# Oracle® SQL Developer for VS Code





Oracle SQL Developer for VS Code, Release 25.2

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## **Preface**

This guide provides usage information about Oracle SQL Developer for VS Code.

## **Audience**

This guide is intended for those using the Oracle SQL Developer extension in Visual Studio Code

## 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.

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## Changes in Release 25.2 for *SQL Developer* for *VS Code*

The new features in this release are:

Using SQLcl MCP Server
 See Using the Oracle SQLcl MCP Server



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## **Getting Started**

Oracle SQL Developer for VS code is a new, more powerful version of Oracle SQL Developer desktop that is now freely available as an extension in Visual Studio Code. In the first release, you can browse, edit, and delete objects, run SQL statements and scripts, edit and run PL/SQL code, and manipulate and export data.

You can connect to any target Oracle Database schema using standard Oracle Database authentication. Once connected, you can perform operations on objects in the database.

#### **Topics:**

- Installing Oracle SQL Developer for VS Code
- · Connecting to Your Database

## 2.1 Installing Oracle SQL Developer for VS Code

Oracle SQL Developer for VS code is available for all major platforms.

Perform the following steps to install Oracle SQL Developer for VS Code:



After installing it the first time, the SQL Developer extension for VS Code is automatically updated as new versions become available.

- 1. Click the **Extensions** icon in the Activity Bar on the left side or use the **View**: **Extensions** command (Ctrl+Shift+X).
- 2. In the Extensions pane, in the Search field, enter **SQL Developer**.
  - SQL Developer appears as one of the search results.
- 3. In the result entry, click Install.
  - SQL Developer appears in the left pane under INSTALLED along with a SQL Developer icon in the left side bar.
- Click the icon to open SQL Developer. In the left pane, Connections and SQL Snippets appear.



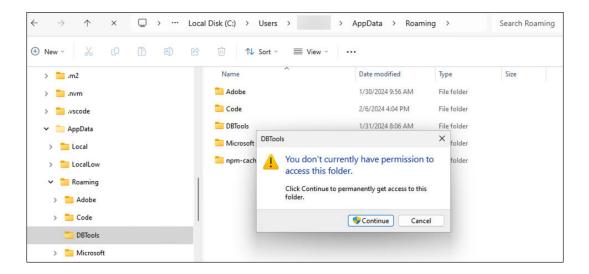
## 2.1.1 File Permissions for User Accounts in Windows Domain

If there are both local and domain accounts for a user in Windows, the directory is assigned to the local account, creating inaccessible secure storage for the domain account. That is, a DBTools directory owned by the local user is created in the domain user's AppData\Roaming location.

To resolve this issue:

- Uninstall SQL Developer for VS Code release 23.4.0.
- 2. Remove the DBTools directory.

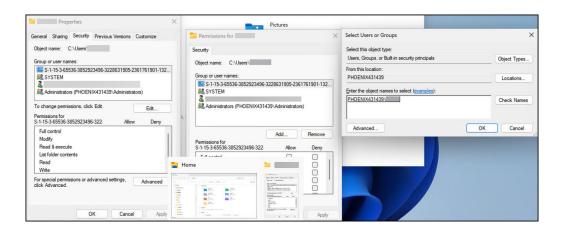
As the domain user, if you try to open <domain-user>/AppData/Roaming/DBTools, you will get an error message.



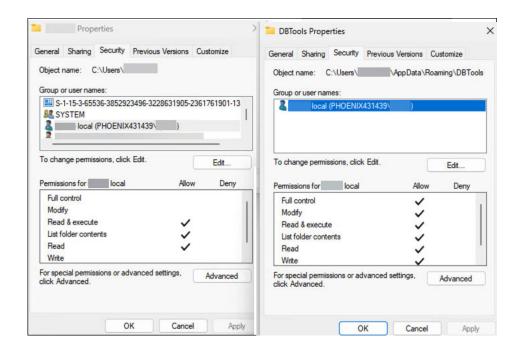
To resolve this, do one of the following:



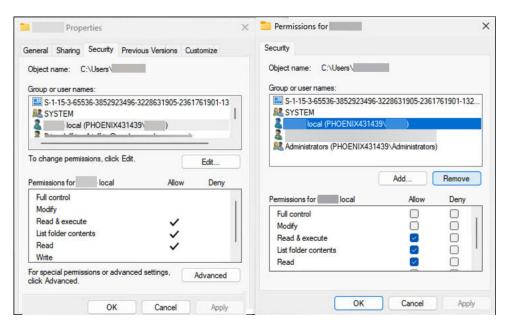
- If you are also an administrator, you are prompted for access, then you can delete the directory before installing a new version.
- If you are not an administrator, contact an administrator who can help to delete the directory.
- If you know both local and domain passwords, provide local account access to your domain user directory.



Ignore any errors as the focus is on the path to AppData\Roaming\DBTools. Permissions are as shown in the following figure:



Log in as domain user and remove local account access to the domain account home directory.



3. Install SQL Developer for VS Code release 23.4.1.

## 2.2 Connecting to Your Database

A connection is a SQL Developer object that specifies the necessary information for connecting to a specific database as a specific user of that database. You must have at least one database connection (existing or created) to use SQL Developer for VS Code.

You can connect to any target Oracle database schema using standard Oracle database authentication. Once connected, you can perform operations on objects in the database.

The actions that you can perform for connections are:

- Add: To create a new connection. Click the Add icon next to Connections, enter the
  connection information and click Connect. For more information, see Creating a
  Connection.
- Edit: To edit an existing connection. In the Connections panel, right-click the connection name and select Edit. Change any connection information except the connection name, and click Save or Connect.
- Clone: To create a new connection when one or more connections already exist. In the
  Connections panel, select an existing connection, right-click and click Clone. Change the
  Connection name to the desired name, edit other connection information as needed, and
  click Save or Connect to create the new connection.
- **Refresh**: To update the connection to include any changes that were made. Click the Refresh icon next to the connection name to refresh the connection.
- Open SQL Worksheet: To open a SQL Worksheet pane for the connection. Right-click the connection name, and select Open SQL Worksheet. See Using the SQL Worksheet
- Open SQLcI: To start the SQLcI command line in the Terminal tab for the opened database connection. Right-click the connection name, and select Open SQLcI.
- Reconnect: To reconnect to a connection where the session has been terminated. Rightclick the name in the Connections panel, and select Reconnect.
- Disconnect: To disconnect from the current connection. Right-click the name in the Connections panel, and select Disconnect.

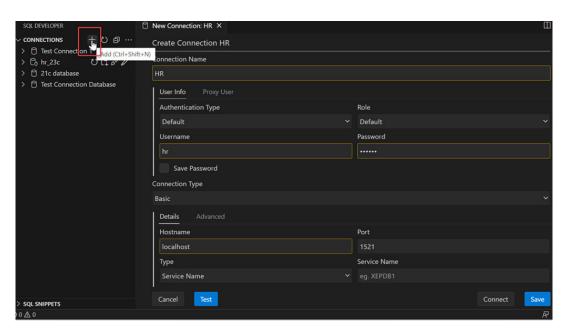
Delete: To delete a connection (that is, delete it from SQL Developer, not merely
disconnect from the current connection), right-click the connection name in the
Connections panel display and select Delete. Deleting a connection does not delete the
user associated with that connection.

## 2.2.1 Creating a Connection

Perform the following steps to create a new connection:

1. In the Connections panel, click the **Add** icon.

The Create Connection pane appears.



2. Enter the fields as follows:

**Connection Name**: An alias for a connection to the database using the information that you enter. (The connection name is not stored in the database, and the connection is not a database object.) Suggestion: Include the database name (SID) and user name in the connection name. Example: personnel\_joe for connecting to the personnel database as user Joe.

#### **User Info** Tab

- Role: The set of privileges to be associated with the connection. For a user that has been granted the SYSDBA system privilege, you can specify a connection that includes the privilege.
- **Username**: Name of the database user for the connection. This user must have sufficient privileges to perform the tasks that you want to perform while connected to the database, such as creating, editing, and deleting tables, views, and other objects.
- Password: Password associated with the specified database user.
- **Save Password**: If this option is checked, the password is saved with the connection information, and you will not be prompted for the password on subsequent attempts to connect using this connection.
- **Connection Type**: Select Basic, TNS, Cloud Wallet, or Custom JDBC URL. The display of fields changes to reflect any change in connection type. For any Oracle

connection type, there is an **Advanced** tab that you can use to set custom JDBC properties.

#### Basic Connection Type

- \* **Hostname**: Host system for the Oracle database.
- Port: Listener port.
- \* Type: Database name.
- \* **Service Name**: Network service name of the database (for a remote database connection over a secure connection).

#### TNS Connection Type

- \* **Network Alias**: Oracle Net alias for the database.
- \* TNS File Location: Displays the directory where your TNSNAMES.ORA file is located. Click the **Edit in Settings** link to add or change the location.
- \* Connect Identifier: Oracle Net connect identifier.

#### Cloud Wallet Connection Type

This connection type is relevant for Oracle Cloud connections that use Oracle Wallet.

- Configuration File: Client credentials zip file downloaded from the Cloud service console.
- \* **Service**: Service name in the client credentials file. This field is automatically prefilled after the client credential file is selected.
- \* Proxy tab: Cloud Wallet connections support a custom proxy.

#### Custom JDBC Connection Type

\* Custom JDBC URL: URL for connecting directly from Java to the database, it overrides any other connection type specification. If you are using TNS or a naming service with the OCI driver, you must specify this information: Example:

```
jdbc:oracle:thin:scott/@localhost:1521:orcl
```

Note that in this example, the "/" is required, and the user will be prompted to enter the password.

- 3. Click **Test** to test the database connection before opening it.
- 4. Click **Save** to save the connection details, or click **Connect** to open the connection.



## Using SQL Developer for VS Code

This chapter covers the following topics:

#### Topics:

- Working with Database Objects
- Working with JSON-Relational Duality Views
- · Managing JavaScript Modules
- Managing MLE Environments
- Entering and Modifying Data
- · Using the SQL Worksheet
- Running Functions and Procedures
- Debugging PL/SQL Objects
- Using Folders to Organize Connections
- Using Filters
- Using Preferences

## 3.1 Working with Database Objects

The SQL Developer for VS code interface uses the left side for navigation to find and select objects, and the right side to display information about selected objects.

In the Connections panel, you can browse, edit and delete objects.

To search for an object within an object type, for example, a specific table, click **Tables** and type the name of the object. Even as you type, objects matching the letters entered are highlighted.

Click a database object to open it in the right panel. A tabular display of the object's properties are displayed. In the following figure, click the SQL tab to see the corresponding SQL source code for the COUNTRIES table.

```
U 12 60 0
✓ 급 Tables
 > 囲 COUNTRIES
 > 囯 DEPARTMENTS
                                                                                                                                                            00
                                          1 CREATE TABLE "HR"."COUNTRIES"
 > III EMPLOYEES
                                                       "COUNTRY_ID" CHAR(2) CONSTRAINT "COUNTRY_ID_NN" NOT NULL ENABLE,
                                                ( "COUNTRY_ID" CHAR(2)
"COUNTRY_NAME" VARCHAR2(40),
 > III JOBS
 > III JOB_HISTORY
                                                 "REGION_ID" NUMBER,
 > III LOCATIONS
                                                  CONSTRAINT "COUNTRY_C_ID_PK" PRIMARY KEY ("COUNTRY_ID") ENABLE,
 > III REGIONS
                                                 CONSTRAINT "COUNTR_REG_FK" FOREIGN KEY ("REGION_ID")

✓ □ Views

                                                    REFERENCES "HR". "REGIONS" ("REGION_ID") ENABLE
 > \( \exists \) EMP_DETAILS_VIEW
                                                ) SEGMENT CREATION IMMEDIATE
                                               ORGANIZATION INDEX NOCOMPRESS PCTFREE 10 INITRANS 2 MAXTRANS 255 LOGGING
> 🖟 Indexes
                                               STORAGE (INITIAL 65536 NEXT 1048576 MINEXTENTS 1 MAXEXTENTS 2147483645
> 🗟 Packages
                                               PCTINCREASE 0 FREELISTS 1 FREELIST GROUPS 1
> En Procedures
                                               BUFFER_POOL DEFAULT FLASH_CACHE DEFAULT CELL_FLASH_CACHE DEFAULT)
TABLESPACE "USERS"
> F Functions
> 譚 Operators
                                             PCTTHRESHOLD 50;
> 🗟 Queues
                                                COMMENT ON COLUMN "HR"."COUNTRIES"."COUNTRY_ID" IS 'Primary key of countries table.';
COMMENT ON COLUMN "HR"."COUNTRIES"."COUNTRY_NAME" IS 'Country name';
COMMENT ON COLUMN "HR"."COUNTRIES"."REGION_ID" IS 'Region ID for the country. Foreign key to r
  R Queues Tables
  Triggers
  Types Types
                                                COMMENT ON TABLE "HR". "COUNTRIES" IS
```

The object types available are:

- Tables
- Views
- Duality Views
- Indexes
- Functions
- Procedures
- Packages
- Triggers
- Types
- Sequences
- · Synonyms (Public and Private)
- Other Users

### 3.1.1 Tables

You can perform the following operations on a table by right-clicking the table name in the Connections navigator and selecting an item from the menu:

- Open: Opens the table in the right panel.
- Table: Table actions include Rename, Copy (create a copy using a different name), Drop (delete the table), Truncate (delete existing data without affecting the table definition), Lock (set the table lock mode: row share, exclusive, and so on), Comment (descriptive comment explaining the use or purpose of the table), Parallel (change the default degree of parallelism for queries and DML on the table), No Parallel (specify serial execution), Count Rows (return the number of rows), and Generate Table API (generate statements for a PL/SQL procedure to perform operations on the table).
- **Column**: Column actions include Comment (descriptive comment about a column), Add, Drop, Rename and Normalize.

- Index: Options include Create (create an index on specified columns), Create Text (create an Oracle Text index on a column), Create Text (create a function-based index on a column), and Drop.
- **Constraint**: Options include Enable or Disable Single, Drop (delete a constraint), Add Check (add a check constraint), Add Foreign Key, and Add Unique.
- Statistics: Options include Gather Statistics (compute exact table and column statistics
  and store them in the data dictionary) and Validate Structure (verifies the integrity of each
  data block and row, and for an index-organized table also generates the optimal prefix
  compression count for the primary key index on the table). Statistics are used by the
  Oracle Database optimizer to choose the execution plan for SQL statements that access
  analyzed objects.
- Storage: Options include Shrink Table (shrink space in a table, for segments in tablespaces with automatic segment management) and Move Table (to another tablespace). The Shrink Table options include Compact (only defragments the segment space and compacts the table rows for subsequent release, but does not readjust the high water mark and does not release the space immediately) and Cascade (performs the same operations on all dependent objects of the table, including secondary indexes on indexorganized tables).
- Trigger: Options include Create, Create PK from Sequence (create a before-insert trigger
  to populate the primary key using values from a specified sequence), Enable or Disable
  All, Enable or Disable Single, and Drop (delete the trigger).

You can perform the following operations on a column in a table by right-clicking the column name in the Connections navigator and selecting an item from the menu:

- Rename: Renames the column.
- Drop: Deletes the column (including all data in that column) from the table.
- Comment: Adds a descriptive comment about the column.
- **Encrypt** (for Oracle Database Release 10.2 and higher, and only if the Transparent Data Encryption feature is enabled for the database): Displays a dialog box in which you specify a supported encryption algorithm to be used for encrypting all data in the column. Current data and subsequently inserted data are encrypted.
- **Decrypt** (for Oracle Database Release 10.2 and higher, and only if the Transparent Data Encryption feature is enabled for the database): Decrypts data in the column that had been encrypted, and causes data that is subsequently inserted not to be encrypted.
- Normalize: Creates a new table using the distinct values in the specified column. You
  must specify names for the new table and its primary key column, as well as a sequence
  name and trigger name.

## 3.1.2 Views

You can perform the following operations on a view by right-clicking the view name in the Connections panel and selecting an item from the menu:

- Open: Opens the view in the right pane.
- Rename: Renames the view.
- Drop: Deletes the view.
- **Compile**: Recompiles the view, to enable you to locate possible errors before runtime. You may want to recompile a view after altering one of its base tables to ensure that the change does not affect the view or other objects that depend on it.



To create a view:

- 1. Right-click the Views node and select Create (simple).
- 2. Enter View Name and SQL Query.
- Click Apply.

## 3.1.3 Duality Views

See Working with JSON-Relational Duality Views

#### 3.1.4 Indexes

You can perform the following operations on an index by right-clicking the index name in the Connections navigator and selecting an item from the menu:

- Open: Opens the index in the right pane.
- Drop: Deletes the index.
- Rebuild: Recreates the index or one of its partitions or subpartitions. If the index is
  unusable, a successful rebuild operation makes the index usable. For a function-based
  index, rebuilding also enables the index; however, if the function on which the index is
  based does not exist, the rebuild operation fails.
- Rename: Changes the name of the index.
- **Make Unusable**: Prevents the index from being used by Oracle in executing queries. An unusable index must be rebuilt, or dropped and re-created, before it can be used again.
- Coalesce: Merges the contents of index blocks, where possible, to free blocks for reuse.
- Compute Statistics: For a function-based index, collects statistics on both the index and
  its base table using the DBMS\_STATS package. Such statistics will enable Oracle
  Database to correctly decide when to use the index.
- Rebuild Index Partition: Rebuilds a specified index partition.
- Drop Index Partition: Drops (deletes) a specified index partition.

## 3.1.5 Packages

You can perform the following operations on a package by right-clicking the package name in the Connections navigator and selecting an item from the menu:

- Open: Opens the package in the right pane.
- Run: Lets you select a member in the package and run it.
- Drop Package: Deletes the package.

## 3.1.6 Procedures

You can perform the following operations on a procedure by right-clicking the procedure name in the Connections navigator and selecting an item from the menu:

Open: Displays the procedure text so that you can view and edit it.



- **Run**: Displays the PL/SQL dialog box, and then executes the procedure.
- Drop: Deletes the procedure.

#### 3.1.7 Functions

You can perform the following operations on a function by right-clicking the function name in the Connections navigator and selecting an item from the menu:

- Open: Opens the function in the right pane.
- Drop: Deletes the function.
- Grant: Enables you to grant available privileges on the function to selected users.
- Revoke: Enables you to revoke available privileges on the function from selected users.

#### 3.1.8 MLE Environments

See Managing MLE Environments

## 3.1.9 JavaScript Modules

See Managing JavaScript Modules

## 3.1.10 Triggers

Triggers are stored PL/SQL blocks associated with a table, a schema, or the database, or anonymous PL/SQL blocks or calls to a procedure implemented in PL/SQL or Java. Oracle Database automatically executes a trigger when specified conditions occur.

See Oracle Database 2 Day Developer's Guide

## 3.1.11 Types

A data type associates a fixed set of properties with the values that can be used in a column of a table or in an argument of a function or procedure. These properties cause Oracle Database to treat values of one data type differently from values of another data type. Most data types are supplied by Oracle, although users can create data types.

See Oracle Database Concepts

## 3.1.12 Sequences

Sequences are used to generate unique integers. You can use sequences to automatically generate primary key values.

See Oracle Database 2 Day Developer's Guide

## 3.1.13 Synonyms (Public and Private)



Synonyms provide alternative names for tables, views, sequences, procedures, stored functions, packages, materialized views, Java class database objects, user-defined object types, or other synonyms. The Connections navigator has a Synonyms node for all synonyms (public and private) owned by the user associated with the specified connection, and a Public Synonyms node for all public synonyms on the database associated with the connection.

See Oracle Database 2 Day Developer's Guide

#### 3.1.14 Other Users

Database users are accounts through which you can log in to the database. In the Connections navigator, you can see the Other Users in the database associated with a connection, but the objects that you are allowed to see for each user are determined by the privileges of the database user associated with the current database connection.

## 3.2 Working with JSON-Relational Duality Views

A JSON-relational duality view exposes data stored in relational database tables as JSON documents. These documents are generated on demand. Duality views organize your data both relationally and hierarchically. This means that applications can access (create, query, modify) the same data as a set of JSON documents or as a set of related tables and columns, and both approaches can be employed at the same time.

For more information about JSON- Relational Duality Views, see *Oracle® Database JSON-Relational Duality Developer's Guide*.

In the SQL Developer extension for VS Code, Duality View is treated as an object type and is available as a separate node in the Connections panel. The tasks that you can perform are:

- Create a duality view using the Duality View Builder.
- Edit a duality view.
- Insert a data record in a duality view.
- Edit a data record in a duality view.
- Display the JSON Data Guide Diagram for a duality view.

## 3.2.1 Create a Duality View

You can use the Duality View Builder to create a duality view.



The tables used to define a duality view must satisfy certain requirements. If these requirements are not met, an error is raised when you try to create the view.

Also, see Restrictions for JSON-Relational Duality Views.

 In the Connections panel, right-click the Duality Views node and select Duality View Builder.



The Duality View Builder interface appears. It consists of three parts: the diagram panel, the preview panel, and the definition panel. Enter a name for the duality view in the **Name** field on top, and click **Save to File** to save and continue working at a later time.

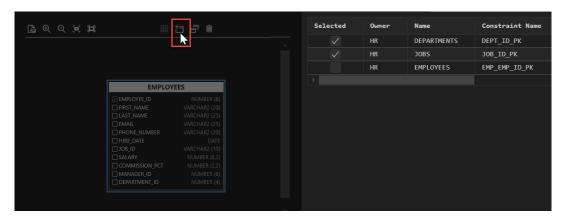
#### **Diagram Panel**

2. From the toolbar, select **Add Root Table**. In the following figure, the table Employees is selected.



- In the Select Root Table pane, select the checkbox for the root table that you want, and click Apply.
  - The selected table appears in the diagram pane. You can zoom in and zoom out and export to SVG format using the icons in the toolbar.
- 4. You can now select Parent and Child Tables. Select the table in the diagram (when selected, a blue border appears around the table) and from the toolbar, and select Add Parent Table(s). Following this, if you want to add child tables, select the parent table and select Add Child Table(s) from the toolbar.

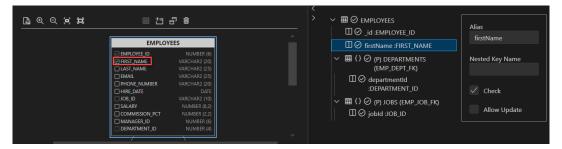
In the following figure, Departments and Jobs are selected as parent tables.



#### **Preview Panel**

- 5. You can select additional columns for the table by selecting the appropriate checkbox in the diagram panel. As you select, these changes instantly appear in the preview panel. Select an object in the preview panel to set additional properties such as Alias, Nested Key Name, Allow Update, Allow Insert, Allow Delete, Check, and Filter.
  - In the following figure, the First\_Name column is selected in the diagram panel and it immediately appears in the preview panel. Select First\_Name in the preview panel to set additional properties such as Nested Key Name, Check and Allow Update.





#### **Definition Panel**

- In the Definition tab, the duality view definition is automatically generated as a SQL Statement.
- 7. To test the SELECT statement, select the **Test Query** tab and click the **Run Query** icon.

```
Test Query
                                                                                 D
                                                                                     0
1 ∨ SELECT JSON {
            '_id' : e.EMPLOYEE_ID,
            'departments':
3 ~
4 🗸
                    'departmentId' : d.DEPARTMENT ID
                FROM DEPARTMENTS d
                 WHERE d.DEPARTMENT ID = e.DEPARTMENT ID
                ( SELECT JSON {
                     'jobId' : j.JOB_ID
                FROM JOBS j
                 WHERE j.JOB_ID = e.JOB_ID
        } AS dv data
```

The output is displayed below the defintion panel.

#### **Create Duality View**

8. After confirming the output, you can create the duality view. In the top right corner, click Create Duality View.

To view the newly created duality view, refresh the Connections panel and expand the Duality View node. Click the duality view name to open it in the right panel.

## 3.2.2 Edit a Duality View

You can use the Duality View Builder to edit a duality view.

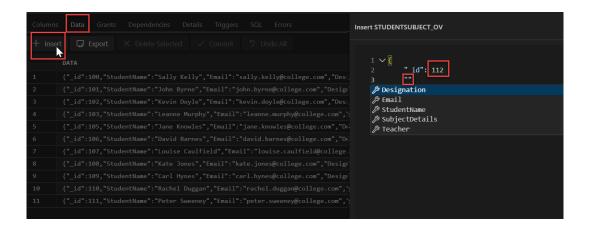
- In the Connections panel, expand the **Duality Views** node, right-click the name of the duality view to edit, and select **Edit**.
  - The duality view appears in the Duality View Builder interface.
- Some of the changes that you can make to the duality view are add or delete tables in the diagram panel, and add columns or set additional properties for objects in the preview panel.

For more information about how to make these changes, see Create a Duality View.

## 3.2.3 Insert a Data Record in a Duality View

This section covers the steps to insert a data record in a duality view.

- In the Connections panel, expand the **Duality Views** node, and then click the duality view name to open it in the right panel.
- 2. Select the **Data** tab.
- Click Insert.
- 4. In the Insert panel, enter the value for the first property. Press the Enter key to move to the next line. When you enter quotation marks, the available properties that you can choose from are displayed in a list.



If you add any new property that is not part of the schema, an error notification is displayed.

After you complete entering all the details, click **Save**.

5. Click **Commit** to commit the changes to the database.

## 3.2.4 Edit a Data Record in a Duality View

This section covers the steps to edit a data record in a duality view.

- 1. In the Connections panel, expand the **Duality Views** node, and then click the duality view name to open it in the right panel.
- 2. Select the **Data** tab.
- Position the cursor on the row that you want to edit, right-click and select Single Record View.

Alternatively, click the **Edit** icon at the end of the row that you want to edit.

4. In the Single Record View panel, click and type to complete the required changes.



```
DATA

("_id":100,"StudentName": "Sally Kelly","Email": "sally.kelly@college.com","Designation": "yr1",

("_id":103,"StudentName": "Leanne Murphy","Email": "kevin.doyle@college.com","Designation": "yr2",

("_id":105,"StudentName": "Leanne Murphy","Email": "leanne.murphy@college.com", "Designation": "yr2",

("_id":105,"StudentName": "Janne Knowles", "Email": "john.knowles@college.com", "Designation": "yr2",

("_id":105,"StudentName": "Janne Knowles", "Email": "david.bannes@college.com", "Designation": "yr2",

("_id":107,"StudentName": "John Byrne_",

("_id":108,"StudentName": "Bou'd Barnes", "Email": "david.bannes@college.com", "Designation": "yr2",

("_id":108,"StudentName": "Kate Jones", "Email": "kate.jones@college.com", "Designation": "yr2",

("_id":109,"StudentName": "Carl Hynes", "Email": "kate.jones@college.com", "Designation": "yr2",

("_id":109,"StudentName": "Carl Hynes", "Email": "rarl.hynes@college.com", "Designation": "yr2",

("_id":110,"StudentName": "Peter Sueeney", "Email": "peter.sweeney@college.com", "Designation": "yr2",

("_id":111,"StudentName": "Peter Sueeney", "Email": "peter.sweeney@college.com", "Designation": "yr2",

("_id":101,"Id":101,"StudentName": "Peter Sueeney", "Em
```

To move to another record, you can use the **move to next row** or **move to previous row** icons.

#### Note:

When using the Single Record View option for a table with a column of JSON data type, note the following:

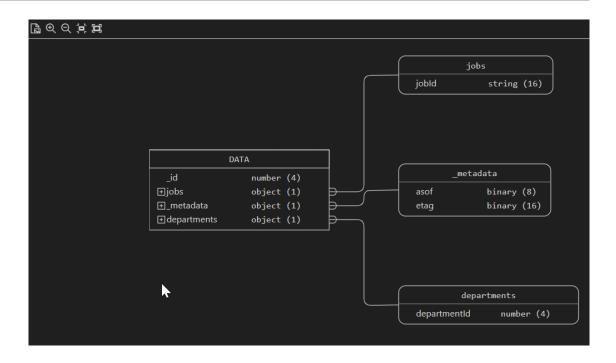
- In a duality view, the metadata-related fields (such as etag, asof) are not available for editing.
- For a regular table that has a column of JSON data type, this restriction does not hold and all the fields can be edited.
- If the result of a SELECT statement in the worksheet is a duality view table or a table with a JSON data type column, then the table remains read-only and cannot be edited.
- 5. After you have completed all your changes, click Save.
  - A star symbol (\*) appears next to the row number. This indicates that the changes to the row have not yet been committed to the database.
- 6. Click **Commit** to commit the changes to the database.

## 3.2.5 Display the JSON Data Guide Diagram for a Duality View

The JSON data guide diagram represents the JSON schema for a duality view.

In the Connections panel, expand the **Duality Views** node, right-click the name of the duality view to edit, and select **Show JSON Data Guide** to display the diagram.

The following figure displays the JSON data guide diagram for the  $\texttt{EMP\_DV}$  duality view that was created in Create a Duality View.



## 3.3 Managing JavaScript Modules

The SQL Developer extension for VS Code enables you to access and manage MLE (Multilingual Engine) objects such as MLE modules.

For more information about MLE, see Introduction to Oracle Database Multilingual Engine in the Oracle Database JavaScript Developer's Guide.

SQL Developer for VS Code allows the creation of JavaScript modules as schema objects, assuming the necessary privileges are in place. JavaScript module is a unit of MLE's language code stored in the database as a schema object. You can create, edit and delete JavaScript modules.

The actions available are:

- Create a JavaScript module
- Open a JavaScript module
- Show JavaScript module details
- Compile a JavaScript module
- Drop a JavaScript module

## 3.3.1 Create a JavaScript Module

To create a JavaScript module:

 In the Connections panel, click the + icon or right-click JavaScript Modules and then click Create.

The **Create** panel appears.

2. In the MLE Module Name field, enter a name for the module.

The SQL pane displays the DDL code for the JavaScript module.



3. Click Apply.

The module is saved and appears in the Connections panel under JavaScript Modules.

## 3.3.1.1 Example for Create a JavaScript Module

This example demonstrates the creation of the **factorial\_mod** JavaScript module.

- In the Connections panel, click the + icon in the JavaScript Modules node and then click Create.
- In the MLE Module Name field, enter factorial\_mod.
- Click Apply.

The module appears under **JavaScript Modules** in the Connections panel.

4. In the Connections panel, expand JavaScript Modules, right-click **factorial\_mod** and select **Open**.

The factorial\_mod module pane appears.

**5.** Enter the following JavaScript function:

```
export function factorial(num) {
   if(num < 0) {
      return -1;
   } else if (num == 0) {
      return 1;
   } else {
      return(num * factorial(num-1));
   }
}</pre>
```

**6.** Click the **Compile** icon to save the JavaScript code.



Alternatively, you can save the code by using ctr + s or cmd + s.

To import a module to an MLE environment, see Example for Create an MLE Environment.

## 3.3.2 Open a JavaScript Module

To open a JavaScript module:

1. In the Connections panel, select the module name under JavaScript Modules, or right-click the module name and click **Open**.

If the module is newly created using the Create action in the context menu, the module's content is //add you code here.

You can add code or modify the existing code in the module. If the code has any syntax errors, the errors are underlined and the file's name turns to red. Also, the syntax errors appear in the Problems panel.

Click the Compile icon to save the code to the database.

After compiling the module, the result is displayed in the Script Output panel. If the execution finishes with errors, these appear in the Problems panel.

## 3.3.3 Show JavaScript Module Details

To show details about a selected module, after opening the module, click the **Show Details Panel** icon, which is located right next to the Compile icon.

The Details panel has three tabs: Privileges, Details and Errors.

If there are any errors in the saved module, the line and position column displays the line, position as a link that takes the cursor to the exact location of the syntax error in the module's file.

You can hide the Details panel by clicking the Hide Details Panel icon.

## 3.3.4 Compile JavaScript Module

To compile a selected JavaScript module:

- In the Connections panel, select the module to compile, right-click and select Compile.
   The Compile panel appears.
- 2. Click Apply.

To compile all MLE modules for the connection, right-click **JavaScript Modules** and select **Compile All**.

To compile all invalid modules for the connection, right-click **JavaScript Modules** and select **Compile All Invalid**.

## 3.3.5 Delete a JavaScript Module

In the Connections panel, select the module to delete, right-click and select **Drop**. The Drop panel appears. Click **Apply**.

## 3.4 Managing MLE Environments

MLE environments are schema objects that can be managed in the database. In the SQL Developer extension for VS Code, you can create, edit and delete MLE environments.

For more information about MLE, see Introduction to Oracle Database Multilingual Engine in the Oracle Database JavaScript Developer's Guide.

The actions available to you are:

- Create an MLE environment
- · Add imports to an MLE environment
- Compile one or all MLE environments
- Delete an MLE environment



#### 3.4.1 Create an MLE Environment

To create an MLE environment:

 In the Connections panel, for a specific connection, click the + icon in the MLE Environments node and then click Create.

The **Create** pane appears.

In the MLE Environment Name field, enter a name for the environment.

The SQL pane displays the DDL code for the new MLE environment.

3. Click Apply.

An empty MLE environment is created and appears in the Connections panel under **MLE Environments**.

## 3.4.1.1 Example for Create an MLE Environment

This example demonstrates the creation of **myfactorialenv** MLE environment and how to import the **factorial\_mod** JavaScript module into this environment.

1. In the Connections panel, right-click **MLE Environments** and then click **Create**.

The Create panel appears.

2. In the MLE Environment Name field, enter a name for the environment, myfactorialenv.

The SQL pane displays the DDL code for the new MLE environment.

Click Apply.

An empty myfactorialenv environment is created and appears in the left pane under **MLE Environments**.

4. In the Connections panel, expand MLE Environments, right-click **myfactorialenv** and click **Add Imports**.

The **Add Imports** pane appears.

- 5. In **Module Name** field, select the module (**factorial mod**) to import.
- 6. In **Import Name** field, enter a name for your import.
- Click Apply.

To view the imported module, in the Connections panel, right click **myfactorialenv** and select **Open**. Three tabs are displayed for the MLE environment: Errors, Grants and SQL.

The imported module appears in the **Imports** panel.

## 3.4.2 Import a Module to an MLE Environment

To import a module for a selected MLE environment:

- In the Connections panel, right-click the MLE environment name and select Add Imports.
   The Add Imports panel appears.
- 2. In the **Module Name** field, a list of the modules that you have created or have been granted access to appears in the list. Select a module from the list.



- 3. Enter an Import Name for the module.
- 4. Click Apply.

## 3.4.3 Compile an MLE Environment

To compile an MLE environment, in the Connections panel, right-click the selected environment name and select **Compile**.

To compile all MLE environments for a connection, in the Connections panel, right-click **MLE environments** and select **Compile All**.

To compile all invalid MLE environments, in the Connections panel, right-click **MLE environments** and select **Compile All Invalid**.

#### 3.4.4 Delete an MLE Environment

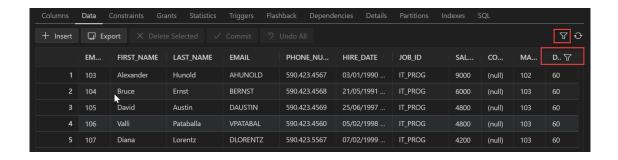
To delete an MLE environment:

- In the Connections panel, right-click the selected MLE environment and select Drop.
   The Drop panel appears.
- 2. Click Apply.

## 3.5 Entering and Modifying Data

You can enter data into tables and views and also edit and delete existing data. To do any of these operations, select the object in the Connections panel, and then click the Data tab in the table detail display. If you click one of the other tabs, Columns, Constraints, Grants, Statistics, Triggers, and so on, you can view the information and perform relevant context menu (right-click) operations.

The following figure shows the Data pane for a table named EMPLOYEES, with a filter applied to show only those employees whose department\_id is 60. A filter icon appears next to the department\_id column name in the table.

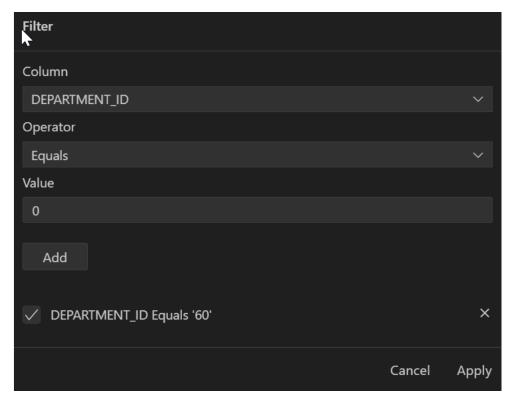


The Data tab provides the following options:

- Insert adds an empty row at the beginning of the table, for you to enter new data.
- Export enables you to export some or all of the table data to a file or to the system clipboard, in any of the following formats: XML (XML tags and data), CSV (commaseparated values including a header row for column identifiers), SQL Insert (INSERT



- statements), or SQL Loader (SQL\*Loader control file). After you select a format, the Database Export (Unload Database Objects and Data) wizard is displayed.
- Delete Selected marks the selected rows for deletion. The actual deletion does not occur until you commit changes.
- Commit ends the current transaction and makes permanent all changes performed in the transaction.
- Undo All reverts back to the previous state before any changes were made in the current transaction.
- Filter icon enables you to add a filter to limit the display of data. Enter the column name, operator and value, and click Add. The filter is added below. Add more filters if needed. Click Apply to apply the filters.



• **Refresh** icon queries the database to update the data display. If a filter is specified, the refresh operation uses the filter.

In the data grid, the context menu (right-click) includes the following commands:

- Single Record View displays the Single Record View dialog box, which enables you to
  edit data for a table or view, one record at a time.
- Count Rows displays the number of rows in the table.
- Export enables you to export some or all of the table data to a file or to the system clipboard, in any of the following formats: XML (XML tags and data), CSV (commaseparated values including a header row for column identifiers), SQL Insert (INSERT statements), or SQL Loader (SQL\*Loader control file). After you select a format, the Database Export (Unload Database Objects and Data) wizard is displayed.

When you right-click a column name, the context menu commands are:

 Auto-fit All Columns adjusts the width of all columns according to your specification (by column header, by column data, or best fit).



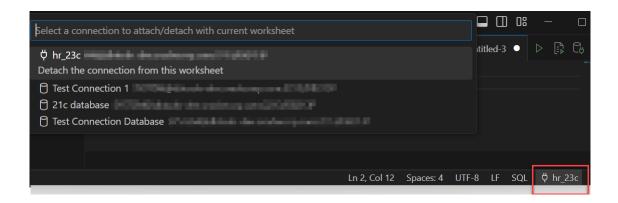
- Auto-fit Selected Columns adjusts the width of the selected columns according to your specification (by column header, by column data, or best fit).
- Columns enables you to reorder, hide or show columns.
- Sort enables you to sort columns in ascending or descending order.

## 3.6 Using the SQL Worksheet

You can use the SQL Worksheet to enter and execute SQL, PL/SQL, and SQLcl statements. You can specify any action that can be processed by the database connection associated with the worksheet, such as creating a table, inserting data, creating and editing a trigger, selecting data from a table, and saving that data to a file.

You can display a SQL Worksheet by right-clicking a connection name in the Connections panel and selecting **Open SQL Worksheet**.

When SQL Worksheet is open and if you also have existing SQL files open, you can attach a connection by clicking the connection icon in the lower right corner. Once a connection is associated with your editor or file, you see the name of your connection displayed in the lower right corner.

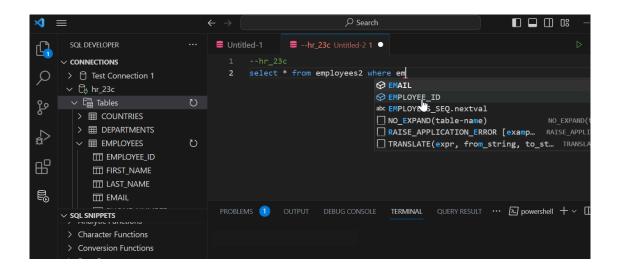


In the editor, you can enter one or more SQL or statements that you intend to execute. For multiple statements, each non-PL/SQL statement must be terminated with either a semicolon or (on a new line) a slash (/), and each PL/SQL statement must be terminated with a slash (/) on a new line. SQL keywords are automatically highlighted.

You can drag some kinds of objects such as tables or views from the Connections navigator and drop them into the editor pane. When you do this, the following options appear: Object Name, Select, Insert, Delete, Update. If you select SELECT, a SELECT statement is constructed with all columns in the table or view. You can then edit the statement, for example, modifying the column list or adding a WHERE clause.

When you press **Ctrl+Space**, a context-sensitive popup window appears. This provides you with a list of possible completions at the insertion point that you can use to autocomplete code that you are editing. This list is based on the code context at the insertion point. To exit at any time, press **Esc** or continue typing.





SQL Worksheet has the following icons at the top right corner:

- Run Statement (Ctrl+Enter) executes the statement at the mouse pointer in the SQL Worksheet. The SQL statements can include bind variables and substitution variables of type VARCHAR2. A pop-up box is displayed for entering variable values. The output is displayed under the Query Result tab in the lower pane.
- Run Script (F5) executes all statements in the SQL Worksheet using the Script Runner.
  The SQL statements can include substitution variables (but not bind variables) of type
  VARCHAR2. A pop-up box is displayed for entering substitution variable values. The
  output is displayed under the Script Output tab in the lower pane.
- Run in SQLcl (Ctrl+Shift+Enter) executes the statement or script by opening a SQLcl command line session and displaying the output.
- Explain Plan (F10) generates the execution plan for the statement (internally executing the EXPLAIN PLAN statement). The results appear under the Explain tab in the lower pane.
- Attach/Detach Connection attaches a new connection or detaches the existing connection from the current worksheet.
- Commit Changes (F11) commits the changes made to the database.
- Rollback Changes (F12) rolls back the changes made to the database.

## 3.6.1 SQLcl Commands Supported in the SQL Worksheet

The SQL Worksheet supports SQLcl commands. SQLcl commands must be interpreted by the SQL Worksheet before being passed to the database. Any commands that are not supported by the SQL Worksheet are ignored and not passed to the database.

For information about SQLcl commands, you can enter the help command. For information about a specific command or topic, include it as the parameter (for example, help @, help exit, or help reserved words). If the command is not supported, or if there are restrictions or usage notes, the help display includes this information.

## 3.6.2 Connection Management



Starting with release 24.1.1, opening a new SQL Worksheet creates a new, dedicated connection to the database. This means that long-running queries in your SQL Worksheet do not block other database requests.

You can control this behaviour using the Session per attached worksheet setting in Preferences.

- 1. From the File menu, go to Preferences and then select Settings from the sub-menu.
- Under User, expand Extensions and then expand Oracle SQL Developer Extension for VS Code.
- 3. In the right panel, under **Database Connections**, in the **Session per attached worksheet** field, select **off** from the drop-down list to remove this setting.

The default setting is on.

## 3.6.3 Script Runner

With Script Runner, you have access to commands such as @, @@, CONNECT, EXIT, QUIT, UNDEFINE, WHENEVER, and substitution variables. For example, to run a script named c:\myscripts\mytest.sql, type @c:\myscripts\mytest in the editor, and select the Run Script icon.

The following considerations apply to using the script runner:

- You cannot use bind variables. (However, you can use bind variables of type VARCHAR2, NUMBER, and DATE.)
- For substitution variables, the syntax &&variable assigns a permanent variable value, and the syntax &variable assigns a temporary (not stored) variable value.
- For EXIT and QUIT, commit is the default behavior, but you can specify rollback. In either
  case, the context is reset, for example, WHENEVER command information and
  substitution variable values are cleared.
- DESCRIBE works for most, but not all object types.

## 3.6.4 Explain Plan

The Execute Explain Plan icon generates the execution plan, which you can see by clicking the Explain Plan tab. The execution plan is the sequence of operations that will be performed to execute the statement.

The Explain Plain diagram view is a graphical representation of the contents of PLAN\_TABLE, which is the default table for the results of the EXPLAIN PLAN statement.

By default, three levels of steps are visible in the diagram. You can use the +/- signs at the bottom of each step (available when the step has children) to expand or collapse. To view all

steps in the diagram, use Expand All in the toolbar.

The diagram also provides the following details:

- Cardinality (number on the arrow to the parent step), which is the number of rows processed
- Operation and options applied in that step
- Execution order, which is the sequential number in the order of execution
- Access predicates CPU cost in percentage (orange bar)



- Total CPU cost for the step in percentage (blue circle)
- Estimated I/O Cost, Bytes processed and Cost metrics



You see a brief description pop-up when you hover over any of the statistics in a step.

The icons in the toolbar are:

- Text View: Displays the execution steps in a plain text format.
  - For the Text View, you can select the level of detail displayed in explain plan by selecting the appropriate option in Using Preferences.
- Diagram View: Displays the execution steps in a flowchart format.
- Chart View: Displays data from PLAN TABLE a flame graph.
- Advanced View: Displays data from PLAN TABLE in a mixed tabular/tree view.
- **Zoom In, Zoom Out**: If a step is selected in the diagram, clicking the Zoom In icon ensures that it remains at the center of the screen.
- Fit Screen: Fits the entire diagram in the visible area.
- Actual Size: Sets the zoom factor to 1.
- Expand All: Displays all steps in the diagram.
- Reset Diagram: Resets the diagram to the initial status, that is, only three levels of steps are displayed.
- Show Info: Shows the SELECT statement used by the Explain Plan functionality.
- Min Visible Total CPU Cost(%): Defines the threshold to filter steps with total CPU cost equal or more than the provided value.
  - Enter a value between 0 and 100. There is no filtering for 0.
- Plan Notes: Displays the Explain Plan notes.

#### **Properties**

Double-click or press **Enter** on a selected step to open the Properties slider, which provides more information about that step. See PLAN\_TABLE in *Oracle Database Reference* for a description of each property.

The Properties slider shows:

 All information for that step extracted from PLAN\_TABLE in a tabular format. Nulls are excluded.

You can select **JSON** to view the properties in JSON format.

• Information from Other XML column of Plan Table.

The information is displayed in JSON format.

#### Navigation

 Press the Tab key to move through the steps in the execution order. The selected step has a blue border around it.

To move in the reverse direction, press the **Shift + Tab** keys.

If no step is selected, pressing the **Tab** key selects the step with execution number 1.

 Depending on the zoom level, use horizontal and vertical scrollbars to view different parts of diagram.

Click the left mouse button and hold it to pan the diagram around up and down.

Use the  $\Box$  icon at the bottom right to scroll to the top of the diagram.

#### **Diagram Navigator**

The Diagram Navigator is at the top right corner and represents a smaller copy of the diagram. The rectangle border allows zoom-in and zoom-out operations and moves to show different parts of the diagram.

The diagram navigator shows a list with steps having more than 1% CPU cost in descending order. Click a step in the list to navigate to the same step in the diagram, enabling you to see it in the context of the other steps.

## 3.6.5 Task Monitor



This feature is available only if you are a user with a Database Administrator role.

The Task Monitor enables you to monitor the progress of all tasks in real time allowing you to effectively manage your time and resources. This is significantly useful for long-running tasks such as large data imports/exports, complex queries, running scripts, or database maintenance tasks. You can prioritize tasks based on their progress and estimated completion time.

The Task Monitor is a tab in the SQL worksheet output panel and displays a list of in-progress and unfinished tasks. Normally completed tasks disappear from the list.

When no tasks are running, the Task Monitor displays the Nothing to show message.



The information displayed for a task consists of the following:

- Icon: Visually indicates the status of the task using icons.
- Connection: Name of the connection.
- Status: Current status of the task.
  - Waiting: The task is queued up to execute.

This only happens if the **Connections Sessions Sharing** option in the Extensions Settings is set to OFF.

- Created: The task is created and waiting to be executed.
- Executing: The task is being executed.
- Completed: The task is completed.
- Error: An error occurred when executing the task.
- Created: Timestamp of the task creation.

When hovering over an entry, a popup is displayed with status-related timestamp information (such as Created, Started).

- **Elapsed**: Depends on the status of the task. When the status is Created, Elapsed refers to the time taken to execute since creation. When the status is Executing, the Elapsed time then resets to calculate the time taken to execute the task.
- Description: SQL statement or script that forms the task.

To cancel a task, right-click the respective task row and click **Cancel**.

## 3.6.6 SQL History

You can click the SQL History tab in the lower right pane to view a list of SQL statements and scripts that you have executed, and optionally double-click one or more statements to have them either replace the statements currently on the SQL Worksheet or be added to the statements currently on the SQL Worksheet. The list is at first organized by date, and then by connection name.

The SQL history list will not contain any statement that can include a password. Such statements include (but are not necessarily limited to) CONNECT, ALTER USER, and CREATE DATABASE LINK.

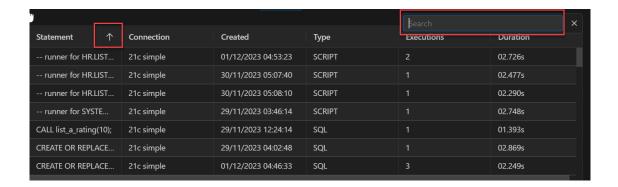
You can control the maximum number of statements in the history by setting the SQL History Limit in Preferences.

When a SQL statement in the SQL History list is selected, it automatically opens the PL/SQL subprogram in the SQL Worksheet pane.



To **sort** the statements in the list, double-click the column header that you want to sort on and the statements are sorted in ascending order. Double-click the header again to sort in descending order. To remove sorting applied to the column, double-click the column header again.

To display the **Search** functionality, in the SQL History pane, press **Ctrl+F** (**Cmd+F** for MacOS).

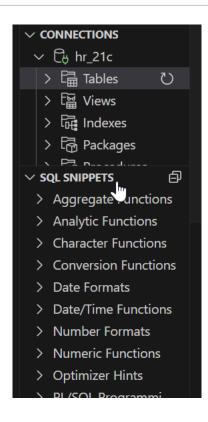


### 3.6.7 Using Snippets to Insert Code Fragments

Snippets are code fragments, such as SQL functions, Optimizer hints, and miscellaneous PL/SQL programming techniques. Some snippets are just syntax, and others are examples. You can insert and edit snippets when you are using the SQL Worksheet or creating or editing a PL/SQL function or procedure.

Snippets are displayed in the lower part of the Connections panel. Click the Expand icon to view all the available sinppets in each group (such as Aggregate Functions or Character Functions). In most cases, the fragments in each group do not represent all available objects in that logical grouping, or all formats and options of each fragment shown. For complete and detailed information, see the Oracle Database documentation.





To insert a snippet into your code in a SQL Worksheet or in a PL/SQL function or procedure, drag the snippet from the left bottom pane and drop it into the desired place in your code. Edit the syntax so that the SQL function is valid in the current context.

For example, you could type SELECT and then drag CONCAT(char1, char2) from the Character Functions group. Then, edit the CONCAT function syntax and type the rest of the statement, such as in the following:

```
SELECT CONCAT(title, ' is a book in the library.') FROM books;
```

### 3.6.8 Reports

Predefined reports are SQL queries that run against the connected database instance.

The Reports feature provides many built-in reports to query and monitor the database and its objects. These reports cover a range of database administration, performance monitoring, and diagnostic needs.

The different types of reports available are Grid, Charts and PL/SQL DBMS OUTPUT.

Some examples of predefined reports are:

- Top SQL by Execution Time: Displays the SQL queries with the highest execution times.
   Useful for performance tuning.
- Database Instance Details: Shows information about the database version, instance name, and startup time.
- Active Sessions: Lists currently active sessions along with key metrics like CPU usage and memory allocation.

#### **Prerequisites**



You require a database connection and relevant permissions to access the database views and objects queried by the report.

#### Accessing a Report

To open a report:

- Expand the Reports panel in the left pane.
- The reports are organized into several categories to help users quickly locate relevant reports such as Database Administration, Data Dictionary, Security and so on.
- 2. Expand a report category and select a report. You are prompted to select the database connection for which to display the report.

Some reports may prompt you to select binds (for example, date ranges, schema names) before generating the report. To specify a bind variable, type an entry in the **Value** column and click **Apply**.

#### **User Actions on a Report**

For more details if available, you can click on a row in a report to view more details about that entry in a bottom panel.

Click **Open in Worksheet** icon to display the SQL statement used to retrieve the information for a report in a SQL Worksheet pane, where you can view, edit, and run the statement.

The default options in the context menu for the report table are **Single Record View** and **Export**. Right-click in a report table and select **Export** to export a report to CSV, PDF, HTML or other formats. The context menu might include more options, which are based on the selected report.

# 3.7 Running Functions and Procedures

You can open and run PL/SQL subprograms (functions and procedures).

- To open a subprogram, click the name in the Connections panel to open, or right-click and select Open.
- To compile a subprogram, open it in the SQL Worksheet, and then select the Compile icon in the top right corner.

To debug a subprogram, open it in the SQL Worksheet, and then select the **Compile for Debug** icon.

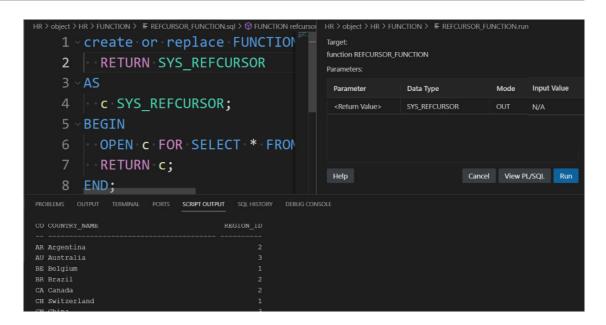
If there are any issues during compilation, these are shown under the Script Output tab in the lower pane.

To run a subprogram, open it in the SQL Worksheet and then select the Run icon. You can
then view the PL/SQL code and edit if needed, and then click Run. The results are
displayed in the Script Output pane below.

The Run, Compile and Compile for Debug icons are also available when opening PL/SQL files with any of the following extensions, KLR, PKB, PKH, PKS, PLB and PLS, from your local device.

In the following figure, the REFCURSOR\_FUNCTION is run and the output is displayed below.





# 3.8 Debugging PL/SQL Objects

You can debug PL/SQL functions and procedures using the PL/SQL Debugger in SQL Developer for VS Code..

This section covers the following topics:

- Required Debugging Database Privileges
- Understanding Database Debug Sessions
- · Debugging a PL/SQL Object

### 3.8.1 Required Debugging Database Privileges

To debug a PL/SQL object, you must have the following privilege:

```
DEBUG CONNECT SESSION
```

You also need DEBUG and EXECUTE privileges on SYS.DBMS\_DEBUG\_JDWP, which is the package used to start or stop the debug session.

If the PL/SQL object to debug belongs to you, no further privileges are required.

If the PL/SQL object does not belong to you, then you must be granted DEBUG and EXECUTE privileges on the PL/SQL object.

### 3.8.2 Understanding Database Debug Sessions

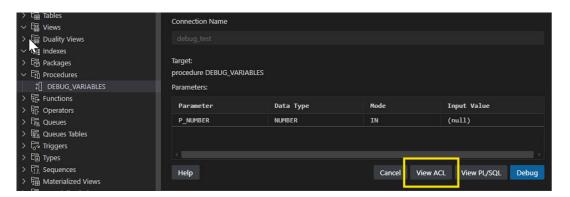
For a database session, the network connection is initiated by the client (SQL Developer for VS Code) and addressed by the server (Oracle Database). For a database debug session, SQL Developer for VS Code acts as the debug server and listens for connections from the debug client (Oracle Database).

The database must initiate the connection to SQL Developer for VS Code. For this to happen:

- The database must be configured to allow network access from the database to SQL Developer for VS Code. This done by creating an entry in the network access control list (ACL).
- The network ACL must specify the IP address (or host name) and port that SQL Developer for VS Code is using to listen for debug connections.
- There must be a network route from the database to SQL Developer for VS Code. For example, the firewall on the machine where SQL Developer for VS Code is running may need to be configured to allow the incoming connection from Oracle Database. Or if the Oracle Database is running within a Docker container, the container's network configuration may need to be adjusted to create a route between the Docker container and the machine where SQL Developer for VS Code is running.

SQL Developer for VS Code can help you add an entry to the ACL required for the database to connect to SQL Developer for VS Code.

- 1. From the Connections panel, open the PL/SQL object to debug and click the **Debug** icon in the toolbar at the top of the worksheet editor panel.
- In the editor pane that appears, click View ACL.

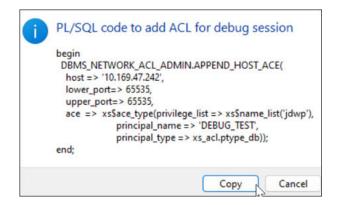


3. You are prompted to provide the IP address that the database should use to connect to SQL Developer for VS Code. Choose one of the suggestions or enter your own.

The PL/SQL code block that is required to add an entry in ACL is shown.



The PL/SQL block must be executed by a user with DBA privileges.



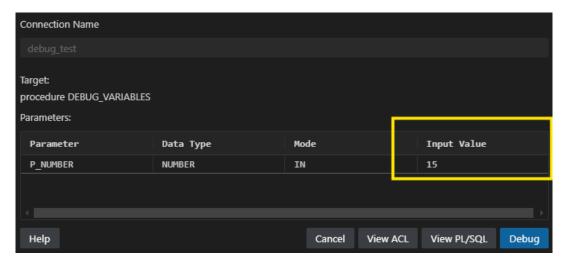
### 3.8.3 Debugging a PL/SQL Object

This section covers the steps to debug a PL/SQL object.

- Before debugging a PL/SQL object, it must be compiled with debug symbols that have been generated. Open the PL/SQL object in the PL/SQL editor and click the Compile for Debug icon in the PL/SQL Editor toolbar.
- 2. After a PL/SQL object has been compiled for debugging, you can set breakpoints on any executable line in the PL/SQL object. To configure a breakpoint, in the gutter to the left of the line number, hover till you see a red dot and then click to set the breakpoint.

```
Compile for Debug
DEBUG_VARIABLES.pls X
debug_test > object > DEBUG_TEST > PROCEDURE > ↑ DEBUG_VARIABLES.pls > ↑ PROCEDURE DEBUG_VARIABLES (p_r
       create or replace PROCEDURE DEBUG_VARIABLES (p_number in NUMBER) AS
         1_string VARCHAR2(20);
         1_number NUMBER(10);
         1_con_string CONSTANT VARCHAR2(20) := 'This is a constant';
         type array_t is varray(3) of varchar2(10);
         l_array array_t := array_t('Matt', 'Joanne', 'Robert');
           l_string := 'Hello World';
  Click to add a breakpoint
                                                           .ng);
  \debug_test\object\DEBUG_TEST\PROCEDURE\DEBUG_VARIABLES.pls
                                                           er);
        dbms output.put line('l con string:' | l con string);
       END DEBUG VARIABLES;
```

To debug the PL/SQL object, expand the Execute icon and then click **Debug**. In the editor pane that appears, provide values for the arguments required (if any) to invoke the PL/SQL object.



4. Click Debug.

If prompted, confirm the IP address that the database should use to connect to the SQL Developer extension.

The execution of the PL/SQL object pauses on the first breakpoint encountered.

Using the icons in the Debug toolbar, you can:

- Step Over: To move to the next statement.
- Step Into: To open and debug the current statement.
- Continue: To resume execution.
- Stop: To stop debugging,

### 3.9 Using Real Time SQL Monitor

The Real Time SQL Monitor feature provides a dashboard interface for real-time monitoring of SQL query execution. Users can view long-running and parallel SQL statements, and relevant performance metrics in a single, centralized location.

SQL monitoring is automatically started when:

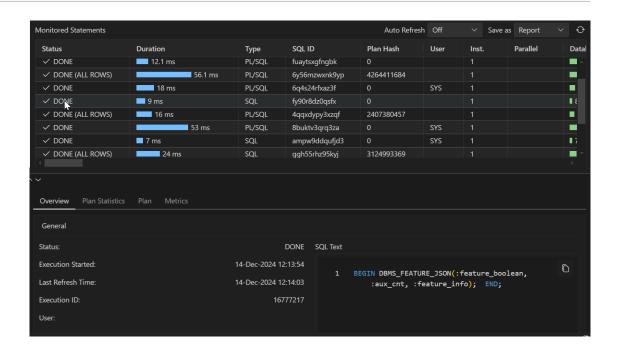
- a SQL statement runs parallel.
- a SQL statement has consumed at least 5 seconds of CPU or I/O time in a single execution.
- the /\*+ MONITOR +\*/ hint is used in the execution of a SQL statement.

#### **Prerequisites**

Real Time SQL Monitor requires:

- the Oracle Database Tuning Pack.
- the Database Administrator role. You do not require any special database privileges to use
  this feature to monitor SQL for schema objects that you own. However, to view all
  monitored SQL in the database, you need the SELECT CATALOG ROLE.

The Real Time SQL Monitor view consists of a table where each row displays information about a query that is currently executing or has completed executing for a selected database connection.



The Monitored Statement table includes the following information:

- **Status**: Current state of the SQL statement execution. For example, a SQL statement that has finished execution shows a DONE status.
- **Duration**: The amount of time taken to execute the statement or the amount of time spent waiting before which the statement is executed.
- Type: Type of statement (SQL or PL/SQL).
- SQL ID: SQL identifier of the monitored statement.
- User: Name of user that executes the statement.
- Parallel: This column shows how many instances and parallel execution servers are allocated. This is shown in the form of number of instances | number of parallel servers.
- **Database Time**: Place the cursor over the database time to see a popup displaying the breakdown of time and wait events.
- Start Time: Time when the execution of the SQL statement starts.
- End Time: Time when the execution of the SQL statement ends.
- SQL Text: SQL statement being monitored.

#### Accessing Real Time SQL Monitor

Real Time SQL Monitor is available in the context menu (right-click) for a connection. Selecting Real Time SQL Monitor opens a table showing all the statements that are currently being monitored or have been monitored in the past.

Click anywhere on a row to access the following details for the corresponding statement:

- Overview: General information about the monitored statement, Time & wait statistics and IO statistics.
- **Plan Statistics**: Explain Plan of the execution of the SQL statement in the form of a table. Each row is a different operation involved in the execution of the SQL statement and it

shows hierarchy dependency by adding a space at the beginning of the text in the Operation column.

- Plan: Explain plan of the execution of the SQL Statement in a tree structure.
- Metrics: This entry tracks key performance metrics collected for the execution, including the CPU, Memory used, I/O Throughput and I/O Requests time.

#### **Monitored Statements Table Toolbar**

- Auto Refresh: Select the time interval (shown in seconds) to refresh the Monitored Statements table.
- Save as: Save the detailed information for a selected statement from the Montiored Statements table as a report.
- Refresh icon: Update the Monitored Statements table.

### 3.10 Using Folders to Organize Connections

You can group and store connections using folders in the Connections panel. For example, one folder for connections on your local system, another for connections on the test system, and another for connections on the production system.

You can perform the following actions to manage connection folders:

#### Create a new connection folder

In the Connections panel, click the **Add Folder** icon, enter the folder name and press **Enter**.

#### Create a new connection sub-folder

In the Connections panel, go to the required folder and then click the **Add Folder** icon, enter the folder name and press **Enter**.

#### Add a connection to a folder

Use one of the following methods to add a connection to a folder:

- For the specific connection, right-click and select Add to Folder to select the folder.
- For the specific connection, drag and drop the connection into the folder.

#### Move a connection out of a folder

To move a connection out of a folder, drag and drop it out of the folder into the Connections panel.

#### Rename a connection folder

To rename a folder, right-click the folder and select **Rename** to specify the folder name.

#### Delete a connection folder

To delete a folder, right-click the folder and select **Delete**.

An empty folder is immediately deleted. But for a folder with contents or subfolders, a notification to confirm appears before the folder is deleted.

### 3.11 Using Filters

Filters enable you to control the objects that appear in the Connections navigator display. The filter can be applied on the following:

- Schema (Connection Tree Node or User Tree Node )
- Object Type (Table, View, Procedure and so on)

To access the Filter pane, right-click a connection node or an object type node (such as Tables) in the Connections navigator and select **Apply Filter**. Use the pane to limit the number of objects of that type that are displayed, according to one or more filter criteria that you specify. For each criterion, specify the following:

- Name (list always includes NAME, other criteria depend on the object type)
- Operator (for example, LIKE)
- Value for comparison (for example EM%)
- Case-sensitive option for character data comparison

For example, to display only tables with names that start with EM, specify NAME, LIKE, and EM% (with the percent sign as a wildcard character).

The following attributes are applicable for object type filters.

**Ignore Schema Filter** (object type node filters): If this option is checked, any filter criterion specified at the connection level is ignored. Only the object type node filter criteria are applied.

**Include Synonym** (object type node filters): If this option is checked, synonyms for objects of this object type are included.

To add another filter criterion, click the Add (+) icon. To delete a criterion, select it and click the Delete (X) icon. To move a criterion up or down in the list, select it and use the arrow icons.

To apply the filter criteria to the Connections navigator display, click **OK**.

To remove the effects of applying a filter, right-click the object type node in the Connections navigator display and select **Clear Filter**.

# 3.12 Using Preferences

To modify SQL Developer preferences, from the **File** menu, select **Preferences** and then **Settings**. Under **User**, expand **Extensions** and select **Oracle SQL Developer Extension for VS Code**.

The preferences available are:

#### **Database Connections**

- Tns Configuration Path: Enter the location of the tnsnames.ora file.
- **Startup Script Path**: Specify the location for the startup script to run when an Oracle database connection is opened. The default location is the default path for scripts.
- Connections Tree

Folders Fetch Size: Specifies the maximum number of rows to be fetched at a time into the data grid display for nodes such as Tables, Views, Materialized Views,

#### **Database NLS**

The NLS settings specify values for globalization support parameters, such as the language, territory, sort preference, and date format. These parameter values are used for SQL Developer session operations, such as for statements executed using the SQL Worksheet and for the National Language Support Parameters report. Specifying values in this preferences



pane does not apply those values to the underlying database itself. To change the database settings, you must change the appropriate initialization parameters and restart the database.

Note that SQL Developer does not use default values from the current system for globalization support parameters; instead, SQL Developer, when initially installed, by default uses parameter values that include the following:

```
NLS_LANG, "ENGLISH"
NLS_TERR, "AMERICA"
NLS_CHAR, "AL32UTF8"
NLS_SORT, "BINARY"
NLS_CAL, "GREGORIAN"
NLS_DATE_LANG, "ENGLISH"
NLS_DATE_FORM, "DD-MM-RR"
```

#### **SQL History**

History Limit: Maximum number of statements that can be stored in SQL History.

#### **Telemetry**

 Allow automated usage reporting to Oracle: Determines whether you consent to usage reporting. If you consent, automated reports can occasionally be sent to Oracle describing the product features in use. No personally identifiable information will be sent and the report will not affect performance.

#### **SQL Worksheet**

Explain Plan: Determines the level of details displayed in the Explain Plan.



4

# Using the Oracle SQLcl MCP Server

The Oracle SQLcl Model Context Protocol (MCP) Server transforms how you interact with the Oracle Database by enabling seamless communication with Artificial Intelligence (AI) applications.

It enables you to perform operations, create reports, and run queries on Oracle Database using natural language through Al-powered interactions. Discover the capabilities of the Oracle SQLcl MCP Server, and learn how to use it with popular MCP clients.

#### A

#### **Caution:**

When you grant a large language model (LLM) access to your database, it introduces significant security risks. Because LLMs use the data you input to generate responses, you might inadvertently expose unintended tables or sensitive details.

To mitigate these risks, implement the following safeguards:

- Assign minimum permissions: Configure the database user account used by the LLM with the absolute minimum permissions required for its tasks. This approach limits what the LLM can access.
- Avoid production database access: Do not grant LLMs direct access to production databases. Instead, you should use a sanitized, read-only replica or a dedicated data subset.
- Audit LLM activity: Regularly audit the queries executed by the LLM. This helps you detect anomalies or the attempts to access restricted data. To support your auditing efforts, the SQLcl MCP Server provides the following built-in monitoring capabilities:
  - Session tracking: It populates V\$SESSION.MODULE with the MCP client in use, and V\$SESSION.ACTION with the LLM's name.
  - Activity logging: It creates a table named DBTOOLS\$MCP\_LOG that records every interaction and SQL execution.
  - Query identification: All LLM-generated queries through the SQLcl MCP Server's tools include the following comment for easy identification in the logs: /\* LLM in use ... \*/.

To learn more about monitoring, see Monitoring the SQLcl MCP Server.

#### Topics:

- About the SQLcl MCP Server
- About the SQLcl MCP Server Tools
- How the SQLcl MCP Server Works
- Preparing Your Environment
- Starting and Managing the SQLcl MCP Server

- Example Use Cases and Prompts
- Monitoring the SQLcl MCP Server

# 4.1 About the SQLcl MCP Server

The Model Context Protocol (MCP) is an open standard that defines a consistent way for applications to provide contextual information to AI models.

MCP standardizes the connection between AI systems and external tools or data sources, such as databases and APIs. To learn more about MCP, see Model Context Protocol.

The SQLcI MCP Server extends Oracle SQLcI to support MCP-based communication. It enables AI applications to interact with Oracle databases using the standardized MCP interface, giving those applications a structured way to discover and use your databases.

By design, the server provides AI applications access to database operations through a defined set of tools. For seamless integration, the server establishes and manages database connections using your preconfigured named or saved SQLcI connections. This allows AI applications to easily and securely access your existing Oracle environments through MCP.

After establishing a connection, an AI client can use natural language to perform the full range of database operations. This includes executing SQL queries, invoking PL/SQL procedures, and running SQLcl-specific commands.

See Also:

Oracle SQLcl User's Guide

# 4.2 About the SQLcl MCP Server Tools

The SQLcI MCP Server exposes a set of tools that enhance the way AI applications interact with Oracle databases. By abstracting the SQLcI commands used for various database operations, these tools empower AI models to autonomously manage databases. This allows you to focus on strategic objectives instead of manual command-line interactions.

Additionally, the tools unlock sophisticated workflows through natural language interfaces, enabling AI systems to execute database demonstrations, manage large-scale data migrations, run complex analytical queries, and automate administrative tasks. Ultimately, the SQLcI MCP Server eliminates the need for direct manual input and allows AI applications to independently perform complex database operations that would've required significant technical expertise and effort.

Currently, the SQLcl MCP Server offers the following tools:

- list-connections: Discovers and lists all saved Oracle Database connections on your machine.
- connect: Establishes a connection to one of your specified named connections.
- **disconnect:** Terminates the current, active Oracle Database connection.
- run-sql: Executes standard SQL queries and PL/SQL code blocks against the connected database.
- run-sqlcl: Executes SQLcl-specific commands and extensions.



# 4.3 How the SQLcl MCP Server Works

The SQLcI MCP Server translates conversational AI requests into powerful, context-aware database operations, ensuring the full capabilities, performance, and integrity of the Oracle environments remain intact.

The server workflow is as follows:

- User request: You make a request to an MCP client (for example, Claude Desktop) in natural language, such as "Retrieve all employees hired last month from the HR schema."
- **2. MCP client processing:** The MCP client performs the following tasks:
  - Interprets your request, identifies the intent, and determines the appropriate SQLcl MCP Server tool to invoke.
  - Calls an AI model, which converts the interpreted request into a corresponding SQL statement.
  - c. Issues a structured tool call to the SQLcl MCP Server using the MCP protocol, triggering the execution of the generated SQL statement.
- 3. **Database operation:** The SQLcl MCP Server receives the request and executes the corresponding SQL query or command through the SQLcl interface against the Oracle Database, using a named or saved connection.
- 4. Response formatting and delivery: SQLcl processes the query and returns the results to the SQLcl MCP Server, which formats the output according to MCP standards and sends it back to the MCP client. Finally, the client presents the information to you in clear, natural language.

### 4.4 Preparing Your Environment

Learn about setting up your environment to use the SQLcl MCP Server.

- Installing the Required Software
- Configuring Database Connections

### 4.4.1 Installing the Required Software

To use the SQLcl MCP Server, you must install the following software on your system:

- Visual Studio Code, version 1.101.0 or higher
- Oracle SQL Developer Extension for VSCode, version 25.2.0 or higher
- GitHub Copilot Chat Extension for VSCode, version 0.28.5 or higher



### 4.4.2 Configuring Database Connections

The SQLcI MCP Server relies on the preconfigured connections saved in the connection store, which is in your ~/.dbtools directory. You can manage these connections using the connect and connmgr commands.

### Note:

- For a connection to be accessible to an MCP client, you must save its password.
   When you create a new connection, use the -savepwd flag to store credentials securely.
- You can also define and manage connections using the Oracle SQL Developer Extension for VS Code.

For information on creating an MCP-compatible connection, see Connecting to Your Database.

### 4.5 Starting and Managing the SQLcl MCP Server

The SQLcI MCP Server is automatically launched and managed when you start SQL Developer.

After the MCP server is initialized, you can access the tools it provides through the GitHub Copilot Chat Extension in Agent mode. You can interact with the agent using either predefined commands or natural language input. Predefined commands help you perform specific actions quickly, while natural language input allows you to type your requests in plain English, which the agent will understand and respond to accordingly.

- Accessing SQLcl MCP Server
- Accessing SQLcl MCP Server Tools
- Using the Agent Mode

### 4.5.1 Accessing SQLcl MCP Server

The SQLcI MCP Server is automatically initialized when you start SQL Developer.

Perform the following steps to access the SQLcl MCP Server:

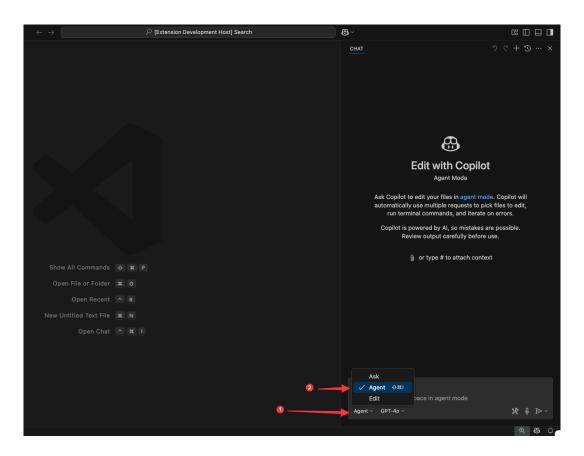
1. Click the Copilot Chat button.





The **Edit with Copilot** chat window appears in the right pane.

2. From the chat mode drop-down list, select **Agent**.

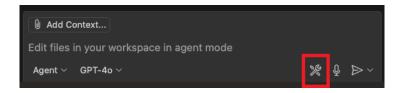


### 4.5.2 Accessing SQLcl MCP Server Tools

The SQLcI MCP Server provides essential tools for performing basic SQL operations, including connecting to an Oracle database, executing SQL and PL/SQL statements, and retrieving and analyzing results.

Perform the following steps to access the MCP Server tools:

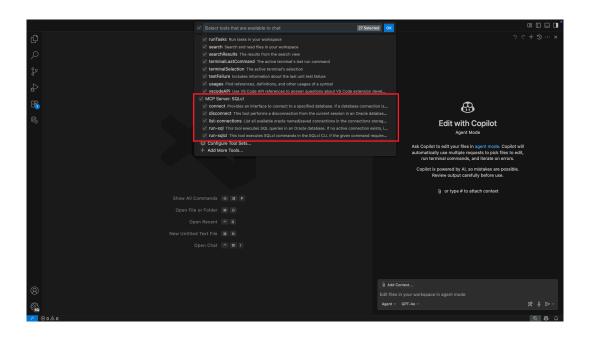
- Access the SQLcl MCP Server. See Accessing SQLcl MCP Server.
- 2. In the Copilot chat view, click the tools button to list the available tools.



**3.** Select or deselect the tools you want to use.

For more information about SQLcl MCP Server tools, see About the SQLcl MCP Server Tools.

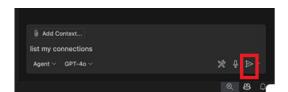
You can also search for any tool by typing its name in the search box.



### 4.5.3 Using the Agent Mode

You can interact with the agent in VS Code by using predefined commands or natural language input. Follow these steps to get started:

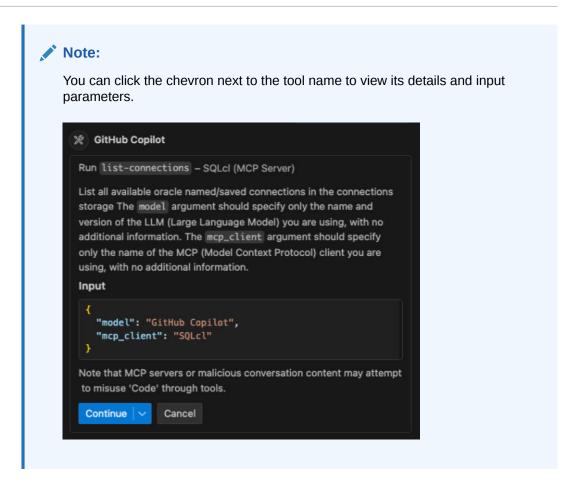
- Open the Chat view. See Accessing SQLcl MCP Server.
- 2. Enter a predefined command or type a natural language query and click the **Send** button.



Copilot requests confirmation to continue using the tool.

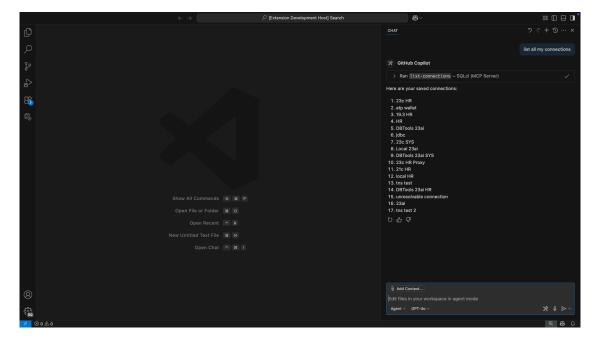
Use the Continue button's dropdown options to automatically confirm the selected tool for the current session, the workspace, or all future sessions.





To learn more about Agent mode, see Use Agent Mode in VS Code.

After the task is executed, a green check mark is shown next to the tool, along with the generated result:



# 4.6 Example Use Cases and Prompts

Here are a few examples of natural language requests you can use to perform various database operations through an MCP client connected to the SQLcl MCP Server.

Table 4-1 Natural Language Prompts for Oracle Database Operations

Operation	Description	Comple xity	Example Prompt to Client
Connecting to databases	Establish database connections with automatic authentication and connection management.	Basic	Connect to the HR database
Running simple queries	Run basic SQL queries with readable results.	Basic	Show me recent orders, or Which customers are in California?
Browsing a database schema	Interactively explore table structures, columns, and relationships.	Basic	Which tables contain customer information?, or Show me the structure of the Orders table
Checking connection status	Monitor the database session health and connectivity with real-time status reporting.	Basic	Which database am I currently connected to?
Performing complex analytical queries	Execute sophisticated analytical operations with hierarchical breakdowns and advanced SQL features.	Advance d	Show me a hierarchical breakdown of sales by region and product category with year-over-year growth percentages
Performing multi- environment operations	Coordinate work across development, testing, and production database environments.	Advance d	Compare the customer counts between our development and production databases
Managing transactions	Manage complex transactions with capabilities for review and rollback.	Advance d	Update all customer records in the Northeast region but let me review the changes before committing
Monitoring performance	Analyze query performance and receive optimization suggestions.	Advance d	Show me which queries are running slow today and provide optimization tips

# 4.7 Monitoring the SQLcI MCP Server

Learn how you can monitor the health, status, and activity of your SQLcI MCP Server.

- · Checking Server Status
- Tracking Activity with Logs
- Assessing Server Health Through Performance



### 4.7.1 Checking Server Status

When the SQLcl MCP Server starts successfully, it displays a confirmation message with the startup timestamp, indicating it's ready to accept connections from the MCP client.

You can verify this message on the **SQL Developer - Log** output panel to confirm server readiness. Here's an example server message on startup:

### 4.7.2 Tracking Activity with Logs

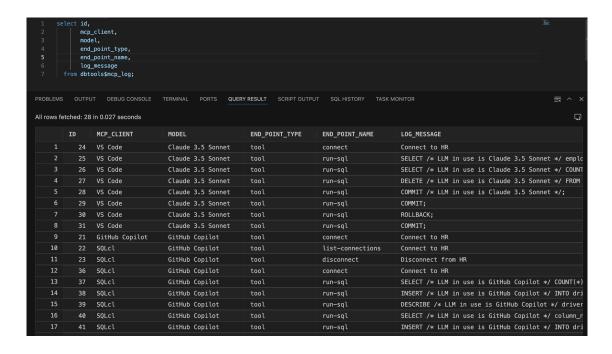
The SQLcI MCP Server provides two main ways to track and monitor database operations: a historical audit trail and real-time session monitoring.

#### **Reviewing the Audit Trail**

The server automatically records the execution history of every request in the <code>DBTOOLS\$MCP\_LOG</code> table. This table provides a complete audit trail of all database operations the server performs. It captures request details, execution times, and results to help you with analysis and troubleshooting.

To maintain optimal database performance, you should prune the DBTOOLS\$MCP\_LOG table regularly. Consider setting a record limit (for example, 1000 records) and creating an automated cleanup procedure to prevent excessive log accumulation.

To view the audit trail, run a query similar to the following example:



#### **Monitoring Live Sessions**

If you have database administrator (DBA) privileges, you can monitor active MCP connections and operations in real-time. The server integrates with Oracle's V\$SESSION view, allowing you to use standard Oracle monitoring tools to track current sessions, resource usage, and performance. To see the MCP client information, you can observe the MODULE and ACTION values in V\$SESSION.

To view active sessions, query the V\$SESSION view:

select \* from V\$SESSION;

### 4.7.3 Assessing Server Health Through Performance

You can gauge server health by observing its performance.

- Normal Operation: Under normal operation, you should experience consistent response times and smooth database operations.
- Potential Issues: If you are experiencing issues, you may notice delayed responses, connection errors, or incomplete results. If these occur, check your client's logs to begin troubleshooting.

# Tutorial: Creating Objects for a Small Database

Create objects for a simplified library database, which will include tables for books, patrons (people who have library cards), and transactions (checking a book out, returning a book, and so on).

The tables are deliberately oversimplified for this tutorial. They would not be adequate for any actual public or organizational library.

This tutorial assumes that you have a database connection to a database user that will own the tables and other objects that you create.

The major steps are:

- Create a Table (BOOKS)
- Create a Table (PATRONS)
- Create a Table (TRANSACTIONS)
- Create Two Sequences
- Insert Data into the Tables
- Create a View
- Create a PL/SQL Procedure
- Use the SQL Worksheet for Queries

### 5.1 Create a Table (BOOKS)

The BOOKS table contains a row for each book in the library. It includes columns of character and number types, a primary key, a unique constraint, and a check constraint.

- Right-click the connection name, and select Open SQL Worksheet.
- **2.** Enter the following statement:

```
CREATE TABLE books (
book_id VARCHAR2(20),
title VARCHAR2(50)

CONSTRAINT title_not_null NOT NULL,
author_last_name VARCHAR2(30)

CONSTRAINT last_name_not_null NOT NULL,
author_first_name VARCHAR2(30),
rating NUMBER,
CONSTRAINT books_pk PRIMARY KEY (book_id),
CONSTRAINT rating_1_to_10 CHECK (rating IS NULL OR
    (rating >= 1 and rating <= 10)),
CONSTRAINT author title unique UNIQUE (author last name, title));
```

3. Click the Run Statement icon.

The following notification is displayed in the Script Output pane:

Table BOOKS created.

# 5.2 Create a Table (PATRONS)

The PATRONS table contains a row for each patron who can check books out of the library.

1. In the SQL Worksheet, enter the following statement:

```
CREATE TABLE patrons (
   patron_id NUMBER,
   last_name VARCHAR2(30)
        CONSTRAINT patron_last_not_null NOT NULL,
   first_name VARCHAR2(30),
   street_address VARCHAR2(50),
   city_state_zip VARCHAR2(50),
   CONSTRAINT patrons pk PRIMARY KEY (patron id));
```

2. Click the Run Statement icon.

The following notification is displayed in the Script Output pane:

Table PATRONS created.

# 5.3 Create a Table (TRANSACTIONS)

The TRANSACTIONS table contains a row for each transaction involving a patron and a book (for example, someone checking a book out or returning a book). It includes two foreign key columns.

In the SQL Worksheet, enter the following statement:

```
CREATE TABLE transactions (
    transaction_id NUMBER,
    patron_id CONSTRAINT for_key_patron_id
        REFERENCES patrons(patron_id),
    book_id CONSTRAINT for_key_book_id
        REFERENCES books(book_id),
    transaction_date DATE
        CONSTRAINT tran_date_not_null NOT NULL,
    transaction_type NUMBER
        CONSTRAINT tran_type_not_null NOT NULL,
    CONSTRAINT transactions pk PRIMARY KEY (transaction_id));
```

2. Click the Run Statement icon.

The following notification is displayed in the Script Output pane:

Table TRANSACTIONS created.



### 5.4 Create Two Sequences

Create two sequence objects, which will be used in INSERT statements to generate unique primary key values in the PATRONS and TRANSACTIONS tables.

In the SQL Worksheet, enter the following statements:

```
CREATE SEQUENCE patron_id_seq
START WITH 100
INCREMENT BY 1;

CREATE SEQUENCE transaction_id_seq
START WITH 100
INCREMENT BY 1;
```

### 5.5 Insert Data into the Tables

Add some sample data to the BOOKS, PATRONS, and TRANSACTIONS tables.

1. Copy and paste the following INSERT statements into the SQL Worksheet:

```
INSERT INTO books VALUES ('A1111', 'Moby Dick', 'Melville', 'Herman', 10);
INSERT INTO books VALUES ('A2222', 'Get Rich Really Fast', 'Scammer',
'Ima', 1);
INSERT INTO books VALUES ('A3333', 'Finding Inner Peace', 'Blissford',
'Serenity', null);
INSERT INTO books VALUES ('A4444', 'Great Mystery Stories', 'Whodunit',
'Rodney', 5);
INSERT INTO books VALUES ('A5555', 'Software Wizardry', 'Abugov', 'D.',
INSERT INTO patrons VALUES (patron id seq.nextval,
   'Smith', 'Jane', '123 Main Street', 'Mytown, MA 01234');
INSERT INTO patrons VALUES (patron id seq.nextval,
   'Chen', 'William', '16 S. Maple Road', 'Mytown, MA 01234');
INSERT INTO patrons VALUES (patron id seq.nextval,
   'Fernandez', 'Maria', '502 Harrison Blvd.', 'Sometown, NH 03078');
INSERT INTO patrons VALUES (patron id seq.nextval,
   'Murphy', 'Sam', '57 Main Street', 'Mytown, MA 01234');
INSERT INTO transactions
 VALUES (transaction id seq.nextval, 100, 'A1111', SYSDATE, 1);
INSERT INTO transactions
 VALUES (transaction id seq.nextval, 100, 'A2222', SYSDATE, 2);
INSERT INTO transactions
 VALUES (transaction id seq.nextval, 101, 'A3333', SYSDATE, 3);
INSERT INTO transactions
 VALUES (transaction id seq.nextval, 101, 'A2222', SYSDATE, 1);
INSERT INTO transactions
 VALUES (transaction id seq.nextval, 102, 'A3333', SYSDATE, 1);
INSERT INTO transactions
 VALUES (transaction id seq.nextval, 103, 'A4444', SYSDATE, 2);
```

```
INSERT INTO transactions
   VALUES (transaction_id_seq.nextval, 100, 'A4444', SYSDATE, 1);
INSERT INTO transactions
   VALUES (transaction_id_seq.nextval, 102, 'A2222', SYSDATE, 2);
INSERT INTO transactions
   VALUES (transaction_id_seq.nextval, 102, 'A5555', SYSDATE, 1);
INSERT INTO transactions
   VALUES (transaction_id_seq.nextval, 101, 'A2222', SYSDATE, 1);
```

2. Click Run Script.

### 5.6 Create a View

Create a view that returns information about patrons and their transactions. This view queries the PATRONS and TRANSACTIONS tables, and returns rows that contain a patron's ID, last name, and first name, along with a transaction and the transaction type. The rows are ordered by patron ID, and by transaction type within patron IDs.

- Right-click the Views node in the schema hierarchy on the left side, and select Create (simple).
- Enter the following information:
  - View Name: Enter patrons\_trans\_view.
  - In SQL Query, enter the following statement:

```
SELECT p.patron_id,
    p.last_name,
    p.first_name,
    t.transaction_type,
    t.transaction_date

FROM patrons p, transactions t
WHERE p.patron_id = t.patron_id
ORDER BY p.patron_id, t.transaction_type
```

3. Click Apply.

# 5.7 Create a PL/SQL Procedure

Create a procedure that lists all books with a specified rating. You can then call this procedure with an input parameter (a number from 1 to 10), and the output will be all the titles of all books with that rating.

To create the procedure:

1. Enter the following procedure text:

```
CREATE OR REPLACE

PROCEDURE list_a_rating(in_rating IN NUMBER) AS

matching_title VARCHAR2(50);

TYPE my_cursor IS REF CURSOR;

the_cursor my_cursor;

BEGIN

OPEN the_cursor

FOR 'SELECT title

FROM books
```

```
WHERE rating = :in_rating'
USING in_rating;

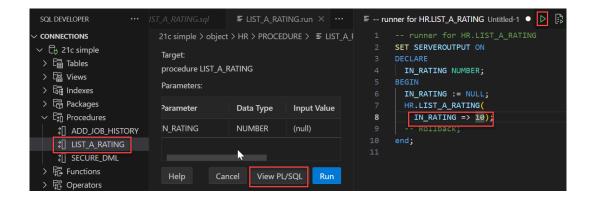
DBMS_OUTPUT.PUT_LINE('All books with a rating of ' || in_rating || ':');
LOOP
   FETCH the_cursor INTO matching_title;
   EXIT WHEN the_cursor%NOTFOUND;
   DBMS_OUTPUT.PUT_LINE(matching_title);
END LOOP;
CLOSE the_cursor;
END list a rating;
```

#### 2. Click Run Script.

The following notification is displayed in the Script Output tab:

```
Procedure LIST A RATING compiled
```

- 3. To run this procedure, right-click LIST\_A\_RATING in the Connections navigator and select **Run**. The parameter and it's properties are displayed.
- Click View PL/SQL.
- 5. Change IN\_RATING => IN\_RATING to IN\_RATING => 10, and click Run Statement.



The result is shown in the Script Output pane:

```
All books with a rating of 10:
Moby
Dick
Software Wizardry
```

# 5.8 Use the SQL Worksheet for Queries

You can use the SQL Worksheet to test SQL statements using a database connection.

 In the right pane, enter the following statement (the semicolon is optional for the SQL Worksheet):

```
SELECT author last name, title FROM books;
```

Notice the automatic highlighting of SQL keywords (SELECT and FROM in this example).

- 2. Click the **Run Statement** icon in the SQL Worksheet toolbar. The results of the query are displayed in the Query Result tab under the area in which you entered the SQL statement.
- **3.** Enter (or copy and paste) the following statement:

- Click the Run Statement icon in the SQL Worksheet toolbar, and view the results of the query.
- 5. Click the **Explain Plan** icon in the SQL Worksheet toolbar to see the execution plan (displayed on the Explain tab) that Oracle Database follows to execute the SQL statement. The information includes the optimizer strategy and the cost of executing the statement.



6

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----- Licenses
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regenerator-runtime
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stylis
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supports-color
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supports-preserve-symlinks-flag
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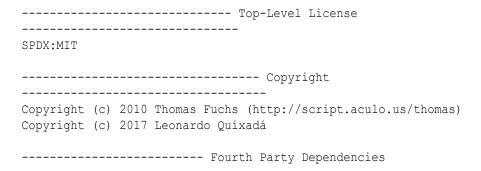
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\* org.eclipse.jetty.orbit:javax.security.auth.message

The following dependencies are EPL and CDDL 1.0.

\* org.eclipse.jetty.orbit:javax.mail.glassfish

The following dependencies are CDDL + GPLv2 with classpath exception. https://glassfish.dev.java.net/nonav/public/CDDL+GPL.html

- \* jakarta.servlet:jakarta.servlet-api
- \* javax.annotation:javax.annotation-api
- \* javax.transaction:javax.transaction-api
- \* javax.websocket:javax.websocket-api

The following dependencies are licensed by the OW2 Foundation according to the terms of http://asm.ow2.org/license.html

- \* org.ow2.asm:asm-commons
- \* org.ow2.asm:asm

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- \* org.apache.taglibs:taglibs-standard-spec
- \* org.apache.taglibs:taglibs-standard-impl

The following dependencies are ASL2 licensed. Based on selected classes from following Apache Tomcat jars, all ASL2 licensed.

- \* org.mortbay.jasper:apache-jsp
- \* org.apache.tomcat:tomcat-jasper
- \* org.apache.tomcat:tomcat-juli
- \* org.apache.tomcat:tomcat-jsp-api
- \* org.apache.tomcat:tomcat-el-api
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- \* org.apache.tomcat:tomcat-api
- \* org.apache.tomcat:tomcat-util-scan
- \* org.apache.tomcat:tomcat-util
- \* org.mortbay.jasper:apache-el
- \* org.apache.tomcat:tomcat-jasper-el
- \* org.apache.tomcat:tomcat-el-api

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\* org.eclipse.jetty.toolchain:jetty-schemas

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# 6.14 react 18.3.1

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# 6.16 react-tabs 6.0.2

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### 6.17 react-window 1.8.10

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## 6.18 vscode-codicons 0.0.36

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