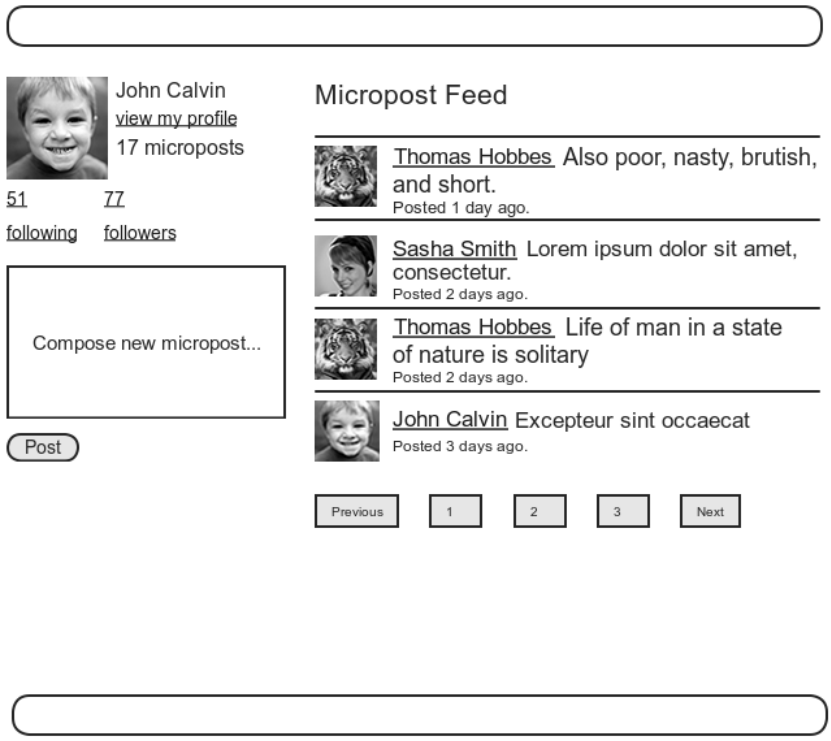

Figure 11.18 A mockup of a user's Home page with a status feed.

11.3.1 Motivation and Strategy

The basic idea behind the feed is simple. Figure 11.19 shows a sample **`microposts`** database table and the resulting feed. The purpose of a feed is to pull out the microposts whose user ids correspond to the users being followed by the current user (and the current user itself), as indicated by the arrows in the diagram.

Since we need a way to find all the microposts from users followed by a given user, we'll plan on implementing a method called **`from_users_followed_by`**, which we will use as follows:

```
Micropost.from_users_followed_by(user)
```

Although we don't yet know how to implement it, we can already write tests for for its functionality. The key is to check all three requirements for the feed: microposts for followed users and the user itself should be included in the feed, but a post from an

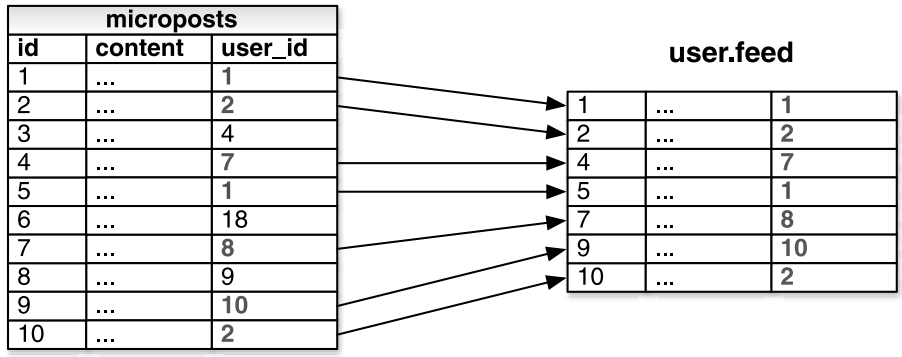

Figure 11.19 The feed for a user (id 1) following users 2, 7, 8, and 10.

unfollowed user should not be included. Two of these requirements already appear in our tests: Listing 10.38 verifies that a user's own microposts appear in the feed, while the micropost from an unfollowed user doesn't appear. Now that we know how to follow users, we can add a third type of test, this time checking that the microposts of a followed user appear in the feed, as shown in Listing 11.41.

Listing 11.41 The final tests for the status feed.
spec/models/user_spec.rb

```
require 'spec_helper'

describe User do
  .
  .
  .
  describe "micropost associations" do
    before { @user.save }
    let!(:older_micropost) do
      FactoryGirl.create(:micropost, user: @user, created_at: 1.day.ago)
    end
    let!(:newer_micropost) do
      FactoryGirl.create(:micropost, user: @user, created_at: 1.hour.ago)
    end
    .
    .
    .
    describe "status" do
      let(:unfollowed_post) do
        FactoryGirl.create(:micropost, user: FactoryGirl.create(:user))
      end
      let(:followed_user) { FactoryGirl.create(:user) }
```

```
      before do
        @user.follow!(followed_user)
        3.times { followed_user.microposts.create!(content: "Lorem ipsum") }
      end

      its(:feed) { should include(newer_micropost) }
      its(:feed) { should include(older_micropost) }
      its(:feed) { should_not include(unfollowed_post) }
      its(:feed) do
        followed_user.microposts.each do |micropost|
          should include(micropost)
        end
      end
    end
  end
end
```

Implementing the feed simply defers the hard work to **`Micropost.from_users_followed_by`**, as shown in Listing 11.42.

Listing 11.42 Adding the completed feed to the User model.
`app/models/user.rb`

```
class User < ActiveRecord::Base
  .
  .
  .
  def feed
    Micropost.from_users_followed_by(self)
  end
  .
  .
  .
end
```

11.3.2 A First Feed Implementation

Now it's time to implement **`Micropost.from_users_followed_by`**, which for simplicity we'll just refer to as "the feed." Since the final result is rather intricate, we'll build up to the final feed implementation by introducing one piece at a time.

The first step is to think of the kind of query we'll need. What we want to do is select from the **microposts** table all the microposts with ids corresponding to the users being followed by a given user (or the user itself). We might write this schematically as follows:

```
SELECT * FROM microposts
WHERE user_id IN (<list of ids>) OR user_id = <user id>
```

In writing this code, we've guessed that SQL supports an **IN** keyword that allows us to test for set inclusion. (Happily, it does.)

Recall from the proto-feed in Section 10.3.3 that Active Record uses the **where** method to accomplish the kind of select shown above, as illustrated in Listing 10.39. There, our select was very simple; we just picked out all the microposts with user id corresponding to the current user:

```
Micropost.where("user_id = ?", id)
```

Here, we expect it to be more complicated, something like

```
where("user_id in (?) OR user_id = ?", following_ids, user)
```

(Here we've used the Rails convention of **user** instead of **user.id** in the condition; Rails automatically uses the **id**. We've also omitted the leading **Micropost.** since we expect this method to live in the Micropost model itself.)

We see from these conditions that we'll need an array of ids corresponding to the users being followed. One way to do this is to use Ruby's **map** method, available on any "enumerable" object, i.e., any object (such as an Array or a Hash) that consists of a collection of elements.[11] We saw an example of this method in Section 4.3.2; it works like this:

```
$ rails console
>> [1, 2, 3, 4].map { |i| i.to_s }
=> ["1", "2", "3", "4"]
```

11. The main requirement is that enumerable objects must implement an **each** method to iterate through the collection.

Situations like the one illustrated above, where the same method (e.g., **to_s**) gets called on each element, are common enough that there's a shorthand notation using an *ampersand* **&** and a symbol corresponding to the method:[12]

```
>> [1, 2, 3, 4].map(&:to_s)
=> ["1", "2", "3", "4"]
```

Using the **join** method (Section 4.3.1), we can create a string composed of the ids by joining them on comma-space :

```
>> [1, 2, 3, 4].map(&:to_s).join(', ')
=> "1, 2, 3, 4"
```

We can use the above method to construct the necessary array of followed user ids by calling **id** on each element in **user.followed_users**. For example, for the first user in the database this array appears as follows:

```
>> User.first.followed_users.map(&:id)
=> [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23,
24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42,
43, 44, 45, 46, 47, 48, 49, 50, 51]
```

In fact, because this sort of construction is so useful, Active Record provides it by default:

```
>> User.first.followed_user_ids
=> [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23,
24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42,
43, 44, 45, 46, 47, 48, 49, 50, 51]
```

Here the **followed_user_ids** method is synthesized by Active Record based on the **has_many :followed_users** association (Listing 11.10); the result is that we need only append **_ids** to the association name to get the ids corresponding to the **user.followed_users** collection. A string of followed user ids then appears as follows:

```
>> User.first.followed_user_ids.join(', ')
=> "4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23,
24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42,
43, 44, 45, 46, 47, 48, 49, 50, 51"
```

12. This notation actually started as an extension Rails made to the core Ruby language; it was so useful that it has now been incorporated into Ruby itself. How cool is that?

When inserting into an SQL string, though, you don't need to do this; the `?` interpolation takes care of it for you (and in fact eliminates some database-dependent incompatibilities). This means we can use

```
user.followed_user_ids
```

by itself.

At this point, you might guess that code like

```
Micropost.from_users_followed_by(user)
```

will involve a class method in the **`Micropost`** class (a construction mentioned briefly in Section 4.4.1). A proposed implementation along these lines appears in Listing 11.43.

Listing 11.43 A first cut at the **`from_users_followed_by`** method.
`app/models/micropost.rb`

```
class Micropost < ActiveRecord::Base
  .
  .
  .
  def self.from_users_followed_by(user)
    followed_user_ids = user.followed_user_ids
    where("user_id IN (?) OR user_id = ?", followed_user_ids, user)
  end
end
```

Although the discussion leading up to Listing 11.43 was couched in hypothetical terms, it actually works! You can verify this yourself by running the test suite, which should pass:

```
$ bundle exec rspec spec/
```

In some applications, this initial implementation might be good enough for most practical purposes. But it's not the final implementation; see if you can make a guess about why not before moving on to the next section. (*Hint*: What if a user is following 5,000 other users?)

11.3.3 Subselects

As hinted at in the last section, the feed implementation in Section 11.3.2 doesn't scale well when the number of microposts in the feed is large, as would likely happen if a user

were following, say, 5000 other users. In this section, we'll reimplement the status feed in a way that scales better with the number of followed users.

The problem with the code in Section 11.3.2 is that

```
followed_user_ids = user.followed_user_ids
```

pulls *all* the followed users' ids into memory and creates an array the full length of the followed users array. Since the condition in Listing 11.43 actually just checks inclusion in a set, there must be a more efficient way to do this, and indeed SQL is optimized for just such set operations. The solution involves pushing the finding of followed user ids into the database using a *subselect*.

We'll start by refactoring the feed with the slightly modified code in Listing 11.44

Listing 11.44 Improving **`from_users_followed_by`**.
app/models/micropost.rb

```
class Micropost < ActiveRecord::Base
  .
  .
  .
  # Returns microposts from the users being followed by the given user.
  def self.from_users_followed_by(user)
    followed_user_ids = user.followed_user_ids
    where("user_id IN (:followed_user_ids) OR user_id = :user_id",
          followed_user_ids: followed_user_ids, user_id: user)
  end
end
```

As preparation for the next step, we have replaced

```
where("user_id IN (?) OR user_id = ?", followed_user_ids, user)
```

with the equivalent

```
where("user_id IN (:followed_user_ids) OR user_id = :user_id",
      followed_user_ids: followed_user_ids, user_id: user)
```

The question mark syntax is fine, but when we want the *same* variable inserted in more than one place the second syntax is more convenient.

The above discussion mentions that we will be adding a *second* occurrence of **user_id** in the SQL query. In particular, we can replace the Ruby code

```
followed_user_ids = user.followed_user_ids
```

with the SQL snippet

```
followed_user_ids = "SELECT followed_id FROM relationships
                     WHERE follower_id = :user_id"
```

This code contains a SQL *subselect*, and internally the entire select for user 1 would look something like this:

```
SELECT * FROM microposts
WHERE user_id IN (SELECT followed_id FROM relationships
                  WHERE follower_id = 1)
      OR user_id = 1
```

This subselect arranges for all the set logic to be pushed into the database, which is more efficient.[13]

With this foundation, we are ready for an efficient feed implementation, as seen in Listing 11.45. Note that, because it is now raw SQL, **followed_user_ids** is *interpolated*, not escaped. (It actually works either way, but logically it makes more sense to interpolate in this context.)

Listing 11.45 The final implementation of **from_users_followed_by**.
app/models/micropost.rb

```
class Micropost < ActiveRecord::Base
   attr_accessible :content
   belongs_to :user

   validates :user_id, presence: true
   validates :content, presence: true, length: { maximum: 140 }

  default_scope order: 'microposts.created_at DESC'
```

13. For a more advanced way to create the necessary subselect, see the blog post "Hacking a subselect in ActiveRecord."

```
  def self.from_users_followed_by(user)
    followed_user_ids = "SELECT followed_id FROM relationships
                         WHERE follower_id = :user_id"
    where("user_id IN (#{followed_user_ids}) OR user_id = :user_id",
          user_id: user.id)
  end
end
```

This code has a formidable combination of Rails, Ruby, and SQL, but it does the job, and does it well. (Of course, even the subselect won't scale forever. For bigger sites, you would probably need to generate the feed asynchronously using a background job. Such scaling subtleties are beyond the scope of this tutorial, but the Scaling Rails screencasts are a good place to start.)

11.3.4 The New Status Feed

With the code in Listing 11.45, our status feed is complete. As a reminder, the code for the Home page appears in Listing 11.46; this code creates a paginated feed of the relevant microposts for use in the view, as seen in Figure 11.20.[14] Note that the **paginate** method actually reaches all the way into the Micropost model method in Listing 11.45, arranging to pull out only 30 microposts at a time from the database. (You can verify this by examining the SQL statements in the development server log file.)

Listing 11.46 The **home** action with a paginated feed.
app/controllers/static_pages_controller.rb

```
class StaticPagesController < ApplicationController

  def home
    if signed_in?
      @micropost  = current_user.microposts.build
      @feed_items = current_user.feed.paginate(page: params[:page])
    end
  end
  .
  .
  .
end
```

14. In order to make a prettier feed for Figure 11.20, I've added a few extra microposts by hand using the Rails console.

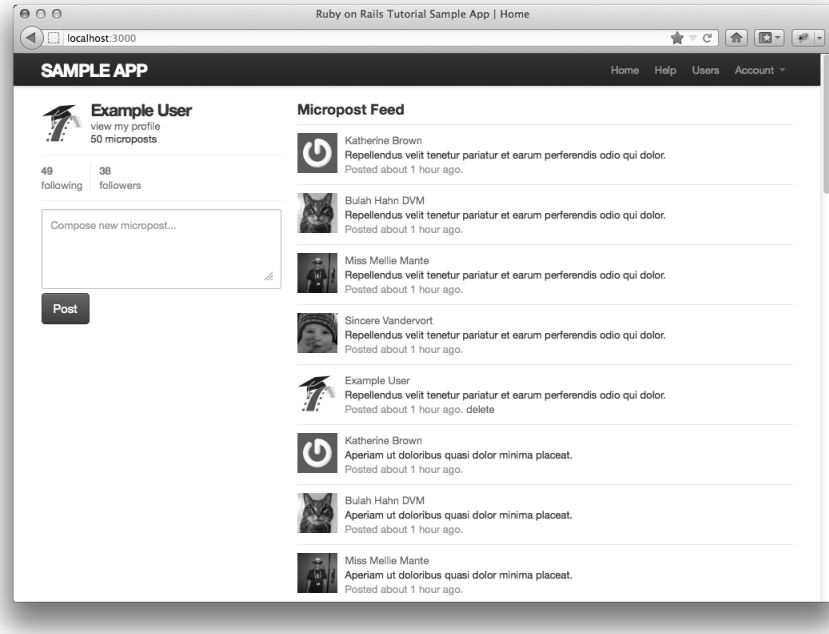

Figure 11.20 The Home page with a working status feed.

11.4 Conclusion

With the addition of the status feed, we've finished the core sample application for the *Rails Tutorial*. This application includes examples of all the major features of Rails, including models, views, controllers, templates, partials, filters, validations, callbacks, **`has_many`**/**`belongs_to`** and **`has_many through`** associations, security, testing, and deployment. Despite this impressive list, there is still much to learn about Rails. As a first step in this process, this section contains some suggested extensions to the core application, as well as suggestions for further learning.

Before moving on to tackle any of the application extensions, it's a good idea to merge in your changes:

```
$ git add .
$ git commit -m "Add user following"
$ git checkout master
$ git merge following-users
```

As usual, you can also push the code and deploy the application if you want:

```
$ git push
$ git push heroku
$ heroku pg:reset SHARED_DATABASE --confirm <name-heroku-gave-to-your-app>
$ heroku run rake db:migrate
$ heroku run rake db:populate
```

11.4.1 Extensions to the Sample Application

The proposed extensions in this section are mostly inspired either by general features common to web applications, such as password reminders and email confirmation, or features specific to our type of sample application, such as search, replies, and messaging. Implementing one or more of these application extensions will help you make the transition from following a tutorial to writing original applications of your own.

Don't be surprised if it's tough going at first; the blank slate of a new feature can be quite intimidating. To help get you started, I can give two pieces of general advice. First, before adding any feature to a Rails application, take a look at the RailsCasts archive to see if Ryan Bates has already covered the subject.[15] If he has, watching the relevant RailsCast first will often save you a ton of time. Second, always do extensive Google searches on your proposed feature to find relevant blog posts and tutorials. Web application development is hard, and it helps to learn from the experience (and mistakes) of others.

Many of the following features are quite challenging, and I have given some hints about the tools you might need to implement them. Even with hints, they are *much* more difficult than the book's end-of-chapter exercises, so don't be discouraged if you can't solve them without considerable effort. Due to time constraints, I am not available for one-on-one assistance, but if there is sufficient interest I might release standalone article/screencast bundles on some of these extensions in the future; go to the main Rails Tutorial website at http://railstutorial.org and subscribe to the news feed to get the latest updates.

15. Note that RailsCasts usually omit the tests, which is probably necessary to keep the episodes nice and short, but you could get the wrong idea about the importance of testing. Once you've watched the relevant RailsCast to get a basic idea of how to proceed, I suggest writing the new feature using test-driven development. (In this context, I recommend taking a look at the RailsCast on "How I test." You'll see that Ryan Bates himself often uses TDD for real-life development, and in fact his testing style is similar to style used in this tutorial.)

Replies

Twitter allows users to make "@replies", which are microposts whose first characters are the user's login preceded by the `@` sign. These posts only appear in the feed of the user in question or users following that user. Implement a simplified version of this, restricting @replies to appear only in the feeds of the recipient and the sender. This might involve adding an **`in_reply_to`** column in the **`microposts`** table and an extra **`including_replies`** scope to the Micropost model.

Since our application lacks unique user logins, you will also have to decide on a way to represent users. One option is to use a combination of the id and the name, such as **`@1-michael-hartl`**. Another is to *add* a unique username to the signup process and then use it in @replies.

Messaging

Twitter supports direct (private) messaging by prefixing a micropost with the letter "d." Implement this feature for the sample application. The solution will probably involve a Message model and a regular expression match on new microposts.

Follower Notifications

Implement a feature to send each user an email notification when they gain a new follower. Then make the notification optional, so that users can opt out if desired. Among other things, adding this feature requires learning how to send mail with Rails. To get started, I suggest viewing the RailsCast on Action Mailer in Rails 3.

Password Reminders

Currently, if our application's users forget their passwords, they have no way to retrieve them. Because of the one-way secure password hashing in Chapter 6, our application can't email the user's password, but it can send a link to a reset form. Follow the steps in the RailsCast on Remember Me & Reset Password to fix this omission.

Signup Confirmation

Apart from an email regular expression, the sample application currently has no way to verify the validity of a user's email address. Add an email address verification step to confirm a user's signup. The new feature should create users in an inactive state, email the user an activation URI, then change the user to an active state when the URI gets hit. You might want to read up on state machines in Rails to help you with the inactive/active transition.

RSS Feed

For each user, implement an RSS feed for their microposts. Then implement an RSS feed for each status feed, optionally restricting access to that feed using an authentication scheme. The RailsCast on generating RSS feeds will help get you started.

REST API

Many websites expose an Application Programmer Interface (API) so that third-party applications can get, post, put, and delete the application's resources. Implement such a REST API for the sample application. The solution will involve adding `respond_to` blocks (Section 11.2.5) to many of the application's controller actions; these should respond to requests for XML. Be careful about security; the API should only be accessible to authorized users.

Search

Currently, there is no way for users to find each other, apart from paging through the user index or viewing the feeds of other users. Implement a search feature to remedy this. Then add another search feature for microposts. The RailsCast on simple search forms will help get you started. If you deploy using a shared host or a dedicated server, I suggest using Thinking Sphinx (following the RailsCast on Thinking Sphinx). If you deploy on Heroku, you should follow the Heroku full text search instructions.

11.4.2 Guide to Further Resources

There are a wealth of Rails resources in stores and on the web—indeed, the supply is so rich that it can be overwhelming. The good news is that, having gotten this far, you're ready for almost anything else out there. Here are some suggestions for further learning:

- The *Rails Tutorial* screencasts: I have prepared a full-length screencast course based on this book. In addition to covering all the material in the book, the screencasts are filled with tips, tricks, and the kind of see-how-it's-done demos that are hard to capture in print. They are available for purchase through the *Rails Tutorial* website. (*Note*: The screencasts for the second edition are currently in preparation. They will be a paid upgrade, but current customers will receive a substantial discount.)

- RailsCasts: It's hard to overemphasize what a great resource the RailsCasts are. I suggest starting by visiting the RailsCasts episode archive and clicking on subjects that catch your eye.
- Scaling Rails: One topic we've hardly covered in the *Rails Tutorial* book is performance, optimization, and scaling. Luckily, most sites will never run into serious scaling issues, and using anything beyond plain Rails is probably premature optimization. If you do run into performance issues, the Scaling Rails series from Gregg Pollack of Envy Labs is a good place to start. I also recommend investigating the site monitoring applications Scout and New Relic.[16] And, as you might suspect by now, there are RailsCasts on many scaling subjects, including profiling, caching, and background jobs.
- Ruby and Rails books: As mentioned in Chapter 1, I recommend *Beginning Ruby* by Peter Cooper, *The Well-Grounded Rubyist* by David A. Black, and *The Ruby Way* by Hal Fulton for further Ruby learning, and *The Rails 3 Way* by Obie Fernandez and *Rails 3 in Action* (wait for the second edition) by Ryan Bigg and Yehuda Katz for more about Rails.
- PeepCode and Code School: The screencasts at PeepCode and interactive courses at Code School are consistently high-quality, and I warmly recommend them.

11.5 Exercises

1. Add tests for destroying relationships associated with a given user (i.e., as implemented by `dependent :destroy` in Listing 11.4 and Listing 11.16). *Hint*: Follow the example in Listing 10.15.
2. The `respond_to` method seen in Listing 11.38 can actually be hoisted out of the actions into the Relationships controller itself, and the `respond_to` blocks can be replaced with a Rails method called `respond_with`. Prove that the resulting code, shown in Listing 11.47, is correct by verifying that the test suite still passes. (For details on this method, do a Google search on "rails respond_with".)
3. Refactor Listing 11.31 by adding partials for the code common to the following/followers pages, the Home page, and the user show page.
4. Following the model in Listing 11.19, write tests for the stats on the profile page.

16. In addition to being a clever phrase—*new relic* being a contradiction in terms—New Relic is also an anagram for the name of the company's founder, Lew Cirne.

Listing 11.47 A compact refactoring of Listing 11.38.

```
class RelationshipsController < ApplicationController
  before_filter :signed_in_user

  respond_to :html, :js

  def create
    @user = User.find(params[:relationship][:followed_id])
    current_user.follow!(@user)
    respond_with @user
  end

  def destroy
    @user = Relationship.find(params[:id]).followed
    current_user.unfollow!(@user)
    respond_with @user
  end
end
```

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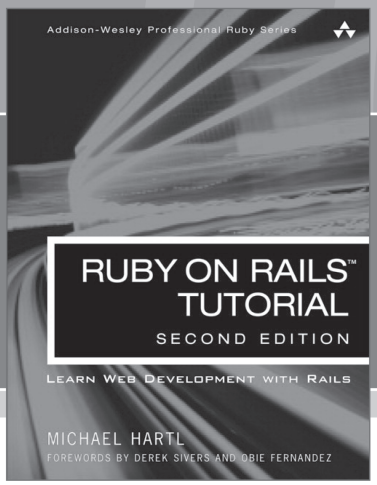

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