

LEARN RUBY ON RAILS



BOOK
ONE

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Learn Ruby on Rails: Book One

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Chapter 1

Introduction

Welcome. This is a first step on your path to learn Ruby on Rails.

This book contains the background that's missing from other tutorials. Here you'll learn key concepts so you'll have a solid foundation for continued study. Whether you choose to continue with another book in this series, a video course, or a code school, everything will make sense when you start here.

You can read this book anywhere, at your leisure, on your phone or tablet. Use this book to gain background understanding when you are not at your computer. With Book Two, the next in the series, you'll need a computer at hand so you can build your first web application.

In Book Two, you'll build a working web application so you'll gain hands-on experience. Along the way, you'll practice techniques used by professional Rails developers. And I'll help you'll understand why Rails is a popular choice for web development.

You can start with Book Two before finishing this book if you're eager to get started building your first application. In fact, I recommend it, because the hands-on learning in Book Two reinforces the concepts you learn in this book.

Is It for You?

If you've built simple websites using HTML, you'll quickly progress to building websites with Rails. Or, if you have experience in a language such as PHP or Java, you'll make the jump to the Rails framework. But I promise you don't need to be a programmer to succeed with this book or the next. You'll be surprised how quickly you become familiar with the Unix command line interface and the Ruby programming language even if you've never tried programming before.

My books are ideal if you are:

- a student
- a startup founder
- making a career change

Some readers are happy to learn to communicate with developers they work with. If you are starting a business, and hiring developers, or working alongside developers as a manager or developer, this book will help you talk with developers. However, the true purpose of my book is to help you become you a Rails developer yourself. I want to help you launch a startup or begin a new career.

What To Expect

There is deep satisfaction in building an application and making it run. With this book and the next, I'll give you everything you need to build a real-world Rails application. More importantly, I'll explain everything you build, so you understand how it works.

When you've completed this tutorial, you will be ready for more advanced self-study, including the [Capstone Rails Tutorials](#), textbook introductions to Rails,

or workshops and code camps that provide intensive training in Ruby on Rails. Other curriculums often skip the basics. With this tutorial you'll have a solid grounding in key concepts. You won't feel overwhelmed or frustrated as you continue your studies. I think you'll also have fun!

This book is good preparation for:

- textbooks such as Michael Hartl's [Ruby on Rails Tutorial](#)
- introductory workshops from [RailsBridge](#) or [Rails Girls](#)
- intensive training with immersive code camps
- [Capstone Rails Tutorials](#) from the [RailsApps Project](#)

We are blessed with many textbooks, workshops, and classroom programs that teach Ruby on Rails. I believe this book is unique in covering the basics while introducing the tools and techniques of professional Rails development.

What's in Book One

Book One is a self-help book that can change your life, though here you won't find any inspirational quotes or magical thinking.

I explain the culture and practices of the Rails community. I introduce the basic concepts you'll need to understand web application development. You'll learn how to be a successful learner and how to get help when you need it. I also provide a plan for study so you can learn more when you need it. There's so much to learn, it helps to have a map so you know where to go next.

Programming can be frustrating and Rails isn't easy for beginners. The chapter, "Rails Challenges," describes many of the problems learners encounter. It's natural to get discouraged so take a look when you begin to feel overwhelmed.

Two chapters, "Crossing the Chasm", and "Level Up", will help you after you put the book down. Many learners feel stranded if their only experience is

step-by-step tutorials. These chapters are designed to give you a strategy for building an application on your own.

What's in Book Two

You'll start coding in Book Two. It's a hands-on tutorial that will lead you through the code needed to build a real-world web application. Don't skip around in Book Two. The tutorial is designed to unfold in steps, one section leading to another, until you reach the "Testing" chapter.

You can complete Book Two in one long weekend, though it will take concentration and stamina. If you work through the book over a longer timespan, try to set aside uninterrupted blocks of two hours or more for reading and coding, as it takes time to focus and concentrate.

Feel free to start Book Two before you finish this book. Begin coding with Book Two while you get background knowledge from this book at your leisure.

A Warning About Links

My books are densely packed with links to background reading. If you click every link, you'll be a well-informed student, but you may never finish the book! It's up to you to master your curiosity. Follow the links only when you want to dive deeper.

What Comes Next

The best way to learn is by doing; when it comes to code, that means building applications. Hands-on learning with actual Rails applications is the key to absorbing and retaining knowledge.

After you read this book, you'll be able to work with the example applications from the [RailsApps Project](#). The project provides open source example ap-

plications for Rails developers, for free. Each application is accompanied by a tutorial in the Capstone Rails Tutorials series, so there's no mystery code. Each application can be generated in a few minutes with the [Rails Composer](#) tool, which professional developers use to create starter applications.

The RailsApps Project is solely supported by sales of the books and the [Capstone Rails Tutorials](#). If you purchase the Capstone Rails Tutorials, you'll keep the project going. And you'll have my sincere appreciation for your support.

Versions

Book One is relevant and useful for any version of Rails. Book Two requires a specific version of Rails (the newest at the time it was revised) and shows how to install the latest version of Rails.

Staying In Touch

If you obtained this book from Amazon or another retailer, take a moment to get on the mailing list for the book. I'll let you know when I release updates to the book.

- [Get on the mailing list for the book](#)

A Note to Reviewers and Teachers

This book approaches the subject differently than most introductions to Rails. It introduces concepts of product planning, project management, and website analytics to place development within a larger context of product development and marketing. In Book Two, rather than show the student how to use scaffolding, I introduce the model-view-controller design pattern by creating the components manually. Lastly, though every other Rails tutorial shows how to

use a database, Book Two doesn't, because I want the book to be a short introduction and I believe the basic principles of a web application stand out more clearly without adding a database to the application. Though this tutorial is not a typical Rails introduction, I hope you'll agree that it does a good job in preparing Rails beginners for continued study, whether it is a course or more advanced books.

Using the Book in the Classroom

If you've organized a workshop, course, or code camp, and would like to assign the book as recommended reading, contact me at daniel@danielkehoe.com to arrange access to the book for your students. The book is available at no charge to students enrolled in qualified workshops or classes.

Let's Get Started

In the next chapter, we'll start with basic concepts.

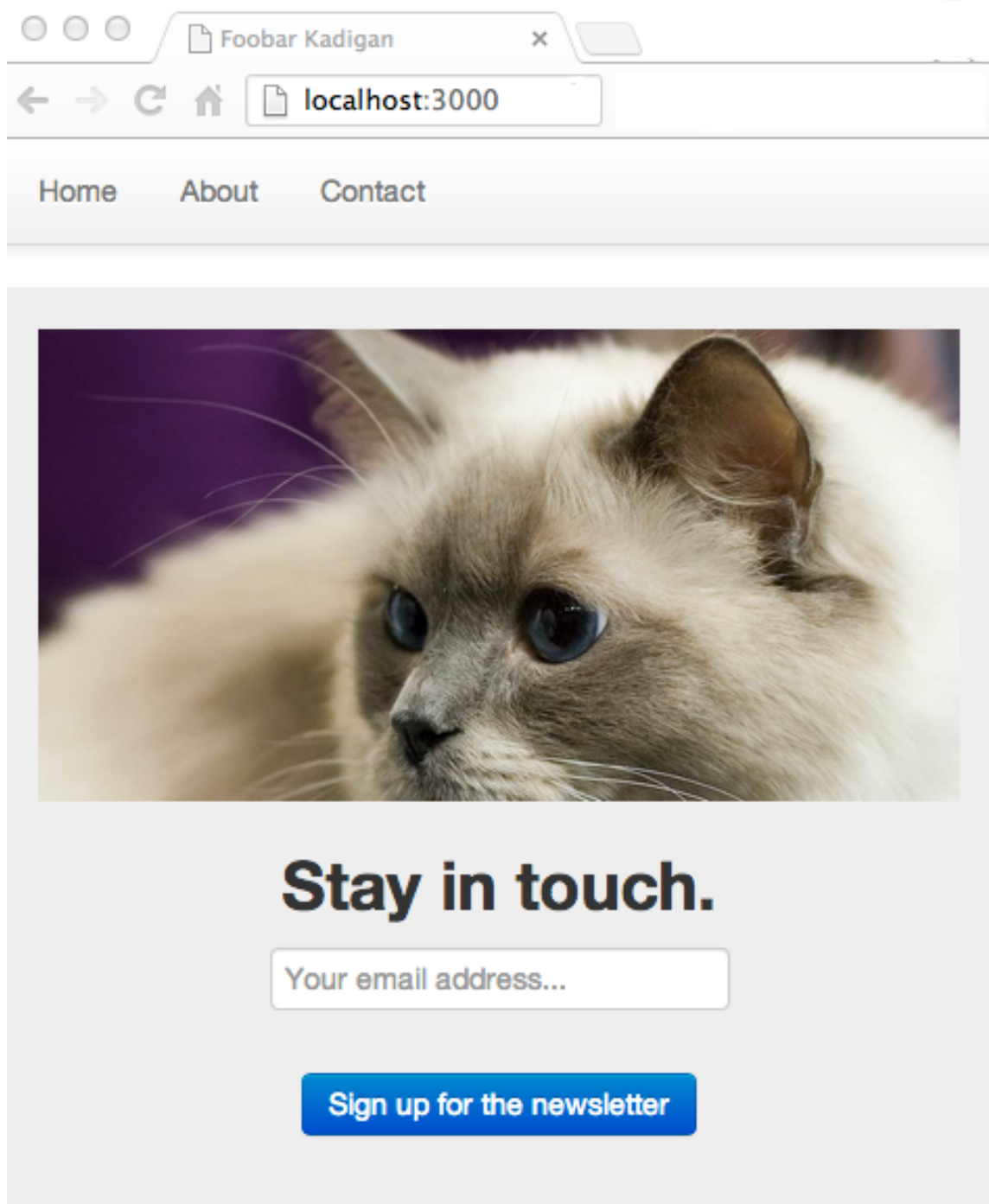


Figure 1.1: The application you will build in Book Two.

Chapter 2

Concepts

This chapter provides the background, or big picture, you will need to understand Rails.

These are the key concepts you'll need to know before you try to use Rails.

In the following two chapters, you'll gain a deeper understanding of Rails, including its history, the guiding principles of Rails, and reasons for its popularity. First, let's consider how the web works.

How the Web Works

We start with absolute basics, as promised.

When you “visit a website on the Internet” you use a *web browser* such as Safari, Chrome, Firefox, or Internet Explorer.

Web browsers are *applications* (software programs) that work by reading *files*.

Compare a *word processing program* with a *web browser*. Both word processing programs and web browsers read files. Microsoft Word reads files that are stored on your computer to display documents. A web browser retrieves files from remote computers called *servers* to display web pages. Simply put, the

World Wide Web is nothing more than files delivered to web browsers by web servers.

Web browsers make *requests* to web servers. Every web address, or *URL*, is a request to a web server. A web server *responds* by sending one or more files. We call this the *request-response cycle*.

Everything displayed by a web browser comes from four kinds of files:

- HTML - *structure* (layout) and *content* (text)
- CSS - *stylesheets* to set visual appearance
- JavaScript - *programming* to alter the page
- Multimedia - images, video, or other media files

At a minimum, a web page requires an HTML file. HTML files contain the words you see on a web page, along with *markup tags* that indicate headlines, paragraphs, and other types of text such as lists. If a web browser receives only an HTML file, it will display text, with default styles for headlines and paragraphs supplied by the browser.

Because it is the World Wide Web, HTML files also contain *hypertext links* to other web pages. Sometimes links appear in the form of a button or an image. Sometimes a web page contains a form with a button that sends information to the web server. Links are web addresses, or URLs, and (you guessed it), they return files.

If the page is always the same, every time it is displayed by the web browser, we say it is *static*. Webmasters don't need software such as Rails to deliver static documents; they just create files for delivery by an ordinary *web server* program. When you learn HTML and create simple web pages, you learn to upload files to a hosting service that provides web servers that deliver your HTML files to web browsers. In principle, you can run a web server delivering web pages from your computer at home but, in practice, most people want a

web server that runs 24 hours a day and is located in a *data center* that has fast and reliable connections to the Internet.

Static websites are ideal for particle-physics papers (which was the original use of the World Wide Web). But most sites on the web, especially those that allow a user to sign in, post comments, or order products and services, generate web pages *dynamically*. When you see a form with a button, you probably are looking at a page that makes a request to a web application.

Dynamic websites often combine web pages with information from a database. A database stores information such as a user's name, comments, advertisements, or any other repetitive, structured data. A database *query* can provide a selection of data that customizes a webpage for a particular user or changes the web page so it varies with each visit.

Dynamic websites use a programming language such as [Ruby](#) to assemble HTML, CSS, and JavaScript files on the fly from component files or a database. A software program written in Ruby and organized using the Rails *development framework* is a Rails *web application*. A web server program that runs Rails applications to generate dynamic web pages is an *application server* (but usually we just call it a web server).

Software such as Rails can access a database, combining the results of a database query with static content to be delivered to a web browser as HTML, CSS, and JavaScript files. Keep in mind that the web browser only receives ordinary HTML, CSS, and JavaScript files; the files themselves are assembled dynamically by the Rails application running on the server.

Even if you are not going to use a database, there are good reasons to generate a website using a programming language. For example, if you are creating several web pages, it often makes sense to assemble an HTML file from smaller components. For example, you might make a small file that will be included on every page to make a footer (Rails calls these “partials”). Just as importantly, if you are using Rails, you can add features to your website with code that has been developed and tested by other people so you don't have to build everything yourself.

The widespread practice of sharing code with other developers for free, and collaborating with strangers to build applications or tools, is known as *open source* software development. Rails is at the heart of a vibrant open source development community, which means you leverage the work of tens of thousands of skilled developers when you build a Rails application. When Ruby code is packaged up for others to share, the package is called a *gem*. The name is apt because shared code is valuable, like a gem.

Ruby is a programming language. *Rails* is a development framework. Rails is software code written in the Ruby language. It is a *library* or collection of gems that we add to the core Ruby language. More importantly, Rails is a set of *structures and conventions* for building a web application using the Ruby language. By using Rails, you get well-tested code that implements many of the most-needed features of a dynamic website. When you need additional features, you can add additional gems.

With Rails, you will be using shared standard practices that make it easier to collaborate with others and maintain your application. As an example, consider the code that is used to access a database. Using Ruby without the Rails framework, or using another language such as PHP, you could mix the complex programming code that accesses the database with the code that generates HTML. With the insight of years of developers' collective experience in maintaining and debugging such code, Rails provides a library of code that segregates database access from the code that displays pages, enforcing *separation of concerns*, and making more modular, maintainable programs.

In a nutshell, that's how the web works, and why Rails is useful.

For more on the history of Rails, and an explanation of why it is popular, see the next chapters. But before we dive into Rails, let's look at the increasingly complex world of web development, particularly the difference between front-end and back-end applications, and the programming languages we use, Ruby and JavaScript.

Programming Languages

JavaScript and Ruby are both general-purpose programming languages.

Developers use other popular programming languages such as C, Python, and Java. And developers like to talk about newer languages such as Elixir and Go, often [comparing the popularity](#) of programming languages. Most developers use only one or two popular languages on the job such as Ruby and JavaScript but hardcode programmers love to try new languages.

Just a note: Java and JavaScript are unrelated, except by name. Java is a general-purpose language used in large enterprises, such as banking, where large teams of developers build applications. JavaScript is a language that was developed for use in web browsers. It was named “JavaScript” to take advantage of the popularity of Java but has little in common with Java except for the name.

And a further note: HTML, the Hypertext Markup Language, is not a programming language. It is a *markup language* that uses tags to add structure and links to text. It doesn’t allow *conditional execution* such as `if... then... else` which is key to programming. If you know HTML you can be a “coder,” writing HTML code, but you are not really a programmer.

Ruby and JavaScript

Ruby is the programming language you’ll use when creating web applications that run on your local computer or a remote server using the Rails web application development framework.

JavaScript is the programming language that controls every web browser. The companies that build web browsers (Google, Apple, Microsoft, Mozilla, and others) agreed to use JavaScript as the standard browser programming language. You might imagine an alternative universe in which Ruby was the browser programming language. That’s not the real world; plus it would be

boring, as learning more than one language makes us smarter and better programmers.

JavaScript and JQuery

Though most of the code in Rails applications is written in Ruby, developers add JavaScript to Rails applications to implement features such as browser-based visual effects and user interaction. For simple Rails applications, you only need to learn Ruby. For more sophisticated web applications, you'll need to know both Ruby and JavaScript.

JavaScript was first used on websites to add little features to the browser. For example, JavaScript can be used to display the current date and time on a web page. Or JavaScript can be used to pop up an annoying window when you try to leave a web page. There was little consistent structure to early JavaScript programs. And because JavaScript is an older language without a built-on package manager, there were no package libraries like Ruby gems to add functionality. Instead, web developers shared scripts or snippets of code to add commonly-implemented features.

JQuery

In 2006, a group of developers released [jQuery](#), a robust collection of scripts that are a foundation for most of the simple interactive user features found on websites today. Rails includes jQuery as part of any Rails application. You'll find jQuery on 65% of websites.

To understand jQuery, you need to know that every web browser takes an intermediate step between receiving an HTML file and displaying a web page. After a web browser receives a file from a web server, it creates code in the computer's memory that describes the web page, complete with text and formatting, which we call the *Document Object Model*, or DOM. JQuery scripts

manipulate the DOM, which is the web browser's internal representation of web page. JQuery commands make changes to the DOM. For example, you can write Javascript that replaces words on the page with different words. Or you can hide and reveal sections of the page.

Many Rails applications use jQuery or pure JavaScript to add interactive browser features. Though it is easy to add JavaScript to web pages generated by Rails, the result is often “JavaScript gravy” or “soup:” a sloppy mix of JavaScript snippets and jQuery plugins poured over Rails views. After seeing applications built with JavaScript soup, developers often get an urge to adopt a framework like Rails for JavaScript, with standard structures and conventions to organize code.

We'll look at JavaScript frameworks later in this chapter. But first, consider a universe where JavaScript is the only language you need to know. Not all developers use Rails; some use full-stack JavaScript.

Full-Stack JavaScript

In the last few years, developers have been improving the JavaScript language so it can be used for server-side development as well as development of applications that run in the browser. System administrators can install the [Node.js](#) code library to enable servers to run JavaScript. Server-side JavaScript web application frameworks are available, such as [Express](#) and [Meteor](#), but none are as popular as Ruby on Rails. Some code schools are now teaching “full stack JavaScript” using the “MEAN Stack,” which combines four popular JavaScript technologies; MongoDB, Express, AngularJS, and Node.js.

There are at least a dozen popular languages that developers use to build web applications. This will continue to be true. Full-stack JavaScript is now an option but Rails is not going away. For now, the Rails ecosystem is better known with more resources for building web applications and learning development. There will always be jobs for Rails developers. Startups will always be able to find developers who have experience with Rails. Your effort in learning Rails will continue to be worthwhile. However, it is important to learn JavaScript as

well.

Front and Back Ends

We often talk about “front-end” and “back-end” development. The architecture of the web, split between web browsers running on local computers and web application programs running on remote servers, is inherently *client-server*. When we write applications for both the front end and back end, we are *full-stack* developers.

Full-stack developers handle it all, including connections to database servers, server-side web applications, JavaScript for web browsers, and *system administration* of Unix servers. Increasingly, as web development gets more complex, there are fewer full-stack developers and more specialists. If you are building a web application for your own business, you may need to be a full-stack developer. But if you look for a job, you may choose to specialize as a front-end or back-end developer. Front-end developers have some design skill, worry a lot about user experience, and develop expertise with JavaScript. Back-end developers don’t worry as much about design. They focus on the architecture of applications, database structure, and application performance using Ruby.

Rails was originally created for full-stack development. Its *model-view-controller* architecture manages both connections to databases and display of web pages, requiring nothing more than the Ruby language and the Rails software library. JavaScript was originally created for front-end development. Some developers now use JavaScript for full-stack development but it is still primarily used for adding interactive features to web pages.

Rails is popular for both the front end and the back end. The conventions of building Rails applications are widely known and a developer can leverage the work of tens of thousands of other developers by including open-source gems. A Rails back end can connect to thousands of different services and efficiently handle traffic for any average website. If your business is so successful that you must deal with problems of scale, you’ll find many Rails experts able to help.

For these reasons, developers continue to use Rails to build web applications, even as full-stack JavaScript grows in popularity.

JavaScript is becoming more popular but developers will continue to build full-stack Rails applications where complex JavaScript user interfaces are not required. This could be quick “minimal viable product” (MVP) tests of business ideas or any project where it is too costly to invest in separate front-end and back-end development. If you are going to quickly build a web application, and launch a business, just build it with Rails and don’t worry about implementing features in JavaScript.

If you want a complex front end that uses JavaScript extensively, you may still want to use Rails for the back end.

Rails 5

The Rails 5 beta version was released December 18, 2015. The final version will be out in early 2016.

Rails 5 recognizes the increasing use of Rails for back-end development. Rails 5 offers an option to build back-end-only applications that don’t generate browser views. Instead, a stripped-down Rails 5 application returns data that can be consumed and displayed by another application. With this approach, you can have Rails on the back end and a JavaScript web browser application, or a mobile application, on the front end.

With Rails 5, you can build a back-end application that just delivers data to a front-end application. Before Rails 5, most Rails applications generated entire web pages containing the results from a database query. Now with Rails 5, Rails developers have begun to build web applications that deliver just data, in the JSON (JavaScript Object Notation) format. With this approach, the Rails application provides an API, or *application programming interface*, that provides standardized responses to requests from an application in the hands of a user, which could be an IOS or Android application on a phone, or a JavaScript application running in a web browser.

Now that you’ve learned about the differences between front-end and back-end applications, let’s learn about popular JavaScript frameworks.

JavaScript Frameworks

I’ve described Rails as a web development framework that uses the Ruby language. You can also find web development frameworks that uses the JavaScript language.

JavaScript frameworks were first developed so developers could build SPAs, *single-page applications*. Early examples of SPAs, such as Apple’s MobileMe or iWork in 2008, were attempts to use JavaScript to build desktop-like applications to run in the web browser. The goal was to create RIAs, rich Internet applications, with similarities to software applications installed on the Mac or Windows, using JavaScript. Of course, no one really wants desktop applications anymore. We browse web pages to get information. We install mobile apps to get access to services. Sometimes we want access to services in web browsers. But we don’t really want desktop applications in a web browser.

AngularJS and Ember.js

[AngularJS](#) and [Ember.js](#) are the most popular JavaScript frameworks used to build single-page applications. They provide the structure and conventions that developers want for maintainable code. For complex, richly interactive web applications, these frameworks get rid of the “JavaScript soup” that is common in Rails applications.

Unlike Rails, which is hugely popular, none of these JavaScript frameworks have achieved hegemony or dominance among developers. For a learner, these frameworks require more programming experience than Rails. All of these frameworks break the familiar request-response cycle of the web. Just one URL delivers the entire single-page application. There are no web pages, only views

that change completely or partially in response to user actions. Drawbacks to single-page applications are a slow initial load of the application, difficulty using analytics tools such as Google Analytics which rely on new pages loading in the browser, and views that won't show up in Google search results. For all these reasons, single-page applications are best used to deliver services, not information, and require advanced skills to develop.

React

There's a newer framework that can be used to dry up JavaScript soup. It's [React](#), a JavaScript framework developed by engineers at Facebook. It can be used for single-page applications or to organize JavaScript for interactive features in ordinary Rails applications. Unlike AngularJS or Ember.js, React only manages views, not connections to databases or routing of requests, so it is not a full-stack framework, just a framework for the view layer. React's approach to building web pages is abstract and complex. But React is a good choice for complex interactive features, if you're determined to avoid JavaScript soup in your Rails application.

Ultimately, your decision to use JavaScript, and how much, depends on the kind of web application you want to build. If you want to build a product catalog, with many simple pages populated by a database, a full-stack Rails application may be all you need, perhaps with a few jQuery plugins. If your application is like Facebook, with lots of interactive features and many different pages, React may be a good choice as part of a full-stack Rails application. If you want to deliver a service such as live stock-market charts, you may want to build a complex single-page application using AngularJS or Ember.js, plus IOS and Android apps, connected to a Rails API server.

If you're going to use JavaScript, either full-stack, or combined with Rails, use a JavaScript framework to avoid JavaScript soup. React could be a good place to start.

You'll have a better idea of the importance of Rails if you understand "What is Rails?" Let's look at that next.

Chapter 3

What is Rails?

Rails is a *library*, or collection of code, plus *structures and conventions* for building a web application.

Technically, it is a package library (a RubyGem), that is installed using the operating system command-line interface, and adds functionality to the Ruby language.

Rails provides structures and conventions for web development, so less code is required to build a web application. All Rails applications use the same structures, providing consistency among applications. Common and well-known conventions make it easy for developers to collaborate on Rails applications and share improvements and add-on code libraries with a wide community.

The structures and conventions of Rails are codified as the Rails API (the [application programming interface](#), or directives that control the code). The Rails API is documented [online](#) and described in books, articles, and blog posts. Learning Rails means learning how to use the Rails conventions and its API.

Rails as a Community

Rails, in a larger sense, is more than a software library and an API. Rails is the central project of a vast community that produces software libraries that simplify the task of building complex websites. Members of the Rails community share many core values, often use the same tools, and support each other with an informal network that is built on volunteerism. Overlapping the informal community is an economic network that includes jobs, recruiters, consulting firms, conferences, businesses that build websites with Rails, and investors that fund startups. Rails is popular among web startups, significantly because the pool of open source software libraries (RubyGems, or “gems”) makes it possible to build complex sites quickly.

This, then, is Rails: a software library and an API, plus a community of enthusiastic developers. But to learn to use Rails, you’ll need to consider it from additional points of view.

Six Perspectives on Rails

To really understand Rails, and succeed in building Rails applications, we need to consider Rails from six additional perspectives.

A parable from the Indian subcontinent describes six blind men who encounter an elephant. The blind man who feels a leg says the elephant is like a pillar; the one who feels the tail says the elephant is like a rope; the one who feels the belly says the elephant is like a wall; and so on. Like six blind men encountering an elephant, it can be difficult to understand Rails unless you look at it from multiple points of view.

Here are six different ways of looking at Rails.

Web Browser Perspective

From the **perspective of the web browser**, Rails is simply a program that generates HTML, CSS, and JavaScript files. These files are generated dynamically. You can't see the files on the server side but you can view these files by using the web developer tools that are built in to every browser. Later you'll examine these files when you learn to troubleshoot a Rails application.

Programmer Perspective

From the **perspective of a programmer**, Rails is a set of files organized with a specific structure. The structure is the same for every Rails application; this makes it easy to collaborate with other Rails developers. We use text editors to edit these files to make a web application.

Software Architect Perspective

From the **perspective of a software architect**, Rails is a structure of *abstractions* that enable programmers to collaborate and organize their code. Thinking in abstractions means we group things in categories and analyze relationships. Conceptual categories and relationships can be made “real” in code. Software programs are built of “concepts made real” that are the moving parts of a software machine.

Notice that we are talking about abstractions, using language like a philosopher. Most tutorials give you step-by-step instructions, like following a recipe. You'll get that in Book Two in this series. But to really understand programming, you should grasp that we are working with “abstractions made real.” The area of your brain that follows instructions is distinct from the area that thinks abstractly. To be a programmer, you'll need both parts of the brain working together. Don't worry; I'll explain the abstractions in terms anyone can understand.

To a software architect, *classes* are the basic parts of a software machine. A class can represent something in the physical world as a collection of various attributes or properties (for example, a User with a name, password, and email address). Or a class can describe another abstraction, such as a Number, with attributes such as quantity, and behavior, such as “can be added and subtracted.” You’ll get a better grasp of classes in Book Two when you learn “Just Enough Ruby.”

To a software architect, Rails is a pre-defined set of classes that are organized into a higher level of abstraction known as an API, or *application programming interface*. The [Rails API](#) is organized to conform to certain widely known *software design patterns*. You’ll become familiar with these abstractions as you build a Rails application. Later in the tutorial, we’ll learn about the *model–view–controller* design pattern. As a beginner, you will see the MVC design pattern reflected in the file structure of a Rails application. That’s where you will first see “abstractions made real.”

Gem Hunter Perspective

We can look at Rails from the **perspective of a gem hunter**. Rails is popular because developers have written and shared many software libraries (RubyGems, or “gems”) that provide useful features for building websites. We can think of a Rails application as a collection of gems that provide basic functionality, plus custom code that adds unique features for a particular website. Some gems are required by every Rails application. For example, database adaptors enable Rails to connect to databases. Other gems are used to make development easier, for example, gems for testing that help programmers find bugs. Still other gems add functionality to the website, such as gems for logging in users or processing credit cards. Knowing what gems to use, and why, is an important aspect of learning Rails. Book Two will show you how to build a web application using some of the most commonly used gems.

Time Traveler Perspective

We can also look at Rails from the **perspective of a time traveler** in order to understand the importance of *software version control*. Specifically, we use the [Git](#) revision control system to record a series of snapshots of your project's filesystem. Git makes it easy to back up and recover files; more importantly, Git lets you make exploratory changes, trying out code you may decide to discard, without disturbing work you've done earlier. You can use Git with [GitHub](#), a popular “social coding” website, for remote backup of your projects and community collaboration. Git can keep multiple versions (“branches”) of your local code in sync with a remote GitHub repository, making it possible to collaborate with others on open source or proprietary projects. Strictly speaking, Git and GitHub are not part of Rails (they are tools that can be used on any development project). And there are several other version control systems that are used in open source development. But a professional Rails developer uses Git and GitHub constantly on any real-world Rails project.

Tester Perspective

Finally, we can consider a Rails application from the **perspective of a tester**. Software testing is part of Rails culture; Rails is the first web development platform to make testing an integrated part of development. Before Rails, automated testing was rarely part of web development. A web application would be tested by users and (maybe) a QA team. If automated tests were used, the tests were often written after the web application was largely complete. Rails introduced the discipline of Test-Driven Development (TDD) to the wider web development community. With TDD, tests are often written *before* any implementation coding. It may seem odd to write tests first, but for a skilled TDD practitioner, it brings coherence to the programming process. First, the developer will give thought to what needs to be accomplished and think through alternatives and edge cases. Second, the developer will have complete test coverage for the project. With good test coverage, it is easier to *refactor*, rearranging code to be more elegant or efficient. Running a test suite after refactoring

provides assurance that nothing inadvertently broke after the changes. TDD is seen as a necessary skill of an experienced Rails developer. Book Two will introduce you to the basic concepts of test-driven development and show you how to write simple tests.

You’ve seen Rails from six different perspectives. You understand Rails is a software library plus an API, as well as a community of developers. Now let’s dive deeper and consider how Rails fits in to a larger *technology stack* and how it can vary within the stack.

Understanding Stacks

To understand Rails from the perspective of a professional Rails developer, you’ll need to grasp the idea of a *technology stack* and recognize that Rails can have more than one stack.

Full Stack

A technology stack is a set of technologies or software libraries that are used to develop an application or deliver web pages. “Stack” is a term that is used loosely and descriptively. It is a collection of technologies that fit together, interacting with each other, and providing different types of services. We say “stack” because we use different software systems or software libraries as if they were building blocks or bricks deployed in layers.

Often we consider a stack as layers added to the operating system. For a web application, we need a web server, a database, a programming language, and perhaps additional software libraries.

Earlier we learned that full-stack developers have skills to work with operating systems, web servers, databases, web applications, and JavaScript programs in a web browser. That’s a formidable stack of technologies.

There is no organization that tells you what building blocks you must use. As a

technologist, your choice of stack reflects your experience, values, and personal preference, just like religion or favorite beverage.

For example, Mark Zuckerberg developed Facebook in 2004 using the [LAMP](#) application stack:

- Linux (operating system)
- Apache (web server)
- MySQL (database)
- PHP (programming language)

Zuckerberg chose an operating system, a web server, a database, and a programming language with which he was comfortable. In 2004, Rails was not well known and Zuckerberg chose to implement his ideas using PHP without any additional web application software library.

For this tutorial, your application stack will be:

- Mac OS X, Linux, or Windows
- WEBrick (web server)
- SQLite (database)
- Ruby on Rails (language and framework)

You'll use an operating system that's familiar to you, a basic web server that comes with Ruby, a database that's preinstalled with Mac or Linux operating system, the Ruby language, and the Rails web application software library.

Rails Stacks

Sometimes when we talk about a stack, we only care about part of a larger stack. For example, a Rails stack includes the gems we choose to add features to a website or make development easier. When we select the gems we'll use for a Rails application, we're choosing a stack or layers of services we need just for a web application.

Sometimes the choice of components is driven by the requirements of an application. At other times, the stack is a matter of personal preference. Just as craftsmen and aficionados debate the merits of favorite tools and techniques in any profession, Rails developers avidly dispute what's the best Rails stack for development.

The company [37signals](#), where the creator of Rails works, uses this Rails stack:

- ERB for view templates
- MySQL for databases
- Minitest for testing

It is not important (at this point) to know what the acronyms mean (we'll learn later).

Another stack is more popular among Rails developers:

- Haml for view templates
- PostgreSQL for databases
- RSpec for testing

We'll learn later what the terms mean. For now, just recognize that parts of the Rails framework can be swapped out, just like making substitutions when you

order from a menu at a restaurant. The Rails stack can vary, and it is part of a larger stack that includes an operating system, web server, and database.

You can learn much about Rails by following the experts' debates about the merits of a favorite stack. The debates are a source of much innovation and improvement for the Rails framework. In the end, the power of the crowd prevails; usually the best components in the Rails stack are the most popular.

The proliferation of choices for the Rails stack can make learning difficult, particularly because the components used by many leading Rails developers are not the components used in many beginner tutorials. In this tutorial, we stick to solid ground where there is no debate. In more advanced tutorials, we'll explore stack choices and choose components that are most often used by professional developers.

Chapter 4

Why Rails?

Before you start building an application with Rails, it may help to know why developers like using Rails. This chapter looks at the history of Rails, its organizing principles, and the reasons for its popularity. First, though, we'll consider Ruby, the language used for Rails.

Why Ruby?

Ruby is a programming language, created 20 years ago by Yukihiro “Matz” Matsumoto. By most measures of programming language popularity, Ruby [ranks among the top ten](#), though usually as tenth (or so) in popularity, and largely due to the popularity of Rails. Like Java or the C language, Ruby is a general-purpose programming language, though it is best known for its use in web programming.

In a podcast from [This Developer's Life](#) and in an [interview from 2005](#), David Heinemeier Hansson, the creator of Rails, describes building an online project management application named BaseCamp in 2004. He had been using the PHP programming language because he could get things done quickly but was frustrated because of a lack of abstraction and frequently repetitive code that made PHP “dirty.” Hansson wanted to use the “clean” software engineering ab-

stractions supported in the Java programming language but found development in Java was cumbersome. He tried Ruby and was excited about the ease of use (he calls it pleasure) he found in the Ruby language.

Ruby is known among programmers for a terse, uncluttered syntax that doesn't require a lot of extra punctuation. Compared to Java, Ruby is streamlined, with less code required to create basic structures such as data fields. Ruby is a modern language that makes it easy to use high-level abstractions such as metaprogramming. In particular, metaprogramming makes it easy to develop a “domain specific language” that customizes Ruby for a particular set of uses (Rails and many gems use this “DSL” capability).

Ruby's key advantage is RubyGems, the package manager that makes it easy to create and share software libraries (gems) that extend Ruby. RubyGems provides a simple system to install gems. Anyone can upload a gem to the central RubyGems website, making the gem immediately available for installation by anyone. The RubyGems website is where you'll obtain the most recent version of Rails. And it is where you will obtain all the gems that help you build complex websites.

Ruby has several disadvantages (at least when programmers want to argue). Its processing performance is slow relative to C++ or Java. The execution speed of a language is seldom important, though, relative to the benefits gained by programmer productivity and the general level of performance required by most websites. For websites that require lots of simultaneous activity, Ruby is not well-suited to the sophisticated software engineering required to execute simultaneous activity efficiently (standard Ruby lacks “parallelism”, though some versions support it). Lastly, some programmers complain that Ruby programs (and especially Rails) contain “too much magic” (that is, complex operations that are hidden behind simple directives). These concerns haven't stopped Rails from becoming a popular web development platform.

Why Rails?

Rails is popular and widely used because its conventions are pervasive and astute. Any web application has complex requirements that include basic functions such as generating HTML, processing form submissions, or accessing a database. Without a web application development framework, a programmer has a mammoth task to implement all the required infrastructure. Even with a web application development framework, a programmer can take an idiosyncratic approach, building something that no one else can easily take apart and understand. The singular virtue of Rails is that Heinemeier Hansson, and the core team that joined him, decided that there is one best way to implement much of the infrastructure required by a web application. Many of the implementation decisions appear arbitrary. In fact, though Heinemeier Hansson is often lambasted as autocratic in his approach to improving Rails, the Rails API reflects deep experience and intelligence in implementing the requirements of a web application development framework. The benefit is that every developer who learns the “Rails way” produces a web application that any other Rails developer can unravel and understand more quickly than if they encountered idiosyncratic code without as many conventions. That means collaboration is easier, development is quicker, and there’s a larger pool of open source libraries to enhance Rails.

The advantage of establishing conventions might seem obvious, but when Rails was released in 2004, web development was dominated by PHP, which lent itself to idiosyncratic code produced by solo webmasters, and Java frameworks such as Struts, which were often seen as burdened by an excess of structure. Other frameworks, such as Apple’s WebObjects, Adobe’s ColdFusion, and Microsoft’s .NET Framework, were in wide use but the frameworks were products controlled by the companies and built by small teams, which tended to restrict innovation. Today PHP, Java frameworks, and .NET remain popular, largely among solo webmasters (PHP), enterprise teams (Java), and Windows aficionados (.NET) but Rails has become very popular and has influenced development of other server-side frameworks.

The design decisions that went into the first version of Rails anchored a vir-

tuous circle that led to Rails's growth. Within the first year, Rails caught the attention of prominent software engineers, notably Martin Fowler and Dave Thomas (proponents of agile software development methodologies). Rails is well-matched to the practices of [agile software development](#), particular in its emphasis on software testing and "convention over configuration." The interest and advocacy of opinion leaders from the agile camp led to greater visibility in the wider open source community, culminating in a [keynote lecture by Heine-meier Hansson](#) at the 2005 O'Reilly Open Source Convention. Because Rails was adopted by software engineers who are influencers and trend setters, it is often said that Rails is favored by "the cool kids." If that is so, it is largely because Rails is well-suited to software engineering practices that are promoted by thought leaders like Fowler and Thomas.

Rails Guiding Principles

The popularity of Rails is an outgrowth of the Rails "philosophy" or guiding principles. If you read blogs by Rails developers, you'll often see references to these principles. Understanding these principles will help you make sense of Rails or, at least, some of the debates on developer blogs.

Rails is Opinionated

In the mid-1990s, web applications were often written in Perl, a programming language that promised, "There's more than one way to do it." Perl is a prime example of "non-opinionated" software; there's no "right way" or "best way" to solve programming problems in Perl. Famously, Perl's [documentation](#) states, "In general, [Perl's built-in functions] do what you want, unless you want consistency."

In contrast, Rails is said to be "opinionated." There is a "Rails way" for many of the problems that must be solved by a web application developer. If you follow the Rails conventions, you'll have fewer decisions to make and you'll

find more of what you need is already built. The benefit is faster development, improved collaboration, and easier maintenance.

Rails is Omakase

Omakase is a Japanese phrase that means “I’ll leave it to you.” Customers at sushi restaurants can order omakase, entrusting the chef to make a pleasing selection instead of making their own à la carte choices. In a famous essay Heinemeier Hansson declared [Rails is Omakase](#), and said, “A team of chefs picked out the ingredients, designed the APIs, and arranged the order of consumption on your behalf according to their idea of what would make for a tasty full-stack framework. . . . When we, or in some cases I — as the head chef of the omakase experience that is Rails — decide to include a dish, it’s usually based on our distilled tastes and preferences. I’ve worked in this establishment for a decade. I’ve poured well in the excess of ten thousand hours into Rails. This doesn’t make my tastes right for you, but it certainly means that they’re well formed.”

Understanding that Rails is omakase means accepting that many of the opinions enshrined in the Rails API are the decisions of a [Benevolent Dictator for Life](#), informed by discussion with other developers who have made significant contributions to the Rails code base. For the most part, Heinemeier Hansson’s “opinions” will serve you well.

Convention Over Configuration

“Convention over configuration” is an example of Rails as “opinionated software.” It is an extension of the concept of a default, a setting or value automatically assigned without user intervention. Some software systems, notably Java web application frameworks, need multiple configuration files, each with many settings. For example, a configuration file might specify that a database table named “sales” corresponds to a class named “Sales.” The configuration

file permits flexibility (a developer can easily change the setting if the table is named “items_sold”). Instead of relying on extensive configuration files, Rails makes assumptions. By convention, if you create a model object in Rails named “User,” it will save data to a database table named “users” without any configuration required. Rails will also assume the table name is plural if the class name is singular.

“Convention over configuration” means you’ll be productive. You won’t spend time setting up configuration files. You’ll spend less time thinking about where things go and what names to assign. And, because other developers have learned the same conventions, it is easier to collaborate.

Don’t Repeat Yourself

Known by the acronym DRY, “Don’t Repeat Yourself” is a principle of software development formulated by Andy Hunt and Dave Thomas and widely advocated among Rails developers. In its simplest form, it is an admonition to avoid duplication. When code is duplicated, an application becomes more complex, making it more difficult to maintain and more vulnerable to unintended behavior (bugs). The DRY principle can be extended to development processes as well as code. For example, manual testing is repetitive; automated testing is DRY. Software design patterns that introduce abstraction or indirection can make code more DRY; for example, by eliminating repetitive if-then logic.

Code reuse is a fundamental technique in software development. It existed long before Andy Hunt and Dave Thomas promoted the DRY principle. Rails takes advantage of Ruby’s metaprogramming features to not just reuse code but eliminate code where possible. With a knowledge of Rails conventions, it’s possible to create entire simple web applications with only a few lines of code.

Where Rails Gets Complicated

It helps to understand the guiding principles of Rails. But it's even more helpful to know how (and why) Rails is complicated by departures from the guiding principles.

When Rails has No Opinion

As you gain experience with Rails, you may encounter areas where Rails doesn't state an opinion. For example, for years there was no "official" approach to queueing background jobs. (Tasks that take time, such as contacting a remote server, are best handled as "background jobs" that won't delay display of a web page.) Fortunately, by 2015, the Rails core maintainers released the `ActiveJob` feature which implemented queueing. Much of the lively debate that drives development of new versions of Rails is focused on thrashing out the "opinions" that eventually will be enshrined in the Rails API.

Omakase But Substitutions Are Allowed

Implicit in the notion of "Rails is omakase" is an understanding that "substitutions are allowed." Most of Heinemeier Hansson's preferences are accepted by all Rails developers. However, many experienced developers substitute items on the menu at the Rails café. This has led to the notion that [Rails has Two Default Stacks](#), as described in an essay by Steve Klabnik. Professional developers often substitute an alternative testing framework or use a different syntax for creating page views than the "official" version chosen by Heinemeier Hansson. This complicates learning because introductory texts often focus on the omakase selections but you'll encounter alternatives in blog posts and example code.

Conventions or Magic?

One of the joys of programming is knowing that everything that happens in an application is explained by the code. If you know where to look, you'll see the source of any behavior. For a skilled programmer, "convention over configuration" adds obscurity. Without a configuration file, there is no obvious code that reveals that data from a class named "Person" is saved to a datatable named "people." As a beginner, you'll simply accept the magic and not confound yourself trying to find how it works. It's not always easy to learn the conventions. For example, you may have a User object and a "users" datatable. Rails will also expect you to create a "controller object." Should it be named "UserController" (singular) or "UsersController" (plural)? You'll only know if you let Rails generate the code or you pay close attention to tutorials and example code.

DRY to Obscurity

The risk that "convention over configuration" leads to obscurity is compounded by the "Don't Repeat Yourself" principle. To avoid repetitive code, Rails often will offer default behavior that looks like magic because the underlying implementation is hidden in the depths of the Rails code library. You can implement a simple web application with only a few lines of custom code but you may wonder where all the behavior comes from. This can be frustrating when, as a beginner, you attempt to customize your application to do more than what's shown in simple tutorials.

In the next chapter, we'll consider some of the challenges that make it difficult to learn and use Rails.

Chapter 5

Rails Challenges

Rails is popular. Rails is powerful. But Rails isn't easy to learn.

You may have heard of a psychological phenomenon called “resistance.” When we struggle with something new, or must adapt to the unfamiliar, we resist. We get discouraged. We complain. Sometimes we feel we should quit.

This chapter is here to help with your resistance.

Its purpose is to acknowledge that, yes, *Rails can be difficult*.

Tens of thousands of people are successfully using Rails. I'll hazard a guess that none are significantly smarter, more motivated, or a better student than you. Perhaps some of them had more time to study or better access to mentors, but these factors simply accelerate the speed of learning Rails. If you get discouraged, or think Rails is too hard, recognize that you are encountering your own resistance, not any genuine limitation. Take a break, set aside your learning materials, and come back when your natural curiosity and eagerness has returned.

Sometimes resistance attaches to imaginary problems (like “I'm not smart enough”). Just as often, resistance attaches to real problems, but magnifies them into insurmountable obstacles (“Rails is impossible to use on Windows!”). The best way to overcome these obstacles is to acknowledge the resistance, investigate

the obstacle, and seek support from peers.

This chapter describes some of things that make Rails difficult.

These Rails challenges are obstacles, but other people overcame them. You can, too.

A List of Challenges

This list is incomplete. If you've encountered a Rails challenge that isn't listed here, email me at daniel@danielkehoe.com and I will add your suggestion to the next revision of the book.

It is difficult to install Ruby.

The installation process for Ruby on Rails is more difficult than downloading and installing any consumer software applications. You are setting up a development environment and you need system software as well as Ruby. Depending on what you've done before, you may have altered your system, introducing potentials for conflicts. Book Two provides links to good installation guides in the "Get Started" chapter. But installation instructions can't accommodate the specific configuration of your computer. Sometimes you just have to look for someone to help. You can also use a hosted development environment, like [Cloud9](#) or [Nitrous.io](#).

Rails is a nightmare on Windows.

Windows is very popular, so why is it difficult to develop with Rails on Windows? It seems the Rails community has a bias against Windows. It does, and there's a reason. Rails is an open source project. Most open source developers use Unix-based system tools. It is difficult and time-consuming to convert Unix-based system tools to the Microsoft Windows operating system. Open

source developers prefer to spend their time maintaining and improving their Unix-based projects. And expert Windows developers are seldom interested in porting Unix-based system tools to Windows. So system utilities such as RVM are not available for Windows. And developers who create gems are seldom interested in spending time to solve the problems that arise when code has to be adapted for the idiosyncrasies of the Windows platform. This situation is not going to change, so you have to make a choice. Stay with Windows or get comfortable with Unix-based systems.

Why do I have to learn Git? It is difficult.

Real software development requires version control and Git is the standard tool for Rails developers. If all you do is build applications as a classroom exercise, you don't need to learn Git. You can skip all the parts of the book that mention Git. But sooner or later, if you start doing real projects, you'll need Git. Simple Git commands are not difficult to learn. When you've developed your skills and confidence you can learn the more advanced Git functions, such as branching.

Why worry about versions?

For simple projects you don't need version management. My books introduce version management and prepare you to handle version conflicts. As you tackle more complex projects, and as new versions of Rails are released, you'll face version issues and version management will be helpful.

Do I really need to learn about testing?

For student projects, no, you don't need to learn about testing. But as soon as money or reputation is at stake on a project, you'll need to begin using test-driven development. Book Two introduces TDD but you'll need intermediate-level tutorials to develop proficiency. Once you've grasped the basics, testing

will become easy, and it actually is fun and satisfying.

Rails error reporting is cryptic.

Actually, Rails error reporting is quite good. Stack traces are detailed and error messages are descriptive. Beginners have a problem because the stack traces and error messages provide a technical analysis of a problem in terms that an experienced developer can understand. If error reporting was “simplified” it might not be as intimidating but it would not as accurate. It’s up to you to gain enough knowledge to understand the error messages. Finally, the error reporting mechanism can point you to the line in your code that triggers a problem, but it can’t know what you trying to do, or describe the error in anything but technical terms.

There is too much magic.

The Rails “convention over configuration” principle leads to obscurity. Default behavior often looks like magic because the underlying implementation is hidden in the depths of the Rails code library. If you like to know how things work, this can be frustrating. You really have only two choices when you encounter Rails magic. You can take time to dig into the source code. If you do so, you’ll encounter frustration as you encounter complex and sophisticated code, but you may also improve your understanding and skill as a Ruby programmer. Or you can take on faith that “it just works.” Often, you just need to use the convention several times in different projects to get comfortable with the magic and stop worrying that you don’t fully understand it.

It is difficult to grasp MVC and REST.

Even if you learn that the acronyms mean *model-view-controller* and *representational state transfer*, MVC and REST are abstract concepts. If you simply

follow a tutorial, the author will show you how to build an application that uses MVC or REST, but you won't see any alternative, or understand why MVC or REST are best practices. When it is time to build your own application, if you don't understand the importance of *separation of concerns* you won't be sure how to structure your application. Understanding software architecture requires abstract reasoning, imagination, and experience, which takes time. It is difficult to grasp but approach it with curiosity, seek explanations, and you'll grasp it soon enough.

Rails contains lots of things I don't understand.

If you look at the Rails directory structure, you'll see many files and folders. If you look at the Rails API, or pick up a Ruby tutorial, you'll also see code that is unfamiliar. Book Two describes some of what you see. As you build more applications, you will gain proficiency and master more of Rails and Ruby. Yet even as you gain mastery of Rails, there will be aspects that remain unfamiliar. Don't let the sheer complexity stop you. The truth is, you don't have to know "all" of Rails or Ruby to build web applications.

There is too much to learn.

Very true. To be a full-stack web developer you need to know HTML, JavaScript, CSS, Ruby, testing, databases, and much, much more. You might think that developers who started ten years ago have an advantage because there wasn't as much to learn when they started. But today there are many more high-quality tutorials and educational programs to accelerate your learning. And resources like Google and Stack Overflow have many more answers to questions. As the knowledge domain has grown, so have the learning resources. You don't have to learn everything. Get a foundation in the basics and then dive deep as a specialist in an area that appeals to you.

It is difficult to find up-to-date advice.

Rails has been around since 2004 with major new versions released every two years. Chances are, answers to questions you find on Stack Overflow or Google were written for an older version of Rails. There is no easy way to determine if the answer is out of date. A particular aspect of Rails may have changed—or not. Even worse, the answer may work, but there may be a better way that reflects current best practices. To filter the outdated in Google, use the “Search Tools” options for specifying a timeframe. Look closely at the date of a blog posting or Stack Overflow answer. Try to find a newer answer. Usually, if there are a series of answers and things have changed, you’ll see the current best answer. If you’re uncertain, don’t be shy about posting your question to Stack Overflow. More importantly, make it your business to keep up with the community, reading Peter Cooper’s [Ruby Weekly](#) email newsletter or his daily [RubyFlow](#) site.

It is difficult to know what gems to use.

There are so many gems available for Rails. Some add useful features, like tagging or a mailing list API. Some are basic, such as gems for a database or front-end framework. Even among basic gems, Rails offers choices. Which are best? The [Ruby Toolbox](#) can help, but mostly you will find guidance from looking at example projects and noticing what other developers are using. There’s wisdom in the crowd.

Rails changes too often.

If you look at the [Ruby on Rails Release History](#) you’ll see there is a new major release approximately every 1.5 years. Each major release is well tested and relatively free of bugs. But new features or new approaches often require rewrites of older applications. Commercial software products often make a priority of keeping the API consistent over time. That’s not Rails. Rails is an

open source project and the core team embraces innovation. The maintainers expect that you'll keep up with changes.

It is difficult to transition from tutorials to building real applications.

Copying and pasting from tutorials is a good way to begin learning Rails. But you'll only become a skilled Rails developer when you build something that is not shown in a tutorial. The first few hours (or days) when you start building a custom application can be very difficult. Focus on the basics that are described in this book. Start with user stories. Build pieces that you know how to do. Look for code samples on blogs or GitHub or Stack Overflow. Try “spikes,” little experiments that test ideas for implementation. Seek advice from peers or mentors. At first it will be slow going. But you will pick up momentum. The chapter, “Crossing the Chasm,” will provide specific strategies to help.

I'm not sure where the code goes.

If you follow tutorials, you'll learn “where the code goes” with the model–view–controller design pattern. With a sense of the request-response cycle, RESTful actions in the controller, and a few guidelines such as “skinny controller, fat model” you'll be able to build intermediate-level Rails applications. Front-end code, particularly JavaScript, can be difficult because not a lot has been published about Rails best practices. In particular, the Rails asset pipeline can be confusing for anyone who has done front-end development without Rails. If you don't know what you're supposed to do, do whatever works, then look for someone who can help you by providing a code review.

People like me don't go into programming.

Until recently in most countries, most Rails developers have been young men with an engineering background. For people who don't fit the stereotypical profile, it can be hard to find role models or peers who demonstrate that Rails is something everyone can learn. The challenge can be subtle, as when you have the feeling that maybe if you were different you'd find it easier to make progress. Or the challenge can be overt, when behavior of fellow students or co-workers is disturbing or hurtful (often they don't even know!). Lack of diversity, and the cluelessness that accompanies it, is unfortunate in the Rails community. But many people are working to make the community more welcoming and inclusive. Organizations such as [Rails Girls](#) and [Railsbridge](#) are creating more diversity in the community. You may find support from peers there to affirm that you, too, are entitled to knowledge and success.

These are some of the challenges you will face in learning and using Rails. Next, we will look at how to get help.

Chapter 6

Get Help When You Need It

Sometimes I’m asked, “Where’s the Rails manual?” There isn’t one. No single document tells you how to use Rails. Instead, there’s a wealth of documentation that describes various aspects of Rails. Book Two contains all the documentation you need to build an application. But before you start, I’d like to suggest additional resources that will be helpful.

Getting Help With the Book

Let’s consider what to do if you encounter problems as you build the tutorial application in Book Two.

If you are in a classroom, or studying in a group, ask a peer to look at your problem. Most problems are caused by simple typos or formatting errors. Your classmate may see what you overlooked.

The code in Book Two was tested by many people and worked flawlessly at the time this was written. The [learn-rails](#) example application on GitHub serves as a “reference implementation” if you have problems. The example application is updated more frequently than the published tutorial.

[Stack Overflow](#) provides a question-and-answer forum for readers of my books.

As the author of this book, I can't solve your individual problems or help you directly by email. If I did, I would not have time to create the tutorials that benefit so many people. However, I watch for questions on Stack Overflow. Everyone benefits when solutions are made public.

- tag your questions on Stack Overflow with **railsapps** for extra attention

If your questions aren't answered on Stack Overflow, try the Reddit forum:

- [/r/learnrubyonrails](#)

The Reddit forum has its own Slack channel for real-time messaging:

- [learnrubyonrails-slack.herokuapp.com/](#)

I sincerely hope you won't encounter obstacles as you build the tutorial application. Thousands of beginners have successfully completed the book and, unless a gem has recently changed, you should have no problem.

Now let's consider where to look for help when you are working on your own Rails projects.

Getting Help With Rails

What will you do when you get stuck?

"Google it," of course. But here's a trick to keep in mind. Google has options under "Search tools" to show only recent results from the past year. Use it to filter out stale advice that pertains only to older versions of Rails.

[Stack Overflow](#) is as important as Google for finding answers to programming problems. Stack Overflow answers are often included in Google search results, but you can go directly to Stack Overflow to search for answers to your

questions. Like Google, answers from Stack Overflow are helpful if you check carefully to make sure the answers are recent. Also be sure to compare answers to similar questions; the most popular answer is not always the correct answer to your particular problem.

Requests for advice (especially anything that provokes opinions) are often rejected on Stack Overflow. Instead, try Reddit for advice or recommendations. You'll find discussion forums ("subreddits") devoted to [Rails](#) and [Ruby](#). You can also visit the [Quora](#) question-and-answer site for topics devoted to [Rails](#) and [Ruby](#).

References

Here are suggestions for the most important references.

If you feel overwhelmed by all the links, remember that you can use Book Two to build the tutorial application without any additional resources. Right now, it's important to know additional help is available when you need it.

RailsGuides

The [Rails Guides](#) are Rails's official documentation, written for intermediate-level developers who already have experience writing web applications. The Rails Guides are an excellent reference if you want to check the correct syntax for Rails code. You'll be able to use the Rails Guides after completing this tutorial.

Cheatsheets

Tobias Pfeiffer has created a useful [Rails Beginner Cheat Sheet](#) that provides a good overview of Rails syntax and commands.

Even better than a cheatsheet, for Mac users, is an application named [Dash](#) that offers fingertip access to reference documentation for Ruby, Rails, HTML, CSS, JavaScript, and many other languages and frameworks.

API Documentation

The API documentation for Ruby and Rails shows every class and method. These are extremely technical documents (the only thing more technical is reading the source code itself). The documents offer very little help for beginners, as each class and method is considered in isolation, but there are times when checking the API documentation is the only way to know for certain how something works.

- [Rails Documentation](#) - official API docs
- [Rails Searchable API Doc](#) - alternative interface for the API docs
- apidock.com/rails - Rails API docs with usage notes
- apidock.com/ruby - Ruby API docs with usage notes
- [Omniref](#) - Ruby and all gem API docs with questions and answers

[Omniref](#) is the best place to ask questions about anything in the Ruby or Rails API.

I recommend [Dash](#) as a tool to look up classes, modules, and methods in Ruby and Rails. Dash is a Mac OS X app; use [Zeal](#) on Linux. Dash and Zeal run offline (they don't need an Internet connection) so you can use them anywhere.

Meetups, Hack Nights, and Workshops

I'd like to urge you to find ways you can work with others who are learning Rails. Peer support is really important when you face a challenge and want to

overcome obstacles.

Most large urban areas have meetups or user group meetings for Rails developers. Try [Meetup.com](https://www.meetup.com) or google “ruby rails (my city)”. The community of Rails developers is friendly and eager to help beginners. If you are near a Rails meetup, it is really worthwhile to connect to other developers for help and support. You may find a group that meets weekly for beginners who study together.

Local user groups often sponsor hack nights or [hackathons](#) which can be evening or weekend collaborative coding sessions. You don’t have to be an expert. Beginners are welcome. You can bring your own project which can be as simple as completing a tutorial. You will likely find a study partner at your level or a mentor to help you learn.

If you are a woman learning Rails, look for one of the free workshops from [RailsBridge](#) or [Rails Girls](#). These are not exclusively for women; everyone considered a “minority” in the tech professions is encouraged to participate; and men are included when invited by a woman colleague or friend.

Pair Programming

Learning to code is challenging, especially if you do it alone. Make it social and you’ll learn faster and have more fun.

There’s a popular trend in the workplace for programmers to work side-by-side on the same code, sharing a keyboard and screen. It’s effective, both to increase productivity and to share knowledge, and many coders love it. When programmers are not in the same office, they share a screen remotely and communicate with video chat.

Look for opportunities to pair program. It’s the best way to learn to code, even if your pairing partner is only another beginner. Learn more about pair programming on the site pairprogramwith.me and find a pairing partner at codermatch.me or letspair.net.

Remote pair programming requires tools for screen sharing and video chat. Pairing sessions often use:

- [Google+ Hangouts](#)
- [Screenhero](#)
- [Floobits](#)
- [Cloud9 IDE](#)
- [Nitrous.io](#)

More tools are emerging as remote pair programming becomes popular.

Pairing With a Mentor

By far, the best way to learn is to have a mentor at your side as you undertake a project. That is an opportunity that is seldom available, unless you've been hired to be part of a team in a company that encourages pair programming.

You can try [RailsMentors](#), a network of volunteer mentors offering free help.

If you can pay for help, find a mentor using [HackHands](#) or [AirPair](#). Market rates are expensive for a student, obviously, but if you are learning on the job or building an application for your own business, connecting online with a mentor might be a godsend.

[AirPair](#) connects developers for real-time help using video chat and screen sharing. Experts set their own rate and the site matches you according to your budget. Expect to pay market rates for consulting ranging from USD \$40 per hour to \$150 per hour or more.

[HackHands](#) promises to instantly connect you with a qualified expert at a cost of one dollar per minute for mentorship using video chat and screen sharing.

Code Review

Code review is an essential part of the development process. There's always more than one way to implement a feature, and some ways are better than others, but you may not know it unless you ask someone to look at your code. When you pair with a mentor, you get the benefit of code review. But even if you don't have a mentor, you can get code review online. StackExchange, the parent of StackOverflow, has a free site for code review, and a new service promises code review as a service:

- codereview.stackexchange.com
- devinput.io

Expert code review will accelerate your learning faster than anything else.

Knowing where to go for help is important; it is just as important to stay current.

Staying Up-to-Date

Rails changes frequently and its community is very active. Changes to Rails, expert blog articles, and new gems can impact your projects, even if you don't work full-time as a Rails developer. Consequently, I urge you to stay up-to-date with news from the community.

For daily news about Rails, check Peter Cooper's [RubyFlow](#) site which lists new blog posts from Rails developers each day.

I urge you to sign up for two weekly email newsletters:

- [Ruby Weekly](#)
- [Green Ruby News](#)

Another weekly email newsletter is more technical, and focused on code arriving in the next version of Rails:

- [This Week in Rails](#)

If you like podcasts, check out [Ruby Rogues](#) and Envy Labs's [Ruby5](#).

Finally, you can follow [@rails_apps](#) on Twitter for news about the RailsApps project.

Chapter 7

Plan Your Product

Tutorials from other authors focus only on coding. But Rails developers do more than code. Software development is a process that begins with planning and ends with analysis and review. Coding, testing, and deployment is at the core but you'll need to learn about the entire process to succeed professionally. That's why we look at product planning and project management.

For this beginning tutorial, we'll introduce concepts about product planning and project management that you will encounter as a Rails developer.

Product Owner

On your project, who is the *product owner*?

The product owner is the advocate for the customer, making sure that the team creates value for the users.

If you are a solo operator, you are the one who will decide what features and functionality will be included in your application. But if you're part of a team, either in a startup, as a consultant, or in a corporate setting, it may not be clear who has responsibility for looking at the application from the point of view of the application user. Someone must decide which features and functionality

are essential and which must be left out. We call this *managing scope* and combating *feature creep*.

It's important to assign a product owner. Without a product owner in charge, tasks remain vague and developers have difficulty making progress.

In large organizations, a product owner may be a [product manager](#) or a [project manager](#). A product owner usually is not a management executive (though there will likely be an [executive sponsor](#)). Everyone on the team — including management, developers, and stakeholders — should agree to designate a product owner and give that person authority to define features and requirements.

User Stories

A product owner's principal tool for product planning is the *user story*.

In the past, when software engineering primarily served government or large corporations, product planning started with [requirements gathering](#) defined as [use cases](#), and culminated in a [requirements specification](#). User stories are a faster, more flexible approach to product planning that originated with an approach called [Agile software development](#).

[User stories](#) are a way to discuss and describe the requirements for a software application. The process of writing user stories helps a product owner identify all the features that are needed for an application. Breaking down the application's functionality into discrete user stories helps organize the work and track progress toward completion.

User stories are often expressed in the following format:

```
As a  
I want  
In order to
```

Here is an example:

```
*Join Mailing List*  
As a visitor to the website  
I want to join a mailing list  
In order to receive news and announcements
```

A typical application has dozens of user stories, from basic sign-in requirements to the particular functionality that makes the application unique.

You don't need special software to write user stories. Just use index cards or a Word document. In the next chapter, we'll see how you can enter user stories as tasks in a to-do list. Here's the format:

FEATURE	
	Request Invitation
As a	visitor to the website
I want	to request an invitation
In order to	be notified when the site is launched
<button>add new line</button>	

Figure 7.1: A user story.

Just like Rails provides a structure for building a web application, user stories provide a structure for organizing your product plan.

Wireframes and Mockups

Often, before writing user stories, a product owner will make rough sketches of various web pages. Sketching is a phase where you try out ideas to clarify your vision for the application. Sketching can lead to a wireframe or a mockup. These terms are often used interchangeably but there are differences in meaning.

A *wireframe* is a drawing showing all functional elements of a web page. It should not depict a proposed graphic design for a website, rather it should be a diagram of a web page, without color or graphics.

A *mockup* adds graphic design to a wireframe; including branding devices, color, and placeholder content. A mockup gives an impression of the website's "personality" as well as proposed functionality.

One of the most popular tools for creating wireframes is [Balsamiq Mockups](#) (despite the name, it produces wireframes, not mockups). There are dozens of others listed in the article [Rails and Product Planning](#).

As a product owner, writing user stories or sketching wireframes will help you refine product requirements. Some people like a visual approach with wireframes; others prefer words and narrative. Either approach will work; both are good.

Graphic Design

Very few people have skills as both a visual designer and a programmer. The tools are different; graphic designers typically use Adobe Photoshop, though web-savvy designers often create designs directly in HTML and CSS, while developers write code.

If you're lucky, you will work with a skilled graphic designer as you build your web application. If you are very lucky, you may work with someone who is a *user experience* (UX) designer or *interaction designer* (IxD). Interaction design is a demanding, sophisticated discipline that requires the mindset of an anthropologist and the eye of a visual artist to find not just the most pleasing, but the most effective visual design for an application user interface. You can find interaction designers discussing their concerns on the [IxDA](#) website, including [the differences](#) between interaction design and UX design.

If you're working with a graphic designer you might collaborate on a *mood-board* or a *design brief* to define the look and feel of your application. If the

designer works in Photoshop, you'll face the challenge of converting design layouts from Photoshop to HTML and CSS. There are service firms that do this for a fee but obviously it's easier to work with a designer who can implement a layout directly in HTML and CSS.

Rails can be particularly challenging when it comes to integrating graphic design with code. Rails uses a hybrid of HTML markup mixed with Ruby programming code in its *view* files (depending on the stack you've selected, the view files can use ERB, Haml, or other syntaxes for mixing HTML and Ruby). Few designers are comfortable with Ruby code mixed with HTML so you may end up doing integration yourself.

If you don't have a skilled graphic designer available to help, you can use [Bootstrap](#) or other front-end frameworks such as [Zurb Foundation](#) to quickly add an attractive design to your application.

In a later chapter that covers HTML and CSS, you'll learn about templates and themes for Bootstrap that provide a beginning point for page design.

Software Development Process

Product planning is the initial phase of a larger software development process. You can approach this casually, and start coding with curiosity and ambition, finding your own best way to the end product, by trial and error. Most hobbyist and student developers need no other approach.

When money or reputation is at stake, casual approaches to software development are risky. Compared to other forms of engineering, software development is peculiarly prone to failure. As recently as 2003, [IBM stated](#), "Most software projects fail. In fact, the Standish group reports that over 80 of projects are unsuccessful either because they are over budget, late, missing function, or a combination. Moreover, 30% of software projects are so poorly executed that they are canceled before completion."

Professional software developers, being intelligent and reflexive, and driven by

a desire to become more efficient, or wanting to avoid the wrath of bosses and clients, frequently look for ways to reduce risk and improve the software development process. In recent years they've succeeded in improving the success rate of software engineering, largely due to the adoption of *software development methodologies* that improve the *business process* of producing software.

If you're a hobbyist or casual programmer, you don't need to learn about software development methodologies.

If you are going to be held accountable for the success or failure of a project, you should learn more about software development methodologies.

If you're going to be interviewing for a job as a programmer, it pays to recognize some of the names of software development methodologies and ask whether your employer has adopted a particular approach, especially if you'd like to work for a company that prides itself on being well-organized and supportive of staff development. Hiring managers may say, "we've synthesized several methodologies," which may mean they don't have a good answer for the question, or it may mean they are prepared to thoughtfully discuss the merits of various approaches to software development. Managers who can discuss software development methodologies are more likely to be concerned about the welfare of their team.

Here are some software development methodologies you may hear about, with some notable characteristics:

- *waterfall process* - an old and disparaged approach
- *Agile software development* - an iterative and incremental approach
- *Scrum* - known for "sprints" and daily standup meetings
- *Extreme Programming (XP)* - pair programming and test-driven development

Agile, Scrum, and XP are all related, and often mixed in practice.

As you mature as a software developer, take time to think about the process of building software and learn more about software development methodologies.

Behavior-Driven Development

There is one prominent software development approach that is important for product planning. It is called Behavior-Driven Development (BDD), or sometimes, Behavior-Driven Design.

BDD takes user stories and turns them into detailed scenarios that are accompanied by tests.

Here's a screenshot from a consultant's web application that shows how a user story can be extended from a "feature" to include detailed "scenarios."

Rails developers turn these scenarios into tests using either a software tool named [Cucumber](#) or [RSpec](#) to run automated test suites. Most developers write scenarios using a simple text editor.

With automated tests, a product owner can determine if developers have succeeded in implementing the required features. This process is called *acceptance testing*. Automated tests also make it easy for developers to determine if the application still works as they add features, fix bugs, or reorganize code. This process is called *regression testing*.

On a small project like our tutorial application, you won't use BDD. It's easy enough to manually test the features before you deploy your application.

For an introductory book, BDD is an advanced topic. But on a project where money and reputation is at stake, BDD can be very important. Every time an application is deployed, there's a chance that something could be broken. Software development is plagued with "fix one thing, accidentally break another" as code is refactored or improved. Manual testing can't be expected to reveal every bug. That's why automated testing, providing coverage of every significant user-facing feature, is the only way to know if you've deployed without known bugs.

In Book Two, a “Testing” chapter will introduce you to the terminology and concepts of automated testing. You won’t have to worry about testing when we build the tutorial application, but afterward you’ll learn enough about testing to be prepared for more advanced tutorials.

Request Invitation

\$600

Close Last edited by Daniel Kehoe on August 9, 2013 at 6:19PM PDT Delete this feature 5 hours

FEATURE Request Invitation

As a

visitor to the website

X

I want

to request an invitation

X

In order to

be notified when the site is launched

X

add new line

SCENARIO User signs up with valid data **HOURS** 4

When

I fill in "Email" with "example@example.com"

X

And

I click a button "Request Invitation"

X

Then

I should see a message "Thank you!"

X

And

my email address should be stored in the database

X

And

my account should be unconfirmed

X

add new step

remove scenario

SCENARIO User signs up with invalid email **HOURS** 1

When

I fill in "Email" with "NotAnEmail"

X

And

I click a button "Request Invitation"

X

Then

I should see an invalid email message

X

add new step

remove scenario

+ Add scenario

Save

Save and close

Cancel

Figure 7.2: Feature and scenario.

Chapter 8

Manage Your Project

How do you know you're making progress? Are you taking care of everything that needs to be done? These questions are at the center of project management. Whether you are working alone or as part of a team, you need to define your tasks and track progress toward your goal.

The previous chapter on product planning showed how *user stories* can be used to break down an application into discrete features. User stories can be the basis for a list of tasks.

To-Do List

You can track your tasks with a simple to-do list. Some entrepreneurs like the discipline of the GTD system ([Getting Things Done](#)) for personal productivity and time management. Our article on [Rails and Project Management](#) offers a list of popular to-do list applications, either for personal task management or team-oriented task management.

Kanban

Kanban is a method of managing projects that has been adapted from [lean manufacturing](#) for use in software development. In Japanese, “Kan” means visual, and “ban” means card or board.

Imagine putting a big whiteboard on your wall and creating columns for a series of to-do lists. The columns, called *swimlanes*, are labelled: Backlog, Ready, Coding, Testing, Done. Each swimlane contains index cards that describe a user story or other task. To plan your work and track progress, you’ll move the index cards across the board from column to column. To stay focused and avoid becoming overwhelmed, you’ll only pick the most important user stories or tasks from the backlog column and you’ll limit the number of items in each column to what can be realistically accomplished in the time available. That’s the essence of kanban as it is used for software development.

See the article on [Rails and Project Management](#) for a list of kanban web applications. [Trello](#) is particularly popular for task management.

Agile Methodologies

For a solo project or a small team, you’ll do fine with a simple to-do list or (even better) a kanban web application for managing your software development process.

If you’ve got enough people to need to hire a project manager, you should look at project management software that supports teams using [Agile software development](#) methodologies. [Pivotal Tracker](#) is the best known tool but there are many other [agile tools](#).

Learn more about Agile if you’re going to hire developers for a startup or if you are going to work for an established company. In most successful companies, Agile processes have replaced the much-maligned [waterfall process](#) that was once the norm for software development.

Chapter 9

Mac, Linux, or Windows

This is a book for every beginner, so I'll explain how we use a text editor and terminal application for development. First, though, let's ask, "Mac OS X, Linux, or Windows?"

Your Computer

You can develop web applications with Rails on computers running Mac OS X, Linux, or Microsoft Windows operating systems. Most Rails developers use Mac OS X or Linux because the underlying Unix operating system has long been the basis for open source programming.

Later in this chapter, I'll give links to installation instructions for Mac OS X and Linux.

For Windows users, I have to say, installing Rails on Windows is frustrating and painful. Readers and workshop students often tell me that they've given up on learning Rails because installation of Ruby on Windows is difficult and introduces bugs or creates configuration issues. Even when you succeed in getting Rails to run on Windows, you will encounter gems you cannot install. For these reasons, I urge you to use Cloud9, a browser-based development

environment, on your Windows laptop.

Hosted Computing

If you are using Windows, or have difficulty installing Ruby on your computer, try using Cloud9.

[Cloud9](#) provides a hosted development environment. That means you set up an account and then access a remote computer from your web browser. The Cloud9 service is free for ordinary use. There is no credit card required to set up an account. You'll only be charged if you add extra computer memory or disk space (which you don't need for ordinary Rails development).

The Cloud9 service gives you everything you need for Rails development, including a Unix shell with Ruby pre-installed, plus a browser-based file manager and text editor. Any device that runs a web browser will give you access to Cloud9, including a tablet or smartphone, though you need a broadband connection, a sizable screen, and a keyboard to be productive.

Installing Ruby

Your first challenge in learning Rails is installing Ruby on your computer.

Frankly, this can be the most difficult step in learning Rails because no tutorial can sort out the specific configuration of your computer. Get over this hump and everything else becomes easy.

The focus of this book is the background you need to understand Rails. In Book Two, you'll build a real-world Rails application. Before you can build the application, you'll need to install the latest versions of the Ruby language and the Rails gem. You can get started now, with the links provided below, or you can wait until you have started reading Book Two.

You'll spend at least an hour installing Ruby and Rails, so defer the task until

you have sufficient time at your computer.

Mac OS X

See this article for Mac OS X installation instructions:

[**Install Ruby on Rails - Mac OS X**](#)

Ubuntu Linux

See this article for Ubuntu installation instructions:

[**Install Ruby on Rails - Ubuntu**](#)

Hosted Computing

[Cloud9](#) is a browser-based development environment. Cloud9 is free for small projects. If you have a fast broadband connection to the Internet, this is your best choice for developing Rails on Windows. And it is a good option if you have any trouble installing Ruby on Mac or Linux because the Cloud9 hosted environment provides everything you need, including a Unix shell with Ruby and RVM pre-installed, plus a browser-based file manager and text editor. Using a hosted development environment is unconventional but leading developers do so and it may be the wave of the future.

See this article for Cloud9 installation instructions:

[**Install Ruby on Rails - Cloud9**](#)

The article shows how to get started with Cloud9.

Windows

Here are your choices for Windows:

- Use the [Cloud9](#) hosted development environment
- Install the [Railsbridge Virtual Machine](#)
- Use [RubyInstaller for Windows](#)

Cloud9 is ideal if you have a fast Internet connection. If not, download the Railsbridge Virtual Machine to create a virtual Linux computer with Ruby 2.2 and Rails 4.2 using [Vagrant](#). Other tutorials may suggest using [RailsInstaller](#), but it will not provide an up-to-date version of Ruby or Rails. Also, RVM does not run on Windows.

Chapter 10

Terminal Unix

You'll need to use the Terminal application and Unix commands to develop Rails applications.

Most people use a graphical user interface (GUI) to interact with their computers, tablets, or phones. As a developer, instead of using the GUI, you'll get “under the hood” and work directly with the engine that controls your computer, the operating system. This is what makes software programming look intimidating to learners. You won't use menus or buttons as you work. Instead, you'll type commands, line by line, into a window that looks like a computer interface from the 1970s. In fact, the terminal, or console, is a direct legacy of computers that were developed even earlier, in the 1960s. The terminal continues to be the fundamental tool of software development.

The Terminal

The Terminal application or console gives us access to the Unix command line, or shell.

We call the command line the *shell* because it is the outer layer of the operating system's internal mechanisms (which we call the *kernel*).

On Mac OS X, you can use the [Terminal application](#). Experienced developers often upgrade to the more powerful [iTerm2](#) application but you can start with the installed Terminal application.

Look for the Terminal in the following places:

- Mac OS X: *Applications > Utilities > Terminal*
- Linux: *Applications > Accessories > Terminal*
- Windows: *Taskbar Start Button > Command Prompt*

On the Mac, search for the Mac OS X Terminal application by pressing the Command-Spacebar combination (which Apple calls “Spotlight Search”) and searching for “Terminal.” The magnifying glass in the upper right corner of your screen will also launch “Spotlight Search.” Or look in the **Applications/Utilities/** folder for the Terminal application. You’ll need to click the name of the application to launch the Terminal.

For Linux or Windows, [The Command Line Crash Course](#) explains [how to launch a terminal application](#).

If you have your computer in front of you, launch your terminal application now.

Try out the terminal application by entering a shell command.

```
$ whoami
```

Don’t type the **\$** character. We call it “the prompt.” The **\$** character is a cue that you should enter a shell command. This is a longtime convention that indicates you should enter a command in the terminal application or console.

The Unix shell command **whoami** returns your username.

```
$ whoami  
danielkehoe
```

Instead, you might see:

```
command not found: $
```

which indicates you typed the `$` character by mistake.

If you are new to programming, using a text editor and the shell will seem primitive compared to the complexity and sophistication of Microsoft Word or Photoshop. Software developers edit files with simple text editors and run programs in the shell. That's all we do. We have to remember the commands we need (or consult a cheatsheet) because there are no graphical menus or toolbars. Yet with nothing more than a text editor and the command line interface, programmers have created everything that you use on your computer.

Unix Commands Explained

Unix commands seem cryptic at first. They are a shorthand that's familiar to experienced developers. If a Unix command is mysterious, you can look it up with Google. But a better approach is to use the website:

- explainshell.com

Try it out. Visit the website and enter `ls -lp`. It's a Unix command we'll use often in Book Two. The site will explain that the command "lists directory contents, one file per line, with a slash appended to directories." Now that you know about explainshell.com, here's no need to ever be mystified by a Unix command.

Getting Fancy With the Prompt

If you watch experienced developers at work, you may see their consoles are colorful, with lots of information shown in the prompt. You'll see Git status, current directory, and RVM gemset or Ruby version. Many developers replace the standard [Bash shell](#) with the [Z shell](#) and [Oh-my-zsh](#). You don't have to install the Z shell to get a fancy prompt; the [Bash-it](#) utility is easy to install and gives you much of the functionality. A fancy prompt is helpful but requires some Unix skills to install. Don't worry about getting fancy now; you can try it down the road.

Learning Unix Commands

You can follow the tutorial in Book Two without learning any Unix commands in advance. Everything you need to know is given at each step. If time is short, and you want to get started, you can jump into the Book Two tutorial without learning Unix commands.

Eventually, you'll realize you've learned quite a few basic Unix commands without making an effort. But if you have time, you'll feel more confident if you spend some time watching a few videos or reading books that teach the Unix command line basics.

If you haven't used the computer's command line interface (CLI) before, I recommend either [Learn Enough Command Line to Be Dangerous](#) or [The Command Line Crash Course](#) to gain confidence with Unix shell commands.

If you don't have time for the books recommended above, continue reading this chapter for an introduction to command line basics.

Exit Gracefully

Before you learn about Unix commands, learn how to exit a command line software program. It is the most important Unix skill you'll need. If you don't learn it now, you'll get stuck inside Unix programs and panic when you can't return to the command line prompt.

If you're keeping a notebook for things you learn, write this down:

```
To EXIT FROM UNIX commands, type:  
Control-c  
  
If that doesn't work, try:  
q  
exit  
Control-d  
Control-z  
  
If nothing works:  
CLOSE THE TERMINAL WINDOW
```

To type **Control-c**, hold down the “Control” key while pressing the **c** key on your keyboard.

There is no universal command to exit a Unix program. Any of these exit techniques might work. None do harm to your computer, so if you get stuck, try them all.

Software developers don't usually say, “I'm running a Unix program.” Usually they say, “I've launched a Unix process.” As you learn more about Unix, you'll learn about the difference between **Control-c**, which “kills a process,” and **Control-z**, which “suspends a process.” Right now, you don't need to learn about processes or what it means to kill or suspend them.

Structure of Unix Commands

Unix commands are cryptic if you've never seen them before. But there's a common pattern you'll begin to recognize.

```
$ command -option argument
```

Notice there are spaces between each part of a Unix command.

Prompt

The **\$** character is the prompt. Sometimes you'll see extra information before the prompt:

```
My-MacBook:~ danielkehoe$
```

The prompt can be customized to provide useful information, such as the name of the current folder or the current user. Some people change the **\$** character to a different character, such as the **>** character.

Don't be confused by a custom prompt and don't worry about customizing your prompt right now. Just remember that when you see a **\$** character on the command line, the computer is waiting for you to enter a command.

Command

```
$ command -option argument
```

Each Unix command is a tiny software program that is already installed on your computer. Each command does a few simple things, such as list the contents of

a folder or create an empty file. There are dozens of Unix commands but you only need to learn a few to develop a Rails application.

Entering a command at the prompt and pressing “Return” (or “Enter”) will result in either of two things. The computer will respond “command not found” or it will run the command and return a result to the terminal window (“the console”).

Sometimes a command is not found because it is not a built-in command and it is not installed on your computer. More often, you’ve made an error in typing the command. Unix doesn’t like capital letters (“uppercase”) so unless there is a capital letter in a filename, you probably will need to type lowercase characters.

Option

```
$ command -option argument
```

Most Unix commands have a default response. Many commands have options for different responses if you set an option “flag” or “switch.” You indicate an option with a `-` character. Most people call that character a hyphen or dash. You may hear programmers call it the “minus” character. Sometimes an option is set with `--`, that you might describe as “dash dash” or “minus minus.” It’s difficult to see on the typeset page of this book, but to get the `-` character you type the “dash” character once. In this book, `-`, which appears as a slightly longer dash, is actually typed as two dashes.

Two options are common among Unix commands: `-help` and `-version` (with double dashes). There are also abbreviated versions: `-h` and `-v` (with a single dash).

If you have a terminal window open on your computer, try typing:

```
$ man -v  
man, version 1.6c
```

If I was coaching a beginner, I would say, “Type man space minus v. Don’t forget the space and be sure to type ‘Enter.’”

The computer returns the version number of the current installed **man** Unix command.

The Unix **man** command provides online documentation for every Unix command. Try:

```
$ man man  
.  
.  
.
```

You’ll see the “man pages” that show exactly what to do with the **man** command.

You can type **man** followed by the name of a command to see the documentation for the command.

It is nice to know that every Unix command comes with complete instructions for use. But try reading some man pages and you’ll understand why most developers never look at man pages. Instead they use Google to search online for instructions about how to use Unix commands. Man pages suffer from the worst features of technical documentation. They are complete to the point of obscurity, providing massive detail without highlighting the most common use cases. You’re better off googling for examples of how to use Unix commands.

You’ll be stuck inside the man pages after you enter **man man**. Refer to your notes about how to exit a Unix program. To get out of the **man** program, type **q** to quit.

Argument

```
$ command -option argument
```

The term “argument” is [borrowed from mathematics](#). Many Unix commands like a good argument. It is information that will be processed by a Unix command. Often it is a filename, if the command will operate on a file or output to a file.

For example, we can create a file with the Unix **touch** command or remove a file with the Unix **rm** command:

```
$ touch myfile  
$ rm myfile
```

In both cases, we must supply a filename as an argument.

Quick Guide to Unix Commands

As you learn Unix commands, it is a good idea to write notes for yourself or prepare a personal cheatsheet. The act of taking notes will help you remember the commands. Ultimately, the commands will become second nature through sheer repetition as you develop Rails applications.

Here are the Unix commands you will use most often.

cd

Computers use file systems to control how data is stored and retrieved using a storage system such as a hard drive. By separating the data into individual pieces, and giving each piece a name, the information is easily separated and

identified. In offices in the 20th century, documents were grouped together as files and kept in file folders in filing cabinets. Computers don't really need to organize information as files but early computer users apparently thought of computer storage as electronic file cabinets.

In Unix, you are always expected to be somewhere in the filing cabinet. The folders, or directories, are hierarchical, so a root folder contains multiple folders, which each contains many more folders and files. One set of nested folders contains the programs and utilities which make up the operating system and system utilities. Another set of nested folders contain folders for every user who can sign in to use the computer.

Unix systems can have more than one user account. Each user is given a home directory that contains the files needed by any software programs he or she will use.

Unix expects you to always be somewhere in your computer's file system. If you get confused or lost, you can always return to your home directory. Unix programmers like cryptic shortcuts that use unique keys from the keyboard. To get to your home directory, you can enter the directory name, which is your user name, or just type the "tilde" or "squiggle" character. On most keyboards, it is the uppercase (shift key) character to the left of the numeral 1. Look at the typeset character `~` in this book. It may look like a smudged dash, but if you look closely, you'll see the squiggle.

Use the `cd` (change directory) command to go to your home directory:

```
$ cd ~
```

The computer will not return a response to the terminal window, but you'll be positioned in your home directory. That means Unix commands will look for files in your home directory or save files in your home directory unless you specify another location.

pwd

Discover where you are by asking for the “present working directory.”

```
$ pwd
/Users/danielkehoe
```

The Unix **pwd** command will show the file path of your current directory.

It is easy to get confused and not be sure where you are. When you feel lost, use the **pwd** command.

ls

Use the **pwd** command to figure out where you are. Then look around with the **ls** command.

The **ls** command lists the files and folders that are contained in your present working directory.

```
$ cd ~
$ ls
Applications Documents Movies Pictures
Downloads Music Public
Desktop Library
```

The response shows a list of files and folders. Your list will be different.

You can use options for many different lists of files and folders.

For example, you can see a list of files and folders in a single column with **ls -1**:

```
$ ls -l
Applications
Desktop
Documents
Downloads
Library
Movies
Music
Pictures
Public
```

Using `ls -lp`, you can see a single column list with slash characters marking the folders:

```
$ ls -lp
Applications/
Desktop/
Documents/
Downloads/
Library/
Movies/
Music/
Pictures/
Public/
```

It seems there are no files in my home directory. But is that true?

Hidden Files and Folders

The Unix operating system allows filenames and folder names that start with a dot. These files are hidden unless you use an `a` option to view them.

```
$ ls -la
total 400
drwxr-xr-x+ 53 danielkehoe  staff   1802 Sep 27 15:48 .
drwxr-xr-x   6 root        admin   204 Dec  8 2014 ..
-rw-r--r--@  1 danielkehoe  staff  16388 Dec  8 05:52 .DS_Store
drwx-----  4 danielkehoe  staff   136 Dec  8 13:13 .Trash
-rw-----  1 danielkehoe  staff  98661 Dec 12 09:00 .bash_history
```



```

-rw-r--r--@ 1 danielkehoe staff 4926 Nov 20 22:10 .bash_profile
-rw-r--r--@ 1 danielkehoe staff 792 Sep 2 2013 .bashrc
drwx----- 6 danielkehoe staff 204 Jun 26 20:24 Applications
drwx-----+ 5 danielkehoe staff 170 Dec 7 08:33 Desktop
drwx-----+ 12 danielkehoe staff 408 Dec 7 08:06 Documents
drwx-----+ 9 danielkehoe staff 306 Dec 12 10:57 Downloads
drwx-----@ 57 danielkehoe staff 1938 Aug 30 20:27 Library
drwx-----+ 3 danielkehoe staff 102 Jul 28 2013 Movies
drwx-----+ 5 danielkehoe staff 170 Sep 21 2014 Music
drwx-----+ 22 danielkehoe staff 748 Nov 26 20:57 Pictures
drwxr-xr-x+ 5 danielkehoe staff 170 Aug 11 2013 Public

```

Now the response is very detailed, showing hidden files as well as information about file permissions, owner name, groups that have access permissions, file size, and creation date.

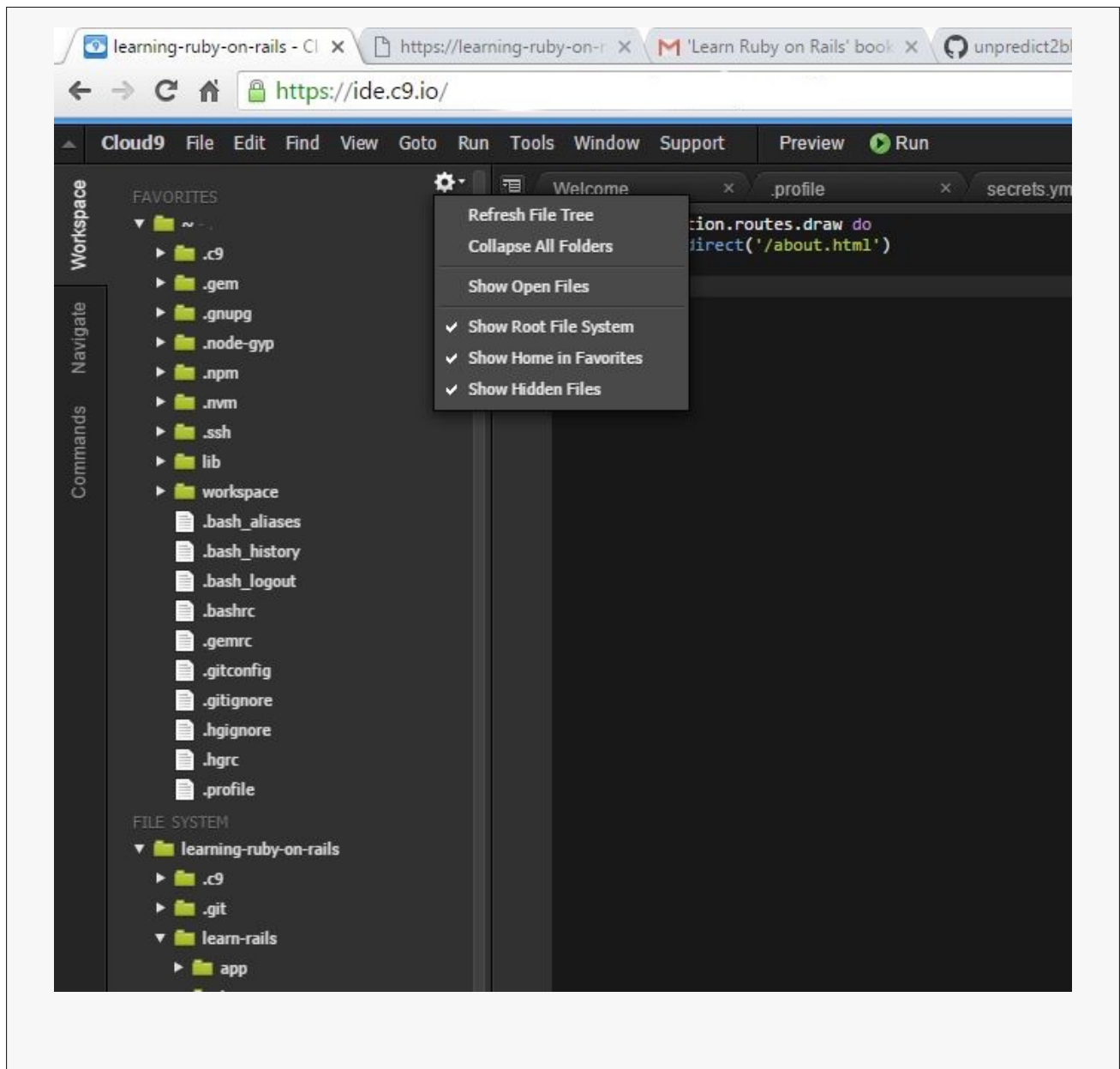
Hidden files are often files that contain configuration settings or user preferences. In the example above, the **.DS_Store** file is created by the Mac operating system to store the screen position of a Finder window. The **.bashrc** file contains configuration settings for the Unix shell program named bash.

Box 10.1. Hidden Files in Cloud9

If you're using Cloud9, you must change preferences to see hidden files. In the window that contains the file list, there is a gear icon (dark in color and difficult to see). Clicking the gear option will give you options:

- Show Root File System
- Show Home in Favorites
- Show Hidden Files

You must select all three options to see the hidden files.



Dots

You might notice that the response lists two files that have dots for names:

```
$ ls -la
drwxr-xr-x+ 53 danielkehoe  staff   1802 Sep 27 15:48 .
drwxr-xr-x   6 root         admin   204 Dec  8  2014 ..
```

These are not really files. These are Unix shortcuts for navigating the file system.

The single dot “file” refers to the present working directory.

The double dot “file” is a shortcut for navigating up one level in the file system hierarchy.

Dot files make Unix commands even more mysterious but they are convenient.

open

On a Mac, you can enter a command in the terminal that opens a Mac Finder file browser window. The command and argument **open .** (open space dot) opens the present working directory. Try it:

```
$ open .
```

You should see files and folders listed in the Finder window that are the same as those displayed in the terminal window. Whether you use the Mac Finder graphical user interface or the terminal, you are looking at the same file system.

On the Mac, you can point and click to move around the file system. If you want to move or delete a file, and you don’t remember the appropriate Unix command, you can use **open** to open a Finder window and make changes the Macintosh way.

mkdir

You can create a new folder with the Unix **mkdir** command.

Let's be sure you are in your home directory by using the **pwd** command. Then create a **workspace** folder.

```
$ cd ~  
$ pwd  
/Users/danielkehoe  
$ mkdir workspace  
$ cd workspace  
$ pwd  
/Users/danielkehoe/workspace
```

After creating the **workspace** folder, we **cd** into the folder and check where we are with the **pwd** command.

touch

You can create a new file with the Unix **touch** command.

Often it is easier to use a text editor to create and save a new file. But we'll use the **touch** command here to create a file we'll remove later. It is called the **touch** command because its intended purpose is update the timestamp on files or folders by “touching” the file or folder. But the command is also useful for creating new files.

If you haven't done anything since entering the previous commands, you'll still be in your **workspace** folder. But let's enter a command to move you to the **workspace** folder, just in case you are elsewhere.

First we **cd** using a filepath that contains the **~** “tilde” shortcut for the home directory. In essence, we are saying, “move to the workspace folder contained in the home directory.”

```
$ cd ~/workspace  
$ pwd  
/Users/danielkehoe/workspace  
$ touch myfile.txt  
$ ls -la
```

```
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:11 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
-rw-r--r--  1 danielkehoe  staff    0 Dec 12 15:11 myfile.txt
```

You’ve created a file **myfile.txt** inside the **workspace** folder. Then we list the contents of the folder so we can see the new file.

mv

Unix provides the **mv** command to rename files and folders. It’s an abbreviation for “move” and was originally intended to move a file from one directory to another. You can use it to move files and folders. And you can use it to “move” the name of the file as well.

Let’s rename **myfile.txt**:

```
$ mv myfile.txt my_file.txt
$ ls -la
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:11 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
-rw-r--r--  1 danielkehoe  staff    0 Dec 12 15:11 my_file.txt
```

We’ve changed the name of the file by adding an underscore character. The underscore character is commonly used as a substitute for a space between words in a filename. The Mac operating system can accommodate spaces in filenames but it is bad practice to use spaces in filenames when you work on the command line. You can work with filenames that contain spaces by surrounding the filename with single quote characters (like ‘my file.txt’) but it is inconvenient and most developers simply avoid spaces in filenames.

cp

You can copy a file with **cp** command. You must enter two filenames as arguments: the name of the original file and the name you want for the copied file.

```
$ cp my_file.txt my_file_2.txt
$ ls -la
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:11 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
-rw-r--r--  1 danielkehoe  staff    0 Dec 12 15:11 my_file.txt
-rw-r--r--  1 danielkehoe  staff    0 Dec 12 15:16 my_file_2.txt
```

The **ls** response shows we have two files.

The **cp** command requires flags if we want to copy a folder.

We'll use the **mkdir** command to create a folder:

```
$ mkdir myfolder
$ ls -la
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:11 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
drwxr-xr-x  2 danielkehoe  staff   68 Dec 13 05:13 myfolder
```

Let's try to copy it:

```
$ cp myfolder myfolder2
cp: myfolder is a directory (not copied).
```

The error message indicates we cannot copy a directory.

Let's try it with the **-r** flag to recursively copy contents from one folder to another:

```
$ cp -r myfolder myfolder2
$ ls -la
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:11 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
drwxr-xr-x  2 danielkehoe  staff   68 Dec 13 05:13 myfolder
drwxr-xr-x  2 danielkehoe  staff   68 Dec 13 05:21 myfolder2
```

With the added flag, we are able to copy a folder.

rm

Let's remove the files we just created. Unix provides **rm**, the “remove” command.

First, let's check that you are still in the **workspace** folder.

```
$ pwd
/Users/danielkehoe/workspace
$ ls -la
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:11 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
-rw-r--r--  1 danielkehoe  staff    0 Dec 12 15:11 my_file.txt
-rw-r--r--  1 danielkehoe  staff    0 Dec 12 15:16 my_file_2.txt
```

Then enter the **rm** command, providing the filename as an argument:

```
$ rm my_file.txt
$ rm my_file_2.txt
$ ls -la
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:11 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
```

The **ls** command shows the files are gone.

When you delete a file using the Mac Finder file browser, the file is moved to a Trash folder. When you use the Unix **rm** command, the file is gone forever. There is no Trash folder for recovering a file when you use the **rm** command.

Removing a Folder

Let's remove a folder. We'll assume you are in the **workspace** folder and the folders you created earlier are still there.

```
$ ls -la
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:21 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
drwxr-xr-x  2 danielkehoe  staff   68 Dec 13 05:13 myfolder
drwxr-xr-x  2 danielkehoe  staff   68 Dec 13 05:21 myfolder2
```

The **ls** command shows we have folders **myfolder** and **myfolder2**.

We can't remove a folder with the ordinary **rm** command:

```
$ rm myfolder
rm: myfolder: is a directory
$ ls -la
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:11 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
drwxr-xr-x  2 danielkehoe  staff   68 Dec 13 05:13 myfolder
drwxr-xr-x  2 danielkehoe  staff   68 Dec 13 05:21 myfolder2
```

We get an error message and the **ls** command shows the file is still there. This can be frustrating for someone who is not skilled with Unix.

You'll need to "set a flag" (use an option) to remove a folder using the **rm** command.


```
$ rm -rf myfolder
$ rm -rf myfolder2
$ ls -la
total 8
drwxr-xr-x  7 danielkehoe  staff   238 Dec 12 15:11 .
drwxr-xr-x+ 53 danielkehoe  staff  1802 Sep 27 15:48 ..
```

Now the **ls** command shows the folders are gone.

We use the **r** option to remove the contents of the folder recursively. And the **f** option to force the removal without asking for confirmation.

The Mouse and the Command Line

The mouse belongs to the graphical user interface. That's why it doesn't work as expected on the command line. Try entering a command at the prompt:

```
$ rm -rf notmyfolder
```

If you want to edit the argument and change “notmyfolder” to “myfolder,” you can try clicking with your mouse at the point where you wish to change the text. But your mouse click will be ignored. It seems you must use the delete key to back up from end of the line to retype the argument.

But there's a trick that works on most computers. If you press “Option” and click with the mouse, you can edit the command and argument as you would expect.

You can also move around on the command line with Ctrl-a to go to the beginning of a line, Ctrl-e to move to the end of the line, and Ctrl-u to delete everything on the command line. If you can't remember these shortcuts, don't worry, you can just use the delete key to move backward and retype when you need to make changes to commands.

Arrow Keys

The most useful trick for typing text on the command line is the “up arrow” key, which scrolls through a list of previous commands. The “down arrow” key scrolls the history of commands in the opposite direction (forward if you’ve moved backward).

With Unix, you only need to type a command once and then you can scroll back to it with the “up arrow” key. It is a real timesaver.

Tab Completion

There’s another trick developers use to save time when entering commands and arguments in the terminal. If you are entering a filename, and the file already exists in the present working directory, you can press the “tab” key to autocomplete the filename after typing a few unique letters of the filename.

If there is more than one filename with the same initial letters, the Unix shell will balk and beep. Pressing tab again will list all the matching filenames. Continue typing a few more letters until the Unix shell can identify one unique filename and autocomplete.

Why Abbreviations?

Our quick introduction to Unix commands taught you about **ls**, **cp**, **rm** and other common Unix commands. If the commands were spelled out as “list,” “copy,” or “remove” they might be easier to remember. Some old-timers say Unix was designed to be efficient on slow teletype terminals. That may be true, but I believe the abbreviations persist because programmers are lazy and want to type as few characters as possible. Unix commands may seem obscure but with repetition they will become familiar. Until then, keep a personal cheat-sheet as your reference.

As you learn Rails and develop applications, you'll gain experience with Unix commands. What you've learned so far is enough to get started.

Chapter 11

Text Editor

You'll need a [text editor](#) for writing code and editing files.

Word processing programs, such as Microsoft Word, will not work because they introduce hidden formatting codes into text files.

Programmers' text editors provide *syntax highlighting*, making software code more readable and programmers more productive. Simple text editors such as TextEdit for Mac OS X, or WordPad for Microsoft Windows, provide no syntax highlighting and should be avoided.

You Don't Need an IDE

Programmers who come to Rails from other platforms, such as Java or C++, often ask for recommendations for an IDE, or an [integrated development environment](#). These are software applications that combine a text editor with built-in tools such as a debugger. Some Rails developers use [JetBrains RubyMine](#), [Aptana Studio](#), or [Komodo](#) but most Rails developers use only a text editor and terminal application. You don't need an IDE unless you're in the habit of using one. For a beginner, they are cumbersome and add little additional value.

Which Text Editor

Old-timers and hardcore technologists use text editors that run in the terminal window:

- [vim](#)
- [Emacs](#)

There is a long-time rivalry between fans of Emacs and vim (and its predecessor vi). Between the two, vim is more popular.

Emacs and vi are popular among skilled programmers because there's no need to leave the terminal window to edit a file. Programmers keep their fingers on the keyboard and don't need to reach for a mouse to use the text editor. That makes programmers more productive. In the long run, learning vim or Emacs will make you more productive as well as impressing your colleagues with your technical skill. Both vim and Emacs are difficult to learn. If you're a beginner, don't attempt to learn vim or Emacs if you're short on time.

Most beginners will use a text editor with a graphical user interface (GUI). You're likely to encounter one of these:

- [Atom](#)
- [Sublime Text](#)
- [TextMate](#)

Atom and Sublime Text are available for Mac OS X, Windows, or Linux.

Atom is an open-source text editor, developed by a team at GitHub. It is the newest of the text editors. If you have not yet installed a text editor, I recommend getting Atom. It can be downloaded and used for free.

Sublime Text has been popular since 2008, particularly among developers who began learning Rails in the last seven years. Developers are expected to pay \$70 USD for use of Sublime Text, which removes a nagging popup that reminds users to pay for Sublime Text.

Textmate has been around since 2004 and remains popular among a small group of veteran Rails developers who have never bothered to learn vim or switch to Sublime Text or Atom. It is a commercial product priced at \$56 USD.

You can find tutorials for these text editors on YouTube. Or skim the [Atom documentation](#) or [Sublime Text documentation](#).

For a book with tips and tricks about using a text editor efficiently, see [Learn Enough Text Editor to Be Dangerous](#).

Editor Shell Command

Carefully follow the instructions for installing your text editor. Installation is like any other desktop application; however, there is an unusual and important final step. Developers want to launch a text editor and open a file for editing by typing a command in the terminal window.

If you’ve installed Atom, click the “Install shell commands” item under the “Atom” menu to enable the `atom` command. If you do so, you can open a file in Atom from the command line:

```
$ atom myfile.txt
```

Sublime Text has a similar configuration option for the Mac, though it takes more fiddling to set up. The [Sublime Text documentation](#) explains how. If you need more help, see Olivier Lacan’s blog post, [Launch Sublime Text 3 from the Command Line](#). After you’ve completed the configuration, you can open a file in Sublime Text from the command line:

```
$ subl myfile.txt
```

Opening a file from the command line is a big win for productivity.

It's even more useful to open an entire folder from the command line. In the “Terminal Unix” chapter, you learned that Unix has a “dot file” that represents the present working directory. To open an entire folder in Atom, try:

```
$ atom .
```

The text editor window will display a “tree view” of files and folders in a window pane. Click on any file to open it. It is very convenient to see an entire project at a glance in your text editor.

Chapter 12

Learn Ruby

Experienced Rails developers debate whether beginners should study Ruby before learning Rails.

Most experienced Rails developers recommend that you study Ruby before attempting to learn Rails. Most code camps teach a week or two of Ruby before introducing web development with Rails. Given that Rails is based on the Ruby programming language, it seems logical to teach Ruby as a prerequisite to learning Rails.

There are several flaws with this approach. Every “learn Ruby” book, video, or online course teaches Ruby with a series of classroom exercises. A concept is introduced, followed by examples, and then a programming puzzle or quiz, much like the way arithmetic was taught to children in the 1950s. If you are academically gifted, you can learn the basics of Ruby with this approach. But many people become frustrated and don’t learn well this way.

Though experienced Rails developers think a beginner should learn Ruby this way, many actually knew other programming languages already, and learned Ruby by skimming a language reference to notice differences, and googled for help when they needed to figure out how to write something in Ruby. They improved their skills by reading blogs or watching screencasts such as Avdi Grimm’s [Ruby Tapas](#). But mostly they learned Ruby by working on real-world

problems that required skill with Ruby.

The fact is, though you can get oriented to the basics of Ruby in a week, it takes a year or more of regular use of the language to gain proficiency. Rubyists develop their skill with Ruby over years, not weeks. That's true of most general purpose programming languages. Learning Ruby is a lifelong education program, not a short course.

Does that mean you'll never learn Rails? On the contrary. Despite what experienced Rails developers will say, you can begin building Rails applications without developing Ruby proficiency. Rails is largely a DSL, or *domain specific language*, with its own keywords and directives built using Ruby, and following the Ruby language syntax. Many developers started learning Rails by following tutorials to build Rails applications without first studying Ruby. You will pick it up as you go along.

Before my colleagues lambast me for leading newbies astray, let me say that trying to learn Rails without making an effort to learn Ruby is inefficient and counter productive. As you follow a Rails tutorial, make a parallel effort to learn Ruby. One will support the other. By building real applications with Ruby and Rails, and making an effort to learn more about Ruby at the same time, you'll be motivated to learn Ruby and you'll retain more knowledge of Ruby. And you'll be a better Rails developer.

Ruby Language Literacy

In this book series, I've taken a realistic approach. In Book Two, you will get started building a real-world Rails application. You will gain familiarity with the syntax of the Ruby language by studying the code that is needed to build the application. After you've been exposed to real-world Rails code, you'll read a short chapter to learn about the basic features of the Ruby language. The goal of the chapter is to develop Ruby language literacy. With a grounding in real-world Rails code, and a short introduction to the Ruby language, you'll have a solid basis to develop your Ruby knowledge plus motivation to do so.

What you need, more than anything, when you start working with Rails, is reading knowledge of Ruby. With a reading knowledge of Ruby you'll avoid feeling overwhelmed or lost when you encounter code examples or work through a tutorial. Later, as you tackle complex projects and write original code, you'll need to know enough of the Ruby language to implement the features you need. But as a student, you'll be following tutorials that give you all the Ruby you need. Your job is to recognize the language keywords and use the correct syntax when you type Ruby code in your text editor.

Your hardest challenge will be to learn the names of the structures you see in code examples. This is why it is helpful to work your way through a short introduction to Ruby. You'll need to be able to recognize when you are looking at an array or a hash. You should recognize when you are looking at an iterator or the Ruby block syntax. Eventually, you'll recognize more exotic Ruby formulations such as the lambda. It is okay if you can't write a lambda function or even know when to use one; many Rails developers start work before learning Ruby thoroughly.

By all means, if you love the precision and order of programming languages, dive into the study of Ruby from the beginning. It's good advice, just not for everyone. If you've got the time and inclination, get started with these recommended books and videos before you read Book Two. If you can, study them at the same time you work on the project in Book Two. At the very least, look at these resources after you finish Book Two and before you start another tutorial. You'll be glad you did.

Resources for Learning Ruby

Collaborative Learning

The best way to learn Ruby is to actually use it. That's the concept behind this site:

- [Exercism.io](#)

With Exercism, you'll work through code exercises and get feedback from other learners.

Online Tutorials

- [TryRuby.org](#) - free browser-based interactive tutorial from Code School
- [Codecademy Ruby Track](#) - free browser-based interactive tutorials from Codecademy
- [Ruby Monk](#) - free browser-based interactive tutorial from C42 Engineering
- [Ruby Koans](#) - free browser-based interactive exercises from Jim Weirich and Joe O'Brien
- [Ruby in 100 Minutes](#) - free tutorial from JumpstartLab
- [Code Like This](#) - free tutorials by Alex Chaffee
- [RailsBridge Ruby](#) - basic introduction to Ruby
- [CodeSchool Ruby Track](#) - instructional videos with in-browser coding exercises

Books

- [Learn To Program](#) - free ebook by Chris Pine
- [Learn To Program](#) - expanded \$18.50 ebook by Chris Pine
- [Learn Code the Hard Way](#) - free from Zed Shaw and Rob Sobers

- [Beginning Ruby](#) - by Peter Cooper
- [Programming Ruby](#) - by Dave Thomas, Andy Hunt, and Chad Fowler
- [Eloquent Ruby](#) - by Russ Olsen
- [Books by Avdi Grimm](#), including *Confident Ruby* and *Objects on Rails*.

Newsletters

- [Practicing Ruby](#) - \$8/month for access to over 90 helpful articles on Ruby
- [RubySteps](#) - weekly lessons by email from Pat Maddox

Screencasts

- [RubyTapas](#) - \$9/month for access to over 100 screencasts on Ruby

Chapter 13

Crossing the Chasm

In my books, you learn how programming is actually done in practice. In this book, you learn about the culture of Rails beyond the code. In Book Two, you'll follow step-by-step instructions to build and deploy a real Rails application.

This chapter is here to help you surmount the problems that come after you finish my books. You can wait and read it later, after you've built applications using tutorials, or you can read it now and learn to overcome the challenges you'll face when you are done reading tutorials.

What comes next partly depends on your goals. You may be eager to launch a startup, you may want a job as a developer, or you may have a project to tackle at work or in your spare time. Whatever you choose to do, you'll face the challenge of building an application without instructions. Here I'll give you ideas about overcoming that challenge.

Facing the Gap

There's a name for the obstacle that lies in wait for beginners who teach themselves to code by following a tutorial. I call it the "tutorial gap." It's the yawning chasm you face when it is time to build a custom application of your own.

Even though you’ve just built and deployed a working application, the moment you are without instructions, the chasm will open wide. You’ll feel it most acutely when you realize you don’t know where to start. Should you search for a gem? Should you start by building a view, a model, or a controller? Should you do test-first development and write a test? What should you test if you don’t know where to start?

A similar problem lies in wait for beginners the first day on the job. You’ll hear it called the “junior gap.” The term refers to the chasm between the time a developer is hired and becomes a “junior dev.” A “junior dev” is a team member who is more-or-less self-sufficient, learning new skills without being a burden for other developers, and able to contribute to a company at a level that increases team productivity. Whether self-taught, hired after graduation from a university, or from a 9 or 12 week code camp, new staff members seldom have the skills to be fully productive members of a team. Your success at a new job depends on how quickly you overcome the junior gap.

The “tutorial gap” and the “junior gap” are versions of the same chasm. You’ll cross the chasm each time you build an application. The more applications you build, the narrower the chasm becomes, and the less help you need, until you’ve crossed the chasm so many times that panic is replaced by delight when someone asks you to implement something you’ve never encountered before. That’s the point when you’ve become a self-sufficient and productive developer.

If you assume that becoming a successful developer depends on acquiring technical skills, the chasm may thwart you. The chasm cannot be crossed with technical knowledge, no matter how much you learn about Ruby, Rails, JavaScript or any other technology. Crossing the chasm requires “soft skills,” including cultivating your own problem-solving abilities, and realizing that software development is fundamentally a social activity.

In this chapter, I’m going to describe two ways to cross the chasm. First, I’ll give you a technique to jump start work on a custom application. It’s a strategy that will enhance your problem-solving abilities. After that I’ll suggest how to get help from a mentor, focusing on the social practice that is at the heart of software development.

Bridging the Gap With a Strategy

When you start work on a custom application, you're like a writer who has to write an essay and faces a blank screen. If you've been taught to write an essay, you probably learned to make an outline and start with a topic sentence or introductory statement. Not every writer starts that way, but it's a strategy to get started. You can use a similar strategy to get started with custom application development. Here's a process you can use:

- Ask: Why will someone want to use your application? Write a product description.
- Ask: What will a visitor first see and do? Write a user story for the home page.
- If you like to think visually, create wireframes for some of the important features.
- Create user stories for some of the important features.
- Generate a starter application with `rails new` or [Rails Composer](#).
- Pick any user story. Make a static page using HTML to mock up what the user will see.
- Write a feature test to verify the content on your static page. This is your first code.
- Create a model. Use the model to set a variable containing some string from the static page.
- Create a controller. Give it the same name as the model. Create a route for the controller.
- Replace the static page with a dynamic page. Use the controller to set an instance variable and render a view.

- Does your feature test still pass? Modify your feature test if necessary.
- Ask: How will data displayed on the page get into the model? From a third-party API? A user-submitted form?
- Replace the hard-coded string in the model with dynamic data obtained from a user or an API.
- Check your feature test. Does it still pass? Do you need to change the test to use the model?
- Ask: Have you implemented the user story? Do you need to revise the user story?
- Commit your work to Git. Then throw it away if you're not satisfied. You can always "do over" later.
- Ask: Is there another user story you can implement? Get started again.

You may have to repeat this process many times before you have something you can keep. Each time, you will discover what you don't know. Perhaps you haven't expressed a user story well and you need to rethink your feature. Or you've reached the limit of your technical knowledge and you need to do some research and further study. Each time you repeat this process you are practicing crossing the chasm.

Not every writer starts an essay the same way, and not every developer will use the strategy detailed above. If you've ever faced writers' block, you may have heard this advice from teachers: Write something, anything, just to get started. It's the same with software code: Just begin, anywhere. If you follow the strategy described above, you'll have a place to get started. It is a process you can repeat when you start any application. If you need more help, see the book [Practicing Rails](#) by Justin Weiss, which provides advice and exercises to overcome the tutorial gap.

Bridging the Gap With Social Practice

Let's consider the social aspect of software development.

If you work on your own, trying to master the art of software development, it will take you a very long time, you'll need extraordinary patience and tenacity, and you won't become a very good software developer. To accelerate the process, and improve your skill, you must reach out to others. If you're shy and introverted, this will be hard; if you're bossy or reluctant to reveal your shortcomings, it may also be difficult. However, you must make the effort if you want to cross the chasm.

Software development often looks like a solo activity but it is not. Developers talk to users to improve the user interface and product features. Open source libraries, whether gems or full frameworks like Rails, are developed collaboratively. Code reviews are an opportunity to ask others to help you improve your implementation. Pairing is an intense and effective way to write better code and share knowledge. You'll learn more, and faster, from both experienced developers and inexperienced peers, when you work with others.

Making an Effort

It is important to have a strategy to get started on your own, as described above. You must make an initial effort, even if picking yourself up by your bootstraps doesn't get you very far. No one, particularly software developers, wants to help someone who can't show they've made a best effort on their own. You may surprise yourself when you make an initial effort; you'll find out what you know and identify what you need to learn. Start a list of topics you need to research or questions you need to answer. Do research. If no clear answer emerges, list the possibilities and show them to someone else. Even if you think you've found the answer on Stack Overflow or a blog, show someone your initial problem and the solution you've found. Find out if your colleague agrees or has another perspective. Showing someone your research shows you've made an effort and it will make it easier to ask for help when research doesn't provide a solution.

(Refer to the “Get Help When You Need It” chapter if you’re not sure where to do research.)

Conversation Starters

You can ask people to answer questions online, on [Stack Overflow](#), [Reddit](#), [Quora](#), mailing lists, forums, IRC channels, or even by directly sending email to developers. This counts as social activity but it is inherently limited. Open-ended interaction is better, either in person or through video chat. Prime the pump with to-the-point questions, as you would on Stack Overflow, but allow the conversation to meander. Make sure your conversation includes conversation helpers like these:

- What do you think?
- How would you do this?
- Is there a better way?
- What do you think I should look at next?

Ask the kind of questions that elicit opinions that you can’t ask on Stack Overflow. Never forget to acknowledge the gift you’re receiving of time and knowledge. Express your thanks, state clearly how the conversation has benefited you, and offer to report back on how the collaboration has helped your progress.

Pay It Forward

Don’t be shy about asking for help. If you’ve made a best effort to solve a problem on your own, and you’re willing to help others in the future, you’ll get all the help you need, and more.

There's an unwritten rule of the open source movement. It applies whenever you ask a stranger for help, whether opening an issue on GitHub or asking for help with a project. You *are not entitled to anything*, whether its software code, a bug fix, or just help, *if you're only consuming*. Open source is free for the taking but you're not welcome if you're a mooch. Luckily for all of us, *causality rules do not apply* (or at least there's no temporal causality). That means, if you contribute something in the future, help will be forthcoming, sometimes more profusely than you've asked for. You must contribute in kind, of course. If you offer to pay money to have a bug fixed, you're violating the spirit of open source, and you can expect either grumpiness, a hefty consulting fee, or both. If you indicate you're willing to help with documentation or code, you'll be welcomed even if you're currently incapable of contributing. This applies in an interesting way to beginners. If you show you've tried to solve a problem on your own, and ask for help, many developers will help without any compensation other than the conviction that someday you'll help someone in a similar situation. Software development relies on a booming [pay it forward](#) economy.

Finding a Mentor

Now that you've given some thought to the social aspect of software development, let's consider where to go for help.

When career advisors talk about closing the junior gap, they'll often point to the importance of mentorship as the key element in becoming a skilled software developer. It's just as important when you're developing software for a startup or a personal project. Mentorship will help you cross the chasm.

You may ask, how can I find a mentor? In your mind's eye, you may be imagining the mentor that will help you become a skilled Rails developer. He or she is a few years older than yourself, has a great job leading a team at a successful startup, probably contributes to several well-known open source gems, and takes a break every Saturday for a few hours to teach you how to code. Sorry,

that is not likely to happen.

The mentors who will help you will not fit the picture of a wise sage or crone, no more than Prince Charming or Princess Buttercup will ever be anyone's spouse. In most situations, the mentorship relationship will be unacknowledged. The seeds of mentorship lie in any interaction where you ask for help and receive guidance.

Mentorship is a relationship you must cultivate, much like friendship. And, like friendship, you will seldom ever ask someone to be your mentor. Most people would balk at the awkwardness, either because they don't see themselves as qualified, or because it suggests an open-ended commitment and responsibility that is intrusive. Like making new friends, it is your job to seek out mentoring moments, ensure the experience is mutually rewarding, and suggest the possibility of repeating the experience. Mentorship is a relationship built from a series of successful mentoring interactions. Repeat the interactions and you have mentorship.

Creating Mentorship Moments

In the chapter “Get Help When You Need It,” you learned where to look for help. Let's consider where you can look for opportunities to experience mentorship moments.

Online

When you ask for help on [Stack Overflow](#), [Reddit](#), or [Quora](#), the answers will be most useful when you focus narrowly on a specific question. Mentorship comes from open-ended interaction, when a conversation can move in unanticipated directions, so most online interactions seldom turn into mentorship moments.

Online interactions may help you find people who can coach you. Clicking on

a user's name on a site such as Stack Overflow, Reddit, or Quora will show you a user's profile. When someone is helpful or knowledgeable, check if they show their geographic location in their profile. If they don't, perhaps they've provided a link to their website or Twitter account. If not, you may be able to send a private message. Reach out and ask where they are located, if they have time to meet to answer more questions, or can suggest anyone in your city who might be helpful. It is worth checking to see if someone is local even though most people online are not nearby.

GitHub

GitHub is a special case. Interactions on GitHub are at the core of the Rails community. It's where open source software gets built. Collaboration on GitHub leads to mentorship, friendships, and business partnerships. That's why it is so important to build a credible GitHub profile by uploading the projects you build while learning, to show that you are working steadily at becoming a better programmer.

When you look at a repository on GitHub, look at the account of the person who maintains the project. Look at the commits and the issues. Click through to the profiles of the people who've made the commits or commented on the issues. Experienced developers often show their location in their profile and provide their email address. If you find someone in your city, make contact. Of course, don't ask a stranger point-blank to be a mentor! Tell them about your experience and what interests you. Ask where you can meet developers locally. You may learn about a meetup or user group meeting. If your contact is helpful, you may have an opportunity to meet for coffee.

Meetups

Meetups are a prime place to cultivate in-person mentorship moments. All large metro areas have active meetups for web developers, Rails developers,

programmers, or startup entrepreneurs. If you're in a rural area, make the drive once a month to the big city to connect with the community. To find the meetups, search [Meetup.com](https://www.meetup.com) or google "ruby rails (my city)". If you're near a university campus, check for activity on the campus. If you're in a tech hub such as San Francisco, there's a meetup almost every night of the week. Smaller cities have relevant meetups monthly. If you can't find a meetup, start one!

When you visit a meetup, remember that mentorship can be hidden in anyone. Like any public event, you'll meet people who are flakey, bigoted, garrulous, prone to halitosis or innumerable personality quirks, as well as a minority who are fascinating and obviously knowledgeable. Don't dismiss anyone. You'll find mentorship moments where you least expect them.

Workshops and Classes

You may be surprised that workshops and classes are not the ideal place to find a mentor. Obviously, given a good instructor and a relevant curriculum, a workshop or class is a great place to learn. However, it is very unlikely that a teacher will become an ongoing mentor. The instructor's goal is to share knowledge with a group of people, so any focus on you as an individual has to be limited. Furthermore, the instructor is probably not available outside of the class or on an ongoing basis. Don't sign up for a class hoping the instructor will become your mentor.

However, a workshop or class is an ideal place to connect with peers. There is no other place where you'll easily find other people who want to learn the same things as you. When I teach, I'm surprised how often people come to a class expecting their education will end as soon as the class is over. If you take a class, seize the opportunity to make one new friend who will be your study partner after the class ends. Better yet, organize a study group to continue after the class is over. If you have only one new study partner, he or she can flake out. Instead, get together with three or four other learners once a week. Support each other, share your excitement, and invite mentors to come speak to your study group.

Peer learning has much in common with mentorship. The leading code camps recognize that collaborative problem-solving skills are as important as technical skills. When students team up to work through exercises or build applications, there's a natural give-and-take as each takes turns making discoveries and sharing knowledge. You don't have to enroll in code camp to be part of a peer learning environment; you can create it yourself in a study group. This isn't a relationship of mentorship, but it is an opportunity to experience mentorship moments.

On the Job

You are most likely to find a commitment to mentorship on the job. If you've been hired to work as a Rails developer, at a company with Rails developers on the team, you're in an ideal environment to learn. Not everyone has the skills to be a good mentor and you may struggle if you are stuck with a senior developer who is a know-it-all or assumes you know more than you do. Still, you have immediate access to developers with knowledge and the company has every reason to encourage you to learn. Unless the company has an explicit program to assign coaches to new hires, you will probably not call someone your mentor. Instead, recognize that you can cultivate mentorship moments by asking for guidance beyond the immediate assignment. In a stressful environment where your team is delivering code against deadlines, not everyone may be able to devote time to teaching. You should seek mentorship moments where you can.

Some companies are committed to building a culture of mentorship. When you are looking for a job, make it your priority to seek a job offer from companies where you will find mentors. For a first job as a developer, the opportunity to learn on the job is far more valuable than any other benefits. When you interview, ask if the company encourages pair programming. Ask if you will have time to work on a pet project to learn new skills, and if it will be acceptable to ask your teammates to answer questions or provide a code review for your pet project. Ask if the company encourages team presentations about new technologies. Ask if anyone from the company volunteers to teach at workshops

or gives presentations at meetups or conferences. Some hiring managers will be proud to describe the company's commitment to developer education. If they're not, it's a red flag that the company may not be a good fit for you.

Small startups are not a good place to look for mentorship, if the runway is short and the founders are trying to launch before funding runs out. Companies that have closed a [Series A round](#) (the first release of stock to venture capital firms and other private equity investors) will still be tightly focused on getting a product to market, with no time to coach new hires. As a company takes additional rounds of investment, beyond the Series B round, the company will have grown beyond an initial two or three engineers and may recognize the value of hiring and coaching inexperienced developers. To some companies, mentorship is part of a strategy to develop their technical depth. These are the companies that are ideal for new developers.

What's Next

If your goal is to start a career as a Rails developer, your objective should be to find a job at company that is committed to mentorship. You'll need to learn more than what is offered in this book and the next, but you can continue learning while you "go social" to cultivate mentorship moments and meet people who can introduce you to companies that are hiring Rails developers. Going to meetups, collaborating on code, and participating in a study group will help you find mentors and help you find a job.

If you are eager to launch a startup, or plan to work on a personal project, your next step will be different. Let's consider what you should do after finishing this book if you're an entrepreneur, developing a lifestyle business, or working on a personal "side project."

Entrepreneurs

If you want to launch a startup, stop and ask yourself what your priorities should be. Startup success depends on asking yourself every day, “What is the most important task I need to accomplish today?” Chances are, it is not learning to code. Working through my books, you’ll learn enough to work with a skilled developer, whether a cofounder, an employee, or contractors. Your most important task is to determine the [product/market fit](#) for your business idea. You must develop a [Minimum Viable Product](#) (MVP) and start the process of acquiring customers who can tell you if your product has value. Anything else defers the day of judgment when real customers will tell you whether they are willing to spend money on your product.

If you are pursuing your own business vision, you’ll only delay judgment day if your priority is to learn Rails. If you haven’t already, start looking for a technical cofounder or people you can hire (if you have your own funds). Angel investors and venture capitalists are reluctant to fund a solo founder, even when an entrepreneur is highly skilled technically. Investors place more importance on the ability and track record of the team than on a business idea; obviously, a skilled team is a better investment risk than a solo founder who just started learning Rails. In today’s investment climate, you won’t be seeking investment if you don’t yet have an MVP and customer traction. But you should start recruiting your team. The good news is that you’ve learned enough about web development to have credibility when approaching a potential technical cofounder. Among developers, there is no one more ridiculed than the non-technical founder who makes no effort to learn to code and expects someone else to do all the technical work (see [Whartonite Seeks Code Monkey](#)). You’re not that guy or girl. You *could* build your web application yourself, given enough time. But in the best interests of your business, you should look for a partner who will be your technical mentor, guide, and helpmate as you become a better coder and build out your MVP.

You can seek a technical cofounder in the same way you seek mentorship moments. Your agenda will be larger; anyone who is a mentor or peer may be a potential business partner. Look for help to improve your technical proficiency.

As you build a personal relationship with a mentor or peer, you may have an opportunity to introduce someone to your business vision. It is very unlikely you can build a business on your own, so start looking for a partner while you continue to learn to code and develop your MVP.

You won't be having meetings with potential partners every day. On days when you are not looking for a partner, work on the user stories that will define the requirements for your MVP. You don't need anything more than you've learned in this book to develop your user stories and plan your product. Work on wireframes and show your ideas to anyone who will listen. Take a break from product planning to work on your coding skills. Try tackling one or two user stories and see if you can implement a basic feature you need for your MVP. There's no better way to learn to code than building the product that you need for your business, especially if you get help and feedback along the way.

Lifestyle Businesses and Personal Projects

Don't let anyone discourage you if you have an idea for a web application that will supplement your earnings from a job, or even let you quit your job to enjoy a "lifestyle." The investment community disdains lifestyle businesses that have limited "upside" (the revenue growth that rewards investors). Personally, I think lifestyle businesses are great. Without the pressure from investors, and with income from an existing job, you can take your time to learn to code, enjoying the process of learning application development with your goal in mind. It is still worthwhile to seek out a mentor, but you can continue to pursue learning on your own with all the resources we list in the next chapter.

Personal projects can become lifestyle businesses when they begin to generate revenue. Of course, there are many personal projects that are not intended to be moneymakers, for example, a web application for a faith group or a charity, or just a side project that helps you learn to code. Again, seek mentorship moments, or work in a group that learns together, and you'll develop your skills faster. Play around with user stories and wireframes to see if it helps you organize your project. Try writing feature tests. You may not need to write

tests for a personal project but you may discover a feeling of competence and confidence that goes with testing. With a personal project, the journey is the reward. Indulge in the luxury of learning for its own sake and focus on the satisfaction of seeing applications run that you've built with technologies that are new to you.

Build Applications

If you want to become a skilled Rails developer, nothing is more important than building applications. As you'll see in the next chapter, there is so much to learn about web application development that you can (and likely will) continue to learn until the web goes dark. Don't try to learn it all. Start building applications now.

Building applications puts everything you learn in practical context. The features you want to build will set the priorities for what you learn next. If you want users to sign in to an application, you'll learn about authentication. If you want to show stock prices or sports scores, you'll learn about JavaScript and charts. There's no better way to learn than by building.

Build simple applications at first, with only one small feature. Take them all the way from user stories to deployment. Use [Rails Composer](#) if you want to get started fast so you can focus on your custom features. Commit your projects to your GitHub account, no matter how trivial or broken. Putting your projects on GitHub will show that you are working hard and gaining experience. If you're going on job interviews, employers probably won't have time to look at your GitHub account, but you'll gain points in a job interview if you can point to a GitHub repository to show something you've built, or when you answer a question like, "What is the hardest problem you've had to solve?"

Some beginners set a goal, such as building one new application every week. That's a great plan. When your applications get more complex, they will make take more than a week to build, but keep on building. If you don't have any ideas for what to build, ask for ideas on [Reddit](#) or [Quora](#) and the indefatigable

commenters will gladly answer. At a minimum, you should build (and thoroughly understand) each of the starter applications you can build with [Rails Composer](#).

With every application you build, the chasm of the “tutorial gap” will narrow and you will broaden your ability to tackle unfamiliar problems and challenges.

In the next chapter, we’ll consider specific technical skills and I’ll make recommendations for books and tutorials that will increase your technical proficiency,

Chapter 14

Level Up

With this book, you're on the way to becoming a successful Rails developer. You've learned about basic concepts and discovered where to go for help. But there's much more to learn about Rails and web application development. This chapter will suggest the next steps on your path to learning Rails.

What to Learn Next

In Book Two, you'll build a simple web application. It will cover the basics:

- Rails directory structure
- using Git
- installing gems
- configuring an application
- the request-response cycle
- model-view-controller architecture

- application layout and views
- front-end frameworks
- forms
- sending mail
- connecting to external services
- deploying an application
- analytics for traffic and usage

In addition, you'll get an introduction to the Ruby language and the basics of testing.

Here are topics you should study after Book Two:

- Databases
- Testing
- Sessions and Authentication
- Authorization
- JavaScript

I'll explain each topic and suggest where to learn more.

Databases

Book Two will explain how to create a model, a software object that represents data in a database.

When you create a model, you create an object that handles data only for the brief life of the request-response cycle, when it is active in a computer's working memory. You'll want data to persist beyond the brief request-response cycle, after objects disappear from working memory. Rails does not include a built-in database. It offers the flexibility of using several different industrial-grade database systems. Relational database management systems such as [SQLite](#), [PostgreSQL](#), [MySQL](#), and [Oracle](#) all use [Structured Query Language \(SQL\)](#) as an interface to store and retrieve data. These databases run separately from a web application, requiring their own database servers.

Rails provides a component, named [Active Record](#), that connects to these database servers. Active Record is a framework for Object-Relational Mapping (ORM), connecting application models to database tables in a relational database management system (DBMS). Active Record makes it possible to save model data as a record in an external database, preserving complex relationships among the data.

Application development would be easy if we could just use spreadsheets to save our data. However, some data, such as a document, is too large to fit in the columns and rows of a spreadsheet. More significantly, database management systems are designed to accommodate relationships among the data. That's why they are called relational database management systems. For example, an ecommerce application might have a Customer model and an Order model. Active Record allows developers to use the Rails API to describe associations among models and interact with a database. For example, you can make sure that an order is not created unless it is associated with a customer. Additionally, Active Record provides a query interface. You can use the query interface to find all orders associated with a particular customer.

Where to Learn

For a focused, fast introduction to Rails and databases, you should read the book:

- [Easy Active Record for Rails Developers](#) by Jason Gilmore (\$29 USD)

It is my recommended follow-on to learn more about databases.

Testing

You learned about the basic concepts and terminology of testing in Book Two. If you're working on a personal project or your own startup, you can learn more about [Minitest](#) to gain the skill you need to write robust tests. If you expect to work with other Rails developers professionally, you'll need to learn to use [RSpec](#) for testing.

Where to Learn

Every intermediate-level Rails book talks about testing, without any introduction to the terminology and concepts of testing. Review the “Testing” chapter in Book Two, then learn to set up and use RSpec with a tutorial I've written, [The RSpec Tutorial](#), which is part of the [Capstone Rails Tutorials](#) series.

To learn more about RSpec, read these two excellent books:

- [Everyday Rails Testing with RSpec](#) by Aaron Sumner (\$19 USD)
- [Rails 4 Test Prescriptions](#) by Noel Rappin (\$25 USD)

You don't have to read these books immediately, but be sure to add them to your reading list.

Authentication and Sessions

Most web applications need a way for users to sign in, permitting access to some features of the application only for signed-in users. The popular gem [Devise](#) is used to add authentication for users who register with an email address

and password. [OmniAuth](#) is a gem for authentication using a service such as Facebook, Twitter, or GitHub. Most Rails developers will use these gems because they are robust and well-tested.

To understand how authentication works, you'll need to learn about *sessions* in a web application. The web, as originally built, was *stateless*. A server simply responded to a request by delivering a file. To enable ecommerce applications, [cookies](#) were adopted in 1997 as a way to preserve state. Each time the browser makes a request, it will send a cookie. A web application will check the value of the cookie and, if the value remains the same, the application will recognize the requests as a sequence of actions or a *session*. A session begins with the first request from a browser to a web application and continues until the browser is closed. Cookie-based sessions give us a way to manage data through multiple browser requests. Rails does all the work of setting up an encrypted, tamper-proof session. The data we most often want to persist throughout a session is an object that represents the user.

Where to Learn

To get started quickly with either Devise or OmniAuth, I've written two tutorials which are part of the [Capstone Rails Tutorials](#) series:

- [Devise Quickstart Guide](#)
- [OmniAuth Tutorial](#)

As a learning exercise, it is worthwhile to build authentication from scratch without Devise or OmniAuth. Michael Hartl's popular book shows how to build authentication from scratch:

- [Ruby on Rails Tutorial](#) by Michael Hartl (free online)

Authorization

We use authentication to verify a user’s registered identity, so we know the person signing in is the same person who signed up earlier. We use *authorization* to limit access to pages of a web application. Authorization is typically restricted by role, so users are assigned roles with differing access privileges. In the simplest implementation, we check if a user has a specific role (such as administrator) and either allow access or redirect with an “Access Denied” message. Roles are attributes associated with a user account, and often implemented in a User model.

There are no standard conventions for implementing roles and authorization in Rails. Developers often implement roles from scratch and use gems such as [Pundit](#) or [CanCanCan](#) to implement authorization. For most web applications, you’ll need to learn how to implement roles and authorization.

Where to Learn

To learn about authorization, start with a free article I’ve written on [Rails Authorization](#). I’ve also written two tutorials which are part of the [Capstone Rails Tutorials](#) series:

- [Role-Based Authorization](#)
- [Pundit Quickstart Guide](#)

These tutorials explain the code from the [rails-devise-roles](#) and [rails-devise-pundit](#) example applications, which you can generate with Rails Composer as starter applications.

JavaScript

JavaScript is a general-purpose programming language (like Ruby). It is the language used to manipulate web pages within a browser. Every web devel-

oper needs to know JavaScript. For a Rails application, you might develop application features such as auto-complete search forms using a combination of [jQuery](#) and [AJAX](#) techniques. For more sophisticated web applications, such as a single-page application (SPA) that loads in the browser as a single web page and offers a fluid user experience similar to a desktop application, you'll need to learn to use a JavaScript framework such as [Ember.js](#), [AngularJS](#), [React](#), or [Backbone.js](#). If you intend to specialize as a front-end developer, focusing on user interaction and the browser interface, you'll need to become an expert in JavaScript.

Where to Learn

There are many resources for JavaScript, more than for learning Ruby or Rails. Here are good curriculum guides:

- [Learn JavaScript by Mozilla](#)
- [The Odin Project: JavaScript and jQuery](#)

The JavaScript course from [Codecademy](#) is universally recommended, as is the book [Eloquent JavaScript](#).

Other Topics

There is much more to learn before you gain full proficiency as a Rails developer. Here's an illustration:

The graphic above is from a blog post, [This is Why Learning Rails is Hard](#), by Brook Riggio of the [Code Fellows](#) code camp in Seattle. You can [see the graphic in detail](#). The first time I saw it, I felt despair. It is a mind map of all the topics a skilled developer should know. The branches on the right side are topics that are specific to Rails, as well as general skills required of a Rails

developer, such as Git, the Ruby language, and software engineering competencies. The branches on the left are general areas of knowledge that would be understood by any web developer, such as the Unix command line, web fundamentals, deployment, testing, and SQL. Brook Riggio says, “If this looks intimidating to you, you’re not alone. . . . Learning Rails is hard because there are many independent concepts to learn.” I recommend you spend half an hour each day googling each topic listed on Brook Riggio’s map. In three months, you’ll have a “big picture” of the knowledge areas that are important to a Rails developer. You can’t learn everything at once, so dive further into the topics that interest you. As you tackle new projects, you’ll learn more, and you’ll add depth to your understanding of each topic on the map.

Curriculum Guides

Brook Riggio’s map gives you a list of topics for learning. But it is helpful to tackle the topics in a sequence that makes sense. You’ll also need recommendations for the best learning materials. For a curriculum that organizes the topics you need to become a web developer, I recommend:

- [The Odin Project](#)

It is a unique community-driven curriculum, organized by Erik Trautman, the founder of [Viking Code School](#), that gives you a roadmap of what to learn, and where to learn it.

Other code camps have published curriculum guides, to be used as “pre-work” for enrolled students:

- [Flatiron School Prework](#)
- [MakerSquare Prework](#)

These curriculum guides point you to important topics as well as recommended books and courses.

Places to Learn

What's your preferred learning mode? Books, classrooms, videos, online courses? I guess you're comfortable with books, so I'll recommend the best ones for further study. But first let's consider other modes of learning.

Code Camps

Starting in New York City with [General Assembly](#) in 2011, and [Dev Bootcamp](#) in San Francisco in 2012, the market for developer education has been booming. Right now, in San Francisco, there are a dozen organizations offering immersive code camps, and dozens more in large cities worldwide. These organizations offer eight- to twelve-week courses, priced around \$10,000 to \$12,000 USD. For a list of code camps, see these websites:

- [Course Report](#)
- [Hack_app](#)
- [Switch](#)
- [Techendo Reviews](#)

Code camps are a great way to become a developer, if you can afford the cost, and intend to recover the cost by finding a high-paying job as a developer. The best code camps create an environment of peer-based learning, where you pair with other students to solve technical problems and build applications, just as you would in the workplace. Code camps also provide relentless pressure to learn, from teachers and peers, but primarily from yourself. The quality and depth of technical knowledge you'll acquire varies greatly depending on the code camp curriculum and the individual instructors they've hired. All code camps provide the motivation and social context for accelerated learning,

delivering self-confidence that comes from the encouragement and feedback of teachers and peers.

If you don't have money to pay for code camp, all is not lost. You can teach yourself Rails with books and, with effort, you'll be good enough to start a web-based business or look for a job. I recommend that you build your self-confidence by developing applications on your own. And certainly, find other learners and study together. Most Rails developers are self-taught, at least within the domain of web application development, so code camps or university programs are wonderful, if you can afford the cost, but not essential.

Other Classrooms

It's unusual to find a university or community college that offers classes in web development with Rails. In the US, university computer science programs focus on analytical reasoning and the conceptual underpinnings required for advanced research in the field. Some community colleges teach web development but it is difficult for the schools to find experienced Rails instructors, especially given the disparity in salaries between teaching and software engineering. However, universities or community colleges are good places to meet other students and form a study group, to provide social support for learning.

Classes taught in the community, often free or low-cost, are surprisingly good places to learn. Teachers and organizers are highly motivated and may be experienced Rails developers giving back to the community. Community-based classes or workshops are often poorly publicized, so you'll have to search hard for these courses.

Women have a good chance of finding peer organizations that teach programming and web development with Rails. Start by looking at the course schedules for these organizations:

- [Rails Girls](#)
- [RailsBridge](#)

- [Girl Develop It](#)
- [Women Who Code](#)

These organizations only offer introductory classes, so you'll have to study on your own for deeper knowledge. Short courses such as weekend workshops are valuable because you can find other students who want to start a study group.

Online Courses

It's no longer necessary to go to a classroom to go to school. Online courses range from online code camps that provide videos and one-on-one coaching, to websites that offer a selection of pre-recorded videos packaged as a course, to MOOCs ([massive open online courses](#)) offered by consortiums of universities.

Chasing the runaway success of classroom-based code camps, you'll find a number of companies that offer code schools delivered online. Here are a few that combine videos with personal coaching:

- [Bloc.io](#)
- [CareerFoundry](#)
- [Code Union](#)
- [Tealeaf Academy](#)
- [The Firehose Project](#)
- [Thinkful](#)
- [Thoughtbot Upcase](#)
- [Viking Code School](#)

The online code schools provide some of the benefits, specifically curriculum and coaching, of the classroom-based code camps, at a fraction of the cost. Videos, homework projects, and online mentors can't reproduce the intense peer-based learning of the classroom code camps. But you don't have to quit your job or move to a another city.

MOOCs provide university-level education online. You can search a database of MOOCs at the [Class Central](#) website. I recommend the edX course:

- [CS169.1x Engineering Software as a Service](#)

It is a nine week class, it is free, and it is taught four times a year. It is based on a software engineering class taught at the University of California, Berkeley. The professors have written their own textbook to accompany the class, [Engineering Software as a Service: An Agile Approach Using Cloud Computing](#). The class is very worthwhile, if you have the time and it fits your schedule.

Videos

Online code camps and MOOCs provide supervised learning, combining videos with access to coaches or instructors. If you want self-paced study, without access to a coach, you'll find hundreds of videos online, varying greatly in quality. There's one big problem with videos: The ones that are easiest to find are often outdated. It is very difficult for producers to revise videos and, as you know, Rails changes often.

Michael Hartl, author of the [Ruby on Rails Tutorial](#), a book I recommend, offers screencasts to accompany the book. The cost is \$149 USD. At this time, a 3rd edition is in production, covering the newest version of Rails. You can find Hartl's [series of free videos](#) on YouTube but they are out of date.

[Go Rails](#) offers several dozen intermediate and advanced screencasts. Chris Oliver started producing the videos in mid-2014, so they are newer than most Rails screencasts you'll find on the web. These are task-focused videos, good

for supplementing a book or course. Some are free, some are available with a \$9 USD subscription.

[RailsCasts](#) seems to always be recommended by Rails developers, and these screencasts were once among the best ways to learn about Rails. RailsCasts creator Ryan Bates left the community in mid-2013 and, unfortunately, many of the screencasts are no longer current or relevant. Still, they are worth a look.

[Lynda.com](#) offers a [Ruby on Rails 4 Essential Training](#) 12 hour video series at a cost of \$25 USD for a monthly subscription. It covers Rails 4.0 and is an adequate introduction at a very low cost.

[Thoughtbot Upcase](#), formerly known as ThoughtBot Learn Prime, is a program from the respected ThoughtBot consulting firm that provides videos for \$49 USD monthly, with coding exercises and a personal coach at a higher price. You can see the [Upcase curriculum](#) for an overview. The program is well-regarded.

[Code School](#) is famous for its [Rails for Zombies](#) course, and the company offers a dozen additional courses that cover both Ruby and Rails. The courses combine instructional videos with in-browser coding exercises at a cost of \$29 USD per month. The quality is high, the videos are current, and the company tries to make the topics entertaining.

[Pragmatic Studio](#), publishers of many high-quality Rails books, offers a series of 26 videos for \$179 USD. The course is a solid introduction to Rails, though it only covers Rails 4.0.

[RubyOnRailsTutor.com](#) is a free series of short screencasts introducing Rails to beginners.

[Baserails.com](#) is a video series, available with a \$25 USD monthly subscription, that shows you how to build an application. It's good if you want practice before building something on your own.

[One Month Rails](#) is an 8 hour video series aimed at beginners. It's priced at \$99 (though you can find discount codes if you search). If you've read Book Two, you should skip One Month Rails and focus on intermediate-level books

and courses.

[Treehouse](#) is a subscription site (\$25 USD per month) with a big budget and many course offerings. The courses on Ruby and Rails don't provide enough depth to take you beyond a beginner level.

[Tuts+](#) offers a 3 hour course [Riding Ruby on Rails](#). The course is out of date.

[Codecademy](#) offers a series of courses that combine videos with interactive quizzes on [Ruby](#) and [JavaScript](#). The course on JavaScript is often recommended. However, the format is very much classroom-oriented without practical context. There is no course on Rails.

[Udemy](#) offers a range of video courses on Ruby and Rails. This is crowd-sourced content (like YouTube) and the quality varies greatly. If you've found a great course on Udemy, email me and I'll list it here in the next version of the book.

[Skillshare](#) is another source of crowd-sourced video courses. The site offers an inexpensive video series on [Ruby on Rails in 30 Days](#) that covers Rails 4. Other offerings on Ruby and Rails are out of date.

As you can see from the long list, videos are plentiful. Avoid the old ones.

Books

At the beginning of this chapter, I recommended [Easy Active Record for Rails Developers](#) by Jason Gilmore because it is focused on databases and Rails, the next thing you need to study. Other books deserve mention.

One book stands out among all:

- [Ruby on Rails Tutorial](#) by Michael Hartl (free online)

More Rails developers read, and recommend, Michael Hartl's book than any other. For you, after reading this book and [Easy Active Record for Rails Devel-](#)

[opers](#), Michael Hartl’s book will be a review of what you’ve learned. I hope you will breeze through it, given the fundamental concepts you’ve already learned.

Three other books on Rails are notable:

- [Agile Web Development with Rails](#) by Sam Ruby, Dave Thomas, and David Heinemeier Hansson
- [The Rails 4 Way](#) by Obie Fernandez, Kevin Faustino, and Vitaly Kushner
- [Rails 4 in Action](#) by Ryan Bigg and Yehuda Katz

All three are dense, comprehensive, and authoritative. In my opinion, you should start building Rails applications before digging into these books. As you begin building applications, dip into any of these books for further explanation and insight.

I recommend the book by Justin Weiss, [Practicing Rails: Learn Rails Without Being Overwhelmed](#). The book provides useful technical tips and tricks, such as techniques for debugging, but the focus of the book is overcoming challenges that new developers commonly face. You’ll find advice about keeping up with the Rails community and managing time and motivation when learning Rails, as well as overcoming “the tutorial gap” to begin building your own applications.

Several other books should be on your reading list to improve your skill:

[Rebuilding Rails](#) by Noah Gibbs. If you like to discover how things work, you’ll gain a deep insight into Rails from Noah Gibbs’s book, as he shows you how to build a framework like Rails from scratch.

[Practical Object-Oriented Design in Ruby](#) by Sandi Metz. A must-read that teaches the techniques of master programmers.

In addition to the books listed here, I recommended several books to help you learn the Ruby programming language at the the end of the chapter, “Just Enough Ruby.”

A Final Word

Keep in mind the reason you're here. You're learning Rails so that you can build applications. I've given you a book that is dense with links and recommendations for further resources. I've met many students who are overwhelmed with all these resources. Some people postpone building anything because there is so much more to learn. Don't be that person. Skip everything I've recommended in this chapter and just get started building. When you need to learn more, you can come back and dig deeper.

Good luck with building the application in Book Two. I hope you like my approach and writing style so that you'll continue with the [Capstone Rails Tutorials](#).

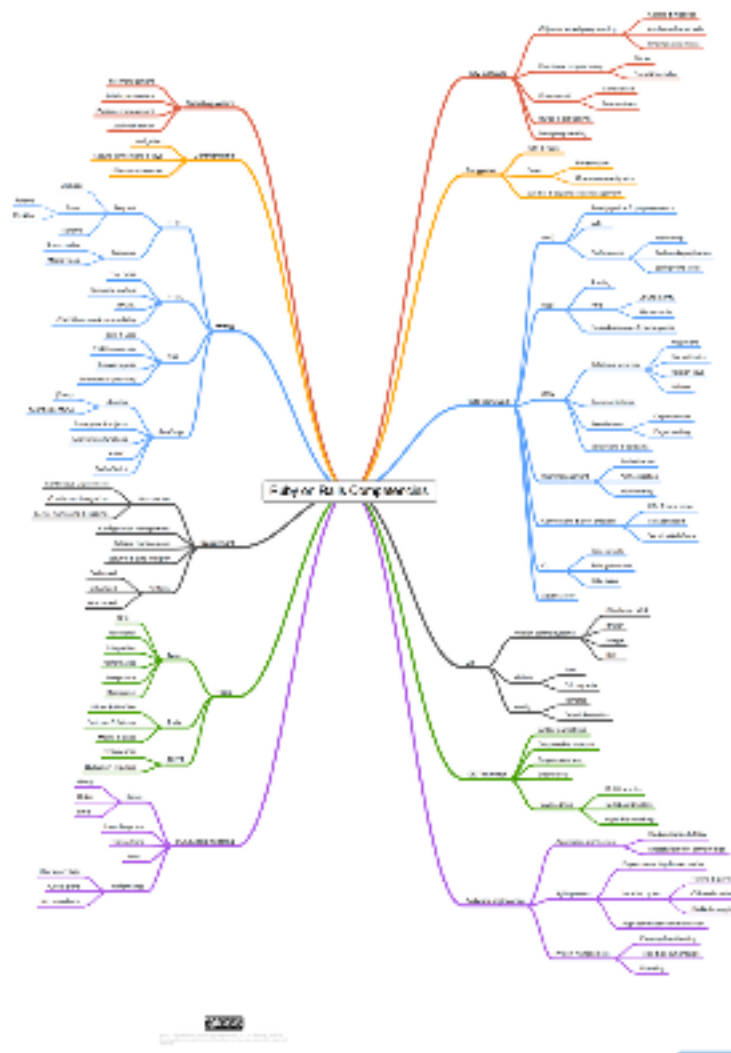


Figure 14.1: Rails Competencies.

Chapter 15

Version Notes

If you've purchased this book as part of the [Capstone Rails Tutorials](#), you have access at any time to the most recent version of the book. If you've gotten your copy of the book elsewhere, you may have an older version that doesn't have the newest updates.

You'll find the version number and release date on the first page of this book (under the book title). Check the [learn-rails GitHub repository](#) to find out if you have the newest version of the book. The README page on the GitHub repo always shows the most recent version number for the book and the tutorial application.

Here are the changes I've made.

Version 3.0.0

Version 3.0.0 was released January 14, 2016

Extensive revision throughout the book, and the length of the book increased, so the book is now two books. Book One contains the introductory and self-help chapters and can be read without access to a computer. Book Two contains the step-by-step tutorial and requires use of a computer.

Version 2.2.2

Version 2.2.2 was released October 30, 2015

In the “Front-End Framework” chapter, updated filename to `1st_load_framework.css` from `framework_and_overrides.css.scss` to reflect a change in the rails_layout gem.

Version 2.2.1

Version 2.2.1 was released September 19, 2015

Updated references to Ruby from version 2.2.0 to 2.2.3.

Updated references to Rails 4.2.0 to Rails 4.2.4.

Updated Visitor model `subscribe` method for the new Gibbon 2.0 API.

Recommending [Cloud9](#) instead of [Nitrous.io](#) because Nitrous.io is no longer free.

Version 2.2.0

Version 2.2.0 was released June 6, 2015

For Amazon customers, added an offer to access the online version or download a PDF at [learn-rails.com](#).

Google now requires use of OAuth 2.0 for application access to Google Drive. The implementation is considerably more complex than the previous implementation using a Gmail address and password. I’ve dropped the “Spreadsheet Connection” chapter.

Minor clarification in the “Layout and Views” chapter.

Version 2.1.6

Version 2.1.6 was released March 17, 2015

Remove references to the Thin web server in the “Deploy” chapter.

Correct version number for `gem 'sass-rails'` in various Gemfile listings. Fixes [issue 49](#) and an error “Sass::SyntaxError - Invalid CSS” when the Foundation front-end framework is used.

In the “Testing” chapter, the file `test/integration/home_page_test.rb` was missing `require 'test_helper'`.

Updated “Rails Composer” chapter to describe new options.

Minor improvements and corrections of typos.

Version 2.1.5

Version 2.1.5 was released March 4, 2015

Use the Ruby 1.9 hash syntax in the `validates_format_of :email` statement.

Minor improvements and corrections of typos.

Version 2.1.4

Version 2.1.4 was released January 3, 2015

Updated references to Ruby from version 2.1.5 to 2.2.0.

Specify the “v0” version of the `google_drive` gem in the “Spreadsheet Connection” chapter.

Version 2.1.3

Version 2.1.3 was released December 25, 2014

Updated references to Rails 4.1.8 to Rails 4.2.0.

Version 2.1.2

Version 2.1.2 was released December 4, 2014

Released for sale as a Kindle book on Amazon, with new cover art (same cat, though).

RailsApps Tutorials now named the [Capstone Rails Tutorials](#).

Updated references to Ruby from version 2.1.3 to 2.1.5.

Updated references to Rails 4.1.6 to Rails 4.1.8 (minor releases with bug and security fixes).

Removed link to the (now defunct?) [Lowdown](#) web application in the “Plan Your Product” chapter.

Changes to the “Asynchronous Mailing” section of “Send Mail” chapter to describe Active Job in Rails 4.2.

Minor improvements to the “Dynamic Home Page,” “Deploy,” “Configure,” “Troubleshoot,” and “Create the Application” chapters.

Version 2.1.1

Version 2.1.1 was released October 22, 2014

Minor rewriting for clarity.

Updated “Precompile Assets” section of the “Deploy” chapter.

Mentioned explainshell.com in the “Get Started” chapter.

Mentioned [Zeal](#) as a Linux alternative to [Dash](#).

Recommended book [Practicing Rails](#) by Justin Weiss.

Version 2.1.0

Version 2.1.0 was released October 12, 2014

Updated references to Ruby from version 2.1.1 to 2.1.3.

Updated references to Rails 4.1.1 to Rails 4.1.6 (minor releases with bug and security fixes).

Four new chapters:

- “Testing”
- “Rails Composer”
- “Crossing the Chasm”
- “Level Up”

Use `ActiveModel` instead of the [activerecord-tableless](#) gem.

In the “Configuration” chapter, add a note to use spaces (not tabs) in the **config/secrets.yml** file.

Updated “Gems” chapter to add a troubleshooting note to the “Install the Gems” section (about errors with the Nokogiri gem).

Added a section on “Multiple Terminal Windows” to the “Create the Application” chapter.

In the “Get Help When You Need It” chapter, updated the list of recommended newsletters, replaced [rubypair.com](#) with [codermatch.me](#), and added a section on code review. Removed reference to defunct [Rails Development Directory](#).

Version 2.0.2

Version 2.0.2 was released May 6, 2014

Updated references to Rails 4.1.0 to Rails 4.1.1 (a minor release with a security fix).

For Nitrous.io users, clarify that “http://localhost:3000/” means the Preview browser window.

Update “Gems” chapter, section “Where Do Gems Live?” to add more explanation.

Minor change to code in the “Mailing List” chapter, setting ‘mailchimp_api_key’ explicitly when instantiating Gibbon, for easier troubleshooting.

Version 2.0.1

Version 2.0.1 was released April 16, 2014

Minor updates for Rails 4.1.0. Mostly small changes to the “Configure” and “Front-End Framework” chapters.

Added an explanation that, in the **config/secrets.yml** file, **domain_name** doesn’t have to be kept secret and set as a Unix environment variable.

Added a hint about passwords that use punctuation marks (plus a completely irrelevant note about profanity).

Replaced **Rails.application.secrets.gmail_username** with **Rails.application.credentials[:gmail_username]**. Also replaced **gmail_password** with **email_provider_password**. Just trying to make things a little more generic in case Gmail is not used as a provider.

Added a section explaining the horrid details of the **config.assets.precompile** configuration setting in the **config/application.rb** file. Please convey my displeasure to those responsible for subjecting beginners to this travesty.

In the “Deploy” chapter, restored `RAILS_ENV=production rake assets:precompile` because Rails 4.1.0 no longer barfs on this.

Added resources to the “Get Help When You Need It” chapter.

Minor rewriting of the introduction.

Version 2.0.0

Version 2.0.0 was released April 8, 2014

Updated references to Ruby from version 2.1.0 to 2.1.1.

Updated the book to Rails 4.1. The application name is no longer used in the **config/routes.rb** file.

Rails 4.1 changes the **app/assets/stylesheets/application.css.scss** file. Updated the “Front-End Framework” chapter. Also expanded the explanation of the Foundation grid.

In Rails 4.1, configuration variables are set in the **config/secrets.yml** file. The Figaro gem is dropped, along with the **config/application.yml** file. Updated the “Configure” chapter and references to configuration variables throughout the book.

In the “Deploy” chapter, changed `RAILS_ENV=production rake assets:precompile` to `rake assets:precompile` to avoid the error “database configuration does not specify adapter.”

Updated “The Parking Structure” chapter with comments about “Folders of Future Importance” that experienced developers often use: **test/**, **spec/**, **features/**, **policies/**, and **services/**. Updated the “Spreadsheet Connection” chapter to mention service-oriented architectures (SOA).

Extended the section on “Limitations of Metaphors” in the “Just Enough Ruby” chapter to include the example of gender when modeling a person.

Minor rewriting for clarity throughout.

Version 1.19

Version 1.19 was released February 1, 2014

Updated the book to use Foundation 5.0. Foundation 5.0.3 was released January 15, 2014 (earlier versions 5.0.1 and 5.0.2 were incompatible with Rails Turbolinks and the Rails asset pipeline). Changed the Gemfile to remove `gem 'compass-rails'` and replace `gem 'zurb-foundation'` with `gem 'foundation-rails'`. Updated a line in the “Front-End Framework” chapter for Foundation 5.0:

```
$ rails generate layout foundation5 --force
```

The files **navigation.html.erb** and **application.html.erb** are changed for Foundation 5.0. The Bootstrap front-end framework is now independent of Twitter, so I call it “Bootstrap” not “Twitter Bootstrap.” Revised the chapter “Just Enough Ruby” to incorporate suggestions from technical editor Pat Shaughnessy. Revised the chapter “Request and Response” to incorporate suggestions from technical editor Kirsten Jones. Minor rewriting for clarity throughout.

Version 1.18

Version 1.18 was released January 10, 2014

Updated references to Ruby from version 2.0.0 to 2.1.0. Changed one line in the “Front-End Framework” chapter to accommodate a change in the rails_layout gem version 1.0.1. The command was:

```
$ rails generate layout foundation4 --force
```

Changed to:


```
$ rails generate layout:install foundation4 --force
```

Updated the “Configure” chapter to add ActionMailer configuration values to the file **config/environments/development.rb**.

Version 1.17

Version 1.17 was released December 21, 2013

Updated Rails version from 4.0.1 to 4.0.2 .

Changed Gemfile to remove `gem 'compass-rails', '> 2.0.alpha.0'` and replace it with `gem 'compass-rails', '> 1.1.2'`. The 2.0.alpha.0 version was yanked from the RubyGems server. The compass-rails gem is needed for Foundation 4.3. It will not be needed for Foundation 5.0.

Changed Gemfile to replace `gem 'zurb-foundation'` with `gem 'zurb-foundation' '> 4.3.2'`. Foundation 5.0 will require `gem 'foundation-rails'` but we can't use it until an [incompatibility with Turbolinks](#) is resolved. So we will stick with Foundation 4.3.2 for now.

Revised code in the “Analytics” chapter. Using `ready page:change` instead of `page:load` to accommodate Turbolinks. Updated the **segmentio.js** file to use a new tracking script from Segment.io. Updated instructions for setting up Google Analytics tracking on Segment.io. Added concluding paragraphs “Making Mr. Kadigan Happy” to the “Analytics” chapter.

Minor clarification in the “Front-End Framework” chapter to explain that the navigation bar won't show a dropdown menu until the next chapter, when we add navigation links.

Minor clarification in the “Spreadsheet Connection” chapter to explain that Google may block access if you attempt access from a new and different computer (including Nitrous.io).

Added cat names in the “Credits and Comments” chapter.

Revised “Getting Help” chapter and added “Version Notes” chapter.

Minor clarifications, plus fixes for various typos and insignificant errors.

Chapter 16

Credits and Comments

Was the book useful to you? Follow [@rails_apps](#) on Twitter and tweet some praise. I'd love to know you were helped out by the tutorial.

You can find me on [Facebook](#) or [Google+](#). I'm happy to connect if you want to stay in touch.

If you'd like to recommend the book to others, the landing page for the book is here:

- <http://learn-rails.com/learn-ruby-on-rails.html>

I'd love it if you mention the book online, whether it is a blog post, Twitter, Facebook, or online forums. Recommending the book with a link makes it easier for people to find the book.

Credits

The book was created with the encouragement, financial support, and editorial assistance of hundreds of people in the Rails community.

Daniel Kehoe wrote the book and implemented the application.

Financial Backers

The following individuals provided financial contributions of over \$50 to help launch the book. Please join me in thanking them for their encouragement and support.

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Dozens of volunteers offered corrections and made suggestions, from fixing typos to advice about organizing the chapters.

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Photos

Images provided by the lorempixel.com service are used under the [Creative Commons license](#). Visit the Flickr accounts of the photographers to learn more about their work:

- photo of a white cat by [Tomi Tapio](#)
- photo of a cat by [Steve Garner](#)
- photo of a cat by [Ian Barbour](#)

The photo of a fluffy white cat by [Tomi Tapio](#) is used in the application.

Comments

I regularly update the book. Your comments and suggestions for improvements are welcome.

Feel free to email me directly at daniel@danielkehoe.com.

Are you stuck with code that won't work? [Stack Overflow](#) provides a question-and-answer forum for readers of this book. Use the tag “learn-ruby-on-rails” or “railsapps” when you post your question.

Found a bug in the tutorial application? Please create an [issue](#) on GitHub.

LEARN RUBY ON RAILS



BOOK
TWO

DANIEL KEHOE

Learn Ruby on Rails: Book Two

Version 3.0.0, 14 January 2016

Daniel Kehoe

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Chapter 1

Introduction

Welcome. This is Book Two in my [Ruby on Rails book series](#).

In this book, you'll build a working web application so you'll gain hands-on experience. Along the way, you'll practice techniques used by professional Rails developers. And I'll help you'll understand why Rails is a popular choice for web development.

I suggest you read Book One at your leisure to get the big picture that's missing from other tutorials. Read it anywhere, on your phone or tablet, to gain background understanding when you are not at your computer. It introduces key concepts so you'll have a solid foundation for continued study. But you can start this book before you finish Book One.

This book (Book Two) is for hands-on learning so you'll need your computer to follow this tutorial.

Is It for You?

You don't need to be a programmer to succeed with this book. You'll be surprised how quickly you become familiar with the Unix command line interface and the Ruby programming language even if you've never tried programming

before.

Book One provides a primer for the Unix command line, the terminal, and a text editor. If you have no experience with Unix commands, the terminal window, or a text editor, read Book One first. Everything else you need is self-contained in this book.

With this book, my aim is to introduce you to Rails and the techniques of web application development so you can launch a startup or begin a new career.

What To Expect

There is deep satisfaction in building an application and making it run. With this book, I'll give you everything you need to build a real-world Rails application. More importantly, I'll explain everything you build, so you understand how it works. There will be no mystery code.

When you've completed this tutorial, you will be ready for more advanced self-study, including the [Capstone Rails Tutorials](#), textbook introductions to Rails such as Michael Hartl's [Ruby on Rails Tutorial](#), or workshops and code camps that provide intensive training in Ruby on Rails.

About Book One

Here's what is covered in Book One, in case you missed it.

In Book One, I explain the culture and practices of the Rails community. I introduce the basic concepts you'll need to understand web application development. You'll learn how to be a successful learner and how to get help when you need it.

Be sure to look at Book One for a roadmap, or study guide, in the "Level Up" chapter, that lays out a path to learning Rails. There's so much to learn, it helps to have a map so you know where to go next. Finally, to become a skilled Rails

developer, you'll need to start building applications, and Book One contains a chapter, "Crossing the Chasm," that will give you a strategy for building your own applications.

What's in This Book

You'll start coding immediately in this book. It's a hands-on tutorial that will lead you through the code needed to build a real-world web application. Don't skip around in this book. The tutorial is designed to unfold in steps, one section leading to another, until you reach the "Testing" chapter.

You can complete this book in one long weekend, though it will take concentration and stamina. If you work through the book over a longer timespan, try to set aside uninterrupted blocks of two hours or more for reading and coding, as it takes time to focus and concentrate.

A Warning About Links

My books are densely packed with links to background reading. If you click every link, you'll be a well-informed student, but you may never finish the book! It's up to you to master your curiosity. Follow the links only when you want to dive deeper.

What Comes Next

The best way to learn is by doing; when it comes to code, that means building applications. Hands-on learning with actual Rails applications is the key to absorbing and retaining knowledge.

After you read this book, you'll be able to work with the example applications from the [RailsApps Project](#). The project provides open source example applications for Rails developers, for free. Each application is accompanied by a

tutorial in the Capstone Rails Tutorials series, so there's no mystery code. Each application can be generated in a few minutes with the [Rails Composer](#) tool, which professional developers use to create starter applications.

The RailsApps Project is solely supported by sales of the books and the [Capstone Rails Tutorials](#). If you purchase the Capstone Rails Tutorials, you'll keep the project going. And you'll have my sincere appreciation for your support.

Versions

This book requires a specific version of Rails (the newest at the time it was revised) and shows how to install the latest version of Rails. The “Get Started” chapter provides details.

Rails changes often, so you must work from the newest edition of this book to avoid problems. If you're not already reading the online edition of this book, I provide an invitation code so you can get the online edition of this book for free. For readers who obtained this book from Amazon or another retailer, the free offer is on the first page of this book, after the table of contents.

Staying In Touch

If you obtained this book from Amazon or another retailer, take a moment to get on the mailing list for the book. I'll let you know when I release updates to the book.

- [Get on the mailing list for the book](#)

A Note to Reviewers and Teachers

This book approaches the subject differently than most introductions to Rails. In this book, rather than show the student how to use scaffolding, I introduce

the model-view-controller design pattern by creating the components manually. Lastly, though every other Rails tutorial shows how to use a database, this book doesn't, because I want the book to be a short introduction and I believe the basic principles of a web application stand out more clearly without adding a database to the application. Though this tutorial is not a typical Rails introduction, I hope you'll agree that it does a good job in preparing Rails beginners for continued study, whether it is a course or more advanced books.

Using the Book in the Classroom

If you've organized a workshop, course, or code camp, and would like to assign the book as recommended reading, contact me at daniel@danielkehoe.com to arrange access to the book for your students. The book is available at no charge to students enrolled in qualified workshops or classes.

Let's Get Started

In the next chapter, we'll learn how to get help when you need it.

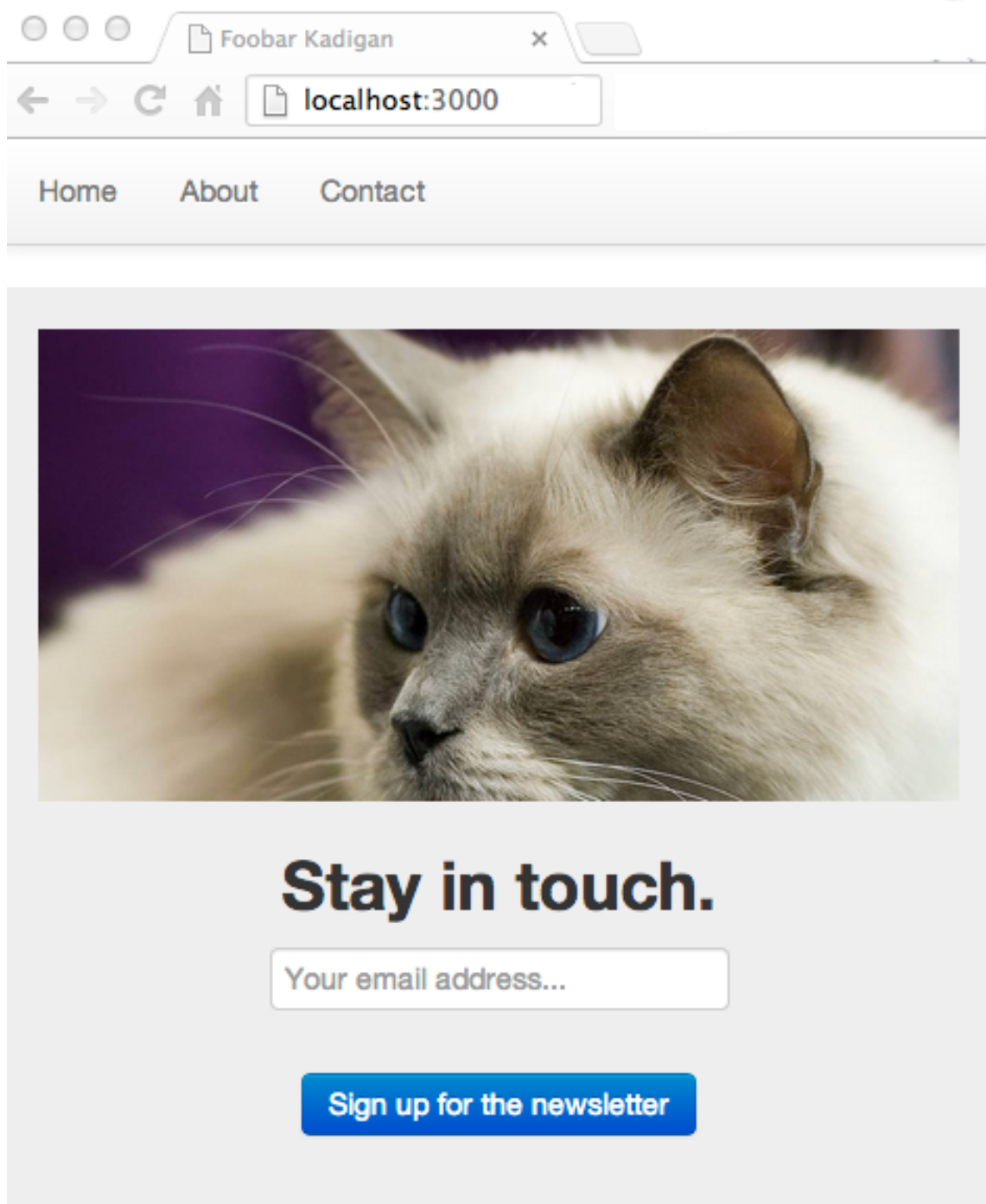


Figure 1.1: The application you will build.

Chapter 2

Get Help When You Need It

This chapter is important. It appears in the first book in this series, but I’ve included an expanded version here in Book Two for easy reference.

Example Code

If you follow this tutorial closely, you’ll have a working application that closely matches the example app in the [learn-rails](#) GitHub repository. If your application doesn’t work after following the tutorial, compare the code to the example app in the GitHub repository, which is known to work.

Version Check

The code in this tutorial was tested by many people and worked flawlessly at the time this was written. The [learn-rails](#) example application on GitHub serves as a “reference implementation” if you have problems. The example application is updated more frequently than the published tutorial.

You’ll find the version number and release date on the first page of this book

(under the book title). Check the [learn-rails GitHub repository](#) to find out if you have the newest version of the book. The README page on the GitHub repo always shows the most recent version number for the book and the tutorial application.

Don't worry if the [learn-rails GitHub repository](#) seems complicated or difficult to understand. You'll get to know GitHub over time and it will become familiar. For now, it is only important to know that it is there in case you have problems.

Take a moment now to look at the [open issues](#) on GitHub to see what problems you may encounter as you work your way through the tutorial. You can look at the [closed issues](#) to see some of the solved problems.

If you have trouble building the application in this book, and suspect something may be out of date, you can [compare the Gemfile in the repo](#) to see if we've changed gems or specified version numbers to avoid compatibility issues.

You can also check the [CHANGELOG](#) and look at [recent commits](#) to see the current state of the application.

Getting Help With the Book

Let's consider what to do if you encounter problems as you build the tutorial application in this book.

If you are in a classroom, or studying in a group, ask a peer to look at your problem. Most problems are caused by simple typos or formatting errors. Your classmate may see what you overlooked.

[Stack Overflow](#) provides a question-and-answer forum for readers of this book. As the author of this book, I can't solve your individual problems or help you directly by email. If I did, I would not have time to create the tutorials that benefit so many people. However, I watch for questions on Stack Overflow. Everyone benefits when solutions are made public.

- tag your questions on Stack Overflow with **railsapps** for extra attention

If your questions aren't answered on Stack Overflow, try the Reddit forum:

- [/r/learnrubyonrails](#)

The Reddit forum has its own Slack channel for real-time messaging:

- [learnrubyonrails-slack.herokuapp.com](#)

I sincerely hope you won't encounter obstacles as you build the tutorial application. Thousands of beginners have successfully completed the book and, unless a gem has recently changed, you should have no problem.

Now let's consider where to look for help when you are working on your own Rails projects.

Getting Help With Rails

What will you do when you get stuck?

"Google it," of course. But here's a trick to keep in mind. Google has options under "Search tools" to show only recent results from the past year. Use it to filter out stale advice that pertains only to older versions of Rails.

[Stack Overflow](#) is as important as Google for finding answers to programming problems. Stack Overflow answers are often included in Google search results, but you can go directly to Stack Overflow to search for answers to your questions. Like Google, answers from Stack Overflow are helpful if you check carefully to make sure the answers are recent. Also be sure to compare answers to similar questions; the most popular answer is not always the correct answer to your particular problem.

Requests for advice (especially anything that provokes opinions) are often rejected on Stack Overflow. Instead, try Reddit for advice or recommendations. You'll find discussion forums ("subreddits") devoted to [Rails](#) and [Ruby](#). You

can also visit the [Quora](#) question-and-answer site for topics devoted to [Rails](#) and [Ruby](#).

References

Here are suggestions for the most important references.

If you feel overwhelmed by all the links, remember that you can use this book to build the tutorial application without any additional resources. Right now, it's important to know additional help is available when you need it.

RailsGuides

The [Rails Guides](#) are Rails's official documentation, written for intermediate-level developers who already have experience writing web applications. The Rails Guides are an excellent reference if you want to check the correct syntax for Rails code. You'll be able to use the Rails Guides after completing this tutorial.

Cheatsheets

Tobias Pfeiffer has created a useful [Rails Beginner Cheat Sheet](#) that provides a good overview of Rails syntax and commands.

Even better than a cheatsheet, for Mac users, is an application named [Dash](#) that offers fingertip access to reference documentation for Ruby, Rails, HTML, CSS, JavaScript, and many other languages and frameworks.

API Documentation

The API documentation for Ruby and Rails shows every class and method. These are extremely technical documents (the only thing more technical is reading the source code itself). The documents offer very little help for beginners, as each class and method is considered in isolation, but there are times when checking the API documentation is the only way to know for certain how something works.

- [Rails Documentation](#) - official API docs
- [Rails Searchable API Doc](#) - alternative interface for the API docs
- [apidock.com/rails](#) - Rails API docs with usage notes
- [apidock.com/ruby](#) - Ruby API docs with usage notes
- [Omniref](#) - Ruby and all gem API docs with questions and answers

[Omniref](#) is the best place to ask questions about anything in the Ruby or Rails API.

I recommend [Dash](#) as a tool to look up classes, modules, and methods in Ruby and Rails. Dash is a Mac OS X app; use [Zeal](#) on Linux. Dash and Zeal run offline (they don't need an Internet connection) so you can use them anywhere.

Meetups, Hack Nights, and Workshops

I'd like to urge you to find ways you can work with others who are learning Rails. Peer support is really important when you face a challenge and want to overcome obstacles.

Most large urban areas have meetups or user group meetings for Rails developers. Try [Meetup.com](#) or google "ruby rails (my city)". The community of

Rails developers is friendly and eager to help beginners. If you are near a Rails meetup, it is really worthwhile to connect to other developers for help and support. You may find a group that meets weekly for beginners who study together.

Local user groups often sponsor hack nights or [hackathons](#) which can be evening or weekend collaborative coding sessions. You don't have to be an expert. Beginners are welcome. You can bring your own project which can be as simple as completing a tutorial. You will likely find a study partner at your level or a mentor to help you learn.

If you are a woman learning Rails, look for one of the free workshops from [RailsBridge](#) or [Rails Girls](#). These are not exclusively for women; everyone considered a “minority” in the tech professions is encouraged to participate; and men are included when invited by a woman colleague or friend.

Pair Programming

Learning to code is challenging, especially if you do it alone. Make it social and you'll learn faster and have more fun.

There's a popular trend in the workplace for programmers to work side-by-side on the same code, sharing a keyboard and screen. It's effective, both to increase productivity and to share knowledge, and many coders love it. When programmers are not in the same office, they share a screen remotely and communicate with video chat.

Look for opportunities to pair program. It's the best way to learn to code, even if your pairing partner is only another beginner. Learn more about pair programming on the site [pairprogramwith.me](#) and find a pairing partner at [codermatch.me](#) or [letspair.net](#).

Remote pair programming requires tools for screen sharing and video chat. Pairing sessions often use:

- [Google+ Hangouts](#)
- [Screenhero](#)
- [Floobits](#)
- [Cloud9 IDE](#)
- [Nitrous.io](#)

More tools are emerging as remote pair programming becomes popular.

Pairing With a Mentor

By far, the best way to learn is to have a mentor at your side as you undertake a project. That is an opportunity that is seldom available, unless you've been hired to be part of a team in a company that encourages pair programming.

You can try [RailsMentors](#), a network of volunteer mentors offering free help.

If you can pay for help, find a mentor using [HackHands](#) or [AirPair](#). Market rates are expensive for a student, obviously, but if you are learning on the job or building an application for your own business, connecting online with a mentor might be a godsend.

[AirPair](#) connects developers for real-time help using video chat and screen sharing. Experts set their own rate and the site matches you according to your budget. Expect to pay market rates for consulting ranging from USD \$40 per hour to \$150 per hour or more.

[HackHands](#) promises to instantly connect you with a qualified expert at a cost of one dollar per minute for mentorship using video chat and screen sharing.

Code Review

Code review is an essential part of the development process. There's always more than one way to implement a feature, and some ways are better than others, but you may not know it unless you ask someone to look at your code. When you pair with a mentor, you get the benefit of code review. But even if you don't have a mentor, you can get code review online. StackExchange, the parent of StackOverflow, has a free site for code review, and a new service promises code review as a service:

- codereview.stackexchange.com
- devinput.io

Expert code review will accelerate your learning faster than anything else.

Knowing where to go for help is important; it is just as important to stay current.

Staying Up-to-Date

Rails changes frequently and its community is very active. Changes to Rails, expert blog articles, and new gems can impact your projects, even if you don't work full-time as a Rails developer. Consequently, I urge you to stay up-to-date with news from the community.

For daily news about Rails, check Peter Cooper's [RubyFlow](http://RubyFlow.com) site which lists new blog posts from Rails developers each day.

I urge you to sign up for two weekly email newsletters:

- [Ruby Weekly](http://RubyWeekly.com)
- [Green Ruby News](http://GreenRubyNews.com)

Another weekly email newsletter is more technical, and focused on code arriving in the next version of Rails:

- [This Week in Rails](#)

If you like podcasts, check out [Ruby Rogues](#) and Envy Labs's [Ruby5](#).

Finally, you can follow [@rails_apps](#) on Twitter for news about the RailsApps project.

Chapter 3

Accounts You May Need

You'll need accounts with four services before you begin building the application in this book.

This tutorial will show you how to save your work using [GitHub](#). You can sign up for a GitHub account for free. Every experienced Rails developer has a GitHub account; it is where we collaborate on our code, both commercial and open source projects.

We'll create a form that allows website visitors to “opt-in” to a mailing list. You'll need a [MailChimp](#) account, which is free. If you send email to a mailing list, you will find it is useful to have an account with MailChimp or a similar service.

We'll also send email from the application, which will require a [Mandrill](#) account. The Mandrill transactional email service integrates well with the MailChimp email list manager service. Mandrill offers a free trial that allows you to send 2,000 messages. You can use Gmail to send email messages to users of your application, but Mandrill is easier to set up.

Finally, we'll deploy the tutorial application to [Heroku](#) which provides Rails application hosting. It costs nothing to set up a Heroku account and deploy as many applications as you want. It is the easiest way to deploy a Rails application and most Rails developers use Heroku at some time in their careers.

GitHub

Rails developers use [GitHub](#) for collaboration and remote backup of projects.

For this tutorial, I suggest you get a [free personal GitHub account](#) if you don't already have one. As a developer, your GitHub account establishes your reputation in the open source community. If you're seeking a job as a developer, employers will look at your GitHub account. When you work with other developers, they may check to see what you've worked on recently. Don't be reluctant to set up a GitHub account, even if you're a beginner. It shows you are serious about learning Rails.

You'll be asked to provide a username. This can be a nickname or short version of your real name (for example, your Twitter username).

You'll be asked to provide an email address. It's very important that you use the same email address for your GitHub account that you use to configure Git locally (there will be more about configuring Git later). If you create a Heroku account to deploy and host your Rails applications, you should use the same email address.

After you create your GitHub account, log in and look for the button "Edit Your Profile." Take a few minutes to add some public information to your account. It is really important to provide your real name and a public email address. Displaying your real name on your GitHub account makes it easy for people to associate you with your work when they meet you in real life, for example at a meetup, a hackathon, or a conference. Providing a public email address makes it possible for other developers to reach you if you ask questions or submit issues. If you can, provide a website address (even just your Twitter or Facebook page). In general, you won't be exposed to stalkers or spammers (except some recruiters) if you are open about yourself on GitHub.

Later I'll show you how to set up and use Git and GitHub.

MailChimp

This tutorial shows how website visitors can sign up to receive a newsletter provided by a [MailChimp](#) mailing list. MailChimp allows you to send up to 12,000 emails/month to a list of 2000 or fewer subscribers for free. There is no cost to set up an account.

After you have set up a MailChimp account, create a new mailing list where you can collect email addresses of visitors who have asked to subscribe to a newsletter. The MailChimp “Lists” page has a button for “Create List.” The list name and other details are up to you.

If you get frustrated with the complex and confusing MailChimp interface, try to remember that the friendly MailChimp monkey is laughing with you, not at you.

Mandrill

Earlier editions of this book showed how to use a [Gmail](#) account to send email from the application. Google has taken steps to make Gmail more secure and now it can be difficult to send email from a Rails application using Gmail.

This tutorial provides instructions for [Mandrill by MailChimp](#). The Mandrill transactional email service integrates well with the MailChimp email list manager service. Every Mandrill account comes with 2,000 free trial sends. Once you’ve finished your free trial, it’s \$9.95/month for 25,000 emails.

Sign up for a MailChimp account to get started. After you’ve created your MailChimp account, see the instructions [How do I use Mandrill if I already have a MailChimp account?](#).

You also can connect directly to an [SMTP mail server](#) to send email. The tutorial won’t show the details but I’ll provide links for more information if you don’t want to use Mandrill.

Heroku

We'll use [Heroku](#) to host the tutorial application so anyone can reach it.

To deploy an app to Heroku, you must have a Heroku account. Visit <https://signup.heroku.com> to set up an account.

Be sure to use the same email address you used to register for GitHub. It's very important that you use the same email address for GitHub and Heroku accounts.

Chapter 4

Get Started

Before you can start building, you'll need to install Ruby (the language) and Rails (the gem). I'll provide links to installation instructions that are up to date. Even if you've already installed Rails, please review the instructions to make sure your development environment is set up correctly. Other books and tutorials often skip important details.

Text Editor and Terminal Applications

I've explained how to use a text editor and terminal application in Book One. If you haven't used the Unix command line before, refer to Book One for an introduction.

I recommend the [Atom](#) text editor but you may use [Sublime Text](#) or any others that provide syntax highlighting. Refer to Book One for important instructions about setting up the text editor so you can open a file from the command line.

Copying and Pasting Code

In the next chapter you'll begin building a Rails application.

You need to get the code from this tutorial into your computer. You could just read and imagine, but really, building a working application is the only way to learn.

The most obvious way is to copy and paste from this tutorial into your text editor, assuming you are reading this on your computer (not a tablet or printed pages). It's a bit tedious and error-prone but you'll have a good opportunity to examine the code closely.

Some students like to type in the code, character by character. If you have patience, it's a worthwhile approach because you'll become more familiar with the code than by copying and pasting.

Don't feel shy about copying code; it's how you will learn. Working programmers spend a lot of time copying code from others. At first, you will copy a lot of code. As you gain proficiency, you will copy code and adapt it, more extensively as you gain confidence and skill. Only when you've been working full-time as a coder for months or years will you find yourself writing code from scratch; even then, when you encounter new problems, you will still look for code examples to copy and adapt.

Box 4.1. Warning About the PDF and Kindle Versions

This book is available in several formats, including online (HTML), PDF, ePub, and mobi (Kindle) versions.

Use the online edition of the book if you can. If you're not already reading the online edition of this book, I provide an invitation code so you can get the online edition of this book for free. For readers who obtained this book from Amazon or another retailer, the free offer is on the first page of this book, after the table of contents.

With the online edition, you'll be able to copy and paste the code without any problem. The ePub version (using Apple iBooks) also preserves line breaks and indentation when copying code.

Copying without line breaks will cause code errors. You'll lose line breaks when copying code with the following versions:

- PDF version on Mac OS X using the Preview application
- mobi (Kindle)

If you use [Adobe Acrobat](#) you'll be able to copy the line breaks (though indenting is lost). You can also open a PDF file in Chrome or Safari web browsers and copy code with line breaks. With the mobi (Kindle) version, you'll have to carefully reformat the code after pasting into your text editor.

Indentation makes code more readable, so try to preserve the indentation you see in the code samples. In YAML files (with the file extension **.yaml**), indentation is required (your application will break without it).

Your Computer

You can develop web applications with Rails on computers running Mac OS X, Linux, or Microsoft Windows operating systems. Most Rails developers use Mac OS X or Linux because the underlying Unix operating system has long been the basis for open source programming.

Later in this chapter, I'll give links to installation instructions for Mac OS X and Linux.

For Windows users, I have to say, installing Rails on Windows is frustrating and painful. Readers and workshop students often tell me that they've given

up on learning Rails because installation of Ruby on Windows is difficult and introduces bugs or creates configuration issues. Even when you succeed in getting Rails to run on Windows, you will encounter gems you cannot install. For these reasons, I urge you to use Cloud9, a browser-based development environment, on your Windows laptop.

Hosted Computing

If you are using Windows, or have difficulty installing Ruby on your computer, try using Cloud9.

Cloud9 provides a hosted development environment. That means you set up an account and then access a remote computer from your web browser. The Cloud9 service is free for ordinary use. There is no credit card required to set up an account. You'll only be charged if you add extra computer memory or disk space (which you don't need for ordinary Rails development).

The Cloud9 service gives you everything you need for Rails development, including a Unix shell with Ruby pre-installed, plus a browser-based file manager and text editor. Any device that runs a web browser will give you access to Cloud9, including a tablet or smartphone, though you need a broadband connection, a sizable screen, and a keyboard to be productive.

Try the Terminal

Look for the Terminal application in the following places:

- Mac OS X: *Applications - Utilities - Terminal*
- Linux: *Applications - Accessories - Terminal*
- Windows: *Taskbar Start Button - Command Prompt*

On the Mac, search for the Mac OS X Terminal application by pressing the Command-Spacebar combination (which Apple calls “Spotlight Search”) and searching for “Terminal.” The magnifying glass in the upper right corner of your screen will also launch “Spotlight Search.” Or look in the **Applications/Utilities/** folder for the Terminal application. You’ll need to click the name of the application to launch the Terminal.

For Linux or Windows, [The Command Line Crash Course](#) explains [how to launch a terminal application](#).

Launch your terminal application now.

Try out the terminal application by entering a shell command.

```
$ whoami
```

Don’t type the **\$** character. The **\$** character is a cue that you should enter a shell command. This is a longtime convention that indicates you should enter a command in the terminal application or console.

The Unix shell command **whoami** returns your username.

Don’t type the **\$** prompt.

You might see:

```
command not found: $
```

which indicates you typed the **\$** character by mistake.

If you are new to programming, using a text editor and the shell will seem primitive compared to the complexity and sophistication of Microsoft Word or Photoshop. Software developers edit files with simple text editors and run programs in the shell. That’s all we do. We have to remember the commands we need (or consult a cheatsheet) because there are no graphical menus or toolbars. Yet with nothing more than a text editor and the command line interface, programmers have created everything that you use on your computer.

Installing Ruby

Your first challenge in learning Rails is installing Ruby on your computer.

Frankly, this can be the most difficult step in learning Rails because no tutorial can sort out the specific configuration of your computer. Get over this hump and everything else becomes easy.

The focus of this book is learning Rails, not installing Ruby, so to keep the book short and readable, I'm going to give you links to articles that will help you install Ruby.

You'll spend at least an hour installing Ruby and Rails, so be sure to allow enough time for the task.

Mac OS X

See this article for Mac OS X installation instructions:

[Install Ruby on Rails - Mac OS X](#)

Ubuntu Linux

See this article for Ubuntu installation instructions:

[Install Ruby on Rails - Ubuntu](#)

Hosted Computing

[Cloud9](#) is a browser-based development environment. Cloud9 is free for small projects. If you have a fast broadband connection to the Internet, this is your best choice for developing Rails on Windows. And it is a good option if you have any trouble installing Ruby on Mac or Linux because the Cloud9 hosted environment provides everything you need, including a Unix shell with Ruby

and RVM pre-installed, plus a browser-based file manager and text editor. Using a hosted development environment is unconventional but leading developers do so and it may be the wave of the future.

See this article for Cloud9 installation instructions:

[Install Ruby on Rails - Cloud9](#)

The article shows how to get started with Cloud9.

Windows

Here are your choices for Windows:

- Use the [Cloud9](#) hosted development environment
- Install the [Railsbridge Virtual Machine](#)
- Use [RubyInstaller for Windows](#)

Cloud9 is ideal if you have a fast Internet connection. If not, download the Railsbridge Virtual Machine to create a virtual Linux computer with Ruby 2.2 and Rails 4.2 using [Vagrant](#). Other tutorials may suggest using [RailsInstaller](#), but it will not provide an up-to-date version of Ruby or Rails. Also, RVM does not run on Windows.

Your Workspace

Take a moment to think about where on your computer you'll do your work and store your files. You may have a **documents/** folder. You could make a similar folder named **projects/** or **code/** or **workspace/** for your programming projects. Use the Unix **mkdir** command to create a folder or create it with your file browser.

If you haven't done so already, make a folder to contain your programming projects. You don't need to do this if you already created a **workspace/** folder in the Unix chapter in Book One.

```
$ cd ~  
$ pwd  
/Users/danielkehoe  
$ mkdir workspace  
$ cd workspace
```

In this tutorial, the terms “folders” and “directories” mean the same thing.

Use the Unix **cd** command to change directories.

When you enter the Unix command **cd ~**, you'll move to your home (or “user”) directory. The squiggly **~** “tilde” character is a Unix shortcut that indicates your home folder.

The Unix **pwd** command shows the “present working directory,” where you are.

The Unix **mkdir** command creates an empty folder and we move into it with the Unix **cd** command.

Understanding Version Numbers

Rails follows a convention named *semantic versioning*:

- The first number denotes a *major version* (Rails 4)
- The second number denotes a *minor release* (Rails 4.2)
- The third number denotes a *patch level* (Rails 4.2.1)

A major release includes new features, including changes which break backward compatibility. For example, switching from Rails 3.2 to Rails 4.0 required a significant rewrite of every Rails application.

A minor release introduces new features but doesn't break anything. For example, Rails 3.2 added the asset pipeline, and Rails 4.2 added the Active Job feature for background processing.

A patch release fixes bugs but doesn't introduce significant features. Usually this means you can change the version number in the Gemfile and run **bundle update** without making any other changes to your application.

Ruby and Rails Version Check

Check that appropriate versions of Ruby and Rails are installed in your development environment. You'll need:

- The Ruby language (version 2.2 or newer)
- The Rails gem (version 4.2 or newer)

Open your terminal application and enter:

```
$ ruby -v
```

You might see:

```
ruby 2.3.0p0 (...)
```

You've got Ruby version 2.3.0, patch level "p0" (Ruby versions add an extra patch level to semantic versioning). If you've got a newer version of Ruby, no problem; minor updates to Ruby don't affect Rails.

Try:

```
$ rails -v
```

You might see:

```
Rails 4.2.5
```

If you have Rails 4.1 or older versions, you must update to Rails 4.2. See the [Installing Rails](#) instructions for your computer.

Versions such as **5.0.0.beta1** or **5.0.0.rc1** are beta versions or “release candidates.” You can use a release candidate in the weeks before a final release becomes available.

If you’ve got Rails 4.2.5 or newer, that’s fine. It means minor bugs have been fixed since this was written, but the book is still current. You can check for the [current version of Rails](#) here.

Box 4.2. Rails 5.0

Rails 5.0 was in pre-release when this edition of the book was released. If you have Rails 5.0, check for a new version of this book. The newest version of the book is listed on the README page of the [learn-rails](#) GitHub repository. If the Rails 5 version of this book is not yet available, you must install Rails 4.2.

RVM

I promised that this book would introduce you to the practices of professional Rails developers. One of the most important utilities you’ll need in setting up

a real-world Rails development environment is RVM, the [Ruby Version Manager](#).

RVM lets you switch between different versions of Ruby. Right now, that might not seem important, but as soon as a new version of Ruby is released, you'll need to upgrade, and it is best to be ready by installing the current version of Ruby with RVM, so you can easily add a new version of Ruby later, and still switch back to older versions as needed.

RVM also helps you manage your collections of gems, by letting you create multiple *gemsets*. Each gemset is the collection of gems you need for a specific project. Rails changes frequently; with RVM, you can install a specific version of Rails in a project gemset, along with all the gems you need for the project. When a new version of Rails is released, you can create a new gemset with the new Rails version when you start a new project. Your old project will still have the version of Rails it needs in its own gemset.

If you've followed the instructions in the article [Installing Rails](#) and installed RVM, you'll be ready to handle multiple versions of Ruby, and multiple versions of Rails. That's as it should be. Most professional Rails developers have more than one version of Ruby or Rails, and RVM makes it easy to switch.

RVM will show you a list of available Ruby versions:

```
$ rvm list
```

You can see a list of available gemsets associated with the current Ruby version:

```
$ rvm gemset list
```

You will see an arrow that shows which gemset is active.

You will see a **global** gemset as well as any others you have created, such as a gemset for **Rails4.2**.

Here's how to switch between gemsets:

```
$ rvm gemset use global
```

And switch back to another:

```
$ rvm gemset use default
```

After you’ve worked on a few Rails applications, you’ll see several project-specific gemsets if you are using RVM in the way most developers do.

RVM is not the only utility you can use to manage multiple Ruby versions. Some developers like [Chruby](#), [rbenv](#), or [others](#). Don’t be worried if you hear debates about RVM versus Chruby or rbenv; developers love to compare the merits of their tools. RVM is popular, well-supported, and an excellent utility to help a developer install Ruby and manage gemsets; that’s why we use it.

Project-Specific Gemset

For our learn-rails application, we’ll create a project-specific gemset using RVM. We’ll give the gemset the same name as our application.

By creating a gemset for our tutorial application, we’ll isolate the current version of Rails and the gems we need for this project. Whether you use RVM or another Ruby version manager, this will introduce you to the idea of “sandboxing” (isolating) your development environment so you can avoid conflicts among projects.

After we create the project-specific gemset, we’ll install the Rails gem into the gemset. Enter these commands:

```
$ rvm use ruby-2.3.0@learn-rails --create  
$ gem install rails
```

The newest Rails version will be installed.

It's absolutely necessary to create a gemset and install Rails so we can move on to creating the application in the next chapter. If you have trouble at this point, refer to the article [Installing Rails](#) or the [RVM website](#). Linux users may need to check instructions for [Integrating RVM](#).

Let's make sure Rails is ready to run. Open a terminal and type:

```
$ rails -v
```

You should see the message “Rails 4.2.5” (or something similar).

Now let's explore the **rails new** command and get started building the tutorial application.

Chapter 5

Create the Application

In this chapter, we'll begin building the tutorial application. But first, let's consider the options you have for starter applications.

Starter Applications

Rails provides a *framework*; that is, a software library that provides utilities, conventions, and organizing principles to allow us to build complex web applications. Without a framework, we'd have to code everything from scratch. Rails gives us the basics we need for many websites.

Still, the framework doesn't give us all the features we need for many common types of websites. For example, we might want users to register for an account and log in to access the website ("user management and authentication"). We might want to restrict portions of our website to just administrators ("authorization"). We also might want to add gems that enhance Rails to aid development (gems for testing, for example) or improve the look and feel of our application (the Bootstrap or Foundation front-end frameworks). Developers often mix and match components to make a customized Rails stack.

Developers often use a *starter application* instead of assembling an application

from scratch. You might call this a “template” but we use that term to refer to the *view files* that combine HTML with Ruby code to generate web pages. Most experienced developers have one or more starter applications that save time when beginning a new project. The [RailsApps project](#) was launched to provide open source starter applications so developers could collaborate on their starter applications and avoid duplicated effort. After you gain some skill with this tutorial, you might use the RailsApps starter apps to instantly generate a Rails application with features like authentication, authorization, and an attractive design. At the end of this book, you’ll learn about [Rails Composer](#), a tool for building starter applications.

For now, we’ll begin with the Rails default starter application.

Workspace Folder and RVM Gemset

Are you in the folder named **workspace/** you created earlier?

```
$ pwd
/Users/danielkehoe/workspace/
```

We already created a project-specific gemset using RVM. Make sure it’s ready to use:

```
$ rvm use ruby-2.3.0@learn-rails
$ rvm gemset list
gemsets for ruby-2.3.0...
  (default)
  global
=> learn-rails
```

You should see an arrow pointing to the **learn-rails** gemset. If not, go back to the previous “Get Started” chapter.

Use “Rails New” to Build the Application

Let’s go! We have selected a gemset, we have Rails installed, and we’re in our **workspace/** folder. Let’s build a Rails application!

To create the Rails default starter application, type:

```
$ rails new learn-rails
```

This will create a new Rails application named “learn-rails.”

It takes a few minutes when the build script runs **bundle install**. Don’t worry; just give it enough time to finish (but no more than five minutes even if your Internet connection is very slow).

In the future, you can give your application a different name. For this tutorial, it is VERY IMPORTANT that you use the name “learn-rails.” You’ll be copying code that assumes the name is “learn-rails;” it will save you trouble to use this name.

The **rails new** command will create ten folders and 53 files.

It will install 44 gems into your gemset.

After you create the application, switch to its folder to continue work directly in the application:

```
$ cd learn-rails
```

This is your project directory. It is also called the application root directory. You’ll spend all your time inside this folder.

Type the **ls** command to show the folders and files in a directory. Soon we’ll learn more about each of these folders and files.

```
$ ls
Gemfile      Rakefile    config      lib          test
Gemfile.lock app         config.ru   log          tmp
README.md   bin         db          public       vendor
```

Make a Sticky Gemset

RVM gives us a convenient technique to make sure we are always using the correct gemset when we enter the project directory. It will create hidden files to designate the correct Ruby version and project-specific gemset. Enter this command to create the hidden files:

```
$ rvm use ruby-2.3.0@learn-rails --ruby-version
```

If you see “ERROR: Gemset ‘learn-rails’ does not exist”, perhaps you overlooked an earlier step in the *Project-Specific Gemset* section (in the previous chapter) where we created the learn-rails gemset. No matter, you can create it now:

```
$ rvm use ruby-2.3.0@learn-rails --create --ruby-version
$ gem install rails
```

The **-ruby-version** argument creates two files, **.ruby-version** and **.ruby-gemset**, that set RVM every time we **cd** to the project directory. Without these two hidden files, you’d need to remember to enter **rvm use ruby-2.3.0@learn-rails** every time you start work on your project after closing the console.

You can confirm you’ve created the two hidden files:

```
$ ls -lpa
./
../
```

```
.gitignore
.ruby-gemset
.ruby-version
Gemfile
Gemfile.lock
README.rdoc
Rakefile
app/
bin/
config/
config.ru
db/
lib/
log/
public/
test/
tmp/
vendor/
```

The “a” flag in the Unix `ls -lpa` command displays hidden files. Each hidden file is listed with a dot (period or full stop) at the beginning of the filename. You’ll notice `.ruby-gemset` and `.ruby-version`.

You’ll also see two “special files” which are not files at all:

- `./` - an alias that represents the current directory
- `../` - an alias that represents the parent directory

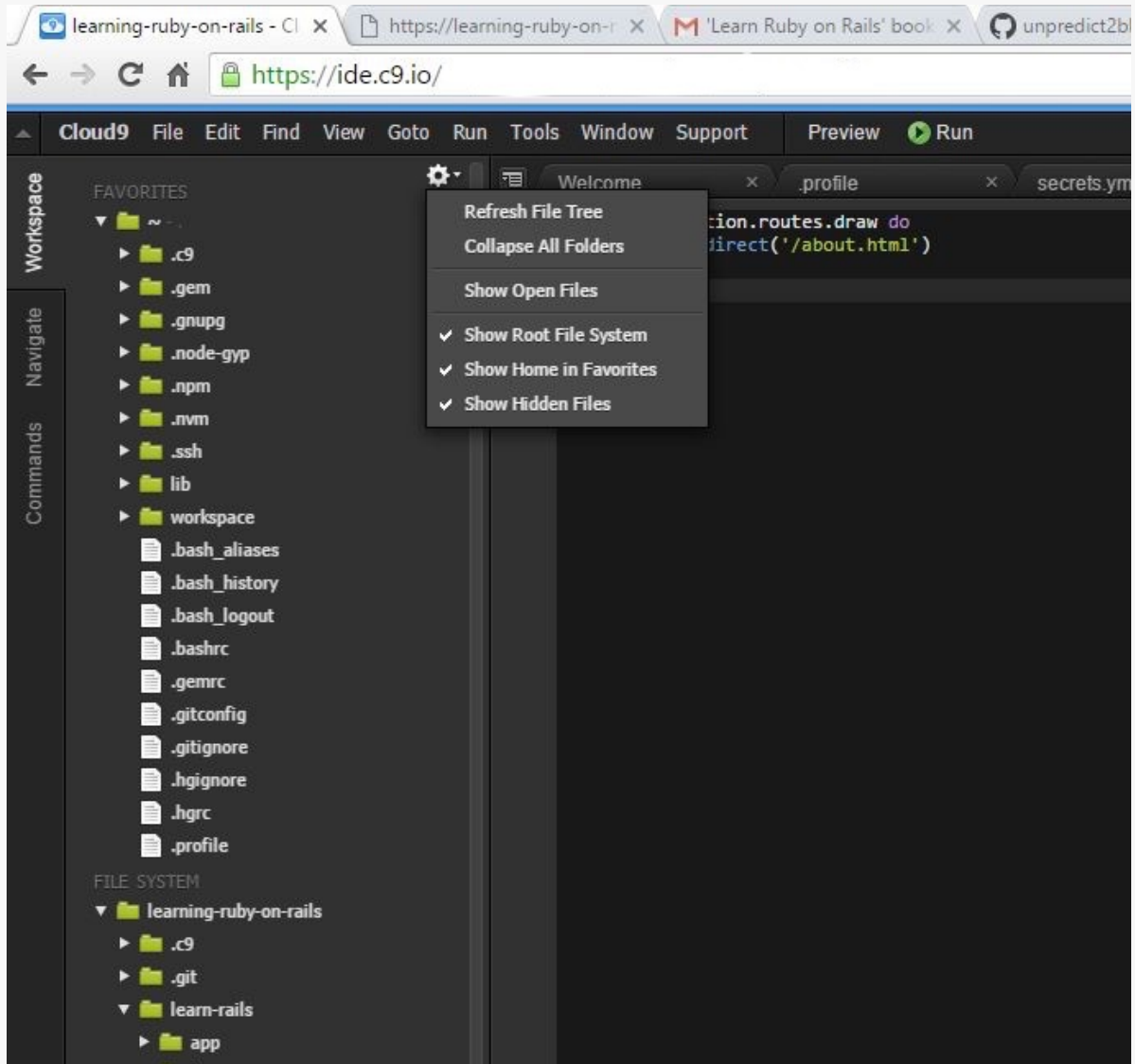
Box 5.1. Hidden Files in Cloud9

If you’re using Cloud9, you must change preferences to see hidden files. In the window that contains the file list, there is a gear icon (dark in color and difficult to see). Clicking the gear option will give you options:

- Show Root File System
- Show Home in Favorites

- Show Hidden Files

You must select all three options to see the hidden files.



That's a brief diversion into Unix; let's try running our new Rails application.

Test the Application

You've created a simple default web application. It's ready to run.

Launching the Web Server

You can launch the application by entering the command:

```
$ rails server
```

Alternatively, to save typing, you can abbreviate the **rails server** command:

```
$ rails s
```

You'll see:

```
=> Booting WEBrick
=> Rails 4.x.x application starting in development on http://0.0.0.0:3000
=> Run `rails server -h` for more startup options
=> Notice: server is listening on all interfaces (0.0.0.0)....
=> Ctrl-C to shutdown server
[... ] INFO  WEBrick 1.3.1
[... ] INFO  ruby 2.x.x (2014-02-24) [x86_64-darwin13.0]
[... ] INFO  WEBrick::HTTPServer#start: pid=38534 port=3000
```

The **rails server** command launches the default **WEBrick web server** that is provided with Ruby.

Errors for Linux Users

If you enter the command `rails server` and get an error message:

```
... Could not find a JavaScript runtime ...
```

You need to install Node.js. For help, see [Install Ruby on Rails - Ubuntu](#).

Viewing in the Web Browser

To see your application in action, open a web browser window and navigate to <http://localhost:3000/>. You'll see the Rails default information page.

Box 5.2. Viewing on a Hosted Platform

It is easy to see your web application in action on your local computer. If you are using a hosted service such as Cloud9 or Nitrous.io, it is a little more complicated.

If you are using **Cloud9**, click the “Preview” link in the IDE menu (at the top of the page). There is a “Run” link, too, but it doesn't work if you have created your Rails application in a folder within the **workspace/** folder. You can also open a browser tab or window and enter the URL for the application, as hosted by Cloud9. When you launch the Rails server, Cloud9 displays a helpful message showing the URL where you can view your application.

If you are using **Nitrous.io**, choose the menu item “Preview” (Port 3000). Throughout this tutorial, we'll refer to <http://localhost:3000/>, but if you are using Nitrous.io, you'll use the Preview browser window.

Watch Log Messages

Notice that messages scroll in the console window when your browser requests the Rails default web page.

Open the file **log/development.log** and you'll see the same messages. When a browser sends requests to the WEBrick web server, diagnostic messages are written to the console and to the **log/development.log** file. These diagnostic messages are an important tool for troubleshooting when you are developing.

Multiple Terminal Windows

You can keep more than one terminal window open. For convenience, you may want to keep a terminal window open for running the web server and watching diagnostic messages. In the Terminal or iTerm2 applications, Command-t opens additional console sessions in new “tabs.”

Developers typically open more than one terminal window when they work on a Rails application. They'll start the server with the **rails server** command in one window (or tab) and watch the log messages. In another window (or tab), they'll enter commands as they build the application. They might create folders with a Unix command, run generators, or try out code with the **rails console** command (you'll learn about the **rails console** command in the “Troubleshoot” chapter).

To some people, the text editor and the terminal window look very similar. When you work on a file in a text editor, you make changes to one file, in one place. The terminal window is very different. Your computer can run multiple programs at once. You can open multiple terminal windows. In each terminal window, you can use the command line to launch a different program. Each program you start in a terminal window is a separate *process* and multiple processes can run simultaneously. You can end a process by pressing Control-c (in most cases), Control-d (in some cases), or closing the terminal window (almost always). From this perspective, a terminal window is a tool you use to launch processes and your computer is a machine that runs processes.

Stop the Web Server

You can stop the server with Control-c to return to the command prompt.

Most of the time you'll keep the web server running as you add or edit files in your project. Changes will automatically appear when you refresh the browser or request a new page. There is a tricky exception, however. If you make changes to the Gemfile, or changes to configuration files, the web server must be shut down and relaunched for changes to be activated.

As a rule of thumb, files that produce web pages can be changed without a restart. This includes any file in the **app/** folder which creates web pages, as well as the **config/routes.rb** file. Changes to files that create the environment for the web application, such as gems or configuration files, and are loaded at web server launch, won't be seen until the web server is restarted.

Get Organized for Efficiency

Before we learn about the Rails directory structure, take a minute to organize your screen real estate. During development, you'll jump between the console in a terminal application, your text editor, and a web browser window. As a Rails developer, you'll do this constantly, so think about how you can do this efficiently. Multiple screens make it easy, but even on a laptop you can get organized for efficiency.

Here's some ideas. Open a window in the terminal application, place it on the left side of your screen, and stretch it to the maximum vertical height of your screen. Open multiple tabs in your terminal application. Keep one tabbed window open for entering shell commands (like **cd** or **ls**) and another terminal window open for running the **rails server** command and viewing the log output.

Place your text editor window next to the terminal window and stretch it to full vertical height. If you are using Atom or Sublime Text, you can open two editor panels side-by-side. Some developers find it helpful to leave the file browser

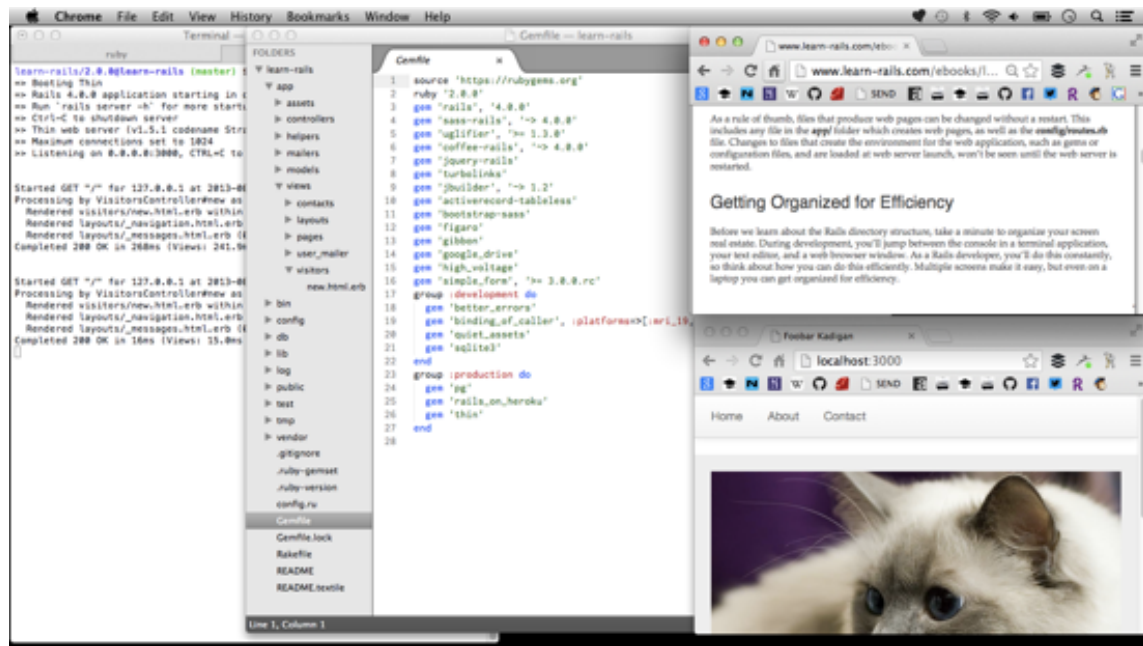


Figure 5.1: Getting organized for efficiency.

panel open to navigate the project directory; others hide the file browser panel to save space.

If you have enough screen space, leave your web browser open and place it next to your text editor. If your screen space is limited, you may have to overlap the web browser with the text editor, but position your web browser window so you can bring it to the front with a single click. You'll need multiple tabs open in your web browser. Unless you like constant distraction, close Gmail, Facebook, Twitter, and Hacker News. Open tabs for <http://localhost:3000/>, this tutorial, and additional references or documentation.

On the Mac, there are window management utilities that reposition windows with just a click or keyboard command; I use [Moom](#) but you can find others if you search for “mac window management utilities.”

This is just a guide; I'm sure you can improve upon these suggestions.

Chapter 6

The Parking Structure

We've created the default Rails starter application.

The `rails new` command has created a project directory for us.

It is a parking structure for our code. Unlike an ordinary parking structure, where you park anywhere you like, this garage has assigned parking. You have to park your code in the right place. This is Rails, where convention brings order to the development process.

As you develop a web application, you'll do all your work in the project directory. It is important to know your way around and understand the purpose of each folder and file.

If you've built simple websites with HTML and CSS, or built websites with unstructured platforms such as Perl or PHP, you'll be surprised at the complexity of the Rails project directory. Rails is a software machine with many moving parts; the project directory provides a structure to manage the complexity. The logic and order of the project directory structure is familiar to every Rails developer, and consistent for every Rails application, which makes it easy to collaborate, maintain an application, and create open source projects.

Project Directory

Use the Unix **ls** command to list the contents of the project directory. For a one-column list that shows each subdirectory (marked with a slash), we'll add the **-lp** option to the command.

```
$ ls -lp
```

You'll see:

```
Gemfile
Gemfile.lock
README.rdoc
Rakefile
app/
bin/
config/
config.ru
db/
lib/
log/
public/
tmp/
vendor/
```

Now is a good time to open a file browser window and look at the contents of the project directory. On the Mac, there's a command you can use to open the graphical file browser from the console. If you're in the project directory, type **open ..** The period (or "dot") is a Unix symbol that means "the directory I'm in."

```
$ open ..
```

You'll learn more about each file and folder as you proceed through the tutorial.

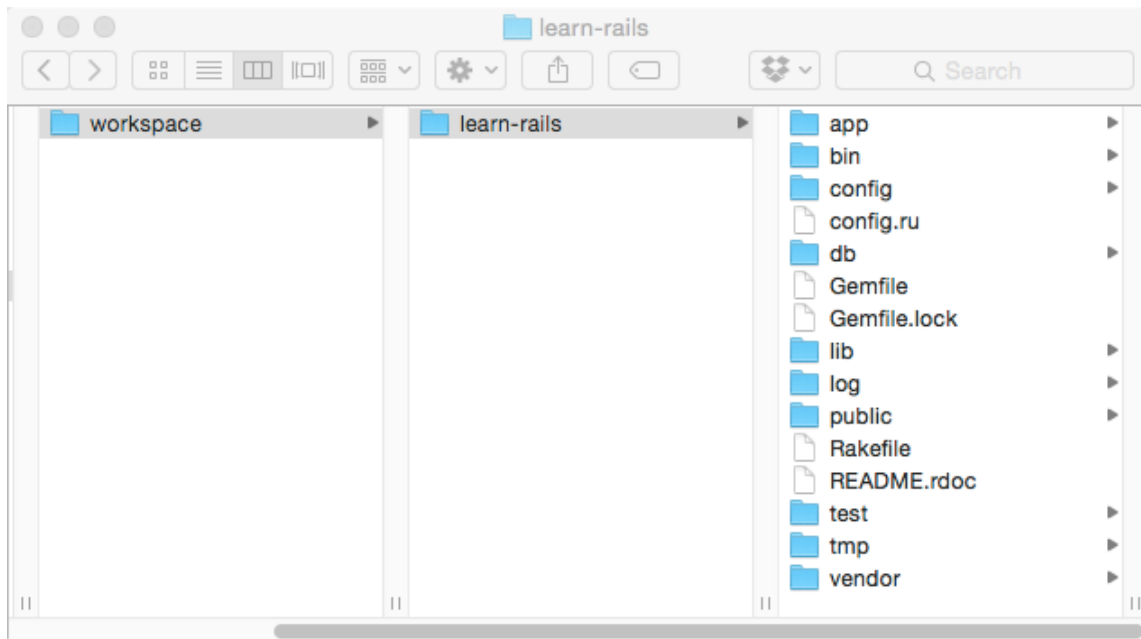


Figure 6.1: Rails directory structure.

Get to Know the Folders and Files

To get you started, here are three tables. The first describes the files and folders that are important for every beginner. The second table describes the files and folders that you can ignore. The third table is a preview of things to come.

Important Folders and Files

These folders and files are **important** to beginners. This is where you will spend your time in Rails.

Gemfile	Lists all the gems used by the application.
Gemfile.lock	Lists gem versions and dependencies.
README.rdoc	A page for documentation.
app/	Application folders and files.

config/	Configuration folders and files.
db/	Database folders and files.
public/	Files for web pages that do not contain Ruby code, such as error pages.

Not-So-Important Folders and Files

These folders and files are **not important** to beginners.

Rakefile	Directives for the Rake utility program.
bin/	Folder for binary (executable) programs.
config.ru	Configuration file for Rack (a software library for web servers).
lib/	Folder for miscellaneous Ruby code.
log/	Folder for application server logfiles.
tmp/	Temporary files created when your application is running.
vendor/	Folder for Ruby software libraries that are not gems.

Folders of Future Importance

test/	Folder for the default Rails testing framework
spec/	Folder for the popular RSpec testing framework
features/	Folder for the Cucumber testing framework

The **test/** folder is present in the default Rails starter app. You'll create the **spec/** folder or **features/** folder when you learn about test-driven development or behavior-driven development.

The App Directory

Take time to drill down into the **app/** folder in the project directory. This is easiest using the file browser.

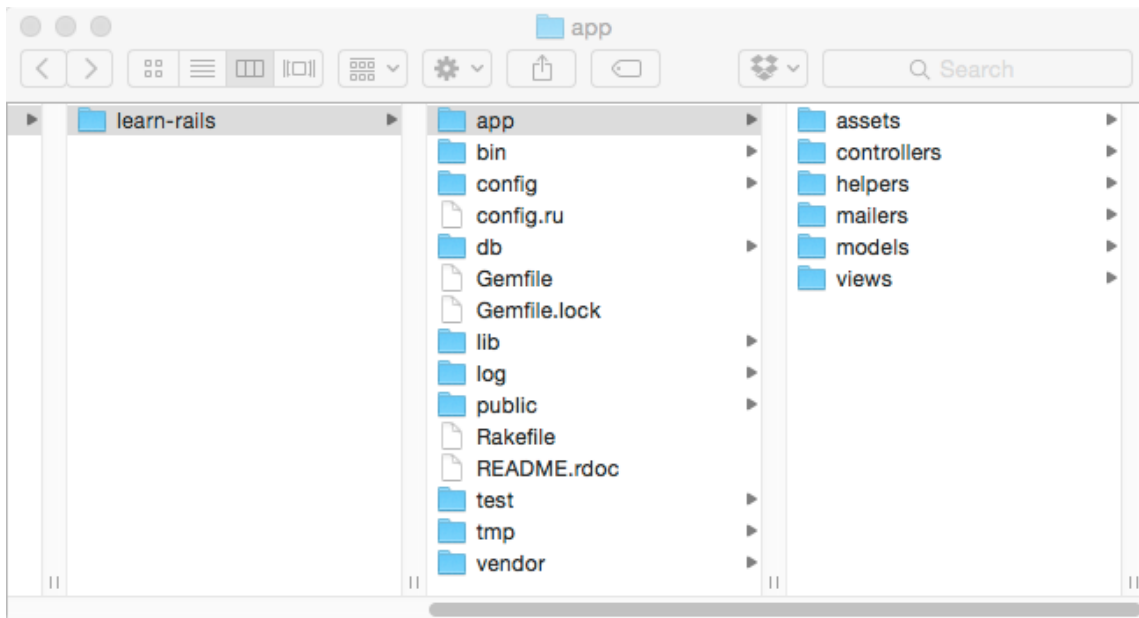


Figure 6.2: Rails app folder.

You can also use your text editor to view the folder.

Or do it with Unix commands:

```
$ cd app
$ ls -lp
assets/
controllers/
helpers/
mailers/
models/
views/
```

Whether you use the file browser, Unix commands, or your text editor, you are looking at the same file system.

Most of the work of developing a Rails application happens in the **app/** folder.

Earlier we described Rails as “a set of files organized with a specific structure.” We said the structure is the same for every Rails application. The **app/** directory

is a good example. The six folders in the **app/** directory are the same in every Rails application. This makes it easy to collaborate with other Rails developers, providing consistency and predictability.

- **assets**
- **controllers**
- **helpers**
- **mailers**
- **models**
- **views**

You may recall our earlier description of Rails from the perspective of a software architect. In this folder, you'll see evidence of the [model–view–controller](#) design pattern. Three folders named **models/**, **views/**, and **controllers/** enforce the software architect's "separation of concerns" and impart structure to our code. As you build the application, we'll explain the role of the MVC components in greater detail.

Two folders, **mailers/** and **helpers/**, play supporting roles. The mailers folder is for code that sends email messages. The helpers folder is for Rails *view helpers*, snippets of reusable code that generate HTML. Later, when we learn more about *views*, we'll say view helpers are like "macros" that expand a short command into a longer string of HTML tags and content.

More Folders of Future Importance

You won't encounter these when you are a beginner:

policies/	Folder for code that controls access to features
services/	Folder for code that reduces the complexity of models and controllers

If you join a project to work on a large and complex Rails application, you may see folders such as these in the **app/** directory. As an application grows in complexity, an experienced software architect may suggest reducing the size of models and controllers by moving code to “POROs” (*plain old Ruby objects*). Code in any folder in the **app/** directory is shared throughout a Rails application without any additional configuration (in contrast, code you add to the **lib/** directory is only available with some extra work). Rails provides a basic model–view–controller framework but it is often necessary to extend it.

Use the `cd ..` command (“change directory dot dot”) to return to the project directory.

```
$ cd ..  
$ pwd  
/Users/danielkehoe/workspace/learn-rails
```

As a Rails developer, you’ll spend most of your time navigating the hierarchy of folders as you create and edit files. And because Rails provides a consistent structure, you’ll quickly find your way on any unfamiliar project.

Chapter 7

Time Travel with Git

Now that we've looked at our Rails project directory from the viewpoint of a programmer and software architect, let's consider the viewpoint of the time traveler.

This chapter will introduce you to software *source control*, also called *version control* or *revision control*. The terms all have the same meaning; at first sight, the concept seems rather dull, like sorting your socks. But it makes professional software development possible and, at the core, it is essentially a form of time travel.

To understand time travel, we need to understand *state*. It's a term you'll encounter often in software development. We know about states of matter. Water can be ice, liquid, or steam. Imagine a machine with a button that, each time it is pressed, changes water from one state to another. We call this a *state machine*. Almost every software program is a state machine. When a program receives an input, it transitions from one state to another. Like flipping a light switch, there's no in-between. Light or dark. Ice, liquid, or steam. Or, in a web application: logged in, logged out.

When we write software code, there's a lot of in-between. We look things up, we think, we type errors and we make corrections. As humans, we spend a lot of time in a flow of undetermined state. We can save our work at any time, but

we may be saving typos or unfinished code that doesn't work. Every so often, we get to a point where a task is finished; we've fixed all our errors and our code runs. We want to preserve the state of our work. That's when we need a version control system.

A version control system does more than a software application's "Save" command. Like a "Save" command, it preserves the current state of our files. It also allows us to add a short note that describes the work we've done. More importantly, it archives a snapshot of the current state in a *repository* where it can be retrieved if needed.

Here's where the time travel comes in. We can go back and recover the state of our work at any point where we committed a snapshot to the repository. In software development, travel to the past is essential because we often make mistakes or false starts and have to return to a point where we know things were working correctly.

What about time travel to the future? Often we need to try out code we may decide to discard, without disturbing work we've done earlier. Version control systems allow us to explore alternative futures by creating a *branch* for our work. If we like what we've done in our branch, we can merge it into the main trunk of our software project.

Unlike time travel in the movies, we can't travel back to any arbitrary point in the flow of time. We can only travel to past or future states we've marked as significant by checking our work into the repository.

Git

The dominant version control system among Rails developers is [Git](#), created by the developer of the Linux operating system.

Unlike earlier version control systems, Git is ideal for wide-scale distributed open source software development. Combined with [GitHub](#), the "social coding" website, Git makes it easy to share and merge code. When you work with

others on a project, your Git *commit messages* (the notes that accompany your snapshot) offer a narrative about the progress of the project. Well-written commit messages describe your work to co-workers or open source collaborators.

GitHub's support for *forking* (making your own copy of a repository) makes it possible to take someone else's project and modify it without impacting the original. That means you can customize an open source project for your own needs. You can also fix bugs or add a feature to an open source project and submit a *pull request* for the project maintainer to add your work to the original. Fixing bugs (large or small) and adding features to open source projects are how you build your reputation in the Rails community. Your GitHub account, which shows all your commits, both to public projects and your own projects, is more important than your resumé when a potential employer considers hiring you because it shows the real work you have done.

Collaboration is easy when you use a *branch* in Git. If you and a coworker are working on the same codebase, you can each make a branch before adding to the code or making changes. Git supports several kinds of *merges*, so you can integrate your branch with the trunk when your task is complete. If your changes collide with your coworker's changes, Git identifies the conflict so you can resolve the collision before completing the merge.

All the power of Git comes at a price. Git is difficult for a beginner to learn, largely because many of its procedures have no real-world analog. Have you noticed how time travel movies require mental gymnastics, especially when you try to make sense of alternative futures and intersecting timelines? Git is a lot like that, mostly because we use it to do things we don't ordinarily do in the real world.

In this tutorial, you won't encounter Git's advanced procedures, like resolving merges or reverting to earlier versions. We'll stick to the basics of archiving our work (and in one case, discarding work that we've done for practice). You can build the tutorial project without using Git. But I urge you to use Git and a GitHub account for this project, for two reasons. First, with your tutorial application on GitHub, you'll show potential employers or collaborators that you've successfully built a useful, functioning Rails application. More impor-

tantly, you must get to know Git if you plan to do any serious coding, either as a professional or a hobbyist.

Before I show you Git commands, I want to mention that some people use graphical client applications to manage Git. Mac OS X has [GitHub for Mac](#), [Git Tower](#), and other [Mac Git clients](#). Graphical applications for Git are useful for colleagues who don't use a Terminal application, such as graphic designers or writers. There's no need for you to install these applications. Every developer I've met uses Git from the command line. It will take effort to master Git; the commands are not intuitive. But it is absolutely necessary to become familiar with Git basics.

Before you do any work on the tutorial application, I'll show you the basics of setting up and using Git.

Is Git Installed?

As a first step, make sure Git is installed on your computer:

```
$ which git
/usr/bin/git
$ git version
git version ...
```

If Git is not found, install Git. See the article [Rails with Git and GitHub](#) for installation instructions.

Is Git Configured?

Make sure Git knows who you are. Every time you update your Git repository with the `git commit` command, Git will identify you as the author of the changes.

```
$ git config --get user.name  
$ git config --get user.email
```

You should see your name and email address. If not, configure Git:

```
$ git config --global user.name "Real Name"  
$ git config --global user.email "me@example.com"
```

Use your real name so people will associate you with your work when they meet you in real life. There's no reason to use a clever name unless you have something to hide.

Use the same email address for Git, your GitHub account, and Heroku to avoid headaches.

Create a Repository

Now we'll add a Git repository to our project. It's a basic step you'll repeat every time you create a new Rails project.

Extending the time traveler analogy, initializing a Git repository is equivalent to setting up the time machine.

The `git init` command sets up a Git repository (a “repo”) in the project directory. We add the Unix symbol that indicates Git should be initialized in the current directory (`git init .`):

```
$ git init .  
Initialized empty Git repository in ...
```

It creates a hidden folder named `.git/` in the project directory. You can peek at the contents:


```
$ ls -lp .git
HEAD
branches/
config
description
hooks/
info/
objects/
refs/
```

All Git commands operate on the hidden files. The hidden files record the changing state of your project files each time you run the `git commit` command. There is no reason to ever edit files inside the hidden `.git/` folder (doing so could break your time machine).

GitIgnore

The hidden `.git/` folder contains the Git repository with all the snapshots of your changing project. The snapshots are highly compressed, only containing records of changes, so the repository takes up very little file space relative to the project as a whole.

Not every file should be included in a Git snapshot. Here are some types of files that should be ignored:

- log files created by the web server
- database files
- configuration files that include passwords or API keys

Git gives us an easy way to ignore files. A hidden file in the project directory named `.gitignore` can specify a list of files that are never seen by Git. The `rails new` command creates a `.gitignore` file with defaults that include log

files and database files. Later, when we add configuration files that include secrets, we'll update the **.gitignore** file.

Take a look at the contents of the **.gitignore** file. We use the Unix **cat** command to display the contents of the file:

```
$ cat .gitignore
# See http://help.github.com/ignore-files/ for more about ignoring files.
#
# If you find yourself ignoring temporary files generated by your text editor
# or operating system, you probably want to add a global ignore instead:
#   git config --global core.excludesfile '~/gitignore_global'
#
# Ignore bundler config.
/.bundle
#
# Ignore the default SQLite database.
/db/*.sqlite3
/db/*.sqlite3-journal
#
# Ignore all logfiles and tempfiles.
/log/*.log
!/log/.keep
/tmp
```

For a **.gitignore** file that ignores more, see an [example .gitignore file](#) from the RailsApps project.

Git Workflow

Your workflow with Git will move through four distinct phases as you add or edit files.

Untracked Files

The first phase is a “dirty” state of untracked and changed files, before any snapshot. The **git status** command lists all folders or files that are not checked into the repository.

```
$ git status
# On branch master
#
# Initial commit
#
# Untracked files:
#   (use "git add ..." to include in what will be committed)
#
# .gitignore
# Gemfile
# Gemfile.lock
# README.rdoc
# Rakefile
# app/
# bin/
# config.ru
# config/
# db/
# lib/
# log/
# public/
# vendor/
nothing added to commit but untracked files present (use "git add" to track)
```

Here the `git status` command tells us that we have many untracked files. We have created new files and they are saved on the computer's hard disk but nothing has been recorded in the Git repository.

Staging

I call this step, “Pose for your snapshot.”

Recording files in the Git repository takes two steps: staging and committing. There will be times when you change many files at once. For example, you may fix a bug, add a new graphic, and change a form. You might think you'd like to have Git automatically record all the changes as you save each file. But the story of your project would be confusing and overly detailed. Git requires you to mark one or more files (“staging”) before recording the changes (“committing”). This gives you fine-grained control over the recorded history of your project.

You can mark individual files to be staged:

```
$ git add Gemfile
```

Adding individual files allows you to selectively record the history of your project. For example, you might stage and commit a series of bug fixes before you stage and commit new features. Applying the time traveler analogy, it will be easier to travel back to look at bug fixes if they are not mixed in with new features.

More often, you'll mark all the files to be staged. Do so now:

```
$ git add -A
```

Running `git status` will show you a long list of files that are staged and ready to commit.

There are three forms of the `git add` command:

- `git add foo.txt` adds a file named `foo.txt`
- `git add .` adds all new files and changed files, except deleted files
- `git add -A` adds everything, including deletions

If it seems nonsensical that the command `git add -A` “adds deletions,” don’t worry. Like time travel, Git will stretch your understanding of what makes sense.

Most often, you can simply use the `git add -A` form of the command.

Now that you’ve marked the files that will be committed to the repository, you’ve told everyone to pose, and you’re ready to take the snapshot.

Committing

The “posing” step, or staging, gives you an opportunity to select particular files before you commit.

If you’ve only worked on one feature, you’ll likely stage and commit all your files.

When you “make a commit”, you include a message that describes the work you’ve done. For a time traveler, the “commit message” is important; you are leaving a trail to help you find your way into the past. Google will show you dozens of blog posts about “writing better commit messages” but common sense can be your guide. Writing “fix registration form to catch blank email addresses” will be more helpful than merely writing “fix bugs.” And if you wonder why commit messages are commonly written in the imperative not past tense (“fix” not “fixed”), it’s a time traveler convention.

Now commit your project to the repository:

```
$ git commit -m "Initial commit"
```

The `-m` flag lets you add a message for the commit.

The pristine state of your new Rails application is now recorded in the repo.

Running `git status` will tell you “nothing to commit, working directory clean.”

Git Log

You can use the `git log` command to see your project history:

```
$ git log
commit 8da41eec9e864ed91b4a445d8cefdf7893e2faf6
Author: Daniel Kehoe <daniel@danielkehoe.com>
Date:   Fri Dec 18 10:30:12 2015 +0700
```

```
Initial commit
```

The long string of characters that follows “commit” is an ID, or marker, that will help you travel back in time if you need to do so.

If you get “stuck” in `git log`, type `q` to return to the command prompt.

I like to use the `git log` command with an option for a compact listing:

```
$ git log --oneline  
8da41ee Initial commit
```

The listing is easier to review when it is displayed in a compact format. The commit ID is abbreviated but it is all you need to travel back in time.

Pushing to GitHub

We’ve seen three phases of the Git workflow: *untracked*, *staged*, and *committed*.

A fourth stage is important when you work with others: *pushing* to GitHub. It’s also important when you access your project from more than one computer or you want an offsite backup of your work.

The repositories hosted on your GitHub account establish your reputation as a Rails developer for employers and developers you may work with. Even if your first project is copied from a tutorial, it shows you are serious about learning Rails and studying conscientiously.

Did you create a GitHub account? Now would be a good time to add your repo to GitHub.

Go to GitHub and [create a new empty repository](#) for your project. Name the repository “learn-rails” and give it a description. If the repository is public, hosting on GitHub is free. Don’t be reluctant to go public with an unfinished

or half-baked project; everyone expects projects on GitHub to be works in progress.

Add GitHub as a remote repository for your project and push your local project to GitHub. Before you copy and paste the command, notice that you need to insert your own GitHub account name. In other words, change **YOUR_GITHUB_ACCOUNT** in the command shown below (or face problems [described here](#)).

```
$ git remote add origin https://github.com/YOUR_GITHUB_ACCOUNT/learn-rails.git
$ git push -u origin master
```

The **-u** option sets up Git so you can use **git push** in the future without explicitly specifying GitHub as the destination.

Now you can view your project repository on GitHub at:

- https://github.com/YOUR_GITHUB_ACCOUNT/learn-rails

Obviously you must change **YOUR_GITHUB_ACCOUNT** in the web address to see your own repository.

Take a look. It's an exact copy of the project on your local computer.

If you haven't used GitHub before, take some time to explore. GitHub is absolutely essential to all open source Rails development.

You may notice that the **README.rdoc** file is automatically incorporated into the home page of the project repository on GitHub. For our next step, we'll update the README file, commit it to the local repo, and push it up to GitHub. It will be good practice for using Git.

The README

Changing the README file is a good way to practice with Git. It's also a good habit to edit the README file whenever you create a new project. It's easy to

neglect the README for little projects that you’ve just started. But replacing a default README file shows you are a disciplined, conscientious developer who will be a good collaborator.

The new README file can be brief. Just state your intentions and acknowledge any code you’ve borrowed. For this project you could say, “Excited to learn Rails with help from the RailsApps project!”

In your text editor, open the file **README.rdoc** and replace the contents:

```
Learning Rails
==

Learning Rails with a tutorial from the RailsApps project.
```

GitHub lets you add formatting using your choice of markup syntax, depending on the file extension you add to the filename:

- README.rdoc uses the [rdoc](#) syntax
- README.md uses the [GitHub Flavored Markdown](#) syntax
- README.textile uses the [Textile](#) syntax

We’ll use Markdown syntax by adding the **==** characters after the first line of text to force a headline.

There’s no requirement that you use Markdown syntax in your README file. Markdown is a popular way to add formatting to improve readability. For us, changing the file to Markdown creates a practical exercise in using Git.

We’ll use the **git mv** command to rename the file to **README.md** and save it.

```
$ git mv README.rdoc README.md
```


Use **git status** to see what has changed:

```
$ git status
# On branch master
# Changes to be committed:
#   (use "git reset HEAD ..." to unstage)
#
# renamed:    README.rdoc -> README.md
#
```

You could also use the Unix **mv** command to rename the file. If you do so, **git status** will show the **README.rdoc** file has been deleted and a new, untracked **README.md** file has been created.

Here's our typical workflow. We'll stage, commit, and push the change to GitHub:

```
$ git add -A
$ git commit -m "update README"
$ git push origin master
```

Take a look at your GitHub repository (refresh the web page). Very cool! The README file has been updated.

The **git log** command will display your project history:

```
$ git log --oneline
69b9b6c update README
8da41ee Initial commit
```

You can read more about [Git and Rails](#) if you need more information about working with Git and GitHub for code source control.

Now that you're comfortable with Git, we can begin customizing our new Rails application.

Chapter 8

Gems

The art of selecting gems is at the heart of Rails development. I explained earlier that gems are packages of code, “software libraries,” that have been developed and tested by other developers. Some gems add functionality or features to a website. Other gems play a supporting role, making development easier or implementing basic infrastructure. Gems are open source. They are available at no charge and can be freely copied and modified.

It is a mark of honor to release a gem for public use, and a developer’s reputation can be established when a gem becomes popular and widely used. Gems are often created when a developer has used the same code as a component in more than one web application. He or she will take time to release the code as a gem. That’s how the Rails ecosystem was built, gem by gem since 2004.

There is no evaluation or review process in publishing gems. Gems are hosted on a public server, rubygems.org. Gems are mostly text files (like any other Ruby code), organized in a particular format with some descriptive information (in a **gemspec** file), and compressed and archived as a single file. A single command, **gem push**, uploads a gem to the rubygems.org server for anyone to use.

Over 50,000 gems have been released since rubygems.org was established. Some of these gems are used by one or two developers on their own projects.

Many others have been neglected and abandoned due to lack of interest. Only a few thousand gems are popular and widely used. As a Rails developer, you must master the art of finding and evaluating gems so you can base your applications on the tried-and-true work of others.

There is no single authoritative source of recommendations for gems. The [Ruby Toolbox](#) website categorizes and ranks many gems by popularity, and it is a good place to begin hunting for useful gems. Other than that, it is useful to study example applications and search for blog posts to find which gems are most often recommended. When you find an interesting gem, search [Stack Overflow](#) or Google to see what people are saying. Look at the gem’s GitHub repository and check:

- How many issues are open? How many are closed?
- How recent are the commits of patches or updates?
- Is there a CHANGELOG file?
- Is the gem well-documented?
- How many “stars” (people watching) or “forks” (people hacking)?

Popular gems are likely to have many reported issues, some of which are trivial problems or feature requests. Gems that are actively maintained will have many closed issues and, ideally, only a few open issues. When you find a gem that has many open issues and no recently closed issues, you’ve probably found a gem that has been abandoned. Also look at the commit log, which you’ll find on the GitHub project page in a tab at the top of the page. Regular and recent activity in the commit log indicates the gem is actively maintained.

Rails Gems

Rails itself is a gem that, in turn, requires a collection of other gems. This becomes clear if you look at the [summary page for Rails](#) on the [rubygems.org](#)

site. On that page, you'll see photos of the Rails core team. More importantly, you'll see a list of gems that are required to use Rails:

- [actionmailer](#) - framework for email delivery and testing
- [actionpack](#) - framework for routing and responding to web requests
- [activerecord](#) - framework for connections to databases
- [activesupport](#) - utility classes and Ruby library extensions
- [bundler](#) - utility to manage gems
- [railties](#) - console commands and generators
- [sprockets-rails](#) - support for the Rails asset pipeline

These are the “runtime dependencies” for Rails. Each of these gems has its own dependencies as well. When you install Rails, a total of 44 gems are automatically installed in your development environment.

Gems for a Rails Default Application

In addition to the Rails gem and its dependencies, a handful of other gems are included in every **rails new** default starter application:

- [sqlite3](#) - adapter for the SQLite database
- [sass-rails](#) - enables use of the SCSS syntax for stylesheets
- [uglifyer](#) - JavaScript compressor
- [coffee-rails](#) - enables use of the CoffeeScript syntax for JavaScript
- [jquery-rails](#) - adds the [jQuery](#) JavaScript library

- [turbolinks](#) - faster loading of webpages
- [jbuilder](#) - utility for encoding JSON data

You may not need a SQLite database, SCSS for stylesheets, jQuery or the others, but many developers use these tools so they are included in the default starter application.

Where Do Gems Live?

Gems are files saved in the computer's disk storage, containing someone else's code that you can use in your own application.

When you run a Rails application, gems are loaded into the computer's working memory immediately before your own custom code is loaded. Gems are handled by the Ruby interpreter no differently than your own code. It's all Ruby code, whether you or someone else wrote it. When you are building an application in Rails, you don't need to think about where gems are stored in your file system. It's all handled automatically.

Experienced programmers who have used software libraries in other languages might wonder how it works. Here's the technical explanation from the experts. Ruby has a **require** method that allows you to import software libraries into your programs. RubyGems extends the **require** method, adding gem directories to a **\$LOAD_PATH**. When Rails loads, it will automatically require each of the gems listed in your Gemfile, finding the gems in the **\$LOAD_PATH** directories.

If you're a curious person, you might like to see where the gems live. You can run the **gem env** command to reveal the RubyGems environment details which are normally hidden from you:

```
$ gem env
RubyGems Environment:
- RUBYGEMS VERSION: 2.4.8
- RUBY VERSION: 2.3.0 (2015-12-16 patchlevel 230) [x86_64-darwin14]
- INSTALLATION DIRECTORY: /Users/danielkehoe/.rvm/gems/ruby-2.3.0@learn-rails
- RUBY EXECUTABLE: /Users/danielkehoe/.rvm/rubies/ruby-2.3.0/bin/ruby
- EXECUTABLE DIRECTORY: /Users/danielkehoe/.rvm/gems/ruby-2.3.0@learn-rails/bin
- SPEC CACHE DIRECTORY: /Users/danielkehoe/.gem/specs
- SYSTEM CONFIGURATION DIRECTORY: /etc
- RUBYGEMS PLATFORMS:
  - ruby
  - x86_64-darwin-14
- GEM PATHS:
  - /Users/danielkehoe/.rvm/gems/ruby-2.3.0@learn-rails
  - /Users/danielkehoe/.rvm/gems/ruby-2.3.0@global
.
.
.
```

If you use RVM, gems are saved to a hidden **.rvm** folder in your user directory. A **global** subfolder contains the Bundler gem. If you’ve followed the instructions in the “Get Started” chapter to install Rails, the project-specific **learn-rails** subfolder contains the Rails gem. If you use Chruby or Rbenv instead of RVM, your gems will be stored in a different location.

Run the **gem which** command and you’ll see where the gems live:

```
$ gem which bundler
/Users/me/.rvm/gems/ruby-2.3.0@global/gems/bundler-1.5.3/lib/bundler.rb
$ gem which rails
/Users/me/.rvm/gems/ruby-2.3.0-p0@learn-rails/gems/railties-4.2.5/lib/rails.rb
```

These are details you’ll never need to know, because Ruby on Rails handles it for you.

You’ll never move or delete gems directly. Instead you’ll manage gems using the **Bundler** utility. The key to Bundler is the Gemfile.

Gemfile

Every Rails application has a Gemfile. Earlier, I described Rails from the viewpoint of the “gem hunter,” the developer who wants to assemble an application from the best open source components he or she can find. To the gem hunter, the Gemfile is the most important file in the application. It lists each gem that the developer wants to use.

The Gemfile provides the information needed by the [Bundler](#) utility to manage gems.

Bundler’s **bundle install** command reads the Gemfile, then downloads and saves each listed gem to the hidden gem folder. Bundler checks to see if the gem is already installed and only downloads gems that are needed. Bundler checks for the newest gem version and records the version number in the **Gemfile.lock** file. Bundler also downloads any gem dependencies and records the dependencies in the **Gemfile.lock** file. Between the Gemfile, with its list of gems that will be used by the application, and the **Gemfile.lock** file, with its list of dependencies and version numbers, you have a complete specification of every gem required to run the application. More importantly, when other developers install your application, Bundler will automatically install all the gems (including dependencies and correct versions) needed to run the application. When you deploy the application to production for others to use, automated deployment scripts (such as those used by Heroku) install all the required gems.

Bundler provides a **bundle update** command when we want to replace any gems with newer versions. If you run **bundle update**, any new gem versions will be downloaded and installed and the **Gemfile.lock** file will be updated. Be aware that updating gems can break your application, so only update gems when you have time to test and resolve any issues. You can run **bundle outdated** to see which gems are available in newer versions.

If you want to prevent your fellow developers (or yourself) from accidentally updating gems, you can specify a gem version number for any gem in the Gemfile. The Gemfile gives fine-grained control over rules for updating:

- `gem 'rails', '4.2.0'` is absolute only version 4.2.0 will be used
- `gem 'rails', '>= 4.2.0'` is optimistic any version newer than 4.2.0 will be used
- `gem 'rails', '~> 4.2.0'` is “pessimistic”

“Pessimistic” versioning needs some explanation. `~> 4.2.0` means use any version greater than 4.2.0 and less than 4.3 (any patch version can be used). `~> 4.2` means use any version greater than 4.2 and less than 5.0 (any minor version can be used).

In general, during development we only lock down any gem versions in the Gemfile if we know newer versions introduce problems. The exception is the Rails gem itself. We always specify the version of Rails we are using for development.

Let’s take a look at the Gemfile created by the `rails new` command.

Gemfile for a Rails Default Application

Open the **Gemfile** with your text editor:

```
source 'https://rubygems.org'

# Bundle edge Rails instead:gem 'rails', github: 'rails/rails'
gem 'rails', '4.2.5'
# Use sqlite3 as the database for Active Record
gem 'sqlite3'
# Use SCSS for stylesheets
gem 'sass-rails', '~> 5.0'
# Use Uglifier as compressor for JavaScript assets
gem 'uglifier', '>= 1.3.0'
# Use CoffeeScript for .coffee assets and views
gem 'coffee-rails', '~> 4.1.0'
# See https://github.com/sstephenson/execjs#readme for more supported runtimes
# gem 'therubyracer', platforms: :ruby

# Use jquery as the JavaScript library
```



```
gem 'jquery-rails'
# Turbolinks makes following links in your web application faster...
gem 'turbolinks'
# Build JSON APIs with ease. Read more: https://github.com/rails/jbuilder
gem 'jbuilder', '~> 2.0'
# bundle exec rake doc:rails generates the API under doc/api.
gem 'sdoc', '~> 0.4.0', group: :doc

# Use ActiveRecord has_secure_password
# gem 'bcrypt', '~> 3.1.7'

# Use Unicorn as the app server
# gem 'unicorn'

# Use Capistrano for deployment
# gem 'capistrano-rails', group: :development

group :development, :test do
  # Call 'byebug' anywhere in the code to stop execution and get a debugger console
  gem 'byebug'

  # Access an IRB console on exception pages or by using <%= console %> in views
  gem 'web-console', '~> 2.0'

  # Spring speeds up development by keeping your application running...
  gem 'spring'
end
```

The file you see will be very similar. Some version numbers may be different if a newer Rails version was released since this was written.

The first line, `source 'https://rubygems.org'`, directs Bundler to use the rubygems.org server as a source for any gems.

Notice that the second uncommented line directs Bundler to use Rails and specifies the version number. It's important to specify which version of Rails we are using. Rails changes frequently and newer versions may not work as we expect.

It's also wise to specify the Ruby version we're using. This is needed for automated deployment scripts such as those used by Heroku. We can add that to the Gemfile:

```
ruby '2.3.0'
```

In the Gemfile you'll see the gems for a Rails default application, such as `sqlite3`, which we described earlier. Other gems are commented out (the lines begin with the `#` character). These are suggestions and we can ignore them or remove them.

We won't use a database for our application but we'll keep the `gem 'sqlite3'` entry. Configuring Rails for no database is complicated; it is easier to keep the `sqlite3` gem and not use it.

The `gem 'sdoc'` line is useful only when using `rake doc:rails` command to generate API documentation so we can remove it.

If you are developing your application on a computer using the Linux operating system, you may need to uncomment and use the statement `gem 'therubyracer', platform: :ruby`. Linux doesn't have a built-in JavaScript interpreter so you must install Node.js in your environment or else add the `therubyracer` gem to each project Gemfile. For help, see [Install Ruby on Rails - Ubuntu](#).

If you remove the extra clutter in the **Gemfile** it will look like this:

```
source 'https://rubygems.org'
ruby '2.3.0'
gem 'rails', '4.2.5'

# Rails defaults
gem 'sqlite3'
gem 'sass-rails', '~> 5.0'
gem 'uglifier', '>= 1.3.0'
gem 'coffee-rails', '~> 4.1.0'
gem 'jquery-rails'
gem 'turbolinks'
gem 'jbuilder', '~> 2.0'
gem 'byebug'
gem 'web-console', '~> 2.0'
gem 'spring'
```

Try it now. Replace the Gemfile with the simplified code above.

Adding Gems

I've identified several gems that will be useful for our tutorial application.

I learned of these gems from a variety of different sources:

- [Ruby Toolbox](#)
- [RailsCasts](#)
- [RubyFlow](#)
- various blog posts
- example code and starter apps on GitHub
- recommendations from colleagues

We're adding these gems at the beginning of our development process since we already know which gems we'll need. On a real project, you'll often discover useful gems and add them to the Gemfile during the ongoing process of development.

Here are gems we'll add to the Gemfile:

- [foundation-rails](#) - front-end framework
- [gibbon](#) - access to the MailChimp API
- [high_voltage](#) - for static pages like "about"
- [simple_form](#) - forms made easy

We'll also add utilities that make development easier:

- [better_errors](#) - helps when things go wrong

- `quiet_assets` - suppresses distracting messages in the log
- `rails_layout` - generates files for an application layout

Open your **Gemfile** and replace the contents with the following:

```
source 'https://rubygems.org'
ruby '2.3.0'
gem 'rails', '4.2.5'

# Rails defaults
gem 'sqlite3'
gem 'sass-rails', '~> 5.0'
gem 'uglifier', '>= 1.3.0'
gem 'coffee-rails', '~> 4.1.0'
gem 'jquery-rails'
gem 'turbolinks'
gem 'jbuilder', '~> 2.0'
gem 'byebug'
gem 'web-console', '~> 2.0'
gem 'spring'

# learn-rails
gem 'foundation-rails'
gem 'gibbon'
gem 'high_voltage'
gem 'simple_form'
group :development do
  gem 'better_errors'
  gem 'quiet_assets'
  gem 'rails_layout'
end
```

Notice that we’ve placed three gems inside a “group.” Specifying a group for development or testing ensures a gem is not loaded in production, reducing the application’s memory footprint. Rails let you specify groups for *development*, *test*, or *production*.

Each time you edit the Gemfile, you will run **bundle install** and restart your web server.

Adjust the Rails Version

The version of Rails specified in your Gemfile should match the version that is installed in your gemset.

What version of Rails is installed in your current gemset? Check with:

```
$ rails -v
```

If you've got Rails 4.2.5, there's no need to make additional changes to the Gemfile.

If you've got a newer version of Rails, update the Gemfile. Change this line as needed:

```
gem 'rails', '4.2.5'
```

If you have Rails 5.0 (which was not available when this was written), you must get a new version of this book (or install Rails 4.2). The newest available version of the book is listed on the README page of the [learn-rails](#) GitHub repository.

Install the Gems

You've edited the Gemfile. Install the required gems on your computer:

```
$ bundle install
```

The **bundle install** command will download the gems from the [rubygems.org](#) server and save them to a hidden directory that is managed by the RVM gemset you've specified.

We'll see all the gems and their dependencies:

```
Fetching gem metadata from https://rubygems.org/.....
Fetching gem metadata from https://rubygems.org/..
Resolving dependencies...
Using rake (10.0.4)
Using i18n (0.6.4)
Installing minitest (4.7.4)
.
.
.
(many more gems not shown... you get the idea)
.
.
.
Your bundle is complete!
Use `bundle show [gemname]` to see where a bundled gem is installed.
```

You can use your text editor to view the contents of **Gemfile.lock** and you will see a detailed listing of every gem and each dependency, with version numbers. There's no reason to edit a **Gemfile.lock** file; if it is ever in error, delete it and run **bundle install** to recreate it.

Run **gem list** to see all the gems that are loaded into the development environment:

```
$ gem list
```

The list of gems loaded in the environment is the same as the list specified in the **Gemfile.lock** file. Here's how it works. RVM makes a place for the gems to be stored (the RVM gemset); the **Gemfile** lists the gems you want to use; **bundle install** reads the Gemfile and installs the gems into the RVM gemset; the **Gemfile.lock** file records dependencies and version numbers; and **gem list** shows you the gems that are in the gemset and available for use.

Troubleshooting

If your development environment is set up correctly, there should be no difficulty installing gems with the `bundle install` command. If your development environment is not set up correctly, you may see error messages when Bundler attempts to install the [Nokogiri](#) gem. Nokogiri is often needed by other gems (it is a *dependency* of some gems) and Nokogiri can become a problem to install. Unlike most gems that are written in pure Ruby, parts of Nokogiri are written in the C language and must be compiled using system tools that vary with different operating systems. If you get an error while installing gems, and the message says, “An error occurred while installing nokogiri,” ask for help on [Stack Overflow](#).

Git

Let’s commit our changes to the Git repository and push to GitHub:

```
$ git add -A
$ git commit -m "add gems"
$ git push origin master
```

After your first use of `git push origin master`, you can use the shortcut `git push`.

If you get a message:

```
fatal: Not a git repository (or any of the parent directories): .git
```

It indicates you are in a folder that has not been initialized with Git. You are probably not in your project directory. Use the Unix command `pwd` to see where you are.

If you get a message:

```
fatal: 'origin' does not appear to be a git repository
fatal: The remote end hung up unexpectedly
```

It shows that you can't connect to GitHub to push the changes. To investigate, enter:

```
$ git remote show origin
```

It is not absolutely necessary to use GitHub for this tutorial. We're only using it so you'll be familiar with the workflow of professional development.

We're ready to configure the application.

Chapter 9

Configure

Rails is known for its “convention over configuration” guiding principle. As applied, the principle reduces the need for many configuration files. It’s not possible to eliminate all configuration files, however. Many applications require configuration of settings such as email account credentials or API keys for external services.

In our tutorial application, we’ll need to store an API key to access MailChimp, which we’ll use to add visitors’ email addresses to a mailing list, as well as an API key so we can send email using the Mandrill transactional email service.

Rails provides the **config/secrets.yml** file for our configuration settings. Any variable that is set in the **config/secrets.yml** file can be used elsewhere in our Rails application, providing a single location for all our configuration variables.

Configuration Security

GitHub is a good place to store and share code. But when your repos are public, they are not a good place for secret account credentials. In fact, any shared Git repository, even a private repo, is a bad place to store email account credentials or private API keys.

Operating systems (Linux, Mac OS X, Windows) provide mechanisms to set local [environment variables](#), as does Heroku and other deployment platforms. With a bit of Unix savvy, you can set environment variables using the Unix shell. Environment variables can be accessed from Rails applications and provide an ideal place to set configuration settings that must remain private.

For the best security, set credentials as Unix environment variables and only use Unix environment variables in the **config/secrets.yml** file.

The article [Rails Environment Variables](#) shows alternatives to using Unix environment variables, if for any reason you cannot set environment variables on your machine.

About Environment Variables

Unix environment variables are typically set in a file that is read when starting an interactive shell. The *shell* is the program that gives us the command line interface we see in the Terminal or console application. Unix gives you a choice of shell programs (with names like *sh*, *bash*, *ksh*, and *zsh*); each has a slightly different way to set environment variables. The most common shell program is *bash*.

Let's find out what shell you are using:

```
$ echo $SHELL
/bin/bash
```

If you see **/bin/bash**, that's great! If not, you may have to do some research to find out how to set environment variables in your shell.

When you open a console window, the *bash* shell reads a configuration file in your user home directory. You can use a Unix command to list all the files in your user home directory (the `~` “tilde” character represents your home directory):

```
$ ls -lpa ~  
.  
.  
.  
.bash_profile  
.bashrc  
.  
.  
.
```

You should see either **.bashrc** or **.bash_profile**. Open either file and you'll likely find a command such as:

```
export PATH=~/.bin:$PATH
```

That is a command that sets the **PATH** environment variable. The command might not be exactly the same but it is likely you will see some **export** commands.

If you don't have a **.bashrc** or **.bash_profile** file in your user home directory, you can create one.

Set Environment Variables

Set the following environment variables in your **.bashrc** or **.bash_profile** file:

```
export MANDRILL_USERNAME="example@example.com"  
export MANDRILL_API_KEY="Your_Mandrill_API_Key"  
export MAILCHIMP_API_KEY="Your_MailChimp_API_Key"  
export MAILCHIMP_LIST_ID="Your_List_ID"  
export OWNER_EMAIL="example@example.com"
```

The files **.bashrc** or **.bash_profile** are hidden in the file browser. You can use **Command-Shift-.** (command shift dot) to show hidden files in the Mac OS X file open dialog.

You should use quotes to surround configuration values (credentials) in the **.bashrc** or **.bash_profile** files.

Mandrill

You'll need your Mandrill username. If you're not sure, you can [sign in to your Mandrill account](#) and select "account" and view the tab for "Username & Contact Info."

Add your Mandrill username to your **.bashrc** or **.bash_profile** file:

```
export MANDRILL_USERNAME="DanielKehoe"
```

Add an environment variable for the MailChimp API key: **MAILCHIMP_API_KEY**. You'll need a Mandrill API key. Here's where to find it.

Visit the Mandrill web site and [sign in to your account](#). Click "Settings" in the navigation links on left side of the Mandrill dashboard. You'll see "SMTP & API Credentials". Click "New API Key". Mandrill gives you options, including a "Test Key" option that logs email messages in Mandrill but does not actually send any emails. For this tutorial, don't select the "Test Key" option. It's more interesting to get actual emails. Click "Create API Key" and you'll see a new API key you can copy and paste into the **.bashrc** or **.bash_profile** file.

```
export MANDRILL_API_KEY="Your_Mandrill_API_Key"
```

Your environment variables are set up to use Mandrill.

MailChimp

When visitors sign up to receive a newsletter, we'll add them to a MailChimp list. Add an environment variable for the MailChimp API key: **MAILCHIMP_API_KEY**.

[Sign in to MailChimp](#) to get your API key. Click your name at the top of the navigation menu, then click “Account.” Click “Extras,” then “API keys.” You have to generate an API key; MailChimp doesn’t create one automatically.

```
export MAILCHIMP_API_KEY="Your_MailChimp_API_Key"
```

You’ll need to create a MailChimp mailing list in preparation for our “Mailing List” chapter. Have you already created a MailChimp mailing list? If not, the MailChimp “Lists” page has a button for “Create List.” The list name and other details are up to you.

We’ll need the **MAILCHIMP_LIST_ID** for the mailing list you’ve created. To find the list ID, on the MailChimp “Lists” page, click the “down arrow” for a menu and click “Settings.” At the bottom of the “List Settings” page, you’ll find the unique ID for the mailing list.

```
export MAILCHIMP_LIST_ID="Your_List_ID"
```

Your environment variables are set up to use MailChimp.

Owner Email

You’ll send email messages to this address when a visitor submits a contact request form. Set **OWNER_EMAIL** with an email address where you receive mail.

```
export OWNER_EMAIL="example@example.com"
```

Enter an email address and your environment variables will be set up with the site owner email address.

Troubleshooting

Check that the Mandrill user name is set in your Unix environment variables:

```
$ echo "$MANDRILL_USERNAME"
```

You should see your Mandrill user name in the console response. Make sure you've used underscores consistently and you've used **MANDRILL_USERNAME** not **MANDRILL_USER_NAME**.

If you've set up Unix environment variables but **echo "\$MANDRILL_USERNAME"** doesn't return the correct variable in the console, you may have a problem with the way you've set Unix environment variables. Most computers use the bash shell and you can set environment variables in your **.bashrc** or **.bash_profile** files. But not every system is alike. If it seems Unix environment variables are not working, you may have to find a colleague who can help you troubleshoot. You can continue with the tutorial and add the credentials directly to the **config/secrets.yml** file.

The Secrets File

Use your text editor to add the Unix environment variables to the file **config/secrets.yml**:

```
# Be sure to restart your server when you modify this file.

# Your secret key is used for verifying the integrity of signed cookies.
# If you change this key, all old signed cookies will become invalid!

# Make sure the secret is at least 30 characters and all random,
# no regular words or you'll be exposed to dictionary attacks.
# You can use `rake secret` to generate a secure secret key.

# Make sure the secrets in this file are kept private
# if you're sharing your code publicly.
```

```
development:
  mandrill_username: <%= ENV["MANDRILL_USERNAME"] %>
  mandrill_api_key: <%= ENV["MANDRILL_API_KEY"] %>
  mailchimp_api_key: <%= ENV["MAILCHIMP_API_KEY"] %>
  mailchimp_list_id: <%= ENV["MAILCHIMP_LIST_ID"] %>
  domain_name: example.com
  owner_email: <%= ENV["OWNER_EMAIL"] %>
  secret_key_base: very_long_random_string

test:
  secret_key_base: very_long_random_string

# Do not keep production secrets in the repository,
# instead read values from the environment.
production:
  mandrill_username: <%= ENV["MANDRILL_USERNAME"] %>
  mandrill_api_key: <%= ENV["MANDRILL_API_KEY"] %>
  mailchimp_api_key: <%= ENV["MAILCHIMP_API_KEY"] %>
  mailchimp_list_id: <%= ENV["MAILCHIMP_LIST_ID"] %>
  domain_name: <%= ENV["DOMAIN_NAME"] %>
  owner_email: <%= ENV["OWNER_EMAIL"] %>
  secret_key_base: <%= ENV["SECRET_KEY_BASE"] %>
```

Be sure to use spaces, not tabs. Make sure there is a space after each colon and before the value for each entry or you will get a message “Internal Server Error: mapping values are not allowed” when you start the web server.

You used quotes to surround configuration values in the **.bashrc** or **.bash_profile** files. Here, in the **config/secrets.yml** file, you don’t need quotes.

Domain Name

We’ll need a domain name when we configure email for delivery in production. For development, use **example.com**. If you have your own domain name, you can use that instead. There’s no need to keep the **domain_name** configuration variable secret, so we don’t need to set it in a Unix environment variable.

You can decide for yourself if the **owner_email** variable really needs to be secret. Just for caution, I’m suggesting you set it as a Unix environment variable.

Securing the Secrets File

Some developers take steps to prevent the **config/secrets.yml** file from being checked into Git. To prevent the file from being saved to your repo you could add the filename to the **.gitignore** file in your application root directory.

If you've used Unix environment variables in the **config/secrets.yml** file, there's no reason to add the file to **.gitignore**. If you only reveal the **SECRET_KEY_BASE** used for development or testing, and no one can access your development machine, no useful secrets will be revealed in your GitHub repo.

When you deploy to Heroku, the **config/secrets.yml** file must be in your Git repository. For that reason, I suggest you save the file in your Git repo and keep your secrets safe by using environment variables.

Troubleshooting

Remember, in YAML files (with the file extension **.yml**), indentation is required (your application will break without it).

Be sure to use spaces, not tabs. Make sure there is a space after each colon and before the value for each entry.

If you have trouble setting Unix environment variables, you can add credentials directly to the **config/secrets.yml** file. If you do so, you should not check the file into Git until you've deleted the secrets from the file.

For example:

```
.  
.   
.   
  
development:   
  mandrill_api_key: very_long_string  
.   
.   
. 
```

Again, DON'T CHECK THE FILE INTO GIT if you've hardcoded your credentials directly in the **config/secrets.yml** file.

The article [Rails Environment Variables](#) shows alternatives to using Unix environment variables, if for any reason you cannot set environment variables on your machine.

Secret Key Base

It's not necessary to set **SECRET_KEY_BASE** as an environment variable on the computer you use for development. Rails generates a unique **SECRET_KEY_BASE** in the **config/secrets.yml** file each time you create a new Rails application and you don't need to replace it. If someone sees the **SECRET_KEY_BASE** in the **config/secrets.yml** file in your GitHub repo, there isn't anything they can do with it, since they don't have access to your local machine.

For your future reference, in case you want to change the **SECRET_KEY_BASE**, here's how. Go to your Rails application directory and create a new secret token:

```
$ rake secret  
very_long_random_string
```

And, if you wish, add it to your **.bashrc** or **.bash_profile** file:

```
export SECRET_KEY_BASE="very_long_random_string"
```

You should always use the environment variable **<%= ENV["SECRET_KEY_BASE"] %>** in the production section of your **config/secrets.yml** file, otherwise, someone who sees the secret token in your GitHub repo can gain access to your application in production. You'll set the environment variables for production when you deploy to Heroku.

Configure Email

Email messages are visible in the console and the log file when you test the application. If you don't want to actually send email, you can skip this step. But it's more fun when your application can actually send email.

You can learn more in the article [Send Email with Rails](#).

Connect to an Email Server

Web servers don't send email. Our Rails application has to connect to an email server (also known as a [mail transfer agent](#) or “mail relay”). In the early days of the Internet, an experienced system administrator could set up an [SMTP server](#) to distribute email. Now, because of efforts to reduce spam, it is necessary to use an established email service to ensure deliverability. In production, for high volume transactional email and improved deliverability, it is best to use a service such as [Mandrill](#) or [Mailgun](#). See the article [Send Email with Rails](#).

We need to configure Rails so the application can connect with an email server. For our tutorial application, we'll connect to Mandrill to send email.

For convenience during development, some developers use their own Gmail account to send email. Google has increased security measures for Gmail, so it can difficult to use Gmail to send email from a Rails application. Mandrill is easier to set up and you're more likely to use it for a real application. That's why we'll use it.

In the file **config/environments/development.rb**, near the end of the file, find the statement:

```
config.assets.debug = true
```

Immediately following, add this:

```
config.action_mailer.smtp_settings = {  
  address: "smtp.mandrillapp.com",  
  port: 587,  
  user_name: Rails.application.secrets.mandrill_username,  
  password: Rails.application.secrets.mandrill_api_key  
}  
# ActionMailer Config  
config.action_mailer.default_url_options = { :host => 'localhost:3000' }  
config.action_mailer.delivery_method = :smtp  
config.action_mailer.raise_delivery_errors = true
```

Note that the password will be your Mandrill API key. You can use port 25, 587, or 2525 (some ISPs restrict connections on port 25).

It's important to add these changes in the body of the configuration file, before the **end** keyword. The order isn't important but don't add the configuration statements after the **end** keyword.

Notice that we are using configuration variables that are set in the **config/secrets.yml** file:

- `Rails.application.secrets.mandrill_username`
- `Rails.application.secrets.mandrill_api_key`

We could “hard code” a username and API key here but that would expose confidential data if your GitHub repository is public. Using configuration variables that are set in the **config/secrets.yml** file keeps your secrets safe.

Again, if you need to troubleshoot, you can enter the Mandrill username and API key directly in this file instead of the configuration variables. But for security, don't commit to Git with the API key hardcoded in this file.

Perform Deliveries in Development

If you want to send real messages when you test the application in development mode, modify the file **config/environments/development.rb**.

After the code you just added, add the statement:

```
# Send email in development mode?  
config.action_mailer.perform_deliveries = true
```

This changes the configuration to send email when you're working on the application.

Make sure any code you've added to the **config/environments/development.rb** file is placed before the final **end** keyword. If you add code after the final **end** keyword, your application will fail with errors when you start the web server.

Later, after we add a contact form to the tutorial application, the application will be ready to send email messages.

Git

Make sure you're in your application root directory.

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "add configuration"  
$ git push
```

We're ready to create a home page for the application.

Chapter 10

Static Pages and Routing

A Rails application can deliver static web pages just like an ordinary web server. The pages are delivered fast and no Ruby code is required. We'll look at simple static pages and learn about Rails routing before we explore the complexities of dynamic web pages in Rails.

Add a Home Page

Make sure you are in your project directory.

Start the application server:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>. You'll see the Rails default information page.

Use your text editor to create and save a file **public/index.html**:

```
<h1>Hello World</h1>
```

Refresh the browser window and you'll see the "Hello World" message.

The Rails application server looks for any pages in the **public** folder by default.

If no filename is specified in the URL, the server will attempt to respond with a file named **index.html**. This is a convention that dates to 1993; if no filename was specified, one of the first web servers ever built (the NCSA httpd server) would return a list of all files in the directory, unless a file named **index.html** was present. Since then, **index.html** has been the default filename for a home page.

Routing Error

What happens when no file matches the requested web address?

Enter the URL <http://localhost:3000/about.html> in your browser.

You'll see an error page that shows a routing error.

If you are using Cloud9 or Nitrous.io, add "/about.html" to the URL in the preview browser window.

Add an About Page

Use your text editor to create and save a file **public/about.html**:

```
<h1>About</h1>
```

Visit the URL <http://localhost:3000/about.html> in your browser. You'll see the new "About" page.

By the way, you’ve just done test-driven development (TDD).

Introducing TDD

With test-driven development, a developer tests behavior before implementing a feature, expecting to see an error condition. Then the developer implements the feature and sees a successful result to the test. That’s exactly what you’ve done, in the simplest way.

Beginners tend to think TDD is scary and complicated. Now that you’ve experienced a simple form of TDD, maybe it won’t be intimidating. Real TDD means writing tests in Ruby before implementing features, but the principle is the same.

Introducing Routes

The guiding principle of “convention over configuration” governs Rails routing. If the web browser requests a page named “index.html”, Rails will deliver the page from the **public** folder by default. No configuration is required. But what if you want to override the default behavior? Rails provides a configuration file to control web request routing.

Remove the **public/index.html** file:

```
$ rm public/index.html
```

If you’ve got only one terminal window open, you’ll have to stop the Rails server with Control-c to get your terminal prompt. Here is where it is helpful to have two terminal sessions going in different tabs.

Now let’s set the “About” page as the home page.

Open the file **config/routes.rb**. Remove all the comments and replace the file with this:

```
Rails.application.routes.draw do
  root to: redirect('/about.html')
end
```

This snippet of Rails routing code takes any request to the application root (<http://localhost:3000/>) and redirects it to the **about.html** file (which is expected to be found in the **public** folder).

There is no need to restart your application server to see the new behavior. If you need to start the server:

```
$ rails server
```

Visit the page <http://localhost:3000/>. You'll see the "About" page.

You've just seen an example of Rails magic. Some developers complain that the "convention over configuration" principle is black magic. It's not obvious why pages are delivered from the **public** folder; it just happens. If you don't know the convention, you could be left scratching your head and looking for the code that maps <http://localhost:3000/> to the **public/index.html** file. The code is buried deep in the Rails framework. However, if you know the convention and the technique for overriding it, you have both convenience and power at your disposal.

Using the "About" Page

We've created an "About" page so we can learn about routing.

For the next chapter, we'll use the static "About" page to investigate how a web application works.

Later in the tutorial we'll create a new "About" page using a different approach.

Chapter 11

Request and Response

You’ve configured the tutorial application, created static pages, and seen the magic of Rails routing.

In this chapter, we’ll investigate the web request-response cycle and look at the model-view-controller design pattern so you’ll be prepared to build a dynamic home page.

Investigating the Request Response Cycle

Remember, at its core, the World Wide Web is nothing more than web browsers that request files from web servers.

Web browsers make *requests*. A web server *responds* to a request by sending an HTML file. Depending on the headers in the HTML file, the web browser may make additional requests and get additional CSS, JavaScript, and image files.

The beauty and simplicity of the World Wide Web architecture, as conceived by Tim Berners-Lee in 1990, is that the web is nothing more than a request from a web browser and a response from a web server. Some web pages now include streaming video, or music, requiring an open “pipe” between the web server

and the web browser, but even so, an initial request-response cycle delivers the page that sets up the stream.

We can reduce the mystery of how the web works to its simplest components when we investigate the request-response cycle. We'll see that everything that happens in a web application takes place within the flow of the request-response cycle.

Let's look at the request-response cycle.

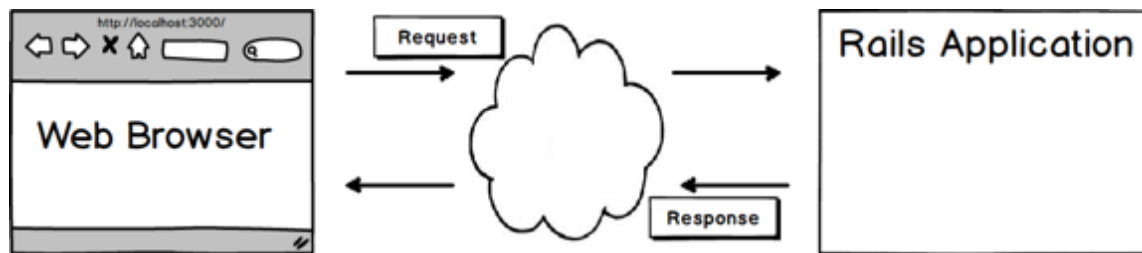


Figure 11.1: The request-response cycle.

Inside the Browser

We can see the actual request, and the actual response, by using the diagnostic tools built into the web browser.

Start the application server if it is not already running:

```
$ rails server
```

Developers use various web browsers during development. I'll provide instructions for Chrome, since it is the most popular. Even if you prefer Mozilla Firefox or Apple Safari, try this in Chrome, so you can follow along with the text.

Start our investigation by putting Chrome into “Incognito Mode” with Command-Shift-N (on a Mac). On Linux, use Ctrl-Shift-N to get in incognito mode with

Chrome. Alternatively, you can clear the browser cache. This clears any files that were previously cached by the browser.

The Developer Tools View is your primary diagnostic tool for front-end (browser-based) development, including CSS and JavaScript.

In Chrome on Mac OS X, press Command-Option-I to open the *Developer Tools View* in a section of the browser window. Alternatively, you can find the menu item under View/Developer/Developer Tools.

In Chrome on Windows or Linux platforms, press Shift-Ctrl-I or select Menu/Tools/Developer Tools.

Select the Network tab in the Developer Tools View.

Initiate the request-response cycle by visiting the “About” page at <http://localhost:3000/about>

In the Developer Tools View, you’ll see files received by the browser from the web server. There is only one: “about.html”. This is the file that the browser evaluates to display a web page.

Click the “about.html” file icon. Then click the tab “Headers.” The diagnostic window shows the entire request sent to the server and the entire response received by the browser.

The request is composed of:

- request URL (<http://localhost:3000/about.html>)
- request method (GET)
- request headers (including cookies and User Agent identifier)

The response is composed of

- status code (200 OK or 304 Not Modified)
- response headers (including date/time and server identifier)

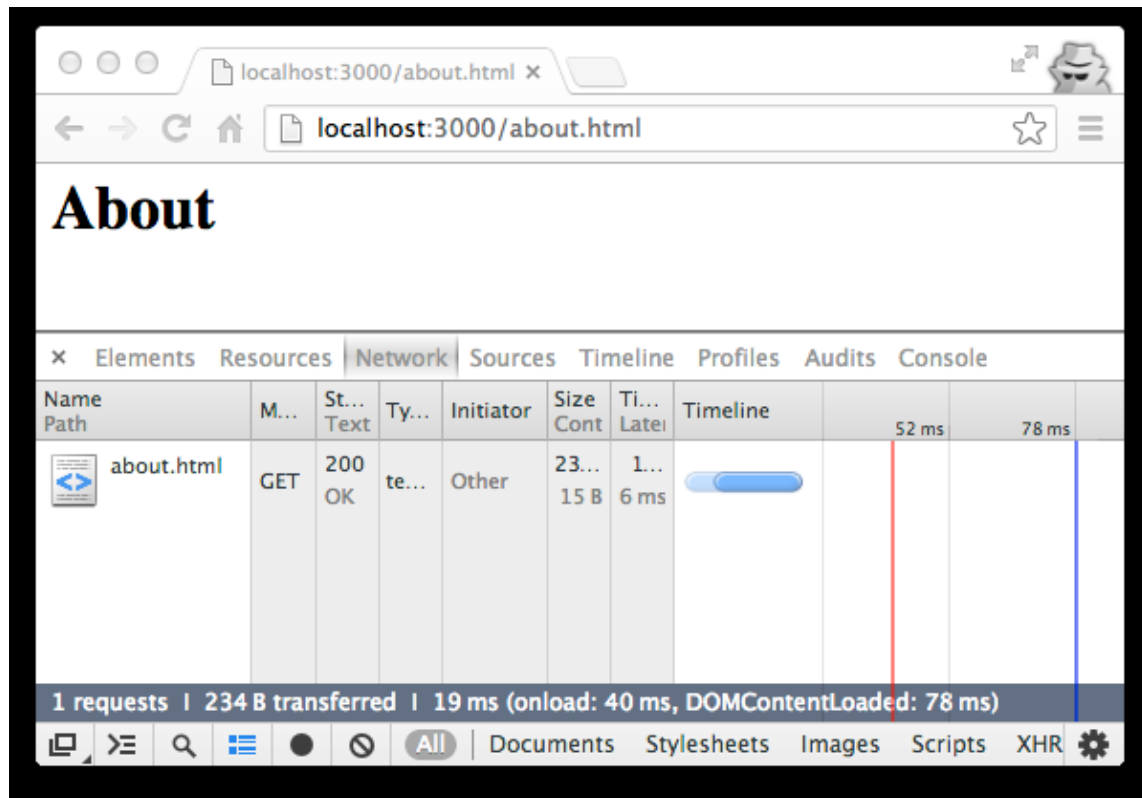


Figure 11.2: Viewing a request in the Developer Tools View.

- HTML

You can see the HTML sent to the browser by clicking the Preview or Response tabs in the diagnostic view.

Now try requesting the home page by entering the URL <http://localhost:3000/>.

You'll see the server returns two files. The first, "localhost", contains a redirect code "301 Moved Permanently" that tells the browser to request the "about.html" file. The second file is the "about.html" file. You may see the status code "200 OK" the first time the file is requested. On subsequent requests, you'll see the "304 Not Modified" code, indicating that the file hasn't changed and the browser should use the file that has been previously cached.

Here's the point of the exercise: The browser's diagnostic view shows all the data exchanged between the browser and server. You're looking at everything that passes through the plumbing.

Inside the Server

The browser's diagnostic view doesn't show you what happens on the server. For that, go to the server logs or the console window.

```
Started GET "/" for 127.0.0.1 at ...
```

Notice how the diagnostic messages in the console window match the headers in the browser diagnostic view. The browser's "Request Method:GET" matches the server's "Started GET." The browser's "Request URL:http://localhost:3000/" matches the server's "/" for 127.0.0.1" (localhost is at IP address 127.0.0.1).

Notice there are no console log messages for pages delivered from the **public** folder.

Soon we'll see much more in the console window, after we've built a dynamic web page that is assembled by the application server.

Document Object Model

What happens after the browser receives a response from the server?

The response is not complete until all files are received (or the browser reaches a time-out limit). Modern browsers retrieve files asynchronously; the order and location of the files in the initial HTML file doesn't matter because the browser will try to load all the files before displaying the page.

When the web browser receives an HTML file, it creates an internal representation of the page in computer memory, called the Document Object Model

(DOM). It provides a structural representation of the document. The DOM works like an API for HTML documents, allowing you to modify the content and visual presentation of the page by using JavaScript.

Later in the tutorial, we'll see how a JavaScript library such as [jQuery](#) can be used to do things like hiding or revealing HTML elements on a page by manipulating the DOM.

Model View Controller

Now that we've investigated the request-response cycle, let's dig deeper to understand what happens inside the Rails application server in response to a browser request.

Here is a diagram that shows what happens in the server during the request-response cycle.

You learned earlier that, from the perspective of a software architect, Rails is organized to conform to the [model–view–controller](#) software design pattern. This enforces “separation of concerns” to keep code manageable and organized. The MVC design pattern is optimal for web applications and is a central organizing principle for Rails.

The MVC design pattern originated in the design of desktop applications. “Model” classes manipulated data; “view” classes created the user interface; and a “controller” class responded to user interaction.

Some computer scientists feel the architecture of web applications doesn't quite match the original MVC design pattern of desktop applications. We can see the reason for the quibble in the next diagram. The diagram shows the MVC architecture as part of the Rails software stack.

At the base of the stack is the web browser. A request flows upward through the layers and encounters the router which dispatches the request to an appropriate controller.

In a Rails application, there is a single routing file, **config/routes.rb**, and multiple controllers, models, and views.

Considering the importance of the router, perhaps we should call our Rails architecture the *RCMV*, or Routing-Controller-Model-View, pattern. Despite the quibble about nomenclature, the architecture is well understood and used by all Rails developers.

Here's the step-by-step walk-through of what happens.

When the web browser makes a request, a *router* component will check the **config/routes.rb** file and determine which *controller* should handle the request, based on the web address and HTTP protocol. The controller will obtain any needed data from a *model*. After obtaining data, the controller will render a response combining data from the model with a *view* component that provides markup and layout. The response is an HTML file that the controller assembles for the browser to display.

The model, view, and controller are files you create containing Ruby code. Each file has a certain structure and syntax based on foundation model, view, and controller classes defined in the Rails framework. The model, view, and controller classes you create will *inherit* behavior from parent classes that are part of the framework, so you will have less code to write yourself.

In most Rails applications, a **model** obtains data from a database, though some models obtain data from a remote connection to another server. For example, a User model might retrieve a user name and email address from a local database. A User model could also obtain a user's recent tweets from Twitter or a user's hometown from Facebook. The controller can obtain data from more than one model if necessary.

A **controller** can have more than one *action*. For example, a User controller might have actions to display a list of users, or add or delete a user from a list. The **config/routes.rb** file matches a web request to a controller action. In the software architects' terminology, each action is a *method* of the controller *class*. We use the terms *action* and *method* interchangeably when we talk about a Rails controller; to be precise, controller actions are implemented as methods.

In practice, Rails developers try to limit controllers to seven standard actions: **index**, **show**, **new**, **create**, **edit**, **update** and **destroy** actions. A controller that offers these actions is said to be “RESTful” (a term that refers to **representational state transfer**, another software design abstraction). It’s not important to understand the abstract principles of RESTful design; recognizing the term and knowing that Rails controllers have seven standard actions is sufficient for beginners.

A **view** file combines Ruby code with HTML markup. Typically there will be a view file associated with each controller action that displays a page. An index view might show a list of users. A “show” view might provide details of a user’s profile. View files look much like ordinary HTML files but typically contain data in the form of Ruby variables. Often you’ll see Ruby statements such as blocks that iterate through lists to create tables. Following the “separation of concerns” principle, it is considered good practice to limit Ruby code in view files to only displaying data; anything else belongs in a model.

Not every controller action has its own view file. In many controllers, on completion, the **destroy** action will redirect to the index view, and **create** will redirect to either **show** or **new**.

This conceptual overview will be easier to grasp when you actually see the code for a model, view, and controller. We’ll create model, view, and controller files in the next chapter.

Remove the About Page

We’ve been using the static “About” page to investigate the request-response cycle.

We’re done, so delete the file **public/about.html**:

```
$ rm public/about.html
```

Make sure you've removed the **public/index.html** file as suggested earlier:

```
$ rm public/index.html
```

Earlier, we set up the **config/routes.rb** file. You can leave it in place. We'll change it in the next chapter.

Now we'll look at ways to implement the home page using the full power of Rails.

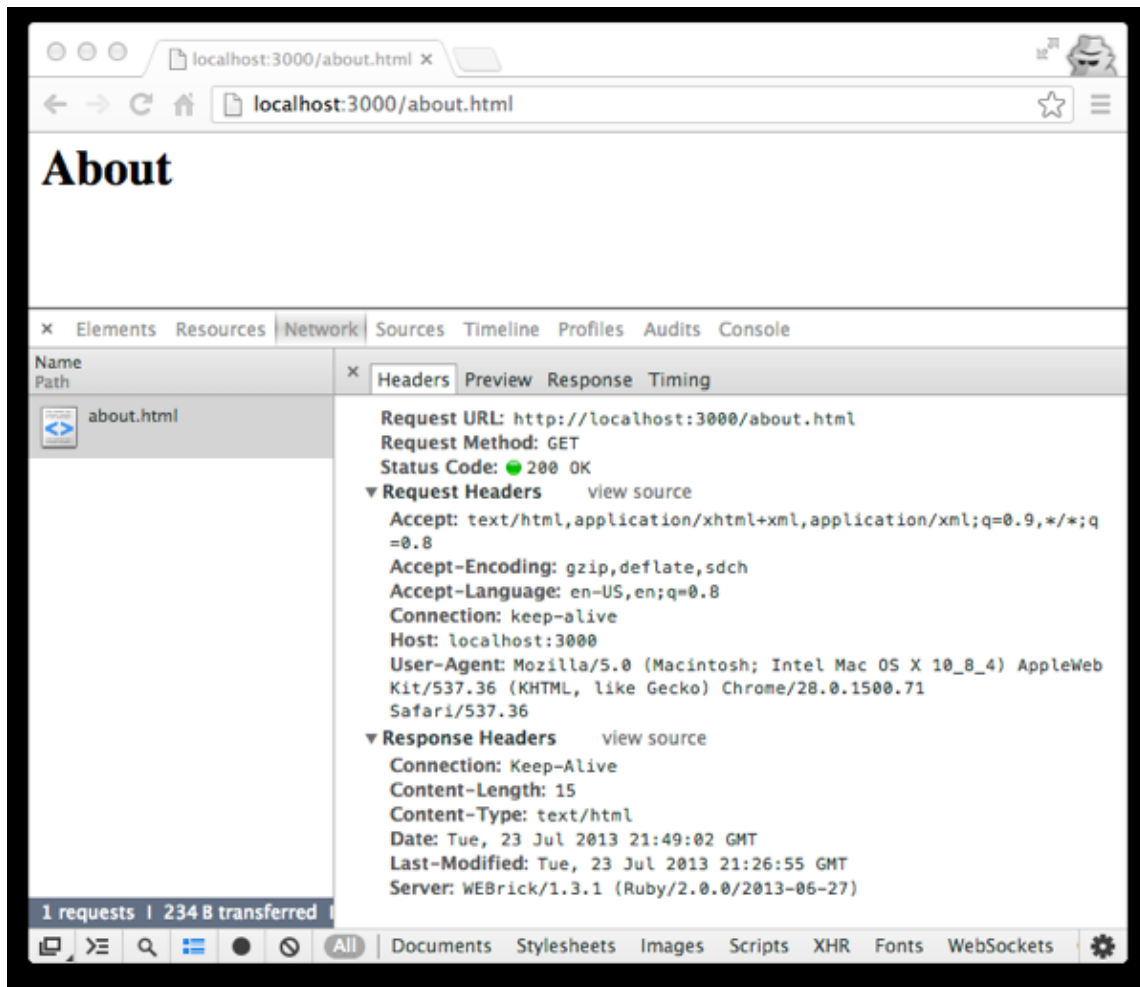


Figure 11.3: Viewing request headers in the Developer Tools View.

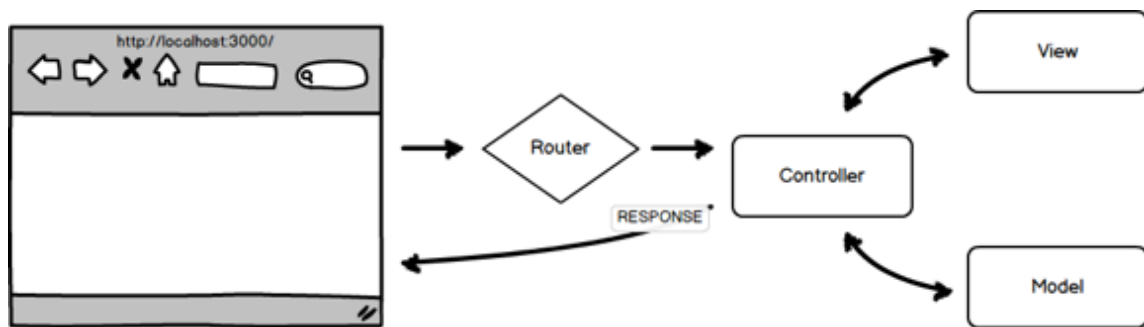


Figure 11.4: Model–View–Controller in Rails.

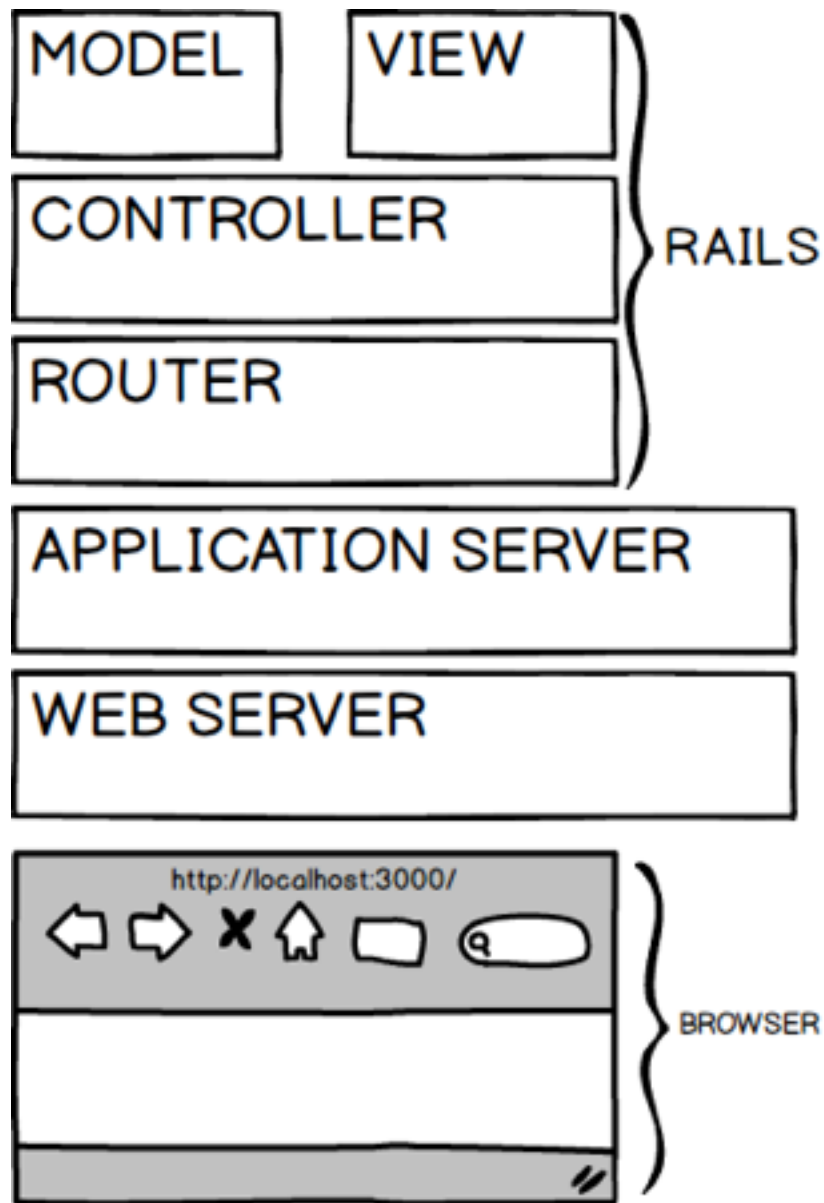


Figure 11.5: Model–View–Controller stack in Rails.

Chapter 12

Dynamic Home Page

Earlier, we saw how Rails can deliver simple static web pages.

Here we'll build a dynamic home page, illustrating basic concepts you'll need to understand Rails.

User Story

We'll plan our work with a user story:

```
*Birthday Countdown*
As a visitor to the website
I want to see the owner's name
I want to see the owner's birthdate
I want to see how many days until the owner's next birthday
In order to send birthday greetings
```

This silly home page will help us explore Rails and learn about the Ruby language.

Our goal is to build a practical web application that you can really use. Later we'll replace this silly home page with a useful web page that encourages visitors to sign up for a mailing list.

Routes, Model, View, and Controller

We'll use the model-view-controller design pattern as we build our new home page.

First, we'll set up a route so a request URL gets directed to the appropriate controller.

We'll set up a model so we obtain data we need for the home page.

We'll set up a view that contains the HTML needed to display our home page.

And finally, we'll create a controller that responds to the request, obtaining data from the model and rendering the view, sending a response to the web browser.

We can create the routes, model, view, and controller in any order. All must exist before our web application will respond to a request for a home page. In this tutorial, I've chosen to create the routes, model, view, and controller in an order that is convenient for learning.

The Name Game

Much of the art of programming lies in choosing suitable names for our creations.

We'll need a model as a source for data about the site owner. Choosing the most obvious name, we'll call it the Owner model:

- Owner - the file will be **app/models/owner.rb**

What about a name for the controller that will render our home page? How about "Home controller" or "Welcome controller?" Those names are acceptable. But if we consider our user story, the name "Visitors controller" is best. A visitor is the actor, so "Visitors controller" is appropriate:

- VisitorsController - the file will be **app/controllers/visitors_controller.rb**

Later we'll see this is a good choice because we'll create a Visitor model to handle data about the website visitor. In Rails, there is often a model with the same name as a controller (though a controller can use data from multiple models).

Naming Conventions

Rails is picky about class names and filenames. That's because of the “convention over configuration” principle. By requiring certain naming patterns, Rails avoids complex configuration files.

Before we look at class and filename conventions, here's a note about typographic terminology:

- a **string** is a sequence of characters
- you're looking at an example of lowercase strings separated by spaces (words!)
- Titlecase means there is an Initial Capital Letter in a string
- **CamelCase** contains a capital letter in the middle of a string
- **snake_case** combines words with an underscore character instead of a space

When you write code, you'll follow rules for class names:

- **class Visitor** - the model class name is capitalized and singular

- `class VisitorsController < ApplicationController` - for a controller, combine a pluralized model name with “Controller” in Camel-Case

Here are the rules for filenames. They are always lowercase, with words separated by underscores (snake_case):

- the model filename matches the model class name, but lowercase, for example **app/models/visitor.rb**
- the controller filename matches the controller class name, but snake_case, for example **app/controllers/visitors_controller.rb**
- the views folder matches the model class name, but plural and lowercase, for example **app/views/visitors**

At first the rules may seem arbitrary, but with experience they will make sense. The rule about no capital letters or spaces in filenames has its origins in computer antiquity.

If you stray from these naming conventions, you’ll encounter unexpected problems and frustration.

Routing

We’ll create the route before we implement the model and controller.

Open the file **config/routes.rb**. Replace the contents with this:

```
Rails.application.routes.draw do
  root to: 'visitors#new'
end
```

Any request to the application root (<http://localhost:3000/>) will be directed to the VisitorsController **new** action.

Don't be overly concerned about understanding the exact syntax of the code. It will become familiar soon and you can look up the details in the reference documentation, [RailsGuides: Routing from the Outside In](#).

In general, when you change a configuration file you must restart your application server. However, the **config/routes.rb** file is an exception. You don't need to restart the server after changing routes.

If you need to start the server:

```
$ rails server
```

Visit the page <http://localhost:3000/>. You'll see an error message because we haven't implemented the controller. The error message, "uninitialized constant VisitorsController," means Rails is looking for a VisitorsController and can't find it.

Model

Most Rails models obtain data from a database. When you use a database, you can use the **rails generate model** command to create a model that inherits from the ActiveRecord class and knows how to connect to a database.

Our tutorial application doesn't need a database. Instead of inheriting from ActiveRecord, we create a Ruby class with methods that return the owner's name, birthdate, and days remaining until his birthday. This simple class provides an easy introduction to Ruby code.

Create a file **app/models/owner.rb**:

```
class Owner

  def name
    name = 'Foobar Kadigan'
  end

  def birthdate
    birthdate = Date.new(1990, 12, 22)
  end

  def countdown
    today = Date.today
    birthday = Date.new(today.year, birthdate.month, birthdate.day)
    if birthday > today
      countdown = (birthday - today).to_i
    else
      countdown = (birthday.next_year - today).to_i
    end
  end

end
```

This is your first close look at Ruby code. The oddest thing you’ll see is the owner’s name, “Foobar Kadigan.” Everything else will make sense with a bit of explanation.

Keep in mind that we are using a text file to create an abstraction that we can manipulate in the computer’s memory. Software architects call these abstractions *objects*. In Ruby, everything we create and manipulate is an *object*. To distinguish one object from another, we define it as a *class*, give it a *class name*, and add behavior in the form of *methods*.

The first line `class Owner` defines the class and assigns a name. At the very end of the file, the `end` keyword completes the class definition.

We define three methods, starting with `def` (for “method definition”) and ending with `end`.

- `def name ... end`
- `def birthdate ... end`

- `def countdown ... end`

Each method contains simple Ruby code that assigns data to a variable. Later, we'll retrieve the data for use in our view file by *instantiating* the class and *calling* a method. Don't be discouraged by the software architects' terminology; the concepts are simple and we'll soon see everything in action.

Ruby makes it easy for a method to *return* data when called; the value assigned by the last statement will be delivered when the method is called.

Looking more closely at the Ruby code inside the method definitions, you'll see Ruby uses the `=` (equals) sign to assign values to a variable. The variable is named on the left side of the equals sign; a value is assigned on the right side. We call the equals sign an *assignment operator*.

We can assign any value to a variable, including a *string* (a series of characters that can be a word or name) such as "Foobar Kadigan." Ruby recognizes a string when characters are enclosed in single or double quotes. Not surprisingly, a number also can be assigned to a variable, either a whole number (an *integer*) or a decimal fraction (a *float*).

More interestingly, any Ruby object can be assigned to a variable. That helps us "move around" any object very easily, giving us access to the object's class methods anywhere we use the variable. We can create our own objects, as we have by creating the Owner class. Or we can use the library of objects that are supplied with Ruby. Ruby's prefabricated objects are defined by the Ruby API (*application programming interface*); essentially the API is a catalog of prebuilt classes that are building blocks for any application. The Rails API gives us additional classes that are useful for web applications. Learning the syntax of Ruby code gets you started with Ruby programming; knowing the API classes leads to mastery of Ruby.

The `Date` class is provided by the Ruby API. It is described in the [Ruby API reference documentation](#). The `Date` class has a `Date.new` method which *instantiates* (creates) a new date when supplied with year, month, and day *parameters*. You can see this syntax when we assign `Date.new(1990, 12, 22)` to the `birthdate` variable.

Note that Ruby has specific expectations about the syntax of numbers. The `Date.new(...)` method expects integers. Imagine a September birthday. You must use `Date.new(1990, 9, 22)`. If you enter a date in the format `Date.new(1990, 09, 22)`, you'll get a syntax error "Invalid octal digit" when you test the application. Ruby expects numbers that begin with zero to be [octal numbers](#); you'll get an error because octal numbers can't contain the digit "9."

Our `countdown` method contains the most complex code in the class.

First, we set a variable `today` with today's date. The `Date.today` method creates an object that represents the current date. When the `Date.today` method is called, Ruby gets the current date from the computer's system clock.

Next we create a `birthday` variable and assign a new date that combines today's year with the month and day of the `birthdate`. This gives us the date of Foobar Kadigan's birthday this year.

The `Date` class can perform complex calendar arithmetic. The variables `birthdate` and `today` are *instances* of the `Date` class. We can use a greater-than operator to determine if Foobar Kadigan's birthday is in the future or the past.

The `if ... else ... end` structure is a *conditional statement*. If the birthday is in the future, we subtract `today` from `birthday` to calculate the number of days remaining until the owner's birthday, which we assign to the `countdown` variable.

If the birthday has already passed, we apply a `next_year` method to the birthday to get next year's birthday. Then we subtract `today` from `birthday.next_year` to calculate the number of days remaining until the owner's birthday, which we assign to the `countdown` variable.

The result might be fractional so we use the utility method `to_i` to convert the result to a whole number (integer) before assigning it to the `countdown` variable.

This shows you the power of programming in Ruby. Notice that I needed 16 paragraphs and over 600 words to explain 15 short lines of code. We used only

seven Ruby abstractions but they represent thousands of lines of code in the Ruby language implementation. With knowledge of Ruby syntax and the Ruby API, a few short lines of code in a text file gives us amazing ability.

In an upcoming chapter, we'll look more closely at the syntax and keywords of the Ruby language. But without knowing more than this, we can build a simple web application.

Let's see how we can put this functionality to use on a web page.

View

The Owner model provides the data we want to see on the Home page.

We'll create the markup and layout in a View file and add variables that present the data.

View files go in folders in the **app/views/** directory. In a typical application, one controller can render multiple views, so we make a folder to match each controller. You can make a new folder using your file browser or text editor. Or use the Unix **mkdir** command:

```
$ mkdir app/views/visitors
```

Create a file **app/views/visitors/new.html.erb**:

```
<h3>Home</h3>
<p>Welcome to the home of <%= @owner.name %>.</p>
<p>I was born on <%= @owner.birthdate %>.</p>
<p>Only <%= @owner.countdown %> days until my birthday!</p>
```

We've created a **visitors/** folder within the **app/views/** directory. We have only a single **new** view but if we had more views associated with the Visitors controller, they'd go in the **app/views/visitors/** folder.

We name our View file **new.html.erb**, adding the **.erb** file extension so that Rails will use the ERB templating engine to interpret the markup.

There are several syntaxes that can be used for a view file. In this tutorial, we'll use the ERB syntax that is most commonly used by beginners. Some experienced developers prefer to add gems that provide the [Haml](#) or [Slim](#) templating engines. As you might guess, a View that uses the Haml templating syntax would be named **new.html.haml**.

Our HTML markup is minimal, using only the `<h3>` and `<p>` tags. The only ERB markup we add are the `<%= ... %>` delimiters. This markup allows us to insert Ruby code which will be replaced by the result of evaluating the code. In other words, `<%= @owner.name %>` will appear on the page as Foobar Kadigan.

You may have noticed that we refer to the Owner model with the variable `@owner`. It will be clear when we create the Visitors controller why we use this syntax (a variable name that begins with the `@` character is called an *instance variable*).

Obviously, if all we wanted to do was include the owner's name on the page, it would be easier to simply write the text. The Rails implementation becomes useful if the name is retrieved from a database or created programmatically.

We can better see the usefulness of the Owner model when we look at the use of `<%= @owner.countdown %>`. There is no way to display a calculation using only static HTML, so Rails gives us a way to display the birthday countdown calculation.

If you're a programmer, you might wonder why we only output the variable on the page. Since we can use ERB to embed any Ruby code, we could perform the calculation right on the page by embedding `<%= (Date.new(today.year, @owner.birthdate.month, @owner.birthdate.day) - Date.today).to_i %>`. If you've used JavaScript or PHP, you may have performed calculations like this, right on the page. Rails would allow us to do so, but the practice violates the "separation of concerns" principle that encourages us to perform complex calculations in a model and only display data in the view.

Before we can display the home page, we need to create the Visitors controller.

Controller

The Visitors controller is the glue that binds the Owner model with the VisitorsController#new view.

Note: When we refer to a controller action, we use the notation “VisitorsController#new,” joining the controller class name with the action (method) that renders a page. In this context, the # character is only a documentation convention.

Note: **VisitorsController** will be the class name and **visitors_controller.rb** will be the filename. The class name is written in **camelCase** (with a hump in the middle, like a camel) so we can combine two words without a space.

Unix commands get messy when filenames include spaces so we create a filename that combines two words with an underscore (sometimes called “snake_case”).

Create a file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
  end

end
```

We define the class and name it **class VisitorsController**, inheriting behavior from the ApplicationController class which is defined in the Rails API.

We only need to define the **new** method. We create an *instance variable* named **@owner** and assign an instance of the Owner model. Any instance variables (variables named with the @ character) will be available in the corresponding view file.

If we don't instantiate the Owner model, we'll get an error when the controller **new** action attempts to render the view because we use the **@owner** instance in the view file.

Keep in mind the purpose of the controller. Each controller action (method) responds to a request by obtaining a model (if data is needed) and rendering a view.

You've already created a view file in the **app/views/visitors** folder. The **new** action of the VisitorsController renders the template **app/views/visitors/new.html.erb**.

The **new** method is deceptively simple. Hidden behavior inherited from the ApplicationController does all the work of rendering the view. We can make the hidden code explicit if we wish to. It would look something like this:

```
class VisitorsController < ApplicationController

  def new

    @owner = Owner.new
    render 'visitors/new'
  end

end
```

This is an example of Rails magic. Some developers complain this is black magic because the “convention over configuration” principle leads to obscurity. Rails often offers default behavior that looks like magic because the underlying implementation is hidden in the depths of the Rails code library. This can be frustrating when, as a beginner, you want to understand what's going on.

Revealing the hidden code, we see that invoking the **new** method calls a **render** method supplied by the ApplicationController parent class. The **render** method searches in the **app/views/visitors** directory for a view file named **new** (the file extension **.html.erb** is assumed by default). The code underlying the **render** method is complex. Fortunately, all we need to do is define the method and instantiate the Owner model. Rails takes care of the rest.

As a beginner, simply accept the magic and don't confound yourself trying to

find how it works. As you gain experience, you can dive into the Rails source code to unravel the magic.

Scaffolding

This tutorial aims to give you a solid foundation in basic concepts. The model–view–controller pattern is one of the most important. I’ve found the best way to understand model–view–controller architecture is to create and examine the model, view, and controller files.

As you continue your study of Rails, you’ll find other tutorials that use the *scaffolding* shortcut. For example, [Rails Guides: Getting Started with Rails](#) includes a section “Getting Up and Running Quickly with Scaffolding” which shows how to use the `rails generate scaffold` command to create model, view, and controller files in a single operation. Students often use scaffolding to create simple Rails applications.

In practice, I’ve observed that working Rails developers seldom use scaffolding. There’s nothing wrong with it; it just seems that scaffolding doesn’t offer much that can’t be done as quickly by hand.

Test the Application

We’ve created a model, view, and controller. Now let’s run the application.

Enter the command:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>. You’ll see our new home page.

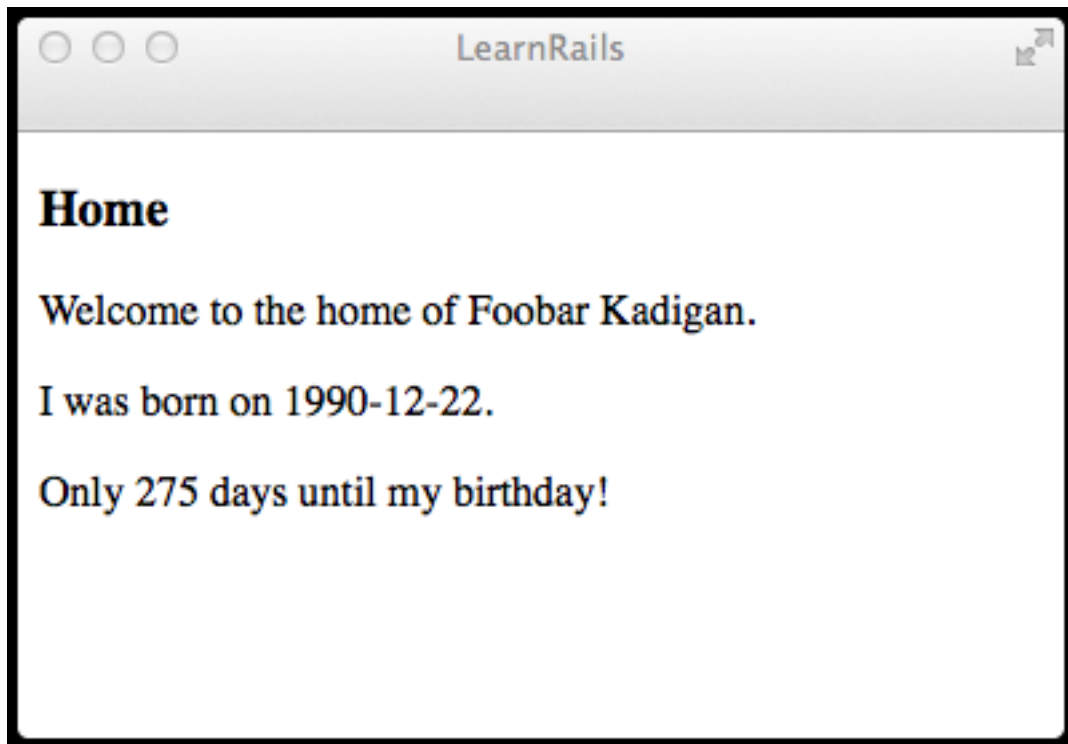


Figure 12.1: Dynamic home page shows days until a birthday.

It's a very simple web page but it uses Ruby to calculate the countdown to the birthday. And the underlying code conforms to the conventions and structure of Rails.

Git

At this point, you might have the Rails server running in your console window. We're going to run a git command in the console now.

You might think you have to enter Control-c to shut down the server and get the command prompt. But that's not necessary. You can open more than one console window. Your terminal application lets you open multiple tabs so you can easily switch between windows without using a lot of screen real estate.

If you haven't tried it, now is a good time. It is convenient to have a console window open for the server and another for various Unix commands.

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "dynamic home page"  
$ git push
```

Now let's take a look at troubleshooting.

Chapter 13

Troubleshoot

In the last chapter, we built a dynamic home page and learned about the model–view–controller architecture of Rails. There was a lot to learn, but the code was simple, and I hope it worked the first time you tried it.

Before we do any more work on our tutorial application, we need to learn about troubleshooting and debugging. As a software developer, you’ll spend a lot of time with code that doesn’t work. You’ll need tools and techniques to diagnose problems.

Git

In this chapter we’ll make changes to the application just for troubleshooting.

Before you get started, make sure the work you’ve done is committed to your git repository. Use the **git status** command to check:

```
$ git status
```

You should see:

```
On branch master
nothing to commit, working directory clean
```

If **git status** reports any uncommitted changes, go back to the last step in the previous chapter and commit your work to the git repository before continuing. At the end of this chapter, we're going to throw away the work we've done in this chapter. We don't want to accidentally throw away work from the previous chapter so make sure it is committed to the repository.

Interactive Ruby Shell

There will be times when you want to try a snippet of Ruby code just to see if it works. Your tool will be IRB, the Interactive Ruby Shell.

IRB is a Ruby interpreter that runs from the command line. It executes any Ruby code and provides an immediate response, allowing you to experiment in real-time.

Let's try it.

```
$ irb
>>
```

The command **irb** launches the program and displays a prompt that show your Ruby version, a line number, and an arrow. If you enter a valid Ruby expression, the interpreter will display the result of evaluating the expression.

Try simple arithmetic:

```
>> n = 2
=> 2
>> n + 2
=> 4
```

Wow! You are using your computer for simple math. Maybe you can delete the calculator app from your phone.

IRB will evaluate any Ruby expression and helps you quickly determine if syntax and logic is correct.

IRB for Blocks of Code

At first glance, it appears IRB works on just one line of code.

Actually, IRB can handle multiple lines of code. Try it:

```
>> n = 10
=> 10
>> if n < 10
>>   puts "small"
>> else
?>   puts "big"
>> end
big
=> nil
>>
```

Here we set `n = 10` and then enter a conditional statement line-by-line. After we enter the final `end`, IRB interprets the code and outputs the result.

You'll often enter more than one line of code in IRB. If you find yourself frustrated because you've entered typos and had to enter the same code repeatedly, you can use IRB to load code you've saved in a file:

```
>> load './mytest.rb'
```

Quitting IRB

It can be very frustrating to find you are stuck inside IRB. Unlike most shell commands, you can't quit with Control-c. Enter Control-d or type `exit` to quit

IRB:

```
$ irb  
>> exit
```

Learn More About IRB

Here's an entertaining way to learn about IRB:

- [Why's \(Poignant\) Guide to Ruby \(with a Basic Introduction to IRB\)](#)

Here's a more conventional way to learn about IRB:

- [The Pragmatic Programmer's Guide](#)

Beyond IRB

If you ask experienced Rails developers for help with IRB, they'll often recommend you switch to Pry. [Pry](#) is a powerful alternative to the standard IRB shell for Ruby. As you gain experience, you might take a look at Pry to see what the enthusiasm is all about. But for now, as a beginner trying out a few lines of Ruby code, there's no need to learn Pry.

Rails Console

IRB only evaluates expressions that are defined in the Ruby API. IRB doesn't know Rails.

It'd be great to have a tool like IRB that evaluates any expression defined in the Rails API. The tool exists; it's called the Rails console. It is particularly useful

because it loads your entire Rails application. Your application will be running as if the application was waiting to respond to a web request. Then you can expose behavior of any pieces of the web application.

```
$ rails console
...
Loading development environment (Rails 4.x.x)
>>
```

The Rails console behaves like IRB but loads your Rails development environment. The prompt shows it is ready to evaluate an expression.

Let's use the Rails console to examine our Owner model:

```
>> myboss = Owner.new
=> #<Owner:0x007fc18e91faf8>
```

We've created a variable named **myboss** and created a new instance of the Owner class. The Rails console responds by displaying the unique identifier it uses to track the object. The identifier is not particularly useful, except to show that something was created.

If you're unsure about the difference between an *instance* and a *class*, we've just seen that we can make one or more instances of a class by calling the **Owner.new** method. When we specify the **Owner** class, the class definition is loaded into the computer's working memory (our development environment) from the class definition file on disk. Then we can use the **Owner.new** method to make one or more instances of the **Owner** class. Each instance is a unique object with its own data attributes but the same behavior as other objects instantiated from its class.

Let's assign the name of our boss to a variable called **name**:

```
>> name = myboss.name
=> "Foobar Kadigan"
```

Our variable `myboss` is an instance of an `Owner` class so it responds to the method `Owner.name` by returning the owner's name.

We want to show respect to our boss so we'll perform some *string manipulation*:

```
>> name = 'Mr. ' + name  
=> "Mr. Foobar Kadigan"
```

We're done for now. When we quit the Rails console or shut down the computer the `Owner` class definition remains stored on disk but the instances disappear. The bits that were organized to create the variable `name` will evaporate into the ether.

Actually, the bits are still there, in the form of logic states in the computer's chips, but they have no meaning until another program uses them.

Enter Control-d or type `exit` to quit the Rails console.

The Rails console is a useful utility. It is like a handy calculator for your code. Use it when you need to experiment or try out short code snippets.

Rails Logger

As you know, a Rails application sends output to the browser that makes a web request. On every request, it also sends diagnostic output to the *server log file*. Depending on whether the application is running in the development environment or in production, the log file is here:

- `log/development.log`
- `log/production.log`

In development, everything written to the log file appears in the console window after you run the `rails server` command. Scrolling the console window is a good way to see diagnostics for every request.

Here's what you see in the log after you visit the application home page:

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
  Rendered visitors/new.html.erb within layouts/application (48.8ms)
Completed 200 OK in 233ms (Views: 211.5ms | ActiveRecord: 0.0ms)
```

You may have more than one console window open in the terminal application. If you don't see your log output in your terminal, check if you have tabs with other windows.

Here's the best part. You can add your own messages to the log output by using the Rails logger. Let's try it out.

Modify the file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    Rails.logger.debug 'DEBUG: entering new method'
    @owner = Owner.new
    Rails.logger.debug 'DEBUG: Owner name is ' + @owner.name
  end

end
```

Visit the home page again and you'll see this in the console output:

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
DEBUG: entering new method
DEBUG: Owner name is Foobar Kadigan
  Rendered visitors/new.html.erb within layouts/application (0.2ms)
Completed 200 OK in 8ms (Views: 4.6ms | ActiveRecord: 0.0ms)
```

If you really needed to do so, you could add a logger statement at every step in the application. You could see how the application behaves, step by step. And you could “print” the value of every variable at every step. You'll never need

diagnostics at this level of detail in Rails, but the logger is extremely useful when you are trying to understand unexpected behavior.

Let's add logger statements to the **Owner** model. Modify the file **app/models/owner.rb**:

```
class Owner

  def name
    name = 'Foobar Kadigan'
  end

  def birthdate
    birthdate = Date.new(1990, 12, 22)
  end

  def countdown
    Rails.logger.debug 'DEBUG: entering Owner countdown method'
    today = Date.today
    birthday = Date.new(today.year, birthdate.month, birthdate.day)
    if birthday > today
      countdown = (birthday - today).to_i
    else
      countdown = (birthday.next_year - today).to_i
    end
  end
end
```

We added the **Rails.logger.debug** statement to the **Owner.countdown** method.

Visit the home page and here's what you'll see in the console output:

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
DEBUG: entering new method
DEBUG: Owner name is Foobar Kadigan
DEBUG: entering Owner countdown method
  Rendered visitors/new.html.erb within layouts/application (0.3ms)
Completed 200 OK in 7ms (Views: 4.2ms | ActiveRecord: 0.0ms)
```

You'll often need to “get inside” the model or controller to see what's happening. The Rails logger is the best tool for the job.

Here are some tricks for the Rails logger.

In a controller, you can use the method `logger` on its own. In a model, you have to write `Rails.logger` (both class and method).

You can use any of the methods `logger.debug`, `logger.info`, `logger.warn`, `logger.error`, or `logger.fatal` to write log messages. By default, you'll see any of these messages in the development log. Log messages written with the `logger.debug` method will not be recorded in a production log file.

If you want your log messages to stand out, you can add formatting code for color:

```
Rails.logger.debug "\033[1;34;40m[DEBUG]\033[0m " + 'will appear in bold blue'
```

For more about the Rails logger, see the [RailsGuide: Debugging Rails Applications](#).

Revisiting the Request-Response Cycle

Earlier, when we investigated the request-response cycle, we looked in the server log to see the response to the web browser request.

Now, with debug statements in the controller and model, we'll see messages showing the server's traverse of the model-view-controller architecture.

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
DEBUG: entering new method
DEBUG: Owner name is Foobar Kadigan
DEBUG: entering Owner countdown method
  Rendered visitors/new.html.erb within layouts/application (0.3ms)
Completed 200 OK in 5ms (Views: 4.2ms | ActiveRecord: 0.0ms)
```

Notice how the diagnostic messages in the console window match the headers in the browser diagnostic view. The browser's "Request Method:GET" matches

the server's "Started GET." The browser's "Request URL:http://localhost:3000/" matches the server's "/" for 127.0.0.1" (localhost is at IP address 127.0.0.1). The browser's "Status Code: 200" matches the server's "Completed 200 OK" (you might have to clear the browser's cache if the browser is showing "304 Not Modified").

We can see evidence of the model-view-controller architecture. "Processing by VisitorsController#new" shows the program flow entering the controller. Our debug statements show we enter the `new` method and reveal the value of the Owner name. The next debug statement reveals the flow has passed to the Owner model. A diagnostic message shows the controller has rendered the `visitors/new.html.erb` view file. Finally, the "Completed 200 OK" message indicates the response has been sent to the browser.

As we learned, the model-view-controller architecture is an abstract design pattern. We've seen it reflected in the file structure of the Rails application directory. Now we can see it as activity in the server log.

The Stack Trace

The Rails logger is extremely useful if you want to insert messages to show program flow or display variables. But there will be times when program flow halts and the console displays a *stack trace*.

Let's deliberately create an error condition and see an error page and stack trace.

Modify the file `app/controllers/visitors_controller.rb`:

```
class VisitorsController < ApplicationController

  def new
    Rails.logger.debug 'DEBUG: entering new method'
    @owner = Owner.new
    Rails.logger.debug 'DEBUG: Owner name is ' + @owner.name
    DISASTER
  end

end
```

```
end
```

Visit the home page and you'll see an error page:

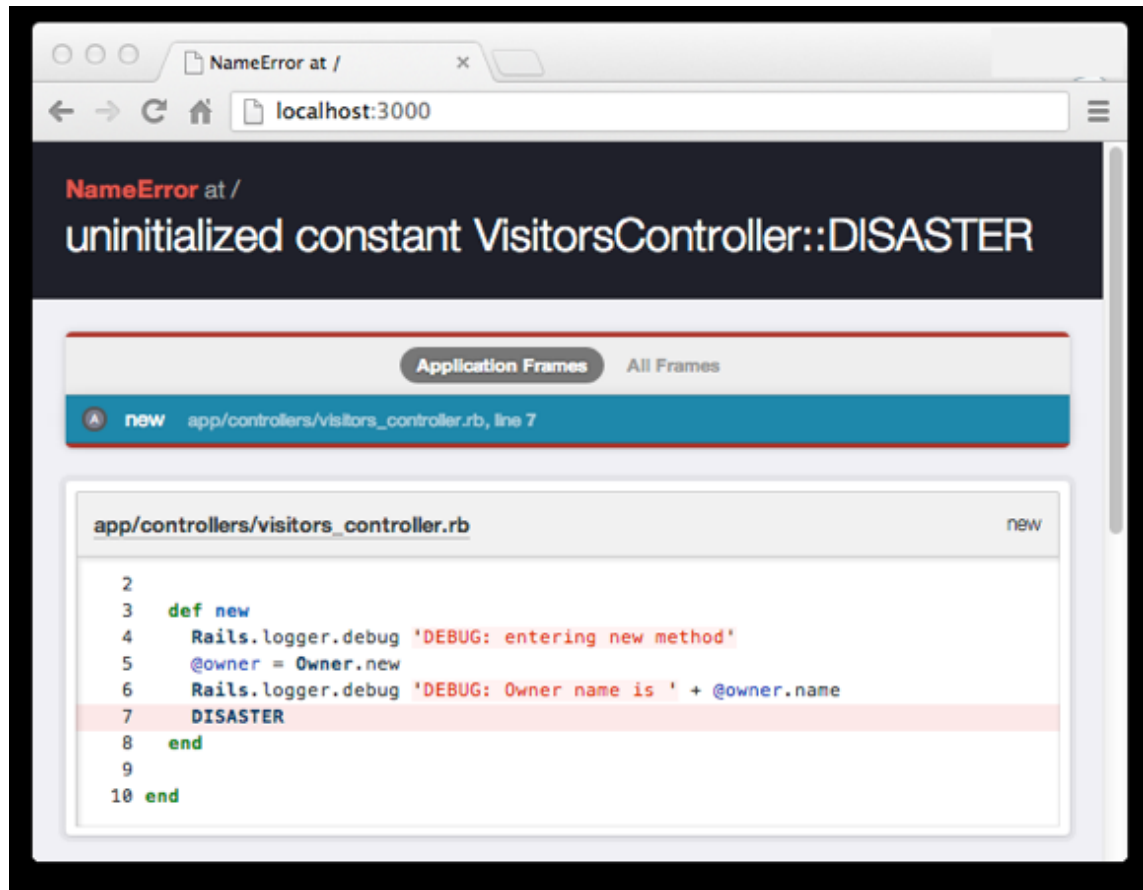


Figure 13.1: Error page.

You'll see this error page because we've installed the [better_errors](#) gem. Without the `better_errors` gem, you'd see the default Rails error page which is quite similar.

In the console log, the stack trace will show everything that happens before Rails encounters the error:


```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
DEBUG: entering new method
DEBUG: Owner name is Foobar Kadigan
Completed 500 Internal Server Error in 10ms

NameError - uninitialized constant VisitorsController::DISASTER:
  app/controllers/visitors_controller.rb:7:in `new'
.
.
.
```

To save space, I’m only showing the top line of the stack trace. I’ve eliminated about sixty lines from the stack trace.

Don’t feel bad if your reaction to a stack trace is an immediate, “TMI!” Indeed, it is usually Too Much Information. There are times when it pays to carefully read through the stack trace line by line, but most often, only the top line of the stack trace is important.

In this case, both the error page and the top line of the stack trace show the application failed (“barfed”) when it encountered an “uninitialized constant” at line 7 of the **app/controllers/visitors_controller.rb** file in the **new** method. It’s easy to find line 7 in the file and see that is exactly where we added a string that Rails doesn’t understand.

The point of this exercise is to encourage you to read the top line of the stack trace and use it to diagnose the problem. I’m always surprised how many developers ignore the stack trace, probably because it looks intimidating.

Raising an Exception

As you just saw, you can purposefully break your application by adding characters that Rails doesn’t understand. However, there is a better way to force your program to halt, called *raising an exception*.

Let’s try it. Modify the file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    Rails.logger.debug 'DEBUG: entering new method'
    @owner = Owner.new
    Rails.logger.debug 'DEBUG: Owner name is ' + @owner.name
    raise 'Deliberate Failure'
  end

end
```

You can throw an error by using the **raise** keyword from the Ruby API. You can provide any error message you'd like in quotes following **raise**.

Here's the console log after you try to visit the home page:

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
DEBUG: entering new method
DEBUG: Owner name is Foobar Kadigan
Completed 500 Internal Server Error in 22ms

RuntimeError - Deliberate Failure:
  app/controllers/visitors_controller.rb:7:in `new'
  .
  .
  .
```

Before we continue, let's remove the deliberate failure. Modify the file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    Rails.logger.debug 'DEBUG: entering new method'
    @owner = Owner.new
    Rails.logger.debug 'DEBUG: Owner name is ' + @owner.name
  end

end
```

Rails and the Ruby API provide a rich library of classes and methods to raise and handle exceptions. For example, you might want to display an error if a

user enters a birthdate that is not in the past. Rails includes various exception handlers to display errors in production so users will see a helpful web page explaining the error.

Git

There's no need to save any of the changes we made for troubleshooting.

You could go to each file and carefully remove the debugging code you added. But there's an easier way.

Check which files have changed:

```
$ git status
# Changes not staged for commit:
#   (use "git add ..." to update what will be committed)
#   (use "git checkout -- ..." to discard changes in working directory)
#
# modified:   app/controllers/visitors_controller.rb
# modified:   app/models/owner.rb
#
no changes added to commit (use "git add" and/or "git commit -a")
```

Use Git to revert your project to the most recent commit:

```
$ git reset --hard HEAD
```

The Git command `git reset --hard HEAD` discards any changes you've made since the most recent commit. Check the status to make sure:

```
$ git status
# On branch master
nothing to commit, working directory clean
```

We've cleaned up after our troubleshooting exercise.

Chapter 14

Just Enough Ruby

Experienced Rails developers debate whether beginners should study Ruby before learning Rails.

By all means, if you love the precision and order of programming languages, dive into the study of Ruby from the beginning. But most people don't delay starting Rails while learning Ruby; realistically, you'll retain more knowledge of Ruby if you learn it as you build things in Rails. That is the approach we've taken in this book. You've already built a simple Rails application and used Ruby as you did so.

Reading Knowledge of Ruby

What you need, more than anything, when you start working with Rails, is reading knowledge of Ruby.

With a reading knowledge of Ruby you'll avoid feeling overwhelmed or lost when you encounter code examples or work through a tutorial. Later, as you tackle complex projects and write original code, you'll need to know enough of the Ruby language to implement the features you need. But as a student, you'll be following tutorials that give you all the Ruby you need. Your job is

to recognize the language keywords and use the correct syntax when you type Ruby code in your text editor.

To that end, this chapter will review the Ruby keywords and syntax you've already learned. And you'll extend your knowledge so you'll be prepared for the Ruby you'll encounter in upcoming chapters.

Ruby Example

To improve your reading knowledge of Ruby, we'll work with an example file that contains a variety of Ruby expressions.

We won't use this file in our tutorial application, so you'll delete it at the end of this chapter. But we'll approach it as real Ruby code, so make a file and copy the code using your text editor.

First we have to consider where the file should go. It will not be a model, view, controller, or any other standard component of Rails. Rails has a place for miscellaneous files that don't fit in the Rails API. We'll create the file in the **lib/** folder. That's the folder you'll use for any supporting Ruby code that doesn't fit elsewhere in the Rails framework.

Create a file **lib/example.rb**:

```
class Example < Object

  # This is a comment.

  attr_accessor :honorific
  attr_accessor :name
  attr_accessor :date

  def initialize(name, date)
    @name = name
    @date = date.nil? ? Date.today : date
  end

  def backwards_name
    @name.reverse
  end
end
```

```
def to_s
  @name
end

def titled_name
  @honorific ||= 'Esteemed'
  titled_name = "#{@honorific} #{@name}"
end

def december_birthdays
  born_in_december = [ ]
  famous_birthdays.each do |name, date|
    if date.month == 12
      born_in_december << name
    end
  end
  born_in_december
end

private

def famous_birthdays
  birthdays = {
    'Ludwig van Beethoven' => Date.new(1770,12,16),
    'Dave Brubeck' => Date.new(1920,12,6),
    'Buddy Holly' => Date.new(1936,9,7),
    'Keith Richards' => Date.new(1943,12,18)
  }
end

end
```

In some ways, this Ruby code is like a poem from Lewis Carroll:

```
'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe;
All mimsy were the borogoves,
And the mome raths outgrabe.

"Beware the Jabberwock, my son!
The jaws that bite, the claws that catch!
Beware the Jubjub bird, and shun
The frumious Bandersnatch!"
```

The poem corresponds to the rules of English syntax but is nonsense.

The code follows the rules of Ruby syntax, and unlike the poem, uses meaningful words. But it is unclear how the author intends anyone to use the code. If you're beginning a career as a Rails developer, this won't be the last time you look at code and wonder what the author was intending. In this case, I just want to give you some code that illustrates typical Ruby syntax and structure.

Ruby Keywords

When reading Ruby code, the first challenge is determining which words are Ruby keywords and which were made up by the developer. Code is only strings of characters. But some strings have special meaning for everyone and all others are arbitrary words that only have meaning to an individual developer.

As you gain experience, you'll recognize Ruby keywords because you've seen them before.

You'll also recognize a developer's made-up words because of their position relative to other words and symbols. Some made-up words will be obvious because they are just too idiosyncratic to be part of the Ruby language. For example, you'll rightly guess that `myapp` or `fluffycat` are not part of the Ruby language.

If you're reading a Lewis Carroll poem, you could look up words in a dictionary to see if you find them.

There is only one way to be sure which words are part of the Ruby language: Check the Ruby API.

As an exercise, pick one of the words from the example code that you think might be a Ruby keyword and search the API to find it.

If you want to be a diligent student, you can check every keyword in the example code to find out whether it is in the Ruby API. It is more practical to learn to recognize Ruby keywords, which we'll do next.

API Documentation

The Ruby API documentation lists every keyword in the language:

- ruby-doc.org - the official Ruby API
- apidock.com/ruby - Ruby API docs with usage notes

Ruby Files

When we write code, we save it in files. We've added our miscellaneous example file to the **lib/** folder.

By convention, Ruby files end with the file extension **.rb**.

Using IRB

In the “Troubleshooting” chapter, you used IRB (the Interactive Ruby Shell) to try out Ruby code. You can use IRB to try out the example code in the console.

```
$ irb
>> load 'lib/example.rb'
=> true
>> require 'date'
=> true
>> ex = Example.new('Daniel', nil)
=> #<Example:0x007fb46c9eecd8 @name="Daniel", @date=#<Date: 2015-12-23 ...
>> list = ex.december_birthdays
=> ["Ludwig van Beethoven", "Dave Brubeck", "Keith Richards"]
>>
```

Entering the **load** directive and the filename brings the code into IRB.

The **require 'date'** statement loads the Ruby date library.

The statement `ex = Example.new('Daniel', nil)` creates an object from the `Example` class.

The `ex.december_birthdays` method returns an array of names.

Remember you can use Control-d to exit from IRB.

Now, for practice, we'll read the Ruby code.

Whitespace and Line Endings

Whitespace characters such as spaces and tabs are generally ignored in Ruby code, except when they are included in strings. There are several special cases where whitespace is significant in Ruby expressions but you are not likely to encounter these cases as a beginning Rails developer.

Some programming languages (Java and the C family) require a semicolon as a terminator character at the end of statements. Ruby does not require a semicolon to terminate a statement. Instead, if the Ruby code on a line is a complete expression, the line ending signifies the end of the statement. If the line ends with a `+` or other operator, or a backslash character, the statement is split into multiple lines.

Comments

Ruby ignores everything that is marked as a comment. Use comments for notes to yourself or other programmers.

```
# This is a comment.
```

You can also turn code into comments if you don't want the code to run. This is a common trick when you want to “turn off” some part of your code but you don't want to delete it just yet, because you are trying out alternatives.

The Heart of Programming

Three principles are at the heart of all programming:

- syntax
- conditional execution
- transformation

Computers allow no ambiguity. Code must exactly follow the *syntax* of a language. Typos, guesses, and code that is almost-but-not-quite right will simply fail, often without any helpful error messages.

Computers seem intelligent because they can execute code *conditionally*. You can write a program so that given one set of conditions, certain parts of the code will execute, and given different conditions, other parts of the code will execute.

Lastly, programs are written to transform abstractions from one form to another. That's why computer programs look like math. When we learn simple arithmetic, we learn we can take the symbols for numbers and add them together to make a different number. Computer programs do more than add numbers; a program can transform words and other abstractions.

Assignment

In Ruby, like many other programming languages, the equals sign indicates we are *assigning* a value.

```
name = 'Foobar Kadigan'
```

Assignment is the first step to transformation. Here `'Foobar Kadigan'` is a string of letters. The equals sign is the assignment operator. And `name` is a *variable* that stores the value so it can be easily reused. We don't have to type `'Foobar Kadigan'` every time we need a name; we can use `name` instead.

Just as we can assign a value to a variable, we can reassign a new value whenever we want. That is why we call them variables; the value can vary.

```
name = 'Mr. Foobar Kadigan'
```

Variables can be assigned strings of letters, numbers, or anything else. “Anything else” is very broad because we can use Ruby to make complex structures that contain data and also “do work.” These complex structures are *objects* and we say that Ruby is *object-oriented* because it is easy to work with objects in Ruby.

Object-Oriented Terminology

Software architects use a common vocabulary to talk about programming languages:

- **class**
- **instance** or **object**
- **method**
- **attribute** or **property**
- **inheritance**
- **class hierarchy**

There are three ways to learn what these words mean. You can memorize the definitions. You can write code and intuitively grasp the meanings. Or you can gain an understanding by applying metaphors.

Houses

For example, some programming textbooks attempt to explain a *class* like this: A blueprint for a house design is like a *class definition*. All the houses built from that blueprint are *objects* of a class we could call House.

Vehicles

Or: The concept of “vehicle” is like a *class*. Vehicles can have *attributes*, like color or number of doors. They have behavior, or *methods*, like buttons that turn on lights or honk a horn. The concepts of “truck” or “car” are also classes, *inheriting* common characteristics from a *superclass* “vehicle.” The blue car in your driveway with four doors is an object, a particular *instance* of the class “car.”

Cookies

I like the cookie metaphor the best.

A *class definition* is like a cookie cutter.

Bits in the computer memory are like cookie dough.

The cookie cutter makes as many individual cookies as you want. Each cookie is an *instance* of the Cookie class, with the same shape and size as the others. Cookies are *objects*.

You can decorate each cookie with sprinkles, which are *attributes* that are unique to each instance. Some cookies get red sprinkles, some get green, but

the shape remains the same.

Running a program is like baking. The cookies change state from raw to cooked.

Sticking a toothpick in a cookie is like calling a *method*. The method returns a result that tells you about the state: Is it done?

Limitations of Metaphors

Metaphors are imperfect.

If baking was like running a program, all the cookies would disappear as soon as the oven was turned off.

When a software program contains a “car” model, it doesn’t fully model cars in the physical world. It represents an abstraction of characteristics a programmer deems significant. Let’s make a model for a Person that contains an attribute Gender. What values are possible for the attribute Gender? For many years, Facebook offered two choices, male and female. In 2014, Facebook suddenly offered a choice of over fifty gender terms. As Sarah Mei discusses in a blog post, [Why Gender is a Text Field on Diaspora](#), your assumptions have consequences when you build a model.

Most classes in software APIs don’t model anything in the real world. They typically represent an abstraction, like an Array or a Hash, which inherits characteristics from another abstraction, for example, a Collection.

Given the limitations of metaphors, maybe it is easier to simply say that software allows us to create abstractions that are “made real” and then manipulated and transformed. Terminology such as *class* and *instance* describe the abstractions and the relationships among them.

Definitions

Here are definitions for some of the terms we encounter when we consider Rails from the perspective of a software architect:

class an abstraction that encapsulates data and behavior

class definition written code that describes a class

instance or object a unique copy of a class that exists only while a program is running

inheritance a way to make a class by borrowing from another class

class hierarchy classes that are related by inheritance

method a command that returns data from an object

attribute or property data that can be set or retrieved from the object

variable a name that can be assigned a value or object

expression or statement any combination of variables, classes, and methods that returns a result

Some of these terms are abstractions that are “made real” in the Ruby API (such as class and method); others are just terms that describe code, much like we use terms such as “adjective” or “noun” to talk about the grammar of the English spoken language.

Classes

You don’t have to create classes to program in Ruby. If you only write simple programs, you won’t need classes. Classes are used to organize your code and

make your software more modular. For the software architect, classes make it possible to create a structure for complex software programs. To use Rails, you'll use the classes and methods that are defined in the Rails API.

There is one class at the apex of the Ruby class hierarchy: **BasicObject**. **BasicObject** is a very simple class, with almost no methods of its own. The **Object** class inherits from **BasicObject**. All classes in the Ruby and Rails APIs inherit behavior from **Object**. **Object** provides basic methods such as **nil?** and **to_s** ("to string") for every class that inherits from **Object**.

We create a class **Example** and inherit from **Object** with the **<** "inherits from" operator:

```
class Example < Object
  .
  .
  .
end
```

The **end** statement indicates all the preceding code is part of the **Example** class.

In Ruby, all classes inherit from the **Object** class, so we don't need to explicitly *subclass* from **Object** as we do here. The example just shows it for teaching purposes.

Here is the **Example** class without the explicit subclassing from **Object**:

```
class Example
  .
  .
  .
end
```

Much of the art of programming is knowing what classes are available in the API and deciding when to subclass to inherit useful methods.

Methods

Classes give organization and structure to a program. Methods get the work done.

Any class can have methods. Methods are a series of expressions that return a result (a value). We say methods describe the class behavior.

A method definition begins with the keyword **def** and (predictably) ends with **end**.

```
def backwards_name
  @name.reverse
end
```

Initializing the object and calling the method returns a result:

```
ex = Example.new('Daniel', nil)
my_backwards_name = ex.backwards_name
=> leinaD
```

We can also *override* a method from the parent class.

```
def to_s
  @name
end
```

Here we are *overriding* the **to_s** (“to string”) method from the parent **Object** class.

Ordinarily, the **to_s** method returns the object’s class name and an object id. Here we will return the string assigned to the variable **@name**.

Most times you won’t override the **to_s** (“to string”) method. This example shows how you can override any method inherited from a parent class.

Dot Operator

The “dot” is the method operator. This tiny punctuation symbol is a powerful operator in Ruby.

It allows us to *call a method* to get a result.

Sometimes we say we *send a message* to the object when we invoke a method, implying the object will send a result.

Some classes, such as **Date**, provide *class methods* which can be called directly on the class without instantiating it first. For example, you can run this in the Rails console:

```
Date.today  
=> Tue, 15 Oct 2013
```

More often, methods are called on variables which are instances of a class. For example:

```
birthdate = Date.new(1990, 12, 22)  
=> Sat, 22 Dec 1990  
birthmonth = birthdate.month  
=> 12
```

We can apply *method chaining* to objects. For example, **String** has methods **reverse** and **upcase** (among many others). We could write:

```
nonsense = 'foobar'  
=> "foobar"  
reversed = nonsense.reverse  
=> "raboof"  
capitalized = reversed.upcase  
=> "RABOOF"
```

It is easier to use method chaining and write:

```
'foobar'.reverse.upcase  
=> "RABOOF"
```

Classes create a structure for our software programs and methods do all the work.

Question and Exclamation Methods

You'll see question marks and exclamation points (sometimes called the “bang” character) used in method names. These characters are simply a naming convention for Ruby methods.

The question mark indicates the method will return a *boolean value* (true or false).

The bang character indicates the method is “dangerous.” In some cases it means the method will change the object rather than just return a result. In Rails an exclamation point often means the method will throw an exception on failure rather than failing silently.

Initialize Method

Objects are created from classes before they are used. As I suggested earlier, class definitions are cookie cutters; the Ruby interpreter uses them to cut cookies. When we call the **new** method, we press the cookie cutter into the dough and get a new object. All the cookies will have the same shape but they can be decorated differently, by sprinkling attributes of different values.

The **initialize** method is one of the ways we sprinkle attributes on our cookie.

```
def initialize(name, date)
```

When we want to use an **Example** object and assign it to a variable, we will instantiate it with **Example.new(name, date)**. The **new** method calls the **initialize** method automatically. If we don't define an **initialize** method, the **new** method still works, inherited from **Object**, so we can always instantiate any class.

Method Parameters

Methods are useful when they operate on data.

If we want to send data to a method, we define the method and indicate it will accept *parameters*. Parameters are placeholders for data values. The values that are passed to a method are *arguments*. “Parameters” are empty placeholders and “arguments” are the actual values. In practice, “parameters” and “arguments” are terms that are used interchangeably and not many developers will notice if you mix up the terms.

Our **initialize** method takes **name** and **date** arguments:

```
def initialize(name, date)
```

Ruby is clever with method parameters. You can define a method and specify default values for parameters. You can also pass extra arguments to a method if you define a method that allows optional parameters. This makes methods very flexible.

We separate our parameters with commas. For readability, we enclose our list of parameters in parentheses. In Ruby, parentheses are always optional but they often improve readability.

Variable

In Ruby, everything is an object. We can assign any object to a variable. The variable works like an alias. We can use a variable anywhere as if it were the assigned object. The variable can be assigned a string, a numeric value, or an instance of any class (all are objects).

```
name
```

You can assign a new value to a variable anywhere in your method. You can assign a different kind of object if you want. You can take away someone's name and give them a number. We can create a variable `player`, assign it the string `'Jackie Robinson'`, replace the value with an integer `42`, or even a date such as `Date.new(1947, 4, 15)`.

Symbol

Obviously, we see many symbols when we read Ruby code, such as punctuation marks and alphanumeric characters. But *symbol* has a specific meaning in Ruby. It is like a variable, but it can only be assigned a value once. After the initial assignment, it is *immutable*; it cannot be changed.

You will recognize a symbol by the colon that is always the first character.

```
:name
```

Symbols are efficient and fast because the Ruby interpreter doesn't have to work to check their current values.

You'll often see symbols used in Rails where you might expect a variable.

Attributes

In an object, methods do the work and data is stored as variables. We can use the `initialize` method to input data to the object. We can't access data in variables from outside the object unless it is exposed as *attributes*.

Classes can have attributes, which we can “set” and “get.” That is, we can establish a value for an attribute and retrieve the value by specifying the attribute name.

Attributes are a convenient way to push data to an object and pull it out later.

In Ruby, attributes are also called properties.

Here we use the `attr_accessor` directive to specify that we want to expose `honorific`, `name` and `date` attributes.

```
attr_accessor :honorific
attr_accessor :name
attr_accessor :date
```

If we use `attr_accessor` to establish attributes, we can use the attribute names as methods. For example, we could write:

```
ex = Example.new('Daniel', nil)
my_name = ex.name
```

In Ruby, attributes are just specialized methods that expose data outside the object.

Instance Variable

Inside an object, an ordinary variable only can be used within the method in which it appears. If you use a variable with the same name in two different

methods, it will have a different value in each method. The *scope* of a variable is limited to the method in which it is used.

Often you want a variable to be available throughout an instance, within any method. You can declare an *instance variable* by using an @ (at) sign as the first character of the variable name.

The instance variable can be used by any method after the class is instantiated.

```
@name = name
```

The values assigned to instance variables are unique for every instance of the class. If you create multiple instances of a class, each will have its own values for its instance variables. Here we create two instances of the **Example** class. The **@name** instance variable will be “Daniel” in the first instance and “Foobar” in the second instance.

```
ex1 = Example.new('Daniel', nil)
ex2 = Example.new('Foobar', nil)
```

An instance variable is not visible outside the object in which it appears; but when you create an **attr_accessor**, it creates an instance variable and makes it accessible outside the object.

Instance Variables in Rails

In a Rails controller, you’ll often see a model assigned to an instance variable. Earlier we saw **@owner = Owner.new** when we instantiated an Owner model. We use an instance variable when we want a model to be available to the view template.

Rails beginners learn the simple rule that you have to use the @ (at) sign if you want a variable to be available in the view. Intermediate Rails developers

learn that the variable with the `@` (at) sign is called an instance variable and is only available within the *scope* of the instance (practically speaking, to other methods in the class definition). That leads to a question: Why is an instance variable available inside a view?

There is a good reason. A Rails view is NOT a separate class. It is a template and, under the hood, it is part of the current controller object. From the viewpoint of a programmer, a Rails controller and a view are separate files, segregated in separate folders. From the viewpoint of a software architect, the controller is a single object that evaluates the template code, so an instance variable can be used in the view file.

This example shows us that the programmer and the software architect have different perspectives on a Rails application. Understanding Rails requires an integration of multiple points of view.

Double Bar Equals Operator

I've suggested that the best way to get help is to use Google or Stack Overflow to look for answers. But that's difficult when you don't know what symbols are called. Try googling "`||=`" and you'll get no results. Instead, try googling "bar bar equals ruby" or "double pipe equals ruby" and you'll find many explanations of the "or equals" operator. This is an example of mysterious shorthand code you'll often find in Rails.

`||=` is used for conditional assignment. In this case, we only assign a value to the variable if no value has been previously assigned.

```
@honorific ||= 'Esteemed'
```

It is equivalent to this conditional expression:

```
if not x
  x = y
end
```

Conditional assignment is often used to assign a “default value” when no other value has been assigned.

Conditional

Conditional logic is fundamental to programming. Our code is always a path with many branches.

When the Ruby interpreter encounters an **if** keyword, it expects to find an expression which evaluates as true or false (a *boolean*).

If the expression is true, the statements following the condition are executed.

If the expression is false, any statements are ignored, unless there is an **else**, in which case an alternative is executed.

```
if date.month == 12
  .
  .
  .
end
```

Sometimes you’ll see **unless** instead of **if**, which is a convenient way of saying “execute the following if the condition is false.”

In Ruby, the conditional expression can be a simple comparison, as illustrated above with the **==** (double equals) operator. Or **if** can be followed by a variable that has been assigned a boolean value. Or you can call a method that returns a boolean result.

Ternary Operator

A basic conditional structure might look like this:

```
if date.nil?  
  @date = Date.today  
else  
  @date = date  
end
```

We test if `date` is undefined (`nil`). If `nil`, we assign today's date to the instance variable `@date`. If `date` is already assigned a value, we assign it to the instance variable `@date`. This is useful in the `initialize(name, date)` method in our example code because we want to set today's date as the default value for the instance variable `@date` if the parameter `date` is `nil`.

Ruby developers like to keep their code tight and compact. So you'll see a condensed version of this conditional structure often, particularly when a default value must be assigned.

This compact conditional syntax is named the *ternary operator* because it has three components. Here is the syntax:

```
condition ? value_if_true : value_if_false
```

Here is the ternary operator we use in our example code:

```
@date = date.nil? ? Date.today : date
```

This is another example of Ruby syntax that you must learn to recognize by sight because it is difficult to interpret if you have never seen it before.

For more Ruby code that has been condensed into obscurity, see an article on [Ruby Golf](#). Ruby golf is the sport of writing code that uses as few characters as possible.

Interpolation

Rubyists love to find special uses for orthography such as hashmarks and curly braces. It seems Rubyists feel sorry for punctuation marks that don't get much use in the English language and like to give them new jobs.

We already know that we can assign a string to a variable:

```
name = 'Foobar Kadigan'
```

We can also perform “string addition” to concatenate strings. Here we add an honorific, a space, and a name:

```
@honorific = 'Mr.'  
@name = 'Foobar Kadigan'  
titled_name = @honorific + ' ' + @name  
=> "Mr. Foobar Kadigan"
```

Single quote marks indicate a string. In the example above, we enclose a space character within quote marks so we add a space to our string.

You can eliminate the ungainly mix of plus signs, single quote marks, and space characters in the example above.

Use double quote marks and you can perform *interpolation*, which gives a new job to the hashmark and curly brace characters:

```
@honorific = 'Mr.'  
@name = 'Foobar Kadigan'  
titled_name = "#{@honorific} #{@name}"  
=> "Mr. Foobar Kadigan"
```

The hashmark indicates any expression within the curly braces is to be evaluated and returned as a string. This only works when you surround the expression with double quote marks.

Interpolation is cryptic when you first encounter the syntax, but it streamlines string concatenation.

Access Control

Any method you define will return a result.

Sometimes you want to create a method that only can be used by other methods in the same class. This is common when you need a simple utility method that is used by several other methods.

Any methods that follow the keyword **private** should only be used by methods in the same class (or a subclass).

```
private
```

You often see private methods in Rails. Ruby provides a *protected* keyword as well, but the difference between *protected* and *private* is subtle and *protected* is seldom seen in Rails applications.

Hash

Our example code includes a private method named **famous_birthdays** that returns a collection of names and birthdays of famous musicians.

Computers have always been calculation machines; they are just as important in managing collections.

One important type of collection is named a Hash. A Hash is a data structure that associates a key to some value. You retrieve the value based upon its key. This construct is called a *dictionary*, an *associative array*, or a *map* in other languages. You use the key to “look up” a value, as you would look up a definition for a word in a dictionary.

You'll recognize a Hash when you see curly braces (again, Rubyists give a job to under-utilized punctuation marks).

```
birthdays = {  
  'Ludwig van Beethoven' => Date.new(1770,12,16),  
  'Dave Brubeck' => Date.new(1920,12,6),  
  'Buddy Holly' => Date.new(1936,9,7),  
  'Keith Richards' => Date.new(1943,12,18)  
}
```

Rubyists also like to create novel uses for mathematical symbols. The combination of an `=` (equals) sign and `>` (greater than) sign is called a *hashrocket*. The `=>` (hashrocket) operator associates a key and value pair in a Hash.

Ruby 1.9 introduced a new way to associate key and value pairs in a Hash:

```
birthdays = {  
  beethoven: Date.new(1770,12,16),  
  brubeck: Date.new(1920,12,6),  
  holly: Date.new(1936,9,7),  
  richards: Date.new(1943,12,18)  
}
```

Here, instead of using a string as the key, we are using Ruby symbols, which enable faster processing. The `:` (colon) character associates the key and value.

Ordinarily, a symbol is defined with a leading colon character. In a Hash, a trailing colon makes a string into a symbol.

If you want to transform a string containing spaces into a symbol in a Hash, you can do it, though the syntax is awkward:

```
birthdays = {  
  : 'Ludwig van Beethoven' => Date.new(1770,12,16)  
}
```

Whether with colons or hashrockets, you'll often see Hashes used in Rails.

Array

An *Array* is a list. Arrays can hold objects of any data type. In fact, arrays can contain a mix of different objects. For example, an array can contain a string and another array (this is an example of a *nested array*).

An array can be instantiated with square brackets:

```
born_in_december = [ ]
```

We can populate the array with values when we create it:

```
my_list = ['apples', 'oranges']
```

If we don't want to use quote marks and commas to separate strings in a list, we can use the `%w` syntax:

```
my_list = %w( apples oranges )
```

We can add new elements to an array with a `push` method:

```
my_list = Array.new  
=> []  
my_list.push 'apples'  
=> ["apples"]  
my_list.push 'oranges'  
=> ["apples", "oranges"]
```

In our example code, we use the `<<` *shovel operator* to add items to the array:

```
born_in_december << name
```

A Ruby array has close to a hundred available methods, including operations such as **size** and **sort**. See the [Ruby API](#) for a full list.

Iterator

Of all the methods available for a Ruby collection such as Hash or Array, the *iterator* may be the most useful.

You'll recognize an iterator when you see the **each** method applied to a Hash or Array:

```
famous_birthdays.each
```

The **each** keyword is always followed by a block of code. Each item in an Array, or key-value pair in a Hash, is passed to the block of code to be processed.

Block

You can recognize a *block* in Ruby when you see a **do ... end** structure. A block is a common way to process each item when an iterator such as **each** is applied to a Hash or Array.

In our example, we iterate over the **famous_birthdays** hash:

```
famous_birthdays.each do |name, date|  
  .  
  .  
  .  
end
```

Within the two pipes (or bars), we assign the key and value to two variables.

The block is like an unnamed method. The two variables are available only within the block. As each key-value pair is presented by the iterator, the variables are assigned, and the statements in the block are executed.

In our example code, we evaluate each date in the `famous_birthdays` hash to determine if the musician was born in December. When we find a December birthday, we add the name of the musician to the `born_in_december` array:

```
famous_birthdays.each do |name, date|  
  if date.month == 12  
    born_in_december << name  
  end  
end
```

When you use a block within a method, any variable in your method is available within the block. That's why we can add `name` to the array `born_in_december`.

Computer scientists consider a block to be a programming language construct called a *closure*. Ruby has other closures, including the *proc* (short for procedure) and the *lambda*. Though blocks are common you'll seldom see procs or lambdas in ordinary Rails code. They are more common in the Rails source code where advanced programming techniques are used more frequently.

The key point to know about a block (or a proc or a lambda) is that it works like a method. Though you don't see a method definition, you can use a block to evaluate a sequence of statements and obtain a result.

Rails and More Keywords

We've looked at only a few of the keywords and constructs you will see in Ruby code. The exercise has improved your Ruby literacy, so you'll have an easier time reading Ruby code.

Nothing in the exercise is Rails. The example code only uses keywords from the Ruby API.

Rails has its own API, with hundreds of classes and methods. The Rails API uses the syntax and keywords of the Ruby language to construct new classes and create new keywords that are specific to Rails and useful for building web applications.

We say Ruby is a general-purpose language because it can be used for anything. Rails is a *domain-specific language* (DSL) because it is used only by people building web applications (in this sense, “domain” means area or field of activity). Ruby is a great language to use for building a DSL, which is why it was used for Rails. Unlike some other programming languages, Ruby easily can be extended or tweaked. For example, developers can redefine classes, add extra methods to existing classes, and use the special `method_missing` method to handle method calls that aren’t previously defined. Software architects call this *metaprogramming* which simply means clever programming that twists and reworks the programming language.

When you add a gem to a Rails project, you’ll add additional keywords. Some of the most powerful gems add their own DSLs to your project. For example, the Cucumber gem provides a DSL for turning user stories into automated tests.

Adding Rails, additional gems, and DSLs provides powerful functionality at the cost of complexity. But it all conforms to the syntax of the Ruby language. As you learn to recognize Ruby keywords and language structures, you’ll be able to pick apart the complexity and make sense of any code.

More Ruby

To develop your proficiency as a Rails developer, I hope you will make an effort to learn Ruby as you learn Rails. Don’t be lazy; when you encounter a bit of Ruby you don’t understand, make an effort to find out what is going on. Spend time with a Ruby textbook or interactive course when you work on Rails projects.

Collaborative Learning

The best way to learn Ruby is to actually use it. That's the concept behind this site:

- [Exercism.io](http://exercism.io)

With Exercism, you'll work through code exercises and get feedback from other learners.

Online Tutorials

- [TryRuby.org](http://tryruby.org) - free browser-based interactive tutorial from Code School
- [Codecademy Ruby Track](http://codecademy.com/ruby) - free browser-based interactive tutorials from Codecademy
- [Ruby Monk](http://rubymonk.com) - free browser-based interactive tutorial from C42 Engineering
- [Ruby Koans](http://rubykoans.com) - free browser-based interactive exercises from Jim Weirich and Joe O'Brien
- [Ruby in 100 Minutes](http://jumpstartlab.com/ruby) - free tutorial from JumpstartLab
- [Code Like This](http://code-like-this.com) - free tutorials by Alex Chaffee
- [RailsBridge Ruby](http://railsbridge.com/ruby) - basic introduction to Ruby
- [CodeSchool Ruby Track](http://codeschool.com/ruby) - instructional videos with in-browser coding exercises

Books

- [Learn To Program](#) - free ebook by Chris Pine
- [Learn To Program](#) - expanded \$18.50 ebook by Chris Pine
- [Learn Code the Hard Way](#) - free from Zed Shaw and Rob Sobers
- [Beginning Ruby](#) - by Peter Cooper
- [Programming Ruby](#) - by Dave Thomas, Andy Hunt, and Chad Fowler
- [Eloquent Ruby](#) - by Russ Olsen
- [Books by Avdi Grimm](#), including *Confident Ruby* and *Objects on Rails*.

Newsletters

- [Practicing Ruby](#) - \$8/month for access to over 90 helpful articles on Ruby
- [RubySteps](#) - weekly lessons by email from Pat Maddox

Screencasts

- [RubyTapas](#) - \$9/month for access to over 100 screencasts on Ruby

Git

There's no need to save the file **lib/example.rb** file we created to learn Ruby.

You can simply delete the file:

```
$ rm lib/example.rb
```

Check the Git status to make sure the file is gone:

```
$ git status
# On branch master
nothing to commit, working directory clean
```

We've cleaned up after our Ruby exercise.

From here on, we're done with silly code examples. No more fooling around. With the next chapter, we start building a real-world Rails website.

Chapter 15

Layout and Views

In previous chapters we created a dynamic home page and learned techniques for troubleshooting.

In this chapter we'll look closely at view files, particularly the application layout, so we can organize the design of our web pages. We'll also learn how to add a CSS stylesheet to improve the graphic design of our web pages.

This chapter covers a lot of ground, so take a break before jumping in, or pace yourself to absorb it all.

Template Languages

HTML is intended for markup, which means applying formatting to a text file. For a web application, ordinary HTML is not sufficient; we need to mix in Ruby code. We'll use a *templating language* that gives us a syntax for mixing HTML tags and Ruby code. The Ruby code will be processed by a *templating engine* built into Rails. The output will be pure HTML sent to the browser.

The most popular templating language available for Rails is *ERB*, Embedded Ruby, which is the Rails default.

In the “Concepts” chapter in Book One, you learned that components of Rails can be mixed for different “stacks.” Some developers substitute [Hamli](#) or [Slim](#) for ERB. We’ll use ERB in this book because it is the most popular.

Introducing the Application Layout

We’ve already created the view file for our home page.

The file `app/views/visitors/new.html.erb` looks like this:

```
<h3>Home</h3>
<p>Welcome to the home of <%= @owner.name %>.</p>
<p>I was born on <%= @owner.birthdate %>.</p>
<p>Only <%= @owner.countdown %> days until my birthday!</p>
```

The first line in the file contains an HTML heading tag, `<h3>`, with headline text, “Home.”

When you used the browser diagnostic view to see the HTML file received by the server, you saw this:

```
<!DOCTYPE html>
<html>
<head>
<title>LearnRails</title>
<link data-turbolinks-track="true"
  href="/assets/application.css?body=1" media="all" rel="stylesheet" />
<script data-turbolinks-track="true" src="/assets/jquery.js?body=1"></script>
<script data-turbolinks-track="true" src="/assets/jquery_ujs.js?body=1"></script>
<script data-turbolinks-track="true" src="/assets/turbolinks.js?body=1"></script>
<script data-turbolinks-track="true" src="/assets/application.js?body=1"></script>
<meta content="authenticity_token" name="csrf-param" />
<meta content="NRPrGFuj5GAyylNpNxQaMHDypcOsu6dmh5DT1yET6hQ=" name="csrf-token" />
</head>
<body>

<h3>Home</h3>
<p>Welcome to the home of Foobar Kadigan.</p>
<p>I was born on 1990-09-22.</p>
<p>Only 126 days until my birthday!</p>
```

```
</body>  
</html>
```

If you've built websites before, you'll recognize the HTML file conforms to the HTML5 specification, with a **DOCTYPE**, **<head>** and **<body>** tags, and miscellaneous tags in the HEAD section, including a title and various CSS and JavaScript assets.

If you look closely, you'll see some HTML attributes you might not recognize, for example the **data-turbolinks-track** attribute. That is added by Rails to support [turbolinks](#), for faster loading of webpages.

For the most part, everything is ordinary HTML. But only part of it originates from the view file we've created for our home page.

Where did all the extra HTML come from?

The final HTML file is more than twice the size of the view file.

The additional tags come from the default *application layout* file.

Rails has combined the Visitors#New view with the default application layout file. To be precise, the **new** method in the Visitors controller has rendered the home page by combining two files:

- the application layout file **app/views/layouts/application.html.erb**
- the Visitors#New template in the file **app/views/visitors/new.html.erb**

Let's examine the application layout file.

Open the file **app/views/layouts/application.html.erb**:

```
<!DOCTYPE html>
<html>
<head>
  <title>LearnRails</title>
  <%= stylesheet_link_tag 'application', media: 'all',
    'data-turbolinks-track' => true %>
  <%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
  <%= csrf_meta_tags %>
</head>
<body>

<%= yield %>

</body>
</html>
```

Static pages delivered from the **public** folder do not use the default application layout. But every page generated by the model-view-controller architecture in the **app/** folder incorporates the default application layout, unless you specify otherwise.

The default application layout is where you put HTML that you want to include on every page of your website.

Remember when we looked at the hidden code in the controller that renders a view? The controller uses the **render** method to combine the view file with the application layout.

Here's the Visitors controller, again, with the hidden **render** method revealed:

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
    render 'visitors/new'
  end

end
```

The **render** method combines the **app/views/visitors/new.html.erb** view file with the **app/views/layouts/application.html.erb** application layout.

Alternatively, you could tell the controller to render the view without any application layout:

```
render 'visitors/new', :layout => false
```

Or you could specify an alternative layout file, for example **app/views/layouts/special.html**.

```
render 'visitors/new', :layout => 'special'
```

An alternative layout can be useful for special categories of pages, such as administrative pages or landing pages.

We won't use alternative layouts in this tutorial application, but it's good to know they are an option. The reference [RailsGuides: Layouts and Rendering in Rails](#) explains more about using alternative layouts.

Yield

How does the **render** method insert the view file in the application layout?

Notice that the default application layout contains the Ruby keyword **yield**.

```
.  
.   
.   
<%= yield %>  
.   
.   
. 
```

The **yield** keyword is replaced with a view file that is specific to the controller and action, in this case, the **app/views/visitors/new.html.erb** view file.

The content from the view is inserted where you place the **yield** keyword.

Yield Variations

We won't do it, but you could also use the **yield** keyword to insert a sidebar or a footer.

Rails provides ways to insert content into a layout file at different places. The **content_for** method is helpful when your layout contains distinct regions such as sidebars and footers that should contain their own blocks of content.

For example, you could create an application layout that includes a sidebar. This is just an example, so don't add it to the application you are building:

```
<!DOCTYPE html>
<html>
<head>
  <title>LearnRails</title>
  <%= stylesheet_link_tag 'application', media: 'all',
    'data-turbolinks-track' => true %>
  <%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
  <%= csrf_meta_tags %>
</head>
<body>
  <div class="main">
    <%= yield %>
  </div>
  <div class="sidebar">
    <%= yield :sidebar %>
  </div>
</body>
</html>
```

This view file provides both the main content and a sidebar:

```
<% content_for :sidebar do %>
  <h3>Contact Info</h3>
  <p>Email: me@example.com</p>
<% end %>
<h3>Main</h3>
<p>Welcome!</p>
```

This section gets inserted at the **<%= yield :sidebar %>** location:

```
<% content_for :sidebar do %>
  <h3>Contact Info</h3>
  <p>Email: me@example.com</p>
<% end %>
.
.
.
```

The rest of the file gets inserted at the main `<%= yield %>` location.

Again, don't add this to your application. I'm just offering it as an example of multiple `yield` statements.

The reference [RailsGuides: Layouts and Rendering in Rails](#) explains more about using `yield` and `content_for`.

ERB Delimiters

Earlier, we saw ERB `<%= ... %>` delimiters allow us to insert Ruby expressions which are replaced by the result of evaluating the code. Here is an example that displays the number 4

```
<%= 2 + 2 %>
```

Look closely and you'll see this ERB delimiter is slightly different:

```
<% 3.times do %>
  <li>list item</li>
<% end %>
```

An ERB delimiter that does not contain the `=` (equals) sign will execute Ruby code but will not display the result. It is commonly used to add Ruby blocks to HTML code, so you'll often see `do` and `end` statements within ERB `<% ... %>` delimiters. The example above will create three list items, like this:

```
<li>list item</li>
<li>list item</li>
<li>list item</li>
```

A third version of the ERB delimiter syntax is rarely seen:

```
<%# this is a comment %>
```

It is only used for adding comments. The expression within the ERB `<%# ... %>` delimiters will not execute and will not appear when the page is output as HTML.

Introducing View Helpers

We can use ERB delimiters to create Rails *view helpers*.

We’ve seen how ERB delimiters can enclose Ruby code.

In the application layout file, the `<%= ... %>` delimiters don’t include anything that looks like Ruby code. For example, we see `<%= csrf_meta_tags %>` which seems to be neither HTML nor anything from the Ruby API. In fact, this expression is Ruby code, but it is from the Rails API and only found in Rails applications.

Ruby is an ideal choice for a web application development platform such as Rails because it can easily be used to create a *domain-specific language* (or *DSL*). Much of Rails is a domain-specific language. The Smalltalk programming language was famous for its mantra “Code should read like a conversation.” Ruby, which borrows much from Smalltalk, makes it easy to add new words to the conversation. We can add new keywords that produce complex behaviour, creating entire new APIs such as Rails. Ruby makes it easy for the Rails core team to add keywords such as `csrf_meta_tags` that are additions to the Ruby language.

In this case, Ruby’s ability to produce a domain-specific language gives us Rails *view helpers*.

Think of Rails view helpers as “macros to generate HTML.” You may have used macros to automate a series of commands in World of Warcraft or other games. If you’re an office worker, you may have used macros in Microsoft Word or Excel. A Rails view helper is a keyword that expands into a longer string of HTML tags and content.

In this case, the `csrf_meta_tags` view helper expands into two lines of HTML:

```
<meta content="authenticity_token" name="csrf-param" />
<meta content="NRprgfuj5GAyy1NpNxQaMHDypcOsu6dmh5DT1yET6hQ=" name="csrf-token" />
```

Why do we need this cryptic code? It turns out that almost any website that accepts user input via a form is vulnerable to a security bug (an *exploit*) named a [cross-site request forgery](#). To prevent rampant CSRF exploits, the Rails core team includes the `csrf_meta_tags` view helper in the default application layout. Rails provides a number of similar features that make websites more secure.

A Rails view file becomes much less mysterious when you realize that many of the keywords you see are view helpers. Strange new keywords may be part of the Rails API. Or they may be provided by gems you’ve added (gem developers often use the Ruby DSL capability to create new keywords). Think of it this way: Ruby gives developers the power to create an unlimited number of new “HTML tags.” These tags are not really HTML because they are not part of the HTML specification. But they serve as shortcuts to produce complex snippets of HTML and content.

Now that we’ve learned about view helpers, we can start building our default application layout.

The Rails Layout Gem

Every Rails application needs a well-designed application layout. The Rails default starter application, which we get when we run **rails new**, provides a barebones application layout. It is purposefully simple so developers can add the code they need to accommodate any front-end framework (we'll look closely at front-end frameworks in the next chapter).

In this chapter we'll start with a simple application layout file, adding a little CSS for simple styling. In the next chapter, we'll upgrade the application layout file to use the Zurb Foundation front-end framework.

To make it easy, we'll use the **rails_layout** gem to generate files for an application layout. In this chapter, we'll use the **rails_layout** gem to create our basic layout and CSS files. In the next chapter, we'll use the **rails_layout** gem to create layout files for Zurb Foundation.

In your **Gemfile**, you've already added:

```
gem 'rails_layout'
```

and previously run **\$ bundle install**.

Rails provides the **rails generate** command to run simple scripts that are packaged into gems.

The **rails_layout** gem uses the **rails generate** command to set up files we need. Run:

```
$ rails generate layout:install simple --force
```

The **-force** argument will force the gem to replace the existing **app/views/layouts/application.html.erb** file.

If you have the **app/views/layouts/application.html.erb** file open in your text editor, it will change.

The rails_layout gem will rename the file:

- **app/assets/stylesheets/application.css**

to:

- **app/assets/stylesheets/application.css.scss**

The gem will add (or modify) five files:

- **app/views/layouts/application.html.erb**
- **app/assets/stylesheets/simple.css**
- **app/views/layouts/_messages.html.erb**
- **app/views/layouts/_navigation.html.erb**
- **app/views/layouts/_navigation_links.html.erb**

Examining these files closely will reveal a great deal about the power of Rails. We'll dedicate the rest of this chapter to exploring the contents of these files.

Basic Boilerplate

Open the file **app/views/layouts/application.html.erb**:

```
<!DOCTYPE html>
<html>
  <head>
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title><%= content_for?(:title) ? yield(:title) : "Learn Rails" %></title>
    <meta name="description" content=
```

```
"<%= content_for?(:description) ? yield(:description) : "Learn Rails" %>">
<%= stylesheet_link_tag 'application', media: 'all',
  'data-turbolinks-track' => true %>
<%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
<%= csrf_meta_tags %>
</head>
<body>
  <header>
    <%= render 'layouts/navigation' %>
  </header>
  <main role="main">
    <%= render 'layouts/messages' %>
    <%= yield %>
  </main>
</body>
</html>
```

Some of this code is already familiar.

You’ll recognize the standard HTML **DOCTYPE**, **<head>**, and **<body>** tags.

We’ve already discussed the **yield** keyword.

We’ve seen the **<%= ... %>** delimiters surrounding the **csrf_meta_tags** view helper:

- **csrf_meta_tags** - generates **<meta>** tags that prevent [cross-site request forgery](#)

The rest of the file may be unfamiliar. We’ll examine it line by line.

Adding Boilerplate

Webmasters who build static websites are accustomed to setting up web pages with “boilerplate,” or basic templates for a standard web page. The well-known [HTML5 Boilerplate](#) project has been recommending “best practice” tweaks to web pages since 2010. Very few of the HTML5 Boilerplate recommendations are relevant for Rails developers, as Rails already provides almost everything

required. We'll discuss one important boilerplate item and a few “nice to have” extras.

If you want to learn more, the article [HTML5 Boilerplate for Rails Developers](#) looks at the recommendations.

Viewport

The **viewport** metatag improves the presentation of web pages on mobile devices. Setting a viewport tells the browser how content should fit on the device's screen. The tag is required for either Bootstrap or Zurb Foundation front-end frameworks.

The **viewport** metatag looks like this:

```
<meta name="viewport" content="width=device-width, initial-scale=1.0">
```

Apple's developer documentation on [Configuring the Viewport](#) provides details.

Title and Description

If you want to maximize traffic to your website, you should make your web pages search-engine friendly. That means adding *title* and *description* metatags. Google uses contents of the title tag to display titles in search results. And it will sometimes use the content of a description metatag in search results snippets. See Google's explanation of how it uses [Site Title and Description](#). Good titles and descriptions improve clickthrough from Google searches.

Title and description looks like this:


```
<title><%= content_for?(:title) ? yield(:title) : "Learn Rails" %></title>
<meta name="description" content="<%= content_for?(:description) ?
  yield(:description) : "Learn Rails" %>">
```

The rails_layout gem has created a default title and description based on our project name.

Later in the tutorial, we'll see how to use a `content_for` statement to set a title and description for each individual page.

The code is complex if you haven't seen advanced Ruby before. It uses the Ruby `ternary operator` which maximizes compactness at the price of introducing obscurity. You'll recall from the "Just Enough Ruby" chapter that it is a fancy conditional statement that says, "if `content_for?(:title)` is present in the view file, use `yield(:title)` to include it, otherwise just display 'Learn Rails'."

Asset Pipeline

You may have noticed these Rails helper methods:

- `stylesheet_link_tag`
- `javascript_include_tag`

These are tags that add CSS and JavaScript to the web page using the Rails *asset pipeline*.

The Rails *asset pipeline* utility is one of the most powerful features of the platform. It offers convenience to the developer and helps organize an application; more importantly, it improves the speed and responsiveness of any complex website. If you're going to do any front-end development with CSS or JavaScript in Rails, you must understand the Rails asset pipeline. Here's how it works.

Assets Without Rails

When building non-Rails websites, webmasters add JavaScript to a page using the `<script>` tag. For every JavaScript file, they add an additional `<script>` tag, so a page HEAD section looks like this:

```
<!DOCTYPE html>
<html>
<head>
  <title>Page that uses multiple JavaScript files</title>
  <script src="jquery.js" type="text/javascript"></script>
  <script src="jquery.plugin.js" type="text/javascript"></script>
  <script src="custom.js" type="text/javascript"></script>
</head>
```

The same is true for CSS files in non-Rails websites. You add a `<link>` tag for each stylesheet file. With multiple stylesheets, the HEAD section of your application layout might look like this:

```
<!DOCTYPE html>
<html>
<head>
  <title>Page that uses multiple CSS files</title>
  <link href="core.css" rel="stylesheet" type="text/css" />
  <link href="site.css" rel="stylesheet" type="text/css" />
  <link href="custom.css" rel="stylesheet" type="text/css" />
</head>
```

If you want to handle CSS and JavaScript without Rails, you can place your files in the **public** folder. If you do so, every time you add a JavaScript or CSS file, you must modify the application layout file. Instead, use the asset pipeline and simplify this.

Assets With Rails

The asset pipeline consists of two folders:

- **app/assets/javascripts/**
- **app/assets/stylesheets/**

Any JavaScript and CSS file you add to these folders is automatically added to every page.

In development, when the web browser makes a page request, the files in the asset pipeline folders are combined together and concatenated as single large files, one for JavaScript and one for CSS.

If you examine the application layout file, you'll see the tags that perform this service:

```
<%= stylesheet_link_tag 'application', media: 'all',  
  'data-turbolinks-track' => true %>  
<%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
```

The HTML delivered to the browser looks like this:

```
<link href="/assets/application.css" media="all" rel="stylesheet" type="text/css" />  
<script src="/assets/application.js" type="text/javascript"></script>
```

Using the asset pipeline, there is no need to modify the application layout file each time you create a new JavaScript or CSS file. Create as many files as you need to organize your JavaScript or CSS code and, in production, you'll automatically get one single file delivered to the browser. In development mode, Rails continues to deliver multiple files for easier debugging.

In production, there's a big performance advantage with the asset pipeline. Requesting files from the server is a time-consuming operation for a web browser, so every extra file request slows down the browser. The Rails asset pipeline eliminates the performance penalty of multiple `<script>` or `<link>` tags. The Rails asset pipeline also compresses JavaScript and CSS files for faster page loads.

The asset pipeline is an example of a Rails convention that helps developers build complex websites. It is not needed for a simple website that uses a few JavaScript or CSS files. But it is beneficial on bigger projects.

Now that you understand the purpose of the Rails asset pipeline, let's look at more of the code in the default application layout file.

Navigation Links

Every website needs navigation links.

You can add navigation links directly to your application layout but many Rails developers prefer to create a [partial template](#) —a “partial”—to better organize the default application layout.

Introducing Partials

A *partial* is similar to any view file, except the filename begins with an underscore character. Place the file in any view folder and you can use the **render** keyword to insert the partial.

We're not going to add a footer to our tutorial application, but here is how we could do it. We'd use the **render** keyword with a file named **app/views/layouts/_footer.html**

```
<%= render 'layouts/footer' %>
```

Notice that you specify the folder within the **app/views/** directory with a truncated version of the filename. The **render** method doesn't want the **_** underscore character or the **.html.erb** file extension. That can be confusing; it makes sense when you remember that Rails likes “convention over configuration” and economizes on extra characters when possible.

We’re not going to add a footer to our application, but we will add navigation links by using a partial. First, let’s learn about *link helpers*.

Introducing Link Helpers

There’s no rule against using raw HTML in our view files, so we could create a partial for navigation links that uses the HTML `<a>` anchor tag like this:

```
<ul class="nav">
  <li><a href="/">Home</a></li>
  <li><a href="/about">About</a></li>
  <li><a href="/contact">Contact</a></li>
</ul>
```

Rails gives us another option, however. We can use the Rails `link_to` view helper instead of the HTML `<a>` anchor tag. The Rails `link_to` helper eliminates the crufty `<>` angle brackets and the unnecessary `href=""`. More importantly, it adds a layer of abstraction, using the routing configuration file to form links. This is advantageous if we make changes to the location of the link destinations. Earlier, when we created a static “About” page, we first set the `config/routes.rb` file with a route to the “About” page: `root to: redirect('/about.html')`. Later we removed the static “About” page and set the `config/routes.rb` file with a route to the dynamic home page: `root to: 'visitors#new'`. If we used the raw HTML `<a>` anchor tag, we’d have to change the raw HTML everywhere we had a link to the home page. Using the Rails `link_to` helper, we name a route and make any changes once, in the `config/routes.rb` file.

When you use the Rails `link_to` helper, you’ll avoid the problem of link maintenance that webmasters face on static websites. Some webmasters like to use *absolute* URLs, specifying a host name in the link, for example `http://www.example.com`. Absolute URLs are a headache when moving the site, for example from `staging.example` to `www.example.com`. The problem is avoided by using *relative* URLs, such as `/about.html`, `about.html`, or even `../about.html`. But relative URLs

are fragile, and moving files or directories often results in overlooked and broken links. Instead, with the Rails `link_to` helper, you always get the destination location specified in the `config/routes.rb` file.

Navigation Partial

Examine the `app/views/layouts/application.html.erb` and you'll see the use of the navigation partial.

We include the navigation partial in our application layout with the expression:

```
.  
.   
.   
<%= render 'layouts/navigation' %>  
.   
.   
. 
```

Open the file `app/views/layouts/_navigation.html.erb`:

```
<ul class="nav">  
  <li><%= link_to 'Home', root_path %></li>  
  <%= render 'layouts/navigation_links' %>  
</ul>
```

You'll see the `link_to` helper.

Here the `link_to` helper takes two parameters. The first parameter is the string displayed as the anchor text (`'Home'`). The second parameter is the route. In this case, the route `root_path` has been set in the `config/routes.rb` file.

The navigation partial includes another partial, which we'll call the navigation links partial:

```
.  
.   
.   
  <%= render 'layouts/navigation_links' %>  
.   
.   
. 
```

This demonstrates that one partial can include another partial, so that partials can be “nested.”

Navigation Links Partial

In our simple application, there’s no obvious reason to nest another partial. But we’ll see in the next chapter that it is convenient, because we can isolate the complex markup required by Zurb Foundation from the simple list of links we need for navigation.

Open the file **app/views/layouts/_navigation_links.html.erb**:

```
<%=# add navigation links to this file %>
```

As we add pages to our application, we’ll add links to this file.

For now, we have nothing to add.

Flash Messages

Rails provides a standard convention to display alerts (including error messages) and other notices (including success messages), called a *flash message*. The name comes from the term “flash memory” and should not be confused with the “Adobe Flash” web development platform that was once popular for

animated websites. The flash message is documented in the [RailsGuides: Action Controller Overview](#).

Here's a flash message you might see after logging in to an application:

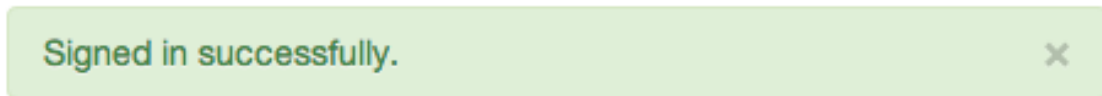


Figure 15.1: Flash message in Rails.

It is called a “flash message” because it appears on a page temporarily. When the page is reloaded or another page is visited, the message disappears.

Typically, you will see only one flash message on a page. But there is no limit to the number of flash messages that can appear on a page.

Creating Flash Messages

Flash messages are created in a controller. For example, we can add messages to the home page by modifying the file **app/controllers/visitors_controller.rb** like this:

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
    flash[:notice] = 'Welcome!'
    flash[:alert] = 'My birthday is soon.'
  end

end
```

If you test the application after adding the messages to the VisitorsController, you'll see two flash messages appear on the page.

Rails provides the **flash** object so that messages can be created in the controller and displayed on the rendered web page.

In this example, we create a flash message by associating the object **flash[:notice]** with the string **'Welcome!'**. We can assign other messages, such as **flash[:alert]** or even **flash[:warning]**. In practice, Rails uses only **:notice** and **:alert** as flash message keys so it is wise to stick with just these.

Flash and Flash Now

You can control the persistence of the flash message by choosing from two variants of the **flash** directive.

Use **flash.now** in the controller when you immediately render a page, for example with a **render :new** directive. With **flash.now**, the message will vanish after the user clicks any links.

Use the simple variant, **flash**, in the controller when you redirect to another page, for example with a **redirect_to root_path** directive. If you use **flash.now** before a redirect, the user will not see the flash message because **flash.now** does not persist through redirects or links. If you use the simple **flash** directive before a **render** directive, the message will appear on the rendered page and reappear on a subsequent page after the user clicks a link.

In our example above, we really need to use the **flash.now** variant because the controller provides a hidden **render** method. Update the file **app/controllers/visitors_controller.rb**

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
    flash.now[:notice] = 'Welcome!'
    flash.now[:alert] = 'My birthday is soon.'
  end

end
```

Using **flash.now** will make sure the message only appears on the rendered

page and will not persist after a user follows a link to a new page.

If you ever see a “sticky” flash message that won’t go away, you need to use `flash.now` instead of `flash`.

Explaining the Ruby Code

If you’re new to programming in Ruby, it may be helpful to learn how the `flash` object works.

The `flash` object is a Ruby *hash*.

You’ll recall from the “Just Enough Ruby” chapter that a hash is a data structure that associates a key to some value. You retrieve the value based upon its key. This construct is called a *dictionary* in other languages, which is appropriate because you use the key to “look up” a value, as you would look up a definition for a word in a dictionary.

Hash is a type of *collection*. Presumably, the Rails core contributors who implemented the code chose to use a collection so that a page could be given multiple flash messages. Because we have a collection with (possibly) multiple messages, we need to retrieve each message one at a time.

We learned earlier that all collections support an *iterator* method named `each`. Iterators return all the elements of a collection, one after the other. The iterator returns each key-value pair, item by item, to a *block*. In Ruby, a block is delimited by `do` and `end` or `{ }` braces. You can add any code to a block to process each item from the collection.

Here is simple Ruby code to iterate through a `flash` object, outputting each flash message in an HTML `div` tag and applying a CSS class for styling:

```
flash.each do |key, value|  
  puts ' ' + value + ' '  
end
```

In this simple example, we use `each` to iterate through the flash hash, retrieving

a **key** and **value** that are passed to a block to be output as a string. We’ve chosen the variable names **key** and **value** but the names are arbitrary. In the next example, we’ll use **name** and **msg** as variables for the key-value pair. The output string will appear as HTML like this:

```
<div class="notice">Welcome!</div>
<div class="alert">My birthday is soon.</div>
```

Let’s continue examining our layout files.

The Flash Messages Partial

Flash messages are a very useful feature for a dynamic website.

Code to display flash messages can go directly in your application layout file or you can use a partial.

Examine the file **app/views/layouts/_messages.html.erb**:

```
<% flash.each do |name, msg| %>
  <% if msg.is_a?(String) %>
    <%= content_tag :div, msg, :class => "flash_#{name}" %>
  <% end %>
<% end %>
```

It improves on our simple Ruby example in several ways. First, the expression **if msg.is_a?(String)** serves as a test to make sure we only display messages that are strings. Second, we use the Rails **content_tag** view helper to create the HTML **div**. The **content_tag** helper eliminates the messy soup of angle brackets and quote marks we used to create the HTML output in the example above. Finally, we apply a CSS **class** and combine the word “flash” with “notice” or “alert” to make the CSS class.

We include the flash messages partial in our application layout with the expression:

```
.  
.   
.   
<%= render 'layouts/messages' %>  
.   
.   
. 
```

HTML5 Elements

Let's look again at the **app/views/layouts/application.html.erb** file.

To complete our examination of the application layout file, we'll look at a few structural elements. These elements are not unique to a Rails application and will be familiar to anyone who has done front-end development.

Notice the tags that are structural elements in the HTML5 specification:

- **<header>**
- **<main>**

These elements add structure to a web page. The tags don't add any new behavior but make it easier to determine the structure of the page and apply CSS styles.

We wrap the navigation partial in the **<header>** tag:

```
<header>  
  <%= render 'layouts/navigation' %>  
</header>
```

The **<header>** tag is typically used for branding or navigation.

Notice the *main tag*:

```
<main role="main">
  <%= render 'layouts/messages' %>
  <%= yield %>
</main>
```

We wrap our messages partial and `yield` expression in a `<main role="main">` element. The `<main>` tag is among the newest HTML5 elements (see the [W3C specification](#) for details). From the specification: “The main content area of a document includes content that is unique to that document and excludes content that is repeated across a set of documents such as site navigation links, copyright information, site logos.” We follow the advice of the specification and wrap our unique content in the `<main>` tag.

The specification recommends, “Authors are advised to use ARIA role=’main’ attribute on the main element until user agents implement the required role mapping.” [ARIA](#), the Accessible Rich Internet Applications Suite, is a specification to make web applications more accessible to people with disabilities. That means the `role="main"` attribute is there for any web browsers that don’t yet recognize the `<main>` tag, and may help people with disabilities.

We could add a `<footer>` tag. It typically contains links to copyright information, legal disclaimers, or contact information. We don’t have a footer in our tutorial application but you can add the `<footer>` tag, with additional content, if you want.

Application Layout

Our application layout is complete. We don’t have to add anything because the `rails_layout` gem has created everything we need.

```
<!DOCTYPE html>
<html>
  <head>
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
```

```
<title><%= content_for?(:title) ? yield(:title) : "Learn Rails" %></title>
<meta name="description" content=
  "<%= content_for?(:description) ? yield(:description) : "Learn Rails" %>">
<%= stylesheet_link_tag 'application', media: 'all',
  'data-turbolinks-track' => true %>
<%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
<%= csrf_meta_tags %>
</head>
<body>
  <header>
    <%= render 'layouts/navigation' %>
  </header>
  <main role="main">
    <%= render 'layouts/messages' %>
    <%= yield %>
  </main>
</body>
</html>
```

We have the **viewport** metatag, a title, and a description.

We have partials for navigation links and flash messages.

Finally we have HTML5 structural elements.

That's all we need for now. In the next chapter, we'll revise it to support styling with Zurb Foundation.

Simple CSS

So far, we've examined four files that were added by the rails_layout gem:

- **app/views/layouts/application.html.erb**
- **app/views/layouts/_messages.html.erb**
- **app/views/layouts/_navigation.html.erb**
- **app/views/layouts/_navigation_links.html.erb**

Let's examine the CSS file that was created by the rails_layout gem.

Open the file **app/assets/stylesheets/simple.css**:

```
/*
 * Simple CSS stylesheet for a navigation bar and flash messages.
 */
main {
  background-color: #eee;
  padding-bottom: 80px;
  width: 100%;
}
header {
  border: 1px solid #d4d4d4;
  background-image: linear-gradient(to bottom, white, #f2f2f2);
  background-color: #f9f9f9;
  -webkit-box-shadow: 0 1px 10px rgba(0, 0, 0, 0.1);
  -moz-box-shadow: 0 1px 10px rgba(0, 0, 0, 0.1);
  box-shadow: 0 1px 10px rgba(0, 0, 0, 0.1);
  margin-bottom: 20px;
  font-family: 'Helvetica Neue', Helvetica, Arial, sans-serif;
}
ul.nav li {
  display: inline;
}
ul.nav li a {
  padding: 10px 15px 10px;
  color: #777777;
  text-decoration: none;
  text-shadow: 0 1px 0 white;
}
.flash_notice, .flash_alert {
  padding: 8px 35px 8px 14px;
  margin-bottom: 20px;
  text-shadow: 0 1px 0 rgba(255, 255, 255, 0.5);
  border: 1px solid #fbedd5;
  -webkit-border-radius: 4px;
  -moz-border-radius: 4px;
  border-radius: 4px;
  font-family: "Helvetica Neue", Helvetica, Arial, sans-serif;
  font-size: 14px;
  line-height: 20px;
}
.flash_notice {
  background-color: #dff0d8;
  border-color: #d6e9c6;
  color: #468847;
}
.flash_alert {
  background-color: #f2dede;
  border-color: #eed3d7;
```

```
color: #b94a48;  
}
```

If you already know CSS, you'll see we've set a background color for the **main** section of the page. We've also set styles for a header, navigation links, and flash messages. This book is about Rails, not CSS, so we won't examine this closely. For more on CSS, there are thousands of tutorials on the web, but I like these:

- [Codecademy](#)
- [HTML Dog](#)

Remember what we learned about the Rails asset pipeline. By default, any CSS file in the **app/assets/stylesheets/** folder will be added automatically to the **application.css** file that is included in the default application layout.

In the next chapter, we remove the **app/assets/stylesheets/simple.css** and use Zurb Foundation to supply styles for the header, navigation links, and flash messages. For now, the **simple.css** file adds some basic styling and layout to the application.

Test the Application

Let's run the application to see how it looks with the new application layout. The web server may already be running. If not, enter the command:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

If you experimented with adding flash messages “Welcome” and “My birthday is soon,” you’ll see the messages when you visit the home page.

Our home page now has only one navigation link, for “Home.” We’ll add links for “About” and “Contact” pages soon.

Git

Let’s commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "update application layout"  
$ git push
```

Chapter 16

Front-End Framework

This chapter discusses front-end development and design using CSS. I'll show you how to add style to a Rails application, using Zurb Foundation for a simple theme.

What do we mean by “front-end development”? A website *back end* is the Rails application that assembles files that are sent to the browser, plus a database and any other server-side services. A website *front end* is all the code that runs in the browser. Everything that controls the appearance of the website in the browser is the responsibility of a front-end developer, including page layout, CSS stylesheets, and JavaScript code.

Front-end development has grown increasingly important as websites have become more sophisticated. And front-end technology has grown increasingly complex, to the degree that front-end development has become a job for specialists.

Front-end developers are primarily concerned with:

- markup - the layout and structure of the page
- style - graphic design for visual communication
- interactivity - browser-based visual effects and user interaction

Broader concerns include:

- cross-browser and cross-device functionality
- interaction design to improve website usability
- accessibility for users with physical or perceptual limitations

For years, front-end development was haphazard; webmasters each had their own quirky techniques. Around the time that Rails became popular, front-end developers at large companies began to share best practices and establish open source projects to bring structure and consistency to front-end development, leading to development of CSS frameworks.

CSS Frameworks

Web developers began putting together “boilerplate” CSS stylesheets as early as 2000, when browsers first began to fully support CSS. Boilerplate CSS made it easy to reuse CSS stylesheet rules from project to project. More importantly, designers often implemented “CSS reset” stylesheets to enforce typographic uniformity across different browsers.

Engineers at Yahoo! released the [Yahoo! User Interface Library](#) (YUI) as an open source project [in February 2006](#). Inspired by an [article by Jeff Croft](#), and reacting to the huge size of the YUI library, independent developers began releasing other CSS frameworks such as the [960 grid system](#) and the [Blueprint](#) CSS framework.

There are [dozens of CSS frameworks](#). In general, they all seek to implement a common set of requirements:

- An easily customizable grid
- Some default typography

- A typographic baseline
- CSS reset for default browser styles
- A stylesheet for printing

More recently, with the ubiquity of smartphones and tablets, CSS frameworks support [responsive web design](#), accommodating differences in screen sizes across a range of devices.

In tandem with the development of CSS frameworks, we've seen the emergence of JavaScript libraries and frameworks.

JavaScript Libraries and Frameworks

JavaScript has nothing like RubyGems, a built-in package manager for code libraries, so initially there were few open source JavaScript libraries. Now there are several competing [JavaScript package managers](#) and many software libraries.

[Prototype](#) was one of the first open source JavaScript libraries, created by Sam Stephenson in February 2005 to improve JavaScript support in Ruby on Rails. [MooTools](#), [Dojo](#), and [jQuery](#) soon followed. Of these libraries, jQuery has become the most popular, largely because of thousands of modular jQuery *plug-ins* that implement a wide range of effects and *widgets* (web page features). These plug-ins are used to add visual effects and interactivity to web pages. Examples are drop-down menus, modal windows, tabbed panels, autocompletion search forms, and sliders or carousels for images. Even without plugins, jQuery is useful as a high-level interface for manipulating the browser DOM ([document object model](#)), to make it easy to do things like hiding or revealing HTML elements on a page. Any Rails application can use jQuery because it is included by default in any new Rails application.

Libraries such as jQuery add functionality to server-side applications, such as those built with Rails. Other JavaScript libraries serve as fully featured web

application development frameworks, allowing developers to build client-side applications that run in the browser and only interact with a server to read or write data. Examples of these full-fledged JavaScript frameworks are [Ember.js](#), [AngularJS](#), and [Backbone.js](#). All use a variant of the model-view-controller (MVC) software design pattern to implement [single-page applications](#) which function more like desktop or mobile applications than websites. Developers who build a single-page application with one of these frameworks often use Ruby on Rails as a back end; an MVC JavaScript framework can replace all the Rails view files. None of these JavaScript frameworks dominate web application development like Ruby on Rails, but they are gaining popularity for single-page applications. We won't look at Ember.js, AngularJS, or Backbone.js in this book; they are an advanced topic and require entire books themselves.

The biggest problem with adding JavaScript to Rails is the difficult-to-maintain “JavaScript soup” that results from adding JavaScript to Rails views. Ember.js, AngularJS, or Backbone.js are more than is needed for simply structuring JavaScript in Rails views. But there's a newer framework that can be used to dry up JavaScript soup. It's [React](#), a JavaScript framework developed by engineers at Facebook. Unlike AngularJS or Ember.js, React only manages views, not connections to databases or routing of requests, so it is not a full-stack framework, just a framework for the view layer. React's approach to building web pages is abstract and complex. But React is a good choice for complex interactive features, if you're determined to avoid JavaScript soup in your Rails application.

We won't look at JavaScript frameworks in this book, but we will use the Zurb Foundation framework to manage our CSS stylesheets.

Front-End Frameworks

Front-end frameworks combine CSS and JavaScript libraries. Many elements that are found on sophisticated web pages, such as modal windows or tabs,

require a combination of JavaScript and CSS. Combining CSS and JavaScript libraries in a common framework makes it possible to standardize and reuse common web page features.

There are many responsive front-end frameworks to choose from, including:

- [Bourbon Neat](#)
- [Cardinal](#)
- [Semantic UI](#)
- [Bootstrap](#)
- [Zurb Foundation](#)
- [and many others](#)

Each has its fans, though Bootstrap and Zurb Foundation are the most popular among Rails developers. Each adds a library of markup, styles, and standardized web page features such as modal windows, pagination, breadcrumbs, and navigation.

[Bootstrap](#) is the best-known front-end framework. It is the result of an effort to document and share common design patterns and assets across projects at Twitter, released as an open source project in August 2011.

[Zurb Foundation](#) was released as an open source project in October 2011, after more than a year of internal use at [Zurb](#), a Silicon Valley design consultancy.

Just ahead, we'll look at why we use Zurb Foundation in this book. But first, you'll need to learn about LESS and Sass.

CSS Preprocessing with LESS or Sass

Ordinary CSS is not a programming language. As a result, CSS rules are verbose and often repetitive. To add efficiency to CSS, Bootstrap and Zurb Foun-

dation rely on CSS preprocessors; [LESS](#) for Bootstrap 3 and [Sass](#) for Bootstrap 4 and Zurb Foundation. LESS and Sass extend CSS to give it more powerful programming language features. As a result, your stylesheets can use variables, mixins, and nesting of CSS rules, just like a real programming language.

For example, in Sass you can create a variable such as `$blue: #3bbfce` and specify colors anywhere using the variable, such as `border-color: $blue`. *Mixins* are like variables that let you use snippets of reusable CSS. *Nesting* eliminates repetition by layering CSS selectors.

Sass is generally recognized as more powerful than LESS, and Sass is included in any new Rails application.

Bootstrap or Zurb Foundation?

Which should you use, Bootstrap or Zurb Foundation?

Zurb Foundation has a solid following among Rails developers. It gained an initial advantage because Zurb provides a gem that adds Foundation to Rails. When Zurb releases new versions of Foundation, the company updates the gem immediately. Another factor is Foundation's use of Sass, leading to easier integration with Rails applications.

Recently (in January 2014), the Bootstrap team started supporting a Ruby gem that provides a drop-in Sass version of Bootstrap for Rails. Now any preference for Foundation over Bootstrap is primarily a matter of personal taste.

Bootstrap has a larger developer community and more third-party projects, as evidenced by a [Big Badass List of Useful Twitter Bootstrap Resources](#). In its sheer magnitude, this list, from Michael Buckbee and Bootstrap Hero, demonstrates the popularity of Bootstrap and the vitality of its open source community. If you're eager to try Bootstrap, the RailsApps project provides a [Rails Bootstrap](#) example application and an accompanying tutorial. We'll use Zurb Foundation here, but after you complete this book, you might want to expand your knowledge and learn about Bootstrap.

Before I show you how to integrate Zurb Foundation with your Rails application, let's briefly consider matters of design.

Graphic Design Options

There are three approaches to graphic design for your Rails application.

If you're well-funded and well-connected, you can put together a team or hire a freelance graphic designer to implement a unique design, built from scratch using CSS or customized from a framework such as Bootstrap or Zurb Foundation. If you've got strong design skills, or can partner with an experienced web designer, you'll get a custom design that expresses the purpose and motif of your website.

A second approach is to use Bootstrap or Zurb Foundation to quickly add attractive CSS styling to your application. Many developers don't have the skill or resources to customize the design. Consequently, sites that use Bootstrap or Zurb Foundation look very similar. If that's your situation, it's okay, really! It's better to have a decent site with the clean look of Bootstrap or Zurb Foundation than to leak ugliness onto the web.

A third option is to purchase a pre-designed theme for your website. You may have visited [ThemeForest](#) or other theme galleries that offer pre-built themes for a few dollars each. These huge commercial galleries offer themes for WordPress, Tumblr, or CMS applications such as Drupal or Joomla. They don't offer themes for Rails and it is not easy to adapt one of their themes for a Rails application. I'm only aware of one firm that sells prepackaged themes for Rails applications using Zurb Foundation: [RailsThemes](#).

You probably don't need a Foundation theme that is built specifically for Rails. Take a look at some of the inexpensive themes for Foundation that you can adapt for Rails:

- [FoundationMade](#)

An alternative is to convert open source themes designed with Bootstrap. The site [Themes for Bootstrap](#) aggregates Bootstrap themes, or you can visit sites such as [Start Bootstrap](#), [Bootswatch](#), or the [Themestrap](#) gallery.

Even if you use a prepackaged theme, you'll need to know how to set up a front-end framework in Rails. We'll look at setting up Zurb Foundation next.

Zurb Foundation Gem

Zurb Foundation provides a standard grid for layout plus dozens of reusable components for common page elements such as navigation, forms, and buttons. More importantly, it gives CSS the kind of structure and convention that makes Rails popular for back-end development. Zurb Foundation is packaged as a gem.

In your **Gemfile**, you've already added:

```
gem 'foundation-rails'
```

and previously run **\$ bundle install**.

Rather than following the installation instructions provided in the [Foundation Documentation](#), we'll use the [rails_layout](#) gem to set up Zurb Foundation and create the files we need. Our approach is slightly different from the Zurb instructions but yields the same results.

Rails Layout Gem with Zurb Foundation

In the previous chapter, we used the [rails_layout](#) gem to configure the default application layout with HTML5 elements, navigation links, and flash messages. Now we'll use the [rails_layout](#) gem to set up Zurb Foundation and generate new

files for the application layout as well as the navigation and messages partials. The new files will replace the layout files we created in the previous chapter.

We'll use the generator provided by the rails_layout gem to set up Foundation and add the necessary files. Run:

```
$ rails generate layout:install foundation5 --force
```

With the **-force** argument, the rails_layout gem will replace existing files.

The gem will create the file:

- **app/assets/stylesheets/1st_load_framework.css.scss**

and modify the files:

- **app/assets/javascripts/application.js**
- **app/views/layouts/_messages.html.erb**
- **app/views/layouts/_navigation.html.erb**
- **app/views/layouts/application.html.erb**

It will also remove the file:

- **app/assets/stylesheets/simple.css**

Finally, it will modify the file **config/application.rb**.

Let's examine the files to see how our application is configured to use Zurb Foundation.

Renaming the application.css File

The rails_layout gem renamed the **app/assets/stylesheets/application.css** file as **app/assets/stylesheets/application.css.scss**. Note the **.scss** file extension. This will allow you to use the advantages of an improved syntax for your application stylesheet.

You learned earlier that stylesheets can use variables, mixins, and nesting of CSS rules when you use Sass.

Sass has two syntaxes. The most commonly used syntax is known as “SCSS” (for “Sassy CSS”), and is a superset of the CSS syntax. This means that every valid CSS stylesheet is valid SCSS as well. SCSS files use the extension **.scss**. The Sass project also offers a second, older syntax with indented formatting that uses the extension **.sass**. We’ll use the SCSS syntax.

You can use Sass in any file by adding the file extension **.scss**. The asset pipeline will preprocess any **.scss** file and expand it as standard CSS.

For more on the advantages of Sass and how to use it, see the [Sass](#) website or the [Sass Basics RailsCast](#) from Ryan Bates.

Before you continue, make sure that the rails_layout gem renamed the **app/assets/stylesheets** file as **app/assets/stylesheets/application.css.scss**. Otherwise you won’t see the CSS styling we will apply.

The application.css.scss File

In the previous chapter, I introduced the Rails *asset pipeline*.

Your CSS stylesheets get concatenated and compacted for delivery to the browser when you add them to this directory:

- **app/assets/stylesheets/**

The asset pipeline helps web pages display faster in the browser by combining all CSS files into a single file (it does the same for JavaScript).

Let's examine the file **app/assets/stylesheets/application.css.scss**:

```
/*
 * This is a manifest file that'll be compiled into application.css, which will include all the
 * listed below.
 *
 * Any CSS and SCSS file within this directory, lib/assets/stylesheets, vendor/assets/stylesheets
 * or vendor/assets/stylesheets of plugins, if any, can be referenced here using a relative path.
 *
 * You're free to add application-wide styles to this file and they'll appear at the bottom of
 * the compiled file so the styles you add here take precedence over styles defined in any styles
 * defined in the other CSS/SCSS files in this directory. It is generally better to create a new
 * file per style scope.
 *
 *= require_tree .
 *= require_self
 */
```

The **app/assets/stylesheets/application.css.scss** file serves two purposes.

First, you can add any CSS rules to the file that you want to use anywhere on your website. Second, the file serves as a *manifest*, providing a list of files that should be concatenated and included in the single CSS file that is delivered to the browser.

If you are familiar with CSS syntax, it may seem odd that the relevant lines are commented out (using asterisks). These lines are not CSS, so they must be commented out so they won't be interpreted as CSS. Though they are commented out, the Rails asset pipeline reads and understands them. It's a bit of a hack, but it works.

A Global CSS File

Any CSS style rules that you add to the **app/assets/stylesheets/application.css.scss** file will be available to any view in the application. You could use this file for any style rules that are used on every page, particularly simple utility rules such

as highlighting or resetting the appearance of links. However, in practice, you are more likely to modify the style rules provided by Zurb Foundation. These modifications don't belong in the **app/assets/stylesheets/application.css.scss** file; they will go in the **app/assets/stylesheets/1st_load_framework.css.scss** file.

In general, it's bad practice to place a lot of CSS in the **app/assets/stylesheets/application.css.scss** file (unless your CSS is very limited). Instead, structure your CSS in multiple files. CSS that is used on only a single page can go in a file with a name that matches the page. Or, if sections of the website share common elements, such as themes for landing pages or administrative pages, make a file for each theme. How you organize your CSS is up to you; the asset pipeline lets you organize your CSS so it is easier to develop and maintain. Just add the files to the **app/assets/stylesheets/** folder.

A Manifest File

It's not obvious from the name of the **app/assets/stylesheets/application.css.scss** file that it serves as a *manifest file* as well as a location for miscellaneous CSS rules. For most websites, you can ignore its role as a manifest file. In the comments at the top of the file, the **`*= require_self`** directive indicates that any CSS in the file should be delivered to the browser. The **`*= require_tree .`** directive (note the Unix "dot operator") indicates any files in the same folder, including files in subfolders, should be combined into a single file for delivery to the browser.

If your website is large and complex, you can remove the **`*= require_tree .`** directive and specify individual files to be included in the file that is generated by the asset pipeline. This gives you the option of reducing the size of the application-wide CSS file that is delivered to the browser. For example, you might segregate a file that includes CSS that is used only in the site's administrative section. In general, only large and complex sites need this optimization. The speed of rendering a single large CSS file is faster than fetching multiple files.

Zurb Foundation JavaScript

Zurb Foundation provides both CSS and JavaScript libraries.

Like the **application.css.scss** file, the **application.js** file is a manifest that allows a developer to designate the JavaScript files that will be combined for delivery to the browser.

The rails_layout gem modified the file **app/assets/javascripts/application.js** to include the Foundation JavaScript libraries:

```
// = require jquery
// = require jquery_ujs
// = require turbolinks
// = require foundation
// = require_tree .
$(function() {
  $(document).foundation();
});
```

It added the directive **// = require foundation** before **// = require_tree** ..

The last three lines use jQuery to load the Foundation JavaScript libraries after the browser has fired a “DOM ready” event (which means the page is fully rendered and not waiting for additional files to download).

```
$(function() {
  $(document).foundation();
});
```

Note that this configuration is different from the instructions provided in the [Foundation Documentation](#). In keeping with Rails best practices, we load the Foundation JavaScript libraries using the asset pipeline in the **<head>** section of the default application layout. Using the jQuery “DOM ready” event to load Foundation insures that Foundation is compatible with other jQuery plugins or JavaScript code.

Zurb Foundation CSS

The rails_layout gem added a file **app/assets/stylesheets/1st_load_framework.css.scss** containing:

```
// import the CSS framework
@import "foundation";
.
.
.
```

The file **app/assets/stylesheets/1st_load_framework.css.scss** is automatically included and compiled into your Rails application.css file by the **`*= require_tree`** . statement in the **app/assets/stylesheets/application.css.scss** file. The file could be named anything. However, by giving it a name beginning with “1” it will load before any other stylesheet files we may add later. The asset pipeline loads files in alphabetical order. We want the Foundation framework to load before any custom CSS files.

The **`@import "foundation";`** directive will import the Foundation CSS rules from the Foundation gem.

You could add the Foundation **`@import`** code to the **app/assets/stylesheets/application.css.scss** file. However, it is better to have a separate **app/assets/stylesheets/1st_load_framework.css.scss** file. You may wish to modify the Foundation CSS rules; placing changes to Foundation CSS rules in the **1st_load_framework.css.scss** file will keep your CSS better organized.

In addition to the simple **`@import "foundation";`** directive, the **app/assets/stylesheets/1st_load_framework.css.scss** contains a collection of Sass mixins. We’ll look at these later in the chapter.

Using Foundation CSS Classes

Now that you’ve installed Zurb Foundation, you have a rich library of interactive effects you can add to your pages.

Take a look at the [Foundation documentation](#) to see your options. Here are just a few examples:

- [buttons](#)
- [pricing tables](#)
- [modal dialogs](#)

At a simpler level, Foundation provides a collection of carefully-crafted styling rules in the form of CSS classes. These are building blocks you use for page layout and typographic styling. For example, Foundation gives you CSS classes to set up rows and columns in a grid system.

Let's take a closer look at the Foundation grid system.

Foundation Grid

The Foundation grid is responsive because it has “breakpoints.” There are actually three grids:

- Small: browser windows 0 to 640 pixels wide (phones)
- Medium: browser windows 641 to 1023 pixels wide (tablets)
- Large: browser windows 1024 pixels and wider (desktops)

Start by designing for the small screen with the classes prefixed “small”; then add classes prefixed “medium” or “large” if you want a layout for larger screens. The layout will change at each breakpoint.

The grid gives you 12 columns by default. You can organize your layout in horizontal and vertical sections using **row** and **columns** classes.

For example, you could use Foundation grid classes to set up an application layout with a footer as a row with two sections:


```
<footer class="row">
  <section class="small-4 columns">
    Copyright 2014
  </section>
  <section class="small-8 columns">
    All rights reserved.
  </section>
</footer>
```

The Foundation **row** class will create a horizontal break. The footer will contain two side-by-side sections. The first will be four columns wide; the second will be eight columns wide.

Here's the same footer with a responsive design:

```
<footer class="row">
  <section class="small-12 medium-4 columns">
    Copyright 2014
  </section>
  <section class="small-12 medium-8 columns">
    All rights reserved.
  </section>
</footer>
```

On desktops and tablets, the footer will contain two side-by-side sections. On phones, each section will expand to take the full browser width, appearing as stacked rows.

To better understand the grid system with all its options, see the [documentation for the Foundation Grid](#).

Presentational Versus Semantic Styles

There are two schools of thought among front-end developers. Some developers are content to use Foundation's classes directly in Rails view files. For these developers, the Foundation classes are both practical and descriptive, making it easy for any developer who knows the Foundation framework to visualize the layout of a page.

Other developers take issue with this approach. They argue that Foundation's markup is often *presentational*, with class names describing the appearance of the page. In an ideal world, all markup would be *semantic*, with class names describing the function or purpose of a style. For example, a submit button often needs styling. Compare these two approaches to markup:

- presentational: `<button class="big red button">Order Now</button>`
- semantic: `<button class="submit">Order Now</button>`

Suppose your user testing indicates a green button generates more sales. With the presentational approach you'd have to change both the Rails view file and the CSS file. With a semantic approach, you'd just change the CSS file to reassign the color of the `submit` class.

Using Foundation Classes Directly

Foundation often mixes presentational and semantic markup.

For quick and simple websites, where you don't need to be concerned about long-term maintenance, use Foundation's CSS classes directly.

For example, you can style a button like this:

- `<button class="large alert button">Order Now</button>`

It is immediately obvious that you'll get a large button. The `alert` class is a bit more semantic, indicating it will apply an "alert color" which is red, by default, in Foundation.

Using Sass Mixins with Foundation

If you don't like the presentational approach, you can use Sass mixins to create your own semantic class names.

Sass mixins add a layer of complexity that can map Foundation class names to your own semantic class names.

For example, the Foundation grid system is presentational. Specifying rows and columns, and quantifying the size of columns, describes the visual appearance of sections of the layout rather than the purpose of each section. The presentational approach makes it easy to visualize the layout of a page. But you'll be tied to Foundation 5.0 class names for the life of your website. If class names change in Foundation 6.0, or you decide to switch to another front-end framework, it will be difficult to update your application, as you will have to carefully rebuild each view file.

Is it worth the effort to add the complexity of Sass mixins just to future-proof your website? Probably not for a simple website such as the one you are building for Foobar Kadigan.

The `rails_layout` gem uses Sass mixins to apply CSS style rules to the default application layout. In doing so, the default application layout is free of framework-specific code and can be used with either Bootstrap or Zurb Foundation.

Before we examine the default application layout, let's take a look at the Sass mixins supplied by the `rails_layout` gem.

Look again at the file `app/assets/stylesheets/1st_load_framework.css.scss` created by the `rails_layout` gem:

```
// import the CSS framework
@import "foundation";

// override for the 'Home' navigation link
.top-bar .name {
  font-size: rem-calc(13);
  line-height: 45px; }
.top-bar .name a {
  font-weight: normal;
  color: white;
  padding: 0 15px; }

// THESE ARE EXAMPLES YOU CAN MODIFY
// create mixins using Foundation classes
@mixin twelve-columns {
```

```
@extend .small-12;
@extend .columns;
}
@mixin six-columns-centered {
  @extend .small-6;
  @extend .columns;
  @extend .text-center;
}
// create your own classes
// to make views framework-neutral
.column {
  @include six-columns-centered;
}
.form {
  @include grid-column(6);
}
.form-centered {
  @include six-columns-centered;
}
.submit {
  @extend .button;
  @extend .radius;
}
// apply styles to HTML elements
// to make views framework-neutral
main {
  @include twelve-columns;
  background-color: #eee;
}
section {
  @extend .row;
  margin-top: 20px;
}
```

The rails_layout gem is in active development so the file you've created may be different from the example in this tutorial. It will probably be very similar.

At the top of the file we import the Foundation framework CSS files from the gem.

We override two Foundation style rules so the “Home” navigation link matches the other links in the navigation bar.

Then we use mixins to create semantic classes.

Mixins are declared in Sass files by the `@mixin` directive, which takes a block of CSS styles, other mixins, or a CSS selector (a CSS class or ID).

If you'd like to combine CSS classes, or rename a CSS class, use the `@extend` directive to add a CSS class to a mixin.

The first declaration `@mixin twelve-columns` combines the Foundation classes `small-12` and `columns` to make a new class, `twelve-columns`.

The second declaration `@mixin six-columns-centered` makes a column that is six columns wide with centered text.

Next we create a few classes that use the mixins or combine Foundation CSS classes. For example, the new `submit` class can be used for a rounded button. When we use it in a view, this class will be purely semantic since it describes the purpose of the element, allowing us to set its appearance outside of any view file.

Finally, to avoid applying Foundation classes in the application layout file, we apply styles to HTML elements `main` and `section` to make the views framework-neutral. We use the `@include` directive to add the mixins we need. We also use the `@extend` directive to add a Foundation CSS class. And we directly set CSS properties such as `background-color` and `margin-top`.

Using this technique, the file `app/assets/stylesheets/1st_load_framework.css.scss` becomes the single point of intersection between the Foundation framework and the application layout. For a simple website, this could be over-engineering and counter-productive. The `rails_layout` gem uses the technique so that either Bootstrap or Zurb Foundation can be used without any change to the default application layout.

We'll use the CSS classes provided by the `rails_layout` gem in the tutorial application, but if you choose to customize the application, feel free to use Foundation classes directly to keep your project simple.

Application Layout with Zurb Foundation

Let's look at the application layout file created by the `rails_layout` gem:

Examine the contents of the file **app/views/layouts/application.html.erb**:

```
<!DOCTYPE html>
<html>
  <head>
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title><%= content_for?(:title) ? yield(:title) : "Learn Rails" %></title>
    <meta name="description" content="<%= content_for?(:description) ? yield(:description) : "L
    <%= stylesheet_link_tag 'application', media: 'all', 'data-turbolinks-track' => true %>
    <%=# Modernizr is required for Zurb Foundation %>
    <%= javascript_include_tag 'vendor/modernizr' %>
    <%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
    <%= csrf_meta_tags %>
  </head>
  <body>
    <header>
      <%= render 'layouts/navigation' %>
    </header>
    <main role="main">
      <%= render 'layouts/messages' %>
      <%= yield %>
    </main>
  </body>
</html>
```

This file is almost identical to the simple application layout file we looked at in the previous chapter.

Because we've applied Foundation classes to the HTML element **main** in the **app/assets/stylesheets/1st_load_framework.css.scss** file, there's no need to use Foundation classes directly in the application layout.

Modernizr JavaScript Library

You'll see the file now includes:

```
.
.
.
.
<%=# Modernizr is required for Zurb Foundation %>
<%= javascript_include_tag 'vendor/modernizr' %>
.
```

```
.  
.
```

The [Modernizr](#) JavaScript library is a prerequisite for Foundation. Modernizr makes it possible for older browsers to use HTML5 elements. It also detects mobile devices. It must be loaded before Foundation, so it is included above `javascript_include_tag "application"`.

config/application.rb

Just for a minute, we're going to dive deeply into a complicated issue that arises when integrating Foundation with Rails. You could skip this section, because the `rails_layout` gem takes care of the messy details. But if you read it, you will understand a little more about the mysteries of the Rails asset pipeline.

Earlier I briefly noted that the `rails_layout` gem makes a necessary change to the `config/application.rb` file. It adds:

```
module LearnRails  
  class Application < Rails::Application  
    .  
    .  
    .  
    # For Foundation 5  
    config.assets.precompile += %w( vendor/modernizr )  
  
  end  
end
```

Modernizer is included in the application layout file with a `javascript_include_tag`. In production (when you deploy to Heroku or elsewhere), any assets not included in the `assets/` folder must be specified with the `config.assets.precompile` configuration setting. And by the way, the `.js` extension gets dropped from the filename. If not, you'll get an error:

```
Sprockets::Rails::Helper::AssetFilteredError at /  
Asset filtered out and will not be served:  
add `config.assets.precompile += %w( vendor/modernizr )`  
to `config/application.rb` and restart your server
```

This is a sanity check to reveal asset pipeline errors that only show up in production ([details](#)).

For now, you can forget you learned this. But now you'll understand the issue if you ever see this error.

You can avoid this issue by never adding an extra `javascript_include_tag` to a layout and always adding JavaScript files to the `assets/` folder where they are compiled automatically.

Flash Messages with Zurb Foundation

The messages partial we use with Zurb Foundation is complex.

Examine the file `app/views/layouts/_messages.html.erb`:

```
<%=# Rails flash messages styled for Zurb Foundation %>  
<%= flash.each do |name, msg| %>  
  <%= if msg.is_a?(String) %>  
    <div data-alert class="alert-box round <%= name.to_s == 'notice' ? 'success' : 'alert' %>">  
      <%= content_tag :div, msg %>  
      <a href="#" class="close">&times;</a>  
    </div>  
  <%= end %>  
<%= end %>
```

We use `each` to iterate through the flash hash, retrieving a `name` and `msg` that are passed to a block to be output as a string. The expression `if msg.is_a?(String)` serves as a test to make sure we only display messages that are strings. We construct a div that applies Foundation CSS styling around the message. Foundation recognizes a class `alert-box` and `round` (for rounded corners). A

class of either **success** or **alert** styles the message. Rails **notice** messages will get styled with the Foundation **success** class. Any other Rails messages, including **alert** messages, will get styled with the Foundation **alert** class.

We use the Rails **content_tag** view helper to create a div containing the message.

Finally, we create a “close” icon by applying the class **close** to a link. We use the HTML entity **×** (a big “X” character) for the link; it could be the word “close” or anything else we like. Foundation’s integrated JavaScript library will hide the alert box when the “close” link is clicked.

Foundation provides [detailed documentation](#) if you want to change the styling of the alert boxes.

Navigation Partial with Zurb Foundation

The layout and styling required for the Foundation navigation bar are in the navigation partial file.

Examine the file **app/views/layouts/_navigation.html.erb**:

```
<%=# navigation styled for Zurb Foundation 5 %>
<nav class="top-bar" data-topbar>
  <ul class="title-area">
    <li class="name"><%= link_to 'Home', root_path %></li>
    <li class="toggle-topbar menu-icon"><a href="#">Menu</a></li>
  </ul>
  <div class="top-bar-section">
    <ul>
      <%= render 'layouts/navigation_links' %>
    </ul>
  </div>
</nav>
```

The navigation partial is now more complex, with layout and Foundation classes needed to produce a responsive navigation bar.

At the conclusion of this chapter, you'll test the responsive navigation by resizing the window. At small sizes, the navigation links will disappear and be replaced by an icon labeled "Menu." Clicking the icon will reveal a vertical menu of navigation links. The navigation menu is a great demonstration of the ability of Zurb Foundation to adjust to the small screen size of a tablet or smartphone.

If you'd like to add a site name or logo to the tutorial application, you can replace the link helper `<%= link_to 'Home', root_path %>`. It is important to preserve the enclosing layout and classes, even if you don't want to display a site name or logo. The enclosing layout is used to generate the navigation menu when the browser window shrinks to accommodate a tablet or smartphone.

You'll see we wrap the nested partial `render 'layouts/navigation_links'` with a Foundation class to complete the navigation bar.

Navigation Links Partial

The file **app/views/layouts/_navigation_links.html.erb** is unchanged:

```
<%=# add navigation links to this file %>
```

Later we'll add links to "About" and "Contact" pages.

The navigation links partial will be simply a list of navigation links. It doesn't require additional CSS styling.

We're following the *separation of concerns* principle here. By separating the links from the styling that creates the navigation bar, we segregate the code that is unique to Zurb Foundation. In the future, if the Zurb Foundation layout or CSS classes change, we can make changes without touching the navigation links. If we wish, we can replace the navigation partial and substitute one that uses Bootstrap styles instead of Foundation, leaving the navigation links intact.

Set up SimpleForm with Zurb Foundation

One of the requirements for our tutorial application is a contact form. We could set up styling for the form when we implement the contact page, but it is convenient to set up form styling now, as we would if we were adding multiple forms to the site.

Rails provides a set of view helpers for forms. They are described in the [RailsGuides: Rails Form Helpers](#) document. But, as you’ve learned, Rails has more than one stack, and most developers use an alternative set of form helpers named SimpleForm, provided by the [SimpleForm gem](#). The SimpleForm helpers are more powerful, easier to use, and offer an option for styling with Zurb Foundation.

In your **Gemfile**, you’ve already added:

```
gem 'simple_form'
```

and previously run **\$ bundle install**.

Run the generator to install SimpleForm with a Zurb Foundation option:

```
$ rails generate simple_form:install --foundation
```

which installs several configuration files:

```
config/initializers/simple_form.rb  
config/initializers/simple_form_foundation.rb  
config/locales/simple_form.en.yml  
lib/templates/erb/scaffold/_form.html.erb
```

Here the SimpleForm gem uses the **rails generate** command to create files for initialization and localization (language translation). SimpleForm can be customized with settings in the initialization file. We’ll use the defaults.

Test the Application

Let's see how the application looks with Zurb Foundation. The web server may already be running. If not, enter the command:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

You should see a new page design that displays Zurb Foundation styling. Thanks to the open source efforts of the Zurb firm, we've added powerful front-end features to our website with little effort.

You can click the “X” close icons to hide the flash messages, thanks to the integrated CSS and JavaScript of the Foundation framework.

Next we'll add “About” and “Contact” pages to the application. After we update the navigation links, you'll see how the Foundation responsive web design adjusts the navigation bar at different browser widths.

Remove the Flash Messages

Before we continue, we'll remove the flash messages we created for our demonstration.

Update the file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
  end

end
```

Git

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "front-end framework"  
$ git push
```

Chapter 17

Add Pages

Let's begin adding pages to our web application.

There are three types of web pages in a Rails application. We've looked at two types so far:

- static pages in the **public/** folder that contain no Ruby code
- dynamic pages such as our home page that use the application layout

There's another type of web page that is required on many websites. It has static content; that is, no dynamic data is needed on the page. But it uses the default application layout to maintain consistency in the website look and feel. We classify this type of page as a:

- static view that uses the application layout

Examples include:

- “About” page
- Legal page

- FAQ page

It's possible to place these pages in the **public/** folder and copy the HTML and CSS from the default application layout but this leads to duplicated code and maintenance headaches. And dynamic elements such as navigation links can't be included. For these reasons, developers seldom create static pages in the **public/** folder.

Alternatively, a dynamic page can be created that has no model, a nearly-empty controller, and a view that contains no instance variables. This solution is quite common for static views that use the application layout.

This solution is implemented so frequently that many developers create a gem to encapsulate the functionality. We're going to use the best-known of these gems, the [high_voltage](#) gem created by the [Thoughtbot](#) consulting firm.

We'll use the High Voltage gem to create an "About" Page.

We also will create a Contact page. We'll again use the High Voltage gem, but only for the first version of the Contact page. Later we'll discard the page we created with the High Voltage gem and replace it with a full model-view-controller implementation. The process will show the difference between an older form of web application architecture and a newer "Rails way."

High Voltage Gem

We can add a page using the High Voltage gem almost effortlessly. The gem implements Rails "convention over configuration" so well that there is nothing to configure. There are alternatives to its defaults which can be useful but we won't need them; visit the GitHub home page for the [high_voltage](#) gem if you want to explore all the options.

In your **Gemfile**, you've already added:

```
gem 'high_voltage'
```

and previously run `$ bundle install`.

Views Folder

Create a folder **app/views/pages**:

```
$ mkdir app/views/pages
```

Any view files we add to this directory will automatically use the default application layout and appear when we use a URL that contains the filename.

The High Voltage gem contains all the controller and routing magic required for this to happen.

Let's try it out.

“About” Page

Create a file **app/views/pages/about.html.erb**:

```
<% content_for :title do %>About<% end %>
<h3>About Foobar Kadigan</h3>
<p>He was born in Waikikamukau, New Zealand. He left New Zealand for England,
  excelled at the University of Mopery, and served in the Royal Loamshire Regiment.
  While in service, he invented the kanuten valve used in the processing of
  unobtainium for industrial use. With a partner, Granda Fairbook, he founded
  Acme Manufacturing, later acquired by the Advent Corporation, to develop his
  discovery for use in the Turboencabulator. Mr. Kadigan is now retired and
  lives in Middlehampton with a favorite cat, where he raises Griadium frieda
  and collects metasyntactic variables.</p>
<p>His favorite quotation is:</p>
<p>Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod
  tempor incididunt ut labore et dolore magna aliqua.</p>
```


Our simple “About” view will be combined with the default application layout by the High Voltage gem.

We include a `content_for` Rails view helper that passes a page title to the application layout.

Contact Page

For the initial version of the Contact page, create a file **app/views/pages/contact.html.erb**:

```
<% content_for :title do %>Contact<% end %>
<h3>Contact</h3>
```

This is a placeholder page we’ll use to test a navigation link.

We include a `content_for` Rails view helper that passes a page title to the application layout.

Routing for the High Voltage Gem

The High Voltage gem provides a PagesController. You’ll never see it; it is packaged inside the gem.

In addition to providing a controller, the High Voltage gem provides default routing so any URL with the form <http://localhost:3000/pages/about> will obtain a view from the **app/views/pages** directory.

Like the PagesController, the code that sets up the route is packaged inside the gem. For details about the syntax of routing directives, refer to [RailsGuides: Routing from the Outside In](#).

Update the Navigation Partial

You can use a Rails route helper to create a link to any view in the **app/views/pages** directory like this:

```
link_to 'About', page_path('about')
```

Let's add links to the “About” and “Contact” pages.

Replace the contents of the file **app/views/layouts/_navigation_links.html.erb** with this:

```
<%=# add navigation links to this file %>
<li><%= link_to 'About', page_path('about') %></li>
<li><%= link_to 'Contact', page_path('contact') %></li>
```

With an updated navigation bar, we can test the application.

Test the Application

The web server may already be running. If not, enter the command:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

Links to the pages “About” and “Contact” should work.

If you get an error “uninitialized constant PagesController,” make sure the **config/routes.rb** file looks like this:

```
Rails.application.routes.draw do
  root to: 'visitors#new'
end
```

Watch what happens when you resize the page. At smaller sizes, the navigation bar changes to display a menu icon. Clicking the menu icon reveals a drop-down menu of navigation links. You’re seeing the power of the Foundation framework.

Here’s a troubleshooting tip. If clicking the menu icon doesn’t reveal a drop-down menu, the application may not be loading the Foundation JavaScript library. Make sure that the file **app/assets/javascripts/application.js** contains:

```
//= require jquery
//= require jquery_ujs
//= require turbolinks
//= require foundation
//= require_tree .
$(function() {
  $(document).foundation();
});
```

Git

Let’s commit our changes to the Git repository and push to GitHub:

```
$ git add -A
$ git commit -m "add 'about' and 'contact' pages"
$ git push
```

There is nothing more we need for our “About” page.

In the next chapter, we’ll explore two different implementations for the Contact page.

Chapter 18

Contact Form

Forms are ubiquitous on the web, to the degree we seldom notice how often they are used for data entry, whether we're logging into a website or posting a blog comment. To build any interactive website, you'll need to understand forms. Here we'll build a contact form for our tutorial application.

A contact form is common on many websites. If you think about it, contact forms are often unnecessary; simply displaying an email address is sufficient, more convenient, and easier to implement. But building a contact form is an excellent way to learn how to handle user data input. We'll pretend that our odd client, Mr. Foobar Kadigan, insists that he needs a contact form on his website.

We're not backing the tutorial application with a database so we won't store the contact data after the information is submitted. Instead, in a subsequent chapter we'll learn how to send the contents of the form by email to the website owner.

The “Old Way” and the “Rails Way”

In this chapter, we'll explore two ways to implement a contact form. The first way will be familiar to anyone who has used PHP or similar web platforms. It is an obvious and straightforward way to handle a form. As we look closer,

we'll see the approach has limitations. We'll discard our first approach and rebuild the Contact page, discovering how the “Rails way” is more powerful.

You may wonder why I'm going to show you two different ways to implement the contact form.

First, it is worthwhile to see there is more than one way to implement a web application. Maturity as a software developer means imagining different approaches and evaluating your options. With this exercise, you'll contrast two approaches and see how we make choices about software architecture.

More importantly, it is not always obvious why we do things in a “Rails way.” It would be easy to simply walk you through the steps to build a contact form without showing you alternative implementations (that's how most tutorials do it). But you'll gain a deeper understanding of Rails by building the contact form in a less sophisticated fashion and then seeing the more elegant Rails approach.

User Story

Let's plan our work with a user story:

```
*Contact Page*
As a visitor to the website
I want to fill out a form with my name, email address, and some text
In order to send a message to the owner of the website
```

Our first step will be to create a route to a controller that will process the submitted form.

Routing

We're going to create a `ContactsController` to process the submitted form data. Every form must have a destination URL that receives the form submission.

We need to set a route to generate the destination URL.

Open the file **config/routes.rb**. Replace the contents with this:

```
Rails.application.routes.draw do
  post 'contact', to: 'contacts#process_form'
  root to: 'visitors#new'
end
```

The route `post 'contact', to: 'contacts#process_form'` will create a route helper that generates a URL and hands off the request to a controller.

You can run the **rake routes** command to see our routes in the console:

```
$ rake routes
Prefix Verb URI Pattern          Controller#Action
contact POST /contact(.:format) contacts#process_form
  root GET  /              visitors#new
  page GET  /pages/*id     high_voltage/pages#show
```

The output of the **rake routes** command is somewhat cryptic but confirms we've created the routes we need.

The first item in the **rake routes** output indicates we can add “contact” to “_path” to get our route helper, **contact_path**:

- **contact_path** - a route helper that can be used in a controller or view

The second item indicates the request will be handled with the HTTP POST protocol:

- **POST** - HTTP method to submit form data

The third item indicates the application will respond to the following URL:

- <http://localhost:3000/contact> - URL generated by the route helper

The fourth item indicates a request to the URL will be handled by:

- **contacts** - the name of the controller
- **process_form** - a controller action

For details about the syntax of routing directives, refer to [RailsGuides: Routing from the Outside In](#).

The route won't work yet; we need to create a `ContactsController`. But first we'll create the form.

Adding a Form to the Contact Page

You'll recall that we set up the [SimpleForm gem](#) when we added Zurb Foundation to our application. The SimpleForm gem provides Rails view helpers for forms. You'll remember that we described Rails view helpers as “macros to generate HTML.” The SimpleForm gem gives us view helpers to generate all the HTML required by complex forms. Forms require some of the most complex HTML a developer will encounter, so the SimpleForm gem is truly worthwhile.

Let's add the code for a contact form to the Contact page.

Replace the contents of the file **app/views/pages/contact.html.erb**:

```
<% content_for :title do %>Contact<% end %>
<h3>Contact</h3>
<div class="form">
  <%= simple_form_for :contact, url: contact_path do |form| %>
    <%= form.input :name, autofocus: true %>
    <%= form.input :email %>
    <%= form.input :content, as: :text %>
    <%= form.button :submit, 'Submit', class: 'submit' %>
  <% end %>
</div>
```

The code is compact but complex. We see several elements:

- `content_for` is a view helper that passes a page title to the application layout
- `<div class="form">` sets the width of the form and applies any styles we desire
- `simple_form_for` is the view helper for the form

The `simple_form_for` view helper instantiates a form object which we assign to a variable named `form`. SimpleForm offers many standard form elements, such as text fields and submit buttons. Each element is available as a method call on the form object.

The view helper `simple_form_for` requires *parameters* and a *block*.

Every form needs a name and a route in the application that will handle processing of the form data. The parameters are:

- `contact` - the name of the form
- `url` - set to `contact_path`, the destination for the form data

Later, when we change this form to accommodate the “Rails way,” we’ll replace these two parameters with a single instance variable. The magic of Rails will generate the name of the form and the destination URL from the instance variable. For now, to implement the “old way,” we supply the name of the form and the destination URL.

The `simple_form_for` view helper accommodates a Ruby block. The block begins with `do` and closes with `end`. The code inside the block works just like code inside a method. In this case, the `form` object is passed to the block and methods belonging to the `form` object are called to produce HTML output.

Inside the block, the `form` object methods generate HTML for:

- a name field
- an email field
- a content field
- a submit button

Each of the form methods takes various parameters, such as:

- **autofocus** - displays the cursor in the field
- **as: :text** - displays a multiline text area
- **input_html** - adds any HTML such as a CSS class
- **class** - applies a CSS class to modify a button's appearance

The structure of the form is clearly visible in the code. The form begins with a **simple_form_for** helper and closes with the **end** keyword. Each line of code produces an element in the form such as a field or a button.

This is a common structure for a Rails view helper and it will soon become familiar.

Controller

We need code to process the form data. The form data is sent to the server as a POST request attached to a URL. As we've learned, in Rails we use controllers to respond to browser requests. For this implementation, we'll create a `ContactsController` to process the submitted form data.

Create a file **app/controllers/contacts_controller.rb**:

```
class ContactsController < ApplicationController

  def process_form
    Rails.logger.debug "DEBUG: params are #{params}"
    flash[:notice] = "Received request from #{params[:contact][:name]}"
    redirect_to root_path
  end
end
```

The ContactsController inherits the behavior of the base ApplicationController. We create a `process_form` method to respond when the form is submitted. Later we'll learn that `process_form` doesn't fit the "Rails way." We'll use it for now.

Before we look closely at the code for the `process_form` method, we need to learn about the `params` hash.

Params Hash

Take a close look at these two lines:

```
Rails.logger.debug "DEBUG: params are #{params}"
flash[:notice] = "Received request from #{params[:contact][:name]}"
```

Notice the `params` object.

Earlier we learned about the Ruby *Hash* class. It is a data structure for key/value pairs and Hash instances are ideal for storing form data. Each field on the form can be mapped as *label* and *data*, or key and value, and stored in a Hash.

Rails does all the work of extracting the form data from the browser's POST request. Rails creates a hash with the form field data mapped to the form field labels and gives the hash the name of the form. Here's the hash as pure Ruby code:

```
contact = {name: 'Daniel', email: 'daniel@danielkehoe.com', content: 'hi!'}
```

Rails goes a step further and nests the form hash inside another hash named **params**.

As pure Ruby code, the **params** hash looks like this:

```
params = {controller: 'contacts',  
          action: 'process_form',  
          contact: {name: 'Daniel', email: 'daniel@danielkehoe.com', content: 'hi!'}  
}
```

The **params** hash includes these elements (plus others we won't cover):

- current controller
- current action
- form data (our **contact** hash)

You will see the contents of the **params** hash in the console log after you submit the form. We'll look at the console log when we test the implementation.

Process_form Method

Now that we know about the **params** hash, take a look again at the **process_form** method:

```
def process_form  
  Rails.logger.debug "DEBUG: params are #{params}"  
  flash[:notice] = "Received request from #{params[:contact][:name]}"  
  redirect_to root_path  
end
```

We use a `logger.debug` method to reveal the form data in our console log by revealing the contents of the `params` hash.

Then we extract the data posted to the name field of the form and construct a flash message. A hash containing the data from the contact form is nested inside the `params` hash. We can retrieve the value of the name field with the expression `params[:contact][:name]`. We use double quotes and string interpolation to form the message using the `#{...}` syntax that evaluates a Ruby expression and combines it with a string.

Finally we use the `redirect_to` directive to render the home page.

We haven't actually sent the contact data to anyone. We'll add code for that later, after we refactor the controller to be a better example of the "Rails way." Before we do that, let's test the current implementation. We've already set up routing for the new controller.

Test the Application

If you need to start the server:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

Click the "Contact" link; then fill out and submit the form.

You should see the flash message "Received request from ..." on the home page. If you see the message "My birthday is soon" you need to delete your earlier experiment from the Visitors controller.

If you get an error message "uninitialized constant ContactsController," make sure you created the file `app/controllers/contacts_controller.rb` as instructed above.

Notice what appears in the console log:

```
Started POST "/contact" for ::1 at 2015-12-24 13:46:34 +0700
Processing by ContactsController#process_form as HTML
Parameters: {"utf8"=>"", "authenticity_token"=>"...",
"contact"=>{"name"=>"Daniel Kehoe", "email"=>"daniel@danielkehoe.com",
"content"=>"Looking forward to your birthday!"}, "commit"=>"Submit"}
DEBUG: params are {"utf8"=>"", "authenticity_token"=>"...",
"contact"=>{"name"=>"Daniel Kehoe", "email"=>"daniel@danielkehoe.com",
"content"=>"Looking forward to your birthday!"}, "commit"=>"Submit",
"controller"=>"contacts", "action"=>"process_form"}
Redirected to http://localhost:3000/
Completed 302 Found in 15ms (ActiveRecord: 0.0ms)
```

The console log is our most important tool for debugging. Let's analyze what we see:

- *Started POST* - shows the server is responding to an HTTP POST request
- *"/contact"* - the path portion of the URL
- *for 127.0.0.1* - the IP address for localhost
- *at ...* - timestamp
- *Processing by ContactsController* - the controller
- *process_form* - the controller action (the method that handles the request)
- *as HTML* - not XML or some other markup
- *Parameters:* - the **params** hash containing all the submitted data
- *"utf8"=""* - a Rails workaround to set the language encoding in Internet Explorer
- *"authenticity token"* - prevents CSRF security exploits
- *"contact"* - a hash containing the form data
- *"commit"* - the "Submit" label from the button

- *DEBUG* - our debug message containing the form data
- *Redirected to http://localhost:3000/* - responded by displaying the home page
- *Completed 302 Found* - HTTP response status code 302 indicating a redirection
- *in 0ms* - time required to process the request

That's a lot of data. For now, we really only care about the form data buried in the **params** hash.

You can see that we really don't need the debug message because the console log shows us the contents of the **params** hash.

The Validation Problem

It looks like we've got everything we need to handle a form submission. As a next step, we could implement code to send an email message using form data extracted from the **params** hash.

But consider a potential problem. What if the email address is poorly formed? The visitor will think the message has been sent but it will never be delivered.

Or what if the name field or message is blank? It's not just a problem for the hapless visitor. An evildoer could repeatedly click the submit button, filling Foobar Kadigan's email inbox with endless empty messages.

We need *validation* of the form data before we process it.

We could dig into the Rails **String** API and look for a way to test if the string is empty or contains only whitespaces. And we could raise an **Exception** if the string is blank.

Here's what validation code could look like. We won't use this code (because there's a better way to do this):

```
class ContactsController < ApplicationController

  def process_form
    if params[:contact][:name].blank?
      raise 'Name is blank!'
    end
    if params[:contact][:email].blank?
      raise 'Email is blank!'
    end
    if params[:contact][:content].blank?
      raise 'Message is blank!'
    end
    message = "Received request from #{params[:contact][:name]}"
    redirect_to root_path, :notice => message
  end
end
```

We would need additional code to test for invalid email addresses (it will be a complex *regex*, or *regular expression*). And we would need a nicer way of showing the error to the visitor (right now, raising the exception displays an error message that makes it appear the application is broken). If we were implementing this on another web application platform, we might go further down this path, googling for code examples, and implementing a lengthy but bulletproof validation function.

Rails offers a better way.

Remove the Contact Page

We will implement a model-view-controller architecture for our Contact feature. That means we need a Contact model, a Contacts controller, and view files in the **app/views/contacts/** folder.

We no longer need the Contact page in the **app/views/pages/** folder.

Let's get started by removing the file **app/views/pages/contact.html.erb**:

```
$ rm app/views/pages/contact.html.erb
```

Before we implement a model-view-controller architecture, let’s take time to understand the advantages of the Rails model-view-controller approach.

Implementing the “Rails Way”

Our initial implementation of the contact form is consistent with the earliest approach to web application development. That’s why I call it the “old way.” It is an approach that originated in 1993 with a specification for CGI, the [Common Gateway Interface](#). Before CGI, every page on the web existed only as a static HTML file. CGI made it possible to run a program, or CGI script, that dynamically generated HTML. In the early years of the web, every web URL matched either an HTML file or a CGI script. This is the “page paradigm” of the web.

So far, we’re following the “page paradigm.” Our Contact page hosts the form. Clicking the submit button makes a request to another page that is actually a program that returns HTML. Until the late 1990s, this is how the web worked. But soon after the introduction of CGI, developers began exploring the possibility of running a single program (an application server) that responds to any URL, parsing the URL to establish routing, and generating pages dynamically. This was the genesis of the “web application paradigm.” It’s how Rails works.

The web application paradigm frees us from one-to-one correspondence of a URL with a single file or script. It allows us to refactor our code into object-oriented classes and methods that can be inherited rather than duplicated, which means we don’t repeat the same code on every page that processes a form.

The web application paradigm makes it possible to use the model-view-controller architecture. Instead of looking at the web as URLs that return pages, we see requests that are routed to controllers that render views. We can segregate any code that manipulates data into a model class, instead of mixing HTML with

data manipulation in a single script. With the “web application paradigm,” we can have a generic model class that isolates the code that connects to a database or validates form data. We can create models that inherit the generic behavior from a parent class and get a database connection or validation “for free.” Unlike the “page paradigm,” we’ll avoid duplicating validation code every time we need to process a form.

Consider our `process_form` method again:

```
class ContactsController < ApplicationController

  def process_form
    if params[:contact][:name].blank?
      raise 'Name is blank!'
    end
    if params[:contact][:email].blank?
      raise 'Email is blank!'
    end
    if params[:contact][:content].blank?
      raise 'Message is blank!'
    end
    message = "Received request from #{params[:contact][:name]}"
    redirect_to root_path, :notice => message
  end

end
```

We’ll replace it with something better.

Our “segregation of concerns” philosophy suggests that validation belongs in a model, since validation is a type of data manipulation (strictly speaking, a test of data integrity). Furthermore, it would be nice to make the validation tests generic so they could be used to validate data submitted from any form.

Rails, as a framework, provides all this for us. We call it the “Rails way.”

ActiveModel

Rails extracts and generalizes common code that every website requires. The code that websites need for access to databases is abstracted into the Rails

[ActiveRecord](#) class. ActiveRecord includes code from the [ActiveModel](#) class that handles interaction with forms and data validation.

The ActiveModel class interfaces with SimpleForm to provide sophisticated validation and error handling. We can mix in behavior from the ActiveModel class to add validation and error handling to any model we create.

SimpleForm will recognize ActiveModel methods if we provide a model as an argument to the SimpleForm view helper. SimpleForm will give the form a name that matches the model name. And SimpleForm will automatically generate a destination URL for the form based on the model name.

More significantly, SimpleForm will add sophisticated error handling to the form. If a visitor doesn't enter a name or submits an invalid email address, and we declare in our model that we require validation, SimpleForm will highlight the invalid field and display an inline message indicating the problem. Compared to what we've implemented so far, this kind of error handling provides a vastly superior user experience. Instead of displaying a message that the application failed, the form will be redisplayed with the problem marked and noted.

Now that we've seen the advantages of the "Rails way," let's re-implement our contact form using the model-view-controller architecture.

Model

When we build database-backed applications with Rails, we base our models on a parent class named ActiveRecord. We are not using a database for our tutorial application, so we'll mix in behavior from ActiveModel, which adds validation and error handling to our model. Let's set up a model that doesn't require a database.

Create a file **app/models/contact.rb**:

```
class Contact
  include ActiveModel::Model
  attr_accessor :name, :string
```

```
attr_accessor :email, :string
attr_accessor :content, :string

validates_presence_of :name
validates_presence_of :email
validates_presence_of :content
validates_format_of :email,
  with: /\A[-a-z0-9_+\.\@]([-a-z0-9]+\.)+[a-z0-9]{2,4}\z/i
validates_length_of :content, :maximum => 500

end
```

When you copy this, be careful to keep the long regex expression (**with: /.../i**) on one line (no line breaks).

We give the model the name “Contact.”

We mix in behavior from the `ActiveModel` class using **`include ActiveModel::Model`**.

We create attributes (data fields) for the model by using the **`attr_accessor`** keyword, specifying that each attribute is a string. The attributes match the fields in the contact form.

`ActiveModel` gives us validation methods named **`validates_presence_of`**, **`validates_format_of`**, and **`validates_length_of`**. We check that **`name`**, **`email`**, and **`content`** exist (no blanks are allowed). We provide a complex *regex*, or *regular expression*, to test if the email address is valid. Finally, we declare that the message content cannot exceed 500 characters.

The model is elegant. We describe the fields we need and state our validation requirements. `ActiveModel` does all the rest.

Next we’ll add a new Contact page by creating a view in the **`app/views/contacts/`** folder.

The new contact form will use our new model.

Create a New Contact Page

First, let's create the **app/views/contacts/** folder:

```
$ mkdir app/views/contacts/
```

Create a file **app/views/contacts/new.html.erb**:

```
<% content_for :title do %>Contact<% end %>
<h3>Contact</h3>
<div class="form">
  <%= simple_form_for @contact do |form| %>
    <%= form.error_notification %>
    <%= form.input :name, autofocus: true %>
    <%= form.input :email %>
    <%= form.input :content, as: :text %>
    <%= form.button :submit, 'Submit', class: 'submit' %>
  <% end %>
</div>
```

The form is the same as we used before, but we're now providing only one argument, the **@contact** instance variable, to the SimpleForm view helper. That's enough to generate the form name and destination URL.

We haven't yet created a controller that assigns the Contact model to the **@contact** instance variable. We'll do that soon.

Earlier, I explained that SimpleForm configures itself if we provide a model that inherits from ActiveRecord. SimpleForm gives the form a name that matches the model name. And SimpleForm generates a destination URL based on the model name.

SimpleForm uses the **@contact** instance variable to name the form, set a destination for the form data, and initialize each field in the form using attributes from the Contact model. Setting the values for the form fields from the attributes in the model is called "binding the form to the object" and you can read about it in the [RailsGuides: Form Helpers](#) article.

We've added the `error_notification` method which provides all the error handling. The method call is very simple but the results will be impressive.

We'll need a controller and routing to complete our model-view-controller architecture. But first, we'll detour to learn about seven standard controller actions.

Seven Controller Actions

Consider all the possibilities for managing a list. It's a list of anything: users, inventory, thingamajigs. We use a web application to manage the list, so we'll fill out a form to record each item in our list.

The web application offers seven features to help us manage our records:

- *index* - display a list of all items
- *show* - display a record of one item
- *new* - display an empty form
- *create* - save a record of a new item
- *edit* - display a record for editing
- *update* - save an edited record
- *destroy* - delete a record

You can manage any list using these seven actions. There are a few extra actions that are helpful, such as:

- *pagination* - displaying a portion of a list
- *sorting* - displaying the list in a different order

- *bulk edit* - changing multiple items at once

But seven basic actions are all you need for managing any list of items.

The “Rails way” is about taking advantage of structure and convention to leverage the power of the framework.

The ApplicationController contains code to implement each of the seven standard actions. When we create a controller that inherits from the ApplicationController, we get these standard actions “for free.” That’s why our **new** method in our VisitorsController was so simple. The controller knew to render a view file named **new.html.erb** from the **views/visitors/** folder because of behavior inherited from the ApplicationController.

Just like the Rails directory structure provides consistency to make it easy for any Rails developer to collaborate with other Rails developers, relying on the seven standard controller actions makes it easy for other team members to understand how your controllers work.

A controller that uses these actions is said to be “RESTful” (a term that refers to **representational state transfer**, a software design abstraction). Experienced Rails developers follow the “Rails way” and try to use RESTful controller methods when possible.

When necessary, you will add other controller actions. For example, imagine you’ve built a subscription website. When a user’s subscription ends, you may not want to **destroy** the subscriber record. Instead you might add a controller **expire** or **suspend** action that marks the subscriber record as expired so you can continue to access the subscriber’s contact information for customer service or renewal offers. To the extent you can, use the seven standard controller actions and be cautious about adding more.

Earlier, I said our ContactsController **process_form** method isn’t suitable for the “Rails way.” With our model-view-controller architecture, we can piggyback on the ApplicationController to display our empty contact form and process the form when it is submitted.

We’ll use only two of the seven standard controller actions:

- *new* - display the empty contact form
- *create* - validate and process the submitted form

Our ContactsController will know to render a view from the **app/views/contacts/new.html.e** file when we call the controller **new** method.

We won't piggyback on behavior from the ApplicationController **create** method. But we'll implement a **create** method because, by convention, the form will submit the data to the controller's **create** method. SimpleForm will create a destination URL that corresponds to the ContactsController#create action.

Controller

Replace the contents of the file **app/controllers/contacts_controller.rb**:

```
class ContactsController < ApplicationController

  def new
    @contact = Contact.new
  end

  def create
    @contact = Contact.new(params)
    if @contact.valid?
      # TODO send message
      flash[:notice] = "Message sent from #{@contact.name}."
      redirect_to root_path
    else
      render :new
    end
  end

  private

  def params
    params.require(:contact).permit(:name, :email, :content)
  end

end
```

We’ve dropped the “old school” `process_form` method and added the “Rails way” `new` and `create` methods.

The controller `new` action will instantiate an empty Contact model, assign it to the `@contact` instance variable, and render the `app/views/contacts/new.html.erb` view. We’ve already created the view file containing the form.

SimpleForm will set a destination URL that corresponds to the `ContactsController#create` action. The `create` method will instantiate a new Contact model using the data from the form (we take steps to avoid security vulnerabilities first—more on that later).

The ActiveRecord class provides a method `valid?` which we can call on the Contact model. Our conditional statement `if @contact.valid?` checks each of the validation requirements we’ve set in the model.

If all the Contact fields are valid, we can send a message (not yet implemented), prepare a flash message, and redirect to the home page. Notice that we don’t need to dig into the `params` hash for the visitor’s name; it is now available as `@contact.name` directly from the model.

If any validation fails, the controller `create` action will render the `app/views/contacts/new` view. This time, appropriate error messages are set and the form object’s `error_notification` method will highlight the invalid field and display a matching prompt.

You’re looking at the tightly bound interaction of the “Rails way” model, view, and controller.

The only element we are missing is routing. But first, let’s look closer at the steps we take to avoid security exploits.

Mass-Assignment Vulnerabilities

Rails protects us from a class of security exploits called “mass-assignment vulnerabilities.” Rails won’t let us initialize a model with just any parameters submitted on a form. Suppose we were creating a new user and one of the user

attributes was a flag allowing administrator access. A malicious hacker could create a fake form that provides a user name and sets the administrator status to “true.” Rails forces us to “white list” each of the parameters used to initialize the model.

We create a method named `secure_params` to screen the parameters sent from the browser. The `params` hash contains two useful methods we use for our screening:

- `require(:contact)` - makes sure that `params[:contact]` is present
- `permit(:name, :email, :content)` - our “white list”

With this code, we make sure that `params[:contact]` only contains `:name`, `:email`, `:content`. If other parameters are present, they are stripped out. Rails will raise an error if a controller attempts to pass params to a model method without explicitly permitting attributes via `permit`.

In older versions of Rails (before Rails 4.0), the mass-assignment exploit was blocked by using a “white list” of acceptable parameters with the `attr_accessible` keyword in a model. You’ll see this code in examples and tutorials that were written before Rails 4.0 introduced “strong parameters” in the controller.

Private Methods

If you paid close attention to the code you added to the Contacts controller, you may have noticed the keyword `private` above the `secure_params` method definition. This is a bit of software architecture that limits access to the `secure_params` method (plus any more methods we might add beneath it).

Very simply, adding the `private` keyword restricts access to the `secure_params` method so only methods in the same class can use it. You might be puzzled; after all, how else could it be accessed? We haven’t explored calling methods from other classes, so I’ll just say that without the `private` keyword, the

`secure_params` method could be used from code anywhere in our application. In this case, we apply the `private` keyword because we want to be sure the `secure_params` method is only used in the `ContactsController` class. It's just a bit of "best practice" and for now, you can simply learn that `secure_params` method should be a private method.

Now let's look at routing for controllers that are built the "Rails way."

Routing

Rails routing is aware of the seven standard controller actions.

In fact, it takes only one keyword (with one parameter) to generate seven different routes for any controller.

The keyword is `resources` and supplying a name that matches a model and controller provides all seven routes.

Open the file `config/routes.rb`. Replace the contents with this:

```
Rails.application.routes.draw do
  resources :contacts, only: [:new, :create]
  root to: 'visitors#new'
end
```

Here we've added `resources :contacts, only: [:new, :create]`.

We only want two routes so we've added the restriction `only: [:new, :create]`.

The `new` route has these properties:

- `new_contact_path` - route helper
- `contacts` - name of the controller (`ContactsController`)
- `new` - controller action

- <http://localhost:3000/contacts/new> - URL generated by the route helper
- **GET** - HTTP method to display a page

The **create** route has these properties:

- **contacts_path** - route helper
- **contacts** - name of the controller (ContactsController)
- **create** - controller action
- <http://localhost:3000/contacts> - URL generated by the route helper
- **POST** - HTTP method to submit form data

You can run the **rake routes** command to see these in the console:

```
$ rake routes
      Prefix Verb URI Pattern               Controller#Action
  contacts POST /contacts(.:format)   contacts#create
new_contact GET  /contacts/new(.:format) contacts#new
      root GET  /                     visitors#new
      page GET  /pages/*id           high_voltage/pages#show
```

The output of the **rake routes** command shows we've created the routes we need.

Our new route **new_contact_path** can now be used. We've completed our move to the model-view-controller architecture by adding the appropriate routes.

Change Navigation Links

With our new model-view-controller architecture, we need to change the navigation links.

Change the file **app/views/layouts/_navigation_links.html.erb**:

```
<%# add navigation links to this file %>
<li><%= link_to 'About', page_path('about') %></li>
<li><%= link_to 'Contact', new_contact_path %></li>
```

We’re ready to test the model-view-controller implementation of the Contact feature.

Be sure you’ve removed the file **app/views/pages/contact.html.erb**, as it is no longer used.

Test the Application

If you need to restart the server:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

Click the “Contact” link; then fill out and submit the form.

You should see the flash message “Message sent from ...” on the home page.

Try submitting the form with a blank name. You’ll see a warning message, “Please review the problems below.”

Try submitting the form with an invalid email address such as “me@foo”. The form will re-display with a message, “Please review the problems below,” and next to the email field, “is invalid.”

Combining SimpleForm error handling with ActiveRecord validation is powerful. If validation fails after the form is submitted, the page will redisplay and SimpleForm will display an appropriate error message.

Git

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "contact form"  
$ git push
```

We've built a sophisticated Contact form.

Chapter 19

Send Mail

Email sent from a web application is called [transactional email](#). As a website visitor, you've probably seen transactional email such as these messages:

- sign up confirmation email
- response to a password reset request
- acknowledgment of a purchase
- notice of a change to a user profile setting

A web application can send email to a visitor. It can also send messages to its owner or webmaster. On large active sites, email notices can be impractical (an admin interface is better) but for our small-volume tutorial application, it makes sense to email the contact request directly to the site owner (Foobar Kadigan is retired and enjoys receiving email).

User Story

Let's plan our work with a user story:

```
*Send Contact Message*  
As the owner of the website  
I want to receive email messages with a visitor's name, email address, and some text  
In order to communicate with visitors
```

To implement the user story, let's create a feature that sends the contact data as an email message.

Implementation

Rails makes it easy to send email. The [ActionMailer](#) gem is part of any Rails installation.

Implementation of email closely follows the model-view-controller architecture. To implement email, you'll need:

- model
- view
- mailer

The “mailer” is similar to a controller, combining data attributes from a model with a view file. Any methods we add to the mailer class can be called from a controller, triggering delivery of an email message.

The model can be any we've already created. In this case, we'll use the Contact model, since it gives us access to the visitor's name, email address, and message.

We'll create a mail-specific view file in the **app/views/user_mailer/** folder. Our folder for mail-specific views will go in the **app/views/** directory as a sibling of the **app/views/layouts** folder.

The Rails directory structure already gives us a folder **app/mailers/** for the mailer class and, not surprisingly, it is a sibling of the **app/controllers/** folder.

We don't have to create the necessary folders and files manually, as the **rails generate** command runs a utility to create what we need.

Create View Folder and Mailer

Use the **rails generate** command to create a mailer with a folder for views:

```
$ rails generate mailer UserMailer
```

The name of the mailer isn't important; we'll use **UserMailer** because it is obvious.

The **rails generate** command will create several files:

- **app/mailers/application_mailer.rb**
- **app/mailers/user_mailer.rb**
- **app/views/layouts/mailer.html.erb**
- **app/views/layouts/mailer.text.erb**

It also creates test files which we won't use in this tutorial.

This implements our model-view-mailer architecture.

Edit the Mailer

Add a **contact_email** method to the mailer by editing the file **app/mailers/user_mailer.r**


```
class UserMailer < ApplicationMailer
  default from: "do-not-reply@example.com"

  def contact_email(contact)
    @contact = contact
    mail(to: Rails.application.secrets.owner_email, from: @contact.email, :subject => "Website"
  end
end
```

The **UserMailer** class inherits behavior from the **ApplicationMailer** class. We'll create a method definition that assigns the **contact** argument to the instance variable **@contact**. Like a controller that combines a model with a view, our mailer class makes the instance variable available in the view.

The name of the method isn't important; it can be anything obvious. We'll use it in the **ContactsController** to trigger mail delivery.

Like the **render** method in a web page controller, the **ActionMailer** parent class has a **mail** method that renders the view.

You'll need to use your email address in the mailer. You should have already set a configuration variable for your email address in the file **config/secrets.yml**. If you haven't done so, do it now. By inserting the configuration variable with your email address after **to:**, your inbox will receive the message. If Foobar Kadigan was a real person, we'd supply his email address here.

We need to insert a "from" address in two places. First there is a default, for all messages that do not set a "from" address. We will use "do-not-reply@example.com" for the default "from" address. The email is originating from a web application that does not receive email, so this indicates the email address should not be used for replies. For emails going to website visitors, it would be best to provide a default email address for a customer service representative on the "from" line, so the recipient can easily reply. We're not sending email messages to visitors so we can ignore this nicety.

For our **contact_email** method, we'll insert the email address of the visitor as the "from" address since we are sending a message to the site owner. This makes it easy for Foobar Kadigan to click "reply" when he is reading the con-

tact messages in his inbox. You can see our use of the email attribute from the Contact model in the expression **from: @contact.email**.

That's all we need for mailer class. Next we'll create a view containing the message.

Create Mailer View

There are two types of mailer views. One contains plain text, for recipients who don't like formatted email (some people still read email from the Unix command line). The other type contains HTML markup to provide formatting. It's good to create a message of both types, though most recipients will benefit from HTML formatting.

The mailer view for formatted email looks very similar to a web page view file. It contains HTML markup plus Ruby expressions embedded in **<%= ... %>** delimiters. In the **UserMailer** class, we've assigned the Contact model to the instance variable **@contact** so any attributes are available for use in the message.

Create a file **app/views/user_mailer/contact_email.html.erb**:

```
<!DOCTYPE html>
<html>
  <head>
    <meta content="text/html; charset=UTF-8" http-equiv="Content-Type" />
  </head>
  <body>
    <h1>Website Contact</h1>
    <p>
      This visitor requested contact:
    </p>
    <p>
      <%= @contact.name %><br/>
      <%= @contact.email %><br/>
    </p>
    <p>
      The visitor said:
    </p>
    <p>
```

```
"<%= @contact.content %>"  
</p>  
</body>  
</html>
```

You can easily imagine how this view would look as a web page. You'll soon see it as an email message in your inbox.

For those recipients who like plain text, create a view without HTML markup.

Create a file **app/views/user_mailer/contact_email.text.erb**:

```
You received a message from <%= @contact.name %> with email address <%= @contact.email %>.  
  
The visitor said:  
  
<%= @contact.content %>
```

You've created views for the email message.

Now we can integrate our email feature with the `ContactsController`.

Modify Controller

We'll add code to the `ContactsController`:

```
UserMailer.contact_email(@contact).deliver_now
```

Replace the contents of the file **app/controllers/contacts_controller.rb**:

```
class ContactsController < ApplicationController  
  
  def new  
    @contact = Contact.new  
  end  
  
end
```

```
def create
  @contact = Contact.new(secure_params)
  if @contact.valid?
    UserMailer.contact_email(@contact).deliver_now
    flash[:notice] = "Message sent from #{@contact.name}."
    redirect_to root_path
  else
    render :new
  end
end

private

def secure_params
  params.require(:contact).permit(:name, :email, :content)
end

end
```

The `UserMailer` class is available to any controller in the application. We call the `contact_email` method we've created, passing the `@contact` instance variable as an argument, which renders the email message. Finally, the `deliver_now` method initiates delivery.

For more on sending email from a Rails application, see [RailsGuides: Action Mailer Basics](#).

Test the Application

If your web server is not running, start it:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

Click the “Contact” link and try submitting the form.

The email message should be visible in the console.

If you didn't get an email message in your inbox, make sure you set your **config/environments/development.rb** file to perform deliveries as described in the "Configuration" chapter. Be sure to restart your server if you change the configuration file.

Troubleshooting

If you get an error, you can practice troubleshooting. You've set up a complex system with many dependencies. It's great if it works, but there are several opportunities for errors.

The most likely errors are a missing user name or password. We are trying to connect to the Mandrill email service. Mandrill expects your Mandrill user name. Mine is **DanielKehoe** (it is not my email address). Mandrill expects an API key instead of a password. Refer to the chapter "Configure" for details about obtaining your Mandrill API key.

User Name Issues

If you get the error message, "SMTP-AUTH requested but missing user name," Mandrill is not receiving a user name it recognizes.

Check that the user name is set in your Unix environment variables:

```
$ echo "$MANDRILL_USERNAME"
```

You should see your Mandrill user name.

Make sure you've used underscores consistently. If your Unix environment variable is **MANDRILL_USER_NAME** and the **config/secrets.yml** file contains **MANDRILL_USERNAME**, you'll have a problem.

API Key Issues

If you get the error message, “SMTP-AUTH requested but missing secret phrase,” Mandrill is not receiving the Mandrill API key.

Check that the Mandrill API key is set in your Unix environment variables:

```
$ echo "$MANDRILL_API_KEY"
```

You should see the long cryptic string in the console response. Again, make sure you’ve used underscores consistently, and **MANDRILL_API_KEY** is used for the Unix environment variable as well as the **config/secrets.yml** file.

Problems with Environment Variables

If you’ve set up Unix environment variables but **echo "\$MANDRILL_USERNAME"** doesn’t return the correct variable in the console, you may have a problem with the way you’ve set Unix environment variables. Most computers use the bash shell and you can set environment variables in your **.bashrc** or **.bash_profile** files. But not every system is alike. If it seems Unix environment variables are not working, you may have to find a colleague who can help you troubleshoot. In the meantime, you can hardcode the variables in your **config/secrets.yml** file:

Replace the following:

```
development:
  mandrill_username: <%= ENV["MANDRILL_USERNAME"] %>
  mandrill_api_key: <%= ENV["MANDRILL_API_KEY"] %>
```

with:

```
development:
  mandrill_username: "YourUserName"
  mandrill_api_key: "your-very-long-API-string-from Mandrill"
```

Remember the security rule: Don't commit the **config/secrets.yml** file to Git if it contains any secrets. Test the application and finish your troubleshooting. Then remove the hardcoded values from the **config/secrets.yml** file before committing to Git.

Asynchronous Mailing

You may notice a delay in the responsiveness of the Contact form after adding the email feature. Unfortunately, there's a performance penalty with our new feature. Our controller code connects to the Mandrill server and waits for a response before it renders the home page and displays the acknowledgment message.

The performance penalty can be avoided by changing the implementation so that the controller doesn't wait for a response from the Mandrill server. We call this *asynchronous* behavior because sending email does not need to be "in sync" with displaying the acknowledgment. Eliminating a delay improves the user experience and makes the site feel more responsive. Asynchronous mailing requires a *queueing system* for *background jobs*.

For our tutorial application, and for a typical small business website, the delay caused by lack of queueing is no big deal. Keep in mind, though, as you tackle bigger projects in Rails, you will need to implement a queueing system. Rails includes the [Active Job](#) feature for background processing. The [Mailing List with Active Job](#) tutorial in the [Capstone Rails Tutorials](#) series explains how to use it.

Git

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "sending mail"  
$ git push
```

You've created a Rails application that handles a form and sends email to the site owner.

Mail is a practical way to connect with site visitors. Let's implement a feature that collects email addresses for mass mailing of a newsletter.

Chapter 20

Mailing List

Even as other messaging avenues become increasingly popular, such as messaging apps or Facebook messages, email remains the most practical way to stay in touch with website visitors. Encouraging a visitor to provide an email address means offering an invitation to a dialog and a relationship beyond a single visit.

If you have a legitimate reason to stay in touch, and you've motivated the visitor to leave an email address, you'll need a mailing list service. You've seen how Rails can send an email message. From what you've seen so far, you can imagine it would not take much code to loop through a list of email addresses from a database, sending a message to each. In the early days of the web, it was easy for any system administrator to write a script for mass mailings. Since there is negligible cost to sending bulk email, unscrupulous and ignorant operators sent email to any address they could scrape, borrow, or steal. The resulting flood of spam made checking one's inbox an icky experience and destroyed much of the early culture of the Internet. Fortunately, services such as Gmail arose to filter email. There is now a thick (but leaky) layer of screening protocols that redirect spam to a junk folder. One reason you won't use a Rails application to send bulk email is that a web application server is not the most efficient tool for sending email. More significantly, there's a good chance your email won't go through or, if it does (and someone complains), you'll quickly see your IP

address blacklisted. That’s why we use mailing list services to send bulk email such as newsletters or promotional offers.

Considerable expertise is required to keep email from being filtered as spam (see MailChimp’s article [Email Delivery For IT Professionals](#). Email service providers increase reliability of delivery. These services track deliveries and show how well your email is being delivered. You’ll also get features such as management of “unsubscribe” requests and templates to design attractive messages.

There are at least a dozen well-established email service providers that allow a Rails application to programmatically connect to the service (via an API) to add or remove email addresses. For a list, see the article [Send Email with Rails](#). For this tutorial application, we’ll use [MailChimp](#) because there is no cost to open an account and you can send up to 12,000 emails/month to list of 2000 or fewer subscribers for free.

Spam is unsolicited email. Don’t ever send spam, whether for yourself, a client, or an employer. If recipients complain, your IP address and domain name will be blacklisted. So be very careful to only send to subscribers who signed up, send what subscribers expect, and be sure to offer value. If you get complaints, or the unsubscribe rate is high, stop.

We’ll assume we’ve discussed the rules with Foobar Kadigan and he is eager to offer a newsletter to his visitors that will be genuinely appreciated.

User Story

Let’s plan our work with a user story:

```
*Subscribe to Mailing List*  
As a visitor to the website  
I want to sign up for a mailing list  
In order to receive news and announcements
```

To implement the user story, we'll add a mailing list feature.

Implementation

We'll use the Rails model-view-controller architecture. We'll need:

- Visitors model
- view for `visitors#new`
- Visitors controller with `new` and `create` methods
- routing for `visitors#new` and `visitors#create`

We'll add a Visitor model that has a data attribute for an email address. We already have a Visitors controller that renders the home page using the file in the `app/views/visitors/` folder. We'll replace the contents of the view file with a nice photo, a marketing message, and a form.

Our Visitors controller `new` and `create` methods will be very similar to what we created for the Contacts controller. Instead of connecting to Mandrill to send a message, we'll call a method to save the visitor's email address to a MailChimp mailing list.

Gibbon Gem

The [Gibbon gem](#) is a convenient wrapper for the [MailChimp API](#). We could connect to the MailChimp API using other gems that provide low-level plumbing such as HTTP connections ([httparty](#)) and data parsing ([multi_json](#)), but other developers have already done the work of wrapping the plumbing in a higher-level abstraction that easily fits into a Rails application. Amro Mousa's [Gibbon gem](#) is popular and actively maintained.

In your **Gemfile**, you’ve already added:

```
gem 'gibbon'
```

and previously run `$ bundle install`.

Home Page

Earlier we built a home page that provided a simple demonstration of the Ruby language. We’ll discard it and replace it with a page that you could adapt for a typical small-business website.

We want a nice photo, space for a marketing message, and the “sign up” form.

Replace the contents of the file **app/views/visitors/new.html.erb**:

```
<% content_for :title do %>Foobar Kadigan<% end %>
<% content_for :description do %>Website of Foobar Kadigan<% end %>
<section>
  
</section>
<section>
  <div class="column">
    <h3>Stay in touch.</h3>
  </div>
  <div class="column">
    <div class="form-centered">
      <%= simple_form_for @visitor do |f| %>
        <%= f.error_notification %>
        <%= f.input :email, label: false, :placeholder => 'Your email address...' %>
        <br/>
        <%= f.button :submit, "Sign up for the newsletter", :class => "submit" %>
      <% end %>
    </div>
  </div>
</section>
```

We include `content_for` view helpers that pass a title and description to the application layout.

We add a photo to the page with an `` tag. We're taking a shortcut and using a placeholder photo from the lorempixel.com service.

The `section` and `<div class="column">` tags apply a grid from Zurb Foundation to create a row with two columns, one for our marketing message, and one for the form.

Our marketing message is merely a placeholder. For a real website, you'd likely craft a stronger call to action than merely "Stay in touch."

The form is very similar to the form on the Contact page, except we initialize it with the `@visitor` instance variable and only need a field for an email address. We suppress display of the email field label with the flag `label: false` and use the `:placeholder` parameter to create a hint in the empty input field.

A submit element will contain the text, "Sign up for the newsletter," and we apply a CSS class to style the element as a button.

Photo Options

You're free to modify this page as you wish, as long as you keep the form intact.

You might wish to modify the placeholder photo. If you don't like cats, try <http://lorempixel.com/1170/600/nightlife/1> or any other categories from the lorempixel.com service. You can change the size by modifying the dimensions from 1170 (pixel width) by 600 (pixel height).

You can replace the placeholder photo with your own. Look for the `app/assets/images` folder and add an image. Instead of the HTML `` tag, use the Rails `image_tag` view helper, like this:

```
<%= image_tag "myphoto.jpg" %>
```

We'll need a Visitor model to initialize the form.

Visitor Model

The Visitor model is almost identical to the Contact model we created earlier, except there is just one data attribute for the email field.

We'll also add a **subscribe** method to add a visitor to a MailChimp list. We'll call this method from the controller when we process the submitted form.

Create a file **app/models/visitor.rb**:

```
class Visitor
  include ActiveRecord::Model
  attr_accessor :email, :string
  validates_presence_of :email
  validates_format_of :email, with: /\A[-a-z0-9_+\.\]@([-a-z0-9]+\.)+[a-z0-9]{2,4}\z/i

  def subscribe
    mailchimp = Gibbon::Request.new(api_key: Rails.application.secrets.mailchimp_api_key)
    list_id = Rails.application.secrets.mailchimp_list_id
    result = mailchimp.lists(list_id).members.create(
      body: {
        email_address: self.email,
        status: 'subscribed'
      })
    Rails.logger.info("Subscribed #{self.email} to MailChimp") if result
  end
end
```

When you copy this, be careful to keep the long regex expression **with: /.../i** on one line (no line breaks).

Just as we did for the Contact model, we use **include ActiveRecord::Model** to mix in behavior from the ActiveRecord class. This is the best way to create a model that does not use a database. In other applications, where models use a database, you will create a model class that inherits from ActiveRecord instead.

We create the email attribute using the **attr_accessor** keyword, specifying the email attribute will be a **string**. We set validation requirements using **validates_presence_of** and **validates_format_of** keywords.

To subscribe a visitor to a mailing list, you need to provide:

- `list_id` - identify the MailChimp list
- `email_address` - address of the visitor
- `status` - subscribed, pending, or unsubscribed

We specify “subscribed” to immediately add the address without asking the user for confirmation. We could specify “Pending” if we wanted to add the address with double-opt-in so the visitor receives a request to confirm the email address before they are subscribed.

Our `subscribe` method does the work of connecting to the MailChimp server to add the visitor to the mailing list. We instantiate the Gibbon object which provides all the connectivity, providing the `mailchimp_api_key` value, which we’ve set in the `config/secrets.yml` file. We assign the Gibbon object to the `mailchimp` variable (we could name it anything).

We set the `list_id` from a configuration variable in the `config/secrets.yml` file.

The visitor’s `email_address` is an attribute of the model we obtain from `self`.

We must set the `status` property to `'subscribed'` to indicate the visitor should receive mailings.

Finally, if the application successfully adds the new subscriber, we write a message to the logger. If we get an error when trying to add the subscriber, Gibbon will raise an exception.

Visitors Controller

We already have a Visitors controller that contains a simple `new` method. We’ll change the `new` method, add a `create` method, and provide a `secure_params` private method to secure the controller from mass assignment exploits.

Replace the contents of the file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    @visitor = Visitor.new
  end

  def create
    @visitor = Visitor.new(secure_params)
    if @visitor.valid?
      @visitor.subscribe
      flash[:notice] = "Signed up #{@visitor.email}."
      redirect_to root_path
    else
      render :new
    end
  end

  private

  def secure_params
    params.require(:visitor).permit(:email)
  end

end
```

Our **new** method now assigns the Visitor model to an instance variable instead of the Owner model.

The **create** method is almost identical to the Contacts controller **create** method. We instantiate the Visitor model with scrubbed parameters from the submitted form.

If the validation check succeeds, we subscribe the visitor to the MailChimp mailing list with the **@visitor.subscribe** method. All the work of connecting to MailChimp happens in the Visitor model.

If the validation check fails, we redisplay the home page (the **new** action).

Clean Up

We no longer use the Owner model, so we can delete the file **app/models/owner.rb**:

```
$ rm app/models/owner.rb
```

There's no harm if it remains but it is good practice to remove code that is no longer used.

Routing

Our routing is now more complex. In addition to rendering the `visitors#new` view as the application root (the home page), we need to handle the **create** action. We can use a “resourceful route” as we did with the Contacts controller.

Open the file **config/routes.rb**. Replace the contents with this:

```
Rails.application.routes.draw do
  resources :contacts, only: [:new, :create]
  resources :visitors, only: [:new, :create]
  root to: 'visitors#new'
end
```

The root path remains **visitors#new**. Order is significant in the **config/routes.rb** file. As the final designated route, the root path will only be active if nothing above it matches the route.

We've added **resources :visitors, only: [:new, :create]**.

We only want two routes so we've added the restriction **only: [:new, :create]**.

The **new** route has these properties:

- **new_visitor_path** - route helper

- **visitors** - name of the controller (VisitorsController)
- **new** - controller action
- <http://localhost:3000/visitors/new> - URL generated by the route helper
- **GET** - HTTP method to display a page

The **create** route has these properties:

- **visitors_path** - route helper
- **visitors** - name of the controller (VisitorsController)
- **create** - controller action
- <http://localhost:3000/visitors> - URL generated by the route helper
- **POST** - HTTP method to submit form data

You can run the **rake routes** command to see these in the console:

```
$ rake routes
  Prefix Verb URI Pattern                  Controller#Action
  contacts POST /contacts(.:format)      contacts#create
  new_contact GET /contacts/new(.:format)    contacts#new
  visitors POST /visitors(.:format)        visitors#create
  new_visitor GET /visitors/new(.:format)    visitors#new
  root GET /                          visitors#new
  page GET /pages/*id          high_voltage/pages#show
```

The output of the **rake routes** command shows we've created the routes we need.

Test the Application

If you need to start the server:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

You'll see our new home page with the placeholder photo and the "sign up" form.

Enter your email address and click the "sign up" button. You should see the page redisplay with an acknowledgment message. Try entering an invalid email address such as "me@foo@", or click the submit button without entering an email address, and you should see an error message.

You'll have to [log in to MailChimp](#) and check your list of subscribers to see if the new email address was added successfully.

With MailChimp, you can send a welcome message automatically when the visitor signs up for the mailing list. Use the welcome message to inform the visitor that they've successfully subscribed to the mailing list and will receive the next newsletter email.

It's a bit difficult to find the MailChimp option to create a welcome message. Strangely, MailChimp considers a welcome message a "form." Here's how to find it. On the MailChimp "Lists" page, click the "down arrow" for a list and click "Signup forms." Then click "General forms." On the "Create Forms" page, there is a drop-down list of "Forms & Response Emails." The gray box shows "Signup form." Click the down arrow. Select the menu item named "Final 'Welcome' Email" and you'll be able to create a welcome message.

Git

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "mailing list"  
$ git push
```

Our tutorial application is feature complete.

Let's deploy it so we can see it running as a real website.

Chapter 21

Deploy

You've been running the default Ruby WEBrick server on your local machine. If you wanted, you could leave your computer running, set up a [managed DNS service](#), and your web application would be accessible to anyone. But even if you wanted to leave your computer running 24 hours a day, you're probably not a security expert, WEBrick isn't tuned to handle much traffic, and your computer is distant from the interconnection hubs where most websites are hosted. For these reasons, when we move a web application from development to production, we deploy it to a [web hosting service](#) that provides a hosting platform on a server located in a strategically-located [data center](#).

Data centers offer [colocation services](#), renting rack-mounted computers with fast Internet connections that can be configured as web servers. In the early days of the web, deploying a web application required [system administration](#) skills to configure and maintain a web server. Today, some developers like to set up their web servers "from bare metal" using [virtual private servers](#) from Linode, Slicehost, Rackspace, Amazon EC2, or others. With sufficient skills and study, they say there is a feeling of satisfaction from doing it yourself. But not everyone wants to be a system administrator. Most Rails developers simply use a hosted [platform as a service](#) (PaaS) provider such as [Heroku](#), [Engine Yard](#), [OpenShift](#), [Cloud Foundry](#), or [Shelly Cloud](#).

You may already be using a [shared web hosting](#) service such as GoDaddy or

DreamHost for a static website or WordPress site. Be skeptical if a shared web hosting service claims to support Rails applications; most do so badly. Shared hosting services offer file space for static websites on servers that are shared by thousands of websites. A Rails application requires considerably greater computing resources and specialized expertise. A PaaS platform provides a hardware and software stack optimized for application performance and developer convenience.

[Heroku](#) is the best known and most popular PaaS provider and we'll use it to deploy the tutorial application. Using Heroku or another PaaS provider means you don't need skills as a system administrator to manage your web server. Instead, you'll have experts maintaining the production environment, tuning system performance, and keeping the servers running.

Heroku Costs

It costs nothing to set up a Heroku account and deploy as many applications as you want. You'll pay only if you upgrade your hosting to accommodate a busy website.

Heroku pricing is based on a measure of computing resources the company calls a “dyno.” Think of a dyno as a virtual server (though it is not). Heroku provides one dyno for every web application for free. For personal projects, you can run your Rails application on a single dyno and never incur a charge.

A single dyno idles after one hour of inactivity, “going to sleep” until it receives a new web request. For a personal project, this means your web application will respond with a few seconds delay if it hasn't received a web request in over an hour. After it wakes up, it will respond quickly to every browser request.

If you want your web application to respond to every request without delay, you can run two dynos. Heroku charges \$35 per month for a second dyno running full time (a dyno is billed at \$0.05/hour).

A single dyno can serve thousands of requests per second, but performance

depends greatly on your application. With the Ruby WEBrick server, Rails processes only one request at a time. Heroku doesn't support WEBrick, but as a default it supports [Thin](#), a similar “single-threaded, non-concurrent” web server. Serving a typical Rails application that takes 100ms on average to process each request, Thin can accommodate about 10 requests per second per dyno, which is adequate for a personal project.

If traffic surges on your website and exceeds 10 requests per second, you can scale up. First, you can use the [Unicorn](#) web server which handles *concurrent* requests. Configuring Unicorn requires some expertise, but [Heroku recommends it](#). Second, you can double the size of Heroku's dynos to handle more requests. Finally, you can buy more dynos, adding as many dynos as you need to handle traffic. This is where convenience comes at a price. You won't need system administration expertise to deploy a website on Heroku but you'll pay a premium to host a high-traffic site.

Heroku is ideal for hosting our application:

- no system administration expertise is required
- hosting is free
- performance is excellent

For this tutorial application, we won't concern ourselves with the possibility that the website may get a lot of traffic. I'm sure you'll join me in offering hearty thanks to Heroku for providing a convenient service that beginners can use for free.

Let's deploy!

Test the Application

Before deploying an application to production, a professional Rails developer runs *integration* or *acceptance* tests. If the developer follows the discipline of

test-driven development, he or she will have a complete test suite that confirms the application runs as expected. Often the developer uses a *continuous integration* server which automatically runs the test suite each time the code is checked into the GitHub repository.

We haven't used test-driven development to build this application so no test suite is available. You've tested the application manually at each stage.

Preparing for Heroku

You'll need to prepare your Rails application for deployment to Heroku.

Gemfile

We need to modify the Gemfile for Heroku.

We add a **group :production** block for gems that Heroku needs:

- **pg** - PostgreSQL gem
- **thin** - web server
- **rails_12factor** - logging and static assets

Heroku doesn't support the SQLite database; the company provides a PostgreSQL database. Though we won't need it for our tutorial application, we must include the PostgreSQL gem for Heroku. We'll mark the **sqlite3** gem to be used in development only.

Note that **Heroku recommends Unicorn** for handling higher levels of traffic efficiently. Unicorn can be difficult to setup and configure, so we'll simple use the default WEBrick server for our tutorial application.

On Heroku, Rails needs an extra gem to handle logging and serve CSS and JavaScript assets. The [rails_12factor](#) gem provides these services.

Open your **Gemfile** and replace the contents with the following:

Gemfile

```
source 'https://rubygems.org'
ruby '2.3.0'
gem 'rails', '4.2.5'
gem 'sass-rails', '~> 5.0'
gem 'uglifier', '>= 1.3.0'
gem 'coffee-rails', '~> 4.1.0'
gem 'jquery-rails'
gem 'turbolinks'
gem 'jbuilder', '~> 2.0'
group :development, :test do
  gem 'byebug'
  gem 'web-console', '~> 2.0'
  gem 'spring'
end
gem 'foundation-rails'
gem 'gibbon'
gem 'high_voltage'
gem 'simple_form'
group :development do
  gem 'better_errors'
  gem 'quiet_assets'
  gem 'rails_layout'
  gem 'sqlite3'
end
group :production do
  gem 'pg'
  gem 'rails_12factor'
end
```

If you've got Rails 4.2.5, there's no need to make additional changes to the Gemfile. If you've got a newer version of Rails, update the Gemfile.

We have to run **bundle install** because we've changed the Gemfile. The gems we've added are only needed in production so we don't install them on our local machine. When we deploy, Heroku will read the Gemfile and install the gems in the production environment. We'll run **bundle install** with the **-without production** argument so we don't install the new gems locally:

```
$ bundle install --without production
```

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "gems for Heroku"  
$ git push
```

Precompile Assets

The [rails_12factor](#) gem automatically runs the `rake assets:precompile` command when you deploy to Heroku, so it isn't strictly necessary to precompile assets yourself. However, it is important to understand that assets must be precompiled before deployment.

We compile assets so we have one file each for all the files in the folders **app/assets/javascripts/** and **app/assets/stylesheets/**. It makes our application faster for the user.

In development mode, the Rails asset pipeline “live compiles” all CSS and JavaScript files. Compiling assets adds processing overhead. In production, a web application would be slowed unnecessarily if assets were compiled for every web request. Consequently, assets must be precompiled before we deploy our application to production.

When assets are precompiled, the Rails asset pipeline will automatically produce concatenated and minified **application.js** and **application.css** files from files listed in the manifest files **app/assets/javascripts/application.js** and **app/assets/stylesheets/application.css**.

Here's how to precompile assets and commit to the Git repo (if you want to do it manually):

```
$ rake assets:precompile
$ git add -A
$ git commit -m "assets compiled for Heroku"
$ git push
```

The result will be several files added to the **public/assets/** folder. The filenames will contain a long unique identifier that prevents caching when you change the application CSS or JavaScript.

Again, the [rails_12factor](#) gem runs the **rake assets:precompile** command when you deploy to Heroku, so you don't have to do it yourself.

Option to Ban Spiders

Do you want your website to show up in Google search results? If there's a link anywhere on the web to your site, within a few days (sometimes hours) the Googlebot spider will visit your site and add it to the database for the Google search engine. Most webmasters want their sites to be found in Google search results. If that's not what you want, you may want to modify the file **public/robots.txt** to prevent indexing by search engines.

Only change this file if you want to prevent your website from appearing in search engine listings:

```
# See http://www.robotstxt.org/robotstxt.html for documentation
#
# To ban all spiders from the entire site uncomment the next two lines:
# User-agent: *
# Disallow: /
```

To block all search engine spiders, remove the commenting from the **User-Agent** and **Disallow** lines.

You can learn more about the format of the [robots exclusion standard](#).

Humans.txt

Many websites include a **robots.txt** file for nosy bots so it's only fair that you offer a **humans.txt** file for nosy people. Few people will look for it but you can add a file **public/humans.txt** to credit and identify the creators and software behind the website. The HTML5 Boilerplate project offers an [example file](#) or you can [borrow from RailsApps](#).

Sign Up for a Heroku Account

In the chapter, “Accounts You May Need,” I suggested you sign up for a Heroku account.

To deploy an app to Heroku, you must have a Heroku account. Visit <https://id.heroku.com/sign-up> to set up an account.

Be sure to use the same email address you used to configure Git locally. You can check the email address you used for Git with:

```
$ git config --get user.email
```

Heroku Toolbelt

Heroku provides a command line utility for creating and managing Heroku apps.

Visit <https://toolbelt.heroku.com/> to install the Heroku Toolbelt. A one-click installer is available for Mac OS X, Windows, and Linux.

The installation process will install the Heroku command line utility. It also installs the [Foreman](#) gem which is useful for duplicating the Heroku production environment on a local machine. The installation process will also make sure Git is installed.

To make sure the Heroku command line utility is installed, try:

```
$ heroku version  
heroku-toolbelt/...
```

You'll see the heroku-toolbelt version number.

You should be able to login using the email address and password you used when creating your Heroku account:

```
$ heroku login  
Enter your Heroku credentials.  
Email: adam@example.com  
Password:  
Could not find an existing public key.  
Would you like to generate one? [Yn]  
Generating new SSH public key.  
Uploading ssh public key /Users/adam/.ssh/id_rsa.pub
```

The Heroku command line utility will create SSH keys if necessary to guarantee a secure connection to Heroku.

Heroku Create

Be sure you are in your application root directory and you've committed the tutorial application to your Git repository.

Use the Heroku create command to create and name your application.

```
$ heroku create myapp
```

Replace **myapp** with something unique. Heroku demands a unique name for every hosted application. If it is not unique, you'll see an error, "name is already taken." Chances are, "learn-rails" is already taken.

If you don't specify your app name (**myapp** in the example above), Heroku will supply a placeholder name. You can easily change Heroku's placeholder name to a name of your choice with the **heroku apps:rename** command (see [Renaming Apps from the CLI](#)).

Don't worry too much about getting the "perfect name" for your Heroku app. The name of your Heroku app won't matter if you plan to set up your Heroku app to use your own domain name. You'll just use the name for access to the instance of your app running on the Heroku servers; if you have a custom domain name, you'll set up DNS (*domain name service*) to point your domain name to the app running on Heroku.

The **heroku create** command sets your Heroku application as a Git remote repository. That means you'll use the **git push** command to deploy your application to Heroku.

Enable Email

You'll need to enable email for production or else you'll get errors when your application tries to send email from Heroku.

To use Mandrill from Heroku, add the following to your **config/environments/production.rb** file:

```
# email enabled in production
config.action_mailer.default_url_options = { :host => Rails.application.secrets.domain_name }
config.action_mailer.delivery_method = :smtp
config.action_mailer.perform_deliveries = true
config.action_mailer.raise_delivery_errors = false
config.action_mailer.smtp_settings = {
  address: "smtp.mandrillapp.com",
  port: 587,
  user_name: Rails.application.secrets.mandrill_username,
  password: Rails.application.secrets.mandrill_api_key
}
```

Be sure to add the new settings before the **end** keyword in the file. The settings

can be added anywhere, as long as they precede the **end** keyword!

You'll need to specify the unique name you've selected for your hosted application. We're using the **Rails.application.secrets.domain_name** configuration variable in two places in the file. The **config/secrets.yml** file sets configuration variables for use in production, which are obtained from Heroku environment variables.

Be sure to commit your code to the Git local repository:

```
$ git add -A
$ git commit -m "email set for Heroku"
$ git push
```

Next we'll set Heroku environment variables.

Set Heroku Environment Variables

You'll need to set Heroku environment variables to provide configuration values for the **config/secrets.yml** file. Heroku doesn't have a **.bashrc** or **.bash_profile** file, so you'll set environment variables on Heroku with **heroku config:add**.

```
$ heroku config:add MANDRILL_USERNAME='MyUsername' MANDRILL_API_KEY='my-key'
$ heroku config:add MAILCHIMP_API_KEY='my-key' MAILCHIMP_LIST_ID='mylistid'
$ heroku config:add OWNER_EMAIL='me@example.com' DOMAIN_NAME='myapp.herokuapp.com'
```

When you set **myapp.herokuapp.com**, replace **myapp** with the name that Heroku is using for your application. If you want to use a custom domain name, you'll need to set up DNS (*domain name service*), which we won't cover in this tutorial.

You don't need to set **SECRET_KEY_BASE**, even though it is in your **config/secrets.yml** file. Heroku sets it automatically.

Check that the environment variables are set with:


```
$ heroku config
```

See the Heroku documentation on [Configuration and Config Vars](#) and the article [Rails Environment Variables](#) for more information.

Push to Heroku

After all this preparation, you can finally push your application to Heroku.

Be sure to commit any recent changes to the Git local repository before you push to Heroku.

You commit your code to Heroku just like you push your code to GitHub.

Here's how to push to Heroku:

```
$ git push heroku master
```

You may see a message, “The authenticity of host ‘heroku.com’ can’t be established. Are you sure you want to continue connecting (yes/no)?”. You can answer “yes” and safely continue.

The push to Heroku takes several minutes. You’ll see a sequence of diagnostic messages in the console, beginning with:

```
-----> Ruby app detected
```

and finishing with:

```
-----> Launching... done
```

Updating the Application

It is likely you'll make changes to your application after deploying to Heroku.

Each time you update your site and push the changes to GitHub, you'll also have to push the new version to Heroku.

If you've changed anything in the **assets** folder (including images, JavaScript, or stylesheets), you'll need to precompile assets. A typical update scenario looks like this:

```
$ git add -A
$ git commit -m "revised application"
$ RAILS_ENV=production rake assets:precompile
$ git add -A
$ git commit -m "assets compiled for Heroku"
$ git push
$ git push heroku master
```

Visit Your Site

Your application will be running at <http://my-app-name.herokuapp.com/>. You can open any web browser and visit the site. For a shortcut, you can open your default web browser and visit your site from the command line:

```
$ heroku open
```

If you're using hosted development such as Cloud9, you'll need to open a browser manually to visit the site.

If you've configured everything correctly, you should be able to sign up for the newsletter and send a contact request.

Customizing

For a real application, you'll likely want to use your own domain name for your app.

See [Heroku's article about custom domains](#) for instructions.

You may also want to improve website responsiveness by adding page caching with a content delivery network such as [CloudFlare](#). CloudFlare can also provide an SSL connection for secure connections between the browser and server.

Heroku offers many [add-on services](#). These are particularly noteworthy:

- [Adept Scale](#) - automated scaling of Heroku dynos
- [New Relic](#) - performance monitoring

For an in-depth look at your options, see the [Rails Heroku Tutorial](#).

Troubleshooting

When you get errors, troubleshoot by reviewing the log files:

```
$ heroku logs
```

If necessary, use the Unix **tail** flag to monitor your log files. Open a new terminal window and enter:

```
$ heroku logs -t
```

to watch the server logs in real time.

Where to Get Help

Your best source for help with Heroku is [Stack Overflow](#). Use the tag “heroku,” “learn-ruby-on-rails,” or “railsapps” when you post your question. Your issue may have been encountered and addressed by others.

You can also check the [Heroku Dev Center](#) or the [Heroku Google Group](#).

Chapter 22

Analytics

In earlier chapters, we built the tutorial application and deployed it for hosting on Heroku.

We've left something out. Though not obvious, it's very important: analytics.

Analytics services provide reports about website traffic and usage.

You'll use the data to increase visits and improve your site. Analytics close the communication loop with your users; your website puts out a message and analytics reports show how visitors respond.

Google Analytics is the best known tracking service. It is free, easy to use, and familiar to most web developers. In this chapter we'll integrate Google Analytics with the tutorial application.

There are several ways to install Google Analytics for Rails. The article on [Analytics for Rails](#) looks at various approaches and explains how Google Analytics works.

For this tutorial, we'll use the [Segment.io](#) service. The service provides an API to send analytics data to dozens of different services, including Google Analytics.

Segment.io

[Segment.io](#) is a subscription service that gathers analytics data from your application and sends it to dozens of different services, including Google Analytics. The service is free for low- and medium- volume websites, providing 100,000 API calls (page views or events) per month at no cost. There is no charge to sign up for the service.

Using Segment.io means you install one JavaScript library and get access to reports from dozens of analytics services. You can [see a list of supported services](#). The company offers helpful advice about [which analytics tools to choose from](#). For low-volume sites, many of the analytics services are free, so Segment.io makes it easy to experiment and learn about the available analytics tools. The service is fast and reliable, so there's no downside to trying it.

Accounts You Will Need

You will need an account with Segment.io. [Sign up for Segment.io](#).

You will need accounts with each of the services that you'll use via Segment.io.

You'll likely want to start with Google Analytics, so you'll need a Google Analytics account and tracking ID.

Visit the [Google Analytics website](#) to obtain the Tracking ID for your website. You'll need to know the domain name of your website to get an account for your website. If you've deployed to Heroku without a custom domain, use the domain that looks like "myapp.herokuapp.com". Or use your custom domain if you have one. Use it for fields for "Website Name," "Web Site URL," and "Account Name."

Choose the defaults when you create your Google Analytics account and click "Get Tracking ID." Your tracking ID will look like this: **UA-XXXXXXX-XX**. You won't need the tracking code snippet as we will use the Segment.io JavaScript snippet instead.

You'll check your Google Analytics account later to verify that Google is collecting data.

Installing the JavaScript Library

Segment.io provides a JavaScript snippet that sets an API token to identify your account and installs a library named **analytics.js**. This is similar to how Google Analytics works. The Segment.io library loads asynchronously, so it won't affect page load speed.

The Segment.io JavaScript snippet should be loaded on every page and it can be included as an application-wide asset using the Rails asset pipeline.

We'll add the Segment.io JavaScript snippet to a file named **app/assets/javascripts/segmentio.js**. The manifest directive `//= require_tree .` in the file **app/assets/javascripts/application.js** will ensure that the new file is included in the concatenated application JavaScript file. If you've removed the `//= require_tree .` directive, you'll have to add a directive to include the **app/assets/javascripts/segmentio.js** file.

Create a file **app/assets/javascripts/segmentio.js** and include the following:

```
// Create a queue, but don't obliterate an existing one!
window.analytics || (window.analytics = []);

// A list of all the methods in analytics.js that we want to stub.
window.analytics.methods = ['identify', 'track', 'trackLink', 'trackForm',
  'trackClick', 'trackSubmit', 'page', 'pageview', 'ab', 'alias', 'ready',
  'group', 'on', 'once', 'off'];

// Define a factory to create queue stubs. These are placeholders for the
// "real" methods in analytics.js so that you never have to wait for the library
// to load asynchronously to actually track things. The `method` is always the
// first argument, so we know which method to replay the call into.
window.analytics.factory = function (method) {
  return function () {
    var args = Array.prototype.slice.call(arguments);
    args.unshift(method);
    window.analytics.push(args);
    return window.analytics;
  };
};
```



```

};

// For each of our methods, generate a queueing method.
for (var i = 0; i < window.analytics.methods.length; i++) {
  var method = window.analytics.methods[i];
  window.analytics[method] = window.analytics.factory(method);
}

// Define a method that will asynchronously load analytics.js from our CDN.
window.analytics.load = function (apiKey) {

  // Create an async script element for analytics.js based on your API key.
  var script = document.createElement('script');
  script.type = 'text/javascript';
  script.async = true;
  script.src = ('https:' === document.location.protocol ? 'https://' : 'http://') +
    'd2dq2ahtl5z1lz.cloudfront.net/analytics.js/v1/' + apiKey + '/analytics.min.js'

  // Find the first script element on the page and insert our script next to it.
  var firstScript = document.getElementsByTagName('script')[0];
  firstScript.parentNode.insertBefore(script, firstScript);
};

// Add a version so we can keep track of what's out there in the wild.
window.analytics.SNIPPET_VERSION = '2.0.8';

// Load analytics.js with your API key, which will automatically load all of the
// analytics integrations you've turned on for your account. Boosh!
window.analytics.load('YOUR_API_TOKEN');

// Make our first page call to load the integrations. If you'd like to manually
// name or tag the page, edit or move this call to use your own tags.
/* */
window.analytics.page();

// accommodate Turbolinks
// track page views and form submissions
$(document).on('ready page:change', function() {
  console.log('page loaded');
  analytics.page();
  analytics.trackForm($('#new_visitor'), 'Signed Up');
  analytics.trackForm($('#new_contact'), 'Contact Request');
})

```

If you find you can't copy this code from this page, you can get it directly from [Segment.io](#), or use a [file](#) from the tutorial application on GitHub.

The Segment.io website offers a minified version of the snippet for faster page loads. We've used the non-minified version so you can read the code and com-

ments. If you want, you can get minified version from the Segment.io website for improved speed.

You **must** replace **YOUR_API_TOKEN** with your Segment.io API token. You can find the API token on your “Settings” page when you [log in to Segment.io](#) (it is labelled “Your API Key”). Add it to the file where you see this line:

```
// Load analytics.js with your API key, which will automatically load all of the
// analytics integrations you've turned on for your account. Boosh!
window.analytics.load('YOUR_API_TOKEN');
```

We’ve added extra code to the minified Segment.io JavaScript snippet. The extra code accommodates page view and event tracking, which we’ll look at next.

Page View Tracking with Turbolinks

Rails 4.0 introduced a feature named [Turbolinks](#) to increase the perceived speed of a website.

Turbolinks makes an application appear faster by only updating the body and the title of a page when a link is followed. By not reloading the full page, Turbolinks reduces browser rendering time and trips to the server.

With Turbolinks, the user follows a link and sees a new page but Segment.io or Google Analytics thinks the page hasn’t changed because a new page has not been loaded. To resolve the issue, you could disable Turbolinks by removing the turbolinks gem from the Gemfile. However, it’s nice to have both the speed of Turbolinks and tracking data, so I’ll show you how get tracking data with Turbolinks.

To make sure every page is tracked when Rails Turbolinks is used, we’ve already appended the following JavaScript to the **app/assets/javascripts/segmentio.js** file:

```
// accommodate Turbolinks
// track page views and form submissions
$(document).on('ready page:change', function() {
  .
  .
  .
  analytics.page();
  .
  .
  .
})
```

We've added it at the end of the file.

Turbolinks fires a **page:change** event when a page has been replaced. The code listens for the **page:change** event and calls the Segment.io **analytics.page()** method. This code will work even on pages that are not visited through Turbolinks (for example, the first page visited).

Event Tracking

Segment.io gives us a convenient method to track page views. Page view tracking gives us data about our website traffic, showing visits to the site and information about our visitors.

It's also important to learn about a visitor's activity on the site. Site usage data helps us improve the site and determine whether we are meeting our business goals. This requires tracking events as well as page views.

The Segment.io JavaScript library gives us two methods to track events:

- **trackLink**
- **trackForm**

Link tracking can be used to send data to Segment.io whenever a visitor clicks a link. It is not useful for our tutorial application because we simply record a new

page view when a visitor clicks a link on our site. However, if you add links to external sites and want to track click-throughs, you could use the **trackLink** method. The method can also be used to track clicks that don't result in a new page view, such as changing elements on a page.

The **trackForm** method is more useful for our tutorial application. We've already appended it to the **app/assets/javascripts/segmentio.js** file:

```
// accommodate Turbolinks
// track page views and form submissions
$(document).on('ready page:change', function() {
  console.log('page loaded');
  analytics.page();
  analytics.trackForm($('#new_visitor'), 'Signed Up');
  analytics.trackForm($('#new_contact'), 'Contact Request');
})
```

I've included a **console.log('page loaded')** statement so you can check the browser JavaScript console to see if the code runs as expected.

The **trackForm** method takes two parameters, the ID attribute of a form and a name given to the event.

Form tracking will show us how many visitors sign up for the newsletter or submit the contact request form. Obviously we can count the number of subscribers in MailChimp or look in the site owner's inbox to see how many contact requests we've received. But form tracking helps us directly correlate the data with visitor data. For example, we can analyze our site usage data and see which traffic sources result in the most newsletter sign-ups.

You can read more about the Segment.io JavaScript library in the [Segment.io documentation](#).

Segment.io Integrations

After installing the Segment.io JavaScript snippet in your application, visit the Segment.io integrations page to select the services that will receive your data.

When you [log in to Segment.io](#) you will see a link to “Integrations” in the navigation bar.

Each service requires a different configuration information. At a minimum, you’ll have to provide an account identifier or API key that you obtained when you signed up for the service.

For Google Analytics, enter your Google Analytics tracking id. It looks like **UA-XXXXXXX-XX**.

Click “Dashboard” in the navigation bar so you can monitor data sent to Segment.io from your application.

When you test the application locally, you should see the results of page visits and form submissions within seconds in the Segment.io Dashboard.

With Google Analytics enabled as a Segment.io integration, you’ll see form submissions appear in the Google Analytics Real-Time report, under the “Events” heading.

Note that Google doesn’t process their data in real-time in most of its reports. Data appears immediately in the Google Analytics Real-Time report. Other Google Analytics reports, such as the Audience report, won’t show data immediately. Check the next day for updated reports.

Deploy

When you are ready to deploy to Heroku, you must recompile assets and commit to the Git repo:

```
$ git add -A
$ git commit -m "analytics"
$ rake assets:precompile
$ git add -A
$ git commit -m "assets compiled for Heroku"
$ git push
```

Then you can deploy to Heroku:

```
$ git push heroku master
```

When you visit the site, you should see real-time tracking of data sent to Segment.io in the Segment.io dashboard.

Log into your Google Analytics account to see real-time tracking of visits to your website. Under “Standard Reports” see “Real-Time Overview.” You’ll see data within seconds after visiting any page.

Improving the User Experience

Website analytics can be used to improve visitors’ experience of the website. Deploying the website is not the last step in your project. Unlike many earlier forms of communication (such as releasing a film, publishing a book, or broadcasting an advertisement), we can see how every visitor responds to the website. That means your work is not done when you deploy the site. Look at your usage data to see which elements of the site are getting attention and which are being used.

Does no one visit the “About” page? Maybe the navigation link is difficult to find. Do many people visit the Contact page but few submit a contact request form? Maybe you should change the label on the button or offer other ways to contact the site owner.

Effective and successful websites often are the result of systematic [A/B testing](#) (sometimes called *split testing*). A/B testing is a technique of creating variations on a web page, such as changing text, layout, or button colors, and using website analytics to measure the effect of the change. You can learn more about services such as [Content Analytics](#) in Google Analytics, [Optimizely](#), or [Visual Website Optimizer](#). These services provide complete “dashboards” to set up usage experiments and measure results ([Optimizely](#) is available as a Segment.io integration).

Conversion Tracking

You may only be interested in knowing that people visit your site, without measuring visitors' engagement or response to the site. But in most cases, if you build a website, you'll offer a way for visitors to respond, whether it is by purchasing a product, signing up for a newsletter, or clicking a "like" button.

The ultimate measure of website effectiveness is the [conversion rate](#). The term comes from the direct marketing industry and originally referred to a measure of how people responded to "junk mail" offers. For a website, the conversion rate indicates the proportion of visitors who respond to a *call to action*, which may be an offer to make a purchase, register for a membership, sign up for a newsletter, or any other activity which shows the visitor is engaged and interested.

For our tutorial application, we can measure our website effectiveness by looking at the conversion rate for newsletter sign-ups.

We're tracking page views which will give us a count of visits to the website home page. And we've got event tracking in place to count newsletter sign-ups. If 100 people visit the home page and 10 people request a newsletter, we've got a conversion rate of 10%.

We can try to improve the conversion rate by improving the user experience (perhaps through A/B testing) or focusing on increasing traffic from sources that provide a higher conversion rate.

You can monitor your site's conversion rate by [setting up events as goals](#) in Google Analytics. Segment.io also integrates with many services which provide conversion tracking.

Enjoy What You've Achieved

You've completed building the tutorial application.

If your project was to build an application for someone else, whether the company you work for, or a client like Foobar Kadigan, you've completed the [deliverable](#).

You started with project planning, in the form of user stories. You implemented the application using a variety of technologies supported by the Ruby on Rails development platform. And you've deployed the application for others to use, with analytics in place to track traffic and usage.

Not every manager or client will appreciate the effort or the complexity of the project you've built. Mr. Kadigan's happiness may depend on how well you've understood his goals and the degree to which you've met his expectations. If you're working for yourself, or launching your startup, you may be your own toughest boss, because there is always more to do.

With technology projects, like many other aspects of life, though it seems you'll never get it right, and never get it done, there are moments when you can savor a sense of accomplishment. This is one of those moments.

Before you start thinking about adding one more feature, or updating the application for the new releases that inevitably came out during the time you were working, take time to bask in the satisfaction of seeing the results of your work.

Software development has its own unique rhythm of frustration and satisfaction. As software developers, we subject ourselves to hours, days, or weeks of struggle with code that is cryptic and resists understanding. We gain mastery for a few minutes and then turn to the next problem. With each feature you implement, or issue you resolve, you'll experience brief elation before resuming the grind of development. But at each milestone, and at the completion of the project, you've built something tangible that you can use. You can try it out yourself and show it to others.

Give yourself full credit. You've built something extraordinary with little more than intelligence and attention. You've leveraged the work of other developers who have contributed to the open source Ruby on Rails platform and you've created your own unique product. This is what drives us as developers; to create something from nothing, using only our collective intelligence and ambition.

Chapter 23

Testing

You don't need to read this chapter if you will always be a student, or a hobbyist, working on personal projects. But if you wish to work as a professional Rails developer, or launch your own startup, with money and reputation at stake, you must learn about testing. In this chapter, I'll introduce the basic concepts of testing and show how to build a test suite for the tutorial application.

Why Test?

Software applications are fragile. When you write a song, you can include a wrong note and the song won't break. In a film, technical flaws like a "jump cut" or a microphone in the frame won't ruin an entire movie. But an unseen error in a software program can disrupt a key feature or crash the entire application.

Software applications are never finished. Songs and movies reach a stage of completion and are delivered to their audience, with no expectation that the completed work will change. With software applications, there's always an upcoming version with bug fixes or new features. As web developers, we continue to make changes to the applications that our customers are actively using.

Sometimes new features are delivered within minutes, or hours, of committing new code to the repository.

Software applications are complex. A web application, or any software program, is a machine with intricately connected parts, or *dependencies*. As an application grows, the connections quickly grow more complex, to the point where no one is able to see all the dependencies at once. Plus, web applications are often a collaborative effort, so no one person is familiar with every line of code.

Combine the evolving nature of an application, with the complexity of the product, and the likelihood that flaws will be immediately noticed by users, and you'll realize why testing is so important to the software development process.

Testing was once considered the sole responsibility of a *quality assurance* (QA) department. Senior developers created new features or fixed bugs. When the work was “done,” lesser paid (and lower status) developers “in QA” clicked through screens, with written notes or scripts, as if they were users testing every feature of a program. Invariably, manual testing led to oversights, because testing notes were out of date, “edge cases” were overlooked, and the work was monotonous. In the best-run companies, QA engineers are now expert consultants on testing methods and a source of guidance for other developers. We now rely on *automated testing*. Even more important, the job of writing test code now belongs to the developer who creates a feature or fixes a bug. It's our responsibility to write adequate tests for any code we add to the repository.

What Are Tests?

Developers talk about testing as if it were an activity different from writing code. It is not. Testing is something we do while writing code. We create tests with the same text editor we use to write code. The tests themselves are written in Ruby, just like any other part of a Rails application. You'll put the test code in either a **tests/** or **spec/** folder, committed to the Git repository with all the other code. You'll use the specialized API of a testing framework

for the methods of your tests, either [Minitest](#) or [RSpec](#). Test code is different from code that implements features in one significant way: Instead of supporting interactions with a user, test code interacts with the code you’ve written, verifying the code behaves as intended.

Scripted or Exploratory

When testing is used for quality assurance, the goal is to create a suite of automated tests that will reveal any bugs that creep into code and break the application. Sometimes this is called *scripted testing*. These tests are checked into the software repository and maintained with the application. Often developers will set up a system for *continuous integration* (CI), which will automatically run the test suite whenever the repository is updated. Developers can set up a CI server such as [Jenkins](#) or use a hosted CI service such as [Travis CI](#), [CircleCI](#), or [Semaphore](#) to run tests automatically. Automated testing with continuous integration serves as a safety net for developers.

There is another role for testing, which is often called *exploratory testing*, or *developer testing*. These tests may end up in an application test suite, but the primary purpose is to help a developer construct an application. Many developers, after gaining experience in writing tests for quality assurance, realize that writing tests can be a useful first step in figuring out how a feature should be implemented. It may seem odd to write tests first, but exploratory testing can clarify what behavior will be required, and help the developer think through alternatives and edge cases. This approach is called *test-first development*, and many developers will tell you that when you write tests first, you’ll be more satisfied; you’ll be more focused; and you’ll avoid tangents and detours of the “nice-to-have-but-not-really-needed” variety. We’ll look closely at test-first development in conjunction with Test-Driven Development (TDD) and Behavior-Driven Development (BDD) at the end of this chapter. First, let’s gain an understanding of testing terminology and practice.

Regression and Acceptance

We describe tests by the purpose they serve. In addition to exploratory testing used in test-first development, there are several kinds of tests used for quality assurance.

Regression tests are run every time we change code. Sometimes we want to make sure new features don't break the existing application. More often, we run tests after changing existing code to make it more readable, elegant, or effective. We call this tinkering "*refactoring*." Refactoring is very similar to what we call editing or rewriting when we work with the written word. Before we refactor, we need to know what results we expect from our code, and we need automated tests to execute our code and check for the expected results. If our automated tests are adequate, we can use the tests as regression tests, making sure our refactoring hasn't introduced new bugs.

Acceptance tests are sometimes identical to regression tests, and may use the same test code. The purpose is different, so we give this kind of testing a different name. Acceptance tests provide accountability and serve a management function. These are tests that determine if a feature has been implemented as expected. It is common to run acceptance tests when an outside contractor delivers code, so we can determine if the team has delivered what we requested. We can also use acceptance tests to determine if our internal team has implemented the stated requirements. Proponents of behavior-driven development claim that the process of creating acceptance tests clarifies the product requirements. Obviously, if we want adequate acceptance tests, we need to plan carefully when specifying the product requirements. If we've planned well, we can turn our user stories into automated tests that serve as acceptance tests. We discussed this process in an earlier chapter, "Plan Your Product."

Units and Integration

We also describe tests by their relationship to the rest of the code.

Unit tests probe the internal workings of the machine. If we've written our code well, a small section of the code, such as a class or a method, will be a discrete unit that can be tested independently of all other units. Unit tests inspect the integrity of small parts of the application in isolation. When a unit test fails, we can quickly identify and fix broken code.

We use *integration tests* to make sure the entire application works as expected. Integration tests mimic the behavior of real users. For a web application, an integration test may simulate a user signing in, filling out forms, clicking between pages, and verifying that contents of pages match expected results. Integration tests can also be called *feature tests* if they are designed to confirm that product features work as expected. Our feature tests can serve as acceptance tests if we use the test suite to determine if we've correctly implemented our user stories or other product specifications. Sometimes these tests are called *black box tests* because the code is tested as if the application was a black box, with the internal workings of the application hidden from the observer. They are also called *system tests* or *end-to-end tests*.

Sample Data

When we write tests, either feature tests or unit tests, we often want to check whether a method returns the data we expect. That means we have to create the data we need in advance of the test. Either we populate a database with the data we expect, or we disconnect the database and instantiate an object that provides the data we expect. Test frameworks give us a tool named a *factory* or a *fixture* to create sample data. Developers argue about what is better, factories or fixtures, but you'll encounter factories more often, particularly the popular [FactoryGirl](#) gem. A factory is an object that creates other objects. When you use FactoryGirl, you have the option of saving your object to the database (which is slow) or building your object in memory only (which is faster). Fixtures are used to populate a database with sample data before your tests run. If you use fixtures, you'll save sample data in a configuration file. Before tests run, Rails automatically loads all fixtures from configuration files

in the **test/fixtures** folder. As you gain experience with testing, you'll become familiar with both factories and fixtures.

Test Doubles

In unit testing, to isolate small parts of the application, sometimes we artificially decouple the code from the rest of the application. For example, with a unit test, we don't want to connect to an external service with an API to obtain data. Or we simply want a method to get a predictable response from another object.

Test doubles stand in for external dependencies. The term is borrowed from Hollywood, where stunt doubles stand in for actors in action scenes. A test double is any kind of pretend object used in place of a real object for testing purposes. There are two types of test doubles, *stubs* and *mocks*. Stubs provide canned answers to calls made during the test, only responding when queried by the test. Sometimes stubs record information about the call, for example, the message sent or the number of times called. Mocks are pre-programmed objects that reproduce the behavior of the object they represent, forming a specification of an object's behavior. It takes time to write stubs and mocks and lots of experience to use them correctly, so as a beginner, you probably won't write stubs and mocks without help. As you can gain experience, you'll better understand the difference between stubs and mocks and learn how to use them. For now, it is enough to recognize the terminology and remember that tests run faster and better when we reduce coupling and complexity with test doubles.

Minitest and RSpec

You've already learned that Rails developers mix and match gems to create a favorite technology *stack*. Not everyone likes ERB for view templates. Some prefer Haml or Slim syntax for mixing HTML and Ruby in a view. Developers

often stray from the default Rails stack when it comes to testing. Since the release of Ruby 1.9, [Minitest](#) has been supplied as a standard gem with all Ruby installations. Yet most Rails developers use [RSpec](#) for testing.

In this tutorial, I'll use Minitest to introduce you to testing. Minitest is easier to set up and offers a syntax that is very similar to RSpec. Some developers say that there is no reason to use RSpec because Minitest provides almost all the convenience of RSpec with smaller size, faster speed, and less complexity. Other developers insist that RSpec is more expressive and flexible. Realistically, if you want a job working on most Rails teams, you'll need to learn RSpec. Get started with Minitest to learn the basics of testing. When you're ready for the next step, I've written an [RSpec Tutorial](#) to take you deeper. I also recommend the books [Rails 4 Test Prescriptions](#) by Noel Rappin and [Everyday Rails Testing with RSpec](#) by Aaron Sumner.

Capybara, the Ghost in the Machine

Unit tests are simple, in principle and often in practice. The tests are just Ruby code, supplemented with methods from the test framework API. If we want unit tests for all the methods of a `User` class, we instantiate the class and write code that calls each method and verifies if the response matches our expectations. Using methods from the Minitest or RSpec test framework, we output a message that indicates whether each unit test passes or fails.

Integration tests, or feature tests, require more of a framework than unit tests. We want our tests to be as realistic as possible, as if a robot was using a web browser and interacting with our web application. Fortunately, the maintainers of the [Capybara](#) gem have created such a robot. To create integration tests, we add the Capybara gem, using it with either Minitest or RSpec. Capybara gives us a `visit` method that simulates a user visiting a page. After we call the `visit` method, Capybara gives us a `page` object and allows us to test whether the page contains the content we expect. Every Rails application relies on a layer of *middleware* named [Rack](#) that ties into a web server. Capybara

interacts with the web application, via calls to Rack, as if it was a browser making requests and receiving HTML files as a response.

When we use Capybara, by default it operates in *headless mode*, interacting directly with the Rails application via Rack. “Headless” means there is no graphical user interface (as if the absent screen was a computer’s head). In headless mode, JavaScript is unavailable. If some of our application features require JavaScript, we must set up Capybara to act as a robot using a real web browser. Capybara has a built-in *driver* (named [Selenium](#)) that gives our robot the option of automatically launching and using a real web browser for each test. By default, Capybara will use the Firefox web browser if it is installed on your computer. What you’ll see is amazing. When you run tests using Capybara with the JavaScript option, the Firefox web browser will pop open on your desktop and you’ll watch a ghost flying through your web application. With Capybara, you now have a ghostly QA department running your integration tests.

Four Phases of Feature Tests

Test code is easier to understand when you recognize that tests proceed in stages, or phases. Code that simulates a user visiting a web page tends to be organized in four phases:

- set up
- visit page
- verify page contents
- neutralize

The setup phase may include creating a user, signing in, or any other activity that creates the conditions for a test. With Capybara, the test visits the page,

which requires Capybara to simulate a browser request to the Rails application. Then, in the third stage, we check if the server response contains the data we expect. Finally, we may need to clean up, resetting the original state of the application, or removing any data the test added to the database.

Four Phases of Unit Tests

Unit tests also are organized in four stages:

- set up
- exercise
- verify
- teardown

When you test a small part of the application in isolation, you'll focus on an object or method which we call the "system under test." The setup phase prepares the system under test. Often this means instantiating an object. Here is an example:

```
user = User.new(email: 'user@example.com')
```

During the exercise phase, something is executed. Often this is a method call:

```
user.save
```

During verification, the result of the exercise is verified against the developer's expectations:

```
user.email.must_equal 'user@example.com'
```

During teardown, the system under test is reset to its initial state. Rails integrates with Minitest or RSpec to reset a database to its initial state. You will seldom write code for the teardown phase.

Now that you’ve learned about the basic concepts of testing, let’s set up Minitest for our first tests.

Set Up Minitest

We’ll set up testing with both Minitest and Capybara, so we can write both unit tests and feature tests. Minitest is a standard Ruby gem, installed when you install Ruby in your environment. We’ll install the [minitest-spec-rails](#) gem which makes it easy to use an RSpec-like syntax with Minitest. We’ll also add the [minitest-rails-capybara](#) gem to integrate Capybara with Minitest and Rails.

Open your **Gemfile** and replace the contents with the following:

Gemfile

```
source 'https://rubygems.org'
ruby '2.3.0'
gem 'rails', '4.2.5'
gem 'sass-rails', '~> 5.0'
gem 'uglifier', '>= 1.3.0'
gem 'coffee-rails', '~> 4.1.0'
gem 'jquery-rails'
gem 'turbolinks'
gem 'jbuilder', '~> 2.0'
group :development, :test do
  gem 'byebug'
  gem 'web-console', '~> 2.0'
  gem 'spring'
end
gem 'foundation-rails'
gem 'gibbon'
gem 'high_voltage'
gem 'simple_form'
```

```
group :development do
  gem 'better_errors'
  gem 'quiet_assets'
  gem 'rails_layout'
  gem 'sqlite3'
end
group :production do
  gem 'pg'
  gem 'rails_12factor'
end
group :test do
  gem 'minitest-spec-rails'
  gem 'minitest-rails-capybara'
end
```

We've added the two gems to the **test** group. Now, some gems are loaded only when we're writing code (during development), some are loaded only when the application is running on Heroku (deployed to production), and our newest additions only are loaded when we run tests. If you've got Rails 4.2.5, there's no need to make additional changes to the Gemfile. If you've got a newer version of Rails, update the Gemfile.

Next, install the additional gems:

```
$ bundle install
```

The **bundle install** command will download and install the gems from the rubygems.org server.

Configure for Capybara

Our application already has a **test/** folder containing a **test_helper.rb** file. We'll modify the helper file so we can write tests that use Capybara.

Modify the **test/test_helper.rb** file:

```
ENV['RAILS_ENV'] ||= 'test'
require File.expand_path('../../config/environment', __FILE__)
require 'rails/test_help'
require 'minitest/rails/capybara'

class ActiveSupport::TestCase
  # Setup all fixtures in test/fixtures/*.yml for all tests in alphabetical order.
  fixtures :all

  # Add more helper methods to be used by all tests here...
end
```

We've added the line `require "minitest/rails/capybara"` to allow use of the Capybara test framework methods.

Run Tests

The command `rake test` will execute Minitest. Let's see what happens when we run tests:

```
$ rake test
Run options: --seed 9073

# Running:

Finished in 0.006803s, 0.0000 runs/s, 0.0000 assertions/s.

0 runs, 0 assertions, 0 failures, 0 errors, 0 skips
```

The output shows that Minitest executes but we have no tests for it to run. Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A
$ git commit -m "set up minitest"
$ git push
```

Unit Test (Standard Syntax)

In its default form, Minitest uses the syntax of the older [test_unit framework](#) that was supplied with Ruby before version 1.9. The `test_unit` syntax uses explicit Ruby to set up tests. Here's an example of Minitest using the `test_unit` syntax:

```
require 'test_helper'

class VisitorTest < ActiveSupport::TestCase

  def valid_params
    { email: 'john@example.com' }
  end

  def test_valid
    visitor = Visitor.new valid_params
    assert visitor.valid?, "Can't create with valid params: #{visitor.errors.messages}"
  end

  def test_invalid_without_email
    params = valid_params.clone
    params.delete :email
    visitor = Visitor.new params
    refute visitor.valid?, "Can't be valid without email"
    assert visitor.errors[:email], "Missing error when without email"
  end

end
```

Notice that we must declare a class `VisitorTest` that inherits from `ActiveSupport::Test`. Then we must define a new method for each test case using the `def` keyword. This syntax is not popular with Rails developers. RSpec offers its own DSL (domain specific language) that hides the overhead of setting up classes and methods behind convenience methods. Minitest offers its own version of the the RSpec DSL, allowing us to use the more popular syntax. I'll use the new RSpec-like syntax in this tutorial, since you are likely to encounter RSpec more frequently.

Unit Test (Spec Syntax)

For our first test, let's create a simple unit test for our Visitor model. Every time we run our tests, we want to know that we're able to create a Visitor model. We'll also check that the Visitor model contains a method that returns an email address.

The default Rails directory structure already contains a **test/models/** folder. Thanks to Rails conventions, we know exactly where to create our test file.

Create a file **test/models/visitor_test.rb**:

```
require 'test_helper'

describe Visitor do

  let(:visitor_params) { {email: 'user@example.com'} }
  let(:visitor) { Visitor.new visitor_params }

  it 'is valid when created with valid parameters' do
    visitor.must_be :valid?
  end

  it 'is invalid without an email' do
    # Delete email before visitor let is called
    visitor_params.delete :email
    visitor.wont_be :valid? # Must not be valid without email
    visitor.errors[:email].must_be :present? # Must have error for missing email
  end

end
```

The test above, written in the RSpec-like syntax, is functionally identical to the previous example, written in the old `test_unit` syntax. Take a close look at both, so the structure and keywords will be familiar when you see it again.

We need `require 'test_helper'` to enable the test framework and apply any configuration settings.

The keywords `describe`, `let`, and `it` are keywords that are also used in the RSpec DSL (domain-specific language). When you see these keywords, you know you are looking at test code, either Minitest or RSpec.

The purpose of a unit test is to describe the system under test, in terms of its expected behavior. We create a `do ... end` block using the `describe` keyword and specifying a class we wish to test:

```
describe Visitor do
  .
  .
  .
end
```

Create a Test Class With Describe

The `describe` keyword creates a test class. In this case, the `describe` keyword will create a class named `VisitorTest` that inherits from `ActiveSupport::TestCase`. Using the old `test_unit` syntax, we could do this with `class VisitorTest < ActiveSupport::TestCase` but the `describe` keyword is more convenient. When Minitest runs, it recognizes and executes test classes. By including our code inside a test class, we get to use methods such as `let` and `it` which are useful for writing tests. Minitest will recognize various classes like models or controllers and provide appropriate behavior.

Setup Phase

We must set up everything we need for the test. Minitest provides a simple way to set up everything before a test using the `before` keyword:

```
before do
  do_some_setup
end
```

We could initialize the Visitor model using a `before` block and setting instance variables:


```
before do
  @visitor_params = {email: 'user@example.com'}
  @visitor = Visitor.new(visitor_params)
end
```

Instead of using a **before** block, we'll use the convenient **let** keyword:

```
let(:visitor_params) { {email: 'user@example.com'} }
let(:visitor) { Visitor.new visitor_params }
```

The **let** keyword is a specialized version of the **before** keyword. It caches the objects that you create so they are ready for every test you write in the test class. And it is *lazy-loaded*, which means it does not require any processing overhead until the first time it is used.

Do It

Each test is defined by the **it** keyword and a **do ... end** block that contains the exercise and verify phases of the test. The **it** keyword must be accompanied by a description. The description will be displayed if the test fails.

For our first test, we want to check if the Visitor model can be created when we provide a valid email address. Before the test runs, the **let** statement makes sure the Visitor object is instantiated with an email value.

The verification phase of each test consists of a comparison between the results of an operation and our expectations. We expect that each time we create a Visitor object with a valid email address, the **visitor.valid?** method will return true. We can create a test:

```
it 'is valid when created with valid parameters' do
  assert_equal visitor.valid?, true
end
```

The keyword `assert_equal` is the old `test_unit` syntax. It compares the result of `visitor.valid?` with `true` and tells Minitest the test has passed or failed.

We can write the same thing using the new RSpec-style syntax:

```
it 'is valid when created with valid parameters' do
  visitor.must_be :valid?
end
```

The method `must_be` is an *expectation*. You can see a [Minitest cheat sheet](#) with a list of all the expectation methods. As you might guess, `must_be` functions as a comparison operator, checking if a call to `visitor.valid?` returns true.

For our second test, we want to make sure the Visitor object is invalid when no email address is provided:

```
it 'is invalid without an email' do
  # Delete email before visitor let is called
  visitor_params.delete :email
  visitor.wont_be :valid? # Must not be valid without email
  visitor.errors[:email].must_be :present? # Must have error for missing email
end
```

We created the `visitor_params` hash with a `let` statement. Before we invoke the Visitor object and call the `visitor.valid?` method, we delete the email address from the `visitor_params` hash. When the Visitor object is invoked, it will be created by the `let` statement without an email address. The `wont_be` expectation confirms that the result of `visitor.valid?` method is `false`. Then we check if a validation error message is present.

At this point, don't expect to be ready to write unit tests for every model method. You'll need to spend time with the [documentation for Minitest expectations](#) or the [Minitest cheat sheet](#) to become familiar with all the possible ways to write tests. This introduction should help you recognize the syntax of tests, understand the structure, and give you the background you need to learn more about unit testing.

Run Tests

Let's run our unit tests:

```
$ rake test
Run options: --seed 53300

# Running:

..

Finished in 0.028884s, 69.2425 runs/s, 103.8637 assertions/s.

2 runs, 3 assertions, 0 failures, 0 errors, 0 skips
```

The output shows that our tests pass.

Breaking the Test

Let's see what happens if we purposefully break our Visitor model. Modify the file **app/models/visitor.rb**:

```
class Visitor
  include ActiveRecord::Model
  attr_accessor :email, :string
  # validates_presence_of :email
  # validates_format_of :email, with: /\A[-a-z0-9_+\.]+\@([[-a-z0-9]+\.)+[a-z0-9]{2,4}\z/i

  def subscribe
    mailchimp = Gibbon::Request.new(api_key: Rails.application.secrets.mailchimp_api_key)
    list_id = Rails.application.secrets.mailchimp_list_id
    result = mailchimp.lists(list_id).members.create(
      body: {
        email_address: self.email,
        status: 'subscribed'
      })
    Rails.logger.info("Subscribed #{self.email} to MailChimp") if result
  end
end
```

When you copy this, be careful to keep the long regex expression (`/^A...\Z/i`) on one line (no line breaks).

We've commented out the statements that require validation for the email attribute. Let's run the tests again:

```
$ rake test
Run options: --seed 34847

# Running:

.F

Finished in 0.013429s, 148.9314 runs/s, 148.9314 assertions/s.

  1) Failure:
Visitor#test_0002_is invalid without an email [/Users/danielkehoe/workspace/wip/learn-rails/test/models/visitor_test.rb:14:in `test_0002_is invalid without an email']
Expected # to not be valid?.

2 runs, 2 assertions, 1 failures, 0 errors, 0 skips
```

The output shows a failure. The diagnostic message displays the description of the failing test, “Visitor#test_0002_is invalid without an email”, and indicates the line number where the test failed. Now you know what a failing test looks like.

Before you continue, restore the file **app/models/visitor.rb** to its original state, and make sure the tests pass.

If you wish, you can continue writing unit tests. You could create a similar unit test for the Contact model. With more experience, or some independent research, you could create a test for the **subscribe** method in the Visitor model. This method connects to an external API, so it requires test doubles to fake the response of the external services. Our goal here is to introduce you to the concepts of testing, so we'll put aside advanced work on unit tests, and take a look at feature tests.

Feature Test

Let's start with a user story for our home page. It might seem trivial to call the home page a “feature” and describe it with a user story, but it illustrates a process that works just as well with more complex features. Here's our user story:

```
*Feature: Home page*
  As a visitor
  I want to visit a home page
  And see a welcome message
```

For our test, we know we want to visit the home page and check if the words “Stay in touch” appear on the page. This is the scenario we'll test:

```
*Scenario: Visit the home page*
  Given I am a visitor
  When I visit the home page
  Then I see "Stay in touch"
```

If you think of your application as a collection of features, and you describe each feature in terms of “As a (role), I want (goal), In order to (benefit),” and then imagine scenarios for each feature using the “Given..., When..., Then...” formula, you'll be able to write automated tests to cover every feature in the application. Let's try it for the home page.

Examine the folders within the **test/** directory. Remember that feature tests are also called integration tests. You'll see a folder **test/integration/**. That's where we'll add our feature tests.

Create a file **test/integration/home_page_test.rb**:

```
require 'test_helper'

# Feature: Home page
#   As a visitor
```

```
# I want to visit a home page
# So I can learn more about the website
feature 'Home page' do

  # Scenario: Visit the home page
  # Given I am a visitor
  # When I visit the home page
  # Then I see "Welcome"
  scenario 'visit the home page' do
    visit root_path
    page.must_have_content 'Stay in touch'
  end
end
```

I've included the user story and scenario description in comments. There's no convention to do so, but it will help you to see the relationship between testing and the product planning process. It should be easy to transform a "Given... When... Then..." scenario into the code needed for a feature test.

Feature

When we created a unit test, we used the **describe** keyword to create a test class. The **feature** keyword creates a test class that inherits from the **Capybara::Rails::TestCase** class, giving us methods such as **visit** and **page**.

Feature tests are created with a **do ... end** block using the **feature** keyword and providing a description of the feature:

```
feature 'Home page' do
  .
  .
  .
end
```

Notice that the description is placed in quotes. In this case, Minitest will automatically generate a class named **HomePageTest**.

Scenario

Typically we test a single feature with multiple scenarios in a single test file.

The **scenario** keyword is similar to the **it** keyword you’ve seen in unit tests. Each feature test is defined by the **scenario** keyword and a **do ... end** block that contains the visit and verify phases of the test. The **scenario** keyword must be accompanied by a description. The description will be displayed if the test fails.

```
scenario 'visit the home page' do
  visit root_path
  page.must_have_content 'Stay in touch'
end
```

The directive **visit** is a Capybara method that takes a URL or Rails route as an argument. You could specify either **visit '/'** or **visit root_path** to direct Capybara to retrieve the home page.

Capybara provides other *actions* in addition to **visit**. You can see the [documentation for Capybara actions](#) that include actions for filling in a form and clicking a button.

Capybara creates a **page** object for us as a response to the visit. The **page** object is a representation of the HTML file returned by the application. We can call the **must_have_content** method, testing if the string “Stay in touch” is present in the page.

Capybara gives us a collection of methods we can use to verify our expectations. The [documentation for Capybara expectations](#) provides an extensive collection of methods we can use to verify what’s on a web page. For example, **must_have_link** checks for a link. With Capybara expectations, you can check almost anything on a page. Combining Capybara actions and expectations allows you to build a powerful page-checking robot.

Run Tests

Let's run all our tests:

```
$ rake test
Run options: --seed 15723

# Running:

...

Finished in 0.165429s, 18.1347 runs/s, 24.1796 assertions/s.

3 runs, 4 assertions, 0 failures, 0 errors, 0 skips
```

We have three tests (in two test files) making four assertions, all passing.

Troubleshooting

You might get an error message:

```
rake aborted!
NoMethodError: undefined method `feature' for main:Object
```

You'll see this error message if you neglected to modify the **test/test_helper.rb** file to allow use of the Capybara test framework methods.

Breaking the Test

Let's see what happens if we purposefully break our home page. Modify the file **app/view/visitors/new.html.erb**:


```
<% content_for :title do %>Foobar Kadigan<% end %>
<% content_for :description do %>Website of Foobar Kadigan<% end %>

GO AWAY!

<%= simple_form_for @visitor do |f| %>
  <%= f.error_notification %>
  <%= f.input :email, label: false, :placeholder => 'Your email address...' %>

  <%= f.button :submit, "Sign up for the newsletter", :class => "submit" %>
<% end %>
```

We’ve changed the welcome message from “Stay in touch” to “GO AWAY!”.

Let’s run the tests again:

```
$ rake test
Run options: --seed 49810

# Running:

..F

Finished in 0.168208s, 17.8351 runs/s, 23.7801 assertions/s.

  1) Failure:
Home page Feature Test#test_0001_visit the home page [/Users/danielkehoe/workspace/wip/learn-ra
Expected to include "Stay in touch".

3 runs, 4 assertions, 1 failures, 0 errors, 0 skips
```

The output shows a failure. The diagnostic message displays the description of the failing test, “Home page Feature Test#test_0001_visit the home page”, showing a failure, “Expected to include ‘Stay in touch’.”

Before you continue, restore the file **app/view/visitors/new.html.erb** to its original state, and make sure the tests pass.

Using Capybara

There is an art to developing feature tests. You can test that all the text on the home page is exactly what you want. That would make your test files large. And your tests would be “brittle,” because any changes you made in development, even the slightest changes to the words on the page, would break your tests. For good integration tests, focus on the features that are essential to your application. For example, use the Capybara robot to make sure the user can follow a critical path through your application, visiting important pages, filling in forms, clicking buttons, and seeing results. Capybara lets you select any HTML element on a page, so you can check an ID or class attribute of an HTML tag, not just text on a page. You’ll want to be confident that application navigation and page flow continues to work after any code changes. That will serve you better than tests that tell you a word changed here or there.

Other Tests

The art of testing lies in making good choices about what to test. It’s common to write feature tests because they will test the entire application from the viewpoint of the user. It is also common to write unit tests for models because models contain much of the uniqueness of an application.

Every other aspect of a Rails application can be tested, including controllers, helpers, and views. Developers seldom write tests for every aspect of a Rails application. If your controllers contain only the standard RESTful actions, with no extra logic, you probably don’t need to write unit tests for your controllers. If you only have simple HTML markup in helpers, helpers don’t need to be tested. And views are rarely tested with unit tests (use feature tests if you want to make sure a page contains what you expect). As a beginner, you’ll make a good start if you concentrate on unit tests for models and integration tests for your page flow.

Behavior-Driven Development

In the “Plan Your Product” chapter, you learned about the software development approach called Behavior-Driven Development (BDD), or sometimes, Behavior-Driven Design. In writing the feature tests for the home page, you saw it in action. With BDD, you turn user stories into detailed scenarios that are accompanied by tests. BDD is a powerful approach for managing software development. It helps you define your product requirements, refine your project scope, and divide your project into well-defined tasks. The BDD process is complete when each feature has automated tests, when you enter **rake test** on the command line and see that every feature is implemented and functioning as expected.

You may feel lost or overwhelmed when you attempt to build a Rails application for the first time, especially if your only experience is following the step-by-step instructions of a tutorial. When you experience that panic, BDD is your lifeline. Start by writing user stories for a few simple features. Write feature tests and implement the code required to make the tests pass. As you focus on the process of writing scenarios and tests, and implementing the code for each feature, you’ll begin to gain momentum, and before you know it, you’ll be over the first hurdle.

Test-Driven Development

You can see how the BDD approach refines the product requirements and user experience. At a microscopic level, a similar discipline, named *test-driven development*, helps refine the implementation. Where BDD is driven by feature tests, TDD is focused on unit tests.

TDD is an approach to software development that emphasizes that all code should be written to be tested. Excellent test coverage, allowing easy refactoring, is not the only goal of TDD. Just as important, the developer focuses on what needs to be accomplished and thinks through alternatives and edge cases.

Some TDD aficionados say testing is a tool to write better code, and regression tests are a side effect. Unit tests are at the heart of TDD, and easiest to write when code is carefully decoupled into systems that can be tested in isolation. An application that is composed of decoupled units with clearly defined interfaces is a well-designed application that is easy to extend and maintain. If you make it a practice to write unit tests in conjunction with all the code you write, you'll write better code, and you'll be practicing TDD.

Test-First Development

Often when you are practicing TDD, you'll write tests before you write implementation code. Earlier in this chapter, I referred to *test-first development* and explained that it serves a different purpose than testing for quality assurance. In some situations, test-first development is simply exploratory testing, a means of describing the behavior of the code that must be built. Test-first development is particularly useful when you've solved a similar problem and know exactly what results to expect, making it easy to write tests before writing the implementation.

Test-first development leads to a “red-green-refactor” workflow. A developer imagines the results of an operation, writes a test that checks for the results, and runs tests which fail (with the right configuration, failing tests display as red in the console). Then the developer writes code that produces the correct results and runs the tests again, improving the code until the tests pass (displaying in green). At this point, the developer has an adequate regression test and can begin to refactor to improve the implementation, checking that the tests continue to pass. Developers like the rhythm and coherency of the “red-green-refactor” workflow. Writing tests creates discrete, manageable tasks. When tests pass, turning green, there is a feeling of satisfaction, of a job well-done. By postponing concerns about improving the code to a refactoring phase, it's easier to get the job done without trying to get it perfect. And perfection can be pursued in the refactoring phase without worrying about regressing to a broken state.

David Heinemeier Hansson, the creator of Rails, famously declared that ““TDD is dead. Long live testing.”: <http://david.heinemeierhansson.com/2014/tdd-is-dead-long-live-testing.html>” He pointed out that sometimes ardent advocates of TDD will try out an implementation before writing tests, to determine what needs to be done, or to clarify a problem. In the real world, even though developers recommend writing tests first, there are often times when a developer will write tests only after writing code and settling on an approach. TDD, which emphasizes the benefit of writing tests as a first step, doesn’t really require that you write tests before you write code, or even that you write tests for all code. The test-first emphasis of TDD is a recommendation, not a rule. You’ll be a better developer if you find opportunities to get “in the zone” with the red-green-refactor workflow of test-first development, but testing is worthwhile whether it comes first or last.

Words of Encouragement

Testing often intimidates the newcomer. It is difficult to find good examples. The syntax of Minitest and RSpec has evolved over time, so there is little consistency among examples you’ll find. Older examples are not a good guide to current practices. But once you gain familiarity with the concepts in this chapter, you can start writing tests.

Testing is one of the few things in Rails that you can jump into without getting just right. You can’t screw up your code base by writing incorrect tests. Experienced developers seem to worry that inexperienced developers will write slow tests, but in truth, a slow test is better than no test. Tests won’t affect the performance of your application in production.

If your code is clumsy, don’t worry, you’ll get better with practice. What’s most important is that you’ve begun writing tests. That’s an indication you are committed to Rails best practices.

Your tests are only “bad” if they don’t cover your code adequately or if they give you a false sense of assurance. You will only discover this over time, as

you find bugs you didn't anticipate (which is inevitable). It's better to just begin testing, even if you're not sure you're doing it right, than to not test at all.

Chapter 24

Rails Composer

I’m going to show you how to skip all the work you already did, and build a ready-to-use Rails application in less than five minutes. When you’re done with this chapter, you may wonder why you read the rest of the book.

This chapter is about [Rails Composer](#), a tool for building starter applications. Rails Composer makes building applications so easy, it feels like a guilty pleasure.

In the introductory “Create the Application” chapter, you learned that developers often use a starter application instead of assembling an application from scratch. You’ve seen how the `rails new` command gives you a rudimentary starter application. Developers typically add a front-end framework, a testing framework, and a handful of favorite gems before they get started on any custom development. Since most applications start with the same basic components, it makes sense to rely on an open source effort to stitch them together, so any integration issues or update problems are quickly resolved by the community. That’s the idea behind the [RailsApps project](#). The project provides a collection of starter applications, plus Rails Composer, a tool that creates the starter applications.

I’ve been leading the RailsApps project for several years because I think the project is very important. I may be biased, so take a look and judge for yourself.

Build ‘Learn Rails’ in Less Than Five Minutes

In less than five minutes, we can build our tutorial application using Rails Composer. It will be identical to the application you’ve built, but we’ll call it “foobar-kadigan.” It’s a new application, so if you’re still in the **workspace/learn-rails/** project directory, move up a level to the **workspace/** project directory:

```
$ cd ../  
$ pwd  
/Users/danielkehoe/workspace
```

Or jump to it directly, if it’s one level below your home directory:

```
$ cd ~/workspace  
$ pwd  
/Users/danielkehoe/workspace
```

Use the “learn-rails” gemset we created earlier:

```
$ rvm use ruby-2.3.0@learn-rails
```

Now create the “foobar-kadigan” application:

```
$ rails new foobar-kadigan -m https://raw.githubusercontent.com/RailsApps/rails-composer/master/composer.r
```

We’re using the **rails new** command and designating “foobar-kadigan” as the name for the application. The **-m** flag applies an *application template*, which is a script that generates an application. The application template can be on your local computer, or retrieved from a remote server. Rails Composer is an application template that is stored on GitHub. When you run the **rails new** command as shown above, a new Rails application is built and then modified by the Rails Composer script.

Here’s the first prompt you’ll see:

```
option  Build a starter application?
      1)  Build a RailsApps example application
      2)  Contributed applications
      3)  Custom application
choose  Enter your selection:
```

Options #2 and #3 are not for beginners. We’ll skip any contributed applications. And the “Custom application” option is strictly for experts. Enter **1** to select “Build a RailsApps example application.” You’ll see a list of available starter applications:

```
option  Choose a starter application.
      1)  learn-rails
      2)  rails-bootstrap
      3)  rails-foundation
      4)  rails-mailinglist-activejob
      5)  rails-omniauth
      6)  rails-devise
      7)  rails-devise-roles
      8)  rails-devise-pundit
      9)  rails-signup-download
     10)  rails-stripe-checkout
     11)  rails-stripe-coupons
choose  Enter your selection:
```

We’ll explore the list later. For now, enter **1** to select “learn-rails”.

```
option  Build a starter application?
      1)  Build a RailsApps example application
      2)  Contributed applications
      3)  Custom application
choose  Enter your selection:
```

Here’s your chance to get news and announcements about Rails Composer:

```
      Get on the mailing list for Rails Composer news?
option  Enter your email address:
```

Either enter your email address (if you want news) or press “return” to skip it (if you’re shy).

You’ll be asked:

```
option Use or create a project-specific rvm gemset? (y/n)
```

Enter “y” or “yes” since you are using RVM. Rails Composer will create a new gemset named “foobar-kadigan.” In less than the time it took me to write this sentence, you’ll have a new Rails application. Look for it in your folder:

```
$ ls -l
foobar-kadigan
learn-rails
```

You’ve just created a new application named “foobar-kadigan” that is almost identical to the “learn-rails” application you created from scratch. If you have a file compare tool on your computer, you can compare the folders and see that the only differences are the application name embedded in the application, plus a few configuration settings such as the secret keys in the **config/secrets.yml** file.

Try running the application.

```
$ cd foobar-kadigan
$ rails server
=> Booting WEBrick
.
.
.
```

As soon as you move into the **foobar-kadigan/** folder, RVM will automatically begin using the gemset named “foobar-kadigan.” That’s because Rails Composer created hidden **.ruby-gemset** and **.ruby-version** files.

Open a web browser window and navigate to <http://localhost:3000/>. Try it out. You'll see our new home page with the placeholder photo and the “sign up” form.

The application will be almost identical to the one you already built. Compare the project files side-by-side in your editor. The files will be nearly identical. In fact, if you made mistakes when you built the tutorial application, Rails Composer will give you the newest and most correct version of the application so you can check for your mistakes with a file compare tool.

You are probably already aware that a perfect version of the tutorial application is already on GitHub, in the [learn-rails GitHub repository](#). You could use `git clone` to get a copy to use as a starter application. The version generated by Rails Composer differs in one important respect. Rails Composer generates the application with any name you give it, so there's no need to search and change every use of the name in the application.

I hope you're not irritated that I asked you to spend hours building the “learn-rails” application, and then showed you how to build the same application in less than five minutes. I promise you the time you spent with the book is worthwhile, because you've gained a knowledge of Rails you can't get from using Rails Composer.

A Collection of Starter Applications

Since you've already built the “learn-rails” application, the identical “foobar-kadigan” application may not be interesting. Let's look at the other applications you can generate with Rails Composer.

Rails Bootstrap

The “rails-bootstrap” application provides an integration of Rails and [Bootstrap](#), the popular front-end framework. You'll recall that Bootstrap and Foun-

dation are very similar. This application gives you everything you built in this book’s chapters on “Layout and Views” and “Front-End Framework,” including flash messages and navigation, set up for Bootstrap.

You can examine the example application on GitHub, in the [rails-bootstrap](#) repository.

You can read the [Bootstrap Quickstart Guide](#) to understand the code.

Rails Foundation

The “rails-foundation” application is just like the “rails-bootstrap” application, only with [Foundation](#) instead of Bootstrap. It’s a stripped-down version of the “learn-rails” application you just built, without the contact form or mailing list sign-up. If you want to build a custom application, starting with nothing more than Foundation and an “about” page, generate the “rails-foundation” application.

You can examine the example application on GitHub, in the [rails-foundation](#) repository.

I’ve written a [Foundation Quickstart Guide](#), but it’s nearly identical to what you’ve already read in this book.

Rails Mailing List with Active Job

Rails 4.2 includes the [Active Job](#) feature for background processing. The [Mailing List with Active Job](#) tutorial explains how to use it. You can use Rails Composer to generate the [rails-mailinglist-activejob](#) starter application.

For a production website, it is smart to use Active Job for better website performance for users.

Rails OmniAuth

[OmniAuth](#) is a gem for authentication. Most web applications need a way for users to sign in, allowing access to some features of the application only for signed-in users. OmniAuth allows a user to sign in using an account they already have with a service such as Facebook, Twitter, or GitHub. If you're building an application that needs quick and easy sign-in, this is a useful starter application.

You can examine the example application on GitHub, in the [rails-omniauth](#) repository.

You can read the [OmniAuth Tutorial](#) to learn about authentication with OmniAuth.

Rails Devise

[Devise](#) is the most popular gem for authentication. Devise provides user management and authentication, letting a user sign up to create an account and log in with an email address and password. Most websites need email/password authentication, so this is a popular starter application.

You can examine the example application on GitHub, in the [rails-devise](#) repository.

You can read the [Devise Quickstart Guide](#) to learn about user management and authentication with Devise.

Rails Devise Roles

Devise is a popular gem for *authentication*, verifying a user's registered identity. In conjunction with authentication, *authorization* limits access to pages of a web application. With role-based authorization, a user can be assigned a role such as "user," "admin," or "VIP" (a "very important person"). If you want

to control access to features of the website by checking a user’s role, this is a useful starter application.

You can examine the example application on GitHub, in the [rails-devise-roles](#) repository.

You can read the [Rails Authorization Tutorial](#) to learn about authorization.

Rails Devise Pundit

To keep controllers skinny, Rails developers often use the [Pundit](#) gem for authorization. It improves upon simple role-based authorization to move access control code from controllers to separate “policy objects.” For complex applications with elegant architecture, use the “rails-devise-pundit” starter application.

You can examine the example application on GitHub, in the [rails-devise-pundit](#) repository.

You can read the [Pundit Quickstart Guide](#) to learn about authorization with Pundit.

Other Starter Applications

Recent additions to the Rails Composer collection include:

- [rails-signup-download](#)
- [rails-stripe-checkout](#)
- [rails-stripe-coupons](#)

You can use the [rails-signup-download](#) application to build a website where a user can download a PDF file after registering with an email address. Using

the code in the [Signup and Download Tutorial](#), you could customize the “learn-rails” application so visitors could download an ebook by Foobar Kadigan after they sign up for his newsletter.

[Stripe](#) is a popular service used to accept credit card payments. Stripe offers two approaches to implementing payment processing. Stripe Checkout is Stripe’s entry-level approach. Stripe Checkout competes with the button-based payment options from Google, PayPal, or Amazon, adding a pop-up payment form to any web page. Stripe Checkout is very limited because the pop-up payment form cannot be customized for use with a Rails application. Our [Stripe Checkout Tutorial](#) shows how to combine Stripe Checkout with Devise for simple applications.

[Stripe.js](#) is optimal for use with a Rails application, allowing full customization of a payment form and integration with Rails form processing. The [rails-stripe-coupons](#) application implements a payment feature using Stripe JS so a visitor pays to download a PDF file. The application accommodates promotional coupons and adds payment forms to landing pages, for real-world payment processing. Our [Stripe JS With Coupons](#) tutorial provides the details.

Rails Composer Options

If all Rails Composer did was copy example applications from GitHub repos, it would be convenient but not very interesting. When you built the “foobar-kadigan” application with Rails Composer, it simply built a replica of our tutorial application. When you build the other starter application, the options get more interesting. Rails Composer lets developers customize their starter applications for their favorite stack (we discussed stacks in the “Concepts” chapter in Book One).

Let’s see what options we get when we build the powerful [rails-devise-roles](#) starter application.

Jump to your **workspace/** folder so we can create a new application:


```
$ cd ~/workspace
$ pwd
/Users/danielkehoe/workspace
```

It’s okay to start with the “learn-rails” gemset. We have to start with a gemset that already has the Rails gem installed. After that, Rails Composer will create a new gemset for the new project.

```
$ rvm use ruby-2.3.0@learn-rails
```

Now generate the “rails-devise-roles” starter application:

```
$ rails new rails-devise-roles -m https://raw.github.com/RailsApps/rails-composer/master/compos
```

Don’t worry if some of the prompts are different from the ones I describe here. Rails Composer changes often. At the time I wrote this, I saw:

```
option  Build a starter application?
        1) Build a RailsApps example application
        2) Contributed applications
        3) Custom application
choose  Enter your selection:
```

Enter **1** to select “Build a RailsApps example application.”

```
option  Choose a starter application.
        1) learn-rails
        2) rails-bootstrap
        3) rails-foundation
        4) rails-mailinglist-activejob
        5) rails-omniauth
        6) rails-devise
        7) rails-devise-roles
        8) rails-devise-pundit
        9) rails-signup-download
       10) rails-stripe-checkout
       11) rails-stripe-coupons
choose  Enter your selection:
```

Select “rails-devise-roles” (it was #7 when I wrote this, but the list may have changed).

```
      Get on the mailing list for Rails Composer news?
option  Enter your email address:
```

Another chance to get on the mailing list. Just hit “return” if you already signed up.

```
option  Web server for development?
      1) WEBrick (default)
      2) Thin
      3) Unicorn
      4) Puma
      5) Phusion Passenger (Apache/Nginx)
      6) Phusion Passenger (Standalone)
choose  Enter your selection:
```

Our first option! We’ve always used WEBrick since it is the easiest to use for development. Choose “WEBrick” to keep things familiar.

```
option  Web server for production?
      1) Same as development
      2) Thin
      3) Unicorn
      4) Puma
      5) Phusion Passenger (Apache/Nginx)
      6) Phusion Passenger (Standalone)
choose  Enter your selection:
```

We could get fancy for deployment (for example, Heroku recommends Unicorn). Choose “Same as development” to stay in our comfort zone.

```
option  Database used in development?
      1) SQLite
      2) PostgreSQL
      3) MySQL
choose  Enter your selection:
```

We haven't explored applications that use databases in this book, but Devise and role-based authorization require saving a User model to a database. Choose "SQLite," which is built-in and ready to run in the Mac or Ubuntu environments. Developers prefer PostgreSQL for production applications, but it takes extra effort to set up, so we'll stick with SQLite for now.

```
option  Template engine?
  1)  ERB
  2)  Haml
  3)  Slim
choose  Enter your selection:
```

In this book, all our view templates were written using the ERB template language. In the "Concepts" chapter in Book One, you learned that components of Rails can be mixed for different stacks. Some developers substitute [Haml](#) or [Slim](#) for ERB. I've written an article on [Haml and Rails](#) if you'd like to know more. Choose "ERB" for now.

```
option  Test framework?
  1)  None
  2)  RSpec with Capybara
choose  Enter your selection:
```

You've had an introduction to testing with Minitest in the "Testing" chapter of this book. [RSpec](#) is popular among many developers, so Rails Composer offers an "RSpec with Capybara" option. Rails Composer will install a test suite for the [rails-devise-roles](#) application when RSpec is selected. If you are a RailsApps subscriber, you can read the [RSpec Quickstart Guide](#) to get started. Otherwise, choose "none."

```
option  Front-end framework?
  1)  None
  2)  Bootstrap 3.3
  3)  Bootstrap 2.3
  4)  Zurb Foundation 5.0
  5)  Zurb Foundation 4.0
  6)  Simple CSS
choose  Enter your selection:
```

You learned to use Foundation in this book, but maybe you'd like to see Bootstrap? Let's try it out. Choose "Bootstrap 3.3."

```
option  Add support for sending email?
  1)  None
  2)  Gmail
  3)  SMTP
  4)  SendGrid
  5)  Mandrill
choose  Enter your selection:
```

Devise will need to send email for its "forgot password" feature. Configuring email took some time for our tutorial application. Rails Composer will instantly set up everything we need to send email using our choice of services. Choose "Gmail" for now.

```
option  Devise modules?
  1)  Devise with default modules
  2)  Devise with Confirmable module
  3)  Devise with Confirmable and Invitable modules
choose  Enter your selection:
```

Choose "Devise with default modules." Devise has options, like a Confirmable module that requires users to click a link in an email message to confirm a new account. The Invitable module provides a feature that allows administrators or other users to invite users to establish accounts. We won't need these extra features.

```
option  Admin interface for database?
  1)  None
  2)  Upmin
choose  Enter your selection:
```

[Upmin](#) adds an administrative interface to a database application. Choose "None" for now.

```
option  Use a form builder gem?  
  1)  None  
  2)  SimpleForm  
choose  Enter your selection:
```

In this book, we used the [SimpleForm](#) gem to make it easy to build forms. Let's add it to the starter application by selecting "SimpleForm."

```
option  Install page-view analytics?  
  1)  None  
  2)  Google Analytics  
  3)  Segment.io  
choose  Enter your selection:
```

In our "Analytics" chapter, I said every application needs a way to analyze traffic. Let's choose "Segment.io" since we learned about it already.

```
option  Segment.io API key?
```

You can enter your Segment.io API key here, if you know it. Otherwise, hit return and you'll get a placeholder you can replace later.

```
option  Prepare for deployment?  
  1)  no  
  2)  Heroku  
  3)  Capistrano  
choose  Enter your selection:
```

This option sets up your starter application for deployment to Heroku. Choose "no" for now.

```
option  Set a robots.txt file to ban spiders? (y/n)
```

In the “Deploy” chapter you learned that you can leave your website out of Google search results with the **robots.txt** file. Let’s answer “y” or “yes” and play it safe.

```
option Create a GitHub repository? (y/n)
```

Rails Composer will create a GitHub repository for your starter application if your credentials are set up correctly. Let’s play it safe and answer “n” or “no” to skip the repository option.

```
option Use or create a project-specific rvm gemset? (y/n)
```

We’ve seen this option before. We’ve been using RVM in this book, so let’s answer “y” or “yes” and have Rails Composer create a “rails-devise-roles” gemset.

Rails Composer has all the answers it needs. On my computer, with a fast Internet connection in the heart of San Francisco, Rails composer takes about thirty seconds to build the starter application. It installs every needed gem; sets configuration files; and generates views, models, controllers, and routes. The developers who maintain the Rails Composer project have worked out any tricky integration issues so you can expect the starter application to work without any problems.

Try It Out

You’ve added a new application to your collection of projects:

```
$ ls -l
foobar-kadigan
learn-rails
rails-devise-roles
```

Let's examine the application.

```
$ cd rails-devise-roles
$ git log --oneline
277ff62 rails_apps_composer: extras
ee761e0 rails_apps_composer: navigation links
7a9f39c rails_apps_composer: set up database
79cc5c9 rails_apps_composer: add README files
35e16cf rails_apps_composer: add analytics
5327024 rails_apps_composer: add pages
f576801 rails_apps_composer: front-end framework
80fdad5 rails_apps_composer: add roles to a User model
e416dd5 rails_apps_composer: devise
e2d4d58 rails_apps_composer: set email accounts
7fa18b9 rails_apps_composer: generators
e56ace2 rails_apps_composer: create database
a538589 rails_apps_composer: Gemfile
6f2d741 rails_apps_composer: initial commit
```

When you move into the **rails-devise-roles/** folder, RVM will automatically begin using the gemset named “rails-devise-roles” because of the hidden **.ruby-gemset** and **.ruby-version** files.

Rails Composer set up a Git repository and committed files as it built the application. We can see a list of Git commits with the **git log -oneline** command.

Let's try running the application:

```
$ rails server
=> Booting WEBrick
.
.
.
```

Open a web browser window and navigate to <http://localhost:3000/>. You'll see a navigation bar with “Sign in” and “Sign up” links that implement an authentication feature using Devise.

The home page shows one user is already registered. Click the “Users” link and you'll see a message “You need to sign in or sign up before continuing.” Sign

in with the email address “user@example.com” and the password “changeme”. You’ll see a list of users (just one initially). The first user (created by Rails Composer) is automatically assigned administrator privileges. You’ll see a link to the Users page in the navigation bar that is only seen by administrators.

Sign out and sign up to create a new account with your own email address and password. You’ll see a message “Welcome! You have signed up successfully.” Click the “Users” link and you’ll see a message “Access denied.” Your new account is an ordinary user without administrator privileges, so you are not allowed to see the list of all users. Notice the navigation link “Edit account.” It displays a page for account management where you can change your name, email address, or password.

Sign out and sign in again with the administrative account “user@example.com” and the password “changeme”. Now you can view the list of users. You can change the role of any user.

You’ve got a useful starter application. Without Rails Composer, an experienced developer needs at least an hour or two to set up a similar starter application (and possibly more time if version updates have created integration issues).

Examine the application in your editor. Here’s where a starter application can be useful as a learning tool. Given what you’ve learned so far, what do recognize as familiar? Every Rails application shares a similar structure, so you will recognize files such as the Gemfile; and folders such as **app/models/**, **app/controllers/**, and **app/views/**. Explore the application. Try to guess the purpose of the unfamiliar files and code.

If you’re overwhelmed by unfamiliar files and code, try building one of the simpler starter applications, such as [rails-bootstrap](#) or [rails-devise](#). Every line of code is explained in the [Bootstrap Quickstart Guide](#), the [Devise Quickstart Guide](#), and the [Rails Authorization Tutorial](#) so there’s no mystery code.

As a beginner, you can use Rails Composer for two purposes. You can quickly build apps that are guaranteed to work and then pick them apart. A “breakable toy” can be a wonderful instrument for learning. Make an effort to understand

everything in the [RailsApps example applications](#) and you'll gain a solid understanding of the basic components used in real-world Rails projects. Secondly, start building custom applications based on the Rails Composer starter applications. By starting with Rails Composer, you'll skip the frustrating preliminaries of setting up a front-end framework, authentication, or authorization and jump right into implementing your ideas for new features. Rails Composer is often used at hackathons, where teams race to build interesting applications for a prize, to avoid the time sink of setting up a basic application.

A final word: Use Rails Composer judiciously. It's intended to be a tool for experienced developers who already know how to build starter applications from scratch using databases, front-end frameworks, authentication, or authorization, and all the bells and whistles offered in the Rails Composer options. Use it to pinpoint what you need to learn, or use it to turbocharge your learning process, but don't use it as a crutch to avoid learning the basics. To learn Rails, you must be able to build every starter application from scratch, without Rails Composer.

To learn more about Rails Composer, see the [Rails Composer](#) home page and the README for the [Rails Composer project](#) on GitHub.

Chapter 25

Version Notes

If you are reading the online edition of the book, you have the most recent version of the book. If you've gotten your copy of the book elsewhere, you may have an older version that doesn't have the newest updates.

You'll find the version number and release date on the first page of this book (under the book title). Check the [learn-rails GitHub repository](#) to find out if you have the newest version of the book. The README page on the GitHub repo always shows the most recent version number for the book and the tutorial application.

If you have trouble building the application in this book, and suspect something may be out of date, you can [check the Gemfile in the repo](#) to see if we've changed gems or specified version numbers to avoid compatibility issues. You can also check the [CHANGELOG](#), look at [recent commits](#), and [check the issues](#) to see the current state of the application.

Here are the changes I've made.

Version 3.0.0

Version 3.0.0 was released January 14, 2016

Extensive revision throughout the book, and the length of the book increased, so the book is now two books. Book One contains the introductory and self-help chapters and can be read without access to a computer. Book Two contains the step-by-step tutorial and requires use of a computer.

Switch to using the Mandrill service to send email. Previously used Gmail but Google has taken steps to make Gmail more secure and now it can be difficult to send email from a Rails application using Gmail.

Sending mail now requires the method `deliver_now` instead of `deliver`. The UserMailer class now inherits from `ApplicationMailer`.

Updated references to Rails from version 4.2.4 to 4.2.5.

Updated references to Ruby from version 2.2.3 to 2.3.0.

Version 2.2.2

Version 2.2.2 was released October 30, 2015

In the “Front-End Framework” chapter, updated filename to `1st_load_framework.css` from `framework_and_overrides.css.scss` to reflect a change in the rails_layout gem.

Version 2.2.1

Version 2.2.1 was released September 19, 2015

Updated references to Ruby from version 2.2.0 to 2.2.3.

Updated references to Rails from 4.2.0 to Rails 4.2.4.

Updated Visitor model `subscribe` method for the new Gibbon 2.0 API.

Recommending [Cloud9](#) instead of [Nitrous.io](#) because Nitrous.io is no longer free.

Version 2.2.0

Version 2.2.0 was released June 6, 2015

For Amazon customers, added an offer to access the online version or download a PDF at learn-rails.com.

Google now requires use of OAuth 2.0 for application access to Google Drive. The implementation is considerably more complex than the previous implementation using a Gmail address and password. I've dropped the "Spreadsheet Connection" chapter.

Minor clarification in the "Layout and Views" chapter.

Version 2.1.6

Version 2.1.6 was released March 17, 2015

Remove references to the Thin web server in the "Deploy" chapter.

Correct version number for `gem 'sass-rails'` in various Gemfile listings. Fixes [issue 49](#) and an error "Sass::SyntaxError - Invalid CSS" when the Foundation front-end framework is used.

In the "Testing" chapter, the file `test/integration/home_page_test.rb` was missing `require 'test_helper'`.

Updated "Rails Composer" chapter to describe new options.

Minor improvements and corrections of typos.

Version 2.1.5

Version 2.1.5 was released March 4, 2015

Use the Ruby 1.9 hash syntax in the `validates_format_of :email` statement.

Minor improvements and corrections of typos.

Version 2.1.4

Version 2.1.4 was released January 3, 2015

Updated references to Ruby from version 2.1.5 to 2.2.0.

Specify the “v0” version of the `google_drive` gem in the “Spreadsheet Connection” chapter.

Version 2.1.3

Version 2.1.3 was released December 25, 2014

Updated references to Rails 4.1.8 to Rails 4.2.0.

Version 2.1.2

Version 2.1.2 was released December 4, 2014

Released for sale as a Kindle book on Amazon, with new cover art (same cat, though).

RailsApps Tutorials now named the [Capstone Rails Tutorials](#).

Updated references to Ruby from version 2.1.3 to 2.1.5.

Updated references to Rails 4.1.6 to Rails 4.1.8 (minor releases with bug and security fixes).

Removed link to the (now defunct?) [Lowdown](#) web application in the “Plan Your Product” chapter.

Changes to the “Asynchronous Mailing” section of “Send Mail” chapter to describe Active Job in Rails 4.2.

Minor improvements to the “Dynamic Home Page,” “Deploy,” “Configure,” “Troubleshoot,” and “Create the Application” chapters.

Version 2.1.1

Version 2.1.1 was released October 22, 2014

Minor rewriting for clarity.

Updated “Precompile Assets” section of the “Deploy” chapter.

Mentioned [explainshell.com](#) in the “Get Started” chapter.

Mentioned [Zeal](#) as a Linux alternative to [Dash](#).

Recommended book [Practicing Rails](#) by Justin Weiss.

Version 2.1.0

Version 2.1.0 was released October 12, 2014

Updated references to Ruby from version 2.1.1 to 2.1.3.

Updated references to Rails 4.1.1 to Rails 4.1.6 (minor releases with bug and security fixes).

Four new chapters:

- “Testing”
- “Rails Composer”

- “Crossing the Chasm”
- “Level Up”

Use `ActiveModel` instead of the [activerecord-tableless](#) gem.

In the “Configuration” chapter, add a note to use spaces (not tabs) in the **config/secrets.yml** file.

Updated “Gems” chapter to add a troubleshooting note to the “Install the Gems” section (about errors with the Nokogiri gem).

Added a section on “Multiple Terminal Windows” to the “Create the Application” chapter.

In the “Get Help When You Need It” chapter, updated the list of recommended newsletters, replaced [rubypair.com](#) with [codermatch.me](#), and added a section on code review. Removed reference to defunct [Rails Development Directory](#).

Version 2.0.2

Version 2.0.2 was released May 6, 2014

Updated references to Rails 4.1.0 to Rails 4.1.1 (a minor release with a security fix).

For Nitrous.io users, clarify that “[http://localhost:3000/](#)” means the Preview browser window.

Update “Gems” chapter, section “Where Do Gems Live?” to add more explanation.

Minor change to code in the “Mailing List” chapter, setting ‘`mailchimp_api_key`’ explicitly when instantiating `Gibbon`, for easier troubleshooting.

Version 2.0.1

Version 2.0.1 was released April 16, 2014

Minor updates for Rails 4.1.0. Mostly small changes to the “Configure” and “Front-End Framework” chapters.

Added an explanation that, in the **config/secrets.yml** file, **domain_name** doesn’t have to be kept secret and set as a Unix environment variable.

Added a hint about passwords that use punctuation marks (plus a completely irrelevant note about profanity).

Replaced **Rails.application.secrets.gmail_username** with **Rails.application.credentials[:gmail_username]**. Also replaced **gmail_password** with **email_provider_password**. Just trying to make things a little more generic in case Gmail is not used as a provider.

Added a section explaining the horrid details of the **config.assets.precompile** configuration setting in the **config/application.rb** file. Please convey my displeasure to those responsible for subjecting beginners to this travesty.

In the “Deploy” chapter, restored **RAILS_ENV=production rake assets:precompile** because Rails 4.1.0 no longer barfs on this.

Added resources to the “Get Help When You Need It” chapter.

Minor rewriting of the introduction.

Version 2.0.0

Version 2.0.0 was released April 8, 2014

Updated references to Ruby from version 2.1.0 to 2.1.1.

Updated the book to Rails 4.1. The application name is no longer used in the **config/routes.rb** file.

Rails 4.1 changes the **app/assets/stylesheets/application.css.scss** file. Updated the “Front-End Framework” chapter. Also expanded the explanation of the Foundation grid.

In Rails 4.1, configuration variables are set in the **config/secrets.yml** file. The Figaro gem is dropped, along with the **config/application.yml** file. Updated the “Configure” chapter and references to configuration variables throughout the book.

In the “Deploy” chapter, changed **RAILS_ENV=production rake assets:precompile** to **rake assets:precompile** to avoid the error “database configuration does not specify adapter.”

Updated “The Parking Structure” chapter with comments about “Folders of Future Importance” that experienced developers often use: **test/**, **spec/**, **features/**, **policies/**, and **services/**. Updated the “Spreadsheet Connection” chapter to mention service-oriented architectures (SOA).

Extended the section on “Limitations of Metaphors” in the “Just Enough Ruby” chapter to include the example of gender when modeling a person.

Minor rewriting for clarity throughout.

Version 1.19

Version 1.19 was released February 1, 2014

Updated the book to use Foundation 5.0. Foundation 5.0.3 was released January 15, 2014 (earlier versions 5.0.1 and 5.0.2 were incompatible with Rails Turbolinks and the Rails asset pipeline). Changed the Gemfile to remove **gem 'compass-rails'** and replace **gem 'zurb-foundation'** with **gem 'foundation-rails'**. Updated a line in the “Front-End Framework” chapter for Foundation 5.0:

```
$ rails generate layout foundation5 --force
```

The files **navigation.html.erb** and **application.html.erb** are changed for Foundation 5.0. The Bootstrap front-end framework is now independent of Twitter, so I call it “Bootstrap” not “Twitter Bootstrap.” Revised the chapter “Just Enough Ruby” to incorporate suggestions from technical editor Pat Shaughnessy. Revised the chapter “Request and Response” to incorporate suggestions from technical editor Kirsten Jones. Minor rewriting for clarity throughout.

Version 1.18

Version 1.18 was released January 10, 2014

Updated references to Ruby from version 2.0.0 to 2.1.0. Changed one line in the “Front-End Framework” chapter to accommodate a change in the rails_layout gem version 1.0.1. The command was:

```
$ rails generate layout foundation4 --force
```

Changed to:

```
$ rails generate layout:install foundation4 --force
```

Updated the “Configure” chapter to add ActionMailer configuration values to the file **config/environments/development.rb**.

Version 1.17

Version 1.17 was released December 21, 2013

Updated Rails version from 4.0.1 to 4.0.2 .

Changed Gemfile to remove `gem 'compass-rails', '> 2.0.alpha.0'` and replace it with `gem 'compass-rails', '> 1.1.2'`. The 2.0.alpha.0 version was yanked from the RubyGems server. The compass-rails gem is needed for Foundation 4.3. It will not be needed for Foundation 5.0.

Changed Gemfile to replace `gem 'zurb-foundation'` with `gem 'zurb-foundation' '> 4.3.2'`. Foundation 5.0 will require `gem 'foundation-rails'` but we can't use it until an [incompatibility with Turbolinks](#) is resolved. So we will stick with Foundation 4.3.2 for now.

Revised code in the “Analytics” chapter. Using `ready page:change` instead of `page:load` to accommodate Turbolinks. Updated the `segmentio.js` file to use a new tracking script from Segment.io. Updated instructions for setting up Google Analytics tracking on Segment.io. Added concluding paragraphs “Making Mr. Kadigan Happy” to the “Analytics” chapter.

Minor clarification in the “Front-End Framework” chapter to explain that the navigation bar won't show a dropdown menu until the next chapter, when we add navigation links.

Minor clarification in the “Spreadsheet Connection” chapter to explain that Google may block access if you attempt access from a new and different computer (including Nitrous.io).

Added cat names in the “Credits and Comments” chapter.

Revised “Getting Help” chapter and added “Version Notes” chapter.

Minor clarifications, plus fixes for various typos and insignificant errors.

Chapter 26

Credits and Comments

Was the book useful to you? Follow [@rails_apps](#) on Twitter and tweet some praise. I'd love to know you were helped out by the tutorial.

You can find me on [Facebook](#) or [Google+](#). I'm happy to connect if you want to stay in touch.

If you'd like to recommend the book to others, the landing page for the book is here:

- <http://learn-rails.com/learn-ruby-on-rails.html>

I'd love it if you mention the book online, whether it is a blog post, Twitter, Facebook, or online forums. Recommending the book with a link makes it easier for people to find the book.

Credits

The book was created with the encouragement, financial support, and editorial assistance of hundreds of people in the Rails community.

Daniel Kehoe wrote the book and implemented the application.

Financial Backers

The following individuals provided financial contributions of over \$50 to help launch the book. Please join me in thanking them for their encouragement and support.

Al Zimmerman, Alan W. Smith, Alberto A. Colón Viera, Andrew Terry, Avi Flombaum, Brian Hays, Charles Treece, Dave Doolin, Denzil Villarico, Derek Rockwell, Eito Katagiri, Evan Sparkman, Frank Castle, Fred Dixon, Fred Schoeneman, Gant Laborde, Gardner Monks, Gerard de Brieder, GoodWorksOnEarth.org, Hanspeter Leupin, Harald Lazardzig, Harsh Patel, James Bond, Jared Koumentis, Jason Landry, Jeff Whitmire, Jesse House, Joe Wilmoth Jr., John Shannon, Joost Baaij, Juan Cristobal Pazos, Kathleen Sidenblad, Laird Hayward, Logan Hasson, Ludovic Kutty, Mark Gilbert, Matt Esterly, Mike Gilbert, Niko Roberts, Norman Cohen, Paul Philippov, Robert Nadar, Rogier Hof, Ross Kinney, Ruben Calzadilla, Stephane Moreau, Susan Wilson, Sven Fuchs, Thomas Nitsche, Tom Michel, Youn Shin Kang, Yuen Lock

Technical Editors

Rails and Ruby experts are very busy. I am very grateful for the assistance I received from my colleagues for the technical review of individual chapters.

- [Kirsten Jones](#), reviewed the chapter “Request and Response”
- [Pat Shaughnessy](#), author of [Ruby Under a Microscope](#), reviewed the chapter “Just Enough Ruby”
- [Noel Rappin](#), author of [Rails Test Prescriptions](#), reviewed chapters 1-7, and the “Testing” chapter
- [Aaron Sumner](#), author of [Everyday Rails Testing with RSpec](#), reviewed the “Testing” chapter
- [Ken Collins](#) reviewed the “Testing” chapter

Buy their books. I recommend them.

Editors and Proofreaders

Dozens of volunteers offered corrections and made suggestions, from fixing typos to advice about organizing the chapters.

Alberto Dubois Ribó, Alex Finnarn, Alex Zielonko, Alexandru Muntean, Alexey Dotokin, Alexey Ershov, André Arko, Andreas Basurto, Ben Swee, Brandon Schabel, Cam Skene, Daniella Zimmermann, Dapo Babatunde, Dave Levine, Dave Mox, David Kim, Duany Dreyton Bezerra Sousa, Erik Trautman, Erin Nedza, Flavio Bordoni, Fritz Rodriguez Jr, Hendri Firmana, Ishan Shah, James Hamilton, Jasna Vukovic, Jeremy Schneider, Joanne Daudier, Joel Dezenzio, Jonah Ruiz, Jonathan Lai, Jonathan Miller, Jordan Stone, Joreal Whitfield, Josh Morrow, Joyce Hsu, Julia Mokus, Julie Hamwood, Jutta Frieden, Laura Pierson Wadden, Marc Ignacio, Mark D. Blackwell, Mark Everhart, Michael Wong, Miguel Herrera, Mike Janicki, Miran Omanovic, Neha Jain, Norman Cohen, Oana Sipos, Peter Rangelov, Richard Afolabi, Robin Paul, Roderick Silva, Sakib Ash, Sebastian Lobato Genco, Silvia Obajdin, Stas Sucov, Stefan Streichsbier, Sven Fuchs, Tam Eastley, Tim Goshinski, Timothy Jones, Tom Connolly, Tom Michel, Tomas Olivares, Verena Brodbeck, Will Schive, William Yorgan, Zachary Davy

Photos

Images provided by the lorempixel.com service are used under the [Creative Commons license](#). Visit the Flickr accounts of the photographers to learn more about their work:

- photo of a white cat by [Tomi Tapio](#)
- photo of a cat by [Steve Garner](#)

- photo of a cat by [Ian Barbour](#)

The photo of a fluffy white cat by [Tomi Tapio](#) is used in the application.

Comments

I regularly update the book. Your comments and suggestions for improvements are welcome.

Feel free to email me directly at daniel@danielkehoe.com.

Are you stuck with code that won't work? [Stack Overflow](#) provides a question-and-answer forum for readers of this book. Use the tag “learn-ruby-on-rails” or “railsapps” when you post your question.

Found a bug in the tutorial application? Please create an [issue](#) on GitHub.

LEARN RUBY ON RAILS



BOOK
TWO

DANIEL KEHOE

Learn Ruby on Rails: Book Two

Version 3.0.0, 14 January 2016

Daniel Kehoe

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Chapter 1

Introduction

Welcome. This is Book Two in my [Ruby on Rails book series](#).

In this book, you'll build a working web application so you'll gain hands-on experience. Along the way, you'll practice techniques used by professional Rails developers. And I'll help you'll understand why Rails is a popular choice for web development.

I suggest you read Book One at your leisure to get the big picture that's missing from other tutorials. Read it anywhere, on your phone or tablet, to gain background understanding when you are not at your computer. It introduces key concepts so you'll have a solid foundation for continued study. But you can start this book before you finish Book One.

This book (Book Two) is for hands-on learning so you'll need your computer to follow this tutorial.

Is It for You?

You don't need to be a programmer to succeed with this book. You'll be surprised how quickly you become familiar with the Unix command line interface and the Ruby programming language even if you've never tried programming

before.

Book One provides a primer for the Unix command line, the terminal, and a text editor. If you have no experience with Unix commands, the terminal window, or a text editor, read Book One first. Everything else you need is self-contained in this book.

With this book, my aim is to introduce you to Rails and the techniques of web application development so you can launch a startup or begin a new career.

What To Expect

There is deep satisfaction in building an application and making it run. With this book, I'll give you everything you need to build a real-world Rails application. More importantly, I'll explain everything you build, so you understand how it works. There will be no mystery code.

When you've completed this tutorial, you will be ready for more advanced self-study, including the [Capstone Rails Tutorials](#), textbook introductions to Rails such as Michael Hartl's [Ruby on Rails Tutorial](#), or workshops and code camps that provide intensive training in Ruby on Rails.

About Book One

Here's what is covered in Book One, in case you missed it.

In Book One, I explain the culture and practices of the Rails community. I introduce the basic concepts you'll need to understand web application development. You'll learn how to be a successful learner and how to get help when you need it.

Be sure to look at Book One for a roadmap, or study guide, in the "Level Up" chapter, that lays out a path to learning Rails. There's so much to learn, it helps to have a map so you know where to go next. Finally, to become a skilled Rails

developer, you'll need to start building applications, and Book One contains a chapter, "Crossing the Chasm," that will give you a strategy for building your own applications.

What's in This Book

You'll start coding immediately in this book. It's a hands-on tutorial that will lead you through the code needed to build a real-world web application. Don't skip around in this book. The tutorial is designed to unfold in steps, one section leading to another, until you reach the "Testing" chapter.

You can complete this book in one long weekend, though it will take concentration and stamina. If you work through the book over a longer timespan, try to set aside uninterrupted blocks of two hours or more for reading and coding, as it takes time to focus and concentrate.

A Warning About Links

My books are densely packed with links to background reading. If you click every link, you'll be a well-informed student, but you may never finish the book! It's up to you to master your curiosity. Follow the links only when you want to dive deeper.

What Comes Next

The best way to learn is by doing; when it comes to code, that means building applications. Hands-on learning with actual Rails applications is the key to absorbing and retaining knowledge.

After you read this book, you'll be able to work with the example applications from the [RailsApps Project](#). The project provides open source example applications for Rails developers, for free. Each application is accompanied by a

tutorial in the Capstone Rails Tutorials series, so there's no mystery code. Each application can be generated in a few minutes with the [Rails Composer](#) tool, which professional developers use to create starter applications.

The RailsApps Project is solely supported by sales of the books and the [Capstone Rails Tutorials](#). If you purchase the Capstone Rails Tutorials, you'll keep the project going. And you'll have my sincere appreciation for your support.

Versions

This book requires a specific version of Rails (the newest at the time it was revised) and shows how to install the latest version of Rails. The “Get Started” chapter provides details.

Rails changes often, so you must work from the newest edition of this book to avoid problems. If you're not already reading the online edition of this book, I provide an invitation code so you can get the online edition of this book for free. For readers who obtained this book from Amazon or another retailer, the free offer is on the first page of this book, after the table of contents.

Staying In Touch

If you obtained this book from Amazon or another retailer, take a moment to get on the mailing list for the book. I'll let you know when I release updates to the book.

- [Get on the mailing list for the book](#)

A Note to Reviewers and Teachers

This book approaches the subject differently than most introductions to Rails. In this book, rather than show the student how to use scaffolding, I introduce

the model-view-controller design pattern by creating the components manually. Lastly, though every other Rails tutorial shows how to use a database, this book doesn't, because I want the book to be a short introduction and I believe the basic principles of a web application stand out more clearly without adding a database to the application. Though this tutorial is not a typical Rails introduction, I hope you'll agree that it does a good job in preparing Rails beginners for continued study, whether it is a course or more advanced books.

Using the Book in the Classroom

If you've organized a workshop, course, or code camp, and would like to assign the book as recommended reading, contact me at daniel@danielkehoe.com to arrange access to the book for your students. The book is available at no charge to students enrolled in qualified workshops or classes.

Let's Get Started

In the next chapter, we'll learn how to get help when you need it.

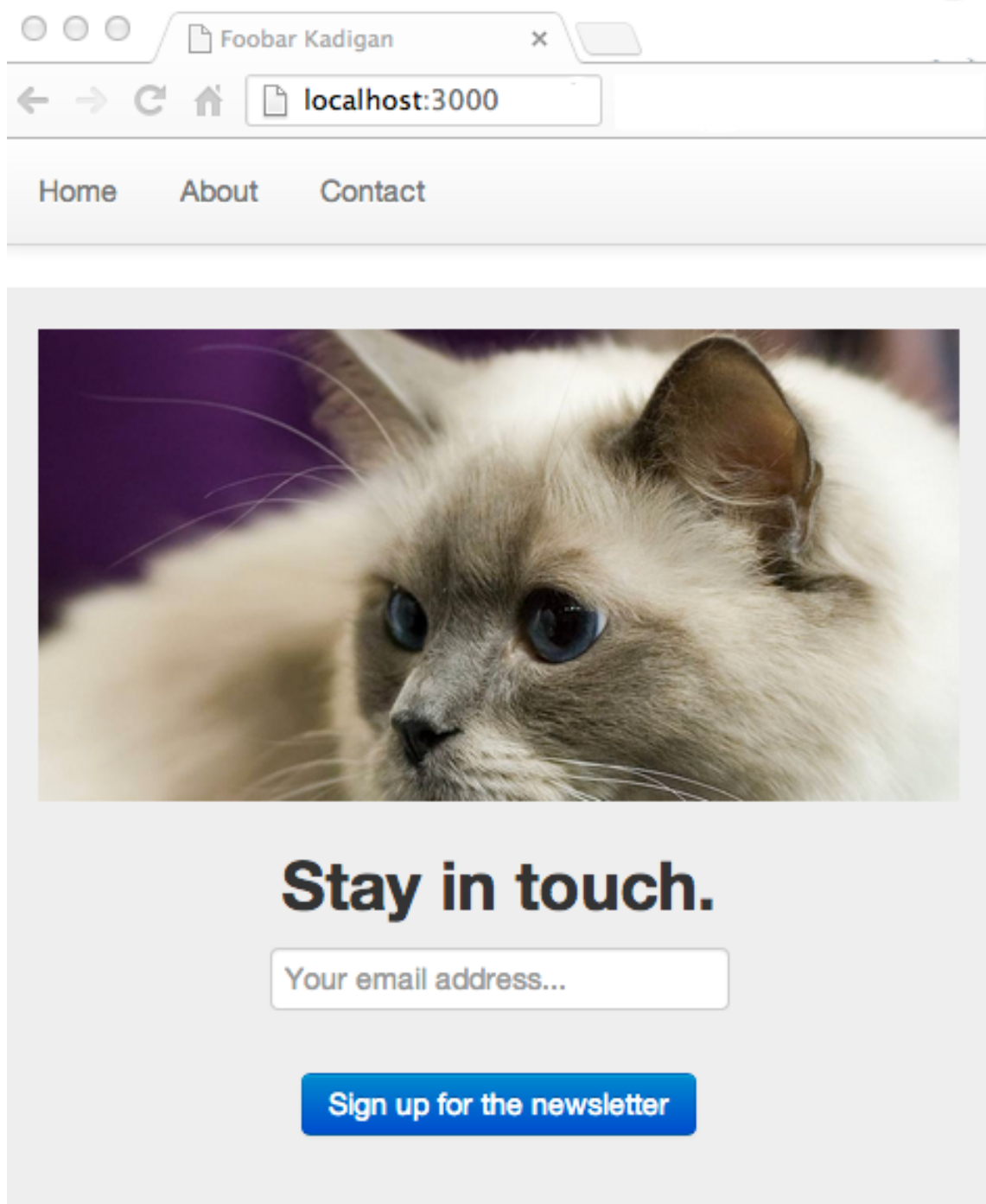


Figure 1.1: The application you will build.

Chapter 2

Get Help When You Need It

This chapter is important. It appears in the first book in this series, but I’ve included an expanded version here in Book Two for easy reference.

Example Code

If you follow this tutorial closely, you’ll have a working application that closely matches the example app in the [learn-rails](#) GitHub repository. If your application doesn’t work after following the tutorial, compare the code to the example app in the GitHub repository, which is known to work.

Version Check

The code in this tutorial was tested by many people and worked flawlessly at the time this was written. The [learn-rails](#) example application on GitHub serves as a “reference implementation” if you have problems. The example application is updated more frequently than the published tutorial.

You’ll find the version number and release date on the first page of this book

(under the book title). Check the [learn-rails GitHub repository](#) to find out if you have the newest version of the book. The README page on the GitHub repo always shows the most recent version number for the book and the tutorial application.

Don't worry if the [learn-rails GitHub repository](#) seems complicated or difficult to understand. You'll get to know GitHub over time and it will become familiar. For now, it is only important to know that it is there in case you have problems.

Take a moment now to look at the [open issues](#) on GitHub to see what problems you may encounter as you work your way through the tutorial. You can look at the [closed issues](#) to see some of the solved problems.

If you have trouble building the application in this book, and suspect something may be out of date, you can [compare the Gemfile in the repo](#) to see if we've changed gems or specified version numbers to avoid compatibility issues.

You can also check the [CHANGELOG](#) and look at [recent commits](#) to see the current state of the application.

Getting Help With the Book

Let's consider what to do if you encounter problems as you build the tutorial application in this book.

If you are in a classroom, or studying in a group, ask a peer to look at your problem. Most problems are caused by simple typos or formatting errors. Your classmate may see what you overlooked.

[Stack Overflow](#) provides a question-and-answer forum for readers of this book. As the author of this book, I can't solve your individual problems or help you directly by email. If I did, I would not have time to create the tutorials that benefit so many people. However, I watch for questions on Stack Overflow. Everyone benefits when solutions are made public.

- tag your questions on Stack Overflow with **railsapps** for extra attention

If your questions aren't answered on Stack Overflow, try the Reddit forum:

- [/r/learnrubyonrails](#)

The Reddit forum has its own Slack channel for real-time messaging:

- [learnrubyonrails-slack.herokuapp.com](#)

I sincerely hope you won't encounter obstacles as you build the tutorial application. Thousands of beginners have successfully completed the book and, unless a gem has recently changed, you should have no problem.

Now let's consider where to look for help when you are working on your own Rails projects.

Getting Help With Rails

What will you do when you get stuck?

“Google it,” of course. But here's a trick to keep in mind. Google has options under “Search tools” to show only recent results from the past year. Use it to filter out stale advice that pertains only to older versions of Rails.

[Stack Overflow](#) is as important as Google for finding answers to programming problems. Stack Overflow answers are often included in Google search results, but you can go directly to Stack Overflow to search for answers to your questions. Like Google, answers from Stack Overflow are helpful if you check carefully to make sure the answers are recent. Also be sure to compare answers to similar questions; the most popular answer is not always the correct answer to your particular problem.

Requests for advice (especially anything that provokes opinions) are often rejected on Stack Overflow. Instead, try Reddit for advice or recommendations. You'll find discussion forums (“subreddits”) devoted to [Rails](#) and [Ruby](#). You

can also visit the [Quora](#) question-and-answer site for topics devoted to [Rails](#) and [Ruby](#).

References

Here are suggestions for the most important references.

If you feel overwhelmed by all the links, remember that you can use this book to build the tutorial application without any additional resources. Right now, it's important to know additional help is available when you need it.

RailsGuides

The [Rails Guides](#) are Rails's official documentation, written for intermediate-level developers who already have experience writing web applications. The Rails Guides are an excellent reference if you want to check the correct syntax for Rails code. You'll be able to use the Rails Guides after completing this tutorial.

Cheatsheets

Tobias Pfeiffer has created a useful [Rails Beginner Cheat Sheet](#) that provides a good overview of Rails syntax and commands.

Even better than a cheatsheet, for Mac users, is an application named [Dash](#) that offers fingertip access to reference documentation for Ruby, Rails, HTML, CSS, JavaScript, and many other languages and frameworks.

API Documentation

The API documentation for Ruby and Rails shows every class and method. These are extremely technical documents (the only thing more technical is reading the source code itself). The documents offer very little help for beginners, as each class and method is considered in isolation, but there are times when checking the API documentation is the only way to know for certain how something works.

- [Rails Documentation](#) - official API docs
- [Rails Searchable API Doc](#) - alternative interface for the API docs
- [apidock.com/rails](#) - Rails API docs with usage notes
- [apidock.com/ruby](#) - Ruby API docs with usage notes
- [Omniref](#) - Ruby and all gem API docs with questions and answers

[Omniref](#) is the best place to ask questions about anything in the Ruby or Rails API.

I recommend [Dash](#) as a tool to look up classes, modules, and methods in Ruby and Rails. Dash is a Mac OS X app; use [Zeal](#) on Linux. Dash and Zeal run offline (they don't need an Internet connection) so you can use them anywhere.

Meetups, Hack Nights, and Workshops

I'd like to urge you to find ways you can work with others who are learning Rails. Peer support is really important when you face a challenge and want to overcome obstacles.

Most large urban areas have meetups or user group meetings for Rails developers. Try [Meetup.com](#) or google "ruby rails (my city)". The community of

Rails developers is friendly and eager to help beginners. If you are near a Rails meetup, it is really worthwhile to connect to other developers for help and support. You may find a group that meets weekly for beginners who study together.

Local user groups often sponsor hack nights or [hackathons](#) which can be evening or weekend collaborative coding sessions. You don't have to be an expert. Beginners are welcome. You can bring your own project which can be as simple as completing a tutorial. You will likely find a study partner at your level or a mentor to help you learn.

If you are a woman learning Rails, look for one of the free workshops from [RailsBridge](#) or [Rails Girls](#). These are not exclusively for women; everyone considered a “minority” in the tech professions is encouraged to participate; and men are included when invited by a woman colleague or friend.

Pair Programming

Learning to code is challenging, especially if you do it alone. Make it social and you'll learn faster and have more fun.

There's a popular trend in the workplace for programmers to work side-by-side on the same code, sharing a keyboard and screen. It's effective, both to increase productivity and to share knowledge, and many coders love it. When programmers are not in the same office, they share a screen remotely and communicate with video chat.

Look for opportunities to pair program. It's the best way to learn to code, even if your pairing partner is only another beginner. Learn more about pair programming on the site [pairprogramwith.me](#) and find a pairing partner at [codermatch.me](#) or [letspair.net](#).

Remote pair programming requires tools for screen sharing and video chat. Pairing sessions often use:

- [Google+ Hangouts](#)
- [Screenhero](#)
- [Floobits](#)
- [Cloud9 IDE](#)
- [Nitrous.io](#)

More tools are emerging as remote pair programming becomes popular.

Pairing With a Mentor

By far, the best way to learn is to have a mentor at your side as you undertake a project. That is an opportunity that is seldom available, unless you've been hired to be part of a team in a company that encourages pair programming.

You can try [RailsMentors](#), a network of volunteer mentors offering free help.

If you can pay for help, find a mentor using [HackHands](#) or [AirPair](#). Market rates are expensive for a student, obviously, but if you are learning on the job or building an application for your own business, connecting online with a mentor might be a godsend.

[AirPair](#) connects developers for real-time help using video chat and screen sharing. Experts set their own rate and the site matches you according to your budget. Expect to pay market rates for consulting ranging from USD \$40 per hour to \$150 per hour or more.

[HackHands](#) promises to instantly connect you with a qualified expert at a cost of one dollar per minute for mentorship using video chat and screen sharing.

Code Review

Code review is an essential part of the development process. There's always more than one way to implement a feature, and some ways are better than others, but you may not know it unless you ask someone to look at your code. When you pair with a mentor, you get the benefit of code review. But even if you don't have a mentor, you can get code review online. StackExchange, the parent of StackOverflow, has a free site for code review, and a new service promises code review as a service:

- codereview.stackexchange.com
- devinput.io

Expert code review will accelerate your learning faster than anything else.

Knowing where to go for help is important; it is just as important to stay current.

Staying Up-to-Date

Rails changes frequently and its community is very active. Changes to Rails, expert blog articles, and new gems can impact your projects, even if you don't work full-time as a Rails developer. Consequently, I urge you to stay up-to-date with news from the community.

For daily news about Rails, check Peter Cooper's [RubyFlow](http://rubyflow.com) site which lists new blog posts from Rails developers each day.

I urge you to sign up for two weekly email newsletters:

- [Ruby Weekly](http://rubyweekly.com)
- [Green Ruby News](http://greenrubynews.com)

Another weekly email newsletter is more technical, and focused on code arriving in the next version of Rails:

- [This Week in Rails](#)

If you like podcasts, check out [Ruby Rogues](#) and Envy Labs's [Ruby5](#).

Finally, you can follow [@rails_apps](#) on Twitter for news about the RailsApps project.

Chapter 3

Accounts You May Need

You'll need accounts with four services before you begin building the application in this book.

This tutorial will show you how to save your work using [GitHub](#). You can sign up for a GitHub account for free. Every experienced Rails developer has a GitHub account; it is where we collaborate on our code, both commercial and open source projects.

We'll create a form that allows website visitors to “opt-in” to a mailing list. You'll need a [MailChimp](#) account, which is free. If you send email to a mailing list, you will find it is useful to have an account with MailChimp or a similar service.

We'll also send email from the application, which will require a [Mandrill](#) account. The Mandrill transactional email service integrates well with the MailChimp email list manager service. Mandrill offers a free trial that allows you to send 2,000 messages. You can use Gmail to send email messages to users of your application, but Mandrill is easier to set up.

Finally, we'll deploy the tutorial application to [Heroku](#) which provides Rails application hosting. It costs nothing to set up a Heroku account and deploy as many applications as you want. It is the easiest way to deploy a Rails application and most Rails developers use Heroku at some time in their careers.

GitHub

Rails developers use [GitHub](#) for collaboration and remote backup of projects.

For this tutorial, I suggest you get a [free personal GitHub account](#) if you don't already have one. As a developer, your GitHub account establishes your reputation in the open source community. If you're seeking a job as a developer, employers will look at your GitHub account. When you work with other developers, they may check to see what you've worked on recently. Don't be reluctant to set up a GitHub account, even if you're a beginner. It shows you are serious about learning Rails.

You'll be asked to provide a username. This can be a nickname or short version of your real name (for example, your Twitter username).

You'll be asked to provide an email address. It's very important that you use the same email address for your GitHub account that you use to configure Git locally (there will be more about configuring Git later). If you create a Heroku account to deploy and host your Rails applications, you should use the same email address.

After you create your GitHub account, log in and look for the button "Edit Your Profile." Take a few minutes to add some public information to your account. It is really important to provide your real name and a public email address. Displaying your real name on your GitHub account makes it easy for people to associate you with your work when they meet you in real life, for example at a meetup, a hackathon, or a conference. Providing a public email address makes it possible for other developers to reach you if you ask questions or submit issues. If you can, provide a website address (even just your Twitter or Facebook page). In general, you won't be exposed to stalkers or spammers (except some recruiters) if you are open about yourself on GitHub.

Later I'll show you how to set up and use Git and GitHub.

MailChimp

This tutorial shows how website visitors can sign up to receive a newsletter provided by a [MailChimp](#) mailing list. MailChimp allows you to send up to 12,000 emails/month to a list of 2000 or fewer subscribers for free. There is no cost to set up an account.

After you have set up a MailChimp account, create a new mailing list where you can collect email addresses of visitors who have asked to subscribe to a newsletter. The MailChimp “Lists” page has a button for “Create List.” The list name and other details are up to you.

If you get frustrated with the complex and confusing MailChimp interface, try to remember that the friendly MailChimp monkey is laughing with you, not at you.

Mandrill

Earlier editions of this book showed how to use a [Gmail](#) account to send email from the application. Google has taken steps to make Gmail more secure and now it can be difficult to send email from a Rails application using Gmail.

This tutorial provides instructions for [Mandrill by MailChimp](#). The Mandrill transactional email service integrates well with the MailChimp email list manager service. Every Mandrill account comes with 2,000 free trial sends. Once you’ve finished your free trial, it’s \$9.95/month for 25,000 emails.

Sign up for a MailChimp account to get started. After you’ve created your MailChimp account, see the instructions [How do I use Mandrill if I already have a MailChimp account?](#).

You also can connect directly to an [SMTP mail server](#) to send email. The tutorial won’t show the details but I’ll provide links for more information if you don’t want to use Mandrill.

Heroku

We'll use [Heroku](#) to host the tutorial application so anyone can reach it.

To deploy an app to Heroku, you must have a Heroku account. Visit <https://signup.heroku.com> to set up an account.

Be sure to use the same email address you used to register for GitHub. It's very important that you use the same email address for GitHub and Heroku accounts.

Chapter 4

Get Started

Before you can start building, you'll need to install Ruby (the language) and Rails (the gem). I'll provide links to installation instructions that are up to date. Even if you've already installed Rails, please review the instructions to make sure your development environment is set up correctly. Other books and tutorials often skip important details.

Text Editor and Terminal Applications

I've explained how to use a text editor and terminal application in Book One. If you haven't used the Unix command line before, refer to Book One for an introduction.

I recommend the [Atom](#) text editor but you may use [Sublime Text](#) or any others that provide syntax highlighting. Refer to Book One for important instructions about setting up the text editor so you can open a file from the command line.

Copying and Pasting Code

In the next chapter you'll begin building a Rails application.

You need to get the code from this tutorial into your computer. You could just read and imagine, but really, building a working application is the only way to learn.

The most obvious way is to copy and paste from this tutorial into your text editor, assuming you are reading this on your computer (not a tablet or printed pages). It's a bit tedious and error-prone but you'll have a good opportunity to examine the code closely.

Some students like to type in the code, character by character. If you have patience, it's a worthwhile approach because you'll become more familiar with the code than by copying and pasting.

Don't feel shy about copying code; it's how you will learn. Working programmers spend a lot of time copying code from others. At first, you will copy a lot of code. As you gain proficiency, you will copy code and adapt it, more extensively as you gain confidence and skill. Only when you've been working full-time as a coder for months or years will you find yourself writing code from scratch; even then, when you encounter new problems, you will still look for code examples to copy and adapt.

Box 4.1. Warning About the PDF and Kindle Versions

This book is available in several formats, including online (HTML), PDF, ePub, and mobi (Kindle) versions.

Use the online edition of the book if you can. If you're not already reading the online edition of this book, I provide an invitation code so you can get the online edition of this book for free. For readers who obtained this book from Amazon or another retailer, the free offer is on the first page of this book, after the table of contents.

With the online edition, you'll be able to copy and paste the code without any problem. The ePub version (using Apple iBooks) also preserves line breaks and indentation when copying code.

Copying without line breaks will cause code errors. You'll lose line breaks when copying code with the following versions:

- PDF version on Mac OS X using the Preview application
- mobi (Kindle)

If you use [Adobe Acrobat](#) you'll be able to copy the line breaks (though indenting is lost). You can also open a PDF file in Chrome or Safari web browsers and copy code with line breaks. With the mobi (Kindle) version, you'll have to carefully reformat the code after pasting into your text editor.

Indentation makes code more readable, so try to preserve the indentation you see in the code samples. In YAML files (with the file extension **.yaml**), indentation is required (your application will break without it).

Your Computer

You can develop web applications with Rails on computers running Mac OS X, Linux, or Microsoft Windows operating systems. Most Rails developers use Mac OS X or Linux because the underlying Unix operating system has long been the basis for open source programming.

Later in this chapter, I'll give links to installation instructions for Mac OS X and Linux.

For Windows users, I have to say, installing Rails on Windows is frustrating and painful. Readers and workshop students often tell me that they've given

up on learning Rails because installation of Ruby on Windows is difficult and introduces bugs or creates configuration issues. Even when you succeed in getting Rails to run on Windows, you will encounter gems you cannot install. For these reasons, I urge you to use Cloud9, a browser-based development environment, on your Windows laptop.

Hosted Computing

If you are using Windows, or have difficulty installing Ruby on your computer, try using Cloud9.

Cloud9 provides a hosted development environment. That means you set up an account and then access a remote computer from your web browser. The Cloud9 service is free for ordinary use. There is no credit card required to set up an account. You'll only be charged if you add extra computer memory or disk space (which you don't need for ordinary Rails development).

The Cloud9 service gives you everything you need for Rails development, including a Unix shell with Ruby pre-installed, plus a browser-based file manager and text editor. Any device that runs a web browser will give you access to Cloud9, including a tablet or smartphone, though you need a broadband connection, a sizable screen, and a keyboard to be productive.

Try the Terminal

Look for the Terminal application in the following places:

- Mac OS X: *Applications - Utilities - Terminal*
- Linux: *Applications - Accessories - Terminal*
- Windows: *Taskbar Start Button - Command Prompt*

On the Mac, search for the Mac OS X Terminal application by pressing the Command-Spacebar combination (which Apple calls “Spotlight Search”) and searching for “Terminal.” The magnifying glass in the upper right corner of your screen will also launch “Spotlight Search.” Or look in the **Applications/Utilities/** folder for the Terminal application. You’ll need to click the name of the application to launch the Terminal.

For Linux or Windows, [The Command Line Crash Course](#) explains [how to launch a terminal application](#).

Launch your terminal application now.

Try out the terminal application by entering a shell command.

```
$ whoami
```

Don’t type the **\$** character. The **\$** character is a cue that you should enter a shell command. This is a longtime convention that indicates you should enter a command in the terminal application or console.

The Unix shell command **whoami** returns your username.

Don’t type the **\$** prompt.

You might see:

```
command not found: $
```

which indicates you typed the **\$** character by mistake.

If you are new to programming, using a text editor and the shell will seem primitive compared to the complexity and sophistication of Microsoft Word or Photoshop. Software developers edit files with simple text editors and run programs in the shell. That’s all we do. We have to remember the commands we need (or consult a cheatsheet) because there are no graphical menus or toolbars. Yet with nothing more than a text editor and the command line interface, programmers have created everything that you use on your computer.

Installing Ruby

Your first challenge in learning Rails is installing Ruby on your computer.

Frankly, this can be the most difficult step in learning Rails because no tutorial can sort out the specific configuration of your computer. Get over this hump and everything else becomes easy.

The focus of this book is learning Rails, not installing Ruby, so to keep the book short and readable, I'm going to give you links to articles that will help you install Ruby.

You'll spend at least an hour installing Ruby and Rails, so be sure to allow enough time for the task.

Mac OS X

See this article for Mac OS X installation instructions:

[Install Ruby on Rails - Mac OS X](#)

Ubuntu Linux

See this article for Ubuntu installation instructions:

[Install Ruby on Rails - Ubuntu](#)

Hosted Computing

[Cloud9](#) is a browser-based development environment. Cloud9 is free for small projects. If you have a fast broadband connection to the Internet, this is your best choice for developing Rails on Windows. And it is a good option if you have any trouble installing Ruby on Mac or Linux because the Cloud9 hosted environment provides everything you need, including a Unix shell with Ruby

and RVM pre-installed, plus a browser-based file manager and text editor. Using a hosted development environment is unconventional but leading developers do so and it may be the wave of the future.

See this article for Cloud9 installation instructions:

[Install Ruby on Rails - Cloud9](#)

The article shows how to get started with Cloud9.

Windows

Here are your choices for Windows:

- Use the [Cloud9](#) hosted development environment
- Install the [Railsbridge Virtual Machine](#)
- Use [RubyInstaller for Windows](#)

Cloud9 is ideal if you have a fast Internet connection. If not, download the Railsbridge Virtual Machine to create a virtual Linux computer with Ruby 2.2 and Rails 4.2 using [Vagrant](#). Other tutorials may suggest using [RailsInstaller](#), but it will not provide an up-to-date version of Ruby or Rails. Also, RVM does not run on Windows.

Your Workspace

Take a moment to think about where on your computer you'll do your work and store your files. You may have a **documents/** folder. You could make a similar folder named **projects/** or **code/** or **workspace/** for your programming projects. Use the Unix **mkdir** command to create a folder or create it with your file browser.

If you haven't done so already, make a folder to contain your programming projects. You don't need to do this if you already created a **workspace/** folder in the Unix chapter in Book One.

```
$ cd ~  
$ pwd  
/Users/danielkehoe  
$ mkdir workspace  
$ cd workspace
```

In this tutorial, the terms “folders” and “directories” mean the same thing.

Use the Unix **cd** command to change directories.

When you enter the Unix command **cd ~**, you'll move to your home (or “user”) directory. The squiggly **~** “tilde” character is a Unix shortcut that indicates your home folder.

The Unix **pwd** command shows the “present working directory,” where you are.

The Unix **mkdir** command creates an empty folder and we move into it with the Unix **cd** command.

Understanding Version Numbers

Rails follows a convention named *semantic versioning*:

- The first number denotes a *major version* (Rails 4)
- The second number denotes a *minor release* (Rails 4.2)
- The third number denotes a *patch level* (Rails 4.2.1)

A major release includes new features, including changes which break backward compatibility. For example, switching from Rails 3.2 to Rails 4.0 required a significant rewrite of every Rails application.

A minor release introduces new features but doesn't break anything. For example, Rails 3.2 added the asset pipeline, and Rails 4.2 added the Active Job feature for background processing.

A patch release fixes bugs but doesn't introduce significant features. Usually this means you can change the version number in the Gemfile and run **bundle update** without making any other changes to your application.

Ruby and Rails Version Check

Check that appropriate versions of Ruby and Rails are installed in your development environment. You'll need:

- The Ruby language (version 2.2 or newer)
- The Rails gem (version 4.2 or newer)

Open your terminal application and enter:

```
$ ruby -v
```

You might see:

```
ruby 2.3.0p0 (...)
```

You've got Ruby version 2.3.0, patch level "p0" (Ruby versions add an extra patch level to semantic versioning). If you've got a newer version of Ruby, no problem; minor updates to Ruby don't affect Rails.

Try:

```
$ rails -v
```

You might see:

```
Rails 4.2.5
```

If you have Rails 4.1 or older versions, you must update to Rails 4.2. See the [Installing Rails](#) instructions for your computer.

Versions such as **5.0.0.beta1** or **5.0.0.rc1** are beta versions or “release candidates.” You can use a release candidate in the weeks before a final release becomes available.

If you’ve got Rails 4.2.5 or newer, that’s fine. It means minor bugs have been fixed since this was written, but the book is still current. You can check for the [current version of Rails](#) here.

Box 4.2. Rails 5.0

Rails 5.0 was in pre-release when this edition of the book was released. If you have Rails 5.0, check for a new version of this book. The newest version of the book is listed on the README page of the [learn-rails](#) GitHub repository. If the Rails 5 version of this book is not yet available, you must install Rails 4.2.

RVM

I promised that this book would introduce you to the practices of professional Rails developers. One of the most important utilities you’ll need in setting up

a real-world Rails development environment is RVM, the [Ruby Version Manager](#).

RVM lets you switch between different versions of Ruby. Right now, that might not seem important, but as soon as a new version of Ruby is released, you'll need to upgrade, and it is best to be ready by installing the current version of Ruby with RVM, so you can easily add a new version of Ruby later, and still switch back to older versions as needed.

RVM also helps you manage your collections of gems, by letting you create multiple *gemsets*. Each gemset is the collection of gems you need for a specific project. Rails changes frequently; with RVM, you can install a specific version of Rails in a project gemset, along with all the gems you need for the project. When a new version of Rails is released, you can create a new gemset with the new Rails version when you start a new project. Your old project will still have the version of Rails it needs in its own gemset.

If you've followed the instructions in the article [Installing Rails](#) and installed RVM, you'll be ready to handle multiple versions of Ruby, and multiple versions of Rails. That's as it should be. Most professional Rails developers have more than one version of Ruby or Rails, and RVM makes it easy to switch.

RVM will show you a list of available Ruby versions:

```
$ rvm list
```

You can see a list of available gemsets associated with the current Ruby version:

```
$ rvm gemset list
```

You will see an arrow that shows which gemset is active.

You will see a **global** gemset as well as any others you have created, such as a gemset for **Rails4.2**.

Here's how to switch between gemsets:

```
$ rvm gemset use global
```

And switch back to another:

```
$ rvm gemset use default
```

After you’ve worked on a few Rails applications, you’ll see several project-specific gemsets if you are using RVM in the way most developers do.

RVM is not the only utility you can use to manage multiple Ruby versions. Some developers like [Chruby](#), [rbenv](#), or [others](#). Don’t be worried if you hear debates about RVM versus Chruby or rbenv; developers love to compare the merits of their tools. RVM is popular, well-supported, and an excellent utility to help a developer install Ruby and manage gemsets; that’s why we use it.

Project-Specific Gemset

For our learn-rails application, we’ll create a project-specific gemset using RVM. We’ll give the gemset the same name as our application.

By creating a gemset for our tutorial application, we’ll isolate the current version of Rails and the gems we need for this project. Whether you use RVM or another Ruby version manager, this will introduce you to the idea of “sandboxing” (isolating) your development environment so you can avoid conflicts among projects.

After we create the project-specific gemset, we’ll install the Rails gem into the gemset. Enter these commands:

```
$ rvm use ruby-2.3.0@learn-rails --create  
$ gem install rails
```

The newest Rails version will be installed.

It's absolutely necessary to create a gemset and install Rails so we can move on to creating the application in the next chapter. If you have trouble at this point, refer to the article [Installing Rails](#) or the [RVM website](#). Linux users may need to check instructions for [Integrating RVM](#).

Let's make sure Rails is ready to run. Open a terminal and type:

```
$ rails -v
```

You should see the message “Rails 4.2.5” (or something similar).

Now let's explore the **rails new** command and get started building the tutorial application.

Chapter 5

Create the Application

In this chapter, we'll begin building the tutorial application. But first, let's consider the options you have for starter applications.

Starter Applications

Rails provides a *framework*; that is, a software library that provides utilities, conventions, and organizing principles to allow us to build complex web applications. Without a framework, we'd have to code everything from scratch. Rails gives us the basics we need for many websites.

Still, the framework doesn't give us all the features we need for many common types of websites. For example, we might want users to register for an account and log in to access the website ("user management and authentication"). We might want to restrict portions of our website to just administrators ("authorization"). We also might want to add gems that enhance Rails to aid development (gems for testing, for example) or improve the look and feel of our application (the Bootstrap or Foundation front-end frameworks). Developers often mix and match components to make a customized Rails stack.

Developers often use a *starter application* instead of assembling an application

from scratch. You might call this a “template” but we use that term to refer to the *view files* that combine HTML with Ruby code to generate web pages. Most experienced developers have one or more starter applications that save time when beginning a new project. The [RailsApps project](#) was launched to provide open source starter applications so developers could collaborate on their starter applications and avoid duplicated effort. After you gain some skill with this tutorial, you might use the RailsApps starter apps to instantly generate a Rails application with features like authentication, authorization, and an attractive design. At the end of this book, you’ll learn about [Rails Composer](#), a tool for building starter applications.

For now, we’ll begin with the Rails default starter application.

Workspace Folder and RVM Gemset

Are you in the folder named **workspace/** you created earlier?

```
$ pwd
/Users/danielkehoe/workspace/
```

We already created a project-specific gemset using RVM. Make sure it’s ready to use:

```
$ rvm use ruby-2.3.0@learn-rails
$ rvm gemset list
gemsets for ruby-2.3.0...
  (default)
  global
=> learn-rails
```

You should see an arrow pointing to the **learn-rails** gemset. If not, go back to the previous “Get Started” chapter.

Use “Rails New” to Build the Application

Let’s go! We have selected a gemset, we have Rails installed, and we’re in our **workspace/** folder. Let’s build a Rails application!

To create the Rails default starter application, type:

```
$ rails new learn-rails
```

This will create a new Rails application named “learn-rails.”

It takes a few minutes when the build script runs **bundle install**. Don’t worry; just give it enough time to finish (but no more than five minutes even if your Internet connection is very slow).

In the future, you can give your application a different name. For this tutorial, it is VERY IMPORTANT that you use the name “learn-rails.” You’ll be copying code that assumes the name is “learn-rails;” it will save you trouble to use this name.

The **rails new** command will create ten folders and 53 files.

It will install 44 gems into your gemset.

After you create the application, switch to its folder to continue work directly in the application:

```
$ cd learn-rails
```

This is your project directory. It is also called the application root directory. You’ll spend all your time inside this folder.

Type the **ls** command to show the folders and files in a directory. Soon we’ll learn more about each of these folders and files.

```
$ ls
Gemfile      Rackfile    config      lib          test
Gemfile.lock app         config.ru   log          tmp
README.md   bin         db          public       vendor
```

Make a Sticky Gemset

RVM gives us a convenient technique to make sure we are always using the correct gemset when we enter the project directory. It will create hidden files to designate the correct Ruby version and project-specific gemset. Enter this command to create the hidden files:

```
$ rvm use ruby-2.3.0@learn-rails --ruby-version
```

If you see “ERROR: Gemset ‘learn-rails’ does not exist”, perhaps you overlooked an earlier step in the *Project-Specific Gemset* section (in the previous chapter) where we created the learn-rails gemset. No matter, you can create it now:

```
$ rvm use ruby-2.3.0@learn-rails --create --ruby-version
$ gem install rails
```

The **-ruby-version** argument creates two files, **.ruby-version** and **.ruby-gemset**, that set RVM every time we **cd** to the project directory. Without these two hidden files, you’d need to remember to enter **rvm use ruby-2.3.0@learn-rails** every time you start work on your project after closing the console.

You can confirm you’ve created the two hidden files:

```
$ ls -lpa
./
../
```

```
.gitignore
.ruby-gemset
.ruby-version
Gemfile
Gemfile.lock
README.rdoc
Rakefile
app/
bin/
config/
config.ru
db/
lib/
log/
public/
test/
tmp/
vendor/
```

The “a” flag in the Unix `ls -lpa` command displays hidden files. Each hidden file is listed with a dot (period or full stop) at the beginning of the filename. You’ll notice `.ruby-gemset` and `.ruby-version`.

You’ll also see two “special files” which are not files at all:

- `./` - an alias that represents the current directory
- `../` - an alias that represents the parent directory

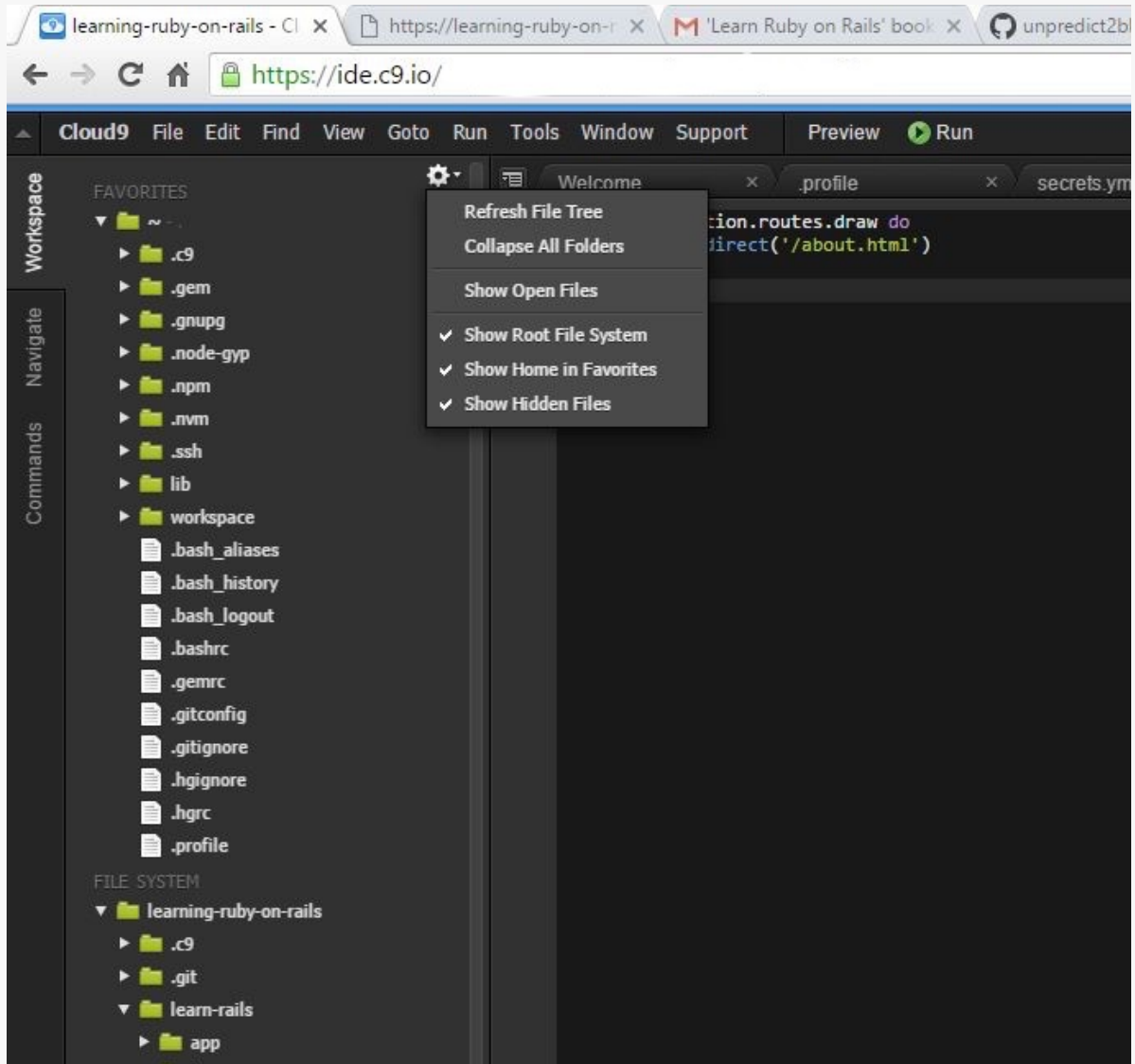
Box 5.1. Hidden Files in Cloud9

If you’re using Cloud9, you must change preferences to see hidden files. In the window that contains the file list, there is a gear icon (dark in color and difficult to see). Clicking the gear option will give you options:

- Show Root File System
- Show Home in Favorites

- Show Hidden Files

You must select all three options to see the hidden files.



That's a brief diversion into Unix; let's try running our new Rails application.

Test the Application

You've created a simple default web application. It's ready to run.

Launching the Web Server

You can launch the application by entering the command:

```
$ rails server
```

Alternatively, to save typing, you can abbreviate the **rails server** command:

```
$ rails s
```

You'll see:

```
=> Booting WEBrick
=> Rails 4.x.x application starting in development on http://0.0.0.0:3000
=> Run `rails server -h` for more startup options
=> Notice: server is listening on all interfaces (0.0.0.0)....
=> Ctrl-C to shutdown server
[... ] INFO  WEBrick 1.3.1
[... ] INFO  ruby 2.x.x (2014-02-24) [x86_64-darwin13.0]
[... ] INFO  WEBrick::HTTPServer#start: pid=38534 port=3000
```

The **rails server** command launches the default **WEBrick web server** that is provided with Ruby.

Errors for Linux Users

If you enter the command `rails server` and get an error message:

```
... Could not find a JavaScript runtime ...
```

You need to install Node.js. For help, see [Install Ruby on Rails - Ubuntu](#).

Viewing in the Web Browser

To see your application in action, open a web browser window and navigate to <http://localhost:3000/>. You'll see the Rails default information page.

Box 5.2. Viewing on a Hosted Platform

It is easy to see your web application in action on your local computer. If you are using a hosted service such as Cloud9 or Nitrous.io, it is a little more complicated.

If you are using **Cloud9**, click the “Preview” link in the IDE menu (at the top of the page). There is a “Run” link, too, but it doesn't work if you have created your Rails application in a folder within the **workspace/** folder. You can also open a browser tab or window and enter the URL for the application, as hosted by Cloud9. When you launch the Rails server, Cloud9 displays a helpful message showing the URL where you can view your application.

If you are using **Nitrous.io**, choose the menu item “Preview” (Port 3000). Throughout this tutorial, we'll refer to <http://localhost:3000/>, but if you are using Nitrous.io, you'll use the Preview browser window.

Watch Log Messages

Notice that messages scroll in the console window when your browser requests the Rails default web page.

Open the file **log/development.log** and you'll see the same messages. When a browser sends requests to the WEBrick web server, diagnostic messages are written to the console and to the **log/development.log** file. These diagnostic messages are an important tool for troubleshooting when you are developing.

Multiple Terminal Windows

You can keep more than one terminal window open. For convenience, you may want to keep a terminal window open for running the web server and watching diagnostic messages. In the Terminal or iTerm2 applications, Command-t opens additional console sessions in new “tabs.”

Developers typically open more than one terminal window when they work on a Rails application. They'll start the server with the **rails server** command in one window (or tab) and watch the log messages. In another window (or tab), they'll enter commands as they build the application. They might create folders with a Unix command, run generators, or try out code with the **rails console** command (you'll learn about the **rails console** command in the “Troubleshoot” chapter).

To some people, the text editor and the terminal window look very similar. When you work on a file in a text editor, you make changes to one file, in one place. The terminal window is very different. Your computer can run multiple programs at once. You can open multiple terminal windows. In each terminal window, you can use the command line to launch a different program. Each program you start in a terminal window is a separate *process* and multiple processes can run simultaneously. You can end a process by pressing Control-c (in most cases), Control-d (in some cases), or closing the terminal window (almost always). From this perspective, a terminal window is a tool you use to launch processes and your computer is a machine that runs processes.

Stop the Web Server

You can stop the server with Control-c to return to the command prompt.

Most of the time you'll keep the web server running as you add or edit files in your project. Changes will automatically appear when you refresh the browser or request a new page. There is a tricky exception, however. If you make changes to the Gemfile, or changes to configuration files, the web server must be shut down and relaunched for changes to be activated.

As a rule of thumb, files that produce web pages can be changed without a restart. This includes any file in the **app/** folder which creates web pages, as well as the **config/routes.rb** file. Changes to files that create the environment for the web application, such as gems or configuration files, and are loaded at web server launch, won't be seen until the web server is restarted.

Get Organized for Efficiency

Before we learn about the Rails directory structure, take a minute to organize your screen real estate. During development, you'll jump between the console in a terminal application, your text editor, and a web browser window. As a Rails developer, you'll do this constantly, so think about how you can do this efficiently. Multiple screens make it easy, but even on a laptop you can get organized for efficiency.

Here's some ideas. Open a window in the terminal application, place it on the left side of your screen, and stretch it to the maximum vertical height of your screen. Open multiple tabs in your terminal application. Keep one tabbed window open for entering shell commands (like **cd** or **ls**) and another terminal window open for running the **rails server** command and viewing the log output.

Place your text editor window next to the terminal window and stretch it to full vertical height. If you are using Atom or Sublime Text, you can open two editor panels side-by-side. Some developers find it helpful to leave the file browser

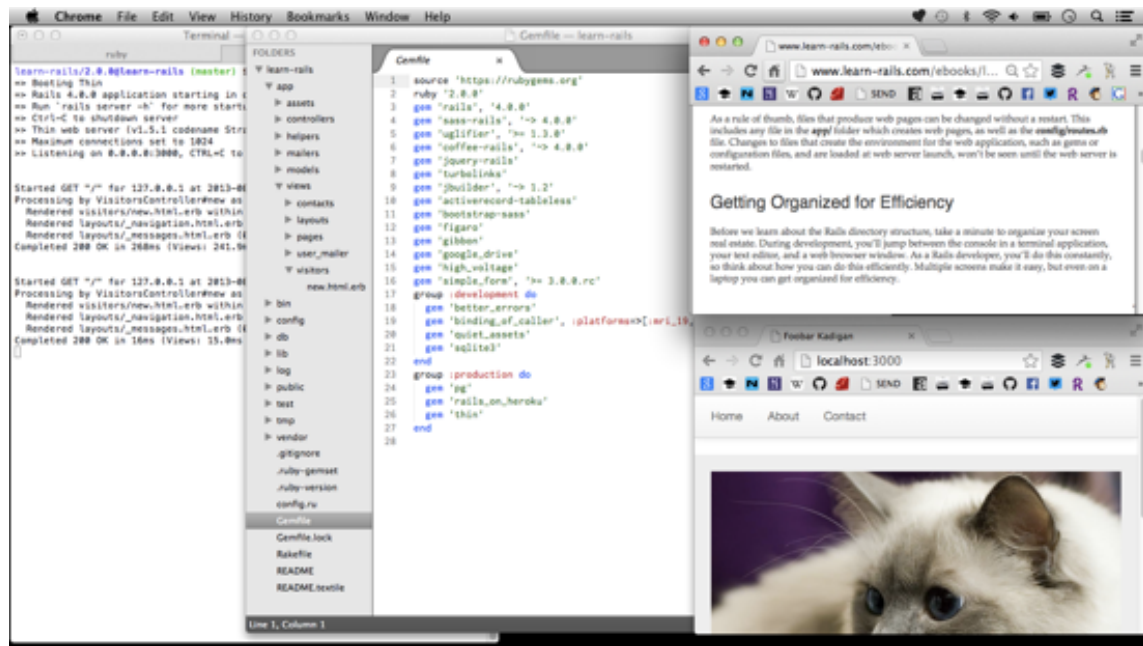


Figure 5.1: Getting organized for efficiency.

panel open to navigate the project directory; others hide the file browser panel to save space.

If you have enough screen space, leave your web browser open and place it next to your text editor. If your screen space is limited, you may have to overlap the web browser with the text editor, but position your web browser window so you can bring it to the front with a single click. You'll need multiple tabs open in your web browser. Unless you like constant distraction, close Gmail, Facebook, Twitter, and Hacker News. Open tabs for <http://localhost:3000/>, this tutorial, and additional references or documentation.

On the Mac, there are window management utilities that reposition windows with just a click or keyboard command; I use [Moom](#) but you can find others if you search for “mac window management utilities.”

This is just a guide; I'm sure you can improve upon these suggestions.

Chapter 6

The Parking Structure

We've created the default Rails starter application.

The **rails new** command has created a project directory for us.

It is a parking structure for our code. Unlike an ordinary parking structure, where you park anywhere you like, this garage has assigned parking. You have to park your code in the right place. This is Rails, where convention brings order to the development process.

As you develop a web application, you'll do all your work in the project directory. It is important to know your way around and understand the purpose of each folder and file.

If you've built simple websites with HTML and CSS, or built websites with unstructured platforms such as Perl or PHP, you'll be surprised at the complexity of the Rails project directory. Rails is a software machine with many moving parts; the project directory provides a structure to manage the complexity. The logic and order of the project directory structure is familiar to every Rails developer, and consistent for every Rails application, which makes it easy to collaborate, maintain an application, and create open source projects.

Project Directory

Use the Unix **ls** command to list the contents of the project directory. For a one-column list that shows each subdirectory (marked with a slash), we'll add the **-lp** option to the command.

```
$ ls -lp
```

You'll see:

```
Gemfile
Gemfile.lock
README.rdoc
Rakefile
app/
bin/
config/
config.ru
db/
lib/
log/
public/
tmp/
vendor/
```

Now is a good time to open a file browser window and look at the contents of the project directory. On the Mac, there's a command you can use to open the graphical file browser from the console. If you're in the project directory, type **open ..** The period (or "dot") is a Unix symbol that means "the directory I'm in."

```
$ open ..
```

You'll learn more about each file and folder as you proceed through the tutorial.

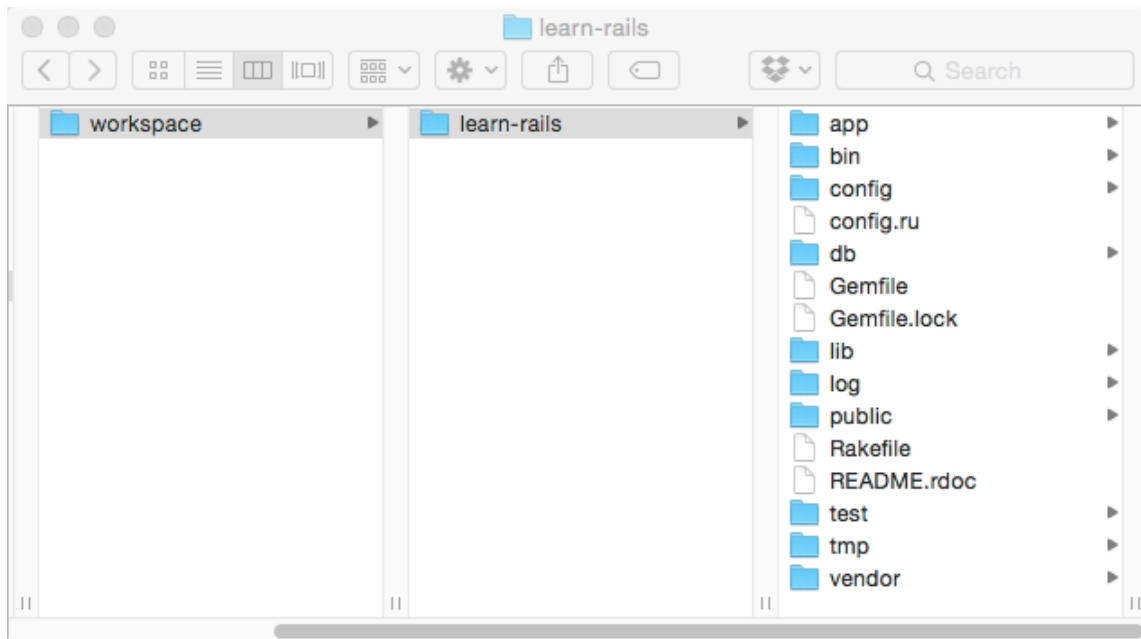


Figure 6.1: Rails directory structure.

Get to Know the Folders and Files

To get you started, here are three tables. The first describes the files and folders that are important for every beginner. The second table describes the files and folders that you can ignore. The third table is a preview of things to come.

Important Folders and Files

These folders and files are **important** to beginners. This is where you will spend your time in Rails.

Gemfile	Lists all the gems used by the application.
Gemfile.lock	Lists gem versions and dependencies.
README.rdoc	A page for documentation.
app/	Application folders and files.

config/	Configuration folders and files.
db/	Database folders and files.
public/	Files for web pages that do not contain Ruby code, such as error pages.

Not-So-Important Folders and Files

These folders and files are **not important** to beginners.

Rakefile	Directives for the Rake utility program.
bin/	Folder for binary (executable) programs.
config.ru	Configuration file for Rack (a software library for web servers).
lib/	Folder for miscellaneous Ruby code.
log/	Folder for application server logfiles.
tmp/	Temporary files created when your application is running.
vendor/	Folder for Ruby software libraries that are not gems.

Folders of Future Importance

test/	Folder for the default Rails testing framework
spec/	Folder for the popular RSpec testing framework
features/	Folder for the Cucumber testing framework

The **test/** folder is present in the default Rails starter app. You'll create the **spec/** folder or **features/** folder when you learn about test-driven development or behavior-driven development.

The App Directory

Take time to drill down into the **app/** folder in the project directory. This is easiest using the file browser.

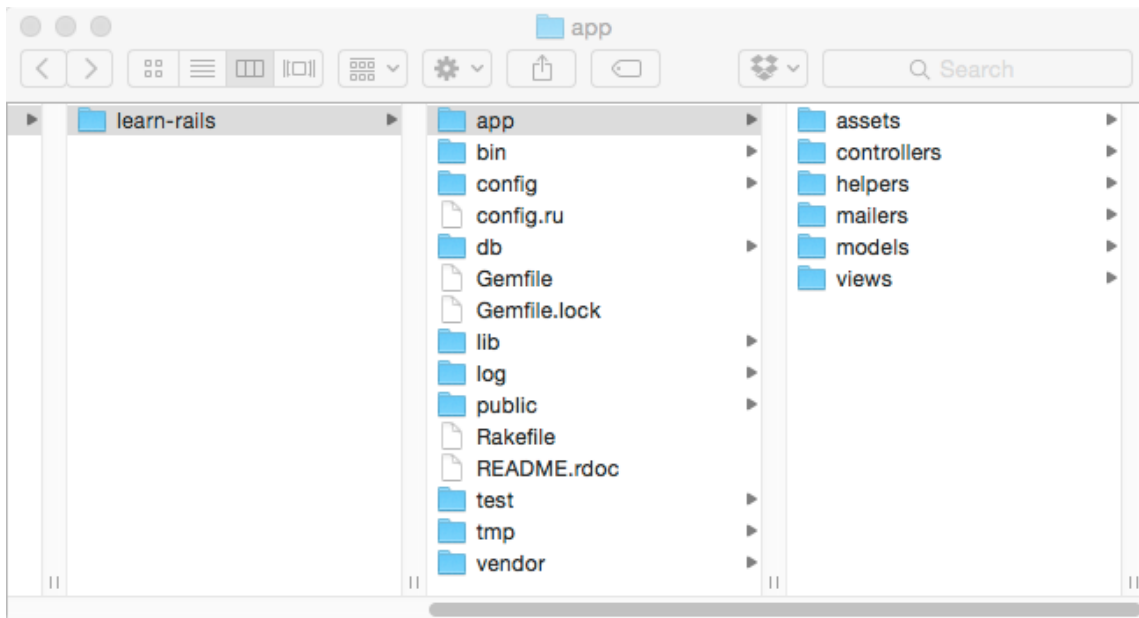


Figure 6.2: Rails app folder.

You can also use your text editor to view the folder.

Or do it with Unix commands:

```
$ cd app
$ ls -lp
assets/
controllers/
helpers/
mailers/
models/
views/
```

Whether you use the file browser, Unix commands, or your text editor, you are looking at the same file system.

Most of the work of developing a Rails application happens in the **app/** folder.

Earlier we described Rails as “a set of files organized with a specific structure.” We said the structure is the same for every Rails application. The **app/** directory

is a good example. The six folders in the **app/** directory are the same in every Rails application. This makes it easy to collaborate with other Rails developers, providing consistency and predictability.

- **assets**
- **controllers**
- **helpers**
- **mailers**
- **models**
- **views**

You may recall our earlier description of Rails from the perspective of a software architect. In this folder, you'll see evidence of the [model–view–controller](#) design pattern. Three folders named **models/**, **views/**, and **controllers/** enforce the software architect's "separation of concerns" and impart structure to our code. As you build the application, we'll explain the role of the MVC components in greater detail.

Two folders, **mailers/** and **helpers/**, play supporting roles. The mailers folder is for code that sends email messages. The helpers folder is for Rails *view helpers*, snippets of reusable code that generate HTML. Later, when we learn more about *views*, we'll say view helpers are like "macros" that expand a short command into a longer string of HTML tags and content.

More Folders of Future Importance

You won't encounter these when you are a beginner:

policies/	Folder for code that controls access to features
services/	Folder for code that reduces the complexity of models and controllers

If you join a project to work on a large and complex Rails application, you may see folders such as these in the **app/** directory. As an application grows in complexity, an experienced software architect may suggest reducing the size of models and controllers by moving code to “POROs” (*plain old Ruby objects*). Code in any folder in the **app/** directory is shared throughout a Rails application without any additional configuration (in contrast, code you add to the **lib/** directory is only available with some extra work). Rails provides a basic model–view–controller framework but it is often necessary to extend it.

Use the `cd ..` command (“change directory dot dot”) to return to the project directory.

```
$ cd ..  
$ pwd  
/Users/danielkehoe/workspace/learn-rails
```

As a Rails developer, you’ll spend most of your time navigating the hierarchy of folders as you create and edit files. And because Rails provides a consistent structure, you’ll quickly find your way on any unfamiliar project.

Chapter 7

Time Travel with Git

Now that we've looked at our Rails project directory from the viewpoint of a programmer and software architect, let's consider the viewpoint of the time traveler.

This chapter will introduce you to software *source control*, also called *version control* or *revision control*. The terms all have the same meaning; at first sight, the concept seems rather dull, like sorting your socks. But it makes professional software development possible and, at the core, it is essentially a form of time travel.

To understand time travel, we need to understand *state*. It's a term you'll encounter often in software development. We know about states of matter. Water can be ice, liquid, or steam. Imagine a machine with a button that, each time it is pressed, changes water from one state to another. We call this a *state machine*. Almost every software program is a state machine. When a program receives an input, it transitions from one state to another. Like flipping a light switch, there's no in-between. Light or dark. Ice, liquid, or steam. Or, in a web application: logged in, logged out.

When we write software code, there's a lot of in-between. We look things up, we think, we type errors and we make corrections. As humans, we spend a lot of time in a flow of undetermined state. We can save our work at any time, but

we may be saving typos or unfinished code that doesn't work. Every so often, we get to a point where a task is finished; we've fixed all our errors and our code runs. We want to preserve the state of our work. That's when we need a version control system.

A version control system does more than a software application's "Save" command. Like a "Save" command, it preserves the current state of our files. It also allows us to add a short note that describes the work we've done. More importantly, it archives a snapshot of the current state in a *repository* where it can be retrieved if needed.

Here's where the time travel comes in. We can go back and recover the state of our work at any point where we committed a snapshot to the repository. In software development, travel to the past is essential because we often make mistakes or false starts and have to return to a point where we know things were working correctly.

What about time travel to the future? Often we need to try out code we may decide to discard, without disturbing work we've done earlier. Version control systems allow us to explore alternative futures by creating a *branch* for our work. If we like what we've done in our branch, we can merge it into the main trunk of our software project.

Unlike time travel in the movies, we can't travel back to any arbitrary point in the flow of time. We can only travel to past or future states we've marked as significant by checking our work into the repository.

Git

The dominant version control system among Rails developers is [Git](#), created by the developer of the Linux operating system.

Unlike earlier version control systems, Git is ideal for wide-scale distributed open source software development. Combined with [GitHub](#), the "social coding" website, Git makes it easy to share and merge code. When you work with

others on a project, your Git *commit messages* (the notes that accompany your snapshot) offer a narrative about the progress of the project. Well-written commit messages describe your work to co-workers or open source collaborators.

GitHub's support for *forking* (making your own copy of a repository) makes it possible to take someone else's project and modify it without impacting the original. That means you can customize an open source project for your own needs. You can also fix bugs or add a feature to an open source project and submit a *pull request* for the project maintainer to add your work to the original. Fixing bugs (large or small) and adding features to open source projects are how you build your reputation in the Rails community. Your GitHub account, which shows all your commits, both to public projects and your own projects, is more important than your resumé when a potential employer considers hiring you because it shows the real work you have done.

Collaboration is easy when you use a *branch* in Git. If you and a coworker are working on the same codebase, you can each make a branch before adding to the code or making changes. Git supports several kinds of *merges*, so you can integrate your branch with the trunk when your task is complete. If your changes collide with your coworker's changes, Git identifies the conflict so you can resolve the collision before completing the merge.

All the power of Git comes at a price. Git is difficult for a beginner to learn, largely because many of its procedures have no real-world analog. Have you noticed how time travel movies require mental gymnastics, especially when you try to make sense of alternative futures and intersecting timelines? Git is a lot like that, mostly because we use it to do things we don't ordinarily do in the real world.

In this tutorial, you won't encounter Git's advanced procedures, like resolving merges or reverting to earlier versions. We'll stick to the basics of archiving our work (and in one case, discarding work that we've done for practice). You can build the tutorial project without using Git. But I urge you to use Git and a GitHub account for this project, for two reasons. First, with your tutorial application on GitHub, you'll show potential employers or collaborators that you've successfully built a useful, functioning Rails application. More impor-

tantly, you must get to know Git if you plan to do any serious coding, either as a professional or a hobbyist.

Before I show you Git commands, I want to mention that some people use graphical client applications to manage Git. Mac OS X has [GitHub for Mac](#), [Git Tower](#), and other [Mac Git clients](#). Graphical applications for Git are useful for colleagues who don't use a Terminal application, such as graphic designers or writers. There's no need for you to install these applications. Every developer I've met uses Git from the command line. It will take effort to master Git; the commands are not intuitive. But it is absolutely necessary to become familiar with Git basics.

Before you do any work on the tutorial application, I'll show you the basics of setting up and using Git.

Is Git Installed?

As a first step, make sure Git is installed on your computer:

```
$ which git
/usr/bin/git
$ git version
git version ...
```

If Git is not found, install Git. See the article [Rails with Git and GitHub](#) for installation instructions.

Is Git Configured?

Make sure Git knows who you are. Every time you update your Git repository with the `git commit` command, Git will identify you as the author of the changes.

```
$ git config --get user.name  
$ git config --get user.email
```

You should see your name and email address. If not, configure Git:

```
$ git config --global user.name "Real Name"  
$ git config --global user.email "me@example.com"
```

Use your real name so people will associate you with your work when they meet you in real life. There's no reason to use a clever name unless you have something to hide.

Use the same email address for Git, your GitHub account, and Heroku to avoid headaches.

Create a Repository

Now we'll add a Git repository to our project. It's a basic step you'll repeat every time you create a new Rails project.

Extending the time traveler analogy, initializing a Git repository is equivalent to setting up the time machine.

The `git init` command sets up a Git repository (a “repo”) in the project directory. We add the Unix symbol that indicates Git should be initialized in the current directory (`git init .`):

```
$ git init .  
Initialized empty Git repository in ...
```

It creates a hidden folder named `.git/` in the project directory. You can peek at the contents:

```
$ ls -lp .git
HEAD
branches/
config
description
hooks/
info/
objects/
refs/
```

All Git commands operate on the hidden files. The hidden files record the changing state of your project files each time you run the `git commit` command. There is no reason to ever edit files inside the hidden `.git/` folder (doing so could break your time machine).

GitIgnore

The hidden `.git/` folder contains the Git repository with all the snapshots of your changing project. The snapshots are highly compressed, only containing records of changes, so the repository takes up very little file space relative to the project as a whole.

Not every file should be included in a Git snapshot. Here are some types of files that should be ignored:

- log files created by the web server
- database files
- configuration files that include passwords or API keys

Git gives us an easy way to ignore files. A hidden file in the project directory named `.gitignore` can specify a list of files that are never seen by Git. The `rails new` command creates a `.gitignore` file with defaults that include log

files and database files. Later, when we add configuration files that include secrets, we'll update the **.gitignore** file.

Take a look at the contents of the **.gitignore** file. We use the Unix **cat** command to display the contents of the file:

```
$ cat .gitignore
# See http://help.github.com/ignore-files/ for more about ignoring files.
#
# If you find yourself ignoring temporary files generated by your text editor
# or operating system, you probably want to add a global ignore instead:
#   git config --global core.excludesfile '~/gitignore_global'
#
# Ignore bundler config.
/.bundle
#
# Ignore the default SQLite database.
/db/*.sqlite3
/db/*.sqlite3-journal
#
# Ignore all logfiles and tempfiles.
/log/*.log
!/log/.keep
/tmp
```

For a **.gitignore** file that ignores more, see an [example .gitignore file](#) from the RailsApps project.

Git Workflow

Your workflow with Git will move through four distinct phases as you add or edit files.

Untracked Files

The first phase is a “dirty” state of untracked and changed files, before any snapshot. The **git status** command lists all folders or files that are not checked into the repository.

```
$ git status
# On branch master
#
# Initial commit
#
# Untracked files:
#   (use "git add ..." to include in what will be committed)
#
# .gitignore
# Gemfile
# Gemfile.lock
# README.rdoc
# Rakefile
# app/
# bin/
# config.ru
# config/
# db/
# lib/
# log/
# public/
# vendor/
nothing added to commit but untracked files present (use "git add" to track)
```

Here the **git status** command tells us that we have many untracked files. We have created new files and they are saved on the computer's hard disk but nothing has been recorded in the Git repository.

Staging

I call this step, “Pose for your snapshot.”

Recording files in the Git repository takes two steps: staging and committing. There will be times when you change many files at once. For example, you may fix a bug, add a new graphic, and change a form. You might think you'd like to have Git automatically record all the changes as you save each file. But the story of your project would be confusing and overly detailed. Git requires you to mark one or more files (“staging”) before recording the changes (“committing”). This gives you fine-grained control over the recorded history of your project.

You can mark individual files to be staged:

```
$ git add Gemfile
```

Adding individual files allows you to selectively record the history of your project. For example, you might stage and commit a series of bug fixes before you stage and commit new features. Applying the time traveler analogy, it will be easier to travel back to look at bug fixes if they are not mixed in with new features.

More often, you'll mark all the files to be staged. Do so now:

```
$ git add -A
```

Running `git status` will show you a long list of files that are staged and ready to commit.

There are three forms of the `git add` command:

- `git add foo.txt` adds a file named `foo.txt`
- `git add .` adds all new files and changed files, except deleted files
- `git add -A` adds everything, including deletions

If it seems nonsensical that the command `git add -A` “adds deletions,” don’t worry. Like time travel, Git will stretch your understanding of what makes sense.

Most often, you can simply use the `git add -A` form of the command.

Now that you’ve marked the files that will be committed to the repository, you’ve told everyone to pose, and you’re ready to take the snapshot.

Committing

The “posing” step, or staging, gives you an opportunity to select particular files before you commit.

If you’ve only worked on one feature, you’ll likely stage and commit all your files.

When you “make a commit”, you include a message that describes the work you’ve done. For a time traveler, the “commit message” is important; you are leaving a trail to help you find your way into the past. Google will show you dozens of blog posts about “writing better commit messages” but common sense can be your guide. Writing “fix registration form to catch blank email addresses” will be more helpful than merely writing “fix bugs.” And if you wonder why commit messages are commonly written in the imperative not past tense (“fix” not “fixed”), it’s a time traveler convention.

Now commit your project to the repository:

```
$ git commit -m "Initial commit"
```

The `-m` flag lets you add a message for the commit.

The pristine state of your new Rails application is now recorded in the repo.

Running `git status` will tell you “nothing to commit, working directory clean.”

Git Log

You can use the `git log` command to see your project history:

```
$ git log
commit 8da41eec9e864ed91b4a445d8cefdf7893e2faf6
Author: Daniel Kehoe <daniel@danielkehoe.com>
Date:   Fri Dec 18 10:30:12 2015 +0700
```

```
Initial commit
```

The long string of characters that follows “commit” is an ID, or marker, that will help you travel back in time if you need to do so.

If you get “stuck” in `git log`, type `q` to return to the command prompt.

I like to use the `git log` command with an option for a compact listing:

```
$ git log --oneline  
8da41ee Initial commit
```

The listing is easier to review when it is displayed in a compact format. The commit ID is abbreviated but it is all you need to travel back in time.

Pushing to GitHub

We’ve seen three phases of the Git workflow: *untracked*, *staged*, and *committed*.

A fourth stage is important when you work with others: *pushing* to GitHub. It’s also important when you access your project from more than one computer or you want an offsite backup of your work.

The repositories hosted on your GitHub account establish your reputation as a Rails developer for employers and developers you may work with. Even if your first project is copied from a tutorial, it shows you are serious about learning Rails and studying conscientiously.

Did you create a GitHub account? Now would be a good time to add your repo to GitHub.

Go to GitHub and [create a new empty repository](#) for your project. Name the repository “learn-rails” and give it a description. If the repository is public, hosting on GitHub is free. Don’t be reluctant to go public with an unfinished

or half-baked project; everyone expects projects on GitHub to be works in progress.

Add GitHub as a remote repository for your project and push your local project to GitHub. Before you copy and paste the command, notice that you need to insert your own GitHub account name. In other words, change **YOUR_GITHUB_ACCOUNT** in the command shown below (or face problems [described here](#)).

```
$ git remote add origin https://github.com/YOUR_GITHUB_ACCOUNT/learn-rails.git
$ git push -u origin master
```

The **-u** option sets up Git so you can use **git push** in the future without explicitly specifying GitHub as the destination.

Now you can view your project repository on GitHub at:

- https://github.com/YOUR_GITHUB_ACCOUNT/learn-rails

Obviously you must change **YOUR_GITHUB_ACCOUNT** in the web address to see your own repository.

Take a look. It's an exact copy of the project on your local computer.

If you haven't used GitHub before, take some time to explore. GitHub is absolutely essential to all open source Rails development.

You may notice that the **README.rdoc** file is automatically incorporated into the home page of the project repository on GitHub. For our next step, we'll update the README file, commit it to the local repo, and push it up to GitHub. It will be good practice for using Git.

The README

Changing the README file is a good way to practice with Git. It's also a good habit to edit the README file whenever you create a new project. It's easy to

neglect the README for little projects that you’ve just started. But replacing a default README file shows you are a disciplined, conscientious developer who will be a good collaborator.

The new README file can be brief. Just state your intentions and acknowledge any code you’ve borrowed. For this project you could say, “Excited to learn Rails with help from the RailsApps project!”

In your text editor, open the file **README.rdoc** and replace the contents:

```
Learning Rails
==
Learning Rails with a tutorial from the RailsApps project.
```

GitHub lets you add formatting using your choice of markup syntax, depending on the file extension you add to the filename:

- README.rdoc uses the [rdoc](#) syntax
- README.md uses the [GitHub Flavored Markdown](#) syntax
- README.textile uses the [Textile](#) syntax

We’ll use Markdown syntax by adding the **==** characters after the first line of text to force a headline.

There’s no requirement that you use Markdown syntax in your README file. Markdown is a popular way to add formatting to improve readability. For us, changing the file to Markdown creates a practical exercise in using Git.

We’ll use the **git mv** command to rename the file to **README.md** and save it.

```
$ git mv README.rdoc README.md
```

Use **git status** to see what has changed:

```
$ git status
# On branch master
# Changes to be committed:
#   (use "git reset HEAD ..." to unstage)
#
# renamed:    README.rdoc -> README.md
#
```

You could also use the Unix **mv** command to rename the file. If you do so, **git status** will show the **README.rdoc** file has been deleted and a new, untracked **README.md** file has been created.

Here's our typical workflow. We'll stage, commit, and push the change to GitHub:

```
$ git add -A
$ git commit -m "update README"
$ git push origin master
```

Take a look at your GitHub repository (refresh the web page). Very cool! The README file has been updated.

The **git log** command will display your project history:

```
$ git log --oneline
69b9b6c update README
8da41ee Initial commit
```

You can read more about [Git and Rails](#) if you need more information about working with Git and GitHub for code source control.

Now that you're comfortable with Git, we can begin customizing our new Rails application.

Chapter 8

Gems

The art of selecting gems is at the heart of Rails development. I explained earlier that gems are packages of code, “software libraries,” that have been developed and tested by other developers. Some gems add functionality or features to a website. Other gems play a supporting role, making development easier or implementing basic infrastructure. Gems are open source. They are available at no charge and can be freely copied and modified.

It is a mark of honor to release a gem for public use, and a developer’s reputation can be established when a gem becomes popular and widely used. Gems are often created when a developer has used the same code as a component in more than one web application. He or she will take time to release the code as a gem. That’s how the Rails ecosystem was built, gem by gem since 2004.

There is no evaluation or review process in publishing gems. Gems are hosted on a public server, rubygems.org. Gems are mostly text files (like any other Ruby code), organized in a particular format with some descriptive information (in a **gemspec** file), and compressed and archived as a single file. A single command, **gem push**, uploads a gem to the rubygems.org server for anyone to use.

Over 50,000 gems have been released since rubygems.org was established. Some of these gems are used by one or two developers on their own projects.

Many others have been neglected and abandoned due to lack of interest. Only a few thousand gems are popular and widely used. As a Rails developer, you must master the art of finding and evaluating gems so you can base your applications on the tried-and-true work of others.

There is no single authoritative source of recommendations for gems. The [Ruby Toolbox](#) website categorizes and ranks many gems by popularity, and it is a good place to begin hunting for useful gems. Other than that, it is useful to study example applications and search for blog posts to find which gems are most often recommended. When you find an interesting gem, search [Stack Overflow](#) or Google to see what people are saying. Look at the gem’s GitHub repository and check:

- How many issues are open? How many are closed?
- How recent are the commits of patches or updates?
- Is there a CHANGELOG file?
- Is the gem well-documented?
- How many “stars” (people watching) or “forks” (people hacking)?

Popular gems are likely to have many reported issues, some of which are trivial problems or feature requests. Gems that are actively maintained will have many closed issues and, ideally, only a few open issues. When you find a gem that has many open issues and no recently closed issues, you’ve probably found a gem that has been abandoned. Also look at the commit log, which you’ll find on the GitHub project page in a tab at the top of the page. Regular and recent activity in the commit log indicates the gem is actively maintained.

Rails Gems

Rails itself is a gem that, in turn, requires a collection of other gems. This becomes clear if you look at the [summary page for Rails](#) on the [rubygems.org](#)

site. On that page, you'll see photos of the Rails core team. More importantly, you'll see a list of gems that are required to use Rails:

- [actionmailer](#) - framework for email delivery and testing
- [actionpack](#) - framework for routing and responding to web requests
- [activerecord](#) - framework for connections to databases
- [activesupport](#) - utility classes and Ruby library extensions
- [bundler](#) - utility to manage gems
- [railties](#) - console commands and generators
- [sprockets-rails](#) - support for the Rails asset pipeline

These are the “runtime dependencies” for Rails. Each of these gems has its own dependencies as well. When you install Rails, a total of 44 gems are automatically installed in your development environment.

Gems for a Rails Default Application

In addition to the Rails gem and its dependencies, a handful of other gems are included in every **rails new** default starter application:

- [sqlite3](#) - adapter for the SQLite database
- [sass-rails](#) - enables use of the SCSS syntax for stylesheets
- [uglifyer](#) - JavaScript compressor
- [coffee-rails](#) - enables use of the CoffeeScript syntax for JavaScript
- [jquery-rails](#) - adds the [jQuery](#) JavaScript library

- [turbolinks](#) - faster loading of webpages
- [jbuilder](#) - utility for encoding JSON data

You may not need a SQLite database, SCSS for stylesheets, jQuery or the others, but many developers use these tools so they are included in the default starter application.

Where Do Gems Live?

Gems are files saved in the computer's disk storage, containing someone else's code that you can use in your own application.

When you run a Rails application, gems are loaded into the computer's working memory immediately before your own custom code is loaded. Gems are handled by the Ruby interpreter no differently than your own code. It's all Ruby code, whether you or someone else wrote it. When you are building an application in Rails, you don't need to think about where gems are stored in your file system. It's all handled automatically.

Experienced programmers who have used software libraries in other languages might wonder how it works. Here's the technical explanation from the experts. Ruby has a **require** method that allows you to import software libraries into your programs. RubyGems extends the **require** method, adding gem directories to a **\$LOAD_PATH**. When Rails loads, it will automatically require each of the gems listed in your Gemfile, finding the gems in the **\$LOAD_PATH** directories.

If you're a curious person, you might like to see where the gems live. You can run the **gem env** command to reveal the RubyGems environment details which are normally hidden from you:

```
$ gem env
RubyGems Environment:
- RUBYGEMS VERSION: 2.4.8
- RUBY VERSION: 2.3.0 (2015-12-16 patchlevel 230) [x86_64-darwin14]
- INSTALLATION DIRECTORY: /Users/danielkehoe/.rvm/gems/ruby-2.3.0@learn-rails
- RUBY EXECUTABLE: /Users/danielkehoe/.rvm/rubies/ruby-2.3.0/bin/ruby
- EXECUTABLE DIRECTORY: /Users/danielkehoe/.rvm/gems/ruby-2.3.0@learn-rails/bin
- SPEC CACHE DIRECTORY: /Users/danielkehoe/.gem/specs
- SYSTEM CONFIGURATION DIRECTORY: /etc
- RUBYGEMS PLATFORMS:
  - ruby
  - x86_64-darwin-14
- GEM PATHS:
  - /Users/danielkehoe/.rvm/gems/ruby-2.3.0@learn-rails
  - /Users/danielkehoe/.rvm/gems/ruby-2.3.0@global
.
.
.
```

If you use RVM, gems are saved to a hidden **.rvm** folder in your user directory. A **global** subfolder contains the Bundler gem. If you’ve followed the instructions in the “Get Started” chapter to install Rails, the project-specific **learn-rails** subfolder contains the Rails gem. If you use Chruby or Rbenv instead of RVM, your gems will be stored in a different location.

Run the **gem which** command and you’ll see where the gems live:

```
$ gem which bundler
/Users/me/.rvm/gems/ruby-2.3.0@global/gems/bundler-1.5.3/lib/bundler.rb
$ gem which rails
/Users/me/.rvm/gems/ruby-2.3.0-p0@learn-rails/gems/railties-4.2.5/lib/rails.rb
```

These are details you’ll never need to know, because Ruby on Rails handles it for you.

You’ll never move or delete gems directly. Instead you’ll manage gems using the **Bundler** utility. The key to Bundler is the Gemfile.

Gemfile

Every Rails application has a Gemfile. Earlier, I described Rails from the viewpoint of the “gem hunter,” the developer who wants to assemble an application from the best open source components he or she can find. To the gem hunter, the Gemfile is the most important file in the application. It lists each gem that the developer wants to use.

The Gemfile provides the information needed by the [Bundler](#) utility to manage gems.

Bundler’s **bundle install** command reads the Gemfile, then downloads and saves each listed gem to the hidden gem folder. Bundler checks to see if the gem is already installed and only downloads gems that are needed. Bundler checks for the newest gem version and records the version number in the **Gemfile.lock** file. Bundler also downloads any gem dependencies and records the dependencies in the **Gemfile.lock** file. Between the Gemfile, with its list of gems that will be used by the application, and the **Gemfile.lock** file, with its list of dependencies and version numbers, you have a complete specification of every gem required to run the application. More importantly, when other developers install your application, Bundler will automatically install all the gems (including dependencies and correct versions) needed to run the application. When you deploy the application to production for others to use, automated deployment scripts (such as those used by Heroku) install all the required gems.

Bundler provides a **bundle update** command when we want to replace any gems with newer versions. If you run **bundle update**, any new gem versions will be downloaded and installed and the **Gemfile.lock** file will be updated. Be aware that updating gems can break your application, so only update gems when you have time to test and resolve any issues. You can run **bundle outdated** to see which gems are available in newer versions.

If you want to prevent your fellow developers (or yourself) from accidentally updating gems, you can specify a gem version number for any gem in the Gemfile. The Gemfile gives fine-grained control over rules for updating:

- `gem 'rails', '4.2.0'` is absolute only version 4.2.0 will be used
- `gem 'rails', '>= 4.2.0'` is optimistic any version newer than 4.2.0 will be used
- `gem 'rails', '~> 4.2.0'` is “pessimistic”

“Pessimistic” versioning needs some explanation. `~> 4.2.0` means use any version greater than 4.2.0 and less than 4.3 (any patch version can be used). `~> 4.2` means use any version greater than 4.2 and less than 5.0 (any minor version can be used).

In general, during development we only lock down any gem versions in the Gemfile if we know newer versions introduce problems. The exception is the Rails gem itself. We always specify the version of Rails we are using for development.

Let’s take a look at the Gemfile created by the `rails new` command.

Gemfile for a Rails Default Application

Open the **Gemfile** with your text editor:

```
source 'https://rubygems.org'

# Bundle edge Rails instead:gem 'rails', github: 'rails/rails'
gem 'rails', '4.2.5'
# Use sqlite3 as the database for Active Record
gem 'sqlite3'
# Use SCSS for stylesheets
gem 'sass-rails', '~> 5.0'
# Use Uglifier as compressor for JavaScript assets
gem 'uglifier', '>= 1.3.0'
# Use CoffeeScript for .coffee assets and views
gem 'coffee-rails', '~> 4.1.0'
# See https://github.com/sstephenson/execjs#readme for more supported runtimes
# gem 'therubyracer', platforms: :ruby

# Use jquery as the JavaScript library
```

```
gem 'jquery-rails'
# Turbolinks makes following links in your web application faster...
gem 'turbolinks'
# Build JSON APIs with ease. Read more: https://github.com/rails/jbuilder
gem 'jbuilder', '~> 2.0'
# bundle exec rake doc:rails generates the API under doc/api.
gem 'sdoc', '~> 0.4.0', group: :doc

# Use ActiveRecord has_secure_password
# gem 'bcrypt', '~> 3.1.7'

# Use Unicorn as the app server
# gem 'unicorn'

# Use Capistrano for deployment
# gem 'capistrano-rails', group: :development

group :development, :test do
  # Call 'byebug' anywhere in the code to stop execution and get a debugger console
  gem 'byebug'

  # Access an IRB console on exception pages or by using <%= console %> in views
  gem 'web-console', '~> 2.0'

  # Spring speeds up development by keeping your application running...
  gem 'spring'
end
```

The file you see will be very similar. Some version numbers may be different if a newer Rails version was released since this was written.

The first line, `source 'https://rubygems.org'`, directs Bundler to use the rubygems.org server as a source for any gems.

Notice that the second uncommented line directs Bundler to use Rails and specifies the version number. It's important to specify which version of Rails we are using. Rails changes frequently and newer versions may not work as we expect.

It's also wise to specify the Ruby version we're using. This is needed for automated deployment scripts such as those used by Heroku. We can add that to the Gemfile:

```
ruby '2.3.0'
```

In the Gemfile you'll see the gems for a Rails default application, such as `sqlite3`, which we described earlier. Other gems are commented out (the lines begin with the `#` character). These are suggestions and we can ignore them or remove them.

We won't use a database for our application but we'll keep the `gem 'sqlite3'` entry. Configuring Rails for no database is complicated; it is easier to keep the `sqlite3` gem and not use it.

The `gem 'sdoc'` line is useful only when using `rake doc:rails` command to generate API documentation so we can remove it.

If you are developing your application on a computer using the Linux operating system, you may need to uncomment and use the statement `gem 'therubyracer', platform: :ruby`. Linux doesn't have a built-in JavaScript interpreter so you must install Node.js in your environment or else add the `therubyracer` gem to each project Gemfile. For help, see [Install Ruby on Rails - Ubuntu](#).

If you remove the extra clutter in the **Gemfile** it will look like this:

```
source 'https://rubygems.org'
ruby '2.3.0'
gem 'rails', '4.2.5'

# Rails defaults
gem 'sqlite3'
gem 'sass-rails', '~> 5.0'
gem 'uglifier', '>= 1.3.0'
gem 'coffee-rails', '~> 4.1.0'
gem 'jquery-rails'
gem 'turbolinks'
gem 'jbuilder', '~> 2.0'
gem 'byebug'
gem 'web-console', '~> 2.0'
gem 'spring'
```

Try it now. Replace the Gemfile with the simplified code above.

Adding Gems

I've identified several gems that will be useful for our tutorial application.

I learned of these gems from a variety of different sources:

- [Ruby Toolbox](#)
- [RailsCasts](#)
- [RubyFlow](#)
- various blog posts
- example code and starter apps on GitHub
- recommendations from colleagues

We're adding these gems at the beginning of our development process since we already know which gems we'll need. On a real project, you'll often discover useful gems and add them to the Gemfile during the ongoing process of development.

Here are gems we'll add to the Gemfile:

- [foundation-rails](#) - front-end framework
- [gibbon](#) - access to the MailChimp API
- [high_voltage](#) - for static pages like "about"
- [simple_form](#) - forms made easy

We'll also add utilities that make development easier:

- [better_errors](#) - helps when things go wrong

- `quiet_assets` - suppresses distracting messages in the log
- `rails_layout` - generates files for an application layout

Open your **Gemfile** and replace the contents with the following:

```
source 'https://rubygems.org'
ruby '2.3.0'
gem 'rails', '4.2.5'

# Rails defaults
gem 'sqlite3'
gem 'sass-rails', '~> 5.0'
gem 'uglifier', '>= 1.3.0'
gem 'coffee-rails', '~> 4.1.0'
gem 'jquery-rails'
gem 'turbolinks'
gem 'jbuilder', '~> 2.0'
gem 'byebug'
gem 'web-console', '~> 2.0'
gem 'spring'

# learn-rails
gem 'foundation-rails'
gem 'gibbon'
gem 'high_voltage'
gem 'simple_form'
group :development do
  gem 'better_errors'
  gem 'quiet_assets'
  gem 'rails_layout'
end
```

Notice that we’ve placed three gems inside a “group.” Specifying a group for development or testing ensures a gem is not loaded in production, reducing the application’s memory footprint. Rails let you specify groups for *development*, *test*, or *production*.

Each time you edit the Gemfile, you will run **bundle install** and restart your web server.

Adjust the Rails Version

The version of Rails specified in your Gemfile should match the version that is installed in your gemset.

What version of Rails is installed in your current gemset? Check with:

```
$ rails -v
```

If you've got Rails 4.2.5, there's no need to make additional changes to the Gemfile.

If you've got a newer version of Rails, update the Gemfile. Change this line as needed:

```
gem 'rails', '4.2.5'
```

If you have Rails 5.0 (which was not available when this was written), you must get a new version of this book (or install Rails 4.2). The newest available version of the book is listed on the README page of the [learn-rails](#) GitHub repository.

Install the Gems

You've edited the Gemfile. Install the required gems on your computer:

```
$ bundle install
```

The **bundle install** command will download the gems from the [rubygems.org](#) server and save them to a hidden directory that is managed by the RVM gemset you've specified.

We'll see all the gems and their dependencies:

```
Fetching gem metadata from https://rubygems.org/.....
Fetching gem metadata from https://rubygems.org/..
Resolving dependencies...
Using rake (10.0.4)
Using i18n (0.6.4)
Installing minitest (4.7.4)
.
.
.
(many more gems not shown... you get the idea)
.
.
.
Your bundle is complete!
Use `bundle show [gemname]` to see where a bundled gem is installed.
```

You can use your text editor to view the contents of **Gemfile.lock** and you will see a detailed listing of every gem and each dependency, with version numbers. There's no reason to edit a **Gemfile.lock** file; if it is ever in error, delete it and run **bundle install** to recreate it.

Run **gem list** to see all the gems that are loaded into the development environment:

```
$ gem list
```

The list of gems loaded in the environment is the same as the list specified in the **Gemfile.lock** file. Here's how it works. RVM makes a place for the gems to be stored (the RVM gemset); the **Gemfile** lists the gems you want to use; **bundle install** reads the Gemfile and installs the gems into the RVM gemset; the **Gemfile.lock** file records dependencies and version numbers; and **gem list** shows you the gems that are in the gemset and available for use.

Troubleshooting

If your development environment is set up correctly, there should be no difficulty installing gems with the **bundle install** command. If your development environment is not set up correctly, you may see error messages when Bundler attempts to install the [Nokogiri](#) gem. Nokogiri is often needed by other gems (it is a *dependency* of some gems) and Nokogiri can become a problem to install. Unlike most gems that are written in pure Ruby, parts of Nokogiri are written in the C language and must be compiled using system tools that vary with different operating systems. If you get an error while installing gems, and the message says, “An error occurred while installing nokogiri,” ask for help on [Stack Overflow](#).

Git

Let’s commit our changes to the Git repository and push to GitHub:

```
$ git add -A
$ git commit -m "add gems"
$ git push origin master
```

After your first use of **git push origin master**, you can use the shortcut **git push**.

If you get a message:

```
fatal: Not a git repository (or any of the parent directories): .git
```

It indicates you are in a folder that has not been initialized with Git. You are probably not in your project directory. Use the Unix command **pwd** to see where you are.

If you get a message:

```
fatal: 'origin' does not appear to be a git repository
fatal: The remote end hung up unexpectedly
```

It shows that you can't connect to GitHub to push the changes. To investigate, enter:

```
$ git remote show origin
```

It is not absolutely necessary to use GitHub for this tutorial. We're only using it so you'll be familiar with the workflow of professional development.

We're ready to configure the application.

Chapter 9

Configure

Rails is known for its “convention over configuration” guiding principle. As applied, the principle reduces the need for many configuration files. It’s not possible to eliminate all configuration files, however. Many applications require configuration of settings such as email account credentials or API keys for external services.

In our tutorial application, we’ll need to store an API key to access MailChimp, which we’ll use to add visitors’ email addresses to a mailing list, as well as an API key so we can send email using the Mandrill transactional email service.

Rails provides the **config/secrets.yml** file for our configuration settings. Any variable that is set in the **config/secrets.yml** file can be used elsewhere in our Rails application, providing a single location for all our configuration variables.

Configuration Security

GitHub is a good place to store and share code. But when your repos are public, they are not a good place for secret account credentials. In fact, any shared Git repository, even a private repo, is a bad place to store email account credentials or private API keys.

Operating systems (Linux, Mac OS X, Windows) provide mechanisms to set local [environment variables](#), as does Heroku and other deployment platforms. With a bit of Unix savvy, you can set environment variables using the Unix shell. Environment variables can be accessed from Rails applications and provide an ideal place to set configuration settings that must remain private.

For the best security, set credentials as Unix environment variables and only use Unix environment variables in the **config/secrets.yml** file.

The article [Rails Environment Variables](#) shows alternatives to using Unix environment variables, if for any reason you cannot set environment variables on your machine.

About Environment Variables

Unix environment variables are typically set in a file that is read when starting an interactive shell. The *shell* is the program that gives us the command line interface we see in the Terminal or console application. Unix gives you a choice of shell programs (with names like *sh*, *bash*, *ksh*, and *zsh*); each has a slightly different way to set environment variables. The most common shell program is *bash*.

Let's find out what shell you are using:

```
$ echo $SHELL
/bin/bash
```

If you see **/bin/bash**, that's great! If not, you may have to do some research to find out how to set environment variables in your shell.

When you open a console window, the *bash* shell reads a configuration file in your user home directory. You can use a Unix command to list all the files in your user home directory (the `~` “tilde” character represents your home directory):

```
$ ls -lpa ~  
.  
.  
.  
.bash_profile  
.bashrc  
.  
.  
.
```

You should see either **.bashrc** or **.bash_profile**. Open either file and you'll likely find a command such as:

```
export PATH=~/.bin:$PATH
```

That is a command that sets the **PATH** environment variable. The command might not be exactly the same but it is likely you will see some **export** commands.

If you don't have a **.bashrc** or **.bash_profile** file in your user home directory, you can create one.

Set Environment Variables

Set the following environment variables in your **.bashrc** or **.bash_profile** file:

```
export MANDRILL_USERNAME="example@example.com"  
export MANDRILL_API_KEY="Your_Mandrill_API_Key"  
export MAILCHIMP_API_KEY="Your_MailChimp_API_Key"  
export MAILCHIMP_LIST_ID="Your_List_ID"  
export OWNER_EMAIL="example@example.com"
```

The files **.bashrc** or **.bash_profile** are hidden in the file browser. You can use **Command-Shift-.** (command shift dot) to show hidden files in the Mac OS X file open dialog.

You should use quotes to surround configuration values (credentials) in the **.bashrc** or **.bash_profile** files.

Mandrill

You'll need your Mandrill username. If you're not sure, you can [sign in to your Mandrill account](#) and select "account" and view the tab for "Username & Contact Info."

Add your Mandrill username to your **.bashrc** or **.bash_profile** file:

```
export MANDRILL_USERNAME="DanielKehoe"
```

Add an environment variable for the MailChimp API key: **MAILCHIMP_API_KEY**. You'll need a Mandrill API key. Here's where to find it.

Visit the Mandrill web site and [sign in to your account](#). Click "Settings" in the navigation links on left side of the Mandrill dashboard. You'll see "SMTP & API Credentials". Click "New API Key". Mandrill gives you options, including a "Test Key" option that logs email messages in Mandrill but does not actually send any emails. For this tutorial, don't select the "Test Key" option. It's more interesting to get actual emails. Click "Create API Key" and you'll see a new API key you can copy and paste into the **.bashrc** or **.bash_profile** file.

```
export MANDRILL_API_KEY="Your_Mandrill_API_Key"
```

Your environment variables are set up to use Mandrill.

MailChimp

When visitors sign up to receive a newsletter, we'll add them to a MailChimp list. Add an environment variable for the MailChimp API key: **MAILCHIMP_API_KEY**.

[Sign in to MailChimp](#) to get your API key. Click your name at the top of the navigation menu, then click “Account.” Click “Extras,” then “API keys.” You have to generate an API key; MailChimp doesn’t create one automatically.

```
export MAILCHIMP_API_KEY="Your_MailChimp_API_Key"
```

You’ll need to create a MailChimp mailing list in preparation for our “Mailing List” chapter. Have you already created a MailChimp mailing list? If not, the MailChimp “Lists” page has a button for “Create List.” The list name and other details are up to you.

We’ll need the **MAILCHIMP_LIST_ID** for the mailing list you’ve created. To find the list ID, on the MailChimp “Lists” page, click the “down arrow” for a menu and click “Settings.” At the bottom of the “List Settings” page, you’ll find the unique ID for the mailing list.

```
export MAILCHIMP_LIST_ID="Your_List_ID"
```

Your environment variables are set up to use MailChimp.

Owner Email

You’ll send email messages to this address when a visitor submits a contact request form. Set **OWNER_EMAIL** with an email address where you receive mail.

```
export OWNER_EMAIL="example@example.com"
```

Enter an email address and your environment variables will be set up with the site owner email address.

Troubleshooting

Check that the Mandrill user name is set in your Unix environment variables:

```
$ echo "$MANDRILL_USERNAME"
```

You should see your Mandrill user name in the console response. Make sure you've used underscores consistently and you've used **MANDRILL_USERNAME** not **MANDRILL_USER_NAME**.

If you've set up Unix environment variables but **echo "\$MANDRILL_USERNAME"** doesn't return the correct variable in the console, you may have a problem with the way you've set Unix environment variables. Most computers use the bash shell and you can set environment variables in your **.bashrc** or **.bash_profile** files. But not every system is alike. If it seems Unix environment variables are not working, you may have to find a colleague who can help you troubleshoot. You can continue with the tutorial and add the credentials directly to the **config/secrets.yml** file.

The Secrets File

Use your text editor to add the Unix environment variables to the file **config/secrets.yml**:

```
# Be sure to restart your server when you modify this file.

# Your secret key is used for verifying the integrity of signed cookies.
# If you change this key, all old signed cookies will become invalid!

# Make sure the secret is at least 30 characters and all random,
# no regular words or you'll be exposed to dictionary attacks.
# You can use `rake secret` to generate a secure secret key.

# Make sure the secrets in this file are kept private
# if you're sharing your code publicly.
```

```
development:
  mandrill_username: <%= ENV["MANDRILL_USERNAME"] %>
  mandrill_api_key: <%= ENV["MANDRILL_API_KEY"] %>
  mailchimp_api_key: <%= ENV["MAILCHIMP_API_KEY"] %>
  mailchimp_list_id: <%= ENV["MAILCHIMP_LIST_ID"] %>
  domain_name: example.com
  owner_email: <%= ENV["OWNER_EMAIL"] %>
  secret_key_base: very_long_random_string

test:
  secret_key_base: very_long_random_string

# Do not keep production secrets in the repository,
# instead read values from the environment.
production:
  mandrill_username: <%= ENV["MANDRILL_USERNAME"] %>
  mandrill_api_key: <%= ENV["MANDRILL_API_KEY"] %>
  mailchimp_api_key: <%= ENV["MAILCHIMP_API_KEY"] %>
  mailchimp_list_id: <%= ENV["MAILCHIMP_LIST_ID"] %>
  domain_name: <%= ENV["DOMAIN_NAME"] %>
  owner_email: <%= ENV["OWNER_EMAIL"] %>
  secret_key_base: <%= ENV["SECRET_KEY_BASE"] %>
```

Be sure to use spaces, not tabs. Make sure there is a space after each colon and before the value for each entry or you will get a message “Internal Server Error: mapping values are not allowed” when you start the web server.

You used quotes to surround configuration values in the **.bashrc** or **.bash_profile** files. Here, in the **config/secrets.yml** file, you don’t need quotes.

Domain Name

We’ll need a domain name when we configure email for delivery in production. For development, use **example.com**. If you have your own domain name, you can use that instead. There’s no need to keep the **domain_name** configuration variable secret, so we don’t need to set it in a Unix environment variable.

You can decide for yourself if the **owner_email** variable really needs to be secret. Just for caution, I’m suggesting you set it as a Unix environment variable.

Securing the Secrets File

Some developers take steps to prevent the **config/secrets.yml** file from being checked into Git. To prevent the file from being saved to your repo you could add the filename to the **.gitignore** file in your application root directory.

If you've used Unix environment variables in the **config/secrets.yml** file, there's no reason to add the file to **.gitignore**. If you only reveal the **SECRET_KEY_BASE** used for development or testing, and no one can access your development machine, no useful secrets will be revealed in your GitHub repo.

When you deploy to Heroku, the **config/secrets.yml** file must be in your Git repository. For that reason, I suggest you save the file in your Git repo and keep your secrets safe by using environment variables.

Troubleshooting

Remember, in YAML files (with the file extension **.yml**), indentation is required (your application will break without it).

Be sure to use spaces, not tabs. Make sure there is a space after each colon and before the value for each entry.

If you have trouble setting Unix environment variables, you can add credentials directly to the **config/secrets.yml** file. If you do so, you should not check the file into Git until you've deleted the secrets from the file.

For example:

```
.  
.   
.   
  
development:   
  mandrill_api_key: very_long_string  
.   
.   
. 
```

Again, DON'T CHECK THE FILE INTO GIT if you've hardcoded your credentials directly in the **config/secrets.yml** file.

The article [Rails Environment Variables](#) shows alternatives to using Unix environment variables, if for any reason you cannot set environment variables on your machine.

Secret Key Base

It's not necessary to set **SECRET_KEY_BASE** as an environment variable on the computer you use for development. Rails generates a unique **SECRET_KEY_BASE** in the **config/secrets.yml** file each time you create a new Rails application and you don't need to replace it. If someone sees the **SECRET_KEY_BASE** in the **config/secrets.yml** file in your GitHub repo, there isn't anything they can do with it, since they don't have access to your local machine.

For your future reference, in case you want to change the **SECRET_KEY_BASE**, here's how. Go to your Rails application directory and create a new secret token:

```
$ rake secret  
very_long_random_string
```

And, if you wish, add it to your **.bashrc** or **.bash_profile** file:

```
export SECRET_KEY_BASE="very_long_random_string"
```

You should always use the environment variable **<%= ENV["SECRET_KEY_BASE"] %>** in the production section of your **config/secrets.yml** file, otherwise, someone who sees the secret token in your GitHub repo can gain access to your application in production. You'll set the environment variables for production when you deploy to Heroku.

Configure Email

Email messages are visible in the console and the log file when you test the application. If you don't want to actually send email, you can skip this step. But it's more fun when your application can actually send email.

You can learn more in the article [Send Email with Rails](#).

Connect to an Email Server

Web servers don't send email. Our Rails application has to connect to an email server (also known as a [mail transfer agent](#) or “mail relay”). In the early days of the Internet, an experienced system administrator could set up an [SMTP server](#) to distribute email. Now, because of efforts to reduce spam, it is necessary to use an established email service to ensure deliverability. In production, for high volume transactional email and improved deliverability, it is best to use a service such as [Mandrill](#) or [Mailgun](#). See the article [Send Email with Rails](#).

We need to configure Rails so the application can connect with an email server. For our tutorial application, we'll connect to Mandrill to send email.

For convenience during development, some developers use their own Gmail account to send email. Google has increased security measures for Gmail, so it can difficult to use Gmail to send email from a Rails application. Mandrill is easier to set up and you're more likely to use it for a real application. That's why we'll use it.

In the file **config/environments/development.rb**, near the end of the file, find the statement:

```
config.assets.debug = true
```

Immediately following, add this:

```
config.action_mailer.smtp_settings = {  
  address: "smtp.mandrillapp.com",  
  port: 587,  
  user_name: Rails.application.secrets.mandrill_username,  
  password: Rails.application.secrets.mandrill_api_key  
}  
# ActionMailer Config  
config.action_mailer.default_url_options = { :host => 'localhost:3000' }  
config.action_mailer.delivery_method = :smtp  
config.action_mailer.raise_delivery_errors = true
```

Note that the password will be your Mandrill API key. You can use port 25, 587, or 2525 (some ISPs restrict connections on port 25).

It's important to add these changes in the body of the configuration file, before the **end** keyword. The order isn't important but don't add the configuration statements after the **end** keyword.

Notice that we are using configuration variables that are set in the **config/secrets.yml** file:

- `Rails.application.secrets.mandrill_username`
- `Rails.application.secrets.mandrill_api_key`

We could “hard code” a username and API key here but that would expose confidential data if your GitHub repository is public. Using configuration variables that are set in the **config/secrets.yml** file keeps your secrets safe.

Again, if you need to troubleshoot, you can enter the Mandrill username and API key directly in this file instead of the configuration variables. But for security, don't commit to Git with the API key hardcoded in this file.

Perform Deliveries in Development

If you want to send real messages when you test the application in development mode, modify the file **config/environments/development.rb**.

After the code you just added, add the statement:

```
# Send email in development mode?  
config.action_mailer.perform_deliveries = true
```

This changes the configuration to send email when you're working on the application.

Make sure any code you've added to the **config/environments/development.rb** file is placed before the final **end** keyword. If you add code after the final **end** keyword, your application will fail with errors when you start the web server.

Later, after we add a contact form to the tutorial application, the application will be ready to send email messages.

Git

Make sure you're in your application root directory.

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "add configuration"  
$ git push
```

We're ready to create a home page for the application.

Chapter 10

Static Pages and Routing

A Rails application can deliver static web pages just like an ordinary web server. The pages are delivered fast and no Ruby code is required. We'll look at simple static pages and learn about Rails routing before we explore the complexities of dynamic web pages in Rails.

Add a Home Page

Make sure you are in your project directory.

Start the application server:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>. You'll see the Rails default information page.

Use your text editor to create and save a file **public/index.html**:


```
<h1>Hello World</h1>
```

Refresh the browser window and you'll see the "Hello World" message.

The Rails application server looks for any pages in the **public** folder by default.

If no filename is specified in the URL, the server will attempt to respond with a file named **index.html**. This is a convention that dates to 1993; if no filename was specified, one of the first web servers ever built (the NCSA httpd server) would return a list of all files in the directory, unless a file named **index.html** was present. Since then, **index.html** has been the default filename for a home page.

Routing Error

What happens when no file matches the requested web address?

Enter the URL <http://localhost:3000/about.html> in your browser.

You'll see an error page that shows a routing error.

If you are using Cloud9 or Nitrous.io, add "/about.html" to the URL in the preview browser window.

Add an About Page

Use your text editor to create and save a file **public/about.html**:

```
<h1>About</h1>
```

Visit the URL <http://localhost:3000/about.html> in your browser. You'll see the new "About" page.

By the way, you’ve just done test-driven development (TDD).

Introducing TDD

With test-driven development, a developer tests behavior before implementing a feature, expecting to see an error condition. Then the developer implements the feature and sees a successful result to the test. That’s exactly what you’ve done, in the simplest way.

Beginners tend to think TDD is scary and complicated. Now that you’ve experienced a simple form of TDD, maybe it won’t be intimidating. Real TDD means writing tests in Ruby before implementing features, but the principle is the same.

Introducing Routes

The guiding principle of “convention over configuration” governs Rails routing. If the web browser requests a page named “index.html”, Rails will deliver the page from the **public** folder by default. No configuration is required. But what if you want to override the default behavior? Rails provides a configuration file to control web request routing.

Remove the **public/index.html** file:

```
$ rm public/index.html
```

If you’ve got only one terminal window open, you’ll have to stop the Rails server with Control-c to get your terminal prompt. Here is where it is helpful to have two terminal sessions going in different tabs.

Now let’s set the “About” page as the home page.

Open the file **config/routes.rb**. Remove all the comments and replace the file with this:

```
Rails.application.routes.draw do
  root to: redirect('/about.html')
end
```

This snippet of Rails routing code takes any request to the application root (<http://localhost:3000/>) and redirects it to the **about.html** file (which is expected to be found in the **public** folder).

There is no need to restart your application server to see the new behavior. If you need to start the server:

```
$ rails server
```

Visit the page <http://localhost:3000/>. You'll see the "About" page.

You've just seen an example of Rails magic. Some developers complain that the "convention over configuration" principle is black magic. It's not obvious why pages are delivered from the **public** folder; it just happens. If you don't know the convention, you could be left scratching your head and looking for the code that maps <http://localhost:3000/> to the **public/index.html** file. The code is buried deep in the Rails framework. However, if you know the convention and the technique for overriding it, you have both convenience and power at your disposal.

Using the "About" Page

We've created an "About" page so we can learn about routing.

For the next chapter, we'll use the static "About" page to investigate how a web application works.

Later in the tutorial we'll create a new "About" page using a different approach.

Chapter 11

Request and Response

You’ve configured the tutorial application, created static pages, and seen the magic of Rails routing.

In this chapter, we’ll investigate the web request-response cycle and look at the model-view-controller design pattern so you’ll be prepared to build a dynamic home page.

Investigating the Request Response Cycle

Remember, at its core, the World Wide Web is nothing more than web browsers that request files from web servers.

Web browsers make *requests*. A web server *responds* to a request by sending an HTML file. Depending on the headers in the HTML file, the web browser may make additional requests and get additional CSS, JavaScript, and image files.

The beauty and simplicity of the World Wide Web architecture, as conceived by Tim Berners-Lee in 1990, is that the web is nothing more than a request from a web browser and a response from a web server. Some web pages now include streaming video, or music, requiring an open “pipe” between the web server

and the web browser, but even so, an initial request-response cycle delivers the page that sets up the stream.

We can reduce the mystery of how the web works to its simplest components when we investigate the request-response cycle. We'll see that everything that happens in a web application takes place within the flow of the request-response cycle.

Let's look at the request-response cycle.

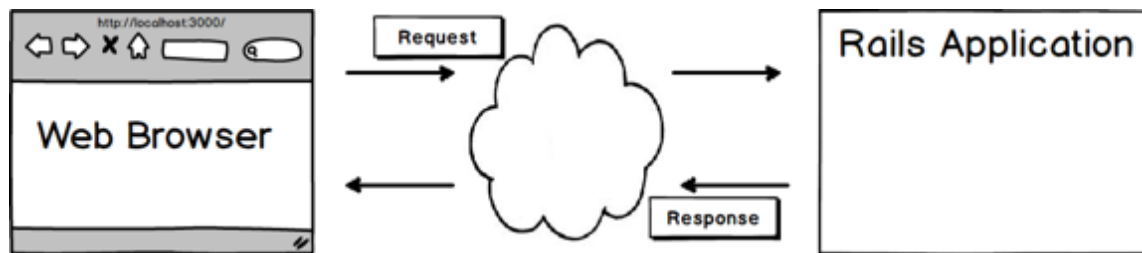


Figure 11.1: The request-response cycle.

Inside the Browser

We can see the actual request, and the actual response, by using the diagnostic tools built into the web browser.

Start the application server if it is not already running:

```
$ rails server
```

Developers use various web browsers during development. I'll provide instructions for Chrome, since it is the most popular. Even if you prefer Mozilla Firefox or Apple Safari, try this in Chrome, so you can follow along with the text.

Start our investigation by putting Chrome into “Incognito Mode” with Command-Shift-N (on a Mac). On Linux, use Ctrl-Shift-N to get in incognito mode with

Chrome. Alternatively, you can clear the browser cache. This clears any files that were previously cached by the browser.

The Developer Tools View is your primary diagnostic tool for front-end (browser-based) development, including CSS and JavaScript.

In Chrome on Mac OS X, press Command-Option-I to open the *Developer Tools View* in a section of the browser window. Alternatively, you can find the menu item under View/Developer/Developer Tools.

In Chrome on Windows or Linux platforms, press Shift-Ctrl-I or select Menu/Tools/Developer Tools.

Select the Network tab in the Developer Tools View.

Initiate the request-response cycle by visiting the “About” page at <http://localhost:3000/about>

In the Developer Tools View, you’ll see files received by the browser from the web server. There is only one: “about.html”. This is the file that the browser evaluates to display a web page.

Click the “about.html” file icon. Then click the tab “Headers.” The diagnostic window shows the entire request sent to the server and the entire response received by the browser.

The request is composed of:

- request URL (<http://localhost:3000/about.html>)
- request method (GET)
- request headers (including cookies and User Agent identifier)

The response is composed of

- status code (200 OK or 304 Not Modified)
- response headers (including date/time and server identifier)

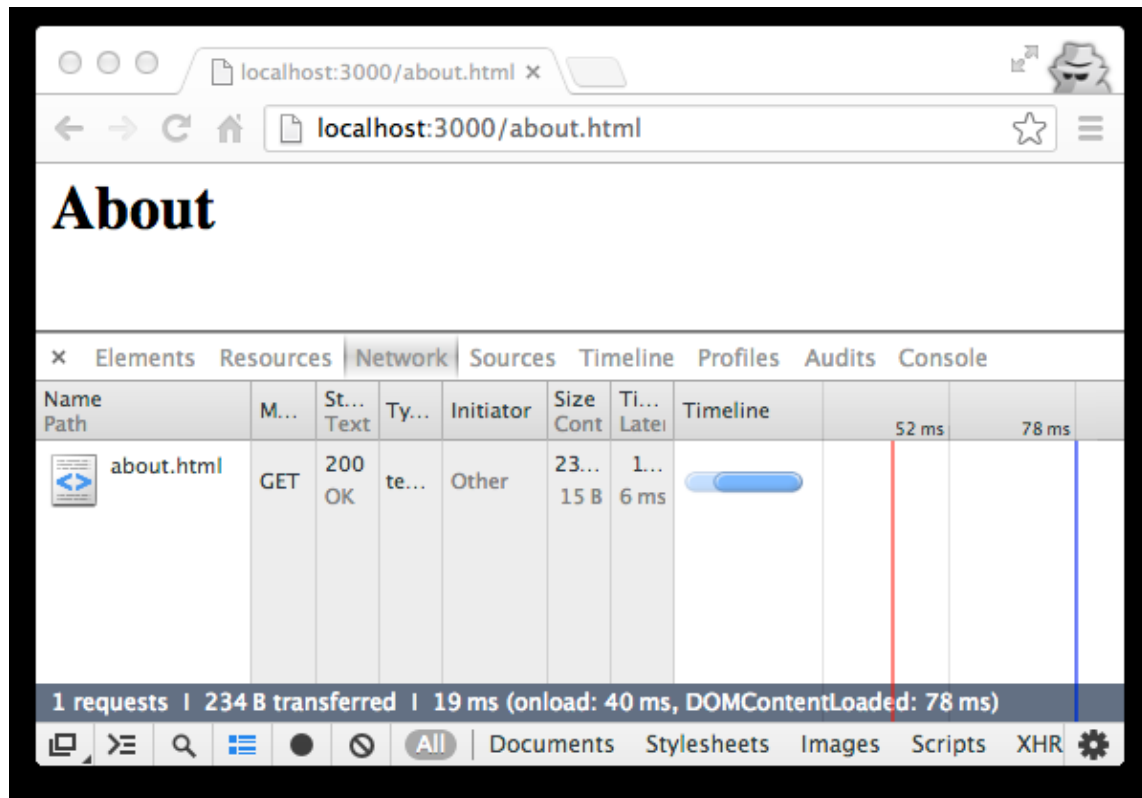


Figure 11.2: Viewing a request in the Developer Tools View.

- HTML

You can see the HTML sent to the browser by clicking the Preview or Response tabs in the diagnostic view.

Now try requesting the home page by entering the URL <http://localhost:3000/>.

You'll see the server returns two files. The first, "localhost", contains a redirect code "301 Moved Permanently" that tells the browser to request the "about.html" file. The second file is the "about.html" file. You may see the status code "200 OK" the first time the file is requested. On subsequent requests, you'll see the "304 Not Modified" code, indicating that the file hasn't changed and the browser should use the file that has been previously cached.

Here's the point of the exercise: The browser's diagnostic view shows all the data exchanged between the browser and server. You're looking at everything that passes through the plumbing.

Inside the Server

The browser's diagnostic view doesn't show you what happens on the server. For that, go to the server logs or the console window.

```
Started GET "/" for 127.0.0.1 at ...
```

Notice how the diagnostic messages in the console window match the headers in the browser diagnostic view. The browser's "Request Method:GET" matches the server's "Started GET." The browser's "Request URL:http://localhost:3000/" matches the server's "/" for 127.0.0.1" (localhost is at IP address 127.0.0.1).

Notice there are no console log messages for pages delivered from the **public** folder.

Soon we'll see much more in the console window, after we've built a dynamic web page that is assembled by the application server.

Document Object Model

What happens after the browser receives a response from the server?

The response is not complete until all files are received (or the browser reaches a time-out limit). Modern browsers retrieve files asynchronously; the order and location of the files in the initial HTML file doesn't matter because the browser will try to load all the files before displaying the page.

When the web browser receives an HTML file, it creates an internal representation of the page in computer memory, called the Document Object Model

(DOM). It provides a structural representation of the document. The DOM works like an API for HTML documents, allowing you to modify the content and visual presentation of the page by using JavaScript.

Later in the tutorial, we'll see how a JavaScript library such as [jQuery](#) can be used to do things like hiding or revealing HTML elements on a page by manipulating the DOM.

Model View Controller

Now that we've investigated the request-response cycle, let's dig deeper to understand what happens inside the Rails application server in response to a browser request.

Here is a diagram that shows what happens in the server during the request-response cycle.

You learned earlier that, from the perspective of a software architect, Rails is organized to conform to the [model–view–controller](#) software design pattern. This enforces “separation of concerns” to keep code manageable and organized. The MVC design pattern is optimal for web applications and is a central organizing principle for Rails.

The MVC design pattern originated in the design of desktop applications. “Model” classes manipulated data; “view” classes created the user interface; and a “controller” class responded to user interaction.

Some computer scientists feel the architecture of web applications doesn't quite match the original MVC design pattern of desktop applications. We can see the reason for the quibble in the next diagram. The diagram shows the MVC architecture as part of the Rails software stack.

At the base of the stack is the web browser. A request flows upward through the layers and encounters the router which dispatches the request to an appropriate controller.

In a Rails application, there is a single routing file, **config/routes.rb**, and multiple controllers, models, and views.

Considering the importance of the router, perhaps we should call our Rails architecture the *RCMV*, or Routing-Controller-Model-View, pattern. Despite the quibble about nomenclature, the architecture is well understood and used by all Rails developers.

Here's the step-by-step walk-through of what happens.

When the web browser makes a request, a *router* component will check the **config/routes.rb** file and determine which *controller* should handle the request, based on the web address and HTTP protocol. The controller will obtain any needed data from a *model*. After obtaining data, the controller will render a response combining data from the model with a *view* component that provides markup and layout. The response is an HTML file that the controller assembles for the browser to display.

The model, view, and controller are files you create containing Ruby code. Each file has a certain structure and syntax based on foundation model, view, and controller classes defined in the Rails framework. The model, view, and controller classes you create will *inherit* behavior from parent classes that are part of the framework, so you will have less code to write yourself.

In most Rails applications, a **model** obtains data from a database, though some models obtain data from a remote connection to another server. For example, a User model might retrieve a user name and email address from a local database. A User model could also obtain a user's recent tweets from Twitter or a user's hometown from Facebook. The controller can obtain data from more than one model if necessary.

A **controller** can have more than one *action*. For example, a User controller might have actions to display a list of users, or add or delete a user from a list. The **config/routes.rb** file matches a web request to a controller action. In the software architects' terminology, each action is a *method* of the controller *class*. We use the terms *action* and *method* interchangeably when we talk about a Rails controller; to be precise, controller actions are implemented as methods.

In practice, Rails developers try to limit controllers to seven standard actions: **index**, **show**, **new**, **create**, **edit**, **update** and **destroy** actions. A controller that offers these actions is said to be “RESTful” (a term that refers to **representational state transfer**, another software design abstraction). It’s not important to understand the abstract principles of RESTful design; recognizing the term and knowing that Rails controllers have seven standard actions is sufficient for beginners.

A **view** file combines Ruby code with HTML markup. Typically there will be a view file associated with each controller action that displays a page. An index view might show a list of users. A “show” view might provide details of a user’s profile. View files look much like ordinary HTML files but typically contain data in the form of Ruby variables. Often you’ll see Ruby statements such as blocks that iterate through lists to create tables. Following the “separation of concerns” principle, it is considered good practice to limit Ruby code in view files to only displaying data; anything else belongs in a model.

Not every controller action has its own view file. In many controllers, on completion, the **destroy** action will redirect to the index view, and **create** will redirect to either **show** or **new**.

This conceptual overview will be easier to grasp when you actually see the code for a model, view, and controller. We’ll create model, view, and controller files in the next chapter.

Remove the About Page

We’ve been using the static “About” page to investigate the request-response cycle.

We’re done, so delete the file **public/about.html**:

```
$ rm public/about.html
```

Make sure you've removed the **public/index.html** file as suggested earlier:

```
$ rm public/index.html
```

Earlier, we set up the **config/routes.rb** file. You can leave it in place. We'll change it in the next chapter.

Now we'll look at ways to implement the home page using the full power of Rails.

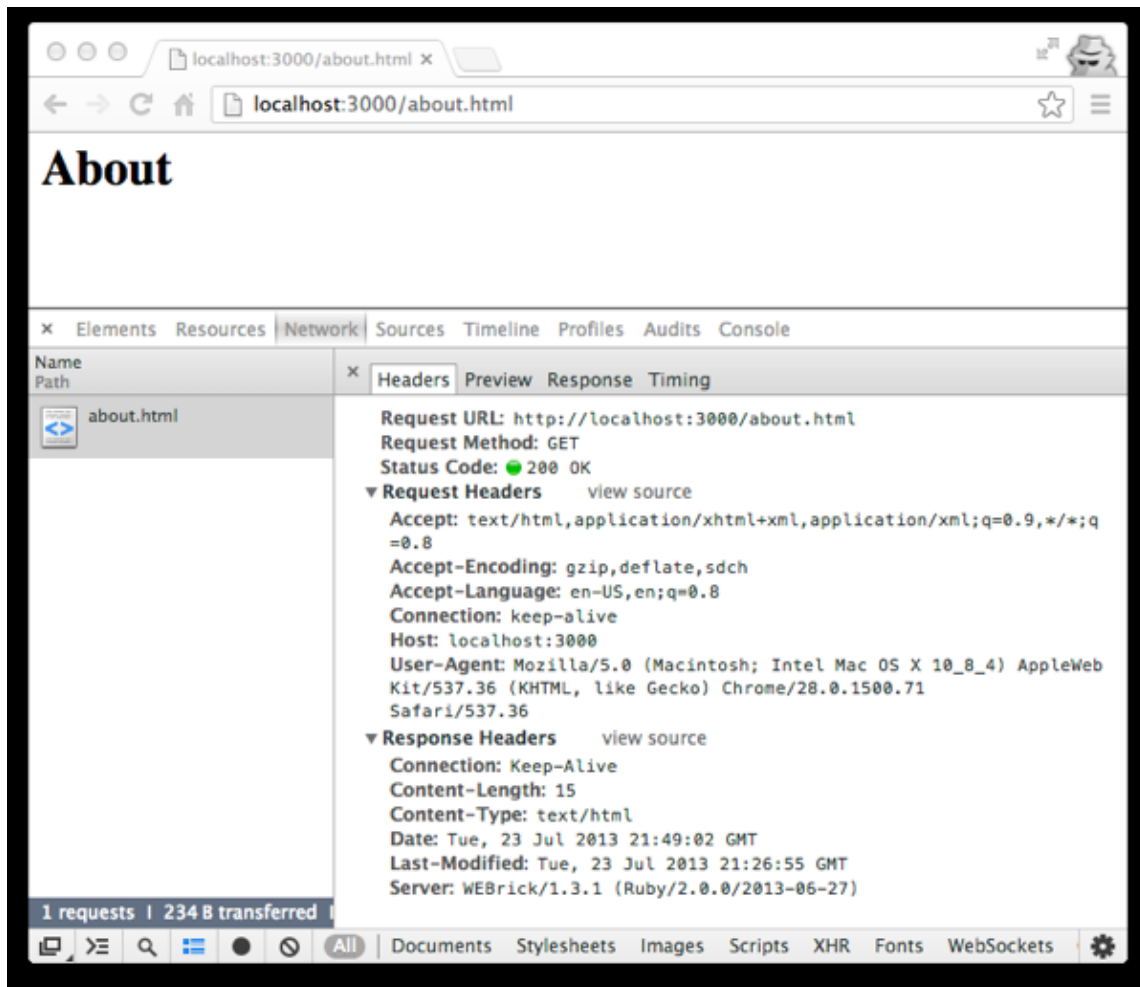


Figure 11.3: Viewing request headers in the Developer Tools View.

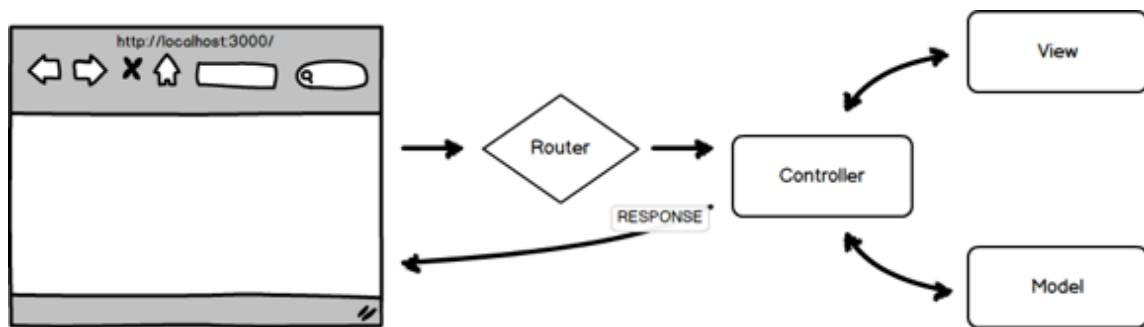


Figure 11.4: Model–View–Controller in Rails.

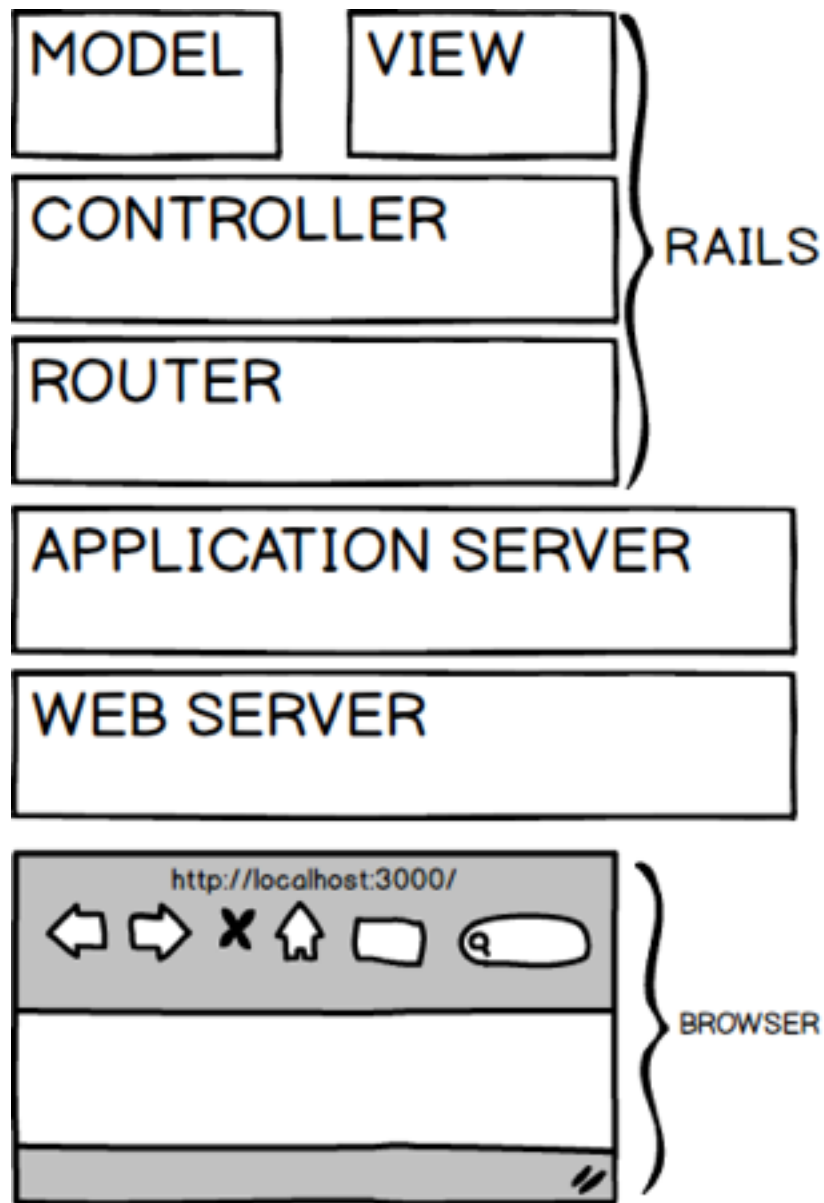


Figure 11.5: Model–View–Controller stack in Rails.

Chapter 12

Dynamic Home Page

Earlier, we saw how Rails can deliver simple static web pages.

Here we'll build a dynamic home page, illustrating basic concepts you'll need to understand Rails.

User Story

We'll plan our work with a user story:

```
*Birthday Countdown*
As a visitor to the website
I want to see the owner's name
I want to see the owner's birthdate
I want to see how many days until the owner's next birthday
In order to send birthday greetings
```

This silly home page will help us explore Rails and learn about the Ruby language.

Our goal is to build a practical web application that you can really use. Later we'll replace this silly home page with a useful web page that encourages visitors to sign up for a mailing list.

Routes, Model, View, and Controller

We'll use the model-view-controller design pattern as we build our new home page.

First, we'll set up a route so a request URL gets directed to the appropriate controller.

We'll set up a model so we obtain data we need for the home page.

We'll set up a view that contains the HTML needed to display our home page.

And finally, we'll create a controller that responds to the request, obtaining data from the model and rendering the view, sending a response to the web browser.

We can create the routes, model, view, and controller in any order. All must exist before our web application will respond to a request for a home page. In this tutorial, I've chosen to create the routes, model, view, and controller in an order that is convenient for learning.

The Name Game

Much of the art of programming lies in choosing suitable names for our creations.

We'll need a model as a source for data about the site owner. Choosing the most obvious name, we'll call it the Owner model:

- Owner - the file will be **app/models/owner.rb**

What about a name for the controller that will render our home page? How about "Home controller" or "Welcome controller?" Those names are acceptable. But if we consider our user story, the name "Visitors controller" is best. A visitor is the actor, so "Visitors controller" is appropriate:

- VisitorsController - the file will be **app/controllers/visitors_controller.rb**

Later we'll see this is a good choice because we'll create a Visitor model to handle data about the website visitor. In Rails, there is often a model with the same name as a controller (though a controller can use data from multiple models).

Naming Conventions

Rails is picky about class names and filenames. That's because of the “convention over configuration” principle. By requiring certain naming patterns, Rails avoids complex configuration files.

Before we look at class and filename conventions, here's a note about typographic terminology:

- a **string** is a sequence of characters
- you're looking at an example of lowercase strings separated by spaces (words!)
- Titlecase means there is an Initial Capital Letter in a string
- **CamelCase** contains a capital letter in the middle of a string
- **snake_case** combines words with an underscore character instead of a space

When you write code, you'll follow rules for class names:

- **class Visitor** - the model class name is capitalized and singular

- `class VisitorsController < ApplicationController` - for a controller, combine a pluralized model name with “Controller” in Camel-Case

Here are the rules for filenames. They are always lowercase, with words separated by underscores (snake_case):

- the model filename matches the model class name, but lowercase, for example **app/models/visitor.rb**
- the controller filename matches the controller class name, but snake_case, for example **app/controllers/visitors_controller.rb**
- the views folder matches the model class name, but plural and lowercase, for example **app/views/visitors**

At first the rules may seem arbitrary, but with experience they will make sense. The rule about no capital letters or spaces in filenames has its origins in computer antiquity.

If you stray from these naming conventions, you’ll encounter unexpected problems and frustration.

Routing

We’ll create the route before we implement the model and controller.

Open the file **config/routes.rb**. Replace the contents with this:

```
Rails.application.routes.draw do
  root to: 'visitors#new'
end
```

Any request to the application root (<http://localhost:3000/>) will be directed to the VisitorsController **new** action.

Don't be overly concerned about understanding the exact syntax of the code. It will become familiar soon and you can look up the details in the reference documentation, [RailsGuides: Routing from the Outside In](#).

In general, when you change a configuration file you must restart your application server. However, the **config/routes.rb** file is an exception. You don't need to restart the server after changing routes.

If you need to start the server:

```
$ rails server
```

Visit the page <http://localhost:3000/>. You'll see an error message because we haven't implemented the controller. The error message, "uninitialized constant VisitorsController," means Rails is looking for a VisitorsController and can't find it.

Model

Most Rails models obtain data from a database. When you use a database, you can use the **rails generate model** command to create a model that inherits from the ActiveRecord class and knows how to connect to a database.

Our tutorial application doesn't need a database. Instead of inheriting from ActiveRecord, we create a Ruby class with methods that return the owner's name, birthdate, and days remaining until his birthday. This simple class provides an easy introduction to Ruby code.

Create a file **app/models/owner.rb**:

```
class Owner

  def name
    name = 'Foobar Kadigan'
  end

  def birthdate
    birthdate = Date.new(1990, 12, 22)
  end

  def countdown
    today = Date.today
    birthday = Date.new(today.year, birthdate.month, birthdate.day)
    if birthday > today
      countdown = (birthday - today).to_i
    else
      countdown = (birthday.next_year - today).to_i
    end
  end

end
```

This is your first close look at Ruby code. The oddest thing you’ll see is the owner’s name, “Foobar Kadigan.” Everything else will make sense with a bit of explanation.

Keep in mind that we are using a text file to create an abstraction that we can manipulate in the computer’s memory. Software architects call these abstractions *objects*. In Ruby, everything we create and manipulate is an *object*. To distinguish one object from another, we define it as a *class*, give it a *class name*, and add behavior in the form of *methods*.

The first line `class Owner` defines the class and assigns a name. At the very end of the file, the `end` keyword completes the class definition.

We define three methods, starting with `def` (for “method definition”) and ending with `end`.

- `def name ... end`
- `def birthdate ... end`

- `def countdown ... end`

Each method contains simple Ruby code that assigns data to a variable. Later, we'll retrieve the data for use in our view file by *instantiating* the class and *calling* a method. Don't be discouraged by the software architects' terminology; the concepts are simple and we'll soon see everything in action.

Ruby makes it easy for a method to *return* data when called; the value assigned by the last statement will be delivered when the method is called.

Looking more closely at the Ruby code inside the method definitions, you'll see Ruby uses the `=` (equals) sign to assign values to a variable. The variable is named on the left side of the equals sign; a value is assigned on the right side. We call the equals sign an *assignment operator*.

We can assign any value to a variable, including a *string* (a series of characters that can be a word or name) such as "Foobar Kadigan." Ruby recognizes a string when characters are enclosed in single or double quotes. Not surprisingly, a number also can be assigned to a variable, either a whole number (an *integer*) or a decimal fraction (a *float*).

More interestingly, any Ruby object can be assigned to a variable. That helps us "move around" any object very easily, giving us access to the object's class methods anywhere we use the variable. We can create our own objects, as we have by creating the Owner class. Or we can use the library of objects that are supplied with Ruby. Ruby's prefabricated objects are defined by the Ruby API (*application programming interface*); essentially the API is a catalog of prebuilt classes that are building blocks for any application. The Rails API gives us additional classes that are useful for web applications. Learning the syntax of Ruby code gets you started with Ruby programming; knowing the API classes leads to mastery of Ruby.

The `Date` class is provided by the Ruby API. It is described in the [Ruby API reference documentation](#). The `Date` class has a `Date.new` method which *instantiates* (creates) a new date when supplied with year, month, and day *parameters*. You can see this syntax when we assign `Date.new(1990, 12, 22)` to the `birthdate` variable.

Note that Ruby has specific expectations about the syntax of numbers. The `Date.new(...)` method expects integers. Imagine a September birthday. You must use `Date.new(1990, 9, 22)`. If you enter a date in the format `Date.new(1990, 09, 22)`, you'll get a syntax error "Invalid octal digit" when you test the application. Ruby expects numbers that begin with zero to be *octal numbers*; you'll get an error because octal numbers can't contain the digit "9."

Our `countdown` method contains the most complex code in the class.

First, we set a variable `today` with today's date. The `Date.today` method creates an object that represents the current date. When the `Date.today` method is called, Ruby gets the current date from the computer's system clock.

Next we create a `birthday` variable and assign a new date that combines today's year with the month and day of the `birthdate`. This gives us the date of Foobar Kadigan's birthday this year.

The `Date` class can perform complex calendar arithmetic. The variables `birthdate` and `today` are *instances* of the `Date` class. We can use a greater-than operator to determine if Foobar Kadigan's birthday is in the future or the past.

The `if ... else ... end` structure is a *conditional statement*. If the birthday is in the future, we subtract `today` from `birthday` to calculate the number of days remaining until the owner's birthday, which we assign to the `countdown` variable.

If the birthday has already passed, we apply a `next_year` method to the birthday to get next year's birthday. Then we subtract `today` from `birthday.next_year` to calculate the number of days remaining until the owner's birthday, which we assign to the `countdown` variable.

The result might be fractional so we use the utility method `to_i` to convert the result to a whole number (integer) before assigning it to the `countdown` variable.

This shows you the power of programming in Ruby. Notice that I needed 16 paragraphs and over 600 words to explain 15 short lines of code. We used only

seven Ruby abstractions but they represent thousands of lines of code in the Ruby language implementation. With knowledge of Ruby syntax and the Ruby API, a few short lines of code in a text file gives us amazing ability.

In an upcoming chapter, we'll look more closely at the syntax and keywords of the Ruby language. But without knowing more than this, we can build a simple web application.

Let's see how we can put this functionality to use on a web page.

View

The Owner model provides the data we want to see on the Home page.

We'll create the markup and layout in a View file and add variables that present the data.

View files go in folders in the **app/views/** directory. In a typical application, one controller can render multiple views, so we make a folder to match each controller. You can make a new folder using your file browser or text editor. Or use the Unix **mkdir** command:

```
$ mkdir app/views/visitors
```

Create a file **app/views/visitors/new.html.erb**:

```
<h3>Home</h3>
<p>Welcome to the home of <%= @owner.name %>.</p>
<p>I was born on <%= @owner.birthdate %>.</p>
<p>Only <%= @owner.countdown %> days until my birthday!</p>
```

We've created a **visitors/** folder within the **app/views/** directory. We have only a single **new** view but if we had more views associated with the Visitors controller, they'd go in the **app/views/visitors/** folder.

We name our View file **new.html.erb**, adding the **.erb** file extension so that Rails will use the ERB templating engine to interpret the markup.

There are several syntaxes that can be used for a view file. In this tutorial, we'll use the ERB syntax that is most commonly used by beginners. Some experienced developers prefer to add gems that provide the [Haml](#) or [Slim](#) templating engines. As you might guess, a View that uses the Haml templating syntax would be named **new.html.haml**.

Our HTML markup is minimal, using only the `<h3>` and `<p>` tags. The only ERB markup we add are the `<%= ... %>` delimiters. This markup allows us to insert Ruby code which will be replaced by the result of evaluating the code. In other words, `<%= @owner.name %>` will appear on the page as Foobar Kadigan.

You may have noticed that we refer to the Owner model with the variable `@owner`. It will be clear when we create the Visitors controller why we use this syntax (a variable name that begins with the `@` character is called an *instance variable*).

Obviously, if all we wanted to do was include the owner's name on the page, it would be easier to simply write the text. The Rails implementation becomes useful if the name is retrieved from a database or created programmatically.

We can better see the usefulness of the Owner model when we look at the use of `<%= @owner.countdown %>`. There is no way to display a calculation using only static HTML, so Rails gives us a way to display the birthday countdown calculation.

If you're a programmer, you might wonder why we only output the variable on the page. Since we can use ERB to embed any Ruby code, we could perform the calculation right on the page by embedding `<%= (Date.new(today.year, @owner.birthdate.month, @owner.birthdate.day) - Date.today).to_i %>`. If you've used JavaScript or PHP, you may have performed calculations like this, right on the page. Rails would allow us to do so, but the practice violates the "separation of concerns" principle that encourages us to perform complex calculations in a model and only display data in the view.

Before we can display the home page, we need to create the Visitors controller.

Controller

The Visitors controller is the glue that binds the Owner model with the VisitorsController#new view.

Note: When we refer to a controller action, we use the notation “VisitorsController#new,” joining the controller class name with the action (method) that renders a page. In this context, the # character is only a documentation convention.

Note: **VisitorsController** will be the class name and **visitors_controller.rb** will be the filename. The class name is written in **camelCase** (with a hump in the middle, like a camel) so we can combine two words without a space.

Unix commands get messy when filenames include spaces so we create a filename that combines two words with an underscore (sometimes called “snake_case”).

Create a file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
  end

end
```

We define the class and name it **class VisitorsController**, inheriting behavior from the ApplicationController class which is defined in the Rails API.

We only need to define the **new** method. We create an *instance variable* named **@owner** and assign an instance of the Owner model. Any instance variables (variables named with the @ character) will be available in the corresponding view file.

If we don't instantiate the Owner model, we'll get an error when the controller **new** action attempts to render the view because we use the **@owner** instance in the view file.

Keep in mind the purpose of the controller. Each controller action (method) responds to a request by obtaining a model (if data is needed) and rendering a view.

You've already created a view file in the **app/views/visitors** folder. The **new** action of the VisitorsController renders the template **app/views/visitors/new.html.erb**.

The **new** method is deceptively simple. Hidden behavior inherited from the ApplicationController does all the work of rendering the view. We can make the hidden code explicit if we wish to. It would look something like this:

```
class VisitorsController < ApplicationController

  def new

    @owner = Owner.new
    render 'visitors/new'
  end

end
```

This is an example of Rails magic. Some developers complain this is black magic because the “convention over configuration” principle leads to obscurity. Rails often offers default behavior that looks like magic because the underlying implementation is hidden in the depths of the Rails code library. This can be frustrating when, as a beginner, you want to understand what's going on.

Revealing the hidden code, we see that invoking the **new** method calls a **render** method supplied by the ApplicationController parent class. The **render** method searches in the **app/views/visitors** directory for a view file named **new** (the file extension **.html.erb** is assumed by default). The code underlying the **render** method is complex. Fortunately, all we need to do is define the method and instantiate the Owner model. Rails takes care of the rest.

As a beginner, simply accept the magic and don't confound yourself trying to

find how it works. As you gain experience, you can dive into the Rails source code to unravel the magic.

Scaffolding

This tutorial aims to give you a solid foundation in basic concepts. The model–view–controller pattern is one of the most important. I’ve found the best way to understand model–view–controller architecture is to create and examine the model, view, and controller files.

As you continue your study of Rails, you’ll find other tutorials that use the *scaffolding* shortcut. For example, [Rails Guides: Getting Started with Rails](#) includes a section “Getting Up and Running Quickly with Scaffolding” which shows how to use the `rails generate scaffold` command to create model, view, and controller files in a single operation. Students often use scaffolding to create simple Rails applications.

In practice, I’ve observed that working Rails developers seldom use scaffolding. There’s nothing wrong with it; it just seems that scaffolding doesn’t offer much that can’t be done as quickly by hand.

Test the Application

We’ve created a model, view, and controller. Now let’s run the application.

Enter the command:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>. You’ll see our new home page.

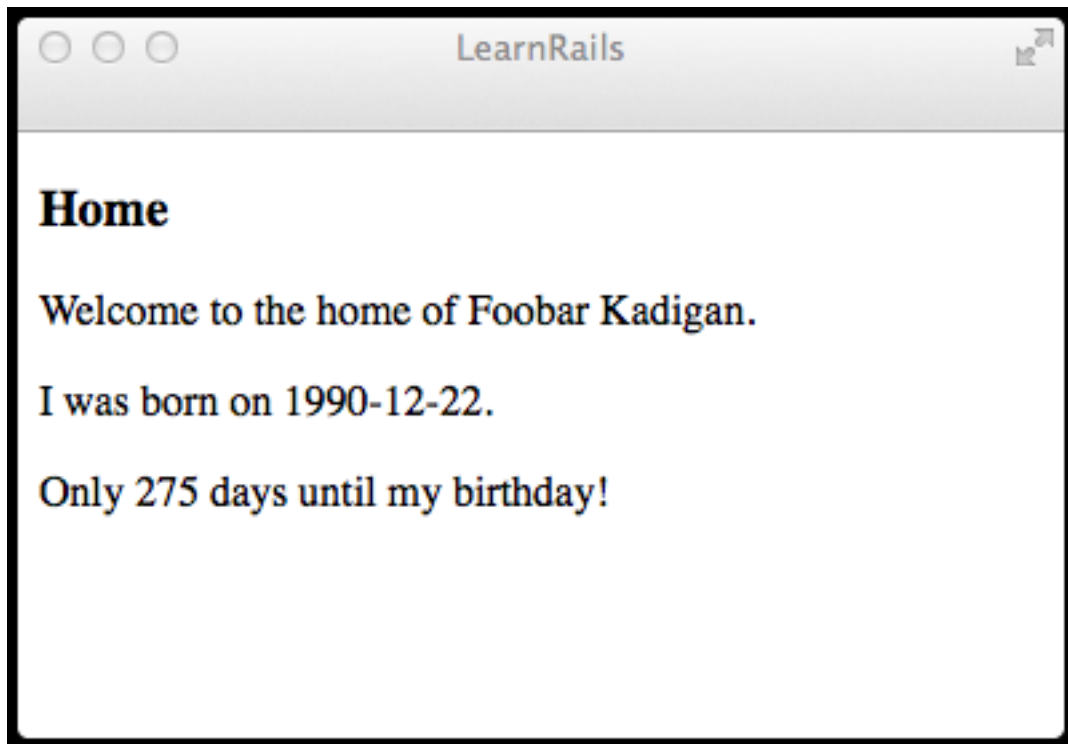


Figure 12.1: Dynamic home page shows days until a birthday.

It's a very simple web page but it uses Ruby to calculate the countdown to the birthday. And the underlying code conforms to the conventions and structure of Rails.

Git

At this point, you might have the Rails server running in your console window. We're going to run a git command in the console now.

You might think you have to enter Control-c to shut down the server and get the command prompt. But that's not necessary. You can open more than one console window. Your terminal application lets you open multiple tabs so you can easily switch between windows without using a lot of screen real estate.

If you haven't tried it, now is a good time. It is convenient to have a console window open for the server and another for various Unix commands.

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "dynamic home page"  
$ git push
```

Now let's take a look at troubleshooting.

Chapter 13

Troubleshoot

In the last chapter, we built a dynamic home page and learned about the model–view–controller architecture of Rails. There was a lot to learn, but the code was simple, and I hope it worked the first time you tried it.

Before we do any more work on our tutorial application, we need to learn about troubleshooting and debugging. As a software developer, you’ll spend a lot of time with code that doesn’t work. You’ll need tools and techniques to diagnose problems.

Git

In this chapter we’ll make changes to the application just for troubleshooting.

Before you get started, make sure the work you’ve done is committed to your git repository. Use the **git status** command to check:

```
$ git status
```

You should see:


```
On branch master
nothing to commit, working directory clean
```

If **git status** reports any uncommitted changes, go back to the last step in the previous chapter and commit your work to the git repository before continuing. At the end of this chapter, we're going to throw away the work we've done in this chapter. We don't want to accidentally throw away work from the previous chapter so make sure it is committed to the repository.

Interactive Ruby Shell

There will be times when you want to try a snippet of Ruby code just to see if it works. Your tool will be IRB, the Interactive Ruby Shell.

IRB is a Ruby interpreter that runs from the command line. It executes any Ruby code and provides an immediate response, allowing you to experiment in real-time.

Let's try it.

```
$ irb
>>
```

The command **irb** launches the program and displays a prompt that show your Ruby version, a line number, and an arrow. If you enter a valid Ruby expression, the interpreter will display the result of evaluating the expression.

Try simple arithmetic:

```
>> n = 2
=> 2
>> n + 2
=> 4
```

Wow! You are using your computer for simple math. Maybe you can delete the calculator app from your phone.

IRB will evaluate any Ruby expression and helps you quickly determine if syntax and logic is correct.

IRB for Blocks of Code

At first glance, it appears IRB works on just one line of code.

Actually, IRB can handle multiple lines of code. Try it:

```
>> n = 10
=> 10
>> if n < 10
>>   puts "small"
>> else
?>   puts "big"
>> end
big
=> nil
>>
```

Here we set `n = 10` and then enter a conditional statement line-by-line. After we enter the final `end`, IRB interprets the code and outputs the result.

You'll often enter more than one line of code in IRB. If you find yourself frustrated because you've entered typos and had to enter the same code repeatedly, you can use IRB to load code you've saved in a file:

```
>> load './mytest.rb'
```

Quitting IRB

It can be very frustrating to find you are stuck inside IRB. Unlike most shell commands, you can't quit with Control-c. Enter Control-d or type `exit` to quit

IRB:

```
$ irb  
>> exit
```

Learn More About IRB

Here's an entertaining way to learn about IRB:

- [Why's \(Poignant\) Guide to Ruby \(with a Basic Introduction to IRB\)](#)

Here's a more conventional way to learn about IRB:

- [The Pragmatic Programmer's Guide](#)

Beyond IRB

If you ask experienced Rails developers for help with IRB, they'll often recommend you switch to Pry. [Pry](#) is a powerful alternative to the standard IRB shell for Ruby. As you gain experience, you might take a look at Pry to see what the enthusiasm is all about. But for now, as a beginner trying out a few lines of Ruby code, there's no need to learn Pry.

Rails Console

IRB only evaluates expressions that are defined in the Ruby API. IRB doesn't know Rails.

It'd be great to have a tool like IRB that evaluates any expression defined in the Rails API. The tool exists; it's called the Rails console. It is particularly useful

because it loads your entire Rails application. Your application will be running as if the application was waiting to respond to a web request. Then you can expose behavior of any pieces of the web application.

```
$ rails console
...
Loading development environment (Rails 4.x.x)
>>
```

The Rails console behaves like IRB but loads your Rails development environment. The prompt shows it is ready to evaluate an expression.

Let's use the Rails console to examine our Owner model:

```
>> myboss = Owner.new
=> #<Owner:0x007fc18e91faf8>
```

We've created a variable named **myboss** and created a new instance of the Owner class. The Rails console responds by displaying the unique identifier it uses to track the object. The identifier is not particularly useful, except to show that something was created.

If you're unsure about the difference between an *instance* and a *class*, we've just seen that we can make one or more instances of a class by calling the **Owner.new** method. When we specify the **Owner** class, the class definition is loaded into the computer's working memory (our development environment) from the class definition file on disk. Then we can use the **Owner.new** method to make one or more instances of the **Owner** class. Each instance is a unique object with its own data attributes but the same behavior as other objects instantiated from its class.

Let's assign the name of our boss to a variable called **name**:

```
>> name = myboss.name
=> "Foobar Kadigan"
```

Our variable `myboss` is an instance of an `Owner` class so it responds to the method `Owner.name` by returning the owner's name.

We want to show respect to our boss so we'll perform some *string manipulation*:

```
>> name = 'Mr. ' + name  
=> "Mr. Foobar Kadigan"
```

We're done for now. When we quit the Rails console or shut down the computer the `Owner` class definition remains stored on disk but the instances disappear. The bits that were organized to create the variable `name` will evaporate into the ether.

Actually, the bits are still there, in the form of logic states in the computer's chips, but they have no meaning until another program uses them.

Enter Control-d or type `exit` to quit the Rails console.

The Rails console is a useful utility. It is like a handy calculator for your code. Use it when you need to experiment or try out short code snippets.

Rails Logger

As you know, a Rails application sends output to the browser that makes a web request. On every request, it also sends diagnostic output to the *server log file*. Depending on whether the application is running in the development environment or in production, the log file is here:

- `log/development.log`
- `log/production.log`

In development, everything written to the log file appears in the console window after you run the `rails server` command. Scrolling the console window is a good way to see diagnostics for every request.

Here's what you see in the log after you visit the application home page:

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
  Rendered visitors/new.html.erb within layouts/application (48.8ms)
Completed 200 OK in 233ms (Views: 211.5ms | ActiveRecord: 0.0ms)
```

You may have more than one console window open in the terminal application. If you don't see your log output in your terminal, check if you have tabs with other windows.

Here's the best part. You can add your own messages to the log output by using the Rails logger. Let's try it out.

Modify the file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    Rails.logger.debug 'DEBUG: entering new method'
    @owner = Owner.new
    Rails.logger.debug 'DEBUG: Owner name is ' + @owner.name
  end

end
```

Visit the home page again and you'll see this in the console output:

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
DEBUG: entering new method
DEBUG: Owner name is Foobar Kadigan
  Rendered visitors/new.html.erb within layouts/application (0.2ms)
Completed 200 OK in 8ms (Views: 4.6ms | ActiveRecord: 0.0ms)
```

If you really needed to do so, you could add a logger statement at every step in the application. You could see how the application behaves, step by step. And you could “print” the value of every variable at every step. You'll never need

diagnostics at this level of detail in Rails, but the logger is extremely useful when you are trying to understand unexpected behavior.

Let's add logger statements to the **Owner** model. Modify the file **app/models/owner.rb**:

```
class Owner

  def name
    name = 'Foobar Kadigan'
  end

  def birthdate
    birthdate = Date.new(1990, 12, 22)
  end

  def countdown
    Rails.logger.debug 'DEBUG: entering Owner countdown method'
    today = Date.today
    birthday = Date.new(today.year, birthdate.month, birthdate.day)
    if birthday > today
      countdown = (birthday - today).to_i
    else
      countdown = (birthday.next_year - today).to_i
    end
  end
end
```

We added the **Rails.logger.debug** statement to the **Owner.countdown** method.

Visit the home page and here's what you'll see in the console output:

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
DEBUG: entering new method
DEBUG: Owner name is Foobar Kadigan
DEBUG: entering Owner countdown method
  Rendered visitors/new.html.erb within layouts/application (0.3ms)
Completed 200 OK in 7ms (Views: 4.2ms | ActiveRecord: 0.0ms)
```

You'll often need to "get inside" the model or controller to see what's happening. The Rails logger is the best tool for the job.

Here are some tricks for the Rails logger.

In a controller, you can use the method `logger` on its own. In a model, you have to write `Rails.logger` (both class and method).

You can use any of the methods `logger.debug`, `logger.info`, `logger.warn`, `logger.error`, or `logger.fatal` to write log messages. By default, you'll see any of these messages in the development log. Log messages written with the `logger.debug` method will not be recorded in a production log file.

If you want your log messages to stand out, you can add formatting code for color:

```
Rails.logger.debug "\033[1;34;40m[DEBUG]\033[0m " + 'will appear in bold blue'
```

For more about the Rails logger, see the [RailsGuide: Debugging Rails Applications](#).

Revisiting the Request-Response Cycle

Earlier, when we investigated the request-response cycle, we looked in the server log to see the response to the web browser request.

Now, with debug statements in the controller and model, we'll see messages showing the server's traverse of the model-view-controller architecture.

```
Started GET "/" for 127.0.0.1 at ...  
Processing by VisitorsController#new as HTML  
DEBUG: entering new method  
DEBUG: Owner name is Foobar Kadigan  
DEBUG: entering Owner countdown method  
  Rendered visitors/new.html.erb within layouts/application (0.3ms)  
Completed 200 OK in 5ms (Views: 4.2ms | ActiveRecord: 0.0ms)
```

Notice how the diagnostic messages in the console window match the headers in the browser diagnostic view. The browser's "Request Method:GET" matches

the server’s “Started GET.” The browser’s “Request URL:http://localhost:3000/” matches the server’s “/” for 127.0.0.1” (localhost is at IP address 127.0.0.1). The browser’s “Status Code: 200” matches the server’s “Completed 200 OK” (you might have to clear the browser’s cache if the browser is showing “304 Not Modified”).

We can see evidence of the model-view-controller architecture. “Processing by VisitorsController#new” shows the program flow entering the controller. Our debug statements show we enter the `new` method and reveal the value of the Owner name. The next debug statement reveals the flow has passed to the Owner model. A diagnostic message shows the controller has rendered the `visitors/new.html.erb` view file. Finally, the “Completed 200 OK” message indicates the response has been sent to the browser.

As we learned, the model-view-controller architecture is an abstract design pattern. We’ve seen it reflected in the file structure of the Rails application directory. Now we can see it as activity in the server log.

The Stack Trace

The Rails logger is extremely useful if you want to insert messages to show program flow or display variables. But there will be times when program flow halts and the console displays a *stack trace*.

Let’s deliberately create an error condition and see an error page and stack trace.

Modify the file `app/controllers/visitors_controller.rb`:

```
class VisitorsController < ApplicationController

  def new
    Rails.logger.debug 'DEBUG: entering new method'
    @owner = Owner.new
    Rails.logger.debug 'DEBUG: Owner name is ' + @owner.name
    DISASTER
  end

end
```

```
end
```

Visit the home page and you'll see an error page:

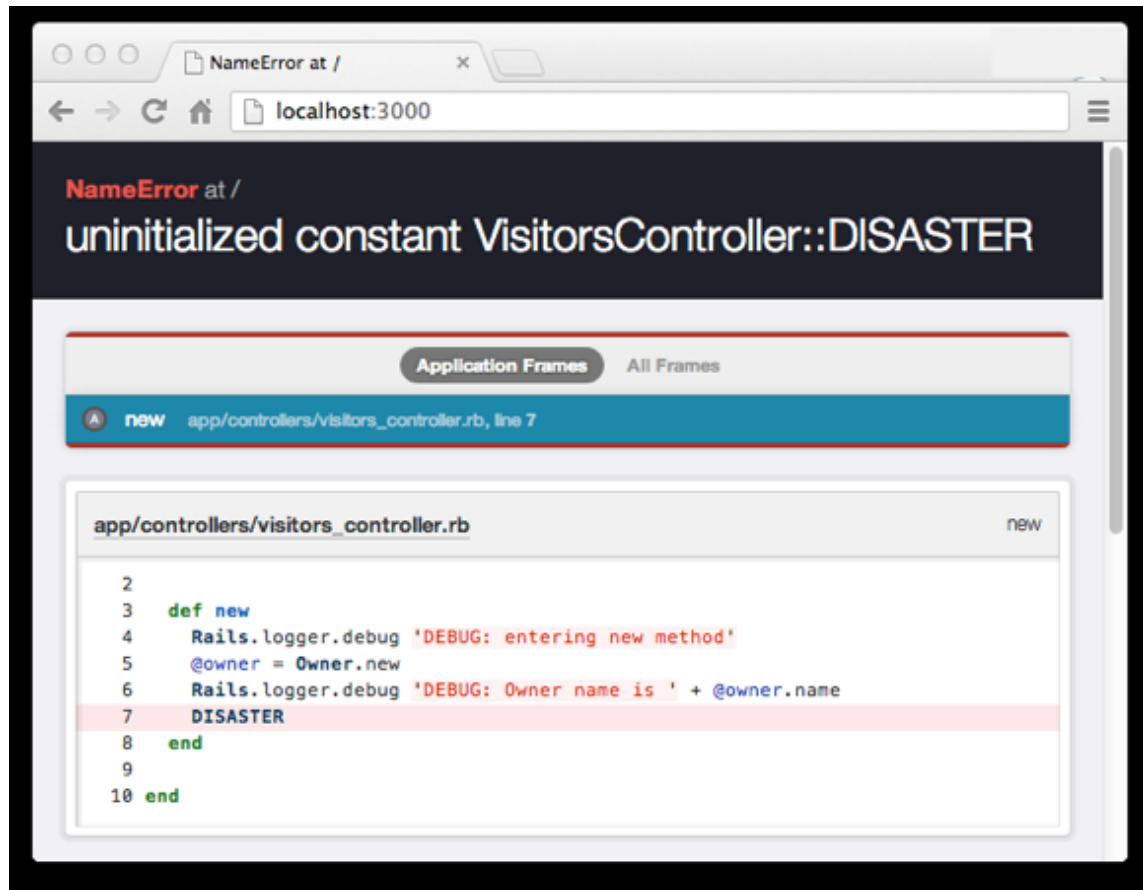


Figure 13.1: Error page.

You'll see this error page because we've installed the [better_errors](#) gem. Without the `better_errors` gem, you'd see the default Rails error page which is quite similar.

In the console log, the stack trace will show everything that happens before Rails encounters the error:

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
DEBUG: entering new method
DEBUG: Owner name is Foobar Kadigan
Completed 500 Internal Server Error in 10ms

NameError - uninitialized constant VisitorsController::DISASTER:
  app/controllers/visitors_controller.rb:7:in `new'
.
.
.
```

To save space, I’m only showing the top line of the stack trace. I’ve eliminated about sixty lines from the stack trace.

Don’t feel bad if your reaction to a stack trace is an immediate, “TMI!” Indeed, it is usually Too Much Information. There are times when it pays to carefully read through the stack trace line by line, but most often, only the top line of the stack trace is important.

In this case, both the error page and the top line of the stack trace show the application failed (“barfed”) when it encountered an “uninitialized constant” at line 7 of the **app/controllers/visitors_controller.rb** file in the **new** method. It’s easy to find line 7 in the file and see that is exactly where we added a string that Rails doesn’t understand.

The point of this exercise is to encourage you to read the top line of the stack trace and use it to diagnose the problem. I’m always surprised how many developers ignore the stack trace, probably because it looks intimidating.

Raising an Exception

As you just saw, you can purposefully break your application by adding characters that Rails doesn’t understand. However, there is a better way to force your program to halt, called *raising an exception*.

Let’s try it. Modify the file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    Rails.logger.debug 'DEBUG: entering new method'
    @owner = Owner.new
    Rails.logger.debug 'DEBUG: Owner name is ' + @owner.name
    raise 'Deliberate Failure'
  end

end
```

You can throw an error by using the **raise** keyword from the Ruby API. You can provide any error message you'd like in quotes following **raise**.

Here's the console log after you try to visit the home page:

```
Started GET "/" for 127.0.0.1 at ...
Processing by VisitorsController#new as HTML
DEBUG: entering new method
DEBUG: Owner name is Foobar Kadigan
Completed 500 Internal Server Error in 22ms

RuntimeError - Deliberate Failure:
  app/controllers/visitors_controller.rb:7:in `new'
  .
  .
  .
```

Before we continue, let's remove the deliberate failure. Modify the file **app/controllers/visitors_controller.rb**.

```
class VisitorsController < ApplicationController

  def new
    Rails.logger.debug 'DEBUG: entering new method'
    @owner = Owner.new
    Rails.logger.debug 'DEBUG: Owner name is ' + @owner.name
  end

end
```

Rails and the Ruby API provide a rich library of classes and methods to raise and handle exceptions. For example, you might want to display an error if a

user enters a birthdate that is not in the past. Rails includes various exception handlers to display errors in production so users will see a helpful web page explaining the error.

Git

There's no need to save any of the changes we made for troubleshooting.

You could go to each file and carefully remove the debugging code you added. But there's an easier way.

Check which files have changed:

```
$ git status
# Changes not staged for commit:
#   (use "git add ..." to update what will be committed)
#   (use "git checkout -- ..." to discard changes in working directory)
#
# modified:   app/controllers/visitors_controller.rb
# modified:   app/models/owner.rb
#
no changes added to commit (use "git add" and/or "git commit -a")
```

Use Git to revert your project to the most recent commit:

```
$ git reset --hard HEAD
```

The Git command `git reset --hard HEAD` discards any changes you've made since the most recent commit. Check the status to make sure:

```
$ git status
# On branch master
nothing to commit, working directory clean
```

We've cleaned up after our troubleshooting exercise.

Chapter 14

Just Enough Ruby

Experienced Rails developers debate whether beginners should study Ruby before learning Rails.

By all means, if you love the precision and order of programming languages, dive into the study of Ruby from the beginning. But most people don't delay starting Rails while learning Ruby; realistically, you'll retain more knowledge of Ruby if you learn it as you build things in Rails. That is the approach we've taken in this book. You've already built a simple Rails application and used Ruby as you did so.

Reading Knowledge of Ruby

What you need, more than anything, when you start working with Rails, is reading knowledge of Ruby.

With a reading knowledge of Ruby you'll avoid feeling overwhelmed or lost when you encounter code examples or work through a tutorial. Later, as you tackle complex projects and write original code, you'll need to know enough of the Ruby language to implement the features you need. But as a student, you'll be following tutorials that give you all the Ruby you need. Your job is

to recognize the language keywords and use the correct syntax when you type Ruby code in your text editor.

To that end, this chapter will review the Ruby keywords and syntax you've already learned. And you'll extend your knowledge so you'll be prepared for the Ruby you'll encounter in upcoming chapters.

Ruby Example

To improve your reading knowledge of Ruby, we'll work with an example file that contains a variety of Ruby expressions.

We won't use this file in our tutorial application, so you'll delete it at the end of this chapter. But we'll approach it as real Ruby code, so make a file and copy the code using your text editor.

First we have to consider where the file should go. It will not be a model, view, controller, or any other standard component of Rails. Rails has a place for miscellaneous files that don't fit in the Rails API. We'll create the file in the **lib/** folder. That's the folder you'll use for any supporting Ruby code that doesn't fit elsewhere in the Rails framework.

Create a file **lib/example.rb**:

```
class Example < Object

  # This is a comment.

  attr_accessor :honorific
  attr_accessor :name
  attr_accessor :date

  def initialize(name, date)
    @name = name
    @date = date.nil? ? Date.today : date
  end

  def backwards_name
    @name.reverse
  end
end
```

```
def to_s
  @name
end

def titled_name
  @honorific ||= 'Esteemed'
  titled_name = "#{@honorific} #{@name}"
end

def december_birthdays
  born_in_december = [ ]
  famous_birthdays.each do |name, date|
    if date.month == 12
      born_in_december << name
    end
  end
  born_in_december
end

private

def famous_birthdays
  birthdays = {
    'Ludwig van Beethoven' => Date.new(1770,12,16),
    'Dave Brubeck' => Date.new(1920,12,6),
    'Buddy Holly' => Date.new(1936,9,7),
    'Keith Richards' => Date.new(1943,12,18)
  }
end

end
```

In some ways, this Ruby code is like a poem from Lewis Carroll:

```
'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe;
All mimsy were the borogoves,
And the mome raths outgrabe.

"Beware the Jabberwock, my son!
The jaws that bite, the claws that catch!
Beware the Jubjub bird, and shun
The frumious Bandersnatch!"
```

The poem corresponds to the rules of English syntax but is nonsense.

The code follows the rules of Ruby syntax, and unlike the poem, uses meaningful words. But it is unclear how the author intends anyone to use the code. If you're beginning a career as a Rails developer, this won't be the last time you look at code and wonder what the author was intending. In this case, I just want to give you some code that illustrates typical Ruby syntax and structure.

Ruby Keywords

When reading Ruby code, the first challenge is determining which words are Ruby keywords and which were made up by the developer. Code is only strings of characters. But some strings have special meaning for everyone and all others are arbitrary words that only have meaning to an individual developer.

As you gain experience, you'll recognize Ruby keywords because you've seen them before.

You'll also recognize a developer's made-up words because of their position relative to other words and symbols. Some made-up words will be obvious because they are just too idiosyncratic to be part of the Ruby language. For example, you'll rightly guess that `myapp` or `fluffycat` are not part of the Ruby language.

If you're reading a Lewis Carroll poem, you could look up words in a dictionary to see if you find them.

There is only one way to be sure which words are part of the Ruby language: Check the Ruby API.

As an exercise, pick one of the words from the example code that you think might be a Ruby keyword and search the API to find it.

If you want to be a diligent student, you can check every keyword in the example code to find out whether it is in the Ruby API. It is more practical to learn to recognize Ruby keywords, which we'll do next.

API Documentation

The Ruby API documentation lists every keyword in the language:

- ruby-doc.org - the official Ruby API
- apidock.com/ruby - Ruby API docs with usage notes

Ruby Files

When we write code, we save it in files. We've added our miscellaneous example file to the **lib/** folder.

By convention, Ruby files end with the file extension **.rb**.

Using IRB

In the “Troubleshooting” chapter, you used IRB (the Interactive Ruby Shell) to try out Ruby code. You can use IRB to try out the example code in the console.

```
$ irb
>> load 'lib/example.rb'
=> true
>> require 'date'
=> true
>> ex = Example.new('Daniel', nil)
=> #<Example:0x007fb46c9eecd8 @name="Daniel", @date=#<Date: 2015-12-23 ...
>> list = ex.december_birthdays
=> ["Ludwig van Beethoven", "Dave Brubeck", "Keith Richards"]
>>
```

Entering the **load** directive and the filename brings the code into IRB.

The **require 'date'** statement loads the Ruby date library.

The statement `ex = Example.new('Daniel', nil)` creates an object from the `Example` class.

The `ex.december_birthdays` method returns an array of names.

Remember you can use Control-d to exit from IRB.

Now, for practice, we'll read the Ruby code.

Whitespace and Line Endings

Whitespace characters such as spaces and tabs are generally ignored in Ruby code, except when they are included in strings. There are several special cases where whitespace is significant in Ruby expressions but you are not likely to encounter these cases as a beginning Rails developer.

Some programming languages (Java and the C family) require a semicolon as a terminator character at the end of statements. Ruby does not require a semicolon to terminate a statement. Instead, if the Ruby code on a line is a complete expression, the line ending signifies the end of the statement. If the line ends with a `+` or other operator, or a backslash character, the statement is split into multiple lines.

Comments

Ruby ignores everything that is marked as a comment. Use comments for notes to yourself or other programmers.

```
# This is a comment.
```

You can also turn code into comments if you don't want the code to run. This is a common trick when you want to “turn off” some part of your code but you don't want to delete it just yet, because you are trying out alternatives.

The Heart of Programming

Three principles are at the heart of all programming:

- syntax
- conditional execution
- transformation

Computers allow no ambiguity. Code must exactly follow the *syntax* of a language. Typos, guesses, and code that is almost-but-not-quite right will simply fail, often without any helpful error messages.

Computers seem intelligent because they can execute code *conditionally*. You can write a program so that given one set of conditions, certain parts of the code will execute, and given different conditions, other parts of the code will execute.

Lastly, programs are written to transform abstractions from one form to another. That's why computer programs look like math. When we learn simple arithmetic, we learn we can take the symbols for numbers and add them together to make a different number. Computer programs do more than add numbers; a program can transform words and other abstractions.

Assignment

In Ruby, like many other programming languages, the equals sign indicates we are *assigning* a value.

```
name = 'Foobar Kadigan'
```

Assignment is the first step to transformation. Here `'Foobar Kadigan'` is a string of letters. The equals sign is the assignment operator. And `name` is a *variable* that stores the value so it can be easily reused. We don't have to type `'Foobar Kadigan'` every time we need a name; we can use `name` instead.

Just as we can assign a value to a variable, we can reassign a new value whenever we want. That is why we call them variables; the value can vary.

```
name = 'Mr. Foobar Kadigan'
```

Variables can be assigned strings of letters, numbers, or anything else. “Anything else” is very broad because we can use Ruby to make complex structures that contain data and also “do work.” These complex structures are *objects* and we say that Ruby is *object-oriented* because it is easy to work with objects in Ruby.

Object-Oriented Terminology

Software architects use a common vocabulary to talk about programming languages:

- **class**
- **instance** or **object**
- **method**
- **attribute** or **property**
- **inheritance**
- **class hierarchy**

There are three ways to learn what these words mean. You can memorize the definitions. You can write code and intuitively grasp the meanings. Or you can gain an understanding by applying metaphors.

Houses

For example, some programming textbooks attempt to explain a *class* like this: A blueprint for a house design is like a *class definition*. All the houses built from that blueprint are *objects* of a class we could call House.

Vehicles

Or: The concept of “vehicle” is like a *class*. Vehicles can have *attributes*, like color or number of doors. They have behavior, or *methods*, like buttons that turn on lights or honk a horn. The concepts of “truck” or “car” are also classes, *inheriting* common characteristics from a *superclass* “vehicle.” The blue car in your driveway with four doors is an object, a particular *instance* of the class “car.”

Cookies

I like the cookie metaphor the best.

A *class definition* is like a cookie cutter.

Bits in the computer memory are like cookie dough.

The cookie cutter makes as many individual cookies as you want. Each cookie is an *instance* of the Cookie class, with the same shape and size as the others. Cookies are *objects*.

You can decorate each cookie with sprinkles, which are *attributes* that are unique to each instance. Some cookies get red sprinkles, some get green, but

the shape remains the same.

Running a program is like baking. The cookies change state from raw to cooked.

Sticking a toothpick in a cookie is like calling a *method*. The method returns a result that tells you about the state: Is it done?

Limitations of Metaphors

Metaphors are imperfect.

If baking was like running a program, all the cookies would disappear as soon as the oven was turned off.

When a software program contains a “car” model, it doesn’t fully model cars in the physical world. It represents an abstraction of characteristics a programmer deems significant. Let’s make a model for a Person that contains an attribute Gender. What values are possible for the attribute Gender? For many years, Facebook offered two choices, male and female. In 2014, Facebook suddenly offered a choice of over fifty gender terms. As Sarah Mei discusses in a blog post, [Why Gender is a Text Field on Diaspora](#), your assumptions have consequences when you build a model.

Most classes in software APIs don’t model anything in the real world. They typically represent an abstraction, like an Array or a Hash, which inherits characteristics from another abstraction, for example, a Collection.

Given the limitations of metaphors, maybe it is easier to simply say that software allows us to create abstractions that are “made real” and then manipulated and transformed. Terminology such as *class* and *instance* describe the abstractions and the relationships among them.

Definitions

Here are definitions for some of the terms we encounter when we consider Rails from the perspective of a software architect:

class an abstraction that encapsulates data and behavior

class definition written code that describes a class

instance or object a unique copy of a class that exists only while a program is running

inheritance a way to make a class by borrowing from another class

class hierarchy classes that are related by inheritance

method a command that returns data from an object

attribute or property data that can be set or retrieved from the object

variable a name that can be assigned a value or object

expression or statement any combination of variables, classes, and methods that returns a result

Some of these terms are abstractions that are “made real” in the Ruby API (such as class and method); others are just terms that describe code, much like we use terms such as “adjective” or “noun” to talk about the grammar of the English spoken language.

Classes

You don’t have to create classes to program in Ruby. If you only write simple programs, you won’t need classes. Classes are used to organize your code and

make your software more modular. For the software architect, classes make it possible to create a structure for complex software programs. To use Rails, you'll use the classes and methods that are defined in the Rails API.

There is one class at the apex of the Ruby class hierarchy: **BasicObject**. **BasicObject** is a very simple class, with almost no methods of its own. The **Object** class inherits from **BasicObject**. All classes in the Ruby and Rails APIs inherit behavior from **Object**. **Object** provides basic methods such as **nil?** and **to_s** ("to string") for every class that inherits from **Object**.

We create a class **Example** and inherit from **Object** with the **<** "inherits from" operator:

```
class Example < Object
  .
  .
  .
end
```

The **end** statement indicates all the preceding code is part of the **Example** class.

In Ruby, all classes inherit from the **Object** class, so we don't need to explicitly *subclass* from **Object** as we do here. The example just shows it for teaching purposes.

Here is the **Example** class without the explicit subclassing from **Object**:

```
class Example
  .
  .
  .
end
```

Much of the art of programming is knowing what classes are available in the API and deciding when to subclass to inherit useful methods.

Methods

Classes give organization and structure to a program. Methods get the work done.

Any class can have methods. Methods are a series of expressions that return a result (a value). We say methods describe the class behavior.

A method definition begins with the keyword **def** and (predictably) ends with **end**.

```
def backwards_name
  @name.reverse
end
```

Initializing the object and calling the method returns a result:

```
ex = Example.new('Daniel', nil)
my_backwards_name = ex.backwards_name
=> leinaD
```

We can also *override* a method from the parent class.

```
def to_s
  @name
end
```

Here we are *overriding* the **to_s** (“to string”) method from the parent **Object** class.

Ordinarily, the **to_s** method returns the object’s class name and an object id. Here we will return the string assigned to the variable **@name**.

Most times you won’t override the **to_s** (“to string”) method. This example shows how you can override any method inherited from a parent class.

Dot Operator

The “dot” is the method operator. This tiny punctuation symbol is a powerful operator in Ruby.

It allows us to *call a method* to get a result.

Sometimes we say we *send a message* to the object when we invoke a method, implying the object will send a result.

Some classes, such as **Date**, provide *class methods* which can be called directly on the class without instantiating it first. For example, you can run this in the Rails console:

```
Date.today  
=> Tue, 15 Oct 2013
```

More often, methods are called on variables which are instances of a class. For example:

```
birthdate = Date.new(1990, 12, 22)  
=> Sat, 22 Dec 1990  
birthmonth = birthdate.month  
=> 12
```

We can apply *method chaining* to objects. For example, **String** has methods **reverse** and **upcase** (among many others). We could write:

```
nonsense = 'foobar'  
=> "foobar"  
reversed = nonsense.reverse  
=> "raboof"  
capitalized = reversed.upcase  
=> "RABOOF"
```

It is easier to use method chaining and write:

```
'foobar'.reverse.upcase  
=> "RABOOF"
```

Classes create a structure for our software programs and methods do all the work.

Question and Exclamation Methods

You'll see question marks and exclamation points (sometimes called the “bang” character) used in method names. These characters are simply a naming convention for Ruby methods.

The question mark indicates the method will return a *boolean value* (true or false).

The bang character indicates the method is “dangerous.” In some cases it means the method will change the object rather than just return a result. In Rails an exclamation point often means the method will throw an exception on failure rather than failing silently.

Initialize Method

Objects are created from classes before they are used. As I suggested earlier, class definitions are cookie cutters; the Ruby interpreter uses them to cut cookies. When we call the **new** method, we press the cookie cutter into the dough and get a new object. All the cookies will have the same shape but they can be decorated differently, by sprinkling attributes of different values.

The **initialize** method is one of the ways we sprinkle attributes on our cookie.

```
def initialize(name, date)
```

When we want to use an **Example** object and assign it to a variable, we will instantiate it with **Example.new(name, date)**. The **new** method calls the **initialize** method automatically. If we don't define an **initialize** method, the **new** method still works, inherited from **Object**, so we can always instantiate any class.

Method Parameters

Methods are useful when they operate on data.

If we want to send data to a method, we define the method and indicate it will accept *parameters*. Parameters are placeholders for data values. The values that are passed to a method are *arguments*. “Parameters” are empty placeholders and “arguments” are the actual values. In practice, “parameters” and “arguments” are terms that are used interchangeably and not many developers will notice if you mix up the terms.

Our **initialize** method takes **name** and **date** arguments:

```
def initialize(name, date)
```

Ruby is clever with method parameters. You can define a method and specify default values for parameters. You can also pass extra arguments to a method if you define a method that allows optional parameters. This makes methods very flexible.

We separate our parameters with commas. For readability, we enclose our list of parameters in parentheses. In Ruby, parentheses are always optional but they often improve readability.

Variable

In Ruby, everything is an object. We can assign any object to a variable. The variable works like an alias. We can use a variable anywhere as if it were the assigned object. The variable can be assigned a string, a numeric value, or an instance of any class (all are objects).

```
name
```

You can assign a new value to a variable anywhere in your method. You can assign a different kind of object if you want. You can take away someone's name and give them a number. We can create a variable `player`, assign it the string `'Jackie Robinson'`, replace the value with an integer `42`, or even a date such as `Date.new(1947, 4, 15)`.

Symbol

Obviously, we see many symbols when we read Ruby code, such as punctuation marks and alphanumeric characters. But *symbol* has a specific meaning in Ruby. It is like a variable, but it can only be assigned a value once. After the initial assignment, it is *immutable*; it cannot be changed.

You will recognize a symbol by the colon that is always the first character.

```
:name
```

Symbols are efficient and fast because the Ruby interpreter doesn't have to work to check their current values.

You'll often see symbols used in Rails where you might expect a variable.

Attributes

In an object, methods do the work and data is stored as variables. We can use the `initialize` method to input data to the object. We can't access data in variables from outside the object unless it is exposed as *attributes*.

Classes can have attributes, which we can “set” and “get.” That is, we can establish a value for an attribute and retrieve the value by specifying the attribute name.

Attributes are a convenient way to push data to an object and pull it out later.

In Ruby, attributes are also called properties.

Here we use the `attr_accessor` directive to specify that we want to expose `honorific`, `name` and `date` attributes.

```
attr_accessor :honorific
attr_accessor :name
attr_accessor :date
```

If we use `attr_accessor` to establish attributes, we can use the attribute names as methods. For example, we could write:

```
ex = Example.new('Daniel', nil)
my_name = ex.name
```

In Ruby, attributes are just specialized methods that expose data outside the object.

Instance Variable

Inside an object, an ordinary variable only can be used within the method in which it appears. If you use a variable with the same name in two different

methods, it will have a different value in each method. The *scope* of a variable is limited to the method in which it is used.

Often you want a variable to be available throughout an instance, within any method. You can declare an *instance variable* by using an @ (at) sign as the first character of the variable name.

The instance variable can be used by any method after the class is instantiated.

```
@name = name
```

The values assigned to instance variables are unique for every instance of the class. If you create multiple instances of a class, each will have its own values for its instance variables. Here we create two instances of the **Example** class. The @name instance variable will be “Daniel” in the first instance and “Foobar” in the second instance.

```
ex1 = Example.new('Daniel', nil)
ex2 = Example.new('Foobar', nil)
```

An instance variable is not visible outside the object in which it appears; but when you create an **attr_accessor**, it creates an instance variable and makes it accessible outside the object.

Instance Variables in Rails

In a Rails controller, you’ll often see a model assigned to an instance variable. Earlier we saw **@owner = Owner.new** when we instantiated an Owner model. We use an instance variable when we want a model to be available to the view template.

Rails beginners learn the simple rule that you have to use the @ (at) sign if you want a variable to be available in the view. Intermediate Rails developers

learn that the variable with the `@` (at) sign is called an instance variable and is only available within the *scope* of the instance (practically speaking, to other methods in the class definition). That leads to a question: Why is an instance variable available inside a view?

There is a good reason. A Rails view is NOT a separate class. It is a template and, under the hood, it is part of the current controller object. From the viewpoint of a programmer, a Rails controller and a view are separate files, segregated in separate folders. From the viewpoint of a software architect, the controller is a single object that evaluates the template code, so an instance variable can be used in the view file.

This example shows us that the programmer and the software architect have different perspectives on a Rails application. Understanding Rails requires an integration of multiple points of view.

Double Bar Equals Operator

I've suggested that the best way to get help is to use Google or Stack Overflow to look for answers. But that's difficult when you don't know what symbols are called. Try googling "`||=`" and you'll get no results. Instead, try googling "bar bar equals ruby" or "double pipe equals ruby" and you'll find many explanations of the "or equals" operator. This is an example of mysterious shorthand code you'll often find in Rails.

`||=` is used for conditional assignment. In this case, we only assign a value to the variable if no value has been previously assigned.

```
@honorific ||= 'Esteemed'
```

It is equivalent to this conditional expression:

```
if not x
  x = y
end
```

Conditional assignment is often used to assign a “default value” when no other value has been assigned.

Conditional

Conditional logic is fundamental to programming. Our code is always a path with many branches.

When the Ruby interpreter encounters an **if** keyword, it expects to find an expression which evaluates as true or false (a *boolean*).

If the expression is true, the statements following the condition are executed.

If the expression is false, any statements are ignored, unless there is an **else**, in which case an alternative is executed.

```
if date.month == 12
  .
  .
  .
end
```

Sometimes you’ll see **unless** instead of **if**, which is a convenient way of saying “execute the following if the condition is false.”

In Ruby, the conditional expression can be a simple comparison, as illustrated above with the **==** (double equals) operator. Or **if** can be followed by a variable that has been assigned a boolean value. Or you can call a method that returns a boolean result.

Ternary Operator

A basic conditional structure might look like this:

```
if date.nil?  
  @date = Date.today  
else  
  @date = date  
end
```

We test if `date` is undefined (`nil`). If `nil`, we assign today's date to the instance variable `@date`. If `date` is already assigned a value, we assign it to the instance variable `@date`. This is useful in the `initialize(name, date)` method in our example code because we want to set today's date as the default value for the instance variable `@date` if the parameter `date` is `nil`.

Ruby developers like to keep their code tight and compact. So you'll see a condensed version of this conditional structure often, particularly when a default value must be assigned.

This compact conditional syntax is named the *ternary operator* because it has three components. Here is the syntax:

```
condition ? value_if_true : value_if_false
```

Here is the ternary operator we use in our example code:

```
@date = date.nil? ? Date.today : date
```

This is another example of Ruby syntax that you must learn to recognize by sight because it is difficult to interpret if you have never seen it before.

For more Ruby code that has been condensed into obscurity, see an article on [Ruby Golf](#). Ruby golf is the sport of writing code that uses as few characters as possible.

Interpolation

Rubyists love to find special uses for orthography such as hashmarks and curly braces. It seems Rubyists feel sorry for punctuation marks that don't get much use in the English language and like to give them new jobs.

We already know that we can assign a string to a variable:

```
name = 'Foobar Kadigan'
```

We can also perform “string addition” to concatenate strings. Here we add an honorific, a space, and a name:

```
@honorific = 'Mr.'  
@name = 'Foobar Kadigan'  
titled_name = @honorific + ' ' + @name  
=> "Mr. Foobar Kadigan"
```

Single quote marks indicate a string. In the example above, we enclose a space character within quote marks so we add a space to our string.

You can eliminate the ungainly mix of plus signs, single quote marks, and space characters in the example above.

Use double quote marks and you can perform *interpolation*, which gives a new job to the hashmark and curly brace characters:

```
@honorific = 'Mr.'  
@name = 'Foobar Kadigan'  
titled_name = "#{@honorific} #{@name}"  
=> "Mr. Foobar Kadigan"
```

The hashmark indicates any expression within the curly braces is to be evaluated and returned as a string. This only works when you surround the expression with double quote marks.

Interpolation is cryptic when you first encounter the syntax, but it streamlines string concatenation.

Access Control

Any method you define will return a result.

Sometimes you want to create a method that only can be used by other methods in the same class. This is common when you need a simple utility method that is used by several other methods.

Any methods that follow the keyword **private** should only be used by methods in the same class (or a subclass).

```
private
```

You often see private methods in Rails. Ruby provides a *protected* keyword as well, but the difference between *protected* and *private* is subtle and *protected* is seldom seen in Rails applications.

Hash

Our example code includes a private method named **famous_birthdays** that returns a collection of names and birthdays of famous musicians.

Computers have always been calculation machines; they are just as important in managing collections.

One important type of collection is named a Hash. A Hash is a data structure that associates a key to some value. You retrieve the value based upon its key. This construct is called a *dictionary*, an *associative array*, or a *map* in other languages. You use the key to “look up” a value, as you would look up a definition for a word in a dictionary.

You'll recognize a Hash when you see curly braces (again, Rubyists give a job to under-utilized punctuation marks).

```
birthdays = {  
  'Ludwig van Beethoven' => Date.new(1770,12,16),  
  'Dave Brubeck' => Date.new(1920,12,6),  
  'Buddy Holly' => Date.new(1936,9,7),  
  'Keith Richards' => Date.new(1943,12,18)  
}
```

Rubyists also like to create novel uses for mathematical symbols. The combination of an `=` (equals) sign and `>` (greater than) sign is called a *hashrocket*. The `=>` (hashrocket) operator associates a key and value pair in a Hash.

Ruby 1.9 introduced a new way to associate key and value pairs in a Hash:

```
birthdays = {  
  beethoven: Date.new(1770,12,16),  
  brubeck: Date.new(1920,12,6),  
  holly: Date.new(1936,9,7),  
  richards: Date.new(1943,12,18)  
}
```

Here, instead of using a string as the key, we are using Ruby symbols, which enable faster processing. The `:` (colon) character associates the key and value.

Ordinarily, a symbol is defined with a leading colon character. In a Hash, a trailing colon makes a string into a symbol.

If you want to transform a string containing spaces into a symbol in a Hash, you can do it, though the syntax is awkward:

```
birthdays = {  
  : 'Ludwig van Beethoven' => Date.new(1770,12,16)  
}
```

Whether with colons or hashrockets, you'll often see Hashes used in Rails.

Array

An *Array* is a list. Arrays can hold objects of any data type. In fact, arrays can contain a mix of different objects. For example, an array can contain a string and another array (this is an example of a *nested array*).

An array can be instantiated with square brackets:

```
born_in_december = [ ]
```

We can populate the array with values when we create it:

```
my_list = ['apples', 'oranges']
```

If we don't want to use quote marks and commas to separate strings in a list, we can use the `%w` syntax:

```
my_list = %w( apples oranges )
```

We can add new elements to an array with a `push` method:

```
my_list = Array.new  
=> []  
my_list.push 'apples'  
=> ["apples"]  
my_list.push 'oranges'  
=> ["apples", "oranges"]
```

In our example code, we use the `<<` *shovel operator* to add items to the array:

```
born_in_december << name
```

A Ruby array has close to a hundred available methods, including operations such as **size** and **sort**. See the [Ruby API](#) for a full list.

Iterator

Of all the methods available for a Ruby collection such as Hash or Array, the *iterator* may be the most useful.

You'll recognize an iterator when you see the **each** method applied to a Hash or Array:

```
famous_birthdays.each
```

The **each** keyword is always followed by a block of code. Each item in an Array, or key-value pair in a Hash, is passed to the block of code to be processed.

Block

You can recognize a *block* in Ruby when you see a **do ... end** structure. A block is a common way to process each item when an iterator such as **each** is applied to a Hash or Array.

In our example, we iterate over the **famous_birthdays** hash:

```
famous_birthdays.each do |name, date|  
  .  
  .  
  .  
end
```


Within the two pipes (or bars), we assign the key and value to two variables.

The block is like an unnamed method. The two variables are available only within the block. As each key-value pair is presented by the iterator, the variables are assigned, and the statements in the block are executed.

In our example code, we evaluate each date in the `famous_birthdays` hash to determine if the musician was born in December. When we find a December birthday, we add the name of the musician to the `born_in_december` array:

```
famous_birthdays.each do |name, date|  
  if date.month == 12  
    born_in_december << name  
  end  
end
```

When you use a block within a method, any variable in your method is available within the block. That's why we can add `name` to the array `born_in_december`.

Computer scientists consider a block to be a programming language construct called a *closure*. Ruby has other closures, including the *proc* (short for procedure) and the *lambda*. Though blocks are common you'll seldom see procs or lambdas in ordinary Rails code. They are more common in the Rails source code where advanced programming techniques are used more frequently.

The key point to know about a block (or a proc or a lambda) is that it works like a method. Though you don't see a method definition, you can use a block to evaluate a sequence of statements and obtain a result.

Rails and More Keywords

We've looked at only a few of the keywords and constructs you will see in Ruby code. The exercise has improved your Ruby literacy, so you'll have an easier time reading Ruby code.

Nothing in the exercise is Rails. The example code only uses keywords from the Ruby API.

Rails has its own API, with hundreds of classes and methods. The Rails API uses the syntax and keywords of the Ruby language to construct new classes and create new keywords that are specific to Rails and useful for building web applications.

We say Ruby is a general-purpose language because it can be used for anything. Rails is a *domain-specific language* (DSL) because it is used only by people building web applications (in this sense, “domain” means area or field of activity). Ruby is a great language to use for building a DSL, which is why it was used for Rails. Unlike some other programming languages, Ruby easily can be extended or tweaked. For example, developers can redefine classes, add extra methods to existing classes, and use the special `method_missing` method to handle method calls that aren’t previously defined. Software architects call this *metaprogramming* which simply means clever programming that twists and reworks the programming language.

When you add a gem to a Rails project, you’ll add additional keywords. Some of the most powerful gems add their own DSLs to your project. For example, the Cucumber gem provides a DSL for turning user stories into automated tests.

Adding Rails, additional gems, and DSLs provides powerful functionality at the cost of complexity. But it all conforms to the syntax of the Ruby language. As you learn to recognize Ruby keywords and language structures, you’ll be able to pick apart the complexity and make sense of any code.

More Ruby

To develop your proficiency as a Rails developer, I hope you will make an effort to learn Ruby as you learn Rails. Don’t be lazy; when you encounter a bit of Ruby you don’t understand, make an effort to find out what is going on. Spend time with a Ruby textbook or interactive course when you work on Rails projects.

Collaborative Learning

The best way to learn Ruby is to actually use it. That's the concept behind this site:

- [Exercism.io](http://exercism.io)

With Exercism, you'll work through code exercises and get feedback from other learners.

Online Tutorials

- TryRuby.org - free browser-based interactive tutorial from Code School
- [Codecademy Ruby Track](http://Codecademy.com/ruby) - free browser-based interactive tutorials from Codecademy
- [Ruby Monk](http://RubyMonk.com) - free browser-based interactive tutorial from C42 Engineering
- [Ruby Koans](http://RubyKoans.com) - free browser-based interactive exercises from Jim Weirich and Joe O'Brien
- [Ruby in 100 Minutes](http://Rubyin100Minutes.com) - free tutorial from JumpstartLab
- [Code Like This](http://CodeLikeThis.com) - free tutorials by Alex Chaffee
- [RailsBridge Ruby](http://RailsBridge.com) - basic introduction to Ruby
- [CodeSchool Ruby Track](http://CodeSchool.com/ruby) - instructional videos with in-browser coding exercises

Books

- [Learn To Program](#) - free ebook by Chris Pine
- [Learn To Program](#) - expanded \$18.50 ebook by Chris Pine
- [Learn Code the Hard Way](#) - free from Zed Shaw and Rob Sobers
- [Beginning Ruby](#) - by Peter Cooper
- [Programming Ruby](#) - by Dave Thomas, Andy Hunt, and Chad Fowler
- [Eloquent Ruby](#) - by Russ Olsen
- [Books by Avdi Grimm](#), including *Confident Ruby* and *Objects on Rails*.

Newsletters

- [Practicing Ruby](#) - \$8/month for access to over 90 helpful articles on Ruby
- [RubySteps](#) - weekly lessons by email from Pat Maddox

Screencasts

- [RubyTapas](#) - \$9/month for access to over 100 screencasts on Ruby

Git

There's no need to save the file **lib/example.rb** file we created to learn Ruby.

You can simply delete the file:

```
$ rm lib/example.rb
```

Check the Git status to make sure the file is gone:

```
$ git status
# On branch master
nothing to commit, working directory clean
```

We've cleaned up after our Ruby exercise.

From here on, we're done with silly code examples. No more fooling around. With the next chapter, we start building a real-world Rails website.

Chapter 15

Layout and Views

In previous chapters we created a dynamic home page and learned techniques for troubleshooting.

In this chapter we'll look closely at view files, particularly the application layout, so we can organize the design of our web pages. We'll also learn how to add a CSS stylesheet to improve the graphic design of our web pages.

This chapter covers a lot of ground, so take a break before jumping in, or pace yourself to absorb it all.

Template Languages

HTML is intended for markup, which means applying formatting to a text file. For a web application, ordinary HTML is not sufficient; we need to mix in Ruby code. We'll use a *templating language* that gives us a syntax for mixing HTML tags and Ruby code. The Ruby code will be processed by a *templating engine* built into Rails. The output will be pure HTML sent to the browser.

The most popular templating language available for Rails is *ERB*, Embedded Ruby, which is the Rails default.

In the “Concepts” chapter in Book One, you learned that components of Rails can be mixed for different “stacks.” Some developers substitute [Hamli](#) or [Slim](#) for ERB. We’ll use ERB in this book because it is the most popular.

Introducing the Application Layout

We’ve already created the view file for our home page.

The file `app/views/visitors/new.html.erb` looks like this:

```
<h3>Home</h3>
<p>Welcome to the home of <%= @owner.name %>.</p>
<p>I was born on <%= @owner.birthdate %>.</p>
<p>Only <%= @owner.countdown %> days until my birthday!</p>
```

The first line in the file contains an HTML heading tag, `<h3>`, with headline text, “Home.”

When you used the browser diagnostic view to see the HTML file received by the server, you saw this:

```
<!DOCTYPE html>
<html>
<head>
<title>LearnRails</title>
<link data-turbolinks-track="true"
      href="/assets/application.css?body=1" media="all" rel="stylesheet" />
<script data-turbolinks-track="true" src="/assets/jquery.js?body=1"></script>
<script data-turbolinks-track="true" src="/assets/jquery_ujs.js?body=1"></script>
<script data-turbolinks-track="true" src="/assets/turbolinks.js?body=1"></script>
<script data-turbolinks-track="true" src="/assets/application.js?body=1"></script>
<meta content="authenticity_token" name="csrf-param" />
<meta content="NRPrGFuj5GAyylNpNxQaMHDypcOsu6dmh5DT1yET6hQ=" name="csrf-token" />
</head>
<body>

<h3>Home</h3>
<p>Welcome to the home of Foobar Kadigan.</p>
<p>I was born on 1990-09-22.</p>
<p>Only 126 days until my birthday!</p>
```

```
</body>  
</html>
```

If you've built websites before, you'll recognize the HTML file conforms to the HTML5 specification, with a **DOCTYPE**, **<head>** and **<body>** tags, and miscellaneous tags in the HEAD section, including a title and various CSS and JavaScript assets.

If you look closely, you'll see some HTML attributes you might not recognize, for example the **data-turbolinks-track** attribute. That is added by Rails to support [turbolinks](#), for faster loading of webpages.

For the most part, everything is ordinary HTML. But only part of it originates from the view file we've created for our home page.

Where did all the extra HTML come from?

The final HTML file is more than twice the size of the view file.

The additional tags come from the default *application layout* file.

Rails has combined the Visitors#New view with the default application layout file. To be precise, the **new** method in the Visitors controller has rendered the home page by combining two files:

- the application layout file **app/views/layouts/application.html.erb**
- the Visitors#New template in the file **app/views/visitors/new.html.erb**

Let's examine the application layout file.

Open the file **app/views/layouts/application.html.erb**:


```
<!DOCTYPE html>
<html>
<head>
  <title>LearnRails</title>
  <%= stylesheet_link_tag 'application', media: 'all',
    'data-turbolinks-track' => true %>
  <%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
  <%= csrf_meta_tags %>
</head>
<body>

<%= yield %>

</body>
</html>
```

Static pages delivered from the **public** folder do not use the default application layout. But every page generated by the model-view-controller architecture in the **app/** folder incorporates the default application layout, unless you specify otherwise.

The default application layout is where you put HTML that you want to include on every page of your website.

Remember when we looked at the hidden code in the controller that renders a view? The controller uses the **render** method to combine the view file with the application layout.

Here's the Visitors controller, again, with the hidden **render** method revealed:

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
    render 'visitors/new'
  end

end
```

The **render** method combines the **app/views/visitors/new.html.erb** view file with the **app/views/layouts/application.html.erb** application layout.

Alternatively, you could tell the controller to render the view without any application layout:

```
render 'visitors/new', :layout => false
```

Or you could specify an alternative layout file, for example **app/views/layouts/special.html**.

```
render 'visitors/new', :layout => 'special'
```

An alternative layout can be useful for special categories of pages, such as administrative pages or landing pages.

We won't use alternative layouts in this tutorial application, but it's good to know they are an option. The reference [RailsGuides: Layouts and Rendering in Rails](#) explains more about using alternative layouts.

Yield

How does the **render** method insert the view file in the application layout?

Notice that the default application layout contains the Ruby keyword **yield**.

```
.  
.   
.   
<%= yield %>  
.   
.   
. 
```

The **yield** keyword is replaced with a view file that is specific to the controller and action, in this case, the **app/views/visitors/new.html.erb** view file.

The content from the view is inserted where you place the **yield** keyword.

Yield Variations

We won't do it, but you could also use the **yield** keyword to insert a sidebar or a footer.

Rails provides ways to insert content into a layout file at different places. The **content_for** method is helpful when your layout contains distinct regions such as sidebars and footers that should contain their own blocks of content.

For example, you could create an application layout that includes a sidebar. This is just an example, so don't add it to the application you are building:

```
<!DOCTYPE html>
<html>
<head>
  <title>LearnRails</title>
  <%= stylesheet_link_tag 'application', media: 'all',
    'data-turbolinks-track' => true %>
  <%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
  <%= csrf_meta_tags %>
</head>
<body>
  <div class="main">
    <%= yield %>
  </div>
  <div class="sidebar">
    <%= yield :sidebar %>
  </div>
</body>
</html>
```

This view file provides both the main content and a sidebar:

```
<% content_for :sidebar do %>
  <h3>Contact Info</h3>
  <p>Email: me@example.com</p>
<% end %>
<h3>Main</h3>
<p>Welcome!</p>
```

This section gets inserted at the **<%= yield :sidebar %>** location:

```
<% content_for :sidebar do %>
  <h3>Contact Info</h3>
  <p>Email: me@example.com</p>
<% end %>
.
.
.
```

The rest of the file gets inserted at the main `<%= yield %>` location.

Again, don't add this to your application. I'm just offering it as an example of multiple `yield` statements.

The reference [RailsGuides: Layouts and Rendering in Rails](#) explains more about using `yield` and `content_for`.

ERB Delimiters

Earlier, we saw ERB `<%= ... %>` delimiters allow us to insert Ruby expressions which are replaced by the result of evaluating the code. Here is an example that displays the number 4

```
<%= 2 + 2 %>
```

Look closely and you'll see this ERB delimiter is slightly different:

```
<% 3.times do %>
  <li>list item</li>
<% end %>
```

An ERB delimiter that does not contain the `=` (equals) sign will execute Ruby code but will not display the result. It is commonly used to add Ruby blocks to HTML code, so you'll often see `do` and `end` statements within ERB `<% ... %>` delimiters. The example above will create three list items, like this:

```
<li>list item</li>
<li>list item</li>
<li>list item</li>
```

A third version of the ERB delimiter syntax is rarely seen:

```
<%# this is a comment %>
```

It is only used for adding comments. The expression within the ERB `<%# ... %>` delimiters will not execute and will not appear when the page is output as HTML.

Introducing View Helpers

We can use ERB delimiters to create Rails *view helpers*.

We’ve seen how ERB delimiters can enclose Ruby code.

In the application layout file, the `<%= ... %>` delimiters don’t include anything that looks like Ruby code. For example, we see `<%= csrf_meta_tags %>` which seems to be neither HTML nor anything from the Ruby API. In fact, this expression is Ruby code, but it is from the Rails API and only found in Rails applications.

Ruby is an ideal choice for a web application development platform such as Rails because it can easily be used to create a *domain-specific language* (or *DSL*). Much of Rails is a domain-specific language. The Smalltalk programming language was famous for its mantra “Code should read like a conversation.” Ruby, which borrows much from Smalltalk, makes it easy to add new words to the conversation. We can add new keywords that produce complex behaviour, creating entire new APIs such as Rails. Ruby makes it easy for the Rails core team to add keywords such as `csrf_meta_tags` that are additions to the Ruby language.

In this case, Ruby’s ability to produce a domain-specific language gives us Rails *view helpers*.

Think of Rails view helpers as “macros to generate HTML.” You may have used macros to automate a series of commands in World of Warcraft or other games. If you’re an office worker, you may have used macros in Microsoft Word or Excel. A Rails view helper is a keyword that expands into a longer string of HTML tags and content.

In this case, the `csrf_meta_tags` view helper expands into two lines of HTML:

```
<meta content="authenticity_token" name="csrf-param" />
<meta content="NRprgfuj5GAyy1NpNxQaMHDypcOsu6dmh5DT1yET6hQ=" name="csrf-token" />
```

Why do we need this cryptic code? It turns out that almost any website that accepts user input via a form is vulnerable to a security bug (an *exploit*) named a [cross-site request forgery](#). To prevent rampant CSRF exploits, the Rails core team includes the `csrf_meta_tags` view helper in the default application layout. Rails provides a number of similar features that make websites more secure.

A Rails view file becomes much less mysterious when you realize that many of the keywords you see are view helpers. Strange new keywords may be part of the Rails API. Or they may be provided by gems you’ve added (gem developers often use the Ruby DSL capability to create new keywords). Think of it this way: Ruby gives developers the power to create an unlimited number of new “HTML tags.” These tags are not really HTML because they are not part of the HTML specification. But they serve as shortcuts to produce complex snippets of HTML and content.

Now that we’ve learned about view helpers, we can start building our default application layout.

The Rails Layout Gem

Every Rails application needs a well-designed application layout. The Rails default starter application, which we get when we run **rails new**, provides a barebones application layout. It is purposefully simple so developers can add the code they need to accommodate any front-end framework (we'll look closely at front-end frameworks in the next chapter).

In this chapter we'll start with a simple application layout file, adding a little CSS for simple styling. In the next chapter, we'll upgrade the application layout file to use the Zurb Foundation front-end framework.

To make it easy, we'll use the **rails_layout** gem to generate files for an application layout. In this chapter, we'll use the **rails_layout** gem to create our basic layout and CSS files. In the next chapter, we'll use the **rails_layout** gem to create layout files for Zurb Foundation.

In your **Gemfile**, you've already added:

```
gem 'rails_layout'
```

and previously run **\$ bundle install**.

Rails provides the **rails generate** command to run simple scripts that are packaged into gems.

The **rails_layout** gem uses the **rails generate** command to set up files we need. Run:

```
$ rails generate layout:install simple --force
```

The **-force** argument will force the gem to replace the existing **app/views/layouts/application.html.erb** file.

If you have the **app/views/layouts/application.html.erb** file open in your text editor, it will change.

The rails_layout gem will rename the file:

- **app/assets/stylesheets/application.css**

to:

- **app/assets/stylesheets/application.css.scss**

The gem will add (or modify) five files:

- **app/views/layouts/application.html.erb**
- **app/assets/stylesheets/simple.css**
- **app/views/layouts/_messages.html.erb**
- **app/views/layouts/_navigation.html.erb**
- **app/views/layouts/_navigation_links.html.erb**

Examining these files closely will reveal a great deal about the power of Rails. We'll dedicate the rest of this chapter to exploring the contents of these files.

Basic Boilerplate

Open the file **app/views/layouts/application.html.erb**:

```
<!DOCTYPE html>
<html>
  <head>
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title><%= content_for?(:title) ? yield(:title) : "Learn Rails" %></title>
    <meta name="description" content=
```



```
"<%= content_for?(:description) ? yield(:description) : "Learn Rails" %>">
<%= stylesheet_link_tag 'application', media: 'all',
  'data-turbolinks-track' => true %>
<%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
<%= csrf_meta_tags %>
</head>
<body>
  <header>
    <%= render 'layouts/navigation' %>
  </header>
  <main role="main">
    <%= render 'layouts/messages' %>
    <%= yield %>
  </main>
</body>
</html>
```

Some of this code is already familiar.

You’ll recognize the standard HTML **DOCTYPE**, **<head>**, and **<body>** tags.

We’ve already discussed the **yield** keyword.

We’ve seen the **<%= ... %>** delimiters surrounding the **csrf_meta_tags** view helper:

- **csrf_meta_tags** - generates **<meta>** tags that prevent [cross-site request forgery](#)

The rest of the file may be unfamiliar. We’ll examine it line by line.

Adding Boilerplate

Webmasters who build static websites are accustomed to setting up web pages with “boilerplate,” or basic templates for a standard web page. The well-known [HTML5 Boilerplate](#) project has been recommending “best practice” tweaks to web pages since 2010. Very few of the HTML5 Boilerplate recommendations are relevant for Rails developers, as Rails already provides almost everything

required. We'll discuss one important boilerplate item and a few “nice to have” extras.

If you want to learn more, the article [HTML5 Boilerplate for Rails Developers](#) looks at the recommendations.

Viewport

The **viewport** metatag improves the presentation of web pages on mobile devices. Setting a viewport tells the browser how content should fit on the device's screen. The tag is required for either Bootstrap or Zurb Foundation front-end frameworks.

The **viewport** metatag looks like this:

```
<meta name="viewport" content="width=device-width, initial-scale=1.0">
```

Apple's developer documentation on [Configuring the Viewport](#) provides details.

Title and Description

If you want to maximize traffic to your website, you should make your web pages search-engine friendly. That means adding *title* and *description* metatags. Google uses contents of the title tag to display titles in search results. And it will sometimes use the content of a description metatag in search results snippets. See Google's explanation of how it uses [Site Title and Description](#). Good titles and descriptions improve clickthrough from Google searches.

Title and description looks like this:

```
<title><%= content_for?(:title) ? yield(:title) : "Learn Rails" %></title>
<meta name="description" content="<%= content_for?(:description) ?
  yield(:description) : "Learn Rails" %>">
```

The rails_layout gem has created a default title and description based on our project name.

Later in the tutorial, we'll see how to use a `content_for` statement to set a title and description for each individual page.

The code is complex if you haven't seen advanced Ruby before. It uses the Ruby `ternary operator` which maximizes compactness at the price of introducing obscurity. You'll recall from the "Just Enough Ruby" chapter that it is a fancy conditional statement that says, "if `content_for?(:title)` is present in the view file, use `yield(:title)` to include it, otherwise just display 'Learn Rails'."

Asset Pipeline

You may have noticed these Rails helper methods:

- `stylesheet_link_tag`
- `javascript_include_tag`

These are tags that add CSS and JavaScript to the web page using the Rails *asset pipeline*.

The Rails *asset pipeline* utility is one of the most powerful features of the platform. It offers convenience to the developer and helps organize an application; more importantly, it improves the speed and responsiveness of any complex website. If you're going to do any front-end development with CSS or JavaScript in Rails, you must understand the Rails asset pipeline. Here's how it works.

Assets Without Rails

When building non-Rails websites, webmasters add JavaScript to a page using the `<script>` tag. For every JavaScript file, they add an additional `<script>` tag, so a page HEAD section looks like this:

```
<!DOCTYPE html>
<html>
<head>
  <title>Page that uses multiple JavaScript files</title>
  <script src="jquery.js" type="text/javascript"></script>
  <script src="jquery.plugin.js" type="text/javascript"></script>
  <script src="custom.js" type="text/javascript"></script>
</head>
```

The same is true for CSS files in non-Rails websites. You add a `<link>` tag for each stylesheet file. With multiple stylesheets, the HEAD section of your application layout might look like this:

```
<!DOCTYPE html>
<html>
<head>
  <title>Page that uses multiple CSS files</title>
  <link href="core.css" rel="stylesheet" type="text/css" />
  <link href="site.css" rel="stylesheet" type="text/css" />
  <link href="custom.css" rel="stylesheet" type="text/css" />
</head>
```

If you want to handle CSS and JavaScript without Rails, you can place your files in the **public** folder. If you do so, every time you add a JavaScript or CSS file, you must modify the application layout file. Instead, use the asset pipeline and simplify this.

Assets With Rails

The asset pipeline consists of two folders:

- **app/assets/javascripts/**
- **app/assets/stylesheets/**

Any JavaScript and CSS file you add to these folders is automatically added to every page.

In development, when the web browser makes a page request, the files in the asset pipeline folders are combined together and concatenated as single large files, one for JavaScript and one for CSS.

If you examine the application layout file, you'll see the tags that perform this service:

```
<%= stylesheet_link_tag 'application', media: 'all',  
  'data-turbolinks-track' => true %>  
<%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
```

The HTML delivered to the browser looks like this:

```
<link href="/assets/application.css" media="all" rel="stylesheet" type="text/css" />  
<script src="/assets/application.js" type="text/javascript"></script>
```

Using the asset pipeline, there is no need to modify the application layout file each time you create a new JavaScript or CSS file. Create as many files as you need to organize your JavaScript or CSS code and, in production, you'll automatically get one single file delivered to the browser. In development mode, Rails continues to deliver multiple files for easier debugging.

In production, there's a big performance advantage with the asset pipeline. Requesting files from the server is a time-consuming operation for a web browser, so every extra file request slows down the browser. The Rails asset pipeline eliminates the performance penalty of multiple `<script>` or `<link>` tags. The Rails asset pipeline also compresses JavaScript and CSS files for faster page loads.

The asset pipeline is an example of a Rails convention that helps developers build complex websites. It is not needed for a simple website that uses a few JavaScript or CSS files. But it is beneficial on bigger projects.

Now that you understand the purpose of the Rails asset pipeline, let's look at more of the code in the default application layout file.

Navigation Links

Every website needs navigation links.

You can add navigation links directly to your application layout but many Rails developers prefer to create a [partial template](#) —a “partial”—to better organize the default application layout.

Introducing Partials

A *partial* is similar to any view file, except the filename begins with an underscore character. Place the file in any view folder and you can use the **render** keyword to insert the partial.

We're not going to add a footer to our tutorial application, but here is how we could do it. We'd use the **render** keyword with a file named **app/views/layouts/_footer.html**

```
<%= render 'layouts/footer' %>
```

Notice that you specify the folder within the **app/views/** directory with a truncated version of the filename. The **render** method doesn't want the **_** underscore character or the **.html.erb** file extension. That can be confusing; it makes sense when you remember that Rails likes “convention over configuration” and economizes on extra characters when possible.

We’re not going to add a footer to our application, but we will add navigation links by using a partial. First, let’s learn about *link helpers*.

Introducing Link Helpers

There’s no rule against using raw HTML in our view files, so we could create a partial for navigation links that uses the HTML `<a>` anchor tag like this:

```
<ul class="nav">
  <li><a href="/">Home</a></li>
  <li><a href="/about">About</a></li>
  <li><a href="/contact">Contact</a></li>
</ul>
```

Rails gives us another option, however. We can use the Rails `link_to` view helper instead of the HTML `<a>` anchor tag. The Rails `link_to` helper eliminates the crufty `<>` angle brackets and the unnecessary `href=""`. More importantly, it adds a layer of abstraction, using the routing configuration file to form links. This is advantageous if we make changes to the location of the link destinations. Earlier, when we created a static “About” page, we first set the `config/routes.rb` file with a route to the “About” page: `root to: redirect('/about.html')`. Later we removed the static “About” page and set the `config/routes.rb` file with a route to the dynamic home page: `root to: 'visitors#new'`. If we used the raw HTML `<a>` anchor tag, we’d have to change the raw HTML everywhere we had a link to the home page. Using the Rails `link_to` helper, we name a route and make any changes once, in the `config/routes.rb` file.

When you use the Rails `link_to` helper, you’ll avoid the problem of link maintenance that webmasters face on static websites. Some webmasters like to use *absolute* URLs, specifying a host name in the link, for example `http://www.example.com`. Absolute URLs are a headache when moving the site, for example from `staging.example` to `www.example.com`. The problem is avoided by using *relative* URLs, such as `/about.html`, `about.html`, or even `../about.html`. But relative URLs

are fragile, and moving files or directories often results in overlooked and broken links. Instead, with the Rails `link_to` helper, you always get the destination location specified in the `config/routes.rb` file.

Navigation Partial

Examine the `app/views/layouts/application.html.erb` and you'll see the use of the navigation partial.

We include the navigation partial in our application layout with the expression:

```
.  
.   
.   
<%= render 'layouts/navigation' %>  
.   
.   
. 
```

Open the file `app/views/layouts/_navigation.html.erb`:

```
<ul class="nav">  
  <li><%= link_to 'Home', root_path %></li>  
  <%= render 'layouts/navigation_links' %>  
</ul>
```

You'll see the `link_to` helper.

Here the `link_to` helper takes two parameters. The first parameter is the string displayed as the anchor text (`'Home'`). The second parameter is the route. In this case, the route `root_path` has been set in the `config/routes.rb` file.

The navigation partial includes another partial, which we'll call the navigation links partial:


```
.  
.   
.   
  <%= render 'layouts/navigation_links' %>  
.   
.   
. 
```

This demonstrates that one partial can include another partial, so that partials can be “nested.”

Navigation Links Partial

In our simple application, there’s no obvious reason to nest another partial. But we’ll see in the next chapter that it is convenient, because we can isolate the complex markup required by Zurb Foundation from the simple list of links we need for navigation.

Open the file **app/views/layouts/_navigation_links.html.erb**:

```
<%=# add navigation links to this file %>
```

As we add pages to our application, we’ll add links to this file.

For now, we have nothing to add.

Flash Messages

Rails provides a standard convention to display alerts (including error messages) and other notices (including success messages), called a *flash message*. The name comes from the term “flash memory” and should not be confused with the “Adobe Flash” web development platform that was once popular for

animated websites. The flash message is documented in the [RailsGuides: Action Controller Overview](#).

Here's a flash message you might see after logging in to an application:

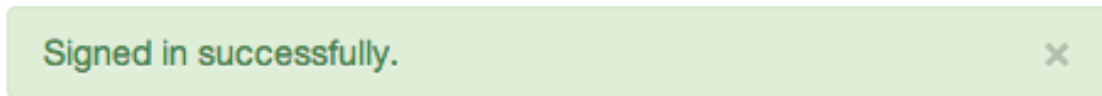


Figure 15.1: Flash message in Rails.

It is called a “flash message” because it appears on a page temporarily. When the page is reloaded or another page is visited, the message disappears.

Typically, you will see only one flash message on a page. But there is no limit to the number of flash messages that can appear on a page.

Creating Flash Messages

Flash messages are created in a controller. For example, we can add messages to the home page by modifying the file **app/controllers/visitors_controller.rb** like this:

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
    flash[:notice] = 'Welcome!'
    flash[:alert] = 'My birthday is soon.'
  end

end
```

If you test the application after adding the messages to the VisitorsController, you'll see two flash messages appear on the page.

Rails provides the **flash** object so that messages can be created in the controller and displayed on the rendered web page.

In this example, we create a flash message by associating the object **flash[:notice]** with the string **'Welcome!'**. We can assign other messages, such as **flash[:alert]** or even **flash[:warning]**. In practice, Rails uses only **:notice** and **:alert** as flash message keys so it is wise to stick with just these.

Flash and Flash Now

You can control the persistence of the flash message by choosing from two variants of the **flash** directive.

Use **flash.now** in the controller when you immediately render a page, for example with a **render :new** directive. With **flash.now**, the message will vanish after the user clicks any links.

Use the simple variant, **flash**, in the controller when you redirect to another page, for example with a **redirect_to root_path** directive. If you use **flash.now** before a redirect, the user will not see the flash message because **flash.now** does not persist through redirects or links. If you use the simple **flash** directive before a **render** directive, the message will appear on the rendered page and reappear on a subsequent page after the user clicks a link.

In our example above, we really need to use the **flash.now** variant because the controller provides a hidden **render** method. Update the file **app/controllers/visitors_controller**

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
    flash.now[:notice] = 'Welcome!'
    flash.now[:alert] = 'My birthday is soon.'
  end

end
```

Using **flash.now** will make sure the message only appears on the rendered

page and will not persist after a user follows a link to a new page.

If you ever see a “sticky” flash message that won’t go away, you need to use `flash.now` instead of `flash`.

Explaining the Ruby Code

If you’re new to programming in Ruby, it may be helpful to learn how the `flash` object works.

The `flash` object is a Ruby *hash*.

You’ll recall from the “Just Enough Ruby” chapter that a hash is a data structure that associates a key to some value. You retrieve the value based upon its key. This construct is called a *dictionary* in other languages, which is appropriate because you use the key to “look up” a value, as you would look up a definition for a word in a dictionary.

Hash is a type of *collection*. Presumably, the Rails core contributors who implemented the code chose to use a collection so that a page could be given multiple flash messages. Because we have a collection with (possibly) multiple messages, we need to retrieve each message one at a time.

We learned earlier that all collections support an *iterator* method named `each`. Iterators return all the elements of a collection, one after the other. The iterator returns each key-value pair, item by item, to a *block*. In Ruby, a block is delimited by `do` and `end` or `{ }` braces. You can add any code to a block to process each item from the collection.

Here is simple Ruby code to iterate through a `flash` object, outputting each flash message in an HTML `div` tag and applying a CSS class for styling:

```
flash.each do |key, value|  
  puts ' ' + value + ' '  
end
```

In this simple example, we use `each` to iterate through the flash hash, retrieving

a **key** and **value** that are passed to a block to be output as a string. We’ve chosen the variable names **key** and **value** but the names are arbitrary. In the next example, we’ll use **name** and **msg** as variables for the key-value pair. The output string will appear as HTML like this:

```
<div class="notice">Welcome!</div>
<div class="alert">My birthday is soon.</div>
```

Let’s continue examining our layout files.

The Flash Messages Partial

Flash messages are a very useful feature for a dynamic website.

Code to display flash messages can go directly in your application layout file or you can use a partial.

Examine the file **app/views/layouts/_messages.html.erb**:

```
<% flash.each do |name, msg| %>
  <% if msg.is_a?(String) %>
    <%= content_tag :div, msg, :class => "flash_#{name}" %>
  <% end %>
<% end %>
```

It improves on our simple Ruby example in several ways. First, the expression **if msg.is_a?(String)** serves as a test to make sure we only display messages that are strings. Second, we use the Rails **content_tag** view helper to create the HTML **div**. The **content_tag** helper eliminates the messy soup of angle brackets and quote marks we used to create the HTML output in the example above. Finally, we apply a CSS **class** and combine the word “flash” with “notice” or “alert” to make the CSS class.

We include the flash messages partial in our application layout with the expression:

```
.  
.   
.   
<%= render 'layouts/messages' %>  
.   
.   
. 
```

HTML5 Elements

Let's look again at the **app/views/layouts/application.html.erb** file.

To complete our examination of the application layout file, we'll look at a few structural elements. These elements are not unique to a Rails application and will be familiar to anyone who has done front-end development.

Notice the tags that are structural elements in the HTML5 specification:

- **<header>**
- **<main>**

These elements add structure to a web page. The tags don't add any new behavior but make it easier to determine the structure of the page and apply CSS styles.

We wrap the navigation partial in the **<header>** tag:

```
<header>  
  <%= render 'layouts/navigation' %>  
</header>
```

The **<header>** tag is typically used for branding or navigation.

Notice the *main tag*:

```
<main role="main">
  <%= render 'layouts/messages' %>
  <%= yield %>
</main>
```

We wrap our messages partial and `yield` expression in a `<main role="main">` element. The `<main>` tag is among the newest HTML5 elements (see the [W3C specification](#) for details). From the specification: “The main content area of a document includes content that is unique to that document and excludes content that is repeated across a set of documents such as site navigation links, copyright information, site logos.” We follow the advice of the specification and wrap our unique content in the `<main>` tag.

The specification recommends, “Authors are advised to use ARIA role=’main’ attribute on the main element until user agents implement the required role mapping.” [ARIA](#), the Accessible Rich Internet Applications Suite, is a specification to make web applications more accessible to people with disabilities. That means the `role="main"` attribute is there for any web browsers that don’t yet recognize the `<main>` tag, and may help people with disabilities.

We could add a `<footer>` tag. It typically contains links to copyright information, legal disclaimers, or contact information. We don’t have a footer in our tutorial application but you can add the `<footer>` tag, with additional content, if you want.

Application Layout

Our application layout is complete. We don’t have to add anything because the `rails_layout` gem has created everything we need.

```
<!DOCTYPE html>
<html>
  <head>
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
```

```
<title><%= content_for?(:title) ? yield(:title) : "Learn Rails" %></title>
<meta name="description" content=
  "<%= content_for?(:description) ? yield(:description) : "Learn Rails" %>">
<%= stylesheet_link_tag 'application', media: 'all',
  'data-turbolinks-track' => true %>
<%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
<%= csrf_meta_tags %>
</head>
<body>
  <header>
    <%= render 'layouts/navigation' %>
  </header>
  <main role="main">
    <%= render 'layouts/messages' %>
    <%= yield %>
  </main>
</body>
</html>
```

We have the **viewport** metatag, a title, and a description.

We have partials for navigation links and flash messages.

Finally we have HTML5 structural elements.

That's all we need for now. In the next chapter, we'll revise it to support styling with Zurb Foundation.

Simple CSS

So far, we've examined four files that were added by the rails_layout gem:

- **app/views/layouts/application.html.erb**
- **app/views/layouts/_messages.html.erb**
- **app/views/layouts/_navigation.html.erb**
- **app/views/layouts/_navigation_links.html.erb**

Let's examine the CSS file that was created by the rails_layout gem.

Open the file **app/assets/stylesheets/simple.css**:

```
/*
 * Simple CSS stylesheet for a navigation bar and flash messages.
 */
main {
  background-color: #eee;
  padding-bottom: 80px;
  width: 100%;
}
header {
  border: 1px solid #d4d4d4;
  background-image: linear-gradient(to bottom, white, #f2f2f2);
  background-color: #f9f9f9;
  -webkit-box-shadow: 0 1px 10px rgba(0, 0, 0, 0.1);
  -moz-box-shadow: 0 1px 10px rgba(0, 0, 0, 0.1);
  box-shadow: 0 1px 10px rgba(0, 0, 0, 0.1);
  margin-bottom: 20px;
  font-family: 'Helvetica Neue', Helvetica, Arial, sans-serif;
}
ul.nav li {
  display: inline;
}
ul.nav li a {
  padding: 10px 15px 10px;
  color: #777777;
  text-decoration: none;
  text-shadow: 0 1px 0 white;
}
.flash_notice, .flash_alert {
  padding: 8px 35px 8px 14px;
  margin-bottom: 20px;
  text-shadow: 0 1px 0 rgba(255, 255, 255, 0.5);
  border: 1px solid #fbedd5;
  -webkit-border-radius: 4px;
  -moz-border-radius: 4px;
  border-radius: 4px;
  font-family: "Helvetica Neue", Helvetica, Arial, sans-serif;
  font-size: 14px;
  line-height: 20px;
}
.flash_notice {
  background-color: #dff0d8;
  border-color: #d6e9c6;
  color: #468847;
}
.flash_alert {
  background-color: #f2dede;
  border-color: #eed3d7;
```

```
color: #b94a48;  
}
```

If you already know CSS, you'll see we've set a background color for the **main** section of the page. We've also set styles for a header, navigation links, and flash messages. This book is about Rails, not CSS, so we won't examine this closely. For more on CSS, there are thousands of tutorials on the web, but I like these:

- [Codecademy](#)
- [HTML Dog](#)

Remember what we learned about the Rails asset pipeline. By default, any CSS file in the **app/assets/stylesheets/** folder will be added automatically to the **application.css** file that is included in the default application layout.

In the next chapter, we remove the **app/assets/stylesheets/simple.css** and use Zurb Foundation to supply styles for the header, navigation links, and flash messages. For now, the **simple.css** file adds some basic styling and layout to the application.

Test the Application

Let's run the application to see how it looks with the new application layout. The web server may already be running. If not, enter the command:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

If you experimented with adding flash messages “Welcome” and “My birthday is soon,” you’ll see the messages when you visit the home page.

Our home page now has only one navigation link, for “Home.” We’ll add links for “About” and “Contact” pages soon.

Git

Let’s commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "update application layout"  
$ git push
```

Chapter 16

Front-End Framework

This chapter discusses front-end development and design using CSS. I'll show you how to add style to a Rails application, using Zurb Foundation for a simple theme.

What do we mean by “front-end development”? A website *back end* is the Rails application that assembles files that are sent to the browser, plus a database and any other server-side services. A website *front end* is all the code that runs in the browser. Everything that controls the appearance of the website in the browser is the responsibility of a front-end developer, including page layout, CSS stylesheets, and JavaScript code.

Front-end development has grown increasingly important as websites have become more sophisticated. And front-end technology has grown increasingly complex, to the degree that front-end development has become a job for specialists.

Front-end developers are primarily concerned with:

- markup - the layout and structure of the page
- style - graphic design for visual communication
- interactivity - browser-based visual effects and user interaction

Broader concerns include:

- cross-browser and cross-device functionality
- interaction design to improve website usability
- accessibility for users with physical or perceptual limitations

For years, front-end development was haphazard; webmasters each had their own quirky techniques. Around the time that Rails became popular, front-end developers at large companies began to share best practices and establish open source projects to bring structure and consistency to front-end development, leading to development of CSS frameworks.

CSS Frameworks

Web developers began putting together “boilerplate” CSS stylesheets as early as 2000, when browsers first began to fully support CSS. Boilerplate CSS made it easy to reuse CSS stylesheet rules from project to project. More importantly, designers often implemented “CSS reset” stylesheets to enforce typographic uniformity across different browsers.

Engineers at Yahoo! released the [Yahoo! User Interface Library](#) (YUI) as an open source project [in February 2006](#). Inspired by an [article by Jeff Croft](#), and reacting to the huge size of the YUI library, independent developers began releasing other CSS frameworks such as the [960 grid system](#) and the [Blueprint](#) CSS framework.

There are [dozens of CSS frameworks](#). In general, they all seek to implement a common set of requirements:

- An easily customizable grid
- Some default typography

- A typographic baseline
- CSS reset for default browser styles
- A stylesheet for printing

More recently, with the ubiquity of smartphones and tablets, CSS frameworks support [responsive web design](#), accommodating differences in screen sizes across a range of devices.

In tandem with the development of CSS frameworks, we've seen the emergence of JavaScript libraries and frameworks.

JavaScript Libraries and Frameworks

JavaScript has nothing like RubyGems, a built-in package manager for code libraries, so initially there were few open source JavaScript libraries. Now there are several competing [JavaScript package managers](#) and many software libraries.

[Prototype](#) was one of the first open source JavaScript libraries, created by Sam Stephenson in February 2005 to improve JavaScript support in Ruby on Rails. [MooTools](#), [Dojo](#), and [jQuery](#) soon followed. Of these libraries, jQuery has become the most popular, largely because of thousands of modular jQuery *plug-ins* that implement a wide range of effects and *widgets* (web page features). These plug-ins are used to add visual effects and interactivity to web pages. Examples are drop-down menus, modal windows, tabbed panels, autocompletion search forms, and sliders or carousels for images. Even without plugins, jQuery is useful as a high-level interface for manipulating the browser DOM ([document object model](#)), to make it easy to do things like hiding or revealing HTML elements on a page. Any Rails application can use jQuery because it is included by default in any new Rails application.

Libraries such as jQuery add functionality to server-side applications, such as those built with Rails. Other JavaScript libraries serve as fully featured web

application development frameworks, allowing developers to build client-side applications that run in the browser and only interact with a server to read or write data. Examples of these full-fledged JavaScript frameworks are [Ember.js](#), [AngularJS](#), and [Backbone.js](#). All use a variant of the model-view-controller (MVC) software design pattern to implement [single-page applications](#) which function more like desktop or mobile applications than websites. Developers who build a single-page application with one of these frameworks often use Ruby on Rails as a back end; an MVC JavaScript framework can replace all the Rails view files. None of these JavaScript frameworks dominate web application development like Ruby on Rails, but they are gaining popularity for single-page applications. We won't look at Ember.js, AngularJS, or Backbone.js in this book; they are an advanced topic and require entire books themselves.

The biggest problem with adding JavaScript to Rails is the difficult-to-maintain “JavaScript soup” that results from adding JavaScript to Rails views. Ember.js, AngularJS, or Backbone.js are more than is needed for simply structuring JavaScript in Rails views. But there's a newer framework that can be used to dry up JavaScript soup. It's [React](#), a JavaScript framework developed by engineers at Facebook. Unlike AngularJS or Ember.js, React only manages views, not connections to databases or routing of requests, so it is not a full-stack framework, just a framework for the view layer. React's approach to building web pages is abstract and complex. But React is a good choice for complex interactive features, if you're determined to avoid JavaScript soup in your Rails application.

We won't look at JavaScript frameworks in this book, but we will use the Zurb Foundation framework to manage our CSS stylesheets.

Front-End Frameworks

Front-end frameworks combine CSS and JavaScript libraries. Many elements that are found on sophisticated web pages, such as modal windows or tabs,

require a combination of JavaScript and CSS. Combining CSS and JavaScript libraries in a common framework makes it possible to standardize and reuse common web page features.

There are many responsive front-end frameworks to choose from, including:

- [Bourbon Neat](#)
- [Cardinal](#)
- [Semantic UI](#)
- [Bootstrap](#)
- [Zurb Foundation](#)
- [and many others](#)

Each has its fans, though Bootstrap and Zurb Foundation are the most popular among Rails developers. Each adds a library of markup, styles, and standardized web page features such as modal windows, pagination, breadcrumbs, and navigation.

[Bootstrap](#) is the best-known front-end framework. It is the result of an effort to document and share common design patterns and assets across projects at Twitter, released as an open source project in August 2011.

[Zurb Foundation](#) was released as an open source project in October 2011, after more than a year of internal use at [Zurb](#), a Silicon Valley design consultancy.

Just ahead, we'll look at why we use Zurb Foundation in this book. But first, you'll need to learn about LESS and Sass.

CSS Preprocessing with LESS or Sass

Ordinary CSS is not a programming language. As a result, CSS rules are verbose and often repetitive. To add efficiency to CSS, Bootstrap and Zurb Foun-

dation rely on CSS preprocessors; [LESS](#) for Bootstrap 3 and [Sass](#) for Bootstrap 4 and Zurb Foundation. LESS and Sass extend CSS to give it more powerful programming language features. As a result, your stylesheets can use variables, mixins, and nesting of CSS rules, just like a real programming language.

For example, in Sass you can create a variable such as `$blue: #3bbfce` and specify colors anywhere using the variable, such as `border-color: $blue`. *Mixins* are like variables that let you use snippets of reusable CSS. *Nesting* eliminates repetition by layering CSS selectors.

Sass is generally recognized as more powerful than LESS, and Sass is included in any new Rails application.

Bootstrap or Zurb Foundation?

Which should you use, Bootstrap or Zurb Foundation?

Zurb Foundation has a solid following among Rails developers. It gained an initial advantage because Zurb provides a gem that adds Foundation to Rails. When Zurb releases new versions of Foundation, the company updates the gem immediately. Another factor is Foundation's use of Sass, leading to easier integration with Rails applications.

Recently (in January 2014), the Bootstrap team started supporting a Ruby gem that provides a drop-in Sass version of Bootstrap for Rails. Now any preference for Foundation over Bootstrap is primarily a matter of personal taste.

Bootstrap has a larger developer community and more third-party projects, as evidenced by a [Big Badass List of Useful Twitter Bootstrap Resources](#). In its sheer magnitude, this list, from Michael Buckbee and Bootstrap Hero, demonstrates the popularity of Bootstrap and the vitality of its open source community. If you're eager to try Bootstrap, the RailsApps project provides a [Rails Bootstrap](#) example application and an accompanying tutorial. We'll use Zurb Foundation here, but after you complete this book, you might want to expand your knowledge and learn about Bootstrap.

Before I show you how to integrate Zurb Foundation with your Rails application, let's briefly consider matters of design.

Graphic Design Options

There are three approaches to graphic design for your Rails application.

If you're well-funded and well-connected, you can put together a team or hire a freelance graphic designer to implement a unique design, built from scratch using CSS or customized from a framework such as Bootstrap or Zurb Foundation. If you've got strong design skills, or can partner with an experienced web designer, you'll get a custom design that expresses the purpose and motif of your website.

A second approach is to use Bootstrap or Zurb Foundation to quickly add attractive CSS styling to your application. Many developers don't have the skill or resources to customize the design. Consequently, sites that use Bootstrap or Zurb Foundation look very similar. If that's your situation, it's okay, really! It's better to have a decent site with the clean look of Bootstrap or Zurb Foundation than to leak ugliness onto the web.

A third option is to purchase a pre-designed theme for your website. You may have visited [ThemeForest](#) or other theme galleries that offer pre-built themes for a few dollars each. These huge commercial galleries offer themes for WordPress, Tumblr, or CMS applications such as Drupal or Joomla. They don't offer themes for Rails and it is not easy to adapt one of their themes for a Rails application. I'm only aware of one firm that sells prepackaged themes for Rails applications using Zurb Foundation: [RailsThemes](#).

You probably don't need a Foundation theme that is built specifically for Rails. Take a look at some of the inexpensive themes for Foundation that you can adapt for Rails:

- [FoundationMade](#)

An alternative is to convert open source themes designed with Bootstrap. The site [Themes for Bootstrap](#) aggregates Bootstrap themes, or you can visit sites such as [Start Bootstrap](#), [Bootswatch](#), or the [Themestrap](#) gallery.

Even if you use a prepackaged theme, you'll need to know how to set up a front-end framework in Rails. We'll look at setting up Zurb Foundation next.

Zurb Foundation Gem

Zurb Foundation provides a standard grid for layout plus dozens of reusable components for common page elements such as navigation, forms, and buttons. More importantly, it gives CSS the kind of structure and convention that makes Rails popular for back-end development. Zurb Foundation is packaged as a gem.

In your **Gemfile**, you've already added:

```
gem 'foundation-rails'
```

and previously run **\$ bundle install**.

Rather than following the installation instructions provided in the [Foundation Documentation](#), we'll use the [rails_layout](#) gem to set up Zurb Foundation and create the files we need. Our approach is slightly different from the Zurb instructions but yields the same results.

Rails Layout Gem with Zurb Foundation

In the previous chapter, we used the [rails_layout](#) gem to configure the default application layout with HTML5 elements, navigation links, and flash messages. Now we'll use the [rails_layout](#) gem to set up Zurb Foundation and generate new

files for the application layout as well as the navigation and messages partials. The new files will replace the layout files we created in the previous chapter.

We'll use the generator provided by the rails_layout gem to set up Foundation and add the necessary files. Run:

```
$ rails generate layout:install foundation5 --force
```

With the **-force** argument, the rails_layout gem will replace existing files.

The gem will create the file:

- **app/assets/stylesheets/1st_load_framework.css.scss**

and modify the files:

- **app/assets/javascripts/application.js**
- **app/views/layouts/_messages.html.erb**
- **app/views/layouts/_navigation.html.erb**
- **app/views/layouts/application.html.erb**

It will also remove the file:

- **app/assets/stylesheets/simple.css**

Finally, it will modify the file **config/application.rb**.

Let's examine the files to see how our application is configured to use Zurb Foundation.

Renaming the application.css File

The rails_layout gem renamed the **app/assets/stylesheets/application.css** file as **app/assets/stylesheets/application.css.scss**. Note the **.scss** file extension. This will allow you to use the advantages of an improved syntax for your application stylesheet.

You learned earlier that stylesheets can use variables, mixins, and nesting of CSS rules when you use Sass.

Sass has two syntaxes. The most commonly used syntax is known as “SCSS” (for “Sassy CSS”), and is a superset of the CSS syntax. This means that every valid CSS stylesheet is valid SCSS as well. SCSS files use the extension **.scss**. The Sass project also offers a second, older syntax with indented formatting that uses the extension **.sass**. We’ll use the SCSS syntax.

You can use Sass in any file by adding the file extension **.scss**. The asset pipeline will preprocess any **.scss** file and expand it as standard CSS.

For more on the advantages of Sass and how to use it, see the [Sass](#) website or the [Sass Basics RailsCast](#) from Ryan Bates.

Before you continue, make sure that the rails_layout gem renamed the **app/assets/stylesheets** file as **app/assets/stylesheets/application.css.scss**. Otherwise you won’t see the CSS styling we will apply.

The application.css.scss File

In the previous chapter, I introduced the Rails *asset pipeline*.

Your CSS stylesheets get concatenated and compacted for delivery to the browser when you add them to this directory:

- **app/assets/stylesheets/**

The asset pipeline helps web pages display faster in the browser by combining all CSS files into a single file (it does the same for JavaScript).

Let's examine the file **app/assets/stylesheets/application.css.scss**:

```
/*
 * This is a manifest file that'll be compiled into application.css, which will include all the
 * listed below.
 *
 * Any CSS and SCSS file within this directory, lib/assets/stylesheets, vendor/assets/stylesheets
 * or vendor/assets/stylesheets of plugins, if any, can be referenced here using a relative path.
 *
 * You're free to add application-wide styles to this file and they'll appear at the bottom of
 * the compiled file so the styles you add here take precedence over styles defined in any styles
 * defined in the other CSS/SCSS files in this directory. It is generally better to create a new
 * file per style scope.
 *
 *= require_tree .
 *= require_self
 */
```

The **app/assets/stylesheets/application.css.scss** file serves two purposes.

First, you can add any CSS rules to the file that you want to use anywhere on your website. Second, the file serves as a *manifest*, providing a list of files that should be concatenated and included in the single CSS file that is delivered to the browser.

If you are familiar with CSS syntax, it may seem odd that the relevant lines are commented out (using asterisks). These lines are not CSS, so they must be commented out so they won't be interpreted as CSS. Though they are commented out, the Rails asset pipeline reads and understands them. It's a bit of a hack, but it works.

A Global CSS File

Any CSS style rules that you add to the **app/assets/stylesheets/application.css.scss** file will be available to any view in the application. You could use this file for any style rules that are used on every page, particularly simple utility rules such

as highlighting or resetting the appearance of links. However, in practice, you are more likely to modify the style rules provided by Zurb Foundation. These modifications don't belong in the **app/assets/stylesheets/application.css.scss** file; they will go in the **app/assets/stylesheets/1st_load_framework.css.scss** file.

In general, it's bad practice to place a lot of CSS in the **app/assets/stylesheets/application.css** file (unless your CSS is very limited). Instead, structure your CSS in multiple files. CSS that is used on only a single page can go in a file with a name that matches the page. Or, if sections of the website share common elements, such as themes for landing pages or administrative pages, make a file for each theme. How you organize your CSS is up to you; the asset pipeline lets you organize your CSS so it is easier to develop and maintain. Just add the files to the **app/assets/stylesheets/** folder.

A Manifest File

It's not obvious from the name of the **app/assets/stylesheets/application.css.scss** file that it serves as a *manifest file* as well as a location for miscellaneous CSS rules. For most websites, you can ignore its role as a manifest file. In the comments at the top of the file, the **`*= require_self`** directive indicates that any CSS in the file should be delivered to the browser. The **`*= require_tree .`** directive (note the Unix "dot operator") indicates any files in the same folder, including files in subfolders, should be combined into a single file for delivery to the browser.

If your website is large and complex, you can remove the **`*= require_tree .`** directive and specify individual files to be included in the file that is generated by the asset pipeline. This gives you the option of reducing the size of the application-wide CSS file that is delivered to the browser. For example, you might segregate a file that includes CSS that is used only in the site's administrative section. In general, only large and complex sites need this optimization. The speed of rendering a single large CSS file is faster than fetching multiple files.

Zurb Foundation JavaScript

Zurb Foundation provides both CSS and JavaScript libraries.

Like the **application.css.scss** file, the **application.js** file is a manifest that allows a developer to designate the JavaScript files that will be combined for delivery to the browser.

The rails_layout gem modified the file **app/assets/javascripts/application.js** to include the Foundation JavaScript libraries:

```
//= require jquery
//= require jquery_ujs
//= require turbolinks
//= require foundation
//= require_tree .
$(function() {
  $(document).foundation();
});
```

It added the directive **//= require foundation** before **//= require_tree** ..

The last three lines use jQuery to load the Foundation JavaScript libraries after the browser has fired a “DOM ready” event (which means the page is fully rendered and not waiting for additional files to download).

```
$(function() {
  $(document).foundation();
});
```

Note that this configuration is different from the instructions provided in the [Foundation Documentation](#). In keeping with Rails best practices, we load the Foundation JavaScript libraries using the asset pipeline in the **<head>** section of the default application layout. Using the jQuery “DOM ready” event to load Foundation insures that Foundation is compatible with other jQuery plugins or JavaScript code.

Zurb Foundation CSS

The rails_layout gem added a file **app/assets/stylesheets/1st_load_framework.css.scss** containing:

```
// import the CSS framework
@import "foundation";
.
.
.
```

The file **app/assets/stylesheets/1st_load_framework.css.scss** is automatically included and compiled into your Rails application.css file by the **`*= require_tree`** statement in the **app/assets/stylesheets/application.css.scss** file. The file could be named anything. However, by giving it a name beginning with “1” it will load before any other stylesheet files we may add later. The asset pipeline loads files in alphabetical order. We want the Foundation framework to load before any custom CSS files.

The **`@import "foundation";`** directive will import the Foundation CSS rules from the Foundation gem.

You could add the Foundation **`@import`** code to the **app/assets/stylesheets/application.css.scss** file. However, it is better to have a separate **app/assets/stylesheets/1st_load_framework.css.scss** file. You may wish to modify the Foundation CSS rules; placing changes to Foundation CSS rules in the **1st_load_framework.css.scss** file will keep your CSS better organized.

In addition to the simple **`@import "foundation";`** directive, the **app/assets/stylesheets/1st_load_framework.css.scss** file contains a collection of Sass mixins. We’ll look at these later in the chapter.

Using Foundation CSS Classes

Now that you’ve installed Zurb Foundation, you have a rich library of interactive effects you can add to your pages.

Take a look at the [Foundation documentation](#) to see your options. Here are just a few examples:

- [buttons](#)
- [pricing tables](#)
- [modal dialogs](#)

At a simpler level, Foundation provides a collection of carefully-crafted styling rules in the form of CSS classes. These are building blocks you use for page layout and typographic styling. For example, Foundation gives you CSS classes to set up rows and columns in a grid system.

Let's take a closer look at the Foundation grid system.

Foundation Grid

The Foundation grid is responsive because it has “breakpoints.” There are actually three grids:

- Small: browser windows 0 to 640 pixels wide (phones)
- Medium: browser windows 641 to 1023 pixels wide (tablets)
- Large: browser windows 1024 pixels and wider (desktops)

Start by designing for the small screen with the classes prefixed “small”; then add classes prefixed “medium” or “large” if you want a layout for larger screens. The layout will change at each breakpoint.

The grid gives you 12 columns by default. You can organize your layout in horizontal and vertical sections using **row** and **columns** classes.

For example, you could use Foundation grid classes to set up an application layout with a footer as a row with two sections:

```
<footer class="row">
  <section class="small-4 columns">
    Copyright 2014
  </section>
  <section class="small-8 columns">
    All rights reserved.
  </section>
</footer>
```

The Foundation **row** class will create a horizontal break. The footer will contain two side-by-side sections. The first will be four columns wide; the second will be eight columns wide.

Here's the same footer with a responsive design:

```
<footer class="row">
  <section class="small-12 medium-4 columns">
    Copyright 2014
  </section>
  <section class="small-12 medium-8 columns">
    All rights reserved.
  </section>
</footer>
```

On desktops and tablets, the footer will contain two side-by-side sections. On phones, each section will expand to take the full browser width, appearing as stacked rows.

To better understand the grid system with all its options, see the [documentation for the Foundation Grid](#).

Presentational Versus Semantic Styles

There are two schools of thought among front-end developers. Some developers are content to use Foundation's classes directly in Rails view files. For these developers, the Foundation classes are both practical and descriptive, making it easy for any developer who knows the Foundation framework to visualize the layout of a page.

Other developers take issue with this approach. They argue that Foundation's markup is often *presentational*, with class names describing the appearance of the page. In an ideal world, all markup would be *semantic*, with class names describing the function or purpose of a style. For example, a submit button often needs styling. Compare these two approaches to markup:

- presentational: `<button class="big red button">Order Now</button>`
- semantic: `<button class="submit">Order Now</button>`

Suppose your user testing indicates a green button generates more sales. With the presentational approach you'd have to change both the Rails view file and the CSS file. With a semantic approach, you'd just change the CSS file to reassign the color of the `submit` class.

Using Foundation Classes Directly

Foundation often mixes presentational and semantic markup.

For quick and simple websites, where you don't need to be concerned about long-term maintenance, use Foundation's CSS classes directly.

For example, you can style a button like this:

- `<button class="large alert button">Order Now</button>`

It is immediately obvious that you'll get a large button. The `alert` class is a bit more semantic, indicating it will apply an "alert color" which is red, by default, in Foundation.

Using Sass Mixins with Foundation

If you don't like the presentational approach, you can use Sass mixins to create your own semantic class names.

Sass mixins add a layer of complexity that can map Foundation class names to your own semantic class names.

For example, the Foundation grid system is presentational. Specifying rows and columns, and quantifying the size of columns, describes the visual appearance of sections of the layout rather than the purpose of each section. The presentational approach makes it easy to visualize the layout of a page. But you'll be tied to Foundation 5.0 class names for the life of your website. If class names change in Foundation 6.0, or you decide to switch to another front-end framework, it will be difficult to update your application, as you will have to carefully rebuild each view file.

Is it worth the effort to add the complexity of Sass mixins just to future-proof your website? Probably not for a simple website such as the one you are building for Foobar Kadigan.

The `rails_layout` gem uses Sass mixins to apply CSS style rules to the default application layout. In doing so, the default application layout is free of framework-specific code and can be used with either Bootstrap or Zurb Foundation.

Before we examine the default application layout, let's take a look at the Sass mixins supplied by the `rails_layout` gem.

Look again at the file `app/assets/stylesheets/1st_load_framework.css.scss` created by the `rails_layout` gem:

```
// import the CSS framework
@import "foundation";

// override for the 'Home' navigation link
.top-bar .name {
  font-size: rem-calc(13);
  line-height: 45px; }
.top-bar .name a {
  font-weight: normal;
  color: white;
  padding: 0 15px; }

// THESE ARE EXAMPLES YOU CAN MODIFY
// create mixins using Foundation classes
@mixin twelve-columns {
```

```
@extend .small-12;
@extend .columns;
}
@mixin six-columns-centered {
  @extend .small-6;
  @extend .columns;
  @extend .text-center;
}
// create your own classes
// to make views framework-neutral
.column {
  @include six-columns-centered;
}
.form {
  @include grid-column(6);
}
.form-centered {
  @include six-columns-centered;
}
.submit {
  @extend .button;
  @extend .radius;
}
// apply styles to HTML elements
// to make views framework-neutral
main {
  @include twelve-columns;
  background-color: #eee;
}
section {
  @extend .row;
  margin-top: 20px;
}
```

The rails_layout gem is in active development so the file you’ve created may be different from the example in this tutorial. It will probably be very similar.

At the top of the file we import the Foundation framework CSS files from the gem.

We override two Foundation style rules so the “Home” navigation link matches the other links in the navigation bar.

Then we use mixins to create semantic classes.

Mixins are declared in Sass files by the `@mixin` directive, which takes a block of CSS styles, other mixins, or a CSS selector (a CSS class or ID).

If you'd like to combine CSS classes, or rename a CSS class, use the `@extend` directive to add a CSS class to a mixin.

The first declaration `@mixin twelve-columns` combines the Foundation classes `small-12` and `columns` to make a new class, `twelve-columns`.

The second declaration `@mixin six-columns-centered` makes a column that is six columns wide with centered text.

Next we create a few classes that use the mixins or combine Foundation CSS classes. For example, the new `submit` class can be used for a rounded button. When we use it in a view, this class will be purely semantic since it describes the purpose of the element, allowing us to set its appearance outside of any view file.

Finally, to avoid applying Foundation classes in the application layout file, we apply styles to HTML elements `main` and `section` to make the views framework-neutral. We use the `@include` directive to add the mixins we need. We also use the `@extend` directive to add a Foundation CSS class. And we directly set CSS properties such as `background-color` and `margin-top`.

Using this technique, the file `app/assets/stylesheets/1st_load_framework.css.scss` becomes the single point of intersection between the Foundation framework and the application layout. For a simple website, this could be over-engineering and counter-productive. The `rails_layout` gem uses the technique so that either Bootstrap or Zurb Foundation can be used without any change to the default application layout.

We'll use the CSS classes provided by the `rails_layout` gem in the tutorial application, but if you choose to customize the application, feel free to use Foundation classes directly to keep your project simple.

Application Layout with Zurb Foundation

Let's look at the application layout file created by the `rails_layout` gem:

Examine the contents of the file **app/views/layouts/application.html.erb**:

```
<!DOCTYPE html>
<html>
  <head>
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title><%= content_for?(:title) ? yield(:title) : "Learn Rails" %></title>
    <meta name="description" content="<%= content_for?(:description) ? yield(:description) : "L
    <%= stylesheet_link_tag 'application', media: 'all', 'data-turbolinks-track' => true %>
    <%=# Modernizr is required for Zurb Foundation %>
    <%= javascript_include_tag 'vendor/modernizr' %>
    <%= javascript_include_tag 'application', 'data-turbolinks-track' => true %>
    <%= csrf_meta_tags %>
  </head>
  <body>
    <header>
      <%= render 'layouts/navigation' %>
    </header>
    <main role="main">
      <%= render 'layouts/messages' %>
      <%= yield %>
    </main>
  </body>
</html>
```

This file is almost identical to the simple application layout file we looked at in the previous chapter.

Because we've applied Foundation classes to the HTML element **main** in the **app/assets/stylesheets/1st_load_framework.css.scss** file, there's no need to use Foundation classes directly in the application layout.

Modernizr JavaScript Library

You'll see the file now includes:

```
.
.
.
.
<%=# Modernizr is required for Zurb Foundation %>
<%= javascript_include_tag 'vendor/modernizr' %>
.
```



```
.  
.
```

The [Modernizr](#) JavaScript library is a prerequisite for Foundation. Modernizr makes it possible for older browsers to use HTML5 elements. It also detects mobile devices. It must be loaded before Foundation, so it is included above `javascript_include_tag "application"`.

config/application.rb

Just for a minute, we're going to dive deeply into a complicated issue that arises when integrating Foundation with Rails. You could skip this section, because the `rails_layout` gem takes care of the messy details. But if you read it, you will understand a little more about the mysteries of the Rails asset pipeline.

Earlier I briefly noted that the `rails_layout` gem makes a necessary change to the `config/application.rb` file. It adds:

```
module LearnRails  
  class Application < Rails::Application  
    .  
    .  
    .  
    # For Foundation 5  
    config.assets.precompile += %w( vendor/modernizr )  
  
  end  
end
```

Modernizer is included in the application layout file with a `javascript_include_tag`. In production (when you deploy to Heroku or elsewhere), any assets not included in the `assets/` folder must be specified with the `config.assets.precompile` configuration setting. And by the way, the `.js` extension gets dropped from the filename. If not, you'll get an error:

```
Sprockets::Rails::Helper::AssetFilteredError at /
Asset filtered out and will not be served:
add `config.assets.precompile += %w( vendor/modernizr )`
to `config/application.rb` and restart your server
```

This is a sanity check to reveal asset pipeline errors that only show up in production ([details](#)).

For now, you can forget you learned this. But now you'll understand the issue if you ever see this error.

You can avoid this issue by never adding an extra `javascript_include_tag` to a layout and always adding JavaScript files to the `assets/` folder where they are compiled automatically.

Flash Messages with Zurb Foundation

The messages partial we use with Zurb Foundation is complex.

Examine the file `app/views/layouts/_messages.html.erb`:

```
<%=# Rails flash messages styled for Zurb Foundation %>
<%= flash.each do |name, msg| %>
  <%= if msg.is_a?(String) %>
    <div data-alert class="alert-box round <%= name.to_s == 'notice' ? 'success' : 'alert' %>">
      <%= content_tag :div, msg %>
      <a href="#" class="close">&times;</a>
    </div>
  <%= end %>
<%= end %>
```

We use `each` to iterate through the flash hash, retrieving a `name` and `msg` that are passed to a block to be output as a string. The expression `if msg.is_a?(String)` serves as a test to make sure we only display messages that are strings. We construct a div that applies Foundation CSS styling around the message. Foundation recognizes a class `alert-box` and `round` (for rounded corners). A

class of either **success** or **alert** styles the message. Rails **notice** messages will get styled with the Foundation **success** class. Any other Rails messages, including **alert** messages, will get styled with the Foundation **alert** class.

We use the Rails **content_tag** view helper to create a div containing the message.

Finally, we create a “close” icon by applying the class **close** to a link. We use the HTML entity **×** (a big “X” character) for the link; it could be the word “close” or anything else we like. Foundation’s integrated JavaScript library will hide the alert box when the “close” link is clicked.

Foundation provides [detailed documentation](#) if you want to change the styling of the alert boxes.

Navigation Partial with Zurb Foundation

The layout and styling required for the Foundation navigation bar are in the navigation partial file.

Examine the file **app/views/layouts/_navigation.html.erb**:

```
<%=# navigation styled for Zurb Foundation 5 %>
<nav class="top-bar" data-topbar>
  <ul class="title-area">
    <li class="name"><%= link_to 'Home', root_path %></li>
    <li class="toggle-topbar menu-icon"><a href="#">Menu</a></li>
  </ul>
  <div class="top-bar-section">
    <ul>
      <%= render 'layouts/navigation_links' %>
    </ul>
  </div>
</nav>
```

The navigation partial is now more complex, with layout and Foundation classes needed to produce a responsive navigation bar.

At the conclusion of this chapter, you'll test the responsive navigation by re-sizing the window. At small sizes, the navigation links will disappear and be replaced by an icon labeled "Menu." Clicking the icon will reveal a vertical menu of navigation links. The navigation menu is a great demonstration of the ability of Zurb Foundation to adjust to the small screen size of a tablet or smartphone.

If you'd like to add a site name or logo to the tutorial application, you can replace the link helper `<%= link_to 'Home', root_path %>`. It is important to preserve the enclosing layout and classes, even if you don't want to display a site name or logo. The enclosing layout is used to generate the navigation menu when the browser window shrinks to accommodate a tablet or smartphone.

You'll see we wrap the nested partial `render 'layouts/navigation_links'` with a Foundation class to complete the navigation bar.

Navigation Links Partial

The file **app/views/layouts/_navigation_links.html.erb** is unchanged:

```
<%=# add navigation links to this file %>
```

Later we'll add links to "About" and "Contact" pages.

The navigation links partial will be simply a list of navigation links. It doesn't require additional CSS styling.

We're following the *separation of concerns* principle here. By separating the links from the styling that creates the navigation bar, we segregate the code that is unique to Zurb Foundation. In the future, if the Zurb Foundation layout or CSS classes change, we can make changes without touching the navigation links. If we wish, we can replace the navigation partial and substitute one that uses Bootstrap styles instead of Foundation, leaving the navigation links intact.

Set up SimpleForm with Zurb Foundation

One of the requirements for our tutorial application is a contact form. We could set up styling for the form when we implement the contact page, but it is convenient to set up form styling now, as we would if we were adding multiple forms to the site.

Rails provides a set of view helpers for forms. They are described in the [RailsGuides: Rails Form Helpers](#) document. But, as you’ve learned, Rails has more than one stack, and most developers use an alternative set of form helpers named SimpleForm, provided by the [SimpleForm gem](#). The SimpleForm helpers are more powerful, easier to use, and offer an option for styling with Zurb Foundation.

In your **Gemfile**, you’ve already added:

```
gem 'simple_form'
```

and previously run **\$ bundle install**.

Run the generator to install SimpleForm with a Zurb Foundation option:

```
$ rails generate simple_form:install --foundation
```

which installs several configuration files:

```
config/initializers/simple_form.rb  
config/initializers/simple_form_foundation.rb  
config/locales/simple_form.en.yml  
lib/templates/erb/scaffold/_form.html.erb
```

Here the SimpleForm gem uses the **rails generate** command to create files for initialization and localization (language translation). SimpleForm can be customized with settings in the initialization file. We’ll use the defaults.

Test the Application

Let's see how the application looks with Zurb Foundation. The web server may already be running. If not, enter the command:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

You should see a new page design that displays Zurb Foundation styling. Thanks to the open source efforts of the Zurb firm, we've added powerful front-end features to our website with little effort.

You can click the "X" close icons to hide the flash messages, thanks to the integrated CSS and JavaScript of the Foundation framework.

Next we'll add "About" and "Contact" pages to the application. After we update the navigation links, you'll see how the Foundation responsive web design adjusts the navigation bar at different browser widths.

Remove the Flash Messages

Before we continue, we'll remove the flash messages we created for our demonstration.

Update the file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    @owner = Owner.new
  end

end
```

Git

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "front-end framework"  
$ git push
```

Chapter 17

Add Pages

Let's begin adding pages to our web application.

There are three types of web pages in a Rails application. We've looked at two types so far:

- static pages in the **public/** folder that contain no Ruby code
- dynamic pages such as our home page that use the application layout

There's another type of web page that is required on many websites. It has static content; that is, no dynamic data is needed on the page. But it uses the default application layout to maintain consistency in the website look and feel. We classify this type of page as a:

- static view that uses the application layout

Examples include:

- “About” page
- Legal page

- FAQ page

It's possible to place these pages in the **public/** folder and copy the HTML and CSS from the default application layout but this leads to duplicated code and maintenance headaches. And dynamic elements such as navigation links can't be included. For these reasons, developers seldom create static pages in the **public/** folder.

Alternatively, a dynamic page can be created that has no model, a nearly-empty controller, and a view that contains no instance variables. This solution is quite common for static views that use the application layout.

This solution is implemented so frequently that many developers create a gem to encapsulate the functionality. We're going to use the best-known of these gems, the [high_voltage](#) gem created by the [Thoughtbot](#) consulting firm.

We'll use the High Voltage gem to create an "About" Page.

We also will create a Contact page. We'll again use the High Voltage gem, but only for the first version of the Contact page. Later we'll discard the page we created with the High Voltage gem and replace it with a full model-view-controller implementation. The process will show the difference between an older form of web application architecture and a newer "Rails way."

High Voltage Gem

We can add a page using the High Voltage gem almost effortlessly. The gem implements Rails "convention over configuration" so well that there is nothing to configure. There are alternatives to its defaults which can be useful but we won't need them; visit the GitHub home page for the [high_voltage](#) gem if you want to explore all the options.

In your **Gemfile**, you've already added:

```
gem 'high_voltage'
```

and previously run `$ bundle install`.

Views Folder

Create a folder **app/views/pages**:

```
$ mkdir app/views/pages
```

Any view files we add to this directory will automatically use the default application layout and appear when we use a URL that contains the filename.

The High Voltage gem contains all the controller and routing magic required for this to happen.

Let's try it out.

“About” Page

Create a file **app/views/pages/about.html.erb**:

```
<% content_for :title do %>About<% end %>
<h3>About Foobar Kadigan</h3>
<p>He was born in Waikikamukau, New Zealand. He left New Zealand for England,
  excelled at the University of Mopery, and served in the Royal Loamshire Regiment.
  While in service, he invented the kanuten valve used in the processing of
  unobtainium for industrial use. With a partner, Granda Fairbook, he founded
  Acme Manufacturing, later acquired by the Advent Corporation, to develop his
  discovery for use in the Turboencabulator. Mr. Kadigan is now retired and
  lives in Middlehampton with a favorite cat, where he raises Griadium frieda
  and collects metasyntactic variables.</p>
<p>His favorite quotation is:</p>
<p>Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod
  tempor incididunt ut labore et dolore magna aliqua.</p>
```

Our simple “About” view will be combined with the default application layout by the High Voltage gem.

We include a `content_for` Rails view helper that passes a page title to the application layout.

Contact Page

For the initial version of the Contact page, create a file **app/views/pages/contact.html.erb**:

```
<% content_for :title do %>Contact<% end %>
<h3>Contact</h3>
```

This is a placeholder page we’ll use to test a navigation link.

We include a `content_for` Rails view helper that passes a page title to the application layout.

Routing for the High Voltage Gem

The High Voltage gem provides a PagesController. You’ll never see it; it is packaged inside the gem.

In addition to providing a controller, the High Voltage gem provides default routing so any URL with the form <http://localhost:3000/pages/about> will obtain a view from the **app/views/pages** directory.

Like the PagesController, the code that sets up the route is packaged inside the gem. For details about the syntax of routing directives, refer to [RailsGuides: Routing from the Outside In](#).

Update the Navigation Partial

You can use a Rails route helper to create a link to any view in the **app/views/pages** directory like this:

```
link_to 'About', page_path('about')
```

Let's add links to the “About” and “Contact” pages.

Replace the contents of the file **app/views/layouts/_navigation_links.html.erb** with this:

```
<%=# add navigation links to this file %>
<li><%= link_to 'About', page_path('about') %></li>
<li><%= link_to 'Contact', page_path('contact') %></li>
```

With an updated navigation bar, we can test the application.

Test the Application

The web server may already be running. If not, enter the command:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

Links to the pages “About” and “Contact” should work.

If you get an error “uninitialized constant PagesController,” make sure the **config/routes.rb** file looks like this:

```
Rails.application.routes.draw do
  root to: 'visitors#new'
end
```

Watch what happens when you resize the page. At smaller sizes, the navigation bar changes to display a menu icon. Clicking the menu icon reveals a drop-down menu of navigation links. You’re seeing the power of the Foundation framework.

Here’s a troubleshooting tip. If clicking the menu icon doesn’t reveal a drop-down menu, the application may not be loading the Foundation JavaScript library. Make sure that the file **app/assets/javascripts/application.js** contains:

```
//= require jquery
//= require jquery_ujs
//= require turbolinks
//= require foundation
//= require_tree .
$(function() {
  $(document).foundation();
});
```

Git

Let’s commit our changes to the Git repository and push to GitHub:

```
$ git add -A
$ git commit -m "add 'about' and 'contact' pages"
$ git push
```

There is nothing more we need for our “About” page.

In the next chapter, we’ll explore two different implementations for the Contact page.

Chapter 18

Contact Form

Forms are ubiquitous on the web, to the degree we seldom notice how often they are used for data entry, whether we're logging into a website or posting a blog comment. To build any interactive website, you'll need to understand forms. Here we'll build a contact form for our tutorial application.

A contact form is common on many websites. If you think about it, contact forms are often unnecessary; simply displaying an email address is sufficient, more convenient, and easier to implement. But building a contact form is an excellent way to learn how to handle user data input. We'll pretend that our odd client, Mr. Foobar Kadigan, insists that he needs a contact form on his website.

We're not backing the tutorial application with a database so we won't store the contact data after the information is submitted. Instead, in a subsequent chapter we'll learn how to send the contents of the form by email to the website owner.

The “Old Way” and the “Rails Way”

In this chapter, we'll explore two ways to implement a contact form. The first way will be familiar to anyone who has used PHP or similar web platforms. It is an obvious and straightforward way to handle a form. As we look closer,

we'll see the approach has limitations. We'll discard our first approach and rebuild the Contact page, discovering how the “Rails way” is more powerful.

You may wonder why I'm going to show you two different ways to implement the contact form.

First, it is worthwhile to see there is more than one way to implement a web application. Maturity as a software developer means imagining different approaches and evaluating your options. With this exercise, you'll contrast two approaches and see how we make choices about software architecture.

More importantly, it is not always obvious why we do things in a “Rails way.” It would be easy to simply walk you through the steps to build a contact form without showing you alternative implementations (that's how most tutorials do it). But you'll gain a deeper understanding of Rails by building the contact form in a less sophisticated fashion and then seeing the more elegant Rails approach.

User Story

Let's plan our work with a user story:

```
*Contact Page*
As a visitor to the website
I want to fill out a form with my name, email address, and some text
In order to send a message to the owner of the website
```

Our first step will be to create a route to a controller that will process the submitted form.

Routing

We're going to create a `ContactsController` to process the submitted form data. Every form must have a destination URL that receives the form submission.

We need to set a route to generate the destination URL.

Open the file **config/routes.rb**. Replace the contents with this:

```
Rails.application.routes.draw do
  post 'contact', to: 'contacts#process_form'
  root to: 'visitors#new'
end
```

The route `post 'contact', to: 'contacts#process_form'` will create a route helper that generates a URL and hands off the request to a controller.

You can run the **rake routes** command to see our routes in the console:

```
$ rake routes
Prefix Verb URI Pattern          Controller#Action
contact POST /contact(.:format) contacts#process_form
  root GET /              visitors#new
  page GET /pages/*id        high_voltage/pages#show
```

The output of the **rake routes** command is somewhat cryptic but confirms we've created the routes we need.

The first item in the **rake routes** output indicates we can add “contact” to “_path” to get our route helper, **contact_path**:

- **contact_path** - a route helper that can be used in a controller or view

The second item indicates the request will be handled with the HTTP POST protocol:

- **POST** - HTTP method to submit form data

The third item indicates the application will respond to the following URL:

- <http://localhost:3000/contact> - URL generated by the route helper

The fourth item indicates a request to the URL will be handled by:

- **contacts** - the name of the controller
- **process_form** - a controller action

For details about the syntax of routing directives, refer to [RailsGuides: Routing from the Outside In](#).

The route won't work yet; we need to create a `ContactsController`. But first we'll create the form.

Adding a Form to the Contact Page

You'll recall that we set up the [SimpleForm gem](#) when we added Zurb Foundation to our application. The SimpleForm gem provides Rails view helpers for forms. You'll remember that we described Rails view helpers as “macros to generate HTML.” The SimpleForm gem gives us view helpers to generate all the HTML required by complex forms. Forms require some of the most complex HTML a developer will encounter, so the SimpleForm gem is truly worthwhile.

Let's add the code for a contact form to the Contact page.

Replace the contents of the file **app/views/pages/contact.html.erb**:

```
<% content_for :title do %>Contact<% end %>
<h3>Contact</h3>
<div class="form">
  <%= simple_form_for :contact, url: contact_path do |form| %>
    <%= form.input :name, autofocus: true %>
    <%= form.input :email %>
    <%= form.input :content, as: :text %>
    <%= form.button :submit, 'Submit', class: 'submit' %>
  <% end %>
</div>
```

The code is compact but complex. We see several elements:

- `content_for` is a view helper that passes a page title to the application layout
- `<div class="form">` sets the width of the form and applies any styles we desire
- `simple_form_for` is the view helper for the form

The `simple_form_for` view helper instantiates a form object which we assign to a variable named `form`. SimpleForm offers many standard form elements, such as text fields and submit buttons. Each element is available as a method call on the form object.

The view helper `simple_form_for` requires *parameters* and a *block*.

Every form needs a name and a route in the application that will handle processing of the form data. The parameters are:

- `contact` - the name of the form
- `url` - set to `contact_path`, the destination for the form data

Later, when we change this form to accommodate the “Rails way,” we’ll replace these two parameters with a single instance variable. The magic of Rails will generate the name of the form and the destination URL from the instance variable. For now, to implement the “old way,” we supply the name of the form and the destination URL.

The `simple_form_for` view helper accommodates a Ruby block. The block begins with `do` and closes with `end`. The code inside the block works just like code inside a method. In this case, the `form` object is passed to the block and methods belonging to the `form` object are called to produce HTML output.

Inside the block, the `form` object methods generate HTML for:

- a name field
- an email field
- a content field
- a submit button

Each of the form methods takes various parameters, such as:

- **autofocus** - displays the cursor in the field
- **as: :text** - displays a multiline text area
- **input_html** - adds any HTML such as a CSS class
- **class** - applies a CSS class to modify a button's appearance

The structure of the form is clearly visible in the code. The form begins with a **simple_form_for** helper and closes with the **end** keyword. Each line of code produces an element in the form such as a field or a button.

This is a common structure for a Rails view helper and it will soon become familiar.

Controller

We need code to process the form data. The form data is sent to the server as a POST request attached to a URL. As we've learned, in Rails we use controllers to respond to browser requests. For this implementation, we'll create a `ContactsController` to process the submitted form data.

Create a file **app/controllers/contacts_controller.rb**:

```
class ContactsController < ApplicationController

  def process_form
    Rails.logger.debug "DEBUG: params are #{params}"
    flash[:notice] = "Received request from #{params[:contact][:name]}"
    redirect_to root_path
  end
end
```

The ContactsController inherits the behavior of the base ApplicationController. We create a `process_form` method to respond when the form is submitted. Later we'll learn that `process_form` doesn't fit the "Rails way." We'll use it for now.

Before we look closely at the code for the `process_form` method, we need to learn about the `params` hash.

Params Hash

Take a close look at these two lines:

```
Rails.logger.debug "DEBUG: params are #{params}"
flash[:notice] = "Received request from #{params[:contact][:name]}"
```

Notice the `params` object.

Earlier we learned about the Ruby *Hash* class. It is a data structure for key/value pairs and Hash instances are ideal for storing form data. Each field on the form can be mapped as *label* and *data*, or key and value, and stored in a Hash.

Rails does all the work of extracting the form data from the browser's POST request. Rails creates a hash with the form field data mapped to the form field labels and gives the hash the name of the form. Here's the hash as pure Ruby code:

```
contact = {name: 'Daniel', email: 'daniel@danielkehoe.com', content: 'hi!'}
```

Rails goes a step further and nests the form hash inside another hash named **params**.

As pure Ruby code, the **params** hash looks like this:

```
params = {controller: 'contacts',  
          action: 'process_form',  
          contact: {name: 'Daniel', email: 'daniel@danielkehoe.com', content: 'hi!'}  
}
```

The **params** hash includes these elements (plus others we won't cover):

- current controller
- current action
- form data (our **contact** hash)

You will see the contents of the **params** hash in the console log after you submit the form. We'll look at the console log when we test the implementation.

Process_form Method

Now that we know about the **params** hash, take a look again at the **process_form** method:

```
def process_form  
  Rails.logger.debug "DEBUG: params are #{params}"  
  flash[:notice] = "Received request from #{params[:contact][:name]}"  
  redirect_to root_path  
end
```

We use a `logger.debug` method to reveal the form data in our console log by revealing the contents of the `params` hash.

Then we extract the data posted to the name field of the form and construct a flash message. A hash containing the data from the contact form is nested inside the `params` hash. We can retrieve the value of the name field with the expression `params[:contact][:name]`. We use double quotes and string interpolation to form the message using the `#{...}` syntax that evaluates a Ruby expression and combines it with a string.

Finally we use the `redirect_to` directive to render the home page.

We haven't actually sent the contact data to anyone. We'll add code for that later, after we refactor the controller to be a better example of the "Rails way." Before we do that, let's test the current implementation. We've already set up routing for the new controller.

Test the Application

If you need to start the server:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

Click the "Contact" link; then fill out and submit the form.

You should see the flash message "Received request from ..." on the home page. If you see the message "My birthday is soon" you need to delete your earlier experiment from the Visitors controller.

If you get an error message "uninitialized constant ContactsController," make sure you created the file `app/controllers/contacts_controller.rb` as instructed above.

Notice what appears in the console log:

```
Started POST "/contact" for ::1 at 2015-12-24 13:46:34 +0700
Processing by ContactsController#process_form as HTML
Parameters: {"utf8"=>"", "authenticity_token"=>"...",
"contact"=>{"name"=>"Daniel Kehoe", "email"=>"daniel@danielkehoe.com",
"content"=>"Looking forward to your birthday!"}, "commit"=>"Submit"}
DEBUG: params are {"utf8"=>"", "authenticity_token"=>"...",
"contact"=>{"name"=>"Daniel Kehoe", "email"=>"daniel@danielkehoe.com",
"content"=>"Looking forward to your birthday!"}, "commit"=>"Submit",
"controller"=>"contacts", "action"=>"process_form"}
Redirected to http://localhost:3000/
Completed 302 Found in 15ms (ActiveRecord: 0.0ms)
```

The console log is our most important tool for debugging. Let's analyze what we see:

- *Started POST* - shows the server is responding to an HTTP POST request
- *"/contact"* - the path portion of the URL
- *for 127.0.0.1* - the IP address for localhost
- *at ...* - timestamp
- *Processing by ContactsController* - the controller
- *process_form* - the controller action (the method that handles the request)
- *as HTML* - not XML or some other markup
- *Parameters:* - the **params** hash containing all the submitted data
- *"utf8"=""* - a Rails workaround to set the language encoding in Internet Explorer
- *"authenticity token"* - prevents CSRF security exploits
- *"contact"* - a hash containing the form data
- *"commit"* - the "Submit" label from the button

- *DEBUG* - our debug message containing the form data
- *Redirected to http://localhost:3000/* - responded by displaying the home page
- *Completed 302 Found* - HTTP response status code 302 indicating a redirection
- *in 0ms* - time required to process the request

That's a lot of data. For now, we really only care about the form data buried in the **params** hash.

You can see that we really don't need the debug message because the console log shows us the contents of the **params** hash.

The Validation Problem

It looks like we've got everything we need to handle a form submission. As a next step, we could implement code to send an email message using form data extracted from the **params** hash.

But consider a potential problem. What if the email address is poorly formed? The visitor will think the message has been sent but it will never be delivered.

Or what if the name field or message is blank? It's not just a problem for the hapless visitor. An evildoer could repeatedly click the submit button, filling Foobar Kadigan's email inbox with endless empty messages.

We need *validation* of the form data before we process it.

We could dig into the Rails **String** API and look for a way to test if the string is empty or contains only whitespaces. And we could raise an **Exception** if the string is blank.

Here's what validation code could look like. We won't use this code (because there's a better way to do this):


```
class ContactsController < ApplicationController

  def process_form
    if params[:contact][:name].blank?
      raise 'Name is blank!'
    end
    if params[:contact][:email].blank?
      raise 'Email is blank!'
    end
    if params[:contact][:content].blank?
      raise 'Message is blank!'
    end
    message = "Received request from #{params[:contact][:name]}"
    redirect_to root_path, :notice => message
  end
end
```

We would need additional code to test for invalid email addresses (it will be a complex *regex*, or *regular expression*). And we would need a nicer way of showing the error to the visitor (right now, raising the exception displays an error message that makes it appear the application is broken). If we were implementing this on another web application platform, we might go further down this path, googling for code examples, and implementing a lengthy but bulletproof validation function.

Rails offers a better way.

Remove the Contact Page

We will implement a model-view-controller architecture for our Contact feature. That means we need a Contact model, a Contacts controller, and view files in the **app/views/contacts/** folder.

We no longer need the Contact page in the **app/views/pages/** folder.

Let's get started by removing the file **app/views/pages/contact.html.erb**:

```
$ rm app/views/pages/contact.html.erb
```

Before we implement a model-view-controller architecture, let’s take time to understand the advantages of the Rails model-view-controller approach.

Implementing the “Rails Way”

Our initial implementation of the contact form is consistent with the earliest approach to web application development. That’s why I call it the “old way.” It is an approach that originated in 1993 with a specification for CGI, the [Common Gateway Interface](#). Before CGI, every page on the web existed only as a static HTML file. CGI made it possible to run a program, or CGI script, that dynamically generated HTML. In the early years of the web, every web URL matched either an HTML file or a CGI script. This is the “page paradigm” of the web.

So far, we’re following the “page paradigm.” Our Contact page hosts the form. Clicking the submit button makes a request to another page that is actually a program that returns HTML. Until the late 1990s, this is how the web worked. But soon after the introduction of CGI, developers began exploring the possibility of running a single program (an application server) that responds to any URL, parsing the URL to establish routing, and generating pages dynamically. This was the genesis of the “web application paradigm.” It’s how Rails works.

The web application paradigm frees us from one-to-one correspondence of a URL with a single file or script. It allows us to refactor our code into object-oriented classes and methods that can be inherited rather than duplicated, which means we don’t repeat the same code on every page that processes a form.

The web application paradigm makes it possible to use the model-view-controller architecture. Instead of looking at the web as URLs that return pages, we see requests that are routed to controllers that render views. We can segregate any code that manipulates data into a model class, instead of mixing HTML with

data manipulation in a single script. With the “web application paradigm,” we can have a generic model class that isolates the code that connects to a database or validates form data. We can create models that inherit the generic behavior from a parent class and get a database connection or validation “for free.” Unlike the “page paradigm,” we’ll avoid duplicating validation code every time we need to process a form.

Consider our `process_form` method again:

```
class ContactsController < ApplicationController

  def process_form
    if params[:contact][:name].blank?
      raise 'Name is blank!'
    end
    if params[:contact][:email].blank?
      raise 'Email is blank!'
    end
    if params[:contact][:content].blank?
      raise 'Message is blank!'
    end
    message = "Received request from #{params[:contact][:name]}"
    redirect_to root_path, :notice => message
  end

end
```

We’ll replace it with something better.

Our “segregation of concerns” philosophy suggests that validation belongs in a model, since validation is a type of data manipulation (strictly speaking, a test of data integrity). Furthermore, it would be nice to make the validation tests generic so they could be used to validate data submitted from any form.

Rails, as a framework, provides all this for us. We call it the “Rails way.”

ActiveModel

Rails extracts and generalizes common code that every website requires. The code that websites need for access to databases is abstracted into the Rails

[ActiveRecord](#) class. ActiveRecord includes code from the [ActiveModel](#) class that handles interaction with forms and data validation.

The ActiveModel class interfaces with SimpleForm to provide sophisticated validation and error handling. We can mix in behavior from the ActiveModel class to add validation and error handling to any model we create.

SimpleForm will recognize ActiveModel methods if we provide a model as an argument to the SimpleForm view helper. SimpleForm will give the form a name that matches the model name. And SimpleForm will automatically generate a destination URL for the form based on the model name.

More significantly, SimpleForm will add sophisticated error handling to the form. If a visitor doesn't enter a name or submits an invalid email address, and we declare in our model that we require validation, SimpleForm will highlight the invalid field and display an inline message indicating the problem. Compared to what we've implemented so far, this kind of error handling provides a vastly superior user experience. Instead of displaying a message that the application failed, the form will be redisplayed with the problem marked and noted.

Now that we've seen the advantages of the "Rails way," let's re-implement our contact form using the model-view-controller architecture.

Model

When we build database-backed applications with Rails, we base our models on a parent class named ActiveRecord. We are not using a database for our tutorial application, so we'll mix in behavior from ActiveModel, which adds validation and error handling to our model. Let's set up a model that doesn't require a database.

Create a file **app/models/contact.rb**:

```
class Contact
  include ActiveModel::Model
  attr_accessor :name, :string
```

```
attr_accessor :email, :string
attr_accessor :content, :string

validates_presence_of :name
validates_presence_of :email
validates_presence_of :content
validates_format_of :email,
  with: /\A[-a-z0-9_+\.\@]([-a-z0-9]+\.)+[a-z0-9]{2,4}\z/i
validates_length_of :content, :maximum => 500

end
```

When you copy this, be careful to keep the long regex expression (**with: /.../i**) on one line (no line breaks).

We give the model the name “Contact.”

We mix in behavior from the `ActiveModel` class using **`include ActiveModel::Model`**.

We create attributes (data fields) for the model by using the **`attr_accessor`** keyword, specifying that each attribute is a string. The attributes match the fields in the contact form.

`ActiveModel` gives us validation methods named **`validates_presence_of`**, **`validates_format_of`**, and **`validates_length_of`**. We check that **`name`**, **`email`**, and **`content`** exist (no blanks are allowed). We provide a complex *regex*, or *regular expression*, to test if the email address is valid. Finally, we declare that the message content cannot exceed 500 characters.

The model is elegant. We describe the fields we need and state our validation requirements. `ActiveModel` does all the rest.

Next we’ll add a new Contact page by creating a view in the **`app/views/contacts/`** folder.

The new contact form will use our new model.

Create a New Contact Page

First, let's create the **app/views/contacts/** folder:

```
$ mkdir app/views/contacts/
```

Create a file **app/views/contacts/new.html.erb**:

```
<% content_for :title do %>Contact<% end %>
<h3>Contact</h3>
<div class="form">
  <%= simple_form_for @contact do |form| %>
    <%= form.error_notification %>
    <%= form.input :name, autofocus: true %>
    <%= form.input :email %>
    <%= form.input :content, as: :text %>
    <%= form.button :submit, 'Submit', class: 'submit' %>
  <% end %>
</div>
```

The form is the same as we used before, but we're now providing only one argument, the **@contact** instance variable, to the SimpleForm view helper. That's enough to generate the form name and destination URL.

We haven't yet created a controller that assigns the Contact model to the **@contact** instance variable. We'll do that soon.

Earlier, I explained that SimpleForm configures itself if we provide a model that inherits from ActiveRecord. SimpleForm gives the form a name that matches the model name. And SimpleForm generates a destination URL based on the model name.

SimpleForm uses the **@contact** instance variable to name the form, set a destination for the form data, and initialize each field in the form using attributes from the Contact model. Setting the values for the form fields from the attributes in the model is called "binding the form to the object" and you can read about it in the [RailsGuides: Form Helpers](#) article.

We've added the `error_notification` method which provides all the error handling. The method call is very simple but the results will be impressive.

We'll need a controller and routing to complete our model-view-controller architecture. But first, we'll detour to learn about seven standard controller actions.

Seven Controller Actions

Consider all the possibilities for managing a list. It's a list of anything: users, inventory, thingamajigs. We use a web application to manage the list, so we'll fill out a form to record each item in our list.

The web application offers seven features to help us manage our records:

- *index* - display a list of all items
- *show* - display a record of one item
- *new* - display an empty form
- *create* - save a record of a new item
- *edit* - display a record for editing
- *update* - save an edited record
- *destroy* - delete a record

You can manage any list using these seven actions. There are a few extra actions that are helpful, such as:

- *pagination* - displaying a portion of a list
- *sorting* - displaying the list in a different order

- *bulk edit* - changing multiple items at once

But seven basic actions are all you need for managing any list of items.

The “Rails way” is about taking advantage of structure and convention to leverage the power of the framework.

The ApplicationController contains code to implement each of the seven standard actions. When we create a controller that inherits from the ApplicationController, we get these standard actions “for free.” That’s why our **new** method in our VisitorsController was so simple. The controller knew to render a view file named **new.html.erb** from the **views/visitors/** folder because of behavior inherited from the ApplicationController.

Just like the Rails directory structure provides consistency to make it easy for any Rails developer to collaborate with other Rails developers, relying on the seven standard controller actions makes it easy for other team members to understand how your controllers work.

A controller that uses these actions is said to be “RESTful” (a term that refers to **representational state transfer**, a software design abstraction). Experienced Rails developers follow the “Rails way” and try to use RESTful controller methods when possible.

When necessary, you will add other controller actions. For example, imagine you’ve built a subscription website. When a user’s subscription ends, you may not want to **destroy** the subscriber record. Instead you might add a controller **expire** or **suspend** action that marks the subscriber record as expired so you can continue to access the subscriber’s contact information for customer service or renewal offers. To the extent you can, use the seven standard controller actions and be cautious about adding more.

Earlier, I said our ContactsController **process_form** method isn’t suitable for the “Rails way.” With our model-view-controller architecture, we can piggyback on the ApplicationController to display our empty contact form and process the form when it is submitted.

We’ll use only two of the seven standard controller actions:

- *new* - display the empty contact form
- *create* - validate and process the submitted form

Our ContactsController will know to render a view from the **app/views/contacts/new.html.e** file when we call the controller **new** method.

We won't piggyback on behavior from the ApplicationController **create** method. But we'll implement a **create** method because, by convention, the form will submit the data to the controller's **create** method. SimpleForm will create a destination URL that corresponds to the ContactsController#create action.

Controller

Replace the contents of the file **app/controllers/contacts_controller.rb**:

```
class ContactsController < ApplicationController

  def new
    @contact = Contact.new
  end

  def create
    @contact = Contact.new(params)
    if @contact.valid?
      # TODO send message
      flash[:notice] = "Message sent from #{@contact.name}."
      redirect_to root_path
    else
      render :new
    end
  end

  private

  def params
    params.require(:contact).permit(:name, :email, :content)
  end

end
```

We’ve dropped the “old school” `process_form` method and added the “Rails way” `new` and `create` methods.

The controller `new` action will instantiate an empty Contact model, assign it to the `@contact` instance variable, and render the `app/views/contacts/new.html.erb` view. We’ve already created the view file containing the form.

SimpleForm will set a destination URL that corresponds to the `ContactsController#create` action. The `create` method will instantiate a new Contact model using the data from the form (we take steps to avoid security vulnerabilities first—more on that later).

The ActiveRecord class provides a method `valid?` which we can call on the Contact model. Our conditional statement `if @contact.valid?` checks each of the validation requirements we’ve set in the model.

If all the Contact fields are valid, we can send a message (not yet implemented), prepare a flash message, and redirect to the home page. Notice that we don’t need to dig into the `params` hash for the visitor’s name; it is now available as `@contact.name` directly from the model.

If any validation fails, the controller `create` action will render the `app/views/contacts/new` view. This time, appropriate error messages are set and the form object’s `error_notification` method will highlight the invalid field and display a matching prompt.

You’re looking at the tightly bound interaction of the “Rails way” model, view, and controller.

The only element we are missing is routing. But first, let’s look closer at the steps we take to avoid security exploits.

Mass-Assignment Vulnerabilities

Rails protects us from a class of security exploits called “mass-assignment vulnerabilities.” Rails won’t let us initialize a model with just any parameters submitted on a form. Suppose we were creating a new user and one of the user

attributes was a flag allowing administrator access. A malicious hacker could create a fake form that provides a user name and sets the administrator status to “true.” Rails forces us to “white list” each of the parameters used to initialize the model.

We create a method named `secure_params` to screen the parameters sent from the browser. The `params` hash contains two useful methods we use for our screening:

- `require(:contact)` - makes sure that `params[:contact]` is present
- `permit(:name, :email, :content)` - our “white list”

With this code, we make sure that `params[:contact]` only contains `:name`, `:email`, `:content`. If other parameters are present, they are stripped out. Rails will raise an error if a controller attempts to pass params to a model method without explicitly permitting attributes via `permit`.

In older versions of Rails (before Rails 4.0), the mass-assignment exploit was blocked by using a “white list” of acceptable parameters with the `attr_accessible` keyword in a model. You’ll see this code in examples and tutorials that were written before Rails 4.0 introduced “strong parameters” in the controller.

Private Methods

If you paid close attention to the code you added to the Contacts controller, you may have noticed the keyword `private` above the `secure_params` method definition. This is a bit of software architecture that limits access to the `secure_params` method (plus any more methods we might add beneath it).

Very simply, adding the `private` keyword restricts access to the `secure_params` method so only methods in the same class can use it. You might be puzzled; after all, how else could it be accessed? We haven’t explored calling methods from other classes, so I’ll just say that without the `private` keyword, the

`secure_params` method could be used from code anywhere in our application. In this case, we apply the `private` keyword because we want to be sure the `secure_params` method is only used in the `ContactsController` class. It's just a bit of "best practice" and for now, you can simply learn that `secure_params` method should be a private method.

Now let's look at routing for controllers that are built the "Rails way."

Routing

Rails routing is aware of the seven standard controller actions.

In fact, it takes only one keyword (with one parameter) to generate seven different routes for any controller.

The keyword is `resources` and supplying a name that matches a model and controller provides all seven routes.

Open the file `config/routes.rb`. Replace the contents with this:

```
Rails.application.routes.draw do
  resources :contacts, only: [:new, :create]
  root to: 'visitors#new'
end
```

Here we've added `resources :contacts, only: [:new, :create]`.

We only want two routes so we've added the restriction `only: [:new, :create]`.

The `new` route has these properties:

- `new_contact_path` - route helper
- `contacts` - name of the controller (`ContactsController`)
- `new` - controller action

- <http://localhost:3000/contacts/new> - URL generated by the route helper
- **GET** - HTTP method to display a page

The **create** route has these properties:

- **contacts_path** - route helper
- **contacts** - name of the controller (ContactsController)
- **create** - controller action
- <http://localhost:3000/contacts> - URL generated by the route helper
- **POST** - HTTP method to submit form data

You can run the **rake routes** command to see these in the console:

```
$ rake routes
      Prefix Verb URI Pattern               Controller#Action
  contacts POST /contacts(.:format)   contacts#create
new_contact GET  /contacts/new(.:format) contacts#new
      root GET  /                     visitors#new
      page GET  /pages/*id           high_voltage/pages#show
```

The output of the **rake routes** command shows we've created the routes we need.

Our new route **new_contact_path** can now be used. We've completed our move to the model-view-controller architecture by adding the appropriate routes.

Change Navigation Links

With our new model-view-controller architecture, we need to change the navigation links.

Change the file **app/views/layouts/_navigation_links.html.erb**:

```
<%# add navigation links to this file %>
<li><%= link_to 'About', page_path('about') %></li>
<li><%= link_to 'Contact', new_contact_path %></li>
```

We’re ready to test the model-view-controller implementation of the Contact feature.

Be sure you’ve removed the file **app/views/pages/contact.html.erb**, as it is no longer used.

Test the Application

If you need to restart the server:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

Click the “Contact” link; then fill out and submit the form.

You should see the flash message “Message sent from ...” on the home page.

Try submitting the form with a blank name. You’ll see a warning message, “Please review the problems below.”

Try submitting the form with an invalid email address such as “me@foo”. The form will re-display with a message, “Please review the problems below,” and next to the email field, “is invalid.”

Combining SimpleForm error handling with ActiveRecord validation is powerful. If validation fails after the form is submitted, the page will redisplay and SimpleForm will display an appropriate error message.

Git

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "contact form"  
$ git push
```

We've built a sophisticated Contact form.

Chapter 19

Send Mail

Email sent from a web application is called [transactional email](#). As a website visitor, you've probably seen transactional email such as these messages:

- sign up confirmation email
- response to a password reset request
- acknowledgment of a purchase
- notice of a change to a user profile setting

A web application can send email to a visitor. It can also send messages to its owner or webmaster. On large active sites, email notices can be impractical (an admin interface is better) but for our small-volume tutorial application, it makes sense to email the contact request directly to the site owner (Foobar Kadigan is retired and enjoys receiving email).

User Story

Let's plan our work with a user story:


```
*Send Contact Message*  
As the owner of the website  
I want to receive email messages with a visitor's name, email address, and some text  
In order to communicate with visitors
```

To implement the user story, let's create a feature that sends the contact data as an email message.

Implementation

Rails makes it easy to send email. The [ActionMailer](#) gem is part of any Rails installation.

Implementation of email closely follows the model-view-controller architecture. To implement email, you'll need:

- model
- view
- mailer

The “mailer” is similar to a controller, combining data attributes from a model with a view file. Any methods we add to the mailer class can be called from a controller, triggering delivery of an email message.

The model can be any we've already created. In this case, we'll use the Contact model, since it gives us access to the visitor's name, email address, and message.

We'll create a mail-specific view file in the **app/views/user_mailer/** folder. Our folder for mail-specific views will go in the **app/views/** directory as a sibling of the **app/views/layouts** folder.

The Rails directory structure already gives us a folder **app/mailers/** for the mailer class and, not surprisingly, it is a sibling of the **app/controllers/** folder.

We don't have to create the necessary folders and files manually, as the **rails generate** command runs a utility to create what we need.

Create View Folder and Mailer

Use the **rails generate** command to create a mailer with a folder for views:

```
$ rails generate mailer UserMailer
```

The name of the mailer isn't important; we'll use **UserMailer** because it is obvious.

The **rails generate** command will create several files:

- **app/mailers/application_mailer.rb**
- **app/mailers/user_mailer.rb**
- **app/views/layouts/mailer.html.erb**
- **app/views/layouts/mailer.text.erb**

It also creates test files which we won't use in this tutorial.

This implements our model-view-mailer architecture.

Edit the Mailer

Add a **contact_email** method to the mailer by editing the file **app/mailers/user_mailer.r**

```
class UserMailer < ApplicationMailer
  default from: "do-not-reply@example.com"

  def contact_email(contact)
    @contact = contact
    mail(to: Rails.application.secrets.owner_email, from: @contact.email, :subject => "Website"
  end
end
```

The **UserMailer** class inherits behavior from the **ApplicationMailer** class. We'll create a method definition that assigns the **contact** argument to the instance variable **@contact**. Like a controller that combines a model with a view, our mailer class makes the instance variable available in the view.

The name of the method isn't important; it can be anything obvious. We'll use it in the **ContactsController** to trigger mail delivery.

Like the **render** method in a web page controller, the **ActionMailer** parent class has a **mail** method that renders the view.

You'll need to use your email address in the mailer. You should have already set a configuration variable for your email address in the file **config/secrets.yml**. If you haven't done so, do it now. By inserting the configuration variable with your email address after **to:**, your inbox will receive the message. If Foobar Kadigan was a real person, we'd supply his email address here.

We need to insert a "from" address in two places. First there is a default, for all messages that do not set a "from" address. We will use "do-not-reply@example.com" for the default "from" address. The email is originating from a web application that does not receive email, so this indicates the email address should not be used for replies. For emails going to website visitors, it would be best to provide a default email address for a customer service representative on the "from" line, so the recipient can easily reply. We're not sending email messages to visitors so we can ignore this nicety.

For our **contact_email** method, we'll insert the email address of the visitor as the "from" address since we are sending a message to the site owner. This makes it easy for Foobar Kadigan to click "reply" when he is reading the con-

tact messages in his inbox. You can see our use of the email attribute from the Contact model in the expression **from: @contact.email**.

That's all we need for mailer class. Next we'll create a view containing the message.

Create Mailer View

There are two types of mailer views. One contains plain text, for recipients who don't like formatted email (some people still read email from the Unix command line). The other type contains HTML markup to provide formatting. It's good to create a message of both types, though most recipients will benefit from HTML formatting.

The mailer view for formatted email looks very similar to a web page view file. It contains HTML markup plus Ruby expressions embedded in **<%= ... %>** delimiters. In the **UserMailer** class, we've assigned the Contact model to the instance variable **@contact** so any attributes are available for use in the message.

Create a file **app/views/user_mailer/contact_email.html.erb**:

```
<!DOCTYPE html>
<html>
  <head>
    <meta content="text/html; charset=UTF-8" http-equiv="Content-Type" />
  </head>
  <body>
    <h1>Website Contact</h1>
    <p>
      This visitor requested contact:
    </p>
    <p>
      <%= @contact.name %><br/>
      <%= @contact.email %><br/>
    </p>
    <p>
      The visitor said:
    </p>
    <p>
```

```
"<%= @contact.content %>"  
</p>  
</body>  
</html>
```

You can easily imagine how this view would look as a web page. You'll soon see it as an email message in your inbox.

For those recipients who like plain text, create a view without HTML markup.

Create a file **app/views/user_mailer/contact_email.text.erb**:

```
You received a message from <%= @contact.name %> with email address <%= @contact.email %>.  
  
The visitor said:  
  
<%= @contact.content %>
```

You've created views for the email message.

Now we can integrate our email feature with the `ContactsController`.

Modify Controller

We'll add code to the `ContactsController`:

```
UserMailer.contact_email(@contact).deliver_now
```

Replace the contents of the file **app/controllers/contacts_controller.rb**:

```
class ContactsController < ApplicationController  
  
  def new  
    @contact = Contact.new  
  end  
  
end
```

```
def create
  @contact = Contact.new(secure_params)
  if @contact.valid?
    UserMailer.contact_email(@contact).deliver_now
    flash[:notice] = "Message sent from #{@contact.name}."
    redirect_to root_path
  else
    render :new
  end
end

private

def secure_params
  params.require(:contact).permit(:name, :email, :content)
end

end
```

The `UserMailer` class is available to any controller in the application. We call the `contact_email` method we've created, passing the `@contact` instance variable as an argument, which renders the email message. Finally, the `deliver_now` method initiates delivery.

For more on sending email from a Rails application, see [RailsGuides: Action Mailer Basics](#).

Test the Application

If your web server is not running, start it:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

Click the “Contact” link and try submitting the form.

The email message should be visible in the console.

If you didn't get an email message in your inbox, make sure you set your **config/environments/development.rb** file to perform deliveries as described in the "Configuration" chapter. Be sure to restart your server if you change the configuration file.

Troubleshooting

If you get an error, you can practice troubleshooting. You've set up a complex system with many dependencies. It's great if it works, but there are several opportunities for errors.

The most likely errors are a missing user name or password. We are trying to connect to the Mandrill email service. Mandrill expects your Mandrill user name. Mine is **DanielKehoe** (it is not my email address). Mandrill expects an API key instead of a password. Refer to the chapter "Configure" for details about obtaining your Mandrill API key.

User Name Issues

If you get the error message, "SMTP-AUTH requested but missing user name," Mandrill is not receiving a user name it recognizes.

Check that the user name is set in your Unix environment variables:

```
$ echo "$MANDRILL_USERNAME"
```

You should see your Mandrill user name.

Make sure you've used underscores consistently. If your Unix environment variable is **MANDRILL_USER_NAME** and the **config/secrets.yml** file contains **MANDRILL_USERNAME**, you'll have a problem.

API Key Issues

If you get the error message, “SMTP-AUTH requested but missing secret phrase,” Mandrill is not receiving the Mandrill API key.

Check that the Mandrill API key is set in your Unix environment variables:

```
$ echo "$MANDRILL_API_KEY"
```

You should see the long cryptic string in the console response. Again, make sure you’ve used underscores consistently, and **MANDRILL_API_KEY** is used for the Unix environment variable as well as the **config/secrets.yml** file.

Problems with Environment Variables

If you’ve set up Unix environment variables but **echo "\$MANDRILL_USERNAME"** doesn’t return the correct variable in the console, you may have a problem with the way you’ve set Unix environment variables. Most computers use the bash shell and you can set environment variables in your **.bashrc** or **.bash_profile** files. But not every system is alike. If it seems Unix environment variables are not working, you may have to find a colleague who can help you troubleshoot. In the meantime, you can hardcode the variables in your **config/secrets.yml** file:

Replace the following:

```
development:
  mandrill_username: <%= ENV["MANDRILL_USERNAME"] %>
  mandrill_api_key: <%= ENV["MANDRILL_API_KEY"] %>
```

with:


```
development:
  mandrill_username: "YourUserName"
  mandrill_api_key: "your-very-long-API-string-from Mandrill"
```

Remember the security rule: Don't commit the **config/secrets.yml** file to Git if it contains any secrets. Test the application and finish your troubleshooting. Then remove the hardcoded values from the **config/secrets.yml** file before committing to Git.

Asynchronous Mailing

You may notice a delay in the responsiveness of the Contact form after adding the email feature. Unfortunately, there's a performance penalty with our new feature. Our controller code connects to the Mandrill server and waits for a response before it renders the home page and displays the acknowledgment message.

The performance penalty can be avoided by changing the implementation so that the controller doesn't wait for a response from the Mandrill server. We call this *asynchronous* behavior because sending email does not need to be "in sync" with displaying the acknowledgment. Eliminating a delay improves the user experience and makes the site feel more responsive. Asynchronous mailing requires a *queueing system* for *background jobs*.

For our tutorial application, and for a typical small business website, the delay caused by lack of queueing is no big deal. Keep in mind, though, as you tackle bigger projects in Rails, you will need to implement a queueing system. Rails includes the [Active Job](#) feature for background processing. The [Mailing List with Active Job](#) tutorial in the [Capstone Rails Tutorials](#) series explains how to use it.

Git

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "sending mail"  
$ git push
```

You've created a Rails application that handles a form and sends email to the site owner.

Mail is a practical way to connect with site visitors. Let's implement a feature that collects email addresses for mass mailing of a newsletter.

Chapter 20

Mailing List

Even as other messaging avenues become increasingly popular, such as messaging apps or Facebook messages, email remains the most practical way to stay in touch with website visitors. Encouraging a visitor to provide an email address means offering an invitation to a dialog and a relationship beyond a single visit.

If you have a legitimate reason to stay in touch, and you've motivated the visitor to leave an email address, you'll need a mailing list service. You've seen how Rails can send an email message. From what you've seen so far, you can imagine it would not take much code to loop through a list of email addresses from a database, sending a message to each. In the early days of the web, it was easy for any system administrator to write a script for mass mailings. Since there is negligible cost to sending bulk email, unscrupulous and ignorant operators sent email to any address they could scrape, borrow, or steal. The resulting flood of spam made checking one's inbox an icky experience and destroyed much of the early culture of the Internet. Fortunately, services such as Gmail arose to filter email. There is now a thick (but leaky) layer of screening protocols that redirect spam to a junk folder. One reason you won't use a Rails application to send bulk email is that a web application server is not the most efficient tool for sending email. More significantly, there's a good chance your email won't go through or, if it does (and someone complains), you'll quickly see your IP

address blacklisted. That’s why we use mailing list services to send bulk email such as newsletters or promotional offers.

Considerable expertise is required to keep email from being filtered as spam (see MailChimp’s article [Email Delivery For IT Professionals](#). Email service providers increase reliability of delivery. These services track deliveries and show how well your email is being delivered. You’ll also get features such as management of “unsubscribe” requests and templates to design attractive messages.

There are at least a dozen well-established email service providers that allow a Rails application to programmatically connect to the service (via an API) to add or remove email addresses. For a list, see the article [Send Email with Rails](#). For this tutorial application, we’ll use [MailChimp](#) because there is no cost to open an account and you can send up to 12,000 emails/month to list of 2000 or fewer subscribers for free.

Spam is unsolicited email. Don’t ever send spam, whether for yourself, a client, or an employer. If recipients complain, your IP address and domain name will be blacklisted. So be very careful to only send to subscribers who signed up, send what subscribers expect, and be sure to offer value. If you get complaints, or the unsubscribe rate is high, stop.

We’ll assume we’ve discussed the rules with Foobar Kadigan and he is eager to offer a newsletter to his visitors that will be genuinely appreciated.

User Story

Let’s plan our work with a user story:

```
*Subscribe to Mailing List*
As a visitor to the website
I want to sign up for a mailing list
In order to receive news and announcements
```

To implement the user story, we'll add a mailing list feature.

Implementation

We'll use the Rails model-view-controller architecture. We'll need:

- Visitors model
- view for `visitors#new`
- Visitors controller with `new` and `create` methods
- routing for `visitors#new` and `visitors#create`

We'll add a Visitor model that has a data attribute for an email address. We already have a Visitors controller that renders the home page using the file in the `app/views/visitors/` folder. We'll replace the contents of the view file with a nice photo, a marketing message, and a form.

Our Visitors controller `new` and `create` methods will be very similar to what we created for the Contacts controller. Instead of connecting to Mandrill to send a message, we'll call a method to save the visitor's email address to a MailChimp mailing list.

Gibbon Gem

The [Gibbon gem](#) is a convenient wrapper for the [MailChimp API](#). We could connect to the MailChimp API using other gems that provide low-level plumbing such as HTTP connections ([httparty](#)) and data parsing ([multi_json](#)), but other developers have already done the work of wrapping the plumbing in a higher-level abstraction that easily fits into a Rails application. Amro Mousa's [Gibbon gem](#) is popular and actively maintained.

In your **Gemfile**, you’ve already added:

```
gem 'gibbon'
```

and previously run `$ bundle install`.

Home Page

Earlier we built a home page that provided a simple demonstration of the Ruby language. We’ll discard it and replace it with a page that you could adapt for a typical small-business website.

We want a nice photo, space for a marketing message, and the “sign up” form.

Replace the contents of the file **app/views/visitors/new.html.erb**:

```
<% content_for :title do %>Foobar Kadigan<% end %>
<% content_for :description do %>Website of Foobar Kadigan<% end %>
<section>
  
</section>
<section>
  <div class="column">
    <h3>Stay in touch.</h3>
  </div>
  <div class="column">
    <div class="form-centered">
      <%= simple_form_for @visitor do |f| %>
        <%= f.error_notification %>
        <%= f.input :email, label: false, :placeholder => 'Your email address...' %>
        <br/>
        <%= f.button :submit, "Sign up for the newsletter", :class => "submit" %>
      <% end %>
    </div>
  </div>
</section>
```

We include `content_for` view helpers that pass a title and description to the application layout.

We add a photo to the page with an `` tag. We're taking a shortcut and using a placeholder photo from the lorempixel.com service.

The `section` and `<div class="column">` tags apply a grid from Zurb Foundation to create a row with two columns, one for our marketing message, and one for the form.

Our marketing message is merely a placeholder. For a real website, you'd likely craft a stronger call to action than merely "Stay in touch."

The form is very similar to the form on the Contact page, except we initialize it with the `@visitor` instance variable and only need a field for an email address. We suppress display of the email field label with the flag `label: false` and use the `:placeholder` parameter to create a hint in the empty input field.

A submit element will contain the text, "Sign up for the newsletter," and we apply a CSS class to style the element as a button.

Photo Options

You're free to modify this page as you wish, as long as you keep the form intact.

You might wish to modify the placeholder photo. If you don't like cats, try <http://lorempixel.com/1170/600/nightlife/1> or any other categories from the lorempixel.com service. You can change the size by modifying the dimensions from 1170 (pixel width) by 600 (pixel height).

You can replace the placeholder photo with your own. Look for the `app/assets/images` folder and add an image. Instead of the HTML `` tag, use the Rails `image_tag` view helper, like this:

```
<%= image_tag "myphoto.jpg" %>
```

We'll need a Visitor model to initialize the form.

Visitor Model

The Visitor model is almost identical to the Contact model we created earlier, except there is just one data attribute for the email field.

We'll also add a **subscribe** method to add a visitor to a MailChimp list. We'll call this method from the controller when we process the submitted form.

Create a file **app/models/visitor.rb**:

```
class Visitor
  include ActiveRecord::Model
  attr_accessor :email, :string
  validates_presence_of :email
  validates_format_of :email, with: /\A[-a-z0-9_+\.\]@([[-a-z0-9]+\.)+[a-z0-9]{2,4}\z/i

  def subscribe
    mailchimp = Gibbon::Request.new(api_key: Rails.application.secrets.mailchimp_api_key)
    list_id = Rails.application.secrets.mailchimp_list_id
    result = mailchimp.lists(list_id).members.create(
      body: {
        email_address: self.email,
        status: 'subscribed'
      })
    Rails.logger.info("Subscribed #{self.email} to MailChimp") if result
  end
end
```

When you copy this, be careful to keep the long regex expression **with: /.../i** on one line (no line breaks).

Just as we did for the Contact model, we use **include ActiveRecord::Model** to mix in behavior from the ActiveRecord class. This is the best way to create a model that does not use a database. In other applications, where models use a database, you will create a model class that inherits from ActiveRecord instead.

We create the email attribute using the **attr_accessor** keyword, specifying the email attribute will be a **string**. We set validation requirements using **validates_presence_of** and **validates_format_of** keywords.

To subscribe a visitor to a mailing list, you need to provide:

- `list_id` - identify the MailChimp list
- `email_address` - address of the visitor
- `status` - subscribed, pending, or unsubscribed

We specify “subscribed” to immediately add the address without asking the user for confirmation. We could specify “Pending” if we wanted to add the address with double-opt-in so the visitor receives a request to confirm the email address before they are subscribed.

Our `subscribe` method does the work of connecting to the MailChimp server to add the visitor to the mailing list. We instantiate the `Gibbon` object which provides all the connectivity, providing the `mailchimp_api_key` value, which we’ve set in the `config/secrets.yml` file. We assign the `Gibbon` object to the `mailchimp` variable (we could name it anything).

We set the `list_id` from a configuration variable in the `config/secrets.yml` file.

The visitor’s `email_address` is an attribute of the model we obtain from `self`.

We must set the `status` property to `'subscribed'` to indicate the visitor should receive mailings.

Finally, if the application successfully adds the new subscriber, we write a message to the logger. If we get an error when trying to add the subscriber, `Gibbon` will raise an exception.

Visitors Controller

We already have a `Visitors` controller that contains a simple `new` method. We’ll change the `new` method, add a `create` method, and provide a `secure_params` private method to secure the controller from mass assignment exploits.

Replace the contents of the file **app/controllers/visitors_controller.rb**:

```
class VisitorsController < ApplicationController

  def new
    @visitor = Visitor.new
  end

  def create
    @visitor = Visitor.new(secure_params)
    if @visitor.valid?
      @visitor.subscribe
      flash[:notice] = "Signed up #{@visitor.email}."
      redirect_to root_path
    else
      render :new
    end
  end

  private

  def secure_params
    params.require(:visitor).permit(:email)
  end

end
```

Our **new** method now assigns the Visitor model to an instance variable instead of the Owner model.

The **create** method is almost identical to the Contacts controller **create** method. We instantiate the Visitor model with scrubbed parameters from the submitted form.

If the validation check succeeds, we subscribe the visitor to the MailChimp mailing list with the **@visitor.subscribe** method. All the work of connecting to MailChimp happens in the Visitor model.

If the validation check fails, we redisplay the home page (the **new** action).

Clean Up

We no longer use the Owner model, so we can delete the file **app/models/owner.rb**:

```
$ rm app/models/owner.rb
```

There's no harm if it remains but it is good practice to remove code that is no longer used.

Routing

Our routing is now more complex. In addition to rendering the `visitors#new` view as the application root (the home page), we need to handle the **create** action. We can use a “resourceful route” as we did with the Contacts controller.

Open the file **config/routes.rb**. Replace the contents with this:

```
Rails.application.routes.draw do
  resources :contacts, only: [:new, :create]
  resources :visitors, only: [:new, :create]
  root to: 'visitors#new'
end
```

The root path remains **visitors#new**. Order is significant in the **config/routes.rb** file. As the final designated route, the root path will only be active if nothing above it matches the route.

We've added **resources :visitors, only: [:new, :create]**.

We only want two routes so we've added the restriction **only: [:new, :create]**.

The **new** route has these properties:

- **new_visitor_path** - route helper

- **visitors** - name of the controller (VisitorsController)
- **new** - controller action
- <http://localhost:3000/visitors/new> - URL generated by the route helper
- **GET** - HTTP method to display a page

The **create** route has these properties:

- **visitors_path** - route helper
- **visitors** - name of the controller (VisitorsController)
- **create** - controller action
- <http://localhost:3000/visitors> - URL generated by the route helper
- **POST** - HTTP method to submit form data

You can run the **rake routes** command to see these in the console:

```
$ rake routes
  Prefix Verb URI Pattern                  Controller#Action
  contacts POST /contacts(.:format)      contacts#create
  new_contact GET /contacts/new(.:format)    contacts#new
  visitors POST /visitors(.:format)        visitors#create
  new_visitor GET /visitors/new(.:format)    visitors#new
  root GET /                          visitors#new
  page GET /pages/*id           high_voltage/pages#show
```

The output of the **rake routes** command shows we've created the routes we need.

Test the Application

If you need to start the server:

```
$ rails server
```

Open a web browser window and navigate to <http://localhost:3000/>.

You'll see our new home page with the placeholder photo and the "sign up" form.

Enter your email address and click the "sign up" button. You should see the page redisplay with an acknowledgment message. Try entering an invalid email address such as "me@foo@", or click the submit button without entering an email address, and you should see an error message.

You'll have to [log in to MailChimp](#) and check your list of subscribers to see if the new email address was added successfully.

With MailChimp, you can send a welcome message automatically when the visitor signs up for the mailing list. Use the welcome message to inform the visitor that they've successfully subscribed to the mailing list and will receive the next newsletter email.

It's a bit difficult to find the MailChimp option to create a welcome message. Strangely, MailChimp considers a welcome message a "form." Here's how to find it. On the MailChimp "Lists" page, click the "down arrow" for a list and click "Signup forms." Then click "General forms." On the "Create Forms" page, there is a drop-down list of "Forms & Response Emails." The gray box shows "Signup form." Click the down arrow. Select the menu item named "Final 'Welcome' Email" and you'll be able to create a welcome message.

Git

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "mailing list"  
$ git push
```

Our tutorial application is feature complete.

Let's deploy it so we can see it running as a real website.

Chapter 21

Deploy

You've been running the default Ruby WEBrick server on your local machine. If you wanted, you could leave your computer running, set up a [managed DNS service](#), and your web application would be accessible to anyone. But even if you wanted to leave your computer running 24 hours a day, you're probably not a security expert, WEBrick isn't tuned to handle much traffic, and your computer is distant from the interconnection hubs where most websites are hosted. For these reasons, when we move a web application from development to production, we deploy it to a [web hosting service](#) that provides a hosting platform on a server located in a strategically-located [data center](#).

Data centers offer [colocation services](#), renting rack-mounted computers with fast Internet connections that can be configured as web servers. In the early days of the web, deploying a web application required [system administration](#) skills to configure and maintain a web server. Today, some developers like to set up their web servers "from bare metal" using [virtual private servers](#) from Linode, Slicehost, Rackspace, Amazon EC2, or others. With sufficient skills and study, they say there is a feeling of satisfaction from doing it yourself. But not everyone wants to be a system administrator. Most Rails developers simply use a hosted [platform as a service](#) (PaaS) provider such as [Heroku](#), [Engine Yard](#), [OpenShift](#), [Cloud Foundry](#), or [Shelly Cloud](#).

You may already be using a [shared web hosting](#) service such as GoDaddy or

DreamHost for a static website or WordPress site. Be skeptical if a shared web hosting service claims to support Rails applications; most do so badly. Shared hosting services offer file space for static websites on servers that are shared by thousands of websites. A Rails application requires considerably greater computing resources and specialized expertise. A PaaS platform provides a hardware and software stack optimized for application performance and developer convenience.

[Heroku](#) is the best known and most popular PaaS provider and we'll use it to deploy the tutorial application. Using Heroku or another PaaS provider means you don't need skills as a system administrator to manage your web server. Instead, you'll have experts maintaining the production environment, tuning system performance, and keeping the servers running.

Heroku Costs

It costs nothing to set up a Heroku account and deploy as many applications as you want. You'll pay only if you upgrade your hosting to accommodate a busy website.

Heroku pricing is based on a measure of computing resources the company calls a “dyno.” Think of a dyno as a virtual server (though it is not). Heroku provides one dyno for every web application for free. For personal projects, you can run your Rails application on a single dyno and never incur a charge.

A single dyno idles after one hour of inactivity, “going to sleep” until it receives a new web request. For a personal project, this means your web application will respond with a few seconds delay if it hasn't received a web request in over an hour. After it wakes up, it will respond quickly to every browser request.

If you want your web application to respond to every request without delay, you can run two dynos. Heroku charges \$35 per month for a second dyno running full time (a dyno is billed at \$0.05/hour).

A single dyno can serve thousands of requests per second, but performance

depends greatly on your application. With the Ruby WEBrick server, Rails processes only one request at a time. Heroku doesn't support WEBrick, but as a default it supports [Thin](#), a similar “single-threaded, non-concurrent” web server. Serving a typical Rails application that takes 100ms on average to process each request, Thin can accommodate about 10 requests per second per dyno, which is adequate for a personal project.

If traffic surges on your website and exceeds 10 requests per second, you can scale up. First, you can use the [Unicorn](#) web server which handles *concurrent* requests. Configuring Unicorn requires some expertise, but [Heroku recommends it](#). Second, you can double the size of Heroku's dynos to handle more requests. Finally, you can buy more dynos, adding as many dynos as you need to handle traffic. This is where convenience comes at a price. You won't need system administration expertise to deploy a website on Heroku but you'll pay a premium to host a high-traffic site.

Heroku is ideal for hosting our application:

- no system administration expertise is required
- hosting is free
- performance is excellent

For this tutorial application, we won't concern ourselves with the possibility that the website may get a lot of traffic. I'm sure you'll join me in offering hearty thanks to Heroku for providing a convenient service that beginners can use for free.

Let's deploy!

Test the Application

Before deploying an application to production, a professional Rails developer runs *integration* or *acceptance* tests. If the developer follows the discipline of

test-driven development, he or she will have a complete test suite that confirms the application runs as expected. Often the developer uses a *continuous integration* server which automatically runs the test suite each time the code is checked into the GitHub repository.

We haven't used test-driven development to build this application so no test suite is available. You've tested the application manually at each stage.

Preparing for Heroku

You'll need to prepare your Rails application for deployment to Heroku.

Gemfile

We need to modify the Gemfile for Heroku.

We add a **group :production** block for gems that Heroku needs:

- **pg** - PostgreSQL gem
- **thin** - web server
- **rails_12factor** - logging and static assets

Heroku doesn't support the SQLite database; the company provides a PostgreSQL database. Though we won't need it for our tutorial application, we must include the PostgreSQL gem for Heroku. We'll mark the **sqlite3** gem to be used in development only.

Note that **Heroku recommends Unicorn** for handling higher levels of traffic efficiently. Unicorn can be difficult to setup and configure, so we'll simple use the default WEBrick server for our tutorial application.

On Heroku, Rails needs an extra gem to handle logging and serve CSS and JavaScript assets. The [rails_12factor](#) gem provides these services.

Open your **Gemfile** and replace the contents with the following:

Gemfile

```
source 'https://rubygems.org'
ruby '2.3.0'
gem 'rails', '4.2.5'
gem 'sass-rails', '~> 5.0'
gem 'uglifier', '>= 1.3.0'
gem 'coffee-rails', '~> 4.1.0'
gem 'jquery-rails'
gem 'turbolinks'
gem 'jbuilder', '~> 2.0'
group :development, :test do
  gem 'byebug'
  gem 'web-console', '~> 2.0'
  gem 'spring'
end
gem 'foundation-rails'
gem 'gibbon'
gem 'high_voltage'
gem 'simple_form'
group :development do
  gem 'better_errors'
  gem 'quiet_assets'
  gem 'rails_layout'
  gem 'sqlite3'
end
group :production do
  gem 'pg'
  gem 'rails_12factor'
end
```

If you've got Rails 4.2.5, there's no need to make additional changes to the Gemfile. If you've got a newer version of Rails, update the Gemfile.

We have to run **bundle install** because we've changed the Gemfile. The gems we've added are only needed in production so we don't install them on our local machine. When we deploy, Heroku will read the Gemfile and install the gems in the production environment. We'll run **bundle install** with the **-without production** argument so we don't install the new gems locally:

```
$ bundle install --without production
```

Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A  
$ git commit -m "gems for Heroku"  
$ git push
```

Precompile Assets

The [rails_12factor](#) gem automatically runs the `rake assets:precompile` command when you deploy to Heroku, so it isn't strictly necessary to precompile assets yourself. However, it is important to understand that assets must be precompiled before deployment.

We compile assets so we have one file each for all the files in the folders **app/assets/javascripts/** and **app/assets/stylesheets/**. It makes our application faster for the user.

In development mode, the Rails asset pipeline “live compiles” all CSS and JavaScript files. Compiling assets adds processing overhead. In production, a web application would be slowed unnecessarily if assets were compiled for every web request. Consequently, assets must be precompiled before we deploy our application to production.

When assets are precompiled, the Rails asset pipeline will automatically produce concatenated and minified **application.js** and **application.css** files from files listed in the manifest files **app/assets/javascripts/application.js** and **app/assets/stylesheets/application.css**.

Here's how to precompile assets and commit to the Git repo (if you want to do it manually):

```
$ rake assets:precompile
$ git add -A
$ git commit -m "assets compiled for Heroku"
$ git push
```

The result will be several files added to the **public/assets/** folder. The filenames will contain a long unique identifier that prevents caching when you change the application CSS or JavaScript.

Again, the [rails_12factor](#) gem runs the **rake assets:precompile** command when you deploy to Heroku, so you don't have to do it yourself.

Option to Ban Spiders

Do you want your website to show up in Google search results? If there's a link anywhere on the web to your site, within a few days (sometimes hours) the Googlebot spider will visit your site and add it to the database for the Google search engine. Most webmasters want their sites to be found in Google search results. If that's not what you want, you may want to modify the file **public/robots.txt** to prevent indexing by search engines.

Only change this file if you want to prevent your website from appearing in search engine listings:

```
# See http://www.robotstxt.org/robotstxt.html for documentation
#
# To ban all spiders from the entire site uncomment the next two lines:
# User-agent: *
# Disallow: /
```

To block all search engine spiders, remove the commenting from the **User-Agent** and **Disallow** lines.

You can learn more about the format of the [robots exclusion standard](#).

Humans.txt

Many websites include a **robots.txt** file for nosy bots so it's only fair that you offer a **humans.txt** file for nosy people. Few people will look for it but you can add a file **public/humans.txt** to credit and identify the creators and software behind the website. The HTML5 Boilerplate project offers an [example file](#) or you can [borrow from RailsApps](#).

Sign Up for a Heroku Account

In the chapter, “Accounts You May Need,” I suggested you sign up for a Heroku account.

To deploy an app to Heroku, you must have a Heroku account. Visit <https://id.heroku.com/sign-up> to set up an account.

Be sure to use the same email address you used to configure Git locally. You can check the email address you used for Git with:

```
$ git config --get user.email
```

Heroku Toolbelt

Heroku provides a command line utility for creating and managing Heroku apps.

Visit <https://toolbelt.heroku.com/> to install the Heroku Toolbelt. A one-click installer is available for Mac OS X, Windows, and Linux.

The installation process will install the Heroku command line utility. It also installs the [Foreman](#) gem which is useful for duplicating the Heroku production environment on a local machine. The installation process will also make sure Git is installed.

To make sure the Heroku command line utility is installed, try:

```
$ heroku version
heroku-toolbelt/...
```

You'll see the heroku-toolbelt version number.

You should be able to login using the email address and password you used when creating your Heroku account:

```
$ heroku login
Enter your Heroku credentials.
Email: adam@example.com
Password:
Could not find an existing public key.
Would you like to generate one? [Yn]
Generating new SSH public key.
Uploading ssh public key /Users/adam/.ssh/id_rsa.pub
```

The Heroku command line utility will create SSH keys if necessary to guarantee a secure connection to Heroku.

Heroku Create

Be sure you are in your application root directory and you've committed the tutorial application to your Git repository.

Use the Heroku create command to create and name your application.

```
$ heroku create myapp
```

Replace **myapp** with something unique. Heroku demands a unique name for every hosted application. If it is not unique, you'll see an error, "name is already taken." Chances are, "learn-rails" is already taken.

If you don't specify your app name (**myapp** in the example above), Heroku will supply a placeholder name. You can easily change Heroku's placeholder name to a name of your choice with the **heroku apps:rename** command (see [Renaming Apps from the CLI](#)).

Don't worry too much about getting the "perfect name" for your Heroku app. The name of your Heroku app won't matter if you plan to set up your Heroku app to use your own domain name. You'll just use the name for access to the instance of your app running on the Heroku servers; if you have a custom domain name, you'll set up DNS (*domain name service*) to point your domain name to the app running on Heroku.

The **heroku create** command sets your Heroku application as a Git remote repository. That means you'll use the **git push** command to deploy your application to Heroku.

Enable Email

You'll need to enable email for production or else you'll get errors when your application tries to send email from Heroku.

To use Mandrill from Heroku, add the following to your **config/environments/production.rb** file:

```
# email enabled in production
config.action_mailer.default_url_options = { :host => Rails.application.secrets.domain_name }
config.action_mailer.delivery_method = :smtp
config.action_mailer.perform_deliveries = true
config.action_mailer.raise_delivery_errors = false
config.action_mailer.smtp_settings = {
  address: "smtp.mandrillapp.com",
  port: 587,
  user_name: Rails.application.secrets.mandrill_username,
  password: Rails.application.secrets.mandrill_api_key
}
```

Be sure to add the new settings before the **end** keyword in the file. The settings

can be added anywhere, as long as they precede the **end** keyword!

You'll need to specify the unique name you've selected for your hosted application. We're using the **Rails.application.secrets.domain_name** configuration variable in two places in the file. The **config/secrets.yml** file sets configuration variables for use in production, which are obtained from Heroku environment variables.

Be sure to commit your code to the Git local repository:

```
$ git add -A
$ git commit -m "email set for Heroku"
$ git push
```

Next we'll set Heroku environment variables.

Set Heroku Environment Variables

You'll need to set Heroku environment variables to provide configuration values for the **config/secrets.yml** file. Heroku doesn't have a **.bashrc** or **.bash_profile** file, so you'll set environment variables on Heroku with **heroku config:add**.

```
$ heroku config:add MANDRILL_USERNAME='MyUsername' MANDRILL_API_KEY='my-key'
$ heroku config:add MAILCHIMP_API_KEY='my-key' MAILCHIMP_LIST_ID='mylistid'
$ heroku config:add OWNER_EMAIL='me@example.com' DOMAIN_NAME='myapp.herokuapp.com'
```

When you set **myapp.herokuapp.com**, replace **myapp** with the name that Heroku is using for your application. If you want to use a custom domain name, you'll need to set up DNS (*domain name service*), which we won't cover in this tutorial.

You don't need to set **SECRET_KEY_BASE**, even though it is in your **config/secrets.yml** file. Heroku sets it automatically.

Check that the environment variables are set with:

```
$ heroku config
```

See the Heroku documentation on [Configuration and Config Vars](#) and the article [Rails Environment Variables](#) for more information.

Push to Heroku

After all this preparation, you can finally push your application to Heroku.

Be sure to commit any recent changes to the Git local repository before you push to Heroku.

You commit your code to Heroku just like you push your code to GitHub.

Here’s how to push to Heroku:

```
$ git push heroku master
```

You may see a message, “The authenticity of host ‘heroku.com’ can’t be established. Are you sure you want to continue connecting (yes/no)?”. You can answer “yes” and safely continue.

The push to Heroku takes several minutes. You’ll see a sequence of diagnostic messages in the console, beginning with:

```
-----> Ruby app detected
```

and finishing with:

```
-----> Launching... done
```

Updating the Application

It is likely you'll make changes to your application after deploying to Heroku.

Each time you update your site and push the changes to GitHub, you'll also have to push the new version to Heroku.

If you've changed anything in the **assets** folder (including images, JavaScript, or stylesheets), you'll need to precompile assets. A typical update scenario looks like this:

```
$ git add -A
$ git commit -m "revised application"
$ RAILS_ENV=production rake assets:precompile
$ git add -A
$ git commit -m "assets compiled for Heroku"
$ git push
$ git push heroku master
```

Visit Your Site

Your application will be running at <http://my-app-name.herokuapp.com/>. You can open any web browser and visit the site. For a shortcut, you can open your default web browser and visit your site from the command line:

```
$ heroku open
```

If you're using hosted development such as Cloud9, you'll need to open a browser manually to visit the site.

If you've configured everything correctly, you should be able to sign up for the newsletter and send a contact request.

Customizing

For a real application, you'll likely want to use your own domain name for your app.

See [Heroku's article about custom domains](#) for instructions.

You may also want to improve website responsiveness by adding page caching with a content delivery network such as [CloudFlare](#). CloudFlare can also provide an SSL connection for secure connections between the browser and server.

Heroku offers many [add-on services](#). These are particularly noteworthy:

- [Adept Scale](#) - automated scaling of Heroku dynos
- [New Relic](#) - performance monitoring

For an in-depth look at your options, see the [Rails Heroku Tutorial](#).

Troubleshooting

When you get errors, troubleshoot by reviewing the log files:

```
$ heroku logs
```

If necessary, use the Unix **tail** flag to monitor your log files. Open a new terminal window and enter:

```
$ heroku logs -t
```

to watch the server logs in real time.

Where to Get Help

Your best source for help with Heroku is [Stack Overflow](#). Use the tag “heroku,” “learn-ruby-on-rails,” or “railsapps” when you post your question. Your issue may have been encountered and addressed by others.

You can also check the [Heroku Dev Center](#) or the [Heroku Google Group](#).

Chapter 22

Analytics

In earlier chapters, we built the tutorial application and deployed it for hosting on Heroku.

We've left something out. Though not obvious, it's very important: analytics.

Analytics services provide reports about website traffic and usage.

You'll use the data to increase visits and improve your site. Analytics close the communication loop with your users; your website puts out a message and analytics reports show how visitors respond.

Google Analytics is the best known tracking service. It is free, easy to use, and familiar to most web developers. In this chapter we'll integrate Google Analytics with the tutorial application.

There are several ways to install Google Analytics for Rails. The article on [Analytics for Rails](#) looks at various approaches and explains how Google Analytics works.

For this tutorial, we'll use the [Segment.io](#) service. The service provides an API to send analytics data to dozens of different services, including Google Analytics.

Segment.io

[Segment.io](#) is a subscription service that gathers analytics data from your application and sends it to dozens of different services, including Google Analytics. The service is free for low- and medium- volume websites, providing 100,000 API calls (page views or events) per month at no cost. There is no charge to sign up for the service.

Using Segment.io means you install one JavaScript library and get access to reports from dozens of analytics services. You can [see a list of supported services](#). The company offers helpful advice about [which analytics tools to choose from](#). For low-volume sites, many of the analytics services are free, so Segment.io makes it easy to experiment and learn about the available analytics tools. The service is fast and reliable, so there's no downside to trying it.

Accounts You Will Need

You will need an account with Segment.io. [Sign up for Segment.io](#).

You will need accounts with each of the services that you'll use via Segment.io.

You'll likely want to start with Google Analytics, so you'll need a Google Analytics account and tracking ID.

Visit the [Google Analytics website](#) to obtain the Tracking ID for your website. You'll need to know the domain name of your website to get an account for your website. If you've deployed to Heroku without a custom domain, use the domain that looks like "myapp.herokuapp.com". Or use your custom domain if you have one. Use it for fields for "Website Name," "Web Site URL," and "Account Name."

Choose the defaults when you create your Google Analytics account and click "Get Tracking ID." Your tracking ID will look like this: **UA-XXXXXXX-XX**. You won't need the tracking code snippet as we will use the Segment.io JavaScript snippet instead.

You'll check your Google Analytics account later to verify that Google is collecting data.

Installing the JavaScript Library

Segment.io provides a JavaScript snippet that sets an API token to identify your account and installs a library named **analytics.js**. This is similar to how Google Analytics works. The Segment.io library loads asynchronously, so it won't affect page load speed.

The Segment.io JavaScript snippet should be loaded on every page and it can be included as an application-wide asset using the Rails asset pipeline.

We'll add the Segment.io JavaScript snippet to a file named **app/assets/javascripts/segmentio.js**. The manifest directive `// = require_tree .` in the file **app/assets/javascripts/application.js** will ensure that the new file is included in the concatenated application JavaScript file. If you've removed the `// = require_tree .` directive, you'll have to add a directive to include the **app/assets/javascripts/segmentio.js** file.

Create a file **app/assets/javascripts/segmentio.js** and include the following:

```
// Create a queue, but don't obliterate an existing one!
window.analytics || (window.analytics = []);

// A list of all the methods in analytics.js that we want to stub.
window.analytics.methods = ['identify', 'track', 'trackLink', 'trackForm',
  'trackClick', 'trackSubmit', 'page', 'pageview', 'ab', 'alias', 'ready',
  'group', 'on', 'once', 'off'];

// Define a factory to create queue stubs. These are placeholders for the
// "real" methods in analytics.js so that you never have to wait for the library
// to load asynchronously to actually track things. The `method` is always the
// first argument, so we know which method to replay the call into.
window.analytics.factory = function (method) {
  return function () {
    var args = Array.prototype.slice.call(arguments);
    args.unshift(method);
    window.analytics.push(args);
    return window.analytics;
  };
};
```

```

};

// For each of our methods, generate a queueing method.
for (var i = 0; i < window.analytics.methods.length; i++) {
  var method = window.analytics.methods[i];
  window.analytics[method] = window.analytics.factory(method);
}

// Define a method that will asynchronously load analytics.js from our CDN.
window.analytics.load = function (apiKey) {

  // Create an async script element for analytics.js based on your API key.
  var script = document.createElement('script');
  script.type = 'text/javascript';
  script.async = true;
  script.src = ('https:' === document.location.protocol ? 'https://' : 'http://') +
    'd2dq2ahtl5zllz.cloudfront.net/analytics.js/v1/' + apiKey + '/analytics.min.js'

  // Find the first script element on the page and insert our script next to it.
  var firstScript = document.getElementsByTagName('script')[0];
  firstScript.parentNode.insertBefore(script, firstScript);
};

// Add a version so we can keep track of what's out there in the wild.
window.analytics.SNIPPET_VERSION = '2.0.8';

// Load analytics.js with your API key, which will automatically load all of the
// analytics integrations you've turned on for your account. Boosh!
window.analytics.load('YOUR_API_TOKEN');

// Make our first page call to load the integrations. If you'd like to manually
// name or tag the page, edit or move this call to use your own tags.
/* */
window.analytics.page();

// accommodate Turbolinks
// track page views and form submissions
$(document).on('ready page:change', function() {
  console.log('page loaded');
  analytics.page();
  analytics.trackForm($('#new_visitor'), 'Signed Up');
  analytics.trackForm($('#new_contact'), 'Contact Request');
})

```

If you find you can't copy this code from this page, you can get it directly from [Segment.io](#), or use a [file](#) from the tutorial application on GitHub.

The Segment.io website offers a minified version of the snippet for faster page loads. We've used the non-minified version so you can read the code and com-

ments. If you want, you can get minified version from the Segment.io website for improved speed.

You **must** replace **YOUR_API_TOKEN** with your Segment.io API token. You can find the API token on your “Settings” page when you [log in to Segment.io](#) (it is labelled “Your API Key”). Add it to the file where you see this line:

```
// Load analytics.js with your API key, which will automatically load all of the
// analytics integrations you've turned on for your account. Boosh!
window.analytics.load('YOUR_API_TOKEN');
```

We’ve added extra code to the minified Segment.io JavaScript snippet. The extra code accommodates page view and event tracking, which we’ll look at next.

Page View Tracking with Turbolinks

Rails 4.0 introduced a feature named [Turbolinks](#) to increase the perceived speed of a website.

Turbolinks makes an application appear faster by only updating the body and the title of a page when a link is followed. By not reloading the full page, Turbolinks reduces browser rendering time and trips to the server.

With Turbolinks, the user follows a link and sees a new page but Segment.io or Google Analytics thinks the page hasn’t changed because a new page has not been loaded. To resolve the issue, you could disable Turbolinks by removing the turbolinks gem from the Gemfile. However, it’s nice to have both the speed of Turbolinks and tracking data, so I’ll show you how get tracking data with Turbolinks.

To make sure every page is tracked when Rails Turbolinks is used, we’ve already appended the following JavaScript to the **app/assets/javascripts/segmentio.js** file:

```
// accommodate Turbolinks
// track page views and form submissions
$(document).on('ready page:change', function() {
  .
  .
  .
  analytics.page();
  .
  .
  .
})
```

We've added it at the end of the file.

Turbolinks fires a **page:change** event when a page has been replaced. The code listens for the **page:change** event and calls the Segment.io **analytics.page()** method. This code will work even on pages that are not visited through Turbolinks (for example, the first page visited).

Event Tracking

Segment.io gives us a convenient method to track page views. Page view tracking gives us data about our website traffic, showing visits to the site and information about our visitors.

It's also important to learn about a visitor's activity on the site. Site usage data helps us improve the site and determine whether we are meeting our business goals. This requires tracking events as well as page views.

The Segment.io JavaScript library gives us two methods to track events:

- **trackLink**
- **trackForm**

Link tracking can be used to send data to Segment.io whenever a visitor clicks a link. It is not useful for our tutorial application because we simply record a new

page view when a visitor clicks a link on our site. However, if you add links to external sites and want to track click-throughs, you could use the **trackLink** method. The method can also be used to track clicks that don't result in a new page view, such as changing elements on a page.

The **trackForm** method is more useful for our tutorial application. We've already appended it to the **app/assets/javascripts/segmentio.js** file:

```
// accommodate Turbolinks
// track page views and form submissions
$(document).on('ready page:change', function() {
  console.log('page loaded');
  analytics.page();
  analytics.trackForm($('#new_visitor'), 'Signed Up');
  analytics.trackForm($('#new_contact'), 'Contact Request');
})
```

I've included a **console.log('page loaded')** statement so you can check the browser JavaScript console to see if the code runs as expected.

The **trackForm** method takes two parameters, the ID attribute of a form and a name given to the event.

Form tracking will show us how many visitors sign up for the newsletter or submit the contact request form. Obviously we can count the number of subscribers in MailChimp or look in the site owner's inbox to see how many contact requests we've received. But form tracking helps us directly correlate the data with visitor data. For example, we can analyze our site usage data and see which traffic sources result in the most newsletter sign-ups.

You can read more about the Segment.io JavaScript library in the [Segment.io documentation](#).

Segment.io Integrations

After installing the Segment.io JavaScript snippet in your application, visit the Segment.io integrations page to select the services that will receive your data.

When you [log in to Segment.io](#) you will see a link to “Integrations” in the navigation bar.

Each service requires a different configuration information. At a minimum, you’ll have to provide an account identifier or API key that you obtained when you signed up for the service.

For Google Analytics, enter your Google Analytics tracking id. It looks like **UA-XXXXXXX-XX**.

Click “Dashboard” in the navigation bar so you can monitor data sent to Segment.io from your application.

When you test the application locally, you should see the results of page visits and form submissions within seconds in the Segment.io Dashboard.

With Google Analytics enabled as a Segment.io integration, you’ll see form submissions appear in the Google Analytics Real-Time report, under the “Events” heading.

Note that Google doesn’t process their data in real-time in most of its reports. Data appears immediately in the Google Analytics Real-Time report. Other Google Analytics reports, such as the Audience report, won’t show data immediately. Check the next day for updated reports.

Deploy

When you are ready to deploy to Heroku, you must recompile assets and commit to the Git repo:

```
$ git add -A
$ git commit -m "analytics"
$ rake assets:precompile
$ git add -A
$ git commit -m "assets compiled for Heroku"
$ git push
```

Then you can deploy to Heroku:

```
$ git push heroku master
```

When you visit the site, you should see real-time tracking of data sent to Segment.io in the Segment.io dashboard.

Log into your Google Analytics account to see real-time tracking of visits to your website. Under “Standard Reports” see “Real-Time Overview.” You’ll see data within seconds after visiting any page.

Improving the User Experience

Website analytics can be used to improve visitors’ experience of the website. Deploying the website is not the last step in your project. Unlike many earlier forms of communication (such as releasing a film, publishing a book, or broadcasting an advertisement), we can see how every visitor responds to the website. That means your work is not done when you deploy the site. Look at your usage data to see which elements of the site are getting attention and which are being used.

Does no one visit the “About” page? Maybe the navigation link is difficult to find. Do many people visit the Contact page but few submit a contact request form? Maybe you should change the label on the button or offer other ways to contact the site owner.

Effective and successful websites often are the result of systematic [A/B testing](#) (sometimes called *split testing*). A/B testing is a technique of creating variations on a web page, such as changing text, layout, or button colors, and using website analytics to measure the effect of the change. You can learn more about services such as [Content Analytics](#) in Google Analytics, [Optimizely](#), or [Visual Website Optimizer](#). These services provide complete “dashboards” to set up usage experiments and measure results ([Optimizely](#) is available as a Segment.io integration).

Conversion Tracking

You may only be interested in knowing that people visit your site, without measuring visitors' engagement or response to the site. But in most cases, if you build a website, you'll offer a way for visitors to respond, whether it is by purchasing a product, signing up for a newsletter, or clicking a "like" button.

The ultimate measure of website effectiveness is the [conversion rate](#). The term comes from the direct marketing industry and originally referred to a measure of how people responded to "junk mail" offers. For a website, the conversion rate indicates the proportion of visitors who respond to a *call to action*, which may be an offer to make a purchase, register for a membership, sign up for a newsletter, or any other activity which shows the visitor is engaged and interested.

For our tutorial application, we can measure our website effectiveness by looking at the conversion rate for newsletter sign-ups.

We're tracking page views which will give us a count of visits to the website home page. And we've got event tracking in place to count newsletter sign-ups. If 100 people visit the home page and 10 people request a newsletter, we've got a conversion rate of 10%.

We can try to improve the conversion rate by improving the user experience (perhaps through A/B testing) or focusing on increasing traffic from sources that provide a higher conversion rate.

You can monitor your site's conversion rate by [setting up events as goals](#) in Google Analytics. Segment.io also integrates with many services which provide conversion tracking.

Enjoy What You've Achieved

You've completed building the tutorial application.

If your project was to build an application for someone else, whether the company you work for, or a client like Foobar Kadigan, you've completed the [deliverable](#).

You started with project planning, in the form of user stories. You implemented the application using a variety of technologies supported by the Ruby on Rails development platform. And you've deployed the application for others to use, with analytics in place to track traffic and usage.

Not every manager or client will appreciate the effort or the complexity of the project you've built. Mr. Kadigan's happiness may depend on how well you've understood his goals and the degree to which you've met his expectations. If you're working for yourself, or launching your startup, you may be your own toughest boss, because there is always more to do.

With technology projects, like many other aspects of life, though it seems you'll never get it right, and never get it done, there are moments when you can savor a sense of accomplishment. This is one of those moments.

Before you start thinking about adding one more feature, or updating the application for the new releases that inevitably came out during the time you were working, take time to bask in the satisfaction of seeing the results of your work.

Software development has its own unique rhythm of frustration and satisfaction. As software developers, we subject ourselves to hours, days, or weeks of struggle with code that is cryptic and resists understanding. We gain mastery for a few minutes and then turn to the next problem. With each feature you implement, or issue you resolve, you'll experience brief elation before resuming the grind of development. But at each milestone, and at the completion of the project, you've built something tangible that you can use. You can try it out yourself and show it to others.

Give yourself full credit. You've built something extraordinary with little more than intelligence and attention. You've leveraged the work of other developers who have contributed to the open source Ruby on Rails platform and you've created your own unique product. This is what drives us as developers; to create something from nothing, using only our collective intelligence and ambition.

Chapter 23

Testing

You don't need to read this chapter if you will always be a student, or a hobbyist, working on personal projects. But if you wish to work as a professional Rails developer, or launch your own startup, with money and reputation at stake, you must learn about testing. In this chapter, I'll introduce the basic concepts of testing and show how to build a test suite for the tutorial application.

Why Test?

Software applications are fragile. When you write a song, you can include a wrong note and the song won't break. In a film, technical flaws like a "jump cut" or a microphone in the frame won't ruin an entire movie. But an unseen error in a software program can disrupt a key feature or crash the entire application.

Software applications are never finished. Songs and movies reach a stage of completion and are delivered to their audience, with no expectation that the completed work will change. With software applications, there's always an upcoming version with bug fixes or new features. As web developers, we continue to make changes to the applications that our customers are actively using.

Sometimes new features are delivered within minutes, or hours, of committing new code to the repository.

Software applications are complex. A web application, or any software program, is a machine with intricately connected parts, or *dependencies*. As an application grows, the connections quickly grow more complex, to the point where no one is able to see all the dependencies at once. Plus, web applications are often a collaborative effort, so no one person is familiar with every line of code.

Combine the evolving nature of an application, with the complexity of the product, and the likelihood that flaws will be immediately noticed by users, and you'll realize why testing is so important to the software development process.

Testing was once considered the sole responsibility of a *quality assurance* (QA) department. Senior developers created new features or fixed bugs. When the work was “done,” lesser paid (and lower status) developers “in QA” clicked through screens, with written notes or scripts, as if they were users testing every feature of a program. Invariably, manual testing led to oversights, because testing notes were out of date, “edge cases” were overlooked, and the work was monotonous. In the best-run companies, QA engineers are now expert consultants on testing methods and a source of guidance for other developers. We now rely on *automated testing*. Even more important, the job of writing test code now belongs to the developer who creates a feature or fixes a bug. It's our responsibility to write adequate tests for any code we add to the repository.

What Are Tests?

Developers talk about testing as if it were an activity different from writing code. It is not. Testing is something we do while writing code. We create tests with the same text editor we use to write code. The tests themselves are written in Ruby, just like any other part of a Rails application. You'll put the test code in either a **tests/** or **spec/** folder, committed to the Git repository with all the other code. You'll use the specialized API of a testing framework

for the methods of your tests, either [Minitest](#) or [RSpec](#). Test code is different from code that implements features in one significant way: Instead of supporting interactions with a user, test code interacts with the code you’ve written, verifying the code behaves as intended.

Scripted or Exploratory

When testing is used for quality assurance, the goal is to create a suite of automated tests that will reveal any bugs that creep into code and break the application. Sometimes this is called *scripted testing*. These tests are checked into the software repository and maintained with the application. Often developers will set up a system for *continuous integration* (CI), which will automatically run the test suite whenever the repository is updated. Developers can set up a CI server such as [Jenkins](#) or use a hosted CI service such as [Travis CI](#), [CircleCI](#), or [Semaphore](#) to run tests automatically. Automated testing with continuous integration serves as a safety net for developers.

There is another role for testing, which is often called *exploratory testing*, or *developer testing*. These tests may end up in an application test suite, but the primary purpose is to help a developer construct an application. Many developers, after gaining experience in writing tests for quality assurance, realize that writing tests can be a useful first step in figuring out how a feature should be implemented. It may seem odd to write tests first, but exploratory testing can clarify what behavior will be required, and help the developer think through alternatives and edge cases. This approach is called *test-first development*, and many developers will tell you that when you write tests first, you’ll be more satisfied; you’ll be more focused; and you’ll avoid tangents and detours of the “nice-to-have-but-not-really-needed” variety. We’ll look closely at test-first development in conjunction with Test-Driven Development (TDD) and Behavior-Driven Development (BDD) at the end of this chapter. First, let’s gain an understanding of testing terminology and practice.

Regression and Acceptance

We describe tests by the purpose they serve. In addition to exploratory testing used in test-first development, there are several kinds of tests used for quality assurance.

Regression tests are run every time we change code. Sometimes we want to make sure new features don't break the existing application. More often, we run tests after changing existing code to make it more readable, elegant, or effective. We call this tinkering "*refactoring*." Refactoring is very similar to what we call editing or rewriting when we work with the written word. Before we refactor, we need to know what results we expect from our code, and we need automated tests to execute our code and check for the expected results. If our automated tests are adequate, we can use the tests as regression tests, making sure our refactoring hasn't introduced new bugs.

Acceptance tests are sometimes identical to regression tests, and may use the same test code. The purpose is different, so we give this kind of testing a different name. Acceptance tests provide accountability and serve a management function. These are tests that determine if a feature has been implemented as expected. It is common to run acceptance tests when an outside contractor delivers code, so we can determine if the team has delivered what we requested. We can also use acceptance tests to determine if our internal team has implemented the stated requirements. Proponents of behavior-driven development claim that the process of creating acceptance tests clarifies the product requirements. Obviously, if we want adequate acceptance tests, we need to plan carefully when specifying the product requirements. If we've planned well, we can turn our user stories into automated tests that serve as acceptance tests. We discussed this process in an earlier chapter, "Plan Your Product."

Units and Integration

We also describe tests by their relationship to the rest of the code.

Unit tests probe the internal workings of the machine. If we've written our code well, a small section of the code, such as a class or a method, will be a discrete unit that can be tested independently of all other units. Unit tests inspect the integrity of small parts of the application in isolation. When a unit test fails, we can quickly identify and fix broken code.

We use *integration tests* to make sure the entire application works as expected. Integration tests mimic the behavior of real users. For a web application, an integration test may simulate a user signing in, filling out forms, clicking between pages, and verifying that contents of pages match expected results. Integration tests can also be called *feature tests* if they are designed to confirm that product features work as expected. Our feature tests can serve as acceptance tests if we use the test suite to determine if we've correctly implemented our user stories or other product specifications. Sometimes these tests are called *black box tests* because the code is tested as if the application was a black box, with the internal workings of the application hidden from the observer. They are also called *system tests* or *end-to-end tests*.

Sample Data

When we write tests, either feature tests or unit tests, we often want to check whether a method returns the data we expect. That means we have to create the data we need in advance of the test. Either we populate a database with the data we expect, or we disconnect the database and instantiate an object that provides the data we expect. Test frameworks give us a tool named a *factory* or a *fixture* to create sample data. Developers argue about what is better, factories or fixtures, but you'll encounter factories more often, particularly the popular [FactoryGirl](#) gem. A factory is an object that creates other objects. When you use FactoryGirl, you have the option of saving your object to the database (which is slow) or building your object in memory only (which is faster). Fixtures are used to populate a database with sample data before your tests run. If you use fixtures, you'll save sample data in a configuration file. Before tests run, Rails automatically loads all fixtures from configuration files

in the **test/fixtures** folder. As you gain experience with testing, you'll become familiar with both factories and fixtures.

Test Doubles

In unit testing, to isolate small parts of the application, sometimes we artificially decouple the code from the rest of the application. For example, with a unit test, we don't want to connect to an external service with an API to obtain data. Or we simply want a method to get a predictable response from another object.

Test doubles stand in for external dependencies. The term is borrowed from Hollywood, where stunt doubles stand in for actors in action scenes. A test double is any kind of pretend object used in place of a real object for testing purposes. There are two types of test doubles, *stubs* and *mocks*. Stubs provide canned answers to calls made during the test, only responding when queried by the test. Sometimes stubs record information about the call, for example, the message sent or the number of times called. Mocks are pre-programmed objects that reproduce the behavior of the object they represent, forming a specification of an object's behavior. It takes time to write stubs and mocks and lots of experience to use them correctly, so as a beginner, you probably won't write stubs and mocks without help. As you can gain experience, you'll better understand the difference between stubs and mocks and learn how to use them. For now, it is enough to recognize the terminology and remember that tests run faster and better when we reduce coupling and complexity with test doubles.

Minitest and RSpec

You've already learned that Rails developers mix and match gems to create a favorite technology *stack*. Not everyone likes ERB for view templates. Some prefer Haml or Slim syntax for mixing HTML and Ruby in a view. Developers

often stray from the default Rails stack when it comes to testing. Since the release of Ruby 1.9, [Minitest](#) has been supplied as a standard gem with all Ruby installations. Yet most Rails developers use [RSpec](#) for testing.

In this tutorial, I'll use Minitest to introduce you to testing. Minitest is easier to set up and offers a syntax that is very similar to RSpec. Some developers say that there is no reason to use RSpec because Minitest provides almost all the convenience of RSpec with smaller size, faster speed, and less complexity. Other developers insist that RSpec is more expressive and flexible. Realistically, if you want a job working on most Rails teams, you'll need to learn RSpec. Get started with Minitest to learn the basics of testing. When you're ready for the next step, I've written an [RSpec Tutorial](#) to take you deeper. I also recommend the books [Rails 4 Test Prescriptions](#) by Noel Rappin and [Everyday Rails Testing with RSpec](#) by Aaron Sumner.

Capybara, the Ghost in the Machine

Unit tests are simple, in principle and often in practice. The tests are just Ruby code, supplemented with methods from the test framework API. If we want unit tests for all the methods of a `User` class, we instantiate the class and write code that calls each method and verifies if the response matches our expectations. Using methods from the Minitest or RSpec test framework, we output a message that indicates whether each unit test passes or fails.

Integration tests, or feature tests, require more of a framework than unit tests. We want our tests to be as realistic as possible, as if a robot was using a web browser and interacting with our web application. Fortunately, the maintainers of the [Capybara](#) gem have created such a robot. To create integration tests, we add the Capybara gem, using it with either Minitest or RSpec. Capybara gives us a `visit` method that simulates a user visiting a page. After we call the `visit` method, Capybara gives us a `page` object and allows us to test whether the page contains the content we expect. Every Rails application relies on a layer of *middleware* named [Rack](#) that ties into a web server. Capybara

interacts with the web application, via calls to Rack, as if it was a browser making requests and receiving HTML files as a response.

When we use Capybara, by default it operates in *headless mode*, interacting directly with the Rails application via Rack. “Headless” means there is no graphical user interface (as if the absent screen was a computer’s head). In headless mode, JavaScript is unavailable. If some of our application features require JavaScript, we must set up Capybara to act as a robot using a real web browser. Capybara has a built-in *driver* (named [Selenium](#)) that gives our robot the option of automatically launching and using a real web browser for each test. By default, Capybara will use the Firefox web browser if it is installed on your computer. What you’ll see is amazing. When you run tests using Capybara with the JavaScript option, the Firefox web browser will pop open on your desktop and you’ll watch a ghost flying through your web application. With Capybara, you now have a ghostly QA department running your integration tests.

Four Phases of Feature Tests

Test code is easier to understand when you recognize that tests proceed in stages, or phases. Code that simulates a user visiting a web page tends to be organized in four phases:

- set up
- visit page
- verify page contents
- neutralize

The setup phase may include creating a user, signing in, or any other activity that creates the conditions for a test. With Capybara, the test visits the page,

which requires Capybara to simulate a browser request to the Rails application. Then, in the third stage, we check if the server response contains the data we expect. Finally, we may need to clean up, resetting the original state of the application, or removing any data the test added to the database.

Four Phases of Unit Tests

Unit tests also are organized in four stages:

- set up
- exercise
- verify
- teardown

When you test a small part of the application in isolation, you'll focus on an object or method which we call the "system under test." The setup phase prepares the system under test. Often this means instantiating an object. Here is an example:

```
user = User.new(email: 'user@example.com')
```

During the exercise phase, something is executed. Often this is a method call:

```
user.save
```

During verification, the result of the exercise is verified against the developer's expectations:

```
user.email.must_equal 'user@example.com'
```

During teardown, the system under test is reset to its initial state. Rails integrates with Minitest or RSpec to reset a database to its initial state. You will seldom write code for the teardown phase.

Now that you’ve learned about the basic concepts of testing, let’s set up Minitest for our first tests.

Set Up Minitest

We’ll set up testing with both Minitest and Capybara, so we can write both unit tests and feature tests. Minitest is a standard Ruby gem, installed when you install Ruby in your environment. We’ll install the [minitest-spec-rails](#) gem which makes it easy to use an RSpec-like syntax with Minitest. We’ll also add the [minitest-rails-capybara](#) gem to integrate Capybara with Minitest and Rails.

Open your **Gemfile** and replace the contents with the following:

Gemfile

```
source 'https://rubygems.org'
ruby '2.3.0'
gem 'rails', '4.2.5'
gem 'sass-rails', '~> 5.0'
gem 'uglifier', '>= 1.3.0'
gem 'coffee-rails', '~> 4.1.0'
gem 'jquery-rails'
gem 'turbolinks'
gem 'jbuilder', '~> 2.0'
group :development, :test do
  gem 'byebug'
  gem 'web-console', '~> 2.0'
  gem 'spring'
end
gem 'foundation-rails'
gem 'gibbon'
gem 'high_voltage'
gem 'simple_form'
```

```
group :development do
  gem 'better_errors'
  gem 'quiet_assets'
  gem 'rails_layout'
  gem 'sqlite3'
end
group :production do
  gem 'pg'
  gem 'rails_12factor'
end
group :test do
  gem 'minitest-spec-rails'
  gem 'minitest-rails-capybara'
end
```

We've added the two gems to the **test** group. Now, some gems are loaded only when we're writing code (during development), some are loaded only when the application is running on Heroku (deployed to production), and our newest additions only are loaded when we run tests. If you've got Rails 4.2.5, there's no need to make additional changes to the Gemfile. If you've got a newer version of Rails, update the Gemfile.

Next, install the additional gems:

```
$ bundle install
```

The **bundle install** command will download and install the gems from the rubygems.org server.

Configure for Capybara

Our application already has a **test/** folder containing a **test_helper.rb** file. We'll modify the helper file so we can write tests that use Capybara.

Modify the **test/test_helper.rb** file:

```
ENV['RAILS_ENV'] ||= 'test'
require File.expand_path('../../config/environment', __FILE__)
require 'rails/test_help'
require 'minitest/rails/capybara'

class ActiveSupport::TestCase
  # Setup all fixtures in test/fixtures/*.yml for all tests in alphabetical order.
  fixtures :all

  # Add more helper methods to be used by all tests here...
end
```

We've added the line `require "minitest/rails/capybara"` to allow use of the Capybara test framework methods.

Run Tests

The command `rake test` will execute Minitest. Let's see what happens when we run tests:

```
$ rake test
Run options: --seed 9073

# Running:

Finished in 0.006803s, 0.0000 runs/s, 0.0000 assertions/s.

0 runs, 0 assertions, 0 failures, 0 errors, 0 skips
```

The output shows that Minitest executes but we have no tests for it to run. Let's commit our changes to the Git repository and push to GitHub:

```
$ git add -A
$ git commit -m "set up minitest"
$ git push
```

Unit Test (Standard Syntax)

In its default form, Minitest uses the syntax of the older [test_unit framework](#) that was supplied with Ruby before version 1.9. The `test_unit` syntax uses explicit Ruby to set up tests. Here's an example of Minitest using the `test_unit` syntax:

```
require 'test_helper'

class VisitorTest < ActiveSupport::TestCase

  def valid_params
    { email: 'john@example.com' }
  end

  def test_valid
    visitor = Visitor.new valid_params
    assert visitor.valid?, "Can't create with valid params: #{visitor.errors.messages}"
  end

  def test_invalid_without_email
    params = valid_params.clone
    params.delete :email
    visitor = Visitor.new params
    refute visitor.valid?, "Can't be valid without email"
    assert visitor.errors[:email], "Missing error when without email"
  end

end
```

Notice that we must declare a class `VisitorTest` that inherits from `ActiveSupport::Test`. Then we must define a new method for each test case using the `def` keyword. This syntax is not popular with Rails developers. RSpec offers its own DSL (domain specific language) that hides the overhead of setting up classes and methods behind convenience methods. Minitest offers its own version of the the RSpec DSL, allowing us to use the more popular syntax. I'll use the new RSpec-like syntax in this tutorial, since you are likely to encounter RSpec more frequently.

Unit Test (Spec Syntax)

For our first test, let's create a simple unit test for our Visitor model. Every time we run our tests, we want to know that we're able to create a Visitor model. We'll also check that the Visitor model contains a method that returns an email address.

The default Rails directory structure already contains a **test/models/** folder. Thanks to Rails conventions, we know exactly where to create our test file.

Create a file **test/models/visitor_test.rb**:

```
require 'test_helper'

describe Visitor do

  let(:visitor_params) { {email: 'user@example.com'} }
  let(:visitor) { Visitor.new visitor_params }

  it 'is valid when created with valid parameters' do
    visitor.must_be :valid?
  end

  it 'is invalid without an email' do
    # Delete email before visitor let is called
    visitor_params.delete :email
    visitor.wont_be :valid? # Must not be valid without email
    visitor.errors[:email].must_be :present? # Must have error for missing email
  end

end
```

The test above, written in the RSpec-like syntax, is functionally identical to the previous example, written in the old `test_unit` syntax. Take a close look at both, so the structure and keywords will be familiar when you see it again.

We need `require 'test_helper'` to enable the test framework and apply any configuration settings.

The keywords `describe`, `let`, and `it` are keywords that are also used in the RSpec DSL (domain-specific language). When you see these keywords, you know you are looking at test code, either Minitest or RSpec.

The purpose of a unit test is to describe the system under test, in terms of its expected behavior. We create a `do ... end` block using the `describe` keyword and specifying a class we wish to test:

```
describe Visitor do
  .
  .
  .
end
```

Create a Test Class With Describe

The `describe` keyword creates a test class. In this case, the `describe` keyword will create a class named `VisitorTest` that inherits from `ActiveSupport::TestCase`. Using the old `test_unit` syntax, we could do this with `class VisitorTest < ActiveSupport::TestCase` but the `describe` keyword is more convenient. When Minitest runs, it recognizes and executes test classes. By including our code inside a test class, we get to use methods such as `let` and `it` which are useful for writing tests. Minitest will recognize various classes like models or controllers and provide appropriate behavior.

Setup Phase

We must set up everything we need for the test. Minitest provides a simple way to set up everything before a test using the `before` keyword:

```
before do
  do_some_setup
end
```

We could initialize the Visitor model using a `before` block and setting instance variables:

```
before do
  @visitor_params = {email: 'user@example.com'}
  @visitor = Visitor.new(visitor_params)
end
```

Instead of using a **before** block, we'll use the convenient **let** keyword:

```
let(:visitor_params) { {email: 'user@example.com'} }
let(:visitor) { Visitor.new visitor_params }
```

The **let** keyword is a specialized version of the **before** keyword. It caches the objects that you create so they are ready for every test you write in the test class. And it is *lazy-loaded*, which means it does not require any processing overhead until the first time it is used.

Do It

Each test is defined by the **it** keyword and a **do ... end** block that contains the exercise and verify phases of the test. The **it** keyword must be accompanied by a description. The description will be displayed if the test fails.

For our first test, we want to check if the Visitor model can be created when we provide a valid email address. Before the test runs, the **let** statement makes sure the Visitor object is instantiated with an email value.

The verification phase of each test consists of a comparison between the results of an operation and our expectations. We expect that each time we create a Visitor object with a valid email address, the **visitor.valid?** method will return true. We can create a test:

```
it 'is valid when created with valid parameters' do
  assert_equal visitor.valid?, true
end
```

The keyword `assert_equal` is the old `test_unit` syntax. It compares the result of `visitor.valid?` with `true` and tells Minitest the test has passed or failed.

We can write the same thing using the new RSpec-style syntax:

```
it 'is valid when created with valid parameters' do
  visitor.must_be :valid?
end
```

The method `must_be` is an *expectation*. You can see a [Minitest cheat sheet](#) with a list of all the expectation methods. As you might guess, `must_be` functions as a comparison operator, checking if a call to `visitor.valid?` returns `true`.

For our second test, we want to make sure the Visitor object is invalid when no email address is provided:

```
it 'is invalid without an email' do
  # Delete email before visitor let is called
  visitor_params.delete :email
  visitor.wont_be :valid? # Must not be valid without email
  visitor.errors[:email].must_be :present? # Must have error for missing email
end
```

We created the `visitor_params` hash with a `let` statement. Before we invoke the Visitor object and call the `visitor.valid?` method, we delete the email address from the `visitor_params` hash. When the Visitor object is invoked, it will be created by the `let` statement without an email address. The `wont_be` expectation confirms that the result of `visitor.valid?` method is `false`. Then we check if a validation error message is present.

At this point, don't expect to be ready to write unit tests for every model method. You'll need to spend time with the [documentation for Minitest expectations](#) or the [Minitest cheat sheet](#) to become familiar with all the possible ways to write tests. This introduction should help you recognize the syntax of tests, understand the structure, and give you the background you need to learn more about unit testing.

Run Tests

Let's run our unit tests:

```
$ rake test
Run options: --seed 53300

# Running:

..

Finished in 0.028884s, 69.2425 runs/s, 103.8637 assertions/s.

2 runs, 3 assertions, 0 failures, 0 errors, 0 skips
```

The output shows that our tests pass.

Breaking the Test

Let's see what happens if we purposefully break our Visitor model. Modify the file **app/models/visitor.rb**:

```
class Visitor
  include ActiveRecord::Model
  attr_accessor :email, :string
  # validates_presence_of :email
  # validates_format_of :email, with: /\A[-a-z0-9_+\.]+\@([[-a-z0-9]+\.)+[a-z0-9]{2,4}\z/i

  def subscribe
    mailchimp = Gibbon::Request.new(api_key: Rails.application.secrets.mailchimp_api_key)
    list_id = Rails.application.secrets.mailchimp_list_id
    result = mailchimp.lists(list_id).members.create(
      body: {
        email_address: self.email,
        status: 'subscribed'
      })
    Rails.logger.info("Subscribed #{self.email} to MailChimp") if result
  end
end
```

When you copy this, be careful to keep the long regex expression (`/^A...\Z/i`) on one line (no line breaks).

We've commented out the statements that require validation for the email attribute. Let's run the tests again:

```
$ rake test
Run options: --seed 34847

# Running:

.F

Finished in 0.013429s, 148.9314 runs/s, 148.9314 assertions/s.

  1) Failure:
Visitor#test_0002_is invalid without an email [/Users/danielkehoe/workspace/wip/learn-rails/test/models/visitor_test.rb:14:in `test_0002_is invalid without an email']
Expected # to not be valid?.

2 runs, 2 assertions, 1 failures, 0 errors, 0 skips
```

The output shows a failure. The diagnostic message displays the description of the failing test, “Visitor#test_0002_is invalid without an email”, and indicates the line number where the test failed. Now you know what a failing test looks like.

Before you continue, restore the file **app/models/visitor.rb** to its original state, and make sure the tests pass.

If you wish, you can continue writing unit tests. You could create a similar unit test for the Contact model. With more experience, or some independent research, you could create a test for the **subscribe** method in the Visitor model. This method connects to an external API, so it requires test doubles to fake the response of the external services. Our goal here is to introduce you to the concepts of testing, so we'll put aside advanced work on unit tests, and take a look at feature tests.

Feature Test

Let's start with a user story for our home page. It might seem trivial to call the home page a “feature” and describe it with a user story, but it illustrates a process that works just as well with more complex features. Here's our user story:

```
*Feature: Home page*  
  As a visitor  
  I want to visit a home page  
  And see a welcome message
```

For our test, we know we want to visit the home page and check if the words “Stay in touch” appear on the page. This is the scenario we'll test:

```
*Scenario: Visit the home page*  
  Given I am a visitor  
  When I visit the home page  
  Then I see "Stay in touch"
```

If you think of your application as a collection of features, and you describe each feature in terms of “As a (role), I want (goal), In order to (benefit),” and then imagine scenarios for each feature using the “Given..., When..., Then...” formula, you'll be able to write automated tests to cover every feature in the application. Let's try it for the home page.

Examine the folders within the **test/** directory. Remember that feature tests are also called integration tests. You'll see a folder **test/integration/**. That's where we'll add our feature tests.

Create a file **test/integration/home_page_test.rb**:

```
require 'test_helper'  
  
# Feature: Home page  
#   As a visitor
```

```
# I want to visit a home page
# So I can learn more about the website
feature 'Home page' do

  # Scenario: Visit the home page
  # Given I am a visitor
  # When I visit the home page
  # Then I see "Welcome"
  scenario 'visit the home page' do
    visit root_path
    page.must_have_content 'Stay in touch'
  end
end
```

I've included the user story and scenario description in comments. There's no convention to do so, but it will help you to see the relationship between testing and the product planning process. It should be easy to transform a "Given... When... Then..." scenario into the code needed for a feature test.

Feature

When we created a unit test, we used the **describe** keyword to create a test class. The **feature** keyword creates a test class that inherits from the **Capybara::Rails::TestCase** class, giving us methods such as **visit** and **page**.

Feature tests are created with a **do ... end** block using the **feature** keyword and providing a description of the feature:

```
feature 'Home page' do
  .
  .
  .
end
```

Notice that the description is placed in quotes. In this case, Minitest will automatically generate a class named **HomePageTest**.

Scenario

Typically we test a single feature with multiple scenarios in a single test file.

The **scenario** keyword is similar to the **it** keyword you’ve seen in unit tests. Each feature test is defined by the **scenario** keyword and a **do ... end** block that contains the visit and verify phases of the test. The **scenario** keyword must be accompanied by a description. The description will be displayed if the test fails.

```
scenario 'visit the home page' do
  visit root_path
  page.must_have_content 'Stay in touch'
end
```

The directive **visit** is a Capybara method that takes a URL or Rails route as an argument. You could specify either **visit '/'** or **visit root_path** to direct Capybara to retrieve the home page.

Capybara provides other *actions* in addition to **visit**. You can see the [documentation for Capybara actions](#) that include actions for filling in a form and clicking a button.

Capybara creates a **page** object for us as a response to the visit. The **page** object is a representation of the HTML file returned by the application. We can call the **must_have_content** method, testing if the string “Stay in touch” is present in the page.

Capybara gives us a collection of methods we can use to verify our expectations. The [documentation for Capybara expectations](#) provides an extensive collection of methods we can use to verify what’s on a web page. For example, **must_have_link** checks for a link. With Capybara expectations, you can check almost anything on a page. Combining Capybara actions and expectations allows you to build a powerful page-checking robot.

Run Tests

Let's run all our tests:

```
$ rake test
Run options: --seed 15723

# Running:

...

Finished in 0.165429s, 18.1347 runs/s, 24.1796 assertions/s.

3 runs, 4 assertions, 0 failures, 0 errors, 0 skips
```

We have three tests (in two test files) making four assertions, all passing.

Troubleshooting

You might get an error message:

```
rake aborted!
NoMethodError: undefined method `feature' for main:Object
```

You'll see this error message if you neglected to modify the **test/test_helper.rb** file to allow use of the Capybara test framework methods.

Breaking the Test

Let's see what happens if we purposefully break our home page. Modify the file **app/view/visitors/new.html.erb**:

```
<% content_for :title do %>Foobar Kadigan<% end %>
<% content_for :description do %>Website of Foobar Kadigan<% end %>

GO AWAY!

<%= simple_form_for @visitor do |f| %>
  <%= f.error_notification %>
  <%= f.input :email, label: false, :placeholder => 'Your email address...' %>

  <%= f.button :submit, "Sign up for the newsletter", :class => "submit" %>
<% end %>
```

We’ve changed the welcome message from “Stay in touch” to “GO AWAY!”.

Let’s run the tests again:

```
$ rake test
Run options: --seed 49810

# Running:

..F

Finished in 0.168208s, 17.8351 runs/s, 23.7801 assertions/s.

  1) Failure:
Home page Feature Test#test_0001_visit the home page [/Users/danielkehoe/workspace/wip/learn-ra
Expected to include "Stay in touch".

3 runs, 4 assertions, 1 failures, 0 errors, 0 skips
```

The output shows a failure. The diagnostic message displays the description of the failing test, “Home page Feature Test#test_0001_visit the home page”, showing a failure, “Expected to include ‘Stay in touch’.”

Before you continue, restore the file **app/view/visitors/new.html.erb** to its original state, and make sure the tests pass.

Using Capybara

There is an art to developing feature tests. You can test that all the text on the home page is exactly what you want. That would make your test files large. And your tests would be “brittle,” because any changes you made in development, even the slightest changes to the words on the page, would break your tests. For good integration tests, focus on the features that are essential to your application. For example, use the Capybara robot to make sure the user can follow a critical path through your application, visiting important pages, filling in forms, clicking buttons, and seeing results. Capybara lets you select any HTML element on a page, so you can check an ID or class attribute of an HTML tag, not just text on a page. You’ll want to be confident that application navigation and page flow continues to work after any code changes. That will serve you better than tests that tell you a word changed here or there.

Other Tests

The art of testing lies in making good choices about what to test. It’s common to write feature tests because they will test the entire application from the viewpoint of the user. It is also common to write unit tests for models because models contain much of the uniqueness of an application.

Every other aspect of a Rails application can be tested, including controllers, helpers, and views. Developers seldom write tests for every aspect of a Rails application. If your controllers contain only the standard RESTful actions, with no extra logic, you probably don’t need to write unit tests for your controllers. If you only have simple HTML markup in helpers, helpers don’t need to be tested. And views are rarely tested with unit tests (use feature tests if you want to make sure a page contains what you expect). As a beginner, you’ll make a good start if you concentrate on unit tests for models and integration tests for your page flow.

Behavior-Driven Development

In the “Plan Your Product” chapter, you learned about the software development approach called Behavior-Driven Development (BDD), or sometimes, Behavior-Driven Design. In writing the feature tests for the home page, you saw it in action. With BDD, you turn user stories into detailed scenarios that are accompanied by tests. BDD is a powerful approach for managing software development. It helps you define your product requirements, refine your project scope, and divide your project into well-defined tasks. The BDD process is complete when each feature has automated tests, when you enter **rake test** on the command line and see that every feature is implemented and functioning as expected.

You may feel lost or overwhelmed when you attempt to build a Rails application for the first time, especially if your only experience is following the step-by-step instructions of a tutorial. When you experience that panic, BDD is your lifeline. Start by writing user stories for a few simple features. Write feature tests and implement the code required to make the tests pass. As you focus on the process of writing scenarios and tests, and implementing the code for each feature, you’ll begin to gain momentum, and before you know it, you’ll be over the first hurdle.

Test-Driven Development

You can see how the BDD approach refines the product requirements and user experience. At a microscopic level, a similar discipline, named *test-driven development*, helps refine the implementation. Where BDD is driven by feature tests, TDD is focused on unit tests.

TDD is an approach to software development that emphasizes that all code should be written to be tested. Excellent test coverage, allowing easy refactoring, is not the only goal of TDD. Just as important, the developer focuses on what needs to be accomplished and thinks through alternatives and edge cases.

Some TDD aficionados say testing is a tool to write better code, and regression tests are a side effect. Unit tests are at the heart of TDD, and easiest to write when code is carefully decoupled into systems that can be tested in isolation. An application that is composed of decoupled units with clearly defined interfaces is a well-designed application that is easy to extend and maintain. If you make it a practice to write unit tests in conjunction with all the code you write, you'll write better code, and you'll be practicing TDD.

Test-First Development

Often when you are practicing TDD, you'll write tests before you write implementation code. Earlier in this chapter, I referred to *test-first development* and explained that it serves a different purpose than testing for quality assurance. In some situations, test-first development is simply exploratory testing, a means of describing the behavior of the code that must be built. Test-first development is particularly useful when you've solved a similar problem and know exactly what results to expect, making it easy to write tests before writing the implementation.

Test-first development leads to a “red-green-refactor” workflow. A developer imagines the results of an operation, writes a test that checks for the results, and runs tests which fail (with the right configuration, failing tests display as red in the console). Then the developer writes code that produces the correct results and runs the tests again, improving the code until the tests pass (displaying in green). At this point, the developer has an adequate regression test and can begin to refactor to improve the implementation, checking that the tests continue to pass. Developers like the rhythm and coherency of the “red-green-refactor” workflow. Writing tests creates discrete, manageable tasks. When tests pass, turning green, there is a feeling of satisfaction, of a job well-done. By postponing concerns about improving the code to a refactoring phase, it's easier to get the job done without trying to get it perfect. And perfection can be pursued in the refactoring phase without worrying about regressing to a broken state.

David Heinemeier Hansson, the creator of Rails, famously declared that ““TDD is dead. Long live testing.”: <http://david.heinemeierhansson.com/2014/tdd-is-dead-long-live-testing.html>” He pointed out that sometimes ardent advocates of TDD will try out an implementation before writing tests, to determine what needs to be done, or to clarify a problem. In the real world, even though developers recommend writing tests first, there are often times when a developer will write tests only after writing code and settling on an approach. TDD, which emphasizes the benefit of writing tests as a first step, doesn’t really require that you write tests before you write code, or even that you write tests for all code. The test-first emphasis of TDD is a recommendation, not a rule. You’ll be a better developer if you find opportunities to get “in the zone” with the red-green-refactor workflow of test-first development, but testing is worthwhile whether it comes first or last.

Words of Encouragement

Testing often intimidates the newcomer. It is difficult to find good examples. The syntax of Minitest and RSpec has evolved over time, so there is little consistency among examples you’ll find. Older examples are not a good guide to current practices. But once you gain familiarity with the concepts in this chapter, you can start writing tests.

Testing is one of the few things in Rails that you can jump into without getting just right. You can’t screw up your code base by writing incorrect tests. Experienced developers seem to worry that inexperienced developers will write slow tests, but in truth, a slow test is better than no test. Tests won’t affect the performance of your application in production.

If your code is clumsy, don’t worry, you’ll get better with practice. What’s most important is that you’ve begun writing tests. That’s an indication you are committed to Rails best practices.

Your tests are only “bad” if they don’t cover your code adequately or if they give you a false sense of assurance. You will only discover this over time, as

you find bugs you didn't anticipate (which is inevitable). It's better to just begin testing, even if you're not sure you're doing it right, than to not test at all.

Chapter 24

Rails Composer

I’m going to show you how to skip all the work you already did, and build a ready-to-use Rails application in less than five minutes. When you’re done with this chapter, you may wonder why you read the rest of the book.

This chapter is about [Rails Composer](#), a tool for building starter applications. Rails Composer makes building applications so easy, it feels like a guilty pleasure.

In the introductory “Create the Application” chapter, you learned that developers often use a starter application instead of assembling an application from scratch. You’ve seen how the `rails new` command gives you a rudimentary starter application. Developers typically add a front-end framework, a testing framework, and a handful of favorite gems before they get started on any custom development. Since most applications start with the same basic components, it makes sense to rely on an open source effort to stitch them together, so any integration issues or update problems are quickly resolved by the community. That’s the idea behind the [RailsApps project](#). The project provides a collection of starter applications, plus Rails Composer, a tool that creates the starter applications.

I’ve been leading the RailsApps project for several years because I think the project is very important. I may be biased, so take a look and judge for yourself.

Build ‘Learn Rails’ in Less Than Five Minutes

In less than five minutes, we can build our tutorial application using Rails Composer. It will be identical to the application you’ve built, but we’ll call it “foobar-kadigan.” It’s a new application, so if you’re still in the **workspace/learn-rails/** project directory, move up a level to the **workspace/** project directory:

```
$ cd ../  
$ pwd  
/Users/danielkehoe/workspace
```

Or jump to it directly, if it’s one level below your home directory:

```
$ cd ~/workspace  
$ pwd  
/Users/danielkehoe/workspace
```

Use the “learn-rails” gemset we created earlier:

```
$ rvm use ruby-2.3.0@learn-rails
```

Now create the “foobar-kadigan” application:

```
$ rails new foobar-kadigan -m https://raw.githubusercontent.com/RailsApps/rails-composer/master/composer.r
```

We’re using the **rails new** command and designating “foobar-kadigan” as the name for the application. The **-m** flag applies an *application template*, which is a script that generates an application. The application template can be on your local computer, or retrieved from a remote server. Rails Composer is an application template that is stored on GitHub. When you run the **rails new** command as shown above, a new Rails application is built and then modified by the Rails Composer script.

Here’s the first prompt you’ll see:

```
option  Build a starter application?
      1)  Build a RailsApps example application
      2)  Contributed applications
      3)  Custom application
choose  Enter your selection:
```

Options #2 and #3 are not for beginners. We’ll skip any contributed applications. And the “Custom application” option is strictly for experts. Enter **1** to select “Build a RailsApps example application.” You’ll see a list of available starter applications:

```
option  Choose a starter application.
      1)  learn-rails
      2)  rails-bootstrap
      3)  rails-foundation
      4)  rails-mailinglist-activejob
      5)  rails-omniauth
      6)  rails-devise
      7)  rails-devise-roles
      8)  rails-devise-pundit
      9)  rails-signup-download
     10)  rails-stripe-checkout
     11)  rails-stripe-coupons
choose  Enter your selection:
```

We’ll explore the list later. For now, enter **1** to select “learn-rails”.

```
option  Build a starter application?
      1)  Build a RailsApps example application
      2)  Contributed applications
      3)  Custom application
choose  Enter your selection:
```

Here’s your chance to get news and announcements about Rails Composer:

```
      Get on the mailing list for Rails Composer news?
option  Enter your email address:
```

Either enter your email address (if you want news) or press “return” to skip it (if you’re shy).

You’ll be asked:

```
option Use or create a project-specific rvm gemset? (y/n)
```

Enter “y” or “yes” since you are using RVM. Rails Composer will create a new gemset named “foobar-kadigan.” In less than the time it took me to write this sentence, you’ll have a new Rails application. Look for it in your folder:

```
$ ls -l
foobar-kadigan
learn-rails
```

You’ve just created a new application named “foobar-kadigan” that is almost identical to the “learn-rails” application you created from scratch. If you have a file compare tool on your computer, you can compare the folders and see that the only differences are the application name embedded in the application, plus a few configuration settings such as the secret keys in the **config/secrets.yml** file.

Try running the application.

```
$ cd foobar-kadigan
$ rails server
=> Booting WEBrick
.
.
.
```

As soon as you move into the **foobar-kadigan/** folder, RVM will automatically begin using the gemset named “foobar-kadigan.” That’s because Rails Composer created hidden **.ruby-gemset** and **.ruby-version** files.

Open a web browser window and navigate to <http://localhost:3000/>. Try it out. You'll see our new home page with the placeholder photo and the “sign up” form.

The application will be almost identical to the one you already built. Compare the project files side-by-side in your editor. The files will be nearly identical. In fact, if you made mistakes when you built the tutorial application, Rails Composer will give you the newest and most correct version of the application so you can check for your mistakes with a file compare tool.

You are probably already aware that a perfect version of the tutorial application is already on GitHub, in the [learn-rails GitHub repository](#). You could use `git clone` to get a copy to use as a starter application. The version generated by Rails Composer differs in one important respect. Rails Composer generates the application with any name you give it, so there's no need to search and change every use of the name in the application.

I hope you're not irritated that I asked you to spend hours building the “learn-rails” application, and then showed you how to build the same application in less than five minutes. I promise you the time you spent with the book is worthwhile, because you've gained a knowledge of Rails you can't get from using Rails Composer.

A Collection of Starter Applications

Since you've already built the “learn-rails” application, the identical “foobar-kadigan” application may not be interesting. Let's look at the other applications you can generate with Rails Composer.

Rails Bootstrap

The “rails-bootstrap” application provides an integration of Rails and [Bootstrap](#), the popular front-end framework. You'll recall that Bootstrap and Foun-

dation are very similar. This application gives you everything you built in this book’s chapters on “Layout and Views” and “Front-End Framework,” including flash messages and navigation, set up for Bootstrap.

You can examine the example application on GitHub, in the [rails-bootstrap](#) repository.

You can read the [Bootstrap Quickstart Guide](#) to understand the code.

Rails Foundation

The “rails-foundation” application is just like the “rails-bootstrap” application, only with [Foundation](#) instead of Bootstrap. It’s a stripped-down version of the “learn-rails” application you just built, without the contact form or mailing list sign-up. If you want to build a custom application, starting with nothing more than Foundation and an “about” page, generate the “rails-foundation” application.

You can examine the example application on GitHub, in the [rails-foundation](#) repository.

I’ve written a [Foundation Quickstart Guide](#), but it’s nearly identical to what you’ve already read in this book.

Rails Mailing List with Active Job

Rails 4.2 includes the [Active Job](#) feature for background processing. The [Mailing List with Active Job](#) tutorial explains how to use it. You can use Rails Composer to generate the [rails-mailinglist-activejob](#) starter application.

For a production website, it is smart to use Active Job for better website performance for users.

Rails OmniAuth

[OmniAuth](#) is a gem for authentication. Most web applications need a way for users to sign in, allowing access to some features of the application only for signed-in users. OmniAuth allows a user to sign in using an account they already have with a service such as Facebook, Twitter, or GitHub. If you're building an application that needs quick and easy sign-in, this is a useful starter application.

You can examine the example application on GitHub, in the [rails-omniauth](#) repository.

You can read the [OmniAuth Tutorial](#) to learn about authentication with OmniAuth.

Rails Devise

[Devise](#) is the most popular gem for authentication. Devise provides user management and authentication, letting a user sign up to create an account and log in with an email address and password. Most websites need email/password authentication, so this is a popular starter application.

You can examine the example application on GitHub, in the [rails-devise](#) repository.

You can read the [Devise Quickstart Guide](#) to learn about user management and authentication with Devise.

Rails Devise Roles

Devise is a popular gem for *authentication*, verifying a user's registered identity. In conjunction with authentication, *authorization* limits access to pages of a web application. With role-based authorization, a user can be assigned a role such as “user,” “admin,” or “VIP” (a “very important person”). If you want

to control access to features of the website by checking a user’s role, this is a useful starter application.

You can examine the example application on GitHub, in the [rails-devise-roles](#) repository.

You can read the [Rails Authorization Tutorial](#) to learn about authorization.

Rails Devise Pundit

To keep controllers skinny, Rails developers often use the [Pundit](#) gem for authorization. It improves upon simple role-based authorization to move access control code from controllers to separate “policy objects.” For complex applications with elegant architecture, use the “rails-devise-pundit” starter application.

You can examine the example application on GitHub, in the [rails-devise-pundit](#) repository.

You can read the [Pundit Quickstart Guide](#) to learn about authorization with Pundit.

Other Starter Applications

Recent additions to the Rails Composer collection include:

- [rails-signup-download](#)
- [rails-stripe-checkout](#)
- [rails-stripe-coupons](#)

You can use the [rails-signup-download](#) application to build a website where a user can download a PDF file after registering with an email address. Using

the code in the [Signup and Download Tutorial](#), you could customize the “learn-rails” application so visitors could download an ebook by Foobar Kadigan after they sign up for his newsletter.

[Stripe](#) is a popular service used to accept credit card payments. Stripe offers two approaches to implementing payment processing. Stripe Checkout is Stripe’s entry-level approach. Stripe Checkout competes with the button-based payment options from Google, PayPal, or Amazon, adding a pop-up payment form to any web page. Stripe Checkout is very limited because the pop-up payment form cannot be customized for use with a Rails application. Our [Stripe Checkout Tutorial](#) shows how to combine Stripe Checkout with Devise for simple applications.

[Stripe.js](#) is optimal for use with a Rails application, allowing full customization of a payment form and integration with Rails form processing. The [rails-stripe-coupons](#) application implements a payment feature using Stripe JS so a visitor pays to download a PDF file. The application accommodates promotional coupons and adds payment forms to landing pages, for real-world payment processing. Our [Stripe JS With Coupons](#) tutorial provides the details.

Rails Composer Options

If all Rails Composer did was copy example applications from GitHub repos, it would be convenient but not very interesting. When you built the “foobar-kadigan” application with Rails Composer, it simply built a replica of our tutorial application. When you build the other starter application, the options get more interesting. Rails Composer lets developers customize their starter applications for their favorite stack (we discussed stacks in the “Concepts” chapter in Book One).

Let’s see what options we get when we build the powerful [rails-devise-roles](#) starter application.

Jump to your **workspace/** folder so we can create a new application:

```
$ cd ~/workspace
$ pwd
/Users/danielkehoe/workspace
```

It’s okay to start with the “learn-rails” gemset. We have to start with a gemset that already has the Rails gem installed. After that, Rails Composer will create a new gemset for the new project.

```
$ rvm use ruby-2.3.0@learn-rails
```

Now generate the “rails-devise-roles” starter application:

```
$ rails new rails-devise-roles -m https://raw.github.com/RailsApps/rails-composer/master/compos
```

Don’t worry if some of the prompts are different from the ones I describe here. Rails Composer changes often. At the time I wrote this, I saw:

```
option  Build a starter application?
        1) Build a RailsApps example application
        2) Contributed applications
        3) Custom application
choose  Enter your selection:
```

Enter **1** to select “Build a RailsApps example application.”

```
option  Choose a starter application.
        1) learn-rails
        2) rails-bootstrap
        3) rails-foundation
        4) rails-mailinglist-activejob
        5) rails-omniauth
        6) rails-devise
        7) rails-devise-roles
        8) rails-devise-pundit
        9) rails-signup-download
       10) rails-stripe-checkout
       11) rails-stripe-coupons
choose  Enter your selection:
```

Select “rails-devise-roles” (it was #7 when I wrote this, but the list may have changed).

```
      Get on the mailing list for Rails Composer news?
option  Enter your email address:
```

Another chance to get on the mailing list. Just hit “return” if you already signed up.

```
option  Web server for development?
      1) WEBrick (default)
      2) Thin
      3) Unicorn
      4) Puma
      5) Phusion Passenger (Apache/Nginx)
      6) Phusion Passenger (Standalone)
choose  Enter your selection:
```

Our first option! We’ve always used WEBrick since it is the easiest to use for development. Choose “WEBrick” to keep things familiar.

```
option  Web server for production?
      1) Same as development
      2) Thin
      3) Unicorn
      4) Puma
      5) Phusion Passenger (Apache/Nginx)
      6) Phusion Passenger (Standalone)
choose  Enter your selection:
```

We could get fancy for deployment (for example, Heroku recommends Unicorn). Choose “Same as development” to stay in our comfort zone.

```
option  Database used in development?
      1) SQLite
      2) PostgreSQL
      3) MySQL
choose  Enter your selection:
```

We haven't explored applications that use databases in this book, but Devise and role-based authorization require saving a User model to a database. Choose "SQLite," which is built-in and ready to run in the Mac or Ubuntu environments. Developers prefer PostgreSQL for production applications, but it takes extra effort to set up, so we'll stick with SQLite for now.

```
option  Template engine?
  1)  ERB
  2)  Haml
  3)  Slim
choose  Enter your selection:
```

In this book, all our view templates were written using the ERB template language. In the "Concepts" chapter in Book One, you learned that components of Rails can be mixed for different stacks. Some developers substitute [Haml](#) or [Slim](#) for ERB. I've written an article on [Haml and Rails](#) if you'd like to know more. Choose "ERB" for now.

```
option  Test framework?
  1)  None
  2)  RSpec with Capybara
choose  Enter your selection:
```

You've had an introduction to testing with Minitest in the "Testing" chapter of this book. [RSpec](#) is popular among many developers, so Rails Composer offers an "RSpec with Capybara" option. Rails Composer will install a test suite for the [rails-devise-roles](#) application when RSpec is selected. If you are a RailsApps subscriber, you can read the [RSpec Quickstart Guide](#) to get started. Otherwise, choose "none."

```
option  Front-end framework?
  1)  None
  2)  Bootstrap 3.3
  3)  Bootstrap 2.3
  4)  Zurb Foundation 5.0
  5)  Zurb Foundation 4.0
  6)  Simple CSS
choose  Enter your selection:
```

You learned to use Foundation in this book, but maybe you'd like to see Bootstrap? Let's try it out. Choose "Bootstrap 3.3."

```
option  Add support for sending email?
  1)  None
  2)  Gmail
  3)  SMTP
  4)  SendGrid
  5)  Mandrill
choose  Enter your selection:
```

Devise will need to send email for its "forgot password" feature. Configuring email took some time for our tutorial application. Rails Composer will instantly set up everything we need to send email using our choice of services. Choose "Gmail" for now.

```
option  Devise modules?
  1)  Devise with default modules
  2)  Devise with Confirmable module
  3)  Devise with Confirmable and Invitable modules
choose  Enter your selection:
```

Choose "Devise with default modules." Devise has options, like a Confirmable module that requires users to click a link in an email message to confirm a new account. The Invitable module provides a feature that allows administrators or other users to invite users to establish accounts. We won't need these extra features.

```
option  Admin interface for database?
  1)  None
  2)  Upmin
choose  Enter your selection:
```

[Upmin](#) adds an administrative interface to a database application. Choose "None" for now.

```
option  Use a form builder gem?  
  1)  None  
  2)  SimpleForm  
choose  Enter your selection:
```

In this book, we used the [SimpleForm](#) gem to make it easy to build forms. Let's add it to the starter application by selecting "SimpleForm."

```
option  Install page-view analytics?  
  1)  None  
  2)  Google Analytics  
  3)  Segment.io  
choose  Enter your selection:
```

In our "Analytics" chapter, I said every application needs a way to analyze traffic. Let's choose "Segment.io" since we learned about it already.

```
option  Segment.io API key?
```

You can enter your Segment.io API key here, if you know it. Otherwise, hit return and you'll get a placeholder you can replace later.

```
option  Prepare for deployment?  
  1)  no  
  2)  Heroku  
  3)  Capistrano  
choose  Enter your selection:
```

This option sets up your starter application for deployment to Heroku. Choose "no" for now.

```
option  Set a robots.txt file to ban spiders? (y/n)
```

In the “Deploy” chapter you learned that you can leave your website out of Google search results with the **robots.txt** file. Let’s answer “y” or “yes” and play it safe.

```
option  Create a GitHub repository? (y/n)
```

Rails Composer will create a GitHub repository for your starter application if your credentials are set up correctly. Let’s play it safe and answer “n” or “no” to skip the repository option.

```
option  Use or create a project-specific rvm gemset? (y/n)
```

We’ve seen this option before. We’ve been using RVM in this book, so let’s answer “y” or “yes” and have Rails Composer create a “rails-devise-roles” gemset.

Rails Composer has all the answers it needs. On my computer, with a fast Internet connection in the heart of San Francisco, Rails composer takes about thirty seconds to build the starter application. It installs every needed gem; sets configuration files; and generates views, models, controllers, and routes. The developers who maintain the Rails Composer project have worked out any tricky integration issues so you can expect the starter application to work without any problems.

Try It Out

You’ve added a new application to your collection of projects:

```
$ ls -l
foobar-kadigan
learn-rails
rails-devise-roles
```


Let's examine the application.

```
$ cd rails-devise-roles
$ git log --oneline
277ff62 rails_apps_composer: extras
ee761e0 rails_apps_composer: navigation links
7a9f39c rails_apps_composer: set up database
79cc5c9 rails_apps_composer: add README files
35e16cf rails_apps_composer: add analytics
5327024 rails_apps_composer: add pages
f576801 rails_apps_composer: front-end framework
80fdad5 rails_apps_composer: add roles to a User model
e416dd5 rails_apps_composer: devise
e2d4d58 rails_apps_composer: set email accounts
7fa18b9 rails_apps_composer: generators
e56ace2 rails_apps_composer: create database
a538589 rails_apps_composer: Gemfile
6f2d741 rails_apps_composer: initial commit
```

When you move into the **rails-devise-roles/** folder, RVM will automatically begin using the gemset named “rails-devise-roles” because of the hidden **.ruby-gemset** and **.ruby-version** files.

Rails Composer set up a Git repository and committed files as it built the application. We can see a list of Git commits with the **git log -oneline** command.

Let's try running the application:

```
$ rails server
=> Booting WEBrick
.
.
.
```

Open a web browser window and navigate to <http://localhost:3000/>. You'll see a navigation bar with “Sign in” and “Sign up” links that implement an authentication feature using Devise.

The home page shows one user is already registered. Click the “Users” link and you'll see a message “You need to sign in or sign up before continuing.” Sign

in with the email address “user@example.com” and the password “changeme”. You’ll see a list of users (just one initially). The first user (created by Rails Composer) is automatically assigned administrator privileges. You’ll see a link to the Users page in the navigation bar that is only seen by administrators.

Sign out and sign up to create a new account with your own email address and password. You’ll see a message “Welcome! You have signed up successfully.” Click the “Users” link and you’ll see a message “Access denied.” Your new account is an ordinary user without administrator privileges, so you are not allowed to see the list of all users. Notice the navigation link “Edit account.” It displays a page for account management where you can change your name, email address, or password.

Sign out and sign in again with the administrative account “user@example.com” and the password “changeme”. Now you can view the list of users. You can change the role of any user.

You’ve got a useful starter application. Without Rails Composer, an experienced developer needs at least an hour or two to set up a similar starter application (and possibly more time if version updates have created integration issues).

Examine the application in your editor. Here’s where a starter application can be useful as a learning tool. Given what you’ve learned so far, what do recognize as familiar? Every Rails application shares a similar structure, so you will recognize files such as the Gemfile; and folders such as **app/models/**, **app/controllers/**, and **app/views/**. Explore the application. Try to guess the purpose of the unfamiliar files and code.

If you’re overwhelmed by unfamiliar files and code, try building one of the simpler starter applications, such as [rails-bootstrap](#) or [rails-devise](#). Every line of code is explained in the [Bootstrap Quickstart Guide](#), the [Devise Quickstart Guide](#), and the [Rails Authorization Tutorial](#) so there’s no mystery code.

As a beginner, you can use Rails Composer for two purposes. You can quickly build apps that are guaranteed to work and then pick them apart. A “breakable toy” can be a wonderful instrument for learning. Make an effort to understand

everything in the [RailsApps example applications](#) and you'll gain a solid understanding of the basic components used in real-world Rails projects. Secondly, start building custom applications based on the Rails Composer starter applications. By starting with Rails Composer, you'll skip the frustrating preliminaries of setting up a front-end framework, authentication, or authorization and jump right into implementing your ideas for new features. Rails Composer is often used at hackathons, where teams race to build interesting applications for a prize, to avoid the time sink of setting up a basic application.

A final word: Use Rails Composer judiciously. It's intended to be a tool for experienced developers who already know how to build starter applications from scratch using databases, front-end frameworks, authentication, or authorization, and all the bells and whistles offered in the Rails Composer options. Use it to pinpoint what you need to learn, or use it to turbocharge your learning process, but don't use it as a crutch to avoid learning the basics. To learn Rails, you must be able to build every starter application from scratch, without Rails Composer.

To learn more about Rails Composer, see the [Rails Composer](#) home page and the README for the [Rails Composer project](#) on GitHub.

Chapter 25

Version Notes

If you are reading the online edition of the book, you have the most recent version of the book. If you've gotten your copy of the book elsewhere, you may have an older version that doesn't have the newest updates.

You'll find the version number and release date on the first page of this book (under the book title). Check the [learn-rails GitHub repository](#) to find out if you have the newest version of the book. The README page on the GitHub repo always shows the most recent version number for the book and the tutorial application.

If you have trouble building the application in this book, and suspect something may be out of date, you can [check the Gemfile in the repo](#) to see if we've changed gems or specified version numbers to avoid compatibility issues. You can also check the [CHANGELOG](#), look at [recent commits](#), and [check the issues](#) to see the current state of the application.

Here are the changes I've made.

Version 3.0.0

Version 3.0.0 was released January 14, 2016

Extensive revision throughout the book, and the length of the book increased, so the book is now two books. Book One contains the introductory and self-help chapters and can be read without access to a computer. Book Two contains the step-by-step tutorial and requires use of a computer.

Switch to using the Mandrill service to send email. Previously used Gmail but Google has taken steps to make Gmail more secure and now it can be difficult to send email from a Rails application using Gmail.

Sending mail now requires the method `deliver_now` instead of `deliver`. The UserMailer class now inherits from `ApplicationMailer`.

Updated references to Rails from version 4.2.4 to 4.2.5.

Updated references to Ruby from version 2.2.3 to 2.3.0.

Version 2.2.2

Version 2.2.2 was released October 30, 2015

In the “Front-End Framework” chapter, updated filename to `1st_load_framework.css` from `framework_and_overrides.css.scss` to reflect a change in the rails_layout gem.

Version 2.2.1

Version 2.2.1 was released September 19, 2015

Updated references to Ruby from version 2.2.0 to 2.2.3.

Updated references to Rails from 4.2.0 to Rails 4.2.4.

Updated Visitor model `subscribe` method for the new Gibbon 2.0 API.

Recommending [Cloud9](#) instead of [Nitrous.io](#) because Nitrous.io is no longer free.

Version 2.2.0

Version 2.2.0 was released June 6, 2015

For Amazon customers, added an offer to access the online version or download a PDF at learn-rails.com.

Google now requires use of OAuth 2.0 for application access to Google Drive. The implementation is considerably more complex than the previous implementation using a Gmail address and password. I've dropped the "Spreadsheet Connection" chapter.

Minor clarification in the "Layout and Views" chapter.

Version 2.1.6

Version 2.1.6 was released March 17, 2015

Remove references to the Thin web server in the "Deploy" chapter.

Correct version number for `gem 'sass-rails'` in various Gemfile listings. Fixes [issue 49](#) and an error "Sass::SyntaxError - Invalid CSS" when the Foundation front-end framework is used.

In the "Testing" chapter, the file `test/integration/home_page_test.rb` was missing `require 'test_helper'`.

Updated "Rails Composer" chapter to describe new options.

Minor improvements and corrections of typos.

Version 2.1.5

Version 2.1.5 was released March 4, 2015

Use the Ruby 1.9 hash syntax in the `validates_format_of :email` statement.

Minor improvements and corrections of typos.

Version 2.1.4

Version 2.1.4 was released January 3, 2015

Updated references to Ruby from version 2.1.5 to 2.2.0.

Specify the “v0” version of the `google_drive` gem in the “Spreadsheet Connection” chapter.

Version 2.1.3

Version 2.1.3 was released December 25, 2014

Updated references to Rails 4.1.8 to Rails 4.2.0.

Version 2.1.2

Version 2.1.2 was released December 4, 2014

Released for sale as a Kindle book on Amazon, with new cover art (same cat, though).

RailsApps Tutorials now named the [Capstone Rails Tutorials](#).

Updated references to Ruby from version 2.1.3 to 2.1.5.

Updated references to Rails 4.1.6 to Rails 4.1.8 (minor releases with bug and security fixes).

Removed link to the (now defunct?) [Lowdown](#) web application in the “Plan Your Product” chapter.

Changes to the “Asynchronous Mailing” section of “Send Mail” chapter to describe Active Job in Rails 4.2.

Minor improvements to the “Dynamic Home Page,” “Deploy,” “Configure,” “Troubleshoot,” and “Create the Application” chapters.

Version 2.1.1

Version 2.1.1 was released October 22, 2014

Minor rewriting for clarity.

Updated “Precompile Assets” section of the “Deploy” chapter.

Mentioned [explainshell.com](#) in the “Get Started” chapter.

Mentioned [Zeal](#) as a Linux alternative to [Dash](#).

Recommended book [Practicing Rails](#) by Justin Weiss.

Version 2.1.0

Version 2.1.0 was released October 12, 2014

Updated references to Ruby from version 2.1.1 to 2.1.3.

Updated references to Rails 4.1.1 to Rails 4.1.6 (minor releases with bug and security fixes).

Four new chapters:

- “Testing”
- “Rails Composer”

- “Crossing the Chasm”
- “Level Up”

Use `ActiveModel` instead of the [activerecord-tableless](#) gem.

In the “Configuration” chapter, add a note to use spaces (not tabs) in the **config/secrets.yml** file.

Updated “Gems” chapter to add a troubleshooting note to the “Install the Gems” section (about errors with the Nokogiri gem).

Added a section on “Multiple Terminal Windows” to the “Create the Application” chapter.

In the “Get Help When You Need It” chapter, updated the list of recommended newsletters, replaced [rubypair.com](#) with [codermatch.me](#), and added a section on code review. Removed reference to defunct [Rails Development Directory](#).

Version 2.0.2

Version 2.0.2 was released May 6, 2014

Updated references to Rails 4.1.0 to Rails 4.1.1 (a minor release with a security fix).

For Nitrous.io users, clarify that “[http://localhost:3000/](#)” means the Preview browser window.

Update “Gems” chapter, section “Where Do Gems Live?” to add more explanation.

Minor change to code in the “Mailing List” chapter, setting ‘`mailchimp_api_key`’ explicitly when instantiating `Gibbon`, for easier troubleshooting.

Version 2.0.1

Version 2.0.1 was released April 16, 2014

Minor updates for Rails 4.1.0. Mostly small changes to the “Configure” and “Front-End Framework” chapters.

Added an explanation that, in the **config/secrets.yml** file, **domain_name** doesn’t have to be kept secret and set as a Unix environment variable.

Added a hint about passwords that use punctuation marks (plus a completely irrelevant note about profanity).

Replaced **Rails.application.secrets.gmail_username** with **Rails.application.credentials[:gmail_username]**. Also replaced **gmail_password** with **email_provider_password**. Just trying to make things a little more generic in case Gmail is not used as a provider.

Added a section explaining the horrid details of the **config.assets.precompile** configuration setting in the **config/application.rb** file. Please convey my displeasure to those responsible for subjecting beginners to this travesty.

In the “Deploy” chapter, restored **RAILS_ENV=production rake assets:precompile** because Rails 4.1.0 no longer barfs on this.

Added resources to the “Get Help When You Need It” chapter.

Minor rewriting of the introduction.

Version 2.0.0

Version 2.0.0 was released April 8, 2014

Updated references to Ruby from version 2.1.0 to 2.1.1.

Updated the book to Rails 4.1. The application name is no longer used in the **config/routes.rb** file.

Rails 4.1 changes the **app/assets/stylesheets/application.css.scss** file. Updated the “Front-End Framework” chapter. Also expanded the explanation of the Foundation grid.

In Rails 4.1, configuration variables are set in the **config/secrets.yml** file. The Figaro gem is dropped, along with the **config/application.yml** file. Updated the “Configure” chapter and references to configuration variables throughout the book.

In the “Deploy” chapter, changed **RAILS_ENV=production rake assets:precompile** to **rake assets:precompile** to avoid the error “database configuration does not specify adapter.”

Updated “The Parking Structure” chapter with comments about “Folders of Future Importance” that experienced developers often use: **test/**, **spec/**, **features/**, **policies/**, and **services/**. Updated the “Spreadsheet Connection” chapter to mention service-oriented architectures (SOA).

Extended the section on “Limitations of Metaphors” in the “Just Enough Ruby” chapter to include the example of gender when modeling a person.

Minor rewriting for clarity throughout.

Version 1.19

Version 1.19 was released February 1, 2014

Updated the book to use Foundation 5.0. Foundation 5.0.3 was released January 15, 2014 (earlier versions 5.0.1 and 5.0.2 were incompatible with Rails Turbolinks and the Rails asset pipeline). Changed the Gemfile to remove **gem 'compass-rails'** and replace **gem 'zurb-foundation'** with **gem 'foundation-rails'**. Updated a line in the “Front-End Framework” chapter for Foundation 5.0:

```
$ rails generate layout foundation5 --force
```

The files **navigation.html.erb** and **application.html.erb** are changed for Foundation 5.0. The Bootstrap front-end framework is now independent of Twitter, so I call it “Bootstrap” not “Twitter Bootstrap.” Revised the chapter “Just Enough Ruby” to incorporate suggestions from technical editor Pat Shaughnessy. Revised the chapter “Request and Response” to incorporate suggestions from technical editor Kirsten Jones. Minor rewriting for clarity throughout.

Version 1.18

Version 1.18 was released January 10, 2014

Updated references to Ruby from version 2.0.0 to 2.1.0. Changed one line in the “Front-End Framework” chapter to accommodate a change in the rails_layout gem version 1.0.1. The command was:

```
$ rails generate layout foundation4 --force
```

Changed to:

```
$ rails generate layout:install foundation4 --force
```

Updated the “Configure” chapter to add ActionMailer configuration values to the file **config/environments/development.rb**.

Version 1.17

Version 1.17 was released December 21, 2013

Updated Rails version from 4.0.1 to 4.0.2 .

Changed Gemfile to remove `gem 'compass-rails', '> 2.0.alpha.0'` and replace it with `gem 'compass-rails', '> 1.1.2'`. The 2.0.alpha.0 version was yanked from the RubyGems server. The compass-rails gem is needed for Foundation 4.3. It will not be needed for Foundation 5.0.

Changed Gemfile to replace `gem 'zurb-foundation'` with `gem 'zurb-foundation' '> 4.3.2'`. Foundation 5.0 will require `gem 'foundation-rails'` but we can't use it until an [incompatibility with Turbolinks](#) is resolved. So we will stick with Foundation 4.3.2 for now.

Revised code in the “Analytics” chapter. Using `ready page:change` instead of `page:load` to accommodate Turbolinks. Updated the `segmentio.js` file to use a new tracking script from Segment.io. Updated instructions for setting up Google Analytics tracking on Segment.io. Added concluding paragraphs “Making Mr. Kadigan Happy” to the “Analytics” chapter.

Minor clarification in the “Front-End Framework” chapter to explain that the navigation bar won't show a dropdown menu until the next chapter, when we add navigation links.

Minor clarification in the “Spreadsheet Connection” chapter to explain that Google may block access if you attempt access from a new and different computer (including Nitrous.io).

Added cat names in the “Credits and Comments” chapter.

Revised “Getting Help” chapter and added “Version Notes” chapter.

Minor clarifications, plus fixes for various typos and insignificant errors.

Chapter 26

Credits and Comments

Was the book useful to you? Follow [@rails_apps](#) on Twitter and tweet some praise. I'd love to know you were helped out by the tutorial.

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I'd love it if you mention the book online, whether it is a blog post, Twitter, Facebook, or online forums. Recommending the book with a link makes it easier for people to find the book.

Credits

The book was created with the encouragement, financial support, and editorial assistance of hundreds of people in the Rails community.

Daniel Kehoe wrote the book and implemented the application.

Financial Backers

The following individuals provided financial contributions of over \$50 to help launch the book. Please join me in thanking them for their encouragement and support.

Al Zimmerman, Alan W. Smith, Alberto A. Colón Viera, Andrew Terry, Avi Flombaum, Brian Hays, Charles Treece, Dave Doolin, Denzil Villarico, Derek Rockwell, Eito Katagiri, Evan Sparkman, Frank Castle, Fred Dixon, Fred Schoeneman, Gant Laborde, Gardner Monks, Gerard de Brieder, GoodWorksOnEarth.org, Hanspeter Leupin, Harald Lazardzig, Harsh Patel, James Bond, Jared Koumentis, Jason Landry, Jeff Whitmire, Jesse House, Joe Wilmoth Jr., John Shannon, Joost Baaij, Juan Cristobal Pazos, Kathleen Sidenblad, Laird Hayward, Logan Hasson, Ludovic Kutty, Mark Gilbert, Matt Esterly, Mike Gilbert, Niko Roberts, Norman Cohen, Paul Philippov, Robert Nadar, Rogier Hof, Ross Kinney, Ruben Calzadilla, Stephane Moreau, Susan Wilson, Sven Fuchs, Thomas Nitsche, Tom Michel, Youn Shin Kang, Yuen Lock

Technical Editors

Rails and Ruby experts are very busy. I am very grateful for the assistance I received from my colleagues for the technical review of individual chapters.

- [Kirsten Jones](#), reviewed the chapter “Request and Response”
- [Pat Shaughnessy](#), author of [Ruby Under a Microscope](#), reviewed the chapter “Just Enough Ruby”
- [Noel Rappin](#), author of [Rails Test Prescriptions](#), reviewed chapters 1-7, and the “Testing” chapter
- [Aaron Sumner](#), author of [Everyday Rails Testing with RSpec](#), reviewed the “Testing” chapter
- [Ken Collins](#) reviewed the “Testing” chapter

Buy their books. I recommend them.

Editors and Proofreaders

Dozens of volunteers offered corrections and made suggestions, from fixing typos to advice about organizing the chapters.

Alberto Dubois Ribó, Alex Finnarn, Alex Zielonko, Alexandru Muntean, Alexey Dotokin, Alexey Ershov, André Arko, Andreas Basurto, Ben Swee, Brandon Schabel, Cam Skene, Daniella Zimmermann, Dapo Babatunde, Dave Levine, Dave Mox, David Kim, Duany Dreyton Bezerra Sousa, Erik Trautman, Erin Nedza, Flavio Bordoni, Fritz Rodriguez Jr, Hendri Firmana, Ishan Shah, James Hamilton, Jasna Vukovic, Jeremy Schneider, Joanne Daudier, Joel Dezenzio, Jonah Ruiz, Jonathan Lai, Jonathan Miller, Jordan Stone, Joreal Whitfield, Josh Morrow, Joyce Hsu, Julia Mokus, Julie Hamwood, Jutta Frieden, Laura Pierson Wadden, Marc Ignacio, Mark D. Blackwell, Mark Everhart, Michael Wong, Miguel Herrera, Mike Janicki, Miran Omanovic, Neha Jain, Norman Cohen, Oana Sipos, Peter Rangelov, Richard Afolabi, Robin Paul, Roderick Silva, Sakib Ash, Sebastian Lobato Genco, Silvia Obajdin, Stas Sucov, Stefan Streichsbier, Sven Fuchs, Tam Eastley, Tim Goshinski, Timothy Jones, Tom Connolly, Tom Michel, Tomas Olivares, Verena Brodbeck, Will Schive, William Yorgan, Zachary Davy

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- photo of a white cat by [Tomi Tapio](#)
- photo of a cat by [Steve Garner](#)

- photo of a cat by [Ian Barbour](#)

The photo of a fluffy white cat by [Tomi Tapio](#) is used in the application.

Comments

I regularly update the book. Your comments and suggestions for improvements are welcome.

Feel free to email me directly at daniel@danielkehoe.com.

Are you stuck with code that won't work? [Stack Overflow](#) provides a question-and-answer forum for readers of this book. Use the tag “learn-ruby-on-rails” or “railsapps” when you post your question.

Found a bug in the tutorial application? Please create an [issue](#) on GitHub.