Exportar e importar datos de Oracle

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1. Exportar datos

- Se utiliza el comando `expdp`
  - Ayuda con `expdp help=yes`
  - Es necesario crear antes el `directory` de **Oracle**

```
Export: Release 12.1.0.2.0 - Production on Fri Dec 16 13:32:15 2016

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The Data Pump export utility provides a mechanism for transferring data objects
between Oracle databases. The utility is invoked with the following command:

   Example: expdp scott/tiger DIRECTORY=dmpdir DUMPFILE=scott.dmp

You can control how Export runs by entering the 'expdp' command followed
by various parameters. To specify parameters, you use keywords:

   Format:  expdp KEYWORD=value or KEYWORD=(value1,value2,...,valueN)
   Example: expdp scott/tiger DUMPFILE=scott.dmp DIRECTORY=dmpdir SCHEMAS=scott
               or TABLES=(T1:P1,T1:P2), if T1 is partitioned table

USERID must be the first parameter on the command line.

------------------------------------------------------------------------------

The available keywords and their descriptions follow. Default values are listed within square brackets.

ABORT_STEP
Stop the job after it is initialized or at the indicated object.
Valid values are -1 or N where N is zero or greater.
N corresponds to the object's process order number in the master table.

ACCESS_METHOD
Instructs Export to use a particular method to unload data.
Valid keyword values are: [AUTOMATIC], DIRECT_PATH and EXTERNAL_TABLE.

ATTACH
Attach to an existing job.
For example, ATTACH=job_name.

CLUSTER
Utilize cluster resources and distribute workers across the Oracle RAC [YES].
```

```
COMPRESSION
Reduce the size of a dump file.
Valid keyword values are: ALL, DATA_ONLY, [METADATA_ONLY] and NONE.

COMPRESSION_ALGORITHM
Specify the compression algorithm that should be used.
Valid keyword values are: [BASIC], LOW, MEDIUM and HIGH.

CONTENT
Specifies data to unload.
Valid keyword values are: [ALL], DATA_ONLY and METADATA_ONLY.

DATA_OPTIONS
Data layer option flags.
Valid keyword values are: XML_CLOBS.

DIRECTORY
Directory object to be used for dump and log files.

DUMPFILE
Specify list of destination dump file names [expdat.dmp].
For example, DUMPFILE=scott1.dmp, scott2.dmp, dmpdir:scott3.dmp.

ENCRYPTION
Encrypt part or all of a dump file.
Valid keyword values are: ALL, DATA_ONLY, ENCRYPTED_COLUMNS_ONLY, METADATA_ONLY and NONE.

ENCRYPTION_ALGORITHM
Specify how encryption should be done.
Valid keyword values are: [AES128], AES192 and AES256.

ENCRYPTION_MODE
Method of generating encryption key.
Valid keyword values are: DUAL, PASSWORD and [TRANSPARENT].

ENCRYPTION_PASSWORD
Password key for creating encrypted data within a dump file.

ENCRYPTION_PWD_PROMPT
Specifies whether to prompt for the encryption password [NO].
Terminal echo will be suppressed while standard input is read.

ESTIMATE
Calculate job estimates.
Valid keyword values are: [BLOCKS] and STATISTICS.

ESTIMATE_ONLY
Calculate job estimates without performing the export [NO].

EXCLUDE
Exclude specific object types.
For example, EXCLUDE=SCHEMA:"='HR'".

FILESIZE
Specify the size of each dump file in units of bytes.

FLASHBACK_SCN
SCN used to reset session snapshot.

FLASHBACK_TIME
Time used to find the closest corresponding SCN value.

FULL
Export entire database [NO].

HELP
Display Help messages [NO].

INCLUDE
Include specific object types.
For example, INCLUDE=TABLE_DATA.

JOB_NAME
Name of export job to create.

KEEP_MASTER
Retain the master table after an export job that completes successfully [NO].

LOGFILE
Specify log file name [export.log].

LOGTIME
Specifies that messages displayed during export operations be timestamped.
Valid keyword values are: ALL, [NONE], LOGFILE and STATUS.
```

```
METRICS
Report additional job information to the export log file [NO].

NETWORK_LINK
Name of remote database link to the source system.

NOLOGFILE
Do not write log file [NO].

PARALLEL
Change the number of active workers for current job.

PARFILE
Specify parameter file name.

QUERY
Predicate clause used to export a subset of a table.
For example, QUERY=employees:"WHERE department_id > 10".

REMAP_DATA
Specify a data conversion function.
For example, REMAP_DATA=EMP.EMPNO:REMAPPKG.EMPNO.

REUSE_DUMPFILES
Overwrite destination dump file if it exists [NO].

SAMPLE
Percentage of data to be exported.

SCHEMAS
List of schemas to export [login schema].

SERVICE_NAME
Name of an active Service and associated resource group to constrain Oracle RAC resources.

SOURCE_EDITION
Edition to be used for extracting metadata.

STATUS
Frequency (secs) job status is to be monitored where
the default [0] will show new status when available.

TABLES
Identifies a list of tables to export.
For example, TABLES=HR.EMPLOYEES,SH.SALES:SALES_1995.

TABLESPACES
Identifies a list of tablespaces to export.

TRANSPORTABLE
Specify whether transportable method can be used.
Valid keyword values are: ALWAYS and [NEVER].

TRANSPORT_FULL_CHECK
Verify storage segments of all tables [NO].

TRANSPORT_TABLESPACES
List of tablespaces from which metadata will be unloaded.

VERSION
Version of objects to export.
Valid keyword values are: [COMPATIBLE], LATEST or any valid database version.

VIEWS_AS_TABLES
Identifies one or more views to be exported as tables.
For example, VIEWS_AS_TABLES=HR.EMP_DETAILS_VIEW.

------------------------------------------------------------------------------

The following commands are valid while in interactive mode.
Note: abbreviations are allowed.

ADD_FILE
Add dumpfile to dumpfile set.

CONTINUE_CLIENT
Return to logging mode. Job will be restarted if idle.

EXIT_CLIENT
Quit client session and leave job running.

FILESIZE
Default filesize (bytes) for subsequent ADD_FILE commands.

HELP
Summarize interactive commands.
```

```
KILL_JOB
Detach and delete job.

PARALLEL
Change the number of active workers for current job.

REUSE_DUMPFILES
Overwrite destination dump file if it exists [NO].

START_JOB
Start or resume current job.
Valid keyword values are: SKIP_CURRENT.

STATUS
Frequency (secs) job status is to be monitored where
the default [0] will show new status when available.

STOP_JOB
Orderly shutdown of job execution and exits the client.
Valid keyword values are: IMMEDIATE.
```

1.1. `directory` de Oracle

- Algunos comandos de **Oracle** necesitan trabajar sobre directorios del disco
- A veces no interesa que los usuarios conozcan/decidan los directorios
  - para no llenar una partición
  - para no divulgar información de la base de datos
  - para no acceder a directorios donde **Oracle** puede, pero el usuario no

1.2. Definir un directorio

```
grant create any directory to unusuario;
create directory mi_directorio_de_backup as '/home/alumno/backups';
```

```
GRANT READ, WRITE ON DIRECTORY mi_directorio_de_backup TO usuario;
```

- Seguridad: es importante dar permisos a los procesos de **Oracle** para acceder y escribir al directorio
  - Pero no al resto de usuarios
  - Mejor `setfacl` que `chmod`

1.3. Caracteres de escape

- A veces hay que pasar parámetros con espacios u otros caracteres especiales
- En `bash` se haría con comillas "dobles.º 'simples'
- `expdp` maneja por sí mismo las comillas, así que hay que escaparlas en `bash`

```
expdp \'sys/alumno@localhost:1521/orclpdb1 as sysdba\' DIRECTORY=datos DUMPFILE=\'con espacios.dmp\'
```

1.4. Ejemplo de exportación

```
[alumno@centos-asgbd ~]$ expdp alumno/alumno directory=mi_directorio_de_backup schemas=alumno dumpfile=alumno.dmp logfile
    ↪ =alumno.log
Export: Release 12.1.0.2.0 - Production on Fri Dec 16 13:07:26 2016

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Connected to: Oracle Database 12c Standard Edition Release 12.1.0.2.0 - 64bit Production
Starting "ALUMNO"."SYS_EXPORT_SCHEMA_01":  alumno/******** directory=mi_directorio_de_backup schemas=alumno dumpfile=
    ↪ alumno.dmp logfile=alumno.log
Estimate in progress using BLOCKS method...
```

```
Processing object type SCHEMA_EXPORT/TABLE/TABLE_DATA
Total estimation using BLOCKS method: 192 KB
Processing object type SCHEMA_EXPORT/PRE_SCHEMA/PROCACT_SCHEMA
Processing object type SCHEMA_EXPORT/TABLE/TABLE
Processing object type SCHEMA_EXPORT/TABLE/GRANT/OWNER_GRANT/OBJECT_GRANT
Processing object type SCHEMA_EXPORT/TABLE/COMMENT
Processing object type SCHEMA_EXPORT/TABLE/INDEX/INDEX
Processing object type SCHEMA_EXPORT/TABLE/CONSTRAINT/CONSTRAINT
Processing object type SCHEMA_EXPORT/TABLE/INDEX/STATISTICS/INDEX_STATISTICS
Processing object type SCHEMA_EXPORT/TABLE/CONSTRAINT/REF_CONSTRAINT
Processing object type SCHEMA_EXPORT/TABLE/STATISTICS/TABLE_STATISTICS
Processing object type SCHEMA_EXPORT/STATISTICS/MARKER
. . exported "ALUMNO"."MATRICULAS"                       6.523 KB      44 rows
. . exported "ALUMNO"."MULTAS"                           8.195 KB      35 rows
. . exported "ALUMNO"."PERSONAS"                         6.875 KB      47 rows
Master table "ALUMNO"."SYS_EXPORT_SCHEMA_01" successfully loaded/unloaded
******************************************************************************
Dump file set for ALUMNO.SYS_EXPORT_SCHEMA_01 is:
  /home/alumno/backups/alumno.dmp
Job "ALUMNO"."SYS_EXPORT_SCHEMA_01" successfully completed at Fri Dec 16 13:08:00 2016 elapsed 0 00:00:33
```

2. Importar datos

- Se utiliza el comando `impdp`
  - Ayuda con `impdp help=yes`

```
Import: Release 12.1.0.2.0 - Production on Fri Dec 16 13:31:18 2016

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The Data Pump Import utility provides a mechanism for transferring data objects
between Oracle databases. The utility is invoked with the following command:

     Example: impdp scott/tiger DIRECTORY=dmpdir DUMPFILE=scott.dmp

You can control how Import runs by entering the 'impdp' command followed
by various parameters. To specify parameters, you use keywords:

     Format:  impdp KEYWORD=value or KEYWORD=(value1,value2,...,valueN)
     Example: impdp scott/tiger DIRECTORY=dmpdir DUMPFILE=scott.dmp

USERID must be the first parameter on the command line.

------------------------------------------------------------------------------

The available keywords and their descriptions follow. Default values are listed within square brackets.

ABORT_STEP
Stop the job after it is initialized or at the indicated object.
Valid values are -1 or N where N is zero or greater.
N corresponds to the object's process order number in the master table.

ACCESS_METHOD
Instructs Import to use a particular method to load data.
Valid keyword values are: [AUTOMATIC], CONVENTIONAL, DIRECT_PATH
and EXTERNAL_TABLE.

ATTACH
Attach to an existing job.
For example, ATTACH=job_name.

CLUSTER
Utilize cluster resources and distribute workers across the Oracle RAC [YES].

CONTENT
Specifies data to load.
Valid keywords are: [ALL], DATA_ONLY and METADATA_ONLY.

DATA_OPTIONS
Data layer option flags.
Valid keywords are: DISABLE_APPEND_HINT and SKIP_CONSTRAINT_ERRORS.

DIRECTORY
Directory object to be used for dump, log and SQL files.

DUMPFILE
List of dump files to import from [expdat.dmp].
For example, DUMPFILE=scott1.dmp, scott2.dmp, dmpdir:scott3.dmp.
```

```
ENCRYPTION_PASSWORD
Password key for accessing encrypted data within a dump file.
Not valid for network import jobs.

ENCRYPTION_PWD_PROMPT
Specifies whether to prompt for the encryption password [NO].
Terminal echo will be suppressed while standard input is read.

ESTIMATE
Calculate network job estimates.
Valid keywords are: [BLOCKS] and STATISTICS.

EXCLUDE
Exclude specific object types.
For example, EXCLUDE=SCHEMA:"='HR'".

FLASHBACK_SCN
SCN used to reset session snapshot.

FLASHBACK_TIME
Time used to find the closest corresponding SCN value.

FULL
Import everything from source [YES].

HELP
Display help messages [NO].

INCLUDE
Include specific object types.
For example, INCLUDE=TABLE_DATA.

JOB_NAME
Name of import job to create.

KEEP_MASTER
Retain the master table after an import job that completes successfully [NO].

LOGFILE
Log file name [import.log].

LOGTIME
Specifies that messages displayed during import operations be timestamped.
Valid keyword values are: ALL, [NONE], LOGFILE and STATUS.

MASTER_ONLY
Import just the master table and then stop the job [NO].

METRICS
Report additional job information to the import log file [NO].

NETWORK_LINK
Name of remote database link to the source system.

NOLOGFILE
Do not write log file [NO].

PARALLEL
Change the number of active workers for current job.

PARFILE
Specify parameter file.

PARTITION_OPTIONS
Specify how partitions should be transformed.
Valid keywords are: DEPARTITION, MERGE and [NONE].

QUERY
Predicate clause used to import a subset of a table.
For example, QUERY=employees:"WHERE department_id > 10".

REMAP_DATA
Specify a data conversion function.
For example, REMAP_DATA=EMP.EMPNO:REMAPPKG.EMPNO.

REMAP_DATAFILE
Redefine data file references in all DDL statements.

REMAP_SCHEMA
Objects from one schema are loaded into another schema.

REMAP_TABLE
Table names are remapped to another table.
For example, REMAP_TABLE=HR.EMPLOYEES:EMPS.
```

```
REMAP_TABLESPACE
Tablespace objects are remapped to another tablespace.

REUSE_DATAFILES
Tablespace will be initialized if it already exists [NO].

SCHEMAS
List of schemas to import.

SERVICE_NAME
Name of an active Service and associated resource group to constrain Oracle RAC resources.

SKIP_UNUSABLE_INDEXES
Skip indexes that were set to the Index Unusable state.

SOURCE_EDITION
Edition to be used for extracting metadata.

SQLFILE
Write all the SQL DDL to a specified file.

STATUS
Frequency (secs) job status is to be monitored where
the default [0] will show new status when available.

STREAMS_CONFIGURATION
Enable the loading of Streams metadata [YES].

TABLE_EXISTS_ACTION
Action to take if imported object already exists.
Valid keywords are: APPEND, REPLACE, [SKIP] and TRUNCATE.

TABLES
Identifies a list of tables to import.
For example, TABLES=HR.EMPLOYEES,SH.SALES:SALES_1995.

TABLESPACES
Identifies a list of tablespaces to import.

TARGET_EDITION
Edition to be used for loading metadata.

TRANSFORM
Metadata transform to apply to applicable objects.
Valid keywords are: DISABLE_ARCHIVE_LOGGING, INMEMORY, INMEMORY_CLAUSE,
LOB_STORAGE, OID, PCTSPACE, SEGMENT_ATTRIBUTES, STORAGE, and
TABLE_COMPRESSION_CLAUSE.

TRANSPORTABLE
Options for choosing transportable data movement.
Valid keywords are: ALWAYS and [NEVER].
Only valid in NETWORK_LINK mode import operations.

TRANSPORT_DATAFILES
List of data files to be imported by transportable mode.

TRANSPORT_FULL_CHECK
Verify storage segments of all tables [NO].
Only valid in NETWORK_LINK mode import operations.

TRANSPORT_TABLESPACES
List of tablespaces from which metadata will be loaded.
Only valid in NETWORK_LINK mode import operations.

VERSION
Version of objects to import.
Valid keywords are: [COMPATIBLE], LATEST, or any valid database version.
Only valid for NETWORK_LINK and SQLFILE.

VIEWS_AS_TABLES
Identifies one or more views to be imported as tables.
For example, VIEWS_AS_TABLES=HR.EMP_DETAILS_VIEW.
Note that in network import mode, a table name may be appended
to the view name.

------------------------------------------------------------------------------

The following commands are valid while in interactive mode.
Note: abbreviations are allowed.

CONTINUE_CLIENT
Return to logging mode. Job will be restarted if idle.

EXIT_CLIENT
Quit client session and leave job running.
```

```
HELP
Summarize interactive commands.

KILL_JOB
Detach and delete job.

PARALLEL
Change the number of active workers for current job.

START_JOB
Start or resume current job.
Valid keywords are: SKIP_CURRENT.

STATUS
Frequency (secs) job status is to be monitored where
the default [0] will show new status when available.

STOP_JOB
Orderly shutdown of job execution and exits the client.
Valid keywords are: IMMEDIATE.
```

2.1. `INCLUDE/EXCLUDE` una tabla

- `INCLUDE` y `EXCLUDE` son filtros, como condiciones de `where`
  - Se puede usar `PARFILE` para no tener que escapar caracteres en la *shell*
- Mejor utilizar `TABLES`

```
impdp USERNAME/PASSWORD schemas=USERNAME directory=backup dumpfile=full.dmp EXCLUDE=TABLE:\"like 'IMG_%%'\" EXCLUDE=TABLE
    ↪ :\"IN \(\'EMP\',\'DEPT\'\)\"
```

2.2. Importar un `schema` en otro `schema`

- Importar un fichero del usuario `profesor` en el usuario `alumno`

```
impdp system/alumno SCHEMAS=alumno remap_schema=alumno:profesor \
           directory=EXPORTDIR \
           dumpfile=profesor.dmp
```

```
[alumno@centos-asgbd backups]$ impdp system/alumno schemas=profesor remap_schema=profesor:alumno directory=
    ↪ mi_directorio_de_backup dumpfile=profesor.dmp

Import: Release 12.1.0.2.0 - Production on Fri Dec 16 13:23:38 2016

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Connected to: Oracle Database 12c Standard Edition Release 12.1.0.2.0 - 64bit Production
Master table "SYSTEM"."SYS_IMPORT_SCHEMA_01" successfully loaded/unloaded
Starting "SYSTEM"."SYS_IMPORT_SCHEMA_01":  system/******** schemas=profesor remap_schema=profesor:alumno directory=
    ↪ mi_directorio_de_backup dumpfile=profesor.dm
p
Processing object type SCHEMA_EXPORT/PRE_SCHEMA/PROCACT_SCHEMA
Processing object type SCHEMA_EXPORT/TABLE/TABLE
Processing object type SCHEMA_EXPORT/TABLE/TABLE_DATA
. . imported "ALUMNO"."MATRICULAS"                       6.523 KB      44 rows
. . imported "ALUMNO"."MULTAS"                           8.195 KB      35 rows
. . imported "ALUMNO"."PERSONAS"                         6.875 KB      47 rows
Processing object type SCHEMA_EXPORT/TABLE/GRANT/OWNER_GRANT/OBJECT_GRANT
Processing object type SCHEMA_EXPORT/TABLE/INDEX/INDEX
Processing object type SCHEMA_EXPORT/TABLE/CONSTRAINT/CONSTRAINT
Processing object type SCHEMA_EXPORT/TABLE/INDEX/STATISTICS/INDEX_STATISTICS
Processing object type SCHEMA_EXPORT/TABLE/CONSTRAINT/REF_CONSTRAINT
Processing object type SCHEMA_EXPORT/TABLE/STATISTICS/TABLE_STATISTICS
Processing object type SCHEMA_EXPORT/STATISTICS/MARKER
Job "SYSTEM"."SYS_IMPORT_SCHEMA_01" successfully completed at Fri Dec 16 13:23:58 2016 elapsed 0 00:00:19
```

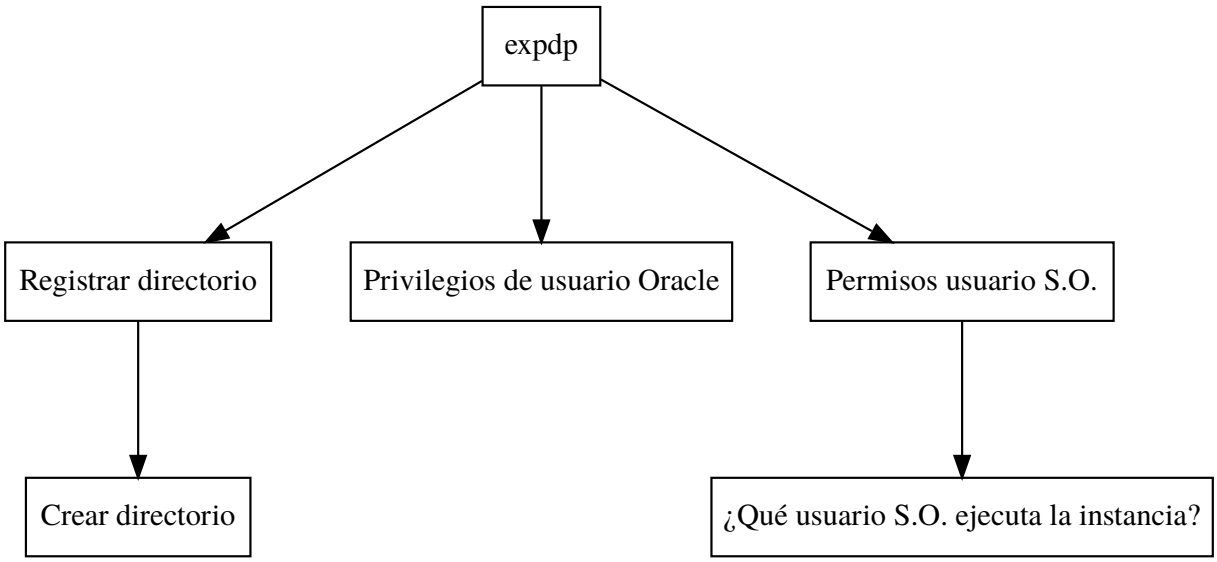
Permiso para cambiar schema

3. Ejercicio (1)

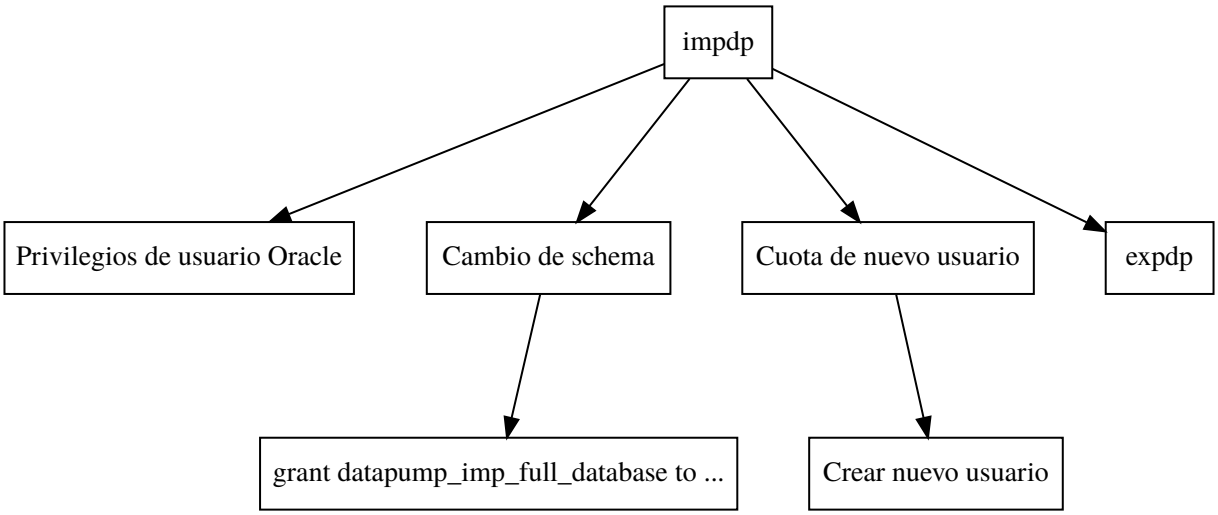
- Crea la base de datos de multas en el usuario `multas` (`../1/sql/multas.sql`)

- Exporta la base de datos al fichero `/datos/exports/multas.dump`
  - Con el usuario `sys`
- Importa las tablas en el usuario `copiamultas`
  - Con un usuario que no sea `sys`

3.1. Tareas para la exportación



3.2. Tareas para la importación

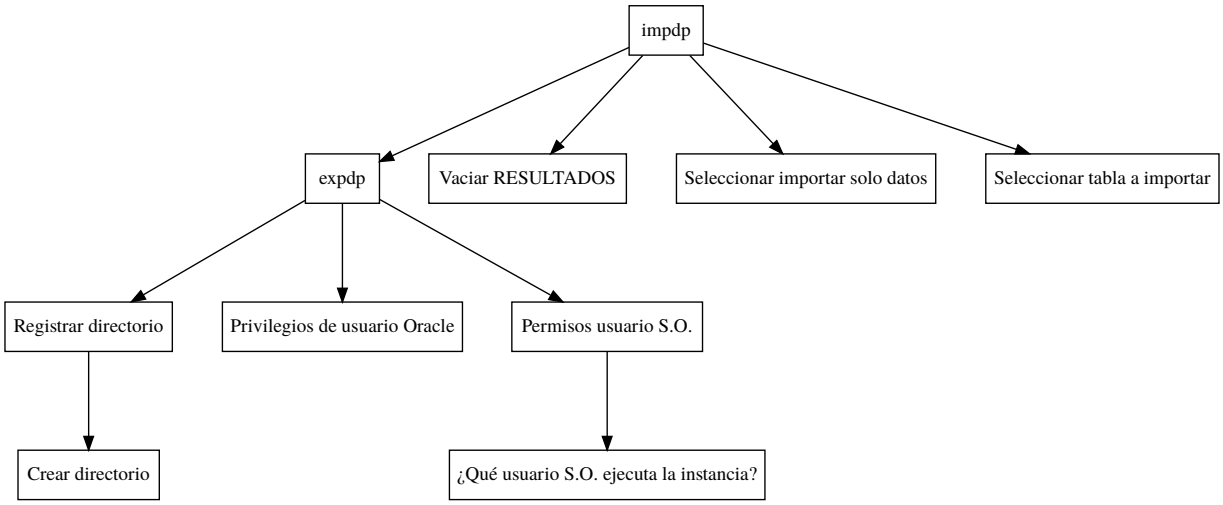


4. Ejercicio (2)

1. Crear la base de datos
   - Con la base de datos de carreras (../1/sql/carreras-coches.sql)
   - Crear el usuario `CARRERAS` y ejecutar el *script* SQL
2. Exportar
   - Exportar las tablas del usuario `CARRERAS` al fichero `carreras.dmp`

3. Importar
    - Borrar las filas de la tabla `CARRERAS.RESULTADOS`
    - Importar los datos desde `carreras.dmp`

4.1. Tareas



5. Otras soluciones

- RMAN
- Copias de *tablespaces*

5.1. RMAN

- Solución de Oracle para backups
- Ventajas
    - Granularidad del backup: incrementales o totales
    - En línea
- Desventajas
    - Mayor complejidad

5.2. Copias de *tablespaces*

- Los datos están en ficheros `dbf`
- Basta con hacer copias de esos ficheros
- Ventajas
    - Fácil, no se necesitan herramientas especiales
- Desventajas
    - Muchas veces es necesario parar Oracle para hacer la copia y la restauración

Fuente: docs.oracle.com

5.2.1. Lista de ficheros a copiar

- El fichero `pfile` o `spfile` indica dónde está el fichero de control
  - Generalmente en `$ORACLE_HOME/dbs/spfile.ora`
  - `SHOW PARAMETER spfile;`
- El fichero de control indica dónde están los ficheros de datos
- Los tablespaces `system` tienen los metadatos necesarios para entender los tablespaces de datos

```
select 'datos', name from v$datafile
union
select 'temporal', name from v$tempfile
union
select 'redo', member from v$logfile
union
select 'control', name from v$controlfile
union
select 'spfile', value from v$parameter where name='spfile';
```

5.2.2. Arrancar la base de datos

Si solo se restauran los ficheros de datos (y se tienen suficientes ficheros de `log`)

```
SQL> startup mount
ORACLE instance started.

Total System Global Area  264241152 bytes
Fixed Size                  1286916 bytes
Variable Size             205524220 bytes
Database Buffers           54525952 bytes
Redo Buffers                2904064 bytes
Database mounted.
SQL> recover database until cancel;
Media recovery complete.
SQL> alter database open resetlogs;

Database altered.

SQL>
```

5.3. Ejercicio

1. Localiza los ficheros de datos de tu instancia
2. Apaga la instancia y haz una copia de los ficheros
3. Arranca la instancia, y realiza cambios en la base de datos
4. Apaga la instancia e intenta recuperar los ficheros de datos
5. Arranca la instancia, y comprueba que todo sigue como antes del paso 1

6. Referencias

- Formatos:
  - Transparencias
  - PDF
  - EPUB
- Creado con:
  - Emacs
  - org-re-reveal
  - Latex
- Alojado en Github