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Cucumber BDD How-to

A short and quick guide to mastering behavior-driven
software development with Cucumber

Wayne Ye

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software development with Cucumber

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Instant Cucumber BDD How-to

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Credits

Author

Wayne Ye

Project Coordinator

Joel Goveya

Reviewers

Ming Jin

Cui Liqiang

Proofreader

Maria Gould

Acquisition Editor

James Jones

Graphics

Ronak Dhruv

Commissioning Editor

Ameya Sawant

Production Coordinator

Arvindkumar Gupta

Technical Editor

Veronica Fernandes

Cover Work

Arvindkumar Gupta

Cover image

Aditi Gajjar

About the Author

Wayne Ye is a software developer, tech lead, and also a geek. He has immersed himself in software development for nearly 8 years, with an emphasis on C#/ASP.NET, Ruby on Rails, HTML5, JavaScript/jQuery, and nodejs. He is an expert in GOF Design Patterns, SOLID principles, MVC/MVVM, SOA, REST, and AOP. He strongly believes in and is a master of Agile, Scrum, and TDD/BDD, and hacks with Vim daily. He is a CodeProject MVP (2012) and a certified PMP. In his spare time, he writes tech/life blogs at WayneYe.com frequently, and spends some wonderful time with his dear wife and lovely son in Shanghai.

About the Reviewers

Ming Jin is a lead consultant at ThoughtWorks and chief editor at InfoQ. He has over 10 years of experience in the IT industry. He has worked on software for many companies from manufacturing ERP to online e-commerce. Besides that, he has also helped several large telecom and banking organizations adopt an agile and continuous delivery approach.

Meanwhile, he has translated several books into Chinese, including *Understanding Patterns of Project Behavior*, *ThoughtWorks Anthology*, and *The Productive Programmer*. He has also given many presentations about software and agile in the community and at conferences.

Cui Liqiang is a software engineer at ThoughtWorks. He has been working at ThoughtWorks since 2010.

For the past 3 years, he has mainly been focusing on enterprise application development using Java/RoR. He is also quite experienced in frontend technologies such as JS, CSS, Flex, and so on.

From 2013, he started to work on some embedded projects with C++.

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Preface

Instant Cucumber BDD How-to covers an overview of Cucumber as an exciting tool to write automated acceptance tests to support software development in **behavior-driven development (BDD)**. It elaborates the basics of TDD/BDD and explains the essence of Cucumber, describes how to write Cucumber features to drive development in a real project, and also depicts many pro tips for writing good Cucumber features and steps. Finally, it introduces some famous third-party libraries used inline with Cucumber.

What this book covers

Understanding behavior-driven development (Intermediate) introduces the concept of TDD and BDD, and explains the benefits of using BDD in software development.

Setting up an environment for Cucumber BDD on Rails (Intermediate) describes how to set up a Cucumber BDD environment based on Rails, and explains what Cucumber is and the typical process of using Cucumber in BDD.

Writing your first Hello World feature (Simple) provides an example for driving a simple "Hello World" feature using Cucumber.

Learning foundation knowledge and skills (Intermediate) explains the basic Cucumber knowledge for writing features and step definitions.

Building a real web application with Cucumber (Intermediate) shows how to use Cucumber to behaviorally drive a real Rails application.

Mastering pro tips for writing expressive Gherkin (Intermediate) introduces many useful and handy tips for writing Gherkin.

Mastering pro tips for writing good steps (Advanced) introduces many useful and handy tips for writing DRY and maintainable step definitions.

Using third-party libraries with Cucumber (Intermediate) introduces several great Ruby gems to support BDD using Cucumber better.

What you need for this book

You will need the following software to follow the recipes in this book:

- ▶ Ruby Version Manager (rvm)
- ▶ Ruby version 1.9.3
- ▶ Rails version 3.2
- ▶ The latest version of Cucumber
- ▶ A handy text editor (Vim or Sublime Text)

Who this book is for

This book is for the agile software development team that wants to adopt a behavior-driven process using Cucumber. It assumes that the team is passionate about reducing communication gaps between developers and product managers, ensuring that the development is always on the right track and always focuses on the minimum marketable value.

Conventions

In this book, you will find a number of styles of text that distinguish between different kinds of information. Here are some examples of these styles, and an explanation of their meaning.

Code words in text, database table names, folder names, filenames, file extensions, pathnames, dummy URLs, user input, and Twitter handles are shown as follows: "By running this, Cucumber will initialize a folder called `features` into your Rails project."

A block of code is set as follows:

```
Feature: Write blog
As a blog owner
I can write new blog post
  Scenario: Write blog
    Given I am on the blog homepage
    When I click "New Post" link
    And I fill "My first blog" as Title
    And I fill "Test content" as content
    And I click "Post" button
    Then I should see the blog I just posted
```

Any command-line input or output is written as follows:

```
$ \curl -L https://get.rvm.io | bash -s stable --ruby f
```

New terms and **important words** are shown in bold. Words that you see on the screen, in menus or dialog boxes for example, appear in the text like this: "And then after clicking on the **Go** button, we will see the search result."



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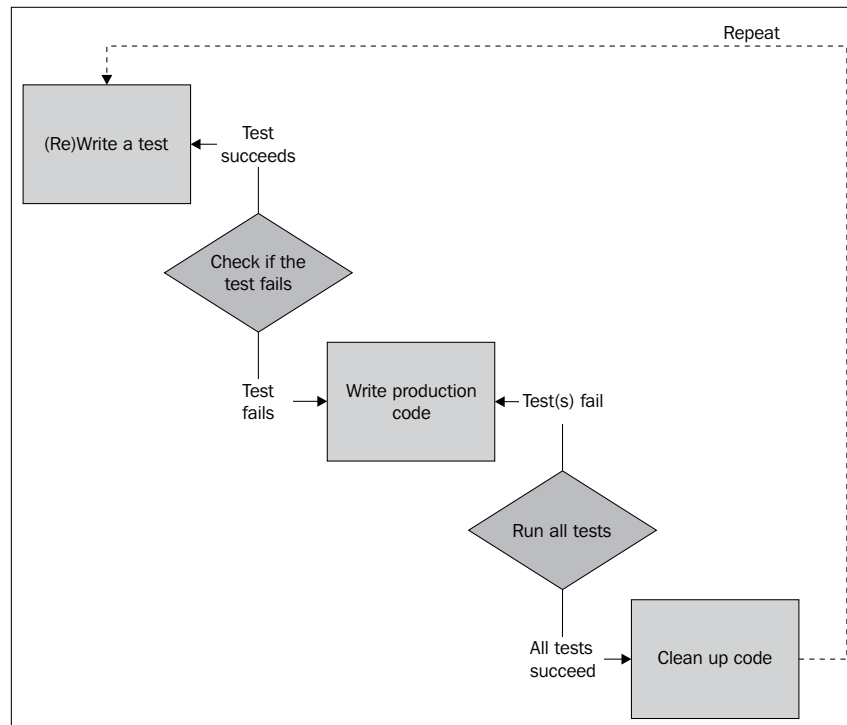
Instant Cucumber BDD How-to

Cucumber is a very fun and cool tool for writing automated acceptance tests to support software development in the **behavior-driven development (BDD)** style. This Instant book will cover the basis of TDD/BDD and explain the essence of Cucumber, describe how to write Cucumber features to drive development in a real project, and also describe many pro tips for writing good Cucumber features and steps. We will finally introduce some famous third-party libraries used in line with Cucumber.

Understanding behavior-driven development (Intermediate)

Test-driven development (TDD) is a software development process originated from **Extreme Programming (XP)** invented by *Kent Beck*, which relies on the repetition of a number of short and continuous development cycles.

TDD can lead to more modularized, flexible, and extensible code; the early and frequent nature of the testing helps to catch defects early in the development cycle, preventing them from becoming endemic and expensive problems. In addition to this, its principle completely practices "keep it simple, stupid" (KISS) and "You ain't gonna need it" (YAGNI). The workflow for TDD is as follows:



BDD is based on TDD; it inherits all the benefits and many of the principles/practices from TDD, but moves one step forward—BDD combines TDD with ideas from **domain-driven design (DDD)** and object-oriented analysis and design which provide software development teams and business people with shared tools and a shared process to collaborate on software development. The inventor of BDD, *Dan North*, defined it as follows:

"BDD is a second-generation, outside-in, pull-based, multiple-stakeholder, multiple-scale, high-automation, agile methodology. It describes a cycle of interactions with well-defined outputs, resulting in the delivery of working, tested software that matters."

BDD focuses on implementing the **minimum marketable feature (MMF)** that will yield the most value. The business team and the development team can cooperate on a common language; this significantly reduces misunderstanding and eliminates waste, unnecessary code, and functionality.

Getting ready

In the BDD style, when a developer starts writing a test case, unlike writing a test method in TDD, he/she writes a "feature" belonging to a "story" which describes the feature's expected behavior. The feature is a business-readable, domain-specific language. Then the developer runs and watches it fail; after that he/she implements the "feature" and makes the test pass just like the same process in TDD. So at its core, BDD is a specialized version of TDD that focuses on the behavioral specification of software units.

How to do it...

The typical process can be described in the following steps:

1. Add a feature test.
2. Run all tests and see if the new one fails.
3. Write some code.
4. Run the automated tests and see them succeed.
5. Refactorize the code.
6. Repeat steps 1 to 5.

There's more...

There are many great resources online for learning BDD:

- ▶ Official page of behavior-driven development: <http://behavior-driven.org/>
- ▶ The behavior-driven development entry on Wikipedia: http://en.wikipedia.org/wiki/Behavior-driven_development
- ▶ 10 Reasons Why BDD Changes Everything: <http://www.agile-doctor.com/2012/03/06/10-reasons-why-bdd-changes-everything/>
- ▶ Behavior Driven Development Content on InfoQ: <http://www.infoq.com/BDD>
- ▶ Introducing BDD: <http://dannorth.net/introducing-bdd/>

Setting up an environment for Cucumber BDD on Rails (Intermediate)

Cucumber is a tool for BDD-style development widely used in the Ruby on Rails platform. It introduced a **domain-specific language (DSL)** named **Gherkin** to allow the execution of feature documentation written in business-facing text, and implement acceptance test code in other languages (for example Ruby).

Cucumber sets up a great bridge between business people and development teams. Its natural and human readable language ultimately eliminates misunderstanding, and the regular expression "translation" layer provides the ability for developers to do anything magical and powerful!

Getting ready

This book will focus on how to use Cucumber in daily BDD development on the Ruby on Rails platform. Please install the following software to get started:

- ▶ Ruby Version Manager
- ▶ Version 1.9.3 of Ruby
- ▶ Version 3.2 of Rails
- ▶ The latest version of Cucumber
- ▶ A handy text editor; Vim or Sublime Text

How to do it...

To install RVM, bundler, and Rails we need to complete the following steps:

1. Install RVM (read the latest installation guide from <http://rvm.io>).

```
$ \curl -L https://get.rvm.io | bash -s stable --ruby
```
2. Install the latest version of Ruby as follows:

```
$ rvm install ruby-1.9.3
```
3. Install bundler as follows:

```
$ gem install bundler
```
4. Install the latest version of Rails as follows:

```
$ gem install rails
```

Cucumber is a Ruby gem. To install it we can run the following command in the terminal:

1. Cucumber contains two parts: **features** and **step definitions**. They are explained in the following section:

```
$ gem install cucumber
```
2. If you are using bundler in your project, you need to add the following lines into your Gemfile:

```
gem 'cucumber'
```

How it works...

We will have to go through the following files to see how this recipe works:

- ▶ Feature files (their extension is `.feature`): Each feature is captured as a "story", which defines the scope of the feature along with its acceptance criteria. A feature contains a feature title and a description of one or more scenarios. One scenario contains describing steps.
- ▶ Feature: A unique feature title within the project scope with a description. Its format is as follows:

```
Feature: <feature title>
<feature description>
```

- ▶ Scenario: This elaborates how the feature ought to behave. Its format is as follows:

```
Scenario: <Scenario short description>
Given <some initial context>
```

```
When <an event occurs>
```

```
Then <ensure some outcomes>
```

- ▶ Step definition files: A step definition is essentially a block of code associated with one or more steps by a regular expression (or, in simple cases, an exact equivalent string).

```
Given "I log into system through login page" do
  visit login_page
  fill_in "User name", :with => "wayne"
  fill_in "Password", :with => "123456"
  click_button "Login"
end
```

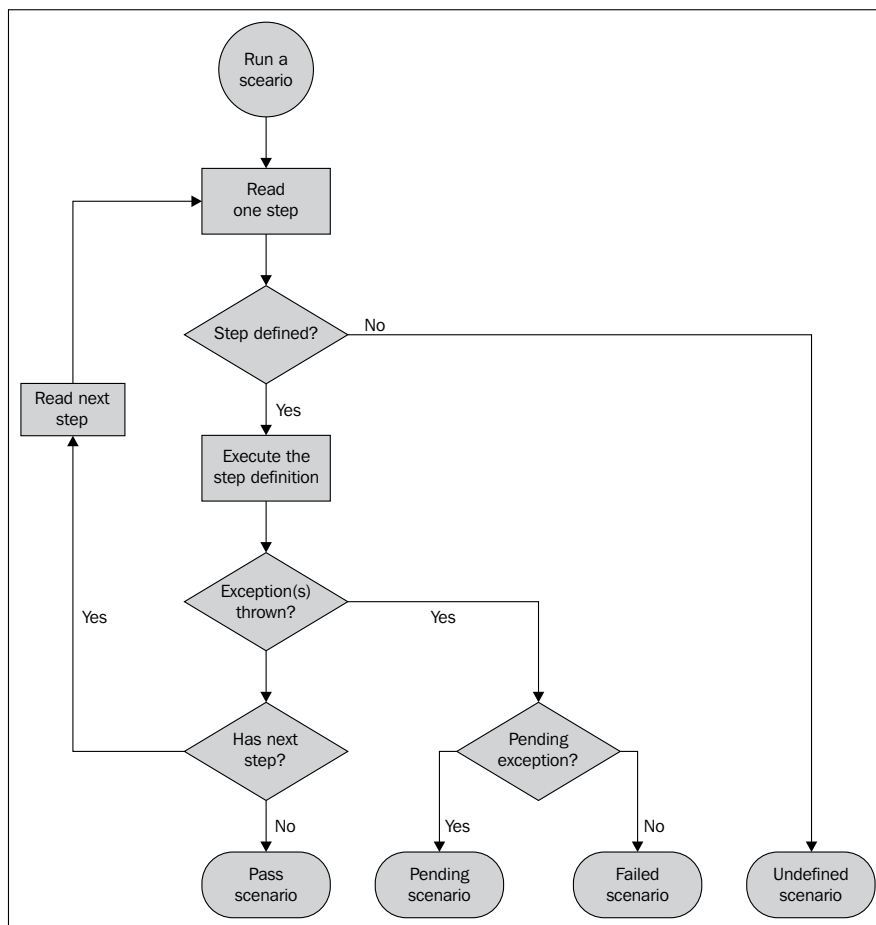
When running a Cucumber feature, each step in the feature file is like a **method invocation** targeting the related step definition. Each step definition is like a Ruby method which takes one or more arguments (the arguments are interpreted and captured by the Cucumber engine and passed to the step method; this is essentially done by regular expression). The engine reads the feature steps and tries to find the step definition one by one. If all the steps match and are executed without any exceptions thrown, then the result will be passed; otherwise, if one or more exceptions are thrown during the run, the exception can be one of the following:

- ▶ `Cucumber::Undefined`: Step was an undefined exception
- ▶ `Cucumber::Pending`: Step was defined but is pending implementation
- ▶ `Ruby runtime exception`: Any kind of exception thrown during step execution

Similar with other unit-testing frameworks, Cucumber runs will either pass or fail depending on whether or not exception(s) are thrown, whereas the difference is that according to different types of exceptions, running a Cucumber could result in the following four kinds:

- ▶ Passed
- ▶ Pending
- ▶ Undefined
- ▶ Failed

The following figure demonstrates the flow chart of running a Cucumber feature:



There's more...

Cucumber is not only for Rails, and the Cucumber feature can be written in many other languages other than English.

Cucumber in other languages/platforms

Cucumber is now available on many platforms. The following is a list of a number of popular ones:

- ▶ JVM: Cucumber-JVM
- ▶ .NET: SpecFlow
- ▶ Python: RubyPython, Lettuce
- ▶ PHP: Behat
- ▶ Erlang: CucumberI

Cucumber in your mother language

We can actually write Gherkin in languages other than English too, which is very important because domain experts might not speak English. Cucumber now supports 37 different languages.

There are many great resources online for learning Cucumber:

- ▶ The Cucumber home page: <http://cukes.info/>
- ▶ The Cucumber project on Github: <https://github.com/cucumber/cucumber>
- ▶ The Cucumber entry on Wikipedia: [http://en.wikipedia.org/wiki/Cucumber_\(software\)](http://en.wikipedia.org/wiki/Cucumber_(software))
- ▶ The Cucumber backgrounder: <https://github.com/cucumber/cucumber/wiki/Cucumber-Backgrounder>

Writing your first Hello World feature (Simple)

During the first two recipes we learnt the concept of BDD and the basics of Cucumber; now we know that we can benefit from BDD using Cucumber, so it is time to write the first **Hello World** Cucumber feature.

Getting ready

In the first recipe we've already successfully installed Ruby, RubyGems, bundle, and Rails. To write our first Cucumber feature, we need a Rails application with Cucumber installed.

How to do it...

Now we create a Rails project and install Cucumber in the project. Follow the given steps:

1. Create a new Rails app, `cucumber_bdd_how_to`, by running the following Rails command in the terminal:
2. Add gem 'cucumber-rails' into the project's Gemfile; it should be similar to the following code snippet:

```
$ rails new cucumber_bdd_how_to

source 'https://rubygems.org'

gem 'rails', '3.2.9'

# Bundle edge Rails instead:
# gem 'rails', :git => 'git://github.com/rails/rails.git'

gem 'sqlite3'

# Gems used only for assets and not required
# in production environments by default.
group :assets do
  gem 'sass-rails', '~> 3.2.3'
  gem 'coffee-rails', '~> 3.2.1'

  # See https://github.com/sstephenson/execjs#readme for
  # more supported runtimes
  # gem 'therubyracer', :platforms => :ruby

  gem 'uglifier', '>= 1.0.3'
end

gem 'jquery-rails'

group :test do
  gem 'cucumber-rails'
end

# To use ActiveRecord::has_secure_password
# gem 'bcrypt-ruby', '~> 3.0.0'

# To use Jbuilder templates for JSON
```

```
# gem 'jbuilder'

# Use unicorn as the app server
# gem 'unicorn'

# Deploy with Capistrano
# gem 'capistrano'

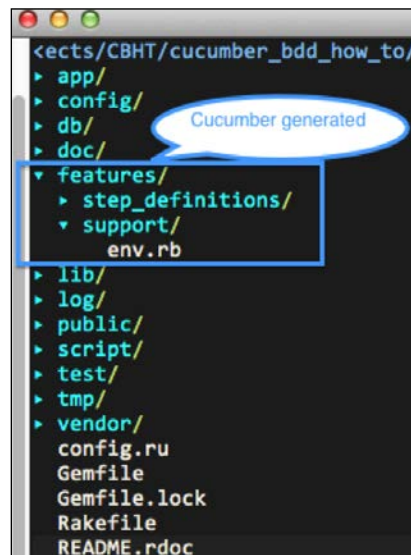
# To use debugger
# gem 'debugger'
```



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3. Run the bundle install in the terminal:
`$ bundle install`
4. After the installation is completed, cd into your RoR project directory and run:
`$ rails generate cucumber:install`
5. By running this, Cucumber will initialize a folder called `features` in your Rails project:

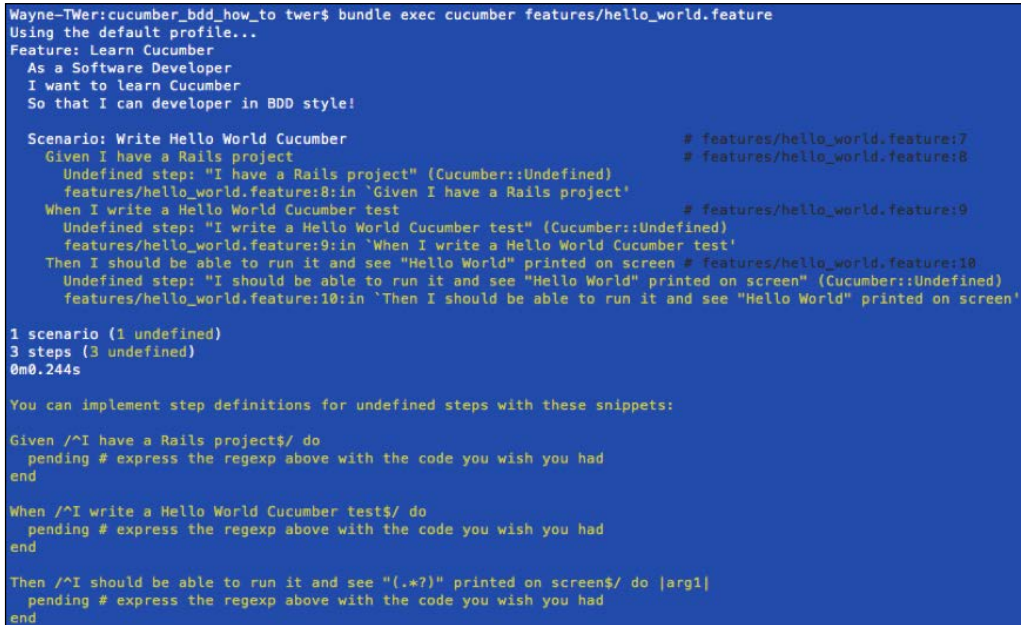


- Now we create a file under the `features` folder called `hello_world.feature`, and write down our first Cucumber test:

```
Feature: Learn Cucumber
  As a Software Developer
  I want to learn Cucumber
  So that I can developer in BDD style!
```

```
Scenario: Write Hello World Cucumber
  Given I have a Rails project
  When I write a Hello World Cucumber test
  Then I should be able to run it and see "Hello World"
  printed on screen
```

- And we go to the terminal and run the following Cucumber command:
\$ bundle exec cucumber features/hello_world.feature
- Now we should see that it fails since we haven't implemented the steps yet. The message should be similar to the following screenshot:



```
Wayne-Twer:cucumber_bdd_how_to twer$ bundle exec cucumber features/hello_world.feature
Using the default profile...
Feature: Learn Cucumber
  As a Software Developer
  I want to learn Cucumber
  So that I can developer in BDD style!

Scenario: Write Hello World Cucumber
  Given I have a Rails project
    Undefined step: "I have a Rails project" (Cucumber::Undefined)
    features/hello_world.feature:8:in `Given I have a Rails project'
  When I write a Hello World Cucumber test
    Undefined step: "I write a Hello World Cucumber test" (Cucumber::Undefined)
    features/hello_world.feature:9:in `When I write a Hello World Cucumber test'
  Then I should be able to run it and see "Hello World" printed on screen
    Undefined step: "I should be able to run it and see "Hello World" printed on screen" (Cucumber::Undefined)
    features/hello_world.feature:10:in `Then I should be able to run it and see "Hello World" printed on screen'

1 scenario (1 undefined)
3 steps (3 undefined)
0m0.244s

You can implement step definitions for undefined steps with these snippets:

Given /^I have a Rails project$/ do
  pending # express the regexp above with the code you wish you had
end

When /^I write a Hello World Cucumber test$/ do
  pending # express the regexp above with the code you wish you had
end

Then /^I should be able to run it and see "(.*)" printed on screen$/ do |arg1|
  pending # express the regexp above with the code you wish you had
end
```

- Create a `hello_world_steps.rb` under the `step_definitions` directory.
- Copy the code shown on the console and paste it to `hello_world_steps.rb`.

11. Modify the step code as follows:

```

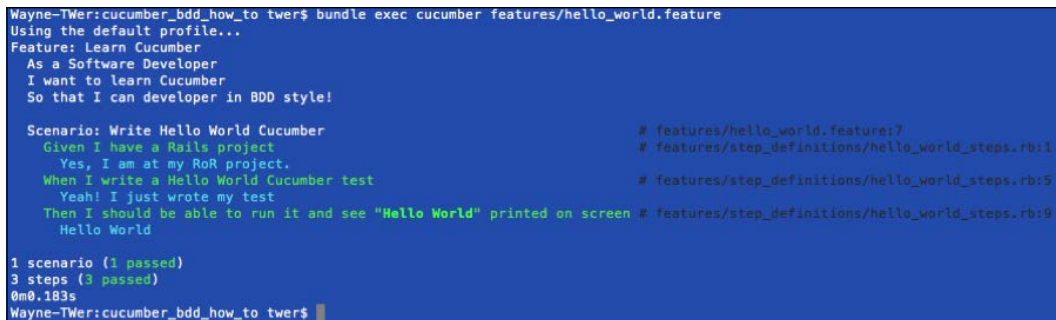
Given /^I have a Rails project$/ do
  puts "Yes, I am at my RoR project."
end

When /^I write a Hello World Cucumber test$/ do
  puts "Yeah! I just wrote my test"
end

Then /^I should be able to run it and see "(.*)" printed
on screen$/ do |arg|
  puts arg
end

```

12. Now we run it again and we see it successfully passed:



```

Wayne-TWer:cucumber_bdd_how_to twer$ bundle exec cucumber features/hello_world.feature
Using the default profile...
Feature: Learn Cucumber
  As a Software Developer
    I want to learn Cucumber
    So that I can developer in BDD style!

  Scenario: Write Hello World Cucumber
    Given I have a Rails project
    Yes, I am at my RoR project.
    When I write a Hello World Cucumber test
    Yeah! I just wrote my test
    Then I should be able to run it and see "Hello World" printed on screen
    Hello World

1 scenario (1 passed)
3 steps (3 passed)
0m0.183s
Wayne-TWer:cucumber_bdd_how_to twer$

```

How it works...

In this simple example, we wrote our first Cucumber feature named "Hello World", it has one scenario, "Write Hello World Cucumber", with three steps. We also implemented three step definitions and successfully made it pass.

In the Cucumber feature, one step is usually started with a preposition or an adverb (**Given**, **When**, **Then**, **And**, and **But**), each step is parsed and corresponding to a step definition, in our previous example the last step accepts one argument to be passed in, which means you can put any word in the step, and we passed the string Hello World, so that it is printed on the screen.

Learning foundation knowledge and skills (Intermediate)

From the *Setting up an environment for Cucumber BDD on Rails (Intermediate)* recipe we know Cucumber contains two parts: **Gherkin** and **Step definitions**, and from the *Writing your first Hello World Feature (Simple)* recipe we got our first Cucumber feature to run successfully. We are now ready to walk into Cucumber world!

Getting ready

In this recipe, we will learn the foundation knowledge and skills for achieving our goal, which is developing features in the BDD style using Cucumber. Let's take a deep look into the Cucumber Gherkin and Step separately.

Gherkin

Gherkin is the language that Cucumber understands; it is a **DSL**. Gherkin has two major missions: it should have a maintainable documentation that is stakeholder-readable/understandable and it should be programmatically testable.

A feature written in Gherkin is as follows:

```
Feature: Credit card payment
  As a online shopper
  I want to pay through my Credit card
  So that I can buy stuff online instead of visiting the super market

  Scenario: transaction completed successfully
    Given ...
    When ...
    Then ...
  Scenario: Credit card is invalid
    Given ...
    When ...
    Then ...
  Scenario: Third party payment system refused the transaction
    Given ...
    When ...
    Then ...
```

A scenario consist of steps beginning with Given, When, Then, or And/But:

- ▶ **Given:** This puts the system in a known state before the user (or external system) starts interacting with the system (in the **When** steps). Examples are as follows:
Given I logged in as a system administrator
Given the user has been authorized to do operation
Given I have two items in my shop cart
- ▶ **When:** A When step represents the **key action** the user performs. The action usually has an observable effect somewhere else. Examples are as follows:
When I press "Submit" on the Contact us area
When I am on the "Shopping Cart" page
When the progress bar is running
When I wait for the Ajax request to finish
- ▶ **Then:** The Then step observes and validates the outcome(s), it is an assertion sentence just like the assert statement in common unit testing frameworks. The Then sentence should be related to the business value/benefit in your feature description. Examples are as follows:
Then the login popup form should be shown
Then user should be redirected to item list page
Then I should receive \$800
- ▶ **And, But:** This is used when we have multiple Given/When/Then steps. Examples are as follows:
Given I have a dummy repository on github
And this project is written in Ruby on Rails
Then I should be able to clone this project
And I should be able to add more developers to folk this project
But I cannot make this project private



Essentially Gherkin treats Given/When/Then/And/But the same, so in theory we can write all the steps with the same prefix. However, we definitely should never do that in the real world.

Cucumber step

Once we write a feature with steps in Gherkin, we need to implement each step. Step definition files are, by convention, under the `features/step_definitions` directory, just like the `hello_world_steps.rb` file we created in the *Writing your first Hello World feature (Simple)* recipe.

Cucumber is widely used in automation testing web applications. In most cases, Cucumber is simulating the behavior of the end user who will be using the developed application, thus verifying whether it passes the acceptance tests. So under the step definition, we will usually do the following things:

- ▶ **Environment preparation:** Examples include simulating user login, and preparing test data in the database
- ▶ **URL navigation:** Examples include opening initial pages and redirecting the user to a predefined URL after a specific action
- ▶ **DOM manipulation:** Examples include filling text in a form, selecting items from drop-down lists, clicking on a link, or pressing a button
- ▶ **Waiting:** Examples include waiting for a specific operation to be finished, waiting for animations to be completed, and simply waiting for a few seconds
- ▶ **Assertion:** Examples include verifying whether a page contains expected content and checking whether the user was redirected to the right page

To achieve the preceding things, we need to use a famous Ruby gem: **Capybara**. It exposes a DSL to simulate and uniform a real user's interaction with a web application. The DSL is designed to be natural. The following code snippets are some examples of the Capybara DSL syntax:

- ▶ To find a DOM element:

```
find_field('blog_title').should be_visible
find_field('blog_content').value.should eq(@content)
find_link('back').click
find("section#main").text.should eq("Foo section")
find("div.main-pillar").find("section#main").text.should eq("Foo
section")
all("a").each { |a| puts a[:href] }
all("input[type='text']").each
{ |textbox| p textbox[:value] }
```
- ▶ To fill text in a textbox:

```
fill_in 'Login', :with => 'user@example.com'
```
- ▶ To select an item in the drop-down list:

```
select("California", :from => 'Choose State')
```
- ▶ To choose the **Male** radio button:

```
choose 'Male'
```
- ▶ To check the **Food** checkbox:

```
check 'Food'
```

- ▶ To click on the **Edit Profile** link:
`click_link 'Edit Profile'`
- ▶ To click on the **Submit** button:
`Click_button 'Submit'`
- ▶ To attach a file:
`attach_file('Image', '/path/to/image.png')`
- ▶ To make assertions:
`page.has_selector?('div.main-pillar section#main').should be_true`
`page.has_selector?(:xpath, '//div/article').should be_true`
`page.has_xpath?('//div/article').should be_true`
`page.has_css?('div.main-pillar section#main').should be_true`
`page.has_content?('Foo section').should be_true`

Other than utilizing Capybara, we also need a number of other Ruby gems, which are widely used in the real BDD project:

- ▶ **rspec-rails**: This is a BDD test framework for Rails. In our Cucumber step implementation, we rely on it to write human-readable test assertions.
- ▶ **Launchy**: The Launchy application inside the Rails application is required when we debug our Cucumber steps.
- ▶ **database-cleaner**: This introduced a set of strategies to ensure a clean state when running Cucumber tests.

How to do it...

1. Add Capybara into our Gemfile, as well as Launchy, which is required when we debug our Cucumber step.

```
group :test do
  gem 'rspec-rails' # library of Rails assertions
  gem 'cucumber-rails', :require => false
  gem 'launchy'
  gem 'database_cleaner'
end
```

2. Then we need to run `bundle install` in the terminal to install the added gems.
3. Finally, make sure you have the latest version of Firefox installed, since Capybara's default web driver is Selenium with Firefox driver.

4. Ok, it's time to run a good sample case to demonstrate the magic of Capybara. Assume we would like to buy baseball gloves on Amazon. We write out a feature in `amazon_search.feature`:

```
Feature: Shopping in Amazon
As an internet user
I want to search stuff on Amazon
So that I can choose and buy items I like

@javascript
Scenario: Search for baseball gloves
  Given I am on Amazon homepage
  When I enter "baseball glove" in the search box
  And I click "Go" button
  Then I should see a list of results related with Baseball
  Gloves
```

5. We run the feature in the terminal and watch it fail, and then create the step file `amazon_search_steps.rb` with the following code:

```
Given /^I am on Amazon homepage$/ do
  visit "http://www.amazon.com"
end

When /^I enter "(.*?)" in the search box$/ do |keywords|
  fill_in "Search", :with => keywords
end

When /^I click "Go" button$/ do
  click_button "Go"
end

Then /^I should see a list of results related with Baseball
Gloves/ do
  page.should have_content("#centerBelow")
end
```

How it works...

We run the feature again and we see how it works. We specified a `@javascript` tag for the scenario. It is a Capybara built-in tag, which runs a feature marked as `@javascript`, and Capybara switches the web driver from the default (RackTest) to `Capybara.javascript_driver`. A Firefox browser will open and automatically perform the actions we defined in the step file.



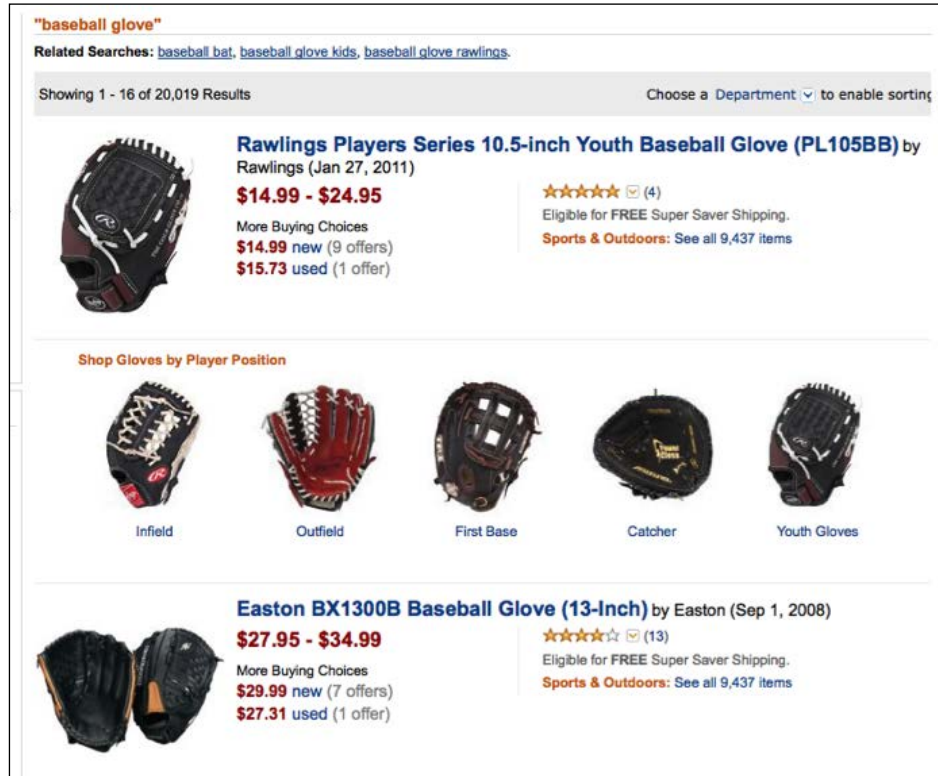
To make this clearer, by default, Capybara uses the `rack_test` driver to drive browsers, which is fast but doesn't support JavaScript. Selenium is the default driver for JavaScript-required scenarios. You can change the value of the `Capybara.javascript_driver` setting to use another JavaScript-capable driver.

The previous Amazon search example requires JavaScript, so we specify a `@javascript` tag prior to Scenario.

The following screenshots demonstrate how our Cucumber feature runs, opens up Amazon's home page, and inputs the keyword `baseball glove`:



And then after clicking on the **Go** button, we will see the search result as follows:



The preceding screenshots were not captured manually; Capybara provides a convenient API called `save_screenshot`, which can be invoked inside any Cucumber step, and then we can use Launchy to open it ASAP or open the screenshot later manually.

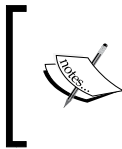


```
When /^I enter "(.*)" in the search box$/ do
  |keywords|
  page.save_screenshot('input_keyword.png')
  Launchy.open 'input_keyword.png'
end
```

Under the hood, Capybara invokes a web driver to communicate with a real browser. It supports the following web drivers:

- ▶ RackTest: This is the default driver which is fast but cannot execute JavaScript
- ▶ Selenium: This is fully functional and ready to use, just a little bit slower

- ▶ Capybara-webkit: It uses QtWebKit to start a rendering engine and is the fastest. It is used for true headless testing and has full JavaScript support
- ▶ Poltergeist: It runs Capybara tests on a headless WebKit browser, unlike Capybara-webkit, and uses PhantomJS as its rendering engine



We can switch Capybara's web driver by executing the following code:

```
Capybara.javascript_driver= :webkit #or  
:rack_test, :selenium, etc.
```

Capybara encapsulates these web driver libraries and exposes a uniformed façade for the higher level, so developers benefit from it by learning uniformed syntax while dealing with various kinds of situations/purposes by switching between different web drivers.

In this Amazon search example, we learnt how to drive an automated web test case using Cucumber and Capybara. In the next recipe we will develop a real project based on this technology combination!

Building a real web application with Cucumber (Intermediate)

In this recipe we are going to build a real web application with a BDD style and process. You will learn how to work with behavior-driven software development using Cucumber.


Getting ready

Assume we are in a web development team and are cooperating with a product manager. Our goal is to develop a simple web blog system, and we have already had a meeting and summarized several user stories as follows:

- ▶ Story #1: As a blog owner, I can write new blog posts.


As a blog owner,
I can write new blog posts

- ▶ Story #2: As a blog visitor, I can see a list of posted blogs.



As a blog visitor,
I can see a list of posted blogs

- ▶ Story #3: As a blog owner, I can edit my blog posts.




As a blog owner,
I can edit my blog posts

- ▶ Story #4: As a blog visitor, I can input comments onto the blog.



As a blog visitor,
I can input comments
onto the blog

- ▶ Story #5: As a blog owner, I can delete comments.



As a blog owner,
I can delete comments

How to do it...

1. Out first step is to let Rails generate a new application called `blog`:

```
$ rails new blog --skip-test-unit
```

And we need the following Ruby gems in Gemfile:

```
group :test do
  gem 'rspec-rails'
  gem 'cucumber-rails'
  gem 'capybara'
  gem 'launchy'
  gem 'database_cleaner'
end
```

2. After `bundle install`, we install Cucumber into the blog project:

```
$ rails generate cucumber:install
```

Story #1: As a blog owner, I can write new blog posts

1. We wait until Rails has finished generating Cucumber files. Then we can start writing the first Cucumber scenario for this story. We add a feature file under the `features` directory named `write_post.feature`:

```
Feature: Write blog
  As a blog owner
  I can write new blog post
  Scenario: Write blog
    Given I am on the blog homepage
    When I click "New Post" link
    And I fill "My first blog" as Title
    And I fill "Test content" as content
    And I click "Post" button
    Then I should see the blog I just posted
```

2. Let's run the `write_post.feature` and watch it fail:

`cucumber features/write_post.feature:`

```
1 scenario (1 undefined)
6 steps (6 undefined)
0m0.274s

You can implement step definitions for undefined steps with these snippets:

Given /^I am on the blog homepage$/ do
  pending # express the regexp above with the code you wish you had
end

When /^I click "(.*)" link$/ do |arg1|
  pending # express the regexp above with the code you wish you had
end

When /^I fill "(.*)" as Title$/ do |arg1|
  pending # express the regexp above with the code you wish you had
end

When /^I fill "(.*)" as content$/ do |arg1|
  pending # express the regexp above with the code you wish you had
end

When /^I click "(.*)" button$/ do |arg1|
  pending # express the regexp above with the code you wish you had
end

When /^I should see the blog I just posted$/ do
  pending # express the regexp above with the code you wish you had
end
```

Yes it fails, which is good and as expected; now we have work to do, that is to implement this feature (also a real story)!

3. So we go to our favorite terminal and have Rails help us generate a Post scaffold:

```
$ rails generate scaffold Post title
content:textpost_time:datetime
```

4. We perform a database migration for both development and test environments:

```
$ rakedb:migrate
$ RAILS_ENV=test rake db:migrate
```

5. We now start implementing the Cucumber step for `write_post`. A little noticeable point is using `@title` to record the entered title for future expected use. The code is shown as follows:

```
Given /^I am on the blog homepage$/ do
  visit("/posts")
```

```

end

When /^I click "New Post" link$/ do
  click_on "New Post"
end

When /^I fill "(.*)" as Title$/ do |title|
  @title = title
  fill_in "Title", :with => title
end

When /^I fill "(.*)" as content$/ do |content|
  fill_in "Content", :with => content
end

When /^I click "(.*)" button$/ do |btn|
  click_button btn
end

Then /^I should see the blog I just posted$/ do
  page.should have_content(@title)
end

```

6. Ok, now we rerun the test and it should pass:

```

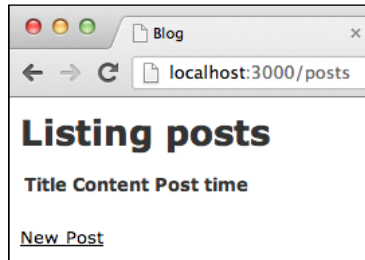
Wayne-TWer:blog twer$ be cucumber features/write_post.feature
Using the default profile...
Rack::File headers parameter replaces cache_control after Rack 1.5.
Feature: Write blog
  As a blog owner
    I can write new blog post

Scenario: Write blog # features/write_post.feature:5
  Given I am on the blog homepage # features/step_definitions/write_post_steps.rb:1
  When I click "New Post" link # features/step_definitions/write_post_steps.rb:5
  And I fill "My first blog" as Title # features/step_definitions/write_post_steps.rb:9
  And I fill "Test content" as content # features/step_definitions/write_post_steps.rb:14
  And I click "Post" button # features/step_definitions/write_post_steps.rb:18
  And I should see the blog I just posted # features/step_definitions/write_post_steps.rb:22

1 scenario (1 passed)
6 steps (6 passed)
0m0.448s
Wayne-TWer:blog twer$

```

7. And if we open the browser to do a manual test on `http://localhost:3000/posts`, we can see it works as expected. The following is a screenshot of the blog home page:



8. The screenshot of the write blog page is as follows:



Story #2: As a blog visitor, I can see a list of posted blogs

1. We create a new feature named `show_blog_list.feature`, and we assume there already exists four blog posts:

```
Feature: Show blog list
  As a blog visitor
  I can see list of posted blogs

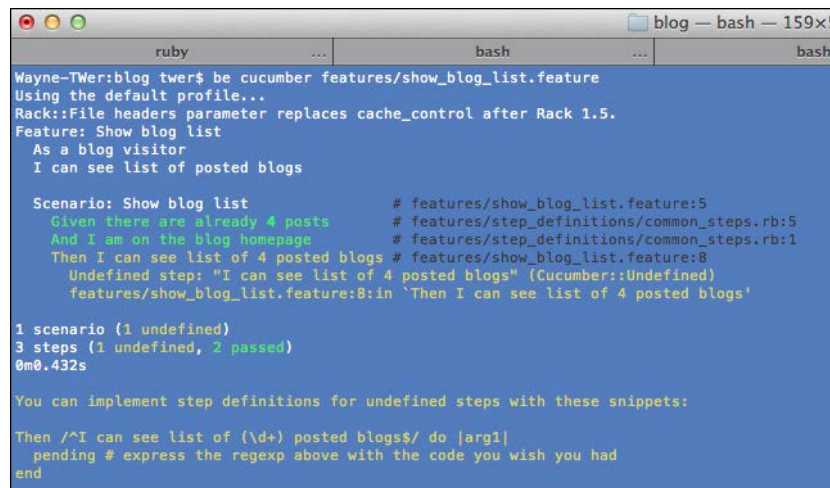
  Scenario: Show blog list
    Given there are already 4 posts
    And I am on the blog homepage
    Then I can see list of 4 posted blogs
```

2. The Given step is exactly the same with the "write blog" feature. We definitely shouldn't repeat ourselves. The "posts preparation" step seems very common, so we can create a `common_steps.rb` under the `step_definitions` directory. After that we move the step `Given I am on the blog homepage` from `write_blog_steps` to `common_steps` and create a shared step for preparing blog posts:

```
Given /^I am on the blog homepage$/ do
  visit("/posts")
end

And /^there are already (\d+) posts$/ do |count|
  count.to_i.times do |n|
    Post.create!({ :title => "Title #{n}", :content =>
      "Content #{n}", :post_time => Time.now })
  end
end
```

3. Ok, now we run `show_blog_list.feature` and watch that it fails. We will see that the two Given steps have already been implemented within `common_steps`:



```
Wayne-Twer:blog twer$ be cucumber features/show_blog_list.feature
Using the default profile...
Rack::File headers parameter replaces cache_control after Rack 1.5.
Feature: Show blog list
  As a blog visitor
  I can see list of posted blogs

  Scenario: Show blog list
    Given there are already 4 posts      # features/show_blog_list.feature:5
    And I am on the blog homepage        # features/step_definitions/common_steps.rb:5
    Then I can see list of 4 posted blogs # features/show_blog_list.feature:8
    Undefined step: "I can see list of 4 posted blogs" (Cucumber::Undefined)
      features/show_blog_list.feature:8:in `Then I can see list of 4 posted blogs'

1 scenario (1 undefined)
3 steps (1 undefined, 2 passed)
0m0.432s

You can implement step definitions for undefined steps with these snippets:

Then /^I can see list of (\d+) posted blogs$/ do |arg1|
  pending # express the regexp above with the code you wish you had
end
```

4. Following the guide we create `show_blog_list_steps.rb`. In the step we expect there to be a list of blogs wrapped within an HTML table with an ID of `posts-list`, and since we prepared four blog posts we expect there to be five rows in the table, so we firstly write our testing code as follows:

```
Then /^I can see list of (\d) posted blogs$/ do |count|
  page.should have_selector
    ("table#posts-list>tr:eq(#{count})")
end
```

5. Now it is time to write real code which is driven by the preceding described behavior code. We modify `app/views/posts/index.html.erb` as follows:

```
<h1>Listing posts</h1>

<table id="posts-list">
  <tr>
    <th>Title</th>
    <th>Content</th>
    <th>Post time</th>
    <th></th>
    <th></th>
    <th></th>
  </tr>

  <% @posts.each do |post| %>
  <tr>
    <td><%= post.title %></td>
    <td><%= post.content %></td>
    <td><%= post.post_time %></td>
    <td><%= link_to 'Show', post %></td>
    <td><%= link_to 'Edit', edit_post_path(post)
      %></td>
    <td><%= link_to 'Destroy', post, method: :delete,
      data: { confirm: 'Are you sure?' } %></td>
  </tr>
  <% end %>
</table>

<br />

<%= link_to 'New Post', new_post_path %>
```

6. Now we rerun `show_blog_list.feature`. It passed, yeah!

Story #3: As a blog owner, I can edit my blog posts

1. We add a new feature named `edit_blog.feature`:

Feature: Edit blog

As a blog owner

I can edit my blog posts

Scenario: Edit blog

Given there is a post with title "Dummy post" and content "Dummy content"

And I am on the blog homepage

When I edit this post

And I update title to "Updated title" and content to "Updated content"

Then I can see it has been updated

2. As usual, we first run it and watch it fail, and then create `edit_blog_steps.rb` with test code as follows:

```
Given /^there is a post with title "(.*)" and content "(.*)"$/  
do |title, content|
```

```
  @post = Post.create!({ :title => title, :content =>  
    content, :post_time => Time.now })
```

```
end
```

```
When /^I edit this post$/ do
```

```
  visit(edit_post_url @post)
```

```
end
```

```
When /^I update title to "(.*)" and content to "(.*)"$/
```

```
do |title, content|
```

```
  @updated_title = title
```

```
  @updated_content = content
```

```
  @post.update_attributes!({ :title => @updated_title,  
    :content => @updated_content })
```

```
end
```

```
Then /^I can see it has been updated$/ do
```

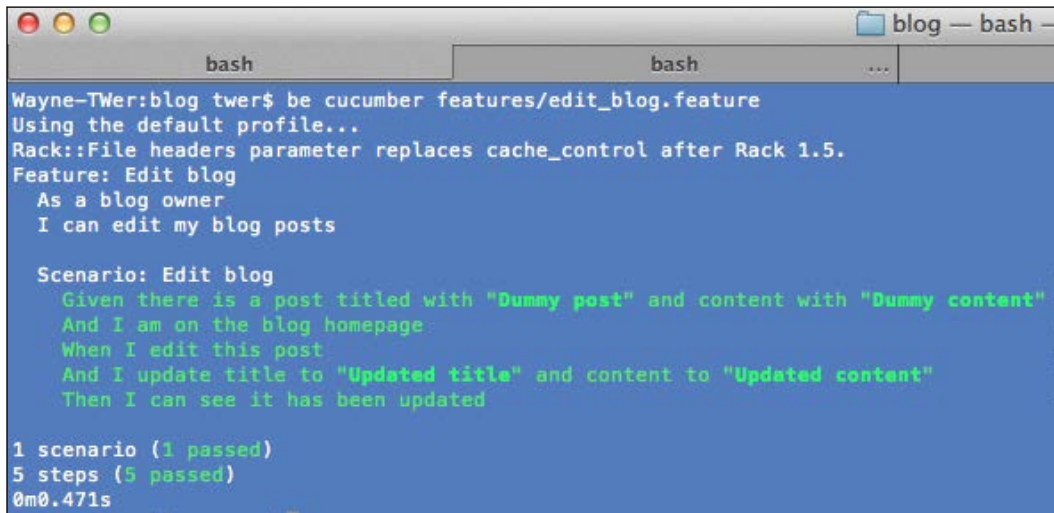
```
  step %[I am on the blog homepage]
```

```
  find("table#posts-list>tr:eq(2) >td:eq(1)").should  
  have_content(@updated_title)
```

```
  find("table#posts-list>tr:eq(2) >td:eq(2)").should  
  have_content(@updated_content)
```

```
end
```


3. When we go back to the terminal and rerun the `edit_blog.feature`, it should now pass. The following screenshot shows `edit_blog.feature` has run successfully:



```
Wayne-Twer:blog twer$ be cucumber features/edit_blog.feature
Using the default profile...
Rack::File headers parameter replaces cache_control after Rack 1.5.
Feature: Edit blog
  As a blog owner
  I can edit my blog posts

  Scenario: Edit blog
    Given there is a post titled with "Dummy post" and content with "Dummy content"
    And I am on the blog homepage
    When I edit this post
    And I update title to "Updated title" and content to "Updated content"
    Then I can see it has been updated

1 scenario (1 passed)
5 steps (5 passed)
0m0.471s
```

Hooray! We've finished three stories so far. They are all around posts creating, editing, and viewing. There are two more stories related with comments. Let's starting developing them with the behavior-driven development style!

Story #4: As a blog visitor, I can input comments onto the blog

1. We first create an `input_comment.feature` for this story:

Feature: Input comment

As a blog visitor

I can input comment onto blog

Scenario: Input comment

Given there is a post titled with "Dummy post" and content with "Dummy content"

And I am on the post page

When I add a comment with the following information

Name	Email	Content
Wayne	admin@wayneeye.com	Test comment

Then I can see the comment has been added onto the post

2. We run the feature and watch it fail:

```

Wayne-Twer:blog twer$ be cucumber features/input_comment.feature
Using the default profile...
Rack::File headers parameter replaces cache_control after Rack 1.5.
Feature: Input comment
  As a blog visitor
  I can input comment onto blog

Scenario: Input comment
  Given there is a post titled with "Dummy post" and content with "Dummy content"
  And I am on the post page
  Undefined step: "I am on the post page" (Cucumber::Undefined)
  features/input_comment.feature:7:in `And I am on the post page'
  When I add a comment with the following information
  | Name | Email | Content |
  | Wayne | admin@wayne.com | Test comment |
  Undefined step: "I add a comment with the following information" (Cucumber::Undefined)
  features/input_comment.feature:8:in `When I add a comment with the following information'
  Then I can see the comment has been added onto the post
  Undefined step: "I can see the comment has been added onto the post" (Cucumber::Undefined)
  features/input_comment.feature:11:in `Then I can see the comment has been added onto the post'

1 scenario (1 undefined)
4 steps (3 undefined, 1 passed)
0m0.335s

You can implement step definitions for undefined steps with these snippets:

Given /^I am on the post page$/ do
  pending # express the regexp above with the code you wish you had
end

When /^I add a comment with the following information$/ do |table|
  # table is a Cucumber::Ast::Table
  pending # express the regexp above with the code you wish you had
end

Then /^I can see the comment has been added onto the post$/ do
  pending # express the regexp above with the code you wish you had
end

```

3. We create `input_comment_steps.rb` and write the test code as follows:

```

Given /^I am on the post page$/ do
  visit(post_path @post)
end

When /^I add a comment with the following information$/
do |table|
  # table is a Cucumber::Ast::Table
  table.hashes.each do |comment_data|
    @commenter = comment_data[:name]
    @email = comment_data[:email]

```

```
@content = comment_data[:content]
@post.comments.create!({ :name => @commenter, :email
=> @email, :content => @content })
end
end
```

```
Then /^I can see the comment has been added onto the
post$/ do
  comments_list = find("div#comments-list")
  comments_list.should have_content(@commenter)
  comments_list.should have_content(@email)
  comments_list.should have_content(@content)
end
```

4. To make our test pass, we let Rails help us to generate a Comment scaffold:

```
$ rails generate scaffold Comment post:references name
email content
```

5. Database migration is as follows:

```
$ rakedb:migrate && RAILS_ENV=test bundle exec rake
db:migrate
```

6. After the migration is done, we update several places in the Rails-generated code. First is `routes.rb`. We specify comments as nested resources under blogs:

```
resources :blogs do
  resources :comments
end
```

7. We've specified that `Comment` belongs to `Post`; we need to update `Post` to contain many comments as well, in `post.rb`:

```
has_many :comments
```

In `CommentsController`, we update the `create` action to load the `post` object that the created comment belongs to:

```
def create
  @comment = Comment.new(params[:comment])
  @comment.post = Post.find_by_id(params[:post_id])

  respond_to do |format|
    if @comment.save
```

```

      format.html { redirect_to @comment.post,
        notice: 'Comment was successfully created.' }
    else
      format.html { render action: "new" }
      format.json { render json: @comment.errors,
        status: :unprocessable_entity }
    end
  end
end
end

```

8. And finally we update the view template `app/views/posts/show.html.erb` for showing a post:

```

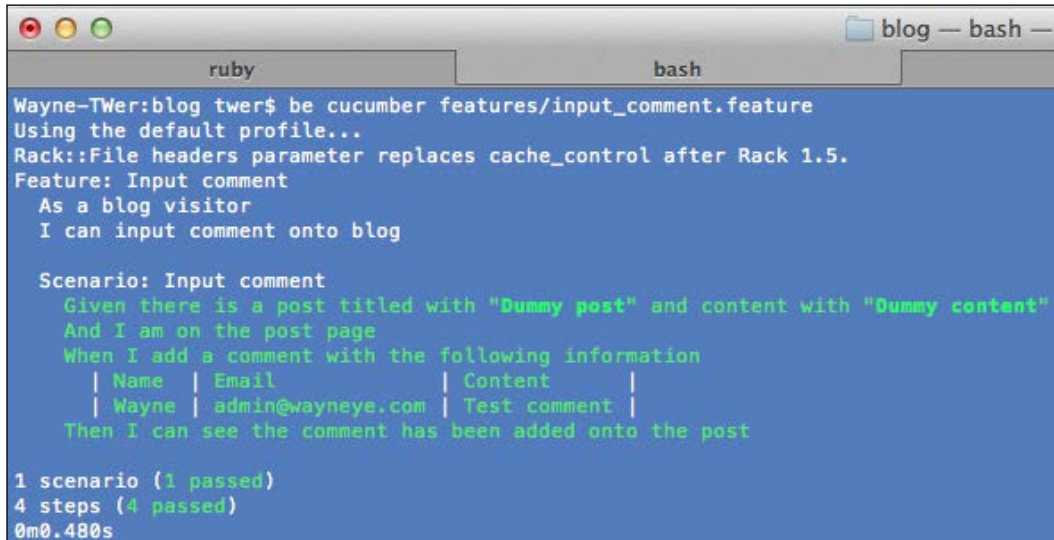
<h2>&darr;Comments&darr;</h2>
<div id="comments-list">
  <% @post.comments.each_with_index do |c,idx| %>
    <p><span>#<%= idx + 1 %>: <%= c.name %></span>:
    <%= c.content %></p>
  <% end %>

  <hr />

  <%= form_for([@post, @post.comments.build]) do |f| %>
    <div class="field">
      <%= f.label :name %><br />
      <%= f.text_field :name %>
    </div>
    <div class="field">
      <%= f.label :email %><br />
      <%= f.text_field :email %>
    </div>
    <div class="field">
      <%= f.label :content %><br />
      <%= f.text_area :content %>
    </div>
    <div class="actions">
      <%= f.submit %>
    </div>
  <% end %>
</div>

```

- At this time, we should be able to pass the input comment feature. The following screenshot shows that `input_comment.feature` has run successfully:



```
Wayne-TWer:blog twer$ be cucumber features/input_comment.feature
Using the default profile...
Rack::File headers parameter replaces cache_control after Rack 1.5.
Feature: Input comment
  As a blog visitor
  I can input comment onto blog

  Scenario: Input comment
    Given there is a post titled with "Dummy post" and content with "Dummy content"
    And I am on the post page
    When I add a comment with the following information
      | Name | Email | Content |
      | Wayne | admin@wayneeye.com | Test comment |
    Then I can see the comment has been added onto the post

1 scenario (1 passed)
4 steps (4 passed)
0m0.480s
```

Story #5: As a blog owner, I can delete comments

- As usual we create a `delete_comment.feature`:
Feature: Delete comment
As a blog owner
I can delete comment

Scenario: Delete comment
Given there is a post titled with "Dummy post" and content with "Dummy content"
And there is a comment on this post
When I am on the post page
And I click "Delete Comment"
Then the comment should be deleted
- Run it and watch it fail, and then implement the steps inside `delete_comment_steps.rb` as follows:

```
Given /^there is a comment on this post$/ do
  @post.comments.create!({ :name => "Wayne",
    :email => "admin@wayneeye.com", :content => "Test deleting comment" })
end

When /^I click "Delete Comment"$/ do
```

```

    click_on "Delete Comment"
  end

  Then /^the comment should be deleted$/ do
    find("#comments-list").should have_no_content("Wayne")
  end

```

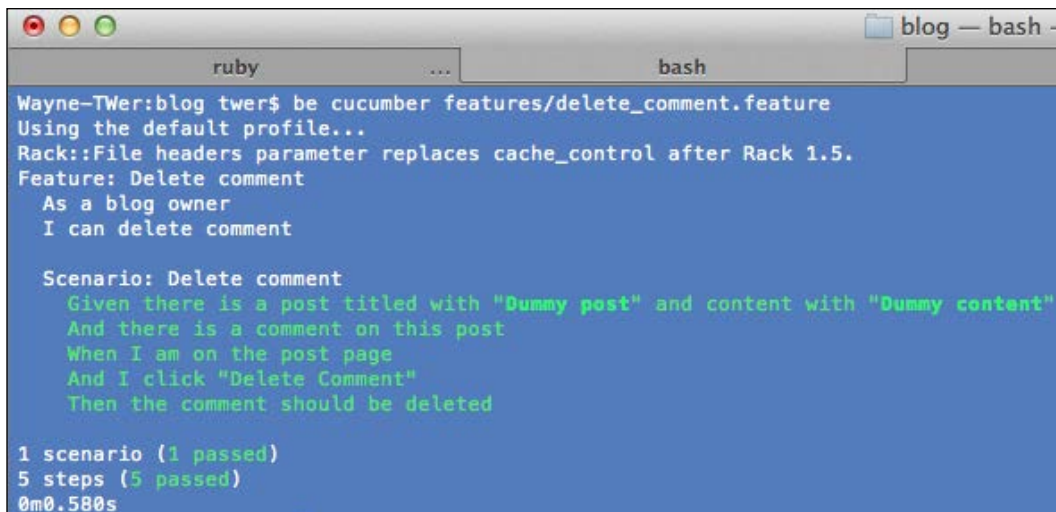
3. To make the test pass, we need to update `show.html.erb` to add the **Delete Comment** link to each comment:

```

<% @post.comments.each_with_index do |c,idx| %>
  <p>
    <span>#<%= idx + 1 %>: <%= c.name %></span>:
    <%= c.content %>
    <%= link_to "Delete Comment", post_comment_path
      (@post, c), :method => :delete, :confirm => "Are you
      sure you want to delete this comment?" %>
  </p>
<% end %>

```

4. Now we rerun `delete_comment.feature`. It passed successfully:



```

Wayne-Twer:blog twer$ be cucumber features/delete_comment.feature
Using the default profile...
Rack::File headers parameter replaces cache_control after Rack 1.5.
Feature: Delete comment
  As a blog owner
  I can delete comment

  Scenario: Delete comment
    Given there is a post titled with "Dummy post" and content with "Dummy content"
    And there is a comment on this post
    When I am on the post page
    And I click "Delete Comment"
    Then the comment should be deleted

1 scenario (1 passed)
5 steps (5 passed)
0m0.580s

```

How it works...

In this recipe we developed a very simple blog application with BDD using Cucumber. We split the requirement into five user stories, and then transformed them into Cucumber features. Next we implemented each story one by one, strictly following the BDD process.

Most of the code was generated by Rails, so we actually wrote very few lines of product code, because our goal is to learn how to use Cucumber to drive a real user story development, so that we are getting used to BDD with one story by another, and one iteration by another, eventually delivering the software.

The essence of BDD using Cucumber is that it describes a feature and its expected behavior. So that drives the development under the definiteness (ideally no misunderstanding); on the other hand, each Cucumber feature is just like an acceptance test case, which can be easily integrated with continuous integration.

Mastering pro tips for writing expressive Gherkin (Intermediate)

In the *Building a real web application with Cucumber (Intermediate)* recipe, we completed five simple user stories driven by Cucumber, and we learnt how to drive a Rails web application development using Cucumber in a BDD style.

Gherkin provides various kinds of expressive syntax. In this recipe, we are going to learn various kinds of skills and tips with Cucumber Gherkin DSL, and how to write readable, organized, and reusable Gherkin to help us solve real-world problems.

Getting ready

We will reuse the Rails application, `cucumber_bdd_how_to`, which we created in the *Writing your first Hello World feature (Simple)* recipe, so please `cd` into that directory to get prepared.

How to do it...

In the following sections, a number of useful Gherkin tips are introduced and covered exhaustively.

Define a background for scenarios

1. When we write Cucumber tests, we usually encounter this situation: a number of scenarios rely on the same step(s). For example, as a registered developer on GitHub, I can manage my profile, my repositories, or my SSH keys, then our feature can be written as follows:

```
Feature: Github account management
In order to manage my profile, repositories and my SSH
Keys
As a registered developer
I Should be able to log into system and manage my account
Scenario: Change my avatar
```

```
Given I logged into Github with account "Wayne Ye"
When I click my avatar to go to the "Your Profile"
page
Then I can change my avatar with "Wayne.png"
```

```
Scenario: View my repositories
  Given I logged into Github with account "Wayne Ye"
  When I click my avatar to go to the "Your Profile"
  page
  And I click on "Repositories" hyperlink
  Then I should be able to see all my repositories
```

```
Scenario: Add a SSH Key
  Given I logged into Github with account "Wayne Ye"
  When I click my avatar to go to the "Your Profile"
  page
  And I click on "SSH Keys" hyperlink
  Then I add a new SSH key
```

2. You will notice that all the scenarios require you to log into GitHub, and in more complex cases the share steps can be more. This could be quite tedious, so in this situation we can use Background:

```
Feature: Github account management
In order to manage my profile, repositories and my SSH
Keys
As a registered developer
I Should be able to log into system and manage my account
```

```
Background:
  Given I logged into Github with account "Wayne Ye"
  When I click my avatar goto the "Your Profile" page
```

```
Scenario: Change my avatar
  Then I can change my avatar with "Wayne.png"
```

```
Scenario: View my repositories
  And I click on "Repositories" hyperlink
  Then I should be able to see all my repositories
```

```
Scenario: Add a SSH Key
  And I click on "SSH Keys" hyperlink
  Then I add a new SSH key
```

Whenever possible, use Gherkin Background to centralize the scenario shared steps, be **DRY (don't repeat yourself)**, and get better maintainability!

Outline-related attributes in a table

1. Sometimes we need to describe the data in steps. When the data is in pieces, our step could be verbose, for example, a user registration feature:

Feature: User registration

In order to shop in ABC online shop

As a user

I should be able to register an account through registration page

Scenario: register with valid information

When I am on the registration page of ABC online shop

And I fill the "Full Name" form with "Wayne Ye"

And I fill the "Address" form with "123 Main Street"

And I fill the "Email" form with "admin@wayenye.com"

And I fill the "Password" form with "asdf"

Then I should be redirected to registration success page

2. Luckily, Gherkin provides a data table to deal with these kinds of scenarios. The data table gives you a way to extend a Gherkin step beyond a single line to include a larger piece of data. The preceding example can be easily and gracefully described as follows:

Feature: User registration

In order to shop in ABC online shop

As a user

I should be able to register an account through registration page

Scenario: register with valid information

When I am on the registration page of ABC online shop

And I fill the form with the following value

	Full Name	Address	Email	Password
	Wayne Ye	No 12 Pt Street	admin@wayenye.com	asdf

Then I should be redirected to registration success page

3. Much greater readability and maintainability! The preceding data table contains column headers to specify each field, and sometimes it can also be used without headers, for example, when it represents a list of data.

Scenario: instance messenger online

When I log into ABC social website

And I open up the IM tab

Then I should see my online friends

	Mark
	Sean
	Shelly
	Wendy

Using a scenario outline

1. Consider a number of scenarios. They require similar steps as a part of them; the difference is different input values. Typically, a registration validation scenario is a good example:

Background:

When I am on the registration page

Scenario: user registration

When I fill "email" field with ""

And I press "Register" button

Then I should see error message "Email cannot be blank"

When I fill "email" field with "wayne"

And I press "Register" button

Then I should see error message "Please input valid Email address"

And I fill "password" field with ""

And I press "Register" button

Then I should see error message "Password cannot be blank"

And I fill "password" field with "asdf"

And I press "Register" button

Then I should see error message "Password is too short"

2. Ouch! A registration in the real world is definitely more complex than this one! The preceding scenario looks so ugly; the right way is to adopt Gherkin's Scenario Outline:

Scenario Outline: user registration

When I fill "<field_name>" field with "<value>"

And I press "Register" button

Then I should see error message "<error_message>"

Examples:

field_name	value	error_message
Email		Email cannot be blank
Email	wayne	Please input valid Email address
Email	admin@wayne.com	Email has already been taken
Password		Password cannot be blank
Password	asdf	Password is too short

By utilizing Scenario Outline, the feature looks clean and easy, and it refrains from writing duplicate steps. Additionally, we can quickly find out missed cases because of its tidy text. For example, in the previous case, we can easily point out that we lack the maximum length check for both the e-mail and password.

Doc strings

1. Sometimes we have a string with a new line in the step; in this scenario we can use Gherkin Dot Strings to represent the long string. Typically a step with account activation e-mail content is as follows:

```
Scenario: User registration
  When the user clicks "Register"
  Then an Email should be sent out with content:
  """
  Dear customer,
  Thank you for registering at ABC website!
  Please click the following link to activate your account!
  http://foo-web.com/user/wayne/activation
  """
```

2. In the implementation step, the string content will be passed in as `Cucumber::Ast::Docstring`:

```
Then /^an Email should be sent out with content:$/ do |string|
  p string.class # Cucumber::Ast::DocString
  p string
  # "Dear customer,\nThank you for registering at ABC
  website!\nPlease click the following link to activate
  your account!\nhttp://foo-web.com/user/wayne/activation"
end
```

There's more...

There are two extra tips for organizing Cucumber features and writing better features.

Using tags

Gherkin allows you to add meaningful tags, for example:

- ▶ Mark important, minimum marketable features as `@important` or `@MMV`
- ▶ Mark features that require logging into the system as `@require_login`
- ▶ Mark work in progress features as `@todo` or `@wip`

Tag(s) can be applied to features or scenarios; scenarios, scenario outlines, or examples will inherit any tags that exist on the containing feature.

Tag(s) are pretty useful and provide many benefits. For example, they can help in organizing and filtering features:

- ▶ We can specify Cucumber to run all features marked as @mandatory:
`$ cucumber --tags @mandatory`
- ▶ We can specify Cucumber to run all features except @todo ones:
`$ cucumber --tags ~@todo`
- ▶ We can specify Cucumber to run all @finished and @integration features:
`$ cucumber --tags @finished --tags @integration`
- ▶ We can specify Cucumber to run features with a maximum number limit. The preceding command demonstrates both the ORing tags and the tag limits:
`$ cucumber --tags @dev:4,@qa:6`

Cucumber will fail if there are more than four @dev features or more than six @qa features, even if all the features passed. This tip will be pretty useful in the **Kanban** development methodology (a scheduling system invented by Toyota for the *Lean* and *Just-in-Time* productions) because we want to limit the number of *Working in Progress* features.

Apply tag logic by using hooks. We can add a block of Ruby code before/around/after a specific tag. This is massively useful, for example, because we can implement login logic before all features/scenarios marked with a @require_login tag:

```
Before('@require_login') do
  # Put login logic here
end
After('@require_login') do
  # Perform logout logic
end
```

When we run the @require_login tag, the login logic hook will be executed automatically. Here it just demonstrates the tagged hooks. There are also scenario hooks, step hooks, and global hooks.

Imperative steps versus declarative steps

Do you remember in the beginning of the previous recipe, we wrote a Gherkin feature for the first story:

```
Feature: Write blog
As a blog owner
I can write new blog post
Scenario: Write blog
  Given I am on the blog homepage
```

```
When I click "New Post" link
And I fill "My first blog" as Title
And I fill "Test content" as content
And I click "Post" button
Then I should see the blog I just posted
```

Every step in this feature is granular; it describes each action used. Steps like these are called **imperative steps** (or communicative); as a comparison, another pattern of writing Gherkin is **declarative** (or informative), which suggests describing the user story over recording the user's actions.

For example, writing the previous feature in the declarative style will be as follows:

```
Feature: Write blog
As a blog owner
I can write new blog post

Scenario: Write blog
  Given I am on the blog homepage
  When I write a new blog post
  Then I should see the blog I just posted
```

A declarative step usually hides more details and provides better readability for business people. Many people prefer declarative steps over imperative steps since imperative steps could be brittle because they are usually tightly coupled with UI or a serial of business logic, whereas both of them could be changed as per the requirement.



In the older version of Cucumber, there used to be a `web_steps.rb` generated under the `step_definitions` directory every time Cucumber got installed. However, to avoid people writing imperative steps, Aslak Hellesøy (the co-author of Cucumber) removed it. His original statement is as follows:

"The reason behind this is that the steps defined in `web_steps.rb` leads people to write scenarios of a very imperative nature that are hard to read and hard to maintain. Cucumber scenarios should not be a series of steps that describe what a user clicks. Instead, they should express what a user does."

However, an imperative step is not always bad. Using imperative steps in some cases is more appropriate and natural than declarative steps. It is usually simple to read and understand, so the suggestion here is trying to write declarative steps but using imperative steps whenever the need arises.

Mastering pro tips for writing good steps (Advanced)

In this recipe, will cover various kinds of tips for writing good, maintainable, and DRY Cucumber steps.

Getting ready

We will reuse the Rails application `cucumber_bdd_how_to` that we've created in the *Writing your first Hello World feature (Simple)* recipe, so please `cd` into that directory to get prepared.

How to do it...

In the following sections, a number of useful step tips will be introduced and covered exhaustively.

Flexible pluralization

1. Let's imagine that we need to write a step that contains a singular or plural noun depending on its count:

```
When the user has 1 gift
...
When the user has 5 gifts
...
```
2. Instead of implementing two similar step definitions, we can adopt a tip in Cucumber called **Flexible Pluralization**; the step to match the preceding steps is as follows:

```
When /^the user has (\d+) gifts?$/ do |num|
  p num.to_i
end
```
3. Notice the `?` (question mark) appended to `gifts`; it means match zero or more of the preceding character, and so the step definition will match both `gift` and `gifts`.

Non-capturing groups

1. Sometimes the plural of a noun is irregular, such as `person/people`, `knife/knives`. We cannot match them through flexible pluralization, and for these scenarios we need to adopt **non-capturing groups**, because Cucumber's step statements are eventually treated as regular expressions:

```
When there is 1 person in the meeting room
When there are 8 people in the meeting room
```

2. We can define our step as follows:

```
When /^there (?:is|are) (\d+) (?:person|people) in the
meeting room$/ do |num|
  p num.to_i
end
```

3. By adding a `?:` before a normal group, the step will try to match one occurrence of the given word and will not pass the matched value into arguments. Non-capturing groups ensure Gherkin's good readability when dealing with singulars and plurals, and in a DRY manner since one generic step matches various kinds of styles.

Step argument transforms (transform wisdom)

1. Manually converting a parameter to an integer all the time would be really annoying! We are able to define a step argument transform rule within a step definition file that can be used by other steps:


```
Transform /^(-?\d+)$/ do |num|
  num.to_i
end
```

2. The argument transform also supports tables! For example, we have a feature with table input as follows:

```
Given this Qatar billionaire has 39 billion
And his wealth consists of the following major parts
| Domain      | Worth |
| Oil         | 21    |
| Real Estate | 8     |
| Financial   | 6     |
| Cargo       | 4     |
```

3. We can then define a transform step to convert the table input into any data we want:

```
Transform /^table:domain,worth/ do |table|
  table.map_headers! { |header| header.downcase.to_sym }
  table.map_column!(:domain)
  { |domain| Domain.parse(domain) }
  table.map_column!(:worth) { |worth| "$#{worth}" }
  table
end
```

 If you want to make the argument transform rule global, create a Ruby file under `/step_definitions/support/transform_rules.rb`, and put the argument transform step inside it.

Defining the methods and extending "World"

1. We can define a number of common use methods under the `features/support` directory, for example creating a `current_user` method and putting it under `features/support/current_user.rb`:

```
def current_user
  # Code to mock a current user object
end
```

2. We can also utilize Cucumber's `World` interface to mix in customized modules, for example, we can define an `add_headers` method:

```
module CapybaraHeadersHelper
  def add_headers(headers)
    headers.each do |name, value|
      page.driver.browser.header(name, value)
    end
  end
end
World(CapybaraHeadersHelper)
```

3. This means that in our step definition we can invoke the `add_headers` method from the `CapybaraHeadersHelper` module to add a customized HTTP header when requesting web pages during a test.

Compound steps

Methods can be reused, and so can steps! This is a widely used tip for writing good and DRY Cucumber steps, known as **compound steps**.

1. Considering a website provider's ability to log in with third-party accounts such as Facebook, Google, or OpenID, the feature can be described as follows:

```
Feature: Login with 3rd party account
As a website user
I can login with 3rd party account
So that I don't have to register a new account
```

```
Scenario: Login with Facebook account
  Given user landed at login page
  And he choose login with Facebook
  Then he should see the Facebook authorization window
```

```
Scenario: Login with Google account
  Given user landed at login page
  And he choose login with Google
```


Then he should see the Google authorization window

Scenario: Login with OpenID account

Given user landed at login page

And he choose login with OpenID

Then he should see the OpenID login window

2. The step user choose login with ** can be implemented using the DRY principle as follows:

```
Given /^he choose login with (.*)$/ do |account_provider|
  step %{user clicks on the #{account_provider} logo}
  step %{login with #{account_provider}}
end
```

```
Given /^user clicks on the (.*) logo$/ do
  |account_provider|
  # DOM operation to trigger clicking on the related logo
end
```

```
Given /^login with (.*)$/ do |account_provider|
  # Implement OAuth login per given 3rd party account
end
```

Unanchored steps

1. In each step's definition, most of the time, the step starts with ^ and ends with \$. It looks as follows:

```
Given /^user landed at login page$/ do
end
```

2. Both ^ and \$ are called "anchors". The preceding step uses ^ and \$ to match the string user landed at login page exactly; then we could probably employ "unanchored steps" as follows:

```
Then /^wait (\d+) seconds?/ do |seconds|
  sleep(seconds.to_i)
end
```

3. Note at the end of the match we use a question mark, ?, to match the flexible pluralization instead of \$, which means all steps containing "wait for x second(s)" will be matched by the preceding step definition, for example:

```
When I wait 5 seconds after the certificate has been
downloaded
```

```
When I wait 4 seconds until the loading animation
finished
```

There's more...

Other than the preceding technical tips, the last one, and also the most important tip, is to keep your steps organized!

Be organized

All the preceding tips are targeted at writing maintainable and DRY Cucumber steps. The last tip is to keep Cucumber steps organized, which is kind of a "soft" skill, even though it might be the most important! Categorizing features and step definition files, using tags or hooks, using Rake tasks to encapsulate common running features, and so on; these "rules" are unobtrusive but really important to keep the Cucumber tests maintainable and make daily BDD development life easier.

Using third-party libraries with Cucumber (Intermediate)

This recipe will introduce a number of awesome third-party libraries used in line with Cucumber; each of them dominates a specific field, and all of them are widely used.

Getting ready

We will be re-using the example project that we created in the *Building a real web application with Cucumber (Intermediate)* recipe, and do some refactoring based on it, so that it is clear to see the differences.

How to do it...

1. Before we get started, please `cd` to the blog directory and open the Gemfile.
2. Make sure the following Ruby gems exist and are installed:

```
gem 'cucumber'
group :development do
  gem 'guard-spork'
  gem 'guard-cucumber'
end

group :test do
  gem 'rspec-rails'
  gem 'cucumber-rails', require => false
  gem 'capybara'
  gem 'launchy'
  gem 'database_cleaner'
```

```
gem 'factory_girl_rails', "~> 4.0"
gem 'webmock'
gem 'pickle'
gem 'spork-rails'
end
```

How it works...

In the following sections, a number of useful Ruby gems will be introduced and covered in detail.

Factory_Girl

Factory_Girl is a fabulous tool that helps you create and build Ruby objects/data for tests. It provides a simple and straightforward syntax to create objects, and it also supports a number of build mechanisms (saved instances, unsaved instances, attribute hashes, and stubbed objects), and it can gracefully build associated objects.

Remember in the *Building a real web application with Cucumber (Intermediate)* recipe we wrote a step to prepare a `Post` object? Using `Factory_Girl`, we can do it in a better way:

1. Create a `factories.rb` under the `spec` directory with the following content:

```
FactoryGirl.define do
  factory :post do
    title 'Test title'
    content 'Test content'
    post_time Time.now
  end
end
```

2. And in the step definition we can write:

```
Given /^there is a post titled with "(.*)" and content
with "(.*)"$/ do |title, content|
  FactoryGirl.create(:post, title: title,
    content: content)
end
```

`Factory_Girl` is good at building associated objects. In the *Building a real web application with Cucumber (Intermediate)* recipe, we wrote two steps to prepare one blog post containing comment(s). If we were using `Factory_Girl`, it would be easier.

3. We can update our `factories.rb` as follows:

```
FactoryGirl.define do
  factory :post do
    title 'Test title'
    content 'Test content'
    post_time Time.now

    factory :post_with_comments do
      ignore do
        comments_count 5
      end

      after(:create) do |post, evaluator|
        FactoryGirl.create_list(:comment,
          evaluator.comments_count, post: post)
      end
    end
  end

  factory :comment do
    name "Wayne"
    email "admin@wayneeye.com"
    content "Test comment content"
  end
end
```

4. We can revise our Gherkin as follows:

Given there is a post with 1 comment

5. We can revise our step definition as follows:

```
Given /^there is a post with (\d) comment$/ do |comments_count|
  @post = FactoryGirl.create(:post_with_comments,
    comments_count: comments_count.to_i)
end
```

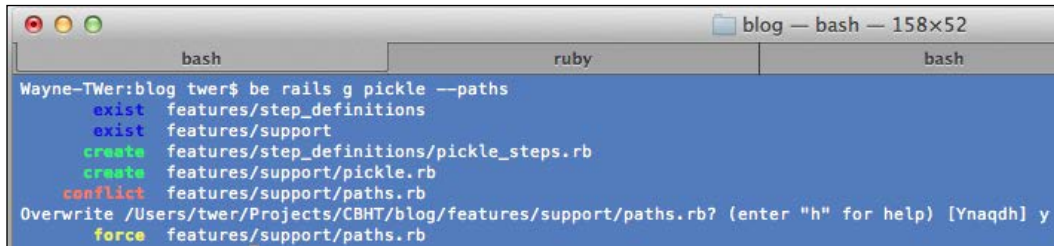
The functionalities of `Factory_Girl` are far more than we demonstrated previously. You can take a look at a brief Getting Started tutorial for `Factory_Girl` on the GitHub page (https://github.com/thoughtbot/factory_girl/blob/master/GETTING_STARTED.md). Whenever we need prepare data for testing, `Factory_Girl` is our friend!

Alternatives to `Factory_Girl` are `Machinist`, `Fabrication`, and so on.

Pickle

Pickle collaborates with the object created/built from *Factory_Girl* (or *Machinist*, *Fabrication*, or *ActiveRecord* objects) and generates many useful steps to help us write Cucumber easily and efficiently as follows:

1. Firstly we bootstrap Pickle to our project:
`$ rails generate pickle --path`
2. This will generate step definition files and `paths.rb`. The following screenshot shows the generation of pickle steps:



```
Wayne-Twer:blog twer$ be rails g pickle --paths
  exist  features/step_definitions
  exist  features/support
  create  features/step_definitions/pickles_steps.rb
  create  features/support/pickles.rb
  conflict features/support/paths.rb
Overwrite /Users/twer/Projects/CBHT/blog/features/support/paths.rb? (enter "h" for help) [Ynaqdh] y
  force  features/support/paths.rb
```

3. Remember in the *Building a real web application with Cucumber (Intermediate)* recipe when we prepared a post object, we wrote a Gherkin step and implemented it ourselves:

```
Given there is a post titled with "Dummy post" and
content with "Dummy content"
```

4. Now if we use Pickle, the step definition is already there! We can write our Gherkin step in the following style:

```
Given a post exists with title: "Dummy post",
content: "Dummy content"
```

5. And we visit a URL inside the step definition, which is hard to maintain as the project gets larger. A recommended way to do this is to centralize all URLs/paths in `features/support/paths.rb`, with Pickle's support, so we can rewrite the Gherkin step as follows:

```
When I am on the post's page
```

6. We update `edit_blog_steps.rb` and `paths.rb` respectively:

```
edit_blog_steps.rb:
When /^I am on the post's page$/ do
  visit(path_to "the edit page for post")
end
paths.rb:
when /^the edit page for #{capture_model}$/
  polymorphic_path(model!($1), :action => "edit")
```

As you can see, by using Pickle we can improve our productivity to a new level, and its predefined steps can satisfy the significant scenarios we need when writing Cucumber tests. This saves a huge amount of time for us!

WebMock

When we write functional tests, it is common we don't really want a real network transaction, we do want to isolate the network requests so that we can focus more on testing the business logic of the module we are testing; in the meantime, some web APIs have invocation limits; we don't want to burn the limits out by our tests.

WebMock is the tool to help! It stubs at a low HTTP client lib level, and it supports many popular Ruby HTTP libraries such as Net::HTTP, Patron, and Typhoeus.

For using WebMock with Cucumber, we need `require` in the `features/support/env.rb`:

```
require 'webmock/cucumber'
```

- ▶ For example, we expect our code to navigate a website, `www.abc.com`, and we expect it to return the content we want. We can stub the request as follows:

```
stub_request(:get, "www.abc.com").to_return  
(:body => "My expected content")
```

- ▶ For another example, we expect our code to submit an HTTP POST request with the expected body to a third-party website. As long as the POST request is submitted with the correct content, the rest of the stuff belongs to a third party. Thus we can stub this request:

```
stub_request(:post, "www.abc.com").with(:body => "My  
expected content", :header => "Content-Type:  
application/json")
```

Another example is that we expect our code to communicate with the GitHub OAuth API and acquire the user's authorization. We need to behave differently according to the user's choice. Using WebMock, we can simulate the OAuth process as follows:

1. Assume we've written the OAuth feature as follows:

```
Feature: OAuth with Github  
In order to provide easy registration and login  
As a web application  
I want submit OAuth request to Github and acquire user's  
authorization
```

```
Scenario: User accept to authorize  
  Given the user landing on homepage  
  When the user clicks "Github" icon within  
  "Registration" area  
  Then the user should see GithubOAuth page
```

```
When the user enter user email and password correctly
And the user clicks "Authorize App"
Then the user should be on registration success page
And I can get user's name on Github
And I can get the user's repositories on Github
```

2. We can simulate the OAuth process by writing a code similar to the following code snippet:

```
stub_request(:POST,
  "https://github.com/login/oauth/access_token").with
  ("client_id={client_id}&client_secret={secret}"
  &code={code}").to_return("access_token={token}"
  &token_type=bearer") stub_request
  (:GET, "https://api.github.com/users/wayne").with
  (:headers => 'Authorization: token'
  {fake_token}).and_return('{"name": "Wayne Ye",
  "public_repos": 9, "company": "ThoughtWorks"}')
```

3. What the preceding code does is simulate GitHub to return a valid `access_token`, so that we can use this fake token to invoke GitHub's API, and the data from the API is also mocked!

Using WebMock, we can stub any real network connection to ensure our code behaves as expected without relying on an active connection. If we do want to test a real network transaction, we can temporarily enable a real network connection by `WebMock.allow_net_connect!`

Alternatives to WebMock are Fake Web, Stale Fish, and so on.

Spork and Guard

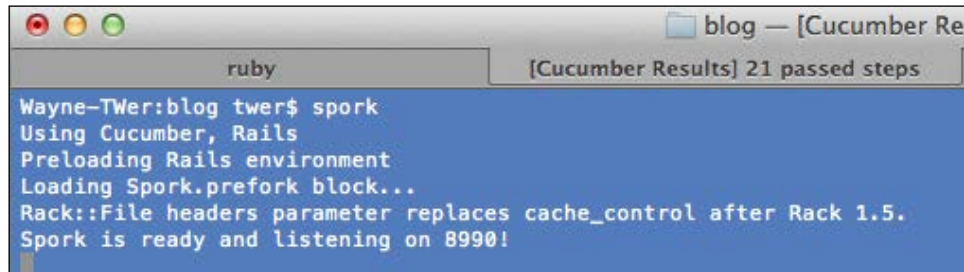
Spork is a very cool and handy gem, which has two major advantages:

- ▶ It hosts a **Distributed Ruby (DRb)** server and pre-loads the Rails environment into the server instance. After that, all further running tests can communicate with the DRb server. Thus there is no need to reload the Rails environment every time! Much faster than the common way!
- ▶ It forks (using `Kernel.fork`) a copy of the server each time we run our tests, thus ensuring a clean state between each other.
- ▶ We can run `spork cucumber -bootstrap` in the terminal to enable Spork for our project.

The first step in running `spork cucumber -bootstrap` in the terminal is as follows:

```
$ spork cucumber --bootstrap
```

Spork will update the `features/support/env.rb` file with guidance for us to modify. Usually one thing we need to do is move the existing code inside `env.rb` to the `Spork.prefork` block. After that we can run `spork` in the terminal to start the DRb server. The following screenshot shows the starting of Spork:



```

Wayne-Twer:blog twer$ spork
Using Cucumber, Rails
Preloading Rails environment
Loading Spork.prefork block...
Rack::File headers parameter replaces cache_control after Rack 1.5.
Spork is ready and listening on 8990!
  
```

With Spork running, we can now run our Cucumber features by passing a `--drb` option:

```
$ bundle exec cucumber --drb features/*.features
```

Cucumber will try to communicate with the local DRb server. It can be imagined as running against a copy of the pre-loaded server and won't load the Rails environment any more, so it would run much faster!

Guard is another very cool gem. It monitors the file you are editing, and as soon as you save the file, the related events will be triggered based on the configuration in `Guardfile`, and then Cucumber tests will respond and run! For example, if it sees that `Gemfile` has been changed, it will trigger the `bundle install` command immediately; if you modify a Cucumber feature, it will automatically run (rerun) this feature. Using Guard in line with Spork will give you an awesome BDD experience!

We can run the following command in a terminal to initialize the guard file with Spork and Cucumber supported:

```
$ guard init spork&& guard init cucumber
```

`Guardfile` basically defines two event handlers to handle the change event of the files passed to the `watch` method as follows:

1. When we open up the `Guardfile`, we should see the content similar to the one that follows. One important point is that we need to ensure we pass `--drb` for running Cucumber.


```

# A sample Guardfile
# More info at https://github.com/guard/guard#readme

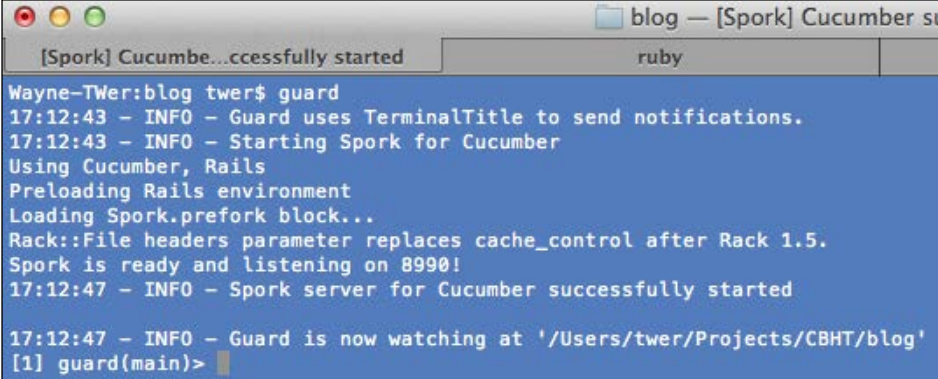
guard 'spork', :cucumber_env => { 'RAILS_ENV' => 'test' }, :rspec_env => { 'RAILS_ENV' => 'test' }, :rspec => false, :cucumber => true, :test_unit => false do
  
```



```
watch('config/application.rb')
watch('config/environment.rb')
watch('config/environments/test.rb')
watch(%r{^config/initializers/.+\.rb$})
watch('Gemfile')
watch('Gemfile.lock')
watch('spec/spec_helper.rb') { :rspec }
watch('test/test_helper.rb') { :test_unit }
watch(%r{features/support/}) { :cucumber }
end

guard 'cucumber', :cli => '-c --drb' do
  watch(%r{^features/.+\.feature$})
  watch(%r{^features/support/.+$}) { 'features' }
  watch(%r{^features/step_definitions/(.+)_steps\.rb$}) { |m|
    Dir[File.join("**/#{m[1]}.feature")][0] || 'features' }
end
```

2. Now we can start Guard in the terminal as follows:



The screenshot shows a terminal window titled "blog — [Spork] Cucumber su". The terminal output is as follows:

```
[Spork] Cucumbe...ccessfully started      ruby
Wayne-Twer:blog twer$ guard
17:12:43 - INFO - Guard uses TerminalTitle to send notifications.
17:12:43 - INFO - Starting Spork for Cucumber
Using Cucumber, Rails
Preloading Rails environment
Loading Spork.prefork block...
Rack::File headers parameter replaces cache_control after Rack 1.5.
Spork is ready and listening on 8990!
17:12:47 - INFO - Spork server for Cucumber successfully started

17:12:47 - INFO - Guard is now watching at '/Users/twer/Projects/CBHT/blog'
[1] guard(main)>
```

- Any further changes on the files that are monitored by Guard will trigger a related response by Guard. The following screenshot is of Guard monitoring:

```

18:02:09 - INFO - Running Cucumber features: bundle exec cucumber-1.3.2/lib/guard/cucumber/notification_formatter.rb
Running tests with args ["-c", "--require", "/Users/twer/.action_formatter.rb", "--format", "Guard::Cucumber::Notification_formatter", "--format", "pretty", "--strict", "--Using the default profile...
Running tests with args ["-c", "--require", "/Users/twer/.action_formatter.rb", "--format", "Guard::Cucumber::Notification_formatter", "--format", "pretty", "--strict", "--Done.

Disabling profiles...
Feature: Input comment
  As a blog visitor
    I can input comment onto blog

Scenario: Input comment
  Given there is a post titled with "Dummy post" and content
  And I am on the post page
  1 When I add a comment with the following information
  5
    | Name | Email | Content |
    | Wayne | admin@wayne.com | Test comment |
  15 Then I can see the comment has been added onto the post

1 scenario (1 passed)
4 steps (4 passed)
0m0.634s

Done.

[1] guard(main)>
  
```

```

1 Given /^I am on the post page$/ do
2   visit(post_path @post)
3 end
4
5 When /^I add a comment with the following information/ do
6   # table is a Cucumber::Ast::Table
7   table.hashes.each do |comment_data|
8     @commenter = comment_data[:name]
9     @email = comment_data[:email]
10    @content = comment_data[:content]
11    @post.comments.create!({ :name => @commenter, :email => @email, :content => @content })
12  end
13 end
14
15 Then /^I can see the comment has been added onto the post/ do
16   comments_list = find("div#comments-list")
17   comments_list.should have_content(@commenter)
18   comments_list.should have_content(@email)
19   comments_list.should have_content(@content)
20 end
  
```




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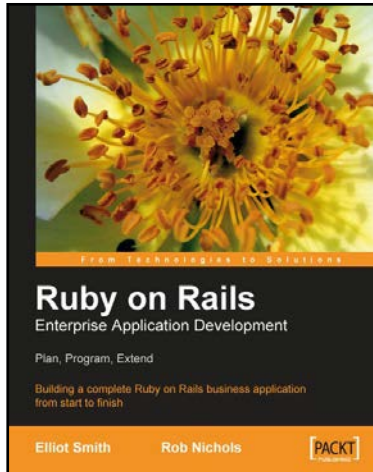
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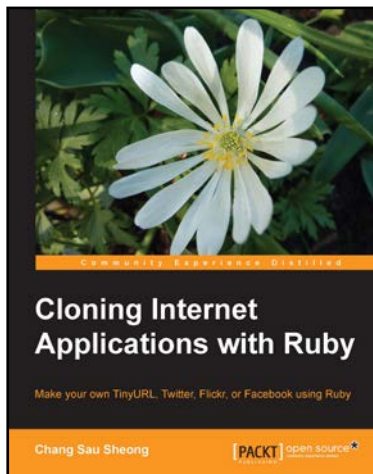
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