Addison-Wesley Professional Ruby Series

RUBY ON RAILS™ TUTORIAL

SEVENTH EDITION

Learn Web Development with Rails

MICHAEL HARTL

Foreword by DEREK SIVERS

Praise for Michael Hartl's Books and Videos on Ruby on Rails

"My former company (CD Baby) was one of the first to loudly switch to Ruby on Rails, and then even more loudly switch back to PHP. (Google me to read about the drama.) This book by Michael Hartl came so highly recommended that I had to try it, and the *Ruby on Rails*™ *Tutorial* is what I used to switch back to Rails again."

—From the Foreword by Derek Sivers (sivers.org)
Formerly: founder of CD Baby
Currently: founder of Thoughts Ltd.

"I started working on a project but didn't quite understand some rails concepts. Needed a good tutorial and found lots of recommendations for @mhartl's rails tutorial . . . and man it's so good. The hype def matches the product."

—Pratik Tamang, https://twitter.com/codingkrazy

"The rails tutorial by @mhartl is the best web dev resource ever written."

—Daniel Gamboa, Product Manager, Figment

"My first programming book was the *Ruby on Rails Tutorial* from @mhartl. The best part was it taught me general skills to be an effective developer."

—Jack Gray, staknine.com

"Michael Hartl's Rails Tutorial book is the #1 (and only, in my opinion) place to start when it comes to books about learning Rails. . . . It's an amazing piece of work and, unusually, walks you through building a Rails app from start to finish with testing. If you want to read just one book and feel like a Rails master by the end of it, pick the *Ruby on Rails*™ *Tutorial*."

—Peter Cooper, editor, Ruby Inside

"Michael Hartl's *Ruby on Rails*™ *Tutorial* seamlessly taught me about not only Ruby on Rails, but also the underlying Ruby language, HTML, CSS, a bit of JavaScript, and even some SQL—but most importantly it showed me how to build a web application (Twitter) in a short amount of time."

—Mattan Griffel, cofounder & CEO of One Month

"Although I'm a Python/Django developer by trade, I can't stress enough how much this book has helped me. As an undergraduate, completely detached from industry, this book showed me how to use version control, how to write tests, and, most importantly—despite the steep learning curve for setting up and getting stuff running—how the end result of perseverance is extremely gratifying. It made me fall in love with technology all over again. This is the book I direct all my friends to who want to start learning programming/building stuff. Thank you, Michael!"
—Prakhar Srivastav, software engineer, Xcite.com, Kuwait

"It has to be the best-written book of its type I've ever seen, and I can't recommend it enough."
—Daniel Hollands, administrator of Birmingham.IO

"For those wanting to learn Ruby on Rails, Hartl's *Ruby on Rails*™ *Tutorial* is (in my opinion) the best way to do it."
—David Young, software developer and author at deepinthecode.com

"This is a great tutorial for a lot of reasons, because aside from just teaching Rails, Hartl is also teaching good development practices."
—Michael Denomy, full-stack web developer

"Without a doubt, the best way I learned Ruby on Rails was by building an actual working app. I used Michael Hartl's *Ruby on Rails*™ *Tutorial*, which showed me how to get a very basic Twitter-like app up and running from scratch. I cannot recommend this tutorial enough; getting something up and going fast was key; it beats memorization by a mile."
—James Fend, serial entrepreneur, JamesFend.com

"The book gives you the theory and practice, while the videos focus on showing you in person how it's done. Highly recommended combo."
—Antonio Cangiano, software engineer, IBM

"The author is clearly an expert at the Ruby language and the Rails framework, but more than that, he is a working software engineer who introduces best practices throughout the text."
—Gregory Charles, principal software developer at Fairway Technologies

RUBY ON RAILS™ TUTORIAL

Seventh Edition

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Ruby on Rails™ Tutorial

Learn Web Development with Rails

Seventh Edition

Michael Hartl

Addison-Wesley

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Foreword

My former company (CD Baby) was one of the first to loudly switch to Ruby on Rails, and then even more loudly switch back to PHP (Google me to read about the drama). This book by Michael Hartl came so highly recommended that I had to try it, and the *Ruby on Rails Tutorial* is what I used to switch back to Rails again.

Though I've worked my way through many Rails books, this is the one that finally made me "get" it. Everything is done very much "the Rails way"—a way that felt very unnatural to me before, but now after doing this book finally feels natural. This is also the only Rails book that does test-driven development the entire time, an approach highly recommended by the experts but which has never been so clearly demonstrated before. Finally, by including Git, GitHub, and Heroku in the demo examples, the author really gives you a feel for what it's like to do a real-world project. The tutorial's code examples are not in isolation.

The linear narrative is such a great format. Personally, I powered through the Rails Tutorial in three long days doing all the examples and challenges at the end of each chapter. [This is not typical! Most readers take much longer to finish the tutorial. —Michael] Do it from start to finish, without jumping around, and you'll get the ultimate benefit.

Enjoy!

—Derek Sivers (sivers.org)
Founder, CD Baby

Preface

Since its initial publication in 2010, the *Ruby on Rails™ Tutorial* has been one of the leading introductions to web development. In this best-selling tutorial, you'll learn how to develop and deploy real, industrial-strength web applications with Ruby on Rails, the open-source web framework that powers top websites such as Hulu, GitHub, Shopify, and Airbnb. Newly updated for Rails 7, the *Ruby on Rails Tutorial* covers both specific aspects of Rails and general principles of web development, so what you learn here can be applied to a wide variety of different situations.

In the *Ruby on Rails Tutorial*, you'll learn by doing through three applications of increasing sophistication. The first application follows a long-standing tradition in programming by developing (and deploying!) a simple app that displays the phrase "hello, world!" The second, a simplified "toy app", develops an application consisting of users and posts, including a database to store user information.

Finally, the full sample app develops a professional-grade web application, including systems for user registration, login and authentication, account activation and password resets, and a follow/unfollow social layer inspired by Twitter. In the course of developing the main sample app, the *Ruby on Rails Tutorial* does everything "for real", with good software-development practices throughout. This includes version control, testing and test-driven development, and deployment to production.

In addition to teaching you specific skills, the *Ruby on Rails Tutorial* also helps you develop *technical sophistication*—the seemingly magical ability to solve practically any technical problem. Technical sophistication includes concrete skills like version control and coding, as well as fuzzier skills like Googling the error message and knowing when to just reboot the darn thing. Throughout the *Ruby on Rails Tutorial*, we'll have abundant opportunities to develop technical sophistication in the context of real-world examples.

Chapter by Chapter

Chapter 1 begins with a self-contained introduction to the basics of Ruby on Rails web development, including setting up a development environment, using Git and GitHub, and deploying to Heroku. The result is a simple but real "hello, world" application deployed to the live Web.

Chapter 2 uses a technique called "scaffolding" to make a rudimentary database-backed web application consisting of users and short ("micro") posts. Although simple, the resulting "toy app" covers several key aspects of modern web development, including using databases to persist user data and following the model-view-controller (MVC) pattern to separate components of the application for maintainability and convenience.

Chapter 3 through Chapter 14 develop the tutorial's full, professional-grade sample application. In Chapter 3, we'll learn how to use Rails to create both static HTML pages and pages with a small amount of dynamic content. Along the way, we'll get our first taste of automated testing, including an introduction to refactoring (changing the code's form without changing its function).

Chapter 4 explores some elements of the Ruby programming language that are important for Rails, whether or not you have prior experience in the language. Topics include data structures, functions, blocks, and classes.

Chapter 5 starts filling in the layout defined in Chapter 3, including an introduction to Cascading Style Sheets (CSS) in Rails. Along the way, we'll learn about partials, Rails routes, and the asset pipeline, including an introduction to Syntactically Awesome Style Sheets (Sass). Finally, this chapter adds an *integration test* to check that the links on the final layout are correct.

In Chapter 6, we'll take the first step toward letting users sign up by creating a *data model* for users of our site, together with a way to store that data. The resulting users have names, email addresses, and secure passwords, as well as validations and tests for all of those attributes.

Chapter 7 uses an HTML *form* to submit user signup information to our application, which will then be used to create a new user and save its attributes to the database.

At the end of the signup process, it's important to render a profile page with the newly created user's information, so we'll begin by making a page for *showing users*, which will serve as the first step toward a full user profile page. Along the way, we'll build on the work in previous chapters to write succinct and expressive integration tests.

In Chapter 8, we'll implement a basic but still fully functional login system that maintains the logged-in state until the browser is closed by the user. The resulting authentication system will allow us to customize the site and implement an authorization model based on login status and identity of the current user.

In Chapter 9, we'll build on the basic login system developed in Chapter 8 to add "remember me" functionality to our site. This involves using *permanent cookies*, first to automatically remember users when they log in, and then to *optionally* remember users with a "remember me" checkbox.

Chapter 10 starts by giving users the ability to update their profiles, which will also provide a natural opportunity to enforce an authorization model. Then we'll make a listing of all users using sample data and pagination. Finally, we'll add the ability to destroy users, wiping them clear from the database. Since we can't allow just any user to have such dangerous powers, we'll take care to create a privileged class of administrative users authorized to delete other users.

Chapter 11 adds an account-activation step to verify that the user controls the email address they used to sign up. This will involve associating an activation token and digest with a user, sending the user an email with a link including the token, and activating the user upon clicking the link. In the process, we'll also have a chance to learn how to send email in Rails, both in development and in production.

Chapter 12 implements a password-reset option to handle the case of users forgetting their passwords. In addition to following similar steps to those covered in Chapter 11, implementing this feature will also require a web interface for sending the password-reset email and actually resetting the password.

Chapter 13 adds small posts, or "microposts", to the sample application. The result is a full-strength version of the sketch from Chapter 2: a Micropost data model, associations with the User model, and the pages needed to manipulate and display the results. This includes the ability to include images in microposts, thereby constituting an introduction to image uploading and storage on Amazon S3.

In Chapter 14, we'll complete the *Ruby on Rails Tutorial* sample application by adding a social layer that allows users to follow and unfollow other users, resulting in each user's Home page displaying a status feed of the followed users' microposts. Topics include modeling relationships between users, building the corresponding web interface (with an introduction to responsive web applications using *Hotwire*), and making a status feed. To help with the transition from tutorial to independent development, we'll end with some pointers to more advanced resources.

Additional Features

The *Ruby on Rails Tutorial* includes a large number of exercises to help you test your understanding and to extend the material in the main text. The exercises include frequent hints and often include the expected answers, with exercise solutions available by separate subscription at www.railstutorial.org.

Final Thoughts

The *Ruby on Rails Tutorial* gives you a thorough and practical introduction to modern web development with Ruby on Rails. After learning the techniques covered in this tutorial, and especially after developing your technical sophistication, you'll know everything you need to develop custom database-backed web applications and deploy them to the live Web. You'll also be ready for a huge variety of other resources, including books, blogs, and online documentation. The resulting skillset will put you in a great position to get a job as a web developer, start a career as a freelancer, or even found a company of your own.

Learn Enough Scholarships

The *Ruby on Rails Tutorial* is part of Learn Enough, which is committed to making a technical education available to as wide a variety of people as possible. As part of this commitment, in 2016 Learn Enough created the *Learn Enough Scholarship program*.[1] Scholarship recipients get free or deeply discounted access to the Learn Enough All Access subscription, which includes online book content, embedded videos, exercises, and community exercise answers for all of the Learn Enough courses (including the full *Ruby on Rails Tutorial*).

As noted in a 2019 RailsConf Lightning Talk,[2] the Learn Enough Scholarship application process is incredibly simple: Just fill out a confidential text area telling us a little about your situation. The scholarship criteria are generous and flexible—we understand that there are an enormous number of reasons for wanting a scholarship,

1. https://www.learnenough.com/scholarship
2. https://www.learnenough.com/scholarship-talk

from being a student, to being between jobs, to living in a country with an unfavorable exchange rate against the U.S. dollar. Chances are that if you feel like you've got a good reason, we'll think so, too.

So far, Learn Enough has awarded more than 2,500 scholarships to aspiring developers around the country and around the world. To apply, visit the Learn Enough Scholarship page at www.learnenough.com/scholarship. Maybe the next scholarship recipient could be you!

Acknowledgments

The *Ruby on Rails™ Tutorial* owes a lot to my previous Rails book, *RailsSpace*, and hence to my coauthor Aurelius Prochazka. I'd like to thank Aure both for the work he did on that book and for his support of this one. I'd also like to thank Debra Williams Cauley, my editor on both *RailsSpace* and the *Ruby on Rails Tutorial*.

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I'd like to thank technical reviewer Andrew Thai for his careful reading of the original manuscript and for his helpful suggestions. I'd also like to thank my cofounders at Learn Enough (https://www.learnenough.com/), Nick Merwin and Lee Donahoe, for all their help in preparing this tutorial.

Finally, many, many readers—far too many to list—have contributed a huge number of bug reports and suggestions during the writing of this book, and I gratefully acknowledge their help in making it as good as it can be.

About the Author

Michael Hartl (https://www.michaelhartl.com/) is the creator of the *Ruby on Rails Tutorial* (https://www.railstutorial.org/), one of the leading introductions to web development, and is cofounder and principal author at Learn Enough (https://www.learnenough.com/). Previously, he was a physics instructor at the California Institute of Technology (Caltech), where he received a Lifetime Achievement Award for Excellence in Teaching. He is a graduate of Harvard College, has a Ph.D. in Physics from Caltech, and is an alumnus of the Y Combinator entrepreneur program.

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Chapter 7
Sign Up

Now that we have a working User model, it's time to add an ability few websites can live without: letting users sign up. We'll use an HTML *form* to submit user signup information to our application (Section 7.2), which will then be used to create a new user and save its attributes to the database (Section 7.4). At the end of the signup process, it's important to render a profile page with the newly created user's information, so we'll begin by making a page for *showing* users, which will serve as the first step toward implementing the REST architecture for users (Section 2.2.2). Along the way, we'll build on our work in Section 5.3.4 to write succinct and expressive integration tests.

In this chapter, we'll rely on the User model validations from Chapter 6 to increase the odds of new users having valid email addresses. In Chapter 11, we'll make *sure* of email validity by adding a separate *account activation* step to user signup.

Although this tutorial is designed to be as simple as possible while still being professional-grade, web development is a complicated subject, and Chapter 7 necessarily marks a significant increase in the difficulty of the exposition. I recommend taking your time with the material and reviewing it as necessary. (Some readers have reported simply doing the chapter twice is a helpful exercise.) You might also consider subscribing to the courses at Learn Enough (https://www.learnenough.com/) to gain additional assistance, both with this tutorial and with related Learn Enough titles (especially *Learn Enough Ruby to Be Dangerous* (https://www.learnenough.com/ruby)).

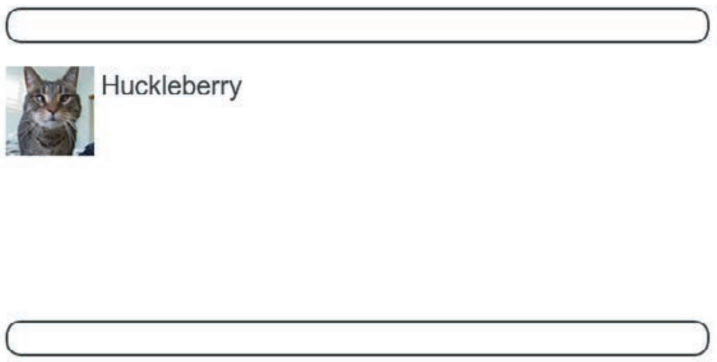


Figure 7.1: A mockup of the user profile made in this section.

7.1 Showing Users

In this section, we'll take the first steps toward the final profile by making a page to display a user's name and profile photo, as indicated by the mockup in Figure 7.1.[1] Our eventual goal for the user profile pages is to show the user's profile image, basic user data, and a list of microposts, as mocked up in Figure 7.2.[2] (Figure 7.2 includes an example of *lorem ipsum* text, which has a fascinating story that you should definitely read about some time.) We'll complete this task, and with it the sample application, in Chapter 14.

If you're following along with version control, make a topic branch as usual:

```
$ git checkout -b sign-up
```

7.1.1 Debug and Rails Environments

The profiles in this section will be the first truly dynamic pages in our application. Although the view will exist as a single page of code, each profile will be customized

1. Mockingbird doesn't support custom images like the profile photo in Figure 7.1; I put that in by hand using GIMP.

2. Hippo image courtesy of Eric Isselee/123RF.

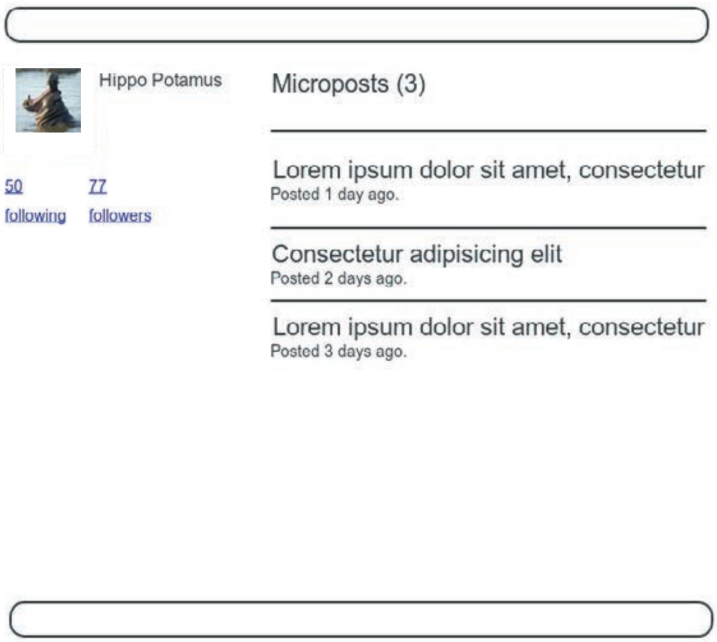

Hippo Potamus
Microposts (3)
Lorem ipsum dolor sit amet, consectetur
Posted 1 day ago.
Consectetur adipisicing elit
Posted 2 days ago.
Lorem ipsum dolor sit amet, consectetur
Posted 3 days ago.
50
following
77
followers

Figure 7.2: A mockup of our best guess at the final profile page.

using information retrieved from the application's database. As preparation for adding dynamic pages to our sample application, now is a good time to add some debug information to our site layout (Listing 7.1). This displays some useful information about each page using the built-in **`debug`** method and **`params`** variable (which we'll learn more about in Section 7.1.2).

Listing 7.1: Adding some debug information to the site layout.
`app/views/layouts/application.html.erb`

```
<!DOCTYPE html>
<html>
  .
  .
  .
  <body>
    <%= render 'layouts/header' %>
    <div class="container">
```

```
      <%= yield %>
      <%= render 'layouts/footer' %>
      <%= debug(params) if Rails.env.development? %>
    </div>
  </body>
</html>
```

Since we don't want to display debug information to users of a deployed application, Listing 7.1 uses

```
if Rails.env.development?
```

to restrict the debug information to the *development environment*, which is one of three environments defined by default in Rails (Box 7.1).[3] In particular, **`Rails.env.development?`** is **`true`** only in a development environment, so the embedded Ruby

```
<%= debug(params) if Rails.env.development? %>
```

won't be inserted into production applications or tests. (Inserting the debug information into tests probably wouldn't do any harm, but it probably wouldn't do any good, either, so it's best to restrict the debug display to development only.)

Box 7.1: Rails environments

Rails comes equipped with three environments: `test`, `development`, and `production`. The default environment for the Rails console is `development`:

```
$ rails console
Loading development environment
>> Rails.env
=> "development"
>> Rails.env.development?
=> true
>> Rails.env.test?
=> false
```

3. You can define your own custom environments as well; see the RailsCast on adding an environment (http://railscasts.com/episodes/72-adding-an-environment) for details.

As you can see, Rails provides a `Rails` object with an `env` attribute and associated environment boolean methods, so that, for example, `Rails.env.test?` returns `true` in a test environment and `false` otherwise.

If you ever need to run a console in a different environment (to debug a test, for example), you can pass the environment as an option to the `console` script:

```
$ rails console --environment test
Loading test environment
>> Rails.env
=> "test"
>> Rails.env.test?
=> true
```

As with the console, `development` is the default environment for the Rails server, but you can also run it in a different environment:

```
$ rails server --environment production
```

If you view your app running in production, it won't work without a production database, which we can create by running `rails db:migrate` in production:

```
$ rails db:migrate RAILS_ENV=production
```

By the way, if you have deployed your sample app to Heroku, you can see its environment using `heroku run rails console`:

```
$ heroku run rails console
>> Rails.env
=> "production"
>> Rails.env.production?
=> true
```

Naturally, since Heroku is a platform for production sites, it runs each application in a production environment.

To make the debug output look nicer, we'll add some rules to the custom stylesheet created in Chapter 5, as shown in Listing 7.2.[4]

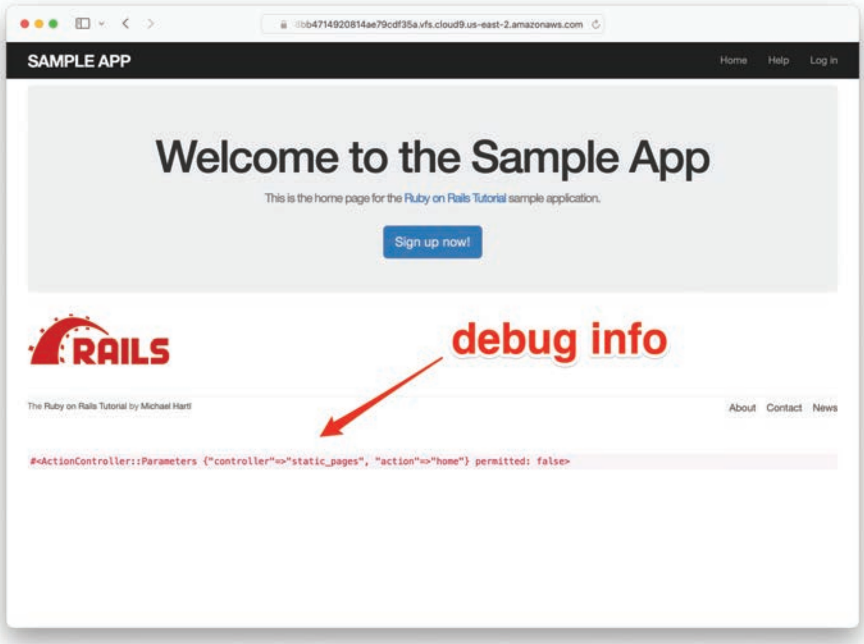
4. The exact appearance of the Rails debug information is slightly version-dependent. For example, as of Rails 5 the debug information shows the **`permitted`** status of the information, a subject we'll cover in Section 7.3.2. Use your technical sophistication (Box 1.2) to resolve such minor discrepancies.

Listing 7.2: Adding code for a prettier debug box.
app/assets/stylesheets/custom.scss

```
@import "bootstrap-sprockets";
@import "bootstrap";
.
.
.
/* miscellaneous */

.debug_dump {
  clear: both;
  float: left;
  width: 100%;
  margin-top: 45px;
}
```

The result is shown in Figure 7.3.

The debug output in Figure 7.3 gives potentially useful information about the page being rendered:


bb4714920814ae79cdf35a.vfs.cloud9.us-east-2.amazonaws.com
SAMPLE APP
Home
Help
Log in
Welcome to the Sample App
This is the home page for the Ruby on Rails Tutorial sample application.
Sign up now!
RAILS
debug info
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

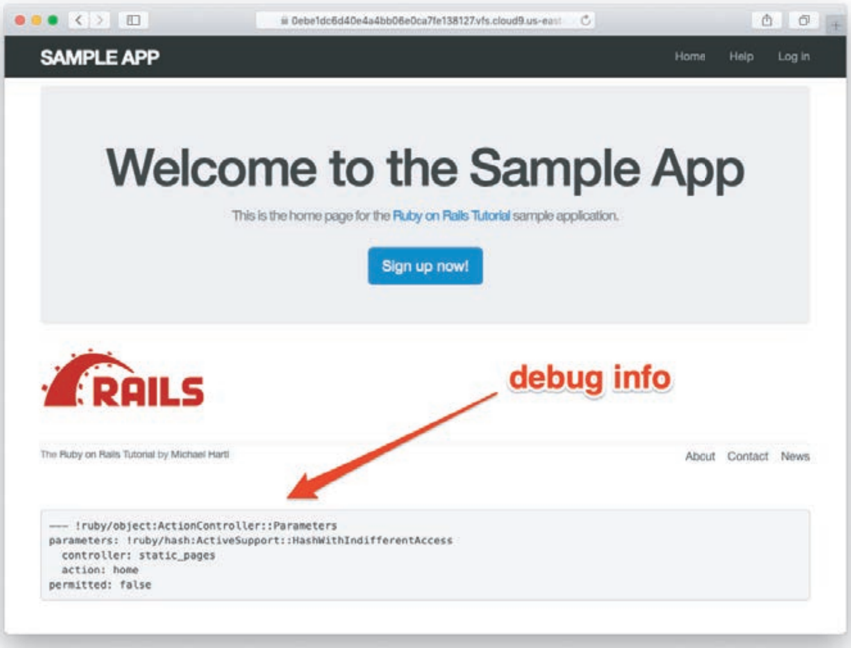
```
#<ActionController::Parameters {"controller"=>"static_pages", "action"=>"home"} permitted: false>
```

Figure 7.3: The sample application Home page with debug information.

```
#<ActionController::Parameters {"controller"=>"static_pages", "action"=>"home"}
permitted: false>
```

This is a literal representation of **`params`**, which is basically a hash, and in this case identifies the controller and action for the page. We'll see another example in Section 7.1.2.

The specific representation of the debug information is exactly the kind of thing that might depend on the exact version of Rails, and in fact prior to Rails 7 **`debug(params)`** was displayed in the so-called YAML format.[5] Because Rails has generally been stable at the level of this tutorial for many years now, some of the screenshots still show this earlier representation (Figure 7.4). Being able to handle such minor discrepancies is a hallmark of technical sophistication (Box 1.2).


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east
SAMPLE APP
Home
Help
Log in
Welcome to the Sample App
This is the home page for the Ruby on Rails Tutorial sample application.
Sign up now!
RAILS
debug info
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: static_pages
  action: home
permitted: false
```

Figure 7.4: The debug information in an earlier version of Rails.

5. YAML is a friendly data format designed to be both machine- *and* human-readable. (Its name is a recursive acronym standing for "YAML Ain't Markup Language".)

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course (https://www.railstutorial.org/) or to the Learn Enough All Access Subscription (https://www.learnenough.com/all-access).

1. Visit /about in your browser and use the debug information to determine the controller and action of the **`params`** hash.
2. In the Rails console, pull the first user out of the database and assign it to the variable **`user`**. What is the output of **`puts user.attributes.to_yaml`**? Compare this to using the **`y`** method via **`y user.attributes`**.

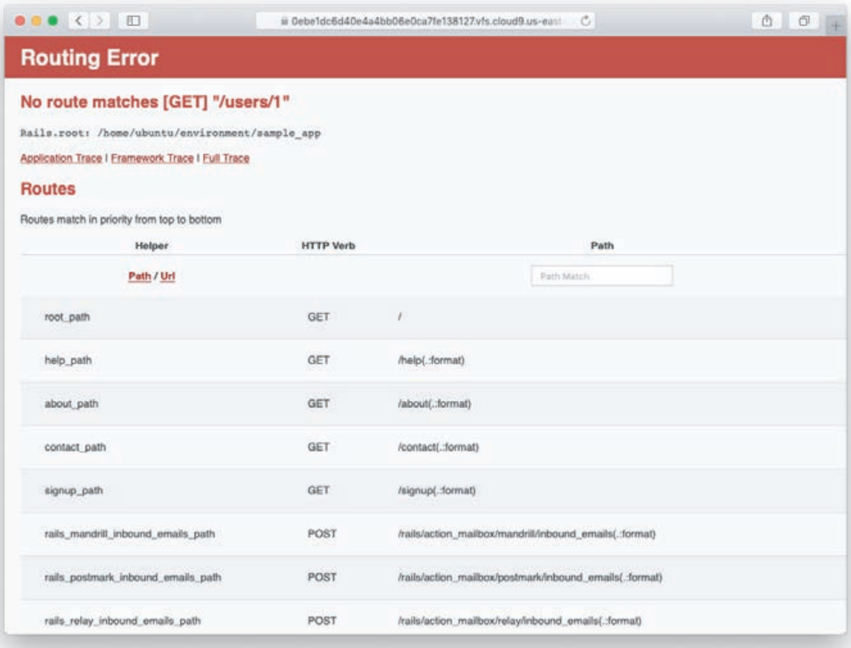
7.1.2 A Users Resource

In order to make a user profile page, we need to have a user in the database, which introduces a chicken-and-egg problem: How can the site have a user before there is a working signup page? Happily, this problem has already been solved—in Section 6.3.4, we created a User record by hand using the Rails console, so there should be one user in the database:

```
$ rails console
>> User.count
=> 1
>> User.first
=> #<User id: 1, name: "Michael Hartl", email: "mhartl@example.com",
created_at: "2022-03-11 03:15:38", updated_at: "2022-03-11 03:15:38",
password_digest: [FILTERED]>
```

(If you don't currently have a user in your database, you should visit Section 6.3.4 now and complete it before proceeding.) We see from the console output above that the user has id **`1`**, and our goal now is to make a page to display this user's information. We'll follow the conventions of the REST architecture favored in Rails applications (Box 2.2), which means representing data as *resources* that can be created, shown, updated, or destroyed—four actions corresponding to the four fundamental operations `POST`, `GET`, `PATCH`, and `DELETE` defined by the HTTP standard (Box 3.2).

When following REST principles, resources are typically referenced using the resource name and a unique identifier. What this means in the context of users—which we're now thinking of as a Users *resource*—is that we should view the user with


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east

Routing Error

No route matches [GET] "/users/1"

```
Rails.root: /home/ubuntu/environment/sample_app
```

Application Trace | Framework Trace | Full Trace

Routes

Routes match in priority from top to bottom

Helper	HTTP Verb	Path
Path / Url		Path Match
root_path	GET	/
help_path	GET	/help(.:format)
about_path	GET	/about(.:format)
contact_path	GET	/contact(.:format)
signup_path	GET	/signup(.:format)
rails_mandrill_inbound_emails_path	POST	/rails/action_mailbox/mandrill/inbound_emails(.:format)
rails_postmark_inbound_emails_path	POST	/rails/action_mailbox/postmark/inbound_emails(.:format)
rails_relay_inbound_emails_path	POST	/rails/action_mailbox/relay/inbound_emails(.:format)

Figure 7.5: The current state of /users/1.

id **1** by issuing a GET request to the URL /users/1. Here the **show** action is *implicit* in the type of request—when Rails' REST features are activated, GET requests are automatically handled by the **show** action.

We saw in Section 2.2.1 that the page for a user with id **1** has URL /users/1. Unfortunately, visiting that URL right now just gives an error (Figure 7.5).

We can get the routing for /users/1 to work by adding a single line to our routes file (**config/routes.rb**):

```
resources :users
```

The result appears in Listing 7.3.

Table 7.1: RESTful routes provided by the Users resource in Listing 7.3.

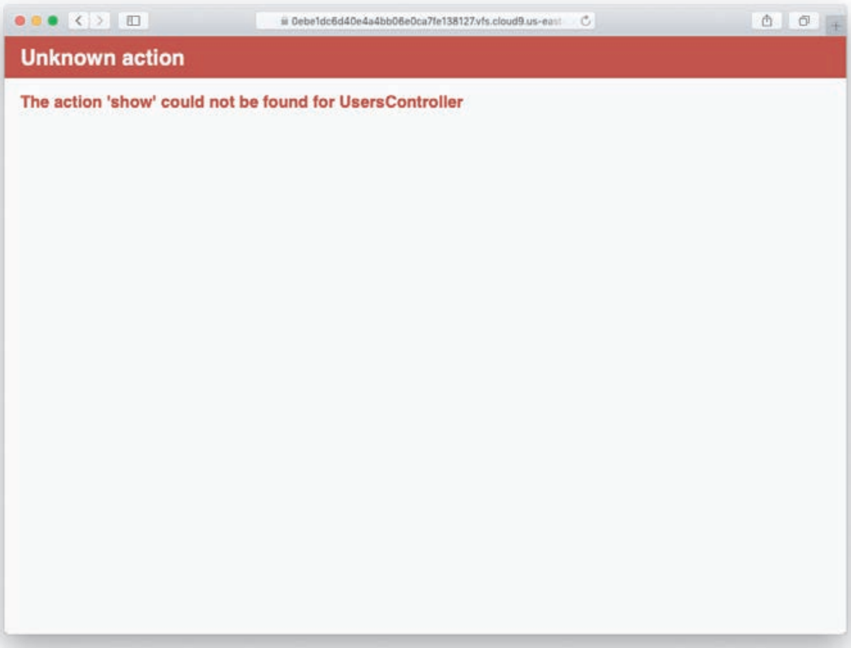
HTTP request method	URL	Action	Named route	Purpose
`GET`	/users	**`index`**	**`users_path`**	page to list all users
`GET`	/users/1	**`show`**	**`user_path(user)`**	page to show user
`GET`	/users/new	**`new`**	**`new_user_path`**	page to make a new user (signup)
`POST`	/users	**`create`**	**`users_path`**	create a new user
`GET`	/users/1/edit	**`edit`**	**`edit_user_path(user)`**	page to edit user with id **`1`**
`PATCH`	/users/1	**`update`**	**`user_path(user)`**	update user
`DELETE`	/users/1	**`destroy`**	**`user_path(user)`**	delete user

Listing 7.3: Adding a Users resource to the routes file.
`config/routes.rb`

```
Rails.application.routes.draw do
  root "static_pages#home"
  get  "/help",    to: "static_pages#help"
  get  "/about",   to: "static_pages#about"
  get  "/contact", to: "static_pages#contact"
  get  "/signup",  to: "users#new"
  resources :users
end
```

Although our immediate motivation is making a page to show users, the single line **`resources :users`** doesn't just add a working /users/1 URL; it endows our sample application with *all* the actions needed for a RESTful Users resource,[6] along with a large number of named routes (Section 5.3.3) for generating user URLs. The resulting correspondence of URLs, actions, and named routes is shown in Table 7.1. (Compare to Table 2.2.) Over the course of the next three chapters, we'll cover all of the other entries in Table 7.1 as we fill in all the actions necessary to make Users a fully RESTful resource.

6. This means that the *routing* works, but the corresponding pages don't necessarily work at this point. For example, /users/1/edit gets routed properly to the **`edit`** action of the Users controller, but since the **`edit`** action doesn't exist yet actually hitting that URL will return an error.


Unknown action

The action 'show' could not be found for UsersController

Figure 7.6: The URL /users/1 with routing but no page.

With the code in Listing 7.3, the routing works, but there's still no page there (Figure 7.6). To fix this, we'll begin with a minimalist version of the profile page, which we'll flesh out in Section 7.1.4.

We'll use the standard Rails location for showing a user, which is **`app/views/-users/show.html.erb`**. Unlike the **`new.html.erb`** view, which we created with the generator in Listing 5.38, the **`show.html.erb`** file doesn't currently exist, so you'll have to create it by hand,[7] and then fill it with the content shown in Listing 7.4.

7. Using, e.g., **`touch app/views/users/show.html.erb`**.

Listing 7.4: A stub view for showing user information.
app/views/users/show.html.erb

```
<%= @user.name %>, <%= @user.email %>
```

This view uses embedded Ruby to display the user's name and email address, assuming the existence of an instance variable called **`@user`**. Of course, eventually the real user show page will look very different (and won't display the email address publicly).

In order to get the user show view to work, we need to define an **`@user`** variable in the corresponding **`show`** action in the Users controller. As you might expect, we use the **`find`** method on the User model (Section 6.1.4) to retrieve the user from the database, as shown in Listing 7.5.

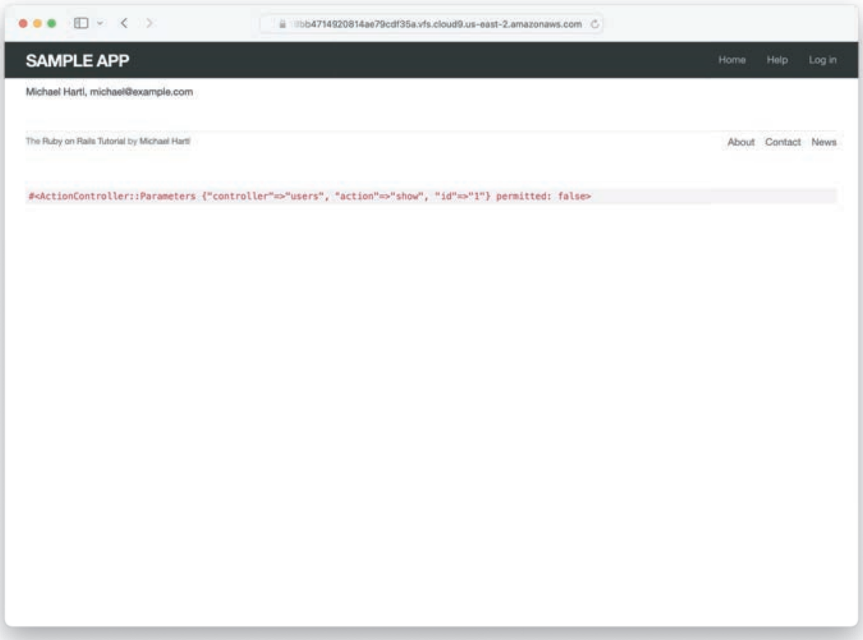
Listing 7.5: The Users controller with a **`show`** action.
app/controllers/users_controller.rb

```
class UsersController < ApplicationController

  def show
    @user = User.find(params[:id])
  end

  def new
  end
end
```

Here we've used **`params`** to retrieve the user id. When we make the appropriate request to the Users controller, **`params[:id]`** will be the user id `1`, so the effect is the same as the **`find`** method **`User.find(1)`** we saw in Section 6.1.4. (Technically, **`params[:id]`** is the string **`"1"`**, but **`find`** is smart enough to convert this to an integer.)

With the user view and action defined, the URL /users/1 works perfectly, as seen in Figure 7.7. (If you haven't restarted the Rails server since adding bcrypt, you may have to do so at this time. This sort of thing is a good application of technical sophistication (Box 1.2).) Note that the debug information in Figure 7.7 confirms the value of **`params[:id]`**:

```
{"controller"=>"users", "action"=>"show", "id"=>"1"}
```



Michael Hartl, michael@example.com

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```
#<ActionController::Parameters {"controller"=>"users", "action"=>"show", "id"=>"1"} permitted: false>
```

Figure 7.7: The user show page after adding a Users resource.

This is why the code

```
User.find(params[:id])
```

in Listing 7.5 finds the user with id `1`.

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. Using embedded Ruby, add the **`created_at`** and **`updated_at`** "magic column" attributes to the user show page from Listing 7.4.
2. Using embedded Ruby, add **`Time.now`** to the user show page. What happens when you refresh the browser?

7.1.3 Debugger

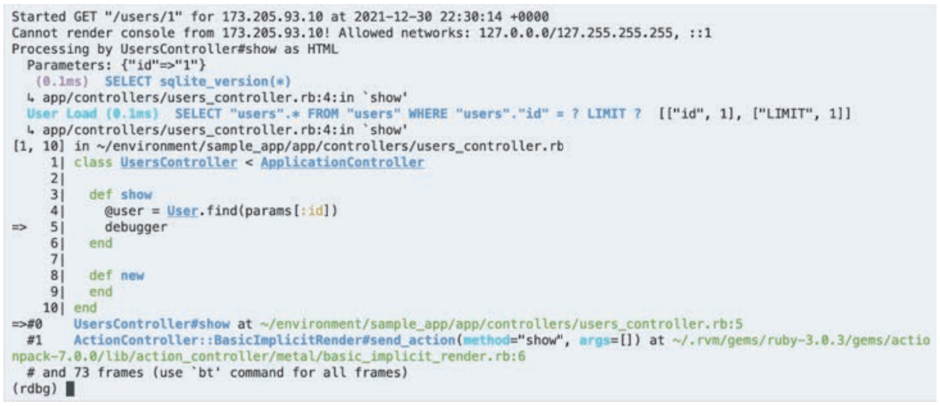
We saw in Section 7.1.2 how the information from the **debug** method could help us understand what's going on in our application, but there's also a more direct way to get debugging information. To see how it works, we just need to add a line consisting of **debugger** to our application, as shown in Listing 7.6.

Listing 7.6: The Users controller with a debugger.
app/controllers/users_controller.rb

```ruby
class UsersController < ApplicationController

  def show
    @user = User.find(params[:id])
    debugger
  end

  def new
  end
end
```

Now, when we visit /users/1, the Rails server shows an **rdbg** (Ruby debugger) prompt (Figure 7.8):

```
(rdbg)
```



```
Started GET "/users/1" for 173.205.93.10 at 2021-12-30 22:30:14 +0000
Cannot render console from 173.205.93.10! Allowed networks: 127.0.0.0/127.255.255.255, ::1
Processing by UsersController#show as HTML
  Parameters: {"id"=>"1"}
   (0.1ms)  SELECT sqlite_version(*)
  ↳ app/controllers/users_controller.rb:4:in `show'
  User Load (0.1ms)  SELECT "users".* FROM "users" WHERE "users"."id" = ? LIMIT ?  [["id", 1], ["LIMIT", 1]]
  ↳ app/controllers/users_controller.rb:4:in `show'
[1, 10] in ~/environment/sample_app/app/controllers/users_controller.rb
     1| class UsersController < ApplicationController
     2|
     3|   def show
     4|     @user = User.find(params[:id])
=>   5|     debugger
     6|   end
     7|
     8|   def new
     9|   end
    10| end
=>#0    UsersController#show at ~/environment/sample_app/app/controllers/users_controller.rb:5
  #1    ActionController::BasicImplicitRender#send_action(method="show", args=[]) at ~/.rvm/gems/ruby-3.0.3/gems/actio
npack-7.0.0/lib/action_controller/metal/basic_implicit_render.rb:6
  # and 73 frames (use `bt' command for all frames)
(rdbg) █
```

Figure 7.8: The debugger prompt in the Rails server.

We can treat the debugger like a Rails console, issuing commands to figure out the state of the application:

```
(rdbg) @user.name
"Michael Hartl"
(rdbg) @user.email
"michael@example.com"
(rdbg) params[:id]
"1"
```

To release the prompt and continue execution of the application, press Ctrl-D, then remove the **debugger** line from the **show** action (Listing 7.7).

Listing 7.7: The Users controller with the debugger line removed.
app/controllers/users_controller.rb

```
class UsersController < ApplicationController

  def show
    @user = User.find(params[:id])
  end

  def new
  end
end
```

Whenever you're confused about something in a Rails application, it's a good practice to put **debugger** close to the code you think might be causing the trouble. Inspecting the state of the system using `byebug` is a powerful method for tracking down application errors and interactively debugging your application.

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. With the **debugger** in the **show** action as in Listing 7.6, hit /users/1. Use **puts** to display the value of the YAML form of the **params** hash. *Hint*: Refer to the relevant exercise in Section 7.1.1. How does it compare to the debug information shown by the **debug** method in the site template?

2. Put the **`debugger`** in the User **`new`** action and hit /users/new. What is the value of **`@user`**?

7.1.4 A Gravatar Image and a Sidebar

Having defined a basic user page in the previous section, we'll now flesh it out a little with a profile image for each user and the first cut of the user sidebar. We'll start by adding a "globally recognized avatar", or Gravatar, to the user profile.[8] Gravatar is a free service that allows users to upload images and associate them with email addresses they control. As a result, Gravatars are a convenient way to include user profile images without going through the trouble of managing image upload, cropping, and storage; all we need to do is construct the proper Gravatar image URL using the user's email address and the corresponding Gravatar image will automatically appear. (We'll learn how to handle custom image upload in Section 13.4.)

Our plan is to define a **`gravatar_for`** helper function to return a Gravatar image for a given user, as shown in Listing 7.8.

Listing 7.8: The user show view with name and Gravatar.
`app/views/users/show.html.erb`

```
<% provide(:title, @user.name) %>
<h1>
  <%= gravatar_for @user %>
  <%= @user.name %>
</h1>
```

By default, methods defined in any helper file are automatically available in any view, but for convenience we'll put the **`gravatar_for`** method in the file for helpers associated with the Users controller. As noted in the Gravatar documentation, Gravatar URLs are based on an MD5 hash of the user's email address. In Ruby, the MD5 hashing algorithm is implemented using the **`hexdigest`** method, which is part of the **`Digest`** library:

8. In Hinduism, an avatar is the manifestation of a deity in human or animal form. By extension, the term *avatar* is commonly used to mean some kind of personal representation, especially in a virtual environment. (In the context of Twitter and other social media, the term *avi* (usually pronounced "ay-vee-eye") has gained currency, which is likely a mutated form of *avatar*.)

```
>> email = "MHARTL@example.COM"
>> Digest::MD5::hexdigest(email.downcase)
=> "1fda4469bcbec3badf5418269ffc5968"
```

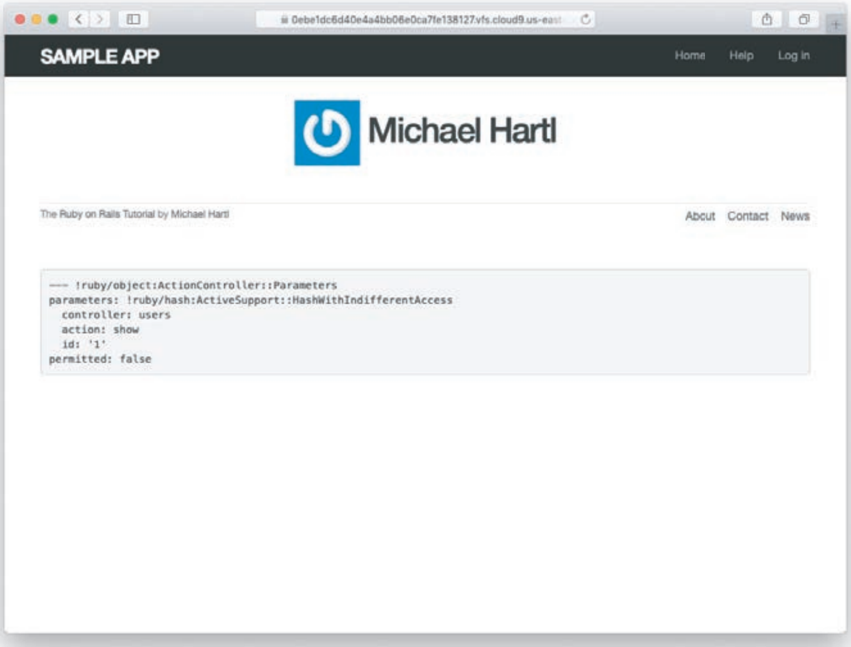
Since email addresses are case-insensitive (Section 6.2.4) but MD5 hashes are not, we've used the **`downcase`** method to ensure that the argument to **`hexdigest`** is all lowercase. (Because of the email downcasing callback in Listing 6.32, this will never make a difference in this tutorial, but it's a good practice in case the **`gravatar_for`** method ever gets used on email addresses from other sources.) The resulting **`gravatar_for`** helper appears in Listing 7.9.

Listing 7.9: Defining a **`gravatar_for`** helper method.
`app/helpers/users_helper.rb`

```ruby
module UsersHelper

  # Returns the Gravatar for the given user.
  def gravatar_for(user)
    gravatar_id  = Digest::MD5::hexdigest(user.email.downcase)
    gravatar_url = "https://secure.gravatar.com/avatar/#{gravatar_id}"
    image_tag(gravatar_url, alt: user.name, class: "gravatar")
  end
end
```

The code in Listing 7.9 returns an image tag for the Gravatar with a **`gravatar`** CSS class and alt text equal to the user's name (which is especially convenient for visually impaired users using a screen reader).

The resulting profile page should appear as in Figure 7.9. The displayed Gravatar image is a generic default because **`michael@example.com`** isn't a real email address and hence can't be associated with a custom Gravatar. (In fact, as you can see by visiting it, the example.com domain is reserved for examples just like this one.) By the way, if you completed the exercises in Section 5.1.2, be sure to remove the CSS from Listing 5.11 so that the gravatar image displays correctly.


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east
SAMPLE APP
Home
Help
Log in
Michael Hartl
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

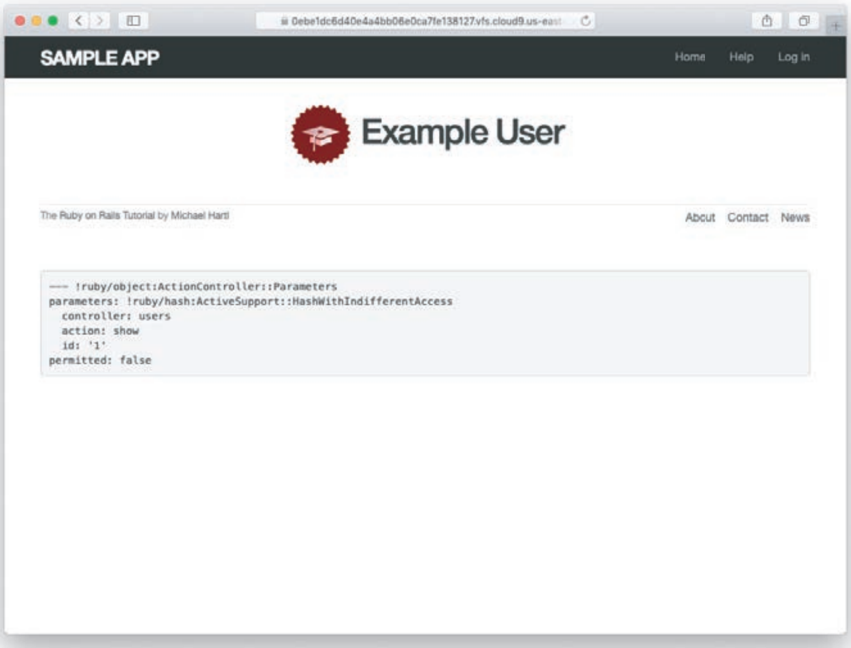
```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: show
  id: '1'
permitted: false
```

Figure 7.9: The user profile page with the default Gravatar.

To get our application to display a custom Gravatar, we'll use the **`update`** method (Section 6.1.5) to change the user's email to something I control:[9]

```
$ rails console
>> user = User.first
>> user.update(name: "Example User",
?>             email: "example@railstutorial.org",
?>             password:              "foobar",
?>             password_confirmation: "foobar")
=> true
```

9. The password confirmation isn't technically necessary here because **`has_secure_password`** (Section 6.3.1) actually allows the confirmation to be **`nil`**. The reason is so that apps that don't need password confirmation can simply omit the confirmation field. We do want a confirmation, though, so we'll include such a field in Listing 7.15.


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east
SAMPLE APP
Home
Help
Log in
Example User
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: show
  id: '1'
permitted: false
```

Figure 7.10: The user show page with a custom Gravatar.

Here we've assigned the user the email address `example@railstutorial.org`, which I've associated with the Rails Tutorial logo, as seen in Figure 7.10.

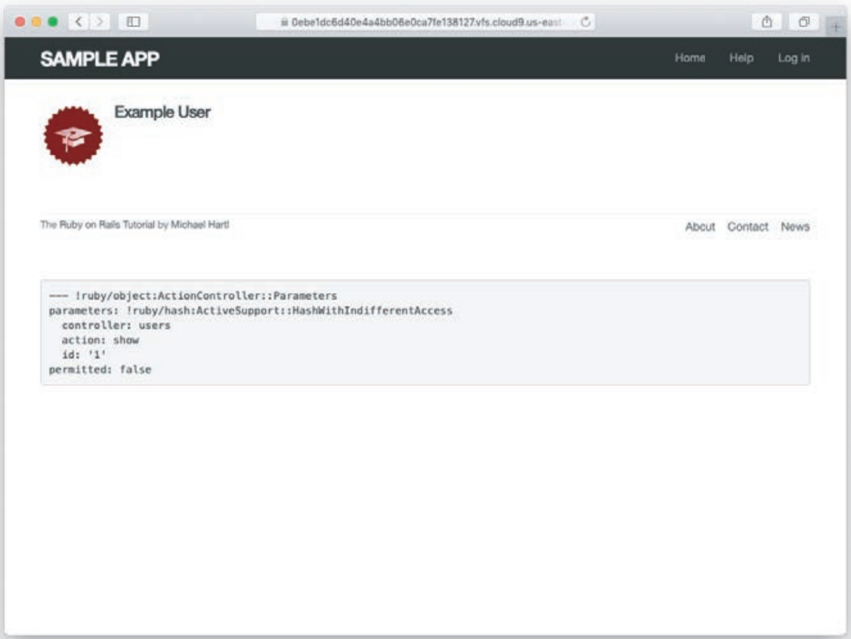
The last element needed to complete the mockup from Figure 7.1 is the initial version of the user sidebar. We'll implement it using the `aside` tag, which is used for content (such as sidebars) that complements the rest of the page but can also stand alone. We include `row` and `col-md-4` classes, which are both part of Bootstrap. The code for the modified user show page appears in Listing 7.10.

Listing 7.10: Adding a sidebar to the user `show` view.
app/views/users/show.html.erb

```
<% provide(:title, @user.name) %>
<div class="row">
  <aside class="col-md-4">
```

```
    <section class="user_info">
      <h1>
        <%= gravatar_for @user %>
        <%= @user.name %>
      </h1>
    </section>
  </aside>
</div>
```

With the HTML elements and CSS classes in place, we can style the profile page (including the sidebar and the Gravatar) with the SCSS shown in Listing 7.11.[10] (Note the nesting of the table CSS rules, which works only because of the Sass engine used by the asset pipeline.) The resulting page is shown in Figure 7.11.


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east
SAMPLE APP
Home
Help
Log in
Example User
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: show
  id: '1'
permitted: false
```

Figure 7.11: The user show page with a sidebar and CSS.

10. Listing 7.11 includes the `.gravatar_edit` class, which we'll put to work in Chapter 10.

Listing 7.11: SCSS for styling the user show page, including the sidebar.
app/assets/stylesheets/custom.scss

```
.
.
.
/* sidebar */

aside {
  section.user_info {
    margin-top: 20px;
  }
  section {
    padding: 10px 0;
    margin-top: 20px;
    &:first-child {
      border: 0;
      padding-top: 0;
    }
    span {
      display: block;
      margin-bottom: 3px;
      line-height: 1;
    }
    h1 {
      font-size: 1.4em;
      text-align: left;
      letter-spacing: -1px;
      margin-bottom: 3px;
      margin-top: 0px;
    }
  }
}

.gravatar {
  float: left;
  margin-right: 10px;
}

.gravatar_edit {
  margin-top: 15px;
}
```

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. Associate a Gravatar with your primary email address if you haven't already. What is the MD5 hash associated with the image?
2. Verify that the code in Listing 7.12 allows the **`gravatar_for`** helper defined in Section 7.1.4 to take an optional **`size`** parameter, allowing code like **`gravatar_for user, size: 50`** in the view. (We'll put this improved helper to use in Section 10.3.1.)
3. The options hash used in the previous exercise is still commonly used, but as of Ruby 2.0 we can use *keyword arguments* instead. Confirm that the code in Listing 7.13 can be used in place of Listing 7.12. What are the diffs between the two?

Listing 7.12: Adding an options hash in the **`gravatar_for`** helper.
`app/helpers/users_helper.rb`

```
module UsersHelper

  # Returns the Gravatar for the given user.
  def gravatar_for(user, options = { size: 80 })
    size         = options[:size]
    gravatar_id  = Digest::MD5::hexdigest(user.email.downcase)
    gravatar_url = "https://secure.gravatar.com/avatar/#{gravatar_id}?s=#{size}"
    image_tag(gravatar_url, alt: user.name, class: "gravatar")
  end
end
```

Listing 7.13: Using keyword arguments in the **`gravatar_for`** helper.
`app/helpers/users_helper.rb`

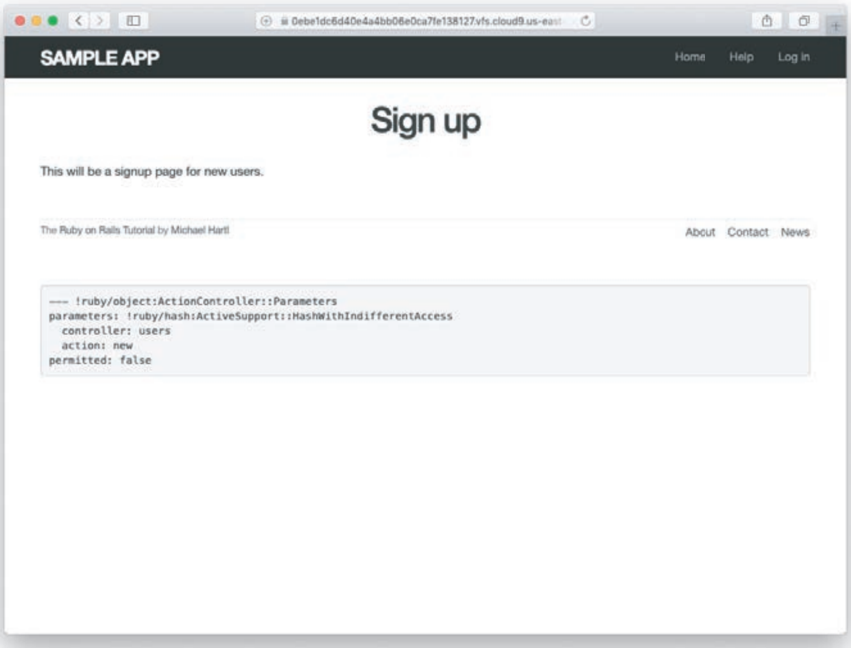
```
module UsersHelper

  # Returns the Gravatar for the given user.
  def gravatar_for(user, size: 80)
    gravatar_id  = Digest::MD5::hexdigest(user.email.downcase)
    gravatar_url = "https://secure.gravatar.com/avatar/#{gravatar_id}?s=#{size}"
    image_tag(gravatar_url, alt: user.name, class: "gravatar")
  end
end
```

7.2 Signup Form

Now that we have a working (though not yet complete) user profile page, we're ready to make a signup form for our site. We saw in Figure 5.11 (shown again in Figure 7.12) that the signup page is currently blank: useless for signing up new users. The goal of this section is to start changing this sad state of affairs by producing the signup form mocked up in Figure 7.13.

7.2.1 Using `form_with`

The heart of the signup page is a *form* for submitting the relevant signup information (name, email, password, confirmation). We can accomplish this in Rails with the



Sign up

This will be a signup page for new users.

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```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: new
permitted: false
```

Figure 7.12: The current state of the signup page /signup.

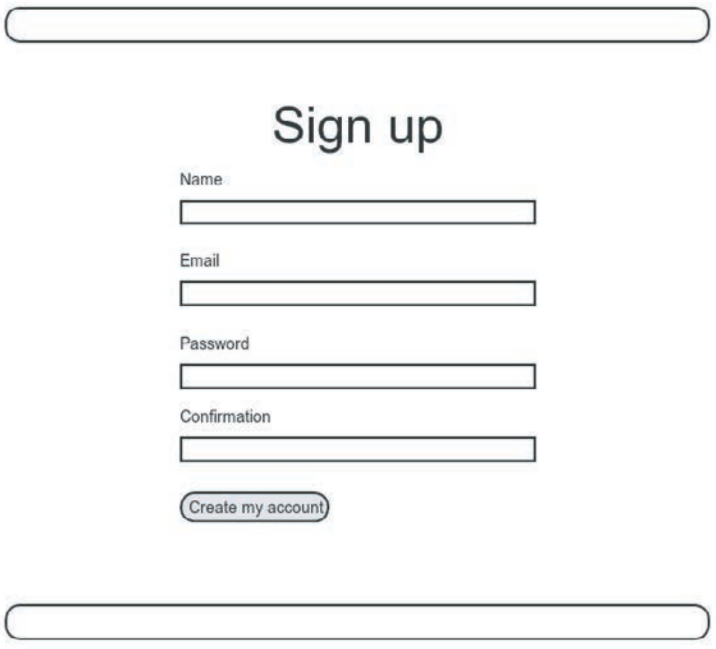


Figure 7.13: A mockup of the user signup page.

`form_with` helper method, which uses an Active Record object to build a form using the object's attributes.

Recalling that the signup page /signup is routed to the `new` action in the Users controller (Listing 5.43), our first step is to create the User object required as an argument to `form_with`. The resulting `@user` variable definition appears in Listing 7.14.

Listing 7.14: Adding an `@user` variable to the `new` action.
app/controllers/users_controller.rb

```
class UsersController < ApplicationController

  def show
    @user = User.find(params[:id])
  end
  def new
    @user = User.new
  end
end
```

The form itself appears as in Listing 7.15. We'll discuss it in detail in Section 7.2.2, but first let's style it a little.

Listing 7.15: A form to sign up new users.
app/views/users/new.html.erb

```
<% provide(:title, 'Sign up') %>
<h1>Sign up</h1>

<div class="row">
  <div class="col-md-6 col-md-offset-3">
    <%= form_with(model: @user) do |f| %>
      <%= f.label :name %>
      <%= f.text_field :name %>

      <%= f.label :email %>
      <%= f.email_field :email %>

      <%= f.label :password %>
      <%= f.password_field :password %>

      <%= f.label :password_confirmation, "Confirmation" %>
      <%= f.password_field :password_confirmation %>

      <%= f.submit "Create my account", class: "btn btn-primary" %>
    <% end %>
  </div>
</div>
```

To make the form look a little nicer, add the SCSS shown in Listing 7.16.

Listing 7.16: CSS for the signup form (including a mixin).
app/assets/stylesheets/custom.scss

```
@import "bootstrap-sprockets";
@import "bootstrap";

/* mixins, variables, etc. */
```

```
$gray-medium-light: #eaeaea;

@mixin box_sizing {
  -moz-box-sizing:    border-box;
  -webkit-box-sizing: border-box;
  box-sizing:         border-box;
}
.
.
.
/* forms */

input, textarea, select, .uneditable-input {
  border: 1px solid #bbb;
  width: 100%;
  margin-bottom: 15px;
  @include box_sizing;
}

input {
  height: auto !important;
}
```

Listing 7.16 introduces the Sass *mixin* facility, in this case called **`box_sizing`**. A mixin allows a group of CSS rules to be packaged up and used for multiple elements, converting

```
input, textarea, select, .uneditable-input {
  .
  .
  .
  @include box_sizing;
}
```

to

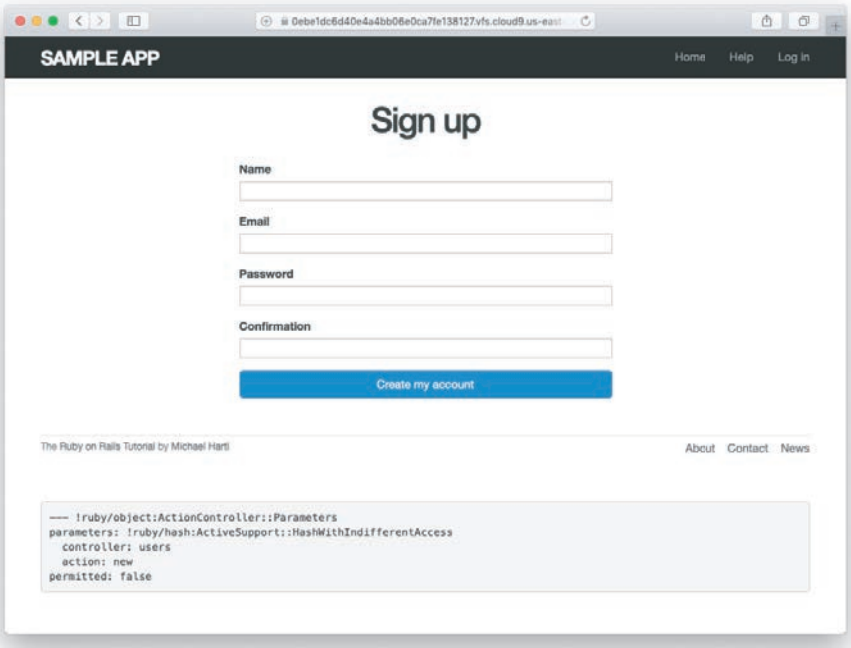
```
input, textarea, select, .uneditable-input {
  .
  .
  .
  -moz-box-sizing:    border-box;
  -webkit-box-sizing: border-box;
  box-sizing:         border-box;
}
```

Once the CSS rules in Listing 7.16 have been applied, the signup page appears as in Figure 7.14.

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. Confirm by replacing all occurrences of `f` with `foobar` that the name of the block variable is irrelevant as far as the result is concerned. Why might `foobar` nevertheless be a bad choice?


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east
SAMPLE APP
Home
Help
Log in
Sign up
Name
Email
Password
Confirmation
Create my account
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About
Contact
News

```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: new
permitted: false
```

Figure 7.14: The user signup form.

7.2.2 Signup Form HTML

To understand the form defined in Listing 7.15, it's helpful to break it into smaller pieces. We'll first look at the outer structure, which consists of embedded Ruby opening with a call to **form_with** and closing with **end**:

```
<%= form_with(model: @user) do |f| %>
  .
  .
  .
<% end %>
```

The presence of the **do** keyword indicates that **form_with** takes a block with one variable, which we've called **f** (for "form").

As is usually the case with Rails helpers, we don't need to know any details about the implementation, but what we *do* need to know is what the **f** object does: When called with a method corresponding to an HTML form element—such as a text field, radio button, or password field—**f** returns code for that element specifically designed to set an attribute of the **@user** object. In other words,

```
<%= f.label :name %>
<%= f.text_field :name %>
```

creates the HTML needed to make a labeled text field element appropriate for setting the **name** attribute of a User model.

If you look at the HTML for the generated form by Ctrl-clicking and using the "inspect element" function of your browser, the page's source should look something like Listing 7.17. Let's take a moment to discuss its structure.

Listing 7.17: The HTML for the form in Figure 7.14.

```
<form accept-charset="UTF-8" action="/users" class="new_user"
      id="new_user" method="post">
  <input name="authenticity_token" type="hidden"
         value="NNb6+J/j46LcrgYUC60wQ2titMuJQ5lLqyAbnbAUkdo=" />
  <label for="user_name">Name</label>
  <input id="user_name" name="user[name]" type="text" />

  <label for="user_email">Email</label>
  <input id="user_email" name="user[email]" type="email" />
  <label for="user_password">Password</label>
  <input id="user_password" name="user[password]"
         type="password" />

  <label for="user_password_confirmation">Confirmation</label>
  <input id="user_password_confirmation"
         name="user[password_confirmation]" type="password" />

  <input class="btn btn-primary" name="commit" type="submit"
         value="Create my account" />
</form>
```

We'll start with the internal structure of the document. Comparing Listing 7.15 with Listing 7.17, we see that the embedded Ruby

```
<%= f.label :name %>
<%= f.text_field :name %>
```

produces the HTML

```
<label for="user_name">Name</label>
<input id="user_name" name="user[name]" type="text" />
```

while

```
<%= f.label :email %>
<%= f.email_field :email %>
```

produces the HTML

```
<label for="user_email">Email</label>
<input id="user_email" name="user[email]" type="email" />
```

and

```
<%= f.label :password %>
<%= f.password_field :password %>
```

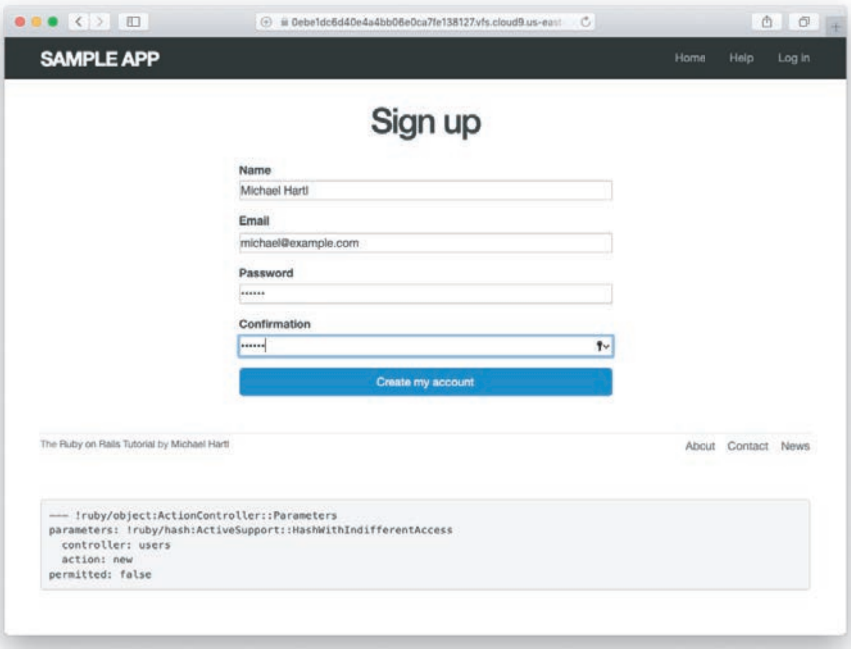
produces the HTML

```
<label for="user_password">Password</label>
<input id="user_password" name="user[password]" type="password" />
```

As seen in Figure 7.15, text and email fields (`type="text"` and `type="email"`) simply display their contents, whereas password fields (`type="password"`) obscure the input for security purposes. (The benefit of using an email field is that some systems treat it differently from a text field; for example, the code `type="email"` will cause some mobile devices to display a special keyboard optimized for entering email addresses.)

As we'll see in Section 7.4, the key to creating a user is the special `name` attribute in each `input`:

```
<input id="user_name" name="user[name]" - - - />
.
.
.
<input id="user_password" name="user[password]" - - - />
```


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east
SAMPLE APP
Home
Help
Log in
Sign up
Name
Email
Password
Confirmation
Create my account
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

Michael Hartl

michael@example.com

```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: new
permitted: false
```

Figure 7.15: A filled-in form with `text` and `password` fields.

These **name** values allow Rails to construct an initialization hash (via the **params** variable) for creating users using the values entered by the user, as we'll see in Section 7.3.

The second important element is the **form** tag itself. Rails creates the **form** tag using the **@user** object: Because every Ruby object knows its own class (Section 4.4.1), Rails figures out that **@user** is of class **User**; moreover, since **@user** is a *new* user, Rails knows to construct a form with the **post** method, which is the proper verb for creating a new object (Box 3.2):

```
<form action="/users" class="new_user" id="new_user" method="post">
```

Here the **class** and **id** attributes are largely irrelevant; what's important is **action="/users"** and **method="post"**. Together, these constitute instructions to issue an HTTP `POST` request to the /users URL. We'll see in the next two sections what effects this has.

(You may also have noticed the code that appears just inside the **form** tag:

```
<input name="authenticity_token" type="hidden"
       value="NNb6+J/j46LcrgYUC60wQ2titMuJQ5lLqyAbnbAUkdo=" />
```

This code, which isn't displayed in the browser, is used internally by Rails, so it's not important for us to understand what it does. Briefly, it includes an *authenticity token*, which Rails uses to thwart an attack called a *cross-site request forgery* (CSRF). Knowing when it's OK to ignore details like this is a good mark of technical sophistication (Box 1.2).)[11]

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. *Learn Enough HTML to Be Dangerous* (https://www.learnenough.com/html), in which all HTML is written by hand, doesn't cover the **form** tag. Why not?

11. See the Stack Overflow entry on the Rails authenticity token (https://stackoverflow.com/questions/941594/understanding-the-rails-authenticity-token) if you're interested in the details of how this works.

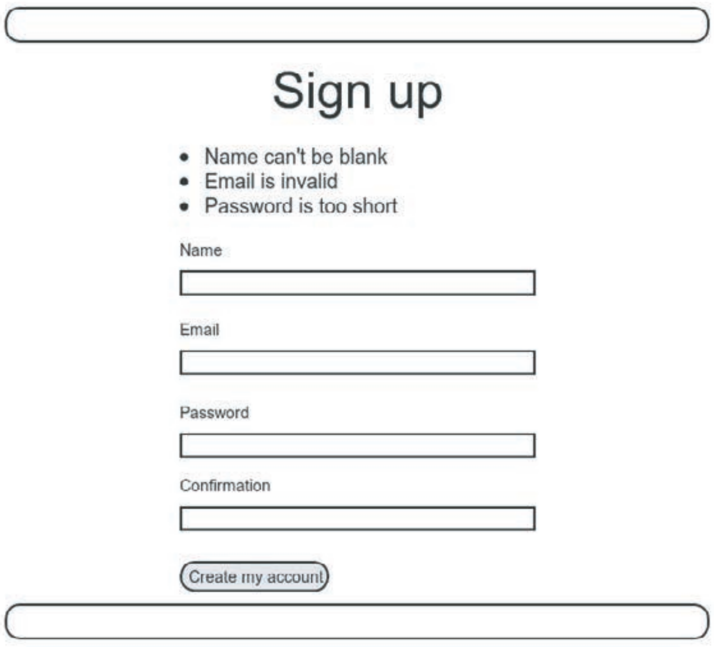


Figure 7.16: A mockup of the signup failure page.

7.3 Unsuccessful Signups

Although we've briefly examined the HTML for the form in Figure 7.14 (shown in Listing 7.17), we haven't yet covered any details, and the form is best understood in the context of *signup failure*. In this section, we'll create a signup form that accepts an invalid submission and re-renders the signup page with a list of errors, as mocked up in Figure 7.16.

7.3.1 A Working Form

Recall from Section 7.1.2 that adding `resources :users` to the `routes.rb` file (Listing 7.3) automatically ensures that our Rails application responds to the RESTful URLs from Table 7.1. In particular, it ensures that a `POST` request to /users is handled by the `create` action. Our strategy for the `create` action is to use the form submission to make a new user object using `User.new`, try (and fail) to save that user, and then render the signup page for possible resubmission. Let's get started by reviewing the code for the signup form:

```
<form action="/users" class="new_user" id="new_user" method="post">
```

As noted in Section 7.2.2, this HTML issues a `POST` request to the /users URL.

Our first step toward a working signup form is adding the code in Listing 7.18. This listing includes a second use of the **`render`** method, which we first saw in the context of partials (Section 5.1.3); as you can see, **`render`** works in controller actions as well. Note that we've taken this opportunity to introduce an **`if`–`else`** branching structure, which allows us to handle the cases of failure and success separately based on the value of **`@user.save`**, which (as we saw in Section 6.1.3) is either **`true`** or **`false`** depending on whether or not the save succeeds.

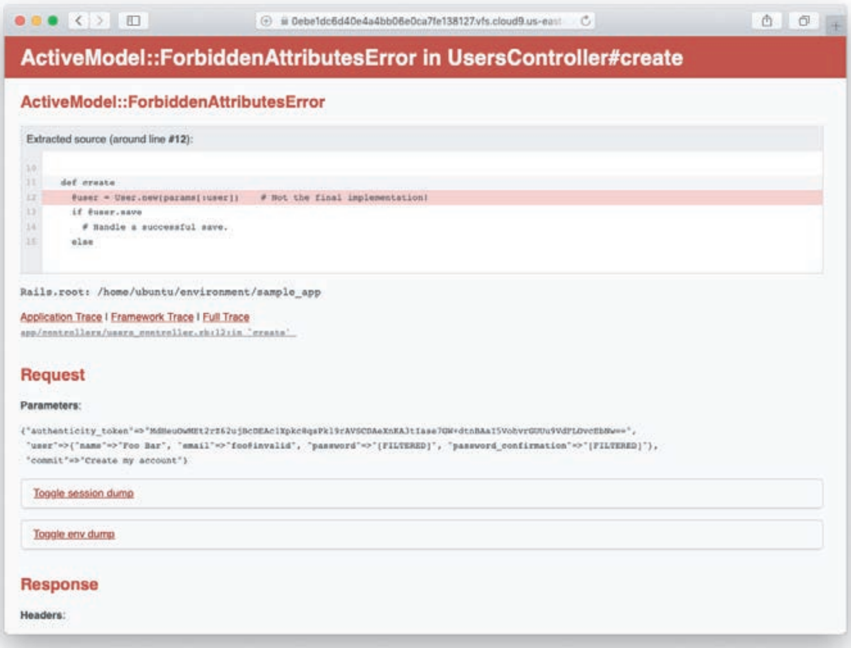
Listing 7.18: A **`create`** action that can handle signup failure.
`app/controllers/users_controller.rb`

```
class UsersController < ApplicationController

  def show
    @user = User.find(params[:id])
  end

  def new
    @user = User.new
  end

  def create
    @user = User.new(params[:user])    # Not the final implementation!
    if @user.save
      # Handle a successful save.
    else
      render 'new', status: :unprocessable_entity
    end
  end
end
```

Note the comment: This is not the final implementation. But it's enough to get us started, and we'll finish the implementation in Section 7.3.2. Also note the use of **`status: :unprocessable_entity`** (corresponding to the HTTP status code `422 Unprocessable Entity`), which is necessary to render regular HTML when using Turbo (which we'll install in Section 8.2.4 and cover in more depth in Section 14.2.5).

The form will work anyway as long as you included `--skip-bundle` as in Listing 3.1, but it would fail in Section 8.2.4 after installing Turbo, and it does no harm to include it now.[12]

The best way to understand how the code in Listing 7.18 works is to *submit* the form with some invalid signup data. The result appears in Figure 7.17, and the full debug information appears in Figure 7.18.



ActiveModel::ForbiddenAttributesError in UsersController#create

ActiveModel::ForbiddenAttributesError

Extracted source (around line #12):

```

  def create
    @user = User.new(params[:user])    # Not the final implementation!
    if @user.save
      # Handle a successful save.
    else
```

```
Rails.root: /home/ubuntu/environment/sample_app
```

Application Trace | Framework Trace | Full Trace
app/controllers/users_controller.rb:12:in `create'

Request

Parameters:

```
{"authenticity_token"=>"MdHeuOwMEt2rZ62ujBcDEAc1Xpkc8qsPkl9rAVSCDAeXnKAJtIase7GW+dtnBAaI5VohvrGUUu9VdFLOvcEbNw==",
 "user"=>{"name"=>"Foo Bar", "email"=>"foo@invalid", "password"=>"[FILTERED]", "password_confirmation"=>"[FILTERED]"},
 "commit"=>"Create my account"}
```

Toggle session dump

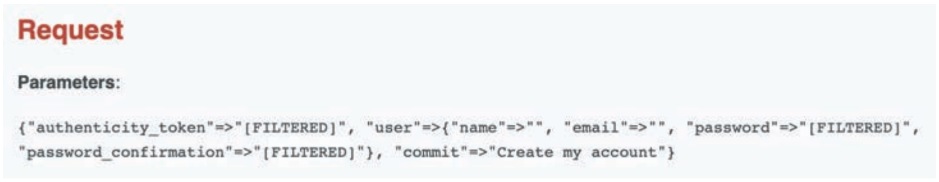
Toggle env dump

Response

Headers:

Figure 7.17: Signup failure upon submitting invalid data.

12. When developing a Rails 7 version of the sample application without including the `--skip-bundle` option to `rails new`, I was initially baffled by the failure of a plain `render 'new'`, which had never failed in any previous version of Rails. After some unsuccessful Googling, I tracked down the issue by looking at some scaffold code similar to the code developed in Chapter 2 but in a project likewise omitting the `--skip-bundle` option. The scaffold code included the crucial use of `status: :unprocessable_entity`, which I had never even heard of before but worked like a charm when I included it in the main sample app. In other words, I used Rails itself to figure out the right way to handle form submission when using Hotwire and Turbo. This is technical sophistication in action.



Request

Parameters:

```
{"authenticity_token"=>"[FILTERED]", "user"=>{"name"=>"", "email"=>"", "password"=>"[FILTERED]",
"password_confirmation"=>"[FILTERED]"}, "commit"=>"Create my account"}
```

Figure 7.18: Signup failure debug information.

To get a better picture of how Rails handles the submission, let's take a closer look at the **`user`** part of the parameters hash from the debug information (Figure 7.18):

```
"user" => { "name" => "Foo Bar",
            "email" => "foo@invalid",
            "password" => "[FILTERED]",
            "password_confirmation" => "[FILTERED]"
          }
```

This hash gets passed to the Users controller as part of **`params`**, and we saw starting in Section 7.1.2 that the **`params`** hash contains information about each request. In the case of a URL like /users/1, the value of **`params[:id]`** is the **`id`** of the corresponding user (**`1`** in this example). In the case of posting to the signup form, **`params`** instead contains a hash of hashes, a construction we first saw in Section 4.3.3, which introduced the strategically named **`params`** variable in a console session. The debug information above shows that submitting the form results in a **`user`** hash with attributes corresponding to the submitted values, where the keys come from the **`name`** attributes of the **`input`** tags seen in Listing 7.17. For example, the value of

```
<input id="user_email" name="user[email]" type="email" />
```

with name **`"user[email]"`** is precisely the **`email`** attribute of the **`user`** hash.

Although the hash keys appear as strings in the debug output, we can access them in the Users controller as symbols, so that **`params[:user]`** is the hash of user attributes—in fact, exactly the attributes needed as an argument to **`User.new`**, as first seen in Section 4.4.5 and appearing in Listing 7.18. This means that the line

```
@user = User.new(params[:user])
```

is mostly equivalent to

```
@user = User.new(name: "Foo Bar", email: "foo@invalid",
                 password: "foo", password_confirmation: "bar")
```

In previous versions of Rails, using

```
@user = User.new(params[:user])
```

actually worked, but it was insecure by default and required a careful and error-prone procedure to prevent malicious users from potentially modifying the application database. In Rails versions later than 4.0, this code raises an error (as seen in Figure 7.17 and Figure 7.18), which means it is secure by default.

7.3.2 Strong Parameters

We mentioned briefly in Section 4.4.5 the idea of *mass assignment*, which involves initializing a Ruby variable using a hash of values, as in

```
@user = User.new(params[:user])    # Not the final implementation!
```

The comment included in Listing 7.18 and reproduced above indicates that this is not the final implementation. The reason is that initializing the entire **`params`** hash is *extremely* dangerous—it arranges to pass to **`User.new`** *all* data submitted by a user. In particular, suppose that, in addition to the current attributes, the User model included an **`admin`** attribute used to identify administrative users of the site. (We will implement just such an attribute in Section 10.4.1.) The way to set such an attribute to **`true`** is to pass the value **`admin='1'`** as part of **`params[:user]`**, a task that is easy to accomplish using a command-line HTTP client such as `curl`. The result would be that, by passing in the entire **`params`** hash to **`User.new`**, we would allow any user of the site to gain administrative access by including **`admin='1'`** in the web request.

Previous versions of Rails used a method called **`attr_accessible`** in the *model* layer to solve this problem, and you may still see that method in legacy Rails applications, but as of Rails 4.0 the preferred technique is to use so-called *strong parameters* in the controller layer. This allows us to specify which parameters are *required* and which ones are *permitted*. In addition, passing in a raw **`params`** hash as above will cause an error to be raised, so that Rails applications are now immune to mass assignment vulnerabilities by default.

In the present instance, we want to require the **`params`** hash to have a **`:user`** attribute, and we want to permit the name, email, password, and password confirmation attributes (but no others). We can accomplish this as follows:

```
params.require(:user).permit(:name, :email, :password, :password_confirmation)
```

This code returns a version of the **`params`** hash with only the permitted attributes (while raising an error if the **`:user`** attribute is missing).

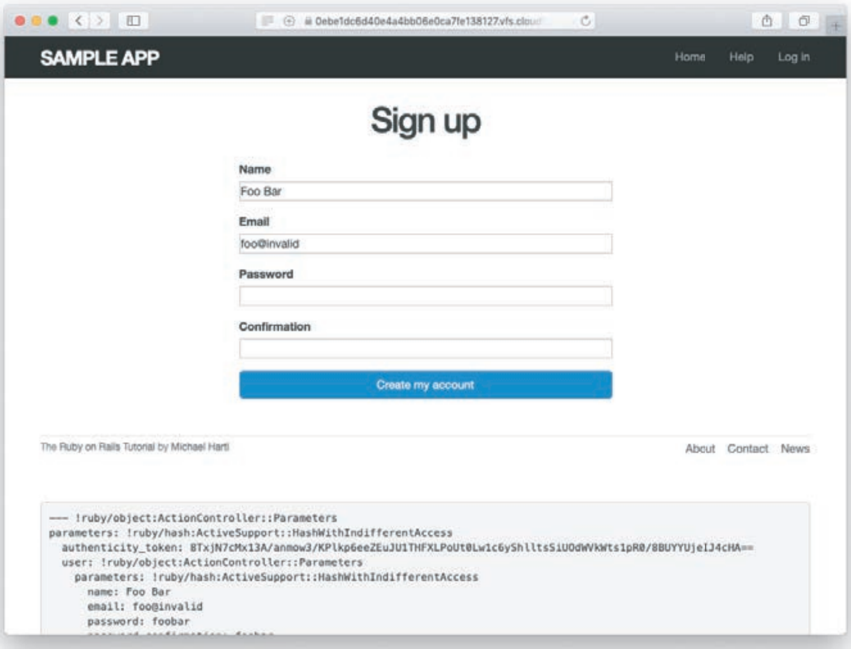
To facilitate the use of these parameters, it's conventional to introduce an auxiliary method called **`user_params`** (which returns an appropriate initialization hash) and use it in place of **`params[:user]`**:

```
@user = User.new(user_params)
```

Since **`user_params`** will only be used internally by the Users controller and need not be exposed to external users via the Web, we'll make it *private* using Ruby's **`private`** keyword, as shown in Listing 7.19. (We'll discuss **`private`** in more detail in Section 9.1.)

Listing 7.19: Using strong parameters in the **`create`** action.
app/controllers/users_controller.rb

```
class UsersController < ApplicationController
  .
  .
  .
  def create
    @user = User.new(user_params)
    if @user.save
      # Handle a successful save.
    else
      render 'new', status: :unprocessable_entity
    end
  end

  private

    def user_params
      params.require(:user).permit(:name, :email, :password,
                                   :password_confirmation)
    end
end
```



```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  authenticity_token: BTxjN7cMx13A/anmow3/KPlkp6eeZEuJU1THFXLPoUt0Lw1c6yShlltsSiUOdWVkWts1pR0/8BUYYUjeIJ4cHA==
  user: !ruby/object:ActionController::Parameters
    parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
      name: Foo Bar
      email: foo@invalid
      password: foobar
```

Figure 7.19: The signup form submitted with invalid information.

By the way, the extra level of indentation on the `user_params` method is designed to make it visually apparent which methods are defined after `private`. (Experience shows that this is a wise practice; in classes with a large number of methods, it is easy to define a private method accidentally, which leads to considerable confusion when it isn't available to call on the corresponding object.)

At this point, the signup form is working, at least in the sense that it no longer produces an error upon submission. On the other hand, as seen in Figure 7.19, it doesn't display any feedback on invalid submissions (apart from the development-only debug area), which is potentially confusing. It also doesn't actually create a new user. We'll fix the first issue in Section 7.3.3 and the second in Section 7.4.

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. By hitting the URL /signup?admin=1, confirm that the **`admin`** attribute appears in the **`params`** debug information.

7.3.3 Signup Error Messages

As a final step in handling failed user creation, we'll add helpful error messages to indicate the problems that prevented successful signup. Conveniently, Rails automatically provides such messages based on the User model validations. For example, consider trying to save a user with an invalid email address and with a password that's too short:

```
$ rails console
>> user = User.new(name: "Foo Bar", email: "foo@invalid",
?>                 password: "dude", password_confirmation: "dude")
>> user.save
=> false
>> user.errors.full_messages
=> ["Email is invalid", "Password is too short (minimum is 6 characters)"]
```

Here the **`errors.full_messages`** object (which we saw briefly before in Section 6.2.2) contains an array of error messages.

As in the console session above, the failed save in Listing 7.18 generates a list of error messages associated with the **`@user`** object. To display the messages in the browser, we'll render an error-messages partial on the user **`new`** page while adding the CSS class **`form-control`** (which has special meaning to Bootstrap) to each entry field, as shown in Listing 7.20. It's worth noting that this error-messages partial is only a first attempt; the final version appears in Section 13.3.2.

Listing 7.20: Code to display error messages on the signup form.
app/views/users/new.html.erb

```
<% provide(:title, 'Sign up') %>
<h1>Sign up</h1>

<div class="row">
```

```
  <div class="col-md-6 col-md-offset-3">
    <%= form_with(model: @user) do |f| %>
      <%= render 'shared/error_messages' %>

      <%= f.label :name %>
      <%= f.text_field :name, class: 'form-control' %>

      <%= f.label :email %>
      <%= f.email_field :email, class: 'form-control' %>

      <%= f.label :password %>
      <%= f.password_field :password, class: 'form-control' %>

      <%= f.label :password_confirmation, "Confirmation" %>
      <%= f.password_field :password_confirmation, class: 'form-control' %>

      <%= f.submit "Create my account", class: "btn btn-primary" %>
    <% end %>
  </div>
</div>
```

Notice here that we `render` a partial called `'shared/error_messages'`; this reflects the common Rails convention of using a dedicated `shared/` directory for partials expected to be used in views across multiple controllers. (We'll see this expectation fulfilled in Section 10.1.1.)

This means that we have to create a new `app/views/shared` directory using `mkdir` and an error-messages partial using (Table 1.1):

```
$ mkdir app/views/shared
```

We then need to create the `_error_messages.html.erb` partial file using `touch` or the text editor as usual. The contents of the partial appear in Listing 7.21.

Listing 7.21: A partial for displaying form submission error messages.
app/views/shared/_error_messages.html.erb

```
<% if @user.errors.any? %>
  <div id="error_explanation">
    <div class="alert alert-danger">
      The form contains <%= pluralize(@user.errors.count, "error") %>.
    </div>
    <ul>
    <% @user.errors.full_messages.each do |msg| %>
      <li><%= msg %></li>
    <% end %>
    </ul>
  </div>
<% end %>
```

This partial introduces several new Rails and Ruby constructs, including two methods for Rails error objects. The first method is **`count`**, which simply returns the number of errors:

```
>> user.errors.count
=> 2
```

The other new method is **`any?`**, which (together with **`empty?`**) is one of a pair of complementary methods:

```
>> user.errors.empty?
=> false
>> user.errors.any?
=> true
```

We see here that the **`empty?`** method, which we first saw in Section 4.2.2 in the context of strings, also works on Rails error objects, returning **`true`** for an empty object and **`false`** otherwise. The **`any?`** method is just the opposite of **`empty?`**, returning **`true`** if there are any elements present and **`false`** otherwise. (By the way, all of these methods—**`count`**, **`empty?`**, and **`any?`**—work on Ruby arrays as well. We'll put this fact to good use starting in Section 13.2.)

The other new idea is the **`pluralize`** text helper, which is available in the console via the **`helper`** object:

```
>> helper.pluralize(1, "error")
=> "1 error"
>> helper.pluralize(5, "error")
=> "5 errors"
```

We see here that **`pluralize`** takes an integer argument and then returns the number with a properly pluralized version of its second argument. Underlying this method is a powerful *inflector* that knows how to pluralize a large number of words, including many with irregular English plurals:

```
>> helper.pluralize(2, "woman")
=> "2 women"
>> helper.pluralize(3, "erratum")
=> "3 errata"
```

As a result of its use of `pluralize`, the code

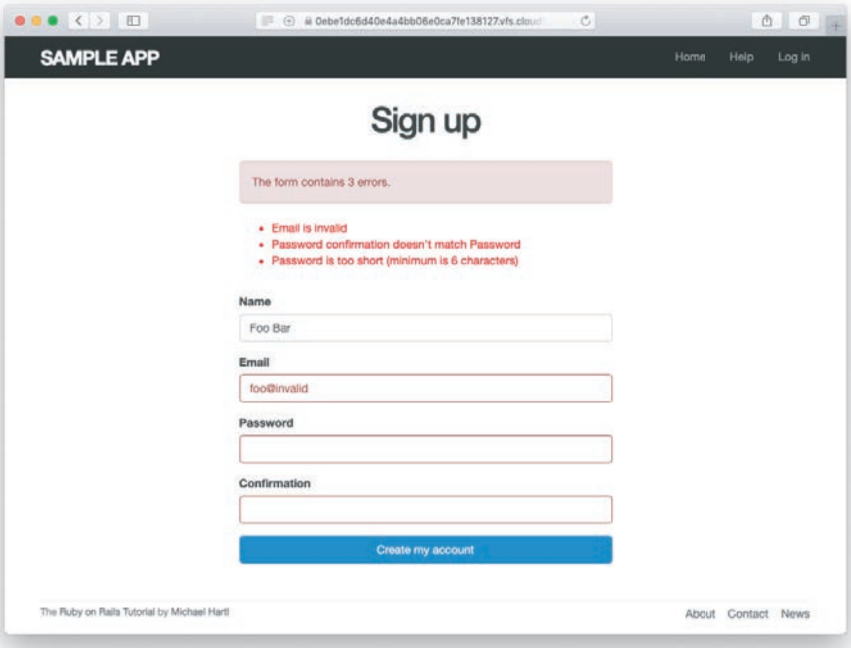
```
<%= pluralize(@user.errors.count, "error") %>
```

returns `"0 errors"`, `"1 error"`, `"2 errors"`, and so on, depending on how many errors there are, thereby avoiding ungrammatical phrases such as `"1 errors"` (a distressingly common mistake in both web and desktop applications).

Note that Listing 7.21 includes the CSS id `error_explanation` for use in styling the error messages. (Recall from Section 5.1.2 that CSS uses the pound sign `#` to style ids.) In addition, after an invalid submission Rails automatically wraps the fields with errors in `div`s with the CSS class `field_with_errors`. These labels then allow us to style the error messages with the SCSS shown in Listing 7.22, which makes use of Sass's `@extend` function to include the functionality of the Bootstrap class `has-error`.

Listing 7.22: CSS for styling error messages.
app/assets/stylesheets/custom.scss

```
.
.
.
/* forms */
.
.
.
#error_explanation {
  color: red;
  ul {
    color: red;
    margin: 0 0 30px 0;
  }
}

.field_with_errors {
  @extend .has-error;
  .form-control {
    color: $state-danger-text;
  }
}
```



The form contains 3 errors.

- Email is invalid
- Password confirmation doesn't match Password
- Password is too short (minimum is 6 characters)

Name: Foo Bar
Email: foo@invalid
Password:
Confirmation:

Figure 7.20: Failed signup with error messages.

With the code in Listing 7.20 and Listing 7.21 and the SCSS from Listing 7.22, helpful error messages now appear when submitting invalid signup information, as seen in Figure 7.20. Because the messages are generated by the model validations, they will automatically change if you ever change your mind about, say, the format of email addresses, or the minimum length of passwords. (*Note*: Because both the presence validation and the `has_secure_password` validation catch the case of *empty* (`nil`) passwords, the signup form currently produces duplicate error messages when the user submits empty passwords. We could manipulate the error messages directly to eliminate such duplicates, but luckily this issue will be fixed automatically by the addition of `allow_nil: true` in Section 10.1.4.)

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. Confirm by changing the minimum length of passwords to 5 that the error message updates automatically as well.
2. How does the URL on the unsubmitted signup form (Figure 7.14) compare to the URL for a submitted signup form (Figure 7.20)? Why don't they match?

7.3.4 A Test for Invalid Submission

In the days before powerful web frameworks with automated testing capabilities, developers had to test forms by hand. For example, to test a signup page manually, we would have to visit the page in a browser and then submit alternately invalid and valid data, verifying in each case that the application's behavior was correct. Moreover, we would have to remember to repeat the process any time the application changed. This process was painful and error-prone.

Happily, with Rails we can write tests to automate the testing of forms. In this section, we'll write one such test to verify the correct behavior upon invalid form submission; in Section 7.4.4, we'll write a corresponding test for valid submission.

To get started, we first generate an integration test file for signing up users, which we'll call **`users_signup`** (adopting the controller convention of a plural resource name):

```
$ rails generate integration_test users_signup
      invoke  test_unit
      create    test/integration/users_signup_test.rb
```

(We'll use this same file in Section 7.4.4 to test a valid signup.)

The main purpose of our test is to verify that clicking the signup button results in *not* creating a new user when the submitted information is invalid. (Writing a test for the error messages is left as an exercise (Section 7.3.4).) The way to do this is to check the *count* of users, and under the hood our tests will use the **`count`** method available on every Active Record class, including **`User`**:

```
$ rails console
>> User.count
=> 1
```

(Here **User.count** is **1** because of the user created in Section 6.3.4, though it may differ if you've added or deleted any users in the interim.) As in Section 5.3.4, we'll use **assert_select** to test HTML elements of the relevant pages, taking care to check only elements unlikely to change in the future.

We'll start by visiting the signup path using **get**:

```
get signup_path
```

In order to test the form submission, we need to issue a POST request to the **users_path** (Table 7.1), which we can do with the **post** function:

```
assert_no_difference 'User.count' do
  post users_path, params: { user: { name:  "",
                                     email: "user@invalid",
                                     password:              "foo",
                                     password_confirmation: "bar" } }
end
```

Here we've included the **params[:user]** hash expected by **User.new** in the **create** action (Listing 7.27). (In versions of Rails before 5, **params** was implicit, and only the **user** hash would be passed. This practice was deprecated in Rails 5.0, and now the recommended method is to include the full **params** hash explicitly.)

By wrapping the **post** in the **assert_no_difference** method with the string argument **'User.count'**, we arrange for a comparison between **User.count** before and after the contents inside the **assert_no_difference** block. This is equivalent to recording the user count, posting the data, and verifying that the count is the same:

```
before_count = User.count
post users_path, ...
after_count  = User.count
assert_equal before_count, after_count
```

Although the two are equivalent, using **assert_no_difference** is cleaner and is more idiomatically correct Rails.

It's worth noting that the **get** and **post** steps above are technically unrelated, and it's actually not necessary to get the signup path before posting to the users path. I prefer to include both steps, though, both for conceptual clarity and to double-check that the signup form renders without error.

We'll also include assertions to verify that the right response code is returned and the right template rendered, which we can do as follows:

```
assert_response :unprocessable_entity
assert_template 'users/new'
```

Compare the first line with **`assert_response :success`** in Listing 3.14 and related tests. This line is useful to verify that the right status is returned by Listing 7.18 and to protect against regressions (Box 3.3).

Putting the above ideas together leads to the test in Listing 7.23. Adding lines to check for the appearance of error messages is left as an exercise (Section 7.3.4).

Listing 7.23: A test for an invalid signup. GREEN
`test/integration/users_signup_test.rb`

```
require "test_helper"

class UsersSignupTest < ActionDispatch::IntegrationTest

  test "invalid signup information" do
    get signup_path
    assert_no_difference 'User.count' do
      post users_path, params: { user: { name:  "",
                                         email: "user@invalid",
                                         password:              "foo",
                                         password_confirmation: "bar" } }
    end
    assert_response :unprocessable_entity
    assert_template 'users/new'
  end
end
```

Because we wrote the application code before the integration test, the test suite should be GREEN:

Listing 7.24: GREEN

```
$ rails test
```

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. Write a test for the error messages implemented in Listing 7.20. How detailed you want to make your tests is up to you; a suggested template appears in Listing 7.25.

Listing 7.25: A template for tests of the error messages.
test/integration/users_signup_test.rb

```
require "test_helper"

class UsersSignupTest < ActionDispatch::IntegrationTest

  test "invalid signup information" do
    get signup_path
    assert_no_difference 'User.count' do
      post users_path, params: { user: { name:  "",
                                         email: "user@invalid",
                                         password:              "foo",
                                         password_confirmation: "bar" } }
    end
    assert_response :unprocessable_entity
    assert_template 'users/new'
    assert_select 'div#<CSS id for error explanation>'
    assert_select 'div.<CSS class for field with error>'
  end
  .
  .
  .
end
```

7.4 Successful Signups

Having handled invalid form submissions, now it's time to complete the signup form by actually saving a new user (if valid) to the database. First, we try to save the user; if the save succeeds, the user's information gets written to the database automatically, and we then *redirect* the browser to show the user's profile (together with a friendly

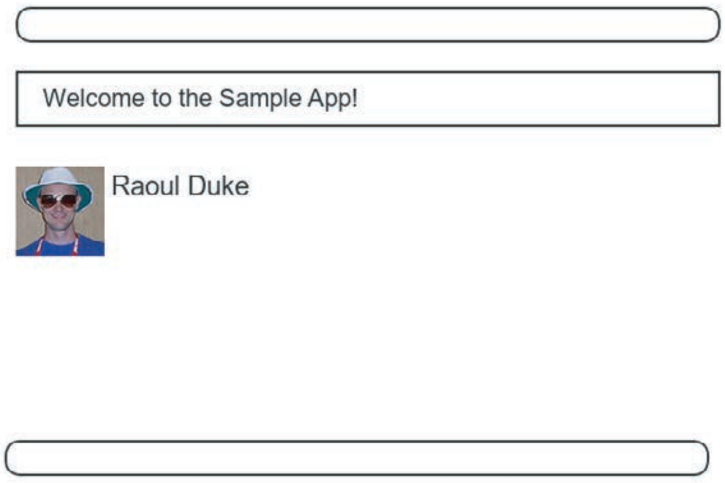


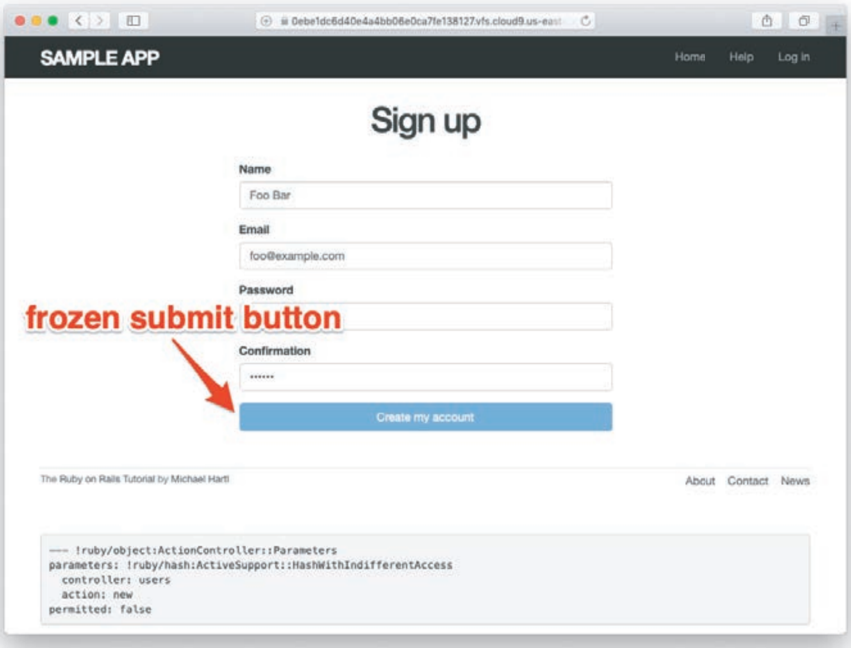
Figure 7.21: A mockup of successful signup.

greeting), as mocked up in Figure 7.21. If it fails, we simply fall back on the behavior developed in Section 7.3.

7.4.1 The Finished Signup Form

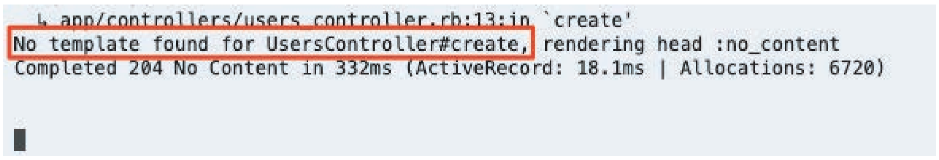
To complete a working signup form, we need to fill in the commented-out section in Listing 7.19 with the appropriate behavior. Currently, the form simply freezes on valid submission, as indicated by the subtle color change in the submission button (Figure 7.22), although this behavior may be system-dependent. This is because the default behavior for a Rails action is to render the corresponding view, and there isn't a view template corresponding to the `create` action (Figure 7.23).

Although it's possible to render a template for the `create` action, the usual practice is to *redirect* to a different page instead when the creation is successful. In particular, we'll follow the common convention of redirecting to the newly created user's profile, although the root path would also work. The application code, which introduces the `redirect_to` method, appears in Listing 7.26.



```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: new
permitted: false
```

Figure 7.22: The frozen page on valid signup submission.



```
  ↳ app/controllers/users_controller.rb:13:in `create'
No template found for UsersController#create, rendering head :no_content
Completed 204 No Content in 332ms (ActiveRecord: 18.1ms | Allocations: 6720)
```

Figure 7.23: The `create` template error in the server log.

Listing 7.26: The user `create` action with a save and a redirect.
app/controllers/users_controller.rb

```
class UsersController < ApplicationController
  .
  .
  .
  def create
    @user = User.new(user_params)
    if @user.save
      redirect_to @user
    else
      render 'new', status: :unprocessable_entity
    end
  end

  private

    def user_params
      params.require(:user).permit(:name, :email, :password,
                                   :password_confirmation)
    end
end
```

Note that we've written

```
redirect_to @user
```

where we could have used the equivalent

```
redirect_to user_url(@user)
```

This is because Rails automatically infers from **`redirect_to @user`** that we want to redirect to **`user_url(@user)`**. (The name **`@user`** is incidental; it could be **`@foo`** and the redirect would still work as long as the object has class **`User`**.)

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. Using the Rails console, verify that a user is in fact created when submitting valid information.
2. Confirm by updating Listing 7.26 and submitting a valid user that **`redirect_to user_url(@user)`** has the same effect as **`redirect_to @user`**.

7.4.2 The Flash

With the code in Listing 7.26, our signup form is actually working, but before submitting a valid registration in a browser we're going to add a bit of polish common in web applications: a message that appears on the subsequent page (in this case, welcoming our new user to the application) and then disappears upon visiting a second page or on page reload.

The Rails way to display a temporary message is to use a special method called the *flash*, which we can treat like a hash. Rails adopts the convention of a **`:success`** key for a message indicating a successful result (Listing 7.27).

Listing 7.27: Adding a flash message to user signup.
`app/controllers/users_controller.rb`

```
class UsersController < ApplicationController
  .
  .
  .
  def create
    @user = User.new(user_params)
    if @user.save
      flash[:success] = "Welcome to the Sample App!"
      redirect_to @user
    else
      render 'new', status: :unprocessable_entity
    end
  end

  private

    def user_params
      params.require(:user).permit(:name, :email, :password,
                                   :password_confirmation)
    end
end
```

By assigning a message to the **`flash`**, we are now in a position to display the message on the first page after the redirect. Our method is to iterate through the **`flash`** and insert all relevant messages into the site layout. You may recall the console example in Section 4.3.3, where we saw how to iterate through a hash using the strategically named **`flash`** variable (Listing 7.28).

Listing 7.28: Iterating through a `flash` hash in the console.

```
$ rails console
>> flash = { success: "It worked!", danger: "It failed." }
=> {:success=>"It worked!", danger: "It failed."}
>> flash.each do |key, value|
?>   puts "#{key}"
?>   puts "#{value}"
>> end
success
It worked!
danger
It failed.
```

By following this pattern, we can arrange to display the contents of the flash site-wide using code like this:

```
<% flash.each do |message_type, message| %>
  <div class="alert alert-<%= message_type %>"><%= message %></div>
<% end %>
```

(This code is a particularly ugly and difficult-to-read combination of HTML and ERb; making it prettier is left as an exercise (Section 7.4.4).) Here the embedded Ruby

```
alert-<%= message_type %>
```

makes a CSS class corresponding to the type of message, so that for a `:success` message the class is

```
alert-success
```

(The key `:success` is a symbol, but embedded Ruby automatically converts it to the string `"success"` before inserting it into the template.) Using a different class for each key allows us to apply different styles to different kinds of messages. For example, in Section 8.1.4 we'll use `flash[:danger]` to indicate a failed login attempt.[13]

13. Actually, we'll use the closely related `flash.now`, but we'll defer that subtlety until we need it.

(In fact, we've already used `alert-danger` once, to style the error-message div in Listing 7.21.) Bootstrap CSS supports styling for four such flash classes for increasingly urgent message types (`success`, `info`, `warning`, and `danger`), and we'll find occasion to use all of them in the course of developing the sample application (`info` in Section 11.2, `warning` in Section 11.3, and `danger` for the first time in Section 8.1.4).

Because the message is also inserted into the template, the full HTML result for

```
flash[:success] = "Welcome to the Sample App!"
```

appears as follows:

```
<div class="alert alert-success">Welcome to the Sample App!</div>
```

Putting the embedded Ruby discussed above into the site layout leads to the code in Listing 7.29.

Listing 7.29: Adding the contents of the `flash` variable to the site layout.
app/views/layouts/application.html.erb

```
<!DOCTYPE html>
<html>
  .
  .
  .
  <body>
    <%= render 'layouts/header' %>
    <div class="container">
      <% flash.each do |message_type, message| %>
        <div class="alert alert-<%= message_type %>"><%= message %></div>
      <% end %>
      <%= yield %>
      <%= render 'layouts/footer' %>
      <%= debug(params) if Rails.env.development? %>
    </div>
    .
    .
    .
  </body>
</html>
```

Exercises

> To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. In the console, confirm that you can use interpolation (Section 4.2.1) to interpolate a raw symbol. For example, what is the return value of `"#{:success}"`?
2. How does the previous exercise relate to the flash iteration shown in Listing 7.28?

7.4.3 The First Signup

We can see the result of all this work by signing up the first user for the sample app. Even though previous submissions didn't work properly (as shown in Figure 7.22), the `user.save` line in the Users controller still works, so users might still have been created. To clear them out, we'll reset the database as follows:

```
$ rails db:migrate:reset
```

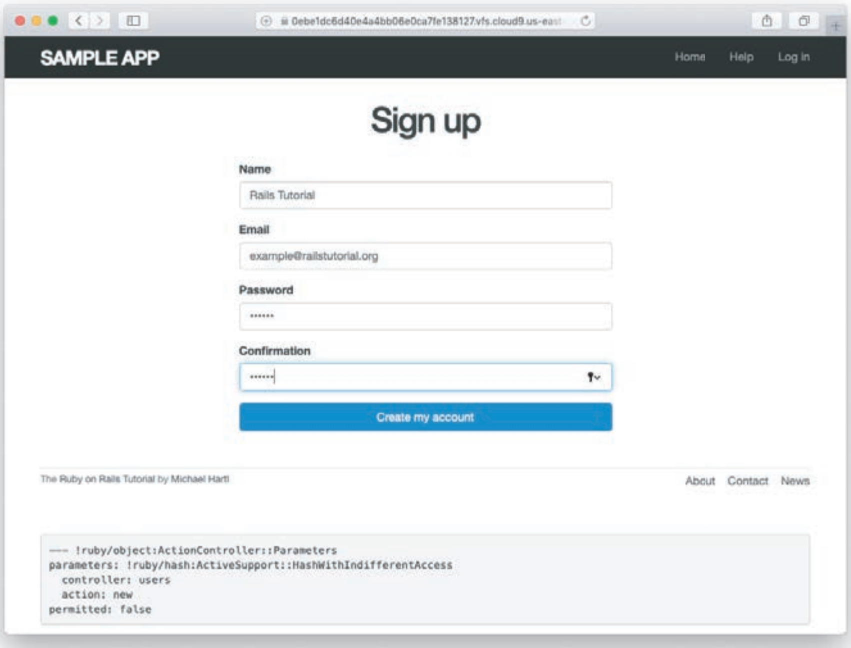
On some systems, you might have to restart the web server (using Ctrl-C) for the changes to take effect (Box 1.2).

We'll create the first user with the name "Rails Tutorial" and email address "example@railstutorial.org", as shown in Figure 7.24. The resulting page (Figure 7.25) shows a friendly flash message upon successful signup, including nice green styling for the `success` class, which comes included with the Bootstrap CSS framework from Section 5.1.2. Then, upon reloading the user show page, the flash message disappears as promised (Figure 7.26).

Exercises

> To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. Using the Rails console, find by the email address to double-check that the new user was actually created. The result should look something like Listing 7.30.
2. Create a new user with your primary email address. Verify that the Gravatar correctly appears.


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east
SAMPLE APP
Home
Help
Log in
Create my account
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

Sign up

Name
Rails Tutorial

Email
example@railstutorial.org

Password
••••••

Confirmation
••••••

```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: new
permitted: false
```

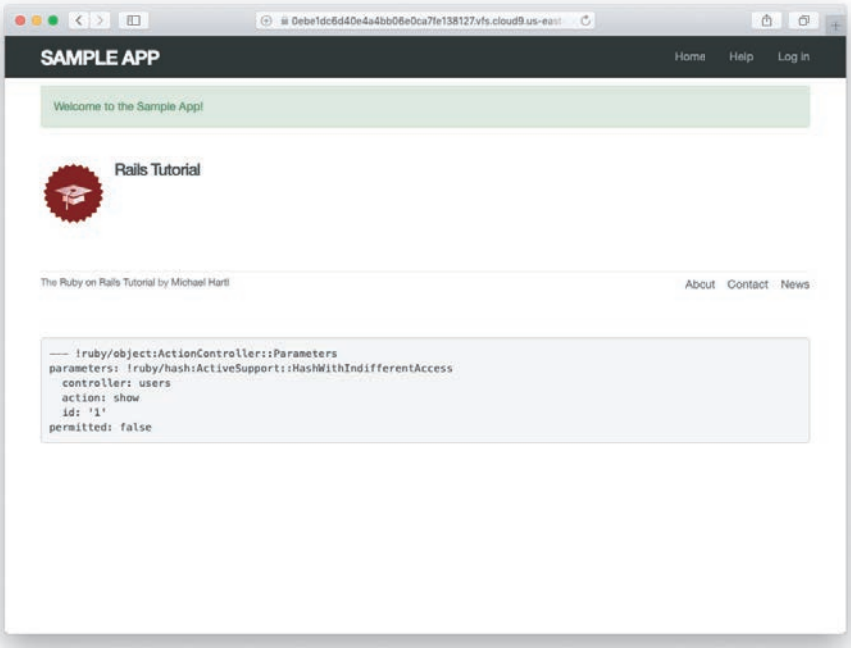
Figure 7.24: Filling in the information for the first signup.

Listing 7.30: Finding the newly created user in the database.

```
$ rails console
>> User.find_by(email: "example@railstutorial.org")
=> #<User id: 1, name: "Rails Tutorial", email: "example@railstutorial.
org", created_at: "2016-05-31 17:17:33", updated_at: "2016-05-31 17:17:33",
password_digest: "$2a$10$8MaeHdnOhZvMk3GmFdmpPOeG6a7u7/k2Z9TMjOanC9G...">
```

7.4.4 A Test for Valid Submission

Before moving on, we'll write a test for valid submission to verify our application's behavior and catch regressions. As with the test for invalid submission in Section 7.3.4, our main purpose is to verify the contents of the database. In this case, we want to


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east
SAMPLE APP
Home
Help
Log in
Rails Tutorial
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

Welcome to the Sample App!

```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: show
  id: '1'
permitted: false
```

Figure 7.25: The results of a successful user signup, with flash message.

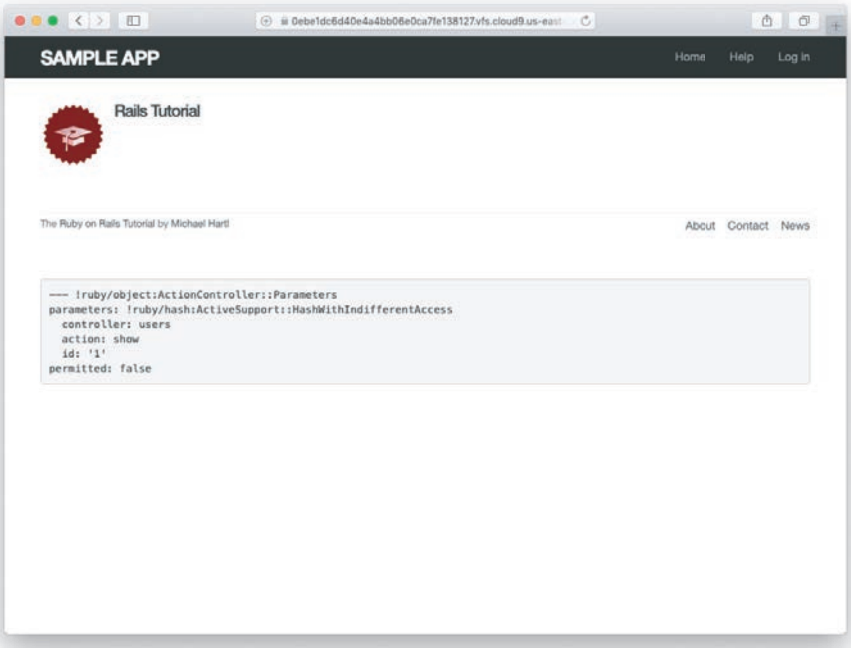
submit valid information and then confirm that a user *was* created. In analogy with Listing 7.23, which used

```
assert_no_difference 'User.count' do
  post users_path, ...
end
```

here we'll use the corresponding `assert_difference` method:

```
assert_difference 'User.count', 1 do
  post users_path, ...
end
```

As with `assert_no_difference`, the first argument is the string `'User.count'`, which arranges for a comparison between `User.count` before and after the contents


0ebe1dc6d40e4a4bb06e0ca7fe138127.vfs.cloud9.us-east
SAMPLE APP
Home
Help
Log in
Rails Tutorial
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

```
--- !ruby/object:ActionController::Parameters
parameters: !ruby/hash:ActiveSupport::HashWithIndifferentAccess
  controller: users
  action: show
  id: '1'
permitted: false
```

Figure 7.26: The `flash`-less profile page after a browser reload.

of the `assert_difference` block. The second (optional) argument specifies the size of the difference (in this case, 1).

Incorporating `assert_difference` into the file from Listing 7.23 yields the test shown in Listing 7.31. Note that we've used the `follow_redirect!` method after posting to the users path. This simply arranges to follow the redirect after submission, resulting in a rendering of the `'users/show'` template. (It's probably a good idea to write a test for the flash as well, which is left as an exercise (Section 7.4.4).)

Listing 7.31: A test for a valid signup. GREEN
test/integration/users_signup_test.rb

```
require "test_helper"

class UsersSignupTest < ActionDispatch::IntegrationTest
```

```
  .
  .
  .
  test "valid signup information" do
    assert_difference 'User.count', 1 do
      post users_path, params: { user: { name:  "Example User",
                                         email: "user@example.com",
                                         password:              "password",
                                         password_confirmation: "password" } }
    end
    follow_redirect!
    assert_template 'users/show'
  end
end
```

Note that Listing 7.31 also verifies that the user show template renders following successful signup. For this test to work, it's necessary for the Users routes (Listing 7.3), the Users **show** action (Listing 7.5), and the **show.html.erb** view (Listing 7.8) to work correctly. As a result, the one line

```
assert_template 'users/show'
```

is a sensitive test for almost everything related to a user's profile page. This sort of end-to-end coverage of important application features illustrates one reason why integration tests are so useful.

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. Write a test for the flash implemented in Section 7.4.2. How detailed you want to make your tests is up to you; a suggested ultra-minimalist template appears in Listing 7.32, which you should complete by replacing **FILL_IN** with the appropriate code. (Even testing for the right key, much less the text, is likely to be brittle, so I prefer to test only that the flash isn't empty.)
2. As noted above, the flash HTML in Listing 7.29 is ugly. Verify by running the test suite that the cleaner code in Listing 7.33, which uses the Rails **content_tag** helper, also works.

3. Verify that the test fails if you comment out the redirect line in Listing 7.26.
4. Suppose we changed `@user.save` to `false` in Listing 7.26. How does this change verify that the `assert_difference` block is testing the right thing?

Listing 7.32: A template for a test of the flash.
test/integration/users_signup_test.rb

```
require "test_helper"

class UsersSignupTest < ActionDispatch::IntegrationTest
  .
  .
  .
  test "valid signup information" do
    assert_difference 'User.count', 1 do
      post users_path, params: { user: { name:  "Example User",
                                         email: "user@example.com",
                                         password:              "password",
                                         password_confirmation: "password" } }
    end
    follow_redirect!
    assert_template 'users/show'
    assert_not flash.FILL_IN
  end
end
```

Listing 7.33: The `flash` ERb in the site layout using `content_tag`.
app/views/layouts/application.html.erb

```
<!DOCTYPE html>
<html>
      .
      .
      .
      <% flash.each do |message_type, message| %>
        <%= content_tag(:div, message, class: "alert alert-#{message_type}") %>
      <% end %>
      .
      .
      .
</html>
```

7.5 Professional-Grade Deployment

Now that we have a working signup page, it's time to deploy our application and get it working in production. Although we started deploying our application in Chapter 3, this is the first time it will actually *do* something, so we'll take this opportunity to make the deployment professional-grade. In particular, we'll add an important feature to the production application to make signup secure, we'll replace the default web server with one suitable for real-world use, and we'll add some configuration for our production database.

As preparation for the deployment, you should merge your changes into the `main` branch at this point:

```
$ git add -A
$ git commit -m "Finish user signup"
$ git checkout main
$ git merge sign-up
```

7.5.1 SSL in Production

When submitting the signup form developed in this chapter, the name, email address, and password get sent over the network, and hence are vulnerable to being intercepted by malicious users. This is a potentially serious security flaw in our application, and the way to fix it is to use Secure Sockets Layer (SSL)[14] to encrypt all relevant information before it leaves the local browser. Although we could use SSL on just the signup page, it's actually easier to implement it site-wide, which has the additional benefits of securing user login (Chapter 8) and making our application immune to the critical *session hijacking* vulnerability discussed in Section 9.1.

Although Heroku now uses SSL for all connections, it's more secure not to rely on the web host for such behavior. Indeed, Heroku didn't used to forward "http" to "https", leading to insecure behavior by default (Figure 7.27).

We can control our app's security ourselves by forcing *all* browsers to use SSL, which is as easy as uncommenting a single line in `production.rb`, the configuration file for production applications. As shown in Listing 7.34, all we need to do is set `config.force_ssl` to `true`.

14. Technically, SSL is now TLS, for Transport Layer Security, but everyone I know still says "SSL".

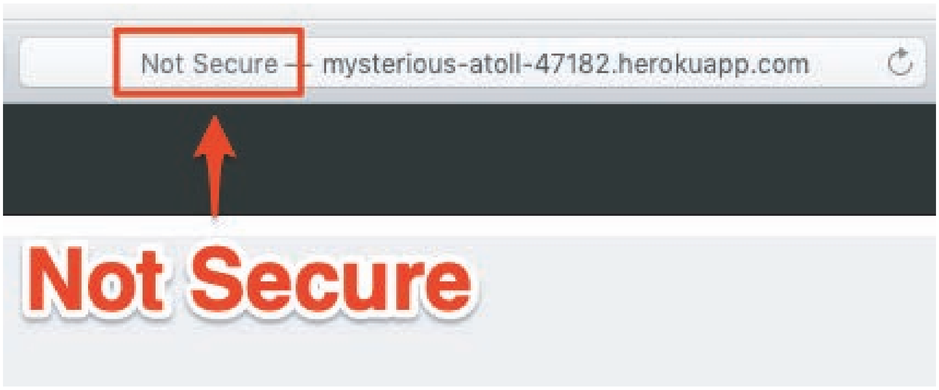


Figure 7.27: Heroku's former behavior using an insecure http URL in production.

Listing 7.34: Configuring the application to use SSL in production.
config/environments/production.rb

```
Rails.application.configure do
  .
  .
  .
  # Force all access to the app over SSL, use Strict-Transport-Security,
  # and use secure cookies.
  config.force_ssl = true
  .
  .
  .
end
```

At this stage, we need to set up SSL on the remote server. Setting up a production site to use SSL involves purchasing and configuring an *SSL certificate* for your domain. That's a lot of work, though, and luckily we won't need it here: For an application running on a Heroku domain (such as the sample application), we can piggyback on Heroku's SSL certificate. As a result, when we deploy the application in Section 7.5.2, SSL will automatically be enabled.

Note: If you're using Cloudflare to handle SSL on a custom domain (as described in *Learn Enough Custom Domains to Be Dangerous* (https://www.learnenough.com/custom-domains)), you *shouldn't* force SSL in the Rails app. Instead, you should keep the **`config.force_ssl`** line in **`production.rb`** commented out (which is the default), or else set it to **`false`** as in Listing 7.35.

Listing 7.35: Configuring a custom domain *not* to use SSL in production.
`config/environments/production.rb`

```ruby
Rails.application.configure do
  .
  .
  .
  # Force all access to the app over SSL, use Strict-Transport-Security,
  # and use secure cookies.
  config.force_ssl = false
  .
  .
  .
end
```

7.5.2 Production Web Server

Having added SSL, we now need to configure our application to use a web server suitable for production applications. Following Heroku's recommendation, we'll use *Puma*, an HTTP server that is capable of handling a large number of incoming requests.

To add the new web server, we simply follow the Heroku Puma documentation (https://devcenter.heroku.com/articles/deploying-rails-applications-with-the-puma-web-server). The first step is to include the `puma` gem in our **`Gemfile`**, but as of Rails 5 Puma is included by default (Listing 3.2). This means we can skip right to the second step, which is to replace the default contents of the file **`config/puma.rb`** with the configuration shown in Listing 7.36. The code in Listing 7.36 comes straight from the Heroku documentation,[15] and there is no need to understand it (Box 1.2).

Listing 7.36: The configuration file for the production web server.
`config/puma.rb`

```ruby
# Puma configuration file.
max_threads_count = ENV.fetch("RAILS_MAX_THREADS") { 5 }
min_threads_count = ENV.fetch("RAILS_MIN_THREADS") { max_threads_count }
```

15. Listing 7.36 changes the formatting slightly so that the code fits in the standard 80 columns.

```
threads min_threads_count, max_threads_count
port        ENV.fetch("PORT") { 3000 }
environment ENV.fetch("RAILS_ENV") { ENV['RACK_ENV'] || "development" }
pidfile ENV.fetch("PIDFILE") { "tmp/pids/server.pid" }
workers ENV.fetch("WEB_CONCURRENCY") { 2 }
preload_app!
plugin :tmp_restart
```

We also need to make a so-called `Procfile` to tell Heroku to run a Puma process in production, as shown in Listing 7.37. The `Procfile` should be created in your application's root directory (i.e., in the same directory as the `Gemfile`).

Listing 7.37: Defining a `Procfile` for Puma.
./Procfile

```
web: bundle exec puma -C config/puma.rb
```

7.5.3 Production Database Configuration

The final step in our production deployment is properly configuring the production database, which (as mentioned briefly in Section 2.3.5) is PostgreSQL. My testing indicates that PostgreSQL actually works on Heroku without any configuration, but the official Heroku documentation recommends explicit configuration nonetheless, so we'll err on the side of caution and include it.

The actual change is easy: All we have to do is update the `production` section of the database configuration file, `config/database.yml`. The result, which I adapted from the Heroku docs, is shown in Listing 7.38.

Listing 7.38: Configuring the database for production.
config/database.yml

```
# SQLite version 3.x
#   gem install sqlite3
#
#   Ensure the SQLite 3 gem is defined in your Gemfile
#   gem 'sqlite3'
#
default: &default
  adapter: sqlite3
  pool: 5
  timeout: 5000

development:
  <<: *default
  database: db/development.sqlite3

# Warning: The database defined as "test" will be erased and
# re-generated from your development database when you run "rake".
# Do not set this db to the same as development or production.
test:
  <<: *default
  database: db/test.sqlite3

 production:
   adapter: postgresql
   encoding: unicode
   # For details on connection pooling, see Rails configuration guide
   # https://guides.rubyonrails.org/configuring.html#database-pooling
   pool: <%= ENV.fetch("RAILS_MAX_THREADS")  5  %>
   database: sample_app_production
   username: sample_app
   password: <%= ENV['SAMPLE_APP_DATABASE_PASSWORD'] %>
```

7.5.4 Production Deployment

With the production web server and database configuration completed, we're ready to commit and deploy:[16]

```
$ rails test
$ git add -A
$ git commit -m "Use SSL and the Puma web server in production"
$ git push && git push heroku
$ heroku run rails db:migrate
```

We can also reset the production database (never do this with a real app's database!) as we did with the development database in Section 7.4.3:

```
$ heroku pg:reset DATABASE
$ heroku run rails db:migrate
```

16. We haven't changed the data model in this chapter, so running the migration at Heroku shouldn't be necessary, but this is true only if you followed the steps in Section 6.4. Because several readers reported having trouble, I've added `heroku run rails db:migrate` as a final step just to be safe.

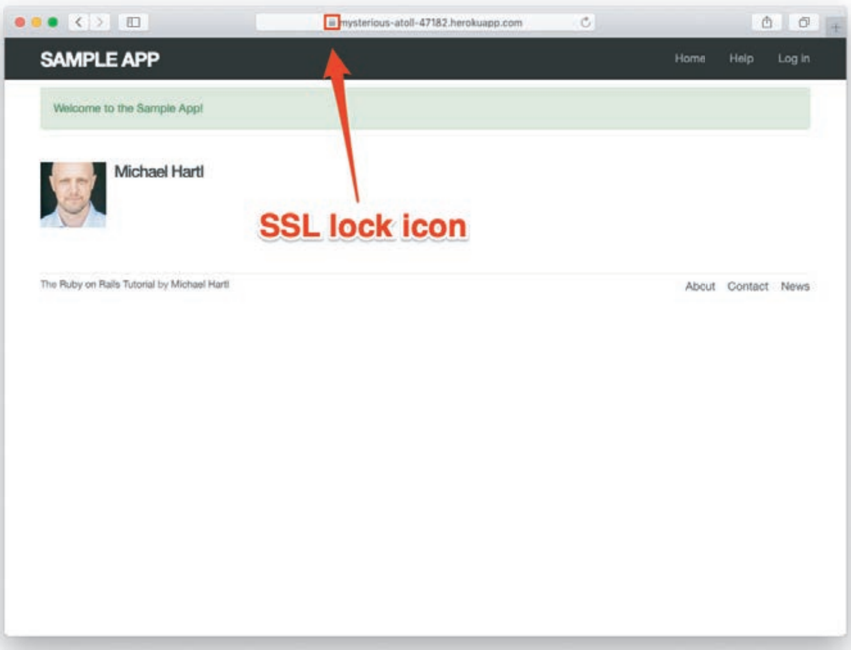

mysterious-atoll-47182.herokuapp.com
SAMPLE APP
Home
Help
Log in
Welcome to the Sample App!
Michael Hartl
SSL lock icon
The Ruby on Rails Tutorial by Michael Hartl
About
Contact
News

Figure 7.28: Signing up on the live Web.

The signup form is now live, and the result of a successful signup is shown in Figure 7.28. Note the presence of a lock icon in the address bar of Figure 7.28, which indicates that SSL is working.

Exercises

To see other people's answers and to record your own, subscribe to the Rails Tutorial course or to the Learn Enough All Access Subscription.

1. Confirm on your browser that the SSL lock and `https` appear.
2. Create a user on the production site using your primary email address. Does your Gravatar appear correctly?

7.6 Conclusion

Being able to sign up users is a major milestone for our application. Although the sample app has yet to accomplish anything useful, we have laid an essential foundation for all future development. In Chapter 8 and Chapter 9, we will complete our authentication machinery by allowing users to log in and out of the application (with optional "remember me" functionality). In Chapter 10, we will allow all users to update their account information, and we will allow site administrators to delete users, thereby completing the full suite of Users resource REST actions from Table 7.1.

7.6.1 What We Learned in This Chapter

- Rails displays useful debug information via the **`debug`** method.
- Sass mixins allow a group of CSS rules to be bundled and reused in multiple places.
- Rails comes with three standard environments: **`development`**, **`test`**, and **`production`**.
- We can interact with users as a *resource* through a standard set of REST URLs.
- Gravatars provide a convenient way of displaying images to represent users.
- The **`form_with`** helper is used to generate forms for interacting with Active Record objects.
- Signup failure renders the new user page and displays error messages automatically determined by Active Record.
- Rails provides the **`flash`** as a standard way to display temporary messages.
- Signup success creates a user in the database and redirects to the user show page, and displays a welcome message.
- We can use integration tests to verify form submission behavior and catch regressions.
- We can configure our production application to use SSL for secure communications and Puma for high performance.

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