

I Am NOT
Your Mother
...

Write Your
Test Code!

Naomi Dushay
Jessie Keck
Willy Mene

Stanford University Libraries

<http://www.outofbodies.com/sketchbook/mamacusumano.jpg>

Ad Hoc Testing



http://farm4.static.flickr.com/3162/2642060163_aed25d8487.jpg

Where's My Safety Net ?!?



You already test.



Did that work?

Is the value correct?

Does it look right?

Why Not Automate?

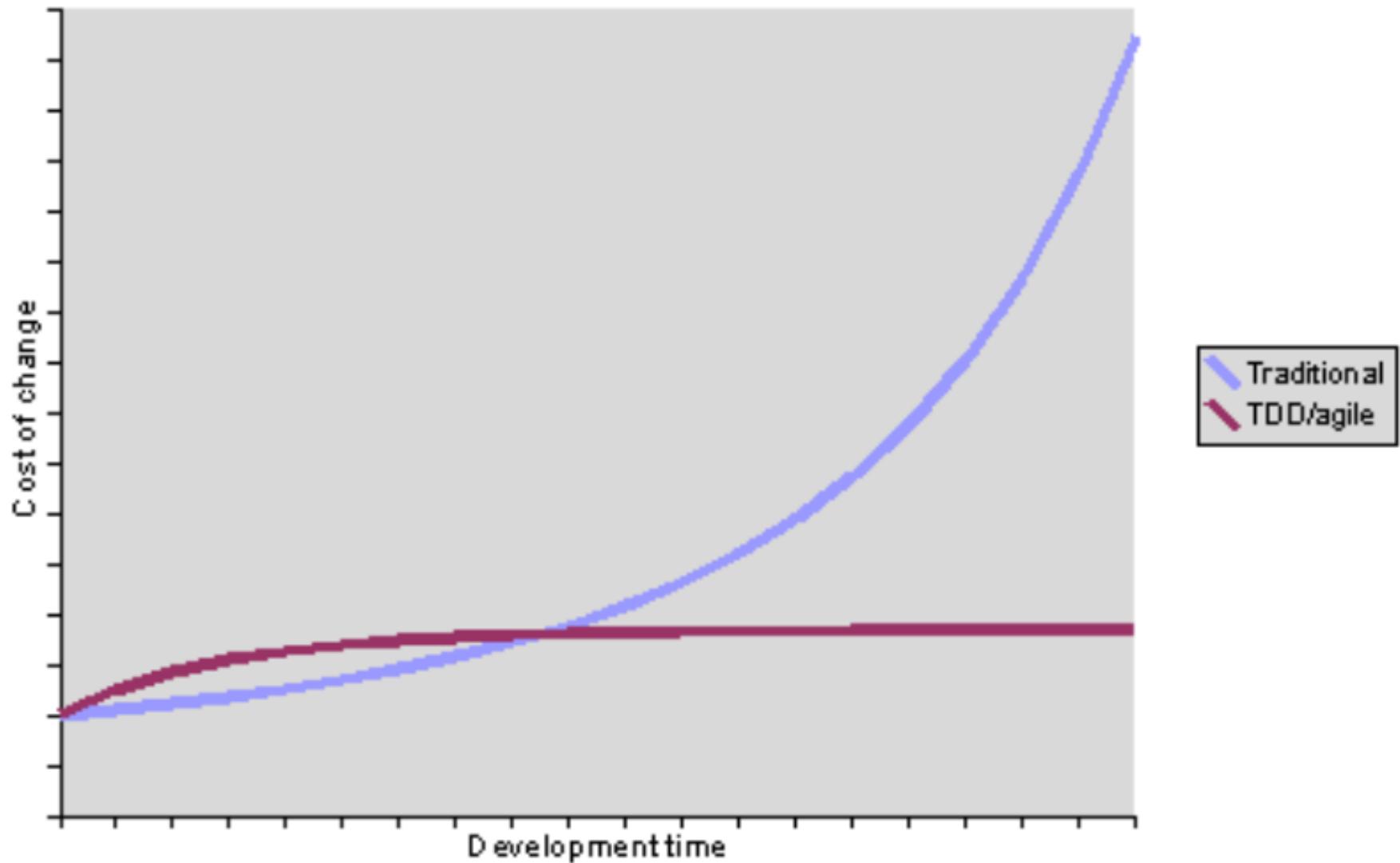
If it's worth checking once ...

Do you enjoy manual repetition?



- Regression Testing
 - Local Code
 - Local Mods to Other Code
- My Code Doesn't Break Her Code
- Refactoring!
- Reduce Design Complexity
- Specify Expected Behaviors
- Catch My Own Errors

Cost of change vs. development time



Test code is only useful if ...



... it is executed.

[Hudson](#)[ENABLE AUTO REFRESH](#)[New Job](#)[Manage Hudson](#)[People](#)[Build History](#)

Build Queue

No builds in the queue.

Build Executor Status

#	Status
1	Idle
2	Idle

All	Collections	LyberTeam	SDR 1.0	SDR 2.0	SearchWorks	+
S	W	Job ↓	Last Success	Last Failure	Last Duration	
		Catalog Service	19 days (#5)	N/A	23 sec	
		CFB	6 days 11 hr (#2)	N/A	4 sec	
		Copyright Renewals	6 days 11 hr (#2)	N/A	10 sec	
		DatabasesAZ Indexer	6 days 11 hr (#1)	N/A	2.4 sec	
		DMS Index	N/A	N/A	N/A	
		dor-robots	6 days 7 hr (#858)	6 days 7 hr (#857)	6.5 sec	
		dor-service	3 days 0 hr (#10)	3 days 0 hr (#9)	1 min 3 sec	
		GATT Digital Library	6 days 11 hr (#3)	N/A	32 sec	
		Google GRIN Download	19 days (#3)	N/A	4.3 sec	
		hydra-etd	8 hr 5 min (#11)	9 days 11 hr (#5)	6 min 20 sec	
		Image Gallery	6 days 11 hr (#3)	N/A	5.2 sec	
		JHOVE1 Toolkit	19 days (#3)	19 days (#2)	3.8 sec	
		MARC to XML	19 days (#2)	N/A	4.6 sec	
		md toolkit	2 hr 37 min (#5)	N/A	2 min 52 sec	

[Back to Dashboard](#)[Status](#)[Changes](#)[Workspace](#)[Build Now](#)[Delete Project](#)[Configure](#)[Rcov report](#)[Rails stats report](#)[Git Polling Log](#)

Build History [\(trend\)](#)

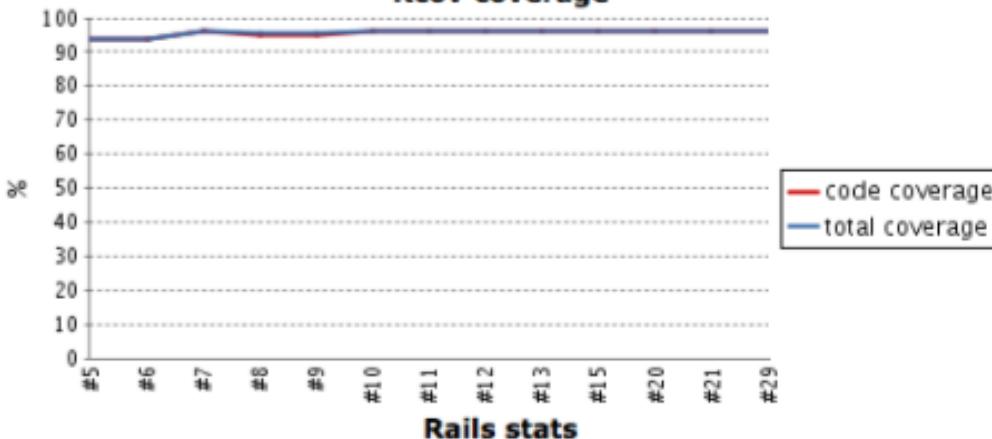
- #29 Feb 10, 2010 3:33:13 PM
- #28 Feb 10, 2010 3:01:24 PM
- #27 Feb 10, 2010 2:50:29 PM
- #26 Feb 10, 2010 2:48:59 PM
- #25 Feb 10, 2010 2:46:26 PM
- #24 Feb 10, 2010 2:41:54 PM
- #23 Feb 10, 2010 2:28:04 PM
- #22 Feb 10, 2010 2:10:08 PM
- #21 Feb 10, 2010 1:51:04 PM
- #20 Feb 9, 2010 3:29:40 PM
- #19 Feb 8, 2010 1:41:02 PM
- #18 Feb 8, 2010 11:41:02 AM
- #17 Feb 8, 2010 11:21:03 AM
- #16 Feb 8, 2010 11:01:13 AM
- #15 Feb 5, 2010 9:50:44 AM
- #13 Feb 4, 2010 11:01:07 AM

Project SearchWorks

SearchWorks project in GIT

[Rcov report](#)[Rails stats report](#)[Workspace](#)[Recent Changes](#)[edit description](#)

Rcov coverage



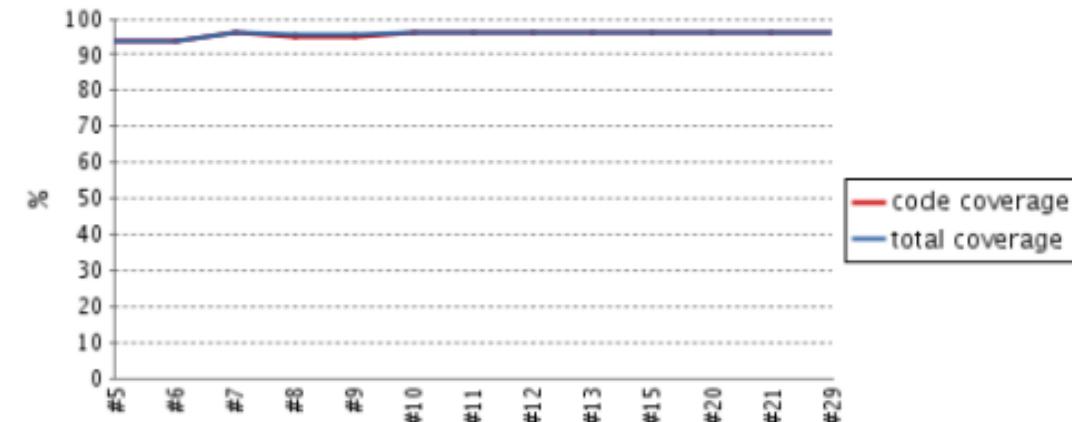
Permalinks

- [Last build \(#29\), 7 hr 0 min ago](#)
- [Last stable build \(#29\), 7 hr 0 min ago](#)
- [Last successful build \(#29\), 7 hr 0 min ago](#)
- [Last failed build \(#28\), 7 hr 32 min ago](#)

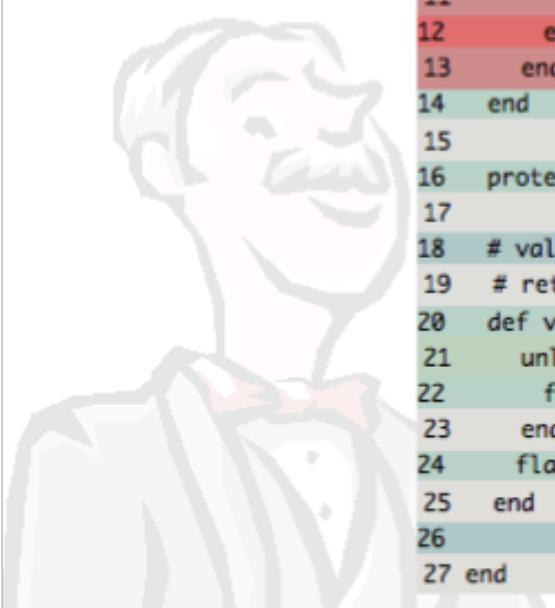


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Rcov coverage report



Name	Total lines	Lines of code	Total coverage	Code coverage
TOTAL	3684	3303	96.2%	<div style="width: 95.9%; background-color: green;"></div> 95.9%
app/controllers/advanced_controller.rb	9	9	100.0%	<div style="width: 100%; background-color: green;"></div> 100.0%
app/controllers/catalog_controller.rb	697	655	87.9%	<div style="width: 87.6%; background-color: green;"></div> 87.6%
app/controllers/feedback_controller.rb	27	22	77.8%	<div style="width: 72.7%; background-color: green;"></div> 72.7%
app/helpers/application_helper.rb	1465	1276	96.7%	<div style="width: 96.2%; background-color: green;"></div> 96.2%
app/models/record_mailer.rb	53	48	100.0%	<div style="width: 100%; background-color: green;"></div> 100.0%
lib/constants.rb	834	818	100.0%	<div style="width: 100%; background-color: green;"></div> 100.0%
lib/stanford/advanced_query_parser.rb	288	267	99.7%	<div style="width: 99.6%; background-color: green;"></div> 99.6%
lib/stanford/nearby_on_shelf.rb	202	148	100.0%	<div style="width: 100%; background-color: green;"></div> 100.0%
lib/stanford/solr_helper.rb	109	60	100.0%	<div style="width: 100%; background-color: green;"></div> 100.0%

[Back to Project](#) [Status](#) [Changes](#) [Console Output \[raw\]](#) [Git Build Data](#) [Rcov report](#) [Rails stats](#) [Previous Build](#)

Rcov report for: app/controllers/feedback_controller.rb

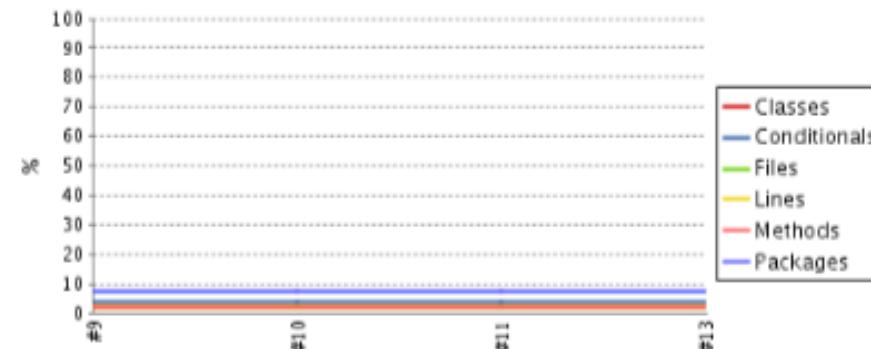
Name	Total lines	Lines of code	Total coverage	Code coverage
app/controllers/feedback_controller.rb	27	22	77.8%	<div style="width: 77.8%; background-color: green; height: 10px;"></div> 72.7% <div style="width: 72.7%; background-color: red; height: 10px;"></div>
<pre>1 class FeedbackController < ApplicationController 2 def show 3 if request.method==:post 4 if validate 5 if params[:message] =~ /.*href=.* .*url=.* / 6 flash[:error] = "Your message appears to be spam, and has not been sent. Please try sending your message again without any links in the comments." 7 redirect_to params[:url] 8 else 9 RecordMailer.deliver_user_feedback(params) 10 redirect_to params[:url] 11 end 12 end 13 end 14 end 15 16 protected 17 18 # validates the incoming params 19 # returns either an empty array or an array with error messages 20 def validate 21 unless params[:message] =~ /\w+/ 22 flash[:error] = 'A message is required' 23 end 24 flash[:error].nil? 25 end 26 27 end</pre>				

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Code Coverage

Cobertura Coverage Report

Trend



Project Coverage Summary

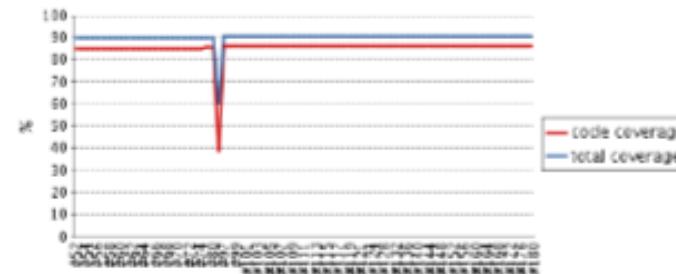
Name	Packages	Files	Classes	Methods	Lines	Conditionals						
Cobertura Coverage Report	8%	1/13	2%	2/102	2%	2/112	2%	17/860	2%	98/5108	4%	88/2332

Coverage Breakdown by Package

Name	Files	Classes	Methods	Lines	Conditionals					
edu.stanford.sulair.parker.access	0%	0/6	0%	0/7	0%	0/64	0%	0/348	0%	0/136
edu.stanford.sulair.parker.contact	0%	0/5	0%	0/5	0%	0/37	0%	0/96	0%	0/8
edu.stanford.sulair.parker.related_links	0%	0/2	0%	0/2	0%	0/5	0%	0/25	0%	0/10
edu.stanford.sulair.parker.util	13%	2/15	13%	2/16	22%	17/79	23%	98/419	44%	88/202
edu.stanford.sulair.parker.site	0%	0/8	0%	0/8	0%	0/28	0%	0/100	0%	0/40
edu.stanford.sulair.parker.search	0%	0/29	0%	0/34	0%	0/375	0%	0/3173	0%	0/1778
edu.stanford.sulair.parker.db	0%	0/2	0%	0/2	0%	0/5	0%	0/14	100%	0/0
edu.stanford.sulair.parker.logging	0%	0/1	0%	0/1	0%	0/3	0%	0/7	0%	0/2
edu.stanford.sulair.parker.security	0%	0/1	0%	0/2	0%	0/9	0%	0/19	0%	0/6
edu.stanford.sulair.parker.tutorial	0%	0/2	0%	0/2	0%	0/5	0%	0/40	0%	0/16
edu.stanford.sulair.parker.registration	0%	0/19	0%	0/19	0%	0/187	0%	0/614	0%	0/104
edu.stanford.sulair.parker.summary	0%	0/2	0%	0/2	0%	0/4	0%	0/27	100%	0/0
edu.stanford.sulair.parker.page_turner	0%	0/10	0%	0/12	0%	0/59	0%	0/226	0%	0/30

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Rcov coverage report



Name	Total lines	Lines of code	Total coverage	Code coverage
TOTAL	2073	1357	90.55%	85.44%
app/controllers/application_controller.rb	59	29	96.61%	93.10%
app/controllers/bookmarks_controller.rb	59	46	100.00%	100.00%
app/controllers/catalog_controller.rb	200	137	96.00%	94.16%
app/controllers/feedback_controller.rb	37	24	35.14%	15.67%
app/controllers/saved_searches_controller.rb	44	34	79.55%	73.53%
app/controllers/search_history_controller.rb	25	21	76.00%	71.43%
app/controllers/user_sessions_controller.rb	43	20	100.00%	100.00%
app/controllers/users_controller.rb	13	8	100.00%	100.00%
app/helpers/application_helper.rb	354	246	90.96%	86.99%
app/helpers/bookmarks_helper.rb	3	2	100.00%	100.00%
app/helpers/catalog_helper.rb	44	29	90.91%	86.21%
app/helpers/feedback_helper.rb	2	2	100.00%	100.00%
app/helpers/saved_searches_helper.rb	2	2	100.00%	100.00%
app/helpers/search_history_helper.rb	2	2	100.00%	100.00%
app/helpers/user_sessions_helper.rb	2	2	100.00%	100.00%
app/helpers/users_helper.rb	2	2	100.00%	100.00%
app/models/bookmark.rb	7	5	100.00%	100.00%
app/models/record_mailer.rb	30	27	100.00%	100.00%
app/models/search.rb	12	7	100.00%	100.00%
app/models/solr_document.rb	6	4	100.00%	100.00%
app/models/user.rb	46	28	86.96%	82.14%
app/models/user_session.rb	4	2	100.00%	100.00%
lib/blacklight.rb	51	32	94.12%	90.62%
lib/blacklight/configurable.rb	46	16	100.00%	100.00%
lib/blacklight/core_ext.rb	50	16	100.00%	100.00%
lib/blacklight/marc.rb	41	31	70.73%	64.52%
lib/blacklight/marc/citation.rb	246	209	94.72%	93.78%
lib/blacklight/routes.rb	35	20	100.00%	100.00%
lib/blacklight/solr.rb	6	4	100.00%	100.00%
lib/blacklight/solr/document.rb	64	31	100.00%	100.00%
lib/blacklight/solr/document/marc.rb	22	11	100.00%	100.00%
lib/blacklight/solr_helper.rb	151	75	88.74%	77.33%
lib/taggable_pagination.rb	31	23	93.55%	91.30%
lib/will_paginate_link_renderer.rb	20	10	70.00%	60.00%

It starts with ...



... ONE Automatable Test

http://farm1.static.flickr.com/46/193824423_e70bd36403.jpg?v=0

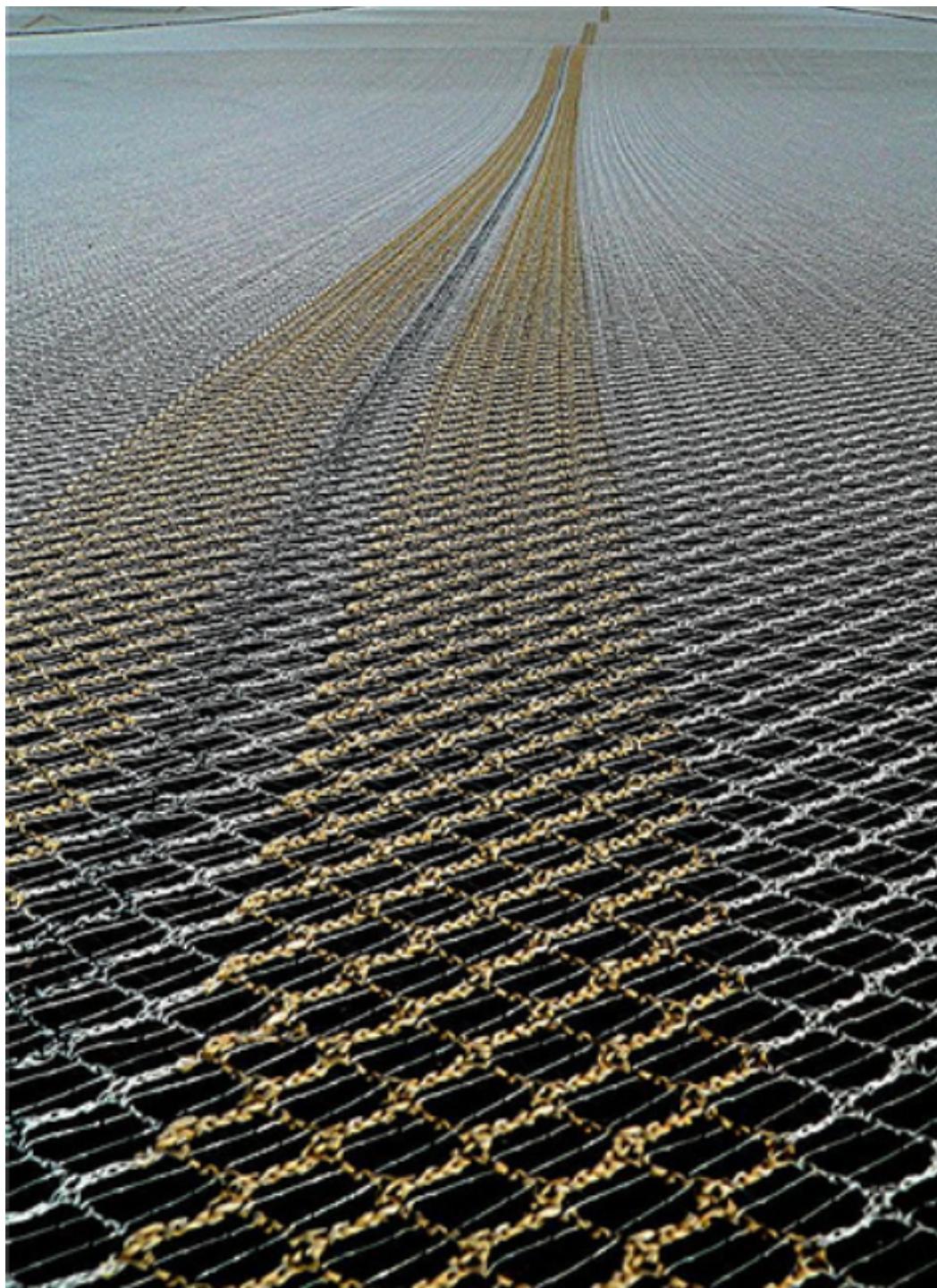
Jessie Keck

- Recent testing convert
 - Past history: little to no testing



<http://www.epmonthly.com/whitecoat/wp-content/uploads/2009/02/broken-net.jpg>

- Current Testing:
 - rSpec
 - Cucumber
 - Rails testing framework



<http://www.flickr.com/photos/mowls/514428409/>

Demos

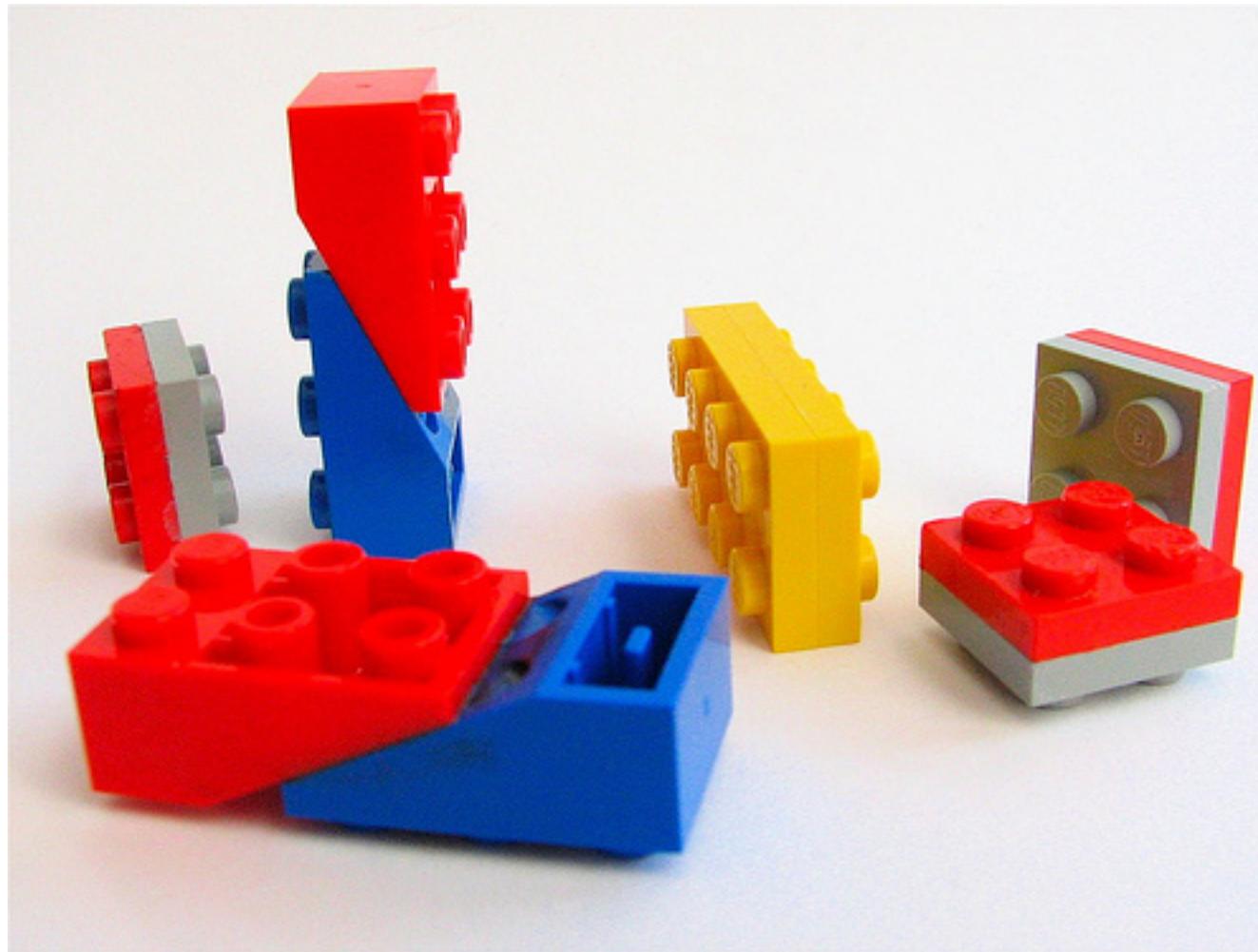
Types of Tests

Unit Tests

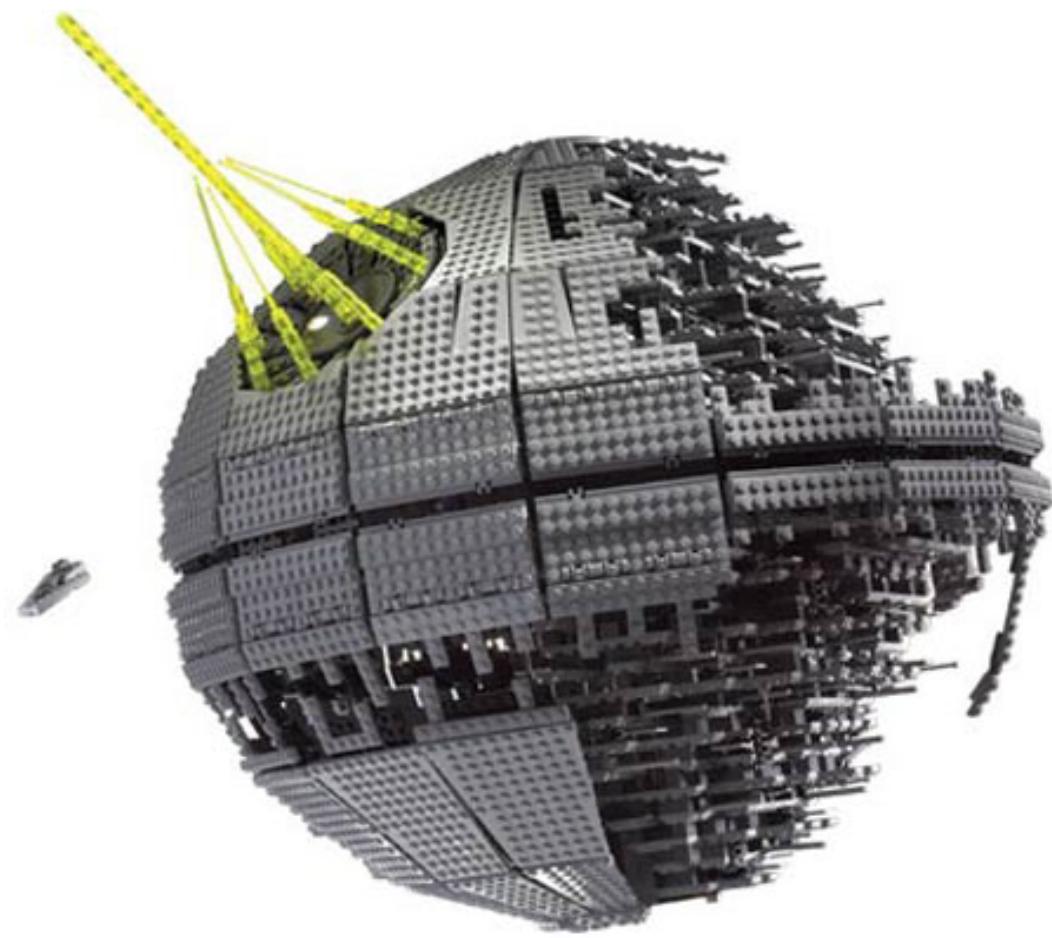


<http://www.breakitdownblog.com/wp-content/uploads/2008/10/red-lego-brick.jpg>

Integration tests



Black Box/Functional/Acceptance Tests



"Now witness the firepower of this fully ARMED and OPERATIONAL battle station!"

-The Emperor, Return of the Jedi

What to test?

You already do this...

```
System.out.println("Title:"  
+ book.
```

```
getTitle());
```

```
System.out.println("Author:"  
+ book.
```

```
getAuthor());
```





<http://www.imageenvision.com/150/23491-clip-art-graphic-of-a-desktop-computer-cartoon-character-looking-through-a-magnifying-glass-by-toons4biz.jpg>

So Do this Instead

```
assertEquals("Bacon: A Love  
Story",  
            book.  
getTitle());
```

```
assertEquals("Lauer, Heather",  
            book.getAuthor());
```



MleWallpapers.com

<http://www.mlewallpapers.com/image/16x9-Widescreen-1/view/Icy-Branches-569.jpg>

At least 3 tests for this method

```
some_method() {  
    ...  
    if(this is true)  
        do this  
    else if(that is true)  
        do that  
    else  
        do this by default  
    ...  
}
```



<http://www.whatandroid.com/wp-content/uploads/2009/11/computer-bug.jpg>

Write tests when fixing bugs

1. Write a test that triggers bug



2. Fix the code
3. Re-run the test



4. You're done when the test passes



A problem has been detected and windows has been shut down to prevent damage to your computer.

DRIVER_IRQL_NOT_LESS_OR_EQUAL

If this is the first time you've seen this stop error screen, restart your computer. If this screen appears again, follow these steps:

Check to make sure any new hardware or software is properly installed. If this is a new installation, ask your hardware or software manufacturer for any Windows updates you might need.

If problems continue, disable or remove any newly installed hardware or software. Disable BIOS memory options such as caching or shadowing. If you need to use Safe Mode to remove or disable components, restart your computer, press F8 to select Advanced Startup Options, and then select Safe Mode.

Technical information:

*** STOP: 0x000000D1 (0x0000000C, 0x00000002, 0x00000000, 0xF86B5A89)

*** gv3.sys - Address F86B5A89 base at F86B5000, Datestamp 3dd991eb

Beginning dump of physical memory

Physical memory dump complete.

Contact your system administrator or technical support group for further assistance.

Error Handling/Corner Cases

```
try
    while(ch != '\0')
        ch = buffer.read_ch
    end
catch Exception
    handle problem here
end
```

Tests for Legacy Code

Start with Bug Fixing



Write high level tests that exercise system as a whole



Write unit tests around the legacy section



<http://www.jacksonmunyezapools.com/safety-net1.jpg>

Enables bug fixing with confidence



Mocks

- Want tests to run fast
- Need to isolate what you're testing
- For dependencies on other processes
 - Network, database, Solr, external services

Rspec Mock Example

Whichever Language, Context

- Java - JUnit
- C# - NUnit
- Php - Php Unit
- Perl - Perl Unit
- Python - PyUnit
- Web - Selenium, WebRat, Watir
- Database - DbUnit

IDE Support

Java - dor-service/test/edu/stanford/sulair/dlss/dor/service/WorkflowServiceTests.java - Eclipse Platform - /Users/wmene/Dev/worksheets/dl...

Package Hierarch Navigat JUnit

Finished after 12.682 sec

Runs: 52/52 Errors: 0 Failures: 1

edu.stanford.sulair.dlss.dor.resource.GoogleWorkflow

edu.stanford.sulair.dlss.dor.dao.ProcessDaoTests [Run]

edu.stanford.sulair.dlss.dor.service.WorkflowServiceTests

- testUpdateExistingWorkflow (0.022 s)
- putGoogleWorkflow (0.085 s)
- findGoogleWorkflowByDruid (0.011 s)

edu.stanford.sulair.dlss.dor.resource.SubresourcesRes

edu.stanford.sulair.dlss.dor.resource.DatastreamsRes

edu.stanford.sulair.dlss.dor.service.DigitalObjectServ

edu.stanford.sulair.dlss.dor.service.SolrIndexServiceI

edu.stanford.sulair.dlss.dor.DigitalObjectTest [Runner]

edu.stanford.sulair.dlss.dor.admin.GoogleWorkflowTe

Failure Trace

java.lang.AssertionError:

- at edu.stanford.sulair.dlss.dor.service.WorkflowServiceT
- at org.springframework.test.context.junit4.SpringTestMe
- at org.springframework.test.context.junit4.SpringMethod
- at org.springframework.test.context.junit4.SpringJUnit4C

applicationContext.x test.properties WorkflowServiceTests 31

```
public void putGoogleWorkflow() {
    //Insert 1 process row
    Process p = new Process();
    p.setDruid("dr:1234");
    p.setDatastream("GoogleWorkflow");
    p.setName("download");
    p.setStatus("pending");
    processDao.persistProcess(p);
    p = processDao.findProcess("dr:1234", "GoogleWorkflow", "download" );
    assertEquals(1, this.countRowsInTable("WORKFLOW"));
    persistGoogleWorkflowWith2Processes();

    //Assert googleworkflow rows added
    assertNotNull(processDao.findProcess("dr:1234", "GoogleWorkflow", "downl
    assertNotNull(processDao.findProcess("dr:1234", "GoogleWorkflow", "conve
    //Assert existing workflow updated
    assertEquals(2, this.countRowsInTable("WORKFLOW"));
    assertTrue(msgService.wasServiceUsed());
    assertFalse(repoService.wasCreateWorkflowDatastreamUsed());
}
```

Problems @ Javadoc Declaration Console History Search

<terminated> test (2) [JUnit] /System/Library/Frameworks/JavaVM.fran

2010-02-11 10:40:20,234 DEBUG [org.springframework.beans.factory.support.DefaultListable

2010-02-11 10:40:20,234 DEBUG [org.springframework.beans.factory.support.DefaultListable

2010-02-11 10:40:20,236 INFO [org.springframework.context.support.GenericApplicationCont

2010-02-11 10:40:20,236 DEBUG [org.springframework.context.support.GenericApplicationCont

2010-02-11 10:40:20,236 INFO [org.springframework.beans.factory.support.DefaultListableB

2010-02-11 10:40:20,236 DEBUG [org.springframework.beans.factory.support.DefaultListable

2010-02-11 10:40:20,236 INFO [org.springframework.orm.hibernate3.annotation.AnnotationSe

2010-02-11 10:40:20,236 INFO [org.hibernate.impl.SessionFactoryImpl] - <closing>

2010-02-11 10:40:20,236 DEBUG [org.springframework.beans.factory.support.DefaultListable

2010-02-11 10:40:20,236 DEBUG [org.springframework.beans.factory.support.DefaultListable

2010-02-11 10:40:20,237 INFO [org.springframework.context.support.GenericApplicationCont

2010-02-11 10:40:20,237 DEBUG [org.springframework.context.support.GenericApplicationCont

2010-02-11 10:40:20,237 INFO [org.springframework.beans.factory.support.DefaultListableB

2010-02-11 10:40:20,237 DEBUG [org.springframework.beans.factory.support.DefaultListable

Writable Smart Insert 110 : 1

RSpec results

active_fedora is Adding count method to Array

RSpec Code Examples

53 examples, 1 failure
Finished in 2.968965 seconds

Etd

Should be a kind of ActiveFedora::Base

Should have a #supplemental_files method

Should have a #permission_files method

```
expected #<Etd:0x4c54e9c @props_changed=false, @datastreams=["workf"]>
```

[/Users/wmene/Dev/git/hydra_etd/spec/models/etd_spec.rb:71](#)

[/tmp/textmate-command-4739.rb:3](#)

```
69 it "Should have a #permission_files method" do
70   @etd.should_not respond_to(:permission_files)
71 end
72
73
```

Should reflect all of the metadata fields

should have versionable set to false for all datastreams

should have a readers datastream of type ReadersDatastream

#set_submit_date_to_now should set the submit_date to the current system timestamp

Etd should handle incoming ps xml

department Medical provost Vice Provost's Name sunetid TESTSTU ps_career Medicine regcomment ps_program Medical etd_type Dissertation documentaccess Yes prefix Mr. regapproval Not Submitted readerapproval Not Submitted name Testing, Student ps_plan Electrical Engineering title Testing the Title univid 05543256 regactiondtm ps_subplan schoolname Humanities And Sciences readeractiondtm 06/19/2009 12:17:56 degree Ph.D. dissertation_id 0001252502 degreeconfyr 2009 suffix Jr. major Electrical Engineering readercomment This is the reader approval. it can have carriage returns.

should set the properties datastream from PS xml

Should refresh an existing Etd with incoming data from PS and set props_changed to true

Should keep Etd#props_changed to false when incoming PS xml is the same data

Should produce dissertation xml for PS when an ETD has been submitted

Etd should handle incoming ps xml submit/reject data

handling#submit_to_registrar

should set the submit date to now

should clear all registrar and reader actions, timestamps, and comments

etd_spec.rb — hydra_etd

```
* util_spec.rb * suri_service_spec.rb * path_encrypter_spec.rb * ps_registrar_service_spec.rb * etd_spec.rb
46 .suboption=>1 code=>, content=> '',
47 :regcomment=>{},
48 :documentaccess=>"Yes",
49 :univid=>"05543256",
50 :title=>"Testing the Title",
51 :schoolname => "Humanities And Sciences",
52 :degreeconfyr => "2009"
53 ]
54
55 Fedora::Repository.stubs(:instance).returns(stub('stub').as_null_object)
56 @etd = Etd.new(:pid => 'my:testpid')
57 @etd.stubs(:create_date).returns("2008-07-02T05:09:42.015Z")
58 @etd.stubs(:modified_date).returns("2008-09-29T21:21:52.892Z")
59 @etd.stubs(:save)
end
60
61
62 it "Should be a kind of ActiveFedora::Base" do
63   @etd.should be_kind_of(ActiveFedora::Base)
64 end
65
66 it "Should have a #supplemental_files method" do
67   @etd.should respond_to(:supplemental_files)
68 end
69
70 it "Should have a #permission_files method" do
71   @etd.should_not respond_to(:permission_files)
72 end
73
74 it "Should reflect all of the metadata fields" do
75   properties_ds = @etd.datastreams['properties']
76
77   #Populate the metadata
78   @properties_sample_values.each_pair do |field, value|
79     eval("properties_ds.#{field.to_s}_values = ['#{value}']")
80   end
81
82   #Test data was set
83   properties_ds = @etd.datastreams['properties']
84
85   @properties_sample_values.each_pair do |field, value|
86     eval("properties_ds.#{field.to_s}_values").should == [value]
87   end
88 end
```

What does all of this buy you?

- Fewer bugs
- Better design
- Refactoring freedom



http://www.geeksix.com/wp-content/uploads/2009/06/startrekdrmcovintage_pb.jpg

Professional Responsibility

- "...it is irresponsible for a developer to ship a line of code he has not executed in a unit test."

*Robert 'Uncle Bob' Martin
-Author and Agile Evangelist*

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www.CartoonStock.com

Brian



Questions?

"Lucky for you there was a safety net."