# Oracle® SQLcl User's Guide





Oracle SQLcl User's Guide, Release 25.1

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## Contents

	eface	
	ience	
	umentation Accessibility	
Con	ventions	
Ch	anges in Release 25.1 for Oracle SQLcl User's Guide	
Us	ing Oracle SQLcl	
2.1	Starting and Leaving SQLcl	2-
2.2	Defining Parameters in SQLcl Scripts Using the ARGUMENT Command	2-
2.3	Starting Up and Shutting Down a Database	2-
2.4	Entering and Executing Commands	2-
2.5	Manipulating SQL, SQLcl, and PL/SQL Commands	2-
2.6	Formatting Query Results	2-1
2.7	Connecting to a Database	2-1
2.8	Loading a File	2-1
	2.8.1 LOAD Command	2-1
	2.8.1.1 SET LOAD Command	2-1
	2.8.1.2 SET LOADFORMAT Command	2-2
2.9	Using the OCI Command for Oracle Cloud Infrastructure REST APIs	2-2
Us	ing Liquibase	
3.1	About Liquibase in SQLcl	3-
3.2	Requirements for Using Liquibase	3-:
3.3	Supported Types	3-
3.4	Supported Liquibase Commands in SQLcl	3-
3.5	Using SQLcl Liquibase Functionality with Open-Source Liquibase	3-
3.6	Dynamic Object Transformation with SQLcl Liquibase and DBMS_METADATA Oracle Database Package	3-1
3.7	Liquibase Open-Source Changesets with SQLcl Liquibase	3-19
3.8	DATABASECHANGELOG_DETAILS VIEW	3-2



3.9 ChangeSets in Liquidase	3-24
3.10 Tips for Liquibase Settings	3-24
3.10.1 How to Exclude Table Properties When Deploying Changelogs to a New Environment	3-25
3.10.2 Create Database Objects in a Schema Different From the Connected Schema	3-28
3.11 Important 23.4 Update with Liquibase Changelog Files	3-30
3.12 Examples Using Liquibase	3-33
3.12.1 Review SQL	3-33
3.12.2 Capture and Deploy an Object	3-33
3.12.3 Capture and Deploy a Schema	3-34
3.12.4 Execute Custom SQL with RunOracleScript	3-34
Database Application CI/CD	
4.1 Introduction	4-1
4.1.1 Supported Objects	4-2
4.1.2 Database CI/CD Concepts	4-3
4.2 About the Project Command	4-9
4.3 Quick Start	4-11
4.3.1 Prerequisites	4-12
4.3.2 Assumptions	4-12
4.3.3 Project Setup	4-13
4.3.4 Ticket-1	4-14
4.3.5 Ticket-2	4-22
4.3.6 Final Steps	4-26
4.3.6.1 Generate Release 1.0.0	4-27
4.3.6.2 Generate an Artifact	4-29
4.3.6.3 Deploy to PROD	4-29
4.4 Examples	4-30
4.4.1 Single Schema	4-30
4.4.2 Administrator Exports HR to Production Schema	4-37
Using Cloud Storage	
5.1 Using DBMS_CLOUD for Authentication	5-1
5.2 Creating the OCI profile for OCI Authentication	5-4
5.3 About the Cloud Storage Command Options	5-4
5.4 Examples	5-5
Using Data Pump	
6.1 Getting Started	6-1
6.1.1 Prerequisites	6-1



	6.1.2	Usage	6-2
	6.2 Data	a Pump Command Syntax and Arguments	6-3
	6.3 Use	Cases	6-11
	6.4 Tips	and Troubleshooting	6-13
7	Using th	he Cloud Premigration Advisor Tool	
	7.1 Ove	rview	7-1
	7.2 Prer	requisites	7-2
	7.3 Abou	ut the MIGRATEADVISOR Command	7-3
	7.4 Exar	mples	7-6
	7.5 Tips	and Troubleshooting	7-7
8	Using th	he PGQL Plug-in	
	8.1 Dow	vnloading and Installing	8-1
	8.2 Abou	ut PGQL Commands	8-1
	8.3 Exar	mples	8-2
9	SQLcl (	Command Reference	
	9.1 AQ (	(Advanced Queuing)	9-1
	9.1.1	Create a Queue Table	9-3
	9.1.2	Alter a Queue Table	9-4
	9.1.3	Drop a Queue Table	9-5
	9.1.4	Create a Queue	9-5
	9.1.5	Alter a Queue	9-6
	9.1.6	Drop a Queue	9-7
	9.1.7	Create a Sharded Queue	9-7
	9.1.8	Alter a Sharded Queue	9-9
	9.1.9	Drop a Sharded Queue	9-10
	9.1.10	Create an Exception Queue	9-10
	9.1.11	Create a Transactional Event Queue	9-11
	9.1.12	Alter a Transactional Event Queue	9-13
	9.1.13	Drop a Transactional Event Queue	9-14
	9.1.14	Create an EQ Exception Queue	9-14
	9.1.15	Start a Queue	9-15
	9.1.16	Stop a Queue	9-15
	9.1.17	Add a Subscriber	9-16
	9.1.18	Alter a Subscriber	9-17
	9.1.19	Remove a Subscriber	9-18
	9.1.20	Enqueue	9-18



	9.1.21	Dequeue	9-20
9.2	AWR		9-24
9.3	BACI	KGROUND	9-24
	9.3.1	Jobs Command	9-25
	9.3	.1.1 Cancel Jobs	9-25
	9.3	.1.2 Log Jobs	9-25
	9.3	.1.3 Delete Jobs	9-26
	9.3.2	Wait4 Command	9-26
9.4	BLO	CKCHAIN_TABLE	9-27
	9.4.1	add_interval_partitioning	9-29
	9.4.2	countersign_row	9-30
	9.4.3	desc	9-32
	9.4.4	delete_expired_rows	9-33
	9.4.5	get_bytes_for_row_hash	9-35
	9.4.6	get_bytes_for_row_signature	9-36
	9.4.7	get_digest	9-38
	9.4.8	get_signed_digest	9-40
	9.4.9	sign_row	9-41
	9.4.10	sign_row_with_countersignature	9-44
	9.4.11	verify_rows	9-47
	9.4.12	verify_table	9-49
	9.4.13	verify_user_chains	9-51
9.5	CER	TIFICATE	9-54
	9.5.1	Add	9-54
	9.5.2	Add_Copy	9-55
	9.5.3	Drop	9-56
	9.5.4	List	9-56
9.6	COD	ESCAN	9-56
9.7	CON	NECT	9-57
	9.7.1	KERBEROS Connection Type	9-58
	9.7.2	NAME Connection Type	9-59
	9.7.3	OCI Connection Type	9-60
	9.7.4	Oracle Connection Type	9-60
	9.7.5	OREST Connection Type	9-61
	9.7.6	RADIUS Connection Type	9-62
	9.7.7	SOCKS Connection Type	9-63
	9.7.8	THIRD Connection Type	9-64
	9.7.9	WALLET Connection Type	9-65
9.8	CON	MGR	9-66
	9.8.1	Clone Connections	9-66
	9.8.2	Import Connections	9-67
	9.8	.2.1 SECRET Command	9-68



9.8.3	List Connections	9-70
9.8.4	Show Connections	9-70
9.8.5	Test Connections	9-70
9.9 DC	G (Data Guard)	9-71
9.10 D	IRS, PUSHD and POPD	9-71
9.11 IN	MMUTABLE_TABLE	9-71
9.11	1 Add Interval Partitioning	9-72
9.11	2 Delete Expired Rows	9-73
9.11	3 Describe Table	9-74
9.12 L	IQUIBASE	9-74
9.12	1 calculate-checksum	9-76
9.12	2 changelog-sync	9-78
9.12	3 changelog-sync-sql	9-79
9.12	4 changelog-sync-to-tag	9-81
9.12	5 changelog-sync-to-tag-sql	9-82
9.12	6 clear-checksums	9-83
9.12	7 data	9-84
9.12	8 db-doc	9-86
9.12	9 diff	9-87
9.12	10 diff-changeLog	9-89
9.12	11 drop-all	9-91
9.12	12 future-rollback-count-sql	9-92
9.12	13 future-rollback-from-tag-sql	9-94
9.12	14 future-rollback-sql	9-95
9.12	15 generate-apex-object	9-96
9.12	16 generate-changelog	9-99
9.12	17 generate-controlfile	9-100
9.12	18 generate-db-object	9-101
9.12	19 generate-ords-module	9-102
9.12	20 generate-ords-schema	9-103
9.12	21 generate-schema	9-104
9.12	22 history	9-106
9.12	23 list-locks	9-107
9.12	24 mark-next-changeset-ran	9-108
9.12	25 mark-next-changeset-ran-sql	9-109
9.12	26 release-locks	9-110
9.12	27 rollback	9-111
9.12	28 rollback-count	9-112
9.12	29 rollback-count-sql	9-114
9.12	30 rollback-sql	9-115
9.12	31 rollback-to-date	9-116
9.12	32 rollback-to-date-sql	9-118



9	.12.33	snapshot	9-120
9	.12.34	status	9-121
9	.12.35	tag	9-122
9	0.12.36	tag-exists	9-123
9	0.12.37	unexpected-changesets	9-124
9	0.12.38	update	9-126
9	.12.39	update-count	9-127
9	.12.40	update-count-sql	9-129
9	.12.41	update-sql	9-130
9	.12.42	update-testing-rollback	9-131
9	0.12.43	update-to-tag	9-132
9	).12.44	update-to-tag-sql	9-134
9	.12.45	validate	9-135
9	.12.46	version	9-136
9.13	MDB		9-137
9.14	MLE		9-138
9	0.14.1	Create Module	9-139
9	0.14.2	Alter Module	9-140
9.15	MOD	ELER	9-141
9.16	PRO	ECT	9-142
9	0.16.1	init	9-143
9	0.16.2	export	9-144
9	0.16.3	config	9-144
9	0.16.4	gen-artifact	9-146
9	0.16.5	deploy	9-146
9	0.16.6	release	9-147
9	0.16.7	verify	9-147
9	0.16.8	stage	9-148
9.17	RES1		9-149
9.18	SDK		9-150
9.19	SET s	system_variable value	9-151
9.20 SHOW option			9-153
9.21	9.21 SODA		

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

### B SQL Performance Troubleshooting



## C Third-Party License Information

C.1	ANTLR4 Java Runtime 4.13.1	C-1
C.2	Apache Mina SSHD-contrib 2.13.2	C-1
C.3	Apache Mina SSHD-osgi 2.13.2	C-19
C.4	Apache Mina SSHD-putty 2.13.2	C-27
C.5	Apache Mina SSHD-scp 2.13.2	C-35
C.6	Apache Mina SSHD-sftp 2.13.2	C-43
C.7	Commons IO 2.16.1	C-48
C.8	Commons Text 1.12.0	C-52
C.9	Eclipse Parsson 1.1.7	C-56
C.10	Google Guava 33.2.1	C-69
C.11	HttpComponentsCore 5.2.4	C-76
C.12	HttpComponents Http Client 5.3.1	C-79
C.13	httpcore5 5.2.4	C-91
C.14	jackson-annotations 2.17.2	C-94
C.15	jackson-core 2.17.2	C-98
C.16	jackson-databind 2.17.2	C-104
C.17	jackson-jr-objects 2.17.2	C-107
C.18	jakarta.json-api 2.1.3	C-111
C.19	JLine 3.26.3	C-129
C.20	Jansi 2.4.1	C-147
C.21	json-base 2.4.3	C-151
C.22	json-flattener 0.16.6	C-154
C.23	liquibase-core 4.25.0	C-170
C.24	OCI SDK for Java 3.57.1	C-175
C.25	org.eclipse.jgit 6.10.0.202406032230-r	C-222
C.26	slf4j-api 2.0.13	C-239
C.27	slf4j-jdk14 2.0.13	C-239
C.28	StringTemplate 4.3.4	C-240
C.29	ucanaccess 5.1.1	C-241



## **Preface**

This guide provides usage information about Oracle SQLcl (SQL Developer Command Line), a Java-based command-line interface for Oracle Database.

### **Audience**

This guide is intended for those using Oracle SQLcl.

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### Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.



1

## Changes in Release 25.1 for *Oracle SQLcl User's Guide*

The new features in this release are:

 New SDK command for installing Azure and OCI SDKs See SDK



## 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 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, 17 or 21. 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:. Check the Java version using the java -version command.
- 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.
- JavaScript is not included with Oracle Java 14 and later versions. It is recommended to download and install GraalVM, and then install JavaScript on GraalVM by using the command gu install js (see Getting Started with GraalVM JavaScript).

#### This chapter contains the following topics:

- Starting and Leaving SQLcl
- Starting Up and Shutting Down a Database
- Entering and Executing Commands
- Manipulating SQL, SQLcl, and PL/SQL Commands
- Defining Parameters in SQLcl Scripts Using the ARGUMENT Command
- Formatting Query Results
- Connecting to a Database
- Loading a File

Using the OCI Command for Oracle Cloud Infrastructure REST APIs

## 2.1 Starting and Leaving SQLcl



#### Startup and Login Scripts

When you start SQLcI, it looks for a startup.sql script. This script is run only once during the program's runtime.

For every connection, SQLcl looks for a login.sql file. This file is run for every connection created.

The Show Login command displays the location of the login.sql file and verifies whether the file exists or not.

#### **Logging In and Logging Out**

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

```
SQL [[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]]
```

where logon has the following syntax:

```
 \{username [/password] \ [@connect\_identifier] \ | \ / \} \ [AS \ \{SYSASM \ | SYSBACKUP \ | SYSDBA \ | SYSDG \ | 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.

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 estß 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\t 25 15:57:21 2020
Copyright (c) 1982, 2020, Oracle. Tous droits r0serv0s....
```

## 2.2 Defining Parameters in SQLcl Scripts Using the ARGUMENT Command

The Argument command enables you to define SQL\*Plus parameters that are passed to SQLcl scripts. This command adds a DEFINE for the parameter if the parameter does not exist.

Parameters are passed by position to scripts where they are assigned a number starting with one for each position. Therefore, to supply a value for parameter 1, use argument 1 [options]; for parameter 2, use argument 2 [options], and so on. See Passing Parameters through the START Command in the *Oracle SOL\*Plus User's Guide* for more information.

#### **Syntax**

```
argument|arg OPTIONS
```

Use the SET PARAMETERPOLICY command to control parameter retention. The parameter retention applies to all parameters whether defined using this command or not.

When SET PARAMETERPOLICY is SHARE (default), defined variables retain their values until you:

- Enter a new DEFINE command referencing the variable.
- Enter an UNDEFINE command referencing the variable.
- Enter an ACCEPT command referencing the variable.



- Reference the variable in the NEW\_VALUE or OLD\_VALUE clause of a COLUMN command and then reference the column in a SELECT command.
- · Exit SQLcl.

When SET PARAMETERPOLICY is ISOLATE:

- Parameter settings are saved and undefined at the start of the script.
- On return from the script, the saved parameters are restored.
- Parameter settings in called scripts do not affect the containing script.

The SET PARAMETERPOLICY command must be specified before the script is called. If SET PARAMETERPOLICY is set to ISOLATE within a script, parameters are removed on return. Parameters cannot be reset as the values were not saved at the start of the script.

#### **Options**

Option	Description	
Required		
arg_num	The position of the parameter relative to 1.	
<pre>action {default prompt}</pre>	The argument action to take when a parameter is not already defined.	
	prompt: Prompts the user for the parameter value and sets it.	
	<ul> <li>default: Sets the default value.</li> </ul>	
action_value	The value to specify for the parameter or the string for prompting the user for the value. Values containing spaces must be enclosed in double quotes.	
Optional		
<pre>comment {comment}</pre>	Associate a comment with the parameter.	
	{comment} - Associate the comment value specified with the parameter.	
comment_value	The comment to associate with the parameter. Values containing spaces must be enclosed in double quotes.	

#### **Examples**

Example 1 - The following example uses the ARGUMENT command to define two parameters in a script (script.sql).

```
script.sql:
prompt 'Give value for 1 or prompt for it: &1'
prompt 'Give value for 99 or prompt for it: &99'

Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0
SQL> arg 99 default 99_set
/* 99 shared with script.sql */

SQL> @script.sql
Enter value for 1: x
'Give value for 1 or prompt for it: x'
'Give value for 99 or prompt for it: 99_set'
SQL> exit
```



```
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0
```

Example 2 - The following example illustrates how the SET PARAMETERPOLICY ISOLATE is used to redefine parameters every time the script is called.

```
SQL> set parameterpolicy isolate
SQL> arg 99 default 99_set
/* 99 is not passed to the script, so prompted for */

SQL> @script.sql
Enter value for 1: x2
'Give value for 1 or prompt for it: x2'
Enter value for 99: x99
'Give value for 99 or prompt for it: x99'
/* 99 restored - set back to the original value when script.sql finishes */

SQL> define 99
DEFINE 99 = "99_set" (CHAR)
```

## 2.3 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.

## 2.4 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.



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.

## 2.5 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. <code>Inline</code> 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 SOLcl 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 | 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 | 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.

## 2.6 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 WRAPPED] | TRU[NCATED]
```

#### **Note:**

Currently only NEW V[ALUE] variable syntax is supported.

Enter COLUMN [ $\{column \mid expr\}$  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.
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.



Element	Examples	Description
В	В9999	Displays blanks for the integer part of a fixed-point number when the integer part is zero, regardless of zeros in the format model.
С	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	9999МІ	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.</angle>
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.

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)



Function	Computes	Applies to Datatypes
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, .1st or .1is, 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
```

## 2.7 Connecting to a Database

Use the CONNECT command to connect to a database.

The options specified automatically determine the kind of connection required, such as whether it is a traditional client-server connection or a wallet-based cloud connection. You can override this by using options that specify a particular connection type. For example, specify - wallet to use the wallet connection type.

The connection types supported in SQLcl are:

KERBEROS

- NAME
- OCI
- ORACLE
- OREST
- RADIUS
- SOCKS
- THIRD
- WALLET

For more information, see the CONNECT command.

Persistent connections can be managed with the CONMGR command. Persistent connections are referenced by a connection name. Connections may store a user name. If a user name is stored, a password may also be stored. Passwords are stored in a secure wallet. If a password is not stored, it is provided when prompted to create the connection. A stored connection may describe a connection in a variety of formats, including basic host name, port and service name values or a TNS name and a cloud configuration.

To add a stored connection, see NAME Connection Type.

To save a stored connection, see the options -save, -savepwd, and -replace in CONNECT.

For more information about the command, see CONMGR.

## 2.8 Loading a File

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

#### 2.8.1 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

#### 2.8.1.1 SET LOAD Command

SET LOAD enables you to set options for loading data when using the LOAD command.

#### **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 <code>CLEAN\_NAMES</code> and <code>MAP\_COLUMN\_NAMES</code> 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 | MAX I MUM 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.

 ${\tt OFF}$ : Allows the load to proceed when columns in the file do not map to a column in the table.

#### 2.8.1.2 SET LOADFORMAT Command

SET LOADFORMAT enables you to set format properties for loading data when using the LOAD command.



#### **Syntax**

SET LOADFORMAT [ default|csv|delimited|html|insert|json|json-formatted|loader|
t2|xml] [options...]

#### where

- default: Load format properties return to default values.
- csv: Comma-separated values.
- delimited: (csv synonym) Delimited format, comma separated values by default.
- html: Hypertext Markup Language. For the UNLOAD command only.
- insert: SQL insert statements. For the UNLOAD command only.
- json: JavaScript Object Notation. For the UNLOAD command only.
- json-formatted: Pretty-formatted JSON. For the UNLOAD command only.
- loader: Oracle SQL Loader format. For the UNLOAD command only.
- t2: T2 Metrics. For the UNLOAD command only.
- xml: Extensible Markup Language. For the UNLOAD command only.

#### options represent the following clauses:

- COLUMN NAMES | COLUMNNAMES | NAMES | ON | OFF | Header row with column names.
- DELIMITER {separator}: Delimiter separating fields in the record.
- DOUBLE [OFF]: (Import only) Embedded right enclosures are doubled. OFF indicates embedded right enclosures are not doubled and embedded right enclosures can lead to unexpected results.
- ENCLOSURES {enclosures|OFF}: Optional left and right enclosures.
  - OFF indicates no enclosures
  - If 1 character is specified, sets left and right enclosures to this value.
  - If 2 or more characters are specified, sets left to the first character, right to the second character and ignores the remaining characters.
  - To set multiple character enclosures, use Set ENCLOSURE\_LEFT and ENCLOSURE\_RIGHT.
- ENCODING {encoding|OFF|""}: Encoding of load file. OFF and "" reset to default encoding for environment.
- LEFT|ENCLOSURE\_LEFT|ENCLOSURELEFT {enclosure|OFF}: Set a 1 or more character left enclosure. If no ENCLOSURE\_RIGHT is specified, it is used for both left and right. OFF indicates no enclosures.
- RIGHT|ENCLOSURE\_RIGHT|ENCLOSURERIGHT {enclosure|OFF}: Set a 1 or more character right enclosure. OFF indicates no right enclosure.
- ROW\_LIMIT|ROWLIMIT|LIMIT} {number\_of\_rows|OFF|""}: Maximum number of rows to read, including the header. OFF and "" set to not limit.
- SKIP|SKIP ROWS|SKIPROWS {number of rows|OFF|""}: Number of rows to skip.



- [[SKIP\_AFTER\_NAMES|SKIPAFTERNAMES|AFTER]|[SKIP\_BEFORE\_NAMES|SKIPBEFORENAMES|BEFORE]]: Skip the rows before or after the (header) Column Names row.
- TERM|ROW\_TERMINATOR {terminator|""|DEFAULT|CR|CRLF|LF}: Character(s) indicating end of row. If the file contains standard line end characters, the line\_end does not need to be specified.
  - "" or DEFAULT specifies the default (any standard terminator) for the LOAD command.
  - "" or DEFAULT specifies the environment default for the UNLOAD command.
  - CRLF specifies WINDOWS terminator, generally for the UNLOAD command.
  - LF specifies UNIX terminator, generally for the UNLOAD command.
  - CR specifies MAC terminator, generally for the UNLOAD command.

#### **Examples**

```
SQL> set loadformat delimited
7369, "SMITH", "CLERK", 7902, 17-DEC-80, 800,, 20, 5555555555554444

SQL> set loadformat delimited enclosures <> line_end {eol}
7369, <SMITH>, <CLERK>, 7902, 17-DEC-80, 800,, 20, 555555555555554444 {eol}

SQL> set loadformat default (restore default settings)
7369, "SMITH", "CLERK", 7902, 17-DEC-80, 800,, 20, 55555555555554444
```

## 2.9 Using the OCI Command for Oracle Cloud Infrastructure REST APIs

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



From SQLcl release 23.3, if you have a DEFAULT OCI profile installed, it is loaded when starting SQLcl.

#### **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 objects
torage.us-ashburn-1.oraclecloud.com/n/abc123/b/testing-bucket oci get /o/emp.cs
v
```



## **Using Liquibase**

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
- · Using SQLcl Liquibase Functionality with Open-Source Liquibase
- Dynamic Object Transformation with SQLcl Liquibase and DBMS\_METADATA Oracle
   Database Package
- Liquibase Open-Source Changesets with SQLcl Liquibase
- DATABASECHANGELOG\_DETAILS VIEW
- ChangeSets in Liquibase
- Tips for Liquibase Settings
- Important 23.4 Update with Liquibase Changelog Files
- 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.



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

## 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 with the Liquibase plug-in available.

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 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:

- the extension installed in your Liquibase environment. Add the following jar files from sqlcl/lib and sqlcl/lib/ext folders to the liquibase/lib folder:
  - \* dbtools-liquibase.jar
  - \* dbtools-apex.jar
  - \* quava-with-lf.jar
  - \* xmlparserv2 sans jaxp services.jar
  - \* dbtools-common.jar
- the privileges to create a table and a package.

The minimum privileges required when using Liquibase in SQLcl are:

- \* create session
- \* create table
- \* create procedure
- \* quota unlimited on [default tablespace], where quota is set as required in your database administration.



to update your properties file by adding the following line:

```
change-exec-listener-class:
liquibase.changelog.visitor.OracleActionChangeListener
```

## 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\_INTITIAL\_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 SQLcI with liquibase or lb.

The SQLcl Liquibase commands that were initially launched in SQLcl release 19.2 has deprecated. The SQLcl plug-in has been updated to synchronize with the new command format introduced by Liquibase.

### **Syntax**

Liquibase|lb COMMAND {OPTIONS}

To see the help for Liquibase in SQLcl, type:

help Liquibase

To only view the examples in help, type:

help liquibase examples

For more information about the SQLcl Liquibase commands, see LIQUIBASE.

# 3.5 Using SQLcl Liquibase Functionality with Open-Source Liquibase

SQLcl Liquibase with Oracle Database provides extended functionality to the Liquibase experience compared to the vanilla Liquibase client. This includes dynamically altering tables using Liquibase and SQLcl-exclusive Liquibase commands, such as generating specialized snapshots for:

- A comprehensive schema (generate-schema)
- Oracle REST Data Service (ORDS) objects (generate-ords-module and generate-ordsschema)
- Oracle APEX objects (generate-apex)

By default, the Liquibase client does not include this enhanced functionality or enable you to read the specialized changelogs generated by SQLcl Liquibase.

You can add the functionality to read these specialized changelogs to the Liquibase client by copying certain jar files from SQLcl and updating your Liquibase properties file. The steps to do this are demonstrated using the following example:

1. Connect to your Oracle Database and start the SQLcl command-line interface. The example database has a few sample tables that you can view.

```
SQL> select table name from user tables;
```

TABLE NAME

REGIONS
LOCATIONS
DEPARTMENTS
JOBS
EMPLOYEES
JOB\_HISTORY
COUNTRIES

7 rows selected.



2. Create a table Fruits. This will serve as an example table to track.

```
SQL> create table fruits (id number(1,0), type varchar2(50), price number, constraint fruits_pk primary key (id));
```

Table FRUITS created.

The table is added to the list of sample tables.

```
SQL> select table_name from user_tables;
```

TABLE NAME

REGIONS
LOCATIONS
DEPARTMENTS
JOBS
EMPLOYEES
JOB\_HISTORY
FRUITS

COUNTRIES

8 rows selected.

7 rows selected.

3. Generate a changelog for the Fruits table.

```
SQL> 1b generate-object -object-type table -object-name fruits;
--Starting Liquibase at 13:43:52 (version 4.15.0 #0 built at 2022-08-19 14:45+000)

Changelog created and written to file fruits_table.xml

Operation completed successfully.
```

**4.** Delete the Fruits table so that you can run some tests generating it with the changelog created.

```
SQL> drop table fruits;

SQL> select table_name from user_tables;

TABLE_NAME
________
REGIONS
LOCATIONS
DEPARTMENTS
JOBS
EMPLOYEES
JOB_HISTORY
COUNTRIES
```



- 5. Switch to the vanilla Liquibase open-source command line client, which you can download from Liquibase's website.
- 6. You must provide the credentials of the Oracle Database that you are connected to in SQLcI for the vanilla Liquibase client. Create a liquibase.properties file from a blank text file. In this example, the liquibase.properties file is created in C:\Users\
  [username] folder on a Windows system. The following figure shows the properties file used in this example. For more information about providing database credentials for Liquibase, see Specifying Properties in a Connection Profile.

```
Iiquibase.properties - Notepad

File Edit Format View Help

changelog-file: example-changelog.xml

driver: oracle.jdbc.OracleDriver

username:

password:

url: jdbc:oracle:thin:@

liquibase.hub.mode=off
```

- 7. Copy and paste the <code>fruits\_table.xml</code> changelog file created earlier from your SQLcl bin folder to the folder location of your <code>liquibase.properties</code> file (in this case, C:\Users\ [username]). To keep your changelog files in a different location, specify the path to the file location in the changelog-file field of your <code>liquibase.properties</code> file.
- 8. Run the update command.

>liquibase --changelog-file=fruits table.xml update

```
>liquibase --changelog-file=fruits_table.xml update
##
                                                           ##
##
                                                           ##
                                                           ##
                                                           ##
                                                           ##
    Get documentation at docs.liquibase.com
    Get certified courses at learn.liquibase.com
                                                           ##
    Free schema change activity reports at https://hub.liquibase.com
                                                           ##
                                                           ##
______
Starting Liquibase at 15:27:36 (version 4.15.0 #4001 built at 2022-08-05 16:17+0000)
Liquibase Version: 4.15.0
Liquibase Community 4.15.0 by Liquibase
Unexpected error running Liquibase: Error parsing fruits_table.xml: Unknown change type 'createSxmlObject'
Check for spelling or capitalization errors and missing extensions such as liquibase-commercial.
 or more information, please use the --log-level flag
 :\Users\
```

The update fails because the SQLcl specialized changelog is an unsupported format in the vanilla Liquibase client.

The next step is to add the functionality to read the changelogs of your SQLcl Liquibase in your vanilla Liquibase client so that you can run the changelog.

- 9. Copy five jar files from the lib and lib/ext folders in your SQLcl folder and add them to the lib folder of your vanilla Liquibase client (liquibase/lib):
  - dbtools-liquibase.jar(sqlcl/lib/ext)
  - dbtools-apex.jar (sqlcl/lib/ext)
  - guava-with-lf.jar(sqlcl/lib)
  - xmlparserv2\_sans\_jaxp\_services.jar(sqlcl/lib)
  - dbtools-common.jar(sqlcl/lib)
- 10. Update your liquibase.properties file by adding the following line:

```
change-exec-listener-class:
liquibase.changelog.visitor.OracleActionChangeListener
```



You can now read SQLcl Liquibase changelogs in your vanilla Liquibase client.

11. Run the SQL Liquibase changelog in the vanilla Liquibase client.

>liquibase update --changelog-file fruits table.xml



```
>liquibase update --changelog-file fruits_table.xml
:\Users\
##
                                              ##
##
                                              ##
##
                                              ##
##
                                              ##
##
                                              ##
##
                                              ##
                                              ##
##
                                              ##
##
                                              ##
  Get documentation at docs.liquibase.com
                                              ##
  Get certified courses at learn.liquibase.com
                                              ##
  Free schema change activity reports at
                                              ##
##
      https://hub.liquibase.com
                                              ##
                                              ##
Starting Liquibase at 09:43:37 (version 4.15.0 #4001 built at 2022-08-05 16:17+0000)
Liquibase Version: 4.15.0
liquibase Community 4.15.0 by Liquibase
Running Changeset: fruits_table.xml::bb9e607c0432c87da2173ad3d5657029804a616e::(HR)-Generated
Table "HR"."FRUITS" created.
iquibase command 'update' was executed successfully.
:\Users\
```

In another command-line window connected to SQL and your database, you can check if the table has been successfully created.

```
SQL> select table_name from user_tables;

TABLE_NAME
_____
REGIONS
LOCATIONS
DEPARTMENTS
JOBS
EMPLOYEES
JOB_HISTORY
COUNTRIES
DATABASECHANGELOGLOCK
DATABASECHANGELOG
FRUITS
COUNTRIES

10 rows selected.
```

With this functionality added to your vanilla Liquibase client, you can also read changelogs for other changelog types such as Oracle Rest Data Services (ORDS), Oracle APEX, and full database schemas along with Oracle SQLcl scripts.



```
>liquibase update --changelog-file controller.xml
##
                                                                              ##
                                                                              ##
                                                                              ##
     Get documentation at docs.liquibase.com
Get certified courses at learn.liquibase.com
                                                                              ##
                                                                              ##
     Free schema change activity reports at https://hub.liquibase.com
                                                                              ##
                                                                              ##
                                                                              ##
 ...............
Starting Liquibase at 07:27:00 (version 4.15.0 #4001 built at 2022-08-05 16:17+0000)
 iquibase Version: 4.15.0
 iquibase Community 4.15.0 by Liquibase
 Running Changeset: departments_seq_sequence.xml::93020a4f5c3fc570029b0695d52763142b6e44e1::(HR)-Generated
Statement executed successfully
Running Changeset: employees_seq_sequence.xml::42e3db1348e500dade36829bab3b7f5343ad6f09::(HR)-Generated Statement executed successfully
Statement executed successfully
Running Changeset: locations_seq_sequence.xml::7ec49fad51eb8c0b53fa0128bf6ef2d3fee25d35::(HR)-Generated
Statement executed successfully
Running Changeset: departments_table.xml::62926485197be515dcecdf2174bca09c4331d020::(HR)-Generated
Table "HR"."DEPARTMENTS" altered.
Running Changeset: employees_table.xml::14662f7d19c2e2d74bd735e31b78b79cf20ee0f6::(HR)-Generated Table "HR"."EMPLOYEES" altered.
Table "HR"."EMPLOYEES" altered.
Table "HR"."EMPLOYEES" altered.
Table "HR"."EMPLOYEES" altered.
```

# 3.6 Dynamic Object Transformation with SQLcl Liquibase and DBMS METADATA Oracle Database Package

Oracle supplies many packages, which are automatically installed with Oracle Database, that extend database functionality. One of these packages, <code>DBMS\_METADATA</code>, provides a way to retrieve metadata from the database dictionary as XML or SQL Data Definition Language (DDL) statements, and to submit the XML to recreate the object.

Oracle SQLcl Liquibase uses the DBMS\_METADATA package to generate and execute specialized changelogs that transform the state of the database objects dynamically. This is a feature not available in the Liquibase open-source client. By using SQLcl-exclusive Liquibase commands such as <code>generate-schema</code>, a complete Oracle database schema can be updated. This includes altering tables and other objects already present according to the changelog's specification. In open-source Liquibase, if the <code>update</code> command is run for a changelog mentioning a table that is pre-existing, it will fail. This is because open-source Liquibase is incapable of altering pre-exising objects.

SQLcl Liquibase's specialized changelogs generated from commands such as <code>generate-schema</code> and <code>generate-object</code> use the SXML data format from the <code>DBMS\_METADATA</code> package to execute these dynamic updates. SXML is an XML representation of object metadata that looks like a direct translation of SQL DDL into XML.

This section demonstrates this concept using a few examples. For these example, a Windows-based operating system is used.

### **Example 1**



Connect to an Oracle database with SQLcl release 22.3. The one featured in this example includes a few sample tables. The tables that are going to be used for this example are employees and departments.

```
SQL> select table_name from user_tables;

TABLE_NAME
______
REGIONS
LOCATIONS
DEPARTMENTS
JOBS
EMPLOYEES
JOB_HISTORY
HIRE_DATE
PERSON_COLLECTION
COUNTRIES
```

1. Generate a schema of the database state using SQLcl Liquibase.

```
SQL> 1b generate-schema
```

9 rows selected.

```
SQL> lb generate-schema
 -Starting Liquibase at 15:59:29 (version 4.15.0 #0 built at 2022-08-19 14:45+0000)
Export Flags Used:
Export Grants
                          false
Export Synonyms
                          false
[Method loadCaptureTable]:
        [Type - TYPE_SPEC]:
                                                       451 ms
         [Type - TYPE_BODY]:
                                                       247 ms
         [Type - SEQUENCE]:
                                                       205 ms
         [Type - DIRECTORY]:
[Type - CLUSTER]:
                                                       112 ms
                                                      1473 ms
         [Type - TABLE]:
                                                     25672 ms
```

 Switching over to another command-line window, use the open-source Liquibase client to generate a changelog of the database state. Because generate-schema is a SQLclexclusive command that uses extended functionality, the open-source Liquibase client must use the generate-changelog command.



You can download the open-source Liquibase client from the Liquibase website.

```
>liquibase --changelog-file=sql test.xml generate-changelog
```



```
:\Users\_____>liquibase --changelog-file=sql_test.xml generate-changelog
                                                               ##
                                                               ##
                                                                ##
                                                                ##
                                                                ##
                                                                ##
   Get documentation at docs.liquibase.com
Get certified courses at learn.liquibase.com
Free schema change activity reports at
                                                                ##
                                                               ##
                                                                ##
        https://hub.liquibase.com
                                                                ##
tarting Liquibase at 17:01:32 (version 4.15.0 #4001 built at 2022-08-05 16:17+0000)
iquibase Version: 4.15.0
iquibase Community 4.15.0 by Liquibase
EST PRACTICE: The changelog generated by diffChangeLog/generateChangeLog should be inspected for correctness and comple
Geness before being deployed. Some database objects and their dependencies cannot be represented automatically, and they
```

The database state is now captured in both SQLcl Liquibase and the open-source Liquibase client.

3. In the SQLcl command-line window, make a few changes to the database.

```
SQL>alter table employees add height number;
Table EMPLOYEES altered.

SQL>alter table employees add mood varchar2(50);
Table EMPLOYEES altered.

SQL>alter table departments add happiness varchar2(50);
Table DEPARTMENTS altered.
```

View these column additions in the database.

```
SQL> select * from departments;
SQL> select * from employees;
```



QL> select * fr	om departments;		
DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID HAPPINESS
10	Administration	200	1700
20	Marketing	201	1800
30	Purchasing	114	1700
40	Human Resources	203	2400
50	Shipping	121	1500
60	IT	103	1400
70	Public Relations	204	2700
80	Sales	145	2500

PLOYEE_ID FIRST_NAME	LAST_NAME	EMAIL	PHONE_NUMBER	HIRE_DATE	JOB_ID	SALARY	COMMISSION_PCT	MANAGER_ID	DEPARTMENT_ID	HEIGHT MOOD
198 Donald	OConnel1	DOCONNEL	650.507.9833	21-JUN-99	SH_CLERK	2600		124	50	
199 Douglas	Grant	DGRANT	650.507.9844	13-JAN-00	SH_CLERK	2600		124		
200 Jennifer	Whalen	JWHALEN	515.123.4444	17-SEP-87	AD_ASST	4488		101		
201 Michael	Hartstein	MHARTSTE	515.123.5555	17-FEB-96	MK MAN	13000		100		
202 Pat	Fay	PFAY	603.123.6666	17-AUG-97	MK_REP	6000		201	20	
203 Susan	Mavris	SMAVRIS	515.123.7777	07-JUN-94	HR_REP	6500		101		
204 Hermann	Baer	HBAER	515.123.8888	97-JUN-94	PR_REP	10000		101		
205 Shelley	Higgins	SHIGGINS	515.123.8080	97-JUN-94	AC_MGR	12000		101	110	
206 William	Gietz	WGIETZ	515.123.8181	97-JUN-94	AC_ACCOUNT	8300		285		
100 Steven	King	SKING	515.123.4567	17-JUN-87	AD_PRES	24000			90	
101 Neena	Kochhan	NKOCHHAR	515.123.4568	21-SEP-89	AD_VP	17000		100	90	
102 Lex	De Haan	LDEHAAN	515.123.4569	13-JAN-93	AD_VP	17000		100	90	
103 Alexander	Hunold	AHUNOLD	590.423.4567	03-JAN-90	IT_PROG	9000		102	60	
104 Bruce	Ernst	BERNST	590.423.4568	21-MAY-91	IT PROG	6000			60	

4. You need to use the Liquibase update command to alter the database to the state of the changelogs. This is the database state where employees and departments tables do not have the extra columns added.

To do that, in the command-line window **not** connected to SQLcl and that was used for running the open-source Liquibase client commands, enter the following command:

```
>liquibase --changelog-file=sql_test.xml update
```



The update command fails because Liquibase encounters objects already existing in the database such as the tables. This standard version of Liquibase does not handle these objects dynamically.

5. In the SQLcl command-line window, the same step is repeated with SQLcl Liquibase.

First, examine the SQL that is used to complete the schema update using the update-sql command.

SQL>lb update-sql -changelog-file controller.xml

Examining the output, you see that departments and employees tables are recognized and that you need to drop the extra columns that you created to return to the state in the changelog.

```
-- Changeset departments_table.xml::18f3f88289eddcfc2b16fdae44a17169f8fe0d3f::(HR)-Generated ALTER TABLE "HR"."DEPARTMENTS" DROP ("HAPPINESS")

-- Changeset employees_table.xml::3679094045b7965245949695613df9351c236f3e::(HR)-Generated ALTER TABLE "HR"."EMPLOYEES" DROP ("HEIGHT")

/ ALTER TABLE "HR"."EMPLOYEES" DROP ("MOOD")
```

In actual use cases that are more complicated, there can often be risks involved with the SQL drop command. Examining the SQL code using the update-sql command is beneficial for review. Any manual changes can then be made to the changesets and checked as needed.

When you run the update command, the schema is successfully updated and the columns are dropped.

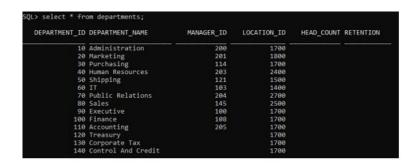
```
SQL> lb update -changelog-file controller.xml
--Starting Liquibase at 68:23:55 (version xml 4.15.0 #0 built at
2022-08-19 14:45+0000)
-- Loaded 38 change(s)
```

### **Example 2**

This example also explains the same concept, this time adding columns and a table.

For this example, in the database, a table Activities has been previously created along with columns Head\_Count and Retention in the departments table and Awards in the employees table.







Changelogs are generated and the Activities table and Head\_count, Retention, and columns are deleted so as to showcase using Liquibase to create them.

Generate the schema in SQLcl.



Move the changelogs from the previous example to a separate folder to avoid issues.

```
SQL> lb generate-schema --Starting Liquibase at 09:33:52 (version 4.15.0 #0 built at 2022-08-19 14:45+0000)
```

2. Switching over to another command-line window to execute commands in the open-source Liquibase client, here also generate a changelog:

>liquibase --changelog-file=sql test2.xml generate-changelog

3. In the SQLcl command-line window, delete the Activities table and Head\_count, Retention, and Awards columns, so that their creation can be demonstrated with the update command.

```
SQL> drop table activities;
Table ACTIVITIES dropped.

SQL> alter table employees drop column awards;
Table EMPLOYEES altered.

SQL> alter table departments drop column head_count;
Table DEPARTMENTS altered.

SQL> alter table departments drop column retention;
Table DEPARTMENTS altered.
```

- 4. In the open-source Liquibase command-line window, run the update command.
  - > liquibase --changelog-file=sql test2.xml update

The update fails when Liquibase encounters pre-existing objects.

5. In the SQLcl command-line window, generate the SQL to examine, then run the update with SQLcl Liquibase .

```
SQL>lb update-sql -changelog-file controller.xml
```

Looking at the SQL output, you can see sections involving the creation of the Activities table and SQLcl Liquibase generating the SQL statements to alter the Departments and Employees table to add the columns.

**6.** Run the update to see that the table and columns are added.

```
SQL> lb update -changelog-file controller.xml
```



```
SQL> 1b update -changelog-file controller.xml
--Starting Liquibase at 10:05:17 (version 4.15.0 #0 built at 2022-08-19 14:45+0000)
-- Loaded 37 change(s)
Running Changeset: departments_seq_sequence.xml::93020a4f5c3fc570029b0695d52763142b6e44e1::(HR)-Generated Statement executed successfully
Running Changeset: employees_seq_sequence.xml::42e3db1348e500dade36829bab3b7f5343ad6f09::(HR)-Generated Statement executed successfully
Running Changeset: locations_seq_sequence.xml::7ec49fad51eb8c0b53fa0128bf6ef2d3fee25d35::(HR)-Generated Statement executed successfully
Running Changeset: departments_table.xml::62926485197be515dcecdf2174bca09c4331d020::(HR)-Generated Table "HR"."DEPARTMENTS" altered.
Table "HR"."DEPARTMENTS" altered.
Table "HR"."DEPARTMENTS" altered.
Table "HR"."DEPARTMENTS" altered.
Running Changeset: employees_table.xml::14662f7d19c2e2d74bd735e31b78b79cf20ee0f6::(HR)-Generated Table "HR"."EMPLOYEES" altered.
Table "HR"."EMPLOYEES" altered.
Table "HR"."EMPLOYEES" altered.
Table "HR"."EMPLOYEES" altered.
Running Changeset: regions_table.xml::52334f421d935229140b0468d06157dd45c20f96::(HR)-Generated Statement executed successfully
Running Changeset: jobs_table.xml::84d6c14a5af0d22812c689a42e58e6c0cf300c1e::(HR)-Generated Statement executed successfully
Running Changeset: activities_table.xml::34941c2352f1cad12cd6e4eadfbd4fc9d1d438d6::(HR)-Generated Table "HR"."ACTIVITIES" created.
Running Changeset: countries_table.xml::43c08b308b52ef60fc8e8f42f33ebda679f18323::(HR)-Generated Statement executed successfully
```

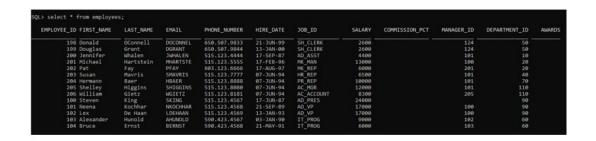
```
SQL>select table_name from user_tables;
SQL>select * from employees;
SQL>select * from departments;

SQL> select table_name from user_tables;

TABLE_NAME
________
REGIONS
LOCATIONS
DEPARTMENTS
JOBS
EMPLOYEES
JOB_HISTORY
DATABASECHANGELOG_ACTIONS
DATABASECHANGELOG
ACTIVITIES
COUNTRIES
```

11 rows selected.





DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID	HEAD_COUNT	RETENTION
10	Administration	200	1700		
20	Marketing	201	1800		
30	Purchasing	114	1700		
40	Human Resources	203	2400		
50	Shipping	121	1500		
60	IT	103	1400		
70	Public Relations	204	2700		
80	Sales	145	2500		
90	Executive	100	1700		
100	Finance	108	1700		
110	Accounting	205	1700		
120	Treasury		1700		
	Corporate Tax		1700		
140	Control And Credit		1700		

## 3.7 Liquibase Open-Source Changesets with SQLcl Liquibase

You can use changesets generated in the open-source Liquibase solution with SQLcl Liquibase. This enables you to carry over previous change management projects to SQLcl to optimize them with your Oracle Database.

The following example demonstrates this using the H2 database available in the open-source download of Liquibase and SQLcl Liquibase:

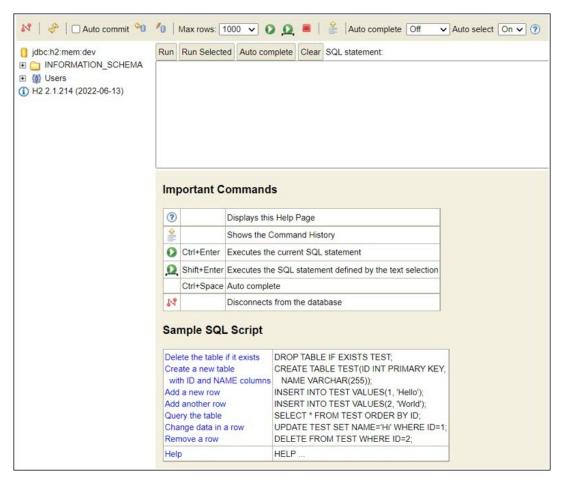
1. Download the open-source Liquibase client available on the Liquibase website. In your command-line interface, create a project folder and example H2 database with the following command:

>liquibase init project

### Start your H2 database:

>liquibase init start-h2

This also launches the database console of the empty H2 database in your browser.



In the browser console, create a sample table using the following command and click Run:

>create table pets (id int, name varchar(256), breed varchar(256), Primary Key (id));



4. Capture this schema consisting of the Pets table with a Liquibase changelog.

Open a new command-line window and generate the changelog:

>liquibase --changelog-file=examplepets.xml generate-changelog

Name the changelog file as examplepets.xml.

The output shows where the file is saved.

5. Connect to your Oracle Database from the SQLcl 22.3 bin location.

You can view the tables in your database with the following command. The example database shows a few sample tables.

```
SQL> select table_name from user_tables;

TABLE_NAME
_____
REGIONS
LOCATIONS
DEPARTMENTS
JOBS
EMPLOYEES
JOB_HISTORY
COUNTRIES
```

7 rows selected.

6. Copy the examplepets.xml changelog file to the SQLcl 22.3 bin folder.

7. In the SQL command-line interface, run the changelog to add the Pets table to your database, and check to see that the table is now included in your list.

```
SQL> lb update --changelog-file examplepets.xml
SQL> select table_name from user_tables;
```

```
SQL> lb update --changelog-file examplepets.xml
 -Starting Liquibase at 14:40:11 (version 4.15.0 #0 built at 2022-08-19 14:45+0000)
- Loaded 1 change(s)
Running Changeset: examplepets.xml::1662750905905-1::
Operation completed successfully.
SQL> select table_name from user_tables;
TABLE_NAME
REGIONS
LOCATIONS
DEPARTMENTS
JOBS
EMPLOYEES
JOB_HISTORY
DATABASECHANGELOGLOCK
DATABASECHANGELOG ACTIONS
DATABASECHANGELOG
PETS
COUNTRIES
11 rows selected.
```

## 3.8 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?	Туре
DEPLOYMENT_ID ID AUTHOR FILENAME SQL SXML DATEEXECUTED EXECTYPE MD5SUM DESCRIPTION COMMENTS	NOT NULL	VARCHAR2 (10) VARCHAR2 (255) VARCHAR2 (255) VARCHAR2 (255) CLOB CLOB TIMESTAMP (6) VARCHAR2 (10) VARCHAR2 (35) VARCHAR2 (255) VARCHAR2 (255) VARCHAR2 (255)
LIQUIBASE		VARCHAR2 (20)

CONTEXTS LABELS

VARCHAR2 (255) VARCHAR2 (255)

## 3.9 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.				
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.				

## 3.10 Tips for Liquibase Settings

This section covers the following:



- How to Exclude Table Properties When Deploying Changelogs to a New Environment
- Create Database Objects in a Schema Different From the Connected Schema

## 3.10.1 How to Exclude Table Properties When Deploying Changelogs to a New Environment

When capturing tables from one environment and deploying to another, there are certain table properties you may want to exclude from the deployment while creating the table. This may be due to these properties being unavailable or undesired in your target environment, such as:

- Partitioning
- Compression
- Tablespace

SQLcl uses the Data Definition Language (DDL) session settings in the target environment, where the database objects are created or altered in (and not the environment the changelog was generated from), to generate the DDL for the objects. By turning off the DDL settings, you can prevent the corresponding table properties from being included in the table creation.

Generate your Liquibase changelog file for the table you want to capture and deploy.

```
liquibase generate-object -object-name [table name] -object-type table
```

As an example, consider the following table:

```
CREATE TABLE "PARTITION COMPRESSION TABLESPACE TEST"
        "A" VARCHAR2(20) NOT NULL ENABLE,
        "B" VARCHAR2(20),
        "C" VARCHAR2 (20) NOT NULL ENABLE,
        CONSTRAINT "PARTITION COMPRESSION TABLESPACE TEST PK" PRIMARY KEY
("A")
  USING INDEX
  PCTFREE 10 INITRANS 2 MAXTRANS 255 LOGGING
 TABLESPACE "USERS" ENABLE
  ) PCTFREE 0 PCTUSED 40 INITRANS 1 COMPRESS BASIC
 STORAGE ( BUFFER POOL DEFAULT FLASH CACHE DEFAULT CELL FLASH CACHE
DEFAULT)
 TABLESPACE "USERS"
 PARTITION BY HASH ("C")
 (PARTITION "SYS P803" SEGMENT CREATION DEFERRED
 COMPRESS BASIC
 TABLESPACE "USERS");
```

The following is an excerpt from the resulting changelog (the partition, compression and tablespace attributes are highlighted):



```
<COL LIST>
               <COL LIST ITEM>
                  <NAME>C</NAME>
               </COL LIST ITEM>
            </COL LIST>
            <DEFAULT PHYSICAL_PROPERTIES>
               <HEAP TABLE>
                  <SEGMENT ATTRIBUTES>
                     <PCTFREE>0</PCTFREE>
                     <PCTUSED>40</PCTUSED>
                     <INITRANS>1</INITRANS>
                     <MAXTRANS>255</MAXTRANS>
                     <STORAGE>
                        <BUFFER POOL>DEFAULT/BUFFER POOL>
                        <FLASH CACHE>DEFAULT</FLASH CACHE>
                        <CELL FLASH CACHE>DEFAULT</CELL FLASH CACHE>
                     </STORAGE>
                     <TABLESPACE>USERS</TABLESPACE>
                  </SEGMENT ATTRIBUTES>
                  <COMPRESS>BASIC</COMPRESS>
               </HEAP TABLE>
            </DEFAULT PHYSICAL PROPERTIES>
            <PARTITION LIST>
               <PARTITION LIST ITEM>
                  <NAME>SYS P803</NAME>
                  <SEGMENT ATTRIBUTES>
                     <SEGMENT CREATION DEFERRED></</pre>
SEGMENT CREATION DEFERRED>
                     <TABLESPACE>USERS</TABLESPACE>
                  </SEGMENT ATTRIBUTES>
                  <COMPRESS>BASIC</COMPRESS>
               </PARTITION LIST ITEM>
            </PARTITION LIST>
         </HASH PARTITIONING>
      </TABLE PROPERTIES>
   </RELATIONAL TABLE>
</TABLE>]]></n0:source>
</n0:createSxmlObject>
</changeSet>
</databaseChangeLog>
```

2. In the environment where you apply the update and generate the table, turn off the following DDL settings:

```
set ddl partitioning off
set ddl segment_attributes off
set ddl tablespace off
```

Partitioning turns off the partitioning property, segment\_attributes turns off the compression property, and tablespace turns off the tablespace property.

```
COLLATION_CLAUSE
CONSTRAINTS
                            : NEVER
                           : ON
CONSTRAINTS_AS_ALTER
                           : ON
EMIT SCHEMA
                            : ON
                            : ON
FORCE
                            : ON
INHERIT
INSERT
                           : ON
                           : ON
OID
PARTITIONING
                           : OFF
                           : ON
PRETTY
REF CONSTRAINTS
                           : ON
SEGMENT_ATTRIBUTES
SIZE_BYTE_KEYWORD
                           : OFF
                           : ON
SPECIFICATION
                           : ON
SQLTERMINATOR
                           : ON
                           : ON
STORAGE
                           : OFF
TABLESPACE
```

End Parameters

3. To confirm that these settings are not included in the table generation, use the liquibase update-sql command. This command shows you the exact SQL and PL/SQL code that will be run by the update command before you execute it.

```
liquibase update-sql -changelog-file
partition compression tablespace test table.xml
```

When partitioning, compression, and tablespace settings are turned off, the SQL code looks like the following snippet:

```
-- Changeset
partition compression tablespace test table.xml::fb1d77405bcd3cf7d60e555337
b80ec9555134d7::(HR)-Generated
CREATE TABLE "PARTITION COMPRESSION TABLESPACE TEST"
        "A" VARCHAR2(20) NOT NULL ENABLE,
        "B" VARCHAR2(20),
        "C" VARCHAR2 (20) NOT NULL ENABLE,
        CONSTRAINT "PARTITION COMPRESSION TABLESPACE TEST PK" PRIMARY KEY
("A")
  USING INDEX ENABLE
   );
```

The following is an example of the SQL code if partitioning, compression, and tablespace settings were turned on:

```
-- Changeset
partition_compression_tablespace test table.xml::fb1d77405bcd3cf7d60e555337
b80ec9555134d7:: (HR) -Generated
CREATE TABLE "PARTITION COMPRESSION TABLESPACE TEST"
        "A" VARCHAR2 (20) NOT NULL ENABLE,
        "B" VARCHAR2(20),
        "C" VARCHAR2 (20) NOT NULL ENABLE,
        CONSTRAINT "PARTITION COMPRESSION TABLESPACE TEST PK" PRIMARY KEY
("A")
```

```
USING INDEX
PCTFREE 10 INITRANS 2 MAXTRANS 255 LOGGING
TABLESPACE "USERS" ENABLE
) PCTFREE 0 PCTUSED 40 INITRANS 1 COMPRESS BASIC
STORAGE(
BUFFER_POOL DEFAULT FLASH_CACHE DEFAULT CELL_FLASH_CACHE DEFAULT)
TABLESPACE "USERS"
PARTITION BY HASH ("C")
(PARTITION "SYS_P803" SEGMENT CREATION DEFERRED
COMPRESS BASIC
TABLESPACE "USERS");
```

4. You can apply the update and create the table by running the update command in your target environment. This creates the table as unpartitioned, uncompressed, and uses the tablespace of the target environment (rather than attempting to use the tablespace of the environment the changelog was generated from).

```
liquibase update -changelog-file
partition_compression_tablespace_test_table.xml
```

## 3.10.2 Create Database Objects in a Schema Different From the Connected Schema

With SQLcl Liquibase, you can make deployments to a different database user schema than the one you are connected to. However, you must have the required permissions for the target user schema.

There are three important parameters related to this for the liquibase update command:

- -output-default-schema|-ouds
   Controls if the schema is output or not when running the data definition language (DDL)
   SQL to create or alter your database object.
  - If -output-default-schema true is set, the schema is included.

```
create table storefront.merchandise ...
```

 If -output-default-schema false is set or -output-default-schema is not set at all, the schema is not included.

```
create table merchandise ...
```

To deploy database objects to a different schema than the connected schema, you must set -output-default-schema true so that you can specify the schema you want to create the objects in using -default-schema-name.

-default-schema-name|-desn
 If -output-default-schema true is set, the -desn parameter controls which schema is output.



Use this parameter to specify the schema in which to create your database objects. For example, if you are connected to test\_user and you want to create your table in storefront, your command would be:

```
liquibase update -changelog-file merchandise_table.xml -output-default-
schema true -default-schema-name storefront
```

If -output-default-schema true is set and -default-schema-name is not set, the schema output is based on the ownerName attribute for your changeset in your changelog file.

```
<n0:createSxmlObject objectName="Merchandise" objectType="TABLE"
ownerName="LBUSER" replaceIfExists="false" >
```

If ownerName is not set, the schema you are connected to is used.

• -liquibase-schema-name|-lbsn

One of the big advantages of the Liquibase functionality in SQLcl is the ability to track and manage your changes. This is mainly done with the databasechangelog tracking tables automatically created and updated in your schema when you run Liquibase.

-liquibase-schema-name allows you to control in which schema you update Liquibase tracking information through the database changelog tables.

This allows you to have use cases such as having a control schema or user that tracks all your Liquibase change information, while applying the database objects themselves to other schemas.

For example, you are connected to the user or schema storefront and want to create your merchandise table using your merchandise\_table.xml changelog file. However, you do not want Liquibase to create your databasechangelog tables in this schema. You want the tracking information to be stored in the pre-existing databasechangelog tables in your schema control user.

The following command accomplishes this:

liquibase update -changelog-file merchandise\_table.xml -liquibase-schemaname control user

### Note:

Storefront needs to have the permission to write on the databasechangelog, databasechangeloglock, and  $databasechangelog_actions$  tables in  $control\_user$ .

```
GRANT SELECT, INSERT, UPDATE, DELETE ON
CONTROL_USER.DATABASECHANGELOG TO STOREFRONT;
GRANT SELECT, INSERT, UPDATE, DELETE ON
CONTROL_USER.DATABASECHANGELOGLOCK TO STOREFRONT;
GRANT SELECT, INSERT, UPDATE, DELETE ON
CONTROL_USER.DATABASECHANGELOG_ACTIONS TO STOREFRONT;
```



## 3.11 Important 23.4 Update with Liquibase Changelog Files

For cross-schema use, changelog files generated before SQLcl release 23.4 may require regeneration or manual updates. These alterations are necessary only if you are changing schema names between your export and import with pre-23.4 changelogs.

If you do not regenerate your changelogs or make the manual adjustments, then:

- Changelogs containing schema names are applied only to the schema named in them, regardless of provided parameters.
- Changelogs not containing schema names are applied only to the schema you are currently connected to with SQLcl, regardless of provided parameters.

SQLcl release 23.4 introduced a  $\USER_NAME\%$  replacement for the schema name stored in changesets.

There are two types of changes for manually updating your changelogs with the proper  $\$  NAME  $\$  substitution:

- Changelogs with <SCHEMA></SCHEMA> XML element
- Changelogs that use SQL within a CDATA field

For changelogs with the <SCHEMA></SCHEMA> XML element, replace the content inside with <code>%USER\_NAME%</code>.

In the following code block, the two <SCHEMA> XML elements that appear in this code are highlighted using bold font. These are replaced with <code>%USER NAME%</code>

```
<?xml version="1.0" encoding="UTF-8"?>
<databaseChangeLog</pre>
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-latest.xsd">
<changeSet id="5b3935a6b05750a24ac6ebc1c646bc6fe4cb4b40" author="(HR)-</pre>
Generated" failOnError="false" runOnChange="true" runAlways="false" >
   <n0:createSxmlObject objectName="MERCHANDISE" objectType="TABLE"
ownerName="HR" replaceIfExists="true" >
       0:source><![CDATA[</pre>
<TABLE xmlns="http://xmlns.oracle.com/ku" version="1.0">
<SCHEMA>HR</SCHEMA>
<NAME>MERCHANDISE</NAME>
<RELATIONAL TABLE>
<COL LIST>
 <COL LIST ITEM>
  <NAME>ID</NAME>
  <DATATYPE>NUMBER
  <IDENTITY COLUMN>
   <SCHEMA>HR</SCHEMA>
   <GENERATION>ALWAYS</GENERATION>
   <START WITH>1</START WITH>
   <INCREMENT>1</INCREMENT>
   <MINVALUE>1</MINVALUE>
```



```
<CACHE>20</CACHE>
</IDENTITY_COLUMN>
```

After you do the manual adjustment, this section changes to:

```
<?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-latest.xsd">
 <changeSet id="5b3935a6b05750a24ac6ebc1c646bc6fe4cb4b40" author="(HR) -</pre>
Generated" failOnError="false" runOnChange="true" runAlways="false" >
   <n0:createSxmlObject objectName="MERCHANDISE" objectType="TABLE"
ownerName="HR" replaceIfExists="true" >
    <n0:source><![CDATA[
<TABLE xmlns="http://xmlns.oracle.com/ku" version="1.0">
<SCHEMA>%USER NAME%</SCHEMA>
<NAME>MERCHANDISE</NAME>
<RELATIONAL TABLE>
  <COL LIST>
    <COL LIST ITEM>
      <NAME>ID</NAME>
      <DATATYPE>NUMBER
      <IDENTITY COLUMN>
      <CHEMA>%USER NAME%</SCHEMA>
      <GENERATION>ALWAYS</GENERATION>
      <START WITH>1</START WITH>
      <INCREMENT>1</INCREMENT>
      <MINVALUE>1</MINVALUE>
      <CACHE>20</CACHE>
      </IDENTITY COLUMN>
```

For changelogs that use SQL within the CDATA field, attach "%USER\_NAME%". to the front of all database object references. If a schema name is in these locations, replace it with "%USER NAME%". Note that there is a period after "%USER NAME%".

Two examples are shown below, each showing a changelog file before and after the manual adjustment, with the area of adjustment highlighted in bold font in the code block for emphasis.

### **Example 1**

```
<?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-latest.xsd">
<changeSet id="f1b1bf677cf990caa0147f863ea18486cdf23815" author="(LBUSER)-Generated" failOnError="false" runOnChange="false" runAlways="false" >
```



```
<n0:createOracleRefConstraint objectName="EMP_JOB_FK"
objectType="REF_CONSTRAINT" ownerName="LBUSER" replaceIfExists="false" >
<n0:source><![CDATA[ALTER TABLE "LBUSER"."EMPLOYEES" ADD CONSTRAINT
"EMP_JOB_FK" FOREIGN KEY ("JOB_ID") REFERENCES "LBUSER"."JOBS" ("JOB_ID")
ENABLE;]]></n0:source>
</n0:createOracleRefConstraint>
</changeSet>
</databaseChangeLog>
```

### After you do the manual adjustment, this section changes to:

```
<?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-latest.xsd">
<changeSet id="f1b1bf677cf990caa0147f863ea18486cdf23815" author="(LBUSER)-</pre>
Generated" failOnError="false" runOnChange="false" runAlways="false" >
<n0:createOracleRefConstraint objectName="EMP JOB FK"
objectType="REF CONSTRAINT" ownerName="LBUSER" replaceIfExists="false" >
<n0:source><![CDATA[ALTER TABLE "%USER NAME%"."EMPLOYEES" ADD CONSTRAINT
"EMP JOB FK" FOREIGN KEY ("JOB ID") REFERENCES "%USER NAME%"."JOBS"
("JOB ID") ENABLE;]]></n0:source>
</n0:createOracleRefConstraint>
</changeSet>
</databaseChangeLog>
```

#### **Example 2**

```
<?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-latest.xsd">
  <changeSet id="2b1ce58fc2f1781ce70d5bb99bf23b6ae8741ff3" author="(TEST9)-</pre>
Generated" failOnError="false"
                                runOnChange="false" runAlways="false" >
     <n0:createOracleProcedure objectName="P SQLCLERROR PROCEDURE"
objectType="PROCEDURE" ownerName="TEST9" replaceIfExists="false" >
       <n0:source><![CDATA[CREATE OR REPLACE EDITIONABLE PROCEDURE]
"TEST9"."P SQLCLERROR PROCEDURE" is
begin
null;
end p sqlclerror procedure;
/]]></n0:source>
                </n0:createOracleProcedure>
        </changeSet>
</databaseChangeLog>
```



### After you do the manual adjustment, this section appears as follows:

```
<?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-latest.xsd">
  <changeSet id="2b1ce58fc2f1781ce70d5bb99bf23b6ae8741ff3" author="(TEST9)-</pre>
Generated" failOnError="false"
                                runOnChange="false" runAlways="false" >
    <n0:createOracleProcedure objectName="P SQLCLERROR PROCEDURE"
objectType="PROCEDURE" ownerName="TEST9" replaceIfExists="false" >
      <n0:source><![CDATA[CREATE OR REPLACE EDITIONABLE PROCEDURE
"%USER NAME%"."P SQLCLERROR PROCEDURE" is
begin
null;
end p sqlclerror procedure;
/11></n0:source>
          </n0:createOracleProcedure>
         </changeSet>
</databaseChangeLog>
```

## 3.12 Examples Using Liquibase

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

- Review SQL
- · Capture and Deploy an Object
- Capture and Deploy a Schema
- Execute Custom SQL with RunOracleScript

### 3.12.1 Review SQL

To review SQL before running maintenance commands:

1. Optionally, set up to save SQL updates.

```
cd <lb-changes-directory>
spool update.sql
```

2. Connect to HR and capture the object.

```
connect <db-connect1-string>
lb update-sql
spool off
```

## 3.12.2 Capture and Deploy an Object

To deploy the EMPLOYEES table from HR to HR2:

1. Set default output path.

```
cd <output-files-path>
```

Connect to HR and capture the object.

```
connect <db-connect1-string>
lb generate-object -object-type table -object-name employees
```

3. Connect to HR2 and ensure the object does not exist.

```
connect <db-connect2-string>
drop table employees
```

4. Create the object in HR2 and verify that it was created.

```
lb update -changelog-file employees_table.xml
desc employees
```

## 3.12.3 Capture and Deploy a Schema

To capture HR schema and reproduce it in HR2 schema:

1. Set default output path.

```
cd <output-files-path>
```

2. Connect to HR and capture the schema.

```
connect <db-connect1-string>
lb generate-schema
```

3. Setup the HR2 user.

```
connect <db-connect-dba-string>
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;
```

4. Create the schema objects deployed from HR in HR2 and verify.

```
lb update -changelog-file controller.xml
tables
```

## 3.12.4 Execute Custom SQL with RunOracleScript

Create a RunOracleScript changeset to create a table and use PL/SQL variables in the script.

```
<?xml version="1.0" encoding="UTF-8"?>
<databaseChangeLog</pre>
```





4

## Database Application CI/CD

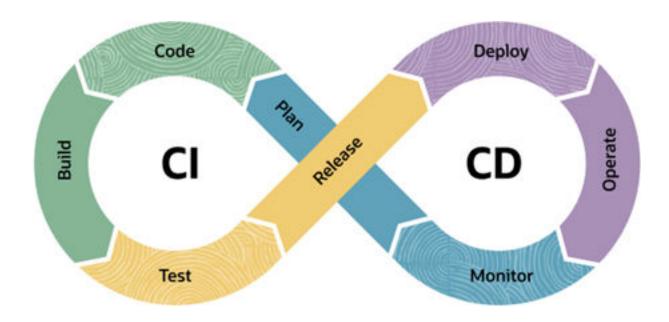
The Oracle SQLcl Projects feature allows users to manage the creation and administration of a database application. It is targeted towards enterprise-level applications that require structured release processes.

This chapter contains the following topics:

- Introduction
- About the Project Command
- Quick Start
- Examples

## 4.1 Introduction

Database Application Continuous Integration and Continuous Delivery (CI/CD) represents a transformative approach in modern database management and application development. This methodology seamlessly integrates database changes into the development pipeline while ensuring swift and secure deployment to production environments. By combining the rapid feedback mechanisms of Continuous Integration with the streamlined deployment processes of Continuous Delivery, Database CI/CD addresses the critical need for agility and reliability in today's fast-paced software development landscape.



At its core, Database CI/CD aims to:

Accelerate time-to-market for new features and updates.

- Maintain a consistently high quality of code and database schema.
- Facilitate immediate issue detection and resolution.
- Ensure that both application and database components are always in a deployable state.

This approach not only enhances development efficiency but also significantly improves the end-user experience through frequent, reliable releases.

The project command in Oracle SQLcI is a powerful tool designed to standardize database software versioning and create releasable artifacts, including APEX elements. This command supports a consistent model of development and operations, enabling repeatable builds that can be applied in a specific order.

The key features of SQLcl Projects include:

- Versioned Feature Management: Allows database developers to identify individual changes and create versioned features or issues.
- Release Artifact Creation: Facilitates rolling multiple changes into a single release artifact that can be published for use.
- Ordered Installation: Ensures that artifacts are installable in the correct sequence, taking into account previously installed components in the environment.
- Source Control Integration: Supports creating branches in source control and exporting
  objects to these branches. Changes are realised using branch diffs and formatted
  consistently, allowing for easy identification through file checksums.
- Automated Release Packaging: When multiple branches or changes are created, SQLcl Projects can wrap them into a release, automatically setting up the execution of all changesets in the correct order on a target system.

The SQLcl Projects feature represents a significant step towards streamlining database development workflows, enhancing version control, and improving the overall efficiency of database application development and deployment processes.

### 4.1.1 Supported Objects

The supported database object types have been tested to work with the project export and project stage commands. All types not included in the following list can be added using the project stage add-custom command with any custom SQL. For more information about the add-custom command, see stage.

The database object types that are supported are:

- APEX APP
- ORDS Modules
- CONSTRAINT
- CONTEXT
- FUNCTION
- INDEX
- MATERIALIZED\_VIEW
- OBJECT\_GRANT
- PACKAGE BODY
- PACKAGE SPEC



- PROCEDURE
- REF CONSTRAINT
- ROLE GRANT
- SEQUENCE
- SYNONYM
- SYSTEM\_GRANT
- TABLE
- TRIGGER
- TYPE BODY
- TYPE\_SPEC
- USER
- VIEW

# 4.1.2 Database CI/CD Concepts

This section covers the concepts relevant to understanding SQLcl Projects.

- Database Continuous Integration (CI) and Database Continuous Delivery (CD)
- Database Project Scaffolding
- Advanced Database Object Explorer
- Automated Database Migration Script Generation
- Building Releasable Artifacts

#### **Database Continuous Integration (CI) and Database Continuous Delivery (CD)**

Database continuous integration (CI) is the process of frequently integrating database schema and logic changes into application development, aiming to provide immediate feedback on any issues. Database continuous delivery (CD) focuses on quickly and safely deploying those changes to production, ensuring that both application and database code are always in a deployable state. Together, database CI/CD reduces time-to-market and delivers consistent end-user value through frequent, high-quality releases.

#### **Database Project Scaffolding**

When initializing SQLcl Projects (using the project init command), SQLcl creates a set of files that are used to manage the creation of files and changelogs.

There are three folders in the initial setup:

- .dbtools: This folder contains the following:
  - Project filters that are used by project export to filter out objects that will be exported.
  - Project format rules that are used to format the code when it is exported.
  - Project configuration settings.
- src: This folder is where the exported objects from the database get placed. This is broken down by schema and objects types.



dist: The release artifacts are created in this folder. This folder gets populated by the
project stage command and the project release command compresses its contents to
create a release artifact.

```
-.dbtools
| filters
| project.filters
| project.config.json
| project.sqlformat.xml
| dist
| install.sql
| src
| database
| gitignore
| README.md
```

#### **Advanced Database Object Explorer**

One of the main features of SQLcl Projects is exporting database objects to the source control repository. The export includes the SQL needed to create the object and a "snapshot" of the object's metadata. The snapshot is stored as a comment and is prefixed with sqlcl\_snapshot. It contains the following information:

- Checksum calculated on the exported code
- Object type
- Object name
- Schema name
- SXML representation of the object as exported (see DBMS METADATA SXML)

The following path is used for exported objects:

```
src/database/<SCHEMA>/<OBJECT_TYPE>/<OBJECT_NAME>[.sql|.pks|.pkb]
```

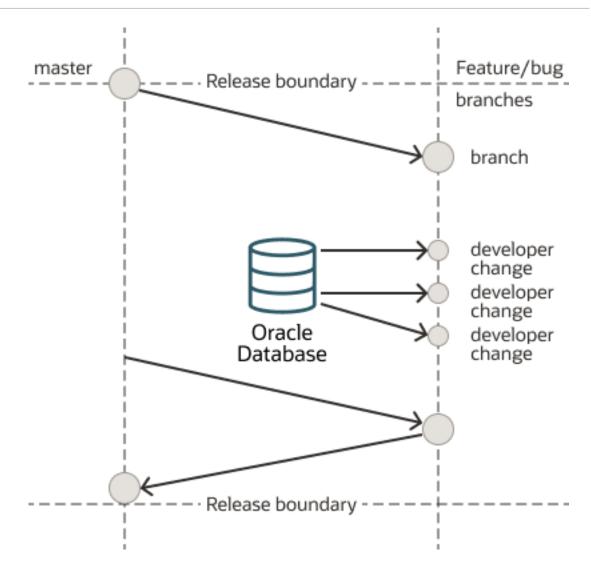
For example, a table called doc in the HR schema, the file path is src/database/hr/tables/doc.sql.

```
create table hr.doc (
    id number
);
-- sqlcl_snapshot
{"hash":"d992dceaa87a936e8242bdc81201f93030084ab5","type":"TABLE","name":"DOC"
,"schemaName":"HR","sxml":"<TABLE xmlns=\"http://xmlns.abc.com/ku\"
version=\"1.0\"> <SCHEMA>HR</SCHEMA> <NAME>DOC</NAME>
<RELATIONAL_TABLE><COL_LIST> <COL_LIST_ITEM><NAME>ID</NAME><DATATYPE>NUMBER<//DATATYPE> </COL_LIST_ITEM></COL_LIST>COLLATION>USING_NLS_COMP</DEFAULT_COLLATION><PHYSICAL_PROPERTIES> <HEAP_TABLE></HEAP_TABLE></PHYSICAL_PROPERTIES> </RELATIONAL_TABLE></TABLE>"}
```

#### **Automated Database Migration Script Generation**

As developers add changes to the database, they are exported to the branch. Git branches are used to identify changes between units of work. Using the diffs between the branches, the changed files are identified.





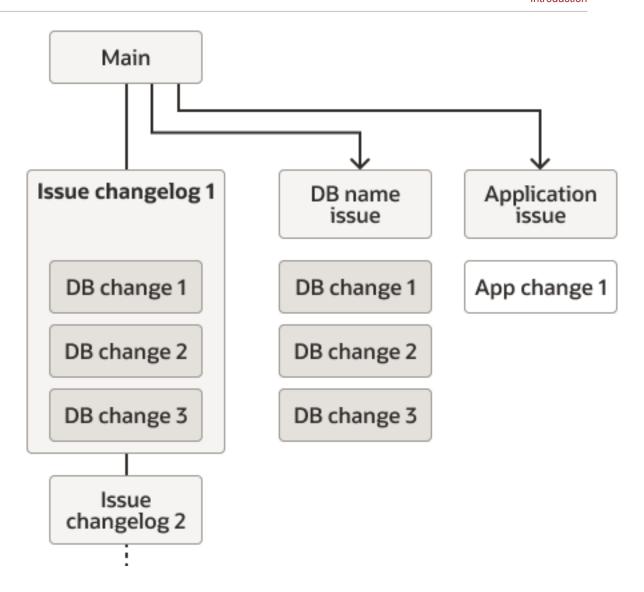
Each object file has a specific checksum and, in some cases, specific SXML for the specification of the object. Using Oracle DBMS\_METADATA\_DIFF, the SXML files are compared and the DDL to make both objects the same is generated and added to the repository.

#### **Building Releasable Artifacts**

To ensure deployment consistency, statements need to run in a particular order. Once a statement is executed, it will never be run again (immutable). Liquibase support, which was introduced in SQLcI to allow users to create changesets for schemas or objects, can be run to install the objects into a database. SQLcI Projects builds on that support to generate changesets for each block of changes on a branch and build those together into a release.

This is achieved by taking the comparison set between branches and generating a hierarchy scaffolding of changelogs that represent the list of comparisons. Then, the comparison set is used to generate the SXML differences, which is then used to generate the DDL for the changes.





After an export of the changes, the project stage command generates the changesets for the differences from the current branch and the main branch.

```
--Example
next
    release.changelog.xml
    changes
    initial-export
    hr
    table
    doc.sql
    stage.changelog.xml
```

In this example, there is one table that is exported into doc.sql. This example has been simplified to explain the concept. The project stage command compares the contents of the current branch and by default compares it against the base branch of the project. The project

configuration that controls the base branch is git.defaultBranch. This can be shown by using the following command:

```
project config -list -name git.defaultBranch
```

To change it, use the same config command with the -set option.

The project stage command also has a prescribed format. When the command is run, it creates the following structure:

```
next/changes/<branch name>
```

In the example, the branch created for the initial export of the hr.doc table is called initial-export. Each time a new branch is created and the stage command is run, there is a new folder underneath next/changes/<br/>
stage command is run, there is a new folder underneath next/changes/<br/>
stage command is run, there is a new folder underneath next/changes/<br/>
stage command is run, there is a new folder underneath next/changes/<br/>
stage command is run, there is a new folder underneath next/changes/<br/>
stage command is run, there is a new folder underneath next/changes/<br/>
stage command is run, there is a new folder underneath next/changes/

In this example, the <code>doc.sql</code> file is automatically prefixed with Liquibase-formatted SQL formats and is defined as an individual changeset. <code>doc.sql</code> will be referenced in a changelog file.

```
-- Liquibase-formatted sql
-- changeset HR:d992dceaa87a936e8242bdc81201f93030084ab5 stripComments:false
logicalFilePath:initial-export/hr/table/doc.sql
-- sqlcl_snapshot src/database/hr/tables/
doc.sql:null:d992dceaa87a936e8242bdc81201f93030084ab5:create

create table hr.doc (
   id number
);
```

In this example, the stage.changelog.xml references the Liquibase-formatted SQL changeset.

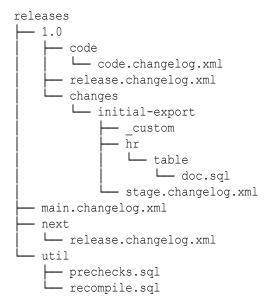


```
<!--END CUSTOM--> </databaseChangeLog>
```

The next folder has a release.changelog.xml right at the top. This file is referenced again in the project release command.

When all the changes are created for a release, run the project release command to take all files under the next folder and move them to a "numbered release" folder.

#### The final structure is:



To generate a re-runnable artifact, run the project gen-artifact command. This creates a file in artifacts/cprojectname>-<version>.zip. By default, artifacts are not included in the Git repository (To change this, modify the .gitignore file).



#### The contents of this artifact include:

```
releases/next/release.changelog.xml
releases/1.0/changes/initial-export/stage.changelog.xml
releases/1.0/changes/initial-export/hr/table/doc.sql
releases/1.0/release.changelog.xml
releases/1.0/code/code.changelog.xml
releases/util/recompile.sql
releases/util/prechecks.sql
releases/main.changelog.xml
README.md
install.sql
```

The last part is deploying the artifacts into a production database. The command project deploy takes the generated artifact and runs it with SQLcl.

```
SQL> project deploy -file demo-1.0.zip
Starting the migration...
Running Changeset: initial-export/hr/table/
doc.sql::d992dceaa87a936e8242bdc81201f93030084ab5::HR
Table HR.DOC created.
Liquibase: Update has been successful. Rows affected: 1
Installing/updating schemas
--Starting Liquibase at 2024-09-19T09:09:02.326601 (version [local build] #0
built at 2024-08-14 18:40+0000)
Table HR.DOC created.
UPDATE SUMMARY
Previously run:
Filtered out:
_____
Total change sets:
Produced logfile: sqlcl-lb-1726733337322.log
Operation completed successfully.
Migration has been completed.
```

# 4.2 About the Project Command

The command in SQLcl for Database CI/CD extension is project. It contains several sub-commands that are used as part of the process to help developers manage database changes and create serialized transactions.

All project sub-commands support -verbose and -debug options, which provide detailed processing information.

Each of the sub-commands are described below.

init|in

Initializes a new project. This command can be run in a new Git repository or in an existing repository.

```
project init -name demo -makeroot -schemas cicd
```

This command creates a project in the current working directory called demo under a new folder called demo. Several folders are created under the project directory including a configuration directory under .dbtools.

This folder and the files under it should be added and committed to the Git repository.

#### config|cfg

Enables you to view and manage your project configuration properties.

This command allows you to look at the current configuration that is used by each of the project commands. The files for the configuration are stored under the .dbtools folder. In the configuration, there are a number of settings that can be configured.

```
project config -list
```

This command lists all the configured options. Most of these options have defaults, which are used in the absence of the parameter. You can see the defaults by using the -verbose option with project config -list.

You can set configuration items by using the following command:

```
project config set -name <configitem> -value <value> -type <value-type>
```

Any invalid configurations are flagged at runtime when a project command is used.

#### export|ex

Exports database objects into your repository.

As a rule, when exporting from the database, a new branch is created. This branch is used when using the stage command to compare with previous branches to generate the DDL statements. You can run the following command in the project to export the objects owned by the schemas identified in the project init command.

```
project export
```

You can also choose to export a specific schema, or even an object.

In the configuration files, there is a specific file for filtering objects that can be modified to clearly identify the correct objects to export.

Export supports normal database objects supported by DBMS\_METADATA and also APEX applications. See the DBMS\_METADATA: Object Types table in *Oracle Database PL/SQL Packages and Types Reference*.

#### stageIst

Creates Liquibase changelogs or changesets for all source files and custom SQL files.

The stage command is used along with the export command. This command takes the current branch and compares it to the base branch and generates the changelogs that will



apply those changes to a database. The command creates a folder in a specific format with a dist folder.

```
src
dist -
     -releases
    -next
     - <stage files>
```

The stage command can also be used to add other custom changesets as part of the change. This generates a file to add SQL and SQLcl commands with a Liquibase SQL changeset header. This file will be added to the changelog hierarchy automatically.

#### release|re

Moves the current set of work into a release state and starts a new body of work.

The release command takes the contents of the dist/next folder and renames it to a given version number.

```
project release -version 1.0
```

And then creates a new next folder under dist.

Once code has been moved into a release it should never be modified. As such, it is recommended that the release command should only be run once the following criteria have been met:

- project verify has successfully ran.
- Test the release against various systems:
  - \* Build system: This confirms that all DDL and code compiles correctly.
  - \* Test system (with data): Confirms that no data integrity issues (For example: Making a column not null only to find out it has null values).

To test a pre-release build, run project gen-artifact and use a version name such as - version 1.0.0-test. This also includes everything in the next folder.

#### gen-artifact|ga

Generates an artifact representing the current state of your project.

#### deploy[dp

Deploys the artifact on a target database.

#### verify|v

Provides the means to test various aspects of your project (snapshots, changes, overall project).

# 4.3 Quick Start

This section introduces the SQLcl Projects feature using a simple setup and list of tasks. The quick start covers:

- How to initialize a new project (for an application with a single schema called demo).
- Work to be done as part of a sprint:
  - Ticket-1



- Create the standard sample dept and emp tables
- Load the tables with sample data
- Ticket-2
  - \* Add a new column named email to the emp table
  - \* Add a new function named get\_display\_name
- How to complete a release, and then generate and deploy an artifact.

#### **Topics**

- Prerequisites
- Assumptions
- Project Setup
- Ticket-1
- Ticket-2
- Final Steps

# 4.3.1 Prerequisites

This Quick Start has the following prerequisites:

You must create two databases, DEV and PROD, with the demo schema pre-created. You
need to connect as the demo user from SQLcl.

```
create user demo identified by demo;
grant resource to demo;
grant connect to demo;
grant create view to demo;
alter user demo quota unlimited on system;
```

 You require two named connections in SQLcl: demo-dev and demo-prod. The following examples show how to add and manage named connections in SQLcl.

```
-Add a new named connection
-Note: -savepwd is an optional parameter to save the password.

SQL> conn -savepwd -save demo-dev demo/demo@//myserver.com:1521/mypdb
-List current connections
SQL> connmgr list
-To connect to a named connection
SQL> conn -name demo-dev
```

### 4.3.2 Assumptions

This quick start assumes the following:

A Git project named demo-project is used.
 All work in the repository is "local" only, a remote server (such as, Github or Gitlab) is not needed for this demo.

- The term ticket (or issue) refers to a unit of work, typically tracked in a system such as Jira.
- SQLcl can run operating system level commands using the host command.
  - For example, host date prints the system date.
  - A shortcut for the host command is !<cmd>. For example, !date is the equivalent of host date.
  - This demo uses a lot of host commands. To avoid exiting and entering SQLcl each time, the ! shortcut is used to execute them directly within SQLcl.

## 4.3.3 Project Setup

Create a Git repository.



This demo uses a local Git repository. In most cases, a clone from a remote Git repository is used as a starting point.

```
-Create and go into new folder
mkdir demo-project
cd demo-project
-Start SQLcl
sql /nolog
-Initialize git repo
SQL> !git init --initial-branch=main
```

#### Initialize the repository for SQLcl Projects.

- project.config.json

```
-The schema that is used for this demo is called "demo".
SQL> project init -name demo project -schemas demo
_____
PROJECT DETAILS
_____
Project name: demo_project Schema(s): DEMO
Schema(s): DEMO
Directory: /private/tmp/demo-project
Connection name:
Project root: demo-project
Your project has been successfully created
-Root folder now looks like:
    dbtools
         └─ project.filters
```



```
project.sqlformat.xml
     dist
      install.sql
    - src
      └─ database
     .gitignore
    - README.md
-Add and commit the initial files to the repository
SQL> !git add --all
SQL> !git commit -m "initial"
[main (root-commit) 5fa6ebd] initial
9 files changed, 188 insertions(+)
create mode 100644 .dbtools/filters/project.filters
create mode 100644 .dbtools/project.config.json
create mode 100644 .dbtools/project.sqlformat.xml
create mode 100644 .gitignore
create mode 100644 README.md
create mode 100644 dist/install.sql
```

### 4.3.4 Ticket-1

In practice, most development is done as part of a ticket in a project management system, such as Jira or GitHub. In this section, ticket-1 is created and has the following requirements:

- 1. Create emp and dept tables.
- Add the initial data.

In the following steps, you will:

- 1. Create and check out a Git branch named ticket-1.
- 2. Create the tables in the database schema.
- 3. Export the objects from the schema to the project's src folder.
- 4. Register the changes in the project's dist folder.
  - Changes are detected automatically by comparing the feature branch to the main branch.
  - Changes are created in the next release as part of ticket-1.
  - Changes are captured as Liquibase changelogs/sets.
- 5. Add a custom script to load the initial data for the emp and dept tables.
- Commit and merge changes to complete the ticket.

#### **Steps**

1. Connect to the the demo-dev server.

```
SQL> conn -name demo-dev Connected.
```



#### 2. Create a new branch called ticket-1.

```
SQL> !git checkout -b ticket-1
Switched to a new branch 'ticket-1'
```

#### 3. Create database objects.

```
SQL> create table dept(
     deptno number (2,0),
     dname varchar2(14),
loc varchar2(13),
     constraint pk dept primary key (deptno)
);
Table DEPT created.
SQL> create table emp(
     empno number (4,0),
     ename varchar2(10)
job varchar2(9),
mgr number(4,0),
                varchar2(10),
     hiredate date,
     sal number (7,2), comm number (7,2), deptno number (2,0),
     constraint pk emp primary key (empno),
     constraint fk deptno foreign key (deptno) references dept (deptno)
);
Table EMP created.
SQL> create index idx emp deptno on emp(deptno);
Index IDX EMP DEPTNO created.
```

#### 4. Export all the objects to the src folder.

The src folder now contains all the scripts required to recreate the objects in the demo schema.

The changes in the  ${\tt src}$  folder are used to detect changes that need to be added to the  ${\tt dist}$  folder for each release.

The folder structure looks as follows:

src database demo indexes idx\_emp\_deptno.sql ref constraints fk\_deptno.sql tables dept.sql

Add and commit the newly created src files.

- emp.sql



#### Note:

It is very important to commit all src changes because only committed changes are used to determine changes for dist/release.

```
SQL> !git add --all
SQL> !git commit -m "TICKET-1: Added dept emp tables, and get_display_name function"

[ticket-1 812db72] TICKET-1: Added dept emp tables, and get_display_name function
4 files changed, 44 insertions(+)
create mode 100644 src/database/demo/indexes/idx_emp_deptno.sql
create mode 100644 src/database/demo/ref_constraints/fk_deptno.sql
create mode 100644 src/database/demo/tables/dept.sql
create mode 100644 src/database/demo/tables/emp.sql
```

5. Generate the scripts and Liquibase changelogs for the current ticket.

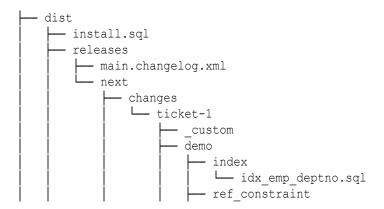
This happens in the background where the changes in branches/ticket-1/src are compared against branches/main/src.

```
SQL> project stage
Stage successfully created, please review and commit your changes to
repository
```

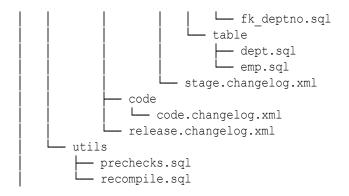
The dist folder now becomes as follows:

#### Note:

- All current work is stored in the releases/next folder. After a release is
  ready, this folder is converted to a release number and a new or empty next
  folder is created.
- Changelogs work as follows: main.changelog.xml references next/ release.changelog.xml, which references ticket-1/stage.changelog.xml, which references all the files that are part of ticket-1.







#### 6. Add and commit the files.

It is recommended to review all generated files before adding to the repository.

```
SQL> !git add --all
SQL> !git status
On branch ticket-1
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        new file: dist/releases/main.changelog.xml
        new file: dist/releases/next/changes/ticket-1/demo/index/
idx emp deptno.sql
        new file: dist/releases/next/changes/ticket-1/demo/
ref constraint/fk deptno.sql
        new file: dist/releases/next/changes/ticket-1/demo/table/dept.sql
        new file: dist/releases/next/changes/ticket-1/demo/table/emp.sql
        new file: dist/releases/next/changes/ticket-1/stage.changelog.xml
        new file: dist/releases/next/code/code.changelog.xml
        new file: dist/releases/next/release.changelog.xml
        new file: dist/utils/prechecks.sql
        new file: dist/utils/recompile.sql
SQL> !git commit -m "TICKET-1: Added dept emp tables"
[ticket-1 261cceb] TICKET-1: Added dept emp tables
10 files changed, 396 insertions (+)
 create mode 100644 dist/releases/main.changelog.xml
 create mode 100644 dist/releases/next/changes/ticket-1/demo/index/
idx emp deptno.sql
 create mode 100644 dist/releases/next/changes/ticket-1/demo/
ref constraint/fk deptno.sql
 create mode 100644 dist/releases/next/changes/ticket-1/demo/table/dept.sql
 create mode 100644 dist/releases/next/changes/ticket-1/demo/table/emp.sql
 create mode 100644 dist/releases/next/changes/ticket-1/stage.changelog.xml
 create mode 100644 dist/releases/next/code/code.changelog.xml
 create mode 100644 dist/releases/next/release.changelog.xml
 create mode 100644 dist/utils/prechecks.sql
 create mode 100644 dist/utils/recompile.sql
```

#### 7. Add sample data for each table using a custom .sql file.

Use the project stage add-custom command to generate custom files, as it autogenerates all the Liquibase-header information.

```
SQL> project stage add-custom -file-name dept-data.sql SQL> project stage add-custom -file-name emp-data.sql
```

The custom files now appear in dist under the \_custom folder.

The following command displays the contents of dept-data.sql.

```
SQL> !cat dist/releases/next/changes/ticket-1/_custom/dept-data.sql
(For Windows, use !type .\dist\releases\next\changes\ticket-1\_custom\dept-
data.sql)
-- liquibase formatted sql
-- changeset SqlCl:f56fcfec11f7d7cb99d74403a0c2727a765ddb99
stripComments:false logicalFilePath:ticket-1/_custom/dept-data.sql
-- sqlcl_snapshot dist/releases/next/changes/ticket-1/_custom/dept-
data.sql:null:null:custom
```

#### 8. Add the sample data for each file.

In  $dist/releases/next/changes/ticket-1/\_custom/dept-data.sql$ , copy and paste the following statements to the end of the file and then save the file.

```
insert into demo.dept values(10, 'ACCOUNTING', 'NEW YORK');
insert into demo.dept values(20, 'RESEARCH', 'DALLAS');
insert into demo.dept values(30, 'SALES', 'CHICAGO');
insert into demo.dept values(40, 'OPERATIONS', 'BOSTON');
```

In dist/releases/next/changes/ticket-1/\_custom/emp-data.sql, copy and paste the following statements to the end of the file and then save the file.

```
insert into demo.emp values( 7839, 'KING', 'PRESIDENT', null,
to_date('17-11-1981','dd-mm-yyyy'), 5000, null, 10);
insert into demo.emp values( 7698, 'BLAKE', 'MANAGER', 7839,
to_date('1-5-1981','dd-mm-yyyy'), 2850, null, 30);
insert into demo.emp values( 7782, 'CLARK', 'MANAGER', 7839,
to_date('9-6-1981','dd-mm-yyyy'), 2450, null, 10);
insert into demo.emp values( 7566, 'JONES', 'MANAGER', 7839,
to_date('2-4-1981','dd-mm-yyyy'), 2975, null, 20);
insert into demo.emp values( 7788, 'SCOTT', 'ANALYST', 7566, to_date('13-JUL-87','dd-mm-rr') - 85, 3000, null, 20);
insert into demo.emp values( 7902, 'FORD', 'ANALYST', 7566,
to date('3-12-1981','dd-mm-yyyy'), 3000, null, 20);
```



```
insert into demo.emp values (7369, 'SMITH', 'CLERK', 7902,
to date('17-12-1980','dd-mm-yyyy'), 800, null, 20);
insert into demo.emp values (7499, 'ALLEN', 'SALESMAN', 7698,
to date('20-2-1981','dd-mm-yyyy'), 1600, 300, 30);
insert into demo.emp values ( 7521, 'WARD', 'SALESMAN', 7698,
to date('22-2-1981','dd-mm-yyyy'), 1250, 500, 30);
insert into demo.emp values (7654, 'MARTIN', 'SALESMAN', 7698,
to date('28-9-1981','dd-mm-yyyy'), 1250, 1400, 30);
insert into demo.emp values (7844, 'TURNER', 'SALESMAN', 7698,
to date('8-9-1981','dd-mm-yyyy'), 1500, 0, 30);
insert into demo.emp values (7876, 'ADAMS', 'CLERK', 7788, to date ('13-
JUL-87', 'dd-mm-rr') - 51, 1100, null, 20);
insert into demo.emp values ( 7900, 'JAMES', 'CLERK', 7698,
to date('3-12-1981','dd-mm-yyyy'), 950, null, 30);
insert into demo.emp values ( 7934, 'MILLER', 'CLERK', 7782,
to date('23-1-1982','dd-mm-yyyy'), 1300, null, 10);
```

Run each file to ensure that the data is loaded into the table.

```
SQL> @dist/releases/next/changes/ticket-1/_custom/dept-data.sql
SQL> @dist/releases/next/changes/ticket-1/_custom/emp-data.sql
SQL> commit;
Commit complete.
```

10. Add and commit the new custom files.

```
SQL> !git add --all
SQL> !git commit -m "TICKET-1: data files"

[ticket-1 ac2488d] TICKET-1: data files
3 files changed, 33 insertions(+)
  create mode 100644 dist/releases/next/changes/ticket-1/_custom/dept-data.sql
  create mode 100644 dist/releases/next/changes/ticket-1/_custom/emp-data.sql
```

**11.** To highlight the order of operations that have automatically been managed, enter the following command:



```
<!--END-->
<!--BEGIN CUSTOM-->
<include file="_custom/dept-data.sql" relativeToChangelogFile="true"/>
<include file="_custom/emp-data.sql" relativeToChangelogFile="true"/>
<!--END CUSTOM-->
```

Ticket-1 is now complete.

#### 12. Merge the changes into the main branch.

This is done through a Merge Request or a Pull Request (depending on your Git provider). Since this is a local repository, you can only merge directly into main.

```
SQL> !git checkout main
Switched to branch 'main'
SQL> !git merge "ticket-1"
Updating f9660ae..ac2488d
Fast-forward
dist/releases/main.changelog.xml
dist/releases/next/changes/ticket-1/ custom/dept-data.sql
                                                    | 11 +++
dist/releases/next/changes/ticket-1/ custom/emp-data.sql
                                                   1 20 +++
dist/releases/next/changes/ticket-1/demo/index/idx emp deptno.sql
dist/releases/next/changes/ticket-1/demo/ref constraint/fk deptno.sql |
dist/releases/next/changes/ticket-1/demo/table/dept.sql
13 +++++++
dist/releases/next/changes/ticket-1/demo/table/emp.sql
18 ++++++++++
dist/releases/next/changes/ticket-1/stage.changelog.xml
16 +++++++++
dist/releases/next/code/code.changelog.xml
dist/releases/next/release.changelog.xml
11 ++++++
dist/utils/prechecks.sql
dist/utils/recompile.sql
+++++++++++++++
src/database/demo/indexes/idx emp deptno.sql
src/database/demo/ref constraints/fk deptno.sql
8 +++++
src/database/demo/tables/dept.sql
12 +++++++
src/database/demo/tables/emp.sql
17 ++++++++++
16 files changed, 473 insertions (+)
```



```
create mode 100644 dist/releases/main.changelog.xml
create mode 100644 dist/releases/next/changes/ticket-1/ custom/dept-
data.sql
create mode 100644 dist/releases/next/changes/ticket-1/ custom/emp-
data.sql
create mode 100644 dist/releases/next/changes/ticket-1/demo/index/
idx emp deptno.sql
create mode 100644 dist/releases/next/changes/ticket-1/demo/
ref constraint/fk deptno.sql
create mode 100644 dist/releases/next/changes/ticket-1/demo/table/dept.sql
create mode 100644 dist/releases/next/changes/ticket-1/demo/table/emp.sql
create mode 100644 dist/releases/next/changes/ticket-1/stage.changelog.xml
create mode 100644 dist/releases/next/code/code.changelog.xml
create mode 100644 dist/releases/next/release.changelog.xml
create mode 100644 dist/utils/prechecks.sql
create mode 100644 dist/utils/recompile.sql
create mode 100644 src/database/demo/indexes/idx emp deptno.sql
create mode 100644 src/database/demo/ref constraints/fk deptno.sql
create mode 100644 src/database/demo/tables/dept.sql
create mode 100644 src/database/demo/tables/emp.sql
```

### 4.3.5 Ticket-2

Now that the first ticket is complete, work can start on TICKET-2. The purpose of this ticket is to highlight the automated DDL management along with soft objects (that is, re-runnable objects such as packages, views, and so on) creation.

TICKET-2 has the following requirements:

- 1. Add a new column emp.email.
- 2. Add a new function get display name.

The steps are:

- 1. Create and check out a Git branch called ticket-2.
- 2. Alter the emp table and add the new column in the database.
- 3. Export the emp table. This will show the new table structure in the src/.../tables/emp.sql file.
- 4. Run the project stage command to register the alter table statements.
- 5. Create a new function, get\_display\_name, in the database and run project export.
- 6. Rerun the project stage command to include the get display name function.
- 7. Commit and merge changes to complete the ticket.

#### Steps

1. Create the ticket-2 branch.

```
SQL> !git checkout -b ticket-2
Switched to a new branch 'ticket-2'
```



2. Make the table changes to the development database.

```
SQL> alter table emp add email varchar2(255); Table EMP altered.
```

3. Run the project export command to get the latest version of the table.



Use the -o argument to only export the demo.emp table.

4. Run the git diff command to show what was changed in the src/database/demo/tables/emp.sql file.



Because the column name is changed, the whole file is marked as changed to add additional spacing.

Only the logical changes are listed below to show the real differences. The diff highlights that the new column (email) is added.

```
!git --no-pager diff src/database/demo/tables/emp.sql
- deptno number(2, 0)
+ deptno number(2, 0),
+ email varchar2(255 byte)
```

5. Add and commit changes, which is required before running the project stage command.

This happens in the background where the changes in branches/ticket-1/src are compared against branches/main/src.

```
SQL> !git add --all
SQL> !git commit -m "TICKET-2: Added emp.email"
```



```
[ticket-2 a3e7508] TICKET-2: Added emp.email
1 file changed, 3 insertions(+), 2 deletions(-)
```

**6.** Run project stage to automatically generate the alter table statement required to add the email column.

```
SQL> project stage
Stage successfully created, please review and commityour changes to
repository
```

The following files have been added:

7. The output of dist/releases/next/changes/ticket-2/demo/table/emp.sql is shown below.

It automatically detected the modification in the emp table and generated the correct <code>alter</code> statement.

```
SQL> !cat dist/releases/next/changes/ticket-2/demo/table/emp.sql
-- liquibase formatted sql
-- changeset DEMO:cffad61078f4afbd0680bfacbe818e5f089ce535
stripComments:false logicalFilePath:ticket-2/demo/table/emp.sql
-- sqlcl_snapshot src/database/demo/tables/
emp.sql:1d12b2ddb0fe34a061ad35dc1990fc3d84d5a676:9c26d3ba57756671939cf399cb
7e96ae0d3ac84e:alter

alter table demo.emp add (
    email varchar2(255)
)
//
```

8. Add and commit changes.

```
SQL> !git add --all
SQL> !git commit -m "TICKET-2: emp.email alter commands"

[ticket-2 582cd63] TICKET-2: emp.email alter commands
3 files changed, 20 insertions(+)
create mode 100644 dist/releases/next/changes/ticket-2/demo/table/emp.sql
create mode 100644 dist/releases/next/changes/ticket-2/stage.changelog.xml
```



9. Create a new function called get\_display\_name. This highlights how the source code can automatically be managed with SQLcl Projects.

```
SQL> create or replace function get_display_name(p_ename in emp.ename%type)
return varchar2
as
begin
    return initcap(p_ename);
end get_display_name;
/
Function GET DISPLAY NAME compiled
```

10. Similar to table changes, running a project export command detects supported object changes.

```
SQL> project export

*** FUNCTIONS ***

*** INDEXES ***

*** TABLES ***

*** REF_CONSTRAINTS ***

TABLE 2
REF_CONSTRAINT 1
INDEX 1
FUNCTION 1

Exported 5 objects
Elapsed 14 sec
```

11. Add and commit followed by project stage to add to the release.

The function was added to the dist/next folder under a common code folder and not ticket-2.

This is done because re-runnable code (packages, functions, and so on) may be modified multiple times within a sprint. In most cases, it only needs to be compiled once.

```
SQL> !git status
On branch ticket-2
Changes not staged for commit:
   (use "git add <file>..." to update what will be committed)
```



12. Add and commit the dist changes.

```
SQL> !git add --all
SQL> !git commit -m "TICKET-2: dist changes for get_display_name"
[ticket-2 706fdb9] TICKET-2: dist changes for get_display_name
    3 files changed, 13 insertions(+)
    create mode 100644 dist/releases/next/code/demo/function/
get display name.sql
```

13. Now that all work on ticket-2 is complete, merge back to main.

```
SQL> !git checkout main
Switched to branch 'main'
SQL> !git merge "ticket-2"
Updating d6abe9d..706fdb9
Fast-forward
dist/releases/next/changes/ticket-2/demo/table/emp.sql
                                                    | 8 ++++++
dist/releases/next/code/code.changelog.xml
dist/releases/next/code/demo/function/get display name.sql | 11 ++++++++
dist/releases/next/release.changelog.xml
                                                      | 2 ++
src/database/demo/functions/get display name.sql
                                                      10 +++++++
src/database/demo/tables/emp.sql
                                                      1 5 +++--
7 files changed, 46 insertions(+), 2 deletions(-)
create mode 100644 dist/releases/next/changes/ticket-2/demo/table/emp.sql
create mode 100644 dist/releases/next/changes/ticket-2/stage.changelog.xml
create mode 100644 dist/releases/next/code/demo/function/
get display name.sql
create mode 100644 src/database/demo/functions/get display name.sql
```

## 4.3.6 Final Steps

After the sprint is complete, the following needs to be done:

- Generate a release (project release)
  - The release command renames the dist/next folder to the release name (in the following example, 1.0.0) and then generates a new (empty) dist/next folder ready for the next sprint's changes.
- Generate an artifact (project gen-artifact)

- gen-artifact creates a zip file that contains a single install.sql file, which points to all
  the different sub-folders in the dist folder. In this example, it only contains one folder
  (1.0.0). Over time, the artifact will contain additional releases, as this is what allows
  Liquibase to upgrade from any point in time.
- Deploy the artifact (project deploy).
  - The deploy command takes an artifact and upgrades an environment to the latest version. For example, if the artifact includes versions 1-10 and the current environment is on version 8, the installer auto-detects the current state and only runs the changes related to version 9 and version 10.

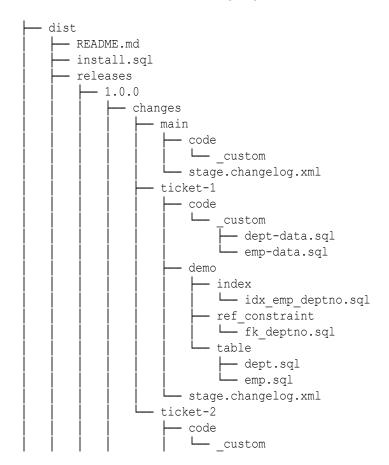
### 4.3.6.1 Generate Release 1.0.0

#### Generating a release:

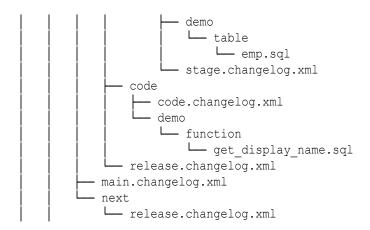
- Moves the contents of dist/next to the name of the release. For example, if generating release 1.0.0, then dist/next > dist/1.0.0.
- Create a new dist/next folder that is open for the next set of work for the next release.
- 1. Generate release 1.0.0

```
SQL> project release -version 1.0.0 Process completed successfully
```

The dist folder now looks like below. Note the dist/next folder has been emptied and there is a new "fresh" release.changelog.xml.







#### 2. Add the changed files and commit.

```
SQL> !git add --all
SQL> !git add .
SQL> !git commit -m "release 1.0.0"
[main 5e1ac12] release 1.0.0
 16 files changed, 25 insertions (+), 4 deletions (-)
 create mode 100644 dist/releases/1.0/changes/main/stage.changelog.xml
 rename dist/releases/{next => 1.0}/changes/ticket-1/code/ custom/dept-
data.sql (100%)
 rename dist/releases/{next => 1.0}/changes/ticket-1/code/ custom/emp-
data.sql (100%)
 rename dist/releases/{next => 1.0}/changes/ticket-1/demo/index/
idx emp deptno.sql (100%)
 rename dist/releases/{next => 1.0}/changes/ticket-1/demo/ref constraint/
fk deptno.sql (100%)
 rename dist/releases/{next => 1.0}/changes/ticket-1/demo/table/dept.sql
(100%)
 rename dist/releases/{next => 1.0}/changes/ticket-1/demo/table/emp.sql
(100%)
 rename dist/releases/{next => 1.0}/changes/ticket-1/stage.changelog.xml
 rename dist/releases/{next => 1.0}/changes/ticket-2/demo/table/emp.sql
 rename dist/releases/{next => 1.0}/changes/ticket-2/stage.changelog.xml
rename dist/releases/{next => 1.0}/code/code.changelog.xml (100%)
 rename dist/releases/{next => 1.0}/code/demo/function/
get display name.sql (100%)
 create mode 100644 dist/releases/1.0/release.changelog.xml
```

#### 3. (Optional) Git tag the release.

```
!git tag release-1.0.0
```

At this point, the <code>dist/release/next</code> folder is ready for the next set of work for the new release.

### 4.3.6.2 Generate an Artifact

An artifact contains all the releases that enable the deployment to automatically detect the instance's current version and the required releases to run through to update to the latest. SQLcl generates the artifact as a zipped file. By default, this file is not included in the Git repository because it is a binary file that can become large over time.



Artifacts must be stored in an artifact repository such as JFrog's Artifactory.

Generate the artifact as follows:

```
SQL> project gen-artifact -version 1.0.0
Your artifact has been generated demo project-1.0.0.zip
```

The artifact directory now contains the following artifact:

```
├─ artifact
│ └─ demo project-1.0.0.zip
```

By default, the artifact directory is included in the .gitignore file and not added to the repository. It is best practice to move these to an artifact repository (for example, JFrog).

## 4.3.6.3 Deploy to PROD

Use the artifact that was generated in the previous step and run the deploy command on a different database. The following steps deploy the artifact on the demo-prod connection.

Connect to the production server.

```
SQL> connect -name demo-prod
```

2. Deploy on the Prod server.

```
SQL> project deploy -file artifact/demo_project-1.0.0.zip

Starting the migration...
Running Changeset: ticket-1/demo/table/
dept.sql::1e18b33eb500d4ccf3880f65c0d06846c793c509::DEMO
Running Changeset: ticket-1/demo/table/
emp.sql::1d12b2ddb0fe34a06lad35dc1990fc3d84d5a676::DEMO
Running Changeset: ticket-1/demo/ref_constraint/
fk_deptno.sql::55dee617886ld12324b4e858b5465b7f4c1a4fcd::DEMO
Running Changeset: ticket-1/demo/index/
idx_emp_deptno.sql::ab1f05f1b3b979156e8b2c8e1608231ae86a14c5::DEMO
Running Changeset: ticket-1/code/_custom/dept-
data.sql::f56fcfec11f7d7cb99d74403a0c2727a765ddb99::SqlC1
Running Changeset: ticket-1/code/_custom/emp-
data.sql::113b7d3b31e5ae089898777aaa7f556ff6f8dbf7::SqlC1
```



```
Running Changeset: ticket-2/demo/table/
emp.sgl::cffad61078f4afbd0680bfacbe818e5f089ce535::DEMO
Running Changeset: ../demo/function/
get display name.sql::4c4e98c47aeddbc5ca84a31d8ab7e1c066296976::DEMO
Liquibase: Update has been successful. Rows affected: 26
Installing/updating schemas
--Starting Liquibase at 2024-11-05T17:00:18.968636 (version [local build]
#0 built at 2024-08-14 18:40+0000)
UPDATE SUMMARY
Run:
Previously run:
Filtered out:
_____
Total change sets:
Produced logfile: sqlcl-lb-1730851216381.log
Operation completed successfully.
Migration has been completed
```

# 4.4 Examples

This section provides examples that make some assumptions around connections and source schemas, and depend on having connections created.

# 4.4.1 Single Schema

This example consists of a single development schema and a single production schema. After it is created, the production schema includes objects from the development schema and the Liquibase changelog objects.

#### Overview

- Create a SQLcl database project.
- 2. Initialize a git repository in the database project and commit initial files to the main branch.
- 3. Create a new branch called base-release, run project export to export the objects from the connection hr-dev and commit the files to the branch.
- 4. Run project stage to compare the branch base-release to the main branch and generate the changelogs for installing the base release.
- 5. Run project release to move the development code to a versioned release called 1.0.
- Run project gen-artifact to create a deployable zip file of the release called
- 7. Connect to the production schema and deploy the artifact with project deploy command.

#### **Connection Definitions**

hr-dev: This is the connection to use as a development schema.



hr-prod: This is the connection to use as the production schema.

#### **Development Connection and Objects**

In the development schema, install the objects for the HR sample schema. These objects are available on Github. Clone the oracle-samples/db-samples-schemas repository.

In this example, an hr user is set up with the password oracle.

```
$> git clone git@github.com:oracle-samples/db-sample-schemas.git
$> cd db-sample-schemas/human resources
$> sql <SYSTEM USER>/<SYSTEMPASSWORD>@<DATABASE URL>
SQL> @hr install
Thank you for installing the Oracle Human Resources Sample Schema.
This installation script will automatically exit your database session
at the end of the installation or if any error is encountered.
The entire installation will be logged into the 'hr install.log' log file.
Enter a password for the user HR: *****
Enter a tablespace for HR [USERS]:
Do you want to overwrite the schema, if it already exists? [YES|no]: YES
Old HR schema has been dropped.
***** Creating REGIONS table ....
***** Creating COUNTRIES table ....
***** Creating LOCATIONS table ....
***** Creating DEPARTMENTS table .....
***** Creating JOBS table ....
***** Creating EMPLOYEES table ....
***** Creating JOB HISTORY table ....
***** Creating EMP_DETAILS_VIEW view ...
***** Creating indexes ...
***** Adding table column comments ...
***** Populating REGIONS table ....
***** Populating COUNTRIES table ....
***** Populating LOCATIONS table ....
***** Populating DEPARTMENTS table ....
***** Populating JOBS table ....
***** Populating EMPLOYEES table ....
***** Populating JOB HISTORY table ....
Installationverification
```

Verification:

Table	provided	actual
regions	5	
countries	25	25
departments	27	27
locations	23	23
employees	107	107
jobs	19	19
job_history	10	10



Create the connection in Oracle SQL Developer extension for VSCode or Oracle SQLcl.

```
SQL> connect -save hr-dev -savepwd hr/oracle@localhost/freepdb1
Name: hr-dev
Connect String: localhost/freepdb1
User: hr
Password: ******
Connected.
SQL> connect -name hr-dev
Connected.
```

Use a login.sql file to customise the login experience. Set up the user, database, project, git status, and current working directory.

#### **Steps**

Create a SQLcl database project.

Choose a directory to create the project and run the project init command.

```
SQL> project init -name demo -schemas hr -makeroot
-------
PROJECT DETAILS
------
Project name: demo
Schema(s): HR
Directory: /Users/abc/sandbox/projects/demo
Connection name: hr-dev
Config Only: false
Project root demo
Your project has been successfully created.
```

This command creates the project and the makeroot option creates a project folder.

2. Initialize the Git repository.

In the project directory, initialize a Git repository and commit the initial files to the main branch. The main branch is called main. On commit, it is important to use the Conventional Commits standard for commit messages so that it is useful on release to identify features, bugs, chores and other types. The code block shows Git running in SQLcl using the host command denoted by the ! character preceding the Git command. This character allows the user to run any command available on the host shell.

```
SQL>cd demo
SQL>pwd
/Users/abc/sandbox/projects/demo
SQL> !git init --initial-branch=main
Initialized empty Git repository in /Users/abc/sandbox/projects/demo/.git/
SQL> !git add .
```



```
SQL> !git commit -m "chore: initializing repository with default project files"

[main (root-commit) 6cc2434] chore: initializing repository with default project files

8 files changed, 145 insertions(+)
create mode 100644 .dbtools/filters/project.filters
create mode 100644 .dbtools/project.config.json
create mode 100644 .dbtools/project.sqlformat.xml
create mode 100644 .gitignore
create mode 100644 dist/README.md
create mode 100644 dist/install.sql
create mode 100644 src/README.md
create mode 100644 src/README.md
create mode 100644 src/database/README.md
```

In the demo folder, there are several folders and files:

- .dbtools: Contains the configuration files for the project.
- src: Contains the source files exported from the schema.
- dist: Contains the generated install files and releases.
- artifact: Contains the zip files generated for a release.
- 3. Create the base-release branch and commit exported files.

Create a branch in Git called base-release and check it out. Run project export to export the objects from the hr-dev connection.

```
SQL> !git checkout -b base-release
Switched to a new branch 'base-release'
SQL> project export
The current connection localhost/freepdb1 HR will be used for all
operations.
*** INDEXES ***
*** PROCEDURES ***
*** SEQUENCES ***
*** TABLES ***
*** TRIGGERS ***
*** VIEWS ***
*** COMMENTS ***
*** REF CONSTRAINTS ***
_____
TABLE
PROCEDURE
                             2
REF CONSTRAINT
                           10
CREATE USER
                             1
TRIGGER
                             2
SEQUENCE
                             3
INDEX
                            11
VIEW
COMMENT
Exported 43 objects.
Elapsed 13 sec.
SQL>!git status
On branch base-release
Untracked files:
```



```
(use "git add <file>..." to include in what will be committed)
   src/database/hr/
SQL>!git add src
SQL>!git status
On branch base-release
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
   new file: src/database/hr/comments/countries.sql
   new file: src/database/hr/comments/regions.sql
   new file: src/database/hr/create users/create user.sql
   new file: src/database/hr/indexes/dept location ix.sql
   new file: src/database/hr/indexes/loc_state_province_ix.sql
   new file: src/database/hr/procedures/add job history.sql
   new file: src/database/hr/procedures/secure dml.sql
   new file: src/database/hr/ref constraints/countr reg fk.sql
   new file: src/database/hr/ref constraints/loc c id fk.sql
   new file: src/database/hr/sequences/departments_seq.sql
   new file: src/database/hr/sequences/employees_seq.sql
   new file: src/database/hr/sequences/locations seq.sql
   new file: src/database/hr/tables/countries.sql
   new file: src/database/hr/tables/regions.sql
   new file: src/database/hr/triggers/secure employees.sql
   new file: src/database/hr/triggers/update job history.sql
   new file: src/database/hr/views/emp details view.sql
!git commit -m "chore: base export of hr schema"
[base-release b481c41] chore: base export of hr schema
44 files changed, 609 insertions(+)
create mode 100644 src/database/hr/comments/countries.sql
create mode 100644 src/database/hr/comments/regions.sql
create mode 100644 src/database/hr/create users/create user.sql
create mode 100644 src/database/hr/indexes/dept_location_ix.sql
create mode 100644 src/database/hr/indexes/loc state province ix.sql
create mode 100644 src/database/hr/procedures/add job history.sql
create mode 100644 src/database/hr/procedures/secure dml.sql
create mode 100644 src/database/hr/ref constraints/countr reg fk.sql
create mode 100644 src/database/hr/ref constraints/loc c id fk.sql
create mode 100644 src/database/hr/sequences/departments seq.sql
create mode 100644 src/database/hr/sequences/locations seq.sql
create mode 100644 src/database/hr/tables/countries.sql
create mode 100644 src/database/hr/tables/regions.sql
create mode 100644 src/database/hr/triggers/secure employees.sql
create mode 100644 src/database/hr/triggers/update job history.sql
create mode 100644 src/database/hr/views/emp details view.sql
```

**4.** Use project stage to create changelogs for installing the base release.

Run the project stage command to compare the base-release branch to the main branch and generate the changelogs for installing the base release.

```
SQL> project stage
Stage successfully created, please review and commit your changes to
repository.
SQL> !git status
On branch base-release
Untracked files:
  (use "git add <file>..." to include in what will be committed)
    dist/releases/
SQL> !find dist/releases/next
dist/releases/next
dist/releases/next/changes
dist/releases/next/changes/base-release
dist/releases/next/changes/base-release/code
dist/releases/next/changes/base-release/code/ custom
dist/releases/next/changes/base-release/stage.changelog.xml
dist/releases/next/changes/base-release/hr
dist/releases/next/changes/base-release/hr/ref constraint
dist/releases/next/changes/base-release/hr/ref constraint/dept loc fk.sql
dist/releases/next/changes/base-release/hr/ref constraint/emp job fk.sql
dist/releases/next/changes/base-release/hr/ref constraint/jhist job fk.sql
dist/releases/next/changes/base-release/hr/ref constraint/jhist dept fk.sql
dist/releases/next/changes/base-release/hr/ref constraint/loc c id fk.sql
dist/releases/next/changes/base-release/hr/ref constraint/countr reg fk.sql
dist/releases/next/changes/base-release/hr/ref constraint/emp dept fk.sql
dist/releases/next/changes/base-release/hr/ref constraint/jhist emp fk.sql
dist/releases/next/changes/base-release/hr/ref constraint/dept mgr fk.sql
dist/releases/next/changes/base-release/hr/ref constraint/
emp manager fk.sql
dist/releases/next/changes/base-release/hr/table
dist/releases/next/changes/base-release/hr/table/jobs.sql
dist/releases/next/changes/base-release/hr/table/departments.sql
dist/releases/next/changes/base-release/hr/table/regions.sql
dist/releases/next/changes/base-release/hr/table/countries.sql
dist/releases/next/changes/base-release/hr/table/employees.sql
dist/releases/next/changes/base-release/hr/table/job history.sql
dist/releases/next/changes/base-release/hr/table/locations.sql
dist/releases/next/changes/base-release/hr/index
dist/releases/next/changes/base-release/hr/index/emp name ix.sql
dist/releases/next/changes/base-release/hr/index/jhist department ix.sql
dist/releases/next/changes/base-release/hr/index/emp manager ix.sql
dist/releases/next/changes/base-release/hr/index/emp department ix.sql
dist/releases/next/changes/base-release/hr/index/loc country ix.sql
dist/releases/next/changes/base-release/hr/index/jhist employee ix.sql
dist/releases/next/changes/base-release/hr/index/jhist job ix.sql
dist/releases/next/changes/base-release/hr/index/loc city ix.sql
dist/releases/next/changes/base-release/hr/index/dept location ix.sql
dist/releases/next/changes/base-release/hr/index/emp job ix.sql
dist/releases/next/changes/base-release/hr/index/loc state province ix.sql
dist/releases/next/changes/base-release/hr/sequence
dist/releases/next/changes/base-release/hr/sequence/departments seq.sql
dist/releases/next/changes/base-release/hr/sequence/locations seq.sql
dist/releases/next/changes/base-release/hr/sequence/employees seq.sql
dist/releases/next/release.changelog.xml
```



```
dist/releases/next/code
dist/releases/next/code/code.changelog.xml
dist/releases/next/code/hr
dist/releases/next/code/hr/trigger
dist/releases/next/code/hr/trigger/update job history.sql
dist/releases/next/code/hr/trigger/secure employees.sql
dist/releases/next/code/hr/comment
dist/releases/next/code/hr/comment/jobs.sql
dist/releases/next/code/hr/comment/departments.sql
dist/releases/next/code/hr/comment/regions.sql
dist/releases/next/code/hr/comment/countries.sql
dist/releases/next/code/hr/comment/employees.sql
dist/releases/next/code/hr/comment/job history.sql
dist/releases/next/code/hr/comment/locations.sql
dist/releases/next/code/hr/procedure
dist/releases/next/code/hr/procedure/secure dml.sql
dist/releases/next/code/hr/procedure/add job history.sql
dist/releases/next/code/hr/view
dist/releases/next/code/hr/view/emp details view.sql
```

**5.** Run project release to complete the release.

Run the project release command to move the development code to a versioned release called 1.0.

```
SQL> project release -version 1.0 -verbose
Creating a release version 1.0 for the current body of work

Updated change:dist/releases/main.changelog.xml
Moved folder "dist/releases/next" to "dist/releases/1.0"
Created file: dist/releases/next
Created change:dist/releases/next/release.changelog.xml
Created change:dist/releases/next/release.changelog.xml
Process completed successfully
```

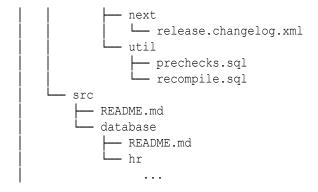
This moves all changes in the next folder to the 1.0 folder under releases.

```
--Cropped Tree Structure
SQL> !tree
  - demo
      - README.md
      - dist
          - install.sql
          — releases
              - 1.0
                 - code

    release.changelog.xml

                    changes
                       - base-release
                         - code
                           - hr
                         stage.changelog.xml
                main.changelog.xml
```





6. Run project deploy to install the artifact into a database.

Connect to the production schema and deploy the artifact with the project deploy command.

```
connect -name production-connection
SQL> project deploy -file artifact/demo-1.0.zip -verbose
Check database connection...
Extract the file name: demo-1.0
Artifact decompression in progress...
Artifact decompressed: /var/folders/35/v7k4b96dld9b61mm93bgjjnr0000gn/T/e6b3d0f0-92d5-4fde-b82c-37ea9ec419c58326209255710673404
Starting the installation...
```

Check the installed schema to check the installed objects.

```
SQL> connect hr/<password>
Connected.
SQL> tables

TABLES

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

The migrated tables are listed along with the management tables for Liquibase.

# 4.4.2 Administrator Exports HR to Production Schema

In this example, the steps are the same as in Single Schema, except for the deploy (step 7), which is done in this case as an administrator. All objects that are created need to be prefaced

# with the schema name. This can be added on export by setting the following configuration item:

project config set -name export.setTransform.emitSchema -value true -type BOOLEAN

#### Run the project deploy command.

```
SQL> connect adminuser/oracle@database
SQL> drop user hr cascade;
SQL> grant connect,resource, dba to hr identified by oracle;
SQL> project deploy -file artifact/demo-1.0.zip -verbose
Check database connection...
Extract the file name: demo-1.0
Artifact decompression in progress...
Artifact decompressed: /var/folders/35/v7k4b96d1d9b61mm93bgjjnr0000gn/T/e6b3d0f0-92d5-4fde-b82c-37ea9ec419c58326209255710673404
Starting the installation...
```

#### After the installation, the main difference in objects is where the Liquibase tables exist.

SQL> show user USER is "ABC" SQL> tables

#### TABLES

DATABASECHANGELOG\_ACTIONS
DATABASECHANGELOG
DATABASECHANGELOGLOCK

SQL> connect hr/oracle
Connected.
SQL> tables

#### TABLES

COUNTRIES
DEPARTMENTS
DOC
EMPLOYEES
JOB\_HISTORY
JOBS
LOCATIONS
REGIONS



# **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 5-1 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
- About the Cloud Storage Command Options
- Examples

# See Also:

- · Loading a File
- Using the OCI Command for Oracle Cloud Infrastructure REST APIs

# 5.1 Using DBMS\_CLOUD for Authentication

You can access the cloud storage using the <code>DBMS\_CLOUD</code> Credential command. Presently, the <code>DBMS\_CLOUD</code> 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_ocid <user-
id> tenancy ocid <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_ocid] [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
Transer 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 CREDENITAL 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 PROFCRED.
```



Transfer method set to DBMS CLOUD.

# 5.2 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  $\sim$ /.oci/config, use the following command:

```
oci profile
```

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

```
oci profile demo
```

# 5.3 About the 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.

# 5.4 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
SOL> 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|"Flori
da"<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|"Illinoi
s"
```

### List Compartments, Buckets, and Objects

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



When using <code>DBMS\_CLOUD</code> credential, you can only list the objects in the bucket. <code>DBMS\_CLOUD</code> 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
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:

# Get a File from Cloud Storage using the GET Command

The following example shows how to get a file from cloud storage using the  $\mbox{CS}$   $\mbox{GET}$  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\TempCSemployees.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
```



6

# **Using Data Pump**

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

# 6.1 Getting Started

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

# 6.1.1 Prerequisites

To use DATAPUMP in SQLcI, 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 About the 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 cprofile>.
  - 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.

# 6.1.2 Usage

The DATAPUMP command creates and submits data pump jobs using the DBMS\_DATAPUMP 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.

# 6.2 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:

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 6-1 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	<pre><file-name>[,] Dump file name(s) when using database directory.</file-name></pre>	<jobname><n>.DMP</n></jobname>
	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.	



Table 6-1 (Cont.) Optional Arguments

File Argument	Description	Default
-dumpuri,-u	[ <uri>[,]   <qualified- name&gt;[,]]</qualified- </uri>	Default object name is <jobname>.DMP</jobname>
	<uri>: Complete URI for the Oracle Object Store file if a default is not set on Cloud Storage command.</uri>	
	<qualifier>: 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.</qualifier>	
	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.	
	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.	
-logdirectory,-ld	Database directory for log file.	-directory if specified or DATA_PUMP_DIR
-logfile,-lf	Log file name in the database directory.	<pre><jobname><n>.LOG</n></jobname></pre>

**Table 6-2 Command Arguments** 

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



**Table 6-3 Common Arguments** 

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



Table 6-3 (Cont.) Common Arguments

Common Argument	Description	Default
-includelist,-il	<pre><object_type>[,] 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: -includelist TABLE, VIEW</object_type></pre>	None
-includemetadata,-im	[TRUE   FALSE]  TRUE: Include metadata in the job.	TRUE
-includerows,-ir	[TRUE   FALSE] TRUE: Include data in the job.	TRUE
-jobname,-j	Name for the data pump job.  Job name is appended with a data pump generated number, unless it ends with a number. jobname <n> is used when submitting the data pump job and as a default name for dump and log file names or object names.</n>	ESQL_ <n>   ISQL_<n> where n is a data pump generated number.</n></n>
-nameexpr,-nx	<pre>{<object-type>=<name- expression="">}[;] For specified object type, provide an expression identifying a set of object names to include in the job. Example: -nameexpr TABLE="IN ('EMPLOYEES', 'DEPARTMENTS')"; PROCEDURE= "IN ('ADD_JOB_HISTORY', 'SECURE _DML')"</name-></object-type></pre>	None
-namelist,nl	{ <object-type>=<name>[,]}[;] For specified object type, provide a comma-separated-value list of objects to include in the job. Example: -namelist TABLE=employees, department s; PROCEDURE=add_job_histor y, secure_dml</name></object-type>	None
-parallel,-p	<pre><degree_integer> 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.</degree_integer></pre>	1



Table 6-3 (Cont.) Common Arguments

Common Argument	Description	Default
-schemas,-s	<pre><schema>[,] - The schema or list of schemas to process. For example: -schemas schema1, schema2</schema></pre>	For export, schema for the current connection. For import, the default is FULL and all objects in the dump file are imported.
-version,-v	{ <nn.n>  COMPATIBLE   LATEST}</nn.n>	COMPATIBLE
	<nn.n>: 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.</nn.n>	
-wait,-w	[TRUE   FALSE]  TRUE: Wait for the data pump job to finish and show summary results.	TRUE
	FALSE: Submit the data pump job without waiting and without showing results.	



**Table 6-4 Export Only Arguments** 

<b>Export-Only Arguments</b>	Description	Default
-compression,-cm	{ALL   DATA_ONLY   METADATA_ONLY   NONE}	METADATA_ONLY
	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.	
-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}	NONE, or ALL if any other encryption option is specified.
	Specifying any encryption option will turn on encryption if you do not specify -encryption NONE.	
-encryptionalgorithm,-ena	{AES128   AES192   AES256}	AES128
	Identifies the cryptographic algorithm to use.	
-encryptionmode,-enm	{DUAL   PASSWORD   TRANSPARENT}	TRANSPARENT, or PASSWORD if -encryptionpassword is
	Identifies the types of security used for encryption and decryption.	specified.
	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.	



**Table 6-4 (Cont.) Export Only Arguments** 

Export-Only Arguments	Description	Default
-filesize,-fs	{ <n>{B   KB   MB   GB   TB}}</n>	500 MB
	Limit for the size of files.	
-flashbackscn,-fb	[TRUE   FALSE]	FALSE
	TRUE: Use consistent database content based on system change number (SCN) at the start time of execution.	
-reusefile,-r	[TRUE   FALSE]	TRUE
	TRUE: Replace existing dump file(s) with a new file.	

**Table 6-5** Import Only Arguments

Import-Only Arguments	Description	Default
-columnencryption,-ce	[TRUE   FALSE]	TRUE if supported by database
	TRUE: Include column encryption clause on table metadata.	
	FALSE Omit column encryption clause.	
-objectid,-oid	[TRUE   FALSE]	TRUE
	TRUE: Assign the exported OID.	
	FALSE: Assign a new OID	
-remapschemas,-rs	{ <oldschema>=<newschema>[,]}</newschema></oldschema>	Not Applicable
	<oldschema> objects in the job are moved to <newschema>. Example: oldschema1=newschema1,oldsch ema2=newschema2.</newschema></oldschema>	
-remaptablespaces,-rt	{ <oldtablespace>=<newtablespace>[,]}</newtablespace></oldtablespace>	Not Applicable
	<oldtablespace> storage segment in the job is relocated to <newtablespace>. Example: oldtablespace1=newtablespace1, oldtablespace2=newtablespace2</newtablespace></oldtablespace>	
-segmentattributes,-sa	[TRUE   FALSE]	TRUE
	TRUE: Include segment attributes clauses (physical attributes, storage attributes, tablespace, logging).	
-skipunusableindexes,-sui	[TRUE   FALSE]	TRUE
	TRUE: Rows are inserted into tables having unusable indexes.	

Table 6-5 (Cont.) Import Only Arguments

Import-Only Arguments	Description	Default
-storage,-st	[TRUE   FALSE]	TRUE
	TRUE: Include storage clauses.	
-tableexists,-te	{APPEND   REPLACE   SKIP   TRUNCATE}	SKIP when -includemetadata true, otherwise APPEND action
	Action to take if table exists during import.	is taken 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.	
-tablecompression,-tc	[TRUE   FALSE]	TRUE
	TRUE: The table compression clause is included if supported.	
	FALSE: The table has the default compression for the tablespace.	

# 6.3 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.

- 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 dpumptest1,dpumptest11 -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 dpumptest1=dpumptest2,dpumptest11=dpumptest21
```

#### 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.
- Export the current schema into DATA\_PUMP\_DIR and copy it to the CS bucket using profile.



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.
- 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
```

# 6.4 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
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
```



7

# Using the Cloud Premigration Advisor Tool

The Cloud Premigration Advisor Tool (CPAT) helps you evaluate an existing Oracle database for compatibility with Oracle Autonomous Database before migration. CPAT identifies potential user actions, prioritizes their importance, and suggests resolutions. Oracle recommends using CPAT to accelerate your migration to Oracle Cloud.

For more information, see Cloud Premigration Advisor Tool in Oracle Database Utilities.

Also, see CPAT Analyzes Databases for Suitability of Cloud Migration (Doc ID 2758371.1) in My Oracle Support.

You can use SQLcl to run CPAT by using the MIGRATEADVISOR command.

#### Topics:

- Overview
- Prerequisites
- About the MIGRATEADVISOR Command
- Examples
- Tips and Troubleshooting

# 7.1 Overview

Using the MIGRATEADVISOR command in SQLcl, you can:

- Analyze an Oracle database to a generic autonomous type or specific instance, and create reports identifying actions recommended for successful migration to Oracle Cloud. A report can be generated in HTML, text or JSON format.
- Optionally, generate a target properties file that will provide more details specific to an autonomous instance.

The following image shows a CPAT report in HTML format.

```
SQL> migrateadvisor advise -schemas hr -outfileprefix xschemas -targettype adws -reportformat HTML
Cloud Premigration Advisor Tool Version 22.5.6-30
Cloud Premigration Advisor Check Summary
Cloud Premigration Advisor Tool completed with overall result: Action Required
    38 Checks run
    79 Schemas in source DB
    1 Schemas analyzed: HR
    1 Action Required: Checks with this result typically need to be resolved before attempting migration.
       Data in Custom Tablespaces (Shared) (25 relevant objects)
    5 Review Required
    3 Review Suggested
    29 Passed
Cloud Premigration Advisor Tool generated report location(s):
    /private/tmp/xschemas_premigration_advisor_report2.json
    /private/tmp/xschemas_premigration_advisor_report2/premigration_advisor_report.html
    /private/tmp/xschemas_premigration_advisor2.log
```

### **CPAT Concepts**

The source analysis in CPAT is done generically for different cloud types:

- ATPS (Autonomous Transaction Processing on Shared Infrastructure)
- ATPD (Autonomous Transaction Processing on Dedicated Infrastructure)
- ADWS (Autonomous Data Warehouse on Shared Infrastructure)
- ADWD (Autonomous Data Warehouse on Dedicated Infrastructure)
- Default (Oracle Database)

The source analysis consists of a series of tests that are executed as SQL Statements. The scope of the tests fall into three categories:

- **SCHEMA**: Checks that are only applicable to data within schemas. For example, tables are checked for usage of deprecated and desupported features.
- **INSTANCE**: Checks that are only applicable to the database instance as a whole. For example, certain parameters and values in the V\$PARAMETER table are checked.
- UNIVERSAL: Checks that are always run.

The source analysis can run in FULL mode, SCHEMA MODE or FULL SCHEMA mode.

- FULL: (Default) Executes all applicable checks in all appropriate schemas. SCHEMA, INSTANCE, and UNIVERSAL scope checks are executed.
- **SCHEMA**: Executes all applicable checks for schemas specified on the command line and UNIVERSAL checks. INSTANCE scope checks are not executed.
- SCHEMA FULL: Executes all applicable checks for schemas specified on the command line and UNIVERSAL and INSTANCE checks.

# 7.2 Prerequisites

The prerequisites for using the migrateadvisor command are:

- Oracle Database 11g Release 2 and later versions are supported.
- The PROPERTIES command is available only if the connected user is granted the SELECT ANY DICTIONARY privilege.
- The ADVISE command is available only if the connected user is granted:
  - the SELECT ANY DICTIONARY privilege
  - the SELECT privilege to access SYSTEM.DUM\$COLUMNS and SYSTEM.DUM\$DATABASE



You need access to the DUM\$ tables only if the source and target character sets indicate that Oracle Database Migration Assistant for Unicode (DMU) is needed.



# 7.3 About the MIGRATEADVISOR Command

You can run the CPAT command in SQLcl using ma or migrateadvisor.

This command inclues the following sub-commands:

- **Properties**: Generates a target properties file for Oracle or Autonomous Database that provides instance-specific analysis.
- Advise: Analyzes the database and produce reports containing information to assist in a successful migration.
- Info: Shows version information for CPAT.

#### **Syntax**

```
migrateadvisor help [examples|syntax] |
advise {{-targettype,-t} {ATPS|ATPD|ADWS|ADWD|DEFAULT} } [<-optional-
argument>,...] |
properties [<optional-argument>,...] |
info
```

The following table lists the required and optional arguments for advise.

Argument	Description	Default	
Required			
DEFAULT}	(ATPS ATPD ADWS ADWD  DEFAULT}	None	
	The type of target database to analyze for migration.		
Optional			



Argument	Description	Default
-analysisprops,-a	<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>	None
	The path and name of a properties file.	

No te: The full path is opti onal . If the full path is not spe cifie d, cd <pa th> is use d as the root . If cd <pa th> is not spe cifie d, then the laun ch path is use d as the root

A properties file that was created using the properties sub-

Argument	Description	Default
	command while connected to the target database.	
-excludeschemas,-x	<schema>[,]</schema>	None
	The schema or comma- separated-value list of schemas to exclude from analysis.	
-full, -f	[TRUE:FALSE]	FALSE when -schemas is not
	Execute the full set of tests.	specified, otherwise the default is TRUE
-maxrelevantobjects,-m	<maxrelevantobjects></maxrelevantobjects>	Include all objects
	The maximum number of "relevant objects" to be included in all reports.	
	This option overrides - maxtextdatarows for TEXT reports.	
-maxtextdatarows,-n	<maxtextdatarows></maxtextdatarows>	-maxrelevantobjects if specified,
	Relevant object rows to be included in text reports (does not apply to JSON reports).	otherwise all relevant objects are included.
-migrationmethod,-mm	{DATAPUMP DATAPUMP_DBLINK  GOLDENGATE}[,]	DATAPUMP
	A comma-separated-value list of methods or tooling that will be used to do the migration. Example: DATAPUMP, GOLDENGATE	
-outdir,-o	<directory></directory>	Current SQLcl directory
	Identifies location for log and report files.	
-outfileprefix,-p	<outfileprefix></outfileprefix>	No prefix
	A prefix to the standard base file name of "premigration_advisor_report".	
-reportformat,-r	{HTML JSON TEXT}[,]	HTML
	Specify one or more <reportformats> where <reportformat> is HTML, JSON, or TEXT.</reportformat></reportformats>	
-schemas,-s	<schema>[,]</schema>	All schemas
	The schema or comma separated value list of schemas to analyze. Example: schema1, schema2	
-sqltext,-q	Include SQL query used for checks in TEXT reports.	Do not include sql text in TEXT reports. Ignored for JSON reports.
-verbose,-ve	[TRUE FALSE]	FALSE
	TRUE shows additional diagnostic output.	



The following table lists the optional arguments for properties.

Argument	Description	Default
-outdir,-o	<pre><directory> Identifies location for log and report files.</directory></pre>	Current SQLcl directory
-outfileprefix,-p	<pre><outfileprefix> A prefix to the standard base file name of "premigration_advisor_report".</outfileprefix></pre>	No prefix

# 7.4 Examples

The following examples illustrate how to use the MIGRATEADVISOR command.

# **Example 1**

Generate the target properties file for Autonomous Database.

```
-- Set default directory
SQL> cd <directory>
-- Connect to target
SQL> set cloudconfig <config-file>
SQL> connect <autonomous-connect-string>
-- Generate the properties file
SQL> migrateadvisor properties -outfileprefix cloud
```

### **Example 2**

Create the HTML Advisor report for a single schema using target properties.

```
-- Set default directory

SQL> cd <directory>
-- Connect to source

SQL> connect <database-connect-string>
-- Generate the report

SQL> migrateadvisor advise -schemas hr -outfileprefix hr -targettype adws -analysisprops propertyFile>
```

### **Example 3**

Create the HTML Advisor report for the full database using target properties.

```
-- Set default directory

SQL> cd <directory>
-- Connect to source

SQL> connect <database-connect-string>
-- Generate the report

SQL> migrateadvisor advise -outfileprefix fulldb -targettype adws -analysisprops propertyFile>
```



### **Example 4**

Create the JSON Advisor report excluding schemas.

```
-- Set default directory

SQL> cd <directory>
-- Connect to source

SQL> connect <database-connect-string>
-- Generate the report

SQL> migrateadvisor advise -excludeschemas hr, sales -outfileprefix xschemas -targettype adws -reportformat json
```

### **Example 5**

Create the HTML Advisor report for multiple schemas including instance tests.

```
-- Set default directory

SQL> cd <directory>
-- Connect to source

SQL> connect <database-connect-string>
-- Generate the report

SQL> migrateadvisor advise -schemas hr, sales -full -outfileprefix fullmulti -targettype adws -analysisprops propertyFile>
```

### Example 6

Create HTML Advisor report for a single schema for migration to an Oracle database with target properties.

```
-- Set default directory

SQL> cd <directory>
-- Connect to target

SQL> connect <database-connect-string>
-- Generate the properties file

SQL> migrateadvisor -gettargetproperties -outfileprefix cloud
-- Connect to source

SQL> connect <database-connect-string>
-- Generate the report

SQL> migrateadvisor advise -schemas hr -outfileprefix ora -targettype adws -analysisprops propertyFile>
```

# 7.5 Tips and Troubleshooting

Some points to note are:

- If the source is an Autonomous Database, running the ADVISE command is not a supported use of CPAT and the result may be unpredictable.
- The PROPERTIES and ADVISE commands require that the connected user has the SELECT ANY DICTIONARY privilege.



# If you do not have the SELECT ANY DICTIONARY privilege, you see the following error:

```
SQL> grant connect, resource, unlimited tablespace to jdoe identified by
jdoe;
Grant succeeded.
SQL> connect jdoe/jdoe
Connected.
SQL> migrateadvisor advise -schemas hr -outfileprefix pre -targettype adws
-reportformat json
CPAT-1004: SQL error while initializing premigration application.
ORA-00942: table or view does not exist
--Ensure the JDBC connection information is correct. See the log file for
more details.
Additional Information: 255: Internal error - please contact support.
**Exception**: /Users/xyz/pre premigration advisor report.json
Log file contains:
Caused by: Error: 942, Position: 20, Sql = SELECT VERSION FROM
V$INSTANCE,
OriginalSql = SELECT VERSION FROM V$INSTANCE,
Error Msg = ORA-00942: table or view does not exist
```



# Using the PGQL Plug-in

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.



Property Graph Query Language for more information about PGQL.

This chapter covers the following topics:

- Downloading and Installing
- About PGQL Commands
- Examples

# 8.1 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.

# 8.2 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:

• schema < schema name>: Make queries run against graphs owned by the specified schema.

- 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 schema and graph values are 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.

# 8.3 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 )
```



```
8
     EDGE TABLES (
  9
      emp AS works for
 10
          KEY(empno)
 11
          SOURCE KEY ( empno ) REFERENCES emp
 12
          DESTINATION KEY ( deptno ) REFERENCES dept
 13
          NO PROPERTIES
 14
 15
      OPTIONS (PG PGQL);
Graph created
PGOL> 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
                    5
RESEARCH
                    6
SALES
```

# **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>
```



9

# **SQLcl Command Reference**

This chapter covers the following sections:

- AQ (Advanced Queuing)
- AWR
- BACKGROUND
- BLOCKCHAIN\_TABLE
- CERTIFICATE
- CODESCAN
- CONNECT
- CONMGR
- DG (Data Guard)
- DIRS, PUSHD and POPD
- IMMUTABLE TABLE
- LIQUIBASE
- MDB
- MLE
- MODELER
- PROJECT
- REST
- SDK
- SET system\_variable value
- SHOW option
- SODA

# 9.1 AQ (Advanced Queuing)

The AQ command in SQLcl enables you to access the Oracle Database Advanced Queuing functionality to create queues and queue tables, enqueue and dequeue messages, add and remove subscribers, and manage transactional event queues (TxEventQ).

### **Prerequisites**

This command requires the ADMIN role.

You must have some working knowledge of Advanced Queuing and Transactional Event Queues and be familiar with the concepts, which are explained in the *Oracle Database Advanced Queuing and Transactional Event Queues User's Guide*.

### **Supported Commands**

You can run Advanced Queuing commands in SQLcl using aq.

To view the help information for Advanced Queuing, enter aq help.

- Create a Queue Table
- Alter a Queue Table
- Drop a Queue Table
- Create a Queue
- Alter a Queue
- Drop a Queue
- Create a Sharded Queue
- Alter a Sharded Queue
- Drop a Sharded Queue
- Create an Exception Queue
- Create a Transactional Event Queue
- Alter a Transactional Event Queue
- Drop a Transactional Event Queue
- Create an EQ Exception Queue
- Start a Queue
- Stop a Queue
- Add a Subscriber
- Alter a Subscriber
- Remove a Subscriber
- Enqueue
- Dequeue

### **Example**

The following example uses Advanced Queuing commands in SQLcl to create a queue, start the queue, add a subscriber to the queue, enqueue a message and then dequeue it.

```
--Create a queue named demo2 with multiple consumers and payload type JSON SQL> aq createteq -name demo2 -mul true -pt JSON

--Show the queue properties
SQL> select name, qid, queue_type, enqueue_enabled, dequeue_enabled, sharded, queue_category, recipients from user_queues;

--Start the queue demo2
SQL> aq startq -name demo2
SQL> select name, qid, queue_type, enqueue_enabled, dequeue_enabled, sharded, queue_category, recipients from user_queues;

--Add subscriber named Bob to queue demo2
```



```
SQL> aq add subscriber -queue demo2 -name bob;

--Enqueue message "hello" to queue demo2
SQL> aq enq -name demo2 -p {"message":"hello"};

--Commit the message (send)
SQL> commit;

--Dequeue from queue demo2 by subscriber named Bob using NEXT_MESSAGE navigation after waiting for 2 seconds
SQL> aq deq -name demo2 -nav NEXT MESSAGE -consumer name bob -wait 2;
```

### 9.1.1 Create a Queue Table

### **Syntax**

```
AQ CREATE QUEUE TABLE/CREATEQT -n[ame] table_name

[-pay[load_type] {JSON | RAW | [schema.]type_name}]

[-sto[rage_clause] string]

[-sort[_list] string]

[-mul[tiple_consumers] {NO | YES}]

[-com[ment] string]

[-primary[_instance] number]

[-secondary[_instance] number]

[-secure {YES | NO}]

[-repl[ication_mode] {NONE | REPLICATION}]
```

Parameter	Description	Default
-name,-n	<name> Name of a queue table to create.</name>	-
-payload_type,-pt	[OBJECT NAME TYPE NAME JSON] Type of the user data stored.	JSON
-storage_clause,-sto	<pre><storage_clause>Storage parameter.</storage_clause></pre>	NULL
	The storage parameter is included in the CREATE TABLE statement when the queue table is created. The storage parameter can be made up of any combinations of the following parameters: PCTFREE, PCTUSED, INITRANS, MAXTRANS, TABLESPACE, LOB, and a table storage clause.	
-sort_list,-sort	<sort_list> The columns to be used as the sort key in ascending order. This parameter has the following format: 'sort_column_1,sort_column_2' The allowed column names are priority, enq_time, and commit_time.</sort_list>	ENQ_TIME



Parameter	Description	Default
-multiple_consumers,-mul	[TRUE FALSE]	False
	TRUE: Queues created in the table can only have one consumer for each message.	
	FALSE: Queues created in the table can have multiple consumers for each message.	
-comment,-c	<comment> User-specified description of the queue</comment>	NULL
	table.	
-primary_instance,-primary	<pre><primary_instance></primary_instance></pre>	0
	The primary owner of the queue table. Queue monitor scheduling and propagation for the queues in the queue table are done in this instance.	
-secondary_instance,-	<secondary_instance></secondary_instance>	0
secondary	The queue table fails over to the secondary instance if the primary instance is not available.	
-secure,-sec	[TRUE FALSE]	False
	TRUE: Use the queue table for secure queues. Secure queues are queues for which AQ agents must be associated explicitly with one or more database users.	
-replication_mode,-repl	[0:NONE 1:REPLICATION_MODE]	0:NONE

# 9.1.2 Alter a Queue Table

### **Syntax**

```
AQ ALTER QUEUE TABLE/ALTERQT -n[ame] table_name
  [-com[ment] string]
  [-primary[_instance] number]
  [-secondary[_instance] number]
  [-repl[ication_mode] {NONE | REPLICATION}]
```

Parameter	Description	Default
-name,-n	<name> Name of a queue table to alter.</name>	-
-comment,-c	<comment></comment>	NULL
	User-specified description of the queue table.	
-primary_instance,-primary	<pre><primary_instance></primary_instance></pre>	0
	The primary owner of the queue table. Queue monitor scheduling and propagation for the queues in the queue table are done in this instance.	



Parameter	Description	Default
-secondary_instance,-	<secondary_instance></secondary_instance>	0
secondary	The queue table fails over to the secondary instance if the primary instance is not available.	
-replication_mode,-repl	[0:NONE 1:REPLICATION_MODE]	0:NONE

## 9.1.3 Drop a Queue Table

### **Syntax**

AQ DROP QUEUE TABLE/DROPQT -n[ame] table\_name [-for[ce] {NO | YES}]

### **Parameters**

Parameter	Description	Default
-name,-n	<name> Name of a queue table to drop.</name>	-
-force,-f	[TRUE FALSE]	False
	TRUE: All queues in the table are stopped and dropped automatically.	
	FALSE: The operation does not succeed if there are any queues in the table.	

## 9.1.4 Create a Queue

### **Syntax**

```
AQ CREATE QUEUE/CREATEQ -n[ame] queue_name
-tab[le_name] [schema.]table_name
[-type {NORMAL | EXCEPTION}]
[-max[_retries] number]
[-retry[_delay] number]
[-retention[_time] number]
[-com[ment] string]
```

Parameter	Description	Default
-name,-n	<name> Name of a queue to create.</name>	-
-table_name,-tab	[schema]. <table_name></table_name>	-
	Name of the queue table that will contain the queue.	



Parameter	Description	Default
-type,-t	[0:NORMAL QUEUE 1:EXCEPTION QUEUE]	0:NORMAL QUEUE
	Specifies whether the queue being created is an exception queue or a normal queue.	
-max_retries,-max	<max_retries number=""></max_retries>	5
	A message is moved to an exception queue if RETRY_COUNT is greater than MAX_RETRIES.	
	RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue.	
-retry_delay,-retry	<retry_delay number=""></retry_delay>	0
	Delay time, in seconds, before this message is scheduled for processing again after an application rollback.	
-comment,-c	<comment></comment>	NULL
	User-specified description of the queue table.	
-retention time,-rtime	<retention_time number=""></retention_time>	0
_	[-1:INFINITE] means the message is retained forever.	
	Number of seconds that a message is retained in the queue table after being dequeued from the queue.	

# 9.1.5 Alter a Queue

### **Syntax**

```
AQ ALTER QUEUE/ALTERQ -n[ame] queue_name
  [-max[_retries] number]
  [-retry[_delay] number]
  [-retention[_time] number]
  [-com[ment] string]
```

Parameter	Description	Default
-name,-n	<name> Name of a queue to alter.</name>	-
-max_retries,-max	<max_retries number=""></max_retries>	NULL - current value will not be altered.
	A message is moved to an exception queue if RETRY_COUNT is greater than MAX_RETRIES.	
	RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue.	



Parameter	Description	Default
-retry_delay,-retry	<retry_delay number=""></retry_delay>	NULL - current value
	Delay time, in seconds, before this message is scheduled for processing again after an application rollback.	will not be altered.
-retention_time,-rtime	<retention_time number=""></retention_time>	0
	[-1:INFINITE] means the message is retained forever.	
	Number of seconds that a message is retained in the queue table after being dequeued from the queue.	
-comment,-c	<comment></comment>	NULL
	User-specified description of the queue table.	

### 9.1.6 Drop a Queue

### **Syntax**

AQ DROP QUEUE/DROPQ -n[ame] queue name

### **Parameters**

Parameter	Description	Default
-name,-n	<name> Name of a queue to drop.</name>	-

## 9.1.7 Create a Sharded Queue

### **Syntax**

```
AQ CREATE SHARDED QUEUE/CREATESQ -n[ame] queue_name
  [-sto[rage_clause] string]
  [-mul[tiple_consumers] {NO | YES}]
  [-max[_retries] number]
  [-com[ment] string]
  [-pay[load_type] {JSON | RAW | [schema.]type_name}]
  [-retry[_delay] number]
  [-retention_time number]
  [-sort[_list] {PRIORITY,ENQ_TIME | ENQ_TIME}]
  [-cache[_hint] {AUTO | UNCACHED | CACHED }]
  [-retention_type string]
  [-repl[ication mode] NONE]
```

Parameter	Description	Default
-name,-n	<name> Name of a queue table to create.</name>	-

Parameter	Description	Default
-storage_clause,-sto	<pre><storage_clause>Storage parameter.</storage_clause></pre>	NULL
	The storage parameter is included in the CREATE TABLE statement when the queue table is created. The storage parameter can be made up of any combinations of the following parameters: PCTFREE, PCTUSED, INITRANS, MAXTRANS, TABLESPACE, LOB, and a table storage clause.	
-multiple_consumers,-mul	[TRUE FALSE]	False
	TRUE: Queues created in the table can only have one consumer for each message.	
	FALSE: Queues created in the table can have multiple consumers for each message.	
-comment,-c	<comment></comment>	NULL
	User-specified description of the queue table.	
-payload_type,-pt	[OBJECT NAME TYPE NAME JSON JMS]  Type of the user data stored.	JMS
-retry_delay,-retry	<retry_delay number=""></retry_delay>	0
	Delay time, in seconds, before this message is scheduled for processing again after an application rollback.	
-retention_time,-rtime	<retention_time number=""></retention_time>	0
	[-1:INFINITE] means the message is retained forever.	
	Number of seconds that a message is retained in the queue table after being dequeued from the queue.	
-sort_list,-sort	<sort_list></sort_list>	PRIORITY,ENQ_TIME
	The columns to be used as the sort key in ascending order. This parameter has the following format: 'sort_column_1,sort_column_2' The allowed column names are priority, enq_time, and commit_time.	
-cache_hint,-cache	[1:AUTO 2:CACHED 3:UNCACHED]	1:AUTO
_	Specifies a hint to sharded queue whether to cache messages or not. User can specify following:	
	<ul> <li>[1:AUTO]: Message cache does best effort based on available memory.</li> <li>[2:CACHED]: Message cache will cache messages and give preference to those queues with CACHED hint.</li> </ul>	
-retention_type,-rtype	[0: DEQUEUE_TIME]	0:DEQUEUE_TIME
	The retention time starts after a subshard is dequeued by all the subscribers. If a new subscriber seeks back before or to this subshard, then the retention clock is reset.	
-replication mode,-repl	[0:NONE 1:REPLICATION MODE]	0:NONE



## 9.1.8 Alter a Sharded Queue

### **Syntax**

```
AQ ALTER SHARDED QUEUE/ALTERSQ -n[ame] queue_name
[-max[_retries] number]
[-com[ment] string]
[-retry[_delay] number]
[-retention_time number]
[-cache[_hint] {AUTO | UNCACHED | CACHED}]
[-retention_type string]
[-repl[ication_mode] NONE]
```

Cname Name of a queue to alter.  Chair retries numbers	Default -
•	-
<max_retries_number></max_retries_number>	
	NULL - current value
A message is moved to an exception queue if RETRY_COUNT is greater than MAX_RETRIES.	will not be altered.
RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue.	
<comment></comment>	NULL
User-specified description of the queue table.	
<retry_delay number=""></retry_delay>	0
Delay time, in seconds, before this message is scheduled for processing again after an application rollback.	
<retention_time number=""></retention_time>	0
[-1:INFINITE] means the message is retained forever.	
Number of seconds that a message is retained in the queue table after being dequeued from the queue.	
<sort_list></sort_list>	PRIORITY,ENQ_TIME
The columns to be used as the sort key in ascending order. This parameter has the following format: 'sort_column_1,sort_column_2' The allowed column names are priority, enq_time, and commit_time.	
	if RETRY_COUNT is greater than MAX_RETRIES.  RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue. <comment> User-specified description of the queue table.  <retry_delay number=""> Delay time, in seconds, before this message is scheduled for processing again after an application rollback.  <retention_time number=""> [-1:INFINITE] means the message is retained forever.  Number of seconds that a message is retained in the queue table after being dequeued from the queue.  <sort_list> The columns to be used as the sort key in ascending order. This parameter has the following format: 'sort_column_1,sort_column_2' The allowed column names are priority, enq_time, and</sort_list></retention_time></retry_delay></comment>



Parameter	Description	Default
-cache_hint,-cache	[1:AUTO 2:CACHED 3:UNCACHED]	1:AUTO
to ca	Specifies a hint to sharded queue whether to cache messages or not. User can specify following:	
	<ul> <li>[1:AUTO]: Message cache does best effort based on available memory.</li> <li>[2:CACHED]: Message cache will cache messages and give preference to those queues with CACHED hint.</li> </ul>	
-retention_type,-rtype	[0: DEQUEUE_TIME]	0:DEQUEUE_TIME
	The retention time starts after a subshard is dequeued by all the subscribers. If a new subscriber seeks back before or to this subshard, then the retention clock is reset.	
-replication_mode,-repl	[0:NONE 1:REPLICATION_MODE]	0:NONE

## 9.1.9 Drop a Sharded Queue

### **Syntax**

AQ DROP SHARDED QUEUE/DROPSQ -n[ame] queue\_name [-for[ce] {NO | YES}]

### **Parameters**

Parameter	Description	Default
-name,-n	<name> Name of a queue table to drop.</name>	-
-force,-f	[TRUE FALSE]	False
	TRUE: The sharded queue is dropped even if the queue is not stopped.	
	FALSE: The sharded queue is not dropped even if the queue is not stopped.	

## 9.1.10 Create an Exception Queue

### **Syntax**

AQ CREATE EXCEPTION QUEUE/CREATEEQ -n[ame] queue\_name -sharded[\_queue\_name] [schema.]queue\_name

Parameter	Description	Default
-name,-n	<name></name>	NULL
	Name of a queue to create.	



Parameter	Description	Default	
-sharded_queue_name,- sharded	[schema]. <name> The name of the sharded queue.</name>	FALSE	

## 9.1.11 Create a Transactional Event Queue



This command is only available for Oracle Database release 21c and later versions.

### **Syntax**

```
AQ CREATE TRANSACTIONAL EVENT QUEUE/CREATETEQ -n[ame] queue_name
[-sto[rage_clause] string]
[-mul[tiple_consumers] {NO | YES}]
[-max[_retries] number]
[-com[ment] string]
[-pay[load_type] {JSON | RAW | JMS | [schema.]type_name}]
[-retry[_delay] number]
[-retention_time number]
[-sort[_list] {PRIORITY,ENQ_TIME | ENQ_TIME}]
[-cache[_hint] {AUTO | UNCACHED | CACHED}]
[-retention_type string]
[-repl[ication mode NONE]
```

Parameter	Description	Default
-name,-n	<name> Name of a queue to create.</name>	-
-storage_clause,-sto	<pre><storage_clause>Storage parameter.</storage_clause></pre>	NULL
	The storage parameter is included in the CREATE TABLE statement when the queue table is created. The storage parameter can be made up of any combinations of the following parameters: PCTFREE, PCTUSED, INITRANS, MAXTRANS, TABLESPACE, LOB, and a table storage clause.	
-multiple_consumers,-mul	[TRUE FALSE]	False
	TRUE: Queues created in the table can only have one consumer for each message.	
	FALSE: Queues created in the table can have multiple consumers for each message.	



Parameter	Description	Default
-max_retries,-max	<max_retries number=""></max_retries>	5
	A message is moved to an exception queue if RETRY_COUNT is greater than MAX_RETRIES.	
	RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue.	
-comment,-c	<comment></comment>	NULL
	User-specified description of the queue table.	
-payload_type,-pt	[OBJECT NAME TYPE NAME JSON JMS]  Type of the user data stored.	JMS
-retry_delay,-retry	<retry_delay number=""></retry_delay>	0
	Delay time, in seconds, before this message is scheduled for processing again after an application rollback.	
-retention_time,-rtime	<retention_time number=""></retention_time>	0
	[-1:INFINITE] means the message is retained forever.	
	Number of seconds that a message is retained in the queue table after being dequeued from the queue.	
-sort_list,-sort	<sort_list></sort_list>	PRIORITY,ENQ_TIME
	The columns to be used as the sort key in ascending order. This parameter has the following format: 'sort_column_1,sort_column_2' The allowed column names are priority, enq_time, and commit_time.	
-cache_hint,-cache	[1:AUTO 2:CACHED 3:UNCACHED]	1:AUTO
	Specifies a hint to sharded queue whether to cache messages or not. User can specify following:	
	<ul> <li>[1:AUTO]: Message cache does best effort based on available memory.</li> <li>[2:CACHED]: Message cache will cache messages and give preference to those queues with CACHED hint.</li> </ul>	
-retention_type,-rtype	[0: DEQUEUE_TIME]	0:DEQUEUE_TIME
	The retention time starts after a subshard is dequeued by all the subscribers. If a new subscriber seeks back before or to this subshard, then the retention clock is reset.	
-replication_mode,-repl	[0:NONE 1:REPLICATION_MODE]	0:NONE



## 9.1.12 Alter a Transactional Event Queue



This command is only available for Oracle Database release 21c and later versions.

### **Syntax**

```
AQ ALTER TRANSACTIONAL EVENT QUEUE/ALTERTEQ -n[ame] queue_name
[-max[_retries] number]
[-com[ment] string]
[-retry[_delay] number]
[-retention_time number]
[-cache[_hint] {AUTO | UNCACHED | CACHED}]
[-retention_type string]
[-repl[ication_mode NONE]
```

Description	Default
<name> Name of a queue to alter.</name>	-
<max_retries number=""></max_retries>	NULL - current value
A message is moved to an exception queue if RETRY_COUNT is greater than MAX_RETRIES.	will not be altered.
RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue.	
<comment></comment>	NULL
User-specified description of the queue table.	
<retry_delay number=""></retry_delay>	0
Delay time, in seconds, before this message is scheduled for processing again after an application rollback.	
<retention_time number=""></retention_time>	0
[-1:INFINITE] means the message is retained forever.	
Number of seconds that a message is retained in the queue table after being dequeued from the queue.	
<sort_list></sort_list>	PRIORITY,ENQ_TIME
The columns to be used as the sort key in ascending order. This parameter has the following format: 'sort_column_1,sort_column_2' The allowed column names are priority, enq_time, and commit_time.	
	<pre><name> Name of a queue to alter. <max_retries number=""> A message is moved to an exception queue if RETRY_COUNT is greater than MAX_RETRIES. RETRY_COUNT is incremented when the application issues a rollback after executing the dequeue. <comment> User-specified description of the queue table. <retry_delay number=""> Delay time, in seconds, before this message is scheduled for processing again after an application rollback. <retention_time number=""> [-1:INFINITE] means the message is retained forever. Number of seconds that a message is retained in the queue table after being dequeued from the queue. <sort_list> The columns to be used as the sort key in ascending order. This parameter has the following format: 'sort_column_1,sort_column_2' The allowed column names are priority, enq_time, and</sort_list></retention_time></retry_delay></comment></max_retries></name></pre>



Parameter	Description	Default
-cache_hint,-cache	[1:AUTO 2:CACHED 3:UNCACHED]	1:AUTO
	Specifies a hint to sharded queue whether to cache messages or not. User can specify following:	
	<ul> <li>[1:AUTO]: Message cache does best effort based on available memory.</li> <li>[2:CACHED]: Message cache will cache messages and give preference to those queues with CACHED hint.</li> </ul>	
-retention_type,-rtype	[0: DEQUEUE_TIME]	0:DEQUEUE_TIME
	The retention time starts after a subshard is dequeued by all the subscribers. If a new subscriber seeks back before or to this subshard, then the retention clock is reset.	
-replication mode,-repl	[0:NONE 1:REPLICATION MODE]	0:NONE

# 9.1.13 Drop a Transactional Event Queue



This command is only available for Oracle Database release 21c and later versions.

### **Syntax**

AQ DROP TRANSACTIONAL EVENT QUEUE/DROPTEQ -n[ame] queue\_name [-for[ce] {NO | YES}]

### **Parameters**

Parameter	Description	Default
-name,-n	<name> Name of a queue to drop.</name>	-
-force,-f	[TRUE FALSE]	FALSE
	TRUE: The sharded queue is dropped even if the queue is not stopped.	
	FALSE: The sharded queue is not dropped even if the queue is not stopped.	

## 9.1.14 Create an EQ Exception Queue

### **Syntax**

AQ CREATE EQ EXCEPTION QUEUE/CREATEEQEQ -n[ame] queue\_name -teq[\_queue\_name] [schema.]queue\_name



#### **Parameters**

Parameter	Description	Default
-name,-n	<name></name>	NULL
	Name of a queue to create.	
-teq_queue_name,-teq	[schema]. <name></name>	FALSE
	The name of the transactional event queue.	

## 9.1.15 Start a Queue

### **Syntax**

```
AQ START QUEUE/STARTQ -n[ame] queue_name [-enq[ueue] {ENABLE | KEEP}] [-deq[ueue] {ENABLE | KEEP}]
```

#### **Parameters**

Parameter	Description	Default
-name,-n	<name></name>	NULL
	Name of a queue to enable.	
-enqueue, -enq	[TRUE FALSE]	TRUE
	TRUE: Enable ENQUEUE.	
	FALSE: Do not alter the current setting.	
-dequeue, -deq	[TRUE FALSE]	TRUE
	TRUE: Enable DEQUEUE.	
	FALSE: Do not alter the current setting.	

## 9.1.16 Stop a Queue

### **Syntax**

```
AQ STOP QUEUE/STOPQ -n[ame] queue_name
  [-enq[ueue] {DISABLE | KEEP}]
  [-deq[ueue] {DISABLE | KEEP}]
  [-wait {YES | NO}]
```

Parameter	Description	Default
-name,-n	<name></name>	NULL
	Name of a queue to disable.	



Parameter	Description	Default
-enqueue, -enq	[TRUE FALSE]	TRUE
	TRUE: Enable ENQUEUE.	
	FALSE: Do not alter the current setting.	
-dequeue, -deq	[TRUE FALSE]	TRUE
	TRUE: Enable DEQUEUE.	
	FALSE: Do not alter the current setting.	
-wait,-w	[TRUE FALSE	TRUE
	TRUE: Wait if there are any outstanding transactions.	
	FALSE: Return immediately either with a success or an error.	

### 9.1.17 Add a Subscriber

### **Syntax**

```
AQ ADD SUBSCRIBER/ADDSUB -n[ame] subscriber_name
-queue[_name] queue_name
[-subscriber_address string]
[-subscriber_protocol number]
[-rule string]
[-trans[formation] [schema.]name]
[-queue_to_queue {NO | YES}] t
[-mode {PERSISTENT | BUFFERED | PERSISTENT_OR_BUFFERED}]
```

Parameter	Description	Default
-name,-n	Name of a producer or consumer of a message.	-
-queue_name,-queue	<name> Name of a queue.</name>	-
-subscriber_address,-sa	<subscriber_address></subscriber_address>	***
	Protocol-specific address of the recipient.	
	If the protocol is 0, then the address is of the form [schema.]queue[@dblink].	
	Name of the queue table that will contain the queue.	
-subscriber_protocol,-sp	<pre><subscriber_protocol> Protocol to interpret the address and propagate the message.</subscriber_protocol></pre>	0



Parameter	Description	Default
-rule,-r	<rule></rule>	NULL
	A conditional expression based on the message properties, the message data properties and PL/SQL functions.	
	A rule is specified as a Boolean expression using syntax similar to the WHERE clause of a SQL query.	
	You must prefix each attribute with tab.user_data as a qualifier to indicate the specific column of the queue table that stores the payload.	
-transformation,-trans	<transformation></transformation>	NULL
	Specifies a transformation that will be applied when this subscriber dequeues the message.	
-queue_to_queue,-q2q	[TRUE FALSE]	FALSE
	TRUE: propagation is from queue-to-queue	
-mode,-m	<pre>[1:PERSISTENT 2:BUFFERED  3:PERSISTENT_OR_BUFFERED]</pre>	PERSISTENT
	Delivery mode of the messages the subscriber is interested in.	

### 9.1.18 Alter a Subscriber

### **Syntax**

```
AQ ALTER SUBSCRIBER/ALTERSUB -n[ame] subscriber_name
[-subscriber_address string]
[-subscriber_protocol number]
-queue[_name] [schema.]queue_name
[-rule string]
[-trans[formation] [schema.]name]
```

Parameter	Description	Default
-name,-n	Name of a producer or consumer of a message.	-
-queue_name,-queue	<name> Name of a queue.</name>	-
-subscriber_address,-sa	<subscriber_address></subscriber_address>	""
	Protocol-specific address of the recipient.	
	If the protocol is 0, then the address is of the form [schema.]queue[@dblink].	
	Name of the queue table that will contain the queue.	
-subscriber protocol,-sp	<subscriber_protocol></subscriber_protocol>	0
_	Protocol to interpret the address and propagate the message.	
-subscriber_protocol,-sp	Protocol to interpret the address and	0



Parameter	Description	Default
-rule,-r	<rule></rule>	NULL
	A conditional expression based on the message properties, the message data properties and PL/SQL functions.	
	A rule is specified as a Boolean expression using syntax similar to the WHERE clause of a SQL query.	
	You must prefix each attribute with tab.user_data as a qualifier to indicate the specific column of the queue table that stores the payload.	
-transformation,-trans	<transformation></transformation>	NULL
	Specifies a transformation that will be applied when this subscriber dequeues the message.	

### 9.1.19 Remove a Subscriber

### **Syntax**

```
AQ REMOVE SUBSCRIBER/REMOVESUB -n[ame] subscriber_name [-subscriber_address string] [-subscriber_protocol number] -queue[ name] [schema.]queue name
```

### **Parameters**

Parameter	Description	Default
-name,-n	Name of a producer or consumer of a message.	-
-queue_name,-queue	<name> Name of a queue.</name>	-
-subscriber_address,-sa	<subscriber_address></subscriber_address>	***
	Protocol-specific address of the recipient.	
	If the protocol is 0, then the address is of the form [schema.]queue[@dblink].	
	Name of the queue table that will contain the queue.	
-subscriber_protocol,-sp	<subscriber_protocol></subscriber_protocol>	0
	Protocol to interpret the address and propagate the message.	

## 9.1.20 Enqueue



### **Syntax**

```
AQ ENQ[UEUE] -n[ame] queue_name
{
    -pay[load] payload
    |
    -file[name] name
}
[-type {JSON | HEX | BINARY}]

[-vis[ibility] {ON_COMMIT | IMMEDIATE}]
[-trans[formation] [schema.]name]
[-mode {PERSISTENT | BUFFERED}]
[-pri[ority] priority]
[-del[ay] delay]
[-exp[iration] expiration]
[-corr[elation] string]
[-rec[ipient_list] agents]
[-exc[eption_queue] name]
[-sender[_agent] name]
[-out_msgid string]
```

Parameter	Description	Default
-name,-n	<name> Name of the queue to which this message should be enqueued.</name>	-
-payload,-p	Message payload.	-
-filename,-file	File to read the message payload.	-
-payload_type,-pt	Payload format type.	JSON
-visibility,-vis	<ul> <li>Specifies the transactional behavior of the enqueue request. Possible settings are:</li> <li>[2:ON_COMMIT]: The enqueue is part of the current transaction. The operation is complete when the transaction commits. This setting is the default.</li> <li>[1: IMMEDIATE]: The enqueue operation is not part of the current transaction, but an autonomous transaction which commits at the end of the operation. This is the only value allowed when enqueuing to a nonpersistent queue.</li> </ul>	2:ON_COMMIT
-mode,-m	[1:PERSISTENT 2:BUFFERED  3:PERSISTENT_OR_BUFFERED]	PERSISTENT
	Delivery mode of the messages the subscriber is interested in.	
-priority,-pri	Specifies the priority of the message. A smaller number indicates higher priority.	1
	The priority can be any number, including negative numbers.	



Parameter	Description	Default
-comment,-c	<comment></comment>	NULL
	User-specified description of the queue table.	
-delay,-del	The delay represents the number of seconds after which a message is available for dequeuing.	0
-expiration,-exp	It determines, in seconds, the duration the message is available for dequeuing.	-1 - NEVER
-correlation,-corr	Specifies the name of the queue into which the message is moved if it cannot be processed successfully.	-
-sender_id,-sid	The application-sender identification specified at enqueue time by the message producer. Sender name is required for secure queues at enqueue time.	-
-out_message_id,-out_msgid	System generated identification of the message. This is a globally unique identifier that can be used to identify the message at dequeue time.	-
	A bind variable can also be used as an input to store the message id. (Example: - out_msgid :xyz)	

### 9.1.21 Dequeue

#### **Syntax**

```
AQ DEQ[UEUE] -n[ame] queue name
  [-cons[umer] name]
    -pay[load] payload
    -file[name] name
  [-type {JSON | HEX | BINARY}]
  [-deq[ueue] mode {REMOVE | BROWSE | LOCKED | REMOVE NODATA}]
  [-nav[igation {NEXT MESSAGE | NEXT TRANSACTION | FIRST MESSAGE}]
  [-vis[ibility] {ON COMMIT | IMMEDIATE}]
  [-wait number]
  [-msgid string]
  [-corr[elation] string]
  [-cond[ition] string]
  [-trans[formation] [schema.]name]
  [-mode {PERSISTENT | BUFFERED | PERSISTENT OR BUFFERED}]
  [-for[mat enqueue time] string]
  [-out msgid string]
  [-out pri[ority] number]
  [-out del[ay] number]
  [-out exp[iration] number]
  [-out corr[elation] string]
  [-out attempts number]
```

[-out\_exc[eption\_queue] name]
[-out\_enqueue\_time string]
[-out\_state string]
[-out\_sender\_agent name]
[-out\_original\_msgid string]
[-out\_mode string]

Parameter	Description	Default
-name,-n	<name> Name of the queue to which this message should be dequeued.</name>	-
-payload,-p	Message payload to be written on the console.	-
-filename,-file	File to write the message payload.	-
-payload_type,-pt	Payload format type.	JSON
-consumer_name,-cons	Only those messages matching the consumer name are accessed. If a queue is not set up for multiple consumers, then this field should be set to NULL.	-
-dequeue_mode,-dm	<ul> <li>Specifies the locking behavior associated with the dequeue. Possible settings are:</li> <li>[1: BROWSE]: Read the message without acquiring any lock on the message. This specification is equivalent to a select statement.</li> <li>[2: LOCKED]: Read and obtain a write lock on the message. The lock lasts for the duration of the transaction. This setting is equivalent to a select for update statement.</li> <li>[3: REMOVE - DEFAULT]: Read the message and delete it.</li> <li>[4: REMOVE_NODATA]: Mark the message as updated or deleted. The message can be retained in the queue table based on the retention properties.</li> </ul>	
-navigation,-nav	<ul> <li>Specifies the position of the message that will be retrieved. Possible settings are:</li> <li>[1: FIRST_MESSAGE:]: Retrieves the first message which is available and matches the search criteria.</li> <li>[2: NEXT_TRANSACTION]: Skip the remainder of the current transaction group (if any) and retrieve the first message of the next transaction group.</li> <li>[3: NEXT_MESSAGE - DEFAULT]: Retrieve the next message that is available and matches the search criteria.</li> </ul>	



Parameter	Description	Default
-visibility,-vis	<ul> <li>Specifies the transactional behavior of the enqueue request. Possible settings are:</li> <li>[2:ON_COMMIT]: The enqueue is part of the current transaction. The operation is complete when the transaction commits. This setting is the default.</li> <li>[1: IMMEDIATE]: The enqueue operation is not part of the current transaction, but an autonomous transaction which commits at the end of the operation. This is the only value allowed when enqueuing to a nonpersistent queue.</li> </ul>	2:ON_COMMIT
-deq_wait,-deq_w	Specifies the wait time if there is currently no message available which matches the search criteria. Possible settings are:  • [-1: FOREVER]: Wait forever. This setting is the default.  • [0: NO_WAIT]: Do not wait.  • [x]: Wait time in seconds. (x seconds)	
-correlation,-corr	Specifies the name of the queue into which the message is moved if it cannot be processed successfully.	-
-condition,-con	A conditional expression based on the message properties, the message data properties, and PL/SQL functions.	-
-message_id, msg_id	Specifies the message identifier of the message to be dequeued. A bind variable can also be used as an input (Example: - msgid:xyz).	-
-transformation,-trans	<transformation></transformation>	NULL
	Specifies a transformation that will be applied after dequeuing the message.	
-mode,-m	[1:PERSISTENT 2:BUFFERED  3:PERSISTENT_OR_BUFFERED]	PERSISTENT
	Delivery mode of the messages the subscriber is interested in.	
-out_message_id,-out_msgid	System generated identification of the message. This is a globally unique identifier that can be used to identify the message at dequeue time.	-
	A bind variable can also be used as an input to store the message id. (Example: - out_msgid :xyz)	
-out_priority,-out_pri	Priority of the message. A smaller number indicates higher priority.	-
	A bind variable can also be used as an input to store the priority. (Example: - out_priority :xyz)	



Parameter	Description	Default
-out_delay,-out_del	The delay represents the number of seconds after which a message is available for dequeuing.	-
	A bind variable can also be used as an input to store the delay. (Example: - out_delay :xyz)	
-out_expiration,-out_exp	The duration the message is available for dequeuing.	-
	A bind variable can also be used as an input to store the expiration. (Example: - out_expiration :xyz)	
-out_correlation,-out_corr	Correlation identifier of the message to be dequeued.	-
	A bind variable can also be used as an input to store the correlation. (Example: - out_correlation :xyz)	
-out_attempts,-out_att	Number of attempts made to dequeue the message.	-
	A bind variable can also be used as an input to store the attempts. (Example: - out_attempts :xyz)	
-out_exception_queue,- out_exc	Name of the queue into which the message is moved if it cannot be processed successfully.	-
	A bind variable can also be used as an input to store the exception queue (Example: -out_exception_queue :xyz)	
-out_enqueue_time,-out_eqt	The time the message was enqueued.	-
	A bind variable can also be used as an input to store the enqueue time. (Example: -out_enqueue_time:xyz)	
-out_state,-out_st	State of the message at the time of the dequeue.	-
	A bind variable can also be used as an input to store the state (Example: - out_state :xyz)	
-out_sender_id,-out_sid	The application-sender identification specified at enqueue time by the message producer.	-
	A bind variable can also be used as an input to store the sender id (Example: - out_sender_id :xyz)	
-out_mode,-out_m	The delivery mode of the messages.	-
	A bind variable can also be used as an input to store the mode (Example: - out_mode :xyz)	



### 9.2 AWR

The awr command creates and retrieves automatic workload repository (AWR) reports for the currently connected instance. These reports provide metrics on the database's workload, performance, and resource usage.

### **Syntax**

```
awr <create_snapshot> | <create_report> | <list_snapshots>
<create_snapshot> := create snapshot (bestfit | lite | typical | all)?
<create_report> := create (html | text) <begin-snapshot-id>
<end-snapshot-id>
t snapshots> := list snap[shots]
```

#### where

<create\_snapshot>: Creates a new snapshot and prints its id. The optional parameter flushlevel of the snapshot are (BESTFIT, LITE, TYPICAL, ALL).

<create\_report>: Creates a new AWR report and writes it to a file called "AWR-<DB\_Name><PDB\_Name>-<Current Timestamp>.[html|txt]" in the current working directory.

<begin-snapshot-id>: Provides the beginning snapshot id for the AWR report. By default, the second last snapshot id is taken if no id has been provided.

<end-snapshot-id>: Provides the ending snapshot id for the AWR report. By default, the last snapshot id is taken if no id has been provided.

/snapshots>: Lists the available snapshots in the database.

### 9.3 BACKGROUND

The BACKGROUND command runs the SQLcl command as a background task.

### **Syntax**

```
background|bg {OPTIONS} <commandspec>
```

where <commandspec> is the SQLcl command.

#### **Options**

Option	Description
-wait4 -w4 < <i>wait4</i> >	List of task names to wait for. See Wait4 Command
-taskname -tn <taskname></taskname>	Name of the task.
	To know the task details, use the Jobs Command.

#### **Examples**

```
SQL> background apex list SQL> background -taskname task3 -wait4 task1,task2 apex list
```



### 9.3.1 Jobs Command

The  ${\scriptsize\texttt{JOBS}}$  command lists the details of jobs that are running in the background.

### **Syntax**

```
jobs|jb {SUBCOMMAND} {OPTIONS}
```

where SUBCOMMAND can be any of the following:

- Cancel: Cancel a running job.
- Logs: Show job logs.
- Delete: Remove jobs from the list.

### **Options**

Option	Description
-id -i < <i>id</i> >	The id of the task.
-taskname -tn <taskname></taskname>	Name of the task.

### **Examples**

```
SQL> jobs -id 2
SQL> jobs logs -id 2
SQL> jobs cancel -id 2
```

### 9.3.1.1 Cancel Jobs

This command cancels a running job.

### **Syntax**

```
jobs|jb cancel|c {OPTIONS}
```

### **Options**

Option	Description
-id -i < <i>id</i> >	The id of the task.
-taskname -tn <taskname></taskname>	Name of the task.

### **Examples**

```
SQL> jobs cancel -id 2
```

### 9.3.1.2 Log Jobs

This command shows the log files for jobs.



### **Syntax**

```
jobs|jb logs|l {SUBCOMMAND} {OPTIONS}
```

#### where SUBCOMMAND is:

delete|d: Delete logfiles for completed jobs.

### **Options**

Option	Description
-id -i < <i>id</i> >	The id of the task.
-taskname -tn <taskname></taskname>	Name of the task.

### **Examples**

```
SQL> jobs logs -id 2
SQL> jobs logs delete
```

### 9.3.1.3 Delete Jobs

This command removes jobs from the list. This could be either a a specific job, or all jobs, or only if the job is finished.

### **Syntax**

```
jobs|jb delete|d {OPTIONS}
```

### **Options**

Option	Description
-id -i < <i>id</i> >	The id of the task.
-taskname -tn <taskname></taskname>	Name of the task.
-all -a	Remove all tasks from the list.
-finished -f	Only remove finished tasks from the list.

### **Examples**

SQL> jobs delete -id 2

### 9.3.2 Wait4 Command

Wait for one or more tasks to finish before continuing the job.

#### **Syntax**

```
wait4|w4 {OPTIONS} {PARAMETERS}
```

### **Options**



Description
Number of milliseconds to wait before continuing with processing.

#### **Parameters**

Option	Description
<tasknames></tasknames>	List of task names to wait for.

#### **Examples**

SQL> wait4 task1, task3

# 9.4 BLOCKCHAIN\_TABLE

This command uses an extension of the <code>DBMS\_BLOCKCHAIN\_TABLE</code> PL/SQL package. A blockchain table is an append-only table designed for centralized blockchain applications. V2 blockchain tables support schema evolution, delegate signatures, and countersignatures in addition to the functionality found in V1 blockchain tables. Blockchain tables support only DER encoding for X.509 certificates, not PEM encoding.

### **Syntax**

```
blockchain_table|bl [add_interval_partitioning|addintpartition] |
[countersign_row|countersign] | desc | [delete_expired_rows|del] |
get_bytes_for_row_hash | get_bytes_for_row_signature | get_digest |
get_signed_digest | [sign_row|sign] |
[sign_row_with_countersignature|signandcountersign] | verify_rows |
verify_table | verify_user_chains
```

The following table provides a description of each sub-command.

Sub-Command	Description
add_interval_partitioning   addintpartition	Adds interval partitioning to an existing, non-partitioned, V1 or V2 blockchain table.
countersign_row   countersign	Procures a countersignature on a specified row in a blockchain table. The countersignature is produced by signing the row data content using the table owner's private key stored in the database wallet.
desc	Describes the details of the blockchain table.
delete_expired_rows   del	Deletes some or all expired rows in the blockchain table.
get_bytes_for_row_hash	Returns in row_data the bytes for the particular row identified (a series of meta-data-value, columndata-value pairs in column position order) followed by the hash for the previous row in the chain in the data format specified.



Sub-Command	Description
get_bytes_for_row_signature	Returns the bytes used to compute a user signature, a delegate signature, or a countersignature. For a user signature or a delegate signature, the command returns in row_data the bytes in the hash in the row without any metadata.
get_digest	Generates and returns a cryptographic hash of the digest for user-specified rows or for a specified blockchain table.
get_signed_digest	Generates and returns the signed digest for user- specified rows (if specified) in a blockchain table using the table owner's private key stored in the database wallet. The particular rows in the digest are specified by the selector parameter. The default value of this field is NULL. The signed_bytes, signed_row_indexes, and schema_certificate_guid are also returned.
sign_row   sign	Provides a signature by the current user on the row content of a previously inserted row.
sign_row_with_countersignature   signandcountersign	Enables the user to request a countersignature from the database. The countersignature is produced by signing the row data content using the table owner's private key stored in the database wallet. This command is an extension of the SIGN_ROW command
verify_rows	Verifies all rows on all applicable system chains for the integrity of the hash column value for rows created in the range of low_timestamp to high_timestamp. Row signatures can be verified as an option.
verify_table	Verifies all rows whose creation-time falls between the minimum value for the row-creation time from begin_bytes_file and the maximum value for row- creation time from end_bytes_file, and returns the number of successfully verified rows.
verify_user_chains	Verifies rows of one or more user chains when the user chains feature is enabled on the blockchain table.

### Example

The following example shows different ways to select rows for operations in a blockchain table.

• Use one of the following commands to select a row using positional parameters (instance id, chain id, sequence id).

```
bl countersign_row -tab <TABLE_NAME> -inst <INSTANCE_ID> -ch <CHAIN_ID> -
seq <SEQUENCE_ID> -countersignalgo <ALGORITHM> -cscg <CERTIFICATE_GUID> -
```

```
bytes_file <PATH_TO_FILE>/countersignBytes.txt -csig
<COUNTERSIGNATURE_VARIABLE>
```

bl get\_bytes\_for\_row\_hash -tab <TABLE\_NAME> -inst <INSTANCE\_ID> -ch
<CHAIN\_ID> -seq <SEQUENCE\_ID> -uchain <USER\_CHAIN>

bl get\_bytes\_for\_row\_signature -tab <TABLE\_NAME> -inst <INSTANCE\_ID> -ch
<CHAIN ID> -seq <SEQUENCE ID> -row data file <PATH TO FILE>/test2.txt

bl sign\_row -tab <TABLE\_NAME> -inst <INSTANCE\_ID> -ch <CHAIN\_ID> -seq
<SEQUENCE\_ID> -row\_hash <ROW\_HASH> -signature\_file <PATH\_TO\_FILE>/
ulr1\_sign.dat -cert\_guid <CERTIFICATE\_GUID> -algo <ALGORITHM>

bl signandcountersign -tab <TABLE\_NAME> -inst <INSTANCE\_ID> -ch <CHAIN\_ID>
-seq <SEQUENCE\_ID> -row\_hash <ROW\_HASH> -signature\_file <PATH\_TO\_FILE>/
ulr11 sign.dat -cert guid <CERTIFICATE GUID> -algo <ALGORITHM>

Use one of the following commands to select a row using key column parameters.

blockchain\_table countersign\_row -tab <TABLE\_NAME> -kc1name <COLUMN\_NAME> kc1val <COLUMN\_VALUE> -countersignalgo <ALGORITHM> -cscg
<CCERTIFICATE\_GUID> -bytes\_file <PATH\_TO\_FILE>/countersignBytes.txt -csig
<COUNTERSIGNATURE\_VARIABLE>

bl get\_bytes\_for\_row\_hash -table\_name <TABLE\_NAME> -kc1name <COLUMN\_NAME> kc1val <COLUMN VALUE>

bl get\_bytes\_for\_row\_signature -tab <TABLE\_NAME> -kc1name <COLUMN\_NAME> -kc1val <COLUMN\_VALUE> -row\_data\_file <PATH\_TO\_FILE>/u1r1.dat

bl sign\_row -tab <TABLE\_NAME> -kc1name <COLUMN\_NAME> -kc1val
<COLUMN\_VALUE> -signature\_file <PATH\_TO\_FILE>/u1r2\_sign.dat -cert\_guid
<CERTIFICATE GUID> -algo <ALGORITHM>

bl signandcountersign -tab <TABLE\_NAME> -kclname <COLUMN\_NAME> -kclval <COLUMN\_VALUE> -signature\_file <PATH\_TO\_FILE>/ulr12\_sign.dat -cert\_guid <CERTIFICATE\_GUID> -algo <ALGORITHM>

### 9.4.1 add interval partitioning

Adds interval partitioning to an existing, non-partitioned, V1 or V2 blockchain table.

#### **Syntax**

blockchain table|bl add interval partitioning|addintpartition {OPTIONS}

#### **Options**



Option	Description
Required -table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.
	Case sensitive, embedded white space table and schema name should be entered as """Alp_ha"".""Be \$a"". The parser parses these values as "Alp_ha"."Be \$a"
<pre>-interval_number -intnum <interval_number></interval_number></pre>	Specifies the interval number that determines how often the database creates partitions for the blockchain table.
<pre>-interval_frequency -intfreq <interval_frequency></interval_frequency></pre>	Specifies the interval frequency that determines how frequently the database creates partitions for blockchain tables within a specified interval set by the interval_number setting. Supported values are YEAR, MONTH, DAY, HOUR, MINUTE.
<pre>-first_high_timestamp -firsthigh <first_high_timestamp></first_high_timestamp></pre>	Specifies a timestamp that determines the upper boundary of the first partition in the blockchain table.

### **Example**

Partition the BCTAB1 blockchain table with a daily frequency, beginning on January 23, 2024, at 12:47:29.

bl addintpartition -tab "ul.""bctabl""" -intnum l -intfreq "DAY" -firsthigh "23-JAN-24 l2.47.29.182463000"

## 9.4.2 countersign\_row

Procures a countersignature on a specified row in a blockchain table. The countersignature is produced by signing the row data content using the table owner's private key stored in the database wallet.

### **Syntax**

blockchain\_table|bl countersign\_row|countersign {OPTIONS}

#### **Options**

### Option Description Required -table name|-tab Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double. double quotes. Note: Case-sensitive, embedded white space, table and schema name must be entered as """Alp ha"".""Be \$a""". The parser parses these values "Alp ha"."Be \$a" Specifies the instance that inserted the row. If -instance id|-inst <instance id> specified, this limits the operation to rows inserted by the given instance. -chain id|-ch <chain id> Specifies the chain containing the row. If specified, this limits operation to rows assigned to the specified chain. By default, there are 32 chains in each instance, and they are numbered from 0 to -sequence id|-seq <sequence id> Specifies the position of the row on the specified chain. Optional -keycol1 name|-kc1name <keycol1 name> Specifies the name of the key column. -keycol1 value|-kc1val <keycol1 value> Specifies the value of the key column. -keycol2 name|-kc2name <keycol2 name> Specifies the name of the second column in a composite key. Specifies the value of the second column in a -keycol2 value|-kc2val <keycol2 value> composite key. Specifies the name of the third column in a -keycol3 name|-kc3name <keycol3 name> composite key. Specifies the value of the third column in a -keycol3 value|-kc3val <keycol3 value> composite key.



Option	Description
-countersignature_algorithm - countersignalgo <countersignature_algorithm></countersignature_algorithm>	Specifies the cryptographic hash algorithm to use for the countersignature. The default value of this field is  DBMS_BLOCKCHAIN_TABLE.SIGN_ALGO_DEFAULT.  If specified, the parameter must be one of the following acceptable string constants:  RSA_SHA2_256  RSA_SHA2_384  RSA_SHA2_512
-bytes_file <bytes_file></bytes_file>	Specifies the name of the file that contains the signed countersignature bytes.
-countersignature -csig <countersignature></countersignature>	Specifies the digital signature on the bytes returned in bytes_file. This is an OUT parameter option, used for storing the output value of the command in a bind variable.
<pre>-countersign_cert_guid -cscg <countersign_cert_guid></countersign_cert_guid></pre>	Specifies a unique identifier for the certificate of the blockchain table owner stored in the database that may be used to verify the countersignature. This is an OUT parameter option, used for storing the output value of the command in a bind variable.
<pre>-content_version <content_version> ('V2_DIGEST')</content_version></pre>	Specifies the version of the data contents and layout that are used as input to the countersignature algorithm. Only V2_DIGEST is supported in this release.

### **Example**

Countersign the row in the  ${\tt BCTAB1}$  blockchain table where COL1 equals 200.

bl countersign -tab ul.bctabl -kclname "COL1" -kclval "200"

### 9.4.3 desc

Describes the details of the blockchain table.

### **Syntax**

blockchain\_table|bl desc {OPTIONS}

### Option

Option	Description
Required	



Option	Description
-table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.
	Case-sensitive, embedded white space, table and schema name should be entered as"""Alp_ha"".""B e \$a""". The parser parses these values as "Alp_ha"."Be \$a"

# 9.4.4 delete\_expired\_rows

Deletes some or all expired rows in the blockchain table.

### **Syntax**

blockchain\_table|bl delete\_expired\_rows|del {OPTIONS}

### **Options**

Option	Description
Required	



"Alp ha"."Be \$a"

Option	Description
-table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.
	Case-sensitive, embedded white space, table and schema name should be entered as:""Alp_ha"".""  Be \$a""". The parser parses these values as:

### Optional

-before timestamp|-before Specifies a timestamp to determine deletion of expired rows. Set this parameter according to the <before timestamp> NLS\_TIMESTAMP\_FORMAT or NLS\_TIMESTAMP\_TZ\_FORMAT. The default value for this parameter is NULL. If the parameter value is NULL, all expired rows in the table are deleted. If the parameter value is not NULL and is older than the timestamp calculated based on the current time and the row retention period, then rows with timestamps earlier than the parameter value are deleted. If the parameter value is not  ${\tt NULL}$  and is more recent than the timestamp calculated based on the current time and row retention period, the calculated timestamp is used, resulting in the

-rowcount <rowcount>

Requests the number of rows deleted. This is an OUT parameter option, used for storing the output value of the command in a bind variable.

deletion of all expired rows.

#### **Example**

Delete expired rows from the BCTAB1 blockchain table where expiry occurred before January 23, 2024, at 11:00 AM, and store the number of deleted rows in the bind variable row count.

```
blockchain_table delete_expired_rows -table_name """bcta _b1""" - before timestamp 23-JAN-23 11.00.00 AM -rowcount ":count1"
```



# 9.4.5 get\_bytes\_for\_row\_hash

Returns in row\_data the bytes for the particular row identified (a series of meta-data-value, column-data-value pairs in column position order) followed by the hash for the previous row in the chain in the data format specified.

### **Syntax**

blockchain table|bl get bytes for row hash {OPTIONS}

### **Options**

Option	Description
Required	
-table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.

### Note:

Case-sensitive, embedded white space, table and schema name should be entered as:""Alp\_ha"".""

Be \$a""". The parser parses these values as:
"Alp\_ha"."Be \$a"
.

-instance_id -inst <instance_id></instance_id>	Specifies the instance that inserted the row. If specified, this limits the operation to rows inserted by the given instance.
-chain_id -ch <chain_id></chain_id>	Specifies the chain containing the row. If specified, this limits operation to rows assigned to the specified chain. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.
-sequence_id -seq <sequence_id></sequence_id>	Specifies the position of the row on the specified chain.
Optional	
-data_format -df <data_format></data_format>	Specifies the version of the data layout for the hash in the specified row. Must be 1 in this release. By default, the value of this option is set as 1.
-row_data_file <row_data_file></row_data_file>	Specifies the file in which the generated row data bytes are saved.



Option	Description
-user_chain -uchain <user_chain></user_chain>	Specifies the name of the user chain when the bytes for the cryptographic hash on the user chain are desired. If the option is not specified, the system chain's cryptographic hash bytes are assumed as the desired output.
-keycol1_name -kc1name <keycol1_name></keycol1_name>	Specifies the name of the key column.
-keycol1_value -kc1val <keycol1_value></keycol1_value>	Specifies the value of the key column.
-keycol2_name -kc2name <keycol2_name></keycol2_name>	Specifies the name of the second column in a composite key.
-keycol2_value -kc2val <keycol2_value></keycol2_value>	Specifies the value of the second column in a composite key.
-keycol3_name -kc3name <keycol3_name></keycol3_name>	Specifies the name of the third column in a composite key.
-keycol3_value -kc3val <keycol3_value></keycol3_value>	Specifies the value of the third column in a composite key.
-pdb_guid <pdb_guid></pdb_guid>	Specifies the identifier of the pluggable database that inserted the row for a V2 blockchain table. If specified, restricts attention to system chains inserted by the specified pluggable database. It must be NULL for a V1 blockchain table.

Retrieve the row hash bytes for the row in the BCTAB1 blockchain table identified by INSTANCE\_ID = 1, CHAIN\_ID = 27, and SEQUENCE\_ID = 2.

blockchain table get bytes for row hash -tab u1.bcTAB1 -inst 1 -ch 27 -seq 2

# 9.4.6 get\_bytes\_for\_row\_signature

Returns the bytes used to compute a user signature, a delegate signature, or a countersignature.

For a user signature or a delegate signature, the command returns in row\_data the bytes in the hash in the row without any metadata. No other columns are involved, either in the row or in the previous row. For a countersignature, the routine returns in row\_data the bytes that are input to the digital signature algorithm that computes a countersignature on the row.

#### **Syntax**

blockchain table|bl get bytes for row signature {OPTIONS}

Option	Description	
Required		



Option	Description
-table_name -tab [table_name]	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.

### Note:

Case-sensitive, embedded white space, table and schema name should be entered as:""Alp\_ha"".""

Be \$a""". The parser parses these values as:
"Alp\_ha"."Be \$a"
.

One of the following: instance\_id or chain\_id and sequence\_id or keycol1\_name and keycol1\_value

• · · · · · · · · · · · · · · · · · · ·	queries_ia er nej eer _i.ae aa nej eer _i.a.ae
-instance_id -inst [instance_id]	Specifies the instance that inserted the row. If specified, this limits the operation to rows inserted by the given instance.
-chain_id -ch [chain_id]	Specifies the chain containing the row. If specified, this limits operation to rows assigned to the specified chain. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.
-sequence_id\-seq <sequence_id></sequence_id>	Specifies the position of the row on the specified chain.
-keycol1_name -kc1name <keycol1_name></keycol1_name>	Specifies the name of the key column.
-keycol1_value -kc1val <keycol1_value></keycol1_value>	Specifies the value of the key column.
Optional	
-data_format -df <data_format></data_format>	Specifies the version of the data layout for the hash in the specified row. Must be 1 in this release. By default, the value of this option is set as 1.
-row_data_file <row_data_file></row_data_file>	Specifies the file in which the generated row_data_bytes are saved.
-keycol2_name -kc2name <keycol2_name></keycol2_name>	Specifies the name of the second column in a composite key.
-keycol2_value -kc2val <keycol2_value></keycol2_value>	Specifies the value of the second column in a composite key.
-keycol3_name -kc3name <keycol3_name></keycol3_name>	Specifies the name of the third column in a composite key.
-keycol3 value -kc3val <keycol3 value=""></keycol3>	Specifies the value of the third column in a

Option	Description
-pdb_guid <pdb_guid></pdb_guid>	Specifies the identifier of the pluggable database that inserted the row for a V2 blockchain table. If specified, restricts attention to system chains inserted by the specified pluggable database. It must be NULL for a V1 blockchain table.
-type <type></type>	The valid values are USER, DELEGATE, and COUNTERSIGNATURE. DELEGATE and USER may be used interchangeably. The default value is USER.

Retrieve the row signature bytes for the row in the BCTAB1 blockchain table where COL1 = 100, and store the output in the row data file ulr1.dat.

bl get\_bytes\_for\_row\_signature -tab u1.bctab1 -kc1name "COL1" -kc1val "100" row data file <PATH TO FILE>/u1r1.dat

# 9.4.7 get\_digest

Generates and returns a cryptographic hash of the digest for user-specified rows or for a specified blockchain table.

### **Syntax**

blockchain\_table|bl get\_digest {OPTIONS}

### **Options**

Option	Description

#### Required



Option	Description	
-table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.	
	Case sensitive, embedded white space table and schema name should be entered as """Alp_ha"".""Be \$a""". The parser parses these values as "Alp_ha"."Be \$a" .	
-digest <digest></digest>	Specifies the output variable containing the hexadecimal representation of the digest. This is an OUT parameter option, used for storing the output value of the command in a bind variable.	
-selector <selector></selector>	ptional  Specifies the condition: A WHERE clause without the WHERE keyword.	
-selector_file <selector_file></selector_file>	Specifies the name of the file which stores the condition, a WHERE clause without the WHERE keyword.	
-bytes_file <bytes_file></bytes_file>	Specifies the name of the file that contains the digest.	
<pre>-digest_file <digest_file></digest_file></pre>	Specifies the name of the file that contains the binary representation of the digest. The digest value contains a header followed by an array of row-info.	
-row_data_file <row_data_file></row_data_file>	Specifies the file in which the generated row data bytes are saved.	
-row_indexes_file <row_indexes_file></row_indexes_file>	Specifies the name of the file that contains the JSON representation of the type ORABCTAB ROW ARRAY T.	
-algorithm -algo <algorithm></algorithm>	Specifies the cryptographic hash algorithm to use. The parameter must be one of the following constants:  SHA2_256 SHA2_384 SHA2_512	

Generate a digest for the rows in the BCTAB1 blockchain table where COL1 = 100 or COL1 = 400, and store the digest in the file dig.txt.

blockchain\_table get\_digest -tab u1.bctab1 -selector "COL1=100 OR COL1=400" digest file <PATH TO FILE>/dig.txt

# 9.4.8 get\_signed\_digest

Generates and returns the signed digest for user-specified rows (if specified) in a blockchain table using the table owner's private key stored in the database wallet.

The particular rows in the digest are specified by the selector parameter. The default value of this field is NULL. The signed\_bytes, signed\_row\_indexes, and schema\_certificate\_guid are also returned.

#### **Syntax**

blockchain table|bl get signed digest {OPTIONS}

#### **Options**

Option	Description
Required	
-table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.



Case sensitive, embedded white space table and schema name should be entered as """Alp\_ha"".""Be \$a"". The parser parses these values as "Alp\_ha"."Be \$a"

-digest <digest>
-digest\_file <digest\_file>

Specifies the output variable that contains the hexadecimal representation of the signed digest. This is an OUT parameter option, used for storing the output value of the command in a bind variable. Specifies the name of the file that contains the

Specifies the name of the file that contains the binary representation of the signed digest.

Optional
-selector <selector>

Specifies the condition: A WHERE clause without the  $\mathtt{WHERE}$  keyword.

Option	Description
-selector_file <selector_file></selector_file>	Specifies the name of the file which stores the condition, a WHERE clause without the WHERE keyword.
-bytes_file <bytes_file></bytes_file>	Specifies the name of the file that contains the digest that is signed.
-row_data_file <row_data_file></row_data_file>	Specifies the file in which the generated row_data_bytes are saved.
-row_indexes_file <row_indexes_file></row_indexes_file>	Specifies the name of the file that contains the JSON representation of the type ORABCTAB_ROW_ARRAY_T.
-cert_guid -cg <cert_guid></cert_guid>	Specifies the Global Unique Identifier (GUID) for the certificate. This is an OUT parameter option, used for storing the output value of the command in a bind variable.
-algorithm -algo <algorithm></algorithm>	Specifies the cryptographic hash algorithm to use. The default value of this field is  DBMS_BLOCKCHAIN_TABLE.SIGN_ALGO_DEFAULT.  If specified, the parameter must be one of the following package constants:  RSA_SHA2_256  RSA_SHA2_384  RSA_SHA2_512

Generate a signed digest for the BCTAB1 blockchain table and store the digest in the bind variable hex.

blockchain\_table get\_signed\_digest -table\_name u1.bctab1 -digest ":hex"

# 9.4.9 sign\_row

This command can be used by the current user to provide a signature on the row content of a previously inserted row. The transaction that inserted the row into the blockchain table must be committed before the SIGN ROW command is executed.

### **Syntax**

blockchain\_table|bl sign\_row|sign {OPTIONS}

Option	Description	
Required		



Option	Description	
-table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.	
	Case sensitive, embedded white space table and schema name should be entered as """Alp_ha"". ""Be \$a""". The parser parses these values as: "Alp_ha". "Be \$a" .	
-cert_guid -cg <cert_guid></cert_guid>	Specifies the Global Unique Identifier (GUID) for the certificate.	
-instance_id -inst <instance_id></instance_id>	Specifies the instance that inserted the row. If specified, this limits the operation to rows inserted by the given instance.	
-chain_id -ch <chain_id></chain_id>	Specifies the chain containing the row. If specified, this limits operation to rows assigned to the specified chain. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.	
-sequence_id -seq <sequence_id></sequence_id>	Specifies the position of the row on the specified chain.	
-signature -sig <signature></signature>	Specifies the bind variable which holds the hexadecimal representation of the user's digital signature on the hash value stored in the row.	
-algorithm -algo <algorithm></algorithm>	Specifies the algorithm used to create the digital signature. The parameter must be one of the following acceptable string constants:  RSA_SHA2_256 RSA_SHA2_384 RSA_SHA2_512	
Optional	- NON_SIIN2_512	
-row_hash <row_hash></row_hash>	Specifies the expected value of the hash in the row to be signed, if $non-Null$ . If $NULL$ , the hash in the row to be signed is not checked. Default value is $NULL$ .	
-signature_file <signature_file></signature_file>	Specifies the file name which holds the binary representation of the user's digital signature on the hash value stored in the row.	

Option	Description
-private_key_for_signature -prvtkey <private_key_for_signature></private_key_for_signature>	Specifies the private key file used to generate a signature using the signature bytes for a particular row. The generated signature is further used for signing a particular row. The private key is cleared out from memory upon signature generation.
-wallet_path -wallet <wallet_path></wallet_path>	Specifies the location of the Wallet. If `private_key_for_signature` is not provided, the private key is extracted and used from the wallet at the specified path.
<pre>-wallet_password -walletpw <wallet_password></wallet_password></pre>	Specifies the password for accessing the local wallet. The password is cleared upon use and is not retained. If a local wallet password is not provided, a prompt appears for interactive entry.
<pre>-wallet_private_key_alias - walletpvtkeyalias <wallet_private_key_alias></wallet_private_key_alias></pre>	Specifies the private key for signature generation. If not specified, the system tries to retrieve the private key associated with the provided CERT_GUID from the local wallet.
<pre>-wallet_private_key_password - walletpvtkeypw <wallet key="" password="" private=""></wallet></pre>	Specifies the password required to access the private key stored in the specified wallet_path.
-keycol1 name -kc1name <keycol1 name=""></keycol1>	Specifies the name of the key column.
-keycol1_value -kc1val <keycol1_value></keycol1_value>	Specifies the value of the key column.
-keycol2_name -kc2name <keycol2_name></keycol2_name>	Specifies the name of the second column in a composite key.
-keycol2_value -kc2val <keycol2_value></keycol2_value>	Specifies the value of the second column in a composite key.
-keycol3_name -kc3name <keycol3_name></keycol3_name>	Specifies the name of the third column in a composite key.
-keycol3_value -kc3val <keycol3_value></keycol3_value>	Specifies the value of the third column in a composite key.
-data_format -df <data_format></data_format>	Specifies the version of the data layout for the hash in the specified row. Must be 1 in this release. By default, the value of this option is set as 1.
-pdb_guid <pdb_guid></pdb_guid>	Specifies the identifier of the pluggable database that inserted the row for a V2 blockchain table. It must be <code>NULL</code> for a V1 blockchain table.
-type <type></type>	The valid values for type are USER and DELEGATE. These values may be used interchangeably. The default value is USER.

Sign the row in the <code>BCTAB1</code> blockchain table identified by the bind variables <code>INSTANCE\_ID</code>, <code>CHAIN\_ID</code>, and <code>SEQUENCE\_ID</code>, using the certificate ID in the bind variable <code>CERTID</code>, the row hash in <code>ROWHASH</code>, and the <code>RSA\_SHA2\_512</code> algorithm.

```
blockchain_table sign_row -tab u1.bctab1 -inst ":instid" -ch ":chainid" -seq
":seqid" -row_hash ":rowhash" -sig ":signature" -cg ":certid" -algo
"RSA SHA2 512"
```



# 9.4.10 sign\_row\_with\_countersignature

Enables the user to request a countersignature from the database.

This command is an extension of the  ${\tt SIGN\_ROW}$  command. The countersignature is produced by signing the row data content using the table owner's private key stored in the database wallet. A row in a blockchain table can be countersigned only if the row belongs to the current epoch for the blockchain table.

### **Syntax**

blockchain\_table|bl sign\_row\_with\_countersignature|signandcountersign
{OPTIONS}

### **Options**

Option	Description
Required	
-table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.

## Note:

Case sensitive, embedded white space table and schema name should be entered as """Alp\_ha"".""Be \$a""". The parser parses these values as "Alp\_ha"."Be \$a"

One of the following is required: instance\_id, or chain\_id and sequence\_id, or keycol1\_name and keycol1\_value

<pre>-instance_id -inst <instance_id></instance_id></pre>	Specifies the instance that inserted the row. If specified, this limits the operation to rows inserted by the given instance.
-chain_id -ch <chain_id></chain_id>	Specifies the chain containing the row. If specified, this limits operation to rows assigned to the specified chain. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.
-sequence_id -seq <sequence_id></sequence_id>	Specifies the position of the row on the specified chain.
-keycol1_name -kc1name <keycol1_name></keycol1_name>	Specifies the name of the key column.
-keycol1_value -kc1val <keycol1_value></keycol1_value>	Specifies the value of the key column.



Option	Description
One of the following: signature, or signature_file, or	private_key_for_signature, or wallet_path
-signature -sig <signature></signature>	Specifies the bind variable which holds the hexadecimal representation of the user's digital signature on the hash value stored in the row.
-signature_file <signature_file></signature_file>	Specifies the file name which holds the binary representation of the user's digital signature on the hash value stored in the row.
<pre>-private_key_for_signature -prvtkey <private_key_for_signature></private_key_for_signature></pre>	Specifies the private key file used to generate signature using the signature bytes for a particular row. The generated signature is further used for signing a particular row. The private key is cleared out from memory upon signature generation.
-wallet_path -wallet <wallet_path></wallet_path>	Specifies the location of the local wallet.
-cert_guid -cg <cert_guid></cert_guid>	Specifies the Global Unique Identifier (GUID) for the certificate.
-algorithm -algo <algorithm></algorithm>	Specifies the algorithm used to create the digital signature. The parameter must be one of the following acceptable string constants:  • RSA_SHA2_256
	• RSA_SHA2_384
	• RSA_SHA2_512
Optional	
-row_hash <row_hash></row_hash>	Specifies the expected value of the hash in the row to be signed, if non-Null. If NULL, the hash in the row to be signed is not checked. Default value is NULL.
<pre>-wallet_password -walletpw <wallet_password></wallet_password></pre>	Specifies the password for accessing the local wallet. The password is cleared upon use and is not retained. If a local wallet password is not provided, a prompt appears for interactive entry.
<pre>-wallet_private_key_alias - walletpvtkeyalias <wallet_private_key_alias></wallet_private_key_alias></pre>	Specifies the private key for signature generation. If not specified, the system tries to retrieve the private key associated with the provided CERT_GUID from the local wallet.
-wallet_private_key_password - walletpvtkeypw <wallet key="" password="" private=""></wallet>	Specifies the password required to access the private key stored in the specified wallet_path.
-keycol2_name -kc2name <keycol2_name></keycol2_name>	Specifies the name of the second column in a
-keycol2_value -kc2val <keycol2_value></keycol2_value>	composite key. Specifies the value of the second column in a
-keycol3 name -kc3name <keycol3 name=""></keycol3>	composite key.  Specifies the name of the third column in a
	composite key.
-keycol3_value -kc3val <keycol3_value></keycol3_value>	Specifies the value of the third column in a composite key.
-data_format -df <data_format></data_format>	Specifies the version of the data layout for the hash in the specified row. Must be 1 in this release. By default, the value of this option is set as 1.
-type <type></type>	The valid values for type are USER and DELEGATE. These values may be used interchangeably. The default value is USER.



Option	Description
-countersignature_algorithm - countersignalgo <countersignature_algorithm></countersignature_algorithm>	Specifies the cryptographic hash algorithm to use for the countersignature. The default value of this field is  DBMS_BLOCKCHAIN_TABLE.SIGN_ALGO_DEFAULT.  If specified, the parameter must be one of the following acceptable string constants:  RSA_SHA2_256  RSA_SHA2_384  RSA_SHA2_512
-bytes_file <bytes_file></bytes_file>	Specifies the name of the file that contains the signed countersignature bytes.
-countersignature -csig <countersignature></countersignature>	Specifies the digital signature on the bytes returned in bytes_file. This is an OUT parameter option, used for storing the output value of the command in a bind variable.
<pre>-countersign_cert_guid -cscg <countersign_cert_guid></countersign_cert_guid></pre>	Specifies a unique identifier for the certificate of the blockchain table owner stored in the database that may be used to verify the countersignature. This is an OUT parameter option, used for storing the output value of the command in a bind variable.
-content_version <content_version></content_version>	Specifies the version of the data contents and layout that are used as input to the countersignature algorithm. Only V2_DIGEST is supported in this release.
-pdb_guid <pdb_guid></pdb_guid>	Specifies the identifier of the pluggable database that inserted the row for a V2 blockchain table. It must be <code>NULL</code> for a V1 blockchain table.

• Sign and countersign the row in the U1.BCTAB1 blockchain table identified by the bind variables :INST\_ID, :CHAIN\_ID, and :SEQ\_ID, using the row hash :ROWHASH, the certificate ID :CERT\_ID2, and the RSA\_SHA2\_512 algorithm. The signature is generated using the content from the file u1r11 sign.dat.

```
bl signandcountersign -tab u1.bctab1 -inst ":inst_id" -ch ":chain_id" -seq
":seq_id" -row_hash ":row_hash" -signature_file
<PATH TO FILE>/u1r11 sign.dat -cert guid ":cert id2" -algo "RSA SHA2 512"
```

Perform signature and countersignature on the row in the U1.BCTAB1 blockchain table identified by :INST\_ID,:CHAIN\_ID, and :SEQ\_ID, using the row hash :ROWHASH, signer certificate ID :CERT\_ID2, and returns the countersigner certificate ID :CERT\_GUID used for countersignature. The RSA\_SHA2\_512 algorithm is used for both signing and countersigning. The signature is generated using the file u1r11\_sign.dat, and the countersignature is provided in hex format using :CSIG and the binary format using countersignBytes.txt.

```
blockchain_table sign_row_with_countersignature -tab u1.bctab1 -inst
":inst_id" -ch ":chain_id" -seq ":seq_id" -row_hash ":row_hash" -
signature_file
<PATH_TO_FILE>/u1r11_sign.dat -cert_guid ":cert_id2" -algo "RSA_SHA2_512" -
cscg ":cert_guid" -bytes_file <PATH_TO_FILE>/countersignBytes.txt -csig
":csig"
-countersignalgo "RSA_SHA2_512"
```



• Sign and countersign the row in the U1.BCTAB1 blockchain table where COL1 = 1200, using the certificate ID :CERT\_ID2 and the RSA\_SHA2\_512 algorithm. The signature is generated from the file u1r12 sign.dat.

```
bl signandcountersign -tab u1.bctab1 -kc1name "COL1" -kc1val "1200" - signature_file <PATH_TO_FILE>/u1r12_sign.dat -cert_guid ":cert_id2" -algo "RSA SHA2 512"
```

# 9.4.11 verify\_rows

Verifies all rows on all applicable system chains for the integrity of the hash column value for rows created in the range of <code>low\_timestamp</code> to <code>high\_timestamp</code>. Row signatures can be verified as an option. An appropriate exception is triggered if the integrity of chains is compromised.

### **Syntax**

blockchain\_table|bl verify\_rows {OPTIONS}

### **Options**

Option	Description
Required	
-table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.

### Note:

Case sensitive, embedded white space table and schema name should be entered as """Alp\_ha"".""Be \$a"". The parser parses these values as "Alp\_ha"."Be \$a"

### **Optional**

Option	Description
-low_timestamp -low <low_timestamp></low_timestamp>	Specifies the low end of the time range. If specified, the low end of the time range is used for verifying rows. The default value is NULL. Use double quotes to enclose the value.
	The low_timestamp should be specified as per the NLS_TIMESTAMP_F ORMAT or NLS_TIMESTAMP_T Z_FORMAT.
<pre>-high_timestamp -high <high_timestamp></high_timestamp></pre>	. Specifies the high end of the time range. If specified, the high end of the time range is used for verifying rows. The default value is <code>NULL</code> . Use double quotes to enclose the value.
	Note:  The high_timestamp should be specified as per the NLS_TIMESTAMP_F ORMAT or NLS_TIMESTAMP_T Z_FORMAT.
-instance_id -inst <instance_id></instance_id>	Specifies the instance that inserted the row. If specified, this limits the operation to rows inserted by the given instance.
-chain_id -ch <chain_id></chain_id>	Specifies the chain containing the row. If specified, this limits operation to rows assigned to the specified chain. By default, there are 32 chains in each instance, and they are numbered from 0 to 31.
-rowcount <rowcount></rowcount>	Specifies the number of rows verified. This is an OUT parameter option, used for storing the output value of the command in a bind variable.



Option	Description
-skip_user_signature -skipuser	Specifies true or false for SKIP_USER_SIGNATURE. The default value is FALSE.  If SKIP_USER_SIGNATURE is specified (set to true), the blockchain verify_rows SQLcl command bypasses the validation of user signature if it is present on any row.  If SKIP_USER_SIGNATURE is not specified (set to false), the hash and user signature are both verified for any row if they are present, otherwise only the hash is verified.
-skip_delegate_signature -skipdlg	Specifies true or false for  SKIP_DELEGATE_SIGNATURE. The default value is  FALSE.  If SKIP_DELEGATE_SIGNATURE is specified (set to true), the blockchain verify_rows  SQLcl command bypasses the validation of delegate signature if it is present on any row.  If SKIP_DELEGATE_SIGNATURE is not specified (set to false), the hash and delegate signature are both verified for any row if they are present, otherwise only the hash is verified.
-skip_countersignature -skipctr	Specifies true or false for  SKIP_COUNTERSIGNATURE. The default value is  FALSE.  If SKIP_COUNTERSIGNATURE is specified (set to true), the blockchain verify_rows SQLcl command bypasses the validation of countersignature if it is present on any row.  If SKIP_COUNTERSIGNATURE is not specified (set to false), the hash and countersignature are both verified for any row if they are present, otherwise only the hash is verified.
-pdb_guid <pdb_guid></pdb_guid>	Specifies the identifier of the pluggable database that inserted the rows for a V2 blockchain table. It must be <code>NULL</code> for a V1 blockchain table.

Verify the integrity of all rows in the BCTAB1 blockchain table.

blockchain\_table verify\_rows -table\_name u1.bctab1

# 9.4.12 verify\_table

Verifies signatures and system chains for all rows where the creation time falls between the minimum value for the row-creation time from <code>begin\_bytes\_file</code> and the maximum value for row-creation time from <code>end\_bytes\_file</code>. The <code>OUT</code> parameter row count returns the number of successfully verified rows.

### **Syntax**

blockchain\_table|bl verify\_table {OPTIONS}



Option	Description
Required	
<pre>-end_bytes_file <end_bytes_file></end_bytes_file></pre>	Specifies a digest populated by a call to either PL/SQL API's  (GET_SIGNED_BLOCKCHAIN_DIGEST, GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECT ED_ROWS, GET_BLOCKCHAIN_DIGEST, or GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS)  or by executing SQLcl command (blockchain_table
	get_digest or get_signed_digest command).
-begin_bytes_file <begin_bytes_file></begin_bytes_file>	Specifies a digest populated by a call to either PL/SQL API's  (GET_SIGNED_BLOCKCHAIN_DIGEST, GET_SIGNED_BLOCKCHAIN_DIGEST_FOR_SELECT ED_ROWS, GET_BLOCKCHAIN_DIGEST, or GET_BLOCKCHAIN_DIGEST_FOR_SELECTED_ROWS) or
	by executing SQLcl command (blockchain_table get_digest or get_signed_digest command) before the end_bytes_file is populated.
Optional	
-rowcount <rowcount></rowcount>	Specifies the number of rows verified. This is an OUT parameter option, used for storing the output value of the command in a bind variable.
-skip_user_signature -skipuser	Specifies true or false for SKIP_USER_SIGNATURE. The default value is FALSE.  If SKIP_USER_SIGNATURE is specified (set to true), the blockchain verify_table SQLcl command bypasses the validation of user signature if it is present on any row.  If SKIP_USER_SIGNATURE is not specified (set to false), the hash and user signature are both verified for any row if they are present, otherwise only the hash is verified.
-skip_delegate_signature -skipdlg	Specifies true or false for  SKIP_DELEGATE_SIGNATURE. The default value is  FALSE.  If SKIP_DELEGATE_SIGNATURE is specified   (set to true), the blockchain verify_table   SQLcl command bypasses the validation of   delegate signature if it is present on any row.  If SKIP_DELEGATE_SIGNATURE is not   specified (set to false), the hash and delegate   signature are both verified for any row if they   are present, otherwise only the hash is   verified.



Option	Description
-skip_countersignature -skipctr	Specifies true or false for SKIP_COUNTERSIGNATURE. The default value is FALSE.  If SKIP_COUNTERSIGNATURE is specified (set to true), the blockchain verify_table SQLcl command bypasses the validation of countersignature if it is present on any row.  If SKIP_COUNTERSIGNATURE is not specified (set to false), the hash and countersignature are both verified for any row if they are present, otherwise only the hash is verified.

Verify the digests defined by the end bytes file latest.txt and the begin bytes file prev1.txt, and store the count of verified rows in the bind variable rowcount.

blockchain\_table verify\_table -end\_bytes\_file <PATH\_TO\_FILE>/latest.txt begin\_bytes\_file <PATH\_TO\_FILE>/prev1.txt -rowcount ":temp"

# 9.4.13 verify\_user\_chains

Verifies rows of one or more user chains when the user chains feature is enabled on the blockchain table.

### Syntax

blockchain\_table|bl verify\_user\_chains {OPTIONS}

### **Options**

Option Description
--------------------

Required



Option	Description
-table_name -tab <table_name></table_name>	Specifies a name for the blockchain table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.
	Case sensitive, embedded white space table and schema name should be entered as: """Alp_ha""."Be \$a""". The parser parses these values as: "Alp_ha"."Be \$a" .
-user_chain -uchain <user_chain></user_chain>	Specifies the name of the row version given when the blockchain table was created.
Optional	
-rowcount <rowcount></rowcount>	Specifies the number of rows verified. This is an OUT parameter option, used for storing the output value of the command in a bind variable.
-keycol1_value -kc1val <keycol1_value></keycol1_value>	Specifies the value of the key column.
-keycol2_value -kc2val <keycol2_value></keycol2_value>	Specifies the value of the second column in a composite key.
-keycol3_value -kc3val <keycol3_value></keycol3_value>	Specifies the value of the third column in a composite key.
-low_timestamp -low <low_timestamp></low_timestamp>	Specifies the low end of the time range. If specified the low end of the time range is used for verifying rows. The default value is NULL. Use double quotes to enclose the value.



The low\_timestamp should be specified as per NLS\_TIMESTAMP\_F ORMAT or NLS\_TIMESTAMP\_T Z\_FORMAT.

Option	Description
-high_timestamp -high <high_timestamp></high_timestamp>	Specifies the high end of the time range. If specified, the high end of the time range is used fo verifying rows. The default value is NULL. Use double quotes to enclose the value.
	The high_timestamp should be specified as per NLS_TIMESTAMP_F ORMAT or NLS_TIMESTAMP_T Z_FORMAT.
-skip_user_signature -skipuser	<ul> <li>Specifies true or false for SKIP_USER_SIGNATURE.</li> <li>The default value is FALSE.</li> <li>If SKIP_USER_SIGNATURE is specified (set to true), the blockchain verify_user_chains SQLcl command bypasses the validation of user signature if it is present on any row.</li> <li>If SKIP_USER_SIGNATURE is not specified (set to false), the hash and user signature are both verified for any row if they are present, otherwise only the hash is verified.</li> </ul>
-skip_delegate_signature -skipdlg	Specifies true or false for  SKIP_DELEGATE_SIGNATURE. The default value is  FALSE.  If SKIP_DELEGATE_SIGNATURE is specified  (set to true), the blockchain  verify_user_chains SQLcl command  bypasses the validation of delegate signature i  it is present on any row.  If SKIP_DELEGATE_SIGNATURE is not  specified (set to false), the hash and delegate  signature are both verified for any row if they  are present, otherwise only the hash is  verified.
-skip_countersignature -skipctr	Specifies true or false for  SKIP_COUNTERSIGNATURE. The default value is  FALSE.  If SKIP_COUNTERSIGNATURE is specified (set to true), the blockchain verify_user_chains SQLcl command bypasses the validation of countersignature if it is present on any row.  If SKIP_COUNTERSIGNATURE is not specified (set to false), the hash and COUNTERSIGNATURE are both verified for any row if they are present, otherwise only the hash is verified.



Option	Description
-pdb_guid <pdb_guid></pdb_guid>	Specifies the identifier of the pluggable database that inserted the rows for a V2 blockchain table. It must be NULL for a V1 blockchain table.

Verify the rows of BCTAB1 COL2 user chain in the BCTAB1 blockchain table.

bl verify\_user\_chains -tab u1.bctab1 -uchain "bctab1\_col2"

# 9.5 CERTIFICATE

Use the certificate command to add and delete X.509 certificates. This command uses an extension of the <code>DBMS\_USER\_CERTS</code> PL/SQL package. The <code>DBMS\_USER\_CERTS</code> PL/SQL package uses <code>ADD\_CERTIFICATE</code> and <code>DROP\_CERTIFICATE</code> subprograms to add and delete X.509 certificates which are used for signature verification for blockchain tables by the current user.

The sub-commands are:

- Add
- Add\_Copy
- Drop
- List

## 9.5.1 Add

Adds an X.509 certificate.



- Pass the full path of the cert\_file on the client machine.
- The certificates should be present on the client machine.

### **Syntax**

certificate add {OPTIONS}

### **Options**

Option	Description
Required	
-cert_file   -cf <cert_file></cert_file>	Specifies the X.509 certificate (saved as a file) used for signature verification of blockchain tables.

### **Optional**



Option	Description
-cert_guid   -cg <cert_guid></cert_guid>	Specifies the Global Unique Identifier (GUID) for the certificate. This is an OUT parameter option, used for storing the output value of the command in a bind variable.
<pre>-wallet_path   -wallet <wallet_path>()</wallet_path></pre>	Specifies the location of the wallet. If `cert_file` is not provided, the certificate is extracted from the specified wallet and added to the user_certs\$ table.
<pre>-wallet_password   -walletpwd <wallet_password>()</wallet_password></pre>	Specifies the password of the local wallet. The password is removed upon use and is not retained. If a wallet password is not provided, then you are prompted to enter the password.
<pre>-wallet_certificate_alias  - walletcertalias <wallet_certificate_alias>()</wallet_certificate_alias></pre>	Specifies the alias of the certificate to be added.

SQL> certificate add -cf <PATH\_TO\_FILE>/u2\_cert.der

# 9.5.2 Add\_Copy

Copies an X.509 certificate from one pluggable database to another while retaining its original GUID.



- Pass the full path of the cert\_file on the client machine.
- The certificates should be present on the client machine.

### **Syntax**

certificate add copy {OPTIONS}

Option	Description
Required	
-cert_file   -cf <cert_file></cert_file>	Specifies the X.509 certificate (saved as a file) used for signature verification of blockchain tables.
-cert_guid   -cg <cert_guid></cert_guid>	Specifies the Global Unique Identifier (GUID) for the certificate.
Optional	
-username   -uname <username></username>	Specifies the user name. If specified, the certificate is added to the schema associated with the mentioned user name.



SQL> certificate add\_copy -cf <PATH\_TO\_FILE>/u2\_cert.der -cg <ORIGINAL\_GUID> -uname "u1"

# 9.5.3 Drop

Drops a certificate. This is used for signature verification of blockchain tables.

### **Syntax**

certificate drop {OPTIONS}

### **Options**

Option	Description
Required	
-cert_guid   -cg <cert_guid></cert_guid>	Specifies the Global Unique Identifier (GUID) for the certificate.

### **Example**

SQL> certificate drop -cg ":cg"

## 9.5.4 List

Lists all previously added certificates that can be used for signature verification of blockchain tables.

### **Syntax**

certificate list|ls

#### **Example**

SQL> certificate list

## 9.6 CODESCAN

Identifies issues with the code using the Trivadis Coding Guidelines, which is available on GitHub.

### **Syntax**

```
codescan { -path dir | -format {json|text} | -ignore ruleNo | -output file | -
settings file }
```

where



- -path checks SQL, PLS and PLB files in the directory for SQL Best Practice violations and generates a report of the issues found.
- format formats the output as structured JSON. For example:

- -output saves the report in a new file.
- -ignore skips specified rule checks.
- -settings imports CODESCAN settings from the JSON file. Currently, only the ignore attribute is supported, example, {"ignored":["G-1050", "G-4010"]}.

#### Set Codescan

Controls warning messages that are triggered for SQLcl command line code quality issues.

### **Syntax**

```
set codescan {ON | OFF}
```

where ON turns on warnings for SQL and PL/SQL best practice violations. The default is OFF.

#### **Example**

```
SQL>set codescan on
SQL>BEGIN
    BEGIN
    null;
END;
END;

ZND best practice warning (1,7): G-1010: Try to label your sub blocks
PL/SQL procedure successfully completed.
```

# 9.7 CONNECT

Connection types in SQLcl:

- KERBEROS
- NAME
- OCI
- ORACLE
- OREST
- RADIUS
- SOCKS
- THIRD



### • WALLET

# 9.7.1 KERBEROS Connection Type

Connect to a database using Kerberos authentication. The connection spec parameter has the following form:

[/][@<url>]



Only Kerberos connections using [/][@<url>] are supported in SQLcl. Active Directory is not supported.

See Enabling Kerberos Authentication in *Oracle Database Security Guide* for more information about Kerberos authentication in Oracle Database.

### **Options**

Option	Description
-kerberos, ker	Specifies a KERBEROS connection type.
-krb5_config, krb5c	Specifies a non-default Kerberos configuration file. This property is specified only when SQLcl is started. These can be passed in by using the relevant -D system property name or environmental variables.
-krb5ccname, krb5cc	Specifies a non-default Kerberos credential file.
-url	Specifies the URL. This is an alternative to providing it in the connection spec parameter.
-role, r	Specifies the database role. This is an alternative to providing it in the connection spec parameter.
-edition, ed	Specifies the Oracle database edition. This is an alternative to providing it in the connection spec parameter.
-verbose, v	Requests output of diagnostic information about the connection.

### **Parameters**

Parameter	Description
<connectionspec></connectionspec>	Provides the connection specification for the target database.

### **Example**

To connect to a database using KERBEROS:

SQL> CONNECT -kerberos /@myhost:1521/myservice

#### See Also:



### Support for Kerberos for troubleshooting information

# 9.7.2 NAME Connection Type

Connect to a database using a stored connection definition. Stored connections are identified using a unique connection name. For more information about stored connections, see CONMGR.

### **Options**

Option	Description
-name, n	Specifies a connection type using a stored connection definition.
-user, u	Specifies the user name. This is an alternative to providing it in the connection spec parameter.
-url	Specifies the URL. This is an alternative to providing it in the connection spec parameter.
-password, pw	Specifies the password. This is an alternative to providing it in the connection spec parameter.
-role, r	Specifies the database role. This is an alternative to providing it in the connection spec parameter.
-edition, ed	Specifies the Oracle database edition. This is an alternative to providing it in the connection spec parameter.
-verbose, v	Requests output of diagnostic information about the connection.

### **Parameters**

Parameter	Description
<connectionspec></connectionspec>	Provides the connection specification for the target database.

### **Examples**

To connect using a stored connection:

SQL> CONNECT -name my\_connection

To connect using a stored connection as a different user:

SQL> CONNECT -name myuser/mypassword@my connection

or

SQL> CONNECT -name myuser@my\_connection



# 9.7.3 OCI Connection Type

Connect to a database using OCI. Before connecting to OCI, it is necessary to specify the profile to use. For example, OCI PROFILE frankfurt.

The connection spec parameter has the following form:

ocid1.databasetoolsconnection.<id>.

#### **Options**

Option	Description
-oci	Specifies an OCI connection type.
-rest, rt	Specifies that the connection should be established using REST.
-proxy, p	Specifies the network proxy to use.
-verbose, v	Requests output of diagnostic information about the connection.

#### **Parameters**

Parameter	Description
<connectionspec></connectionspec>	Provides the connection specification for the target database.

### **Example**

To connect using an OCID:

SQL> CONNECT ocid1.databasetoolsconnection.oc1.xxxyyyyzz.aabbccd

# 9.7.4 Oracle Connection Type

Connect to a database using Oracle Relational Database Management System.

The connection spec parameter has the following form:

<username>[/<password>][@<url>][as <role>][edition= <edition>]

### where

- <username> may be proxyuser>[<username>] if a proxy user is required. Note that the brackets around user name are required syntax.
- The <url>

   can take either of the following forms:

```
//<host>:<port>/<service>
<host>:<port>/<service>
```

or it may be a TNS name or an LDAP specification.



### **Options**

Option	Description
-oracle, o	Specifies an Oracle connection type.
-user, u	Specifies the user name. This is an alternative to providing it in the connection spec parameter.
-password, pw	Specifies the password. This is an alternative to providing it in the connection spec parameter.
-url	Specifies the URL. This is an alternative to providing it in the connection spec parameter.
-role, r	Specifies the database role. This is an alternative to providing it in the connection spec parameter.
-edition, ed	Specifies the Oracle database edition. This is an alternative to providing it in the connection spec parameter.
-verbose, v	Requests output of diagnostic information about the connection.

### **Parameters**

Parameter	Description
<connectionspec></connectionspec>	Provides the connection specification for the target database.

### Example

To connect using EZCONNECT:

SQL> CONNECT myuser/passwd@myhost:1521/myservice

# 9.7.5 OREST Connection Type

Connect to a database using REST. The connection spec parameter has the form:

<username>[/<password>][@<url>][as <role>][edition= <edition>]

The <url> can take the form:

http://<host>:<port>/ords/<schema>

Option	Description
-orest, or	Specifies a connection type that uses REST.
-user, u	Specifies the user name. This is an alternative to providing it in the connection spec parameter.
-password, pw	Specifies the password. This is an alternative to providing it in the connection spec parameter.
-url	Specifies the URL. This is an alternative to providing it in the connection spec parameter.



Option	Description
-role, r	Specifies the database role. This is an alternative to providing it in the connection spec parameter.
-edition, ed	Specifies the Oracle database edition. This is an alternative to providing it in the connection spec parameter.
-verbose, v	Requests output of diagnostic information about the connection.

Parameter	Description
<connectionspec></connectionspec>	Provides the connection specification for the target database.

### **Example**

To connect using REST:

SQL> CONNECT myuser/passwd@http://myhost:9213/ords/myschema

# 9.7.6 RADIUS Connection Type

Connect to a database using RADIUS authentication. The connection spec parameter has the form:

[<username>] [/<password>] [@<url>]

RADIUS can also be configured to authenticate using <number> from two-factor authenication:

[<username>]/[<password>][<number from device or command>][<@url>]



Challenge response two-factor authentication for RADIUS is not supported in this release

See Configuring RADIUS Authentication in *Oracle Database Security Guide* for more information about RADIUS authentication.

Option	Description
-radius, rad	Specifies a RADIUS connection type.
-user, u	Specifies the user name. This is an alternative to providing it in the connection spec parameter.
-password, pw	Specifies the password. This is an alternative to providing it in the connection spec parameter.



Option	Description
-url	Specifies the URL. This is an alternative to providing it in the connection spec parameter.
-role, r	Specifies the database role. This is an alternative to providing it in the connection spec parameter.
-edition, ed	Specifies the Oracle database edition. This is an alternative to providing it in the connection spec parameter.
-verbose, v	Requests output of diagnostic information about the connection.

Parameter	Description
<connectionspec></connectionspec>	Provides the connection specification for the target database.

### **Example**

To connect using RADIUS:

SQL> CONNECT -radius myuser/passwd@myhost:1521/myservice

### See Also:

Support for RADIUS for troubleshooting information

# 9.7.7 SOCKS Connection Type

Connect to a database using a SOCKS proxy. Before connecting, set up the proxy process on the local machine by using the ssh command. For example:

```
ssh -N -D 127.0.0.1:1087 opc@123.456.789.120.
```

The connection spec parameter has the form:

[<username>] [/<password>] [@<url>]

Option	Description
-socks s	Specifies a SOCKS connection type.
-socksproxy sp	Specifies the socks proxy.
-cloudconfig, cc	Specifies the wallet to establish the connection.
-proxy, p	Specifies the network proxy to use.
-user, u	Specifies the user name. This is an alternative to providing it in the connection spec parameter.



Option	Description
-password, pw	Specifies the password. This is an alternative to providing it in the connection spec parameter.
-url	Specifies the URL. This is an alternative to providing it in the connection spec parameter.
-role, r	Specifies the database role. This is an alternative to providing it in the connection spec parameter.
-edition, ed	Specifies the Oracle database edition. This is an alternative to providing it in the connection spec parameter.
-verbose, v	Requests output of diagnostic information about the connection.

Parameter	Description
<connectionspec></connectionspec>	Provides the connection specification for the
	target database.

### **Example**

To set the SOCKS and wallet properties and then connect:

```
SQL> SET socksproxy socks5h://localhost:1080
SQL> SET cloudconfig mywallet.zip
SQL> CONNECT myuser/passwd@mycloudtns
```

#### Alternatively, do it using one command:

SQL> CONNECT -socksproxy socks5h://localhost:1080 -cloudconfig mywallet.zip myuser/passwd@mycloudtns

# 9.7.8 THIRD Connection Type

Connect to a third-party database. You need to add the appropriate driver jar to <sqlcl-root>/lib/drivers/. For example, for MYSQL you can download mysql-connector-java-8.0.30.jar.

The connection spec parameter is specific to the database but generally takes the form:

<username>[/<password>]@jdbc:<dbtype>://<host>:<port>

Option	Description
-third, t	Specifies a THIRD connection type.
-user, u	Specifies the user name. This is an alternative to providing it in the connection spec parameter.



Option	Description
-password, pw	Specifies the password. This is an alternative to providing it in the connection spec parameter.
-url	Specifies the URL. This is an alternative to providing it in the connection spec parameter.
-role, r	Specifies the database role. This is an alternative to providing it in the connection spec parameter.
-edition, ed	Specifies the Oracle database edition. This is an alternative to providing it in the connection spec parameter.
-verbose, v	Requests output of diagnostic information about the connection.

Parameter	Description
<connectionspec></connectionspec>	Provides the connection specification for the
	target database.

### **Example**

To connect to MySQL:

SQL> CONNECT myuser/passwd@jdbc:mysql://myhost:9906

# 9.7.9 WALLET Connection Type

Connect to a database using a wallet. The connection spec parameter has the form:

[<username>] [/<password>] [@<url>]

Option	Description
-wallet, w	Specifies a WALLET connection type.
-cloudconfig, cc	Specifies the wallet to establish the connection.
-proxy, p	Specifies the network proxy to use.
-user, u	Specifies the user name. This is an alternative to providing it in the connection spec parameter.
-password, pw	Specifies the password. This is an alternative to providing it in the connection spec parameter.
-url	Specifies the URL. This is an alternative to providing it in the connection spec parameter.
-role, r	Specifies the database role. This is an alternative to providing it in the connection spec parameter.
-edition, ed	Specifies the Oracle database edition. This is an alternative to providing it in the connection spec parameter.



Option	Description
-verbose, v	Requests output of diagnostic information about the connection.

Parameter	Description
<connectionspec></connectionspec>	Provides the connection specification for the target database.

### **Example**

To set the wallet property and then connect:

```
SQL> SET cloudconfig mywallet.zip
SQL> CONNECT myuser/passwd@mycloudtns
```

### Alternatively, do it using one command:

SQL> CONNECT -cloudconfig mywallet.zip myuser/passwd@mycloudtns

## 9.8 CONMGR

The sub-commands are:

- Clone
- Import
- List
- Show
- Test

## 9.8.1 Clone Connections

Clones an existing connection. By default, the credentials stored with the original connection are used for the new connection. To change the user name, the <code>-user</code> option can be used. If the user changes, a password prompt is displayed unless the <code>-nopwd</code> option is used

### **Syntax**

connmgr|cm clone {OPTIONS} {PARAMETERS}

Option	Description	Default
-original, -o	The name of the source connection being cloned.	Required



Option	Description	Default
-nopwd	Whether to create the connection without a stored password.	-
-user, -u	The user name to store with the connection. If no user name is specified, you may be prompted to provide one when using the connection, depending on the authentication configuration.	-

Parameter	Description
<name></name>	The name of the connection. Connection names are case-sensitive.

### **Example**

To clone an existing connection:

```
SQL> CONNMGR CLONE -original original_name newname SQL> CONNMGR CLONE -original original name -user newname
```

# 9.8.2 Import Connections

Import one or more connections to the common connection store.

Connect files may contain encrypted passwords and other credentials.

When importing connections with encrypted passwords, the encryption key is required to decrypt the passwords. The encryption key may be provided with the import command by first securing it with a secret. For more information about using a secret, see SECRET Command. If no key is provided with the import command, a prompt is displayed to request the key.

The passwords can be removed from imported connections by specifying the - strip passwords option.

### **Syntax**

```
connmgr|cm import {OPTIONS} {PARAMETERS}
```



Option	Description
-duplicates   d   dups	{ignore rename replace}
	Indicates how to handle imported connections whose names match an existing connection.
	<ul> <li>IGNORE: Skips the duplicate connections.</li> </ul>
	<ul> <li>RENAME: Renames the duplicate connections by appending a unique number to the end of the name.</li> <li>REPLACE: Replaces the existing connection with the new connection.</li> </ul>
-key	The public name of a secret that protects the encryption key used to encrypt passwords in the file.
	Note:  If the encryption key is invalid, the connections are imported with the passwords removed.

-strip\_passwords | s | strip

Parameter	Description
path	A single file or directory containing one or more connections to import. If the path is an archive file, the archive is checked for a single connection definition. If the path is a JSON file, it is checked for legacy connection definitions. If the path is a directory, it is checked for more archives containing connection definitons.

Indicates that encrypted passwords be stripped

from imported connections.

### **Example**

To create a secret for the encryption key and specify the secret name when importing connections from a file:

SQL> SECRET SET mySecret <encryption key>
 SQL> CONNMGR IMPORT -KEY mySecret myconns.json

## 9.8.2.1 SECRET Command

This command is used to securely store secret values in memory. The Connection Manager (connmgr) commands enable the use of the secret name to identify secure values such as passwords and encryption keys. Using the secret name in this way ensures that secure values



are not displayed on the command line and do not persist in command history. Secure values cannot be retrieved with the SECRET command.

#### **Syntax**

secret {SUBCOMMAND}

where the subcommands are:

- Set
- List
- Unset

#### Set

Sets a name for a secret value. The secret name can be used with commands that support secure values.

### **Syntax**

secret set {PARAMETERS}

#### **Parameters**

Parameter	Description
secret_name	The public name that can be used to represent a secure value.
secret_value	The protected secret value that is associated with the secret name.

#### List

Lists the currently stored secret names.

### **Syntax**

secret list

#### Unset

Removes the secret value for the secret name.

### **Syntax**

secret unset <secret name>

where secret\_name is the public name used to represent a secret value.

### **Example**



Set a name for a secret value and use it to import connections.

```
SQL> secret set my_name myEncryptionKey
secret my_name stored
SQL> connmgr import -encryption key my name conns.json
```

## 9.8.3 List Connections

List the names of the connections.

#### **Syntax**

cnnmgr|cm list

#### **Example**

To list the names of connections, enter:

SQL> CONNMGR LIST

## 9.8.4 Show Connections

Shows the details for a connection, including the connection URL and the user name (if stored). Additional details are displayed depending on the stored connection description.

### **Syntax**

connmgr|cm show {PARAMETERS}

### **Parameters**

Description	
The name of the connection. Connection names are case-sensitive.	

### **Example**

To show the details for MyConnection:

SQL> CONNMGR SHOW MyConnection

## 9.8.5 Test Connections

A test connection is opened and then closed. This test connection does not affect the current SQLcl connection. The credentials stored with the connection are used for the test. If no password is stored, the user is prompted for the password. If the -user option is used, the provided user is tested instead. A password will need to be provided when prompted.



#### **Syntax**

connmgr|cm test {OPTIONS} {PARAMETERS}

### **Options**

Option	Description
-user, -u	Specify a user name instead of using the one stored with the connection definition. Casesensitive user names are quoted to preserve case.

#### **Parameters**

Parameter	Description
<name></name>	The name of the connection. Connection names are case-sensitive.

### **Example**

To test the connection MyConnection for user name SCOTT:

```
SQL> CONNMGR TEST MyConnection
SQL> CONNMGR TEST -USER SCOTT MyConnection
```

# 9.9 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.

# 9.10 DIRS, PUSHD and POPD

With these commands, you can view and work with the directory stack (a list of recently-visited directories) and change the current working directory in Linux and other Unix type operating systems.

- dirs: Displays the list of currently saved directories.
- pushd: Adds directories to the stack.
- popd: Removes directories from the stack.

Refer to the SQLcl command-line help for more information about these commands.

# 9.11 IMMUTABLE\_TABLE

This command uses an extension of the DBMS IMMUTABLE TABLE PL/SQL package.

Immutable tables are read-only tables that protect data against unauthorized modification. These tables also prevent against accidental data modifications that may be caused by human

errors. The DBMS\_IMMUTABLE\_TABLE PL/SQL package enables you to delete the expired rows in an immutable table and add interval partitioning.

The sub-commands are:

- Add Interval Partitioning
- Delete Expired Rows
- Describe Table

## 9.11.1 Add Interval Partitioning

Adds interval partitioning to an existing, non-partitioned, V1 or V2 immutable table.

#### **Syntax**

immutable table|im add interval partitioning|addintpartition {OPTIONS}

#### **Options**

Option	Description
Required	
-table_name -tab <table_name></table_name>	Specifies a name for the immutable table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.



Case sensitive, embedded white space table and schema name should be entered as """Alp\_ha"".""Be \$a""". The parser parses these values as "Alp\_ha"."Be \$a"

```
-interval_number|-intnum
<interval_number>
-interval_frequency|-intfreq
<interval_frequency>

-first_high_timestamp|-firsthigh
<first_high_timestamp>
```

Specifies the interval number that determines how often the database creates partitions for the immutable table.

Specifies the interval frequency that determines how frequently the database creates partitions for immutable tables within a specified interval set by the interval\_number setting. Supported values are YEAR, MONTH, DAY, HOUR, and MINUTE.

Specifies a timestamp that determines the upper boundary of the first partition in the immutable table.

# 9.11.2 Delete Expired Rows

Deletes some or all of the expired rows from the immutable table. This command does not commit if the database release is 19c or 21c. This command commits if the database release is at least 23ai.

#### **Syntax**

immutable\_table|im delete\_expired\_rows|del {OPTIONS}

#### **Options**

Option	Description
Required	
-table_name -tab <table_name></table_name>	Specifies a name for the immutable table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.



Case sensitive, embedded white space table and schema name should be entered as """Alp\_ha"".""Be \$a""". The parser parses these values as "Alp\_ha"."Be \$a"

#### Optional

-before\_timestamp|-before
<before\_timestamp>

Specifies a timestamp to determine deletion of expired rows. Set this parameter according to the NLS\_TIMESTAMP\_TZ\_FORMAT or NLS\_TIMESTAMP\_FORMAT. The default value for this parameter is NULL.

- If the parameter value is NULL, all expired rows in the table are deleted.
- If the parameter value is not NULL and is older than the timestamp calculated based on the current time and the row retention period, then rows with timestamps earlier than the parameter value are deleted.
- If the parameter value is not NULL and is more recent than the timestamp calculated based on the current time and row retention period, the calculated timestamp is used, resulting in the deletion of all expired rows.



Option	Description
-rowcount <rowcount></rowcount>	Requests the number of rows deleted. This is an OUT parameter option, used for storing the output value of the command in a bind variable.

# 9.11.3 Describe Table

Describes the details of the specified immutable table.

### **Syntax**

immutable\_table|im desc {OPTIONS}

Option	Description
Required	
-table_name -tab <table_name></table_name>	Specifies a name for the immutable table. The name can be preceded by the respective schema name. To specify a case-sensitive schema or table name, enclose the entire name in double quotes and then enclose the individual names in double, double quotes.

# 9.12 LIQUIBASE

#### **Database Diff Commands**

New Command	Description
diff	Writes description of differences between two databases to standard out.
diff-changeLog	Adds any differences between the databases specified to a changelog. Can append in any of the supported changelog formats.

#### **Database Rollback Commands**

New Command	Description
rollback	Rolls back the database to the state it was in when the tag was applied.
rollback-sql	A helper command that produces the raw SQL Liquibase would run when using the rollbackByTag command.
rollback-to-date	Rolls back the database to the state it was in at the given date/time.
rollback-to-date-sql	A helper command that allows you to inspect the SQL Liquibase will run while using the rollback-to-date command.
rollback-count	Rolls back the last <value> changesets.</value>
rollback-count-sql	Writes SQL to roll back the last <value> changesets to STDOUT.</value>



New Command	Description
future-rollback-sql	Writes SQL to roll back the database to the current state after the changes in the changelog have been applied.
future-rollback-count-sql	Generates the SQL that Liquibase would use to sequentially revert the number of changes associated with undeployed changesets, which are added to a changelog file.
future-rollback-from-tag-sql	Produces the raw SQL Liquibase would need to roll back all undeployed changes made up to the specified tag.

## **Database Snapshot Commands**

New Command	Description
data	Generate changelogs for the data.
generate-apex-object	Generate apex objects from a database
generate-controlfile	Generate an empty control file that you can use to start a new changelog.
generate-db-object	Generate database objects from a database
generate-ords-module, generate-ords-schema	Generate ords objects from a database
generate-schema	Generate all supported objects in a schema and controller file.
generate-changelog	Generate a changelog from a database when adding Liquibase to a new project. This is synonymous with snapshot with the exception of saving the output as XML in the changelog.
snapshot	Gathers the current database schema and displays that information to STDOUT. With options, can save the schema in JSON format, and that JSON snapshot can serve as a comparison database.
update-to-tag-sql	A helper command that inspects the SQL code Liquibase will run when using the update-to-tag <tag> command.</tag>

## **Database Update Commands**

New Command	Description
update	Updates the database to the current version.
update-sql	A helper command that enables you to inspect the SQL code that Liquibase will run when using the update command.
update-count	Applies the next <value> changesets.</value>
update-count-sql	Writes SQL to apply the next <value> changesets to STDOUT.</value>
update-testing-rollback	Updates the database, then rolls back changes before updating again.
update-to-tag	Applies sequential changes to your database from the newest changeset to the changeset with the tag you specified and applied earlier.
update-to-tag-sql	A helper command that inspects the SQL code Liquibase will run when using the update-to-tag <tag> command.</tag>



#### **Documentation Commands**

New Command	Description
db-doc	Generates Javadoc-like documentation based on current database and changelog.

#### **Maintenance Commands**

New Command	Description
calculate-checksum	Calculates and prints a checksum for the changeset with the specified id in the following format: filepath::id::author.
changelog-sync	Marks all changes as executed in the database.
changelog-sync-sql	Writes SQL to mark all changes as executed in the database to STDOUT.
changelog-sync-to-tag	Marks all undeployed changesets from your changelog up to and including the specified tag as executed in your database.
changelog-sync-to-tag-sql	Produces the raw SQL that Liquibase would run when using the changelog-sync-to-tag command to mark all undeployed changesets associated with the specified tag as executed in your database.
clear-checksums	Removes current checksums from database. On next update changesets that have already been deployed will have their checksums recomputed, and changesets that have not been deployed will be deployed.
drop-all	Drops all database objects owned by the user.
list-locks	Lists who currently has locks on the database changelog.
mark-next-changeset-ran	Mark the next changeset as executed in the database.
mark-next-changeset-ran-sql	Inspects the SQL Liquibase will run while using the mark-next-changeset-ran command.
release-locks	Releases all locks on the database changelog.
tag	"Tags" the current database state for future rollback.
tag-exists	Checks whether the given tag already exists.
unexpected-changesets	Produces a list of changesets that were run in the database but do not exist in the current changelog.
validate	Checks the changelog for errors.

#### **Status Commands**

New Command	Description
history	Lists all deployed changesets and their deploymentIds.
status	Outputs the count (or list, ifverbose) of changesets that have not been deployed.

# 9.12.1 calculate-checksum

Calculates and prints a checksum for the changeset with the given ID in the format filepath::id::author.



#### **Syntax**

Liquibase|lb calculate-checksum|cac {OPTIONS}

The calculate-checksum command is typically used to compute an MD5 checksum, which serves as a unique identifier for the changeset. As a result, you can see whether the changeset has been changed and whether it has to be deployed differently. The MD5SUM column in the DATABASECHANGELOG table contains a checksum of the changeset and any change made in the changeset will result in a different checksum.

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-changeset-identifier -chi	Changeset ID identifier of form filepath::id::author.	-
Optional		
-database-changelog-table- name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False



#### Calculate a checksum for changeset:

```
SQL> lb calculate-checksum --changelog-file countries_table.xml --changeset-
identifier
countries_table.xml::382e51cedfbfc7ba59568dd09dcd4e110b9fbeca::(USER) -
Generated
SQL> liquibase calculate-checksum changelog.oracle.sql::myID_123::Steve
```

# 9.12.2 changelog-sync

Marks all changes as executed in the database.

#### **Syntax**

Liquibase|lb changelog-sync|chs {OPTIONS}

#### Uses include:

- Creating a new baseline database.
- Excluding objects from a database.
- Marking a change as executed. The change was created manually.

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def <defaults-file> {FILE}</defaults-file>	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-



Option	Description	Default
-log -lo	Enable logging.  Standard logging is INFO level (no debug flag).  Debug logging is FINEST level (both log and debug flag).	-
-search-path -sep	Complete list of locations to search for files such as changelog files. You can specify multiple paths by separating them with commas.	-
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.  An example is disabling remote XML entity support.	True
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

Mark changes as executed in the database:

```
-- Set default output path

SQL> cd <output-files-path>
-- Connect to target and execute command

SQL> connect <db-connect-string>

SQL> lb changelog-sync -changelog-file countries_table.xml
```

# 9.12.3 changelog-sync-sql

Output the raw SQL used by Liquibase when running changelogsync.

#### **Syntax**

Liquibase|lb changelog-sync-sql|chss {OPTIONS}

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-



Option	Description	Default
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.  Standard logging is INFO level (no debug flag).  Debug logging is FINEST level	-
	(both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	

Generate SQL to mark changes as executed in the database:

```
-- Set default output path
SQL> cd <output-files-path>
-- Connect to target and execute command
SQL> connect <db-connect-string>
SQL> lb changelog-sync-sql -changelog-file countries_table.xml -outputfile countries_synch.sql
```



# 9.12.4 changelog-sync-to-tag

Marks all undeployed changesets as executed starting from the top of the changelog file and moving down up to and including the tag.

### **Syntax**

Liquibase||bchangelog-sync-to-tag||chstt {OPTIONS}

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-tag -ta < <i>tag</i> >	The tag to be used during the execution of command.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
<pre>-defaults-file -def <defaults-file> {FILE}</defaults-file></pre>	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	



Option	Description	Default
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

Mark changes as executed in the database up to and including tag.

```
cd <1b-changes-directory>
-- Edit changelog file and add tagDatabase entries for versions.
-- Execute command using a tag specified in tagDatabase in the changelog file.
SQL> lb changelog-sync-to-tag -tag version1 -changelog-file controller.xml
```

# 9.12.5 changelog-sync-to-tag-sql

Output the raw SQL used by Liquibase when running changelogSyncToTag.

#### **Syntax**

Liquibase|| changelog-sync-to-tag-sql|chstts {OPTIONS}

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-tag -ta < <i>tag</i> >	The tag to be used during the execution of the command.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def <defaults-file> {FILE}</defaults-file>	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-



Option	Description	Default
-log -lo	Enable logging.  Standard logging is INFO level (no debug flag).  Debug logging is FINEST level (both log and debug flag).	-
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	

Mark changes as executed in database up to and including tag.

```
cd <1b-changes-directory>
```

- -- Edit changelog file and add tagDatabase entries for versions.
- -- Execute command using a tag specified in tagDatabase in the changelog file. SQL> 1b changelog-sync-to-tag-sql -tag version1 -changelog-file

controller.xml -outputfile synch.sql

## 9.12.6 clear-checksums

Clears all checksums and nullifies the MD5SUM column of the DATABASECHANGELOG table so that they will be recomputed on the next database update.

#### **Syntax**

Liquibase|lb clear-checksums|clc {OPTIONS}

Option	Description	Default
-database-changelog-table- name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-



Option	Description	Default
-default-schema-name -desn <default-schema-name></default-schema-name>	The default schema name to use for the database connection.	-
-defaults-file -def <defaults-file> {FILE}</defaults-file>	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-liquibase-schema-name - lbsn < <i>liquibase-schema-</i> name>	Schema to use for Liquibase objects.	-
<pre>-liquibase-tablespace- name -lbtn <liquibase- tablespace-name=""></liquibase-></pre>	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.  Standard logging is INFO level (no debug flag).  Debug logging is FINEST level (both log and debug flag).	-
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

#### Clear checksums:

-- Connect to target and execute command. SQL> connect <db-connect-string> SQL> clear-checksums

## 9.12.7 data

Generate changelogs for the data. Creates a changelog for data from all objects or as filters are specified.

#### **Syntax**

Liquibase|lb data|da {OPTIONS}



Option	Description	Default
-data-output-directory - daod <data-output- directory&gt;</data-output- 	Directory to write data to, only applicable when <diff_type> includes data.</diff_type>	-
<pre>-database-changelog-table- name -dactn &lt; database- changelog-table-name&gt;</pre>	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn <default-schema-name></default-schema-name>	The default schema name to use for the database connection.	-
-defaults-file -def <defaults-file> {FILE}</defaults-file>	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-exclude-objects -exo <exclude-objects></exclude-objects>	Objects to exclude from diff.	-
-include-objects -ino <include-objects></include-objects>	Objects to include in diff.	-
-include-schema -ins <include-schema></include-schema>	If true, the schema is included in generated changesets.	False
<pre>-include-tablespace -int <include-tablespace></include-tablespace></pre>	Include the tablespace attribute in the changelog.	False
<pre>-liquibase-schema-name - lbsn <liquibase-schema- name=""></liquibase-schema-></pre>	Schema to use for Liquibase objects.	-
<pre>-liquibase-tablespace- name -lbtn <liquibase- tablespace-name=""></liquibase-></pre>	Tablespace to use for Liquibase objects.	
-log -lo	Enable logging. Standard logging is INFO level (no debug flag).	-
	Debug logging is FINEST level (both log and debug flag).	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False
<pre>-output-file -ouf <output- file&gt;</output- </pre>	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in directory. This will not affect other files.	-
-schemas -sc <schemas></schemas>	Schemas to include operation.	-
-search-path -sep <search- path&gt;</search- 	Complete list of locations to search for files such as changelog files. Multiple paths can be specified by separating them with commas.	-



Option	Description	Default
-secure-parsing -scp <secure-parsing></secure-parsing>	Keep functionality from file parsers which could be used insecurely. Examples include (but not limited to) disabling remote XML entity support.	True

# 9.12.8 db-doc

Generates JavaDoc documentation for the existing database and changelogs.

## Syntax

Liquibase|lb db-doc|dbd {OPTIONS}

Option	Description	Default
Required		
-changelog-file -chf <changelog-file></changelog-file>	The root changelog file.	-
-output-directory -oud <output-directory></output-directory>	The directory where the documentation is generated.	-
Optional		
<pre>-database-changelog-table- name -dactn <database- changelog-table-name&gt;</database- </pre>	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn <default-schema-name></default-schema-name>	The default schema name to use for the database connection.	-
-defaults-file -def <defaults-file> {FILE}</defaults-file>	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-liquibase-schema-name -	Schema to use for Liquibase	
lbsn <liquibase-schema- name&gt;</liquibase-schema- 	objects.	
-liquibase-tablespace- name -lbtn <liquibase- tablespace-name&gt;</liquibase- 	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging. Standard logging is INFO level (no debug flag). Debug logging is FINEST level (both log and debug flag).	-



Option	Description	Default
-search-path -sep <search-path></search-path>	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp <secure-parsing></secure-parsing>	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds <output-default- schema=""></output-default->	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

#### Generate db documentation:

```
-- Set default output path
SQL> cd <output-files-path>
-- Generate doc
SQL> lb db-doc -output-directory ./dbdoc -changelog-file controller.xml
```

# 9.12.9 diff

### Compare two databases.

#### **Syntax**

Liquibase|lb diff|di {OPTIONS}

Option	Description	Default
Required		
-reference-password -rep	The reference database password.	-
-reference-url -reur	The JDBC reference database connection URL.	-
-reference-username -reu	The reference database username.	-
Optional		
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema- -desn	The default schema name to use for the database connection.	-



Option	Description	Default
-defaults-file -def	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-diff-types -dit	Types of objects to compare.	catalogs, tables, views, columns, indexes, foreignkeys, primarykeys, uniqueconstraints, data, storedprocedures, sequences{catalogs  tables  views  columns  indexes  foreignkeys  primarykeys  uniqueconstraints  data  storedprocedures  sequences}
-exclude-objects -exo <exclude-objects></exclude-objects>	Objects to exclude from diff.	-
-include-objects -ino <include-objects></include-objects>	Objects to include in diff.	-
-include-schema -ins <include-schema></include-schema>	If true, the schema will be included in generated changesets.	False
-include-tablespace -int <include-tablespace></include-tablespace>	Include the tablespace attribute in the changelog.	False
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.  Standard logging is INFO level (no debug flag).	-
	Debug logging is FINEST level (both log and debug flag).	
-overwrite-files -ovf	Overwrite any existing files in directory. This will not affect other files.	-
-search-path -sep <search-path></search-path>	Complete list of locations to search for files such as changelog files. Specify multiple paths by separating them with commas.	-
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-



Option	Description	Default
-reference-default-schema- name -redsn	The reference default schema name to use for the database connection.	-
-schemas -sc	Schemas to include operation.	-

Compare two databases and spool output.

```
-- Set default output path

SQL> cd <output-files-path>

SQL> spool diff.sql
-- Connect to target database

SQL> connect <db-connect-string>
-- Compare to a reference database

SQL> lb diff -reference-url <reference-db-url> -reference-username <reference-db-user> -reference-password <reference-db-password>

SQL> spool off
```

Compare tables, indexes and views between two databases.

```
-- Set default output path
SQL> cd <output-files-path>
SQL> spool diff.sql
-- Connect to comparison database
SQL> connect <db-connect-string>
-- Compare to a reference database
SQL> lb diff -diff-types tables,indexes,views -reference-url <db-url>
-reference-username <db-user> -reference-password <db-password>
```

## 9.12.10 diff-changeLog

Compare two databases to produce changesets and write them to a changelog file.

#### **Syntax**

Liquibase|lb diff-changelog|dic {OPTIONS}

Option	Description	Default
Required		
-reference-password -rep	The reference database password.	-
-reference-url -reur	The JDBC reference database connection URL.	-
-reference-username -reu	The reference database username.	-



Option	Description	Default
Optional		
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-diff-types -dit	Types of objects to compare	catalogs, tables, views, columns, indexes, foreignkeys, primarykeys, uniqueconstraints, data, storedprocedures, sequences{catalogs  tables  views  columns  indexes  foreignkeys  primarykeys  uniqueconstraints  data  storedprocedures  sequences}
-exclude-objects -exo	Objects to exclude from diff	-
-include-objects -ino	Objects to include in diff	-
-include-schema -ins	If true, the schema is included in generated changesets.	False
-include-tablespace -int	Include the tablespace attribute in the changelog	False
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-schemas -sc	Schemas to include in diff	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	



Option	Description	Default
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-

Create changelog to synchronize two databases.

```
-- Set default output path
SQL> cd <output-files-path>
-- Connect to target database
SQL> connect <db-connect-string>
-- Compare to a reference database and create a changelog to synchronize them
SQL> lb diff-changelog -changelog-file diff.xml -reference-url <db-url> -
reference-username <db-user> -reference-password <db-password>
```

Create changelog to synchronize table excluding employees between two databases.

```
-- Set default output path

SQL> cd <output-files-path>
-- Connect to comparison database

SQL> connect <db-connect-string>
-- Compare tables to a reference database

SQL> lb diff-changelog -changelog-file diff.xml -diffTypes=tables -exclude-objects employees -reference-url <db-url>
-reference-username <db-user> -reference-password <db-password>
```

# 9.12.11 drop-all

Drops all database objects owned by the user.

#### **Syntax**

Liquibase|lb drop-all|dra {OPTIONS}

Option	Description	Default
-database-changelog-table- name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-



Option	Description	Default
-defaults-file -def	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging. Standard logging is INFO level (no debug flag). Debug logging is FINEST level	-
-output-default-schema - ouds	(both log and debug flag).  Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.  An example is disabling remote	True
	XML entity support.	
-schemas -sc	Schemas to include operation.	-

To drop all database objects owned by the user, enter:

SQL> lb drop-all

# 9.12.12 future-rollback-count-sql

Generates SQL that is used to sequentially revert the specified number of undeployed changes.

### **Syntax**

Liquibase|| future-rollback-count-sql|furcs {OPTIONS}



## Options

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-count -cu	The number of changes to roll back.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	False
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true, they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	

## Example

Generate SQL to roll back the specified number of undeployed changes.

```
-- Set default output path
SQL> cd <output-files-path>
-- Connect to target
```



SQL> connect <db-connect-string>
-- Generate SQL to roll back 1 undeployed change
SQL> lb future-rollback-count-sql -count 1 -changelog-file controller.xml

# 9.12.13 future-rollback-from-tag-sql

Generates SQL to revert future undeployed changes up to the specified tag.

#### **Syntax**

Liquibase|lb future-rollback-from-tag-sql|furfts {OPTIONS}

Option	Description	Default
Required	· · · · · · · · · · · · · · · · · · ·	
-changelog-file -chf	The root changelog file.	-
-tag -ta	Generic 'tag to apply action to'.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
•	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true, they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-



Option	Description	Default
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	

Generate SQL to roll back undeployed changes to tag.

```
-- Set default output path
SQL> cd <output-files-path>
-- Connect to target
SQL> connect <db-connect-string>
-- Generate SQL to roll back 1 undeployed change
SQL> lb future-rollback-count-sql -count 1 -changelog-file controller.xml
-- Edit changelog file and add tagDatabase entries for versions
-- Generate SQL to roll undeployed changes back to version1
SQL> lb future-rollback-from-tag-sql -tag version1 -changelog-file controller.xml
```

# 9.12.14 future-rollback-sql

Generate the raw SQL needed to roll back future undeployed changes.

#### **Syntax**

Liquibase|lb future-rollback-sql|furs {OPTIONS}

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-



Option	Description	Default
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true, they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	

Generate SQL to roll back undeployed changes.

```
-- Set default output path
SQL> cd <output-files-path>
-- Connect to target
SQL> connect <db-connect-string>
-- Generate SQL to roll back 1 undeployed change
SQL> lb future-rollback-count-sql -count 1 -changelog-file controller.xml
-- Generate SQL to rollback all undeployed changes
SQL> lb future-rollback-sql -changelog-file controller.xml
```

# 9.12.15 generate-apex-object

Generates the changeset for an APEX object.

#### **Syntax**

Liquibase|lb generate-apex-object|geao {OPTIONS}



Option	Description	Default
-applicationid -api	ID for application to be exported.	-
-changesby -chb	Expects string parameter. Limit - list values to changes by the given user.	-
-changessince -chs	Expects date parameter (YYYY-MM-DD). Limit -list values to changes since the given date.	-
-contexts -co	Context string to use for filtering which changes to operate on.	-
-debug -de	{true false}	-
	Enable debug output.	
-deploymentsystem -desy	Deployment system for exported feedback.	-
-dir -di	Save all files in the given directory. Example: -dir some/sub/directory	-
-exporiginalids -dxoi	Export will not emit ids as they were when the application was imported.	-
-runalways -ra	{true false}	False
	Set runAlways attribute to true in changelog.	
-expaclassignments -exacl	Export ACL user role assignments.	-
-expcomments -exco	Export developer comments.	-
-expcomponents -exc	-	-
-expfeedback -exfe	Export team development feedback for all workspaces or identified by -workspaceid.	-
-expfeedbacksince -exfs	Export team development feedback since date in the format YYYYMMDD.	-
-expfiles -exfi	Export all workspace files identified by -workspaceid.	-
-expirnotif -exir	Export all interactive report notifications.	-
-expminimal -exmi	Only export workspace definition, users, and groups.	-
-expnosubscriptions -exns	Do not export references to subscribed components.	-
-exppubreports -exre	Export all user saved public interactive reports.	-
-expsavedreports -exsr	Export all user saved interactive reports.	-
-expsupportingobjects - exso	Pass (Y)es, (N)o or (I)nstall to override the default.	-
-expteamdevdata -exte	Export team development data for all workspaces or identified by - workspaceid.	-



Option	Description	Default
-exptranslations -extr	Export the translation mappings and all text from the translation repository	-
-exptype -exty	Comma delimited list of export types to perform:  • APPLICATION_SOURCE: export an APEX application using other parameters passed.	
	EMBEDDED_CODE: Export code such as SQL, PL/SQL and Javascript. APEX ignores all other options when EMBEDDED_CODE is selected.	
	<ul> <li>CHECKSUM-SH1: Export a SHA1 checksum that is independent of IDs and can be compared across instances and workspaces.</li> </ul>	
	<ul> <li>CHECKSUM-SH256: Export an SHA-256 checksum that is independent of IDs and can be compared across instances and workspaces.</li> </ul>	
	READABLE_JSON: Export a readable version of the application metadata in JSON format.  PEADABLE VAME Fronts	
	<ul> <li>READABLE_YAML: Export a readable version of the application metadata in YAML format.</li> </ul>	
-expworkspace -exwo	Export workspace identified by - workspaceid or all workspaces if - workspaceid not specified.	-
-fail-on-error -foe	{true false} Set failonError attribute to true in changelog.	False
-instance -in	Export all applications.	-
-skipexportdate -ked	Include export date in application export files.	-
-labels -la	Label expression to use for filtering which changes to operate on.	-
-list -li	Lists applications installed in the database.	-
-log -lo	<pre>{true false} Enable logging. Standard logging is INFO level (no debug flag).</pre>	-
	Debug logging is FINEST level (both log and debug flag).	



Option	Description	Default
-nochecksum -noch	Overwrite existing files even if the contents have not changed.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	=
-split -sp	{true false} This makes the export split the files into directories based on the object types.	False
-workspaceid -woi	Workspace ID to export all applications to or the workspace to be exported.	-

# 9.12.16 generate-changelog

Writes changelog XML to copy the current state of the database to standard output or a file (uses core Liquibase functionality).

#### **Syntax**

Liquibase|lb generate-changelog|gec {OPTIONS}

Option	Description	Default
-data-output-directory -daod	Directory to write data to.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-diff-types -dit	Types of objects to compare	catalogs, tables, views, columns, indexes, foreignkeys, primarykeys, uniqueconstraints, data, storedprocedures, sequences{catalogs  tables  views  columns  indexes  foreignkeys  primarykeys  uniqueconstraints  data  storedprocedures  sequences}
-exclude-objects -exo	Objects to exclude from diff	-
-include-objects -ino	Objects to include in diff	-
-include-schema -ins	If true, the schema is included in generated changeSets.	False
-include-tablespace -int	Include the tablespace attribute in the changelog	False
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-



Option	Description	Default
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
<pre>-output-file -ouf <output- file=""></output-></pre>	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-defaults-file -def	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-schemas -sc	Schemas to include in diff	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing cp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	

#### Generate XML files for a database.

-- Set default output path
SQL> cd <output-files-path>
-- Generate xml files
SQL> lb generate-changelog

#### Generate XML files for specific schemas in a database.

SQL> 1b generate-changelog -schemas hr, sales

# 9.12.17 generate-controlfile

Generates an empty control file that you can use to start a new changelog.



#### **Syntax**

Liquibase|lb generate-controlfile {OPTIONS}

#### **Options**

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-debug -de	Enable debug output.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	

#### **Example**

#### Generate control file:

```
--Set default output path
SQL> cd <output-files-path>
SQL> lb generate-controlfile
```

# 9.12.18 generate-db-object

Writes change log XML to copy the current state of the database object to a file. Syntax

lb generate-db-object|geo {OPTIONS}

Option	Description	Default
-database-changelog-table- name -dactn <database- changelog-table-name&gt;</database- 	Name of table to use for tracking change history.	-
-debug -de	Enable debug output	-
-default-schema-name -desn <default-schema-name></default-schema-name>	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use.  Example: -defaults- file/tmp/ liquibase.properties	-
-fail-on-error -foe	Set failonError attribute to true in changelog.	False



Option	Description	Default
-liquibase-schema-name - lbsn <liquibase-schema- name&gt;</liquibase-schema- 	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn <liquibase- tablespace-name&gt;</liquibase- 	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging	-
-object-name -obn	Name of the object.	-
-object-type  -obt	Type of object.	-
-output-default-schema - ouds <output-default- schema=""></output-default->	Control whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	
-sql -sq	Generate a sql file along with the changelog showing the DDL for the object. This sql is not intended to be used for anything other than review.	-
-replace -re	Set replacelfExists attribute to true in changelog.	-
-runalways -ra	Set runAlways attribute to false in changelog	-
-runonchange -rc	Set runOnChange attribute to true in changelog.	-

Generate the XML file for a specific object.

```
-- Set default output path

SQL> cd <output-files-path>
-- Generate xml files

SQL> lb generate-object -object-type table -object-name employees
```

# 9.12.19 generate-ords-module

Generates the code necessary to reproduce a module and all children using the ORDS APIs.



#### **Syntax**

Liquibase|| denerate-ords-module|| geom {OPTIONS}

#### **Options**

Option	Description	Default
Required		
-module-name -mon	The module name for which to generate code.	-
Optional		
-debug -de	Enable debug output.	-
-exclude-enable-schema -exes	Dictates whether the enable_schema call will be included in the export.	-
-exclude-privs -exp	Dictates whether privileges will be included in the export.	-
-log -lo	Enable logging.  Standard logging is INFO level (no debug flag).  Debug logging is FINEST level (both log and debug flag).	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-

#### **Example**

#### Generate ORDS module object:

```
-- Set default output path SQL> cd <output-files-path> -- Generate XML files SQL> lb generate-ords-module
```

# 9.12.20 generate-ords-schema

Generates the code necessary to reproduce all modules and children using the ORDS APIs.

#### **Syntax**

Liquibase|lb generate-ords-schema|geos {OPTIONS}

Option	Description	Default
-debug -de	Enable debug output.	-
-exclude-enable-schema -exes	Dictates whether the enable_schema call is included in the export.	-



Option	Description	Default
-exclude-privs -exp	Dictates whether privileges will be included in the export.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-

# 9.12.21 generate-schema

Writes changelog XML to copy the current state of the database to files.

#### **Syntax**

Liquibase|| denerate-schema|| ges {OPTIONS}

This command uses custom extension functionality. XML files are generated defining the DDL for each object in the database. A controller XML file is created or updated identifying the individual XML files generated. The files are used to deploy using UPDATE commands.

Option	Description	Default
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history	DATABASECHANGELOG
-debug -de	Enable debug output.	-
-fail-on-error -foe	{true false} Set failonError attribute to true in changelog.	False



Option	Description	Default
-filter -fi	The filter value is the right-hand side of a SQL comparison, that is, a SQL comparison operator (=,!=, and so on) and the value compared against. The value must contain parentheses and quotation marks where appropriate. For example: "IN ('DEPT','EMP')" The filter value is combined with the object attribute corresponding to the object name to produce a WHERE condition in the query that fetches the objects. In the preceding example, objects named DEPT and EMP are retrieved. By default, all named objects of object_type are selected.	-
-grants -gr	Export Object, System and Role grants.	-
-labels -la	Label expression to use for filtering which changes to operate on.	-
-log -lo	Enable logging.  Standard logging is INFO level (no debug flag).  Debug logging is FINEST level (both log and debug flag).	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-perform-detail-parse - pdp	Setting this flag will cause all functions, procedures and packages to undergo a complete parse to determine dependencies. This addistional processesing will cause the generation to take more time. This flag should only be used when there is a sorting issue in functions, procedures or packages.	
-replace -re	Set replacelfExists attribute to true in changelog.	-
-runalways -ra	Set runAlways attribute to false in changelog.	-
-runonchange -rc	Set runOnChange attribute to true in changelog.	-
-split -sp	This makes the export split the files into directories based on the object types.	-



Option	Description	Default
-sql -sq	Generate a SQL file along with the changelog showing the DDL for the object. This SQL is not intended for anything other than review.	-
-synonyms -sy	Export public synonymns.	-

Generate XML files into separate directories.

```
-- Set default output path
SQL> cd <output-files-path>
-- Generate xml files
SQL> lb generate-schema -split
```

Generate XML files using a filter to include specific object types.

SQL> lb generate-schema -filter "IN ('DEPARTMENTS', 'EMPLOYEES')"

# 9.12.22 history

List all deployed changesets and their deployment ID.

#### **Syntax**

Liquibase|lb history|hi {OPTIONS}

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-contexts -co <contexts></contexts>	Context string to use for filtering the changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la < <i>labels</i> >	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-



Option	Description	Default
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-search-path sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

Show the deployment history.

```
-- Connect to target
SQL> connect <db-connect-string>
SQL> lb history
```

# 9.12.23 list-locks

List the hostname, IP address, and timestamp of the Liquibase lock record.

#### **Syntax**

Liquibase|lb list-locks|lil {OPTIONS}

The databasechangeloglock table is read to show lock details based on the connection.

Option	Description	Default
-database-changelog-table- name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-



Option	Description	Default
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-search-path -sep <search-path></search-path>	Complete list of locations to search for files such as changelog files. Specify multiple paths by separating them with commas.	-
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

# 9.12.24 mark-next-changeset-ran

Marks the next change you apply as executed in your database.

### **Syntax**

Liquibase|lb mark-next-changeset-ran|mancr {OPTIONS}

The mark-next-changeset-ran command is used when deploy errors occur due to Liquibase not being synchronized with changes made outside of Liquibase.

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-



Option	Description	Default
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

# 9.12.25 mark-next-changeset-ran-sql

Writes the SQL used to mark the next change you apply as executed in your database.

### **Syntax**

Liquibase|lb mark-next-changeset-ran-sql|mancrs {OPTIONS}

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-



Option	Description	Default
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true, they are qualified. If false, only objects outside the default schema are fully qualified.	False
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	-
	An example is disabling remote XML entity support.	
-output-file -ouf	The name of the file to write the output to.	-

# 9.12.26 release-locks

Remove the Liquibase lock record from the  ${\tt DATABASECHANGELOG}$  table.

### **Syntax**

Liquibase|lb release-locks|rel {OPTIONS}

Option	Description	Default
-database-changelog-table- name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-



Option	Description	Default
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-search-path -sep <search-path></search-path>	Complete list of locations to search for files such as changelog files. Specify multiple paths by separating them with commas.	-
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

# 9.12.27 rollback

Roll back changes made to the database based on the specified tag.

### **Syntax**

Liquibase|lb rollback|rb {OPTIONS}

The rollback command is used to revert all changes that were made to the database after a defined tag. All deployed changes are rolled back until the tag row in the DATABASECHANGELOG table.

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-tag -ta	The tag to use during the execution of the command.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-



Option	Description	Default
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-rollback-script -ros	Rollback script to execute.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely. An example is disabling remote XML entity support.	True
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

### Roll back changes to tag.

```
-- Set default output path

SQL> cd <output-files-path>
-- Connect to target

SQL> connect <db-connect-string>
-- Apply update for versions adding new tag for each version

SQL> lb update -changelog-file controller.xml

SQL> lb tag -tag version1

SQL> lb update -changelog-file controller.xml

SQL> lb tag -tag version2
-- Roll back to version1

SQL> lb rollback-sql -tag version1 -changelog-file controller.xml
```

## 9.12.28 rollback-count

Roll back the specified number of changes made to the database.

### **Syntax**

Liquibase|lb rollback-count|rbc {OPTIONS}

The rollback-count command is used to revert the specified number of changes to the database starting from the most recent changes.



### **Options**

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-count -cu	The number of changes to apply.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-rollback-script -ros	Rollback script to execute.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

### Example

Roll back the specified number of changes.

```
-- Set default output path
SQL> cd <output-files-path>
-- Connect to target
SQL> connect <db-connect-string>
-- Apply update for versions adding new tag for each version
SQL> lb update -changelog-file controller.xml
```



```
SQL> lb update -changelog-file controller.xml
-- Roll back to version1
SQL> lb rollback-count -count 1 -changelog-file controller.xml
```

# 9.12.29 rollback-count-sql

Generate the SQL to roll back the specified number of changes.

### **Syntax**

Liquibase|lb rollback-count-sql|rbcs {OPTIONS}

The rollback-count command is used to revert the specified number of changes to the database starting from the most recent changes.

_		
Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-count -cu	The number of changes to apply.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-



Option	Description	Default
-rollback-script -ros	Rollback script to execute.	-
-search-path -sep <search- path&gt;</search- 	Complete list of locations to search for files such as changelog files in. Specify multiple paths by separating them with commas.	-
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	-
	An example is disabling remote XML entity support.	

Generate SQL to roll back the specified number of changes.

```
-- Set default output path

SQL> cd <output-files-path>
-- Connect to target

SQL> connect <db-connect-string>
-- Apply update for versions

SQL> lb update -changelog-file controller.xml

SQL> lb update -changelog-file controller.xml
-- Roll back to version1

SQL> lb rollback-count-sql -count1 -changelog-file controller.xml
```

## 9.12.30 rollback-sql

Generate the SQL to roll back changes made to the database after a defined tag.

### **Syntax**

Liquibase||b rollback-sql|rbs {OPTIONS}

The SQL will contain all deployed changes being rolled back until the tag row in the DATABASECHANGELOG table.

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-tag -ta	The tag to use during the execution of the command.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-



Option	Description	Default
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.  Standard logging is INFO level (no debug	-
	flag).	
	Debug logging is FINEST level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-rollback-script -ros	Rollback script to execute.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	

Generate SQL to roll back the specified number of changes.

```
-- Set default output path
SQL> cd <output-files-path>
-- Connect to target
SQL> connect <db-connect-string>
-- Apply update for versions adding new tag for each version
SQL> lb update -changelog-file controller.xml
SQL> lb tag -tag version1
SQL> lb update -changelog-file controller.xml
SQL> lb tag -tag version2
-- Roll back to version1
SQL> lb rollback-sql -tag version1 -changelog-file controller.xml
```

## 9.12.31 rollback-to-date

Roll back changes made to the database back to the specified date and time.



## **Syntax**

Liquibase|lb rollback-to-date|rbtd {OPTIONS}

The rollback-to-date command is used to revert changes from today's date to the specified date and time..

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-date -da [	Date to use when determining what changes to apply. The date format is YYYY-MM-DD HH:MM:SS. If including time, enclose the entire date/time in double quotes.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging. Standard logging is INFO level (no debug flag).	-
	Debug logging is FINEST level (both log and debug flag).	
-rollback-script -ros	Rollback script to execute.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	



Option	Description	Default
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

Roll back to the specified date and time.

```
-- Set default output path
SQL> cd <output-files-path>
-- Connect to target
SQL> connect <db-connect-string>
-- Apply update update on 2022-09-01
SQL> lb update -changelog-file controller.xml
-- Apply update on 2022-09-02
SQL> lb update -changelog-file controller.xml
-- Apply update on 2022-09-03
SQL> lb update -changelog-file controller.xml
-- Roll back to version1
SQL> lb rollback-to-date -date 2022-09-02 -changelog-file controller.xml
```

# 9.12.32 rollback-to-date-sql

Generate SQL to roll back changes made to the database back to the specified date and time.

### **Syntax**

Liquibase|lb rollback-to-date-sql|rbtds {OPTIONS}

The rollback-to-date-sql command is used to generate SQL to revert changes from today's date to the specified date and time.

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-date -da [	Date to use when determining what changes to apply. The date format is YYYY-MM-DD HH:MM:SS. If including time, enclose the entire date/time in double quotes.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-



Option	Description	Default
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-rollback-script -ros	Rollback script to execute.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.	True
	An example is disabling remote XML entity support.	

Generate SQL to roll back the specified date.

```
-- Set default output path
SQL> cd <output-files-path>
-- Connect to target
SQL> connect <db-connect-string>
-- Apply update on 2022-09-01
SQL> lb update -changelog-file controller.xml
-- Apply update on 2022-09-02
SQL> lb update -changelog-file controller.xml
-- Apply update on 2022-09-03
SQL> lb update -changelog-file controller.xml
-- Roll back to version1
SQL> lb rollback-to-date-sql -date 2022-09-02 -changelog-file controller.xml
```



# 9.12.33 snapshot

Capture the current state of a target database.

### **Syntax**

Liquibase|lb snapshot|sn {OPTIONS}

The snapshot command is used to:

- Review and track changes in your target database
- Compare a previous database state to an online database
- Compare a previous database state to another snapshot

Option	Description	Default
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-schemas -sc	Schemas to include in diff.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-snapshot-format -snf	Output format to use (JSON, YAML, or TXT)	-



Option	Description	Default
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

Generate a snapshot capturing the current state of a database.

```
-- Set default output path

SQL> cd <output-files-path>
-- Connect to target

SQL> connect <db-connect-string>
-- Take a snapshot

SQL> lb snapshot -snapshot-format json -outputfile snaptgt20220901.json
```

## 9.12.34 status

Generate a list of pending changesets.

### **Syntax**

Liquibase|lb status|st {OPTIONS}

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-



Option	Description	Default
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-verbose -ve	Verbose flag	True
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

Report the number of undeployed changesets and identify them.

```
-- Set default output path
SQL> cd <output-files-path>
-- Check the status
SQL> lb status -verbose -changelog-file controller.xml
```

# 9.12.35 tag

Mark the current database state with the specified tag to use for roll back.

#### **Syntax**

Liquibase|lb tag|ta {OPTIONS}

For example, you can use the tag to mark the current database state for version, release, and so on. The tag is added to the last row in the DATABASECHANGELOG table.

Option	Description	Default
Required		
-tag -ta	The tag to use during the execution of the command.	-
Optional		
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-



Option	Description	Default
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

Create initial tag and version tags.

```
-- Set default output path

SQL> cd <output-files-path>
-- Connect to target and add base tag

SQL> connect <db-connect-string>

SQL> lb tag -tag baseversion1
-- Apply update for version adding and add new tag for each version

SQL> lb update -changelog-file controller.xml

SQL> lb tag -tag version1
```

# 9.12.36 tag-exists

Verify the existence of the specified tag.

### **Syntax**

Liquibase|lb tag-exists|tae {OPTIONS}



### **Options**

Option	Description	Default
Required		
-tag -ta	The tag to use during the execution of the command.	-
Optional		
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

# 9.12.37 unexpected-changesets

Generate a list of changesets that have been executed but are not in the current changelog.

### **Syntax**

Liquibase|| unexpected-changesets|| unc {OPTIONS}

This command detects and compares the changes between the  ${\tt DATABASECHANGELOG}$  table and the current changelog and reports:

- Changesets in the DATABASECHANGELOG table that do not exist in the current changelog.
- Previously deployed changesets that were deleted from your current changelog.



## Options

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def <defaults-file> {FILE}</defaults-file>	Fully qualified path to the properties file you want to use. For example, defaults-file /tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.  Standard logging is INFO level (no debug flag).	-
	Debug logging is FINEST level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers, which can be used insecurely.  An example is disabling remote XML entity support.	True
-verbose  -ve	Verbose flag	True

## Example

Report unexpected changesets.

-- Set default output path
SQL> cd <output-files-path>



-- Connect to target and run command
SQL> connect <db-connect-string>
SQL> lb unexpected-changesets -changelog-file controller.xml

## 9.12.38 update

Deploy any changes in the changelog file that have not been deployed.

### **Syntax**

Liquibase|lb update|up {OPTIONS}

When you run the update command, the changesets in the changelog file are read sequentially. The unique identifiers (file::id::author) in the file are compared to those stored in the DATABASECHANGELOG table.

- If the unique identifiers do not exist, Liquibase will apply the changeset to the database.
- If the unique identifiers exist, the MD5Sum of the changeset is compared to the one in the database.

If they are different, Liquibase will produce an error message that someone has changed it unexpectedly.

If the status of the runOnChange or runAlways changeset attribute is set to TRUE, Liquibase will re-apply the changeset. Example: <changeSet id="2" author="bob" runAlways="true">

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table- name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-



Option	Description	Default
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-show-summary -shs <show- summary&gt; {OFF SUMMARY  VERBOSE}</show- 	Produces a summary list of any changesets skipped and why they were skipped. Valid values are OFF, SUMMARY, and VERBOSE.	SUMMARY
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False
-override-app-alias -ovaa	Override value to be used for the APEX application alias.	-
-override-app-id -ovai	Override value to be used for the APEX application id.	-
-override-app-schema -ovas	Override value to be used for the APEX workspace schema.	-
-override-app-workspace - ovaw	Override value to be used for the APEX application workspace.	-

## 9.12.39 update-count

Deploy the specified number of changes from the changelog file.

### **Syntax**

Liquibase|| lb update-count|| upc {OPTIONS}

The update-count command applies changes and updates changesets sequentially, starting from the top of the changelog file until the number specified is reached.

- If the unique identifiers do not exist, Liquibase will apply the changeset to the database.
- If the unique identifiers exist, the MD5Sum of the changeset is compared to the one in the database.

If they are different, Liquibase will produce an error message that someone has changed it unexpectedly.

If the status of the runOnChange or runAlways changeset attribute is set to TRUE, Liquibase will re-apply the changeset. Example: <changeSet id="2" author="bob" runAlways="true">

## **Options**

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-count -cu	The number of changes to apply.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
<pre>-database-changelog-table- name -dactn</pre>	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels 1-	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-show-summary -shs <show- summary&gt; {OFF SUMMARY  VERBOSE}</show- 	Produces a summary list of any changesets skipped and why they were skipped. Valid values are OFF, SUMMARY, and VERBOSE.	SUMMARY
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

### Example

Update database with the specified number of changesets in the changelog file.

```
SQL> cd <1b-changes-directory> SQL> 1b update -changelog-file controller.xml -count 2
```



# 9.12.40 update-count-sql

Generate the SQL to deploy the specified number of changes for review before running the update command.

### **Syntax**

Liquibase|lb update-count-sql|upcs {OPTIONS}

Liquibase uses the raw SQL to apply database changes you have added to the changelog file.

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
-count -cu	The number of changes to apply.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
<pre>-database-changelog-table- name -dactn</pre>	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	



Option	Description	Default
-secure-parsing scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	

# 9.12.41 update-sql

Generate the SQL identified in the changelog for review before running the update command.

### **Syntax**

Liquibase|lb update-sql|ups {OPTIONS}

Liquibase uses the raw SQL to apply database changes you have added to the changelog file.

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	



Option	Description	Default
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-override-app-alias -ovaa	Override value to be used for the APEX application alias.	-
-override-app-id -ovai	Override value to be used for the APEX application id.	-
-override-app-schema -ovas	Override value to be used for the APEX workspace schema.	-
-override-app-workspace - ovaw	Override value to be used for the APEX application workspace.	-

# 9.12.42 update-testing-rollback

Updates database, then rolls back changes before updating again. It provides testing of rollback funtionality.

### **Syntax**

Liquibase|lb update-testing-rollback|uptr {OPTIONS}

Use only when all pending changelogs have been verified as ready to be deployed.

A multi-step operation is used and runs in sequential order:

update changeset1; update changeset2; update changeset3\
rollback changeset3; rollback changeset2; rollback changeset1
update changeset1; update changeset3

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-



Option	Description	Default
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	-
	An example is disabling remote XML entity support.	

# 9.12.43 update-to-tag

Deploy changes sequentially from the newest changeset up to and including the changeset with the specified tag.

#### **Syntax**

Liquibase|lb update-to-tag|uptt OPTIONS

The update-to-tag command will deploy changes only when you have previously added a tag Database Change Type in your changelog file. You cannot use the update-to-tag command with the reference to a tag created in the DATABASECHANGELOG table using the tag command. An update-to-tag-sql should always be run to review the SQL before running update-to-tag.

Option	Description	Default
Required		



Option	Description	Default
-changelog-file -chf	The root changelog file.	-
-tag -ta	The tag to use during the execution of the command.	-
Optional		
-contexts -co	Context string to use for filtering which changes to operate on.	-
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	-
	An example is disabling remote XML entity support.	
-show-summary -shs <show- summary&gt; {OFF SUMMARY  VERBOSE}</show- 	Produces a summary list of any changesets skipped and why they were skipped. Valid values are OFF, SUMMARY, and VERBOSE.	SUMMARY
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

Update database with the changesets up to and including the changeset with the specified database tag.

SQL> cd <1b-changes-directory>

- -- Edit changelog file and add tagDatabase entries for versions
- -- Execute an update-to-tag using a tag specified in tagDatabase in the



changelog file
SQL> lb update-to-tag -tag version1 -changelog-file controller.xml

## 9.12.44 update-to-tag-sql

Generate the SQL from the newest changeset up to and including the changeset with the specified tag.

### **Syntax**

Liquibase|lb update-to-tag-sql|uptts {OPTIONS}

An update-to-tag-sql should always be run to review the SQL before running update-to-tag The update-to-tag-sql command will generate SQL when you have previously added a tag Database Change Type in your changelog file. You cannot use the update-to-tag command with the reference to a tag created in the DATABASECHANGELOG table using the tag cde command.

Option	Description	Default
Required	·	
-changelog-file -chf	The root changelog file.	-
-tag -ta	The tag to use during the execution of the command.	-
Optional		
contexts -co	Context string to use for filtering which changes to operate on.	-
database-changelog-table- ame -dactn	Name of table to use for tracking change history.	-
debug -de	Enable debug output.	-
default-schema-name -desn	The default schema name to use for the database connection.	-
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-labels -la	Label expression to use for filtering the changes to operate on.	-
liquibase-schema-name - bsn	Schema to use for Liquibase objects.	-
liquibase-tablespace- ame -lbtn	Tablespace to use for Liquibase objects.	-
log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is ${\tt FINEST}$ level (both log and debug flag).	
-output-default-schema - ouds	Control whether names of objects in the default schema are fully qualified or not. If true they are qualified. If false, only objects outside the default schema are fully qualified.	False



Option	Description	Default
-output-file -ouf	The name of the file to write the output to.	-
-overwrite-files -ovf	Overwrite any existing files in the directory. This will not affect other files.	-
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	

Update database with the changesets up to and including the changeset with the specified database tag.

```
SQL> cd <1b-changes-directory>
-- Edit changelog file and add tagDatabase entries for version1
SQL> lb update-to-tag-sql -tag version1 -changelog-file controller.xml
```

# 9.12.45 validate

Validate the changelog for errors that may cause an UPDATE to fail.

### **Syntax**

Liquibase|lb validate|va {OPTIONS}

The following checks are done:

- XML, YAML, JSON, and SQL structure
- Referenced files exist
- Required or prohibited attributes are correct for your database
- Duplicated id, author, and file combinations
- Checksum errors

Option	Description	Default
Required		
-changelog-file -chf	The root changelog file.	-
Optional		
-database-changelog-table-name -dactn	Name of table to use for tracking change history.	-
-debug -de	Enable debug output.	-
-default-schema-name -desn	The default schema name to use for the database connection.	-



Option	Description	Default
-defaults-file -def	Fully qualified path to the properties file you want to use. Example: -defaults-file/tmp/liquibase.properties	-
-liquibase-schema-name - lbsn	Schema to use for Liquibase objects.	-
-liquibase-tablespace- name -lbtn	Tablespace to use for Liquibase objects.	-
-log -lo	Enable logging.	-
	Standard logging is INFO level (no debug flag).	
	Debug logging is FINEST level (both log and debug flag).	
-search-path -sep	Complete list of locations to search for files such as changelog files.	-
	You can specify multiple paths by separating them with commas.	
-secure-parsing -scp	If true, remove functionality from file parsers that could be used insecurely.	True
	An example is disabling remote XML entity support.	
-output-default-schema - ouds	Controls whether names of objects in the default schema are fully qualified or not. If false, only objects outside the default schema are fully qualified.	False

### Validate before running UPDATE.

```
-- Set default output path

SQL> cd <output-files-path>
-- Connect to target and validate

SQL> connect <db-connect-string>

SQL> lb validate -changelog-file controller.xml
```

## 9.12.46 version

Display version information.

### **Syntax**

Liquibase|lb version|ve

Option	Description	Default
-debug -de	Enable debug output.	-



## 9.13 MDB

The MDB command enables the import of tables and data from MDB (Microsoft Access Database) files into an Oracle database schema.

You can run the MDB command in SQLcl using mdb.

To view the help information for MDB, enter help mdb.

The following two sub-commands are supported, enabling listing or copying data from a Microsoft Access database file.

#### **List Data**

Lists tables or saved queries (views) that exist in the specified MDB file and outputs the list.

### **Syntax**

```
mdb list {OPTIONS}
```

### **Options**

Option	Description
Required	
-file -fi <file></file>	Path of the Microsoft Access database file.
Optional	
-tables -tabs	Only the tables that exist in the specified Microsoft Access file.
-views -vw	Only the views or saved queries that are saved in the Microsoft Access database.

#### **Examples**

List all tables and saved queries in an MDB file.

```
mdb list -file mdb_file.mdb
```

### **Copy Data**

Copy tables or views from the Microsoft Access database to the Oracle Database.

### **Syntax**

```
mdb copy {OPTIONS}
```

Option	Description
Required	
-file -fi <file></file>	Path of the Microsoft Access database file.
Optional	



Option	Description
-tables -tabs	Only the tables that exist in the specified Microsoft Access file.
-views -vw	Only the views or saved queries that are saved in the Microsoft Access database.
-prefix -pr <prefix></prefix>	Name to add before the table or view table names.
-table -tab	Copy a specific table from MDB file into Oracle Database.
-mode -mo <mode> {APPEND REPLACE SKIP  TRUNCATE} (REPLACE)</mode>	Specify the mode of operation for handling existing data in the destination table. The available options are:
	<ul> <li>replace: If the target table exists, drop it, then recreate it and add the new data.</li> </ul>
	<ul> <li>append: Add the new data to the existing data in the target table, if any.</li> </ul>
	<ul> <li>truncate: Clear all existing data in the target table before adding the new data.</li> </ul>
	<ul> <li>skip: If the target table already exists, do nothing. Otherwise, create the table and add the new data.</li> </ul>

Copy all from MDB file to Oracle Database.

```
SQL> mdb copy -file mdb_file.mdb
```

Replace the existing target table by dropping it if it exists, then recreate it and add the data.

SQL> mdb copy -table employees -file mdb\_file.mdb -mode replace

## 9.14 MLE

Use the MLE command to load JavaScript libraries to the database as MLE modules.

The sub-commands are:

- Create Module
- Alter Module

### **Prerequisites**

This command requires:

- Oracle Database Release 23ai.
- The CREATE TABLE privilege is required for the create-module sub-command. If creating a module in another schema, then the CREATE ANY TABLE privilege is required.
- System privileges documented in the *Oracle Database JavaScript Developer's Guide*.



## 9.14.1 Create Module

Creates an MLE module.

### **Syntax**

mle create-module {OPTIONS}

### **Options**

Option	Description
Required	
-filename <filename></filename>	Specifies the path to a valid JavaScript file.
-module-name <module></module>	Specifies the name of the module to create in the current schema.
Optional	
-bundler <bundler> {rollup}</bundler>	Specifies the name of a supported program that can bundle a JavaScript file with its dependencies. See JavaScript with External Dependencies.
-bundler-config <bundler-config> {file}</bundler-config>	Specifies the name of a configuration file for the bundler program.
-if-not-exists	Creates the module only if it does not exist.
-language <language></language>	Specifies the name of a supported programming language. The default value is JavaScript.
-metadata <metadata></metadata>	Specifies any valid JSON text that describes the module. This option is mutually exclusive with - metafile.
-metafile <metafile></metafile>	Specifies the path to a valid JSON file that describes the module. This option is mutually exclusive with -metadata.
-sbom <sbom> {syft}</sbom>	Specifies the name of a supported program that can create a Software Bill of Materials.
-replace	Replaces the module if it exists or create one if it does not exist.
-schema <schema></schema>	Specifies the name of an alternate schema to own the module.
-verbose	Emits additional diagnostic information as the command makes progress.
-version <version></version>	Specifies the version of the programming language.

### **JavaScript with External Dependencies**

The Create Module sub-command can load a JavaScript file that refers to other JavaScript modules. To accomplish this, the MLE command bundles the specified JavaScript file with all its dependencies and uses the external rollup command.

### Install rollup and syft

For bundling external dependencies, install rollup. For SBOM (Software Bill of Materials), install syft. You can use brew install for both.

### Configuring rollup execution



The intended usage for bundling is to bundle a single JavaScript file that has external dependencies. For example, if bundling should exclude one or more external dependencies, then those exclusions would be specified in a configuration file specified with the -bundler-config option. Not all bundling requires a configuration. In any case, the single JavaScript file to bundle is always specified with the -filename option, even if the input filename is specified in the configuration file.

#### Mutating dependency

If you create an MLE module from a.js, modify c.js, and then create another MLE module from b.js, then you have two MLE modules with a mutated dependency, c.js. To avoid this, reorganize the code so that you create three MLE modules and avoid the bundling.

#### Debugging

When a bundled JavaScript file is created by the host command (using the -bundler option), the resulting JavaScript file is not an exact representation of what exists on the file system. Therefore, when you attach a debugger to the MLE module's execution, you do not know which external JavaScript file and line number you are viewing.

## 9.14.2 Alter Module

Change an existing MLE module.

#### **Syntax**

mle alter-module {OPTIONS}

### **Options**

Option	Description
Required	
-module-name <module></module>	The name of the module to change in the current schema.
-metadata <metadata></metadata>	Any valid JSON text that describes the module. This option is mutually exclusive with -metafile.
-metafile <metafile></metafile>	The path to a valid JSON file that describes the module. This option is mutually exclusive with - metadata.
Optional	
-if-exists	Modify the module only if it exists.
-verbose	Emit additional diagnostic information as the command makes progress.
-schema <schema></schema>	The name of an alternate schema that owns the module.

#### **Examples**

 Modify an existing MLE module by updating the metadata and specifying the module name.

```
SQL> mle alter-module -metadata '{"name":"getOrderTotal",
"version":"1.1"}' -module-name abc
```



Display the MLE module metadata.

SQL> select metadata from user mle modules where module name = 'ABC'

## 9.15 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 Lanaguage 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 Lanaguage statements from the selected Data Modeler design.

### **Syntax**

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

### **Parameters**

Parameter	Description
-design (d) <file></file>	Full path to the design's file name.
-relmodel (rm) < name>	Name of the relational model.
-dbsite (ds) <name></name>	(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.
-outputfile (o) <file></file>	Full path to the output file for the generated DDL content.
-systemTypesDir (td) <path></path>	Full path to the system types directory.
-settingsFile (s) <file></file>	Full path to the exported Data Modeler settings file.
-ddlConfigFile (c) <file></file>	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**

 $\label{eq:modeler} \begin{tabular}{ll} MODELER REPORT - design $<$ file> - type $<$ type> [-title $<$ name>] - filename $<$ name> - outputpath $<$ path>$ \\ \end{tabular}$ 

#### **Parameters**

Parameter	Description
-design (d) <file></file>	Full path to the design's file name.
-type (tp)	Specify the type of report. Available types are: Tables, TableViews, TablesAndViews, Entities, EntityViews, EntitiesAndViews, Domains.
-filename (f) <name></name>	Name of the generated HTML file.
-outputpath (o) <path></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>	Name of the relational model (for Tables and Table Views only).
-title (tt) <name></name>	(Optional) Title of the report.
-standardTemplate (st) <name></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></name>	(Optional) Name of the template for a custom report.
-reportConfTemplate (c) <name></name>	(Optional) Name of the template that defines the set of objects and subviews to include in the report.
-companyname (cn) <name></name>	(Optional) Name of the company.
-systemTypesDir (td) <path></path>	Full path to the system types directory.
-settingsFile (s) <file></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"

## 9.16 PROJECT

The command in SQLcI for Database CI/CD extension is project. It contains several subcommands that are used as part of the process to help developers manage database changes and create serialized transactions.

### **Syntax**

```
project|proj [init|in] | [export|ex] | [config|cfg] | [gen-artifact|ga] |
[deploy|dp] | [release|re] | [verify|v] | [stage|st]
```

The following table provides a description of each sub-command.



Sub-Command	Description
init in	Initializes a new project. This command can be run in a new Git repository or in an existing repository.
config cfg	Enables you to view and manage your project configuration properties. This command allows you to look at the current configuration that is used by each of the project commands.
export ex	Exports database objects into your repository.
stage st	Creates Liquibase changelogs or changesets for all source files and custom SQL files. The stage command is used along with the export command.
release re	Moves the current set of work into a release state and starts a new body of work. The release command takes the contents of the dist/next folder and renames it to a given version number, then creates a new next folder under dist.
gen-artifact ga	Generates an artifact representing the current state of your project.
deploy dp	Deploys the artifact on a target database.
verify v	Provides the means to test various aspects of your project (snapshots, changes, overall project).

# 9.16.1 init

Initializes a new project.

## Syntax

project|proj init|in {OPTIONS}

Description of the second of t		
Option	Description	
Required		
-name -n <name></name>	Specifies a name for the project.	
Optional		
-schemas -s <schemas></schemas>	Specifies a comma-separated list of schemas to export.	
-directory -d <directory></directory>	Specifies the path of the directory where the project should be created. If no path is specified, the project is created in the current directory.	
-connection-name -con <connection-name></connection-name>	Specifies the SQLcl connection name. If you do not provide a connection name and are connecting through a named connection, the system automatically adds that connection name to the connectionName configuration property. If no named connection is used, the connectionName property remains empty.	
-makeroot -mr	Creates a root folder named after the project and stores all files in this directory.	
-debug -de	Displays the debug information in the output.	
-verbose -v	Displays in the output additional details about the current process.	



#### **Examples**

- Initialize a project with the following details:
  - Project name: apexsb
  - Schemas to export: apexsb\_data,apexsb
  - Directory: /workspace/projects/
  - SQLcl connection name: apexsb\_conn

SQL> project init -name apexsb -schemas apexsb\_data,apexsb -d /workspace/ projects -con apexsb conn

# 9.16.2 export

Exports database objects to your repository.

#### **Syntax**

project|proj export|ex {OPTIONS}

#### **Options**

Option	Description
-list -l	Lists all objects in alphabetical order. The list of objects to export is output based on the current parameters.
-objects -o <objects></objects>	Specifies comma-separated list of objects to export. For example, HR.COUNTRIES.
-schemas -s <schemas></schemas>	Specifies a comma-separated list of schemas to export. For example, HR.
-threads -t <threads></threads>	Specifies the number of concurrent threads to use with cloned JDBC connections for executing DBMS_METADATA.getDDL. The default value is five.
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output.

#### **Example**

**Export custom export filters from** .dbtools/filters/project.filters.

 $\mbox{SQL}\mbox{>}$  project export -debug -list -objects REGIONS, COUNTRIES -schemas HR, SCOTT -threads 4

# 9.16.3 config

Enables you to view and manage the project configuration properties.

#### **Syntax**

project|proj config|cfg {SUBCOMMAND} {OPTIONS}



#### **Options**

Option	Description
Required	
-list -li	Lists your current configuration settings
Optional	
-name -n <name< td=""><td>Specifies the config parameter name that can be used when filtering or editing.</td></name<>	Specifies the config parameter name that can be used when filtering or editing.
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output.

## **Examples**

List the configuration for the sqlcl.version parameter. Use -verbose to include default value and description.

project config -list -name sqlcl.version -verbose

#### **Sub-Commands**

The sub-commands are:

- set: To add or update project configuration parameters.
- delete: To remove a config parameter from the project configuration.

## Add or Update a Configuration Parameter

Use the set command to add a new configuration parameter or update the existing one.

## **Syntax**

project|proj config|cfg set|s {OPTIONS}

# **Options**

Option	Description
Required	
-name -n <name></name>	Specifies the name for the project.
-value -va <value></value>	Specifies the value that should be assigned to the configuration parameter.
Optional	
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output .

#### **Example**

Set the parameter export.demo.demoComments to true.

SQL> project config set -name export.demo.demoComments -type BOOLEAN -value TRUE -verbose



#### **Remove Configuration Parameter**

Use the delete command to remove a configuration parameter from the project configuration.

## **Syntax**

project|proj config|cfg delete|d {OPTIONS}

## **Options**

Option	Description
-name -n <name></name>	Specifies the configuration parameter name that can be used when filtering or editing.
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output.

# 9.16.4 gen-artifact

Generates an artifact representing the current state of your project.

### **Syntax**

project|proj gen-artifact|ga {OPTIONS}

## **Options**

Option	Description
-name -n <name></name>	Specifies a custom name for the artifact.
-format -fo <format></format>	Specifies the desired compression format. Supported values are, zip or tgz.
-version -ve <version></version>	Specifies the artifact version.
-force -f	Overwrites the artifact if it exists.
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output.

#### **Example**

Generate an artifact named R1-1 in zip format. The artifact is saved in the artifact folder.

SQL> project gen-artifact -name R1 -version 1 -format zip -verbose

# 9.16.5 deploy

Deploys the artifact on a target database.

# Syntax

project|proj deploy|dp {OPTIONS}



## **Options**

Option	Description
Required	
-file -fs <file> {FILE}</file>	Specifies the artifact file location path.
Optional	
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output.

#### **Example**

Extract the artifact file from the specified path. The command executes <code>@dist/install.sql</code> and initiates the Liquibase installer on the target database.

SQL> project deploy -file /Users/user1/Desktop/project1/artifact/R1-1.zip -verbose

# 9.16.6 release

Moves the current set of work into a release state and starts a new body of work.

#### **Syntax**

project|proj release|re {OPTIONS}

#### **Options**

Option	Description
Required	
-version -ve <version></version>	Specifies the release version to label the release.
Optional	
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output.

#### **Example**

Package a unit of work into a release.

SQL> project release -version 1.0

# 9.16.7 verify

Tests various aspects of your project (snapshots, changes, overall project).

The sub-commands are:

- verify-stage: To execute all the verify tests registered for the stage group.
- snapshot: To execute all the verify tests registered for the snapshot group.



#### **Verify Tests for the Stage Group**

Use the <code>verify-stage</code> command to execute all the verify tests registered for the stage group.

## **Syntax**

project|proj verify|v verify-stage|st {OPTIONS}

#### **Options**

Option	Description
Optional	
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output.

#### **Verify Tests for the Snapshot Group**

Use the snapshot command to execute all the verify tests registered for the snapshot group.

## **Syntax**

project|proj verify|v snapshot|ss {OPTIONS}

## **Options**

Option	Description
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output.

# 9.16.8 stage

Creates Liquibase changelogs or changesets for all source files and custom SQL files.

It is used along with the export command. It can also be used to add other custom changesets as part of the change. This generates a file to add SQL and SQLcl commands with a Liquibase SQL changeset header. This file will be added to the changelog hierarchy automatically.

## **Syntax**

project|proj stage|st {SUBCOMMAND} {OPTIONS}

# **Options**

Option	Description
-branch-name -bn	Specifies the branch name for comparison. If not provided, the value from the configuration file (git.defaultBranch) is used, with develop as the default.
-debug -de	Displays the debug information in the output.



Option	Description
-verbose -v	Displays additional details about the current process, in the output.

#### **Examples**

Create a new directory under dist/releases/next specifying the branch name.

SQL> project stage -branch-name branch1

#### Add a Custom File to Stage

Use the add-custom command to add a custom file to stage.

#### **Syntx**

project|proj stage|st add-custom|ac {OPTIONS}

#### **Options**

Option	Description
Required	
-file-name -fn <file-name></file-name>	Specifies the name for the custom file.
Optional	
-debug -de	Displays the debug information in the output.
-verbose -v	Displays additional details about the current process, in the output.

## **Example**

Add feature1.sql custom file.

SQL> project stage add-custom -file-name feature1.sql

# 9.17 **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\_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

# 9.18 SDK

You can use the SDK command to install SDKs (Software Development Kit) from external cloud providers such as Azure and OCI. This command helps to install external software with all its related dependencies. The SDKs available are jdbc-oci and jdbc-azure.

#### **Syntax**

```
sdk|sd [ [list|l] | [install|i] | [update|u] | [remove|r] ]
```

#### List

Lists the available SDKs with their available versions and status (installed or not). For an update, this command shows the latest version.

#### Install

Installs the latest SDK from a cloud provider. The install command has verbose (-verbose) and debug (-debug) modes available.

After the install is over, restart SQLcl. The installed SDKs and its dependencies appear in the created directory under sqlcl/lib/sdks/[the new sdk].



When installing SDKs with the SDK command, the dependencies that are already installed in the classpath with SQLcl are not re-installed.

#### **Example**

```
SQL> sdk install jdbc-oci
Downloading the ojdbc-provider-oci SDK and all its dependencies.
The jdbc-oci SDK is installed successfully, restart SQLcl for changes to take effect.
```

#### **Update**

Updates the selected SDK to the latest version. This command removes and re-installs the SDK and its dependencies

You can also update by using the sdk install command on an already installed SDK.

#### Remove

Deletes the created directory for the SDK installed inside the SDK's directory in the lib folder. The contents of the directory are also deleted.



# 9.19 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] \{\underline{15} \mid 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=cproxyhost>:<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] \{\underline{0} \mid 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] \{\underline{\&} \mid c \mid \underline{ON} \mid \mathsf{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] \{ \setminus c \mid ON \mid OFF \}
SET ESCCHAR {@ | ? | % | $ | OFF}
SET EXITC[OMMIT] {ON | OFF}
SET FEED[BACK] \{\underline{6} \mid n \mid \underline{ON} \mid \text{OFF}\} [SQL ID]
SET FLU[SH] {ON | OFF}
SET HEA[DING] {ON | OFF}
SET HEADS[EP] \{ \underline{\ } \mid c \mid \underline{\text{ON}} \mid \text{OFF} \}
SET HISTORY [FAILS [LIMIT [ n | DEFAULT ] ] | NOFAILS | FILTER [DEFAULT
<command list>?!<command list>?] |LIMIT [n|DEFAULT]]
```

```
SET LIN[ESIZE] \{80 \mid n\}
  SET LOAD default [options...]
  SET LOADFORMAT [ DEFAULT | CSV | DELIMITED | HTML | INSERT | JSON | JSON-
  FORMATTED | LOADER | T2 | XML ] [options...]
  SET LONG \{80 \mid n\}
  SET LONGC [HUNKSIZE] \{80 \mid n\}
  SET MAXROWS { n>1 | DEFAULT}
  SET MAXSPOOLROWSTRUNCATE [ON | OFF | DEFAULT]
  SET NET {ON | OFF | READONLY}
  SET NEWP[AGE] \{1 \mid n \mid NONE\}
  SET NOVERWRITE {ON | OFF | WARN}
  SET NULL text
  SET NUMF[ORMAT] format
  SET NUM[WIDTH] \{\underline{10} \mid n\}
  SET PAGES[IZE] \{\underline{14} \mid n\}
  SET PARAMETERPOLICY {default | isolate}
  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 \geq | 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 LDAPCON

```
SET ENCODING <encoding>
```

Allows you to set the encoding for the current session. Use <code>SHOW ENCODING</code> to view the encoding set for the current session. Use <code>SHOW ENCODINGS</code> 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

# 9.20 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 <code>system\_variable</code>. SHOW SGA can only be used by a DBA user. Use one of the following terms or clauses in place of <code>option</code>:

```
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
SP00[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.

# 9.21 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>



A

# 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

B

# 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-guery
- 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 1
WHERE
  b.language = 1.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.c2) = SYS OP MAP NONNULL(D2.c2)

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.c16) = SYS OP MAP NONNULL(D2.c17)

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:

In this example, table  $\[mu]$ 2 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:

#### 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 |
215 | 4 (0) | 00:00:01 |
|* 2 | INDEX RANGE SCAN
                                 | XLA AE HEADERS U1 |
    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:



\_\_\_\_\_

```
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

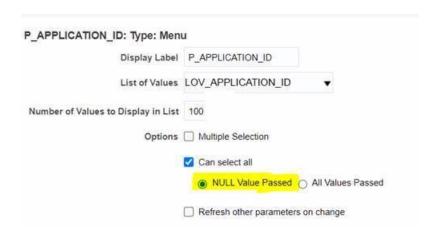
The option to pass more than one value to SQL through bind parameters makes reports very flexible and versatile. However, if the number of passed values is not limited, it could generate a SQL with very large number of IN-LIST values, possibly hitting the internal Oracle limit of maximum 1,000 IN-LIST 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:



## 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 mcc1
    WHERE mcc1.category_id = mat.parent_category_id
      AND mcc1.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.



C

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# C.1 ANTLR4 Java Runtime 4.13.1

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# C.2 Apache Mina SSHD-contrib 2.13.2

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====== 4th party Dependencies =======

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NAME: SLF4J-API

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Dependency #2

NAME: JCL-OVER-SLF4J

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Dependency #2

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This project provides parsers for double, float, BigDecimal and BigInteger values.

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Jackson Databind

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https://github.com/eclipse-ee4j/jsonp

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javax.ws.rs-api:2.0.1 (2.0.1)

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Fourth Party dependencies

org.slf4j: slf4j-api

org.slf4j: slf4j-jdk14



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## C.21 json-base 2.4.3

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This is a Java port of Daniel Lemire's fast\_float project.
This project provides parsers for double, float, BigDecimal and BigInteger values.

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# C.24 OCI SDK for Java 3.57.1

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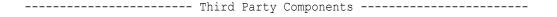
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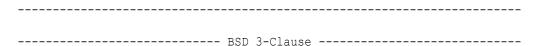
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#### # Jackson JSON processor

Jackson is a high-performance, Free/Open Source JSON processing library. It was originally written by Tatu Saloranta (tatu.saloranta@iki.fi), and has been in development since 2007.

It is currently developed by a community of developers.

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#### ## FastDoubleParser

jackson-core bundles a shaded copy of FastDoubleParser <https://github.com/ wrandelshofer/FastDoubleParser>.

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jakarta.ws.rs-api

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Notices for fastdoubleparser

# FastDoubleParser

This is a Java port of Daniel Lemire's fast\_float project.
This project provides parsers for double, float, BigDecimal and BigInteger values.

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### C.29 ucanaccess 5.1.1

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----- Separator -----

Dependency: com.healthmarketscience.jackcess:jackcess

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```
----- Separator -----
Dependency: commons-logging:commons-logging
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 ./license-header.txt
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 * See the License for the specific language governing permissions and
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 * /
----- Separator -----
 ./LICENSE.txt
Apache 2.0 ( same as in io.github.spannm:ucanaccess)
----- Separator -----
 ./NOTICE.txt
Apache Commons Logging
Copyright 2003-2014 The Apache Software Foundation
This product includes software developed at
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----- Separator -----
Dependency: org.apache.commons:commons-lang3
Copyright: The Apache Software Foundation
License: Apache 2.0
 ./LICENSE.txt
Apache 2.0 ( same as in io.github.spannm:ucanaccess)
```

```
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 ./NOTICE.txt
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 ./hsqldb lic.txt
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