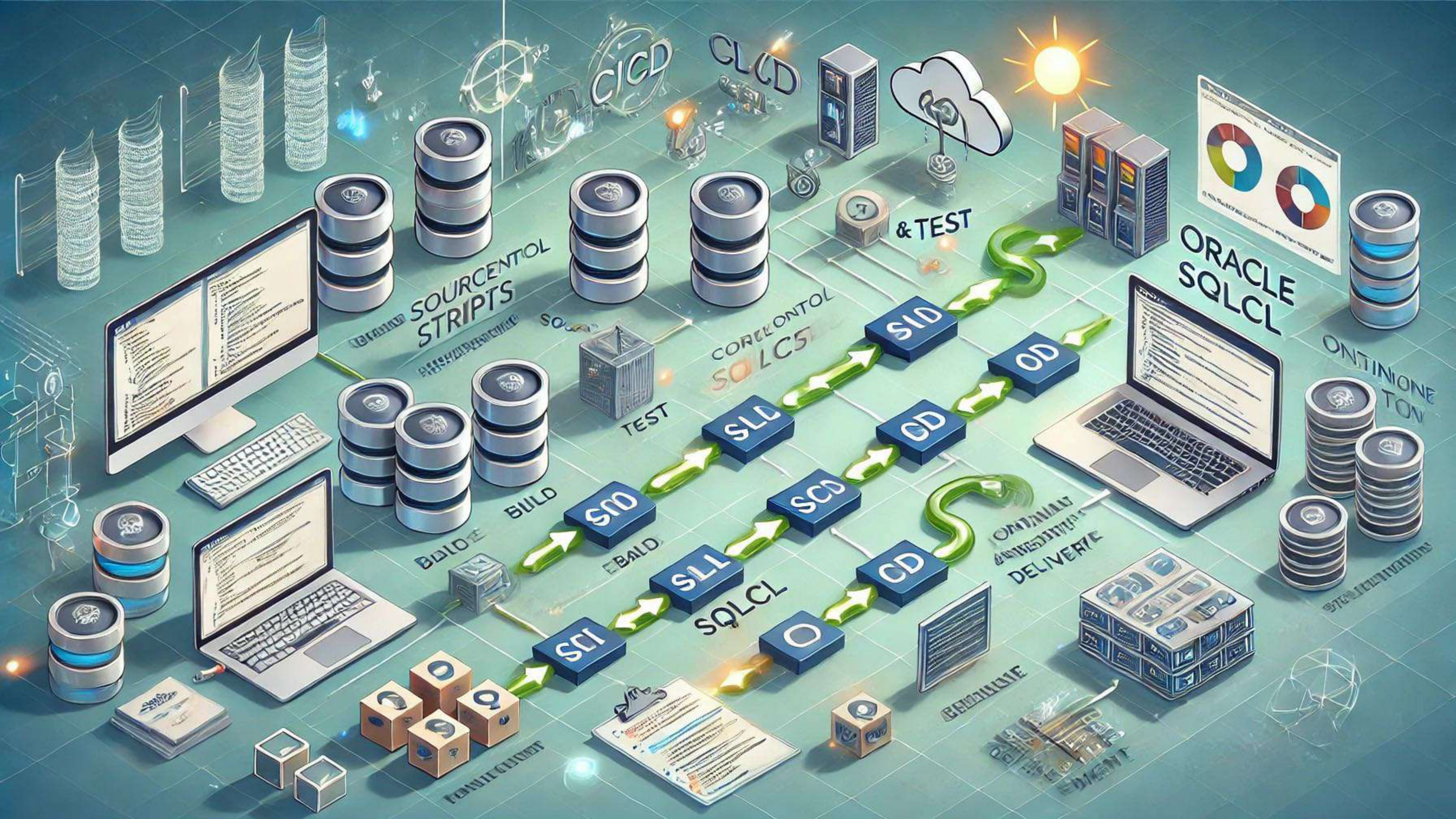






Edit Profile



Roel

@apexconsulting.nl

490 followers **176** following **24** posts



Director of APEX Consulting



Sr. APEX Developer



Oracle ACE Director



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Runner



The Netherlands

CI/CD using SQLcl project

why CI/CD?

- short feedback loop
- “always” ready for production
- short time to market
- gradual product evolution



current approach

- manual scripts
- tools
 - FlexDeploy
 - FlyWay
 - Liquibase
- orchestrator
 - Github Actions
 - Gitlab Pipelines
 - Jenkins
- combination





Patrizia Regenbergs

@p-regenberg.bsky.social

Finally got a chance to try [#SQLcl](#) projects! Initially struggled, expecting it to work like Liquibase, but once I realized Git is central to the workflow, everything clicked. I think it has huge potential—not just for big teams with CI/CD, but also for beginners and citizen developers.

February 25, 2025 at 4:20 PM Everybody can reply



Dan McGhan

@dmcghan.bsky.social

In the beginning, SQLcl Projects can feel intimidating. Lot's of commands, processes, etc. But after a few weeks it should start to feel more natural. Once you get to that point, undoing things that commands like stage and release do should be simpler.

February 25, 2025 at 2:40 AM



Plamen Mushkov

@apexapplab.dev



Oracle ACE

But I hope I start deploying in production soon. I face some issues at times and I try to do more tests before I feel confident enough. Had issues with triggers that failed on deployment, had issues with apps deployment too. So trying to figure out the cause/solution for them.

February 25, 2025 at 11:25 AM

SQLcl project

- standard Git repo
- generated scripts
- add custom scripts when needed
- Liquibase
- full life cycle



SQLcl project stages

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project init

```
SQL> project init -name demo -makeroot -schemas demo -verbose
```

```
Cleaning and validating project name as needed
```

```
The final project name will be "demo"
```

```
Created dir:    demo
```

```
Created dir:    demo/.dbtools
```

```
Created dir:    demo/.dbtools/filters
```

```
Created dir:    demo/dist
```

```
Created dir:    demo/src
```

```
Created dir:    demo/src/database
```

```
Created dir:    demo/src/database/demo
```

```
Created file:   demo/.dbtools/project.sqlformat.xml
```

```
Created file:   demo/.dbtools/filters/project.filters
```

```
Created file:   demo/dist/install.sql
```

```
Created file:   demo/.gitignore
```

```
Created file:   demo/README.md
```

```
-----  
PROJECT DETAILS  
-----
```

```
Project name:    demo
```

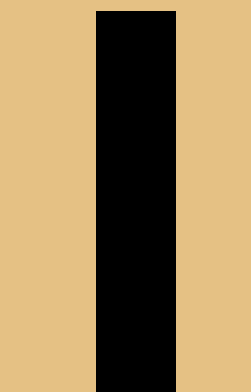
```
Schema(s):       DEMO
```

```
Directory:       /Users/Roel/sqlclproject/demo
```

```
Connection name: demo
```

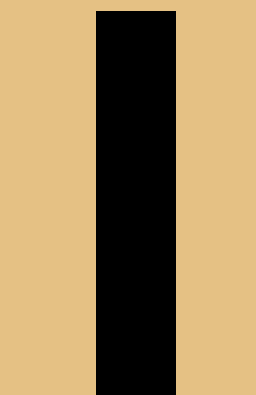
```
Project root:    demo
```

```
Your project has been successfully created
```

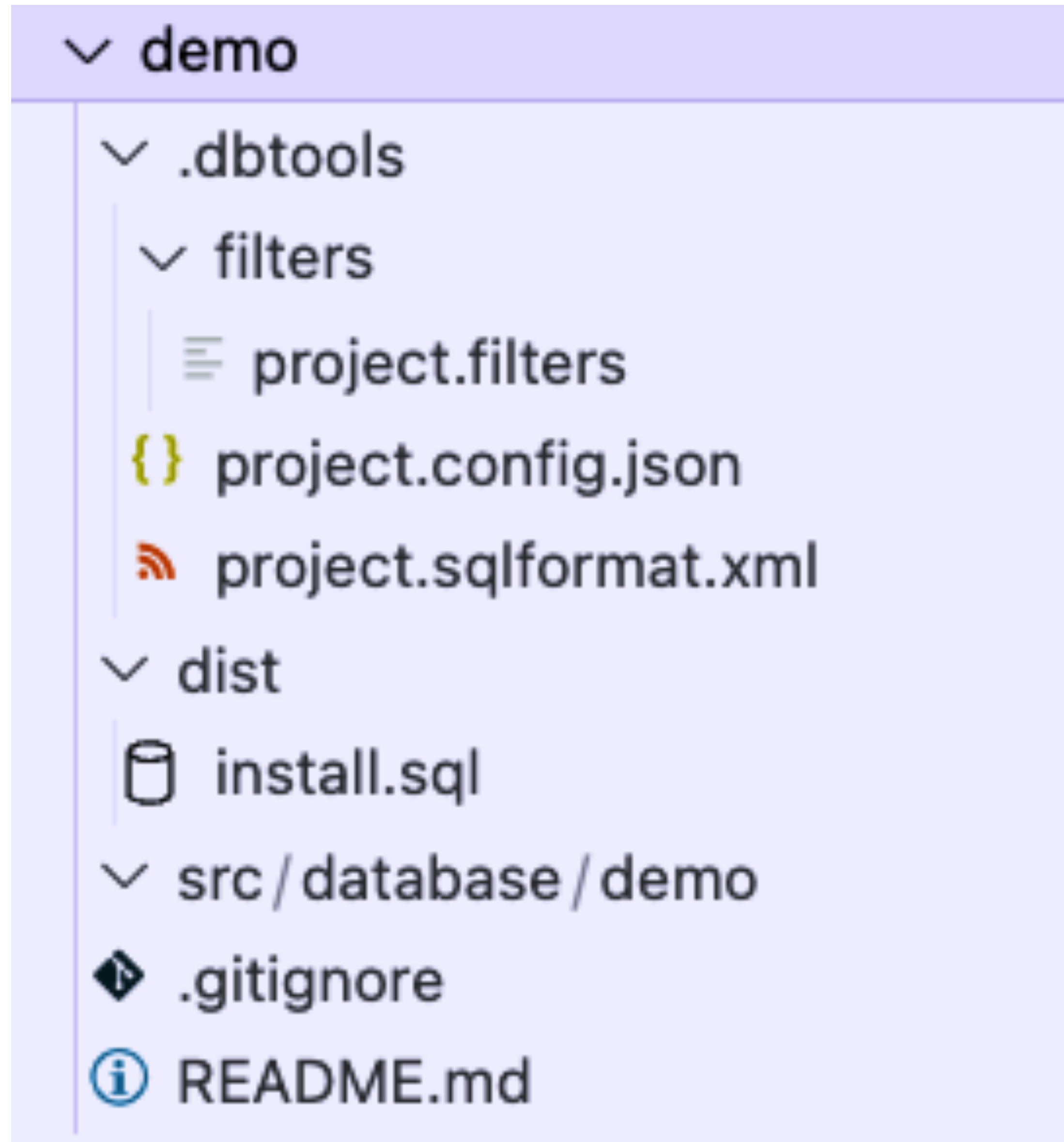


INIT

project init



INIT



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project config

SQL> project config -list -verbose

SETTING NAME	VALUE	DEFAULT VALUE	DESCRIPTION
project	demo		the project name
sqlcl.connectionName	demo		Connection name
sqlcl.version	24.4.1.0		SQLcl version
schemas	["DEMO"]		Array of schemas to include in this project
lastReleaseVersion			The last version released
export.format.enable	true	true	Format code after export
export.setTransform.collationClause	NEVER	NEVER	There are three possible values:- NEVER : Collation clauses are never generated.-ALWAYS : Collation clauses are always generated.-NON_DEFAULT : Collation clauses other than USING_NLS_COMP are generated
export.setTransform.constraints	true	true	If TRUE, include all non-referential table constraints in the DDL. If FALSE, omit them. Defaults to TRUE
export.setTransform.constraintsAsAlter	true	true	If TRUE, include table constraints as separate ALTER TABLE (and, if necessary, CREATE INDEX) statements. If FALSE, specify table constraints as part of the CREATE TABLE statement. Defaults to FALSE. Requires that CONSTRAINTS be TRUE. Note: The CONSTRAINTS_AS_ALTER parameter has no effect when an index and a constraint are created for a table in two separate DDL statements
export.setTransform.emitSchema	true	true	Determines if exports include the schema in the name of the object. If your schema names are the same across environments set to true . If not (example one database with multiple _dev_test_prod schemas) set to false
export.setTransform.force	true	true	If TRUE, use the FORCE keyword in the CREATE VIEW statement. If FALSE, do not use the FORCE keyword in the CREATE VIEW statement. Defaults to TRUE
export.setTransform.partitioning	false	false	If TRUE, include partitioning clauses in the DDL. If FALSE, omit them
export.setTransform.segmentAttributes	false	false	If TRUE, include segment attributes clauses (physical attributes, storage attributes, tablespace, logging) in the DDL. If FALSE, omit them
export.setTransform.sizeByteKeyword	true	true	If TRUE, include the BYTE keyword as part of the size specification of CHAR and VARCHAR2 columns that use byte semantics. If FALSE, omit the keyword
export.setTransform.sqlterminator	true	true	If TRUE, append a SQL terminator (; or /) to each DDL statement



project config

```
{
  "project" : "demo",
  "sqlcl" : {
    "connectionName" : "demo_dev_system",
    "version" : "24.4.1.0"
  },
  "schemas" : [ "DEMO" ],
  "lastReleaseVersion" : "",
  "export" : {
    "format" : {
      "enable" : true
    },
    "setTransform" : {
      "collationClause" : "NEVER",
      "constraints" : true,
      "constraintsAsAlter" : true,
      "emitSchema" : true,
      "force" : true,
      "partitioning" : false,
      "segmentAttributes" : false,
      "sizeByteKeyword" : true,
      "sqlterminator" : true,
      "storage" : false,
      "tablespace" : false
    },
    "apex" : {
      "exptype" : [ "READABLE_YAML", "APPLICATION_SOURCE" ],
      "expAclAssignments" : false,
      "expComments" : false,
      "skipExportDate" : true,
      "skipExportFormat" : false
    }
  }
}
```



CONFIG

project config

```
    "segmentAttributes" : false,
    "sizeByteKeyword" : true,
    "sqlterminator" : true,
    "storage" : false,
    "tablespace" : false
  },
  "apex" : {
    "exptype" : [ "READABLE_YAML", "APPLICATION_SOURCE" ],
    "expAclAssignments" : false,
    "expComments" : false,
    "skipExportDate" : true,
    "expirNotif" : false,
    "expOriginalIds" : false,
    "expSavedReports" : false,
    "expPubReports" : false,
    "expSubscriptions" : false,
    "expSupportingObjects" : "N",
    "expTranslations" : false,
    "auditType" : "NULL"
  }
},
"git" : {
  "protectedBranches" : [ "main", "master" ],
  "defaultBranch" : "main"
},
"stage" : {
  "change" : { },
  "excludeObjects" : [ "ALL.user" ],
  "generatedFormat" : "liquibase",
  "softObjectIsolation" : "change"
}
}
```

A large, white, stylized letter 'C' is centered within an orange, rounded rectangular shape that resembles a sign or a button.

CONFIG

project config

```
SQL> !git init --initial-branch=main  
Initialized empty Git repository in ~/demo/.git/
```

```
SQL> !git add .
```

```
SQL> !git commit -m "Initialization"  
[main (root-commit) 5ef93e4] Initialization  
6 files changed, 204 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
```



CONFIG



PLEASE RING BELL
ONCE ONLY
AND WAIT FOR
ATTENTION

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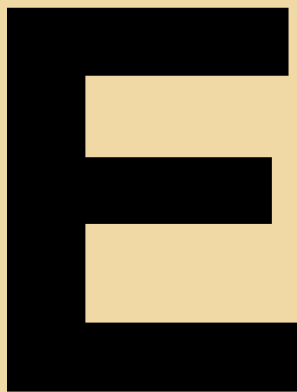
D

DEPLOY

project export

```
SQL> !git checkout -b ticket-001
Switched to a new branch 'ticket-001'
```

```
SQL> project export -objects demo.dept,demo.emp -verbose
The current connection //localhost:1521/APEX242 SYSTEM will be used for all operations
*** INDEXES ***
DEMO.EMP_1
DEMO.EMP_2
*** TABLES ***
DEMO.DEPT
DEMO.EMP
*** REF_CONSTRAINTS ***
DEMO.EMP_MGR_FK
DEMO.EMP_DEPT_FK
-----
TABLE                                2
REF_CONSTRAINT                       2
INDEX                                2
-----
Exported 6 objects
Elapsed 12 sec
```



EXPORT

project export

E

EXPORT

▼	src / database / <u>demo</u>	●
▼	indexes	●
🗄	emp_1.sql	U
🗄	emp_2.sql	U
▼	ref_constraints	●
🗄	emp_dept_fk.sql	U
🗄	emp_mgr_fk.sql	U
▼	tables	●
🗄	dept.sql	U
🗄	emp.sql	U

project export

./src/database/demo/tables/emp.sql

```
create table demo.emp (  
    empno      number(4, 0)  
        generated by default on null as identity minvalue 1 maxvalue 90000 increment by 10  
        start with 8000 nocache noorder nocycle nokeep noscale not null enable,  
    ename      varchar2(20 byte),  
    job        varchar2(50 byte),  
    mgr        number(4, 0),  
    hiredate   date,  
    sal        number(7, 2),  
    comm       number(7, 2),  
    deptno     number(4, 0)  
);
```

```
create unique index demo.emp_pk on  
    demo.emp (  
        empno  
    );
```

```
alter table demo.emp  
    add constraint emp_pk primary key ( empno )  
    using index demo.demp_pk enable;
```

```
-- sqlcl_snapshot {"hash":"b39d960a44d294df3b157977ea7b5c91ab2c10c1","type":"TABLE","name":"EMP","schemaName":"DEMO","sxml":"<TABLE xmlns =\\"http://xmlns.oracle.com/ku\\" version  
=\\"1.0\\"><SCHEMA>DEMO</SCHEMA><NAME>EMP</NAME><RELATIONAL_TABLE><COL_LIST><COL_LIST_ITEM><NAME>EMPNO</NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>4</PRECISION><SCALE>0</  
SCALE><IDENTITY_COLUMN><SCHEMA>DEMO</SCHEMA><GENERATION>DEFAULT</GENERATION><ON_NULL></ON_NULL><START_WITH>8000</START_WITH><INCREMENT>10</INCREMENT><MINVALUE>1</  
MINVALUE><MAXVALUE>90000</MAXVALUE><CACHE>0</CACHE><SCALE>NOSCALE</SCALE></IDENTITY_COLUMN><NOT_NULL></NOT_NULL></COL_LIST_ITEM><COL_LIST_ITEM><NAME>ENAME</  
NAME><DATATYPE>VARCHAR2</DATATYPE><LENGTH>50</LENGTH><COLLATE_NAME>USING NLS_COMP</COLLATE_NAME></COL_LIST_ITEM><COL_LIST_ITEM><NAME>JOB</NAME><DATATYPE>VARCHAR2</  
DATATYPE><LENGTH>50</LENGTH><COLLATE_NAME>USING NLS_COMP</COLLATE_NAME></COL_LIST_ITEM><COL_LIST_ITEM><NAME>MGR</NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>4</PRECISION><SCALE>0</  
SCALE></COL_LIST_ITEM><COL_LIST_ITEM><NAME>HIREDATE</NAME><DATATYPE>DATE</DATATYPE></COL_LIST_ITEM><COL_LIST_ITEM><NAME>SAL</NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>7</  
PRECISION><SCALE>2</SCALE></COL_LIST_ITEM><COL_LIST_ITEM><NAME>COMM</NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>7</PRECISION><SCALE>2</SCALE></  
COL_LIST_ITEM><COL_LIST_ITEM><NAME>DEPTNO</NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>4</PRECISION><SCALE>0</SCALE></COL_LIST_ITEM></  
COL_LIST><PRIMARY_KEY_CONSTRAINT_LIST><PRIMARY_KEY_CONSTRAINT_LIST_ITEM><NAME>EMP_PK</NAME><COL_LIST><COL_LIST_ITEM><NAME>EMPNO</NAME></COL_LIST_ITEM></COL_LIST><USING_INDEX></  
USING_INDEX></PRIMARY_KEY_CONSTRAINT_LIST_ITEM></PRIMARY_KEY_CONSTRAINT_LIST><DEFAULT_COLLATION>USING_NLS_COMP</DEFAULT_COLLATION><PHYSICAL_PROPERTIES><HEAP_TABLE></HEAP_TABLE></  
PHYSICAL_PROPERTIES></RELATIONAL_TABLE></TABLE>"}
```

E

EXPORT

project export

```
./dbtools/filters/project.filters
```

```
/* Comma separated list of predicates to be fine-tuned for individual project.
```

```
Run
```

```
    project export -debug
```

```
to double check the dictionary queries
```

```
with internal and custom filters applied.
```

```
*/
```

```
-- Uncomment the line below if don't want to export grants:
```

```
-- export_type not in ('ALL_TAB_PRIVS','USER_SYS_PRIVS'),
```

```
( export_type = 'ALL_TAB_PRIVS' and grantee in ('PSIQ','PSIQINSIGHT','PSIXAOP','PSI_FBDA_ADMIN')),
```

```
not ( export_type = 'ALL_TAB_PRIVS' and object_name like '%%=%%'),
```

```
/** Reference list of export_types from internal.fixed.filters
```

```
    'ALL_OBJECTS',
```

```
    'APEX_APPLICATION',
```

```
    'ALL_TAB_PRIVS',
```

```
    'USER_SYS_PRIVS',
```

```
    'CREATE_USER',
```

```
    'ORDS_SCHEMA'
```

```
*/
```

```
-- Liquibase Tables
```

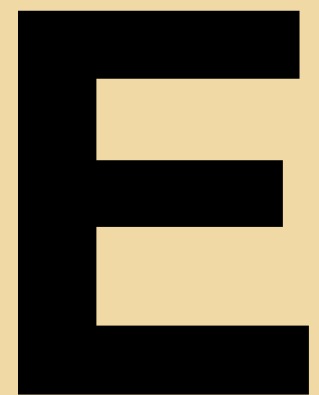
```
object_type != 'TABLE' or object_name not in ('DATABASECHANGELOG',
```

```
                                                'DATABASECHANGELOGLOCK',
```

```
                                                'DATABASECHANGELOG_ACTIONS'
```

```
),
```

```
not (object_type = 'VIEW'      and object_name ='DATABASECHANGELOG_DETAILS'),
```

A large, bold, black letter 'E' is centered within a yellow, rounded rectangular shape that serves as a background for the 'EXPORT' label.

EXPORT

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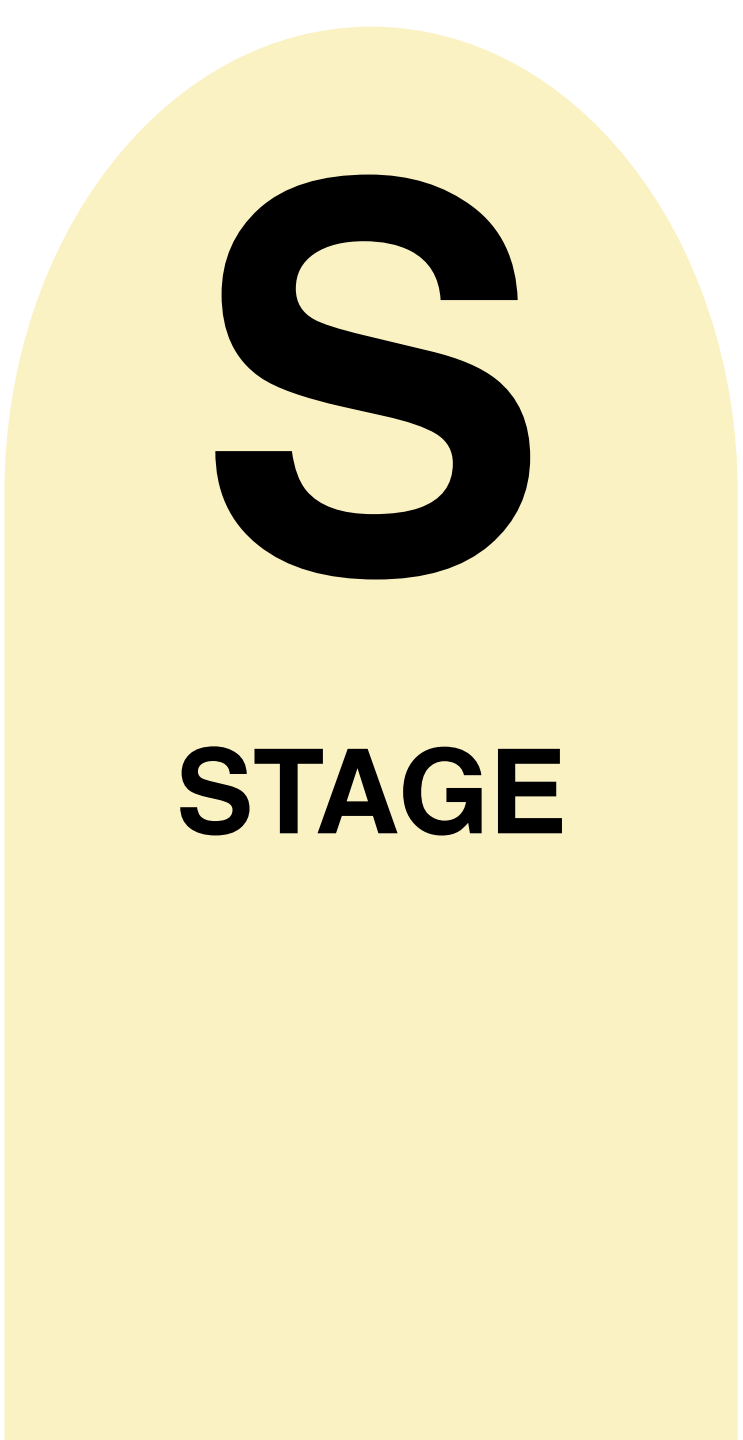
DEPLOY

project stage

```
SQL> !git add .
```

```
SQL> !git commit -m "Ticket 1 created"
```

```
[ticket-001 5c387ad] Ticket 1 created  
6 files changed, 80 insertions(+)  
create mode 100644 src/database/demo/indexes/emp_1.sql  
create mode 100644 src/database/demo/indexes/emp_2.sql  
create mode 100644 src/database/demo/ref_constraints/emp_dept_fk.sql  
create mode 100644 src/database/demo/ref_constraints/emp_mgr_fk.sql  
create mode 100644 src/database/demo/tables/dept.sql  
create mode 100644 src/database/demo/tables/emp.sql
```



S

STAGE

project stage

SQL> project stage -verbose

Starting execution of stage command using the current branch

Stage is Comparing:

Old Branch refs/heads/main

New Branch refs/heads/ticket-001

Created dir: dist/releases

Created dir: dist/utils

Created dir: dist/releases/next

Created dir: dist/releases/next/changes

Created dir: dist/releases/next/changes/ticket-001

Created dir: dist/releases/next/changes/ticket-001/_custom

Created change:dist/releases/next/changes/ticket-001/stage.changelog.xml

Created change:dist/releases/main.changelog.xml

Created change:dist/releases/next/release.changelog.xml

Created file: dist/utils/recompile.sql

Created file: dist/utils/prechecks.sql

Created file: dist/releases/next/changes/ticket-001/demo/indexes/emp_1.sql

Updated change:dist/releases/next/changes/ticket-001/stage.changelog.xml

Created file: dist/releases/next/changes/ticket-001/demo/indexes/emp_2.sql

Updated change:dist/releases/next/changes/ticket-001/stage.changelog.xml

Created file: dist/releases/next/changes/ticket-001/demo/ref_constraints/emp_dept_fk.sql

Updated change:dist/releases/next/changes/ticket-001/stage.changelog.xml

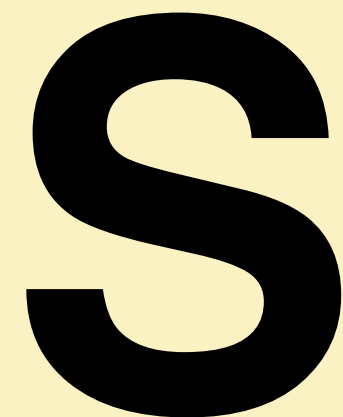
Created file: dist/releases/next/changes/ticket-001/demo/ref_constraints/emp_mgr_fk.sql

Updated change:dist/releases/next/changes/ticket-001/stage.changelog.xml

Created file: dist/releases/next/changes/ticket-001/demo/tables/dept.sql

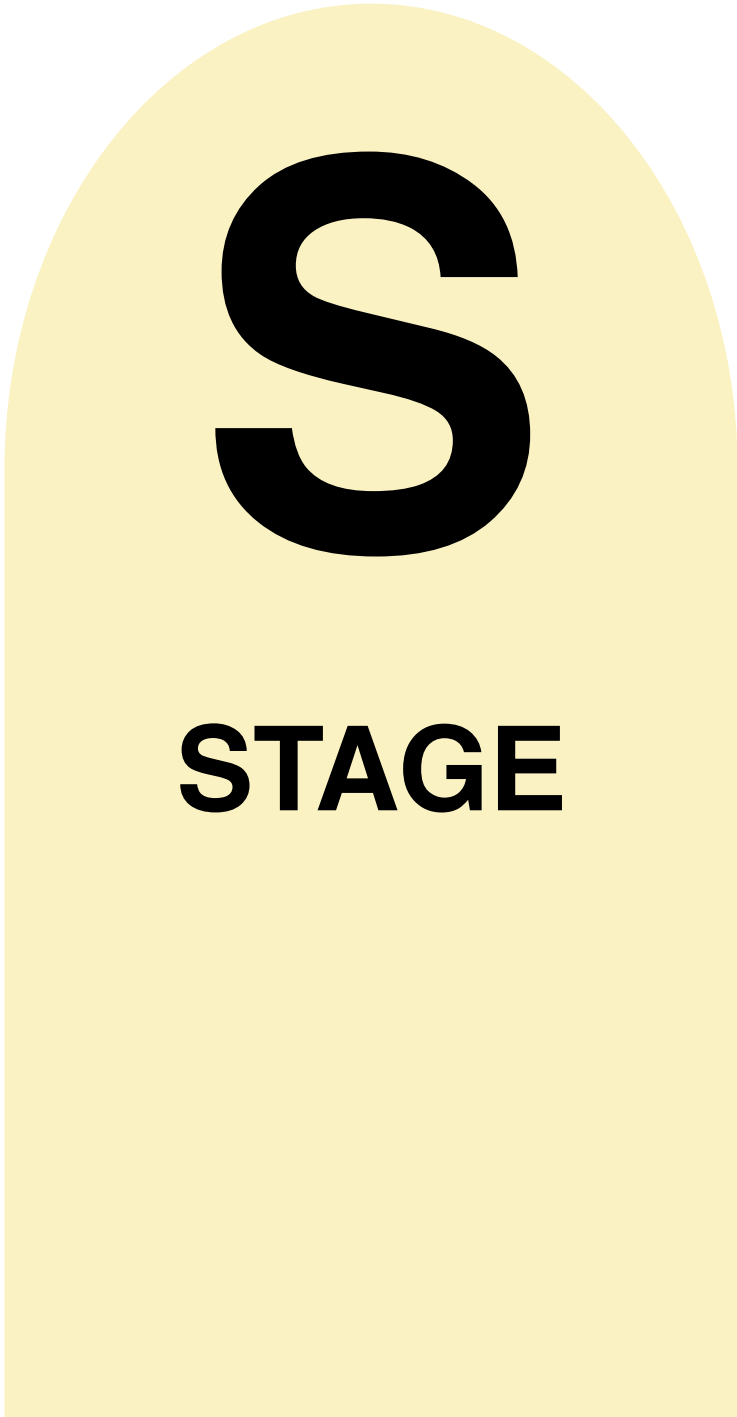
Updated change:dist/releases/next/changes/ticket-001/stage.changelog.xml

Created file: dist/releases/next/changes/ticket-001/demo/tables/emp.sql



STAGE

project stage



▼ dist	●
▼ releases	●
▼ next	●
▼ changes / ticket-001	●
▼ code / _custom	
▼ demo	●
▼ index	●
emp_1.sql	U
emp_2.sql	U
▼ ref_constraint	●
emp_dept_fk.sql	U
emp_mgr_fk.sql	U
▼ table	●
dept.sql	U
emp.sql	U
stage.changelog.xml	U
release.changelog.xml	U
main.changelog.xml	U
▼ utils	●
prechecks.sql	U
recompile.sql	U
install.sql	
README.md	

project stage

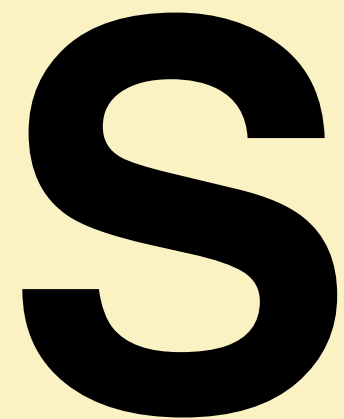
```
./dist/releases/next/changes/ticket-001/demo/table/emp.sql
```

```
-- liquibase formatted sql
-- changeset DEMO:1740387307323 stripComments:false logicalFilePath:ticket-001/demo/table/emp.sql
-- runAlways:false runOnChange:false replaceIfExists:true failOnError:true
-- sqlcl_snapshot src/database/demo/tables/emp.sql:null:b39d960a44d294df3b157977ea7b5c91ab2c10c1:create
```

```
create table demo.emp (
    empno      number(4, 0)
               generated by default on null as identity minvalue 1 maxvalue 90000 increment by 10
               start with 8000 nocache noorder nocycle nokeep noscale not null enable,
    ename      varchar2(50 byte),
    job        varchar2(50 byte),
    mgr        number(4, 0),
    hiredate   date,
    sal        number(7, 2),
    comm       number(7, 2),
    deptno     number(4, 0)
);
```

```
create unique index demo.emp_pk on
    demo.emp (
        empno
    );
```

```
alter table demo.emp
    add constraint emp_pk primary key ( empno )
    using index demo.emp_pk enable;
```



STAGE

project stage

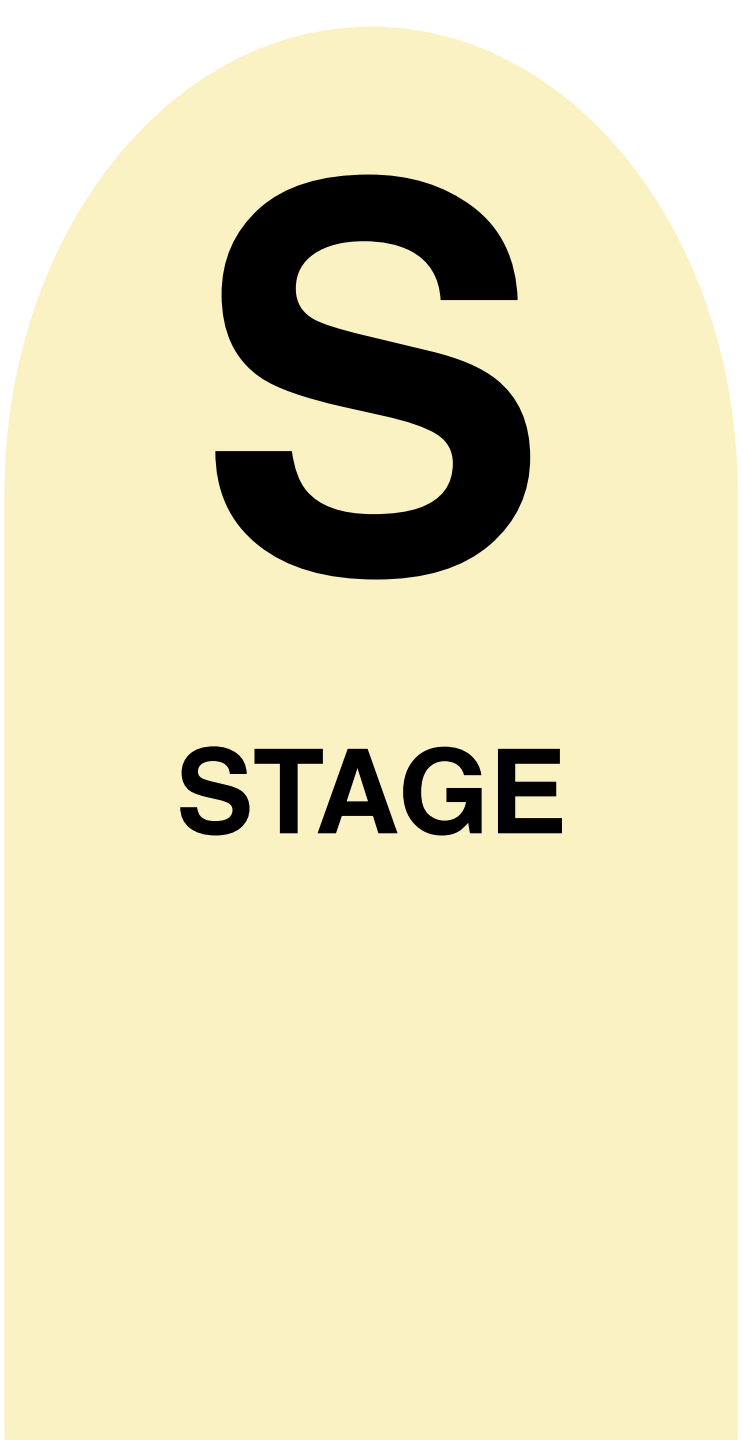
```
SQL> !git add .
```

```
SQL> !git commit -m "Ticket 1 done!"
```

```
[ticket-001 a4b029b] Ticket 1 done!  
11 files changed, 419 insertions(+)  
create mode 100644 dist/releases/main.changelog.xml  
create mode 100644 dist/releases/next/changes/ticket-001/demo/index/emp_1.sql  
create mode 100644 dist/releases/next/changes/ticket-001/demo/index/emp_2.sql  
create mode 100644 dist/releases/next/changes/ticket-001/demo/ref_constraint/emp_dept_fk.sql  
create mode 100644 dist/releases/next/changes/ticket-001/demo/ref_constraint/emp_mgr_fk.sql  
create mode 100644 dist/releases/next/changes/ticket-001/demo/table/dept.sql  
create mode 100644 dist/releases/next/changes/ticket-001/demo/table/emp.sql  
create mode 100644 dist/releases/next/changes/ticket-001/stage.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
```

```
SQL> !git checkout main
```

```
Switched to branch 'main'
```



S

STAGE

project stage

SQL> !git merge ticket-001

Updating 5ef93e4..373326c

Fast-forward

dist/releases/main.changelog.xml		7	+
dist/releases/next/changes/ticket-001/demo/indexes/emp_1.sql		8	++
dist/releases/next/changes/ticket-001/demo/indexes/emp_2.sql		8	++
.../next/changes/ticket-001/demo/ref_constraints/emp_dept_fk.sql		9	++
.../next/changes/ticket-001/demo/ref_constraints/emp_mgr_fk.sql		9	++
dist/releases/next/changes/ticket-001/demo/tables/dept.sql		22	+++
dist/releases/next/changes/ticket-001/demo/tables/emp.sql		30	++++
dist/releases/next/changes/ticket-001/stage.changelog.xml		12	++
dist/releases/next/release.changelog.xml		8	++
dist/utils/prechecks.sql		81	+++++++++
dist/utils/recompile.sql		225	+++++++++
src/database/demo/indexes/emp_1.sql		7	+
src/database/demo/indexes/emp_2.sql		7	+
src/database/demo/ref_constraints/emp_dept_fk.sql		8	++
src/database/demo/ref_constraints/emp_mgr_fk.sql		8	++
src/database/demo/tables/dept.sql		21	+++
src/database/demo/tables/emp.sql		29	++++

17 files changed, 499 insertions(+)

create mode 100644 dist/releases/main.changelog.xml

create mode 100644 dist/releases/next/changes/ticket-001/demo/indexes/emp_1.sql

create mode 100644 dist/releases/next/changes/ticket-001/demo/indexes/emp_2.sql

create mode 100644 dist/releases/next/changes/ticket-001/demo/ref_constraints/emp_dept_fk.sql

create mode 100644 dist/releases/next/changes/ticket-001/demo/ref_constraints/emp_mgr_fk.sql

create mode 100644 dist/releases/next/changes/ticket-001/demo/tables/dept.sql

create mode 100644 dist/releases/next/changes/ticket-001/demo/tables/emp.sql

create mode 100644 dist/releases/next/changes/ticket-001/stage.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/emp_1.sql

create mode 100644 src/database/demo/indexes/emp_2.sql

create mode 100644 src/database/demo/ref_constraints/emp_dept_fk.sql

create mode 100644 src/database/demo/ref_constraints/emp_mgr_fk.sql

create mode 100644 src/database/demo/tables/dept.sql

create mode 100644 src/database/demo/tables/emp.sql

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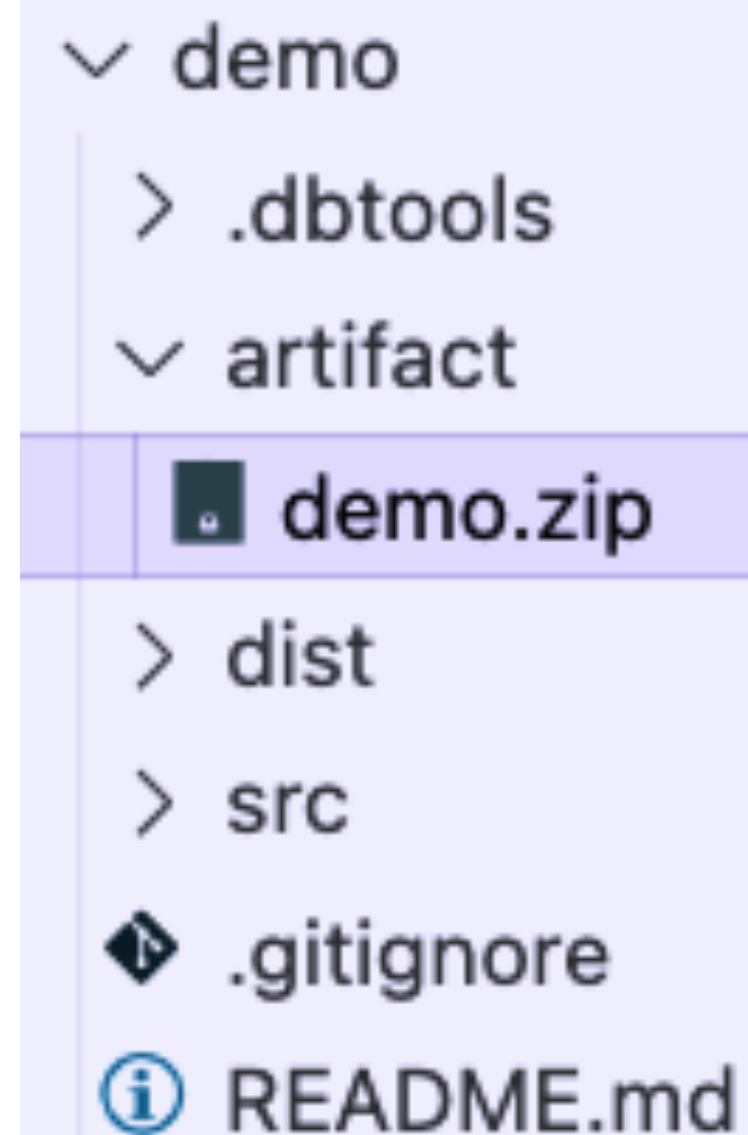
D

DEPLOY

project gen-artifact

```
SQL> project gen-artifact -force -verbose
```

```
file : /Users/Roel/sqlclproject/demo/dist/releases/next/release.changelog.xml
file : /Users/Roel/sqlclproject/demo/dist/releases/next/changes/ticket-001/demo/tables/emp.sql
file : /Users/Roel/sqlclproject/demo/dist/releases/next/changes/ticket-001/demo/tables/dept.sql
file : /Users/Roel/sqlclproject/demo/dist/releases/next/changes/ticket-001/demo/ref_constraints/emp_mgr_fk.sql
file : /Users/Roel/sqlclproject/demo/dist/releases/next/changes/ticket-001/demo/ref_constraints/emp_dept_fk.sql
file : /Users/Roel/sqlclproject/demo/dist/releases/next/changes/ticket-001/demo/indexes/emp_2.sql
file : /Users/Roel/sqlclproject/demo/dist/releases/next/changes/ticket-001/demo/indexes/emp_1.sql
file : /Users/Roel/sqlclproject/demo/dist/releases/next/changes/ticket-001/stage.changelog.xml
file : /Users/Roel/sqlclproject/demo/dist/releases/main.changelog.xml
file : /Users/Roel/sqlclproject/demo/dist/utils/recompile.sql
file : /Users/Roel/sqlclproject/demo/dist/utils/prechecks.sql
file : /Users/Roel/sqlclproject/demo/dist/install.sql
Your artifact has been generated demo.zip
```



SQLcl project stages

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DEPLOY

project deploy

```
SQL> conn -name demo_test_system
```

```
Connected.
```

```
SQL> project deploy -file artifact/demo.zip -verbose
```

```
Check database connection...
```

```
Extract the file name: demo
```

```
Artifact decompression in progress...
```

```
Artifact decompressed: /var/folders/mf/nd_5604142z9_cb98xzwzrd00000gn/T/a0fcd26c-629f-4498-8201-a9f583f4126c17875445916515426890
```

```
Starting the migration...
```

```
Running Changeset: ticket-001/demo/tables/dept.sql::1740387307323::DEMO
```

```
Table DEMO.DEPT created.
```

```
Index DEMO.DEPT_PK created.
```

```
Table DEMO.DEPT altered.
```

```
Running Changeset: ticket-001/demo/tables/emp.sql::1740387307323::DEMO
```

```
Table DEMO.EMP created.
```

```
Index DEMO.EMP_PK created.
```

```
Table DEMO.EMP altered.
```

```
Table DEMO.EMP altered.
```

```
Running Changeset: ticket-001/demo/indexes/emp_1.sql::1740387307316::DEMO
```

```
Index DEMO.EMP_1 created.
```

```
Running Changeset: ticket-001/demo/indexes/emp_2.sql::1740387307321::DEMO
```

```
Index DEMO.EMP_2 created.
```

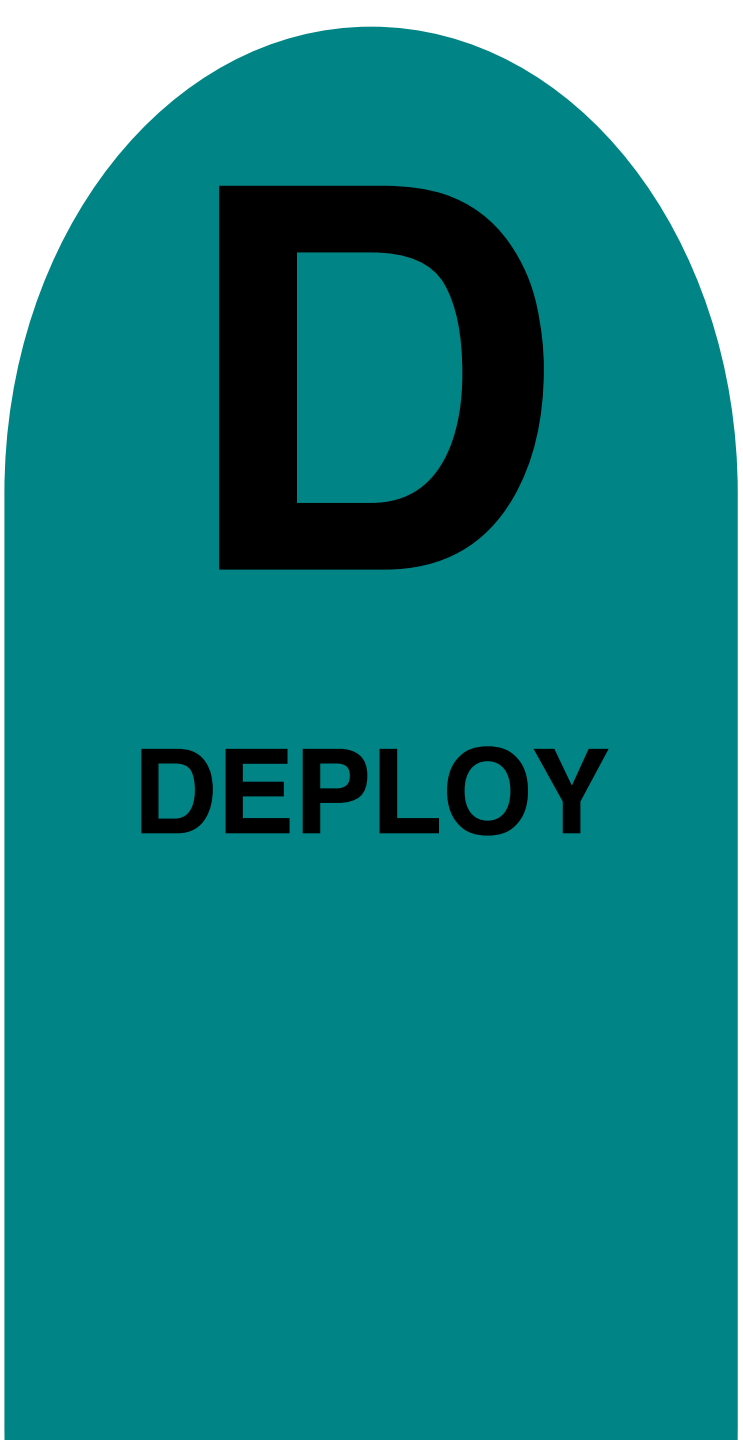
```
Running Changeset: ticket-001/demo/ref_constraints/emp_dept_fk.sql::1740387307321::DEMO
```

```
Table DEMO.EMP altered.
```

```
Running Changeset: ticket-001/demo/ref_constraints/emp_mgr_fk.sql::1740387307322::DEMO
```

```
Table DEMO.EMP altered.
```

```
Liquibase: Update has been successful. Rows affected: 6
```



D

DEPLOY

SQLcl project stages

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DEPLOY

project verify

SQL> project verify -verbose

```
----- Results Summary -----
Errors:      0
Warnings:    0
Info:        6
-----
```

Level	Group Name	Test Name	Message
INFO	settings	verifynonpublicsettings	No unsupported internal settings found
INFO	init	verifyprojectname	The final project name will be "demo"
INFO	examples	exampletest	a message
INFO	stage	stagechangelogcomplete	Stage Changelog validation found no issues.
INFO	project	sqlclversion	SQLcl Version check passed
INFO	snapshot	verifysnapshot	Snapshot validation found no issues.



**CHANGES
ARE COMING!**



project export

```
SQL> !git checkout -b ticket-002  
Switched to a new branch 'ticket-002'
```

```
SQL> alter table demo.emp add ( trained boolean default false );  
Table EMP altered.
```

```
SQL> alter table demo.emp add constraint emp_ck1 check ( sal > 0 );  
Table EMP altered.
```

```
SQL> alter table demo.emp modify ( ename varchar2(20));  
Table EMP altered.
```

```
SQL> project export -objects demo.emp -verbose
```

A large yellow rounded rectangle with a black letter 'E' inside it.

EXPORT

project export

```
./src/database/demo/tables/emp.sql
```

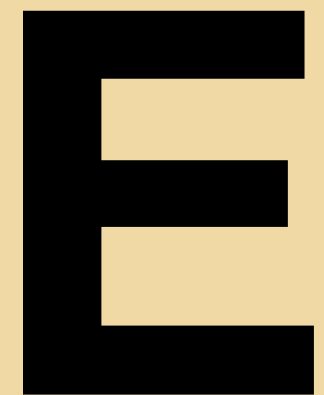
```
create table demo.emp (  
    empno      number(4, 0)  
        generated by default on null as identity minvalue 1 maxvalue 90000 increment by 10 start  
with 8000 nocache noorder nocycle nokeep  
        noscale  
    not null enable,  
    ename      varchar2(20 byte),  
    job        varchar2(50 byte),  
    mgr        number(4, 0),  
    hiredate   date,  
    sal        number(7, 2),  
    comm       number(7, 2),  
    deptno     number(4, 0),  
    trained    boolean default false  
);
```

```
create unique index demo.emp_pk on demo.emp ( empno );
```

```
alter table demo.emp add constraint emp_ck1 check ( sal > 0 ) enable;
```

```
alter table demo.emp add constraint emp_pk primary key ( empno ) using index demo.emp_pk enable;
```

```
-- sqlcl_snapshot {"hash": "cff61bf6746b3443d7c1357c2b25e7fe3333cc50", "type": "TABLE", "name": "EMP", "schemaName": "DEMO", "sxml": "<TABLE xmlns =\"http://xmlns.oracle.com/ku\"  
version =\"1.0\"><SCHEMA>DEMO</SCHEMA><NAME>EMP</NAME><RELATIONAL_TABLE><COL_LIST><COL_LIST_ITEM><NAME>EMPNO</NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>4</  
PRECISION><SCALE>0</SCALE><IDENTITY_COLUMN><SCHEMA>DEMO</SCHEMA><GENERATION>DEFAULT</GENERATION><ON_NULL></ON_NULL><START_WITH>8000</START_WITH><INCREMENT>10</  
INCREMENT><MINVALUE>1</MINVALUE><MAXVALUE>90000</MAXVALUE><CACHE>0</CACHE><SCALE>NOSCALE</SCALE></IDENTITY_COLUMN><NOT_NULL></NOT_NULL></  
COL_LIST_ITEM><COL_LIST_ITEM><NAME>ENAME</NAME><DATATYPE>VARCHAR2</DATATYPE><LENGTH>20</LENGTH><COLLATE_NAME>USING_NLS_COMP</COLLATE_NAME></  
COL_LIST_ITEM><COL_LIST_ITEM><NAME>JOB</NAME><DATATYPE>VARCHAR2</DATATYPE><LENGTH>50</LENGTH><COLLATE_NAME>USING_NLS_COMP</COLLATE_NAME></  
COL_LIST_ITEM><COL_LIST_ITEM><NAME>MGR</NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>4</PRECISION><SCALE>0</SCALE></COL_LIST_ITEM><COL_LIST_ITEM><NAME>HIREDATE</  
NAME><DATATYPE>DATE</DATATYPE></COL_LIST_ITEM><COL_LIST_ITEM><NAME>SAL</NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>7</PRECISION><SCALE>2</SCALE></  
COL_LIST_ITEM><COL_LIST_ITEM><NAME>COMM</NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>7</PRECISION><SCALE>2</SCALE></COL_LIST_ITEM><COL_LIST_ITEM><NAME>DEPTNO</  
NAME><DATATYPE>NUMBER</DATATYPE><PRECISION>4</PRECISION><SCALE>0</SCALE></COL_LIST_ITEM><COL_LIST_ITEM><NAME>TRAINED</NAME><DATATYPE>BOOLEAN</DATATYPE><DEFAULT>false</  
DEFAULT></COL_LIST_ITEM></COL_LIST><CHECK CONSTRAINT LIST><CHECK CONSTRAINT LIST_ITEM><NAME>EMP_CK1</NAME><CONDITION>sal>0</CONDITION></CHECK CONSTRAINT LIST_ITEM></  
CHECK CONSTRAINT LIST><PRIMARY KEY CONSTRAINT LIST><PRIMARY KEY CONSTRAINT LIST_ITEM><NAME>EMP_PK</NAME><COL_LIST><COL_LIST_ITEM><NAME>EMPNO</NAME></COL_LIST_ITEM></  
COL_LIST><USING_INDEX></USING_INDEX></PRIMARY KEY CONSTRAINT LIST_ITEM></PRIMARY KEY CONSTRAINT LIST><DEFAULT_COLLATION>USING_NLS_COMP</
```



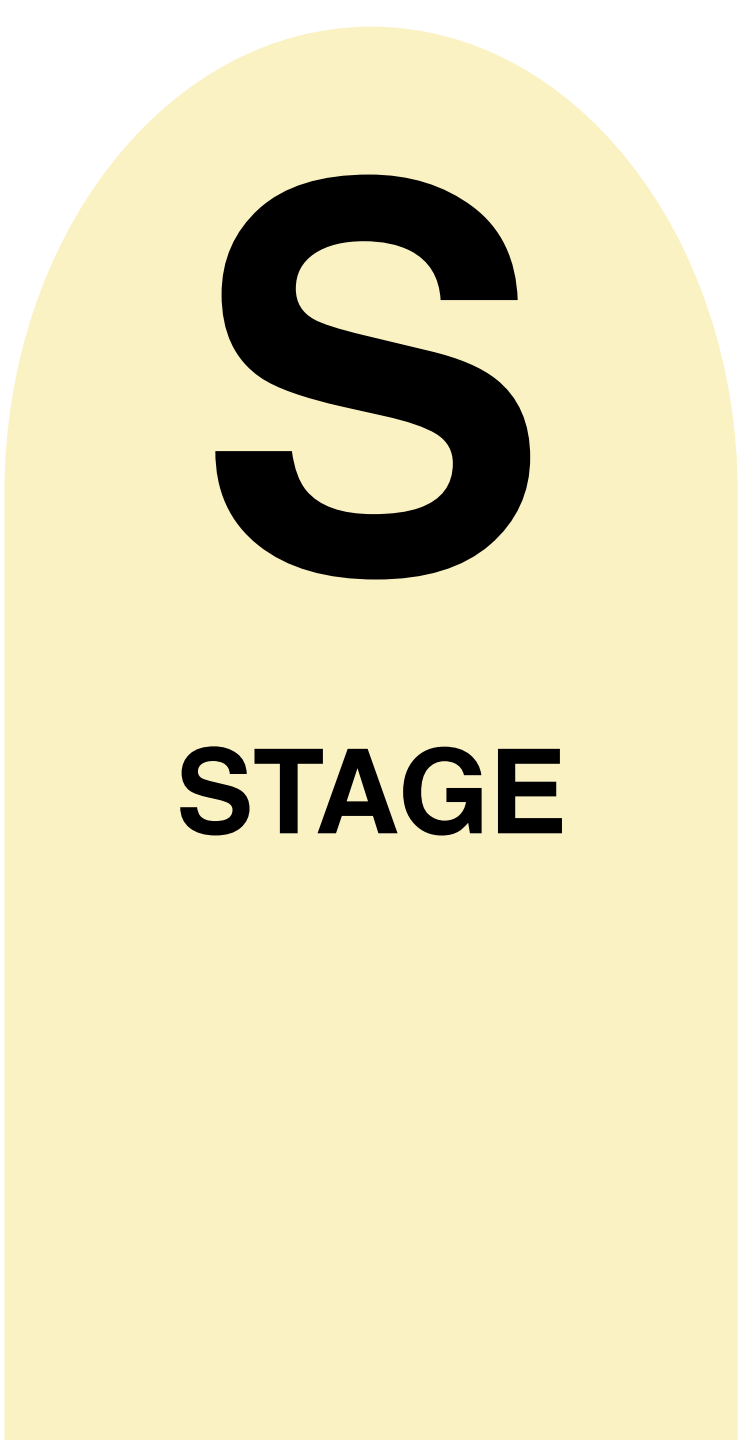
EXPORT

project stage

```
SQL> !git add .
```

```
SQL> !git commit -m "Ticket 2 created"
```

```
[ticket-002 b1edbc6] Ticket 2 created  
1 file changed, 6 insertions(+), 3 deletions(-)
```



S

STAGE

project stage

SQL> project stage -verbose

Starting execution of stage command using the current branch

Stage is Comparing:

Old Branch refs/heads/main

New Branch refs/heads/ticket-002

Created dir: dist/releases/next/changes/ticket-002

Created dir: dist/releases/next/changes/ticket-002/code

Created dir: dist/releases/next/changes/ticket-002/code/_custom

Created change:dist/releases/next/changes/ticket-002/stage.changelog.xml

Created file: dist/releases/next/changes/ticket-002/demo/table/emp.sql

Updated change:dist/releases/next/changes/ticket-002/stage.changelog.xml

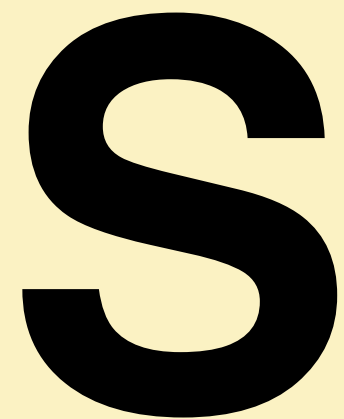
Updated change:dist/releases/next/changes/ticket-002/stage.changelog.xml

Updated change:dist/releases/next/release.changelog.xml

Updated change:dist/releases/next/release.changelog.xml

Completed executing stage command on branch: ticket-002

Stage successfully created, please review and commit your changes to repository



STAGE

project stage

S

STAGE

▼ dist	●
▼ releases	●
▼ next	●
▼ changes	●
> ticket-001	
▼ ticket-002	●
▼ code/_custom	
▼ demo/table	●
📄 emp.sql	U
📡 stage.changelog.xml	U
📡 release.changelog.xml	M
📡 main.changelog.xml	
> utils	
📄 install.sql	
📖 README.md	

project stage

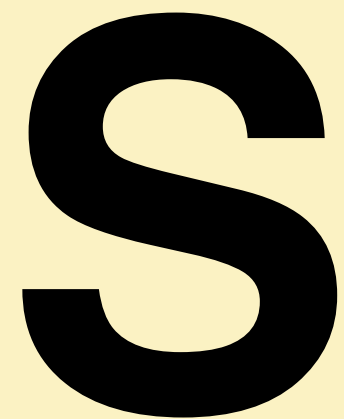
```
./dist/releases/next/changes/ticket-002/demo/table/emp.sql
```

```
-- liquibase formatted sql  
-- changeset DEMO:947df637b1893276bc6dd15e24a7421bc83611c4 stripComments:false  
logicalFilePath:ticket-002/demo/table/emp.sql  
-- sqlcl_snapshot src/database/demo/tables/  
emp.sql:b39d960a44d294df3b157977ea7b5c91ab2c10c1:cff61bf6746b3443d7c1357c2b25e7fe3333cc50:alter
```

```
alter table demo.emp add (  
    trained boolean default false  
)  
/
```

```
alter table demo.emp modify (  
    ename varchar2(20)  
)  
/
```

```
alter table demo.emp add constraint emp_ck1 check ( sal > 0 ) enable  
/
```

A large, bold, black letter 'S' is centered within a yellow, rounded rectangular background element on the left side of the slide.

STAGE

project stage

```
SQL> !git add .
```

```
SQL> !git commit -m "Ticket 2 done!"
```

```
[ticket-002 bb83c73] Ticket 2 done!  
3 files changed, 28 insertions(+)  
create mode 100644 dist/releases/next/changes/ticket-002/demo/table/emp.sql  
create mode 100644 dist/releases/next/changes/ticket-002/stage.changelog.xml
```

```
SQL> !git checkout main  
Switched to branch 'main'
```

```
SQL> !git merge ticket-002
```

```
Updating f0f95a5..bb83c73
```

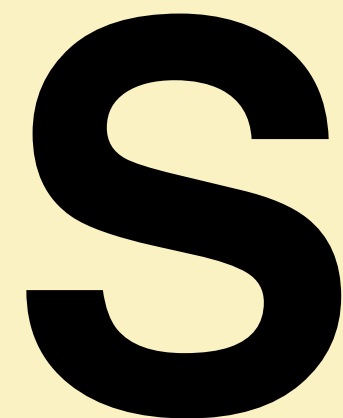
```
Fast-forward
```

```
dist/releases/next/changes/ticket-002/demo/table/emp.sql | 16 ++++++++  
dist/releases/next/changes/ticket-002/stage.changelog.xml | 11 ++++++++  
dist/releases/next/release.changelog.xml | 1 +  
src/database/demo/tables/emp.sql | 9 +++++---
```

```
4 files changed, 34 insertions(+), 3 deletions(-)
```

```
create mode 100644 dist/releases/next/changes/ticket-002/demo/table/emp.sql
```

```
create mode 100644 dist/releases/next/changes/ticket-002/stage.changelog.xml
```



STAGE

project release

R

RELEASE



project release

```
SQL> project release -verbose -version 1.0.0
```

Creating a release version 1.0.0 for the current body of work

Updated change:dist/releases/main.changelog.xml

Moved folder "dist/releases/next" to "dist/releases/1.0.0"

Created file: dist/releases/next

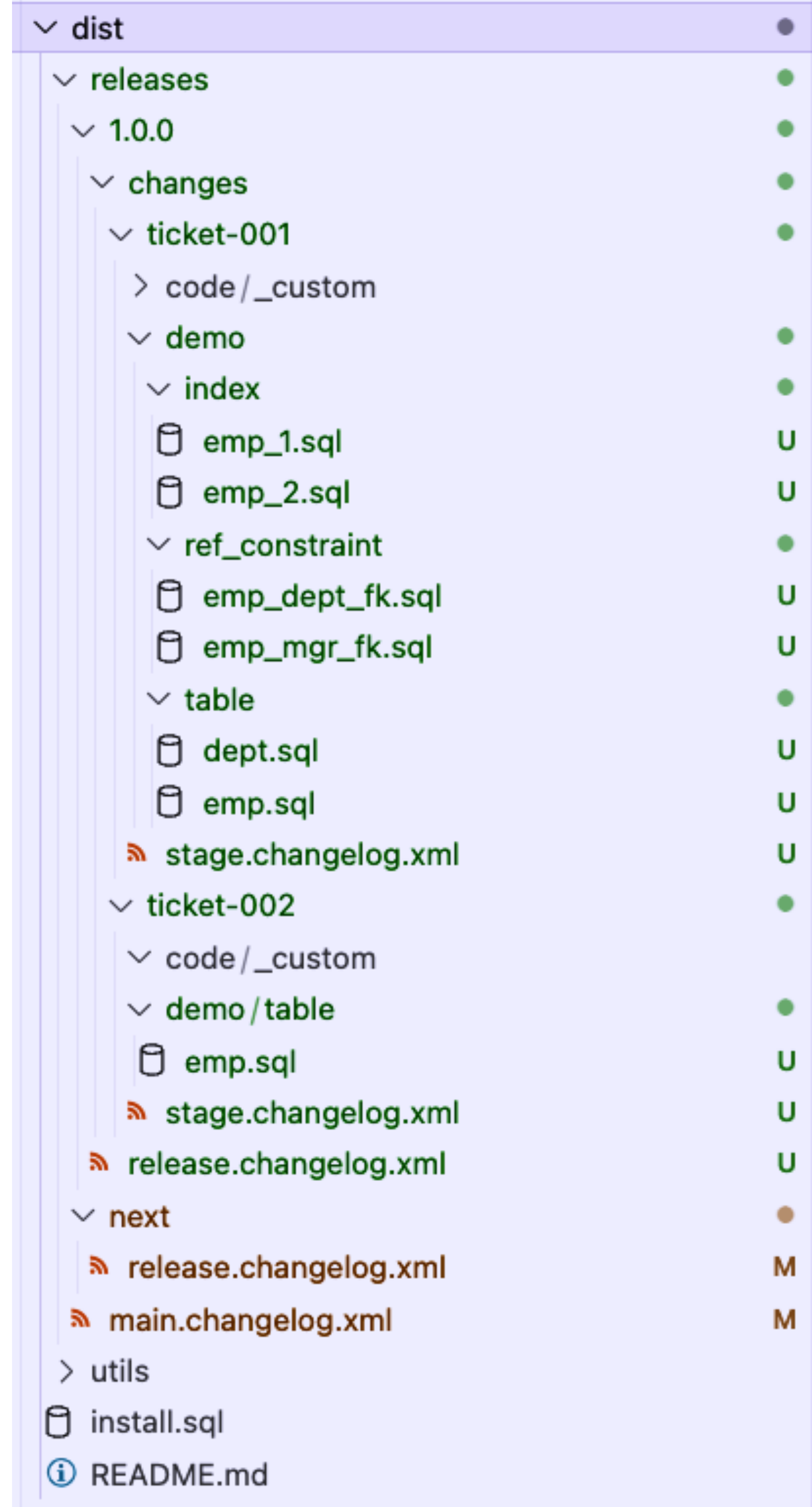
Created change:dist/releases/next/release.changelog.xml

Created change:dist/releases/next/release.changelog.xml

Process completed successfully

R

RELEASE



project gen-artifact

```
SQL> project gen-artifact -force
```

```
Your artifact has been generated demo-1.0.0.zip
```

A large, bold, black letter 'G' is centered within a teal-colored rounded rectangle. The rectangle has a flat bottom and a semi-circular top.

**GEN
ARTIFACT**

project deploy

SQL> conn -name demo_test_system
Connected.

SQL> project deploy -file artifact/demo-1.0.0.zip
Starting the migration...
Running Changeset: ticket-002/demo/table/emp.sql::947df637b1893276bc6dd15e24a7421bc83611c4::DEMO

Table DEMO.EMP altered.

Table DEMO.EMP altered.

Table DEMO.EMP altered.

Liquibase: Update has been successful. Rows affected: 1
Installing/updating schemas
--Starting Liquibase at 2025-01-27T14:09:10.976386 (version 4.25.0.305.0400 #0 built at 2024-10-31 21:25+0000)

Table DEMO.EMP altered.

Table DEMO.EMP altered.

Table DEMO.EMP altered.

UPDATE SUMMARY	
Run:	1
Previously run:	6
Filtered out:	0

Total change sets:	7

Produced logfile: sqlcl-lb-1737983350678.log

Operation completed successfully.

Migration has been completed



deployment details

`./dist/install.sql`

```
-- Use the SQLCL engine for formatted sql changelog not the JDBC engine
-- The value can be sqlcl or
-- liquibase set engine sqlcl

-- Prechecks modifiable helper
-- Check running with SQLcl
-- Check minimum DB version
-- Check character set
-- @utils/prechecks.sql

-- SLOT
-- Custom pre Liquibase code here (perhaps creation of a schema)
-- This is MINIMAL pre setup, everything that can go through Liquibase - SHOULD

-- Kick off Liquibase
prompt "Installing/updating schemas"
lb update -log -changelog-file releases/main.changelog.xml -search-path "."

--@utils/recompile.sql
```



D

DEPLOY

deployment details

`./dist/releases/main.changelog.xml`

```
<?xml version="1.0" encoding="UTF-8"?>
<databaseChangeLog xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.liquibase.org/xml/ns/dbchangelog"
  xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog
    http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-4.3.xsd">

  <!--BEGIN-->
  <include file="1.0.0/release.changelog.xml" relativeToChangelogFile="true"/>
  <include file="next/release.changelog.xml" relativeToChangelogFile="true"/>
  <!--END-->
</databaseChangeLog>
```

D
DEPLOY



deployment details

`./dist/releases/1.0.0/release.changelog.xml`

```
<?xml version="1.0" encoding="UTF-8"?>
<databaseChangeLog xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.liquibase.org/xml/ns/dbchangelog"
  xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog
    http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-4.3.xsd">
  <!--BEGIN CHANGES-->
  <include file="changes/ticket-001/stage.changelog.xml" relativeToChangelogFile="true"/>
  <include file="changes/ticket-002/stage.changelog.xml" relativeToChangelogFile="true"/>
  <!--END CHANGES-->
  <!--BEGIN CODE-->
  <!--END CODE-->
</databaseChangeLog>
```



D

DEPLOY

deployment details

`./dist/releases/1.0.0/changes/ticket-002/stage.changelog.xml`

```
<?xml version="1.0" encoding="UTF-8"?>
<databaseChangeLog xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.liquibase.org/xml/ns/dbchangelog"
  xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog
    http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-4.3.xsd">

  <!--BEGIN-->
  <include file="demo/table/emp.sql" relativeToChangelogFile="true"/>
  <!--END-->
  <!--BEGIN CUSTOM-->
  <!--END CUSTOM-->
</databaseChangeLog>
```

D
DEPLOY



export / deploy APEX application

```
SQL> !git checkout -b ticket-003
```

```
SQL> project export -objects apex.100
```

```
The current connection //localhost:1523/APEX242 SYSTEM will be used for all operations
```

```
*** APEX_APPLICATION ***
```

```
Exporting Workspace DEMO - application 100:DB23ai for the APEX Developer
```

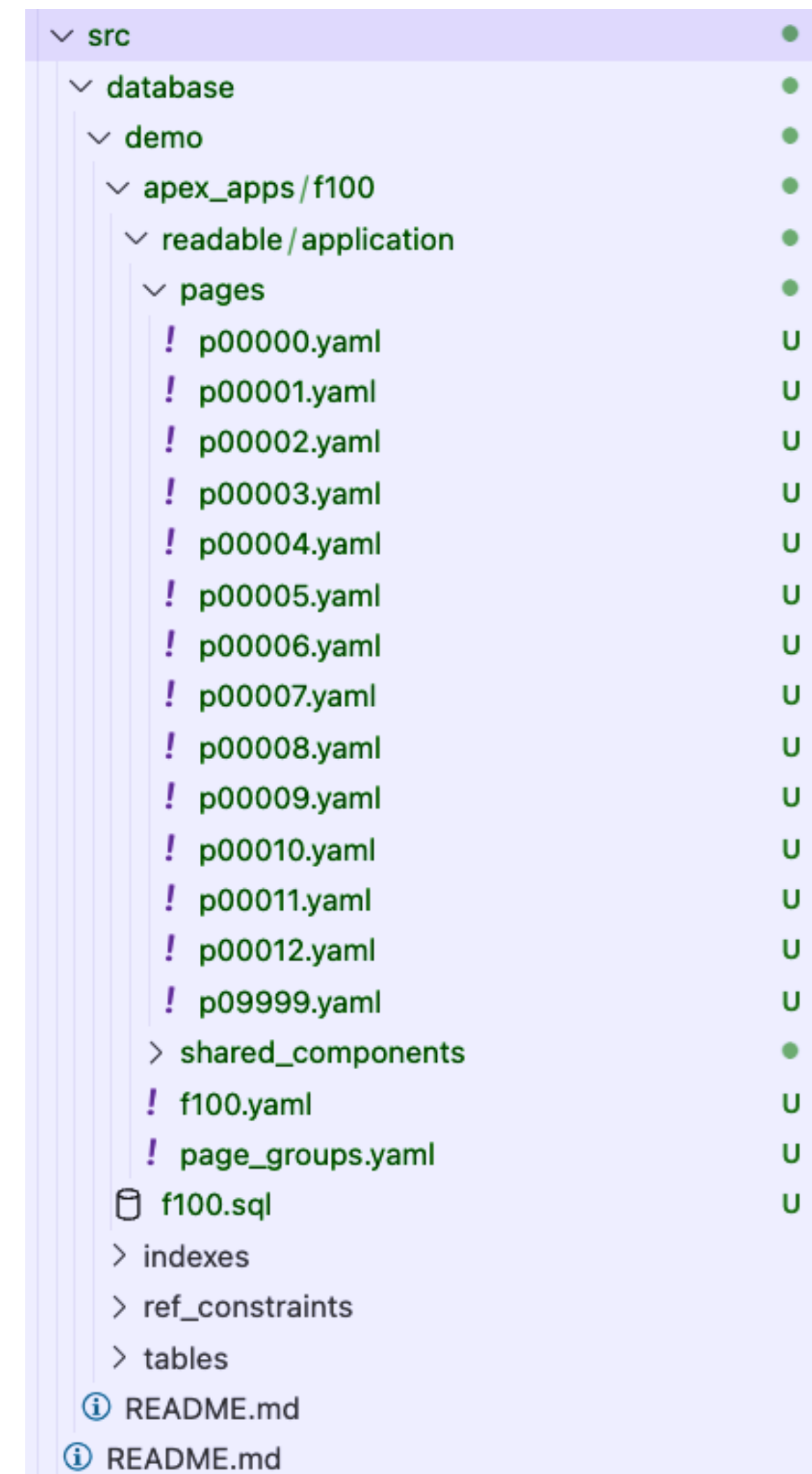
```
-----  
APEX_APPLICATION          1  
-----
```

```
Exported 1 objects
```

```
Elapsed 19 sec
```

E

EXPORT



export / deploy APEX application

```
SQL> !git add .
```

```
SQL> !git commit -m "Ticket 3 - APEX app 100"
```

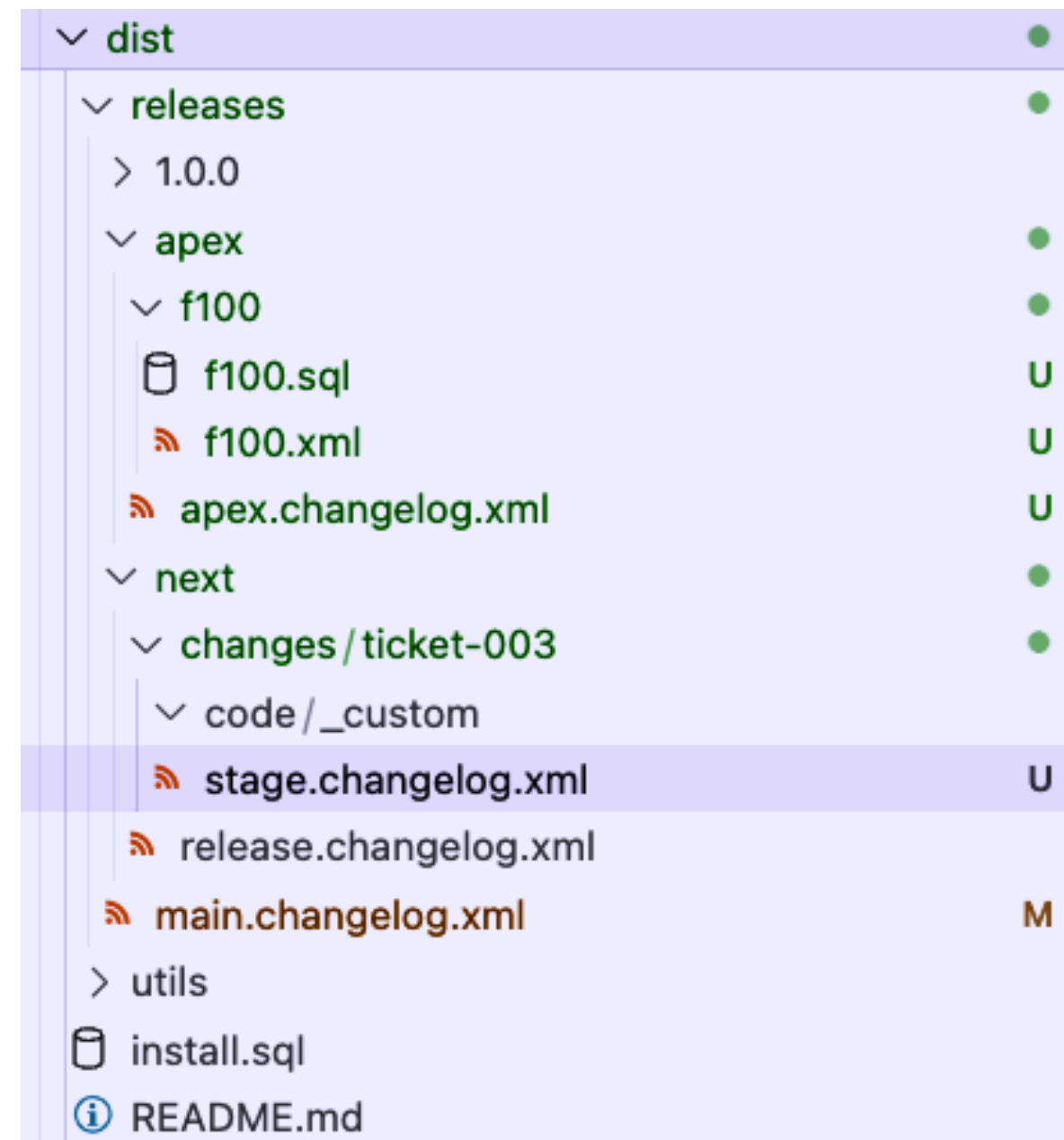
```
[ticket-003 5ec68f5] Ticket 3 - APEX app 100  
 43 files changed, 86537 insertions(+)
```

```
.....
```

```
SQL> project stage
```

S

STAGE



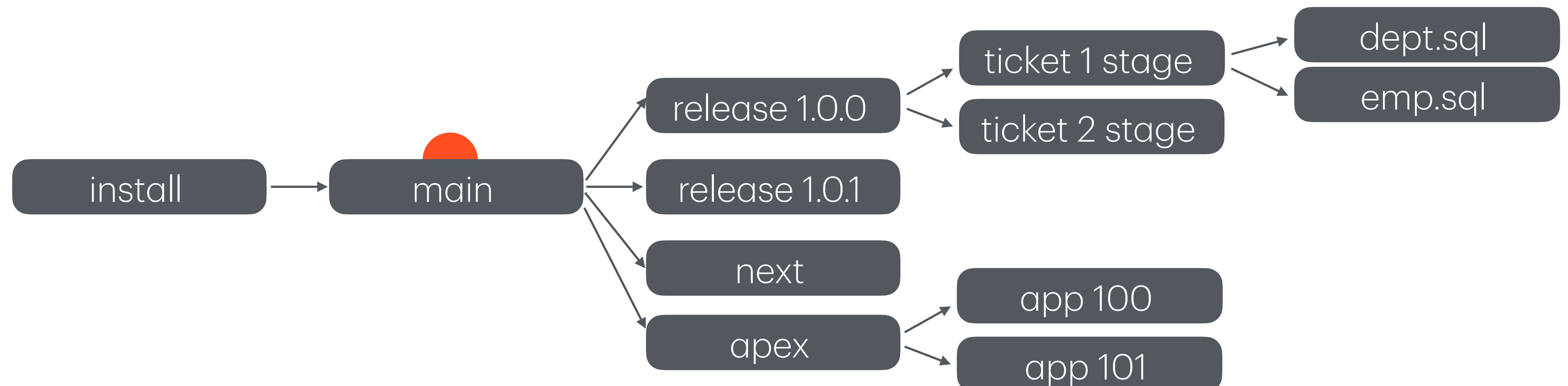
export / deploy APEX application

`./dist/releases/main.changelog.xml`

```
<?xml version="1.0" encoding="UTF-8"?>
<databaseChangeLog xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.liquibase.org/xml/ns/dbchangelog"
  xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog
    http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-4.3.xsd">

  <!--BEGIN-->
  <include file="1.0.0/release.changelog.xml" relativeToChangelogFile="true"/>
  <include file="next/release.changelog.xml" relativeToChangelogFile="true"/>
  <!--END-->
  <include file="apex/apex.changelog.xml" relativeToChangelogFile="true"/>
</databaseChangeLog>
```

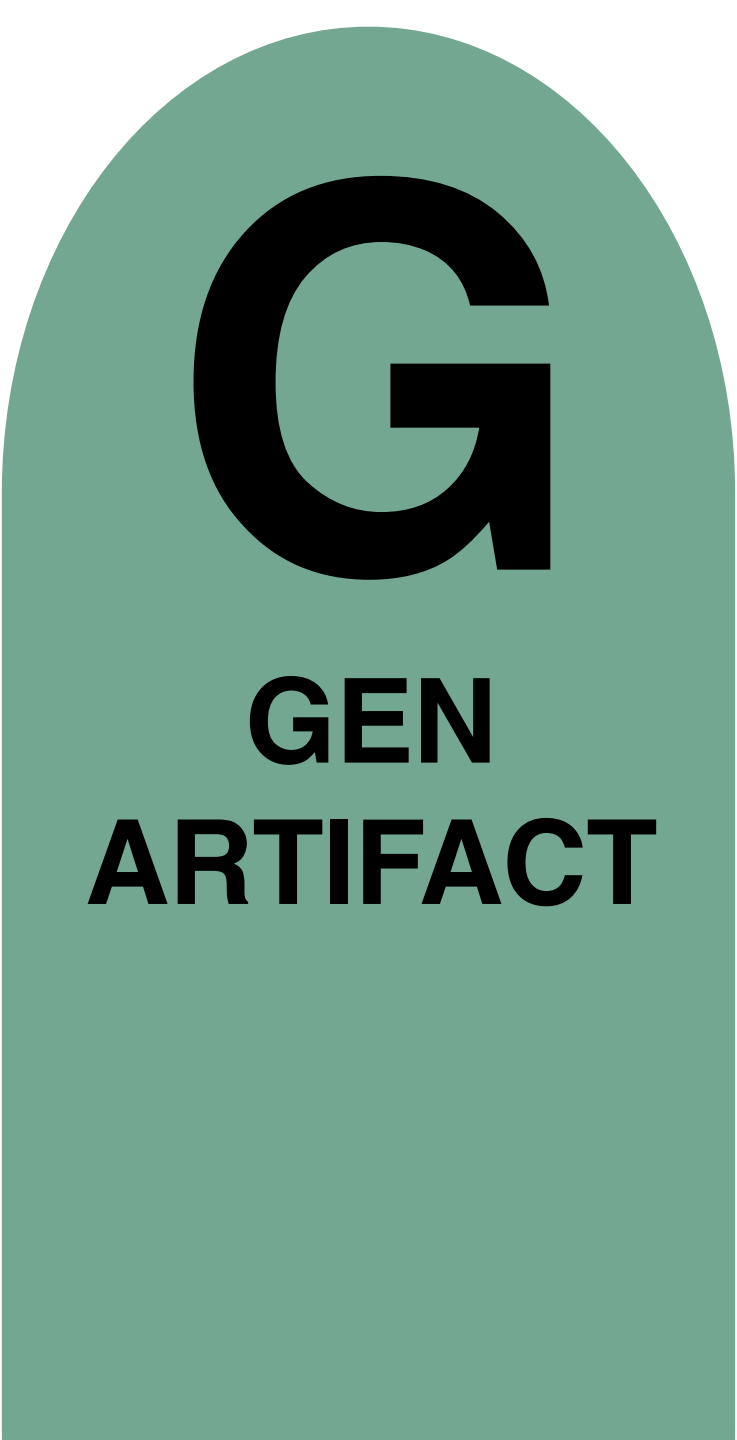
S
STAGE



export / deploy APEX application

```
SQL> project gen-artifact -force -version 1.0.1
```

```
Your artifact has been generated demo-1.0.1.zip
```



G

**GEN
ARTIFACT**

export / deploy APEX application

```
SQL> conn -name demo_test_system  
Connected.
```

```
SQL> project deploy -file artifact/demo-1.0.1.zip  
Starting the migration...
```

```
.....  
ORA-20987: APEX - Invalid workspace ID. - Contact your application administrator.  
...  
Migration has been completed
```



D

DEPLOY

export / deploy APEX application

```
SQL> project stage add-custom -file-name create_workspace.sql
```



```
1  -- liquibase formatted sql
2  -- changeset SqlCl:f2bf5f9c8a61008cef79ee81bc1c4b9ca09b32aa stripComments:false logicalFilePath:ticket-003/code/_custom/create_workspace.sql
3  -- sqlcl_snapshot dist/releases/next/changes/ticket-003/code/_custom/create_workspace.sql:null:null:custom
4
5  declare
6      l_workspace_id      apex_workspaces.workspace_id%type := 2400900122040953; --Get this value from DEV so it's the same everywhere
7      l_workspace         constant varchar2(255) := 'DEMO';
8      l_primary_schema    constant varchar2(255) := 'DEMO';
9      workspace_exists exception;
10     pragma exception_init ( workspace_exists, -20987 );
11 begin
12     -- This call will commit internally
13     apex_instance_admin.add_workspace(
14         p_workspace_id => l_workspace_id,
15         p_workspace => l_workspace,
16         p_primary_schema => l_primary_schema
17     );
18 exception
19     -- It's possible the workspace was created beforehand.
20     when workspace_exists then
21         null;
22 end;
23 /
```



```
1  <?xml version="1.0" encoding="UTF-8"?>
2  <databaseChangeLog xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
3      xmlns="http://www.liquibase.org/xml/ns/dbchangelog"
4      xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog
5          http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-4.3.xsd">
6      <!--BEGIN-->
7      <!--END-->
8      <!--BEGIN CUSTOM-->
9      <include file="code/_custom/create_workspace.sql" relativeToChangelogFile="true"/>
10     <!--END CUSTOM-->
11 </databaseChangeLog>
```

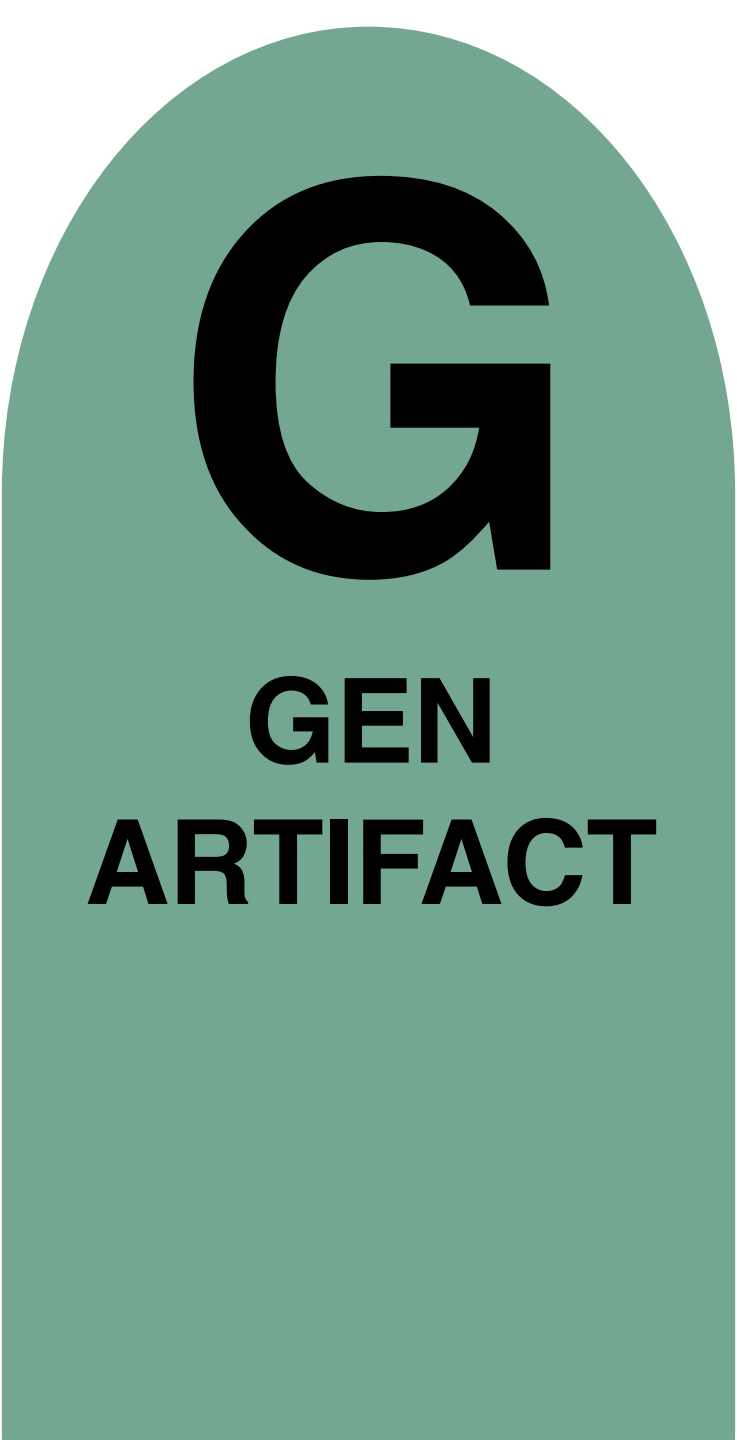
S

STAGE

export / deploy APEX application

```
SQL> project gen-artifact -force -version 1.0.1
```

```
Your artifact has been generated demo-1.0.1.zip
```



G

**GEN
ARTIFACT**

export / deploy APEX application

```
SQL> conn -name demo_test_system  
Connected.
```

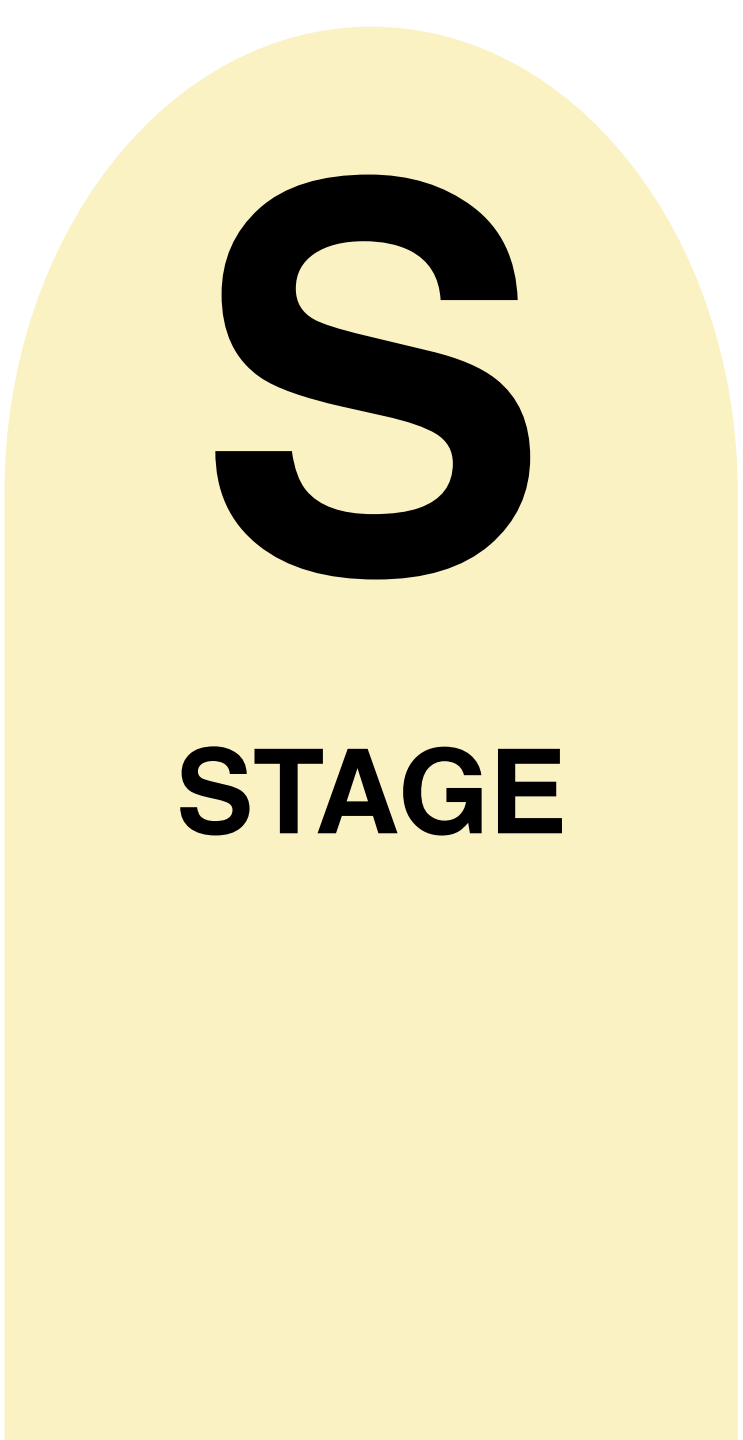
```
SQL> project deploy -file artifact/demo-1.0.1.zip  
Starting the migration...  
.....  
Migration has been completed
```

A teal-colored rounded rectangle button with a large, bold, black letter 'D' centered inside it.

DEPLOY

project stage add-custom -file-name x.sql

- create objects not supported by “project” (yet)
 - workspaces
 - workspace static files
 - ORDS modules
 - other ...
- data (insert statements)



S

STAGE

SQLcl project stages

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R

RELEASE

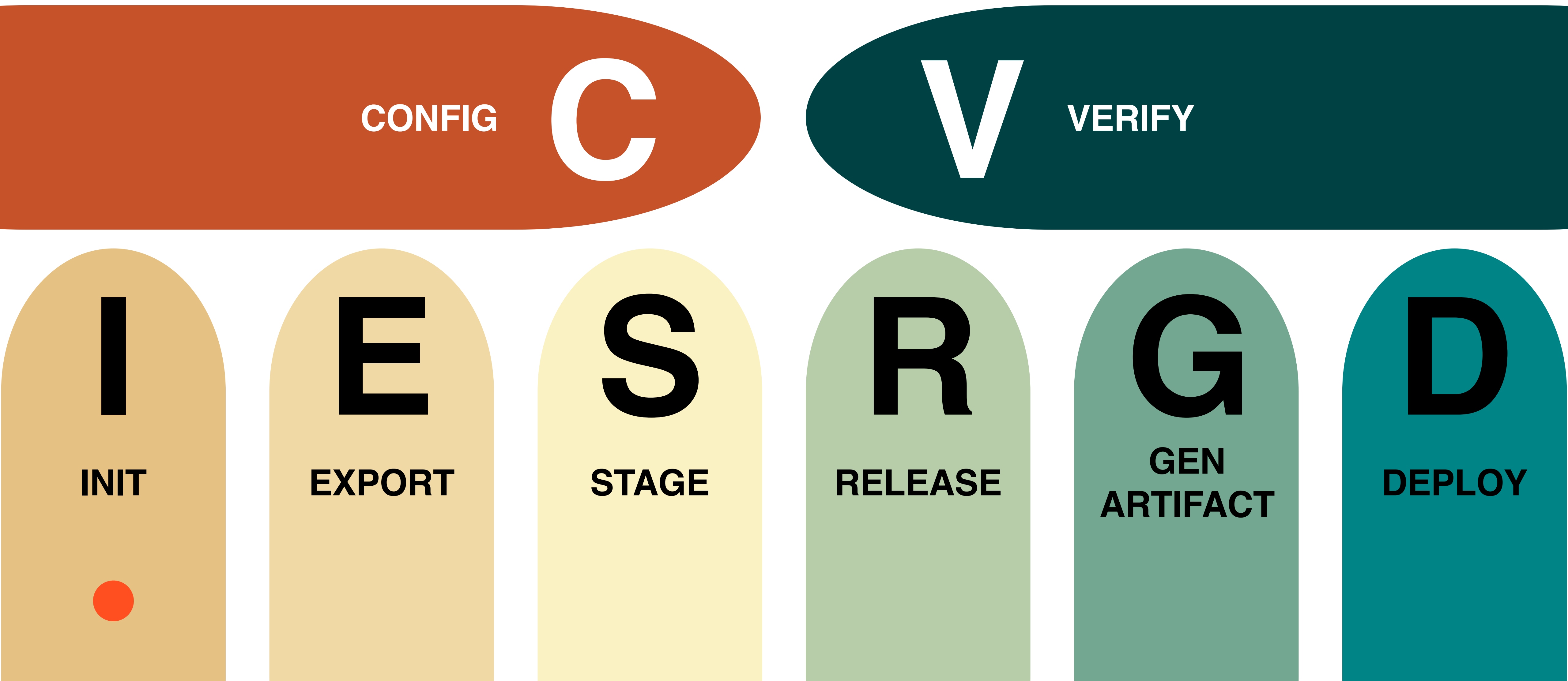
G

GEN
ARTIFACT

D

DEPLOY

SQLcl project stages - single developer (once)



SQLcl project stages - developer

CONFIG

C

V

VERIFY

I

INIT

E

EXPORT



S

STAGE



R

RELEASE

G

GEN
ARTIFACT

D

DEPLOY

SQLcl project stages - merge pipeline

CONFIG

C

V

VERIFY

I

INIT

E

EXPORT

S

STAGE

R

RELEASE

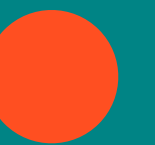
G

GEN
ARTIFACT



D

DEPLOY



SQLcl project stages - release pipeline

CONFIG

C

V

VERIFY

I

INIT

E

EXPORT

S

STAGE

R

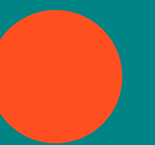
RELEASE

G

GEN
ARTIFACT

D

DEPLOY





Migrate your project

- init, export, stage
- modify dist/install.sql : **liquibase update** -> **liquibase changelog-sync**
- release, generate artifact
- remove old Liquibase objects in target database (optional)
- deploy - might need to fix ordering of objects in xml (if you need to re-install)
- verify

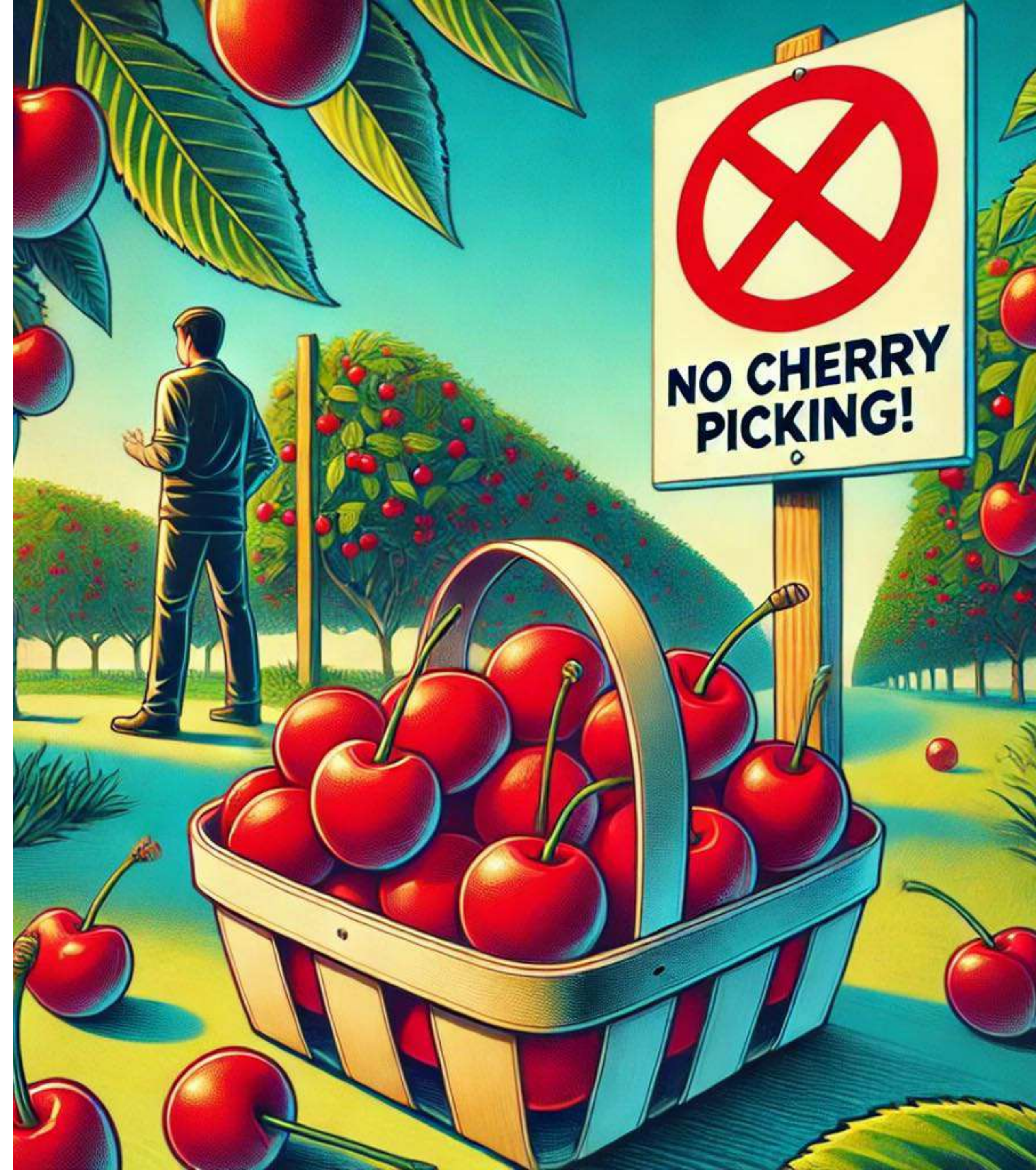
Migrate your project

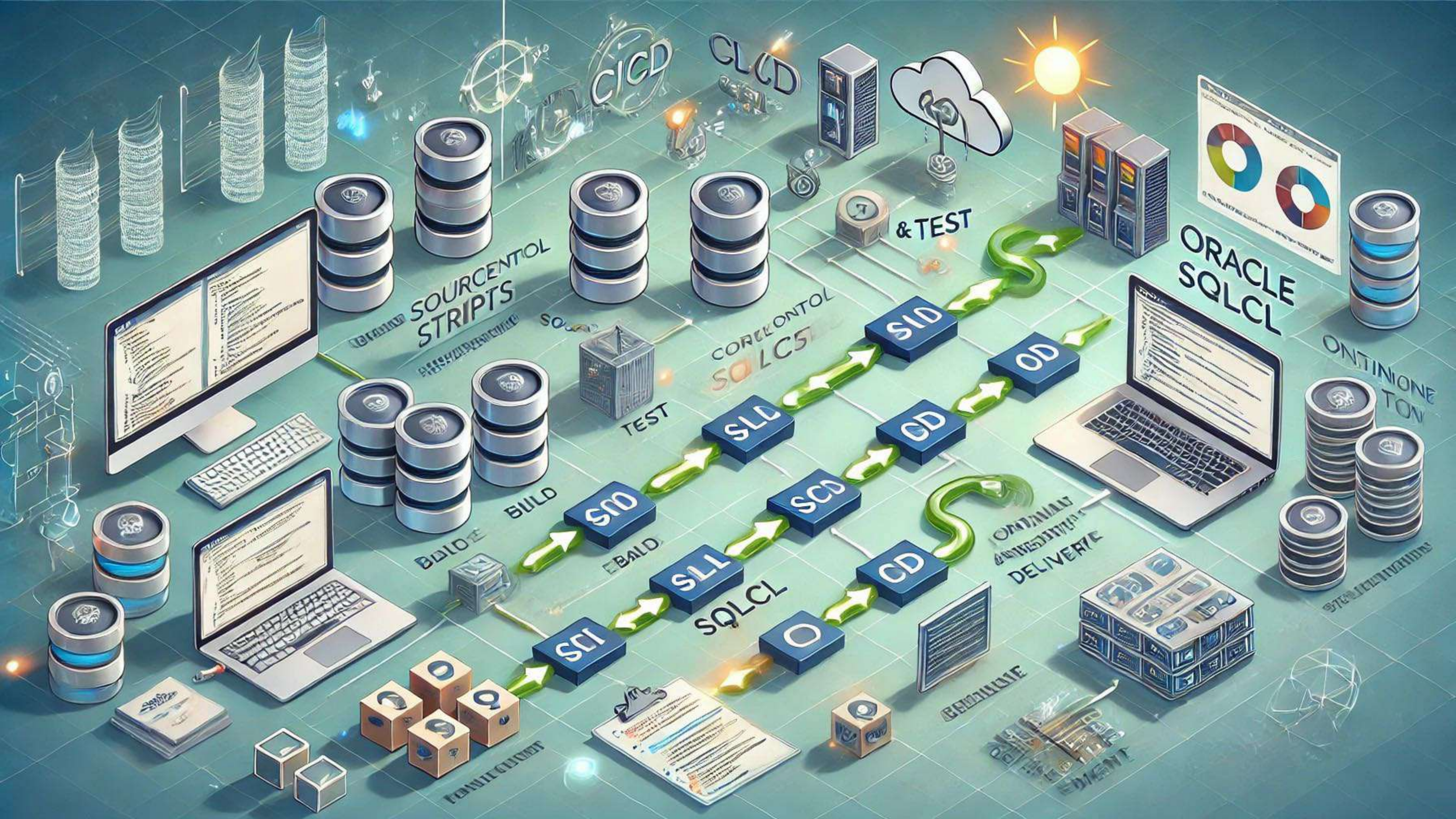
- add pre- / post-release scripts (optional) to dist/install.sql
 - create users
 - update application settings
 - recompile
 - start automations
 - etc.

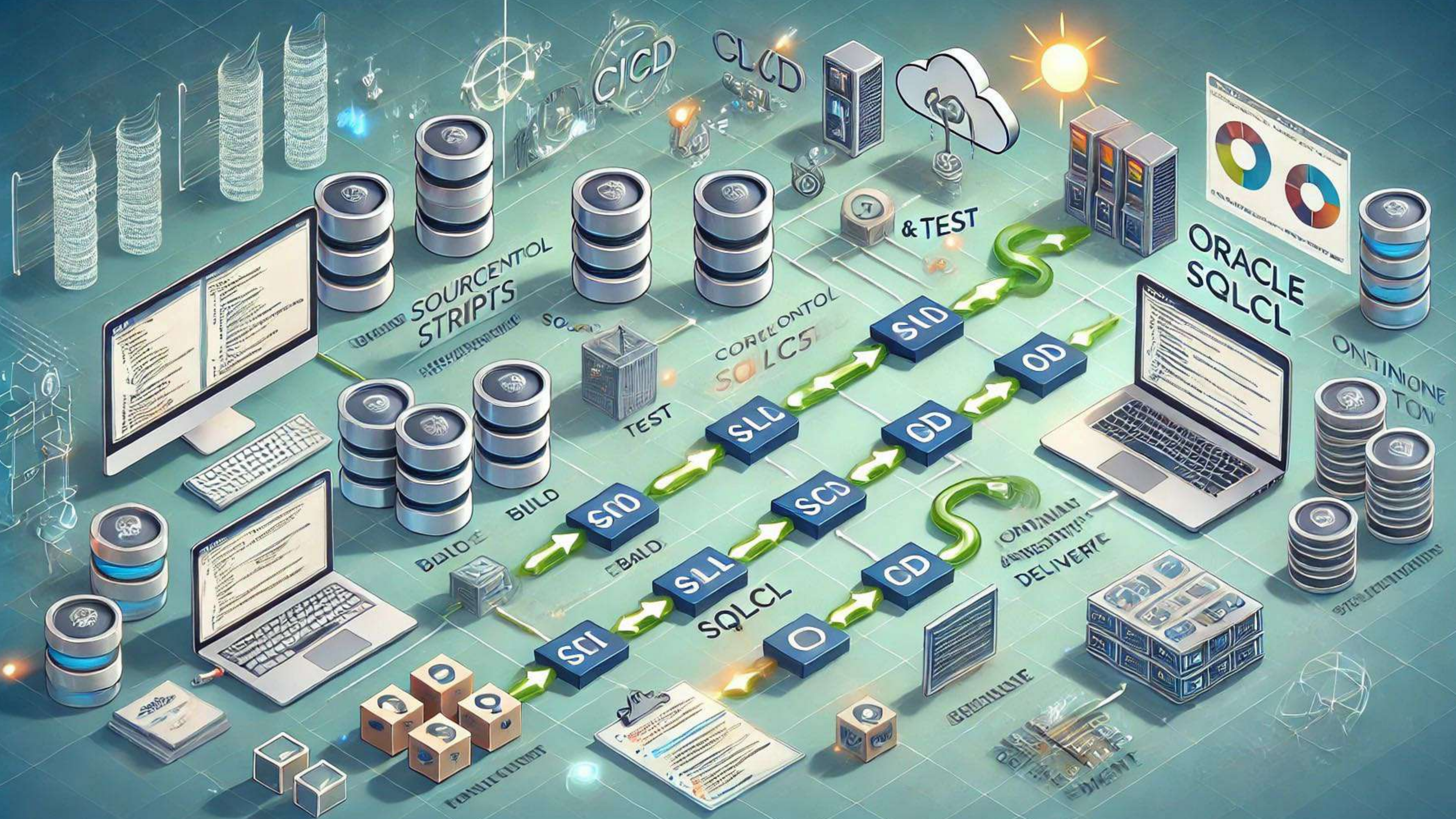


- optional for export
- makes deployment easier and safer
 - no switching connections in deployment
 - easier management of inter-schema dependencies
 - lock down of object owners / APEX runtime users

- no cherry-picking
- one database per developer
- working copies









Creating a CI/CD pipeline using SQLcl project-Roel Hartman

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Please fill in your evaluations