Testing PL/SQL with Ounit

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Disclaimer

Auspices Statement

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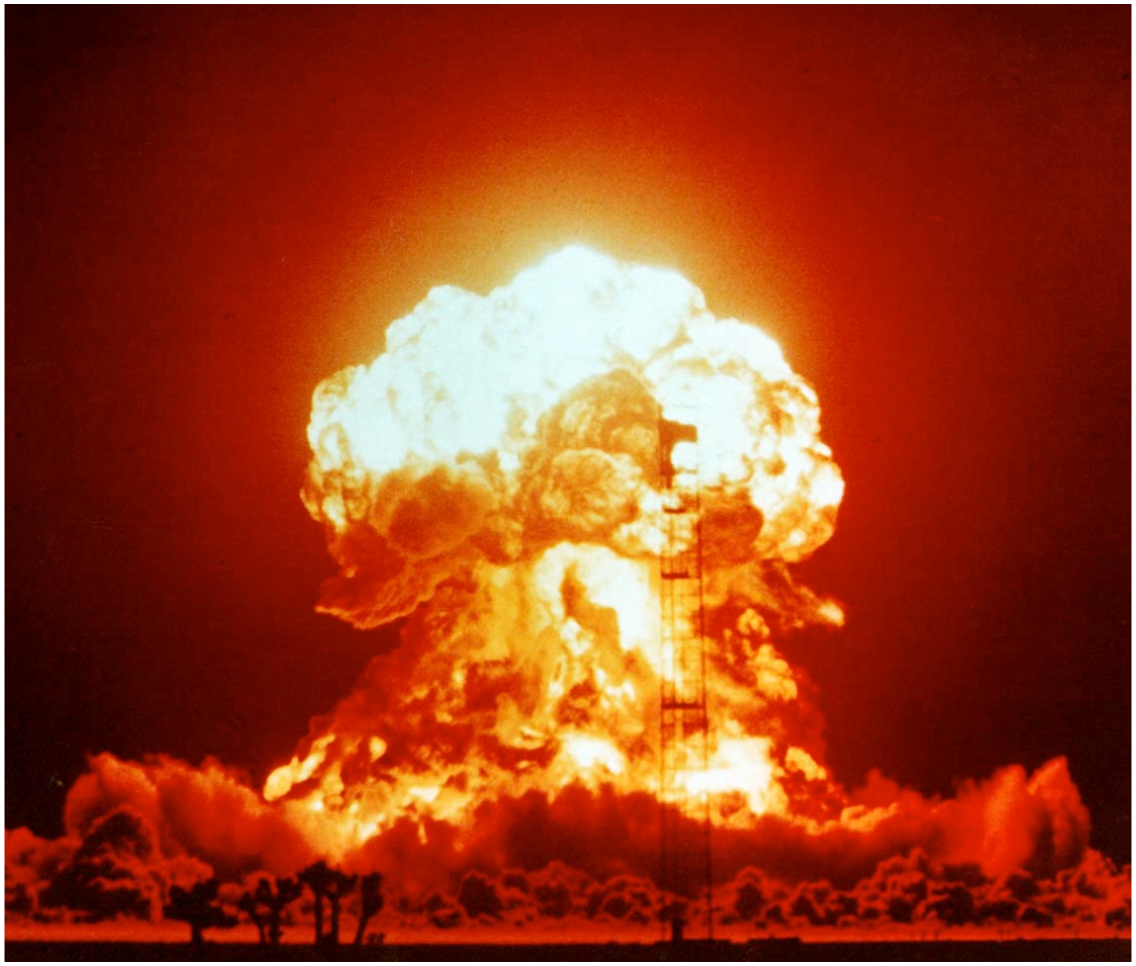
Definition

- **Software testing** is a process used to identify the correctness, completeness and quality of developed computer software.
- Actually, testing can **never** establish the correctness of computer software, as this can only be done by formal verification. It can only find defects, not prove that there are none.
- There are many approaches to software testing, but effective testing of complex products is essentially a process of **investigation**, not merely a matter of creating and following rote procedure.

Why do we test ?

Its something we just do.

Why do we really test !



Because failure is not an option.

Where did Ounit come from

Steven Feuerstein

What is Ounit ?

- Ounit is a utility that helps Oracle developers unit test their code faster, easier and more comprehensively than ever before.
- Ounit offers a powerful graphical interface to utPLSQL, the open source unit testing framework for the Oracle PL/SQL language.
  - Ounit gui only available on windows
  - utPLSQL available anywhere SQL/PLUS works
- With Ounit, you can simply point and click your way through testing sessions, and instantly see the outcomes. Because testing is easier and faster you will test more frequently and more thoroughly.
- How much does it cost? It’s FREE.

What isn’t Ounit

- Ounit does not help you build your test cases and unit test procedures.
- Ounit is not intended to replace powerful interactive development environments. Instead, they will complement those tools with powerful, GUI-driven testing.

What is utPLSQL

- utPLSQL is a unit **testing framework** for programmers using Oracle's PL/SQL language. It allows the automated testing of PL/SQL packages, functions and procedures.
- You must develop the test code to exercise your application code and return results that the utAssert command can analyze.
- How much does it cost? It’s FREE.

Testing with Ounit and utlPLSQL

- Build a test package
  - Generate a test package shell with **utGen** package procedure
  - Modify test package

SQL/PLUS script

```
SET serveroutput on size 1000000
SPOOL c:\temp\cca_to_room.sql

EXEC utgen.testpkg('cca_to_room',null,null,'UT_');

SPOOL off
```

Generated Test Package

```
CREATE OR REPLACE PACKAGE BODY ut_cca_to_room IS
  PROCEDURE ut_setup IS
  BEGIN
    NULL;
  END;
  PROCEDURE ut_teardown IS
  BEGIN
    NULL;
  END;
  PROCEDURE ut_cca_to_room IS   -- Verify and complete data types.
    against_this   VARCHAR2(2000);
    check_this     VARCHAR2(2000);
  BEGIN
-- Define "control" operation
    against_this := NULL;
-- Execute test code
    check_this := cca_to_room(string_in => '');
-- Compare the two values.
    utassert.eq('Test of CCA_TO_ROOM', check_this, against_this);
  END ut_cca_to_room;
END ut_cca_to_room;
```

Modify test package

- Modify test package
  - Add Setup and Teardown code
  - Add specific test case
    - Start with null case
    - Add case for every possible combination of inputs or as many as needed

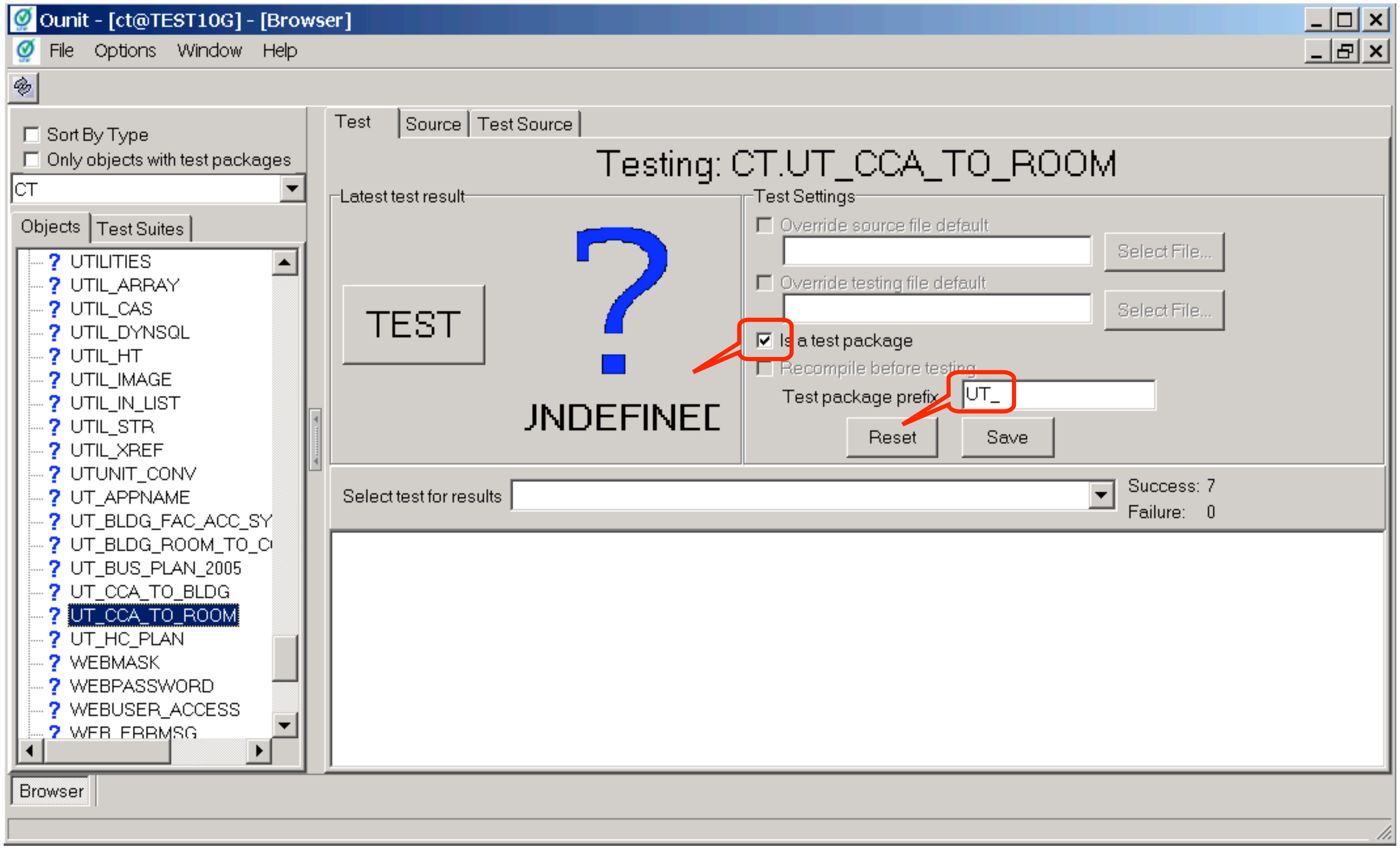
Modified Test Package

```
PROCEDURE ut_cca_to_room IS      -- Verify and complete data types.
     against_this   VARCHAR2(2000);  check_this    VARCHAR2(2000);
BEGIN
-- Null test case 1.0
 against_this := NULL;
 check_this := cca_to_room(string_in => NULL);
 utassert.isnull('Test 1.0 of cca_to_room null', check_this);
-- Normal test case 1.1
 against_this := '100';
 check_this := cca_to_room(string_in => 'B111 R100');
 utassert.eq('Test 1.1 of cca_to_room B111 R100',check_this,against_this);
-- Leading Blank test case 1.2
 against_this := 'B100';
 check_this := cca_to_room(string_in => ' B111 RB100');
 utassert.eq('Test 1.2 of cca_to_room B111 RB100',check_this against_this);
…
END ut_cca_to_room;
```

Testing with Ounit and utlPLSQL

- Build a test package
  - Generate a test package shell with **utGen** package procedure
  - Modify test package
    - Add Setup and Teardown code
    - Add specific test case
      - Start with null case
      - Add case for every possible combination of inputs or as many as needed
- Run test case with Ounit
  - Set the test package to use with program being tested
  - Run test package
  - Make adjustments to test package or program based on results of test.
  - When you make changes to program rerun test to make sure everything is still working properly.

Ounit Test Package Coordination



Ounit - [ct@TEST10G] - [Browser]

File Options Window Help

☐ Sort By Type
☐ Only objects with test packages

CT

Objects | Test Suites

? UTILITIES
? UTIL_ARRAY
? UTIL_CAS
? UTIL_DYNSQL
? UTIL_HT
? UTIL_IMAGE
? UTIL_IN_LIST
? UTIL_STR
? UTIL_XREF
? UTUNIT_CONV
? UT_APPNAME
? UT_BLDG_FAC_ACC_SY
? UT_BLDG_ROOM_TO_C
? UT_BUS_PLAN_2005
? UT_CCA_TO_BLDG
? UT_CCA_TO_ROOM
? UT_HC_PLAN
? WEBMASK
? WEBPASSWORD
? WEBUSER_ACCESS
? WEB_ERRMSG

Test | Source | Test Source

Testing: CT.UT_CCA_TO_ROOM

Latest test result

TEST

?

JNDEFINEI

Test Settings

☐ Override source file default [Select File...]

☐ Override testing file default [Select File...]

☑ Is a test package

☐ Recompile before testing

Test package prefix UT_

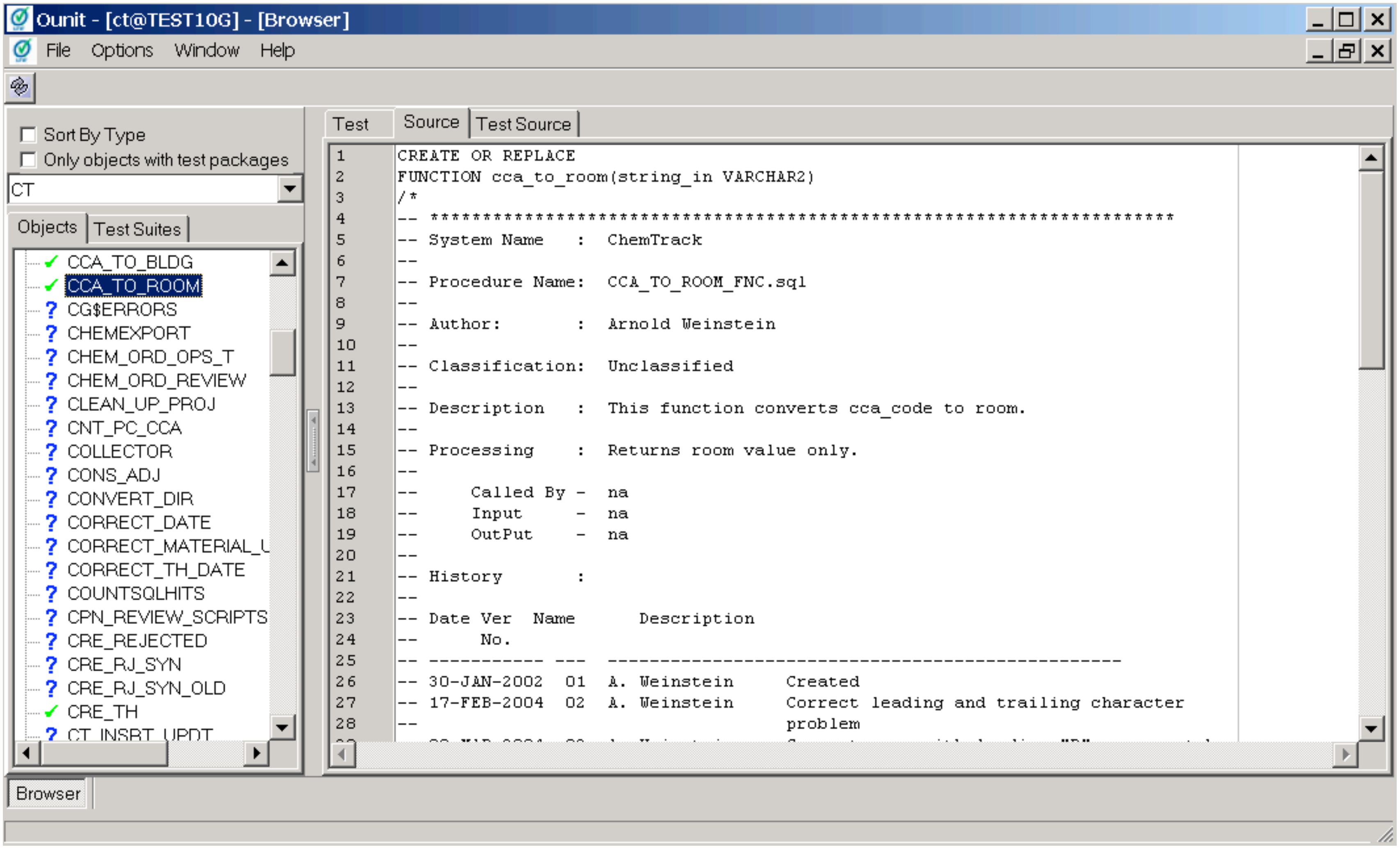
Reset | Save

Select test for results

Success: 7
Failure: 0

Browser

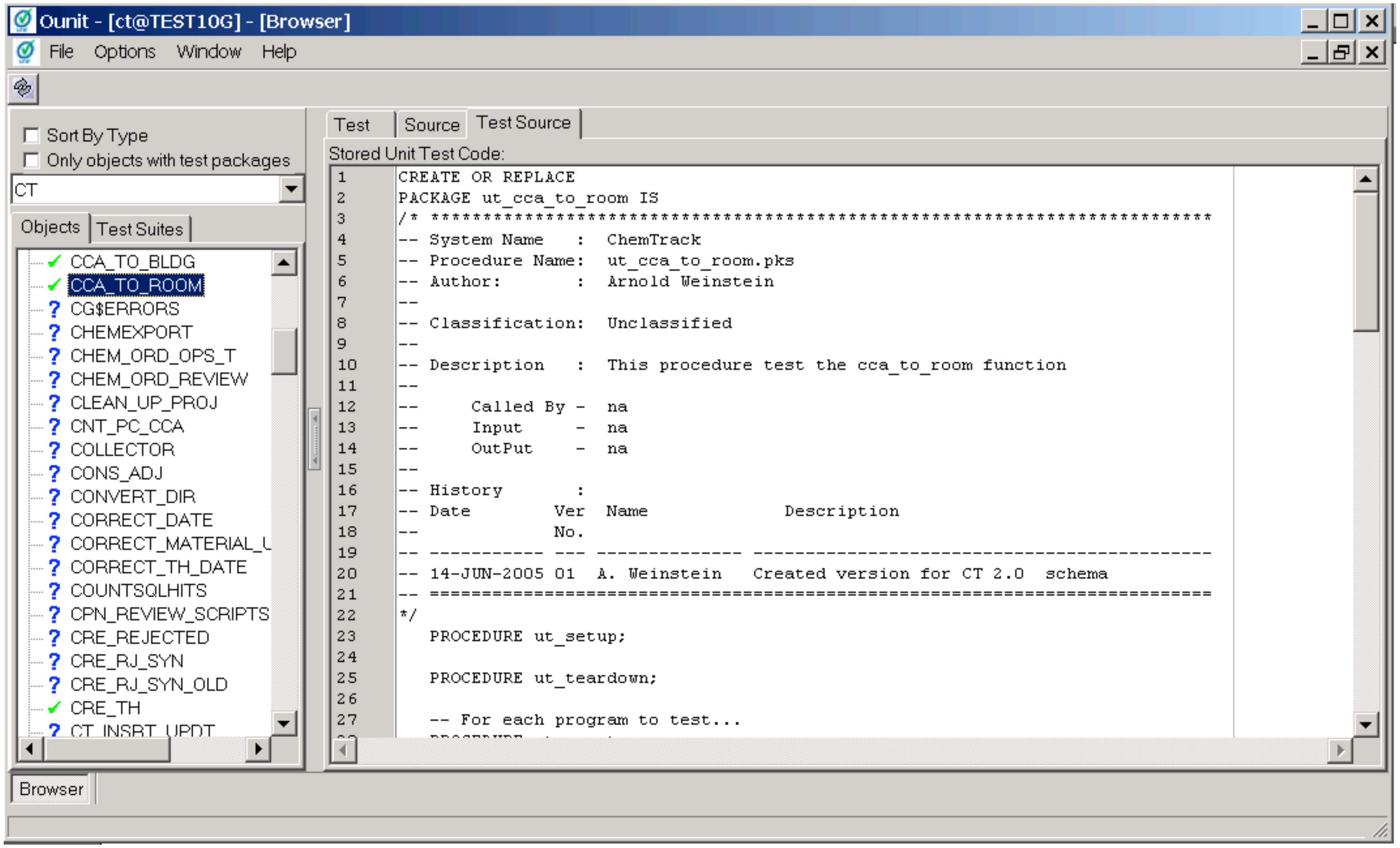
Ounit Test Package Source



✓ CCA_TO_BLDG
✓ CCA_TO_ROOM
? CG$ERRORS
? CHEMEXPORT
? CHEM_ORD_OPS_T
? CHEM_ORD_REVIEW
? CLEAN_UP_PROJ
? CNT_PC_CCA
? COLLECTOR
? CONS_ADJ
? CONVERT_DIR
? CORRECT_DATE
? CORRECT_MATERIAL_L
? CORRECT_TH_DATE
? COUNTSQLHITS
? CPN_REVIEW_SCRIPTS
? CRE_REJECTED
? CRE_RJ_SYN
? CRE_RJ_SYN_OLD
✓ CRE_TH
? CT_INSRT_UPDT

```
CREATE OR REPLACE
FUNCTION cca_to_room(string_in VARCHAR2)
/*
-- ***********************************************************************
-- System Name    :  ChemTrack
--
-- Procedure Name:  CCA_TO_ROOM_FNC.sql
--
-- Author:        :  Arnold Weinstein
--
-- Classification:  Unclassified
--
-- Description    :  This function converts cca_code to room.
--
-- Processing     :  Returns room value only.
--
--      Called By -  na
--      Input     -  na
--      OutPut    -  na
--
-- History        :
--
-- Date Ver  Name      Description
--      No.
-- ----------- ---  -------------------------------------------------
-- 30-JAN-2002  01  A. Weinstein      Created
-- 17-FEB-2004  02  A. Weinstein      Correct leading and trailing character
--                                    problem
```

Ounit Test Package Test Source



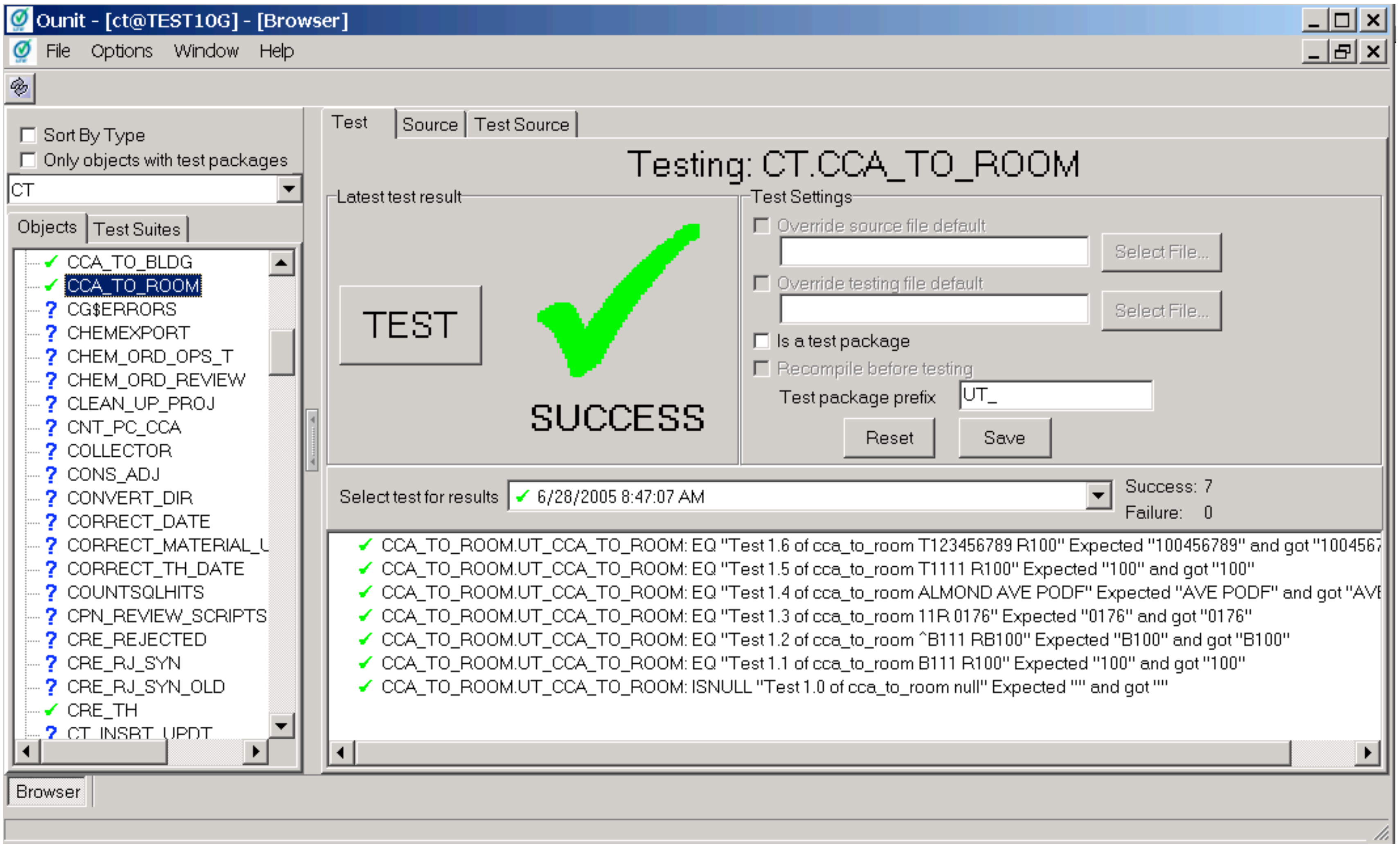
✓ CCA_TO_BLDG
✓ CCA_TO_ROOM
? CG$ERRORS
? CHEMEXPORT
? CHEM_ORD_OPS_T
? CHEM_ORD_REVIEW
? CLEAN_UP_PROJ
? CNT_PC_CCA
? COLLECTOR
? CONS_ADJ
? CONVERT_DIR
? CORRECT_DATE
? CORRECT_MATERIAL_L
? CORRECT_TH_DATE
? COUNTSQLHITS
? CPN_REVIEW_SCRIPTS
? CRE_REJECTED
? CRE_RJ_SYN
? CRE_RJ_SYN_OLD
✓ CRE_TH
? CT_INSRT_UPDT

```
CREATE OR REPLACE
PACKAGE ut_cca_to_room IS
/* ***************************************************************************
-- System Name    :  ChemTrack
-- Procedure Name:  ut_cca_to_room.pks
-- Author:        :  Arnold Weinstein
--
-- Classification:  Unclassified
--
-- Description    :  This procedure test the cca_to_room function
--
--      Called By -  na
--      Input     -  na
--      OutPut    -  na
--
-- History        :
-- Date          Ver  Name             Description
--               No.
-- ----------- --- -------------- ------------------------------------------
-- 14-JUN-2005 01   A. Weinstein   Created version for CT 2.0  schema
-- ==========================================================================
*/
   PROCEDURE ut_setup;

   PROCEDURE ut_teardown;

   -- For each program to test...
```

Ounit Test Package Results



```
✓ CCA_TO_ROOM.UT_CCA_TO_ROOM: EQ "Test 1.6 of cca_to_room T123456789 R100" Expected "100456789" and got "1004567
✓ CCA_TO_ROOM.UT_CCA_TO_ROOM: EQ "Test 1.5 of cca_to_room T1111 R100" Expected "100" and got "100"
✓ CCA_TO_ROOM.UT_CCA_TO_ROOM: EQ "Test 1.4 of cca_to_room ALMOND AVE PODF" Expected "AVE PODF" and got "AVE
✓ CCA_TO_ROOM.UT_CCA_TO_ROOM: EQ "Test 1.3 of cca_to_room 11R 0176" Expected "0176" and got "0176"
✓ CCA_TO_ROOM.UT_CCA_TO_ROOM: EQ "Test 1.2 of cca_to_room ^B111 RB100" Expected "B100" and got "B100"
✓ CCA_TO_ROOM.UT_CCA_TO_ROOM: EQ "Test 1.1 of cca_to_room B111 R100" Expected "100" and got "100"
✓ CCA_TO_ROOM.UT_CCA_TO_ROOM: ISNULL "Test 1.0 of cca_to_room null" Expected "" and got ""
```

Test Package Results from SQL/PLUS

```
execute utPLSQL.test ('CCA_TO_ROOM', recompile_in => FALSE);

SUCCESS: "CCA_TO_ROOM"

> Individual Test Case Results:

SUCCESS - CCA_TO_ROOM.UT_CCA_TO_ROOM: ISNULL "Test 1.0 of cca_to_room null“

Expected "" and got ""

SUCCESS - CCA_TO_ROOM.UT_CCA_TO_ROOM: EQ "Test 1.1 of cca_to_room B111 R100“

Expected "100" and got "100"

SUCCESS - CCA_TO_ROOM.UT_CCA_TO_ROOM: EQ "Test 1.2 of cca_to_room ^B111 RB100“

Expected "B100" and got "B100"

…

>

> Errors recorded in utPLSQL Error Log:

> NONE FOUND
```

Using setup and teardown

```
PROCEDURE utsetup IS
 BEGIN
   -- Remove test cases
   DELETE     bldgs
        WHERE bldg IN('001TEST', '011TEST', '111TEST');
--
   DELETE     chemcontrolarea
        WHERE bldg IN('001TEST', '011TEST', '111TEST');
 END;
 PROCEDURE utteardown IS
 BEGIN
   -- Remove test cases
   DELETE     bldgs
        WHERE bldg IN('001TEST', '011TEST', '111TEST');
--
   DELETE     chemcontrolarea
        WHERE bldg IN('001TEST', '011TEST', '111TEST');
 END;
```

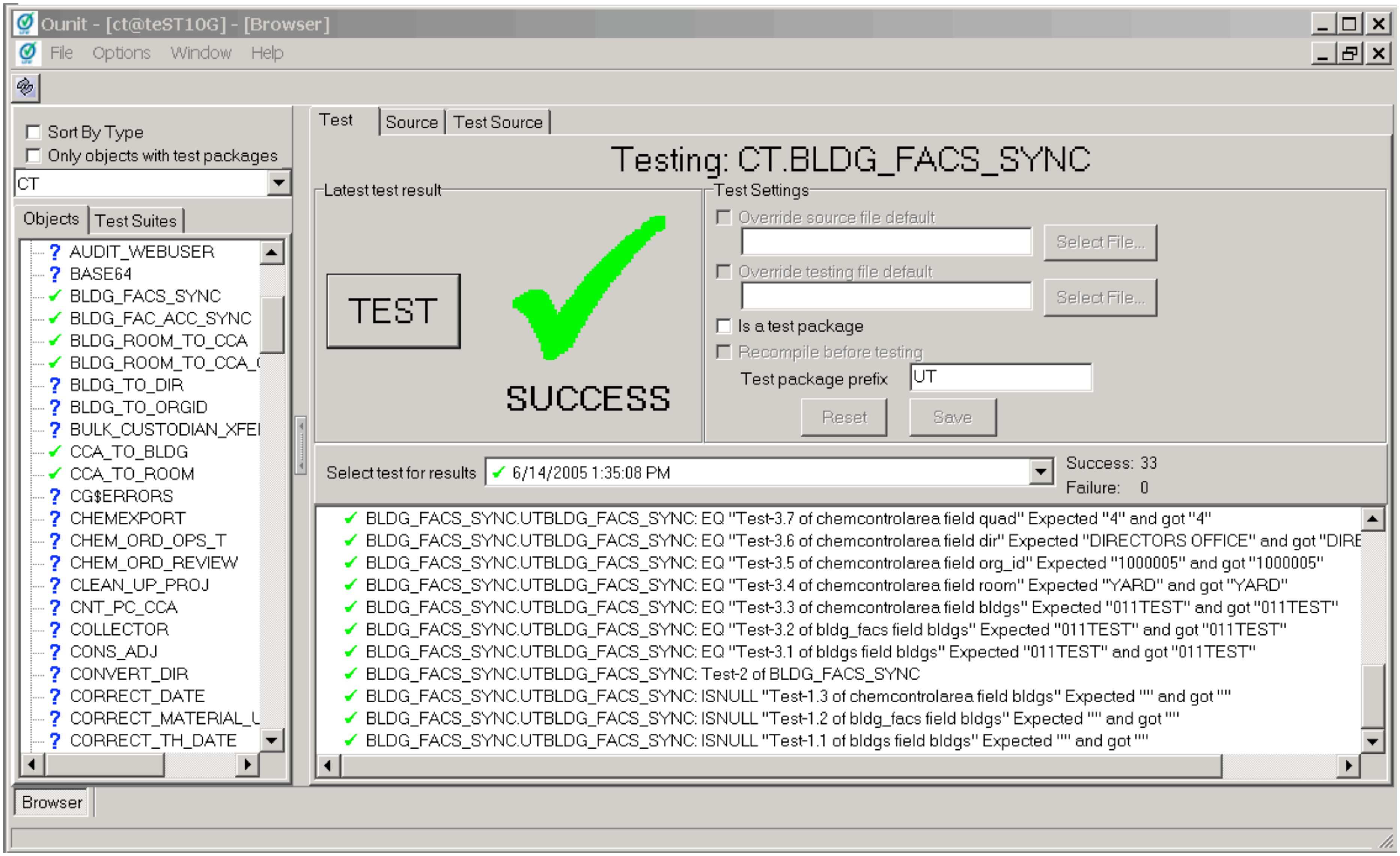
Setup Data

```
-- Test for proper set-up of no records matching test records
--
  bldg_v := '011TEST';
 OPEN bldgs_curvar FOR SELECT * FROM bldgs WHERE bldg = bldg_v;
 FETCH bldgs_curvar INTO bldgs_rec;
--
 OPEN bldg_facs_curvar FOR SELECT * FROM bldg_facs WHERE bldg = bldg_v;
 FETCH bldg_facs_curvar INTO bldg_facs_rec;
--
…
--
 utassert.isnull('Test-1.1 of bldgs field bldgs', bldgs_rec.bldg);
 utassert.isnull('Test-1.2 of bldg_facs field bldgs', bldg_facs_rec.bldg);
…
--
 CLOSE bldgs_curvar;
 CLOSE bldg_facs_curvar;
 CLOSE cca_curvar;
```

Create some Data

```
-- Build first set of records for CCA="B11TEST YARD"
--
   INSERT INTO chemcontrolarea (cca_code, admin_org_id, TIMESTAMP, quad)
         VALUES ('B011test YARD', 1000005, 465722822, '4');
--
   OPEN bldgs_curvar FOR SELECT *FROM bldgs WHERE bldg = bldg_v;
   FETCH bldgs_curvar INTO bldgs_rec;
   OPEN bldg_facs_curvar FOR SELECT * FROM bldg_facs WHERE bldg = bldg_v;
   FETCH bldg_facs_curvar INTO bldg_facs_rec;
…
--
  utassert.this('Test-2 of BLDG_FACS_SYNC', if_true);
  utassert.eq('Test-3.1 of bldgs field bldgs', bldgs_rec.bldg, bldg_v);
  utassert.eq('Test-3.2 of bldg_facs field bldgs', bldg_facs_rec.bldg, bldg_v);
…
--
     CLOSE bldgs_curvar;
     CLOSE bldg_facs_curvar;
…
```

Ounit Results



☐ Sort By Type
☐ Only objects with test packages

CT

- ? AUDIT_WEBUSER
- ? BASE64
- ✓ BLDG_FACS_SYNC
- ✓ BLDG_FAC_ACC_SYNC
- ✓ BLDG_ROOM_TO_CCA
- ✓ BLDG_ROOM_TO_CCA_(
- ? BLDG_TO_DIR
- ? BLDG_TO_ORGID
- ? BULK_CUSTODIAN_XFEI
- ✓ CCA_TO_BLDG
- ✓ CCA_TO_ROOM
- ? CG$ERRORS
- ? CHEMEXPORT
- ? CHEM_ORD_OPS_T
- ? CHEM_ORD_REVIEW
- ? CLEAN_UP_PROJ
- ? CNT_PC_CCA
- ? COLLECTOR
- ? CONS_ADJ
- ? CONVERT_DIR
- ? CORRECT_DATE
- ? CORRECT_MATERIAL_L
- ? CORRECT_TH_DATE

Testing: CT.BLDG_FACS_SYNC

Latest test result

✓ SUCCESS

Test Settings

☐ Override source file default
☐ Override testing file default
☐ Is a test package
☐ Recompile before testing

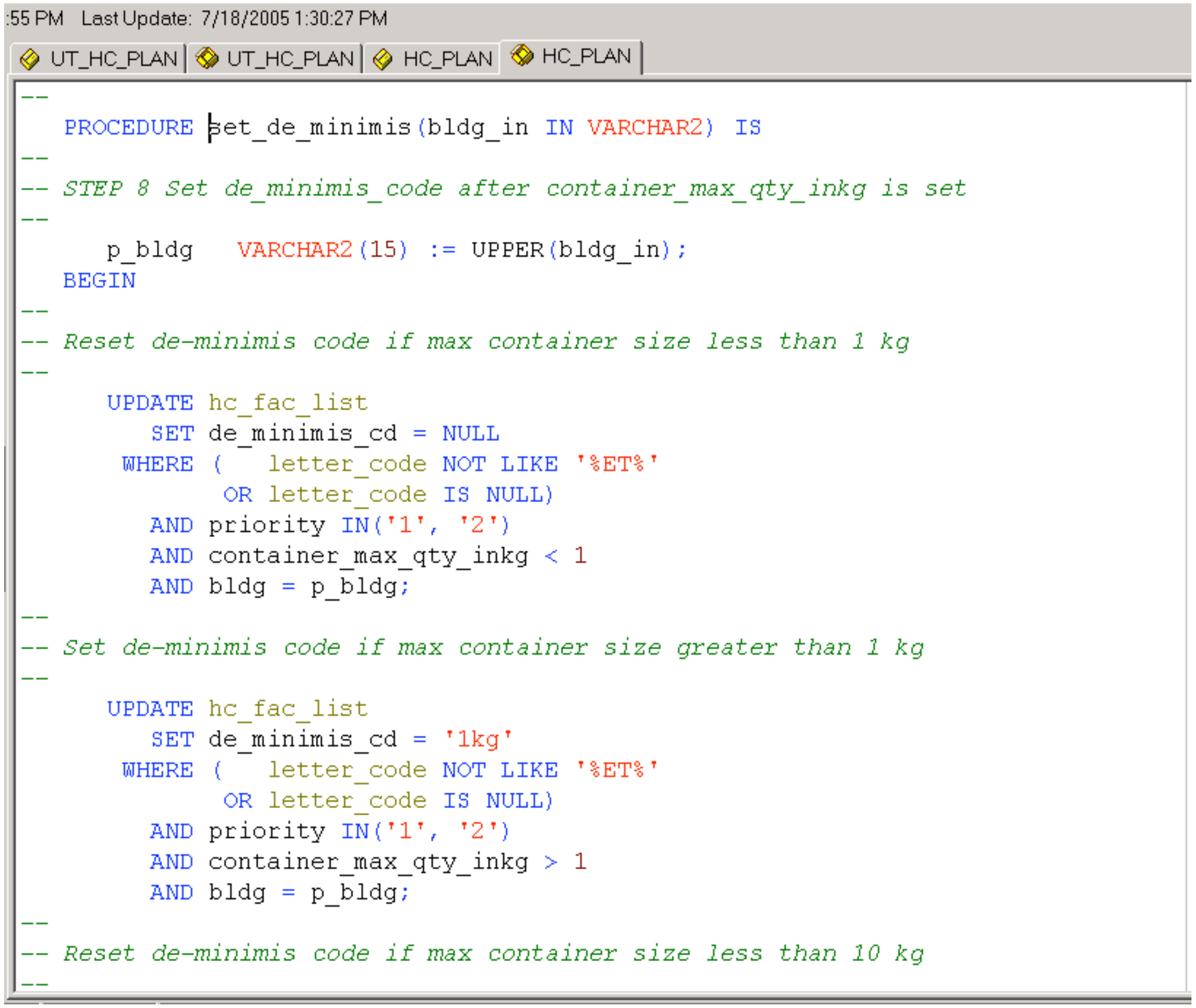
Test package prefix: UT

Select test for results: ✓ 6/14/2005 1:35:08 PM

Success: 33
Failure: 0

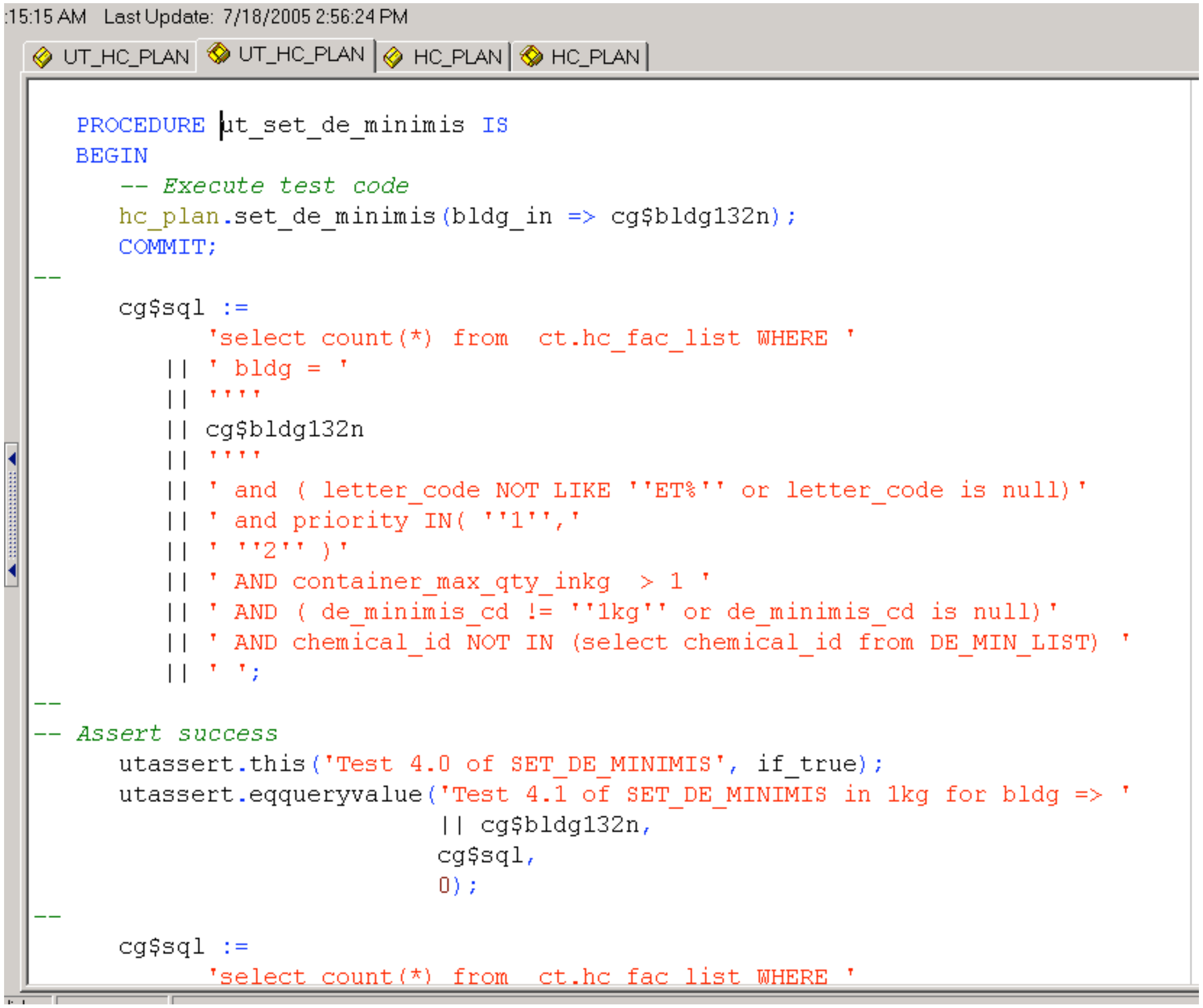
```
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: EQ "Test-3.7 of chemcontrolarea field quad" Expected "4" and got "4"
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: EQ "Test-3.6 of chemcontrolarea field dir" Expected "DIRECTORS OFFICE" and got "DIRE
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: EQ "Test-3.5 of chemcontrolarea field org_id" Expected "1000005" and got "1000005"
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: EQ "Test-3.4 of chemcontrolarea field room" Expected "YARD" and got "YARD"
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: EQ "Test-3.3 of chemcontrolarea field bldgs" Expected "011TEST" and got "011TEST"
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: EQ "Test-3.2 of bldg_facs field bldgs" Expected "011TEST" and got "011TEST"
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: EQ "Test-3.1 of bldgs field bldgs" Expected "011TEST" and got "011TEST"
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: Test-2 of BLDG_FACS_SYNC
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: ISNULL "Test-1.3 of chemcontrolarea field bldgs" Expected "" and got ""
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: ISNULL "Test-1.2 of bldg_facs field bldgs" Expected "" and got ""
✓ BLDG_FACS_SYNC.UTBLDG_FACS_SYNC: ISNULL "Test-1.1 of bldgs field bldgs" Expected "" and got ""
```

TOAD and Procedure



```
--
   PROCEDURE set_de_minimis(bldg_in IN VARCHAR2) IS
--
-- STEP 8 Set de_minimis_code after container_max_qty_inkg is set
--
      p_bldg    VARCHAR2(15) := UPPER(bldg_in);
   BEGIN
--
-- Reset de-minimis code if max container size less than 1 kg
--
      UPDATE hc_fac_list
         SET de_minimis_cd = NULL
       WHERE (   letter_code NOT LIKE '%ET%'
              OR letter_code IS NULL)
         AND priority IN('1', '2')
         AND container_max_qty_inkg < 1
         AND bldg = p_bldg;
--
-- Set de-minimis code if max container size greater than 1 kg
--
      UPDATE hc_fac_list
         SET de_minimis_cd = '1kg'
       WHERE (   letter_code NOT LIKE '%ET%'
              OR letter_code IS NULL)
         AND priority IN('1', '2')
         AND container_max_qty_inkg > 1
         AND bldg = p_bldg;
--
-- Reset de-minimis code if max container size less than 10 kg
--
```

TOAD and utPLSQL test



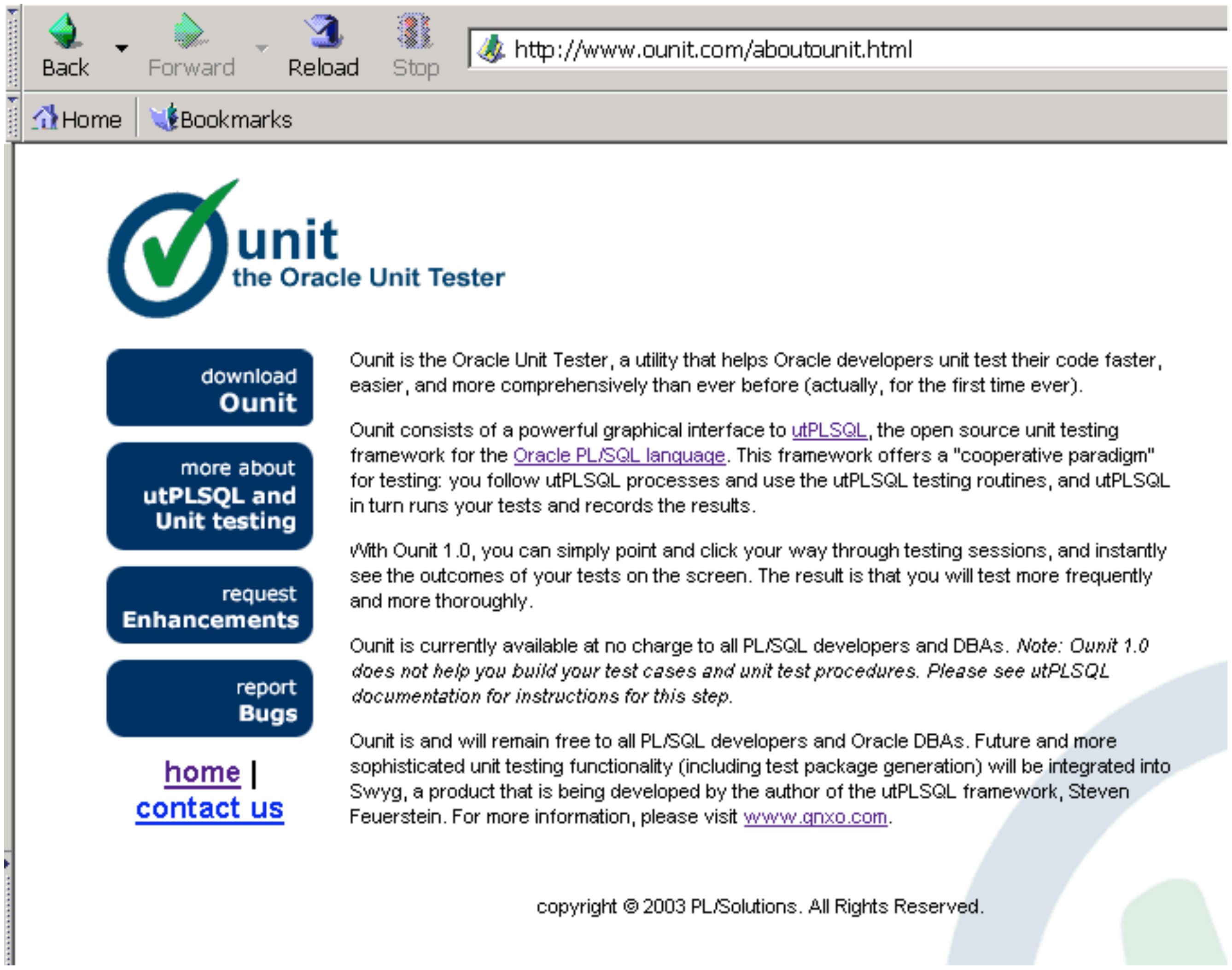
:15:15 AM Last Update: 7/18/2005 2:56:24 PM

UT_HC_PLAN | UT_HC_PLAN | HC_PLAN | HC_PLAN

```
  PROCEDURE ut_set_de_minimis IS
  BEGIN
     -- Execute test code
     hc_plan.set_de_minimis(bldg_in => cg$bldg132n);
     COMMIT;
--
     cg$sql :=
           'select count(*) from  ct.hc_fac_list WHERE '
        || ' bldg = '
        || ''''
        || cg$bldg132n
        || ''''
        || ' and ( letter_code NOT LIKE ''ET%'' or letter_code is null)'
        || ' and priority IN( ''1'','
        || ' ''2'' )'
        || ' AND container_max_qty_inkg  > 1 '
        || ' AND ( de_minimis_cd != ''1kg'' or de_minimis_cd is null)'
        || ' AND chemical_id NOT IN (select chemical_id from DE_MIN_LIST) '
        || ' ';
--
-- Assert success
     utassert.this('Test 4.0 of SET_DE_MINIMIS', if_true);
     utassert.eqqueryvalue('Test 4.1 of SET_DE_MINIMIS in 1kg for bldg => '
                           || cg$bldg132n,
                           cg$sql,
                           0);
--
     cg$sql :=
           'select count(*) from  ct.hc fac list WHERE '
```

12/21/05

Ounit Home Page



Ounit is the Oracle Unit Tester, a utility that helps Oracle developers unit test their code faster, easier, and more comprehensively than ever before (actually, for the first time ever).

Ounit consists of a powerful graphical interface to utPLSQL, the open source unit testing framework for the Oracle PL/SQL language. This framework offers a "cooperative paradigm" for testing: you follow utPLSQL processes and use the utPLSQL testing routines, and utPLSQL in turn runs your tests and records the results.

With Ounit 1.0, you can simply point and click your way through testing sessions, and instantly see the outcomes of your tests on the screen. The result is that you will test more frequently and more thoroughly.

Ounit is currently available at no charge to all PL/SQL developers and DBAs. *Note: Ounit 1.0 does not help you build your test cases and unit test procedures. Please see utPLSQL documentation for instructions for this step.*

Ounit is and will remain free to all PL/SQL developers and Oracle DBAs. Future and more sophisticated unit testing functionality (including test package generation) will be integrated into Swyg, a product that is being developed by the author of the utPLSQL framework, Steven Feuerstein. For more information, please visit www.qnxo.com.

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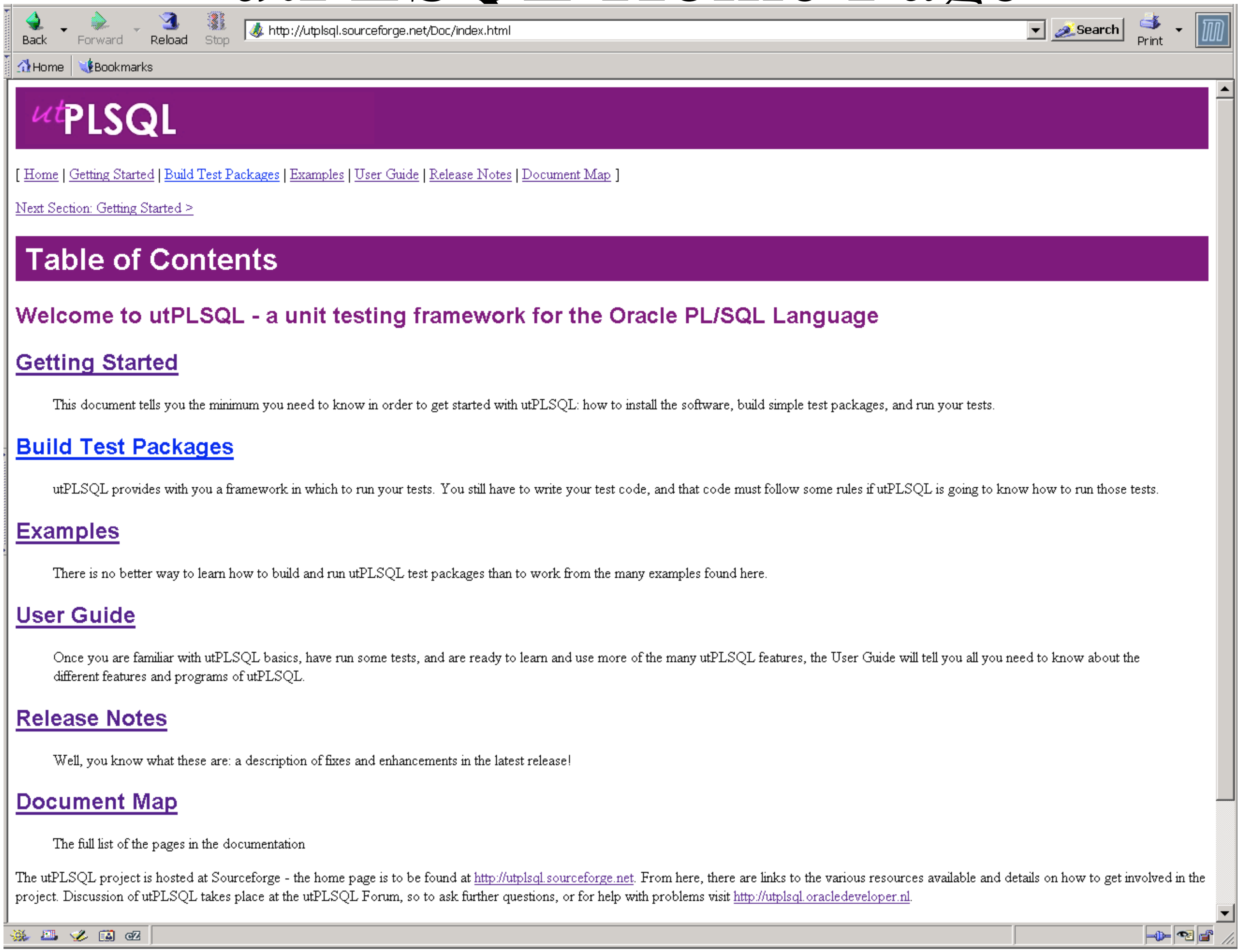
utPLSQL Home Page



[Home | Getting Started | Build Test Packages | Examples | User Guide | Release Notes | Document Map]

Next Section: Getting Started >

Table of Contents

Welcome to utPLSQL - a unit testing framework for the Oracle PL/SQL Language

Getting Started

This document tells you the minimum you need to know in order to get started with utPLSQL: how to install the software, build simple test packages, and run your tests.

Build Test Packages

utPLSQL provides with you a framework in which to run your tests. You still have to write your test code, and that code must follow some rules if utPLSQL is going to know how to run those tests.

Examples

There is no better way to learn how to build and run utPLSQL test packages than to work from the many examples found here.

User Guide

Once you are familiar with utPLSQL basics, have run some tests, and are ready to learn and use more of the many utPLSQL features, the User Guide will tell you all you need to know about the different features and programs of utPLSQL.

Release Notes

Well, you know what these are: a description of fixes and enhancements in the latest release!

Document Map

The full list of the pages in the documentation

The utPLSQL project is hosted at Sourceforge - the home page is to be found at http://utplsql.sourceforge.net. From here, there are links to the various resources available and details on how to get involved in the project. Discussion of utPLSQL takes place at the utPLSQL Forum, so to ask further questions, or for help with problems visit http://utplsql.oracledeveloper.nl.

Summary

- Testing is good, but its time consuming and difficult.
- Ounit and utPLSQL are very useful tools for testing PL/SQL.
  - They make testing PL/SQL easier and faster
  - They are easy to install and configure
  - They formalize and store test procedures so they can be rerun as changes are made to the code.
- The testing however is only as good as you make it. But with this frame work your **testing will improve**.