【TTS】传输表空间 Linux asm -> AIX asm

1.1 BLOG 文档结构图

1.2 前言部分

1.2.1 导读和注意事项

各位技术爱好者，看完本文后，你可以掌握如下的技能，也可以学到一些其它你所不知道的知识，~O(∩_∩)O~：

① 异构平台下传输表空间的实施

② 传输表空间基于表空间的 read only 和 rman2 种方式

③ 平台字节序、自包含概念

④ expdp/impdp 的应用

Tips：

① 若文章代码格式有错乱，推荐使用搜狗或 360 浏览器，也可以下载 pdf 格式的文档来查看，pdf 文档下载地址：http://yunpan.cn/cdEQedhCs2kFz （提取码：ed9b）

② 本篇 BLOG 中命令的输出部分需要特别关注的地方我都用灰色背景和粉红色字体来表示，比如下边的例子中，thread 1 的最大归档日志号为 33，thread 2 的最大归档日志号为 43 是需要特别关注的地方；而命令一般使用黄色背景和红色字体标注；对代码或代码输出部分的注释一般采用蓝色字体表示。

```
List of Archived Logs in backup set 11
Thrd Seq     Low SCN    Low Time             Next SCN   Next Time
---- ------- ---------- -------------------- ---------- ---------
1    32      1621589    2015-05-29 11:09:52 1625242    2015-05-29 11:15:48
1    33      1625242    2015-05-29 11:15:48 1625293    2015-05-29 11:15:58
2    42      1613951    2015-05-29 10:41:18 1625245    2015-05-29 11:15:49
2    43      1625245    2015-05-29 11:15:49 1625253    2015-05-29 11:15:53



[ZFXDESKDB1:root]:/>lsvg -o
T_XDESK_APP1_vg
rootvg
[ZFXDESKDB1:root]:/>
00:27:22 SQL> alter tablespace idxtbs read write;


====》2097152*512/1024/1024/1024=1G
```

本文如有错误或不完善的地方请大家多多指正，ITPUB 留言或 QQ 皆可，您的批评指正是我写作的最大动力。

1.2.2 相关参考文章链接

其他异构平台迁移的一些文章参考：

【推荐】 oracle 异构平台迁移之传输表空间一例 http://blog.itpub.net/26736162/viewspace-1391913/

【推荐】 oracle 传输表空间一例 http://blog.itpub.net/26736162/viewspace-1375260/

【推荐】 利用 rman 来实现 linux 平台数据库复制到 windows 平台数据库 http://blog.itpub.net/26736162/viewspace-1352436/

【推荐】 直接复制数据文件实现 linux 平台数据库复制到 windows 平台数据库 http://blog.itpub.net/26736162/viewspace-1352243/

1.3 相关知识点扫盲

可传输表空间的特性主要用于进行库对库的表空间复制，要进行传输的表空间必须置于 read-only 模式。如果生产库不允许表空间置为只读模式，没关系，方法还是有的，通过 RMAN 备份也可以创建可传输表空间集。要使用可传输表空间的特性，oracle 至少是8i 企业版或更高版本。如果是相同操作系统平台相互导入，则8i 及以上版本均可支持，但如果是不同操作系统平台，数据库版本至少10g。被传输的表空间即可以是字典管理，也可以是本地管理。并且自 oracle9i 开始，被传输表空间的 block size 可以与目标数据库的 block size 不同。

可传输表空间(还有个集)最大的优势是其速度比 export/import 或 unload/load 要快的多。因为可传输表空间主要是复制数据文件到目标路径，然后再使用 export/import 或 Data Pump export/import 等应用仅导出/导入表空间对象的元数据到新数据库。

关于可传输表空间，还有个集(Transportable Tablespace Sets)的创建，其中都提到了很重要一点，就是被传输的表空间在传输过程中必须置为 read-only。而在实际操作过程中，对于某些生产数据库，将表空间置为 read-only 是件非常复杂的事情甚至完全不允许，有了 RMAN 的 Transportable Tablespace，这一切都得以避免。RMAN 通过备份创建可传输表空间集，它并不需要存取活动的数据文件，相应也就不需要将表空间置为 read-only。因此，数据库可用性得到提升，尤其对于超大的表空间，因为被传输的表空间在此期间仍可进行读写操作，而且把表空间置为 read-only 模式可能会花费较长时间，

使用 RMAN 创建可传输表空间集，允许你在传输过程中指定目标恢复时间点或 SCN，这样传输的数据可以更灵活，不必完全复制现有表空间，只要备份中存在，你就可以选择性的恢复数据。例如，你的备份策略为保留一周，你希望创建的可传输表空间中数据是截止本月底最后一天的数据，那么你在下个月第一周内任何时候都可以进行传输操作而不需要考虑这期间生产库是否会有写入操作。

1.3.1 注意事项

☞ **注意：**

① source 和 target database 的数据库版本最好一致，否则会因为 db time zone 不一致导致报如下错误，但是如果 source 大于等于 target 的话是可以的，向下兼容的

```
ORA-39002: invalid operation
```

ORA-39322: Cannot use transportabletablespace with timestamp with timezone columns and different timezone version.

② source 和 target 端的字符集必须一致，例如如下情况报错：

source 为 ZHS16GBK，target 为 AL32UTF8

```
ORA-39123: Data Pump transportable tablespace job aborted
ORA-29345: cannot plug a tablespace into a database using an incompatible character set

Tartget db char set AL32UTF8 is not a superset of ZHS16GBK.
Failed to plug in a tablespace due to incompatible
  database character set"AL32UTF8" and
  transportable set database character set "ZHS16GBK"
```

③ source 和 target database 的 compatible 参数最好一致，但 source 如果小于等于 target 端的话是可以的，例如 source 为 11.2.0.4.0，target 为 11.2.0.0.0 就不行，impdp 的时候报错：

```
ORA-39123: Data Pump transportable tablespace job aborted
ORA-00721: changes by release 11.2.0.4.0 cannot be used by release 11.2.0.0.0
```

1.4 实验部分

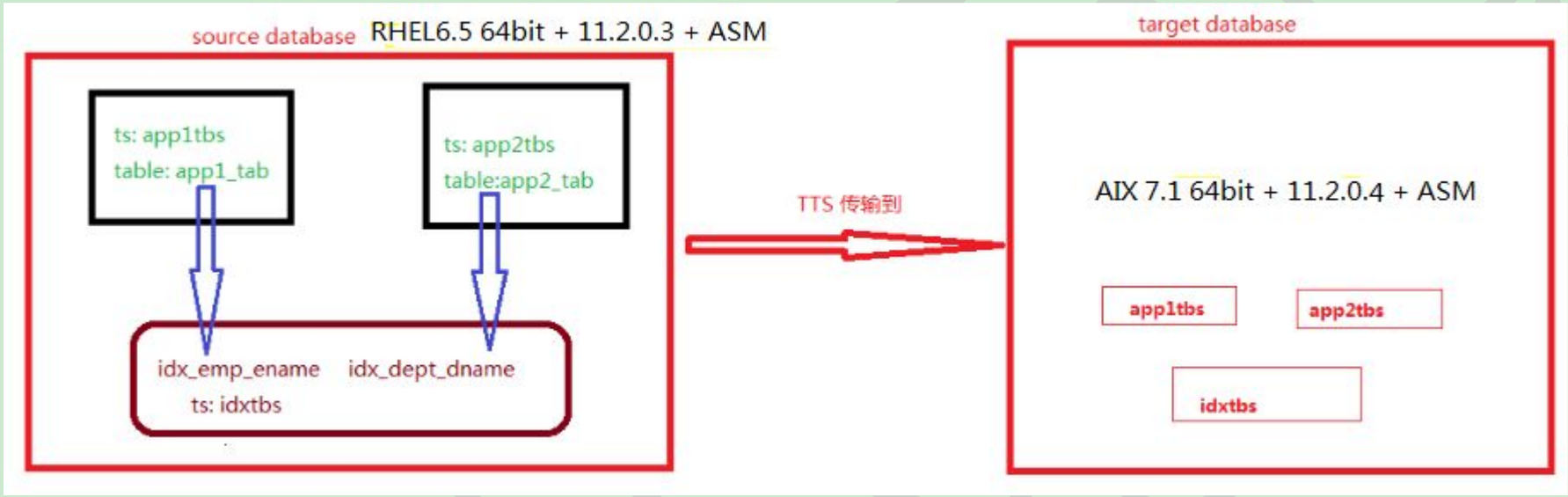
1.4.1 实验环境介绍

项目	source db	target db
db 类型	单实例	单实例
db version	11.2.0.3	11.2.0.4
db 存储	ASM	ASM
ORACLE_SID	orclasm	ora2lhr
db_name	orclasm	ora2lhr
主机 IP 地址：	192.168.59.30	22.188.194.66
OS 版本及 kernel 版本	RHEL6.5 64 位， 2.6.32-504.16.2.el6.x86_64	AIX 64 位 7.1.0.0
OS hostname	rhel6_lhr	ZFXDESKDB2
platform_name	Linux x86 64-bit	AIX-Based Systems (64-bit)
db time zone	14	14

字符集	ZHS16GBK	ZHS16GBK
compatible	11.2.0.0.0	11.2.0.4.0
归档模式	Archive Mode	Archive Mode

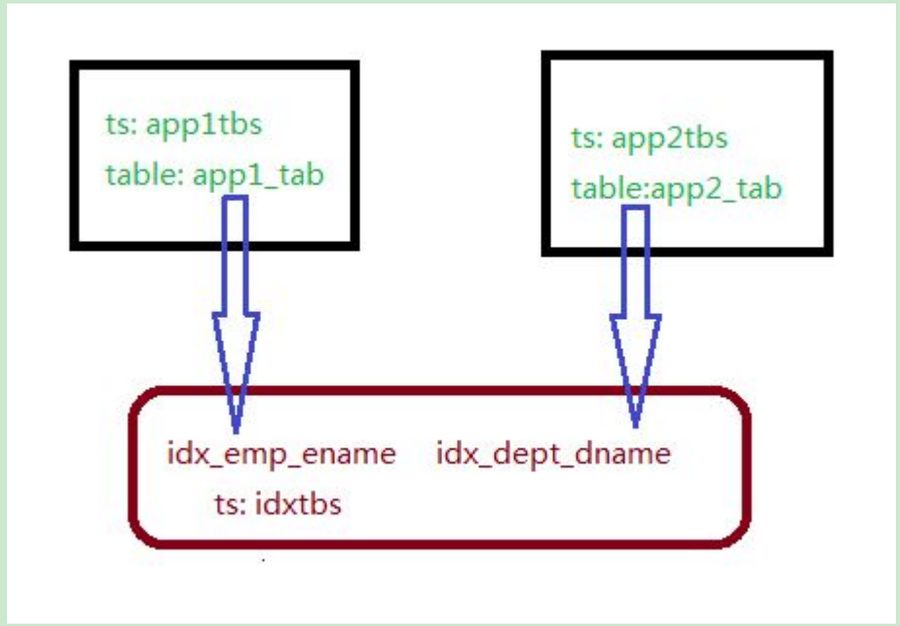
1.4.2 实验目标

要实现将自定义的应用程序表空间 app1tbs,app2tbs,idxtbs 从源平台传递到目标平台，而在实际的工作过程中，需要将 AIX 上的数据库迁移到 Linux，或者将 Linux 上的数据库迁移到 AIX 上，除了 exp/imp 和 expdp/impdp 外，最常用的就是传输表空间了，若是整个库迁移的话，我们需要做的就是把业务用户和业务表空间的数据迁移过来就行，Undo、temp、system 等等的就不用迁移了，整个处理过程和本文档的处理过程大同小异，需要关注的是业务对象的个数、大小、状态等。



1.4.3 实验过程

1.5 source 端环境准备



1.5.1 在源库上创建 3 个用户应用的表空间

```
[oracle@rhel6_lhr ~]$ sqlplus / as sysdba

SQL*Plus: Release 11.2.0.3.0 Production on 星期日 1月 31 23:34:27 2016

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连接到:
Oracle Database 11g Enterprise Edition Release 11.2.0.3.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Data Mining
and Real Application Testing options

23:34:27 SQL>  create tablespace app1tbs datafile '+DATA' size 10m;

表空间已创建。

已用时间:  00: 00: 07.60
23:34:42 SQL> create tablespace app2tbs datafile '+DATA' size 10m;

表空间已创建。

已用时间:  00: 00: 27.25
23:35:53 SQL> create tablespace idxtbs datafile '+DATA' size 10m;

表空间已创建。

已用时间:  00: 00: 09.45
23:36:09 SQL> set line 9999 pagesize 9999
23:36:12 SQL> SELECT   a.NAME,  b.NAME FROM v$tablespace a , v$datafile b WHERE a.TS#=b.TS#  ;

NAME                           NAME
------------------------       --------------------------------------------------------------------------------
SYSTEM                         +DATA/orclasm/datafile/system.256.850260145
```

```
SYSAUX                         +DATA/orclasm/datafile/sysaux.257.850260145
UNDOTBS1                       +DATA/orclasm/datafile/undotbs1.258.851526539
USERS                          +DATA/orclasm/datafile/users.259.850260147
EXAMPLE                        +DATA/orclasm/datafile/example.265.850260295
APP1TBS                        +DATA/orclasm/datafile/app1tbs.268.902619275
APP2TBS                        +DATA/orclasm/datafile/app2tbs.280.902619327
TS_LHR                         +DATA/orclasm/datafile/ts_lhr.269.852632495
ENCRYPTED_TS                   +DATA/orclasm/datafile/encrypted_ts.272.854650889
GOLDENGATE                     +DATA/orclasm/datafile/goldengate.273.862829891
IDXTBS                         +DATA/orclasm/datafile/idxtbs.281.902619361
TS_LHR                         +DATA/orclasm/datafile/ts_lhr.284.869738273
USERS                          +FRA/orclasm/datafile/users.449.880121199
SYSTEM                         +FRA/orclasm/datafile/system.349.880121287

已选择 14 行。

已用时间:  00: 00: 00.80
23:36:21 SQL>
```

1.5.2 在相应的表空间创建表和索引

```
23:36:21 SQL> create user user_app1 identified by user_app1 default tablespace app1tbs;

用户已创建。

已用时间:  00: 00: 00.14
23:40:13 SQL> create user user_app2 identified by user_app2 default tablespace app1tbs;

用户已创建。

已用时间:  00: 00: 00.35
23:43:51 SQL> create user user_app2 identified by user_app2 default tablespace app2tbs;

用户已创建。

已用时间:  00: 00: 02.72
23:43:56 SQL>  grant connect,resource to user_app1;

授权成功。

已用时间:  00: 00: 00.06
23:44:50 SQL>  grant connect,resource to user_app2;

授权成功。

已用时间:  00: 00: 00.00
23:44:52 SQL> create table user_app1.app1_tab tablespace app1tbs as select * from scott.emp;

表已创建。

已用时间:  00: 00: 01.02
23:45:09 SQL>  create table user_app2.app2_tab tablespace app2tbs as select * from scott.dept;

表已创建。

已用时间:  00: 00: 00.23
23:45:27 SQL>  create index user_app1.idx_emp_ename on user_app1.app1_tab(ename) tablespace idxtbs;

索引已创建。

已用时间:  00: 00: 00.25
23:45:51 SQL> create index user_app2.idx_dept_dname on user_app2.app2_tab(dname) tablespace idxtbs;
```

```
索引已创建。

已用时间:  00: 00: 00.01
23:46:13 SQL>
```

1.6 判断平台支持并确定字节序

如果传输表空间集到不同的平台，则要确定对于源和目标平台这种跨平台表空间被支持，也要确定每个平台的字节序，如果平台具有相同的字节序，则不需要进行转化，否则必须做一个表空间集转化，在源端或目标端。

1.6.1 在源平台查询

```
23:46:13 SQL>  col platform_name for a40
23:48:55 SQL> select d.platform_name,tp.endian_format from v$transportable_platform tp,v$database d where tp.platform_name=d.platform_name;

PLATFORM_NAME                            ENDIAN_FORMAT
---------------------------------------- --------------
Linux x86 64-bit                         Little

已用时间:  00: 00: 00.19
23:49:13 SQL>
```

结论：当前的系统平台支持跨平台表空间传输（因为上面的查询有记录返回）

1.6.2 在目标平台查询

```
[ZFXDESKDB2:oracle]:/oracle>ORACLE_SID=ora2lhr
[ZFXDESKDB2:oracle]:/oracle>sqlplus / as sysdba

SQL*Plus: Release 11.2.0.4.0 Production on Mon Feb 1 13:47:14 2016

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Oracle Database 11g Enterprise Edition Release 11.2.0.4.0 - 64bit Production
With the Partitioning, Real Application Clusters, Automatic Storage Management, OLAP,
Data Mining and Real Application Testing options

SYS@ora2lhr> col platform_name for a40
SYS@ora2lhr> select d.platform_name,tp.endian_format from v$transportable_platform tp,v$database d where tp.platform_name=d.platform_name;

PLATFORM_NAME                            ENDIAN_FORMAT
---------------------------------------- --------------------------
AIX-Based Systems (64-bit)               Big
```

结论： 当前的 AIX 平台支持跨平台的表空间传输

源平台和目标平台的 Endian_format 不同，source 端为 Little，target 端为 Big，所以需要进行表空间集转换，前边说过在源端或目标端都可以进行转换，这里我们选择在目标端来进行转换。

1.7 选择自包含的表空间集

1.7.1 进行检查

Indicates whether a full or partial dependency check is required. If TRUE, treats all IN and OUT pointers(dependencies) and captures them as violations if they are not self-contained in the transportable set.

先试试要传输 app1tbs 和 idxtbs 这 2 个表空间：

```
SQL> execute dbms_tts.transport_set_check('app1tbs,idxtbs',true);

PL/SQL procedure successfully completed.
```

1.7.2 查看检查结果

```
SQL> col violations for a70

23:50:53 SQL> select * from transport_set_violations;

VIOLATIONS
----------------------------------------------------------------------------------------------------------------------------------
ORA-39907: 索引 USER_APP2.IDX_DEPT_DNAME (在表空间 IDXTBS 中) 指向表 USER_APP2.APP2_TAB (在表空间 APP2TBS 中)。

已用时间:  00: 00: 00.18
23:51:14 SQL>
```

结论： 在 idxtbs 表空间中 IDX_DEPT_DNAME 索引指向了表空间集外的 USER_APP2.APP2_TAB 表，所以这里选择 app1tabs,app2tabs,idxtbs 作为新的表空间集再次进行检查

```
23:51:14 SQL> execute dbms_tts.transport_set_check('app1tbs,app2tbs,idxtbs',true);

PL/SQL 过程已成功完成。

已用时间:  00: 00: 07.24
23:52:14 SQL> select * from transport_set_violations;

未选定行

已用时间:  00: 00: 00.00
23:52:54 SQL>
```

结论： 此时这个表空间集已经不再违背自包含的条件，可以确定为一个可传输表空间集。在实际生产环境中也是如此检查的，若是全库迁移，得把需要迁移的表空间修改为自包含的。

1.8 产生可传输表空间集

1.8.1 使自包含的表空间集中的所有表空间变为只读状态

```
23:52:54 SQL> alter tablespace app1tbs read only;

表空间已更改。

已用时间:  00: 00: 00.36
23:54:31 SQL> alter tablespace app2tbs read only;

表空间已更改。

已用时间:  00: 00: 00.15
23:54:42 SQL> alter tablespace idxtbs read only;

表空间已更改。

已用时间:  00: 00: 00.14
23:54:48 SQL>
```

1.8.2 使用数据泵导出工具，导出要传输的各个表空间的元数据

1.8.2.1 确定导出目录

```
23:55:51 SQL> set line 9999
23:56:07 SQL> col directory_name for a28
23:56:07 SQL> col directory_path for a100
23:56:07 SQL> select directory_name,directory_path from dba_directories;

DIRECTORY_NAME               DIRECTORY_PATH
---------------------------- ----------------------------------------------------------------------------------------------------
OSDESC                       /home/oracle/
ASMSRC                       +DATA/orclasm/datafile/
DIR_ALERT                    /u01/app/oracle/diag/rdbms/orclasm/orclasm/trace
SCHEDULER$_WALLET_DIR        /u01/app/oracle/product/11.2.0/dbhome_1/scheduler/wallet
TMP_HF_DIR                   +DATA/orclasm/datafile/
FY_DATA_DIR                  /tmp
REPDIR                       /oradata06/repdir
DIR_ALERT_CHECKHELTH_LHR_1   /u01/app/oracle/diag/rdbms/orclasm/orclasm/trace
SUBDIR                       /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/order_entry//2002/Sep
SS_OE_XMLDIR                 /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/order_entry/
LOG_FILE_DIR                 /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/log/
MEDIA_DIR                    /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/product_media/
XMLDIR                       /u01/app/oracle/product/11.2.0/dbhome_1/rdbms/xml
DATA_FILE_DIR                /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/sales_history/
DATA_PUMP_DIR                /u01/app/oracle/admin/orclasm/dpdump/
ORACLE_OCM_CONFIG_DIR        /u01/app/oracle/product/11.2.0/dbhome_1/ccr/state

已选择 16 行。

已用时间:  00: 00: 00.01
23:56:08 SQL>
```

1.8.2.2 开始导出

```
[oracle@rhel6_lhr ~]$ env | grep ORACLE
ORACLE_SID=orclasm
ORACLE_BASE=/u01/app/oracle
ORACLE_HOME=/u01/app/oracle/product/11.2.0/dbhome_1

[oracle@rhel6_lhr ~]$ expdp \'/ as sysdba\' dumpfile=expdat_20160131.dmp directory=DATA_PUMP_DIR transport_tablespaces=app1tbs,app2tbs,idxtbs transport_full_check=y
logfile=tts_export_20160131.log

Export: Release 11.2.0.3.0 - Production on 星期一 2月 1 00:03:39 2016

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连接到: Oracle Database 11g Enterprise Edition Release 11.2.0.3.0 - 64bit Production
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and Real Application Testing options
启动 "SYS"."SYS_EXPORT_TRANSPORTABLE_01":  "/******** AS SYSDBA" dumpfile=expdat_20160131.dmp directory=DATA_PUMP_DIR transport_tablespaces=app1tbs,app2tbs,idxtbs transport_full_check=y
logfile=tts_export_20160131.log
处理对象类型 TRANSPORTABLE_EXPORT/PLUGTS_BLK
处理对象类型 TRANSPORTABLE_EXPORT/TABLE
处理对象类型 TRANSPORTABLE_EXPORT/INDEX/INDEX
处理对象类型 TRANSPORTABLE_EXPORT/INDEX_STATISTICS
处理对象类型 TRANSPORTABLE_EXPORT/POST_INSTANCE/PLUGTS_BLK
已成功加载/卸载了主表 "SYS"."SYS_EXPORT_TRANSPORTABLE_01"
******************************************************************************
SYS.SYS_EXPORT_TRANSPORTABLE_01 的转储文件集为:
  /u01/app/oracle/admin/orclasm/dpdump/expdat_20160131.dmp
******************************************************************************
可传输表空间 APP1TBS 所需的数据文件:
  +DATA/orclasm/datafile/app1tbs.268.902619275
可传输表空间 APP2TBS 所需的数据文件:
  +DATA/orclasm/datafile/app2tbs.280.902619327
可传输表空间 IDXTBS 所需的数据文件:
  +DATA/orclasm/datafile/idxtbs.281.902619361
作业 "SYS"."SYS_EXPORT_TRANSPORTABLE_01" 已于 00:07:22 成功完成

[oracle@rhel6_lhr ~]$
```

查看文件：

```
[oracle@rhel6_lhr ~]$ cd  /u01/app/oracle/admin/orclasm/dpdump/
[oracle@rhel6_lhr dpdump]$ ll
total 13536
-rw-r----- 1 oracle asmadmin  110592 Feb  1 00:07 expdat_20160131.dmp
-rw-r--r-- 1 oracle asmadmin    1450 Feb  1 00:07 tts_export_20160131.log
[oracle@rhel6_lhr dpdump]$
```

告警日志可以看到：

```
Sun Dec 21 17:48:50 2014
DM00 started with pid=45, OS id=13188, job SYSTEM.SYS_EXPORT_TRANSPORTABLE_01
Sun Dec 21 17:48:56 2014
DW00 started with pid=46, OS id=13190, wid=1, job SYSTEM.SYS_EXPORT_TRANSPORTABLE_01
Sun Dec 21 17:49:15 2014
XDB installed.
XDB initialized.
```

1.8.3 生成数据文件

```
[root@rhel6_lhr ~]# su - grid
[grid@rhel6_lhr ~]$ asmcmd
ASMCMD> cd  +DATA/orclasm/datafile/
ASMCMD> ls
APP1TBS.274.866911939
APP2TBS.275.866912075
ENCRYPTED_TS.272.854650889
EXAMPLE.265.850260295
GOLDENGATE.273.862829891
IDXTBS.276.866912133
SYSAUX.257.850260145
SYSTEM.256.850260145
TBS_RC.268.852116523
TS_LHR.269.852632495
UNDOTBS1.258.851526539
UNDOTBS2.267.851204361
USERS.259.850260147
example.265.850260295_bk
ASMCMD> cp APP1TBS.274.866911939 /u01/app/oracle/admin/orclasm/dpdump
copying +DATA/orclasm/datafile/APP1TBS.274.866911939 -> /u01/app/oracle/admin/orclasm/dpdump/APP1TBS.274.866911939
ASMCMD-8016: copy source->'+DATA/orclasm/datafile/APP1TBS.274.866911939' and target->'/u01/app/oracle/admin/orclasm/dpdump/APP1TBS.274.866911939' failed
ORA-19505: failed to identify file "/u01/app/oracle/admin/orclasm/dpdump/APP1TBS.274.866911939"
ORA-27040: file create error, unable to create file
Linux-x86_64 Error: 13: Permission denied
Additional information: 1
ORA-15120: ASM file name '/u01/app/oracle/admin/orclasm/dpdump/APP1TBS.274.866911939' does not begin with the ASM prefix character
ORA-06512: at "SYS.X$DBMS_DISKGROUP", line 413
ORA-06512: at line 3 (DBD ERROR: OCIStmtExecute)
```

无权限，暂时拷贝到 grid 目录下：

```
ASMCMD> cp APP1TBS.274.866911939 /home/grid
copying +DATA/orclasm/datafile/APP1TBS.274.866911939 -> /home/grid/APP1TBS.274.866911939
ASMCMD> cp APP2TBS.275.866912075 /home/grid
copying +DATA/orclasm/datafile/APP2TBS.275.866912075 -> /home/grid/APP2TBS.275.866912075
ASMCMD> cp IDXTBS.276.866912133 /home/grid
copying +DATA/orclasm/datafile/IDXTBS.276.866912133 -> /home/grid/IDXTBS.276.866912133
ASMCMD>

[grid@rhel6_lhr ~]$ asmcmd
ASMCMD> cd  +DATA/orclasm/datafile/
ASMCMD> ls
APP1TBS.268.902619275
APP2TBS.280.902619327
ENCRYPTED_TS.272.854650889
EXAMPLE.265.850260295
GOLDENGATE.273.862829891
IDXTBS.281.902619361
SYSAUX.257.850260145
SYSTEM.256.850260145
TS_LHR.269.852632495
TS_LHR.284.869738273
UNDOTBS1.258.851526539
USERS.259.850260147
example.265.850260295_bk
ASMCMD> rm -rf example.265.850260295_bk
ASMCMD> ls
APP1TBS.268.902619275
APP2TBS.280.902619327
ENCRYPTED_TS.272.854650889
EXAMPLE.265.850260295
GOLDENGATE.273.862829891
IDXTBS.281.902619361
```

```
SYSAUX.257.850260145
SYSTEM.256.850260145
TS_LHR.269.852632495
TS_LHR.284.869738273
UNDOTBS1.258.851526539
USERS.259.850260147
ASMCMD> cp APP1TBS.268.902619275 /u01/app/oracle/admin/orclasm/dpdump
copying +DATA/orclasm/datafile/APP1TBS.268.902619275 -> /u01/app/oracle/admin/orclasm/dpdump/APP1TBS.268.902619275
ASMCMD-8016: copy source->'+DATA/orclasm/datafile/APP1TBS.268.902619275' and target->'/u01/app/oracle/admin/orclasm/dpdump/APP1TBS.268.902619275' failed
ORA-19505: failed to identify file "/u01/app/oracle/admin/orclasm/dpdump/APP1TBS.268.902619275"
ORA-27040: file create error, unable to create file
Linux-x86_64 Error: 13: Permission denied
Additional information: 1
ORA-15120: ASM file name '/u01/app/oracle/admin/orclasm/dpdump/APP1TBS.268.902619275' does not begin with the ASM prefix character
ORA-06512: at "SYS.X$DBMS_DISKGROUP", line 413
ORA-06512: at line 3 (DBD ERROR: OCIStmtExecute)
ASMCMD> cp APP1TBS.268.902619275 /home/grid
copying +DATA/orclasm/datafile/APP1TBS.268.902619275 -> /home/grid/APP1TBS.268.902619275
ASMCMD> cp APP2TBS.280.902619327 /home/grid
copying +DATA/orclasm/datafile/APP2TBS.280.902619327 -> /home/grid/APP2TBS.280.902619327
ASMCMD> cp IDXTBS.281.902619361 /home/grid
copying +DATA/orclasm/datafile/IDXTBS.281.902619361 -> /home/grid/IDXTBS.281.902619361
ASMCMD>
```

然后利用 root 用户将数据文件和 expdp 出来的源数据再拷贝到同一个目录下：

```
[root@rhel6_lhr ~]# ll /home/grid
total 209832
-rw-r--r--  1 grid oinstall      316 Jan  5  2015 aa.txt
-rw-r--r--. 1 grid oinstall      244 Jun 23  2014 a.ora
-rw-r-----  1 grid oinstall 10493952 Feb  1 00:22 APP1TBS.268.902619275
-rw-r-----  1 grid oinstall 52436992 Dec 21  2014 APP1TBS.274.866911939
-rw-r-----  1 grid oinstall 52436992 Dec 21  2014 APP2TBS.275.866912075
-rw-r-----  1 grid oinstall 10493952 Feb  1 00:22 APP2TBS.280.902619327
-rw-r-----  1 grid oinstall 52436992 Dec 21  2014 IDXTBS.276.866912133
-rw-r-----  1 grid oinstall 10493952 Feb  1 00:22 IDXTBS.281.902619361
drwxr-xr-x. 3 grid oinstall     4096 Jun 14  2014 oradiag_grid
-rw-r-----. 1 grid oinstall     3584 Jul  1  2014 spfileorclasm.ora
-rw-r-----  1 grid oinstall  2105344 Jan 13  2015 testdg.dbf
-rw-r-----  1 grid oinstall 23950848 Dec 24  2014 thread_1_seq_754.333.865158557
[root@rhel6_lhr ~]# cp /home/grid/APP1TBS.268.902619275 /u01/app/oracle/admin/orclasm/dpdump/
[root@rhel6_lhr ~]# cp /home/grid/APP2TBS.280.902619327 /u01/app/oracle/admin/orclasm/dpdump/
[root@rhel6_lhr ~]# cp /home/grid/IDXTBS.281.902619361  /u01/app/oracle/admin/orclasm/dpdump/
[root@rhel6_lhr ~]#
[root@rhel6_lhr ~]# ll  /u01/app/oracle/admin/orclasm/dpdump/
total 40540
-rw-r----- 1 root   root     10493952 Feb  1 00:28 APP1TBS.268.902619275
-rw-r----- 1 root   root     10493952 Feb  1 00:28 APP2TBS.280.902619327
-rw-r----- 1 oracle asmadmin   110592 Feb  1 00:07 expdat_20160131.dmp
-rw-r----- 1 root   root     10493952 Feb  1 00:28 IDXTBS.281.902619361
-rw-r--r-- 1 oracle asmadmin     1450 Feb  1 00:07 tts_export_20160131.log
[root@rhel6_lhr ~]#
```

1.9 还原源库中的表空间为读/写模式

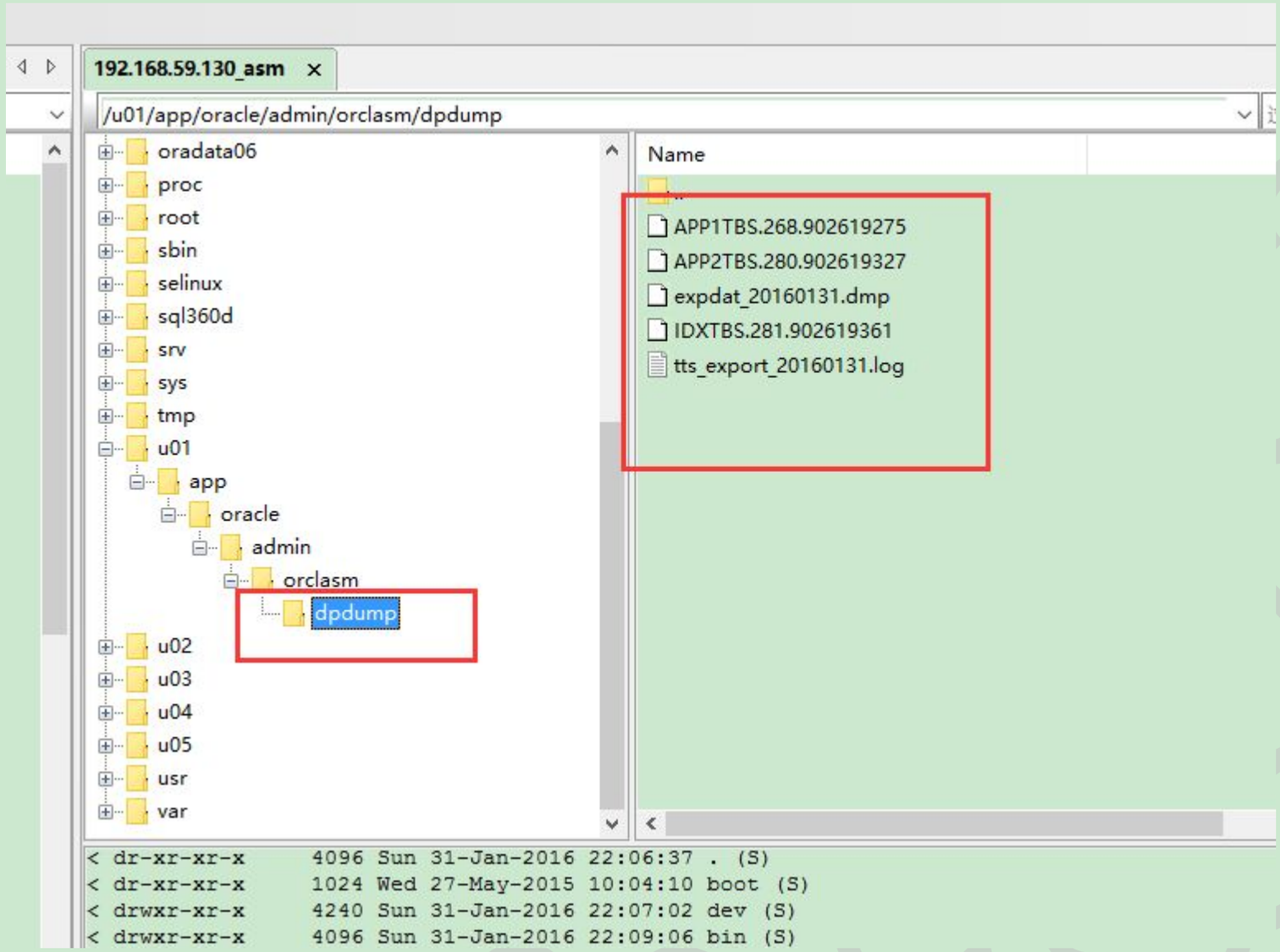
```
[oracle@rhel6_lhr dpdump]$ sqlplus / as sysdba

SQL*Plus: Release 11.2.0.3.0 Production on 星期一 2月 1 00:27:13 2016
```

```
Copyright (c) 1982, 2011, Oracle.  All rights reserved.


连接到:
Oracle Database 11g Enterprise Edition Release 11.2.0.3.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Data Mining
and Real Application Testing options

00:27:13 SQL> alter tablespace app1tbs read write;

表空间已更改。

已用时间:  00: 00: 01.19
00:27:16 SQL> alter tablespace app2tbs read write;

表空间已更改。

已用时间:  00: 00: 00.11
00:27:22 SQL> alter tablespace idxtbs read write;

表空间已更改。

已用时间:  00: 00: 00.17
00:27:31 SQL> exit
从 Oracle Database 11g Enterprise Edition Release 11.2.0.3.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Data Mining
and Real Application Testing options 断开
[oracle@rhel6_lhr dpdump]$
```

1.10 传输数据文件和元数据到 target 端

这里需要传输转储元文件和数据文件到目标库

1.10.1 传输转储元文件到目标库



1.10.2 查看目标库数据文件位置和目录

```
[ZFXDESKDB2:oracle]:/oracle>ORACLE_SID=ora2lhr
[ZFXDESKDB2:oracle]:/oracle>sqlplus / as sysdba

SQL*Plus: Release 11.2.0.4.0 Production on Mon Feb 1 14:53:49 2016

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Connected to:
Oracle Database 11g Enterprise Edition Release 11.2.0.4.0 - 64bit Production
With the Partitioning, Real Application Clusters, Automatic Storage Management, OLAP,
Data Mining and Real Application Testing options

SYS@ora2lhr> select name from v$datafile;

NAME
--------------------------------------------------------------------------------------------------------------------------------
+DATA/ora2lhr/datafile/system.335.902674033
+DATA/ora2lhr/datafile/sysaux.336.902674033
+DATA/ora2lhr/datafile/undotbs1.337.902674033
```
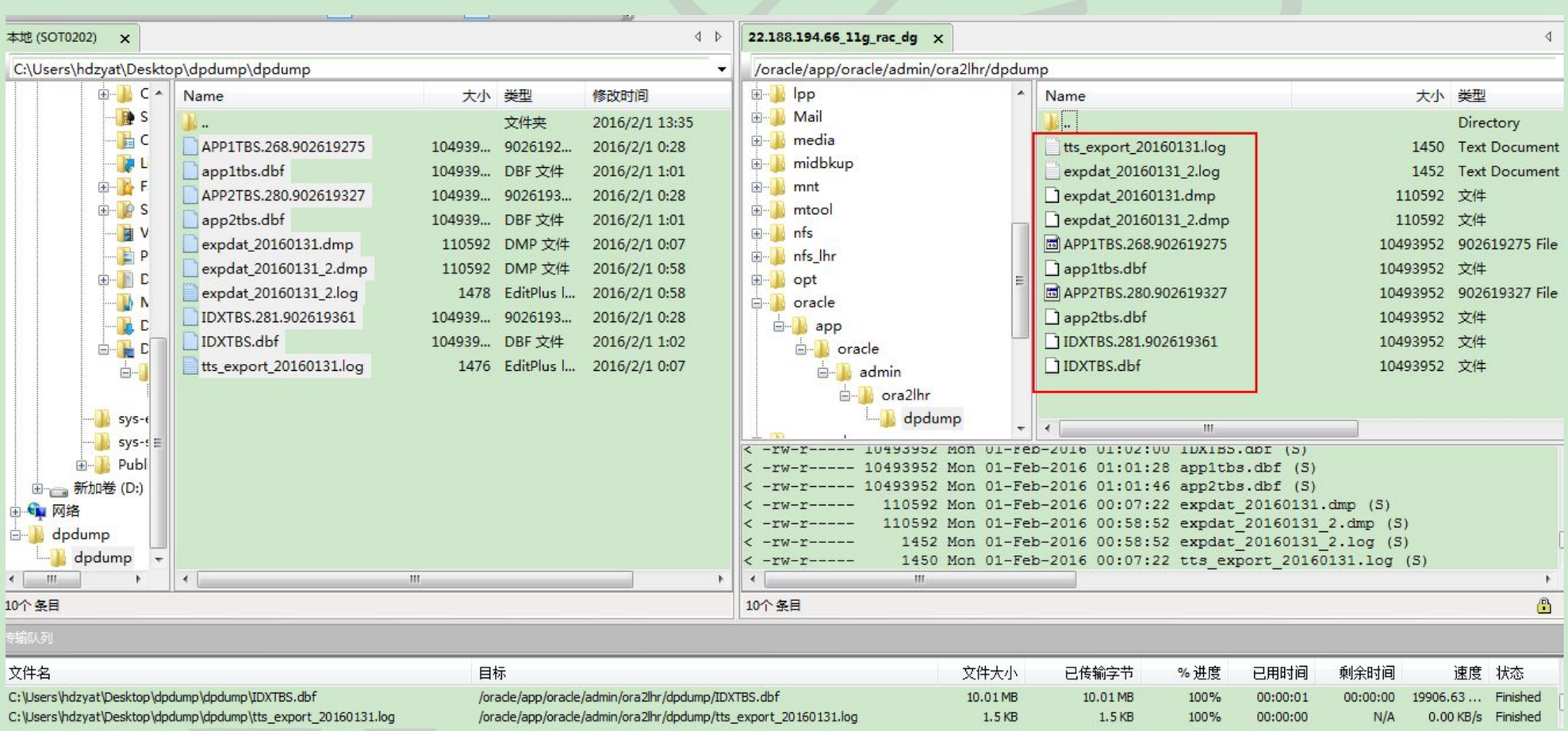

```
+DATA/ora2lhr/datafile/users.338.902674033
+DATA/ora2lhr/datafile/example.348.902674109

SYS@ora2lhr> set line 9999
SYS@ora2lhr> col directory_name for a28
SYS@ora2lhr> col directory_path for a100
SYS@ora2lhr> select directory_name,directory_path from dba_directories;

DIRECTORY_NAME               DIRECTORY_PATH
---------------------------- ----------------------------------------------------------------------------------------------------
SUBDIR                       /oracle/app/oracle/product/11.2.0/db/demo/schema/order_entry//2002/Sep
SS_OE_XMLDIR                 /oracle/app/oracle/product/11.2.0/db/demo/schema/order_entry/
LOG_FILE_DIR                 /oracle/app/oracle/product/11.2.0/db/demo/schema/log/
MEDIA_DIR                    /oracle/app/oracle/product/11.2.0/db/demo/schema/product_media/
DATA_FILE_DIR                /oracle/app/oracle/product/11.2.0/db/demo/schema/sales_history/
XMLDIR                       /oracle/app/oracle/product/11.2.0/db/rdbms/xml
ORACLE_OCM_CONFIG_DIR        /oracle/app/oracle/product/11.2.0/db/ccr/state
DATA_PUMP_DIR                /oracle/app/oracle/admin/ora2lhr/dpdump/
ORACLE_OCM_CONFIG_DIR2       /oracle/app/oracle/product/11.2.0/db/ccr/state

9 rows selected.

SYS@ora2lhr>
SYS@ora2lhr>
```

1.10.3 拷贝文件到目标库相应位置并修改权限

将表空间文件和元数据文件拷贝到/oracle/app/oracle/admin/ora2lhr/dpdump/ 下，如下：



```
[ZFXDESKDB2:root]:/>cd /oracle/app/oracle/admin/ora2lhr/dpdump
[ZFXDESKDB2:root]:/oracle/app/oracle/admin/ora2lhr/dpdump>l
total 123424
-rw-r-----    1 root     system     10493952 Feb 01 00:28 APP1TBS.268.902619275
-rw-r-----    1 root     system     10493952 Feb 01 00:28 APP2TBS.280.902619327
-rw-r-----    1 root     system     10493952 Feb 01 00:28 IDXTBS.281.902619361
-rw-r-----    1 root     system     10493952 Feb 01 01:02 IDXTBS.dbf
-rw-r-----    1 root     system     10493952 Feb 01 01:01 app1tbs.dbf
-rw-r-----    1 root     system     10493952 Feb 01 01:01 app2tbs.dbf
-rw-r-----    1 root     system       110592 Feb 01 00:07 expdat_20160131.dmp
-rw-r-----    1 root     system       110592 Feb 01 00:58 expdat_20160131_2.dmp
-rw-r-----    1 root     system         1452 Feb 01 00:58 expdat_20160131_2.log
-rw-r-----    1 root     system         1450 Feb 01 00:07 tts_export_20160131.log
[ZFXDESKDB2:root]:/oracle/app/oracle/admin/ora2lhr/dpdump>chown oracle:dba ./*
[ZFXDESKDB2:root]:/oracle/app/oracle/admin/ora2lhr/dpdump>l
total 123424
-rw-r-----    1 oracle   dba        10493952 Feb 01 00:28 APP1TBS.268.902619275
-rw-r-----    1 oracle   dba        10493952 Feb 01 00:28 APP2TBS.280.902619327
-rw-r-----    1 oracle   dba        10493952 Feb 01 00:28 IDXTBS.281.902619361
-rw-r-----    1 oracle   dba        10493952 Feb 01 01:02 IDXTBS.dbf
-rw-r-----    1 oracle   dba        10493952 Feb 01 01:01 app1tbs.dbf
-rw-r-----    1 oracle   dba        10493952 Feb 01 01:01 app2tbs.dbf
-rw-r-----    1 oracle   dba          110592 Feb 01 00:07 expdat_20160131.dmp
-rw-r-----    1 oracle   dba          110592 Feb 01 00:58 expdat_20160131_2.dmp
-rw-r-----    1 oracle   dba            1452 Feb 01 00:58 expdat_20160131_2.log
-rw-r-----    1 oracle   dba            1450 Feb 01 00:07 tts_export_20160131.log
```

1.11 target 端转换字节序

```
[ZFXDESKDB2:root]:/oracle/app/oracle/admin/ora2lhr/dpdump>su - oracle
[ZFXDESKDB2:oracle]:/oracle>ORACLE_SID=ora2lhr
[ZFXDESKDB2:oracle]:/oracle>rman target /

Recovery Manager: Release 11.2.0.4.0 - Production on Mon Feb 1 14:58:54 2016

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connected to target database: ORA2LHR (DBID=4055514164)

RMAN>

RMAN> CONVERT DATAFILE
2> "/oracle/app/oracle/admin/ora2lhr/dpdump/APP1TBS.268.902619275",
3> "/oracle/app/oracle/admin/ora2lhr/dpdump/APP2TBS.280.902619327",
4> "/oracle/app/oracle/admin/ora2lhr/dpdump/IDXTBS.281.902619361"
5> TO PLATFORM="AIX-Based Systems (64-bit)"
6> FROM PLATFORM="Linux x86 64-bit"
7> FORMAT '+DATA';

Starting conversion at target at 2016-02-01 15:00:07
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=222 device type=DISK
channel ORA_DISK_1: starting datafile conversion
input file name=/oracle/app/oracle/admin/ora2lhr/dpdump/APP1TBS.268.902619275
converted datafile=+DATA/ora2lhr/datafile/appltbs.350.902674809
channel ORA_DISK_1: datafile conversion complete, elapsed time: 00:00:01
channel ORA_DISK_1: starting datafile conversion
input file name=/oracle/app/oracle/admin/ora2lhr/dpdump/APP2TBS.280.902619327
converted datafile=+DATA/ora2lhr/datafile/app2tbs.351.902674809
channel ORA_DISK_1: datafile conversion complete, elapsed time: 00:00:01
channel ORA_DISK_1: starting datafile conversion
input file name=/oracle/app/oracle/admin/ora2lhr/dpdump/IDXTBS.281.902619361
```

```
converted datafile=+DATA/ora2lhr/datafile/idxtbs.352.902674811
channel ORA_DISK_1: datafile conversion complete, elapsed time: 00:00:01
Finished conversion at target at 2016-02-01 15:00:11

RMAN>
```

```
[ZFXDESKDB2:root]:/oracle/app/oracle/admin/ora2lhr/dpdump>
[ZFXDESKDB2:root]:/oracle/app/oracle/admin/ora2lhr/dpdump>su - grid
[ZFXDESKDB2:grid]:/home/grid>asmcmd
ASMCMD> cd +DATA/ora2lhr/datafile/
ASMCMD> ls
APP1TBS.350.902674809
APP2TBS.351.902674809
EXAMPLE.348.902674109
IDXTBS.352.902674811
SYSAUX.336.902674033
SYSTEM.335.902674033
UNDOTBS1.337.902674033
USERS.338.902674033
ASMCMD> ls -l
Type      Redund  Striped  Time             Sys  Name
DATAFILE  UNPROT  COARSE   FEB 01 15:00:00  Y    APP1TBS.350.902674809
DATAFILE  UNPROT  COARSE   FEB 01 15:00:00  Y    APP2TBS.351.902674809
DATAFILE  UNPROT  COARSE   FEB 01 14:00:00  Y    EXAMPLE.348.902674109
DATAFILE  UNPROT  COARSE   FEB 01 15:00:00  Y    IDXTBS.352.902674811
DATAFILE  UNPROT  COARSE   FEB 01 14:00:00  Y    SYSAUX.336.902674033
DATAFILE  UNPROT  COARSE   FEB 01 14:00:00  Y    SYSTEM.335.902674033
DATAFILE  UNPROT  COARSE   FEB 01 14:00:00  Y    UNDOTBS1.337.902674033
DATAFILE  UNPROT  COARSE   FEB 01 14:00:00  Y    USERS.338.902674033
ASMCMD>
```

1.12 开始导入

1.12.1 创建 source 库的 2 个用户并赋权限

如果不创建用户会报如下的错误：

ORA-39123: Data Pump transportable tablespace job aborted
ORA-29342: user USER_APP1 does not exist in the database

```
[ZFXDESKDB2:oracle]:/oracle>sqlplus / as sysdba

SQL*Plus: Release 11.2.0.4.0 Production on Mon Feb 1 15:07:32 2016

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Connected to:
Oracle Database 11g Enterprise Edition Release 11.2.0.4.0 - 64bit Production
With the Partitioning, Real Application Clusters, Automatic Storage Management, OLAP,
Data Mining and Real Application Testing options

SYS@ora2lhr> create user user_app1 identified by user_app1;

User created.
```

```
SYS@ora2lhr> create user user_app2 identified by user_app2;

User created.

SYS@ora2lhr> grant connect , resource to user_app1;

Grant succeeded.

SYS@ora2lhr> grant connect , resource to user_app2;

Grant succeeded.

SYS@ora2lhr> exit
Disconnected from Oracle Database 11g Enterprise Edition Release 11.2.0.4.0 - 64bit Production
With the Partitioning, Real Application Clusters, Automatic Storage Management, OLAP,
Data Mining and Real Application Testing options
[ZFXDESKDB2:oracle]:/oracle>
```

1.12.2 开始导入

```
[ZFXDESKDB2:oracle]:/oracle>impdp \'/ as sysdba \' DUMPFILE=expdat_20160131.dmp DIRECTORY=DATA_PUMP_DIR
TRANSPORT_DATAFILES='+DATA/ora2lhr/datafile/APP1TBS.350.902674809','+DATA/ora2lhr/datafile/app2tbs.351.902674809','+DATA/ora2lhr/datafile/idxtbs.352.902674811'
LOGFILE=impdp_tts_20160131.log

Import: Release 11.2.0.4.0 - Production on Mon Feb 1 15:08:24 2016

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Connected to: Oracle Database 11g Enterprise Edition Release 11.2.0.4.0 - 64bit Production
With the Partitioning, Real Application Clusters, Automatic Storage Management, OLAP,
Data Mining and Real Application Testing options
Master table "SYS"."SYS_IMPORT_TRANSPORTABLE_01" successfully loaded/unloaded
Starting "SYS"."SYS_IMPORT_TRANSPORTABLE_01":  "/******** AS SYSDBA" DUMPFILE=expdat_20160131.dmp DIRECTORY=DATA_PUMP_DIR
TRANSPORT_DATAFILES=+DATA/ora2lhr/datafile/APP1TBS.350.902674809,+DATA/ora2lhr/datafile/app2tbs.351.902674809,+DATA/ora2lhr/datafile/idxtbs.352.902674811 LOGFILE=impdp_tts_20160131.log
Processing object type TRANSPORTABLE_EXPORT/PLUGTS_BLK
Processing object type TRANSPORTABLE_EXPORT/TABLE
Processing object type TRANSPORTABLE_EXPORT/INDEX/INDEX
Processing object type TRANSPORTABLE_EXPORT/INDEX_STATISTICS
Processing object type TRANSPORTABLE_EXPORT/POST_INSTANCE/PLUGTS_BLK
Job "SYS"."SYS_IMPORT_TRANSPORTABLE_01" successfully completed at Mon Feb 1 15:08:32 2016 elapsed 0 00:00:06

[ZFXDESKDB2:oracle]:/oracle>
```

日志：

```
Plug in tablespace APP1TBS with datafile
  '+DATA/ora2lhr/datafile/APP1TBS.350.902674809'
Plug in tablespace APP2TBS with datafile
  '+DATA/ora2lhr/datafile/app2tbs.351.902674809'
Plug in tablespace IDXTBS with datafile
  '+DATA/ora2lhr/datafile/idxtbs.352.902674811'
```

1.12.3 查看目标平台信息

```
SYS@ora2lhr> select tablespace_name,status from dba_tablespaces;
```

```
TABLESPACE_NAME                STATUS
------------------------------ ---------
SYSTEM                         ONLINE
SYSAUX                         ONLINE
UNDOTBS1                       ONLINE
TEMP                           ONLINE
USERS                          ONLINE
EXAMPLE                        ONLINE
APP1TBS                        READ ONLY
APP2TBS                        READ ONLY
IDXTBS                         READ ONLY

9 rows selected.


SYS@ora2lhr> alter tablespace APP1TBS read write;

Tablespace altered.

SYS@ora2lhr> alter tablespace APP2TBS read write;

Tablespace altered.

SYS@ora2lhr> alter tablespace IDXTBS read write;

Tablespace altered.

SYS@ora2lhr> select tablespace_name,status from dba_tablespaces;

TABLESPACE_NAME                STATUS
------------------------------ ---------
SYSTEM                         ONLINE
SYSAUX                         ONLINE
UNDOTBS1                       ONLINE
TEMP                           ONLINE
USERS                          ONLINE
EXAMPLE                        ONLINE
APP1TBS                        ONLINE
APP2TBS                        ONLINE
IDXTBS                         ONLINE

9 rows selected.

SYS@ora2lhr>
SYS@ora2lhr> SELECT d.username,d.default_tablespace FROM dba_users d where d.username like 'USER_%' ;

USERNAME                       DEFAULT_TABLESPACE
------------------------------ ------------------------------
USER_APP2                      USERS
USER_APP1                      USERS

SYS@ora2lhr> alter user user_app1 default tablespace app1tbs;

User altered.

SYS@ora2lhr> alter user user_app2 default tablespace app2tbs;

User altered.

SYS@ora2lhr>  SELECT d.username,d.default_tablespace FROM dba_users d where d.username like 'USER_%' ;

USERNAME                       DEFAULT_TABLESPACE
------------------------------ ------------------------------
USER_APP2                      APP2TBS
USER_APP1                      APP1TBS

SYS@ora2lhr>
```

1.13 查看导入后结果

```
SYS@ora2lhr> set line 9999 pagesize 9999
SYS@ora2lhr> select * from user_app1.app1_tab;

     EMPNO ENAME      JOB              MGR HIREDATE                 SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ------------------- ---------- ---------- ----------
      7369 SMITH      CLERK           7902 1980-12-17 00:00:00        800                    20
      7499 ALLEN      SALESMAN        7698 1981-02-20 00:00:00       1600        300         30
      7521 WARD       SALESMAN        7698 1981-02-22 00:00:00       1250        500         30
      7566 JONES      MANAGER         7839 1981-04-02 00:00:00       2975                    20
      7654 MARTIN     SALESMAN        7698 1981-09-28 00:00:00       1250       1400         30
      7698 BLAKE      MANAGER         7839 1981-05-01 00:00:00       2850                    30
      7782 CLARK      MANAGER         7839 1981-06-09 00:00:00       2450                    10
      7839 KING       PRESIDENT            1981-11-17 00:00:00       5000                    10
      7844 TURNER     SALESMAN        7698 1981-09-08 00:00:00       1500          0         30
      7900 JAMES      CLERK           7698 1981-12-03 00:00:00        950                    30
      7902 FORD       ANALYST         7566 1981-12-03 00:00:00       3000                    20
      7934 MILLER     CLERK           7782 1982-01-23 00:00:00       1300                    10

12 rows selected.

SYS@ora2lhr> select * from user_app2.app2_tab;

    DEPTNO DNAME          LOC
---------- -------------- -------------
        10 ACCOUNTING     NEW YORK
        20 RESEARCH       DALLAS
        30 SALES          CHICAGO
        40 OPERATIONS     BOSTON

SYS@ora2lhr>  select D.owner,D.index_name,D.table_name,D.tablespace_name from dba_indexes d WHERE d.table_name in ('APP1_TAB','APP2_TAB');

OWNER                          INDEX_NAME                     TABLE_NAME                     TABLESPACE_NAME
------------------------------ ------------------------------ ------------------------------ ------------------------------
USER_APP2                      IDX_DEPT_DNAME                 APP2_TAB                       IDXTBS
USER_APP1                      IDX_EMP_ENAME                  APP1_TAB                       IDXTBS

SYS@ora2lhr> SELECT   a.NAME,  b.NAME FROM v$tablespace a , v$datafile b WHERE a.TS#=b.TS#  ;

NAME                           NAME
------------------------------ --------------------------------------------------------------------------------
SYSTEM                         +DATA/ora2lhr/datafile/system.335.902674033
SYSAUX                         +DATA/ora2lhr/datafile/sysaux.336.902674033
UNDOTBS1                       +DATA/ora2lhr/datafile/undotbs1.337.902674033
USERS                          +DATA/ora2lhr/datafile/users.338.902674033
EXAMPLE                        +DATA/ora2lhr/datafile/example.348.902674109
APP1TBS                        +DATA/ora2lhr/datafile/app1tbs.350.902674809
APP2TBS                        +DATA/ora2lhr/datafile/app2tbs.351.902674809
IDXTBS                         +DATA/ora2lhr/datafile/idxtbs.352.902674811

8 rows selected.

SYS@ora2lhr>
```

至此说明 3 个表空间已经完全由 Linux 平台迁移到 AIX 平台上。

1.14 总结

到此所有的处理算是基本完毕，过程很简单，但是不同的场景处理方式有很多种，我们应该学会灵活变通。

1.15 About Me

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本文作者：小麦苗，只专注于数据库的技术，更注重技术的运用

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