

Testing Web Applications

By
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Testing Web Applications

- Going Faster: Testing The Web Application
 - Edward Heatt and Robert Mee (IEEE Software)
- Analysis and Testing of Web Applications
 - Filippo Ricca and Paolo Tonella

An Article: Going Faster- Testing The Web Application

Testing Challenges

- The web Browser has an ability to send information through a map of string to a web server
- The server deals with the requests by passing it off to an engine running application code
- Test Client and server part
- Difficult to come up with testing framework for testing both at once

Solutions

- Test parts of the server side code that are not directly concerned with being part of web application
- Test parts of the client side code that have no server interaction
 - JsUnit a testing framework for testing JavaScript
- Functional test that simulate the request/response environment
 - Framework:
 - State of the code
 - Simulate user interaction with UI

Testing Server Output

- Goal: Test data in the output not the web page look
- Create UI <- XML -> HTML(using XSLT)
- Clean separation of testable data from HTML
- Compare the actual output with expected output

Unit Test

- Unit test, for a new piece, before coding
- Positively affect overall code design
- Code Reusability
- Loose coupling between classes

Example: Testing the Servlet

- For example: overloading service()
- Servlet subclass, or a whole hierarchy of different classes makes it difficult to test
- Test-first approach removes code that handles request from the servlet itself and put it into its own class
- Modified Service(): creating new object (dispatcher) and handle the control to it.
- The dispatcher and each command object have their own tests.

Acceptance Tests

- Allows product managers to express tests at the scenario level
- Testing tool that express operations in the system and the expected results as XML.
- EAI (Enterprise Application Integration) tool configured to generate XML
- XML though workable, is awkward for a human to write
- Evant Script Programming (ESP), which is more compact and readable than XML

Analysis and Testing of Web Applications

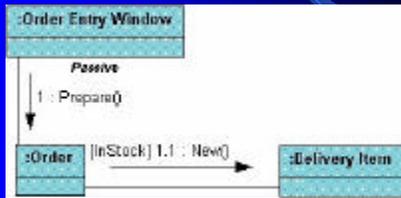
Outline

- Create a model of Web Application
 - UML
- Use Model to Test Application
 - Test case generation
- Tools
 - ReWeb
 - TestWeb
- Example applications:
 - Wordnet
 - Amazon.com

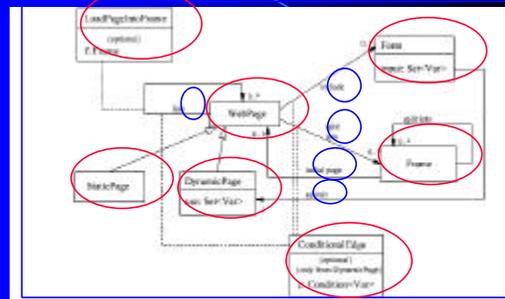
Unified Modeling Language

- Standard for building object oriented software
- UML defines the notation and semantics for the following domains:
 - Use Case Model
 - The Interaction or Collaboration Model
 - The Logical or Class Model
 - The Physical Component Model

Example: UML

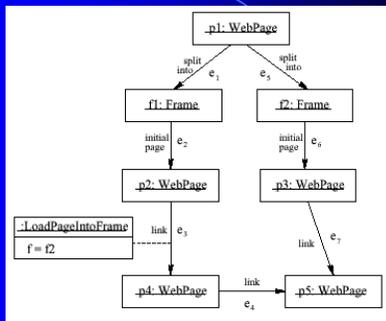


Analysis Model

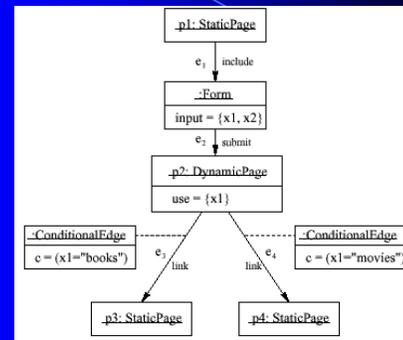


Generic Web Application Structure

Model with Frames



Model with a Form



Testing: Static Verification

- Static analyzers
 - to scan the HTML pages in a web site
 - detect possible faults and anomalies
- Analyzing models of site helps determining:
 - Unreachable Pages
 - Ghost Pages
 - Reaching Pages
 - Data Dependencies
 - Dominators

Testing: Dynamic Validation

- White box testing
- Test case for a web application is a sequence of pages to be visited + the input values to be provided to pages containing forms
- Execution consists of requesting the Web Server for the URLs in the sequence and storing the output pages

Dynamic Validation (cont...)

- White box testing criteria:
 - Page testing
 - Hyperlink testing
 - Definition-use testing
 - All-use testing
 - All-paths testing
- Def-use and All-paths criteria are often impractical because of the infinite paths in a site
- But can be satisfied with additional constraints

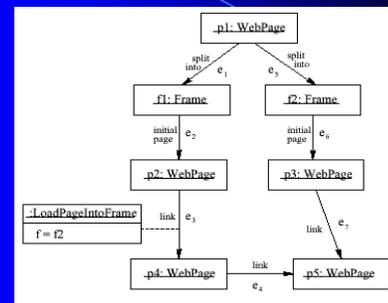
Dynamic Validation (cont...)

- Reduced Graph:
 - Retain relevant entities
 - Remove static pages not containing forms and link all its predecessors to all its successors
- Effective way of generating test cases

Test case Generation

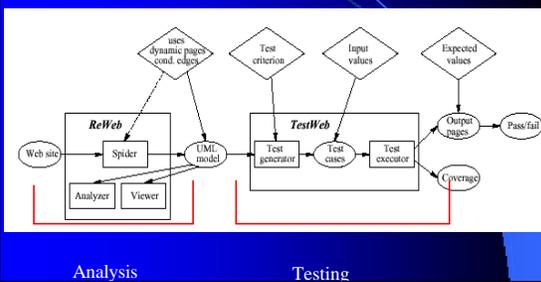
- Select a set of paths in the web site graph and provide input
- Based on path expression
- Since Path expression directly represents all paths in the graph, it can be used to generate test cases.
- Tester has to insert input values for the variables collected through forms
- Highly benefits regression testing

Model with a Frame



Path Expression: $e_1e_2e_3e_4 + e_5e_6e_7$

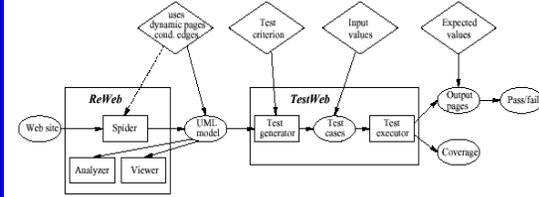
ReWeb and TestWeb



ReWeb

- Spider
- Analyzer
- Viewer
- User can attach conditions to edges whose existence depends on the input values

ReWeb and TestWeb

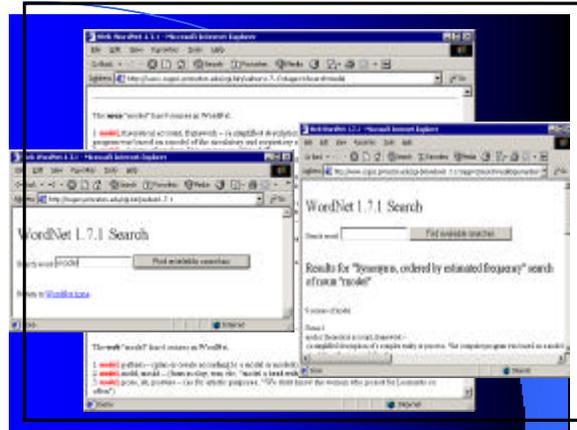


TestWeb

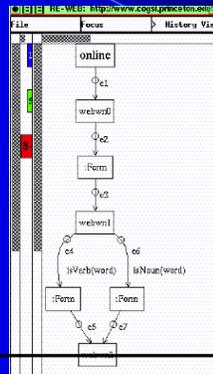
- Test case generation engine
- Determines path from model and generates test cases
- Test cases are sequences of URLs
- Satisfying selected coverage criteria
- Input value supplied by user

Experiment

- ReWeb and TestWeb on Wordnet (<http://cogsci.princeton.edu/~wn/>)
- Wordnet is a lexical reference system
- English nouns, verbs, adjective and adverb are organized into synonym sets, each representing one underlying lexical concept
- Different relation links the synonym sets



ReWeb Model of Wordnet



Wordnet

- Three stages
 - 0 webwn0: initial input page
 - 1 webwn1: selection among alternative senses
 - 2 webwn2: final output
- Hidden stages with page webwn, incremented values are passed to server each time (using cookies)

Test case Generation and Execution

- Feasible paths can be computed from path expression $e_1e_2e_3(e_4e_5 + e_6e_7)$
- Insert edge conditions (isNoun(word), etc)
- Select input to make each condition true
- Generate test cases
- Executed test cases
- No defect found

Conclusion

- The technique and analysis proposed helps in assessing the site quality
- Allows a deep insight in the internal functioning of the web applications
- Future work
 - Reduction of the manual activities (e.g. State unrolling)