

Oracle External Tables

Features you can start using today.

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**WHAT IS AN EXTERNAL TABLE AND
HOW IS IT USED?**

Create table ...

```
CREATE TABLE emp_ext
(
  EMPLOYEE_ID NUMBER(6),
  FIRST_NAME VARCHAR2(20),
  LAST_NAME VARCHAR2(25),
  EMAIL VARCHAR2(25),
  HIRE_DATE DATE,
  JOB_ID VARCHAR2(10)
)
ORGANIZATION EXTERNAL
(
  DEFAULT DIRECTORY ext_dir
  ACCESS PARAMETERS()
  LOCATION ('emp_load.csv')
);
```

Extend SQL Loader with external tables

- SELECT flat-file as a read-only table
- Flat-file must reside in local host directory
- External Table defined in database
- Uses Oracle directory for file processing

Pros

- Same name, same format, no problem
- Based on and is an alternative to SQL*LOADER
- Save tablespace
- Defined in the Data Dictionary

Cons

- If one time load, could just use SQL*Loader
- SQL*Loader can serve most purposes
- File in the OS not backed up by Oracle RMAN
- File needs to be secured in the OS

Create an Oracle Directory

- create directory EXT_DIR as 'c:\load';
- Copy in the comma-separated file to c:\load

csv file emp_load.csv

300,Edward,Wong,EWONG,07-JUL-02,AC_ACCOUNT

301,Edward I,Wong,E1WONG,07-JUL-03,AC_ACCOUNT

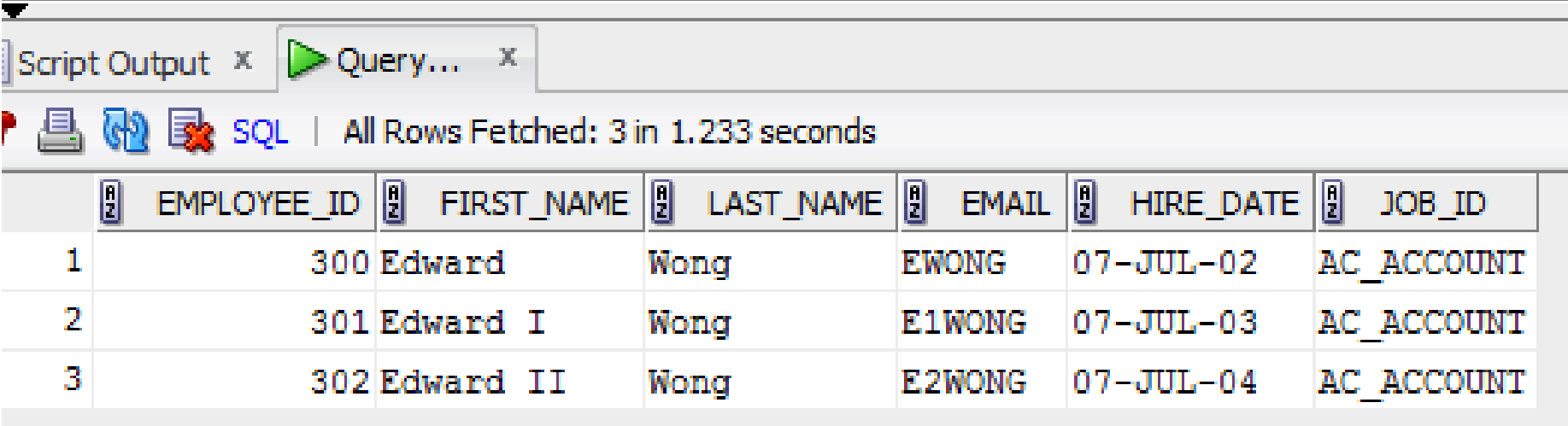
302,Edward II,Wong,E2WONG,07-JUL-04,AC_ACCOUNT

Create the external table

```
CREATE TABLE emp_ext
(
  EMPLOYEE_ID NUMBER(6),
  FIRST_NAME VARCHAR2(20),
  LAST_NAME VARCHAR2(25),
  EMAIL VARCHAR2(25),
  HIRE_DATE DATE,
  JOB_ID VARCHAR2(10)
)
ORGANIZATION EXTERNAL
(
  DEFAULT DIRECTORY ext_dir
  ACCESS PARAMETERS()
  LOCATION ('emp_load.csv')
);
```

Can now select from the external table

```
select * from emp_ext;
```



The screenshot shows a SQL client interface with a 'Script Output' window. The window title is 'Query...' and it displays the results of the query 'select * from emp_ext;'. The status bar indicates 'All Rows Fetched: 3 in 1.233 seconds'. The results are presented in a table with 7 columns: EMPLOYEE_ID, FIRST_NAME, LAST_NAME, EMAIL, HIRE_DATE, and JOB_ID. The data is as follows:

	EMPLOYEE_ID	FIRST_NAME	LAST_NAME	EMAIL	HIRE_DATE	JOB_ID
1	300	Edward	Wong	EWONG	07-JUL-02	AC_ACCOUNT
2	301	Edward I	Wong	E1WONG	07-JUL-03	AC_ACCOUNT
3	302	Edward II	Wong	E2WONG	07-JUL-04	AC_ACCOUNT

Recap

- An alternative to SQLLDR
- Benefits – save space, time.
- Create table – add ORGANIZATION EXTERNAL

FIXED-LENGTH FILES

Control file – load.ctl

LOAD DATA

```
INFILE 'C:\load\emp_load.dat'  
BADFILE      'emp_load_BAD.log'  
DISCARDFILE  'emp_load_DISCARDED.log'  
APPEND  
INTO TABLE  hr.employees
```

```
( EMPLOYEE_ID POSITION(1:6) CHAR  
, FIRST_NAME  POSITION(7:26) CHAR  
, LAST_NAME   POSITION(27:51) CHAR  
, EMAIL       POSITION(52:76) CHAR  
, HIRE_DATE   POSITION(77:85) DATE  
, JOB_ID      POSITION(86:95) CHAR  
)
```

Let SQL*Loader generate code

```
SQLLDR SYSTEM/ORACLE@XE CONTROL=loadctl  
EXTERNAL_TABLE=GENERATE_ONLY
```

Outputs file load.log – includes
create, load, drop scripts

Section of DDL

ACCESS PARAMETERS

(

RECORDS DELIMITED BY NEWLINE

FIELDS

(

EMPLOYEE_ID (1:6) CHAR(6),

FIRST_NAME (7:26) CHAR(20),

LAST_NAME (27:51) CHAR(25),

EMAIL (52:76) CHAR(25),

HIRE_DATE (77:85) CHAR(9)

DATE_FORMAT DATE MASK "DD-MON-RR",

JOB_ID (86:95) CHAR(10)

)

)

Can now select from the external table

```
SELECT * FROM hr_app.emp_fixed_ext;
```

Query Result x

SQL | All Rows Fetched: 3 in 0.236 seconds

	EMPLOYEE_ID	FIRST_NAME	LAST_NAME	EMAIL	HIRE_DATE	JOB_ID
1	300	Edward	Wong	EWONG	07-JUL-02	AC_ACCOUNT
2	301	Edward	Wong	EWONG	07-JUL-03	AC_ACCOUNT
3	302	Edward	Wong	EWONG	07-JUL-04	AC_ACCOUNT

Recap

- Fixed length files
 - Character positions instead of comma delimiters
 - Record terminator
 - Faster load than comma delimited
- Use control files to generate code
- Positions listed in ACCESS PARAMETER section

EBCDIC FILES

EBCDIC

- File format used by IBM in place of ASCII
- Based on punched card code
- Less common, many have been fleeing EBCDIC for years, moved to ASCII.

EBCDIC file

- Requires CHARACTERSET WE8EBCDIC500
 - Not loaded with Oracle Express, using an Oracle VirtualBox appliance.
 - Used to read from non-ascii files.

How to create an EBCDIC file

Using Linux:

```
'dd conv=ebcdic if=emp_load.dat  
of=emp_load_ebcdic.dat'
```

Validate conversion worked, reverse:

```
'dd conv=ascii if=emp_load_ebcdic.dat'
```

Load the EBCDIC file

We reuse fixed-length file emp_load.dat

```
+++++1+++++2+++++3+++++4+++++5+++++6+++++7+++++8+++++9+++++
12345678901234567890123456789012345678901234567890123456789012345
300 Edward Wong EWONG 07-JUL-02AC_ACCOUNT
301 Edward wong E1WONG 07-JUL-03AC_ACCOUNT
302 Edward wong E2WONG 07-JUL-04AC_ACCOUNT
```

Becomes emp_load_ebcdic.dat

```
óðð@@@Å,,|™,,@@@@@@@@@@@@@@@@@@æ-•‡@@@@@@@@@@@@@@@@@@@@@@@@@ÅæöÖç@@@@@@@@@@@@@@@@@@@@@@@@@ð÷`ÑäÓ`ðòÁÃmÁÃÄÖäÖã%
óðñ@@@Å,,|™,,@@@@@@@@@@@@@@@@@@æ-•‡@@@@@@@@@@@@@@@@@@@@@@@@@ÅñæöÖç@@@@@@@@@@@@@@@@@@@@@@@@@ð÷`ÑäÓ`ðóÁÃmÁÃÄÖäÖã%
óðò@@@Å,,|™,,@@@@@@@@@@@@@@@@@@æ-•‡@@@@@@@@@@@@@@@@@@@@@@@@@ÅòæöÖç@@@@@@@@@@@@@@@@@@@@@@@@@ð÷`ÑäÓ`ðôÁÃmÁÃÄÖäÖã%
```

create directory EXT_DIR as '/home/oracle/load'

ReCap

- Non-ASCII files
 - Fixed length file converted to EBCDIC
 - Characterset WE8EBCDIC500
 - Loaded EBCDIC (non-ASCII) file

**PREPROCESSING - VIEW ZIPPED
FILES, LEAVING THEM INTACT**

Syntax for PreProcessor

PREPROCESSOR directory_spec: 'file_spec'

Example:

```
ACCESS PARAMETERS  
(RECORDS DELIMITED BY NEWLINE  
PREPROCESSOR EXEC_DIR: 'preprocess.bat'  
FIELDS TERMINATED BY '  
)
```

*Note: optional execute directory **exec_dir** and not shown is the location file which will be the name of the zipped file.*

preprocess.bat

```
@echo off
```

```
C:\oracle\exe\app\oracle\product\1  
1.2.0\server\bin\unzip.exe -qc  
%1
```

Preprocessing

- User accessing the external table needs to be granted EXECUTE on Oracle directory
 - Can specify separate directory for scripts
 - Two directories separate the functions
 - Data directory for read/write privileges
 - Exec directory for read/execute privileges

Oracle White Paper

- http://download.oracle.com/otndocs/products/database/enterprise_edition/utilities/pdf/xtables_preproc11g_1106.pdf

ReCap

- Access Parameter: PREPROCESSOR
- Executable commands in script/cmd file
- Limit privileges
 - EXECUTE on Oracle directory
 - READ/WRITE on Host OS directory
- SELECT from compressed files

END-TO-END SECURITY ASPECTS

Operating System

- Limit users with access to external table files
- Create own filesystem
 - Full filesystem won't affect other processes
 - Consider encryption
- Set immutable flag in Linux 'chattr -V +I'
 - Use on files that should not change
 - Run as root
 - Can restrict changes to preprocessor scripts

Oracle

- Create Oracle directory
 - Will be owned by SYS
- Grant write only as required
 - Needed to write out log files
 - Or revoke write, then use NOLOG clause

Securing the ORACLE_LOADER Access Driver

- http://docs.oracle.com/cd/E11882_01/network.112/e16543/guidelines.htm#DBSEG10007

Keep track of all external tables and
who has privileges.

dba_external_tables

all_directories

dba_tab_privs

ReCap

- Coordinate security plans at DB and OS
- Preprocessor requires commands packaged as shell or batch script
- Check logs manually and/or use external tables to monitor logs.

COMMON ERRORS ASSOCIATED WITH EXTERNAL TABLES

Where to look

- Syntax errors in the ORGANIZATION EXTERNAL/Access Parameters clause display as KUP% errors.
- Check logs for clues
 - Logfile for data errors
 - Badfile for malformed records
 - Discardfile for files not loaded

KUP-04011 file system is full

- **Cause:** An operation on a file failed because the file system is full. The message preceding this one contains the name of the file.
- **Action:** Free space on the file system or move the file to a different file system.

ORA-29913

- The ORA-29913 error can also happen in external tables when you don't grant read and write permissions to the directory:
- ```
CREATE OR REPLACE DIRECTORY extdir AS
'/u01/app/oracle/extdir';
GRANT READ ON DIRECTORY extdir TO
myowner;
GRANT WRITE ON DIRECTORY extdir TO
myowner;
```

Source: <http://www.dba-oracle.com/t ora 29913 external table error.htm>

# KUP-04062 no data source specified

- **Cause:** No location for the data source of the external table was specified when the external table was created. An empty string is not valid.
- **Action:** Specify the name of the data source in the `LOCATION` clause when creating an external table.

# ReCap

- KUP% errors
- Remember to set and review logs
- Warning to trim log files regularly.

# Oracle External Tables

- Features you can start using today
  - Comma separated files
  - Fixed length files
  - Unusual files (EBCDIC)
  - Preprocessing with zipped files
- E-mail me w/ subject “External Table scripts”
  - [uintafun@gmail.com](mailto:uintafun@gmail.com)
  - I’ll send you a copy of scripts I used in presentation

# Useful resources

Oracle Documentation

[www.oracle.com/pls/db112/homepage](http://www.oracle.com/pls/db112/homepage)

Tom Kyte

<http://asktom.oracle.com>

Mike McLaughlin

<http://blog.mclaughlinsoftware.com>

Arup Nanda

<http://www.oracle.com/technetwork/issue-archive/2011/11-mar/o21nanda-312277.html>

Oracle Developer Network

<http://www.oracle-developer.net/display.php?id=204>

# Thank you

