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Database Programming with PL/SQL

11-2
Using Oracle-Supplied Packages

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Objectives

This lesson covers the following objectives:

- Describe two common uses for the DBMS_OUTPUT server-supplied package
- Recognize the correct syntax to specify messages for the DBMS_OUTPUT package
- Describe the purpose for the UTL_FILE server-supplied package
- Recall the exceptions used in conjunction with the UTL_FILE server-supplied package
- Describe the main features of the UTL_MAIL server-supplied package

Purpose

- You already know that Oracle supplies a number of SQL functions (UPPER, T0_CHAR, and so on) that you can use in your SQL statements when required.
- It would be wasteful for you to have to “re-invent the wheel” by writing your own functions to do these things.
- In the same way, Oracle supplies a number of ready-made PL/SQL packages to do things that most application developers and/or database administrators need to do from time to time.

Purpose

- In this lesson, you learn how to use two of the Oracle-supplied PL/SQL packages.
- These packages focus on generating text output and manipulating text files.

Using Oracle-Supplied Packages

- You can use these packages directly by invoking them from your own application, exactly as you would invoke packages that you had written yourself.
- Or, you can use these packages as ideas when you create your own subprograms.
- Think of these packages as ready-made “building blocks” that you can invoke from your own applications.

List of Some Oracle-Supplied Packages

Tab	Function
DBMS_LOB	Enables manipulation of Oracle Large Object column datatypes: CLOB, BLOB and BFILE
DBMS_LOCK	Used to request, convert, and release locks in the database through Oracle Lock Management services
DBMS_OUTPUT	Provides debugging and buffering of messages
HTP	Writes HTML-tagged data into database buffers
UTL_FILE	Enables reading and writing of operating system text files
UTL_MAIL	Enables composing and sending of e-mail messages
DBMS_SCHEDULER	Enables scheduling of PL/SQL blocks, stored procedures, and external procedures or executables

The DBMS_OUTPUT Package

- The DBMS_OUTPUT package sends text messages from any PL/SQL block into a private memory area, from which the message can be displayed on the screen.
- Common uses of DBMS_OUTPUT include:
  - You can output results back to the developer during testing for debugging purposes.
  - You can trace the code execution path for a function or procedure.

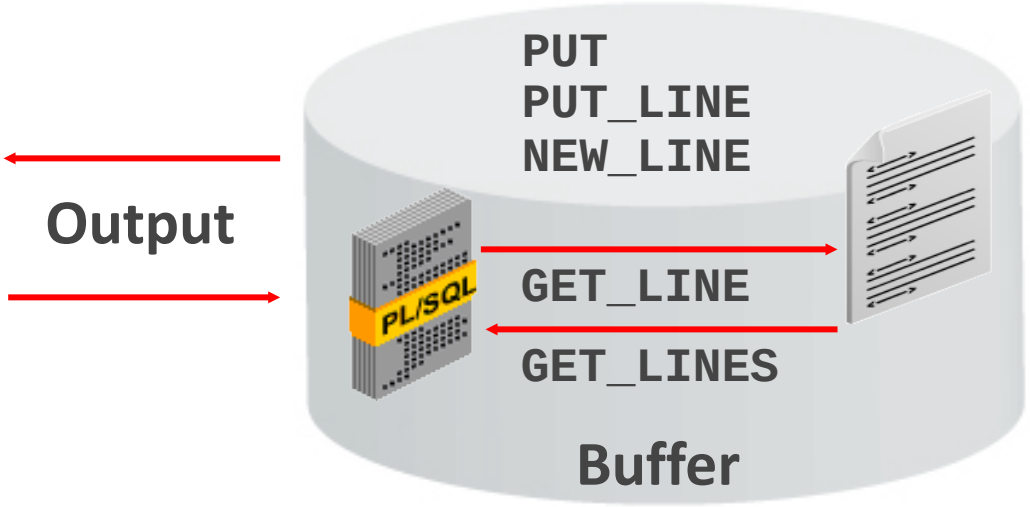
How the DBMS_OUTPUT Package Works

- The DBMS_OUTPUT package enables you to send messages from stored subprograms and anonymous blocks.
- PUT places text in the buffer.
- NEW_LINE sends the buffer to the screen.
- PUT_LINE does a PUT followed by a NEW_LINE.
- GET_LINE and GET_LINES read the buffer.
- Messages are not sent until after the calling block finishes.

How the DBMS_OUTPUT Package Works

ORACLE Application Express

```
BEGIN
   DBMS_OUTPUT...;
END;
```



Using DBMS_OUTPUT: Example 1

- You have already used DBMS_OUTPUT.PUT_LINE.
- This writes a text message into a buffer, then displays the buffer on the screen:

```
BEGIN
  DBMS_OUTPUT.PUT_LINE('The cat sat on the mat');
END;
```

- If you wanted to build a message a little at a time, you could code:

```
BEGIN
  DBMS_OUTPUT.PUT('The cat sat ');
  DBMS_OUTPUT.PUT('on the mat');
  DBMS_OUTPUT.NEW_LINE;
END;
```

Using DBMS_OUTPUT: Example 2

You can trace the flow of execution of a block with complex IF…ELSE, CASE, or looping structures:

```
DECLARE
  v_bool1    BOOLEAN := true;
  v_bool2    BOOLEAN := false;
  v_number   NUMBER;
BEGIN
  ...
  IF v_bool1 AND NOT v_bool2 AND v_number < 25 THEN
    DBMS_OUTPUT.PUT_LINE('IF branch was executed');
  ELSE
    DBMS_OUTPUT.PUT_LINE('ELSE branch was executed');
  END IF;
  ...
END;
```

DBMS_OUTPUT Is Designed for Debugging Only

- You would not use DBMS_OUTPUT in PL/SQL programs that are called from a “real” application, which can include its own application code to display results on the user’s screen.
- Instead, you would return the text to be displayed as an OUT argument from the subprogram.

DBMS_OUTPUT Is Designed for Debugging Only

- For example:

```
CREATE OR REPLACE PROCEDURE do_some_work (...) IS
BEGIN
  ... DBMS_OUTPUT.PUT_LINE('string'); ...
END;
```

- Would be converted to:

```
CREATE OR REPLACE PROCEDURE do_some_work
      (... p_output OUT VARCHAR2)
IS BEGIN
  ... p_output := 'string'; ...
END;
```

DBMS_OUTPUT Is Designed for Debugging Only

- For this reason, you should not use DBMS_OUTPUT in subprograms, but only in anonymous PL/SQL blocks for testing purposes.
- Instead of:

```
CREATE OR REPLACE PROCEDURE do_some_work IS BEGIN
  ... DBMS_OUTPUT.PUT_LINE('string');
...  END;

BEGIN    do_some_work;
END;     -- Test the procedure
```

DBMS_OUTPUT Is Designed for Debugging Only

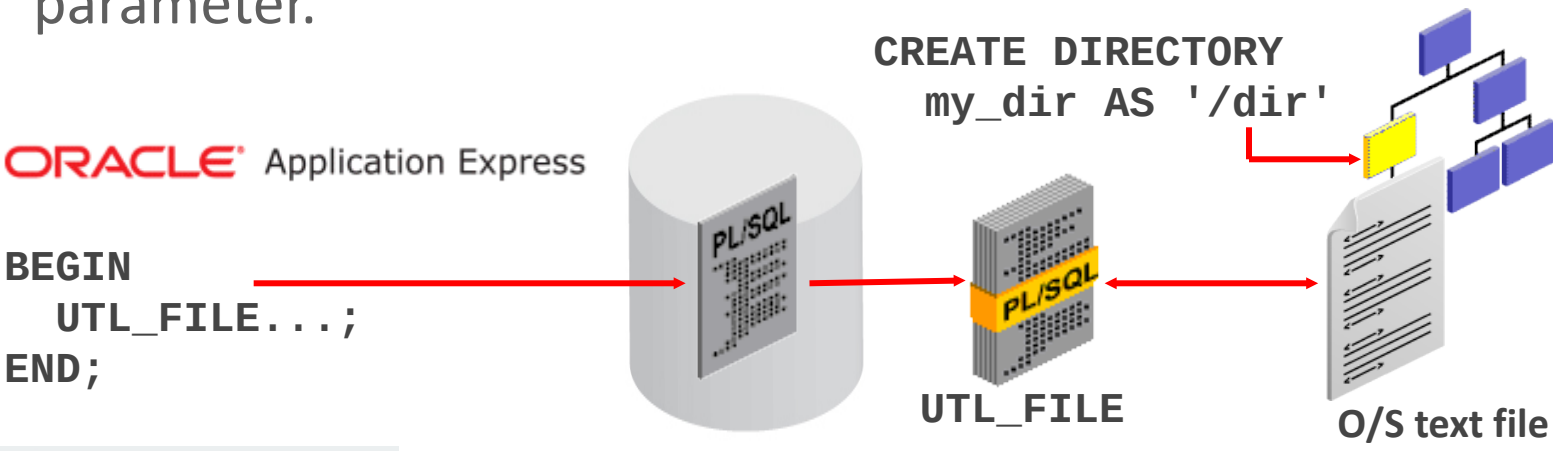
You should use:

```
CREATE OR REPLACE PROCEDURE do_some_work
    (p_output OUT VARCHAR2) IS BEGIN
   ... p_output := 'string';
...  END;

DECLARE v_output VARCHAR2(100);
BEGIN  --Test
  do_some_work(v_output);
  DBMS_OUTPUT.PUT_LINE(v_output);
 END;
```

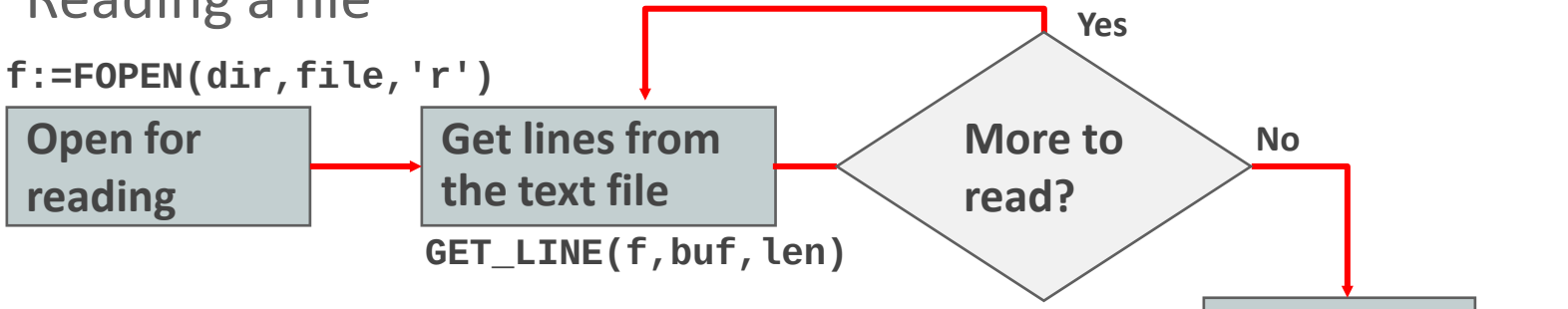
The UTL_FILE Package

- Allows PL/SQL programs to read and write operating system text files.
- Can access text files in operating system directories defined by a CREATE DIRECTORY statement.
- You can also use the utl_file_dir database parameter.

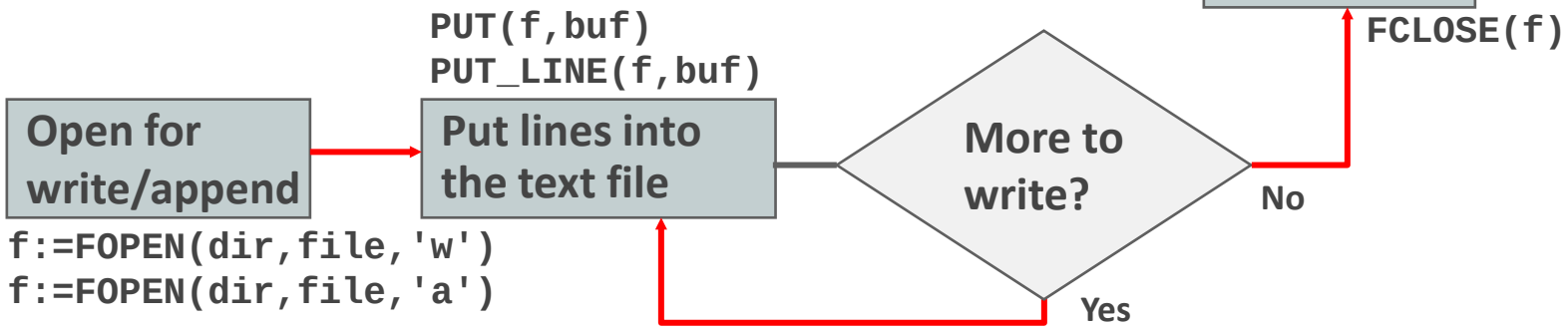


File Processing Using the UTL_FILE Package

- Reading a file



- Writing or appending to a file



File Processing Using the UTL_FILE Package

- The GET_LINE procedure reads a line of text from the file into an output buffer parameter.
- The maximum input record size is 1,023 bytes.
- The PUT and PUT_LINE procedures write text to the opened file.
- The NEW_LINE procedure terminates a line in an output file.
- The FCLOSE procedure closes an opened file.

Exceptions in the UTL_FILE Package

UTL_FILE has its own set of exceptions that are applicable only when using this package:

- INVALID_PATH
- INVALID_MODE
- INVALID_FILEHANDLE
- INVALID_OPERATION
- READ_ERROR
- WRITE_ERROR
- INTERNAL_ERROR

Exceptions in the UTL_FILE Package

The other exceptions not specific to the UTL_FILE package are:

- NO_DATA_FOUND
- VALUE_ERROR

FOPEN and IS_OPEN Function Parameters

```
FUNCTION FOPEN (location IN VARCHAR2,
                filename IN VARCHAR2,
                open_mode IN VARCHAR2)
RETURN UTL_FILE.FILE_TYPE;
```

```
FUNCTION IS_OPEN (file IN FILE_TYPE)
RETURN BOOLEAN;
```

Example:

```
PROCEDURE read(dir VARCHAR2, filename VARCHAR2) IS
  file UTL_FILE.FILE_TYPE;
BEGIN
  IF NOT UTL_FILE.IS_OPEN(file) THEN
    file := UTL_FILE.FOPEN (dir, filename, 'r');
  END IF; ...
END read;
```

Using UTL_FILE Example

- In this example, the `sal_status` procedure uses `UTL_FILE` to create a text report of employees for each department, along with their salaries.
- In the code, the variable `v_file` is declared as `UTL_FILE.FILE_TYPE`, a `BINARY_INTEGER` datatype that is declared globally by the `UTL_FILE` package.

Using UTL_FILE Example

- The `sal_status` procedure accepts two `IN` parameters: `p_dir` for the name of the directory in which to write the text file, and `p_filename` to specify the name of the file.
- To invoke the procedure, use (for example):

```
BEGIN sal_status('MY_DIR', 'salreport.txt');
END;
```

Using UTL_FILE Example

```
CREATE OR REPLACE PROCEDURE sal_status(
  p_dir IN VARCHAR2, p_filename IN VARCHAR2) IS
  v_file UTL_FILE.FILE_TYPE;
  CURSOR empc IS
    SELECT last_name, salary, department_id
      FROM employees ORDER BY department_id;
  v_newdeptno employees.department_id%TYPE;
  v_olddeptno employees.department_id%TYPE := 0;
BEGIN
  v_file:= UTL_FILE.FOPEN (p_dir, p_filename, 'w');   -- 1
  UTL_FILE.PUT_LINE(v_file,                           -- 2
    'REPORT: GENERATED ON ' || SYSDATE);
  UTL_FILE.NEW_LINE (v_file); ...                     -- 3
```

Using UTL_FILE Example

```
 FOR emp_rec IN empc LOOP
    UTL_FILE.PUT_LINE (v_file,                          -- 4
       '  EMPLOYEE: ' || emp_rec.last_name ||
       'earns: ' || emp_rec.salary);
  END LOOP;
  UTL_FILE.PUT_LINE(v_file,'*** END OF REPORT ***');  -- 5
  UTL_FILE.FCLOSE (v_file);                           -- 6
EXCEPTION
  WHEN UTL_FILE.INVALID_FILEHANDLE THEN               -- 7
    RAISE_APPLICATION_ERROR(-20001,'Invalid File.');
  WHEN UTL_FILE.WRITE_ERROR THEN                      -- 8
    RAISE_APPLICATION_ERROR (-20002, 'Unable to
                             write to file');
END sal_status;
```

Using UTL_FILE Invocation and Output Report Example

- Suppose you invoke your procedure by:

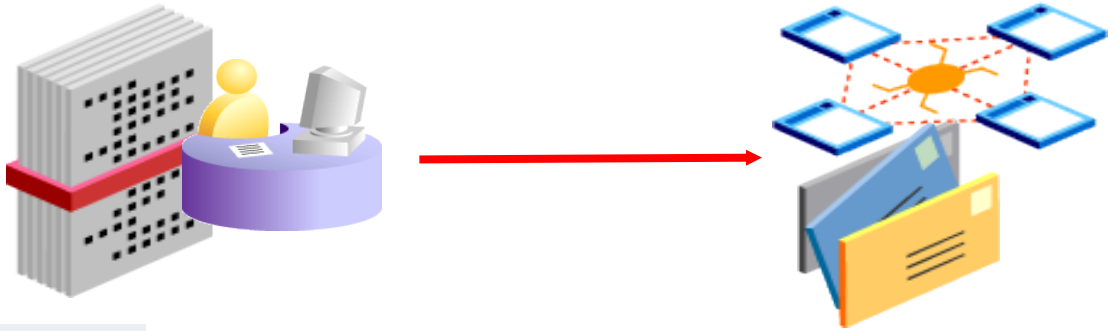
```
BEGIN   sal_status('MYDIR', 'salreport.txt');   END;
```

- The output contained in the file is:

```
SALARY REPORT: GENERATED ON 29-NOV-06
               EMPLOYEE: Whalen earns: 4400
               EMPLOYEE: Hartstein earns: 13000
        EMPLOYEE: Fay earns: 6000
                         ...
               EMPLOYEE: Higgins earns: 12000
               EMPLOYEE: Gietz earns: 8300
               EMPLOYEE: Grant earns: 7000
        *** END OF REPORT ***
```

The UTL_MAIL Package

- The UTL_MAIL package allows sending email from the Oracle database to remote recipients.
- Contains three procedures:
  - SEND for messages without attachments
  - SEND_ATTACH_RAW for messages with binary attachments
  - SEND_ATTACH_VARCHAR2 for messages with text attachments



The UTL_MAIL.SEND Procedure Example

- Sends an email to one or more recipients.
- No attachments are allowed.

```
UTL_MAIL.SEND (
   sender      IN    VARCHAR2,
   recipients  IN    VARCHAR2,
   cc          IN    VARCHAR2 DEFAULT NULL,
   bcc         IN    VARCHAR2 DEFAULT NULL,
   subject     IN    VARCHAR2 DEFAULT NULL,
   message     IN    VARCHAR2,
   ...);
```

```
BEGIN
 UTL_MAIL.SEND('database@oracle.com',
               'joe43@yahoo.com',
    message => 'Friday's meeting will be at 10:30 in
Room 6',
    subject => 'Our PL/SQL meeting');
END;
```

The UTL_MAIL.SEND_ATTACH_RAW Procedure

- Similar to UTL_MAIL.SEND, but allows sending an attachment of data type RAW (for example, a small picture).

```
UTL_MAIL.SEND_ATTACH_RAW (
   sender            IN    VARCHAR2,
   recipients        IN    VARCHAR2,
   cc                IN    VARCHAR2 DEFAULT NULL,
   bcc               IN    VARCHAR2 DEFAULT NULL,
   subject           IN    VARCHAR2 DEFAULT NULL,
   message           IN    VARCHAR2 DEFAULT NULL,
   ...
   attachment        IN    RAW,
   ...);
```

- The maximum size of a RAW file is 32,767 bytes, so you cannot use this to send a large JPEG, MP3, or WAV file.

The UTL_MAIL.SEND_ATTACH_RAW Example

- In this example, the attachment is read from an operating system image file (named company_logo.gif) by a PL/SQL function (GET_IMAGE) which RETURNs a RAW data type.
- Notice that all UTL_MAIL procedures allow you to send to more than one recipient.
- The recipients must be separated by commas.

```
BEGIN
  UTL_MAIL.SEND_ATTACH_RAW(
    sender     => 'marketing@ourcompany.com',
    recipients => 'sally@ourcompany.com,bill@ourcompany.com',
    message    => 'Please display this logo on our website',
    subject    => 'Display Logo',
    attachment => get_image('company_logo.gif'),
END;
```

The UTL_MAIL.SEND_ATTACH_RAW Example

- Notice that all UTL_MAIL procedures allow you to send to more than one recipient.
- The recipients must be separated by commas.

```
BEGIN
  UTL_MAIL.SEND_ATTACH_RAW(
    sender     => 'marketing@ourcompany.com',
    recipients => 'sally@ourcompany.com,bill@ourcompany.com',
    message    => 'Please display this logo on our website',
    subject    => 'Display Logo',
    attachment => get_image('company_logo.gif'),
END;
```

The UTL_MAIL.SEND_ATTACH_VARCHAR2 Procedure

- This is identical to UTL_MAIL.SEND_ATTACH_RAW, but the attachment is a VARCHAR2 text.
- Again, the maximum size of a VARCHAR2 argument is 32,767 bytes, but this can be quite a large document.

```
UTL_MAIL.SEND_ATTACH_VARCHAR2 (
   sender           IN    VARCHAR2,
   recipients       IN    VARCHAR2,
   cc               IN    VARCHAR2 DEFAULT NULL,
   bcc              IN    VARCHAR2 DEFAULT NULL,
   subject          IN    VARCHAR2 DEFAULT NULL,
   message          IN    VARCHAR2 DEFAULT NULL,
   ...
   attachment       IN    VARCHAR2,
   ...);
```

UTL_MAIL.SEND_ATTACH_VARCHAR2: Example

- In this example, the attachment is passed to a procedure as an argument, instead of being read from an operating system file.

```
CREATE OR REPLACE PROCEDURE send_mail_with_text
                (p_text_attachment IN VARCHAR2)
IS BEGIN
  UTL_MAIL.SEND_ATTACH_VARCHAR2(
    sender     => 'me@here.com',
    recipients => 'you@somewhere.net',
    message    => 'See attachment',
    subject    => 'Useful document for our project',
    attachment => p_text_attachment,
END send_mail_with_text;
```

```
BEGIN
  send_mail_with_text('This document is designed to help in
                       creating a project ...');
END;
```

Terminology

Key terms used in this lesson included:

- DBMS_OUTPUT package
- UTL_FILE package
- UTL_MAIL package

Summary

In this lesson, you should have learned how to:

- Describe two common uses for the DBMS_OUTPUT server-supplied package
- Recognize the correct syntax to specify messages for the DBMS_OUTPUT package
- Describe the purpose for the UTL_FILE server-supplied package
- Recall the exceptions used in conjunction with the UTL_FILE server-supplied package
- Describe the main features of the UTL_MAIL server-supplied package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