

# Oracle® SQLcl

## User's Guide



Release 22.1

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# Preface

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bouncycastle v1.60 (optional)

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slf4j, v1.7.25,

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tomcat-apr, v5.5.23 (optional)

Apache Tomcat

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## jackson-core 2.12.4

Jackson Core

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## jackson-databind 2.12.4

Jackson Databind

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## Launch4j 3.14

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Code Generation Library (cglib:cglib-nodep:2.2.2 - <http://cglib.sourceforge.net/>)

Commons CLI (commons-cli:commons-cli:1.2 - <http://commons.apache.org/cli/>)

Logging (commons-logging:commons-logging:1.1 - [http://jakarta.apache.org/commons/\\${pom.artifactId.substring\(8\)}/](http://jakarta.apache.org/commons/${pom.artifactId.substring(8)}/))

ant-antunit (org.apache.ant:ant-antunit:1.3 - no url defined)

AssertJ fluent assertions (org.assertj:assertj-core:1.5.0 - <http://nexus.sonatype.org/oss-repository-hosting.html/assertj-parent-pom/assertj-core>)

Groovy (org.codehaus.groovy:groovy-all:2.3.10 - <http://groovy.codehaus.org/>)

Objenesis (org.objenesis:objenesis:1.2 - <http://objenesis.googlecode.com/svn/docs/index.html>)

osgi.core (org.osgi:org.osgi.core:4.3.1 - <http://www.osgi.org>)

powermock-api-mockito (org.powermock:powermock-api-mockito:1.5.6 - <http://www.powermock.org/powermock-api/powermock-api-mockito>)

powermock-api-support (org.powermock:powermock-api-support:1.5.6 - <http://www.powermock.org/powermock-api/powermock-api-support>)

powermock-core (org.powermock:powermock-core:1.5.6 - <http://www.powermock.org>)

powermock-module-junit4 (org.powermock:powermock-module-junit4:1.5.6 - <http://www.powermock.org>)

powermock-module-junit4-common (org.powermock:powermock-module-junit4-common:1.5.6 - <http://www.powermock.org/powermock-modules/powermock-module-junit4-common>)

powermock-reflect (org.powermock:powermock-reflect:1.5.6 - <http://www.powermock.org/powermock-reflect>)

Spock Framework - Core Module (org.spockframework:spock-core:1.0-groovy-2.3 - <http://spockframework.org>)

Spring Framework (org.springframework:spring:2.0.6 - <http://www.springframework.org>)

SnakeYAML (org.yaml:snakeyaml:1.17 - <http://www.snakeyaml.org>)

avalon-framework (avalon-framework:avalon-framework:4.1.3 - no url defined)

log4j (log4j:log4j:1.2.12 - no url defined)

org.apache.tools.ant (org.apache.ant:ant:1.7.1 - <http://ant.apache.org/ant/>)

ant-launcher (org.apache.ant:ant-launcher:1.7.1 - <http://ant.apache.org/ant-launcher/>)

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servlet-api (javax.servlet:servlet-api:2.4 - no url defined)

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## StringTemplate 4.3.1

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# 1

## Changes in Release 22.1 for *Oracle SQLcl User's Guide*

This section lists the changes for this release.

### **New Features**

New features in this release are:

- Support for encryption, parallelism and filtering in Data Pump  
See [Data Pump Support in SQLcl](#)
- Enhancements to the SET CODESCAN command  
See SET CODESCAN in [SET system\\_variable value](#)
- Support for Data Guard commands  
See [DG \(Data Guard\)](#)



# 2

## Using Oracle SQLcl

Oracle SQLcl (SQL Developer Command Line) is a Java-based command-line interface for Oracle Database. Using SQLcl, you can execute SQL and PL/SQL statements interactively or as a batch file. SQLcl provides inline editing, statement completion, command recall, and also supports existing SQL\*Plus scripts.

Oracle SQLcl is available for download from Oracle Technology Network.

### Note:

- To run SQLcl, you need to install Oracle Java 11 or later versions. If the Java version is less than 11, then the SQLcl installation fails with the following error message: Error: A JNI error has occurred, please check your installation and try again Exception in thread "main" java.lang.UnsupportedClassVersionError:..
- On Windows, Java is searched for in the following directories:
  - For SQLcl (sql.exe):  
..\..\jdk\jre\bin;%JAVA\_HOME%\bin;%PATH%;%ORACLE\_HOME%\jdk\jre\bin
  - For SQLcl installed with Oracle Database:  
%JAVA\_HOME%\bin;%PATH%;..\jdk\jre\bin;%ORACLE\_HOME%\jdk\jre\bin
- If the Java file is not found in those directories, Java is searched for in the registry, the minimum version (version more than or equal to) being 11.0.9.

This chapter contains the following topics:

- [Alphabetic List of SQLcl Commands](#)
- [List of Unsupported SQL\\*Plus Commands and Features](#)
- [Starting and Leaving SQLcl](#)
- [Starting Up and Shutting Down a Database](#)
- [Entering and Executing Commands](#)
- [Manipulating SQL, SQLcl, and PL/SQL Commands](#)
- [Formatting Query Results](#)
- [Accessing Databases](#)
- [Miscellaneous Commands](#)
- [Loading a File](#)
- [Calling Oracle Cloud Infrastructure REST APIs Using the OCI Command](#)

## 2.1 Alphabetic List of SQLcl Commands

`@{url | file_name[.ext]} [arg ...]`

`@@ { url | file_name[.ext] } [arg ...]`

`/ (slash)`

`ACC[EPT] variable [NUM[BER] | CCHAR | DATE | BINARY_FLOAT | BINARY_DOUBLE] [FOR[MAT] format] [DEF[AULT] default] [PROMPT text | NOPR[OMPT]] [HIDE]`

`ALIAS [<name>=<SQL statement>;| LOAD [<filename>]|SAVE [<filename>] | LIST [<NAME>] | DROP <name> | DESC <name> <Description String>]`

`APEX [export <application_id>]`

`A[PPEND] text`

`ARCHIVE LOG LIST`

`BRE[AK] [ON report_element [action [action]]] ...`

`BRIDGE`

`BTI[TLE] [printspect [text | variable] ...] | [ON | OFF]`

`CD [<directory>]`

`C[HANGE] sepchar old [sepchar [new [sepchar]]]`

`CL[EAR] option ...`

`COL[UMN] [{column | expr} [option ...]]`

`COMP[UTE] [function [LAB[EL] text] ... OF {expr | column | alias} ...ON {expr | column | alias | REPORT | ROW} ...]`

`CONN[ECT] [{<logon>| / |proxy} [AS {SYSOPER | SYSDBA | SYSASM}] [edition=value]]`

`CTAS table new_table`

`COPY {FROM database | TO database | FROM database TO database} {APPEND | CREATE | INSERT | REPLACE | APPEND_BYTE | CREATE_BYTE | REPLACE_BYTE} destination_table[(column, column, column, ...)] USING query`

`DDL [object_name [type] [SAVE filename]]`

`DEF[INE] [variable] | [variable = text]`

`DEL [n | n m | n * | n LAST | * | * n | * LAST | LAST]`

`DESC[RIBE] [{schema.]object[@connect_identifier]}`

`DG`

`DISC[ONNECT]`

`ED[IT] [file_name[.ext]]`

`EXEC[UTE] statement`

```

{EXIT | QUIT} [SUCCESS | FAILURE | WARNING | n | variable | :BindVariable]
[COMMIT | ROLLBACK]

FIND [<filename>]

FORMAT [BUFFER | RULES <filename> | FILE <input_file> <output_file>]

GET [FILE] file_name [.ext] [LIST | NOLIST]

HELP | ? [topic]

HISTORY [index | FULL | USAGE | SCRIPT | TIME | CLEAR (SESSION)?]

HO[ST] [command]

INFO[RMATION] {[schema.]object[@connect_identifier]}

I[NPUT] [text]

L[IST] [n | n m | n * | n LAST | * | * n | * LAST | LAST]

LOAD [schema.]table_name[@db_link] file_name

OERR <facility> <error>

PASSW[ORD] [username]

PAU[SE] [text]

PRINT [variable ...]

PRO[MPT] [text]

{QUIT | EXIT} [SUCCESS | FAILURE | WARNING | n | variable | :BindVariable]
[COMMIT | ROLLBACK]

REM[ARK]

REPEAT <iterations> <sleep>

REST [export [<module_name> | <module_prefix>] | modules | privileges | schemas]

R[UN]

SAV[E] [FILE] file_name [.ext] [CRE[ATE] | REP[LACE] | APP[END]]

SCRIPT <script file>

SET system_variable value

SHO[W] [option]

SHUTDOWN [ABORT | IMMEDIATE | NORMAL | TRANSACTIONAL [LOCAL]]

SODA

SPO[OL] [filename [.ext] [CRE[ATE] | REP[LACE] | APP[END]] | OFF | OUT]

SSTUNNEL <username>@<hostname> -i <identity_file> [-L
localPort:Remotehost:RemotePort]

STA[RT] { url | file_name [.ext] } [arg ...]

STARTUP db_options | cdb_options | upgrade_options

```

```

STORE {SET} file_name [.ext] [CRE[ATE] | REP[LACE] | APP[END]]

TNSPING <address>

TTI[TLE] [printspec [text | variable] ...] | [ON | OFF]

UNDEF[INE] variable ...

WHENEVER OSERROR {EXIT [SUCCESS | FAILURE | n | variable | :BindVariable]
[COMMIT | ROLLBACK] | CONTINUE[COMMIT | ROLLBACK | NONE] }

WHENEVER SQLERROR {EXIT [SUCCESS | FAILURE | WARNING | n | variable
| :BindVariable] [COMMIT | ROLLBACK] | CONTINUE [COMMIT | ROLLBACK |
NONE] }

WHICH <filename>

XQUERY xquery_statement

```

**Note:**

You can use the up and down arrow keys to cycle through the previous 100 statements or scripts.

## 2.2 List of Unsupported SQL\*Plus Commands and Features

### Commands

- REPHEADER
- REPFOOTER
- TIMING

The TIMING command is replaced by the SET TIMING command.

### System Variables and Environment Settings through the SET Command

- describe
- flagger
- fullcolname
- logsource
- loboffset
- markup
- recsep
- shiftinout
- sqlterminator
- underline
- xmloptimizationcheck

## 2.3 Starting and Leaving SQLcl

### Logging In and Logging Out

Use the following commands to log in to and out of SQLcl.

```
SQLCL [[option] [logon | / NOLOG] [start]]
```

where *option* has the following syntax:

```
-H[ELP] | -V[ERSION] | [ [-C[OMPATIBILITY] x.y[.z]]] [-L[OGON]] [-NOLOGINTIME]
[-R[ESTRICT] {1 | 2 | 3}] [-S[ILENT]] [-AC]]
```

where *logon* has the following syntax:

```
{username[/password] [@connect_identifier] | /} [AS {SYSASM | SYSBACKUP | SYSDBA |
SYSDBG | SYSOPER | SYSRAC | SYSKM}] [edition=value]
```

and where *start* has the following syntax:

```
@{url | file_name[.ext]} [arg ...]
{EXIT | QUIT} [SUCCESS | FAILURE | WARNING | n | variable | :BindVariable]
[COMMIT | ROLLBACK]
```

Commits or rolls back all pending changes, logs out of Oracle, terminates SQLcl and returns control to the operating system.

```
{QUIT | EXIT} [SUCCESS | FAILURE | WARNING | n | variable | :BindVariable]
[COMMIT | ROLLBACK]
```

Commits or rolls back all pending changes, logs out of Oracle, terminates SQLcl and returns control to the operating system.

### Setting JVM Options

To set an Oracle Java Virtual Machine (JVM) option in SQLcl, use the following environment variable:

```
JAVA_TOOL_OPTIONS
```

The following example shows in Windows, how to change the user interface language in SQLcl to Spanish (es):

```
c:\SQLDev\sqlcl\20.2\sqlcl\bin>SET JAVA_TOOL_OPTIONS=-Duser.language=es
c:\SQLDev\sqlcl\20.2\sqlcl\bin>sql hr/oracle
Picked up JAVA_TOOL_OPTIONS: -Duser.language=es
SQLcl: Versi<n 20.2 Production en mar. ago. 25 15:37:58 2020
Copyright (c) 1982, 2020, Oracle. Todos los derechos reservados.
Last Successful login time: Mar Ago 25 2020 15:38:01 -04:00
Conectado a:
Oracle Database 12c Enterprise Edition Release 12.2.0.1.0 - 64bit Production

Se ha encontrado login.sql en el CWD. El acceso a la DB est& restringido
para login.sql.
```

Ajuste SQLPATH para incluir la ruta y activar la funcionalidad completa.  
SQL>

The following example shows how to change the user interface language in SQLcl to French (fr), and also increase the maximum memory available to SQLcl (-Xmx800m):

```
c:\SQLDev\sqlcl\20.2\sqlcl\bin>SET JAVA_TOOL_OPTIONS=-
Duser.language=fr -Xmx800m
c:\SQLDev\sqlcl\20.2\sqlcl\bin>sql hr/oracle
Picked up JAVA_TOOL_OPTIONS: -Duser.language=fr -Xmx800m
SQLcl : version 20.2 Production sur mar. ao\ 25 15:57:21 2020
Copyright (c) 1982, 2020, Oracle. Tous droits r@serv@s....
```

## 2.4 Starting Up and Shutting Down a Database

Starting up and shutting down a database requires DBA privileges.

*STARTUP db\_options | cdb\_options | upgrade\_options*

where *db\_options* has the following syntax:

```
[FORCE] [RESTRICT] [PFILE=filename] [QUIET] [ MOUNT [dbname] | [ OPEN
[open_db_options] [dbname] ] | NOMOUNT ]
```

where *open\_db\_options* has the following syntax:

```
READ {ONLY | WRITE [RECOVER]} | RECOVER
```

where *cdb\_options* has the following syntax:

*root\_connection\_options | pdb\_connection\_options*

where *root\_connection\_options* has the following syntax:

```
PLUGGABLE DATABASE pdbname [FORCE] | [RESTRICT] [ OPEN {open_pdb_options}]
```

where *pdb\_connection\_options* has the following syntax:

```
[FORCE] | [RESTRICT] [ OPEN {open_pdb_options}]
```

where *open\_pdb\_options* has the following syntax:

```
READ WRITE | READ ONLY
```

and where *upgrade\_options* has the following syntax:

```
[PFILE=filename] {UPGRADE | DOWNGRADE} [QUIET]
```

Starts an Oracle Database instance with several options, including mounting and opening a database.

```
SHUTDOWN [ABORT | IMMEDIATE | NORMAL | TRANSACTIONAL [LOCAL]]
```

Shuts down a currently running Oracle instance, optionally closing and dismounting a database.

## 2.5 Entering and Executing Commands

Use the following commands to execute and collect timing statistics on SQL commands and PL/SQL blocks:

```
/ (slash)
```

Executes the most recently executed SQL command or PL/SQL block which is stored in the SQL buffer. Does not list the command. Use slash (/) at the command prompt or line number prompt in SQLcl command line.

```
EXEC[UTE] statement
```

Executes a single PL/SQL statement or runs a stored procedure.

```
R[UN]
```

Lists and executes the most recently executed SQLcl command or PL/SQL block which is stored in the SQL buffer. The buffer has no command history list and does not record SQLcl commands.

```
TIMI[NG]
```

Timing is only available as a switch.

Use the following command to access the help system:

```
HELP | ? [topic]
```

Accesses the command-line help system. Enter `HELP INDEX` or `? INDEX` for a list of topics. You can view the Oracle Database Library at <http://www.oracle.com/technology/documentation>.

Use the following command to execute operating system commands:

```
HO[ST] [command]
```

Executes an operating system command without leaving SQLcl. Enter `HOST` without command to display an operating system prompt. You can then enter multiple operating system commands.

With some operating systems, you can use another character instead of `HOST` such as `!` (UNIX) and `$` (Windows). See the Oracle installation and user's manuals provided for your operating system for details.

You can use the `_RC` variable to return the exit status of the command executed with `HOST`.

### Note:

When connecting to a database using bequeath protocol (where a client connection is passed directly to a dedicated server process without going through the listener), the `_RC` variable is not automatically updated. Set `bequeath_detach=yes` in the `sqlnet.ora` configuration file to update the `_RC` variable.

Use the following command to recall the history of SQLcl commands:

```
HISTORY [index | FULL | USAGE | SCRIPT | TIME | CLEAR (SESSION)?] | FAILS
```



- Use the Up and Down arrow keys to navigate through history items at the prompt.
- Use the `HISTORY` command to print the history contents.
- History is limited to the last 100 statements.
- `SET HISTORY LIMIT N` allows you to change the default limit, where *N* is the maximum number.
- History is retained between SQLcl sessions.
- By default, the `SHOW`, `HISTORY`, `CONNECT`, and `SET` commands are not saved in history.
- `SET HISTORY FILTER` allows you to set the commands that should not be recorded in history.

## 2.6 Manipulating SQL, SQLcl, and PL/SQL Commands

Use the following commands to edit SQL commands and PL/SQL blocks:

```
A[PPEND] text
```

Adds specified text to the end of the current line in the SQL buffer. To separate *text* from the preceding characters with a space, enter two spaces. To append *text* that ends with a semicolon, end the command with two semicolons (a single semicolon is interpreted as a command terminator).

```
C[HANGE] sepchar old [sepchar [new [sepchar]]]
```

Changes first occurrence of *old* on the current line of the SQL buffer. The buffer has no command history list and does not record SQLcl commands. You can use any non-alphanumeric character such as "/" or "!" as a *sepchar*. You can omit the space between `CHANGE` and the first *sepchar*.

```
DEL [n | n m | n * | n LAST | * | * n | * LAST | LAST]
```

Deletes one or more lines of the SQL buffer ("\*" indicates the current line). You can omit the space between `DEL` and *n* or *\**, but not between `DEL` and `LAST`. Enter `DEL` with no clauses to delete the current line of the buffer. The buffer has no command history list and does not record SQLcl commands.

```
I[NPUT] [text]
```

Adds one or more new lines of text after the current line in the SQL buffer. The buffer has no command history list and does not record SQLcl commands.

```
L[IST] [n | n m | n * | n LAST | * | * n | * LAST | LAST]
```

Lists one or more lines of the most recently executed SQL command or PL/SQL block which is stored in the SQL buffer. Asterisk (\*) indicates the current line. You can omit the space between `LIST` and *n* or *\**, but not between `LIST` and `LAST`. Enter `LIST` with no clauses to list all lines.

In SQLcl, you can also use ";" to list all the lines in the SQL buffer. The buffer has no command history list and does not record SQLcl commands.

Use the following commands to run scripts:

```
@ { url | file_name[.ext] } [arg ...]
```

Runs the SQLcl statements in the specified script. The script can be called from the local file system or a web server. You can pass values to script variables in the usual way.

```
@ { url | file_name[.ext] } [arg ...]
```

Runs the SQLcl statements in the specified script. This command is almost identical to the @ command. It is useful for running nested scripts because it has the additional functionality of looking for the specified script in the same path or *url* as the calling script.

```
REPEAT <iterations> <sleep>
```

Repeats the current SQL in the buffer at the specified times with sleep intervals. The maximum sleep interval is 120 seconds.

```
SCRIPT <script file>
```

Runs the SQLcl statements in the specified script.

```
STA[RT] { url | file_name[.ext] } [arg ...]
```

Runs the SQLcl statements in the specified script. The script can be called from the local file system or a web server. You can pass values to script variables in the usual way.

Use the following commands to create and modify scripts:

```
ED[IT] [file_name[.ext]]
```

Invokes an operating system text editor on the contents of the specified file or on the contents of the SQL buffer. To edit the buffer contents, omit the file name.

The DEFINE variable `_EDITOR` can be used to set the editor to use. In SQLcl, `_EDITOR` can be set to any editor that you prefer. *Inline* will set the editor to be the SQLcl editor. This supports the following shortcuts:

- `^R` - Run the current buffer
- `^W` - Go to top of buffer
- `^S` - Go to bottom of buffer
- `^A` - Go to start of line
- `^E` - Go to end of line

```
FORMAT
```

- `FORMAT BUFFER` - formats the script in the SQLcl Buffer
- `FORMAT RULES <filename>` - Loads SQLDeveloper Formatter rules file to formatter
- `FORMAT FILE <input_file> <output_file>`

```
GET file_name[.ext] [LIST | NOLIST]
```

Loads a SQL statement or PL/SQL block from a file into the SQL buffer. The buffer has no command history list and does not record SQLcl commands.

```
REM[ARK]
```

Begins a comment in a script. The REMARK command must appear at the beginning of a line, and the comment ends at the end of the line (a line cannot contain both a comment and a command). SQLcl does not interpret the comment as a command.

```
SAV[E] [FILE] file_name[.ext] [CRE[ATE] | REP[LACE] | APP[END]]
```

Saves the contents of the SQL buffer in a script. The buffer has no command history list and does not record SQLcl commands.

```
STORE {SET} file_name [.ext] [CRE[ATE] | REP[LACE] | APP[END]]
```

Saves attributes of the current SQLcl environment in a file.

```
WHENEVER OSERROR {EXIT [SUCCESS | FAILURE | n | variable | :BindVariable]  
[COMMIT | ROLLBACK] | CONTINUE [COMMIT | ROLLBACK | NONE]}
```

Performs the specified action (exits SQLcl by default) if an operating system error occurs (such as a file writing error).

```
WHENEVER SQLERROR {EXIT [SUCCESS | FAILURE | WARNING | n | variable  
| :BindVariable] [COMMIT | ROLLBACK] | CONTINUE [COMMIT | ROLLBACK |  
NONE]}
```

Performs the specified action (exits SQLcl by default) if a SQL command or PL/SQL block generates an error.

Use the following commands to write interactive commands:

```
ACC[EPT] variable [NUM[BER] | CHAR | DATE | BINARY_FLOAT | BINARY_DOUBLE]  
[FOR[MAT] format] [DEF[AULT] default] [PROMPT text | NOPR[OMPT]] [HIDE]
```

Reads a line of input and stores it in a given substitution variable.

```
DEF[INE] [variable] | [variable = text]
```

Specifies a substitution variable and assigns a CHAR value to it, or lists the value and variable type of a single variable or all variables.

```
PAU[SE] [text]
```

Displays the specified text then waits for the user to press RETURN.

```
PRO[MPT] [text]
```

Sends the specified message or a blank line to the user's screen.

```
UNDEF[INE] variable ...
```

Deletes one or more substitution variables that you defined either explicitly (with the DEFINE command) or implicitly (with a START command argument).

Use the following commands to create and display bind variables:

```
PRINT [variable ...]
```

Displays the current values of bind variables, or lists all bind variables.

Use the following symbols to create substitution variables and parameters for use in scripts:

```
&n
```

Specifies a parameter in a script you run using the START command. START substitutes values you list after the script name as follows: the first for &1, the second for &2, and so on.

```
&user_variable, &&user_variable
```

Indicates a substitution variable in a SQL or SQLcl command. SQLcl substitutes the value of the specified substitution variable for each substitution variable it encounters. If the substitution variable is undefined, SQLcl prompts you for a value *each time* an "&" variable is found, and the *first time* an "&&" variable is found.

. (period)

Terminates a substitution variable followed by a character that would otherwise be part of the variable name.

## 2.7 Formatting Query Results

Use the following commands to format, store and print your query results.

```
BRE[AK] [ON report_element [action [action]]] ...
```

Specifies where changes occur in a report and the formatting action to perform, such as:

- suppressing the display of duplicate values for a given column
- skipping a line each time a given column value changes
- printing computed figures each time a given column value changes or at the end of the report

Enter `BREAK` with no clauses to list the current `BREAK` definition.

Where *report\_element* has the following syntax:

```
{column | expression | ROW | REPORT}
```

and where *action* has the following syntax:

```
[SKI[P] n | [SKI[P]] PAGE] [NODUP[LICATES] | DUP[LICATES]]
```

```
BTI[TLE] [printspec [text | variable] ...] | [ON | OFF]
```

Places and formats a title at the bottom of each report page, or lists the current `BTITLE` definition. Use one of the following clauses in place of *printspec*:

```
BOLD
CE[NTER]
COL n
FORMAT text
LE[FT]
R[IGHT]
S[KIP] [n]
TAB n
```

```
CL[EAR] option ...
```

Resets or erases the current value or setting for the specified option.

Where *option* represents one of the following clauses:

```
BRE[AKS]
BUFF[ER]
COL[UMNS]
COMP[UTES]
```

```
CONTEXT
SCR[EEN]
SQL
TIMI[NG]
```

```
COL[UMN] [{column | expr} [option ...]]
```

Specifies display attributes for a given column, such as:

- text for the column heading
- alignment for the column heading
- format for NUMBER data
- wrapping of column data

Also lists the current display attributes for a single column or for all columns.

Where *option* represents one of the following clauses:

```
ALI[AS] alias
CLE[AR]
ENTMAP {ON | OFF}
FOR[MAT] format
HEA[DING] text
JUS[TIFY] {L[EFT] | C[ENTER] | R[IGHT]}
LIKE {expr | alias}
NEWL[INE]
NEW_V[ALUE] variable
NOPRI[NT] | PRI[NT]
NUL[L] text
OLD_V[ALUE] variable
ON | OFF
WRA[PPED] | WOR[D_WRA]PPED | TRU[NCATED]
```

 **Note:**

Currently only NEW\_V[ALUE] variable syntax is supported.

Enter COLUMN [{column |expr} FORMAT *format*] where the *format* element specifies the display format for the column.

To change the display format of a NUMBER column, use FORMAT followed by one of the elements in the following table:

Element	Examples	Description
, (comma)	9,999	Displays a comma in the specified position.
. (period)	99.99	Displays a period (decimal point) to separate the integral and fractional parts of a number.
\$	\$9999	Displays a leading dollar sign.

Element	Examples	Description
0	0999 9990	Displays leading or trailing zeros (0).
9	9999	Displays a value with the number of digits specified by the number of 9s. Value has a leading space if positive, a leading minus sign if negative. Blanks are displayed for leading zeros. A zero (0) is displayed for a value of zero.
B	B9999	Displays blanks for the integer part of a fixed-point number when the integer part is zero, regardless of zeros in the format model.
C	C999	Displays the ISO currency symbol in the specified position.
D	99D99	Displays the decimal character to separate the integral and fractional parts of a number.
EEEE	9.999EEEE	Displays a value in scientific notation (format must contain exactly four "E"s).
G	9G999	Displays the group separator in the specified positions in the integral part of a number.
L	L999	Displays the local currency symbol in the specified position.
MI	9999MI	Displays a trailing minus sign after a negative value. Displays a trailing space after a positive value.
PR	9999PR	Displays a negative value in <angle brackets>. Displays a positive value with a leading and trailing space.
RN rn	RN rn	Displays uppercase Roman numerals. Displays lowercase Roman numerals. Value can be an integer between 1 and 3999.
S	S9999 9999S	Displays a leading minus or plus sign. Displays a trailing minus or plus sign.
TM	TM	Displays the smallest number of decimal characters possible. The default is TM9. Fixed notation is used for output up to 64 characters, scientific notation for more than 64 characters. Cannot precede TM with any other element. TM can only be followed by a single 9 or E.
U	U9999	Displays the dual currency symbol in the specified position.

```
COMP[UTE] [function [LAB[EL] text] ... OF {expr | column | alias} ...ON {expr | column | alias | REPORT | ROW} ...]
```

In combination with the `BREAK` command, calculates and prints summary lines using various standard computations. It also lists all `COMPUTE` definitions. The following table lists valid functions. All functions except `NUMBER` apply to non-null values only. `COMPUTE` functions are always executed in the following sequence `AVG`, `COUNT`, `MINIMUM`, `MAXIMUM`, `NUMBER`, `SUM`, `STD`, `VARIANCE`.

Function	Computes	Applies to Datatypes
AVG	Average of non-null values	NUMBER
COU[NT]	Count of non-null values	All types
MIN[IMUM]	Minimum value	NUMBER, CHAR, NCHAR, VARCHAR2 (VARCHAR), NVARCHAR2 (NCHAR VARYING)
MAX[IMUM]	Maximum value	NUMBER, CHAR, NCHAR, VARCHAR2 (VARCHAR), NVARCHAR2 (NCHAR VARYING)
NUM[BER]	Count of rows	All types
SUM	Sum of non-null values	NUMBER
STD	Standard deviation of non-null values	NUMBER
VAR[IANCE]	Variance of non-null values	NUMBER

`SET SQLFORMAT {csv | html | xml | json | ansiconsole | insert | loader | fixed | default}`

Outputs reports in various formats. The `ansiconsole` option formats and resizes data according to the column widths, for easier readability. The `json` option returns a query in JSON format.

`SET SQLFORMAT DELIMITED <delimiter> <left enclosure> <right enclosure>` allows you to set a custom delimited format.

`SET SQLFORMAT JSON-FORMATTED` returns a query in well formatted JSON output.

`SPO[OL] [filename.ext] [CRE[ATE] | REP[LACE] | APP[END]] | OFF | OUT`

Stores query results in a file, or optionally sends the file to a printer. `OFF` stops spooling. `OUT` stops spooling and sends the file to your computer's default printer. Enter `SPOOL` with no clauses to list the current spooling status. If no file extension is given, the default extension, `.lst` or `.lis`, is used.

`TTI[TLE] [printspec [text | variable] ...] | [ON | OFF]`

Places and formats a specified title at the top of each report page, or lists the current TTITLE definition. The old form of TTITLE is used if only a single word or a string in quotes follows the TTITLE command.

Where *printspec* represents one or more of the following clauses:

BOLD  
 CE[NTER]  
 COL *n*  
 FORMAT *text*  
 LE[FT]  
 R[IGHT]  
 S[KIP] [*n*]  
 TAB *n*



## 2.8 Accessing Databases

Use the following commands to access and copy data between tables on different databases:

```
CONN[ECT] [{<logon>| / |proxy} [AS {SYSOPER | SYSDBA | SYSASM}] [edition=value]]
```

where *logon* has the following syntax:

```
username[/password] [@connect_identifier]
```

where *proxy* has the following syntax:

```
proxyuser[username] [/password] [@connect_identifier]
```

### Note:

The brackets around *username* in *proxy* are required syntax.

Connects a given username to the Oracle Database. If you omit *connect\_identifier*, SQLcl connects you to the default database. If you omit *username* and/or *password*, SQLcl prompts you for them. CONNECT followed by a slash (/) connects you using a default (OPS\$) logon.

When you run a CONNECT command, the site profile, *glogin.sql*, and the user profile, *login.sql*, are processed in that order. CONNECT does not reprompt for username or password if the initial connection does not succeed.

```
DISC[ONNECT]
```

Commits pending changes to the database and logs the current user out of Oracle, but does not exit SQLcl. In SQLcl command line, use EXIT or QUIT to log out of Oracle and return control to your computer's operating system.

```
COPY {FROM database | TO database | FROM database TO database} {APPEND | CREATE  
| INSERT | REPLACE | APPEND_BYTE | CREATE_BYTE | REPLACE_BYTE}  
destination_table[(column, column, column, ...)] USING query
```

where *database* has the following syntax:

```
username[/password]@connect_identifier
```

Copies data from a query to a table in the same or another database. APPEND, CREATE, INSERT or REPLACE specifies how COPY treats the existing copy of the destination table (if it exists). USING *query* identifies the source table and determines which rows and columns COPY copies from it. COPY supports CHAR, DATE, LONG, NUMBER and VARCHAR2 datatypes.

```
PASSW[ORD] [username]
```

Allows you to change a password without displaying it on an input device.

```
XQUERY xquery_statement
```

Allows you to run an XQuery from SQLcl.

## 2.9 Miscellaneous Commands

```
ALIAS [<name>=<SQL statement>;| LOAD [<filename>]|SAVE [<filename>] | LIST
 [<NAME>] | DROP <name> | DESC <name> <Description String>]
```

Alias is a command which allows you to save a SQL, PL/SQL or SQL\*Plus script and assign it a shortcut command.

- ALIAS — Print a list of aliases
- ALIAS LIST <alias\_name> — List the contents of the alias

The following example shows how to create a simple alias:

```
SQL> ALIAS action1=select :one from dual;
```



### Note:

Define an alias simply by using the alias keyword followed by a single identifier name followed by an '='. Anything after the '=' will be used as the alias contents. If it is SQL, it will be terminated by ';'. If it is PL/SQL, it will be terminated by '/'.

APEX

Lists Application Express Applications. Use APEX EXPORT <app id> to export the application which could be combined with spool for writing to a file.

ARCHIVE LOG LIST

Displays information about redo log files.

```
BRIDGE <targetTableName> as "<jdbcURL>" (<sqlQuery>);
```

Used mainly to script data move between two connections/schemas. It also includes functionality to dynamically create Oracle tables which "fit" the data being received through JDBC. The following functionality is available:

1. Query tables in other connections
2. Query tables in multiple connections in the same statement
3. Insert data from one connection into another
4. Create a table and insert data into it from another connection

```
CTAS table new_table
```

Uses DBMS\_METADATA to extract the DDL for the existing table, then modifies that into a create table as select \* from.

```
DDL [object_name [type] [SAVE filename]]
```

Generates the code to reconstruct the object listed. Use the *type* option for materialized views. Use the SAVE option to save the DDL to a file.

```
DESC[RIBE] {[schema.]object[@connect_identifier]}
```

Lists the column definitions for a table, view or synonym, or the specifications for a function or procedure.

```
FIND [<filename>]
```

Searches the SQLPATH and its directories for the specified file name. `FIND where <filename>` lists all the SQLPATH locations where it finds files matching the specified file name.

```
INFO[RMATION] {[schema.]object[@connect_Identifier]}
```

Lists more detailed information about the column definitions for a table, view or synonym, or the specifications for a function or procedure.



### Note:

INFORMATION+ will show column statistics.

```
OERR <facility> <error>
```

Displays information about errors. Facility is identified by the prefix string in the error message. For example, if you get ORA-7300, "ora" is the facility and "7300" is the error. So you should type "oerr ora 7300".

```
SSHTUNNEL <username>@<hostname> -i <identity_file> [-L  
localPort:Remotehost:RemotePort]
```

Creates a tunnel using standard ssh options such as port forwarding like option -L of the given port on the local host will be forwarded to the given remote host and port on the remote side. It also supports identity files, using the ssh -i option. If passwords are required, they will be prompted for.

```
TNSPING <address>
```

The TNSPING utility determines whether the listener for a service on an Oracle Net network can be reached successfully.

```
WHICH
```

Searches the SQLPATH and its directories for the specified file name and prints the name of the first file matching the specified file name in the SQLPATH.

## 2.9.1 REST

REST enables you to export Oracle REST Data Services 3.x services. This is applicable for Oracle REST Data Services release 3.0.5 or later. If you have an earlier version of Oracle REST Data Services, you will need to upgrade. See the Installing Oracle REST Data Services section in *Oracle REST Data Services Installation, Configuration, and Development Guide* for details.

The options are:

- `REST export` — Export all Oracle REST Data Services 3.x service modules
- `REST export <module_name>` — Export a specific module

- `REST export <module_uri_prefix>` — Export a specific module related to the given prefix
- `REST modules` — List the available modules
- `REST privileges` — List the existing privileges
- `REST schemas` — List the available schemas

## 2.9.2 SODA

SODA allows schemaless application development using the JSON data model. The options are:

- `SODA create <collection_name>` — Create a new collection
- `SODA list` — List all the collections
- `SODA get <collection_name> [-all | -f | -k | -klist] [{<key> | <k1> <k2> ... | <qbe>}]` — List documents the collection. Optional arguments:
  - `all`: list the keys of all docs in the collection
  - `k`: list docs matching the specific `<key>`
  - `klist`: list docs matching the list of keys
  - `f`: list docs matching the `<qbe>`
- `SODA insert <collection_name> <json_str | filename>` — Insert a new document within a collection
- `SODA drop <collection_name>` — Delete existing collection
- `SODA count <collection_name> [<qbe>]` — Count number of documents inside collection. Optional parameter `<qbe>` returns number of matching documents
- `SODA replace <collection_name> <oldkey> <new_{str | doc}>` — Replace one document with another
- `SODA remove <collection_name> [-k | -klist | -f] {<key> | <k1> <k2> ... | <qbe>}` — Remove documents from collection. Optional arguments:
  - `k`: Remove document in collection matching the specific `<key>`
  - `klist`: Remove document in collection matching the list `<key1> <key2> ...`
  - `f`: Remove document in collection matching `<qbe>`

## 2.9.3 MODELER

The `MODELER` command provides a command-line interface for Oracle SQL Developer Data Modeler features.

The options available are:

- `modeler help <command>` — Displays help information about the specified modeler command.
- `modeler ddl <parameters>` — Generates the Data Definition Language statements from the selected Data Modeler design.

- `modeler report <parameters>` — Generates the report from the selected Data Modeler design.

## MODELER DDL

Generates the Data Definition Language statements from the selected Data Modeler design.

### Syntax

```
MODELER DDL -design <file> -relmodel <name> [-outputfile <name>]
```

### Parameters

Parameter	Description
<code>-design (d) &lt;file&gt;</code>	Full path to the design's file name.
<code>-relmodel (rm) &lt;name&gt;</code>	Name of the relational model.
<code>-dbsite (ds) &lt;name&gt;</code>	(Optional) Name of the physical model database site. If this is not specified, then the default relational database management system site for the provided relational model is used.
<code>-outputfile (o) &lt;file&gt;</code>	Full path to the output file for the generated DDL content.
<code>-systemTypesDir (td) &lt;path&gt;</code>	Full path to the system types directory.
<code>-settingsFile (s) &lt;file&gt;</code>	Full path to the exported Data Modeler settings file.
<code>-ddlConfigFile (c) &lt;file&gt;</code>	Full path to the exported DDL configuration file.

### Example

```
modeler ddl -design "C:/Designs/SH.dmd" -relmodel "SH" -outputfile "C:/DDL.sql"
```

## MODELER REPORT

Generates the report from the selected Data Modeler design.

### Syntax

```
MODELER REPORT -design <file> -type <type> [-title <name>] -filename <name> -outputpath <path>
```

### Parameters

Parameter	Description
<code>-design (d) &lt;file&gt;</code>	Full path to the design's file name.
<code>-type (tp)</code>	Specify the type of report. Available types are: Tables, TableViews, TablesAndViews, Entities, EntityViews, EntitiesAndViews, Domains.
<code>-filename (f) &lt;name&gt;</code>	Name of the generated HTML file.

Parameter	Description
-outputpath (o) <path>	Full path to the folder for the generated HTML content. The report file is put in that folder and a "css" sub-directory with the CSS files used is created.
-relmodel (rm) <name>	Name of the relational model (for Tables and Table Views only).
-title (tt) <name>	(Optional) Title of the report.
-standardTemplate (st) <name>	Name of the template for a standard report, defining the set of report sections to include (optional). If this is not specified, all report sections are included.
-customTemplate (ct) <name>	(Optional) Name of the template for a custom report.
-reportConfTemplate (c) <name>	(Optional) Name of the template that defines the set of objects and subviews to include in the report.
-companyname (cn) <name>	(Optional) Name of the company.
-systemTypesDir (td) <path>	Full path to the system types directory.
-settingsFile (s) <file>	Full path to the exported Data Modeler settings file.

### Example

```
modeler report -design "C:/Designs/SH.dmd" -type "Tables" -filename
"SHTablesReport" -outputpath "C:/Reports"
```

## 2.9.4 DG (Data Guard)

Enables you to manage Oracle Data Guard broker for Oracle Database release 21c only.

See [Data Guard Commands](#) in *Oracle Data Guard Broker* for information about Data Guard commands and parameters.

## 2.9.5 SET *system\_variable value*

Sets a system variable to alter the SQLcl environment settings for your current session.

For example, to:

- Set the display width for data
- Customize HTML formatting
- Enable or disable printing of column headings
- Set the number of lines per page

Enter a system variable followed by a value as shown below:

```
SET APPI[NFO] {ON | OFF | text}
SET ARRAY[SIZE] {15 | n}
```

```
SET AUTO[COMMIT] {ON | OFF | IMM[EDIATE] | n}
SET AUTOP[RINT] {ON | OFF}
SET AUTORECOVERY {ON | OFF}
SET AUTOT[RACE] {ON | OFF | TRACE[ONLY]}
SET BLO[CKTERMINATOR] {_ | c | ON | OFF}
SET CLASSIC [ ON | OFF ]
SET CLEAR [ TOP | BOTTOM | SAME ]
SET CLOUDCONFIG [ -proxy=<proxyhost>:<port> ] <wallet.zip location>
SET CMDS[EP] {; | c | ON | OFF}
SET CODESCAN [ON | SQLINJECTION | SQLPERFORMANCE | OFF] (For more details, see
the description at the bottom.)
SET COLSEP {_ | text}
SET CON[CAT] { . | c | ON | OFF }
SET COPYC[OMMIT] {0 | n}
SET COPYTYPECHECK {ON | OFF}
SET DDL [ [ PRETTY | SQLTERMINATOR | CONSTRAINTS | REF_CONSTRAINTS |
CONSTRAINTS_AS_ALTER|OID | SIZE_BYTE_KEYWORD | PARTITIONING |
SEGMENT_ATTRIBUTES | STORAGE | TABLESPACE | SPECIFICATION | BODY | FORCE |
INSERT | INHERIT | RESET] {on|off} ] | OFF ]
SET DEF[INE] {& | c | ON | OFF}
SET ECHO {ON | OFF}
SET EDITF[ILE] file_name[.ext]
SET EMB[EDDED] {ON | OFF}
SET ENCODING
SET ERRORL[OGGING] {ON | OFF} [TABLE [schema.]tablename] [TRUNCATE]
[IDENTIFIER identifier]
SET ESC[APE] { \ | c | ON | OFF }
SET ESCCHAR {@ | ? | % | $ | OFF}
SET EXITC[OMMIT] {ON | OFF}
SET FEED[BACK] {6 | n | ON | OFF} [SQL_ID]
SET FLU[SH] {ON | OFF}
SET HEA[DING] {ON | OFF}
SET HEADS[EP] {_ | c | ON | OFF}
SET HISTORY [FAILS [LIMIT [ n | DEFAULT ] ] | NOFAILS | FILTER [DEFAULT
<command list>?|<command list>?] |LIMIT [n|DEFAULT]]
SET LDAPCON
SET LIN[ESIZE] {80 | n}
SET LOAD default [options...]
SET LOADFORMAT [ DEFAULT | CSV | DELIMITED | HTML | INSERT | JSON | JSON-
FORMATTED | LOADER | T2 | XML ] [options...]
SET LONG {80 | n}
SET LONGC[HUNKSIZE] {80 | n}
SET MAXROWS {n>1 | DEFAULT}
SET MAXSPOOLROWSTRUNCATE [ON | OFF | DEFAULT]
SET NET {ON | OFF | READONLY}
SET NEWP[AGE] {1 | n | NONE}
SET NEVERWRITE {ON | OFF | WARN}
SET NULL text
SET NUMF[ORMAT] format
SET NUM[WIDTH] {10 | n}
```



```

SET PAGES[IZE] {14 | n}
SET PAU[SE] {ON | OFF | text}
SET RECSEPCHAR {_ | c}
SET SERVEROUT[PUT] {ON | OFF} [SIZE {n | UNL[IMITED]}] [FOR[MAT]
{WRA[PPED] | WOR[D_WRAPPED] | TRU[NCATED]}]
SET SHOW[MODE] {ON | OFF}
SET SQLBL[ANKLINES] {ON | OFF}
SET SQLC[ASE] {MIX[ED] | LO[WER] | UP[PER]}
SET SQLCO[NTINUE] {> | text}
SET SQLFORMAT {csv | html | xml | json | ansiconsole | insert | loader
| fixed | default}
SET SQLPLUSCOMPAT[IBILITY] {x.y[.z]}
SET SQLPRE[FIX] {# | c}
SET SQLP[ROMPT] {SQL> | text}
SET SUF[FIX] {SQL | text}
SET T2 METRICDATA NAMESPACE {text}
SET T2 METRICDATA COMPARTMENTID {text}
SET T2 METRICDATA NAME {text}
SET T2 DIMENSIONS RESOURCEID {text}
SET T2 DIMENSIONS REGION {text}
SET T2 METADATA UNIT {text}
SET TAB {ON | OFF}
SET TERM[OUT] {ON | OFF}
SET TI[ME] {ON | OFF}
SET TIMI[NG] {ON | OFF}
SET TRIM[OUT] {ON | OFF}
SET TRIMS[POOL] {ON | OFF}
SET VER[IFY] {ON | OFF}
SET WRA[P] {ON | OFF}

SET DDL [[ PRETTY | SQLTERMINATOR | CONSTRAINTS | REF_CONSTRAINTS |
CONSTRAINTS_AS_ALTER|OID | SIZE_BYTE_KEYWORD | PARTITIONING |
SEGMENT_ATTRIBUTES | STORAGE | TABLESPACE | SPECIFICATION | BODY | FORCE |
INSERT | |INHERIT | RESET] {on|off} ] | OFF ]

```

Allows you to set the DDL transform option on DBMS\_METADATA.

```
SET ENCODING <encoding>
```

Allows you to set the encoding for the current session. Use SHOW ENCODING to view the encoding set for the current session. Use SHOW ENCODINGS to list the encodings available on your platform.

```
SET CODESCAN [ON | SQLINJECTION | SQLPERFORMANCE | OFF]
```

Controls warning messages issued for code quality issues. ON turns on warnings for possible SQL injection vulnerabilities and SQL performance issues. See [SQL Performance Troubleshooting](#)

## 2.9.6 SHOW *option*

Shows the value of a SQLcl system variable, or the current SQLcl environment. Enter any system variable set by the SET command in place of *system\_variable*. SHOW SGA can only be used by a DBA user. Use one of the following terms or clauses in place of *option*:

```
system_variable  
ALL  
BTI [TLE]  
CON_ID  
CON_NAME  
CONNECTION  
DDL  
EDITION  
ENCODING  
ENCODINGS  
ERR[ORS] [ {FUNCTION | PROCEDURE | PACKAGE | PACKAGE BODY | TRIGGER | VIEW |  
TYPE | TYPE BODY | DIMENSION | JAVA CLASS} [schema.]name]  
INSTANCE  
JAVA  
JDBC  
LNO  
NLS  
PARAMETER[S] [parameter_name]  
PDBS  
PNO  
RECYC[LEBIN] [original_name]  
REL[EASE]  
REPF[OOTER]  
REPH[EADER]  
SGA  
SPOOL[L]  
SPPARAMETER[S] [parameter_name]  
SQLCODE  
SQLPATH  
TNS  
TTI [TLE]  
USER  
VERSION
```

```
SHOW ENCODING
```

Shows the encoding which is set for the client.

```
SHOW ENCODINGS
```

Shows the available encodings for the client.

## 2.10 Loading a File

Use the `LOAD` command in SQLcl to load a comma-separated value file from a local directory or cloud storage location into a table.

### 2.10.1 LOAD Command

Loads a comma-separated value (csv) file from a local directory or cloud storage location into a table.

#### Syntax

```
LOAD [TABLE] [schema.]table_name { <file-specification> | <cloud-  
storage-specification> }  
[NEW | SHOW | SHOW_DDL | CREATE | CREATE_DDL]
```

where

`[schema.]table_name` identifies the table to load. If the schema is omitted, the table for the connected user schema is loaded.

*file-specification* has the following syntax:

```
{ <fully-qualified-file-name> | <file-name> }
```

- *fully-qualified-file-name*: Identifies the full path to the file to load.
- *file-name*: Identifies the file to load. The file must be located in the default path.

*cloud-storage-specification* has the following syntax:

```
{ CLOUDSTORAGE | CS | CLOUD_STORAGE } [ <url> | <qualified-name> ]
```

- *url*: Complete URL for the cloud storage file if a default cloud storage URL is not set using the Cloud Storage command.
- *qualified-name*: Name of the object, optionally qualified by the namespace and bucket. The qualified name combined with the URL specified by the Cloud Storage command must fully identify the object URL. If *url* and *qualified-name* are omitted, the default Cloud Storage URL must be set to the object.

`NEW` creates a table and loads data.

`[SHOW | SHOW_DDL]` executes the DDL generation phase and shows the DDL.

`[CREATE | CREATE_DDL]` executes the DDL generation phase and creates the table.

Use `SET LOAD` and `SET LOADFORMAT` to specify properties for DDL analysis and generation.

Create table DDL generation pre-scans the data file to determine column properties. Use `SET LOAD SCAN <n>` to specify the number of rows to scan for DDL. 100 is the default. To turn off scanning, set to 0.

Use `SET LOAD COL_SIZE` to change column sizes that are generated. Use `SET LOAD MAP_NAMES` to map file column names to table column names.

For more information about the Cloud Storage command, see [Using Cloud Storage](#).

The defaults for the file format are:

- The columns are delimited by a comma and may optionally be enclosed in double quotes.
- Lines are terminated with standard line terminators for Windows, UNIX or Mac.
- File is encoded UTF8.

The default load:

- Processes with 50 rows per batch.
- If `AUTOCOMMIT` is set in `SQLcL`, a commit is done every 10 batches.
- The load is terminated if more than 50 errors are found.

Use `SET LOADFORMAT` options for reading the file (delimiter, enclosures).

Use `SET LOAD` options for loading the data (rows per batch, date formats).

### Example

The following example shows how to load a file from local storage into a table.

```
--Create Table "countries"
create table countries(countries_id NUMBER(5),countries_name VARCHAR2(40));
Table COUNTRIES created

--Load file COUNTRIES_DATA_TABLE.csv in local storage to "countries" table
load countries C:\Users\JDOE\SQLcL\COUNTRIES_DATA_TABLE.csv

format csv

column_names on
delimiter ,
enclosure_left "
enclosure_right "
encoding UTF8
row_limit off
row_terminator default
skip_rows 0
skip_after_names

--Number of rows processed: 30
--Number of rows in error:
0 - SUCCESS: Load processed without errors

--Check the number of rows in countries table
select count(*) from countries;

COUNT(*)
-----
30
```

The following example shows how to load data into a new table EMP.

```
load emp empfile.csv new

--Create new table and load data into table HR.EMP

csv
column_names on
delimiter ,
enclosures ""
encoding UTF8
row_limit off
row_terminator default
skip_rows 0
skip_after_names

#INFO DATE format detected: RRRR-MM-DD

CREATE TABLE HR.EMP
(
  EMPLOYEE_ID NUMBER(5),
  FIRST_NAME VARCHAR2(26),
  LAST_NAME VARCHAR2(26),
  EMAIL VARCHAR2(26),
  PHONE_NUMBER VARCHAR2(26),
  HIRE_DATE DATE,
  JOB_ID VARCHAR2(26),
  SALARY NUMBER(9, 2),
  COMMISSION_PCT VARCHAR2(26),
  MANAGER_ID NUMBER(5),
  DEPARTMENT_ID NUMBER(5)
)
;

#INFO Table created
#INFO Number of rows processed: 21
#INFO Number of rows in error: 0
#INFO Last row processed in final committed batch: 21
SUCCESS: Processed without errors
```

The following example shows how to create a new table from a local file.

```
load emp1 empfile.csv create_ddl

--Create new table HR.EMP1

csv
column_names on
delimiter ,
enclosures ""
encoding UTF8
row_limit off
row_terminator default
```

```
skip_rows 0
skip_after_names
batch_rows 50
batches_per_commit 10
clean_names transform
column_size rounded
commit on
date_format
errors 50
map_column_names off
method insert
timestamp_format
timestamptz_format
locale English United States
scan_rows 100
truncate off
unknown_columns_fail on

--Pre-scans the date format
#INFO DATE format detected: RRRR-MM-DD

CREATE TABLE SYSTEM.EMP1
(
  EMPLOYEE_ID NUMBER(5),
  FIRST_NAME VARCHAR2(26),
  LAST_NAME VARCHAR2(26),
  EMAIL VARCHAR2(26),
  PHONE_NUMBER VARCHAR2(26),
  HIRE_DATE DATE,
  JOB_ID VARCHAR2(26),
  SALARY NUMBER(9, 2),
  COMMISSION_PCT VARCHAR2(26),
  MANAGER_ID NUMBER(5),
  DEPARTMENT_ID NUMBER(5)
)
;

#INFO Table created
SUCCESS: Processed without errors
```

### 2.10.1.1 SET LOAD Command

SET LOAD enables you to set options for loading data.

#### Syntax

```
SET LOAD default | [options...]
```

#### where

default means load method properties return to default values.

options represents the following:

- `BATCH_ROWS|BATCHROWS <number_of_rows>`

Data loading is done in batches. Specifies the number of rows to include in each batch.

- `BATCHES_PER_COMMIT|BATCHESPERCOMMIT <batches_per_commit>`

Commit after processing *number\_of\_batches*. If the number is equal to 0, commit happens at the end of the load. If the number is greater than or equal to 0, `COMMIT ON` is set.

- `CLEAN_NAMES [ TRANSFORM | TRANSFORM128 | QUOTE | QUOTE128 | UNIQUE ]`

Identifies the rule for making table and column names compliant with database identifiers. Names are cleaned before they are mapped to provide consistency with previous releases. If both `CLEAN_NAMES` and `MAP_COLUMN_NAMES` are used, then clean names should be specified.

The standard identifiers are:

- No longer than 30 or 128 characters.
- Not a reserved word.
- Starts with a letter and contains only letters, digits, or one of `_` `$` `#`.
- Uppercase
- Names that do not comply must be quoted. Length rules always apply.

 **Note:**

Data that is enclosed in quotes will have quotes in the header row removed before names are cleaned.

`TRANSFORM` (default)

Indicates that names are transformed as follows:

- Names are in uppercase.
- If the name starts and ends with the quote character, the quotes are removed.
- Names that are reserved words are appended with a dollar sign (`$`).
- Names that start with a number or special character is prefixed with an `X`.
- Spaces and hyphens are replaced with underscores (`_`). `$` and `#` characters are retained.
- Special characters other than `$` and `#` is replaced with the number sign (`#`).
- Names are truncated to 30 or 128 characters depending on database `MAX_STRING_SIZE`.
- After names are cleaned, non-unique names within the column set are appended with a unique sequence number. If truncation is required, the sequence number is maintained.



TRANSFORM (default)

Applies all transform rules. Names may be 128 characters.

QUOTE

Quote non-compliant names and shorten to 30 or 128 characters depending on database `MAX_STRING_SIZE`.

QUOTE128

Quote non-compliant names. Names may be 128 characters.

UNIQUE

Compatibility option with previous releases of load service. Names that are not unique within the column set are appended with a unique sequential number. Truncation is not provided.

- `COLUMN_SIZE | COLUMNSIZE | COLSIZE {ACTUAL | ROUND | ROUNDED | MAX | MAXIMUM}`

Create table column size strategy.

`ACTUAL` uses the largest size found during the scan.

`ROUND | ROUNDED` uses a size a little larger than the largest size found during the scan.

`MAX | MAXIMUM` uses the database maximum size for the data type that was detected.

- `COMMIT {ON | OFF}`

Enable or disable data commits.

- `DATE | DATE_FORMAT | DATEFORMAT format_mask`

The format of all `DATE` data type columns loaded. Specify no `format_mask` or `DEFAULT` to use database default.

For `DATE` columns, if `format` is not set and `SCAN_ROWS = 0`, the data is not scanned for a valid mask.

`ERRORS {number_of_rows | UNLIMITED}|-1`: Indicates the number of error rows allowed.

If this number is exceeded, the load will be terminated.

`-1` and `UNLIMITED` indicate no error limit.

All rows in a batch may be in error if any row fails.

- `LOCALE { <language country> | DEFAULT | "" }`

Specify locale language and optionally country.

`DEFAULT | ""` : Set to default locale.

- `MAP_COLUMN_NAMES | MAPCOLUMNNAMES | MAPNAMES { OFF | (<file-col-name>=<table-col-name>, ... ) }`

Provide a mapping from the column names specified in the file to column names in the table.

- `METHOD INSERT`

Method to use for data loads.

- `SCAN_ROWS | SCANROWS | SCAN <1-5000>`

Identify the number of rows to scan for create table generation. Default is 100 rows.

- `TIMESTAMP | TIMESTAMP_FORMAT | TIMESTAMPFORMAT`

The format of all `TIMESTAMP` data type columns being loaded. Specify no `format_mask` or `DEFAULT` to use database default. For `TIMESTAMP` columns, if format is not set and `SCAN_ROWS` not equal to 0, the data is scanned for a valid mask.

- `TIMESTAMPTZ | Timestamptz_format | Timestamptzformat`

The format of all `TIMESTAMPTZ` data type columns being loaded. Specify no `format_mask` or `DEFAULT` to use database default. For `TIMESTAMPTZ` columns, if format is not set and `SCAN_ROWS` not equal to 0, the data is scanned for a valid mask.

- `TRUNCATE {OFF|ON}`

Truncate `ON` truncates the table before loading

- `UNKNOWN_COLUMNS_FAIL | UNKNOWNCOLUMNSFAIL | UNKNOWNFAIL {ON|OFF}`

`ON`: Terminates the load if any columns in the file do not map to a column in the table.

`OFF`: Allows the load to proceed when columns in the file do not map to a column in the table.

## 2.11 Calling Oracle Cloud Infrastructure REST APIs Using the OCI Command

Starting from SQLcl release 20.2, you can call Oracle Cloud Infrastructure (OCI) REST APIs using the `OCI` command.



### See Also:

[Oracle Cloud Infrastructure API Documentation](#)

## Prerequisites

To use the OCI command, you need to first set the OCI profile for authentication and access.

For more information about how to set up the required SSH keys and configure your Oracle Cloud Infrastructure Software Development Kits, see [Setup and Prerequisites](#) in the *Oracle Cloud Infrastructure Documentation*.

To list profiles contained in the OCI configuration file at `~/.oci/config`, enter:

```
oci profile
```

To set the profile name as "demo", enter:

```
oci profile demo
```

## Two Syntax Formats

There are two syntax formats available for using the OCI command.

### Specify Target

In the first syntax format, the target is specified completely in the OCI command:

```
oci <host> <method> [file-to-send-as-body] <request-target>
```

where

*method* is GET, PUT or DELETE.

*request-target* is the path to the namespace, bucket or object on *host*.

### Examples

To delete the emp.csv file from testing-bucket:

```
oci objectstorage.us-ashburn-1.oraclecloud.com delete /n/abc123/b/testing-  
bucket/o/emp.csv
```

To list the contents of testing-bucket:

```
oci objectstorage.us-ashburn-1.oraclecloud.com get /n/abc123/b/testing-  
bucket/o/
```

To put the emp.csv file into testing-bucket:

```
oci objectstorage.us-ashburn-1.oraclecloud.com put ./emp.csv /n/abc123/b/  
testing-bucket/o/emp.csv
```

To get the emp.csv file from testing-bucket:

```
oci objectstorage.us-ashburn-1.oraclecloud.com get /n/abc123/b/testing-  
bucket/o/emp.csv
```

## Specify Target using Cloud Storage Command

In the second syntax format, the target is a complete or partial URL to the location, which is set using the Cloud Storage command (`cs`):

```
oci <method> [file-to-send-as-body] <qualifier>
```

where

*method* is GET, PUT or DELETE.

*qualifier* is the cloud storage namespace or bucket. *qualifier* is appended to the location specified on the set Cloud Storage command and must form the complete URL to the namespace, bucket, or object used by the *method*.

For more information about the Cloud Storage command, see [Using Cloud Storage](#).

### Examples

To delete emp.csv from testing-bucket:

```
cs objectstorage.us-ashburn-1.oraclecloud.com
oci delete /n/abc123/b/testing-bucket/o/emp.csv
```

To list contents of testing-bucket:

--Using the OCI Command (`oci get`)

```
cs objectstorage.us-ashburn-1.oraclecloud.com/n/abc123/b/testing-
bucket/o/
oci get
```

--Using the Cloud Storage Command (`cs listo`)

```
cs objectstorage.us-ashburn-1.oraclecloud.com/n/abc123/b/testing-
bucket/o/
cs listo
```

To put emp.csv into testing-bucket:

```
cs objectstorage.us-ashburn-1.oraclecloud.com/n/abc123/b/testing-bucket
oci put ./emp.csv /o/emp.csv
```

To get emp.csv from testing-bucket:

```
cs objectstorage.us-ashburn-1.oraclecloud.com/n/abc123/b/testing-bucket
oci get /o/emp.csv
```

# 3

## Liquibase Support in SQLcl

This chapter covers the Liquibase feature in SQLcl. It has the following topics:

- [About Liquibase in SQLcl](#)
- [Requirements for Using Liquibase](#)
- [Supported Types](#)
- [Supported Liquibase Commands in SQLcl](#)
- [DATABASECHANGELOG\\_DETAILS VIEW](#)
- [ChangeSets in Liquibase](#)
- [Examples Using Liquibase](#)

### 3.1 About Liquibase in SQLcl

Liquibase is an open-source database-independent library for tracking, managing and applying database schema changes.

For an understanding of the major concepts in Liquibase, see [Major Concepts](#).



#### Note:

Liquibase is not available in SQLcl that is part of the SQL Developer installation. To use this feature, you need to download the standalone SQLcl offering.

The Liquibase feature in SQLcl enables you to execute commands to generate a changelog for a single object or for a full schema (changeset and changelogs). You can process these objects manually using SQLcl or through any of the traditional Liquibase interfaces.

With the Liquibase feature in SQLcl, you can:

- Generate and execute single object changelogs
- Generate and execute schema changesets with object dependencies
- Automatically sort a changeset during creation based on object dependencies
- Record all SQL statements for changeset or changelog execution, as it is generated
- Provide full rollback support for changesets and changelogs automatically

See this [LiveLabs workshop](#) on change management using SQLcl and Liquibase.

## 3.2 Requirements for Using Liquibase

The two important aspects for using the Liquibase functionality are capturing and deploying objects in an Oracle database.

### Capture Objects

To capture an object or a schema, you must have SQLcl 19.2 or later installed.

In this release, you can only capture objects from the schema you are connected to in SQLcl. You also need write permission on the directory in which you save the files.

If you are capturing an entire schema, the user you are connected to must have the privilege to create a table. The DATABASECHANGELOG\_EXPORT table is created internally to gather object details and sort them correctly. The created object is automatically excluded from the capture process and destroyed upon capture completion.

### Deploy Objects

Liquibase uses the DATABASECHANGELOG table to track the changesets that have been run. The DATABASECHANGELOGLOCK table ensures that only one instance of Liquibase is running at a time. The DATABASECHANGELOG\_ACTIONS table tracks the object state and the SQL statements executed during deployment.

- **SQLcl**

Deploying changes to any database through SQLcl requires the 19.2 release or later and the privilege to create a table. You must have necessary permissions to create any object type through the change that you are deploying.

- **Liquibase**

If you use Liquibase directly to deploy changesets, you need to have:

- the extension installed in your Liquibase environment. Add the `dbtools-liquibase.jar` file in `liquibase/lib/ext`.
- the privileges to create a table and a package.

## 3.3 Supported Types

DDL types use create or replace syntax. A snapshot of the object is taken before applying the change so automatic rollback to the last known state is supported.

SXML types support automatic alter generation with automatic rollback support.

DDL types have their own change type.

- CONSTRAINT
- DIMENSION
- DIRECTORY
- FUNCTION
- JOB
- OBJECT\_GRANT

- PACKAGE\_BODY
- PACKAGE\_SPEC
- PROCEDURE
- PUBLIC\_SYNONYM
- REF\_CONSTRAINT
- SYNONYM
- TRIGGER
- TYPE BODY
- TYPE SPEC

SXML types share the SXML change type.

- AQ\_QUEUE
- AQ\_QUEUE\_TABLE
- AQ\_TRANSFORM
- ASSOCIATION
- AUDIT
- AUDIT\_OBJ
- CLUSTER
- CONTEXT
- DB\_LINK
- DEFAULT\_ROLE
- FGA\_POLICY
- JOB
- LIBRARY
- MATERIALIZED\_VIEW
- MATERIALIZED\_VIEW\_LOG
- OPERATOR
- PROFILE
- PROXY
- REFRESH\_GROUP
- RESOURCE\_COST
- RLS\_CONTEXT
- RLS\_GROUP
- RMGR\_CONSUMER\_GROUP
- RMGR\_INITIAL\_CONSUMER\_GROUP
- RMGR\_PLAN
- RMGR\_PLAN\_DIRECTIVE
- ROLE



- ROLLBACK\_SEGMENT
- SEQUENCE
- TABLE
- TABLESPACE
- TRIGGER XS\_ACL
- TRUSTED\_DB\_LINK
- USER
- VIEW
- XMLSCHEMA
- XS\_ACL\_PARAM INDEX
- XS\_DATA\_SECURITY
- XS\_ROLE
- XS\_ROLESET
- XS\_ROLE\_GRANT
- XS\_SECURITY\_CLASS
- XS\_USER

## 3.4 Supported Liquibase Commands in SQLcl

You can invoke the Liquibase commands in SQLcl with `liquibase` or `lb`.

To display a list of all available commands, execute `liquibase` or `lb` with no arguments.

- `LB GENOBJECT`
- `LB GENSCHEMA`
- `LB GENCONTROLFILE`
- `LB UPDATE`
- `LB UPDATESQL`
- `LB ROLLBACK`
- `LB ROLLBACKSQL`
- `LB DIFF`
- `LB DBDOC`
- `LB CHANGELOGSYNC`
- `LB CLEARCHECKSUMS`
- `LB LISTLOCKS`
- `LB RELEASELOCKS`
- `LB STATUS`
- `LB VALIDATE`
- `LB VERSION`

## 3.4.1 LB GENOBJECT

Generates change logs for APEX, ORDS RESTful Service Modules, or database objects.

### APEX

#### Syntax

```
lb genobject -type {APEX} -applicationid APPLICATIONID -workspaceid
WORKSPACEID
[-instance] [-expWorkspace] [-expMinimal] [-expFiles] [-skipExportDate] [-
expPubReports] [-expSavedReports]
[-expIRNotif] [-expTranslations] [-expFeedback] [-expTeamdevdata] [-
deploymentSystem DEPLOYMENTSYSTEM]
[-expFeedbackSince EXPFEEDBACKSINCE] [-expOriginalIds] [-expNoSubscriptions]
[-expComments]
[-expSupportingObjects {Y,N,I}] [-expACLAssignments] [-dir DIR] [-list LIST]
[-changesSince CHANGESINCE] [-changesBy CHANGESBY] [-nochecksum] [-split]
[-expComponents EXPCOMPONENTS] [-context CONTEXT] [-label LABEL]
[-emit_schema] [-fail] [-replace] [-runonchange] [-runalways] [-debug]
```

Generates a change log for APEX objects.

#### Named Parameters

Parameter	Description	Default
-type {APEX}	Generate output for APEX objects.	-
-applicationid APPLICATIONID	Specify ID for application to be exported.	-
-workspaceid WORKSPACEID	Specify workspace ID for all applications to be exported or the workspace to be exported.	-
-instance	Export all applications.	False
-expWorkspace	Export workspace identified by -workspaceid or all workspaces if -workspaceid not specified.	False
-expMinimal	Export only workspace definition, users, and groups.	False
-expFiles	Export all workspace files identified by -workspaceid.	False
-skipExportDate	Exclude export date from application export files	False
-expPubReports	Export all user-saved public interactive reports.	False
-expSavedReports	Export all user-saved interactive reports.	False
-expIRNotif	Export all interactive report notifications.	False
-expTranslations	Export the translation mappings and all text from the translation repository.	False
-expFeedback	Export team development feedback for all workspaces or identified by -workspaceid.	False
-expTeamdevdata	Export team development data for all workspaces or identified by -workspaceid.	False

Parameter	Description	Default
-deploymentSystem <i>DEPLOYMENTSYSTEM</i>	Specify deployment system for exported feedback.	-
-expFeedbackSince <i>EXPFEEDBACKSINCE</i>	Export team development feedback since date in the format YYYYMMDD.	-
-expOriginalIds	Export emits ids as they were when the application was imported.	False
-expNoSubscriptions	Does not export references to subscribed components.	False
-expComments	Export developer comments.	False
-expSupportingObjects {Y,N,I}	Export supporting objects. Pass (Y)es, (N)o or (I)nstall to override the default (default: N).	N
-expACLAssignments	Export ACL User Role Assignments.	False
-dir <i>DIR</i>	Save all files in the given directory. For example, -dir some/sub/directory.	-
-list <i>LIST</i>	List all changed applications in the workspace or components in the application.	-
-changesSince <i>CHANGESINCE</i>	Expect date parameter (yyyy-mm-dd). Limit -list values to changes since the given date.	-
-changesBy <i>CHANGESBY</i>	Expect string parameter. Limit -list values to changes by the given user.	-
-nochecksum	Overwrite existing files even if the contents have not changed.	False
-split	Split applications into multiple files.	False
-expComponents <i>EXPCOMPONENTS</i>	Export application components. All remaining parameters must be of form TYPE:ID.	-

### Common Generator Parameters

Parameter	Description	Default
-context <i>CONTEXT</i>	Specify changeset contexts to execute	-
-label <i>LABEL</i>	Filter the changelog using labels	-
-emit_schema	Include the schema when generating DDL	False
-fail	Set failOnError value in changeset	False
-replace	Set replaceIfExists value in changeset	False
-runonchange	Set runOnChange value in changeset	False
-runalways	Set runAlways value in changeset	False
-debug	Generate and display additional debug output	False

## Example

```
SQL> lb genobject -type apex -applicationid 4900
Exporting Application 4900
Action successfully completed please review created file f4900.xml
```

## ORDS RESTful Service Modules

### Syntax

```
lb genobject -type {ORDS} -name NAME [-noenable] [-noprivs]
[-context CONTEXT] [-label LABEL] [-emit_schema] [-fail]
[-replace] [-runonchange] [-runalways] [-debug]
```

Generates a change log for an ORDS (Oracle REST Data Services) RESTful service module.

### Named Parameters

Parameter	Description	Default
-type {ORDS}	Generate output for ORDS module	-
-name <i>NAME</i>	Module name	-
-noenable	Dictates whether the enable_schema call is included in the export	True
-noprivs	Dictates whether Privs is included in the export	True

### Common Generator Parameters

Parameter	Description	Default
-context <i>CONTEXT</i>	Specify changeset contexts to execute	-
-label <i>LABEL</i>	Filter the changelog using labels	-
-emit_schema	Include the schema when generating DDL	False
-fail	Set failOnError value in changeset	False
-replace	Set replaceIfExists value in changeset	False
-runonchange	Set runOnChange value in changeset	False
-runalways	Set runAlways value in changeset	False
-debug	Generate and display additional debug output	False

## Database Object

### Syntax

```
lb genobject -type TYPE -name NAME
[-context CONTEXT] [-label LABEL] [-emit_schema]
[-fail] [-replace] [-runonchange] [-runalways] [-debug]
```

Generates a change log for a specified database object.

### Named Parameters

Parameter	Description
-type <i>TYPE</i>	Type of object in the database
-name <i>NAME</i>	Object name

### Common Generator Parameters

Parameter	Description	Default
-context <i>CONTEXT</i>	Specify changeset contexts to execute	-
-label <i>LABEL</i>	Filter the changelog using labels	-
-emit_schema	Include the schema when generating DDL	False
-fail	Set failOnError value in changeset	False
-replace	Set replaceIfExists value in changeset	False
-runonchange	Set runOnChange value in changeset	False
-runalways	Set runAlways value in changeset	False
-debug	Generate and display additional debug output	False

### Database Object Types Supported

Type	Type	Type
AQ_QUEUE	AQ_QUEUE_TABLE	AQ_TRANSFORM
ASSOCIATION	AUDIT	AUDIT_OBJ
CLUSTER	CONSTRAINT	CONTEXT
DB_LINK	DEFAULT_ROLE	DIMENSION
FGA_POLICY	FUNCTION	INDEX
JOB	LIBRARY	MATERIALIZED_VIEW
MATERIALIZED_VIEW_LOG	OBJECT_GRANT	OPERATOR
PACKAGE_SPEC	PACKAGE_BODY	PROCEDURE
PROFILE	PROXY	PUBLIC_SYNONYM
REF_CONSTRAINT	REFRESH_GROUP	RESOURCE_COST

Type	Type	Type
RLS_CONTEXT	RLS_GROUP	RLS_POLICY
RMGR_CONSUMER_GROUP	RMGR_PLAN	RMGR_PLAN_DIRECTIVE
ROLE	ROLLBACK_SEGMENT	SEQUENCE
SYNONYM	TABLE	TABLESPACE
TRIGGER	TRUSTED_DB_LINK	TYPE
TYPE_SPEC	TYPE_BODY	USER
VIEW	XMLSCHEMA XS_USER	XS_ROLE
XS_ROLESET	XS_ROLE_GRANT	XS_SECURITY_CLASS
XS_DATA_SECURITY	XS_ACL	XS_ACL_PARAM
XS_NAMESPACE	RMGR_INITIAL_CONSUME R_GROUP	

### Example

```
SQL> lb genobject -type table -name zipcodes
Action successfully completed please review created file zipcodes_table.xml
```

## 3.4.2 LB GENSCHEMA

Generates changelogs and controller file for the connected schema.

### Syntax

```
liquibase(lb) genschema [-noreport] [-synonyms] [-grants]
[-context CONTEXT] [-label LABEL] [-emit_schema]
[-fail] [-replace] [-runonchange] [-runalways] [-debug]
```

Captures the entire schema that the user is connected to in SQLcl. An XML file is created in the current working directory for each object in the schema, and a controller.xml file is created. The controller file is a change log that includes all files in the proper order to enable the schema to be deployed correctly.

### Named Parameters

Parameter	Description	Default
-noreport	Suppress screen output	True
-synonyms	Include public synonyms	False
-grants	Include grants	False

### Common Generator Parameters

Parameter	Description	Default
-context <i>CONTEXT</i>	Specify changeset contexts to execute	-
-label <i>LABEL</i>	Filter the changelog using labels	-

Parameter	Description	Default
-emit_schema	Include the schema when generating DDL	False
-fail	Set failOnError value in changeset	False
-replace	Set replaceIfExists value in changeset	False
-runonchange	Set runOnChange value in changeset	False
-runalways	Set runAlways value in changeset	False
-debug	Generate and display additional debug output	False

### Example

```
SQL> lb genschema
lb genschema
[Type - TYPE_SPEC]: 153 ms
[Type - TYPE_BODY]: 29 ms
[Type - SEQUENCE]: 48 ms
[Type - CLUSTER]: 27 ms
[Type - TABLE]: 36 ms
[Type - MATERIALIZED_VIEW_LOG]: 19 ms
[Type - MATERIALIZED_VIEW]: 6 ms
[Type - VIEW]: 148 ms
[Type - REF_CONSTRAINT]: 272 ms
[Type - DIMENSION]: 23 ms
[Type - FUNCTION]: 27 ms
[Type - PROCEDURE]: 64 ms
[Type - PACKAGE_SPEC]: 171 ms
[Type - DB_LINK]: 14 ms
[Type - SYNONYM]: 22 ms
[Type - INDEX]: 202 ms
[Type - TRIGGER]: 51 ms
[Type - PACKAGE_BODY]: 252 ms
[Method loadCaptureTable]: 1864 ms
[Method parseCaptureTableRecords]: 7342 ms
[Method sortCaptureTable]: 30 ms
[Method createExportChangeLogs]: 3 ms

Export Flags Used:
Export Grants false
Export Synonyms false
```

## 3.4.3 LB GENCONTROLFILE

Generates a blank controller.xml as a sample.

### Syntax

```
liquibase(lb) gencontrolfile
```

Creates an empty changelog, `master.xml`, with a placeholder to include files in the current working directory. You can use this command when you are creating your own changelog with custom changeset inclusions.

### Example

```
SQL> lb gencontrolfile
Action successfully completed please review created file controller.xml
```

## 3.4.4 LB UPDATE

Applies the specified change log using the current connection.

### Syntax

```
liquibase(lb) update -changelog CHANGELOG [-context CONTEXT]
[-label LABEL] [-emit_schema] [-fail] [-replace] [-runonchange] [-runalways]
[-debug]
```

Enables you to apply database changes that you and other developers have added to the change log file.

### Named Parameters

Parameter	Description
<code>-changelog CHANGELOG</code>	Specify the changelog file to use

### Common Update Parameters

Parameter	Description	Default
<code>-context CONTEXT</code>	Specify changeset contexts to execute	-
<code>-label LABEL</code>	Filter the changelog using labels	-
<code>-emit_schema</code>	Include the schema when generating DDL	False
<code>-log</code>	Generate a log of work performed	False
<code>-debug</code>	Generate and display additional debug output	False

### Example

```
SQL> lb update -changelog zipcodes_table.xml
ScriptRunner
Executed:zipcodes_table.xml::3b128595dbfbc34086c0a18ff38e090529999::Generated
```



## 3.4.5 LB UPDATESQL

Generates SQL to update the database to the current version.

### Syntax

```
liquibase(lb) updatesql -changelog CHANGELOG [-context CONTEXT]
[-label LABEL] [-emit_schema] [-fail] [-replace] [-runonchange] [-
runalways] [-debug]
```

Generates and renders to the screen the SQL statements that would be applied for a specific change log.

### Named Parameters

Parameter	Description
-changelog <i>CHANGELOG</i>	Specify the changelog file to use

### Common Generator Parameters

Parameter	Description	Default
-context <i>CONTEXT</i>	Specify changeset contexts to execute	-
-label <i>LABEL</i>	Filter the changelog using labels	-
-emit_schema	Include the schema when generating DDL	False
-fail	Set failOnError value in changeset	False
-replace	Set replaceIfExists value in changeset	False
-runonchange	Set runOnChange value in changeset	False
-runalways	Set runAlways value in changeset	False
-debug	Generate and display additional debug output	False

### Example

```
SQL> lb updatesql -changelog zipcodes_tablev2.xml
--
*****
-- Update Database Script
--
*****
-- Change Log: zipcodes_tablev2.xml
-- Ran at: 6/3/20 12:49 PM
-- Against: JDOE@jdbc:oracle:thin:@localhost:1521/ORCLPDB1
-- Liquibase version: 3.8.9
```

```
-- *****

-- Lock Database
UPDATE JDOE.DATABASECHANGELOGLOCK SET LOCKED = 1, LOCKEDBY = '192.168.1.175
(192.168.1.175)',
LOCKGRANTED = TO_TIMESTAMP('2020-06-03 12:49:05.779', 'YYYY-MM-DD
HH24:MI:SS.FF') WHERE ID = 1 AND LOCKED = 0;

-- Changeset
zipcodes_tablev2.xml::3595dbfbc34086449c0a18ff38e090529999::Generated
ALTER TABLE "ZIPCODES" ADD ("LON" NUMBER)
/

-- Logging Oracle Extension actions to the Database.
DECLARE
id varchar2(200) := '3595dbfbc34086449c0a18ff38e090529999';
rawAction clob;
rawSxml clob;
myrow varchar2(2000);
action clob := '';
sxml clob := '';
dep varchar2(200) := '1202945773';
author varchar2(200) := 'Generated';
filename varchar2(200) := 'zipcodes_tablev2.xml';
insertlog varchar2(200) := 'insert into DATABASECHANGELOG_ACTIONS
(id,author,filename,sql,sxml,deployment_id)
values (:id,:author,:filename,:action,:sxml,:dep) returning rowid into :out';
updateaction varchar2(200) := 'update DATABASECHANGELOG_ACTIONS set sql =
sql ||:action where rowid = :myrow ';
updatesxml varchar2(200) := 'update DATABASECHANGELOG_ACTIONS set sxml =
sxml ||:sxml where rowid = :myrow ';
begin
action :=
utl_raw.cast_to_varchar2(utl_encode.base64_decode(utl_raw.cast_to_raw(q'
{QUxURVIGVEFCTEUgI1pJUENPREVTIiBBREQgKCJMT04iIE5VTUJFUikKLWogIC0tIE9SQS0zOTMO
MTogQ
2Fubm90IGNvbnZ1cnQgYW4gZXhpc3RpbmcgY29sdW1uIGludG8gYW4gaWRlbnRpdHkgY29sdW1uIG
ov}')));
sxml :=
utl_raw.cast_to_varchar2(utl_encode.base64_decode(utl_raw.cast_to_raw(q'
{PD94bWwgdmVyc2lvcj0iMS4wIiBlbmNvZGluc20iVVRGLTgiIHN0YW5kYWxvbmU9Im5vIj8+PFRB
QkxFIHhtbG5zPSJodHRwOi8veG1sbnMub3Jh
Y2xlLmNvbS9rdSIgdmVyc2lvcj0iMS4wIj4KICAgPFNDSEVNQT5TS1VUWjwvU0NIRU1BPgogICA8T
kFNRT5aSVBDT0RFUzwwTkFNRT4KICAgPFJFT
EFUSU90QUxfVEFCTEU+CiAgICAgIDxDT0xfTElTVD4KICAgICAgICAgPENPTf9MSVNUX01URU0+Ci
AgICAgICAgICAgIDxOQU1FPk1EPC9OQU1FPg
ogICAgICAgICAgICA8REFUQVRZUEU+TlVNQkVSPC9EQVRBVFlQRT4KICAgICAgICAgICAgPE5PVF9
OVUxMLZ4KICAgICAgICAgPC9DT0xfTElTVF9
JVEVNPgogICAgICAgICA8Q09MX0xJU1rfSVRFTT4KICAgICAgICAgICAgPE5BTUU+Q09ERTwvTkFN
RT4KICAgICAgICAgICAgPERBVEFUVWVBFPlZBU
kNIQVIyPC9EQVRBVFlQRT4KICAgICAgICAgICAgPExFTkdUSD42PC9MRU5HVEg+CiAgICAgICAgIC
AgIDxDT0xMQVRFX05BTUU+VVNJTkdfTkxTX0N
PTVA8L0NPTExBVEVfTkFNRT4KICAgICAgICAgPC9DT0xfTElTVF9JVEVNPgogICAgICAgICA8Q09M
X0xJU1rfSVRFTT4KICAgICAgICAgICAgPE5BT
UU+Q01UWTwvTkFNRT4KICAgICAgICAgICAgPERBVEFUVWVBFPlZBUkNIQVIyPC9EQVRBVFlQRT4KIC
```

```

AgICAgICAgICAgPExFtKdUSD41MDwvTEVOR1R
IPgogICAgICAgICAgICA8Q09MTEFURV9OQU1FP1VTSU5HX05MU19DT01QPC9DT0xMQVRFX0
5BTUU+CiAgICAgICAgICAgIDwvQ09MX0xJU1RfSVRFTT4KI
CAgICAgICAgPENPTF9MSVNUX01URU0+CiAgICAgICAgICAgIDxOQU1FP1NUQVRFP9C9QU1F
PpogICAgICAgICAgICA8REFUQVRZUEU+VkfSQ0hBUjI
8L0RBVEFUWVBFpogICAgICAgICAgICA8TEVOR1RIPjUwPC9MRU5HVEg+CiAgICAgICAgIC
AgIDxDT0xMQVRFX05BTUU+VVNJTkdfTkxTX0NPTVA8L
0NPTExBVEVfTkFNRT4KICAgICAgICAgPC9DT0xfTElTVF9JVEVNPgogICAgICAgICA8Q09M
X0xJU1RfSVRFTT4KICAgICAgICAgICAgPE5BTUU+Q09
VT1RZPC9OQU1FPpogICAgICAgICAgICA8REFUQVRZUEU+VkfSQ0hBUjI8L0RBVEFUWVBFpog
ogICAgICAgICAgICA8TEVOR1RIPjUwPC9MRU5HVEg+C
iAgICAgICAgICAgIDxDT0xMQVRFX05BTUU+VVNJTkdfTkxTX0NPTVA8L0NPTExBVEVfTkFN
RT4KICAgICAgICAgPC9DT0xfTElTVF9JVEVNPgogICA
gICAgICA8Q09MX0xJU1RfSVRFTT4KICAgICAgICAgICAgPE5BTUU+QVJFQV9DT0RFPC9OQU
1FPpogICAgICAgICAgICA8REFUQVRZUEU+T1VNQkVSP
C9EQVRBVF1QRT4KICAgICAgICAgICAgPFBSRUNJU01Ptj4zPC9QUkVDSVNJT04+CiAgICAg
ICAgICAgIDxTQ0FMRT4wPC9TQ0FMRT4KICAgICAgICA
gPC9DT0xfTElTVF9JVEVNPgogICAgICAgICA8Q09MX0xJU1RfSVRFTT4KICAgICAgICAgIC
AgPE5BTUU+TEFUPC9OQU1FPpogICAgICAgICAgICA8R
EFUQVRZUEU+T1VNQkVSPC9EQVRBVF1QRT4KICAgICAgICAgPC9DT0xfTElTVF9JVEVNPgog
ICAgICA8L0NPTEF9MSVNUPgogICAgICA8UFJTUF9SWV9
LRV1fQ09OU1RSQU1OVF9MSVNUPgogICAgICAgICA8UFJTUF9SWV9LRV1fQ09OU1RSQU1OVF
9MSVNUX01URU0+CiAgICAgICAgICAgIDxDT0xfTElTV
D4KICAgICAgICAgICAgICAgPENPTF9MSVNUX01URU0+CiAgICAgICAgICAgICAgICAgIDxO
QU1FPk1EPC9OQU1FPpogICAgICAgICAgICAgICA8L0N
PTF9MSVNUX01URU0+CiAgICAgICAgICAgIDwvQ09MX0xJU1Q+CiAgICAgICAgICAgIDxVU0
1OR19JTkRfWD4KICAgICAgICAgICAgICAgPE1OREVYX
0FUVFJJQ1VURVM+CiAgICAgICAgICAgICAgICAgIDxQQ1RGUkVFPjEwPC9QQ1RGUkVFPpog
ICAgICAgICAgICAgICAgICA8SU5JVfJBT1M+MjwvSU5
JVfJBT1M+CiAgICAgICAgICAgICAgICAgIDxNQVhUUkFOUz4yNTU8L01BWF9RSQU5TPgogIC
AgICAgICAgICAgICA8VEFCTEVTUEFDRT5VU0VSU
zwvVEFCTEVTUEFDRT4KICAgICAgICAgICAgICAgICAgPExPR0dJTkC+WtwvTE9HR01ORz4K
ICAgICAgICAgICAgICAgPC9JTkRfWF9BVFRSSUJVVEV
TPgogICAgICAgICAgICA8L1VTSU5HX01OREVYPgogICAgICAgICA8L1BSSU1BU11fS0VZX0
NPT1NUUkFJT1RfTElTVF9JVEVNPgogICAgICA8L1BSS
U1BU11fS0VZX0NPT1NUUkFJT1RfTElTVD4KICAgICAgPERFRkFVTFRfQ09MTEFUSU9OPlVT
SU5HX05MU19DT01QPC9ERUZBVUxUX0NPTExBVElPTj4
KICAgICAgPFBIWVNJQ0FMX1BST1BFU1RJRVM+CiAgICAgICAgIDxIRUFQX1RBQkxFPpogIC
AgICAgICAgICA8U0VHTUVOVF9BVFRSSUJVVEVTPgogI
CAgICAgICAgICAgICA8U0VHTUVOVF9DUkVBVElPT19ERUZFULJFRC8+CiAgICAgICAgICAg
ICAgIDxQQ1RGUkVFPjEwPC9QQ1RGUkVFPpogICAgICA
gICAgICAgICA8UENUVVNF40MDwvUENUVVNF40KICAgICAgICAgICAgICAgPE1OSVRSQU
5TPjE8L01OSVRSQU5TPgogICAgICAgICAgICAgICA8T
UFYVfJBT1M+MjU1PC9NQVhUUkFOUz4KICAgICAgICAgICAgICAgPF9BQkxFU1BBQ0U+VVNF
U1M8L1RBQkxFU1BBQ0U+CiAgICAgICAgICAgICAgIDx
MT0dHSU5HP1k8L0xPR0dJTkC+CiAgICAgICAgICAgIDwvU0VHTUVOVF9BVFRSSUJVVEVTPg
ogICAgICAgICAgICA8Q09NUFJFU1M+TjwvQ09NUFJFU
1M+CiAgICAgICAgIDwvSEVBUf9UQUJMRT4KICAgICAgPC9QSF1TSUNBTF9QUk9QRVJUSUVT
PpogICA8L1JFTEFUSU9OQUxfVEFCTEU+CjwvVEFCTEU+))));

```

```

execute immediate insertlog using id,author,filename,action,sxml,dep
returning into myrow;
end;
/
--;

```

```
INSERT INTO JDOE.DATABASECHANGELOG (ID, AUTHOR, FILENAME, DATEEXECUTED,
ORDEREXECUTED, MD5SUM, DESCRIPTION,
COMMENTS, EXECTYPE, CONTEXTS, LABELS, LIQUIBASE, DEPLOYMENT_ID) VALUES
('3595dbfbc34086449c0a18ff38e090529999',
'Generated', 'zipcodes_tablev2.xml', SYSTIMESTAMP, 2,
'8:5262bd1c3989655295b5641b82868158',
'createXmlObject objectName=ZIPCODES, ownerName=JDOE, '', 'EXECUTED', NULL,
NULL, '3.8.9', '1202945773');

-- Release Database Lock
UPDATE JDOE.DATABASECHANGELOGLOCK SET LOCKED = 0, LOCKEDBY = NULL,
LOCKGRANTED = NULL WHERE ID = 1;
```

## 3.4.6 LB ROLLBACK

Rolls back the state requested.

### Syntax

```
liquibase(lb) rollback -changelog CHANGELOG [-context CONTEXT]
[-label LABEL] [-emit_schema] [-fail] [-replace] [-runonchange] [-runalways]
[-log]
[-debug] (-count COUNT | -date DATE)
```

Rolls back changes starting from the last change applied using the input change log. The count can be higher than the changes in the change log. 999, which is the maximum size, rolls back all the changes.

### Named Parameters

Parameter	Description
-changelog <i>CHANGELOG</i>	Specify the changelog file to use

### Rollback Style Options

Select one of the following options:

Option	Description
-count <i>COUNT</i>	Number of changes to apply
-date <i>DATE</i>	Date to roll back to

### Common Update Parameters

Parameter	Description	Default
-context <i>CONTEXT</i>	Specify changeset contexts to execute	-
-label <i>LABEL</i>	Filter the changelog using labels	-
-emit_schema	Include the schema when generating DDL	False

Parameter	Description	Default
-fail	Set failOnError value in changeset	False
-replace	Set replaceIfExists value in changeset	False
-runonchange	Set runOnChange value in changeset	False
-runalways	Set runAlways value in changeset	False
-log	Generate a log of work performed	False
-debug	Generate and display additional debug output	False

**Example**

```
lb rollback -changelog zipcodes_tablev2.xml -count 100
ScriptRunner
Executed:zipcodes_tablev2.xml::3595dbfbc34086449c0a18ff38e090529999::Generated
```

## 3.4.7 LB ROLLBACKSQL

Writes SQL to roll back the database to the state requested.

**Syntax**

```
liquibase(lb) rollbacksql -changelog CHANGELOG [-context CONTEXT]
[-label LABEL] [-emit_schema] [-fail] [-replace] [-runonchange] [-runalways] [-debug]
(-count COUNT | -date DATE)
```

**Named Parameters**

Parameter	Description
-changelog <i>CHANGELOG</i>	Specify the changelog file to use

**Rollback Style Options**

Select one of the following options:

Option	Description
-count <i>COUNT</i>	Number of changes to apply
-date <i>DATE</i>	Date to roll back to

## Common Update Parameters

Parameter	Description	Default
-label <i>LABEL</i>	Filter the changelog using labels	-
-context <i>CONTEXT</i>	Specify changeset contexts to execute	-
-emit_schema	Include the schema when generating DDL	False
-fail	Set failOnError value in changeset	False
-replace	Set replaceIfExists value in changeset	False
-runonchange	Set runOnChange value in changeset	False
-runalways	Set runAlways value in changeset	False
-debug	Generate and display additional debug output	-

## Example

```

lb rollbacksql -changelog zipcodes_tablev2.xml -count 100

-- *****
-- Rollback 100 Change(s) Script
-- *****
-- Change Log: zipcodes_tablev2.xml
-- Ran at: 6/3/20 12:55 PM
-- Against: JDOE@jdbc:oracle:thin:@localhost:1521/ORCLPDB1
-- Liquibase version: 3.8.9
-- *****

-- Lock Database
UPDATE JDOE.DATABASECHANGELOGLOCK SET LOCKED = 1, LOCKEDBY = '192.168.1.175
(192.168.1.175)',
LOCKGRANTED = TO_TIMESTAMP('2020-06-03 12:55:19.175', 'YYYY-MM-DD
HH24:MI:SS.FF')
WHERE ID = 1 AND LOCKED = 0;

-- Rolling Back ChangeSet:
zipcodes_tablev2.xml::3595dbfbc34086449c0a18ff38e090529999::Generated

ALTER TABLE "JDOE"."ZIPCODES" DROP ("LON");

delete from DATABASECHANGELOG_actions where id =
'3595dbfbc34086449c0a18ff38e090529999' and
filename = 'zipcodes_tablev2.xml' and author = 'Generated' and sequence =
(select Max(sequence)
from DATABASECHANGELOG_actions where id =
'3595dbfbc34086449c0a18ff38e090529999' and
filename = 'zipcodes_tablev2.xml' and author = 'Generated');

```

```
DELETE FROM JDOE.DATABASECHANGELOG WHERE ID =
'3595dbfbc34086449c0a18ff38e090529999' AND
AUTHOR = 'Generated' AND FILENAME = 'zipcodes_tablev2.xml';

-- Release Database Lock
UPDATE JDOE.DATABASECHANGELOGLOCK SET LOCKED = 0, LOCKEDBY = NULL,
LOCKGRANTED = NULL WHERE ID = 1;
```

## 3.4.8 LB DIFF

Writes a description of differences between two databases to standard output.

### Syntax

```
liquibase(lb) diff -url URL -user USER -pass PASS [-noreport]
```

Displays differences between the current connection and the specified database. When the report is true, the output will be in the form of a text report. When the report is false, which is the default, the output will be in the form of a change log.

The destination URL format is HOST:PORT:SID or HOST:PORT/SERVICE.

### Named Parameters

Parameter	Description	Default
-url <i>URL</i>	JDBC URL for destination database	-
-user <i>USER</i>	Destination user	-
-pass <i>PASS</i>	Destination password	-
-noreport	Results output as a changelog, not a text report	True

### Example

```
lb diff -url localhost:1521/ORCLPDB1 -user hr -password hr
```

```
Action successfully completed please review created file diffResult.txt
```

```
!more diffResult.txt
Reference Database: JDOE @ jdbc:oracle:thin:@localhost:1521/ORCLPDB1
(Default Schema: JDOE)
Comparison Database: HR @ jdbc:oracle:thin:@localhost:1521/ORCLPDB1
(Default Schema: HR)
Compared Schemas: JDOE -> HR
Product Name: EQUAL
Product Version: EQUAL
Missing Catalog(s): NONE
Unexpected Catalog(s): NONE
Changed Catalog(s): NONE
Missing Column(s):
    JDOE.ZIPCODES.AREA_CODE
    JDOE.DATABASECHANGELOG.AUTHOR
```

```

JDOE.DATABASECHANGELOG_ACTIONS.AUTHOR
JDOE.DATABASECHANGELOG_DETAILS.AUTHOR
JDOE.ZIPCODES.CITY
JDOE.ZIPCODES.CODE
JDOE.DATABASECHANGELOG.COMMENTS
JDOE.DATABASECHANGELOG_DETAILS.COMMENTS
JDOE.DATABASECHANGELOG.CONTEXTS
JDOE.DATABASECHANGELOG_DETAILS.CONTEXTS
JDOE.ZIPCODES.COUNTY
JDOE.DATABASECHANGELOG.DATEEXECUTED
JDOE.DATABASECHANGELOG_DETAILS.DATEEXECUTED
JDOE.DATABASECHANGELOG_DEPLOYMENT_ID
JDOE.DATABASECHANGELOG_ACTIONS.DEPLOYMENT_ID
JDOE.DATABASECHANGELOG_DETAILS.DEPLOYMENT_ID
JDOE.DATABASECHANGELOG.DESCRPTION
JDOE.DATABASECHANGELOG_DETAILS.DESCRPTION
JDOE.DATABASECHANGELOG.EXECTYPE
JDOE.DATABASECHANGELOG_DETAILS.EXECTYPE
JDOE.DATABASECHANGELOG.FILENAME
JDOE.DATABASECHANGELOG_ACTIONS.FILENAME
JDOE.DATABASECHANGELOG_DETAILS.FILENAME
JDOE.DATABASECHANGELOG.ID
JDOE.DATABASECHANGELOGLOCK.ID
JDOE.DATABASECHANGELOG_ACTIONS.ID
JDOE.DATABASECHANGELOG_DETAILS.ID
JDOE.ZIPCODES.ID
JDOE.DATABASECHANGELOG.LABELS
JDOE.DATABASECHANGELOG_DETAILS.LABELS
JDOE.ZIPCODES.LAT
JDOE.DATABASECHANGELOG.LIQUIBASE
JDOE.DATABASECHANGELOG_DETAILS.LIQUIBASE
JDOE.DATABASECHANGELOGLOCK.LOCKED
JDOE.DATABASECHANGELOGLOCK.LOCKEDBY
JDOE.DATABASECHANGELOGLOCK.LOCKGRANTED
JDOE.ZIPCODES.LON
JDOE.DATABASECHANGELOG.MD5SUM
JDOE.DATABASECHANGELOG_DETAILS.MD5SUM
JDOE.DATABASECHANGELOG.ORDEREXECUTED
JDOE.DATABASECHANGELOG_ACTIONS.SEQUENCE
JDOE.DATABASECHANGELOG_ACTIONS.SQL
JDOE.DATABASECHANGELOG_DETAILS.SQL
JDOE.ZIPCODES.STATE
JDOE.DATABASECHANGELOG_ACTIONS.SXML
JDOE.DATABASECHANGELOG_DETAILS.SXML
JDOE.DATABASECHANGELOG.TAG
Unexpected Column(s): NONE
Changed Column(s): NONE
Missing Foreign Key(s): NONE
Unexpected Foreign Key(s): NONE
Changed Foreign Key(s): NONE
Missing Index(s):
    PK_DATABASECHANGELOGLOCK UNIQUE ON JDOE.DATABASECHANGELOGLOCK(ID)
    SYS_C00122620 UNIQUE ON JDOE.DATABASECHANGELOG_ACTIONS(ID, AUTHOR,
FILENAME, SEQUENCE)
    SYS_C00122637 UNIQUE ON JDOE.ZIPCODES(ID)

```



```

Unexpected Index(s): NONE
Changed Index(s): NONE
Missing Primary Key(s):
    PK_DATABASECHANGELOGLOCK on JOE.DATABASECHANGELOGLOCK (ID)
    SYS_C00122620 on JOE.DATABASECHANGELOG_ACTIONS (ID, AUTHOR,
FILENAME, SEQUENCE)
    SYS_C00122637 on JOE.ZIPCODES (ID)
Unexpected Primary Key(s): NONE
Changed Primary Key(s): NONE
Missing Sequence(s): NONE
Unexpected Sequence(s): NONE
Changed Sequence(s): NONE
Missing Table(s):
    DATABASECHANGELOG
    DATABASECHANGELOGLOCK
    DATABASECHANGELOG_ACTIONS
    ZIPCODES
Unexpected Table(s): NONE
Changed Table(s): NONE
Missing Unique Constraint(s): NONE
Unexpected Unique Constraint(s): NONE
Changed Unique Constraint(s): NONE
Missing View(s):
    DATABASECHANGELOG_DETAILS
Unexpected View(s): NONE
Changed View(s): NONE

```

```
SQL> lb diff -url localhost:1521/ORCLPDB1 -user hr -password hr -
noreport
```

Action successfully completed please review created file diffResult.xml

```

diffResult.xml
!more diffResult.xml
<?xml version="1.1" encoding="UTF-8" standalone="no"?>
<databaseChangeLog xmlns="http://www.liquibase.org/xml/ns/dbchangelog"
xmlns:ext="http://www.liquibase.org/xml/ns/dbchangelog-ext"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog-ext
http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-ext.xsd
http://www.liquibase.org/xml/ns/dbchangelog
http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-3.8.xsd">
  <changeSet author="jdoe (generated)" id="1591203948991-1">
    <createTable tableName="DATABASECHANGELOG_ACTIONS">
      <column name="ID" type="VARCHAR2(255 BYTE)">
        <constraints nullable="false"/>
      </column>
      <column name="SEQUENCE" type="NUMBER">
        <constraints nullable="false"/>
      </column>
      <column name="SQL" type="CLOB"/>
      <column name="SXML" type="CLOB"/>
      <column name="AUTHOR" type="VARCHAR2(255 BYTE)">
        <constraints nullable="false"/>

```

```
        </column>
        <column name="FILENAME" type="VARCHAR2(255 BYTE)">
            <constraints nullable="false"/>
        </column>
        <column name="DEPLOYMENT_ID" type="VARCHAR2(10 BYTE)"/>
    </createTable>
</changeSet>
<changeSet author="jdoe (generated)" id="1591203948991-2">
    <createView fullDefinition="true"
viewName="DATABASECHANGELOG_DETAILS">
CREATE OR REPLACE FORCE VIEW DATABASECHANGELOG_DETAILS (DEPLOYMENT_ID, ID,
AUTHOR,
FILENAME, SQL, SXML, DATEEXECUTED, EXECTYPE, MD5SUM, DESCRIPTION, COMMENTS,
LIQUIBASE,
CONTEXTS, LABELS) AS SELECT da.deployment_id, da.id, da.author,
da.filename, da.sql, da.sxml, d.dateexecuted, d.exectype,
d.md5sum,
d.description, d.comments, d.liquibase, d.contexts, d.labels
FROM databasechangelog d LEFT JOIN databasechangelog_actions da ON d.id =
da.id
AND d.author = da.author AND
d.filename = da.filename ORDER BY 1,7</createView>
</changeSet>
<changeSet author="jdoe (generated)" id="1591203948991-3">
    <createTable tableName="ZIPCODES">
        <column name="ID" type="NUMBER">
            <constraints nullable="false" primaryKey="true"
primaryKeyName="SYS_C00122637"/>
        </column>
        <column name="CODE" type="VARCHAR2(6 BYTE)"/>
        <column name="CITY" type="VARCHAR2(50 BYTE)"/>
        <column name="STATE" type="VARCHAR2(50 BYTE)"/>
        <column name="COUNTY" type="VARCHAR2(50 BYTE)"/>
        <column name="AREA_CODE" type="NUMBER(3, 0)"/>
        <column name="LAT" type="NUMBER"/>
        <column name="LON" type="NUMBER"/>
    </createTable>
</changeSet>
<changeSet author="jdoe (generated)" id="1591203948991-4">
    <createIndex indexName="SYS_C00122620"
tableName="DATABASECHANGELOG_ACTIONS" unique="true">
        <column name="ID"/>
        <column name="AUTHOR"/>
        <column name="FILENAME"/>
        <column name="SEQUENCE"/>
    </createIndex>
</changeSet>
<changeSet author="skutz (generated)" id="1591203948991-5">
    <addPrimaryKey columnNames="ID, AUTHOR, FILENAME, SEQUENCE"
constraintName="SYS_C00122620"
forIndexName="SYS_C00122620" tableName="DATABASECHANGELOG_ACTIONS"/>
</changeSet>
</databaseChangeLog>
```

## 3.4.9 LB DBDOC

Generates Javadoc-like documentation based on the current database and change log.

### Syntax

```
liquibase(lb) dbdoc -changelog CHANGELOG -dir DIR [-context CONTEXT] [-label LABEL]
```

### Named Parameters

Parameter	Description
-changelog <i>CHANGELOG</i>	Specify the changelog file to use
-dir <i>DIR</i>	Saves all files in the given directory, example, -dir some/sub/directory

### Common Update Parameters

Parameter	Description
-context <i>CONTEXT</i>	Specify the changeset contexts to execute
-label <i>LABEL</i>	Filter the changelog using labels

### Example

```
SQL> lb dbdoc -changelog states_table.xml -dir ./doc
SQL> !ls -l ./doc
total 56
drwxr-xr-x  3 jdoe  staff   96 Jun  3 13:25 authors
-rw-r--r--  1 jdoe  staff  449 Jun  3 13:25 authors.html
drwxr-xr-x  3 jdoe  staff   96 Jun  3 13:25 changelogs
-rw-r--r--  1 jdoe  staff  474 Jun  3 13:25 changelogs.html
drwxr-xr-x 31 jdoe  staff  992 Jun  3 13:25 columns
-rw-r--r--  1 jdoe  staff  555 Jun  3 13:25 currenttables.html
-rw-r--r--  1 jdoe  staff  899 Jun  3 13:25 globalnav.html
-rw-r--r--  1 jdoe  staff  769 Jun  3 13:25 index.html
-rw-r--r--  1 jdoe  staff  445 Jun  3 13:25 overview-summary.html
drwxr-xr-x  4 jdoe  staff  128 Jun  3 13:25 pending
drwxr-xr-x  3 jdoe  staff   96 Jun  3 13:25 recent
-rw-r--r--  1 jdoe  staff 1202 Jun  3 13:25 stylesheet.css
drwxr-xr-x  4 jdoe  staff  128 Jun  3 13:25 tables
```

[Figure 3-1](#) shows the index page that is created by the DBDOC command. It enables you to navigate the various details of the changelog used to produce the document.

Figure 3-1 Index Page

<p>Current Tables Authors Change Logs Pending Changes Pending SQL Most Recent Changes</p> <p>Current Tables DATABASECHANGELOG_ACTIONS ETHNICITIES EXPOSURE DURATIONS EXPOSURE LOCATIONS EXPOSURE VICINITIES FACILITIES FACILITY LOGS FACILITY PEOPLE FACILITY PEOPLE LOGS HEALTH_SYSTEM LOGS HEALTH_SYSTEM PEOPLE HEALTH_SYSTEM PEOPLE LOGS HEALTH SYSTEMS HTML09 PLAN_TABLE LANGUAGES LOAD FACILITIES LOAD FACILITY ERRORS LOAD PARTICIPANT ERRORS LOAD PARTICIPANTS MEDICAL TEST LOGS MEDICAL TESTS NOTIFICATION_LOG PEOPLE PEOPLE LOGS PREFERENCES STATES STATUS_UPDATE LOGS STATUS_UPDATES SYMPTOMS TEST TYPES TEST VENDORS TRANSLATIONS ZIPCODES</p>	<p><b>Changes affecting table "LOAD_FACILITY_ERRORS"</b></p> <table border="1"> <thead> <tr> <th colspan="3">Current Columns</th> </tr> </thead> <tbody> <tr><td>NUMBER</td><td>NOT NULL</td><td>ID</td></tr> <tr><td>NUMBER</td><td>NULL</td><td>LINE_NUMBER</td></tr> <tr><td>NUMBER</td><td>NULL</td><td>HEALTH_SYSTEM_ID</td></tr> <tr><td>VARCHAR(4000 BYTE)</td><td>NULL</td><td>REASON</td></tr> <tr><td>VARCHAR(4000 BYTE)</td><td>NULL</td><td>SOL_ERROR</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NULL</td><td>HEALTH_SYSTEM</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NULL</td><td>NAME</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NULL</td><td>ADDRESS</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NULL</td><td>ADDRESS2</td></tr> <tr><td>VARCHAR(100 BYTE)</td><td>NULL</td><td>CITY</td></tr> <tr><td>VARCHAR(2 BYTE)</td><td>NULL</td><td>STATE</td></tr> <tr><td>VARCHAR(50 BYTE)</td><td>NULL</td><td>COUNTY</td></tr> <tr><td>VARCHAR(10 BYTE)</td><td>NULL</td><td>ZIP</td></tr> <tr><td>NUMBER</td><td>NULL</td><td>MAIN_COORDINATOR_ID</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NULL</td><td>MAIN_COORDINATOR_EMAIL</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NULL</td><td>MAIN_COORDINATOR_FIRST_NAME</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NULL</td><td>MAIN_COORDINATOR_LAST_NAME</td></tr> <tr><td>VARCHAR(20 BYTE)</td><td>NULL</td><td>MAIN_COORDINATOR_MOBILE</td></tr> <tr><td>TIMESTAMP(6) WITH LOCAL TIME ZONE(11)</td><td>NOT NULL</td><td>CREATED</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NOT NULL</td><td>CREATED_BY</td></tr> <tr><td>TIMESTAMP(6) WITH LOCAL TIME ZONE(11)</td><td>NOT NULL</td><td>UPDATED</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NOT NULL</td><td>UPDATED_BY</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NULL</td><td>CREATED_BY_SID</td></tr> <tr><td>VARCHAR(255 BYTE)</td><td>NULL</td><td>UPDATED_BY_SID</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="3">Current Table Indexes</th> </tr> </thead> <tbody> <tr><td>Primary Key</td><td>LOAD_FACILITY_ERRO_ID_PK</td><td>HMS.ID</td></tr> <tr><td>Non-Unique</td><td>LOAD_FACILITY_ERRORS_I1</td><td>HMS.MAIN_COORDINATOR_ID</td></tr> <tr><td>Non-Unique</td><td>LOAD_FACILITY_ERRORS_I2</td><td>HMS.HEALTH_SYSTEM_ID</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="4">Current Table Foreign Keys</th> </tr> </thead> <tbody> <tr><td>LOAD_FAC_ERR_MAIN_COORD_FK</td><td>HMS.MAIN_COORDINATOR_ID</td><td>PEOPLE</td><td>HMS.ID</td></tr> <tr><td>LOAD_FACILITY_ERR_HS_FK</td><td>HMS.HEALTH_SYSTEM_ID</td><td>HEALTH_SYSTEMS</td><td>HMS.ID</td></tr> </tbody> </table> <p><b>Pending Changes</b> None Found</p> <p><b>Past Changes</b> None Found</p>	Current Columns			NUMBER	NOT NULL	ID	NUMBER	NULL	LINE_NUMBER	NUMBER	NULL	HEALTH_SYSTEM_ID	VARCHAR(4000 BYTE)	NULL	REASON	VARCHAR(4000 BYTE)	NULL	SOL_ERROR	VARCHAR(255 BYTE)	NULL	HEALTH_SYSTEM	VARCHAR(255 BYTE)	NULL	NAME	VARCHAR(255 BYTE)	NULL	ADDRESS	VARCHAR(255 BYTE)	NULL	ADDRESS2	VARCHAR(100 BYTE)	NULL	CITY	VARCHAR(2 BYTE)	NULL	STATE	VARCHAR(50 BYTE)	NULL	COUNTY	VARCHAR(10 BYTE)	NULL	ZIP	NUMBER	NULL	MAIN_COORDINATOR_ID	VARCHAR(255 BYTE)	NULL	MAIN_COORDINATOR_EMAIL	VARCHAR(255 BYTE)	NULL	MAIN_COORDINATOR_FIRST_NAME	VARCHAR(255 BYTE)	NULL	MAIN_COORDINATOR_LAST_NAME	VARCHAR(20 BYTE)	NULL	MAIN_COORDINATOR_MOBILE	TIMESTAMP(6) WITH LOCAL TIME ZONE(11)	NOT NULL	CREATED	VARCHAR(255 BYTE)	NOT NULL	CREATED_BY	TIMESTAMP(6) WITH LOCAL TIME ZONE(11)	NOT NULL	UPDATED	VARCHAR(255 BYTE)	NOT NULL	UPDATED_BY	VARCHAR(255 BYTE)	NULL	CREATED_BY_SID	VARCHAR(255 BYTE)	NULL	UPDATED_BY_SID	Current Table Indexes			Primary Key	LOAD_FACILITY_ERRO_ID_PK	HMS.ID	Non-Unique	LOAD_FACILITY_ERRORS_I1	HMS.MAIN_COORDINATOR_ID	Non-Unique	LOAD_FACILITY_ERRORS_I2	HMS.HEALTH_SYSTEM_ID	Current Table Foreign Keys				LOAD_FAC_ERR_MAIN_COORD_FK	HMS.MAIN_COORDINATOR_ID	PEOPLE	HMS.ID	LOAD_FACILITY_ERR_HS_FK	HMS.HEALTH_SYSTEM_ID	HEALTH_SYSTEMS	HMS.ID
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### 3.4.10 LB CHANGELOGSYNC

Writes the SQL statements to mark all changes in the change log as executed in the database to a file.

#### Syntax

```
liquibase(lb) changelogsync -changelog CHANGELOG
```

#### Named Parameters

Parameter	Description
-changelog <i>CHANGELOG</i>	Specify the changelog file to use

#### Example

```
SQL> lb changelogsync -changelog zipcodes_table.xml
-- *****
```

```

-- SQL to add all changesets to database history table
--
*****
-- Change Log: zipcodes_table.xml
-- Ran at: 6/3/20 1:28 PM
-- Against: JDOE@jdbc:oracle:thin:@localhost:1521/ORCLPDB1
-- Liquibase version: 3.8.9
--
*****

-- Lock Database
UPDATE JDOE.DATABASECHANGELOGLOCK SET LOCKED = 1, LOCKEDBY =
'192.168.1.175 (192.168.1.175)',
LOCKGRANTED = TO_TIMESTAMP('2020-06-03 13:28:24.686', 'YYYY-MM-DD
HH24:MI:SS.FF')
WHERE ID = 1 AND LOCKED = 0;

INSERT INTO JDOE.DATABASECHANGELOG (ID, AUTHOR, FILENAME,
DATEEXECUTED, ORDEREXECUTED,
MD5SUM, DESCRIPTION, COMMENTS, EXECTYPE, CONTEXTS, LABELS, LIQUIBASE,
DEPLOYMENT_ID)
VALUES ('e6568d24910039bf3d4241e7edff5ec82612c60f', 'Generated',
'zipcodes_table.xml',
SYSTIMESTAMP, 3, '8:e4fe731b3a40f479dec11e234e4a69ac',
'createSxmlObject objectName=ZIPCODES,
ownerName=JDOE', '', 'EXECUTED', NULL, NULL, '3.8.9', '1205304697');

-- Release Database Lock
UPDATE JDOE.DATABASECHANGELOGLOCK SET LOCKED = 0, LOCKEDBY = NULL,
LOCKGRANTED = NULL WHERE ID = 1;

```

### 3.4.11 LB CLEARCHECKSUMS

Removes current checksums from the database. For the next update, changesets that have already been deployed will have their checksums recomputed, and changesets that have not been deployed will be deployed.

#### Syntax

```
liquibase(lb) clearchecksums -changelog CHANGELOG
```

#### Named Parameters

Parameter	Description
-changelog <i>CHANGELOG</i>	Specify the changelog file to use

#### Example

```
SQL> lb clearchecksums -changelog zipcodes_table.xml
```

## 3.4.12 LB LISTLOCKS

Lists who currently has locks on the database change log.

### Syntax

```
liquibase(lb) listlocks -changelog CHANGELOG
```

### Named Parameters

Parameter	Description
<code>-changelog <i>CHANGELOG</i></code>	Specify the changelog file to use

### Example

```
SQL> lb listlocks -changelog zipcodes_table.xml  
No locks currently in use
```

## 3.4.13 LB RELEASELOCKS

Releases all locks on the database change log.

### Syntax

```
liquibase(lb) releaselocks -changelog CHANGELOG
```

### Named Parameters

Parameter	Description
<code>-changelog <i>CHANGELOG</i></code>	Specify the changelog file to use

### Example

```
SQL> lb releaselocks -changelog zipcodes_table.xml
```

## 3.4.14 LB STATUS

Outputs a list of change sets that have not been applied.

### Syntax

```
liquibase(lb) status -changelog CHANGELOG
```

Checks the status of the change log using the current connection. This shows if the change log has been applied and the result of the change log.

**Named Parameters**

Parameter	Description
-changelog <i>CHANGELOG</i>	Specify the changelog file to use

**Example**

```
SQL> lb status -changelog zipcodes_table.xml
```

```
1 change sets have not been applied to
JDOE@jdbc:oracle:thin:@localhost:1521/ORCLPDB1
zipcodes_table.xml::e6568d24910039bf3d4241e7edff5ec82612c60f::Generated
```

## 3.4.15 LB VALIDATE

Checks the changelog for errors.

**Syntax**

```
liquibase(lb) validate -changelog CHANGELOG
```

**Named Parameters**

Parameter	Description
-changelog <i>CHANGELOG</i>	Specify the changelog file to use

**Example**

```
lb validate -changelog zipcodes_table.xml
No issues were found in file zipcodes_table.xml, validation passed
```

## 3.4.16 LB VERSION

Display product version information.

**Syntax**

```
liquibase(lb) version
```

**Example**

```
SQL> lb version
```

```
Liquibase version: 3.8.9
Extension Version: 2.0.0.0.0
```

## 3.4.17 LB HELP

Lists the available Liquibase commands.

### Syntax

```
liquibase(lb) help command
```

Type a command with no options for help on a specific command.

### Example

```
SQL> lb help
usage: lb COMMAND ...
```

Commands:

The following commands are available within the liquibase feature.

lb help COMMAND for command specific help

COMMAND

genobject	Generate change log for a specific database object
genschema	Generate changelogs and controller for connected schema
gencontrolfile	Remove locks held by changelog
update	Updates database to current version
updatesql	Generates SQL to update database to current version
rollback	Rolls back the state requested
rollbacksql	Writes SQL to roll back the database to the state requested
diff	Writes description of differences between two databases to standard out.
dbdoc	Generates Javadoc-like documentation based on current database and change log.
changelogsync	Mark all changes as executed in the database.
clearchecksums	Removes current checksums from database.
listlocks	Lists who currently has locks on the database changelog.
releaselocks	Releases all locks on the database changelog.
status	Outputs list of unrun change sets.
validate	Checks the changelog for errors.
version	Display product version information

## 3.5 DATABASECHANGELOG\_DETAILS VIEW

DATABASECHANGELOG\_DETAILS is a view that consolidates information from the DATABASECHANGELOG and DATABASECHANGELOG\_ACTIONS tables for easier reporting and troubleshooting.

This view enables a better understanding of the status and work performed by each change applied to the database. The SQL column shows the actual SQL that was run in the database. The SXML column shows the state of the object prior to the change being applied.



**Example**

```
SQL> desc DATABASECHANGELOG_DETAILS
```

Name	Null?	Type
DEPLOYMENT_ID		VARCHAR2 (10)
ID		VARCHAR2 (255)
AUTHOR		VARCHAR2 (255)
FILENAME		VARCHAR2 (255)
SQL		CLOB
SXML		CLOB
DATEEXECUTED	NOT NULL	TIMESTAMP (6)
EXECTYPE	NOT NULL	VARCHAR2 (10)
MD5SUM		VARCHAR2 (35)
DESCRIPTION		VARCHAR2 (255)
COMMENTS		VARCHAR2 (255)
LIQUIBASE		VARCHAR2 (20)
CONTEXTS		VARCHAR2 (255)
LABELS		VARCHAR2 (255)

## 3.6 ChangeSets in Liquibase

The following table lists the changeSets and provides a description for each of them. To learn more about changeSets, see <changeSet> tag.

ChangeSet	Description
CreateOracleConstraint	Creates a constraint from SQL.
CreateOracleDirectory	Creates a directory from SQL.
CreateOracleFunction	Creates a function from SQL.
CreateOracleGrant	Creates a grant from SQL.
CreateOraclePackageBody	Creates a package body from SQL.
CreateOracleJob	Creates a DBMS_Scheduler job from SQL.
CreateOraclePackageSpec	Creates a package specification from SQL.
CreateOracleProcedure	Creates a procedure from SQL.
CreateOraclePublicSynonym	Creates a public synonym from SQL.
CreateOracleRefConstraint	Creates a referential constraint from SQL.
CreateOracleSynonym	Creates a synonym from SQL.
CreateOracleTrigger	Creates a trigger from SQL.
CreateOracleTypeBody	Creates a type body from SQL.
CreateOracleTypeSpec	Creates a type spec from SQL.
CreateSxmlObject	Creates a function from SQL.
DropOracleConstraint	Drops a constraint.
DropOracleFunction	Drops a function.
DropOracleGrant	Drops a grant.
DropOraclePackageBody	Drops a package body.

ChangeSet	Description
DropOraclePackageSpec	Drops a package specification.
DropOracleProcedure	Drops a procedure.
DropOracleRefConstraint	Drops a referential constraint.
DropOracleTrigger	Drops a trigger.
DropOracleTypeBody	Drops a type body.
DropOracleTypeSpec	Drops a type specification.
DropOracleSynonym	Drops a synonym.
DropSxmlObject	Drops an SXML object. If the object was created through createSxmlObject, this rolls back the object to the last state. If not created, the object is just dropped. This is primarily used internally for SXML object handling.
RunOracleScript	Executes a SQL script using the SQLcl engine and therefore supports all SQLcl commands. Supports script, file, and URL sources. See <a href="#">Execute Custom SQL with RunOracleScript</a>

## 3.7 Examples Using Liquibase

Some examples of using the Liquibase functionality for database change management tasks:

- [Capture and Deploy an Object](#)
- [Capture and Deploy a Schema](#)
- [Generate the Master Control File](#)
- [Capture and Deploy a Schema and then Upgrade it and Redeploy](#)
- [Execute Custom SQL with RunOracleScript](#)

See this [LiveLabs workshop](#) on change management using SQLcl and Liquibase.

### 3.7.1 Capture and Deploy an Object

To deploy the EMPLOYEES table from HR to HR2:



#### Note:

The syntax for the GENOBJECT command has changed. See [LB GENOBJECT](#)

1. Connect to HR.

```
SQL> connect hr/hr
Connected.
```

## 2. Capture the object.

```
SQL> lb genobject -type table -name employees
Action successfully completed please review created file
employees_table1.xml
```

## 3. Connect to the other user.

```
SQL> connect hr2/hr2
Connected.
```

## 4. Ensure the object does not already exist.

```
SQL> drop table employees
Table EMPLOYEES dropped.
```

## 5. Create the object in the current schema.



### Note:

As the schema name has changed, you must set *include schema* to *false* or it will try and create the object in the hr schema.

```
SQL> lb update -changelog employees_table.xml
ScriptRunner Executed:/Users/jdoe/Documents/lbtest/v2/
employees_table.xml::6486f968-93fe-4e1c-ac59-17ef392e1423::Generated
```

## 6. Verify the object was created.

```
SQL> desc employees
-----
EMPLOYEE_ID      NOT NULL      NUMBER(6)
FIRST_NAME                VARCHAR2(20)
LAST_NAME               NOT NULL      VARCHAR2(25)
EMAIL                   NOT NULL      VARCHAR2(25)
PHONE_NUMBER                VARCHAR2(20)
HIRE_DATE                NOT NULL      DATE
JOB_ID                   NOT NULL      VARCHAR2(10)
SALARY                          NUMBER(8,2)
COMMISSION_PCT                NUMBER(2,2)
MANAGER_ID                NUMBER(6)
DEPARTMENT_ID                NUMBER(4)
```

## 3.7.2 Capture and Deploy a Schema

To capture the HR schema and reproduce it in the HR2 schema:

```
sql.exe hr/hr@pdb1
```

```
SQL> lb genschema
```

```
[Type - TYPE_SPEC]: 107 ms
[Type - TYPE_BODY]: 80 ms
[Type - SEQUENCE]: 26 ms
[Type - CLUSTER]: 25 ms
[Type - TABLE]: 721 ms
[Type - MATERIALIZED_VIEW_LOG]: 18 ms
[Type - MATERIALIZED_VIEW]: 9 ms
[Type - VIEW]: 81 ms
[Type - REF_CONSTRAINT]: 128 ms
[Type - DIMENSION]: 14 ms
[Type - FUNCTION]: 43 ms
[Type - PROCEDURE]: 47 ms
[Type - PACKAGE_SPEC]: 24 ms
[Type - DB_LINK]: 14 ms
[Type - SYNONYM]: 23 ms
[Type - INDEX]: 102 ms
[Type - TRIGGER]: 25 ms
[Type - PACKAGE_BODY]: 33 ms
[Type - JOB]: 14 ms
[Method loadCaptureTable]: 1534 ms
[Method parseCaptureTableRecords]: 5479 ms
[Method sortCaptureTable]: 37 ms
[Method createExportChangeLogs]: 0 ms
```

Export Flags Used:

```
Export Grants          false
Export Synonyms        false
SQL>
```

setup the hr2 user --

```
drop user hr2 cascade;
create user hr2 identified by hr2;
grant connect,resource, create view to hr2;
alter user hr2 quota unlimited on users;
alter user hr2 quota unlimited on sysaux;
```

```
SQL> drop user hr2 cascade;
User HR2 dropped.
```

```
SQL> create user hr2 identified by hr2;
User HR2 created.
```

```
SQL> grant connect,resource, create view to hr2;
Grant succeeded.
```

```
SQL> alter user hr2 quota unlimited on users;
User HR2 altered.
```

```
SQL> alter user hr2 quota unlimited on sysaux;
User HR2 altered.
```

```
SQL> connect hr2/hr2
Connected.
```

```
SQL> lb update -changelog controller.xml
ScriptRunner
Executed:person_typ_type_spec.xml::32492b89db4b0e2a115caa3e7e6c3d29c11f
aldb::Generated
ScriptRunner
Executed:emp_person_typ_type_spec.xml::cb314e652bc79126fa0a2b5261720d15
728c7e04::Generated
ScriptRunner
Executed:people_typ_type_spec.xml::cc5c2298290e3ce2dc1563da82ddd9ea33a7
68c8::Generated
```

```
SQL> tables
```

```
TABLES
```

```
-----
DATABASECHANGELOG
DATABASECHANGELOGLOCK
DATABASECHANGELOG_ACTIONS
COUNTRIES
REGIONS
LOCATIONS
DEPARTMENTS
JOBS
EMPLOYEES
JOB_HISTORY
```

```
10 rows selected.
```

### 3.7.3 Generate the Master Control File

```
SQL> lb gencontrolfile
Action successfully completed please review created file controller.xml
```

```
SQL> !more controller.xml
<?xml version="1.0" encoding="UTF-8"?>
<databaseChangeLog
  xmlns="http://www.liquibase.org/xml/ns/dbchangelog"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog
http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-3.1.xsd">
  <include file="{filename.xml}"/>
</databaseChangeLog>
```

### 3.7.4 Capture and Deploy a Schema and then Upgrade it and Redeploy

The steps are:

1. Migrate the HR schema to the HR2 schema, then modify the HR schema and update HR2.

```
setup the hr2 user --
drop user hr2 cascade;
create user hr2 identified by hr2;
grant connect,resource, create view to hr2;
alter user hr2 quota unlimited on users;
alter user hr2 quota unlimited on sysaux;

SQL> drop user hr2 cascade;
User HR2 dropped.

SQL> create user hr2 identified by hr2;
User HR2 created.

SQL> grant connect,resource, create view to hr2;
Grant succeeded.

SQL> alter user hr2 quota unlimited on users;
User HR2 altered.

SQL> alter user hr2 quota unlimited on sysaux;
User HR2 altered.

SQL> connect hr2/hr2
Connected.

SQL> !mkdir v1

SQL> cd v1
SQL> connect hr/hr
Connected.
SQL> lb genschema
[Type - TYPE_SPEC]:                185 ms
[Type - TYPE_BODY]:                84 ms
[Type - SEQUENCE]:                 41 ms
[Type - CLUSTER]:                  38 ms
[Type - TABLE]:                   702 ms
[Type - MATERIALIZED_VIEW_LOG]:     20 ms
[Type - MATERIALIZED_VIEW]:        10 ms
[Type - VIEW]:                      85 ms
[Type - REF_CONSTRAINT]:           142 ms
[Type - DIMENSION]:                21 ms
[Type - FUNCTION]:                 45 ms
[Type - PROCEDURE]:                52 ms
[Type - PACKAGE_SPEC]:             30 ms
[Type - DB_LINK]:                  18 ms
[Type - SYNONYM]:                  30 ms
[Type - INDEX]:                    125 ms
[Type - TRIGGER]:                   31 ms
[Type - PACKAGE_BODY]:             39 ms
[Type - JOB]:                       19 ms
[Method loadCaptureTable]:         1717 ms
[Method parseCaptureTableRecords]: 6243 ms
```

```
[Method sortCaptureTable]:          42 ms
[Method createExportChangeLogs]:    1 ms
```

```
Export Flags Used:
Export Grants           false
Export Synonyms         false
```

## 2. Modify the HR schema.

```
SQL> ALTER TABLE DEPARTMENTS ADD (COLUMN1 VARCHAR2(20) );
Table DEPARTMENTS altered.
```

```
SQL> ALTER TABLE COUNTRIES ADD (COLUMN1 VARCHAR2(20) );
Table COUNTRIES altered.
```

```
SQL> ALTER TABLE LOCATIONS ADD (COLUMN1 VARCHAR2(20) );
Table LOCATIONS altered.
```

```
SQL> CREATE OR REPLACE PROCEDURE PROCEDURE2 (PARAM1 IN
VARCHAR2,PARAM2 IN VARCHAR2,PARAM3 IN VARCHAR2, PARAM4 IN VARCHAR
2) AS BEGIN NULL; END PROCEDURE2;
Procedure PROCEDURE2 compiled
```

## 3. Make a change to the v2 directory.

```
SQL> cd ..
SQL> !mkdir v2
SQL> cd v2
```

## 4. Export v2 of the HR schema.

```
SQL> lb genschema
[Type - TYPE_SPEC]:          102 ms
[Type - TYPE_BODY]:         74 ms
[Type - SEQUENCE]:          26 ms
[Type - CLUSTER]:           25 ms
[Type - TABLE]:            534 ms
[Type - MATERIALIZED_VIEW_LOG]: 13 ms
[Type - MATERIALIZED_VIEW]:  10 ms
[Type - VIEW]:              78 ms
[Type - REF_CONSTRAINT]:    119 ms
[Type - DIMENSION]:         15 ms
[Type - FUNCTION]:          44 ms
[Type - PROCEDURE]:         46 ms
[Type - PACKAGE_SPEC]:      25 ms
[Type - DB_LINK]:           14 ms
[Type - SYNONYM]:           24 ms
[Type - INDEX]:             100 ms
[Type - TRIGGER]:           25 ms
[Type - PACKAGE_BODY]:      34 ms
[Type - JOB]:               14 ms
[Method loadCaptureTable]:   1322 ms
[Method parseCaptureTableRecords]: 5452 ms
[Method sortCaptureTable]:   37 ms
[Method createExportChangeLogs]: 0 ms
```

```
Export Flags Used:  
Export Grants      false  
Export Synonyms    false
```

To import v1, change back to the v1 directory and connect as HR2.

```
SQL> cd ..  
SQL> connect hr2/hr2  
Connected.
```

**5. Now import the capture into the HR2 schema.**

```
SQL> lb update -changelog controller.xml  
ScriptRunner  
Executed:person_typ_type_spec.xml::f9d8cb37f8030674b1d0060b054254a28f96dd5  
1::Generated  
ScriptRunner  
Executed:emp_person_typ_type_spec.xml::cabf96af49def8fc164a6c0aa7be69c1a78  
d46c4::Generated  
ScriptRunner  
Executed:people_typ_type_spec.xml::6a98e2a2ec56a7ca6b716a114804081f8760ec7  
8::Generated  
ScriptRunner  
Executed:dept_persons_typ_type_spec.xml::e250a6757e4e023a30c1b9f458149e4df  
a0ad6bc::Generated  
ScriptRunner  
Executed:employee_type_type_spec.xml::aa2ef7c172e6df08e4082a4f139f4c6edf6e  
14bc::Generated  
ScriptRunner  
Executed:person_typ_type_body.xml::bd29fd1d0827b70ae4b644781eeb9a69f7caf95  
6::Generated  
ScriptRunner  
Executed:departments_seq_sequence.xml::ea03838db9dc0613a5128090c9388ff1b8d  
c8a1a::Generated  
ScriptRunner  
Executed:locations_seq_sequence.xml::2aba6107a95a977632161be9ca920bdb836f1  
8fc::Generated  
ScriptRunner  
Executed:employees_seq_sequence.xml::2379ab3cbd7f84f52f6596fa16479bb6ccf72  
1ca::Generated  
ScriptRunner  
Executed:countries_table.xml::8e87e94fd74b172dc76d950216e057827e2e3f83::Ge  
nerated  
ScriptRunner  
Executed:countries_comments.xml::8797a740e38cf3ef7da36b6ba4aa5497cfd6b457:  
:Generated
```

**6. Check a table to verify.**

```
SQL> show user  
USER is "HR2"  
  
SQL> desc departments
```



Name	Null?	Type
DEPARTMENT_ID	NOT NULL	NUMBER (4)
DEPARTMENT_NAME	NOT NULL	VARCHAR2 (30)
MANAGER_ID		NUMBER (6)
LOCATION_ID		NUMBER (4)

### 7. Switch to v2 and import the capture.

```
SQL> cd v2
SQL> lb update -changelog controller.xml
ScriptRunner
Executed:countries_table.xml::31a15fa402822ae67ae588a74e2b0d9506f1dc
26::Generated
ScriptRunner
Executed:locations_table.xml::9548f26f7f8b53bc3639869e23b118b4fe0936
3b::Generated
ScriptRunner
Executed:departments_table.xml::560727e73ed902cd0ad3e25793987d323580
b823::Generated
ScriptRunner
Executed:emp_email_uk_index.xml::99a0278c50a75912985023c6a075514ec93
9d233::Generated
ScriptRunner
Executed:secure_employees_trigger.xml::cfe2f3f3443973ee9d43f4cc77701
d211c6023ba::Generated
ScriptRunner
Executed:update_job_history_trigger.xml::aa8e35e3de04b9bb0ef3c47885f
175e20be6c59e::Generated
```

### 8. Verify that you are on v2.

```
SQL> desc departments
```

Name	Null?	Type
DEPARTMENT_ID	NOT NULL	NUMBER (4)
DEPARTMENT_NAME	NOT NULL	VARCHAR2 (30)
MANAGER_ID		NUMBER (6)
LOCATION_ID		NUMBER (4)
COLUMN1		NUMBER

## 3.7.5 Execute Custom SQL with RunOracleScript

Create a RunOracleScript changeset where the source can be a script, a link to a file, or a URL. The changeset in this example shows how to create a table and use PL/SQL variables in the script.

```
#### SCRIPT - STRING EXAMPLE ####

<?xml version="1.0" encoding="UTF-8"?>
<databaseChangeLog
  xmlns="http://www.liquibase.org/xml/ns/dbchangelog"
```

```

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n0="http://www.oracle.com/xml/ns/dbchangelog-ext"
xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog http://
www.liquibase.org/xml/ns/dbchangelog/dbchangelog-3.6.xsd">
  <changeSet id="runScriptString" author="jdoe">
    <n0:runOracleScript objectName="myScript" ownerName="JDOE"
sourceType="STRING">
      <n0:source><![CDATA[DEFINE table_name = RUNNERSTRING;create table
&&table_name (id number);]]></n0:source>
    </n0:runOracleScript>
  </changeSet>
</databaseChangeLog>

```

```

SQL> tables
no rows selected

```

```

SQL> lb update -changelog stringscript.xml
ScriptRunner Executed:stringscript.xml::runScriptString::jdoe

```

```

SQL> tables
TABLES

```

```

-----
DATABASECHANGELOGLOCK
DATABASECHANGELOG
DATABASECHANGELOG_ACTIONS
RUNNERSTRING

```

```

#### SCRIPT - FILE EXAMPLE ####

```

```

filescript.xml

```

```

-----
<?xml version="1.0" encoding="UTF-8"?>
<databaseChangeLog
  xmlns="http://www.liquibase.org/xml/ns/dbchangelog"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:n0="http://www.oracle.com/xml/ns/dbchangelog-ext"
  xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog http://
www.liquibase.org/xml/ns/dbchangelog/dbchangelog-3.6.xsd">
  <changeSet id="RunScriptFile" author="jdoe">
    <n0:runOracleScript objectName="myScript" ownerName="JDOE"
sourceType="FILE">
      <n0:source><![CDATA[/Volumes/SSD/work/sqlcl/scriptFILE.sql]]></
n0:source>
    </n0:runOracleScript>
  </changeSet>
</databaseChangeLog>

```

```

scriptFILE.sql

```

```
-----  
CREATE TABLE RUNNERFILE (id number)  
-----  
-----
```

```
SQL> tables  
TABLES
```

```
-----  
DATABASECHANGELOGLOCK  
DATABASECHANGELOG  
DATABASECHANGELOG_ACTIONS  
RUNNERSTRING
```

```
SQL> lb update -changelog filescript.xml  
ScriptRunner Executed:/Volumes/SSD/work/sqlcl/  
filescript.xml::RunScriptFile::jdoe
```

```
SQL> tables  
TABLES
```

```
-----  
DATABASECHANGELOGLOCK  
DATABASECHANGELOG  
DATABASECHANGELOG_ACTIONS  
RUNNERSTRING  
RUNNERFILE
```

```
#### SCRIPT - URL EXAMPLE ####
```

```
urlscript.xml  
-----  
-----
```

```
-----  
<?xml version="1.0" encoding="UTF-8"?>  
<databaseChangeLog  
  xmlns="http://www.liquibase.org/xml/ns/dbchangelog"  
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
  xmlns:n0="http://www.oracle.com/xml/ns/dbchangelog-ext"  
  xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog  
http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-3.6.xsd">  
  <changeSet id="RunScriptUrl" author="jdoe">  
    <n0:runOracleScript objectName="myScript" ownerName="JDOE"  
sourceType="URL">  
      <n0:source><![CDATA[file:///Volumes/SSD/work/sqlcl/  
scriptURL.sql]]></n0:source>  
    </n0:runOracleScript>  
  </changeSet>  
</databaseChangeLog>
```

```
-----  
-----  
scriptURL.sql  
-----  
-----
```

```
CREATE TABLE RUNNERURL (id number)
```

```
-----  
-----  
  
SQL> tables  
TABLES
```

```
-----  
DATABASECHANGELOGLOCK  
DATABASECHANGELOG  
DATABASECHANGELOG_ACTIONS  
RUNNERSTRING  
RUNNERFILE
```

```
SQL> lb update -changelog urlscript.xml  
ScriptRunner Executed:/Volumes/SSD/work/sqlcl/  
urlscript.xml::RunScriptUrl::jdoe
```

```
SQL> tables  
TABLES
```

```
-----  
DATABASECHANGELOGLOCK  
DATABASECHANGELOG  
DATABASECHANGELOG_ACTIONS  
RUNNERSTRING  
RUNNERFILE  
RUNNERURL
```

# 4

## Using Cloud Storage

Starting from SQLcl release 21.2, you can use the `DBMS_CLOUD` package for authentication to access objects in Cloud Storage.

The following actions can be performed with either `OCI` or `DBMS_CLOUD`:

- Put, get, delete, and peek objects in Cloud Storage.
- Load database objects from objects in Cloud Storage.
- Unload a database table to an object in Cloud Storage.

**Table 4-1 Accessing the cloud storage**

Using OCI	Using DBMS_CLOUD
Can access on-premises database and cloud database	Can access cloud database only
Set a default Cloud Storage URL, list compartments, buckets and objects, and view some of the contents of an object in Cloud Storage	Set a default Cloud Storage URL, list objects, and view some of the contents of an object in Cloud Storage
Create an OCI profile for authentication and access as a prerequisite step	Authentication is done using existing OCI or Swift credentials

Use the Cloud Storage (`cs`) command to set a default Cloud Storage URI, list compartments, buckets and objects, and view some of the contents of an object in Cloud Storage.

### Topics

- [Using DBMS\\_CLOUD for Authentication](#)
- [Creating the OCI profile for OCI Authentication](#)
- [Cloud Storage Command Options](#)
- [Examples](#)



#### See Also:

- [Loading a File](#)
- [Calling Oracle Cloud Infrastructure REST APIs Using the OCI Command](#)

## 4.1 Using DBMS\_CLOUD for Authentication

You can access the cloud storage using the `DBMS_CLOUD Credential` command. Presently, the `DBMS_CLOUD Credential` supports Oracle Cloud database.

With the `DBMS_CLOUD Credential` command (`dbcc`), you can:

- Create a credential using Swift, OCI credentials, or an existing OCI profile.
- Enable, disable, update, and drop a credential.
- List the credentials.
- Set the default credential.

### Create a Credential

To create authentication using the Swift credential, use the following command:

```
dbcc create <new-credential-name> user <username> pass <password>
```

To create authentication using the OCI credential, use the following command:

```
dbcc create <new-credential-name> fingerprint <fingerprint> user_ociid  
<user-id> tenancy_ociid <tenancy-id> private_path <path-to-private-key>
```

To create authentication using OCI profile, use the following command:

```
dbcc create <new-credential-name> profile <oci-profile-name>
```

### Enable, Disable, Update, and Drop a Credential

To enable a credential, use the following command:

```
dbcc enable <credential-name>
```

To disable a credential, use the following command:

```
dbcc disable <credential-name>
```

To update a credential, use the following command:

```
dbcc update <credential-name> <attribute> <value>
```

**where** <attribute> : [user\_ociid] [tenancy | tenancy\_id] [key\_path |  
private\_key\_path] [print | fingerprint]

To drop a credential, use the following command:

```
dbcc drop <credential-name>
```

### List the Credentials

To display a list of available credentials, use the following command:

```
dbcc list
```

## Set the Default Credential

To set `mycred` as the default credential, use the following command:

```
dbcc mycred
```

To find help on the `dbcc` command, use the following command:

```
help dbccred
```

## An Example to Create and Set a DBMS\_CLOUD Credential

The following example details the steps to create and set different types of `DBMS_CLOUD` credentials.

```
--Set the path to the Wallet zip file on your system
SQL> set cloudconfig <path-to-Wallet-file>
Operation is successfully completed.

--Supply the database user name, password and the database service name
provided in the tnsnames.ora
SQL> connect admin/<password>@adw20200526_high
Connected.

--Set Cloud Storage URL to the bucket
SQL> cs https://objectstorage.us-ashburn-1.example.com/n/test/b/example
DBMS_CLOUD Credential: Not Set
OCI Profile: Not Set
Transfer Method: Not Set
URI as specified: https://objectstorage.us-ashburn-1.example.com/n/test/b/
example

--create CREDENTIAL using Swift authentication
SQL> dbcc create swiftcred user <username> pass <password>
Credential SWIFTCRED created.
DBMS_CLOUD Credential set to SWIFTCRED.
Transfer method set to DBMS_CLOUD.

--create CREDENTIAL using OCI authentication
SQL> dbcc create ocicred fingerprint ec:98:83:**:**:**:b5
      user_ocid ocid1.user.oc1.....**g4xoca
      tenancy_ocid ocid1.tenancy.oc1.....a**3n3a
      private_path C:\\Users\\test\\oci/freedb_api_key.pem
Credential OCICRED created.
DBMS_CLOUD Credential set to OCICRED.
Transfer method set to DBMS_CLOUD.

--create CREDENTIAL using an existing OCI profile called freedb
--If profile name is not passed as a parameter, it takes the default
OCI profile details which is already set.
SQL> dbcc create profcred profile [freedb]
Credential PROFCRED created.
```

```
DBMS_CLOUD Credential set to PROFCCRED.  
Transfer method set to DBMS_CLOUD.
```

## 4.2 Creating the OCI profile for OCI Authentication

For using the OCI authentication scheme, you must first set the OCI profile.

For more information about how to set up the required SSH keys and configure your Oracle Cloud Infrastructure Software Development Kits, see [Setup and Prerequisites](#) in the *Oracle Cloud Infrastructure Documentation*.

Note the following points:

- Generate a RSA key pair in PEM format (minimum 2048 bits required) **without a passphrase**. Use this `key_file` in the profile.
- Do not use relative paths inside the configuration file because relative paths resolve based on the SQLcl launch directory. Therefore, the `key_file` may not be found.
- Use double backslashes (`\\`) instead of a single backslash (`\`) for specifying the path of the `key_file` in Windows.

To display the list of profiles contained in the OCI configuration file at `~/.oci/config`, use the following command:

```
oci profile
```

To set the profile as `demo`, use the following command:

```
oci profile demo
```

## 4.3 Cloud Storage Command Options

You can invoke the Cloud Storage command in SQLcl with `cloudstorage` or `cloud_storage` or `cs`.

The Cloud Storage Command provides Cloud Storage functions to:

- Set and show the default cloud storage URI.
- Set and show the transfer method, profile and credential.
- List compartment, bucket and objects in cloud storage.
- Get, put, delete, and peek a Cloud Storage Object.

For a list of the Cloud Storage command options in SQLcl, enter:

```
help cs
```

The command options are:



- `cs [ uri ] <uri>`: Sets the default Cloud Storage URI. The URI must contain the host and optionally the namespace, bucket, and object.

Example:

```
--host
cs https://objectstorage.us-ashburn-1.oraclecloud.com
--namespace
cs https://objectstorage.us-ashburn-1.oraclecloud.com/n/test
--bucket
cs https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/example
--object
cs https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/example/o/
employees.csv
```

- `cs oci [<profile>]`: Sets the default transfer as OCI. Optionally, specify the profile to be used.
- `cs {DBC | DBMS_CLOUD} [<credential>]`: Sets the default transfer as DBMS\_CLOUD. Optionally, specify the credential to use.
- `cs clear`: Clears the Cloud Storage URI including URI and transfer options.
- `cs show`: Shows the current default Cloud Storage URI, transfer method, profile and credential.
- `cs listc [ <compartment> ]`: Lists the compartments in the specified *compartment*. If *compartment* is not specified, lists the compartments in the namespace as identified by the profile. (OCI only)
- `cs listb <compartment>`: Lists the buckets in a compartment. (OCI only)
- `cs listo [ <bucket> ]`: Lists the objects in a bucket. Bucket must be specified in the URI or on the `listo` command.
- `cs delete [<qualifier>]`: Delete the object from cloud storage.
- `cs get [<qualifier>]`: Get the object from cloud storage.
- `cs PUT [file-to-send-as-body] <qualifier>`: Copy the file to cloud storage.
- `cs peek [ <qualifier> ] [ { pos | position} <position> ] [ size <size> ]`: Displays the contents of the object where:

*qualifier* is the name of the object, optionally qualified by the namespace and the bucket. The qualified name combined with the default URI specified must fully identify the object URI.

*position* is the start location in the object for display.

*size* is the number of characters to display. If omitted, 2000 characters are displayed.

## 4.4 Examples

This section provides some examples:

- [Load a Cloud Storage File into a Table](#)
- [Unload Table Data into Cloud Storage](#)
- [List Compartments, Buckets, and Objects](#)
- [Load a Local File into Cloud Storage using the PUT command](#)

- [Get a File from Cloud Storage using the GET Command](#)
- [Delete a File in Cloud Storage using the DELETE Command](#)
- [Grant a DBMS\\_CLOUD Credential to Another User](#)

### Load a Cloud Storage File into a Table

The following example shows how to load a cloud storage file into a database table:

**Use Case 1:** When using the DBMS\_CLOUD authentication scheme, the DBMS\_CLOUD credential is set and transfer method is set to dbms\_cloud.

```
--Set the DBMS_CLOUD credential
SQL> cs dbc swiftcred

--Set Cloud Storage URI to the bucket
SQL> cs https://objectstorage.us-ashburn-1.example.com/n/test/b/example

DBMS_CLOUD Credential: SWIFTCRED
OCI Profile: Not Set
Transfer Method: dbms_cloud
URI as specified: https://objectstorage.us-ashburn-1.example.com/n/
test/b/example
```

**Use Case 2:** When using the OCI Profile authentication scheme, the OCI profile is set and transfer method is set to oci.

```
--Set the OCI profile
SQL> cs oci demo
--Set Cloud Storage URI to the bucket

SQL> cs https://objectstorage.us-ashburn-1.example.com/n/test/b/example

DBMS_CLOUD Credential: Not Set
OCI Profile: Demo
Transfer Method: oci
URI as specified: https://objectstorage.us-ashburn-1.example.com/n/
test/b/example

--Create Table "locations"
SQL> create table locations(location_id NUMBER(5),location_name
VARCHAR2(40));
Table LOCATIONS created

--Load data from LOCATIONS_DATA_TABLE.csv in cloud storage into
"locations" table of the schema for the current user
SQL> load locations cs /o/LOCATIONS_DATA_TABLE.csv

format csv

column_names on
delimiter ,
enclosure_left "
```

```
enclosure_right "
encoding UTF8
row_limit off
row_terminator default
skip_rows 0
skip_after_names

--Number of rows processed: 50
--Number of rows in error: 0
--Last row processed in final committed batch: 50
0 - SUCCESS: Load processed without errors

SQL> select count(*) from locations;

COUNT(*)
-----
50

--Load data from LOCATIONS_DATA_TABLE.csv in your current local folder into
"locations" table
  of the schema for the current user
SQL> load locations cs LOCATIONS_DATA_TABLE.csv
```

### Unload Table Data into Cloud Storage

The following example shows how to unload data from the `locations` table into cloud storage. The data is unloaded to the cloud storage location and is named `LOCATIONS_DATA_TABLE.csv`.

```
--Set Cloud Storage URI to the bucket
SQL> cs https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/example

--Specify delimiter as | and terminator as <eol>
SQL> set loadformat delimiter | term <eol> csv

--Unload locations table into cloud storage
SQL> unload locations cs

DBMS_CLOUD Credential: SWIFTCRED          --Using DBMS_CLOUD authentication
OCI Profile: Not Set
Transfer Method: dbms_cloud
URI as specified: https://objectstorage.us-ashburn-1.oraclecloud.com/n/
test/b/example/o/
Final URI: https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/
example/o/

format csv

column_names on
delimiter |
enclosure_left "
enclosure_right "
encoding UTF8
row_terminator <eof>
```

```

** UNLOAD Start ** at 2020.09.10-17.08.34
Export Separate Files to https://objectstorage.us-
ashburn-1.oraclecloud.com/n/test/b/example
DATA TABLE LOCATIONS
File Name: LOCATIONS_DATA_TABLE.csv
Number of Rows Exported: 23
** UNLOAD End ** at 2020.09.10-17.08.39

-- Show file contents
SQL> cs peek /o/LOCATIONS_DATA_TABLE.csv

"LOCATION_ID"|"LOCATION_NAME"<eof>01|"California"<eof>02|"Alaska"<eof>03
|"Florida"<eof>04|"Texas"<eof>05|"Virginia"<eof>
06|"Louisiana"<eof>07|"Massachusetts"<eof>08|"Arkansas"<eof>09|"Oregon"
<eof>10|"Hawaii"<eof>11|"Maryland"<eof>
12|"Pennsylvania"<eof>13|"Colorado"<eof>14|"Michigan"<eof>15|"Minnesota"
<eof>16|"Ohio"<eof>17|"Maine"<eof>18|"Arizona"<eof>
19|"Missouri"<eof>20|"Vermont"<eof>21|"Kansas"<eof>22|"Nevada"<eof>23|"
Illinois"

```

### List Compartments, Buckets, and Objects

The following example shows how to list compartments, buckets, and objects in cloud storage:



#### Note:

When using `DBMS_CLOUD` credential, you can only list the objects in the bucket. `DBMS_CLOUD` transfer method does not support listing compartments and buckets.

```

cs https://objectstorage.us-ashburn-1.oraclecloud.com/n/test

--Lists the compartments in the namespace
SQL> cs listc

COMP_APEX
dbtst
old
ords
pdf-fn-compartment
sandbox
sqldev

--Lists the compartments in the compartment sqldev
SQL> cs listc sqldev

sqldev1

--Lists the buckets in the compartment sqldev
SQL> cs listb sqldev

```

```
example
test

--Lists the objects in the bucket transfer
SQL> cs listo /b/example

COUNTRIES_DATA_TABLE.csv
DEPARTMENTS_DATA_TABLE.csv
REGIONS_DATA_TABLE.csv
LOCATIONS_DATA_TABLE.csv

--Displays the first 2000 characters of LOCATIONS_DATA_TABLE file
SQL> cs peek /o/LOCATIONS_DATA_TABLE.csv
```

### Load a Local File into Cloud Storage using the PUT command

The following example shows how to load a local file into cloud storage using the `CS PUT` command and the Cloud Storage command:

```
--Set Cloud Storage URI to the bucket
SQL> cs https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/example

--Put an object from local directory into cloud storage
SQL> cs put C:\\Users\\JDOE\\EMPLOYEES_DATA_TABLE.csv /o/myemployees.csv

Put C:\\Users\\JDOE\\EMPLOYEES_DATA_TABLE.csv copied
    to https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/
example/o/myemployees.csv

--List the objects in the bucket
SQL> cs listo

COUNTRIES_DATA_TABLE.csv
DEPARTMENTS_DATA_TABLE.csv
REGIONS_DATA_TABLE.csv
LOCATIONS_DATA_TABLE.csv
myemployees.csv
```

### Get a File from Cloud Storage using the GET Command

The following example shows how to get a file from cloud storage using the `CS GET` command and the Cloud Storage command:

```
--Set Cloud Storage URI to the bucket
SQL> cs https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/
example/o/

--Set the local directory
SQL> cd C:\\Users\\JDOE\\TempCS

--Get the myemployees.csv file from cloud storage
SQL> cs get /o/myemployees.csv
```

```
Get Object https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/
example/o/myemployees.csv
copied to C:\Users\JDOE\TempCS\employees.csv
```

### Delete a File in Cloud Storage using the DELETE Command

The following example shows how to delete a file in cloud storage using the `CS DELETE` command and the Cloud Storage command:

```
--Set Cloud Storage URI to the bucket
SQL> cs https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/
example/o/

--Set the local directory
SQL> cd C:\\Users\JDOE\\TempCS

--Delete the myemployees.csv file in cloud storage
SQL> cs delete /n/test/b/example/o/myemployees.csv

Deleted Object
https://objectstorage.us-ashburn-1.oraclecloud.com/n/test/b/example/o/
myemployees.csv
```

### Grant a DBMS\_CLOUD Credential to Another User

The following example shows how to create and grant a `DBMS_CLOUD` credential to another user:

```
-- Create a DBMS_CLOUD credential using oci-profile
SQL> dbcc create jdoecred profile freedb

DBMS_CLOUD Credential: JDOECRED
OCI Profile: Not Set
Transfer Method: dbms_cloud
URI as specified: https://objectstorage.us-ashburn-1.example.com/n/
test/b/example

-- Grant jdoecred to user jdoe
SQL> grant all on jdoecred to jdoe;

-- Connect to the Cloud instance as jdoe
SQL> connect jdoe/*****@adw20200526_high

-- Create a synonym for jdoecred
SQL> create synonym mycred for admin.jdoecred;

-- Set the transfer method using the synonym mycred
SQL> cs dbc mycred

-- User can now list the objects in the Cloud Storage 'test' bucket
because jdoe.mycred exists (as synonym)
```

```
SQL> cs listo
```

# 5

## Data Pump Support in SQLcl

You can import and export data and metadata using Data Pump. Data Pump is made available in SQLcl using the PL/SQL package, `DBMS_DATAPUMP`.

You can do the following:

- Export one or more schemas.
- Import one or more schemas with the `remap schema` option.
- Use `DATAPUMP` export and import for Oracle Database and Oracle Autonomous Database Cloud Services.
- Use database directory or Oracle Object Store for dump files, which can be optionally encrypted.
- Perform parallel processing of dump files.
- Filter objects by object types or names.
- Use the `SET DATAPUMP` command to set defaults and save them with the `STORE` command.
- Use the Cloud Storage feature to put or get from the database directory.

### Topics

- [Getting Started](#)
- [Data Pump Command Syntax and Arguments](#)
- [Use Cases](#)
- [Tips and Troubleshooting](#)

## 5.1 Getting Started

The following sections provide information needed to get started with the `DATAPUMP` command in SQLcl.

### 5.1.1 Prerequisites

To use `DATAPUMP` in SQLcl, you need to know the following:

- When you are the logged-in user that is exporting or importing:
  - You must have the appropriate system privileges or adequate user space resource on the tablespace.
  - If you do not have the `DBA` or `PDB_DBA` role, you need access to the Oracle Directory for importing or exporting your own schema.



For example:

```
grant read, write on directory DATA_PUMP_DIR to dpumpnotdba;
```

- When using other schemas:
  - See [Required Roles](#) to learn about the required roles for data pump import and export operations.
  - You must have permissions for the tablespace to import.
- If you are unable to use Data Pump, you can instead load a file using [Loading a File](#).
- To connect to an Autonomous Database:
  - Download the wallet file for the Oracle Cloud connection. See [Download Client Credentials](#).
  - For importing to Autonomous, see [Cloud Premigration Advisor Tool \(CPAT\)](#).
- To use object storage from Oracle Database:
  - See [Cloud Storage Command Options](#) and [Setup and Prerequisites](#) in the *Oracle Cloud Infrastructure Documentation*.
  - You must install an OCI profile configuration file.
  - The OCI profile must be set using `OCI PROFILE <name>` or `CS OCI <profile>`.
  - You can copy dump files to object storage as the last step of an export using the `-copycloud` option on the data pump export.
  - You can copy dump files from object storage as the first step of an import using the `-copycloud` option on the data pump import.
  - You can copy dump files between cloud storage and Oracle Directories using the Cloud Storage command (put and get).
- To use object storage from Autonomous Database:
  - See [Using DBMS\\_CLOUD for Authentication](#).
  - You must set the credential for object storage using Cloud Storage, `SET DATAPUMP` or `DATAPUMP` command.
  - You can export dump files directly to object storage without using a database directory.
  - You can import dump files directly from object storage without using a database directory.
  - You cannot write log files directly to object storage but you can copy them to cloud storage using the Cloud Storage command.
- The Time Zone File version is shown during export. The dump file can only be imported into a database with the same (or later) time zone file version.
- Transparent and Dual encryption modes require Transparent Data Encryption (TDE). If TDE is not available, you can use only password encryption.

## 5.1.2 Usage

The `DATA_PUMP` command creates and submits data pump jobs using the `DBMS_DATA_PUMP` package.

- For importing to Autonomous, see [Cloud Premigration Advisor Tool \(CPAT\)](#).
- You can have different hardware, operating systems, character sets, time zones, and versions in the source and target databases.
- All object types and data types existing in Oracle Database release 11g and later versions are supported.
- You can transfer and filter data and metadata.
- You can transform schema names, tablespace names, and metadata at import time.
- You can unload and load data in an Oracle proprietary format.
- You can encrypt dump files to ensure your data is secure. You can use transparent if available on the database or use password as the encryption mode.
- You can filter the import or export process to limit the objects types and objects included.

### Export

Data Pump export is used to unload metadata and data into a dump file, which can be stored in an Oracle Directory or object storage.

- If a schema or list of schemas is not provided, the current schema is exported.
- If a directory or object storage and a credential are not provided, the dump file is stored in `DATA_PUMP_DIR`.
- Job name is created as `ESQL_<n>`, if one is not provided.
- If a dump file name is not provided, the dump file is stored as `<jobname>.DMP`.
- If a log file name is not provided, the log file is stored as `<jobname>.LOG`.

### Import

Data Pump import is used to load metadata and data from a previously exported dump file, which was stored in an Oracle Directory or object storage.

- If a schema or list of schemas is not provided, all the objects in the dump file are imported (`FULL` import by default). You can use a filter to limit the number of objects imported.
- If a database directory or object storage and a credential are not provided, the dump file is stored in `DATA_PUMP_DIR`.
- Job name is created as `ISQL_<n>`, if one is not provided.
- If a dump file name is not provided, the dump file is stored as `<jobname>.DMP`.
- If a log file name is not provided, the log file is stored as `<jobname>.LOG`.

## 5.2 Data Pump Command Syntax and Arguments

You can invoke the Data Pump command using `dp` or `datapump`.

### Syntax

```
dp help [examples|syntax] | export [<optional-argument>,...] | import
[<optional-argument>,...] |
```

To see the help description for data pump in SQLcl, type one of the following:

```
datapump help
```

```
dp help
```

To quickly view the syntax and exclude other details, type

```
dp help syntax
```

To only view the examples in help, type:

```
dp help examples
```

*<optional argument>*: The following table describes the possible optional arguments along with default values for each of them.

**Table 5-1 Optional Arguments**

File Argument	Description	Default
-credential, -c	Credential for dump file access in Oracle Object Store.	As specified in the Cloud Storage command
-directory, -d	Default database directory for reading and writing dump and log files.	DATA_PUMP_DIR
-dumpdirectory, -dd	Database directory for dump file.	-directory if specified or DATA_PUMP_DIR
-dumpfile, -f	<i>&lt;file-name&gt;</i> [...] Dump file name(s) when using database directory. You can specify multiple files whether parallelism is enabled or not. The number of files specified must be at least as large as the degree of parallelism.	<i>&lt;jobname&gt;</i> <n>.DMP

Table 5-1 (Cont.) Optional Arguments

File Argument	Description	Default
-dumpuri,-u	<p>[&lt;uri&gt;[,...]]   &lt;qualified-name&gt;[,...]]</p> <p>&lt;uri&gt;: Complete URI for the Oracle Object Store file if a default is not set on Cloud Storage command.</p> <p>&lt;qualifier&gt;: Name of the object, optionally qualified by the namespace and the bucket. The qualified name concatenated to the URI specified on Cloud Storage command must fully identify the object URI.</p> <p>Credential must be set for direct read/write access to Oracle Object Store from Autonomous database. For -copycloud between database directory and Oracle Object Store, OCI PROFILE must be set.</p> <p>You can specify multiple URIs whether parallelism is enabled or not. The number of files specified should be at least as large as the degree of parallelism.</p>	Default object name is <jobname>.DMP
-logdirectory,-ld	Database directory for log file.	-directory if specified or DATA_PUMP_DIR
-logfile,-lf	Log file name in the database directory.	<jobname><n>.LOG

Table 5-2 Command Arguments

Command Argument	Description	Default
-noexec,-ne	<p>[TRUE   FALSE]</p> <p>TRUE: Validate and generate the PL/SQL, but do not execute it.</p>	FALSE
-verbose,-ve	<p>[TRUE   FALSE]</p> <p>TRUE: Show additional diagnostic output.</p>	FALSE

Table 5-3 Common Arguments

Common Argument	Description	Default
-copycloud,-cc	<p>[TRUE   FALSE]</p> <p>TRUE: Copy the dump file between database directory and Oracle Object Store.</p> <p>For export, copy the dump file from the database directory to Oracle Object Store after the data pump job completes.</p> <p>For import, copy the dump file from Oracle Object Store to the database directory before the data pump job starts.</p> <p>Set the OCI PROFILE using OCI command or CLOUDSTORAGE command. Set the cloud storage URI using the CLOUDSTORAGE command, SET datapump command or DATAPUMP command.</p>	FALSE
-encryptionpassword,-enp	<p>&lt;password&gt;</p> <p>If password is not specified, a prompt for the password is given.</p> <p>For export, the dump files are encrypted using the password. For import, the same password used for export is provided.</p>	None
-excludeexpr,-ex	<p>&lt;object_type_expression&gt;</p> <p>Specify an expression identifying an object type or set of object types to exclude from the job. Example:-</p> <pre>excludeexpr "IN ('GRANT', 'INDEX', 'TRIGGER')"</pre>	None
-excludelist,-el	<p>&lt;object-type&gt;[,...]</p> <p>Specify a comma-separated-value list of object types to exclude from the job.</p> <p>Example:-excludelist GRANT, INDEX, TRIGGER</p>	None

Table 5-3 (Cont.) Common Arguments

Common Argument	Description	Default
-includeexpr,-ix	<p><i>&lt;object_type_expression&gt;</i></p> <p>Specify an expression identifying an object type or set of object types to include in the job. Only matching object types and their dependents are included in the job. Use -excludelist or -excludeexpr to exclude dependent objects. Example:</p> <pre>-includeexpr "IN ('TABLE', 'VIEW')"</pre>	None
-includelist,-il	<p><i>&lt;object_type&gt;[,...]</i></p> <p>Specify a comma-separated-value list of object types to include in the job. Only matching object types and their dependents are included in the job. Use -excludelist or -excludeexpr to exclude dependent objects. Example:</p> <pre>-includelist TABLE,VIEW</pre>	None
-includemetadata,-im	<p>[TRUE   FALSE]</p> <p>TRUE: Include metadata in the job.</p>	TRUE
-includerows,-ir	<p>[TRUE   FALSE]</p> <p>TRUE: Include data in the job.</p>	TRUE
-jobname,-j	<p>Name for the data pump job. Job name is appended with a data pump generated number, unless it ends with a number. <i>jobname&lt;n&gt;</i> is used when submitting the data pump job and as a default name for dump and log file names or object names.</p>	ESQL_<n>   ISQL_<n> where <i>n</i> is a data pump generated number.
-nameexpr,-nx	<p>{<i>&lt;object-type&gt;=&lt;name-expression&gt;</i>}[;...]</p> <p>For specified object type, provide an expression identifying a set of object names to include in the job. Example:</p> <pre>-nameexpr TABLE="IN ('EMPLOYEES', 'DEPARTMENTS')"; PROCEDURE="IN ('ADD_JOB_HISTORY', 'SECURE_DML')"</pre>	None

**Table 5-3 (Cont.) Common Arguments**

Common Argument	Description	Default
-namelist,nl	<p>{&lt;object-type&gt;=&lt;name&gt;[,...]} [;...]</p> <p>For specified object type, provide a comma-separated-value list of objects to include in the job. Example: - namelist TABLE=employees,departments;PROCEDURE=add_job_history,secure_dml</p>	None
-parallel,-p	<p>&lt;degree_integer&gt;</p> <p>Adjusts the degree of parallelism within a job allowing multiple processes simultaneously. Specify the same number of files as the degree or some processes may remain idle.</p>	1
-schemas,-s	<p>&lt;schema&gt;[,...] - The schema or list of schemas to process. For example:  -schemas schema1, schema2</p>	For export, schema for the current connection. For import, the default is FULL and all objects in the dump file are imported.
-version,-v	<p>{&lt;nn.n&gt;   COMPATIBLE   LATEST}</p> <p>&lt;nn.n&gt;: A specific database version, for example, 11.0.0. When exporting from Oracle Database 11g release 2 (11.2.0.3) or later into an Oracle Database 12 c Release 1 (12.1), specify a value of 12 to allow all existing database features, components, and options to be exported. This applies to a multitenant container database (CDB) or a non-CDB.  COMPATIBLE: Uses the metadata version from the database compatibility level and the compatibility release level for the feature.  LATEST: The version of the metadata corresponds to the database version.</p>	COMPATIBLE

**Table 5-3 (Cont.) Common Arguments**

Common Argument	Description	Default
-wait,-w	[TRUE   FALSE] TRUE: Wait for the data pump job to finish and show summary results. FALSE: Submit the data pump job without waiting and without showing results.	TRUE

**Table 5-4 Export Only Arguments**

Export-Only Arguments	Description	Default
-compression,-cm	{ALL   DATA_ONLY   METADATA_ONLY   NONE} Indicates if compression is needed for user data and metadata. ALL: Compress user data and metadata. DATA_ONLY: Compress only user data. METADATA_ONLY: Compress only metadata. NONE: Do not compress user data or metadata.	METADATA_ONLY
-estimate,-e	{BLOCKS   STATISTICS} Specifies the estimate method for the size of the tables. It should be performed before starting the job. BLOCKS: Estimate is calculated using the count of blocks allocated to the user tables. STATISTICS: Estimate is calculated using the statistics for each table. If no statistics are available for a table, BLOCKS is used.	
-encryption,-en	{ALL   DATA_ONLY   ENCRYPTED_COLUMNS_ONLY   METADATA_ONLY   NONE} Specifying any encryption option will turn on encryption if you do not specify -encryption NONE.	NONE, or ALL if any other encryption option is specified.
-encryptionalgorithm,-ena	{AES128   AES192   AES256} Identifies the cryptographic algorithm to use.	AES128



**Table 5-4 (Cont.) Export Only Arguments**

Export-Only Arguments	Description	Default
-encryptionmode,-enm	{DUAL   PASSWORD   TRANSPARENT}  Identifies the types of security used for encryption and decryption.  PASSWORD encrypts the dump files using the provided password.  TRANSPARENT enables encryption if the Oracle Encryption Wallet is available.  DUAL enables import using the Oracle Encryption Wallet or the password. When using DUAL, -encryptionpassword must be specified.	TRANSPARENT, or PASSWORD if -encryptionpassword is specified.
-filesize,-fs	{<n>{B   KB   MB   GB   TB}}  Limit for the size of files.	500 MB
-flashbackscn,-fb	[TRUE   FALSE]  TRUE: Use consistent database content based on system change number (SCN) at the start time of execution.	FALSE
-reusefile,-r	[TRUE   FALSE]  TRUE: Replace existing dump file(s) with a new file.	TRUE

**Table 5-5 Import Only Arguments**

Import-Only Arguments	Description	Default
-columnencryption,-ce	[TRUE   FALSE]  TRUE: Include column encryption clause on table metadata.  FALSE Omit column encryption clause.	TRUE if supported by database
-objectid,-oid	[TRUE   FALSE]  TRUE: Assign the exported OID.  FALSE: Assign a new OID	TRUE

Table 5-5 (Cont.) Import Only Arguments

Import-Only Arguments	Description	Default
-remapschemas,-rs	<i>{&lt;oldSchema&gt;=&lt;newSchema&gt;[,...]}</i>  <oldSchema> objects in the job are moved to <newSchema>. Example: oldschema1=newschema1,old schema2=newschema2.	Not Applicable
-remaptablespaces,-rt	<i>{&lt;oldTablespace&gt;=&lt;newTablespace&gt;[,...]}</i>  <oldTablespace> storage segment in the job is relocated to <newTablespace>. Example: oldtablespace1=newtablespace1,oldtablespace2=newtablespace2	Not Applicable
-segmentattributes,-sa	[TRUE   FALSE]  TRUE: Include segment attributes clauses (physical attributes, storage attributes, tablespace, logging).	TRUE
-skipunusableindexes,-sui	[TRUE   FALSE]  TRUE : Rows are inserted into tables having unusable indexes.	TRUE
-storage,-st	[TRUE   FALSE]  TRUE: Include storage clauses.	TRUE
-tableexists,-te	{APPEND   REPLACE   SKIP   TRUNCATE}  Action to take if table exists during import.  APPEND: New rows are added to the existing rows in the table.  REPLACE: Before creating the new table, the old table is dropped.  SKIP: The preexisting table is left unchanged.  TRUNCATE: Rows are removed from a preexisting table before inserting rows from the import.	SKIP when - includemetadata true, otherwise APPEND action is taken if table exists during import.

**Table 5-5 (Cont.) Import Only Arguments**

Import-Only Arguments	Description	Default
-tablecompression,-tc	[TRUE   FALSE] TRUE: The table compression clause is included if supported. FALSE: The table has the default compression for the tablespace.	TRUE

## 5.3 Use Cases

The following use cases illustrate how to use the `DATAPUMP` command to import and export data.

### Use Case 1

Copy tables, views and functions in current schema from database to database.

1. Export the current schema into `DATA_PUMP_DIR`.
2. Import the schema from `DATA_PUMP_DIR`.

```
-- Export the current schema into DATA_PUMP_DIR
SQL> connect <db-connect1-string>
SQL> dp export -dumpfile my_dump.dmp -includelist table,view,function

-- Import from DATA_PUMP_DIR
SQL> connect <db-connect2-string>
SQL> dp import -dumpfile my_dump.dmp
```

### Use Case 2

Copy current schema from database to Autonomous Database. Encryption is done using prompt for password.

1. Set up for Oracle access to Oracle Object Store using an OCI profile.
2. Export current schema into an encrypted dump file in `DATA_PUMP_DIR` and copy it to the CS bucket using profile.
3. Import encrypted file from Oracle Object Store using credential.

```
-- Set up for Oracle access to Oracle Object Store using an OCI profile
SQL> oci profile my-profile
SQL> cs https://swiftobjectstorage.us-ashburn-1.oraclecloud.com/v1/
abc123/testing-bucket/

-- Export current schema into an encrypted dump file in DATA_PUMP_DIR
and copy it to the CS bucket using profile
SQL> connect <db-connect-string>
SQL> dp export -copycloud -dumpfile my_dump.dmp -encryptionpassword
```

```
-- Import encrypted file from Oracle Object Store using credential
SQL> set cloudconfig <wallet>
SQL> connect <cloud-connect-string>
SQL> dp import -dumpuri /o/my_dump.dmp -encryptionpassword -c SWIFTCRED
```

### Use Case 3

Copy multiple schemas from database to Autonomous Database with remap schemas.

1. Set up for Oracle access to Oracle Object Store using an OCI profile.
2. Export schemas into database directory and copy to cloud.
3. Import from Oracle Object Store using credential. Remap the schemas.

```
-- Set up for Oracle access to Oracle Object Store using an OCI profile
SQL> oci profile my-profile
SQL> cs https://swiftobjectstorage.us-ashburn-1.oraclecloud.com/v1/abc123/
testing-bucket/

-- Export schemas into database directory and copy to cloud
SQL> connect <db-connect-string>
SQL> dp export -schemas dpumpstest1,dpumpstest11 -dumpfile DPUMPTEST1_11.DMP -
cc

-- Import from Oracle Object Store using credential. Remap the schemas
SQL> set cloudconfig <wallet>
SQL> connect <cloud-connect-string>
SQL> dp import -dumpuri /o/DPUMPTEST1_11.DMP -c SWIFTCRED -rs
dpumpstest1=dpumpstest2,dpumpstest11=dpumpstest21
```

### Use Case 4

Copy multiple schemas from database to Autonomous Database with remap tablespace using OCI profile only.

1. Set up for Oracle access to Oracle Object Store using an OCI profile.
2. Export the current schema into DATA\_PUMP\_DIR and copy it to the CS bucket using profile.
3. Copy from Oracle Object Store into directory and import from directory. Remap the tablespace.

```
-- Set up for Oracle access to Oracle Object Store using an OCI profile
SQL> oci profile my-profile
SQL> cs https://swiftobjectstorage.us-ashburn-1.oraclecloud.com/v1/abc123/
testing-bucket/

-- Export the current schema into DATA_PUMP_DIR and copy it to the CS bucket
using profile
SQL> connect <db-connect-string>
SQL> dp export -copycloud

-- Copy from Oracle Object Store into directory and import from directory.
Remap the tablespace.
```

```
SQL> set cloudconfig <wallet>
SQL> connect <cloud-connect-string>
SQL> dp import -copycloud -dumpuri /o/ESQL_<n>.DMP -rt DATA=USERS
```

### Use Case 5

Copy current schema from database to Autonomous Database using parallel processors.

1. Set up for Oracle access to Oracle Object Store using an OCI profile.
2. Export the current schema into DATA\_PUMP\_DIR and copy all files to the CS bucket using profile.
3. Import from Oracle Object Store using credential.

```
-- Set up for Oracle access to Oracle Object Store using an OCI profile
SQL> oci profile my-profile
SQL> cs https://swiftobjectstorage.us-ashburn-1.oraclecloud.com/v1/
abc123/testing-bucket/
```

```
-- Export the current schema into DATA_PUMP_DIR and copy all files to
the CS bucket using profile
SQL> connect <db-connect-string>
SQL> dp export -copycloud -parallel 3 -dumpfile
my_dump1.dmp,my_dump2.dmp,my_dump3.dmp
```

```
-- Import from Oracle Object Store using credential
SQL> set cloudconfig <wallet>
SQL> connect <cloud-connect-string>
SQL> dp import -dumpuri /o/my_dump1.dmp,/o/my_dump2.dmp,/o/
my_dump3.dmp -c SWIFTCRED
```

## 5.4 Tips and Troubleshooting

The `DATAPUMP` command builds PL/SQL that uses the `DBMS_DATAPUMP` package to execute exports and imports.

- Preview the PL/SQL and Parameters
  - Use the `-noexec` option to validate the export or import. This option shows the generated PL/SQL and parameters but does not submit the job for execution.
- Get additional information about the command processing
  - Use the `-verbose` option to see additional diagnostic information.
  - This option also provides queries that you can copy to view the last line of the log and percentage completed.
- View the job log
  - When using the `-wait` option, the log is written to the console.
  - When using `-wait false`, you can copy the log to object storage if you cannot see files in the directory.

- When using `-wait false`, you can view the log file with the following code block for Oracle Database release 12.2 and later versions:

```
var c clob;
set long 32000
begin select to_clob(BFILENAME('DATA_PUMP_DIR','ESQL_<n>.LOG'))
into :c from dual; end;
/
print c
```

- When importing or exporting as the logged-in user, it is recommended not to use the `SYS` role.
- Inserting a row into a table confirms you have quota on the tablespace. If you do not have quota, you see the following error after you run a `DATAPUMP` command: **ORA-31626: job does not exist.**

The following code snippet illustrates this problem:

```
*** Error with DataPump command

grant connect, resource, create session to user1 identified by user1;
grant read on directory DATA_PUMP_DIR to user1;
grant write on directory DATA_PUMP_DIR to user1;

SQL> connect <db-connect-string>
Connected

SQL> datapump export -schemas user1

Datapump Command Start ** at 2022.03.10-15.51.28
Initiating DATA PUMP
DATABASE TIME ZONE: VERSION:32 CON_ID:0
Log
Location: DATA_PUMP_DIR:ESQL_1614.LOG
ORA-31626: job does not exist
ORA-06512: at "SYS.DBMS_SYS_ERROR", line 79
ORA-06512: at "SYS.DBMS_DATAPUMP", line 1849
ORA-06512: at "SYS.DBMS_DATAPUMP", line 6869
ORA-06512: at line 25

** Datapump Command End ** at 2022.03.10-15.51.30
SQL> exit

***Resolve Error by Granting Tablespace Quota to User
Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0

SQL> alter user user1 quota 128M on users;
Grant succeeded.

SQL> connect <db-connect-string>
Connected.

SQL> datapump export -schemas user1
```

```
** Datapump Command Start ** at 2022.03.10-15.54.15
Initiating DATA PUMP
DATABASE TIME_ZONE: VERSION:32 CON_ID:0
Log Location: DATA_PUMP_DIR:ESQL_1616.LOG
Starting "USER1"."ESQL_1616":
Processing object type SCHEMA_EXPORT/TABLE/TABLE_DATA
Processing object type SCHEMA_EXPORT/TABLE/INDEX/STATISTICS/
INDEX_STATISTICS
Processing object type SCHEMA_EXPORT/TABLE/STATISTICS/
TABLE_STATISTICS
Processing object type SCHEMA_EXPORT/PRE_SCHEMA/PROCACT_SCHEMA
Processing object type SCHEMA_EXPORT/TABLE/TABLE
Processing object type SCHEMA_EXPORT/TABLE/COMMENT
Processing object type SCHEMA_EXPORT/TABLE/INDEX/INDEX
Master table "USER1"."ESQL_1616" successfully loaded/unloaded
*****
*****
Dump file set for USER1.ESQL_1616 is:
  /opt/oracle/admin/DB193C/dpdump/D9C3824B6E651CA4E053020014C3358C/
ESQL_1616.DMP
Job "USER1"."ESQL_1616" successfully completed at Thu Mar 10
15:54:52 2022 elapsed 0 00:00:33
DataPump Operation Status 'COMPLETED'
Jobname = ESQL_1616
** Datapump Command End ** at 2022.03.10-15.54.56
```

# 6

## PGQL Plug-in for SQLcl

Property Graph Query Language (PGQL) is a graph pattern-matching query language for the property graph data model. The PGQL plug-in enables execution and translation of PGQL statements from the command line in SQLcl.

The PGQL plug-in for SQLcl is available with Oracle Graph Server and Client Release 20.3 and later releases.



### See Also:

[Property Graph Query Language](#) for more information about PGQL.

This chapter covers the following topics:

- [Downloading and Installing](#)
- [About PGQL Commands](#)
- [Examples](#)

### 6.1 Downloading and Installing

You can download the plug-in either from [Oracle Software Delivery Cloud](#) (search for "Oracle Graph Server and Client") or from [Oracle Graph Server and Client Downloads](#).

To install the PGQL plug-in for SQLcl, you need to unzip the downloaded plug-in into the `lib/ext` directory of your local SQLcl installation.

### 6.2 About PGQL Commands

To run PGQL statements against a database, start SQLcl and then turn on PGQL mode by using the following command:

```
pgql auto on;
```

After PGQL mode is turned on, all subsequent `SELECT`, `INSERT`, `UPDATE`, `DELETE`, `CREATE`, and `DROP` statements are considered as PGQL statements.

You can also provide different arguments when turning on PGQL mode:

```
pgql auto on [args]
```

The possible arguments are:



- `graph <graph_name>`: Make queries run against the specified graph.
- `execute`: Turn on PGQL execution.
- `executeonly`: Turn on PGQL execution and do not show PGQL-to-SQL translation.
- `translate`: Show PGQL-to-SQL translation.
- `translateonly`: Show PGQL-to-SQL translation and turn off PGQL execution.
- `parallel <parallel>`: Run (or translate) PGQL queries using the specified parallel value.
- `dynamic_sampling <dynamic_sampling>`: Run (or translate) PGQL queries using the specified dynamic sampling value.

By default, the `graph` value is not set, PGQL execution is turned on, and PGQL to SQL translation is turned off. The default value for `parallel` is 0, and the default value for `dynamic_sampling` is 6.

To run SQL statements again, turn PGQL mode off:

```
pgql auto off;
```

To reset all parameters to their default values, turn PGQL mode off and then turn on again.

## 6.3 Examples

This section provides some examples:

- [Turn On PGQL Mode](#)
- [Create a Property Graph and Execute a Query](#)
- [Define a Graph Parameter](#)
- [Show SQL Translation Using Parallel Value 2](#)
- [Turn Off PGQL Mode](#)

### Turn On PGQL Mode

This example turns PGQL mode on. The PGQL prompt appears when PGQL is enabled.

```
SQL> pgql auto on;
```

```
PGQL Auto enabled for graph=[null], execute=[true], translate=[false]  
PGQL>
```

## Create a Property Graph and Execute a Query

This example creates a property graph and executes a query against the newly created "scott\_hr" graph.

```

PGQL> CREATE PROPERTY GRAPH scott_hr
2   VERTEX TABLES (
3     emp KEY(empno) LABEL Employee
4     PROPERTIES ARE ALL COLUMNS EXCEPT ( deptno ),
5     dept KEY(deptno) LABEL Department
6     PROPERTIES ( deptno, dname )
7   )
8   EDGE TABLES (
9     emp AS works_for
10    SOURCE KEY ( empno ) REFERENCES emp
11    DESTINATION KEY ( deptno ) REFERENCES dept
12    NO PROPERTIES
13  );

```

Graph created

```

PGQL> column name format a15;
PGQL> SELECT e.ename AS name
2   FROM MATCH (e:Employee) ON scott_hr
3   ORDER by e.ename
4   LIMIT 4;

```

NAME

```

-----
ADAMS
ALLEN
BLAKE
CLARK

```

## Define a Graph Parameter

You can define a graph parameter to run all PGQL queries against a particular graph. This example sets graph to scott\_hr. Note that the query does not need an ON clause.

```

PGQL> pgql auto on graph scott_hr;

```

```

PGQL Auto enabled for graph=[SCOTT_HR], execute=[true], translate=[false]

```

```

PGQL> column department format a20;
PGQL> column employees format a10;
PGQL> SELECT d.dname AS department, COUNT(e) AS employees
2   FROM MATCH (e:Employee) -[:works_for]-> (d:Department)
3   GROUP BY d
4   ORDER BY employees
5*  LIMIT 3;

```

```

DEPARTMENT          EMPLOYEES
-----
ACCOUNTING          3

```

```
RESEARCH          5
SALES              6
```

### Show SQL Translation Using Parallel Value 2

This example shows the SQL translation of a PGQL query using a parallel value of 2. Note that the SQL translation has a hint using the defined parallel value.

```
SQL> pgql auto on translateonly parallel 2;
```

```
PGQL Auto enabled for graph=[null], execute=[false], translate=[true]
PGQL> SELECT id(n) FROM MATCH (n) ON scott_hr;
SELECT /*+ parallel(2) */ * FROM(SELECT 7 AS "id(n)$T",
to_nchar(T0$0.VID,'TM9','NLS_Numeric_Characters=''.','') AS "id(n)$V",
T0$0.VID AS "id(n)$VN",
to_timestamp_tz(null) AS "id(n)$VT"
FROM "SCOTT".SCOTT_HRVD$ T0$0);
```

### Turn Off PGQL Mode

This example shows how to turn PGQL mode off.

```
PGQL> pgql auto off;
```

```
PGQL Auto disabled
SQL>
```

# A

## SQL Performance Troubleshooting

This appendix provides a list of SQL coding patterns that cause potential performance issues in SQL queries.

- [Columns Defined as Literal Constants in Sub-Query Joined Later in Main Query](#)
- [Redundant Table in LEFT OUTER JOIN](#)
- [Too Many Join Conditions Between Factored WITH Sub Queries](#)
- [Data Security Predicates Wrapped Inside Redundant Sub-Query](#)
- [Aggregate Functions in Correlated Scalar Sub-query](#)
- [Use XMLTYPE Data Type Instead of CLOB](#)
- [Large Number of UNION \(ALL\) Query Blocks in a Single SQL](#)
- [Function Calls in WHERE Clause Predicates](#)
- [Long CASE Expressions in SELECT and WHERE Clauses](#)
- [Long in IN-LISTS in SQL Clauses](#)
- [Scalar Sub-Queries with DISTINCT Modifier or ROWNUM Keyword](#)
- [Custom PL/SQL Calls in SELECT Clause](#)

### Columns Defined as Literal Constants in Sub-Query Joined Later in Main Query

In cases where you have literal constants defined as columns in a single sub-query and later used in joins in the main query, consider passing them as direct filters instead. Refer to the following example of such usage:

```
(SELECT
  ...
  UPPER('HXT') AS DUMMY
  ...
) V1,
(SELECT
  T2.C2 AS C2
  FROM T2
) V2
WHERE
  V1.DUMMY = V2.C2
...
```

The more efficient SQL design is to pass it directly to the main query:

```
(SELECT
  ...
) V1,
(SELECT
```

```

        T2.C2 AS C2
    FROM T2
) V2
WHERE
    V2.C2 = UPPER('HXT')
...

```

### Redundant Table in LEFT OUTER JOIN

Some of Left Outer Joins (LOJ) may be redundant if you join two tables through LOJ but do not select any attributes from the table on the 'optional' side of the LOJ. Review the following example:

```

SELECT
    b.book_title,
    b.author,
    b.language
FROM
    books b,
    book_languages l
WHERE
    b.language = l.language (+);

```

The table `BOOK_LANGUAGES` is on the optional side of the OUTER join and no columns from it are in the `SELECT` clause. The query above is functionally equivalent (that is, it produces the same exact result set) with both the table and LOJ removed:

```

SELECT
    b.book_title,
    b.author,
    b.language
FROM
    books b;

```

Complex SQL queries with redundant OUTER joined tables may result in additional performance overhead during parse time as well as at run time. The optimizer may be unable to eliminate unused outer joined table as outer joins are usually harder to process than the ordinary inner joins. Make sure you carefully validate your functionality to evaluate the impact from removing such joins and tables in your reports.

### Too Many Join Conditions Between Factored WITH Sub Queries

When you join two factored WITH sub-queries using too many join conditions, the optimizer may estimate low join cardinality for the respective tables and not choose the best execution plan. Refer to the following example, showing the sub-optimal generated SQL pattern as the result of having too many joins between two factored WITH sub-queries:

```

FROM SAWITH1 D1
    FULL OUTER JOIN SAWITH2 D2
    ON SYS_OP_MAP_NONNULL(D1.c3) = SYS_OP_MAP_NONNULL(D2.c3)
    AND SYS_OP_MAP_NONNULL(D1.c5) = SYS_OP_MAP_NONNULL(D2.c5)
    AND SYS_OP_MAP_NONNULL(D1.c12) = SYS_OP_MAP_NONNULL(D2.c12)

```

```

AND SYS_OP_MAP_NONNULL(D1.c14) = SYS_OP_MAP_NONNULL(D2.c14)
AND SYS_OP_MAP_NONNULL(D1.c11) = SYS_OP_MAP_NONNULL(D2.c11)
AND SYS_OP_MAP_NONNULL(D1.c2) = SYS_OP_MAP_NONNULL(D2.c2)
AND SYS_OP_MAP_NONNULL(D1.c13) = SYS_OP_MAP_NONNULL(D2.c13)
AND SYS_OP_MAP_NONNULL(D1.c15) = SYS_OP_MAP_NONNULL(D2.c15)
AND SYS_OP_MAP_NONNULL(D1.c9) = SYS_OP_MAP_NONNULL(D2.c9)
AND SYS_OP_MAP_NONNULL(D1.c10) = SYS_OP_MAP_NONNULL(D2.c10)
AND SYS_OP_MAP_NONNULL(D1.c8) = SYS_OP_MAP_NONNULL(D2.c8)
AND SYS_OP_MAP_NONNULL(D1.c7) = SYS_OP_MAP_NONNULL(D2.c7)
AND SYS_OP_MAP_NONNULL(D1.c18) = SYS_OP_MAP_NONNULL(D2.c18)
AND SYS_OP_MAP_NONNULL(D1.c21) = SYS_OP_MAP_NONNULL(D2.c21)
AND SYS_OP_MAP_NONNULL(D1.c4) = SYS_OP_MAP_NONNULL(D2.c4)
AND SYS_OP_MAP_NONNULL(D1.c6) = SYS_OP_MAP_NONNULL(D2.c6)
AND SYS_OP_MAP_NONNULL(D1.c22) = SYS_OP_MAP_NONNULL(D2.c22)
AND SYS_OP_MAP_NONNULL(D1.c20) = SYS_OP_MAP_NONNULL(D2.c20)
AND SYS_OP_MAP_NONNULL(D1.c16) = SYS_OP_MAP_NONNULL(D2.c16)
AND SYS_OP_MAP_NONNULL(D1.c17) = SYS_OP_MAP_NONNULL(D2.c17)
AND SYS_OP_MAP_NONNULL(D1.c19) = SYS_OP_MAP_NONNULL(D2.c19)

```

Carefully review all the joins in your SQL logic, and keep them to the bare minimum to address the functional requirements.

### Data Security Predicates Wrapped Inside Redundant Sub-Query

Securing data in your reports requires very thorough analysis, and careful coding in your SQL queries. Data Security Predicates (DSP) or security clauses, that you append to ensure secure reporting in your SQLs, could have a performance impact on your SQL execution. For example, if you choose to re-use DSPs from other SQLs that pull in View Object security clauses, you could end up with the pattern described below:

```

(SELECT ...
  FROM T1,
    (SELECT ...
      FROM T2 ...
      WHERE (DSP predicate1) OR (DSP predicate2)
    )
  WHERE ...

```

In this example, table T2 got secured through two DSP predicates in a separate sub-query. As part of the overall optimization process, Oracle optimizer performs recursive optimization of each inline view (sub query) before optimizing the main query. Such a pattern could affect the query parsing time and possibly produce a less efficient execution plan. Consider using a more efficient pattern rewrite:

```

(SELECT ...
  FROM T1,
    T2, ...
  WHERE (DSP predicate1) OR (DSP predicate2))
  ...

```

## Aggregate Functions in Correlated Scalar Sub-query

Aggregate functions such as MAX/MIN/COUNT in scalar subquery can be safely and efficiently replaced by performing alternative rewrites. Refer to the following example:

**--Sub-optimal pattern:**

```
SELECT t1.c1,
       (SELECT MAX(t2.c2) as maxc2
        FROM t2
        WHERE t2.id=t1.id
       ) as c2
FROM t1;
```

**--Optimal pattern:**

```
SELECT t1.c1,
       t2alias.max_c2
FROM t1,
     (SELECT MAX(t2.c2) as max_c2
      T2.id as id
      FROM t2
      GROUP BY t2.id
     ) t2alias
WHERE t2alias.id=t1.id;
```

A scalar sub-query is executed for every row returned by the enclosing query block's row sources (here t1). It means the aggregated MAX is executed as many times as the number of fetched rows in the main query, resulting in slower performance. Moving the aggregated MAX into the FROM clause of the main query will aggregate the data once and speed up the overall query.

### Note:

If the number of rows returned by the enclosing block (here t1) is moderate/low and the scalar sub-query is correlated on a selective indexed column, then the aggregate operation can be kept inside the correlated scalar sub-query.

## Use XMLTYPE Data Type Instead of CLOB

Avoid using CLOB data type for storing XML data. The conversion of CLOB to XML on the fly using XMLTYPE function during report runtime could be very expensive. Instead, consider using XMLTYPE for storing XML documents in the database.

## Large Number of UNION (ALL) Query Blocks in a Single SQL

A single SQL with multiple UNION (or UNION ALL) query blocks should be carefully analyzed to consolidate UNIONS into fewer sub-queries. The excessive use of UNIONS is a strong indicator of logic redundancy and SQL complexity. It results in a much larger SQL statement, which would take much longer to parse and execute in the database, as each UNION query block by default is executed serially, one-by-one.

Forcing `/*+ PARALLEL */` hint would not help to run multiple UNION branches at the same time. The hint `/*+ PQ_CONCURRENT_UNION */` could help with parallel UNION branch executions, but it could result in more database workload, especially if the UNION branches have very expensive tables and no selective filters.

In the most cases, the Union branches may be nearly identical with minor differences such as slightly different filters or different expressions on columns in SELECT lists, and so on. Consider reworking multiple-UNION query into a much simpler shape by factoring out one or two common denominator WITH sub-queries and reusing them as per functional requirements. Such an approach results in much less logical reads, lesser database impact and faster query performance. If the same WITH factored sub-query is called more than once, Oracle would 'materialize' its result set in a temporary segment and use it throughout the SQL.

### Function Calls in WHERE Clause Predicates

Expressions in WHERE clauses employ filter and join expressions to constrain rows from data sources (tables, views, inline views). When the estimated number of rows after filter/join operation using indexed attributes is low, the optimizer will choose an index to directly access the required data blocks. Applying SQL or PL/SQL functions to columns in filter/join expressions disables index usage and reverts table access to full table scan.

Alternatively, if there is a function-based index (FBI) defined, but filter or join expressions do not use the exact function in the join predicates, the optimizer chooses less optional full table scan as well. For example, the PERSON\_NUMBER column in the table PER\_ALL\_PEOPLE\_F is indexed via function-based index (FBI) using UPPER(PERSON\_NUMBER). The appropriate use for PERSON\_NUMBER in WHERE clause will be UPPER(PERSON\_NUMBER). Refer to two separate sections on the recommended use of UPPER and TRUNC in WHERE clauses.

Consider the following example:

```
SELECT * FROM XLA_AE_HEADERS WHERE AE_HEADER_ID = '1511989';
```

There is a unique index defined on the primary key column AE\_HEADER\_ID, that makes access to desired data very fast and efficient through the INDEX RANGE SCAN operation:

```
-----
| Id | Operation                               | Name                | Rows |
Bytes | Cost (%CPU)| Time          |      |
-----
|  0 | SELECT STATEMENT                         |                     |    1 |
215 |      4  (0)| 00:00:01 |      |
|  1 | TABLE ACCESS BY INDEX ROWID BATCHED    | xla_ae_headers      |    1 |
215 |      4  (0)| 00:00:01 |      |
|*  2 | INDEX RANGE SCAN                         | XLA_AE_HEADERS_U1  |    1 |
|      |      3  (0)| 00:00:01 |      |
-----
```

Predicate Information (identified by operation id):

```
-----
2 - access("AE_HEADER_ID"=1511989)
```



When the function TO\_CHAR() is used on AE\_HEADER\_ID column, the plan changes to:

```
SELECT * FROM XLA_AE_HEADERS WHERE TO_CHAR(AE_HEADER_ID) = '1511989';
```

```
-----
| Id | Operation          | Name                | Rows | Bytes | Cost
(%CPU)| Time              |                    |      |      |
-----
|  0 | SELECT STATEMENT   |                    |     1 |   215 | 5788
(1) | 00:00:01          |                    |      |      |
|*  1 | TABLE ACCESS FULL| xla_ae_headers     |     1 |   215 | 5788
(1) | 00:00:01          |                    |      |      |
-----
```

Predicate Information (identified by operation id):

```
-----
1 - filter(TO_CHAR("AE_HEADER_ID")='1511989')
```

There may be valid cases where SQL or PL/SQL functions in WHERE clause are required by functional design. For example, aggregate functions in WHERE clauses (MAX, MIN, COUNT, AVG, ) may be needed for the functional logic. In such cases, ensure you have effective filters on other columns with supporting indexes to ensure optimal performance.

### Long CASE Expressions in SELECT and WHERE Clauses

Complex CASE expressions can affect query performance in multiple ways. CASE expressions found in SELECT list are CPU-intensive operations. CASE expressions in WHERE clause (filter and join predicates) may result in incorrect join cardinality estimate and miscalculating the costs. As a result, sub-optimal join method can be selected causing potentially long run time of the query, increasing probability of **ORA-01555** (snapshot too old) error and significant TEMP tablespace usage by the SQL. Carefully inspect your SQL for any large CASE clauses and explore the options to simplify the logic. Refer to the following sub-optimal and rewritten CASE structures:

**-- Sub-optimal structure:**

```
(CASE WHEN .. THEN
  (CASE WHEN .. THEN
    (CASE WHEN .. THEN
      (...))
    END)
  END)
ELSE ... END)
```

**-- Rewritten optimal structure:**

```
(CASE WHEN ... THEN
  WHEN ... THEN
  WHEN ... THEN
```

```

ELSE ...
END)

```

### Long in IN-LISTS in SQL Clauses

The option to pass more than one value to SQL through bind parameters makes reports very flexible and versatile. However, if the number of passed values is not limited, it could generate a SQL with very large number of IN-LIST values, possibly hitting the internal Oracle limit of maximum 1,000 IN-LIST values (and get ORA-01795 maximum number of expressions in a list is 1000).

The Oracle optimizer converts IN-list expressions into Boolean OR-expressions. For instance, the following expression: COL\_A IN (1, 2, 3) is converted into COL\_A = 1 OR COL\_A = 2 OR COL\_A = 3. Depending on how statistics are collected on a table and its columns, the optimizer may produce incorrect cardinality estimate for that IN-list expression. The more literals are in the IN-LIST, the larger the deviation from the actual cardinality. The incorrect cardinality may cause the optimizer to select less join method. Refer to the following example of long IN-LIST in CASE clause:

```

CASE WHEN dl.c40 NOT IN (
    'CALL',
    'CALL_IB',
    'DEMAND_GENERATION',
    'DEMO',
    'DEMO_IN_PERSON',
    'DISCOVERY',
    'DISCOVERY_PERSON',
    'EMAIL',
    'EMAIL_ELOQUA_ENGAGE',
    'EMAIL_ELOQUA_ENGCAMPAIGN',
    'EMAIL_IB',
    'EMAIL_OUTLOOK',
    'INPERSON_INTRO_MEETING',
    'INPERSON_MEETING',
    'INTRO_MEETING',
    'MANUAL_CALL',
    'MEETING',
    'RESEARCH',
    'SALES_CHAT',
    'SOCIAL_MEDIA',
    'TODO',
    'WORKSHOPS'
) THEN ...

```

Carefully design the parameters and lists of values that get passed to reports to avoid generating long IN-LISTS in the SQL queries. Do not create long checklists and an option to check all, as that would lead to generate such IN-clauses and affect performance. To avoid passing 'all' and causing the performance with long IN-LISTS, select 'NULL Value Passed' when you define the parameters for your data model. Then NULL is passed to the bind variable instead of the long IN-LIST:

**P\_APPLICATION\_ID: Type: Menu**

Display Label

List of Values

Number of Values to Display in List

Options  Multiple Selection

Can select all

NULL Value Passed  All Values Passed

Refresh other parameters on change

### Scalar Sub-Queries with DISTINCT Modifier or ROWNUM Keyword

Scalar sub-query is a SQL query block that is used as a column in a SELECT clause. It is called scalar because it must produce exactly one value (a scalar) to use in the main SELECT. If a sub-query is written in such a way that it returns more than one row, ORA-01427 exception is raised.

A typical usage pattern of scalar sub-queries is to deliver a single column value by joining a table inside the sub-query to an external table using a unique (primary key) column. That guarantees a single scalar value to be returned by such a sub-query.

If a scalar sub-query produces more than one row, either DISTINCT or ROWNUM may get (wrongly) used as workarounds to enforce a single scalar value. Both workarounds could result in incorrect functionality as well as cause performance overhead, as they get applied as the last step to potentially a very large result set produced by the sub-query.

```
SELECT
  mpm.level_member_id,
  archive.archive_id,
  mat.category_name,
  (
    SELECT DISTINCT category_name
    FROM msc_catalog_categories mccl
    WHERE mccl.category_id = mat.parent_category_id
      AND mccl.parent_category_id IS NOT NULL
  ) cgt_category_name,
  ...
```

#### Note:

When you design your SQLs with correlated sub-queries in SELECT, ensure that they use index access path, as they get executed once for every single row. If a sub-query employs a full table scan due to the lack of indexes in join predicate, you end up with as many full table scans as the number of fetched rows in the main sub-queries. In that case, you should rewrite it to use the join logic in WHERE clause instead of SELECT.

### Custom PL/SQL Calls in SELECT Clause

Use of PL/SQL functions in SELECT clauses could lead to slower SQL performance. The optimizer has no methods to merge the code from PL/SQL functions into the main SQL query, so the functions are called as many times as the number of rows fetched by the main query. The PL/SQL complexity multiplied by a number of its executions could become a major performance factor, often overlooked in SQL optimization.

Refer to the following example, showing the use of such function call, with another SELECT wrapped inside, with both the function and the SELECT invoked once for every fetched row from the main SELECT:

```
SELECT ...
  ff_user_tables_pkg.get_table_value(
    (SELECT l_data_grp.legislative_data_group_id
     FROM   per_legislative_data_groups_vl l_data_grp
     WHERE  l_data_grp.name = 'US'),
    'RETIREMENT_ELIGIBILITY',
    'AGE',
    to_char((months_between(sysdate, pp.date_of_birth) / 12)),
    trunc(sysdate)
  ) l_data_grp_pkg_call,
  ....
```

Ensure you review the use of such PL/SQL functions, and if their use is required by the functional logic, apply effective filters to reduce the number of fetched rows and the result number of PL/SQL executions for the SQL.