Oracle 11g – PL SQL

Cursors:
Implicit & Explicit

About Explicit Cursors

- Define Cursor Types
- What is Explicit Cursors? Functionality
- Explicit Cursors Flow (Graphical)
- Declaring the Cursor
- Open the Cursor
- Fetch data from the Cursor
- Close the Cursor
- Explicit Cursor Attributes
- Usage of *%ISOPEN, %NOTFOUND, %ROWCOUNT* Attributes
- Cursor FOR loop

Define Cursor Types

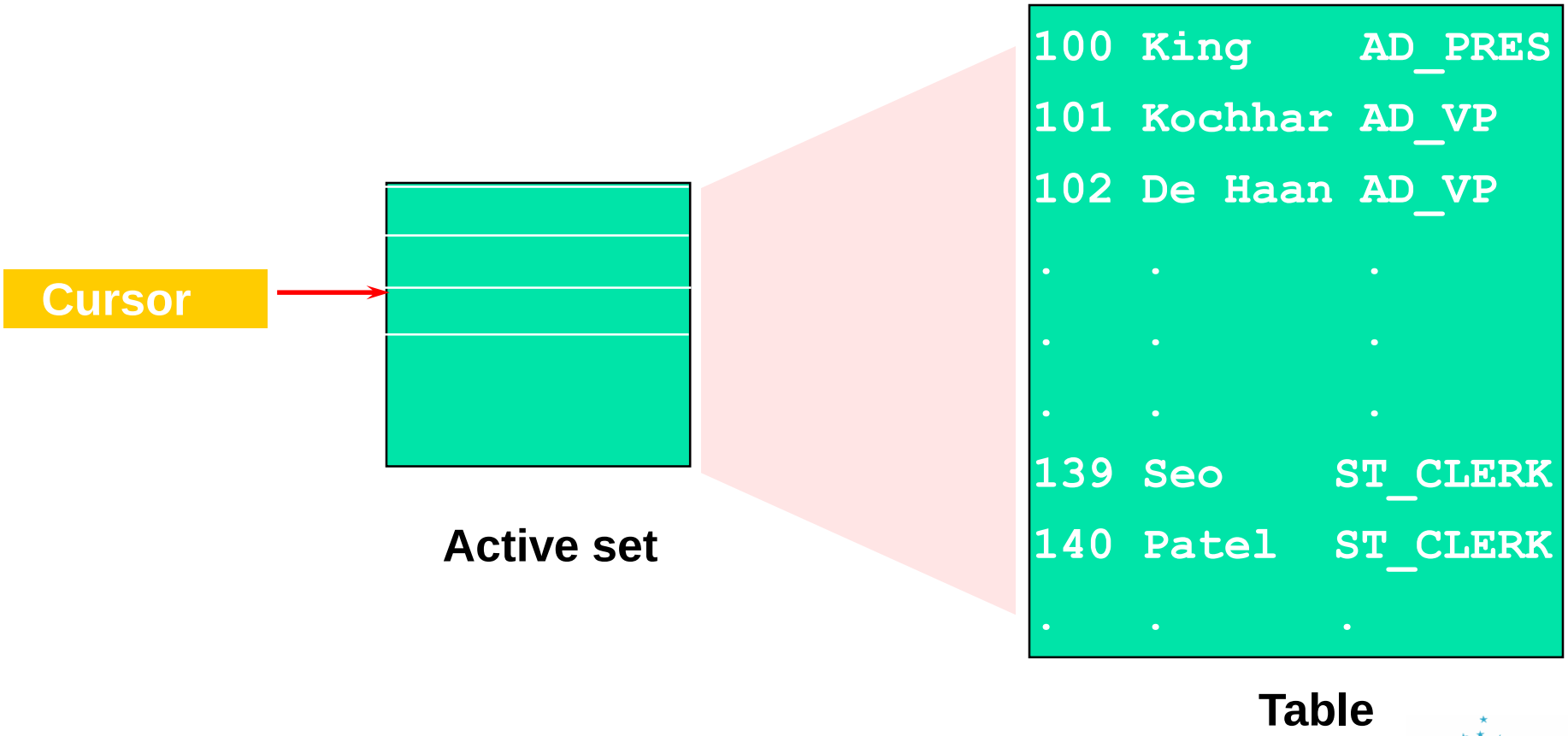
- A cursor is a private SQL work area.
- There are two types of cursors:
  - Implicit cursors
  - Explicit cursors
- The Oracle server uses implicit cursors to parse and execute your SQL statements.
- Explicit cursors are explicitly declared by the programmer (Covered later sessions)

What is Explicit Cursors

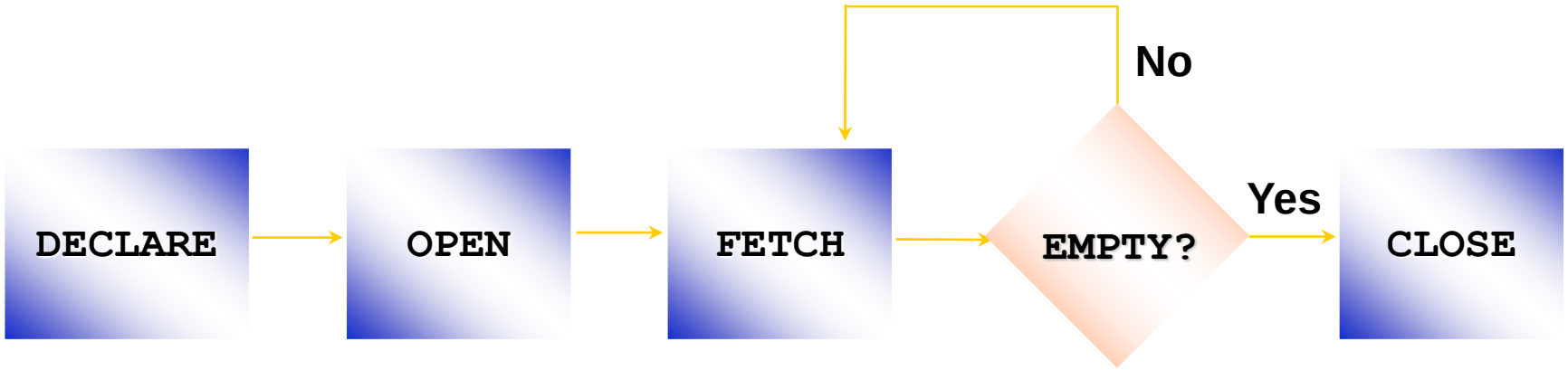
- A cursor is a pointer to this context area.
- You can name a cursor so that it could be referred to in a program to fetch and process the rows returned by the SQL statement, one at a time.
- Explicit cursors are programmer defined cursors for gaining more control over the **context area**. An explicit cursor should be defined in the declaration section of the PL/SQL Block. It is created on a SELECT Statement which returns more than one row.

What is Explicit Cursor

A cursor holds the rows (one or more) returned by a SQL statement. The set of rows the cursor holds is referred to as the **active set**.



Explicit Cursors Flow (Graphical)

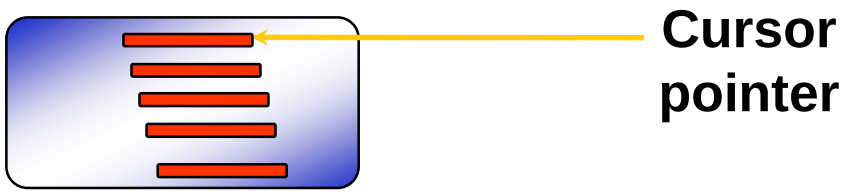


- Create a named SQL area
- Identify the active set
- Load the current row into variables
- Test for existing rows
- Return to `FETCH` if rows are found
- Release the active set

Explicit Cursors Flow (Graphical)

1. **Open the cursor**
2. **Fetch a row**
3. **Close the Cursor**

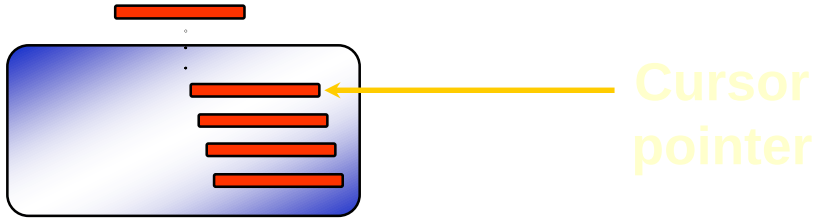
1. Open the cursor.



Explicit Cursors Flow (Graphical)

1. **Open the cursor**
2. **Fetch a row**
3. **Close the Cursor**

2. Fetch a row using the cursor.

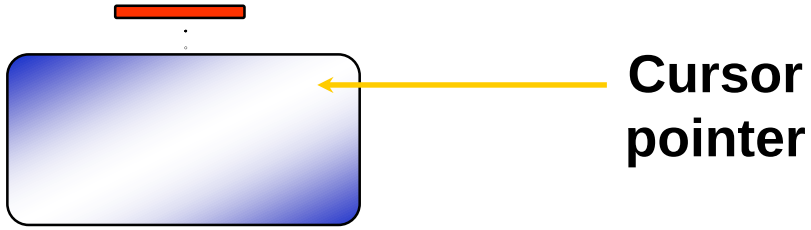


Continue until empty.

Explicit Cursors Flow (Graphical)

1. **Open the cursor**
2. **Fetch a row**
3. **Close the Cursor**

3. **Close the cursor.**



Declaring the Cursor

Syntax:

```
CURSOR cursor_name IS
      select_statement;
```

- Do not include the `INTO` clause in the cursor declaration.
- If processing rows in a specific sequence is required, use the `ORDER BY` clause in the query.

Declaring the Cursor

Example:

```
DECLARE
  CURSOR emp_cursor IS
    SELECT employee_id, last_name
    FROM   employees;

  CURSOR dept_cursor IS
    SELECT *
    FROM   departments
    WHERE  location_id = 170;
BEGIN
  ...
```

Opening the Cursor

Syntax:

```
OPEN  cursor_name;
```

- Open the cursor to execute the query and identify the active set.
- If the query returns no rows, no exception is raised.
- Use cursor attributes to test the outcome after a fetch.

Fetching Data from the Cursor

Syntax:

```
FETCH cursor_name INTO  [variable1, variable2, ...]
                        | record_name];
```

- Retrieve the current row values into variables.
- Include the same number of variables.
- Match each variable to correspond to the columns positionally.
- Test to see whether the cursor contains rows.

Fetching Data from the Cursor

Example:

```
LOOP
  FETCH emp_cursor INTO v_empno,v_ename;
  EXIT WHEN ...;
  ...
    -- Process the retrieved data
  …
END LOOP;
```

Closing the Cursor

Syntax:

```
CLOSE     cursor_name;
```

- Close the cursor after completing the processing of the rows.
- Reopen the cursor, if required.
- Do not attempt to fetch data from a cursor after it has been closed.

Explicit Cursor Attributes

Obtain status information about a cursor.

Attribute	Type	Description
%ISOPEN	Boolean	Evaluates to TRUE if the cursor is open
%NOTFOUND	Boolean	Evaluates to TRUE if the most recent fetch does not return a row
%FOUND	Boolean	Evaluates to TRUE if the most recent fetch returns a row; complement of %NOTFOUND
%ROWCOUNT	Number	Evaluates to the total number of rows returned so far

The %ISOPEN Attribute

- Fetch rows only when the cursor is open.
- Use the %ISOPEN cursor attribute before performing a fetch to test whether the cursor is open.

Example:

```
IF NOT emp_cursor%ISOPEN THEN
    OPEN emp_cursor;
END IF;
LOOP
  FETCH emp_cursor...
```

Controlling Multiple Fetches

- Process several rows from an explicit cursor using a loop.
- Fetch a row with each iteration.
- Use explicit cursor attributes to test the success of each fetch.

The %NOTFOUND and %ROWCOUNT Attributes

- Use the %ROWCOUNT cursor attribute to retrieve an exact number of rows.
- Use the %NOTFOUND cursor attribute to determine when to exit the loop.

Example on %ROWCOUNT

- Delete rows that have the specified employee ID from the EMPL table. Print the number of rows deleted.

- Example: %ROWCOUNT

```
VARIABLE rows_del VARCHAR2(30)
DECLARE
  v_empl_id empl.empl_id%TYPE := 176;
BEGIN
  DELETE FROM  empl
  WHERE        empl_id = v_empl_id;
  :rows_del := (SQL%ROWCOUNT ||' row(s) deleted.');
END;
/
PRINT rows_del
```

Example %NOTFOUND

```
DECLARE
      v_empno  employees.employee_id%TYPE;
      v_ename  employees.last_name%TYPE;
      CURSOR emp_cursor IS
        SELECT employee_id, last_name
        FROM   employees;
    BEGIN
      OPEN emp_cursor;
      LOOP
        FETCH emp_cursor INTO v_empno, v_ename;
        EXIT WHEN emp_cursor%ROWCOUNT > 10 OR
                          emp_cursor%NOTFOUND;
        DBMS_OUTPUT.PUT_LINE (TO_CHAR(v_empno)
                              ||'   '|| v_ename);
      END LOOP;
      CLOSE emp_cursor;
END ;
```

Cursors and Records

Process the rows of the active set by fetching values into a PL/SQL RECORD.

```
DECLARE
  CURSOR emp_cursor IS
    SELECT  employee_id, last_name
    FROM    employees;
  emp_record   emp_cursor%ROWTYPE;
BEGIN
  OPEN emp_cursor;
  LOOP
    FETCH emp_cursor INTO emp_record;
  ...
```

emp_record

employee_id	last_name
100	King

Cursor FOR Loops

Syntax:

```
FOR record_name IN cursor_name LOOP
  statement1;
  statement2;
  . . .
END LOOP;
```

- The cursor FOR loop is a shortcut to process explicit cursors.
- Implicit open, fetch, exit, and close occur.
- The record is implicitly declared.

Cursor FOR Loops

Print a list of the employees who work for the sales department.

```
DECLARE
  CURSOR emp_cursor IS
    SELECT last_name, department_id
    FROM   employees;
BEGIN
  FOR emp_record IN emp_cursor LOOP
         -- implicit open and implicit fetch occur
    IF emp_record.department_id = 80 THEN
      ...
  END LOOP; -- implicit close occurs
END;
/
```

Cursor FOR Loops Using Subqueries

No need to declare the cursor.

Example:

```
BEGIN
  FOR emp_record IN (SELECT last_name, department_id
                     FROM   employees) LOOP
        -- implicit open and implicit fetch occur
    IF emp_record.department_id = 80 THEN
      ...
  END LOOP; -- implicit close occurs
END;
```