ORACLE

8

Backup and Duplicate

Objectives

After completing this lesson, you should be able to:

- Back up a CDB
- Back up a PDB
- Duplicate an active PDB into an existing CDB
- Duplicate a CDB as encrypted
- Validate CDB and PDBs

Goals

Back up CDB and PDBs independently:
- ARCHIVELOG mode at CDB level
- CDB backups and PDB backups: cold and hot backups

Recover CDB or PDBs:
- Instance failure: CDB level
- Complete media recovery:
    - CDB or PDB tempfile
    - Control file / redo log file / CDB root essential data file: CDB mounted
    - PDB data file: PDB opened if non-essential data file / PDB mounted if essential data file
- Incomplete media recovery: CDB mounted or PDB closed
- Flashback database: CDB mounted or PDB closed
- Flashback PDB using PDB snapshots

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Syntax and Clauses in RMAN

```
$ export ORACLE_SID=cdb1
$ rman TARGET /  <------->  $ rman TARGET jim@pdb1
```

- `DATABASE` keyword operates on all PDBs and CDB root or on only one PDB.

```
RMAN> BACKUP DATABASE;
RMAN> RECOVER DATABASE;
```

- `PLUGGABLE DATABASE` keywords operate on individual PDBs.

```
RMAN> BACKUP PLUGGABLE DATABASE hr_pdb, sales_pdb;
RMAN> RECOVER PLUGGABLE DATABASE hr_pdb;
```

- Back up, restore, recover the CDB root using `CDB$ROOT` keyword.

```
RMAN> BACKUP PLUGGABLE DATABASE "CDB$ROOT";
```

- Qualify tablespace of PDB with PDB name.

```
RMAN> BACKUP TABLESPACE sales_pdb:tbs2;
RMAN> RESTORE TABLESPACE system;
```
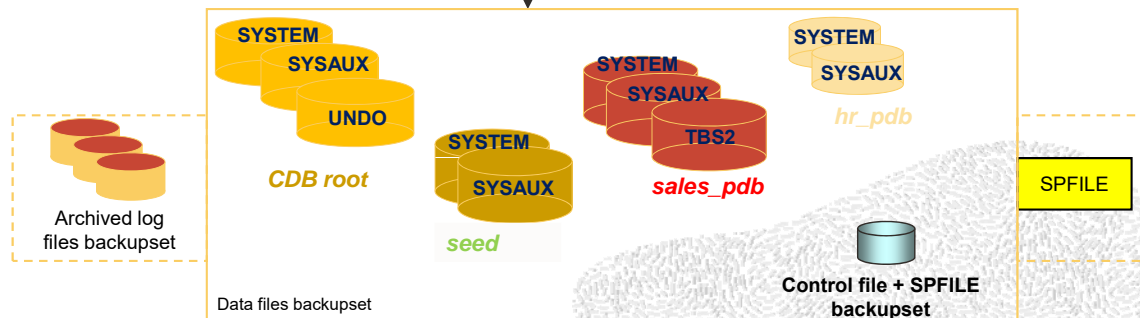
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CDB Backup: Whole CDB Backup

- Back up all PDBs data files and CDB root files.

```
$ rman TARGET /
RMAN> CONFIGURE CONTROLFILE AUTOBACKUP ON;
RMAN> BACKUP DATABASE PLUS ARCHIVELOG;
```
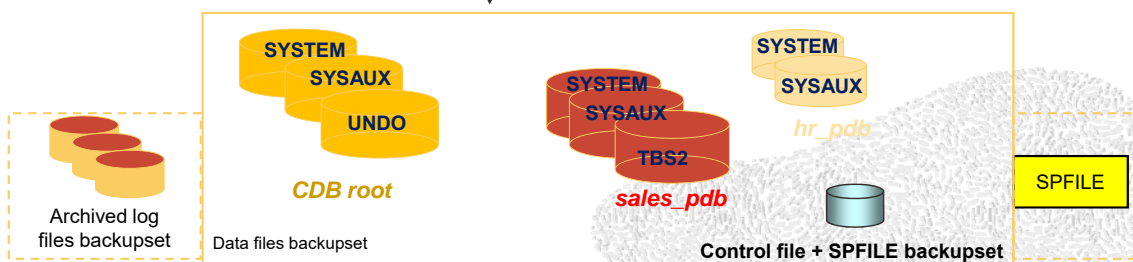
SYSTEM
SYSAUX
UNDO

CDB root

SYSTEM
SYSAUX

seed

SYSTEM
SYSAUX
TBS2

sales_pdb

SYSTEM
SYSAUX

hr_pdb

SPFILE

Archived log files backupset

Data files backupset

Control file + SPFILE backupset

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CDB Backup: Partial CDB Backup

- Back up the CDB root and/or individual PDBs.

```
$ rman TARGET /
RMAN> BACKUP PLUGGABLE DATABASE "CDB$ROOT", sales_pdb;
RMAN> BACKUP PLUGGABLE DATABASE hr_pdb PLUS ARCHIVELOG;
```
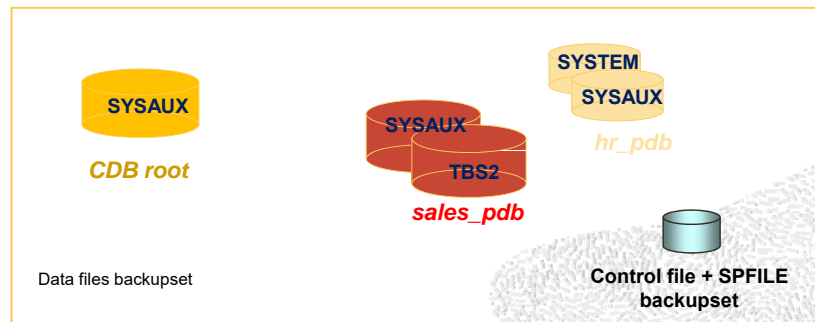
```
$ rman TARGET sys@hr_pdb
RMAN> BACKUP DATABASE;
```

SYSTEM
SYSAUX
UNDO

CDB root

SYSTEM
SYSAUX
TBS2

sales_pdb

SYSTEM
SYSAUX

hr_pdb

SPFILE

Archived log files backupset

Data files backupset

Control file + SPFILE backupset

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PDB Backup: Partial PDB Backup

```
$ rman TARGET /
RMAN> REPORT SCHEMA;
RMAN> BACKUP TABLESPACE sales_pdb:tbs2;
RMAN> BACKUP TABLESPACE hr_pdb:system, sales_pdb:sysaux;
RMAN> BACKUP TABLESPACE sysaux, hr_pdb:sysaux;
```


SYSAUX

CDB root

SYSAUX
TBS2

sales_pdb

SYSTEM
SYSAUX

hr_pdb

SPFILE

Data files backupset

Control file + SPFILE backupset

Using RMAN Backup to Plug an Unplugged PDB

Source Identification Storage Schedule Review

Create Pluggable Database : Source

Source Type
Specify the source of the pluggable database.

○ Create a new PDB
   Creates a PDB in a CDB using PDB seed.

◉ Plug an unplugged PDB
   Requires PDB archive or PDB file set (RMAN backup and PDB XML metadata file) created using Unplug PDB operation.

○ Clone PDB
   Create a PDB by cloning a source PDB and plugging the clone into the CDB. T

Source PDB

Database Link

Container Database Host Credentials
Specify host credentials. Host credentials are required to perform validations and i

Credential
◉ Preferred ○ Named ○ New
Preferred Credential Name
Normal Host Credentials
Credential Details

Attribute	Value
UserName	oracle
Password	******

More Details

SYSTEM
SYSAUX
TBS2

sales_pdb
Datafiles backupset

XML metadata file

```
<?xml version="1.0" encoding="UTF-8"?>
<tablespaces>
   <byteorder>1</byteorder>
   <vsn>202375424</vsn>
   <cid>4</cid>
   <dbid>3305365761</dbid>
   <cdbid>771288139</cdbid>
<guid>CCF18F2D95598B87EA</guid>
   <uscnbas>2235351</uscnbas>
   <uscnwrp>0</uscnwrp>
   <rdba>4194824</rdba>
   <tablespace>
      <name>SYSTEM</name>
```

Duplicating Pluggable Databases

- A single pluggable database

```
RMAN> DUPLICATE DATABASE TO cdb1 PLUGGABLE DATABASE pdb1;
```

- Several pluggable databases

```
RMAN> DUPLICATE DATABASE TO cdb1 PLUGGABLE DATABASE pdb1, pdb3;
```

- All pluggable databases except one

```
RMAN> DUPLICATE DATABASE TO cdb1 SKIP PLUGGABLE DATABASE pdb3;
```

- A PDB and tablespaces of other PDBs

```
RMAN> DUPLICATE DATABASE TO cdb1
            PLUGGABLE DATABASE pdb1 TABLESPACE pdb2:users;
```


Example: 1

To duplicate `pdb1` from `CDB1` into `CDB2`:
1. Set the `REMOTE_RECOVERY_FILE_DEST` initialization parameter in `CDB2`.

```
SQL> ALTER SYSTEM SET REMOTE_RECOVERY_FILE_DEST='/dir_to_restore_archive log files';
```

2. Connect to the source (`TARGET` for `DUPLICATE` command): `CDB1`
3. Connect to the existing `CDB2` that acts as the auxiliary instance:

```
RMAN> CONNECT TARGET "sys/oracle_4U@cdb1 AS SYSDBA"
RMAN> CONNECT AUXILIARY "sys/oracle_4U@cdb2 AS SYSDBA"
```

CDB1 — pdb1 **DUPLICATE pdb1** → CDB2 — pdb1

4. Start duplicate.

```
RMAN> DUPLICATE PLUGGABLE DATABASE pdb1 TO cdb2 FROM ACTIVE DATABASE;
```

Example: 2

To duplicate `pdb1` from `CDB1` into `CDB2` as `pdb2`:

1. Set the `REMOTE_RECOVERY_FILE_DEST` initialization parameter in `CDB2`.

   ```
   SQL> ALTER SYSTEM SET REMOTE_RECOVERY_FILE_DEST='/dir_to_restore_archive log files';
   ```

2. Connect to the source (`TARGET` for `DUPLICATE` command): `CDB1`

3. Connect to the existing `CDB2` that acts as the auxiliary instance:

   ```
   rman TARGET sys@cdb1 AUXILIARY sys@cdb2
   ```
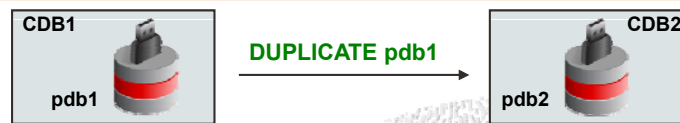

4. Start duplicate.

   ```
   RMAN> DUPLICATE PLUGGABLE DATABASE pdb1 AS pdb2 TO cdb2 FROM ACTIVE DATABASE;
   ```
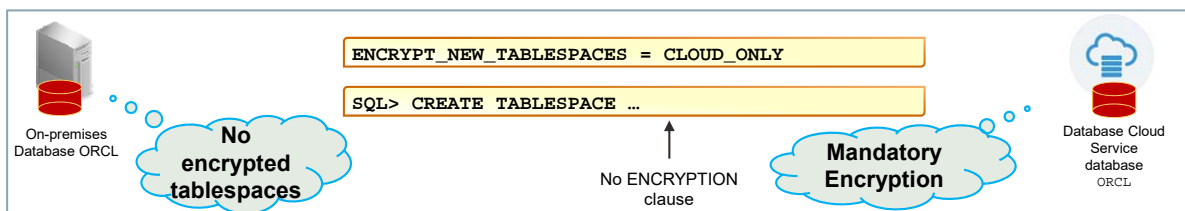
Duplicating On-Premises CDB as Cloud Encrypted CDB

Duplicating an on-premises CDB to the Cloud:
- Any newly created tablespace is encrypted in the Cloud CDB.

- The Cloud CDB holds a keystore because this is the default behavior on Cloud.
- All forms of normal duplication are compatible:
  – Active duplication
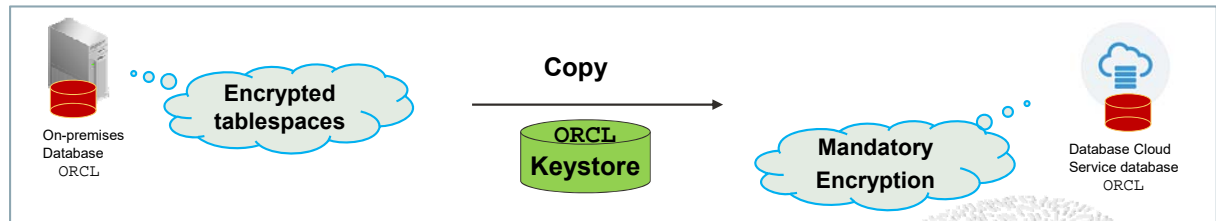 – Backup-based duplication
  – Targetless duplicate

Duplicating On-Premises Encrypted CDB as Cloud Encrypted CDB

Duplicating an on-premises CDB with encrypted tablespaces to the Cloud:
- Tablespaces of the source CDB need to be decrypted.

- Restored tablespaces are re-encrypted in the Cloud CDB.
    - Requires the master TDE key from the source CDB keystore
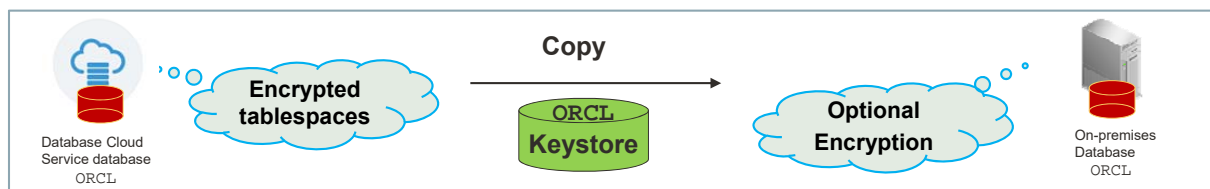   - Requires the source keystore to be copied and opened at the destination CDB

```
RMAN> SET DECRYPTION WALLET OPEN IDENTIFIED BY password;
RMAN> DUPLICATE DATABASE TO orcl FROM ACTIVE DATABASE AS ENCRYPTED;
```

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Migrating Cloud Encrypted CDB as On-Premises CDB

- Tablespaces of the source CDB are necessarily encrypted.

- Restored tablespaces need to be decrypted to be created:
    - Requires the TDE master key from the source CDB keystore
    - Requires the source keystore to be copied and opened at the destination CDB

```
RMAN> SET DECRYPTION WALLET OPEN IDENTIFIED BY password;
RMAN> DUPLICATE DATABASE TO orcl FROM ACTIVE DATABASE AS DECRYPTED;
```

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Checking for Block Corruption

Invoking proactive health check of the database and its components using RMAN `VALIDATE` command:

- Scans the specified files and verifies their contents
    - CDB: All data files of the CDB root and PDBs
    ```
    RMAN> VALIDATE DATABASE;
    ```
    - CDB root: All data files of the CDB root only
    ```
    RMAN> VALIDATE DATABASE ROOT;
    ```
    - PDB: All data files of the listed PDBs
    ```
    RMAN> VALIDATE PLUGGABLE DATABASE pdb1, pdb2;
    ```
- Confirms that the data files exist and are in the correct location
- Checks for corrupt data blocks

Summary

In this lesson, you should have learned how to:

- Back up a CDB

- Back up a PDB

- Duplicate an active PDB into an existing CDB

- Duplicate a CDB as encrypted

- Validate CDB and PDBs

Practice 8: Overview

- 8-1: RMAN whole CDB backup

- 8-2: RMAN PDB backup

- 8-3: Duplicating a PDB into an existing CDB

- 8-4: Duplicating an on-premises CDB for Cloud

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