

RMAN: Cross-Platform Backup & Restore

Oracle Database 12c for SAP

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Oracle Database Online or offline migration

- Software Provisioning Manager (SWPM) - formerly SAPinst (offline)
- ACS Lifecycle Migration Services (offline and online)
- Data Guard
- Duplicate from Active Database RMAN (online)
- Cross-Platform Transportable Tablespace (offline)
- **12c: Cross-Platform backup and restore**

Migration on same Endian

- RMAN duplicate from Active Database
 - Supported for source databases in “mount” or “open” state
 - Can be applied if source and target run on the same platform:
 - Solaris-x64/Windows/linux-x64 to/from Solaris-x64/Windows/linux-x64
 - HP-UX, AIX, SPARC to/from HP-UX, AIX, SPARC
- Data Guard
 - Same Operating System
 - Does not affect the source system
 - Can be used for migration tests

Traditional Cross Platform Transportable Tablespaces

- The high-level steps in a typical XTTS scenario are the following:
 - Make tablespaces in source database READ ONLY
 - Transfer datafiles to destination system
 - Convert datafiles to destination system Endian format
 - Export metadata of objects in the tablespaces from source database using Data Pump
 - Import metadata of objects in the tablespaces into destination database using Data Pump
 - Make tablespaces in destination database READ WRITE

RMAN 12c: XTTS Overall Improvements

Applicable to Both Regular XTTS and Using Incremental Backups

- Now supports **backup sets**
 - Unused block compression, smaller transport size, multi-section
- New Keyword: **FOR TRANSPORT**
- New Keywords: **TO PLATFORM** (at source) and **FROM PLATFORM** (destination)
 - No longer require CONVERT TABLESPACE or CONVERT DATAFILE
 - Can include tablespace metadata if that tablespace is read-only (final step)
 - Preferred to perform the conversion at the destination using FROM PLATFORM
- New Keyword: **ALLOW INCONSISTENT** to backup tablespaces that are not in read-only mode.
- XTTS with incremental backups reduces downtime up to **8X**
- Backups from 10g, 11g can be restored to a 12c destination

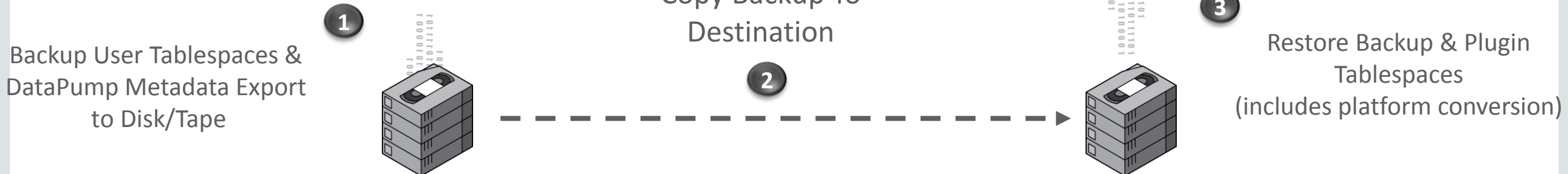
Cross-Platform Backup & Restore

Simplified Platform Migration

Source Database (AIX)



Destination Database (Linux)



- Simplifies procedure for platform migration
 - **Cross-platform Transportable Database** : Same Endian, Tablespaces : Same or across Endians
- Minimize read-only impact using incremental-based approach
- New 12c Syntax: **FOR TRANSPORT / TO PLATFORM**

Reduce Downtime using Cross Platform Incremental Backup

Part I

- Prepare phase (source data remains online)
 - Backup (level=0) of tablespaces to be transported
 - Transfer backup and other necessary setup files to destination system
 - Restore datafiles on destination system Endian format
- Roll Forward phase (source data remains online - Repeat x times)
 - Create incremental backup on source system,
 - Transfer, **convert Endian** (implicit), and apply
 - Repeat steps until ready to transport the tablespace.

Reduce Downtime using Cross Platform Incremental Backup

Part II

- Transport phase (source data is READ ONLY)
 - Make tablespaces in source database READ ONLY
 - Repeat the Roll Forward phase one final time
 - This step makes destination datafile copies consistent with source database and generates necessary export.
 - Time for this step is significantly shorter than traditional XTTS method when dealing with large data because the incremental backup size is smaller.
 - Import metadata of objects in the tablespaces into destination database using Data Pump
 - Make tablespaces in destination database READ WRITE

Cross-Platform Backup & Restore

Prepare target platform

- Create database (SYSTEM, SYSAUX, PSAPUNDO, PSAPTEMP)
 - For sample script see [Best Practices for Migration of an SAP Database to Oracle ASM](#)
 - Run Post-DB-creation scripts
 - Create Database Roles 'SAPCONN' and 'SAPDBA'
- Import all metadata (except tables of schema SAPSR3)
- Grant 'SAPCONN' and 'SAPDBA' roles

Example: Minimize Read-Only Downtime

AIX to Linux – Step (1) Database in R/W: Incremental Backups

- On destination Linux host:
 - Create 'shell' database (**SYSTEM, SYSAUX, UNDO**)
- On source AIX database (while tablespaces are in **read-write** mode):
 1. Check that tablespaces are self-contained using **DBMS_TTS.TRANSPORT_SET_CHECK**
 2. Day 1:

```
BACKUP FOR TRANSPORT ALLOW INCONSISTENT
INCREMENTAL LEVEL 0
TABLESPACE PSAPSR3, PSAPSR3740, PSAPSR3USR
FORMAT '/<NFS-mount>/xplat_backups/X11_tbs_incon.bck';
```
 3. Day 2..N:

```
BACKUP FOR TRANSPORT ALLOW INCONSISTENT
INCREMENTAL LEVEL 1
TABLESPACE PSAPSR3, PSAPSR3740, PSAPSR3USR
FORMAT '/<NFS-mount>/xplat_backups/X11_tbs_inconn.bck';
```
 4. Copy backups to destination server
 5. Repeat **INCREMENTAL LEVEL 1** backup + copy to destination server, as desired

Example: Minimize Read-Only Downtime

AIX to Linux – Step (2) Restore and Recover the Incrementals

- On destination Linux database (as and when backups copied from source):
 - **Level 0:** Restores and converts incremental blocks, then applies blocks to the restored data files

```
RESTORE FROM PLATFORM 'AIX-Based Systems (64-bit)'  
  FOREIGN DATAFILE  
    6 FORMAT '/<target-filesystem>/<datafile_6>.df'  
    10 FORMAT '/<target-filesystem>/<datafile_10>.df'  
FROM BACKUPSET '/<NFS-mount>/xplat_backups/X11_tbs_incon.bck';
```

- DATAFILE <#> is the <#> used in source AIX database

- **Level 1:** Run **RECOVER** command for each new incremental taken on source

```
RECOVER FROM PLATFORM 'AIX-Based Systems (64-bit)'  
  FOREIGN DATAFILECOPY  
  '/<target-filesystem>/<datafile_6>.df', '/<target-filesystem>/<datafile_10>.df'  
FROM BACKUPSET '/<NFS-mount>/xplat_backups/X11_tbs_incon.bck';
```

Example: Minimize Read-Only Downtime

AIX to Linux – Step (3) Database in R/O : Final Backup & Recovery

- On source AIX database:

- Place user tablespaces in **read-only** mode, prior to final incremental and Data Pump dump file backups

```
BACKUP FOR TRANSPORT INCREMENTAL LEVEL 1 TABLESPACE PSAPSR3,PSAPSR3USR,PSAPSR3730
  FORMAT '/<NFS-mount>/xplat_backups/X11_tbs_ro_incr.bck'
  DATAPUMP FORMAT '<NFS-mount>/xplat_backups/X11_tbs_dp.bck';
```

- Copy incremental and Data Pump metadata dump file backups to destination Linux host

- On destination Linux database:

- Recover the last incremental level 1 datafiles

```
RECOVER FROM PLATFORM 'AIX-Based Systems (64-bit)'
  FOREIGN DATAFILECOPY
  '/<target-filesystem>/<datafile_6>.df', '/<target-filesystem>/<datafile_10>.df'
  FROM BACKUPSET '/tmp/xplat_restores/X11_tbs_ro_incr.bck';
```

- Extract dumpfile data (Data Pump format) from the backupset

```
RESTORE FROM PLATFORM 'AIX-Based Systems (64-bit)'
  DUMP FILE 'X11_tbs_dp.dmp'
  DATAPUMP DESTINATION '/tmp/dump'
  FROM BACKUPSET '/tmp/xplat_restores/X11_tbs_dp.bck';
```

Example: Minimize Read-Only Downtime

AIX to Linux – Step (4) Import Metadata & Plug-in Tablespaces

- On destination Linux database:

1. Create tablespace users as they exist on source database
2. Run **CREATE DIRECTORY** to create **DP_DIR** directory object, mapped to the dump file directory (**/tmp/dump**)
3. Import Data Pump metadata dump file to 'plug in' new user tablespaces

```
IMPDP DIRECTORY=DP_DIR  
DUMPFILE=X11_tbs_dp.dmp  
TRANSPORT_DATAFILES '/<target-filesystem>/<datafile_6>.df',  
'/<target-filesystem>/<datafile_10>.dff'  
NOLOGFILE=Y
```

4. Tablespaces are made read-write

```
SQL> ALTER TABLESPACE PSAPSR3, PSAPSR3USR, PSAPSR730 READ WRITE;
```

Backup Level 0

- **backup for transport allow inconsistent incremental level 0 datafile 24**
format '/oracle/MXL/RMAN-bck/%N_%f_%U.bkp';
– PSAPSR3USR
- backup for transport allow inconsistent incremental level 0 datafile
4,5,6,7,8,9,10,11,12,13,14,15,16,17,18 format '/oracle/MXL/RMAN-
bck/%N_%f_%U.bkp';
– PSAPSR3
- backup for transport allow inconsistent incremental level 0 datafile
19,20,21,22,23 format '/oracle/MXL/RMAN-bck/%N_%f_%U.bkp';
– PSAPSR730

Restore the datafiles

- restore from platform 'Solaris[tm] OE (64-bit)' FOREIGN **DATAFILE 13** format '/oracle/MXL/sapdata2/sr3_10/sr3.data10' from backupset '/oracle/MXL/RMAN-bck/PSAPSR3_13_4ds237cr_1_1.bkp';
- restore from platform 'Solaris[tm] OE (64-bit)' FOREIGN **DATAFILE 10** format '/oracle/MXL/sapdata2/sr3_7/sr3.data7', **15** format '/oracle/MXL/sapdata2/sr3_12/sr3.data12' from backupset '/oracle/MXL/RMAN-bck/PSAPSR3_15_47s237ck_1_1.bkp';
- restore from platform 'Solaris[tm] OE (64-bit)' FOREIGN **DATAFILE 9** format '/oracle/MXL/sapdata2/sr3_6/sr3.data6', **17** format '/oracle/MXL/sapdata2/sr3_14/sr3.data14' from backupset '/oracle/MXL/RMAN-bck/PSAPSR3_17_4bs237cn_1_1.bkp';

Incremental backup

- backup for transport allow INCONSISTENT incremental from scn 139479375 tablespace 'PSAPSR3' format '/oracle/MXL/RMAN-bck/%U';
- backup for transport allow INCONSISTENT incremental from scn 139479375 tablespace 'PSAPSR3730' format '/oracle/MXL/RMAN-bck/%U';
- backup for transport allow INCONSISTENT incremental from scn 139479375 tablespace 'PSAPSR3USR' format '/oracle/MXL/RMAN-bck/%U';

Apply incremental backup

- recover from platform 'Solaris[tm] OE (64-bit)' FOREIGN DATAFILECOPY '/oracle/MXL/sapdata4/sr3usr_1/sr3usr.data1' from backupset '/oracle/MXL/RMAN-bck/51s25j1k_1_1';
- recover from platform 'Solaris[tm] OE (64-bit)' FOREIGN DATAFILECOPY '/oracle/MXL/sapdata2/sr3_6/sr3.data6','/oracle/MXL/sapdata2/sr3_14/sr3.data14' from backupset '/oracle/MXL/RMAN-bck/4ps25ia3_1_1';
- recover from platform 'Solaris[tm] OE (64-bit)' FOREIGN DATAFILECOPY '/oracle/MXL/sapdata2/sr3_2/sr3.data2','/oracle/MXL/sapdata2/sr3_5/sr3.data5' from backupset '/oracle/MXL/RMAN-bck/4ks25ia2_1_1';

Create and recover the final incremental Backup

- **BACKUP FOR TRANSPORT INCREMENTAL** from scn 153438311 TABLESPACE PSAPSR3,PSAPSR3730,PSAPSR3USR **FORMAT** '/oracle/MXL/RMAN-bck/%U' **DATAPUMP FORMAT** '/oracle/MXL/RMAN-bck/%U';
- **recover from platform** 'Solaris[tm] OE (64-bit)' **FOREIGN DATAFILECOPY** '/oracle/MXL/sapdata2/sr3_6/sr3.data6', '/oracle/MXL/sapdata2/sr3_13/sr3.data13', '/oracle/MXL/sapdata3/sr3730_3/sr3730.data3' **from backupset** '/oracle/MXL/RMAN-bck/3vrajves_1_1';
- **recover from platform** 'Solaris[tm] OE (64-bit)' **FOREIGN DATAFILECOPY** '/oracle/MXL/sapdata2/sr3_6/sr3.data6', '/oracle/MXL/sapdata2/sr3_14/sr3.data14' **from backupset** '/oracle/MXL/RMAN-bck/7ns2kta0_1_1';

Apply metadata

```
directory=dpump_tts logfile=tts_imp.log network_link=ttslink transport_full_check=no
transport_tablespaces=PSAPSR3,PSAPSR3730,PSAPSR3USR
transport_datafiles='/oracle/MXL/sapdata2/sr3_1/sr3.data1','/oracle/MXL/sapdata2/sr
3_2/sr3.data2','/oracle/MXL/sapdata2/sr3_3/sr3.data3','/oracle/MXL/sapdata2/sr3_4/sr
3.data4','/oracle/MXL/sapdata2/sr3_5/sr3.data5','/oracle/MXL/sapdata2/sr3_6/sr3.data
6','/oracle/MXL/sapdata2/sr3_7/sr3.data7','/oracle/MXL/sapdata2/sr3_8/sr3.data8','/or
acle/MXL/sapdata2/sr3_9/sr3.data9','/oracle/MXL/sapdata2/sr3_10/sr3.data10','/orac
le/MXL/sapdata2/sr3_11/sr3.data11','/oracle/MXL/sapdata2/sr3_12/sr3.data12','/oracle
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cle/MXL/sapdata3/sr3730_2/sr3730.data2','/oracle/MXL/sapdata3/sr3730_3/sr3730.da
ta3','/oracle/MXL/sapdata3/sr3730_4/sr3730.data4','/oracle/MXL/sapdata3/sr3730_5/s
r3730.data5','/oracle/MXL/sapdata4/sr3usr_1/sr3usr.data1'
```

Final steps

- RMAN> validate tablespace PSAPSR3, PSAPSR3USR, PSAPSR3730
- SQL>alter tablespace PSAPSR3 read write;
 - Same for PSAPSR3USR, PSAPSR3730
- SQL> select tablespace_name,status from dba_tablespaces;
- Set default tablespace and temporary tablespace

Cross Platform Incremental Backup Supporting Scripts (I)

MOS 2005729.1

- Run the backup on the source system
 - [oracle@source]\$ \$ORACLE_HOME/perl/bin/perl xttdriver.pl –backup
- Restore the datafiles on the destination system
 - [oracle@dest]\$ \$ORACLE_HOME/perl/bin/perl xttdriver.pl –restore
- Create an incremental backup of the tablespaces being transported on the source system
 - [oracle@source]\$ \$ORACLE_HOME/perl/bin/perl xttdriver.pl –bkpinc
- Apply the incremental backup to the datafile copies on the destination system
 - [oracle@dest]\$ \$ORACLE_HOME/perl/bin/perl xttdriver.pl –recover

Cross Platform Incremental Backup Supporting Scripts (II)

MOS 2005729.1

- Determine the FROM_SCN for the next incremental backup
 - [oracle@source]\$ \$ORACLE_HOME/perl/bin/perl xttdriver.pl -s
- Final Incremental Backup
 - Alter source tablespace(s) READ ONLY in the source database
- Create the final incremental backup and transfer necessary files to the destination datafiles
 - [oracle@source]\$ \$ORACLE_HOME/perl/bin/perl xttdriver.pl -bkpexport
- Apply last incremental backup to destination datafiles
 - [oracle@dest]\$ \$ORACLE_HOME/perl/bin/perl xttdriver.pl --resincrdmp

Cross Platform Incremental Backup Supporting Scripts (III)

MOS 2005729.1

- Modify and execute Impdp command:
 - `impdp directory=DATA_PUMP_DIR logfile=tts_imp.log network_link=ttslink transport_full_check=no transport_tablespaces=PSAPSR3,PSAPSR3730,PSAPSR3USR transport_datafiles='/oracle/MXL/sapdata2/sr3_1/sr3.data1','/oracle/MXL/sapdata2/sr3_2/sr3.data2','/oracle/MXL/sapdata2/sr3_3/sr3.data3','/oracle/MXL/sapdata2/sr3_4/sr3.data4' etc..`
- `RMAN>validate tablespace PSAPSR3,PSAPSR3730,PSAPSR3USR check logical;`
- `SQL>alter tablespace SAPSR3 read write;`
 - Same for SAPSR3USR, SAPSR3730
- `startsap`

Information sources

- [Best Practices for Migration of an SAP Database to Oracle ASM](#)
- [12c – Reduce Transportable Tablespace Downtime using Cross Platform Incremental Backup \(Doc ID 2005729.1\)](#)
- [Best Practices for Migrating SAP Systems to Oracle Infrastructure--Part 4: SAP Database Migration Method 2--Transportable Tablespaces](#)
- Email: abdelrhani.boukachabine@oracle.com

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