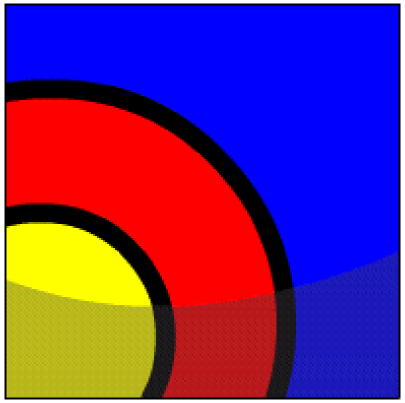
Dynamic SQL

What Will I Learn?

In this lesson, you will learn to:

- Recall the stages through which all SQL statements pass
- Describe the reasons for using dynamic SQL to create an SQL statement
- List four PL/SQL statements supporting Native Dynamic SQL
- Describe the benefits of `EXECUTE IMMEDIATE` over `DBMS_SQL` for Dynamic SQL



Why Learn It?

In this lesson, you learn to construct and execute SQL statements dynamically—in other words, at run time using the Native Dynamic SQL statements in PL/SQL.

Dynamically executing SQL and PL/SQL code extends the capabilities of PL/SQL beyond query and transactional operations.

The lesson also compares Native Dynamic SQL to the `DBMS_SQL` package, which provides similar capabilities.

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Execution Flow of SQL

- All SQL statements in the database go through various stages:
  - Parse: Pre-execution "is this possible?" checks including syntax, object existence, privileges, and so on.
  - Bind: Getting the actual values of any variables referenced in the statement.
  - Execute: The statement is executed.
  - Fetch: Results are returned to the user.

- Some stages might not be relevant for all statements, for example, the fetch phase is applicable to queries but not DML.

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Execution Flow of SQL in PL/SQL Subprograms

When an SQL statement is included in a PL/SQL subprogram, the parse and bind phases are normally done at compile time, that is, when the procedure, function or package body is CREATEd.

What if the text of the SQL statement is not known when the procedure is created? How could the Oracle server parse it? It couldn't. For example, suppose you want to DROP a table, but the user enters the table name at execution time:

```
CREATE PROCEDURE drop_any_table(p_table_name VARCHAR2)
IS BEGIN
  DROP TABLE p_table_name; -- cannot be parsed
END;
```

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Dynamic SQL

You use dynamic SQL to create an SQL statement whose text is not completely known in advance. Dynamic SQL:

- Is constructed and stored as a character string within a subprogram.
- Is an SQL statement with varying column data, or different conditions with or without placeholders (bind variables)
- Enables data-definition, data-control, or session-control statements to be written and executed from PL/SQL
- Is executed with Native Dynamic SQL statements (`EXECUTE IMMEDIATE`) or the `DBMS_SQL` package

Dynamic SQL statements are parsed at execution time, not at compile time.

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Native Dynamic SQL

- Provides native support for Dynamic SQL directly in the PL/SQL language
- Provides the ability to execute SQL statements whose structure is unknown until execution time
- Uses the `EXECUTE IMMEDIATE` PL/SQL statement
- Can also use the `OPEN-FOR`, `FETCH`, and `CLOSE` PL/SQL statements.

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Using the EXECUTE IMMEDIATE Statement

Use the `EXECUTE IMMEDIATE` statement for Native Dynamic SQL in PL/SQL anonymous blocks or subprograms:

```
EXECUTE IMMEDIATE dynamic_string
 [INTO {define_variable
     [, define_variable] ... | record}]
 [USING [IN|OUT|IN OUT] bind_argument
     [, [IN|OUT|IN OUT] bind_argument] ... ];
```

- `INTO` is used for single-row queries and specifies the variables or records into which column values are retrieved.
- `USING` holds all bind arguments. The default parameter mode is `IN`, if not specified.

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Using the EXECUTE IMMEDIATE Statement (continued)

```
EXECUTE IMMEDIATE dynamic_string
 [INTO {define_variable
     [, define_variable] ... | record}]
 [USING [IN|OUT|IN OUT] bind_argument
     [, [IN|OUT|IN OUT] bind_argument] ... ];
```

dynamic_string is a character variable or literal containing the text of an SQL statement.

define_variable is a PL/SQL variable that stores a selected column value.

record is a user-defined or %ROWTYPE record that stores a selected row.

bind_argument is an expression whose value is passed to the dynamic SQL statement at execution time.

USING clause holds all bind arguments. The default parameter mode is IN.

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Example 1: Dynamic SQL with a DDL Statement

Constructing the dynamic statement in-line

```
CREATE PROCEDURE drop_any_table(p_table_name VARCHAR2) IS
BEGIN
  EXECUTE IMMEDIATE 'DROP TABLE '||p_table_name;
END;
```

Constructing the dynamic statement in a variable

```
CREATE PROCEDURE drop_any_table(p_table_name VARCHAR2) IS
  v_dynamic_stmt  VARCHAR2(50);
BEGIN
  v_dynamic_stmt := 'DROP TABLE '||p_table_name;
  EXECUTE IMMEDIATE v_dynamic_stmt;
END;
```

```
BEGIN  drop_any_table('EMPLOYEE_NAMES');   END;
```

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Example 2: Dynamic SQL with a DML Statement

Deleting all the rows from any table and returning a count

```
CREATE FUNCTION del_rows(p_table_name VARCHAR2)
RETURN NUMBER IS
BEGIN
  EXECUTE IMMEDIATE 'DELETE FROM '||p_table_name;
  RETURN SQL%ROWCOUNT;
END;
```

Invoking the function

```
DECLARE
  v_count  NUMBER;
BEGIN
  v_count := del_rows('EMPLOYEE_NAMES');
  DBMS_OUTPUT.PUT_LINE(v_count|| ' rows deleted.');
END;
```

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Example 3: Dynamic SQL with a DML Statement

Inserting a row into a table with two columns

```
CREATE PROCEDURE add_row(p_table_name VARCHAR2,
   p_id NUMBER, p_name VARCHAR2) IS
BEGIN
  EXECUTE IMMEDIATE 'INSERT INTO '||p_table_name||
        ' VALUES (p_id, p_name)';
END;
```

Invoking the procedure

```
BEGIN
  add_row('EMPLOYEE_NAMES', 250, 'Chang');
END;
```

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Example 4: Using Native Dynamic SQL to Recompile PL/SQL Code

You can recompile PL/SQL objects without recreating them by using the following ALTER statements:

```
ALTER PROCEDURE procedure-name COMPILE;
ALTER FUNCTION  function-name  COMPILE;
ALTER PACKAGE   package_name   COMPILE SPECIFICATION;
ALTER PACKAGE   package-name   COMPILE BODY;
```

The next slide shows a procedure that recompiles a PL/SQL object whose name and type is entered at run-time.

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Example 4 (continued)

Creating the procedure

```
CREATE PROCEDURE compile_plsql
 (p_name VARCHAR2,p_type VARCHAR2,p_options VARCHAR2 := NULL)
IS
  v_stmt VARCHAR2(200);
BEGIN
  v_stmt := 'ALTER '||p_type||' '||p_name||' COMPILE'
            ||' '||p_options;
  EXECUTE IMMEDIATE v_stmt;
END;
```

Example invocation

```
BEGIN   compile_plsql('MYPACK','PACKAGE','BODY');  END;
```

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Using the `DBMS_SQL` Package

Before Oracle 8i, the `EXECUTE IMMEDIATE` statement did not exist in PL/SQL, and the presupplied `DBMS_SQL` package was the only way to write dynamic SQL.

Some of the procedures and functions of the `DBMS_SQL` package are:

- `OPEN_CURSOR`
- `PARSE`
- `BIND_VARIABLE`
- `EXECUTE`
- `FETCH_ROWS`
- `CLOSE_CURSOR`

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Using DBMS_SQL with a DML Statement

Example of deleting rows:

```
CREATE OR REPLACE FUNCTION del_rows
 (p_table_name VARCHAR2) RETURN NUMBER IS
  v_csr_id      INTEGER;
  v_rows_del    NUMBER;
BEGIN
  v_csr_id := DBMS_SQL.OPEN_CURSOR;
  DBMS_SQL.PARSE(v_csr_id,
    'DELETE FROM '||p_table_name, DBMS_SQL.NATIVE);
  v_rows_del := DBMS_SQL.EXECUTE (v_csr_id);
  DBMS_SQL.CLOSE_CURSOR(v_csr_id);
  RETURN v_rows_del;
END;
```

Compare this with the `del_rows` function earlier in this lesson. They are functionally identical, but which is simpler?

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Using DBMS_SQL with a Parameterized DML Statement

```
CREATE PROCEDURE add_row (p_table_name VARCHAR2,
  p_id NUMBER, p_name VARCHAR2) IS
  v_csr_id      INTEGER;
  v_stmt        VARCHAR2(200);
  v_rows_added NUMBER;
BEGIN
  v_stmt := 'INSERT INTO '||p_table_name||
          ' VALUES ('||p_id||','''||p_name||''')';
  v_csr_id := DBMS_SQL.OPEN_CURSOR;
  DBMS_SQL.PARSE(v_csr_id,v_stmt, DBMS_SQL.NATIVE);
  v_rows_added := DBMS_SQL.EXECUTE(v_csr_id);
  DBMS_SQL.CLOSE_CURSOR(v_csr_id);
END;
```

Again, compare this with the `add_row` procedure earlier in this lesson. Which would you rather write?

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Comparison of Native Dynamic SQL and the `DBMS_SQL` Package

Native Dynamic SQL:

- Is easier to use than `DBMS_SQL`
- Requires less code than `DBMS_SQL`
- Often executes faster than `DBMS_SQL` because there are fewer statements to execute.

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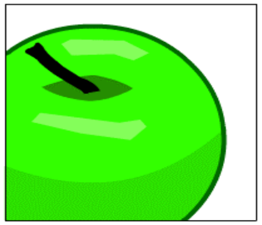

Terminology

Key terms used in this lesson include:

Dynamic SQL

`EXECUTE IMMEDIATE`

Summary

In this lesson, you learned to:

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- Describe the reasons for using dynamic SQL to create an SQL statement
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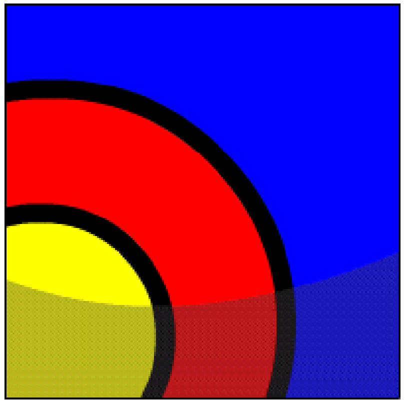

Try It / Solve It

The exercises in this lesson cover the following topics:

- Recalling the stages through which all SQL statements pass
- Describing the reasons for using dynamic SQL to create an SQL statement
- Listing four PL/SQL statements supporting Native Dynamic SQL
- Describing the benefits of `EXECUTE IMMEDIATE` over `DBMS_SQL` for Dynamic SQL