

Oracle 迁移LightDB用例

1.ora2pg简介

ora2pg是一款免费迁移工具，能将Oracle迁移到LightDB，简单使用并记录过程如下

官方文档: <http://ora2pg.darold.net/>

2.ora2pg部署

2.1 安装perl依赖

ora2pg是Perl语言编写的，所以需要先安装相关环境依赖

```
[root@localhost ~]$ yum install -y perl perl-ExtUtils-CBuilder perl-ExtUtils-MakeMaker
Loaded plugins: langpacks, ulninfo
Resolving Dependencies
--> Running transaction check
---> Package perl.x86_64 4:5.16.3-294.el7_6 will be updated
---> Package perl.x86_64 4:5.16.3-297.el7 will be an update

(省略中间...)

Dependency Installed:
  gdbm-devel.x86_64 0:1.10-8.el7
  perl-ExtUtils-Install.noarch 0:1.58-297.el7
  perl-ExtUtils-ParseXS.noarch 1:3.18-3.el7
  perl-Locale-Maketext.noarch 0:1.23-3.el7
  perl-Module-CoreList.noarch 1:2.76.02-297.el7
  perl-Module-Load-Conditional.noarch 0:0.54-3.el7
  perl-Params-Check.noarch 1:0.38-2.el7
  perl-Test-Harness.noarch 0:3.28-3.el7
  perl-version.x86_64 3:0.99.07-6.el7
  systemtap-sdt-devel.x86_64 0:4.0-13.0.1.el7
  libdb-devel.x86_64 0:5.3.21-25.el7
  perl-ExtUtils-Manifest.noarch 0:1.61-244.el7
  perl-IPC-Cmd.noarch 1:0.80-4.el7
  perl-Locale-Maketext-Simple.noarch 1:0.21-297.el7
  perl-Module-Load.noarch 1:0.24-3.el7
  perl-Module-Metadata.noarch 0:1.000018-2.el7
  perl-Perl-OSType.noarch 0:1.003-3.el7
  perl-devel.x86_64 4:5.16.3-297.el7
  pyparsing.noarch 0:1.5.6-9.el7

Updated:
  perl.x86_64 4:5.16.3-297.el7

Dependency Updated:
  perl-libs.x86_64 4:5.16.3-297.el7

Complete!
```

2.2 安装DBI模块

DBI, Database Independent Interface, 是Perl语言连接数据库的接口

下载地址<https://metacpan.org/release/DBI> 下载出DBI-1.643.tar.gz

然后解压安装

```
[root@localhost /usr/local]$ tar -xzvf DBI-1.643.tar.gz
[root@localhost /usr/local/DBI-1.643]$ cd DBI-1.643/
[root@localhost /usr/local/DBI-1.643]$ perl Makefile.PL
[root@localhost /usr/local/DBI-1.643]$ make
[root@localhost /usr/local/DBI-1.643]$ make install
```

2.3 安装DBD::Oracle模块

添加环境变量

```
export ORACLE_HOME=/u01/app/oracle/product/11.2.0/dbhome_1
export PATH=$PATH:$ORACLE_HOME/bin
export LD_LIBRARY_PATH=/u01/app/oracle/product/11.2.0/dbhome_1/lib
```

安装DBD-Oracle驱动, 下载地址<https://metacpan.org/pod/release/PYTHIAN/DBD-Oracle-1.74/lib/DBD/Oracle.pm>, 下载出DBD-Oracle-1.74.tar.gz

```
[root@localhost /usr/local/DBD-Oracle-1.74]$ tar -zxvf DBD-Oracle-1.74.tar.gz
[root@localhost /usr/local/DBD-Oracle-1.74]$ cd DBD-Oracle-1.74/
[root@localhost /usr/local/DBD-Oracle-1.74]$ perl Makefile.PL
[root@localhost /usr/local/DBD-Oracle-1.74]$ make
[root@localhost /usr/local/DBD-Oracle-1.74]$ make install
```

2.4 安装DBD::Pg模块

安装DBD-Pg驱动, 下载地址<https://metacpan.org/release/DBD-Pg>, 下载出DBD-Pg-3.14.2.tar.gz

```
[root@localhost /usr/local]$ cd DBD-Pg-3.14.2/
[root@localhost /usr/local]$ perl Makefile.PL
[root@localhost /usr/local]$ make
[root@localhost /usr/local]$ make install
```

2.5 安装ORA2PG

下载地址<https://sourceforge.net/projects/ora2pg/>

```
[root@localhost /usr/local]$ cd ora2pg-21.0/
[root@localhost /usr/local/ora2pg-21.0]$ ls
changelog doc INSTALL lib LICENSE Makefile.PL MANIFEST packaging README scripts
[root@localhost /usr/local/ora2pg-21.0]$ perl Makefile.PL
Checking if your kit is complete...
Looks good
Writing Makefile for Ora2Pg

Done...
-----
Please read documentation at http://ora2pg.darold.net/ before asking for help
-----

Now type: make && make install
[root@localhost /usr/local/ora2pg-21.0]$ make
cp lib/Ora2Pg.pm blib/lib/Ora2Pg.pm
cp lib/Ora2Pg/GEOM.pm blib/lib/Ora2Pg/GEOM.pm
cp lib/Ora2Pg/PLSQL.pm blib/lib/Ora2Pg/PLSQL.pm
cp lib/Ora2Pg/MySQL.pm blib/lib/Ora2Pg/MySQL.pm
cp scripts/ora2pg blib/script/ora2pg
/usr/bin/perl -MExtUtils::MY -e 'MY->fixin(shift)' -- blib/script/ora2pg
cp scripts/ora2pg_scanner blib/script/ora2pg_scanner
/usr/bin/perl -MExtUtils::MY -e 'MY->fixin(shift)' -- blib/script/ora2pg_scanner
Manifying blib/man3/ora2pg.3
[root@localhost /usr/local/ora2pg-21.0]$ make install
Installing /usr/local/share/perl5/Ora2Pg.pm
Installing /usr/local/share/perl5/Ora2Pg/GEOM.pm
Installing /usr/local/share/perl5/Ora2Pg/PLSQL.pm
Installing /usr/local/share/perl5/Ora2Pg/MySQL.pm
Installing /usr/local/share/man/man3/ora2pg.3
Installing /usr/local/bin/ora2pg
```

```
Installing /usr/local/bin/ora2pg_scanner
Installing default configuration file (ora2pg.conf.dist) to /etc/ora2pg
Appending installation info to /usr/lib64/perl5/perllocal.pod
[root@localhost /usr/local/ora2pg-21.0]$
```

2.6 查看软件是否安装成功

```
[root@localhost ~]$ cat check.pl
#!/usr/bin/perl
use strict;
use ExtUtils::Installed;
my $inst=ExtUtils::Installed->new();
my @modules = $inst->modules();
foreach(@modules){
    my $ver = $inst->version($_) || "???";
    printf("%-12s -- %s\n",$_,$ver);
}
exit;[root@localhost ~]$ perl check.pl
DBD::Oracle -- 1.74
DBD::Pg -- 3.14.2
DBI -- 1.643
Ora2Pg -- 21.0
Perl -- 5.16.3
```

测试

```
[root@hs-10-20-30-128 ~]# cat ora2pg_procedure.conf
ORACLE_HOME /home/oracle/LINUX.X64_193000_db_home
ORACLE_DSN dbi:Oracle:host=192.168.51.20;sid=ora19c
ORACLE_USER ps_standard_test
ORACLE_PWD ps_standard_test
SCHEMA ps_standard_test
TYPE PROCEDURE
LightDB_VERSION 13
LightDB_NUMERIC_TYPE 0
LightDB_INTEGER_TYPE 1
DEFAULT_NUMERIC float
SKIP fkeys pkeys ukeys indexes checks
NLS_LANG AMERICAN_AMERICA.UTF8
OUTPUT /root/ora2pg/new_produce.sql
[root@hs-10-20-30-128 ~]# ora2pg -t SHOW_VERSION -c ora2pg_procedure.conf
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0
```

3. 迁移表

3.1 编译配置文件

创建ora2pg_table.conf, 导出表结构的配置文件,内容见测试部分
创建ora2pg_data.conf, 导出数据, 内容如下

```
[root@hs-10-20-30-128 ~]# cat ora2pg_data.conf
ORACLE_HOME /home/oracle/LINUX.X64_193000_db_home
ORACLE_DSN dbi:Oracle:host=192.168.51.20;sid=ora19c
ORACLE_USER ps_standard_test
ORACLE_PWD ps_standard_test
SCHEMA ps_standard_test
TYPE COPY
PG_NUMERIC_TYPE 0
PG_INTEGER_TYPE 1
DEFAULT_NUMERIC float
SKIP fkeys pkeys ukeys indexes checks
NLS_LANG AMERICAN_AMERICA.UTF8
OUTPUT /root/ora2pg/data.sql
```

3.2 导出数据

执行导出命令，导出表结构和数据

```
[root@localhost ~]$ ora2pg -c ora2pg_data.conf
WARNING: target LightDB version must be set in PG_VERSION configuration directive. Using default: 11
[=====>] 4/4 tables (100.0%) end of scanning.
[=====>] 4/4 tables (100.0%) end of table export.
Fixing function calls in output files...
[root@localhost ~]$ ora2pg -c ora2pg_data.conf
WARNING: target LightDB version must be set in PG_VERSION configuration directive. Using default: 11
[=====>] 4/4 tables (100.0%) end of scanning.
[=====>] 0/0 rows (100.0%) Table BONUS (0 recs/sec)
[> ] 0/23 total rows (0.0%) - (0 sec., avg: 0 recs/sec).
[=====>] 4/4 rows (100.0%) Table DEPT (4 recs/sec)
[=====> ] 4/23 total rows (17.4%) - (0 sec., avg: 4 recs/sec).
[=====>] 14/14 rows (100.0%) Table EMP (14 recs/sec)
[=====> ] 18/23 total rows (78.3%) - (0 sec., avg: 18 recs/sec).
[=====>] 5/5 rows (100.0%) Table SALGRADE (5 recs/sec)
[=====>] 23/23 total rows (100.0%) - (0 sec., avg: 23 recs/sec).
[=====>] 23/23 rows (100.0%) on total estimated data (1 sec., avg: 23 recs/sec)
Fixing function calls in output files...
```

查看导出的SQL

```
[root@hs-10-20-30-128 tables]# ll
total 1864
-rw-r--r-- 1 root root 41579 Jul 24 17:19 CONSTRAINTS_table.sql
-rw-r--r-- 1 root root 9276 Jul 24 17:19 FKEYS_table.sql
-rw-r--r-- 1 root root 59934 Jul 24 17:19 INDEXES_table.sql
-rw-r--r-- 1 root root 1789028 Jul 24 17:19 table.sql
[root@hs-10-20-30-128 tables]# cat INDEXES_table.sql
-- Generated by Ora2Pg, the Oracle database Schema converter, version 22.1
-- Copyright 2000-2021 Gilles DAROLD. All rights reserved.
-- DATASOURCE: dbi:Oracle:host=192.168.51.20;sid=ora19c

SET client_encoding TO 'UTF8';

\set ON_ERROR_STOP ON

CREATE INDEX act_idx_bytear_depl ON act_ge_bytearray (deployment_id_);
CREATE INDEX act_idx_hi_act_inst_end ON act_hi_actinst (end_time_);
CREATE INDEX act_idx_hi_act_inst_exec ON act_hi_actinst (execution_id_, act_id_);
CREATE INDEX act_idx_hi_act_inst_procinstant ON act_hi_actinst (proc_inst_id_, act_id_);
CREATE INDEX act_idx_hi_act_inst_start ON act_hi_actinst (start_time_);
(省略中间...)
```

```
CREATE UNIQUE INDEX iuser_pro_quota ON user_pro_quota (user_code, pro_code);
CREATE INDEX idx_fundreturndailyrange_stk ON v4_fundreturndailyrange_stk (lipperid);
CREATE INDEX idx_fundreturndaily_stk ON v4_fundreturndaily_stk (lipperid, d_date);
CREATE INDEX idx_fundreturnmonthrange_stk ON v4_fundreturnmonthrange_stk (lipperid);
CREATE INDEX idx_fundreturnmonth_stk ON v4_fundreturnmonth_stk (lipperid, d_date);
CREATE INDEX idx_view_temp ON view_temp_data (view_name, tenant_code);
[root@hs-10-20-30-128 tables]#
```

3.3 导入数据

```
[root@localhost ~/ora2pg]$ ltsql postgres postgres -f table.sql
SET
SET
CREATE TABLE
CREATE TABLE
CREATE TABLE
CREATE TABLE
[root@localhost ~/ora2pg]$ ltsql postgres postgres -f data.sql
BEGIN
COPY 0
COPY 4
COPY 14
COPY 5
COMMIT
```

4 迁移视图

4.1 编译配置文件

```
[root@hs-10-20-30-128 ~]# cat ora2pg_view.conf
ORACLE_HOME /home/oracle/LINUX.X64_193000_db_home
ORACLE_DSN dbi:Oracle:host=192.168.51.20;sid=ora19c
ORACLE_USER ps_standard_test
ORACLE_PWD ps_standard_test
SCHEMA ps_standard_test
TYPE VIEW
PG_VERSION 13
PG_NUMERIC_TYPE 0
PG_INTEGER_TYPE 1
DEFAULT_NUMERIC float
SKIP fkeys pkeys ukeys indexes checks
NLS_LANG AMERICAN_AMERICA.UTF8
OUTPUT /root/ora2pg/new_view.sql
```

4.2 导出视图

```
[root@localhost ~]$ ora2pg -c ora2pg_view.conf
WARNING: target LightDB version must be set in PG_VERSION configuration directive. Using default: 11
[=====>] 1/1 views (100.0%) end of output.
Fixing function calls in output files...
[root@localhost ~]$ cd ora2pg/
[root@localhost ~/ora2pg]$ ls
data.sql table.sql view.sql
[root@localhost ~/ora2pg]$ cat view.sql
-- Generated by Ora2Pg, the Oracle database Schema converter, version 21.0
-- Copyright 2000-2020 Gilles DAROLD. All rights reserved.
-- DATASOURCE: dbi:Oracle:host=192.168.168.3;sid=orcl
```

```
SET client_encoding TO 'UTF8';

\set ON_ERROR_STOP ON

SET check_function_bodies = false;

CREATE OR REPLACE VIEW view_test (dname, sal) AS SELECT b.dname,sum(a.sal) sal FROM emp a join dept b on
a.deptno=b.deptno group by b.dname;
```

4.3 导入视图

```
[root@localhost ~/ora2pg]$ ltsql postgres://ps_standard_test:ps_standard_test@10.20.30.128:5432/ps_standard_test -f
view.sql
SET
SET
CREATE VIEW
```

5 迁移存储过程

5.1 编译配置文件

```
[root@hs-10-20-30-128 ~]# cat ora2pg_procedure.conf
ORACLE_HOME /home/oracle/LINUX.X64_193000_db_home
ORACLE_DSN dbi:Oracle:host=192.168.51.20;sid=ora19c
ORACLE_USER ps_standard_test
ORACLE_PWD ps_standard_test
SCHEMA ps_standard_test
TYPE PROCEDURE
PG_VERSION 13
PG_NUMERIC_TYPE 0
PG_INTEGER_TYPE 1
DEFAULT_NUMERIC float
SKIP fkeys pkeys ukeys indexes checks
NLS_LANG AMERICAN_AMERICA.UTF8
OUTPUT /root/ora2pg/new_produce.sql
```

5.2 导出存储过程

```
[root@localhost ~]$ ora2pg -c ora2pg_procedure.conf
WARNING: target LightDB version must be set in LightDB_VERSION configuration directive. Using default: 11
[=====>] 1/1 procedures (100.0%) end of procedures export.
Fixing function calls in output files...
[root@localhost ~]$ cd ora2pg/
[root@localhost ~/ora2pg]$ ls
data.sql procedure.sql table.sql view.sql
```

5.3 导入存储过程

```
[root@localhost ~/ora2pg]$ psql postgres postgres -f procedure.sql
SET
SET
CREATE PROCEDURE
[root@localhost ~/ora2pg]$
```

6. 迁移评估

```
[root@hs-10-20-30-128 ~]# ora2pg -t SHOW_REPORT --estimate_cost -c ora2pg_procedure.conf
```

```
[=====>] 1408/1408 tables (100.0%) end of scanning.
```

```
[=====>] 17/17 objects types (100.0%) end of objects auditing.
```

```
-----  
Ora2Pg v22.1 - Database Migration Report  
-----
```

```
Version Oracle Database 19c Enterprise Edition Release 19.0.0.0.0
```

```
Schema PS_STANDARD_TEST
```

```
Size 17718.88 MB  
-----
```

```
-----  
Object Number Invalid Estimated cost Comments Details  
-----
```

```
DATABASE LINK 0 0 0.00 Database links will be exported as SQL/MED LightDB's Foreign Data Wrapper (FDW)  
extensions using oracle_fdw.
```

```
FUNCTION 5 0 25.50 Total size of function code: 5482 bytes. f_spellcn: 7.3. queryuniv: 4. get_assetnum:  
3. strcat: 3. fn_sc_tc: 3.2.
```

```
GLOBAL TEMPORARY TABLE 2 0 20.00 Global temporary table are not supported by LightDB and will not be  
exported. You will have to rewrite some application code to match the LightDB temporary table behavior.  
pro_attribution_result_temp. tmp_mf_assetallocation.
```

```
INDEX 1088 0 192.80 1088 index(es) are concerned by the export, others are automatically generated and will  
do so on LightDB. Bitmap will be exported as btree_gin index(es). Domain index are exported as b-tree but commented  
to be edited to mainly use FTS. Cluster, bitmap join and IOT indexes will not be exported at all. Reverse indexes  
are not exported too, you may use a trigram-based index (see pg_trgm) or a reverse() function based index and  
search. Use 'varchar_pattern_ops', 'text_pattern_ops' or 'bpchar_pattern_ops' operators in your indexes to improve  
search with the LIKE operator respectively into varchar, text or char columns. 1088 b-tree index(es).
```

```
INDEX PARTITION 105 0 0.00 Only local indexes partition are exported, they are build on the column used for  
the partitioning.
```

```
TYPE 1 0 0.00 0 type(s) are concerned by the export, others are not supported. Note that Type inherited  
and Subtype are converted as table, type inheritance is not supported. 1 type boby.
```

```
TYPE BODY 1 0 10.00 Export of type with member method are not supported, they will not be exported.
```

```
VIEW 15 0 15.00 Views are fully supported but can use specific functions.  
-----
```

```
Total 3026 0 1939.90 1939.90 cost migration units means approximatively 24 man-day(s). The migration unit  
was set to 5 minute(s)  
-----
```

```
Migration level : C-5  
-----
```

```
Migration levels:
```

```
A - Migration that might be run automatically
```

```
B - Migration with code rewrite and a human-days cost up to 5 days
```

```
C - Migration with code rewrite and a human-days cost above 5 days
```

```
Technical levels:
```

```
1 = trivial: no stored functions and no triggers
```

```
2 = easy: no stored functions but with triggers, no manual rewriting
```

```
3 = simple: stored functions and/or triggers, no manual rewriting
```

```
4 = manual: no stored functions but with triggers or views with code rewriting
```

```
5 = difficult: stored functions and/or triggers with code rewriting  
-----
```

```
Details of cost assessment per function
```

```
Function pkg_dw_transdata.sp_fund_sector_map total estimated cost: 58.9
```

```
SIZE => 31
```

```
CONCAT => 16 (cost: 0.1)
```

```
MERGE => 16
```

```
ROWID => 10 (cost: 2)
```

```
TO_NUMBER => 2 (cost: 0.1)
```

OUTER JOIN => 2 (cost: 2)
TEST => 2
ADD_MONTHS => 1 (cost: 0.1)
Function pkg_dc_tinf_load.load_products total estimated cost: 36.4
TO_NUMBER => 39 (cost: 0.1)
SIZE => 30
MERGE => 10
CONCAT => 4 (cost: 0.1)
TEST => 2
TO_CHAR => 1 (cost: 0.1)

TEST => 2
SIZE => 1

Function pkg_dc_cal_nav.f_nlssort total estimated cost: 3

TEST => 2
SIZE => 1

Function prc_sys_writelog total estimated cost: 3

TEST => 2
SIZE => 1

Function j_p_init_java_smartbeta_config total estimated cost: 3

TEST => 2
SIZE => 1

Function pkg_dc_trans_data.fc_lastworkday total estimated cost: 3

TEST => 2
SIZE => 1

Details of cost assessment per trigger

Trigger t_adm_role_menu_map_logs total estimated cost: 3

TEST => 2
SIZE => 1

Trigger t_adm_menu_logs total estimated cost: 3

TEST => 2
SIZE => 1

Trigger t_adm_rebalance_process_log total estimated cost: 3

TEST => 2
SIZE => 1

Trigger tblobstorage_trigger total estimated cost: 3

TEST => 2
SIZE => 1

Trigger django_migrations_tr total estimated cost: 3

TEST => 2
SIZE => 1

Trigger django_admin_log_tr total estimated cost: 3

TEST => 2
SIZE => 1

Trigger t_qrtz_process_logs total estimated cost: 3

TEST => 2
SIZE => 1

Trigger auth_group_permissions_tr total estimated cost: 3

TEST => 2
SIZE => 1

Trigger t_adm_wms_logs total estimated cost: 3

TEST => 2
SIZE => 1

Trigger t_adm_user_logs total estimated cost: 3

TEST => 2
SIZE => 1

Trigger django_content_type_tr total estimated cost: 3

TEST => 2


```
SIZE => 1
Trigger auth_user_tr total estimated cost: 3
TEST => 2
SIZE => 1
Trigger auth_user_groups_tr total estimated cost: 3
TEST => 2
SIZE => 1
Trigger t_adm_ws_logs total estimated cost: 3
TEST => 2
SIZE => 1
Trigger t_adm_user_role_map_logs total estimated cost: 3
TEST => 2
SIZE => 1
Trigger t_adm_login_user_logs total estimated cost: 3
TEST => 2
SIZE => 1
Trigger t_pro_sector_lipper_map_logs total estimated cost: 3
TEST => 2
SIZE => 1
Trigger t_adm_msg_validate_code total estimated cost: 3
TEST => 2
SIZE => 1
Trigger t_adm_role_logs total estimated cost: 3
TEST => 2
SIZE => 1
Trigger t_pro_sector_logs total estimated cost: 3
TEST => 2
SIZE => 1
Trigger auth_permission_tr total estimated cost: 3
TEST => 2
SIZE => 1
Trigger t_adm_logs total estimated cost: 3
TEST => 2
SIZE => 1
Trigger auth_user_user_permissions_tr total estimated cost: 3
TEST => 2
SIZE => 1
Trigger auth_group_tr total estimated cost: 3
TEST => 2
SIZE => 1
-----
[root@hs-10-20-30-128 ~]#
```

7.ora2pg迁移总结

```
-- 如果使用 ZIP 压缩版的 Instant Client, 环境变量 LD_LIBRARY_PATH 和 ORACLE_HOME 需要设置为相同的值, 也就是安装文件的所在目录
-- 先导出表结构, 然后在同步数据;
-- 在导出表结构的时候禁用分区表;
-- 注意LightDB的保留的关键字是否为oracle表字段名;
-- 删除所有外键约束。
-- 直接通过ora2pg迁移数据, 不要将oracle表数据导出为csv格式, 然后再导入LightDB数据库。
参考链接: https://ora2pg.darold.net/index.html
```