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Test driven Web development

with Ruby on Rails

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# Overview of Technologies used

## Ruby

Ruby emerged on the software landscape in late 1995. Initially a part-time project of its creator Yukihiro "Matz" Matsumoto Ruby became successful through its unique focus on readability, simplicity and openness.

Often […] computer engineers, focus on the machines. They think, "By doing this, the machine will run […] more effectively[…]" But in fact we need to focus on humans[…]. We are the masters. They are the slaves. --- Matz

Readability is the feature most people see immediately when getting in contact with Ruby code.   
A simple task like printing ‘hello’ 5 times can be a cryptic text only decipherable by adept programmers like this Java block (left) or just understandable and simple like ruby (right).

for(int i=0;i<6;i++){System.out.println(“Hello“);} print 5 \* ”Hallo”

This level of readability can only be achieved by making many of the established code conventions optional. No more; to terminate a statement, () for method arguments, return for return values, freeing the “if“ and utilizing punctuation character for method names.

delete record if record.new?

def say\_hello

“hello“

end

Openness and modularity are a great source of power in Ruby. All classes can be changed at runtime, allowing for context-specific methods on base classes like String. Functionality can be placed in modules and be reused without changing inheritance chains, which frees programs from deep and fragile inheritance trees that are common in most other programming languages.

class ResourceManager

include Singleton

...

end

ResourceManager.instance.find “example“

Simplicity is another virtue of Ruby. The programmer is freed from the complexity of choice between logically equivalent classes like int, BigInt, double, float, Vector and LinkedHashSetMapList by only giving the choice between Integer, Float, String, Array and Hash, which simplifies writing and learning Ruby. A golden rule in ruby is “least surprise”, e.g. the normally failure-attracting case (also known as switch) statement does not fall through. The rule also implies that a method should not perform actions which cannot be derived from its name. This can be observed on String, where modifying operations all use the “!“, to be distinguishable from their harmless counterparts that only return a modified copy e.g. String.reverse! and String.reverse .

Ruby is a dynamic scripting language, which allows assigning a value to any variables, without restriction to a specific type. A complete program can be as short as a single method call and does not need to be compiled, making it easy to start programming and to write small scripts.

The language has had a small community of enthusiasts until in 2003 Ruby on Rails arrived. “Rails” is a web-development framework which uses many techniques and architectures that would not be possible in most other languages. Its new simplicity, ease of use and reusability has attracted countless programmers. Since the release of Rails the number of Rubyists has strongly increased and the demand for Ruby or Rails developers has more than doubled every year since 2005 .

## Web application

In contrast to a desktop program a typical web-application is restful. Users do not interact with a live application, but only see a representation of its current state in their browser and can send requests to the server to see another state or send date so that the current state changes.

This architecture yields many unique challenges, like knowing which user has access to a certain part of the application, handling concurrent updates without compromising data integrity, timely responses to users from all over the world, working without a local storage, security limitations from different clients and many more.

Working with these limitations can be hard but nevertheless web applications manage to claim a huge market share, because they allow millions to use an application without prior installation, enables them to work together, to receive instant software updates, to share their data and use their data from anywhere in the world.

A standard HTML based web application uses 3 server-side layers; a database for data-storage and retrieval, a controller that receives and responds to user requests and a view that represents the current application state as HTML.

## Ruby on Rails

Rails was created by David Heinemeier Hansson in 2003, on his quest to make a simple, extendable web-application framework, that makes building fast and easy as long as one obeys commonly acknowledged best practices.

Rails is built as Model-View-Controller, where the Model is an Active-Record , the Controller translates a browsers request to an action and then displays the result in a View.

By default Rails is split in 3 environments, namely production, development and test. In production everything is optimized for speed and reliability, whereas development focuses on helpful error reporting and a direct change-result feedback. Testing behaves like development but has all dangerous action turned off, it will not send real emails or only use a mocked payment system.

Conventions are what makes development so dry, it is not necessary to specify where your model file lies, or which controller is called when the user visits http://website.com/movies/1 . Not even which fields models uses, since this is all automatically inferred. If the database has a column named email in the users table, then the User model, which lives in /app/models/user.rb, will have an email field, no configuration or setup required.

Since these conventions define how a application should be organized, many generators have been built, that obey these conventions and generate common or otherwise repetitive code. They allow users to simply get started, without having to read endless documentation.

script/generate scaffold car name:string model:string description:text

The application is complete! Cars can be created, shown, updated and deleted. The generated code helps new users to understand what they have to do when they want to build any custom logic and prevents experienced users from having to define the same standard controllers and models all over. Furthermore tests are created, so that users know how they should test and where they should test which component.

Testing is a central part of Ruby’s and Rails philosophy. Rails provides the user with countless testing helpers and an organized testing structure, so that models, controllers, views, helpers, mailers, …, can be tested with ease. As the scaffold generator shown above, all other generators build the tests that are required by the code they produce.

Plugins are where most reuse can be found in the Rails world. Every piece of logic that many people use has been turned into a plugin, they are easy to create, easy to install (script/plugin install URL) and act as a separation of concerns since they contain all relevant logic and the tests for one part of the application. Plugins are very powerful, since Ruby allows them to temper any class in the Rails ecosystem, meaning that no Rails developer must build a public API before anyone can change Rails behavior. The Rails conventions make it easy to integrate plugins since they obey the same conventions the developer uses, mostly making additional configuration obsolete.

Through those simple concepts and the resulting productivity and reuse, many developers have been drawn to Rails. Other web-frameworks have been heavily influenced by it (Groovy on Rails, CakePHP, …), resulting in Rails-clones in many different programming languages. Even the enterprise world starts to notice Rails as a possible deployment platform, after large-scale websites (twitter, yellow-pages, basecamp… ) have been successfully built with it.

# Introduction

## Testing a web application

Web development, especially HTML/Ajax based, has a long tradition of untested code, because unlike in a normal programming environment the developers here have to handle 2 separate domains:

* Model/HTML generation (calculations and rendering) through MVC
* Browser behavior (page change/forms/redirects…)

In many web-application frameworks, developers can only test that calculations inside the model are correct (normal Unit testing) and that the rendered HTML is valid. Testing that the correct action is called upon entering a URL is mostly unpractical since Apache rewrite rules are used for this purpose, which are hard to test. For the same reason it is hard to fake a request-response cycle when one first has to set up all kinds of global variables (php: $\_GET, $\_REQUEST…) or build a session object. Some modern web frameworks provide ways of testing (Symfony/CakePHP..) , but for most small framework this stays a half-hearted approach, therefore automated Controller or view testing is only achievable through a remote controlled browser, which is difficult to setup and use.

Rails changes this, by allowing programmers to test between controller-actions and view-rendering. Now they can make requests, see the controller change and verify that a view works with edge-case inputs. With the help of plugins it is even possible to submit forms or click links. All these basic actions allow to thoroughly test code without opening the browser.

If we still were in web 1.0 land with 98% users on IE5, no CSS or JS, the story would end here and the web developers would live happily ever after…

## Browser differences

While most other languages have one default compiler or platform, Javascript has many. Every browser interprets Javascript and something as simple as {‘a’:1,} will work in Firefox and Opera and will crash in Internet Explorer. While most other platforms can simulate almost any user interaction, even the most basic, like simulating a mouseover, fail with Javascript. The main problem is not that no Javascript compiler exists (there are even some that run from the command line like rhino), but that passing tests in any of them does not mean the code will run in the real, browser-world. Therefore even if Javascript syntax or execution was tested from inside Rails, it still would not be sure that it works in all browsers, leaving only the possibility to test inside real browsers.

Hence any good test has to run through a browser, which means opening a browser and going through all test pages. As far as I have seen this burden seems too hard for many developers, because most low-to-medium sized projects lack even basic Javascript tests.

Another part that is very hard to test is CSS, since it changes the graphical output and has no testable text-representation and therefore verifying that a page looks the same on all browsers can hardly be automated. Watching the same page in all browsers is a very dull task and it has to be repeated after any change. It is possible to test some basic parts of CSS, for example positions of elements, can be checked with Javascript by testing if the offsetWidth/offsetHeight/… of an element is correct . Since testing everything, for example if opacity works or not, only basic alignment or pixel-exact positioning can be tested.

To visually test a layout in all major browsers many professionals use BrowserShots.org or a similar services, where a webpage is rendered in different browsers and the resulting screenshots are returned. Most are free as long as one is willing to wait for ca. 2 hours until the screenshots arrive. Priority processing can be bought for a monthly fee, which is worth the time saved to setup all browsers and systems needed for such a complete test.

## Conclusion

Testing web applications bears many challenges and often is time consuming and some parts, like page layout, can only be tested manually. Rails offers a basic set of tools to make testing effective and provides tests for all code it generates, which is an advantage compared to many other web frameworks that seldom encourage their users to write tests. But these basic tools are not yet sufficient to thoroughly test a whole application, because some basic parts like e.g. Javascript are not testable with standard Rails tests. Therefore to build a complete and automated test from model through controller and views up to Javascript many more specialized tools are required.

# Testing Basics

## Introduction

Testing can be a waste of time when it is not done with the right techniques. Simply “writing a test” may be a good intention, but if a test does not prove any feature or breaks on any minor change, the test is worthless.

Testing first is a technique to bypass most of the problems that testing last creates. By writing tests before writing code, developers are forced to think about how the code could be made testable, which leads to loosely coupled code and cannot lead to tests that prove nothing, since it is instantly visible if the test for a non-existent feature succeeds.

When writing the code to satisfy tests, just write enough to pass, not more. Writing more means writing something that is not tested, but looks as if it was tested. Finish the first idea, see it pass and then extend it with a new test case. Finally refactor, for code maintainability or performance.

When something goes wrong or an email saying “when I do this, it shows me that” comes in, it is the perfect opportunity to build a test case with this information and see it fail. And in the case that it does not fail, a new test case was build and the problem was further narrowed down. See 5.3.3 “Bug to Testcase”.

## Getting started

### Before wrting tests, learn

It is essential to not just start writing tests and hope to refactor or fix any error that occurs. Be sure that what is build will work. Understand the problem domain by reading the manual or looking at example code.After the basic idea is clear, start with a prototype (a real throw-away-and-never-look-at-again kind of prototype). Alternatively irb(Ruby console) or script/console (always use “script/console test” to not mess up the development environment) can be of great help in learning the basics of a new library.

Even after starting to test, some problems may occur, that cannot be fixed with testing alone. If it is unclear what is right or why something fails, reading and playing with the console is faster than writing countless tests.

Sample console session, after getting stuck with a failing test:

script/console test

Loading test environment (Rails 2.2.2)

**>> r = Rating.new**

=> #<Rating id: nil, r1: 0, r2: 0, r3: 0, r4: 0, r5: 0, rating: nil, movie\_id: nil, created\_at: nil, updated\_at: nil>

**>> r.save!**

ActiveRecord::StatementInvalid: Mysql::Error: #23000Column 'movie\_id' cannot be null: INSERT INTO …

**>>r.movie = Movie.new**

=> #<Movie id: nil, country: nil, year: nil, duration: nil, title: nil, director: nil,

**>> r.save!**

Mysql::Error: #23000Column 'movie\_id' cannot be null

#Movie was assigned and there is no id, digging deeper may help…

**>> r.movie.save!**

ActiveRecord::RecordInvalid: Validation failed: Title can't be blank

#problem found!

**>> r.movie.title = 'test'**

**>> r.movie.save!**

=> true

#success, now check if all other values are correct too

**>> y r** #y is a shorthand for outputting a readable(YAML) version of an object

--- &id003 !ruby/object:Rating

attributes:

rating: 0

movie\_id: 633756704

id: 953125646

r1: 0

…

After having learned where the problem exactly lies, it is easy to see if either the testcase needs repair or if the logic is was defective in the first place.

### Integration and Unit testing

There are 2 common types of testing mentalities, integration testing (testing deep) and unit testing (testing small). Integration testing means: writing a test case that touches a lot of code and verify that all works in unison. This can work good to verify that something is working as expected, since failures would be visible in the final result. This kind of testing is often used for test last development, since testing here only serves as verification that the code runs as expected. But this approach has many drawbacks. There is no safety that everything is tested, different failures arise when changing one aspect, most failure messages are unclear thus requiring more “digging” and it is not usable for test-driven development, since everything has to be build at once.

In consequence it is better to rely on unit testing for test driven development. But unit testing can go wrong easily, some bad examples include testing more than one aspect in a single test case, testing 2 paths of execution (success and failure) at once, testing something without verifying an underlying assumption first, not naming the test cases descriptive and many more. Here is a small example to illustrate:

**def** test\_new\_rating\_should\_change\_score

assert\_equal "2.83", **@rating**.rate!(**2**).rating

**end**

* Assumes that rate! returns itself, test this first 🡪

**def** test\_rate\_should\_return\_self

assert\_equal **@rating**, **@rating**.rate!(**2**)

**end**

There is a border where testing something to trivial will only slow down work, but in general it is better to err on the side of making to small test, since they are easier to understand and maintain.

Another example refactoring:

**def** test\_save

get **:edit**, **:id** => Rating.first.id

submit\_form **:rating** => {**:r1** => **3**}

assert\_response :redirect

assert\_equal **3**, Rating.first.r1

assert\_match(/success/, flash[**:notice**])

assert\_redirected\_to **:controller** => 'rating', **:action** => 'index'

**end**

Refactoring steps to better unit tests:

* Split tests, so that one assertion is made per test case
* Move requests to a helper method, since they will be repeated
* Remove duplicate redirect test
* Move Rating.first to setup (@rating = Rating.first) or use fixtures
* Rename test to express what they are testing

**def** save(params = {})

get **:edit**, **:id** => **@rating**.id

submit\_form **:rating** => params

**end**

**def** test\_should\_update\_rating\_on\_successful\_save

save **:r1**=>**3**

**@rating**.reload.r1.should == **3** #reload from db to see if it relly was stored

**end**

**def** test\_should\_redirect\_to\_index\_on\_successful\_save

save

assert\_redirected\_to **:controller** => 'rating', **:action** => 'index'

assert\_false flash[**:notice**].blank?

**end**

The refactored test is lighter and more verbose. It is easier to understand and it now seems obvious, that a failing save was never tested, but before it was hard to spot.

### naming conventions

Tests should be named for what they verify. If it is hard to find a good name, it often means too much is being tested and breaking it down in 2 cases often makes finding names easier. A good scheme for naming is the assumption itself. “update should redirect me to index when successful”, this can be shortened to “update should redirect to index on success”, which results in test\_update\_should\_redirect\_to\_index\_on\_success.

These names seem rather long, but they clearly state what is tested. If not, tests often end up being named test\_save, which suggests “save is covered, no more testing required” even if the test just verifies half of the behavior. It also helps when seeing the failure output; it is instantly obvious where and why (“because it did not redirect to index”) something is broken. Other developers or the “later self” can see what was intended without reading the code, which may test something different than stated or be hard to understand.

## Guidelines

### Loose coupled tests

It is best to have a tight coupling between behavior and test, so that e.g. the model tests fails when the model breaks, which makes testing and error finding faster through the fast feedback. But tests should be decoupled from ever-changing aspects like spelling, that do not influencing the behavior and where every typo means that tests have to be altered.

assert\_equals 'Your transaction was successfull!', message #bad

assert\_match / success/, message #good

### Flash messages

It is a good practice to separate flash messages into success (flash[:notice]) and failure(flash[:error]). User will faster recognize if something succeeded or not when used with different styles (e.g. green for successful actions; red for failed actions) and tests can use assert flash[:notice] to test if a success notification was sent, meaning that they will not break on wording changes, since they depend directly on the behavior.

### Duck typing

„*If it walks like a duck and quacks like a duck, I would call it a duck.*“ - James Whitcomb Riley

Rely on duck typing, testing something behaves in a desired way and not that it is an instance of some specific type. The methods kind\_of? and respond\_to? are far more robust than instance\_of when changing the type of a parameter or refactoring.

### Push don’t pull

Push information and configuration into your objects. They will be easier to reuse and easy to fill with mock servers/service providers/databases/… . It should be a warning sign when some Objects need to load a configuration file or pull information from the environment using something like GlobalConfig[:information]. Make all these connections with the environment as loose as possible, by pushing them in using the constructor or explicit setters .

## Fixtures

#### Valid fixtures

Using invalid fixtures for something like testing edge-case behavior will increase the number of fixtures that have to be maintained and also makes maintaining all fixtures harder, because invalid fixtures cannot be distinguish from broken fixtures. Therefore it is best to only change fixtures inside the ‘failure behavior’ test cases. This way fewer fixtures are needed and failure cause and failure handling are kept close by. When all fixtures should be valid, it is easy to run a task to check that all fixtures are indeed valid. This saves time when introducing new model validations or model attributes. An example refactoring away from invalid fixtures:

**def** test\_user\_should\_not\_be\_valid\_without\_email

assert\_invalid users(**:no\_email**)

**end**

* Without invalid fixtures, code gets clearer and saves 1 fixture

**def** test\_user\_should\_not\_be\_valid\_without\_email

u = users(**:one**)

u.email = ''

assert\_invalid u

**end**

A rake task to validate all fixtures and all models can be found at , its output helps to find out which fixtures are invalid and what attributes are not valid:

$ rake db:validate\_fixtures

-- records - model --

1x FtpAccount

22x Movie

Movie: id=5

["Title can't be blank"]

8x Order

24x Rating

1x User

Example output: 1 movie does not have the required title and should be corrected.

#### Many Fixtures

When large amounts of fixtures are needed, for testing speed or pagination, it is best to create them inside the actual test (def create\_100\_fixtures) or to use the plugin. Fixture-scenarios allow having sets of fixture in subfolders. These specialized fixtures get combined with the normal fixtures, only for certain tests. Either way the goal is to keep the test environment free from unnecessary fixtures, which make testing slower and more complicated.

## Develop without opening your browser

Verify with tests and console first and save the browser as last method. Clicking around and filling forms is slow and leaves nothing that can be automated, while writing tests helps to become better at it and leaves an automated suite for all other developers to use. Testing first and then seeing it break in the browser, because there was no redirect/input/link/… , raises awareness for what aspects often lack testing and therefore results in better test cases and higher coverage.

## Testing views

It is cumbersome to test view markup with assert\_tag or assert\_select (verifying that some tags exist) and results in tests breaking when only changing view layout or structure, therefore only test view behavior not markup.

For me the things that break in views are always mistyped functions which results in errors that are visible when rendering the view, CSS problems which will only be uncovered by looking in the browser or syntax errors that are hard to see in a browser but can easily be found via html\_test (5.3.7). Hence the only thing left to test is if the correct content is displayed and if the view logic worked.

To test the logic in the views, remove it from the views and place it in view helpers, where it according to Rails conventions, naturally belongs. Testing helpers will be easier, since most of the time they only return a line of text or a link. From my experience, the only things worth testing are that a form has all fields required for an update or create, that the page is valid HTML, that all generated links are valid and that the layout is correct.

The first 3 can be tested with form\_test\_helper (5.3.5) and html\_test (5.3.7). When there is still logic left, test for the most relevant result (e.g. a link to go to the admin page is shown or not:

assert\_equal 1,tags("[@href=#{admin\_url}]").size

To illustrate the redundancy of markup validations, a simple demonstration using RSpec and 2 Users:

it "sould have one row for each user" **do**

render '/users/index'

response.should have\_tag('table tr', :count => 2)

**end**

Is wrong and unnecessary:

* because the table has 3 rows (2 Users + Heading)
* tr is always inside a table, or it would raise a syntax error (html\_test (5.3.7)).

It is hard to maintain, since it was not asserted that 2 users where rendered, but that 2 rows exists, which could contain anything and nothing.

* When adding another heading, the test has to be changed
* When adding a table to describe the contents, a new selector has to be found
* When refactoring using divs, everything breaks even though the same information is displayed
* When the resulting table cells are empty, nothing fails

## Conclusion

When not using the right techniques testing efforts may be fruitless. When done right, testing will not only lead to verified code, but to better, loosely coupled code. Focus on the risky parts of the application and do not spend time testing each and every part, especially when some parts are ever-changing (e.g. HTML structure) without effect on the behavior. Since time is limited one should opt for a maximum amount of security per written test case. On an imaginary list of risk factors where  
risk = (amount of money lost)\*(chance this will happen)  
anything below a certain threshold should be discarded.

# Testing Tools

## Introduction

Rails comes with a rich assortment of testing tools and a well-defined test layout structure. For small application that often is sufficient. When an application gets larger, tests usually grow faster than the application itself, which often results in an unorganized test structure and duplication. Problems arise that do not seem to be testable (e.g. caching, emails, Javascript…) and especially when more than a single developer works on the codebase a better organization repays fast. The following chapter shows many possibilities to write dryer and more efficient tests, how to structure tests, how to see which parts lack testing, which possibilities exist for Javascript testing and an alternative testing framework.

## Installation Tips

### Plugins

It is recommended to document all plugins and gems installed, to remember how the system was set up, repeat a setup or help coworkers understand the dependencies.

There are 3 often used ways to install a plugin, 2 of them are not recommended since they will destabilize the environment. Here they are, sorted from bad to good.

#### Automatically updating dependencies

With script/plugin –x or svn:external dependencies will always be up to date. It sounds good, to always have the latest version of a plugin, but when the author decides that a ‘bit of testing’ is enough for the feature or the API changes, one day before the plugin is installed to the server, there will be no clue why suddenly the application fails.

Furthermore, changes in the plugin cannot be saved or committed. Every newly checked out version will have to be changed again. More on the subject of safely changing and modifying plugins can be found at

#### Using plain script/install

This will make a local copy of the plugin and is by far the most often used method, but also has drawbacks. In case the plugin was modified locally, an upgrade to the newer version with a new ‘script/plugin install’ will remove all SVN information, meaning the plugin has to be completely removed, committed and re-added, then all changes have to be reapplied, which can fail if the changes were not properly documented and it often means a lot of work.

#### Piston

A combination of all the advantages and none of the disadvantages can be found in piston. The plugin is copied into the local application, can be committed and can be kept up to date with the latest plugin revision. Running ‘piston update’ works like a normal SVN update and warns about conflicts and merges inside the plugin resulting from local changes that were made. Only piston will treat the plugin as an external repository.

gem install piston

svn update #before each import, to stop piston from complaining

piston import svn://somehost.com/svn/plugins/my\_plugin \

vendor/plugins/my\_plugin

piston update vendor/plugins/my\_plugin #get new version

* ‘piston status’ to see which repository’s have changed and which plugins are locally modified
* ‘piston convert /folder/’ convert an existing svn:externals folder into a piston-managed folder
* ‘piston lock /folder/’ lock one of the piston-managed folders, so that all others can be updated, but the one plugin whose new version does not work, stays the same

Piston also works with GIT version controlled project and plugins. More commands and help can be found at the projects homepage .

### Gems

To clearly document which gems an application needs and to always check if they are installed,  
 config.gem "gem\_name" is be added to config/environment.rb . To install missing gems use  
rake gems:install or rake gems:unpack to generate a local copy that does not depend on the global system configuration. If the name of the gem does not equal the name of the required library, add the libraries name too (see example below). Documenting the version of a gem is important since gems are often updated by accident when another installed gem requires a newer version of a gem that is already present. The gems version must be added or the code may break on one server and run fine on another.

config.gem "SQS", :version => "0.1.7",:lib => 'sqs'.

## Tools

### cache\_test

Testing caching-logic, like sweepers or other cache-expiry methods, is rather hard since the test environment has turned caching off and therefore will never cache a page and cannot test if it would have been cached or expired. With the plugin these tests become possible, to install it copy the extracted archive into vendor/plugins.

**def** test\_expiring

assert\_expire\_pages("ratings ", "ratings/1") **do** |\*urls|

delete "ratings/1"

**end**

**end**

This test makes sure that the index and the show actions are expired when the corresponding model gets deleted.

### Red Green

The normal test results are hard to read, since they are only displayed in black-on-white, which makes seeing the difference between a failed, pending or passed test run difficult. Therefore it is recommended to use RedGreen, a very simple plugin that changes test results to red (failed) / yellow (pending) / green (passed), so the test result is instantly visible without further reading the output.

sudo gem install RedGreen

rg test/unit/rating\_test.rb

....

Finished in 2.358123 seconds.

4 tests, 13 assertions, 0 failures, 0 error

To see this colorful output, test must be run with the rg command or require ‘redgreen’ is added to test/test\_helper.rb.

### Bug to testcase (laziness)

Laziness is helpful way to convert most bug-reports into test cases, since every failing request will print a small test case to repeat it, on the normal Rails error page, this test can simply be copied and run to see if the error is reproducible. Most of the time it is only a starting point, but is very helpful if a lot of parameters are passed to a request or it is not sure which of the parameters (session/cookies/headers/…) has caused the error.

script/plugin install http://svn.extendviget.com/lab/laziness/trunk

An example output from one of my error pages that was created automatically and could reproduce the error:

**def** test\_get\_rating\_edit\_should\_not\_raise\_activerecord\_recordnotfound\_exception

assert\_nothing\_raised(ActiveRecord::RecordNotFound) **do**

get **:edit**, {"id"=>"1"}, {**:user\_id**=>**nil**, **:return\_to**=>"/orders/1"}, {}, {"\_session\_id"=>["…"]}

**end**

**end**

### ZenTest

ZenTest is a gem that provides a whole collection of useful tools and test helpers, the best parts are Autotest and Test::Rails, which will be cover here. Additionally it comes with a tool called multi-ruby that can easily test code in multiple versions of ruby, very useful when building libraries, plugins or gems.

sudo gem install ZenTest

#### Autotest

When working with continuous integration there is nothing better than continuous testing. With Autotest this is easy, since it will run the matching test suite for every file that is changed. When user.rb is saved, it runs units/user\_test.rb, the only thing developers have to do is to watch their console to see if the tests ran successfully.

Editing movie\_controller.rb

Running test/movies\_controller\_test.rb...

Finished in 15.106864 seconds.

24 tests, 49 assertions, 0 failures, 0 errors

Once a test fails Autotest will re-run only this failed one, not the whole suite, so the problem can be narrowed down while having fast feedback. It also strips most of the useless error output (framework-trace) and only leaves the applications own callstack. After the last failure has been removed, autotest runs the complete suite again, to see if any new errors have been introduced.

It is even possible to stop looking at the console and make Autotest play a sound if it fails or raise a desktop notification .

#### Test::Rails

Test::Rails introduces new testing possibilities, helpers, assertions and Test classes. More in-depth knowledge can be found at . It supports the idea of separating functional tests, Rails integrated views and controller tests, into separate controller and view tests, which follows the basic principles of unit testing, to test as small as possible. When modifying views, controller tests should not fail and when controllers change, view-tests should not fail. Testing the interaction of views and controllers, like submitting forms or following a redirect, is left for the integration tests.

##### Test::Rails::ControllerTestCase

The ControllerTestCase is responsible for assuring that all values get assigned (assert\_assigned), that the right model actions were called (save/create…) and flash/session is set correctly. It is a great place to use mocking (see Mocha 5.3.8) since not all attributes of an object need to be known (they are never displayed), and controllers can be seperated from all validation logic (failing actions are tested by mocking model.valid? to false).

Steps for migrating from a normal functional test to ControllerTestCase:

* Replace old extends with ControllerTestCase
* Remove @response, @request, @controller lines from setup and call super
* When the test does not follow the naming of the controller tested, set the controller name by hand, e.g. with this snippet, which infers the current controller from the file the test lies in:

**@controller\_class\_name** = File.basename(**\_\_FILE\_\_**,"\_test.rb").classify

More info on ControllerTestCase setup and usage can be found at

##### Test::Rails::ViewTestCase

This type of TestCase sits between a controller and its view. It provides the parameters for the view and tests only what the view does with the given input. This way edge-case behavior of views can be tested without building the normally needed support-code. Partials which are used by different views can be tested with varying input and the application layout can be inspected on its own by rendering it with an empty content:  
render :text => '', :layout => 'application'

ViewTestCase comes with many specialized assertions like assert\_links\_to, assert\_post\_form, assert\_input… This example Testcase shows how a test is set up, by assigning the variables the controller normally would provide and then testing if the form is posted to the form\_url when the ‘Delete!’ button is pressed.

**class** MovieViewTest < Test::Rails::ViewTestCase

**def** test\_show\_has\_working\_delete\_form

assigns[**:loggedin\_user**] = users(**:herbert**)

assigns[**:movie**] = movies(**:two**)

render ‘show’

assert\_submit form\_url, 'Delete!'

**end**

**end**

This approach is time-consuming when only a simple action and its resulting view should be tested but the more complex controllers get, and the more edge cases views have to handle, the more appealing this approach becomes. It is possible to use a mixture of functional and pure controller/view tests, but once started, it is wise to switch all functional to controller/view tests, since then rails\_test\_audit can be used.

##### rails\_test\_audit

When used in combination ViewTestCase and ControllerTestCase supply a new feature: running   
rake rails\_test\_audit will show which variables have been tested for in the controller (by assert\_assigned), that have not been supplied in the ViewTestCase (by assign) and vice versa, this helps to find unnecessarily assigned variables or missing input for views.

### form\_test\_helper

Form\_test\_helper can submit a form that was created in a previous request and test if it transmits all necessary fields to create or update a model. It also reduces the work for testing a post request, by using the values already filled in the form.

script/plugin install http://form-test-helper.googlecode.com/svn/form\_test\_helper/

  
A small example that fills a form and then submits it, more can be found at.

submit\_form **do** |form|

form.movie.title = 'Test movie'

form.movie.plublic.uncheck #checkbox handling

**end**

#OR

movie = {‘title‘=>‘Test movie‘,‘public‘ =>**false**}

submit\_form {|form| form.movie.update(movie)}

assert\_response :success

With the help of syntactic sugar it is even possible to click a link from inside your tests, making it possible to test real user interaction and not only calling urls that possibly never were displayed, thereby also testing that the link exists on the current page.

#test/test\_helper.rb

**def** click(text)

select\_link(text).click

**end**

On revision 69 it is necessary to apply this patch for click to work with Rails new post/put/delete links.

#vendor/plugins/form\_test\_helper/lib/form\_test\_helper.rb

-if self["onclick"] && self["onclick"] =~ /'\_method'.\*'value', '(\w+)'/

- $1.to\_sym

+if self["onclick"] && self["onclick"] =~ /\.method = '(.\*)'/

+ $1.downcase.to\_sym

### RailsTidy

Railstidy is a plugin that can validate existing html pages on a server or validate all the pages that are generated during test runs for compliance with the WC3 standarts. For more details see . Installation is rather complicated, here are the steps to get it working on Ubuntu 8.10.

#installation for Ubuntu 8.10, from a Rails directory

sudo apt-get install tidy

sudo gem install tidy

wget http://www.cosinux.org/~dam/projects/rails-tidy/rails\_tidy-0.2/tidy.patch

sudo patch /var/lib/gems/1.8/gems/tidy-1.1.2/lib/tidy/tidybuf.rb < tidy.patch

cd vendor/plugins/

wget http://www.cosinux.org/~dam/projects/rails-tidy/rails\_tidy-0.2.tar.bz2

tar -xf rails\_tidy-0.2.tar.bz2

rm rails\_tidy-0.2.tar.bz2

To try it out, validate all current view templates:

rake test:templates

/home/data/projekte/short/app/views/movie/list.rhtml ERRORS

/home/data/projekte/short/app/views/movie/edit.rhtml OK

These results show where problems lie, but to narrow down the search each individual file hast to be parsed:

rake test:templates FILE=app/views/movie/list.rhtml

app/views/movie/list.rhtml ERRORS

line 6 column 1 - Warning: <br> element not empty or not closed

line 10 column 1 - Warning: <table> lacks "summary" attribute

...

2 warnings, 0 errors were found!

After all problems are resolved, RailsTidy can easily protect you from inserting any new errors by always validating the HTML output generated during normal test runs, by adding a global after-test callback that will validate the rendered page.

#test\_helper.rb

**class Test::Unit::TestCase**

**def** teardown

assert\_tidy **if @response**

**end**

**end**

Tidy detected html errors in response body:

------------------HTML of whole page----------------------

line 65 column 33 - Warning: inserting implicit <p>

line 65 column 33 - Warning: trimming empty <p>

Some of the errors result from using html helpers like form\_tag, so this output can indicate an error when there was nothing done wrong by the user, which can be frustrating. To silence useless warnings like “table lacks "summary" attribute”, it is possible to configure RailsTidy with custom ignore patterns, by modifying config/tidy.rc. A list of possible configuration options can be found at .

### Html\_TEST

Contrary to RailsTidy, html\_test is not a real validation library, but a tool to make validation testing simple and pain-free. It can use up to 3 different validators, validate the response of every test-request, suppress useless warnings and check all rendered links to see if they would direct to an existing resource (no 404). To use the HTML validation, you need to first install RailsTidy or any other of the 3 supported validators then install html\_test:

script/plugin install http://htmltest.googlecode.com/svn/trunk/html\_test

The configuration I will validate all responses with RailsTidy, ignore many useless or outdated warnings and validate all generated links as well as redirects.

#insert into test/test\_helper.rb

#validate every request

ApplicationController.validate\_all = **true**

ApplicationController.validators = [:tidy]

#ignore common warnings

Html::Test::Validator.tidy\_ignore\_list = [

/<table> lacks "summary" attribute/,

/trimming empty <fieldset>/,#errors\_on missing -> empty fieldset

/line 1.\*Warning: inserting missing 'title' /,#redirect html has no title....

/Warning: replacing invalid character code 130/, #€ not supported…

]

#check urls

ApplicationController.check\_urls = **true**

ApplicationController.check\_redirects = **true**

It is also possible to check URLs on a production server by letting html\_test check all links on a given page. This does not allow for detailed configuration, e.g. which warnings to ignore, so the output will contain many unwanted warnings, but it is a good tool to find broken links to pages that do not exist anymore.

vendor/plugins/html\_test/script/validate http://my.blog.com --validators tidy

### Mocha

Mocha is a Mocking / Stubbing framework, which can helps to separate controller and view tests from database and validations. With Mocha you can separate all model specific aspects (validations and environment requirements) from unit tests. Therefore the controller tests can validate pure request/response logic, without worrying that e.g. an User needs a Email to be saved. All complex or time-consuming model and database operations can be skipped.

script/plugin install svn://rubyforge.org/var/svn/mocha/trunk

Here is a basic test to verify that the correct record was assigned.

**def** test\_edit\_should\_assign\_rating

rating = Rating.new

Rating.expects(**:find**).with('1').returns(rating)

get **:edit**, **:id** =>'1'

assert\_equals rating, assigns[**:rating**]

**end**

If all your test cases use Mocha, stubbing can be placed inside the setup.

**def** setup

**@rating** = Rating.new

Rating.stubs(**:find**).returns(**@rating**)

**end**

**def** test\_edit\_should\_assign\_rating

get **:edit**, **:id** => **1**

assert\_equals **@rating**, assigns(**:rating**)

**end**

The difference is: The first test will fail if find is called with 2, or find is not called or find is called twice. Whereas the second test only verifies that the rating is assigned, not caring from where it came.

Mocking a method call like find with e.g. stubs(:find).with(:all) will cause any other call to find to make your tests fail, therefore all calls to find that will be used inside the test must be mocked as well (find :first, find 13…). More details can be found at the projects homepage .

### RCov

RCov is a code coverage analyzer for ruby, which also includes the RCov Rails plugin, that can be used to analyze your tests code coverage, without learning all RCov command line options. The result is a HTML file for every file under test, with detailed execution coverage, and an index.html including the overall coverage for all tested files.

wget http://rubyforge.org/frs/download.php/28270/rcov-0.8.1.2.tar.gz

tar -xf rcov-0.8.1.2.tar.gz

sudo ruby rcov-0.8.1.2/setup.rb

rm -rf rcov-0.8.1.2

script/plguin install http://svn.codahale.com/rails\_rcov

#IMG

To run the whole test suite and generate a coverage report afterwards, run “rake test:rcov”.

Most useful parameters:

* Show only selected parts: SHOW\_ONLY=m,l,c,v (model,lib,controller,view)
* Run a single tests: rcov FILE --rails (the --rails option will ignore config and environment)
* Add RCov parameters: RCOV\_PARAMS=""
* Sort by coverage: COV\_PARAMS="--sort=coverage"
* Hide fully covered: RCOV\_PARAMS=" --only-uncovered"

Ignoring all standard libraries helps keeping the output to a manageable size. When using the command line, add RCOV\_PARAMS="-exclude ‘/var/|/usr/’ ” , /var/ and /usr/ being the folders where your libraries and gems lie. When using rake, this can be done the same way, but is a bit repetitive. For this purpose it can be simpler to directly modify the plugin.

#vendor/plugins/rails\_rcov/tasks/rails\_rcov.rake @ line ~60

**if** show\_only.any?

reg\_exp = ['/var/','/usr/'] #CHANGED

**for** show\_type **in** show\_only

Additional usage information and setup instructions can be found at the authors homepage .

## RSpec

### RSpec on Rails

sudo gem install rspec

sudo gem install rspec-rails

script/generate rspec

RSpec focuses on BDD (Behavior Driven Design). When you are doing TDD right, you are doing BDD. The problem RSpec is trying to solve lies mostly in syntax and task splitting. Normal test verify that something is the way it should be, whereas the idea behind of TDD is that you state what should work and then make it work. So RSpec uses a syntax that focuses on ‘should’ and not assert.

Another main part is the story framework, which makes it possible to let your customers write and review the tests, by using normal English sentences as steps. Once a step is programmed, it can be combined freely in any number of stories.

RSpec uses different words for test related things: test=spec, test case=example, integration test=story (I will only demonstrate stories for integration testing, but they also could be used for other test areas). The best part about Rspec is that its syntax almost reads like English, which improves readability and makes it easier to write.

assert\_equal ‘new’, rating.status #Test::Unit

@rating.status.should == ‘new’ #RSpec

#### Stories

The most simple and stunning part of RSpec, is a story, it is readable even to non-programmers and can be build from normal sentences, it’s structure was derived from story based XP development. A story can consist of many scenarios that illustrate the story in detail. The scenarios consist of any combination of When, Then and Given, where an And is translated to the last used identifier, meaning that Given x, And y is the same as Given x, Given y.

Story: transfer from savings to checking account

As a savings account holder

I want to transfer money from my savings account to my checking account

So that I can get cash easily from an ATM

Scenario: savings account has sufficient funds

Given my savings account balance is $100

And my checking account balance is $10

When I transfer $20 from savings to checking

Then my savings account balance should be $80

And my checking account balance should be $30

To transform this story into a working test case, we need to define what ‘Given my savings account balance is $100’means in program terms, this is done in the steps file that belongs to any story. This way an executive or designer can write stories and later the programmer can fill them with life.

steps\_for(**:accounts**) **do**

Given("my $account\_type account balance is $amount") **do** \

|account\_type, amount|

create\_account(account\_type, amount)

**end**

When("I transfer $amount from $source\_account to $target\_account") **do** \

|amount, source\_account, target\_account|

get\_account(source\_account).transfer(amount).to(get\_account(target\_account))

**end**

Then("my $account\_type account balance should be $amount") **do** \

|account\_type, amount|

get\_account(account\_type).should have\_a\_balance\_of(amount)

**end**

**end**

#IMG

When a steps for all sentences used are defined, any number of test cases can be run with them. Not all steps have to be built at the same time, missing steps will be marked as pending and the story can be executed until the first missing step is reached. Users that like the story feature, but want to stay with the Test::Unit syntax, can use ‘assert’ in their step definitions.

#### Models, Controllers, Views, Helpers

But stories are not everything; they are just the top part, the former integration tests. For all other ‘small’ parts normal RSpec tests can be used. These are split into 4 different categories: Model, Controller, View, Helpers. Controllers and views are the former parts of a functional test, like Test::Rails (5.3.4), controller tests only verify that i.e. an object was assigned and a view was rendered, whereas a view test gets predefined assigns and verifies that it renders correctly. Only when used with integrate\_views, controller tests behave like functional (Test::Unit) tests.

RSpec test work like normal unit/functional tests and are a good point of starting to learn RSpec syntax. A helpful learning recourse is the RSpec cheat sheet and the RSpec converting table .

A basic controller spec looks like this, not so different from Test::Unit.

describe RatingController **do**

integrate\_views #render views

fixtures **:ratings**

before **do**

**@rating** = ratings(**:one**)

**end**

it 'renders index' **do**

get **:index**

response.should render\_template‘index’

**end**

**end**

(Requiring the controller or is no longer necessary and the 3 old @controller, @request, @response statements can be left out too.)

#### Stub and mock

RSpec contains a mocking framework whose syntax is not as clean as Mochas (5.3.8), but it offers comparable abilities.

**@rating** = mock("rating")

**@rating**.stub!(**:new\_record?**).and\_return(**false**)

Rating.stub!(**:new**).and\_return(**@rating**)

Rating.new.new\_record?.should == **false** #Rating.new.should\_not be\_new\_record

To stay with Mocha mocking, this configuration must be added to spec/spec\_helper.rb.

Spec::Runner.configure **do** |config|

config.mock\_with **:mocha**

**end**

#### Running RSpec

There are 2 ways of running RSpec. Specs can be run direct via rake “rake spec:models”, where you can use models/controllers/views/helpers/plugins and app/all. “all” = “app” + “plugins”. Test execution can be slow, since the whole Rails framework has to be loaded before tests can be run. For faster test execution, you can host a spec server.

script/spec\_server –d #run server as deamon (kill:‘ps –A’,‘kill ID’)

echo ‘--drb’ >> spec/spec.opts #add –drb to spec options

rake spec #run spec as normal

#INSTALL

When the spec server is running, testing no longer requires starting up the Rails framework, and should therefore be faster.

#### Running Stories

Getting started with stories is rather hard, since there is no generator to help and the default helper.rb and all.rb are not suited for a large set of stories, since they force all stories and steps to share a common namespace.

helper.rb – when placing all stories in stories/stories/{name}.txt and all steps in stories/steps/{name}.rb

ENV["RAILS\_ENV"] = "test"

require File.expand\_path(File.dirname(**\_\_FILE\_\_**) + "/../config/environment")

require 'spec/rails/story\_adapter'

#load all steps

Dir[File.join(File.dirname(**\_\_FILE\_\_**), "steps”, ”\*.rb")].each **do** |file|

require file

**end**

#run a story

**def** run\_story(file\_name)

run File.join(File.dirname(**\_\_FILE\_\_**),"stories”,”#{file\_name}.txt"), **:type** => RailsStory

**end**

The story runner lies in stories/{name}.rb and is executed with ‘ruby stories/{name}.rb‘, for the rating stories it would look like this:

require File.join(File.dirname(**\_\_FILE\_\_**),"helper")

with\_steps\_for **:rating**, **:general do**

run\_story 'rating'

**end**

### RSpec converter

Converting old Test::Unit test cases by hand can be very helpful in learning RSpec syntax, but once the syntax is understood, it is a painful and repetitive task.

script/plugin install \ http://svn.davidjrice.co.uk/svn/projects/plugins/test\_unit\_to\_rspec\_converter

rake convert\_to\_rspec

Notice: it will overwrite all specs, that happen to be where the new specs should be created.

With the converter, all your old tests will be mostly converted to RSpec. Not all old asserts need to be replaced, since RSpec can work with Test::Unit assertions. But before everything runs you need to do a bit of hand work:

1. Copy old code from test/test\_helper.rb to spec/spec\_helper.rb (leave include‘s outside of Spec::Runner.configure do)
2. Change spec/spec\_helper.rg ‘config.fixture\_path =‘ to test/fixtures OR copy all fixturesfrom test to spec (svn cp test/fixtures spec/fixtures)
3. Correct syntax errors in converted files

When all you tests run successfully, remove the old fixtures and see if they still run. When everything works, commit and start refactoring.

### test\_spec

For those that like RSpec syntax, but can or will not make the switch, there are 2 alternatives:

#### test\_spec

Test\_spec is an RSpec like syntax replacement for Test::Unit. It allows mixing of RSpec coding style and normal tests.

sudo gem install test-spec

script/plugins install \

http://svn.techno-weenie.net/projects/plugins/test\_spec\_on\_rails/

#test/test\_helper.rb

require 'test/spec/rails'

Syntax cheat sheets can be found at http://cheat.errtheblog.com/s/test\_spec/. Syntax example:

**@rating**.should.validate #assert @rating.valid?

response.should.be.redirected #assert\_response :redirect

#### Using RSpec with Test::Unit

When normal Test::Unit files are run as a spec, they behave exactly like before, but can use should / should\_not etc. for validation. So drop all your functional tests into spec/controllers, copy the fixtures, replace all test/xxx with spec/xxx and your tests should pass as if nothing has happened.

## Javascript

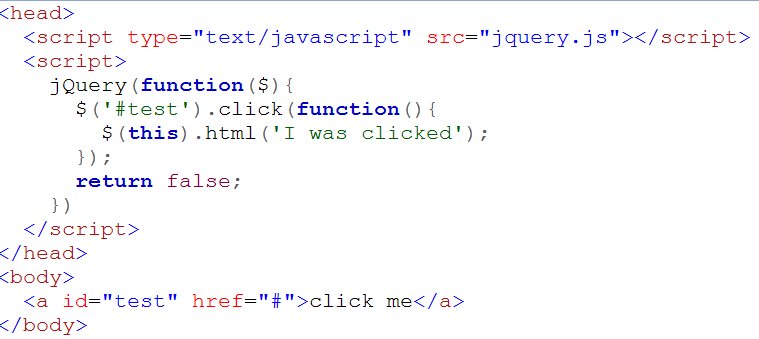
### Unobstrusive JS

There are 2 ways of building an application with JS, obtrusive or unobtrusive. Here is a small example to show the difference.

<div onclick=”hello()”> text </div>

This is obtrusive, since it changes the structure of the HTML document (the Document Object Model, further referred to as DOM) by inserting attributes (onclick,onmouseover,…) to the DOM that do not describe its structure.

Unobtrusive by example: ( examples/unobtrusive/unobstrusive.html )



2

3

1

1. load the library
2. “when the page is loaded, start this function” and “pass the jQuery object as parameter $ to it”
3. when test is clicked, change its ‘innerHtml’ to ‘I was clicked’

Using this setup (step 1 + 2) can be overhead for simple cases like this. But for larger projects, not using it leads to ever-increasing complexity.

In general there should be 3 Layers in your Frontend: HTML(Structure), CSS(Style), JS(Behavior). Unobtrusive in this context means: “separate JS from HTML like CSS”.

A short list of obtrusive disadvantages:

* using onclick=”” limits your code to have one event per element
* JS messes up the HTML
* JS is repeated several times 🡪 ~~DRY~~, debugging gets harder, files get larger
* you cannot turn off JS
* hard to move behavior from one component to another, or reuse it

### Problems with unobtrusive JS

Everything is cleanly separated from HTML, but how to test that the JS works or even if it is there after all? It is not possible to write something like “test that HTML changes when link #test is clicked” since Rails only knows the pure HTML output that came from the controller, and has no idea of any attached JS behavior.

Simple structures written in obtrusive JS are testable by “assert there is an onclick attribute that looks like /$(‘#test’).click(/”. But this kind of testing does not help, since we cannot be sure the script will work, we just can get sure that it looks like it could work. What nevertheless some frameworks do.

script/plugin install http://thar.be/svn/projects/plugins/arts/

### Javascript\_test

  
script/plugin install http://dev.rubyonrails.org/svn/rails/plugins/javascript\_test/

With javascript\_test it is possible to run JsUnit tests automatically in up to 4 different browsers. To use this feature you have to install all browsers you need (currently supported: IE and Firefox for Windows, Firefox and Safari for Mac, Firefox and Konqueror for Linux). On Windows all browsers must be installed in their default location and tests in Internet Explorer have to be closed by hand. It is hard to get javascript\_test running properly, but if it works you can save a lot of repetition.

The plugin also allows you to generate a Javascript test scaffold, with:

script/generate javascript\_test my\_app

create test/javascript/my\_app\_test.html ...

This gives you a good starting point for test setup and organization, even if you run your tests by hand (loading them in the browser) and do not automate them.

### UnitTest.js

A test framework build using prototype.js, it is easy to get started and has graphic output.  
Test setup:

...

<script src="path/to/prototype.js" type="text/javascript"></script>

<script src="path/to/unittest.js" type="text/javascript"></script>

...

<div id="testlog"> </div>

<div>Test text</div>

<script type="text/javascript" language="javascript">

new Test.Unit.Runner({

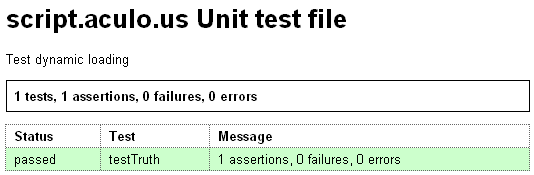
setUp: function(){},

testTruth: function () {

this.assertEqual(2, 1+1);

}});

</script>

Result:   
 

More information can be found at a live demo can be found at

To get started, go to the demo and save the page to your Desktop, it includes every JS and CSS file you need.

### jqUnit

JqUnit is a testrunner that was originally developed by the jQuery team, and was given TestCase support as well as some basic anonymity by Colin Clar and me. Its current home is http://code.google.com/p/jqunit/ it hopefully will be integrated into jQuery core soon.

JqUnit is originally not a xUnit framework, for example assertrEquals(1,output()) is written as equals(output(),1). It still supports all standard xUnit commands. JQUnit uses the full power of javascript, by breaking out of xUnit conventions.

* The whole page will be reset after each test, so there almost never is a setup/teardown needed
* Click an test output line to unfold Test-Results (see each assertion)
* Double Click to rerun the selected Test
* test.html?xxx -> run only tests that match /xxx/

It is possible to use TestCase or to just start writing tests with test().

with(jqUnit){

module('With local interface');

test('test 1', function(){

ok(true);

});

};

//same Using TestCase

var t = new jqUnit.TestCase('TestCase',function(){

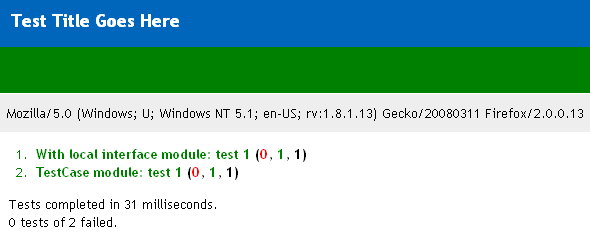
/\*setup\*/

},function(){

/\*teardown\*/

});

t.test('test 1',function(){with(jqUnit){ this.ok(true) }});

Result:  


The advantage using TestCase is that setup and teardown will run each time you run a t.test .

To get started, download the demo and source packaged from the homepage.

### Selenium

script/plugin install <http://svn.openqa.org/svn/selenium-on-rails/selenium-on-rails>

For detailed installation instructions and ‘getting started’ help can be found at .

Selenium is a tool for browser-automation. It comes with a Rails plugin and an IDE to create Unittests simply by surfing a website and hitting the record button. Recorded surfing sessions can then be automated inside a normal Unittest using Seleniums ‘Remote Control’ Browser API. All that is left to the developer is inserting the right assertions for the displayed content and for the Data that is saved to the database.

To test your website automatically, you will need the Selenium Remote Control Server. It runs on any operating system and will execute your test calls. This way testing of any browser on any system is possible.

* When the brower hangs press F5
* Pressing ‘return’ is “ key\_press locator, ‘/13’ “
* Locators can be ids(#search = ‘search’) or CSS (input with name search=“//input[@name='search']”)

To see if Selenium is the right tool for you, start with the standalone Ruby Client that comes with the Remote Controll Server. Start the server with “java –jar selenium-server.jar” and then run your tests.

require 'test/unit'

require 'selenium'

**class** ExampleTest < Test::Unit::TestCase

include SeleniumHelper

**def** setup

ie = '\*iexplore C:\Programme\Internet Explorer\IEXPLORE.EXE'

url = "http://www.ebay.com/"

**@selenium** = Selenium::SeleniumDriver.new("localhost", **4444**, ie, url, **6000**);

**@selenium**.start

**end**

**def** teardown

**@selenium**.stop

**end**

**def** test\_small

open "/"

type 'satitle', 'all'

click '//input[@value=\'Search\']'

sleep **7**

assert\_equal('My Ebay', get\_text('MyEbay'))

**end**

**end**

Simple sample Selenium TestCase.

In conclusion, Selenium is a powerful tool, that’s hard to setup and maintain, but it allows simultaneous browser interaction on many remote servers. And it is the only tool so far, that delivers this ease of TestCase construction with the integrated Selenium IDE and clients in 7 programming languages.

## Helpers and Tasks

### valid\_attributes

Validation tests are repetitive tasks and can be simplified with

script/plugin install git://github.com/grosser/valid\_attributes.git

With a very simple syntax, the most common validation rules can be tested:

assert\_invalid\_attributes User, **:login** => ['',**nil**], **:email** => [**nil**,'','ohno']

Each failing test results in a readable failure message:

<User.email> expected to be invalid when set to <ohno>

Additionally it can be used to generate customized objects for other testing scenarios:

user = valid User | user = valid(User,:email=>‘sam@web.de‘)

### agiledox

With AgileDox you can convert your test cases into documentation and insert this documentation into the corresponding models/controllers, to always have a reference when developing.

Copy into lib/tasks from

Then you can run rake dox or rake spec:models:dox or rake test:units:dox to get your tests displayed in this format:

A User:

- should not be valid without login

- should not be valid without email

A Users Controller's:

'new' action:

- should succeed

'edit' action:

- should succeed

A /users/edit:

- sould show errors

Changing the options :write value to true (in agiledox.rake) it will also write these comments to your classes:

#AGILEDOX

#A User:

# - should not be valid without a name

# - should be valid withou an email

#AGILEDOX

**class** User < ActiveRecord::Base

...

**end**

### Single Test

  
script/plugin install git://github.com/grosser/single\_test.git

Running the whole test suite can be time-consuming and to run a single test file one has to know the command-line interface of the testing framework and type the path to the test file.

rake test:rating:should\_rate\_

🡪 run every test that matches /should\_rate\_/ in test/units/rating\_test.rb

rake test:ratings\_c

🡪 run test/functionals/ratings\_controller\_test.rb

It also works nicely with RSpec, where the syntax translates to spec:\*.

## Plugin Recourses

Many of the plugins and tools have alternatives that almost do the same thing, and all the time new plugins and gems are created. To know which plugins exist and which where newly created and maybe solve a problem that has been ignored since a long time can save many hours of work and bring the security of a proven technology. To stay current on plugins news, I recommend to subscribe to some of these plugin resources.

http://wiki.rubyonrails.org/rails/pages/Testing+Plugins

http://svn.techno-weenie.net/projects/plugins/

http://dev.rubyonrails.org/svn/rails/plugins/

http://wiki.rubyonrails.com/rails/pages/plugins

http://topfunky.net/svn/plugins

http://www.agilewebdevelopment.com/plugins/index

## Conclusion

With these tools testing can be done more efficient, covering more application logic with fewer, robust tests. Readability and organization also increase when tools are used rather than endless lines of setup code that only distract the developer. These are of course not all tools, just a collection found most useful when developing my recent applications. Most times when you need to test this new feature that is hard to test, another developer has already released a plugin, so search for it on google or github before writing endless lines of test-code that will have to be maintained and refactored. Countless plugins and gems are available; the best way to stay informed about the ever-changing world of tools is subscribing to some plugin or gem resources.

# Example TDD

## Introduction

Since only reading about a problem is often very abstract, we will now build an example application, first using traditional Test::Unit with normal functional tests. Halfway through we will convert to RSpec and finish by separating our functional tests into Controller and View tests with support from Mocha. This provides a first-hand experience with most of the tools from chapter 5 and will help to clarify when and where they can be used and how they play together to thoroughly test an application.

The application created will by no means be a complete website, but a typical section of it, Model View and Controller of one resource that is handled by the application. Since most applications have to deal with users in some way or another the example will focus on creation and management of users.

## Basic User tests

To make thing fast and short, we rely mostly on scaffold code, and we will only test things we build ourselves.

$ rails tdd-example

$ script/generate scaffold user

#change config/routes.rb (map.root :controller => "users")

#delete public/index.html

Before doing anything, we build some basic unit tests, to sort out what our model needs. Install Single Testvalid\_attributes and then continue with test/unit/user\_test.rb:

**class** UserTest < ActiveSupport::TestCase

fixtures **:users**

**def** setup

**@user** = users(**:one**)

**end**

it 'valid attributes should create valid user' **do**

create\_valid User

**end**

it 'should find invalid attributes' **do**

assert\_invalid\_attributes User, **:login** => ['',**nil**], **:email** => [**nil**,'','ohno']

**end**

it 'should not allow duplicated fields' **do**

**@user** = create\_valid User

assert\_invalid\_attributes User, **:login** => **@user**.login, **:email** => **@user**.email

**end**

**end**

When we try to see the tests fail, we get information that we first need to run migrations, so be it.

#db/migrate/001\_create\_users.rb

create\_table **:users do** |t|

t.string **:email**, **:login**, **:null** => **false**

t.timestamps

**end**

$ rake db:migrate

$ rake test:user #see 5.6.3 or use rake test:units

Test results: 6 tests, 5 assertions, 5 failures, 0 errors  
To satisfy our tests, we modify app/models/user.rb

**class** User < ActiveRecord::Base

validates\_presence\_of **:email**, **:login**

validates\_format\_of **:email**, **:with** => /@/

validates\_uniqueness\_of **:email**, **:login**

**end**

Test results: 6 tests, 5 assertions, 0 failures, 0 errors

## Basic controller test

Now we turn to the controller, install form\_test\_helper 5.3.5 (optional: railstidy 5.3.6, html\_test 5.3.7).

Test result of then generated tests: 7 tests, 11 assertions, 1 failures, 0 errors   
Why do they fail? Some quick investigation shows that create fails, since we already changed our model validations. So first we fix that.

Now we can define some scenarios where validations fail and result in a different template being rendered.

**def** test\_create\_should\_fail\_when\_data\_is\_invalid\_and\_show\_new

get **:new**

submit\_form **:user** => {**:email** =>’something@web.de’,**:login**=>’’}

assert\_template 'new'

**end**

#similar for update

Test result: 9 tests, 17 assertions, 0 failures, 2 errors, both failures are ‘Field named 'user' not found in FieldsHash’, meaning that the user form has no room for login and email.

We make these tests pass by building the appropriate user-form:

app/views/users/edit.html.erb and new.html.erb:

<% form\_for(@user) do |f| %>

<%= render :partial => 'form', :locals =>{:f => f}%>

app/views/users/\_form.html.erb

<fieldset>

<label for="user\_login">Login</label> <%= f.text\_field 'login' %> <br/>

<label for="user\_email">Email</label> <%= f.text\_field 'email' %> <br/>

</fieldset>

Test result: 9 tests, 23 assertions, 0 failures, 0 errors

## Converting to RSpec

Install RSpec (5.4), RSpec Converter + patch (5.4.2).

Test Results (using rake spec): 15 examples, 0 failures, there are not 23+6 examples. RSpec counts each test case, unlike Test::Unit which counts every assertion.

If your results are not as green as they should be, it is time for a bug-hunt…

Now I will delete all old tests, to not overwrite my specs in case I happen to run convert\_to\_rspec again. Then I will have a look at the specs and refactor anything that could be enhanced.

assert\_difference('User.count', -**1**) **do**

delete **:destroy**, **:id** => users(**:one**).id

**end**

* in create and delete

lambda {

delete **:destroy**, **:id** => users(**:one**).id

}.should change(User,**:count**).by(-**1**)

assigns(**:user**).valid?.should\_not be\_true

* in many examples, makes our intent clearer

assigns(**:user**).should\_not be\_valid

## Splitting the controller

Split the users\_controller\_spec into Controller, View specs and stories. For this we need Mocha 5.3.8. And then uncomment spec/spec\_helper.rb # config.mock\_with :mocha.

We do not want to decrease our test coverage and keep everything running, so we work on the view tests first, and then the stories and then strip any view/integration related testing from the controllers.

### Views



$ script/generate rspec\_controller users index

Will give us a view test for index in spec/views/users/index.html.erb\_spec.rb which we change to look like this:

require File.dirname(**\_\_FILE\_\_**) + '/../../spec\_helper'



describe "/users/index" **do**

fixtures **:users**

before(**:each**) **do**

assigns[**:users**]=[users(**:one**),users(**:one**)]

**end**

it "sould have a row for each item" **do**

render '/users/index'

response.should have\_tag('#user\_listing tr',**:count**=>**2**+**1**) #2items + heading

**end**

**end**

Result of rake spec:view: 1 example, 0 failures.

### Stories

See RSpec:Running Stories 5.4.1 for getting started help.  
The runner lies in stories/run.rb and is executed with ‘ruby stories/run.rb‘

require File.join(File.dirname(**\_\_FILE\_\_**),"helper")

require File.join(File.dirname(**\_\_FILE\_\_**),'form')

with\_steps\_for **:users**, **:general do**

run\_story 'users'

**end**

For form interaction (using form\_test\_helper plugin 5.3.5) we need stories/form.rb

#re-selecting the form means loosing field-data

**def** form(selector=**nil**)

**@form** ||= select\_form selector

**end**

#reset the form object on each submit

**def** form\_submit

**@form**.submit

**@form** = **nil**

**end**

#enter a nested value into the form

**def** form\_enter(type, valid\_attributes)

valid\_attributes.each { |field,value| form.send("#{type}[#{field}]=",value)}

**end**

And finally our user story is in stories/stories/users.txt

Story: User interaction

Scenario: protect from creating a user without email

When i go to users/new

And i enter valid attributes except email

And i submit

Then i should stay at new

And the user should have an error on email

Scenario: create a new user

When i go to users/new

And i enter valid attributes

And i submit

Then i should be redirected to the user

Now that everything is set up and we can run the story. At the moment we only see a reminding ‘(PENDING)‘ behind each line of the story, saying: “not build yet”.

There are 2 kinds of ‘sentences’ in this story, Then and When, all ‘And’ sentences are the same type as the one before them. Now we write the steps, that the story needs in stories/steps/users.rb.

valid\_attributes = {'login'=>'newuser', 'email'=>'new@email'}

steps\_for(**:users**) **do**

When("i enter valid attributes") **do**

form\_enter 'user', valid\_attributes

**end**

When("i enter valid attributes except $attribute") **do** |attribute|

form\_enter('user', valid\_attributes)

form.user[attribute]=''

**end**

**end**

All general steps are in stories/steps/general.rb

steps\_for(**:general**) **do**

When("i go to $url") **do** |page|

get page

**end**

When("i submit") **do**

form\_submit

**end**

Then("i should stay at $url") **do** |url\_or\_action|

response.should render\_template(url\_or\_action)

**end**

Then("the $record should have an error on $field") **do** |record,field|

assigns(record).errors.on(field).should\_not be\_nil

**end**

Then("i should be redirected to the $record") **do** |record|

response.should redirect\_to(assigns(record))

**end**

**end**

With 7 steps, from which 2 are ‘user’ centered, we covered 9 story sentences.

Running the story now should succeed without pending steps.

### Mocking in the controller

The form interaction is covered inside the stories. We can remove it from our controllers. We start mocking all database actions, so we no longer have to worry about whether the controller logic failed, or the object was not saved properly. Real “Controller unit tests” without any view or database interaction.

Remove ‘integrate\_views’ from the tests, then define general stubs (using Mocha). We no longer need valid\_attributes, since it is no longer important if something is valid

All invocations of calls to User will be mocked inside the testcase that uses it, e.g. index:

User.expects(**:find**).with(**:all**).returns([])

For each action we test the success and failure route to see if the controller reacted appropriately. We do not test if a record is valid or that the User.count was increased, since we now eliminate all database concerns.

it 'destroy should delete record and redirect to users' **do**

**@user**.expects(**:destroy**). once.returns(**true**)

delete **:destroy**, **:id** => users(**:one**).id

response.should redirect\_to(users\_path)

**end**

it 'create should build new User,then save and redirect to the new User' **do**

expect\_new

expect\_save **true**

#without this user\_path(@user) would return /users/

**@user**.stubs(**:new\_record?**).returns(**false**)

post **:create**, **:user** => {}

response.should redirect\_to(user\_path(**@user**))

**end**

it 'create should render new when failing to save' **do**

expect\_new

expect\_save **false**

post **:create**, **:user** => {}

response.should render\_template('new')

**end**

The helpers excpect\_new and excpect\_save are stores in spec/spec\_helper.rb:

**def** expect\_new

**@user** = User.new

User.expects(**:new**).returns(**@user**)

**end**

**def** expect\_save val

**@user**.excpects(**:save**).returns(val)

**end**

## Starting from scratch

Now we build a new feature truly test-first, as opposed to the last example were we only converted, translated and refactored existing code.

User story: When users behave badly, it should be possible to deactivate them and reactivate them if necessary. This implies:

* A new user is activated by default
* A user should be deactivateable
* A deactivated user should be activateable
* Index should only show activated users

### Integration test

From this requirement we build a new user story (integration test).

Scenario: deactivating a user

When i go to users

And i change the first user to activated = false

And i go to users

Then i do not see the first user

I did not use the whole form submission process, since it is already covered by our other stories, so we can proceed without having “to go to edit”, “change the form” and “submit the form”.

Write the missing steps in stories/steps/users.rb

When("i change the first user to $field = $value") **do** |field,value|

response.body.should have\_tag('#users tr a') **do** |links|

**next if** (links.to\_s !~ %r[/edit/(\d+)])

**@first\_user\_id** = $1

User.find(**@first\_user\_id**).update\_attribute(field, value)

**end**

**end**

Then("i do not see the first user") **do**

response.body.should\_not =~ %r[/edit/#{**@first\_user\_id**}[^\d]/]

**end**

Finally add 'activated' =>'1' to the valid attributes for the user form test, to make sure it has the corresponding field.

And see it fail 3 scenarios: 2 succeeded, 1 failed, 0 pending.

### Model tests

We build our model test cases:

it 'should be activated by default' **do**

User.new.should be\_activated

**end**

it 'should only find activated' **do**

create\_valid User, **:activated** => **false**

create\_valid User, **:activated** => **true**

User.activated.should\_not be\_empty

User.activated.reject(&**:activated?**).should be\_empty

**end**

See it fail: 8 examples, 2 failures, build the migration:

$ script/generate migration add\_activated\_to\_users

**class** AddActivatedToUsers < ActiveRecord::Migration

**def self**.up

#we have to add null=>false, or else it can be true,false and nil!

add\_column "users", "activated", **:boolean**, **:default** => **true, :null** => **false**

**end**

**def self**.down

remove\_column "users", "activated"

**end**

**end**

Migrate db:migrate && rake db:test:prepare and test again: 8 examples, 1 failure  
Alter the model (app/models/user.rb):

named\_scope **:activated**, **:conditions** => { **:activated** => **true** }

And test again: 8 examples, 0 failures

### Controller tests

Activated will only be another field in the user form, so create and save have it already covered, but we need to make sure that activated is used, so we change the controller test for index.

User.expects(**:activated**).returns([])

See it fail 9 examples, 1 failure and make it pass:

**def** index

**@users** = User.activated

Run the controller tests: 9 examples, 0 failures.

### View tests

There is no test for the \_form partial. All that I want to verify is that every model field has a corresponding form element and we already test this with our stories.

We still have to fix the app/users/\_form.html.erb by adding:

<label for="user\_activated">Activated</label>

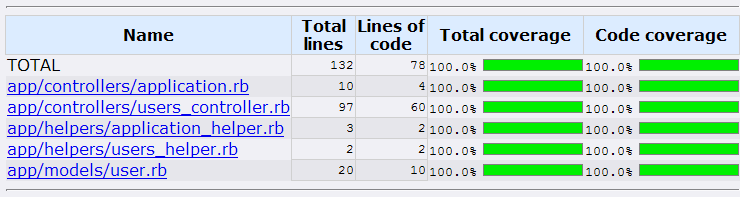
<%= f.check\_box 'activated' %> <br/>

### Integration Test Continued

Now we come to the final step and run our stories and see them pass   
3 scenarios: 3 succeeded, 0 failed, 0 pending.

### RCOV

After this we can run rake spec:rcov to see if we left anything out (modify spec/rcov.opts if there are to many unneeded files in the output).



## Conclusion

This sample section of a real application provides an overview of techniques and organization principles needed for testing. Extending it with new features or starting from scratch with a new application should be easy, once the initial blocker of “where to start” and the first setup problems are overcome. When only building more or less standard parts like the UsersController shown, repetition may occur, that can be dried up with customized helpers (e.g. assert\_behaves\_like\_index) or by using a library (e.g. make\_resourceful / resource\_controller), so that they only need testing when you leave the standard path.

# Conclusion

"There's an[..] quality about test-first design that gives you a sense of unhurriedness. You are actually moving very quickly, [..] because you are creating little micro-goals for yourself and satisfying them. At each point you know you are doing one micro-goal piece of work, and it's done when the test passes.[And] You just have to think about one little piece of responsibility. "

Testing is integrated into Rails and an essential part of its architecture. As soon as one gets started with a new application there are test directories and structures, just waiting to be filled, an invitation for every developer to start testing. Starting to test and using the included tools can be an enormous advance for developers that seldom tested before, but without a testing guideline and specialized tools these efforts can stay fruitless since they become dull and repetitive. The right methods and tools can keep the tests organized and dry, thus making the developer more productive.

With the Test-Driven approach code and coverage can be improved without requiring more time for tests than before, since theoretically the same amount of tests would be written, and leads to better tested, loosely coupled code that is easier to maintain. Most of the shown tools and techniques can be used without test driven development, but doing so would be a waste of potential. The goal of these techniques is to build automate tests from model through controller and views, up until the Javascript, so that the whole application logic is covered with tests and developers can work and refactor without having to open the browser and click through all scenarios.

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