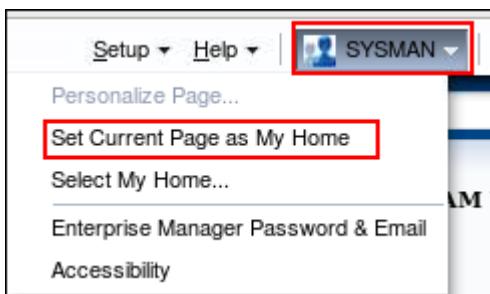
You completed the previous practices and have a terminal window open (pointing to the ORCL instance).

Tasks

1. Using a browser, launch Enterprise Manager Cloud Control by entering <https://<hostname>:7802/em> as the URL.

The first time you launch Enterprise Manager Cloud Control, you must accept the untrusted connection. In Firefox, click **I Understand the Risks > Add Exception > With "Permanently store this exception" selected, click Confirm Security Exception.**

2. Log in as the SYSMAN user with the password provided to you.
 - a. On the Accessibility Preference page, select the appropriate options. Click **Save and Continue**.
 - b. If the License Agreement page is displayed, click **I Accept**.
 - c. You do not need to select any item on the Select Enterprise Manager Home page.
3. Configure the Databases page as your home page in Cloud Control.
 - a. Expand **Targets** (top-left) and click **Databases**.
 - b. Select **Search List**.
 - c. For your own convenience, make this your home page by clicking **SYSMAN** (top-right) > **Set Current Page as My Home**.



- d. You receive a confirmation message that your home page has been updated.

Note: If you are new to Cloud Control, consider viewing videos on OLL or YouTube for your “after-class” learning:

- [Oracle Enterprise Manager 12c: Perform a Simple Installation](#)
- [Oracle Enterprise Manager 12c: Console Overview and Customization](#)

If you query OLL with the search "Enterprise Manager Cloud Control," you will receive over 140 suggestions. View anything that interests you.

4. Click the `orcl` link.

The screenshot shows the Oracle Enterprise Manager Cloud Control 12c interface. In the top navigation bar, 'Enterprise Manager' is selected. The main content area is titled 'Databases'. A confirmation message box says 'Your Home Page has been updated'. Below it is a search bar with a 'Find Name' input field. A table lists two database instances:

Name	Type	Status	Target Version	Incidents	Average Compliance Score	Member Status Summary
orcl	Database Instance	▲	12.1.0.2.0	0 0 0	n/a	0 0 0 0 0
rcat	Database Instance	▲	12.1.0.2.0	0 0 0	n/a	0 0 0 0 0

Note: The databases appear on this list because they have been "discovered" as part of the course setup.

5. The `orcl` home page will be a starting point in later navigation tips.

The screenshot shows the Oracle Enterprise Manager Cloud Control 12c home page for the 'orcl' database. The top navigation bar includes links for 'Enterprise', 'Targets', 'Favorites', 'History', 'Setup', 'SYSMAN', and a refresh button. The main content area has several sections:

- Status:** Shows up time (0 days, 0 hrs), version (12.1.0.2.0), load (0.01 average active sessions), total sessions (66), last backup (Dec 3, 2014 12:33:50 PM), available space (0.07 GB), used space (2.66 GB), and total SGA (512.00 MB).
- Diagnostics:** Shows ADDM Findings (0) and Incidents (0).
- Compliance Summary:** Shows Compliance Standard and Average Score.
- Performance:** Includes a chart titled 'Activity Class' showing Active Sessions over time (8:12 AM to 8:22 AM). The chart legend indicates Wait (orange), User I/O (blue), CPU (green), and CPU Cores (red line).
- Resources:** Shows the 'SQL Monitor - Last Hour' section with a table for Status, Duration, SQL ID, Session ID, Parallel, and Database Time. It notes 'No data to display.'

6. To confirm your current recovery settings, click **Availability > Backup & Recovery > Recovery Settings**.

Note: For your "after-class" learning, consider viewing the *Oracle Enterprise Manager 12c: Create and Use Named Credentials* video on OLL or YouTube.

7. Review the entire page, using the scrollbars as needed. Answer the questions that follow.

The screenshot shows the 'Recovery Settings' page in Oracle Database. At the top right, it says 'Logged in as SYS'. Below that are 'Show SQL', 'Revert', and 'Apply' buttons. The 'Instance Recovery' section contains a note about the fast-start checkpointing feature and a configuration for 'Current Estimated Mean Time To Recover (seconds)'. The 'Media Recovery' section notes the database is in ARCHIVELOG mode and lists a single archived redo log destination named 'USE_DB_RECOVERY_FILE_DEST'.

Number	Archived Redo Log Destination	Status	Type
1	USE_DB_RECOVERY_FILE_DEST	VALID	Local

TIP: It is recommended that archived redo log files be written to multiple locations spread across the different disks.
TIP: You can specify up to 10 archived redo log destinations.

Enable Minimal Supplemental Logging
Minimal supplemental logging logs the minimal amount of information needed for LogMiner (and any product building on LogMiner technology) to identify, group, and merge the redo operations associated with DML changes.

- a. **Question:** Is ARCHIVELOG mode enabled?

Answer: Yes, because it was configured in a previous practice.

- b. **Question:** Is the fast recovery area enabled?

Answer: Yes, because the FRA was configured in a previous practice.

- c. **Question:** Where is the location of the fast recovery area?

Answer: /u01/app/oracle/fast_recovery_area

- d. **Question:** Which essential DBA tasks can you perform in this section?

Answer: You can change the location, size, or retention time for the fast recovery area, as well as enable the Flashback Database functionality.

- e. **Question:** Does changing the size of the Fast Recovery Area require the database to be restarted?

Answer: No, a restart is not required for this change.

Practice 3-6: Configuring Redo Log Files

Overview

In this practice, you check how many members are in each redo log group. Ensure that there are at least two redo log members in each group. One member of each group should be stored in the Fast Recovery Area.

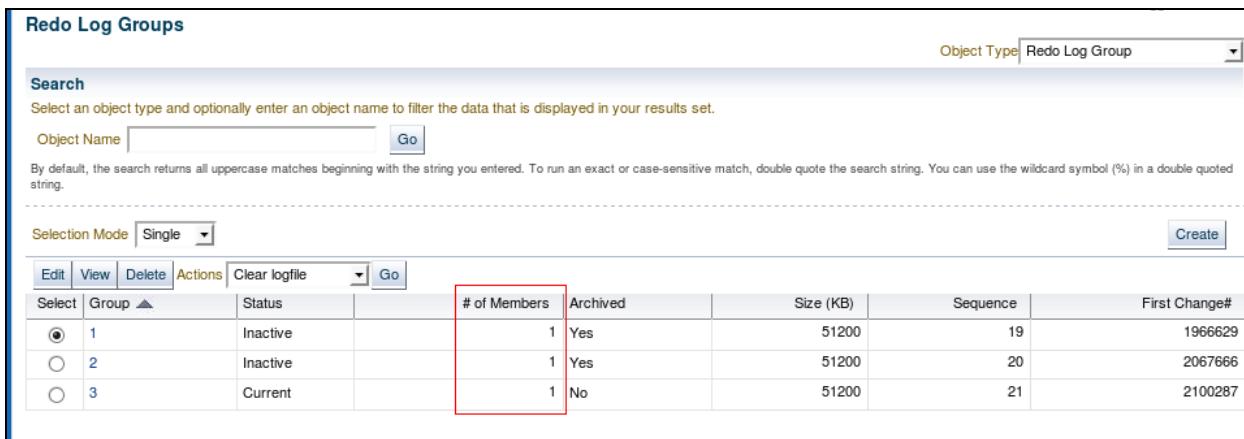
Assumptions

You completed the previous practice and are logged in to Cloud Control as the SYSMAN user.

Tasks

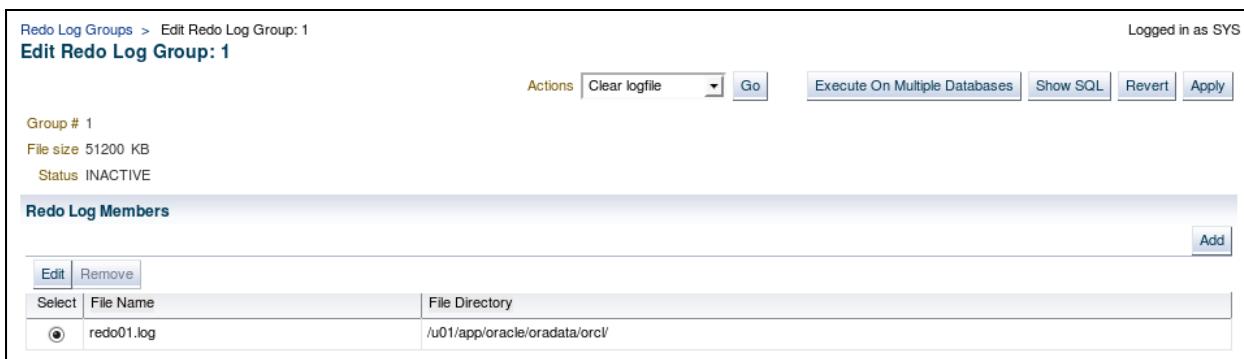
- Click **Administration > Storage > Redo Log Groups** and note how many members are in the “# of Members” column.

Answer: There is only one member in each group.



Select	Group	Status	# of Members	Archived	Size (KB)	Sequence	First Change#
<input checked="" type="radio"/>	1	Inactive	1	Yes	51200	19	1966629
<input type="radio"/>	2	Inactive	1	Yes	51200	20	2067666
<input type="radio"/>	3	Current	1	No	51200	21	2100287

- Select one of your redo log groups and click Edit to see where the member of that group is stored.



Select	File Name	File Directory
<input checked="" type="radio"/>	redo01.log	/u01/app/oracle/oradata/orcl/

- Click **Add** to add a member to the group.

4. Enter `redonnb.log` in the File Name field where `nn` represents the redo log group number. **Note:** For the purposes of this practice, you are going to create the second member in the same directory. In a production environment, you should create any additional members of a log group on different disks to protect against loss due to disk failure.

Redo Log Groups > Edit Redo Log Group: 1: Add Redo Log Member
Edit Redo Log Group: 1: Add Redo Log Member

Logged in as SYS

* File Name: redo01b.log

* File Directory: /u01/app/oracle/oradata/orcl/

Reuse File

Cancel Continue

5. Click **Continue** and then click **Apply**.
6. Click **Redo Log Groups** in the locator link and repeat the tasks in steps 2-5 for each of the redo log groups.
7. Log out of Enterprise Manager Cloud Control.
8. Optionally, log in to Enterprise Manager Database Express and review your modified redo log groups by clicking **Storage > Redo Log Groups**. Note that you could have added members to the redo log groups by using Enterprise Manager Database Express. Log out of Enterprise Manager Database Express after you view the redo log groups.

ORACLE Enterprise Manager Database Express 12c

ORCL (12.1.0.2.0) Configuration Storage Security Performance

Page Refreshed 11:52:45 AM GMT

Redo Log Groups

Name	Status	Member C...	Archived	Size	Sequence	First Change Num...	File Direct...
Redo Log Group 1	Inactive	2	✓	100MB	19	1966629	
redo01.log				50MB			/u01/app/or...
redo01b.log				50MB			/u01/app/or...
Redo Log Group 2	Inactive	2	✓	100MB	20	2067666	
redo02.log				50MB			/u01/app/or...
redo02b.log				50MB			/u01/app/or...
Redo Log Group 3	Current	2		100MB	21	2100287	
redo03.log				50MB			/u01/app/or...
redo03b.log				50MB			/u01/app/or...

Practices for Lesson 4: Using the RMAN Recovery Catalog

Chapter 4

Practices for Lesson 4: Overview

Practices Overview

In these practices, you will perform the one-time setup tasks:

- Create a recovery catalog owner.
- Create a recovery catalog.
- Register the ORCL database in the recovery catalog.
- Perform EM setup tasks.

Then, you will prepare your training environment by creating a backup that will enable you to restore the database if you are unable to complete the practices as described.

Practice 4-1: Creating a Recovery Catalog Owner

Overview

In this practice, you create a user and grant appropriate privileges.

Assumptions

The `rcat` database has been created as part of the practice setup. The initialization parameters have been set as follows:

```
DB_RECOVERY_FILE_DEST = /u01/app/oracle/fast_recovery_area  
DB_RECOVERY_FILE_DEST_SIZE = 10000M
```

You are in a terminal window with the environment variables pointing to the **rcat** database instance.

Tasks

1. If you have not already done so, use `oraenv` to set the environment for the `rcat` database.

```
$ . oraenv  
ORACLE_SID = [orcl] ? rcat  
The Oracle base for  
ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1 is  
/u01/app/oracle  
$
```

2. Log in to SQL*Plus as the `SYS` user with the `SYSDBA` role and create a tablespace named `RCATBS` to hold the repository data. Make it 15 MB in size.

```
$ sqlplus / as sysdba  
  
SQL> CREATE TABLESPACE rcatbs DATAFILE  
'/u01/app/oracle/oradata/rcat/rcat01.dbf' SIZE 15M REUSE;  
Tablespace created.  
SQL>
```

3. Create a user that will own the recovery catalog data. Name the user `RCATOWNER`. The default tablespace should be the `RCAT` tablespace, and the user should have unlimited quota on that tablespace.

```
SQL> CREATE USER rcatowner IDENTIFIED BY "oracle_4U" DEFAULT  
TABLESPACE rcatbs QUOTA unlimited on rcatbs;  
User created.  
SQL>
```

4. Grant the RECOVERY_CATALOG_OWNER role to the RCATOWNER user. Exit from SQL*Plus.

```
SQL> GRANT recovery_catalog_owner to rcatowner;  
Grant succeeded.  
SQL> exit  
$
```

Practice 4-2: Creating the Recovery Catalog

In this practice, you use RMAN to create the recovery catalog in the recovery catalog database.

Assumptions

You finished the previous practice. A terminal window is open with the environment variables pointing to the rcat database instance.

Tasks

1. Connect to the recovery catalog database by using RMAN. Log in as the recovery catalog owner you just created.

```
$ rman catalog rcatowner@rcat  
  
recovery catalog database Password: oracle_4U <<<not displayed  
connected to recovery catalog database  
RMAN>
```

2. Create the recovery catalog. This command may take a couple of minutes to complete. When you see the RMAN> prompt, exit the RMAN session.

```
RMAN> create catalog;  
  
recovery catalog created  
  
RMAN> exit  
$
```

Practice 4-3: Registering a Database in the Recovery Catalog

In this practice, you use RMAN to register the ORCL database in the recovery catalog that you just created.

Assumptions

You finished the previous practices. A terminal window is open.

Tasks

1. Set up the environment for the ORCL database. (*If you were to continue in your previous RMAN session, you would be pointing to the wrong database.*)

```
$ . oraenv  
ORACLE_SID = [orcl] ? orcl  
$
```

2. Connect to the target database (to be registered) and the recovery catalog database by using RMAN.

```
$ rman target ''/ as sysbackup'' catalog rcatowner@rcat  
  
connected to target database: ORCL (DBID=1345675044)  
recovery catalog database Password: oracle_4U <<<not displayed  
connected to recovery catalog database  
  
RMAN>
```

3. Register the database in the catalog.

```
RMAN> register database;  
  
database registered in recovery catalog  
starting full resync of recovery catalog  
full resync complete  
  
RMAN>
```

4. To verify that the registration was successful, execute the REPORT SCHEMA command. Then exit.

```
RMAN> REPORT SCHEMA;  
Report of database schema for database with db_unique_name ORCL  
  
List of Permanent Datafiles  
=====  
File  Size (MB)  Tablespace          RB  segs  Datafile Name  
-----  -----  -----  -----  
-----  -----  -----  -----  
-----  -----  -----  -----
```

```
1     810      SYSTEM             YES
/u01/app/oracle/oradata/orcl/system01.dbf
3     770      SYSAUX            NO
/u01/app/oracle/oradata/orcl/sysaux01.dbf
4     150      UNDOTBS1          YES
/u01/app/oracle/oradata/orcl/undotbs01.dbf
5    1243      EXAMPLE            NO
/u01/app/oracle/oradata/orcl/example01.dbf
6      5      USERS              NO
/u01/app/oracle/oradata/orcl/users01.dbf

List of Temporary Files
=====
File  Size (MB)  Tablespace        Maxsize (MB) Tempfile Name
-----  -----
1     197      TEMP                32767
/u01/app/oracle/oradata/orcl/temp01.dbf
RMAN> exit
$
```

Note:

- The **size** of the data files may vary in your setup.
- If you are not connected to the recovery catalog, the **RB segs** column contains ******* as a value. It contains the **YES** and **NO** values when you are connected to the recovery catalog.

Practice 4-4: Configuring Enterprise Manager for the RMAN Catalog

In this practice, you register the recovery catalog to be used by Enterprise Manager Cloud Control.

Assumptions

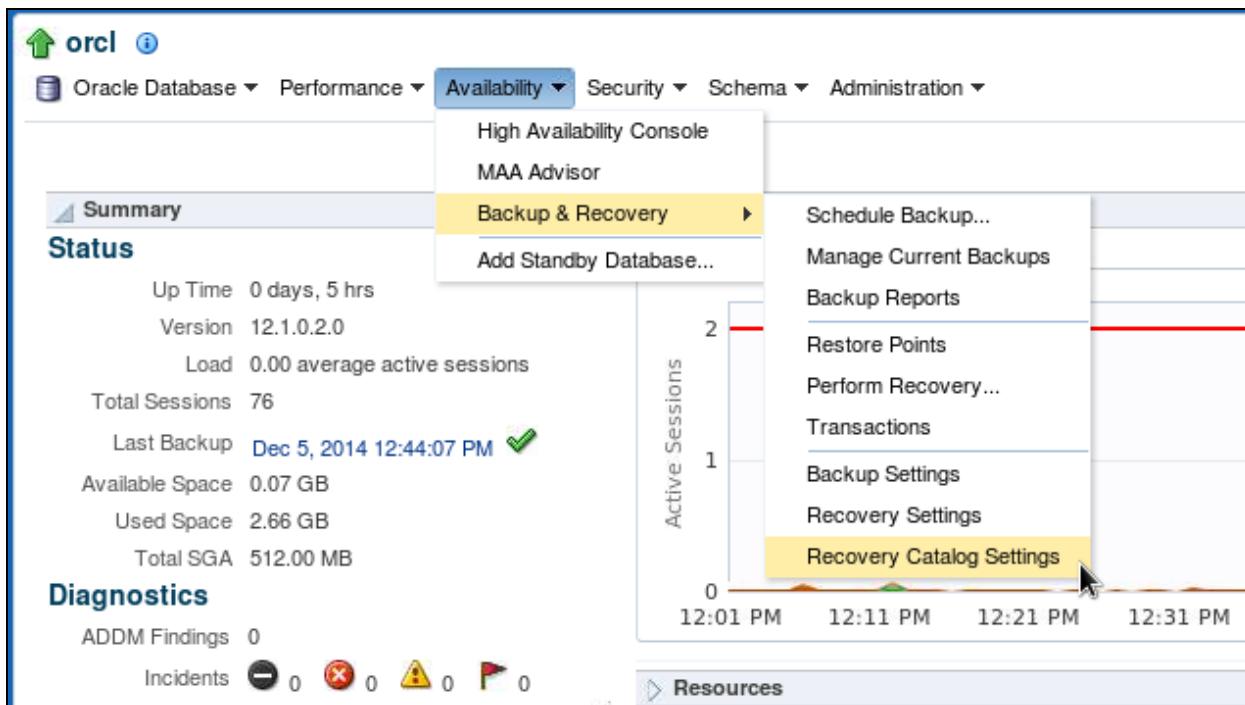
You completed the previous practices.

Enterprise Manager Cloud Control 12c is installed. The ORCL and RCAT database instances are added as managed targets.

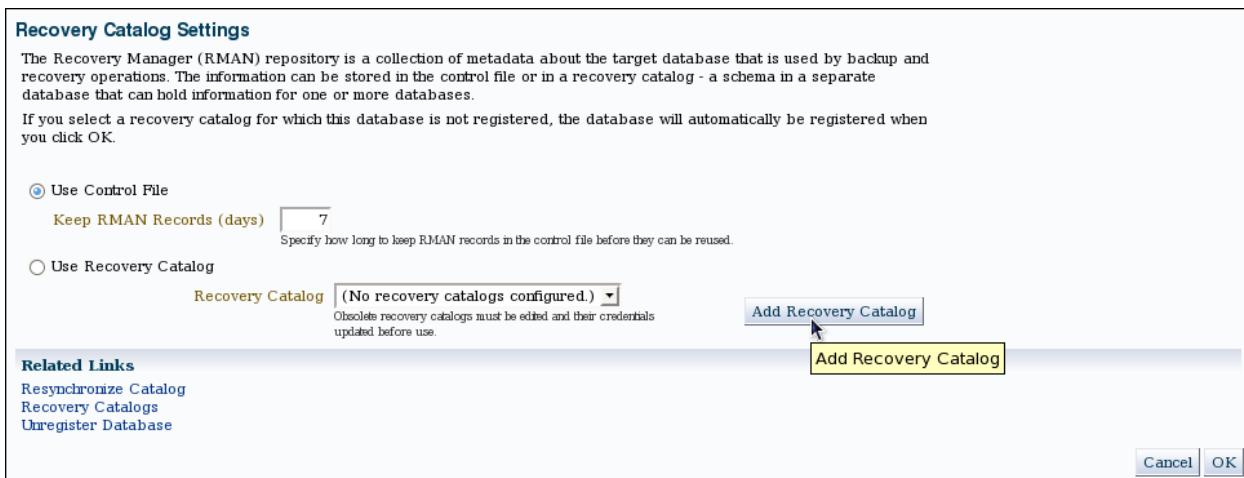
If you would like to review the Cloud Control login procedure, see practice 3-5 for the Enterprise Manager login as the SYSMAN user. Navigate to the orcl home page.

Tasks

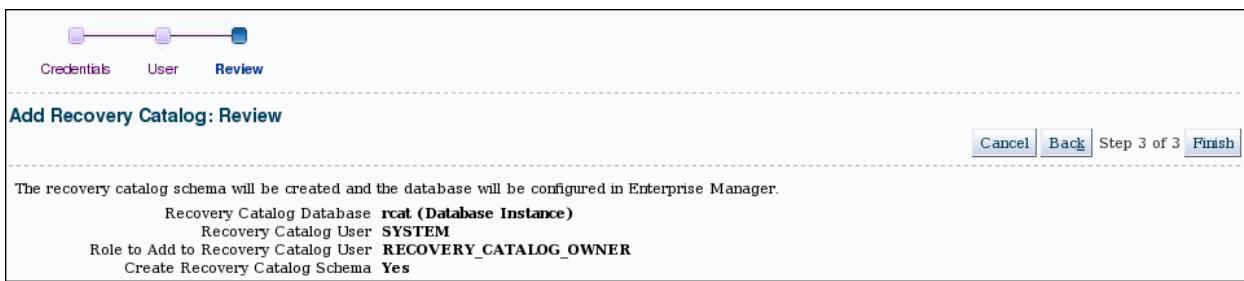
1. In Enterprise Manager, navigate to **Availability > Backup & Recovery > Recovery Catalog Settings**.



2. Click the **Add Recovery Catalog** button.



3. On the Add Recovery Catalog: Database page, ensure that `rcat` (Database Instance) is selected as **Database Target**, and then click **Next**.
4. On the Add Recovery Catalog: Credentials page, perform the following steps:
 - a. Click **New** in the **Host Credentials** section. Enter `oracle` in the User Name field. Enter the operating system password you have been provided in the Password and Confirm Password fields. Select **Save As** and enter `NC_RCAT_HOST_ORACLE` in the field.
 - b. Click **Test**. You should get a Success message.
 - c. Click **New** in the **Database Credentials** section. Enter `sys` in the Username field. Enter `oracle_4U` in the Password and Confirm Password fields. Select **SYSDBA** in the Role menu. Select **Save As** and enter `NC_RCAT_DB_SYSDBA` in the field.
 - d. Click **Test**. You should get a Success message.
 - e. Click **Next**.
5. On the Add Recovery Catalog: User page, specify the `NC_SYSTEM` credentials for the `RCATOWNER` user.
 - a. Click **Named** and select `NC_SYSTEM` in the Credential Name menu.
 - b. Click **More Details**.
 - c. Click **Test**. You should see a "Test Successful" message.
 - d. Click **Next**.
6. On the Add Recovery Catalog: Review page, review your configuration and click **Finish**. (A Processing window may appear.)



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7. Back on the Recovery Catalog Settings page, select **Use Recovery Catalog**.
8. Click **New** in the Host Credentials section. Enter `oracle` in the User Name field. Enter the operating system password you have been provided in the Password and Confirm Password fields. Select **Save As** and enter `NC_ORCL_HOST_ORACLE` in the field. Click **OK**.
The processing window may appear, followed by the information that the target database has been registered in the recovery catalog.
9. Log out of Enterprise Manager Cloud Control.

Practice 4-5: Configuring the Recovery Catalog for Recovery

Overview

Your organization determined that if the recovery catalog is lost or damaged, it needs to be restored quickly and completely.

In this practice, you configure the retention policy for the recovery catalog (retaining two backups), enable archive log mode, and back up your RCAT database.

You back up the recovery catalog to implement a backup strategy of incremental backups applied to image copies. This provides a method of fast restore by switching to the image copy rather than copying the backups back to the original location.

The practice performs the tasks in command line, but a SYSDBA can also perform them in Cloud Control. (*Perform the tasks in one chosen interface.*)

Navigation tips:

- **To configure the retention policy:** RCAT home page > Availability > Backup & Recovery > Backup Settings > Policy tab > Delete archived redo log files after they have been backed up the specified number of times > Backups: 2
- **To enable archive log mode:** RCAT home page > Availability > Backup & Recovery > Recovery Settings > ARCHIVELOG Mode* *The database must be restarted.* (A wizard will guide you through the steps.)
- **To back up the database:** RCAT home page > Availability > Backup & Recovery > Schedule Backup > Schedule Customized Backup > Full > Next > Disk > Next > One Time (Immediately) > Next > Submit Job.

Assumptions

You finished the previous practices. A terminal window is open with the environment variables pointing to the ORCL database instance.

Tasks

1. Configure the retention policy with at least redundancy 2.
 - a. Start RMAN and use the recovery catalog database as the target, with no catalog specified.

```
$ rman target sys@rcat

target database Password: <<< not displayed
connected to target database: RCAT (DBID=590042858)
RMAN>
```

- b. Make sure that the retention policy for the recovery catalog is set to redundancy greater than 1. If it is not, set it to at least 2. Exit RMAN.

```
RMAN> show retention policy;

using target database control file instead of recovery catalog
RMAN configuration parameters for database with db_unique_name
RCAT are:
```

```
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default

RMAN> configure retention policy to redundancy 2;
new RMAN configuration parameters:
CONFIGURE RETENTION POLICY TO REDUNDANCY 2;
new RMAN configuration parameters are successfully stored

RMAN> exit
$
```

2. To enable archive log mode:

- Ensure that the environment variables are set for the RCAT database.

```
$ . oraenv
ORACLE_SID = [rcat] ? rcat
The Oracle base remains unchanged with value /u01/app/oracle
```

- Log in to SQL*Plus. Configure the recovery catalog database for ARCHIVELOG mode. Exit SQL*Plus.

```
$ sqlplus / as sysdba
SQL> SHUTDOWN IMMEDIATE
Database closed.
Database dismounted.
ORACLE instance shut down.

SQL> STARTUP MOUNT
ORACLE instance started.

Total System Global Area  746586112 bytes
Fixed Size                  2928872 bytes
Variable Size                301993752 bytes
Database Buffers              436207616 bytes
Redo Buffers                  5455872 bytes
Database mounted.

SQL> ALTER DATABASE ARCHIVELOG;
Database altered.

SQL> ALTER DATABASE OPEN;
Database altered.

SQL> archive log list
Database log mode           Archive Mode
Automatic archival          Enabled
```

Archive destination	USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence	35
Next log sequence to archive	37
Current log sequence	37
SQL> EXIT	
\$	

The recovery catalog database has been placed in archive log mode to do a complete restore.

3. Back up the recovery catalog database as an image copy and a base for incremental backups. This provides a method of fast restore by switching to the image copy rather than copying the backups back to the original location. (*You can use a terminal window pointing to RCAT.*)
- a. Start RMAN and use the recovery catalog database as the target, with no catalog specified.

```
$ rman target sys@rcat

target database Password: <<< not displayed
connected to target database: RCAT (DBID= 637378352)

RMAN>
```

- b. Back up the recovery catalog database as an image copy and a base for incremental backups.

```
RMAN> BACKUP AS COPY INCREMENTAL LEVEL 0 DATABASE;
Starting backup at 2014-12-09:14:13:32
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=273 device type=DISK
channel ORA_DISK_1: starting datafile copy
input datafile file number=00005
name=/u01/app/oracle/oradata/rcat/example01.dbf
output file
name=/u01/app/oracle/fast_recovery_area/RCAT/datafile/o1_mf_exam
ple_b8g0wg3g_.dbf tag=TAG20141209T141333 RECID=1 STAMP=865865638
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:36
channel ORA_DISK_1: starting datafile copy
input datafile file number=00003
name=/u01/app/oracle/oradata/rcat/sysaux01.dbf
output file
name=/u01/app/oracle/fast_recovery_area/RCAT/datafile/o1_mf_syst
em_b8g0xkg0_.dbf tag=TAG20141209T141333 RECID=2 STAMP=865865667
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:25
channel ORA_DISK_1: starting datafile copy
```

```
input datafile file number=00001
name=/u01/app/oracle/oradata/rcat/system01.dbf
output file
name=/u01/app/oracle/fast_recovery_area/RCAT/datafile/o1_mf_system_b8g0ybnq_.dbf tag=TAG20141209T141333 RECID=3 STAMP=865865691
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:25
channel ORA_DISK_1: starting datafile copy
input datafile file number=00004
name=/u01/app/oracle/oradata/rcat/undotbs01.dbf
output file
name=/u01/app/oracle/fast_recovery_area/RCAT/datafile/o1_mf_undotbs1_b8g0z3y1_.dbf tag=TAG20141209T141333 RECID=4
STAMP=865865703
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:07
channel ORA_DISK_1: starting datafile copy
input datafile file number=00002
name=/u01/app/oracle/oradata/rcat/rcat01.dbf
output file
name=/u01/app/oracle/fast_recovery_area/RCAT/datafile/o1_mf_rcatbs_b8g0zc37_.dbf tag=TAG20141209T141333 RECID=5 STAMP=865865707
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:02
channel ORA_DISK_1: starting datafile copy
copying current control file
output file
name=/u01/app/oracle/fast_recovery_area/RCAT/controlfile/o1_mf_TAG20141209T141333_b8g0zd8f_.ctl tag=TAG20141209T141333 RECID=6
STAMP=865865709
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:03
channel ORA_DISK_1: starting datafile copy
input datafile file number=00006
name=/u01/app/oracle/oradata/rcat/users01.dbf
output file
name=/u01/app/oracle/fast_recovery_area/RCAT/datafile/o1_mf_users_b8g0zhk5_.dbf tag=TAG20141209T141333 RECID=7 STAMP=865865711
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:01
channel ORA_DISK_1: starting incremental level 0 datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
including current SPFILE in backup set
channel ORA_DISK_1: starting piece 1 at 2014-12-09:14:15:12
channel ORA_DISK_1: finished piece 1 at 2014-12-09:14:15:13
```

```
piece
handle=/u01/app/oracle/fast_recovery_area/RCAT/backupset/2014_12
_09/o1_mf_nnsn0_TAG20141209T141333_b8g0zjqn_.bkp
tag=TAG20141209T141333 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 2014-12-09:14:15:13
RMAN>
```

Question: Is the current SPFILE included?

Answer: Yes

- c. Review the output (find the tablespace that you created for the recovery catalog) and then exit.

```
RMAN> exit
$
```


Practices for Lesson 5: Backup Strategies and Terminology

Chapter 5

Practices for Lesson 5: Overview

Practices Overview

In this practice, you will develop backup strategies for different types of databases with different requirements.

Practice 5-1: Case Study: Developing a Backup Strategy

Overview

In this practice, you will develop backup strategies for different types of databases with different requirements.

Assumptions

The full range of Oracle backup and recovery tools are available.

Tasks

1. The first case is an online transaction processing (OLTP) database, handling a large number of transactions per day. The business requirements are no data loss, with minimal downtime. The time to restore and recover must be less than an hour. The database is 300 GB. Several TB of disk space is available for backups. All the available disks have the same properties (size, I/O rate, and latency). Tape backup is available.

Question: What steps do you take to protect the database (for instance, place the database in ARCHIVELOG mode)?

Question: How much disk space will you need?

Question: What is the retention policy?

Question: Will you use a Fast Recovery Area?

Question: Will you use backup sets or image copies?

Question: Will you use full or incremental backups?

Question: What recovery method will you use?

2. The database is a Decision Support System (DSS). Data is loaded via SQL*Loader files each night from several transaction databases. The database DSS keeps data for 10 years. The transaction databases keep only 1 year worth of data. The data is updated only in the transaction databases, and is replaced in the DSS database. Only new and updated records are transferred to the DSS database. The DSS database is 10 TB. Separate tablespaces are used to hold the data by year. There are approximately 200 tablespaces.

Question: What else do you need to know to design a backup strategy?

Examples: What is the cost, availability, and speed of disk storage?

Question: What steps do you take to protect the database?

Question: How much disk or tape space will you need?

Question: What is the retention policy?

Question: Will you use a Fast Recovery Area?

Question: Will you use backup sets or image copies?

Question: Will you use full or incremental backups?

Question: What recovery method will you use?

3. The database is a recovery catalog, holding the RMAN catalog information for more than 20 databases in the company. Backups and restore operations may be going on at anytime. The databases are mission critical.

Question: How are the database recovered if the recovery catalog is unavailable?

Question: What is the retention policy?

Question: Will you use a fast recovery area?

Question: Will you use backup sets or image copies?

Questions: Will you use full or incremental backups?

Question: What recovery method will you use?

Practice 5-2: Creating a Backup Schedule

Overview

In this practice you will create a backup schedule in Cloud Control. You can view the RMAN Script on the Review page (step 6).

Assumptions

The previous practices have been completed.

You are logged into Cloud Control as SYSMAN and have the menus of the rcat home page displayed.

Tasks

Schedule nightly disk-based incremental online backups for your whole database, including archive logs. Configure the archive logs for deletion from disk after the backup is complete. Schedule the backup for execution at 11:00 PM. The schedule should be in effect indefinitely.

1. From the rcat database home page, navigate to **Availability > Backup & Recovery > Schedule Backup**.
2. If needed, choose NC_SYSDBA as **Database Credentials** and click **Login**.
3. Confirm or select **Whole Database** as the object to be backed up and NC_RCAT_HOST_ORACLE as Host Credentials, and then click **Schedule Customized Backup**.

4. On the Schedule Customized Backup: Options page, confirm or select the following settings and then click **Next**.

Backup Type	Incremental Backup
Backup Mode	Online Backup
Advanced	<ul style="list-style-type: none"> Also back up all archived logs on disk. Delete all archived logs from disk after they are successfully backed up. Delete obsolete backups.

Schedule Customized Backup: Options

Database **rcat**
 Backup Strategy **Customized Backup**
 Object Type **Whole Database**

Cancel Step 1 of 4 **Next**

Backup Type

Full Backup
 Use as the base of an incremental backup strategy
 Incremental Backup
 Refresh the latest datafile copy on disk to the current time using the incremental backup
 Perform cumulative instead of differential backup
Enabling results in faster recovery since fewer incremental backups need to be applied during recovery. Disabling results in faster daily backups that use less disk space.

Backup Mode

Online Backup
Can be performed when the database is open.
 Offline Backup
If the database is open at the time of backup, it will be shut down and mounted before the backup, then re-opened after the backup.

Advanced

Also back up all archived logs on disk
 Delete all archived logs from disk after they are successfully backed up
 Delete obsolete backups
Delete backups that are no longer required to satisfy the retention policy.

Use proxy copy supported by media management software to perform a backup
If proxy copy of the selected files is not supported, a conventional backup will be performed.

Maximum Files per Backup Set
 Section Size KB

Backs up large files in parallel, using sections of the specified size. (Cannot be used if Maximum Backup Piece Size is set in Backup Settings.)

5. On the Schedule Customized Backup: Settings page, select **Disk** as your backup location, and then click **Next**.

6. On the Schedule Customized Backup: Schedule page, confirm or select the following settings and then click **Next**.

Job Name	NIGHTLY_BACKUP
Job Description	Whole Database Backup
Schedule Type	Repeating
Frequency Type	By Days
Repeat Every	1 (Days)
Time Zone	<i>Your time zone or the time zone suggested by your instructor.</i>
Start Date	<i>Today's date</i>
Start Time	<i>11:00 PM (This time should not interfere with your regular course hours. Your instructor might suggest a different time.)</i>
Repeat Until	Indefinite

Schedule Customized Backup: Schedule

Database **rcat**
 Backup Strategy **Customized Backup**
 Object Type **Whole Database**

Job

* Job Name **NIGHTLY_BACKUP**
 Job Description **Whole Database Backup**

Schedule

Type One Time (Immediately) One Time (Later) Repeating

Frequency Type **By Days**

Repeat Every **1** Days

Time Zone **(UTC-05:00) US Eastern Time (EST)**

Start Date **Dec 10, 2014**

Start Time **11 :00** AM PM

Repeat Until Indefinite
 Specified Date

Date **Dec 10, 2014**
(example: Dec 10, 2014)

Time **11 :00** AM PM

7. On the Schedule Customized Backup: Review page, review your settings and the RMAN script, and then click **Submit Job**.

Schedule Customized Backup: Review

Database: rcat
Backup Strategy: Customized Backup
Object Type: Whole Database

Settings

Destination: Disk
Backup Type: Incremental Differential Backup
Backup Mode: Online Backup
Fast Recovery Area: /u01/app/oracle/fast_recovery_area

RMAN Script

The RMAN script below is generated based on previous input.

```
backup incremental level 1 device type disk tag '%TAG' database;
backup device type disk tag '%TAG' archivelog all not backed up delete all input;
run {
allocate channel oem_backup_disk1 type disk maxpiecesize 1000 G;
backup tag '%TAG' current controlfile;
release channel oem_backup_disk1;
```

8. You should receive a success message. Click **View Job**.
9. On the Execution:rcat page, you should see your job scheduled. Note some of the characteristics that you provided.
10. Click the **Job Activity** link in the navigation bar. The Job Activity page displays a summary of your jobs. You might decide to use it in later practices also by navigating: Enterprise > Job > Activity.

Job Activity

Status	Active	Name	Actions		Go	Advanced Search						
<input checked="" type="checkbox"/> TIP By default, results for the last 24 hours are displayed. Use 'Advanced Search' for more options.												
View Results	Edit	Create Like	Copy To Library	Suspend	Resume	Stop	Delete	View	Runs	Create Job	OS Command	Go
Select	Name	Status (Executions)		Scheduled		Targets	Target Type	Owner	Job Type			
<input type="radio"/>	MDADCSTATUSJOB	1 Scheduled		Dec 11, 2014 4:31:00 AM GMT+0:00				SYSMAN	MDADCStatus			
<input type="radio"/>	MDADATAPURGEJOB	1 Scheduled		Dec 11, 2014 4:31:00 AM GMT+0:00				SYSMAN	MDADataMovementAndPurge			
<input type="radio"/>	MDADATAMOVEMENTJOB	1 Scheduled		Dec 11, 2014 4:31:00 AM GMT+0:00				SYSMAN	MDADataMovementAndPurge			
<input type="radio"/>	REFRESH UPDATES FROM ORACLE	1 Scheduled		Dec 11, 2014 4:02:00 AM GMT				SYSMAN	Refresh Updates			
<input checked="" type="radio"/>	NIGHTLY_BACKUP	1 Scheduled		Dec 10, 2014 11:00:00 PM EST	rman	Database Instance	SYSMAN	Database Backup				
<input type="radio"/>	SWLIBPURGE	1 Scheduled		Dec 11, 2014 2:00:00 AM GMT+0:00				SYSMAN	Software Library Purge			

Navigation Tip: There are multiple ways to navigate to a database home page, for example, if you want to navigate from the RCAT to the ORCL database, you can click: Targets > All Targets, then click the `orcl` **Database Instance** link or use the **History** pull-down.

11. Log out of Enterprise Manager Cloud Control.

Practices for Lesson 6: Creating Backups

Chapter 6

Practices for Lesson 6: Overview

Practices Overview

In these practices, you will configure block change tracking, create incremental backups, back up the control file, and back up the archived redo log files.

Practice 6-1: Configuring Block Change Tracking

Overview

In this practice, you will configure Block Change Tracking (BCT). Although BCT is optional, it reduces the time required for an incremental backup from the time to scan all the blocks in the database to a time proportional to the number of blocks that have changed since the last backup.

Note: The BCT file can only contain 8 bitmaps, so the backup cannot be optimized if there have been more than 8 incremental backups since the parent level backup that the new incremental will be based on. Consider the 8-bitmap limit when developing your incremental backup strategy. For example, if you make a level 0 database backup followed by 7 differential incremental backups, then the block change tracking file now includes 8 bitmaps. If you then make a cumulative level 1 incremental backup, RMAN cannot optimize the backup because the bitmap corresponding to the parent level 0 backup is overwritten with the bitmap that tracks the current changes.

Assumptions

The previous practices have been completed.

You have a terminal window open. Environment variables are set for the `orcl` database instance. The current directory is `/home/oracle/labs` as set by `$LABS`.

Tasks

1. Configure block change tracking to place the BCT file in the default data file creation destination.
 - a. Start SQL*Plus and connect to your `orcl` database with administrator privileges.

```
$ sqlplus / as sysdba
```

- b. Ensure that the `DB_CREATE_FILE_DEST` initialization parameter is set to the correct location.

```
SQL> ALTER SYSTEM SET DB_CREATE_FILE_DEST =
  '/u01/app/oracle/oradata/orcl';

System altered.

SQL> SHOW PARAMETER DB_CREATE_FILE_DEST
NAME          TYPE        VALUE
-----
db_create_file_dest    string      /u01/app/oracle/oradata/orcl
SQL>
```

- c. Enable block change tracking. Execute the following ALTER DATABASE statement:

```
SQL> ALTER DATABASE ENABLE BLOCK CHANGE TRACKING;  
Database altered.  
SQL>
```

Note: In practice 6-2, step 6, you will disable block change tracking again, because it is not a meaningful setting for this training environment.

2. Exit SQL*Plus.

```
SQL> exit
```

Practice 6-2: Using Incremental Backup

Overview

In this practice, you create an image copy of the target database for use as a base for an incremental backup strategy. You perform an incremental level 1 backup, and apply the incremental to the level 0 backup.

Note: Applying the incremental backup to the level 0 image copies makes the level 0 backup the same as if you had taken a level 0 instead of level 1.

Assumptions

The previous practices have been completed.

You have two terminal windows open. The current directory is the \$LABS directory. Environment variables are set for the orcl database instance.

Tasks

1. Execute the lab_06_02_01.sh script from the labs directory. This script creates the INVENTORY tablespace, the INVENTORY user, and populates the schema in NOLOGGING mode. (The execution of the script might take a while because several tables with over 90,000 rows are created. *Your row count might be different.*)

```
$ cd $LABS
$ ./lab_06_02_01.sh
. . .
SQL>    2      3      4      5      6      7      8      9      10
91794 rows created.

SQL>    2
Commit complete.
SQL>    2
Table altered.
SQL> SQL>
Index created.
SQL> SQL>
Table altered.
SQL> SQL>
Table altered.

SQL> SQL> SQL> Disconnected from Oracle Database 12c Enterprise
Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real
Application Testing options
$
```

Note: This script can be run multiple times, but note that it completely resets the INVENTORY schema each time it runs.

2. Back up the orcl database to the /u01/backup/orcl directory.

Note: This is not the default area.

Use the RMAN command line and set the incremental level to 0.

- a. Perform a database incremental level 0 backup. Allocate a channel to use the /u01/backup/orcl directory for the data file copies destination.

```
$ rman target ''/ as sysbackup'

RMAN> run {
2> ALLOCATE CHANNEL "ch1" DEVICE TYPE DISK FORMAT
"/u01/backup/orcl/%U";
3> BACKUP AS COPY TAG 'BASE01' INCREMENTAL LEVEL 0 DATABASE;
4> }

using target database control file instead of recovery catalog
allocated channel: ch1
channel ch1: SID=281 device type=DISK

Starting backup at 2014-12-10:12:44:06
channel ch1: starting datafile copy
input datafile file number=00005
name=/u01/app/oracle/oradata/orcl/example01.dbf
output file name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-
EXAMPLE_FNO-5_09ppqj0m tag=BASE01 RECID=1 STAMP=865946666
channel ch1: datafile copy complete, elapsed time: 00:00:25
channel ch1: starting datafile copy
input datafile file number=00001
name=/u01/app/oracle/oradata/orcl/system01.dbf
output file name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-
SYSTEM_FNO-1_0appqj1f tag=BASE01 RECID=2 STAMP=865946690
channel ch1: datafile copy complete, elapsed time: 00:00:25
channel ch1: starting datafile copy
input datafile file number=00003
name=/u01/app/oracle/oradata/orcl/sysaux01.dbf
output file name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-
SYSAUX_FNO-3_0bppqj28 tag=BASE01 RECID=3 STAMP=865946713
channel ch1: datafile copy complete, elapsed time: 00:00:25
channel ch1: starting datafile copy
input datafile file number=00004
name=/u01/app/oracle/oradata/orcl/undotbs01.dbf
output file name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-
UNDOTBS1_FNO-4_0cppqj32 tag=BASE01 RECID=4 STAMP=865946725
channel ch1: datafile copy complete, elapsed time: 00:00:07
channel ch1: starting datafile copy
```

```
input datafile file number=00007
name=/u01/app/oracle/oradata/inventory02.dbf
output file name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-
INVENTORY_FNO-7_0dppqj39 tag=BASE01 RECID=5 STAMP=865946730
channel ch1: datafile copy complete, elapsed time: 00:00:03
channel ch1: starting datafile copy
input datafile file number=00002
name=/u01/backup/orcl/inventory01.dbf
output file name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-
INVENTORY_FNO-2_0eppqj3c tag=BASE01 RECID=6 STAMP=865946733
channel ch1: datafile copy complete, elapsed time: 00:00:01
channel ch1: starting datafile copy
input datafile file number=00006
name=/u01/app/oracle/oradata/orcl/users01.dbf
output file name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-
USERS_FNO-6_0fppqj3d tag=BASE01 RECID=7 STAMP=865946734
channel ch1: datafile copy complete, elapsed time: 00:00:01
Finished backup at 2014-12-10:12:45:34

Starting Control File and SPFILE Autobackup at 2014-12-
10:12:45:34
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_10/o1_mf_s_865946734_b8jj3hkg_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 2014-12-
10:12:45:37
released channel: ch1

RMAN>
```

- b. As the backup is performed, notice where the backup files are created. Be sure to create a tag for this backup. In this example, 'BASE01' is the tag.
3. In another terminal window (in the \$LABS directory, pointing to the orcl database instance), start a workload that updates your database by executing the lab_06_02_03.sh script.

Note: The script updates over 2000 rows.

```
$ ./lab_06_02_03.sh
. . .
2745 rows updated.
. . .
$
```

4. In your RMAN session, perform an incremental level 1 backup to the /u01/backup/orcl directory. Use the RMAN command as shown.

```
RMAN> run {
2> ALLOCATE CHANNEL "ch1" DEVICE TYPE DISK FORMAT
"/u01/backup/orcl/%U";
3> BACKUP TAG 'incr_update' INCREMENTAL LEVEL 1 DATABASE;
4> }
allocated channel: ch1
channel ch1: SID=281 device type=DISK

Starting backup at 2014-12-10:13:23:44
channel ch1: starting incremental level 1 datafile backup set
channel ch1: specifying datafile(s) in backup set
input datafile file number=00005
name=/u01/app/oracle/oradata/orcl/example01.dbf
input datafile file number=00001
name=/u01/app/oracle/oradata/orcl/system01.dbf
input datafile file number=00003
name=/u01/app/oracle/oradata/orcl/sysaux01.dbf
input datafile file number=00004
name=/u01/app/oracle/oradata/orcl/undotbs01.dbf
input datafile file number=00007
name=/u01/app/oracle/oradata/inventory02.dbf
input datafile file number=00002
name=/u01/backup/orcl/inventory01.dbf
input datafile file number=00006
name=/u01/app/oracle/oradata/orcl/users01.dbf
channel ch1: starting piece 1 at 2014-12-10:13:23:44
channel ch1: finished piece 1 at 2014-12-10:13:23:59
piece handle=/u01/backup/orcl/0hppqlb0_1_1 tag=INCR_UPDATE
comment=NONE
channel ch1: backup set complete, elapsed time: 00:00:15
Finished backup at 2014-12-10:13:23:59

Starting Control File and SPFILE Autobackup at 2014-12-
10:13:23:59
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_10/o1_mf_s_865949039_b8jlcjmfp_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 2014-12-
10:13:24:02
released channel: ch1
RMAN>
```

Note: The time of the incremental data file backup is faster than the original level 0 and some data files do not need to be backed up at all.

5. Apply the incremental backups to the existing level 0 backup. Notice the recovery of the data file copy and the restore operation.

```
RMAN> run {  
2> ALLOCATE CHANNEL "ch1" DEVICE TYPE DISK FORMAT  
"/u01/backup/orcl/%U";  
3> RECOVER COPY OF DATABASE WITH TAG 'BASE01';  
4> }  
allocated channel: ch1  
channel ch1: SID=281 device type=DISK  
  
Starting recover at 2014-12-10:13:33:29  
channel ch1: starting incremental datafile backup set restore  
channel ch1: specifying datafile copies to recover  
recovering datafile copy file number=00001  
name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-SYSTEM_FNO-  
1_0appqj1f  
recovering datafile copy file number=00002  
name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-INVENTORY_FNO-  
2_0eppqj3c  
recovering datafile copy file number=00003  
name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-SYSAUX_FNO-  
3_0bppqj28  
recovering datafile copy file number=00004  
name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-UNDOTBS1_FNO-  
4_0cppqj32  
recovering datafile copy file number=00005  
name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-EXAMPLE_FNO-  
5_09ppqj0m  
recovering datafile copy file number=00006  
name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-USERS_FNO-  
6_0fppqj3d  
recovering datafile copy file number=00007  
name=/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-INVENTORY_FNO-  
7_0dppqj39  
channel ch1: reading from backup piece  
/u01/backup/orcl/0hppqlb0_1_1  
channel ch1: piece handle=/u01/backup/orcl/0hppqlb0_1_1  
tag=INCR_UPDATE  
channel ch1: restored backup piece 1  
channel ch1: restore complete, elapsed time: 00:00:07  
Finished recover at 2014-12-10:13:33:37  
  
Starting Control File and SPFILE Autobackup at 2014-12-  
10:13:33:37
```

```
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_10/o1_mf_s_865949617_b8jlx14q_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 2014-12-
10:13:33:40
released channel: ch1

RMAN>
```

6. Disable block change tracking in the training environment. You can execute the command either in SQL*Plus or in RMAN.

```
RMAN> ALTER DATABASE DISABLE BLOCK CHANGE TRACKING;
Statement processed
RMAN>
```

7. Exit the RMAN client and **cleanup your test data** by executing the cleanup_06_02.sh script, which removes the INVENTORY tablespace and the INVENTORY user.

```
RMAN> exit
$ ./cleanup_06_02.sh
$
```

8. Optionally, use another terminal window to view the output in the /tmp/cleanup.log file while the script is executing.

```
$ cat /tmp/cleanup.log
SQL*Plus: Release 12.1.0.2.0 Production on Wed Dec 10 13:40:05
2014

Copyright (c) 1982, 2014, Oracle. All rights reserved.

SQL> Connected.
SQL>
User dropped.

SQL>
Tablespace dropped.

SQL> SQL> Disconnected from Oracle Database 12c Enterprise
Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real
Application Testing options
Cleanup done.
$
```

9. As SYSBACKUP, delete obsolete backups.

```
$ rman target ''/ as sysbackup'

RMAN> delete obsolete;
using target database control file instead of recovery catalog
RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=40 device type=DISK
Deleting the following obsolete backups and copies:
Type          Key    Completion Time   Filename/Handle
-----        ----   -----:-----:-----:-----
---  
Backup Set      3      2014-12-05:12:10:16  
  Backup Piece   3      2014-12-05:12:10:16  
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_05/o1_  
mf_nnndf_TAG20141205T120952_b8384lhs_.bkp  
Backup Set      4      2014-12-05:12:10:20  
  Backup Piece   4      2014-12-05:12:10:20  
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_05/o1_  
mf_ncsnf_TAG20141205T120952_b8385cno_.bkp  
Backup Set      5      2014-12-05:12:44:02  
  Backup Piece   5      2014-12-05:12:44:02  
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_05/o1_  
mf_nnndf_TAG20141205T124402_b83b4lc4_.bkp  
Archive Log     4      2014-12-09:10:05:13  
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_09/o1_  
_mf_1_20_b8flbrsh_.arc  
Backup Set      6      2014-12-05:12:44:04  
  Backup Piece   6      2014-12-05:12:44:04  
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_05/o1_  
_mf_s_865514643_b83b4n9r_.bkp  
Archive Log     5      2014-12-09:22:01:00  
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_09/o1_  
_mf_1_21_b8gw8v94_.arc  
Backup Set      7      2014-12-09:11:56:56  
  Backup Piece   7      2014-12-09:11:56:56  
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_09/o1_  
_mf_s_865857414_b8frw7pz_.bkp  
Archive Log     6      2014-12-09:23:01:02  
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_09/o1_  
_mf_1_22_b8gzsfg2_.arc  
Archive Log     7      2014-12-10:12:00:12  
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_10/o1_  
_mf_1_23_b8jfgcsp_.arc
```

```
Archive Log      8      2014-12-10:12:34:03
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_10/o1
_mf_1_24_b8jhfty6_.arc

Archive Log      9      2014-12-10:12:34:36
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_10/o1
_mf_1_25_b8jhgvtb_.arc

Backup Set       8      2014-12-10:12:39:13
  Backup Piece    8      2014-12-10:12:39:13
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_10/o1
_mf_s_865946352_b8jhqk38_.bkp

Backup Set       9      2014-12-10:12:45:35
  Backup Piece    9      2014-12-10:12:45:35
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_10/o1
_mf_s_865946734_b8jjj3hkg_.bkp

Backup Set       11     2014-12-10:13:24:00
  Backup Piece    11     2014-12-10:13:24:00
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_10/o1
_mf_s_865949039_b8jlcjmf_.bkp

Datafile Copy    12      2014-12-10:13:33:33
/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-INVENTORY_FNO-
2_0eppqj3c

Datafile Copy    11      2014-12-10:13:33:33
/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-INVENTORY_FNO-
7_0dppqj39

Do you really want to delete the above objects (enter YES or
NO)? y

deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_05/o1_mf_nnndf_TAG20141205T120952_b8384lhs_.bkp  RECID=3
STAMP=865512594
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_05/o1_mf_ncsnf_TAG20141205T120952_b8385cno_.bkp  RECID=4
STAMP=865512619
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_05/o1_mf_nnndf_TAG20141205T124402_b83b4lc4_.bkp  RECID=5
STAMP=865514642
deleted archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
09/o1_mf_1_20_b8flbrsh_.arc  RECID=4 STAMP=865850713
deleted backup piece
```

```
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_05/o1_mf_s_865514643_b83b4n9r_.bkp RECID=6 STAMP=865514644
deleted archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
09/o1_mf_1_21_b8gw8v94_.arc RECID=5 STAMP=865893660
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_09/o1_mf_s_865857414_b8frw7pz_.bkp RECID=7 STAMP=865857415
deleted archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
09/o1_mf_1_22_b8gzsfg2_.arc RECID=6 STAMP=865897262
deleted archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
10/o1_mf_1_23_b8jfgcsp_.arc RECID=7 STAMP=865944012
deleted archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
10/o1_mf_1_24_b8jhfty6_.arc RECID=8 STAMP=865946043
deleted archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
10/o1_mf_1_25_b8jhgvtb_.arc RECID=9 STAMP=865946076
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_10/o1_mf_s_865946352_b8jhqk38_.bkp RECID=8 STAMP=865946353
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_10/o1_mf_s_865946734_b8jj3hkg_.bkp RECID=9 STAMP=865946735
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_10/o1_mf_s_865949039_b8jlcjmfp_.bkp RECID=11 STAMP=865949040
deleted datafile copy
datafile copy file name=/u01/backup/orcl/data_D-ORCL_I-
1393010434_TS-INVENTORY_FNO-2_0eppqj3c RECID=12 STAMP=865949613
deleted datafile copy
datafile copy file name=/u01/backup/orcl/data_D-ORCL_I-
1393010434_TS-INVENTORY_FNO-7_0dppqj39 RECID=11 STAMP=865949613
Deleted 16 objects

RMAN>
```

Note: Your output may be different depending on the repetition of practices.

10. Optionally, crosscheck all data file copies of the ORCL database. Then exit.

```
RMAN> crosscheck datafilecopy all;

released channel: ORA_DISK_1
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=40 device type=DISK
validation succeeded for datafile copy
datafile copy file name=/u01/backup/orcl/data_D-ORCL_I-
1393010434_TS-SYSTEM_FNO-1_0appqj1f RECID=9 STAMP=865949612
validation succeeded for datafile copy
datafile copy file name=/u01/backup/orcl/data_D-ORCL_I-
1393010434_TS-SYSAUX_FNO-3_0bppqj28 RECID=13 STAMP=865949615
validation succeeded for datafile copy
datafile copy file name=/u01/backup/orcl/data_D-ORCL_I-
1393010434_TS-UNDOTBS1_FNO-4_0cppqj32 RECID=10 STAMP=865949612
validation succeeded for datafile copy
datafile copy file name=/u01/backup/orcl/data_D-ORCL_I-
1393010434_TS-EXAMPLE_FNO-5_09ppqj0m RECID=14 STAMP=865949615
validation succeeded for datafile copy
datafile copy file name=/u01/backup/orcl/data_D-ORCL_I-
1393010434_TS-USERS_FNO-6_0fppqj3d RECID=8 STAMP=865949611
Crosschecked 5 objects

RMAN> exit
$
```

Note: Five validated backup should remain.

11. Optionally, view your backups in Cloud Control.
 - a. Navigate from the `orcl` home page: **Availability > Backup & Recovery > Backup Reports**.
 - b. If needed, select `NC_SYSDBA` as your Named Credential for the database login.
 - c. You can customize the View Backup Report page. By default, all types of backups are displayed, sorted by start time in descending order.

The screenshot shows the 'View Backup Report' page in Oracle Cloud Control. At the top, it says 'Logged in as SYS'. Below that, it displays a search interface with filters for Status (All), Start Time (Within 1 month), and Type (All). A tooltip indicates that a checkmark in the 'Output Devices' column means backups are on DISK and SBT_TAPE. The results section shows a table of backup jobs:

Backup Name	Status	Start Time	Type	Output Devices	Input Size	Output Size	Output Rate (Per Sec)
2014-12-10T12:42:58	COMPLETED	Dec 10, 2014 12:44:06 PM UTC	DB Full	DISK	4.31G	3.07G	1.06M
2014-12-05T12:24:23	COMPLETED	Dec 5, 2014 12:44:01 PM UTC	DB Incr	DISK	11.56M	11.25M	1.88M
2014-12-05T12:08:47	COMPLETED	Dec 5, 2014 12:09:52 PM UTC	Recvr Area	DISK	2.71G	1.35G	47.59M
2014-12-03T12:11:26	COMPLETED	Dec 3, 2014 12:32:59 PM UTC	SPFile	DISK	2.67G	1.32G	26.45M
2014-12-03T12:11:26	FAILED	Dec 3, 2014 12:18:53 PM UTC	00:00:51	DB FULL		0.00K	0.00K
			00:00:00	DB FULL		0.00K	0.00K

A tooltip at the bottom left says: 'TIP * in Output Devices column indicates that backups from this job are on DISK and SBT_TAPE'.

Note: Some practices intentionally introduce errors for your learning purpose. Your output might look different, but it should have a mixture of COMPLETED and FAILED backups.

Practices for Lesson 7: Improving Your Backups

Chapter 7

Practices for Lesson 7: Overview

Practices Overview

In these practices, you will back up the control file, back up the archived redo log files, and create a `KEEP FOREVER` database backup that you can use for recovery if some of your activities were to require it.

Practice 7-1: Backing up Other Database Files

Overview

In this practice, you create backups of important database files that are not part of the default backup set.

Assumptions

The previous practices have been completed.

You are in a terminal window pointing to the `orcl` database instance.

Tasks

1. Log in to SQL*Plus and back up the control file to a binary file in the `/u01/backup/orcl` directory.

Note: You have already configured automatic backup for the control file. These commands show you how to perform a manual backup of the control file (for learning purposes).

- a. Log in to SQL*Plus as `SYSBACKUP`.

```
$ sqlplus / as sysbackup  
.  
.  
SQL> show user  
USER is "SYSBACKUP"  
SQL>
```

- b. Use the `ALTER DATABASE BACKUP CONTROLFILE` command to create a backup copy of the control file.

```
SQL> ALTER DATABASE BACKUP CONTROLFILE TO  
'/u01/backup/orcl/control.ctl';  
Database altered.  
SQL>
```

- c. Be sure to record the names of all data files that are included in the control file at the time of this backup.

```
SQL> SELECT name FROM v$datafile;  
NAME  
-----  
/u01/app/oracle/oradata/orcl/system01.dbf  
/u01/app/oracle/oradata/orcl/sysaux01.dbf  
/u01/app/oracle/oradata/orcl/undotbs01.dbf  
/u01/app/oracle/oradata/orcl/example01.dbf  
/u01/app/oracle/oradata/orcl/users01.dbf  
SQL>  
-----  
-----  
-----
```

- d. Be sure to record the names of all redo log files that are included in the control file at the time of this backup.

```
SQL> SELECT member FROM v$logfile;

MEMBER
-----
/u01/app/oracle/oradata/orcl/redo03.log
/u01/app/oracle/oradata/orcl/redo02.log
/u01/app/oracle/oradata/orcl/redo01.log
/u01/app/oracle/oradata/orcl/redo01b.log
/u01/app/oracle/oradata/orcl/redo02b.log
/u01/app/oracle/oradata/orcl/redo03b.log
6 rows selected.

SQL>
```

2. Back up the control file to a trace file. Then view the trace file and exit SQL*Plus.

Note: This command creates a SQL script to re-create a control file.

- a. Use the ALTER DATABASE BACKUP CONTROLFILE TO TRACE SQL command.

```
SQL> ALTER DATABASE BACKUP CONTROLFILE TO TRACE AS
  '/u01/backup/orcl/control.sql';

Database altered.

SQL> exit
```

- b. View the trace file in a terminal window. What can you learn from its content?

```
$ cat /u01/backup/orcl/control.sql
-- The following are current System-scope REDO Log Archival
related
-- parameters and can be included in the database initialization
file.
--
-- LOG_ARCHIVE_DEST=''
-- LOG_ARCHIVE_DUPLEX_DEST=''
```

```
--  
-- LOG_ARCHIVE_FORMAT=%t_%s_%r.dbf  
--  
-- DB_UNIQUE_NAME="orcl"  
--  
-- LOG_ARCHIVE_CONFIG='SEND, RECEIVE, NODG_CONFIG'  
-- LOG_ARCHIVE_MAX_PROCESSES=4  
-- STANDBY_FILE_MANAGEMENT=MANUAL  
-- STANDBY_ARCHIVE_DEST=?/ dbs/arch  
-- FAL_CLIENT=''  
-- FAL_SERVER=''  
--  
-- LOG_ARCHIVE_DEST_1='LOCATION=USE_DB_RECOVERY_FILE_DEST'  
-- LOG_ARCHIVE_DEST_1='MANDATORY NOREOPEN NODELAY'  
-- LOG_ARCHIVE_DEST_1='ARCH NOAFFIRM NOVERIFY SYNC'  
-- LOG_ARCHIVE_DEST_1='NOREREGISTER NOALTERNATE NODEPENDENCY'  
-- LOG_ARCHIVE_DEST_1='NOMAX_FAILURE NOQUOTA_SIZE NOQUOTA_USED  
NODB_UNIQUE_NAME'  
-- LOG_ARCHIVE_DEST_1='VALID_FOR=(PRIMARY_ROLE, ONLINE_LOGFILES)'  
-- LOG_ARCHIVE_DEST_STATE_1=ENABLE  
--  
-- Below are two sets of SQL statements, each of which creates a new  
control file and uses it to open the database. The first set  
opens  
the database with the NORESETLOGS option and should be used  
only if  
the current versions of all online logs are available. The  
second  
set opens the database with the RESETLOGS option and should  
be used  
if online logs are unavailable.  
The appropriate set of statements can be copied from the  
trace into  
a script file, edited as necessary, and executed when there  
is a  
need to re-create the control file.  
--  
-- Set #1. NORESETLOGS case  
--  
-- The following commands will create a new control file and use  
it  
-- to open the database.
```

```
-- Data used by Recovery Manager will be lost.  
-- Additional logs may be required for media recovery of offline  
-- Use this only if the current versions of all online logs are  
-- available.  
  
-- After mounting the created controlfile, the following SQL  
-- statement will place the database in the appropriate  
-- protection mode:  
-- ALTER DATABASE SET STANDBY DATABASE TO MAXIMIZE PERFORMANCE  
  
STARTUP NOMOUNT  
CREATE CONTROLFILE REUSE DATABASE "ORCL" NORESETLOGS ARCHIVELOG  
    MAXLOGFILES 16  
    MAXLOGMEMBERS 3  
    MAXDATAFILES 100  
    MAXINSTANCES 8  
    MAXLOGHISTORY 292  
LOGFILE  
    GROUP 1 (  
        '/u01/app/oracle/oradata/orcl/redo01.log',  
        '/u01/app/oracle/oradata/orcl/redo01b.log'  
    ) SIZE 50M BLOCKSIZE 512,  
    GROUP 2 (  
        '/u01/app/oracle/oradata/orcl/redo02.log',  
        '/u01/app/oracle/oradata/orcl/redo02b.log'  
    ) SIZE 50M BLOCKSIZE 512,  
    GROUP 3 (  
        '/u01/app/oracle/oradata/orcl/redo03.log',  
        '/u01/app/oracle/oradata/orcl/redo03b.log'  
    ) SIZE 50M BLOCKSIZE 512  
-- STANDBY LOGFILE  
DATAFILE  
    '/u01/app/oracle/oradata/orcl/system01.dbf',  
    '/u01/app/oracle/oradata/orcl/sysaux01.dbf',  
    '/u01/app/oracle/oradata/orcl/undotbs01.dbf',  
    '/u01/app/oracle/oradata/orcl/example01.dbf',  
    '/u01/app/oracle/oradata/orcl/users01.dbf'  
CHARACTER SET AL32UTF8  
;  
  
-- Configure RMAN configuration record 1  
VARIABLE RECNO NUMBER;
```

```
EXECUTE :RECNO := SYS.DBMS_BACKUP_RESTORE.SETCONFIG('CONTROFILE AUTOBACKUP', 'ON');

-- Commands to re-create incarnation table
-- Below log names MUST be changed to existing filenames on
-- disk. Any one log file from each branch can be used to
-- re-create incarnation records.
-- ALTER DATABASE REGISTER LOGFILE
'/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_11/o1_mf_1_1_%u_.arc';
-- ALTER DATABASE REGISTER LOGFILE
'/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_11/o1_mf_1_1_%u_.arc';
-- Recovery is required if any of the datafiles are restored
-- backups,
-- or if the last shutdown was not normal or immediate.
RECOVER DATABASE

-- All logs need archiving and a log switch is needed.
ALTER SYSTEM ARCHIVE LOG ALL;

-- Database can now be opened normally.
ALTER DATABASE OPEN;

-- Commands to add tempfiles to temporary tablespaces.
-- Online tempfiles have complete space information.
-- Other tempfiles may require adjustment.
ALTER TABLESPACE TEMP ADD TEMPFILE
'/u01/app/oracle/oradata/orcl/temp01.dbf'
      SIZE 206569472 REUSE AUTOEXTEND ON NEXT 655360 MAXSIZE
32767M;
-- End of tempfile additions.

--
--      Set #2. RESETLOGS case

--
-- The following commands will create a new control file and use
it
-- to open the database.
-- Data used by Recovery Manager will be lost.
-- The contents of online logs will be lost and all backups will
-- be invalidated. Use this only if online logs are damaged.

-- After mounting the created controlfile, the following SQL
-- statement will place the database in the appropriate
-- protection mode:
```

```
-- ALTER DATABASE SET STANDBY DATABASE TO MAXIMIZE PERFORMANCE

STARTUP NOMOUNT
CREATE CONTROLFILE REUSE DATABASE "ORCL" RESETLOGS ARCHIVELOG
  MAXLOGFILES 16
  MAXLOGMEMBERS 3
  MAXDATAFILES 100
  MAXINSTANCES 8
  MAXLOGHISTORY 292
LOGFILE
  GROUP 1 (
    '/u01/app/oracle/oradata/orcl/redo01.log',
    '/u01/app/oracle/oradata/orcl/redo01b.log'
  ) SIZE 50M BLOCKSIZE 512,
  GROUP 2 (
    '/u01/app/oracle/oradata/orcl/redo02.log',
    '/u01/app/oracle/oradata/orcl/redo02b.log'
  ) SIZE 50M BLOCKSIZE 512,
  GROUP 3 (
    '/u01/app/oracle/oradata/orcl/redo03.log',
    '/u01/app/oracle/oradata/orcl/redo03b.log'
  ) SIZE 50M BLOCKSIZE 512
-- STANDBY LOGFILE
DATAFILE
  '/u01/app/oracle/oradata/orcl/system01.dbf',
  '/u01/app/oracle/oradata/orcl/sysaux01.dbf',
  '/u01/app/oracle/oradata/orcl/undotbs01.dbf',
  '/u01/app/oracle/oradata/orcl/example01.dbf',
  '/u01/app/oracle/oradata/orcl/users01.dbf'
CHARACTER SET AL32UTF8
;

-- Configure RMAN configuration record 1
VARIABLE RECNO NUMBER;
EXECUTE :RECNO := SYS.DBMS_BACKUP_RESTORE.SETCONFIG('CONTROLFILE
AUTOBACKUP','ON');

-- Commands to re-create incarnation table
-- Below log names MUST be changed to existing filenames on
-- disk. Any one log file from each branch can be used to
-- re-create incarnation records.
-- ALTER DATABASE REGISTER LOGFILE
'/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_11/o
1_mf_1_1_%u_.arc';
```

```
-- ALTER DATABASE REGISTER LOGFILE
'/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_11/o
1_mf_1_1_%u_.arc';
-- Recovery is required if any of the datafiles are restored
backups,
-- or if the last shutdown was not normal or immediate.
RECOVER DATABASE USING BACKUP CONTROLFILE

-- Database can now be opened zeroing the online logs.
ALTER DATABASE OPEN RESETLOGS;

-- Commands to add tempfiles to temporary tablespaces.
-- Online tempfiles have complete space information.
-- Other tempfiles may require adjustment.
ALTER TABLESPACE TEMP ADD TEMPFILE
'/u01/app/oracle/oradata/orcl/temp01.dbf'
      SIZE 206569472 REUSE AUTOEXTEND ON NEXT 655360 MAXSIZE
32767M;
-- End of tempfile additions.

$
```

Note: The trace file requires some editing before it can be used.

3. Back up the archive log files of the ORCL database, deleting all the archive files once the backup is complete. (*Enter rman connection command on one line.*)

```
$ rman target ''/ as sysbackup'' catalog
rcatowner/oracle_4U@rcat

RMAN> run {
2> allocate channel "CH1" DEVICE TYPE DISK FORMAT
'/u01/backup/orcl/%U';
3> backup archivelog all delete all input;
4> }

starting full resync of recovery catalog
full resync complete
allocated channel: CH1
channel CH1: SID=237 device type=DISK

Starting backup at 2014-12-11:07:45:23
current log archived
channel CH1: starting archived log backup set
channel CH1: specifying archived log(s) in backup set
input archived log thread=1 sequence=26 RECID=10 STAMP=865972854
input archived log thread=1 sequence=27 RECID=11 STAMP=865980133
```

```
input archived log thread=1 sequence=28 RECID=12 STAMP=865987219
input archived log thread=1 sequence=29 RECID=13 STAMP=866015124
channel CH1: starting piece 1 at 2014-12-11:07:45:25
channel CH1: finished piece 1 at 2014-12-11:07:45:28
piece handle=/u01/backup/orcl/0lppslsl_1_1
tag=TAG20141211T074525 comment=NONE
channel CH1: backup set complete, elapsed time: 00:00:03
channel CH1: deleting archived log(s)
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
10/o1_mf_1_26_b8k9moms_.arc RECID=10 STAMP=865972854
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
10/o1_mf_1_27_b8kjq4nh_.arc RECID=11 STAMP=865980133
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
11/o1_mf_1_28_b8kgnlsg_.arc RECID=12 STAMP=865987219
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
11/o1_mf_1_29_b8llwmx2_.arc RECID=13 STAMP=866015124
Finished backup at 2014-12-11:07:45:29

Starting Control File and SPFILE Autobackup at 2014-12-
11:07:45:29
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_11/o1_mf_s_866015129_b8llwtol_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 2014-12-
11:07:45:32
released channel: CH1

RMAN>
```

Note: The number of your archive log files is most likely different than this example.

4. List the backup archivelog files that could be used to recover to a point in time 1 hour ago ('`sysdate-1/24`'). Then exit.

Note: You may need to adjust the following `SYSDATE` expression to what is meaningful in your training environment. For example, '`sysdate-05/60/24`' indicates 5 minutes ago.

```
RMAN> list backup of archivelog until time 'sysdate-05/60/24';
```

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

BS	Key	Size	Device	Type	Elapsed Time	Completion Time
-	-	-	-	-	-	-

```

150      148.11M    DISK        00:00:00    2014-12-11:07:45:25
          BP Key: 153    Status: AVAILABLE  Compressed: NO   Tag:
TAG20141211T074525
          Piece Name: /u01/backup/orcl/0lpps1sl_1_1

List of Archived Logs in backup set 150
Thrd Seq      Low SCN     Low Time           Next SCN     Next
Time
-----
-- 
 1    26      2170331    2014-12-10:12:34:35 2187468    2014-
12-10:20:00:53
 1    27      2187468    2014-12-10:20:00:53 2198258    2014-
12-10:22:02:11
 1    28      2198258    2014-12-10:22:02:11 2205067    2014-
12-11:00:00:18
 1    29      2205067    2014-12-11:00:00:18 2221102    2014-
12-11:07:45:23

RMAN> exit
$
```

5. Optionally, view the archive logs in Cloud Control.

- Navigate from the `orcl` home page: **Administration > Storage > Archive Logs**.
- If needed, select `NC_SYSDBA` as your Named Credential for the database login.

Name	Sequence	Thread	# Backups	First Change #	First Time	Archival Time
/u01/app/oracle/oradata/orcl/redo01.log	19	1	0	1966629	Dec 4, 2014 7:51:00 AM UTC	Dec 4, 2014 8:23:17 AM UTC
/u01/app/oracle/oradata/orcl/redo03.log	18	1	0	1866094	Dec 4, 2014 7:28:42 AM UTC	Dec 4, 2014 8:23:17 AM UTC
/u01/app/oracle/oradata/orcl/redo02.log	17	1	0	1844468	Dec 3, 2014 10:27:02 PM UTC	Dec 4, 2014 8:23:17 AM UTC

Date of Oldest Non-Backup Archive Log Dec 3, 2014 10:27:02 PM UTC
Total Size of Non-Backup Archive Logs (KB) 2147513941.5

6. Optionally, view the archive logs in EM Express.
 - a. Navigate: **Storage > Archive Logs**.
 - b. If you want to change the default display order of the archive logs, you can click the column name to toggle between ascending and descending.

File Name	Sequen...	Thread	First Change ...	First Change Time	Completion Time	Created in Flash Re...	File Size	File Dir...
redo01.log	19	1	1966629	Thu Dec 4 07:51:00 ...	Thu Dec 4 08:23:17 ...	No	2TB	/u01/ap...
redo02.log	17	1	1844468	Wed Dec 3 22:27:02 ...	Thu Dec 4 08:23:17 ...	No	29MB	/u01/ap...
redo03.log	18	1	1866094	Thu Dec 4 07:28:42 ...	Thu Dec 4 08:23:17 ...	No	190KB	/u01/ap...
NULL	20	1	2067666	Thu Dec 4 08:27:20 ...	Tue Dec 9 10:05:13 ...	Yes	43MB	NULL
NULL	21	1	2100287	Tue Dec 9 10:05:12 ...	Tue Dec 9 22:01:00 ...	Yes	41MB	NULL

Practice 7-2: Creating an Archival Backup

Overview

In this practice, you create an archival backup, that is, a backup that is not under your normal retention policies and it is not in your normal FRA destination. This `KEEP FOREVER` database backup could be used for recovery if some of your later hands-on activities were to require it. Archival backups can be created with an open or with a mounted database.

Assumptions

You are in a terminal window as the `oracle` OS user, pointing to the `orcl` database instance.

Tasks

1. Log in to RMAN by using the recovery catalog.

```
$ rman target ''/ as sysbackup'' catalog rcatowner@rcat
...
recovery catalog database Password: oracle_4U <<<not displayed
connected to recovery catalog database

RMAN>
```

2. Shut down and restart the database instance so you can create a backup copy of the entire database in a mounted state.

```
RMAN> SHUTDOWN IMMEDIATE;

starting full resync of recovery catalog
full resync complete
database closed
database dismounted
Oracle instance shut down

RMAN> STARTUP MOUNT;

connected to target database (not started)
Oracle instance started
database mounted

Total System Global Area      536870912 bytes

Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers             247463936 bytes
Redo Buffers                 5459968 bytes

RMAN>
```

3. Backup your ORCL database as an archival backup. *Expect an error.*

```
RMAN> backup as copy database keep forever;
Starting backup at 2014-12-11:09:10:27

allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=12 device type=DISK
backup will never be obsolete
archived logs required to recover from this backup will be
backed up
channel ORA_DISK_1: starting datafile copy
input datafile file number=00005
name=/u01/app/oracle/oradata/orcl/example01.dbf
RMAN-03009: failure of backup command on ORA_DISK_1 channel at
12/11/2014 09:10:29
ORA-19811: cannot have files in DB_RECOVERY_FILE_DEST with keep
attributes
continuing other job steps, job failed will not be re-run
channel ORA_DISK_1: starting datafile copy
input datafile file number=00003
name=/u01/app/oracle/oradata/orcl/sysaux01.dbf
RMAN-03009: failure of backup command on ORA_DISK_1 channel at
12/11/2014 09:10:29
ORA-19811: cannot have files in DB_RECOVERY_FILE_DEST with keep
attributes
continuing other job steps, job failed will not be re-run
channel ORA_DISK_1: starting datafile copy
input datafile file number=00001
name=/u01/app/oracle/oradata/orcl/system01.dbf
RMAN-03009: failure of backup command on ORA_DISK_1 channel at
12/11/2014 09:10:29
ORA-19811: cannot have files in DB_RECOVERY_FILE_DEST with keep
attributes
continuing other job steps, job failed will not be re-run
channel ORA_DISK_1: starting datafile copy
input datafile file number=00004
name=/u01/app/oracle/oradata/orcl/undotbs01.dbf
RMAN-03009: failure of backup command on ORA_DISK_1 channel at
12/11/2014 09:10:30
ORA-19811: cannot have files in DB_RECOVERY_FILE_DEST with keep
attributes
continuing other job steps, job failed will not be re-run
channel ORA_DISK_1: starting datafile copy
input datafile file number=00006
name=/u01/app/oracle/oradata/orcl/users01.dbf
```

```
RMAN-00571:  
=====  
RMAN-00569: ====== ERROR MESSAGE STACK FOLLOWS  
=====  
RMAN-00571:  
=====  
RMAN-03002: failure of backup command at 12/11/2014 09:10:30  
ORA-19811: cannot have files in DB_RECOVERY_FILE_DEST with keep attributes  
  
RMAN>
```

Question: Why did the backup command fail?

Possible answer: It failed because a backup with the KEEP attribute (an archival backup) cannot be written to the Flash Recovery Area. Allowing this has the potential of causing the Flash Recovery Area to quickly run out of space. This error forces you to specify a different location.

4. Create an archival backup with a FORMAT clause that creates the backup in the /u01/backup directory.

```
RMAN> BACKUP DATABASE FORMAT '/u01/backup/%U' TAG keep_db_tag  
KEEP forever RESTORE POINT KEEPDB;  
  
Starting backup at 2014-12-11:09:13:36  
  
using channel ORA_DISK_1  
backup will never be obsolete  
archived logs required to recover from this backup will be  
backed up  
channel ORA_DISK_1: starting full datafile backup set  
channel ORA_DISK_1: specifying datafile(s) in backup set  
input datafile file number=00005  
name=/u01/app/oracle/oradata/orcl/example01.dbf  
input datafile file number=00003  
name=/u01/app/oracle/oradata/orcl/sysaux01.dbf  
input datafile file number=00001  
name=/u01/app/oracle/oradata/orcl/system01.dbf  
input datafile file number=00004  
name=/u01/app/oracle/oradata/orcl/undotbs01.dbf  
input datafile file number=00006  
name=/u01/app/oracle/oradata/orcl/users01.dbf  
channel ORA_DISK_1: starting piece 1 at 2014-12-11:09:13:36  
channel ORA_DISK_1: finished piece 1 at 2014-12-11:09:14:31  
piece handle=/u01/backup/0sppsr20_1_1 tag=KEEP_DB_TAG  
comment=NONE  
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:55
```

```
using channel ORA_DISK_1
backup will never be obsolete
archived logs will not be kept or backed up
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
including current SPFILE in backup set
channel ORA_DISK_1: starting piece 1 at 2014-12-11:09:14:33
channel ORA_DISK_1: finished piece 1 at 2014-12-11:09:14:34
piece handle=/u01/backup/0tppsr3p_1_1 tag=KEEP_DB_TAG
comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01

using channel ORA_DISK_1
backup will never be obsolete
archived logs will not be kept or backed up
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
including current control file in backup set
channel ORA_DISK_1: starting piece 1 at 2014-12-11:09:14:36
channel ORA_DISK_1: finished piece 1 at 2014-12-11:09:14:37
piece handle=/u01/backup/0uppsr3r_1_1 tag=KEEP_DB_TAG
comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 2014-12-11:09:14:37
RMAN>
```

5. Open the database and exit RMAN.

```
RMAN> alter database open;
Statement processed
RMAN> exit
$
```

6. For an alternate view of the backups, optionally, log in to Cloud Control as the SYSMAN user and navigate to **Availability > Backup & Recovery > Manage Current Backups**. (Look for the KEEP_DB_TAG tag.)
7. If you do not see your archival backup (that is, there is no backup with `Forever` in the `Keep` column), then:
 - a. Set the NC_ORCL_HOST_ORACLE host credentials at the bottom of the page, click **Crosscheck All**.
 - b. Execute the job `Immediately`. **Click Submit Job > View Job** to confirm that the job execution succeeds.

- c. When the job succeeded, navigate again to the Manage Current Backups page (for example via: **History > orcl > Availability > Backup & Recovery > Manage Current Backups**).

Select	Key	Tag	Completion Time	Contents	Device Type	Status	Keep	Pieces
<input type="checkbox"/>	139	KEEP_DB_TAG	Dec 11, 2014 9:14:36 AM	CONTROFILE	DISK	AVAILABLE	Forever	1
<input type="checkbox"/>	138	KEEP_DB_TAG	Dec 11, 2014 9:14:33 AM	SPFILE	DISK	AVAILABLE	Forever	1
<input type="checkbox"/>	137	KEEP_DB_TAG	Dec 11, 2014 9:14:27 AM	DATAFILE	DISK	AVAILABLE	Forever	1
<input type="checkbox"/>	136	TAG20141211T074529	Dec 11, 2014 7:45:30 AM	CONTROFILE, SPFILE	DISK	AVAILABLE	NO	1
<input type="checkbox"/>	135	TAG20141211T074525	Dec 11, 2014 7:45:25 AM	ARCHIVED LOG	DISK	AVAILABLE	NO	1
<input type="checkbox"/>	134	TAG20141210T134918	Dec 10, 2014 1:49:19 PM	CONTROFILE, SPFILE	DISK	AVAILABLE	NO	1
<input type="checkbox"/>	133	TAG20141210T133337	Dec 10, 2014 1:33:38 PM	SPFILE, CONTROFILE	DISK	AVAILABLE	NO	1

Note: The Backup Sets tabbed page shows the archival CONTROLFILE, SPFILE, and DATAFILE.

8. Optionally, to view your restore points In Cloud Control, navigate: **Availability > Backup & Recovery > Restore Points**.

Select	Restore Point Name	Restore Point Time	Restore Point Type	Storage Size	Creation SCN
<input checked="" type="radio"/>	KEEPDB	2014-12-11 09:14:32.0	NORMAL	N/A	2224614

TIP A non-guaranteed restore point does not require additional storage.

Question: Does a non-guaranteed restore point use additional space?

Answer: No.

Listed in the following are recovery steps using the archival backup. **DO NOT EXECUTE THESE STEPS AT THIS TIME!**

Recovery steps for possible **later** use of the archival backup:

- a. With your environment variables pointing to the ORCL instance, log in to RMAN and connect to the RMAN catalog:

```
rman target ''/ as sysbackup'' catalog rcatowner@rcat
```

- b. Confirm the name of the restore point to be used, KEEPDB in this example:

```
LIST RESTORE POINT ALL;
```

- c. Restore and recover your database by using your restore point:

```
RESTORE DATABASE UNTIL RESTORE POINT 'KEEPDB';
```

```
RECOVER DATABASE UNTIL RESTORE POINT 'KEEPDB';
```

- d. Because your database is now at an earlier point in time, open it with the RESETLOGS option, and display the newly created DBID:

```
ALTER DATABASE OPEN RESETLOGS;
```

```
SELECT DBID FROM V$DATABASE;
```

- e. In most environments, Oracle recommends to perform a new backup after a recovery:

```
BACKUP DATABASE PLUS ARCHIVELOG DELETE INPUT;
```

Practices for Lesson 8: Using RMAN-Encrypted Backups

Chapter 8

Practices for Lesson 8: Overview

Practices Overview

In these practices, you will use RMAN to encrypt a backup with a password.

Practice 8-1: Encrypting a Backup with RMAN

Overview

In this practice, you create a password encrypted backup of the ENCTBS tablespace. The practice shows the steps in Cloud Control. For command line, see the RMAN Script in step 10.

Assumptions

You are logged in to Enterprise Manager Cloud Control as the SYSMAN user and have the orcl home page displayed.

You also have a terminal window open with /home/oracle/labs as the current directory. Environment variables are pointing to the orcl instance.

Tasks

1. In a terminal window as the oracle user, execute the lab_08_01_01.sh script. This script creates the ENC user and the ENCTBS tablespace for this practice. The output can be viewed in the /tmp/setup.log file.


```
$ ./lab_08_01_01.sh
$
```
2. In Enterprise Manager Cloud Control, navigate to **Availability > Backup & Recovery > Schedule Backup**. If needed, log in with the NC_SYSDBA named credentials.
3. On the Schedule Backup page, ensure that the **Host Credentials** are set to NC_ORCL_HOST_ORACLE. Select **Tablespaces** and then click **Schedule Customized Backup**.
4. On the Schedule Customized Backup: Tablespaces page, click **Add**.
5. Select the ENCTBS tablespace and then click the **Select** button.
6. Back on the Schedule Customized Backup: Tablespaces page, click **Next**.

Tables	Options	Settings	Schedule	Review										
Schedule Customized Backup: Tablespaces														
Database orcl Backup Strategy Customized Backup Object Type Tablespaces Recovery Catalog Username system Recovery Catalog Database rcat (Database Instance)														
Add the tablespaces you want to back up. <input type="button" value="Add"/> <input type="button" value="Remove"/> Select All <input type="checkbox"/> Select None <input type="checkbox"/> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Select</th> <th style="text-align: left;">Tablespace Name</th> <th style="text-align: left;">Tablespace Number</th> <th style="text-align: left;">Status</th> <th style="text-align: left;">Contents</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/></td> <td>ENCTBS</td> <td>9</td> <td>ONLINE</td> <td>PERMANENT</td> </tr> </tbody> </table> Return to Schedule Backup					Select	Tablespace Name	Tablespace Number	Status	Contents	<input type="checkbox"/>	ENCTBS	9	ONLINE	PERMANENT
Select	Tablespace Name	Tablespace Number	Status	Contents										
<input type="checkbox"/>	ENCTBS	9	ONLINE	PERMANENT										
<input type="button" value="Cancel"/> Step 1 of 5 <input type="button" value="Next"/>														

7. On the Schedule Customized Backup: Options page:
 - a. Confirm the following selections:
 - Full Backup
 - Also back up all archived logs on diskAll other choices should be deselected.
 - b. Expand the Encryption section and select the following options:
 - Use Recovery Manager encryption
 - Encryption Algorithm: AES128
 - Backups will be encrypted using the following password
 - c. Enter **oracle_4U** or a password of your choice in **Password** and **Confirm Password**. If you choose another password, **please ensure that you will remember it**. When you use password encryption, you **must** provide the same password for the backup and restore operations. This is an appropriate technique for backups that will be restored at a remote location.

The screenshot shows the 'Encryption' configuration page. It includes the following elements:

- Use Recovery Manager encryption**: A checked checkbox.
- Encryption Algorithm**: A dropdown menu set to **AES128**.
- Encryption Mode**:
 - Backups will be encrypted using the Oracle Encryption Wallet
 - Backups will be encrypted using the following password
- TIP**: A note stating "Checking both encryption modes will provide the flexibility of restoring a backup using either the Oracle Encryption Wallet or a password."
- Password** and **Confirm Password**: Fields containing masked text.
- Buttons**: **Return to Schedule Backup**, **Cancel**, **Back**, **Step 2 of 5**, and **Next**.

Note: You can use the Oracle Encryption Wallet (also known as keystore) only after it is created and opened, as shown in a later practice.

- d. Click **Next**.
8. On the Schedule Customized Backup: Settings page, accept **Disk** as the destination, and click **Next**.
9. On the Schedule Customized Backup: Schedule page, enter **BACUP_ENC** as **Job Name**, accept the Job Description, ensure the Schedule is **One Time (Immediately)**, and then click **Next**.

10. Review the entire Schedule Customized Backup: Review page and then click **Submit Job**.

Schedule Customized Backup: Review

Database: orcl
Backup Strategy: Customized Backup
Object Type: Tablespaces
Recovery Catalog Username: system
Recovery Catalog Database: rcat (Database Instance)

Settings

Destination: Disk
Backup Type: Full Backup
Backup Mode: Online Backup
Encryption Algorithm: AES128
Encryption Mode: Password
Fast Recovery Area: /u01/app/oracle/fast_recovery_area

Tablespaces

- ENCTBS

RMAN Script

The RMAN script below is generated based on previous input.

```
set encryption on for all tablespaces algorithm 'AES128' identified by "%PASSWORD" only;
backup device type disk tag '%TAG' tablespace 'ENCTBS';
backup device type disk tag '%TAG' archivelog all not backed up;
```

Note: The password is not displayed in text form because that would be a security violation.

If you are using the command-line interface, you also use the `SET ENCRYPTION ON... IDENTIFIED BY password ONLY` command in your RMAN script to enable password encryption.

- Click **View Job**.
- On the Execution: orcl page, click the **Show** link of the **Backup Script**.
- Note that also the backup script itself does not show the password. Click **OK**.

Backup Script

```
$rman_script="set encryption on for all tablespaces algorithm 'AES128' identified by '%PASSWORD' only;
backup device type disk tag '%TAG' tablespace 'ENCTBS';
backup device type disk tag '%TAG' archivelog all not backed up;
";
&br_save_agent_env();
&br_prebackup($l_db_connect_string, $l_is_cold_backup, $l_use_rcvcat, $l_db_10_or_higher, $l_backup_strategy, "FALSE");
my $result = &br_backup();
exit($result);
```

- If your backup job is still running, click the Refresh icon (top-right).

15. Optionally, click the **Succeeded** link in the Status column for Step: Backup, review the Output Log, and then click **Execution:orcl** in the navigation bar.

Execution History					
Name	Targets	Status	Started	Ended	Elapsed Time
Execution: orcl	orcl	Succeeded	Dec 11, 2014 1:53:31 PM GMT+00:00	Dec 11, 2014 1:54:05 PM GMT+00:00	34 seconds
Step: Pre-Backup	orcl	Succeeded	Dec 11, 2014 1:53:32 PM GMT+00:00	Dec 11, 2014 1:53:37 PM GMT+00:00	5 seconds
Step: Backup	orcl	Succeeded	Dec 11, 2014 1:53:38 PM GMT+00:00	Dec 11, 2014 1:54:03 PM GMT+00:00	25 seconds
Step: Post-Backup	orcl	Succeeded	Dec 11, 2014 1:54:05 PM GMT+00:00	Dec 11, 2014 1:54:05 PM GMT+00:00	0 seconds

16. From the Execution:orcl page, there are several ways that you can return to the orcl home page. For example, click **History > orcl**. Alternatives are **Targets > Databases > orcl** or **All Targets > orcl** (Database Instance).

Note: Most of the next practice is optional, but the last cleanup and backup tasks (step 16) are mandatory.

Practice 8-2: Restoring an Encrypted Backup

Overview

This is an optional challenge practice (because most likely you have not yet covered the restore and recover operations in class). Attempt this challenge only if you have enough time to complete it.

In this practice, you will restore a password-encrypted backup.

Only the last cleanup and backup tasks are mandatory for all.

Assumptions

You completed the previous practice and remember your encryption password.

You are logged in to Cloud Control as the `SYSMAN` user and have the `orcl` home page displayed.

You also have a terminal window open.

Tasks

1. In the terminal window, create an issue by aborting the `ORCL` database and deleting the data file of the `ENCTBS` tablespace. Then mount the database.

```
$ sqlplus / as sysdba
...
SQL> shutdown abort
ORACLE instance shut down.
SQL> host
$ rm /u01/backup/orcl/enctbs01.dbf
$ exit
exit

SQL> startup mount
ORACLE instance started.

Total System Global Area  536870912 bytes
Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers              247463936 bytes
Redo Buffers                  5459968 bytes
Database mounted.
SQL> exit
$
```

2. Optionally, confirm that the data file is removed.

```
$ ls /u01/backup/orcl
0lpps1sl_1_1
control.ctl
control.sql
data_D-ORCL_I-1393010434_TS-EXAMPLE_FNO-5_09ppqj0m
data_D-ORCL_I-1393010434_TS-SYSAUX_FNO-3_0bppqj28
data_D-ORCL_I-1393010434_TS-SYSTEM_FNO-1_0appqj1f
data_D-ORCL_I-1393010434_TS-UNDOTBS1_FNO-4_0cppqj32
data_D-ORCL_I-1393010434_TS-USERS_FNO-6_0fppqj3d
$
```

Your output may look different, but you should not see the enctbs01.dbf data file.

3. In Cloud Control, navigate to **Availability > Backup & Recovery > Perform Recovery**. (If needed, log in with the NC_SYSDBA named credentials.)

Note: It could be that the database failure was already discovered, but for the sake of your learning experience execute the following steps.

4. On the Perform Recovery page:

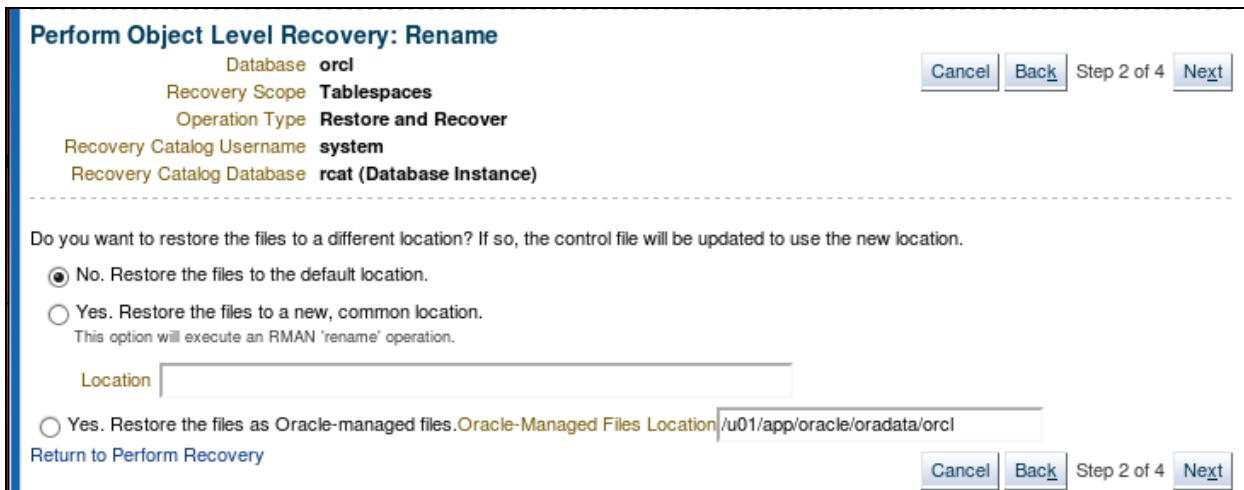
- Select **Tablespaces** as Recovery Scope.
- Ensure that "Recover to current time or a previous point-in-time" is selected.
- Expand **Decrypt Backups** and enter the password from the previous practice (either oracle_4U or the password you chose) as **Password** and **Confirm Password**.
- Confirm the NC_ORCL_HOST_ORACLE host credentials and click **Recover**.

5. On the Perform Object Level Recovery: Tablespaces page, click **Next**.

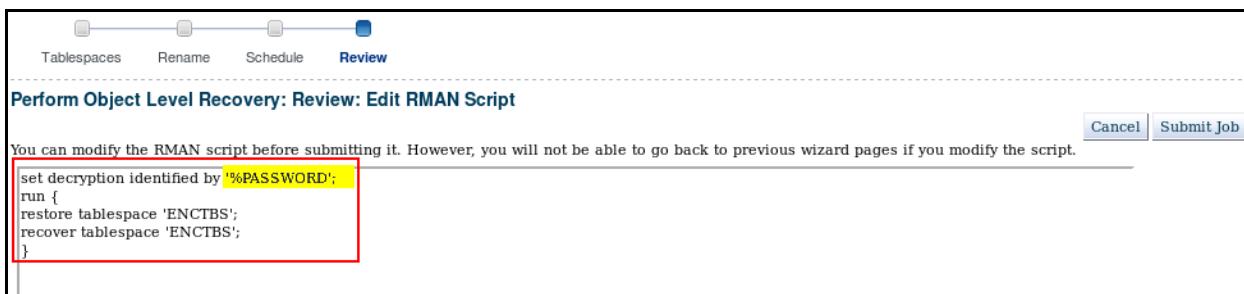
Note: If the ENCTBS is not displayed, click **Add**, select ENCTBS, and click the **Select** button.

Select	Tablespace Name	Tablespace Number	Status	Contents
<input checked="" type="checkbox"/>	ENCTBS	9		

6. Confirm "No. Restore the files to the default location." and then click **Next**.



7. On the Perform Object Level Recovery: Schedule page, enter RECOVERY_ENC as **Job Name**, accept the Job Description, and click **Next**.
 8. On the Perform Object Level Recovery: Review page, click **Edit RMAN Script**.



For the command-line interface, you enter the commands shown in this RMAN script.

Note:

- The password is not displayed for security reasons.
- If you perform this type of recovery in an online database, you would see the following commands:

```
set decryption identified by '%PASSWORD';
run {
  sql 'alter tablespace "ENCTBS" offline immediate';
  restore tablespace 'ENCTBS';
  recover tablespace 'ENCTBS';
  sql 'alter tablespace "ENCTBS" online';
}
```

9. Click **Submit Job**.
 10. Click **View Job**.
 11. On the Execution: orcl page, optionally click the **Show** link to view the recovery script. Review the script, and then click **OK**.
 12. Refresh the Execution: orcl page until you see that the job has the status **Succeeded**.

13. Open the ORCL database, if you executed step 1 of this practice.

```
$ sqlplus / as sysdba
SQL> ALTER DATABASE OPEN;
Database altered.

SQL> exit
$
```

14. Mandatory cleanup and backup tasks:

- a. Execute the `cleanup_08_02.sh` script from the `$LABS` directory to remove the test data used in this practice. The output can be viewed in the `/tmp/cleanup.log` file.

```
$ ./cleanup_08_02.sh
$
```

- b. Execute the `backup_orcl.sh` script from the `$LABS` directory to create a new database backup for the next practices. The output can be viewed in the `/tmp/backup.log` file.

```
$ ./backup_orcl.sh
$
```

Practices for Lesson 9: Diagnosing Database Failure

Chapter 9

Practices for Lesson 9: Overview

Practices Overview

In these practices, you will use the Data Recovery Advisor to diagnose database failure.

Practice 9-1: Diagnosing and Repairing Database Failure

Overview

In this practice you will use Data Recovery Advisor via the RMAN client interface to diagnose and repair the loss of a data file.

Assumptions

You have a terminal window open with \$LABS as the current directory. Environment variables are set for the orcl instance.

Tasks

1. Execute the `setup_09_01.sh` script. This script creates the BAR91TBS tablespace in the file system, the BAR91 user, the BARCOPY table, and populates the table. The script continues and takes a backup of the tablespace and updates the table. The output of the script can be viewed in the `/tmp/setup.log` file.

```
$ ./setup_09_01.sh  
$
```

2. Execute the `break_09_01.sh` script. This script deletes a data file and causes the database to fail. The output of the script can be viewed in the `/tmp/break.log` file.

```
$ ./break_09_01.sh  
$
```

3. Continue in another terminal window as the oracle user with the environment variables pointing to orcl. Attempt to start the instance and open the database. Observe the error messages. Exit SQL*Plus.

```
$ sqlplus / as sysdba  
  
Connected to an idle instance.  
  
SQL> startup  
ORACLE instance started.  
  
Total System Global Area  536870912 bytes  
Fixed Size                  2926472 bytes  
Variable Size                281020536 bytes  
Database Buffers              247463936 bytes  
Redo Buffers                  5459968 bytes  
Database mounted.  
ORA-01157: cannot identify/lock data file 2 - see DBWR trace  
file  
ORA-01110: data file 2: '/u01/backup/orcl/bar91tbs01.dbf'  
  
SQL> exit
```

4. Use the Data Recovery Advisor to list the database failure.

```
$ rman target ''/ as sysbackup'

connected to target database: ORCL (DBID= 1393010434, not open)

RMAN> LIST FAILURE;
using target database control file instead of recovery catalog
Database Role: PRIMARY

List of Database Failures
=====

Failure ID Priority Status      Time Detected      Summary
-----
62          HIGH    OPEN        2014-12-12:09:07:21 One or more
non-system datafiles are missing
RMAN>
```

Note: If you see more than one failure ID, focus on Failure ID 62. The same applies to the following steps.

5. Use the Data Recovery Advisor to obtain advice on how to repair the failure.

```
RMAN> ADVISE FAILURE;

Database Role: PRIMARY

List of Database Failures
=====

Failure ID Priority Status      Time Detected      Summary
-----
62          HIGH    OPEN        2014-12-12:09:07:21 One or more
non-system datafiles are missing

analyzing automatic repair options; this may take some time
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=12 device type=DISK
analyzing automatic repair options complete

Mandatory Manual Actions
=====
no manual actions available

Optional Manual Actions
```

```
=====
1. If file /u01/backup/orcl/bar91tbs01.dbf was unintentionally
renamed or moved, restore it

Automated Repair Options
=====
Option Repair Description
-----
1      Restore and recover datafile 2
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_567210019.hm

RMAN>
```

Note: If you see more than one optional manual action, focus on the one that references bar91tbs01.dbf.

6. Use the Data Recovery Advisor to repair the failure. Examine the script that was generated for this repair before it executes. Enter Y or YES when prompted to execute the script and to open the database.

```
RMAN> repair failure;

Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_567210019.hm

contents of repair script:
# restore and recover datafile
restore ( datafile 2 );
recover datafile 2;
sql 'alter database datafile 2 online';

Do you really want to execute the above repair (enter YES or
NO)? y
executing repair script

Starting restore at 2014-12-12:09:19:49
using channel ORA_DISK_1

channel ORA_DISK_1: restoring datafile 00002
input datafile copy RECID=16 STAMP=866105617 file
name=/u01/app/oracle/fast_recovery_area/ORCL/datafile/o1_mf_bar9
1tbs_b8oc8khx_.dbf
```

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```
destination for restore of datafile 00002:  
/u01/backup/orcl/bar91tbs01.dbf  
channel ORA_DISK_1: copied datafile copy of datafile 00002  
output file name=/u01/backup/orcl/bar91tbs01.dbf RECID=0 STAMP=0  
Finished restore at 2014-12-12:09:19:50  
  
Starting recover at 2014-12-12:09:19:50  
using channel ORA_DISK_1  
  
starting media recovery  
media recovery complete, elapsed time: 00:00:00  
  
Finished recover at 2014-12-12:09:19:52  
  
sql statement: alter database datafile 2 online  
repair failure complete  
  
Do you want to open the database (enter YES or NO)? y  
database opened  
  
RMAN> exit  
$
```

7. Clean up the environment following this practice by executing the `cleanup_09_01.sh` script. The output is in the `/tmp/cleanup.log` file.

```
$ ./cleanup_09_01.sh  
$
```

Practice 9-2: Performing and Analyzing Instance Recovery

Overview

In this practice you will force an instance failure and examine the steps taken by the instance during instance recovery.

Assumptions

You have a terminal window open with \$LABS as the current directory. Environment variables are set for the orcl instance.

Tasks

1. Abort the instance and restart it. You can abort the instance in multiple ways:
 - The simplest is to use the SQL*Plus SHUTDOWN ABORT command or the stop database -d orcl -o abort SRVCTL command.
 - Other methods, such as finding the process ID of the SMON process and executing the kill -9 <pid> OS command may not be effective if you are working in an environment where Oracle Restart is installed, as in the classroom.

```
$ sqlplus / as sysdba

SQL> shutdown abort
ORACLE instance shut down.

SQL> startup
ORACLE instance started.

Total System Global Area  536870912 bytes
Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers              247463936 bytes
Redo Buffers                  5459968 bytes
Database mounted.
Database opened.
SQL> exit
$
```

2. Examine the alert log for the orcl instance. Starting from the most recent entries at the bottom of the file, find the restart of the instance. What are the steps the instance performed to recover the instance and ensure database consistency?
 - a. Using the ADRCI show alert command, view the alert log for the orcl instance. Set the editor to gedit to view the alert log more easily. The default editor is vi. The gedit window opens after you select an alert log. You might have different alert logs based on prior activities. Select your orcl alert log.

```
$ adrci
ADRCI: Release 12.1.0.2.0 - Production on Fri Dec 12 11:11:00
2014

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rights reserved.

ADR base = "/u01/app/oracle"

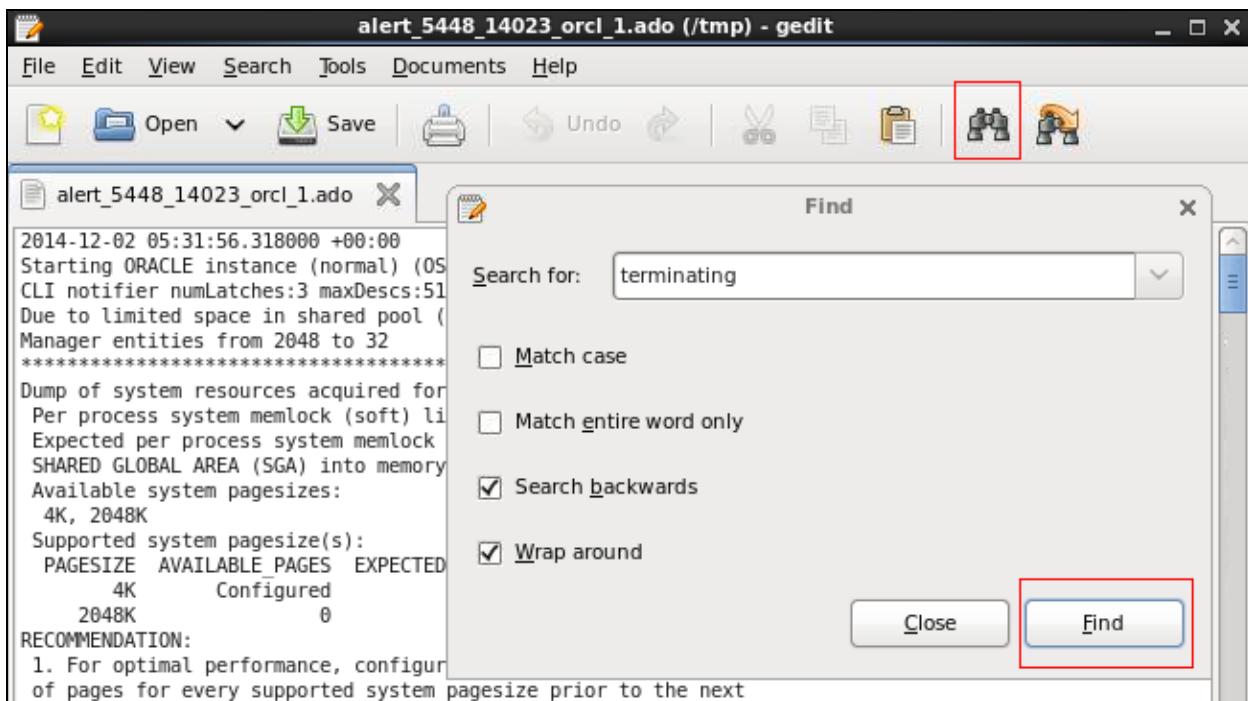
adrci> set editor gedit
adrci> show alert

Choose the home from which to view the alert log:
1: diag/rdbms/emrep/emrep
2: diag/rdbms/orcl/orcl
3: diag/rdbms/rcat/rcat
4: diag/tnslsnr/EDRSR43P1/listener
Q: to quit
Please select option: 2
Output the results to file: /tmp/alert_5448_14023_orcl_1.ado

Please select option:
```

- b. Examine the alert log in the gedit window. Interesting portions of an alert log are shown in the next few steps.

- c. Find the output starting with "terminating." Click the binoculars icon, enter search values and click **Find**.



```
TABLE SYS.WRP$_REPORTS: ADDED INTERVAL PARTITION SYS_P520 (100) VALUES LESS THAN (TO_DATE('2014-12-13 01:00:00', 'SYDDD-MM-DD HH24:MI:SS', 'NLS_CALENDAR=GREGORIAN'))  
TABLE SYS.WRP$_REPORTS_DETAILS: ADDED INTERVAL PARTITION SYS_P527 (1807) VALUES LESS THAN (TO_DATE('2014-12-13 01:00:00', 'SYDDD-MM-DD HH24:MI:SS', 'NLS_CALENDAR=GREGORIAN'))  
TABLE SYS.WRP$_REPORTS_TIME_BANDS: ADDED INTERVAL PARTITION SYS_P530 (1806) VALUES LESS THAN (TO_DATE('2014-12-12 01:00:00', 'SYDDD-MM-DD HH24:MI:SS', 'NLS_CALENDAR=GREGORIAN'))  
2014-12-12 09:24:13.375000 +00:00  
DROP TABLESPACE bar91tbs INCLUDING CONTENTS AND DATAFILES  
2014-12-12 09:24:18.742000 +00:00  
Deleted file /u01/backup/orcl/bar91tbs01.dbf  
Completed: DROP TABLESPACE bar91tbs INCLUDING CONTENTS AND DATAFILES  
2014-12-12 11:05:21.742000 +00:00  
Shutting down instance (abort)  
license high water mark = 20  
USER (ospid: 4263): terminating the instance  
2014-12-12 11:05:22.814000 +00:00  
Instance terminated by USER, pid = 4263  
Instance shutdown complete
```

- d. Find the release of the database that you started and its spfile location.

The screenshot shows a window titled "alert_5448_14023_orcl_1.ado". The content of the window is as follows:

```
SYS auditing is enabled
NOTE: remote asm mode is local (mode 0x1; from cluster type)
NOTE: Using default ASM root directory ASM
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing options.
ORACLE_HOME = /u01/app/oracle/product/12.1.0/dbhome_1
System name:Linux
Node name:EDRSR43P1
Release:2.6.39-200.24.1.el6uek.x86_64
Version:#1 SMP Sat Jun 23 02:39:07 EDT 2012
Machine:x86_64
Using parameter settings in server-side spfile /u01/app/oracle/product/12.1.0/dbhome_1/dbs/
spfileorcl.ora
System parameters with non-default values:
processes          = 300
sga_max_size       = 512M
streams_pool_size  = 8M
sga_target         = 512M
control_files      = "/u01/app/oracle/oradata/orcl/control01.ctl"
control_files      = "/u01/app/oracle/fast_recovery_area/orcl/control02.ctl"
db_block_size      = 8192
compatible         = "12.1.0.2.0"
db_create_file_dest = "/u01/app/oracle/oradata/orcl"
db_recovery_file_dest = "/u01/app/oracle/fast_recovery_area"
db_recovery_file_dest_size= 4560M
undo_tablespace    = "UNDOTBS1"
remote_login_passwordfile= "EXCLUSIVE"
db_domain          = ""
dispatchers        = "(PROTOCOL=TCP) (SERVICE=orclXDB)"
```

- e. Find the instance recovery action. The redo roll forward action makes the database consistent.

Note: After other processes perform their activities, transaction rollback is enabled and any transactions that were incomplete are rolled back.

```

alert_5448_14023_orcl_1.ado

ALTER DATABASE MOUNT
2014-12-12 11:07:21.859000 +00:00
Using default pga_aggregate_limit of 2048 MB
2014-12-12 11:07:23.823000 +00:00
Successful mount of redo thread 1, with mount id 1393894631
Database mounted in Exclusive Mode
Lost write protection disabled
Completed: ALTER DATABASE MOUNT
ALTER DATABASE OPEN
Ping without log force is disabled

.
Beginning crash recovery of 1 threads
parallel recovery started with 2 processes
Started redo scan
Completed redo scan
read 2283 KB redo, 447 data blocks need recovery
Started redo application at
Thread 1: logseq 38, block 12489
Recovery of Online Redo Log: Thread 1 Group 2 Seq 38 Reading mem 0
  Mem# 0: /u01/app/oracle/oradata/orcl/redo02.log
  Mem# 1: /u01/app/oracle/oradata/orcl/redo02b.log
Completed redo application of 1.54MB
2014-12-12 11:07:27.337000 +00:00
Completed crash recovery at
Thread 1: logseq 38, block 17055, scn 2705078
447 data blocks read, 447 data blocks written, 2283 redo k-bytes read
Starting background process TMON
TMON started with pid=27, OS id=4716
LGWR: STARTING ARCH PROCESSES
Starting background process ARC0
ARC0 started with pid=28, OS id=4718
ARC0: Archival started
LGWR: STARTING ARCH PROCESSES COMPLETE
ARC0: STARTING ARCH PROCESSES
Starting background process ARC1

```

- f. After the database is opened, you get recovery related space information.

```

Starting background process CJQ0
Completed: ALTER DATABASE OPEN
CJQ0 started with pid=37, OS id=4751
2014-12-12 11:07:35.181000 +00:00
Shared IO Pool defaulting to 16MB. Trying to get it from Buffer Cache for process 4655.
=====
Dumping current patch information
=====
No patches have been applied
=====
2014-12-12 11:07:36.907000 +00:00
db_recovery_file_dest_size of 4560 MB is 35.26% used. This is a
user-specified limit on the amount of space that will be used by this
database for recovery-related files, and does not reflect the amount of
space available in the underlying filesystem or ASM diskgroup.

```

- g. Exit the editor by clicking the x (close Window) icon.

- h. Enter **Q** to quit the `show alert` command in ADRCI.

```
Please select option: q  
adrci>
```

- i. Enter `exit` to exit ADRCI.

```
adrci> exit  
$
```

Practice 9-3: Repairing Block Corruption

Overview

In this practice you will use the Data Recovery Advisor to set up, discover, and repair a corrupted block in a data file.

Assumptions

You have a terminal window open with \$LABS as the current directory. Environment variables are set for the orcl instance.

Tasks

1. Set up for this practice by executing the `setup_09_04.sh`. This script creates the BC user, the BCTBS tablespace, and the BCCOPY table. The table is populated, a backup is taken and the table is updated to prepare for this practice. The output can be viewed by using the `cat /tmp/setup.log` Linux command.

```
$ ./setup_09_04.sh  
$
```

2. Corrupt a data file created in the previous step by executing the `break_09_04.sql` script.

Note: The corrupt block error is expected. The script performs a query against the BCCOPY table to force the corrupt block to be discovered.

```
$ sqlplus /nolog @break_09_04.sql  
.  
FILE_NO    BLOCK_NO  
-----  
          7        129  
  
System altered.  
  
'Enter Block number when prompted'  
Enter value for block_no: 129 <<< enter your BLOCK_NO  
0+1 records in  
0+1 records out  
80 bytes (80 B) copied, 3.7931e-05 s, 2.1 MB/s  
0+1 records in  
0+1 records out  
79 bytes (79 B) copied, 2.9639e-05 s, 2.7 MB/s  
  
SELECT * from bc.bccopy  
*  
ERROR at line 1:  
ORA-01578: ORACLE data block corrupted (file # 2, block # 129)  
ORA-01110: data file 2: '/u01/backup/orcl/bctbs01.dbf'
```

3. Using RMAN as SYSBACKUP, connect to the orcl instance and check for failures with the LIST FAILURE command.

```
$ rman target ''/ as sysbackup''  
...  
RMAN> LIST FAILURE;  
using target database control file instead of recovery catalog  
Database Role: PRIMARY  
  
List of Database Failures  
=====  
  
Failure ID Priority Status      Time Detected      Summary  
----- ----- -----  
1167      HIGH    OPEN       2014-12-12:12:06:55 Datafile 2:  
'/u01/backup/orcl/bctbs01.dbf' contains one or more corrupt  
blocks  
RMAN>
```

4. Use the RMAN ADVISE FAILURE command and view the suggested repair strategy.

```
RMAN> ADVISE FAILURE;  
  
Database Role: PRIMARY  
  
List of Database Failures  
=====  
  
Failure ID Priority Status      Time Detected      Summary  
----- ----- -----  
1167      HIGH    OPEN       2014-12-12:12:06:55 Datafile 2:  
'/u01/backup/orcl/bctbs01.dbf' contains one or more corrupt  
blocks  
  
analyzing automatic repair options; this may take some time  
allocated channel: ORA_DISK_1  
channel ORA_DISK_1: SID=261 device type=DISK  
analyzing automatic repair options complete  
  
Mandatory Manual Actions  
=====  
no manual actions available
```

```
Optional Manual Actions
=====
no manual actions available

Automated Repair Options
=====
Option Repair Description
-----
1      Recover multiple corrupt blocks in datafile 2
      Strategy: The repair includes complete media recovery with no
      data loss
      Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_2973384501.hm
RMAN>
```

5. Use the RMAN REPAIR FAILURE command to recover the corrupted blocks.

Note: The name of the repair script is listed so that you can inspect it before you execute it.

```
RMAN> REPAIR FAILURE;
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_2973384501.hm

contents of repair script:
# block media recovery for multiple blocks
recover datafile 2 block 129 to 130;

Do you really want to execute the above repair (enter YES or
NO)? y
executing repair script

Starting recover at 2014-12-12:12:12:49
using channel ORA_DISK_1

channel ORA_DISK_1: restoring block(s) from datafile copy
/u01/app/oracle/fast_recovery_area/ORCL/datafile/o1_mf_bctbs_b8o
pj176_.dbf

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

Finished recover at 2014-12-12:12:12:58
repair failure complete

RMAN>
```

6. Optionally, confirm that there are no other failures.

```
RMAN> list failure;
Database Role: PRIMARY
no failures found that match specification
RMAN>
```

7. Exit RMAN and **clean up from the block corruption practice** by executing the cleanup_09_04.sh script. The output can be viewed by using the cat /tmp/cleanup.log Linux command.

```
RMAN> exit
...
$ ./cleanup_09_04.sh
$
```

Practices for Lesson 10: Restore and Recovery Concepts

Chapter 10

Practices for Lesson 10: Overview

Practices Overview

In this practice you will consider the circumstances of a failure and the backup setting to determine a strategy for restoration and recovery.

Practice 10-1: Case Study: Determining Recovery Procedures

Overview

In this practice you will consider the circumstances of a failure and the backup setting to determine a strategy for restoration and recovery.

Assumptions

You are familiar with Oracle backup and recovery.

Tasks

Case 1: The backups are taken during a nightly shutdown, with an incremental backup strategy. A level 1 backup is applied to the previous Level 0 backup each night. The ARCHIVE LOG LIST command shows the following:

```
SQL> archive log list
Database log mode          No Archive Mode
Automatic archival         Disabled
Archive destination         USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence  61
Next log sequence to archive 63
Current log sequence       63
```

A disk containing the SYSAUX tablespace data files has crashed.

- Is complete recovery possible? What are the steps?

Answer: Yes, if all the redo log files from most the recent backup to the current log file are available. Restore the SYSAUX data files, recover the data files, and open the database.

- If complete recovery is not possible what are the steps to recover as much as possible? What data (transactions) will be lost?

Answer: If there are ANY missing redo log files, between the time the backup was taken and the current time (when the database shut down) a complete recovery is not possible. In this case, restore all the database files, apply the most recent incremental backups (RMAN RECOVER command), and open the database with the RESETLOGS option. Any transactions between the time of the backup and the current time will be lost.

Case 2: The database backups are taken nightly online, with an incremental backup strategy. A level 1 backup is applied to the previous level 0 backup each night. The ARCHIVE LOG LIST command shows the following:

```
SQL> archive log list
Database log mode          Archive Mode
Automatic archival         Enabled
Archive destination         USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence  61
```

Next log sequence to archive	63
Current log sequence	63

A data file that is part of the application tablespace, containing critical data, has been lost. Describe the steps to perform a complete recovery.

Answer: Use the Data Recovery Advisor to determine which files have been lost, restore the data files, recover the data files, and open the database.

Case 3: The effects of a batch job that was incorrectly executed on the database last night at 8:00 p.m. have been removed by performing an incomplete recovery to 6:00 p.m. After the incomplete recovery the database was reopened. The checks that were performed following the recovery revealed that some critical transactions performed prior to 7:15 p.m. are not in the database.

- c. What are valid options to recover these transactions?

Answer: The incomplete recovery can be restarted by using a control file that matches the structure of the previous incarnation of the database at 7:15 p.m. and restoring a backup of the database from before 6:00 p.m. Then an incomplete recovery using the archive log files from the previous incarnation can be performed to recover the database to its state at 7:15 p.m.

- d. Describe the requirements for recovering these transactions.

Answer: The backup used in the previous incomplete recovery or an older backup must be available. The archive log files and redo for that incarnation must be available. When using RMAN, set the incarnation number to get the proper set of redo and archive logs.

Practices for Lesson 11: Performing Recovery

Chapter 11

Practices for Lesson 11: Overview

Practices Overview

In these practices, you will recover from a number of different database failures. It is highly recommended to complete the ones you start, because it affects the following practices.

Ensure that you completed the practice 7-3 "Creating an Archival Backup," because in case a recovery fails, the duplicated database files can be used for a "rescue" operation.

Possible recovery steps by using the archival backup:

- a. With your environment variables pointing to the ORCL instance, log in to RMAN and connect to the RMAN catalog:

```
rman target ''/ as sysbackup'' catalog rcatowner@rcat
```
- b. Confirm the name of the restore point to be used, KEEPDB in this example:

```
LIST RESTORE POINT ALL;
```
- c. Restore and recover your database by using your restore point:

```
RESTORE DATABASE UNTIL RESTORE POINT 'KEEPDB';
RECOVER DATABASE UNTIL RESTORE POINT 'KEEPDB';
```
- d. Because your database is now at an earlier point in time, open it with the RESETLOGS option, and display the newly created DBID:

```
ALTER DATABASE OPEN RESETLOGS;
SELECT DBID FROM V$DATABASE;
```
- e. In most environments, Oracle recommends to perform a new backup after a recovery:

```
BACKUP DATABASE PLUS ARCHIVELOG DELETE INPUT;
```

Practice 11-1: Recovering from Media Failure (Loss of a Data File)

Overview

In this practice you will first create an issue by deleting the `USERS` data file. Then you perform a complete recovery of the database because of the loss of an essential data file. In this case Data Recovery Advisor cannot be used.

Assumptions

You have a terminal window open with `$LABS` as the current directory. Environment variables are set for the `orcl` instance.

Tasks

1. Execute the `setup_11_01.sh` script and ensure that you have a **backup of the entire database** in ARCHIVELOG mode. For example, use the RMAN client to execute:

```
BACKUP DATABASE PLUS ARCHIVELOG DELETE INPUT;
```

or use the `backup_orcl.sh` script. The output is in `/tmp/backup.log`.

```
$ ./setup_11_01.sh
$ 
$ ./backup_orcl.sh
$
```

2. Cause a failure in the database by executing the `break_11_01.sh` script which removes the `USERS` tablespace data files. The output of the script is redirected to `/tmp/break.log`.

```
$ ./break_11_01.sh
$
```

3. Optionally, view the output file in a different terminal window with the `cat /tmp/break.log` Linux command. You can view the output while the `break_11_01.sh` file is executing.

```
$ cat /tmp/break.log
orcl
BREAK_11_01.SH: Abort ORCL database

SQL*Plus: Release 12.1.0.2.0 Production on Fri Dec 12 13:52:48
2014

Copyright (c) 1982, 2014, Oracle. All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 -
64bit Production
```

With the Partitioning, OLAP, Advanced Analytics and Real Application Testing options

```
SQL> ORACLE instance shut down.
SQL> Disconnected from Oracle Database 12c Enterprise Edition
Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real
Application Testing options
Fri Dec 12 13:53:22 UTC 2014
Confirm: ora_pmon_orcl should NOT be listed
12852 ora_pmon_emrep
15784 ora_pmon_rcat
Issue created.
$
```

- Continue in a terminal window as the `oracle` user with the environment variables pointing to the `orcl` instance. In SQL*Plus attempt to start the `orcl` database instance. Notice the error messages.

```
$ sqlplus / as sysdba

Connected to an idle instance.

SQL> startup
Oracle instance started.

Total System Global Area  536870912 bytes
Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers              247463936 bytes
Redo Buffers                   5459968 bytes
Database mounted.

ORA-01157: cannot identify/lock data file 6 - see DBWR trace
file
ORA-01110: data file 6:
'/u01/app/oracle/oradata/orcl/users01.dbf'
SQL>
```

- Diagnose the failure. Follow the error message directions (for training purposes).

- What is the meaning of the error message codes?

Use the `oerr` utility to determine the meaning of the error codes.

- ORA-01110 _____
- ORA-01157 _____

```
SQL> ! oerr ORA 01110
01110, 00000, "data file %s: '%s'"
```

```

// *Cause: Reporting file name for details of another error.
The reported
//           name can be of the old file if a data file move
operation is
//           in progress.
// *Action: See associated error message.
SQL>

```

```

SQL> ! oerr ORA 1157
01157, 00000, "cannot identify/lock data file %s - see DBWR
trace file"
// *Cause: The background process was either unable to find one
of the data
//           files or failed to lock it because the file was
already in use.
//           The database will prohibit access to this file but
other files will
//           be unaffected. However the first instance to open the
database will
//           need to access all online data files. Accompanying
error from the
//           operating system describes why the file could not be
identified.
// *Action: Have operating system make file available to
database. Then either
//           open the database or do ALTER SYSTEM CHECK DATAFILES.
SQL>

```

- b. Find and examine the DBWR trace file listed in the output from the STARTUP command in step 5. The trace file will be in the directory listed in the DIAGNOSTIC_DEST parameter, in the diag/rdbms/orcl/orcl/trace subdirectory.

```

SQL> show parameter DIAG

NAME                      TYPE          VALUE
-----
diagnostic_dest            string        /u01/app/oracle
SQL>

```

- c. Add the diag/rdbms/orcl/orcl/trace subdirectory to the path name or display the BACKGROUND_DUMP_DEST parameter. Then exit SQL*Plus.

```

SQL> show parameter dump_dest

NAME                      TYPE          VALUE
-----

```

```
background_dump_dest    string
/u01/app/oracle/product/12.1.0/dbhome_1/rdbms/log
core_dump_dest          string
/u01/app/oracle/diag/rdbms/orcl/orcl/cdump
user_dump_dest          string
/u01/app/oracle/product/12.1.0/dbhome_1/rdbms/log
SQL>
SQL> exit
$
```

- d. Use another terminal window. The `ls -ltr` Linux command lists files in the trace directory in reverse order by time. The most recent file is listed last.

```
$ cd /u01/app/oracle/diag/rdbms/orcl/orcl/trace
$ ls -ltr *dbw*
...
-rw-r----- 1 oracle oinstall  944 Dec 12 11:07
orcl_dbw0_4637.trc
-rw-r----- 1 oracle oinstall  471 Dec 12 13:57
orcl_dbw0_30109.trm
-rw-r----- 1 oracle oinstall 1740 Dec 12 13:57
orcl_dbw0_30109.trc
$
```

- e. Review the last trace dbw trace file. Usually, the last error message lists the cause.

```
$ cat orcl_dbw0_30109.trc
Trace file
/u01/app/oracle/diag/rdbms/orcl/orcl/trace/orcl_dbw0_30109.trc
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 -
64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real
Application Testing options
ORACLE_HOME = /u01/app/oracle/product/12.1.0/dbhome_1
System name:   Linux
Node name:     EDRSR43P1
Release:  2.6.39-200.24.1.el6uek.x86_64
Version: #1 SMP Sat Jun 23 02:39:07 EDT 2012
Machine:  x86_64
Instance name: orcl
Redo thread mounted by this instance: 0 <none>
Oracle process number: 12
Unix process pid: 30109, image: oracle@EDRSR43P1 (DBW0)

*** 2014-12-12 13:57:27.957
*** CLIENT ID:() 2014-12-12 13:57:27.957
```

```

*** SERVICE NAME:() 2014-12-12 13:57:27.957
*** MODULE NAME:() 2014-12-12 13:57:27.957
*** CLIENT DRIVER:() 2014-12-12 13:57:27.957
*** ACTION NAME:() 2014-12-12 13:57:27.957

2014-12-12 13:57:27.956776 :kjcipctxinit(): (pid|psn)=(12|1):
initialised and linked pctx 0x7dae3ac8 into process list

*** 2014-12-12 13:57:32.929
*** SESSION ID:(6.18147) 2014-12-12 13:57:32.929
*** SERVICE NAME:() 2014-12-12 13:57:32.929

DDE rules only execution for: ORA 1110
----- START Event Driven Actions Dump -----
----- END Event Driven Actions Dump -----
----- START DDE Actions Dump -----
Executing SYNC actions
----- START DDE Action: 'DB_STRUCTURE_INTEGRITY_CHECK' (Async) -
-----
Successfully dispatched
----- END DDE Action: 'DB_STRUCTURE_INTEGRITY_CHECK' (SUCCESS, 0
csec) -----
Executing ASYNC actions
----- END DDE Actions Dump (total 0 csec) -----
ORA-01157: cannot identify/lock data file 6 - see DBWR trace
file
ORA-01110: data file 6:
'/u01/app/oracle/oradata/orcl/users01.dbf'
ORA-27037: unable to obtain file status
Linux-x86_64 Error: 2: No such file or directory
Additional information: 3
[oracle@EDRSR43P1 trace] $

```

Question: What is the problem?

Answer: A data file in the *USERS* tablespace is missing.

- Using the RMAN command line (pointing to the *orcl* instance) and check what Data Recovery Adviser reports about the failure.

```

$ rman target ''/ as sysbackup''

connected to target database: ORCL (DBID=1393010434, not open)

RMAN> list failure;

using target database control file instead of recovery catalog

```

```
Database Role: PRIMARY

List of Database Failures
=====

Failure ID Priority Status      Time Detected      Summary
-----
62          HIGH    OPEN        2014-12-12:13:57:33 One or more
non-system datafiles are missing
RMAN>
```

7. Using the RMAN command line, gather advice, and repair the failure. Restore, recover, and open the database.
 - a. To gather advice:

```
RMAN> advise failure;
atabase Role: PRIMARY

List of Database Failures
=====

Failure ID Priority Status      Time Detected      Summary
-----
62          HIGH    OPEN        2014-12-12:13:57:33 One or more
non-system datafiles are missing

analyzing automatic repair options; this may take some time
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=12 device type=DISK
analyzing automatic repair options complete

Mandatory Manual Actions
=====
no manual actions available

Optional Manual Actions
=====
1. If file /u01/app/oracle/oradata/orcl/users01.dbf was
unintentionally renamed or moved, restore it

Automated Repair Options
=====
Option Repair Description
-----
```

```
1      Restore and recover datafile 6
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_927113290.hm
RMAN>
```

- b. Optionally, to preview the potential repair:

```
RMAN> repair failure preview;
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_927113290.hm

contents of repair script:
# restore and recover datafile
restore ( datafile 6 );
recover datafile 6;
sql 'alter database datafile 6 online';
RMAN>
```

- c. To repair the failure and open the database:

```
RMAN> repair failure;
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_927113290.hm

contents of repair script:
# restore and recover datafile
restore ( datafile 6 );
recover datafile 6;
sql 'alter database datafile 6 online';

Do you really want to execute the above repair (enter YES or
NO)? y
executing repair script

Starting restore at 2014-12-12:14:20:05
using channel ORA_DISK_1

channel ORA_DISK_1: starting datafile backup set restore
channel ORA_DISK_1: specifying datafile(s) to restore from
backup set
```

```
channel ORA_DISK_1: restoring datafile 00006 to
/u01/app/oracle/oradata/orcl/users01.dbf
channel ORA_DISK_1: reading from backup piece
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_12/o1_
mf_nnndf_TAG20141212T133245_b8ovmz11_.bkp
channel ORA_DISK_1: piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_12/o1_mf_nnndf_TAG20141212T133245_b8ovmz11_.bkp
tag=TAG20141212T133245
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:01
Finished restore at 2014-12-12:14:20:07

Starting recover at 2014-12-12:14:20:07
using channel ORA_DISK_1

starting media recovery
media recovery complete, elapsed time: 00:00:01

Finished recover at 2014-12-12:14:20:08

sql statement: alter database datafile 6 online
repair failure complete

Do you want to open the database (enter YES or NO)? y
database opened

RMAN>
```

8. Check Data Recovery Advisor for other failures.

```
RMAN> list failure;
Database Role: PRIMARY
no failures found that match specification
RMAN>
```

9. Clean up your test case with the cleanup_11_01.sh script from the \$LABS directory (output is in /tmp/cleanup.log).

```
$ ./cleanup_11_01.sh
$
```

10. In your RMAN session, back up the database with the BACKUP DATABASE PLUS ARCHIVELOG command. The output is in /tmp/backup.log. Then exit.

```
RMAN> BACKUP DATABASE PLUS ARCHIVELOG;
RMAN> exit
$
```

Practice 11-2: Recovering from Media Failure: Incomplete Recovery

Overview

In this practice you set up a scenario that requires an incomplete recovery. Then you perform the steps that are needed when an archive log is missing after the last backup (and transactions exist that cannot be re-created); therefore, complete recovery is not possible.

Assumptions

A full backup exists and the archive log files from the time of the backup to the current time are available.

Tasks

1. Set up for this practice by executing the `setup_11_02.sh` script from the `$LABS` directory. With this script a new tablespace and user are created. The user creates a table and populates it. A backup of the tablespace is performed and then the table is updated. The output is in the `/tmp/setup.log` file.

```
$ ./setup_11_02.sh  
$
```

2. Cause a failure in the database by executing the `break_11_02.sh` script. Before the failure the user table is updated several times. An extended period of time is simulated and several log switches occur.

The output is in the `/tmp/break.log` file.

```
$ ./break_11_02.sh  
The last digit of the salary indicates how many times this table  
has been updated  
SALARY  
-----  
24009  
System altered.  
$
```

3. Attempt to start the database instance. Notice the error messages. These are the same error messages as seen in practice 11-1.

```
$ sqlplus / as sysdba  
Connected to an idle instance.  
SQL> startup  
ORACLE instance started.  
  
Total System Global Area 536870912 bytes  
Fixed Size 2926472 bytes  
Variable Size 281020536 bytes  
Database Buffers 247463936 bytes
```

```

Redo Buffers           5459968 bytes
Database mounted.
ORA-01157: cannot identify/lock data file 2 - see DBWR trace
file
ORA-01110: data file 2: '/u01/backup/orcl/bartbs.dbf'
SQL>

```

4. Note your data file number. _____
It is **data file 2** in this example. **You must use your own data file number for recovery.**
5. Optionally, in another terminal window, check the DBWR trace file, and then return to the \$LABS directory.

```

$ cd /u01/app/oracle/diag/rdbms/orcl/orcl/trace
$ ls -ltr *dbw*
. . .
rw-r----- 1 oracle oinstall  946 Dec 15 12:17
orcl_dbw0_26306.trc
-rw-r----- 1 oracle oinstall  489 Dec 16 07:08
orcl_dbw0_29806.trm
-rw-r----- 1 oracle oinstall 1726 Dec 16 07:08
orcl_dbw0_29806.trc
$ 

```

```

$ cat orcl_dbw0_29806.trc
. . .
ORA-01157: cannot identify/lock data file 2 - see DBWR trace
file
ORA-01110: data file 2: '/u01/backup/orcl/bartbs.dbf'
ORA-27037: unable to obtain file status
Linux-x86_64 Error: 2: No such file or directory
Additional information: 3
$
$ cd $LABS
$ 

```

6. Use the RMAN LIST FAILURE command to find more information. You may only see one failure listed.

```

$ rman target ''/ as sysbackup''

RMAN> list failure;
using target database control file instead of recovery catalog
Database Role: PRIMARY

List of Database Failures
=====

```

Failure ID	Priority	Status	Time Detected	Summary
1560	HIGH	OPEN	2014-12-16:07:18:26	One or more non-system datafiles need media recovery
62	HIGH	OPEN	2014-12-16:07:08:44	One or more non-system datafiles are missing

RMAN>

7. Use the RMAN ADVISE FAILURE command to determine if automated recovery is available. You may only see one failure listed.

```
RMAN> ADVISE FAILURE;
Database Role: PRIMARY

List of Database Failures
=====

Failure ID Priority Status      Time Detected      Summary
-----
1560      HIGH    OPEN       2014-12-16:07:18:26 One or more
non-system datafiles need media recovery
62        HIGH    OPEN       2014-12-16:07:08:44 One or more
non-system datafiles are missing

analyzing automatic repair options; this may take some time
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=250 device type=DISK
analyzing automatic repair options complete

Mandatory Manual Actions
=====
1. If you restored the wrong version of data file
/u01/backup/orcl/bartbs.dbf, then replace it with the correct
one
2. If file /u01/backup/orcl/bartbs.dbf was unintentionally
renamed or moved, restore it
3. If you have an export of tablespace BARTBS, offline its data
files, open the database read/write, then drop and re-create the
tablespace and import the data.
4. Contact Oracle Support Services if the preceding
recommendations cannot be used, or if they do not fix the
failures selected for repair

Optional Manual Actions
=====
```

```
no manual actions available

Automated Repair Options
=====
no automatic repair options available
RMAN>
```

8. There is only one data file missing, but there is no automatic recovery available. This indicates that the advisor found some problem with the restoration or recovery. Attempt a restore and recovery of the data file specified by the list failure command. The data file number on your system may vary.

Note: DO NOT perform any action that is not reversible. You are expecting this restore and recovery to fail. You are looking for errors and information that will help you diagnose the cause of this failure.

```
RMAN> restore datafile 2; (enter your datafile number)
Starting restore at 2014-12-16:08:08:38
using channel ORA_DISK_1

channel ORA_DISK_1: restoring datafile 00002
input datafile copy RECID=21 STAMP=866448235 file
name=/u01/backup/orcl/bartestdata_D-ORCL_I-1393010434_TS-
BARTBS_FNO-2_25pq9sr
destination for restore of datafile 00002:
/u01/backup/orcl/bartbs.dbf
channel ORA_DISK_1: copied datafile copy of datafile 00002
output file name=/u01/backup/orcl/bartbs.dbf RECID=0 STAMP=0
Finished restore at 2014-12-16:08:08:40
RMAN>
```

```
RMAN> recover datafile 2; (enter your datafile number)
Starting recover at 2014-12-16:08:09:49
using channel ORA_DISK_1

starting media recovery

archived log for thread 1 with sequence 65 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_65_b8zsvh3_.arc
archived log for thread 1 with sequence 66 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_66_b8zsvy81_.arc
archived log for thread 1 with sequence 67 is already on disk as
file
```

```
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_67_b8zsw34h_.arc
archived log for thread 1 with sequence 68 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_68_b8zsw655_.arc
archived log for thread 1 with sequence 69 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_69_b8zsw96w_.arc
archived log for thread 1 with sequence 71 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_71_b8zswh8j_.arc
archived log for thread 1 with sequence 72 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_72_b8zswl8f_.arc
RMAN-00571:
=====
RMAN-00569: ====== ERROR MESSAGE STACK FOLLOWS
=====
RMAN-00571:
=====
RMAN-03002: failure of recover command at 12/16/2014 08:09:49
RMAN-06053: unable to perform media recovery because of missing
log
RMAN-06025: no backup of archived log for thread 1 with sequence
70 and starting SCN of 3484657 found to restore
RMAN>
```

The error message indicates that **archive log file 70** is missing.

Note: If you get two RMAN-06025 error messages, focus on the latest one, that is, the one with the highest digits also in the following steps.

In a production system you would determine if there is another copy of this file, possibly in an OS backup that is unknown to RMAN. If the archive log file can be found and restored, a complete recovery is possible. **For this practice assume the archive log file is lost.**

Note: The archive log sequence number that you find may be different than the one shown in the example. **Make note of your missing archive log sequence number:**

9. Complete recovery is not possible in this situation. Use your SQL*Plus session to determine how much data will be lost. In this example, the current redo log file is sequence number **73** and log number **70** is missing. **So all the data contained in log files 70 through 73 will be lost.**

SQL> archive log list	
Database log mode	Archive Mode
Automatic archival	Enabled

```

Archive destination          USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence 71
Next log sequence to archive 73
Current log sequence       73
SQL>

```

Note: If you attempt to query the CURRENT_SCN column of the V\$DATABASE view, you will get a value of 0 (zero), and not the last "current" SCN.

```

RMAN> SELECT NAME, DBID, CURRENT_SCN, LOG_MODE, OPEN_MODE FROM
      V$DATABASE;

NAME           DBID CURRENT_SCN LOG_MODE      OPEN_MODE
----           ----        ----      ----
ORCL          1393010434          0 ARCHIVELOG    MOUNTED
RMAN>

```

- Determine the starting SCN and start time of your missing log (log 70 in this example). Record the values from the FIRST_CHANGE# and FIRST_TIME columns.

The value in FIRST_TIME can be used to inform users how far back they have to go to recover any transactions that have been lost. Log out of SQL*Plus.

```

SQL> select sequence#, first_change#, first_time, status
  from v$archived_log
 where sequence# = 70 and name is not null; (Enter your missing log
sequence number)

SEQUENCE#  FIRST_CHANGE#  FIRST_TIME          STATUS
-----      -----        -----
          70          3484657  2014-12-16:08:04:24  A
SQL> exit

```

Note: The SCN was already displayed in the RMAN error message, but the first time that this archive log was used, it was not previously displayed.

Also note that the V\$ARCHIVED_LOG view contains historic information of prior database incarnations. The NAME column of the active database incarnation contains the path and name of the archive log; historic incarnations have a null value. The status A is for archived logs, D is for deleted ones.

11. It is recommended to always restore the control file first for incomplete recovery so that potential changes in the data structures are known to RMAN.

- a. Bring the database to NOMOUNT state.

```
RMAN> shutdown immediate;

database dismounted
Oracle instance shut down

RMAN> startup nomount;
connected to target database (not started)
Oracle instance started

Total System Global Area      536870912 bytes

Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers             247463936 bytes
Redo Buffers                 5459968 bytes
RMAN>
```

- b. Restore the control file from autobackup.

```
RMAN> restore controlfile from autobackup;

Starting restore at 2014-12-16:08:21:04
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=12 device type=DISK

recovery area destination: /u01/app/oracle/fast_recovery_area
database name (or database unique name) used for search: ORCL
channel ORA_DISK_1: AUTOBACKUP
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_16/o1
_mf_s_866448236_b8zsvf34_.bkp found in the recovery area
channel ORA_DISK_1: looking for AUTOBACKUP on day: 20141216
channel ORA_DISK_1: restoring control file from AUTOBACKUP
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_16/o1
_mf_s_866448236_b8zsvf34_.bkp
channel ORA_DISK_1: control file restore from AUTOBACKUP
complete
output file name=/u01/app/oracle/oradata/orcl/control01.ctl
output file
name=/u01/app/oracle/fast_recovery_area/orcl/control02.ctl
Finished restore at 2014-12-16:08:21:06

RMAN>
```

- c. Mount the database.

```
RMAN> alter database mount;
Statement processed
released channel: ORA_DISK_1
RMAN>
```

12. Restore the entire database from a backup that was taken before the missing archive log file with the RESTORE DATABASE UNTIL SEQUENCE *nn* command.

```
RMAN> RESTORE DATABASE UNTIL SEQUENCE 70; (Enter your missing log sequence number)
```

```
Starting restore at 2014-12-16:08:23:21
Starting implicit crosscheck backup at 2014-12-16:08:23:21
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=12 device type=DISK
Crosschecked 23 objects
Finished implicit crosscheck backup at 2014-12-16:08:23:22
```

```
Starting implicit crosscheck copy at 2014-12-16:08:23:22
using channel ORA_DISK_1
Crosschecked 11 objects
Finished implicit crosscheck copy at 2014-12-16:08:23:22
```

```
searching for all files in the recovery area
cataloging files...
cataloging done
```

```
List of Cataloged Files
```

```
=====
```

```
File Name:
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_67_b8zsw34h_.arc
File Name:
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_69_b8zsw96w_.arc
File Name:
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_65_b8zsvwh3_.arc
File Name:
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_72_b8zswl8f_.arc
File Name:
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_71_b8zwh8j_.arc
```

```
File Name:  
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1  
_mf_1_66_b8zsvy81_.arc  
File Name:  
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1  
_mf_1_68_b8zsw655_.arc  
File Name:  
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_16/o1  
_mf_s_866448236_b8zsvf34_.bkp  
  
using channel ORA_DISK_1  
  
skipping datafile 2; already restored to file  
/u01/backup/orcl/bartbs.dbf  
channel ORA_DISK_1: starting datafile backup set restore  
channel ORA_DISK_1: specifying datafile(s) to restore from  
backup set  
channel ORA_DISK_1: restoring datafile 00001 to  
/u01/app/oracle/oradata/orcl/system01.dbf  
channel ORA_DISK_1: restoring datafile 00003 to  
/u01/app/oracle/oradata/orcl/sysaux01.dbf  
channel ORA_DISK_1: restoring datafile 00004 to  
/u01/app/oracle/oradata/orcl/undotbs01.dbf  
channel ORA_DISK_1: restoring datafile 00005 to  
/u01/app/oracle/oradata/orcl/example01.dbf  
channel ORA_DISK_1: restoring datafile 00006 to  
/u01/app/oracle/oradata/orcl/users01.dbf  
channel ORA_DISK_1: reading from backup piece  
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_12/o1  
_mf_nnndf_TAG20141212T143119_b8oz1tnl_.bkp  
channel ORA_DISK_1: piece  
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12  
_12/o1_mf_nnndf_TAG20141212T143119_b8oz1tnl_.bkp  
tag=TAG20141212T143119  
channel ORA_DISK_1: restored backup piece 1  
channel ORA_DISK_1: restore complete, elapsed time: 00:01:05  
Finished restore at 2014-12-16:08:24:29  
  
RMAN>
```

13. Recover the database through your last available log file.

Note: If incremental backups are available they will be applied first, and then the archive logs. The number of log files that need to be applied may vary from the example shown.

```
RMAN> recover database until sequence 70; (Enter your missing log  
sequence number)
```

```
Starting recover at 2014-12-16:08:26:27
```

```
using channel ORA_DISK_1

starting media recovery

archived log for thread 1 with sequence 43 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_12/o1
_mf_1_43_b8oz2vco_.arc
archived log for thread 1 with sequence 44 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_15/o1
_mf_1_44_b8ylyt6x_.arc
archived log for thread 1 with sequence 45 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_15/o1
_mf_1_45_b8ypklyr_.arc
...
archived log for thread 1 with sequence 67 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_67_b8zsw34h_.arc
archived log for thread 1 with sequence 68 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_68_b8zsw655_.arc
archived log for thread 1 with sequence 69 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_16/o1
_mf_1_69_b8zsw96w_.arc
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
12/o1_mf_1_43_b8oz2vco_.arc thread=1 sequence=43
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
15/o1_mf_1_44_b8ylyt6x_.arc thread=1 sequence=44
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
15/o1_mf_1_45_b8ypklyr_.arc thread=1 sequence=45
...
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_67_b8zsw34h_.arc thread=1 sequence=67
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_68_b8zsw655_.arc thread=1 sequence=68
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_69_b8zsw96w_.arc thread=1 sequence=69
```

```
media recovery complete, elapsed time: 00:01:00
Finished recover at 2014-12-16:08:27:29

RMAN>
```

The number of log files in your environment may be different.

14. Open the database using the RESETLOGS option. Query V\$DATABASE to display the CURRENT_SCN and DBID.

```
RMAN> alter database open resetlogs;
Statement processed.

RMAN> SELECT NAME, DBID, CURRENT_SCN, LOG_MODE, OPEN_MODE FROM
V$DATABASE;

NAME          DBID  CURRENT_SCN LOG_MODE      OPEN_MODE
-----  -----
ORCL        1393010434    3486115 ARCHIVELOG   READ WRITE
RMAN>
```

15. Use the Data Recovery Advisor LIST FAILURE command to verify that the failures have been repaired. **Then you must exit so that you can connect to the recovery catalog in the next step.**

```
RMAN> list failure;
Database Role: PRIMARY
no failures found that match specification
RMAN> exit
$
```

16. Because the break_11_02.sh script removed an archive log to create an issue for your learning purpose, crosscheck all archive logs **connected to the recovery catalog**.

```
$ rman target ''/ as sysbackup'' catalog rcatowner@rcat

RMAN> CROSSCHECK ARCHIVELOG ALL;

new incarnation of database registered in recovery catalog
starting full resync of recovery catalog
full resync complete
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=33 device type=DISK
validation succeeded for archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/01_mf_1_65_b8zsvwh3_.arc RECID=51 STAMP=866449402
validation succeeded for archived log
```

```
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_66_b8zsvy81_.arc RECID=54 STAMP=866449403
validation succeeded for archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_67_b8zsw34h_.arc RECID=49 STAMP=866449402
validation succeeded for archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_68_b8zsw655_.arc RECID=55 STAMP=866449403
validation succeeded for archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_69_b8zsw96w_.arc RECID=50 STAMP=866449402
validation succeeded for archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_71_b8zvvn8_.arc RECID=63 STAMP=866450043
validation succeeded for archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_71_b8zswh8j_.arc RECID=53 STAMP=866449403
validation succeeded for archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_72_b8zvmw1r_.arc RECID=64 STAMP=866450044
validation succeeded for archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_72_b8zswl8f_.arc RECID=52 STAMP=866449403
validation succeeded for archived log
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
16/o1_mf_1_73_b8zvmv2b_.arc RECID=62 STAMP=866450043
Crosschecked 10 objects

RMAN>
```

Note: Your number of objects might be different.

17. Delete obsolete backups and then exit the RMAN client.

```
RMAN> delete noprompt obsolete;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
using channel ORA_DISK_1
```

```
Deleting the following obsolete backups and copies:
Type          Key    Completion Time   Filename/Handle
-----
Backup Set      125    2014-12-10:13:33:38
  Backup Piece   127    2014-12-10:13:33:38
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_10/o1
_mf_s_865949617_b8jlx14q_.bkp
Datafile Copy    133    2014-12-10:13:33:31
/u01/backup/orcl/data_D-ORCL_I-1393010434_TS-USERS_FNO-
6_0fppqj3d
...
Backup Set      697    2014-12-16:08:03:57
  Backup Piece   699    2014-12-16:08:03:57
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_16/o1
_mf_s_866448236_b8zsvf34_.bkp
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_10/o1_mf_s_865949617_b8jlx14q_.bkp RECID=12 STAMP=865949618
deleted datafile copy
datafile copy file name=/u01/backup/orcl/data_D-ORCL_I-
1393010434_TS-USERS_FNO-6_0fppqj3d RECID=8 STAMP=865949611
...
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_12/o1_mf_annnn_TAG20141212T133237_b8ovmosl_.bkp RECID=33
STAMP=866122357
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_12/o1_mf_s_866122405_b8ovo6ch_.bkp RECID=36 STAMP=866122406
deleted backup piece
backup piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_16/o1_mf_s_866448236_b8zsvf34_.bkp RECID=45 STAMP=866449403
Deleted 27 objects

RMAN> exit
$
```

Note: Your number of objects might be different.

18. Optionally, log in to SQL*Plus. Select the SALARY column from one row of the BAR.BARCOPY table. The last digit of the salary indicates the number of times the BARCOPY table has been updated. The difference between this result and the result in step 2 illustrates that multiple updates could be missing after an incomplete recovery. Exit from SQL*Plus.

```
SQL> select salary from bar.barcopy where rownum < 2;

          SALARY
-----
        2605
SQL> exit
$
```

19. Execute the cleanup_11_02.sh script from the \$LABS directory to remove the new user and tablespace created in this practice. The output is in the /tmp/cleanup.log file.

```
$ ./cleanup_11_02.sh
```

20. Back up the database. You have a new incarnation of the database and the older backups are obsolete, although there are certain cases where the older backups can be used. A new incarnation of the database was created when the RESETLOGS command was executed. Either use the RMAN client to create a new, full backup:

BACKUP DATABASE PLUS ARCHIVELOG DELETE INPUT;

or use the backup_orcl.sh script in a terminal window. The output is in /tmp/backup.log.

```
$ ./backup_orcl.sh
$
```

Practices for Lesson 12: Performing Recovery II

Chapter 12

Practices for Lesson 12: Overview

Practices Overview

In these practices, you will recover from a number of different database failures. It is highly recommended to complete the ones you start, because it affects the following practices.

Practice 12-1: Recovering the Loss of a Parameter File

Overview

In this practice you will create an issue by deleting the `initorcl.ora` parameter file. After creating the issue, you **must** restore the parameter file.

Assumptions

A full backup of the database is assumed. Autobackup of the control file and `SPFILE` is assumed to be configured in the fast recovery area.

Two terminal windows are open and you are logged in as the `oracle` OS user. `$LABS` is the current directory. Environment variables are set for the `orcl` instance.

Tasks

1. Set up for this practice by executing the `setup_12_01.sh` script from the `$LABS` directory. In this script:

- The `initorcl.ora` file is deleted from the `$ORACLE_HOME/dbs` directory;
- A new tablespace and user are created.
- The user creates a table and populates it.
- A backup of the tablespace is performed and then the table is updated.
- The output is in the `/tmp/setup.log` file.

```
$ ./setup_12_01.sh  
$
```

2. Cause a failure in the database by executing the `break_12_01.sh` script from the `$LABS` directory. The output is in the `/tmp/break.log` file.

```
$ ./break_12_01.sh  
$
```

3. Attempt to start the database instance. Notice the error messages. Exit from SQL*Plus.

```
$ sqlplus / as sysdba  
...  
Connected to an idle instance.  
  
SQL> startup  
ORA-01078: failure in processing system parameters  
LRM-00109: could not open parameter file  
'/u01/app/oracle/product/12.1.0/dbhome_1/dbs/initorcl.ora'  
SQL> exit  
$
```

4. Start the database by using RMAN.

```
$ rman target '' as sysbackup"  
connected to target database (not started)
```

```
RMAN> startup;
startup failed: ORA-01078: failure in processing system
parameters
      LRM-00109: could not open parameter file
      '/u01/app/oracle/product/12.1.0/dbhome_1/dbs/initorcl.ora'

      starting Oracle instance without parameter file for retrieval of
      spfile
      Oracle instance started
      RMAN-00571:
=====
RMAN-00569: ====== ERROR MESSAGE STACK FOLLOWS
=====
RMAN-00571:
=====
RMAN-03002: failure of startup command at 12/16/2014 12:48:09
ORA-00205: error in identifying control file, check alert log
for more info

RMAN>
```

Note: The database has been started with a dummy parameter file to allow the SPFILE to be restored.

5. Restore the SPFILE. Because the database has been started with a dummy parameter file, the location of the autobackup must be specified. In this case we are using the recovery area and DB_NAME options to specify where the backups can be found.

```
RMAN> restore spfile from autobackup recovery area
      '/u01/app/oracle/fast_recovery_area' db_name 'orcl';

      Starting restore at 2014-12-16:12:58:12
      using channel ORA_DISK_1

      recovery area destination: /u01/app/oracle/fast_recovery_area
      database name (or database unique name) used for search: ORCL
      channel ORA_DISK_1: AUTOBACKUP
      /u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_16/o1
      _mf_s_866463724_b908zf2m_.bkp found in the recovery area
      AUTOBACKUP search with format "%F" not attempted because DBID
      was not set
      channel ORA_DISK_1: restoring spfile from AUTOBACKUP
      /u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_16/o1
      _mf_s_866463724_b908zf2m_.bkp
      channel ORA_DISK_1: SPFILE restore from AUTOBACKUP complete
      Finished restore at 2014-12-16:12:58:13

RMAN>
```

6. Shut down the database instance and restart it with the restored SPFILE.

```
RMAN> shutdown;
Oracle instance shut down

RMAN> startup;
connected to target database (not started)
Oracle instance started
database mounted
database opened

Total System Global Area      536870912 bytes

Fixed Size                  2926472 bytes
Variable Size                289409144 bytes
Database Buffers             239075328 bytes
Redo Buffers                 5459968 bytes

RMAN>
```

7. Execute the `cleanup_12_01.sh` script to clean up from this practice. The output is in the `/tmp/cleanup.log` file.

```
$ ./cleanup_12_01.sh
$
```

8. In preparation for the next practice, back up your `orcl` database, remove obsolete backups, and ensure that no failures are listed. Then exit from RMAN.

```
RMAN> BACKUP DATABASE PLUS ARCHIVELOG DELETE INPUT;
...
RMAN> delete noprompt obsolete;
...
RMAN> list failure;
Database Role: PRIMARY

no failures found that match specification

RMAN> exit
$
```

Practice 12-2: Restoring the Control File

Overview

In this practice, you first create an issue for recovery by deleting the `control02.ctl` control file. After creating the issue, you **must** restore this single "lost" control file.

Assumptions

A full backup of the database is available. Autobackup of the control file and SPFILE to the fast recovery area is configured.

Two terminal windows are open and you are logged in as the `oracle` OS user. `$LABS` is the current directory. Environment variables are set for the `orcl` instance.

Tasks

1. Set up for this practice by executing the `setup_12_02.sh` script from the `$LABS` directory. In this script a new tablespace and user are created. The user creates a table and populates it. A backup of the tablespace is performed and then the table is updated.

The output is redirected to `/tmp/setup.log` and can be viewed there during the execution of the script.

```
$ ./setup_12_02.sh
$
```

2. Cause a failure in the database by executing the `break_12_02.sh` script from the `$LABS` directory. The output is in the `/tmp/break.log` file.

```
$ ./break_12_02.sh
$
```

3. Attempt to start the database. Review the error messages. Then exit SQL*Plus.

```
$ sqlplus / as sysdba
Connected to an idle instance.

SQL> startup
ORACLE instance started.

Total System Global Area  536870912 bytes
Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers              247463936 bytes
Redo Buffers                  5459968 bytes
ORA-00205: error in identifying control file, check alert log
for more info

SQL> exit
```

4. View the `orcl/orcl` alert log. Scroll to the most recent entries to see the errors from this practice.

```
$ adrci

adrci> set editor gedit
adrci> show alert

Choose the alert log from the following homes to view:

1: diag/rdbms/dummy/orcl
2: diag/rdbms/emrep/emrep
3: diag/rdbms/orcl/orcl
4: diag/rdbms/rcat/rcat
5: diag/tnslsnr/EDRSR43P1/listener
Q: to quit

Please select option: 3

Output the results to file: /tmp/alert_24622_1400_orcl_1.ado

/* Scroll to bottom of the file to see the following */

...
ALTER DATABASE MOUNT
ORA-00210: cannot open the specified control file
ORA-00202: control file:
'/u01/app/oracle/fast_recovery_area/orcl/control02.ctl'
ORA-27037: unable to obtain file status
Linux-x86_64 Error: 2: No such file or directory
Additional information: 3
ORA-205 signalled during: ALTER DATABASE MOUNT...
Checker run found 1 new persistent data failures
2014-12-16 13:36:51.803000 +00:00
Using default pga_aggregate_limit of 2048 MB
```

5. Close the gedit window by clicking the close window icon (x) and exit adrci.

```
Please select option: Q
adrci> exit
$
```

6. Check the Data Recovery Advisor for a solution. Preview the suggested solution before executing it.

```
$ rman target ''/ as sysbackup''  
connected to target database: ORCL (not mounted)  
  
RMAN> LIST FAILURE;  
  
using target database control file instead of recovery catalog  
List of Database Failures  
=====  
Failure ID Priority Status      Time Detected      Summary  
-----  
2149      CRITICAL OPEN      2014-12-16:13:36:49 Control file  
/u01/app/oracle/fast_recovery_area/orcl/control02.ctl is missing
```

```
RMAN> ADVISE FAILURE;  
  
List of Database Failures  
=====  
  
Failure ID Priority Status      Time Detected      Summary  
-----  
2149      CRITICAL OPEN      2014-12-16:13:36:49 Control file  
/u01/app/oracle/fast_recovery_area/orcl/control02.ctl is missing  
  
analyzing automatic repair options; this may take some time  
allocated channel: ORA_DISK_1  
channel ORA_DISK_1: SID=12 device type=DISK  
analyzing automatic repair options complete  
  
Mandatory Manual Actions  
=====  
no manual actions available  
  
Optional Manual Actions  
=====  
no manual actions available  
  
Automated Repair Options  
=====  
Option Repair Description  
-----
```

```
1      Use a multiplexed copy to restore control file
/u01/app/oracle/fast_recovery_area/orcl/control02.ctl
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3817167846.hm
RMAN>
```

```
RMAN> REPAIR FAILURE PREVIEW;
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3817167846.hm

contents of repair script:
# restore control file using multiplexed copy
restore controlfile from
'/u01/app/oracle/oradata/orcl/control01.ctl';
sql 'alter database mount';
RMAN>
```

7. Restore the control file. You can either execute the commands via the RMAN command line, or use the REPAIR FAILURE command to perform the task for you.

Note: Any existing copy of the control file can be used to restore the missing copy.

Enter **y** or **yes** when prompted to execute the repair and to open the database.

```
RMAN> REPAIR FAILURE;
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3817167846.hm

contents of repair script:
# restore control file using multiplexed copy
restore controlfile from
'/u01/app/oracle/oradata/orcl/control01.ctl';
sql 'alter database mount';

Do you really want to execute the above repair (enter YES or
NO)? y
executing repair script

Starting restore at 2014-12-16:13:49:34
using channel ORA_DISK_1
```

```
channel ORA_DISK_1: copied control file copy
output file name=/u01/app/oracle/oradata/orcl/control01.ctl
output file
name=/u01/app/oracle/fast_recovery_area/orcl/control02.ctl
Finished restore at 2014-12-16:13:49:36

sql statement: alter database mount
released channel: ORA_DISK_1
repair failure complete

Do you want to open the database (enter YES or NO)? y
database opened

RMAN>
```

8. Use the LIST FAILURE command to verify that the failure has been repaired.

```
RMAN> list failure;
no failures found that match specification

RMAN>
```

9. Clean up the practice environment by running the cleanup_12_02.sh script in another terminal window. The output is in the /tmp/cleanup.log file.

```
$ ./cleanup_12_02.sh
$
```

10. In preparation for the next practice, back up your orcl database, remove obsolete backups, and ensure that no failures are listed.

```
RMAN> BACKUP DATABASE PLUS ARCHIVELOG DELETE INPUT;
...
RMAN> delete noprompt obsolete;
...
RMAN> list failure;
Database Role: PRIMARY

no failures found that match specification
RMAN> exit
$
```

Practice 12-3: Recovering from the Loss of all Control Files

Overview

In this practice, you create an issue by removing control files. **After creating the issue, you must restore the control files.**

Assumptions

A full backup of the database is available. Autobackup of the control file and SPFILE is configured.

Two terminal windows are open and you are logged in as the `oracle` user. `$LABS` is the current directory. Environment variables are set for the `orcl` instance.

Tasks

1. Set up for this practice by executing the `setup_12_03.sh` script from the `$LABS` directory. In this script a new tablespace and user are created. The user creates a table and populates it. A backup of the tablespace is performed and then the table is updated.

The output is redirected to `/tmp/setup.log` and can be viewed during the execution of the script.

```
$ ./setup_12_03.sh
$
```

2. Cause a failure in the database by executing the `break_12_03.sh` script from the `$LABS` directory. The output is in the `/tmp/break.log` file.

```
$ ./break_12_03.sh
$
```

3. Log in to SQL*Plus and attempt to start the database. Notice the error message. Exit from SQL*Plus.

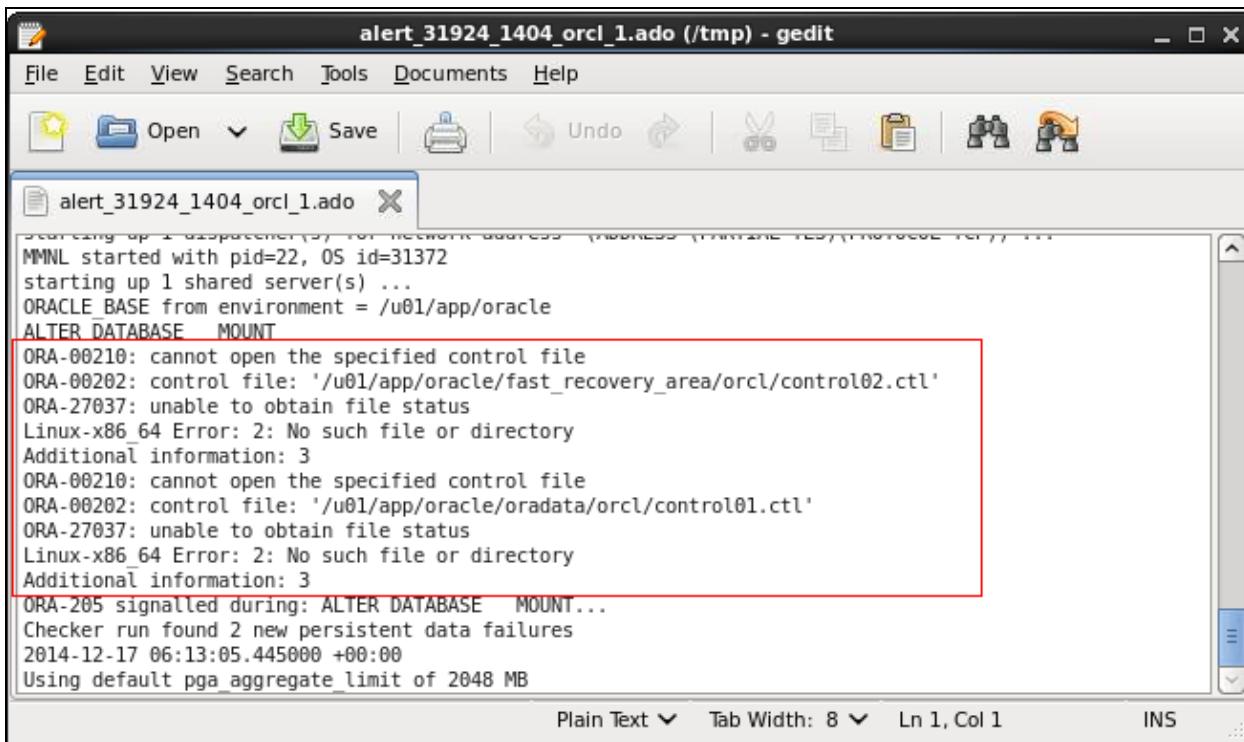
```
$ sqlplus / as sysdba
Connected to an idle instance.

SQL> startup
ORACLE instance started.

Total System Global Area  536870912 bytes
Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers              247463936 bytes
Redo Buffers                  5459968 bytes
ORA-00205: error in identifying control file, check alert log
for more info
SQL> exit
$
```

4. View the alert log. Scroll to the most recent entries to see the errors from this practice.

```
$ adrci  
adrci> set editor gedit  
adrci> show alert  
  
Choose the home from which to view the alert log:  
  
1: diag/rdbms/dummy/orcl  
2: diag/rdbms/emrep/emrep  
3: diag/rdbms/orcl/orcl  
4: diag/rdbms/rcat/rcat  
5: diag/tnslsnr/EDRSR43P1/listener  
Q: to quit  
  
Please select option: 3 <<< Enter your orcl alert log number  
Output the results to file: /tmp/alert_31924_1404_orcl_1.ado  
Please select option:
```



5. Exit from viewing the alert log by clicking the x icon to close the gedit window. Exit adrci by entering Q, and then exit.

```
...  
Please select option: Q  
adrci> exit  
$
```

6. Use the RMAN LIST FAILURE and ADVISE FAILURE commands to determine the failures and proposed solutions.

```
$ rman target ''/ as sysbackup''  
connected to target database: ORCL (not mounted)  
  
RMAN> list failure;  
  
using target database control file instead of recovery catalog  
List of Database Failures  
=====
```

Failure ID	Priority	Status	Time Detected	Summary
2335	CRITICAL	OPEN	2014-12-17:06:13:03	Control file /u01/app/oracle/fast_recovery_area/orcl/control02.ctl is missing
2332	CRITICAL	OPEN	2014-12-17:06:13:03	Control file /u01/app/oracle/oradata/orcl/control01.ctl is missing

```
RMAN>
```

```
RMAN> advise failure;  
  
List of Database Failures  
=====
```

Failure ID	Priority	Status	Time Detected	Summary
2335	CRITICAL	OPEN	2014-12-17:06:13:03	Control file /u01/app/oracle/fast_recovery_area/orcl/control02.ctl is missing
2332	CRITICAL	OPEN	2014-12-17:06:13:03	Control file /u01/app/oracle/oradata/orcl/control01.ctl is missing

```
analyzing automatic repair options; this may take some time  
allocated channel: ORA_DISK_1  
channel ORA_DISK_1: SID=12 device type=DISK  
analyzing automatic repair options complete  
  
Mandatory Manual Actions  
=====
```

no manual actions available

```
Optional Manual Actions  
=====
```

```

1. If file /u01/app/oracle/fast_recovery_area/orcl/control02.ctl
was unintentionally renamed or moved, restore it
2. If file /u01/app/oracle/oradata/orcl/control01.ctl was
unintentionally renamed or moved, restore it
3. If this is a standby database, restore the controlfile for a
standby database using RESTORE STANDBY CONTROLFILE FROM
AUTOBACKUP command
4. If this is a primary database and a standby database is
available, then perform a Data Guard failover initiated from the
standby

Automated Repair Options
=====
Option Repair Description
-----
1      Restore a backup control file
      Strategy: The repair includes complete media recovery with no
      data loss
      Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_1664629383.hm

RMAN>

```

- Review the commands generated by the REPAIR FAILURE PREVIEW command.

```

RMAN> repair failure preview;
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_1664629383.hm

contents of repair script:
# restore control file
restore controlfile from autobackup;
sql 'alter database mount';
RMAN>

```

- Use RMAN command line to restore the control files and mount the database.

Note: If you use the REPAIR FAILURE command at this point, then new failures are created, so that the database must be recovered and you need to execute these RMAN commands (again) to complete your database recovery:

```

LIST FAILURE;
ADVISE FAILURE;
REPAIR FAILURE PREVIEW;
REPAIR FAILURE;

```

Then continue with step 12.

If you are unsure, follow the steps exactly as described:

```
RMAN> restore controlfile from autobackup;

Starting restore at 2014-12-17:06:28:23
using channel ORA_DISK_1

recovery area destination: /u01/app/oracle/fast_recovery_area
database name (or database unique name) used for search: ORCL
channel ORA_DISK_1: AUTOBACKUP
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_16/o1
_mf_s_866469210_b90gbvq6_.bkp found in the recovery area
AUTOBACKUP search with format "%F" not attempted because DBID
was not set
channel ORA_DISK_1: restoring control file from AUTOBACKUP
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_16/o1
_mf_s_866469210_b90gbvq6_.bkp
channel ORA_DISK_1: control file restore from AUTOBACKUP
complete
output file name=/u01/app/oracle/oradata/orcl/control01.ctl
output file
name=/u01/app/oracle/fast_recovery_area/orcl/control02.ctl
Finished restore at 2014-12-17:06:28:24

RMAN> ALTER DATABASE MOUNT;

Statement processed
released channel: ORA_DISK_1

RMAN>
```

9. Attempt to open the database.

```
RMAN> ALTER DATABASE OPEN;
RMAN-00571: =====
RMAN-00569: ====== ERROR MESSAGE STACK FOLLOWS
RMAN-00571: =====
RMAN-03002: failure of sql statement command at 12/17/2014
06:29:52
ORA-01589: must use RESETLOGS or NORESETLOGS option for database
open
RMAN>
```

Question: Why is RESETLOGS necessary?

Answer: RESETLOGS is required because the SCN in the restored control file does not match the SCN recorded in the data files.

10. Attempt to open the database with the RESETLOGS option.

```
RMAN> ALTER DATABASE OPEN RESETLOGS;

RMAN-00571: =====
RMAN-00569: ===== ERROR MESSAGE STACK FOLLOWS
RMAN-00571: =====
RMAN-03002: failure of sql statement command at 12/17/2014
06:32:01
ORA-01194: file 1 needs more recovery to be consistent
ORA-01110: data file 1:
'/u01/app/oracle/oradata/orcl/system01.dbf'
RMAN>
```

Question: Why did the database open still fail with the RESETLOGS option?

Answer: The SCN in the control file is older than the SCN in the data files and the data files have not been restored with the UNTIL cause. [The database needs to be recovered so that the control file can be synchronized with the data files.](#)

11. Recover the database.

```
RMAN> recover database;

Starting recover at 2014-12-17:06:32:53
Starting implicit crosscheck backup at 2014-12-17:06:32:53
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=12 device type=DISK
Crosschecked 10 objects
Finished implicit crosscheck backup at 2014-12-17:06:32:54

Starting implicit crosscheck copy at 2014-12-17:06:32:54
using channel ORA_DISK_1
Finished implicit crosscheck copy at 2014-12-17:06:32:54

searching for all files in the recovery area
cataloging files...
cataloging done

List of Cataloged Files
=====
File Name:
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_16/o1
_mf_s_866469210_b90gbvq6_.bkp

using channel ORA_DISK_1
```

```
starting media recovery

archived log for thread 1 with sequence 9 is already on disk as
file /u01/app/oracle/oradata/orcl/redo03.log
archived log file name=/u01/app/oracle/oradata/orcl/redo03.log
thread=1 sequence=9
media recovery complete, elapsed time: 00:00:06
Finished recover at 2014-12-17:06:33:03

RMAN>
```

12. Open the database with RESETLOGS.

```
RMAN> ALTER DATABASE OPEN RESETLOGS;
Statement processed
RMAN>
```

13. Optionally, query V\$DATABASE to view the values of DBID and CURRENT_SCN.

```
RMAN> SELECT NAME, DBID, CURRENT_SCN, LOG_MODE, OPEN_MODE FROM
V$DATABASE;

NAME          DBID  CURRENT_SCN LOG_MODE      OPEN_MODE
-----        -----
ORCL          1393010434    3710270 ARCHIVELOG   READ WRITE
RMAN>
```

14. Use the LIST FAILURE command to verify that the failure has been repaired.

```
RMAN> list failure;
Database Role: PRIMARY
no failures found that match specification
RMAN>
```

15. In another terminal window, clean up the practice environment by using the cleanup_12_03.sh script from the \$LABS directory. The output is in the /tmp/cleanup.log file.

```
$ ./cleanup_12_03.sh
$
```

16. In preparation for the next practice, back up your `orcl` database, remove obsolete backups, and ensure that no failures are listed. Then exit from RMAN.

```
RMAN> BACKUP DATABASE PLUS ARCHIVELOG DELETE INPUT;  
...  
RMAN> delete noprompt obsolete;  
...  
RMAN> list failure;  
Database Role: PRIMARY  
no failures found that match specification  
RMAN> exit  
$
```

Practice 12-4: Restoring the Password File

Overview

In this practice you recover from the loss of the database password file. The database password is required for remote access to the database by SYSDBA privileged users.

Assumptions

A full backup of the database is available.

Two terminal windows are open and you are logged in as the oracle OS user. \$LABS is the current directory. Environment variables are set for the orcl instance.

Tasks

1. Cause a failure in the database by executing the break_12_04.sh script from the \$LABS directory. The output is redirected to /tmp/break.log and can be viewed during the execution of the script.

```
$ ./break_12_04.sh  
$
```

2. Attempt to connect to the database using a remote connection. Notice the error messages.

```
$ sqlplus sys@orcl as sysdba  
  
Enter password: <<< not displayed  
ERROR:  
ORA-01017: invalid username/password; logon denied  
Enter user-name: (Control-c, then return)  
$
```

Note: The remote connection requires the use of a password file.

3. Check if the password file exists. The name of the orcl database password file for Linux and UNIX systems is \$ORACLE_HOME/dbs/orapworcl.ora.

```
$ ls $ORACLE_HOME/dbs/orapw*  
/u01/app/oracle/product/12.1.0/dbhome_1/dbs/orapwemrep  
/u01/app/oracle/product/12.1.0/dbhome_1/dbs/orapwrcat  
$
```

The orapworcl.ora should not be listed (because it was deleted by the break_12_04.sh script).

Note: It is critically important to the security of your system that you protect your password file and the environment variables that identify the location of the password file. Any user with access to these could potentially compromise the security of the connection.

4. Optionally, view the description of the orapwd parameters. Invoke orapwd in a terminal window.

```
$ orapwd  
Usage: orapwd file=<fname> entries=<users> force=<y/n> asm=<y/n>
```

```
dbuniqueName=<dbname> format=<legacy/12> sysbackup=<y/n>
sysdg=<y/n> syskm=<y/n> delete=<y/n> input_file=<input-fname>

Usage: orapwd describe file=<fname>

where
    file - name of password file (required),
    password - password for SYS will be prompted
                if not specified at command line.
                Ignored, if input_file is specified,
    entries - maximum number of distinct DBA (optional),
    force - whether to overwrite existing file (optional),
    asm - indicates that the password to be stored in
          Automatic Storage Management (ASM) disk group
          is an ASM password. (optional).
    dbuniqueName - unique database name used to identify
database
                password files residing in ASM diskgroup
only.
                Ignored when asm option is specified
(optional),
    format - use format=12 for new 12c features like SYSBACKUP,
SYSDG and SYSKM support, longer identifiers, etc.
                If not specified, format=12 is default (optional),
    delete - drops a password file. Must specify 'asm',
              'dbuniqueName' or 'file'. If 'file' is specified,
              the file must be located on an ASM diskgroup
(optional),
    sysbackup - create SYSBACKUP entry (optional and requires
the
                12 format). Ignored, if input_file is specified,
    sysdg - create SYSDG entry (optional and requires the 12
format), Ignored, if input_file is specified,
    syskm - create SYSKM entry (optional and requires the 12
format), Ignored, if input_file is specified,
    input_file - name of input password file, from where old
user
                entries will be migrated (optional),
    describe - describes the properties of specified password
file
                (required).

There must be no spaces around the equal-to (=) character.
```

\$

5. Create a new password file by using the orapwd utility.

```
$ orapwd FILE=$ORACLE_HOME/dbs/orapworcl ENTRIES=15  
Enter password for SYS: oracle_4U <<< Not displayed  
$
```

Note: When you exceed the allocated number of password entries, you must create a new password file. To avoid this necessity, allocate more entries than you think you will ever need.

6. Test the remote SYSDBA login. Now it should be successful. Exit from SQL*Plus.

```
$ sqlplus sys@orcl as sysdba  
Enter password: <<< not displayed  
SQL>
```

7. Optionally, review the V\$PFILE_USERS view.

```
SQL> desc V$PFILE_USERS  
Name Null? Type  
-----  
USERNAME          VARCHAR2(30)  
SYSDBA           VARCHAR2(5)  
SYSOPER          VARCHAR2(5)  
SYSASM           VARCHAR2(5)  
SYSBACKUP        VARCHAR2(5)  
SYSDG            VARCHAR2(5)  
SYSKM            VARCHAR2(5)  
CON_ID           NUMBER  
  
SQL> SELECT * FROM V$PFILE_USERS;  
  
USERNAME      SYSDB  SYSOP  SYSAS  SYSBA  SYSDG  SYSKM  CON_ID  
-----  
SYS          TRUE   TRUE   FALSE  FALSE  FALSE  FALSE    0  
SQL>
```

8. Exit SQL*Plus.

```
SQL> exit  
$
```

Practice 12-5: Recovering a Tempfile

Overview

In this practice you examine the actions of the Oracle Database server when a tempfile is missing.

Assumptions

The temporary tablespace is named TEMP and located in /u01/app/oracle/oradata/orcl.

Two terminal windows are open and you are logged in as the oracle OS user. \$LABS is the current directory. Environment variables are set for the orcl instance.

Tasks

1. Set up for this practice by executing the `setup_12_05.sh` script from the \$LABS directory. In this script a new tablespace and user are created. The user creates a table, populates it and performs a query with an ORDER BY clause. (Some of these activities use a tempfile.) A backup of the tablespace is performed and then the table is updated.

The output is redirected to `/tmp/setup.log` and can be viewed there also during the execution of the script.

```
$ ./setup_12_05.sh  
$
```

2. Cause a failure in the database by executing the `break_12_05.sh` script in the \$LABS directory. The output is in the `/tmp/break.log` file.

```
$ ./break_12_05.sh  
$
```

3. Start the database instance. Exit from SQL*Plus.

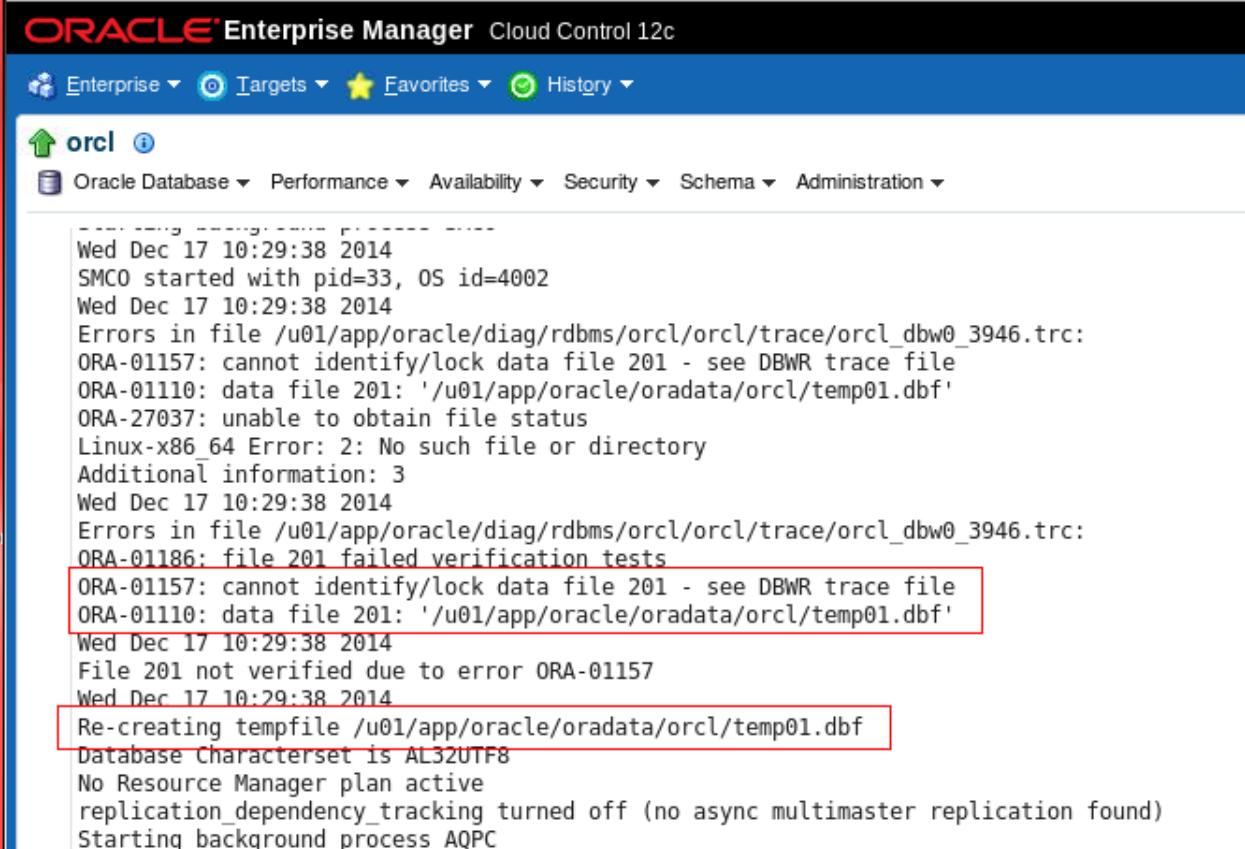
```
$ sqlplus / as sysdba  
Connected to an idle instance.
```

```
SQL> startup  
ORACLE instance started.  
  
Total System Global Area 536870912 bytes  
Fixed Size 2926472 bytes  
Variable Size 281020536 bytes  
Database Buffers 247463936 bytes  
Redo Buffers 5459968 bytes  
  
Database mounted.  
Database opened.  
  
SQL> exit
```

4. View the end of the `orcl` alert log. The most recent entries show that the startup processing includes the re-creation of tempfiles, if needed.

Either use the `adrci` command line utility (as shown in earlier practices) or log in to EM Cloud Control as the `SYSMAN` user.

- From the `orcl` database home page, navigate: **Oracle Database > Logs > Alert Log Content** and click **Switch to Text Alert Log Contents**.
- Enter date and time values that include the time when you performed the startup operation and then click **Go**.
- You can either scroll through your selected portion of the alert log, or use your browser's search functionality (Firefox: Ctrl + F, and then enter a search word) to see the re-creating of the tempfile entry as shown in the screenshot.



```
-----  
Wed Dec 17 10:29:38 2014  
SMCO started with pid=33, 05 id=4002  
Wed Dec 17 10:29:38 2014  
Errors in file /u01/app/oracle/diag/rdbms/orcl/orcl/trace/orcl_dbw0_3946.trc:  
ORA-01157: cannot identify/lock data file 201 - see DBWR trace file  
ORA-01110: data file 201: '/u01/app/oracle/oradata/orcl/temp01.dbf'  
ORA-27037: unable to obtain file status  
Linux-x86_64 Error: 2: No such file or directory  
Additional information: 3  
Wed Dec 17 10:29:38 2014  
Errors in file /u01/app/oracle/diag/rdbms/orcl/orcl/trace/orcl_dbw0_3946.trc:  
ORA-01186: file 201 failed verification tests  
ORA-01157: cannot identify/lock data file 201 - see DBWR trace file  
ORA-01110: data file 201: '/u01/app/oracle/oradata/orcl/temp01.dbf'  
Wed Dec 17 10:29:38 2014  
File 201 not verified due to error ORA-01157  
Wed Dec 17 10:29:38 2014  
Re-creating tempfile /u01/app/oracle/oradata/orcl/temp01.dbf  
Database character set is AL32UTF8  
No Resource Manager plan active  
replication_dependency_tracking turned off (no async multimaster replication found)  
Starting background process AQPC
```

5. Log out and close all windows.

Practice 12-6: Creating Encrypted Backups

Overview

In this practice you create an encrypted backup that is protected against data breach if the backup media is lost. In this example you will be using transparent encryption which depends on an encryption wallet. If the encryption wallet is lost, the backup is not recoverable. To mitigate the loss of a wallet or to allow the backup to be recovered on a different machine you can use password encryption instead of transparent encryption, or use both so that either the wallet or the password will allow the backup to be recovered.

Assumptions

Two terminal windows are open and you are logged in as the `oracle` OS user. `$LABS` is the current directory. Environment variables are set for the `orcl` instance.

Tasks

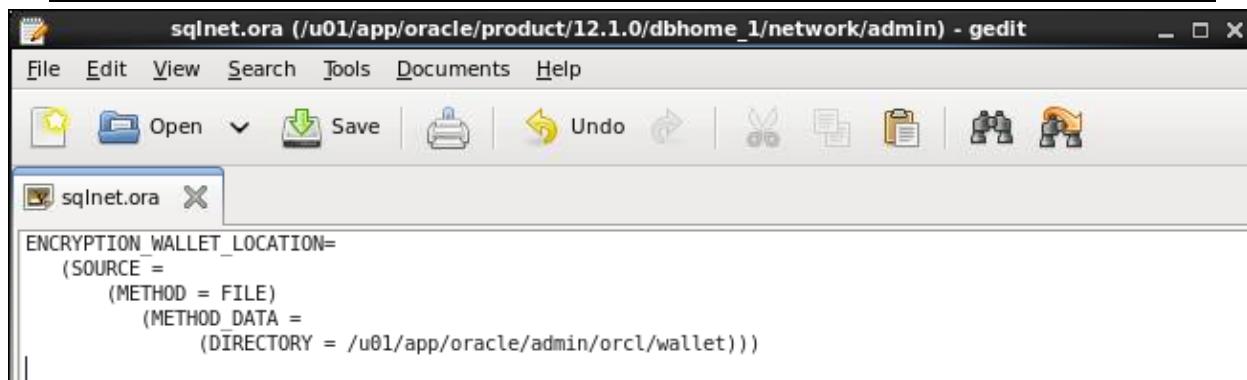
1. Prepare the database for encryption.
 - a. Set the environment variables for your `orcl` database instance. If it does not exist, create a directory named `$ORACLE_BASE/admin/orcl/wallet` for the Oracle wallet.

```
$ ls $ORACLE_BASE/admin/orcl/wallet
ls: cannot access /u01/app/oracle/admin/orcl/wallet: No such
file or directory
$ mkdir -p $ORACLE_BASE/admin/orcl/wallet
$
```

- b. Edit the `$ORACLE_HOME/network/admin/sqlnet.ora` file to add the following lines:

```
ENCRYPTION_WALLET_LOCATION=
  ( SOURCE =
    (METHOD = FILE)
    (METHOD_DATA =
      (DIRECTORY = /u01/app/oracle/admin/orcl/wallet)))
```

```
$ gedit
/u01/app/oracle/product/12.1.0/dbhome_1/network/admin/sqlnet.ora
```



Save the `sqlnet.ora` file and exit from `gedit`.

2. Create a password-based keystore and back it up.

- Connect to the `orcl` database instance as `SYSDBA` or as a user with the `SYSKM` privilege.

```
$ sqlplus / as sysdba  
SQL>
```

- Create a password-based keystore.

```
SQL> ADMINISTER KEY MANAGEMENT CREATE KEYSTORE  
'/u01/app/oracle/admin/orcl/wallet' IDENTIFIED BY secret;  
keystore altered.  
SQL>
```

- Confirm that the wallet exists.

```
SQL> ! ls -l /u01/app/oracle/admin/orcl/wallet  
total 4  
-rw-r--r-- 1 oracle oinstall 2408 Dec 17 12:30 ewallet.p12  
SQL>
```

- Open the keystore.

```
SQL> ADMINISTER KEY MANAGEMENT SET KEYSTORE OPEN IDENTIFIED BY  
secret;  
keystore altered.  
SQL>
```

- Optionally, view information about the wallet in the data dictionary.

```
SQL> SELECT WRL_PARAMETER, STATUS, WALLET_TYPE FROM  
V$ENCRYPTION_WALLET;  
WRL_PARAMETER          STATUS          WALLET_TYPE  
-----  
/u01/app/oracle/admin/orcl/wallet  OPEN_NO_MASTER_KEY PASSWORD  
SQL>
```

- Generate the master encryption key.

```
SQL> ADMINISTER KEY MANAGEMENT SET KEY IDENTIFIED BY secret WITH  
BACKUP USING 'test';  
keystore altered.  
SQL>
```

- Verify that the keystore has been backed up before the master key generation.

```
SQL> !ls -l /u01/app/oracle/admin/orcl/wallet  
total 8  
-rw-r--r-- 1 oracle oinstall 2408 Dec 17 12:36  
ewallet_2014121712362544_test.p12  
-rw-r--r-- 1 oracle oinstall 3848 Dec 17 12:36 ewallet.p12  
SQL>
```

Notice that if you regenerate the master key, the file is growing. All previous master keys are kept for data which could have used the previous master keys.

- Generate another key and view the keystore file.

```
SQL> ADMINISTER KEY MANAGEMENT SET KEY
IDENTIFIED BY secret WITH BACKUP;
keystore altered.

SQL> !ls -l /u01/app/oracle/admin/orcl/wallet
total 16
-rw-r--r-- 1 oracle oinstall 2408 Dec 17 12:36
ewallet_2014121712362544_test.p12
-rw-r--r-- 1 oracle oinstall 3848 Dec 17 12:38
ewallet_2014121712382193.p12
-rw-r--r-- 1 oracle oinstall 6048 Dec 17 12:38 ewallet.p12
SQL>
```

- Back up the keystore containing the current master key. Exit from SQL*Plus.

```
SQL> ADMINISTER KEY MANAGEMENT BACKUP KEYSTORE IDENTIFIED BY
secret;
keystore altered.

SQL> !ls -l /u01/app/oracle/admin/orcl/wallet
total 24
-rw-r--r-- 1 oracle oinstall 2408 Dec 17 12:36
ewallet_2014121712362544_test.p12
-rw-r--r-- 1 oracle oinstall 3848 Dec 17 12:38
ewallet_2014121712382193.p12
-rw-r--r-- 1 oracle oinstall 6048 Dec 17 12:39
ewallet_2014121712395820.p12
-rw-r--r-- 1 oracle oinstall 6048 Dec 17 12:39 ewallet.p12
SQL>
SQL> exit
```

Notice that both the current keystore and the backup files have the same size.

- Using RMAN, create a transparent encrypted backup with a password. Use the lab_12_06_02.rman script.
- As always, it is a good idea to review a script before executing it.

```
$ cat lab_12_06_02.rman
set encryption on for all tablespaces algorithm 'AES128';
run {
allocate channel enc_backup_disk1 type disk format
'/u01/backup/orcl/%U';
backup as BACKUPSET tag 'TRANSPARENT' database;
```

```
backup as BACKUPSET tag 'TRANSPARENT' archivelog all not backed
up;
release channel enc_backup_disk1;
}
$
```

- b. Execute the lab_12_06_02.rman script.

```
$ rman target ''/ as sysbackup'' @lab_12_06_02.rman
Recovery Manager: Release 12.1.0.2.0 - Production on Wed Dec 17
12:44:36 2014

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rights reserved.

connected to target database: ORCL (DBID=1393010434)

RMAN> set encryption on for all tablespaces algorithm 'AES128';
2> run {
3> allocate channel enc_backup_disk1 type disk format
'/u01/backup/orcl/%U';
4> backup as BACKUPSET tag 'TRANSPARENT' database;
5> backup as BACKUPSET tag 'TRANSPARENT' archivelog all not
backed up;
6> release channel enc_backup_disk1;
7> }
8>
executing command: SET encryption
using target database control file instead of recovery catalog

allocated channel: enc_backup_disk1
channel enc_backup_disk1: SID=41 device type=DISK

Starting backup at 2014-12-17:12:44:38
channel enc_backup_disk1: starting full datafile backup set
channel enc_backup_disk1: specifying datafile(s) in backup set
input datafile file number=00005
name=/u01/app/oracle/oradata/orcl/example01.dbf
input datafile file number=00003
name=/u01/app/oracle/oradata/orcl/sysaux01.dbf
input datafile file number=00001
name=/u01/app/oracle/oradata/orcl/system01.dbf
input datafile file number=00004
name=/u01/app/oracle/oradata/orcl/undotbs01.dbf
input datafile file number=00002
name=/u01/backup/orcl/bartbs.dbf
```

```
input datafile file number=00006
name=/u01/app/oracle/oradata/orcl/users01.dbf
channel enc_backup_disk1: starting piece 1 at 2014-12-
17:12:44:38
channel enc_backup_disk1: finished piece 1 at 2014-12-
17:12:45:13
piece handle=/u01/backup/orcl/38pqd1lm_1_1 tag=TRANSPARENT
comment=NONE
channel enc_backup_disk1: backup set complete, elapsed time:
00:00:35
Finished backup at 2014-12-17:12:45:13

Starting backup at 2014-12-17:12:45:14
current log archived
channel enc_backup_disk1: starting archived log backup set
channel enc_backup_disk1: specifying archived log(s) in backup
set
input archived log thread=1 sequence=3 RECID=84 STAMP=866543377
input archived log thread=1 sequence=4 RECID=85 STAMP=866550986
input archived log thread=1 sequence=5 RECID=86 STAMP=866551515
channel enc_backup_disk1: starting piece 1 at 2014-12-
17:12:45:15
channel enc_backup_disk1: finished piece 1 at 2014-12-
17:12:45:16
piece handle=/u01/backup/orcl/39pqd1mr_1_1 tag=TRANSPARENT
comment=NONE
channel enc_backup_disk1: backup set complete, elapsed time:
00:00:01
Finished backup at 2014-12-17:12:45:16

Starting Control File and SPFILE Autobackup at 2014-12-
17:12:45:16
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_17/o1_mf_s_866551516_b92ypx3r_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 2014-12-
17:12:45:19

released channel: enc_backup_disk1

Recovery Manager complete.
$
```

4. Verify that the backup pieces were encrypted. Use the lab_12_06_03.sql script.

```
$ cat lab_12_06_03.sql
-- DISCLAIMER:
-- This script is provided for educational purposes only. It is
-- NOT supported by Oracle World Wide Technical Support.
-- The script has been tested and appears to work as intended.
-- You should always run new scripts on a test instance
initially.

/* display the backup pieces and the encryption status of each
*/
/* Where the Tag is 'TRANSPARENT' */
SET PAGES 99
COL_BS_REC FORMAT 99999
COL_BP_REC FORMAT 99999
COL_ENCRYPTED FORMAT A7
COL_TAG FORMAT A12
COL_MEDIA_HANDLE FORMAT a40

SELECT s.recid as BS_REC, P.RECID as BP_REC, P.ENCRYPTED, P.TAG,
p.HANDLE as MEDIA_HANDLE
from v$BACKUP_PIECE P, V$BACKUP_SET S
WHERE P.SET_STAMP=S.SET_STAMP
and P.SET_COUNT = S.SET_COUNT
and P.TAG='TRANSPARENT'
/
exit
$
```

```
$ sqlplus / as sysdba @lab_12_06_03.sql
```

BS_REC	BP_REC	ENCRYPT	TAG	MEDIA_HANDLE
73	73	YES	TRANSPARENT	/u01/backup/orcl/38pqd1lm_1_1
74	74	YES	TRANSPARENT	/u01/backup/orcl/39pqd1mr_1_1

```
$
```

Practice 12-7: Recovering by Using an Encrypted Backup

Overview

In this practice you will recover a lost data file by using an encrypted backup.

Assumptions

Practice 12-6 has been completed. An encryption wallet exists and a full database backup using transparent encryption has been created.

Two terminal windows are open and you are logged in as the `oracle` OS user. `$LABS` is the current directory. Environment variables are set for the `orcl` instance.

Tasks

- Set up for this practice by executing the `setup_12_07.sh` script from the `$LABS` directory. In this script a new tablespace and user are created. The user creates a table and populates it. A backup of the tablespace is performed and then the table is updated. The output is in the `/tmp/setup.log` file.

```
$ ./setup_12_07.sh  
$
```

- Cause a failure in the database by executing the `break_12_07.sh` script from the `$LABS` directory. The output is in the `/tmp/break.log` file.

```
$ ./break_12_07.sh  
$
```

- Attempt to start the database. Notice the error messages.

```
$ sqlplus / as sysdba  
Connected to an idle instance.  
SQL> startup  
ORACLE instance started.  
  
Total System Global Area 536870912 bytes  
Fixed Size 2926472 bytes  
Variable Size 281020536 bytes  
Database Buffers 247463936 bytes  
Redo Buffers 5459968 bytes  
Database mounted.  
ORA-01157: cannot identify/lock data file 3 - see DBWR trace  
file  
ORA-01110: data file 3:  
'/u01/app/oracle/oradata/orcl/sysaux01.dbf'  
SQL>
```

4. In another terminal window, use the LIST FAILURE and ADVISE FAILURE commands to diagnose the problem.

```
$ rman target ''/ as sysbackup''  
  
RMAN> LIST FAILURE;  
using target database control file instead of recovery catalog  
Database Role: PRIMARY  
  
List of Database Failures  
=====  
  
Failure ID Priority Status      Time Detected      Summary  
----- ----- -----  
62        HIGH    OPEN       2014-12-18:07:00:34 One or more  
non-system datafiles are missing  
  
RMAN> ADVISE FAILURE;  
  
Database Role: PRIMARY  
  
List of Database Failures  
=====  
  
Failure ID Priority Status      Time Detected      Summary  
----- ----- -----  
62        HIGH    OPEN       2014-12-18:07:00:34 One or more  
non-system datafiles are missing  
  
analyzing automatic repair options; this may take some time  
allocated channel: ORA_DISK_1  
channel ORA_DISK_1: SID=250 device type=DISK  
analyzing automatic repair options complete  
  
Mandatory Manual Actions  
=====  
no manual actions available  
  
Optional Manual Actions  
=====  
1. If file /u01/app/oracle/oradata/orcl/sysaux01.dbf was  
unintentionally renamed or moved, restore it  
  
Automated Repair Options
```

```
=====
Option Repair Description
-----
1      Restore and recover datafile 3
      Strategy: The repair includes complete media recovery with no
      data loss
      Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3924442055.hm

RMAN>
```

5. Review the repair commands with the REPAIR FAILURE PREVIEW command.

```
RMAN> repair failure preview;
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3924442055.hm

contents of repair script:
# restore and recover datafile
restore ( datafile 3 );
recover datafile 3;
sql 'alter database datafile 3 online';
RMAN>
```

6. Optionally, execute the repair and expect an error.

```
RMAN> REPAIR FAILURE;
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3924442055.hm

contents of repair script:
# restore and recover datafile
restore ( datafile 3 );
recover datafile 3;
sql 'alter database datafile 3 online';

Do you really want to execute the above repair (enter YES or
NO)? y
executing repair script

Starting restore at 2014-12-18:07:06:10
using channel ORA_DISK_1
```

```

channel ORA_DISK_1: starting datafile backup set restore
channel ORA_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_DISK_1: restoring datafile 00003 to
/u01/app/oracle/oradata/orcl/sysaux01.dbf
channel ORA_DISK_1: reading from backup piece
/u01/backup/orcl/38pqd11m_1_1
RMAN-00571:
=====
RMAN-00569: ====== ERROR MESSAGE STACK FOLLOWS
=====
RMAN-00571:
=====
RMAN-03002: failure of repair command at 12/18/2014 07:06:11
RMAN-03015: error occurred in stored script Repair Script
ORA-19870: error while restoring backup piece
/u01/backup/orcl/38pqd11m_1_1
ORA-19913: unable to decrypt backup
ORA-28365: wallet is not open

RMAN>

```

- Because the database was restarted and the encryption wallet is not configured to be an auto-login wallet, the encryption wallet must be opened before the recovery can begin. Logged in to SQL*Plus as SYSDBA or SYSKM, open the keystore and then exit.

```

SQL> ADMINISTER KEY MANAGEMENT SET KEYSTORE OPEN IDENTIFIED BY
secret;
keystore altered.

SQL> EXIT
$ 

```

- In your RMAN session, repair the failure and open the database. Notice that one of the pieces of the encrypted backup was used to restore the tablespace.

```

RMAN> REPAIR FAILURE;
Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3924442055.hm

contents of repair script:
# restore and recover datafile
restore ( datafile 3 );
recover datafile 3;
sql 'alter database datafile 3 online';

```

```
Do you really want to execute the above repair (enter YES or
NO)? y
executing repair script

Starting restore at 2014-12-18:07:14:55
using channel ORA_DISK_1

channel ORA_DISK_1: starting datafile backup set restore
channel ORA_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_DISK_1: restoring datafile 00003 to
/u01/app/oracle/oradata/orcl/sysaux01.dbf
channel ORA_DISK_1: reading from backup piece
/u01/backup/orcl/38pqd11m_1_1
channel ORA_DISK_1: piece handle=/u01/backup/orcl/38pqd11m_1_1
tag=TRANSPARENT
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:35
Finished restore at 2014-12-18:07:15:30

Starting recover at 2014-12-18:07:15:30
using channel ORA_DISK_1

starting media recovery

archived log for thread 1 with sequence 5 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_17/o1
_mf_1_5_b92ypv1r_.arc
archived log for thread 1 with sequence 6 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_17/o1
_mf_1_6_b93z92j8_.arc
archived log for thread 1 with sequence 7 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_17/o1
_mf_1_7_b93zb9t6_.arc
archived log for thread 1 with sequence 8 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_18/o1
_mf_1_8_b94jv9x5_.arc
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
17/o1_mf_1_5_b92ypv1r_.arc thread=1 sequence=5
```

```
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
17/o1_mf_1_6_b93z92j8_.arc thread=1 sequence=6
media recovery complete, elapsed time: 00:00:28
Finished recover at 2014-12-18:07:15:59

sql statement: alter database datafile 3 online
repair failure complete

Do you want to open the database (enter YES or NO)? y
database opened

RMAN>
```

9. Use the LIST FAILURE command to verify that the failure has been repaired. Then exit RMAN.

```
RMAN> list failure;
Database Role: PRIMARY
no failures found that match specification

RMAN> exit
Recovery Manager complete.
$
```

Practice 12-8: Recovering a Lost Encryption Wallet

Overview

In this practice you will recover a lost encryption wallet.

Note: If you lose the wallet and do not have a backup of it, you will have to recover the database to a point in time before the wallet was used.

Assumptions

Practices 12-6 and 12-7 have been completed.

Two terminal windows are open and you are logged in as the `oracle` OS user. `$LABS` is the current directory. Environment variables are set for the `orcl` instance.

Tasks

1. Copy the keystore (or encryption wallet), which is located at

```
$ORACLE_BASE/admin/orcl/wallet/ewallet.p12, to the /u01/backup/orcl directory.
```

```
$ cp $ORACLE_BASE/admin/orcl/wallet/ewallet.p12  
/u01/backup/orcl/ewallet.p12  
$  
$ ls /u01/backup/orcl/ewal*  
/u01/backup/orcl/ewallet.p12  
$
```

Note: Continue only if you see the backup of the wallet.

2. Remove the keystore by executing the `break_12_08.sh` script. The output is in the `/tmp/break.log` file.

```
$ ./break_12_08.sh  
$
```

3. Attempt to start the database by using SQL*Plus.

```
$ sqlplus / as sysdba  
  
SQL> startup  
Total System Global Area 536870912 bytes  
Fixed Size 2926472 bytes  
Variable Size 281020536 bytes  
Database Buffers 247463936 bytes  
Redo Buffers 5459968 bytes  
Database mounted.  
ORA-01157: cannot identify/lock data file 3 - see DBWR trace  
file  
ORA-01110: data file 3:  
'/u01/app/oracle/oradata/orcl/sysaux01.dbf'  
SQL>
```

- This is exactly the same message you received in the previous practice where you recovered from a missing SYSAUX tablespace. Attempt to open the keystore.

```
SQL> ADMINISTER KEY MANAGEMENT SET KEYSTORE OPEN IDENTIFIED BY  
secret;  
ERROR at line 1:  
ORA-28367: wallet does not exist  
  
SQL>
```

- Restore the wallet.

```
SQL> ! cp /u01/backup/orcl/ewallet.p12  
$ORACLE_BASE/admin/orcl/wallet/ewallet.p12  
  
SQL> !ls $ORACLE_BASE/admin/orcl/wallet  
ewallet.p12  
SQL>
```

Note: The exclamation mark (!) temporarily leaves the SQL*Plus session to execute an OS command.

- Open the keystore. Then exit from SQL*Plus.

```
SQL> ADMINISTER KEY MANAGEMENT SET KEYSTORE OPEN IDENTIFIED BY  
secret;  
keystore altered.  
  
SQL>  
SQL> exit
```

- Use the Data Recovery Adviser RMAN commands to recover and open the database. Then confirm that there are no failures and exit RMAN.

```
$ rman target ''/ as sysbackup''  
  
RMAN> list failure;  
  
using target database control file instead of recovery catalog  
Database Role: PRIMARY  
  
List of Database Failures  
=====
```

Failure ID	Priority	Status	Time Detected	Summary
62	HIGH	OPEN	2014-12-18:07:42:24	One or more non-system datafiles are missing

```
RMAN> advise failure;
```

```
Database Role: PRIMARY

List of Database Failures
=====

Failure ID Priority Status      Time Detected      Summary
-----  -----  -----  -----
62       HIGH    OPEN     2014-12-18:07:42:24 One or more
non-system datafiles are missing

analyzing automatic repair options; this may take some time
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=12 device type=DISK
analyzing automatic repair options complete

Mandatory Manual Actions
=====
no manual actions available

Optional Manual Actions
=====
1. If file /u01/app/oracle/oradata/orcl/sysaux01.dbf was
unintentionally renamed or moved, restore it

Automated Repair Options
=====
Option Repair Description
-----
1      Restore and recover datafile 3
      Strategy: The repair includes complete media recovery with no
      data loss
      Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3806251676.hm

RMAN>

RMAN> repair failure;

Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3806251676.hm
```

```
contents of repair script:  
# restore and recover datafile  
restore ( datafile 3 );  
recover datafile 3;  
sql 'alter database datafile 3 online';  
  
Do you really want to execute the above repair (enter YES or  
NO)? y  
executing repair script  
  
Starting restore at 2014-12-18:07:48:23  
using channel ORA_DISK_1  
  
channel ORA_DISK_1: starting datafile backup set restore  
channel ORA_DISK_1: specifying datafile(s) to restore from  
backup set  
channel ORA_DISK_1: restoring datafile 00003 to  
/u01/app/oracle/oradata/orcl/sysaux01.dbf  
channel ORA_DISK_1: reading from backup piece  
/u01/backup/orcl/38pqd11m_1_1  
channel ORA_DISK_1: piece handle=/u01/backup/orcl/38pqd11m_1_1  
tag=TRANSPARENT  
channel ORA_DISK_1: restored backup piece 1  
channel ORA_DISK_1: restore complete, elapsed time: 00:00:25  
Finished restore at 2014-12-18:07:48:48  
  
Starting recover at 2014-12-18:07:48:48  
using channel ORA_DISK_1  
  
starting media recovery  
  
archived log for thread 1 with sequence 5 is already on disk as  
file  
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_17/o1  
_mf_1_5_b92ypv1r_.arc  
archived log for thread 1 with sequence 6 is already on disk as  
file  
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_17/o1  
_mf_1_6_b93z92j8_.arc  
archived log for thread 1 with sequence 7 is already on disk as  
file  
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_17/o1  
_mf_1_7_b93zb9t6_.arc
```

```
archived log for thread 1 with sequence 8 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_18/o1
_mf_1_8_b94jv9x5_.arc
archived log for thread 1 with sequence 9 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_18/o1
_mf_1_9_b94ztl7w_.arc
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
17/o1_mf_1_5_b92ypv1r_.arc thread=1 sequence=5
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
17/o1_mf_1_6_b93z92j8_.arc thread=1 sequence=6
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
17/o1_mf_1_7_b93zb9t6_.arc thread=1 sequence=7
media recovery complete, elapsed time: 00:00:35
Finished recover at 2014-12-18:07:49:25

sql statement: alter database datafile 3 online
repair failure complete

Do you want to open the database (enter YES or NO)? y
database opened

RMAN>

RMAN> list failure;

Database Role: PRIMARY

no failures found that match specification

RMAN> exit
$
```

8. Clean up the practice environment by executing the `cleanup_12_08.sh` script. This script removes the encrypted backups and disables encrypted backups. The output is in the `/tmp/cleanup.log` file.

```
$ ./cleanup_12_08.sh
$
```

Practices for Lesson 13: RMAN and Oracle Secure Backup

Chapter 13

Practices for Lesson 13: Overview

Practices Overview

In these practices, you install and use Oracle Secure Backup.

Practice 13-1: Installing Oracle Secure Backup

Overview

In this practice you install Oracle Secure Backup from a staging area.

Assumptions

You have an `orcl` database instance up and running and you performed the RMAN configuration in earlier practices.

Two terminal windows are open and you are logged in as the `root` OS user. `$LABS` is the current directory. Environment variables are set for the `orcl` instance.

The Oracle Secure Backup software is staged and unzipped in the `/stage/software` directory.

Tasks

1. Log in as the `root` user and confirm that the `/usr/local/oracle/backup` directory exists. This is the Oracle Secure Backup home directory and it is recommended to start the installation from that directory. (If you were to choose another directory, the OSB product documentation, as well as all related training files would not be synchronized and not work as they are.)

```
$ su - root  
Password: <password> <<< not displayed  
# cd /usr/local/oracle/backup  
#
```

2. To install the OSB software in your training environment:
 1. Execute `/stage/<osb_installmedia>/setup` in the directory.
 2. If asked, accept the default to not edit the `obparameters` file.
 3. Accept the default to install now.
 4. Select installation option a (administrative server, media server and client).
 5. Set the password for the encryption key store to `oracle_4U`.
 6. Set the password for the `admin` user to `oracle_4U`.
 7. Do not enter an e-mail address for the `admin` user, just press the enter key.
 8. Accept the default to not connect to tape libraries.
 9. Accept the default to not connect to tape drives.
 10. Exit the `root` OS user account.

```
# /stage/software/osb-10.4.0.3.0_linux.x64_release/setup
```

```
Welcome to Oracle's setup program for Oracle Secure Backup.  
This program loads Oracle Secure Backup software from the CD-ROM  
to a filesystem directory of your choosing.
```

```
This CD-ROM contains Oracle Secure Backup version  
10.4.0.3.0_LINUX64.
```

Please wait a moment while I learn about this host... done.

- - - - -
1. linux86_64

administrative server, media server, client

- - - - -
Loading Oracle Secure Backup installation tools... done.

Loading linux86_64 administrative server, media server, client... done.

- - - - -
Loading of Oracle Secure Backup software from CD-ROM is complete.

You may unmount and remove the CD-ROM.

Would you like to continue Oracle Secure Backup installation with 'installob' now? (The Oracle Secure Backup Installation Guide contains complete information about installob.)

Please answer 'yes' or 'no' [yes]:

- - - - -
Welcome to installob, Oracle Secure Backup's installation program.

For most questions, a default answer appears enclosed in square brackets.

Press Enter to select this answer.

Please wait a few seconds while I learn about this machine... done.

Have you already reviewed and customized install/obparameters for your Oracle Secure Backup installation [yes]?

- - - - -
Oracle Secure Backup is not yet installed on this machine.

Oracle Secure Backup's Web server has been loaded, but is not yet configured.

Choose from one of the following options. The option you choose defines the software components to be installed.

Configuration of this host is required after installation completes.

You can install the software on this host in one of the following ways:

- (a) administrative server, media server and client
- (b) media server and client
- (c) client

If you are not sure which option to choose, please refer to the Oracle Secure Backup Installation Guide. (a,b or c) [a]?

Beginning the installation. This will take just a minute and will produce several lines of informational output.

Installing Oracle Secure Backup on edRSr43p1 (Linux version 2.6.39-200.24.1.el6uek.x86_64)

You must now enter a password for the Oracle Secure Backup encryption key store. Oracle suggests you choose a password of at least 8 characters in length, containing a mixture of alphabetic and numeric characters.

Please enter the key store password:

Re-type password for verification:

You must now enter a password for the Oracle Secure Backup 'admin' user.

Oracle suggests you choose a password of at least 8 characters in length, containing a mixture of alphabetic and numeric characters.

Please enter the admin password:

Re-type password for verification:

You should now enter an email address for the Oracle Secure Backup 'admin' user. Oracle Secure Backup uses this email address to send job summary reports and to notify the user when a job requires input. If you leave this blank, you can set it later using the obtool's 'chuser' command.

Please enter the admin email address:

```
generating links for admin installation with Web server
updating /etc/ld.so.conf
checking Oracle Secure Backup's configuration file
(/etc/obconfig)
    setting Oracle Secure Backup directory to
/usr/local/oracle/backup in /etc/obconfig
    setting local database directory to /usr/etc/ob in
/etc/obconfig
    setting temp directory to /usr/tmp in /etc/obconfig
    setting administrative directory to
/usr/local/oracle/backup/admin in /etc/obconfig
    setting version to 10.4.0.3.0 in /etc/obconfig
protecting the Oracle Secure Backup directory
creating /etc/rc.d/init.d/bserviced
activating bbserviced via chkconfig
initializing the administrative domain
```

***** N O T E *****

On Linux systems Oracle recommends that you answer no to the next two questions. The preferred mode of operation on Linux systems is to use the /dev/sq devices for attach points as described in the 'ReadMe' and in the 'Installation and Configuration Guide'.

Is edRSr43p1 connected to any tape libraries that you'd like to use with Oracle Secure Backup [no]?

Is edRSr43p1 connected to any tape drives that you'd like to use with Oracle Secure Backup [no]?

Installation summary:

Move	Installation Reboot	Host Mode	OS Name	Driver Name	OS Installed?
	Required?	Required?			
no	admin	edRSr43p1	Linux	no	no

Oracle Secure Backup is now ready for your use.

```
# exit
logout
$
```

Practice 13-2: Configuring Oracle Secure Backup

Overview

In this practice, you configure Oracle Secure Backup and RMAN and then initiate a backup to tape to test your configuration.

Assumptions

Two terminal windows are open and you are logged in as the `oracle` OS user. `$LABS` is the current directory. Environment variables are set for the `orcl` instance.

You completed the previous practice 13-1 and installed the software using the directories and passwords as indicated.

Tasks

1. Execute the `setup_13_osb.sh` script (which calls the `osb_in.sh` script that updates the `osb_out.sh` script with **your** hostname and then executes the `osb_out.sh` script).

The scripts create two virtual test libraries, some virtual test drives, insert volumes, and create a preauthorized `oracle` OSB user.

THESE VIRTUAL TEST DEVICES USED IN THIS PRACTICE ARE FOR TRAINING PURPOSES ONLY. THEY ARE NOT SUPPORTED FOR PRODUCTION USE.

The output is in the `/tmp/setup.log` file.

Optionally, review the `setup_13_osb.sh` file.

```
$ cat setup_13_osb.sh
#!/bin/bash
# -- DISCLAIMER:
# -- This script is provided for educational purposes only. It is
# -- NOT supported by Oracle World Wide Technical Support.
# -- The script has been tested and appears to work as intended.
# -- You should always run new scripts on a test instance initially.
#
# Run as oracle OS user
. $LABS/set_db.sh > /tmp/setup.log

if [ `whoami` != "oracle" ]; then
    echo "You are supposed to be logged on as oracle when running this script."
    exit
fi
x=`hostname --short`
echo $x >> /tmp/setup.log
```

```
sed 's/edrsr04p1/'$x'/' osb_in.sh > osb_out.sh

cat $LABS/osb_out.sh >> /tmp/setup.log
. $LABS/osb_out.sh

ls /u01 >> /tmp/setup.log

obtool --user admin --password oracle_4U mkuser --class oracle --
--password oracle_4U --unixname oracle --unixgroup dba --ndmpuser
no --preauth *:*:*+rman+cmdline oracle
echo "Created preauthorized OSB user oracle with password
oracle_4U" >> /tmp/setup.log

echo "OSB configuration script completed." >> /tmp/setup.log

$ ./setup_13_osb.sh
$
```

- With the obtool command line, review the elements that you just created.

Note: OSB commands are case-sensitive like Linux.

- Log in to obtool as the admin OSB user. As the preauthorized oracle user, you do not need to enter the password.

```
$ obtool
ob>
```

- View the RMAN-DEFAULT media family with the lsmf --long command.

```
ob> lsmf --long
OSB-CATALOG-MF:
  Write window:          7 days
  Keep volume set:      14 days
  Appendable:           yes
  Volume ID used:      unique to this media family
  Comment:              OSB catalog backup media family
  UUID:                 665c7896-68c0-1032-adf7-f04da20dee25

RMAN-DEFAULT:
  Keep volume set:      content manages reuse
  Appendable:           yes
  Volume ID used:      unique to this media family
  Comment:              Default RMAN backup media family
  UUID:                 65892996-68c0-1032-adf7-f04da20dee25
ob>
```

- c. View your currently configured devices with the `lsdev` command.

```
ob> lsdev
library          vlib           in service
  drive 1        vdte1          in service
  drive 2        vdte2          in service
  drive 3        vdte3          in service
  drive 4        vdte4          in service
library          vlib2          in service
  drive 1        vdrive1         in service
  drive 2        vdrive2         in service
ob>
```

- d. List the volumes inserted into the `vlib2` library with the `lsvol` command.

```
ob> lsvol -L vlib2
Inventory of library vlib2:
  in  1:          unlabeled, barcode
6b14594e68ca103a480f04da20dee25
  in  2:          unlabeled, barcode
6b23524668ca103a480f04da20dee25
  in  3:          unlabeled, barcode
6b32427e68ca103a480f04da20dee25
  in  4:          unlabeled, barcode
6b41354068ca103a480f04da20dee25
  in  5:          unlabeled, barcode
6b4ff3c868ca103a480f04da20dee25
  in  6:          unlabeled, barcode
6b5efd1e68ca103a480f04da20dee25
  in  7:          unlabeled, barcode
6b6dbdf468ca103a480f04da20dee25
  in  8:          unlabeled, barcode
6b7d05ac68ca103a480f04da20dee25
  in  9:          unlabeled, barcode
6b8b760068ca103a480f04da20dee25
  in 10:          unlabeled, barcode
6b9a247068ca103a480f04da20dee25
  in 11:          unlabeled, barcode
6ba909cc68ca103a480f04da20dee25
  in 12:          unlabeled, barcode
6bb7f0ae68ca103a480f04da20dee25
  in 13:          unlabeled, barcode
6bc6ccfa68ca103a480f04da20dee25
  in 14:          unlabeled, barcode
6bd5aedc68ca103a480f04da20dee25
ob>
```

- e. Exit the `obtool` utility.

```
ob> exit  
$
```

3. In the web tool, optionally explore the elements that you created and then configure a database backup storage selector. (*Step 5 following is mandatory.*)

Note: You could also have created this object with the `obtool` utility. The practice uses the graphic tool for learning purposes. The equivalent is true for the objects that you created in the previous step with `obtool` scripts: you could also have created them in the web tool.

- a. Log in to the web tool. The URL is: `https://<hostname>`.
- b. The first time you log in to the web tool you need to confirm the security exception. (Firefox: **I Understand the Risks > Add Exception > Confirm Security Exception**)
- c. Enter `admin` as **User Name** and `oracle_4U` as **Password**, and then click **Login**.

The screenshot shows the Oracle Secure Backup Login page. At the top, there is the Oracle logo and the text "SECURE BACKUP". Below that, the heading "Oracle Secure Backup Login" is displayed. There are two input fields: "User Name" containing "admin" and "Password" containing a masked value. A "Login" button is located below the password field. At the bottom of the page, there is a copyright notice: "Copyright © 1991, 2013, Oracle. All rights reserved. Unauthorized use of this site is prohibited and may be subject to civil and criminal prosecution."

- d. On your OSB home page, you can see jobs and their status from within the last 24 hours. The lower part of the page displays existing devices. Click **Preferences**.



The screenshot shows the Oracle Secure Backup interface. At the top, there's a navigation bar with links for Home, Configure, Manage, Backup, Restore, Help, Logout, Preferences (which is highlighted with a red box), and About. Below the navigation bar, there are four sections: Failed Jobs, Active Jobs, Pending Jobs, and Completed Jobs, each showing 0 jobs in the last 24 hours. A large red box highlights the 'Devices' section below. This section has a header 'Devices' and lists various storage components with columns for Type (DTE), Name, and State. All entries show 'device not in use'. At the bottom right of the page is a 'Refresh' button.

Devices			Hide device status
Type (DTE)	Name	State	
library	vlib	device not in use	
drive (1)	vdrive1	device not in use	
drive (2)	vdrive2	device not in use	
drive (3)	vdrive3	device not in use	
drive (4)	vdrive4	device not in use	
library	vlib2	device not in use	
drive (1)	vdrive1	device not in use	
drive (2)	vdrive2	device not in use	

- e. Select **On** for "Extended command output." Click **Apply**. Then click **Home**.



The screenshot shows the Preferences page. At the top, there's a navigation bar with links for Home, Configure, Manage, Backup, Restore, and a success message 'Success: options updated'. Below the navigation bar is a 'Preferences' heading. There's a '2 Apply' button at the top right. A red box highlights the 'Setting' column for the 'Extended command output' option. The table shows three settings: Extended command output (radio button selected for 'On'), Background timeout (24 hours), and Select table size (8 rows). At the bottom right of the page is a 'Cancel' button.

Option	Setting
Extended command output	<input checked="" type="radio"/> On <input type="radio"/> Off
Background timeout	24 hours
Select table size	8 rows

- f. Scroll to the bottom of the page. You see a new area which displays recent obtool commands and their status.

Extended Command Output	
Command	/usr/local/oracle/backup/.bin.linux86_64/obtool -gui -u 'admin' lsdaemon -long obscheduled
Status	Success: command completed without error.
Command	/usr/local/oracle/backup/.bin.linux86_64/obtool -gui -u 'admin' lsj -long -subjobs -active -type backup,restore,orabackup,orarestore,mediamovement,duplication -from 2014/12/17.10:14:59 -to 2014/12/18.10:14:59
Status	Success: command completed without error.
Command	/usr/local/oracle/backup/.bin.linux86_64/obtool -gui -u 'admin' lsj -long -subjobs -complete -type backup,restore,orabackup,orarestore,mediamovement,duplication -from 2014/12/17.10:14:59 -to 2014/12/18.10:14:59
Status	Success: command completed without error.
Command	/usr/local/oracle/backup/.bin.linux86_64/obtool -gui -u 'admin' lsj -long -subjobs -pending -type backup,restore,orabackup,orarestore,mediamovement,duplication -from 2014/12/17.10:14:59 -to 2014/12/18.10:14:59
Status	Success: command completed without error.
Command	/usr/local/oracle/backup/.bin.linux86_64/obtool -gui -u 'admin' lsdev -v
Status	Success: command completed without error.

4. Optionally, review the elements that were created for you. Click **Configure** and then click any element that interests you.

The screenshot shows the Oracle Secure Backup configuration interface. The top navigation bar has tabs: Home, Configure (which is selected and highlighted in blue), Manage, Backup, and Restore. Below this, under the 'Basic' tab, there is a list of configuration items: Users, Hosts, Devices, Media Families, Database Backup Storage Selectors, and Storage Selectors. The 'Hosts' link is currently selected and highlighted in orange.

- a. On the Configure: Hosts page, review the roles that you chose during the software installation. When you finished reviewing hosts, click Configure (either the tabbed page or the breadcrumb) to return to the Configure overview page.

The screenshot shows the 'Configure: Hosts' page. At the top, there is a toolbar with buttons for Help, Logout, Home, Configure (selected), Manage, Backup, and Restore. Below this, the page title is 'Configure: Hosts'. The main content is a table with the following data:

Host Name	Status	Roles
ED	P1 in service	admin, mediaserver, client

At the bottom of the table, there are buttons for Add, Edit, Remove, Rename, Update, and a checkbox for 'Suppress communication with host'. There are also buttons for Add, Edit, Remove, Rename, Update at the very bottom of the page.

- b. On the Configure: Devices page, review your library and tape drives that were created with obtool scripts. Optionally, select a device and ping it. Then return to the Configure overview page.

Configure: Devices

Type (DTE)	Status	Device Name
library	in service	vlib
drive (1)	in service	vdte1
drive (2)	in service	vdte2
drive (3)	in service	vdte3
drive (4)	in service	vdte4
library	in service	vlib2
drive (1)	in service	vdrive1
drive (2)	in service	vdrive2

Extended Command Output

Command	/usr/local/oracle/backup/.bin.linux86_64/obtool --gui -u 'admin' pingdev 'vdte2'
Status	Success: command completed without error.

- c. On the Configure: Media Families page, review the RMAN-DEFAULT media family that was created during the software installation. Return to the Configure overview page.

Configure: Media Families

Media Family Name	Write Window	Keep Volume Set
OSB-CATALOG-MF	7 days	14 days
RMAN-DEFAULT		content manages reuse

- d. On the Configure: Users page, select the oracle user and click **Edit**.

Configure: Users

User Name	Class	Email Address
admin	admin	[none]
oracle	oracle	[none]

You see the page where the oracle OS user is mapped to the oracle OSB user.

Configure: Users > oracle

User oracle	
User class:	oracle
Given name:	
UNIX name:	oracle
UNIX group:	dba
NDMP server user:	no
Email address:	

- e. Click **Preauthorized Access**.

Configure: Users > oracle > Preauthorized Access

Host	Username	Windows Domain	Attributes
*	*	rman, cmdline	

Hosts: all hosts Use * or leave blank to select all users
OS username: Windows domain name: Use * or leave blank to select all Windows domains
Attributes: cmdline rman

You see that the oracle user is preauthorized for both command line (cmdline) and rman operations.

- f. When you are finished reviewing the oracle OSB user, click **Configure** in the top-left.

5. Navigate to **Configure > Database Backup Storage Selectors**, click **Add** and configure a database backup storage selector as shown in the screenshot.

Note: You must click the host name for the Apply to work.

- Click **Apply**. (You should see a success message.)

Scroll to the bottom of the page and review the `obtool` command.

Extended Command Output	
Command	/usr/local/oracle/backup/.bin.linux86_64/obtool --gui -u "admin" mkssel --content "*" --dbname 'orcl' --host 'edrsr39p1' -f 'RMAN-DEFAULT' --copynum '*' --encryption 'off' --restrict "" --waittime forever 'my_ssel'
Status	Success: command completed without error.

- Return to the OSB Home page, but do not exit the web tool.

6. Switch to a terminal window. Log in to the RMAN client in the `SYSBACKUP` role and configure a channel for backing up to tape. Either enter the command on one line or use `run { ... }` to configure your channel.

```
$ rman target ''/ as sysbackup''
```

```
RMAN> CONFIGURE CHANNEL DEVICE TYPE 'SBT_TAPE' PARMS
'ENV=(OB_DEVICE=vdrive1)';
```

```
using target database control file instead of recovery catalog
new RMAN configuration parameters:
CONFIGURE CHANNEL DEVICE TYPE 'SBT_TAPE' PARMS
'ENV=(OB_DEVICE=vdrive1)';
new RMAN configuration parameters are successfully stored
RMAN>
```

7. Optionally, review all parameters and note the ones about SBT_TAPE that were created as part of your channel configuration.

```
RMAN> show all;
RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
CONFIGURE BACKUP OPTIMIZATION OFF; # default
CONFIGURE DEFAULT DEVICE TYPE TO DISK; # default
CONFIGURE CONTROLFILE AUTOBACKUP ON;
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO
'%F'; # default
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE SBT_TAPE
TO '%F'; # default
CONFIGURE DEVICE TYPE DISK PARALLELISM 1 BACKUP TYPE TO
BACKUPSET; # default
CONFIGURE DEVICE TYPE SBT_TAPE PARALLELISM 1 BACKUP TYPE TO
BACKUPSET; # default
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 'SBT_TAPE' PARMS
'ENV=(OB_DEVICE=vdrive1)';
CONFIGURE MAXSETSIZE TO UNLIMITED; # default
CONFIGURE ENCRYPTION FOR DATABASE OFF; # default
CONFIGURE ENCRYPTION ALGORITHM 'AES128'; # default
CONFIGURE COMPRESSION ALGORITHM 'BASIC' AS OF RELEASE 'DEFAULT'
OPTIMIZE FOR LOAD TRUE ; # default
CONFIGURE RMAN OUTPUT TO KEEP FOR 7 DAYS; # default
CONFIGURE ARCHIVELOG DELETION POLICY TO NONE; # default
CONFIGURE SNAPSHOT CONTROLFILE NAME TO
'/u01/app/oracle/product/12.1.0/dbhome_1/dbs/snapcf_orcl.f'; # default
RMAN>
```

8. In RMAN, perform a backup of the USERS tablespace to the device type of tape.

```
RMAN> backup device type SBT_TAPE tablespace users;
Starting backup at 2014-12-18:14:17:56
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=39 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: Oracle Secure Backup
channel ORA_SBT_TAPE_1: starting full datafile backup set
channel ORA_SBT_TAPE_1: specifying datafile(s) in backup set
input datafile file number=00006
name=/u01/app/oracle/oradata/orcl/users01.dbf
channel ORA_SBT_TAPE_1: starting piece 1 at 2014-12-18:14:17:56
channel ORA_SBT_TAPE_1: finished piece 1 at 2014-12-18:14:18:21
piece handle=3fpqfrgk_1_1 tag=TAG20141218T141756 comment=API
Version 2.0,MMS Version 10.4.0.3
channel ORA_SBT_TAPE_1: backup set complete, elapsed time:
00:00:25
Finished backup at 2014-12-18:14:18:21

Starting Control File and SPFILE Autobackup at 2014-12-
18:14:18:21
piece handle=c-1393010434-20141218-03 comment=API Version
2.0,MMS Version 10.4.0.3
Finished Control File and SPFILE Autobackup at 2014-12-
18:14:18:46
RMAN>
```

9. Review your tape backups in RMAN, and then exit.

```
RMAN> list backup device type SBT_TAPE;

List of Backup Sets
=====

BS Key  Type LV Size          Device Type Elapsed Time Completion
Time
----- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
79      Full   1.63M          SBT_TAPE    00:00:16    2014-12-
18:14:18:12
          BP Key: 79     Status: AVAILABLE  Compressed: NO    Tag:
TAG20141218T141756
          Handle: 3fpqfrgk_1_1   Media: RMAN-DEFAULT-000001
List of Datafiles in backup set 79
File LV Type Ckp SCN      Ckp Time           Name
----- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
6        Full 4301029    2014-12-18:14:17:56
/u01/app/oracle/oradata/orcl/users01.dbf
```

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```

BS Key Type LV Size           Device Type Elapsed Time Completion
Time

-----
-----
80      Full    9.81M        SBT_TAPE     00:00:17      2014-12-
18:14:18:38
          BP Key: 80      Status: AVAILABLE  Compressed: NO   Tag:
TAG20141218T141821
          Handle: c-1393010434-20141218-03  Media: RMAN-DEFAULT-
000001
          SPFILE Included: Modification time: 2014-12-18:12:01:07
          SPFILE db_unique_name: ORCL
          Control File Included: Ckp SCN: 4301046      Ckp time: 2014-
12-18:14:18:21

RMAN>
RMAN> exit
$
```

Note: The device type is SBT_TAPE, the backups are stored on volume 000001; the first backup contains the data file, the second the SPFILE and the control file.

10. Return to the web tool and refresh the page, and then click **Show completed jobs**.

Failed Jobs					0 jobs in the last 24 hours	Page Refreshed Thu Dec 18, 2014, 2:21 pm UTC
ID	Type	Level	Scheduled time	Status	Hide failed jobs	
Active Jobs						
ID	Type	Level	Scheduled time	Status	Hide active jobs	
Pending Jobs						
ID	Type	Level	Scheduled time	Status	Hide pending jobs	
Completed Jobs						
ID	Type	Level	Scheduled time	Status	Hide completed jobs	
oracle1_1	datafile backup	n/a	immediate	completed successfully at 2014/12/18.14:18		
oracle2_1	controlfile autobackup	n/a	immediate	completed successfully at 2014/12/18.14:18		

11. Optionally, view the jobs in the obtool with the lsj command.

```
$ obtool
ob> lsj -A
Job ID          Sched time  Contents
State
-----
oracle/1        none       database orcl (dbid=1393010434)
completed successfully at 2014/12/18.14:18
oracle/1.1      none       datafile backup
completed successfully at 2014/12/18.14:18
oracle/2        none       database orcl (dbid=1393010434)
completed successfully at 2014/12/18.14:18
oracle/2.1      none       controlfile autobackup
completed successfully at 2014/12/18.14:18
ob>
```

The output should show the successful completion for a datafile backup and controlfile autobackup.

12. Exit all windows and tools.

Practices for Lesson 14: Using Flashback Technologies

Chapter 14

Practices for Lesson 14: Overview

Practices Overview

In these practices, you will configure your database for the use of flashback technologies. You will then use flashback technologies to restore a dropped table and reverse the actions of a transaction.

Practice 14-1: Preparing to Use Flashback Technologies

Overview

In this practice, you will configure the database to use the flashback transaction and flashback table features.

Assumptions

You have two terminal windows open and are logged in as the oracle OS user. \$LABS is the current directory. Environment variables are set for the orcl instance.

Tasks

- Determine how far the undo data will allow you to flash back transactions in the current database. The V\$UNDOSTAT view contains up to 4 days of statistics, over each 10-minute interval. The first row contains the current (partial) time period statistics. (*Your value may be different.*)

```
$ sqlplus / as sysdba

SQL> select tuned_undoretention from v$undostat where rownum =
1;

TUNED_UNDORETENTION
-----
1760

SQL>
```

Question: What does the value of TUNED_UNDORETENTION time represent?

Answer: The number of seconds the data is being retained in the database at any given time. Undo retention is not guaranteed by default. If the system needs more space, the Oracle database can overwrite unexpired undo with more recently generated undo data

- Set the UNDO_RETENTION parameter and RETENTION GUARANTEE clause on the undo tablespace to guarantee retention for 24 hours. Change the properties of the tablespace so you will not run out of space in the tablespace.
 - Change the UNDO_RETENTION parameter to 14400 seconds (4 hours).

Note: Increasing the value of UNDO_RETENTION to more than a few days can cause unreasonable growth of the undo tablespace.

```
SQL> ALTER SYSTEM SET UNDO_RETENTION = 14400 SCOPE=BOTH;
System altered.

SQL>
```

- b. Find the name of the undo tablespace.

```
SQL> SHOW PARAMETER UNDO
```

NAME	TYPE	VALUE
temp_undo_enabled	boolean	FALSE
undo_management	string	AUTO
undo_retention	integer	14400
undo_tablespace	string	UNDOTBS1

- c. Change the RETENTION GUARANTEE value of the undo tablespace.

```
SQL> ALTER TABLESPACE UNDOTBS1 RETENTION GUARANTEE;
Tablespace altered.
SQL>
```

- d. Find the names of the data files associated with the UNDOTBS1 tablespace. Note the FILE_ID value _____.

```
SQL> select file_name, file_id from dba_data_files where
tablespace_name = 'UNDOTBS1';

FILE_NAME                                FILE_ID
-----
/u01/app/oracle/oradata/orcl/undotbs01.dbf      4
SQL>
```

- e. Configure the undo tablespace data file to automatically extend if more space is needed to keep unexpired undo and active undo records. Use your own FILE_ID value.

```
SQL> ALTER DATABASE DATAFILE 4 AUTOEXTEND ON MAXSIZE UNLIMITED;
Database altered.
SQL>
```

Question: What happens if undo retention is guaranteed and no more space is available for active undo records (either because the undo tablespace has filled, reached the maximum size, or there is no more space left on the storage device [disk])?

Answer: Transactions fail due to lack of space in the undo tablespace.

3. View the value of the RECYCLEBIN parameter, then exit SQL*Plus.
Note: ON is the default value.

```
SQL> show parameter recyclebin
```

NAME	TYPE	VALUE
recyclebin	string	on

```
SQL> exit
```

4. Optionally, view your modified settings in EM Express.

a. Logged in as the SYS user and SYSDBA privileges, navigate from the orcl database home page: **Configuration > Initialization Parameters**.

b. On the Current tabbed page, enter UNDO. You see the same values as in step 2b.

Name	Value	Comment	Modifi...	Dyn...	Sess...	Basic	Type	Category	Desc...	
temp_undo_enabled	false					✓	✓	Bool...	Undo Management	is te...
undo_management	AUTO							String	Undo Management	instan...
undo_retention	14400					✓	✓	Integ...	Undo Management	undo ...
undo_tablespace	UNDOTBS1					✓	✓	String	Undo Management	use/s...

c. If you want to change an initialization parameter, you can select the parameter, click **Set**, and enter the desired values. At this point, you do not want to change any values so click **Cancel**.

- d. You can enter `recyclebin` in the search field to see the same value as shown in step 3.
- e. To view the current values of the `UNDOTBS1` tablespace, navigate to: **Storage > Tablespaces**.

Tablespaces

Page Refreshed 10:00:14 AM GMT

Name	Size	Free Space	Used (%)	Auto...	Ma...	Status	Type	Grou...	Auto...	Directory
EXAMPLE	1GB	25MB	98	✓	Unlim	●	File		✓	/u01/app/oracl...
SYSAUX	910MB	73MB	92	✓	Unlim	●	File		✓	/u01/app/oracl...
SYSTEM	810MB	3MB	99.6	✓	Unlim	●	File			/u01/app/oracl...
TEMP	60MB	58MB	3.3	✓	Unlim	●	File			/u01/app/oracl...
UNDOTBS1	150MB	135MB	10.2	✓	Unlim	●	File			/u01/app/oracl...
USERS	5MB	3MB	33.8	✓	Unlim	●	File		✓	/u01/app/oracl...

Note: You see that the tablespace is unlimited, as configured in step 2e. Your numeric values may be different.

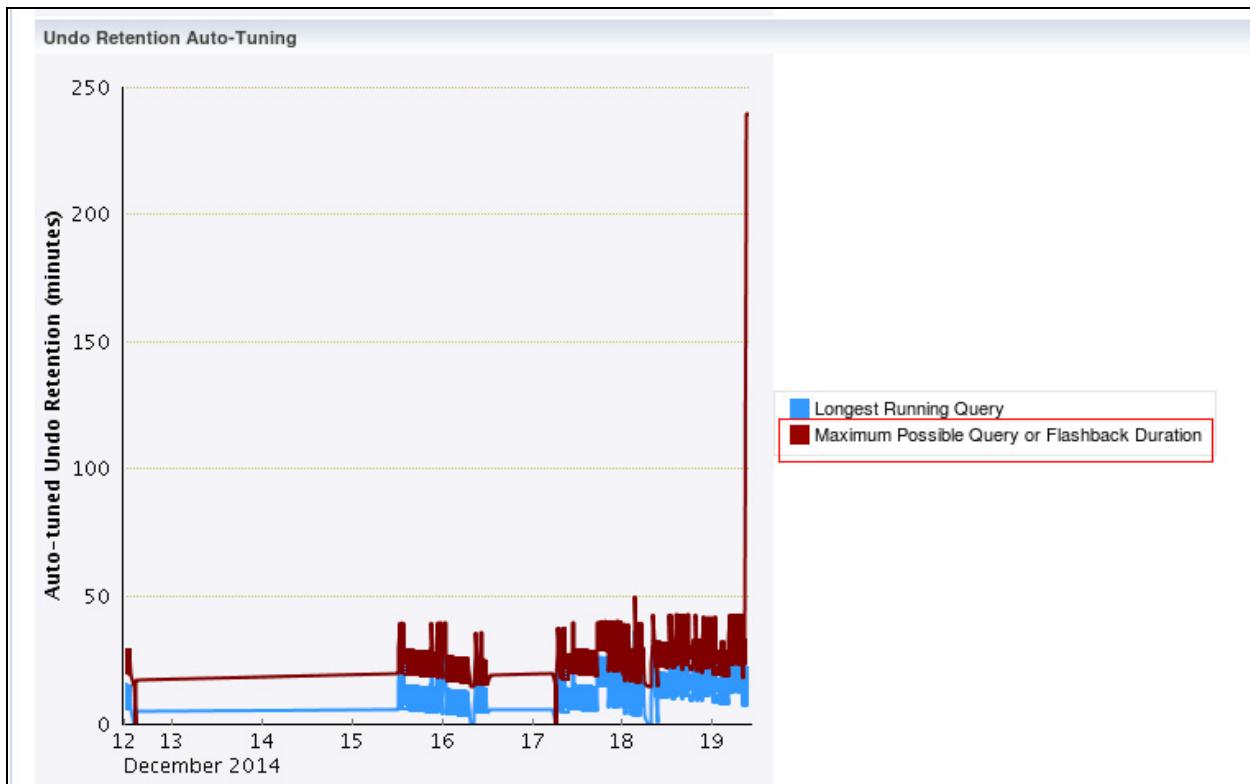
- f. Return to the Database Home page by clicking **ORCL (12.1.0.2.0)**.
 - g. Log out of Enterprise Manager Database Express.
5. Optionally, view your modified settings in Enterprise Manager Cloud Control.
- a. Logged in as the `SYSMAN` user, navigate from the `orcl` database home page: **Administration > Initialization Parameters > Current** (tabbed page). Enter `UNDO` in the Name field and click **Go**. You see the same values as in step 2b and 4b.
 - b. Enter `recyclebin` in the Name field and click **Go**. You see the same value as shown in step 3 and 4d.
 - c. Navigate to **Administration > Storage > Automatic Undo Management** and explore the General and System Activity pages including their graphs.

Automatic Undo Management

In the General tab, you can view the current undo settings for your instance and use the Undo Advisor to analyze the undo tablespace requirements. This analysis can be performed based on the specified analysis period or the desired undo retention. The system activity for the specified time period can be viewed in the System Activity tab.

General	System Activity
Undo Retention Settings <p>Undo Retention (minutes) 240 Retention Guarantee Yes</p>	Undo Tablespace for this Instance <p>Tablespace UNDOTBS1 Change Tablespace Size (MB) 150 Auto-Extensible Yes</p>
Undo Advisor: Undo Retention and Undo Tablespace Sizing Advice <p>Undo retention is the length of time that undo data is retained in the undo tablespaces. Undo data must be retained for the length of the longest running query, the longest running transaction, and the longest flashback duration (except for Flashback Database). The undo tablespace should be sized large enough to hold the undo generated by the database during the undo retention period. Note that the undo retention parameter is also used as the retention value for LOB columns.</p>	
Analysis Period <p>Analysis Time Period Last Seven Days Desired Undo Retention <input checked="" type="radio"/> Automatically chosen based on longest query in analysis period <input type="radio"/> Specified manually to allow for longer duration queries or flashback Duration 240 minutes Run Analysis</p>	

- d. Find the graph on the System Activity page that shows the *Maximum Possible Query or Flashback Duration*.



- e. Log out of Enterprise Manager Cloud Control.

Practice 14-2: Restoring a Dropped Table

Overview

In this practice, you will recover a table that has been dropped.

Assumptions

The RECYCLEBIN parameter is set to ON (which you confirmed in the previous practice).

You have two terminal windows open and are logged in as the oracle OS user. \$LABS is the current directory. Environment variables are set for the orcl instance.

Tasks

1. Execute the `setup_14_02.sh` script to create the practice environment. The output is in the `/tmp/setup.log` file.

```
$ ./setup_14_02.sh  
$
```

2. Execute the `break_14_02.sh` script to simulate work done by a developer. The output is in the `/tmp/break.log` file.

```
$ ./break_14_02.sh  
$
```

3. A developer (with the BAR Oracle user account) comes to you and asks you to restore a table that was dropped. He explains there were several iterations of this table but the one he needs was named BAR102 in the BAR schema. It should have 12 columns, one of which was named LOCATION_ID. There is currently a BAR102 table in the BAR schema. Restore the requested table to BAR102A.

- a. Attempt to use the `SHOW RECYCLEBIN` command to view the contents of the recycle bin.

```
$ sqlplus / as sysdba  
SQL> show recyclebin  
SQL>  
ORIGINAL NAME      RECYCLEBIN NAME          OBJECT TYPE  
DROP TIME  
-----  
-----  
WRI$_RCS_270_1    BIN$CkllZ/ktNOjgU48juYsHCA==$0      TABLE  
2014-12-15:22:02:18  
WRI$_RCS_270_1    BIN$CfjtGl8XToXgU48juYvr1g==$0      TABLE  
2014-12-11:22:02:03  
WRI$_RCS_279_1    BIN$CeTQkxycEQXgU48juYuO/g==$0      TABLE  
2014-12-10:22:02:25  
WRI$_RCS_281_1    BIN$CdC1XW1XUDHgU48juYvOkA==$0      TABLE  
2014-12-09:22:03:09
```

```

WRI$_RCS_30_1    BIN$CUP7/LsbIu/gU48juYsGtQ==$0      TABLE
2014-12-02:22:09:43

WRI$_RCS_35_1    BIN$CnGfIydnG8HgU48juYtFQQ==$0      TABLE
2014-12-17:22:01:46

WRI$_RCS_37_1    BIN$CoW+DtpTZs3gU48juYsmGw==$0      TABLE
2014-12-18:22:02:04

WRI$_RCS_41_1    BIN$CVf9y6xlVrLgU48juYsLEQ==$0      TABLE
2014-12-03:22:01:53

SQL>

```

Note: The SHOW RECYCLEBIN command shows only those objects that belong to the **current** user. Because you are the DBA and do not know the password for the BAR user, the SHOW RECYCLEBIN command does not show the dropped tables you are interested in restoring.

- Examine the objects in the dba_recyclebin view. Optionally, change the SQL*Plus page size to 99 lines.

```

SQL> set pages 99
SQL> select original_name, object_name, droptime
  from dba_recyclebin
 where owner = 'BAR';
 2      3
ORIGINAL_NAME OBJECT_NAME                      DROPTIME
-----
BAR101      BIN$CpAWzw2VDS3gU48juYsdeA==$0 2014-12-19:10:22:43
BAR102      BIN$CpAWzw2QDs3gU48juYsdeA==$0 2014-12-19:10:22:43
BAR102      BIN$CpAWzw2LDs3gU48juYsdeA==$0 2014-12-19:10:22:42
SQL>

```

Note: Above you see the same object dropped twice at different points in time. With the time stamp, you determine which version of the table you really want to restore.

- Determine which object contains the column of interest. **Your** object names will be different. **Use your own values.**

Note: The object name from the recycle bin must be in double quotes because it may contain special characters.

```

SQL> select location_id
  from BAR."BIN$CpAWzw2QDs3gU48juYsdeA==$0"
 where rownum = 1;
 2      3  select location_id
 *
LOCATION_ID
-----
SQL> select location_id
  from BAR."BIN$CpAWzw2LDs3gU48juYsdeA==$0"
 where rownum = 1;
 2      3

```

```
*  
ERROR at line 1:  
ORA-00904: "LOCATION_ID": invalid identifier  
SQL>
```

- d. Restore the object that has the correct columns.

```
SQL> FLASHBACK TABLE BAR."BIN$CpAwzw2QDs3gU48juYsdeA==$0" TO  
BEFORE DROP RENAME TO BAR102A;  
  
Flashback complete.  
SQL>
```

4. Confirm that the BAR.BAR102A table has been restored by selecting the first row. (*It does not matter which row appears, just that there is one row.*) Then exit.

```
SQL> select * from BAR.BAR102A where rownum = 1;  
  
EMPLOYEE_ID FIRST_NAME LAST_NAME  
-----  
EMAIL PHONE_NUMBER HIRE_DATE JOB_ID  
-----  
SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID LOCATION_ID  
-----  
100 Steven King  
SKING 515.123.4567 2003-06-17:00:00:00  
AD_PRES  
24001 90  
  
SQL> exit  
$
```

5. Clean up this practice environment by using the cleanup_14_02.sh script.

Note: This script uses the PURGE DBA_RECYCLEBIN command to remove all objects from the recycle bin. The output is in the /tmp/cleanup.log file.

```
$ ./cleanup_14_02.sh  
$
```

Practice 14-3: Using Flashback Table

Overview

In this practice, you will use flashback table to reverse a rogue transaction.

Assumptions

Practice 14-1 has been completed.

You have two terminal windows open and are logged in as the oracle OS user. \$LABS is the current directory. Environment variables are set for the orcl instance.

Tasks

1. Execute the `setup_14_03.sh` script to create the user and tables used in this practice. The tables have a foreign-key relationship. The output is in the `/tmp/setup.log` file.

```
$ ./setup_14_03.sh  
$
```

2. Determine the current time to the nearest second. Record this as T1: _____

Note: The format of `SYSDATE` is not the default format. The format has been altered by the `NLS_DATE_FORMAT` environment variable that was set in the Practice titled "Setting the Date and Time Format for RMAN."

```
$ sqlplus / as sysdba  
  
SQL> select sysdate from dual;  
  
SYSDATE  
-----  
2014-12-19 10:48:47  
SQL>
```

3. In another terminal window, execute the `break_14_03.sh` script. This simulates a rogue transaction that scrambles the data in the BARCOPY and BARDEPT tables. There is a foreign key constraint between BARCOPY and BARDEPT. The output is in the `/tmp/break.log` file.

```
$ ./break_14_03.sh  
$
```

4. The HR representative reports that an employee has incorrectly changed the names of the departments, and scrambled which employees are assigned to which departments. The tables were correct at time T1 and no authorized changes have been made since that time. The tables involved are BAR.BARCOPY and BAR.DEPT. Restore the tables to the state they were at T1. **You must use your own T1 values.**

Because there is a foreign key relationship, both tables must be restored. (Continue in your SQL*Plus session.)

```
SQL> ALTER TABLE BAR.BARDEPT ENABLE ROW MOVEMENT;  
Table altered.
```

```
SQL> ALTER TABLE BAR.BARCOPY ENABLE ROW MOVEMENT;
Table altered.

SQL> FLASHBACK TABLE BAR.BARDEPT TO TIMESTAMP
TO_TIMESTAMP('2014-12-19:10:48:47', 'YYYY-MM-DD:HH24:MI:SS');

Flashback complete.

SQL> FLASHBACK TABLE BAR.BARCOPY TO TIMESTAMP
TO_TIMESTAMP('2014-12-19:10:48:47', 'YYYY-MM-DD:HH24:MI:SS');

Flashback complete.

SQL>
```

5. Check that you have correctly restored the tables. The results of the following query should match yours, although the row order may be different. Then exit SQL*Plus.

```
SQL> @check_14_03.sql

DEPARTMENT_ID DEPARTMENT_NAME          COUNT (*)
-----
100 Finance           24
50 Shipping            180
70 Public Relations     4
90 Executive           12
30 Purchasing          24
10 Administration        4
110 Accounting          8
40 Human Resources      4
20 Marketing             8
60 IT                  20
80 Sales                136

11 rows selected.

SQL> exit
```

6. Clean up the practice environment by running the cleanup_14_03.sh script.

```
$ ./cleanup_14_03.sh
$
```

7. In preparation for the next practice, back up your `orcl` database, remove obsolete backups, and ensure that no failures are listed. Then exit from RMAN.

```
$ rman target ''/ as sysbackup"  
RMAN> BACKUP DATABASE PLUS ARCHIVELOG DELETE INPUT;  
...  
RMAN> delete noprompt obsolete;  
...  
RMAN> list failure;  
  
Database Role: PRIMARY  
  
no failures found that match specification  
  
RMAN> exit  
$
```


Practices for Lesson 15: Flashback Database

Chapter 15

Practices for Lesson 15: Overview

Practices Overview

In these practices, you will enable flashback logging and perform flashback database.

Practice 15-1: Enabling Flashback Logging

Overview

In this practice, you will enable flashback logging.

Assumptions

You have two terminal windows open and are logged in as the oracle OS user. \$LABS is the current directory. Environment variables are pointing to the orcl instance.

Tasks

1. Log in to SQL*Plus and determine whether flashback logging is enabled.

```
$ sqlplus / as sysdba
SQL> SELECT flashback_on FROM v$database;

FLASHBACK_ON
-----
NO
SQL>
```

2. Create a guaranteed restore point and check your current FLASHBACK_ON status.

Note that guaranteed restore points affect your space usage.

```
SQL> CREATE RESTORE POINT rp1 GUARANTEE FLASHBACK DATABASE;
Restore point created.

SQL> SELECT FLASHBACK_ON FROM V$DATABASE;

FLASHBACK_ON
-----
RESTORE POINT ONLY
SQL>
```

3. Enable flashback logging with a tool of your choice.

```
SQL> ALTER DATABASE FLASHBACK ON;
Database altered.
SQL>
```

Question: Which other tool could you have used to enable flashback logging for the database?

Possible answer: Enterprise Manager Cloud Control

Question: What are the navigational steps for Enterprise Manager Cloud Control?

Possible answer: Availability > Backup & Recovery > Recovery Settings.

4. Verify that flashback logging has been enabled.

```
SQL> SELECT FLASHBACK_ON FROM V$DATABASE;  
  
FLASHBACK_ON  
-----  
YES  
SQL>
```

Practice 15-2: Performing Flashback Database

Overview

In this practice you will flash back your database after some incorrect updates to the database. *This practice is for learning purposes. If you had a scenario similar to this in a production environment, you would probably choose a different solution to limit your flashback to the affected objects, rather than choose a flashback of the entire database.*

Assumptions

You have completed practice 15-1.

You have two terminal windows open and are logged in as the oracle OS user. \$LABS is the current directory. Environment variables are set for the orcl instance.

Tasks

- There are several ways in which you can perform a flashback database operation. You can use a guaranteed restore point, SCN, time value, threads, and so on. This example uses the SCN, but you could also use the RP1 restore point you created in the previous practice.

Determine your current SCN. It is _____. *You will need to use it in a later practice step.*

```
SQL> SELECT current_scn FROM v$database;  
  
CURRENT_SCN  
-----  
4368114  
SQL>
```

- View HR data. You will use this information for comparison during this practice.

- Determine the sum of the SALARY column in the HR.EMPLOYEES table.

```
SQL> SELECT sum(salary) FROM hr.employees;  
SUM(SALARY)  
-----  
691416  
SQL>
```

- Determine the total number of employees in department 90.

```
SQL> SELECT count(*) FROM hr.employees where department_id=90;  
COUNT(*)  
-----  
3  
SQL>
```

3. Execute the `lab_15_02_03.sql` script to update tables in the `HR` schema. It creates issues from which you will “recover” by flashing back the database in this practice.

```
SQL> @lab_15_02_03.sql
SQL> update hr.employees
  2  set department_id = 90
  3  where job_id = 'IT_PROG'
  4  /
5 rows updated.

SQL> update hr.employees e
  2  set salary = least(e.salary,
  3    (select (min_salary + max_salary)/2 * 1.10
  4     from hr.jobs j
  5    where j.job_id = e.job_id))
  6  where job_id not like 'AD_%'
  7  /
103 rows updated.

SQL>
```

4. Commit your data and determine the current SCN.

```
SQL> COMMIT;
Commit complete.
SQL> SELECT current_scn FROM v$database;

CURRENT_SCN
-----
4368295
SQL>
```

5. Query the data in the `HR` schema again and compare the results to the values you received in the queries in step 2.

- a. Determine the sum of the `SALARY` column in the `HR.EMPLOYEES` table.

```
SQL> SELECT sum(salary) FROM hr.employees;

SUM(SALARY)
-----
679092.4
SQL>
```

- b. Determine the total number of employees in department 90.

```
SQL> SELECT count(*) FROM hr.employees where department_id=90;
   COUNT (*)
-----
          8
SQL>
```

6. You need to restore the database so that the data is as it was when you started this practice. For training purposes, use Flashback Database for this operation.

Question: In which state must the database be for a flashback database operation?

Possible answer: The database must be mounted.

- a. Shut down the database instance and start it in MOUNT mode.

```
SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.

SQL> startup mount
ORACLE instance started.

Total System Global Area  536870912 bytes
Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers              247463936 bytes
Redo Buffers                   5459968 bytes
Database mounted.

SQL> exit
$
```

- b. Log in to RMAN and use the FLASHBACK DATABASE command to flash back the database to the SCN you noted in step 1. Exit RMAN.

```
$ rman target '' as sysbackup" nocatalog

RMAN> flashback database to scn=4368114; (Enter your SCN number)

Starting flashback at 2014-12-19:11:34:40
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=248 device type=DISK
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=13 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: Oracle Secure Backup
```

```
starting media recovery
media recovery complete, elapsed time: 00:00:03

Finished flashback at 2014-12-19:11:34:44

RMAN> exit
```

- c. Verify that the database was flashed back correctly by querying the HR.EMPLOYEES table again. The values should match the values you obtained in the queries in step 2.

```
$ sqlplus / as sysdba

SQL> alter database open read only;
Database altered.

SQL> SELECT sum(salary) FROM hr.employees;
SUM(SALARY)
-----
691416

SQL> SELECT count(*) FROM hr.employees where department_id=90;

COUNT(*)
-----
3
SQL>
```

- d. After you verified that you flashed back to the desired state, open the database for read/write operations.

```
SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.

SQL> startup mount
ORACLE instance started.

Total System Global Area  536870912 bytes
Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers              247463936 bytes
Redo Buffers                  5459968 bytes
Database mounted.

SQL> alter database open resetlogs;
```

```
Database altered.  
SQL>
```

7. Disable flashback logging.

```
SQL> ALTER DATABASE FLASHBACK OFF;  
Database altered.  
SQL>
```

8. Drop the RP1 guaranteed restore point. Then exit SQL*Plus.

```
SQL> DROP RESTORE POINT rp1;  
Restore point dropped.  
SQL> exit  
$
```


Practices for Lesson 16: Transporting Data

Chapter 16

Practices for Lesson 16: Overview

Practices Overview

In these practices, you will transport a tablespace. You will also perform the steps that it takes to transport a tablespace from one platform to another (although in the training environment each student has access to one host, not several).

Practice 16-1: Transporting a Tablespace

Overview

In this practice, you will transfer a tablespace with all the steps that it would take to transfer it across different platforms (although in your training environment you are using only one host on one platform).

Assumptions

Two terminal windows are open. \$LABS is the current directory. ORCL is your source database, RCAT your destination database. The practice indicates when it is necessary to switch environment variables.

Tasks

1. Set up for this practice by executing the `setup_16_01.sh` script from the \$LABS directory. In this script:

- A new tablespace and user are created.
- The user creates a table and populates it.
- The output is in the `/tmp/setup.log` file.

```
$ . oraenv
ORACLE_SID = [oracle] ? orcl
The Oracle base has been set to /u01/app/oracle
$ ./setup_16_01.sh
$
```

2. Start a SQL*Plus session on your ORCL source database and verify the prerequisites for transporting a tablespace across platforms.

- a. Log in as the `SYS` user and verify that the source database is in read-write mode.

```
$ sqlplus / as sysdba

SQL> SELECT NAME, LOG_MODE, OPEN_MODE, CURRENT_SCN FROM
V$DATABASE;

NAME        LOG_MODE        OPEN_MODE          CURRENT_SCN
-----      -----          -----            -----
ORCL        ARCHIVELOG     READ WRITE        4371530
SQL>
```

- b. For performing cross-platform tablespace transport, you must know the exact name of the destination platform to which you are transporting data.

```
SQL> col platform_name format a30

SQL> SELECT PLATFORM_ID, PLATFORM_NAME, ENDIAN_FORMAT
FROM V$TRANSPORTABLE_PLATFORM
WHERE UPPER(PLATFORM_NAME) LIKE '%LINUX%';
```

PLATFORM_ID	PLATFORM_NAME	ENDIAN_FORMAT
10	Linux IA (32-bit)	Little
11	Linux IA (64-bit)	Little
9	IBM zSeries Based Linux	Big
13	Linux x86 64-bit	Little
18	IBM Power Based Linux	Big

SQL>

- Make the BARTBS tablespace read-only. This is required for the export of the tablespace metadata. Then exit.

```
SQL> ALTER TABLESPACE bartbs READ ONLY;
Tablespace altered.

SQL> exit
$
```

- Start an RMAN session and connect to your ORCL source database as the target instance.

```
$ . oraenv
ORACLE_SID = [orcl] ?
The Oracle base remains unchanged with value /u01/app/oracle
$ rman target ''/ as sysbackup''
RMAN>
```

- Back up the source tablespace by using the BACKUP command with TO PLATFORM clause. Use the DATAPUMP clause to indicate that an export dump file for the tablespaces must be created for the tablespace metadata.

```
RMAN> BACKUP TO PLATFORM 'Linux x86 64-bit' FORMAT
'/u01/backup/test.bck' DATAPUMP FORMAT '/u01/backup/test.dmp'
TABLESPACE bartbs;

Starting backup at 2014-12-19:12:21:54
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=240 device type=DISK
Running TRANSPORT_SET_CHECK on specified tablespaces
TRANSPORT_SET_CHECK completed successfully

Performing export of metadata for specified tablespaces...
EXPDP> Starting "SYSBACKUP"."TRANSPORT_EXP_ORCL_ykfv":
EXPDP> Processing object type TRANSPORTABLE_EXPORT/PLUGTS_BLK
EXPDP> Processing object type TRANSPORTABLE_EXPORT/TABLE
EXPDP> Processing object type
TRANSPORTABLE_EXPORT/TABLE_STATISTICS
```

```
EXPDP> Processing object type
TRANSPORTABLE_EXPORT/STATISTICS/MARKER
EXPDP> Processing object type
TRANSPORTABLE_EXPORT/POST_INSTANCE/PLUGTS_BLK
EXPDP> Master table "SYSBACKUP"."TRANSPORT_EXP_ORCL_ykfv"
successfully loaded/unloaded
EXPDP>
*****
EXPDP> Dump file set for SYSBACKUP.TRANSPORT_EXP_ORCL_ykfv
is:
EXPDP>
/u01/app/oracle/product/12.1.0/dbhome_1/dbs/backup_tts_ORCL_9432
9.dmp
EXPDP>
*****
EXPDP> Datafiles required for transportable tablespace
BARTBS:
EXPDP> /u01/backup/orcl/bartbs.dbf
EXPDP> Job "SYSBACKUP"."TRANSPORT_EXP_ORCL_ykfv" successfully
completed at Fri Dec 19 12:23:22 2014 elapsed 0 00:01:18
Export completed

channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00002
name=/u01/backup/orcl/bartbs.dbf
channel ORA_DISK_1: starting piece 1 at 2014-12-19:12:23:26
channel ORA_DISK_1: finished piece 1 at 2014-12-19:12:23:27
piece handle=/u01/backup/test.bck tag=TAG20141219T122155
comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
channel ORA_DISK_1: starting full datafile backup set
input Data Pump dump
file=/u01/app/oracle/product/12.1.0/dbhome_1/dbs/backup_tts_ORCL_
94329.dmp
channel ORA_DISK_1: starting piece 1 at 2014-12-19:12:23:27
channel ORA_DISK_1: finished piece 1 at 2014-12-19:12:23:28
piece handle=/u01/backup/test.dmp tag=TAG20141219T122155
comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 2014-12-19:12:23:28

RMAN>
```

- Allow read-write operations on the BARTBS tablespace. Then exit RMAN.

```
RMAN> alter tablespace bartbs READ WRITE;
Statement processed

RMAN> exit
$
```

Note: Normally, after you disconnected from the source database, you move the backup sets and the Data Pump export dump file to the destination host with operating system utilities. *In this training example, you do not need to do it because you only have one host available.*

- As the SYS user, connect to the RCAT destination host as the target. (*You log in as SYS, not as SYSBACKUP, because you will create the BAR user in the destination database*).

```
$ . oraenv
ORACLE_SID = [orcl] ? rcat
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1 is
/u01/app/oracle

$ rman target /

connected to target database: RCAT (DBID= 637378352)
RMAN>
```

- Ensure that the destination database is opened in read-write mode.

```
RMAN> SELECT NAME, LOG_MODE, OPEN_MODE, CURRENT_SCN FROM
V$DATABASE;

using target database control file instead of recovery catalog
NAME      LOG_MODE        OPEN_MODE          CURRENT_SCN
-----  -----
RCAT      ARCHIVELOG     READ WRITE        2881514

RMAN>
```

- Create the BAR user and grant the CREATE SESSION privilege.

```
RMAN> CREATE USER BAR IDENTIFIED BY oracle_4U;
Statement processed

RMAN> GRANT CREATE SESSION TO BAR;
Statement processed

RMAN>
```

9. Use the RESTORE command with the FOREIGN TABLESPACE clause. The FORMAT clause specifies the file destination. Use the DUMP FILE FROM BACKUPSET clause to restore the metadata from the dump file, which is required to plug the tablespace in to the destination database.

```
RMAN> RESTORE FOREIGN TABLESPACE bartbs FORMAT
'./u01/backup/rcat/bartbs.dbf' FROM BACKUPSET
'./u01/backup/test.bck' DUMP FILE FROM BACKUPSET
'./u01/backup/test.dmp';

Starting restore at 2014-12-19:12:29:43
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=38 device type=DISK

channel ORA_DISK_1: starting datafile backup set restore
channel ORA_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_DISK_1: restoring all files in foreign tablespace
BARTBS
channel ORA_DISK_1: reading from backup piece
/u01/backup/test.bck
channel ORA_DISK_1: restoring foreign file 2 to
/u01/backup/rcat/bartbs.dbf
channel ORA_DISK_1: foreign piece handle=/u01/backup/test.bck
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:02
channel ORA_DISK_1: starting datafile backup set restore
channel ORA_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_DISK_1: restoring Data Pump dump file to
/u01/app/oracle/product/12.1.0/dbhome_1/dbs/backup_tts_RCAT_1745
9.dmp
channel ORA_DISK_1: reading from backup piece
/u01/backup/test.dmp
channel ORA_DISK_1: foreign piece handle=/u01/backup/test.dmp
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:02

Performing import of metadata...
IMPDP> Master table "SYS"."TSPITR_IMP_RCAT_Etpo" successfully
loaded/unloaded
IMPDP> Starting "SYS"."TSPITR_IMP_RCAT_Etpo":
IMPDP> Processing object type TRANSPORTABLE_EXPORT/PLUGTS_BLK
IMPDP> Processing object type TRANSPORTABLE_EXPORT/TABLE
IMPDP> Processing object type
TRANSPORTABLE_EXPORT/TABLE_STATISTICS
```

```
IMPDP> Processing object type
TRANSPORTABLE_EXPORT/STATISTICS/MARKER
IMPDP> Processing object type
TRANSPORTABLE_EXPORT/POST_INSTANCE/PLUGTS_BLK
IMPDP> Job "SYS"."TSPITR_IMP_RCAT_Etpo" successfully
completed at Fri Dec 19 12:29:58 2014 elapsed 0 00:00:07
Import completed

Finished restore at 2014-12-19:12:30:00
RMAN>
```

10. Confirm that the tablespace exists in your destination database. Then exit

```
RMAN> select tablespace_name, status from dba_tablespaces;

TABLESPACE_NAME          STATUS
-----
SYSTEM                  ONLINE
SYSAUX                 ONLINE
UNDOTBS1                ONLINE
TEMP                   ONLINE
USERS                  ONLINE
EXAMPLE                ONLINE
RCATBS                 ONLINE
BARTBS                 READ ONLY

8 rows selected

RMAN> exit
$
```

11. Clean up the practice environment by executing the `cleanup_16_01.sh` script. This script removes the original and the transported tablespace, as well as the backup and dump files. The output is in the `/tmp/cleanup.log` file.

```
$ ./cleanup_16_01.sh
$
```

Practices for Lesson 17: Performing Point-in-Time Recovery

Chapter 17

Practices for Lesson 17: Overview

Practices Overview

In these practices, you will recover a table from a backup set without affecting other objects in the tablespace or schema.

Practice 17-1: Recovering a Table from a Backup

Overview

In this practice you will recover a table from a backup set (without affecting other objects in the tablespace or schema). The tasks include the following:

- Set up your test environment and confirm the configuration, which typically is a one-time task.
- In RMAN, perform a level 0 backup plus archive logs and delete obsolete backups.
- In SQL*Plus, create and populate a new TEST_TABLE. Note the SCN after commit.
- In RMAN, perform a level 1 backup.
- In SQL*Plus, create the need to recover a table by purging TEST_TABLE.
- In RMAN, recover your test table to the SCN.
- In SQL*Plus, confirm the success of the recovery.
- Clean up your practice environment.

Assumptions

Two terminal windows are open and you are logged in as the oracle OS user. \$LABS is the current directory. Environment variables are set for the orcl database instance.

Tasks

1. Set up for this practice by executing the setup_17_01.sh script from the \$LABS directory.
In this script:
 - A new tablespace and user are created.
 - The user creates a table and populates it.
 - The output is in the /tmp/setup.log file.

```
$ ./setup_17_01.sh  
$
```

2. Start a SQL*Plus session and verify your test configuration.
 - a. Log in as the SYS user.

```
$ sqlplus / as sysdba  
SQL>
```

- b. Confirm that the database is in archive log mode.

```
SQL> SELECT NAME, LOG_MODE, OPEN_MODE FROM V$DATABASE;  
NAME        LOG_MODE      OPEN_MODE  
-----  
ORCL        ARCHIVELOG    READ WRITE  
SQL>
```

- c. Confirm that compatibility is set to 12.0 or higher.

```
SQL> show parameter compatible
NAME                      TYPE        VALUE
-----
compatible                string      12.1.0.2.0
noncdb_compatible         boolean    FALSE
SQL>
```

- d. Confirm your backup location and size.

```
SQL> show parameter recovery_f
NAME                      TYPE        VALUE
-----
db_recovery_file_dest     string      /u01/app/oracle/fast_recovery_area
db_recovery_file_dest_size big integer 4560M
SQL>
```

- e. Confirm the setup by executing the lab_17_02.sql script from the \$LABS directory. The BAR user should own the BARCOPY table.

```
SQL> @lab_17_02.sql
SQL> COL TABLE_NAME   FORMAT A30
SQL> COL TABLESPACE_NAME FORMAT A15
SQL> COL OWNER       FORMAT A10
SQL>
SQL> SELECT TABLE_NAME, TABLESPACE_NAME, STATUS
  2  FROM DBA_TABLES
  3 WHERE OWNER = 'BAR';

TABLE_NAME          TABLESPACE_NAME STATUS
-----
BARCOPY             BARTBS        VALID
SQL>
```

3. In another terminal window, start an RMAN session and connect to your ORCL database as the target instance.

Note: The easiest way to send RMAN output both to a log file and to standard output is to use the Linux tee command or its equivalent. There is no need to do this, if your standard output allows you to scroll as much as you wish. You can view the output in the /home/oracle/rman_17.log file.

```
$ rman target ''/ as sysbackup'' | tee /home/oracle/rman_17.log
RMAN>
```

4. Confirm or configure autobackup of the control file and perform a level 0 backup.

```
RMAN> show CONTROLFILE AUTOBACKUP;
using target database control file instead of recovery catalog
RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE CONTROLFILE AUTOBACKUP ON;

RMAN> backup incremental level 0 database plus archivelog;
...
Finished backup at 2014-12-29:07:43:12

Starting Control File and SPFILE Autobackup at 2014-12-
29:07:43:12
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_29/o1_mf_s_867570192_bb21jkgo_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 2014-12-
29:07:43:15
RMAN>
```

5. In SQL*Plus, create and populate a new table named BAR.TEST_TABLE. Note the SCN after the commit.

```
SQL> @lab_17_05.sql
SQL> -- DISCLAIMER:
SQL> -- This script is provided for educational purposes only.
It is
SQL> -- NOT supported by Oracle World Wide Technical Support.
SQL> -- The script has been tested and appears to work as
intended.
SQL> -- You should always run new scripts on a test instance
initially
SQL> -- Create an additional test table
SQL> -- First drop it, so that this script can be executed
repeatedly.
SQL>
SQL> set echo on
SQL> DROP TABLE BAR.test_table;
DROP TABLE BAR.test_table
*
ERROR at line 1:
ORA-00942: table or view does not exist

SQL> CREATE TABLE BAR.test_table
2  (NUM number(8),
```

```
3  NAME varchar2(25) ,
4  NOW  date
5  )
6 /
Table created.

SQL> INSERT INTO BAR.test_table VALUES (1,'First test
row',sysdate);
1 row created.

SQL> INSERT INTO BAR.test_table VALUES (2,'Second test
row',sysdate);
1 row created.

SQL> INSERT INTO BAR.test_table VALUES (3,'Third test
row',NULL);
1 row created.

SQL> commit;
Commit complete.

SQL> ALTER SYSTEM SWITCH logfile;
System altered.

SQL> ALTER SYSTEM checkpoint;
System altered.

SQL>
SQL> -- **** Note the SCN!
SQL> SELECT NAME, CURRENT_SCN FROM V$DATABASE;

NAME      CURRENT_SCN
-----
ORCL      4379440
SQL>
```

Note your own SCN. You will use it for recovery! _____

6. In your RMAN session, perform a level 1 backup. If you started your RMAN session with the `tee` command, then your output is redirected to the `/home/oracle/rman_17.log` file.

```
RMAN> backup incremental level 1 database plus archivelog;
...
Finished backup at 2014-12-29:07:48:34
```

```

Starting Control File and SPFILE Autobackup at 2014-12-
29:07:48:34
piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_29/o1_mf_s_867570514_bb21tmfn_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 2014-12-
29:07:48:37
RMAN>

```

- In SQL*Plus, create the need to recover a table by purging it. Optionally, view your SCN before and after the `DROP TABLE` command.

```

SQL> SELECT NAME, CURRENT_SCN FROM V$DATABASE;
NAME      CURRENT_SCN
-----
ORCL      4379565

SQL> drop table BAR.test_table purge;
Table dropped.
SQL> SELECT NAME, CURRENT_SCN FROM V$DATABASE;
NAME      CURRENT_SCN
-----
ORCL      4382141
SQL>

```

Note: Assume that you do not have this table duplicated or in flashback logs or anywhere else, so there is a need to recover it from your backups.

- Optionally, view the current tables that the `BAR` user owns. The `TEST_TABLE` should not be displayed.

```

SQL> SELECT table_name FROM dba_tables WHERE owner = 'BAR';

TABLE_NAME
-----
BARCOPY

SQL>

```

- In RMAN, recover your test table to **YOUR** SCN. Provide the following input with the `RECOVER` command:

- Names of tables or table partitions to be recovered
- SCN (or point in time) to which the tables or table partitions need to be recovered
- Whether the recovered tables or table partitions must be imported into the target database (default is Yes.)
- Auxiliary destination '`/u01/backup/test`'.

First, confirm that the directory of the auxiliary destination is empty and then execute your `RECOVER` command.

```
RMAN> HOST "ls /u01/backup/test/*";
ls: cannot access /u01/backup/test/*: No such file or directory
host command complete
RMAN-00571: =====
RMAN-00569: ====== ERROR MESSAGE STACK FOLLOWS
RMAN-00571: =====
RMAN-06135: error executing host command: Additional
information: 512
```

Note: This positive error prior to the RECOVER command confirms that the auxiliary destination is empty.

```
RMAN> RECOVER TABLE BAR.TEST_TABLE UNTIL SCN 4379440 <<Your SCN
2> AUXILIARY DESTINATION '/u01/backup/test';

Starting recover at 2014-12-29:07:54:15
using channel ORA_DISK_1
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=43 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: Oracle Secure Backup
RMAN-05026: WARNING: presuming following set of tablespaces
applies to specified Point-in-Time

List of tablespaces expected to have UNDO segments
Tablespace SYSTEM
Tablespace UNDOTBS1

Creating automatic instance, with SID='wcpz'

initialization parameters used for automatic instance:
db_name=ORCL
db_unique_name=wcpz_pitr_ORCL
compatible=12.1.0.2.0
db_block_size=8192
db_files=200
diagnostic_dest=/u01/app/oracle
_system_trig_enabled=FALSE
sga_target=512M
processes=200
db_create_file_dest=/u01/backup/test
log_archive_dest_1='location=/u01/backup/test'
#No auxiliary parameter file used
```

```
starting up automatic instance ORCL

Oracle instance started

Total System Global Area      536870912 bytes

Fixed Size                  2926472 bytes
Variable Size                163580024 bytes
Database Buffers             364904448 bytes
Redo Buffers                 5459968 bytes
Automatic instance created

contents of Memory Script:
{
# set requested point in time
set until scn 4379440;
# restore the controlfile
restore clone controlfile;

# mount the controlfile
sql clone 'alter database mount clone database';

# archive current online log
sql 'alter system archive log current';
}
executing Memory Script

executing command: SET until clause

Starting restore at 2014-12-29:07:55:17
allocated channel: ORA_AUX_DISK_1
channel ORA_AUX_DISK_1: SID=12 device type=DISK
allocated channel: ORA_AUX_SBT_TAPE_1
channel ORA_AUX_SBT_TAPE_1: SID=173 device type=SBT_TAPE
channel ORA_AUX_SBT_TAPE_1: Oracle Secure Backup

channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: restoring control file
channel ORA_AUX_DISK_1: reading from backup piece
/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_12_29/o1
_mf_s_867570192_bb21jkgo_.bkp
```

```
channel ORA_AUX_DISK_1: piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/autobackup/2014_1
2_29/o1_mf_s_867570192_bb21jkgo_.bkp tag=TAG20141229T074312
channel ORA_AUX_DISK_1: restored backup piece 1
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:01
output file
name=/u01/backup/test/ORCL/controlfile/o1_mf_bb2276kj_.ctl
Finished restore at 2014-12-29:07:55:19

sql statement: alter database mount clone database

sql statement: alter system archive log current

contents of Memory Script:
{
# set requested point in time
set until scn 4379440;
# set destinations for recovery set and auxiliary set datafiles
set newname for clone datafile 1 to new;
set newname for clone datafile 4 to new;
set newname for clone datafile 3 to new;
set newname for clone tempfile 1 to new;
# switch all tempfiles
switch clone tempfile all;
# restore the tablespaces in the recovery set and the auxiliary
set
restore clone datafile 1, 4, 3;

switch clone datafile all;
}
executing Memory Script

executing command: SET until clause

executing command: SET NEWNAME

executing command: SET NEWNAME

executing command: SET NEWNAME

executing command: SET NEWNAME
```

```
renamed tempfile 1 to
/u01/backup/test/ORCL/datafile/o1_mf_temp_%u_.tmp in control
file

Starting restore at 2014-12-29:07:55:30
using channel ORA_AUX_DISK_1
using channel ORA_AUX_SBT_TAPE_1

channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_AUX_DISK_1: restoring datafile 00001 to
/u01/backup/test/ORCL/datafile/o1_mf_system_%u_.dbf
channel ORA_AUX_DISK_1: restoring datafile 00004 to
/u01/backup/test/ORCL/datafile/o1_mf_undotbs1_%u_.dbf
channel ORA_AUX_DISK_1: restoring datafile 00003 to
/u01/backup/test/ORCL/datafile/o1_mf_sysaux_%u_.dbf
channel ORA_AUX_DISK_1: reading from backup piece
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_29/o1_
mf_nnnd0_TAG20141229T074155_bb21g46j_.bkp
channel ORA_AUX_DISK_1: piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_
29/o1_mf_nnnd0_TAG20141229T074155_bb21g46j_.bkp
tag=TAG20141229T074155
channel ORA_AUX_DISK_1: restored backup piece 1
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:45
Finished restore at 2014-12-29:07:56:16

datafile 1 switched to datafile copy
input datafile copy RECID=32 STAMP=867570976 file
name=/u01/backup/test/ORCL/datafile/o1_mf_system_bb227mvz_.dbf
datafile 4 switched to datafile copy
input datafile copy RECID=33 STAMP=867570977 file
name=/u01/backup/test/ORCL/datafile/o1_mf_undotbs1_bb227mxb_.dbf
datafile 3 switched to datafile copy
input datafile copy RECID=34 STAMP=867570977 file
name=/u01/backup/test/ORCL/datafile/o1_mf_sysaux_bb227mtg_.dbf

contents of Memory Script:
{
# set requested point in time
set until scn 4379440;
# online the datafiles restored or switched
sql clone "alter database datafile 1 online";
sql clone "alter database datafile 4 online";
```

```
sql clone "alter database datafile 3 online";
# recover and open database read only
recover clone database tablespace "SYSTEM", "UNDOTBS1",
"SYSAUX";
sql clone 'alter database open read only';
}
executing Memory Script

executing command: SET until clause

sql statement: alter database datafile 1 online

sql statement: alter database datafile 4 online

sql statement: alter database datafile 3 online

Starting recover at 2014-12-29:07:56:18
using channel ORA_AUX_DISK_1
using channel ORA_AUX_SBT_TAPE_1

starting media recovery

archived log for thread 1 with sequence 4 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_29/o1
_mf_1_4_bb21jh4t_.arc
archived log for thread 1 with sequence 5 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_29/o1
_mf_1_5_bb21ptgj_.arc
archived log for thread 1 with sequence 6 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_29/o1
_mf_1_6_bb21sp0k_.arc
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
29/o1_mf_1_4_bb21jh4t_.arc thread=1 sequence=4
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
29/o1_mf_1_5_bb21ptgj_.arc thread=1 sequence=5
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
29/o1_mf_1_6_bb21sp0k_.arc thread=1 sequence=6
media recovery complete, elapsed time: 00:00:01
Finished recover at 2014-12-29:07:56:21
```

```
sql statement: alter database open read only

contents of Memory Script:
{
    sql clone "create spfile from memory";
    shutdown clone immediate;
    startup clone nomount;
    sql clone "alter system set control_files =
    '/u01/backup/test/ORCL/controlfile/o1_mf_bb2276kj_.ctl'";
comment=
    ''RMAN set'' scope=spfile";
    shutdown clone immediate;
    startup clone nomount;
# mount database
sql clone 'alter database mount clone database';
}
executing Memory Script

sql statement: create spfile from memory

database closed
database dismounted
Oracle instance shut down

connected to auxiliary database (not started)
Oracle instance started

Total System Global Area      536870912 bytes

Fixed Size                  2926472 bytes
Variable Size                167774328 bytes
Database Buffers            360710144 bytes
Redo Buffers                 5459968 bytes

sql statement: alter system set control_files =
    '/u01/backup/test/ORCL/controlfile/o1_mf_bb2276kj_.ctl'
comment= ''RMAN set'' scope=spfile

Oracle instance shut down

connected to auxiliary database (not started)
Oracle instance started
```

```
Total System Global Area      536870912 bytes

Fixed Size                  2926472 bytes
Variable Size                167774328 bytes
Database Buffers             360710144 bytes
Redo Buffers                 5459968 bytes

sql statement: alter database mount clone database

contents of Memory Script:
{
# set requested point in time
set until scn 4379440;
# set destinations for recovery set and auxiliary set datafiles
set newname for datafile 2 to new;
# restore the tablespaces in the recovery set and the auxiliary
# set
restore clone datafile 2;

switch clone datafile all;
}
executing Memory Script

executing command: SET until clause

executing command: SET NEWNAME

Starting restore at 2014-12-29:07:57:25
allocated channel: ORA_AUX_DISK_1
channel ORA_AUX_DISK_1: SID=12 device type=DISK
allocated channel: ORA_AUX_SBT_TAPE_1
channel ORA_AUX_SBT_TAPE_1: SID=173 device type=SBT_TAPE
channel ORA_AUX_SBT_TAPE_1: Oracle Secure Backup

channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_AUX_DISK_1: restoring datafile 00002 to
/u01/backup/test/WCPZ_PITR_ORCL/datafile/o1_mf_bartbs_%u_.dbf
channel ORA_AUX_DISK_1: reading from backup piece
/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12_29/o1_
mf_nnnd0_TAG20141229T074155_bb21g46j_.bkp
```

```
channel ORA_AUX_DISK_1: piece
handle=/u01/app/oracle/fast_recovery_area/ORCL/backupset/2014_12
_29/o1_mf_nnnd0_TAG20141229T074155_bb21g46j_.bkp
tag=TAG20141229T074155
channel ORA_AUX_DISK_1: restored backup piece 1
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:01
Finished restore at 2014-12-29:07:57:27

datafile 2 switched to datafile copy
input datafile copy RECID=36 STAMP=867571047 file
name=/u01/backup/test/WCPZ_PITR_ORCL/datafile/o1_mf_bartbs_bb22c
655_.dbf

contents of Memory Script:
{
# set requested point in time
set until scn 4379440;
# online the datafiles restored or switched
sql clone "alter database datafile 2 online";
# recover and open resetlogs
recover clone database tablespace "BARTBS", "SYSTEM",
"UNDOTBS1", "SYSAUX" delete archivelog;
alter clone database open resetlogs;
}
executing Memory Script

executing command: SET until clause

sql statement: alter database datafile 2 online

Starting recover at 2014-12-29:07:57:27
using channel ORA_AUX_DISK_1
using channel ORA_AUX_SBT_TAPE_1

starting media recovery

archived log for thread 1 with sequence 4 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_29/o1
_mf_1_4_bb21jh4t_.arc
archived log for thread 1 with sequence 5 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_29/o1
_mf_1_5_bb21ptgj_.arc
```

```
archived log for thread 1 with sequence 6 is already on disk as
file
/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_29/o1
_mf_1_6_bb21sp0k_.arc
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
29/o1_mf_1_4_bb21jh4t_.arc thread=1 sequence=4
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
29/o1_mf_1_5_bb21ptgj_.arc thread=1 sequence=5
archived log file
name=/u01/app/oracle/fast_recovery_area/ORCL/archivelog/2014_12_
29/o1_mf_1_6_bb21sp0k_.arc thread=1 sequence=6
media recovery complete, elapsed time: 00:00:01
Finished recover at 2014-12-29:07:57:29

database opened

contents of Memory Script:
{
# create directory for datapump import
sql "create or replace directory TSPITR_DIROBJ_DPDIR as ''
/u01/backup/test'";
# create directory for datapump export
sql clone "create or replace directory TSPITR_DIROBJ_DPDIR as ''
/u01/backup/test'";
}
executing Memory Script

sql statement: create or replace directory TSPITR_DIROBJ_DPDIR
as ''/u01/backup/test''

sql statement: create or replace directory TSPITR_DIROBJ_DPDIR
as ''/u01/backup/test''

Performing export of tables...
EXPDP> Starting "SYS"."TSPITR_EXP_wcpz_ypjq":
EXPDP> Estimate in progress using BLOCKS method...
EXPDP> Processing object type TABLE_EXPORT/TABLE/TABLE_DATA
EXPDP> Total estimation using BLOCKS method: 64 KB
EXPDP> Processing object type TABLE_EXPORT/TABLE/TABLE
EXPDP> Processing object type
TABLE_EXPORT/TABLE/STATISTICS(TABLE_STATISTICS
EXPDP> Processing object type
TABLE_EXPORT/TABLE/STATISTICS/MARKER
```

```
EXPDP> ORA-39127: unexpected error from call to export_string
:=SYS.DBMS_TRANSFORM_EXIMP.INSTANCE_INFO_EXP('AQ$_ORDERS_QUEUEABLE_S','IX',1,1,'12.01.00.02.00',newblock)
ORA-00376: file 5 cannot be read at this time
ORA-01110: data file 5:
'/u01/app/oracle/oradata/orcl/example01.dbf'
ORA-06512: at "SYS.DBMS_TRANSFORM_EXIMP", line 197
ORA-06512: at line 1
ORA-06512: at "SYS.DBMS_METADATA", line 10261
ORA-39127: unexpected error from call to export_string
:=SYS.DBMS_TRANSFORM_EXIMP.INSTANCE_INFO_EXP('AQ$_STREAMS_QUEUE_TABLE_S','IX',1,1,'12.01.00.02.00',newblock)
ORA-00376: file 5 cannot be read at this time
ORA-01110: data file 5:
'/u01/app/oracle/oradata/orcl/example01.dbf'
ORA-06512: at "SYS.DBMS_TRANSFORM_EXIMP", line 197
ORA-06512: at line 1
ORA-06512: at "SYS.DBMS_METADATA", line 10261
EXPDP> . . exported "BAR"."TEST_TABLE"
6.015 KB      3 rows
EXPDP> Master table "SYS"."TSPITR_EXP_wcpz_ypjq" successfully
loaded/unloaded
EXPDP>
*****
*****
```

```
EXPDP> Dump file set for SYS.TSPITR_EXP_wcpz_ypjq is:
EXPDP>   /u01/backup/test/tspitr_wcpz_98117.dmp
EXPDP> Job "SYS"."TSPITR_EXP_wcpz_ypjq" completed with 2
error(s) at Mon Dec 29 07:58:12 2014 elapsed 0 00:00:23
Export completed
```

contents of Memory Script:

```
{
# shutdown clone before import
shutdown clone abort
}
executing Memory Script
```

Oracle instance shut down

Performing import of tables...

```
IMPDP> Master table "SYSPUMP"."TSPITR_IMP_wcpz_dygv" 
successfully loaded/unloaded
IMPDP> Starting "SYSPUMP"."TSPITR_IMP_wcpz_dygv":
```

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```
IMPDP> Processing object type TABLE_EXPORT/TABLE/TABLE
IMPDP> Processing object type TABLE_EXPORT/TABLE/TABLE_TABLE_DATA
IMPDP> . . imported "BAR"."TEST_TABLE"
6.015 KB      3 rows
IMPDP> Processing object type
TABLE_EXPORT/TABLE/STATISTICS/TABLE_STATISTICS
IMPDP> Processing object type
TABLE_EXPORT/TABLE/STATISTICS/MARKER
IMPDP> Job "SYSBACKUP"."TSPITR_IMP_wcpz_dygv" successfully
completed at Mon Dec 29 07:58:28 2014 elapsed 0 00:00:07
Import completed

Removing automatic instance
Automatic instance removed
auxiliary instance file
/u01/backup/test/ORCL/datafile/o1_mf_temp_bb2295mq_.tmp deleted
auxiliary instance file
/u01/backup/test/WCPZ_PITR_ORCL/onlinelog/o1_mf_3_bb22ccnj_.log
deleted
auxiliary instance file
/u01/backup/test/WCPZ_PITR_ORCL/onlinelog/o1_mf_2_bb22cbj3_.log
deleted
auxiliary instance file
/u01/backup/test/WCPZ_PITR_ORCL/onlinelog/o1_mf_1_bb22c9by_.log
deleted
auxiliary instance file
/u01/backup/test/WCPZ_PITR_ORCL/datafile/o1_mf_bartbs_bb22c655_.
dbf deleted
auxiliary instance file
/u01/backup/test/ORCL/datafile/o1_mf_sysaux_bb227mtg_.dbf
deleted
auxiliary instance file
/u01/backup/test/ORCL/datafile/o1_mf_undotbs1_bb227mxb_.dbf
deleted
auxiliary instance file
/u01/backup/test/ORCL/datafile/o1_mf_system_bb227mvz_.dbf
deleted
auxiliary instance file
/u01/backup/test/ORCL/controlfile/o1_mf_bb2276kj_.ctl deleted
auxiliary instance file tspitr_wcpz_98117.dmp deleted
Finished recover at 2014-12-29:07:58:32
RMAN>
```

Note: RMAN uses your input to automate the process of recovering the specified table. It performs the following tasks:

- a. RMAN determines the backup based on YOUR SCN.
 - b. RMAN creates an auxiliary instance.
 - c. RMAN recovers your tables or table partitions, up to the specified point in time, into this auxiliary instance.
 - d. RMAN creates a Data Pump export dump file that contains the recovered objects.
 - e. RMAN imports the recovered objects into the target database.
 - f. RMAN removes the auxiliary instance.
10. Delete obsolete archive logs and then exit RMAN.

```
RMAN> delete noprompt obsolete;  
...  
Deleted 16 objects  
  
RMAN> exit  
$
```

11. In SQL*Plus, query all rows of the test table to confirm the success of the recovery. Then exit.

```
SQL> SELECT * FROM BAR.TEST_TABLE;  
  
        NUM  NAME          NOW  
-----  
          1 First test row 2014-12-29:07:46:34  
          2 Second test row 2014-12-29:07:46:34  
          3 Third test row  
  
SQL> exit  
$
```

12. Clean up the practice environment by executing the `cleanup_17_01.sh` script. This script removes the original and the transported tablespace, as well as the backup and dump files. The output is in the `/tmp/cleanup.log` file.

```
$ ./cleanup_17_01.sh  
$
```


Practices for Lesson 18: Duplicating a Database

Chapter 18

Practices for Lesson 18: Overview

Practices Overview

In these practices, you will prepare and then duplicate a database.

Practice 18-1: Duplicating a Database

Overview

In this practice, you learn how to duplicate an active database. ORCL is the active database that will be duplicated or cloned as DBTEST. The tasks include the following:

- Prepare the destination for the future DBTEST database with Oracle Net connectivity, password file, and a minimal initdbtest.ora file.
- Confirm source database configuration settings.
- Duplicate the ORCL database by using RMAN.
- Test access to the cloned database.

Assumptions

Two terminal windows are open and you are logged in as the oracle OS user. \$LABS is the current directory. Environment variables are set for the orcl database instance.

Tasks

1. Create new directories for the dbtest database.

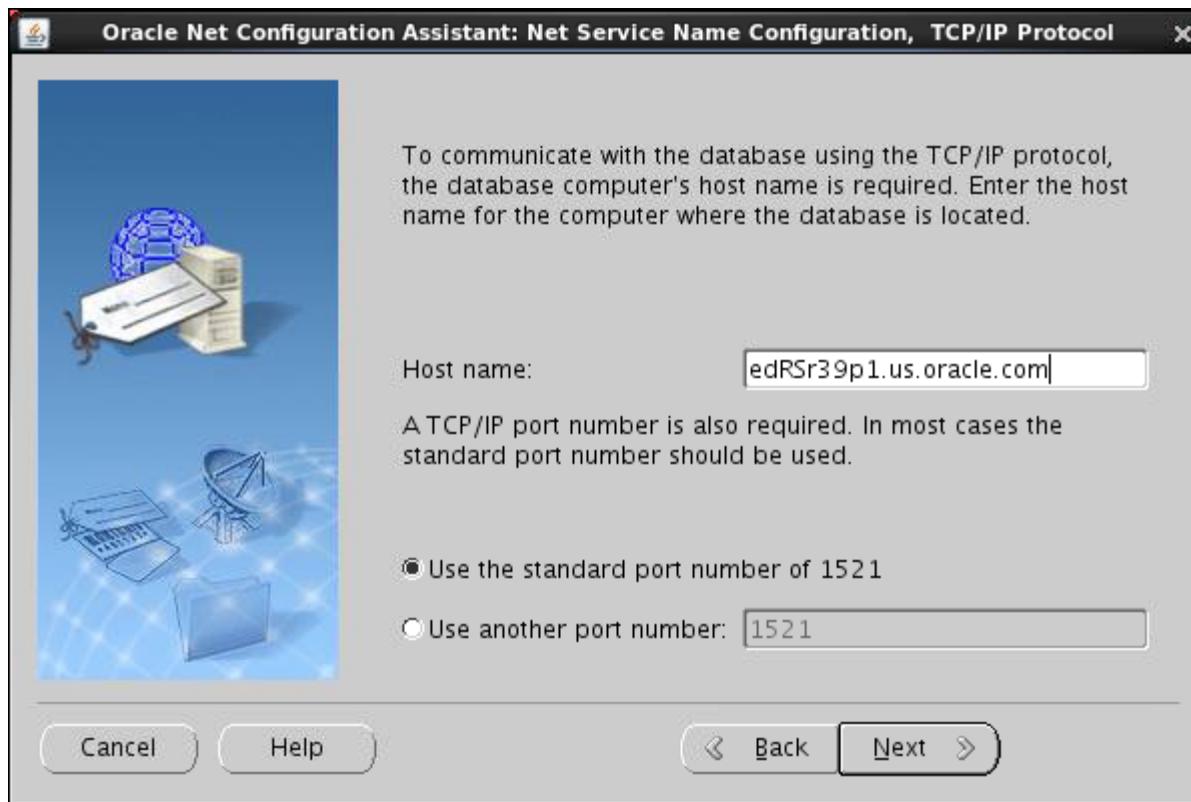
```
$ cd /u01/app/oracle
$ ls
admin  cfgtoollogs  diag          oradata
audit   checkpoints  fast_recovery_area  product
$ mkdir dbtest_fra
$ ls -l
total 36
drwxrwx---  9 oracle oinstall 4096 Dec 30 06:57 admin
drwxrwx---  5 oracle oinstall 4096 Dec  2 05:34 audit
drwxrwx---  4 oracle oinstall 4096 Dec  2 03:11 cfgtoollogs
drwxrwx---  2 oracle oinstall 4096 Dec  2 05:47 checkpoints
drwxr-xr-x  2 oracle oinstall 4096 Dec 30 08:05 dbtest_fra
drwxrwx--- 19 oracle oinstall 4096 Dec  2 03:10 diag
drwxrwx--- 10 oracle oinstall 4096 Dec 30 07:34
fast_recovery_area
drwxrwx---  6 oracle oinstall 4096 Dec 30 06:51 oradata
drwxrwx---  7 oracle oinstall 4096 Dec  2 04:44 product
$ cd dbtest_fra
$ mkdir orcl
$ cd ..
$ cd oradata
$ ls
emrep  orcl  rcat
$ mkdir dbtest
$ ls -l
```

```
total 16
drwxr-xr-x 2 oracle oinstall 4096 Dec 30 06:57 dbtest
drwxrwx--- 2 oracle oinstall 4096 Dec  2 03:42 emrep
drwxr-x--- 3 oracle oinstall 4096 Dec 18 07:48 orcl
drwxrwx--- 2 oracle oinstall 4096 Dec  9 12:49 rcat
$ cd $LABS
$ pwd
/home/oracle/labs
$
```

2. Prepare Oracle Net connectivity by using the `netca` utility. Add a `dbtest` entry to the `tnsnames.ora` file.

```
$ netca
```

- a. On the Oracle Net Configuration Assistant: Welcome page, select **Local Net Service Name configuration** and click **Next**.
- b. Confirm that **Add** is selected and click **Next**.
- c. Enter `dbtest` as **Service Name** and click **Next**.
- d. Select **TCP** as protocol and click **Next**.
- e. Enter your host and domain name (for example, `edRSr39p1.us.oracle.com`) in the **Host name** field. If you are unsure about the format, execute the command in the next step to view currently active examples.
- f. Confirm that **Use the standard port number of 1521** is selected and click **Next**.



- g. Select **No, do not test**, because your dbtest instance does not yet exist, and click **Next**.
- h. Confirm dbtest as **Net Service Name** and click **Next**.
- i. Answer **No** to the question: **Would you like to configure another net service name** and click **Next**.
- j. You should see the message: **Net service name Configuration Complete!** Click **Next**.
- k. Click **Finish**. You will see a successful configuration message.

```
$ netca

Oracle Net Services Configuration:
Default local naming configuration complete.
    Created net service name: dbtest
Oracle Net Services configuration successful. The exit code is 0
$
```

3. View the DBTEST entry in the \$ORACLE_HOME/network/admin/tnsnames.ora file.

```
$ cat $ORACLE_HOME/network/admin/tnsnames.ora

# tnsnames.ora Network Configuration File:
/u01/app/oracle/product/12.1.0/dbhome_1/network/admin/tnsnames.ora
# Generated by Oracle configuration tools.

EMREP =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP) (HOST = edRSr43p1.us.oracle.com) (PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = emrep)
    )
  )

RCAT =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP) (HOST = edRSr43p1.us.oracle.com) (PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = rcat)
    )
  )
```

```
DBTEST =
  (DESCRIPTION =
    (ADDRESS_LIST =
      (ADDRESS = (PROTOCOL = TCP)(HOST =
edrsr43P1.us.oracle.com)(PORT = 1521))
    )
    (CONNECT_DATA =
      (SERVICE_NAME = dbtest)
    )
  )
$>

ORCL =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST =
edRSr43p1.us.oracle.com)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = orcl)
    )
  )
$
```

4. Comparing the DBTEST entry with the ORCL configuration, you notice that (SERVER = DEDICATED) is missing.
 - a. Update the tnsnames.ora file by using the gedit or vi editor so that the DBTEST entry contains the SERVER = DEDICATED parameter.

```
$ gedit $ORACLE_HOME/network/admin/tnsnames.ora
```

```
RCAT =
(DESCRIPTION =
(ADDRESS = (PROTOCOL = TCP)(HOST = edRSr39p1.us.oracle.com)(PORT = 1521))
(CONNECT_DATA =
(SERVER = DEDICATED)
(SERVICE_NAME = rcat)
)
)

DBTEST =
(DESCRIPTION =
(ADDRESS_LIST =
(ADDRESS = (PROTOCOL = TCP)(HOST = edRSr39p1.us.oracle.com)(PORT = 1521))
)
(CONNECT_DATA =
(SERVER = DEDICATED)
(SERVICE_NAME = dbtest)
)
)

ORCL =
(DESCRIPTION =
(ADDRESS = (PROTOCOL = TCP)(HOST = edRSr39p1.us.oracle.com)(PORT = 1521))
(CONNECT_DATA =
(SERVER = DEDICATED)
(SERVICE_NAME = orcl)
)
)
```

- b. After you finished your edit, confirm that the entry is now:

```
...
DBTEST =
(DESCRIPTION =
(ADDRESS_LIST =
(ADDRESS = (PROTOCOL = TCP)(HOST =
edRSr39p1.us.oracle.com)(PORT = 1521))
)
(CONNECT_DATA =
(SERVER = DEDICATED)
(SERVICE_NAME = dbtest)
)
)
```

5. Create a password file for the future DBTEST database to allow OS authentication.
- As the oracle OS user, point the environment variables to the dbtest instance.

```
$ . oraenv
ORACLE_SID = [orcl] ? dbtest
```

```
ORACLE_HOME = [/home/oracle] ?
/u01/app/oracle/product/12.1.0/dbhome_1/
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1/ is
/u01/app/oracle
$
```

- b. Create the \$ORACLE_HOME/dbs/orapwdtestfile by using the orapwd utility.

```
$ orapwd file=$ORACLE_HOME/dbs/orapwdtest entries=15
password=oracle_4U
$
```

- c. Optionally, confirm that the file exists.

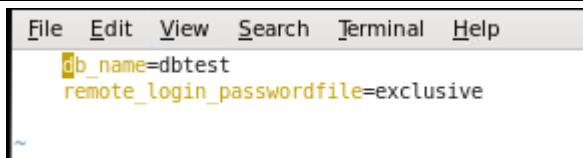
```
$ ls $ORACLE_HOME/dbs/*ora*
/u01/app/oracle/product/12.1.0/dbhome_1//dbs/init.ora
/u01/app/oracle/product/12.1.0/dbhome_1//dbs/orapwdtest
/u01/app/oracle/product/12.1.0/dbhome_1//dbs/orapwemrep
/u01/app/oracle/product/12.1.0/dbhome_1//dbs/orapworcl
/u01/app/oracle/product/12.1.0/dbhome_1//dbs/orapwrcat
/u01/app/oracle/product/12.1.0/dbhome_1//dbs/spfileemrep.ora
/u01/app/oracle/product/12.1.0/dbhome_1//dbs/spfileorcl.ora
/u01/app/oracle/product/12.1.0/dbhome_1//dbs/spfilercat.ora
/u01/app/oracle/product/12.1.0/dbhome_1//dbs/spfilewcpz.ora
$
```

6. In the same directory, create a minimal initdbtest.ora file with the following entries:

```
db_name=dbtest
remote_login_passwordfile=exclusive
```

Then confirm your content with the cat command.

```
$ vi $ORACLE_HOME/dbs/initdbtest.ora
```



```
$ cat $ORACLE_HOME/dbs/initdbtest.ora
```

```
db_name=dbtest
remote_login_passwordfile=exclusive
$
```

7. Point environment variables to the dbtest instance (as shown in step 7 a). Log in to SQL*Plus as SYSDBA, start the dbtest instance in NOMOUNT mode with the initdbtest.ora file. Then exit.

```
$ . oraenv
ORACLE_SID = [dbtest] ?
```

```

ORACLE_HOME = [/home/oracle] ?
/u01/app/oracle/product/12.1.0/dbhome_1
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1 is
/u01/app/oracle
$ 
$ sqlplus / as sysdba
SQL>
SQL> startup NOMOUNT
pfile='/u01/app/oracle/product/12.1.0/dbhome_1/dbs/initdbtest.or
a'
ORACLE instance started.

Total System Global Area  234881024 bytes
Fixed Size                  2922904 bytes
Variable Size                176162408 bytes
Database Buffers            50331648 bytes
Redo Buffers                 5464064 bytes
SQL> exit
$ 

```

8. Confirm the ORCL source database configuration settings in SQL*Plus.
 - a. With your environment variables pointed to orcl, log in to SQL*Plus as SYSBDA. Confirm that compatibility is set to 12.0 or higher to take advantage of the features new to Oracle Database 12c.

SQL> show parameters compatible		
NAME	TYPE	VALUE
-----	-----	-----
Compatible	string	12.1.0.2.0
noncdb_compatible	boolean	FALSE
SQL>		

- b. Confirm your backup location and size. If the FRA is smaller than 10G, enlarge it by using the following command:

```
ALTER SYSTEM SET db_recovery_file_dest_size = 10G SCOPE=BOTH;
```

SQL> show parameters recovery_f		
NAME	TYPE	VALUE
-----	-----	-----
db_recovery_file_dest	string	/u01/app/oracle/fast_recovery_area
db_recovery_file_dest_size	big integer	4560M
SQL>		
SQL> ALTER SYSTEM SET db_recovery_file_dest_size = 10G		
SCOPE=BOTH;		

```
System altered.
```

```
SQL>
```

- c. Confirm that the database is in archive log mode. Then exit.

```
SQL> SELECT NAME, LOG_MODE, OPEN_MODE FROM V$DATABASE;
```

NAME	LOG_MODE	OPEN_MODE
ORCL	ARCHIVELOG	READ WRITE

```
SQL> exit
$
```

Note: If your values differ, discuss with your instructors which steps you may need to take to prepare the database that you wish to duplicate.

9. In your cloning session set the \$TNS_ADMIN environment variable as oracle OS user, because the server processes will try to resolve the AUXILIARY service name by using \$TNS_ADMIN/tnsnames.ora.

```
$ export
TNS_ADMIN=/u01/app/oracle/product/12.1.0/dbhome_1/network/admin
$ echo $TNS_ADMIN
/u01/app/oracle/product/12.1.0/dbhome_1/network/admin
$
```

10. Use RMAN to duplicate the ORCL database as DBTEST database.

Note that for the target and catalog connections, the service names are used, but NOT for the auxiliary connection. So you must set the environment variables for the dbtest instance.

```
$ . oraenv
ORACLE_SID = [orcl] ? dbtest
ORACLE_HOME = [/home/oracle] ?
/u01/app/oracle/product/12.1.0/dbhome_1
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1 is
/u01/app/oracle
$ echo $ORACLE_SID
dbtest
$
$ rman target sys/<password>@orcl auxiliary sys/<password>
catalog rcatowner/oracle_4U@rcat
Recovery Manager: Release 12.1.0.2.0 - Production on Tue Dec 30
06:45:38 2014

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rights reserved.
```

```

connected to target database: ORCL (DBID=1393010434)
connected to recovery catalog database
connected to auxiliary database: DBTEST (not mounted)

```

RMAN>

Note: It is recommended that you DO NOT enter a password on the command line. You used this approach only to avoid ambiguity (*and enable you to copy-and-paste it*).

- Duplicate the ORCL database as DBTEST database by using the following command:

```

DUPLICATE TARGET DATABASE TO dbtest FROM ACTIVE DATABASE
SPFILE PARAMETER_VALUE_CONVERT
'/u01/app/oracle/oradata/orcl','/u01/app/oracle/oradata/dbtest',
'/u01/app/oracle/fast_recovery_area','/u01/app/oracle/dbtest_fra',
'ORCL','DBTEST'

SET DB_RECOVERY_FILE_DEST_SIZE='10G';

```

```

RMAN> DUPLICATE TARGET DATABASE TO dbtest FROM ACTIVE DATABASE
      SPFILE PARAMETER_VALUE_CONVERT
      '/u01/app/oracle/oradata/orcl','/u01/app/oracle/oradata/dbtest',
      '/u01/app/oracle/fast_recovery_area','/u01/app/oracle/dbtest_fra',
      'ORCL','DBTEST'
      SET DB_RECOVERY_FILE_DEST_SIZE='10G';

```

```

2> 3> 4>
Starting Duplicate Db at 2014-12-30:12:09:27
allocated channel: ORA_AUX_DISK_1
channel ORA_AUX_DISK_1: SID=13 device type=DISK
current log archived

```

contents of Memory Script:

```
{
  restore clone from service 'orcl' spfile to
  '/u01/app/oracle/product/12.1.0/dbhome_1/dbs/spfiledbtest.ora';
    sql clone "alter system set spfile=
  ''/u01/app/oracle/product/12.1.0/dbhome_1/dbs/spfiledbtest.ora''
";
}
executing Memory Script
```

```

Starting restore at 2014-12-30:12:09:30
using channel ORA_AUX_DISK_1

```

```
channel ORA_AUX_DISK_1: starting datafile backup set restore
```

```
channel ORA_AUX_DISK_1: using network backup set from service
orcl
channel ORA_AUX_DISK_1: restoring SPFILE
output file
name=/u01/app/oracle/product/12.1.0/dbhome_1/dbs/spfiledbtest.or
a
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:01
Finished restore at 2014-12-30:12:09:32

sql statement: alter system set spfile=
''/u01/app/oracle/product/12.1.0/dbhome_1/dbs/spfiledbtest.ora''

contents of Memory Script:
{
    sql clone "alter system set db_name =
'DBTEST' comment=
'duplicate' scope=spfile";
    sql clone "alter system set control_files =
''/u01/app/oracle/oradata/dbtest/control01.ctl'',
''/u01/app/oracle/dbtest_fra/orcl/control02.ctl'' comment=
'' scope=spfile";
    sql clone "alter system set DB_RECOVERY_FILE_DEST_SIZE =
10G comment=
'' scope=spfile";
    shutdown clone immediate;
    startup clone nomount;
}
executing Memory Script

sql statement: alter system set db_name = ''DBTEST'' comment=
'duplicate' scope=spfile

sql statement: alter system set control_files =
''/u01/app/oracle/oradata/dbtest/control01.ctl'',
''/u01/app/oracle/dbtest_fra/orcl/control02.ctl'' comment= ''
scope=spfile

sql statement: alter system set DB_RECOVERY_FILE_DEST_SIZE =
10G comment= '' scope=spfile

Oracle instance shut down

connected to auxiliary database (not started)
Oracle instance started
```

```
Total System Global Area      536870912 bytes

Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers             247463936 bytes
Redo Buffers                 5459968 bytes

contents of Memory Script:
{
    sql clone "alter system set db_name =
    ''ORCL'' comment=
    ''Modified by RMAN duplicate'' scope=spfile";
    sql clone "alter system set db_unique_name =
    ''DBTEST'' comment=
    ''Modified by RMAN duplicate'' scope=spfile";
    shutdown clone immediate;
    startup clone force nomount
    restore clone from service 'orcl' primary controlfile;
    alter clone database mount;
}
executing Memory Script

sql statement: alter system set db_name = ''ORCL'' comment=
''Modified by RMAN duplicate'' scope=spfile

sql statement: alter system set db_unique_name = ''DBTEST''
comment= ''Modified by RMAN duplicate'' scope=spfile

Oracle instance shut down

Oracle instance started

Total System Global Area      536870912 bytes

Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers             247463936 bytes
Redo Buffers                 5459968 bytes

Starting restore at 2014-12-30:12:10:13
allocated channel: ORA_AUX_DISK_1
channel ORA_AUX_DISK_1: SID=12 device type=DISK
```

```
channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: using network backup set from service
orcl
channel ORA_AUX_DISK_1: restoring control file
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:02
output file name=/u01/app/oracle/oradata/dbtest/control01.ctl
output file name=/u01/app/oracle/dbtest_fra/orcl/control02.ctl
Finished restore at 2014-12-30:12:10:15

database mounted

contents of Memory Script:
{
    set newname for clone datafile 1 to new;
    set newname for clone datafile 3 to new;
    set newname for clone datafile 4 to new;
    set newname for clone datafile 5 to new;
    set newname for clone datafile 6 to new;
    restore
    from service 'orcl' clone database
    ;
    sql 'alter system archive log current';
}
executing Memory Script

executing command: SET NEWNAME

Starting restore at 2014-12-30:12:10:21
using channel ORA_AUX_DISK_1

channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: using network backup set from service
orcl
```

```
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_AUX_DISK_1: restoring datafile 00001 to
/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_system_%u_.db
f
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:26
channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: using network backup set from service
orcl
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_AUX_DISK_1: restoring datafile 00003 to
/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_sysaux_%u_.db
f
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:25
channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: using network backup set from service
orcl
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_AUX_DISK_1: restoring datafile 00004 to
/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_undotbs1_%u_.
dbf
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:07
channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: using network backup set from service
orcl
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_AUX_DISK_1: restoring datafile 00005 to
/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_example_%u_.
dbf
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:25
channel ORA_AUX_DISK_1: starting datafile backup set restore
channel ORA_AUX_DISK_1: using network backup set from service
orcl
channel ORA_AUX_DISK_1: specifying datafile(s) to restore from
backup set
channel ORA_AUX_DISK_1: restoring datafile 00006 to
/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_users_%u_.dbf
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:02
Finished restore at 2014-12-30:12:11:46

sql statement: alter system archive log current
current log archived
```

```
contents of Memory Script:  
{  
    restore clone force from service  'orcl'  
        archivelog from scn  4562818;  
    switch clone datafile all;  
}  
executing Memory Script  
  
Starting restore at 2014-12-30:12:11:48  
using channel ORA_AUX_DISK_1  
  
channel ORA_AUX_DISK_1: starting archived log restore to default  
destination  
channel ORA_AUX_DISK_1: using network backup set from service  
orcl  
channel ORA_AUX_DISK_1: restoring archived log  
archived log thread=1 sequence=20  
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:01  
channel ORA_AUX_DISK_1: starting archived log restore to default  
destination  
channel ORA_AUX_DISK_1: using network backup set from service  
orcl  
channel ORA_AUX_DISK_1: restoring archived log  
archived log thread=1 sequence=21  
channel ORA_AUX_DISK_1: restore complete, elapsed time: 00:00:02  
Finished restore at 2014-12-30:12:11:52  
  
datafile 1 switched to datafile copy  
input datafile copy RECID=34 STAMP=867672712 file  
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_system_b  
b55kgg4_.dbf  
datafile 3 switched to datafile copy  
input datafile copy RECID=35 STAMP=867672712 file  
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_sysaux_b  
b55l7vn_.dbf  
datafile 4 switched to datafile copy  
input datafile copy RECID=36 STAMP=867672713 file  
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_undotbs1  
_bb55m1bo_.dbf  
datafile 5 switched to datafile copy  
input datafile copy RECID=37 STAMP=867672713 file  
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_example_  
bb55m8fz_.dbf  
datafile 6 switched to datafile copy
```

```
input datafile copy RECID=38 STAMP=867672713 file
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_users_bb
55n1h7_.dbf

contents of Memory Script:
{
    set until scn 4562983;
    recover
    clone database
    delete archivelog
;
}
executing Memory Script

executing command: SET until clause

Starting recover at 2014-12-30:12:11:54
using channel ORA_AUX_DISK_1

starting media recovery

archived log for thread 1 with sequence 20 is already on disk as
file
/u01/app/oracle/fast_recovery_area/DBTEST/archivelog/2014_12_30/
o1_mf_1_20_bb55n62w_.arc
archived log for thread 1 with sequence 21 is already on disk as
file
/u01/app/oracle/fast_recovery_area/DBTEST/archivelog/2014_12_30/
o1_mf_1_21_bb55n72m_.arc
archived log file
name=/u01/app/oracle/fast_recovery_area/DBTEST/archivelog/2014_1
2_30/o1_mf_1_20_bb55n62w_.arc thread=1 sequence=20
archived log file
name=/u01/app/oracle/fast_recovery_area/DBTEST/archivelog/2014_1
2_30/o1_mf_1_21_bb55n72m_.arc thread=1 sequence=21
media recovery complete, elapsed time: 00:00:01
Finished recover at 2014-12-30:12:11:57
Oracle instance started

Total System Global Area      536870912 bytes

Fixed Size                  2926472 bytes
Variable Size                281020536 bytes
Database Buffers             247463936 bytes
Redo Buffers                 5459968 bytes
```

```
contents of Memory Script:  
{  
    sql clone "alter system set db_name =  
    ''DBTEST'' comment=  
    ''Reset to original value by RMAN'' scope=spfile";  
    sql clone "alter system reset db_unique_name scope=spfile";  
}  
executing Memory Script  
  
sql statement: alter system set db_name = ''DBTEST'' comment=  
    ''Reset to original value by RMAN'' scope=spfile  
  
sql statement: alter system reset db_unique_name scope=spfile  
Oracle instance started  
  
Total System Global Area      536870912 bytes  
  
Fixed Size                  2926472 bytes  
Variable Size                281020536 bytes  
Database Buffers             247463936 bytes  
Redo Buffers                 5459968 bytes  
sql statement: CREATE CONTROLFILE REUSE SET DATABASE "DBTEST"  
RESETLOGS ARCHIVELOG  
    MAXLOGFILES      16  
    MAXLOGMEMBERS    3  
    MAXDATAFILES     100  
    MAXINSTANCES     8  
    MAXLOGHISTORY   292  
LOGFILE  
    GROUP    1  SIZE 50 M ,  
    GROUP    2  SIZE 50 M ,  
    GROUP    3  SIZE 50 M  
DATAFILE  
  
'/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_system_bb55k  
gg4_.dbf'  
CHARACTER SET AL32UTF8  
  
contents of Memory Script:  
{  
    set newname for clone tempfile 1 to new;
```

```
switch clone tempfile all;
catalog clone datafilecopy
"/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_sysaux_bb551
7vn_.dbf",

"/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_undotbs1_bb5
5m1bo_.dbf",

"/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_example_bb55
m8fz_.dbf",

"/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_users_bb55n1
h7_.dbf";
switch clone datafile all;
}
executing Memory Script

executing command: SET NEWNAME

renamed tempfile 1 to
/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_temp_%u_.tmp
in control file

cataloged datafile copy
datafile copy file
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_sysaux_b
b5517vn_.dbf RECID=1 STAMP=867672749
cataloged datafile copy
datafile copy file
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_undotbs1
_bb55m1bo_.dbf RECID=2 STAMP=867672750
cataloged datafile copy
datafile copy file
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_example_
bb55m8fz_.dbf RECID=3 STAMP=867672750
cataloged datafile copy
datafile copy file
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_users_bb
55n1h7_.dbf RECID=4 STAMP=867672750

datafile 3 switched to datafile copy
input datafile copy RECID=1 STAMP=867672749 file
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_sysaux_b
b5517vn_.dbf
datafile 4 switched to datafile copy
```

```

input datafile copy RECID=2 STAMP=867672750 file
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_undotbs1
_bb55m1bo_.dbf
datafile 5 switched to datafile copy
input datafile copy RECID=3 STAMP=867672750 file
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_example_
bb55m8fz_.dbf
datafile 6 switched to datafile copy
input datafile copy RECID=4 STAMP=867672750 file
name=/u01/app/oracle/oradata/orcl/DBTEST/datafile/o1_mf_users_bb
55n1h7_.dbf

contents of Memory Script:
{
    Alter clone database open resetlogs;
}
executing Memory Script

database opened
Finished Duplicate Db at 2014-12-30:12:12:45
RMAN>
```

Optionally, review the output. Find the major steps that RMAN performs for you:

- Registering the new database in the recovery catalog
- Cloning the SPFILE
- Cloning the control file
- Cloning the data files
- Switching to the data file copies
- Performing media recovery
- Opening DBTEST in RESETLOGS mode

12. Exit RMAN.

```
RMAN> exit
$
```

13. Confirm the availability and accessibility of your newly created dbtest database.

```

$ . oraenv
ORACLE_SID = [oracle] ? dbtest
ORACLE_HOME = [/home/oracle] ?
/u01/app/oracle/product/12.1.0/dbhome_1
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1 is
/u01/app/oracle

$ sqlplus / as sysdba

```

```
SQL> select dbid, name, created, open_mode from v$database;

      DBID NAME          CREATED          OPEN_MODE
----- -----          -----          -----
1260535604 DBTEST    2014-12-30:12:12:36  READ WRITE

SQL> exit
$
```


Practices for Lesson 19: RMAN Troubleshooting and Tuning

Chapter 19

Practices for Lesson 19: Overview

Practices Overview

In these practices, you will prepare your environment for the workshop

Practice 19-1: Resetting Your Training Databases

Overview

This lesson does not have a tuning hands-on practice. In this practice you will reset your training environment for the backup and recovery workshop. The `RESET_BAR.sh` script takes down your current `ORCL` and `RCAT` databases, and re-creates them. The script does not touch the other databases or Enterprise Manager Cloud Control.

1. Close all sessions and windows that may be open from previous tasks.

```
$ exit
```

2. Log in as root OS user.

```
$ su - root  
Password: <root password> <<< not displayed  
#
```

3. Skip this step when you are resetting your course environment for the **first time**. The commands are used to delete the `BAR.rebuild` file that flags the completion of the reset.

```
# rm -f /stage/MBS/logs/BAR.rebuild  
# rm -f /stage/MBS/targets/D78850GC20.reset1  
#
```

4. Navigate to the `/stage/MBS/scripts` directory.

```
# cd /stage/MBS/scripts  
#
```

5. Execute the `RESET_BAR.sh` script to rebuild your training databases. (*The script may take one or more hours to complete.*)

```
# ./RESET_BAR.sh  
starting DB teardown log file: /stage/MBS/logs/BARreset1.log  
starting DB rebuild log file: /stage/MBS/logs/BAR.rebuild  
finished rebuild: Check logfiles in /stage/MBS/logs  
#
```


Practices for Lesson 20: Workshop

Chapter 20

Practices for Lesson 20: Overview

Practices Overview

In these practices, you will protect the ORCL database with backups. Then, known and unknown issues will be introduced into your environment by you or your instructor. Your task is to recover the database with no or minimal data loss.

Practice 20-1: Preparing for the Backup and Recovery Workshop

Overview

In this practice, you have a chance to apply all that you learned. Your tasks are to secure the availability of your database by appropriate backup and recovery strategies. Then your configuration will be tested: Known and unknown issues will be introduced (either by you or your instructor) so that you have the opportunity to recover with no or minimal data loss in a real-life scenario.

Assumptions

You are familiar with Oracle backup and recovery operations. You completed practice 19, so that the ORCL and RCAT databases are in the default configuration, as at the beginning of the course.

Tasks

1. Configure the recovery settings. Use Enterprise Manager or commands as shown in the practices to configure the settings you wish to use to protect your database. Assume that this is a production database, and the business requirement is minimum loss of data. Complete recovery is desired if at possible. Consider the following:
 - ARCHIVELOG mode (*Practice 3-1*)
 - Archive log file destination (*Practice 3-1*)
 - Fast recovery area (*Practice 3-1*)
 - Default backup location (*Practice 3-1*)
 - Backupsets or image copies
 - Incremental or full backups
 - Backup retention policy (suggested redundancy of 2 for these exercises) (*Practice 3-3*)
 - Number and location of control files (*Practice 3-4*)
 - Number and location of redo log files (*Practice 3-6*)
 - Location of parameter and password files (*Practice 12*)
 - Tablespaces and location of the data files
 - Backup strategy for the control file (*Practice 3-3, 7-1*)
 - Use of a recovery catalog (*Practice 4*)
2. Record the DBID of the orcl database: _____
3. After your database is fully configured for your backup and recovery strategy, perform two backups of your choice.

Practice 20-2: Experience the Real-Life Workshop

Overview

In this workshop, the instructor will present a random scenario. Your tasks are to diagnose the problem and perform a complete recovery on the database, if possible.

When a complete recovery is not possible, recover to as recent a point in time as you can.

Assumptions

Practices 19 and 20-1 have been completed.

Tasks

1. The first step in every scenario is to log in to the database and attempt to start it.
2. Diagnose the problem by reviewing the error messages, alert log, or other indicators.
3. Decide on a recovery plan, and implement it.
4. **IMPORTANT:** If you perform an incomplete recovery, you must perform a new backup to protect your database.
5. When you are satisfied that the database has been recovered and protected, ask the instructor to assign another scenario.

Practice 20-3: Your Scenarios

Overview

In this practice, you are presented with a database that is not functioning. You must determine the cause of failure and the resources available to repair the database. Then repair the database, recovering as much data as possible.

In each of the scenarios, a new tablespace with a new schema is created. Sometimes it has been backed up. A check of the alert log will show tablespaces created since the last backup. A new schema has been created in the USERS tablespace.

If the instructor initiates the crash scenarios (which is the recommended method), then the instructor will ftp to your training environment and locally initiate one of the scenarios.

Use the following commands only if you work without an instructor and want to introduce your own “crash scenario.” (Replace *nn* with the scenario number.)

```
$ cd $WORKS  
$ ./wksh_20_nn.sh  
$
```

After most recoveries, it is highly recommended to take a new full database backup.

Assumptions

The recovery strategy you put in place may have been compromised. The database may have been taken out of ARCHIVELOG mode, the type of backups used may have changed, or particular files you expected to be safe may be lost.

Warmup Scenarios

1. Recover from the loss of a redo log file (inactive).

An inactive redo log file has been lost. A complete recovery is possible.

- a. Start the database instance. Normal operation of the instance is not affected as long as at least one group member is still functioning.
- b. It is important to review the end of the `alert_orcl.log` to see the error. A redo log file is missing.
- c. Determine which redo log file group or member is missing.
- d. Determine the status of the redo log group: CURRENT, ACTIVE, or INACTIVE from `V$LOG`.
- e. You can restore the missing log file by dropping the lost redo log member and adding a new member.
- f. If the group with the missing log file has been archived, you can clear the log group to re-create the missing file `ALTER DATABASE CLEAR [UNARCHIVED] LOGFILE GROUP <number>` command.
- g. Perform a full backup.

2. Recover from the loss of a redo log file (current). You can use either the RMAN client or Cloud Control for these tasks.

An active or current redo log file has been lost. A complete recovery may not be possible.

- a. Start the database instance. Normal operation of the instance is not affected as long as at least one group member is still functioning.
- b. It is important to review the end of the `alert_orcl.log` to see the error. A redo log file is missing.
- c. Determine which redo log file group or member is missing.
- d. Determine the status of the redo log group (CURRENT, ACTIVE, or INACTIVE) from `V$LOG`. Record the sequence number and starting SCN of the missing group.

Note: If the `V$LOG` view is not available, shut down the database and use the `STARTUP MOUNT` command.

- e. You can restore the missing log file by dropping the lost redo log member and adding a new member.
- f. If the group with the missing log file has been archived, you can clear the log group to re-create the missing file `ALTER DATABASE CLEAR [UNARCHIVED] LOGFILE GROUP <number>` command.
- g. Start RMAN and list failures. If the database cannot be made consistent, then an incomplete recovery is required. You can perform it with the `REPAIR FAILURE` command. Notice the `UNTIL SCN` clause.
- h. Perform a full backup. (*This is required especially after an incomplete recovery.*)

3. Loss of a keystore with loss of a tablespace.

This scenario uses an encrypted backup. A tablespace is lost and the keystore is lost. A backup of the keystore (or encryption wallet) is in `/u01/backup/orcl/ewallet.p12`. The keystore password is "secret". The keystore was created in the default location in the `$ORACLE_BASE/admin/orcl/wallet/ewallet.p12` directory.

- a. Determine the failure. (Loss of a data file will be the first error.)
- b. Restore the data file. (The restore will fail with an error on encrypted backup.)
- c. Attempt to open the keystore as SYSDBA.

```
ADMINISTER KEY MANAGEMENT SET KEYSTORE OPEN IDENTIFIED BY  
secret;
```

This fails with ORA-28367: wallet does not exist

- d. Restore the keystore to the default location and then open the keystore.
- e. Use `LIST FAILURE, ..., REPAIR FAILURE`.
- f. Open the database.
- g. Revert to unencrypted backups. Execute the `$WORKS/cleanup_20_03.sh` script to create a new level 0 backup.

4. Recover a lost read-only tablespace.

Recovery of a lost read-only tablespace is the same as any other tablespace as long as the control file correctly identifies the state of the tablespace. A complete recovery is possible, if archive logs can be applied.

5. Recover a tablespace without a backup (in ARCHIVELOG mode).

Recovery of a tablespace without a backup is the same as any other tablespace as long as the control file is current, that it has a record of the tablespace existence, and the archive log files exist to recover to the current point-in-time.

6. Recover a tablespace in NOARCHIVELOG mode.

Note: The database is in NOARCHIVELOG mode. A tablespace has been lost. A complete recovery is not possible unless all the changes since the last backup are contained in the online redo logs.

a. Diagnose the failure.

b. Determine the backups that are available for restoration.

Hint: Check the backups that are available by using the LIST BACKUP command.

There are two possible recovery paths: 1) Drop the missing tablespace or 2) Recover the entire database to the time of the last backup. With option 1, you lose everything in the single tablespace, and it must be re-entered by some other means. With option 2, you will lose everything entered since the last backup. This is the option presented with the ADVISE FAILURE command.

Option 1: Issue the following commands.

Note: The BARTBS tablespace has been lost. If the data is important it must be reconstructed by some other means. In this solution the database does not get a new incarnation.

```
$ sqlplus / as sysdba
SQL> ALTER DATABASE DATAFILE <filenumber or 'filename'> OFFLINE
FOR DROP;
SQL> ALTER DATABASE OPEN;
SQL> DROP TABLESPACE BARTBS INCLUDING CONTENTS AND DATAFILES;
SQL> EXIT;
```

Option 2: Issue the following commands.

```
$ rman target /
RMAN> list failure;
RMAN> advise failure;
RMAN> repair failure;
RMAN> exit
```

- c. After recovering the database execute the \$WORKS/cleanup_20_06.sh script.

7. Recover the control file by using the control file trace file.

The scenario creates a control file trace at /u01/backup/orcl/control.trc. The control file autobackup is not available.

- a. Start the database instance by using SQL*Plus and determine the failure.
 - b. Determine that all the control files are missing by viewing the alert_orcl.log file.
 - c. Change to the /u01/app/oracle/oradata/orcl directory and verify that all the other database files are present.
 - d. Find the control file trace file and make a copy to control.sql. Edit the control.sql file.
 - e. Make sure all the data files are listed, including the data file for the BARTBS tablespace.
 - f. Because all the redo logs are still in place, use the “Set #1. NORESETLOGS case” SQL statements in the control file trace to re-create the control file.
- Note:** The control files will be created in the locations specified in the initialization parameter file.
- g. Confirm that the files named in the various statements exist. Use the ls OS command to check.
 - h. Delete or comment out all of the “Set #2. RESETLOGS case” commands.
 - i. Shut down the database.

```
$ sqlplus / as sysdba
SQL> shutdown immediate
ORA-01507: database not mounted
```

ORACLE instance shut down.

```
SQL>
```

- j. Execute the control.sql file.

```
SQL> @control.sql
```

- k. If the script fails, check the file existence again and correct the script.

- l. Check that the database is in ARCHIVELOG mode.

```
SQL> archive log list
```

- m. At this point, check the incarnation table and the backups that are recorded. Check the control file autobackup configuration. Check that all the tablespaces are correctly configured.

```
$ rman target /
RMAN> list incarnation;
RMAN> list backup summary;
RMAN> show controlfile autobackup;
RMAN> report schema;
```

```
Report of database schema for database with db_unique_name ORCL

List of Permanent Datafiles
=====
File Size(MB) Tablespace          RB segs Datafile Name
-----
1     810      SYSTEM             YES
/u01/app/oracle/oradata/orcl/system01.dbf
2     10       BARTBS            NO
/u01/backup/orcl/bartbs.dbf
3     730      SYSAUX            NO
/u01/app/oracle/oradata/orcl/sysaux01.dbf
4     150      UNDOTBS1         YES
/u01/app/oracle/oradata/orcl/undotbs01.dbf
5    1243      EXAMPLE           NO
/u01/app/oracle/oradata/orcl/example01.dbf
6      5       USERS              NO
/u01/app/oracle/oradata/orcl/users01.dbf
List of Temporary Files
=====
File Size(MB) Tablespace          Maxsize(MB) Tempfile Name
-----
1     197      TEMP               32767
/u01/app/oracle/oradata/orcl/temp01.dbf
```

- After this practice, execute /home/oracle/workshop/cleanup_20_07.sh. This script includes a new backup.

Scenarios:

For the following scenarios, diagnose the failure and perform the recovery. There are minimal hints.

- Loss of tablespace and current redo log file.
- Recover from the loss of all control files and a tablespace. This will require restoring the control file from a backup set.

This scenario requires that there is a backup of the control file. Either backups must be done with INCLUDING CONTROLFILE or with CONTROLFILE AUTORECOVER ON. It is possible to restore using a control file backup to trace, but it requires that you know the location of the data files belonging to the lost tablespace. In all cases, a complete recovery is possible.

- Loss of all control files, and a tablespace dropped and re-created since the last backup.
Hint: The creation of the tablespace is visible in the alert log.

11. Loss of a tablespace with backups that have not been cataloged. Recover using an uncataloged backup set.

The setup creates a copy of backup files in the /u01/backup/alt directory.

Hint: Catalog the existing backup files, then recover using the REPAIR FAILURE command.