Persistent Stored Modules (Stored Procedures) : PSM

Stored Procedures

- What is stored procedure?
  - SQL allows you to define procedures and functions and store them in the database server
  - Executed by the database server
- Advantages
  - Complex application logic executed while “close” to the data: usually implies efficiency
  - Contrast with tuple-at-a time processing by JDBC etc through “cursors”
  - Reuse the application logic

Stored Procedures in Oracle

- Oracle supports a slightly different version of PSM called PL/SQL
- mySQL support is only in later versions

Defining a stored procedure

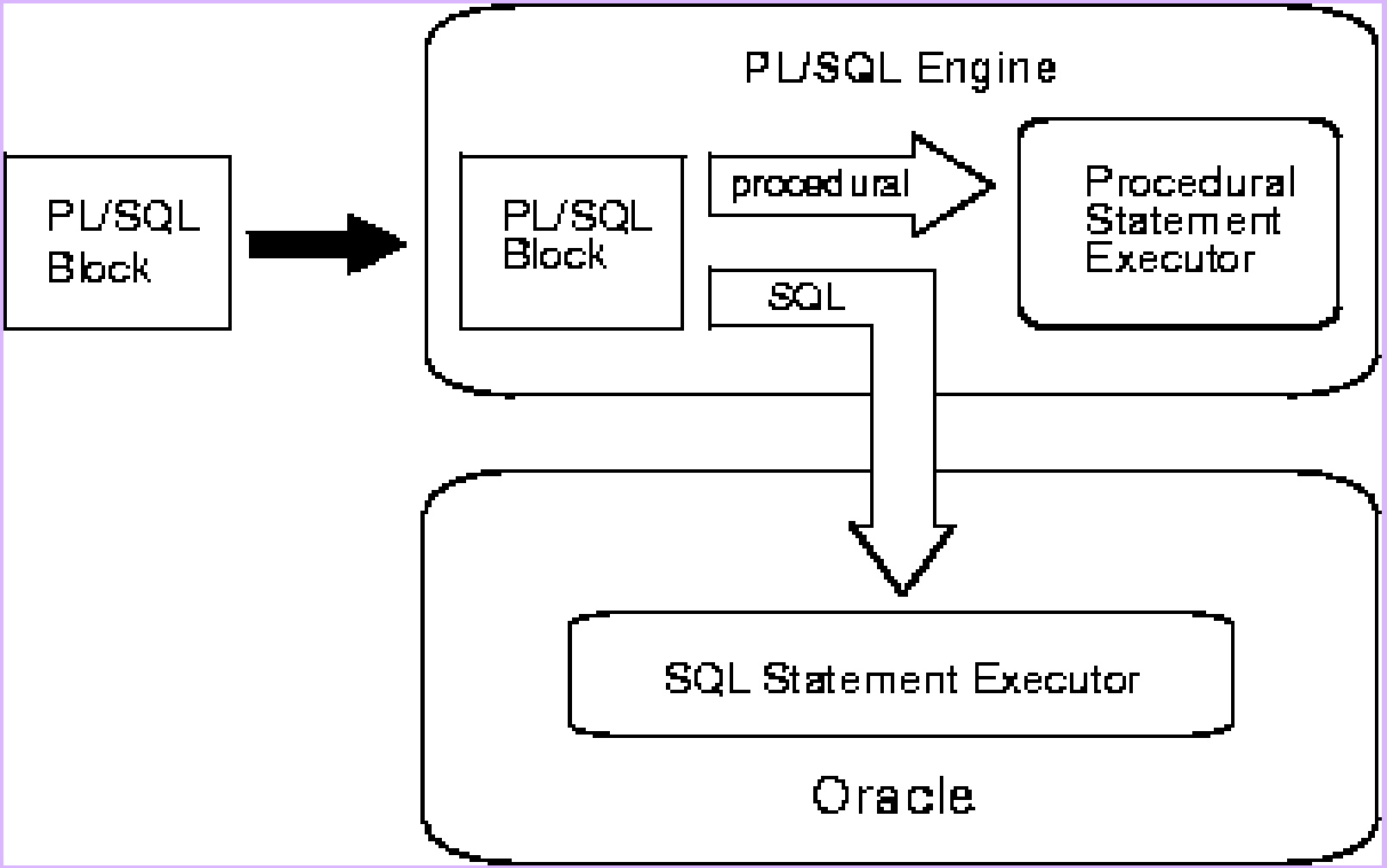
CREATE PROCEDURE <procedureName>
[(<paramList>)]
<localDeclarations>
<procedureBody>;

A parameter in the paramList is specified as:
<name> <mode> <type>
<mode> is one of {IN, OUT, INOUT}
eg: val1 IN int

You can drop procedure by
DROP PROCEDURE <procedureName>

In PL/SQL, you can replace procedure by
CREATE OR REPLACE PROCEDURE
<procedureName> …

PL/SQL Engine



Example: Procedure in PSM

```
CREATE PROCEDURE testProcedure
    BEGIN
        INSERT INTO Student VALUES (5, ‘Joe’);
    END;
```

Oracle PL/SQL:

```
CREATE PROCEDURE testProcedure IS
    BEGIN
        INSERT INTO Student VALUES (5, ‘Joe’);
    END;
.
run;
```

More about Procedures

- If there is an error in your procedure, Oracle will give you a warning. Use command `SHOW ERRORS` to show the errors in your procedure.
- Calling Procedures

  call <procedureName> [(<paramList>)];

Example

```
CREATE PROCEDURE testProcedure (num IN
   int, name IN varchar) IS
   BEGIN
   /* Insert values */
        INSERT INTO Student VALUES (num,
   name);
   END;
.
run;
```

Local Declarations

Example:

```
CREATE PROCEDURE testProcedure (num IN int, name
    IN varchar) IS
    num1 int;    -- local variable
    BEGIN
        num1 := 10;
        INSERT INTO Student VALUES (num1, name);
    END;
.
run;
```

Other PSM features

Assignment statements: PL/SQL

<varName> **:=** <expression>

Control Structures: IF THEN ELSE

IF <condition> THEN

<statementList>

ELSIF <condition> THEN

<statementList>

ELSIF

…

ELSE <statementList>

END IF;

Loops

LOOP

<statementList>

END LOOP;

To exit from a loop use

EXIT;

Loops: Example

```
CREATE PROCEDURE testProcedure (num IN int, name IN
    varchar) IS
    num1 int;
    BEGIN
        num1 := 10;
        LOOP
            INSERT INTO Student VALUES (num1, name);
            num1 := num1 + 1;
            IF (num1 > 15) THEN EXIT; END IF;
        END LOOP;
    END;
.
run;
```

FOR Loops

FOR i in [REVERSE] <lowerBound> .. <upperBound>
    LOOP
    <statementList>
END LOOP

Example:

```
FOR i in 1 .. 5 LOOP
    INSERT INTO Student (sNumber) values (10 + i);
END LOOP;
```

WHILE LOOPS

```
WHILE <condition> LOOP
   <statementList>
END LOOP;
```

Functions

CREATE FUNCTION <functionName>
[(<paramList>)] RETURNS type IS
<localDeclarations>
BEGIN <functionBody>; END;

You can call a function as part of a sql expression

Drop a function:

drop function <functionName>

Functions: Example

```
CREATE FUNCTION testFunction RETURN int IS
num1 int;
BEGIN
    SELECT MAX (sNumber) INTO num1 FROM Student;
    RETURN num1;
END;
.
run;

SELECT * from Student where sNumber = testFunction ();
```

- Oracle stores procedures and functions in catalog as relational tables.
  - Check user_procedures
  - Check user_functions
  - You may run queries etc against them such as
    - describe user_procedures;
    - select object_name from user_procedures;

Cursors

When we execute a statement, a relation is returned. It is stored in private work area for the statement. Cursor is a pointer to this area.

To create a cursor

```
CURSOR c_customers is
    SELECT * from CUSTOMERS;
```

Cursors

We can open the cursor.

OPEN c_customers;

We can select data from the cursor.

FETCH c_customers into customers_rec;

And we can close the cursor.

CLOSE c_customers;

Implicit & Explicit Cursors

Every SQL data manipulation statements including queries that return only one row is an implicit cursor. An explicit cursor is what we create. For queries that return more than one row, you must declare an explicit cursor

```
CREATE OR REPLACE PROCEDURE copyProcedure IS
stID INT; name VARCHAR (10);
CURSOR myCursor IS SELECT * FROM STUDENT;
BEGIN
  OPEN myCursor;
  LOOP
    FETCH myCursor INTO stID, name;
    EXIT WHEN myCURSOR%NOTFOUND;
    INSERT INTO newStudent VALUES (stID, name);
  END LOOP;
  CLOSE myCursor;
END;
```

Cursor Attributes

The SQL cursor attributes are :-

- %ROWCOUNT: The number of rows processed by a SQL statement.
- %FOUND : TRUE if at least one row was processed.
- %NOTFOUND : TRUE if no rows were processed.
- %ISOPEN : TRUE if cursor is open or FALSE if cursor has not been opened or has been closed.

  Only used with explicit cursors.

Advanced Explicit Cursor

Cursor that uses parameters

```
CURSOR c_students
(p_Department
  classes.department%TYPE
  p_Course classes.department%TYPE
  ) IS
        SELECT * FROM classes
        WHERE department =
                    p_Department
        AND course = p_Course;
```

To call the cursor

```
OPEN c_students('CS',101);
```

Cursors for update

The syntax for this parameter in the SELECT statement is:

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

where `column_reference` is a column in the table against which the query is performed. A list of columns can also be used.

Example…for update

```
DECLARE
CURSOR c_AllStudents IS
SELECT *
  FROM students
  FOR UPDATE OF first_name, last_name;
```

Or the cursor can select every column by not specifing a range

```
DECLARE
CURSOR c_AllStudents IS
SELECT *
  FROM students
  FOR UPDATE;
```

SUMMARY

- Procedures
- Functions
- Cursors