New Tools for Testing Web Applications with Python

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Test Types / Coverage

- Unit tests exercise components in isolation
- Integration tests exercise “assemblies”
- Functional tests exercise “slices” of the system, according to usage
- System tests exercise the configured system as a whole
- The further we go “up”, the poorer our coverage (generally)

Qui custodiet custodiens?

- Tests verify system functionality
  - who verifies tests?
- Nearer the “surface” of an application, user verification becomes more important
- Traditional spellings are aimed at programmers, not users (“whitebox”)
- “Blackbox” testing aimed at users (or QA)

New Testing Technologies

- Doctests
  - “whitebox” developer documentation
  - Unit, functional, or integration testing
- Funkload
  - “blackbox” testing at the system level
  - Functional testing, load, and stress testing over HTTP
- Selenium
  - “blackbox” browser testing
  - Simulates user interaction inside a “real” browser
  - Tests as specifications, from POV of the user

Doctest example

- Tests specify behavior from programmer's POV
- Storytelling, with executable examples

```
Using mylib
===========

First, we create an instance of the Foo class:
  >>> from mylib import Foo
  >>> foo = Foo('This is a Foo')

Now, we can query the title:
  >>> foo.title
  'This is a Foo'
```

Funkload Features

- Mixes 'unittest' and 'webunit' to emulate a browser from within Python
- Records test scenarios using 'TCPWatch'
- Able to generate “random” input data
- Can be driven from doctest
- Reuse “functional” tests for benchmarking
- Generates ReST or HTML reports with benchmarking data

Funkload Example

- Iterate over a set of URLs

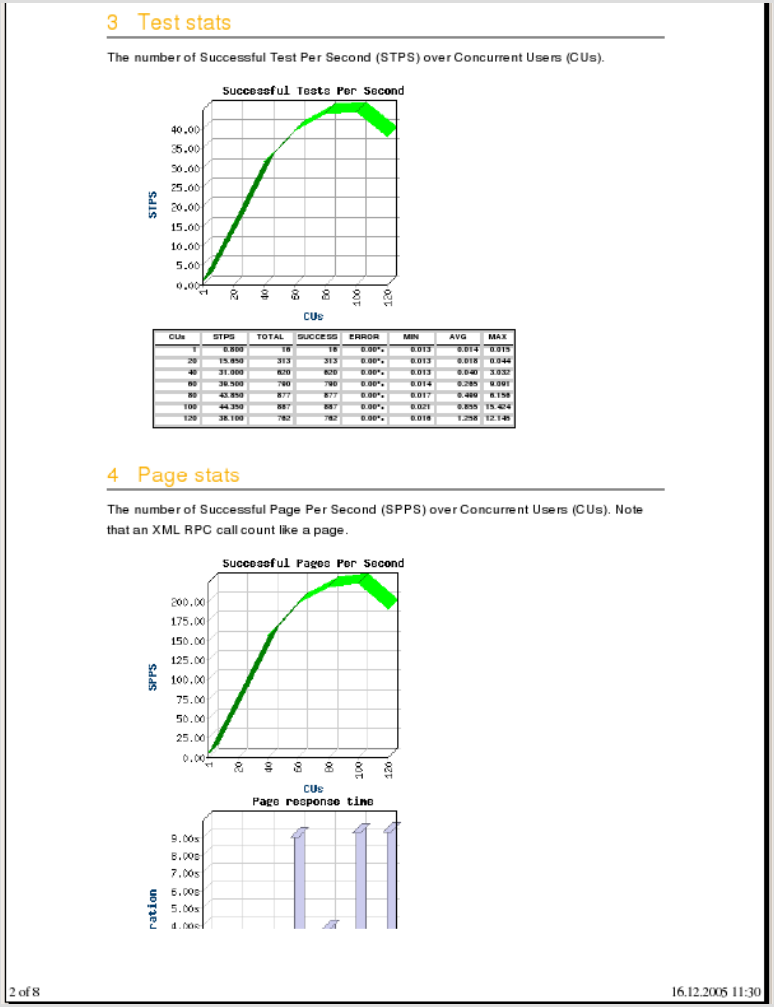
```
import unittest
from funkload.FunkLoadTestCase import FunkLoadTestCase
class SimpleTest(FunkLoadTestCase):
    def test_simple(self):
        SERVER_URL = 'http://localhost:8080/site'
        PAGES = ('index.html', 'about.html', 'login.html')
        for i in range(10):
            for page in PAGES:
                page_url = '%s/%s' % (SERVER_URL, page)
                self.get(page_url, description='Get %s' % page)
if __name__ == '__main__':
    unittest.main()
```

Funkload Testrunners

- Standard testrunner
  - `fl-run-test test_simple.py`
  - Supports both pyUnit and doctest formats
- Benchmarking testrunner
  - `fl-run-bench test_simple.py SimpleTest.test_simple`
  - Saves profile information in XML file for later processing

Funkload Benchmarking Output

- Benchmark analysis
- `fl-build-report funload.xml`
- Generated ReST / HTML
- Can be converted to PDF



3 Test stats

The number of Successful Test Per Second (STPS) over Concurrent Users (CUs).

CUs	STPS	TOTAL	SUCCESS	ERROR	MIN	AVG	MAX
1	0.800	16	16	0.00%	0.013	0.014	0.015
20	15.650	313	313	0.00%	0.013	0.018	0.044
40	31.900	620	620	0.00%	0.013	0.040	3.037
60	38.500	780	780	0.00%	0.014	0.285	9.091
80	43.850	877	877	0.00%	0.017	0.489	8.158
100	44.350	887	887	0.00%	0.021	0.855	15.424
120	38.100	762	762	0.00%	0.018	1.258	12.145

4 Page stats

The number of Successful Page Per Second (SPPS) over Concurrent Users (CUs). Note that an XML RPC call count like a page.

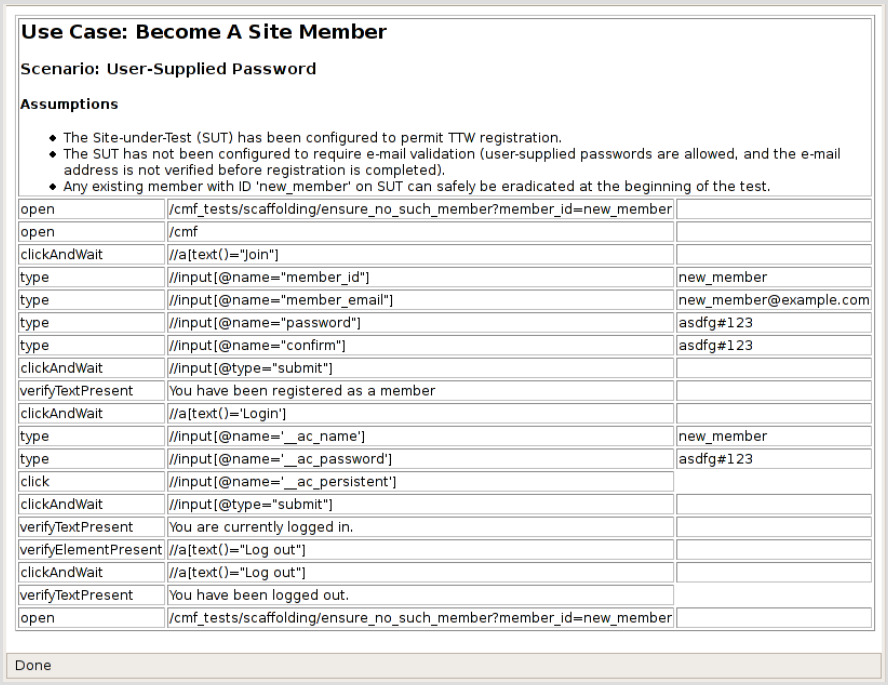
Browser Testing Addresses Gaps

- Web applications are increasingly pushing more behavior into the browser
  - “AJAX” (Javascript + XML/RPC)
  - “Deferred page assembly”
- Traditional testing cannot exercise this functionality well
- Server-side testing which “emulates” browsers may yield false confidence

Other Advantages

- Cross-browser compatibility tests
  - Browsers are a major source of bugs!
- Test specifications users understand
  - Shared understanding increases acceptance, productivity
  - “FIT” project results
- Bug reporting
  - Blue sky: record user reproducing bug, generate test case

Anatomy of a Selenium Test Case



Use Case: Become A Site Member

Scenario: User-Supplied Password

Assumptions

- The Site-under-Test (SUT) has been configured to permit TTW registration.
- The SUT has not been configured to require e-mail validation (user-supplied passwords are allowed, and the e-mail address is not verified before registration is completed).
- Any existing member with ID 'new_member' on SUT can safely be eradicated at the beginning of the test.

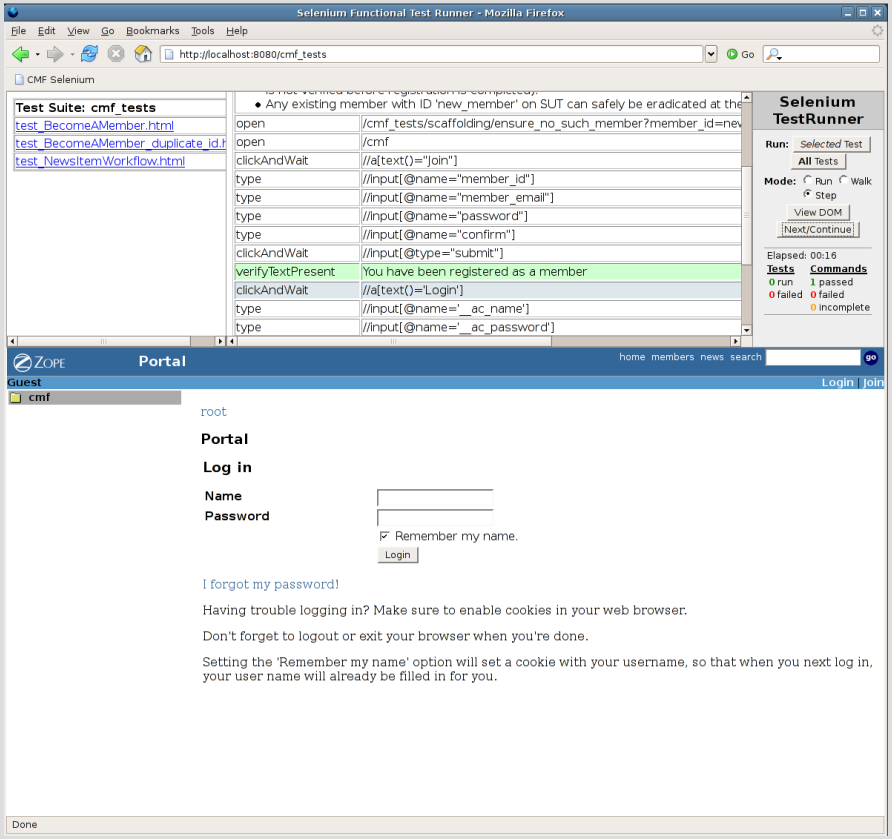
open	/cmf_tests/scaffolding/ensure_no_such_member?member_id=new_member	
open	/cmf	
clickAndWait	//a[text()="Join"]	
type	//input[@name="member_id"]	new_member
type	//input[@name="member_email"]	new_member@example.com
type	//input[@name="password"]	asdfg#123
type	//input[@name="confirm"]	asdfg#123
clickAndWait	//input[@type="submit"]	
verifyTextPresent	You have been registered as a member	
clickAndWait	//a[text()='Login']	
type	//input[@name='__ac_name']	new_member
type	//input[@name='__ac_password']	asdfg#123
click	//input[@name='__ac_persistent']	
clickAndWait	//input[@type="submit"]	
verifyTextPresent	You are currently logged in.	
verifyElementPresent	//a[text()="Log out"]	
clickAndWait	//a[text()="Log out"]	
verifyTextPresent	You have been logged out.	
open	/cmf_tests/scaffolding/ensure_no_such_member?member_id=new_member	

Done

- Each test case is a simple HTML page, containing a 3-column table
  - First row is ignored
  - Rows consist of triples: VERB | TARGET | DATA
  - Each row is either an “action” or an “assertion”
  - Triples use a FIT-inspired language, “Selenese”

Running a Test Case

- Testrunner sets up “application-under-test” in bottom frame
- As tests run, testcase rows turn green / red
- Tests can be single-stepped, including interaction with browser



Authoring Selenium Test Cases

- Authoring tests can be specification
  - “Fleshing out” use cases
  - Can be done in advance, e.g. using mockups
- Simple HTML format, easy to manage in text editor
  - or with tools like Composer

Recording Selenium Test Cases

- Mozilla / Firefox extensions allow recording / editing test cases
  - http://www.kbmj.com/~shinya/seleniumrecorder/
  - http://www.augure.com/dev/SeleniumEditor.xpi
- zope.testrecorder works in IE as well:
  - http://svn.zope.org/zope.testrecorder/
- Solutions which use 'TCPWatch' unsatisfactory, as they can't seen user “gestures”, only HTTP wire traffic

Resources

- Doctest reference, http://docs.python.org/lib/module-doctest.html
- Selenium site, http://selenium.thoughtworks.com
- Zelenium (Zope integration), http://www.zope.org/Members/tseaver/Zelenium
- Funkload site, http://funkload.nuxeo.com/
- ZC TestBrowser, http://svn.zope.org/Zope3/trunk/src/zope/testbrowser/
- ZC TestRecorder, http://svn.zope.org/zope.testrecorder/
- FIT: Framework for Integrated Test, http://fit.c2.com/wiki.cgi

Q & A

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