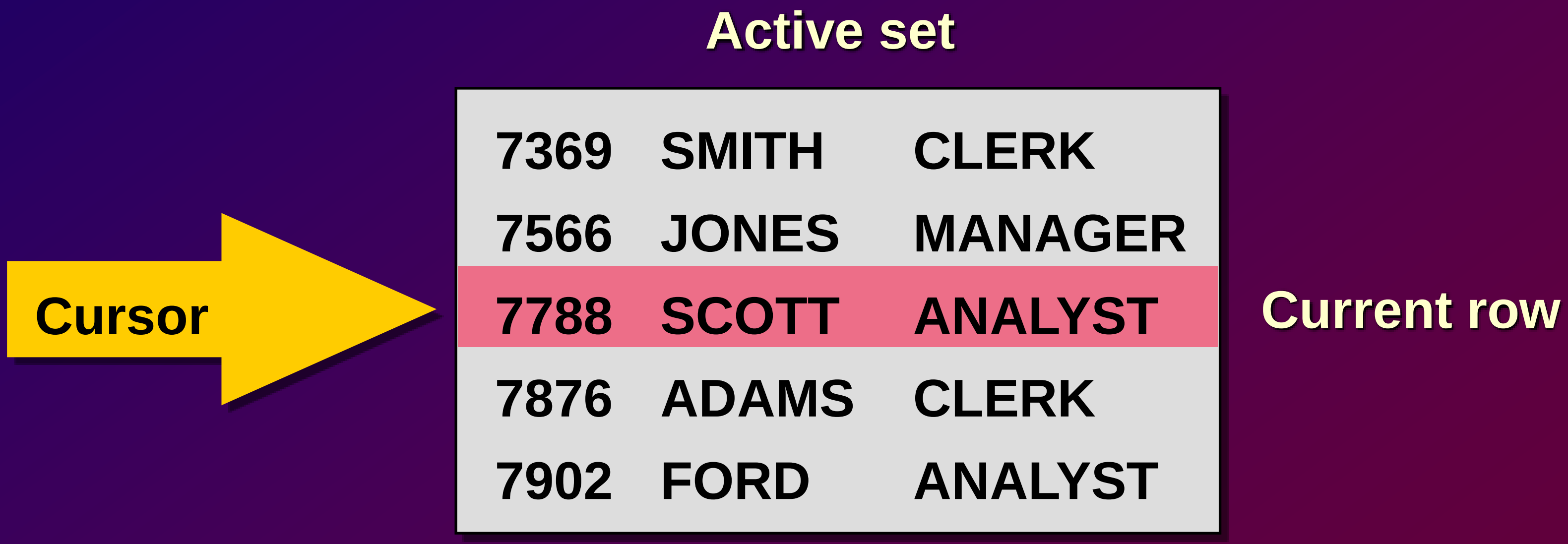
About Cursors

Every SQL statement executed by the Oracle Server has an individual cursor associated with it:

- Implicit cursors: Declared for all DML and PL/SQL SELECT statements
- Explicit cursors: Declared and named by the programmer

Explicit Cursor Functions



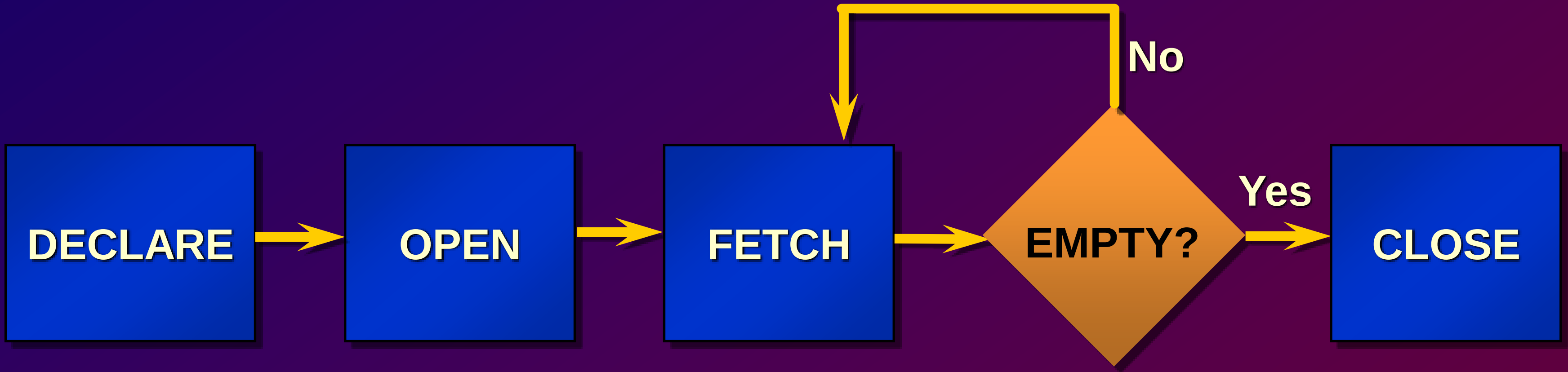
Active set

7369	SMITH	CLERK
7566	JONES	MANAGER
7788	SCOTT	ANALYST
7876	ADAMS	CLERK
7902	FORD	ANALYST

Cursor

Current row

Controlling Explicit Cursors



- Create a named SQL area

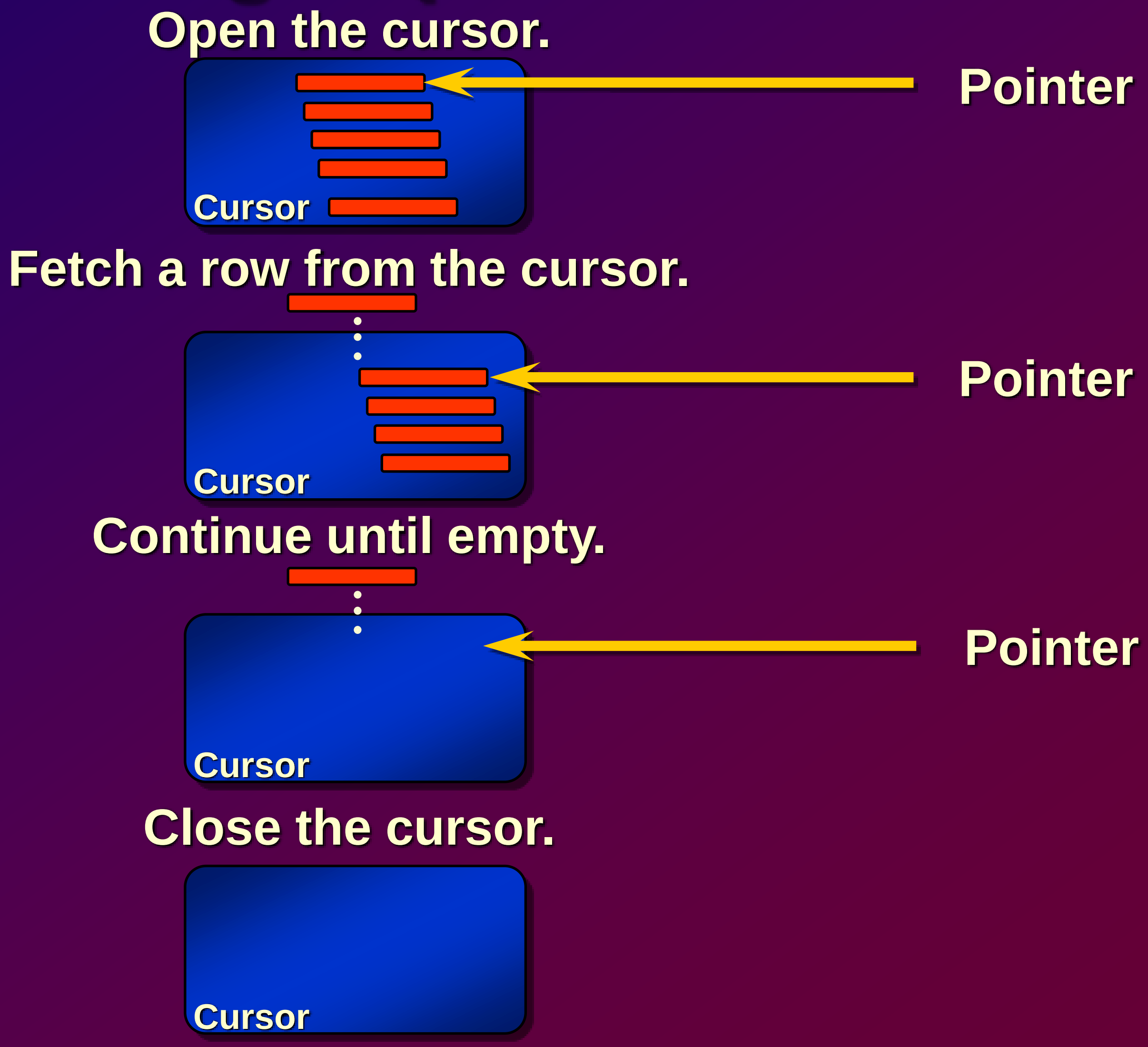
- Identify the active set

- Load the current row into variables

- Test for existing rows
- Return to FETCH if rows found

- Release the active set

Controlling Explicit Cursors



Open the cursor.

Fetch a row from the cursor.

Continue until empty.

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 empno, ename
    FROM   emp;

  CURSOR dept_cursor IS
    SELECT *
    FROM   dept
    WHERE  deptno = 10;
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 output variables.
- Include the same number of variables.
- Match each variable to correspond to the columns positionally.
- Test to see if the cursor contains rows.

Fetching Data from the Cursor

Examples

```
FETCH emp_cursor INTO v_empno, v_ename;
```

```
...
OPEN defined_cursor;
LOOP
  FETCH defined_cursor INTO defined_variables
  EXIT WHEN ...;
  ...
    -- Process the retrieved data
  ...
END;
```

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 once 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

Controlling Multiple Fetches

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

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...
```

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.

Cursors and Records

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

Example

```
DECLARE
   CURSOR emp_cursor IS
      SELECT  empno, ename
      FROM    emp;
   emp_record    emp_cursor%ROWTYPE;
BEGIN
   OPEN emp_cursor;
   LOOP
      FETCH emp_cursor INTO emp_record;
   ...
```

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, and close occur.
- The record is implicitly declared.

Cursor FOR Loops

Retrieve employees one by one until no more are left.

Example

```
DECLARE
  CURSOR emp_cursor IS
    SELECT ename, deptno
    FROM   emp;
BEGIN
  FOR emp_record IN emp_cursor LOOP
         -- implicit open and implicit fetch occur
    IF emp_record.deptno = 30 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 ename, deptno
                      FROM   emp) LOOP
         -- implicit open and implicit fetch occur
    IF emp_record.deptno = 30 THEN
      ...
  END LOOP; -- implicit close occurs
END;
```

Cursors with Parameters

Syntax

```
CURSOR cursor_name
  [(parameter_name datatype, ...)]
IS
  select_statement;
```

- Pass parameter values to a cursor when the cursor is opened and the query is executed.
- Open an explicit cursor several times with a different active set each time.

Cursors with Parameters

Pass the department number and job title to the WHERE clause.

Example

```
DECLARE
  CURSOR emp_cursor
  (v_deptno NUMBER, v_job VARCHAR2) IS
    SELECT    empno, ename
    FROM      emp
    WHERE     deptno = v_deptno
     AND      job = v_job;
BEGIN
  OPEN emp_cursor(10, 'CLERK');
...
```

The FOR UPDATE Clause

Syntax

```
SELECT ...
FROM          ...
FOR UPDATE [OF column_reference][NOWAIT]
```

- Explicit locking lets you deny access for the duration of a transaction.
- Lock the rows *before* the update or delete.

The FOR UPDATE Clause

Retrieve the employees who work in department 30.

Example

```
DECLARE
  CURSOR emp_cursor IS
    SELECT empno, ename, sal
    FROM   emp
    WHERE  deptno = 30
    FOR UPDATE NOWAIT;
```

The WHERE CURRENT OF Clause

Syntax

```
WHERE CURRENT OF cursor
```

- Use cursors to update or delete the current row.
- Include the FOR UPDATE clause in the cursor query to lock the rows first.
- Use the WHERE CURRENT OF clause to reference the current row from an explicit cursor.

The WHERE CURRENT OF Clause

Example

```
DECLARE
  CURSOR sal_cursor IS
    SELECT    sal
    FROM      emp
    WHERE     deptno = 30
    FOR UPDATE NOWAIT;
BEGIN
  FOR emp_record IN sal_cursor LOOP
    UPDATE    emp
    SET       sal = emp_record.sal * 1.10
    WHERE CURRENT OF sal_cursor;
  END LOOP;
  COMMIT;
END;
```

Cursors with Subqueries

Example

```
DECLARE
  CURSOR my_cursor IS
    SELECT t1.deptno, dname, STAFF
    FROM   dept t1, (SELECT deptno,
                       count(*) STAFF
                     FROM   emp
                     GROUP BY deptno) t2
    WHERE  t1.deptno = t2.deptno
    AND    STAFF >= 5;
```