



Intrusive unit testing for Web applications

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Intrusive unit testing for Web applications



Testing a Web application:

User operations:

- Get the welcome page
 - Click on a link
 - Fill a form
 - Check the pages
 - etc
- 

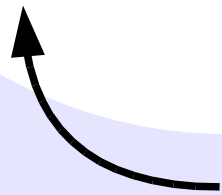
Features expected:

- Support of Javascript/AJAX
- Multiples windows/frames
- Forms, prompts, alerts
- etc

Operations to perform by a robot:

- A robot can replay the tests
- A robot won't complain
- A robot doesn't make mistakes (except those of the test designer)
- So far, a robot can't check what really happened server-side, except by checking the response sent to the client

WUnit can!
(yes we can!)



- ✓ XML/XPath
 - Require basic XSLT knowledge
 - Lots of XML libraries already available
- ✗ Not designed for low-level tests
(does my Javascript/CSS hack works in IE and Firefox ?)
 - Use Selenium instead
- ✓ Tests-driven development
 - Write your tests BEFORE coding the Web app
- ✓ **Intrusive**: can act on server-side components
(user session, request, response, Web application, servlet)
 - AFAIK, no other tool can do that
 - Examine what happens in the server
 - Update server components, GET the page that render them
(REAL UNIT TEST)

▪ Non-intrusive mode

Start a conversation with a real server (Apache, Tomcat, PHP, etc):

```
<wunit:conversation>
  <!--your tests here-->
</wunit:conversation>
```

Wunit gives you the control of the Web client

▪ Intrusive mode

Start a conversation with an emulator (servlets only):

```
<wunit:conversation
  application="file:///path/to/webapps/hello/WEB-INF/web.xml"
  uri="http://www.example.com/">
  <!--your tests here-->
</wunit:conversation>
```

WUnit gives you the control of:

- the Web client
- the Web server (for the host specified in @uri)

- GET a page:

```
<wunit:GET url="http://www.example.com/index.html?who=John Doe"/>
```

- Click a link:

```
<wunit:click target="{ $wunit:document//A[@href][2] }"/>
```

- Fill a form:

```
<wunit:fill-form form="{ $wunit:document//FORM[@name='login'] }">  
  <xcl:param name="user" value="Bill"/>  
  <xcl:param name="password" value="Sesame"/>  
</wunit:fill-form>
```

- POST datas:

```
<wunit:POST url="http://www.example.com/login.html">  
  <xcl:param name="user" value="Bill"/>  
  <xcl:param name="password" value="Sesame"/>  
</wunit:POST>
```

- Check HTTP headers (and cookies):

```
<xunit:assert-number-equals expected="200"  
  result="{ value($wunit:frame/@wunit:response-code) }"/>  
<xunit:assert-string-equals expected="text/html"  
  result="{ string($wunit:frame/@wunit:mime-type) }"/>
```

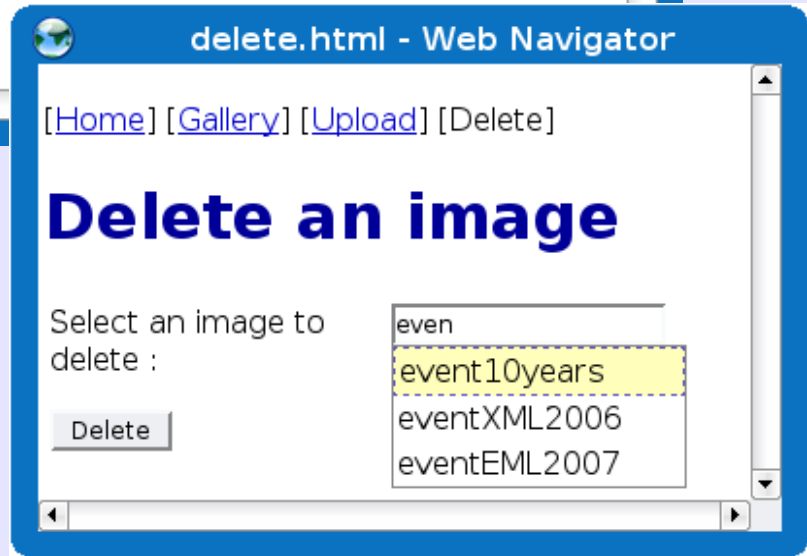
- **WUnit** is just a module (a library) from a larger framework called **Active Tags** that allows to design XML-based applications.
- **Reflex** is an implementation of **Active Tags** in Java.

Each module can define active tags `<my:elem>`, XPath functions `my:funct()`, XPath variables `$my:var`, foreign attributes `@my:attr`, data types `#my:data-types`

Tag libraries available (from Active Tags and Reflex):

- **WUnit**: `<wunit:GET>`, `<wunit:click>`, `$wunit:document`, etc
- **XUnit**: `<xunit:test-case>`, `<xunit:assert-node-equals>`, etc
- **XCL (the XML Control Language)**: `<xcl:if>`, `<xcl:then>`, `<xcl:else>`, `<xcl:parse>`, `<xcl:transform>` (XSLT), etc
- **I/O**: `io:file()`, `#io:input`, etc
- **Web**: `<web:mapping>`, `$web:session`, `#web:x-session`, `web:mime-type()`
- etc (SQL, XQuery...)

Hundreds of active materials are available



AJAX autocompleter


```

<!--set the boundary of the test case-->
<xunit:test-case name="report/1-gallery-welcome" label="[Web] Welcome page">
  <!--start to discuss with the servlet emulator-->
  <wunit:conversation application="../webapp/WEB-INF/web.xml"
    uri="http://www.example.com/">
    <!--get the welcome page hosted in our server emulator-->
    <wunit:GET url="http://www.example.com/">
    <!--do we have it ?
      we ask to the $wunit:frame predefined property
      what is the HTTP response code-->
    <xunit:assert-number-equals
      result="{ value( $wunit:frame/@wunit:response-code ) }"
      expected="200"/>
    <!--is it an HTML page ?-->
    <xunit:assert-string-equals
      result="{ string( $wunit:frame/@wunit:mime-type ) }"
      expected="text/html"/>
    <!--parse the static welcome page from the file system...-->
    <xcl:parse-html source="../webapp/index.html" name="expected"/>
    <!--...and compare it with those returned by the server.
      $wunit:document is a predefined property that refers to
      the DOM of the HTML document of the current page-->
    <xunit:assert-node-equals
      result="{ $wunit:document }"
      expected="{ $expected }"/>
  </wunit:conversation>
</xunit:test-case>

```

But, it is empty !?!

Yes, but let's store authoritatively some images in the user session (because this application works like this), and check how is rendered the page

```

<wunit:conversation application="../../webapp/WEB-INF/web.xml"
    uri="http://www.example.com/">
  <!--store directly some objects in the current session server-side
    (objects are stored as attributes) ;
    the objects stored are images from the file system-->
  <xcl:attribute referent="{ $wunit:session }"
    name="item1"
    value="{ io:file( '../img/xml-10.png' ) }"/>
  <xcl:attribute referent="{ $wunit:session }"
    name="item2"
    value="{ io:file( '../img/xml2006-logo.png' ) }"/>
  <!--get the gallery page-->
  <wunit:GET url="http://www.example.com/gallery.html"/>
  <!--check the result:
    .../...

-->

```

```
<!--  
    .../...  
-->  
<!--check what we GET:-->  
<xunit:assert-number-equals  
    result="{ value( $wunit:frame/@wunit:response-code ) }"  
    expected="200"/>  
<xunit:assert-string-equals  
    result="{ string( $wunit:frame/@wunit:mime-type ) }"  
    expected="text/html"/>  
<!--we should have 2 rows-->  
<xunit:assert-number-equals  
    result="{ count( $wunit:document//TR ) }"  
    expected="2"/>  
<!--first row-->  
<xunit:assert-string-equals  
    result="{ $wunit:document//TR[1]/TD[1] }"  
    expected="item1"/>  
<xunit:assert-string-equals  
    result="{ $wunit:document//TR[1]/TD[2]/IMG/@src }"  
    expected="images/item1"/>  
<!--second row-->  
<xunit:assert-string-equals  
    result="{ $wunit:document//TR[2]/TD[1] }"  
    expected="item2"/>  
<xunit:assert-string-equals  
    result="{ $wunit:document//TR[2]/TD[2]/IMG/@src }"  
    expected="images/item2"/>  
</wunit:conversation>
```

Upload a file and test if it's in the Web server

```
<!--fill the HTML form and POST it to the server-->
<wunit:fill-form form="{ $wunit:document//FORM[@name='upload'] }">
  <!--the text input is a string-->
  <xcl:param name="imageName" value="test1"/>
  <!--the file to upload, just give it a file-->
  <xcl:param name="imageFile" value="{ io:file( '../img/xml-10.png' ) }"/>
</wunit:fill-form>
<!--check the message in the
response page sent
by the server-->
<xunit:assert-string-equals
  result="{ normalize-space( $wunit:document//BODY/DIV[1] ) }"
  expected="xml-10.png uploaded."/>
<!--check that the session object was created ;
it contains a reference to a file stored in the server ;
we just check the name of the file-->
<xunit:assert-string-equals
  result="{ name( value( $wunit:session/@test1 ) ) }"
  expected="xml-10.png"/>
```

xml-10.png uploaded.

Other tests to consider:

- The AJAX autocompleter (please refer to the RefleX web site)
- A complete scenario (please refer to the RefleX web site)
- Checking database updates: this could be perform with a direct SQL or XQuery query to the database.

Tools for running all the test cases, aggregating the results in a single XML report, and an XSLT stylesheet are supplied

XUnit report - Web Navigator

XUnit report

Test name	Skip	Tests	Errors	Failure
Summary of Web-Gallery tests	0	7 (124)	2 (3)	0 (0)
1/7 [Web] Welcome page		79	0	0
2/7 [Web] Gallery page		10	0	0
				[Display sysout]
3/7 [Web] Upload page		4	0	0
				[Display sysout]
4/7 [Web] Delete page : AJAX		9	1	0
				[Close errors]
Node expected :	/ul[1]			
Result node :	/ol[1]			
Local name comparison	Expected "ul" but was "ol"			
5/7 [Web] Delete page : form		6	0	0
				[Display sysout]
6/7 [Web] Delete page : javascript		4	2	0
				[Display errors]
7/7 [Web] Scenario		12	0	0
				[Display sysout]

- SSL and certificates:
Could use a dummy certificate server-side
- JNDI support:
Would allow to have a testing environment that includes test databases (SQL, XQuery, etc) that could be initialized by the test suite
Right now: use the production database or duplicate the Web application
- WUnit/XUnit as an output language for Selenium ?
- A better error report (with HTML rendered fragments in the output)

About the engine

- Chap 8: "Native XML Programming: Make Your Tags Active" in "Open and Novel Issues in XML Database Applications: Future Directions and Advanced Technologies" (April 2009)

ISBN: 978-1-60566-308-1

<http://www.igi-global.com/reference/details.asp?ID=33277>



- Properties of schema mashups: dynamicity, semantic, mixins, hyperschemas

<http://www.balisage.net/Proceedings/html/2008/Poulard01/Balisage2008-Poulard01.html>

<http://hal.inria.fr/docs/00/32/26/61/ANNEX/Bal2008poul061003.pdf>

Balisage 2008
The Markup Conference

- Active Tags: Mastering XML with XML

<http://www.idealliance.org/papers/extreme/proceedings/html/2007/Poulard01/EML2007Poulard01.html>

<http://hal.inria.fr/docs/00/17/37/16/ANNEX/eml2007-active-tags.pdf>

2007
Extreme Markup Languages®
a registered trademark of IDEAlliance

- Active Tags: an XML system for Native XML Programming

<http://2006.xmlconference.org/programme/presentations/156.html>



Free, open source

RefleX

The Active Tags engine, in Java

- 110,000 lines of code (stripped from comments and blank lines)
- Jar size: 1.3MB

▪ Have the RefleX !

<http://reflex.gforge.inria.fr>

▪ XUnit:

<http://reflex.gforge.inria.fr/xunit.html>

▪ WUnit:

<http://reflex.gforge.inria.fr/wunit.html>

<http://reflex.gforge.inria.fr/wunit-quick-start.html>

▪ Active Tags:

<http://ns.inria.org/active-tags/>

<http://ns.inria.org/active-tags/references/references.html>

Questions ?