Ruby on Rails Short Course Part 5: AJAX & Testing

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Outline of the day

1. Web apps, MVC, SQL, Hello World
2. Just enough Ruby
3. Basic Rails

Lunch break

4. Advanced model relations
5. AJAX & intro to testing
6. Configure & deploy

Informal discussion: RoR and pedagogy

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- AJAX 101
  - XHTML DOM, JavaScript, prototype, script.aculo.us
  - Javascript integration with Rails
- Testing Basics
  - test infrastructure built right in
  - unit, functional, integration tests; fixtures
- Potpourri of miscellaneous cool stuff

Web 1.0 ‖ Web 2.0

- Web 1.0 (“old world”) GUI: click ‖ page reload
- Web 2.0: click ‖ page updates in place
  - also timer-based interactions, drag-and-drop, animations, etc.

How is this done?

1. Document Object Model (c.1998, W3C) represents document as a hierarchy of elements
2. JavaScript (c.1995; now ECMAScript) makes DOM available programmatically
3. XMLHttpRequest (MSIE 5, c.2000; others, c.2002) allows async (callback semantics) HTTP transactions decoupled from page reload

- Practical implication: server workloads denser & relatively more write-intensive

JavaScript

- A browser-side scripting language that
  - is dynamic
  - is weakly-typed (implicit conversion)
  - is prototype-based (vs. class-based)
  - has first-class functions, closures, H.O. functions
  - is embedded in most browsers since c.1998
  - keeps many security researchers' jobs safe
- Browser exposes some of its behaviors & attributes to JavaScript environment
  - eg, *window, document* objects
  - eg, *XmlHttpRequest* browser method

The DOM & JavaScript

- A platform-independent (?) hierarchical object model representing HTML or XML doc
  - part of a *separate* standards effort; in practice, implementations vary
- Exposed to JavaScript interpreter
  - Inspect DOM element value/attribs
  - Change value/attribs ‖ redisplay

```
<input type="text" name="phone_number" id="phone_number"/>
<script type="text/javascript">
 var phone = document.getElementById('phone_number');
 phone.value='555-1212';
 phone.disabled=true;
 document.images[0].src="http://.../some_other_image.jpg";
</script>
```

JavaScript Libraries

- *prototype* provides functions and shortcuts for working with DOM & XmlHttpRequest

```
$("submit_btn").disabled = true;
var AjaxOpts = {
  method: "get",
  parameters: "id=3&user=" + $("usrname").value,
  onComplete: displayResponse };
var AjaxReq = new Ajax.Request (url,AjaxOpts);
function displayResponse() {...}
```

- *Handlers* allow associating JavaScript functions with events on DOM elements
  – e.g., `onClick, onMouseOver, onFocus`...

So: What's AJAX?

- **A**synchronous **J**avaScript **A**nd **X**ML
  - Early showcase app: Google Maps
- Recipe (to a zeroth order):
  - attach JavaScript function callbacks to various events on browser objects
  - in callback, inspect/modify DOM elements and optionally do an asynchronous HTTP req. to server
  - on server response, pass result to yet another JavaScript function that will monkey with DOM again
- Rails integrates seamless Ajax support
  - *Prototype* to deal with cross-browser issues, common Ajax functionality, etc.
  - Script.aculo.us, a JavaScript library of visual effects

A Rails View of AJAX

- What events should be listened for?
  - Individual DOM element value changes?
  - Anything on a form changes?
  - Timeout?
- How should event be handled?
  - What controller & method should be called?
  - What DOM element value(s) should be marshalled & passed to it?
- What to do with the result?
  - Update DOM element *in place* with returned content?
  - Callbacks? (waiting, receiving, complete, error...)

Listening For Events

- Not surprisingly, Rails lets you listen at the *element* or *form* level

```
observe_field('student[last_name]',
  :url => {:controller=>'students',
               :action=>'lookup_by_lastname'}, :
  update=>'lastname_completions')
```

- when `student[last_name]` field changes, call method `lookup_by_lastname` in *StudentController* with new field value
- returned text from controller method will *replace* the “inner contents” of element ID *lastname_completions*
  - typically using `render :partial` or `render :text`

Listening on a Whole Form

```
observe_form('student_form',
  :url => {:controller => 'students',
           :action => 'process_form'},
  :update => 'student_info_panel')
```

- When any element of *student_form* changes, call *process_form* method in *StudentsController,* marshalling all elements into `params[]`

Specifying Event Handlers

- Event handlers are just controller methods!
  - Rails wrappers around *prototype* library functions marshal arguments & do XHR call
- Controller method can use *render :partial* to produce a result
  - Typical example: table with collapsible entries
  - or *render :text* to send raw content back
- Method can tell how it was called by calling @*request.xhr?*

What to Do With Results

- Typically, results *replace* content of an HTML element
  - Remember you can “elementize” (almost) any arbitrary chunk using `<span>` or `<div>`
- Additional keyword-like arguments to `observe_field` and `observe_form` allow separate handling of other callback events
  - states: server contacted, waiting, receiving, done
  - different error codes for failures

Graceful Fallback to Web 1.0

- What if AJAX support not available in user’s browser?
- Specifying a fallback in the AJAX tags
  - `:html` => *options*
  - how does view know whether to use it or not?
- How does the controller know what to do?
  - request. xhr?

Dressing it up with effects

- Script.aculo.us also wrapped in Ruby as part of standard Rails distro
- Effect.new(...)

Cool GUI Tasks as AJAX

- “Auto-completion” of a text field?
- “Update now” button?
- Periodically polling for updates?
- Cross-field validation in a form?
- Repopulate popup menus constrained to choices in other menus?

Remote Javascript templates

- What if the thing you want to return is not actually content, but JS code?
- Place it in an *.rjs (remote JS)* template!

```
page['student_menu'].value =
  page['other_menu'].value
```

  - "Rendering" *rjs* template wraps your code in `try {... } catch {`*...show alert...*`}`, among other things

The dark side of AJAX, RJS, etc.

- *Lots* of layers of code; can be hard to debug
- Browsers tend to fail silently when they choke on JS-related errors
  - Can open JS console log, but who does that?
- *On the plus side...*
  - eminently more maintainable
  - probably more robust and browser-neutral

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Test Infrastructure Built Right In

- Separate database for testing
  - Testing tasks automatically create its schema at beginning of test run
  - Automatically cleaned out and populated with *fixtures* before each individual test suite is run
- Test “scaffolds” created as by-product of creating app
  - when generate scaffold
  - when generate migration
  - etc.

Test Fixtures

- Data preloaded into testing database

```
armando:
  id: 1
  last_name: Fox
  degree_expected: <%= Date.parse("June 15, 2007") %>
  ucb_id: 999988
```

  – &/or generate *dynamic fixtures* at test-run time

```
<% (1..100).each do |i| %>
student_<%= i %>:
  id:          <%= 1000+i %>
  last_name:   <%= "Dummy_#{i}" %>
<% end %>
```

A Simple Unit Test

- Note use of assertions throughout
- Only method names starting with test_ are run
- Run rake test:clone_structure to clone schema of development DB to test DB
- Run unit test(s) with rake test:units
  - rake test wraps all these tasks together
- Large library of assertions for checking tests

A Simple Functional Testcase

- Note examination of the flash to check that correct result was displayed to user

```
def test_000_failed_login
  post :login, :customer => {:login => customers(:tom).login,
    :password => 'BAD'}
  assert_nil session[:cid]
  assert_match /mistyped your password/i, flash[:notice]
  post :login, :customer => {:login => 'NOBODY', :password => 'BAD'}
  assert_match /can\'t find that email address/i, flash[:notice]
  assert_nil session[:cid]
  post :login, :customer => {}
  assert_match /please provide both/i, flash[:notice]
end
```

- Testing actions that fail & redirect

```
def test_003_non_admin_cant_view_cust_record
  simulate_login(customers(:tom))
  get :list
  assert_redirected_to :action => 'login'
end
```

Scanning the Output

- A more complicated example...
  - scan output for tags
  - submit XmlHttpRequests to trigger Ajax actions
  - use a helper function to “simulate” login (which is tested separately in another functional test)

Integration Testing

- Goal: navigate the site from a user's point of view
  - create a *session object* per dummy user
  - use same kinds of assertions but in the context of each user's session
  - can dynamically create many sessions (as with fixtures) to do directed random-interleaved testing

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Code Stats & Microbenchmarks

- *rake stats:* how much code did I write? ratio of lines of test code to lines of app code?
- *script/profiler:* method-level profiling tools
- *script/benchmarker:* sanity-check *μ*bench individual method calls
- (coming soon) `-rcoverage` option to Ruby when running tests
  - reports % coverage and which lines of code not covered by tests

Plug-Ins

- A separable extension to Rails framework
  - just copy a directory!
  - relies on Ruby classes being open, and on various mechanics of the mixin (Module) mechanism
- A plug-in...
  - defines additional classes and modules
  - provides one or more methods that result in the calling class “pulling in” plug-in
  - result: calling class(es) extended with plug-in methods

Example Plugins I Love

- Example 1: SslRequired

```
include SslRequirement
ssl_required :checkout, :place_order
ssl_allowed :index, :list_products
```

  – Inserts before-filters that check protocol of controller request, perform redirect if bad

- Example 2: ExceptionNotifiable

```
# in application.rb (toplevel controller)
include ExceptionNotification
# in environment.rb or environments/production.rb
config.after_initialize do
  ExceptionNotifier.exception_recipients =
  'fox@cs.berkeley.edu'
end
```

Other Cool Stuff (so you know what you don’t know)

- View caching
- In-memory distributed session storage
- Slipping in another database
- Action Mailer
- `script/runner` for (e.g.) `cron(8)` actions
- REST & RXML
- API’s to the rest of the world
  - Google Maps, Amazon, Facebook...
- ISP’s that provide a Rails “virtual machine”

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Yow! Questions?