Fernando J. Miguel, Ray Bogman,
Vladimir Kerkhoff, Bret Williams,
Jonathan Bownds

Magento 2 - Build World-Class online stores

Learning Path

Create rich and compelling solutions for Magento 2 by developing and implementing solutions, themes, and extensions





Packt

Magento 2 - Build World-Class online stores

Create rich and compelling solutions for Magento 2 by developing and implementing solutions, themes, and extensions

A course in three modules



BIRMINGHAM - MUMBAI

Magento 2 - Build World-Class online stores

Copyright © 2016 Packt Publishing

All rights reserved. No part of this course may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, without the prior written permission of the publisher, except in the case of brief quotations embedded in critical articles or reviews.

Every effort has been made in the preparation of this course to ensure the accuracy of the information presented. However, the information contained in this course is sold without warranty, either express or implied. Neither the authors, nor Packt Publishing, and its dealers and distributors will be held liable for any damages caused or alleged to be caused directly or indirectly by this course.

Packt Publishing has endeavored to provide trademark information about all of the companies and products mentioned in this course by the appropriate use of capitals. However, Packt Publishing cannot guarantee the accuracy of this information.

Published on: April 2017

Production reference: 1210317

Published by Packt Publishing Ltd.
Livery Place
35 Livery Street
Birmingham B3 2PB, UK.

ISBN 978-1-78829-802-5

www.packtpub.com

Credits

Authors

Fernando J. Miguel

Ray Bogman

Vladimir Kerkhoff

Bret Williams

Jonathan Bownds

Reviewers

Michel Arteta

Miquel Balparda

Clive Walkden

Kevin Schroder

Andre Gugliotti

Content Development Editor

Sreeja Nair

Graphics

Jason Monteiro

Production Coordinator

Deepika Naik

Preface

Magento is the leading e-commerce software trusted by world`s leading organizations. Used by thousands of merchants for their transactions worth billions, it provides the flexibility to customize the content and functionality of your website. Our Magento Couse will help you gain knowledge and skills that are required to design & develop world class online stores.

What this learning path covers

Module 1, Magento 2 Development Essentials - This fast-paced tutorial will provide you with skills you need to successfully create themes, extensions, and solutions to Magento 2 projects. This book begins by setting up Magento 2 before gradually moving onto setting the basic options of the Sell System. You will take advantage of Search Engine Optimization aspects, create design and customize theme layout, develop new extensions, and adjust the Magento System to achieve great performance. By sequentially working through the steps in each chapter, you will quickly explore all the features of Magento 2 to create a great solution.

Module 2, Magento 2 Cookbook – This guide will provide you with the necessary insights to get a better understanding on what is needed to build powerful commerce platform. The book is divided into several recipes, which show you which steps to take to complete a specific action. In each recipe, we have a section that explains how everything works. It will cover configuring your categories and products, performance tuning, creating a theme, developing a module, and much more. At the end of this book, you will gain the knowledge to start building a success website.

Module 3, Mastering Magento 2– This is a comprehensive guide to using the all new features and interface of Magento 2 to build, extend, and design online stores. From planning your Magento installation through to advanced techniques designed to make your store as successful as possible, this book is your roadmap to managing your Magento store. Focusing on Magento's Community version, the book covers everything from creating and managing multiple stores to fi ne-tuning Magento for speed and performance. You'll learn how to manage categories, products, design themes, extensions, and more.

What you need for this learning path

You'll need Magento 2.0.

Who this learning path is for

This course is for anyone who wants to mould their skills in building amazing e-commerce websites using Magento. We begin right from getting you started with Magento to becoming an expert at building your own online stores with it.

Reader feedback

Feedback from our readers is always welcome. Let us know what you think about this course—what you liked or disliked. Reader feedback is important for us as it helps us develop titles that you will really get the most out of.

To send us general feedback, simply e-mail feedback@packtpub.com, and mention the course's title in the subject of your message.

If there is a topic that you have expertise in and you are interested in either writing or contributing to a book, see our author guide at www.packtpub.com/authors.

Customer support

Now that you are the proud owner of a Packt course, we have a number of things to help you to get the most from your purchase.

Downloading the example code

You can download the example code files for this course from your account at http://www.packtpub.com. If you purchased this course elsewhere, you can visit http://www.packtpub.com/support and register to have the files e-mailed directly to you.

You can download the code files by following these steps:

1. Log in or register to our website using your e-mail address and password.
2. Hover the mouse pointer on the SUPPORT tab at the top.
3. Click on Code Downloads & Errata.
4. Enter the name of the course in the Search box.
5. Select the course for which you're looking to download the code files.
6. Choose from the drop-down menu where you purchased this course from.
7. Click on Code Download.

You can also download the code files by clicking on the Code Files button on the course's webpage at the Packt Publishing website. This page can be accessed by entering the course's name in the Search box. Please note that you need to be logged in to your Packt account.

Once the file is downloaded, please make sure that you unzip or extract the folder using the latest version of:

- WinRAR / 7-Zip for Windows
- Zipeg / iZip / UnRarX for Mac
- 7-Zip / PeaZip for Linux

The code bundle for the course is also hosted on GitHub at https://github.com/PacktPublishing/Magento-2-Build-World-Class-online-stores/. We also have other code bundles from our rich catalog of books, videos, and courses available at https://github.com/PacktPublishing/. Check them out!

Errata

Although we have taken every care to ensure the accuracy of our content, mistakes do happen. If you find a mistake in one of our courses—maybe a mistake in the text or the code—we would be grateful if you could report this to us. By doing so, you can save other readers from frustration and help us improve subsequent versions of this course. If you find any errata, please report them by visiting http://www.packtpub.com/submit-errata, selecting your course, clicking on the Errata Submission Form link, and entering the details of your errata. Once your errata are verified, your submission will be accepted and the errata will be uploaded to our website or added to any list of existing errata under the Errata section of that title.

To view the previously submitted errata, go to https://www.packtpub.com/books/content/support and enter the name of the course in the search field. The required information will appear under the Errata section.

Piracy

Piracy of copyrighted material on the Internet is an ongoing problem across all media. At Packt, we take the protection of our copyright and licenses very seriously. If you come across any illegal copies of our works in any form on the Internet, please provide us with the location address or website name immediately so that we can pursue a remedy.

Please contact us at copyright@packtpub.com with a link to the suspected pirated material.

We appreciate your help in protecting our authors and our ability to bring you valuable content.

Questions

If you have a problem with any aspect of this course, you can contact us at questions@packtpub.com, and we will do our best to address the problem.

Module 1: Magento 2 Development Essentials

Chapter 1: Magento Fundamentals 3

- XAMPP PHP development environment 4
- XAMPP installation 5
- Magento 9
- Summary 16

Chapter 2: Magento 2.0 Features 17

- The revolution of Magento 2.0 18
- An introduction to the Magento order management system 21
- Magento 2.0 command-line configuration 24
- The command-line utility 24
- Summary 28

Chapter 3: Working with Search Engine Optimization 29

- Magento SEO management 30
- Store configuration 30
- SEO and searching 31
- SEO catalog configuration 34
- Google Analytics tracking code 36
- Optimizing Magento pages 36
- Summary 41

Chapter 4: Magento 2.0 Theme Development – the Developers' Holy Grail 43
The basic concepts of Magento themes 44
Magento 2.0 theme structure 44
The Magento Luma theme 46
Magento theme inheritance 47
CMS blocks and pages 49
Custom variables 49
Creating a basic Magento 2.0 theme 52
Summary 59
Chapter 5: Creating a Responsive Magento 2.0 Theme 61
The CompStore theme 61
Composer – the PHP dependency manager 62
Building the CompStore theme 64
CSS preprocessing with LESS 66
Applying new CSS to the CompStore theme 67
Creating the CompStore logo 69
Applying the theme 70
Creating CompStore content 71
Customizing Magento 2.0 templates 76
Summary 77
Chapter 6: Write Magento 2.0 Extensions – a Great Place to Go 79
Magento development overview 80
Using the Zend framework 80
Magento 2.0 extension structure 80
Developing your first Magento extension 82
The Twitter REST API 82
The TweetsAbout module structure 84
Using TwitterOAuth to authenticate our extension 85
Developing the module 86
Summary 102
Chapter 7: Go Mobile with Magento 2.0! 103
Testing the website on different devices 104
Adjusting the CompStore theme for mobile devices 112
The Magento 2.0 responsive design 112
The Magento UI 113
Implementing a new CSS mixin media query 115
Adjusting tweets about extensions for mobile devices 120
Summary 124

Chapter 8: Speeding up Your Magento 2.0 125
Magento Entity-Attribute-Value 126
Indexing and caching Magento 127
Indexing and re-indexing data 127
The Magento cron job 129
Caching 130
Fine-tuning the Magento hosting server 132
Selecting the right Magento hosting service 132
Apache web server deflation 133
Enabling the expires header 134
Minifying scripts 138
Summary 139
Chapter 9: Improving Your Magento Skills 141
Magento Connect extensions 141
Magento knowledge center 147
Improving your Magento skills 148
Summary 149

Module 2: Magento 2 Cookbook

Chapter 1: Magento 2 System Tools 153
Introduction 153
Installing Magento 2 sample data via GUI 157
Installing Magento 2 sample data via the command line 163
Managing Magento 2 indexes via the command line 166
Managing Magento 2 cache via the command line 169
Managing Magento 2 backup via the command line 174
Managing Magento 2 set mode (MAGE_MODE) 178
Transferring your Magento 1 database to Magento 2 181
Chapter 2: Enabling Performance in Magento 2 189
Introduction 189
Configuring Redis for backend cache 190
Configuring Memcached for session caching 199
Configuring Varnish as the Full Page Cache 203
Configuring Magento 2 with CloudFlare 209
Configuring optimized images in Magento 2 217
Configuring Magento 2 with HTTP/2 221
Configuring Magento 2 performance testing 228

Chapter 3: Creating Catalogs and Categories 235
Introduction 235
Create a Root Catalog 237
Create subcategories 244
Manage attribute sets 247
Create products 251
Manage products in a catalog grid 260
Chapter 4: Managing Your Store 265
Introduction 265
Creating shipping and tax rules 266
Managing customer groups 278
Configuring inventories 280
Configuring currency rates 284
Managing advanced pricing 285
Chapter 5: Creating Magento 2 Extensions – the Basics 291
Introduction 291
Initializing extension basics 292
Working with database models 296
Creating tables using setup scripts 298
Creating a web route and controller to display data 309
Creating system configuration fields 315
Creating a backend data grid 320
Creating a backend form to add/edit data 330
Chapter 6: Creating Magento 2 Extensions – Advanced 341
Introduction 341
Using dependency injection to pass classes to your own class 342
Modifying functions with the use of plugins – Interception 345
Creating your own XML module configuration file 349
Creating your own product type 356
Working with service layers/contracts 362
Creating a Magento CLI command option 382

Module 3: Mastering Magento 2

Chapter 1: Planning for Magento 393

Defining your scope 394
Technical considerations 398
Global-Website-Store methodology 401
Planning for multiple stores 404
Summary 407

Chapter 2: Managing Products 409

Catalogs and categories 409
Managing products the customer focused way 419
Creating products 439
Managing inventory 451
Pricing tools 453
Autosettings 455
Related products, up-sells, and cross-sells 456
Importing products 459
Summary 461

Chapter 3: Designs and Themes 463

The Magento theme structure 464
Default installation of design packages and themes 471
Installing third-party themes 473
Inline translations 475
Working with theme variants 476
Customizing themes 480
Customizing layouts 481
Summary 488

Chapter 4: Configuring to Sell 491

The sales process 492
Payment methods 499
Shipping methods 506
Managing taxes 514
Transactional e-mails 526
Summary 532

Chapter 5: Managing Non-Product Content 533
The Magento content management system 533
Summary 555
Chapter 6: Marketing Tools 557
Customer groups 557
Promotions 559
Newsletters 577
Using sitemaps 582
Optimizing for search engines 584
Summary 587
Chapter 7: Extending Magento 589
Magento Connect 590
The new Magento module architecture 592
Extending Magento functionality with Magento plugins 594
Building your own extensions 597
Summary 603
Chapter 8: Optimizing Magento 605
Exploring the EAV 606
Indexing and caching 611
Caching in Magento 2 – not just FPC 615
Tuning your server for speed 615
Summary 620
Chapter 9: Advanced Techniques 621
Setting up a staging environment 621
Version control 623
Magento cron 630
Backing up your database 637
Upgrading Magento 639
Summary 643

Chapter 10: Pre-Launch Checklist **645**
A word about scope **646**
System configurations **646**
Design configurations **649**
Search engine optimization **651**
Sales configurations **651**
Product configurations **656**
Maintenance configurations **662**
Summary **662**
Bibliography **665**
Index **667**

Module 1

Magento 2 Development Essentials

Get up and running with Magento 2 to create custom solutions, themes, and extensions effectively

1
Magento Fundamentals

Magento is a highly customizable e-commerce platform and content management system. Magento is one of the most used e-commerce systems to create online stores around the world by providing management of inventory, orders, customers, payments, and much more. It has a powerful scalable architecture.

Are you ready to start on the world of Magento development?

First of all, we will need to set up our environment. In this book, we will cover how to set up a local environment. It is very important to have this local ecosystem development to work smoothly and in an agile way.

In every chapter of this book, we will work with a mini project. It's kind of a sprint to learn the path. In this chapter, our mission is to create a work environment and understand the basic concepts of Magento (`http://magento.com/`).

After setting up the environment, you'll study the Magento folder structure and work on a basic **Model View Controller** (**MVC**) software architecture pattern and Magento basic setup.

Basically, we will work on this chapter with the following topics:

- XAMPP PHP development environment
- Magento e-commerce system
- Magento system structure
- Magento basic setup

Are you ready for fun some? Let's go!

XAMPP PHP development environment

The **XAMPP** is a complete web development environment. On its install package, we can find **Apache**, **MySQL**, **PHP**, and **Perl**. This is everything that you will want to develop your solutions!

At this time, you can imagine the meaning of XAMPP, but the **X** before the AMPP has the meaning of cross or cross-platform. So, we have XAMMP: (**X**) Cross-platform, **A**pache, **M**aria DB, **P**HP, and **P**erl.

The goal of XAMPP is to build an easy-to-install distribution for developers to get into the world of Apache. XAMPP is a project of **Apache Friends** (Apache Friends is a non-profit project to promote the Apache web server).

Why we are working with this software? Let's find out:

- **Apache** (`http://httpd.apache.org/`): This has been the most popular web server on the Internet since April 1995 providing secure, efficient, and extensible HTTP services in sync with the current HTTP standards
- **MariaDB** (`https://mariadb.org/`): This strives to be the logical choice for database professionals looking for a robust, scalable, and reliable SQL server
- **PHP** (`http://php.net/`): This is a popular general-purpose scripting language that is especially suited to web development; and, most importantly, it is the main language of Magento
- **Perl** (`https://www.perl.org/`): This is a highly capable, feature-rich programming language with over 27 years of development

So far so good, but how about doing some action?

XAMPP installation

First of all, let's access the XAMPP website on `https://www.apachefriends.org/`.



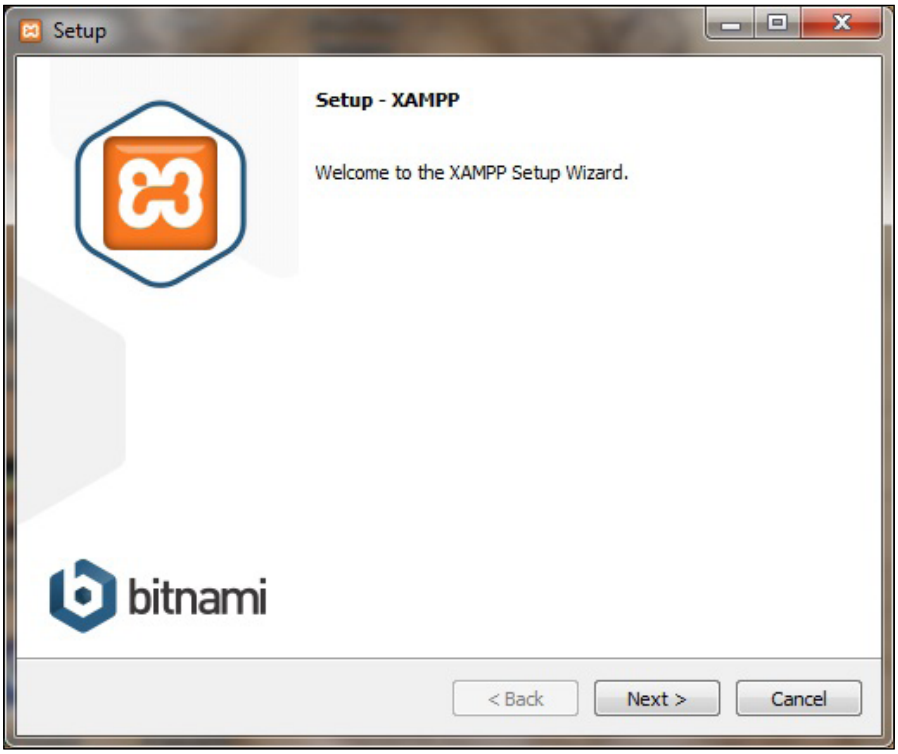
XAMPP has three distinct versions for different **operating systems** (**OS**): Windows, Linux, and OS X. Choose your preferred version to download, and start the installation process.

XAMPP for Windows installation

XAMPP for Windows has three different kinds of installation files:

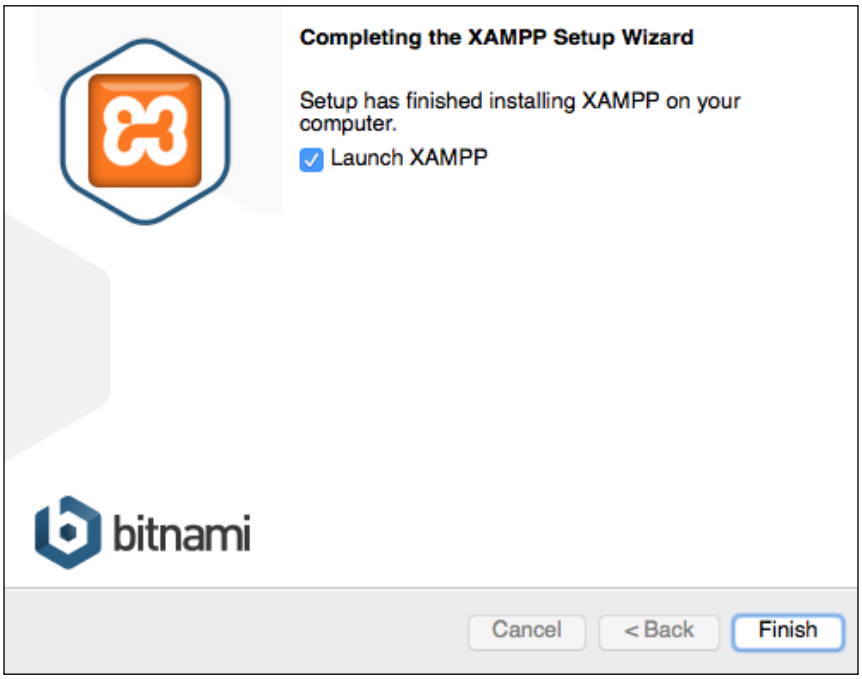
- **Installer**: This is a classic Windows installation method
- **Zip**: This method uses compressed files to install manually
- **7zip**: This method uses compressed files to install manually

The (`.exe`) installer is the most popular process to install. Download it and execute to start the installation process, shown as follows:

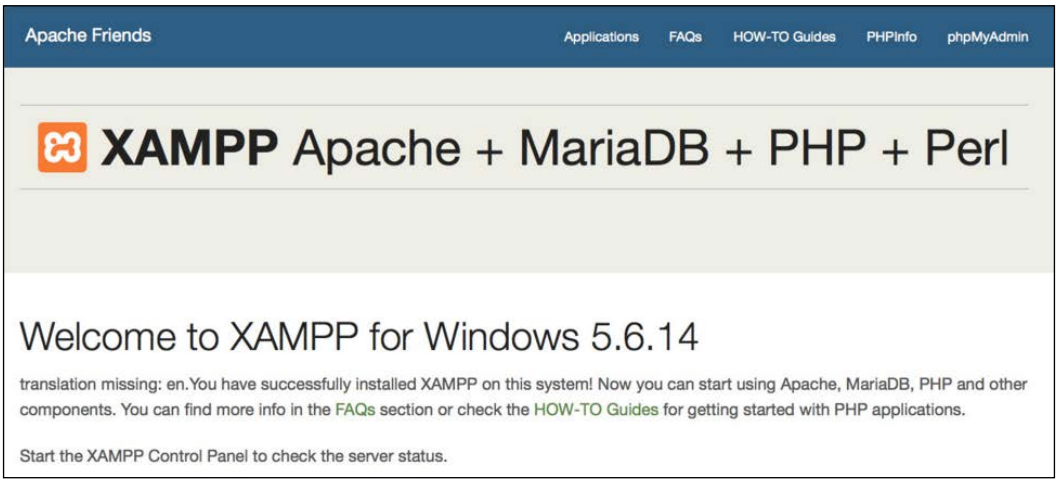


1. You can skip FileZilla FTP Server, Mercury Mail Server, and Tomcat for our installation purposes but feel free to consult **Apache Friends Support Forum** for further information at `https://community.apachefriends.org`.
2. On XAMPP, we have the option to use **Bitnami** (`https://bitnami.com/xampp`), but for learning purposes, we will install Magento in a classic way.

3. Complete the installation by pressing the **Finish** button.



4. In order to start XAMPP for Windows, you can execute `xampp-control.exe` and start the **Apache** web server.
5. To test if everything is working, type `http://localhosturl` in your favorite web browser. You will see the XAMPP start page:



XAMPP for Linux installation

XAMPP for Linux has two main versions of installation files:

- 32-bit version
- 64-bit version

Choose the file according to your architecture and follow these steps:

1. Change the permissions to the installer:

   ```
   chmod 755 xampp-linux-*-installer.run
   ```

2. Run the installer:

   ```
   sudo ./xampp-linux-*-installer.run
   ```

   XAMPP is now installed below the `/opt/lampp` directory.

3. To start XAMPP, execute this command on terminal:

   ```
   sudo /opt/lampp/lampp start
   ```

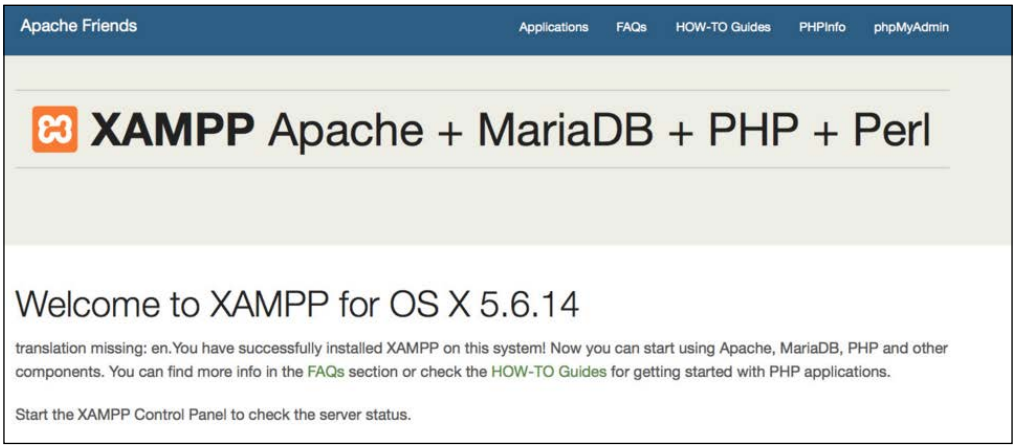
4. To test if everything is working, type the `http://localhost` URL in your favorite web browser. You will see the XAMPP start page:



XAMPP for OS X installation

To install XAMPP for OS X, you simply need to follow these steps:

1. Download the DMG image file.
2. Open the image file to start the installation process.
3. The steps are pretty much the same as Windows installation.
4. To test if everything is working, type the `http://localhost` URL in your favorite web browser. You will see the XAMPP start page:



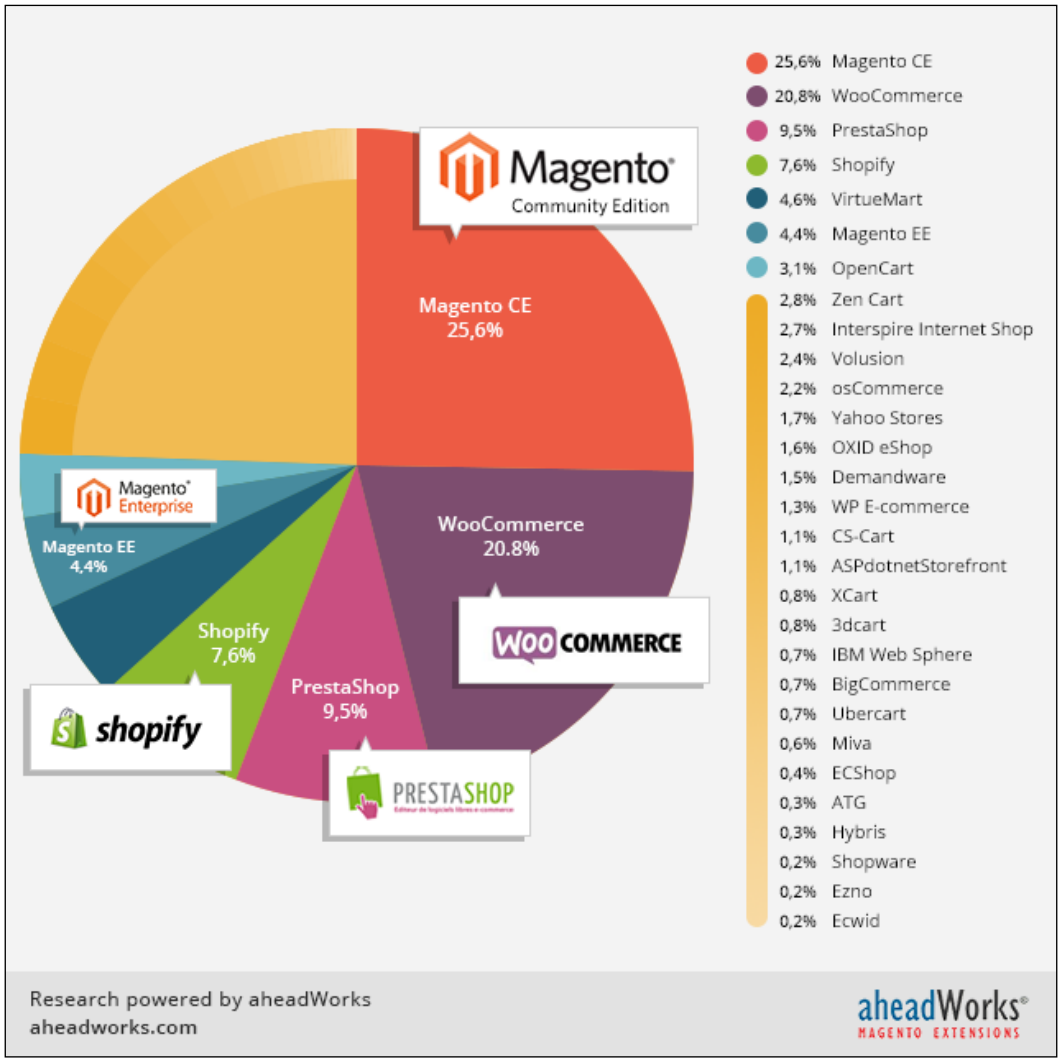
The XAMPP `htdocs` folder is the *docroot* folder of your server. Everything that you save on `htdocs` can be accessed via any browser. For example, if you save `index.php` inside the `htdocs` root, you can access this script by entering `http://localhost/index.php`. If you save your file in the `packt` folder, you can access it by `http://localhost/packt/index.php`. Piece of cake!

Magento

Magento is an open source content management system for e-commerce websites. It's one of the most important e-commerce systems, which has grown fast since its launch in 2008.

Basically, Magento works with two different types of Magento: **Community Edition** (**CE**) and **Enterprise Edition** (**EE**). In this book, we will cover CE.

On a study provided by aheadWorks (`https://aheadworks.com/`) in October 2014, Magento CE has taken the leading position among examined e-commerce platforms.

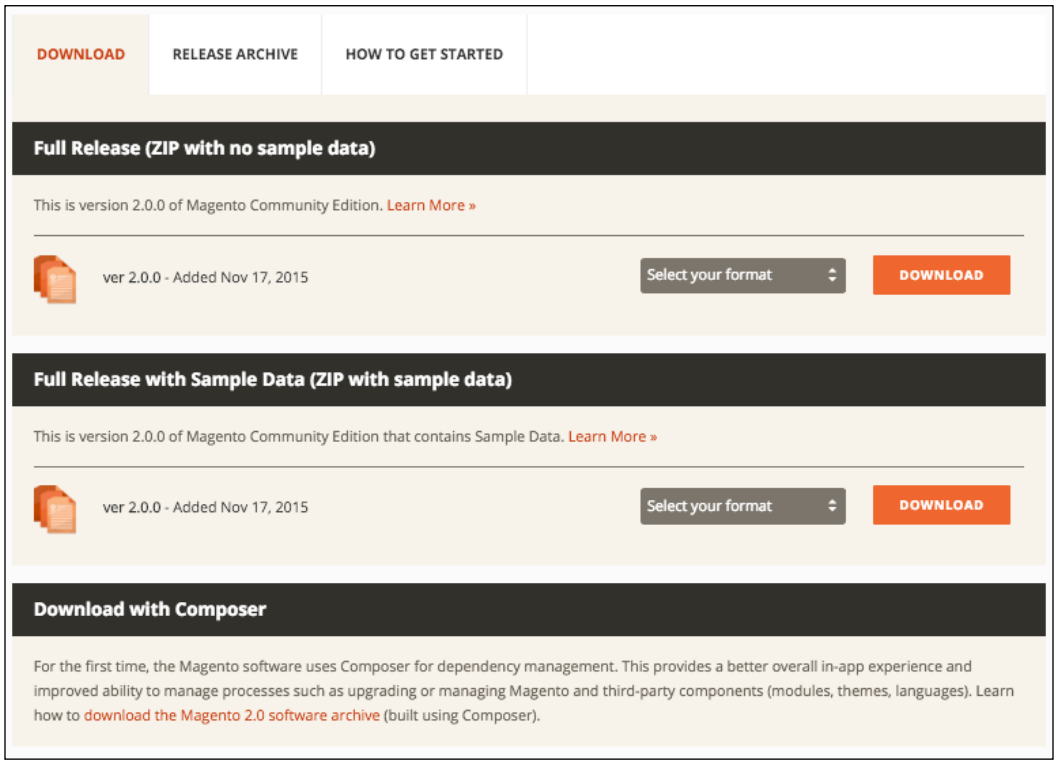


Now, we have solid concepts about "where we are going". It's very important to have solids concepts about every aspect that you are working on in this moment. Globally, e-commerce shows a remarkable potential market and Magento professionals are welcome.

Magento installation

First of all, we need to create a user account on the Magento website (`http://www.magento.com`) to download Magento CE. Click on the top-menu link **My Account** and after clicking the button labeled **Register**, fill out the form and confirm your registration.

Once registered, you gain access to download Magento CE. You can access the **Products** | **Open Source/CE** and **VIEW AVAILABLE DOWNLOADS** menus.



On this page, we have three important options:

- **Full Release (ZIP with no sample data)**: This is a complete download of the last and stable Magento version
- **Full Release with Sample Data (ZIP with sample data)**: This is important to create example products to our store for testing.
- **Download with Composer**: This is the dependency management installation tool

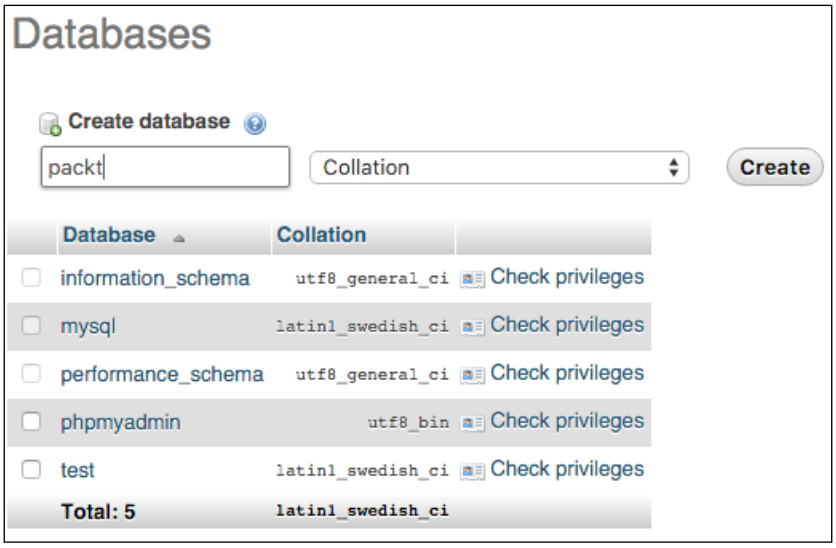
Choose the **Full Release with Sample Data (ZIP with sample data)** option for downloading Magento. Extract the compressed files in the XAMPP `htdocsfolder` and rename the folder to `packt`.



Remember to start Apache and MySQL services on the XAMPP panel before the installation.

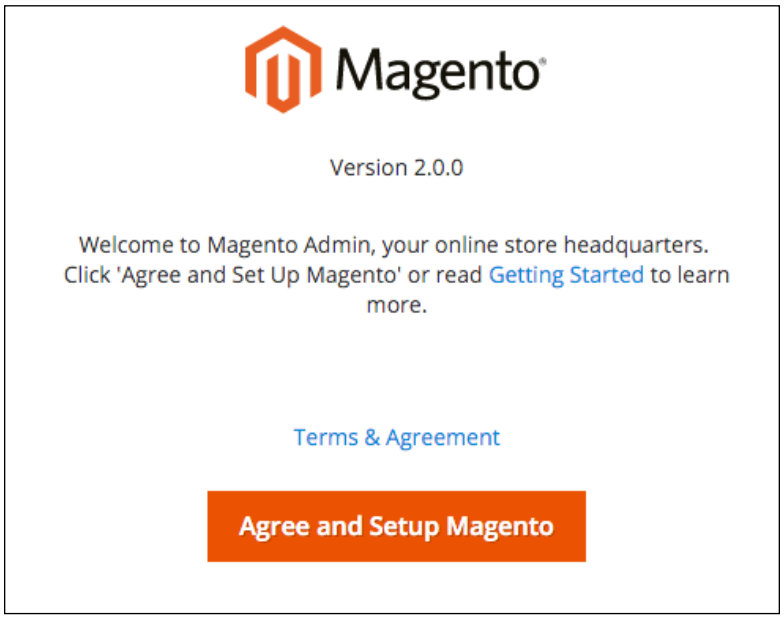
Before starting the Magento installation, we'll need to create a new MySQL database instance to store the Magento data. **phpMyAdmin** is a MySQL web app to manage your database and can be accessed at `http://localhost/phpmyadmin/`.

Click on the **Databases** menu and the **Create database** option to create the `packt` database.



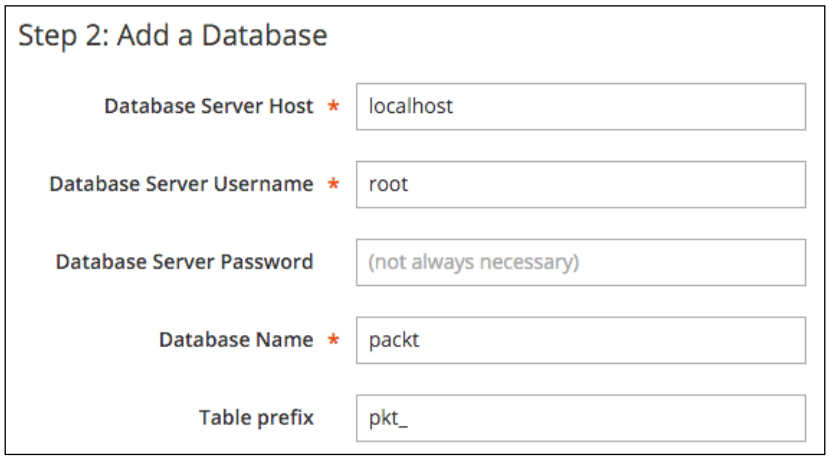
Now, let's start our Magento installation. On your browser, access `http://localhost/packt/setup`.

By now, you will see this installation page on your browser:

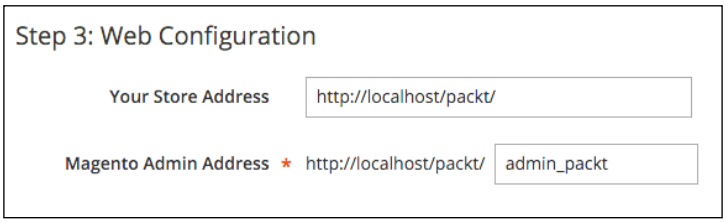


Let's start the Magento installation by following these steps:

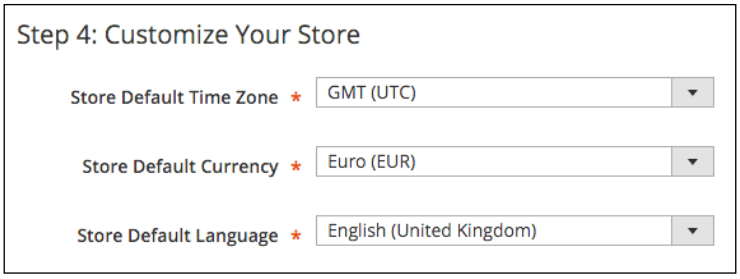
1. **Readiness Check**: Check the environment for the correct PHP version, PHP extensions, file permissions, and compatibility.
2. **Add a Database**: Fill the database form with your connection information. By default, you can follow the suggestions given here:



3. **Web Configuration**: Enter you store address and admin address here:



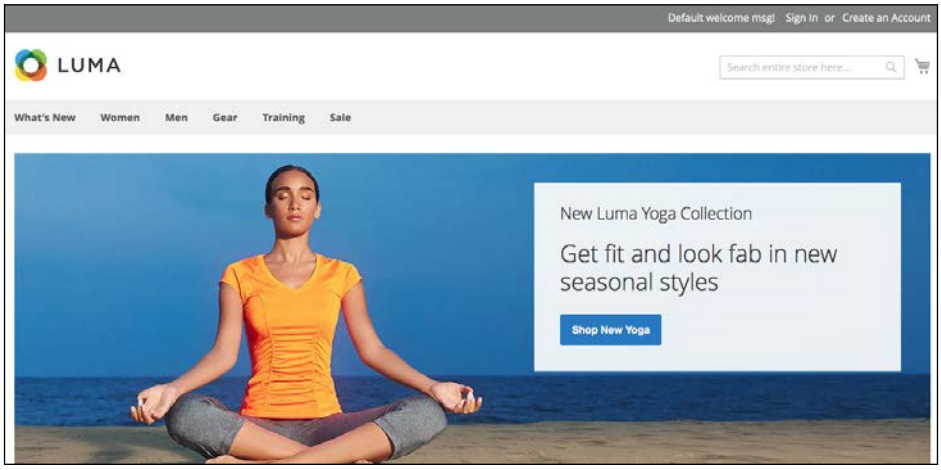
4. **Customize Your Store**: In this step you provide the time zone, currency, and language information:



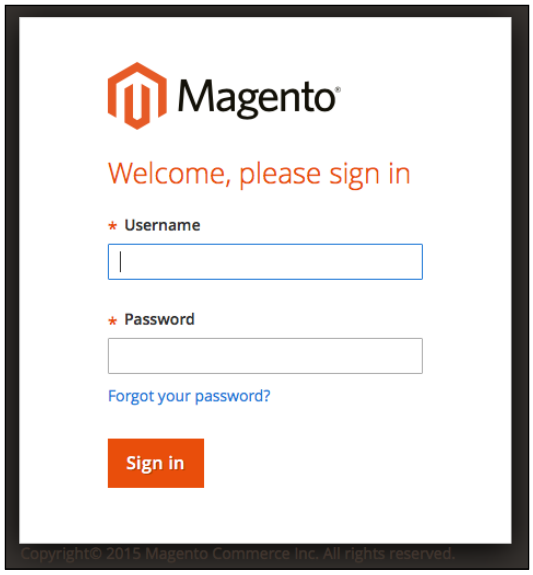
5. **Create an Admin Account**: Enter with personal login information and set the admin address to `packt-admin`.

After all these steps, we are done! Congratulations! We have our first Magento installation!

You can access your new site by accessing the URL at `http://localhost/packt`:



And you can access the admin area by accessing the URL at `http://localhost/packt/admin-packt`:



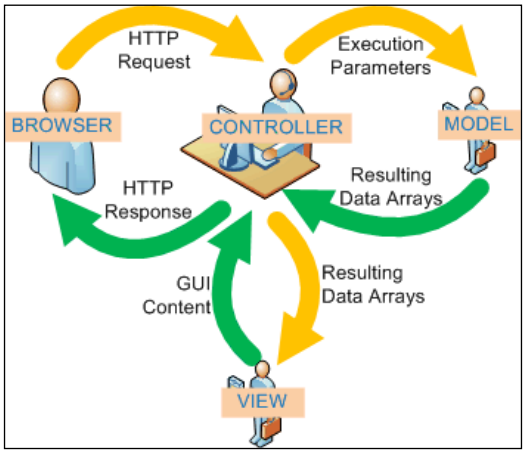
For more information about Magento installation, access `http://devdocs.magento.com/guides/v2.0/install-gde/bk-install-guide.html`.

Magento MVC architecture

MVC is an architectural software pattern that works with three different but interconnected parts. Its principal mission is to abstract the development work into interdependent layers providing the best practices to documentation and organization of software projects.

The Magento e-commerce solution is written with the PHP **Zend** framework, which is one of the most powerful PHP frameworks. For more information, access `http://framework.zend.com/`.

Magento is a *configuration-based* MVC System. For example, when you develop a module (we will check this in the next chapters), besides creating new files and classes to your module, you need to also create a `config.xml` file. This file contains all the configuration data for Magento module. These practices abstract some important information that you can easily edit to set the module as you need.



In this book, we will cover only the very basic Magento software architecture concepts, but it's highly recommended that you to study more software design patterns, especially in our case MVC software architecture needs to be understood well to best experience the field of software development.

Summary

You've now seen what Magento can do; you have installed Magento too. You started to understand the basic concepts of Magento, and certainly, you'll get more experience in developing your own Magento solutions by working in the projects of this book.

In the next chapter, we'll work with some Magento Sell System features.

2
Magento 2.0 Features

Magento has many features to provide a great experience to the users and developers. Understanding what Magento can provide is the key to success in the development of Magento. All Magento developers seek for improvements in this area.

On the Magento Connect site (`https://www.magentocommerce.com/magento-connect/`), you can search for uncountable extensions to improve your Magento solution: `Checkout`, `Cart`, `Order Management`, `Gifting`, `Pricing`, and `Promotion`, and a lot more. At this point, it is crucial to understand that Magento has a native solution and how its features can help you think of some great solutions for development.

In the previous chapter, you learned the fundamentals to create a basic local Magento environment to work with book projects. In this chapter, you will learn how Magento manages and improves system sell processes.

The following topics will be covered in this chapter:

- Magento features
- Magento architecture
- Magento order management
- Magento command-line utility configurations

Have fun!

The revolution of Magento 2.0

Magento Commerce has promoted important changes between its 1.x and 2.0 versions. Some usual problems of the Magento 1.x version were fixed in this new version. The following processes/modules have received improvements in Magento 2.0:

- Performance
- Payment method
- Checkout
- Catalog
- CMS
- Web API
- Framework
- Setup

All good software or systems pass through incremental improvements for evolving according to its production environment; it couldn't be different with a commerce platform that powers over 250,000 online stores worldwide.

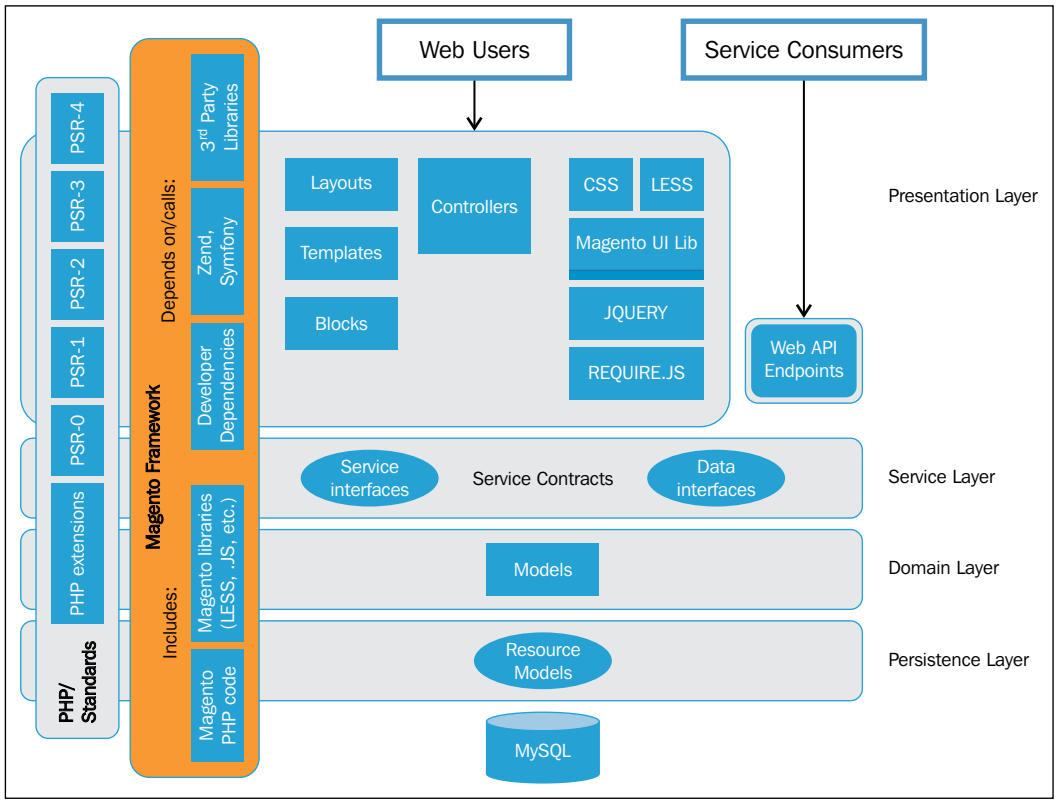
Magento 2.0 CE has a flexible architecture and a modular code base; it has a modern theming and an extensive **Application Programming Interface** (**API**). To get a better performance, Magento 2.0 compresses JavaScript files and images and gives support to **Apache Varnish** integration on the server side to enable faster performance.

Security is another subject treated in the Magento 2.0 system. According to its official documentation (`http://goo.gl/E7sPm3`), Magento 2.0 has had substantial enhancements in its security layer:

- Enhanced password management
- An improved prevention of cross-site scripting (XSS)
- Restricted permissions for file access
- An improved prevention of click jacking exploits
- The use of non-default admin URL

Extensibility and modularity allow Magento to be highly customizable. As an objected-oriented solution, Magento follows good architectural principles and coding standards that provide *high cohesion* and *loose coupling*.

The following diagram illustrates Magento's architecture and how the components are integrated:



Magento works with **PHP Standards Recommendations** (**PSR**). The PSR establishes the following good programming practices:

- **PHP extensions**: This allows Magento to work with some PHP extension solutions that are required by Magento, for example, **PDO** and **Memcache**.
- **PSR-0—Autoloading Standard**: This enables class autoloading on the PHP code. It's highly recommended to use PSR-4 instead of PSR-0, but the PSR-0 standard illustrates only the Magento architecture standards.
- **PSR-1—Basic Coding Standard**: These are some good practices to write the PHP code.
- **PSR-2—Coding Style Guide**: This extends PSR-1, adding the layout code presentation.

- **PSR-3—Logger Interface**: This exposes eight methods to write logs to the eight RFC 5424 levels (`debug`, `info`, `notice`, `warning`, `error`, `critical`, `alert`, and `emergency`).
- **PSR-4—Autoloading Standard**: This describes a specification for autoloading classes from file paths.

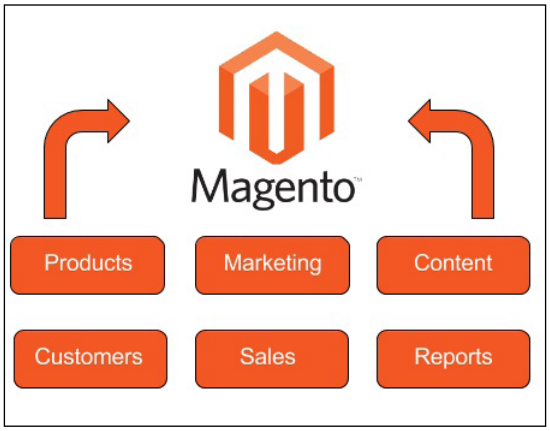


To know more about this, access `http://www.php-fig.org/psr/`.

On **Magento Framework**, we have some libraries and dependencies of this architecture. **Zend Framework** (**ZF**) is a very important layer of this architecture; once Magento was written in ZF; as we saw earlier.

Finally, we have **Web Users** (frontend/backend), **Service Consumers** (API and endpoints), **Service Layers** (interfaces/contracts), and **Models** (resources and database).

On the Web Users layer, we can define Magento's main processes as:



- **Products**: This manages the configuration of products in Magento, such as catalogs, inventory, categories, and attributes
- **Marketing**: This manages promotions, communications, and SEO
- **Content**: This manages the pages content
- **Customers**: This manages and gets information about customers
- **Sales**: This manages cart process, checkout, orders, shipping, and payments
- **Reports**: This generates reports and statics of e-commerce

We will discuss these topics in the coming chapters, but now, I'd like to introduce to you one of the most important processes of any kind of e-commerce: the **Sales** layer or **Magento Order Management**. This is one of the most important things to understand the Magento development core.

An introduction to the Magento order management system



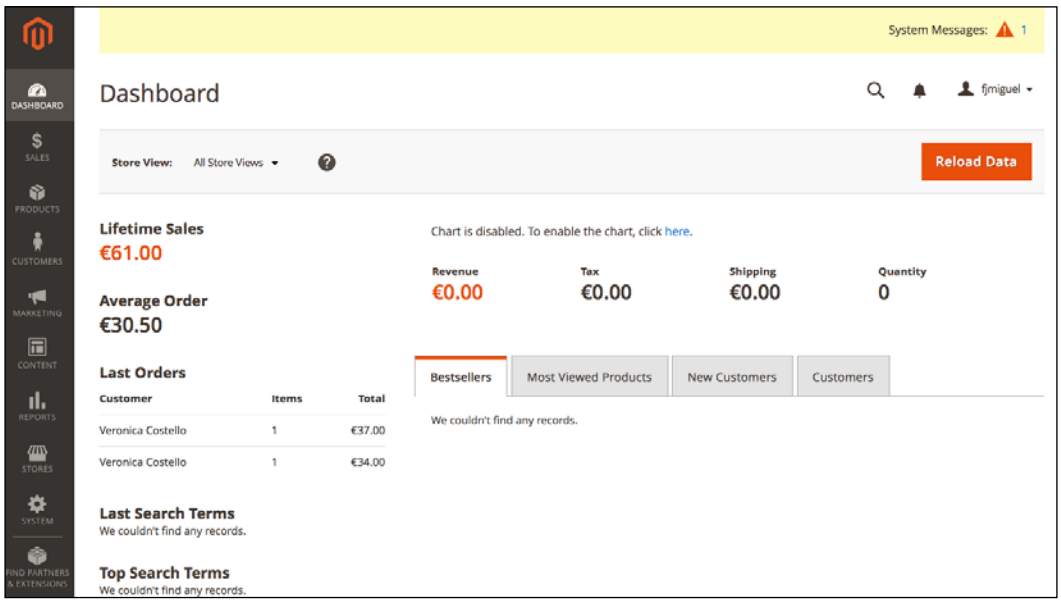
On the e-commerce systems, the sell process is one of the most important features of every online business, providing a good e-commerce life cycle.

Some processes will be triggered when a customer confirms his order. Magento collects all the customer data and processes the request turning it into an order. This book will only cover the basic concepts of this process, but it's very important to understand them to develop consistent Magento extension solutions (we will see about this in *Chapter 6, Write Magento 2.0 Extensions – a Great Place to Go*).

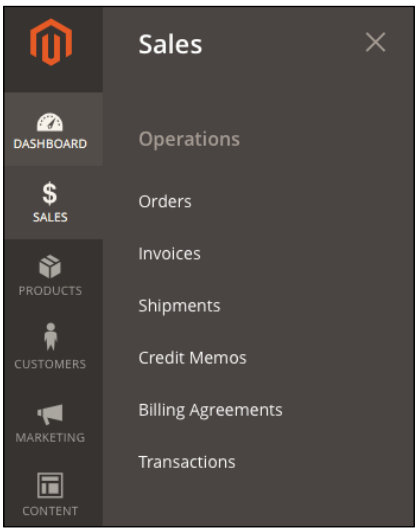
Let's take a look at the Magento sales operations basics.

Sales operations

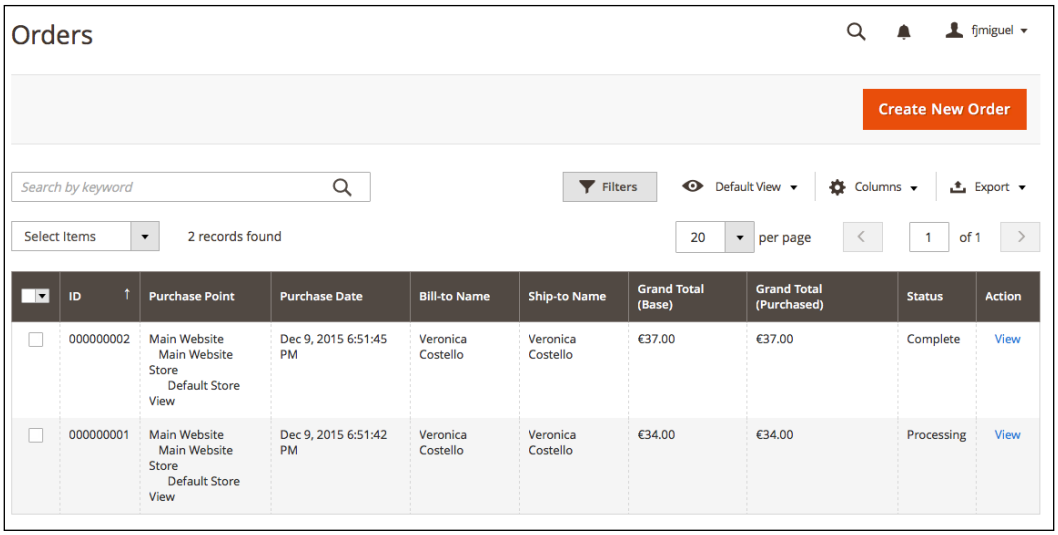
Let's play with the Magento admin area. In your favorite browser, enter the URL `http://localhost/packt/admin-packt`. Now, enter with your login credentials to access the admin area:



In Magento 2.0, you can manage sales operations by accessing the **Sales** menu in the admin area. Magento gives you the possibility to configure the following **Sales** options:



These options give you the power to manage your sales system as you want. Though it's, it's important to explore some Magento tools, extensions, and techniques to take full advantage and make improvements on your sales system to gather techniques to develop your own solution:



We have many options to make improvements on sales operations. You can configure up-sells and cross-sells features, for example, to give your customer more ways to order on your store. To do so, take advantage of a search engine optimization, work with a multilingual store, a geo-targeting, responsive design, and a simplified checkout process.

A simplified checkout process

In this section, we'll see how to implement a simplified checkout process on our store.

Orders

As a system administrator, you can access the admin area (`http://localhost/mymagento/admin`) to get all the customer order information, generate the product tracking code, invoices, and send a message to your customer. Magento stores all the order data on the **admin area** | **Sales** | **Orders**.

As an admin, Magento gives you the option to order products directly for your customer. On Magento, we have a persistent cart, print invoices, credit memo, and transactions.

Payments

You have a few options of payment methods in Magento. Magento has a native support to **Google Checkout** and **PayPal**. They both are payment gateways that provide the entire sell transaction environment to your store.

Basically, you choose your payment method and choose how you will pay for your product: credit card or deposit.

Promotions

With the products prices defined, you can set up promotions in advance. Promotion systems are very useful to establish a solid relationship with the customer.

In Magento, it is possible to define catalog price rules and shopping cart rules. Basically, you can define price behavior according to your promotions and customer defined rules, such as postal code, and certain value of discount.

You can provide coupon codes for your customers to raise Magento sells.

Magento 2.0 command-line configuration

Once you have installed Magento 2.0 CE, you will need to configure some options and manage the system life cycle according to your specific needs. You can start your Magento configuration and administration using the **command-line utility**.

Let's see how this feature works.

The command-line utility

Magento 2.0 has a command-line utility to help developers manage installation and configuration tasks. The new command-line interface can do the following:

- Install Magento
- Manage the cache
- Manage indexers
- Configure and run cron
- Compile code
- Set the Magento mode
- Set the URN highlighter

- Create dependency reports
- Translate dictionaries and language packages
- Deploy static view files
- Create symlinks to LESS files
- Run unit tests
- Convert layout into XML files
- Generate data for performance testing
- Create CSS from LESS (CSS real-time compilation)

To work with this tool, you will need to open a terminal (Linux, OS X) or command prompt (Windows) and access the `<your Magento install dir>/bin` directory. Then, enter with the `php magento` command to see all the available commands of the command-line utility:

```
[FernandoMiguel:bin fjmiguel$ cd /Applications/XAMPP/htdocs/packt/bin/
[FernandoMiguel:bin fjmiguel$ php magento --list
 Magento CLI version 2.0.0

 Usage:
  command [options] [arguments]

 Options:
  --help (-h)           Display this help message
  --quiet (-q)          Do not output any message
  --verbose (-v|vv|vvv) Increase the verbosity of messages: 1 for normal output,
  --version (-V)        Display this application version
  --ansi                Force ANSI output
  --no-ansi             Disable ANSI output
  --no-interaction (-n) Do not ask any interactive question

 Available commands:
  help                                  Displays help for a command
  list                                  Lists commands
 admin
  admin:user:create                     Creates an administrator
  admin:user:unlock                     Unlock Admin Account
```



Remember to configure the PHP path to the system environment variable to execute the command. For further information, access `http://php.net/manual/en/faq.installation.php`.

Let's play a little bit with the utility by disabling your Magento system cache:

- Run the `php magento cache:status` command. The cache will probably be enabled.
- Run the `php magento cache:disable` command to disable any cache system.

```
[FernandoMiguel:bin fjmiguel$ php magento cache:status
Current status:
                        config: 1
                        layout: 1
                     block_html: 1
                    collections: 1
                     reflection: 1
                         db_ddl: 1
                            eav: 1
              config_integration: 1
          config_integration_api: 1
                     full_page: 1
                     translate: 1
               config_webservice: 1
[FernandoMiguel:bin fjmiguel$ php magento cache:disable
Changed cache status:
                        config: 1 -> 0
                        layout: 1 -> 0
                     block_html: 1 -> 0
                    collections: 1 -> 0
                     reflection: 1 -> 0
                         db_ddl: 1 -> 0
                            eav: 1 -> 0
              config_integration: 1 -> 0
          config_integration_api: 1 -> 0
                     full_page: 1 -> 0
                     translate: 1 -> 0
               config_webservice: 1 -> 0
FernandoMiguel:bin fjmiguel$
```



To know more about cache management in command-utility tools, access `http://goo.gl/c5ivCY`.

Now let's try to manage Magento indexing. Magento indexing transforms the data to improve the performance of your system by executing the following commands. Indexing technique optimizes the price calculations process, for example, and it has an important role to play in the Magento performance:

- Run the `php magento indexer:info` command to view the lists of indexers
- Run the `php magento indexer:status` command to view the real-time status
- Run the `php magento indexer:reindex` command to rebuild the indexation

```
[FernandoMiguel:bin fjmiguel$ php magento indexer:info
customer_grid                   Customer Grid
catalog_category_product        Category Products
catalog_product_category        Product Categories
catalog_product_price           Product Price
catalog_product_attribute       Product EAV
cataloginventory_stock          Stock
catalogsearch_fulltext          Catalog Search
catalogrule_rule                Catalog Rule Product
catalogrule_product             Catalog Product Rule
[FernandoMiguel:bin fjmiguel$ php magento indexer:status
Customer Grid:                                  Ready
Category Products:                              Reindex required
Product Categories:                             Reindex required
Product Price:                                  Ready
Product EAV:                                    Ready
Stock:                                          Ready
Catalog Search:                                 Ready
Catalog Rule Product:                           Reindex required
Catalog Product Rule:                           Ready
[FernandoMiguel:bin fjmiguel$ php magento indexer:reindex
Customer Grid index has been rebuilt successfully in 00:00:04
Category Products index has been rebuilt successfully in 00:00:01
Product Categories index has been rebuilt successfully in 00:00:00
Product Price index has been rebuilt successfully in 00:00:04
Product EAV index has been rebuilt successfully in 00:00:03
Stock index has been rebuilt successfully in 00:00:01
Catalog Search index has been rebuilt successfully in 00:00:04
Catalog Rule Product index has been rebuilt successfully in 00:00:05
Catalog Product Rule index has been rebuilt successfully in 00:00:03
```

Magento indexing was successfully rebuilt, thanks to the command-line utility actions!

You can build **cron** jobs in a remote server to automate some Magento actions. For example, create an automation routine to re-index Magento periodically.

I strongly advise you to play more with the command-line utility. You can consult the online documentation available at `http://goo.gl/iVnQSn`.

Summary

We started this chapter to get the real bases of Magento power. It's important to get solid concepts, before you eagerly jump and begin developing Magento solutions. Take a moment to understand the scope of your project. This will make Magento development a much more rewarding experience.

Magento has a solid structure to develop your own solutions. You can automate some tasks using the Magento command-line utility and optimize Magento resources to get better results.

In the next chapter, we will work with Magento search engine optimization.

3
Working with Search Engine Optimization

Search Engine Optimization (**SEO**) is a technique to build your site following good practices established by W3C Consortium and search engines, such as Google, to increase your site's visitation and ranking. On Magento, we need to configure the system properly to take advantage of this feature. Nowadays, SEO is a prerequisite on every website on the Internet.

Magento has a great variety of tools to configure the store of SEO and allows SEO adjustment for products, categories and CMS page titles, metainformation, and headings.

SEO application is a constant job; it never ends. Basically, you need to know how Magento SEO works and what options you have to optimize its working. Magento is a search engine-friendly e-commerce platform, and you will discover its main concepts in this chapter.

In this book, you will learn some good techniques and apply them by configuring the default installation.

The following topics will be covered in this chapter:

- Magento SEO management
- SEO catalog configuration
- XML sitemap manager
- Google Analytics tracking code
- Optimizing Magento pages, products, and categories

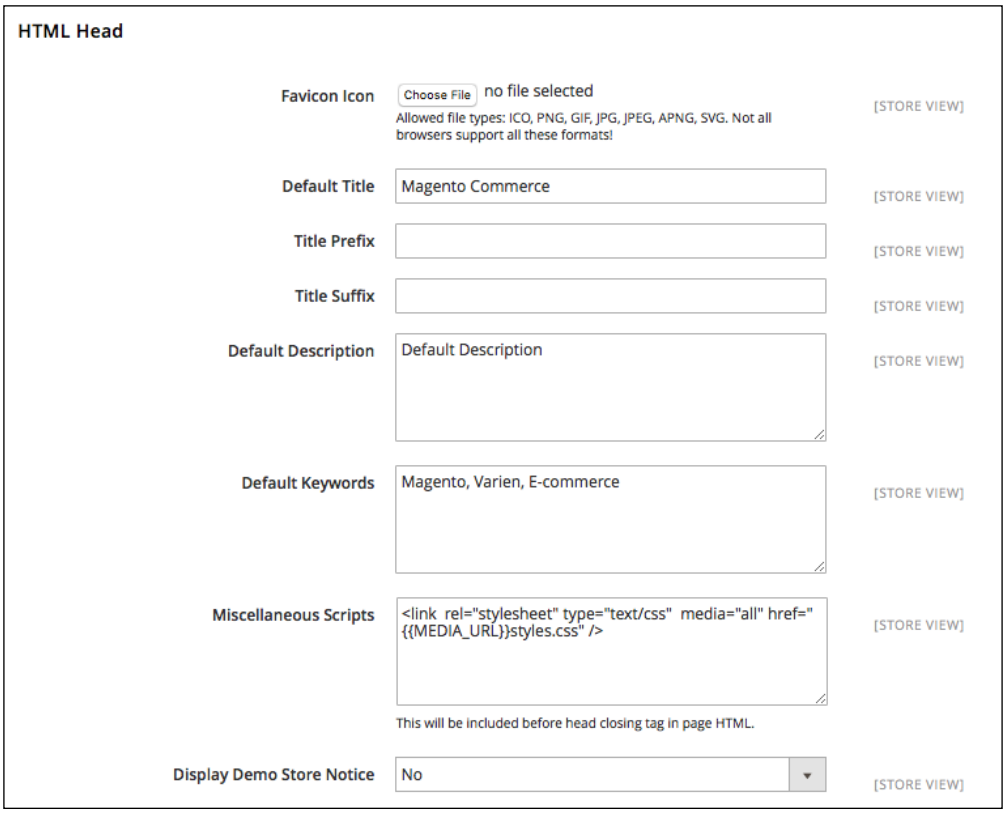
Magento SEO management

SEO is the technique of developing a site according to the high standards defined by the World Wide Web Consortium and search engine companies, such as Google, in order to provide good content visualization to the users and rank the site in organic searches.

Magento provides the user with some significant tools for SEO. Let's take a look at some of these techniques and tools.

Store configuration

By default, Magento's basic installation has the title `Magento Commerce` on the header settings. It is very important to choose a strong main title to get the right amount of traffic on your site. For example, if you are working on the SEO of a sports store, you can set the main title as **My Sports Store** to increase the traffic through the title. When people search for something, they always notice the earlier words first.



To adjust your store settings, you need to navigate to **Stores** | **Configuration** | **Design** | **HTML Head** in the Magento admin area (`http://localhost/packt/admin-packt`).

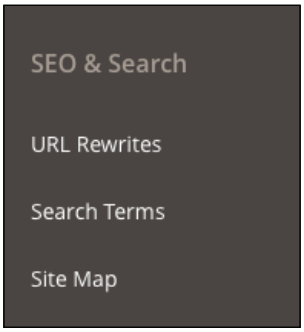
Choose a good descriptive title for your Magento commerce. It is possible and recommended to name all your page titles, including categories and products, by entering the site title in the **Title Suffix** field. To give density to the content for SEO engines by configuring the SEO on CMS pages and products, keep **Default Description** and **Default Keywords** empty.

For a local and nonproduction environment, prevent the indexing of the site by setting **Default Robots** to `NOINDEX, NOFOLLOW`. Otherwise, it is recommended to set it to `INDEX, FOLLOW`.

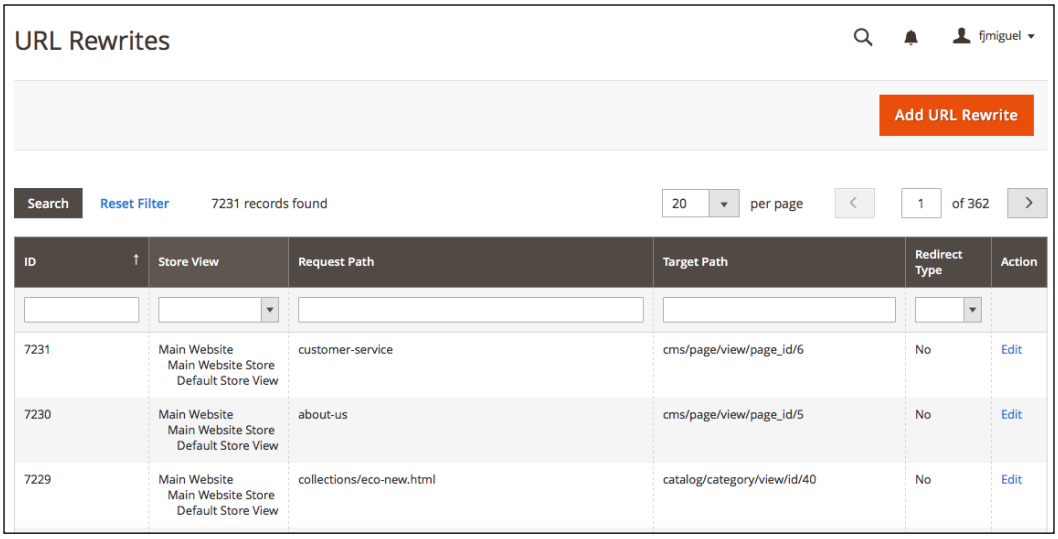
By working on this configuration, you will find that the main SEO parameters of the `<head>` tag are automatically fulfilled to be run on Magento commerce.

SEO and searching

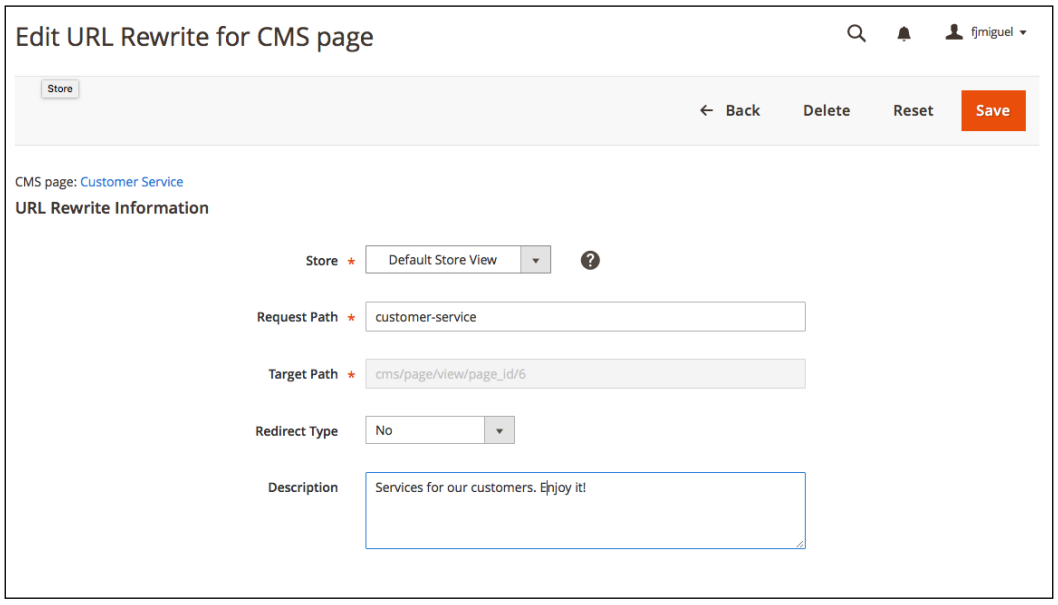
Magento has a specific SEO configuration panel for multiple sections. To access the main Magento SEO configuration, enter in the Magento admin area (`http://localhost/packt/admin-packt`), and you will find the panel by clicking on the menu at **Marketing** | **SEO & Search**:



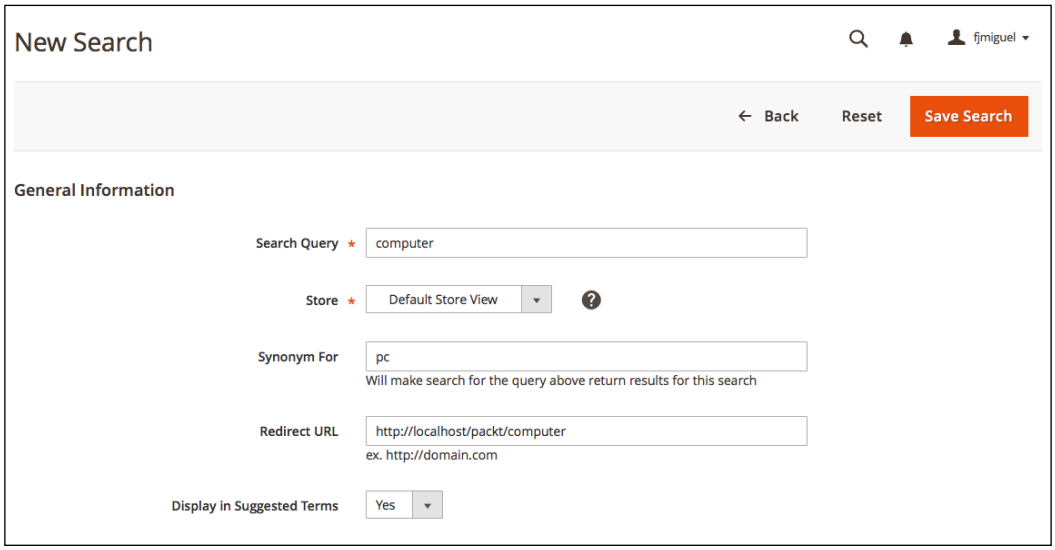
Magento 2.0 changed some functionality in comparison with its previous version. For example, in the **URL Rewrites** menu, you can manage and define all the URL addresses of Magento in order to increase the SEO's friendly URLs.



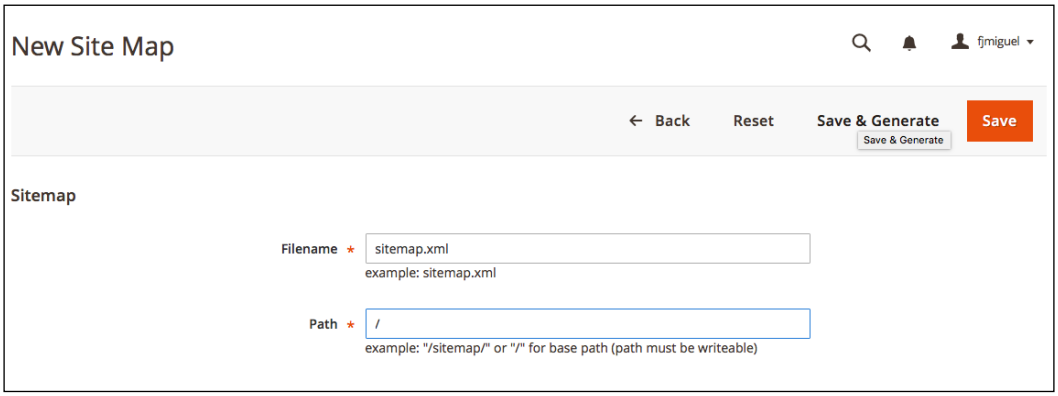
Here, you can simply choose **Request Path** to edit and enter a description for each of them, as shown in the following screenshot:



In **Search Terms**, you can define and redirect the URL according to the search made by the user by adding a new search term:

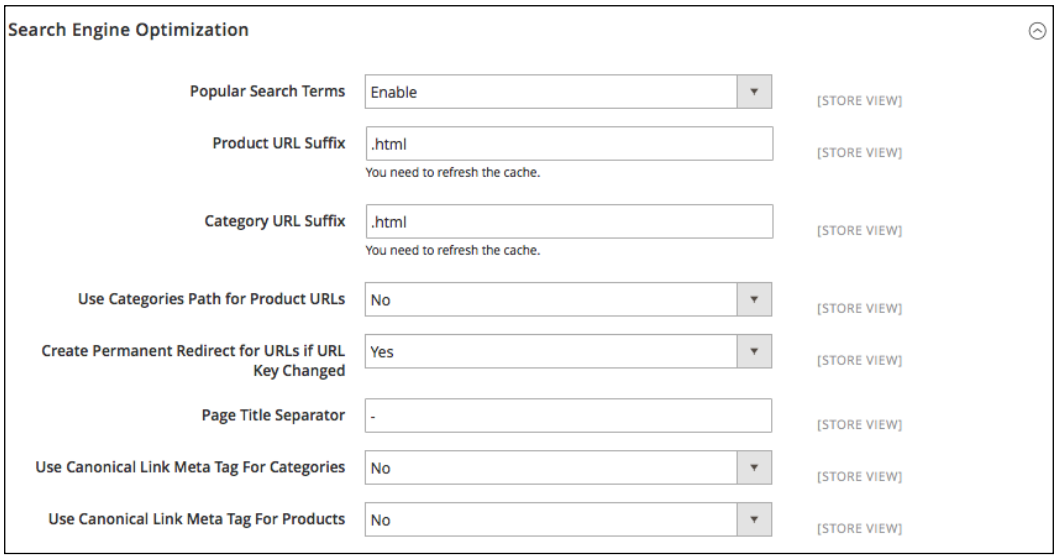


Finally, in the **New Site Map** section, you can generate **Sitemap** of your Magento installation as shown in the following screenshot:



SEO catalog configuration

Magento has a special panel to take care of the catalog categories of SEO. To access this panel, navigate to **Stores** | **Configuration** | **Catalog** | **Search Engine Optimization**, as follows:



This panel has the following options:

- **Popular Search Terms**: This allows pages to display your most popular search phrases. Set this to **Yes**.
- **Product URL Suffix**: This is the suffix that is added to the end of your product URLs.
- **Category URL Suffix**: This is the suffix that is added to the end of your category URLs.
- **Use Categories Path for Product URLs**: This includes the category URL in your URL string.
- **Create Permanent Redirect for URLs if URL Key Changed**: This automatically creates a redirect via the URL Rewrites' module in Magento if the URL key is changed in any page on your website.
- **Page Title Separator**: This separates the page titles on the frontend of your store.

- **Use Canonical Link Meta Tag For Categories**: This displays the main version of the category page. This is picked up by search engines to avoid duplicate content.
- **Use Canonical Link Meta Tag For Products**: This has the same functionality as the previous item, but it works on the products layer.

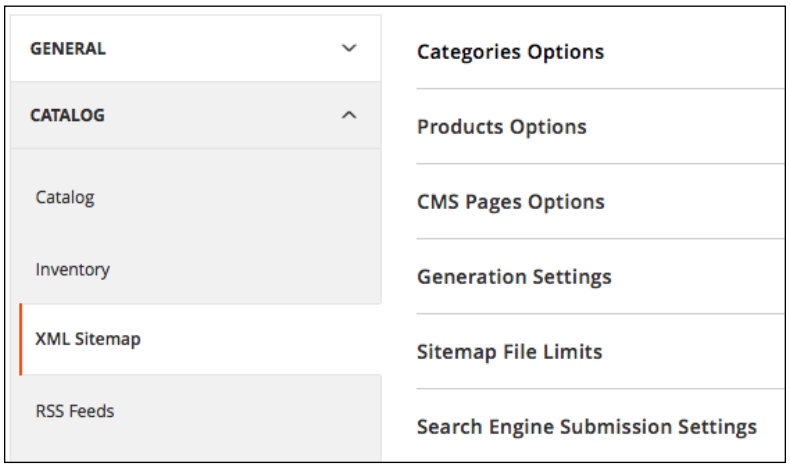


Source: `http://slpxya.appspot.com/moz.com/ugc/setting-up-magento-for-the-search-engines`.

With these options, you can choose the best strategy for SEO on catalog's default options. Magenta gives the administrator the opportunity to tune these options on catalog pages. We will work this out later in this chapter.

XML sitemap manager

Magento automatically generates an XML sitemap for your store and also keeps it up to date. In order to enable this, navigate to **Stores** | **Configuration** | **Catalog** | **XML Sitemap**. Magento has the following options for this section:



Basically, with these options, it is possible to choose the frequency and priority of updates. You may set additional options, such as **Start Time** and **Error Notifications**, only in the **GENERAL** settings tab. It's important to configure the cron job functionality in your web server to enable this feature.

Google Analytics tracking code

Google Analytics helps track all the statistics for your site. To add Google Analytics on Magento, generate a tracking code on your Google Analytics account (`http://analytics.google.com`) first of all. After this, navigate to **System** | **Configuration** | **Google API**.

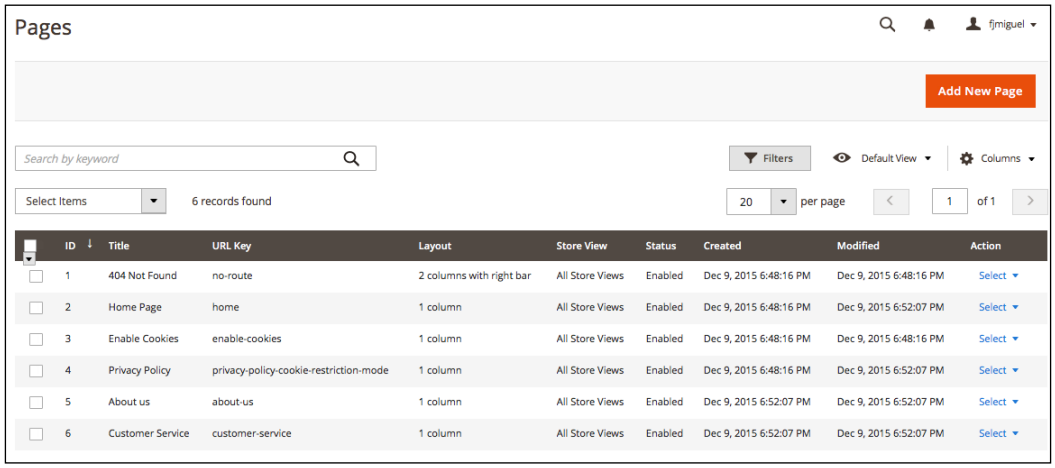
This option works only on hosted Magento sites (that is, the remote server). Take note of this for when you work on a remote production Magento site. For the purposes of this book, it isn't necessary, but you need to keep this option in mind when you start to work on remote projects.

Optimizing Magento pages

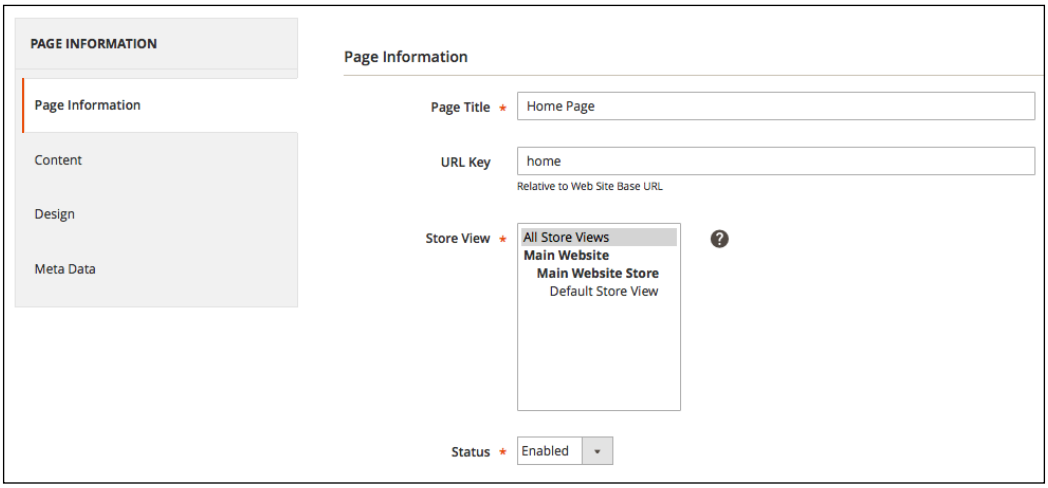
Once you make Magento SEO system configurations, it's time to set specific options directly on Magento pages. This Magento SEO flow gives the user the flexibility to focus on content and page ranking.

CMS pages

The Magento **Content Management System** (**CMS**) manager is a very simple but powerful tool that provides us with control over each aspect of the Magento page. To access Magento CMS pages configuration in the admin area, go to **Content** | **Pages**, as shown in the following screenshot:



Magento's default installation provides some demo content to test CMS pages. Check the **Home Page** content by selecting the **Edit** option.



For the purpose of SEO, Magento's CMS page administration has two main SEO side menus: **Page Information** and **Meta Data**.

In **Page Information**, you can set the following options:

- **Page Title**: This should correspond to the main title of the page
- **URL Key**: This is very important to set a great **Search Engine Friendly** (**SEF**) URL identifier to increase SEO ranking
- **Store View**: Here, you can choose the views on the page
- **Status**: This has simple **Enabled** and **Disabled** options.

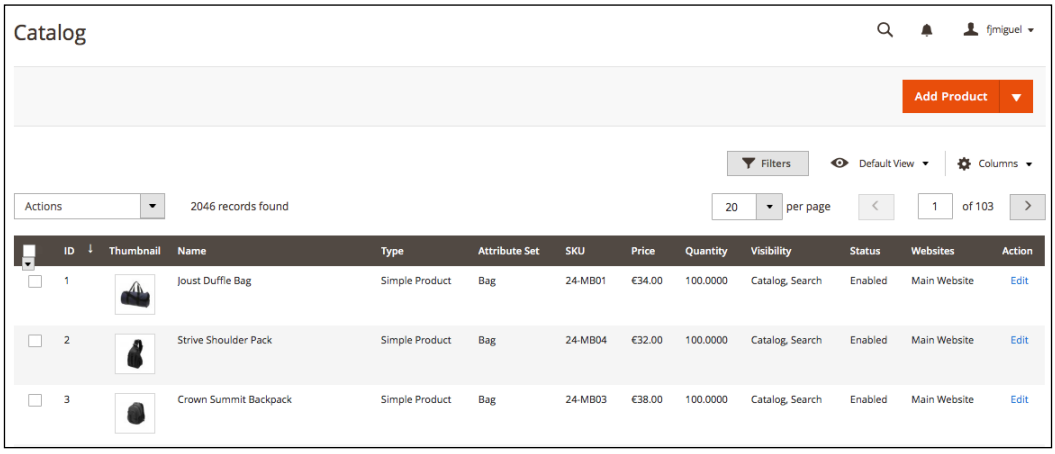
In **Meta Data**, you can set the following options:

- **Keywords**: Here, enter the keywords that correspond to your site's scope.
- **Description**: Make sure to use this field the right way. A good description means a good chance of increasing access and sales.

The content of your page must be aligned with the metadata for a good SEO implementation.

Product pages

This is the most important layer in a Magento store. Besides providing a lot of options to configure the product to be sold, this also makes it possible to tune the SEO configuration to increase sales through the search engine page ranking system. In order to access **Product** options, navigate to **Products** | **Catalog**, as shown in the following screenshot:

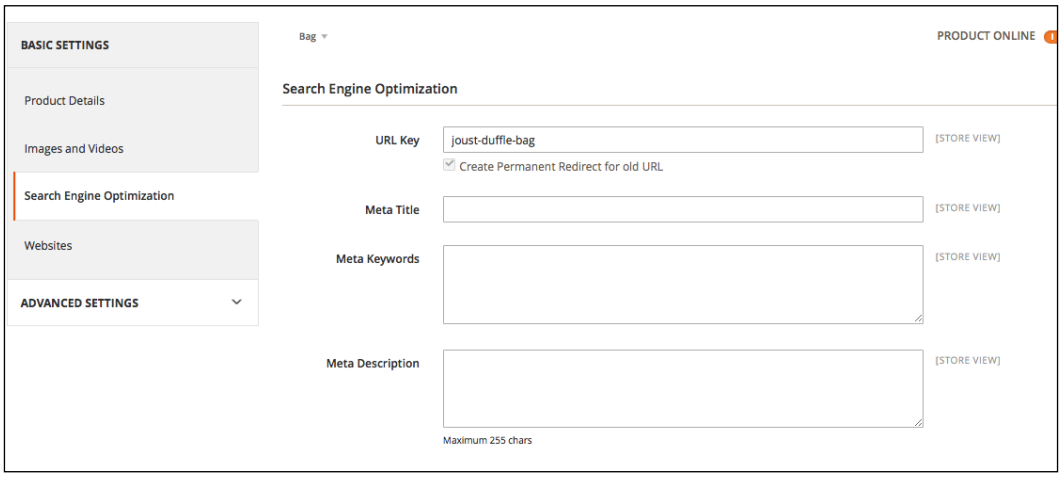


Click on the first product of the list to take a look at the SEO options. For the purpose of SEO, **Product Details** has the following options:

- **Name**: You need to make this descriptive; think about what people might search for
- **Description**: Here, you must detail the product as much as possible to make your content unique and helpful to users
- **Categories**: This is the category of the product.

Search Engine Optimization has the following options:

- **URL Key**: This is the URL that the product will be visible on. If the product has a version number or some specific detail, try to put this on the URL.
- **Meta Information**: Choose the best **Meta Title**, **Meta Keywords**, and **Meta Description** input for your product.

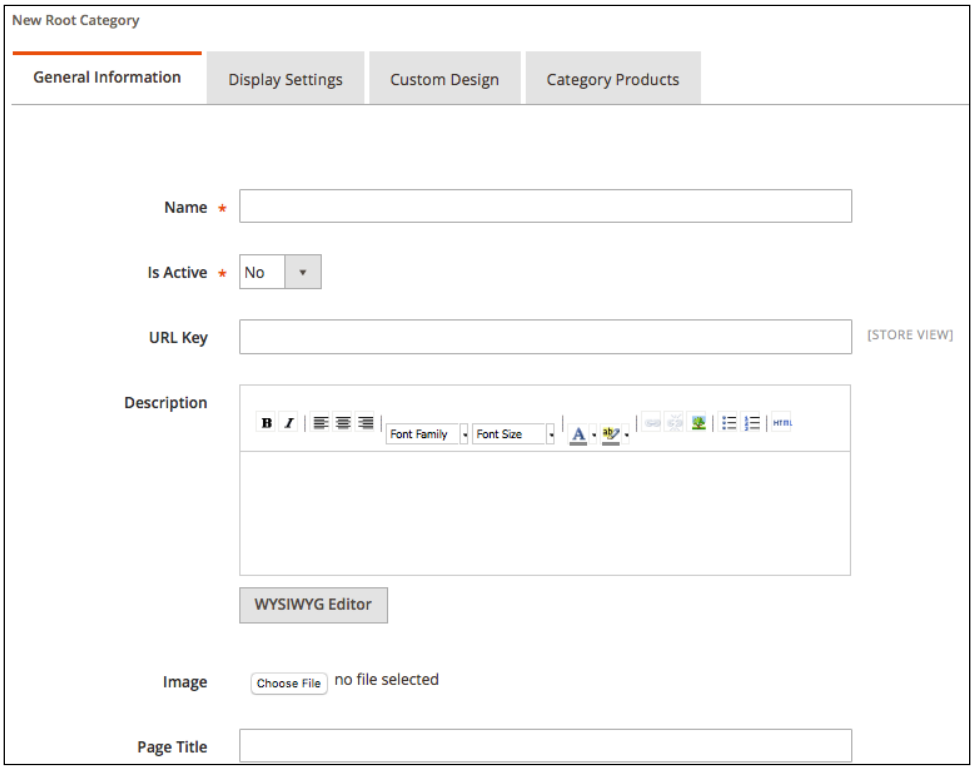


Every single product gives the administrator these options to tune SEO on a Magento website.

Category pages

Magento category pages have great SEO options. As you can note, all the content pages on Magento give us administration options to manage SEO. Every aspect on Magento configuration is integrated to provide the user with the best experience.

To access the **Categories** configuration, navigate to **Products** | **Categories** on the admin dashboard, as shown in the following screenshot:



This will provide an option to create a new category, and in the side menu, it is possible to check all the categories registered on Magento. For the purpose of SEO, Magento has the following options in this section:

- **Name**: This is the category name.
- **Description**: This is the description of the category. Focus on using keywords strategically for SEO.
- **Page Title**: This refers to the metatitle. Enter your keyword with a few words to describe the page.
- **Meta Keywords**: Here, enter the keywords separated by commas.
- **Meta Description**: This is a very important option, so make sure that your description covers the products that you're selling and reinforces your brand.

Make sure to follow a pattern in your content referring to SEO.

Summary

Magento SEO is a powerful tool to increase sales. As a developer, it is very important to keep these options and techniques in mind to create mechanisms that would get better results for Magento users through new extensions and customizations.

In this chapter, we discussed the following:

- Magento SEO management
- SEO catalog configuration
- XML sitemap manager
- Google Analytics tracking code
- Optimizing Magento pages, products, and categories

In the next chapter, we will cover Magento theme development and customization. We have a lot of work coming up!

4
Magento 2.0 Theme Development – the Developers' Holy Grail

Magento 2.0 has a complex control of its themes. It works with multiple directories to generate the final result for the user on its frontend.

In this chapter we will consolidate the basic concepts that you need to create your very first example of Magento theme and activate it.

At the end of this chapter, you will be able to create the basic structure of your own theme. The following topics are covered in this chapter:

- The basic concepts of Magento themes
- Magento 2.0 theme structure
- The Magento Luma theme
- Magento theme inheritance
- CMS blocks and pages
- Custom variables
- Creating a basic Magento 2.0 theme

The basic concepts of Magento themes

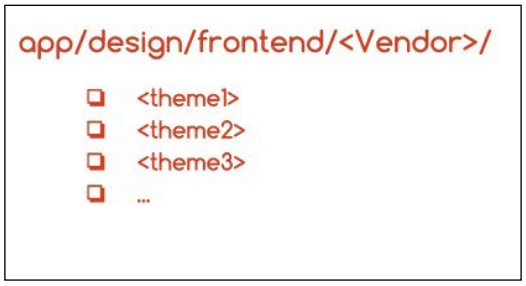
According to the official documentation available at `http://goo.gl/D4oxO1`, a **Magento theme** is a component that provides the visual design for an entire application area using a combination of custom templates, layouts, styles, or images. Themes are implemented by different vendors (frontend developers) and intended to be distributed as additional packages for Magento systems similar to other components.

Magento has its own particularities because it is based on Zend Framework and consequently adopts the MVC architecture as a software design pattern. When the Magento theme process flow becomes a subject, you have some concerns to worry about when you plan to create your own theme. Let's focus on these concepts to create our own theme by the end of this chapter.

Magento 2.0 theme structure

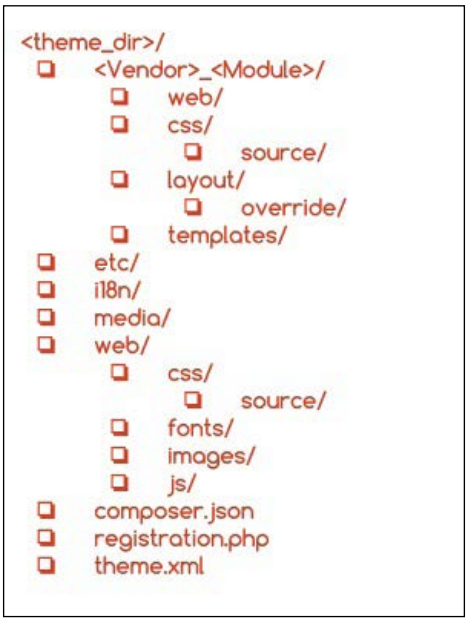
Magento 2.0 has a new approach toward managing its themes. Generally, the Magento 2.0 themes are located in the `app/design/frontend/<Vendor>/` directory. This location differs according to the built-in themes, such as the **Luma** theme, which is located in `vendor/magento/theme-frontend-luma`.

The different themes are stored in separate directories, as in the following screenshot:



Each vendor can have one or more themes attached to it. So, you can develop different themes inside the same vendor.

The theme structure of Magento 2.0 is illustrated as follows:



How the Magento theme structure works is quite simple to understand: each `<Vendor>_<Module>` directory corresponds to a specific module or functionality of your theme. For example, `Magento_Customer` has specific `.css` and `.html` files to handle the `Customer` module of the `Magento` vendor. Magento handles a significant number of modules. So, I strongly suggest that you navigate to the `vendor/magento/theme-frontend-luma` folder to take a look at the available modules for the default theme.

In the Magento 2.0 structure, we have three main files that manage the theme behavior, which are as follows:

- `composer.json`: This file describes the dependencies and meta information
- `registration.php`: This file registers your theme in the system
- `theme.xml`: This file declares the theme in system and is used by the Magento system to recognize the theme

All the theme files inside the structure explained previously can be divided into **static view files** and **dynamic view files**. The static view files have no processing by the server (images, fonts, and `.js` files), and the dynamic view files are processed by the server before delivering the content to the user (template and layout files).

Static files are generally published in the following folders:

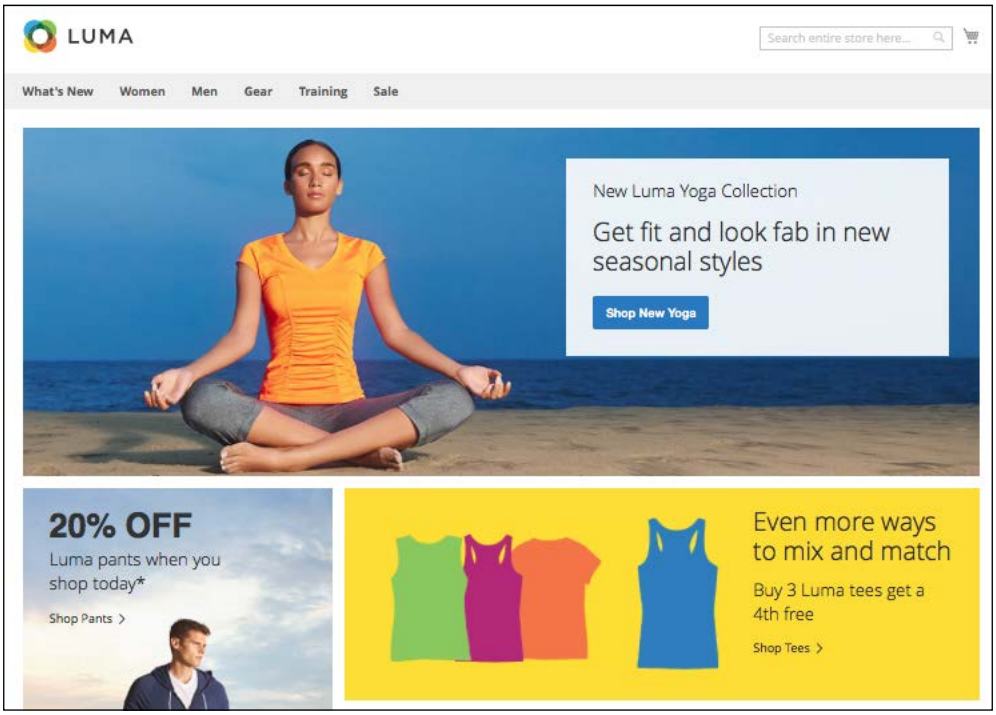
- `/pub/static/frontend/<Vendor>/<theme>/<language>`
- `<theme_dir>/media/`
- `<theme_dir>/web`



For further information, please access the official Magento theme structure documentation at `http://goo.gl/ov3IUJ`.

The Magento Luma theme

The Magento CE 2.0 version comes with a new theme named Luma that implements **Responsive Web Design** (**RWD**) practices.



The Luma theme style is based on the Magento **user interface** (**UI**) library and uses CSS3 media queries to work with screen width, adapting the layout according to device access.

The Magento UI is a great toolbox for theme development in Magento 2.0 and provides the following components to customize and reuse user interface elements:

- The actions toolbar
- Breadcrumbs
- Buttons
- Drop-down menus
- Forms
- Icons
- Layout
- Loaders
- Messages
- Pagination
- Popups
- Ratings
- Sections
- Tabs and accordions
- Tables
- Tooltips
- Typography
- A list of theme variables

The Luma theme uses some of the **blank** theme features to be functional. The Magento 2.0 blank theme, available in the `vendor/magento/theme-frontend-blank` folder, is the basic Magento theme and is declared as the **parent theme** of Luma. How is this possible? Logically, Magento has distinct folders for every theme, but Magento is too smart to reuse code; it takes advantage of **theme inheritance**. Let's take a look at how this works.

Magento theme inheritance

The frontend of Magento allows designers to create new themes based on the basic blank theme, reusing the main code without changing its structure. The fallback system is a theme's inheritance mechanism and allows developers to create only the files that are necessary for customization.

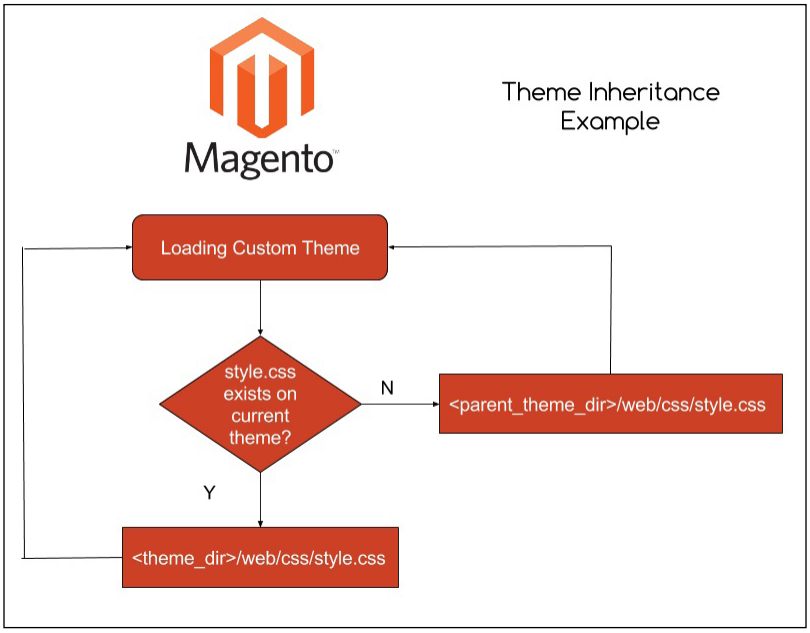
The Luma theme, for example, uses the fallback system by inheriting the blank theme basic structure. The Luma theme parent is declared in its `theme.xml` file as follows:

```
<theme xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNam
espaceSchemaLocation="urn:magento:framework:Config/etc/theme.xsd">
    <title>Magento Luma</title>
    <parent>Magento/blank</parent>
    <media>
        <preview_image>media/preview.jpg</preview_image>
    </media>
</theme>
```

Inheritance works similar to an override system. You can create new themes using the existent ones (parents) and by replacing (that is, overriding) an existing file with the same name but in your specific theme folder (child).

For example, if you create a new theme in the `app/design/frontend/<Vendor>/<theme>/` folder and declare `Magento/blank` as a parent theme, the `theme.xml` file and `registration.php`, you have the entire blank theme structure ready to work in your new theme, including RWD layouts and styles.

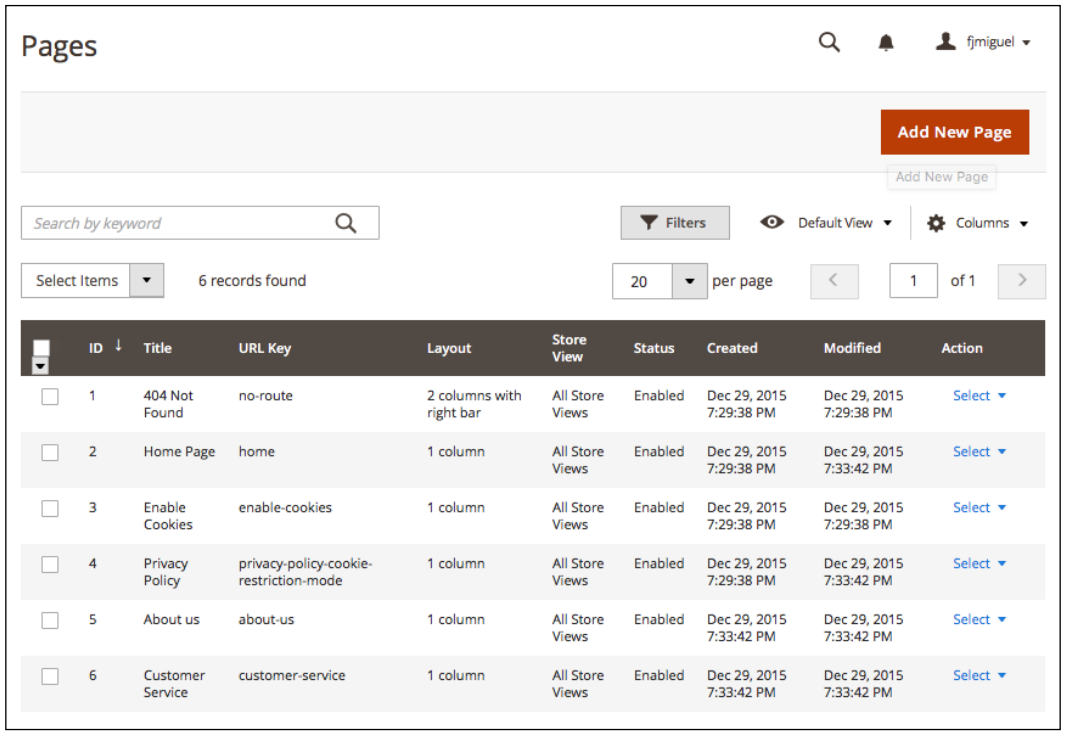
Let's say that you have a specific `.css` file available in the `<theme_dir>/web/css` folder. If you delete this file, the fallback system will search the file in the `<parent_theme_dir>/web/css` folder, as shown in the following figure:



CMS blocks and pages

Magento has a flexible theme system. Beyond Magento code customization, the admin can create blocks and content on the Magento admin panel, such as **Home Page**, **About us**, or any static page that you want to create. CMS pages and blocks on Magento give you the power to embed HTML code in your page.

You can create or edit pages and blocks by accessing the Admin area (`http://localhost/packt/admin_packt`) by navigating to **Content** | **Pages**.



Custom variables

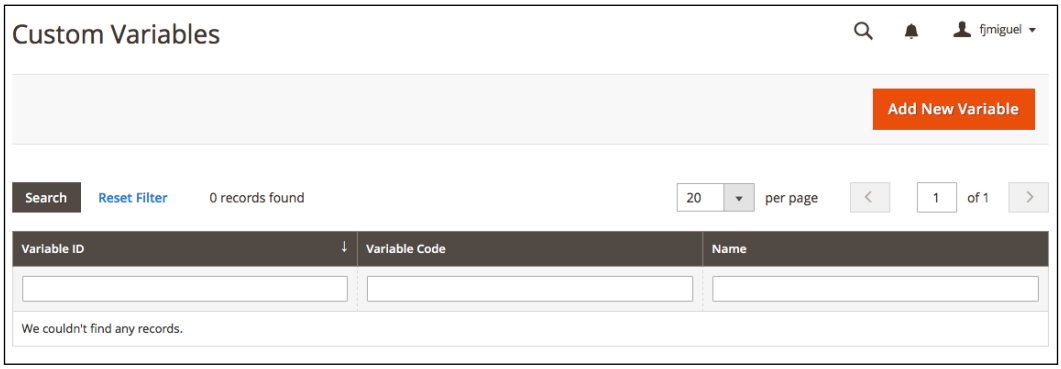
Custom variables are pieces of HTML code that contain specific values as programming variables. By creating a custom variable, you can apply it to multiple areas on your site. An example of the custom variable structure is shown here:

```
{{config path="web/unsecure/base_url"}}
```

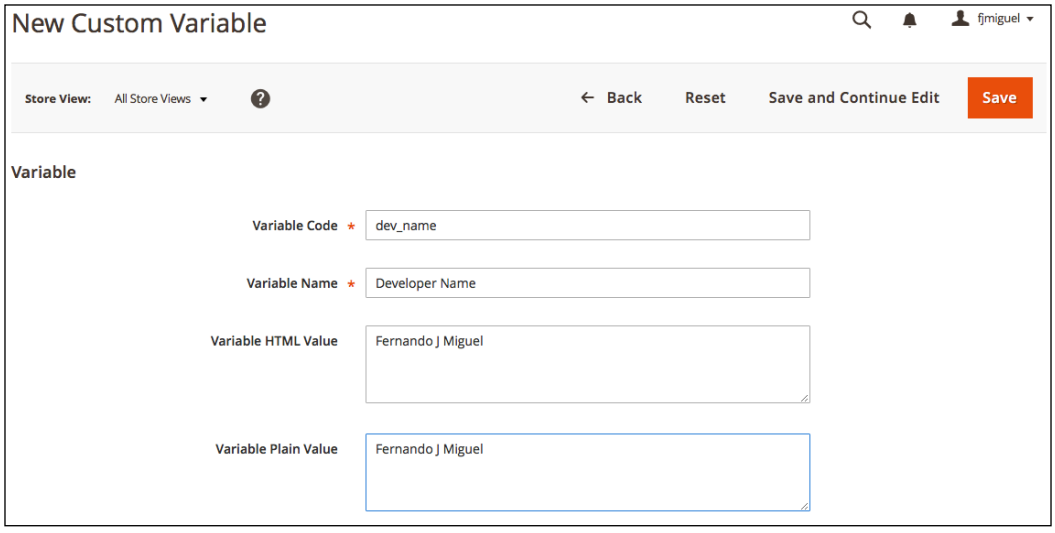
This variable shows the URL of the store.

Now, let's create a custom variable to see how it works. Perform the following steps:

1. Open your favorite browser and access the admin area through `http://localhost/packt/admin_packt`.
2. Navigate to **System** | **Custom Variables**
3. Then, click on the **Add New Variable** button.



4. In the **Variable Code** field, enter the variable in lowercase with no spaces—for example, `dev_name`.
5. Enter the variable name, which explains the variable purpose.
6. Enter the HTML and plain text values of the custom variable in the **Variable HTML Value** and **Variable Plain Value** fields and save it.

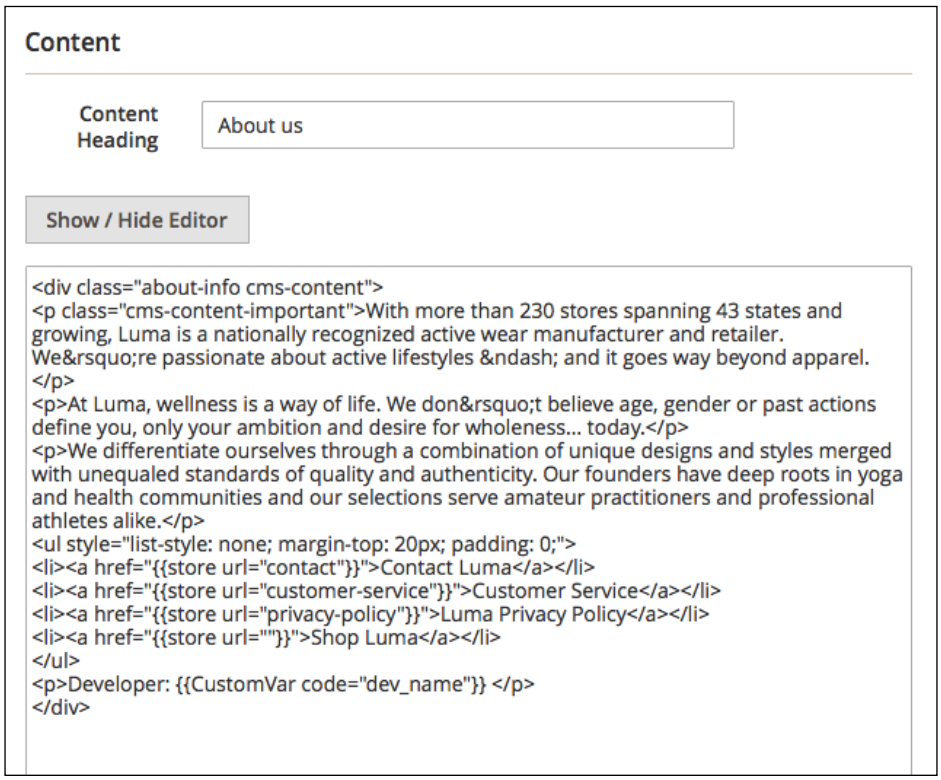


Now, we have a custom variable that stores the developer's name. Let's use this variable inside the CMS **About Us** page via the following steps:

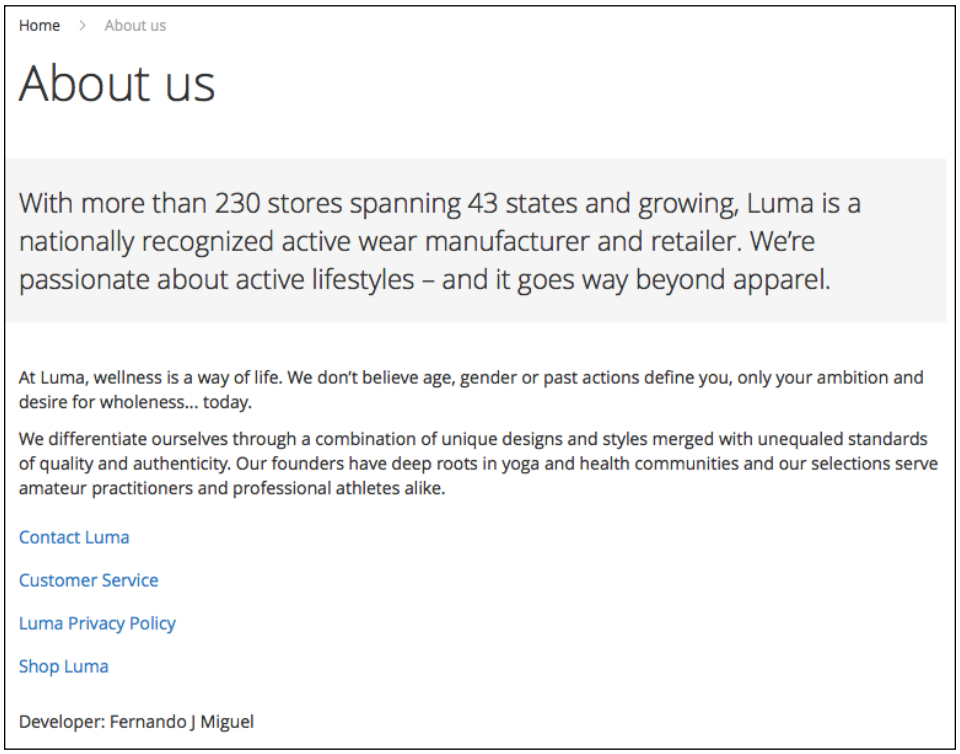
1. In the **Admin** area, navigate to **Content** | **Pages**.
2. Click to edit the **About Us** item.
3. Then, click on the **Content** side menu.
4. Click on the **Show / Hide Editor** button to hide the HTML editor.
5. Put the following code at the end of the content:

```
{{CustomVar code="dev_name"}}
```

6. Finally, save the content.



Let's take a look at the result in the following screenshot:



Creating a basic Magento 2.0 theme

After understanding the basic Magento 2.0 theme structure, you have the right credentials to go to the next level: creating your own theme. In this chapter, we will develop a simple theme and activate it on the **Magento Admin** panel. The basic idea is to give you the right directions to Magento theme development and provide you with the tools to let your imagination fly around the creation of various Magento themes!

Before starting the creation, let's disable Magento **cache management**. It is important when you work with Magento development to get updates in real time. You learned about cache management in *Chapter 2*, *Magento 2.0 Features*:

1. Open the terminal (Linux, OS X) or command prompt (Windows) and access the `<your Magento install dir>/bin` directory.
2. Then, run the `php magento cache:disable` command to disable all the cache systems.



Creating and declaring a theme

To create a basic theme structure, follow these steps:

1. Create a new vendor directory named `Packt` at the following path:

   `<Magento root directory>/app/design/frontend/`**`Packt`**

2. Under the `Packt` directory, create the theme directory named `basic` by executing the following:

   `<Magento root directory>/app/design/frontend/`**`Packt/basic`**

The next step is to declare the theme information for Magento to recognize it as a new theme. Perform the following:

1. Open your preferred code editor (**Sublime Text2**, **TextMate**, **Atom.io**).
2. Create a new file named `theme.xml` under your theme directory (`app/design/frontend/Packt/basic/theme.xml`).
3. Use the following code in the `theme.xml` file and save the file:

```
<theme xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:n
oNamespaceSchemaLocation="urn:magento:framework:Config/etc/theme.
xsd">
     <title>Basic theme</title>
     <parent>Magento/blank</parent>
    <!-- <media>
         <preview_image>media/preview.jpg</preview_image>
     </media>-->
</theme>
```

This is a basic declaration for the Magento system to recognize our theme as an official theme. This code configures the theme name, parent, and preview image. The preview image is a preview for basic visualization purposes. We don't have a preview image right now, which is the why the code is commented; avoid unnecessary errors.

Once we have the basic configurations, we need to register the theme in the Magento system:

1. Open your preferred code editor (**Sublime Text2**, **TextMate**, or **Atom.io**).
2. Create new file named `registration.php` under your theme directory (`app/design/frontend/Packt/basic/registration.php`).
3. Use the following code in registration.php and save the file:

```
<?php
/**
 * Copyright © 2016 Magento. All rights reserved.
 * See COPYING.txt for license details.
 */
\Magento\Framework\Component\ComponentRegistrar::register(
    \Magento\Framework\Component\ComponentRegistrar::THEME,
    'frontend/Packt/basic',
    __DIR__
);
```

This code simply registers our theme in the Magento system by passing a parameter of your new theme's structure directory.

Simple product image configuration

In your theme, you can configure the image properties of the products in the Magento Catalog module by creating the `view.xml` file. You can control this specific configuration using the `id` attribute of every product's HTML5 element:

1. Open your preferred code editor (Sublime Text2, TextMate, or Atom.io).
2. Create a new directory named `etc` under your theme directory (`app/design/frontend/Packt/basic/etc`).
3. Create a new file named `view.xml` under your `etc` directory (`app/design/frontend/Packt/basic/etc/view.xml`).
4. Then, use the following code in `view.xml` and save the file:

```
<image id="category_page_grid" type="small_image">
        <width>250</width>
```

```
            <height>250</height>
    </image>
```

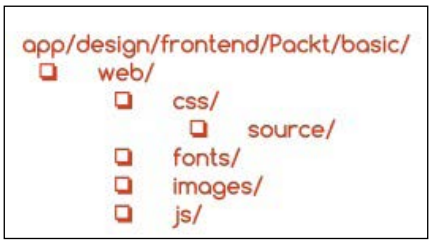
In the `view.xml` file, we declared the values of the width and height of the product image. The `id` and `type` attributes specified the kind of image that this rule will be applied to.



For further information, visit `http://goo.gl/73IQSz`.

Creating static files' directories

The static files (images, `.js` files, `.css` files, and fonts) will be stored in the `web` directory. Inside the `web` directory, we will organize our static files according to its scope. Create a new directory named `web` under your `directory app/design/frontend/Packt/basic/web` theme and create the following directory structure:



With this simple structure, you can manage all the static files of your custom theme.

Creating a theme logo

By default in Magento 2.0, the theme logo is always recognized by the system by the name `logo.svg`. Magento 2.0 also recognizes the logo's default directory as `<theme_dir>/web/images/logo.svg`. So, if you have a `logo.svg` file, you can simply put the file in the right directory.

However, if you want to work with a different logo's name with a different format, you have to declare it in the Magento system. We will make a declaration with this new logo in the `Magento_Theme` directory because the new logo is a customization of the `Magento_Theme` module. We will override this module by taking advantage of the fallback system. As you may note, Magento has a specific pattern of declaring elements. This is the way in which Magento organizes its life cycle.

Let's declare a new theme logo by performing the following steps:

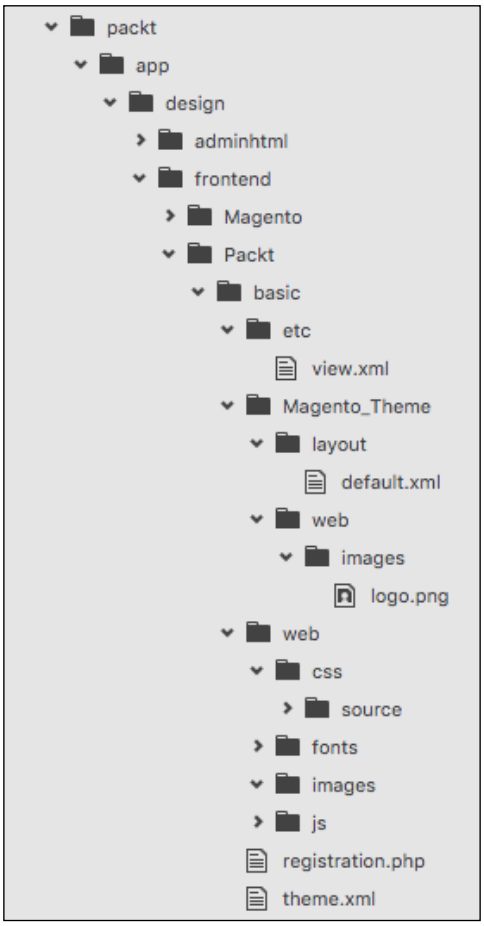
1. Choose one logo for the example and save the file as `logo.png` in the `app/design/frontend/Packt/basic/Magento_Theme/web/images` directory.
2. Open your preferred code editor (Sublime Text2, TextMate, or Atom.io).
3. Create new file named `default.xml` under your `layout` directory (`app/design/frontend/Packt/basic/Magento_Theme/layout`).
4. Use the following code in `default.xml` and save the file:

```
<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:n
oNamespaceSchemaLocation="urn:magento:framework:View/Layout/etc/
page_configuration.xsd">
    <body>
        <referenceBlock name="logo">
            <arguments>
              <argument name="logo_file" xsi:type="string">
Magento_Theme/images/logo.png
</argument>
              <argument name="logo_img_width" xsi:type="number">
your_logo_width
</argument>
<argument name="logo_img_height" xsi:type="number">
your_logo_height
</argument>
             </arguments>
        </referenceBlock>
    </body>
</page>
```

This declaration has three different arguments to manage three attributes of your new logo: filename, width, and height. Don't forget to replace the `your_logo_width` and `your_logo_height` attributes with the correct size of the logo that you choose.

The `logo_file` argument seems to be wrong because we created our image in the `Magento_Theme/web/images` directory; however, thank God this is not true. I'll explain: when we activate the new theme, Magento processes the static files and copies them to the `pub/static` directory. This occurs because static files can be cached by Magento, and the correct directory for this is `pub`. So, we need to create the `web` directory for Magento to recognize the files as static files.

The final theme directory structure is illustrated as follows:

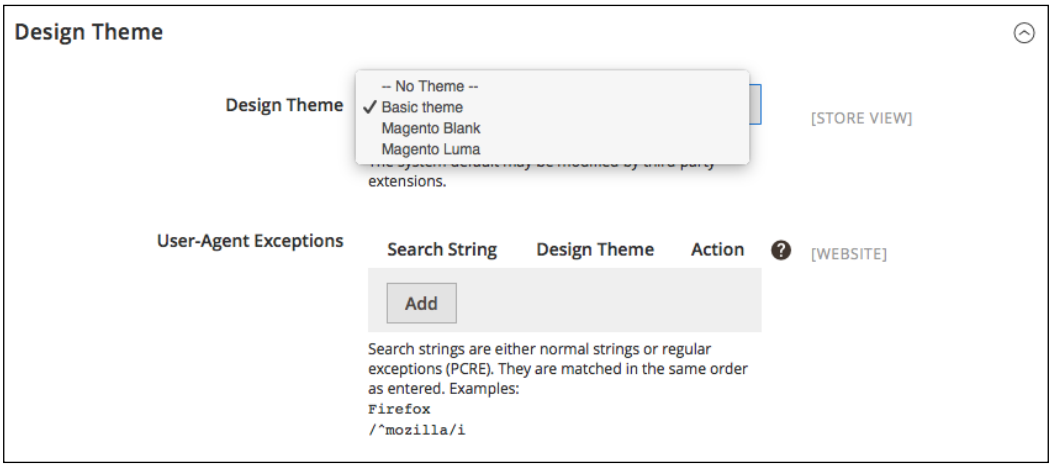


Applying the theme

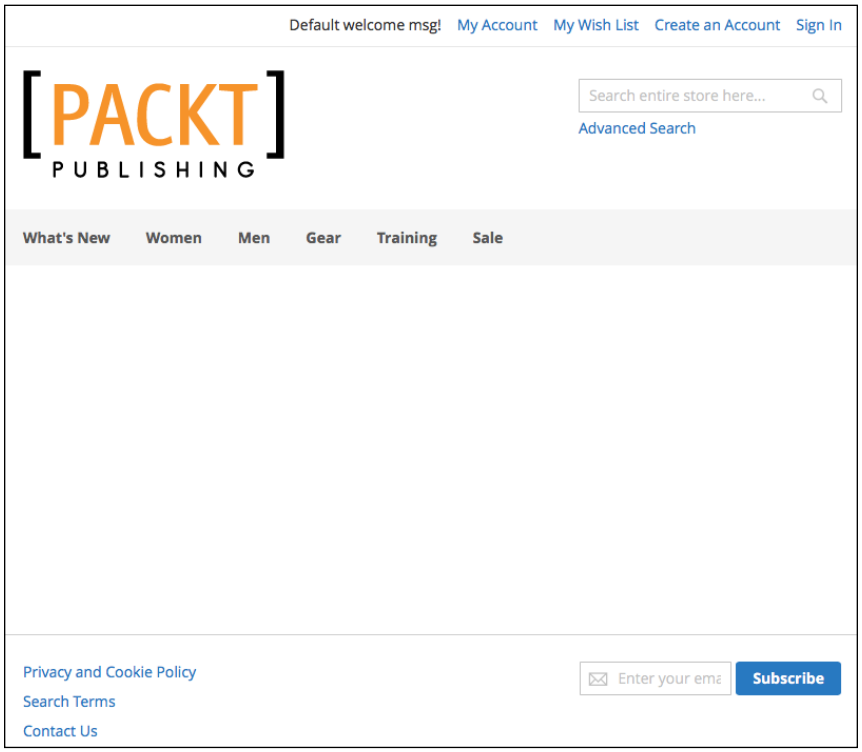
Once we have the theme ready to launch, we need to activate it in the Magento admin dashboard:

1. First, access the Magento admin area URL (`http://localhost/packt/admin_packt`) in your favorite browser.
2. Navigate to **Stores** | **Configuration** | **Design**.

3. Then, select the **Basic theme** option as your **Design Theme** value and save the configuration.



Navigate to the home page of your site by accessing the `http://localhost/packt` URL to see the final result:



Summary

Now, you have all the basic concepts to create a custom theme for Magento and all the information to think in terms of the Magento structure when an idea for your new design comes to mind.

In this chapter, you learned the basic concepts of Magento 2.0 themes, how theme inheritance (that is, the fallback system) works, and which directories Magento uses to create its themes according to the admin area configurations. Finally, you created your own basic theme with these examples.

However, what about creating a quality theme? Is it possible with the knowledge acquired in this chapter? Of course! We will go to the next level in the next chapter and create a responsive theme by example.

5
Creating a Responsive Magento 2.0 Theme

In the previous chapter, you learned the fundamentals of creating a custom Magento 2.0 theme, and we created the basic structure by example. In this chapter, we will create our own theme project called the **CompStore** theme.

The following topics will be covered in this chapter:

- Developing the CompStore theme
- Introduction to Composer Dependency Manager
- CSS preprocessing with LESS
- Creating new content for the CompStore theme
- Developing a custom CompStore theme using CSS
- Creating a custom template

The CompStore theme

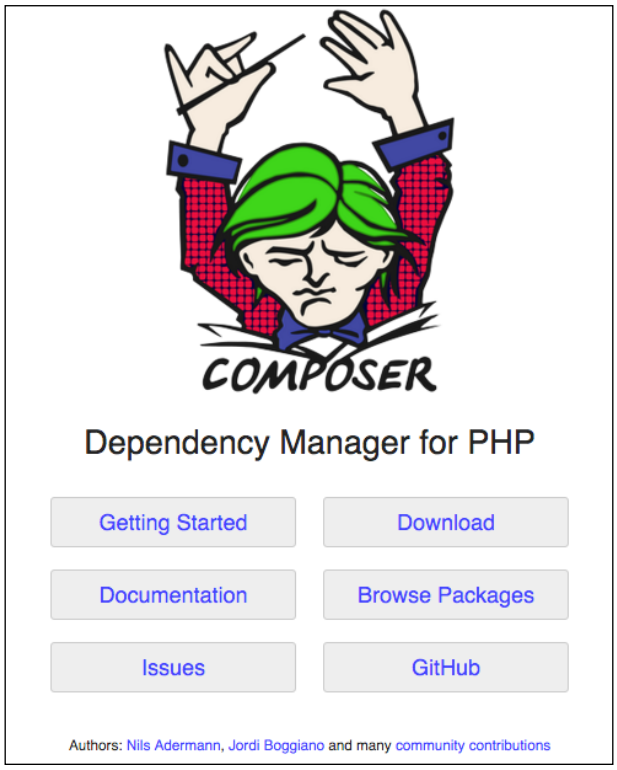
The CompStore theme project is the new Magento 2.0 theme that you will develop for a hypothetical computer store client or for a theme marketplace such as `http://themeforest.net/`. I strongly suggest you to take a look at the **Become an author** page at `http://themeforest.net/become_an_author` in order to explore the options to monetize your Magento theme development expertise. Logically, you have to work harder before publishing and selling your own theme solution, but it will be worth it!

Magento 2.0 themes and modules work with the **Composer** (`https://getcomposer.org/`) dependency manager for PHP to generate a reliable deployment of Magento components. This is a great evolution in the Magento universe because this management can provide a powerful environment for the deployment of modules and themes. So, we will create a `composer` file for our new theme solution.

Before we start the theme development, let's take a look at Composer.

Composer – the PHP dependency manager

Inspired by **npm** (`https://www.npmjs.com/`) and **bundler** (`http://bundler.io/`), Composer (`https://getcomposer.org/`) manages the dependencies of your project and installs packages in predetermined directories (for example, `vendor`) using the `composer.json` file in the Magento module or theme. This kind of management is very useful once each library has your specific dependency. Composer doesn't let you waste your time by connecting the dependencies to every deployment that you want to do.



In the next chapters, we will use Composer to install components on Magento. However, first, we will start the development of our theme; it is necessary to declare our `composer.json` file. For now, let's install Composer on the operating system.

Installing Composer on Unix-like operating systems

To install Composer on Unix-like systems (such as Unix, Linux, and OS X), you simply need to run these two commands in the terminal:

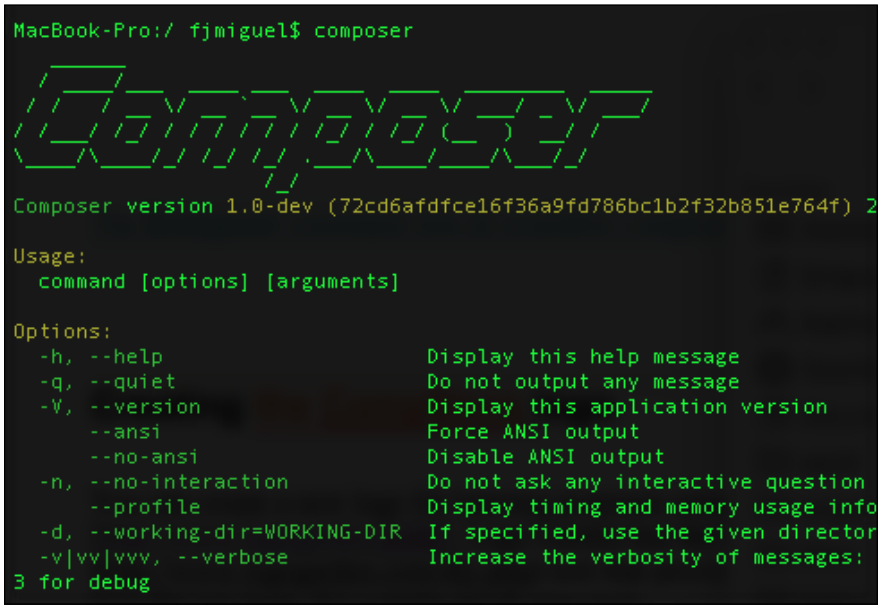
```
$ curl -s https://getcomposer.org/installer | php
$ sudo mv composer.phar /usr/local/bin/composer
```

The first command downloads the `composer.phar` installation file. The second command moves the file to the `bin` directory to install Composer globally on your computer.

Run the following command to check whether Composer was successfully installed:

```
$ composer
```

The `$ composer` command lists all the available Composer commands and their descriptions:



Installing Composer on Windows

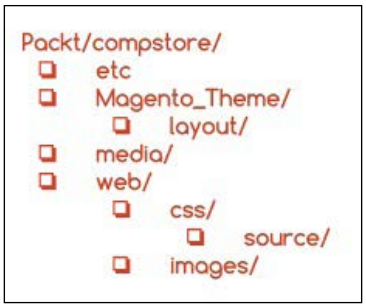
To install Composer on Windows, you simply have to download and execute `Composer-Setup.exe`, which is available on `https://getcomposer.org/Composer-Setup.exe`.

This executable file will install the latest Composer version and set up your path to use the `composer` command in the command prompt window. Open the command prompt window and run `command composer` to get the list of available commands of Composer.

Building the CompStore theme

As you noted in the previous chapter, Magento can store different themes inside the same vendor scope. The proposal project called CompStore will be a template of the Packt vendor. This is the same vendor created in the previous chapter.

First of all, it is important to build the theme directory in the `Packt` vendor directory (`<Magento root directory>/app/design/frontend/Packt/compstore`). Create this folder as the following image suggests:



The `etc` directory usually handles the XML configuration of some components. The `Magento_Theme` directory will override the native `Magento_Theme` module by adding new functionalities. The `media` directory will store the preview image of the CompStore theme. Meanwhile, the `web` directory would have store CSS and image files by now.

The Compstore theme will have Luma as the parent theme. This example shows you the power of the abstraction used in Magento theme projects. Create the `theme.xml` file in the `Packt/compstore` directory with the following code:

```
<theme xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNam
espaceSchemaLocation="urn:magento:framework:Config/etc/theme.xsd">
    <title>CompStore Electronics</title>
```

```
    <parent>Magento/luma</parent>
    <media>
        <preview_image>media/preview.jpg</preview_image>
    </media>
</theme>
```

The `theme.xml` file declares the title and parent of the CompStore theme. Create a simple `preview.jpg` image with a size of 800 x 800 and save it in the `Packt/compstore/media` directory. For example, the Magento logo is centered at the image size of 800 x 800.

This image shows the preview of the new theme, but as you don't have a preview yet, you can create a placeholder for now.

The next step is creating the `registration.php` file in the `Packt/compstore` directory with the following code:

```
<?php

\Magento\Framework\Component\ComponentRegistrar::register(
    \Magento\Framework\Component\ComponentRegistrar::THEME,
    'frontend/Packt/compstore',
    __DIR__
);
```

In the `registration.php` file, the CompStore theme of the `Packt` vendor registers the new theme of the Magento system.

The `theme.xml` and `registration.php` files were created earlier. By now, I think you are very comfortable with the structure of these files because you worked with them in the basic theme and now in the CompStore theme. This point forward, you will be introduced to some new concepts of theme development in Magento 2.0, starting with the creation of the `composer.json` file. Create the `composer.json` file in the `Packt/compstore` directory with the following code:

```
{
    "name": "packt/compstore",
    "description": "CompStore electronics theme",
    "require": {
        "php": "~5.5.0|~5.6.0|~7.0.0",
        "magento/theme-frontend-luma": "~100.0",
        "magento/framework": "~100.0"
    },
    "type": "magento2-theme",
    "version": "1.0.0",
    "license": [
```

```
            "OSL-3.0",
            "AFL-3.0"
        ],
        "autoload": {
            "files": [ "registration.php" ]
        }
    }
```

This file has the `.json` (`http://www.json.org/`) format and handles important information of the project and its dependencies. As we discussed earlier, this kind of control is crucial because it generates more organization for your project. Let's navigate to the principal parameters of the `composer.json` file:

- **Name**: This refers to the name of the component
- **Description**: This provides the description of the component
- **Require**: These are the dependencies of the project (the PHP version and the Magento libraries)
- **Type**: This describes the type of component (the theme or module)
- **Version**: This describes the version of the component
- **License**: This parameter describes the licenses applied on a component (Open Source License or Academic Free License)
- **Autoload**: This parameter defines the files and classes that will be autoloaded upon component activation.

CSS preprocessing with LESS

Before applying CSS in the CompStore Magento theme, it is important to study CSS behavior in the Magento system. The stylesheets in Magento 2.0 are preprocessed and compiled to CSS using the **LESS** technology. LESS (`http://lesscss.org/`) is a CSS preprocessor that extends the CSS traditional features by including variables and functions to generate a powerful CSS code and saves the time in maintaining the code.

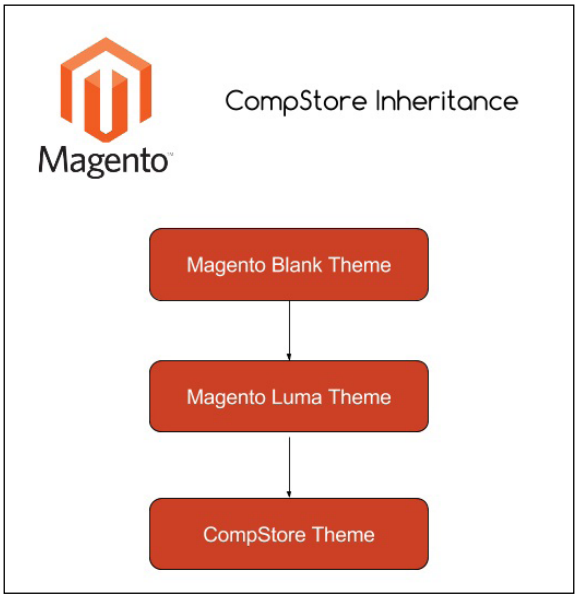
All the `.less` files that you will save in your theme are compiled by the LESS engine but you will always declare `.css` in the Magento theme frontend. Here are a couple of examples:

- Frontend declaration: `<css src="css/styles.css" />`
- Root source file: `<Magento _theme_dir>/web/css/styles.less`

For further information, access the Magento 2.0 official documentation at `http://goo.gl/XLkOcQ`.

Applying new CSS to the CompStore theme

A CompStore theme inherits the Luma theme, which in turn inherits a blank theme, as shown here:



Once you have to make changes in CompStore in order to customize the new theme, you can think about the functionalities already available in the other themes to apply your changes.

The `vendor` directory under the Magento 2.0 root directory handles all the native Magento modules and themes. The Magento blank and Luma themes, which you have been working on until now, are available in `vendor/magento/theme-frontend-blank` and `vendor/magento/theme-frontend-luma`, respectively. So, the CompStore theme "receives" all the features of the themes under these folders. It's important to fix these basic concepts to understand the context that you inserted when you developed a Magento theme solution.

Once you have a solid concept about the behavior, let's create a custom `.css` file for the CompStore theme:

1. Copy the `packt/vendor/magento/theme-frontend-blank/web/css/_styles.less` file to the `packt/app/design/frontend/Packt/compstore/web/css` location

2. Open the copied file and insert an `import` command as the following example:

```
@import 'source/lib/_lib.less';
@import 'source/_sources.less';
@import 'source/_components.less';
@import 'source/compstore.less';
```

3. Save the file.
4. Now, open your favorite code editor and create the `compstore.less` file under the `packt/app/design/frontend/compstore/web/css/source` directory and type this code:

```
@color-compstore: #F6F6F6;

body{
background: @color-compstore;
}
```

5. Using override, let's change the product page color schema by creating the `_theme.less` file under the `packt/app/design/frontend/compstore/web/css/source` directory. Execute the following:

```
//Change color of elements in Product Page
@color-catalog: #4A96AD;
@page__background-color: @color-catalog;
@sidebar__background-color: @color-gray40;
@primary__color: @color-gray80;
@border-color__base: @color-gray76;
@link__color: @color-gray56;
@link__hover__color: @color-gray60;
@button__color: @color-gray20;
@button__background: @color-gray80;
@button__border: 1px solid @border-color__base;
@button-primary__background: @color-orange-red1;
@button-primary__border: 1px solid @color-orange-red2;
@button-primary__color: @color-white;
@button-primary__hover__background: darken(@color-orange-red1,
5%);
@button-primary__hover__border: 1px solid @color-orange-red2;
@button-primary__hover__color: @color-white;
@navigation-level0-item__color: @color-gray80;
@submenu-item__color: @color-gray80;
@navigation__background: @color-gray40;
@navigation-desktop-level0-item__color: @color-gray80;
@navigation-desktop-level0-item__hover__color: @color-gray34;
```

```
@navigation-desktop-level0-item__active__color: @navigation-
desktop-level0-item__color;
@tab-control__background-color: @page__background-color;
@form-element-input__background: @color-gray89;
@form-element-input-placeholder__color: @color-gray60;
@header-icons-color: @color-gray89;
@header-icons-color-hover: @color-gray60;
```

With the `compstore.less` and `_theme.less` files, the background and product page colors will change according to the new proposal of the CompStore theme.

Creating the CompStore logo

You can create a new logo for learning purposes using the **Logomakr** free online service (`http://logomakr.com/`). It's a pretty easy tool.



I created this logo for the CompStore theme using Logomakr:



My CompStore proposal of the logo was made in Logomakr, which is a solution developed by **Webalys** (`http://www.streamlineicons.com`) and **FlatIcon** (`http://www.flaticon.com`) and licensed under **Creative Commons by 3.0** (`http://creativecommons.org/licenses/by/3.0`). If you use this solution for other projects, don't forget to give the due credit to Logomakr.

After finishing the logo, save it under the `app/design/frontend/Packt/compstore/Magento_Theme/web/images/logo.png` path.

You can feel free to use your own solution for logo instead of using Logomakr.

Applying the theme

As you learned in the previous chapter, it's time to activate the new theme. Activate the CompStore Electronics theme in the Admin area (`http://localhost/packt/admin_packt`) to see the following result:



Sometimes, when you update in the Magento structure or activate a new theme, you need to deploy the theme and module changes. If you want to deploy your changes, follow these steps:

1. Open the terminal or command prompt.
2. Delete the `packt/pub/static/frontend/<Vendor>/<theme>/<locale>` directory.
3. Delete the `var/cache` directory.
4. Delete the `var/view_preprocessed` directory.
5. Then, access the `packt/bin` directory.
6. Run the php `magento setup:static-content:deploy` command.

7. In some cases, it is necessary to give `write` permissions again to the directories.

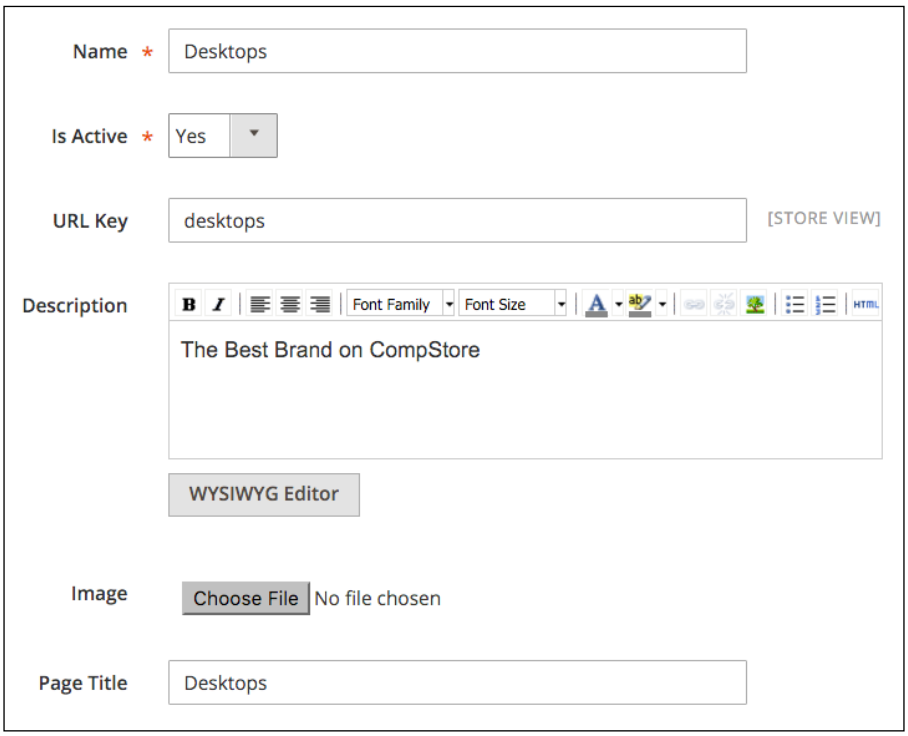
Creating CompStore content

Once the new theme is activated, it's time to handle the content by creating some options and configuring the products and categories.

To create new categories, you will need access the Admin area (`http://localhost/packt/admin_packt`) and follow this recipe:

1. Navigate to the **Products** | **Categories** menu.
2. Delete all the subcategories of **Default Category** by clicking on them and pressing the **Delete Category** button.
3. Create three new subcategories of **Default Category** named **Notebook**, **Desktops**, and **Peripherals**. Be sure to set to **Yes** the **Include in Navigation Menu** option for each category.

In the Add Category option, you have option to fill the **Description**, **Page Title**, and **Meta Information** areas for SEO purposes, as shown in the following screenshot:



To create new products, you will need access to the Admin area (`http://localhost/packt/admin_packt`) and follow this recipe:

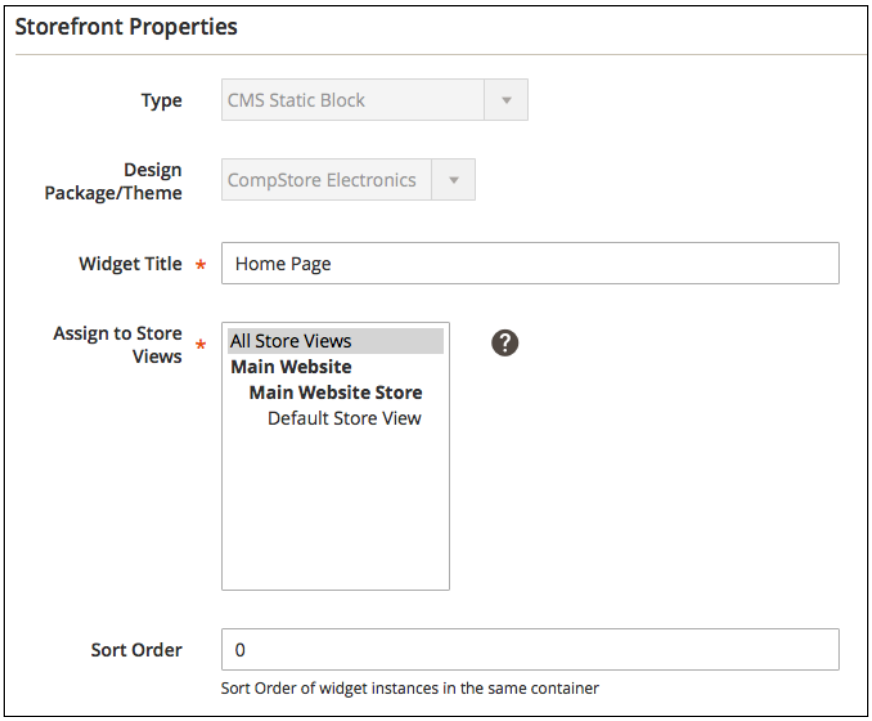
1. Access the Admin area (`http://localhost/packt/admin_packt`) and navigate to **Products** | **Catalog**.
2. Click on the **Add Product** button.
3. In the **New Product** page, enter all the required **Product Information** input.
4. Set the values of **Price** and **Quantity** categories.
5. Choose an image to upload.
6. Choose **In Stock** for the **Stock Availability** field.
7. Choose **Main Website** in the **Websites** tab.
8. Save your new product.
9. You can add three to nine products for testing purposes.

ID ↑	Thumbnail	Name	Type	Attribute Set	SKU	Price	Quantity	Visibility
2055		Printer 3	Simple Product	Default	Printer3	$80.00	10.0000	Catalog, Search
2054		Printer 2	Simple Product	Default	Printer 2	$80.00	10.0000	Catalog, Search
2053		Printer 1	Simple Product	Default	Printer 1	$80.00	10.0000	Catalog, Search
2052		Desktop 3	Simple Product	Default	Desktop3	$500.00	10.0000	Catalog, Search

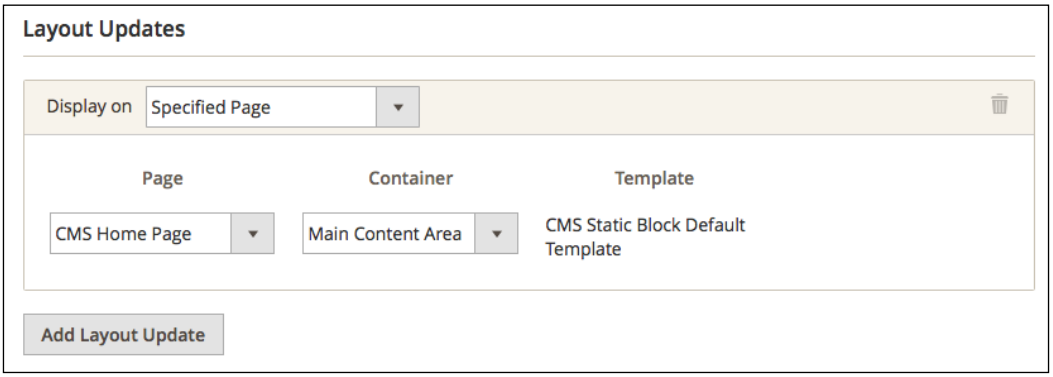
Magento has a **widget** management system that allows the flexibility of the content. The widget helps create a specific list of new products in the home page. To create a new widget, follow these steps:

1. Navigate to **Content** | **Widgets**
2. Click on the **Add Widget** button
3. Then, in the **StoreFront** properties, perform the following:
    1. Select **CMS Static Block** as **Type** and **Compstore Electronics** as **Design Theme**.
    2. Type `Home Page` in the **Widget title** field.

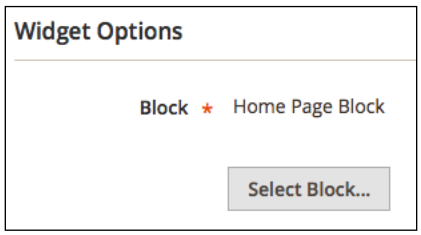
3. Select the **All Store Views** option.



4. In **Layout Updates**, select the following options:
   - For the **Display on** field, select the **Specified Page** option
   - In the **Page** field, select the **CMS Home Page** option
   - In the **Container** field, select the **Main Content Area** option
   - The **Template** field should be **CMS Static Block Default Template**



4. In **Widget Options**, perform the following:
    1. Select **Home Page Block**.
    2. Then, click on the **Save** button.

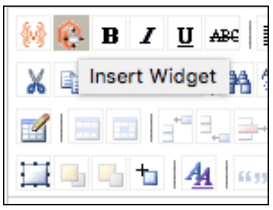


The default block configuration contains the images and products of the Luma theme. Let's change it via the following steps:

1. Navigate to **Content** | **Blocks**.
2. Click to edit **Home Page Block**
3. In the **Content** field, enter the following HTML code:

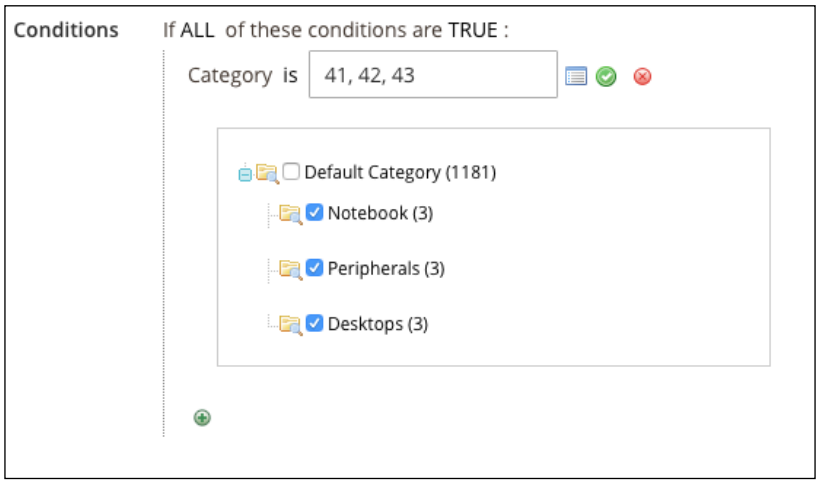
```
<div class="blocks-promo">
<a class="block-promo home-main" href="{{store url=""}}notebook.
html">
<img src="{{media url="wysiwyg/home-main.jpg"}}" alt="" />
<span class="content bg-white"><span class="info">New Desktop
available!</span>
<strong class="title">New Brands</strong>
<span class="action more button">Shop New Desktop</span> </span>
</a>
</div>
<div class="content-heading">
<h2 class="title">New Products</h2>
<p class="info">Here is what`s trending on CompStore now</p>
```

4. Position the cursor under the last line of the HTML code and click on the **Insert Widget** icon, as shown in the following screenshot:



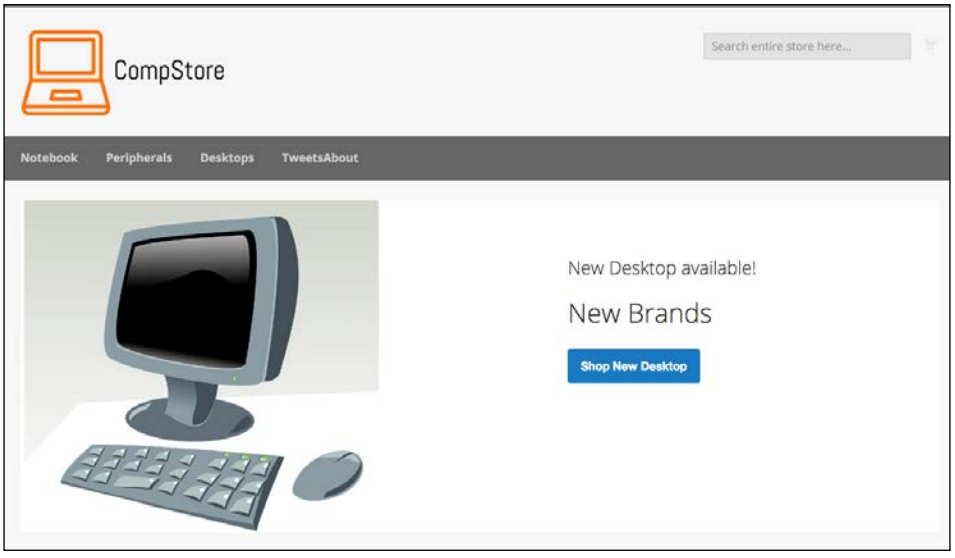
5. Select **Catalog Products List** as **Widget Type**.

6. Select all the categories created earlier in the **Conditions** field.



7. Click on the **Insert Widget** button.
8. If you prefer, you can change the image of the block.
9. Finally, click on the **Save Block** button.

Go to the Home page to see the final result:



Customizing Magento 2.0 templates

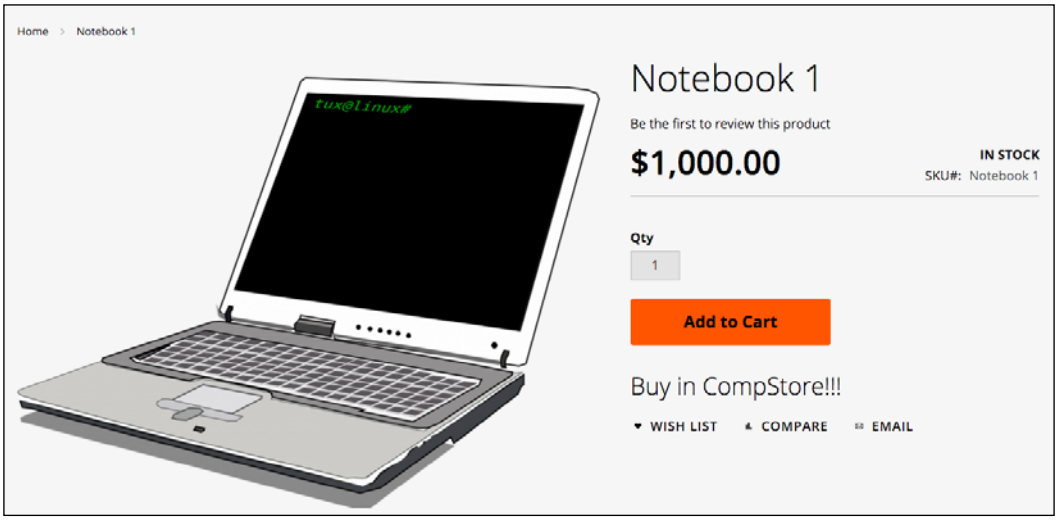
Magento works with `.phtml` template files to generate the view layer for the users. The modules and themes in Magento have its specific group of `.phtml` files to show data to the users. Let's create a custom template example in the CompStore theme to see how it works:

1. Create the `Magento_Catalog` directory under the `compstore` theme directory.
2. Copy the contents of `vendor/magento/module_catalog/view/frontend/templates` to `app/design/frontend/Packt/compstore/`Magento_Catalog/templates.
3. Then, open the `app/design/frontend/Packt/compstore/Magento_Catalog/templates/product/view/addto.phtml` file in your favorite code editor.
4. Go to Line 17 and enter the following code:

```
<div><h2>Buy in CompStore!!!</h2></div>
```

5. Save the file.
6. Delete the `var/view_preprocessed/` and `pub/static/frontend/Packt/compstore/` directories.
7. Deploy static content files by running the `php magento setup:static-content:deploy` command.
8. If necessary, give `write` permission to the `pub` directory.

Navigate to the product page to see the result, as in the following screenshot:



Summary

With the content learned in this chapter, you can now develop your own themes and customize solutions. The modern developer creates tools that can maximize the quality and minimize the effort to develop.

As a suggestion, try to read *Chapter 4*, *Magento 2.0 Theme Development – the Developers' Holy Grail*, again to create specific Magento pages and layout rules for the CompStore theme. You have uncountable possibilities to develop quality themes for Magento e-commerce and a great solid path to specialize more and more.

Now that you have all the tools to develop a theme for Magento, we will start discovering how to write Magento extensions by programming specific solutions in the next chapter.

6
Write Magento 2.0 Extensions – a Great Place to Go

In the previous chapter, we created a custom Magento 2.0 theme called CompStore. However, what do you think about extending our Magento expertise by creating our own extension? In this chapter, we will create a new extension called **TweetsAbout**, add a brand new functionality in our theme, learn the main concepts of Magento extension development, and take a look at how the extension packaging process works.

The following topics will be covered in this chapter:

- Magento development overview
- The Zend framework basics
- The Magento 2.0 extension structure
- The Twitter REST API
- Twitter OAuth
- Magento extension project – TweetsAbout

Magento development overview

Magento is an MVC-based application divided into modules. Each module has a specific job inside Magento, following a mature software pattern. For example, Magento has a specific module to control product shipping. This kind of approach is very important to create new functionalities and have the flexibility and modularity to extend its power.

Using the Zend framework

According to *Zend Framework Case Study* available at `https://www.zend.com/topics/Magento-CS.pdf`, the Magento project chose to go with industry-standard PHP and the Zend framework because of the extremely simple, object-oriented, and flexible solution that encapsulates best practices and agile testing methodologies and that would result in a very rapid development of enterprise-grade web applications.

Using the Zend framework as the main pillar in the Magento project definitely includes the following advantages:

- Magento contributors around the world know the Zend framework
- There is great web services support to integrate Magento with different software solutions in order to share data
- The MVC design pattern helps organize project development

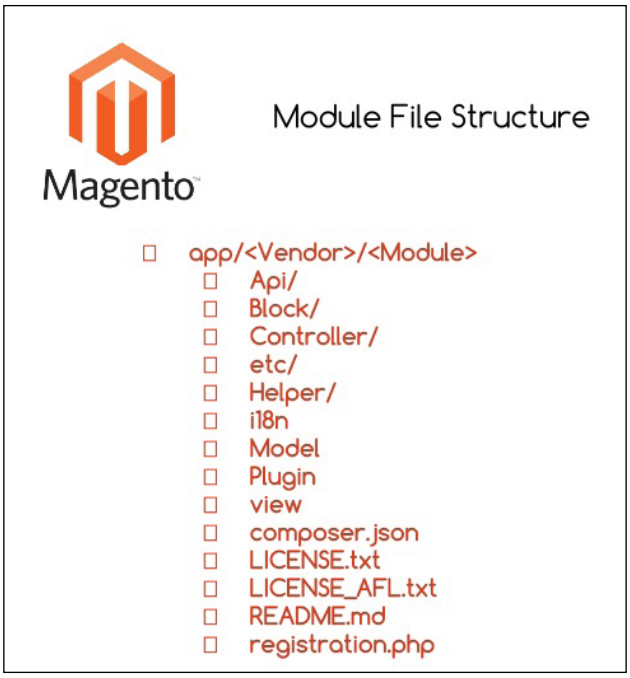
With the Zend framework, Magento has great flexibility in creating and customizing modules, developing new features for the system, and maintaining the core code.

A basic understanding of Zend components could be interesting for developers to take advantage of this great MVC framework.

You can learn more about Zend framework at `http://framework.zend.com/`.

Magento 2.0 extension structure

Magento 2.0 is a modular system as you can see. That is why it is important to maintain all the code organized, and it couldn't be different with Magento extensions. In previous chapters you saw all the directory structure of Magento, but now let's give special attention to the basic Magento module file structure:



In order to create a new extension according to the preceding image, we must create the same directory structure. However, how will they interact with the Magento system?

Some of these directories have an important role to play in the Magento system. They are directories that are responsible for providing basic functionalities and coupling between modules and the Magento system:

- `Block`: Blocks are View classes that are responsible for providing visualization layers between the logical and frontend layer.
- `Controller`: These control all the actions of the Magento. Web servers process the requests and Controller redirects them to specific modules according to the URL.
- `etc`: This stores all the module XML configuration files.
- `Helper`: This stores auxiliary classes that provide forms, validators, and formatters, which are commonly used in business logic.
- `Model`: This stores all business logic and the access layer to the data.
- `Setup`: Setup classes are classes that control installation and upgrading functionalities.

The other directories support additional configurations and implementations of the module; these are as follows:

- `Api`: This directory contains classes to control the API's layers
- `i18n`: This directory contains files responsible for translating (internationalization) the module view layer
- `Plugin`: This directory handles plugins if necessary
- `view`: This directory handles all the template and layout files

The files presented in the root directory are files on which you worked before. The `LICENSES` and `README` files are those available for extension distribution purposes.

Developing your first Magento extension

Now, you have a general concept of creating a new extension for Magento. As a scenario to our development, we will create a simple extension called TweetsAbout to communicate with Twitter via the API and get the latest tweets with the `#magento`, `#packtpub`, and `#php` hashtags.

We will have two simple pages; the first will show a link to the results, and the second will show the tweets.

Let's get to work!

The Twitter REST API

Representational State Transfer (**REST**) is an architecture created to provide a simple communication channel between different applications over the Internet using mainly the HTTP protocol. It is the hottest data technology nowadays. **Facebook**, **Google**, **Twitter**, and a lot of huge companies have adopted REST applications. With REST APIs, you can read, post, and delete data.

Twitter has a specific format to spread its data on the Web in order to create great integration with different kinds of applications that consume its service. According to **Twitter Developers Documentation** available at `https://dev.twitter.com/rest/public`, Twitter REST APIs provide programmatic access to read and write Twitter data. You can author a new Tweet, read an author profile or follower data, and more. The REST API identifies Twitter applications and users using Oauth, and the responses are available in JSON.

Before beginning to code the Magento extension, let's create an account on Twitter Developer to authenticate our new application on the Twitter platform.

Create a new account in **Twitter** (`https://twitter.com/`) if you don't have one and access the **Twitter Developer page** (`https://dev.twitter.com/`), as in the following screenshot:



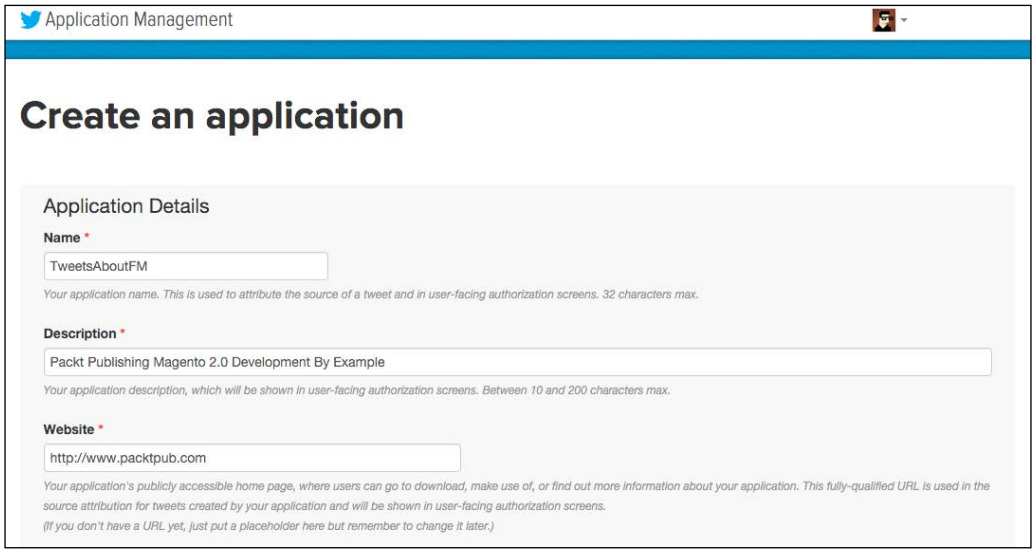
We have a lot of options on the developer's website, such as gathering real-time data, **crashlytics**, and **mopub**. I strongly suggest that you take a good look at these tools later.

So, let's create a new application to consume Twitter services. Access the URL `https://apps.twitter.com/` to create a new Twitter application. In order to use Twitter's public API services, you need to identify your application by generating a token and a secret key.

You can create a new application by clicking on the **Create New App** button and filling in the form with the following required fields:

- **Name**: Choose a unique name for your app
- **Description**: Describe your app
- **Website**: Provide a personal website/URL

Accept the **Developer Agreement** to finish your app registration and click on the **Create your Twitter Application** button.

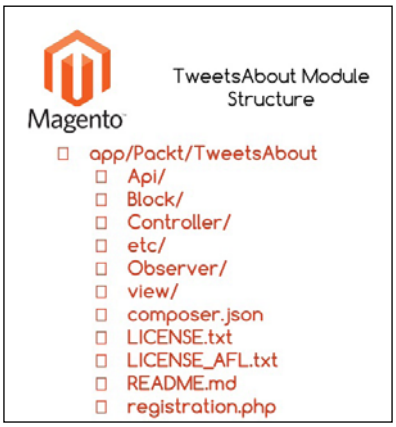


You can access your application's configurations by clicking on the name of your application. Later on in this chapter, we will discuss how to get the right credentials to integrate our application with Twitter.

Now, we can finally start our Magento 2.0 extension solution.

The TweetsAbout module structure

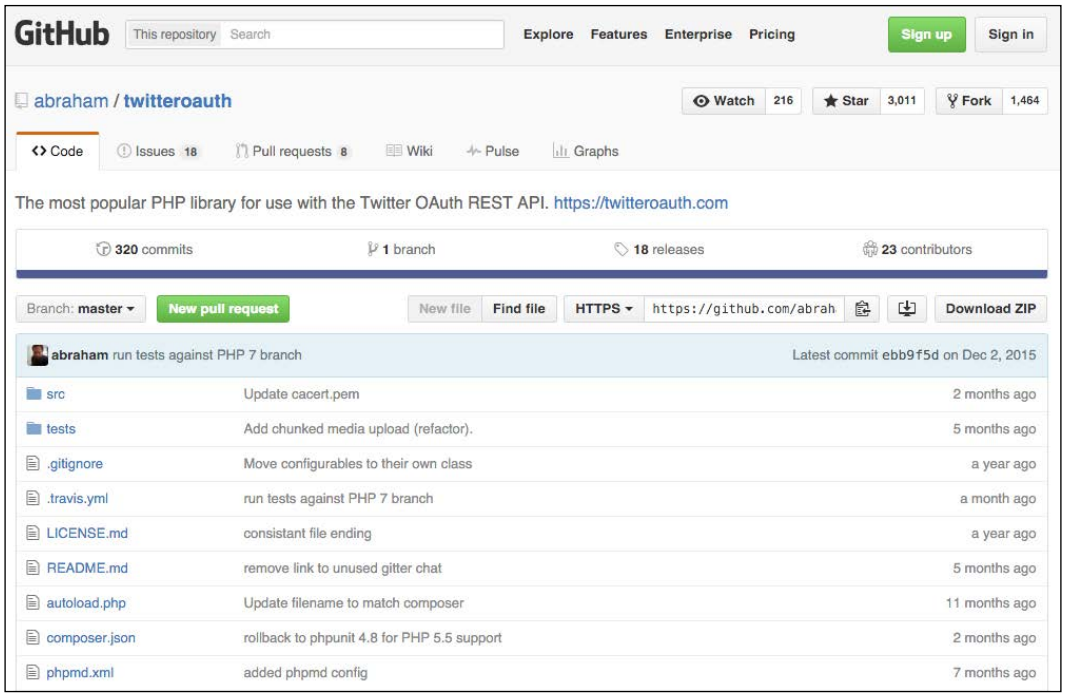
Create the following basic directory structure for the project:



Using TwitterOAuth to authenticate our extension

The **TwitterOAuth** (`https://twitteroauth.com/`) library provides communication with Twitter via an API. In the TweetsAbout project, this kind of communication is essential for the final proposal of our extension solution. TwitterOAuth is the most popular PHP library to use with the TwitterOAuth REST API.

This project is also available on **GitHub** (`https://github.com/abraham/twitteroauth`), as shown in the following screenshot:



To install TwitterOAuth on the TweetsAbout extension, follow this recipe:

1. Open the terminal or command prompt.
2. Under the `packt/app/code/Packt/TweetsAbout/Api` directory, run the `composer require abraham/twitteroauth` command.

3. Access `https://apps.twitter.com/`, click on your application, and click on the **Keys and Access Tokens** tab to get the following:
    - **Consumer Key (API Key)**
    - **Consumer Secret (API Secret)**
    - **Access Token**
    - **Access Token Secret**

We'll need these credentials to use on our extension later.

Developing the module

To start the module development, we will declare the basic module configurations. Open your favorite code editor, create a new file called `module.xml`, and save the file in `app/code/Packt/TweetsAbout/etc`. Enter this code in the file:

```
<?xml version="1.0"?>
  <config xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:no
NamespaceSchemaLocation="urn:magento:framework:Module/etc/module.xsd">
      <module name="Packt_TweetsAbout" setup_version="2.0.0"/>
  </config>
```

Magento 2.0 works with **Uniform Resource Names** (**URN**) schema validation to reference XML declarations, as you can observe in the `<config>` tag. The `module.xsd` file works by validating whether your module declaration follows the module declaration schema.

The `<module>` tag contains the vendor and module name. Always follow this example of module name declaration: `Vendor_Module`.

Under `app/code/Packt/TweetsAbout/etc/frontend`, create two new files, as follows:

- `routes.xml`
- `events.xml`

The `routes.xml` file contains the following code:

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNa
mespaceSchemaLocation="urn:magento:framework:App/etc/routes.xsd">
    <router id="standard">
        <route id="tweetsabout" frontName="tweetsabout">
            <module name="Packt_TweetsAbout" />
```

```
        </route>
    </router>
</config>
```

The `routes.xml` file tells Magento where to look for the controllers (TweetsAbout/Controller) when the URL `http://localhost/packt/tweetsabout` is accessed (MVC).

The `events.xml` file contains the following code:

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNa
mespaceSchemaLocation="urn:magento:framework:Event/etc/events.xsd">
    <event name="page_block_html_topmenu_gethtml_before">
        <observer name="Packt_TweetsAbout_observer" instance="Packt\
TweetsAbout\Observer\Topmenu" />
    </event>
</config>
```

The `events.xml` file declares an **Observer** event handler in the module, and this file has the mission of configuring a new TweetsAbout top menu link to access the module in the frontend. Observer listens to events triggered by the user or system. The `<event>` tag gets basic information of the top menu Block to be handled later in the PHP code, and the `<observer>` tag declares the `Topmenu` observer class. In this chapter, we will take a look at how the `Topmenu` class works. For now, it's important to declare this option.

For further information about Observer, access the Magento official documentation at `http://goo.gl/0CTzmn`.

Now, it is time to create the `registration.php` file under the root directory of TweetsAbout. Run the following code:

```
<?php
\Magento\Framework\Component\ComponentRegistrar::register(
    \Magento\Framework\Component\ComponentRegistrar::MODULE,
    'Packt_TweetsAbout',
    __DIR__
);
```

The `registration.php` file has the same role as that of theme registration in Magento System.

Create the `composer.json` file under the root directory of TweetsAbout via the following code:

```
{
  "name": "packt/tweets-about",
  "description": "Example of Magento Module - Packt Publishing",
  "type": "magento2-module",
  "version": "1.0.0",
  "license": [
    "OSL-3.0",
    "AFL-3.0"
  ],
  "require": {
    "php": "~5.5.0|~5.6.0|~7.0.0",
    "magento/framework": "~100.0",
    "abraham/twitteroauth": "^0.6.2"
  },
  "autoload": {
    "files": [ "registration.php" ],
    "psr-4": {
      "Packt\\TweetsAbout\\": ""
    }
  },
  "extra": {
        "installer-paths": {
            "app/code/Packt/TweetsAbout/Api": ["abraham/twitteroauth"]
        }
    }
}
```

You can observe in the `composer.json` file the declaration of the TwitterOAuth project as a required package to our extension. Also, the file defines the installation directory.



For further information about Composer packages, refer to the link `https://packagist.org/`.

You can copy the `LICENSE.txt` and `LICENSE_AFL.txt` files from the Magento root directory to your `Packt/TweetsAbout` directory. The `README.md` file is responsible for storing information about the module's scope and some considerations for the purposes of publishing on GitHub (`http://github.com/`). You can feel free to create the `README.md` file as you wish.

For now, we have the module declaration and registration files. It's time to create the controllers to start giving some life to the TweetsAbout module.

Controllers

First, let's create a new file named `Index.php`. This file will control the access to the initial page of the module. Save it under `app/code/Packt/TweetsAbout/Controller/Index/` with the following code:

```
<?php

  namespace Packt\TweetsAbout\Controller\Index;

  class Index extends \Magento\Framework\App\Action\Action{

      protected $resultPageFactory;

      public function __construct(
          \Magento\Framework\App\Action\Context $context,
          \Magento\Framework\View\Result\PageFactory
$resultPageFactory
      ) {
          $this->resultPageFactory = $resultPageFactory;
          parent::__construct($context);
      }

      public function execute(){
          return $this->resultPageFactory->create();
      }
  }
```

Create another file named `Index.php` under `app/code/Packt/TweetsAbout/Controller/Magento/`. This file will control the access to the Magento Tweets page of the module. Save it with the following code:

```
<?php

  namespace Packt\TweetsAbout\Controller\Magento;

  class Index extends \Magento\Framework\App\Action\Action{

      protected $resultPageFactory;

      public function __construct(
          \Magento\Framework\App\Action\Context $context,
          \Magento\Framework\View\Result\PageFactory
$resultPageFactory
```

```
        ) {
            $this->resultPageFactory = $resultPageFactory;
            parent::__construct($context);
        }

        public function execute(){
            return $this->resultPageFactory->create();
        }
    }
```

Create another file named `Index.php` under `app/code/Packt/TweetsAbout/Controller/Packt/`. This file will control the access to the `Packt` tweets page of the module. Save it with the following code:

```
<?php

  namespace Packt\TweetsAbout\Controller\Packt;

  class Index extends \Magento\Framework\App\Action\Action{

      protected $resultPageFactory;

      public function __construct(
          \Magento\Framework\App\Action\Context $context,
          \Magento\Framework\View\Result\PageFactory
$resultPageFactory
      ) {
          $this->resultPageFactory = $resultPageFactory;
          parent::__construct($context);
      }

      public function execute(){
          return $this->resultPageFactory->create();
      }
  }
```

Create another file named `Index.php` under `app/code/Packt/TweetsAbout/Controller/Php/`. This file will control the access to the PHP tweets page of the module. Save it with the following code:

```
<?php

  namespace Packt\TweetsAbout\Controller\Php;

  class Index extends \Magento\Framework\App\Action\Action{
```

```
        protected $resultPageFactory;

        public function __construct(
            \Magento\Framework\App\Action\Context $context,
            \Magento\Framework\View\Result\PageFactory
$resultPageFactory
        ) {
            $this->resultPageFactory = $resultPageFactory;
            parent::__construct($context);
        }

        public function execute()
        {
            return $this->resultPageFactory->create();
        }
    }
```

Magento 2.0 uses **namespaces** as a PHP standard recommendation (`http://www.php-fig.org/psr/`) to avoid name collisions between classes and to improve the readability of the code. So, in the namespace instruction, we will declare the class path to follow the **PSR-4 pattern** (`http://www.php-fig.org/psr/psr-4/`).

The `extends` functionality (inheritance) of `\Magento\Framework\App\Action\Action` provides a functionality to handle actions triggered by the URL access. For example, when the user enters the URL `http://<magento_url>/tweetsabout`, the `routes.xml` file redirects to the `Index/Index.php` controller to treat the user request made by accessing the URL.

The **dependency injection** of the `__construct()` method—`\Magento\Framework\App\Action\Context $context` and `\Magento\Framework\View\Result\PageFactory $resultPageFactory`—declares the initial construct of the `Action` class and the view layer to work with the template file.



For further information about the dependency injection, access the Magento official documentation at `http://goo.gl/jHFPTr`.

Finally, the `execute()` method renders the layout. We will declare the layout files later on.

At this point, it's important to be familiar with PHP object-oriented programming (`http://php.net/manual/en/language.oop5.php`). I strongly suggest that you study the main concepts to increase the understanding of the book.

Blocks

Blocks in Magento 2.0 provide presentation logic for your view templates. In the TweetsAbout project, we will use two blocks to process the view template files.

Under the `app/code/Packt/TweetsAbout/Block` directory, create a file named `Index.php` with the following code:

```
<?php

  namespace Packt\TweetsAbout\Block;

  class Index extends \Magento\Framework\View\Element\Template{

      public function getMagentoUrl(){
          return $this->getData('urlMagento');
      }

      public function getPHPUrl(){
          return $this->getData('urlPHP');
      }

      public function getPacktUrl(){
          return $this->getData('urlPackt');
      }
  }
```

The three methods, `getMagentoUrl()`, `getPHPUrl()`, and `getPacktUrl()`, get data from layout declaration files to define a URL for each kind of controller and give it to the initial layout of the module.

Now, under the `app/code/Packt/TweetsAbout/Block` directory, create a file named `Tweets.php` with the following code:

```
<?php
  namespace Packt\TweetsAbout\Block;

  require $_SERVER['DOCUMENT_ROOT'] . "/packt/app/code/Packt/
TweetsAbout/Api/vendor/autoload.php";
  use Abraham\TwitterOAuth\TwitterOAuth;

  class Tweets extends \Magento\Framework\View\Element\Template{

      private $consumerKey;
      private $consumerSecret;
```

```
        private $accessToken;
        private $accessTokenSecret;

      public function searchTweets(){
        $connection = $this->twitterDevAuth();
        $result = $connection->get("search/tweets", array("q" =>$this-
>getData('hashtag'), "result_type"=>"recent", "count" => 10));

        return $result->statuses;
      }

      private function twitterDevAuth(){
        $this->consumerKey = YOUR_CONSUMER_KEY;
        $this->consumerSecret = YOUR_CONSUMER_SECRET;
        $this->accessToken = YOUR_ACCESS_TOKEN;
        $this->accessTokenSecret  = YOUR_ACCESS_TOKEN_SECRET;

        return new TwitterOAuth($this->consumerKey, $this-
>consumerSecret, $this->accessToken, $this->accessTokenSecret);
      }
    }
```

Here are some things to consider about the `Tweets.php` code:

- The required instruction is to call the autoload, and the use is to append the namespace of the `TwitterOAuth` library to work on our extension
- In the `twitterDevAuth()` method, you must enter the Twitter API credentials
- In the `searchTweets()` method, the `$connection->get("search/tweets", array("q" =>$this->getData('hashtag'), "result_type"=>"recent", "count" => 10))` instruction works with the Twitter search API, getting the last 10 results of Twitter posts

Observer

Under the `app/code/Packt/TweetsAbout/Observer` directory, create the `Topmenu.php` file with the following code:

```
<?php
namespace Packt\TweetsAbout\Observer;
use Magento\Framework\Event\Observer as EventObserver;
use Magento\Framework\Data\Tree\Node;
use Magento\Framework\Event\ObserverInterface;
```

```
class Topmenu implements ObserverInterface{

    /**
     * @param EventObserver $observer
     * @return $this
     */
    public function execute(EventObserver $observer)
    {

      $urlInterface = \Magento\Framework\App\
ObjectManager::getInstance()->get('Magento\Framework\UrlInterface');

      $active = strpos($urlInterface->getCurrentUrl(), "tweetsabout");


        /** @var \Magento\Framework\Data\Tree\Node $menu */
        $menu = $observer->getMenu();
        $tree = $menu->getTree();
        $data = [
            'name'      => __("TweetsAbout"),
            'id'        => 'tweetsmenu',
            'url'       => $urlInterface->getBaseUrl() .
'tweetsabout',
            'is_active' => $active
        ];
        $node = new Node($data, 'id', $tree, $menu);
        $menu->addChild($node);
        return $this;
    }
}
```

The `Topmenu.php` file dynamically creates a new top menu item for the TweetsAbout module by adding a node in the top menu link schema. The `\Magento\Framework\App\ObjectManager::getInstance()->get('Magento\Framework\UrlInterface')` instruction gets the base URL and the current URL to create a specific link to the TweetsAbout module. The `Topmenu` observer works with the **Document Object Model** (**DOM**) concept of nodes and trees dynamically.

Views

It's time to handle the presentation layer of the project. First, we will create the layout files (`.xml`) to handle template behavior and to pass arguments to the template via blocks. Every layout file is assigned by following this pattern: `<module_name>_<controller>_<controller_file>.xml`. This pattern allows the Magento system to assign the correct files according to its controller automatically.

Under the `app/code/Packt/TweetsAbout/view/frontend/layout` path, create the `tweetsabout_index_index.xml` file with the following code:

```
<?xml version="1.0"?>
<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
layout="1column" xsi:noNamespaceSchemaLocation="urn:magento:framework:
View/Layout/etc/page_configuration.xsd">
    <head>
        <title>
            TweetsAbout Module
        </title>
    </head>
    <body>
        <referenceContainer name="content">
            <block class="Packt\TweetsAbout\Block\Index"
template="Packt_TweetsAbout::index.phtml">
                <arguments>
                    <argument name="urlMagento" xsi:type="url"
path="tweetsabout/magento" />
                    <argument name="urlPHP" xsi:type="url"
path="tweetsabout/php" />
                    <argument name="urlPackt" xsi:type="url"
path="tweetsabout/packt" />
                </arguments>
            </block>
        </referenceContainer>
    </body>
</page>
```

The `<block>` tag binds the `Index.php` Block to the `index.phtml` template, and the `<arguments>` tag transports three URL parameters to the Block. These parameters will be used in the `index.phtml` file.

Under the `app/code/Packt/TweetsAbout/view/frontend/layout` path, create the `tweetsabout_magento_index.xml` file with the following code:

```
<?xml version="1.0"?>
<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
layout="1column" xsi:noNamespaceSchemaLocation="urn:magento:framework:
View/Layout/etc/page_configuration.xsd">
    <head>
        <title>
            TweetsAbout #Magento
        </title>
        <css src="Packt_TweetsAbout::css/source/module.css"/>
    </head>
    <body>
        <referenceContainer name="content">
            <block class="Packt\TweetsAbout\Block\Tweets"
template="Packt_TweetsAbout::tweets.phtml">
                <arguments>
                    <argument name="hashtag"
xsi:type="string">#magento</argument>
                </arguments>
            </block>
        </referenceContainer>
    </body>
</page>
```

Under the `app/code/Packt/TweetsAbout/view/frontend/layout` path, create the `tweetsabout_packt_index.xml` file with the following code:

```
<?xml version="1.0"?>
<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
layout="1column" xsi:noNamespaceSchemaLocation="urn:magento:framework:
View/Layout/etc/page_configuration.xsd">
    <head>
        <title>
            TweetsAbout #Packtpub
        </title>
        <css src="Packt_TweetsAbout::css/source/module.css"/>
    </head>
    <body>
        <referenceContainer name="content">
```

```
            <block class="Packt\TweetsAbout\Block\Tweets"
template="Packt_TweetsAbout::tweets.phtml">
                <arguments>
                    <argument name="hashtag"
xsi:type="string">#packtpub</argument>
                </arguments>
            </block>
        </referenceContainer>
    </body>
</page>
```

Under the `app/code/Packt/TweetsAbout/view/frontend/layout` path, create the `tweetsabout_php_index.xml` file with the following code:

```
<?xml version="1.0"?>
<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
layout="1column" xsi:noNamespaceSchemaLocation="urn:magento:framework:
View/Layout/etc/page_configuration.xsd">
    <head>
        <title>
            TweetsAbout #PHP
        </title>
        <css src="Packt_TweetsAbout::css/source/module.css"/>
    </head>
    <body>
        <referenceContainer name="content">
            <block class="Packt\TweetsAbout\Block\Tweets"
template="Packt_TweetsAbout::tweets.phtml">
                <arguments>
                    <argument name="hashtag" xsi:type="string">#php</
argument>
                </arguments>
            </block>
        </referenceContainer>
    </body>
</page>
```

The `<css>` tag loads the CSS rules of the template. The `<block>` tag binds the `Tweets.php` Block to the `tweets.phtml` file. The `<argument name="hashtag">` tag transports the **hashtag** parameter to the `Tweets.php` Block to search the latest mentions of the specific hashtag in the Twitter database.

Now, let's create the `template` files.

Under the `app/code/Packt/TweetsAbout/view/frontend/templates` path, create the `index.phtml` file with the following code:

```
<h2>Recent TweetsAbout: </h2>
<ul>
  <li>
    <a href="<?php echo $block->escapeHtml($block->getMagentoUrl())
?>">
      <span><?php echo __('Magento')?></span>
    </a>
  </li>
  <li>
    <a href="<?php echo $block->escapeHtml($block->getPacktUrl()) ?>">
      <span><?php echo __('Packtpub')?></span>
    </a>
  </li>
  <li>
    <a href="<?php echo $block->escapeHtml($block->getPHPUrl()) ?>">
      <span><?php echo __('PHP')?></span>
    </a>
  </li>
</ul>
```

The `$block` object has access to the methods of `Block/Index.php`, and the URL of the pages build dynamically.

Under the `app/code/Packt/TweetsAbout/view/frontend/templates` path, create the `tweets.phtml` file with the following code:

```
<?php
  $tweets = $block->searchTweets();
?>

<?php foreach ($tweets as $tweet){ ?>
  <p class="tweet">
    <a href="<?php echo $tweet->user->url; ?>">
      <img src="<?php echo $tweet->user->profile_image_url; ?>"
alt="profile">
    </a>
```

```
    <b>Created: </b><?php echo $tweet->created_at; ?>
    <br />
    <br />

    <a href="<?php echo isset($tweet->entities->urls[0]->url) ?
$tweet->entities->urls[0]->url : "#"; ?>" target="_blank"><?php echo
$tweet->text;?></a>

  </p>
  <hr />
<?php } ?>
```

The `searchTweets()` method loads tweets according to the URL accessed, and PHP processes the data to show the results to the user.

CSS

Under the `app/code/Packt/TweetsAbout/view/frontend/web/css/source` path, create the `module.less` file with the following code:

```
 .tweet {background-color: #878787; padding:15px; border:1px dotted}
.tweet a {color: #ffffff}
.tweet a:hover {text-decoration: underline;}
```

Deploying the module

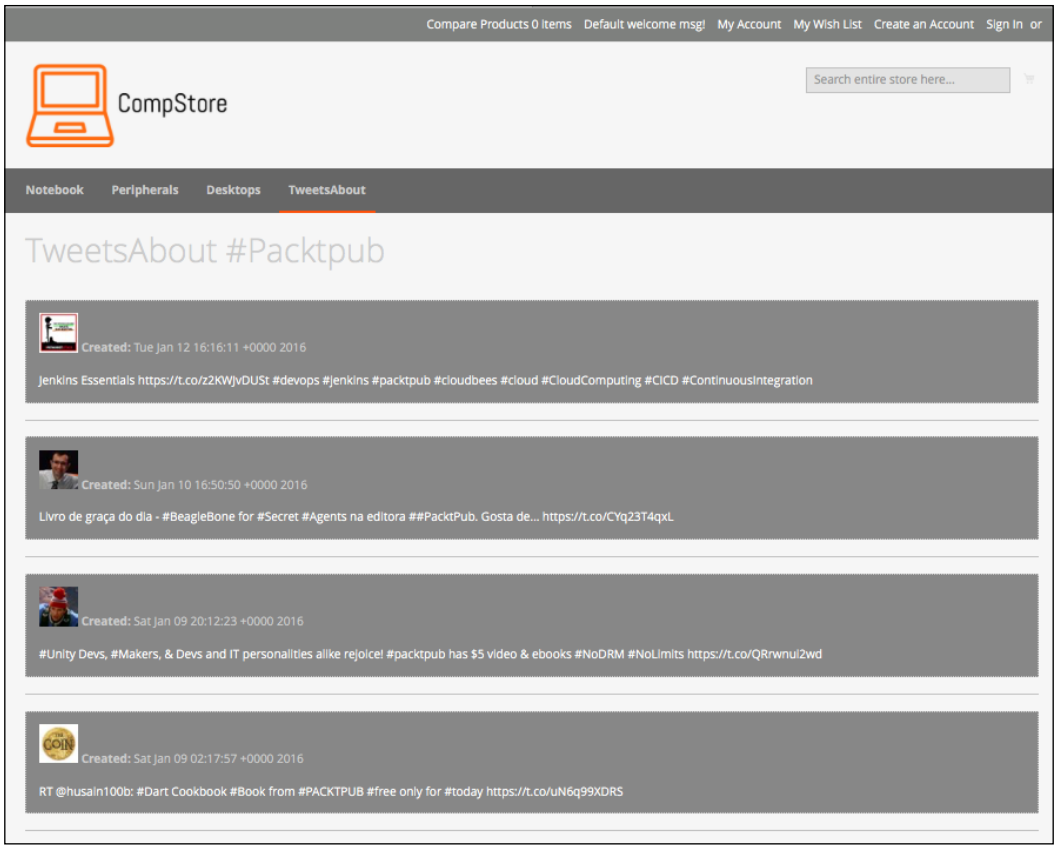
To deploy the module, follow this recipe:

1. Open the terminal or command prompt.
2. Access the `packt/bin` directory.
3. Then, run the `php magento module:enable --clear-static-content Packt_TweetsAbout` command.
4. Run the `php magento setup:upgrade` command.
5. Next, run the `php magento setup:static-content:deploy` command.
6. In some cases, it is necessary to give `write` permissions again to the directories.

If everything goes alright, when you access the URL `http://localhost/packt`, you will see one link for the `TweetsAbout` extension in the topmost menu. Just click on it to see how the extension works. Take a look at the following screenshot:



You can navigate to the links to see how the pages work, as in the following screenshot:



The extension gets the ten last tweets in real time with the date, picture, and post. It's really awesome to watch our work running!

For sure, this extension can get a lot better, but it is only a starting point for big achievements.

Magento Connect

Once you have your extension ready to work, you can publish it in the Magento Connect service (`http://www.magentocommerce.com/magento-connect`). Magento Connect is a service in which Magento members can share their open source or commercial extensions with Magento Community. The main contributions are generally based on the following:

- Modules
- Language packs
- Design interfaces
- Themes

Packaging and publishing your module

Once you have the `composer.json` file configured, you can package your module by compacting it as a `.zip` file in the `vendor-name_package-name-1.0.0.zip` format.

Upload the module in your personal account in GitHub, and Magento can retrieve it to publish.

For further information, it's strongly recommended that you to access the official documentation available on the Magento Developers official site at `http://devdocs.magento.com/guides/v2.0/extension-dev-guide/package_module.html`.

Summary

You worked on a lot in this chapter! Congratulations. Now, you have solid grasp of the concept in Magento 2.0 extension development. You can note that Magento development has strict rules, but once you learn the basics, you can master Magento with hard work and study. Keep the good work going!

As a suggestion, try to read the official documentation and do projects that demand more user interaction, such as the admin panel and development of dynamic formularies. You can even increase the power of TweetsAbout. The sky is the limit!

In the next chapter, we will start to work with Magento mobile by testing and configuring some great options. See you!

7
Go Mobile with Magento 2.0!

Nowadays e-commerce stores must be responsive and mobile friendly to increase sales according to the huge number of people using mobile devices to buy products and services. It's very important to know the right tools to provide a mobile-friendly Magento theme for your project. Let's go mobile with Magento!

The following topics will be covered in this chapter:

- Why mobile and responsive?
- Testing the website on different devices
- The Google Chrome DevTools device mode
- Responsive web designer tester extension
- Adjusting the CompStore theme for mobile devices
- Adjusting tweets for mobile devices

According to a research called **State of Mobile Commerce Growing like a weed Q1 2015** conducted by **Criteo** (`http://www.criteo.com/`), a digital marketing company, mobile accounts for 29% of e-commerce transactions in the US and 34% globally. By the end of 2015, mobile share is forecast to reach 33% in the US and 40% globally. This research is available at `http://www.criteo.com/media/1894/criteo-state-of-mobile-commerce-q1-2015-ppt.pdf`.

This is one of the main reasons for which all Magento developers must create responsive designs. We started this process indirectly by creating a new theme with **Webcomm Magento Boilerplate**. Despite its basic mobile support, we have to make some adjustments to create a completely responsive Magento theme. Let's return to work!

Testing the website on different devices

In order to test your website in different devices and, consequently, different screen sizes, it is recommended to use a specific software or service to simulate the screen sizes of devices. If you perform a search on the web, you may find a great number of online test tools, but these tools work only with published websites. Our Magento site works, for now, on our local development environment.

To take advantage of our local development environment, let's work with the **Google Chrome DevTools Device Mode** and the **Responsive Web Designer Tester** extensions. In this book, we'll have two options to work with mobile theme development. You choose both of them!

If you don't have Google Chrome installed, download it from the URL `https://www.google.com/intl/en/chrome/browser/desktop/` to install it on your operating system.

The Google Chrome DevTools device mode

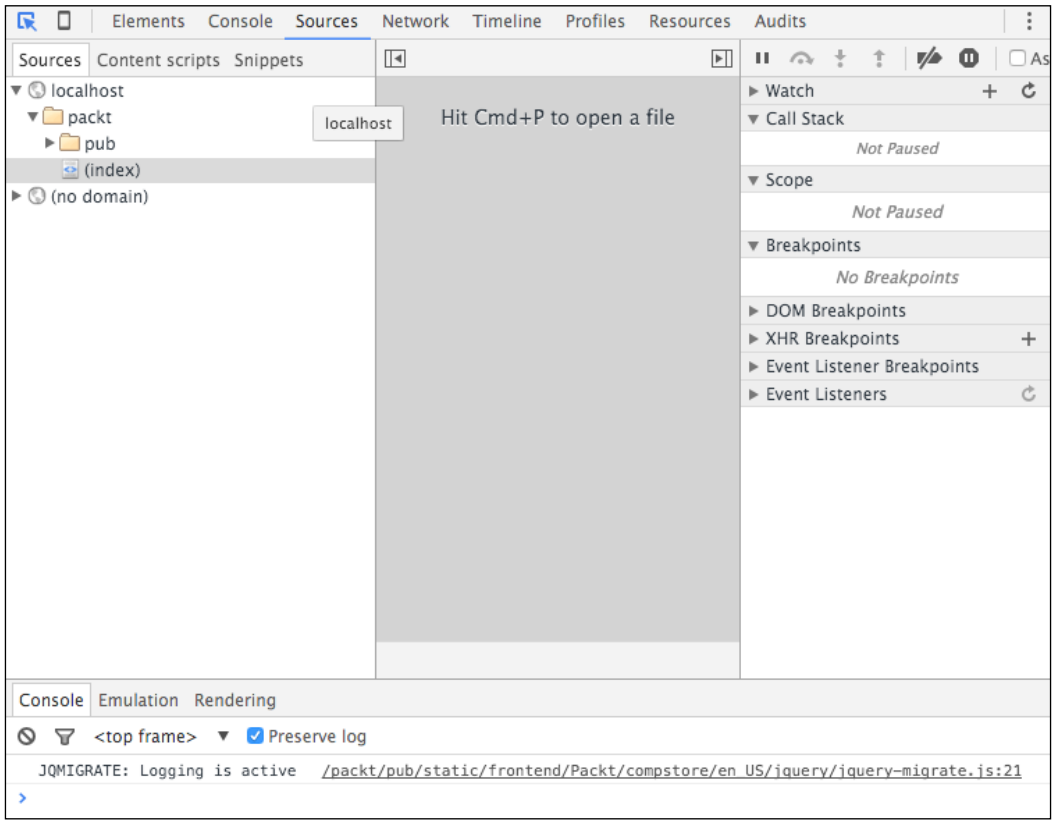
Google Chrome DevTools is a native tool of Google Chrome that provides a bunch of tools for web developers. By working with DevTools, you can optimize your frontend code, including HTML, CSS, and JavaScript.

Before accessing the DevTools extensions, access your Magento CompStore website at the `http://localhost/packt` URL.

To access DevTools, in the Google Chrome browser, follow these steps:

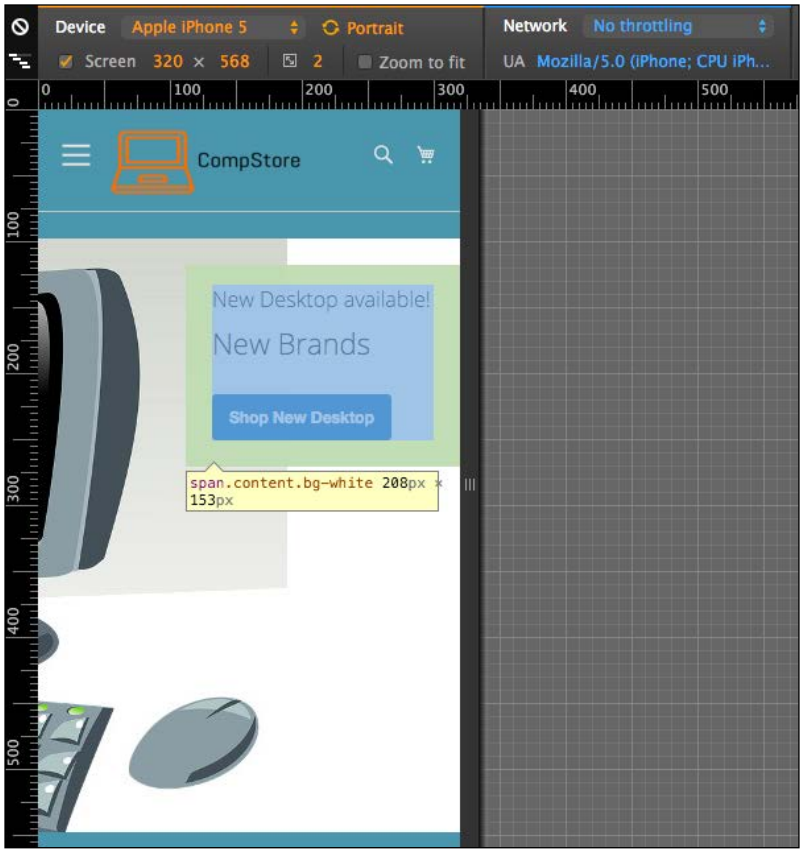
1. Click on the Google Chrome menu.
2. Click on the **More Tools** option.

3. Click on the **Developer Tools** option.



Now, you can see the **DevTools** window, as in the preceding screenshot.

To activate **Device Mode**, click on the smartphone icon next to the **Elements** menu item. Now, you can see the page rendering with different options, as in the following screenshot:



According to the Google DevTools official page available at `https://developers.google.com/web/tools/chrome-devtools/iterate/device-mode/`, you can use the DevTools device mode to do the following:

- Test your responsive designs
- Visualize and inspect CSS queries
- Use a network emulator to evaluate site performance
- Enhance your debugging workflow

The DevTools extension has the following options to enhance developer experience:

- **Device preset**
- **Network connectivity**
- **Inspecting media queries**
- **View CSS**
- **Add custom devices**

Changing the device preset

To change the device preset, click on the **Device** options:

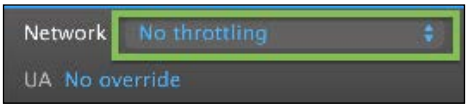


You can choose from among iPhone, Google Nexus, Samsung Galaxy, and Blackberry, and you can create custom devices to test the screen size.



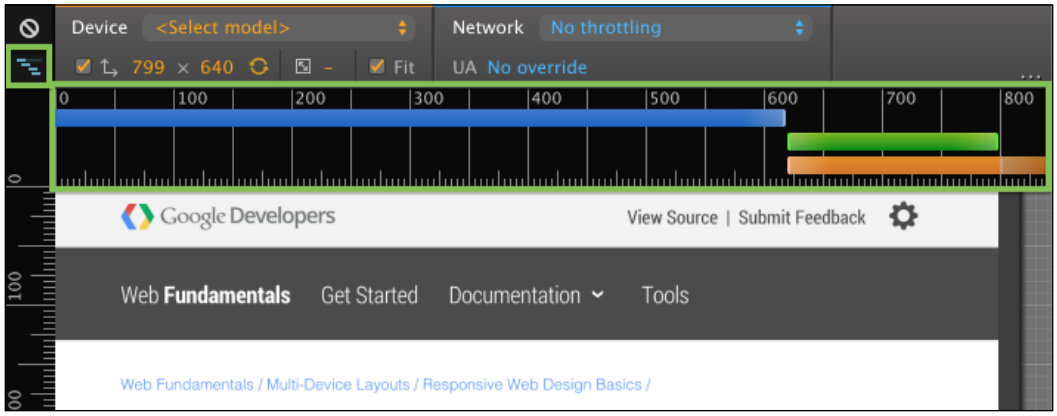
Network connectivity

This option emulates various network conditions of your website access.



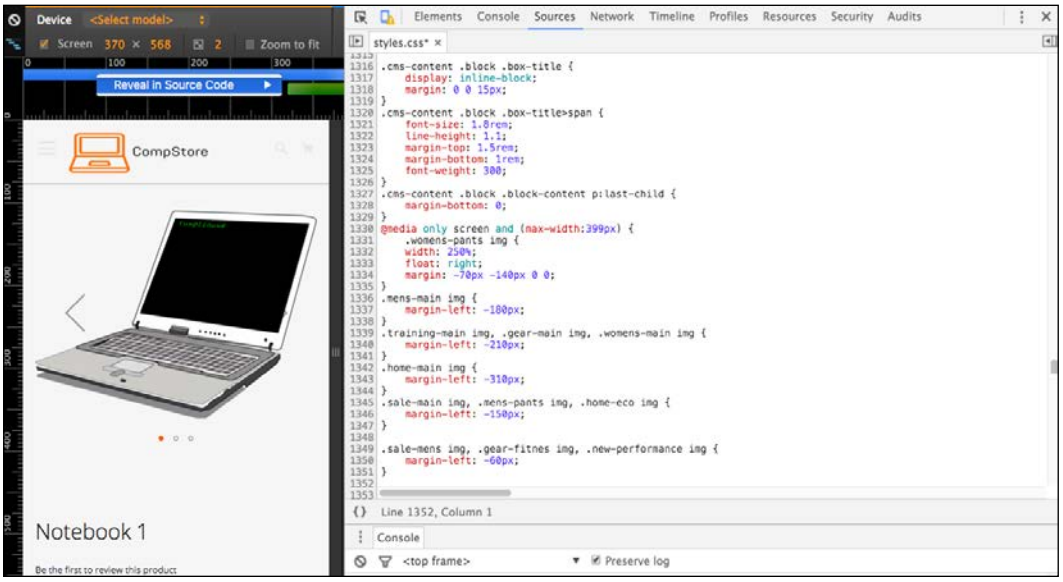
Inspecting media queries

The media queries are responsible for defining the CSS rule for each screen size. You can access all of these using DevTools. To access media queries, click on the icon in the upper-left corner:



Viewing CSS

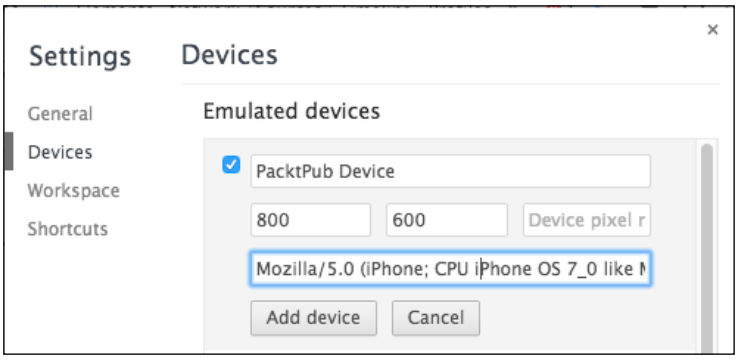
Right-click on a bar to view the CSS media query rule. You can make adjustments in the CSS code:



Adding custom devices

To create custom devices, follow these steps:

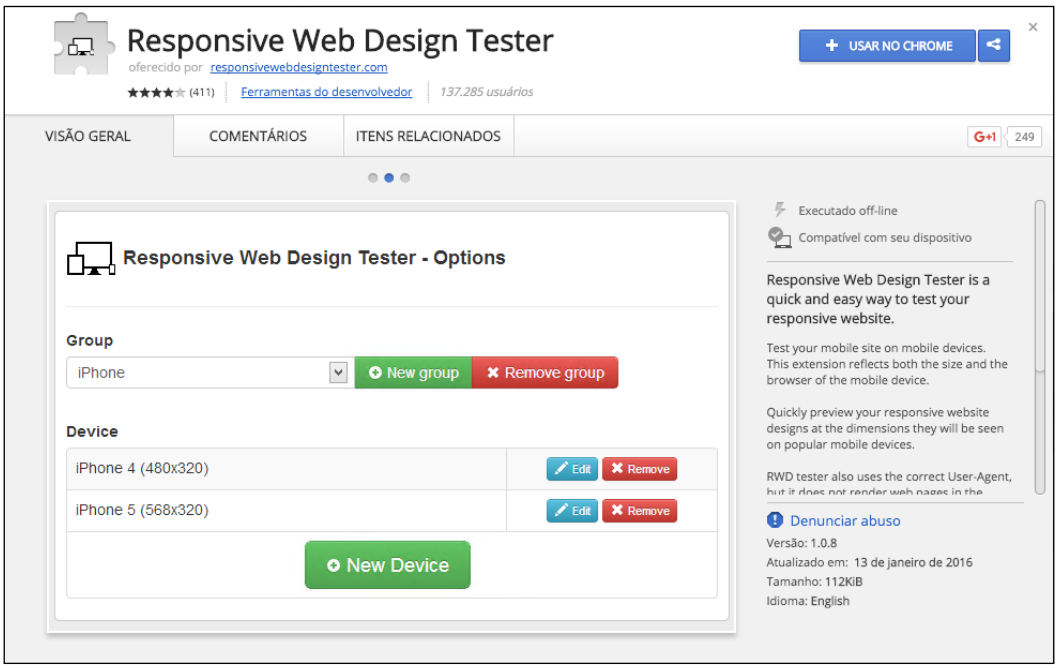
1. In the **Developer Tools** topmost menu, click on **Settings**.
2. Click on the **Devices** tab.
3. Then, click on the **Add Custom Device** button.
4. Fill the form according your need.
5. Next, click on the **Add Device** button.



Now, you have your own device to test your code.

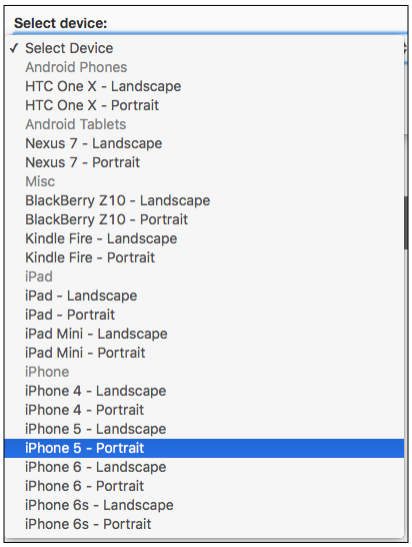
Responsive Web Designer tester

Now, open the Google Chrome browser and navigate to the address `https://chrome.google.com/webstore/category/apps` to access Chrome Web Store. Conduct a search to find the **Responsive Web Designer Tester** extension and then add the extension to Google Chrome, as follows:



Great work! Now, let's take a look at how this extension works. On your browser, go to your Magento local site, also known as CompStore, by accessing `http://localhost/packt`. Remember that you have to turn on Apache Service in XAMMP to test the local website.

Click on the button of the **Responsive Web Designer Tester** extension shown on the right-hand side of your screen (generally near the end of the browser address bar) and select the **iPhone 5—Portrait** option for the first test:



After you select the device, you will see a pop-up window having the size of iPhone 5 screen. Navigating on the page, you will see also that the layout is not fully responsive. We have some issues in the home page presentation:



Now we have a tool to test site behavior between the different devices. It is time to make our CompStore theme 100% compatible with multiple devices!

Adjusting the CompStore theme for mobile devices

Both the Magento 2.0 native themes, Blank and Luma, use **Responsive Web Design** (**RWD**) to provide good visualization in different devices, such as desktops, tablets, and mobiles.

In spite of the fact that the CompStore theme inherited the Luma theme, you can customize the template and CSS codes, as we discussed in *Chapter 6*, *Write Magento 2.0 Extensions – a Great Place to Go*. So, what do you think about improving the CompStore theme to make it more user friendly?

The actual mobile version of CompStore has some differences in the desktop version, including colors, elements positioning, and image size. Before creating some mobile standards for the CompStore theme, it's important to fix some CSS responsive design concepts of Magento. Let's get to work!

The Magento 2.0 responsive design

To handle accessibility for different devices, the Magento 2.0 native themes (Blank and Luma) work with an RWD engine, as we discussed in the *Chapter 4*, *Magento 2.0 Theme Development – the Developers' Holy Grail*, and *Chapter 5*, *Creating a Responsive Magento 2.0 Theme*. The stylesheets engine provided by the LESS preprocessor is the main utility responsible for this design approach.

The Magento 2.0 native themes were built based on the **Magento UI library**.
The Magento UI library works with **CSS 3 media queries** to render a page with predefined rules according to the device, which requests the page. An example of media queries would be one that applies a specific rule for screens with a maximum width of 640 px; take a look at the following code:

```
@media only screen and (max-width: 640px) {
…
}
```

With media queries, the themes apply **breakpoints** to handle different screen-width rules for different screen sizes of devices in a progression scale of pixels, as follows:

- 320 px (mobile)
- 480 px (mobile)
- 640 px (tablet)
- 768 px (tablet to desktop)
- 1024 px (desktop)
- 1440 px (desktop)

For further information about media queries, refer to the **W3C** official documentation available at `https://www.w3.org/TR/css3-mediaqueries/`.

The Magento UI

The Magento 2.0 system works with the LESS CSS preprocessor to extend the features of CSS and enable the opportunity to create theme inheritance with minimal and organized effort. With this premise, to help theme developers, we have the Magento UI library in Magento 2.0.

The Magento UI library is based on LESS and provides a set of components to develop themes and frontend solutions:

- Actions toolbar
- Breadcrumbs
- Buttons
- Drop-down menus
- Forms
- Icons
- Layout
- Loaders
- Messages
- Pagination
- Popups
- Ratings
- Sections
- Tabs and accordions

- Tables
- Tooltips
- Typography
- A list of theme variables

Another important resource of the Magento UI and of LESS is the **mixin** capability. The mixin allows developers to group style rules to work with different devices.

For example, consider that you declared the following CSS code in one determined file:

```
.media-width(@extremum, @break) when (@extremum = 'max') and (@break =
@screen__m) {
    .example-responsive-block {
        background: #ffc;
    }
    .example-responsive-block:before {
        content: 'Mobile styles ';
        font-weight: bold;
    }
}
```

Then, you executed this CSS code in a different file:

```
.media-width(@extremum, @break) when (@extremum = 'min') and (@break =
@screen__m) {
    .example-responsive-block {
        background: #ccf;
    }
    .example-responsive-block:before {
        content: 'Desktop styles ';
        font-weight: bold;
    }
}
```

In spite of the two files declaring a mixin named `.media-width` to the `.example-responsive-block` class in different files, the mixin allows LESS to make a single query, grouping the rules instead of making multiple calls according to the device rule applied.

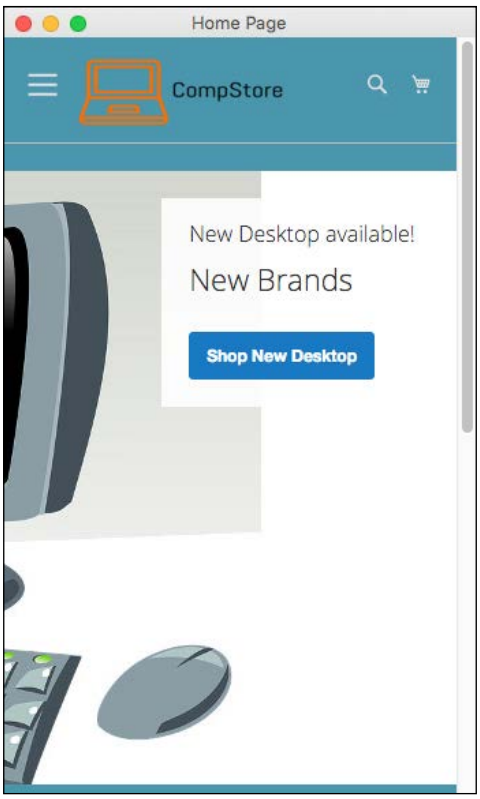
You can access the local Magento UI documentation by accessing the URL `http://<magento_local_url>/pub/static/frontend/Magento/blank/en_US/css/docs/responsive.html`.



For further information about the Magento UI, take a look at the Magento official `readme.md` file available at `https://github.com/magento/magento2/blob/2.0.0/lib/web/css/docs/source/README.md`.

Implementing a new CSS mixin media query

First of all, let's take a look at the current mobile version of the CompStore theme. Using Chrome DevTools or Responsive Web Designer Tester, select an Apple iPhone 5 (portrait) device to test the site. You will probably be redirected to home page:





In spite of the previous adjustment in the CompStore theme, when a mobile device accesses a theme, CSS rules don't apply some important features, such as colors and the positioning of elements. As a suggestion, let's create a standard declaration of color approach and configure CSS to show only one product when the mobile device accesses the site. How can we implement these new features? Using media queries, of course!

In your favorite code editor, open the `compstore.less` file available under the `app/design/frontend/Packt/compstore/web/css/source` directory and use the following CSS 3 code:

```
@color-compstore: #F6F6F6;

body{
  background: @color-compstore;
```

```
}

.media-width(@extremum, @break) when (@extremum = 'max') and (@break =
@screen__s) {
  body{
    background: @color-compstore;
  }
  .widget .block-promo img{
    height: 600px;
  }

  .products-grid .product-item {
    width: 100%;
    display: inline-block;
  }
}

.media-width(@extremum, @break) when (@extremum = 'min') and (@break =
@screen__s) {
  body{
    background: @color-compstore;
  }
  .widget .block-promo img{
    height: 600px;
  }
  .products-grid .product-item {
    width: 100%;
    display: inline-block;
  }
}
```

The Magento UI break points predefined variables to identify the scope of media queries, which are as follows:

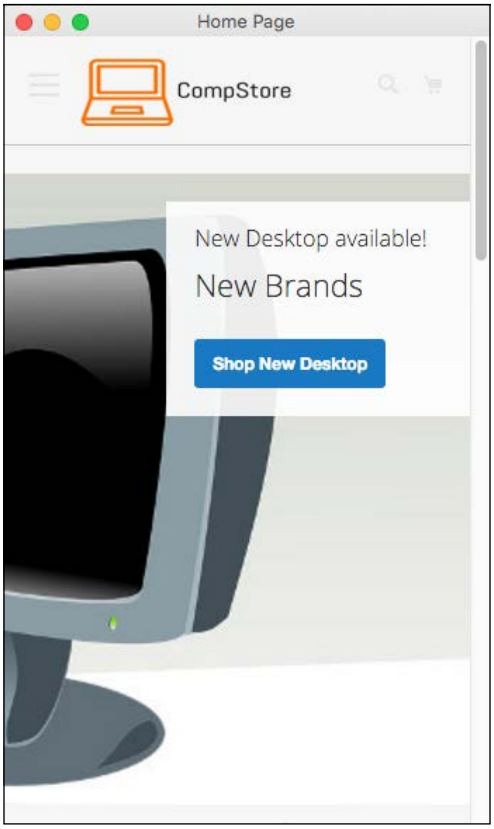
- `@screen__xxs`: 320 px
- `@screen__xs`: 480 px
- `@screen__s`: 640 px
- `@screen__m`: 768 px
- `@screen__l`: 1024 px
- `@screen__xl`: 1440 px

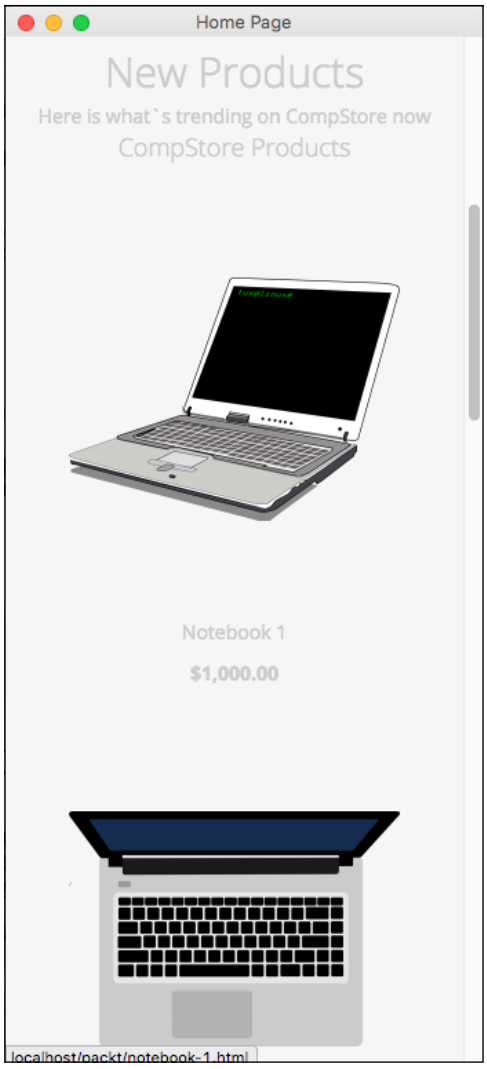
So, in the CSS 3 new proposal, the media queries use the `@screen_s` variable to define the application of new rules. We will propose via mixin to change the background color, promo image size, and product size inside mobile rules for portrait and landscape purposes.

To apply the changes, follow this recipe:

1. Save the file.
2. Open the terminal or command prompt.
3. Delete the `packt/pub/static/frontend/<Vendor>/<theme>/<locale>` directory.
4. Delete the `var/cache` directory.
5. Then, delete the `var/view_preprocessed` directory.
6. Access the `packt/bin` directory.
7. Next, run the `php magento setup:static-content:deploy` command.
8. In some cases, it is necessary to give `write` permissions again to the directories.

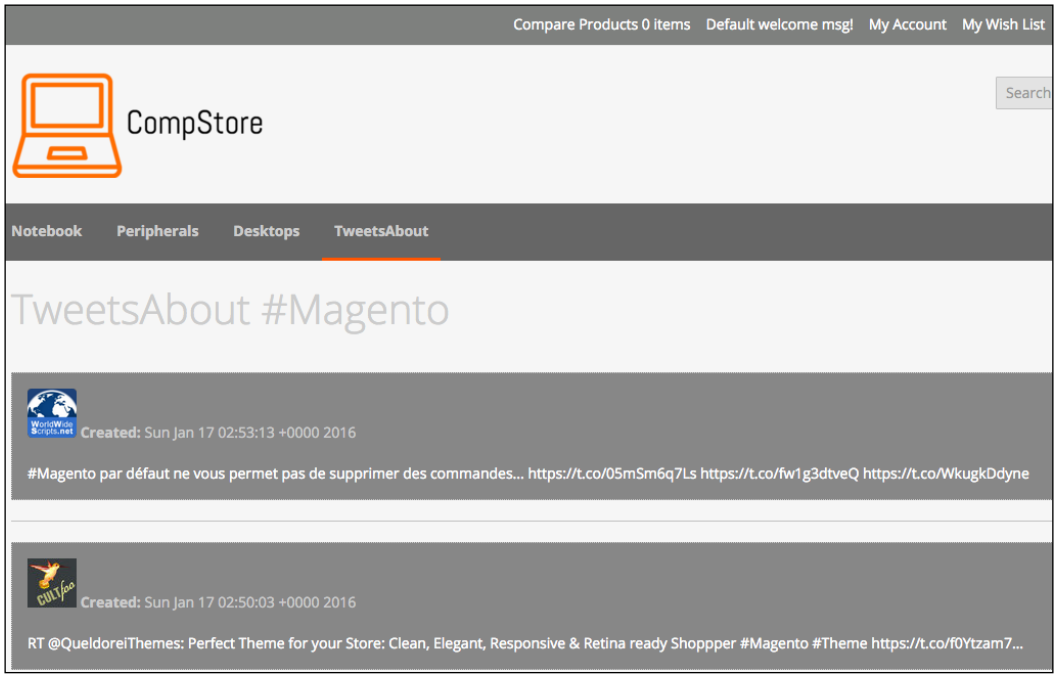
Test the site again to get the new home page, as in the following screenshot:




Home Page
New Products
Here is what`s trending on CompStore now
CompStore Products
Notebook 1
$1,000.00
localhost/packt/notebook-1.html

Adjusting tweets about extensions for mobile devices

The extension that we created in *Chapter 6*, *Write Magento 2.0 Extensions – a Great Place to Go*, tweets about extension and has the following appearance:



Let's improve the CSS extension rules to turn it into a mobile-friendly one.

Using Chrome DevTools or Responsive Web Designer Tester, select an Apple iPhone 5—portrait device to test our code optimization.

Open the `module.less` file available under the `packt/app/code/Packt/TweetsAbout/view/frontend/web/css/source` directory and add the following code:

```
/*Tweets About Style*/

@media (min-width: 960px){
#wrapper {
width: 90%;
max-width: 1100px;
```

```
min-width: 800px;
margin: 50px auto;
  }

  #columns {
    -webkit-column-count: 3;
    -webkit-column-gap: 10px;
    -webkit-column-fill: auto;
    -moz-column-count: 3;
    -moz-column-gap: 10px;
    -moz-column-fill: auto;
    column-count: 3;
    column-gap: 15px;
    column-fill: auto;
  }
}

.tweet {
    display: inline-block;
    background: #FEFEFE;
    border: 2px solid #FAFAFA;
    box-shadow: 0 1px 2px rgba(34, 25, 25, 0.4);
    margin: 0 2px 15px;
    -webkit-column-break-inside: avoid;
    -moz-column-break-inside: avoid;
    column-break-inside: avoid;
    padding: 15px;
    padding-bottom: 5px;
    background: -webkit-linear-gradient(45deg, #FFF, #F9F9F9);
    opacity: 1;

    -webkit-transition: all .2s ease;
    -moz-transition: all .2s ease;
    -o-transition: all .2s ease;
    transition: all .2s ease;
}

.tweetimg {
    width: 15%;
    display:block;
    float:left;
    margin: 0px 5px 0px 0px;
}

.tweet p {
    font: 12px/18px Arial, sans-serif;
```

```
    color: #333;
    margin: 0;
}

#columns:hover .img:not(:hover) {
    opacity: 0.4;
}
```

After saving the `module.less` file, change the `tweets.phtml` code available under `packt/app/code/Packt/TweetsAbout/view/frontend/templates`, change the file with this new code, and save it, as follows:

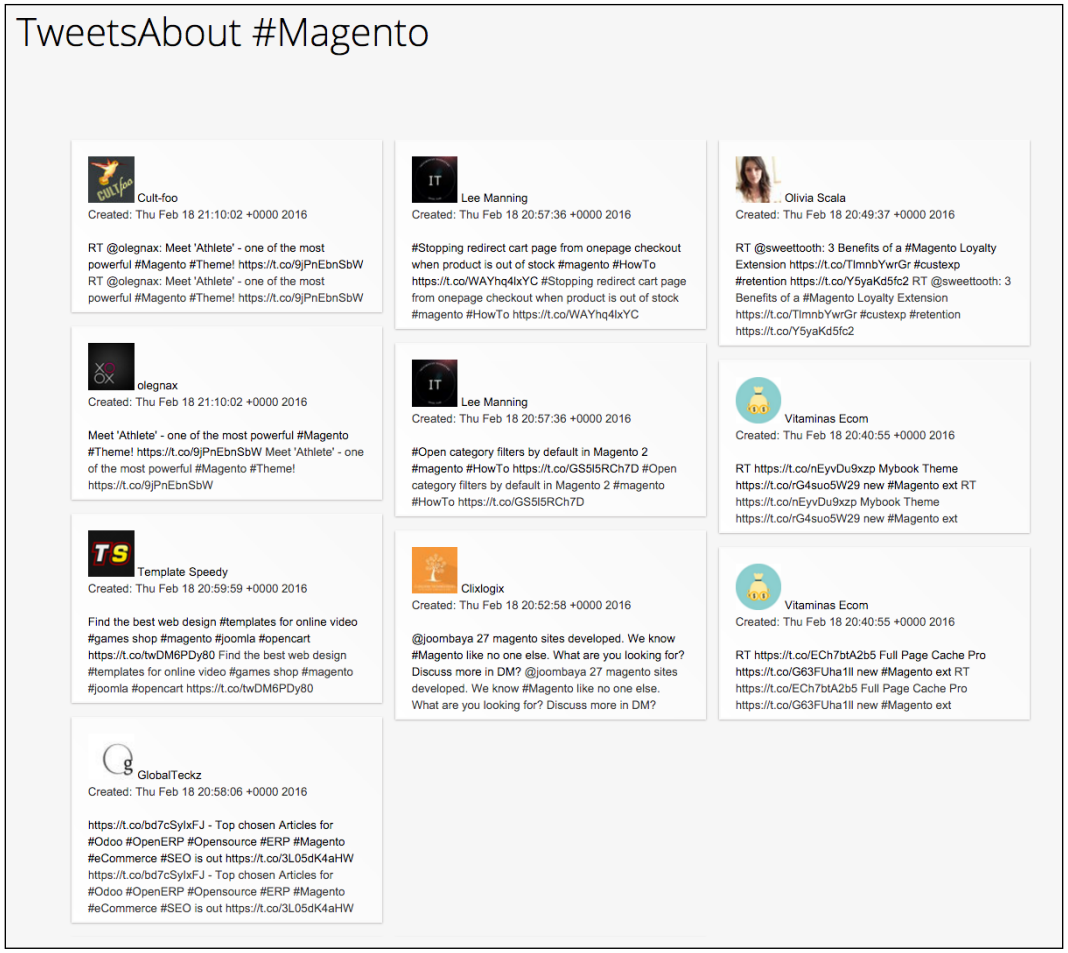
```
<?php
  $tweets = $block->searchTweets();
?>

<div id="wrapper">
  <div id="columns">
    <?php foreach ($tweets as $tweet){ ?>
      <div class="tweet">
        <p>
          <a href="https://twitter.com/intent/user?user_id=<?php echo
$tweet->user->id; ?>" target="_blank">
            <img src="<?php echo $tweets->user->profile_image_url; ?>"
alt="profile">
            <?php echo $tweet->user->name; ?>
          </a>
          <br />
          Created: <?php echo $tweets->created_at; ?>
          <br /><br />
          <a href="<?php echo isset($tweet->entities->urls[0]->url) ?
$tweet->entities->urls[0]->url : "#"; ?>" target="_blank"><?php echo
$tweet->text;?></a>
            <?php echo $tweets->text;?>
          </a>
        </p>
      </div>
    <?php } ?>
  </div>
</div>
```

To deploy the module update, follow this recipe:

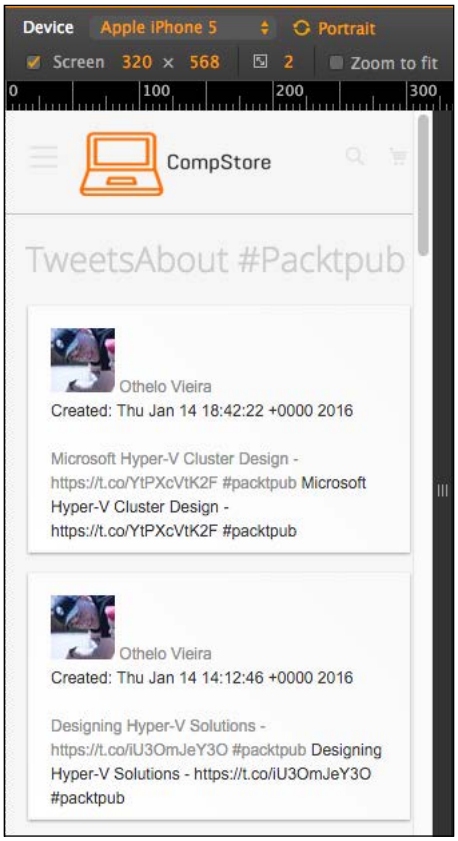
1. Open the terminal or command prompt.
2. Access the `packt/bin` directory.

3. Then, run the `php magento module:enable --clear-static-content Packt_TweetsAbout` command.
4. Run the `php magento setup:upgrade` command.
5. Next, run the `php magento setup:static-content:deploy` command.
6. In some cases, it is necessary to give `write` permissions again to the directories (`var` and `pub`).

Now, test the tweets about extension by accessing `http://localhost/packt/tweetsabout` to see the new responsive look, as shown in the following screenshot:



If you activate DevTools and choose an iPhone 5 device, you will see a result similar to the following screenshot:



Summary

In this chapter, you learned about tools that provide you with a great environment to develop Magento frontend themes.

You also increased the power of CompStore CSS to handle access from specific mobile devices. Of course, you can modify the code constantly to have a better experience by fine-tuning in your code. However, this is only the beginning.

In the next chapter, we will start configuring our Magento software, on which we have been working until now, to improve its speed. We will installing solutions and configure the already native Magento options.

8
Speeding up Your Magento 2.0

Despite the existence of a great solution such as Zend Framework for its system, Magento 2.0 needs some fine tuning to get the best performance in order to provide the users with a better shopping experience. As you noted in the previous chapters, it is very important to focus on every aspect for successful e-commerce.

The following topics will be covered in this chapter:

- Magento Entity-Attribute-Value
- Indexing and re-indexing data
- Caching
- Selecting the right Magento hosting service
- Apache web server deflation
- Enabling the `expires` header
- PHP memory configuration
- Optimizing the MySQL server
- Cleaning the database log
- Minifying scripts
- CDN for Magento

Magento Entity-Attribute-Value

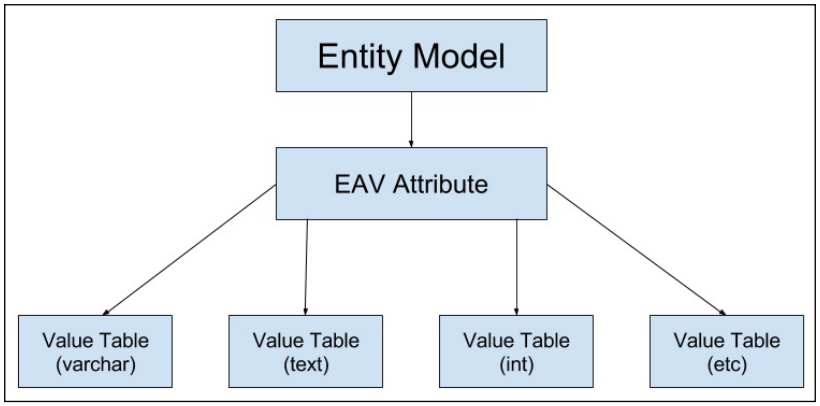
With a complex system architecture, Magento developers realized that a traditional development approach could be counterproductive for a scalable idea to implement an e-commerce solution.

Developers, therefore, decided to adopt the **Entity-Attribute-Value** (**EAV**) architecture approach.

This database structure embraces the Magento 2.0 complexity processes and variables and allows an unlimited numbers of attributes to any item, such as categories, products, costumers, addresses, and more.

The three main points of EAV can be described as follows:

- **Entity**: Data items are represented as entities. In the database, each entity has a record.
- **Attribute**: Many attributes could belong to a specific entity; for example, the customer entity has name, birth date, phone, and so on. In Magento, all the attributes are listed in a single table.
- **Value**: This is the value of each attribute. For example, customer is an entity that has an attribute called name with the value Fernando Miguel.



This book is a hands–on guide to Magento, but I strongly suggest you to read more about EAV in the Magento official documentation at `http://devdocs.magento.com/guides/v2.0/extension-dev-guide/attributes.html`.

Indexing and caching Magento

With the increase in content, images, and script demands for a better experience in e-commerce, we have to handle network consumption in order to provide fast access to our system. Search engines measure some technical points with their algorithms, and fast access is, of course, one of the requisites validated.

Magento has a complex architecture and works with MySQL database constant queries to show specific products information, render pages, and process checkouts. This high process volume demand can slow the download speed when your Magento 2.0 solution is in a production environment.

To improve the Magento 2.0 performance, we can use two important tools: **indexing** and **caching**.

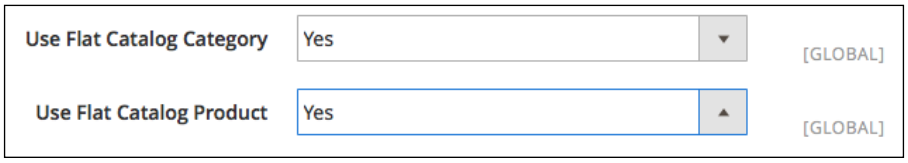
Indexing and re-indexing data

In the Magento 2.0 life cycle, at a determined point, we will have considerable megabytes of data on the MySQL database, including information regarding products, orders, customers, and payments. To improve its performance, Magento uses indexed tables to provide faster lookups.

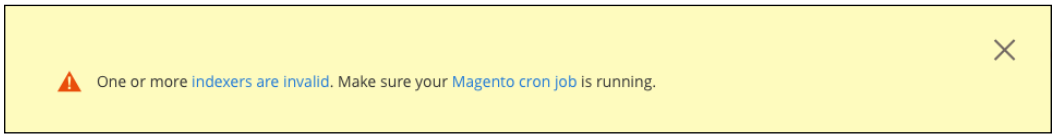
However, as your Magento 2.0 e-commerce grows, the indexation feature starts to lose performance too.

In order to correct this issue, you can precompile database relationships using the **flat table** option in Magento. This technique combines EAV relationships for categories and products in one table to increase the speed of queries. To enable this feature, you can follow these instructions:

1. Log in to your Magento backend (`http://localhost/packt/admin_packt`).
2. Go to **Stores** | **Configuration** | **Catalog**.
3. Expand the **Storefront** option and select **Yes** for both **Use Flat Category** and **Use Flat Catalog Product**.
4. Next, click on **Save Config**.



5. After the activation of the flat resource, you will probably get this Magento message:



If you make changes to your catalog, product, or some page that has a relationship with **indexers**, the Magento system needs to re-index the information to keep the flat table schema working. You can manage the indexers with the Magento command-line tool, as follows:

1. Open the terminal or command prompt.
2. Access the `packt/bin` directory. Then, run the `php magento indexer:reindex` command.
3. In some cases, it is necessary to give write permissions again to the directories.

```
Customer Grid index has been rebuilt successfully in 00:00:05
Product Flat Data index has been rebuilt successfully in 00:00:07
Category Flat Data index has been rebuilt successfully in 00:00:02
Category Products index has been rebuilt successfully in 00:00:00
Product Categories index has been rebuilt successfully in 00:00:00
Product Price index has been rebuilt successfully in 00:00:08
Product EAV index has been rebuilt successfully in 00:00:02
Stock index has been rebuilt successfully in 00:00:00
Catalog Search index has been rebuilt successfully in 00:00:04
Catalog Rule Product index has been rebuilt successfully in 00:00:03
Catalog Product Rule index has been rebuilt successfully in 00:00:02
```

The `reindex` command rebuilds all the product, catalog, customer, and stock information. The index feature enables a fast return of data once the system has no need to process any basic data, such as product price, every single time that the user accesses the store.

Did you notice in the preceding system message one issue about **Magento cron job**? Cron job allows you to automate this task and others to improve your efficiency. Let's take a look at how cron job works.



For further information about Magento indexing, take a look at the official Magento documentation at `http://devdocs.magento.com/guides/v2.0/extension-dev-guide/indexing.html`.

The Magento cron job

Magento has important system processes that are very important to maintain the system's working at its full potential. These processes need automated executions to handle the updates made by the user and administrator. That is the why this feature is critical to Magento.

Cron job works with UNIX systems and can schedule specific tasks to be executed in a predetermined time on the server. The following activities can be scheduled to execute on the Magento 2.0 system:

- The updating of currency rates
- Customer notifications
- The generation of Google sitemap
- Price rules
- Sending e-mails
- Re-indexing

To configure the cron job, follow this recipe.

Find the `php.ini` file path.

If you use XAMPP, as was suggested for a web server solution at the beginning of the book, you simply can use the `XAMPP/xamppfiles/etc/php.ini` path. If you use a Unix-based terminal, you can use the command to find the PHP configuration file. Perform the following steps:

1. Open the terminal.
2. Run the `sudo crontab -u magento_user –e` command; here, `magento_user` refers to your system's owner.
3. Enter with the following instructions in the text editor that will show up:

```
*/1 * * * * php -c <php-ini-file-path> <your Magento install dir>/
bin/magento cron:run
*/1 * * * * php -c <php-ini-file-path> <your Magento install dir>/
update/cron.php
*/1 * * * * php -c <php-file-path> <your Magento install dir>/bin/
magento setup:cron:run
```

   Here's an example:

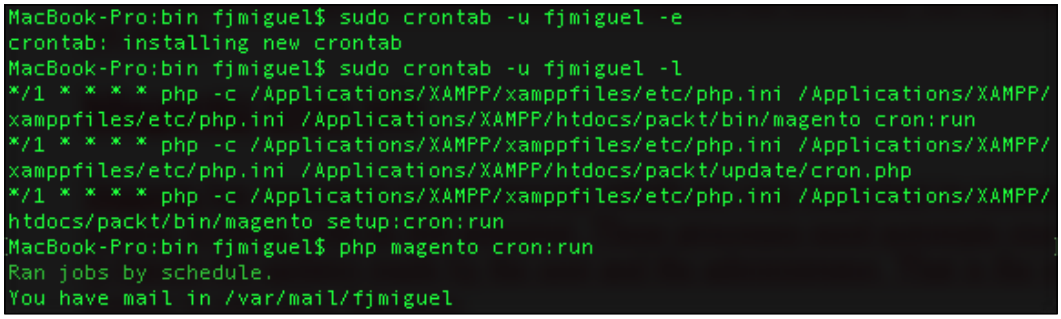
```
*/1 * * * * php -c /Applications/XAMPP/xamppfiles/etc/php.ini /
Applications/XAMPP/xamppfiles/etc/php.ini /Applications/XAMPP/
htdocs/packt/bin/magento cron:run
```

```
*/1 * * * * php -c /Applications/XAMPP/xamppfiles/etc/php.ini /
Applications/XAMPP/xamppfiles/etc/php.ini /Applications/XAMPP/
htdocs/packt/update/cron.php
*/1 * * * * php -c /Applications/XAMPP/xamppfiles/etc/php.ini /
Applications/XAMPP/htdocs/packt/bin/magento setup:cron:run
```

4. Run the `sudo crontab -u fjmiguel -l` command to take a look at your new cron job configuration.
5. Save the changes and exit the text editor.

In some cases, it is necessary to give write permissions again to the directories.

The `*/1 * * * *` configuration specifies that the cron job will be executed every minute. The cron job will now run in the background every minute. To manually execute the cron job, you can run the `php magento cron:run` command on the Magento command-line tool, as shown in the following figure:



For further information about the cron job, follow the link at `https://help.ubuntu.com/community/CronHowto`.

For Magento cron, take a look at the official Magento documentation `http://devdocs.magento.com/guides/v2.0/config-guide/cli/config-cli-subcommands-cron.html`.

Caching

While the indexing technique works on database layer, the caching feature does the same for the HTML page components to increase fast access to the frontend. Caching stores this kind of data in order to provide the visitors with access to faster download.

To enable caching, you need to perform the following steps:

1. Open the terminal or command prompt.
2. Access the `packt/bin` directory.
3. Run the `php magento cache:enable` command.

```
[MacBook-Pro:bin fjmiguel$ php magento cache:status
Current status:
                        config: 0
                        layout: 0
                    block_html: 0
                   collections: 0
                    reflection: 0
                        db_ddl: 0
                           eav: 0
               config_integration: 0
           config_integration_api: 0
                     full_page: 0
                     translate: 0
                config_webservice: 0
[MacBook-Pro:bin fjmiguel$ php magento cache:enable
Changed cache status:
                        config: 0 -> 1
                        layout: 0 -> 1
                    block_html: 0 -> 1
                   collections: 0 -> 1
                    reflection: 0 -> 1
                        db_ddl: 0 -> 1
                           eav: 0 -> 1
               config_integration: 0 -> 1
           config_integration_api: 0 -> 1
                     full_page: 0 -> 1
                     translate: 0 -> 1
                config_webservice: 0 -> 1
Cleaned cache types:
config
layout
block_html
collections
reflection
db_ddl
eav
config_integration
config_integration_api
full_page
translate
config_webservice
```

For further information about cache configuration, follow the link at `http://devdocs.magento.com/guides/v2.0/config-guide/cli/config-cli-subcommands-cache.html`.

You can work with third-party cache solutions to provide a better performance. Some of this solution has support and works very well with the Magento 2.0 solution. This book doesn't cover server configurations, but I strongly suggest you to take a look at the following:

- **Redis** can be found at `http://devdocs.magento.com/guides/v2.0/config-guide/redis/config-redis.html`
- **Memcached** session storage can be found at `http://devdocs.magento.com/guides/v2.0/config-guide/memcache/memcache.html`
- **Varnish** cache can be found at `http://devdocs.magento.com/guides/v2.0/config-guide/varnish/config-varnish.html`

Fine-tuning the Magento hosting server

Magento 2.0 has a complex structure, but it follows the good practices of software development, which gives the administrators and the developers of this fantastic e-commerce solution the real possibility to implement a scalable system to conquer a great site traffic and constantly increase the sales.

Despite this advantage, all the scalable systems need a great server infrastructure to provide fast content access through the Internet.

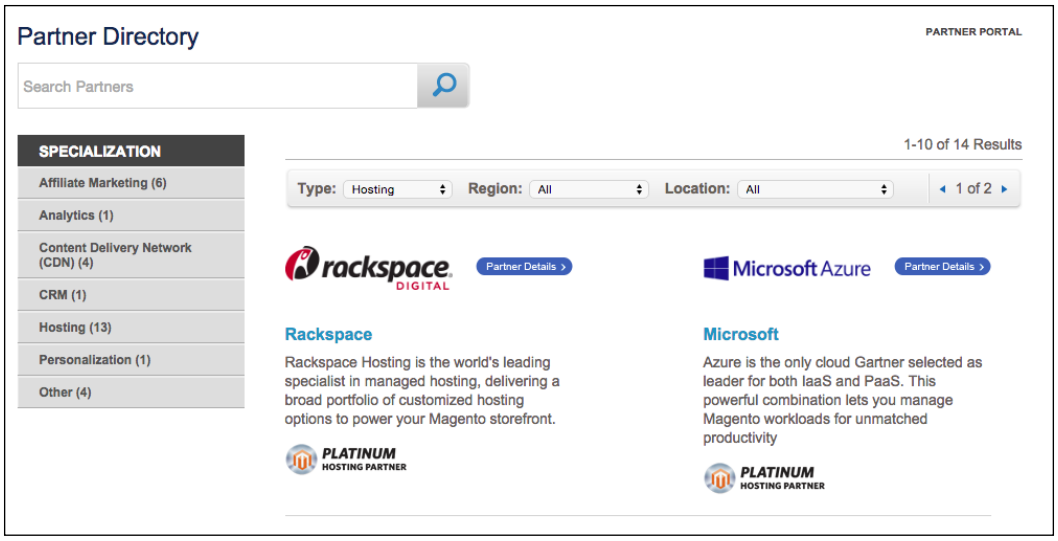
As a developer, you need to always think about all the stages that a successful software needs to go through in an order to aggregate the real value to its administrator and to its users. Try to always see the big picture of your project.

Let's take a look at some techniques and tips to increase your Magento server's capability.

Selecting the right Magento hosting service

First of all, we need to conduct a deep research on the existent solutions. We will try to gather information about clients of these solutions and test Magento's performance by accessing the Magento website as a visitor.

The Magento official project website provides you with an online tool to search for Magento. You can use this tool by accessing the URL at `http://partners.magento.com/partner_locator/search.aspx`.



Apache web server deflation

Magento hosting services generally use Apache as a web server solution. Magento is written in PHP, and Apache has a mature environment to handle PHP processes.

In order to give fast response to visitors' requests, we will use Apache's `mod_deflate` to speed up server response.

According to Apache's official documentation (`http://httpd.apache.org/docs/2.2/mod/mod_deflate.html`), this module provides the `deflate` output filter that allows output from your server to be compressed before being sent to the client over the network.

To enable this feature on your server, you need to create the `.htaccess` file and enter the following code:

```
<IfModule mod_deflate.c>

##############################################
## enable apache served files compression
## http://developer.yahoo.com/performance/rules.html#gzip

    # Insert filter on all content
    SetOutputFilter DEFLATE
    # Insert filter on selected content types only
```

```
    AddOutputFilterByType DEFLATE text/html text/plain text/xml text/
css text/javascript

    # Netscape 4.x has some problems...
    BrowserMatch ^Mozilla/4 gzip-only-text/html

    # Netscape 4.06-4.08 have some more problems
    BrowserMatch ^Mozilla/4\.0[678] no-gzip

    # MSIE masquerades as Netscape, but it is fine
    BrowserMatch \bMSIE !no-gzip !gzip-only-text/html

    # Don't compress images
    SetEnvIfNoCase Request_URI \.(?:gif|jpe?g|png)$ no-gzip dont-vary

    # Make sure proxies don't deliver the wrong content
    Header append Vary User-Agent env=!dont-vary

</IfModule>
```

This adjustment reduces about 70% of the amount of data delivered.

For further information about the `.htaccess` and `mod_deflate` configurations, take a look at the links at `http://httpd.apache.org/docs/current/howto/htaccess.html` and `http://httpd.apache.org/docs/2.2/mod/mod_deflate.html`.

Enabling the expires header

Continuing to take advantage of the Apache web server, we will activate the `mod_expires` module. This module sends a message to the client machine about the document's validity, and the client can store a cache of the site until the client receives a new message from the server expiration of data. This technique increases the speed of download.

To activate this feature, you can open the `.htaccess` file available in the Magento root directory and enter this block of code:

```
<IfModule mod_expires.c>

##############################################
## Add default Expires header
## http://developer.yahoo.com/performance/rules.html#expires

    ExpiresActive On
```

```
    ExpiresDefault "access plus 1 year"

</IfModule>
```

For further information about the `.htaccess` configuration, follow the link at `http://httpd.apache.org/docs/2.2/mod/mod_expires.html`.

PHP memory configuration

Increasing PHP memory by host configuration has a direct relationship with your contracted hosting service. Some shared hosting services do not give this option to the developers. This is one of the main reasons to choose a specialized Magento hosting service.

Generally, this configuration can be done by adding the following code to the `.htaccess` file available in the Magento root directory:

```
<IfModule mod_php5.c>

##########################################
## adjust memory limit

php_value memory_limit 256M
php_value max_execution_time 18000

</IfModule>
```

Optimizing the MySQL server

MySQL has the **query cache** feature to provide fast queries on a database. Once again, you need to conduct deep research on your possible hosting services before contracting any to make sure you have all the services you need for a great production environment.

Before starting the optimization, refer to the PHP and MySQL documentations of your hosting service to check the availability of these changes.

Open the `php.ini` hosting service file and place these configurations:

```
;;;;;;;;;;;;;;;;;;
; Resource Limits ;
;;;;;;;;;;;;;;;;;;

max_execution_time = 30     ; Maximum execution time of each script,
in seconds
```

```
max_input_time = 60     ; Maximum amount of time each script may spend
parsing request data
memory_limit = 512M      ; Maximum amount of memory a script may
consume (8MB)
query_cache_size = 64M

[MySQLi]
; Please refer to http://php.net/manual/en/mysqli.configuration.php
for further information

; Maximum number of persistent links.  -1 means no limit.
mysqli.max_persistent = -1

; Allow accessing, from PHP's perspective, local files with LOAD DATA
statements
;mysqli.allow_local_infile = On

; Allow or prevent persistent links.
mysqli.allow_persistent = On

; Maximum number of links.  -1 means no limit.
mysqli.max_links = -1

; If mysqlnd is used: Number of cache slots for the internal result
set cache
mysqli.cache_size = 2000

; Default port number for mysqli_connect().  If unset, mysqli_
connect() will use
; the $MYSQL_TCP_PORT or the mysql-tcp entry in /etc/services or the
; compile-time value defined MYSQL_PORT (in that order).  Win32 will
only look
; at MYSQL_PORT.
mysqli.default_port = 3306

; Default socket name for local MySQL connects.  If empty, uses the
built-in
; MySQL defaults.
mysqli.default_socket =

; Default host for mysql_connect() (doesn't apply in safe mode).
mysqli.default_host =

; Default user for mysql_connect() (doesn't apply in safe mode).
mysqli.default_user =

; Default password for mysqli_connect() (doesn't apply in safe mode).
; Note that this is generally a *bad* idea to store passwords in this
file.
```

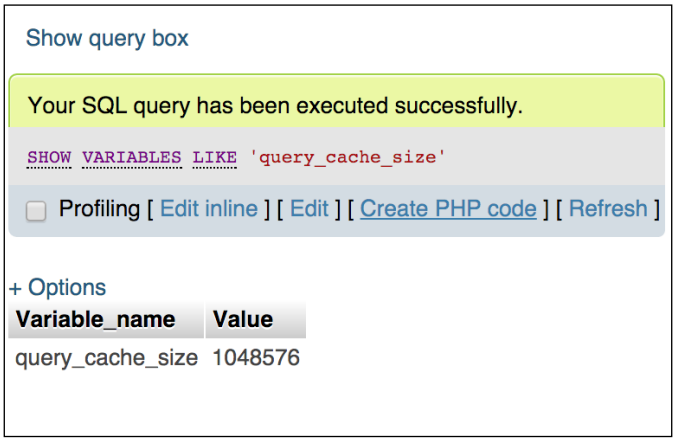
```
; *Any* user with PHP access can run 'echo get_cfg_var("mysqli.
default_pw")
; and reveal this password!  And of course, any users with read access
to this
; file will be able to reveal the password as well.
mysqli.default_pw =

; Allow or prevent reconnect
mysqli.reconnect = Off
```

Now, let's configure the `query_cache_size` variable directly on the MySQL database.

Open the phpMyAdmin web SQL console, and execute the `SHOW VARIABLES LIKE 'query_cache_size';` query without selecting a database. The query will probably return the `0` value for the `query_cache_size` variable.

Execute the `SET GLOBAL query_cache_size = 1048576;` query and execute `SHOW VARIABLES LIKE 'query_cache_size';` again.

The query will probably return the following information:



The `query_cache_size` variable was activated with success!

For further information about the MySQL cache size configuration, follow the link at `https://dev.mysql.com/doc/refman/5.0/en/query-cache-configuration.html`.

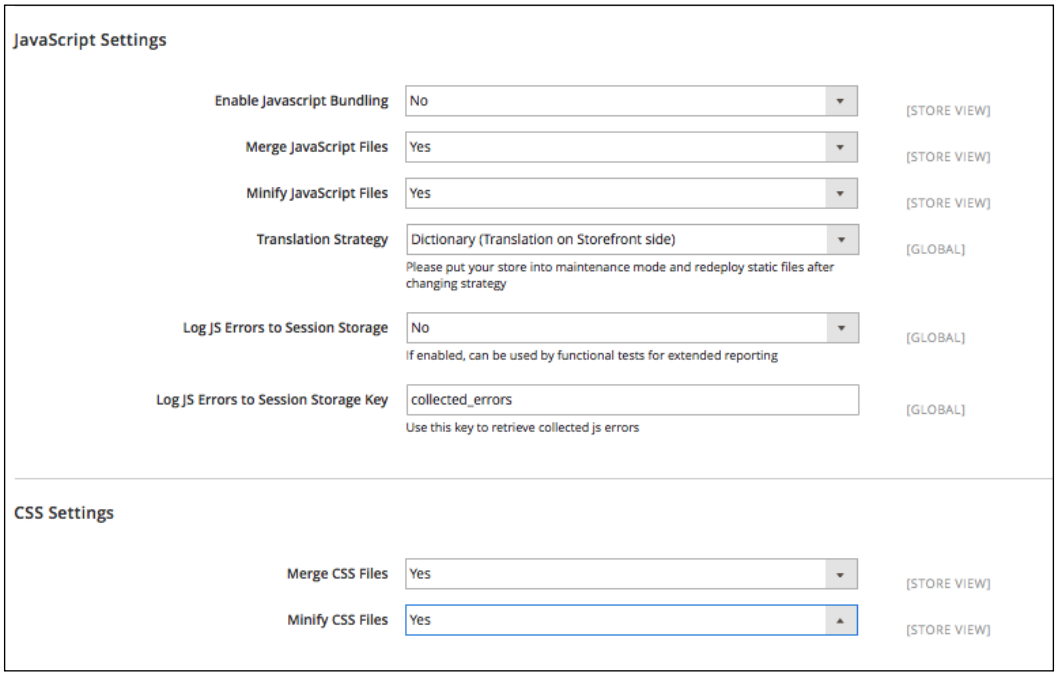
Even by testing these configurations in your localhost environment, you can feel the huge positive difference between the first access in your Magento installation and the last access after the configuration. This is really awesome!

Minifying scripts

Code minification is a technique to remove unnecessary characters from the source code. Minify your JavaScript (`.js`) and stylesheets (`.css`) files and improve the load time of your site by compressing the files.

In order to activate this process in Magento, navigate to the admin area (`http://localhost/packt/admin_packt`) and follow these instructions:

1. First, navigate to **Stores** | **Configuration** | **Advanced** | **Developer**.
2. Expand the **JavaScript Settings** options and select the **Yes** option for **Merge JavaScript Files** and **Minify JavaScript Files**.
3. Expand the **CSS Settings** options and select the **Yes** option for **Merge CSS Files** and **Minify CSS Files**.
4. Finally, click on the **Save Config** button.



CDN for Magento

Content Delivery Networks, also known as **CDN**, are servers of fast access for your static or non-dynamic content. JavaScript files and images are examples of files hosted on CDN servers.

The main idea behind the use of CDN is saving the process time of your Magento server using a CDN solution.

I suggest you to conduct research on hosting services that provide this integration. For example, **Nexcess** as a Magento partner company provides specific documentation about CDN integration on the URL `https://docs.nexcess.net/article/how-to-configure-cdn-access-for-magento.html`.

For JavaScript CDN, we have a free-of-charge service available on the Internet! This is thanks to Google for providing us with this amazing feature at `https://developers.google.com/speed/libraries/`.

Summary

In this chapter, you learned important lessons about how to improve Magento performance and pay attention to all the aspects that can make a positive difference in Magento development, including how to create a full-speed environment for Magento System.

I invite you to think in this very for now. We are progressing and walking through all the aspects of Magento: design, development, marketing, and performance. I feel comfortable to say to you, dear reader, that you have the tools to elevate your Magento professional career. Just keep continuing to study hard.

In this chapter, you learned how to:

- Increase Magento performance in different aspects and technologies
- Use the power of indexation and caching
- Develop solutions to create a better Magento user experience through fast download techniques

In the final chapter, we will explore some tools and ways to improve your Magento skills. See you!

9
Improving Your Magento Skills

We are at the end of the book, but this only the beginning of your walk through the Magento training. It's important to know some Magento extension options, but it is more important to build your own path in the Magento world by studying for a certification and achieving a new professional level.

The following topics will be covered in this chapter:

- Magento Connect extensions
- Installing a Magento extension
- Debugging Grunt.js styles
- Magento knowledge center
- Improving your Magento skills

Magento Connect extensions

The Magento 2.0 architecture allows a natural improvement of native resources and the addition of new ones. Magento 2.0 is built based on the best software development practices. Its architecture is modular, which allows the development of extensions, as we discussed in an earlier chapter.

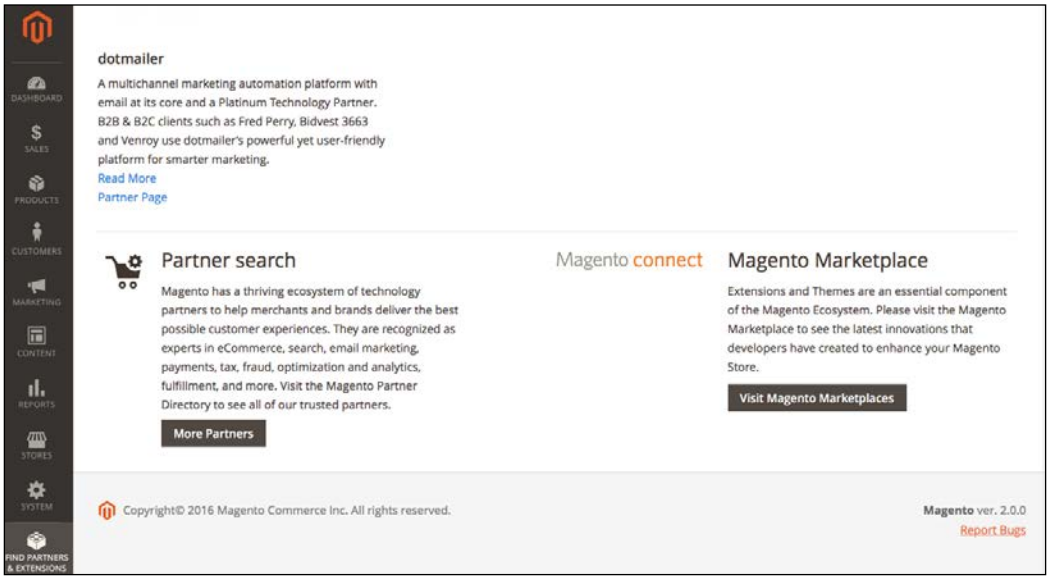
Magento Commerce maintains a marketplace to provide Magento extensions known as **Magento Connect** (`https://www.magentocommerce.com/magento-connect`). Magento Connect includes extensions that provide new functionalities, such as modules, add-ons, language packs, design interfaces, and themes to extend the power of your store.

I strongly suggest that you visit Magento Connect to get some ideas for personal projects and follow the extension development tendency in the marketplace.

Installing a Magento extension

Besides the Magento Connect marketplace, to search for Magento extension solutions, you can access the extension options through your admin area. To access Magento extension options in your admin area, perform the following steps:

1. Access your admin area at `http://localhost/admin_packt`.
2. Navigate to **Find Partners and Extensions** | **Visit Magento Marketplaces**.



3. Once you choose the extension to install, Magento 2.0 offers two options for extension installation:
    - Installation via Composer
    - Manual installation

To install the extensions via Composer, you need to configure `composer.json` to work with the **Magento 2 Composer** repository (`http://packages.magento.com/`) as a repository solution for **Magento Core** extensions. The composer already has the **Packagist** (`https://packagist.org/`) configuration. To proceed with this configuration, perform the following:

1. Open the terminal or command prompt.
2. Go to the root directory of your Magento installation.
3. Run the `composer config repositories.magento composer http://packages.magento.com` command.

To install a Magento extension via `composer`, do the following:

1. Open the terminal or command prompt.
2. Go to the root directory of your Magento installation.
3. Run the `composer require <vendor>/<module>` command.
4. An example of this is `composer require Packt/TweetsAbout`.
5. Run the `composer update` command.
6. Then, run the `php bin/magento setup:upgrade` command.
7. In some cases, it is necessary to give write permissions again to the directories.

To install a Magento extension manually, perform the following steps:

1. Download the `.zip` file of the module.
2. Extract it and move it under the `<magento_root_directory>/app/code` directory.
3. Run the `php bin/magento setup:upgrade` command.
4. In some cases, it is necessary to give write permissions again to the directories (for example, the `var` directory)

Debugging styles with the Grunt task runner

As you noted in the previous chapters, for every change that you apply in a Magento extension or theme styles, you need to clean the static files directory and deploy it to see the effect. This process takes time and unnecessary effort. So, what if you have a tool to automate this process?

Grunt.js (`http://gruntjs.com/`) is a task runner to automate tasks; for example, it provides productivity in Magento development by automating CSS changes. To install Grunt, follow these steps:

1. Install **Node.js** (`https://nodejs.org`) in your machine.
2. Open the terminal or command prompt.
3. Run the `npm install -g grunt-cli` command to install the Grunt command-line interface.
4. Go to the `packt/` Magento root directory and run the `npm install grunt --save-dev` command.
5. Still under the `packt` directory, run the `npm install` command.
6. Then, run the `npm update` command.
7. In your favorite code editor open, the `packt/dev/tools/grunt/configs/theme.js` file, add the following code, and save it:

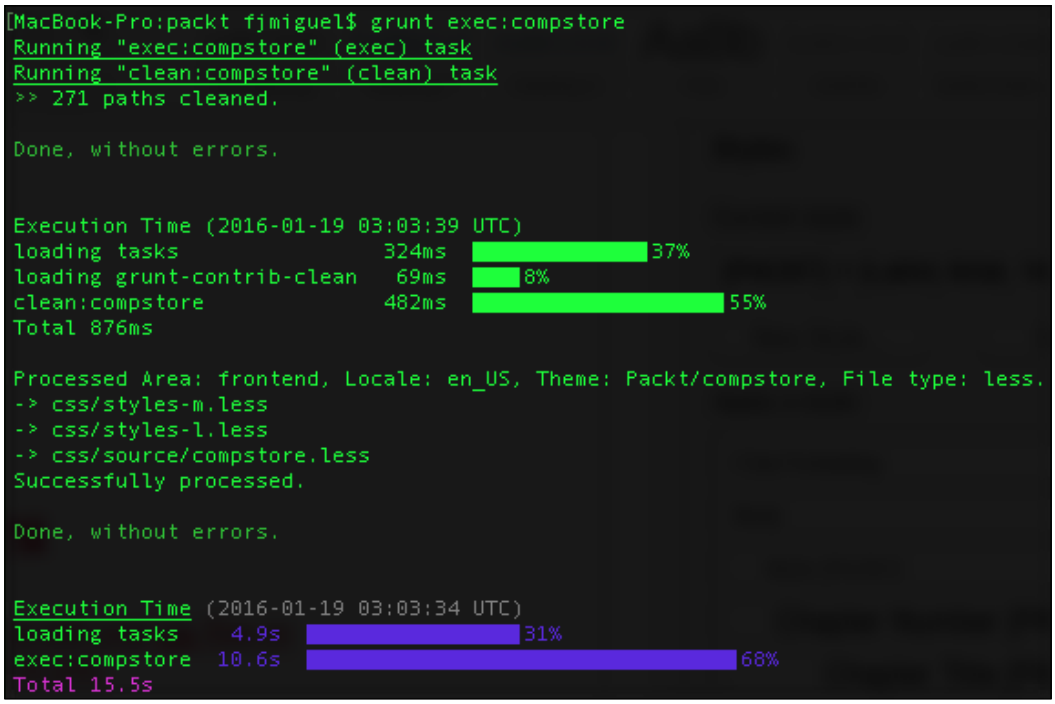
```
'use strict';

module.exports = {
    blank: {
        area: 'frontend',
        name: 'Magento/blank',
        locale: 'en_US',
        files: [
            'css/styles-m',
            'css/styles-l',
            'css/email',
            'css/email-inline'
        ],
        dsl: 'less'
    },
    luma: {
        area: 'frontend',
        name: 'Magento/luma',
        locale: 'en_US',
        files: [
            'css/styles-m',
            'css/styles-l'
        ],
```

```
            dsl: 'less'
        },
        backend: {
            area: 'adminhtml',
            name: 'Magento/backend',
            locale: 'en_US',
            files: [
                'css/styles-old',
                'css/styles'
            ],
            dsl: 'less'
        },

        compstore: {
            area: 'frontend',
            name: 'Packt/compstore',
            locale: 'en_US',
            files: [
              'css/styles-m',
              'css/styles-l',
              'css/source/compstore'
            ],
            dsl: 'less'
        }
    };
```

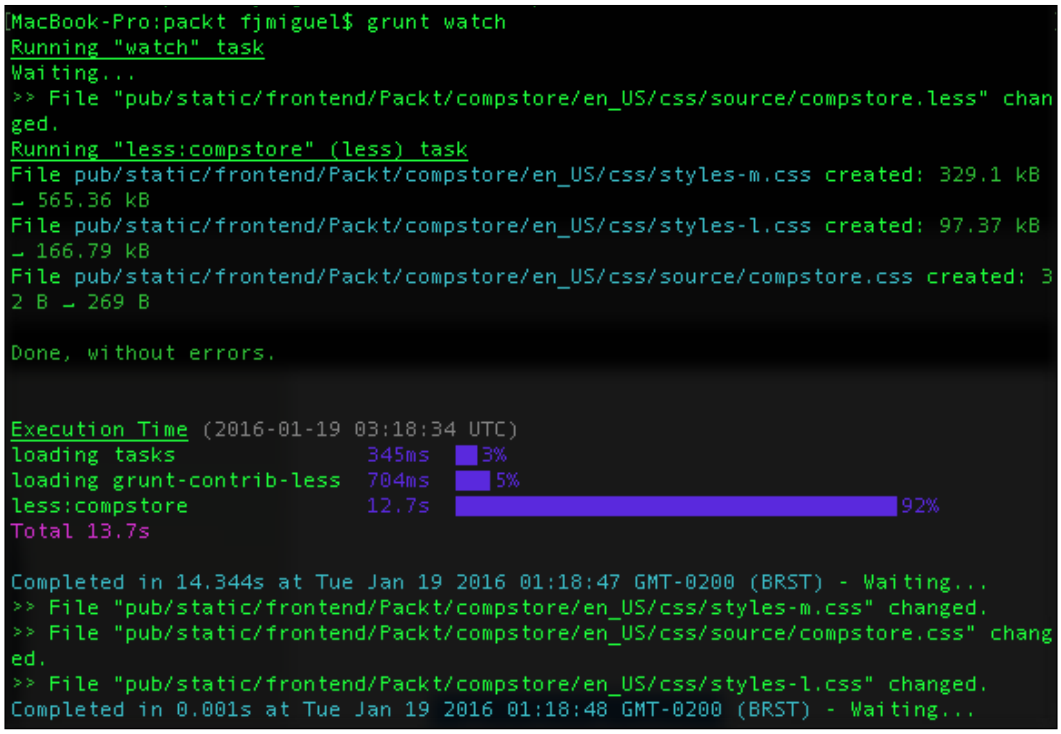
Once the Grunt environment is configured, it's time to test Grunt. Perform the following steps:

1. Open the terminal or command prompt.
2. Run the `grunt exec:compstore` command.
3. Then, run the `grunt less:compstore` command.

4. Run the `grunt watch` command.



These commands will create a direct channel with the possibility to edit your `.CSS` files on the fly. The `grunt watch` command shows you the update in real time. With "grunt watch" still active in your terminal/prompt window, try to edit and save the body's background color in the `app/design/frontend/Packt/compstore/web/css/source/compstore.less` file to see the result in the browser by accessing your base URL:

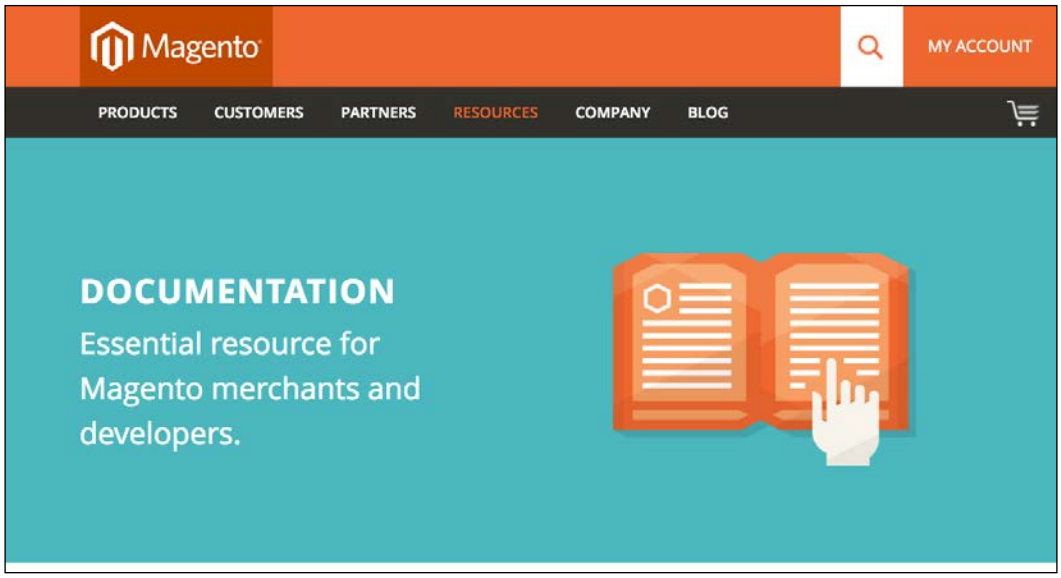


Magento knowledge center

The Magento team provides great resources of documentation in order to increase the Magento developer's knowledge.

In the Magento documentation (`http://magento.com/help/documentation`), the user can access the **USER GUIDES** section for **ENTERPRISE EDITION**, **COMMUNITY EDITION**, **DESIGNER'S GUIDE**, and **DEVELOPER DOCUMENTATION**.

I strongly suggest that you, dear reader, study Magento's **COMMUNITY EDITION**, **DESIGNER'S GUIDE**, and **DEVELOPER DOCUMENTATION** in the first instance. These three documentations have solid concepts, and you can certainly take advantage by building your Magento concepts.



Improving your Magento skills

Welcome to the world of information technology! The professionals of this area need to study harder every single day. It's totally crazy how technology is always in mutation. New technologies and solutions come in a short period of time, and professionals must be prepared all the time to keep an open mind, absorbing this situation assertively.

Magento provides an official training program available at `http://magento.com/training/overview`. You can access information about courses, and I strongly suggest that you think about **Magento certification**. Certifications can boost your career.

To learn more about Magento certification, refer to `http://magento.com/training/catalog/certification`. You can download a free Magento study guide by visiting `http://magento.com/training/free-study-guide`.

You have a lot of options, such as books, articles, and blogs, to train and improve your Magento skills. Be persistent on your objectives!

Summary

Congratulations! You won one more challenge; first, you acquired this great book, and then you completed the reading with merits. It was not easy, but I'm certain it was worth it.

In this chapter, you learned how to:

- Manage Magento extensions
- Test some Magento extension options
- Build your own path to become a Magento success professional

Thank you so much. I know you can climb the highest mountains; never lose faith in yourself. Good luck!

Module 2

Magento 2 Cookbook

Over 50 practical recipes that will help you realize the full potential of Magento in order to build a professional online store

1
Magento 2 System Tools

In this chapter, we will cover the basic tasks related to managing the system tools of Magento 2. You will learn the following recipes:

- Installing Magento 2 sample data via GUI
- Installing Magento 2 sample data via the command line
- Managing Magento 2 indexes via the command line
- Managing Magento 2 cache via the command line
- Managing Magento 2 backup via the command line
- Managing Magento 2 set mode (MAGE_MODE)
- Transferring your Magento 1 database to Magento 2

Introduction

This chapter explains how to install and manage Magento 2 on a production-like environment. We will be installing a new Magento 2 instance via the shell command with and without sample data. Besides the setup, managing Magento 2 is different from the current Magento version. We will be using a lot of tools from the command line so basic shell knowledge is advised. The command-line tool in the `/bin` directory is similar to the current **Swiss army knife** tool in the current Magento version known as **n98-magerun**.

Using `bin/magento` and **Composer** is one of the new key features in Magento 2 that will rock your world.

The recipes in this chapter will focus primarily on a more advanced setup of how to install Magento 2 and manage it. However, in some situations, we will dive in deeper related to the subject.

Here is an overview of all the command-line tools in Magento 2:

```
root@mage2cookbook:/var/www/html# bin/magento
Magento CLI version 2.0.0

Usage:
 command [options] [arguments]

Options:
 --help (-h)       Display this help message
 --quiet (-q)      Do not output any message
 --verbose (-v|vv|vvv) Increase the verbosity of messages: 1 for normal
output, 2 for more verbose output and 3 for debug
 --version (-V)    Display this application version
 --ansi        Force ANSI output
 --no-ansi       Disable ANSI output
 --no-interaction (-n) Do not ask any interactive question
```

The following commands are available in the command-line tools in Magento 2:

Commands	Description
`help`	This displays help for a command
`list`	This lists the commands
admin	
`admin:user:create`	This creates an administrator
`admin:user:unlock`	This unlocks the administrator account
cache	
`cache:clean`	This cleans the cache type(s)
`cache:disable`	This disables the cache type(s)
`cache:enable`	This enables the cache type(s)
`cache:flush`	This flushes the cache storage used by the cache type(s)
`cache:status`	This checks the cache status
catalog	
`catalog:images:resize`	This creates resized product images

Commands	Description
cron	
`cron:run`	This runs jobs by schedule
customer	
`customer:hash:upgrade`	This upgrades the customer's hash according to the latest algorithm
deploy	
`deploy:mode:set`	This sets the application mode
`deploy:mode:show`	This displays the current application mode
dev	
`dev:source-theme:deploy`	This collects and publishes source files for a theme
`dev:tests:run`	This runs tests
`dev:urn-catalog:generate`	This generates the catalog of URNs to `*.xsd`
`dev:xml:convert`	This converts XML files using XSL style sheets
i18n	
`i18n:collect-phrases`	This discovers phrases in the code base
`i18n:pack`	This saves language packages
`i18n:uninstall`	This uninstalls language packages
indexer	
`indexer:info`	This shows allowed indexers
`indexer:reindex`	This reindexes data
`indexer:set-mode`	This sets the index mode type
`indexer:show-mode`	This shows the index mode
`indexer:status`	This shows the status of an indexer
maintenance	
`maintenance:allow-ips`	This sets the maintenance mode exempt IPs
`maintenance:disable`	This disables the maintenance mode
`maintenance:enable`	This enables the maintenance mode
`maintenance:status`	This displays the maintenance mode status
module	
`module:disable`	This disables specified modules
`module:enable`	This enables specified modules
`module:status`	This displays the status of modules
`module:uninstall`	This uninstalls modules installed by Composer
sampledata	
`sampledata:deploy`	This deploys sample data modules

Commands	Description
`sampledata:remove`	This removes all sample data from `composer.json`
`sampledata:reset`	This resets sample data modules for reinstallation
theme	
`theme:uninstall`	This uninstalls the theme
info	
`info:adminuri`	This displays the Magento Admin URI
`info:backups:list`	This prints a list of available backup files
`info:currency:list`	This displays the list of available currencies
`info:dependencies:show-framework`	This shows the number of dependencies on the Magento framework
`info:dependencies:show-modules`	This shows the number of dependencies between modules
`info:dependencies:show-modules-circular`	This shows the number of circular dependencies between modules
`info:language:list`	This displays a list of available language locales
`info:timezone:list`	This displays a list of available time zones
setup	
`setup:backup`	This takes a backup of the Magento Application code base, media, and database
`setup:config:set`	This creates or modifies the deployment configuration
`setup:cron:run`	This runs a cron job scheduled for the setup application
`setup:db-data:upgrade`	This installs and upgrades data in the DB
`setup:db-schema:upgrade`	This installs and upgrades the DB schema
`setup:db:status`	This checks whether the DB schema or data require an upgrade
`setup:di:compile`	This generates the DI configuration and all non-existing interceptors and factories
`setup:di:compile-multi-tenant`	This generates all non-existing proxies and factories and precompiles class definitions, inheritance information, and plugin definitions
`setup:install`	This installs the Magento application
`setup:performance:generate-fixtures`	This generates fixtures
`setup:rollback`	This rolls back the Magento application code base, media, and database

Commands	Description
`setup:static-content:deploy`	This deploys static view files
`setup:store-config:set`	This installs the store configuration
`setup:uninstall`	This uninstalls the Magento application
`setup:upgrade`	This upgrades the Magento application, DB data, and schema

We will be using an NGINX-based setup. The Apache setup is pretty straightforward; when needed, we will address specified configuration settings when they occur.

Installing Magento 2 sample data via GUI

Installing Magento 2 via the **graphical user interface** (**GUI**) is not new. Now, we will be installing a new clean version including the sample data.

The sample data can be installed during and at the end of the procedure. We will be using a `composer.json` file for our setup prerequisites. First, we will be installing a clean version with sample data, and later, I will show you how to install it at the end in case you already have a preinstalled version.

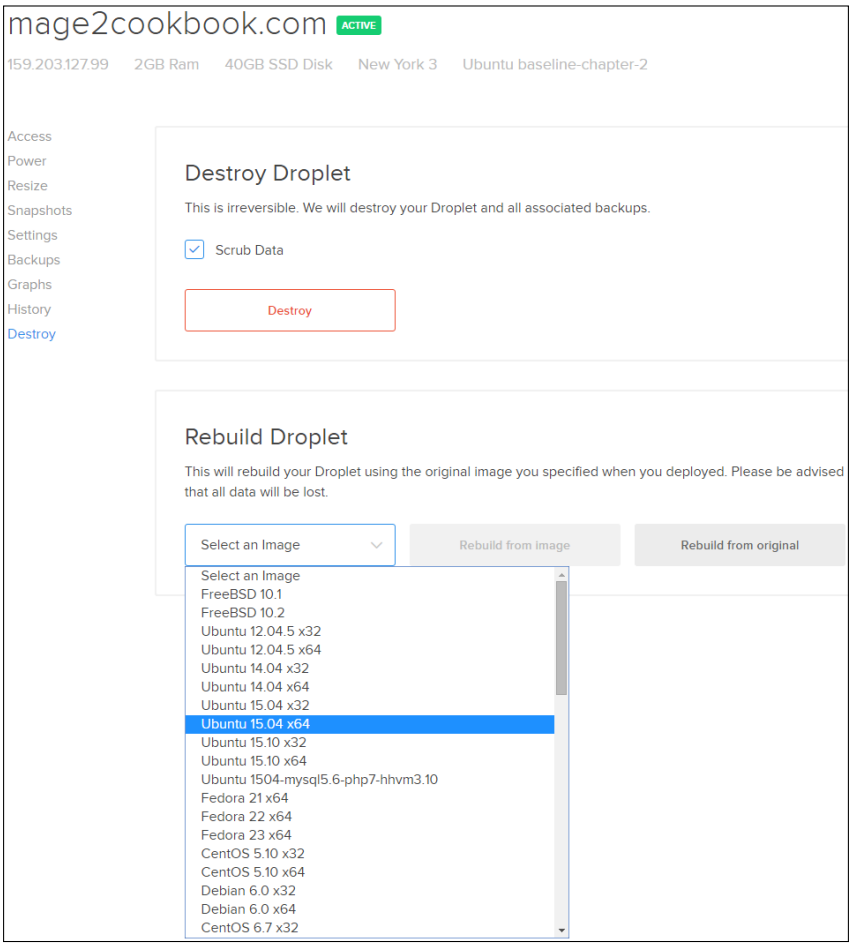
Getting ready

For this recipe, we will use a Droplet *and NGINX*, at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup. No other prerequisites are required.

How to do it...

For the first step, you can either create a new Droplet or rebuild a clean Droplet based on a Ubuntu or RedHat DigitalOcean image.

The option to rebuild is located in the DigitalOcean control panel in the **Destroy** menu and then rebuild Droplet:



The steps to install Magento 2 sample data via GUI are as follows:

1. Preferably, pick the new snapshot or the already created one and press **Rebuild from Image**. The rebuild will take around 60 seconds.
2. Now log in to your new or current Droplet. We will be referring to a new build Droplet throughout this recipe.

3. Now let's download the latest Magento 2 version including sample data. Go to `https://www.magentocommerce.com/download`, pick **Full Release with Sample Data (ZIP with sample data)**, and unpack this in your web directory. We refer to `/var/www/html` in this recipe.

   If you are using a ZIP package, make sure that you install the unzip package first, running the following command on the shell:

   ```
   apt-get install unzip
   ```

4. Now let's set the ownership and permissions:

   ```
   chown -R www-data:www-data /var/www/html


   find . -type d -exec chmod 770 {} \; && find . -type f -exec chmod
   660 {} \; && chmod u+x bin/magento
   ```

5. Now we use Composer to resolve all of our dependencies. Run the following command from the shell:

   ```
   cd /var/www/html/ && composer install
   ```

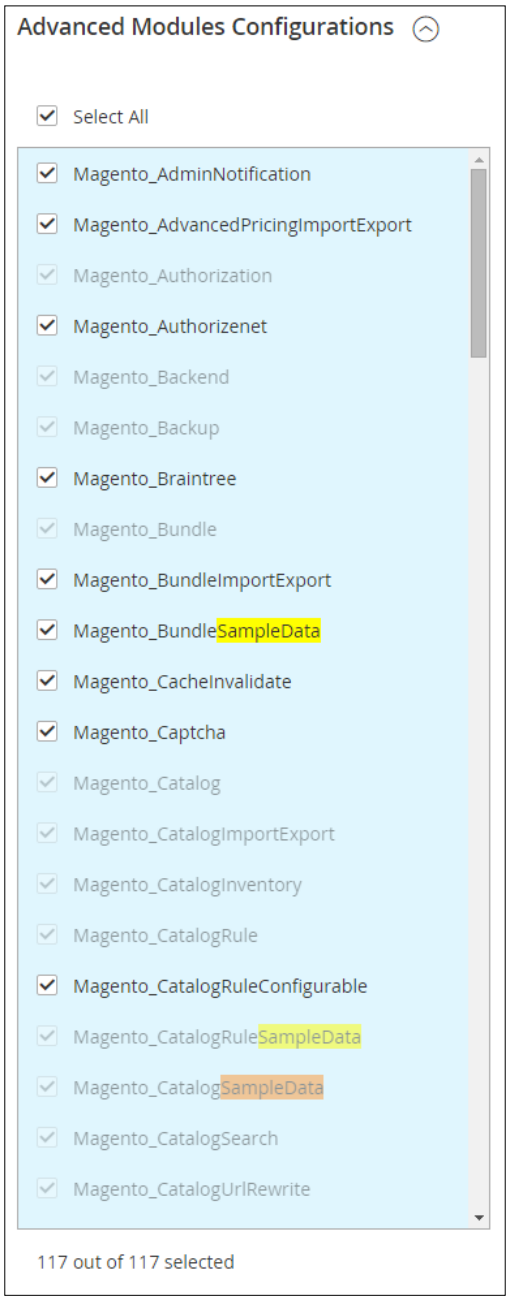
   During the installation process, you will get a notice to create a GitHub OAuth token. The download rate limit is pretty small. Copy the URL from your shell window in your browser, log in at GitHub or create an account, and create the token.

6. Next, we will be using the setup wizard to continue the rest of the installation. In this chapter, we will be using the shell installation method. Go to your favorite browser and enter the following URL:

   `http://yourdomain.com/setup`

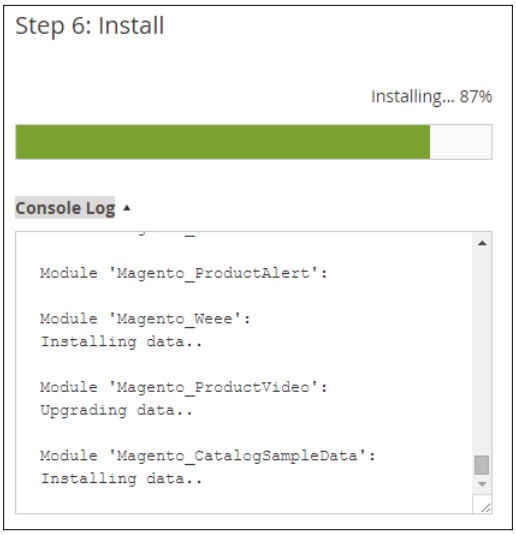
   Continue your flow until **Step 4: Customize Your Store**. As we have chosen a Magento 2 package including sample data, all software modules are preinstalled and listed in the advanced modules configurations list.

Here is an overview of all the modules selected by Magento that can be managed during installation:

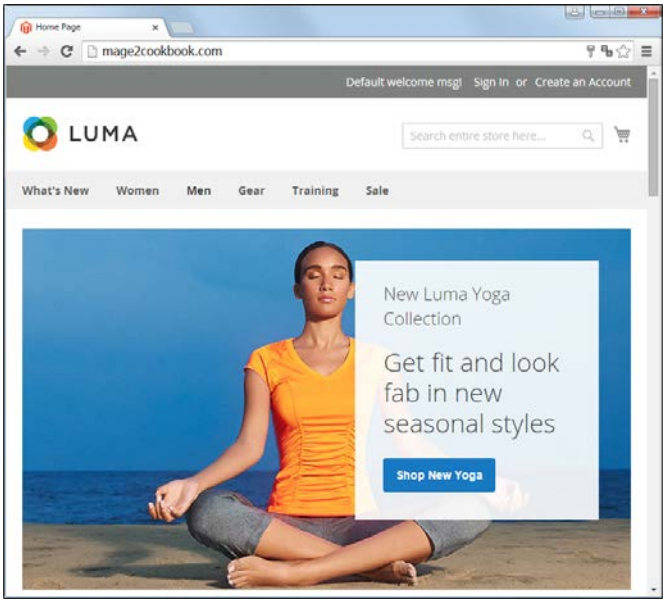


7. Now, continue the rest of the steps and install Magento 2. Installing sample data can take some time, so don't close or refresh your browser.

   The progress bar and console log will share all details regarding the current status:



Congratulations, you just finished the installation of Magento 2 including sample data. Now go to your browser using `yourdomain.com`; you will see the default Magento 2 layout theme called **Luma**, as follows:



How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 6, we created a Magento 2 version including sample data. The most important change is that we downloaded a full version including sample data. In this build, Magento submitted all of the media files and data sample packages that we need to complete the process. During the graphical setup, we were able to choose which sample data packages are needed. This process could take some time to complete.

There's more...

In the `/var` directory, you can find the following hidden file with the current state of the installed sample data:

```
less /var/www/html/var/.sample-data-state.flag
```

Want to start all over again? Magento 2 has a magic uninstall option that cleans everything on the fly, cache, and database. You can use the `php bin/magento setup:uninstall` command on the shell, as shown here:

```
root@mage2cookbook:/var/www/html# php bin/magento setup:uninstall
Are you sure you want to uninstall Magento?[y/N]y
Starting Magento uninstallation:
Cache cleared successfully
Cleaning up database `magento2`
File system cleanup:
/var/www/html/pub/static/_requirejs
/var/www/html/pub/static/adminhtml
/var/www/html/pub/static/frontend
/var/www/html/var/cache
/var/www/html/var/composer_home
/var/www/html/var/di
/var/www/html/var/generation
/var/www/html/var/log
/var/www/html/var/page_cache
/var/www/html/var/tmp
/var/www/html/var/view_preprocessed
/var/www/html/app/etc/config.php
/var/www/html/app/etc/env.php
```

Installing Magento 2 sample data via the command line

Installing Magento 2 via the shell is not new. In the current Magento version, it was already possible using the `install.php` file. The configuration looked like this:

```
/usr/local/bin/php -f install.php -- \
--license_agreement_accepted "yes" \
--locale "en_US" \
--timezone "America/Los_Angeles" \
--default_currency "USD" \
--db_host "mysql.example.com" \
--db_name "your_db_name" \
--db_user "your_db_username" \
--db_pass "your_db_password" \
--db_prefix "" \
--admin_frontname "admin" \
--url "http://www.examplesite.com/store" \
--use_rewrites "yes" \
--use_secure "no" \
--secure_base_url "" \
--use_secure_admin "no" \
--admin_firstname "your_first_name" \
--admin_lastname "your_last_name" \
--admin_email "your_email@example.com" \
--admin_username "your_admin_username" \
--admin_password "your_admin_password"
```

It was very easy to script and use multiple times on any given environment.

In Magento 2, the logic stayed the same but now, it's much easier to use. We will be using a `composer.json` file for our setup prerequisites.

Getting ready

For this recipe, we will use a Droplet at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to create a Magento 2 hosting environment including sample data. The following steps will guide you through this:

1. In this recipe, check your `/root/.composer/auth.json` file if you have a Magento of GitHub repository token, username, and password. If not, create them. Here is an example (the username and password are dummies):

```
{
  "http-basic": {
    "repo.magento.com": {
      "username": "256e8f49b66689ecf18b07bc3cc2ca2d",
      "password": "cb1c7ef2e14b666d8a4e99fe40c8393a"
    }
  },
  "github-oauth": {
    "github.com": "e960f7000803e2832ce5f7a637d58a666"
  }
}
```

   You can create a Magento authentication key in the user section of the Magento connect portal. Go to `http://www.magentocommerce.com/magento-connect/`, navigate to the **Developers** | **Secure Keys** menu item, and create one. **Public Key** is your username and **Private Key** is your password.

   The GitHub token can be created under the tokens section of your GitHub account. Go to `https://github.com/settings/tokens` and press **Generate new token**. Copy the token in your `auth.json` file of your home or root directory.

2. Now, let's create a Composer project using the shell. Go to your web server `/var/www/html` directory and use the following command:

```
composer create-project "magento/project-community-edition" /var/
www/html --prefer-dist --repository-url https://repo.magento.com/
```

3. Now use the following command on the shell. This will add the sample data package to the Magento `composer.json` file.

```
php bin/magento sampledata:deploy
```

   You may get the following error notice; ignore this once you set up the `auth.json` file:

```
[Composer\Downloader\TransportException]

The 'https://repo.magento.com/packages.json' URL required
authentication.

You must be using the interactive console to authenticate
```

4. Run the following command on the shell. This will download all sample data to your Magento 2 environment.

   ```
   composer update
   ```

5. Make sure that you have the correct file permission before you continue:

   ```
   chown -R www-data:www-data /var/www/html
   ```

   The easy way to continue is to visit our setup page from the browser as we did in the *Installing Magento 2 sample data via GUI* recipe of this chapter using the `http://yourdomain.com/setup` URL.

6. We can also use the shell to finish the setup using the following script:

   ```
   bin/magento setup:install \
       --db-host=localhost \
       --db-name=<your-db-name> \
       --db-user="<db-user>" \
       --db-password="<db-password>" \
       --backend-frontname=<admin-path> \
       --base-url=http://yourdomain.com/ \
       --admin-lastname=<your-lastname> \
       --admin-firstname=<your-firstname> \
       --admin-email=<your-email> \
       --admin-user=<your-admin-user> \
       --admin-password=<your-password> \
   ```



Always make sure that `bin/magento` has the correct permissions to execute:

```
chmod 755 bin/magento
```

Congratulations, you just finished the installation of Magento 2 including sample data. Now go to your browser using `yourdomain.com`, and you will see the default Magento 2 layout theme called Luma.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 6, we installed Magento 2 via the command shell. Before we could continue, we needed to create an `auth.json` file that stores our Magento and GitHub tokens. Without them, we may not be able to install the software easily due to download restrictions or dependencies.

In step 2, we used one line of code to trigger the whole download process of Magento 2. Depending on whether this is your first call, the process can take some time. Once you install Magento for the second time, the process installs much faster because of the locally stored cache files.

In step 3, we used `bin/magento` to update the `composer.json` file including the sample data packages. Then we needed to update Composer before we could install Magento 2 from the shell; otherwise, the sample data would not be included.

In step 6, we used the `bin/magento setup:install` parameter to commit all of the database, URL admin path, domain name, and user credentials to the setup of Magento 2.

There's more...

Always make sure that your system `PATH` is exported to your system using the following command from the shell (where `/var/www/html` is your Magento root folder):

```
export PATH=$PATH:/var/www/html/bin
```

More information on environmental variables can be found here:

`https://www.digitalocean.com/community/tutorials/how-to-read-and-set-environmental-and-shell-variables-on-a-linux-vps`

Managing Magento 2 indexes via the command line

In the current version of Magento, using indexes is one of the most important key features. Without the correct indexes, we will not be able to use Magento properly.

What do the indexes do, and why are they so important? One of the key elements is to make things run faster. Without indexing, Magento 2 would have to calculate data on the fly. In Magento 2, we will be using the following nine indexes:

- **Customer Grid**: This indexer rebuilds the customer's grid. This is a new indexer in Magento 2 for optimized rendering of the `adminhtml` backend pages.
- **Category Products**: This indexer creates the association between categories and products based on the associations that you set in the backend on the categories and relates to the Product Categories indexer. The flat catalog indexer creates a flat optimized table in the database.
- **Product Categories**: This indexer creates the association between products and categories based on the associations that you set in the backend on the products and relates to the Category Products indexer. The flat product indexer creates a flat optimized table in the database.

- **Product Price**: This indexer relates to the products and their advanced pricing options based on, for example, customer group, website, and catalog discount rules. The indexer aggregates the data in tables (`catalog_product_index_price_*`) and makes the selects (sorting and filtering) much easier.
- **Product EAV**: This indexer reorganizes the **Entity Attribute Value** (**EAV**) product structure to the flat structure. The product EAV indexer is related to the Category Products and Product Categories indexer and creates a flat optimized table in the database.
- **Stock**: This indexer rebuilds and calculates the current stock data.
- **Catalog Search**: This indexer rebuilds the catalog product fulltext search.
- **Catalog Rule Product**: This indexer creates and updates the created catalog price rule set.
- **Catalog Product Rule**: This indexer creates and updates the created shopping cart price rule set.

The database table looks as follows:

state_id	indexer_id	status
1	customer_grid	valid
2	catalog_category_product	invalid
3	catalog_product_category	invalid
4	catalog_product_price	valid
5	catalog_product_attribute	valid
6	cataloginventory_stock	valid
7	catalogsearch_fulltext	valid
8	catalogrule_rule	invalid
9	catalogrule_product	valid

The control panel of the backend looks like this:

Indexer	Description	Mode	Status	Updated
Customer Grid	Rebuild Customer grid index	UPDATE ON SAVE	READY	Nov 23, 2015, 9:18:31 PM
Category Products	Indexed category/products association	UPDATE ON SAVE	REINDEX REQUIRED	Nov 23, 2015, 9:19:05 PM
Product Categories	Indexed product/categories association	UPDATE ON SAVE	REINDEX REQUIRED	Nov 23, 2015, 9:19:05 PM
Product Price	Index product prices	UPDATE ON SAVE	READY	Nov 23, 2015, 9:18:33 PM
Product EAV	Index product EAV	UPDATE ON SAVE	READY	Nov 23, 2015, 9:18:34 PM
Stock	Index stock	UPDATE ON SAVE	READY	Nov 23, 2015, 9:18:34 PM
Catalog Search	Rebuild Catalog product fulltext search index	UPDATE ON SAVE	READY	Nov 23, 2015, 9:18:37 PM
Catalog Rule Product	Indexed rule/product association	UPDATE ON SAVE	REINDEX REQUIRED	Nov 23, 2015, 9:19:14 PM
Catalog Product Rule	Indexed product/rule association	UPDATE ON SAVE	READY	Nov 23, 2015, 9:18:37 PM

Getting ready

For this recipe, we will use a Droplet at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup. A working Magento 2 setup is required.

How to do it...

The following are the steps to implement the recipe:

1. In Magento 2, we only have the option to change the **Update on Save** or **Update by Schedule** state:

   Update on Save: Index tables are updated immediately after the dictionary data is changed

   Update by Schedule: Index tables are updated by cron job according to the configured schedule

2. We will be using the shell during this. This will be the only way to update your indexes. Go to your shell and run the following command from your web server directory:

   ```
   php bin/magento indexer:info
   ```

   We now get an overview of all the indexers.

3. Now run `php bin/magento indexer:status`; this will give us an up-to-date status of the current indexes.
4. Now run `php bin/magento indexer:show-mode`; this information is related to the Update on Save or Update by Schedule modes.
5. We can switch the modes using the following command on the shell:

   ```
   php bin/magento indexer:info realtime customer_grid
   ```

   Using the mode option **realtime** (Update on Save) or **schedule** (Update by Schedule) may set the indexer.

6. One of the most commonly used commands is as follows:

   ```
   php bin/magento indexer:reindex
   ```

   This will reindex all the indexers. However, you can also reindex them individually using the following command:

   ```
   php bin/magento indexer:reindex customer_grid
   ```

We can also use the following command:

```
php bin/magento indexer:reindex customer_grid catalog_category_
product etc…
```

7. Now you can rerun `indexer:status` to check whether all the indexers are up to date.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 7, you learned how to use the `bin/magento` indexer.

In step 5, you learned how to check what the current status is of all the indexes. In step 4, we saw how to switch from the realtime Update on Save to the schedule Update on Schedule modes.

In step 6, you learned how to reindex them individually.

There's more...

You can also check the current status of the indexer using MySQL. Run the following command in the shell:

```
mysql -u <username> --database <dbname> -p -e "select * from indexer_
state"
```

Managing Magento 2 cache via the command line

Cache management is one of the new optimized key features in Magento 2. We will be using the following cache types:

Cache types	Cache type code name	Description
Configuration	`config`	Magento collects configuration from all modules, merges it, and saves the merged result to the cache. This cache also contains store-specific settings stored in the filesystem and database. Clean or flush this cache type after modifying configuration files.

Cache types	Cache type code name	Description
Layout	`layout`	This is the compiled page layout (that is, the layout components from all components). Clean or flush this cache type after modifying layout files.
Block HTML output	`block_html`	This is the HTML page fragments per block. Clean or flush this cache type after modifying the view layer.
Collections data	`collections`	This is the result of database queries. If necessary, Magento cleans up this cache automatically, but third-party developers can put any data in any segment of the cache. Clean or flush this cache type if your custom module uses logic that results in cache entries that Magento cannot clean.
DDL	`db_ddl`	This is the database schema. If necessary, Magento cleans up this cache automatically, but third-party developers can put any data in any segment of the cache. Clean or flush this cache type after you make custom changes to the database schema (in other words, updates that Magento does not make itself). One way to update the database schema automatically is using the `magento setup:db-schema:upgrade` command.
EAV	`eav`	This is metadata related to EAV attributes (for example, store labels, links to related PHP code, attribute rendering, search settings, and so on). You should not typically need to clean or flush this cache type.

Cache types	Cache type code name	Description
Page cache	`full_page`	This is the generated HTML pages. If necessary, Magento cleans up this cache automatically, but third-party developers can put any data in any segment of the cache. Clean or flush this cache type after modifying code level that affects HTML output. It's recommended to keep this cache enabled because caching HTML improves performance significantly.
Reflection	`reflection`	This removes a dependency between the web API module and the Customer module.
Translations	`translate`	This is the merged translations from all modules.
Integration configuration	`config_integration`	This is the compiled integrations. Clean or flush this cache after changing or adding integrations.
Integration API configuration	`config_integration_api`	This is the compiled integration APIs.
Web services configuration	`config_webservice`	This is the web API structure.

By default, we will be using Full Page Cache now in the community version, which is a great improvement next to the web services (API) caches.

Depending on the current **development**, **default**, and **production** state, caches will be different.

In the next recipes of this chapter, we will dive deeper into the use of different states.

Getting ready

When cleaning or flushing your cache, Magento will flush its content from either the `var/cache` or `var/full_page` directory. In this recipe, we will refer to the `bin/magento cache:enable`, `bin/magento cache:disable`, `bin/magento cache:clean`, or `bin/magento cache:flush` options.

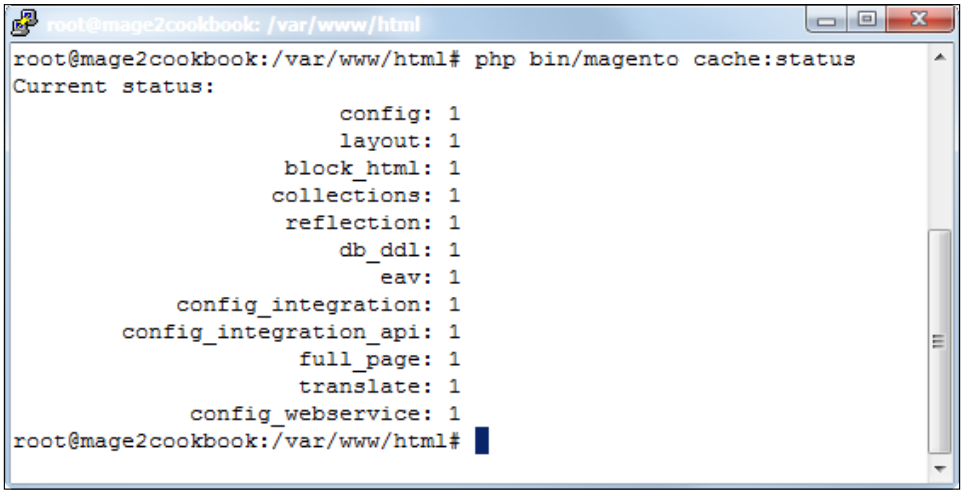
How to do it...

For the purpose of this recipe, let's assume that we need to manage the Magento 2 cache setup. The following steps will guide you through this:

1. Let's first check the current status using the following command:

   ```
   php bin/magento cache:status
   ```

   The output looks like this:



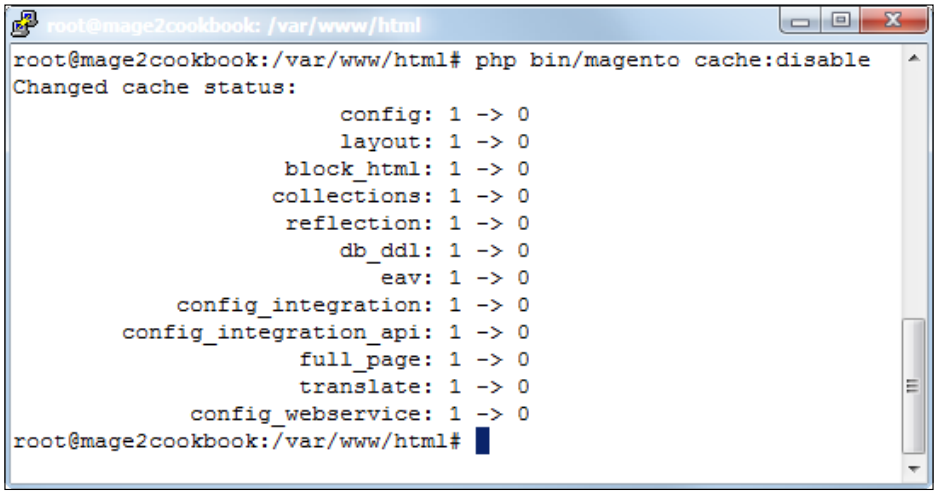
2. Now we will check how to enable and disable caches individually or all at once. Use the following command to disable the caches individually:

   ```
   php bin/magento cache:disable config
   ```

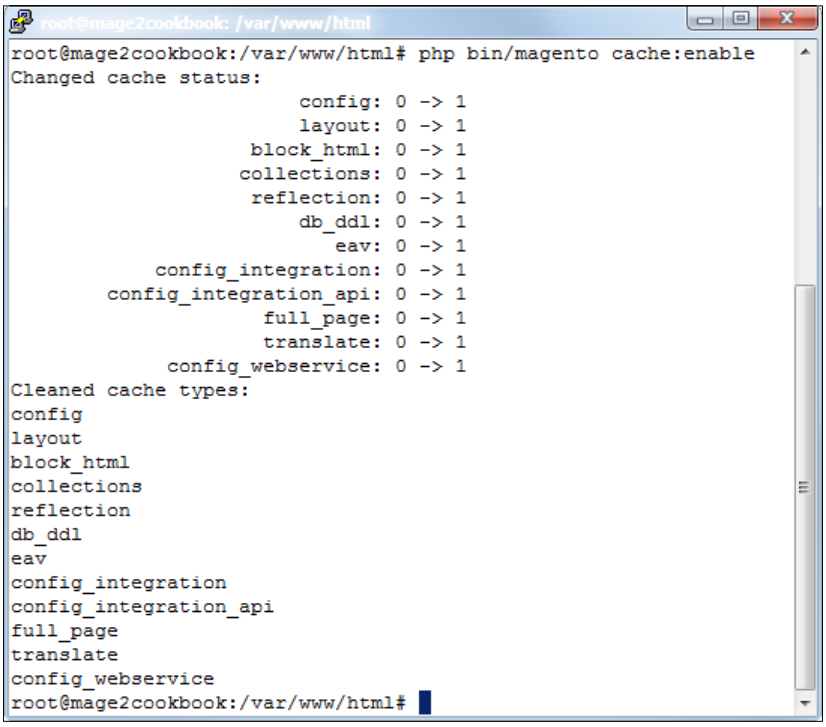
   This will disable the cache for only `config`. You may pick any cache type code name. To enable the `config` cache back, use the following command:

   ```
   php bin/magento cache:enable config
   ```

When skipping the cache type code name behind the command, we will be able to enable or disable the caches all at once. It will look like this when we disable the cache:



3. When we want to re-enable all caches, we use `php bin/magento cache:enable`. As you can see now, after enabling the caches, they are cleaned as well:



4. Now let's clean the caches individually using `php bin/magento cache:clean config`. By removing the cache type code name, we will be able to clean all of them at once.
5. Now let's flush the caches individually using `php bin/magento cache:flush config`. By removing the cache type code name, we will be able to clean all of them at once.



Cleaning a cache type deletes all items from enabled Magento cache types only. In other words, this option does not affect other processes or applications because it cleans only the cache that Magento uses.

Disabled cache types are not cleaned.

Flushing a cache type purges the cache storage (such as Redis, Memcache, and so on), which might affect other process' applications that are using the same storage.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 5, you learned how to manage the cache in Magento 2.

In step 1, you learned how to use the `status` option to check what the current cache status is. In step 2, we were able to enable or disable the caches individually.

In steps 4 and 5, you learned how to flush and clean the caches individually.

There's more...

You can also flush all cached items running the following command from the shell:

```
php bin/magento cache:flush -all
```

Keep in mind that cleaning or flushing your Full Page Cache can resolve in a cold (no-cache) page, so warming up all pages is advised.

Managing Magento 2 backup via the command line

Every production environment needs a proper backup plan. By default, Magento 2 has a complete set of options to create and roll back backups.

When creating a backup, we can use one of the following options:

Option	Meaning	Backup file name
`--code`	This creates a backup from the filesystem (excluding `/var` and `/pub/static`	`var/backups/<timestamp>_filesystem.tgz`
`--media`	This creates a backup from the `/media` directory	`var/backups/<timestamp>_filesystem_media.tgz`
`-db`	This creates a backup from the current database	`var/backups/<timestamp>_db.gz`



Besides the Magento backup options, it is always advisable to use an alternative backup solution connected to a backup storage.

Getting ready

When creating a backup, Magento will store it in the `var/backups` directory. In this recipe, we will refer to the `bin/magento setup:backup` and `bin/magento setup:rollback` options.

How to do it...

For the purpose of this recipe, let's assume that we need to manage the Magento 2 backup setup. The following steps will guide you through this:

1. Let's start creating a code-only backup using the following command:

   ```
   php bin/magento setup:backup --code
   ```

   Once Magento sets the maintenance code flag, the web shop is offline for everybody. Creating a code backup takes some time. The backup will be stored in `var/backups`. A clean Magento 2 code backup is around 123 MB.

2. Now we will create a database-only backup using the following command:

   ```
   php bin/magento setup:backup --db
   ```

   A clean Magento 2 database backup is around 14 MB.

3. For a media backup, we use the following command:

   ```
   php bin/magento setup:backup --media
   ```

   A clean Magento 2 media backup with sample data is around 153 MB.

4. Now let's check what backups have been created, using the following command:

```
php bin/magento info:backup:list
```

   This will give us an overview of what's available:

```
Showing backup files in /var/www/html/var/backups.
+---------------------------------+-------------+
| Backup Filename          | Backup Type |
+---------------------------------+-------------+
| 1448480907_filesystem_code.tgz  | code     |
| 1448481232_db.gz         | db       |
| 1448481295_filesystem_media.tgz | media      |
+---------------------------------+-------------+
```

5. Rolling back a backup is very easy. You can use the following command on the shell:

```
php bin/magento setup:rollback [-c|--code-file="<name>"] [-m|--
media-file="<name>"] [-d|--db-file="<name>"]
```

   For example, to restore a database backup, we can use the following command:

```
php bin/magento setup:rollback -d 1448481232_db.gz
```

   You will get the following notification to confirm your action:

```
You are about to remove current code and/or database tables. Are
you sure?[y/N]
```



While confirming the action, you could get a **Segmentation fault**. You can fix this using the following command. This could be related to PHP 7. Always use the latest version:

```
ulimit -s 65536
```

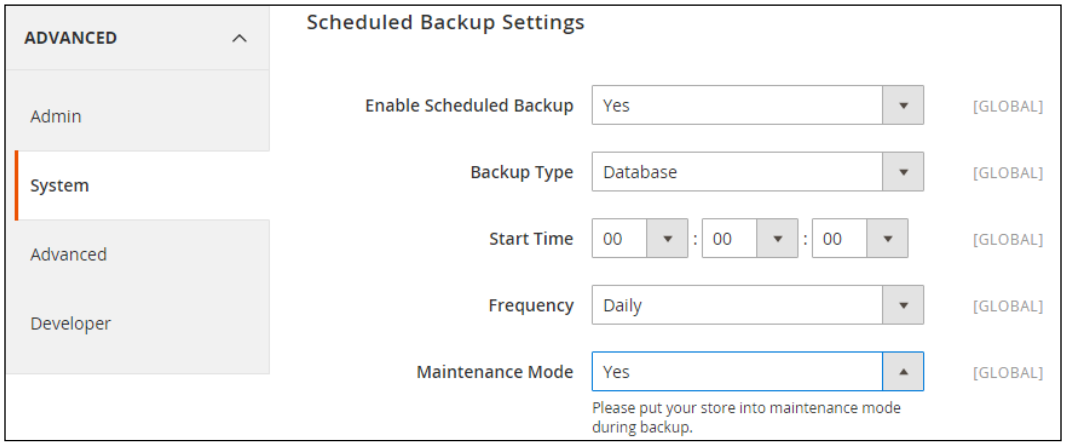
You can also store this in the `.bashrc` file on your system.

6. Congratulations, you just rolled back a backup. Pick any type to do the same. Always flush and clean your cache once you are done.
7. Setting up a scheduled backup schema is a whole different ball game. We first need to set up a cron job using the following command:

```
crontab -e
*/1 * * * * php /var/www/html/bin/magento cron:run
```

   This command will create a cron schedule in the Magento 2 database.

8. Creating a daily, weekly, or monthly backup can be done in the administrator backend. Log in and navigate to **Stores** | **Configuration** | **Advanced** | **System** | **Scheduled Backup Settings**:



How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 8, you learned how to create rollbacks and manage backups via the command line.

In step 1, we created a backup for our code base only. In step 2, we created a backup for the database and in step 3, for all the media files.

In step 4, we listed all the created backups that are located in `var/backups`.

The process in step 5 is related to the rollback scenario. Depending on the backup size, rolling back could take some time.

In steps 7 and 8, we configured a cron job to schedule our daily backup process automatically.

There's more...

You can also check the current status of the cron schedule using MySQL. Run the following command from the shell:

```
mysql -u <username> --database <dbname> -p -e "select * from cron_
schedule"
```

Managing Magento 2 set mode (MAGE_MODE)

Magento 2 comes with a new feature set called MAGE_MODE. This option gives you the configuration to run Magento in either **developer**, **default**, or **production** mode.

This feature is very important during development and product phases. It gives a developer the tool to debug or created optimized caches for high performance needs.

By default, the **default** mode is set.

The following table describes the modes in which we can run Magento:

Mode name	Description
`default`	When no given mode is given, this is explicitly set and has the following benefits: • Static view file caching is enabled • Enables automatic code compilation (code optimization) • Exceptions are written to the log files. • Hides the custom X-Magento-* HTTP response header
`developer`	It has the following benefits: • Disables static view file caching • Enables automatic code compilation (code optimization) • Shows the custom X-Magento-* HTTP response header • Verbose logging • Slowest performance state
`production`	It has the following benefits: • Optimized caches available • Exceptions are written to the log files. • Static files are not cached



When using a **Development Test Acceptance Production** (**DTAP**) environment, it is important to run your DTA in development mode and production on P.

Getting ready

Always check what web server you are using; the settings for Apache and NGINX are not the same. In this recipe, we will be showing you how to set this on both of them.

How to do it...

For the purpose of this recipe, let's assume that we need to manage the Magento 2 production or development setup. The following steps will guide you through this:

1. In this recipe, the setup of the MAGE_SET option is different for NGINX and Apache. In Apache, we can use either the `.htaccess` file or configure this in the `vhost` file. We will first look into the Apache setup. While all recipes of this chapter are based on NGINX, it's best to skip this part and continue to the next listed topic or retrieve an DigitalOcean Droplet

   Go to the `.htaccess` file in your web root directory and remove the # (hash or pound sign) at the fifth line from the top:

   ```
   SetEnv MAGE_MODE developer
   ```

   Change it to the following:

   ```
   SetEnv MAGE_MODE production
   ```

   If you are using a server-based configuration instead of the `.htaccess` file, use the following then:

   ```
   SetEnv MAGE_MODE "developer"
   ```

   The following code is for the current `000-default.conf`:

   ```
   <VirtualHost *:80>
   ServerAdmin webmaster@localhost
   DocumentRoot /var/www/html
   SetEnv MAGE_MODE "developer"
   <Directory /var/www/html>
   Options Indexes FollowSymLinks
   AllowOverride All
   Order allow,deny
   allow from all
   </Directory>

   ErrorLog ${APACHE_LOG_DIR}/error.log
   CustomLog ${APACHE_LOG_DIR}/access.log combined

   ProxyPassMatch ^/(.*\.php(/.*)?)$ fcgi://127.0.0.1:9000/var/www/
   html/$1
   </VirtualHost>
   ```

   Now continue to step 3.

2. Now let's do the setup for NGINX. Go to your `vhost` file. you will find it in `/etc/nginx/conf.d/default.conf`.

   Open the `default.conf` file and go to the following rule:

   ```
   set $MAGE_MODE developer;
   ```

   Change this to the following:

   ```
   set $MAGE_MODE production;
   ```

   Restart your NGINX server now using the following command:

   ```
   service nginx restart
   ```

3. Check the current status in Magento using the following command:

   ```
   php bin/magento deploy:mode:show
   ```

   By default, it shows the default status. We now switch the status using the following:

   ```
   php bin/magento deploy:mode:set production
   ```

   We can also use the following command:

   ```
   php bin/magento deploy:mode:set developer
   ```

   This will trigger the maintenance mode and start creating all necessary optimized static files needed.

4. We can also run this manually. However, first we will need to create static files in the `pub/static` directory. Run the following command on the shell:

   ```
   php bin/magento setup:static-content:deploy
   ```

5. If you want to skip the code compilation, use the `--skip-compilation` option, as shown in the following command:

   ```
   php bin/magento deploy:mode:set developer --skip-compilation
   ```

6. Remember to check your permissions and ownership of the newly created files.



Code compilation consists of caches, optimized code, optimized dependency injection, proxies, and so on. Magento 2 needs these files to serve an optimized code base to the client's browser.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 6, you learned configuring the development and production modes in Magento 2.

In step 1, we configured the `SetEnv` parameter in the `.htaccess` file of Apache to set the correct mode. There is also an option to configure this in the Apache configuration file instead.

In step 2, we configured the `set $MAGE_MODE` parameter in NGINX to use the correct mode.

In step 3, we used the `bin/magento deploy` option to tell Magento to start using the selected mode in NGINX or Apache, and create additional static files when running in production mode or show the correct debug headers in the developer mode.

In step 4, you learned how to deploy static content in the `pub/static` directory when running in production mode. This option will trigger the whole process of merging and compiling the correct code in the public folder.

There's more...

Use **curl** to check your HTTP response header to see what current state you are running, as shown in the following:

```
curl -I http://mage2cookbook.com/


HTTP/1.1 200 OK
Server: nginx/1.9.6
X-Magento-Cache-Debug: HIT
```

Always check the current status in your HTTP header and Magento shell. Only setting the web server configuration will not automatically trigger the Magento configuration and can mislead you.

Transferring your Magento 1 database to Magento 2

Moving your Magento 1 to Magento 2 may be one of the most challenging things out there. Luckily, Magento supported us with a database migration option.

The Magento 2 **Data Migration Tool** is here to help you convert your products, customers, order/sales data, store configuration, promotions/sales rules, and more to move to a clean Magento 2 setup.

Custom code, Extensions, and Themes are out of the current scope of the Data Migration Tool.

The currently supported migrations are the **Community Edition** (**CE**) versions 1.6.x, 1.7.x, 1.8.x, and 1.9.x and **Enterprise Edition** (**EE**) versions 1.11.x, 1.12.x, 1.14.x, and 1.14.x.



Check with your third-party extension developer for a Data Migration Tool to move the database code base to Magento 2.

Getting ready

Before we can start migrating our system, we need to check the following:

- Have a clean Magento 2 system running.
- Disable your cron jobs.
- Always back up your databases and old and new Magento versions.
- Check whether there is a network connection from the current Magento 1 to Magento 2 server. Check the firewall for database access if needed (port 3306).
- Only use the exact version number, so that the data-migration-tool 2.0.0 corresponds with Magento 2.0.0.



You may copy your current production database to the new Magento 2 server and run it there.

A migration of Magento 1 to Magento 2 has the following five phases that are important to follow in the correct order:

1. **Settings**: Migration of the settings is step 1. This will transfer all information from the stores, website, and system configuration.

   The command is `php bin/magento migrate:settings`.

2. **Data**: Migration of the data is step 2. This will transfer all categories, products, customers, orders, wishlists, ratings, and so on

   The command is `php bin/magento migrate:data`.

3. **Delta**: Migration of the delta is step 3. This is an important step and is used to transfer Magento 1 data to Magento 2 where new updates occur. It will update the most recent data of customers, orders, or other customer-related data. It is common to use this command before going live.

   The command is `php bin/magento migrate:delta`.

4. **Media**: Migration of the media files is easy; just copy all files from `/media` to `/pub/media`.

5. **Custom modules/themes**: Migration of your modules or themes is out of the scope of the migration tool. Contact your solutions provider to check whether they have a new version available. This also applies to any custom-made themes of theme packages bought online.

How to do it...

For the purpose of this recipe, let's assume that we need to manage a Magento 1 to Magento 2 migration setup. The following steps will guide you through this:

1. First, we need to run the following command to add `data-migration-tool` to your current Composer setup:

   ```
   composer config repositories.data-migration-tool git https://
   github.com/magento/data-migration-tool-ce
   composer require magento/data-migration-tool:dev-master
   ```

   Wait while all dependencies are updated.

2. Now check whether the migration tools are available in the `bin/magento` shell tool:

Commands	Description
migrate	
`migrate:data`	Main migration of data
`migrate:delta`	Migration of the data that is added to Magento after the main migration
`migrate:settings`	Migration of the system configuration

3. For this recipe, we will be using a Magento 1 database installation on our DigitalOcean Droplet. You may pick any of your production or Magento 1 sample data SQL dumps. We will be using a Magento 1.9.2.2 sample data SQL dump. Our database is called **magento1**.

4. Now, we need to map the database configuration files from the Magento 1 database to the Magento 2 database. Always make sure that you are using a clean database; otherwise, you can run the following command:

   ```
   php bin/magento setup:uninstall
   ```

   Go to `/var/www/html/vendor/magento/data-migration-tool/etc/ce-to-ce` and pick the correct database version mentioned in the directory. If correct, you will see two files called `config.xml.dist` and `map.xml.dist`.

5. Copy `config.xml.dist` to `config.xml` using the `cp` command:

   ```
   cp config.xml.dist config.xml
   ```

6. Open your `config.xml` and look for the `<source>` tag (line 94). Change it accurately with the database username and password:

```
<source>
  <database host="localhost" name="magento1" user="root"
    password="mypassword"/>
</source>
<destination>
  <database host="localhost" name="magento2" user="root"
    password="mypassword"/>
</destination>
<options>
  <source_prefix>myprefix-from-magento1</source_prefix>
  <crypt_key>mycrypt-key-from-magento1</crypt_key>
</options>
```

   If you are using a custom prefix in your database or you wish to use your encryption key on your Magento 2 setup, you can add this to the `<options>` section, as shown in the previous code.

7. Now we can start step 1 of the settings migration using the following command:

```
php bin/magento migrate:settings /var/www/magento2/vendor/magento/
data-migration-tool/etc/ce-to-ce/1.9.2.2/config.xml
```

   As you can see, here we are using the 1.9.2.2 version. Depending on your version, you may change this before running the command.

   The output result looks like this:

```
[2015-12-02 20:28:56][INFO][mode: settings][stage: integrity
check][step: Settings Step]: started

100% [============================] Remaining Time: 1 sec

[2015-12-02 20:28:56][INFO][mode: settings][stage: integrity
check][step: Stores Step]: started

100% [============================] Remaining Time: 1 sec

[2015-12-02 20:28:56][INFO][mode: settings][stage: data migration]
[step: Settings Step]: started

100% [============================] Remaining Time: 1 sec

[2015-12-02 20:28:59][INFO][mode: settings][stage: data migration]
[step: Stores Step]: started

100% [============================] Remaining Time: 1 sec

[2015-12-02 20:28:59][INFO][mode: settings][stage: volume check]
[step: Stores Step]: started

100% [============================] Remaining Time: 1 sec

[2015-12-02 20:28:59][INFO][mode: settings][stage: volume check]
[step: Stores Step]: Migration completed
```

8. You can check your Magento 2 system configuration backend if all updated settings are available. If so, you can continue.
9. If step 1 is correct, we continue to migrate our data to Magento 2 using the following command:

   ```
   php bin/magento migrate:data /var/www/magento2/vendor/magento/
   data-migration-tool/etc/ce-to-ce/1.9.2.2/config.xml
   ```

   The output result looks like this:

```
[2015-12-03 19:06:28][INFO][mode: data][stage: integrity check][step: EAV Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:29][INFO][mode: data][stage: integrity check][step: Customer Attributes Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:29][INFO][mode: data][stage: integrity check][step: Map Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:33][INFO][mode: data][stage: integrity check][step: Url Rewrite Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:33][INFO][mode: data][stage: integrity check][step: Log Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:33][INFO][mode: data][stage: integrity check][step: Ratings Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:33][INFO][mode: data][stage: integrity check][step: ConfigurablePrices step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:33][INFO][mode: data][stage: integrity check][step: OrderGrids Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:33][INFO][mode: data][stage: integrity check][step: Tier Price Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:33][INFO][mode: data][stage: integrity check][step: SalesIncrement Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:33][INFO][mode: data][stage: setup triggers][step: Stage]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:36][INFO][mode: data][stage: data migration][step: EAV Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:37][INFO][mode: data][stage: volume check][step: EAV Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:37][INFO][mode: data][stage: data migration][step: Customer Attributes Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:37][INFO][mode: data][stage: volume check][step: Customer Attributes Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:37][INFO][mode: data][stage: data migration][step: Map Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: volume check][step: Map Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: data migration][step: Url Rewrite Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: volume check][step: Url Rewrite Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: data migration][step: Log Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: volume check][step: Log Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: data migration][step: Ratings Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: volume check][step: Ratings Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: data migration][step: ConfigurablePrices step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: volume check][step: ConfigurablePrices step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:46][INFO][mode: data][stage: data migration][step: OrderGrids Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:47][INFO][mode: data][stage: volume check][step: OrderGrids Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:47][INFO][mode: data][stage: data migration][step: Tier Price Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:47][INFO][mode: data][stage: volume check][step: Tier Price Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:47][INFO][mode: data][stage: data migration][step: SalesIncrement Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:47][INFO][mode: data][stage: volume check][step: SalesIncrement Step]: started
100% [============================] Remaining Time: 1 sec
[2015-12-03 19:06:47][INFO][mode: data][stage: volume check][step: SalesIncrement Step]: Migration completed
```

10. You can check your Magento 2 catalogs, products, orders, and customers if they are all updated. If so, you can continue.

11. Before you continue, make sure to reindex and flush your caches at once:

    ```
    php bin/magento indexer:reindex
    php bin/magento cache:clean
    php bin/magento cache:flush
    ```

12. Now check the frontend and backend whether your data is available in Magento 2. If not, check the `migration.log` file located in `/var`.
13. In this recipe, we used a default Magento 1.9.2.2 setup. After the settings and data migration, we created a sales order in Magento 1. Now, using the `delta` option, we push the data to Magento 2 using the following command:

    ```
    php bin/magento migrate:delta /var/www/magento2/vendor/magento/
    data-migration-tool/etc/ce-to-ce/1.9.2.2/config.xml
    ```

    The output result looks like this:

```
[2015-12-03 19:54:15][INFO][mode: delta][stage: delta delivering][step: Customer Attributes Step]: started
[2015-12-03 19:54:16][INFO][mode: delta][stage: volume check][step: Customer Attributes Step]: started
[2015-12-03 19:54:16][INFO][mode: delta][stage: delta delivering][step: Map Step]: started
..........
[2015-12-03 19:54:16][INFO][mode: delta][stage: volume check][step: Map Step]: started
[2015-12-03 19:54:16][INFO][mode: delta][stage: delta delivering][step: Log Step]: started
.
[2015-12-03 19:54:16][INFO][mode: delta][stage: volume check][step: Log Step]: started
[2015-12-03 19:54:16][INFO][mode: delta][stage: delta delivering][step: OrderGrids Step]: started
..............
[2015-12-03 19:54:16][INFO][mode: delta][stage: volume check][step: OrderGrids Step]: started
[2015-12-03 19:54:16][INFO][mode: delta][stage: delta delivering][step: SalesIncrement Step]: started
.
[2015-12-03 19:54:16][INFO][mode: delta][stage: volume check][step: SalesIncrement Step]: started
[2015-12-03 19:54:17][INFO][mode: delta][stage: volume check][step: SalesIncrement Step]: Migration completed successfully
[2015-12-03 19:54:17][INFO][mode: delta][stage: volume check][step: SalesIncrement Step]: Automatic restart in 5 sec. Use CTRL-C to abort
[2015-12-03 19:54:22][INFO][mode: delta][stage: delta delivering][step: Customer Attributes Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: volume check][step: Customer Attributes Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: delta delivering][step: Map Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: volume check][step: Map Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: delta delivering][step: Log Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: volume check][step: Log Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: delta delivering][step: OrderGrids Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: volume check][step: OrderGrids Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: delta delivering][step: SalesIncrement Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: volume check][step: SalesIncrement Step]: started
[2015-12-03 19:54:22][INFO][mode: delta][stage: volume check][step: SalesIncrement Step]: Migration completed successfully
[2015-12-03 19:54:22][INFO][mode: delta][stage: volume check][step: SalesIncrement Step]: Automatic restart in 5 sec. Use CTRL-C to abort
```

14. Now check your sales and customer data. Congratulations, you successfully migrated your database from Magento 1 to Magento 2.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 14, you learned how to use the Magento 2 migration tool.

In step 1, we used Composer to add an additional repository for data migration. After installing all of the packages, they are available in the `bin/magento` tool. In this setup example, we used a clean Magento 1.9.x database.

In step 4, we made sure to run on a clean Magento 2 setup. Depending on your setup, go to `vendor/magento/data-migration-tool/etc` and select the correct version. Magento 2 supports the migration option for CE and EE. Once we configured the `config.xml` file with the Magento 1 database information in step 6, we were ready to go.

In step 7, we used the `bin/magento` migration setting to start the whole process. We started with the setting parameter and continued with the `data` and `delta` parameters in steps 7 through 13. We must not forget the reindexing and updating of our caches before using them. The `delta` parameter option can be run multiple times as it only updates the latest information, which is helpful before going live and switching to production.

There's more...

As every Magento setup is unique, migrating from Magento 1 to Magento 2 can be hard sometimes. In some situations, you may need to change your tables in the mapping configuration located in `vendor/magento/data-migration-tool/etc/ce-to-ce/<version>map.xml.dist`.

Resetting your **setting**, **data**, and **delta** migration is easy using the `[-r|--reset]` parameter in your command. This allows you to rerun all migration scripts from the beginning.

Always check for the currently supported versions on the Magento GitHub Data Migration Tool page at the following link:

`https://github.com/magento/data-migration-tool-ce`



There is also an alternative Data Migration Tool available by **UberTheme** at `https://github.com/ubertheme/magento2_data_migration`.

2
Enabling Performance in Magento 2

In this chapter, we will cover the basic tasks related to optimizing your performance in Magento 2. You will learn the following recipes:

- Configuring Redis for backend cache
- Configuring Memcached for session caching
- Configuring Varnish as a Full Page Cache
- Configuring Magento 2 with CloudFlare
- Configuring optimized images in Magento 2
- Configuring Magento 2 with HTTP/2
- Configuring Magento 2 performance testing

Introduction

This chapter explains one of the most important elements of Magento. From the early Magento days, performance has been a hard topic to cover. Many setups out there in the e-commerce world are performance-great, but most of the time, the majority are having issues. Magento 1 may not be the best performance platform out there.

However, now we have Magento 2, a brand new platform designed for performance. From the very first day, the main Magento developers focused on a better framework and the outcome is great. According to the latest information, Magento focused on a **Google PageSpeed** ranking of 90% or more.

In this chapter, we will dive in deeper on how to configure Redis caching and Memcached sessions. By default, Magento 2 supports Varnish, and we will manage all of the steps on how to set it up.

Serving the correct catalog or product images is very important, and will save lots of bandwidth on a desktop but most of all on a mobile device, which will have a better user experience.

The new HTTP/2 protocol is a very new important element in the web server configuration. We will set up a
full-force HTTP/2 configuration, including SSL.

For a high-demanding Magento 2 website serving customers all over the globe, we introduce **CloudFlare**, which is a CDN provider optimized for Magento.

Without performance testing, Magento 2 will not perform well. You will learn how to create a company-like profile, including websites, stores, catalogs, products, orders, and much more.



Throughout this recipe, you can pick your own preferred hosting setup We will be using an NGINX-based setup. The Apache setup is pretty straightforward; when needed, we will address specified configuration settings when they occur.

Configuring Redis for backend cache

Redis may be one of the best improvements since we used Memcache(d) or **Alternative PHP Cache** (**APC**). For the last couple of years, Redis is available in Magento 1 and has a big performance benefit.

What is Redis and why is it important for Magento? Well, Redis is not new; its initial release dates to the beginning of 2009—almost as young as Magento 1. Redis is a key-value storage database that stores the data in-memory of your web server. Besides this, the in-memory caches are fast and also have a persistence feature that is really important when a server reboots. All caches are not flushed during a reboot and are available in-memory when the web server is up again.

In the beginning of the Magento 1 area, we used Memcache(d) or APC, which worked very well but not as well as Redis. In Magento 1, Redis was used for a backend cache and session storage most of the time. Some websites also used it as a **Full Page Cache** (**FPC**) storage.

One other great advantage of Redis is that it has multiple database containers, one for the default cache and the other for the FPC. Although the Redis performance is better in a lot of cases, it is not the *Holy Grail*. There are drawbacks to its architecture.

Getting ready

For this recipe, we will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup, including sample data connected to a Redis server. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to create a Magento 2 Redis setup. The following steps will guide you through this:

1. First, we need to install the Redis server and Redis PHP client before we can connect it to Magento. Follow the next step on the shell:

```
cd /opt
wget http://download.redis.io/releases/redis-3.0.5.tar.gz
tar xzf redis-3.0.5.tar.gz
cd redis-3.0.5
make && make install
```

   Change the version number of the current one if needed.

2. Go to the `/opt/redis-3.0.5/utils` directory and run the following script:

```
./install-server.sh
```

3. Commit to the following questions: (Press *Enter* to all of them; the default is just fine.)

```
Welcome to the redis service installer
This script will help you easily set up a running redis server

Please select the redis port for this instance: [6379]
Selecting default: 6379
Please select the redis config file name [/etc/redis/6379.conf]
Selected default - /etc/redis/6379.conf
Please select the redis log file name [/var/log/redis_6379.log]
Selected default - /var/log/redis_6379.log
Please select the data directory for this instance [/var/lib/
redis/6379]
Selected default - /var/lib/redis/6379
Please select the redis executable path [/usr/local/bin/redis-
server]
```

```
Selected config:
Port            : 6379
Config file     : /etc/redis/6379.conf
Log file        : /var/log/redis_6379.log
Data dir        : /var/lib/redis/6379
Executable      : /usr/local/bin/redis-server
Cli Executable : /usr/local/bin/redis-cli
Is this ok? Then press ENTER to go on or Ctrl-C to abort.
Copied /tmp/6379.conf => /etc/init.d/redis_6379
Installing service...
Success!
Starting Redis server...
Installation successful!
```

4. Now let's test our Redis server using the following command:

```
redis-cli -version
service redis_6379 status
netstat -anp | grep redis
```

   As you can see, the Redis server is running under port 6379.

5. The next important element is installing a PHP module that can communicate with the Redis server. We will use PHP Redis here (`https://github.com/phpredis/phpredis`).

   Use the following command to install PHP Redis:

```
cd /opt
git clone https://github.com/phpredis/phpredis.git
cd phpredis
phpize
./configure
make && make install
```

6. Now, we need to let PHP know there is a Redis extension available that we can use. Run the following command:

   ```
   echo "extension=redis.so" | sudo tee /etc/php5/mods-available/
   redis.ini
   ```

   Depending on whether you are using PHP 5 or PHP 7, you may want to change the PHP path.

7. Now we need to link the Redis PHP extension to PHP-FPM and PHP CLI. Run the following commands:

   ```
   cd /
   ln -s /etc/php5/mods-available/redis.ini /etc/php5/fpm/conf.d/20-
   redis.ini
   ln -s /etc/php5/mods-available/redis.ini /etc/php5/cli/conf.d/20-
   redis.ini
   ```

8. If everything is correct, we can restart the PHP-FPM server to activate the Redis PHP extension. Run the following command:

   ```
   service php5-fpm restart
   ```

9. To make sure that the Redis PHP and Redis server are running together, we can use the following command:

   ```
   php -r "if (new Redis() == true){ echo \"\r\n OK \r\n\"; }"
   ```

   By default, creating a `phpinfo.php` page in the root directory in Magento 2 will not work. First, you need to create the `phpinfo.php` file in the `/pub` directory. Then, you need to change the NGINX configuration (`nginx.conf.sample`) from `location ~ (index|get|static|report|404|503)\.php$ {` to `location ~ (index|get|static|report|404|503|phpinfo)\.php$ {`, which is located at the bottom of the file. In Apache, we don't have an issue like this; it works by default.



Use `phpinfo.php` wisely on a production environment. Sharing this information on a production website is not advised and could expose your security risks.

10. Congratulations, you just finished the Redis server and PHP Redis setup. Now let's continue with the Magento 2 part.

11. Open the `env.php` file in Magento 2 located at `/app/etc` and add the following code at the top:




```
<?php
return array (
  'cache' =>
  array (
    'frontend' =>
    array (
      'default' =>
      array (
        'backend' => 'Cm_Cache_Backend_Redis',
        'backend_options' =>
        array (
          'server' => '127.0.0.1',
          'port' => '6379',
          'persistent' => '',
          'database' => '0',
          'force_standalone' => '0',
          'connect_retries' => '1',
          'read_timeout' => '10',
          'automatic_cleaning_factor' => '0',
          'compress_data' => '1',
          'compress_tags' => '1',
          'compress_threshold' => '20480',
          'compression_lib' => 'gzip',
        ),
      ),
      'page_cache' =>
      array (
        'backend' => 'Cm_Cache_Backend_Redis',
        'backend_options' =>
        array (
          'server' => '127.0.0.1',
          'port' => '6379',
          'persistent' => '',
          'database' => '1',
          'force_standalone' => '0',
          'connect_retries' => '1',
          'read_timeout' => '10',
          'automatic_cleaning_factor' => '0',
          'compress_data' => '0',
          'compress_tags' => '1',
          'compress_threshold' => '20480',
          'compression_lib' => 'gzip',
        ),
      ),
    ),
  ),
  'backend' =>
  array (
    'frontName' => 'admin',
  ),
  'install' =>
```

12. As you can see, we are using two databases—one for the default cache and one for **page_cache** (Full Page Cache). Now, save your file and remove any cache in `/var/page_cache` and `/var/cache`. Let's open up your browser and refresh your website.

    If everything is configured correctly in the `env.php` file, you should not get any errors and the `ar/page_cache` and `var/cache` directories should be empty.

13. To check how many keys Redis received, we can run the following command from the shell:

    ```
    redis-cli
    ```

    On the prompt, continue with `INFO`; this will give you a list of the following details:

```
root@mage2cookbook:/var/www/magento2/var/cache# redis-cli INFO
# Server
redis_version:3.0.5
redis_git_sha1:00000000
redis_git_dirty:0
redis_build_id:76f6ee2908f61611
redis_mode:standalone
os:Linux 3.13.0-57-generic x86_64
arch_bits:64
multiplexing_api:epoll
gcc_version:4.9.2
process_id:9713
run_id:8eb836577d6f3ec4a2d1a179ee99e538543589e6
tcp_port:6379
uptime_in_seconds:86922
uptime_in_days:1
hz:10
lru_clock:6845253
config_file:/etc/redis/6379.conf

# Clients
connected_clients:1
client_longest_output_list:0
client_biggest_input_buf:0
blocked_clients:0

# Memory
used_memory:5661432
used_memory_human:5.40M
used_memory_rss:11952128
used_memory_peak:7778328
used_memory_peak_human:7.42M
used_memory_lua:39936
mem_fragmentation_ratio:2.11
mem_allocator:jemalloc-3.6.0
```

    To close the Redis terminal, use `exit`.

14. Congratulations, you just finished configuring the Redis server and PHP Redis with Magento 2.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 13, we installed a Redis server and configured Magento 2 to store the backend cache.

In step 1, we installed Redis from source and compiled the code. This version is more stable than the default one available in Ubuntu. After compiling the code, we are able to use an install script to create a working setup running on port `6379`.

After installing and testing the code in steps 3 and 4, we start installing the PHP Redis module. This code is pulled from GitHub and compiled from source.

In step 6, we created a `redis.ini` file, which is linked in step 7 with the correct PHP module directory. Before we can test it, we need to restart the PHP-FPM server and use a simple PHP command to test if everything is working fine.

In step 11, we added an additional piece of code to the `env.php` file, which will tell Magento 2 to store all of the cache in Redis as of now.

There's more...

If you are interested in monitoring your Redis server, the next step is interesting. Clone **PHPRedMin** (`https://github.com/sasanrose/phpredmin`) in your Magento 2 root directory, `/var/www/html`. Make sure to change the ownership to `www-data` for the owner and group.

Go to your `/var/www/html/pub` directory and create a symbolic link using the following command:

```
ln –s ../phpredmin/public phpredmin
```

Chown the ownership of the symbolic link with the following command:

```
chown -h www-data:www-data phpredmin
```

Go to to your NGINX configuration directory, `/etc/nginx/conf.d`, open the `default.conf` file, and including the following content below `error_log`:

```
location ~ ^/phpredmin/.+\.php {
  fastcgi_split_path_info ^(.+\.php)(/.+)$;

  set $fsn /index.php;
  if (-f $document_root$fastcgi_script_name) {
    set $fsn $fastcgi_script_name;
  }

  # php5-fpm
  fastcgi_pass fastcgi_backend;
  fastcgi_index  index.php;

  fastcgi_param  SCRIPT_FILENAME  $document_root$fsn;
  fastcgi_param  PATH_INFO  $fastcgi_path_info;
  fastcgi_param  PATH_TRANSLATED  $document_root$fsn;

  include fastcgi_params;
}
```

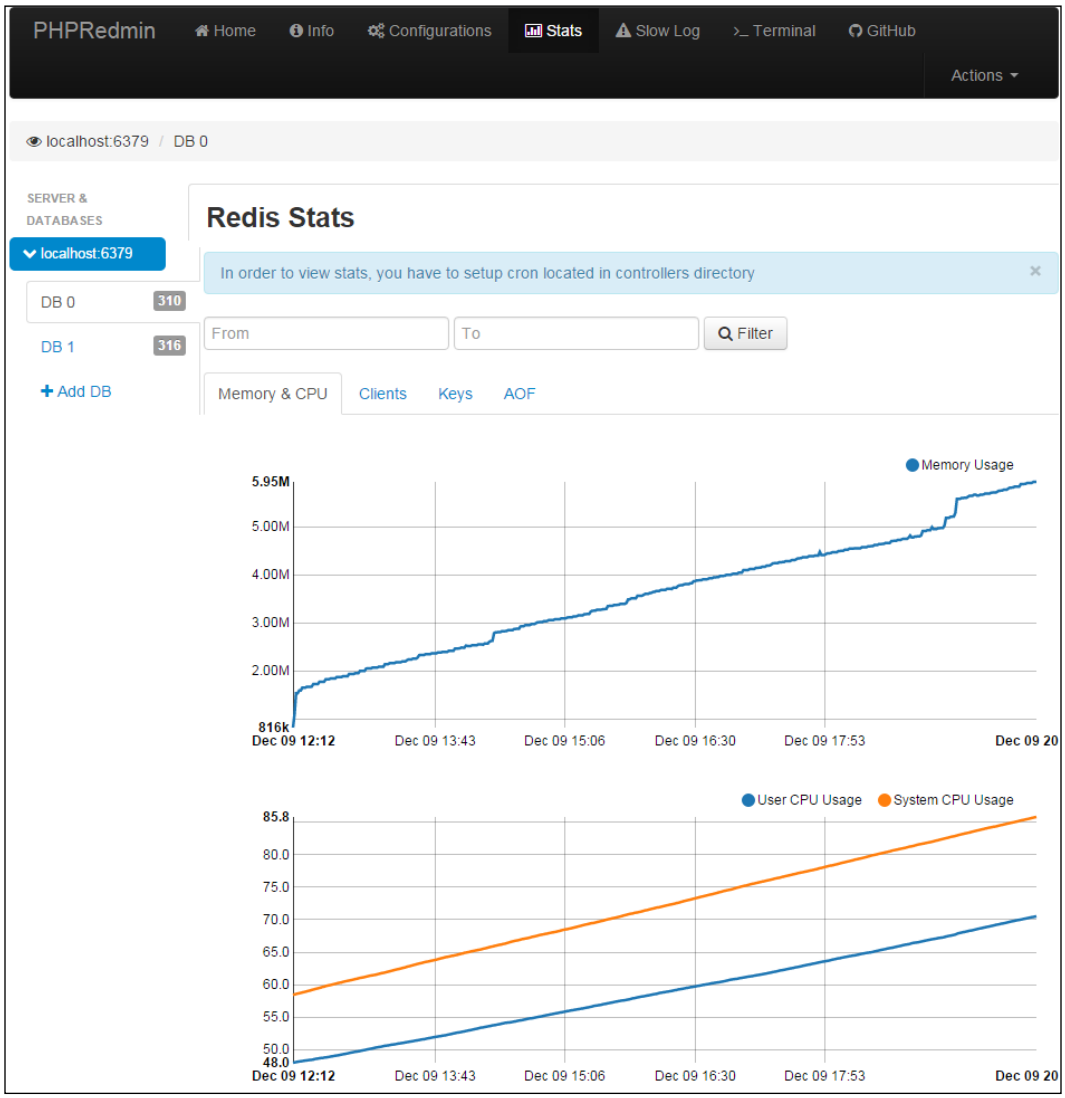
Now save and restart your NGINX server with `service nginx restart`.

Before we can continue, we need to add a cronjob rule to gather our Redis data and show it in PHPRedMin. Add the following rule to your crontab.

Open crontab using `crontab -e`:

```
* * * * * cd /var/www/html/pub/phpredmin && php index.php cron/index
```

Open your browser and surf to `http://yourdomain.com/phpredmin`, and press **Stats** in the top menu. Now you should see the following information:





On a production site, you will want to add an IP block so that only you can gain access.

Configuring Memcached for session caching

As Magento 2 does not support Redis session caching from the beginning, we need to use Memcached instead. Memcached has been around for a long time and was used in Magento 1, since the beginning, as backend and session caching.

Memcached is a distributed memory caching system. It is a flexible in-memory storage container to cache data. As the session handler in the PHP Redis does not support session locking, we use Memcached instead. Keep in mind that Memcached is not persisted, so after restarting the server or daemon, all the data is gone. This could have an impact on a production environment—lost sessions or baskets.

Getting ready

For this recipe, we will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup including sample data connected to a Memcached server. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to create a Magento 2 Memcached setup. The following steps will guide you through this:

1. First, we need to install the Memcached server and Memcached PHP client before we can connect it to Magento. Follow the next step on the shell:

   ```
   apt-get install -y libevent-dev
   apt-get install –y memcached
   ```

2. Now let's test our Memcached server using the following command:

   ```
   memcached –V
   service memcached status
   netstat –anp | grep memcached
   ```

   As you can see, the Memcached server is running under port 11211.

3. The next important element is installing a PHP module that can communicate with the Memcached server. We will be using the PHP Memcached extension and not the PHP Memcache extension (without the *d* at the end). The PHP Memcached (*d*) will be supporting PHP 7.

   Use the following command to install PHP Memcached:

   ```
   apt-get install php5-memcached
   ```

We can also use the following command to install it:

```
apt-get install php-memcached (php7)
```

4. Now let's check whether PHP has the correct Memcached extension installed. Run the following command:

   ```
   cat /etc/php5/mods-available/memcached.ini
   ```

   Now you should see the Memcached extension called `extension=memcached.so`.

   Depending on whether you are using PHP 5 or PHP 7, you may want to change the PHP path.

5. If everything is correct, we can restart the PHP-FPM server to activate the Memcached PHP extension. Run the following command:

   ```
   service php5-fpm restart
   ```

6. To make sure that the Memcached PHP and Memcached servers are running together, we can check using the following command:

   ```
   php -r "if (new Memcached() == true){ echo \"\r\n OK \r\n\"; }"
   ```

   It can also be checked using the following command:

   ```
   echo "stats settings" | nc localhost 11211
   ```

   By default, creating a `phpinfo.php` page in the root directory in Magento 2 will not work. First, you need to create the `phpinfo.php` file in the `/pub` directory. Then, you need to change the NGINX configuration from `location ~ (index|get|static|report|404|503)\.php$ {` to `location ~ (index|get|static|report|404|503|phpinfo)\.php$ {`, which is located at the bottom of the file. In Apache, we don't have an issue like this; it works by default.



Use `phpinfo.php` wisely on a production environment. Sharing this information on a production website is not advised and could expose your security risks.

7. Congratulations, you just finished the Memcached server and PHP Memcached setup. Now let's continue with the Magento 2 part.

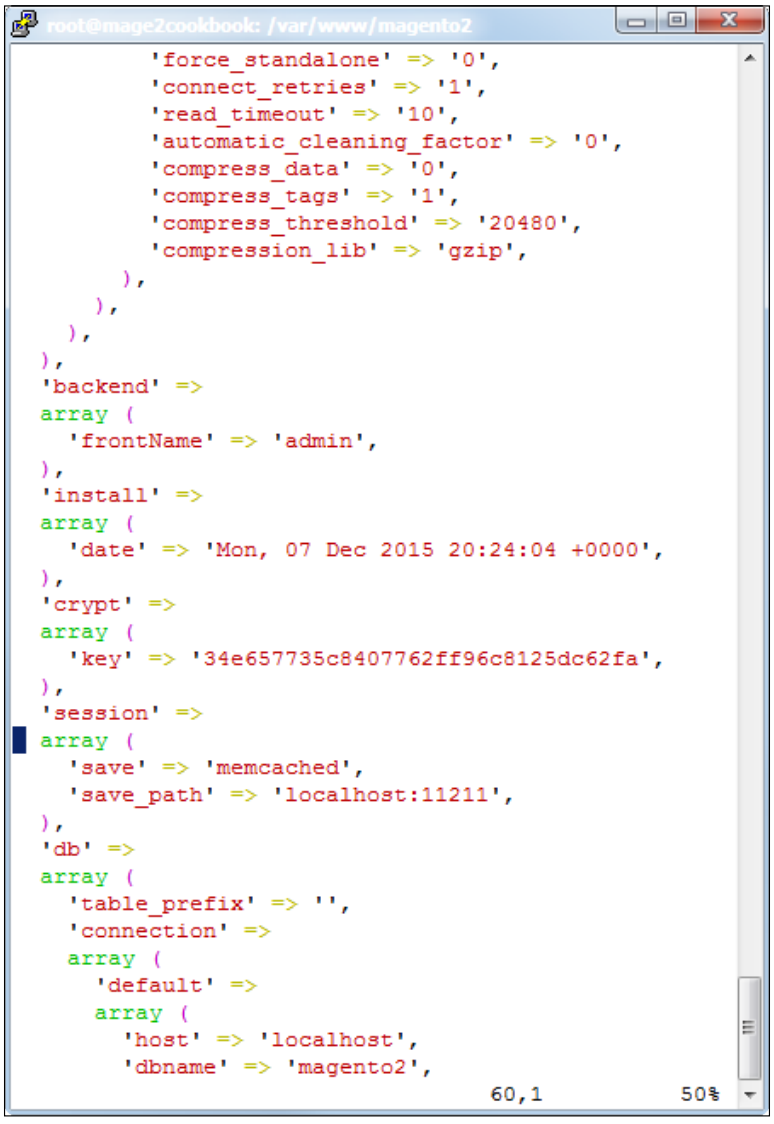
8. Open the `env.php` file in Magento 2 located at `/app/etc` and change the following code in the `session` section:

   ```
   'session' =>
       array (
       'save' => 'files',
   ),
   ```

Change the preceding code to the following:

```
'session' =>
   array (
    'save' => 'memcached',
    'save_path' => 'localhost:11211'
),
```

This is shown in the following screenshot:



9. Now save your file and remove any caches and sessions in `var/page_cache`, `var/cache` and `var/session`. Restart your website using the following command:

   ```
   service nginx restart && service php-fpm restart
   ```

   Let's open up your browser and refresh your website.

   If everything is configured correctly in the `env.php` file, you should not get any errors and the `/var/session` directory should be empty.

10. To check how many keys Memcached received, we can run the following command from the shell:

    ```
    echo "stats items" | nc localhost 11211
    ```

11. Congratulations, you just finished configuring the Memcached server and PHP Memcached with Magento 2.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 11, we installed a Memcached server and configured Magento 2 to store the sessions.

In steps 1 through 3, we installed the default Ubuntu Memcached server and PHP Memcached client modules. Depending on whether we are using PHP 5 or 7, we pick a different one. Before this, we make sure to restart the PHP-FPM server and test if everything is working correctly.

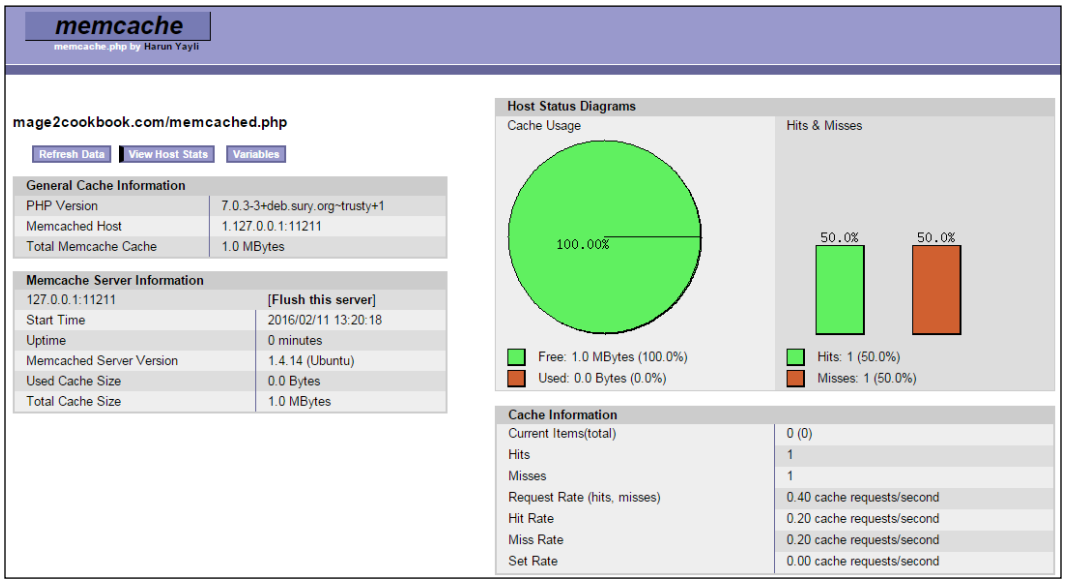
In step 8, we added an additional piece of code to the `env.php` file, which will tell Magento 2 to store all of the sessions in Memcached as of now.

There's more...

If you are interested in monitoring your Memcached server, the next step is interesting. Clone the `memcached.php` file from the GitHub Gist (`https://gist.github.com/raybogman/b8b7b4d21bf34ed9dd76`) in your Magento 2 root directory, `/var/www/html/pub`. Make sure to change the ownership to `www-data` for the owner and group.

By default, creating a `memcached.php` page in the root directory in Magento 2 will not work. First, you need to store the `memcached.php` file in the `/pub` directory. Then, you need to change the NGINX configuration from `location ~ (index|get|static|report|404|503)\.php$ {` to `location ~ (index|get|static|report|404|503|memcached)\.php$ {`, which is located at the bottom of the file. In Apache, we don't have an issue like this; it works by default.

Once installed correctly, the page will look as follows:





Note that this Memcached viewer is an outdated version created in 2008 by Harun Yayli and is not maintained anymore. Use it wisely.

As an alternative, you can also use `https://github.com/clickalicious/phpMemAdmin`.

Configuring Varnish as the Full Page Cache

Varnish may be one of the most interesting elements described in this book, besides Magento 2, of course. What is Varnish and why is it that important? Well, Varnish is like a Ferrari, very fast on the track but hard to maintain or tune. In technical terms, Varnish is an HTTP accelerator designed for heavy websites. Magento users love fast websites.

By default, Varnish support is now included in Magento 2. In Magento 1, we commonly used **Turpentine** by **Nexcess** (`https://github.com/nexcess/magento-turpentine`). The configuration of Varnish is not for the faint-hearted. Varnish includes a **Varnish Configuration Language** (**VCL**) file, which holds all the elements to be cached or not.

Setting up a Varnish server may be simple; configuring the VCL is not. Magento 2 provides a default VCL file that works out of the box, but be aware of any custom extensions or layout updates. Any customization has to be added manually in the VCL file before Varnish can cache them.



By default, Varnish does not support HTTPS; you may need an SSL proxy such as NGINX or Apache to do this.

Getting ready

For this recipe, we will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup including sample data connected to a Varnish server. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to create a Magento 2 Varnish setup. The following steps will guide you through this:

1. First, we need to install the Varnish server before we can connect it to Magento. Follow the next step on the shell:

   ```
   apt-get install –y apt-transport-https
   ```

   By default, all current Ubuntu versions support apt-transport-https.

2. Let's create a new Varnish repository using the following code:

   ```
   echo "deb https://repo.varnish-cache.org/ubuntu/ trusty
   varnish-4.1" | sudo tee -a  /etc/apt/sources.list.d/varnish-cache.
   list
   ```

3. Add the Varnish key to our system using the following command:

   ```
   curl https://repo.varnish-cache.org/GPG-key.txt | apt-key add -
   ```

4. Now we can update our server so that the Varnish software is made available for use. Run the following command:

   ```
   apt-get update && apt-get install -y varnish
   service varnish start
   ```

5. Now let's test our Varnish server using the following command:

   ```
   varnishd –V
   service varnish status
   netstat –anp | grep varnish
   ```

   As you can see, the Varnish server is running under ports 6081 and 6082.

6. Before we can use Varnish as a frontend server, we need to change the NGINX or Apache port. In NGINX, we use the following command:

   ```
   sed -i 's/80/8080/' /etc/nginx/conf.d/default.conf
   ```

   We are using port 8080 as an internal port.

   Your configuration file could look as follows:

   ```
   server {
     listen 8080;

     server_name  yourdomain.com;
   ```

7. Now let's update the Varnish server. We need to change the default port `6081` to `80`. Use the following command to change the `/etc/default/varnish` file:

   ```
   sed -i 's/6081/80/' /etc/default/varnish
   ```

8. By default, there is a small bug in the Ubuntu system that is using the new `systemd` setup. The `systemd` servers will not update their configuration script after a restart or reboot. Let's update this manually using the following command:

   ```
   sed -i 's/6081/80/' /lib/systemd/system/varnish.service
   ```

   Update the `systemd` process with the following code:

   ```
   systemctl daemon-reload
   ```

9. Next, we restart the Varnish and NGINX (or Apache) servers. Run the following command:

   ```
   service varnish restart && service nginx restart
   ```

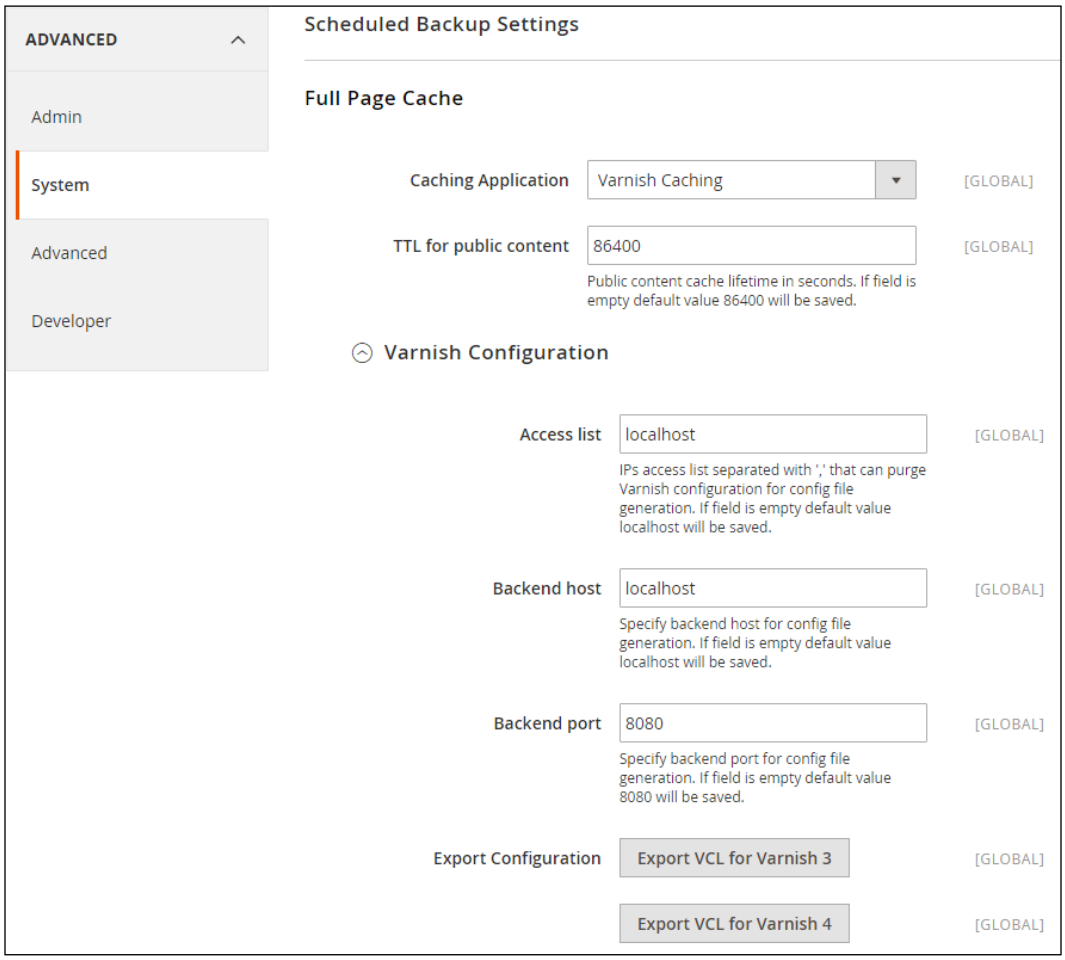
10. Now you can check whether Varnish and NGINX are running on the correct port. Use the following command:

    ```
    netstat -upnlt | egrep 'varnish|nginx'
    ```

11. Congratulations, Varnish is running on port 80 and NGINX is running on port 8080.

12. Now update Magento. Log in to the backend of your Magento site, navigate to **Stores** | **Configuration** | **Advanced** | **System** | **Full Page Cache**, and select **Varnish Caching** in the drop-down menu. If you are running Varnish on the same server as your website, you are okay with the localhost and backend port 8080. It's better to install Varnish on a single dedicated server. You may need to change these settings correctly. Export the correct VCL for the Varnish file. As we are using Varnish 4, we will download it.

Always make sure that Magento is running in the developer mode when setting up Varnish. When ready to launch, we can switch to the production mode:



13. Copy the file to the server and replace the current `/etc/varnish/default.vcl` file. Now open the file and change `backend default` to the following:

```
backend default {
  .host = "127.0.0.1";
  .port = "8080";
}
```

14. Now let's restart the Varnish server to use the current VCL setup and flush our Magento cache:

```
service varnish restart
php bin/magento cache:clean
php bin/magento cache:flush
```

15. Using the Magento 2 developer mode is necessary; it will show us an **X-Magento-Cache-Debug** notice. Use the following command to see if we have received a cache **HIT**:

```
curl -I http://yourdomain.com
```

    The output of this command should be as follows:

```
root@mage2cookbook:~# curl -I http://mage2cookbook.com
HTTP/1.1 200 OK
Date: Mon, 14 Dec 2015 19:15:40 GMT
Content-Type: text/html; charset=UTF-8
X-Frame-Options: SAMEORIGIN
X-Content-Type-Options: nosniff
X-XSS-Protection: 1; mode=block
X-Magento-Cache-Control: max-age=86400, public, s-maxage=86400
Pragma: no-cache
Expires: -1
Cache-Control: no-store, no-cache, must-revalidate, max-age=0
Vary: Accept-Encoding
Age: 1127
X-Magento-Cache-Debug: HIT
Accept-Ranges: bytes
Connection: keep-alive
```

16. Congratulations, you just finished configuring a Varnish server with Magento 2.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 16, we installed and configured Varnish to speed up the full page caching.

In steps 1 through 4, we added the official repository to our system and installed Varnish.

In steps 6 and 7, we changed the NGINX port to 8080 instead of 80, and the Varnish port to 80. Now, Varnish will be our gatekeeper after restarting the NGINX and Varnish servers.

In step 12, we told Magento to start communicating with the Varnish server so that all frontend cacheable data is stored here.

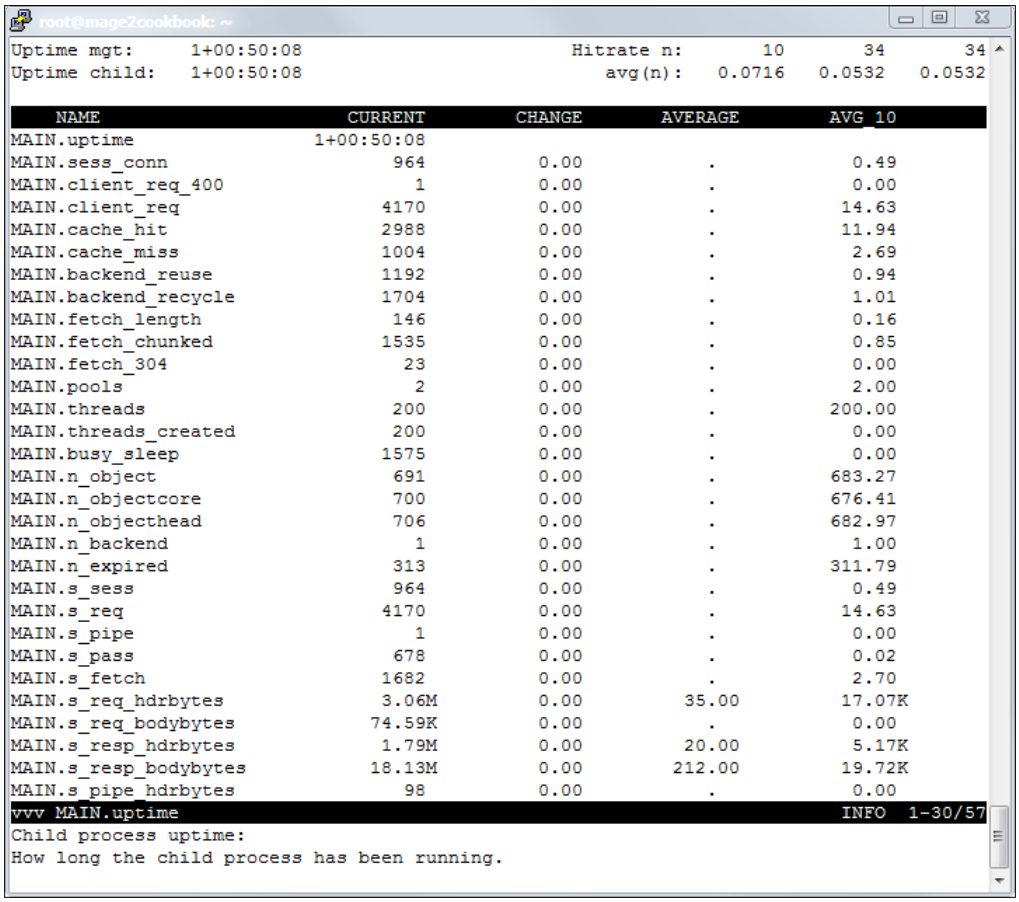
There's more...

The current lifetime of the cache is 86,400 seconds, which is one day. So, installing a cache warmer will speed up your pages after an automatic cache flush by Magento. Always keep in mind that by default, all the pages are cold (without a cache hit) and the first GET (page view) can take longer. Varnish needs to build up the cache before customers can benefit from it.

Check out the following Varnish tools to monitor all the incoming data live:

`varnishstat`

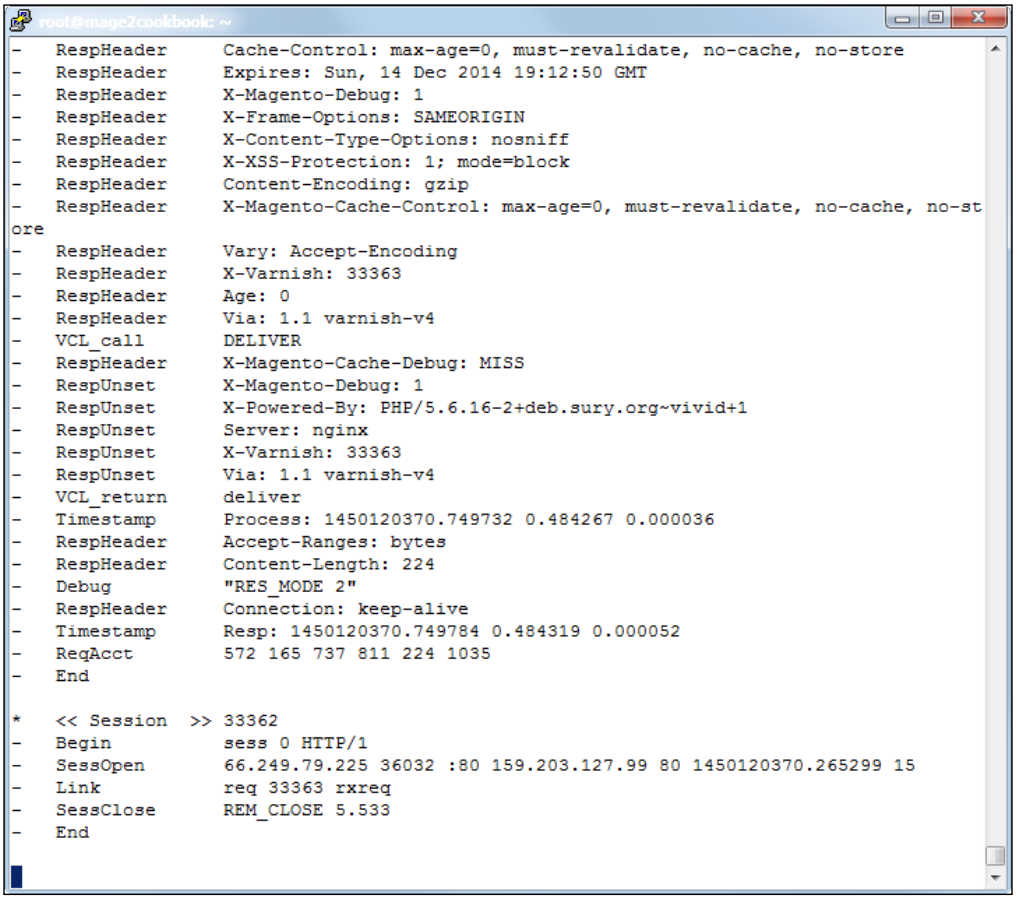
The output of this command will be as follows:



Now, let's execute the following command:

```
Varnishlog
```

The output of this command will be as follows:



Configuring Magento 2 with CloudFlare

Are you managing an international-based brand-serving customer all over the globe? Then, using a **Content Delivery Network** (**CDN**) is the best idea. CDNs are a well-known technique to manage high-traffic websites. It is commonly used to distribute static assets such as images, CSS, and JavaScript as quickly as possible to the nearest location of the customers, which decreases the download times of the website.

The modern CDNs have much more to offer than just serving the assets to the customer. Currently, they improve the user experience with optimized HTML output, merging and deferring JavaScript, TCP optimization, and much more. Basic or advanced security is also top-of-mind, such as (D)DoS protection, SSL, **Web Application Firewall** (**WAF**), and much more.



Before using a CDN on production, test which CDN provider fits best for your purpose. Make sure that the POP locations that they serve match your customer locations.

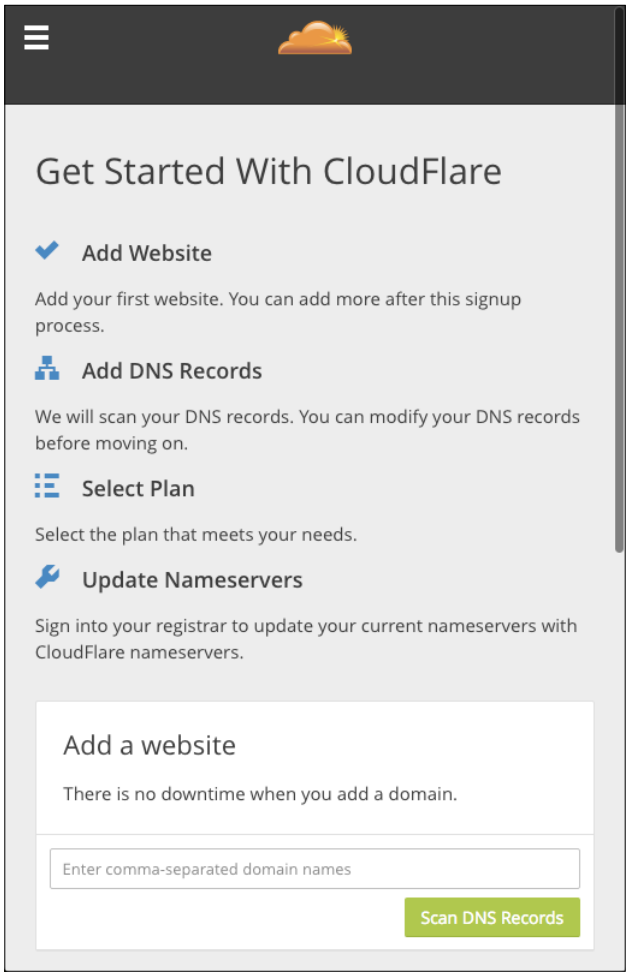
Getting ready

For this recipe, we will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup including sample data connected to the CloudFlare CDN. No other prerequisites are required.

How to do it...

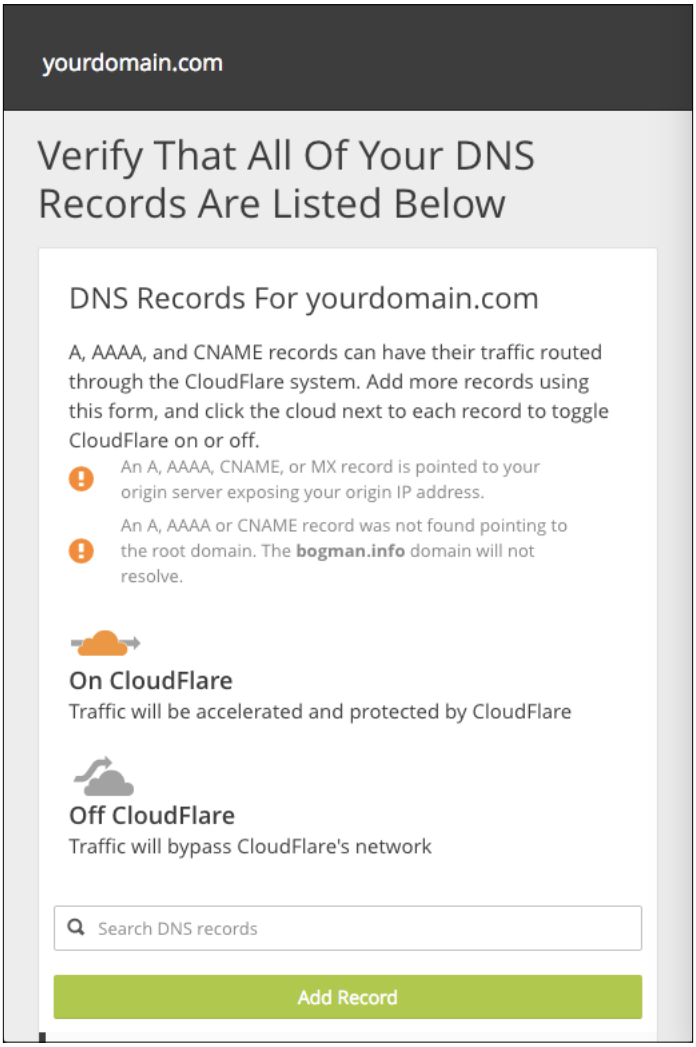
For the purpose of this recipe, let's assume that we need to create a Magento 2 Varnish setup. The following steps will guide you through this:

1. First, we need to create an account at CloudFlare. Go to `https://www.cloudflare.com/a/sign-up` and complete the supplied form.
2. Now add a website URL. Choose the default URL of your Magento website, (We can add more URLs under the same CloudFlare account later.) and press **Scan DNS Records**:

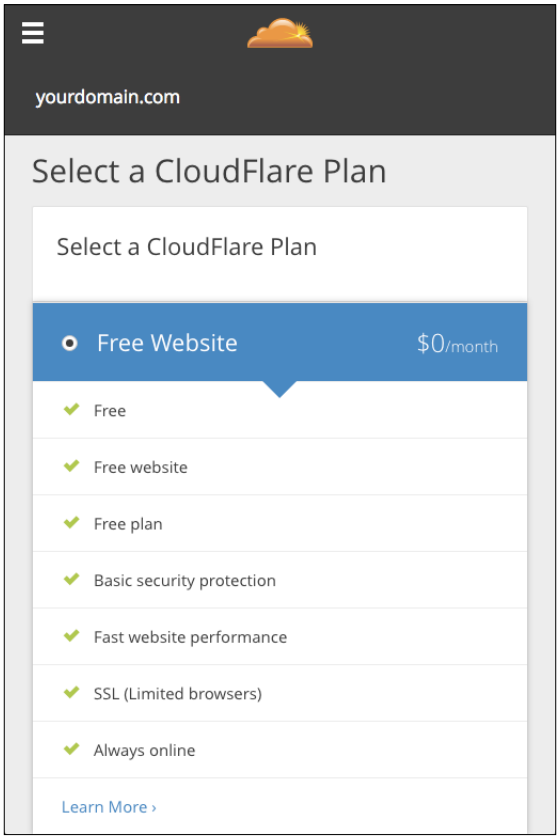


3. Once completed, we need to verify that all of our DNS records are listed. This step is really important so make sure to check your current DNS settings and compare or add them to your CloudFlare DNS setup. By default, CloudFlare cannot match all the DNS records automatically.

Changing your records in this screen will not change anything in production yet. We still need to adjust the primary and secondary **Nameservers** before everything works. We will do this as shown in the following screenshot:



4. Choose your CloudFlare plan. Let's start with the **Free Website** plan. In a production environment, upgrading to a **Pro** or **Business** account is simple; just complete the billing form and you are all set. All new features will be available on the fly and ready to use:



5. Now we need to update our Nameservers. CloudFlare will list the Nameservers that we need to complete the last step.

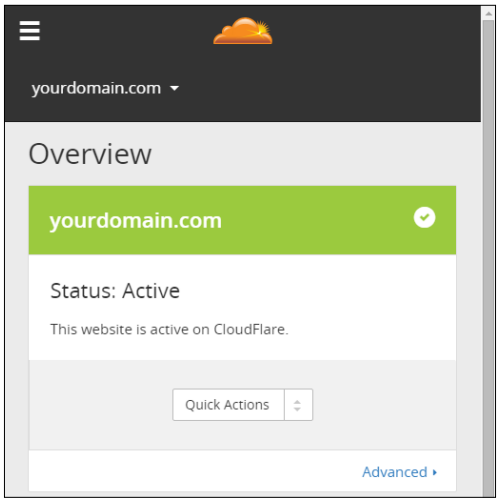
   Depending on your current DNS provider, this could be a simple or hard step. Changing the Nameservers is not always allowed by your provider.



When ordering a new domain, check whether your provider allows you to change the Nameservers. Choosing the correct domain provider is not always a simple job.

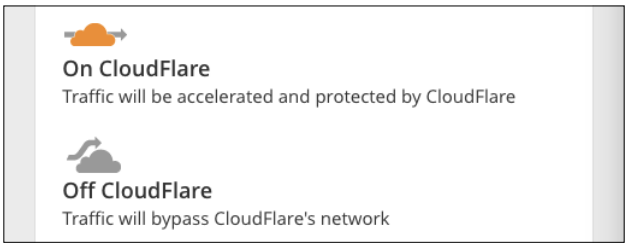
6. After changing the Nameservers, we need to wait a maximum of 24 hours. The time depends on how quickly your current DNS provider updates them.

   You can check your e-mail or refresh the CloudFlare dashboard to check whether your domain is **Active**:



7. Let's go to the DNS dashboard and check whether our domain name is served using the CloudFlare accelerated and protection technique.

   Once the cloud is orange, including an arrow passing through, then you are connected. Click on the cloud icon to change it:



8. Let's check whether the DNS server is serving the correct records and CloudFlare is working. Run the following command on the shell of your current server:

```
dig yourdomain.com NS +short
```

   The output looks as follows:

```
root@mage2cookbook:~# dig mage2cookbook.com NS +short
rocky.ns.cloudflare.com.
kate.ns.cloudflare.com.
```

You can also use the following command to check the IPs:

```
dig yourdomain.com +short
```

The output looks as follows:

```
root@mage2cookbook:~# dig mage2cookbook.com +short
104.18.56.216
104.18.57.216
```

9. Congratulations, you just finished configuring a CloudFlare CDN server with Magento 2.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 9, we installed CloudFlare as a CDN to optimize our worldwide performance.

In steps 1 through 8, we created an account and moved our domain to the CloudFlare DNS. In step 7, we activated the orange cloud in DNS to start using the CDN optimization.

There's more...

If you are interested in how to test the performance of the CloudFlare setup, stay put. Here are some basic commands that you can use:

```
time curl --I http://yourdomain.com
```

The output looks as follows:

```
time curl -I http://mage2cookbook.com
HTTP/1.1 200 OK
X-Magento-Cache-Debug: HIT
Server: cloudflare-nginx
CF-RAY: 257330a8444d2bd6-AMS

real    0m0.198s
user    0m0.006s
sys     0m0.005s
```

Without CloudFlare, it looks as follows:

```
time curl -I http://mage2cookbook.com
HTTP/1.1 200 OK
X-Magento-Cache-Debug: HIT


real    0m0.253s
user    0m0.011s
sys     0m0.010s
```

Keep in mind that this current website is using Varnish. Our Magento 2 server is located in New York while our test server is located in Amsterdam. As you can see, in this test, we save `0.055s`. This test is done from server to server. Doing a test from server to real browser clients on a desktop, or mobile device, will result in larger numbers. Larger numbers result in slower connections, which will result in lesser user experience.

Another great load testing tool is Siege. Using Siege helps you to understand how many concurrent clients can visit your website during high loads. We will just cover the basics of Siege here. Install Siege on another Droplet somewhere else in the world. Use the following command to install Siege:

```
apt-get install siege
```

Now let's run the following command. We will simulate 50 concurrent users for a period of three minutes. The `-d` option is the internal delay, in seconds, for which the users sleeps:

```
siege -c50 -d10 -t3M http://yourdomain.com
```

Without CloudFlare, the output looks as follows:

```
siege -c50 -d10 -t3M http://mage2cookbook.com


Transactions:                   1732 hits
Availability:                 100.00 %
Elapsed time:                 179.79 secs
Data transferred:              15.47 MB
Response time:                  0.18 secs
Transaction rate:               9.63 trans/sec
Throughput:                     0.09 MB/sec
Concurrency:                    1.71
Successful transactions:        1732
```

```
Failed transactions:               0
Longest transaction:            0.34
Shortest transaction:           0.15
```

With CloudFlare, the output looks as follows:

```
siege -c50 -d10 -t3M http://mage2cookbook.com

Transactions:                   1716 hits
Availability:                 100.00 %
Elapsed time:                 179.74 secs
Data transferred:              14.05 MB
Response time:                  0.10 secs
Transaction rate:               9.55 trans/sec
Throughput:                     0.08 MB/sec
Concurrency:                    0.96
Successful transactions:        1716
Failed transactions:               0
Longest transaction:            0.62
Shortest transaction:           0.08
```

In the last test, we can see that the **Response time** is 0.10 seconds compared to 0.18 seconds.

The test Droplet that we used was located in Amsterdam using two CPUs and 4 GB memory. For a real browser test, it is best to use tools such as Chrome developer tools. Those timings are more accurate and give you a better idea of the real user experience. Testing on a mobile device is a totally different ball game and is out of the scope of this book.

Configuring optimized images in Magento 2

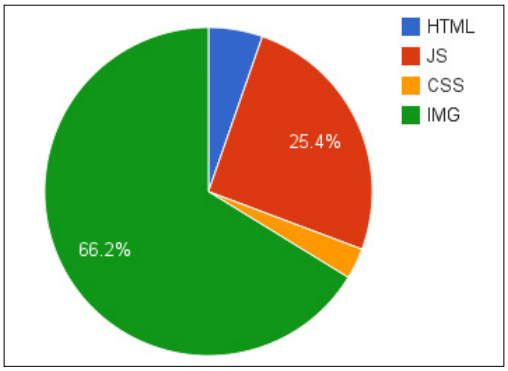
Running a Magento store can be difficult—configuring the server, creating store views, and adding categories and products. Everyone knows that every product needs at least one product image. In some setups, we even have more than one. From this single master image, multiple thumbs are created, such as base image, small image, swatch image, and thumbnail.

By default, images are not optimized for the web when saving them in Photoshop. Images shown on a website are not exactly the same as images for print. The **Exchangeable Image File** (**EXIF**) data, for example, is not needed, and by removing this metadata, you can save lots of bytes. The smaller the image, the faster it's shown in the browser of the customer.

Here is an example of EXIF data (not optimized). The current file size is 620,888 bytes:

```
EXIF Data

File:
  ExifByteOrder: Big-endian (Motorola, MM)
  CurrentIPTCDigest: 50bb6030364fbdfb1842e98de0e81efe
  ImageWidth: 1024
  ImageHeight: 768
  EncodingProcess: Baseline DCT, Huffman coding
  BitsPerSample: 8
  ColorComponents: 3
  YCbCrSubSampling: YCbCr4:4:4 (1 1)
```

Storing all these images on your Magento server will result in slower pages and slower rendering of them. Almost 70% of all the content from a single page is filled with images:



So, optimizing images is not only important for desktop users, but also for mobile users. The less data they need to download, the better the user experience. Besides this, it's great for your search ranking optimization, battery consumption, and bandwidth/data plan.



By default, Magento 1 did not optimize the created catalog and CMS images. This could be optimized using software binaries such as **jpegtran**, **jpegoptim**, and **OptiPNG**.

If you don't have the option to install these, you could use **Rapido** image optimizer (`https://www.rapido.nu/`), which is a SaaS-based image optimizer for Magento. It is also the only optimizer that checks for the best available optimization per image and tunes all the images in the image cache directory on a daily basis.

Getting ready

For this recipe, we will use a Droplet created in *Chapter 2*, *Magento 2 System Tools*, at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup including sample data for image optimization. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to optimize all Magento 2 images. The following steps will guide you through this:

1. By default, Magento 2 now uses an optimized GD2 PHP library, which is installed during the installation. The following command should be used during installation:

   ```
   apt-get install php5-gd
   ```

   Instead, we can also use the following command:

   ```
   apt-get install php7.0-gd
   ```

   To make sure that GD is installed correctly, run the following command:

   ```
   php -i |  grep gd
   ```

   Run the following command to test which version of GD you are running:

   ```
   echo '<?php var_dump(gd_info()); ?>' > gd.php
   php gd.php
   ```

   The output looks as follows:

   ```
   root@mage2cookbook:/var/www/magento2/pub# php gd.php
   array(13) {
     ["GD Version"]=>
     string(9) "2.1.1-dev"
   ```

2. Now let's log in to the backend of your Magento 2 control panel and navigate to the **Stores** | **Configuration** | **Advanced** | **Developer** section.

   Here, you will find the following options:

   - **Template Settings**
   - **JavaScript Settings**
   - **CSS Settings**
   - **Image Processing Settings**
   - **Static Files Settings**

We first make sure that our `Image Adapter` is set to `PHP GD2`. We don't use the **ImageMagick** setting here. In the *There's more...* section of this recipe, you can find more information on this.

3. Next, we change the **CSS Settings**, **JavaScript Settings**, **Static Files Settings**, and **Template Settings**. In the **Template Settings**, adjust **Minify HTML** to **YES**.

   Next, enable **JavaScript Bundling**, **Merge JavaScript**, and **Minify JavaScript** to **YES**.

   Next, enable **Merge CSS** and **Minify CSS** to **YES**.

   Last but not least, enable **Static Files** to **YES**. Save all the settings.

4. Before we have all the optimized code available, we need to recompile all static assets. Let's assume that we are preparing for production. Run the following code on the shell:

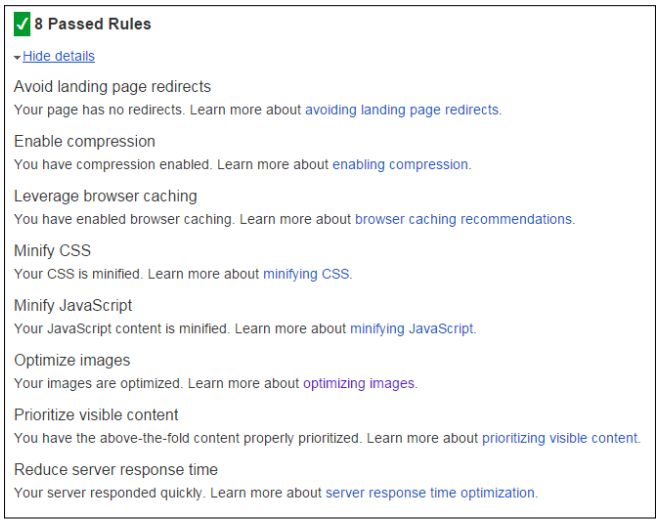
   ```
   php bin/magento deploy:mode:set production
   ```

   Before running the code, make sure to change your Apache or NGINX configuration to `set $MAGE_MODE production;(Nginx)` or `SetEnv MAGE_MODE production (Apache)`. In *Managing Magento 2, set mode (MAGE_MODE)* recipe of *Chapter 1*, *Magento 2 System Tools*, we covered everything in detail.

   After running this code, make sure to change your user and group permissions. Run the following command:

   ```
   chown -R www-data:www-data *
   ```

5. Congratulations, you just finished configuring optimized images, JavaScript, and CSS with Magento 2. The following image is a screenshot from the Google PageSpeed insight page (`https://developers.google.com/speed/pagespeed/insights/`), where you can test your own pages:



How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 5, we configured the image optimizing technique, which is now by default available in Magento 2.

In step 1, we installed the PHP GD library and tested it. In step 2, we configured the Magento backend to start using the optimization by selecting the GD option and additional merging for JS and CSS.

In step 4, we ran the `bin/magento` production mode to start optimizing all of the code.

There's more...

Besides the `PHP GD2` library, Magento 2 offers the option to switch to the ImageMagick library (`http://www.imagemagick.org/`). In basis, this library works great for image optimization, but during some tests, we found out that the GD2 had a smaller output. Besides the difference in size, ImageMagick generated files in the baseline (renders top-down) format instead of the progressive (renders from blurry to sharp) format that GD2 does.

Using progressive is the best commonly used format for web pages. It starts as a blurry image and turns sharp when done. It improves the user experience by loading the images incrementally.

If you still want to use ImageMagick, here are some basic commands. Run the following code on your shell. Then, switch to ImageMagick in your Magento configuration backend:

```
apt-get install -y imagemagick --fix-missing
apt-get install -y php5-imagick
service php-fpm restart
php -i | grep imagick
```

Configuring Magento 2 with HTTP/2

December 17, 2015, is the day Google mentioned that HTTPS pages have top priority by default. Many Magento websites still use the default SSL pages or, even worse, don't use SSL at all.

Well, this will change now if your website depends on Google's search ranking. Using HTTP/2 in your setup is a must for high-performing and secure websites. The new protocol will be the new standard for fast and secure browsing.

HTTP/2 has many new benefits such as multiple TCP connections, cache pushing (server push), data compression, and much more. By default, HTTP/2 does not need SSL, but many browsers out there will support it only when configured using SSL. NGINX, for example, supports HTTP/2 only when configured including SSL; Apache, on the other hand, supports both, with or without SSL.

So, it is mandatory that we start using HTTP/2 including SSL for a safer and faster web.

Getting ready

For this recipe, we will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup including sample data for HTTP/2. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to create a Magento 2 using HTTP/2 including SSL. The following steps will guide you through this:

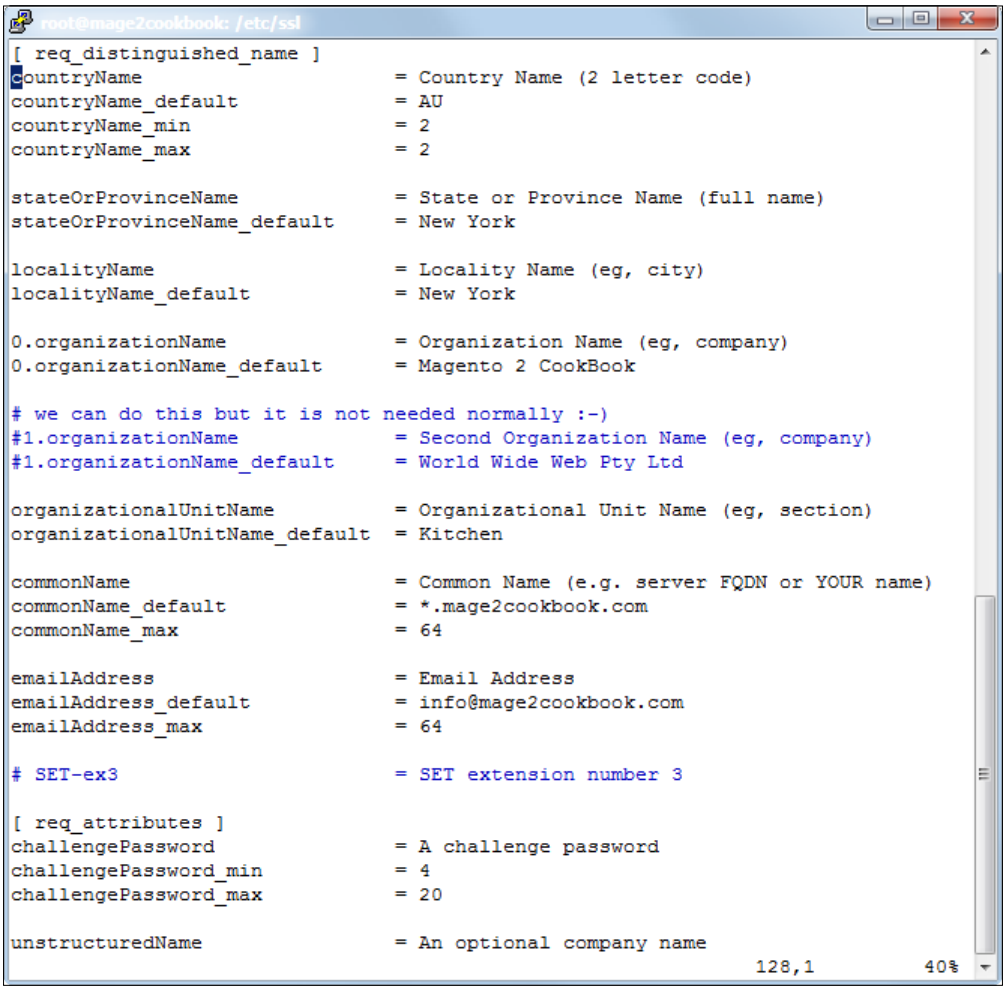
1. First, we need to configure and create an SSL certificate. Open `openssl.conf` located in `/etc/ssl` with your favorite editor:

   `vi /etc/ssl/openssl.conf`

   Go to line 127 `[ req_distinguished_name ]` and change or add the settings regarding your company and domain. Change the following lines; here is an example:

```
countryName_default             = Some-CountryName
stateOrProvinceName_default     = Some-State
localityName_default            = Some-CityName
0.organizationName_default      = Some-CompanyName
organizationalUnitName_default  = Some-DepartmentName
commonName_default              = Some-DomainName
emailAddress_default            = Some-Email
```

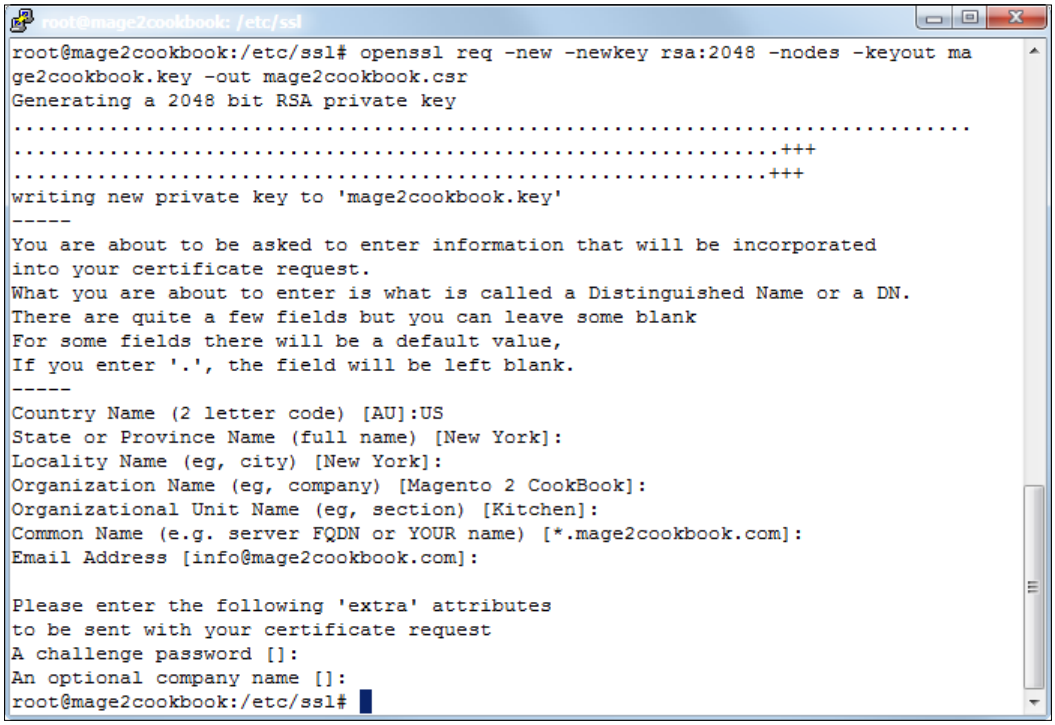
The following screenshot depicts an example of the same:



2. After saving your `openssl.conf` file, we can create the `*.csr` and `*.key` files. We need the `*.csr` file and send it to our SSL provider. You may pick any SSL provider. Run the following command to generate them:

   `openssl req -new -newkey rsa:2048 -nodes -keyout yourname.key -out yourname.csr`

Change `yourname` with any given name. When running the command, questions will be asked; hit enter to prompt when the default is okay. Here is a screenshot of the process:



Check your certificate before you submit it. Run the following code to confirm your settings:

```
openssl req -in yourname.csr -text -noout
```

In this example, we used a wildcard SSL certificate. The wildcard starts with `*.yourdomain.com`. We use a wildcard to create unlimited subdomain names, which we will use later to create localized domain names such as `de.yourdomain.com` or `fr.yourdomain.com`.

If you don't need a wildcard domain and would rather use `www.yourdomain.com` or a naked domain such as `yourdomain.com`, commit this in your `openssl.conf` file.

3. Submit the `*.csr` file to your SSL provider and continue all the steps necessary. Depending on your provider, it can take minutes or hours. For the purpose of demonstration, we used `https://www.buy-certificate.com/`. On this website, there is an option to create a 30-day free SSL certificate. The whole process takes two to three minutes.

4. Now let's download the ZIP file from your mail account to your Droplet and open it in your root directory. Unzip the `yourdomain-com.zip` file by running the following command:

   ```
   unzip mage2cookbook-com.zip
   ```

5. Your ZIP contains the following files (or similar ones):

   ```
   Archive:   mage2cookbook-com.zip
   inflating: mage2cookbook-com.cer
   inflating: readme.txt
   inflating: RapidSSLSHA256CA-G3.cer
   inflating: GeoTrustGlobalCA.cer
   inflating: siteseal_nw4all.html
   ```

6. Now we will merge the certificate and CA authority key. Use the following command on the shell:

   ```
   cat mage2cookbook-com.cer RapidSSLSHA256CA-G3.cer > mage2cookbook-com-2015.cert
   ```

7. Now let's copy the `mage2cookbook-com-2015.cert` file to `/etc/ssl/cert` using the following command:

   ```
   cp mage2cookbook-com-2015.cert /etc/ssl/cert
   ```

8. Move the generated `mage2cookbook.key` to `/etc/ssl/private` using the following command: (Let's assume that you are running the `openssl reg` command in the `/etc/ssl` directory.)

   ```
   mv /etc/ssl/mage2cookbook.key /etc/ssl/private
   ```

9. Now let's create a symbolic link of the keys. Run the following command:

   ```
   ln -s /etc/ssl/private/mage2cookbook-com.key /etc/ssl/mage2cookbook-com.key
   ln -s /etc/ssl/certs/mage2cookbook-com-2015.cer /etc/ssl/mage2cookbook-com.cert
   ```

   Try to list all the files in the `/etc/ssl` directory using the following command. You should see the names of the files that we linked:

   ```
   ll /etc/ssl
   ```

10. Now let's go to the NGINX configuration directory and update `default.conf` in `/etc/nginx/conf.d`. Open the `default.conf` file and change it with the following settings:

    ```
    upstream fastcgi_backend {
      server  127.0.0.1:9000;
    }
    ```

```
server {
  listen       80;
  listen       443 ssl http2;

  server_name  yourdomain.com;

  set $MAGE_ROOT /var/www/html;
  set $MAGE_MODE developer;

  ssl_certificate /etc/ssl/yourdomain-com.cert;
  ssl_certificate_key /etc/ssl/yourdomain-com.key;

  include /var/www/html/nginx.conf.sample;

  access_log /var/log/nginx/access.log;
  error_log /var/log/nginx/error.log;

  location ~ /\.ht {
    deny  all;
  }
}
```

As you can see, we created a new `listen 443 ssl http2` section. Besides the `listen` section, we also created `ssl_certificate` and `ssl_certificate_key`.

The `http2` flag in the `listen` section covers the entire `HTTP/2` configuration.

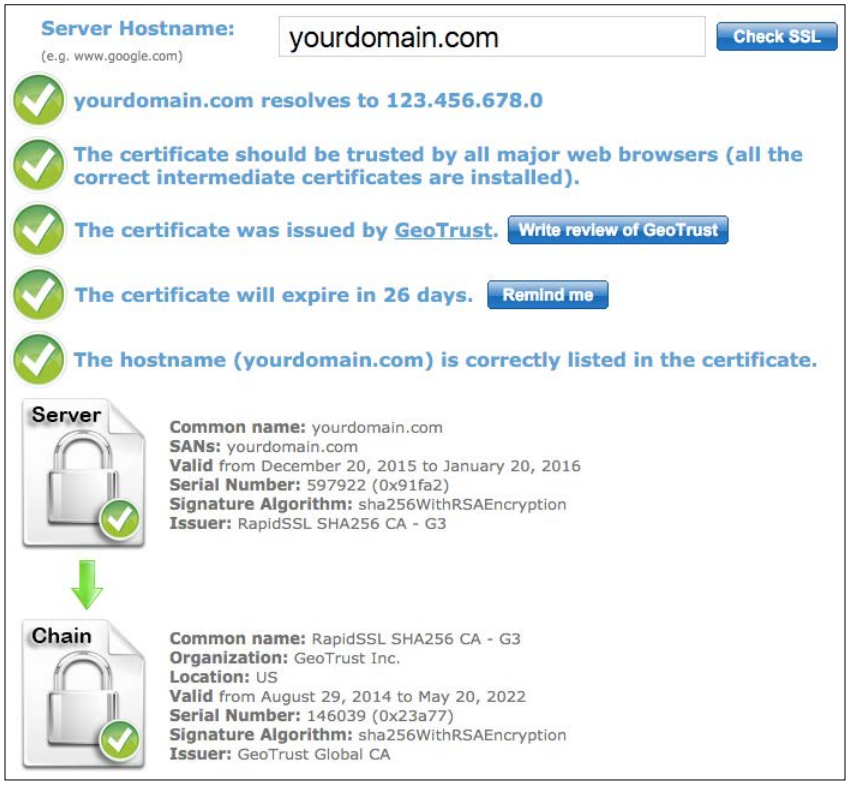
11. Now, all you have to do is restart NGINX to use your new settings. Run the following command:

```
service nginx restart
```

12. Before we can test Magento in our browser, we need to flush and clean the cache. We also need to update Magento's configuration with the new secure URL. Run the following commands:

```
php bin/magento setup:store-config:set --base-url-secure="https://
yourdomain.com/"
php bin/magento setup:store-config:set --use-secure-admin="1"
php bin/magento setup:store-config:set --use-secure="1"


php bin/magento setup:static-content:deploy
php bin/magento cache:clean
php bin/magento cache:flush
```

Next, we go to `https://www.sslshopper.com/ssl-checker.html` and check our setup. Commit your domain name in the box and submit. If everything is configured correctly, the output should look as follows:



13. Congratulations, you just finished configuring HTTP/2 with Magento 2. To test your HTTP/2 protocol, go to `https://tools.keycdn.com/http2-test` and submit `yourdomain.com`.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 13, we created an SSL certificate, which we need to configure HTTP/2 in NGINX.

In step 1, we configured the `openssl.conf` file with our domain and business data.
In step 2, we created a certificate request that we will be sending to the SSL provider.

In step 4, we downloaded the provided certificate file and unzipped the content. In step 6, we merged the domain certificate and certificate authority file into a single one. This file was then copied to the SSL directory.

In step 6, we copied the private key to the SSL private directory before we started creating a symlink of the private key and merge certificate in the `/etc/ssl` directory. The main reason why we stored the files in the private and cert directory is maintenance. When replacing or updating keys or certificates in the future, we only need to create a new symlink while our NGINX or Apache configuration can stay the same.

In step 10, we updated the NGINX configuration and added the `ssl_certificate` parameter including the correct SSL directory. In the `listen` parameter, we added the `http2` flag behind the `443 ssl` flag and restarted the NGINX server.

In step 12, we configured the HTTPS domains using the `bin/magento setup:store-config:set` option.

There's more...

Setting up Magento 2 including SSL and HTTP/2 is pretty straightforward. However, by default, the only URLs that serve HTTPS are `customer/account/login/`, `customer/account/create/`, `checkout/`, `checkout/cart/`, `contact/`, and `sales/guest/form/`. Currently, it's mandatory to have a full HTTPS website (Google: HTTPS as a ranking signal).

It is easy to update the Magento configuration to serve every URL on HTTPS using the following command:

```
php bin/magento setup:store-config:set --base-url="https://yourdomain.com/"
php bin/magento setup:static-content:deploy
php bin/magento cache:clean
php bin/magento cache:flush
```



When using Varnish in your setup, make sure to offload your SSL. Varnish does not support SSL. The best common setup is NGINX as an SSL Proxy on the frontend, rather than Varnish, and in the backend, NGINX or Apache.

Configuring Magento 2 performance testing

Performance, performance, performance! This may be one of the most used words in the Magento 1 period. Every Magento website benefits from a great performing platform, and every customer loves it.

However, before we can create a great performing website, all sorts of elements have to be conquered. One of the missing elements in Magento 1 was creating sample data based on a company profile. As every Magento website is unique, so is performance testing based on their profile. Some companies have only one website, store catalog, and store view. Others have 800 websites and are converting one million orders per day.

Magento 2 now provides us with the option to run a profile that creates sample data based on your company profile. By default, there are four sample data profiles. Depending on the profile, creating the sample data may take a long time, so keep this in mind.

After creating the sample data based on your profile, you can start doing performance-based testing. Based on this profile, you may need to scale up or tune one of the components before going into production.

Getting ready

For this recipe, we will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean, `https://www.digitalocean.com/`. We will be using NGINX, PHP-FPM, and a Composer-based setup including Magento 2 (without sample data). No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to run a Magento 2 performance test. The following steps will guide you through this:

1. Before we can start generating a profile, we need a clean setup. Run the following command to start with a clean Magento 2 instance:

```
rm -rf * /var/www/html

composer create-project --repository-url=https://repo.magento.com/
magento/project-community-edition /var/www/html --prefer-dist

chown -R www-data:www-data /var/www/html
```

2. Now let's install Magento 2 without sample data. Run the following command. We will be using the same procedure as we used in *Installing Magento 2 sample data via the command line* recipe of *Chapter 1*, *Magento 2 System Tools*:

```
bin/magento setup:install \
        --db-host=localhost \
        --db-name=<your-db-name> \
        --db-user="<db-user>" \
        --db-password="<db-password>" \
        --backend-frontname=<admin-path> \
        --base-url=http://yourdomain.com/ \
        --admin-lastname=<your-lastname> \
        --admin-firstname=<your-firstname> \
        --admin-email=<your-email> \
        --admin-user=<your-admin-user> \
        --admin-password=<your-password> \
        --use-rewrites=1 \
        --cleanup-database \
```

3. After completing the install via the shell, we need to compile our code before we can start using it. Run the following command on the shell:

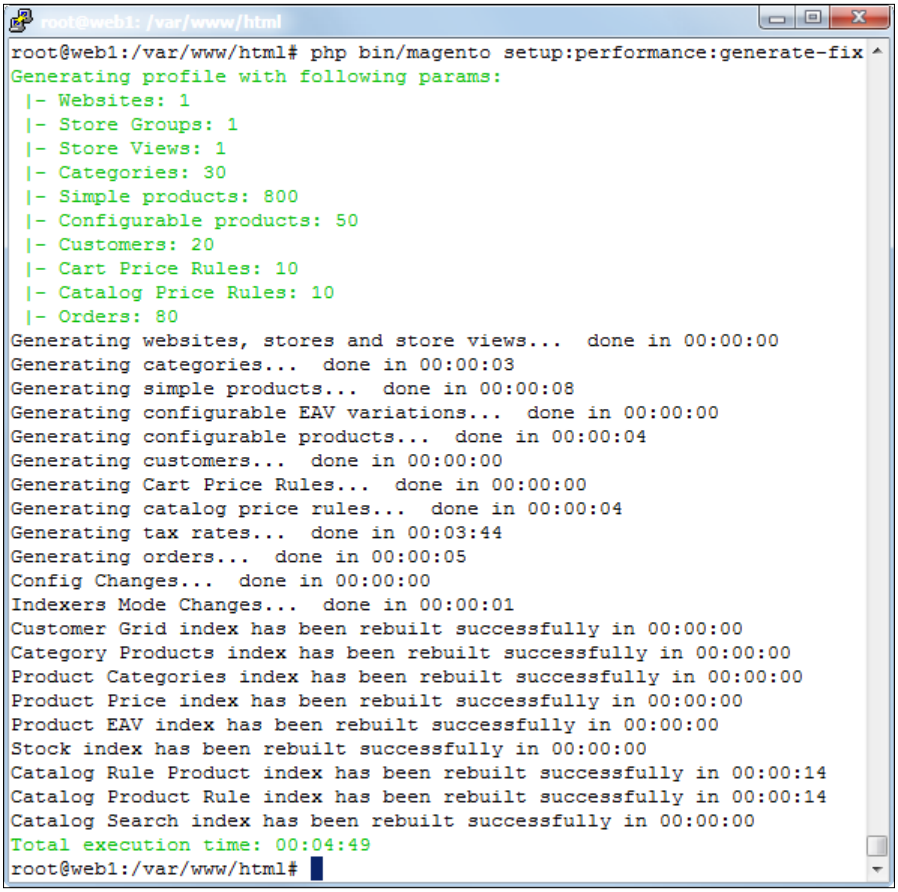
   ```
   php bin/magento setup:di:compile-multi-tenant
   chown -R www-data:www-data /var/www/html
   ```

4. Check in your browser whether everything is working correctly before starting the small data profile. We use the small data profile because it does not take too long to run. Run the following command:

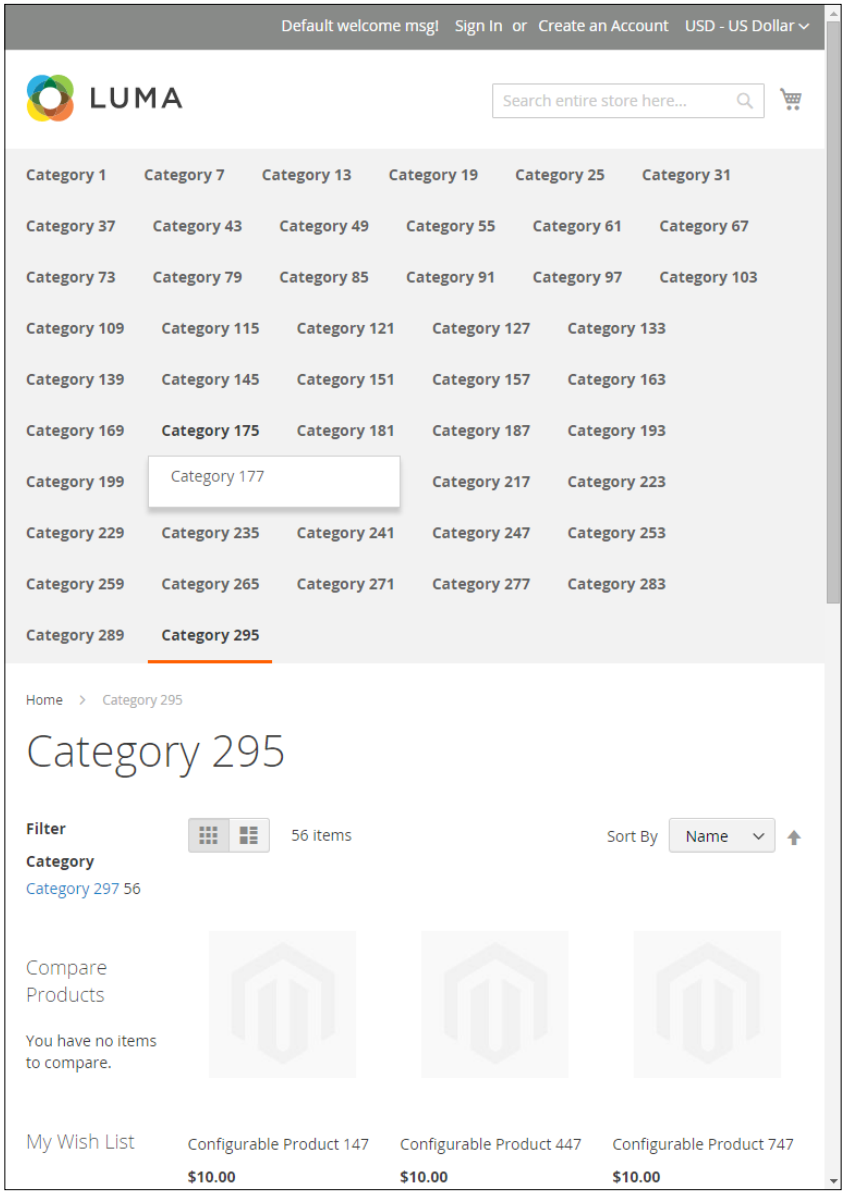
   ```
   php bin/magento setup:perf:generate-fixtures /var/www/html/setup/
   performance-toolkit/profiles/ce/small.xml
   ```

5. All data profiles are located in the `setup/performance-toolkit/profiles/` directory. Depending on whether you are running CE or EE, you need to choose one of the subdirectories.

6. Depending on the profile that you ran, the output looks as follows:



7. Now you can open a browser and surf to `yourdomain.com`, and check whether everything is correct. You can also log in to the backend of your Magento website and check all the created settings.
8. Congratulations, you just finished creating profiles for performance testing with Magento 2. Now you can choose your favorite performance test tool and test your server:



How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 8, we created sample data to test the performance of the Magento 2 website.

In steps 1 and 2, we started with a clean Magento 2 setup using Composer and `bin/magento setup:install`.

In step 3, we needed to compile our Magento code base before we could input the sample data.

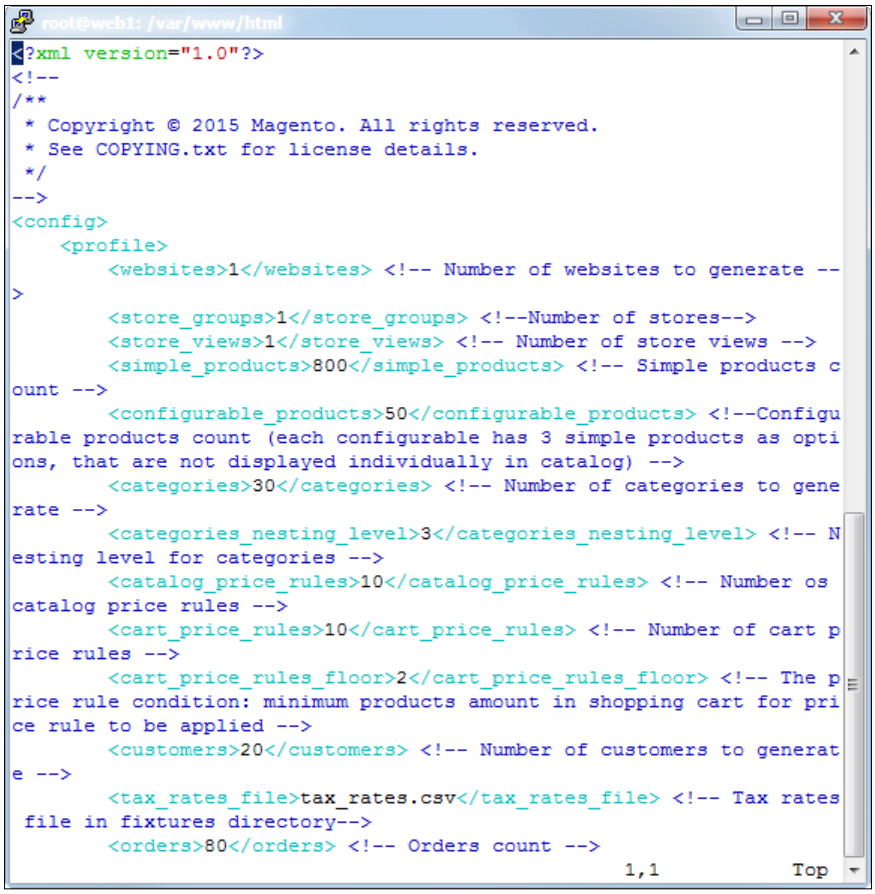
In step 4, we ran a generated fixture profile using the `bin/magento setup:perf` option. Depending on the profile, Magento will start creating all of the required data. Running a large profile set can take up to several hours. Adjusting the profile is self-explanatory.

There's more...

If the default profile does not fit your needs, you can create a custom profile. For example, copy the `small.xml` file to `mycustom.xml` in the same directory and open the file in your favorite editor. Run the following command on the shell:

```
cd /var/www/html/setup/performance-toolkit/profiles/ce/small.xml
cp small.xml mycustom.xml
vi mycustom.xml
```

Now you can change data such as `websites`, `store_groups`, `store_views`, `simple_products`, `configurable_products`, `categories`, `categories_nesting_level`, `catalog_price_rules`, `catalog_target_rules`, `cart_price_rules`, `cart_price_rules_floor`, `customers`, `tax_rates_file`, and `orders`:



Save your file, and use the following command:

```
Esc + :wq
```

Before we start, you need to check whether your setup is clean. Otherwise, start with step 1 of the recipe.

Now we can run the `mycustom.xml` file with the following command:

```
php bin/magento setup:perf:generate-fixtures /var/www/html/setup/
performance-toolkit/profiles/ce/mycustom.xml
```



Running the profile can take some time. Be aware to adjust your server setup accordingly. An extra large profile can take up to a couple of hours to create.

3
Creating Catalogs and Categories

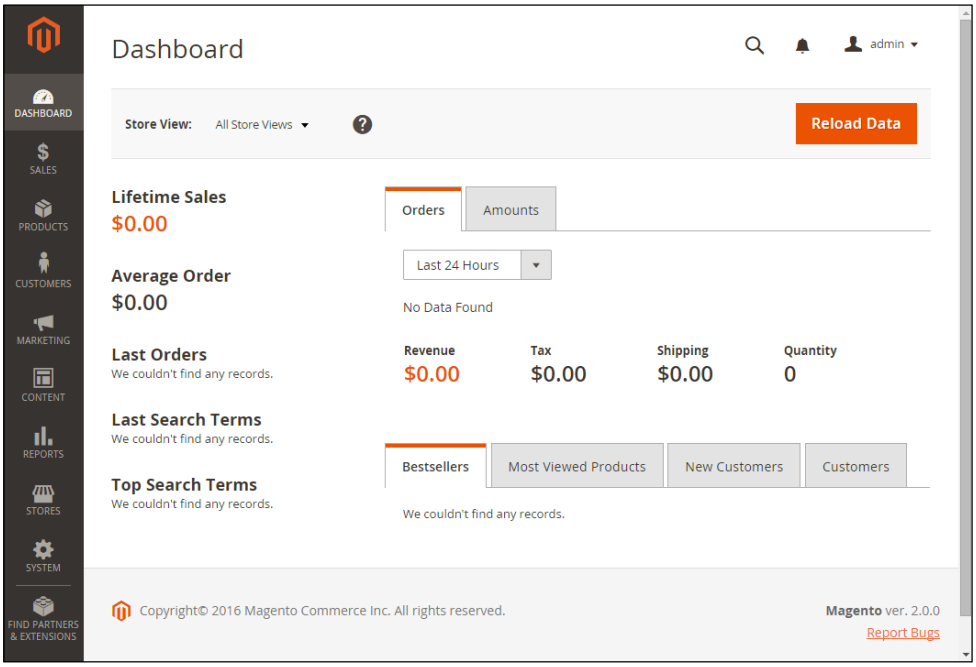
In this chapter, we will cover the basic tasks related to creating a catalog and products in Magento 2. You will learn how to:

- Create a Root Catalog
- Create subcategories
- Manage attribute sets
- Create products
- Manage products in a catalog grid

Introduction

This chapter explains how to set up a vanilla Magento 2 store. If Magento 2 is totally new to you, then lots of new basic whereabouts are pointed out. Are you currently working with Magento 1? If so, not much has changed since then.

The new backend of Magento 2 is the biggest improvement of them all. The design is built responsively and has a great user experience. Compared to Magento 1, this is a great improvement. The menu is located vertically on the left of the screen and works great on desktop and mobile environments:

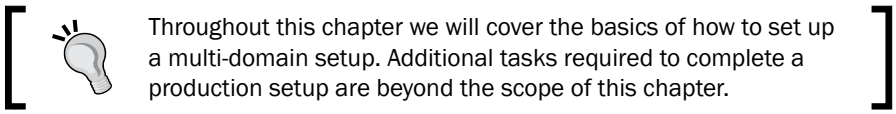


Within this chapter, we will learn how to set up a website with multiple domains using different catalogs and products. Depending on the website, store, and store view setup, we can create different subcategories, URLs, and products for any domain name.

There are a number of different ways customers can browse your store, but one of the most effective is **layered navigation**. Layered navigation is located in your catalog and holds product features to sort or filter. We will learn how to create product attributes for use in layered navigation.

Every website benefits from great **search engine optimization** (**SEO**). We will learn how to define catalog URLs for catalogs.

Without products, the most important element of the website is missing. We will be creating different types of product in our multi-website setup.



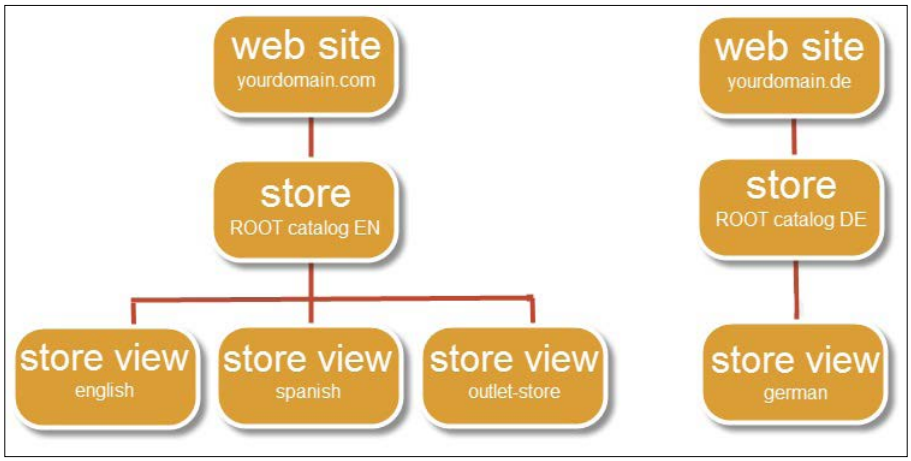
Create a Root Catalog

The first thing we need to do when setting up a vanilla Magento 2 website is define our **website**, **store**, and **store view** structure.

So what is the difference between website, store, and store view, and why is it important?

- Website is the top-level container and the most important of the three. It is the parent level of the entire store and used, for example, to define domain names, different shipping methods, payment options, customers, orders, and so on.
- Stores can be used to define, for example, different store views with the same information. A store is always connected to a Root Catalog that holds all the categories and subcategories. One website can manage multiple stores, but every store has a different Root Catalog. When using multiple stores, it is not possible to share one basket. The main reason for this has to do with the configuration setup, where shipping, catalog, customer, inventory, taxes, and payment settings are not shareable between different sites.
- Store view is the lowest level and mostly used to handle different localizations. Every store view can have a different language. Besides using store views just for localizations, they can also be used for **Business to Business** (**B2B**), hidden private sales pages (with `noindex` and `nofollow`), and so on. The option where we use the Base Link URL, for example, (`yourdomain.com/myhiddenpage`) is easy to set up.

The website, store, and store view structure is shown in the following image:



Getting ready

To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean (`https://www.digitalocean.com/`). We will be using an NGINX, PHP-FPM, Composer-based setup with Magento 2 preinstalled. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to create a multi-website setup including three domains (`yourdomain.com`, `yourdomain.de`, and `yourdomain.fr`) and separated Root Catalogs. The following steps will guide you through this:

1. First we need to update our NGINX. We need to configure the additional domains before we can connect them to Magento. Make sure that all domain names are connected to your server and DNS is configured correctly.

   Go to `/etc/nginx/conf.d`, open the `default.conf` file, and include the following content at the top of your file:

```
map $http_host $magecode {
  hostnames;
    default base;
    yourdomain.de de;
    yourdomain.fr fr;
}
```

2. Your configuration should look like this now:

```
map $http_host $magecode {
  hostnames;
    default base;
    yourdomain.de de;
    yourdomain.fr fr;
}

upstream fastcgi_backend {
  server  127.0.0.1:9000;
}
server {
  listen  80;
  listen   443 ssl http2;

  server_name  yourdomain.com;

  set $MAGE_ROOT /var/www/html;
```

```
  set $MAGE_MODE developer;

  ssl_certificate /etc/ssl/yourdomain-com.cert;
  ssl_certificate_key /etc/ssl/yourdomain-com.key;

  include /var/www/html/nginx.conf.sample;

  access_log /var/log/nginx/access.log;
  error_log /var/log/nginx/error.log;

  location ~ /\.ht {
    deny  all;
  }
}
```

3. Now let's go to the Magento 2 configuration file in `/var/www/html/` and open the `nginx.conf.sample` file. Go to the bottom and look for:

   ```
   location ~ (index|get|static|report|404|503)\.php$
   ```

   Now we add the following lines to the file under `fastcgi_pass   fastcgi_backend;`:

   ```
   fastcgi_param MAGE_RUN_TYPE website;
   fastcgi_param MAGE_RUN_CODE $magecode;
   ```

4. Your configuration should look like this now (this is only a small section of the bottom):

   ```
   location ~ (index|get|static|report|404|503)\.php$ {
     try_files $uri =404;
     fastcgi_pass   fastcgi_backend;

     fastcgi_param MAGE_RUN_TYPE website;
     fastcgi_param MAGE_RUN_CODE $magecode;

     fastcgi_param  PHP_FLAG  "session.auto_start=off \n
       suhosin.session.cryptua=off";
     fastcgi_param  PHP_VALUE "memory_limit=256M \n
       max_execution_time=600";
     fastcgi_read_timeout 600s;
     fastcgi_connect_timeout 600s;
     fastcgi_param  MAGE_MODE $MAGE_MODE;

     fastcgi_index  index.php;
     fastcgi_param  SCRIPT_FILENAME
       $document_root$fastcgi_script_name;
     include    fastcgi_params;
   }
   ```

The current setup uses the `MAGE_RUN_TYPE website` variable. You may change `website` to `store`, depending on your setup preferences. When changing the variable, you need your `default.conf` mapping codes as well.

5. Now all you have to do is restart NGINX and PHP-FPM to use your new settings. Run the following command:

   ```
   service nginx restart && service php-fpm restart
   ```

6. Before we continue, we need to check if our web server is serving the correct codes. Run the following command in the Magento 2 web directory:

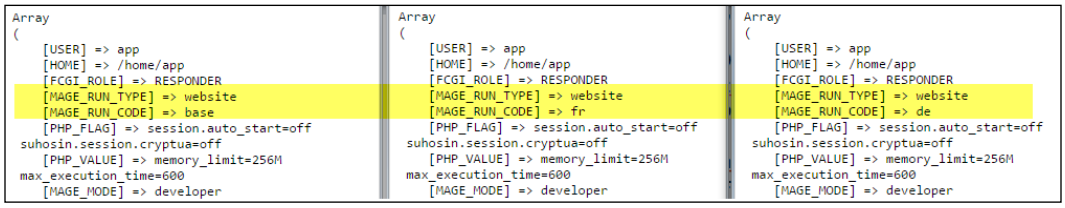
   ```
   var/www/html/pub
   ```

   ```
   echo "<?php header("Content-type: text/plain"); print_r($_SERVER); ?>" > magecode.php
   ```

   Don't forget to update your `nginx.conf.sample` file with the new `magecode` code. It's located on the bottom of your file and should look like this:

   ```
   location ~ (index|get|static|report|404|503|magecode)\.php$ {
   ```

   Restart NGINX and open the file in your browser. The output should look as follows. As you can see, the created `MAGE_RUN` variables are available:



7. Congratulations, you just finished configuring NGINX including additional domains. Now let's continue connecting them in Magento 2.

8. Log in to the backend and go to **Stores** | **All Stores**. By default, Magento 2 has one **Website**, **Store**, and **Store View** setup. Now click on **Create Website** and commit the following details:

Name	`My German Website`
Code	`de`

Next, click on **Create Store** and commit the following details:

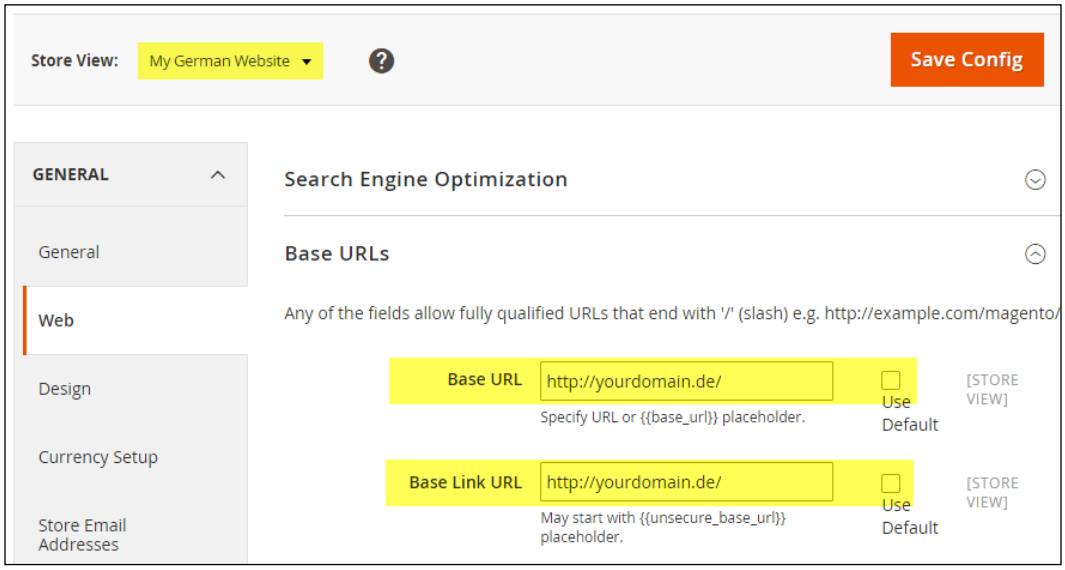
Website	`My German Website`
Name	`My German Website`
Root Category	`Default Category` (we will change this later)

Next, click on **Create Store View** and commit the following details:

Store	`My German Website`
Name	`German`
Code	`de`
Status	`Enabled`

Repeat the same steps for the French domain. Make sure that the **Code** in **Website** and **Store View** is `fr`.

9. The next important step is to connect the websites with the domain name. Go to **Stores** | **Configuration** | **Web** | **Base URLs**. Change the **Store View** scope at the top to **My German Website**. You will be prompted when switching; press **OK** to continue. Now uncheck the checkbox called **Use Default** from the **Base URL** and **Base Link URL** fields and commit your domain name. Now click **Save Config** and continue the same procedure for the other website. The output should look like this:



10. Save your entire configuration and clear your cache. Now go to **Products** | **Categories** and click on **Add Root Category** with the following data:

Name	`Root German`
Is Active	`Yes`
Page Title	`My German Website`

Perform the same steps for the French domain. You may add additional information here but it is not needed. Changing the current Root Category called **Default Category** to `Root English` is also optional but advised.

Save your configuration and go to **Stores** | **All Stores** and change all of the stores to the appropriate Root Catalog we just created. Every Root Category should now have a dedicated Root Catalog.

11. Congratulations, you just finished configuring Magento 2 including additional domains and dedicated Root Categories. Now let's open up a browser and surf to the domain names you created: `yourdomain.com`, `yourdomain.de`, and `yourdomain.fr`.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 11, we created a multi-store setup for `.com`, `.de`, and `.fr` domains using a separate Root Catalog.

In steps 1 through 4, we configured the domain mapping in the NGINX `default.conf` file. Then we added the `fastcgi_param MAGE_RUN` code to the `nginx.conf.sample` file; this will manage which website or store view to request within Magento.

In step 6, we used an easy test method to check if all domains run the correct `MAGE_RUN` code.

In steps 7 through 9, we configure the website, store, and store view names and codes for the given domain names.

In step 10, we created additional Root Catalogs for the remaining German and French stores. They are then connected to the previously created store configuration. All stores have their own Root Catalog now.

There's more...

Are you able to buy additional domain names, but would like to try setting up a multi-store? Here are some tips to create one. Depending on whether you are using Windows, Mac OS, or Linux, the following options apply:

- **Windows**: Go to `C:\Windows\System32\drivers\etc` and open up the `hosts` file as an administrator. Add the following (change the IP and domain name accordingly):

```
123.456.789.0    yourdomain.de
123.456.789.0    yourdomain.fr
123.456.789.0    www.yourdomain.de
123.456.789.0    www.yourdomain.fr
```

Save the file and click on the **Start** button. Search then for `cmd.exe` and commit the following:

```
ipconfig /flushdns
```

- **Mac OS**: Go to the `/etc/` directory, open up the `hosts` file as a superuser, and add the following (change the IP and domain name accordingly):

```
123.456.789.0    yourdomain.de
123.456.789.0    yourdomain.fr
123.456.789.0    www.yourdomain.de
123.456.789.0    www.yourdomain.fr
```

  Save the file and run the following command on the shell:

```
dscacheutil -flushcache
```

  Depending on your Mac version, check out the different commands here: `http://www.hongkiat.com/blog/how-to-clear-flush-dns-cache-in-os-x-yosemite/`

- **Linux**: Go to the `/etc/` directory, open up the `hosts` file as a root user, and add the following (change the IP and domain name accordingly):

```
123.456.789.0    yourdomain.de
123.456.789.0    yourdomain.fr
123.456.789.0    www.yourdomain.de
123.456.789.0    www.yourdomain.fr
```

  Save the file and run the following command on the shell:

```
service nscd restart
```

  Depending on your Linux version, check out the different commands here: `http://www.cyberciti.biz/faq/rhel-debian-ubuntu-flush-clear-dns-cache/`

Open up your browser and surf to the custom domains.

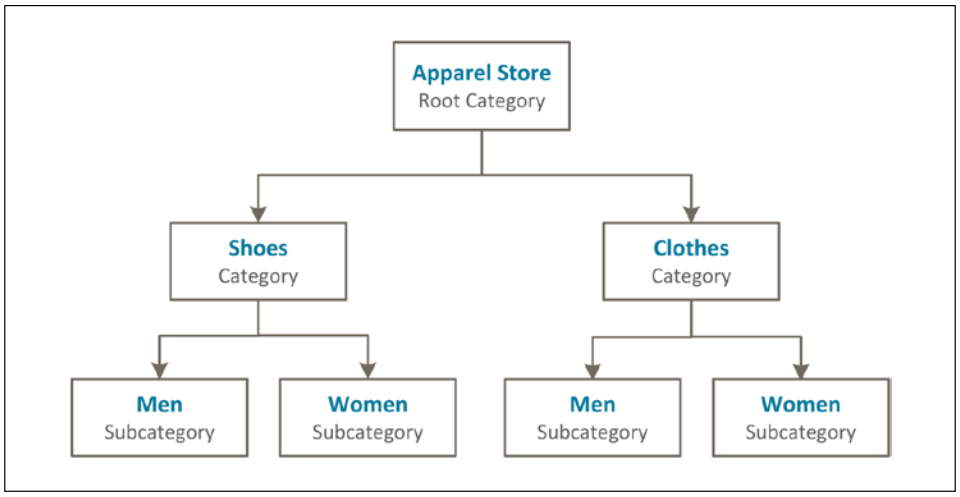


These domains only work on your PC. You can copy these IP and domain names on as many PC as you prefer. This method also works great when you are developing or testing and your production domain is not available on your development environment.

Create subcategories

After creating the foundation of the website, we need to set up a catalog structure. Setting up a catalog structure is not difficult but needs to be well thought out.

Some websites have an easy setup using two levels, while others sometimes use five or more subcategories. Always keep in mind user experience: your customer needs to crawl the pages easily. Keep it simple! The following image shows a simple catalog structure:



Getting ready

To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean (`https://www.digitalocean.com/`). We will be using an NGINX, PHP-FPM, Composer-based setup with Magento 2 preinstalled. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to set up a catalog including subcategories. The following steps will guide you through this:

1. First, log in to the backend of Magento 2 and then go to **Products** | **Categories**.

   Since we have already created Root Catalogs, we start with using the Root English catalog first.

2. Click on the **Root English** catalog on the left and then select the **Add Subcategory** button above the menu. Now commit the following and repeat all steps again for the other Root Catalogs:

Name	`Shoes (Schuhe) (Chaussures)`
Is Active	`Yes`
Page Title	`Shoes (Schuhe) (Chaussures)`

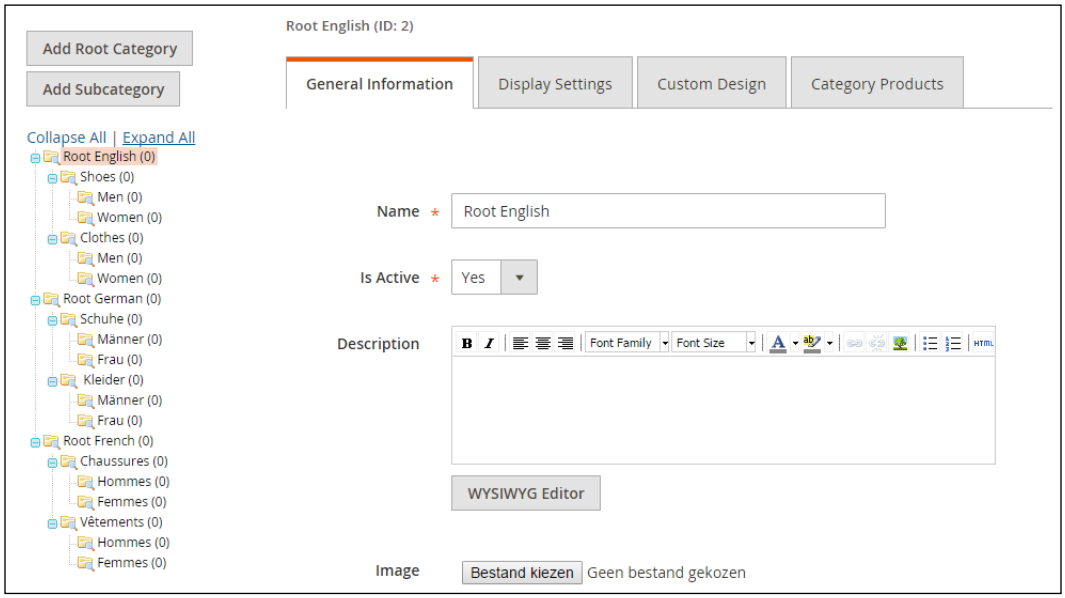
Name	`Clothes (Kleider) (Vêtements)`
Is Active	`Yes`
Page Title	`Clothes (Kleider) (Vêtements)`

3. Since we created the first level of our catalog, we can continue with the second level. Now click on the first level, which you need to extend with subcategories, and select the **Add Subcategory** button. Commit the following and repeat all steps again for the other Root Catalogs:

Name	`Men (Männer) (Hommes)`
Is Active	`Yes`
Page Title	`Men (Männer) (Hommes)`

Name	`Women (Frau) (Femmes)`
Is Active	`Yes`
Page Title	`Women (Frau) (Femmes)`

4. Congratulations, you just finished configuring subcategories in Magento 2. Now let's open up a browser and surf to the domain names you created earlier: `yourdomain.com`, `yourdomain.de`, and `yourdomain.fr`. Your categories should now look as follows:



How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 4, we created subcategories for the English, German, and French stores. In this recipe, we created a dedicated Root Catalog for every website. This way, every store can be configured using their own tax and shipping rules.

There's more...

In our example, we only submitted **Name**, **Is Active**, and **Page Title**. You may continue to commit the **Description**, **Image**, **Meta Keywords**, and **Meta Description** fields. By default, the URL key is similar to the **Name** field; you can change this depending on your SEO needs.

Every category or subcategory has a default page layout defined by the theme. You may need to override this. Go to the **Custom Design** tab and click the **Page Layout** drop-down menu. We can choose from the following options: **1 column**, **2 columns with left bar**, **2 columns with right bar**, **3 columns**, and **Empty layout**.

Manage attribute sets

Every product has a unique DNA; some, such as shoes, could have different colors, brands, and sizes, while a snowboard could have weight, length, torsion, manufacturer, and style.

Setting up a website with all the attributes does not make sense. Depending on the products you sell, you should create attributes specific to each website.

When creating products for your website, attributes are the key element and need to be thought through. What and how many attributes do you need? And how many values do you need? These are all types of question that could have a great impact on your website; and don't forget performance. Creating an attribute such as color and having 100,000 of different key values stored will not improve your overall speed and user experience. Always think things through.

After creating the attributes, we combine them in attribute sets, which can be picked when starting to create a product. Some attributes can be used more than once, while others are unique to one product or attribute set.

Getting ready

To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean (`https://www.digitalocean.com/`). We will be using an NGINX, PHP-FPM, Composer-based setup with Magento 2 preinstalled. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to create product attributes and sets. The following steps will guide you through them:

1. First, log in to the backend of Magento 2 and go to **Stores** | **Products**.

   Since we are using a vanilla setup, only system attributes and one attribute set are installed. Now click on **Add New Attribute** and commit the following data in the **Properties** tab:

Attribute Properties	
Default label	`shoe_size`
Catalog Input Type for Store Owners	Drop-down
Values Required	No

Manage Options (values of your attribute)			
English	**Admin**	**French**	**German**
4	4	35	35
4.5	4.5	35	35
5	5	35-36	35-36
5.5	5.5	36	36
6	6	36-37	36-37
6.5	6.5	37	37
7	7	37-38	37-38
7.5	7.5	38	38
8	8	38-39	38-39
8.5	8.5	39	39
Advanced Attribute Properties			
Scope		Global	
Unique Value		No	
Add to Column Options		Yes	
Use in Filer Options		Yes	



Since we have already set up a multi-website selling shoes and clothes, we will stick with this. The attributes we need for selling shoes are: `shoe_size`, `shoe_type`, `width`, `color`, `gender`, and `occasion`.

Continue the rest of the chart accordingly (`http://www.shoesizingcharts.com`).

2. Click on **Save and Continue Edit** now and continue on the **Manage Labels** tab with the following information:

Manage Titles (Size, Color, and so on)		
English	**French**	**German**
Size	Taille	Größe

3. Click on **Save and Continue Edit** now and continue on the **Storefront Properties** tab with the following information:

Storefront Properties	
Use in Search	No
Comparable in Storefront	No
Use in Layered Navigation	Filterable (with result)
Use in Search Result Layered Navigation	No

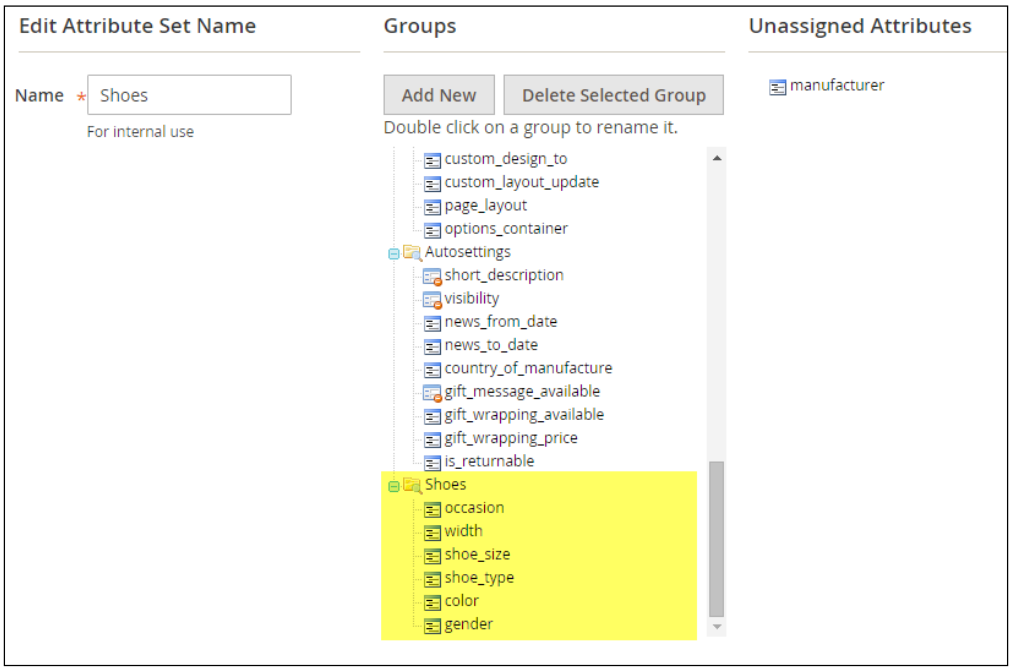
Storefront Properties	
Position	0
Use for Promo Rule Conditions	No
Allow HTML Tags on Storefront	Yes
Visible on Catalog Pages on Storefront	Yes
Used in Product Listing	No
Used for Sorting in Product Listing	No

4. Click on **Save Attribute** now and clear the cache. Depending on whether you set up index management accordingly through the Magento 2 `cronjob`, it will automatically update the newly created attribute.
5. The configuration for the additional `shoe_type`, `width`, `color`, `gender`, and `occasion` attributes can be downloaded at `https://github.com/mage2cookbook/chapter4`.
6. After creating all of the attributes, we combine them in an attribute set called `Shoes`. Go to **Stores** | **Attribute Set**, click **Add Attribute Set**, and commit the following data:

Edit Attribute Set Name	
Name	`Shoes`
Based On	`Default`

7. Now click in the **Groups** section, click on the **Add New** button, and commit the group name called **Shoes**.
8. The newly created group is now located at the bottom of the list. You may need to scroll down before you see it. It is possible to drag and drop the group higher up in the list.
9. Now drag and drop the created `shoe_size`, `shoe_type`, `width`, `color`, `gender`, and `occasion` attributes in the group and save the configuration. The `cronjob` notice is automatically updated, depending on your settings.

10. Congratulations, you just finished creating attributes and attribute sets in Magento 2. These can be seen in the following screenshot:



How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 10, we created attributes that will be used in an attribute set. The attributes and sets are the fundamentals for every website.

In steps 1 through 5, we created multiple attributes to define all details about the shoes and clothes we would like to sell. Some attributes are later used as configurable values on the frontend while others only indicate the gender or occasion.

In steps 6 through 9, we connect the attributes to the related attribute set. Thus, when creating a product, all the correct elements are available.

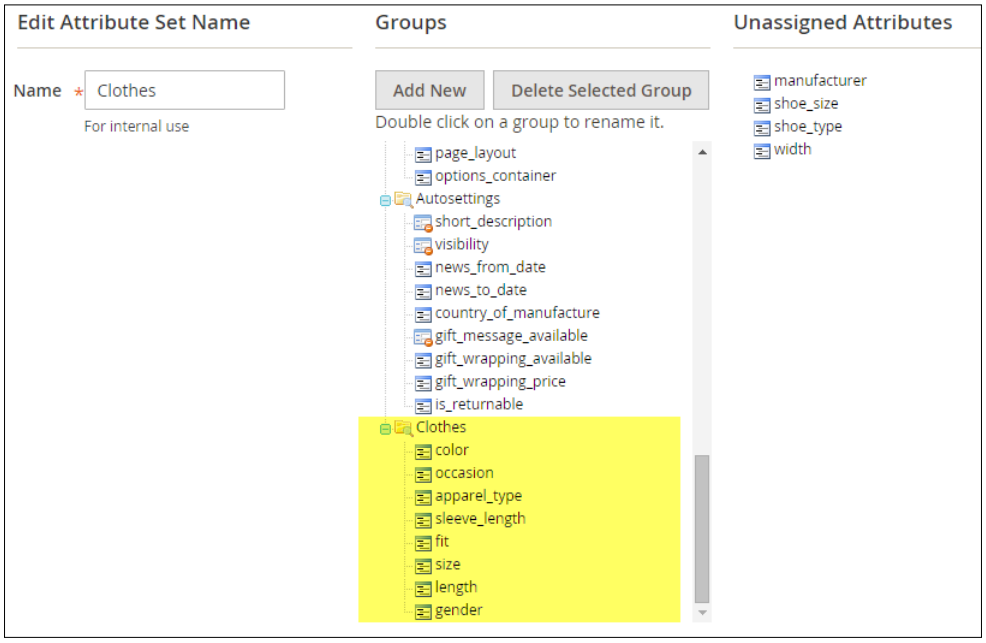
There's more...

After creating the Shoe attribute set, continue by creating an attribute set for Clothes.

Use the following attributes to create the set: `color`, `occasion`, `apparel_type`, `sleeve_length`, `fit`, `size`, `length`, and `gender`.

Follow the same steps we performed before to create a new attribute set. You may reuse the `color`, `occasion`, and `gender` attributes. Details of all the attributes can be found here: `https://github.com/mage2cookbook/chapter4#clothes-set`.

The following screenshot shows the **Clothes** attribute set:



Create products

Eventually, after creating attributes and sets, it comes down to adding products. Magento 2 uses the same types of product as Magento 1. This also includes Magento 2 Enterprise.

The product types we can choose from are: Simple Product, Configurable Product, Grouped Product, Virtual Product, Bundle Product, Downloadable Product, and, for the **Enterprise Edition** (**EE**), Gift Card.

Depending on the products you would like to sell, you may use one or two of the types. The most used types are Simple and Configurable Products because they rely on one another when you sell shoes, for example.

Product type definitions are as follows:

- **Simple Product**: A Simple Product in Magento is a physical product. There are no options such as size or color that the end user can pick during the order. One example of a Simple Product type is a broom or umbrella.
- **Configurable Product**: A combination of Simple Products organized with different colors, sizes, or other attributes is called a Configurable Product. One example of a Configurable Product is a shoe or shirt.
- **Grouped Product**: A Grouped Product is a collection of Simple Products related to one another. Each Simple Product could be sold separately, but is cheaper as a set. One example of a Grouped Product is a camera plus a photo bag and memory card. This set might offer a special price.
- **Virtual Product**: A Virtual Product is a non-physical product. One example of a Virtual Product is a service warranty for your computer or a membership.
- **Bundle Product**: A Bundle Product is an extension of a Grouped Product. A Grouped Product does not have the option to configure different choices. But this can be managed using a Bundle Product. One example of a Bundle Product is a building a computer; a customer can choose from a set of different hard disks, monitors, CPUs, memory, and so on.
- **Downloadable Product**: A Downloadable Product is a non-physical product. One example of a Downloadable Product is software or an eBook; you can download them online.
- **Gift Card** (EE only): A Gift Card can be a physical, virtual, or combined product. This is used as a store credit and can be sold as a gift.

Besides the regular ones, it is possible you may need extra options, depending on your product base. In Magento 1, additional third-party modules, such as Configurable Bundles, Events, Training, Rental, and Recurring, could be bought and installed to manage this.

Using product types is now easier than ever. Magento 2 created a user-friendly flow for configuring Configurable Products on the fly.

Getting ready

To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean (`https://www.digitalocean.com/`). We will be using an NGINX, PHP-FPM, Composer-based setup with a single Magento 2 website, Root Catalog, store view, categories, and attributes preinstalled. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to create Configurable Product for Magento 2. The following steps will guide you through them:

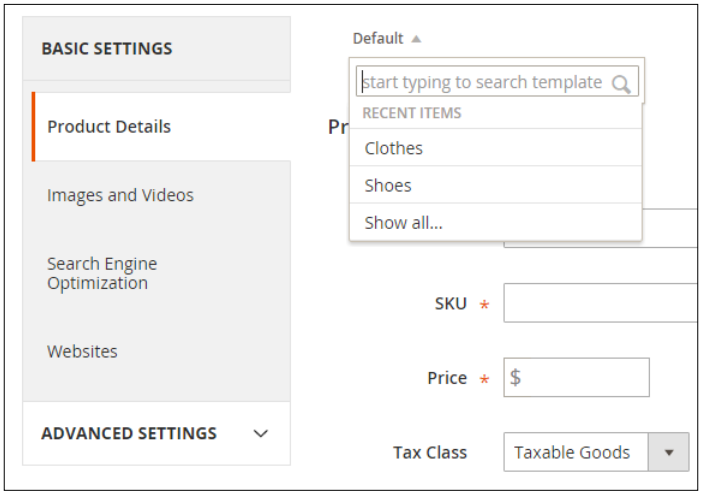
1. First, log in to the backend of Magento 2 and go to **Products** | **Catalog**. Click on the **Add Product** button and continue with the following information:

Product Details	
Name	Ellis Flat
SKU	shw005
Price	250.00
Tax Class	Taxable Goods
Images and Videos	Download the images here: `https://github.com/mage2cookbook/chapter4`
Quantity	100
Weight	Yes
Categories	Shoes
Description	Suede upper. Rubber 0.5" heel. Domestic.

2. Now hit the **Save** button. As you can see, you stay in the same screen while your data is being saved. When you want to **Save & Close** then choose from the drop-down arrow and continue.
3. Open a new tab in your browser, click the drop-down arrow in the top-right corner, and choose **Customer View**. This trick will open up a new tab and launch your home page.
4. Go to your **Shoes** menu and the newly created product should be visible. In some situations, it is best to clear your cache first if you are having issues.

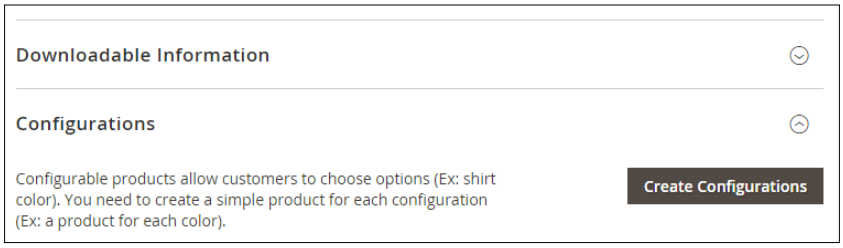
5. Congratulations, you just finished creating a Simple Product in Magento 2.

   Now let's go back to our backend and open up the newly created product. Next we are going to set our attribute set we created earlier in this chapter. This option is located above the **Product Details** title. Here we choose the **Shoes** attribute set, as shown in the following screenshot:

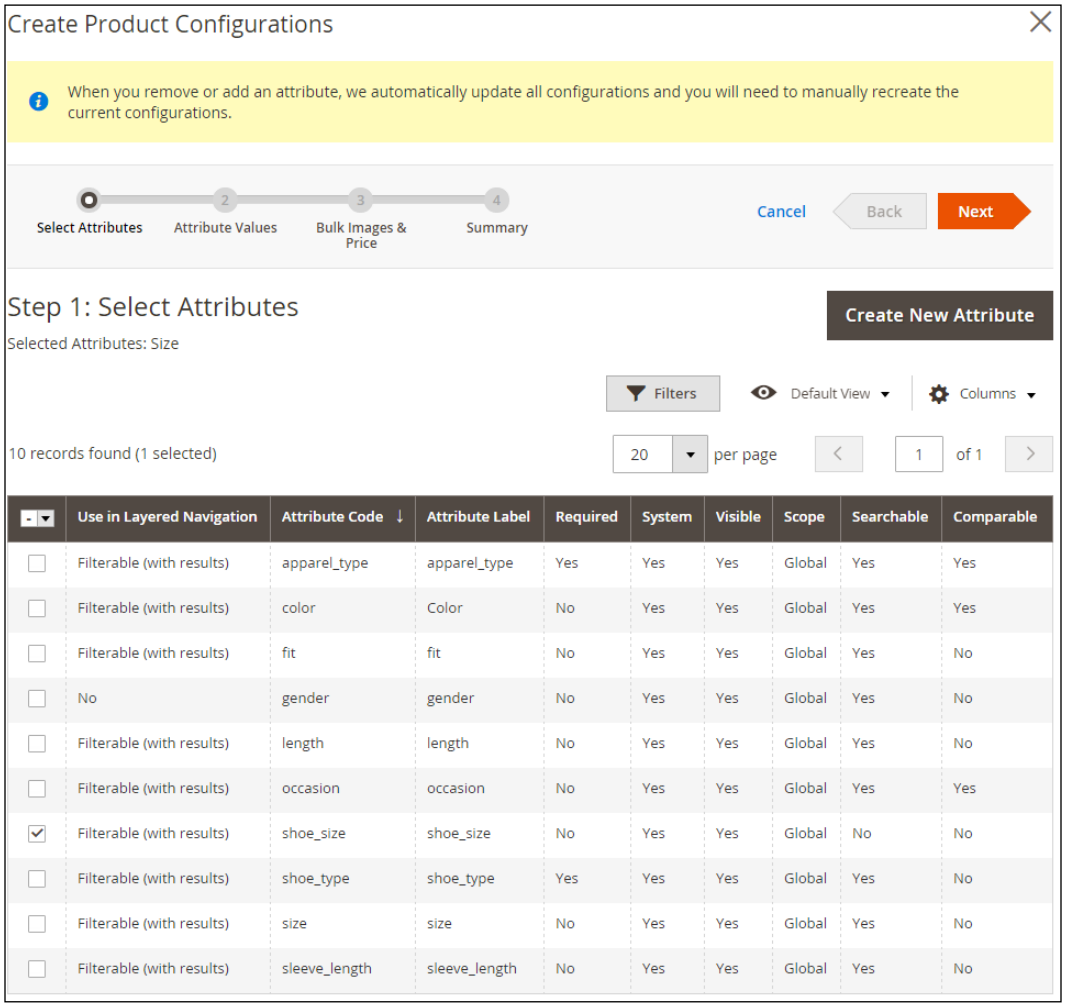


6. After choosing the option, you will see that Magento 2 has loaded a new menu called **Shoes** under the **Search Engine Optimization** menu.

7. Next scroll to the bottom and open up the **Configurations** drop-down menu. Click the **Create Configurations** button. This is shown in the following screenshot:

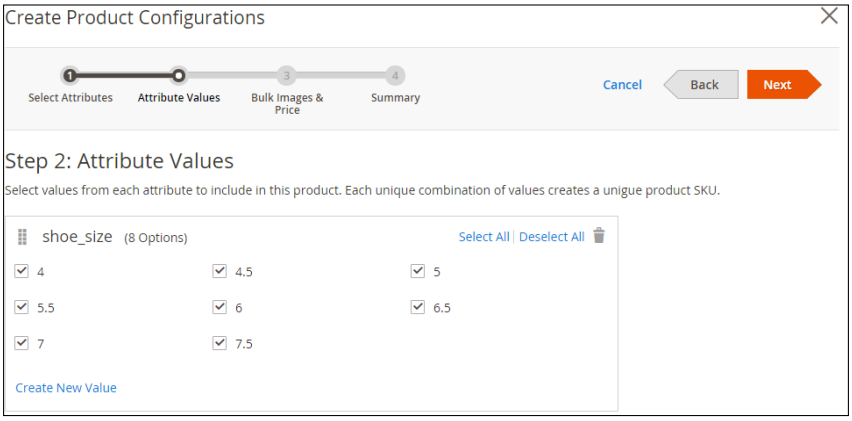


8. Next we will use one of the brand new features of Magento 2. This workflow helps to create Configurable Product on the fly. Depending on the attributes, the list of attributes could be long. For now, we pick the **shoe_size** option. Continue to the next step by hitting the **Next** button in the top-right corner, as shown in the following screenshot:

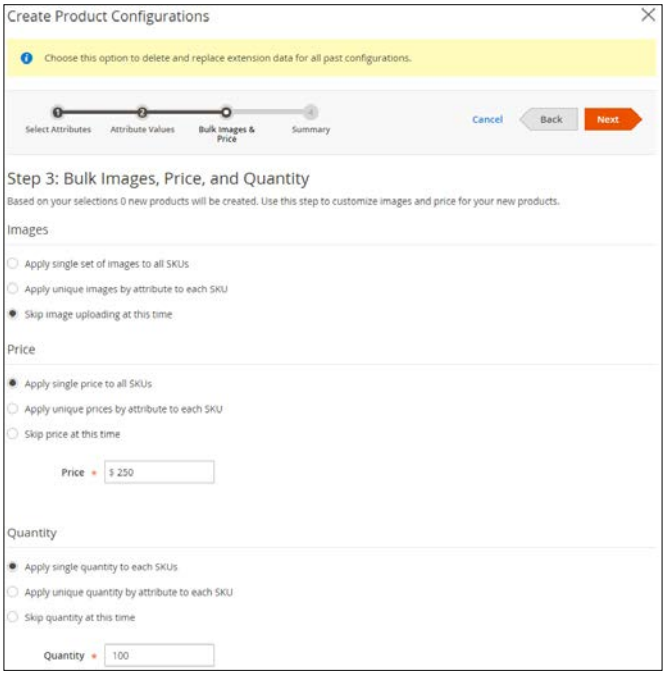


Use in Layered Navigation	Attribute Code	Attribute Label	Required	System	Visible	Scope	Searchable	Comparable
Filterable (with results)	apparel_type	apparel_type	Yes	Yes	Yes	Global	Yes	Yes
Filterable (with results)	color	Color	No	Yes	Yes	Global	Yes	Yes
Filterable (with results)	fit	fit	No	Yes	Yes	Global	Yes	No
No	gender	gender	No	Yes	Yes	Global	Yes	No
Filterable (with results)	length	length	No	Yes	Yes	Global	Yes	No
Filterable (with results)	occasion	occasion	No	Yes	Yes	Global	Yes	Yes
Filterable (with results)	shoe_size	shoe_size	No	Yes	Yes	Global	No	No
Filterable (with results)	shoe_type	shoe_type	Yes	Yes	Yes	Global	Yes	No
Filterable (with results)	size	size	No	Yes	Yes	Global	Yes	No
Filterable (with results)	sleeve_length	sleeve_length	No	Yes	Yes	Global	Yes	No

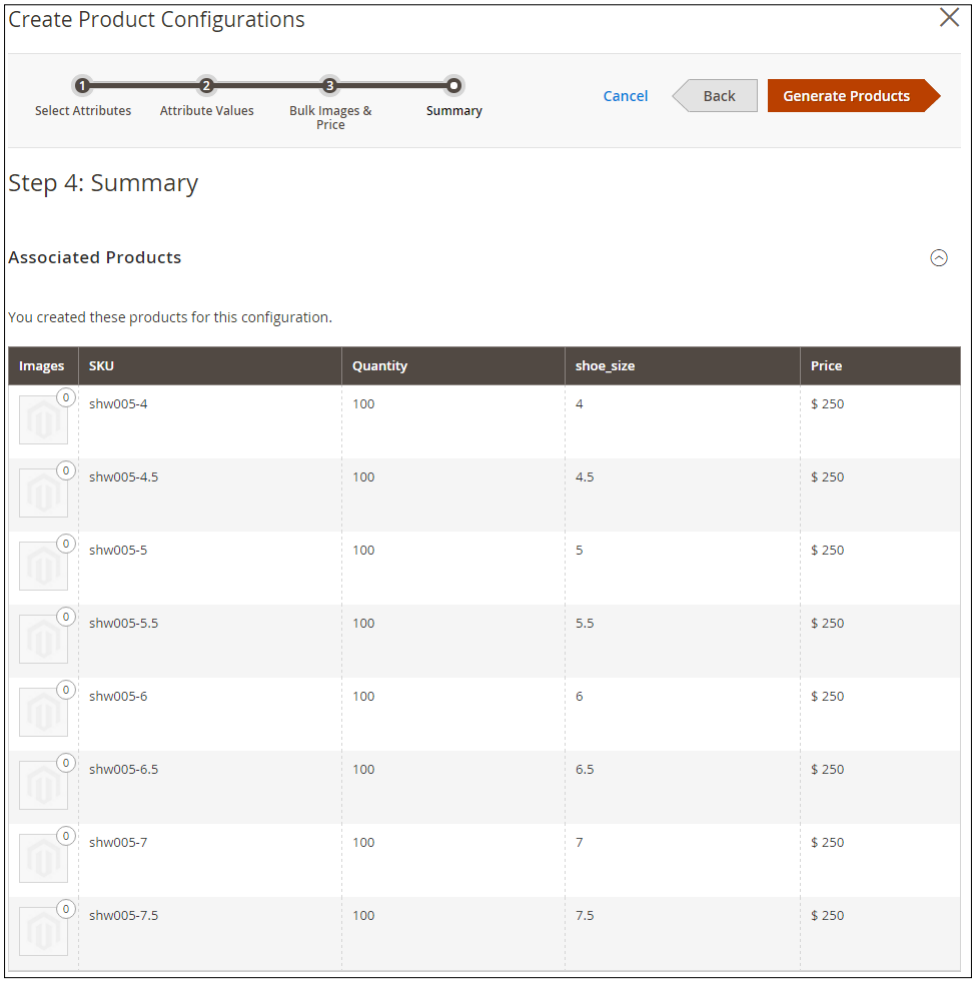
9. A list shows all the attribute values we created earlier. Click **Select All** and continue to the next step, as shown in the following screenshot:



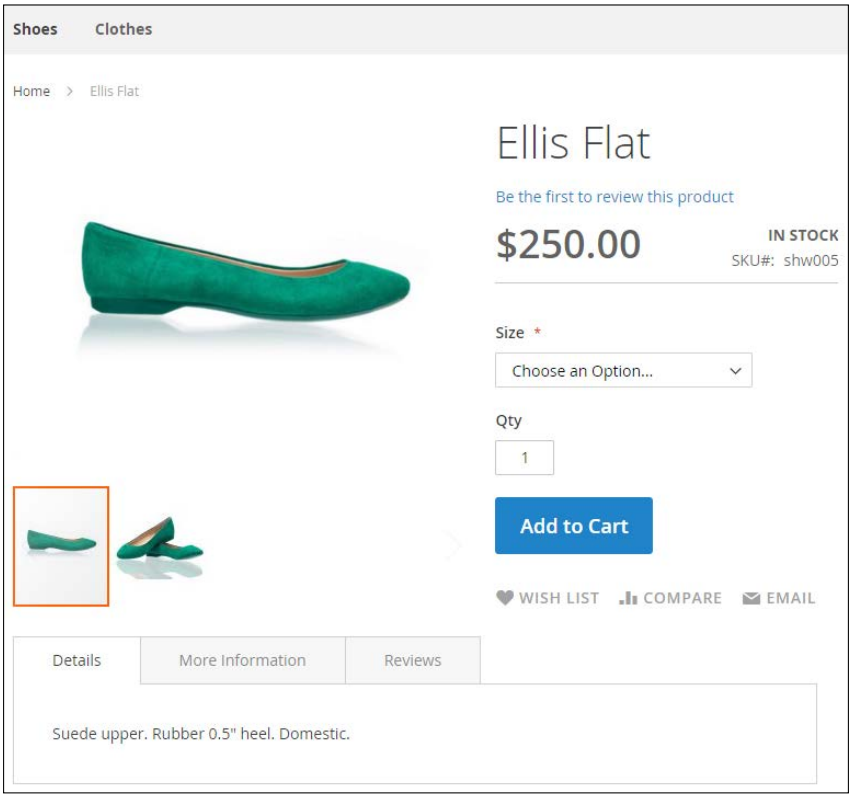
10. **Step 3: Bulk Images, Price, and Quantity** to create a Configurable Product is an important step. Commit a price and quantity here, otherwise the product will not show up on the screen (adjusting the value later is straightforward using the same flow). Select **Apply single price to all SKUs** and **Apply single quantity to each SKU** and fill in `250` for the **Price** and `100` for the **Quantity**. Continue to the next step, as shown in the following screenshot:



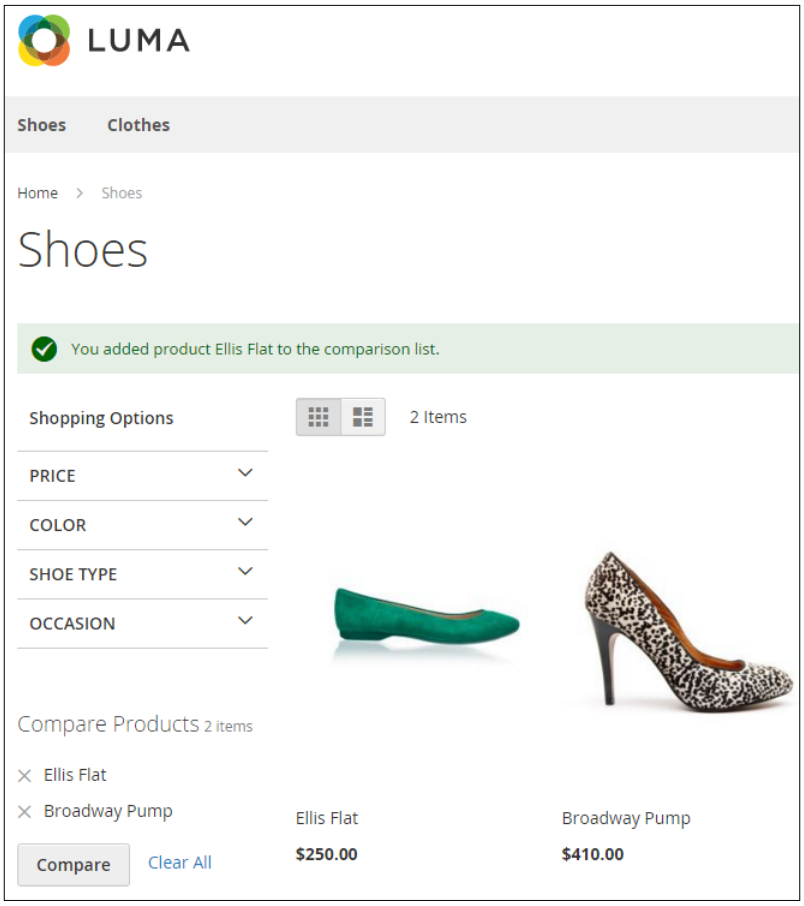
11. Depending on the values in the attribute list, **Associated Products** are created. Now click the **Generate Products** button and all of them are created, as shown in the following screenshot:



12. Now save the new setup and check in your browser; the result should be as shown in the following screenshot:



13. Congratulations, you just finished creating a Configurable Product in Magento 2.
14. Now go to `https://github.com/mage2cookbook/chapter4#creating-products` and continue to the rest of the **Shoes** and **Clothes** products. After creating a minimum of two products, our catalog navigation filter (layered navigation) pops up and looks like this:



How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 13, we created a Configurable Product using the new Magento workflow.

In steps 1 through 4, we created a Simple Product and connected it to the attribute set. This product will be the starting point for creating a Configurable Product.

In steps 8 through 11, we used the configurations workflow to select the attributes related to this product and set its values. Depending on the setup, we can apply a single price, image, or quantity to all of the Simple Products created during this process.

There's more...

By default, when creating a product, Magento 2 starts with a Virtual Product. When changing settings such as **Weight** (*Does this have a weight?*) to **Yes**, the product switches to a Simple Product. The same goes for Downloadable and Configurable Product.

This new technique is stunning and a great benefit for store owners. Everybody can now create and change products on the fly.

Bundle and Grouped Products, on the other hand, are more like Magento 1. You first need to choose the product type using the drop-down arrow in the **Add Product** button and then continue the same flow, as shown in the following screenshot:



Manage products in a catalog grid

Managing products on a daily basis may not be one of the most entertaining tasks. The product grid in Magento 1 is, out of the box, not the best tool. Lots of merchants install a third-party extension for better use and configuration. Depending on the extension, it is possible to tune the grid accordingly.

Now the new Magento 2 catalog grid is better than ever. Every backend user can create their own view and select the appropriate attributes for the best view ever.

Besides all the fancy features, the product grid loads asynchronously, which means that the page refreshes its data in the background. This is great for performance and user experience.

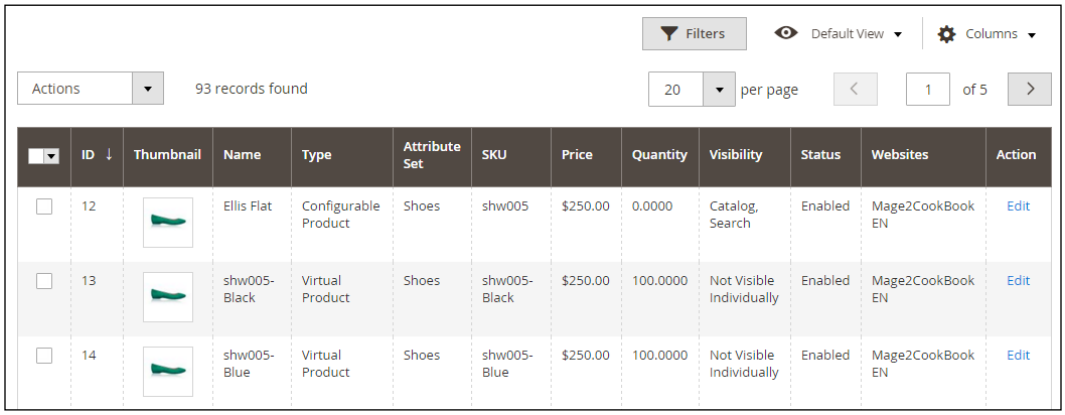
Getting ready

To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools*, at DigitalOcean (`https://www.digitalocean.com/`). We will be using an NGINX, PHP-FPM, Composer-based setup including a single Magento 2 website, Root Catalog, store view, categories, and attributes and four configurable products preinstalled. No other prerequisites are required.

How to do it...

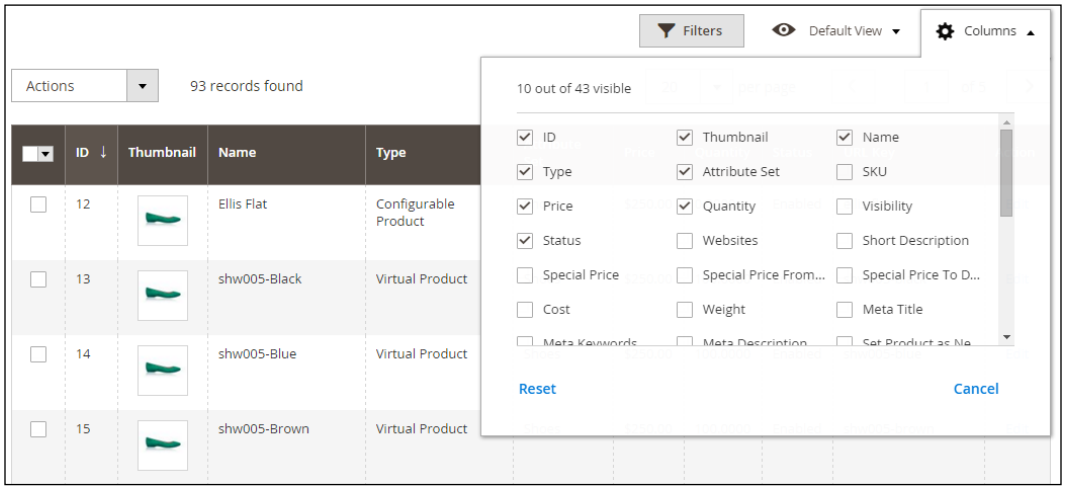
For the purpose of this recipe, let's assume that we need to a create a custom product grid in Magento 2. The following steps will guide you through this:

1. First, log in to the backend of Magento 2 and go to **Products** | **Catalog**. Depending on the previous recipe, you will have a list which looks as follows:

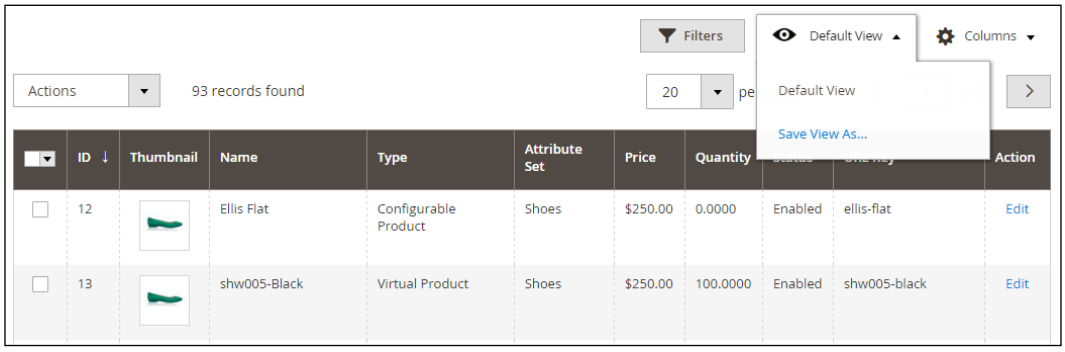


ID	Thumbnail	Name	Type	Attribute Set	SKU	Price	Quantity	Visibility	Status	Websites	Action
12		Ellis Flat	Configurable Product	Shoes	shw005	$250.00	0.0000	Catalog, Search	Enabled	Mage2CookBook EN	Edit
13		shw005-Black	Virtual Product	Shoes	shw005-Black	$250.00	100.0000	Not Visible Individually	Enabled	Mage2CookBook EN	Edit
14		shw005-Blue	Virtual Product	Shoes	shw005-Blue	$250.00	100.0000	Not Visible Individually	Enabled	Mage2CookBook EN	Edit

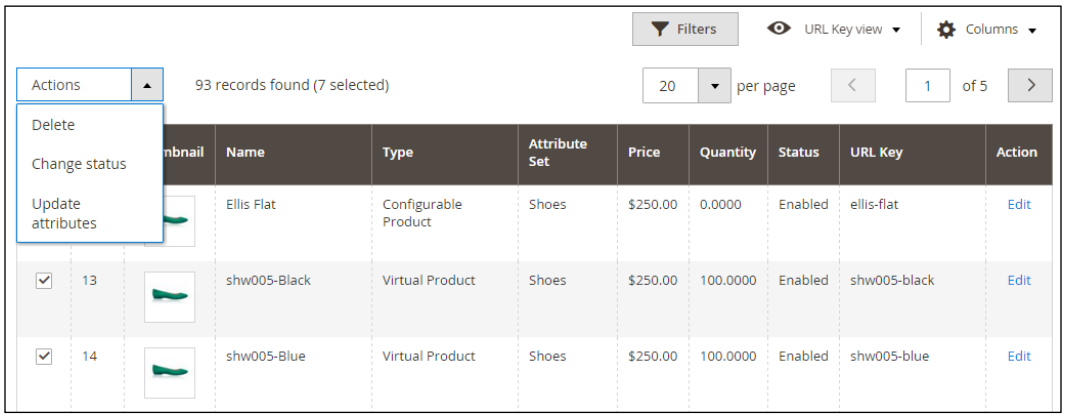
2. Click in the top-right corner on the arrow to the right of **Columns**. By default, Magento lists 12 options. Now select **URL key**, and deselect the **SKU**, **Visibility**, and **Websites** checkboxes. Then point your mouse at the grid again. Be aware there is no **Save** button. The grid should look as follows:



3. Now click on the **Default View** button, and click **Save View As...**. Pick a name and click the right arrow to save your work. The grid view should now look like this:



4. You can create as many views as necessary. Keep in mind that all created views only apply to the user who has created them. Currently, there is no shareable grid view option.
5. If you ever need to update the status of **Enabled** or **Disabled**, go to the left drop-down **Actions** menu and choose **Change status**.
6. Use the **Update attributes** option in the drop-down **Actions** menu to update one of the attributes. First select the products which you need to update. Then click on **Update attributes**, as shown in the following screenshot:



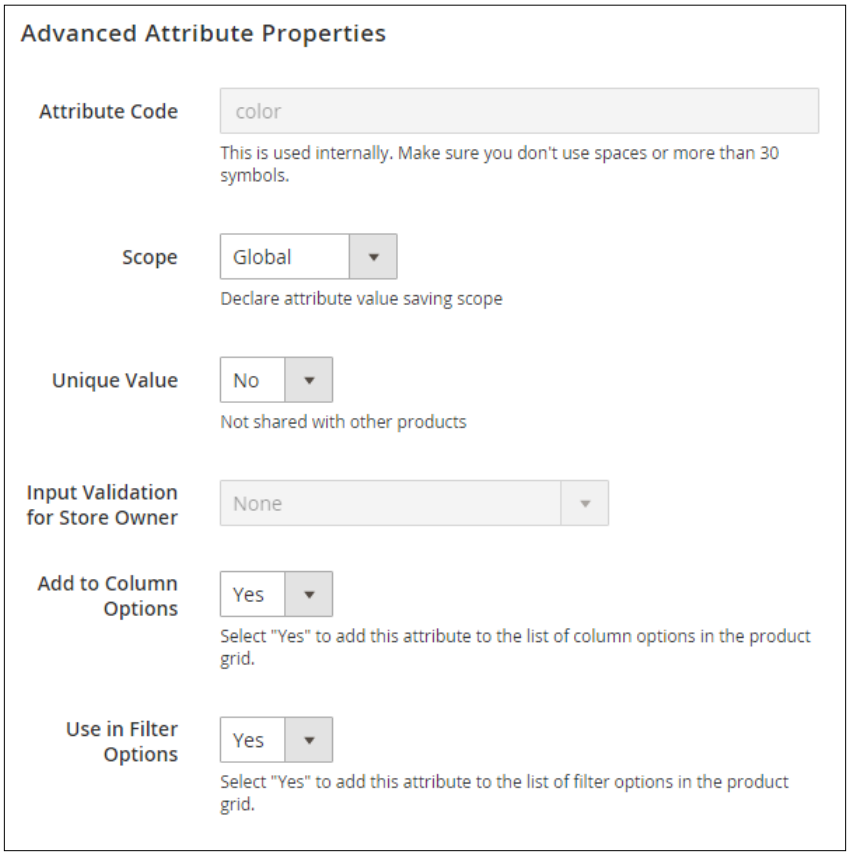
7. Next go to **shoe_type**, mark checkbox and select the appropriate option, and click **Save**.
8. Congratulations, you just finished managing the product grid catalog in Magento 2.

How it works...

Let's recap and find out what we did throughout this recipe. In steps 1 through 8, we created a custom grid for the catalog view. You can create as many grids as you like and select your preferred attributes in it. Saving the new grid views is straightforward.

There's more...

If you like managing attributes in your grid or columns, go to **Stores** | **Product** and select one of the attributes. In the **Properties** tab, look for **Advanced Attribute Properties**. At the bottom, change **Add to Column Options** and **Use in Filter Options** appropriately, as shown in the following screenshot:



4
Managing Your Store

In this chapter, we will cover the basic tasks related to creating a catalog and products in Magento 2. You will learn the following:

- Creating shipping and tax rules
- Managing customer groups
- Configuring inventories
- Configuring currency rates
- Managing advanced pricing

Introduction

Although we've created categories and products, we are not yet ready to go online. Depending on the country or state we live in and ship to, we have to levy additional charges such as VAT and shipping fees.

These shipping fees and tax rates need to be configured correctly according to the website or store view. Shipping options can be straightforward from free shipping to advanced calculations. But keep in mind that, depending on the situation, it is not as easy as it looks and could take some time to set up.

Besides shipping and tax, we should not forget the inventory. Without the correct inventory setup, we could create issues when it comes to stock management. Magento 2 uses the same inventory setup as Magento 1, and is straightforward to configure out of the box.

Are you selling products overseas and need to use different currency rates? Magento 2 is your best friend. This functionality in a multi-store setup is easy to configure.

Some products may depend on special prices related to customer groups. Creating B2C or B2B groups is straightforward and can be connected to advanced pricing within the product types. These prices will be shown after login or store view.



Lots of system configuration features are basically the same as in Magento 1. Within this chapter we will cover the basics and show Magento 2-specific features when they apply.

Creating shipping and tax rules

The topic of shipping is so huge that you could write a book about it. The options related, for example, to width, length and height, breakable, edible, and so on, are endless.

After configuring these attributes for a product, we can start relating them to our shipping setup and shipping vendor. Magento has a huge selection of shipping vendors to choose from. It's important to choose the right vendor and the correct Magento extension. This could be challenging. Do not immediately pick the cheapest shipping vendor. Check the quality of their service, their specialty when it comes to shipping your products, and their Magento extension.

Creating the correct tax rules is not for the fainthearted. Are you in the USA, Europe, Asia, or somewhere else? Every country has its own tax rules. Always check with the local authorities to find out which rules to apply.

Getting ready

To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools* at DigitalOcean `https://www.digitalocean.com/`. We will be using an NGINX, PHP-FPM, Composer-based setup including sample data. No other prerequisites are required.

How to do it...

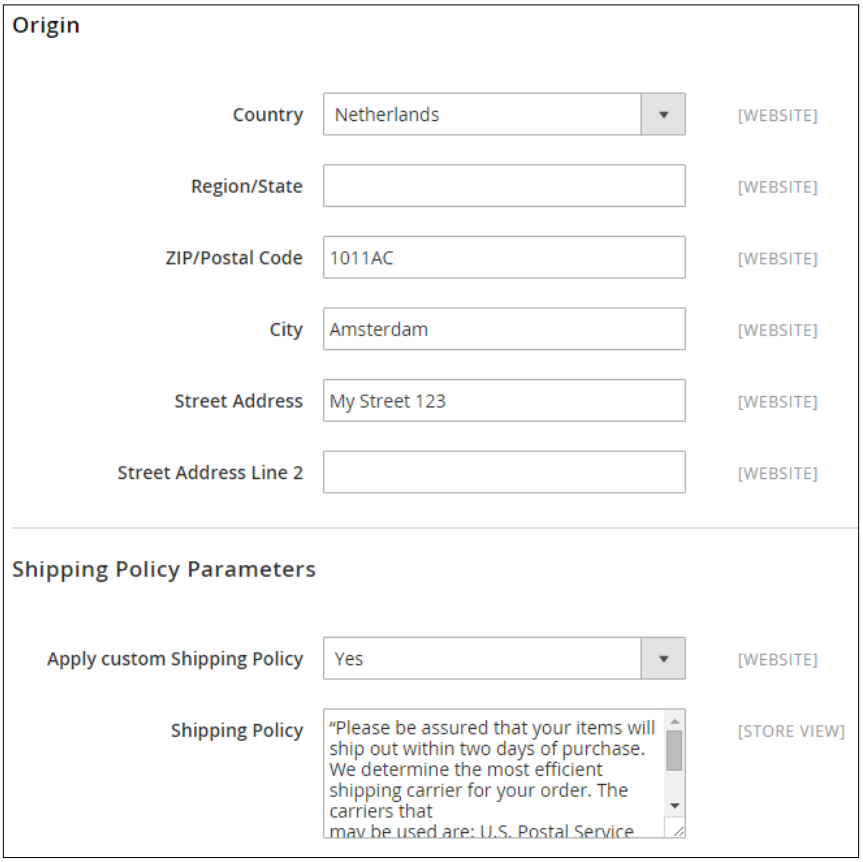
For the purpose of this recipe, let's assume that we need to create shipping and tax rules for the European Union. The shipping rules apply to a `Table Rates` setup using a local shipping vendor. The following steps will guide you through them.

1. First we start setting up the shipping rates. Go to **Stores** | **Configuration** | **Sales**. We have three menus to choose from. Let's start with the **Shipping Settings** first. Click on the **Menu** tab. You see two drop-down menus called **Origin** and **Shipping Policy Parameters**.

   Now complete the entire field set related to your company. This is the starting point. When using the **Shipping Policy**, just mark it **Yes** and commit your policy. Here is an example of how a policy could look:



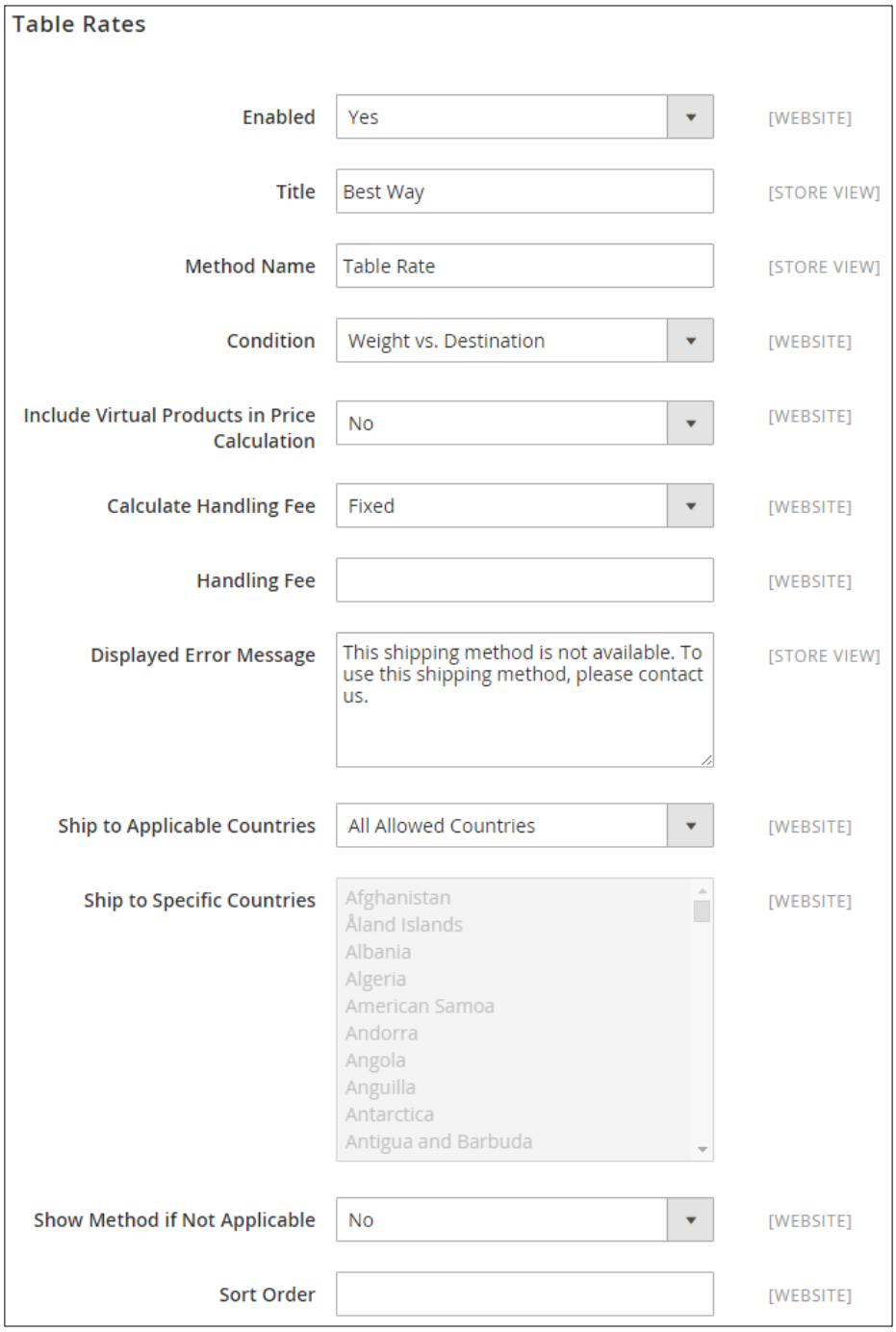
Please be assured that your items will ship out within two days of purchase. We determine the most efficient shipping carrier for your order. The carriers that may be used are: TNT, DHL, United Parcel Service (UPS), or FedEx. Sorry but we cannot ship to P.O. Boxes.



2. Now continue to the **Multishipping Settings** menu. By default, we stay with the **Allow Shipping to Multiple Addresses** option.
3. Next, we click **Shipping Methods**. The default shipping options in Magento 2 are: **Free Shipping**, **Flat Rate**, **Table Rates**, **UPS**, **USPS**, **FedEx**, and **DHL**.

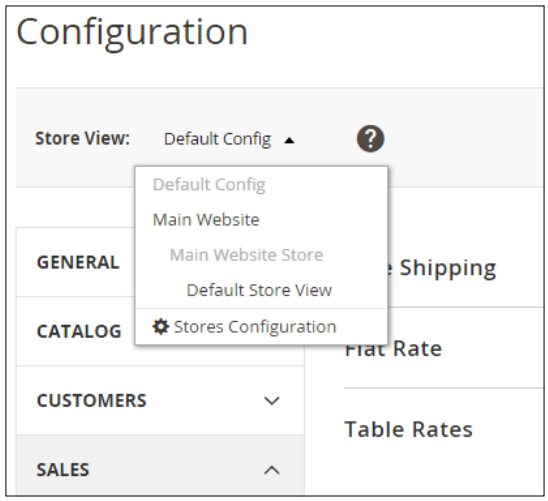
   Since the scope of this recipe is **Table Rates**, using **Free Shipping** and **Flat Rate** is pretty straightforward.

Now click on the **Table Rates** drop-down arrow, and commit the following information:



In the **Condition** drop-down menu we use the **Weight vs. Destination** option. Beside this option we also can choose from **Price vs. Destination** or **# (number) of items vs. Destination**. Depending on your needs, pick one of them. Since we are using the **Weight** option, we need to make sure that our entire product set has the correct weight configured.

4. For the purpose of this recipe, disable the **Flat Rate** option in the menu.
5. Now click **Save Config** and update your cache.
6. Next we need to switch to the correct website using the **Store View** switcher in the **Stores** | **Configuration** menu. Click the drop-down arrow in the top-left menu, and select **Main Website** (or the name of your website):



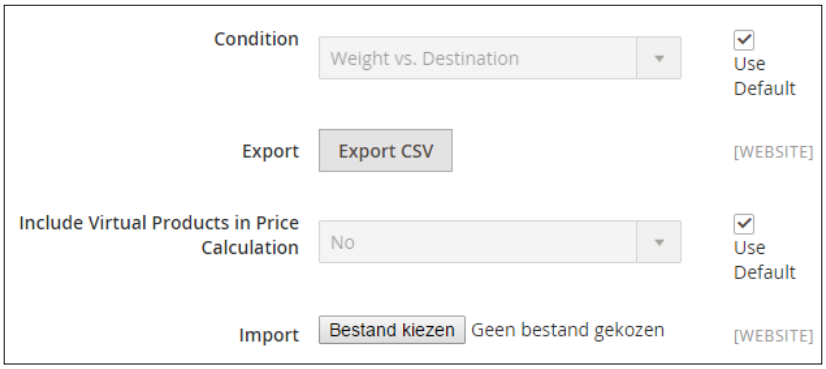
7. Confirm the pop-up window to continue and check the **Table Rates** options. Now we have two new options visible. The **Export CSV** gives us a comma-separated file called `tablesrates.csv` that we need to complete. Download the file and open up a spreadsheet editor, such as MS Excel, OpenOffice Calc, or Google Docs Spreadsheet.

   Since we are using the **Weight vs. Destination** option, the CSV schema looks as follows:

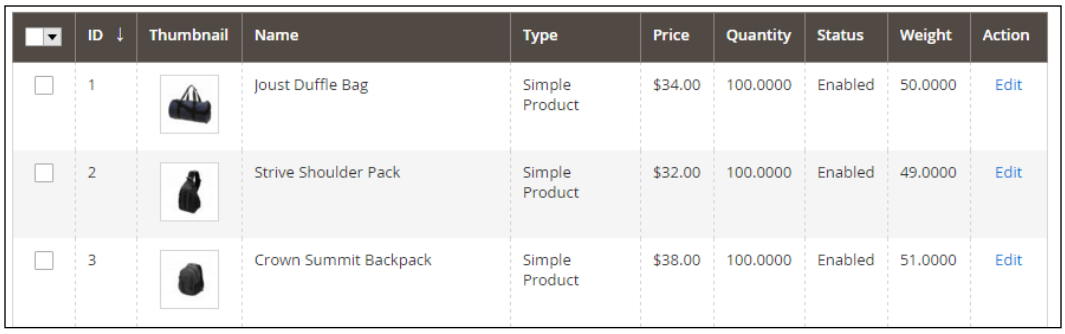
Country	Region/State	Zip/Postal Code	Weight (and above)	Shipping Price
NLD	*	*	0	6.95
NLD	*	*	50	9.95
NLD	*	*	100	14.50
DEU	*	*	0	10.50
DEU	*	*	50	17.50
DEU	*	*	100	22.50

Country	Region/State	Zip/Postal Code	Weight (and above)	Shipping Price
FRA	*	*	0	10.50
FRA	*	*	50	17.50
FRA	*	*	100	22.50

In this example, we use a wildcard for the **Region/State** and **Zip/Postal Code**. You can replace this wildcard with the appropriate value. Upload your saved `tablesrates.csv` file in the **Import** section and click **Save Config**, and clean the cache:



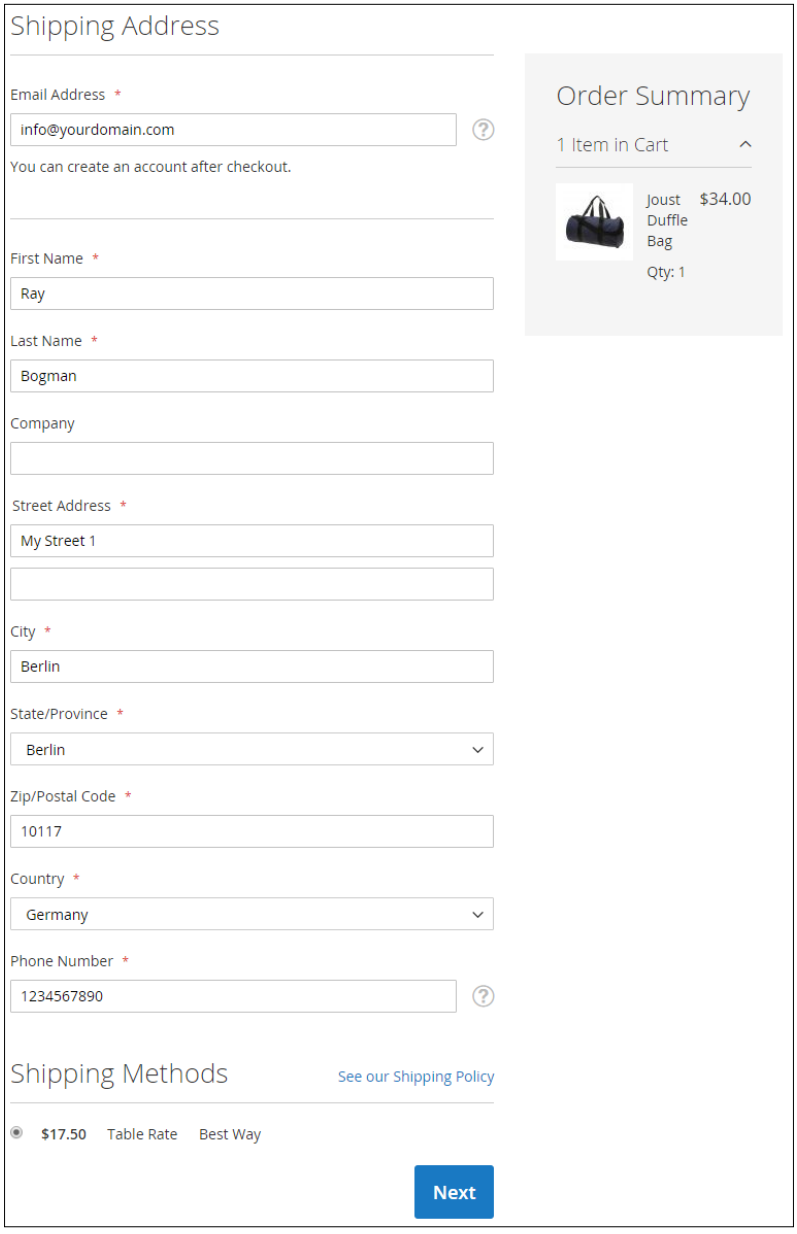
8. Before we can verify it is working, we need to update the weight of the product we want to sell. Go to **Products** | **Catalog** and update your grid using the weight attribute. Check out the *Manage products in a catalog grid* recipe of *Chapter 3*, *Creating Catalogs and Categories* for how to do this.
9. Now let's edit **Joust Duffle Bag** from the sample data. Set the **Weight** to `50` and click **Save & Close**. Do the same for **Strive Shoulder Pack** (`49`) and **Crown Summit Backpack** (`51`). Your product grid should now look as follows:



ID	Thumbnail	Name	Type	Price	Quantity	Status	Weight	Action
1		Joust Duffle Bag	Simple Product	$34.00	100.0000	Enabled	50.0000	Edit
2		Strive Shoulder Pack	Simple Product	$32.00	100.0000	Enabled	49.0000	Edit
3		Crown Summit Backpack	Simple Product	$38.00	100.0000	Enabled	51.0000	Edit

10. Finally, we can test if the checkout and shipping fee are configured correctly. Open up a browser, add the **Joust Duffle Bag** to you basket, and check it out. Complete your personal data and check the shipping **Table Rate** at the bottom.

    We only used German, French, and Dutch codes in this example. If you want to have your country shipping fees in the **Table Rate** CSV file, update them accordingly:

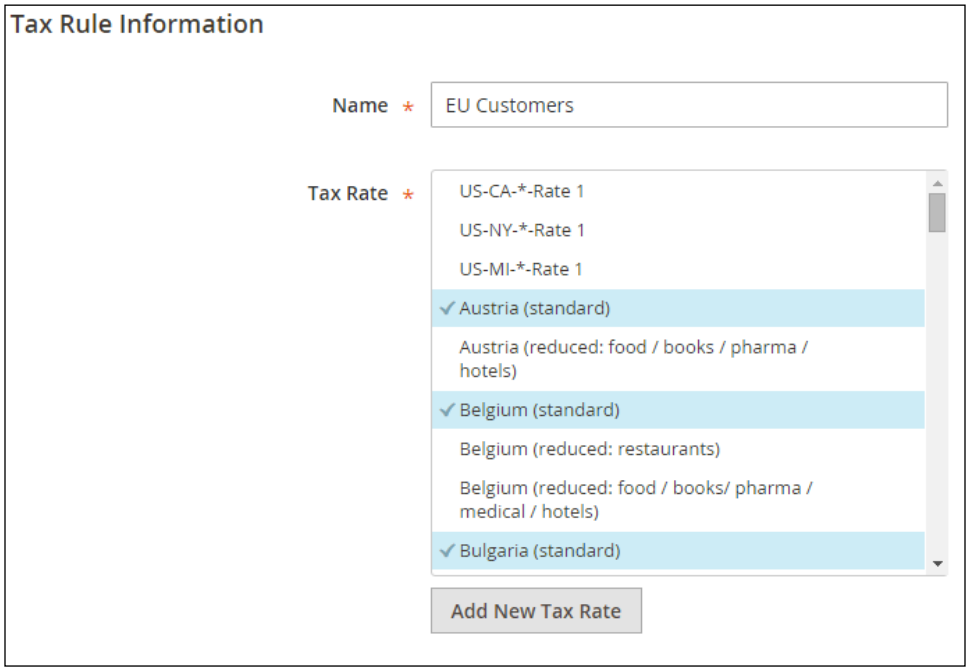


11. Congratulations, you just finished configuring shipping rules in Magento 2.
12. Next we continue to configure the appropriate tax rules. Since we cannot cover all the different tax rules worldwide, we will stick for now with the European Union. Import to the following **tax_rates.csv** file to **System** | **Import/Export Tax Rates**. The file can be downloaded from `https://github.com/mage2cookbook/chapter5`.
13. To check if all tax rates are created, go to **Stores** | **Tax Zone and Rates**. You see a large list of all rates and countries.



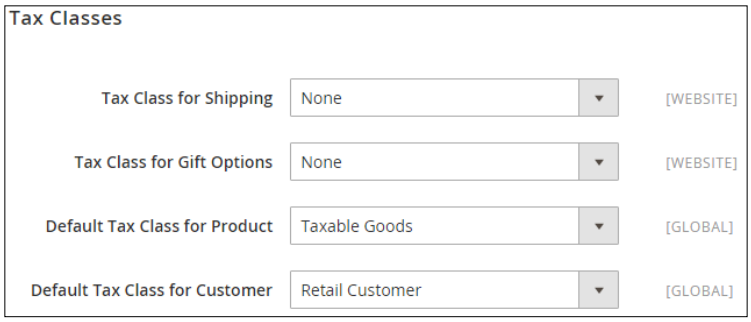
All rates apply to the current tax regulation of the European Union with effect from the 1st of January 2015. The calculated tax is based on the country of the seller.

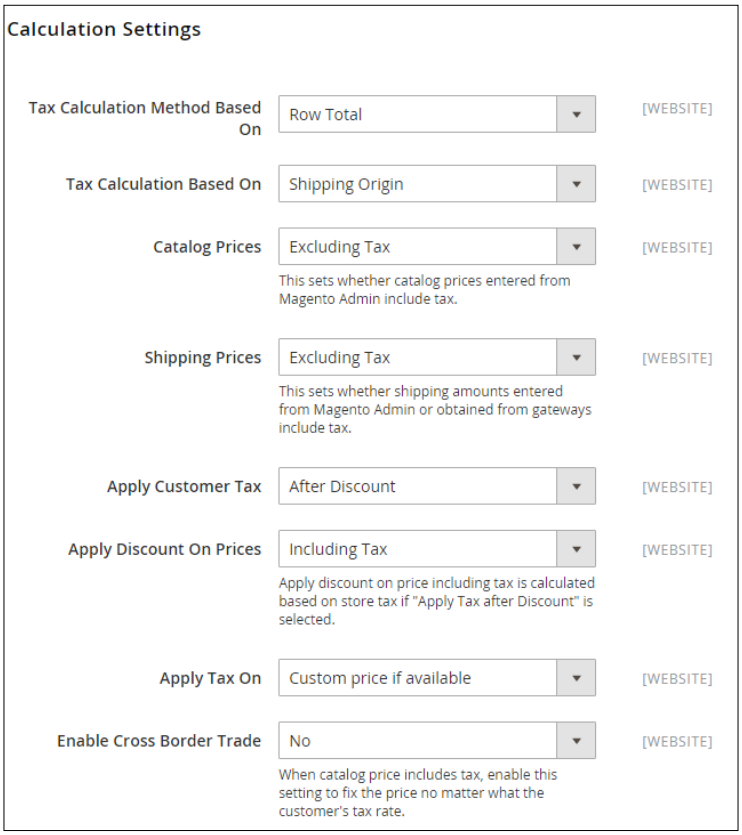
14. Now go to **Stores** | **Tax Rules** and click on **Rule 1**. For this example we change the **Name** to `EU Customers`. Now let's select all the EU countries with the (standard) tax Rate and click **Save Rule**:

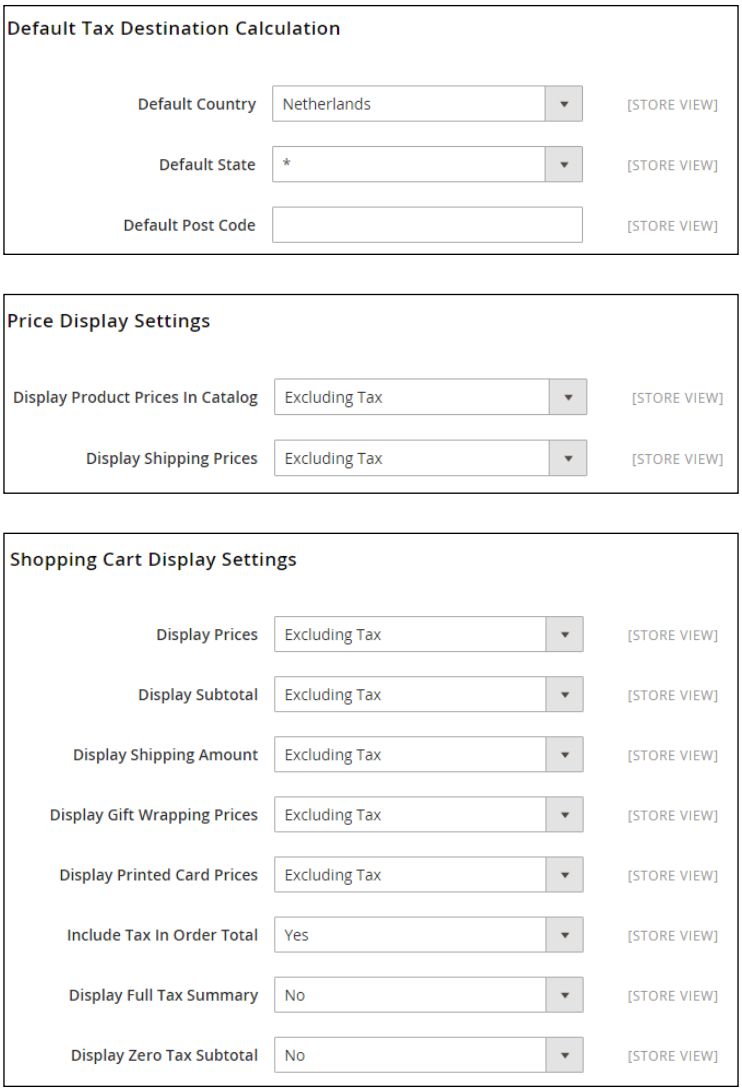


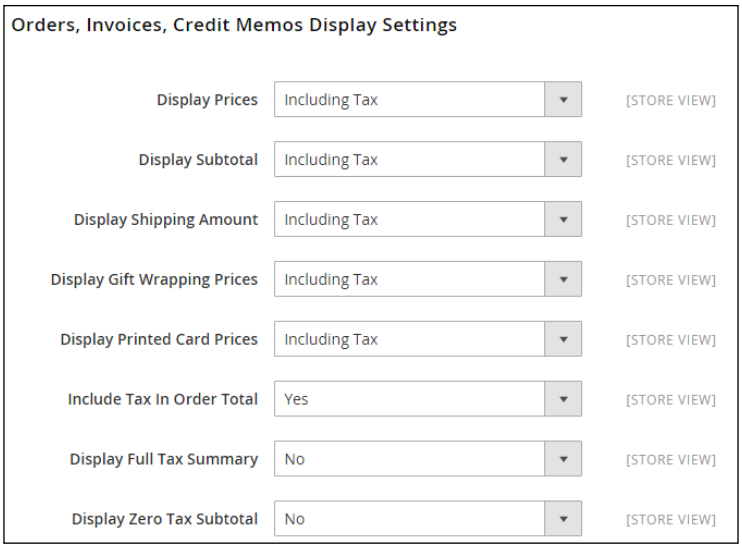
In this example we set the default rule to the high tax rate. Create a new rule when you are selling services or products that have a lower tax rate. But don't forget to create a new **Product Tax Class** in the **Additional Settings**. This class can then be used in every product type where it applies.

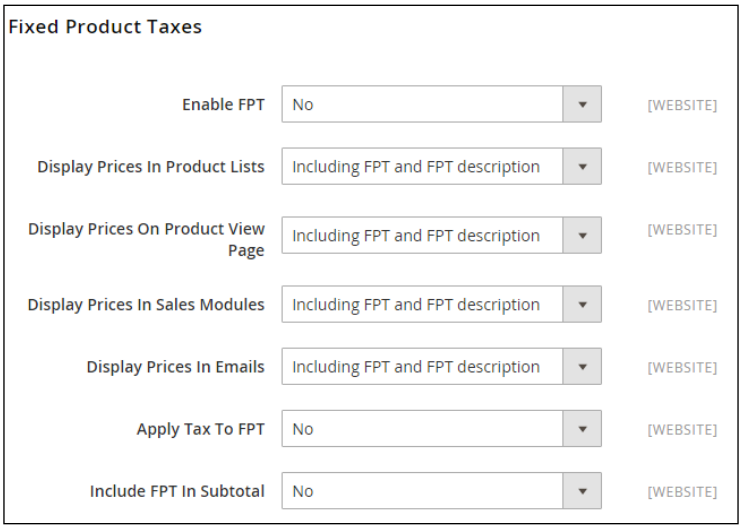
15. Next we need to configure the tax system setup. Go to **Stores** | **Configuration** | **Sales** | **Tax**. Depending on your production setup, using a multi domain with different shipping vendors and warehouse configuration may change. Always use the **Store View** switcher on the top to change the settings according to the domain or country you are selling in. The following examples will give you an overview of a basic setup created in Magento 2 Enterprise Edition. In the Magento 2 Community Edition some features, such as Gift Wrapping and Printed Card Prices, will not be shown:





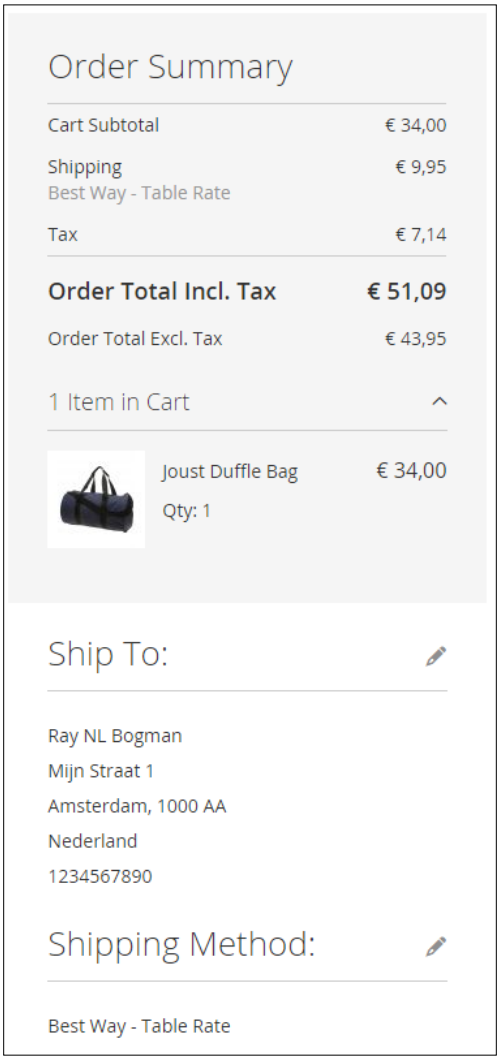

Default Tax Destination Calculation
Default Country
Netherlands
[STORE VIEW]
Default State
*
[STORE VIEW]
Default Post Code
[STORE VIEW]
Price Display Settings
Display Product Prices In Catalog
Excluding Tax
[STORE VIEW]
Display Shipping Prices
Excluding Tax
[STORE VIEW]
Shopping Cart Display Settings
Display Prices
Excluding Tax
[STORE VIEW]
Display Subtotal
Excluding Tax
[STORE VIEW]
Display Shipping Amount
Excluding Tax
[STORE VIEW]
Display Gift Wrapping Prices
Excluding Tax
[STORE VIEW]
Display Printed Card Prices
Excluding Tax
[STORE VIEW]
Include Tax In Order Total
Yes
[STORE VIEW]
Display Full Tax Summary
No
[STORE VIEW]
Display Zero Tax Subtotal
No
[STORE VIEW]





16. Change the setting and click **Save Config**.
17. Since we are using the Magento 2 sample data, we are ready to perform the test. Every product is configured with the **Taxable Goods Tax Class**.

18. Finally, we can test if the checkout and tax rates are configured correctly. Open up a browser and add the **Joust Duffle Bag** to your basket and check it out. Complete your personal data and check the **Review & Payments** step on the right in the checkout. The **Order Summary** should now look like this:



19. Congratulations, you just finished configuring tax rules in Magento 2.

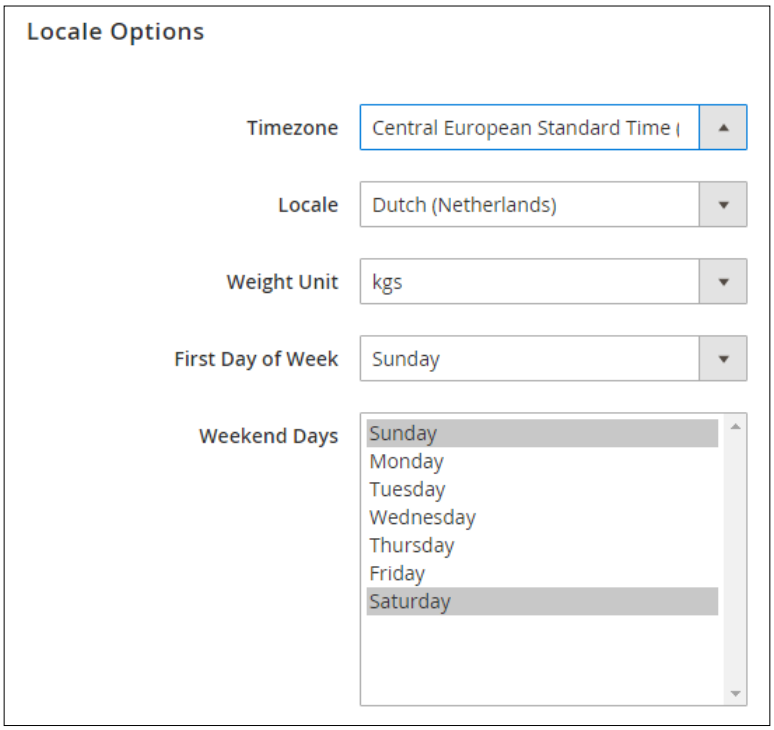
How it works...

Let's recap and find out what we did throughout the preceding recipe. In Steps 1 through 10, we configured a shipping method called **Table Rates** to handle all the shipping. We used the **Weight vs. Destination** option. Using this option we needed to update all our products with the correct weight attribute value.

In Steps 12 through 18, we configured tax rules for the European Union using a **tax_rates.csv** file from GitHub. By using this file, it was easy to configure the appropriate tax rule. In Step 15, we gave an example of how a system configuration for a store view could look.

There's more...

Depending on where you live or are sending products to, using the correct measuring units in Magento 2 is important. This new feature helps us to configure whether we calculate the weight in **lbs** (pounds) or **kgs** (kilograms). We can find this new option in **Stores** | **Configuration** | **General** | **Locale Options**. Here is an example showing the **Weight Unit** field:



Managing customer groups

Everybody knows that every website is different. Some sites only sell products to **Business to Consumer** (**B2C**) while others sell to **Business to Business** (**B2B**) or both.

In the B2C market it is pretty common to only have one customer group called **Retailer**. While the B2B market is related to the **Wholesaler**. Beside these two, we could also have groups such as Platinum, Gold, Silver, Special members, or groups based on their location. So the options are unlimited. Setting up the correct infrastructure for your customers helps you to segment these groups and offer them different prices.

Magento offers by default the following groups: General, NOT LOGGED IN, Retailer, and Wholesale.



By default, all groups are related to the Tax Class: Retail Customer. You may need to change this depending on your locale regulations.

Getting ready

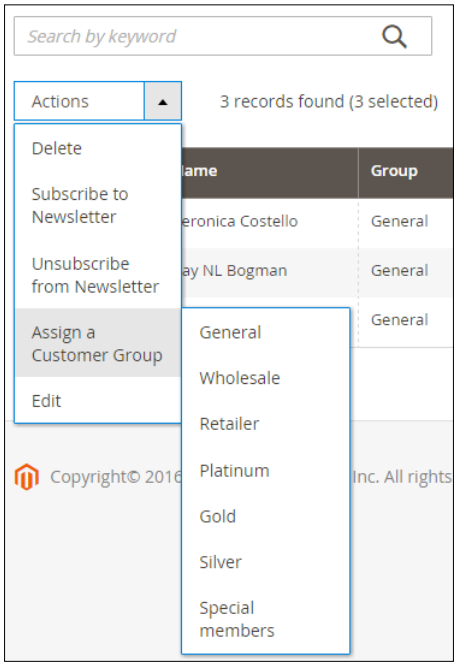
To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools* at DigitalOcean `https://www.digitalocean.com/`. We will be using an NGINX, PHP-FPM, Composer-based setup including sample data. No other prerequisites are required.

How to do it...

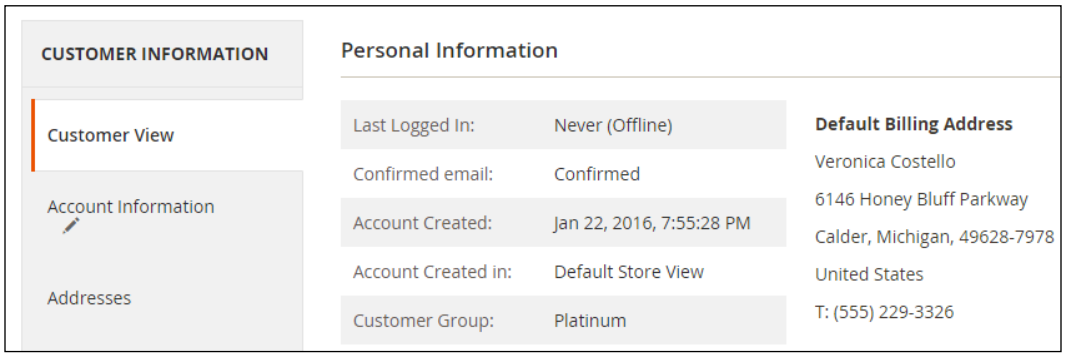
For the purpose of this recipe, let's assume that we need to add additional customer groups. We want to create the following groups: Platinum, Gold, and Silver. The following steps will guide you through this.

1. First login to the backend of Magento, and go to **Stores** | **Other Settings** | **Customer Groups**.
2. Click on the **Add New Customer Group** button and create three new groups for Platinum, Gold, and Silver. Connect them to the Tax Class: Retail Customer for now and click **Save Customer Group**.
3. Make sure to update your indexers. When you have your `crontab` configured correctly, you do not have to worry about this. Magento 2 will update this for you every minute.
4. Now click on **Customers** | **All Customers** in the default menu. Select all the customers you want to upgrade to another group by marking them on the left of the grid.

5. Click on the drop-down **Actions** menu and choose **Assign a Customer Group**. A new menu will be listed where we can pick one of the newly created groups. Select one of the options, and click **OK** in the pop-up window:



6. To confirm the changes are OK, click the edit link on the right. In the **Customer View** tab we see the **Personal Information** and the listed **Customer Group**:



7. Congratulations, you have just finished configuring Customer Groups in Magento 2.

How it works...

Let's recap and find out what we did throughout the preceding recipe. In Steps 1 through 6, we configured different Customer Groups and connected them to the appropriate customer.

There's more...

Creating customers groups basically does nothing. It is the relation to marketing or segmentation that makes the difference. In Magento 2, we got **Catalog** and **Cart Price Rules**. When combining them with the **Customers Group** we are able to create member discounts.

Go to **Marketing** | **Promotions** | **Catalog Price Rules,** or **Cart Price Rules** and click **Add New Rule**. In the **General Information** section we see the **Customer Groups** list.

Now go ahead and create a new rule and use one of the groups. Here is an example. Create a new rule called Platinum 25%, and select the **Customer Groups Platinum**. Now go to the **Actions** tab menu and choose the **Apply** rule: **Percent of product price discount**. In the Discount Amount commit 25. This is the amount of percent the Platinum member gets discounted from the total of his shopping cart.

Make sure when testing that the customer login is in this group.

Configuring inventories

When selling physical products, it makes sense that every product in the warehouse is related to inventory or stock management. Configuring and managing stock is a day-to-day job. A basic inventory setup in Magento 2 is straightforward and comparable to Magento 1. With growth, a **product inventory management** (**PIM**) system will be needed.

Getting ready

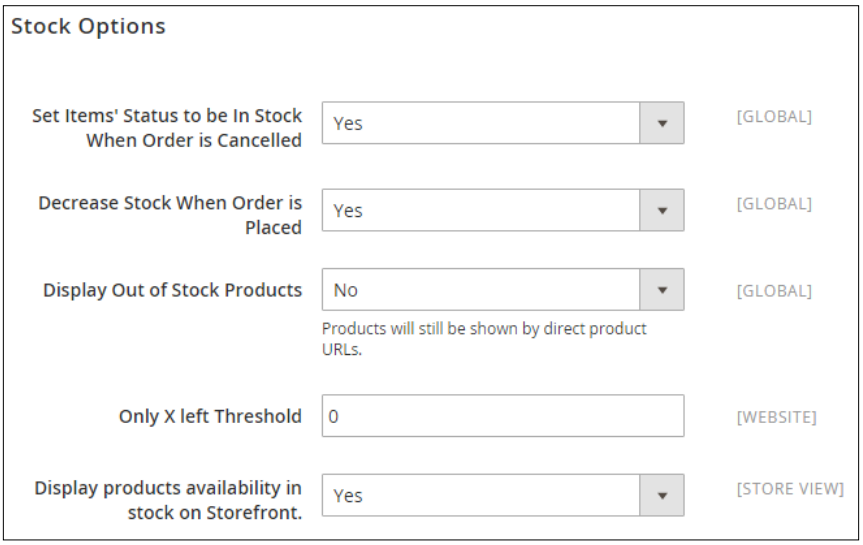
To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools* at DigitalOcean `https://www.digitalocean.com/`. We will be using an NGINX, PHP-FPM, Composer-based setup including sample data. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to configure an inventory for a Magento 2 setup. The following steps will guide you through this.

1. First, log in to the backend of Magento and go to **Stores** | **Configuration** | **Catalog** | **Inventory**. You will see two menu options: **Stock Options** and **Product Stock Options**.

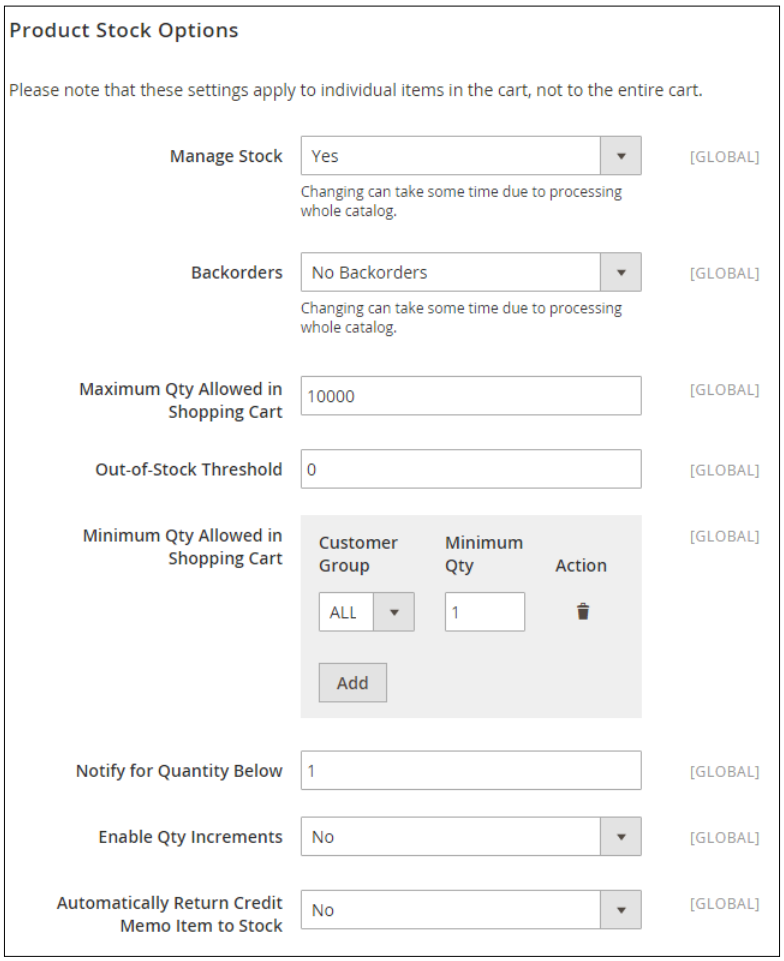
   In **Stock Options** you can configure the following:



   All options are self-explanatory. One of the more interesting options is **Display Out of Stock Products**. This can be used to show the product even when it is currently not available. Some websites have a limited stock amount; by using this, the product is not always removed from the web, which is bad for **search engine optimization** (**SEO**).

2. In **Product Stock Options** you can configure the following. All options are self-explanatory. Interesting options here are **Out-of-Stock Threshold**, **Minimum Qty Allowed in Shopping Cart** and **Automatically Return Credit Memo Item to Stock**.

The **Out-of-Stock Threshold** is set as Global, which means that it is related to all the products. **Minimum Qty Allowed in Shopping Cart** is related to the **Customer Groups** we created in the *Managing customer groups* recipe. Configuring the correct **Minimum Qty** amount helps to set the default before the discount rule applies. **Automatically Return Credit Memo Item to Stock** is helpful in managing credit orders. After creating a credit order, all items are updated in the current stock:

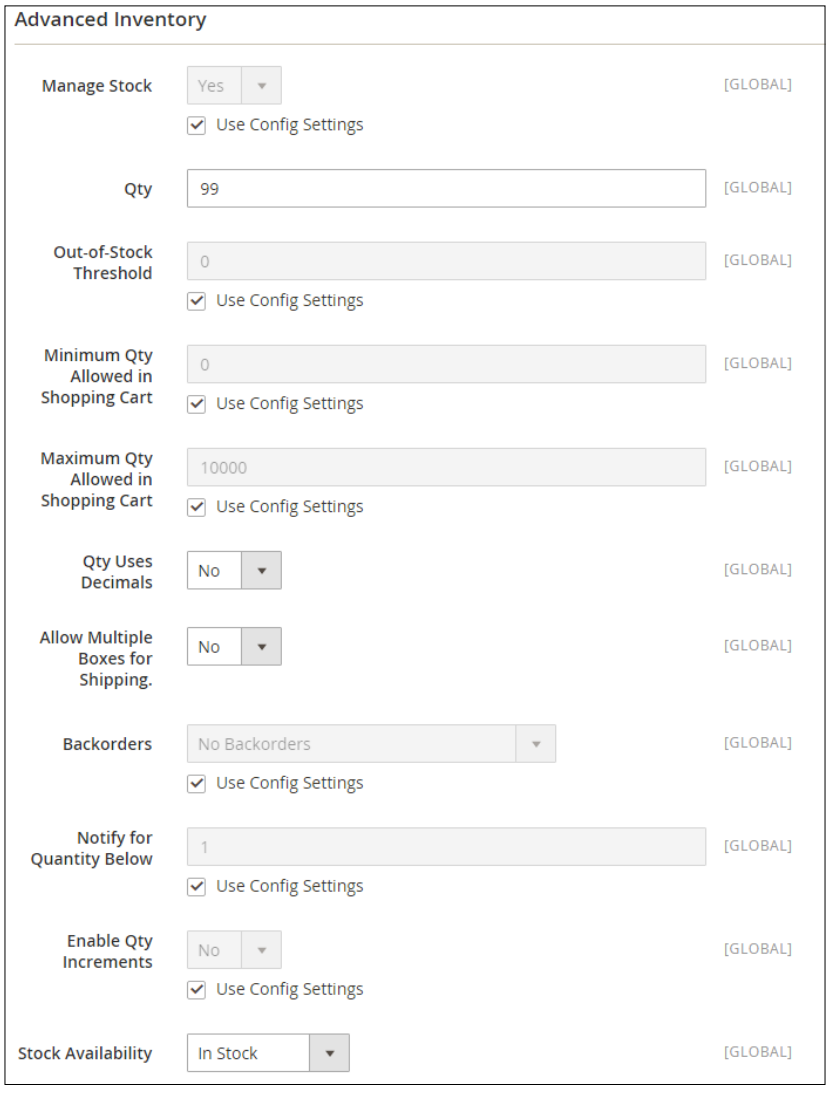


3. After configuring all elements, click **Save Config** and update your cache.
4. Now go to **Products** | **Catalog** and click edit on the **Joust Duffle Bag** product. On the product page we have two options to change the current stock. The first option is **Quantity** in the **Product Detail** tab in **Basic Settings**. This option is straightforward. The second, more detailed option is in the **Advanced Settings** tab called **Advanced Inventory**. These options here only relate to this product. Depending on the configuration, you are able to override the **Config Setting** of the system.

In **Advanced Inventory** you can configure the following. All options are self-explanatory. Interesting options are **Qty Uses Decimals** and **Allow Multiple Boxes for Shipping**.

The **Qty Uses Decimals** setting determines whether decimals will be used in the quantity field for the product (for example, 3.5 yards) or not.

The **Allow Multiple Boxes for Shipping** setting determines whether multiple boxes will be used for the product during shipping (for example, custom build computer incl. monitor) or not:



5. Congratulations, you just finished configuring inventory management in Magento 2.

How it works...

Let's recap and find out what we did throughout the preceding recipe. In Steps 1 through 4, we configured an inventory on a global system level and an advanced product inventory level. Depending on your system setup, you can change them in line with the website or store view.

There's more...

Depending on your setting, it is best to check your low stock on a daily basis. Go to **Reports** | **Products** | **Low Stock**. All products with a low stock setting will be listed here.

Configuring currency rates

Every website selling products uses some kind of currency. Without a valid currency things would start to get messy.

Configuring these currencies is pretty straightforward. The most interesting part is the currency rate exchange. Every day this rate needs to be checked and updated. Decreases in value are important on the product you sell. So choosing the correct default currency needs to be considered appropriately.

Getting ready

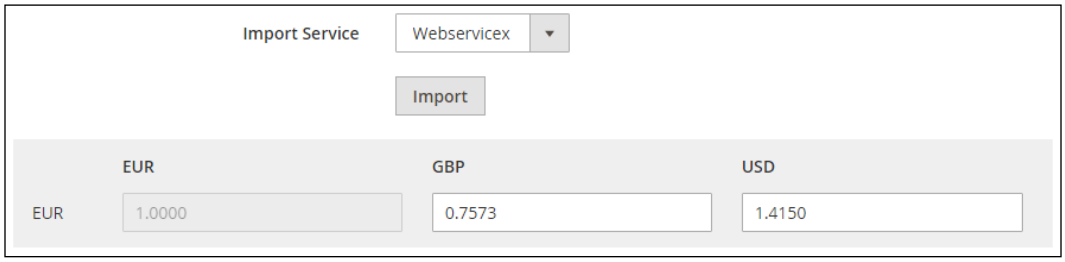
To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools* at DigitalOcean `https://www.digitalocean.com/`. We will be using an NGINX, PHP-FPM, Composer-based setup including sample data. No other prerequisites are required.

How to do it...

For the purpose of this recipe, let's assume that we need to configure three currencies—US Dollar, Euro, and Pound Sterling—with Magento 2. The following steps will guide you through this.

1. First log in to the backend of Magento. Go to **Stores** | **Configuration** | **General** | **Currency Setup** and select the **Base Currency**. Now select **Default Display Currency**. When running a multi website or store view, you may need to switch to the appropriate website or store view to change the value.
2. Next select in the multi select window a currency from **British Pound Sterling**, **Euro**, and **US Dollar**. Hold down the Ctrl key as you select from the list and click **Save Config**. Make sure you update your cache.
3. Now go to **Stores** | **Currency Symbols** to check if they are correct. Make adjustments when needed.

4. Now go to **Stores** | **Currency Rates** and click on the **Import** button. Depending on the default currency, the exchange rate between GBP, EUR, or USD is calculated. Check if the rates are correct and click **Save Currency Rates**. Make sure you update your cache:



5. Next open up a new browser and go to your home page. In the top right corner there is a drop-down with all the listed currencies. Select one of them to test if the currencies are correct.
6. Congratulations, you just finished configuring currency rates in Magento 2.

How it works...

Let's recap and find out what we did throughout the preceding recipe. In Steps 1 through 5, we configured additional currency for our website. Depending on the currencies you are selling, this can be updated in the backend. On the frontend, customers can easily switch and buy in their preferred currency.

There's more...

Would you like to update the currency rates on a daily, weekly, or monthly basis? Go to **Stores** | **Configuration** | **General** | **Currency Setup** | **Scheduled Import Setting** and **Enable** this depending on your needs. This service will update the rates on the selected time basis.

Managing advanced pricing

Selling products can be hard. Lots of websites are selling the same product. But how can we attract new customers and persuade them to buy our goods?

Many websites have the same default retail price shown on their site. When using advanced pricing we can show special prices within a particular date range, or display tier prices for our beloved platinum members.

Another option could be using a **minimum advertised price** (**MAP**). This feature is useful if your product manufacturer has established a **Manufacturer's Suggested Retail Price** (**MSRP**), and you want to sell the product at a price lower than the MSRP. What this feature basically does is hide the product price display in your catalog and only shows this during product purchase.

Getting ready

To step through this recipe, you will use a Droplet created in *Chapter 1*, *Magento 2 System Tools* at DigitalOcean `https://www.digitalocean.com/`. We will be using an NGINX, PHP-FPM, Composer-based setup including sample data. No other prerequisites are required.

How to do it...

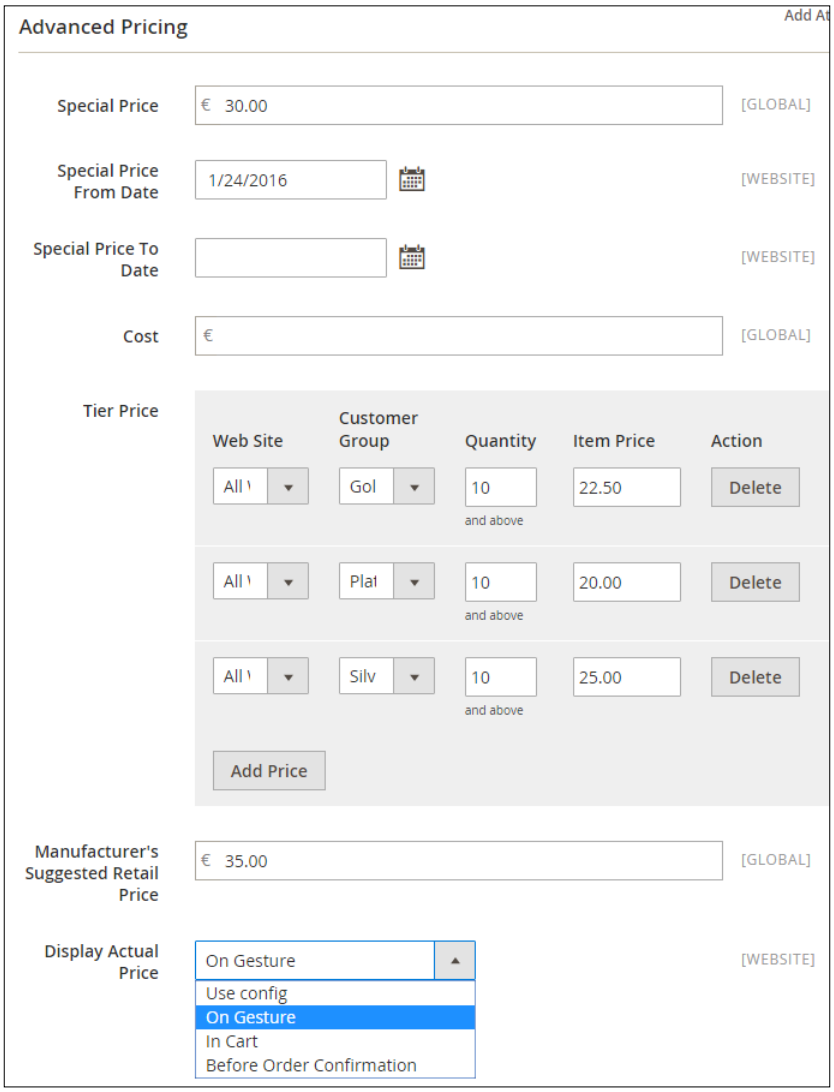
For the purpose of this recipe, let's assume that we need to create advanced pricing for some of our products in Magento 2. The following steps will guide you through this.

1. First log in to the backend of Magento, go to **Products | Catalog** and open **Joust Duffle Bag**.
2. Now click on the **Advanced Pricing** menu on the left and set a new **Special Price** from the date range you prefer.
3. Now update your **Tier Price** using the Platinum, Gold, and Silver **Customer Groups**.
4. Finally, set the new price for the **Manufacturer's Suggested Retail Price** and choose the correct **Display Actual Price** option.

   You can choose from **Use Config**, **On Gesture**, **In Cart**, and **Before Order Confirmation**.

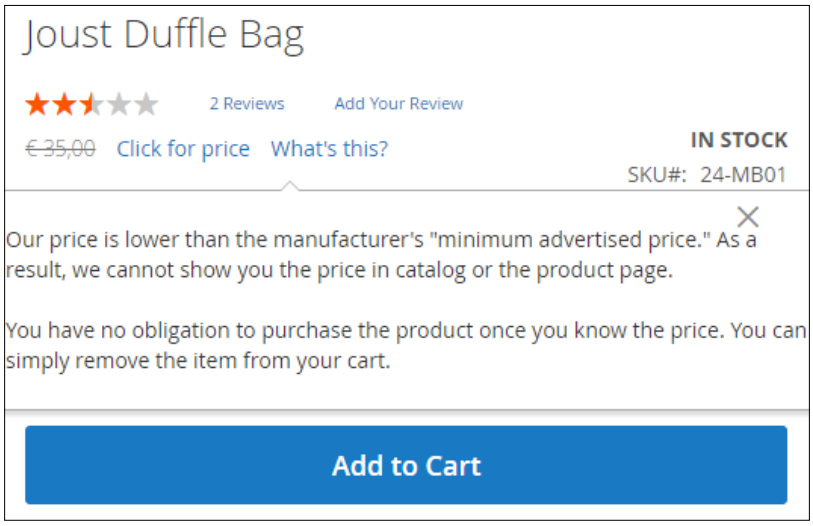
   - **Use Config**: The default configuration located in **Stores** | **Configuration** | **Sales** | **Sales** | **Minimum Advertised Price**.
   - **On Gesture**: Product prices are shown in the catalog pages but only when the user clicks on the link, which shows the price in a pop-up.
   - **In Cart**: Customers can see product prices when products have been added to the cart.

- **Before Order Confirmation**: Product prices are shown on the checkout page:



5. Next open up a new browser and go to `http://yourdomain.com/joust-duffle-bag.html`. Depending on your configuration, it should look as follows:





6. Congratulations, you just finished managing advanced pricing in Magento 2.

How it works...

Let's recap and find out what we did throughout the preceding recipe. In Steps 1 through 5, we configured advanced pricing using a special price, a tier price, and the minimum advertised price in a product.

5
Creating Magento 2 Extensions – the Basics

In this chapter, we will cover the basics on how to create your own Magento 2 extensions with the following recipes:

- Initializing extension basics
- Working with database models
- Creating tables using setup scripts
- Creating a web route and controller to display data
- Creating system configuration fields
- Creating a backend data grid
- Creating a backend form to add/edit data

Introduction

Now that we have installed and configured Magento 2, we will see the basics on how to create a new Magento 2 extension. If you are familiar with creating an extension for Magento 1.x, you will notice that there are some concepts that look a lot like how it is done in Magento 1. However, as the code is a completely new framework, there are also lots of changes in the module structure and necessary files.

Some of the major changes that change the way a extension is created are as follows:

- **A new module structure**: The directory structure has changed, moving all parts of an extension into a single container, and files are no longer spread between different locations. This makes it easier to maintain an extension.

- **Configuration files**: In Magento 2, the configuration of an extension is split into multiple smaller files that are validated by an **XML Schema Definition** (**XSD**) schema. Additionally, some configuration files can be area-specific (adminhtml, frontend, cron, and api) to overwrite the general settings.
- **Namespaces and dependency injection**: In Magento 2, the code uses PHP namespaces to identify class names. Additionally, classes necessary are no longer loaded through `Mage::getModel()` (or similar functions), but injected into your class through a dependency injection.

Initializing extension basics

The way in which a new extension is built in Magento 2 is a bit different than it was in Magento 1. The major change is that all files are now included in the extension directory. This makes it easier to manage and remove.

The location of an extension is also different; there are no longer separate codepools as used in Magento 1 (core, community, and local). Depending on the way the extension is installed, the extension will be running from the `vender` directory when installed through Composer. For project-specific extensions, it is also possible to place them in `app/code`.

Getting ready

When developing an extension, it is advised to run Magento 2 in developer mode as this will give better error messages explaining what went wrong and make debugging a lot easier.

To display all PHP errors and activate developer mode, activate the `display_errors` setting in `app/bootstrap.php` and run the following command:

```
bin/magento deploy:mode:set developer
```

The code used in this chapter is based on naming the module `Genmato_Sample` and all files will be placed in the following:

```
app/code/Genmato/Sample/
```

How to do it...

Follow these steps to initialize a new extension:

1. Create the module initialization file:

   `etc/module.xml`:

   ```
   <?xml version="1.0"?>
   <config xmlns:xsi="http://www.w3.org/2001/
     XMLSchema-instance" xsi:noNamespaceSchemaLocation=
   ```

```
  "urn:magento:framework:Module/etc/module.xsd">
  <module name="Genmato_Sample" setup_version="0.1.3">
    <sequence>
      <module name="Magento_Store"/>
    </sequence>
  </module>
</config>
```

2. Create the module registration file:

   `registration.php`

```
<?php

\Magento\Framework\Component\ComponentRegistrar::register(
  \Magento\Framework\Component\ComponentRegistrar::MODULE,
  'Genmato_Sample',
  __DIR__
);
```

3. Create the module `composer.json` file:

   `composer.json`

```
{
  "name": "genmato/sample",
  "description": "Genmato Magento2 Sample extension",
  "keywords": ["magento2", "genmato", "m2sample"],
  "type": "magento2-module",
  "license": "OSL-3.0",
  "require": {
    "php": "~5.5.0|~5.6.0|~7.0.0"
  },
  "autoload": {
    "files": [ "registration.php" ],
    "psr-4": {
      "Genmato\\Sample\\": ""
    }
  }
}
```

4. Enable the module with Magento. To do this, run the following command:

   `bin/magento module:enable Genmato_Sample`

5. Run the upgrade command to register the module:

   `bin/magento setup:upgrade`

How it works...

The module declaration in step 1 registers the module in Magento; here, the version number and dependencies are also specified to manipulate the load order. The following XML nodes are available:

- **Module name**: `Genmato_Sample`
- **Setup version**: `0.1.3` is used for the setup/upgrade scripts creating database schemas
- **Sequence**: Here we can define the modules that this extension is depending on

With the use of Composer, modules can be placed in two locations currently. In order for the autoloader to know what file to load when a class is instantiated, the path needs to be registered. Through `registration.php` from step 2, the (`__DIR__`) location is stored for a specified package. The registration can be done for the following types of packages:

- `MODULE`: This is for extensions/modules
- `LIBRARY`: This is for extensions that are used as a library
- `THEME`: This is for themes
- `LANGUAGE`: This is for language packs

In order to use Composer to install the module, it is required to add a `composer.json` file to the module. The most important elements in this file are as follows:

- `Name`: The extension package name is in the format of `<vendor name>/<extension name>`; it is important to only use lowercase letters. This name is also used to install the extension through Composer.
- `Type`: This defines the package type; the possible options are as follows:
  - `magento2-module`: Extensions/modules
  - `magento2-theme`: Themes
  - `magento2-language`: Language packages
- `require`: This defines the packages needed to be installed on the system for this package to work. During installation of the package, Composer will check the requirements and try to install the missing packages. When it's not possible to install them, the installation will fail.
- `Autoload`: This element is to specify information that needs to be loaded through the Composer autoloader.

There's more...

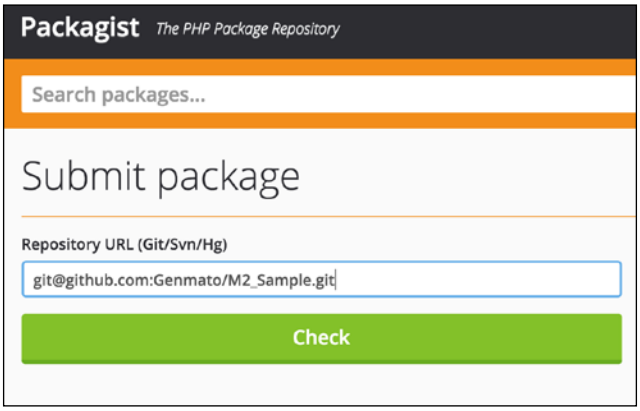
In order to install packages in your project, they have to be available for Composer to install. There are a few options available to install packages from:

- **Magento marketplace**: Currently, installing Magento 2 through Composer is done from the Magento repository. In the future, paid and free modules/packages bought through the marketplace will be available through the same repository through your account. This will make installing and managing packages easy.
- **From version control repository**: For private packages that you use in your project, it is possible to install them directly from your version control repository; for this, you need to add the following to the `composer.json` file located in your Magento 2 installation root:

```
{
  "repositories": [
    {
      "type": "vcs",
      "url": "https://github.com/[github
        account]/[package]"
    }
  ]
}
```

- **Packagist**: For freely available packages, it is also possible to register them on Packagist, which is the default repository that is available in Composer to install packages. To add a Magento 2 extension to Packagist, you will need to store the extension in a public repository, which can be GitHub (`http://www.github.com`) or BitBucket (`http://www.bitbucket.com`).

  On Packagist, you can submit your package by specifying your extension repository URL:



Every package is now installable by running the following command in your Magento 2 installation root:

```
composer require <vendor-name>/<module-name>
```

Working with database models

Storing data in a database table is handled through a `Model` class; this model holds the data. While saving the data, a `ResourceModel` is used, and this class is the link between the `Model` and database table, and all CRUD operations go through the `ResourceModel`. When loading a set of records, a `Collection` is used; it is possible to apply filters to this collection.

Getting ready

Using database models requires that the module configuration is done correctly; otherwise, the autoloader won't be able to find the files to load.

How to do it...

The following steps in this recipe will add the database models to your module:

1. Create the `Model` class:

   `Model/Demo.php`

```
<?php
namespace Genmato\Sample\Model;
use Magento\Framework\Model\AbstractModel;
class Demo extends AbstractModel
{
  /**
  * Initialize resource model
  * @return void
  */
  protected function _construct()
  {
    $this->_init('Genmato\Sample\Model\ResourceModel\
      Demo');
  }
}
```

2. Create the `ResourceModel` class:

   `Model/ResourceModel/Demo.php`

```
<?php
namespace Genmato\Sample\Model\ResourceModel;
use Magento\Framework\Model\ResourceModel\Db\AbstractDb;
class Demo extends AbstractDb
{
  /**
  * Initialize resource model
  * @return void
  */
  protected function _construct()
  {
    $this->_init('genmato_demo', 'demo_id');
  }
}
```

3. Create the `Collection` class:

   `Model/ResourceModel/Demo/Collection.php`

```
<?php
namespace Genmato\Sample\Model\ResourceModel\Demo;
use Magento\Framework\Model\ResourceModel\Db\Collection\
AbstractCollection;
class Collection extends AbstractCollection
{
  /**
  * @var string
  */
  protected $_idFieldName = 'demo_id';

  /**
  * Define resource model
  * @return void
  */
  protected function _construct()
  {
    $this->_init('Genmato\Sample\Model\Demo',
      'Genmato\Sample\Model\ResourceModel\Demo');
  }
}
```

How it works...

The `Model` class specifies the used `ResourceModel` in the constructor through the `_init()` function. When the `save()` function is called on a `Model`, it will call the `save()` function on the `ResourceModel`; see the `save()` function in `AbstractModel` that is extended:

```
/**
* Save object data
*
* @return $this
* @throws \Exception
*/
public function save()
{
  $this->_getResource()->save($this);
  return $this;
}
```

Here, `_getResource()` returns an instance of the class specified in the `_init()` function.

In the `ResourceModel` class constructor, the `_init()` function is called to specify the `genmato_demo` database table and primary key in the `demo_id` table. This will be used when creating the queries necessary to load or save the data. Depending on the action performed (save new, save existing, or delete), a corresponding query is generated using an INSERT, UPDATE, or DELETE query. This is handled by the framework and is built (currently) on the `Zend_Db_Adapter_Pdo_Mysql` class.

In the `Collection` class, both `Model` and `ResourceModel` are specified in the `_init()` function. `ResourceModel` is necessary to connect to the database and load the records from the right database table, allowing you to use filters to select the records necessary. The collection is then represented as an array of Models to allow all functionality available to models (magic getters/setters, adding data, and delete/save).

Creating tables using setup scripts

When using database models, as explained in the previous recipe, the corresponding tables needs to be created during setup. These operations are placed in setup scripts and executed during the installation of an extension.

Getting ready

While running the installation of a module, there are four files executed to create schemas and insert data. To create schemas, the files used are as follows:

`Setup/InstallSchema.php`

`Setup/UpgradeSchema.php`

The installation file is executed only when there is no record in the `setup_module` table for the module. The upgrade file is executed only when the current version number in the `setup_module` table is lower than the version configured in your `etc/module.xml` file.

When it's necessary to insert default values into a table or new EAV attributes need to be created, these actions need to be configured in the following files:

`Setup/InstallData.php`

`Setup/UpgradeData.php`

Magento keeps track of which version is installed for an extension in the `setup_module` table; here, the current installed version for the schema and data is stored:

Objects | setup_module @magento2rc (L...

module	schema_version	data_version
Genmato_Sample	0.1.3	0.1.3
Magento_AdminNotification	2.0.0	2.0.0
Magento_AdvancedPricingImportExport	2.0.0	2.0.0
Magento_Authorization	2.0.0	2.0.0
Magento_Authorizenet	2.0.0	2.0.0
Magento_Backend	2.0.0	2.0.0

How to do it...

Follow these steps to create your database tables:

1. The following is the table schema installation:

   `Setup/InstallSchema.php`

```
<?php
namespace Genmato\Sample\Setup;

use Magento\Framework\Setup\InstallSchemaInterface;
```

```
use Magento\Framework\Setup\ModuleContextInterface;
use Magento\Framework\Setup\SchemaSetupInterface;
use Magento\Framework\DB\Adapter\AdapterInterface;

class InstallSchema implements InstallSchemaInterface
{
  public function install(SchemaSetupInterface $setup,
    ModuleContextInterface $context)
  {
    $installer = $setup;

    $installer->startSetup();

    /**
    * Create table 'genmato_demo'
    */
    $table = $installer->getConnection()->newTable(
      $installer->getTable('genmato_demo')
    )->addColumn(
      'demo_id',
      \Magento\Framework\DB\Ddl\Table::TYPE_SMALLINT,
      null,
      ['identity' => true, 'nullable' => false, 'primary'
        => true],
      'Demo ID'
    )->addColumn(
      'title',
      \Magento\Framework\DB\Ddl\Table::TYPE_TEXT,
      255,
      ['nullable' => false],
      'Demo Title'
    )->addColumn(
      'creation_time',
      \Magento\Framework\DB\Ddl\Table::TYPE_TIMESTAMP,
      null,
      [],
      'Creation Time'
    )->addColumn(
      'update_time',
      \Magento\Framework\DB\Ddl\Table::TYPE_TIMESTAMP,
      null,
      [],
      'Modification Time'
    )->addColumn(
```

```
            'is_active',
            \Magento\Framework\DB\Ddl\Table::TYPE_SMALLINT,
            null,
            ['nullable' => false, 'default' => '1'],
            'Is Active'
          )->addIndex(
            $setup->getIdxName(
              $installer->getTable('genmato_demo'),
              ['title'],
              AdapterInterface::INDEX_TYPE_FULLTEXT
            ),
            ['title'],
            ['type' => AdapterInterface::INDEX_TYPE_FULLTEXT]
          )->setComment(
            'Demo Table'
          );
          $installer->getConnection()->createTable($table);

          $installer->endSetup();
        }
    }
```

2. Trigger the execution of the setup scripts:

```
bin/magento setup:upgrade
```

How it works...

In Magento 2, the running of the setup scripts is no longer triggered by the first request after flushing the cache; to initiate the running of these scripts, run the command specified in step 2. When running the upgrade command, all modules are evaluated on their current version and module version in the configuration file. First, all schema installations/updates are executed, and next, the data installations/updates are processed.

The `InstallData` and `InstallSchema` files are executed only when there is no prior registration of the extension in the `setup_module` table. To run the installation files during testing, it is possible to remove the module row from the table and run the `bin/magento setup:upgrade` command.

The available methods to create a new table are defined in the `Magento\Framework\DB\Adapter\AdapterInterface\Table` class and are as follows:

- `addColumn`: This adds a new column to the table; this method has the following parameters:
  - `name`: This is the name of the table
  - `type`: This is the table type; the available column types are defined as constants in the `Magento\Framework\DB\Adapter\AdapterInterface\Table` class as `TYPE_*`:

    `TYPE_BOOLEAN`

    `TYPE_SMALLINT`

    `TYPE_INTEGER`

    `TYPE_BIGINT`

    `TYPE_FLOAT`

    `TYPE_NUMERIC`

    `TYPE_DECIMAL`

    `TYPE_DATE`

    `TYPE_TIMESTAMP`

    `TYPE_DATETIME`

    `TYPE_TEXT`

    `TYPE_BLOB`

    `TYPE_VARBINARY`

  - `size`: This specifies the size of the column
  - `options`: This is used to specify extra column options; the available options are as follows:

    `unsigned`: This is only for number types; allows True/False (default: False)

    `precision`: This is only for decimal and numeric types (default: calculated from size parameter or 0 if not set)

    `scale`: This is only for decimal and numeric types (default: calculated from size parameter or 10 if not set)

    `default`: The default value is used when creating a new record

    `nullable`: In case a column is NULL (default: True)

    `primary`: This makes a column a primary key

    `primary_position`: This is only for primary keys and sets the sort order for the primary keys

`identity/auto_increment`: This auto-increments a column on inserting a new record (used to identify a unique record ID)

- `comment`: This is the description of the column

- `addForeignKey`: This adds a foreign key relation to another table; the parameters allowed are as follows:
  - `fkName`: This is the name of the foreign key
  - `column`: This is the column used as the foreign key
  - `refTable`: This is the table where the key references to
  - `refColumn`: This is the column name in the referenced table
  - `onDelete`: This sets the action to be performed when deleting a record; the available options are (constants as defined in `Magento\Framework\DB\Adapter\AdapterInterface\Table`):

    `ACTION_CASCADE`

    `ACTION_RESTRICT`

    `ACTION_SET_DEFAULT`

    `ACTION_SET_NULL`

    `ACTION_NO_ACTION`

- `addIndex`: This adds a column to the search index; the available parameters are as follows:
  - `indexName`: This is the name used for the index
  - `fields`: These are the column(s) used for the index (can be a single column or an array of columns)
  - `options`: This is an array with extra options; currently, only the option type is used to specify the index type

When changing an existing table, it is possible to use the following methods; these are the methods that can be used directly on the `$installer->getConnection()` class:

- `dropTable`: This removes a table from the database; the available parameters are as follows:
  - `tableName`: This is the name of the table to delete
  - `schemaName`: This is the optional schema name used

- `renameTable`: This renames a table from the database; the available parameters are as follows:
  - `oldTableName`: This is the current name of the table
  - `newTableName`: This is the new name for the table
  - `schemaName`: This is the optional schema name
- `addColumn`: This adds an extra column to a table; the available parameters are as follows:
  - `tableName`: This is the name of the table to alter
  - `columnName`: This is the name of the new column
  - `definition`: This is an array with the following parameters:

    `Type`: Column type

    `Length`: Column size

    `Default`: Default value

    `Nullable`: If a column can be NULL

    `Identify/Auto_Increment`: Used as an identity column

    `Comment`: Column description

    `After`: Specify where to add the column
  - `schemaName`: This is the optional schema name
- `changeColumn`: This changes the column name and definition; the available parameters are as follows:
  - `tableName`: This is the name of the table to change
  - `oldColumnName`: This is the current column name
  - `newColumnName`: This is the new name for the column
  - `definition`: This is the table definition; see `addColumn` for available values
  - `flushData`: This flushes the table cache
  - `schemaName`: This is the optional schema name
- `modifyColumn`: This changes the column definition; the available parameters are as follows:
  - `tableName`: This is the name of the table
  - `columnName`: This is the column name to change
  - `definition`: This is the table definition; see `addColumn` for available values

- `flushData`: This flushes the table cache
- `schemaName`: This is the optional schema name

- `dropColumn`: This removes a column from the table; the available parameters are as follows:
  - `tableName`: This is the name of the column
  - `columnName`: This is the name of the column to remove
  - `schemaName`: This is the optional schema name
- `addIndex`: This adds a new index; the available parameters are as follows:
  - `tableName`: This is the name of the table to change
  - `indexName`: This is the name of the index to add
  - `fields`: These are the columns to be used as the index
  - `indexType`: This is the type of index; the available options (constants defined in (`Magento\Framework\DB\Ddl\Table\AdapterInterface`) are as follows:

    `INDEX_TYPE_PRIMARY`

    `INDEX_TYPE_UNIQUE`

    `INDEX_TYPE_INDEX`

    `INDEX_TYPE_FULLTEXT`
  - `schemaName`: This is the optional schema name
- `dropIndex`: This removes an index from a table; the available parameters are as follows:
  - `tableName`: This is the name of the column
  - `indexName`: This is the name of the index
  - `schemaName`: This is the optional schema name
- `addForeignKey`: This adds a new foreign key; the available parameters are as follows:
  - `fkName`: This is the name of the foreign key
  - `tableName`: This is the name of the table
  - `columnName`: This is the name of the column used in the foreign key
  - `refTableName`: This is the name of the referenced table
  - `refColumnName`: This is the name of the referenced column
  - `onDelete`: This is the action to perform on delete (see the preceding `addForeignKey` description for available options)

- `purge`: This removes invalid data (default: false)
- `schemaName`: This is the optional schema name
- `refSchemaName`: This is the option-referenced schema name

There's more...

When, in a later version of the extension, there are extra fields necessary (or the current fields need to be changed), this is handled through the `UpgradeSchema` function, `upgrade`:

`Setup/UpgradeSchema.php`

```
<?php
namespace Genmato\Sample\Setup;

use Magento\Framework\DB\Ddl\Table;
use Magento\Framework\Setup\UpgradeSchemaInterface;
use Magento\Framework\Setup\ModuleContextInterface;
use Magento\Framework\Setup\SchemaSetupInterface;

class UpgradeSchema implements UpgradeSchemaInterface
{
  public function upgrade(SchemaSetupInterface $setup,
    ModuleContextInterface $context)
  {
    $setup->startSetup();

    if (version_compare($context->getVersion(), '0.1.1', '<')) {
      $connection = $setup->getConnection();

      $column = [
        'type' => Table::TYPE_SMALLINT,
        'length' => 6,
        'nullable' => false,
        'comment' => 'Is Visible',
        'default' => '1'
      ];
      $connection->addColumn($setup->getTable('genmato_demo'),
        'is_visible', $column);
    }

    $setup->endSetup();
  }
}
```

As this file is run every time the module version is different than the currently installed version, it is necessary to check the current version that is installed to execute only the updates necessary:

```
if (version_compare($context->getVersion(), '0.1.1', '<')) {
```

The preceding statement will make sure that the schema changes are executed only if the current version is less than `0.1.1`.

Data installation

In order to provide default content during installation (this can be records in a table or adding extra attributes to some entity), the data installation function is used:

`Setup/InstallData.php`

```
<?php
namespace Genmato\Sample\Setup;

use Genmato\Sample\Model\Demo;
use Genmato\Sample\Model\DemoFactory;
use Magento\Framework\Setup\InstallDataInterface;
use Magento\Framework\Setup\ModuleContextInterface;
use Magento\Framework\Setup\ModuleDataSetupInterface;

class InstallData implements InstallDataInterface
{
  /**
  * Demo factory
  *
  * @var DemoFactory
  */
  private $demoFactory;

  /**
  * Init
  *
  * @param DemoFactory $demoFactory
  */
  public function __construct(DemoFactory $demoFactory)
  {
    $this->demoFactory = $demoFactory;
  }

  /**
  * {@inheritdoc}
```

```
     * @SuppressWarnings(PHPMD.ExcessiveMethodLength)
     */
     public function install(ModuleDataSetupInterface $setup,
       ModuleContextInterface $context)
     {
       $demoData = [
         'title' => 'Demo Title',
         'is_active' => 1,
       ];

       /**
       * Insert demo data
       */
       $this->createDemo()->setData($demoData)->save();

     }

     /**
     * Create demo
     *
     * @return Demo
     */
     public function createDemo()
     {
       return $this->demoFactory->create();
     }
   }
```

In this example, there is one record created in the table created during setup. For this, the `DemoFactory` class is injected through dependency injection into the constructor function of this class. `DemoFactory` is an automatically created class that allows you to instantiate a class (in this case, `Genmato\Sample\Model\Demo`) without injecting this directly into the constructor. Here, this is done in the `createDemo` function:

```
$this->demoFactory->create();
```

Similar to `SchemaUpgrade`, there is also a `DataUpgrade` option to insert data while upgrading to a newer version.

Creating a web route and controller to display data

In order to display data from your extension on the frontend (the public part of the website), the following is necessary:

- A configured route
- A controller handling the request
- A layout file to specify what to show
- The block class as specified in the layout file
- A template file (optional)

How to do it...

Follow these steps to extend your module with a frontend web route and output data from a template file:

1. Create a route in the frontend area:

   `etc/frontend/routes.xml`

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/
  XMLSchema-instance" xsi:noNamespaceSchemaLocation=
  "urn:magento:framework:App/etc/routes.xsd">
  <router id="standard">
    <route id="sample" frontName="sample">
      <module name="Genmato_Sample" />
    </route>
  </router>
</config>
```

2. Create the controller that handles the request and renders the output:

   `Controller/Index/Index.php`

```
<?php
namespace Genmato\Sample\Controller\Index;
use Magento\Framework\App\Action\Action;

class Index extends Action
{
  /**
  * @var \Magento\Framework\View\Result\PageFactory
```

```
    */
    protected $resultPageFactory;

    /**
    * @param \Magento\Framework\App\Action\Context $context
    * @param \Magento\Framework\View\Result\PageFactory
      resultPageFactory
    */
    public function __construct(
      \Magento\Framework\App\Action\Context $context,
      \Magento\Framework\View\Result\PageFactory
        $resultPageFactory
    )
    {
      $this->resultPageFactory = $resultPageFactory;
      parent::__construct($context);
    }

    /**
    * Renders Sample Index
    */
    public function execute()
    {
      return $this->resultPageFactory->create();
    }
}
```

3. Create the layout file to specify what to display:

```
view/frontend/layout/sample_index_index.xml
```

```
<?xml version="1.0"?>
<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  layout="1column" xsi:noNamespaceSchemaLocation=
  "urn:magento:framework:View/Layout/etc/
  page_configuration.xsd">
  <head>
    <title>Sample DemoList</title>
  </head>
  <body>
    <referenceContainer name="content">
      <block class="Genmato\Sample\Block\DemoList"
        name="demoList" template=
        "Genmato_Sample::list.phtml" />
    </referenceContainer>
  </body>
</page>
```

4. In order to show the data, the `Block` class is called to render the template specified:

`Block/DemoList.php`

```
<?php
namespace Genmato\Sample\Block;

use Magento\Framework\View\Element\Template;
use Genmato\Sample\Model\ResourceModel\Demo\Collection as
  DemoCollection;
use Magento\Store\Model\ScopeInterface;

class DemoList extends Template
{
  /**
  * Demo collection
  *
  * @var DemoCollection
  */
  protected $_demoCollection;

  /**
  * Demo resource model
  *
  * @var \Genmato\Sample\Model\ResourceModel\Demo\
    CollectionFactory
  */
  protected $_demoColFactory;

  /**
  * @param Template\Context $context
  * @param \Genmato\Sample\Model\ResourceModel\Demo\
    CollectionFactory $collectionFactory
  * @param array $data
  * @SuppressWarnings(PHPMD.ExcessiveParameterList)
  */
  public function __construct(
    Template\Context $context,
    \Genmato\Sample\Model\ResourceModel\Demo\
      CollectionFactory $collectionFactory,
    array $data = []
  ) {
    $this->_demoColFactory = $collectionFactory;
    parent::__construct(
      $context,
```

```
            $data
        );
    }

    /**
    * Get Demo Items Collection
    * @return DemoCollection
    */
    public function getDemoItems()
    {
        if (null === $this->_demoCollection) {
            $this->_demoCollection =
                $this->_demoColFactory->create();
        }
        return $this->_demoCollection;
    }
}
```

5. In the template, the data collected in the `Block` class can be used to build the page:

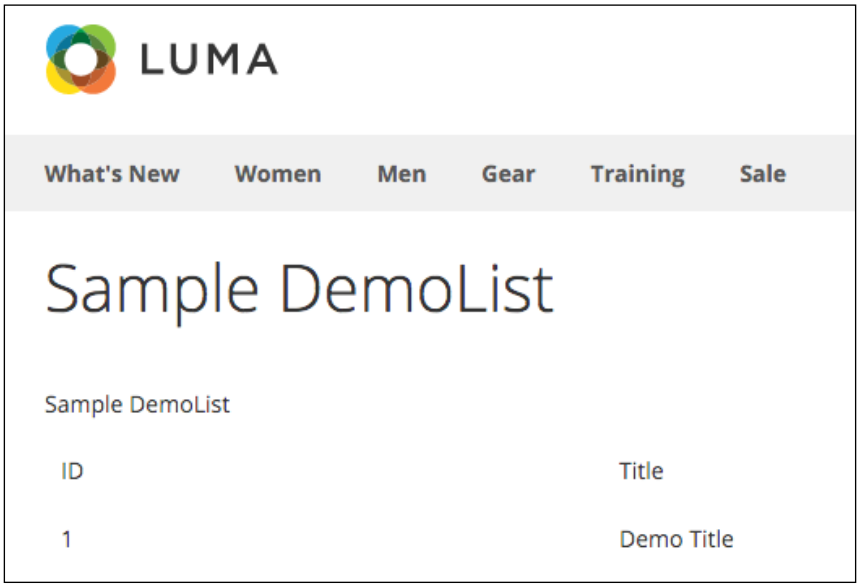
   `view/frontend/templates/list.phtml`

```
<table>
    <tr>
        <td>ID</td>
        <td>Title</td>
    </tr>
    <?php foreach($block->getDemoItems() as $item): ?>
    <tr>
        <td><?php echo $item->getId(); ?></td>
        <td><?php echo $item->getTitle();?></td>
    </tr>
    <?php endforeach; ?>
</table>
```

6. Refresh the cache to update the configuration:

```
bin/magento cache:clean
```

In your browser, open `http://[your hostname]/sample/index/index/`. This will result in the following page when you access the URL:





If you have not set the deploy mode to developer, it is possible that the accessed URL will not render. If this is the case, you need to run the compile command:

```
bin/magento setup:di:compile
```

How it works...

When a request is received in the application, the path is evaluated and executed in the following order:

1. A request is received by `index.php`.
2. The `index.php` file creates a `bootstrap`:

```
$bootstrap = \Magento\Framework\App\Bootstrap::create(BP, $_
SERVER);
```

3. The `bootstrap` creates a new HTTP application:

```
$app = $bootstrap->createApplication('Magento\Framework\App\
Http');
```

4. The `bootstrap` application is started:

```
$bootstrap->run($app);
```

5. In the `run` function of the `bootstrap` class, the created application is launched:

```
$response = $application->launch();
```

6. The application launch function will instantiate the `frontcontroller` and dispatch the request:

```
$frontController = $this->_objectManager->get(
  'Magento\Framework\App\FrontControllerInterface');
$result = $frontController->dispatch($this->_request);
```

7. The `frontcontroller` loops through all the available configured controllers and checks whether there is a match. When a match is found, the controller is instantiated and the `execute` method is called:

```
$result = $actionInstance->execute();
```

8. This will evaluate the layout file for the route loaded and render the blocks that are specified there.

To activate a route on the frontend, it needs to be configured by specifying the first part of the URL. This first part maps the request to the extension that will handle the request.

Here, `frontName` (`sample`) is mapped to the extension, `Genmato_Sample`, allowing it to handle all requests on the frontend.

In order to handle the request to a URL, there needs to be a controller. In Magento 2, the controller now handles only *one* action (whereas Magento 1 has a controller that has the option to handle multiple actions). Every request consists of three parts:

```
[route]/[controller]/[action]
```

`[route]`: This is the configured `frontName`

`[controller]`: This is the path to identify the controller

`[action]`: This is the action that is executed (the PHP class)

In this case, a request is made to the following:

```
http://example.com/sample/
```

This will result with a request to the following:

```
http://example.com/sample/index/index
```

This will load the following file:

```
Genmato\Sample\Controller\Index\Index.php
```

The executed controller relies on the layout file to render the page by including the specified blocks in the page. Just like the controllers, the layout files are now separate files per page handle. The name of the file is built in the same way as the controllers:

```
[route]_[controller]_[action].xml
```

This makes it easier to change a specific page handle in a theme.

The loaded `Block` class is the location to handle the collection of the data necessary to be shown in the template (just like in Magento 1). Here, we load the collection from the database so that it can be used in the template.

Creating system configuration fields

In Magento, it is possible to store configuration values for global/website or store in the backend. These values can be used to store simple module settings such as API -keys, module enable/disable options, or any setting that you might require for your module. The data is stored in the `core_config_data` table.

Getting ready

As the configuration fields are only accessible through the backend web pages, the configuration file is stored in the `etc/adminhtml` directory.

How to do it...

Create your own configuration options with the following step:

1. Create the system configuration file:

```
etc/adminhtml/system.xml
```

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/
  XMLSchema-instance" xsi:noNamespaceSchemaLocation=
  "urn:magento:module:Magento_Config:etc/system_file.xsd">
  <system>
    <section id="sample" translate="label" type="text"
      sortOrder="2000" showInDefault="1" showInWebsite="1"
      showInStore="1">
      <label>Sample Configuration</label>
      <tab>general</tab>
      <resource>Genmato_Sample::config_sample</resource>
      <group id="demo" translate="label" type="text"
        sortOrder="100" showInDefault="1" showInWebsite="1"
        showInStore="1">
```

```
            <label>Sample</label>
            <field id="header" translate="label" type="text"
              sortOrder="1" showInDefault="1" showInWebsite="1"
              showInStore="1">
              <label>Header Title</label>
            </field>
            <field id="selectsample" translate="label"
              type="select" sortOrder="2" showInDefault="1"
              showInWebsite="1" showInStore="1">
              <label>Sample Select</label>
              <source_model>Genmato\Sample\Model\Config\Source\
                DemoList</source_model>
            </field>
          </group>
        </section>
      </system>
    </config>
```

How it works...

The Magento store configuration is divided in separate sections and contains multiple groups of configuration fields. Every section is assigned to a main tab that is displayed above the sections.

Creating a new tab

When the configuration options that you want to add can't fit in one of the existing tabs, it is possible to add your own through the `system.xml` file. For this, add the following to your system configuration file:

```
<tab id="<unique tab name>" translate="label"
  sortOrder="<sort order>" class="<class>">
  <label>[label]</label>
</tab>
```

In the configuration, you can use the following attributes:

- `id`: This is a unique identifier for the tab, which is also used to reference to the tab in your sections
- `translate`: This specifies the elements that need to be available for translation (in this case, only the label field is available)
- `sortOrder`: This is the numeric value to use to sort the tabs
- `class`: This is the optional class name for your tab

The label element is used as the visible name of the tab in the configuration; it is important to make it as descriptive as possible for customers to understand.

Creating a new section

Every section is shown below the tab referenced in the configuration. In every section, multiple groups can be configured that can hold multiple fields. Adding a new section can be done by adding the following to your `system.xml` file:

```
<section id="<unique_section_name>" translate="label"
  type="<text>" sortOrder="<sort order>" showInDefault="<0/1>"
  showInWebsite="<0/1>" showInStore="<0/1>">
  <class>[class]</class>
  <header_css>[header_css]</header_css>
  <label>[label]</label>
  <tab>[tab]</tab>
  <resource>[resource]</resource>
</section>
```

The attributes used are as follows:

- `id`: This is the unique section identifier
- `translate`: This specifies the elements that need to be available for translation (in this case, only the `label` field is available)
- `type`: This is the type of field used (normally text)
- `sortOrder`: This is the numeric value to use to sort the sections
- `showInDefault`: This shows sections in the default store configuration
- `showInWebsite`: This displays sections in the website configuration
- `showInStore`: This displays sections in the store configuration

The available elements in this configuration are as follows:

- `class`: This is the class used for the section
- `header_css`: This is the CSS class to use in the text header for the section
- `label`: This is the text to display in the section
- `tab`: This is the reference to the tab where the section should be added
- `resource`: This is the **access control list** (**ACL**) resource referenced, which is used to check whether the user logged in has access to the section

Creating a new group

In a section, it is possible to create multiple groups; they are displayed as separate fieldsets that can be expanded/collapsed and can hold one or multiple fields. To create a new group, add the following (in the section to hold the group) to the `system.xml` file:

```
<group id="<group_id>" translate="label" type="text"
  sortOrder="<sort order>" showInDefault="<0/1>"
  showInWebsite="<0/1>" showInStore="<0/1>">
  <label>[label]</label>
</group>
```

The attributes to configure a group are as follows:

- `id`: This is the unique ID for the group (in the section)
- `translate`: These are the fields that needs to be translated, in this case, only the label option
- `type`: This is the field type (text in this case)
- `sortOrder`: This is the numeric value used to sort the groups
- `showInDefault`: This shows a group in the default store configuration
- `showInWebsite`: This shows a group in the website configuration
- `showInStore`: This shows a group in the store configuration

The label element is shown as the heading of the group.

Creating a new field

Every group can have one or multiple fields. In the database, the configuration is stored as a path build, `<section>/<group>/<field>`. A new config field can be one of the following types: text input, textarea, select, multiselect, or a custom data renderer. To add a field, add the following to a group:

```
<field id="<field_id>" translate="label" type="<type>"
  sortOrder="<sort order>" showInDefault="<0/1>"
  showInWebsite="<0/1>" showInStore="<0/1>">
  <label>[comment]</label>
  <comment>[comment]</comment>
</field>
```

The attributes used for the field configuration are as follows:

- `id`: This is the unique ID of the field in the group
- `translate`: These are the fields that need to be translated (can be the label, comment, tooltip, or hint elements)

- `type`: This is the input type, which can be the following:
  - `text`: Default text input field
  - `textarea`: Text area input
  - `obscure`: Password input
  - `select`: Drop-down select

    This needs a `source_model` element to specify the available options to select.

  `multiselect`: This is the multiple item select box. This needs a `source_model` element to specify the available options to select.

  `image`: This is the image upload with a preview if the file is uploaded. This needs different `backend_model` (to store the uploaded file), `upload_dir` (to specify where to save the file), and `base_url` (path used to build the URL to access from the frontend) elements.
- `sortOrder`: This is the numeric value used to sort the fields in the group
- `showInDefault`: This shows fields in the default store configuration
- `showInWebsite`: This shows fields in the website configuration
- `showInStore`: This shows fields in the store configuration

There are also some extra elements available to configure the field:

- `label`: This is the label, which shows in front of the input field
- `comment`: This is the comment shown below the input field
- `tooltip`: This is the text shown when hovering the question mark
- `frontend_class`: This is the class used for the field
- `frontend_model`: This is the custom frontend model (block) that will be used to render the input area
- `backend_model`: This is the backend model used when saving the data to process inserted values
- `source_model`: This is the data source used for select and multiselect fields
- `depends`: This is the option to hide/show a field based on a value used by another field, for example:

```
<depends>
  <field id="[field_name_to_check]">[value_to show]</field>
</depends>
```

  When `[field_name_to_check]` has the `[value_to_show]` value, the field will be visible, if it contains a different value, then the field is hidden for the user.

There's more...

To get the data stored in the `sample/demo/header` field, add the following to the template `Block` class in our template block:

`Block/DemoList.php`

```
/**
* Get Header from configuration value
* @return string
*/
public function getHeader()
{
  return $this->_scopeConfig->getValue('sample/demo/header',
    ScopeInterface::SCOPE_STORE);
}
```

The `_scopeConfig` class is injected through **dependency injection** (**DI**) into the `Block` class in the constructor and allows us to read data stored in the configuration.

Next, we want to display the data in our template by adding the following line at the top of the file:

`view/frontend/templates/list.phtml`

```
<p><?php echo $this->getHeader();?></p>
```

Creating a backend data grid

Adding a page to the backend requires, just like the frontend, a configured route, controller, and layout file. In order to display a grid page to show data from a table, there are currently three ways available:

- Creating a grid container and specifying the fields to display and data source to use in the grid class. This method is similar to how a grid is built in Magento 1 and is not really flexible/easy to extend. An example of how this is used can be found in the CMS `Page` module:

  `Magento\Cms\Block\Adminhtml\Page`

  `Magento\Cms\Block\Adminhtml\Page\Grid`

- Using this method, there is only a grid container `Block` class created. The grid fields and options are defined in the layout XML file. This makes it possible to extend the grid easily by adding extra fields to the XML. An example of this can be found in the Customer Group code in the following:

  `Magento\Customer\view\adminhtml\layout\customer_group_index.xml`

- The last option is fully configured through XML and gives the option to specify the data source, quick search, available advanced filters, mass actions, row actions, and columns to show. It also gives you the option to customize the columns shown in the backend by the user.

In this example, we will use the last option to build a grid. As this option uses quite a large set of files and long XML listings, the complete code can be found on GitHub (`https://github.com/Genmato/M2_Sample`).

How to do it...

The following steps will describe how to add a backend data grid:

1. Configure routes for use in the `adminhtml` area:

   `etc/adminhtml/routes.xml`

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/
  XMLSchema-instance" xsi:noNamespaceSchemaLocation=
  "urn:magento:framework:App/etc/routes.xsd">
  <router id="admin">
    <route id="sample" frontName="sample">
      <module name="Genmato_Sample"
        before="Magento_Backend" />
    </route>
  </router>
</config>
```

2. Create the Controller for the backend:

   `Controller/Adminhtml/Demolist/Index.php`

```
<?php
namespace Genmato\Sample\Controller\Adminhtml\Demolist;

use Magento\Backend\App\Action\Context;
use Magento\Framework\View\Result\PageFactory;
```

```
use Magento\Backend\App\Action as BackendAction;

class Index extends BackendAction
{
  /**
  * @var PageFactory
  */
  protected $resultPageFactory;

  /**
  * @param Context $context
  * @param PageFactory $resultPageFactory
  */
  public function __construct(
    Context $context,
    PageFactory $resultPageFactory
  ) {
    parent::__construct($context);
    $this->resultPageFactory = $resultPageFactory;
  }
  /**
  * Check the permission to run it
  *
  * @return bool
  */
  protected function _isAllowed()
  {
    return $this->_authorization->isAllowed(
      'Genmato_Sample::demolist');
  }

  /**
  * Index action
  *
  * @return \Magento\Backend\Model\View\Result\Page
  */
  public function execute()
  {
    /** @var \Magento\Backend\Model\View\Result\Page
      $resultPage */
    $resultPage = $this->resultPageFactory->create();
    $resultPage->setActiveMenu('Genmato_Sample::demolist');
    $resultPage->addBreadcrumb(__('CMS'), __('CMS'));
```

```
        $resultPage->addBreadcrumb(__('Demo List'), __('Demo
          List'));
        $resultPage->getConfig()->getTitle()->prepend(__('Demo
          List'));

        return $resultPage;
      }
    }
```

3. Control the access to the page through the ACL:

   `etc/acl.xml`

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/
  XMLSchema-instance" xsi:noNamespaceSchemaLocation=
  "urn:magento:framework:Acl/etc/acl.xsd">
  <acl>
    <resources>
      <resource id="Magento_Backend::admin">
        <resource id="Magento_Backend::content">
          <resource id="Magento_Backend::content_elements">
            <resource id="Genmato_Sample::demolist"
              title="Demo List" sortOrder="10" />
          </resource>
        </resource>
      </resource>
    </resources>
  </acl>
</config>
```

4. The following is the `layout` file to specify the grid `uiComponent` used:

   `view/adminhtml/layout/sample_demolist_index.xml`

```
<?xml version="1.0"?>
<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="urn:magento:framework:
  View/Layout/etc/page_configuration.xsd">
  <update handle="styles"/>
  <body>
    <referenceContainer name="content">
      <uiComponent name="sample_demolist_listing"/>
    </referenceContainer>
  </body>
</page>
```

5. Create the `uiComponent` configuration:

   The referenced `uiComponent` configuration is quite large. In the sample code (on GitHub), this file can be found at the following:

   `https://github.com/mage2cookbook/M2_Sample/blob/master/view/adminhtml/ui_component/sample_demolist_listing.xml`

6. Add resources used in `uiComponent` to the dependency injection configuration:

   `etc/di.xml`

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/
  XMLSchema-instance" xsi:noNamespaceSchemaLocation=
  "urn:magento:framework:ObjectManager/etc/config.xsd">
  <preference for="Genmato\Sample\Model\DemoInterface"
    type="Genmato\Sample\Model\Demo" />

  <type name="Magento\Framework\View\Element\UiComponent\
    DataProvider\CollectionFactory">
    <arguments>
      <argument name="collections" xsi:type="array">
        <item name="sample_demolist_listing_data_source"
          xsi:type="string">Genmato\Sample\Model\
          ResourceModel\Demo\Grid\Collection</item>
      </argument>
    </arguments>
  </type>
  <type name="Genmato\Sample\Model\ResourceModel\Demo\
    Grid\Collection">
    <arguments>
      <argument name="mainTable" xsi:type="string">
        genmato_demo</argument>
      <argument name="eventPrefix" xsi:type="string">
        sample_demolist_grid_collection</argument>
      <argument name="eventObject" xsi:type="string">
        sample_demolist_collection</argument>
      <argument name="resourceModel" xsi:type="string">
        Genmato\Sample\Model\ResourceModel\Demo</argument>
    </arguments>
  </type>
  <virtualType name="DemoGridFilterPool" type="Magento\
    Framework\View\Element\UiComponent\DataProvider\
    FilterPool">
    <arguments>
      <argument name="appliers" xsi:type="array">
```

```
            <item name="regular" xsi:type="object">
              Magento\Framework\View\Element\UiComponent\
              DataProvider\RegularFilter</item>
            <item name="fulltext" xsi:type="object">
              Magento\Framework\View\Element\UiComponent\
              DataProvider\FulltextFilter</item>
          </argument>
        </arguments>
      </virtualType>
      <virtualType name="DemoGridDataProvider" type="Magento\
        Framework\View\Element\UiComponent\DataProvider\
        DataProvider">
        <arguments>
          <argument name="collection" xsi:type="object"
            shared="false">Genmato\Sample\Model\ResourceModel\
            Demo\Collection</argument>
          <argument name="filterPool" xsi:type="object"
            shared="false">DemoGridFilterPool</argument>
        </arguments>
      </virtualType>
    </config>
```

7. Add the mass action controller:

```
Controller/Adminhtml/Demolist/MassDelete.php
```

```
<?php
namespace Genmato\Sample\Controller\Adminhtml\Demolist;

use Magento\Framework\Controller\ResultFactory;
use Magento\Backend\App\Action\Context;
use Magento\Ui\Component\MassAction\Filter;
use Genmato\Sample\Model\ResourceModel\Demo\CollectionFactory;
use Magento\Backend\App\Action;

class MassDelete extends Action
{

  /**
  * @var CollectionFactory
  */
  protected $collectionFactory;

  /**
  * @param Context $context
  * @param Filter $filter
```

```
     * @param CollectionFactory $collectionFactory
     */
     public function __construct(Context $context, Filter
       $filter, CollectionFactory $collectionFactory)
     {
       $this->filter = $filter;
       $this->collectionFactory = $collectionFactory;
       parent::__construct($context);
     }

     /**
     * Execute action
     *
     * @return \Magento\Backend\Model\View\Result\Redirect
     */
     public function execute()
     {
       $collection = $this->filter->getCollection(
         $this->collectionFactory->create());
       $collectionSize = $collection->getSize();

       foreach ($collection as $item) {
         $item->delete();
       }

       $this->messageManager->addSuccess(__('A total of %1
         record(s) have been deleted.', $collectionSize));

       /** @var \Magento\Backend\Model\View\Result\Redirect
         $resultRedirect */
       $resultRedirect = $this->resultFactory->create(
         ResultFactory::TYPE_REDIRECT);
       return $resultRedirect->setPath('*/*/');
     }
   }
```

8. Add options to the menu:

   `etc/adminhtml/menu.xml`

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/
  XMLSchema-instance" xsi:noNamespaceSchemaLocation=
  "urn:magento:module:Magento_Backend:etc/menu.xsd">
  <menu>
```

```
        <add id="Genmato_Sample::demolist" title="Demo List"
          module="Genmato_Sample" sortOrder="10"
          parent="Magento_Backend::content_elements"
          action="sample/demolist"
          resource="Genmato_Sample::demolist"/>
      </menu>
    </config>
```

How it works...

The controller and layout file are the same for the frontend, only the backend is protected through an ACL. This allows administrators to create specific user rules and allow access only to the selected pages.

The resource access is checked in the controller in the following function:

```
protected function _isAllowed()
```

The uiComponent configuration

As the complete configuration through uiComponent results in a large XML file, we will explain some parts on how they are configured and hook in to the system.

Data source

The data source is specified through the XML node:

```
<listing>
<dataSource name="sample_demolist_listing_data_source">
<argument name="dataProvider" xsi:type="configurableObject">
<argument name="class" xsi:type="string">
  DemoGridDataProvider</argument>
```

The specified data class, `DemoGridDataProvider`, is configured through dependency injection and specified in the `etc/di.xml` file. Here, `DemoGridDataProvider` corresponds to the `Genmato\Sample\Model\ResourceModel\Demo\Collection` collection. Additionally, `DemoGridFilterPool` and the collection are configured through this file to load the data.

Mass actions for grid

It is also easy to specify multiple mass actions to be used in the grid; you can specify the title, action to execute, and optional message alert box:

```
<massaction name="listing_massaction">
  <argument name="data" xsi:type="array">
    <item name="config" xsi:type="array">
```

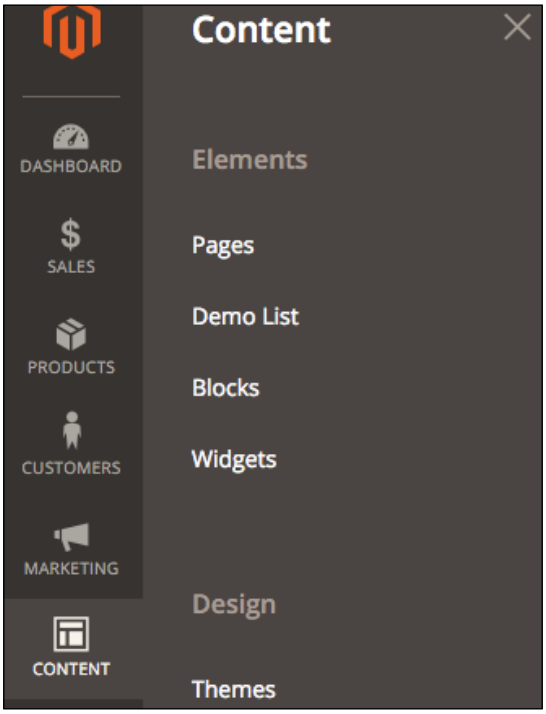
```
        <item name="selectProvider" xsi:type="string">
          sample_demolist_listing.sample_demolist_listing.
          sample_demolist_columns.ids</item>
        <item name="indexField" xsi:type="string">demo_id</item>
      </item>
    </argument>
    <action name="delete">
      <argument name="data" xsi:type="array">
        <item name="config" xsi:type="array">
          <item name="type" xsi:type="string">delete</item>
          <item name="label" xsi:type="string" translate
            ="true">Delete</item>
          <item name="url" xsi:type="url" path=
            "sample/demolist/massDelete"/>
          <item name="confirm" xsi:type="array">
            <item name="title" xsi:type="string"
              translate="true">Delete items</item>
            <item name="message" xsi:type="string" translate="true">
              Are you sure you want to delete selected items?
              </item>
          </item>
        </item>
      </argument>
    </action>
  </massaction>
```

In this example, we add an option to delete records from the database. In order to delete the records from the database, you need to create a controller that handles the removal of the records. You need to create a `Controller` class for every action you specify, this controller contains your custom code to be executed.

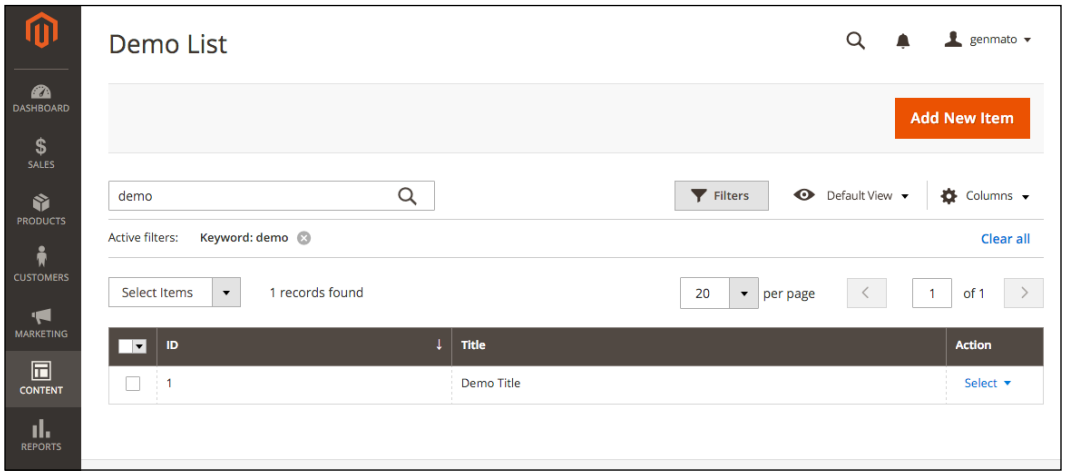
By adding the menu option in the **Content** menu below the **Pages** menu item, the page can be accessed through the backend. This link action will go to the specified `sample/demolist` URL that will result in the full URL:

`http://example.com/admin/sample/demolist/`

The `resource` argument defines the ACL that is used to show/hide the menu option depending on the user rights:



When clicking on the menu option, the resulting page will look as follows:



See also

For more information about uiComponents that are available, you can refer to the following:

`http://devdocs.magento.com/guides/v2.0/ui-components/ui-component.html`

Creating a backend form to add/edit data

If you want to add a new record or edit an existing record, it is possible to create a form to have a user friendly way to process the data. In this example, we will see how to create a form to edit an existing record. The path used to add a record will be as follows:

`http://example.com/admin/sample/demolist/new/`

This will require the controller name to be new, but as this is a reserved word in PHP, the class name used will be `newAction`. The execute function is not only used to add a new record, but it can also be used to edit an existing record. In the following code, only the execute action is shown; see the sample code for the complete source.

Getting ready

In this recipe, we will add the option to add or edit records; for this, the route used in the previous chapter is used, only new controllers and blocks are shown.

How to do it...

Follow these steps to add a form to your module:

1. Add the controller:

   `Controller/Adminhtml/Demolist/NewAction.php`

```
<?php
namespace Genmato\Sample\Controller\Adminhtml\Demolist;
use Magento\Backend\App\Action;
class NewAction extends Action
{
  public function execute()
  {
    $demoId = $this->getRequest()->getParam('demo_id');
```

```
        $this->_coreRegistry->register('current_demo_id',
          $demoId);

        /** @var \Magento\Backend\Model\View\Result\Page
          $resultPage */
        $resultPage = $this->resultPageFactory->create();
        if ($demoId === null) {
          $resultPage->addBreadcrumb(__('New DemoList'),
            __('New DemoList'));
          $resultPage->getConfig()->getTitle()->prepend(__('New
            DemoList'));
        } else {
          $resultPage->addBreadcrumb(__('Edit DemoList'),
            __('Edit DemoList'));
          $resultPage->getConfig()->getTitle()->
            prepend(__('Edit DemoList'));
        }
        // Build the edit form
        $resultPage->getLayout()->addBlock(
          'Genmato\Sample\Block\Adminhtml\Demo\Edit',
          'demolist', 'content')
        ->setEditMode((bool)$demoId);

        return $resultPage;
      }
    }
```

2. Create the `Form` container:

```
Block/Adminhtml/Demo/Edit.php
```

```
<?php
namespace Genmato\Sample\Block\Adminhtml\Demo;
use Magento\Backend\Block\Widget\Form\Container;
class Edit extends Container
{
  /**
  * Remove Delete button if record can't be deleted.
  *
  * @return void
  */
  protected function _construct()
  {
    $this->_objectId = 'demo_id';
    $this->_controller = 'adminhtml_demo';
```

```
        $this->_blockGroup = 'Genmato_Sample';
        parent::_construct();
        $demoId = $this->getDemoId();
        if (!$demoId) {
          $this->buttonList->remove('delete');
        }
      }

      /**
      * Retrieve the header text, either editing an existing
        record or creating a new one.
      *
      * @return \Magento\Framework\Phrase
      */
      public function getHeaderText()
      {
        $demoId = $this->getDemoId();
        if (!$demoId) {
          return __('New DemoList Item');
        } else {
          return __('Edit DemoList Item');
        }
      }

      public function getDemoId()
      {
        if (!$this->demoId) {
          $this->demoId=$this->coreRegistry->
            registry('current_demo_id');
        }
        return $this->demoId;
      }
    }
```

3. Build the form by defining the fields and types that are used:

```
Block/Adminhtml/Demo/Edit/Form.php
```

```
<?php
namespace Genmato\Sample\Block\Adminhtml\Demo\Edit;
use Magento\Customer\Controller\RegistryConstants;
use Magento\Backend\Block\Widget\Form\Generic;
class Form extends Generic
{
  /**
```

```
* Prepare form for render
*
* @return void
*/
protected function _prepareLayout()
{
  parent::_prepareLayout();

  /** @var \Magento\Framework\Data\Form $form */
  $form = $this->_formFactory->create();

  $demoId = $this->_coreRegistry->registry(
    'current_demo_id');
  /** @var \Genmato\Sample\Model\DemoFactory $demoData */
  if ($demoId === null) {
    $demoData = $this->demoDataFactory->create();
  } else {
    $demoData = $this->demoDataFactory->create()->load(
      $demoId);
  }

  $yesNo = [];
  $yesNo[0] = 'No';
  $yesNo[1] = 'Yes';

  $fieldset = $form->addFieldset('base_fieldset',
    ['legend' => __('Basic Information')]);

  $fieldset->addField(
    'title',
    'text',
    [
      'name' => 'title',
      'label' => __('Title'),
      'title' => __('Title'),
      'required' => true
    ]
  );

  $fieldset->addField(
    'is_active',
    'select',
    [
      'name' => 'is_active',
```

```
        'label' => __('Active'),
        'title' => __('Active'),
        'class' => 'required-entry',
        'required' => true,
        'values' => $yesNo,
      ]
    );

    $fieldset->addField(
      'is_visible',
      'select',
      [
        'name' => 'is_visible',
        'label' => __('Visible'),
        'title' => __('Visible'),
        'class' => 'required-entry',
        'required' => true,
        'values' => $yesNo,
      ]
    );

    if ($demoData->getId() !== null) {
      // If edit add id
      $form->addField('demo_id', 'hidden', ['name' =>
        'demo_id', 'value' => $demoData->getId()]);
    }

    if ($this->_backendSession->getDemoData()) {
      $form->addValues($this->_backendSession->
        getDemoData());
      $this->_backendSession->setDemoData(null);
    } else {
      $form->addValues(
        [
          'id' => $demoData->getId(),
          'title' => $demoData->getTitle(),
          'is_active' => $demoData->getIsActive(),
          'is_visible' => $demoData->getIsVisible(),
        ]
      );
    }

    $form->setUseContainer(true);
    $form->setId('edit_form');
    $form->setAction($this->getUrl('*/*/save'));
```

```
    $form->setMethod('post');
    $this->setForm($form);
  }
}
```

4. Add the `Save` action controller, which is called when pressing the **Submit** button:

   `Controller/Adminhtml/Demolist/Save.php`

```
<?php
namespace Genmato\Sample\Controller\Adminhtml\Demolist;
use Magento\Backend\App\Action;
class Save extends Action
{
  /**
  * Save DemoList item.
  *
  * @return \Magento\Backend\Model\View\Result\Page|\
    Magento\Backend\Model\View\Result\Redirect
  */
  public function execute()
  {
    $id = $this->getRequest()->getParam('demo_id');
    $resultRedirect = $this->resultRedirectFactory->
      create();
    try {
      if ($id !== null) {
        $demoData = $this->demoFactory->create()->
        load((int)$id);
      } else {
        $demoData = $this->demoFactory->create();
      }
      $data = $this->getRequest()->getParams();
      $demoData->setData($data)->save();

      $this->messageManager->addSuccess(__('Saved DemoList
        item.'));
      $resultRedirect->setPath('sample/demolist');
    } catch (\Exception $e) {
      $this->messageManager->addError($e->getMessage());
      $this->_getSession()->setDemoData($data);

      $resultRedirect->setPath('sample/demolist/edit',
        ['demo_id' => $id]);
    }
    return $resultRedirect;
  }
}
```

How it works...

In the controller, the `demo_id` parameter is stored in the Magento registry; this makes the data available to retrieve in the same request in other blocks/models to do further processing with it. Additionally, the `Genmato\Sample\Block\Adminhtml\Demo\Edit` class is loaded. This class will generate the container for the form and load the `Genmato\Sample\Block\Adminhtml\Demo\Edit\Form` class that will generate the form to be shown.

Building the form

Every form is built from the following:

```
$form = $this->_formFactory->create();
```

As it is not possible to add fields to a form directly, you need to create a fieldset first. It is possible to add multiple fieldsets to a single form and assign multiple form fields to a fieldset. To create a fieldset, use the following command:

```
$fieldset = $form->addFieldset('[name]', ['legend' => __([heading])]);
```

Adding a form field

Adding a form field to the fieldset is done as follows:

```
$fieldset->addField([elementId], [type], [config], [after]);
```

This method has the following parameters:

- `elementId`: This is the unique name of the form field element.
- `type`: This defines the type of element that is used as the input field. This can be your own class that implements the `Magento\Framework\Data\Form\Element\AbstractElement` class or one of the following:
  - button
  - checkbox
  - checkboxes
  - column
  - date
  - editablemultiselect
  - editor
  - fieldset
  - file
  - gallery

- hidden
- image
- imagefile
- label
- link
- multiline
- multiselect
- note
- obscure
- password
- radio
- radios
- reset
- select
- submit
- text
- textarea
- time

These input types are rendered from the classes found under the `Magento\Framework\Data\Form\Element\` directory.

- `config`: This is an array of extra configuration data; some of the options are as follows:
  - `name`: This is the name of the element from the data model that holds the data
  - `label`: This is the text that is used as a label
  - `title`: This is the text that is used as the field title parameter
  - `class`: This is the optional class for the input field, which can be used for form validation
  - `required`: This is optional. This is set if a field is required to have data.
  - `value`: This is the value used for select/multiselect
- `after`: This is the optional parameter to specify where the form field needs to be placed; use `elementId` of the form field that you want to place this field after.

Loading the data

In order to display the data currently stored for the record that we want to edit, the stored `demo_id` is retrieved from the registry:

```
$demoId = $this->_coreRegistry->registry('current_demo_id');
```

Next, we check whether there is a valid value stored as `demoId` and load the data from the database (or just set an empty object):

```
/** @var \Genmato\Sample\Model\DemoFactory $demoData */
if ($demoId === null) {
  $demoData = $this->demoDataFactory->create();
} else {
  $demoData = $this->demoDataFactory->create()->load($demoId);
}
```

Now that the data is loaded, it is possible to set this data to the form fields:

```
$form->addValues(
  [
    'id' => $demoData->getId(),
    'title' => $demoData->getTitle(),
    'is_active' => $demoData->getIsActive(),
    'is_visible' => $demoData->getIsVisible(),
  ]
);
```

Saving the data

When submitting the form to save the data, the action and method should be set to the URL that handles the save action:

```
$form->setAction($this->getUrl('*/*/save'));
$form->setMethod('post');
```

The URL `*/*/save` maps to the `Controller/Adminhtml/Demolist/Save` controller and will handle the save action.

In the controller, we first load the current record to load all the current values:

```
if ($id !== null) {
  $demoData = $this->demoFactory->create()->load((int)$id);
} else {
  $demoData = $this->demoFactory->create();
}
```

Next, we retrieve the submitted data, store it in the loaded object, and save the object:

```
$data = $this->getRequest()->getParams();
$demoData->setData($data)->save();
```

6
Creating Magento 2 Extensions – Advanced

In this chapter, we will cover some of the more advanced features when building Magento 2 extensions in the following recipes:

- Using dependency injection to pass classes to your own class
- Modifying functions with the use of plugins – Interception
- Creating your own XML module configuration file
- Creating your own product type
- Working with service layers/contracts
- Creating a Magento CLI command option

Introduction

In the previous chapter, we explained the basics on how to create a Magento 2 extension/module, including how to store data in a database and create a frontend page and backend grid with a form to add/edit data. In this chapter, we will explain some more advanced functions that can be used while developing custom extensions. The first two recipes are informational and describe the basic usage of dependency injection and plugins. The other recipes are examples on how to add your custom XML configuration file and commands to the Magento CLI tool.

Using dependency injection to pass classes to your own class

In Magento 2, they introduced the usage of dependency injection, which is a well-known design pattern that changes the way you use resources in the code. Using dependency injection, all the required resources are created when the class is instantiated instead of creating an object (through the Magento 1.x `Mage` class) when necessary. The benefit of this is that it is easier to use unit testing as it is possible to mock the required objects.

Getting ready

In this example, we will see how to create a new record in the `demolist` model created in the previous chapter. The record is created using an observer on the `sales_order_place_after` event that is dispatched after a new order is saved.

How to do it...

Follow these steps on how to use dependency injection:

1. First, we declare the `Observer` to listen to the event that we want:

   `etc/events.xml:`

```
<config xmlns:xsi="http://www.w3.org/2001/
  XMLSchema-instance" xsi:noNamespaceSchemaLocation=
  "urn:magento:framework:Event/etc/events.xsd">
  <event name="sales_order_place_after">
    <observer name="sample" instance=
      "Genmato\Sample\Observer\PlaceOrder"/>
  </event>
</config>
```

2. Next, we create the `Observer` class as defined in step 1:

   `Observer/PlaceOrder.php:`

```
<?php
namespace Genmato\Sample\Observer;

use Magento\Framework\Event\ObserverInterface;
use Magento\Framework\Event\Observer as EventObserver;
use Genmato\Sample\Model\DemoFactory;

class PlaceOrder implements ObserverInterface
{
```

```
    /**
    * @var DemoFactory
    */
    protected $demoFactory;

    /**
    * @param DemoFactory $demoFactory
    */
    public function __construct(DemoFactory $demoFactory)
    {
      $this->demoFactory = $demoFactory;
    }

    /**
    * Add record to demoList when new order is placed
    *
    * @param EventObserver $observer
    * @return void
    */
    public function execute(EventObserver $observer)
    {
      /** @var \Magento\Sales\Model\Order $order */
      $order = $observer->getEvent()->getOrder();

      $demoList = $this->demoFactory->create();

      $demoList->setTitle(__('New order (%1) placed!',
        $order->getIncrementId()));

      try {
        $demoList->save();
      } catch (\Exception $ex) {
        // Process error here....
      }

    }
}
```

3. Refresh the cache:

```
bin/magento cache:clean
```

How it works...

In the `Observer` class defined in step 2, the object that we need to create a new record in is injected into the constructor function:

```
public function __construct(DemoFactory $demoFactory)
```

During the instantiation of the class, the necessary classes are injected by the Magento 2 **dependency injection** (**DI**) framework. In this case, it adds the `Genmato\Sample\Model\DemoFactory` class to the constructor. This class is not a real existing class; this is because the class that we want to use is a non-injectable class. A non-injectable class is a class that you create yourself through the `new [classname]` command or the `Mage::getModel()` call in Magento 1.x. With the use of dependency injection, creating a new object should be handled by the object manager, but in order to be able to use unit testing, it is not advisable to create the object directly in the code. To solve this, the Magento framework uses autogenerated classes. In this example, the generated class is stored in `var/generation/Genmato/Sample/Model/DemoFactory.php`:

```
<?php
namespace Genmato\Sample\Model;

/**
 * Factory class for @see \Genmato\Sample\Model\Demo
 */
class DemoFactory
{
  /**
  * Object Manager instance
  *
  * @var \Magento\Framework\ObjectManagerInterface
  */
  protected $_objectManager = null;

  /**
  * Instance name to create
  *
  * @var string
  */
  protected $_instanceName = null;

  /**
  * Factory constructor
  *
  * @param \Magento\Framework\ObjectManagerInterface
    $objectManager
```

```
     * @param string $instanceName
     */
     public function __construct(\Magento\Framework\
       ObjectManagerInterface $objectManager, $instanceName =
       '\\Genmato\\Sample\\Model\\Demo')
     {
       $this->_objectManager = $objectManager;
       $this->_instanceName = $instanceName;
     }

     /**
     * Create class instance with specified parameters
     *
     * @param array $data
     * @return \Genmato\Sample\Model\Demo
     */
     public function create(array $data = array())
     {
       return $this->_objectManager->create($this->_instanceName,
         $data);
     }
   }
```

In this case, the autogenerated class is a `Factory` class that has only the `create()` function available. In the create function, the object manager is used to instantiate the `Genmato\Sample\Model\Demo` class; this object can then be used to load an existing record or create a new record and save the data stored in the object.

Modifying functions with the use of plugins – Interception

One of the biggest problems in Magento 1.x was that changing the behavior of a function in a class that didn't have an event trigger had to be rewritten. This works fine if only a single rewrite for a class was used, but when using a large number of extensions, there is a risk that multiple extensions rewrite the same class, which can result in unpredictable results.

In Magento 2, this problem is partly solved by introducing Interception in the form of plugins. With the use of plugins, it is possible to modify a function in three places:

- **Before execution**: With the before plugin, it is possible to (pre)process any data given to the original function by modifying the original function arguments; this allows you to replace the original method or change the input variables and supply them to the original method.

- **Around execution**: In the around plugin, you can modify both the input and output values of the original function. In your own function, you decide what action to do before the original function call and what will be done after it.
- **After execution**: The after plugin takes the result generated from the original function, modifies the result, and the modified result is then returned to the caller of the original function.

Getting ready

The use of plugins is controlled through `di.xml`. It is possible to use the global from `etc/` or the area specific from `etc/[area]`; in this case, we will use the global, which means that it is used in all areas.

How to do it...

Create the following files in this recipe to try the use of plugins:

1. To enable the plugins, add the following lines to `di.xml`:

   `etc/di.xml`

```
<type name="Magento\Cms\Model\Page">
  <plugin name="sample_before" type=
    "Genmato\Sample\Plugin\BeforePage" sortOrder="1"/>
</type>

<type name="Magento\Catalog\Model\Product">
  <plugin name="sample_around" type=
    "Genmato\Sample\Plugin\AroundProduct" sortOrder="1"/>
</type>

<type name="Magento\Cms\Model\Page">
  <plugin name="sample_after" type=
    "Genmato\Sample\Plugin\AfterPage" sortOrder="1"/>
</type>
```

2. The following is the before plugin class:

   `Plugin/BeforePage.php`

```
<?php
namespace Genmato\Sample\Plugin;

use Magento\Cms\Model\Page;

class BeforePage
```

```
{
  public function beforeSetContent(Page $subject, $content)
  {
    return $subject->setContent('<!--'.$content.'-->');
  }
}
```

3. The following is the around plugin class:

Plugin/AroundProduct.php

```
<?php

namespace Genmato\Sample\Plugin;

use Magento\Catalog\Model\Product;

class AroundProduct
{
  public function aroundSave(Product $subject, \Closure
    $proceed)
  {
    $subject->setMyCustomAttribute('sample');

    $return = $proceed();

    $subject->setMyCustomAttribute('');

    return $return;
  }
}
```

4. The following is the after plugin class:

Plugin/AfterPage.php

```
<?php
namespace Genmato\Sample\Plugin;

use Magento\Cms\Model\Page;

class AfterPage
{

  public function afterGetTitle(Page $subject, $result)
  {
```

```
        return 'SAMPLE: '.$result;
    }

}
```

5. To refresh the cache, execute the following command:

```
bin/magento cache:clean
```

How it works...

All configured interceptors/plugins are evaluated during initialization. When a call is made to a function that is extended through a plugin, all plugin functions are executed based on the configured `sortOrder` as configured in `di.xml`. If there are multiple plugins that extend the same original function, they are executed in the following sequence:

1. The before plugin with the lowest `sortOrder`
2. The around plugin with the lowest `sortOrder`
3. Other before plugins (from the lowest to highest `sortOrder`)
4. Other around plugins (from the lowest to highest `sortOrder`)
5. The after plugin with the highest `sortOrder`
6. Other after plugins (from the highest to lowest `sortOrder`)

There are some limitations on where you can use plugins; it is not possible to use plugins for the following:

- Final methods/classes
- Non-public methods
- Class methods (such as static methods)
- Inherited methods
- `__construct`
- Virtual types

If you need to modify one of these types listed, the only option to do this is to rewrite (preference) your class through `di.xml`.

Creating your own XML module configuration file

In Magento 1.x, it was possible to use the `.xml` file to include custom configuration options that might be necessary for an extension. This is no longer possible with Magento 2 because the XML files are all validated against a schema and anything other than predefined options are not allowed. To solve this, it is possible to generate your own custom XML file to set up the parameters that you need. This also allows other extensions to define settings as the output is generated from all modules that have this file configured.

Getting ready

In order to use your own XML configuration file, it is important that you generate a valid schema (XSD) file that will be used to validate the XML files when they are merged.

How to do it...

The following steps show you how to define a custom XML configuration file for your module:

1. First, we create the `Reader` for the XML file and define the name of the file that should be read from all modules:

```
Model/Sample/Reader.php

<?php
namespace Genmato\Sample\Model\Sample;

use Magento\Framework\Config\Reader\Filesystem;
use Magento\Framework\Config\FileResolverInterface;
use Magento\Framework\Config\ConverterInterface;
use Genmato\Sample\Model\Sample\SchemaLocator;
use Magento\Framework\Config\ValidationStateInterface;

class Reader extends Filesystem
{
  protected $_idAttributes = [
    '/table/row' => 'id',
    '/table/row/column' => 'id',
  ];

  /**
  * @param FileResolverInterface $fileResolver
  * @param ConverterInterface $converter
```

```
     * @param SchemaLocator $schemaLocator
     * @param ValidationStateInterface $validationState
     * @param string $fileName
     * @param array $idAttributes
     * @param string $domDocumentClass
     * @param string $defaultScope
     */
    public function __construct(
        FileResolverInterface $fileResolver,
        ConverterInterface $converter,
        SchemaLocator $schemaLocator,
        ValidationStateInterface $validationState,
        $fileName = 'sample.xml',
        $idAttributes = [],
        $domDocumentClass = 'Magento\Framework\Config\Dom',
        $defaultScope = 'global'
    ) {
        parent::__construct(
            $fileResolver,
            $converter,
            $schemaLocator,
            $validationState,
            $fileName,
            $idAttributes,
            $domDocumentClass,
            $defaultScope
        );
    }
}
```

2. To validate the schema, the `Reader` must know where to find the schema file:

   `Model/Sample/SchemaLocator.php`

```
<?php
namespace Genmato\Sample\Model\Sample;

use Magento\Framework\Config\SchemaLocatorInterface;
use Magento\Framework\Config\Dom\UrnResolver;

class SchemaLocator implements SchemaLocatorInterface
{
    /** @var UrnResolver */
```

```
    protected $urnResolver;

    public function __construct(UrnResolver $urnResolver)
    {
      $this->urnResolver = $urnResolver;
    }

    /**
    * Get path to merged config schema
    *
    * @return string
    */
    public function getSchema()
    {
      return $this->urnResolver->getRealPath(
        'urn:genmato:module:Genmato_Sample:/etc/sample.xsd');
    }

    /**
    * Get path to pre file validation schema
    *
    * @return string
    */
    public function getPerFileSchema()
    {
      return $this->urnResolver->getRealPath(
        'urn:genmato:module:Genmato_Sample:/etc/sample.xsd');
    }
}
```

3. A single class is used to get the merged data and cache the XML:

Model/Sample/Data.php

```
<?php
namespace Genmato\Sample\Model\Sample;

use Magento\Framework\Config\Data\Scoped;
use Genmato\Sample\Model\Sample\Reader;
use Magento\Framework\Config\ScopeInterface;
use Magento\Framework\Config\CacheInterface;

class Data extends Scoped
{
  /**
```

```
     * Scope priority loading scheme
     *
     * @var array
     */
     protected $_scopePriorityScheme = ['global'];

     /**
     * @param Reader $reader
     * @param ScopeInterface $configScope
     * @param CacheInterface $cache
     * @param string $cacheId
     */
     public function __construct(
       Reader $reader,
       ScopeInterface $configScope,
       CacheInterface $cache,
       $cacheId = 'sample_config_cache'
     ) {
       parent::__construct($reader, $configScope, $cache,
         $cacheId);
     }
   }
```

4. Add the XSD schema file:

   `etc/sample.xsd`

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="table">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="row" maxOccurs="unbounded"
          minOccurs="0">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="column"
                maxOccurs="unbounded" minOccurs="0">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element type="xs:string"
                      name="label">
                      <xs:annotation>
```

```
                        <xs:documentation>from first xml
                          from second xmlthey apear in
                          both xmls with the same path
                          and id and second one overrides
                          the value for `attr1` from
                          first xml  from first
                          xml</xs:documentation>
                      </xs:annotation>
                    </xs:element>
                  </xs:sequence>
                  <xs:attribute type="xs:string"
                    name="id" use="optional"/>
                  <xs:attribute type="xs:byte"
                    name="sort" use="optional"/>
                  <xs:attribute type="xs:string"
                    name="attr1" use="optional"/>
                  <xs:attribute type="xs:string"
                    name="disabled" use="optional"/>
                </xs:complexType>
              </xs:element>
            </xs:sequence>
            <xs:attribute type="xs:string" name="id"
              use="optional"/>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

5. Add the configuration file for your module:

```
etc/sample.xml
```

```
<?xml version="1.0"?>
<table xmlns:xsi="http://www.w3.org/2001/
  XMLSchema-instance" xsi:noNamespaceSchemaLocation=
  "urn:genmato:module:Genmato_Sample:/etc/sample.xsd">
  <row id="row1">
    <column id="col1" sort="10" attr1="val1">
      <label>Col 1</label>
    </column>
  </row>
  <row id="row2">
    <column id="col1" sort="10" attr1="val1">
      <label>Col 1</label>
    </column>
```

```
    <column id="col2" sort="20" disabled="true"
      attr1="val2" >
      <label>Col 2</label>
    </column>
    <column id="col3" sort="15" attr1="val1">
      <label>Col 3</label>
    </column>
  </row>
</table>
```

6. Get and display the merged data: (This is optional; in this example, we display the data through a frontend route.)

```
Controller/Index/Sample.php
```

```
<?php
namespace Genmato\Sample\Controller\Index;

use Magento\Framework\App\Action\Action;
use Magento\Framework\App\Action\Context;
use Magento\Framework\View\Result\PageFactory;
use Genmato\Sample\Model\Sample\DataFactory;

class Sample extends Action
{
  /**
  * @var PageFactory
  */
  private $resultPageFactory;

  /** @var  DataFactory $dataReader */
  private $dataReader;

  /**
  * @param Context $context
  * @param PageFactory $resultPageFactory
  * @param DataFactory $dataReader
  */
  public function __construct(
    Context $context,
    PageFactory $resultPageFactory,
    DataFactory $dataReader
  )
  {
```

```
        $this->dataReader = $dataReader;
        parent::__construct($context);
    }

    /**
    * Renders Sample
    */
    public function execute()
    {
        $myConfig = $this->dataReader->create();
        print_r($myConfig->get());
    }
}
```

7. Refresh the cache using the following command:

   bin/magento cache:clean

8. Now you can check the result data using the following command:

   `http://example.com/sample/index/sample/`

How it works...

The configuration reader defines the file that is used in the (`$fileName = 'sample.xml'`) constructor. Make sure that the filename used is unique; otherwise, configuration data from another module will be merged and validation will fail as it won't match the schema that you defined. A solution could be to use `<vendor>_<module>.xml` as the filename.

In the constructor, `SchemaLocator` is also defined; this will define the schema (XSD file) that is used to validate the XML. To be able to get the schema file independent from where the module is installed (`vendor/` or `app/code`), the schema location is built from the defined URN: `urn:genmato:module:Genmato_Sample:/etc/sample.xsd`. This URN is parsed and translated to the directory where the module is installed, which is done through `ComponentRegistrar`, and the module location is registered in `registration.php` as described in *Chapter 6*, *Creating Magento 2 Extensions – the Basics*.

It is possible to get all data using the `read()` method on the `Reader` class, this will result in re-reading and merging all XML files, which will impact every request. This can delay the website; therefore, the `Data` class is added. Here, `Reader` is injected through the constructor. To get the data, you can call the `get()` method of the `Data` class. This will read and merge all XML files if they are not cached and return the cached version when available. If you don't supply an argument to the `get()` method, it will return all data, but it's also possible to specify a node that you would like.

The `Data` class can be added everywhere that you need to get your configuration data; for this, you add `Genmato\Sample\Model\Sample\DataFactory` to the constructor. This autogenerated class allows you to instantiate your configuration data class:

```
$myConfig = $this->dataReader->create();
```

This gets a value from the configuration:

```
$myConfig->get('<node>');
```

Creating your own product type

In Magento 2, it is easy to add your own product type, which can be useful when you want to add some special features that are not available through the default product types. In this recipe, we will see a minimal new product type that calculates the price based on the cost of the product; you can easily extend it further to fit your own needs.

Getting ready

Every product type has its own unique code specified, and it's important to use a short code to identify your product type.

How to do it...

The following steps in this recipe show you how to create a (minimal) new product type:

1. First, we need to declare the new product type:

   `etc/product_types.xml`

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/XMLSchema-
  instance" xsi:noNamespaceSchemaLocation="urn:
  magento:module:Magento_Catalog:etc/product_types.xsd">
  <type name="demo" label="Demo Product"
    modelInstance="Genmato\Sample\Model\Product\Type\Demo"
    indexPriority="80" sortOrder="80">
    <priceModel instance=
      "Genmato\Sample\Model\Product\Type\Demo\Price" />
    <customAttributes>
      <attribute name="refundable" value="true"/>
      <attribute name="taxable" value="true"/>
    </customAttributes>
  </type>
</config>
```

2. Now, we create `modelInstance` as configured in the product type definition; this is the minimal product type code definition. You can add your own functions that would be necessary to your product here:

   `Model/Product/Type/Demo.php`

```
<?php
namespace Genmato\Sample\Model\Product\Type;

use Magento\Catalog\Model\Product\Type\AbstractType;

class Demo extends AbstractType
{
  /**
  * Product-type code
  */
  const TYPE_CODE = 'demo';

  /**
  * Delete data specific for Simple product-type
  *
  * @param \Magento\Catalog\Model\Product $product
  * @return void
  */
  public function deleteTypeSpecificData(
    \Magento\Catalog\Model\Product $product)
  {
  }
}
```

3. To calculate the price based on the cost attribute, `priceModel` is specified. This class holds the code to get the price of a product. Here, we use a fixed value of *1.25*cost* attribute. It is also possible to get this value from another attribute or system configuration field:

   `Model/Product/Type/Demo/Price.php`

```
<?php
namespace Genmato\Sample\Model\Product\Type\Demo;

use Magento\Catalog\Model\Product\Type\Price as
  ProductPrice;

class Price extends ProductPrice
{

  /**
```

```
    * Default action to get price of product
    *
    * @param Product $product
    * @return float
    */
    public function getPrice($product)
    {
      return $product->getData('cost')*1.25;
    }
}
```

4. By default, the cost attribute is only available for all product types; therefore, we need to add our product type to the `apply_to` field of the cost attribute. This will be done through an `UpgradeData` script:

   `Setup/UpgradeData.php`

```
<?php
namespace Genmato\Sample\Setup;

use Magento\Eav\Setup\EavSetup;
use Magento\Eav\Setup\EavSetupFactory;
use Magento\Framework\Setup\UpgradeDataInterface;
use Magento\Framework\Setup\ModuleContextInterface;
use Magento\Framework\Setup\ModuleDataSetupInterface;
use Magento\Catalog\Model\Product;

/**
 * @codeCoverageIgnore
 */
class UpgradeData implements UpgradeDataInterface
{
  /**
  * EAV setup factory
  *
  * @var EavSetupFactory
  */
  private $eavSetupFactory;

  /**
  * Init
  *
  * @param EavSetupFactory $eavSetupFactory
  */
```

```
public function __construct(EavSetupFactory
  $eavSetupFactory)
{
  $this->eavSetupFactory = $eavSetupFactory;
}

/**
* {@inheritdoc}
* @SuppressWarnings(PHPMD.ExcessiveMethodLength)
*/
public function upgrade(ModuleDataSetupInterface $setup,
  ModuleContextInterface $context)
{
  if (version_compare($context->getVersion(), '0.8.4',
    '<')) {
    /** @var EavSetup $eavSetup */
    $eavSetup = $this->eavSetupFactory->create(['setup'
      => $setup]);

    $fieldList = [
      'price',
      'special_price',
      'special_from_date',
      'special_to_date',
      'minimal_price',
      'cost',
      'tier_price',
      'weight',
    ];

    // make these attributes applicable to demo product
    foreach ($fieldList as $field) {
      $applyTo = explode(
        ',',
        $eavSetup->getAttribute(Product::ENTITY, $field,
          'apply_to')
      );
      if (!in_array('demo', $applyTo)) {
        $applyTo[] = 'demo';
        $eavSetup->updateAttribute(
          Product::ENTITY,
          $field,
          'apply_to',
```

```
                implode(',', $applyTo)
              );
            }
          }
        }
      }
    }
```

5. Specify the available product types that can be used to create an order:

   `etc/sales.xml`

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi
:noNamespaceSchemaLocation="urn:magento:module:Magento_Sales:etc/
sales.xsd">
  <order>
    <available_product_type name="demo"/>
  </order>
</config>
```

6. Optionally, it is possible to specify a custom renderer to create the `Invoice` and `Creditmemo` PDF documents:

   `etc/pdf.xml`

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/
  XMLSchema-instance" xsi:noNamespaceSchemaLocation=
  "urn:magento:module:Magento_Sales:etc/pdf_file.xsd">
  <renderers>
    <page type="invoice">
      <renderer product_type="demo">Magento\Sales\Model\
        Order\Pdf\Items\Invoice\DefaultInvoice</renderer>
    </page>
    <page type="creditmemo">
      <renderer product_type="demo">Magento\Sales\Model\
        Order\Pdf\Items\Creditmemo\DefaultCreditmemo
        </renderer>
    </page>
  </renderers>
</config>
```

7. As we added a data upgrade script, it is necessary to increment `setup_version` in the module configuration. In this case, the version has been updated from `0.8.3` to `0.8.4`. This is used in the upgrade script to execute only if the installed version is lower than the new version.

   `etc/module.xml`

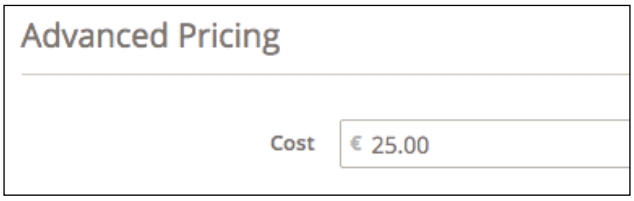
```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xs
i:noNamespaceSchemaLocation="urn:magento:framework:Module/etc/
module.xsd">
  <module name="Genmato_Sample" setup_version="0.8.4">
    <sequence>
      <module name="Magento_Store"/>
    </sequence>
  </module>
</config>
```

8. After this, run the `upgrade` command to update the attributes specified in the `upgrade` command. The cache is flushed at the same time to read the updated configuration.

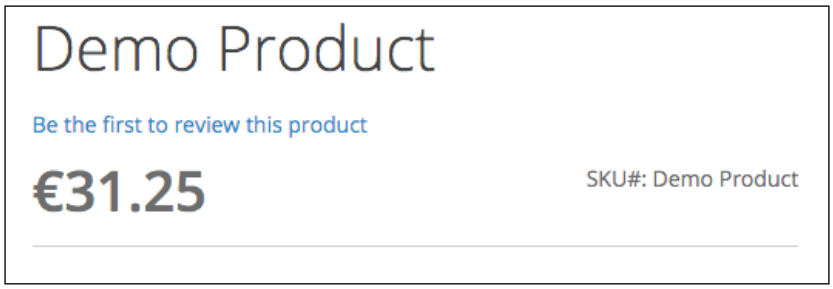
How it works...

The new defined product type is now available in the backend to create a new product. The attributes used are similar to a simple product, and you can add your own fields if necessary. The `priceModel` instance specified will calculate the product price on rendering on the frontend; in this case, the cost attribute is used and multiplied by 1.25.

While creating the product, it is possible to set the **Cost** attribute in the **Advanced Pricing** tab. In this example, we used a product cost of **€25.00**:



When the product is saved and requested on the frontend, the price will be calculated based on the preceding values and result in a final price of **€31.25**:



In the configuration of the new product type (in `product_types.xml`), it is also possible to specify the following items:

- `indexerModel`: This is to specify a custom indexer for your product type
- `stockIndexerModel`: This is to specify a custom indexer to manage the stock of your product type

Working with service layers/contracts

A service layer/contract is a fixed interface to get and store data without knowing the underlying layer. It is possible to swap the way the data is stored without changing the service layer.

A service layer consists of three interface types:

- **Data interface**: A data interface is a read-only presentation of a record, and therefore, this type of interface only has getters to represent a data record.
- **Repository interface**: A repository interface gives access to read and write (and delete) data. Every repository interface has the following methods:
  - `getList`: This returns a list of records based on the (optionally) provided search parameters
  - `get`: This loads the data from the database and returns a data interface for the specified ID
  - `save`: This saves the record specified in the data interface
  - `delete`: This deletes the record specified in the data interface
  - `deleteById`: This deletes the record specified by the ID
- **Management interface**: In a management interface, it is possible to specify special management functions that are not related to the repository.

Using a service layer also makes it easy to extend your module to access the web API; you only need to add a declaration in the appropriate XML to configure the link from the API command to the right interface.

How to do it...

In this recipe, we will add the option to read, create, or delete a record through a service layer contract:

1. Create a repository interface where the available commands are declared:

   Api/DemoRepositoryInterface.php

```
<?php
namespace Genmato\Sample\Api;

interface DemoRepositoryInterface
{
  /**
  * Save demo list item.
  *
  * @api
  * @param \Genmato\Sample\Api\Data\DemoInterface $demo
  * @return \Magento\Customer\Api\Data\GroupInterface
  * @throws \Magento\Framework\Exception\InputException If
    there is a problem with the input
  * @throws \Magento\Framework\Exception\
    NoSuchEntityException If a group ID is sent but the
    group does not exist
  * @throws \Magento\Framework\Exception\State\
    InvalidTransitionException
  *If saving customer group with customer group code that
    is used by an existing customer group
  * @throws \Magento\Framework\Exception\LocalizedException
  */
  public function save(
    \Genmato\Sample\Api\Data\DemoInterface $demo);

  /**
  * Get demo list item by ID.
  *
  * @api
  * @param int $id
  * @return \Genmato\Sample\Api\Data\DemoInterface
  * @throws \Magento\Framework\Exception\
    NoSuchEntityException If $groupId is not found
```

```
     * @throws \Magento\Framework\Exception\LocalizedException
     */
    public function getById($id);

    /**
     * Retrieve demo list items.
     *
     * The list of demo items can be filtered
     *
     * @api
     * @param \Magento\Framework\Api\SearchCriteriaInterface
       $searchCriteria
     * @return \Genmato\Sample\Api\Data\
       DemoSearchResultsInterface
     * @throws \Magento\Framework\Exception\LocalizedException
     */
    public function getList(\Magento\Framework\Api\
      SearchCriteriaInterface $searchCriteria);

    /**
     * Delete demo list item.
     *
     * @api
     * @param \Genmato\Sample\Api\Data\DemoInterface $demo
     * @return bool true on success
     * @throws \Magento\Framework\Exception\StateException If
       customer group cannot be deleted
     * @throws \Magento\Framework\Exception\LocalizedException
     */
    public function delete(
      \Genmato\Sample\Api\Data\DemoInterface $demo);

    /**
     * Delete demolist by ID.
     *
     * @api
     * @param int $id
     * @return bool true on success
     * @throws \Magento\Framework\Exception\
       NoSuchEntityException
     * @throws \Magento\Framework\Exception\StateException If
       customer group cannot be deleted
     * @throws \Magento\Framework\Exception\LocalizedException
     */
    public function deleteById($id);
}
```

2. Create the repository resource model. Here, the defined functions from the interface have the actual code:

Model/ResourceModel/DemoRepository.php

```
<?php
namespace Genmato\Sample\Model\ResourceModel;

use Genmato\Sample\Model\DemoRegistry;
use Genmato\Sample\Model\DemoFactory;
use Genmato\Sample\Api\Data\DemoInterface;
use Genmato\Sample\Api\Data\DemoInterfaceFactory;
use Genmato\Sample\Api\Data\DemoExtensionInterface;
use Genmato\Sample\Api\Data\
  DemoSearchResultsInterfaceFactory;
use Genmato\Sample\Model\Demo;
use Genmato\Sample\Model\ResourceModel\Demo as
  DemoResource;
use Genmato\Sample\Model\ResourceModel\Demo\Collection;
use Genmato\Sample\Api\DemoRepositoryInterface;

use Magento\Framework\Exception\CouldNotDeleteException;
use Magento\Framework\Exception\CouldNotSaveException;
use Magento\Framework\Exception\NoSuchEntityException;
use Magento\Framework\Api\SearchCriteriaInterface;
use Magento\Framework\Reflection\DataObjectProcessor;
use Magento\Framework\Api\ExtensionAttribute\
  JoinProcessorInterface;

class DemoRepository implements DemoRepositoryInterface
{

  /** @var DemoRegistry  */
  private $demoRegistry;

  /** @var DemoFactory  */
  private $demoFactory;

  /** @var DemoInterfaceFactory  */
  private $demoDataFactory;

  /** @var  Demo */
  private $demoResourceModel;

  /**
  * @var DataObjectProcessor
  */
```

```
    private $dataObjectProcessor;

    /**
    * @var DemoSearchResultsInterfaceFactory
    */
    protected $searchResultsFactory;

    /**
    * @var JoinProcessorInterface
    */
    protected $extensionAttributesJoinProcessor;

    /**
    * @param DemoRegistry $demoRegistry
    * @param DemoFactory $demoFactory
    * @param DemoInterfaceFactory $demoDataFactory
    * @param DemoResource $demoResourceModel
    * @param DataObjectProcessor $dataObjectProcessor
    * @param DemoSearchResultsInterfaceFactory
      $searchResultsFactory
    * @param JoinProcessorInterface
      $extensionAttributesJoinProcessor
    */
    public function __construct(
      DemoRegistry $demoRegistry,
      DemoFactory $demoFactory,
      DemoInterfaceFactory $demoDataFactory,
      DemoResource $demoResourceModel,
      DataObjectProcessor $dataObjectProcessor,
      DemoSearchResultsInterfaceFactory
        $searchResultsFactory,
      JoinProcessorInterface
        $extensionAttributesJoinProcessor
    ) {
      $this->demoRegistry = $demoRegistry;
      $this->demoFactory = $demoFactory;
      $this->demoDataFactory = $demoDataFactory;
      $this->demoResourceModel = $demoResourceModel;
      $this->dataObjectProcessor = $dataObjectProcessor;
      $this->searchResultsFactory = $searchResultsFactory;
      $this->extensionAttributesJoinProcessor =
        $extensionAttributesJoinProcessor;
    }
    /**
    * {@inheritdoc}
    */
    public function save(DemoInterface $demo)
```

```
{
  /** @var Demo $demoModel */
  $demoModel = $this->demoFactory->create();

  if ($demo->getId()) {
    $demoModel->load($demo->getId());
  }
  $demoModel
  ->setTitle($demo->getTitle())
  ->setIsVisible($demo->getIsVisible())
  ->setIsActive($demo->getIsActive());

  try {
    $demoModel->save();
  } catch (\Exception $exception) {
    throw new CouldNotSaveException(__($exception->
      getMessage()));
  }
  return $demoModel->getData();
}

/**
* {@inheritdoc}
*/
public function getById($id)
{
  $demoModel = $this->demoRegistry->retrieve($id);
  $demoDataObject = $this->demoDataFactory->create()
    ->setId($demoModel->getId())
    ->setTitle($demoModel->getTitle())
    ->setCreationTime($demoModel->getCreationTime())
    ->setUpdateTime($demoModel->getUpdateTime())
    ->setIsVisible($demoModel->getIsVisible())
    ->setIsActive($demoModel->getIsActive());
  return $demoDataObject;
}

/**
* {@inheritdoc}
*/
public function getList(SearchCriteriaInterface
  $searchCriteria)
{
  $searchResults = $this->searchResultsFactory->create();
  $searchResults->setSearchCriteria($searchCriteria);

  /** @var Collection $collection */
```

```
        $collection = $this->demoFactory->create()->
          getCollection();
        foreach ($searchCriteria->getFilterGroups() as
          $filterGroup) {
          foreach ($filterGroup->getFilters() as $filter) {
            $condition = $filter->getConditionType() ?: 'eq';
            $collection->addFieldToFilter($filter->getField(),
              [$condition => $filter->getValue()]);
          }
        }
        $searchResults->setTotalCount($collection->getSize());
        $sortOrders = $searchCriteria->getSortOrders();
        if ($sortOrders) {
          /** @var SortOrder $sortOrder */
          foreach ($sortOrders as $sortOrder) {
            $collection->addOrder(
              $sortOrder->getField(),
              ($sortOrder->getDirection() ==
                SortOrder::SORT_ASC) ? 'ASC' : 'DESC'
            );
          }
        }
        $collection->setCurPage($searchCriteria->
          getCurrentPage());
        $collection->setPageSize($searchCriteria->
          getPageSize());
        /** @var DemoInterface[] $demos */
        $demos = [];
        /** @var Demo $demo */
        foreach ($collection as $demo) {
          /** @var DemoInterface $demoDataObject */
          $demoDataObject = $this->demoDataFactory->create()
            ->setId($demo->getId())
            ->setTitle($demo->getTitle())
            ->setCreationTime($demo->getCreationTime())
            ->setUpdateTime($demo->getUpdateTime())
            ->setIsVisible($demo->getIsVisible())
            ->setIsActive($demo->getIsActive());

          $demos[] = $demoDataObject;
        }
        $searchResults->setTotalCount($collection->getSize());
        return $searchResults->setItems($demos);
      }

      /**
      * Delete demo list item.
```

```
    *
    * @param DemoInterface $demo
    * @return bool true on success
    * @throws \Magento\Framework\Exception\StateException If
      customer group cannot be deleted
    * @throws \Magento\Framework\Exception\LocalizedException
    */
    public function delete(DemoInterface $demo)
    {
      return $this->deleteById($demo->getId());
    }

    /**
    * Delete demo list item by ID.
    *
    * @param int $id
    * @return bool true on success
    * @throws \Magento\Framework\Exception\
      NoSuchEntityException
    * @throws \Magento\Framework\Exception\StateException If
      customer group cannot be deleted
    * @throws \Magento\Framework\Exception\LocalizedException
    */
    public function deleteById($id)
    {
      $demoModel = $this->demoRegistry->retrieve($id);

      if ($id <= 0) {
        throw new \Magento\Framework\Exception\
          StateException(__('Cannot delete demo item.'));
      }

      $demoModel->delete();
      $this->demoRegistry->remove($id);
      return true;
    }


}
```

3. Create the registry class; this stores the loaded records:

   `Model/DemoRegistry.php`

```
<?php
/**
* Sample
*
```

```
* @package Genmato_Sample
* @author  Vladimir Kerkhoff <support@genmato.com>
* @created 2015-12-23
* @copyright Copyright (c) 2015 Genmato BV,
  https://genmato.com.
*/
namespace Genmato\Sample\Model;

use Genmato\Sample\Api\Data\DemoInterface;
use Magento\Framework\Exception\NoSuchEntityException;

class DemoRegistry
{
  /**
  * @var array
  */
  protected $registry = [];

  /**
  * @var DemoFactory
  */
  protected $demoFactory;

  /**
  * @param DemoFactory $demoFactory
  */
  public function __construct(DemoFactory $demoFactory)
  {
    $this->demoFactory = $demoFactory;
  }

  /**
  * Get instance of the Demo Model identified by an id
  *
  * @param int $demoId
  * @return Demo
  * @throws NoSuchEntityException
  */
  public function retrieve($demoId)
  {
    if (isset($this->registry[$demoId])) {
      return $this->registry[$demoId];
    }
    $demo = $this->demoFactory->create();
```

```
        $demo->load($demoId);
        if ($demo->getId() === null || $demo->getId() !=
          $demoId)
        {
          throw NoSuchEntityException::singleField(
            DemoInterface::ID, $demoId);
        }
        $this->registry[$demoId] = $demo;
        return $demo;
      }

      /**
      * Remove an instance of the Demo Model from the registry
      *
      * @param int $demoId
      * @return void
      */
      public function remove($demoId)
      {
        unset($this->registry[$demoId]);
      }
    }
```

4. Create a data interface; here, the available attributes (getters and setters) are defined:

    Api/Data/DemoInterface.php

```
<?php
namespace Genmato\Sample\Api\Data;

use Genmato\Sample\Api\Data\DemoExtensionInterface;
use Magento\Framework\Api\ExtensibleDataInterface;

interface DemoInterface extends ExtensibleDataInterface
{

  const ID = 'id';
  const TITLE = 'title';
  const CREATION_TIME = 'creation_time';
  const UPDATE_TIME = 'update_time';
  const IS_ACTIVE = 'is_active';
  const IS_VISIBLE = 'is_visible';

  /**
  * Get id
  *
```

```
     * @api
     * @return int|null
     */
    public function getId();

    /**
     * Set id
     *
     * @api
     * @param int $id
     * @return $this
     */
    public function setId($id);

    /**
     * Get Title
     *
     * @api
     * @return string
     */
    public function getTitle();

    /**
     * Set Title
     *
     * @api
     * @param string $title
     * @return $this
     */
    public function setTitle($title);

    /**
     * Get Is Active
     *
     * @api
     * @return bool
     */
    public function getIsActive();

    /**
     * Set Is Active
     *
     * @api
     * @param bool $isActive
```

```
* @return $this
*/
public function setIsActive($isActive);

/**
* Get Is Visible
*
* @api
* @return bool
*/
public function getIsVisible();

/**
* Set Is Active
*
* @api
* @param bool $isVisible
* @return $this
*/
public function setIsVisible($isVisible);

/**
* Get creation time
*
* @api
* @return string
*/
public function getCreationTime();

/**
* Set creation time
*
* @api
* @param string $creationTime
* @return $this
*/
public function setCreationTime($creationTime);

/**
* Get update time
*
* @api
* @return string
*/
```

```
    public function getUpdateTime();

    /**
    * Set update time
    *
    * @api
    * @param string $updateTime
    * @return $this
    */
    public function setUpdateTime($updateTime);

    /**
    * Retrieve existing extension attributes object or create
      a new one.
    *
    * @api
    * @return DemoExtensionInterface|null
    */
    public function getExtensionAttributes();

    /**
    * Set an extension attributes object.
    *
    * @api
    * @param DemoExtensionInterface $extensionAttributes
    * @return $this
    */
    public function setExtensionAttributes(
      DemoExtensionInterface $extensionAttributes);
}
```

5. Create the data mapping class:

Model/Data/Demo.php

```
<?php
namespace Genmato\Sample\Model\Data;

use Magento\Framework\Api\AbstractExtensibleObject;
use Genmato\Sample\Api\Data\DemoInterface;
use Genmato\Sample\Api\Data\DemoExtensionInterface;

class Demo extends AbstractExtensibleObject implements
  DemoInterface
{

  /**
```

```
* Get id
*
* @return int|null
*/
public function getId()
{
  return $this->_get(self::ID);
}

/**
* Set id
*
* @param int $id
* @return $this
*/
public function setId($id)
{
  return $this->setData(self::ID, $id);
}

/**
* Get code
*
* @return string
*/
public function getTitle()
{
  return $this->_get(self::TITLE);
}

/**
* Set code
*
* @param string $title
* @return $this
*/
public function setTitle($title)
{
  return $this->setData(self::TITLE, $title);
}

/**
* Get Is Active
*
```

```
* @return bool
*/
public function getIsActive()
{
  return $this->_get(self::IS_ACTIVE);
}

/**
* Set Is Active
*
* @param bool $isActive
* @return $this
*/
public function setIsActive($isActive)
{
  return $this->setData(self::IS_ACTIVE, $isActive);
}

/**
* Get Is Visible
*
* @return bool
*/
public function getIsVisible()
{
  return $this->_get(self::IS_VISIBLE);
}

/**
* Set Is Active
*
* @param bool $isVisible
* @return $this
*/
public function setIsVisible($isVisible)
{
  return $this->setData(self::IS_VISIBLE, $isVisible);
}

/**
* Get creation time
*
* @return string
*/
```

```
public function getCreationTime()
{
  return $this->_get(self::CREATION_TIME);
}

/**
* Set creation time
*
* @param string $creationTime
* @return $this
*/
public function setCreationTime($creationTime)
{
  return $this->setData(self::CREATION_TIME,
    $creationTime);
}

/**
* Get update time
*
* @return string
*/
public function getUpdateTime()
{
  return $this->_get(self::UPDATE_TIME);
}

/**
* Set update time
*
* @param string $updateTime
* @return $this
*/
public function setUpdateTime($updateTime)
{
  return $this->setData(self::UPDATE_TIME, $updateTime);
}

/**
* {@inheritdoc}
*
* @return DemoExtensionInterface|null
*/
public function getExtensionAttributes()
```

```
    {
      return $this->_getExtensionAttributes();
    }

    /**
    * {@inheritdoc}
    *
    * @param DemoExtensionInterface $extensionAttributes
    * @return $this
    */
    public function setExtensionAttributes(
      DemoExtensionInterface $extensionAttributes)
    {
      return $this->_setExtensionAttributes(
        $extensionAttributes);
    }
}
```

6. Create the search results interface; this is used in the `getList` command:

`Api/Data/DemoSearchResultsInterface.php`

```
<?php
namespace Genmato\Sample\Api\Data;

use Genmato\Sample\Api\Data\DemoInterface;
use Magento\Framework\Api\SearchResultsInterface;

interface DemoSearchResultsInterface extends
  SearchResultsInterface
{
  /**
  * Get demo item list.
  *
  * @api
  * @return DemoInterface[]
  */
  public function getItems();

  /**
  * Set demo item list.
  *
  * @api
  * @param DemoInterface[] $items
```

```
  * @return $this
  */
  public function setItems(array $items);

}
```

7. Bind the interfaces through `di.xml` by adding the following lines:

`etc/di.xml`

```
  <preference for="Genmato\Sample\Api\
    DemoRepositoryInterface"
    type="Genmato\Sample\Model\ResourceModel\
      DemoRepository" />

  <preference for="Genmato\Sample\Api\Data\DemoInterface"
    type="Genmato\Sample\Model\Data\Demo" />
  <preference for="Genmato\Sample\Api\Data\
    DemoSearchResultsInterface"
    type="Magento\Framework\Api\SearchResults" />
```

8. Add the `Test` controller; here, we test the working of the service layer: (This is optional.)

`Controller/Index/Test.php`

```
<?php
namespace Genmato\Sample\Controller\Index;

use Magento\Framework\App\Action\Action;
use Magento\Framework\App\Action\Context;
use Magento\Framework\View\Result\PageFactory;
use Magento\Framework\Api\SearchCriteriaBuilder;
use Genmato\Sample\Api\DemoRepositoryInterface;
use Genmato\Sample\Model\Data\DemoFactory;
use Genmato\Sample\Api\Data\DemoInterface;

class Test extends Action
{
  /**
  * @var PageFactory
  */
  private $resultPageFactory;

  /** @var  DemoRepositoryInterface */
```

```
    private $demoRepository;

    /** @var DemoFactory  */
    private $demo;

    /**
    * @var SearchCriteriaBuilder
    */
    private $searchCriteriaBuilder;
    /**
    * @param Context $context
    * @param PageFactory $resultPageFactory
    * @param DemoRepositoryInterface $demoRepository
    * @param SearchCriteriaBuilder $searchCriteriaBuilder
    * @param DemoFactory $demoFactory
    */
    public function __construct(
      Context $context,
      PageFactory $resultPageFactory,
      DemoRepositoryInterface $demoRepository,
      SearchCriteriaBuilder $searchCriteriaBuilder,
      DemoFactory $demoFactory
    )
    {
      $this->demoRepository = $demoRepository;
      $this->searchCriteriaBuilder = $searchCriteriaBuilder;
      $this->demo = $demoFactory;
      parent::__construct($context);
    }

    /**
    * Renders Sample
    */
    public function execute()
    {
      echo '<pre>';

      // Create new record through service layer/contract

      /** @var DemoInterface $demoRecord */
      $demoRecord = $this->demo->create();
      $demoRecord->setIsActive(1)
        ->setIsVisible(1)
```

```
            ->setTitle('Test through Service Layer');

        $demo = $this->demoRepository->save($demoRecord);
        print_r($demo);

        // Get list of available records
        $searchCriteria = $this->searchCriteriaBuilder->
          create();
        $searchResult = $this->demoRepository->
          getList($searchCriteria);
        foreach ($searchResult->getItems() as $item) {
          echo $item->getId().' => '.$item->getTitle().'<br>';
        }
      }

    }
```

9. Refresh the cache and generated data:

   bin/magento setup:upgrade

10. Access the result of the test URL:

    `http://example.com/sample/index/test/`

How it works...

The service layer/contract defines the methods and data format through these interfaces.

DemoRepositoryInterface

This interface describes the available methods, input, and output that is expected. The actual logic for the methods is done by the `Model\ResourceModel\ DemoRepository` class. In `di.xml`, there is a preference created that will use `DemoRepository` instead of the `Interface` class:

```
<preference for="Genmato\Sample\Api\DemoRepositoryInterface"
  type="Genmato\Sample\Model\ResourceModel\DemoRepository" />
```

DemoInterface

In this interface, the available getters and setters for the object are described. Just like `RepositoryInterface`, the actual processing of the data is mapped through `di.xml` to the `Data\Demo` class:

```
<preference for="Genmato\Sample\Api\Data\DemoInterface"
  type="Genmato\Sample\Model\Data\Demo" />
```

See also

In the next recipe, we will see how the `getById`, `deleteById`, `list`, and `save` methods can be used in your own code.

Creating a Magento CLI command option

With Magento 2, there is a **command-line interface** (**CLI**) available to run several tasks. The `bin/magento` command replaces the separate shell scripts that were used in Magento 1. This command is based on the **Symfony Console** component and looks just like `n98-magerun` that is available for Magento 1. Just like the rest of Magento 2, it's possible to extend the CLI tool with your own commands.

Getting ready

Adding commands to the CLI script requires some knowledge of the Symfony Console component. This recipe also uses the service layer created in the previous recipe.

How to do it...

In this recipe, we will add four options to the `bin/magento` CLI command with the following steps:

1. Create the `AddCommand` class; this is used to create a new record through the CLI:

   `Console/Command/AddCommand.php`

```
<?php
namespace Genmato\Sample\Console\Command;

use Genmato\Sample\Api\DemoRepositoryInterface;
use Genmato\Sample\Model\Data\DemoFactory;
use Genmato\Sample\Api\Data\DemoInterface;

use Symfony\Component\Console\Input\InputOption;
use Symfony\Component\Console\Input\InputArgument;
use Symfony\Component\Console\Command\Command;
use Symfony\Component\Console\Input\InputInterface;
use Symfony\Component\Console\Output\OutputInterface;
use Symfony\Component\Console\Question\ConfirmationQuestion;


class AddCommand extends Command
```

```
{

  /** @var  DemoRepositoryInterface */
  private $demoRepository;

  /** @var DemoFactory  */
  private $demoFactory;

  /**
  * AddCommand constructor.
  * @param DemoRepositoryInterface $demoRepository
  * @param DemoFactory $demoFactory
  * @param null $name
  */
  public function __construct(
    DemoRepositoryInterface $demoRepository,
    DemoFactory $demoFactory,
  $name = null)
  {
    parent::__construct($name);

    $this->demoRepository = $demoRepository;
    $this->demoFactory = $demoFactory;
  }

  /**
  * {@inheritdoc}
  */
  protected function configure()
  {
    $this->setName('demo:add')
      ->setDescription('Add demo record')
      ->addArgument('title',InputArgument::OPTIONAL,
        'Title')
      ->addOption('active', null, InputOption::VALUE_NONE,
        'Active')
      ->addOption('visible', null, InputOption::VALUE_NONE,
        'Visible')
    ;
  }

  /**
  * {@inheritdoc}
  */
```

```
    protected function execute(InputInterface $input,
      OutputInterface $output)
    {
      $title = $input->getArgument('title');
      $active = $input->getOption('active')? 1:0;
      $visible = $input->getOption('visible')? 1:0;
      if (!$title) {
        $dialog = $this->getHelper('dialog');

        $title = $dialog->ask($output, '<question>Enter the
          Title:</question> ',false);
        $active = $dialog->ask($output, '<question>Should
          record be active: [Y/n]</question> ','y');
        $active = (strtolower($active) == 'y') ? 1:0;
        $visible = $dialog->ask($output, '<question>Should
          record be visible: [Y/n]</question> ','y');
        $visible = (strtolower($visible) == 'y') ? 1:0;
      }

      /** @var DemoInterface $demoRecord */
      $demoRecord = $this->demoFactory->create();
      $demoRecord->setIsActive($active)
        ->setIsVisible($visible)
        ->setTitle($title);

      try {
        $demo = $this->demoRepository->save($demoRecord);
        $output->writeln('New record created (id='.$demo->
          getId().')');
      }catch (\Exception $ex) {
        $output->writeln('<error>'.$ex->
          getMessage().'</error>');
      }
    }
}
```

2. Create the delete option class; this is used to delete a record through the CLI:

```
Console/Command/DeleteCommand.php

<?php
namespace Genmato\Sample\Console\Command;

use Genmato\Sample\Api\DemoRepositoryInterface;

use Symfony\Component\Console\Input\InputOption;
```

```
use Symfony\Component\Console\Command\Command;
use Symfony\Component\Console\Input\InputInterface;
use Symfony\Component\Console\Output\OutputInterface;
use Symfony\Component\Console\Question\ConfirmationQuestion;

class DeleteCommand extends Command
{

  /** @var  DemoRepositoryInterface */
  private $demoRepository;

  public function __construct(
    DemoRepositoryInterface $demoRepository,
  $name = null)
  {
    parent::__construct($name);

    $this->demoRepository = $demoRepository;
  }

  /**
  * {@inheritdoc}
  */
  protected function configure()
  {
    $this->setName('demo:delete')
      ->setDescription('Delete demo record')
      ->addOption(
        'id',
        null,
        InputOption::VALUE_REQUIRED,
        'Demo record ID to delete'
      )
      ->addOption(
        'force',
        null,
        InputOption::VALUE_NONE,
        'Force delete without confirmation'
      );
  }

  /**
  * {@inheritdoc}
```

```
    */
    protected function execute(InputInterface $input,
      OutputInterface $output)
    {
      $helper = $this->getHelper('question');

      $id = $input->getOption('id');

      try {
        if (!$input->getOption('force')) {
          $data = $this->demoRepository->getById($id);
          $output->writeln('Id        :' . $data->getId());
          $output->writeln('Title     :' . $data->
            getTitle());
          $question = new ConfirmationQuestion('Are you sure
            you want to delete this record? ', false);

          if (!$helper->ask($input, $output, $question)) {
            return;
          }
        }

        $data = $this->demoRepository->deleteById($id);
        if ($data) {
          $output->writeln('<info>Record deleted!</info>');
        } else {
          $output->writeln('<error>Unable to delete
            record!</error>');
        }
      } catch (\Exception $ex) {
        $output->writeln('<error>'.$ex->
          getMessage().'</error>');
      }
    }
}
```

3. Create the get option class; this is used to list a single record through the CLI:

`Console/Command/GetCommand.php`

```
<?php

namespace Genmato\Sample\Console\Command;

use Genmato\Sample\Api\DemoRepositoryInterface;

use Symfony\Component\Console\Command\Command;
```

```
use Symfony\Component\Console\Input\InputArgument;
use Symfony\Component\Console\Input\InputOption;
use Symfony\Component\Console\Input\InputInterface;
use Symfony\Component\Console\Output\OutputInterface;

class GetCommand extends Command
{

  /** @var  DemoRepositoryInterface */
  private $demoRepository;

  public function __construct(
    DemoRepositoryInterface $demoRepository,
  $name = null)
  {
    parent::__construct($name);

    $this->demoRepository = $demoRepository;
  }

  /**
  * {@inheritdoc}
  */
  protected function configure()
  {
    $this->setName('demo:get')
      ->setDescription('Get demo records')
      ->addOption(
        'id',
        null,
        InputOption::VALUE_REQUIRED,
        'Demo record ID to display'
       );
  }

  /**
  * {@inheritdoc}
  */
  protected function execute(InputInterface $input,
    OutputInterface $output)
  {
    $id = $input->getOption('id');

    try {
```

```
            $data = $this->demoRepository->getById($id);

            $table = $this->getHelper('table');
            $table
              ->setHeaders(array(__('ID'), __('Title'),
                __('Created'), __('Updated'), __('Visible'),
                __('Active')))
              ->setRows([[
                $data->getId(),
                $data->getTitle(),
                $data->getCreationTime(),
                $data->getUpdateTime(),
                $data->getIsVisible() ? __('Yes') : __('No'),
                $data->getIsActive() ? __('Yes') : __('No')
                ]]);
            $table->render($output);
          } catch (\Exception $ex) {
            $output->writeln('<error>'.$ex->
              getMessage().'</error>');
          }
        }
    }
```

4. Create the list option class; this is used to list the available records through the CLI:

   `Console/Command/ListCommand.php`

```
<?php
namespace Genmato\Sample\Console\Command;

use Magento\Framework\Api\SearchCriteriaBuilder;
use Genmato\Sample\Api\DemoRepositoryInterface;

use Symfony\Component\Console\Command\Command;
use Symfony\Component\Console\Input\InputInterface;
use Symfony\Component\Console\Output\OutputInterface;

class ListCommand extends Command
{

  /** @var  DemoRepositoryInterface */
  private $demoRepository;

  /**
  * @var SearchCriteriaBuilder
  */
```

```
    private $searchCriteriaBuilder;

    public function __construct(
      DemoRepositoryInterface $demoRepository,
      SearchCriteriaBuilder $searchCriteriaBuilder,
      $name = null)
    {
      parent::__construct($name);

      $this->demoRepository = $demoRepository;
      $this->searchCriteriaBuilder = $searchCriteriaBuilder;
    }

    /**
    * {@inheritdoc}
    */
    protected function configure()
    {
      $this->setName('demo:list')->setDescription('List demo
        records');
    }

    /**
    * {@inheritdoc}
    */
    protected function execute(InputInterface $input,
      OutputInterface $output)
    {
      // Get list of available records
      $searchCriteria = $this->searchCriteriaBuilder->
        create();
      $searchResult = $this->demoRepository->
        getList($searchCriteria);
      $rows = [];
      foreach ($searchResult->getItems() as $item) {
        $rows[] = [$item->getId(), $item->getTitle()];
      }

      $table = $this->getHelper('table');
      $table
        ->setHeaders(array(__('ID'), __('Title')))
        ->setRows($rows)
      ;
      $table->render($output);
    }
  }
```

5. Register the commands so that they are available for the CLI by adding the following lines to the `di.xml` configuration file:

   `etc/di.xml`

```
<type name="Magento\Framework\Console\CommandList">
  <arguments>
    <argument name="commands" xsi:type="array">
      <item name="demoadd" xsi:type="object">
        Genmato\Sample\Console\Command\AddCommand</item>
      <item name="demolist" xsi:type="object">
        Genmato\Sample\Console\Command\ListCommand</item>
      <item name="demoget" xsi:type="object">
        Genmato\Sample\Console\Command\GetCommand</item>
      <item name="demodelete" xsi:type="object">
        Genmato\Sample\Console\Command\DeleteCommand</item>
    </argument>
  </arguments>
</type>
```

6. Refresh the cache and generated data:

   `bin/magento setup:upgrade`

7. Check whether the added commands are available by running the following command:

   `bin/magento`

How it works...

Registering new commands works by registering new items through `di.xml` with the `Magento\Framework\Console\CommandList` class. In the XML file, every item that we want to add is listed with a unique name and the class that is used for this command.

In the class listed, there are two methods that are used:

- `configure`: In the `configure` method, the command is added with the following parameters:
  - `setName`: This is the option used for the command
  - `setDesciption`: This is a short description of the command, which is shown in the command listing
  - `setArgument` (optional): This sets arguments necessary for the command
  - `setOption` (optional): This sets options necessary for the command
- `execute`: This is the actual method that is executed; here, the logic that you want to perform is located

Module 3

Mastering Magento 2

Maximize the power of Magento 2 to create productive online stores

1
Planning for Magento

It's not difficult to download Magento 2. With some hosting companies, it only takes a simple request or "one-click" to do an initial installation of this powerful e-commerce platform. The question now becomes, "where do you go from here?"

Before you even download and install Magento, it's important that you take some time to plan. The temptation to dive right in and get your feet wet is strong – especially for those of us who enjoy exploring new technologies. However, this is perhaps the primary reason why many people abandon Magento even before they get off the ground. Not only are there lots of wonderful features and configurations to tackle, there are significant installation issues to consider even before you download the installer.



Avoid the "uninstall-reinstall" syndrome. Plan your installation before you install and you're less likely to have to start all over again at a later date.

In this chapter, the following topics will be covered:

- How to form a plan for your Magento installation
- How to analyze and research your hosting alternatives
- How Magento's powerful Global-Website-Store methodology gives you tremendous power to run more than one website in a single installation
- How to plan for multiple languages, business entities, and domains

Defining your scope

There are three important areas to consider when defining your e-commerce project:

- Your project requirements (What do you want to accomplish?)
- Your users (Who will be using your Magento installation? What are their roles and capabilities?)
- Your technical resources (What are your own skills? Do you have others on whom you will rely?)

It is never wise to skimp on defining and analyzing any of these, as they all play crucial roles in the successful implementation of any e-commerce project (or any web project). Let's look at each of them in detail.

Project requirements

Magento is a powerful, full-featured e-commerce platform. With that power comes a certain degree of complexity (one very good reason to keep this book handy!). It's important to take your analysis of how to leverage this power one step at a time. As you discover the many facets of Magento, it's easy to become overwhelmed. Don't worry. With proper planning, you'll soon find that Magento is quite manageable for whatever e-commerce project you have in mind.

It is very likely that your e-commerce project is ideal for Magento, particularly if you intend to grow the online business well beyond its initial design and configuration – and who doesn't? Magento's expandability and continued development insures that, as an open source platform, Magento is the ideal technology for both start-up and mature stores.

When considering Magento as a platform, here's what Magneto offers that makes it shine:

- Large numbers of products, categories, and product types.
- Multiple stores, languages, and currencies sharing the same product catalog.
- The ability to add features as needed, whether obtained from third parties or by your own efforts.
- Large, involved developer community, with thousands of experienced developers around the world. You are now a member of that community and able to share your questions and experiences through forums and blogs hosted by Magento and others, such as `MageDaily.com`.
- Robust, yet usable user interface for administering your store.

Where you might find Magento to be more than required is if you have only a small handful of products to offer or expect very few sales.

If you think that Magento might be too complicated to use as an e-commerce platform, think again. Power always involves some level of complexity. With *Mastering Magento 2*, we feel the challenge of using Magento will quickly become an appreciation for all the ways you can sell more products online.

Requirements checklist

How are you going to be using your Magento installation? This list will help you focus on particular areas of interest in this book. Answer these questions, as they pertain to your single Magento installation:

- Will you build more than one online store? How many? Will each store share the same products or different catalogs?
- Will you build different versions of stores in multiple languages and currencies?
- What types of products will be offered? Hard goods? Downloadable? Subscriptions? How many products will be offered?
- Will products be entered individually or imported from lists?
- How many customers do you expect to serve on a monthly basis? What is your anticipated growth rate?
- Are there particular features you consider to be "must-haves" for your stores, such as social marketing, gift certificates, newsletters, customer groups, telephone orders, and so on?

Whatever you can conceive for an e-commerce store, it can almost always be accommodated with Magento!

Planning for users

The second stage to defining your scope is to think about "users" – those who will be actually interacting with Magento: customers and store staff. These are people who have no technical expertise, and for whom using the site should be straightforward and intuitive.

Designers and developers may use Magento's administration screens to configure an installation, but it's the ones actually interacting with Magento on a daily basis for which designers and developers must plan. As you use this book to craft a successful Magento store, always keep the end-user in mind.

Who are your users? Basically, your users are divided into two segments: staff and customers.

Staff

Staff refers to those who will be using the Magento administration screens on a daily basis. Magento's administration screens are elegant and fairly easy to use, although you'll want to pay close attention to how you create user permissions Some users won't need access to all the backend features. By turning off certain features, you can make the administration area much more user-friendly and less overwhelming. Of course, regarding staff managers, additional permissions can give them access to reports, marketing tools, and content management sections. In short, as you work with staff, you can fine tune their back-end experience and maximize their effectiveness.



One key staff user should be designated as the "Administrator". If you're the one who will be responsible for managing the Magento configurations on an ongoing basis, congratulations! You now have at your fingertips the power to adjust your online business in ways both significant and subtle. You also have in front of you the guidebook to give you a full appreciation of your capabilities.

For store administrators, *Packt Publishing* offers a companion book, *Learning Magento 2 Administration*. This book, authored by Bret and Cyndi Williams, is the perfect training and reference book for your staff.

Customers

There are several types of **customers**, and they are based on their relationship to the vendor: retail and wholesale. Among these customers, you can also have customers that are members of the site – and therefore privy to certain pricing and promotions – both on the retail and wholesale level. You can also subdivide wholesalers into many other levels of manufacturers, jobbers, distributors, and dealers, all operating through the supply chain.

Magento has the ability to handle a variety of different users and user types, including all the ones mentioned above.



The one caveat to consider when scoping users is that if you are going to use a single Magento installation to operate more than one business – which can certainly be done – you cannot create unique permissions for staff users which restrict them to managing the content, customers, and orders of any one business.

Assessing technical resources

As reviewed in the Preface, there are basically three different types of people who will be involved in any Magento installation: the Administrator, the Designer, and the Developer. Which one, or ones, are you?

As a complete, installable platform, make sure you have sufficient technical resources to handle all aspects of web server configuration and administration. It is not uncommon to find one or maybe two people tackling the installation, configuration, and management of a Magento installation. The web industry is well populated with "Jacks-of-all-Trades." As you analyze your own technical abilities, you may find it necessary to hire outside help. These are the disciplines that can help you maximize your Magento success:

- **User interface design**: Even if you use one of the many themes available for Magento stores, you will find the need to adjust and modify layouts to give your users a great online experience. Knowledge of HTML, CSS, and JavaScript is critical, and the use of these across multiple browser types means maximum accessibility. As we'll learn in this book, specific knowledge of the Magento design architecture is a plus.
- **PHP**: Many people setting up a Magento store can avoid having to work with the underlying PHP programming code. However, if you want to expand functionality or significantly modify layouts, the ability to at least navigate PHP code is important. Furthermore, a familiarity with programming standards, such as the model-view-controller methodology used in Magento coding (explained in *Chapter 5*, *Managing Non-Product Content*), will increase your ability to modify and, when necessary, fix code.



When hiring a developer for your Magento store, make sure you find someone with specific experience with Magento 2. The new architecture and coding standards require particular knowledge. Magento provides a list of certified Magento developers at `http://www.magentocommerce.com/certification/directory`. Be sure to inquire about Magento 2 qualifications.

- **Sales processes**: Selling online is more complex than most newcomers imagine. While it appears fairly simple and straightforward from the buyers point of view, the backend management of orders, shipping, payment gateways, distribution, tracking, and so on requires a good understanding of how products will be priced and offered, inventory managed, orders and returns processed, and shipping handled. Businesses vary as much by how they sell their products as they do by the product categories they offer.
- **Server administration**: From domain names and SSL encryption to fine-tuning for performance, the management of your Magento installation involves a thorough understanding of how to configure and manage everything from web and mail servers to databases and FTP accounts. In addition, PCI compliance and security is becoming an increasingly important consideration.



Fortunately, many Magento-friendly hosting providers offer assistance and expertise when it comes to optimizing your Magento installation. In *Chapter 8*, *Optimizing Magento*, we explain ways you can perform many of the optimization functions yourself, but don't hesitate to have frank discussions with potential hosting providers to find out just how much and how well they can help you with your installation.

If you choose to host the installation on your own in-house servers, note that Magento does require certain "tweaks" for performance and reliability, which we cover in *Chapter 8*, *Optimizing Magento*.

Technical considerations

You have assessed the technical knowledge and experience of yourself and others with whom you may be working, now it is important that you understand the technical requirements of installing and managing a Magento installation.

Hosting provider

If you're new to Magento, I certainly recommend that you find a capable hosting provider with specific Magento experience. There are many hosting companies that provide hosting suitable for Magento, but far fewer who invest resources toward supporting their clients with specific Magento-related needs. Keep these points in mind as you research possible hosting candidates:

- Do they provide specific Magento support for installing and optimizing? (You'll learn how to do that in this book, but if you're hesitant to do it yourself, find a provider who can help.)

- Can they provide PCI compliance? (If you're going to accept credit cards online, you'll be asked by your merchant account provider to be "PCI" compliant. We'll cover this in *Chapter 4*, *Configuring to Sell*.)
- Are they a Magento Partner? (The Magento website lists companies who they have designated as "Solution Partners." While this is a good place to start, there are many other hosting providers who are not official partners, but who do an excellent job in hosting Magento stores.)
- Do they have links to client sites? (If Magento stores are properly optimized, and the servers are fast, the websites will load quickly.)

In-house hosting

You may already be hosting PHP based websites, have a robust server setup, or manage racked servers at a hosting facility. In these instances, you might well be capable of managing all aspects of hosting a Magento installation. In this book, you will find considerable information to help you configure and manage the server aspects of your Magento installation. We do repeat the advice that if you're new to Magento, an experienced hosting provider could be your best friend.

Servers

Due to Magento's complex architecture, your servers should be powerful. The architecture, indexing, and caching schemas of Magento require considerable resources. While we will attack these issues in *Chapter 8*, *Optimizing Magento*, the more horsepower you have, the better your store will perform.

To host your own Magento installation, your server must have the following *minimum* requirements:

- Linux x86-64 operating system.
- Apache 2.2 or 2.4, or nginx 1.8+. The apache `mod_rewrite` module must be enabled.
- MySQL 5.6 (Oracle or Percona).
- PHP 5.5.10-5.5.16 or 5.6.0, with these extensions:
    - PDO_MySQL
    - Mbstring
    - Mcrypt
    - Mhash
    - SimpleXML

    - Curl
    - Xsl
    - gd, ImageMagick 6.3.7+, or both
    - soap
    - intl
    - bc-math (only for Enterprise Edition)
    - openssl

- SSL Certificate for secure administration access on production servers. Self-signed certificates are not supported.
- **Mail transfer agent** (**MTA**) or an SMTP server.

Magento 2 can also use **Redis** 3.0 or **Varnish** 3.5/4.x for page caching and **memcached** for session storage.

The best of both worlds

Most Magento Community users we know (and there are lots!) opt for a hosted solution. Even with our own experience managing web servers, we too use a third-party hosting provider. It's easier, safer, and in most cases, far less expensive than duplicating the same degree of service in-house.

However, we do enjoy installing and testing open source platforms in-house, rather than setting up another hosting account. This is especially true when working with new platforms. Setting up an in-house installation can also allow you to test modifications, extensions, and updates before installing them on your live production server.

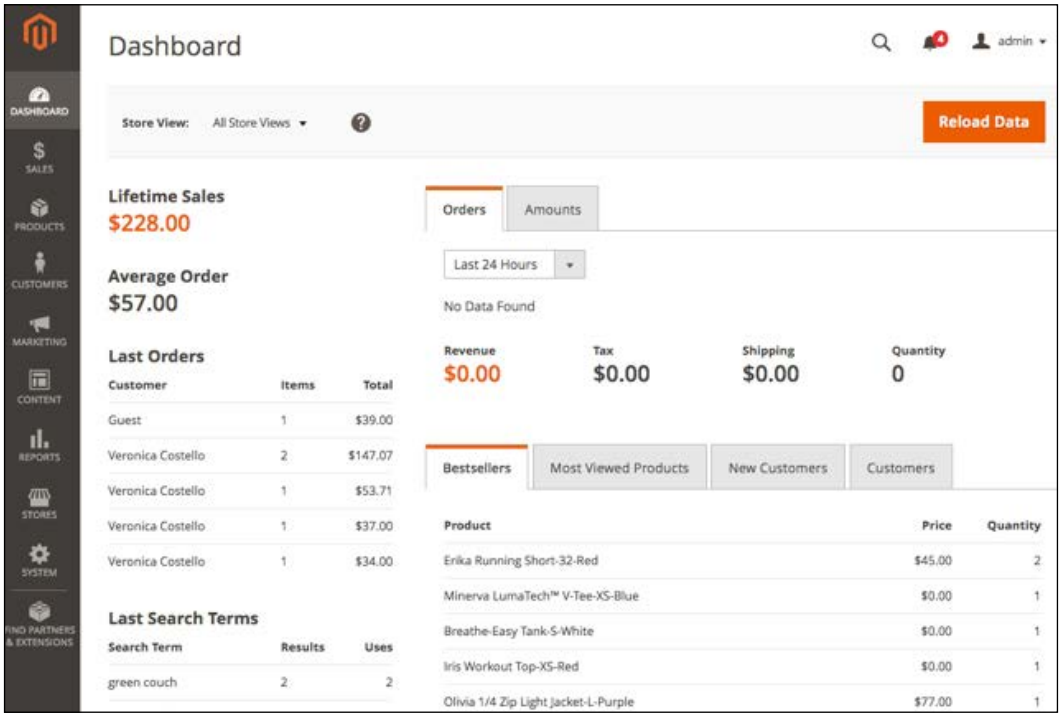
Setting up a local test installation

You can set up a complete Magento environment with PHP and MySQL on your own desktop computer or a local server in your office. In *Chapter 9*, *Advanced Techniques*, we'll provide detailed instructions for several different methods that can be used to install Magento on a local machine.

Global-Website-Store methodology

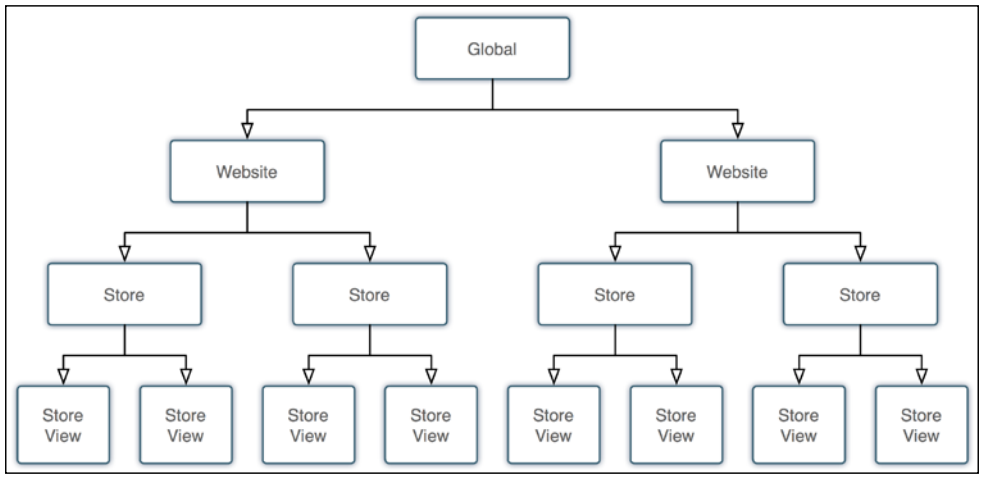
Now you're probably itching to install your first Magento store. In fact, you probably have done that already and have been fumbling through the vast labyrinth of configuration menus and screens. If you're like so many first-time Magento installers, you might feel ready to uninstall and reinstall; to start all over.

Most of the time, this "restart" happens when users try to take advantage of one of Magento's most powerful features: managing multiple stores. It seems easy when you look at the **store management** screen until you begin setting up stores, configuring URLs, and assigning specific configurations to each frontend website.



Before you begin laying out your master plan for the various websites and stores you intend to create (and even if you're only beginning with one website), you need to master the Magento methodology for multiple stores. Magento describes this as "**GWS**," which stands for "Global, Website, Store." Each Magento installation automatically includes one of each part of this hierarchy, plus one more for "Store View."

The following diagram shows how each part of **GWS** is related to one another:



Global

Global refers to settings (for example, stock management rules) and values (for example, product price) for the entire installation. Throughout your Magento installation, you'll find **Global** displayed next to various form fields.

In terms of installation planning, your *Global* considerations should include:

- Will customers be shared among all sites? You can elect not to give customers the ability to register for one website and automatically be registered to all others.
- Can I allow any user with Admin permissions to see all orders and customers from all websites and stores within the single installation? Without modification, Magento does not allow you to set up Admin users by limiting them to certain websites and stores. If an Admin user can see orders, they can see all orders for all customers.
- Will all stores within an installation use the same rules for managing inventory? Inventory rules, such as whether stock is to be managed or whether backorders are allowed, are system-wide choices. (These choices can be changed, in some cases, at the product level, though that does mean paying careful attention to how products are configured and managed.)

In general, we recommend that you consider a single Magento installation only for multiple websites and stores that are similar in concept. For example, if your online business is selling drop-shipped furniture through several differently branded websites, then a single Magento installation is ideal. However, if you have two or more different businesses, each with a different product focus, company name, banking, and so on, it is best to use a separate Magento installation for each discrete business.

Website

The **website** is the "root" of a Magento store. From the website, multiple stores are created that can each represent different products and focus. However, it is at the website level that certain configurations are applied that control common functions among its children stores and Store Views.

As described above, one of the most important considerations at the website level is whether or not customer data can be shared among websites. The decision to share this information is a *Global* configuration; however, remember that you cannot elect to share customer data among some websites and not others: it's an all or nothing configuration.



If you do need to create a group of websites among which customer data is to be shared, and create other websites among which the data is not to be shared, you will need more than one installation of Magento.

Store

What can sometimes be confusing is that "**Store**" for Magento is used to describe both a store structure as well as a Store View. When configuring your hierarchal structure, "Store" is used to associate different product catalogs to different stores under a single "Website," whereas "Store Views" can be created to display a "Store" in multiple languages or styles, each with their own URL or path. Each Store View can be assigned different themes, content, logos, and so on.

Yet, throughout Magento's many administration screens, you will see that "Store" is used to define the scope of a particular value or setting. In these instances, entered values will affect all Views under a Store hierarchy. We know this can be confusing; it was to us, too. However, by following the processes in this book, you'll quickly come to not only understand how a Store and Store View is referred within Magento, but also appreciate the tremendous flexibility this gives you.



Perhaps the best way to consider Stores and Store Views is to learn that a View is what your website visitor will see in terms of language, content and graphics, while Store refers to the data presented in each view.

Planning for multiple stores

How you utilize **GWS** in your particular case depends on the purpose of your Magento installation. With GWS, you have an enormous number of configuration possibilities to explore. That said, your configuration planning would generally fall within three major categories: multiple domains, multiple businesses, and multiple languages. Of course, in the real world, a Magento installation may include aspects of all three.



It's important to realize that Magento allows you to drive your e-commerce strategy according to your own business and marketing goals, rather than conforming to any limitations according to what your e-commerce platform might or might not be able to deliver.

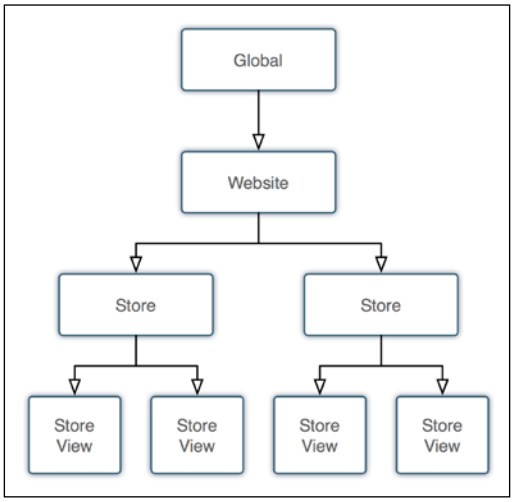
Using multiple domains for effective market segmentation

It's becoming more popular in e-commerce to create multiple storefronts selling the same or similar products, each having a different domain name, branding design, and content. In this way, merchants can extend their marketing by appealing to different market segments, not just having one website trying to satisfy all consumers.

For example, let's assume you want to sell shoes online. You have a great distribution source where you can source all kinds of shoes, from dress to casual, running to flip-flops. While you can certainly have a comprehensive, "all types available" online shoe store, you might elect to secure different domain names focused on different segments of the shoe market. `www.runningshoes4you.com` would cater to joggers, while `www.highheelsemporium.com` features designer-quality dress shoes for women.

In Magento, you would create one website but create at least two stores, one for each of your domains. You might also create a third as an overall retail store for all your shoes. Each store could either share the same product catalog or each have its own separate catalog. By having all stores assigned to the same website, you have the ability to control certain configurations that apply to all stores. For example, if all the stores belong to the same retailer, as in this example, all would offer the same payment methods, such as `PayPal.com` or `Authorize.Net`. Most likely, the shipping methods you offer would be the same as well as your policies for returns and shipping.

In short, if all the domains belong to the same retail business, it may make sense to have one website with multiple stores, rather than to create entire website-store hierarchies for each product-focused domain. As you can see in the following diagram, this makes for a slimmer, more manageable structure:



Using multiple businesses to keep finances separate

In contrast, if your installation will be used to manage multiple businesses, you will need to create multiple websites. The reason for this is that actual, separate business entities will have separate payment system accounts (for example, PayPal, credit card merchant accounts, shipping), and therefore need to be able to segregate these between different websites.

To extend our example, let's assume your shoe retailer also owns a sideline business selling women's sportswear. This other business exists under a separate legal entity (for example, corporation, partnership), and therefore has different bank accounts, distributors, and customers. With Magento, you should create separate websites for each, even if they are to share certain products.

For instance, the sportswear site might also feature women's casual shoes, which are also offered by the shoe website. The same product can be assigned to multiple product catalogs (and therefore different stores) even if the catalogs belong to separate businesses. And somehow, through a complex database architecture, Magento succeeds in keeping all this straight for you. Amazing.



Remember that Magento 2 does not allow you to give back-end user permissions based on the website. Permissions can only be set at the Global level.

Using multiple languages to sell globally

Even among some of Magento's top competitors in the open source e-commerce arena, very few provide the ability to create multiple language views of a website. Multiple language views are not simple matters for several reasons:

- All site content, including links, instructions, error messages, and so on must be translated to the intended language.
- The platform must seamlessly provide multiple language selection and, if possible, intelligently provide the appropriate language to the website visitor based on their geographical location.
- Multiple languages can also infer the need to provide product prices in multiple currencies. Conversion rates vary almost minute-by-minute. Daily swings in conversion rates can affect profitability if the amounts shown online are not updated.

Magento has several tools to help you create multiple languages and currencies for retailers wanting to sell globally (or just provide multiple languages to users within a single country) It all begins with creating multiple views for a given store.

In our example, our running shoe website needs to be available in both English and French, so you would create two views within the running shoe store, one for each language. In your Magento-powered website, you can easily include a small drop-down selector which allows a visitor to choose their preferred language based on the views you have created.

In fact, in most Magento theme designs, this dropdown is automatic whenever there are multiple views created for any given store.



Another interesting use of multiple views could be to segment your customer market within a store. For example, if you wanted your shoe store to have a different overall look for men versus women versus children, you could create multiple views for each customer segment, and then allow the visitor to choose their desired view.

Summary

The power of Magento can also be a curse, particularly if you're like many of us: eager to jump in and begin building an online store. However – and this comes from the experience of investing lots of hours – taking a moment to understand the scope of your undertaking will make navigating the intricacies of Magento a much more rewarding experience.

In this chapter, we outlined the key areas to consider when planning our Magento installation. We also learned about the powerful Global-Website-Store methodology for managing multiple web stores in a single installation. In addition, we looked at the possibilities of introducing multiple languages, businesses, and domains for effective market segmentation.

As we go forward in this book, we'll learn how each decision we make in installing, configuring, and managing Magento traces back to what we covered in this chapter. In the next chapter, we will be taking your plans from this chapter and applying them to a new Magento installation.

2
Managing Products

After successfully installing Magento, you can now take on the task of creating and configuring your store. You could begin by crafting the design that reflects your store's brand, or you could start configuring the many settings that will direct how your customers will interact with your online store.

However, selling online really boils down to the products you are selling. Additionally, many of Magento's configurations are dependent on the products you're offering and how they are arranged into categories.

Therefore, when we create a new Magento-powered store, we begin at the root, so to speak: the products.

In this chapter, we will tackle:

- Creating categories
- Managing products and attributes to help your customers shop more easily
- Setting up reviews, tags, and feeds to help promote your products
- Importing products en masse

Catalogs and categories

The use of the terms **catalogs** and **categories** in Magento used to be a bit confusing, as Magento tended to use these terms with some inconsistency. In Magento 2, the distinction is better defined.

In Magento, the catalog is the full collection of products within your Magento installation. Looking under **Products** | **Catalog** in the backend, you can view all your products regardless of to which Website or categories they may be assigned.

Categories in Magento 2 are just that: categories of products. Let us delve a bit deeper into this.

Creating categories

We created the root categories needed for our new stores. Now, we need to learn how to create sub-categories that will allow us to assign products and display them in logical groups on our store.

For our furniture store, we want to create a new subcategory for sofas:

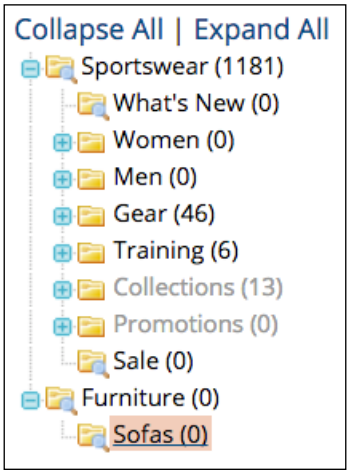
1. Go to **Products** | **Categories** in your Magento backend.
2. Click on **Furniture** in the list of categories on the left.



You must first click on the parent category before creating a subcategory (although you can always drag and drop categories to re-position them if you need to later).

3. Click on **Add Subcategory**.
4. For **Name**, enter `Sofas`.
5. Set **Is Active** to `Yes`.
6. Click on **Save Category**.

This is how the additional subcategory would then appear:



You can, of course, add additional subcategories, as well as subcategories of subcategories. But, before you go to too much trouble building a huge category hierarchy, be sure to read through the section on *Attributes and Attribute Sets* later in this chapter.

Let's now explore the other panels and fields in the category detail screen.



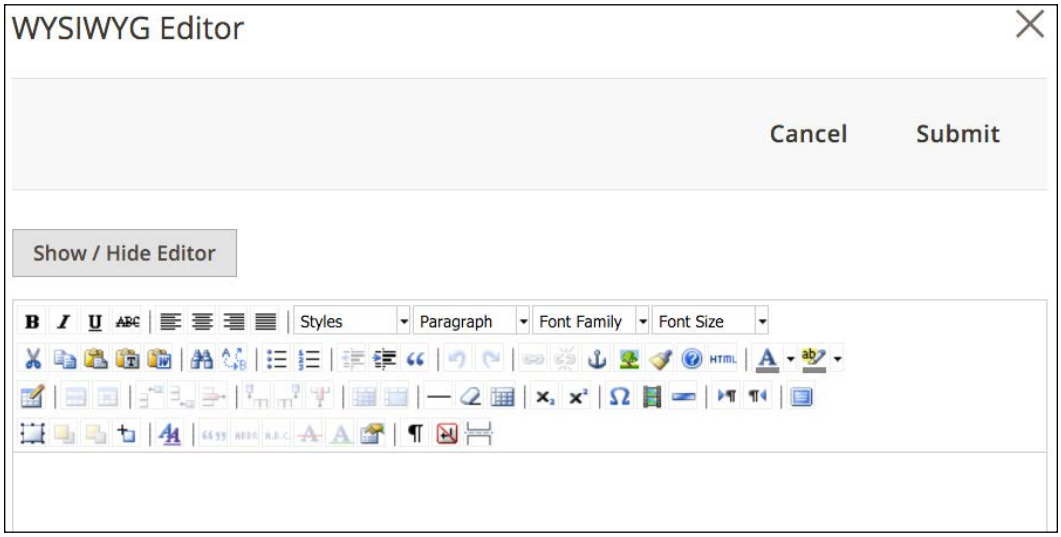
Don't be afraid to experiment! While this book provides a considerable amount of detail and helpful advice, the power of Magento can only truly be appreciated the more you work with it. Test various setting combinations. You may well come up with a particular configuration that helps you better connect with your shoppers.

General information tab

As you will noticed, there are only two required fields when creating a category (**Name** and **Is Active**). But others, as shown below, on this tab are important as well.

- **URL Key**: Once you create a category, Magento will automatically create a unique URL Key. This becomes the path for your category, such as `www.acmefurniture.com/sofas.html`. The sofas part is the URL Key. If you create more than one category with the same name, Magento will create unique keys by adding an incremental number, such as "sofas-1," "sofas-2." You can rename this to any value you wish, and in some cases, it may have more *SEO value* for you to enter a key such as "cheap-sofas" or "living-room-sofas." If you change the key of an existing category, you can select **Create Permanent Redirect for old URL** and Magento will create the necessary **URL rewrites** so that anyone still trying to view your category with the old URL Key will be automatically re-routed to the new path.

- **Description**: In the front end of your store, the **Description** tab will appear at the top of the category page, giving you the ability to describe the category to shoppers, as well as adding more SEO rich content. The field has a very basic WYSIWYG editor. However, you can access a WYSIWYG editor with considerably more features by clicking on **WYSIWYG Editor**. A panel will slide from the right with the enhanced field.



- **Image**: You can upload an image to appear at the top of the category. Your theme design may dictate how and where this image is displayed.
- **Page Title**: The page title shown at the top of a web browser window — this is also displayed as the title of your category in Google search results — is automatically created according to how you configure your store settings. However, you can override your default settings by entering a value here.



Page title defaults are configured under **Stores** | **Configuration** | **General** | **Design** | **HTML Head**.

- **Meta Keywords**: Modern search engines don't use meta keywords for determining page rankings or content. However, if you want to enter keywords here, you may enter them inserting a comma between each keyword or phrase.

- **Meta Description**: In Magento, the meta description that is added to the header of your page for search engines to use is automatically taken from the **Description** field. However, Google only displays approximately the first 160 characters of a description. You may want to compose a different description here for that purpose.
- **Include in Navigation Menu**: You will most likely want a category displayed in your main navigation menu. However, there are instances where you may not want the category listed. For example, as discussed later under the section, *Special Categories*, you may want to create a Featured category that displays products in a special location on your site, but is not listed in the main menu.

Display Settings tab

As you build out your category schema, you may decide that you don't want products displayed on all category pages. For example, a top-level "Furniture" category might display graphics for each subcategory (for example, "Sofas", "Chairs", "Tables"). However, within those subcategories, you probably do want to display the list of products available. Let us have a look at the various attributes within this tab:

- **Display Mode**: In *Chapter 5*, *Managing Non-Product Content*, we'll explain about **static blocks** — content that can be used as desired within your site. You can elect to show products, a static block, or both products and a static block.

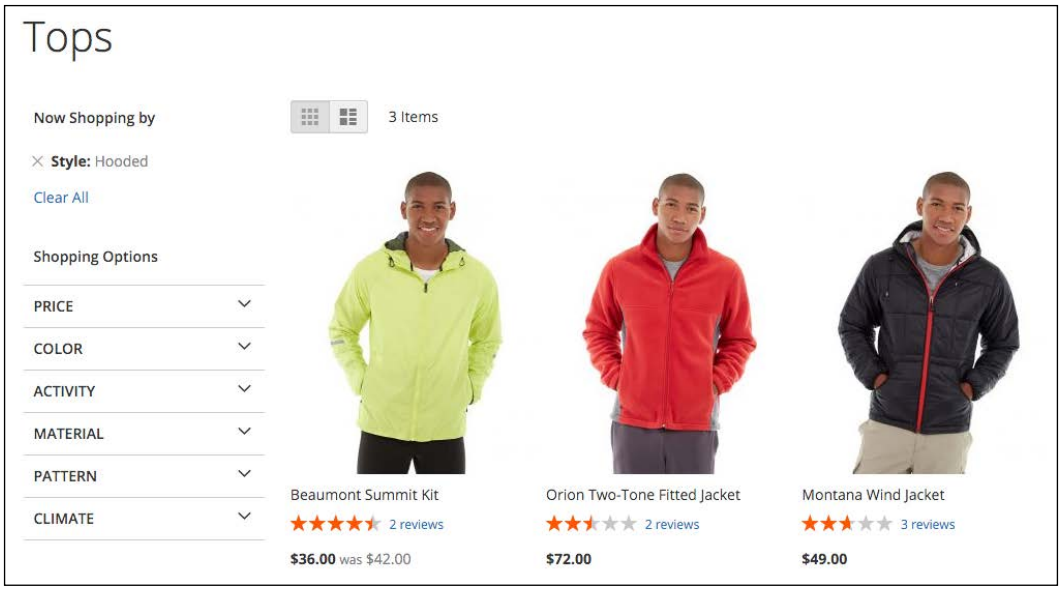


Unless your theme is configured otherwise, the description and image you add in the **General Information** tab will still show even if you choose **Products only** for **Display Mode**.

Why use a static block if you can simply add a category description? Good question, and one we're often asked. Static blocks are very useful for displaying the same content in many places. For instance, you may want to use a static block to regularly display a new product announcement or discount. By using a static block, you can update this information in one place and have it instantly appear throughout your site wherever it is referenced.

- **CMS Block**: If you do choose to display a static block, you can choose the block to show within this drop-down menu.

- **Is Anchor**: Later in this chapter, we will explore attributes and how you can use them in **filtered navigation**. If you want your category page to show layered navigation for the products within the category (if products are shown), set this to **Yes**, as shown in the following screenshot:



- **Available Product Listing Sort By**: By default, Magento allows products to be sorted by position, name, and price. Position is managed within the **Category Products** tab (this will be explained a bit later). You can choose which of these sorts to include.
- **Default Product Listing Sort By**: You can also choose which sort you wish to use by default when a customer first views a category page.
- **Layered Navigation Price Step**: Based on your configurations, Magento will automatically calculate the price steps shown in the layered navigation sidebar. You can override this by entering the steps you wish to show by entering the amounts separated by commas (for example, "0,50,100,500").



Default price step configurations are in **Stores** | **Configuration** | **Catalog** | **Catalog** | **Layered Navigation**.

Custom Design tab

In this tab, you can control specific display configurations for your category.

- **Use Parent Category Settings**: You can choose to have any subcategory use the same display settings as its parent category.
- **Apply To Products**: Setting it to **Yes** will apply any applicable design settings to products shown within the category.
- **Custom Theme**: If you have another theme you wish to apply to a category — perhaps a holiday-focused theme — you can choose that theme in this field.
- **Active From/Active To**: These date fields, if filled in, allow you to control the dates on which any custom theme will be applied.
- **Page Layout**: Depending on the capabilities of your theme, you can choose an alternative layout scheme for the category. Your choices include one column, two columns with either left or right sidebar, three columns, or empty (this requires the definition of your own page layout using XML).
- **Custom Layout Update**: You can enter custom XML code to alter the display of your category page.



For more on themes, see *Chapter 3*, *Designs and Themes*.

Category Products tab

When you create products in your Magento store, you can assign the product to a category. Alternatively, you can assign multiple products to a category within this tab. Use the search features to find your products.

- **Selection Column**: The first field at the top of the column allows you to search for products that are (**Yes**), are not (**No**), or either (**Any**) assigned already to your category. For example, if you want to identify products not already assigned to your category, select **No**.
- **Search Fields**: The empty fields at the top of the other columns allow you to enter a search criteria for further filtering your search results.

Once you have identified the products you wish to add, select the ones you wish to add. Be sure to click **Save Category** in order to complete your assignments.

Re-ordering categories

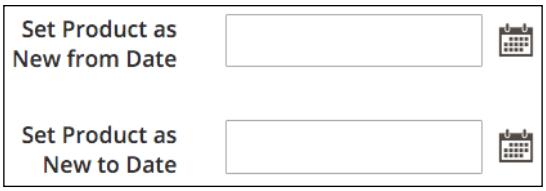
We mentioned it earlier, but it deserves repeating: you can re-arrange the order of your categories — and how they will appear in navigation menus — by dragging and dropping your categories in the sidebar display. The order in which they appear can be set differently for each website or store view.



Re-arranging categories is a very intensive computing operation owing to the work that Magento has to perform in order to update its data tables and re-index. If you intend to make several changes, you may want to disable caching until you complete your work, although each change may still take some time. *Be patient*. After each re-arrangement, make sure Magento has completed its work before making the next change. Otherwise, your data tables may become "confused."

Special categories

Magento provides some inherent tools for grouping products for special display purposes. For example, by designating **New From** and **New To** dates in the **Advanced Settings** | **Autosetting** panel of a product detail screen, as shown in the following screenshot, Magento will display a product within a **New Products** block if today's date falls within the range of these dates.

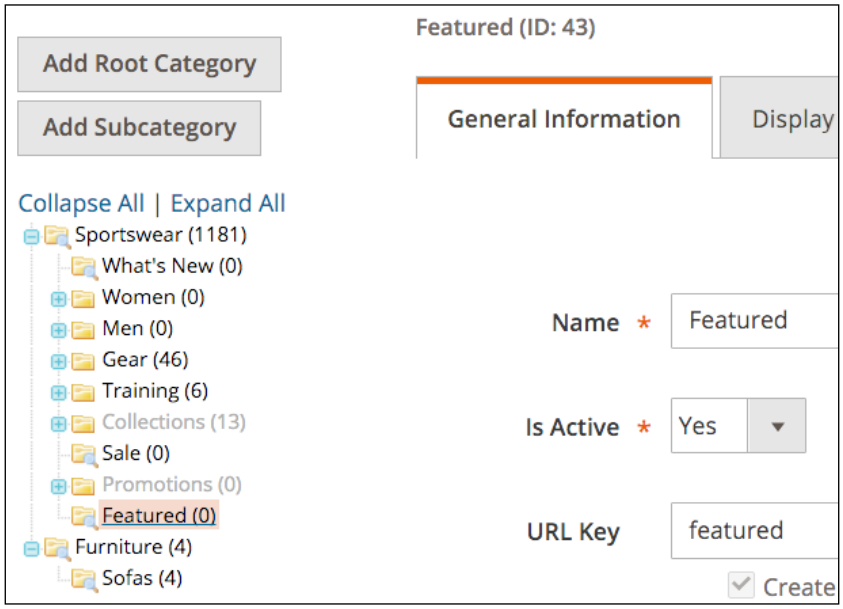


However, in some cases, you may want to display groups of products for other reasons. It's not uncommon to show **Featured** products on an e-commerce website. You might even want to show products grouped by family or purpose.

Let's take the case of creating a **Featured** products section for our homepage. Let's also assume that you don't want **Featured** as a category in your navigation bar just as a "special" category.

1. Go to **Products** | **Categories** in your Magento backend.
2. Click on the root category under which you wish to create your special category.
3. Click on **Add Subcategory**.

4. In the center part of the screen, enter the following values:
    - **Name**: **Featured**
    - **Is Active**: **Yes**
    - **Include in Navigation Menu**: **No**
5. Click on the tab at the top labeled **Category Products**.
6. Find the product you wish to add to this category and check the box in the left-most column.
7. Click on **Save Category**.
8. After the screen refreshes, note the ID number of the category at the top of the screen, as shown in the following screenshot (in this example, the category ID is **43**):



You've now created a new category called **Featured** and added some products. Now we need to add a block to the homepage that will display your **Featured Products**.

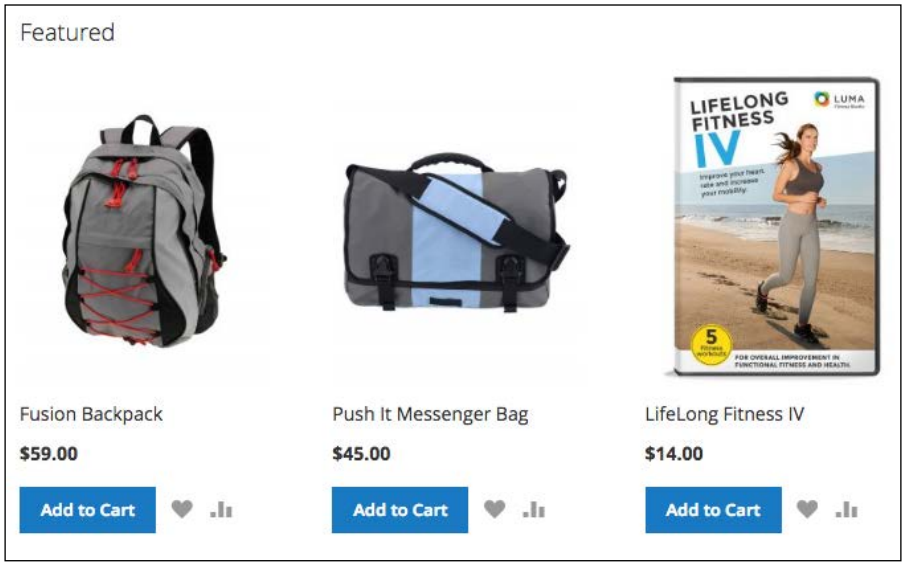
1. Go to **Content** | **Pages**.
2. Select to edit the home page for the store you wish to update.
3. Click the side tab labeled **Content**.

4. If the WYSIWYG editor is showing, click on **Show/Hide Editor** to reveal the HTML code.
5. Find in the code where you want to put your **Featured Products** section and position the cursor there.
6. Click the **Insert Widget** button.
7. For **Widget Type**, select **Catalog Product List**.
8. Add a custom title.
9. Once this is done you should see something similar to the following block notation in the content pane:

```
{{widget type="Magento\CatalogWidget\Block\Product\ProductsList"
title="Featured" products_count="10" template="product/widget/
content/grid.phtml"}}
```

10. Click **Save Page** (or **Save and Continue Edit**).

When you view the homepage, you should see a section displaying the featured items you assigned to this special category:



Furthermore, you can access this category and its products by appending the name of your special category to your store URL. For example, to see the entire **Featured** product category, you can go to `http://www.yourstoredomain.com/featured.html`.

In *Chapter 5*, *Managing Non-Product Content*, we'll go into more detail about blocks and how to use them in creative ways, giving your online store more features and functionality.

Managing products the customer focused way

The heart of any online store is the selection of products offered to visiting customers. Yet, as simple as that may sound, creating online stores to present the vast array of products and product types has proven to be one of the most challenging quests for platform programmers.

If all stores sold each product as an individual item without different colors, sizes, or add-ons, e-commerce would be much simpler. But that's not how the real world works. If you sell t-shirts (the classic example for this discussion), you might sell each color as a separate item, especially if you only offer a few shirts. However, it would make shopping very cumbersome to your customers if you also had each size of each color listed as a separate product.

People shop by product style, then decide upon variations such as size and color. To reflect this shopping "workflow," we need to create products in our store that are presented in the most convenient and logical manner possible.

The simple product type

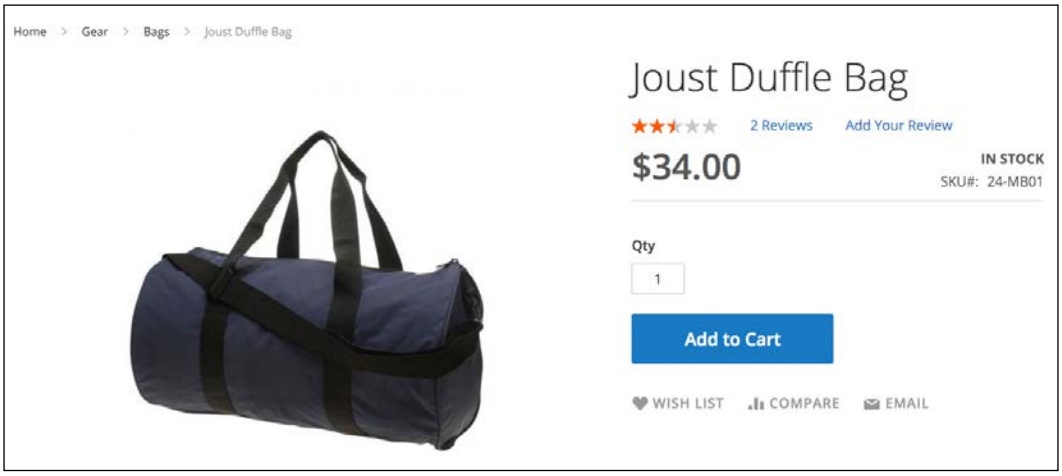
If you shop online for a golf putter, you could well find a list of putters sold online where each style is a separate product. The individual putter products would be considered **simple products**.

In Magento, we think of a simple product as one for which there is a single **stock keeping unit** (**SKU**), or if the putter has a SKU of PUT1234, then we would build it in Magento as a simple product.

Simple products can have **custom options**, though. For instance, we could offer this putter in different shaft lengths, but with a simple product, we cannot manage inventory for each option. Therefore, if we are stocking each putter in different shafts, then we would need to create simple products for each **variant**.



Variant is a common term used in e-commerce to describe related variations of a product. For example, a t-shirt that comes in small, medium, and large would be referred to as having three variants; each size would be a variant of the t-shirt.



The preceding figure illustrates a simple product. It has no other sizes or colors and is not a bundle or group of products.

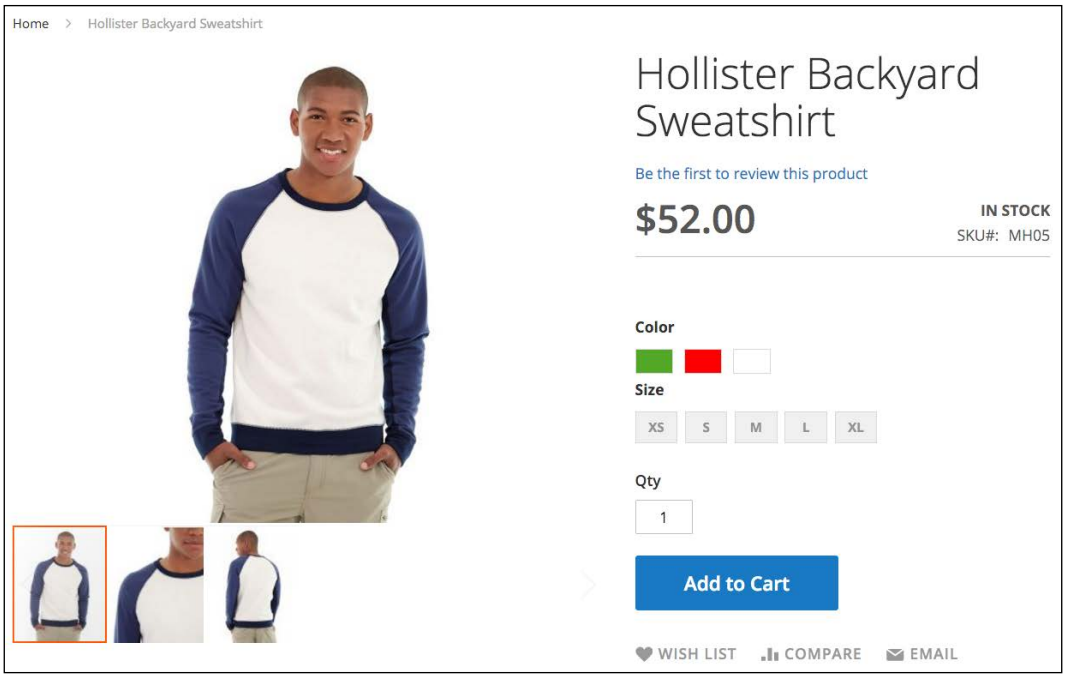
Simple products in Magento become the basis for all other tangible complex product types, which we'll discuss in the next section. The important concept to learn here is that all tangible products begin with the simple product.

The complex product types

When two or more simple products are combined in a single product representation, we are creating a **complex product type**. In Magento, we also consider virtual and downloadable products as "complex" because of the additional considerations needed to manage non-tangible products.

Configurable product type

Perhaps the most popular complex product type is the **configurable product type**. This type is used when you sell an item that comes in different sizes, colors, and so on. The most common example is clothing.



As shown in the preceding screenshot, this sweatshirt comes in three different colors and five different sizes. In Magento, there are actually two ways you can build out this product:

- You can build a simple product and create options for the colors and sizes
- You can build simple products for each combination of color and size (for example, Red-Small, Red-Medium, White-Small, and so on) and present all the variations as a single configurable product

The key to which method to use boils down to how you answer the following questions:

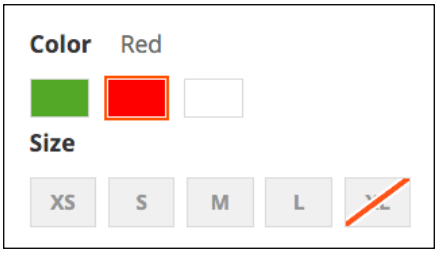
1. Do you need to track inventory for each variant?
2. For all the colors and sizes of this item, will any of the possible combinations not be available (for example, you might not be able to source White-XL sweatshirts)?

If you answer Yes to either question, then you should use a configurable product. You cannot track inventory on **Custom Options** (which we'll go into in more detail later in this chapter), and for whatever **Custom Options** you create, customers will be able to choose all possible combinations.

Configurable products also give you tremendous content versatility as well. For example, in the sweatshirt product (included in the Magento 2 Sample Data), as the customer selects a different color, the main image changes to that of the associated simple product image.



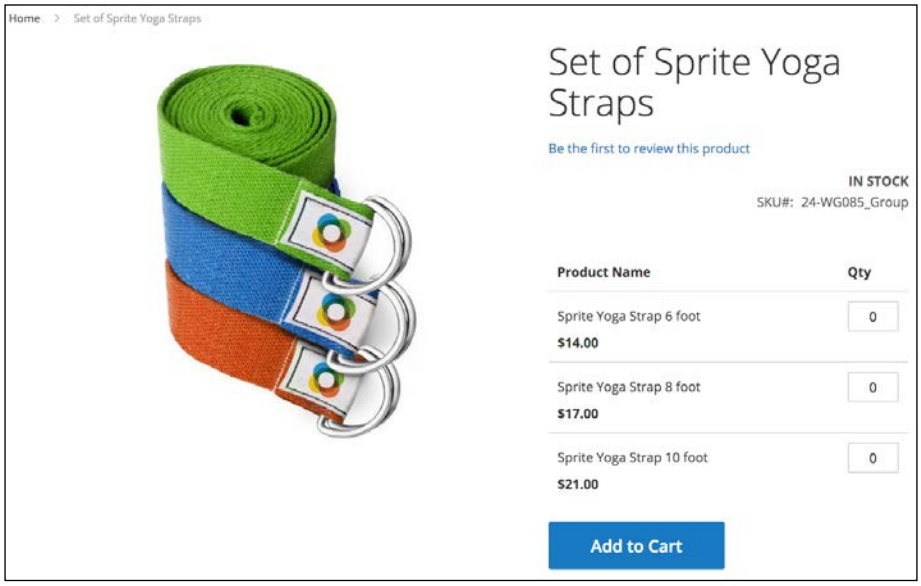
Additionally, the stock available for each combination selected is shown to the customer. Any associated simple product that is not available will be indicated, as shown in the following screenshot: when **Red** is selected, the **XL** size is not available.



As we'll see when we create a configurable product type later, Magento 2 introduces new tools for rapidly creating the needed variants.

Grouped product type

Sometimes it's helpful to display several different products as a related group to make it easier for customers to choose one or more products. The grouped product type associates simple or virtual product types into one complex product.



As shown in the sample Yoga Straps, the customer can choose any quantity of any of the products, which exist as simple products in your catalog. Each product chosen will appear separately in the customer's shopping cart.



Keep in mind that a grouped product cannot use simple products that have **Custom Options**.

Bundle product type

A complex product similar to the grouped product is the bundle product type. It is similar in that it associates simple or virtual products that do not have **Custom Options**, but different in that you can create a *base collection* of products for the bundle and set a price for the combined items. You can also create additional options for the user to choose and allow the pricing to be determined *dynamically*.

If it's the latter, the product listing will show a range of pricing based on the least expensive and most expensive possible configurations. There's a lot of versatility to the bundle product type.



Although not completely supported, the bundle product can be used to create what is often called a **kit**. As we use this term, it refers to the assembling of various individual products into a single presented product, usually priced at a discount from the sum of the individual product prices. Let's explore a possible scenario to better understand the concept of a kit.

We have a client who sells dictation-related products. He wants to combine a digital recorder that retails for $500 with a transcription kit that retails for $400 and offer this combined "kit" for a special discounted price of $800, saving the customer $100 if purchased separately. In addition, he needs to maintain inventory counts for both items, so that if one goes out of stock, the bundle is, therefore, not in stock.

Using a bundle product, our client can build this kit — or bundle — assigning its special price, yet maintain each one separately for inventory and shipping purposes.



The big "issue" with using the bundle product type for kits is that, by default, the customer must still click to **Customize** the bundle before adding it to their cart. Even though you may not have any options available for the customer, this extra step is still required. Look for innovative developers to create modifications that will modify this behavior.

Virtual product type

Just as the name implies, a virtual product type is an intangible product. Typical virtual products include subscriptions, memberships, and warranties.

Unlike tangible products, virtual products have no shipping weight and no shipping options will appear during the checkout process, unless a tangible product is also included in the customer's order.

Downloadable product type

We live in a world of digital distribution. Books, music, and software are more commonly downloaded today than sent on CDs or — anyone remember these? — floppy disks.



In Magento, you can sell and distribute digital products using the **downloadable product type**. When customers purchase the product, they are emailed links to files on your server or on another server. Customers can also access their downloadable products when they log into their account in your store.

With a downloadable product, you can set the maximum number of downloads you will allow a customer and whether the link is "shareable" with others.

Attributes and attribute sets

Before diving into the creation of products, we need to explore a very important — and powerful — feature of Magento: product attributes. We have yet to find another common platform that provides the level of sophistication for product attributes as well as Magento.

Every field related to a product is called, in Magento, an attribute. The description, price, weight, and SKU are attributes. In fact, all the fields that appear by default on a product detail screen are attributes.

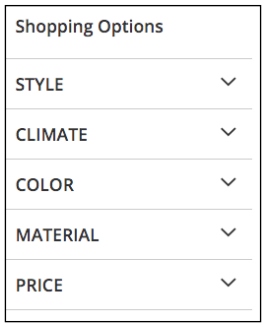
But the real power comes in those attributes when you can add to your product screens to capture more granular aspects of your products, such as color, size, kHz, and screen size. Obviously, not all attributes are relevant to all products. For instance, t-shirt size would not be applicable to your furniture products. Fabric would not be a useful attribute for computer monitors, and that's where Magento really shines!

If you view the **More Information** tab under the **Sample Data** product Montana Wind Jacket, for example, you will see four attributes listed.



Each of these relevant attributes helps your customers get a better understanding of your products. You can certainly include this information in your product description field, but by creating attributes your customers can use them for comparison purposes, and it makes it easier for you to make sure you have included all product specifications when creating new products in your store.

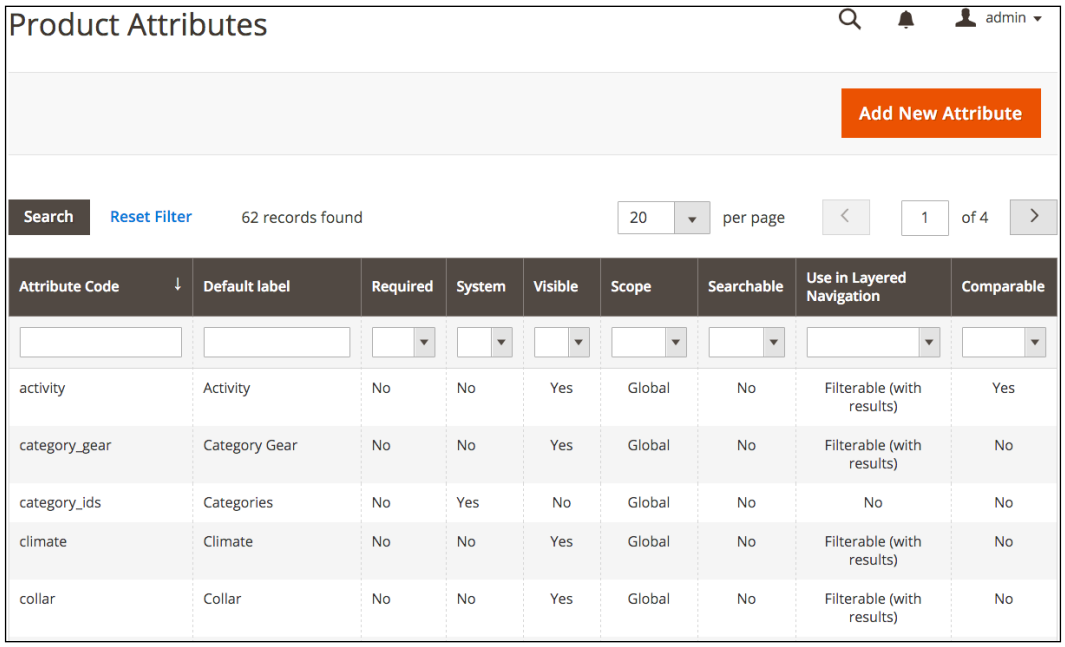
Furthermore, attributes can be used to create the **layered navigation** that appears in the sidebar on your category pages (if **Is Anchor** is set to **Yes**; see *Chapter 3*, *Designs and Themes*).





Only certain attribute types can be used in layered navigation: Multiple Select, Dropdown, Price, Visual Swatch, and Text Swatch. See the next section for more information on attribute types.

In your Magento 2 backend, go to **Stores** | **Product** (under the **Attributes** group heading).



Attribute Code	Default label	Required	System	Visible	Scope	Searchable	Use in Layered Navigation	Comparable
activity	Activity	No	No	Yes	Global	No	Filterable (with results)	Yes
category_gear	Category Gear	No	No	Yes	Global	No	Filterable (with results)	No
category_ids	Categories	No	Yes	No	Global	No	No	No
climate	Climate	No	No	Yes	Global	No	Filterable (with results)	No
collar	Collar	No	No	Yes	Global	No	Filterable (with results)	No

Here, you will see a listing of all the product attributes, both default and user-added, that are available for your products.

To use attributes for creating products, you create attribute sets (also referred to as product templates in Magento 2) to group attributes into meaningful sets relevant to the various products you are offering. We'll explore attribute sets in a moment, once we learn how to create individual attributes.

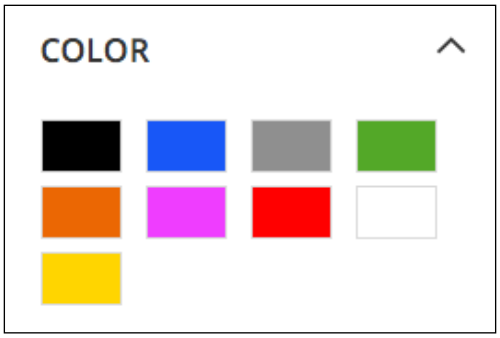
Attribute types

Before we begin building or editing product attributes, let's learn about the different attribute types accommodated in Magento 2. Each has its own considerations and features.

Attributes are considered name-value pairs, meaning that for each attribute there is a name, such as "Size," and one or more values, such as "Small, Medium, Large." The values you need for each attribute — and how you wish to use the attribute — is what helps you determine the type of attribute to create.

- **Text field**: As the name implies, this attribute allows you to enter any text information you wish to describe the feature.
- **Text area**: Similar to a text field, the text area field allows for a larger entry. Plus, you can use the WYSIWYG editor to style the content, insert HTML tags, or use other editing features.
- **Date**: You might have a product with a release date (such as a music album) or another date-specific feature. Use the date field to allow you to easily input a date using a pop-up calendar.
- **Yes/No**: As the name implies, it allows you to simply choose between "Yes" and "No" as values. This might be useful for question type features, such as "Includes Power Cord?" or "Eligible for Extended Warranty?"
- **Multiple select**: This field type presents you with a list of choices for the attribute. You can choose one or more from the list. You have full control over the items in the value list (as we'll see a bit later in this section).
- **Dropdown**: Similar to the multiple select, except that you can only choose one from a list of possible choices.
- **Price**: You can create additional price fields for your products in addition to the Price, Special Price, Tier Prices, and Cost fields already in Magento. While additional price fields aren't used during the checkout process, you could create fields to present prices for other reasons, such as "Compare At" or "Sold in Stores At."
- **Media image**: You can add additional image fields to your products in addition to the base, small, and thumbnail images. You can exclude this new image from the thumbnail gallery or allow it to be included.

- **Fixed product tax**: If you have a product that has a fixed tax amount, you could use this attribute type. The values entered would be included in any tax reporting or display based on your general tax settings (see *Chapter 3, Designs and Themes*).
- **Visual swatch**: A new feature in Magento 2, this field allows you to present the attribute as a color or image, such as a texture or cloth.



- **Text swatch**: This new Magento 2 attribute type displays text as a button. You could use this for things such as shoe sizes or kHz.

Selecting an attribute type

Before you begin creating attributes, it's important to understand the implication of using one attribute type over another. Each type has its own particular abilities.

The one ability that is usually the most important is whether or not the attribute can be used in layered navigation (as described earlier). For an attribute to be used as a layered attribute, it has to have fixed values. Magento indexes attributes and it makes sense that it cannot provide layered navigation on free-form fields. Therefore, if you wish to use an attribute in layered navigation, it must be a multiple select, dropdown, price, visual swatch, or text swatch attribute type. Eligible attribute types can also be designated for use in the layered navigation of search results.

Another ability commonly considered for attributes is whether the attribute will be used when customers compare products. In the comparison display, only those attributes chosen for comparison will be shown side-by-side. All attribute types, except for media image and fixed product tax, are eligible for use in comparisons.

Creating an attribute

We're going to create a new attribute to use for our furniture products called "fabric," which will help us learn how to add new attributes. We want to use this value in layered navigation and for comparison purposes.

To begin, click **Add New Attribute** at the top of the attribute list.



As with many configurations in Magento, the availability of certain fields and choices is often determined by other field choices. If some fields we discuss are not visible, it may be due to a previous choice.

Attribute properties

On the first panel, you'll find the following fields:

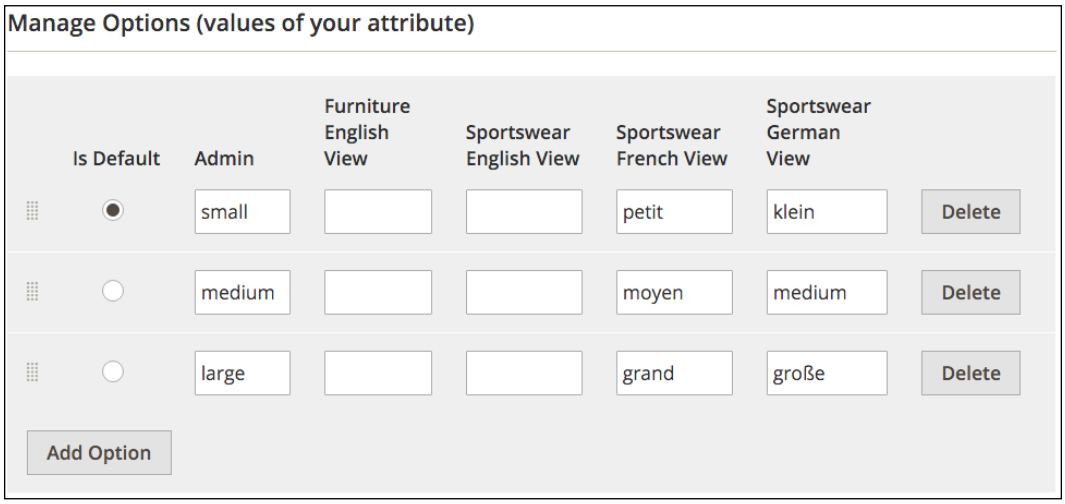
- **Default label**: Regardless of what you wish to have the attribute labeled as on your store (which we'll discuss a bit later), you can name it for your backend use. In our example, we would enter Fabric.
- **Catalog Input Type for Store Owner**: Use this to select the type of attribute you wish to create (see the previous section for more on attribute types).
- **Values Required**: If you wish to require that a value be entered or selected, choose Yes.
- **Update Product Preview Image**: For applicable attribute types, this will allow the main product image on a catalog listing page to display the related swatch value (applies only to the backend catalog listing).
- **Use Product Image for Swatch if Possible**: When using swatches in configurable products, the product will display the swatches as selectors. When a swatch is selected, the main image can be replaced with the base image of the associated product.



Manage options

This section will only appear if you select **Multiple Select** or **Dropdown** as your attribute type (**Catalog Input Type for Store Owner**). For these attribute types, you have to provide the possible value choices. Let's take t-shirt size as an example. If you use a **Dropdown** type, you can enter all possible size choices — make sure they're presented and spelled as you would like them to appear.

To create an option, click on **Add Option**. Enter the value you want for the option in the **Admin** column. If you want different displayed values for your multiple stores, enter those into the other fields. Any store views without a value will use the admin column value.

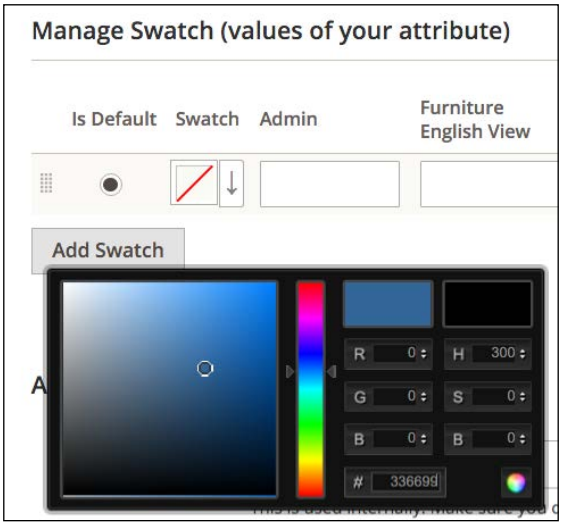


Once you have more than one value, you can choose which will be the default value when creating a new product by clicking the **Is Default** radio button. You can also re-arrange the order of the values by clicking and dragging the handle on the left end of an option row.

Manage Swatch

If you choose a Visual or Text Swatch attribute type, this section will be available. Adding swatch options works very similarly to the **Options** described before, except that you are working with swatches instead of option values.

Visual swatches are configured by selecting either a color value or uploading an image of the swatch. Using the down-arrow menu, select **Choose a Color** to reveal a color selector pop-up. You can move your mouse across the color spectrums, enter RGB or HSB numerical values, or enter a hexadecimal value to choose your color. Once you make your selection, click the small, round rainbow-colored button in the lower right-hand color of the selector.



If you choose **Upload a File** for your swatch, you can select a swatch image on your computer to upload.



If you use swatch images, try to create your swatches so that they're big enough to display enough texture, if that's important. For layout quality, your swatches should all be the same size.

Text swatches will display the values you enter as a "button." The swatches will show all available values and if any are out of stock or not available, it will appear as crossed out.



Advanced attribute properties

Expand this panel to reveal the following field choices:

- **Attribute Code**: This is an internal code used by Magento (and perhaps your developer if they customize your installation). Similar to a URL path, the key should be all lowercase and not include spaces. If you don't enter one, Magento will create one automatically.
- **Scope**: Use this to decide whether the entry should apply to all products at the Global, Website, or Store level. For instance, if you select Global, then whatever is entered in your attribute for a product will apply at all scope levels and cannot be changed at the website or store level.
- **Default Value**: If you want to have a default value displayed when the field is presented in a product edit screen, enter it here.
- **Unique Value**: There may be certain times you want a value to only apply to one product.
- **Input Validation for Store Owner**: You can have Magento validate whether a value entered meets certain requirements: decimal number (such as 12.43 — a number with a decimal point), integer value (for example, 2 or 77 — no decimal point), email address, a URL (web address containing "http" or "https"), letters (a through z), or letters and numbers (a-z and 0-9). If the entry does not match the validation selection, the user will receive an error message.
- **Add to Column Options**: You can elect to have an attribute appear in the list of products when viewing the catalog.
- **Use in Filter Options**: In addition, you can allow the backend user to filter listed products using your new attribute.

Managing labels

By default, your attribute will be named by the value you enter in the **Default** label field. However, if you want to display the name of your attribute on your store frontend, you may want to supply alternatives for each of your store views. For instance, if you create an attribute called "screen size," you will probably want to translate it for stores you build in other languages.

Storefront properties

This is the section that allows you to affect how your attribute can be used by your customers.



As noted earlier, different attribute types will determine what properties may or may not be available.

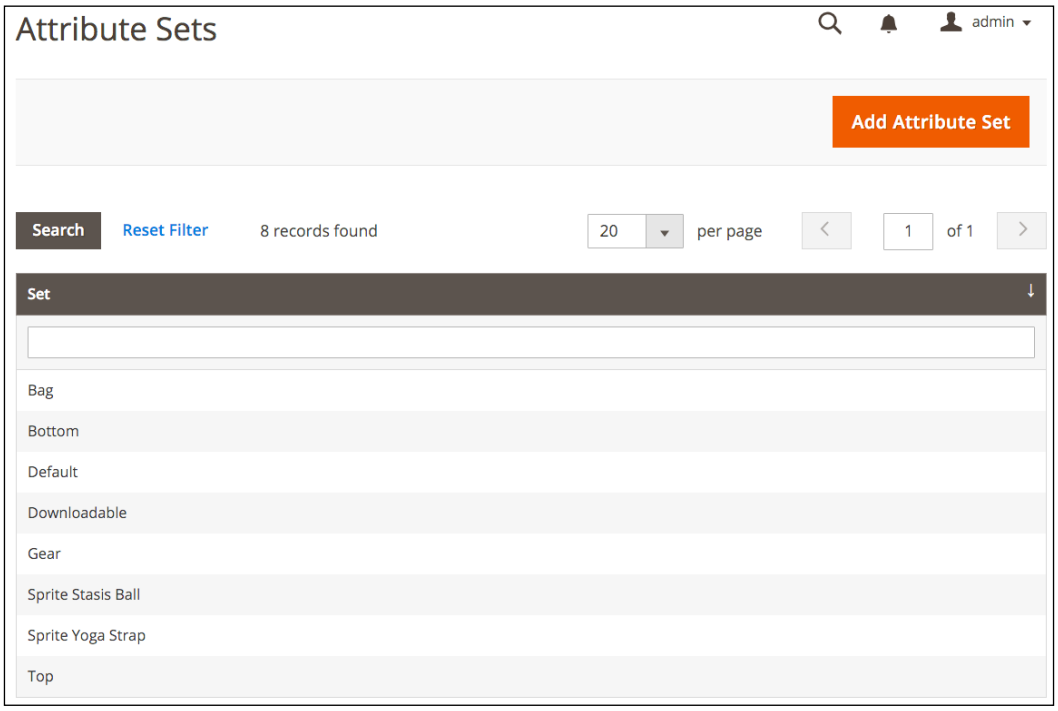
- **Use in Search**: When customers search for products on your site, you can include the values of this attribute as a search value. For example, you may have customers that often search for "halogen light bulbs." If all your products have "halogen" in their title, no problem, but what if many of your products do not include "halogen" in the title? You could create an attribute called "Bulb Type" with "halogen" as one of the values. By setting this attribute field to Yes, if someone searches for "halogen light bulbs," products with this attribute set to "halogen" would be included in the search results.
- **Comparable on Storefront**: You can select attributes to be included in the side-by-side product comparisons for your customers.
- **Use in Layered Navigation**: For applicable attribute types, you can choose to use them in the frontend layered navigation.
- **Use in Search Results Layered Navigation**: Likewise for layered navigation in search results.
- **Position**: If you do use an attribute in layered navigation, you can command its position relative to other attributes by entering a number in this field. Attributes will be shown in ascending order (lowest to highest) according to this field.
- **Use for Promo Rule Conditions**: As we will discuss in *Chapter 7*, *Extending Magento*, you can construct discounts and promotions based on the values of attributes for which this field is set to Yes.
- **Allow HTML Tags on Storefront**: For applicable attribute types, you can allow the use of HTML tags in the field value. For instance, you might want to bold part of a value, such as Contains EPA-Approved cleaners.

- **Visible on Catalog Pages on Storefront**: Setting to Yes will display this attribute on the product detail page.
- **Used in Product Listing**: Depending on your theme, setting this to Yes may allow the attribute to be shown on the category listing pages.
- **Used for Sorting in Product Listing**: Also dependent on your theme, this may allow your attribute to be included as a sorting criteria, much as price, position and name are used by default.

Creating attribute sets

In order to have attributes available for use when creating a product, it should belong in an **attribute set**. Attribute sets also allow you to make available similar attributes across similar products.

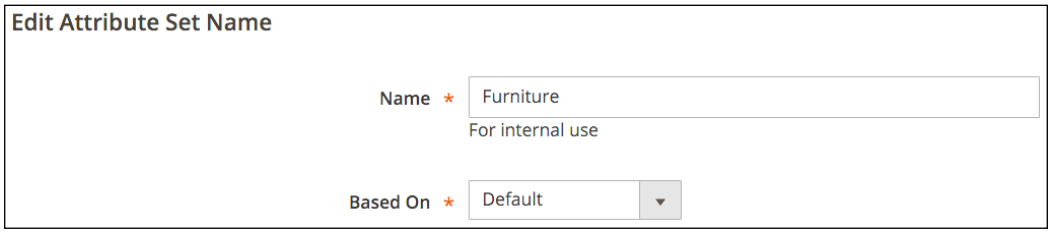
To view existing attribute sets, go to **Stores** | **Attribute Sets**.



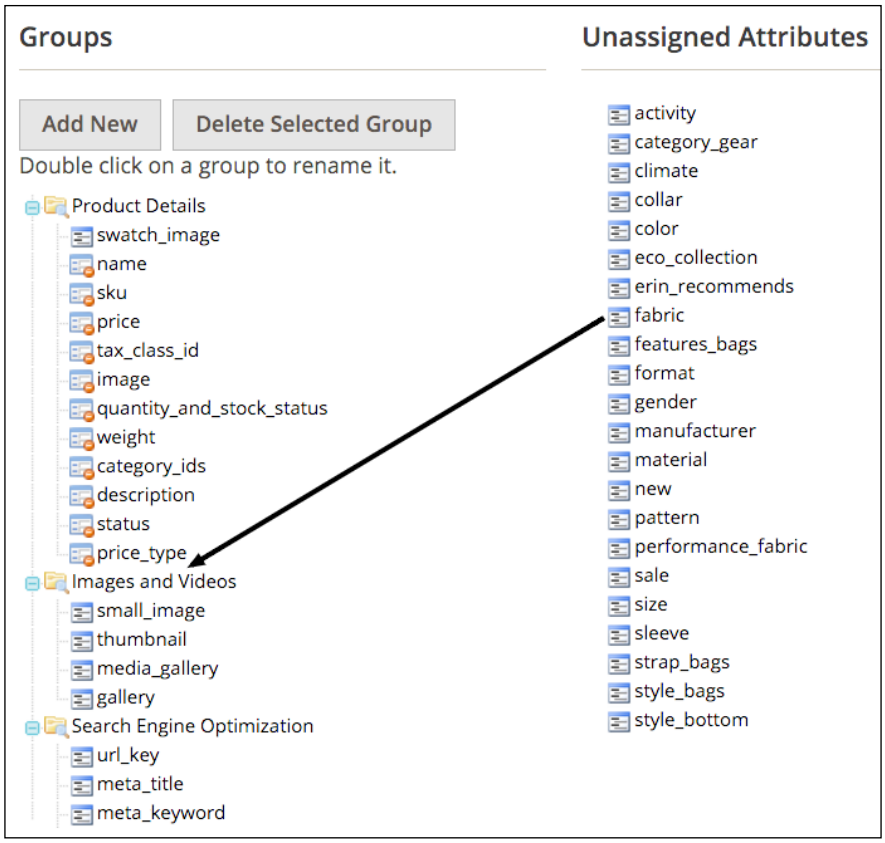
Each existing attribute set (the default will appear if you have not created any sets) contains attributes assigned to that set. Let's create a new attribute set for our furniture products.

For this exercise, we have already created one new attribute: fabric.

1. To begin creating our new attribute set, click on **Add Attribute Set**.
2. On the first screen, enter the name of your attribute set as you would like it to appear in the backend (your customers will never see attribute sets).
3. If you wish, you can base your new set on an existing attribute set, which can help reduce your configuration time if an existing set has most of the attributes you wish to use. For our example, we're going to select **Default**.



4. Click on **Save** to advance to the next screen.
5. To add **fabric** to our new attribute set, we need to drag it from the right **Unassigned Attributes** column and place it where we want it to appear on the **Product Detail** screen. We can place and move attributes into any order or group within the attribute set. A "Group" is noted by the folders in the **Groups** column.



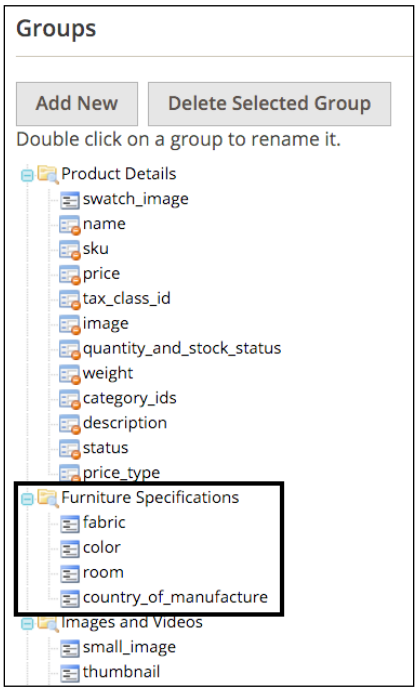


Attributes marked with a "Do not enter" icon cannot be removed from attribute sets. These are required fields for products. All others can be added or removed as needed.

6. If you wish, you can create additional groups within an attribute set by clicking **Add New** at the top of the **Groups** column.
7. Click **Save** to commit your new attribute set.



We often create a group within an attribute set to contain special, related attributes. For instance, we could create a group called "Furniture Specifications" and drag "fabric" and any other new, related attributes into this new group, as seen in the following screenshot. This can help focus attention on these special attributes when creating or editing products. The order and groups of attributes have no effect on the front end presentation nor will they change any programmatic aspects of Magento 2.



Now that we have created a new "Furniture" attribute set, we can add additional attributes as needed to help describe our furniture offerings. We can also use this attribute set when adding new furniture products so we have just the attributes related to our needs.



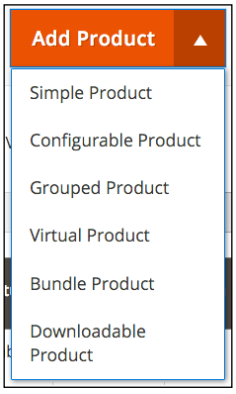
A new and powerful feature of Magento 2 is the ability to add existing attributes within the **Product Edit** screen. This means that as you create products, you can add attributes you need without having to leave your current work. These attributes will also be added to the attribute set you have applied to your current product, which means the attribute will also be added to all products using the same attribute set.

Creating products

Now that we've discussed the various Magento product types, let's go over the process of creating a new product in the Magento 2 backend. While there are some differences based on product type, the overall process and options are very similar.

The new product screen

After you go to **Products** | **Catalog** in the backend, you will see a list of the products in your catalog. In the upper right-hand corner is an orange button, titled **Add Product**. If you click on **Add Product**, you can create a simple, configurable, virtual, or downloadable product. For all types — including the bundled and grouped product types — you can also click the button menu (the down arrow on the right side of the button) and choose a specific product type.



The configurable, virtual, and downloadable product types can be created simply by changing settings within the simple product detail panel. For example, you can start with a simple product, add configurations, and the product type will automatically change to a configurable product type.



As we go through the product creation process, you'll learn that Magento has really upped their game in Magento 2, making it much easier for you to manage your products. For instance, you can start out adding all the various t-shirt styles you sell as simple products, and then go back and create the various size and color variants within those products. In Magento 1.x, you could not change the type of an existing product without first deleting the product, then re-adding it.

So, let's begin by building a simple product and then exploring how to create the other complex product types. For our example, we'll start with a red couch.

Creating a simple product

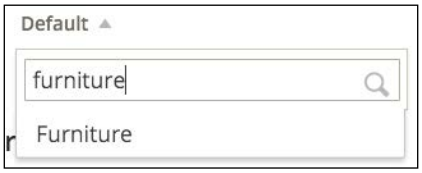
To begin, click on **Add Product** button on the **Products | Catalog** screen.

We're going to fill in the fields in the **Product Details** section as follows:

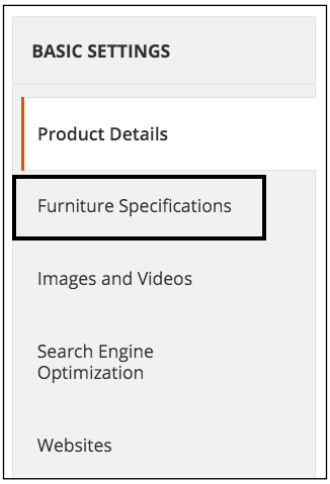
- **Name**: **Couch**
- **SKU**: **C1234**
- **Price**: **599.99**
- **Tax Class**: **Taxable Goods**
- **Quantity**: **100, In Stock**
- **Weight**: **Yes, 200 lbs**
- **Categories**: **Sofas**
- **Description**: **Beautiful, comfortable and stylish. Our Acme sofa is the perfect couch for formal or casual decór. Durable, yet supple microfiber fabric will last for years.**
- For the **Images and Videos** section, we're going to upload an image of a red sofa we have taken from sample data provided in earlier Magento versions.

Save your product now before proceeding.

Next, we want to click the small down arrow to the right of **Default** at the top of the screen and type **Furniture** to select the **Furniture Attribute Set** we created earlier.



After the screen refreshes, you'll see an additional attribute group you created in the left sidebar, and any attributes you added to the attribute set will be available to you.



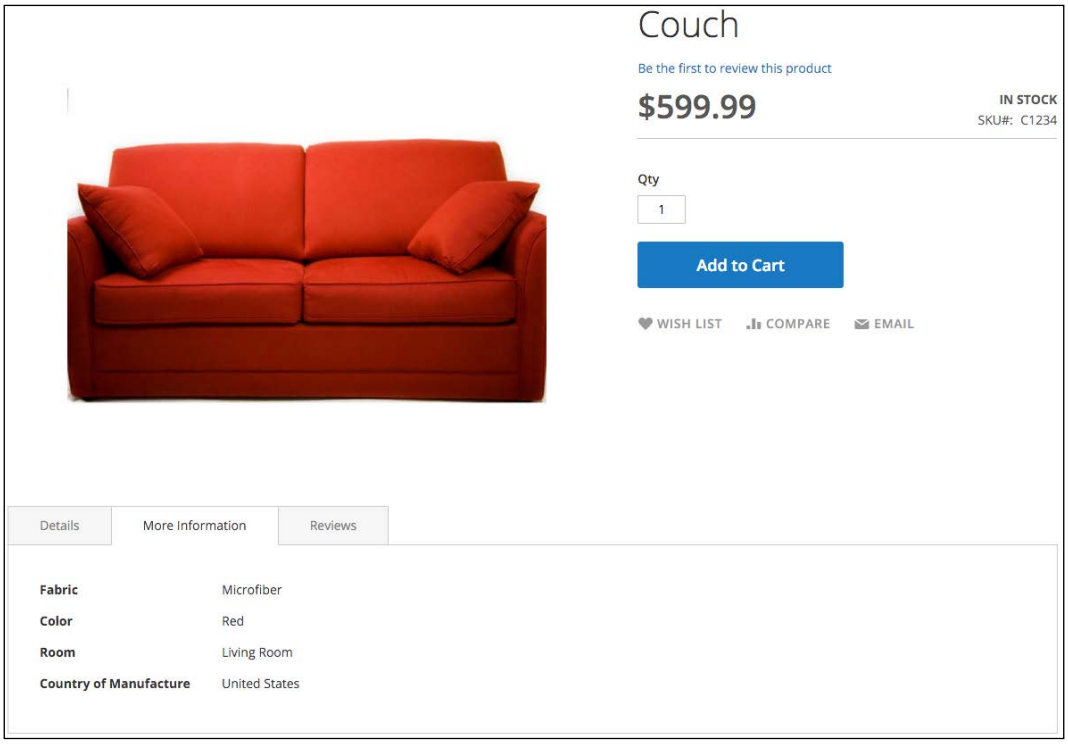
In the **Furniture Specifications** panel, we will enter the following values:

- **Fabric**: **microfiber**
- **Color**: **Red**
- **Room**: **Living Room**
- **Country of Manufacture**: **United States**

Under the **Websites** panel, we need to select **Furniture Website** so that the new product will appear in the stores within the furniture website.

We're going to leave all the other settings as they are for now and click on **Save**.

When we view the product on the website and click on the **More Information** tab, we can see the values of the attributes we have selected.





For attributes to appear on your product detail screen, as shown in the preceding screenshot, you must set **Visible on Catalog Pages on Storefront** to **Yes** in the **Attribute** properties.

Creating a configurable product

Let's say we have our couch available in three colors: red, blue, and green. How would we present all three choices as a single product yet allow the customer to select their desired color?

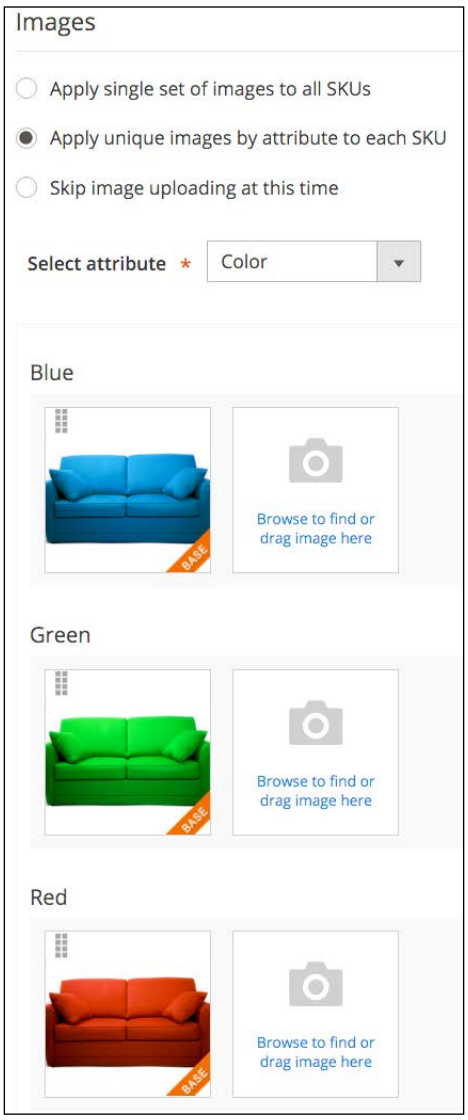
The simplest way would be to add colors as an option in our simple product. However, if we manage inventory separately for each color (let's say we have 100 red, 50 blue, and 30 green sofas in the warehouse), we have to, in essence, create three simple products and *associate* them to a single configurable product.

To do that, we have two options: auto-create the associated products from the configurable product or create the three individual simple products then associate them to a new, configurable product.

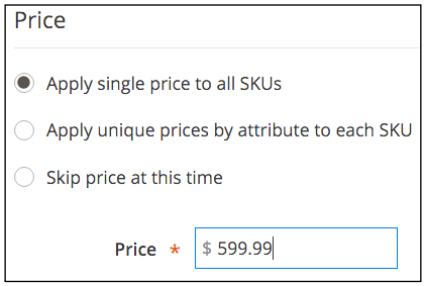
First, let's try method one using the couch simple product we just created:

1. Open the **Product Edit** screen in the backend and scroll down to the bottom panel titled **Configurations**. Expand this panel.
2. Click on **Create Configurations**. A new screen will appear from the right side of your browser window. A step-by-step navigation will appear at the top to note your progress in creating the associated products.
3. The next step is to select one or more attributes that will determine the product variants. In our case, we have different sofas based on color. If we have sofas of different colors and fabrics (three colors and two fabrics would produce six possible combinations), we could select both attributes. For now, we will only select **Color** and click on **Next**.
4. Now, we get to select all the different colors we wish to use. We will select **Blue**, **Green,** and **Red** for our example. Click on **Next** to proceed.

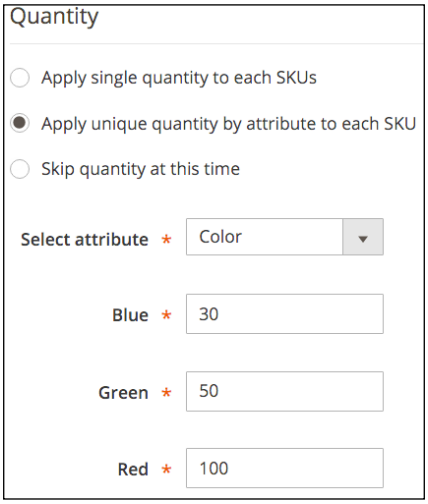
5. In Step 3, we have some choices to make regarding our images, prices, and quantities. As per our example, we will select **Apply unique images by attribute to each SKU** for **Images**; **Apply single price to all SKUs** for **Price** (all sofas are the same price); and **Apply unique quantity by attribute to each SKU** for **Quantity**. As we make our choices, we have the opportunity to add images and note quantities, since we elected to manage these uniquely for each variant. We will also be able to enter the price common to all sofas (in our case, $599.99). Click on **Next** when you have completed this step.



First, you are allowed to choose whether to use the same images for all variants, or assign unique images to each. As with any of these choices, you can also opt to skip this for later.



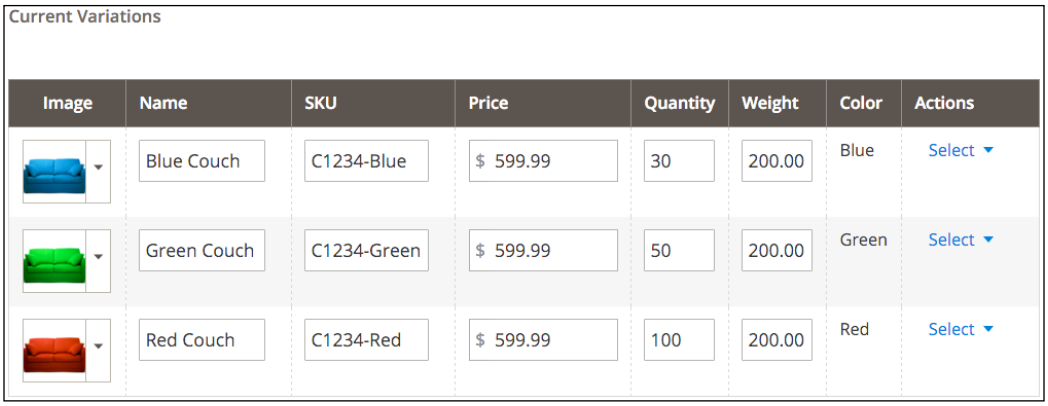
Alternatively, within the **Price** box, you can assign the same or unique prices to all variations.



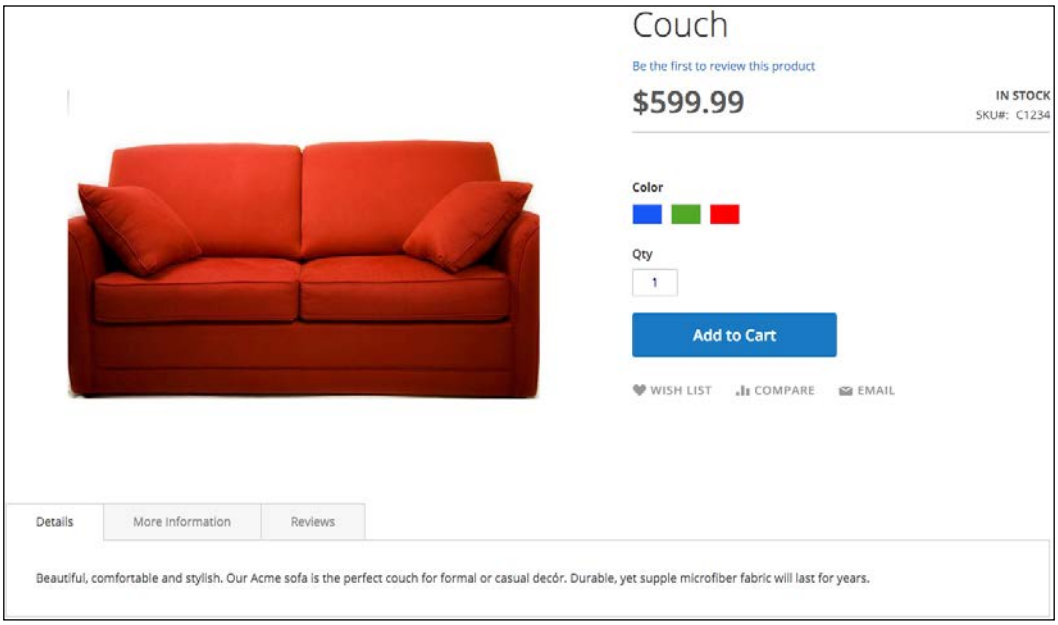
Finally, if you wish, you can assign inventory quantities for the associated products.

6. On the final step, you will be able to review your variants to make sure you have them as you wish. When you're satisfied, click **Generate Products**.

7. The overlay will disappear and you will see your new variants listed in the **Configurations** panel. Here, you can modify the **Name** and **SKU** fields for each variant to meet your needs. Once you have completed this, click on **Save** to complete creating your configurable product.



Having completed creating the configurable product, the product on the frontend now displays the color swatches for each variant (and removes the **Color** field from the **More Information** tab contents). As you click on each swatch, the main image will also change to reflect the image you uploaded for the particular variant.



In the backend, under **Products** | **Catalog**, you'll find four products now: the **Configurable Product** and the three new associated **Simple Products**.

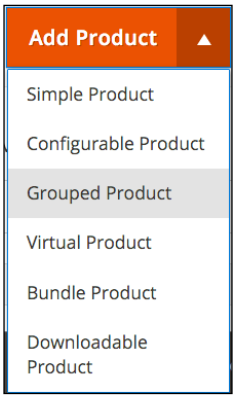
	ID ↑	Thumbnail	Name	Type	Attribute Set	SKU	Price	Quantity
☐	2055		Red Couch	Simple Product	Furniture	C1234-Red	$599.99	100.0000
☐	2054		Green Couch	Simple Product	Furniture	C1234-Green	$599.99	50.0000
☐	2053		Blue Couch	Simple Product	Furniture	C1234-Blue	$599.99	30.0000
☐	2052		Couch	Configurable Product	Furniture	C1234	$599.99	0.0000

Alternatively, if you already have the **Simple Products** added to your store, you can create the configurable product and add the associated products manually instead of creating them automatically, as we just did.

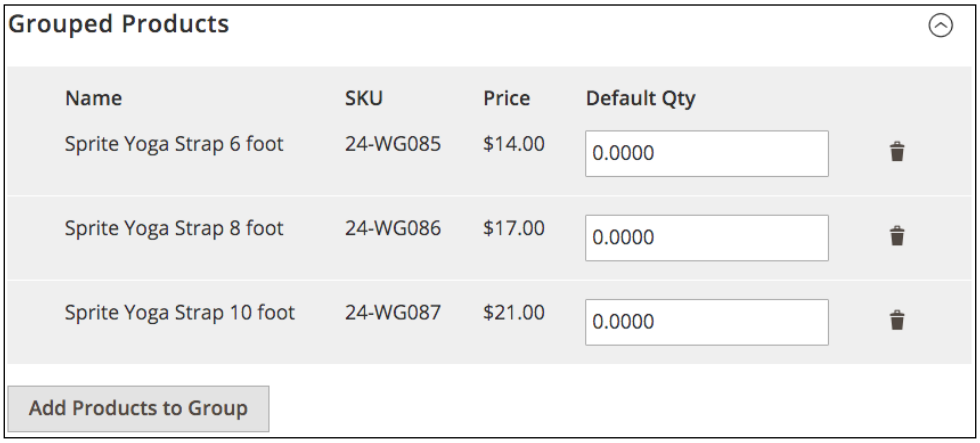
Creating a grouped product

If you have a collection of related products, such as yoga straps (included in the Magento 2 Sample Data set), you can present them as a group. Customers can then select which individual items they want by entering a quantity for each associated product.

To create a grouped product, choose **Grouped Product** in the **Add Product** dropdown menu, as shown in the following screenshot:



At the bottom of the **Product Details** screen, under **Grouped Products**, you add products to the group and any default quantity you wish to set (customers can always override any default).



Grouped products are not really products at all but simply a *virtual* grouping of products you wish to present together.

Creating bundled products

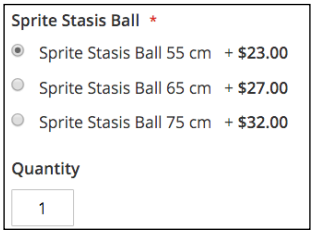
Bundled products are similar to grouped products but with some differences. The biggest difference is that you are creating a bundle of products presented to the customer as one "set" or "bundle." Furthermore, you can configure the product so that the customer can select options of each product, if they wish.

Let's look at the **Sprite Yoga Companion Kit** product provided in the Magento 2 Sample Data. This is a bundle of yoga equipment that has been configured to include four required products: a Stasis Ball, a Foam Yoga Brick, a Yoga Strap, and a Foam Roller. Customers can select larger balls and longer straps. The price of the bundle is automatically calculated based on their selections.



When the customer clicks on **Customize and Add to Cart**, the choices available for the bundle are revealed.

First are the choices for the Stasis Ball:



As customers select alternative sizes, the total cost of the bundle will adjust accordingly.

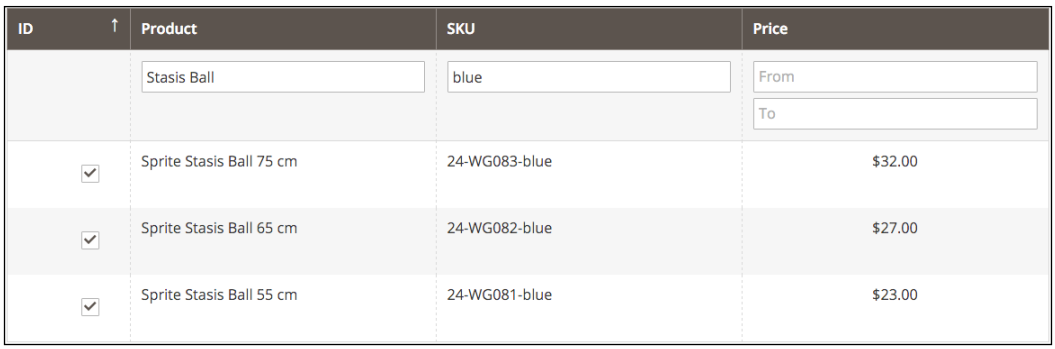
Bundled products are created in two steps: creating the options for each bundle component, then attaching simple products to those options.



Simple products used in bundled products cannot have custom options. Remember, as with all complex product types, you can only associate simple or virtual products. Complex product types cannot be associated to other complex product types.

Let's build the **Sprite Stasis Ball** bundle option, as shown, in the **Product Detail** screen to illustrate this two-step process.

1. Under the **Bundle** panel, click on **Create New Option**.
2. For **Option Title**, we'll enter **Sprite Stasis Ball**.
3. We can allow the customer to make their selection using a drop-down menu, radio buttons, or a checkbox. You should use whatever you feel best communicates the choices to your customers. For our example, we're going to select **Radio Buttons**.
4. Our next step is to click on **Add Products to Option**. We can then use the search tools to find the products we want to add to this option. In our case, we're going to search for products with "Stasis Ball" in the title and "blue" in the SKU. We will check each product we want to attach to our option and click on **Add Selected Products**.



Once you have created your options and attached the associated products, you can save your product.



There are lots of great possibilities for how you can use bundled products in Magento. You should experiment, trying various configurations and settings to arrive at the ideal product setup for your needs.

Creating a downloadable product

In today's digital world, many online retailers offer files that can be purchased and downloaded, such as books, music, and software. Creating a downloadable product is achieved by attaching the files to the product. Once purchased, the customer will receive a link they can click to download their purchase to their computer.



Note that many downloadable products cannot be redeemed on mobile devices. Music, for example, may not always be able to be downloaded and played on a mobile device by clicking the redemption link. Please experiment and test your offerings so you know how to communicate any restrictions to your customers.

A downloadable product is created by making two initial selections:

- **Weight**: For the question "Does this have a weight?" you should select **No**.
- **Is this a downloadable Product?**: This box is checked to reveal the fields necessary to attach files that define your product.

In the **Downloadable Information** panel, there are two sections: **Links** and **Samples**. The **Links** section allows you to attach files that will be provided to customers once they purchase your products. The **Samples** section will provide linked files for shoppers to download as examples of what they will get when they buy the product. You can also use this section to attach files to promote the product.

When creating a downloadable product, you have controls over how easily it is for the customer to share their download link and how many times they can download their purchase. While these are not foolproof, they can help restrict the distribution of your digital products.

Creating a virtual product

A virtual product is just as it sounds: a product that doesn't actually exist, but can be purchased by the customer. Basically, a virtual product is one that has no weight and therefore cannot be shipped.

What kinds of product fall into this type? We've used the virtual product type for extended warranties, training courses, and hosting packages.

Managing inventory

If you sell actual products, you no doubt have inventory stock. Except in cases where you are having products drop-shipped from a distributor and have no means of monitoring inventory availability, you need to make sure you have enough inventory on hand to fulfill your orders. Furthermore, you may want to restrict customers' ability to order products that are out-of-stock — or, alternatively, allow customers to place backorders.

Magento has a host of configurations to help you establish your inventory rules and policies. Most can be overridden at the product level, too, giving you even more granular control over your product inventory needs.



You can manage the individual inventory configurations of each product on the **Advanced Inventory** panel under **Advanced Settings**. These settings are very similar to the ones found in the **Stores** | **Configuration** | **Catalog** | **Inventory** panel.

Here, let's discuss some additional tools in Magento that can help you manage your inventory.

Low stock notifications

One of the inventory configurations is that of **Notify for Quantity Below**. This value sets the threshold whereby Magento will send you an email notification if a product's inventory falls below this quantity. This notification will only come once each day for a given product. Using this feature can help you avoid running out of stock.

Product reports

Under the **Reports** menu in your Magento backend are several reports under the **Products** section. Use these reports regularly to help you monitor your inventory movements and plan your stock purchases. Let's have a look at these reports in brief:



Before using reports, you may need to refresh Magento's statistics under **Reports** | **Refresh Statistics**.

- **Views**: This report shows the popularity of your products in terms of how often products are viewed by customers. If you have products that are often viewed but convert to few sales, you may want to evaluate pricing and content for possible improvements to encourage more sales.
- **Bestsellers**: Magento keeps track of the number of times products are sold and presents a list of these products to show you which are the most commonly purchased.
- **Low Stock**: With this report, you can list products that fall within a specified stock quantity. This is useful in planning your re-stocking purchases.

- **Ordered**: The ordered report shows for each given period (day, month, or year) how many of each SKU was purchased during the time span specified.
- **Downloads**: For downloadable products, this report shows how many times any digital file was downloaded by your customers.

Pricing tools

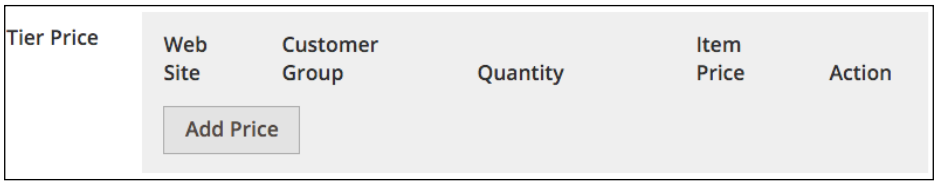
Many times we're faced with needing to manage special pricing for different customer groups or based on quantities purchased. Flexibility in pricing can help you meet the needs of your market and Magento gives you the tools necessary to accommodate those considerations.

Pricing by customer group

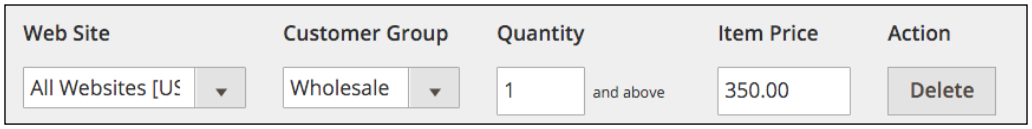
In *Chapter 3*, *Designs and Themes*, we learned how to create customer groups. You may, for instance, wish to offer discounted pricing for your wholesale customers — those who buy from you for resell to their customers. At the same time, you want to sell products at regular retail prices for your regular customers.

By creating a customer group — say "Wholesale" — and assigning select customers to that group, you can set up specific pricing for a product that will appear to customers who are logged into your store and are assigned to the particular customer group.

Let's use our green couch we created earlier as an example of how to configure pricing for a customer group. If we go to the **Product Detail** screen for this product and click on **Advanced Pricing** under the **Advanced Settings** menu in the left sidebar menu, we see a section called **Tier Price** (we will also refer to this section later when we discuss quantity-based pricing).



To add pricing for a customer group, click on **Add Price**. If we wish to set the price for this couch — normally selling for $599.99 — at $350.00 for our wholesale customer, we might configure this new entry as shown in the following screenshot:



With this configuration, any logged in customer who belongs to the wholesale customer group will see this couch priced at $350.00 on your store.

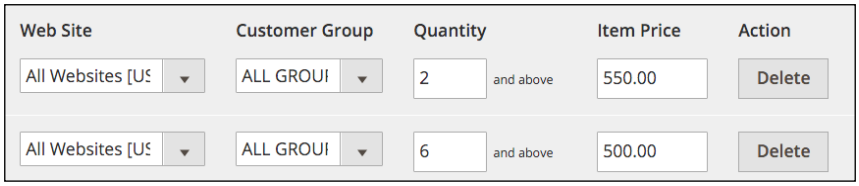
Quantity-based pricing

It's probably quite obvious now how you can create quantity-based — or **tiered**—pricing for your products using the same configuration tool. By adding additional pricing tiers and setting a new quantity value, you can create pricing that changes based on the number of items a customer purchases.

As an example, let's configure the pricing to show a price of $550.00 if a customer buys two-five couches and a price of $500.00 if they buy six or more. We will apply this to all customer groups.



Be careful when using tiered pricing and multiple customer groups. Test your configurations carefully.



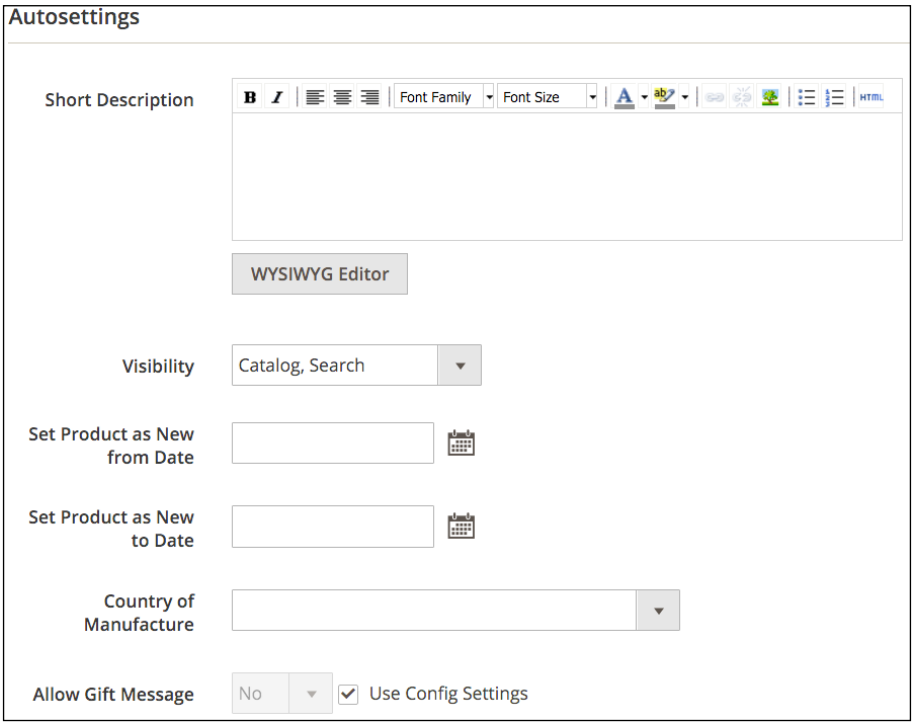
If we commit this pricing scheme, then when viewing the green couch in the store, we would see this pricing notice:



This notice may help stimulate higher purchased quantities by showing customers how much they can save buying more!

Autosettings

Before we leave our discussion of product creation and management, we need to discuss a special panel in the **Product Detail** screen: **Autosettings**. This panel is found in the **Advanced Settings** submenu.



Let's go over the particular settings found on this panel. You'll find these can be valuable to your product presentation efforts.

- **Short Description**: The description you enter here will be used in category listings as a brief description of your product. In many themes, this description also appears at the top of the product detail page, usually below the title.
- **Visibility**: You can choose whether you want the product visible to customers within category listings (catalog), search results, or not at all. In our couch example, we might not want the individual color couches available outside of the configurable product; therefore, we would set this field to **Not Visible Individually**.
- **Set Product as New from Date/Set Product as New to Date**: In many themes, you can present new items in special display blocks or the word "New" might appear on the product listing. This trigger can be managed by setting from and to dates in these fields. If the current date falls within the dates used here (inclusive), then the product will be considered "New."
- **Country of Manufacture**: In our global economy, jurisdictions and regulations often require that a product's country of origin be presented to customers. This is not, by default, a required field, but you can use it to denote from where a product originates.
- **Allow Gift Message**: You can allow customers to add gift messages to products purchased. These messages appear on the packing slip.

Related products, up-sells, and cross-sells

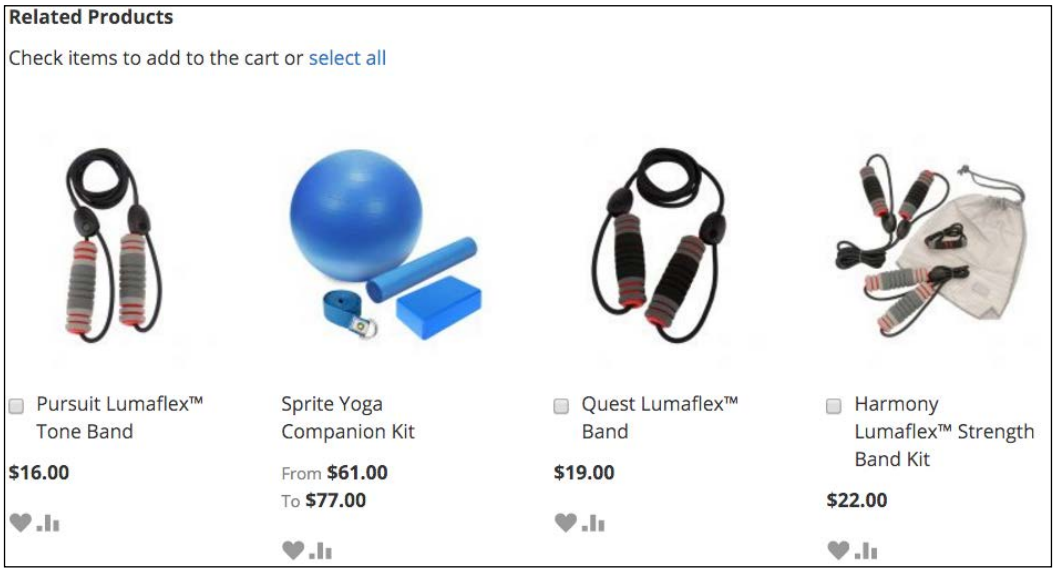
For each product you create in Magento, you have the opportunity to attract additional purchases from customers by linking products together. These crosslinks allow you to encourage shoppers to consider buying more products than the one they're reviewing. In the bricks-and-mortar world we're constantly bombarded with similar promotions. For instance, if you go into the grocery store, you'll often find small, red coupon machines hanging off the shelves, encouraging you by their flashing red light to pull a coupon out while you're reaching for the canned peaches you came for. Throughout the store, placards and banners promote "2-for-1" specials or "buy 1, get 1 free." The area around the checkout lane is crowded with magazines, razor blades, batteries and gum, put there to catch your eye just as you're about to leave the store.

In a similar fashion, Magento allows you, the store administrator, to encourage shoppers to spend more during their online visit using related products, up-sells, and cross-sells. All three types are managed within the **Product Detail** screen.

Each of the following product selling features are configured in the **Product Detail** screen under the **Advanced Settings** section. Each one has particular features and purposes.

Related products

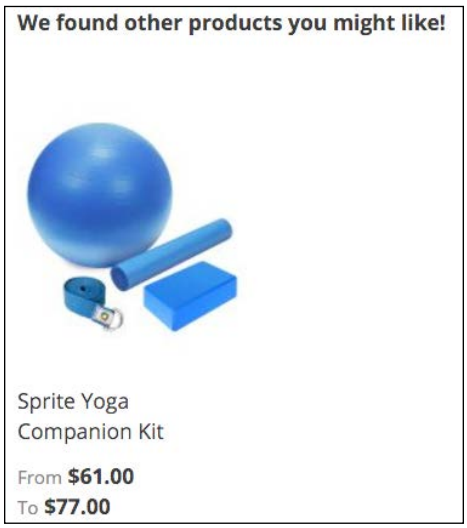
Related products are those which you wish to present to customers as additional purchases to include when adding a viewed product to their shopping cart. In other words, if a customer is interested in product A, they may also want to purchase product B and product C at the same time.



As you can see, a customer may select one or more related items to include *with* the product they are currently viewing.

Upsell products

By contrast, upsell products are those to be considered as alternatives to the product the customer is viewing. That is, if the customer is interested in product A, they might instead consider product B. Not as an additional purchase, but instead of purchasing product A.





The manner in which related or upsold products are displayed on your store will depend on your theme. Consult your developer if you wish to change how these products are presented.

Cross-sell products

Cross-sell products are presented to your customer on the shopping cart page. For instance, if you want to encourage the purchase of an extended warranty, you could add it as a cross-sell product and it would be presented on the shopping cart. Your customer can add it to their order directly from the shopping cart.

Importing products

Creating products one-by-one is fine if you're only selling a few products, but many people choose Magento as a platform to sell hundreds and thousands of different products. Entering each product individually can take a long time, especially if you're writing unique product descriptions, uploading photos, and adding crosslinked products.

With Version 2.0.1, Magento has greatly improved the performance of product imports. In previous versions, importing thousands of products could take hours – literally. We once tried to import 19,000 products and the job took 20 hours to complete! The improvements to Magento importing have greatly decreased that time.

The shortcut to importing products

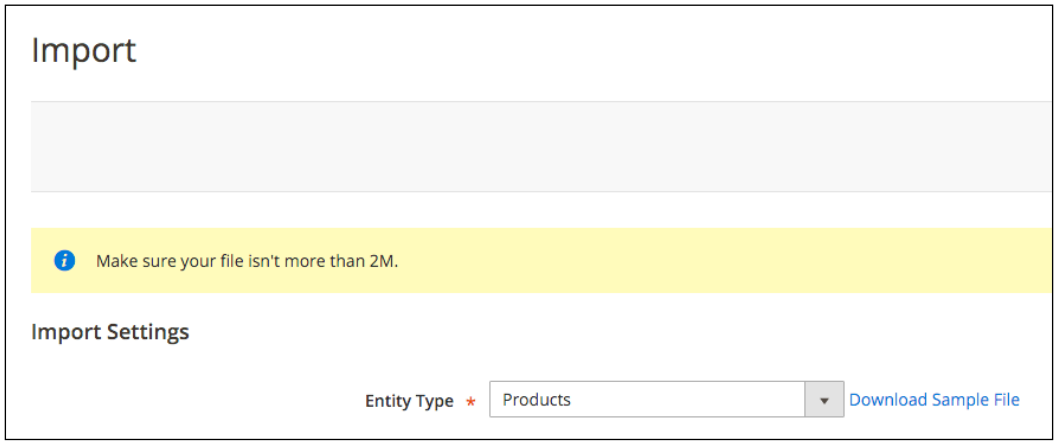
After spending hundreds of hours wrestling with the importing schemas of Magento over several versions of the platform, I'm happy to say that, starting with Version 2.0.1, there is one shortcut to helping you import products successfully.

Magento imports CSV files according to a specific layout scheme. Trying to configure an import file to accurately import a variety of different products, product types, attribute sets, and so on, will lead to many, many failed attempts as you try different ways of configuring the CSV to meet your needs. Therefore, my best advice is:

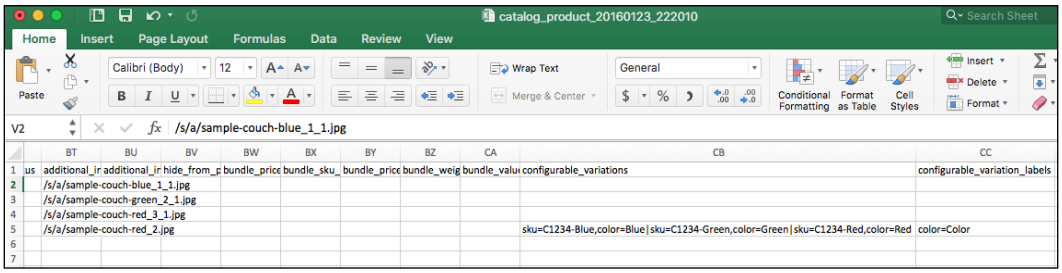
1. Enter at least one product into your store representing the different types (simple, complex, bundle, and so on) that you will be using.
2. Fully enter the data for each product, including all options. You don't have to upload images, however.
3. Go to **System** | **Import/Export** | **Export** in your backend.
4. Export a product CSV file to your computer using your browser (in previous Magento versions, this export would be placed on your server and you would have had to FTP to your server to retrieve it).
5. Open the downloaded CSV file in Excel or Numbers.

Now you can easily see how each type of product is configured in the export file. Using this format, you can easily add additional products, simply by following a similar pattern.

In the Magento 2.0.1 import interface, there is an option to download a sample file. This is a great step in the right direction and can be very helpful as a reference. Because this file only covers default products, though, we would suggest entering the type of product(s) you intend to sell into your store as described above to generate a more specific reference template.

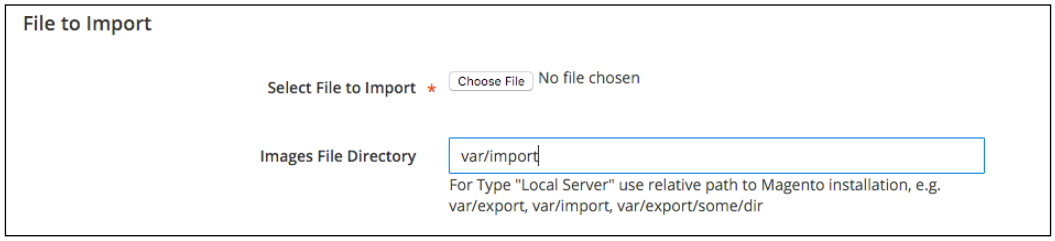


Notice that for products with various options, particularly configurable products, only the differences between each iteration are included on the rows below the main product row. Never repeat any other fields that are the same between variations. A unique SKU is required of each product, though. For configurable products, you'll need to include a **pipe delimited** list of the configurable SKUS and the attribute they vary by (in the example below, this is the **Color** attribute).



You don't need to worry about this for simple products, but if you do have a batch of configurable products it will really help to have a sample configurable product export file as a starting point.

To import images, you must upload the images to your server in the `/var/import` folder. If the `/var/import` folder doesn't exist, you can create it (or another of your directory) and specify it as part of the import process.



Put the name of the image file in the image columns of your import CSV file (don't include any path). Magento will pick the image out of the `/var/import` folder, resize it as needed, and store it within the `images/catalog` folder hierarchy. Never use capitals, spaces, or other strange characters in your image names; only the letters a through z, the numbers 0 through 9, and the underscore.



The most important thing to remember is to remove any unused columns before importing. For example, if you are not going to include categories in your import, leave that column out. This is especially important if you are re-importing or importing product updates. If you leave a column blank, then Magento will enter a blank value for that column in your product record. Oops!

Summary

Selling online begins with your products. Your products have to be presented well and in logical categories. Furthermore, Magento gives you additional, powerful tools for promoting your products to potential customers.

In this chapter, we learned how catalogs and categories relate to each other, and to your stores, and the different types of products that can be sold in a Magento store. We also went in-depth into how to create and manage attributes and attribute sets and discussed inventory management configurations. Finally, we learned a shortcut for configuring product imports.

Getting a handle on how the complexity of categories and products in Magento work is actually one of its greatest strengths and puts you in a better position to leverage the remaining topics in this book towards encouraging more sales from your visiting customers. Next, we turn our attention to grabbing attention: how to theme your Magento store.

3
Designs and Themes

Selling online, as with brick-and-mortar retailing, is more than simply having products to offer to customers. Buyers make purchases based on many things apart from the item itself. Customers want to understand the purpose of the retailer and have confidence that the seller is legitimate, safe, and honest. Corporations have spent billions over the years creating this understanding among their active and potential customers, through logos, design, copy, and service. Creating this understanding is called **branding**.

For an online store, branding is very important. However, unlike the offline shopper who drives to a store, parks, and enters the store to spend several minutes shopping; an online shopper may click to your online store, spend a few seconds to determine if they wish to remain, and leave to visit another website. Therefore, your store's brand—it's graphics, copy and function—must address the following in a matter of seconds:

- Does this online store have what I'm looking for? Can I easily find what they sell?
- Do I trust this seller if I've never heard of them before?
- Does the retailer make it easy for me to shop and purchase?
- Does it appear that the store owner is interested in helping me buy?

Magento gives you, or your client, the functional tools and systems to provide a powerfully rich shopping experience for your customers. It cannot, however, provide the branding aspects relating to design. You have to craft the outward appearance that will communicate to the potential buyer feelings of convenience, product selection, and security.

In this chapter, we will teach you:

- The Magento theme structure
- How to install third-party themes
- Creative translations
- Using theme variants
- How to customize themes to create your own unique look and feel
- Building theme packages

The Magento theme structure

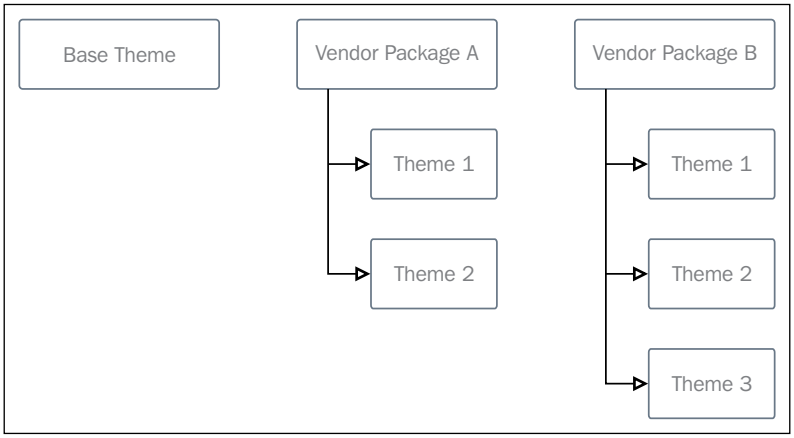
In *Chapter 2*, *Managing Products*, we discussed the **Global-Website-Store**, or **GWS**, methodology. As we have learned, Magento allows you to customize many store aspects at some, or all, of the GWS levels.

The same holds true for themes. You can specify the look and feel of your stores at the Global, Website, or Store View levels (themes can be applied for individual Store Views relating to a store) by assigning a specific theme.

In Magento, a group of related themes is referred to as a design package. Design packages contain files that control various functional elements common among the themes within the package. By default, Magento Community installs one design package with two themes.

Themes within a design package contain the various elements that determine the look and feel of the site: layout files, templates, CSS, images, and JavaScript. Each design package must have at least one theme, but can contain other theme variants. You can include any number of theme variants within a design package and use them, for example, for seasonal purposes (such as holidays or back-to-school).

The following graphic shows the relationship between design packages and themes:

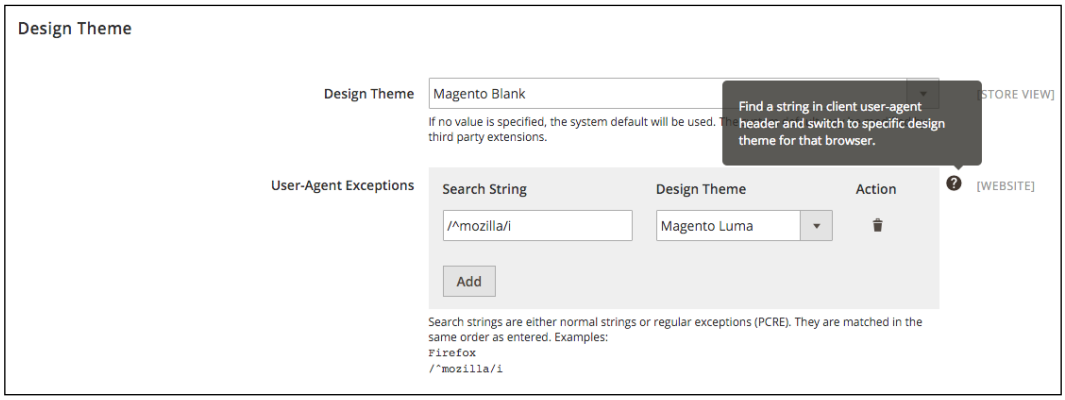


A design package and theme can be specified at the Global, Website, or Store levels.



Most Magento users will use the same design package for a website and all descendant stores. Usually, related stores within a website business share very similar functional elements, as well as similar style features. This is not mandatory; you're free to specify a completely different design package and theme for each store view within your website hierarchy.

A design package and theme can also be specified based on a per browser basis at the global and website level, by providing a **User-Agent Exception**. In the following example, the string for the Firefox browser is provided:

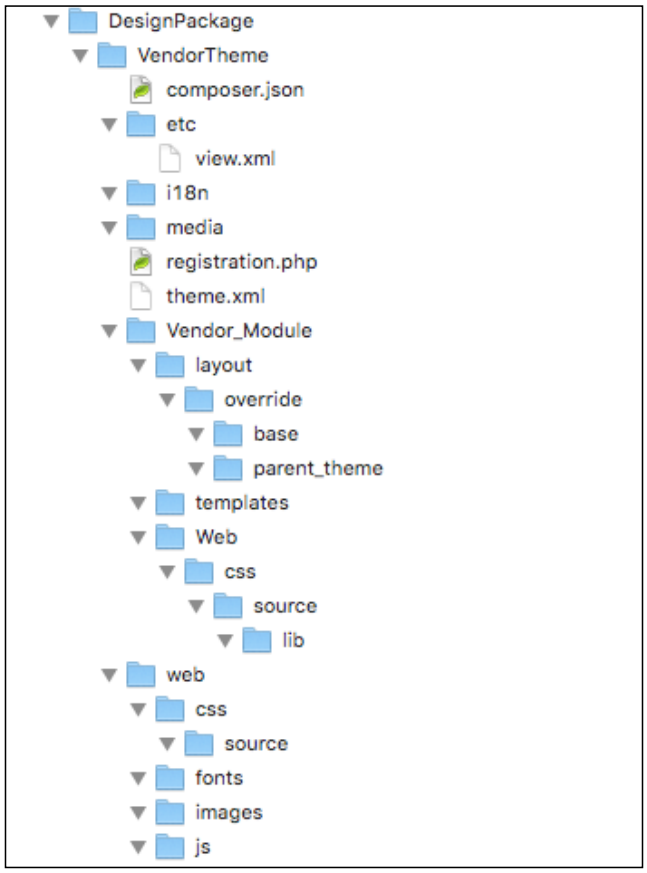




To be certain about the string used in the User-Agent Header, you can check `http://whatsmyua.com/` from the browser in question. This site will provide a very specific string you can use for the **Search String** field.

Magento 2 is a departure from Magento 1.x in that the `skin` directory used in Magento 1.x is absent, and the structure has been simplified. All files have been consolidated into one location, stored under the `/app` directory. Additionally, the `layout` and `template` directories from Magento 1.x have moved. Now, every module has its own `layout` and `template` directories in which you can access all template, layout, JS, and CSS/Less files.

Let's take a closer look at the new structure of a theme for Magento 2.0. The `theme` directory will typically include the files and directories visible in the following image:



The theme directory



You may notice that in some default Magento 2.x builds, some themes are found in the `vendor/` directory. This indicates that a theme has been added via a composer dependency. We'll cover packaging your theme via composer later in the chapter. While Magento does check the `vendor/` directory for themes, you should never add a theme directly to this directory. When creating a new theme, always start in the `app/design/frontend/` directory.

Theme files and directories

In the new theme structure for Magento 2, all of the files related to design are in the preceding layout, under the `VendorTheme` directory. To clarify this new layout, we've provided a brief description of the role of each of the files and directories here:

- `/composer.json`: This file is not a required file, but you'll use it to describe the dependencies your theme has and metadata for your theme. This file is essentially for use if you intend your theme to be a `composer` package.
- `/etc/view.xml`: This file is required for a theme, but only if it doesn't already exist in a parent theme. We'll review parent themes later in this chapter as well. It includes information about product images and thumbnails.
- `/i18n`: This directory includes CSV translation files.
- `/media`: The `/media` directory contains a theme thumbnail, typically a screenshot of the theme that serves as a preview of the theme when it's being installed in the admin. This directory is required.
    - `/registration.php`: This file is required; it registers your theme within the system.
    - `/theme.xml`: Also mandatory, the `theme.xml` file declares the theme as a system component. It contains information about the theme like the theme name, the parent theme name, and so on.
- `/Vendor_Module`: This directory is the parent for module specific styles, and the naming convention is important. Magento will use it to determine which module it needs to apply the styles, layouts and templates to. If the module being overridden was the `Catalog` module, the directory would be `Magento_Catalog`. It is only required for modules that are being overridden.
    - `/Vendor_Module/layout`: This directory contains files that extend or establish module layouts. Layout files are XML that determines the position of blocks and containers on any given Magento page. We'll go into additional detail around layout files and the elements in them in the *customizing themes* section of this chapter.

        - `/Vendor_Module/layout/override/base`: Files in this directory specifically override the default layouts for the module in question.
        - `/Vendor_Module/layout/override/parent_theme`: Layout files in this directory specifically override the parent theme layouts for the module specified.
    - `/Vendor_Module/templates`: This directory contains template files that override either default or parent templates in place for this module. If there are custom templates for this module, they're stored in this directory as well. We'll review template files in greater detail in the *customizing themes* section.

- `/web`: This directory contains static files that can be loaded directly from the frontend. For example, if you wanted to reference a specific image, you could include it here, and you would be able to refer to it in a template file.
    - `/web/css/source`: This is the location where Less CSS configuration files for the theme are stored. Less is a CSS pre-processor that allows for variables and functions, making CSS for the theme more maintainable and extensible.
        - `/web/css/source/lib`: This directory contains files that extend or establish module layouts. Layout files are XML that determine the position of blocks and containers on any given Magento page. We'll go into additional detail around layout files and the elements in them in the *using themes to create your own look and feel* section of this chapter.
    - `/web/fonts`: This contains fonts specific to this theme. Everything in the `web` directory is static, so this folder is simply here for organizational purposes.
    - `/web/images`: This directory stores images specific to this theme.
    - `/web/js`: This location contains JavaScript specific to this theme. We'll talk more about how to insert JavaScript into a template in the *using themes to create your own look and feel* section.

The concept of theme inheritance

A very important aspect of Magento theming is the **fallback model**. Theme inheritance in Magento 2.x has been completely redesigned. The primary upshot of this is that unlimited fallbacks are supported and the default directory is no longer a part of the fallback mechanism.

The fallback order is slightly different for static assets (JavaScript, Less CSS, CSS) and templates, so we'll review both of these cases in detail. Before we explain the fallback order though, we'll need to begin with how parent themes are established in `theme.xml`.

Configuring a parent theme in theme.xml

This is new and central to the new theme fallback model. In any given theme, you have the option of identifying the parent theme. This is done in the `theme.xml` file, in the root directory of the theme. The following is an example of what text from a sample `theme.xml` file might look like:

```
<theme xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNam
espaceSchemaLocation="urn:magento:framework:Config/etc/theme.xsd">
     <title>Vendor Theme</title>
     <parent>Magento/luma</parent>
     <media>
         <preview_image>media/vendorpreview.jpg</preview_image>
     </media>
</theme>
```

As you can see, the parent theme is specified explicitly, and in this case it's the Magento `Luma` theme. That means that any files not found in the "Vendor Theme" theme will be pulled from the Luma theme. Any files not found there will, by default, be pulled from the Magento "Blank" theme, and if they're not found there, they'll be pulled from the module theme files.

Overriding static files

Static assets are content such as JavaScript files, CSS, images, fonts, and Less CSS files. Even though Less CSS files are not, technically speaking, static files, they produce the final CSS, so are categorized as such:

1. If the module context is not defined for a file, Magento will begin by checking the current theme's static files, in the `web` directory, `<theme_directory>/web/imagename.jpg`.
    - If a match is not found there, it will recursively check the ancestor theme's static files until a theme with no parent is found.
    - If there is still no match, Magento will check the library static view files in `lib/web/`.
2. If there is a module context established for a static file, the fallback is a little different. It will start with the current theme module's static files.

3. After this it will search for ancestors, again recursively, until a theme with no parent is found. Magento will then search module static files for the frontend area: `<module_dir>/view/frontend/web/`.
4. And finally the base area, `<module_dir>/view/base/web/`.

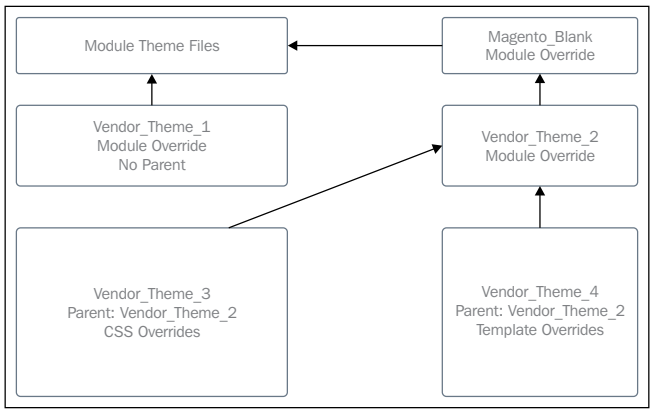
Overriding theme files

The fallback mechanism for theme files is simpler, because the module context is always known for them.

1. Magento starts by looking at the templates for the current theme in `<theme_dir>/<Namespace>_<Module>/templates`.
2. Next, Magento checks for ancestor templates until an ancestor with no parent is reached: `<parent_theme_dir>/<Namespace>_<Module>/templates`.
3. Finally, the module templates: `<module_dir>/view/frontend/templates`.

Here's a pictorial representation of the new fallback model in Magento 2.0. It's a little bit tricky, so we'll walk through each scenario represented here:

- In the case of **Vendor_Theme_1**, there is no parent declared in `theme.xml`, and there are no `module_override` files and there are no static override files. In this case, requests to the theme will fall back to the module theme files.
- In the case of **Vendor_Theme_2**, there is a module override, but no parent has been declared. Requests to the theme here will fall back to `magento_blank`, and subsequently the module theme files.
- **Vendor_Theme_3** and **Vendor_Theme_4** both have **Vendor_Theme_2** identified as a parent in the `theme.xml`, and have CSS overrides. In these cases, requests to the CSS will fall back to **Vendor_Theme_2**, and then `Magento_Blank`:

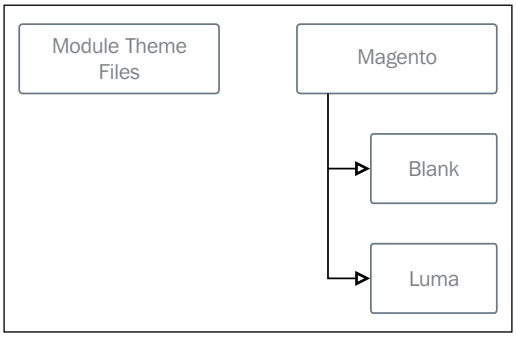


The fallback model is a tremendous shortcut for developers. When a new theme is created, it only has to contain those elements that are different from what is provided by the `Parent` or `Module` package files. For example, if all parts of a desired site design are similar to the `Parent` theme, except for the graphic appearance of the site, a new theme can be created simply by adding new CSS and image files to a new theme. Any new CSS files will need to be included in the `local.xml` file for your theme (we discuss the `local.xml` file later in this chapter). If the design requires different layout structures, only the changed layout and template files need to be created; everything that remains the same need not be duplicated.

If you're careful not to alter the `magento_blank` theme and default module theme files, then future upgrades to the core functionality of Magento will not break your installation. You will have access to the new improvements based on your custom design package or theme, making your installation virtually upgrade proof.

Default installation of design packages and themes

In a new, clean Magento Community installation, you are provided with the following design packages and themes:

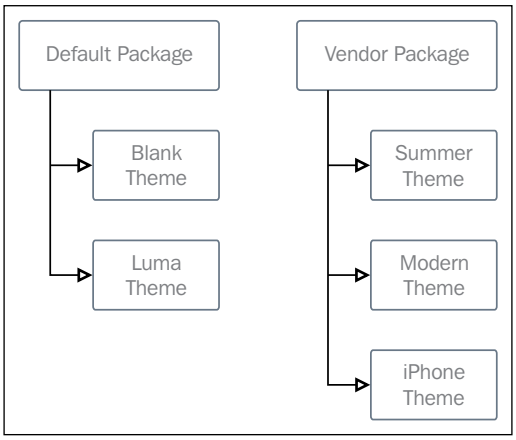


Depending on your needs, you could add additional custom design packages, or custom themes within the Magento design package:

- If you're going to install a group of related themes, you should probably create a new design package
- On the other hand, if you're only using one or two themes based on the feature of the Magento design package, you can install the themes within the Magento design package hierarchy

We like to make sure that whatever we customize can be "undone" if necessary. It's difficult for us to make changes to the core, installed files; we prefer to work on duplicate copies, preserving the originals in case we need to revert back. After re-installing Magento for the umpteenth time because we had altered too many core files, we learned this the hard way!

Your new theme hierarchy might now look like this:

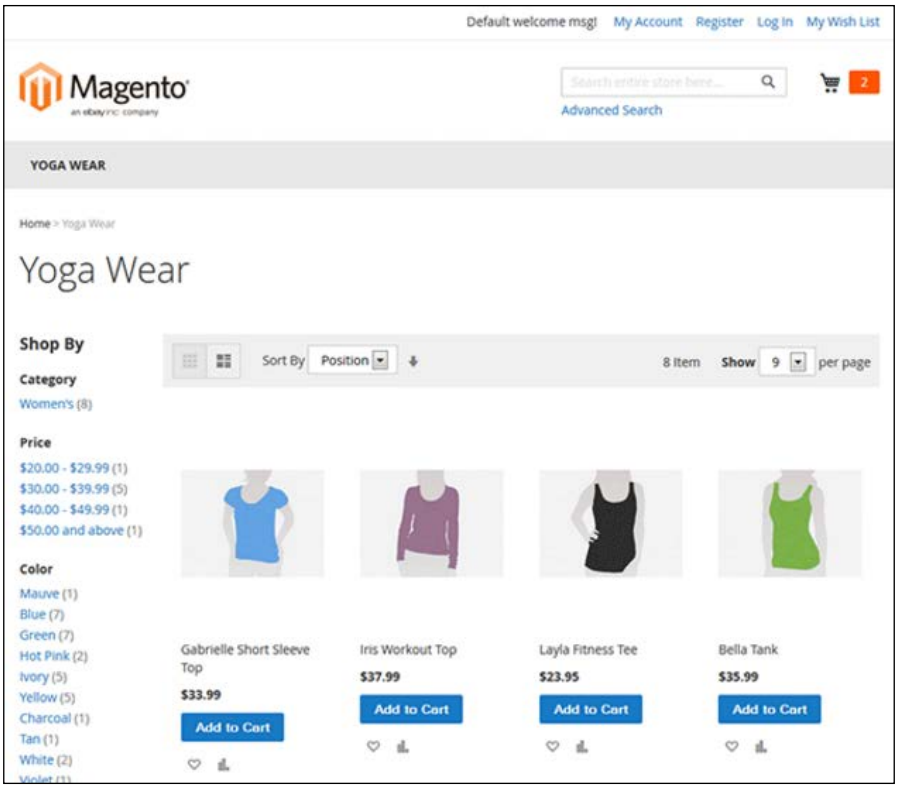


If you decide to use one of the installed default themes as the basis for designing a new, custom theme, duplicate and rename the theme to preserve the original as your fallback.



The Blank Theme

A default installed theme is called **Blank**. If the customization to your Magento stores is primarily one of colors and graphics, this is not a bad theme to use as a starting point. As the name implies, it's a pretty stark layout, as shown in the following screenshot. However, it does give you all the basic structures and components.



Stark layout

Installing third-party themes

In most cases, beginner level Magento users will explore the many available Magento themes created by third-party designers. While there are many free themes available, most are sold by dedicated designers.



Shopping for themes

One of the great good/bad aspects of Magento is third-party themes. The architecture of the Magento theme model gives knowledgeable theme designers tremendous abilities to construct themes that are virtually upgrade proof, while possessing powerful enhancements. Unfortunately, not all designers have either upgraded older themes properly or create new themes fully honoring the new 2.0 fallback model. If the older fallback model is still used for current Magento versions, upgrades to the base package could adversely affect your theme.

Therefore, as you review third-party themes, take time to investigate how the designer constructs their themes. Most provide some type of site demo. As you learn more about using themes, you'll find it easier to analyze third-party themes.

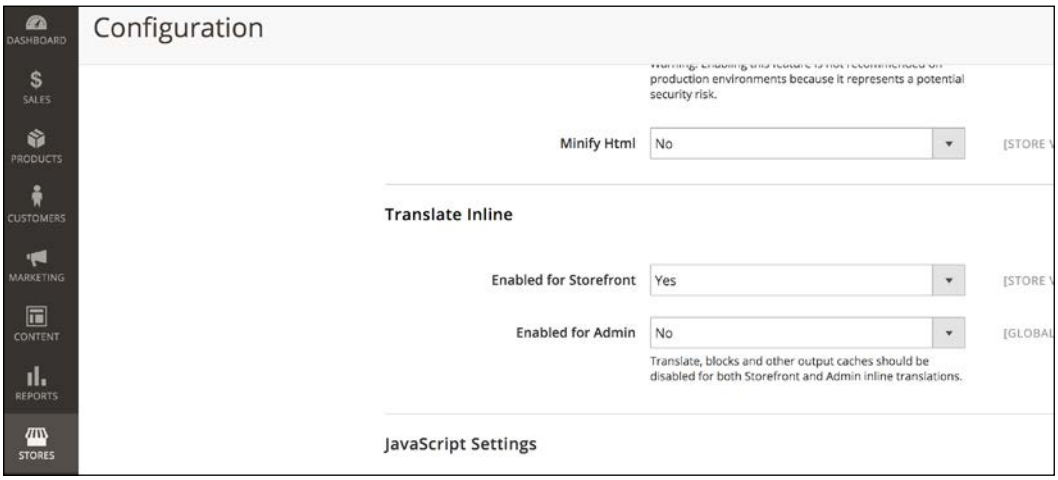
Most themes require that you install the necessary files manually, by FTP or SFTP, to your server. Every third-party theme I've ever used has included some instructions on how to install the files to your server. However, allow us to offer the following helpful guidelines:

- When using FTP/SFTP to upload theme files, use the merge function so that only additional files are added to each directory instead of replacing entire directories. If you're not sure your FTP client provides merge capabilities, or not sure how to configure for merge, you will need to open each directory in the theme and upload the individual files to the corresponding directories on your server.
- If you have set your CSS and JS files to merge under **Store | Configuration | Advanced | Developer**, you should turn merging off while installing and modifying your theme.
- After uploading themes or any component files (such as templates, CSS, images), clear the Magento caches under **System | Cache Management** in your backend.

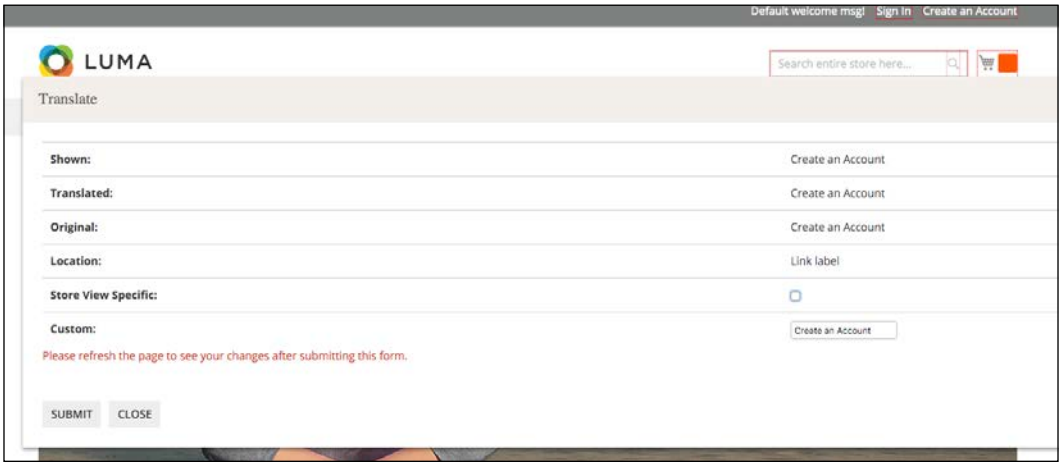
- Disable your Magento cache while you install and configure themes. While not critical, it will allow you to see changes immediately instead of having to constantly clear the Magento cache. You can disable the cache under **System | Cache Management** in the backend.
- If you wish to make any changes to a theme's individual files, make a duplicate of the original file before making your changes. That way, if something goes awry, you can always re-install the duplicated original.

Inline translations

We learned how to create Store Views in different languages. There's another very powerful tool available to store owners as well, whereby it's possible to provide translations manually. To enable the mode for editing/translating text, log into the administrative interface and visit **Store | Configuration | Advanced | Developer**. You'll see the option to translate inline,
for the storefront and for the backend:



Enable this, and you'll be prompted to clear the cache, with a link to **System | Cache Management** to do so. Once the cache has been cleared, visit the front page of the site. You'll see red boxes around certain portions of the page. When you hover over these boxes, a dictionary will appear. When you click on this dictionary icon, you can provide inline translation that will be stored in Magento's translation database:



Working with theme variants

Let's assume we have created a new design package called `sportswear_package`. Within this design package, create a new theme and call it `sportswear_theme`. Our new design package file hierarchy, in `/app/design/`, might resemble the following hierarchy:

```
app/
  design/
    frontend/
      Magento/
        blank/
        luma/
      sportswear_package/
        sportswear_theme/
```

Because we want to use the blank theme as a starting point, the `theme.xml` in the root directory of our theme will look something like this:

```
<theme xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNa
mespaceSchemaLocation="../../../../../lib/internal/Magento/Framework/
Config/etc/theme.xsd">
    <title>Sportswear Theme</title>
    <parent>Magento/blank</parent>
    <media>
        <preview_image>media/preview.jpg</preview_image>
    </media>
</theme>
```

However, let's also take one more customization step here. We can create variations of a theme that are simply controlled by CSS and images by creating more than one skin. For "Sportswear", we might want to have our English language store in a blue color scheme, but our French language store in a green color scheme. We could take the `sportswear_theme/` directory and duplicate it, renaming both for the new colors:

```
app/
  design/
    frontend/
      Magento/
        blank/
        luma/
      sportswear_package/
        sportswear_theme/
        sportswear_blue_theme/
        sportswear_green_theme/
```

Before we continue, let's go over something that is especially relevant to what we have just created.

For our sportswear theme, we created two skin variants: blue and green. However, what if the difference between the two is only one or two files? If we make changes to other files that would affect both color schemes, but which are otherwise the same for both, this would create more work to keep both color variations in sync, right?

Remember, with the Magento `fallback` method, if your site calls on a file, it first looks into the assigned theme, then the parent theme, the blank theme, and finally, the module-specific theme files. Therefore, in this example, you could use the `sportswear_theme` as a common parent to contain all files common to both blue and green. You would only need to include files or CSS impacting the color of these themes.

Assigning themes

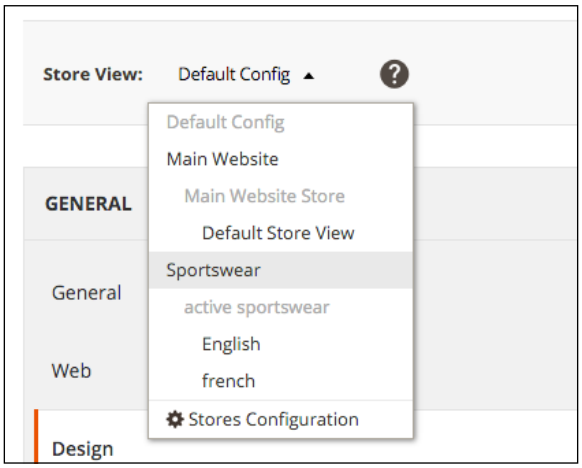
As mentioned earlier, you can assign design packages and themes at any level of the GWS hierarchy. As with any configuration, the choice depends on the level you wish to assign control. Global configurations affect the entire Magento installation. Website level choices set the default for all subordinate Store Views, which can also have their own theme specifics, if desired.

Let's walk through the process of assigning a custom design package and themes. For the sake of this exercise, let's continue with our sportswear theme, as described earlier.

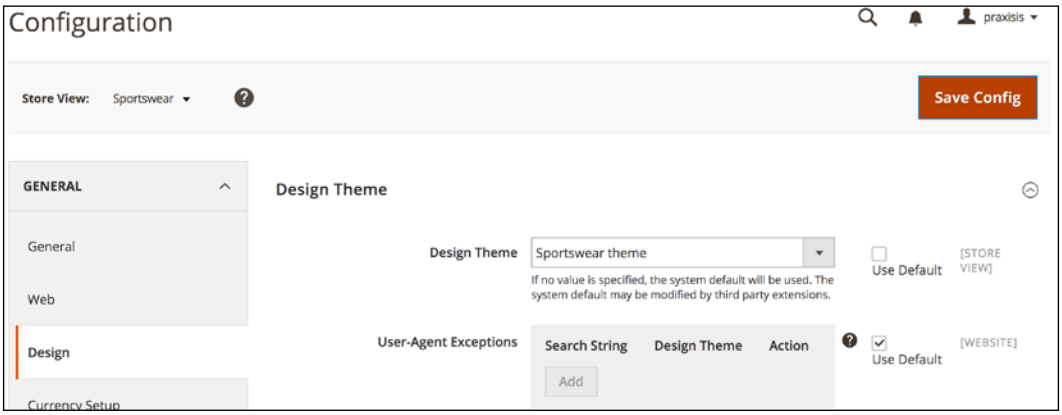
Web Site	Store	Store View
Main Website	Main Website Store	Default Store View
Sportswear	active sportswear	English
Sportswear	active sportswear	french

We're going to now assign our sportswear theme to the sportswear **Website** and **Store View**. Our first task is to assign the design package and theme to the **Website** as the default for all subordinate **Store View**:

1. Go to **Stores** | **Configuration** | **Design** in your Magento backend.
2. In the **Current Configuration Scope** dropdown menu, choose **Sportswear**:



3. As shown in the following screenshot, enter the name of your design package, template, layout, and skin. You will have to uncheck the boxes labeled **Use Default** beside each field you wish to use.
4. Click **Save Config**:



The reason you enter **default** in the fields as shown above is to provide the fallback protection we described earlier. Magento needs to know where to look for any files that may be missing from your theme files.

Applying theme variants

Besides the obvious use of different themes within a package for different looks among Store Views, theme variants can be used to provide alternative frontend layouts based on date, such as holiday shopping season, or device, such as smartphone or tablet.

Scheduling a theme variant

It would be painful if changes that affect your public site content had to be manually turned on at the exact date and time you wished. For products, you can schedule price changes to automatically take effect between any two dates and times (you could have a one-hour sale price!) simply by adding the date/time configuration in the product detail screen.

Likewise, you can schedule changes in your stores' themes to take effect while you sleep! To schedule a theme variant based on a date:

1. Go to **Content** | **Design** | **Schedule** in your Magento backend.
2. Click on **Add Design Change**.

3. Select the Store View you wish to change.
4. Choose from the **Custom Design** drop-down for the theme variant you want.
5. Enter the **Date From** and **Date To** dates and times for the period of time you want the change to take effect.
6. Click on **Save**.

Customizing themes

I've never met a person yet that installed a theme and was ready to launch their Magento store without wanting or even needing changes made to the store design. It's natural, as a store needs to have its own personality and its own brand. In this section, we hope to uncover many of the mysteries of how Magento controls a store's look and feel through layered components that, once you understand how they work together, will give you a tremendous ability to make your Magento store a unique, productive online retail destination.



Finding CSS

While you can view the source code of a webpage in any browser, there are better ways of identifying not only the HTML elements of a page, but the exact CSS style(s) that are controlling how that component appears.

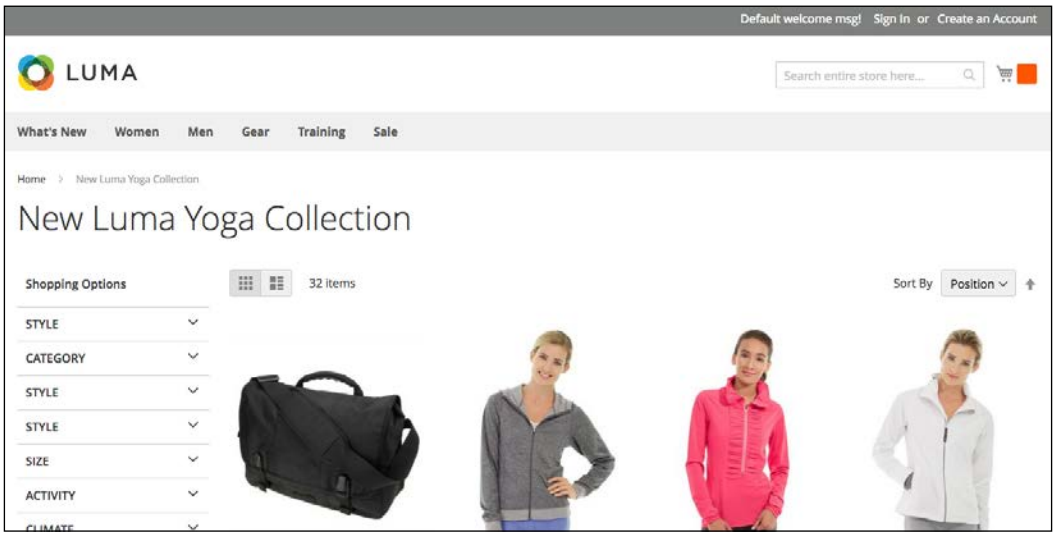
For Firefox browsers, you can install the Firebug plugin (`http://getfirebug.com`). For Safari and Chrome users, this functionality is included with the browser. Another great tool for Firefox users is the Web developer add-on (`https://addons.mozilla.org/pt-br/firefox/addon/web-developer/`). These tools allow you to select an element on the page and view in another window, what the styling rules are that apply to the element. Once you know that, you can easily find the CSS style statement in the theme's CSS stylesheets and make any changes you wish.

Customizing layouts

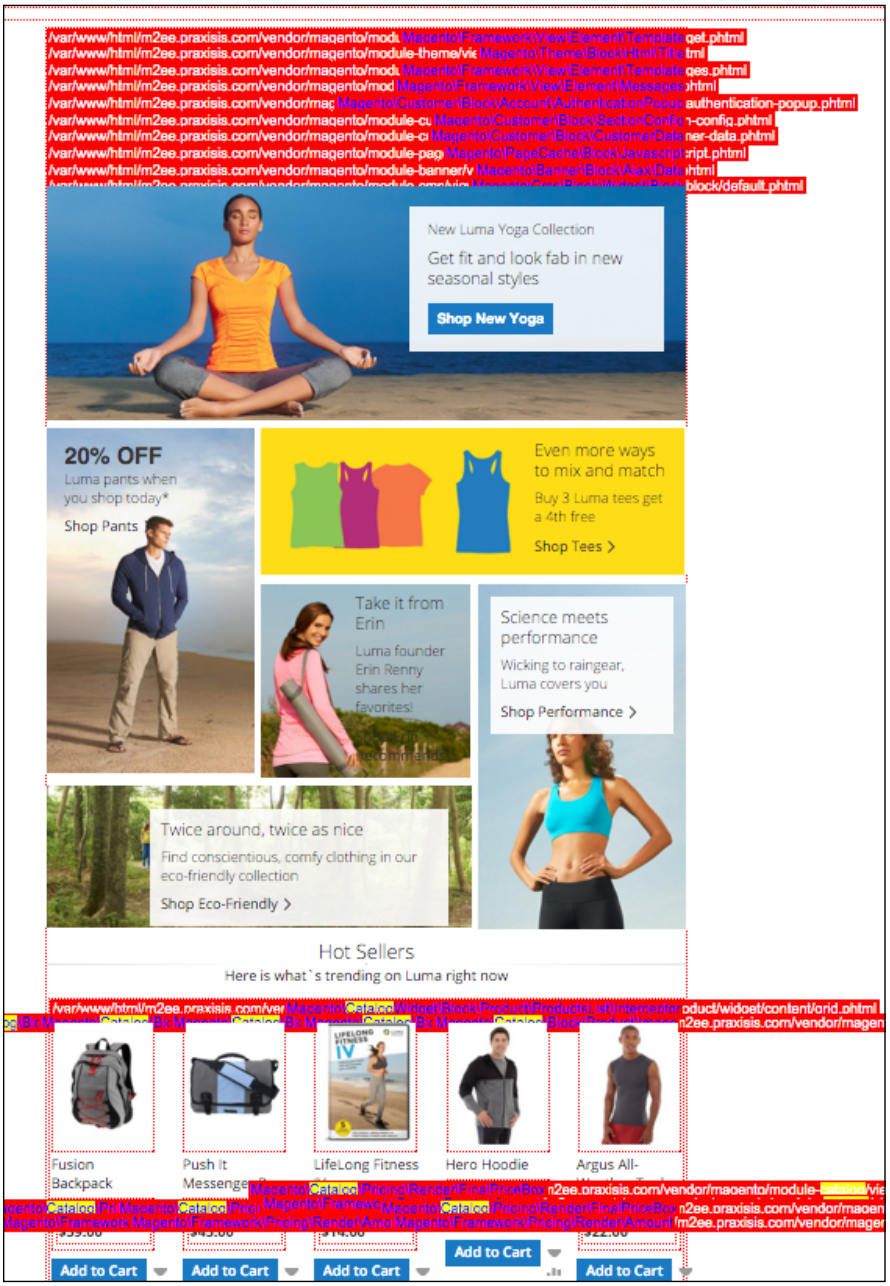
Page layouts in Magento are managed by XML files that control how the various components on a page are to be assembled. Think of layout files as the blueprints of your site, in that they contain the instructions that direct how various content blocks and template files are combined to produce the structural blocks that define the final output.

Blocks are elements in Magento that are responsible for rendering a discreet piece of content to the page. For example, a product display, category list, user login area, all would likely have their own blocks. These blocks in turn reference template files to generate the HTML for any given area.

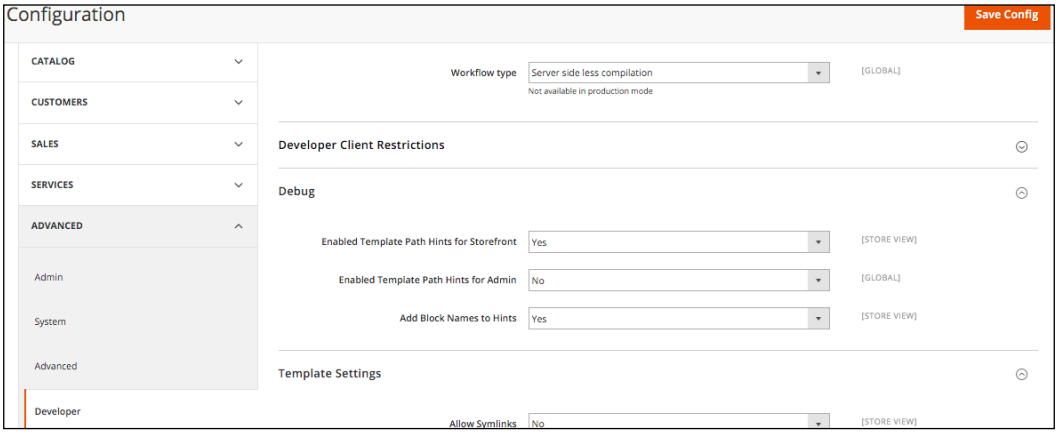
Let's take a visual look at how structural blocks and content blocks are combined on a typical page, by analyzing a category page captured from our sample data default installation:



Now, let's look at this page with the structural blocks and content blocks shown inline:



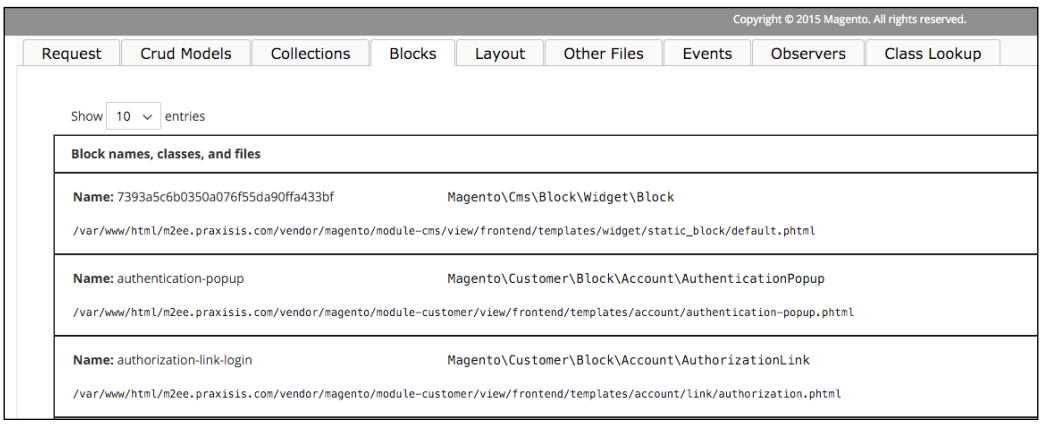
To enable a view like this, that shows which blocks are being rendered on a page, you can visit **Stores** | **Configuration** | **Advanced** | **Developer** and enable template hints in the debug section:



Enabling template path hints in Debug section



Another less cluttered way to view which blocks and templates are included in any given page is to install the commerce bug extension for Magento 2.0. The extension was written by the exceptional Alan Storm, and can be found here: `http://store.pulsestorm.net/products/commerce-bug-3/`. As you can see in the following screenshot, the tabular section at the bottom of the page provides a much cleaner account of the blocks and templates being used on a page. If you plan to do any significant work with Magento 2 theming, this extension is well worth its cost.



Expertly controlling layouts

Magento newcomers, particularly designers, feel a bit lost among the many layout and template files that comprise a Magento theme. However, with a bit of study (this book!) and adherence to a few best practices, anyone can become a Magento design aficionado.

First, keep in mind the concept of the Magento fallback method we previously covered. Layouts are dictated by the most forward layer. This means that if the chosen theme lacks a needed layout or template file, Magento will look into the default directory for the design package, then into the blank theme where, unless you've been naughty and changed anything, Magento will at last find any missing components.

As a designer, this means that you can change layout structures and blocks by creating or editing files within your theme directory, and focus on overriding any base theme behaviors. In short, a theme only has to have only those components that are different from the base design package.

I want to emphasize the enormity of this concept. When I wear my designer's hat, I don't have to replicate all the many layout and template files when creating a theme; I only have to include those most likely few files that will define the delta or difference between the base package and my new theme.



This more robust fallback method (when compared to previous Magento versions) has not been completely absorbed by third-party theme producers. You may find some themes that have many files that really define no difference from the base package. This practice does not conform to Magento's best practices, as it can cause core Magento updates to not be properly reflected in the theme files. In general, we look for themes structures—whether third-party or home-grown—to add only those files necessary to provide the differences between the default layouts and the customized design.

When looking for a file to edit for your intended change, first look into your theme directory. If the file is not there, look to the parent or blank theme directories. If you find the file there, copy it into the same relative position within your theme directory.

Layout files control the various Magento modules, such as Sales, Customers, and Catalog, by using a layout XML file defining their structural blocks, content blocks, and functional components. Page layouts can be located in one of two spots:

- For module page layouts, you'll find them in the `<module_dir>/view/frontend/page_layout` directory:
- In the case of layouts specific to a theme, you'll find them in the `<theme_dir>/<Namespace>_<Module>/page_layout` directory:

Now, here's where it may get just a bit complex: each layout file contains **Layout Handles**, groups of block definitions that generally correspond with a type of page produced by Magento. Handles fall into three categories:

- The first is the **page type layout handle**, which corresponds to the controller actions. An example of this might be `catalog_product_view`.
- The second type of layout handle is the **page layout handle**. The page layout handle refers to identifiers of specific pages and corresponds to controller actions with arguments that specify particular pages, like `catalog_product_view_type_simple_id_128`.
- The third and most common type of handle is an arbitrary handle, which doesn't correspond to any page type but can be included by other blocks or containers.

To get a better understanding of handles, let's review an example handle. This is a handle from `/layout/catalog_category_view_type_default.xml`.

```
<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noN
amespaceSchemaLocation="urn:magento:framework:View/Layout/etc/page_
configuration.xsd">
    <body>
        <referenceContainer name="sidebar.main">
            <block class="Magento\Catalog\Block\Navigation"
name="catalog.leftnav" before="-" template="navigation/left.phtml"/>
        </referenceContainer>
    </body>
</page>
```

From this code snippet, we can find out quite a bit about what it does to affect your layout:

`<referenceContainer>` tells us in what container the enclosed content is to be defined. For example, `<referenceContainer name="footer_links">` suggests that the output generated by the enclosed code will be placed within a block defined elsewhere as `footer_links`. We can use these references to modify where various elements may appear on a page, as we will explore a little later in this chapter.

As you look within each `<referenceContainer>` or `<referenceBlock>` tag, you'll typically find a `<block>` tag and corresponding `<argument>` tags. Here's the block reference from the preceding handle:

```
<block class="Magento\Catalog\Block\Navigation" name="catalog.leftnav"
before="-" template="navigation/left.phtml"/>
```



While it may appear to be a bit "inside-out", it is the `<block>` tag we are most interested in. The `<block>` defines the content. The `<referenceBlock>` tag merely designates where the content block is to be placed. We can change the `<referenceBlock>` tag without affecting the output of the content block.

The `<block>` tag also specifies a template file, in this case `left.phtml` that contains the HTML and PHP code defining the visual output for this block (not all blocks have related `.phtml` files, though).

The attributes for the `<block>` tag include:

- `type`: Defines the functional purpose of the block. Do not modify this.
- `name`: Used by other blocks as a reference to which the block is to be assigned.
- `before` and `after`: this attribute can be used to position the block before or after other referenced blocks that will be placed within the same referenced block. `before="-"` and `after="-"` position the block at the very top or very bottom of the referenced block.
- `template`: calls the template file that supplies the output functionality of the block.
- `action`: a subordinate tag that controls functionality, such as setting values, loading or unloading JavaScript, and more.
- `as`: the name which is used by templates to call the block. For example, `getChildHtml('left.permanent.callout')` would include the block within the template file.



It's important to remember that like all XML tags, `<block>` tags must be closed. That is, the tag must either be matched with `</block>` or, where there are no child tags, closed with `/>`, such as in `<block name="call-out" />`

Using the reference tag to relocate blocks

In our previous example, the graphic callout defined by the `catalog.leftnav` block was designed to be placed within the left structural block, not by the name of the block, but rather by the `<referenceBlock name="left">` tag. The block could be named just about anything; it's the reference tag that dictates into which structural block on the page the block will be rendered.

If we wanted this block to be positioned within the right structural block, we simply change the reference tag to `<referenceBlock name="right">`. By using reference tags, we can position our content blocks into the general areas of the page. To refine the placement, we can use the block attributes of `before` and `after`, or call the block from within a template file using the `as` attribute.

Customizing the default layout file

Up to this point, we've discussed how, by copying and modifying a few files for your theme, you can change the appearance of various blocks within your layout file. This often-overlooked feature is perhaps one of the most powerful layout tools in your arsenal.

By creating a file called `default.xml` and placing it within the corresponding module directory of your theme, you can alter your layout by turning off any blocks defined by the base package `default.xml` file. In other words, if you don't need or want a specific block, you can simply tell Magento to ignore it or, in Magento-ese, remove it. You can also use the default layout file to reposition blocks (as we described previously) or re-define specific handles. In short, it's a great way to make changes to your layouts without having to get deep into the various layout files we discussed earlier.

The first step is to create a `default.xml` file, if one doesn't already exist, and place it within the `/app/design/frontend/[design package]/[design theme]/[module name]/view/frontend/layout/` directory. Add the following code to this text file:

```
<?xml version="1.0" ?>
<page>
  <!-- Put block overrides here -->
</page>
```

Within this small collection of code, you can add blocks and handles, as well as specialized statements. For example, to remove the callout block with which we have been working, add the following code between the `<page>` and `</page>` tags of your `default.xml` file:

```
<remove name="[block_name]" />
```

Just like that, the block is no longer appearing on your site.

The scope of possibilities for using the default layout file is quite extensive. As you begin exploring the use of this file, I would offer the following advice:

- Use the `<remove>` tag to completely disable blocks rather than removing them from layout files. If you don't have any other use for the layout file that contains the block, then you won't even have the need to copy it from the base package into your theme.
- Use `<action method="unsetChild">` to simply disable the block from the current layout, but allow it to be used in another position.
- If you want to modify a block or handle, copy it from the base package layout file and paste it into your `default.xml` file. Then make the changes you want to make. Again, this negates the need for replicating layout files, and it gives you a much quicker ability to make modifications and test them to see if they are behaving as you expected.

Summary

Creating the look and feel of a new Magento store is, for those designers among us, one of the most exciting aspects of creating a new website. However, as we have seen, to give store owners the level of power and functionality that Magento affords, designers can no longer build static HTML pages, slap in a bit of PHP, and upload to the server. With high levels of functionality come higher levels of architectural complexity.

Fortunately, the complexity of Magento is not nearly as daunting once you understand the methodologies of how pages are built, rendered, and styled. I struggled initially to fully understand this system. However, today I feel very comfortable navigating the design-related components of Magento, after taking the time to understand how it all pieces together. Today, you have the added advantage of a much improved architecture, as well as this book in your hands.

Hopefully, I've also shown you that in most cases, if you want an extensively customized theme, you really don't have to start from scratch. By using the existing default themes, or using a third-party theme, you can do some quite extensive customizations simply by modifying a few key files.

Experiment and have fun!

In this chapter, we explored the Magento theme architecture, learning how the Magento Fallback Method works to ensure our pages always have something to show. We also covered the installation and configuration of themes in the Magento 2 store structure and learned how to modify our themes by understanding the use of layouts, handles, and blocks. Finally, we were introduced to a very powerful tool—the default layout file.

You'll no doubt want to spend some time exploring the concepts of this chapter. I don't blame you. Just writing this chapter makes me want to dig into a new design!

When you're ready to move on, we will begin the process of configuring your store for what it is intended: to sell.

4
Configuring to Sell

If you've been following along, chapter by chapter, you've created a working, accessible online store front by now. Are you ready to take orders now?

Not just yet. There's still more to do before you can swing open the virtual doors to your new Magento store. Specifically, we need to:

- Understand the Magento sales process
- Configure the payment gateways to allow you to take online credit card payments
- Set up how your products will be shipped
- Configure sales tax rules
- Create customized outgoing e-mails

If you're the developer or designer of a Magento powered site, this is usually the time when you consult with your client – the store owner – to learn how they want to take payments, charge for shipping, and offer promotional discounts. Once you understand the concepts in this chapter, you'll be well prepared to ask the right questions.

For store owners and administrators, this chapter will give you insights into what can be managed with Magento. Fortunately, there are few limitations to Magento; however, we are consistently amazed at the various ways retailers price and vend their products. Hopefully, whatever unique selling programs you currently employ can be replicated online with your Magento store. We're betting they can.

The sales process

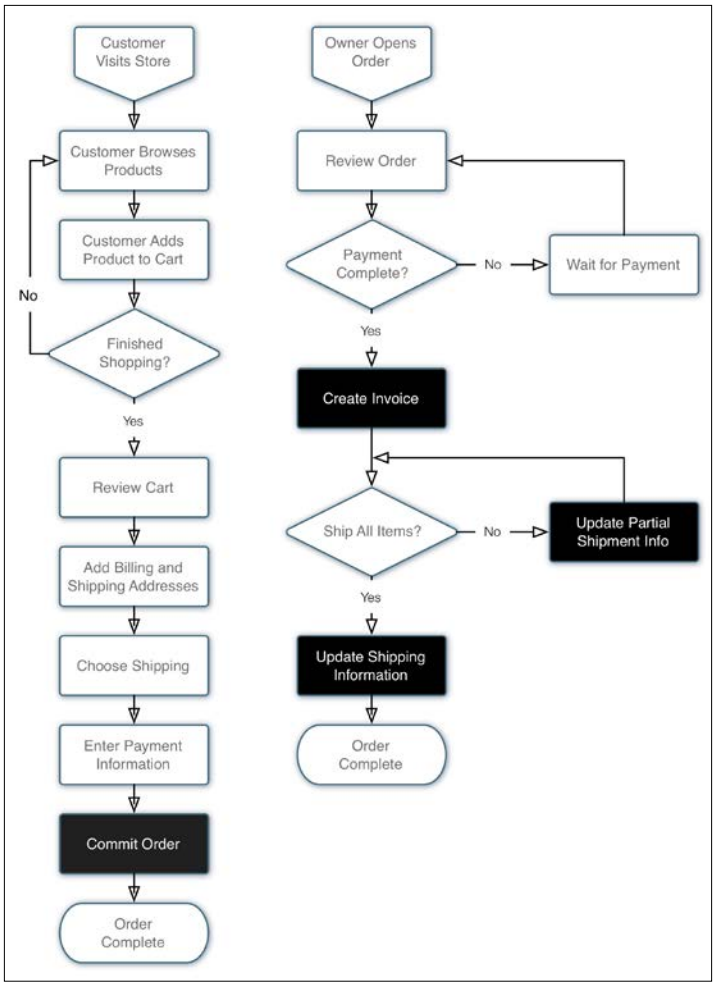
If you've shopped online before, you no doubt have some understanding of the usual online sales process:

1. You browse and find a product you want to purchase.
2. You "add" the product to your virtual shopping cart.
3. When you're finished shopping, you go to a checkout page.
4. In most online stores, you will first enter your billing and shipping addresses.
5. From this information, various shipping alternatives are presented, from which you choose the most appropriate for your needs and budget.
6. Next, you choose a payment method – usually a credit card – and enter your payment information.
7. After reviewing your order details, you commit to the purchase and moments later, you receive confirmation that your order has been processed. You usually receive an e-mail receipt of your purchase.
8. After a day or so, you receive another e-mail announcing that your order has been shipped. This e-mail may also include package tracking numbers so you can follow the progress of your package from distribution to doorstep.

The Magento sales process

Magento duplicates this sales process in pretty much the same way. For our purposes, though, we need to understand what happens after the customer commits to the order, for that is when the store administrator's participation is required.

The following chart illustrates both the frontend and backend steps of the Magento sales process:



The black boxes with white type are steps that generally create an e-mail to the customer.

As we'll see in this chapter, there are occasional variations to this process, but in general, the Magento sales process is pretty straightforward. What you'll find impressive is the scope of Magento's ability to give you a wider latitude on adjusting the sales process to meet your particular needs. For instance, if you're selling downloadable products, such as e-books, music or software, you don't need the shipping process steps. Yet, if you sell proprietary digital media, you will need to manage the distribution of the products to your customers. For instance, to prevent unlimited downloads.

Managing backend orders

Before mapping out the business rules that you will use to configure Magento, it's helpful to see and understand how orders are processed in the Magento backend. Many times, developers and administrators new to Magento rush to configure the myriad of settings (which we will be covering in this chapter) without fully realizing how those choices might impact on the overall sales process. It's understandable because most will want to test the ordering system with all the settings in place. It's a bit of a catch-22: you have no orders to use to understand the configurations, yet without the configurations, you can't test the ordering process.

Fortunately, a basic Magento 2 install with the sample data (again with the sample data? Yes!) gives you the basic configurations to allow you to place some sample orders and review the order process.



Give it a whirl!

If you've installed the sample data, or you have a store already configured to accept some type of test payments, you should spend time placing and processing orders. Try any number of different combinations. Ask your colleagues to place dummy orders, imagining that they are actual shoppers. You'll soon get a real handle on the process, and if you're a developer, your client will certainly appreciate the added insight you have to the Magento ordering process. This is incredibly important to your client, so it should be important to you!

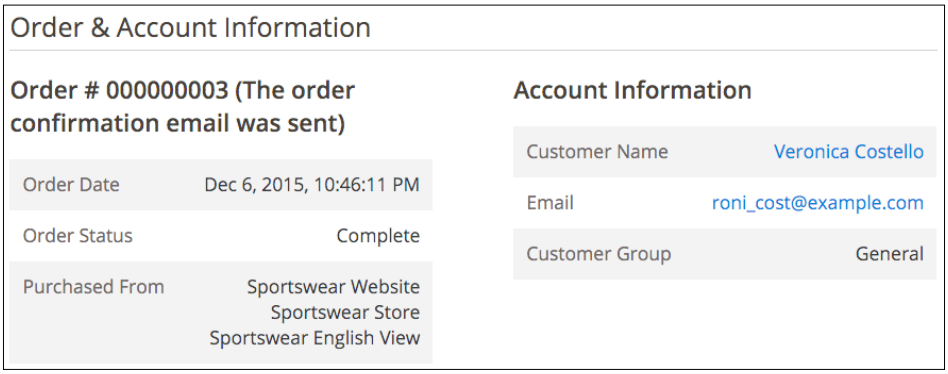
Logging into the Magento backend, we can see our latest orders listed in the left sidebar of the dashboard:

Last Orders

Customer	Items	Total
Veronica Costello	1	$53.71
Veronica Costello	1	$37.00
Veronica Costello	1	$34.00

From here we can click on the **order** we wish to process, or we can go to **Sales** | **Orders** in the top navigation bar and then select the **order** from the list of all orders. Either way, we end up with a detailed view of the **order**.

Let's take each section of this screen separately and explain what each contributes to the ordering process.



The first section, shown in the preceding image on the left, summarizes key order information, including the timestamp of the order (date and time), the current status (which by default is pending), and from which Magento store the purchase was made.

New orders, by default, are marked as **pending**. This means the **order** is awaiting your attention. The customer has already been charged and has received an e-mail confirmation of their order, but it's now up to you to complete the **order**, eventually taking it to a stage of complete.

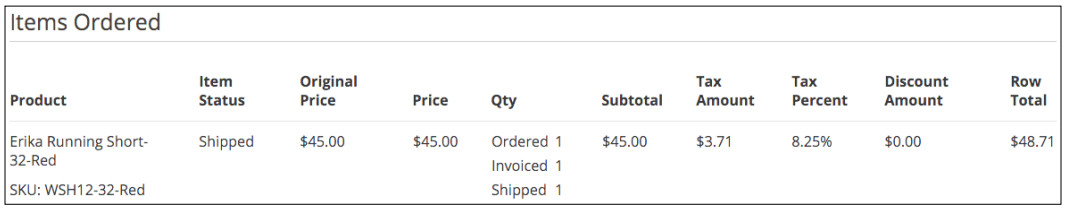
The box on the right tells us the name of the customer, their e-mail address, and the fact that they checked out without registering (more on customer groups later in this chapter).



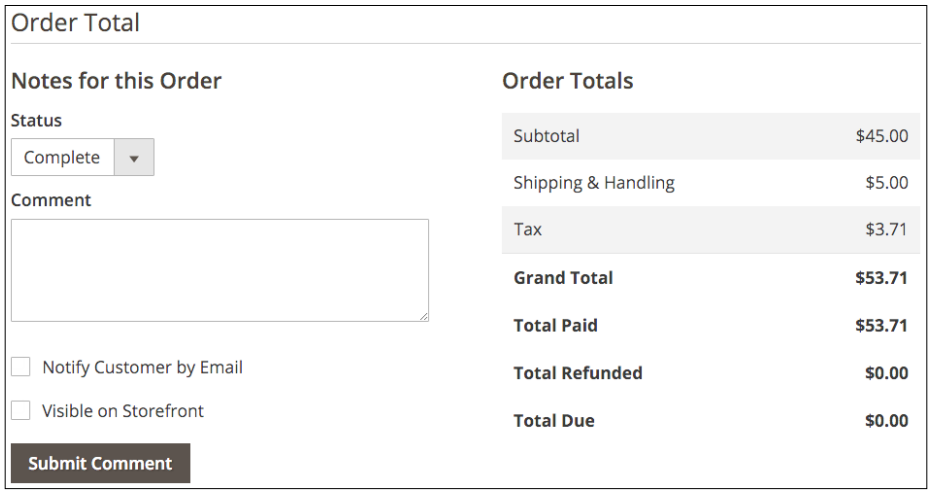
The next row of boxes shows the billing and shipping addresses for the purchaser. Notice that these are *editable*. Sometimes a customer, upon receiving their e-mail receipt, will see that they made an error in either or both of these. If the customer contacts you with corrected information, you can easily make the changes here.



The third row of boxes give you information about the payment method and the buyer's choice of shipping for the order.



On row four, you'll find the list of products ordered by the customer, the amount charged and the amount of sales tax applicable for each line item.



The final row of boxes are quite interesting and important. First, on the left in the preceding image, is how you can keep notes on an order and update the customer. Let's say, as in this case, that you have discovered that you only have one remaining chair and that more chairs won't arrive for another two weeks. By filling in this information here, and checking the **Notify Customer by Email** box, you can update the customer ("**Would you like us to hold your order, or cancel it?**") and have the update sent automatically to the buyer. Furthermore, by checking the **Visible on Storefront** box, the customer – if they are registered – can view the update in the **Account Information** section of your store.

All comments entered will be appended to the list at the bottom of the box.

The box to the right is the transaction summary of the order.

Convert orders to invoices

The next step for you, as the person who is processing orders, is to invoice this order. In Magento, this means that you are confirming the **order**, and proceeding with processing.



You can go straight to shipping for an order without having to generate an invoice. However, it is good practice to go from **Order** to **Invoice** to **Shipping**. In this manner, you are tracking not only the products, but the payments, as well.

To convert an **order** into an invoice, click the button at the top of the page labeled **Invoice**. The resulting page is similar to the order page, except that it allows you to perform certain additional functions:

- **Create Shipment**: In the box titled **Shipping Information**, you can check the box labeled **Create Shipment** and add any tracking numbers to the invoice.
- **Change the Quantity of Products to Invoice**: As in our first example, if you have less products in stock than actually on hand, you may want to alter the number of products you are invoicing. Any remaining products will cause the order to remain open for future invoicing.
- **Add Comments**: As on the **Order** page, you can add a comment to the invoice and select whether the comment should be appended to the **Invoice**. Otherwise, the comment will be added to the order history.

Once you have made any of the preceding changes, you can click on **Submit Invoice**, which will convert the **order** to an invoice, and record the **order** as an actual **sale**. This is key, as your analysis of sales for your store rely on the analysis of invoices, not orders. If you have not shipped the items yet, the status of the order is now shown as **Processing**.



Orders are not **Sales**. **Invoices** are **Sales**.

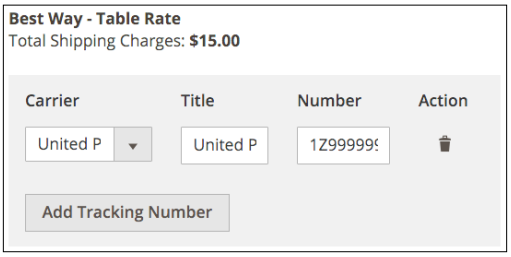
Now that we have converted an **order** into an **invoice**, the box on the **Dashboard** screen, titled **Lifetime Sales**, is now updated showing the total sales for the chosen period, less shipping and sales taxes, as shown in the following screenshot.



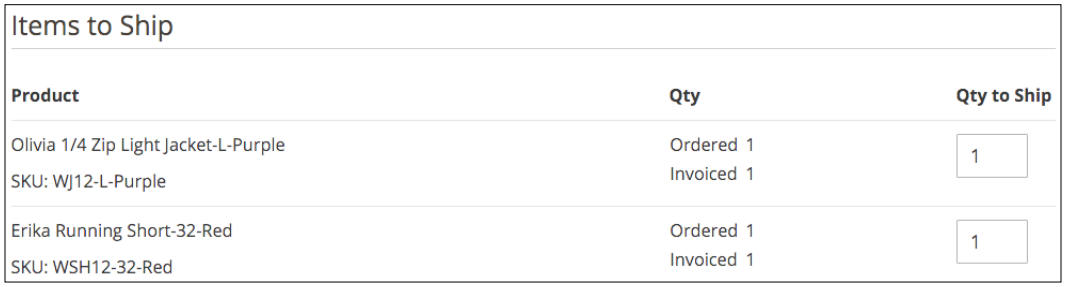
Creating shipments

Now that we have created our **invoice**, and once we have shipped the purchased products, we can create one or more **shipments**. To do this, open the **order** as before and click the **Ship** button near the top of the screen.

On this screen, you can add tracking numbers for your shipments, as well as indicate the quantity of each product shipped. In the following image, I have added a sample UPS tracking number. You can add as many as required (you may need to ship an order in more than one box, for instance).



Lower on the page, you will find each line item of the **order**, with a field allowing you to change the number of products shipped, as shown in the following screenshot:



Once you have made any changes, including adding any comments, you can click **Submit Shipment**. If you ship all ordered items, the status of the **order** will change to **Complete**; otherwise, the **order** will remain **Processing**.

Once you become familiar with the sales process, you'll have a much better understanding of how various system configurations affect how orders are moved through Magento.

Payment methods

In today's online retailing world, most purchasers use credit cards (or debit cards) as payment currency. Nothing new there. However, the process of taking someone's credit card online, verifying the card for available purchasing limit, and drawing the amount of the purchase from the buyer's account and into your bank account is one that remains a mystery to many. Of all the components that comprise online commerce, the process of moving money – in this case from the credit card account of the buyer to your bank account – remains one of the most complex of them all.

Without the ease of credit cards, online e-commerce might well be growing at a much slower pace. However, the use of credit cards – and the potential for misuse – concerns your shoppers, particularly when the press relates stories of hackers breaking into retailer databases. What is important is that online purchases have never been "hacked." That is, no one has been prosecuted for stealing credit card information used to buy online as long as the store is using SSL encryption. To ease consumers' fears, several payment systems have evolved over the past decade, each designed to help you process the financial transactions for your store, while providing the increased security and processes necessary to give both you and your buyer a safer, easier transaction process.

As a Magento administrator, you have within Magento, several default payment systems available based on your own needs. Each one requires that the store owner enrolls and qualifies, but, having done so, allows the store to provide buyers with a convenient, secure means of paying for their purchase.

In this section, we will cover the most common, popular payment systems and how they work with Magento. This is intended to familiarize you with how each system interacts with Magento, the buyer, and the store owner. Once you understand how they work, you will be able to decide on which system(s) you want to employ, which also makes configuring Magento easier.

PCI compliance

The protection of your customer's payment information is extremely important. Not only would a breach of security cause damage to your customer's credit and financial accounts, but the publicity of such a breach could be devastating to your business.

Merchant account providers will require that your store meet stringent guidelines for PCI compliance, a set of security requirements called **Payment Card Industry Data Security Standard** (**PCI DSS**). Your ability to be PCI compliant is based on the integrity of your hosting environment and by which methods you allow customers to enter credit card information on your site.

Magento 2 no longer offers a "stored credit card" payment method. It is highly unlikely that you could — or would want to — provide a server configuration secure enough to meet PCI DSS requirements for storing credit card information. You probably don't want the liability exposure, either.

You can, however, provide SSL encryption that could satisfy PCI compliance as long as the credit card information is encrypted before being sent to your server, and then from your server to the credit card processor. As long as you're not storing the customer's credit card information on your server, you can meet PCI compliance as long as your hosting provider can assure compliance for server and database security.



Even with SSL encryption, not all hosting environments will pass PCI DSS standards. It's vital that you work with a hosting company that has real Magento experience and can document proof of PCI compliance.

Therefore, you should decide whether to provide onsite or offsite credit card payments. In other words, do you want to take payment information within your Magento checkout page or redirect the user to a payment service, such as PayPal, to complete their transaction?

There are pros and cons of each method. Onsite transactions may be perceived as less secure and you do have to prove PCI compliance to your merchant account provider on an ongoing basis. However, onsite transactions mean that the customer can complete their transaction without leaving your website. This helps to preserve your brand experience for your customers.

Fortunately, Magento is versatile enough to allow you to provide both options to your customers. Personally, we feel that offering multiple payment methods means you're more likely to complete a sale, while also showing your customers that you want to provide the most convenience in purchasing.

Let's now review the various payment methods offered by default in Magento 2.



Magento 2 comes with a host of the most popular and common payment methods. However, you should review other possibilities, such as **Amazon Payments**, **Stripe,** and **Moneybookers**, depending on your target market. We anticipate that developers will be offering add-ons for these and other payment methods.



Note that as you change the **Merchant Location** at the top of the **Payment Methods** panel, the payment methods available to you may change.

Classes of payment systems

The determination of which payment system to utilize in your Magento store is driven by a comparison of pros and cons (isn't everything in life?). In terms of credit card sales, there are two basic classifications of payment systems: **off-site** and **on-site**.

Off-site payment systems

Off-site systems allow buyers to make purchase choices, but pay for their order on another website which offers the buyer a sense of greater security and fraud protection. The buyer is actually paying the off-site payment provider, who in turn pays the store owner once there is sufficient verification that the order has been processed and shipped. Each system has different degrees of verification based on the type of products sold, the history of the merchant (for example, has there been previous problems with the merchant's reliability?), and the amount of the purchase.

Pros

The pros of this type of payment method are as follows:

- Provides extra layer of protection to buyers against unscrupulous merchants.
- Quick merchant approval. No credit report is required.
- No PCI compliance requirements.
- Easy integration into almost any e-commerce platform.

Many buyers prefer these systems because of the added layer of protection against merchants who fail to deliver the expected results.

Additionally, the off-site system qualifies the merchant as opposed to a merchant account provider or bank. For first-time e-commerce merchants, this qualification is usually easier to obtain, as no credit report is required.

Cons

The cons of this type of payment method are as follows:

- Takes buyers off your e-commerce site
- May require the buyer to enroll in a third-party payment system
- Merchant has limited access to buyer information, including e-mail addresses

The dominant off-site systems are **PayPal Express**, **PayPal Standard,** and **Authorize.net Direct Post**.

On-site payment systems

Almost any well-developed e-commerce store will allow buyers to pay directly on the site without having to go off-site to another payment system. While most will also provide off-site payment alternatives, by providing an on-site payment process, the merchant eliminates any reluctance the buyer may have to enroll in a third-party payment system.

Pros

The pros of this type of payment method are as follows:

- Keeps the buyer on the site, surrounded by the merchant's branding design
- Eliminates the need for the buyer to register or enroll with an outside payment system
- Gives the merchant access to all buyer information for follow-up, processing, and future marketing

In order to succeed with on-site payment systems, merchants need to consider design elements and payment system brands that will help buyers have confidence in the security of the payment process. Most buyers have no history with new merchants; therefore, merchants, if they wish to offer on-site payments, should pay special attention to methods of communicating the security of the buyer's information.

Cons

The cons of this type of payment method are as follows:

- Requires a merchant banking account, which can be difficult to obtain for new businesses
- Site may be subject to PCI compliance
- Integration with e-commerce platforms is more complex

Off-site payments are processed through gateways. Gateways accept the customer payment information, as well as the order total, by means of a secure connection between your store server and the gateway's servers. The gateway validates the buyer's information and returns a result of success or error, which your store platform processes accordingly.

PayPal

Today, PayPal remains one of the most popular payment systems in the world because it does allow for global purchases. You can sell to buyers in other countries, as long as they have a PayPal account, knowing that you will receive payment. Most regular merchant accounts, such as those used by bricks and mortar retailers, restrict sales to only buyers with cards issued by US banks.

In the past, the downside to using PayPal was that buyers would have to sign up for PayPal if you, the merchant, offered it as a payment system. That changed some years ago: today your buyers don't have to sign up for PayPal. They can purchase using a credit card without enrolling.

PayPal all-in-one payment solutions

While PayPal is commonly known for their quick and easy PayPal Express, PayPal can provide you with credit and debit card solutions that allow customers to use their cards without needing a PayPal account. To the customer, the Magento checkout appears no different than if they were using a normal credit card checkout process.

The big difference is that you have to set up a business account with PayPal before you can begin accepting non-PayPal account payments. Proceeds will go almost immediately into your PayPal account (you have to have a PayPal account), but your customers can pay by using a credit/debit card or their own PayPal account.

With the all-in-one solution, PayPal approves your application for a merchant account and allows you to accept all popular cards, including American Express, at a flat 2.9% rate, plus $0.30/transaction. PayPal payments incur normal per transaction PayPal charges.

PayPal provide two ways to incorporate credit card payment capture on your website:

- **PayPal Payments Advanced** inserts a form on your site that is actually hosted from PayPal's highly secure servers. The form appears as part of your store, but you don't have any PCI compliance concerns.
- **PayPal Payments Pro** allows you to obtain payment information using the normal Magento form, then submits it to PayPal for approval.

The difference to your customer is that for Advanced, there is a slight delay while the credit card form is inserted into the checkout page. You may also have some limitations in terms of styling.

PayPal Standard, also a part of the all-in-one solution, takes your customer to a PayPal site for payment. Unlike PayPal Express, however, you can style this page to better reflect your brand image. Plus, customers do not have to have a PayPal account in order to use this checkout method.

PayPal payment gateways

If you already have a merchant account for collecting online payments, you can still utilize the integration of PayPal and Magento by setting up a PayPal business account that is linked to your merchant account. Instead of paying PayPal a percentage of each transaction — you would pay this to your merchant account provider — you simply pay a small per transaction fee.

PayPal Express

Offering PayPal Express is as easy as having a PayPal account. It does require some configurations of API credentials, but it does provide the simplest means of offering payment services without setting up a merchant account.

PayPal Express will add **Buy Now** buttons to your product pages and the cart page of your store, giving shoppers quick and immediate ability to checkout using their PayPal account.

Braintree

PayPal recently acquired Braintree, a payment services company that adds additional services to merchants. While many of their offerings appear to overlap PayPal's, Braintree brings additional features to the marketplace such as **Bitcoin**, **Venmo**, **Android Pay,** and **Apple Pay** payment methods, **recurring billing,** and **fraud protection**. Like PayPal Payments, Braintree charges 2.9% + $0.30/transaction.

Check/money order

If you have customers for whom you will accept payment by check and/or money order, you can enable this payment method. Be sure to enter all the information fields, especially **Make Check Payable to** and **Send Check to**. You will most likely want to keep the **New Order Status** as **Pending**, which means the order is not ready for fulfillment until you receive payment and update the order as **Paid**.

As with any payment method, be sure to edit the **Title** of the method to reflect how you wish to communicate it to your customers. If you only wish to accept money orders, for instance, you might change **Title** to **Money Orders (sorry, no checks)**.

Bank transfer payment

As with check/money order, you can allow customers to wire money to your account by providing information to your customers who choose this method.

Cash on delivery payment

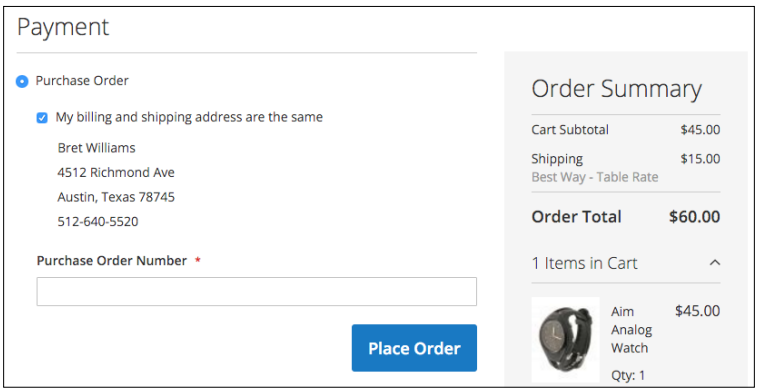
Likewise, you can offer COD payments. We still see this method being made available on wholesale shipments, but very rarely on B2C (business-to-consumer) sales. COD shipments usually cost more, so you will need to accommodate this added fee in your pricing or shipping methods. At present, there is no ability to add a COD fee using this payment method panel.

Zero subtotal checkout

If your customer, by use of discounts or credits, or selecting free items, owes nothing at the checkout, enabling this method will cause Magento to hide payment methods during checkout. The content in the **Title** field will be displayed in these cases.

Purchase order

In B2B (business-to-business) sales, it's quite common to accept **purchase orders** (**PO's**) for customers with approved credit. If you enable this payment method, an additional field is presented to customers for entering their PO number when ordering.



Authorize.net direct post

Authorize.net — perhaps the largest payment gateway provider in the USA — provides an integrated payment capture mechanism that gives your customers the convenience of entering credit/debit card information on your site, but the actual form submission bypasses your server and goes directly to Authorize.net. This mechanism, as with PayPal Payments Advanced, lessens your responsibility for PCI compliance as the data is communicated directly between your customer and Authorize.net instead of passing through the Magento programming.

Shipping methods

Once you get paid for a sale, you need to fulfill the order and that means you have to ship the items purchased. How you ship products is largely a function of what shipping methods you make available to your customers.

Shipping is one of the most complex aspects of e-commerce, and one where you can lose money if you're not careful. As you work through your shipping configurations, it's important to keep in mind the following:

- What you charge your customers for shipping does not have to be exactly what you're charged by your carriers. Just as you can offer free shipping, you can also charge flat rates based on weight or quantity, or add a surcharge to "live" rates.

- By default, Magento does not provide you with highly sophisticated shipping rate calculations, especially when it comes to "dimensional" shipping. Consider shipping rate calculations as *estimates* only. Consult with whomever is actually doing your shipping to determine if any rate adjustments should be made to accommodate dimensional shipping.



Dimensional shipping refers to a recent change by UPS, FedEx, and others to charge you the greater of two rates: the cost based on weight or the cost based on a formula to determine the equivalent weight of a package based on its size: (Length x Width x Height) ÷ 166 (for US domestic shipments; other factors apply for other countries and exports). Therefore, if you have a large package that doesn't weigh much, the live rate quoted in Magento might not be reflective of your actual cost once the dimensional weight is calculated. If your packages may be large and lightweight, consult your carrier representative or shipping fulfillment partner for guidance.

- If your shipping calculations need more sophistication than provided natively in Magento 2, consider an add-on. However, remember that what you charge to your customers does *not* have to be what you pay. For that reason — and to keep it simple for your customers — consider offering table rates (as described later).



WebShopApps (`http://webshopapps.com`) is perhaps the pre-eminent Magento shipping add-on provider. More recently, they have created a hosted shipping configuration system called ShipperHQ (`https://shipperhq.com`), which we have used to configure some rather complex shipping rules. If your shipping rules are more than Magento can natively accommodate, you may want to check these out.

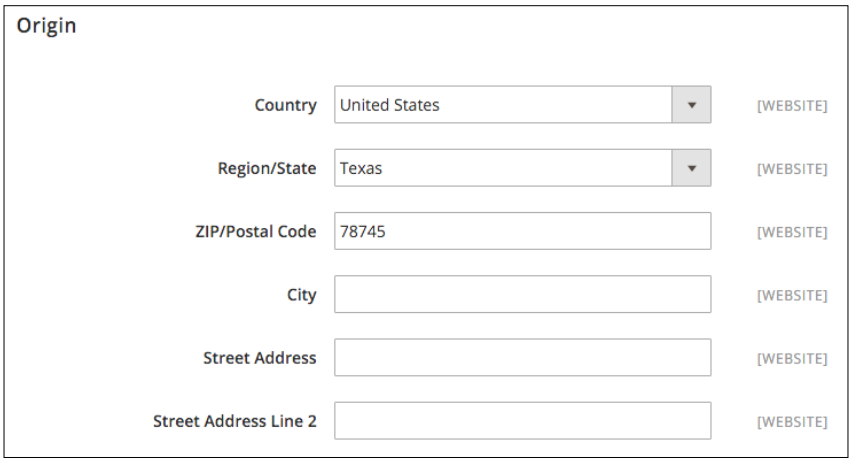
- Each method you choose will be displayed to your customers if their cart and shipping destination matches the conditions of the method. Take care not to confuse your customers with too many choices: simpler is better.

Keeping these insights in mind, let's explore the various shipping methods available by default in Magento 2.

Before we go over the shipping methods, let's go over some basic concepts that will apply to most, if not all, shipping methods.

Origin

Where you ship your products from will determine shipping rates, especially for carrier rates (for example, UPS, FedEx). To set your origin, go to **Stores** | **Configuration** | **Sales** | **Shipping Settings** and expand the **Origin** panel. At the very least, enter the **Country**, **Region/State** and **ZIP/Postal Code** field. The others are optional for rate calculation purposes.



At the bottom of this panel is the choice to **Apply Custom Shipping Policy**. If enabled, a field will appear where you can enter text about your overall shipping policy. For instance, you may want to enter **Orders placed by 12:00 PM CT will be processed for shipping on the same day. Applies only to orders placed Monday-Friday, excluding shipping holidays.**

Handling fee

You can add an *invisible* handling fee to all shipping rate calculations. Invisible in that it does not appear as a separate line item charge to your customers. To add a handling fee to a shipping method:

- Choose whether you wish to add a fixed amount or a percentage of the shipping cost
- If you choose to add a percentage, enter the amount as a decimal number instead of a percentage (for example, 0.06 instead of 6%)

Allowed countries

As you configure your shipping methods, don't forget to designate to which countries you will ship. If you only ship to the US and Canada, for instance, be sure to have only those countries selected. Otherwise, you'll have customers from other countries placing orders you will have to cancel and refund.

Method not available

In some cases, the method you configured may not be applicable to a customer based on destination, type of product, weight, or any number of factors. For these instances, you can choose to:

- Show the method (for example, UPS, USPS, DHL, and so on), but with an error message that the method is not applicable
- Don't show the method at all



Depending on your shipping destinations and target customers, you may want to show an error message just so the customer knows why no shipping solution is being displayed. If you don't show any error message and the customer disqualifies for any shipping method, the customer will be confused.

Free shipping

There are several ways to offer free shipping to your customers. If you want to display a **Free Shipping** option to all customers whose carts meet a minimum order amount (not including taxes or shipping), enable this panel.

However, you may want to be more judicious in how and when you offer free shipping. Other alternatives include:

- Creating shopping cart promotions (see *Chapter 6*, *Marketing Tools*)
- Include a free shipping method in your table rates (see later in this section)
- Designate a specific free shipping method and minimum qualifying amount within a carrier configuration (such as UPS and FedEx).

If you choose to use this panel, note that it will apply to all orders. Therefore, if you want to be more selective, consider one of the above methods.

Flat rate

As with free shipping, above, the **Flat Rate** panel allows you to charge one, singular flat rate for all orders regardless of weight or destination. You can apply the rate on a per item or per order basis, as well.

Table rates

While using live carrier rates can provide more accurate shipping quotes for your customers, you may find it more convenient to offer a series of rates for your customers at certain break points.

For example, you might only need something as simple as follows, for any domestic destination:

- 0-5 lbs, $5.99
- 6-10 lbs, $8.99
- 11+ lbs, $10.99

Let's assume you're a US-based shipper. While these rates will work for you when shipping to any of the contiguous 48 states, you need to charge more for shipments to Alaska and Hawaii. For our example, let's assume tiered pricing of $7.99, $11.99, and $14.99 at the same weight breaks.

All of these conditions can be handled using the table rates shipping method. Based on our example, we would first start by creating a spreadsheet (in Excel or Numbers) similar to the following:

Country	Region/State	Zip/Postal code	Weight (and above)	Shipping price
USA	*	*	0	5.99
USA	*	*	6	8.99
USA	*	*	11	10.99
USA	AK	*	0	7.99
USA	AK	*	6	11.99
USA	AK	*	11	14.99
USA	HI	*	0	7.99
USA	HI	*	6	11.99
USA	HI	*	11	14.99

Let's review the columns in this chart:

- **Country**: Here, you would enter the three-character country code (for a list of valid codes, see `http://goo.gl/6A1woj`).
- **Region/State**: Enter the two-character code for any state or province.
- **Zip/Postal code**: Enter any specific postal codes for which you wish the rate to apply.
- **Weight (and above)**: Enter the minimum applicable weight for the range. The assigned rate will apply until the weight of the cart products combined equals a higher weight tier.
- **Shipping price**: Enter the shipping charge you wish to provide to the customer. Do not include the currency prefix (for example, "$" or "€").

Now, let's discuss the asterisk (*) and how to limit the scope of your rates. As you can see in the chart, we have only indicated rates for US destinations. That's because there are no rows for any other countries. We could easily add rates for *all other countries*, simply by adding rows with an asterisk in the first column. By adding those rows, we're telling Magento to use the US rates if the customer's ship-to address is in the US, and to use other rates for all other country destinations.

Likewise for the **Region/State** column, Magento will first look for matches for any state codes listed. If it can't find any, then it will look for any rates with an asterisk. If no asterisk is present for a qualifying weight, then no applicable rate will be provided to the customer.

The asterisk in the **Zip/Postal code** column means that the rates apply to all postal codes for all states.



To get a sample file with which to configure your rates, you can set your configuration scope to one of your websites (furniture or sportswear in our examples) and click **Export CSV** in the **Table Rates** panel.

Quantity- and price-based rates

In the above example, we used the weight of the items in the cart to determine shipping rates. You can also configure table rates to use calculations based on the number of items in the cart or the total price of all items (less taxes and shipping).

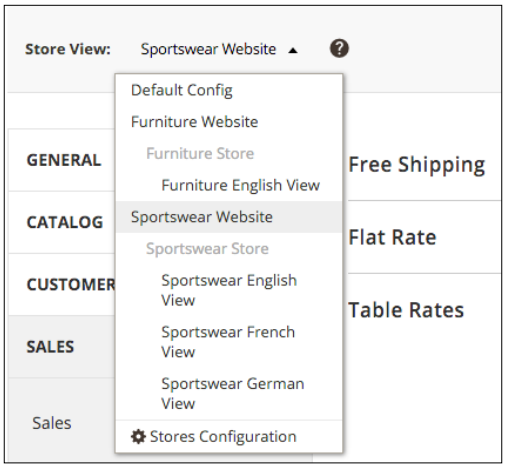
To set up your chart, simply rename the fourth column **Quantity (and above)** or **Subtotal (and above)**.

Save your rate table

To upload your table rates, you'll need to save/export your spreadsheet as a CSV file. You can name it whatever you like. Save it to your computer where you can find it for the next steps.

Table rate settings

Before you upload your new rates, you should first set your table rates configurations. To do so, you can set your default settings at the default configuration scope. However, to upload your CSV file, you will need to switch your store view to the appropriate website scope.



When changing to a website scope, you will see the **Export CSV** button and the ability to upload your rate table file. You'll note that all other settings may have **Use Default** checked. You can, of course, uncheck this box beside any field and adjust the settings according to your preferences.

Let's review the unique fields in this panel:

- **Enabled**: Set to **Yes** to enable table rates
- **Title**: Enter the name you wish displayed to customers when they're presented with a table rate-based shipping charge in the checkout process
- **Method Name**: This name is presented to the customer in the shopping cart



You should probably change the default Table Rate to something more descriptive, as this term is likely irrelevant to customers. We have used terms Standard Ground, Economy, or Saver as names. The **Title** should probably be the same, as well, so that the customer, during checkout, has a visual confirmation of their shipping choice.

- **Condition**: This allows you to choose the calculation method you want to use. Your choices, as we described earlier, are Weight vs. Destination, Price vs. Destination, and # of items vs. Destination.
- **Include Virtual Products in Price Calculation**: Since virtual products (see *Chapter 2*, *Managing Products*) have no weight, this will have no effect on rate calculations for weight-based rates. However, it will affect rate calculations for price or quantity-based rates.

Once you have your settings, click on **Save Config**.

Upload rate table

Once you have saved your settings, you can now click the button next to **Import** and upload your rate table. Be sure to test your rates to see that you have properly constructed your rate table.

Carrier methods

The remaining shipping methods involve configuring UPS, USPS, FedEx, and/or DHL to provide "live" rate calculations. UPS is the only one that is set to query for live rates *without* the need for you to have an account with the carrier. This is both good and bad. It's good, as you only have to enable the shipping method to have it begin querying rates for your customers. On the flip side, the rates that are returned are not negotiated rates. Negotiated rates are those you may have been offered as discounted rates based on your shipping volume.

FedEx, USPS, and DHL require account-specific information in order to activate. This connection with your account should provide rates based on any discounts you have established with your carrier. If you wish to use negotiated rates for UPS, you may have to find a Magento add-on that will provide a modified rate query.

Managing taxes

The great unavoidable factor: taxes. If you're a retailer — and even as a wholesaler in some jurisdictions — you will need to master the management of tax rates and rules in your Magento store. We've had to deal with this issue on many other platforms, and while some do provide some cool features, none, in our opinion, offer as much flexibility for taxes as Magento; especially when it comes to VAT taxes.

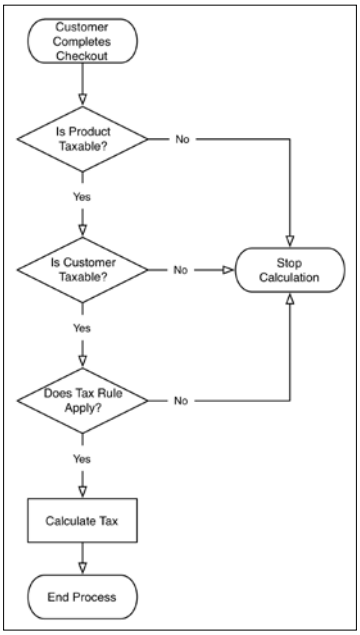


You'll appreciate as you go through this section, that taxes can be quite complicated. Before configuring taxes in your online store, you should consult your tax professional. Making errors in taxes can not only present legal issues for your business, but also erode consumer confidence if the customers feel they're being inappropriately taxed on purchases.

How Magento manages taxes

Taxes are applied to products based on assigned **tax classes**. Tax classes are combined with **tax zones and rates** to create **tax rules**. Tax rules are what are applied to each product or shopping cart to determine the amount of tax charged in a transaction.

Here's a flow chart on how Magento calculates sales taxes based on a tax rule:



There are two types of tax classes in Magento:

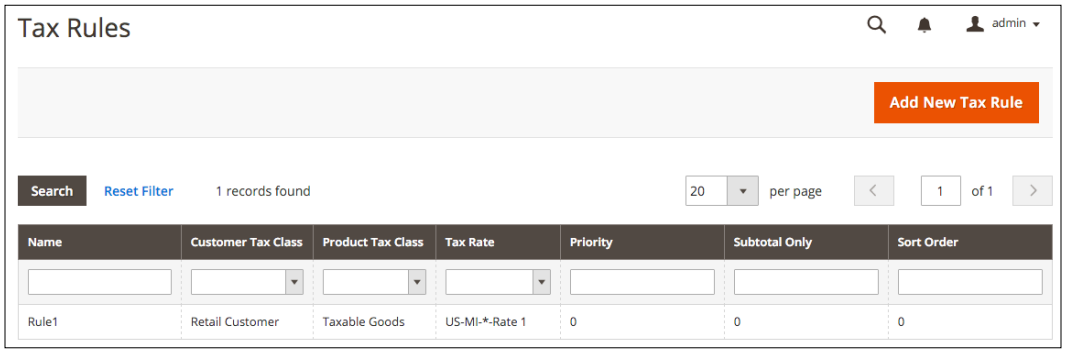
- **Product tax class**: A product is usually considered taxable or non-taxable. If a product is not to be taxed, a value of None is selected for its tax class. You may find it necessary to have different product tax classes if you have different taxing rules for different products.
- **Customer tax class**: As we saw in creating customer groups, customers are assigned to a tax class, usually based on whether they are retail or wholesale customers.

Creating tax rules

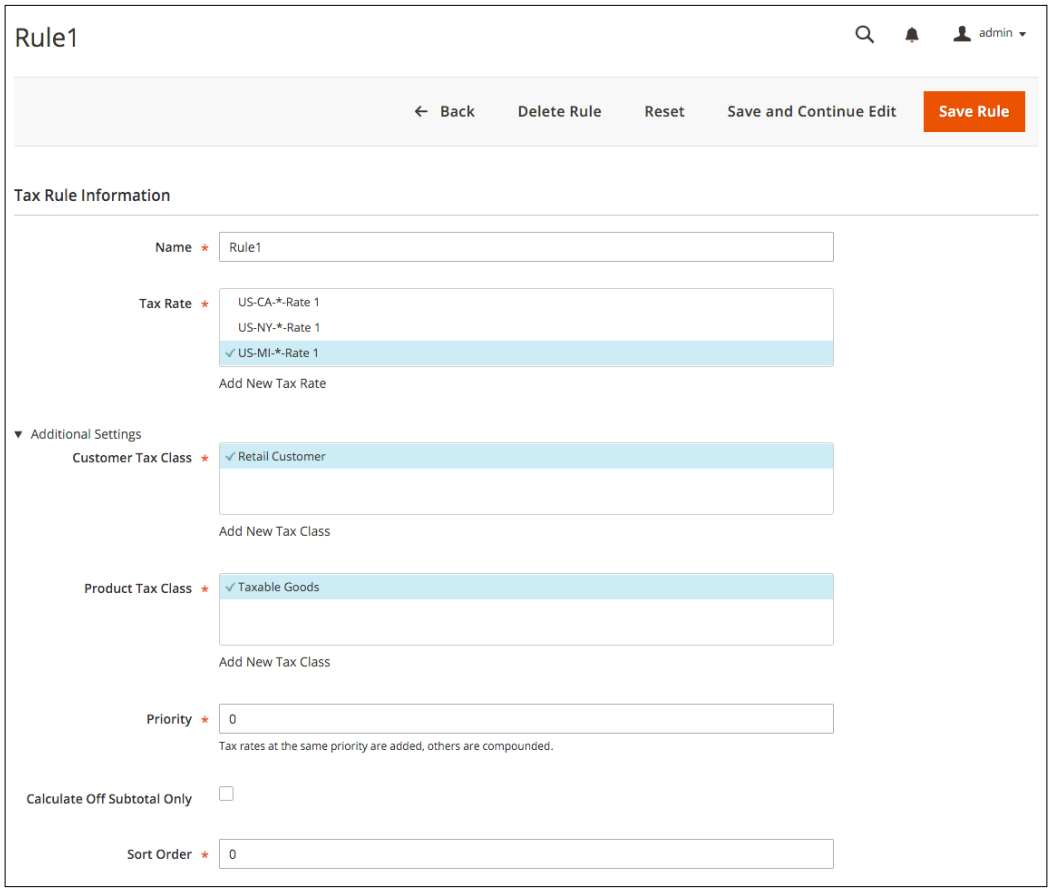
Tax rules are created based on jurisdiction and rate: creating a zone for a country, state, and/or zip code, and a percentage used to calculate the tax.

To illustrate, let's review a tax rule included in the default installation for Magento 2:

1. Go to **Stores** | **Tax Rules** in your Magento backend.
2. Click on **Rule 1** listed in the tax rules table.



Let's now take a look at the layout of a tax rule:



- **Name**: While Rule 1 is fine, it's not really descriptive, particularly in a list of rules. You can name the rule whatever you feel works best for you.

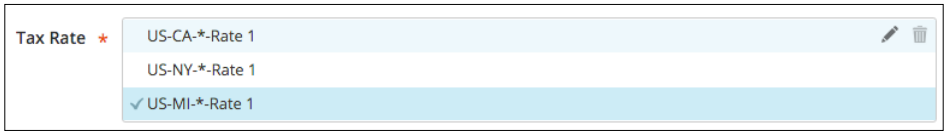
- **Tax Rate**: This field allows you to select one or more rates you want to apply to the rule. You might have to apply several tax rates if you have multiple distribution locations or nexuses. The rate is determined by the location of the buyer, usually their *Ship To* address.



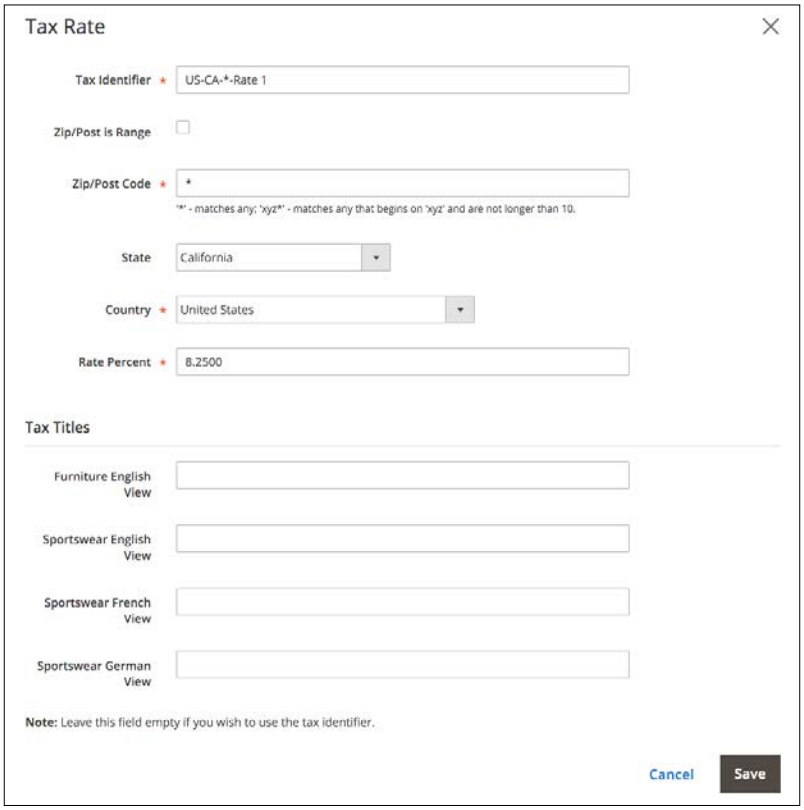
A **nexus** is generally considered if you have an active business in a particular state or locality. For instance, if your office is in Texas and you ship your products from a warehouse in Illinois, then, for taxing purposes, you're considered to have a nexus in Texas and Illinois. Therefore, as it stands at this moment, you are required to collect sales tax on any sales to buyers in Texas and Illinois. However, there are efforts in the United States Congress to radically change taxing laws on online sales transactions. Some state legislatures are also grappling with this issue. We know you're used to hearing this, but you do need to consult a tax professional to make sure you're correctly charging sales tax.

A leader in e-commerce sale tax is TaxJar (`https://www.taxjar.com`), a company that can provide integration with your store to precisely calculate required sales taxes and help with reporting to the various taxing jurisdictions. Using a tool such as TaxJar could greatly reduce your tax configuration time, while providing greater sales tax accuracy.

You can add or edit tax rates here or under **Stores** | **Tax Zones and Rates**. Let's edit the California tax rate here to understand the process:

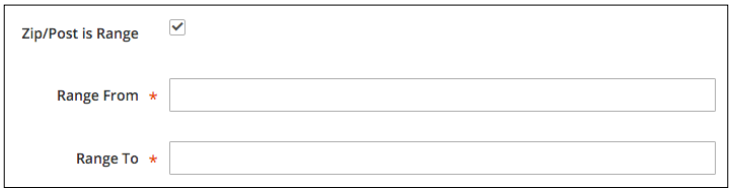


To the right of the **US-CA-*-Rate 1** item name, when you hover your mouse over the item, you will see a pencil icon. Click this to reveal the tax rate modal dialogue.



Let's have a look at the various fields here:

- **Tax Identifier**: You can enter whatever you wish in this space. The naming scheme shown was created by Magento in setting up this default rate.
- **Zip/Post is Range**: By checking this box, the **Zip/Post Code** field is replaced by range fields, into which you can enter a starting and ending code range. This is particularly useful if you need to apply a different rate to a range of zip codes within a larger region.



- **Zip/Post Code**: As indicated, an asterisk is considered a wild card. That is, any value will match. If you want to, for example, apply the rate to all zip codes beginning in 78 (for example, 78001, 78002, and so on), you could enter 78*.
- **State**: Select the state for which the rate applies. The selections will change based on your country selection. An asterisk in this selection will apply the rate to all states and regions within the country.
- **Country**: Select the country for which the rate applies.
- **Rate Percent**: Enter the rate to be applied as a percentage amount. In other words, if the rate is 8.25%, enter 8.25, not 0.0825.
- **Tax Titles**: As in so many places in Magento, you can specifically name this item as you would like it to appear in your various store views. You might, for instance, wish to call the rule CA Sales Tax for your English views, but CA La Taxe De Vente for your French store view. If you leave any of these blank, your customer will be shown the Tax Identifier value.

You can use the same field specifics for creating a new tax rate by clicking **Add New Tax Rate** at the bottom of the **Tax Rate list** field.

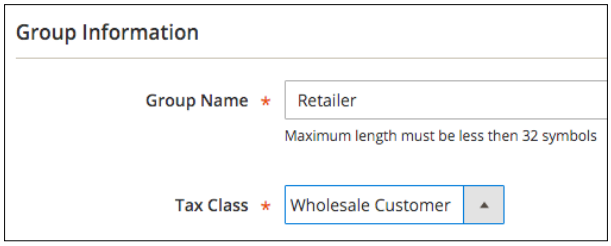
To view the remaining fields, expand the **Additional Settings** section.

- **Customer Tax Class**: As discussed earlier, **Customer Tax Classes** allow you to assign customer groups to different tax groups. For instance, you will probably have sales taxes only apply to retail customers.



Wholesale Customer Tax Class

In Magento 2, there is no one place to go to create **Customer Tax Classes**. Therefore, you should create a **Wholesale Customer** Tax class in any tax rule so that it will be available to you when managing customer groups.



- **Product Tax Class**: If you need additional **Product Tax Classes**, you can also add them here and they will be available for selection in product edit panels.

- **Priority**: If you have more than one tax rate that might apply to a customer's shopping cart, those with the same priority will be added. That is, each tax rule will be calculated separately, and then added together. If the priorities are different, then the rates will be compounded in order of priority. Let's take an example: you have two taxes that will apply to a product — a federal excise tax of 5% and a state sales tax of 8%. If the priorities for both are the same, the shopper's purchase of $100 will be taxed a total of $13: $5 for 5% and $8 for 8%. If you put a priority of 1 for the excise tax and a priority of 2, for instance, for the state sales tax, then the customer is taxed $13.40: $5 for the excise tax and $8.40 for the 8% of $105 ($100 plus the $5 excise tax). The latter is an example of compounded sales tax. Taxes with different priorities will also be listed as separate tax line items to your customers.
- **Calculated Off Subtotal Only**: Now, take what we just said about priority and consider this: if you want each applicable tax — such as GST and PST taxes in Canada — to display separately to the customer, each tax must have a different priority. However, you don't want these taxes compounding, as explained above. Therefore, to prevent compounding, yet have the tax shown as a separate line item, check this box and the tax will only be applied to the order subtotal, not as a compounded tax calculation.
- **Sort Order**: If you have more than one applied tax, you can control the order in which they are listed to your customers. This will not change any compounding based on priority.

Importing tax rates

While you can't import tax rules, you can import **tax rates**, which may be a time saver, particularly where you have multiple taxing jurisdictions to whom you have to report tax collections.

As with many importing capabilities in Magento 2, the easiest way to begin is by exporting the current tax rules and expanding on the CSV file, then importing your changes. To import tax rates, view any tax rule. At the bottom of the screen are buttons to import and export tax rates. Export the current tax rate file, add or edit your rates, then re-import.

Value added tax configurations

In some countries, goods and services are taxed in a means similar to sales tax, but calculated and managed differently. These **Value-Added Taxes** (**VAT**) are made even more complex due to varying rates among countries, different rules for registration, and rules for taxation based on the type of product or service sold.



As usual, we can't begin to counsel you on taxes. VAT rules can be complicated, especially for non-EU countries selling into EU countries. We highly suggest you consult with your tax professionals. If you doubt the complexity of EU VAT taxes, see `http://goo.gl/y07Pb`.

The VAT process in Magento involves three basic components — the needs of them are based on your location:

- **VAT validation**: For customers who provide a VAT ID, Magento 2 is able to query the European Commission to verify their VAT ID
- **VAT tax rules**: As with sales taxes, the creation of tax rules based on certain conditions or considerations
- **System configuration**: Activate the rules that will manage VAT-eligible purchases

In Magento, VAT is charged if both the seller and customer are located in the same EU country. If both are EU-registered businesses, no VAT tax is collected if the seller and customer are in different countries.

When selling to consumers in EU countries, the amount of VAT collected is based on what country the seller is located (if the seller is an EU country). These are called **intra-EU sales**.

One exception (there's always one, yes?) is that when selling digital goods (for example, music, software), the VAT rate to be charged is that of the destination country, not the source country.

The key to effectively managing this complexity is the creation of multiple customer groups that can be automatically assigned during the checkout or registration process based on the VAT ID validation of the buyer.

Setup VAT taxes

It would be so easy for us to stop here, call it a day, and leave VAT tax configuration to your imagination. After all, we can play the "too complex for a book" card, correct?

The truth is that VAT taxes can be quite complex. If you're an EU business or exporting to the EU countries, you already understand the complexities. However, we do want you to get the most from Magento 2 and demonstrate its incredible ability to fulfill your tax calculation needs.

To that end — and perhaps the best way to demonstrate the process — we're going to set up VAT taxes as if we were a business based in France (we love Paris!).

Since we're considered, in this example, as an EU member country, we will need to provide for VAT ID validation of our customers and classify them accordingly.

Earlier in this chapter, we added four additional customer groups, specifically for VAT tax use. If we look under **Stores | Customer Groups**, based on our example Magento install, we should see the following:

ID	Group ↓	Tax Class
5	Domestic	Retail Customer
1	General	Retail Customer
6	Intra-EU	Retail Customer
7	Invalid VAT ID	Retail Customer
0	NOT LOGGED IN	Retail Customer
4	Preferred Customers	Retail Customer
3	Retailer	Retail Customer
8	Validation Error	Retail Customer
2	Wholesale	Wholesale Customer

Next, we want to create the product classes that we will need for applying the appropriate French VAT tax rates. France groups products into four rate categories, each of which should have a different product class added for taxing purposes:



All tax rates and information shown here are for illustrative purposes only and should not be used without validation.

- **Standard VAT**: These will be taxed at 20%.
- **Reduced VAT 1**: Applies to books, transportation, entertainment events and hotels. Taxed at 10%.
- **Reduced VAT 2**: Applies to medical, food and book products. Taxed at 5.5%.
- **Reduced VAT 3**: Applies to newspaper and pharmaceuticals. Taxed at 2.1%.

We now have to consider that for customers living in other EU countries, we will charge our VAT tax rate on purchases of physical products, but charge the buyer's VAT tax rate for digital or virtual purchases.

That means that if we are selling digital products (for example, music, software, and so on) to other EU customers, we have to charge VAT tax at the rate in *their* country, not France. In order to do that, we have to add tax rates in Magento for every other EU country. As you can imagine, setting up all those tax rates and rules can be quite time consuming.

We have created a CSV file of all EU countries with their standard VAT tax rates (as of the time of writing). You can use this to upload the tax rates to your Magento 2 install.

For France, we need to create the four tax rates described above. After adding these under **Stores | Tax Zones and Rates** in our Magento 2 backend, the list of tax rates looks like this:

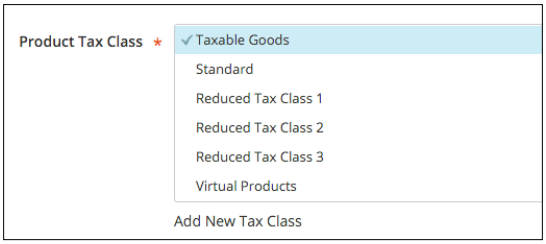
France Reduced VAT 1	France	*	*	10.00
France Reduced VAT 2	France	*	*	5.5
France Reduced VAT 3	France	*	*	2.1
France Standard	France	*	*	20.00

Our next chore is to create the product tax classes that are needed to separate our products according to the taxes we have to apply. For our France-based example, we will need five product tax classes:

- **Standard**: These are physical products and services that don't fall into the other product classes
- **Reduced Tax Class 1**: In France, these include passenger transportation, events (sports and entertainment), hotels, and restaurants
- **Reduced Tax Class 2**: Medical, food, and books
- **Reduced Tax Class 3**: Newspapers and pharmaceuticals
- **Virtual Products**: Music, software, and other non-physical products

While you may not currently sell products that fall into all of these classes, you may want to go ahead and set them up so they're available to you.

Remember, to create additional product tax classes; just click to edit any tax rule, expand **Additional Settings**, and add your new classes. After adding the above classes, this section will look like the following screenshot:



With the preceding preparation completed, we can now create the tax rules that will be used to calculate VAT taxes on purchases. We need to create the following tax rules to meet our needs as a French online business:

- Domestic customers purchasing standard products
- Domestic customers purchasing **Reduced Tax Class 1** products
- Domestic customers purchasing **Reduced Tax Class 2** products
- Domestic customers purchasing **Reduced Tax Class 3** products
- All customers purchasing virtual products
- Intra-EU customers purchasing non-virtual products

Once entered into our Magento 2 example, our **Tax Rules** screen would include the following:

Domestic Customer - Standard	Retail Customer	Standard	France Standard	0	0	0
Domestic Customer - Reduced 1	Retail Customer	Reduced Tax Class 1	France Reduced VAT 1	0	0	0
Domestic Customer - Reduced 2	Retail Customer	Reduced Tax Class 2	France Reduced VAT 2	0	0	0
Domestic Customer - Reduced 3	Retail Customer	Reduced Tax Class 3	France Reduced VAT 3	0	0	0
EU Customer - Virtual	Retail Customer	Virtual Products	Austria, Belgium, Bulgaria, Coratia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France Standard, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom	0	0	0
Intra-EU Customer - Non-Virtual	Retail Customer	Standard, Reduced Tax Class 1, Reduced Tax Class 2, Reduced Tax Class 3	Austria, Belgium, Bulgaria, Coratia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom	0	0	0



Remember, we are NOT tax experts. Your tax rules may differ from the example shown. The purpose of this exercise is to demonstrate the various steps needed to add VAT tax calculations to a Magento 2 store.

The final piece is to configure your **Customer Configuration** so that customers are automatically assigned to the proper customer group based on their VAT ID validation. To do that, go to **Stores** | **Configuration** | **Customers** | **Customer Configuration** and expand the **Create New Account Options** panel. Some of these settings are done at the global, website, and store view levels, so pay close attention to your store view scope setting in the upper right-hand part of the screen. For our example, we only want to automatically assign customers who visit our French store. Therefore, we will only enable this feature at the **Sportswear French View**.

Once you have changed to the appropriate store view level, the key fields to configure are:

- **Enable Automatic Assignment to Customer Group**: Set to **Yes** and Magento will reveal additional configuration fields.
- **Tax Calculation Based On**: Usually, you will set this to **Shipping Address** so that taxes are based on the customer's taxing jurisdiction, although there are exceptions.
- **Default Group**: At the store view level, you may want to set this to **Domestic**.
- **Group for Valid VAT ID – Domestic**: Set to your domestic group, **Domestic**.
- **Group for Valid VAT ID – Intra-Union**: Set to **Intra-EU**.
- **Group of Invalid VAT ID**: Set to **Invalid VAT ID**.
- **Validation Error Group**. Set to **Validation Error** as the customer group.
- **Validate on Each Transaction**: If you're going to calculate VAT taxes, then you would most like set this to **Yes**.
- **Default Value for Disable Automatic Group Changes Based on VAT ID**: This feature allows Magento to re-assign customers if their VAT ID or address changes. If you do not want this feature, set this to **Yes**.

As with any store configuration, especially one as complex as VAT taxes, we highly recommend that you test your configurations thoroughly.

Transactional e-mails

As customers make purchases in your store, Magento sends — based on your configurations — a number of e-mails to notify customers about their purchases. There are also e-mails for recovering passwords, creating accounts and more.

Magento installs some basic templates for all these transactional e-mails. You can create new e-mail templates to use for your stores that reflect your branding and messaging. In Magento 2, this is quite easy to do.



Many new Magento store owners will simply use the default e-mails that are installed with Magento. While these e-mails are not *bad*, you should invest the time to modify each to meet your specific brand and design.

When you first go to **Marketing | Email Templates**, you'll see an empty list. That's normal. The base templates installed with Magento will not appear in this list — but they are there, nonetheless. E-mail templates can also be included in Magento themes added to your installation. These will also not show in the list, but will be available for customization.

The process of customizing e-mail templates is:

1. Create a new template.
2. Apply an existing template to your new template.
3. Modify to accommodate your needs.

Once you create your new e-mail template, you can assign it for use as sales e-mails, customer account e-mails, and so on.

You can create new e-mail templates for the following purposes:

- Failed Payment*
- Contact Us Form
- Forgot Password
- New Account
- New Account Confirmation Key
- New Account Confirmed
- New Account Without Password
- Remind Password
- Reset Password
- Currency Update Warning*

- Subscription Confirmation
- Subscription Success
- Unsubscription Success
- Cron Error Warning*
- Price Alert
- Stock Alert
- Credit Memo Update
- Credit Memo Update for Guest (purchaser who does not log in)
- Invoice Update
- Invoice Update for Guest
- New Credit Memo
- New Credit Memo for Guest
- New Invoice
- New Invoice for Guest
- New Order
- New Order for Guest
- Order Update
- Order Update for Guest
- Shipment Update
- Shipment Update for Guest
- Send Product Link to Friend
- Sitemap Generation Warnings*
- Forgot Admin Password
- Reset Password
- Wish List Sharing

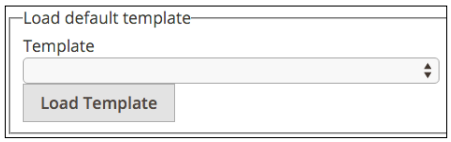
As you can see, Magento has quite a number of e-mails. The items in this list with an asterisk (*) are e-mails that are not sent to your customers, but, rather, sent to you or someone you designate. These e-mails are for alerting your team when something doesn't quite go right.

There are also two additional templates that are used to create the headers and footers for your e-mails. In other words, you can manage the top and bottom of your e-mails without having to modify every single e-mail if, for example, you want to change your logo or phone number.

To illustrate how to do this, let's create a new e-mail template for our sportswear store. We will begin by modifying the header and footer for our sportswear store, then create a new *New Order* e-mail template.

Create a new header template

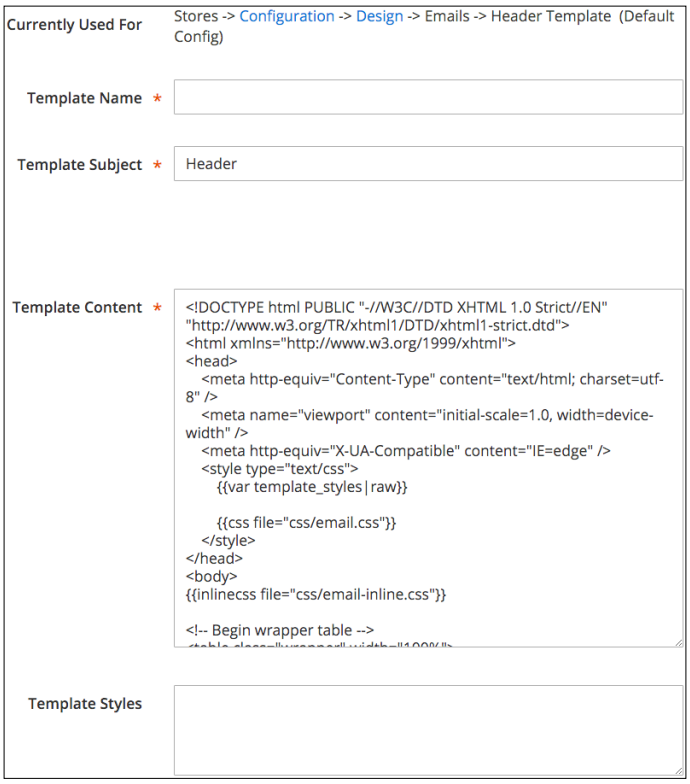
On the **Email Templates** panel, click on **Add New Template**. At the top of the **New Template** panel, you'll see an area titled **Load default template**. Here, you can select the base template — or a template provided by a theme — and load it into the **New Template** panel for modification.





You could, of course, create a template from scratch, but it can be a real time-saver to modify an existing template.

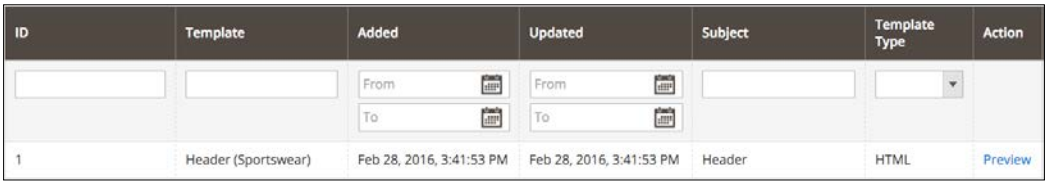
For our new header, select **Header** and click on **Load Template**. This will load the base header template into our **New Template** form.



Let's first review the fields shown on this screen:

- **Currently Used For**: Not actually an editable field, this shows where this e-mail is assigned for use. In this case, we can see that the header template we loaded is being used in the **Stores** | **Configuration** | **Design** | **Emails** | **Header Template** configuration at the *Default* configuration scope. That means that the header template is used as the default header for all e-mails in your installation. Once we build our sportswear header (and footer) templates, we will assign them at the sportswear website configuration scope so that they will be used for all sportswear e-mails.
- **Template Name**: Use a name that is useful when shown in the list of e-mail templates. In our example here, we might use **Header** (Sportswear).
- **Template Subject**: For e-mails, this is the subject that would appear in the e-mail sent. For the header and footer, leave as shown so they are properly included in generated e-mails.
- **Template Content**: It is into this field that you will make any changes to layout and content.

Once we have modified the header to our liking, we can save it by clicking **Save Template**. If we look at our list of e-mail templates, we now have the one template listed.



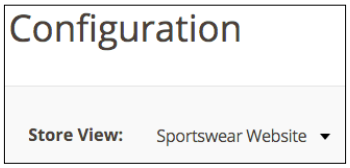
Assign e-mail header and footer

If we click on the template and view its detail, we can see that it has no **Currently Used For** field, as it has not been assigned to a particular website or store. Once we have created our sportswear footer (it is not necessarily required to create both to be able to create and assign only a header or footer), we can now assign these to our sportswear website so that they appear for each store view.



This capability gives you the ability to create multiple language e-mails, as well as translating your website for your international customers.

1. Go to **Stores** | **Configuration** | **General** | **Design** in your backend.
2. Change your **Store View** setting to **Sportswear Website**.



3. Expand the **Emails** panel.
4. Beside **Header Template** and **Footer Template**, uncheck the **Use Default** checkbox.
5. For **Header Template**, select **Header (Sportswear)** in the drop-down menu.
6. For **Footer Template**, select **Footer (Sportswear)**.
7. Click **Save Config**.

We have now assigned our new e-mail header and footer to all outgoing e-mails related to the sportswear stores. If you view the detail for your header and footer e-mail templates, they will now display a **Currently Used For** value.

Currently Used For	Stores -> Configuration -> Design -> Emails -> Header Template (Sportswear Website)

Create new e-mail template

Now that we have created our special header and footer, we can create our new order email for our sportswear customers.

1. Return to **Marketing** | **Email Templates**.
2. Click on **Add New Template**.
3. Load the **New Order** default template. Note that for the Magento Luma theme, there is an installed new order template specific to the Luma theme. Since we're using the Luma theme for our example stores, we will choose **New Order (Magento/luma)** as our default template.

4. Give your new e-mail template a suitable name. In our case, we'll use **new order** (sportswear).
5. For our template subject, we're going to adjust it a bit by replacing its default contents with `Thanks for Your {{var store.getFrontendName()}} Order!`



As you can see, the subject contains a Magento variable that will dynamically include the name of the store. Since we name our sportswear stores Sportswear English View, Sportswear French View, and Sportswear German View, we may not want to use the dynamic store view name, as these don't sound particularly consumer-friendly.

For our example, we would prefer to use **Thanks for Your Acmes Sportswear Order!**

6. Make any other changes you wish to the **Template Content** and **Template Styles**.
7. Click on **Save Template**.

As with the header and footer, we will now assign this e-mail to the appropriate sales e-mail:

1. Go to **Stores** | **Configuration** | **Sales** | **Sales Emails**.
2. Change **Store View** to **Sportswear Website**.
3. Open the **Order** panel.
4. For **New Order Confirmation Template**, uncheck **Use Default** and select **New Order (Sportswear)** in the dropdown.
5. Click on **Save Config**.

We have now created a modified new order template for our logged-in purchasers and assigned it for our sportswear stores.



There are different e-mails for logged in and guest customers because logged-in customer e-mails can include links to the customer's account. Guest customers cannot log into your Magento store, as no account is set up when a customer checks out as a guest.

Summary

As we've seen in this chapter, before you can begin selling on a Magento store, there are considerable configurations that have to be addressed. We have covered managing orders, payment gateway settings, shipping configurations, sales and VAT taxes, and transactional e-mails.

Take your time with these settings and continually test to make sure you have the configurations correct. Mistakes could end up being costly.

In the next chapter, we will discuss how to manage the non-product content of your site: the static pages and text that helps define your brand and give greater confidence to your customers.

5
Managing Non-Product Content

As important as products and product information are to e-commerce, successful online stores need more in order to attract customers and fortify the store's brand. Even printed catalogs often contain information about the seller, including hours of operation, return policies, company history, and more. This **non-product content** is essential.

To gain an understanding of how to create and manipulate non-product content, we will cover the following topics:

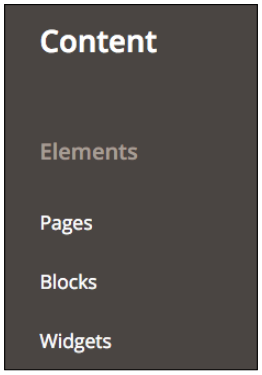
- Review how Magento incorporates content
- Learn how to create content pages in your Magento store
- Create and use static blocks
- Utilize built-in content widgets

Once you know how to interweave non-product content throughout your online store, you will no doubt discover innovative ways to increase customer engagement.

The Magento content management system

As with most e-commerce platforms, Magento's management of non-product content lacks some of the more robust features of a dedicated **content management system** (**CMS**) – such as *WordPress*, *Business Catalyst*, or *Joomla*. However, to its credit, Magento does provide a versatile system that takes into account the possible need for unique content for each of your stores.

As you would expect, the area of the backend for managing the CMS functions of Magento is under the **Content** menu. This area includes sections for managing **Pages**, **Blocks**, and **Widgets**, as shown in the following screenshot:



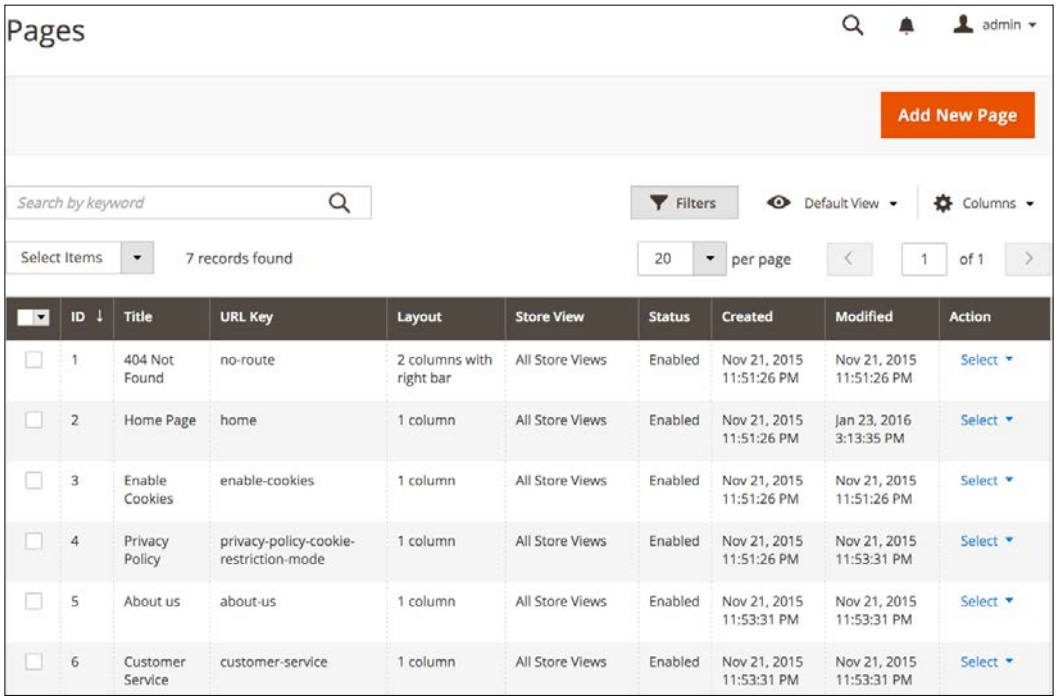
Before we dig into each of these items, it's important to recall our discussion about blocks in *Chapter 3*, *Designs and Themes*. Whether configuring a page, or placing a static block or widget, Magento builds the final results by assembling blocks of information.

Pages

The pages we will use in the CMS are not actually complete pages, as they lack controls for the overall template items of header, navigation, and footer. These pages actually refer to the central content of a page – that which lies within the overall page template. Within this page, we can add text, images, static blocks, and widgets to give the page its core content. As we will examine in this section, you can add some of the same code as you did in the `default.xml` file to even manipulate elements outside the core content area, including blocks within the header, navigation, and footer.

To begin, let's look at and alter a default page provided by the sample data installed into a new Magento store.

Go to **CMS** | **Pages** in the Magento backend. With the sample data installed, you should see a list of pages, much like those shown in the following screenshot:



	ID	Title	URL Key	Layout	Store View	Status	Created	Modified	Action
	1	404 Not Found	no-route	2 columns with right bar	All Store Views	Enabled	Nov 21, 2015 11:51:26 PM	Nov 21, 2015 11:51:26 PM	Select
	2	Home Page	home	1 column	All Store Views	Enabled	Nov 21, 2015 11:51:26 PM	Jan 23, 2016 3:13:35 PM	Select
	3	Enable Cookies	enable-cookies	1 column	All Store Views	Enabled	Nov 21, 2015 11:51:26 PM	Nov 21, 2015 11:51:26 PM	Select
	4	Privacy Policy	privacy-policy-cookie-restriction-mode	1 column	All Store Views	Enabled	Nov 21, 2015 11:51:26 PM	Nov 21, 2015 11:53:31 PM	Select
	5	About us	about-us	1 column	All Store Views	Enabled	Nov 21, 2015 11:53:31 PM	Nov 21, 2015 11:53:31 PM	Select
	6	Customer Service	customer-service	1 column	All Store Views	Enabled	Nov 21, 2015 11:53:31 PM	Nov 21, 2015 11:53:31 PM	Select

While it's not absolutely necessary that you keep these pages enabled, for e-commerce best practices, it's generally a good idea to retain these core pages.

- **404 Not Found**: This page is displayed to visitors who land on a non-existing page in your site. For example, you might have a product that is discontinued and you no longer wish to have it visible to your customers. However, a search engine, blog, or other websites may have a link to that product. If a customer clicks that link and comes to your site, since the item is no longer visible, they would be shown this page. A 404 error is *webspeak* for a missing page. You can provide branded content to visitors who try to access a missing page. Without this page, such a visitor would simply see a stark 404 error page provided by your web server, and it's neither appealing nor branded.
- **Home Page**: Obviously, this is the home page for your site. The content and design elements that appear in the core of your home page are managed on this page.

- **Enable Cookies**: In order for your store's shopping cart, login, and other features to work properly, a customer's web browser must allow cookies to be used. If Magento detects that cookies cannot be used on a customer's browser, they will see the content of this page. You can use this page to help customers understand cookies and how to activate them on their browser.
- **Privacy Policy**: Online privacy and the sharing of information is increasingly important to consumers. Furthermore, Google will favorably consider sites that have a comprehensive privacy policy on their site. It's just good business sense! The default Magento privacy policy content is a great boilerplate with which to construct your own policy.
- **About Us**: Would you hand over your hard-earned money to someone you didn't trust? There are lots of ways to demonstrate your good faith and reputation on your site, and the About Us page is one ideal place to start. Give your shoppers a sense of your mission, leadership team, and history.
- **Customer Service**: You can create other service-related pages (for example, **Returns Policy**, **FAQs**). In the least case, you should have a page that discusses your customer service policies. Magento provides this page with the initial installation because any reputable online store should make their service policies available to online shoppers.

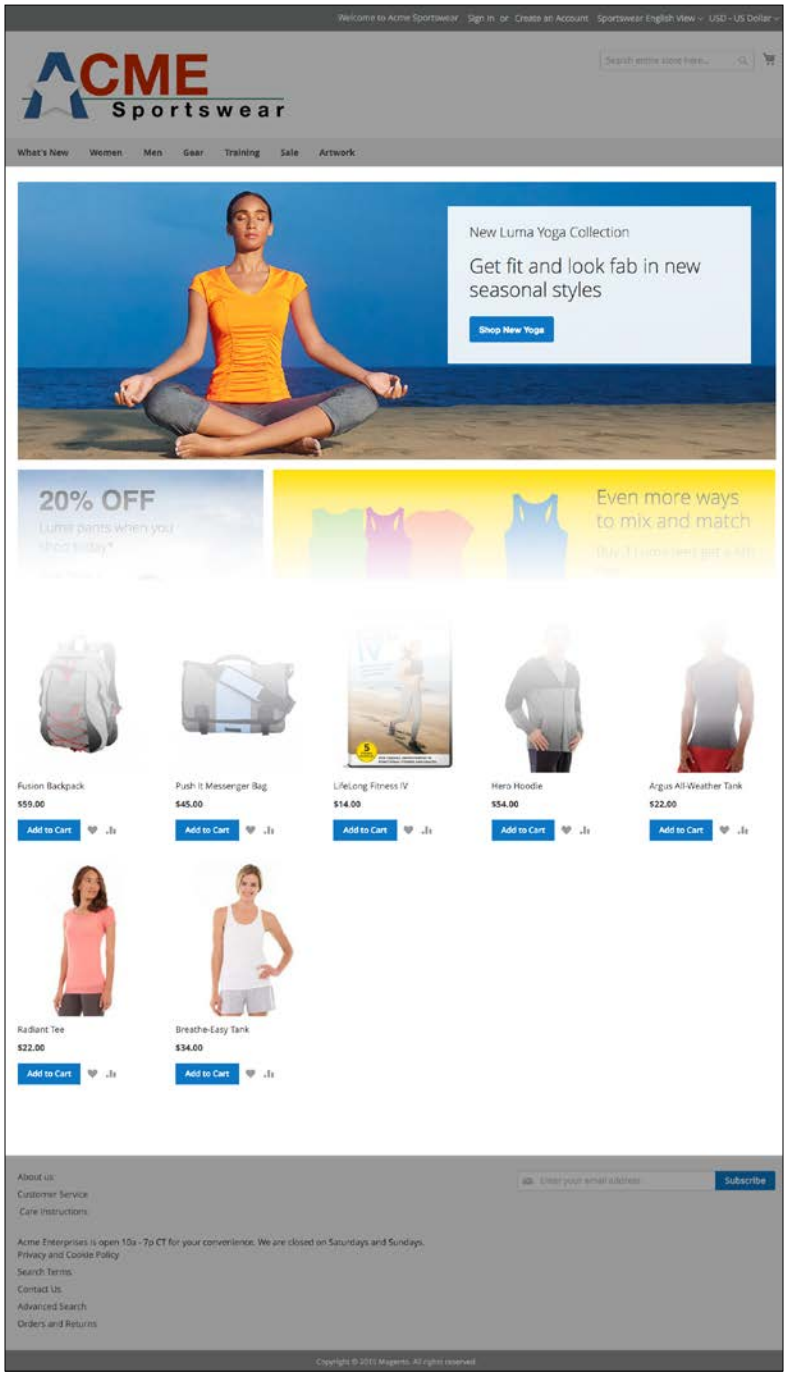
No doubt, you will find other pages to insert in your Magento store. Creating and managing CMS pages is really quite straightforward.

Customizing a CMS page

The first place most designers want to begin modifying a store's design is with the **Home Page**.

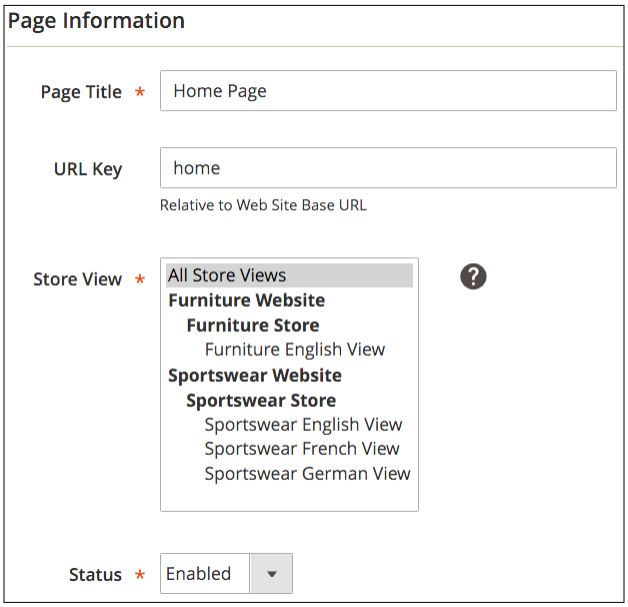
Modifying the Home Page layout

First, we need to understand that pages created in the Magento CMS primarily dictate what appears in the **content section** of the page. This is the area, highlighted below, apart from the **header**, **top navigation,** and **footer** regions.



The content section of the Home Page

On the **Page Information** panel of the **Edit Page** screen, you should see the following:



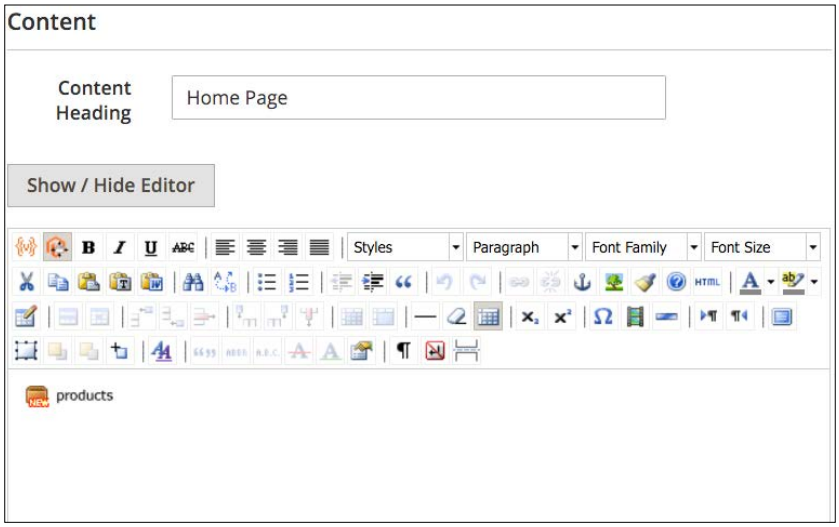
Let us go through the various fields:

- **Page Title**: This is the title that will appear in the top of your browser, as well as the default name of any link you create to this page.
- **URL Key**: This field shows how the page is accessed in a URL path. For example, this page is accessible by going to `http://www.storedomain.com/home.html`. Magento assumes that your **Home Page** will have a **URL Key** of home. You should not change this unless you know what you're doing.
- **Store View**: This field allows you to select for which stores your page is applicable. When you save your page, Magento does check to make sure another page with the same **URL Key** has not already been assigned to the same stores.
- **Status**: Of course, means whether the page is active or not.

The Content screen

In the left tabs, click **Content**. This is the screen where you can add text, images, or dynamic content that will display in the center content area of your page.

Notice that in the following screenshot, this sample data home page contains a widget.



This widget displays products according to the parameters of the widget (we'll discuss widgets later in this chapter). What you don't see — and we're sure you've realized this — are the instructions that control the other graphics and "Hotsellers" shown on the home page.

The other parts of the home page are inserted by using blocks. We will explore the use of blocks a bit later in this chapter. What is important here is that you can create tremendous versatility in your CMS pages by using tools beyond hardcoding layout changes within the theme modules.

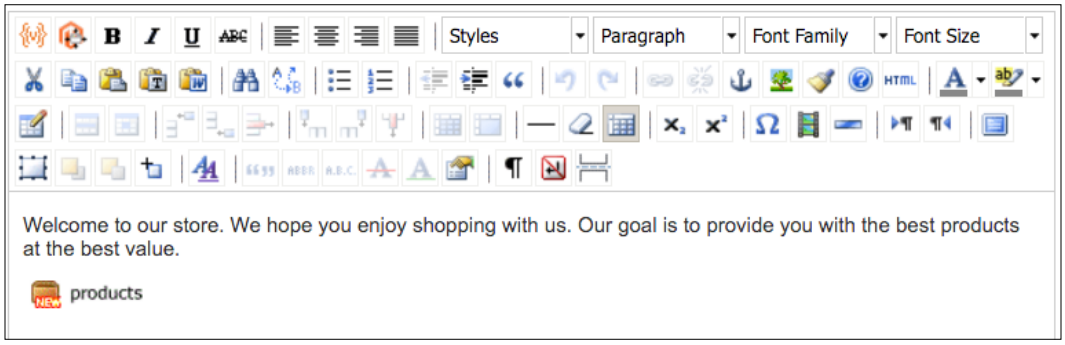


When we create home page layouts, we use blocks and widgets wherever possible so that the store operator can immediately manage changes that they feel are important. We use the content area of the CMS page to allow the store operator to quickly edit text.

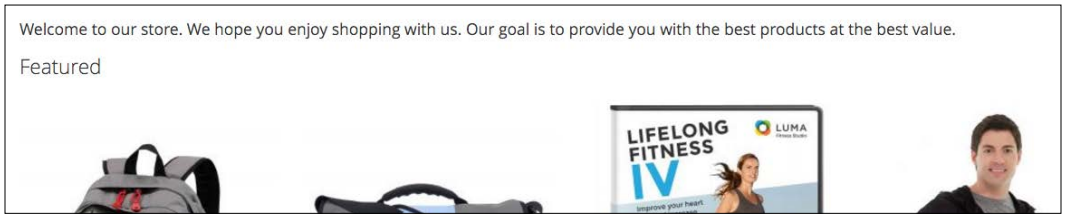
For our exercise, let's add some copy to our home page so that it precedes the featured product display.

In the editor field, enter the following before the widget:

Welcome to our store. We hope you enjoy shopping with us. Our goal is to provide you with the best products at the best value.



Click on **Save and Continue Edit** (this will let you remain on this screen) and open your home page in another browser window or tab. It should display your new content:



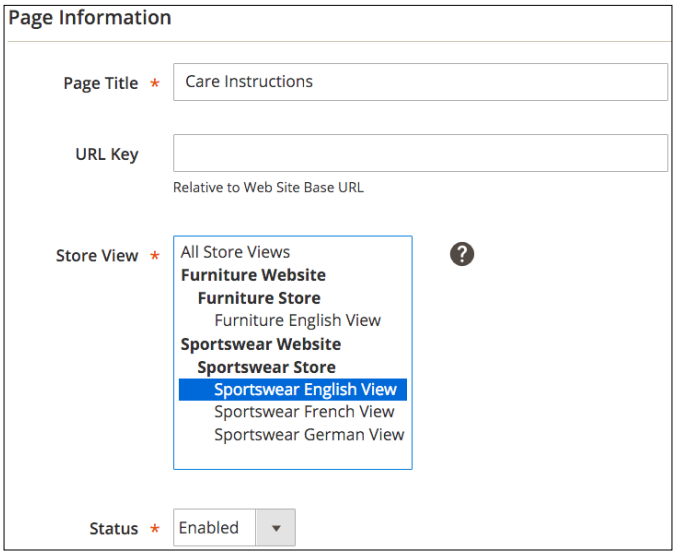
You've now added content to your default home page. As you go through the remainder of this chapter, you'll discover additional ways to add or affect the content of your home page. We will now create a new CMS page to use on our site. This exercise will also give you additional insights into how to use Magento's CMS feature.

Creating a CMS page

Let's add a new page to our site called **Care Instructions**. We want to provide information to our apparel site customers on proper techniques for washing the clothing items they purchase from Acme Sportwear:

1. Go to **Content** | **Pages** in the Magento 2 backend.
2. Click on **Add New Page**.

The first panel is titled **Page Information**, as shown in the following screenshot:

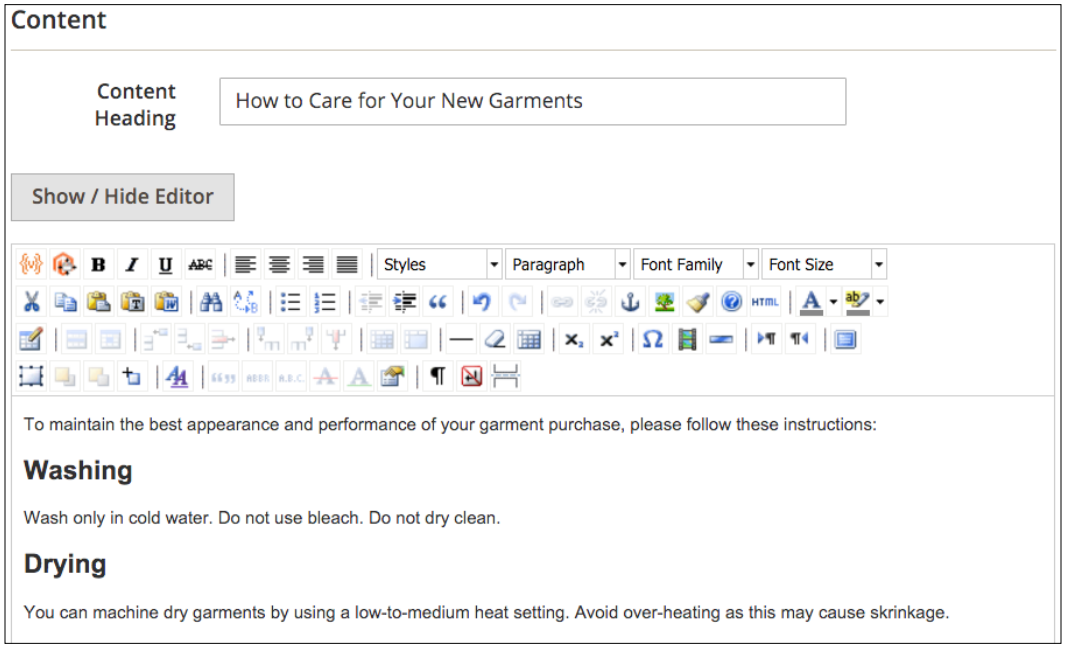


As shown, we have entered the initial information for our new page. Magento will create the URL Key once the new page is saved. However, you can enter a URL Key here. The URL Key will be the actual name used in the URL to access your page: `http://www.acmesportswear.com/care-instructions.html`. If you want another URL Key value, you can enter it here.



If you build different pages for different store views, they can each use the same URL Key. However, if you try to use the same URL Key for two pages which are both assigned to the same store view, you will get an error.

The next panel in the new product screen is **Content**. It is in this panel that you can create the words, images, and so on that will appear in the main content portion of your new page.



The **WYSIWYG editor** gives you a lot of great tools to help you build your page content. You can easily insert images, videos, tables, and other styled content.

The **Content Heading** will appear at the top of your page. It will be displayed within a `<h1>` tag.

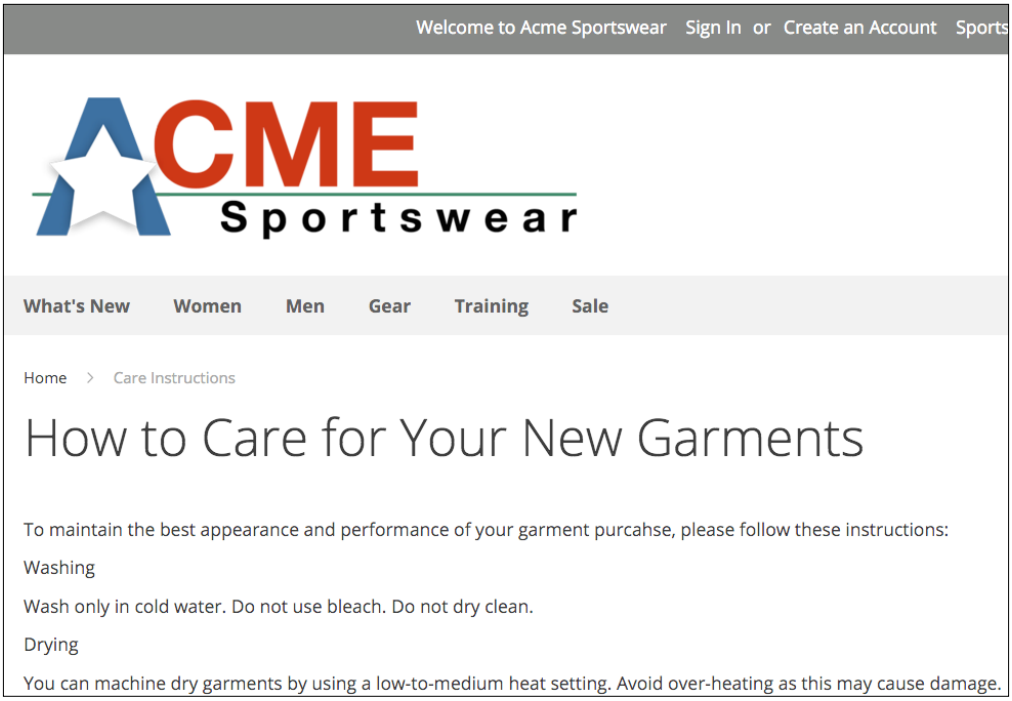


If you're not familiar with HTML heading tags — or other HTML elements — you should consider enlisting the assistance of an experienced web content editor. The proper use of headings, styles, and other HTML elements can have an effect on how well your content is indexed by Google.

The third panel in the menu on the left side is labeled **Design**. Based on your theme, you can change the layout of the page to a one-, two-, or three-column display. You can also specify a special theme design. There are additional XML statements that can be inserted that will affect your display. See *Chapter 3*, *Designs and Themes*, for guidance on various XML statements that can be used to control layout.

The last panel is **Meta Data**. Keep this in mind for when we discuss meta information later in this chapter.

Once saved, we can view our new page by going to the URL path we created for this page.



The next step is to add a link to your new page from your site navigation. One easy way is to edit a block that contains links to pages within your site.

Using blocks and widgets

Blocks are sections of content that are specified by your theme to appear in various places throughout your site. Blocks can be placed on all pages, some pages, product pages, category pages, or in special, designated spots.

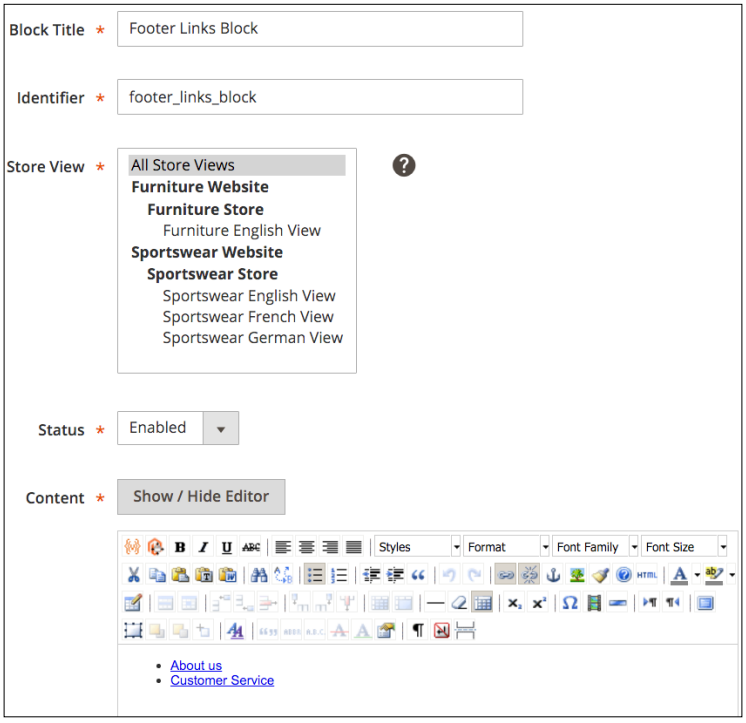
In addition to block locations that are configured within your theme, blocks can be inserted into various areas and pages within your site by using widgets, which we will explore just a bit later in this section.

To view all the blocks in your site, go to **Content** | **Blocks**. If you have installed the Magento 2 sample data, you'll see as many as 18 blocks. By their names, you can probably figure out where they appear on your site.

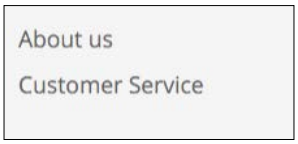
	ID ↓	Title	Identifier	Store View	Status
☐	1	Footer Links Block	footer_links_block	All Store Views	Enabled
☐	2	Contact us info	contact-us-info	All Store Views	Enabled
☐	3	Sale Left Menu Block	sale-left-menu-block	All Store Views	Enabled
☐	4	Gear Left Menu Block	gear-left-menu-block	All Store Views	Enabled
☐	5	Men Left Menu Block	men-left-menu-block	All Store Views	Enabled

Adding a page link

To understand how CMS blocks work — and to add our **Care Instructions** page link — click on the **Select** drop-down menu to the far right of the first block, **Footer Links Block**, and click on **Edit**.



This block contains the information that appears in the bottom footer of all our sites.

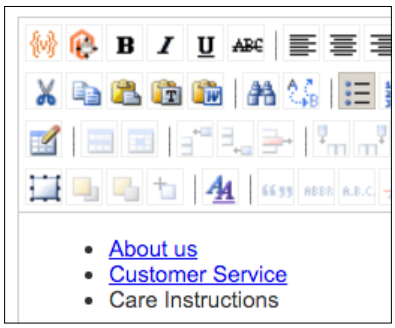


We want to add our **Care Instructions** link to this block. Now, this is where things get just a bit complex, so read through this process carefully, as it applies anytime you wish to add a link to a page in your site to a block. We are going to explain three different methods of accomplishing the same result.

Using WYSIWYG

We can add a link using the WYSIWIG editor, or we could change the view to HTML mode and edit the actual HTML code. Let's do it using the WYSIWYG editor, first.

In the editor space, add the link name as you wish for it to appear on the frontend by adding another bullet row below the **Customer Service** label. You can, of course, insert your new link anywhere in the list.

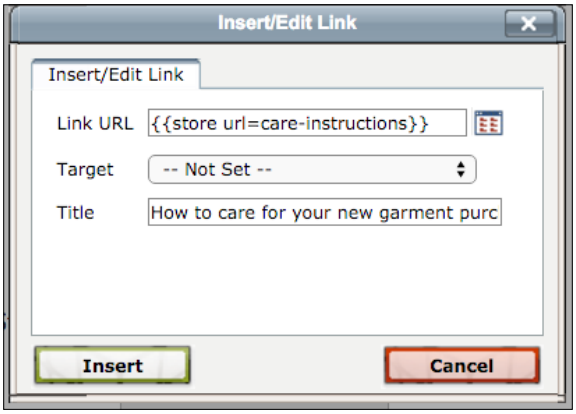


To create the link, select the title you just entered and click the link icon in the menu toolbar. A *modal* dialogue will appear for entering your link URL.

Magento provides a library of variables which can be used to dynamically insert values and content where appropriate. In this case, the use of a system variable for inserting the store URL is worth learning for our purposes.

The store URL variable is inserted when used in the following format: `{{store url=URL_Key}}`, where `URL_Key` is the URL Key for the page, category, or product you wish to access.

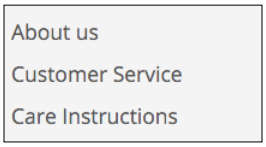
Therefore, for our new page, we will insert the following into **Link URL**: `{{store url=care-instructions}}`. Add a **Title** for your link so that it will appear when your customer mouses over the link, and to help describe the link to search engines.





In most Magento help guides, the format for entering a store URL variable is `{{store url="URL_Key"}}`, with quotes (") around the URL Key. However, we must leave out the quotes when using this variable within the link dialogue box. It's quite possible to use the store URL variable without quotes elsewhere, too. This behavior does not apply when adding links using HTML (see the next section).

Once you click on **Import**, the text will be linked. If you look on the frontend of your website, you will now see a new link in the footer.





If you select a link in WYSIWYG and click the link icon, the URL that shows in the dialogue field is a very long, encrypted string. This is due to the way Magento stores link references. You can edit the link by replacing it with what you prefer as the link, but you may find building and managing links much easier using HTML rather than the WYSIWYG view.

Using HTML

The method of adding a link using the store URL variable is the same if you work in the HTML view. The key, of course, knows how to properly code an HTML link.

In the block screen, click on **Show/Hide Editor** to reveal the underlying HTML for this block.

```
<ul class="footer links">
<li class="nav item"><a href="{{store url="about-us"}}">About us</a></
li>
<li class="nav item"><a href="{{store url="customer-
service"}}">Customer Service</a></li>
<li class="nav item"><a title="How to care for your new garment
purchases." href="{{store%20url=care-instructions}}">Care
Instructions</a></li>
</ul>
```

You'll notice that the link you created for the **Care Instructions** page is slightly different from the other links in the block. This is due to the manner in which the link dialogue saves your entry.

You could also use `{{store url="care-instructions"}}` for the link code — in HTML view only — and achieve the same results.

Using a widget

If you're hesitant about using the store URL variable or coding HTML, you can use one additional technique for inserting a link: the CMS widget. In fact, as you explore this method, you'll find it can be used to insert the following:

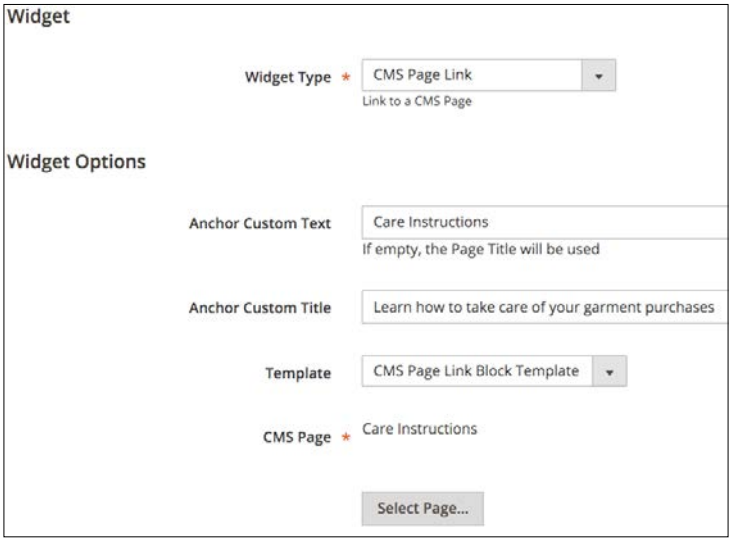
- A CMS page link
- A CMS block
- A link to a category listing
- A link to a product page
- A list of new products
- A list of products belonging to a specific category
- A form for customers to use to look up orders and/or request a return
- A list of recently compared products
- A list of recently viewed products

For our example, we want to insert a link to a CMS page. In the WYSIWYG view (you can also use the HTML view), click the widget icon in the top menu bar.



A panel will open from the right side of your screen. For **Widget Type**, select **CMS Page Link**. Additional fields will appear:

- **Anchor Custom Text**: Enter how you wish the link to show to your customer. In our case, we would enter **Care Instructions**.
- **Anchor Custom Title**: Enter the hidden title that you wish to use to describe the link to search engines and have displayed to customers if they hover over the link with their mouse.
- **Template**: If you wish to insert the link on a line by itself, select **CMS Page Link Block Template**. If the link is to appear within a paragraph of text, choose **CMS Page Link Inline Template**.
- **CMS Page**: Click **Select Page…** to choose the page that you want to link.



After you insert the widget, it will appear in your WYSIWYG editor as an icon labeled **page link**. If you want to edit the link, simply double-click on the icon to open the **Widget** panel.





You may find that using a widget will add additional HTML to the actual code. In our example case, the link title is enclosed by a `<span>` tag. Your site's CSS styling may add additional styling to this added HTML code that may affect your site appearance.

Using variables

The store URL variable is only one of many available for use in Magento 2. Within the CMS page and block editors, you do have access to a list of standard variables that will *dynamically* insert information into your content.

- **Base Unsecure URL**
- **Base Secure URL**
- **General Contact Name**
- **General Contact Email**
- **Sales Representative Contact Name**
- **Sales Representative Contact Email**
- **Custom1 Contact Name**
- **Custom1 Contact Email**
- **Custom2 Contact Name**
- **Custom2 Contact Email**
- **Store Name**
- **Store Phone Number**
- **Store Hours**
- **Country**
- **Region/State**
- **Zip/Postal Code**

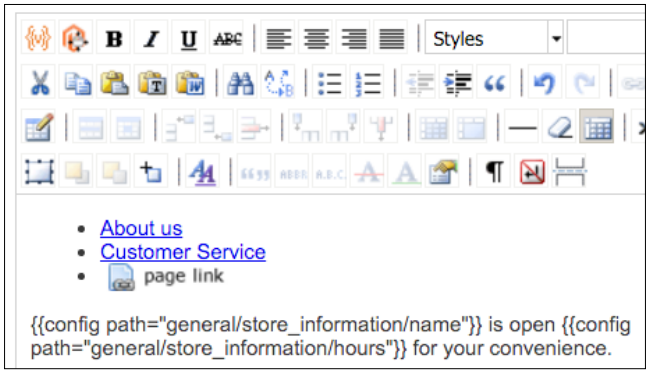
- **City**
- **Street Address 1**
- **Street Address 2**

Let's say we wanted to include the name and store hours of our business in the same footer block we have been editing:

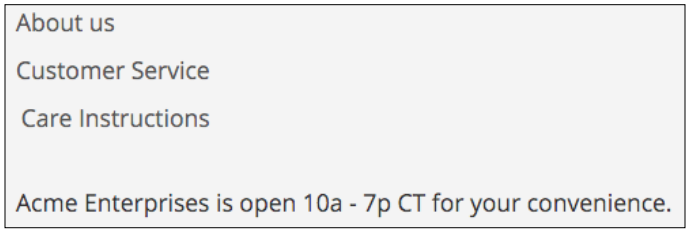
1. Click in the WYSIWYG where you wish to insert your new text and variables.
2. Insert any text you wish.
3. Place your cursor where you wish to insert a variable.
4. Click the variable icon in the WYSIWYG editor menu.



5. Click on the variable you wish to insert. In our case, we will be clicking on **Store Name** and **Store Hours**. Magento will insert the proper variable code into your text.



After saving the block, you will see on your site that the actual saved information for store name and store hours is inserted into
its proper places.



Creating your own variables

This is one of the least known features of Magento, and yet it can be powerful for reducing the need to edit changes in multiple places in your site. In fact, custom variables can be used not only in pages and blocks, but also in e-mail templates.

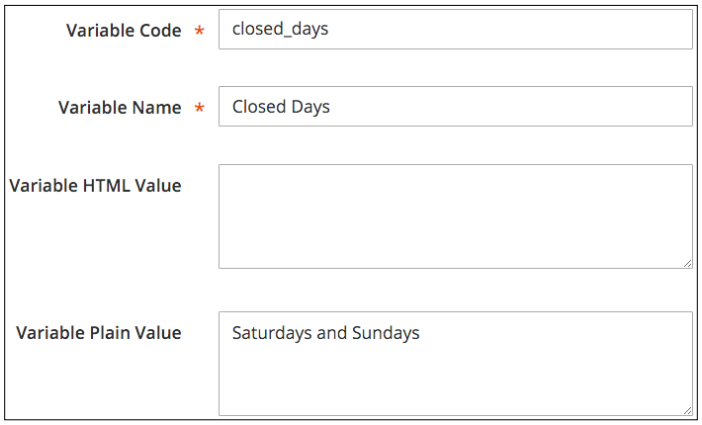
As an example, let's say you'd like to add the days on which you are closed to your footer message, but you'd like to use a variable just in case you decide later to change the days on which you are not open:

1. Go to **System** | **Custom Variables** in your store backend.
2. Click on **Add New Variable**.

Let's go through the various fields you will encounter here:

- **Variable Code**: Enter a code for your variable, using only lowercase letters, numbers and underscore (_). This code is used by Magento's programming to reference your variable.
- **Variable Name**: Enter a name that will appear in the list of variables.
- **Variable HTML Value**: If you wish to insert HTML code as part of the variable value, enter it in this space.
- **Variable Plain Value**: If you do not need any HTML code, enter the value of the variable in this field.

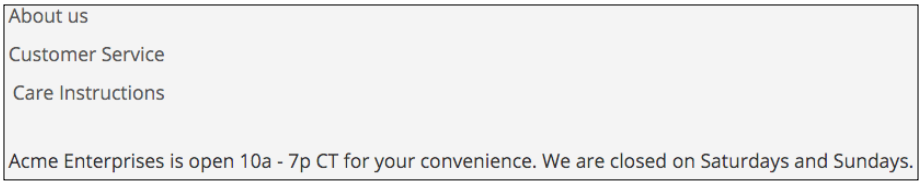
The various fields are shown in the following screenshot:



Now, you can return to your footer block and insert your new variable just as you inserted the variables for **Store Name** and **Store Hours**.

```
{{config path="general/store_information/name"}} is open {{config
path="general/store_information/hours"}} for your convenience. We are
closed on {{customVar code=closed_days}}.
```

With these variables inserted, your site footer now shows the added variable value.



Custom variables could be handy for managing content that you may wish to edit from time to time, yet needs to be displayed in multiple places such as the following:

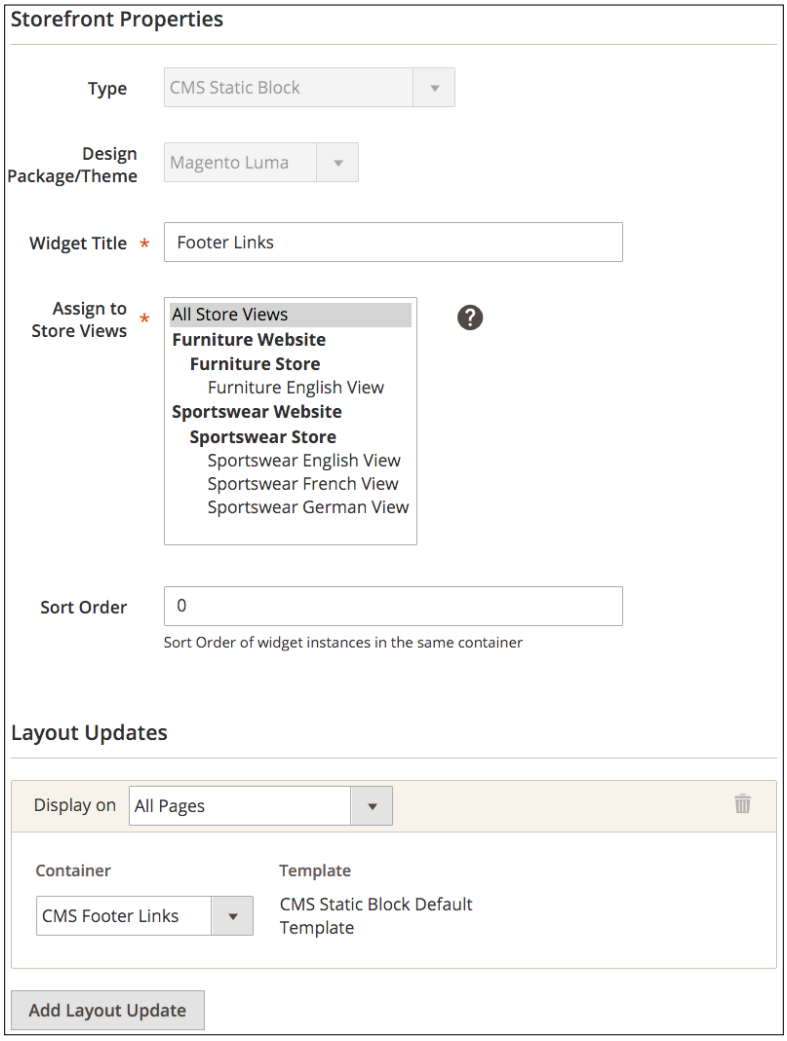
- Estimated shipping time
- Credit cards and payment methods accepted
- Store pick-up hours
- Alternate phone numbers
- Customer service hours and/or phone number

If any of these need updating on your site, you simply have to change the value of the custom variable.

Using widgets to insert content onto site pages

The widgets we used in editing blocks allowed us to insert dynamic links to blocks and pages. However, widgets can also be used to insert dynamic content into multiple pages and theme locations, such as products, categories, footers, and so on. In fact, the footer links block we have been editing is inserted into the theme's footer content area using a widget.

Let's take a look at this particular widget to see how that is configured. Go to **Content** | **Widgets**. Click on the **Footer Links** widget shown in the list.



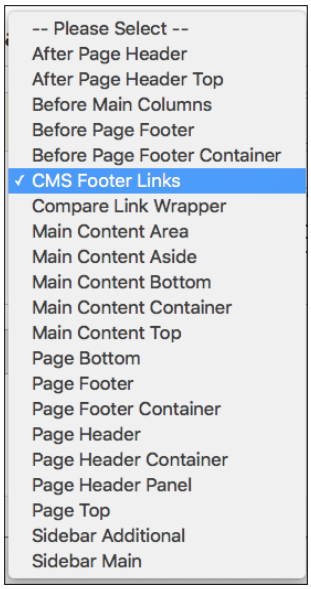
The first panel, **Storefront Properties**, configures where the widget will display its contents. The **Type** and **Design Package/Theme** are set when the widget is created and cannot be changed later (although the widget can be deleted and re-created).

You can assign the widget to appear in only certain store views, as well, and control the order in which it may appear if other widgets are also assigned to the same layout section.

The **Layout Updates** section is where so much of the magic of widgets comes in. You can assign a widget to appear on all pages, certain pages, or certain types of page (or any combination thereof!).

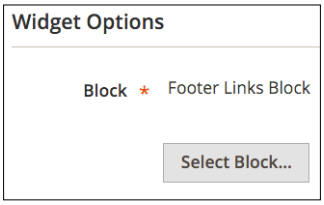
For categories and products, you can also specify specific categories and products. For instance, you could create a widget that would insert a block of content to appear only on the **Furniture** category page.

In this particular example, this widget inserts a CMS block (our footer links) into a container called **CMS Footer Links**. Depending on your theme, you can have many different containers to choose from, such as in the Luma theme used in our demo store.



By clicking **Add Layout Update**, you can also insert the widget content into other containers in your site.

Finally, the **Widget Options** panel allows you to select the block, link, and so on. Your widget will be inserted. This depends on the type of widget you are creating.





Widgets can be very powerful tools, especially when combined with blocks. We've seen many situations where even experienced developers have programmed block insertions instead of using the simple widget tools in Magento. Get to know blocks and widgets, and we're certain you'll come up with some very creative ways of adding true value to your brand and customer experience.

Summary

The Magento CMS provides you with the capability to customize your store without directly altering the XML and HTML files of your theme. You can build productive pages, blocks, and widgets, adding increased functionality and buyer conveniences.

That said, we should never shy away from rolling up our sleeves and diving into the actual theme files. By combining both disciplines, you have greatly elevated the potential of Magento to meet your retailing needs.

In this chapter, we learned about the Magento CMS functionality, viewed how to create and customize pages, explored the creation of blocks, and reviewed the many widgets available for your use.

Now that our store has products and content, it's time to let the world know your store exists as a premiere online shopping destination.

6
Marketing Tools

The online marketplace is crowded. Thousands of new stores are coming online each day. With Magento 2, you have one of the most powerful open source platforms for presenting and selling your products and services. But to be noticed — and to create valuable repeat business — you have to do more than just point a domain name to your store.

The key is marketing: presenting a selling proposition to potential customers that will entice them to at least visit your online showroom.

In this chapter, we will explore some of Magento's key marketing tools, including:

- Customer groups
- Promotions
- Newsletters
- Sitemaps
- Search engine optimization

As you prepare your store for launch, you need to spend some time becoming familiar with how these tools can help you attract and close more sales.

Customer groups

If you're new to e-commerce, you may not quite have a handle on how to group your potential customers outside of retail and wholesale. Most of you will build retail stores, fewer will build wholesale businesses, and even fewer will do both.

Yet, if you give some careful thought to how you intend to market to your customers, you may find that there are more **customers segments** you need to identify. Here are examples of some other possible customer groups:

- Distributors who will re-sell your product to retailers
- Tax-exempt organizations, such as charities or government agencies
- Groups or teams, such as associations or athletic leagues
- Professionals, as opposed to hobbyists or amateurs
- Certified or approved buyers meeting a licensing or other qualification



Customer groups in Magento are not to be confused with customer profiles, such as age, sex, or preferences. A customer can only belong to one Magento group, so profile attributes cannot really be accommodated.

As you contemplate your groups, consider the following:

- Groups should be segments of your customer base that might have different pricing, benefits, or product focus
- Groups can be used (as we'll see later in this chapter) for specific marketing promotions using newsletters and promotional codes
- Groups can be assigned different tax classes for the purpose of charging (or not charging) sales tax

By default, Magento creates three customer groups: **General**, **Retailer**, and **Wholesale**. When a customer registers in your store, they are automatically put into the General group. You can manually assign a customer to another group, either after they have registered or if you create the customer yourself in the administrative backend to your store.

Creating a customer group

Creating a new customer group is perhaps the simplest operation in Magento!

1. Go to **Stores** | **Customer Groups** in your Administration menu.
2. Click on **Add New Customer Group**.
3. Enter a **Group Name**.
4. Assign a **Tax Class**.
5. Click on **Save Customer Group**.

And that's all there is to it. Now that you understand how customer groups are created in Magento, let's see how we can use these for marketing.

Promotions

Every retailer with whom we work finds it beneficial to offer promotions from time to time. From free shipping to coupons, promotions can help consumers choose your products over competitors, particularly if they feel they're getting a great bargain in the process.

As with sales tax, promotions are rule-based, meaning that the application and calculation of a promotion are based on rules you create. In Magento, there are two types of promotion rules:

- **Catalog price rules** apply to any product that meets certain criteria. The discount is applied automatically.
- **Cart price rules**, on the other hand, can be set to be only applied when a valid coupon is entered by the customer during checkout. **Shopping cart rules** can also be applied automatically. Furthermore, shopping cart rules — or coupons — can be publicized by adding them to an RSS feed for your site.

Creating a catalog price rule

As described, a catalog price rule is a discount that is applied to selected products automatically. For example, let's assume you wish to provide a 5% discount on all women's apparel priced over $50 sold between November 24, 2016 through November 26, 2016, as a special *Black Friday* promotion.



Black Friday and Cyber Monday

For years in the United States, the day after Thanksgiving — the last Friday of November, *Black Friday* — has been one of the busiest shopping days of the Christmas season. Retailers offer huge discounts and shoppers begin lining up well before dawn just to be the first one in the door. To counter the brick and mortar retailers, online retailers created *Cyber Monday*, the Monday following *Black Friday*, likewise offering huge discounts and special offers. Personally, we like the sound of *Cyber Monday* over the morbid moniker of *Black Friday*. We also like e-commerce!

To create a catalog price rule, you need to perform the following steps:

1. Go to **Marketing** | **Catalog Price Rules**.
2. Click on **Add New Rule**.
3. Enter the following in the **Rule Information** screen:

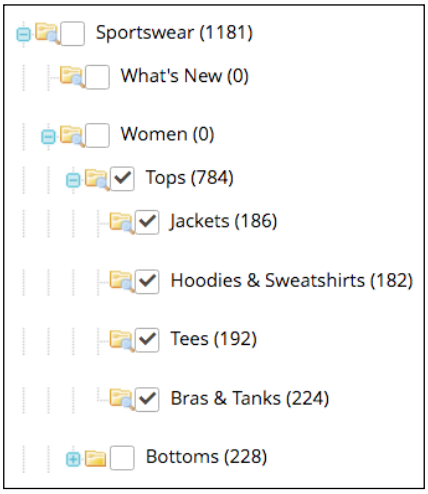


4. Click on **Conditions** in the left tab menu. Now, here's where it gets interesting!
5. Click the green plus sign to add a condition to your rule.



Any underlined items in these screens can be clicked to reveal additional choices. Don't hesitate to click and discover!

6. In the drop-down menu that appears, choose **Category**.
7. Click on **is** and select **is one of**.
8. Click the ellipsis (**...**).
9. Click the small, square icon to the right to reveal a hierarchy of categories. Select the categories you wish to apply the discount to. Your selections will add the category IDs into the empty field.



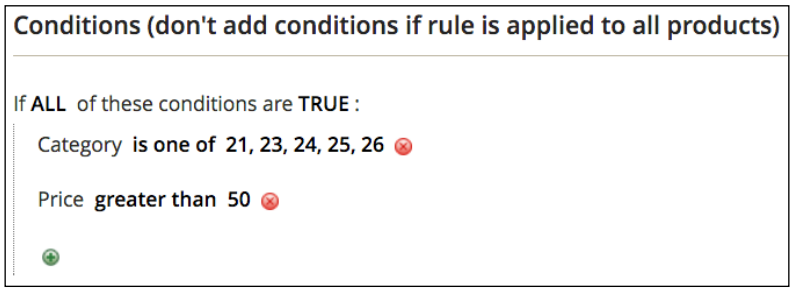
10. Click on the green checkmark icon to save your category selections.
11. Click on the green plus sign again and choose **Price** from the drop-down menu.



If you don't see **Price** in the drop down of choices, you may need to change the **Price** product attribute. Find **Price** under **Stores** | **Product**. In the **Storefront Properties** panel, change **User for Promo Rule Conditions** to **Yes** and click on **Save Attribute**.

12. Click on **is**. Select **greater than** from the drop-down menu.

13. Click the following ellipsis. Enter **50.00** in the field and click outside the field.





The amount of the discount is based on the default currency for the website. If your site's default currency is Euros, then the discount would be 500 Euros.

Now, we need to create the discount calculation:

1. Click on the **Actions** menu tab.
2. Since we're going to apply a percentage discount to the price of the product, we can leave **Apply** as is.



The four choices for **Apply** give you tremendous flexibility but may not be clearly understood.

3. **By Percentage of the Original Price** reduces the price of the product by the percentage specified, such as 15%off the price.
4. **By Fixed Amount** will reduce the product's price by a specified amount, such as 50 dollars off.
5. To **Percentage of the Original Price**, by contrast to **By Percentage of the Original Price**, sets the price at the percentage you enter. For example, if you enter 75, the price of the product would be 75% of its original price.
6. Likewise, **To Fixed Amount**, sets the price of the product at the price you enter instead of reducing the price by a fixed amount.

7. In **Discount Amount**, enter **5**.
8. If you want the discounts to apply to not only a complex product type (for example, configurable, bundle, or group) but to their associated products as well, set **Subproduct discounts** to **Yes** and configure the amount of discount to apply to any subproducts.
9. If we do not want to apply any other promotion rules to these applicable products, choose **Yes** for **Discard subsequent rules**. For example, you may not want a customer to receive multiple discounts on the same product.
10. Click on **Save Rule**.

You now have a new rule that will automatically take effect at 12:01 AM on Friday, November 24th and run until 11:59 PM on Sunday, November 26th. However, there is one final action to take!

Before your new rule can take effect, click on **Apply Rules** at the top of the **Catalog Price Rules** page. Magento needs to set itself to apply the rules to the applicable products.



Please note that immediate price changes (promotions without a set start date) will be visible when Magento re-indexes its prices, usually within a few minutes.



Creating cart price rules

Magento has some very powerful and flexible tools for creating discounts that can be applied once the customer has reached the shopping cart part of their visit. In fact, we have found it difficult to identify a single discount scenario we could not accommodate in Magento.

The key features of cart price rules for which you should be aware are:

- You can create rules for any or all of your websites. Rules apply to all store views within a website.
- You can allow discounts for only selected customer groups. You could offer coupons to wholesalers, for instance, that could not be used for retail customers.
- You do not have to use a coupon code. Your rules can be applied automatically as long as the shopping cart meets the required criteria.
- You can limit the number of times a coupon is used. Or you can allow a coupon code to be used multiple times by a given customer.
- Product attributes can be used as criteria. As noted in *Chapter 2*, *Managing Products*, a product attribute can be configured so that you can apply a discount based on the value of that attribute within one or more products in the customer's shopping cart.
- You can apply the discount to the entire cart or to only select products in the cart. For instance, if you are giving a 20% discount to shirts only, but customers put other types of products in their cart, you can configure the discount so that it deducts 20% from the price of the shirts in the cart and not from any other product.
- Magento can generate coupon codes. Some e-commerce systems require that you contrive the coupon codes you wish to use. In Magento, you have the ability to generate and manage as many codes as you need.



We have worked with clients that have had millions of generated coupon codes. While this many codes may require more horsepower for your server, Magento has no problem storing and using a very large number of codes.

Let's use a specific example to learn how to create a cart price rule:

- Retail customers only. We'll assume we have 100 customers on our newsletter list.
- Unique coupon codes for each user (we'll email them to existing customers).
- Customer must buy $100 or more of women's tops or three or more of any women's apparel items.
- Discount gives 20% off on women's apparel.
- Discount also provides free ground shipping.
- Coupon can only be used once per customer.
- Coupon is only active starting on April 1, 2016 and expiring on August 31, 2016.
- Coupon cannot be combined with any other discounts.

The process of building our rule will follow these steps:

1. Adding the new rule.
2. Defining the rule's conditions.
3. Defining the rule's actions.
4. Modifying the rule's labels.
5. Generating coupon codes (if needed).
6. Testing the rule.

Adding the new rule

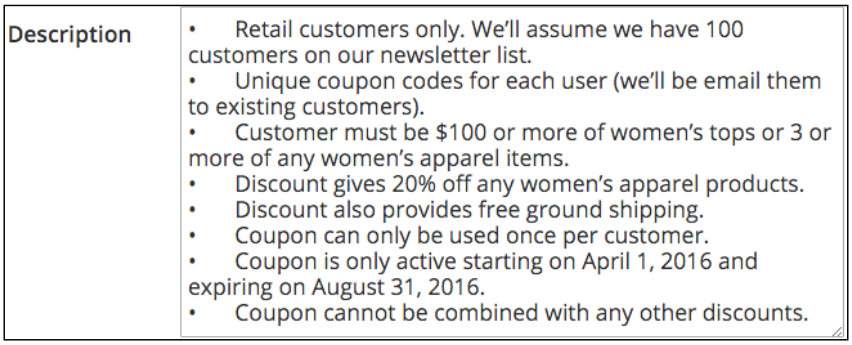
To begin building our cart price rule, go to **Marketing | Cart Price Rules** in your Magento 2 backend. Click on **Add New Rule**.

The **Rule Information** panel for our new rule has several fields to use to set up the rule:

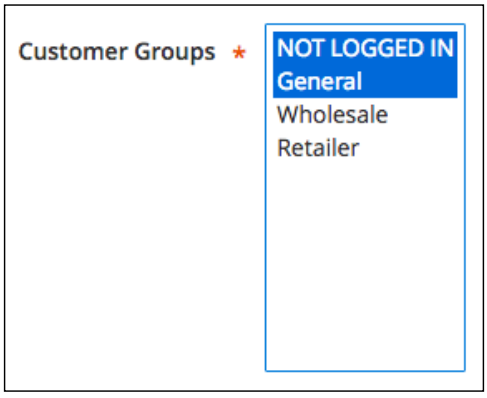
- **Rule Name**: Enter **Free Shipping & 20% off Women's Apparel** as the name of your rule. This will be shown in your list of rules.



- **Description**: You can use this field to fully describe the rule. In our example, we will enter the coupon specifics we outlined for this example.



- **Status**: Select **Active** when you wish for the coupon to be available for use.
- **Websites**: Select **Sportswear Website**, since our example rule only applies to products purchased in that store. You can select any number (or all) of the websites shown. Our selection also means that visitors to all three sportswear store views (English, French, and German) can use the code.
- **Customer Groups**: Since we only want our coupon to be used for retail customers, we would select **NOT LOGGED IN** and **General**. If we only want logged in retail customers, we would only select **General**.



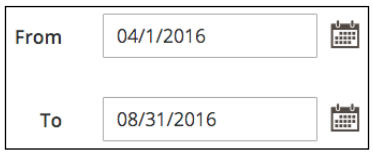
- **Coupon**: We will be using a coupon code; therefore, select **Specific Coupon**.

- **Coupon Code**: Our goal is to create 100 unique codes to distribute. This may help us track code usage by customer, and it will allow us to restrict the usage of the code to only one use, since we will be distributing to customers that are not logged in. Instead of entering a specific coupon code, check the box labeled **Use Auto Generation**. (We will be managing the generation of codes in a moment.)
- **Uses per Coupon**: Enter **1**, as we want to only allow a customer to use it once before expiring.
- **Uses per Customer**: This value only applies to logged in customers. We will also enter **1** in this field.



Entering zero (0) in either of the **Uses** fields allows unlimited use of a coupon.

- **From/To**: These are the first and last dates the coupon can be used. If you leave **FROM** blank, the coupon will be immediately available (if "**Active**"); if **TO** is blank, the coupon code will never expire. Using the calendar pop-up (click the small icon to the right), choose April 1, 2016 for **From** and August 31, 2016 for **To**.



- **Priority**: If you have more than one active rule, they will be applied in an order based on this field. The order is numeric, descending, with 1 being the highest priority.
- **Public In RSS Feed**: If you want to publicize your discount in your store's RSS field, set this option to **Yes**. Since ours requires a specific coupon code and we wish to limit to known newsletter subscribers, we will select **No** for this field.



As with all multi-panel screens in Magento, it's probably a good idea to click **Save and Continue Edit** after you complete each panel. Just in case!

Defining the rule's conditions

A rule's conditions can be considered as minimum requirements. In other words, what is necessary about a customer's shopping cart for the rule to be valid?

In our example, a coupon code can only be used if the shopping cart contains $100 or more of women's tops or 3 or more women's apparel items. To create this condition, go to the **Conditions** panel.



If we leave this panel blank (for example, do not add any conditions), then the coupon code will be valid for any products present in the shopping cart and for any amount.

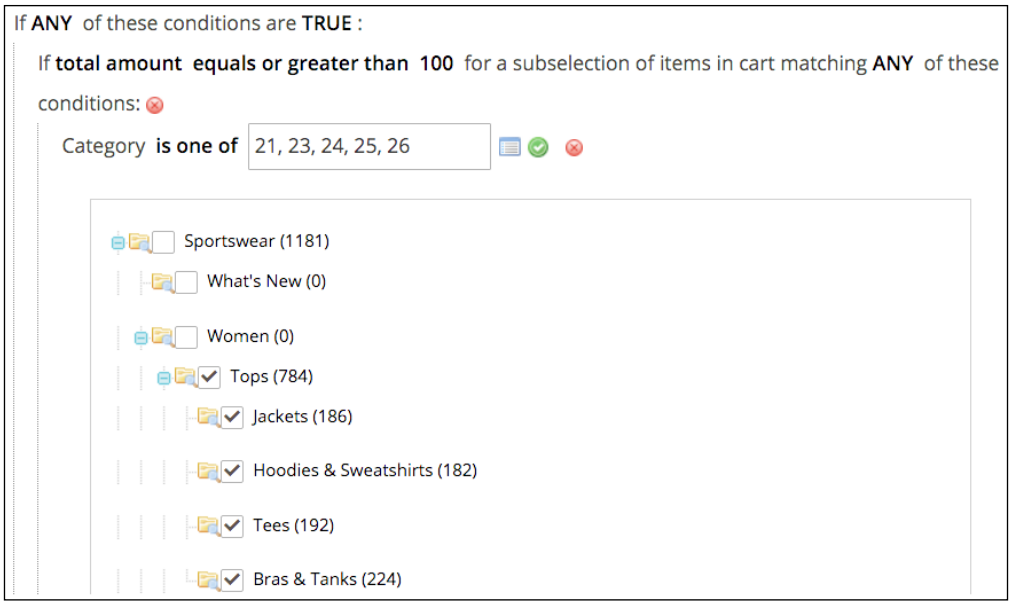
Since we have two conditions, both of which are valid, click the **ALL** in **In ALL of these conditions are TRUE**. It will allow you to select **ANY**. These creates an "or" condition.



Pay attention if you use nested conditions, as the ALL/ANY applies to only the top level conditions. You can use condition combinations to create nested and/or conditions.

Our first condition will test whether the customer has $100 or more of women's tops in their shopping cart:

1. Click the green **+** icon to create your first condition.
2. In the dropdown, choose **Products subselection**. We are creating a rule that will apply to only a particular selection of qualifying products.
3. Click on the words **total quantity is** and select **total amount**.
4. Click the word **is** and select **equals or greater than**.
5. Click the following ellipsis (**...**) and enter **100**. Hit your *Enter* key.
6. Change **ALL** to **ANY** in the condition description.
7. Click the green **+** icon nested within this condition.
8. Select **Category** from the dropdown menu.
9. Click **is** and select **is one of** from the dropdown menu.
10. Click the following ellipsis (**...**), and by either using the list icon or by typing the category IDs of the categories you wish to use, choose the **Tops** category and all sub-categories within, as shown in the following screenshot:





It's a good idea to select all subcategories as well, since you may have items that are only assigned to a sub-category and not to the top level category.

11. Once you have selected your categories, click the green checkmark icon to save your choices.

Next, we need to add the or condition that tests whether the customer has three or more women's apparel items into their cart:

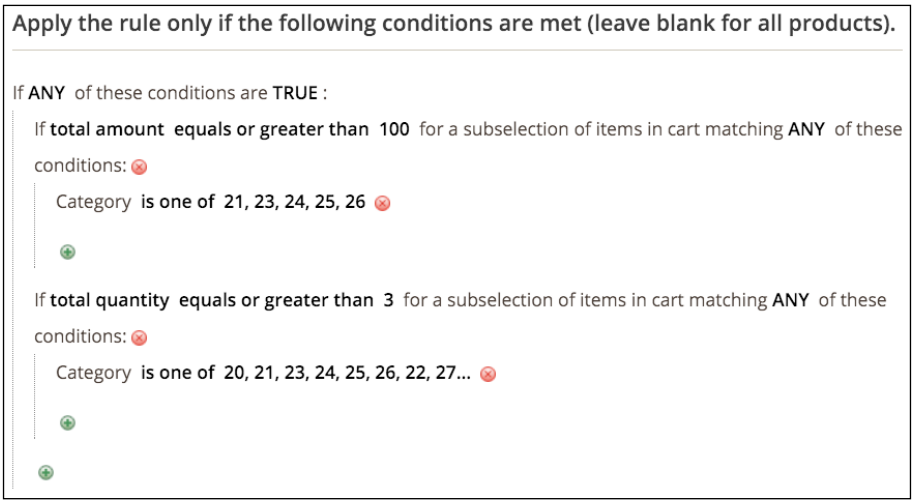
1. Click the left-most green **+** icon.
2. Select **Products subselection** in the resulting dropdown.
3. Select **equals or greater than** for the comparison value.
4. Enter **3** for the amount.
5. Change **ALL** to **ANY** in the condition description.
6. Click the nested green **+** icon.
7. Select **Category** from the dropdown.
8. Click **is** and select **is one of** from the dropdown choices.

9. Click the ellipsis (**...**) and select all categories within the women's apparel section, as you can see in the following image.



10. Click **Save and Continue Edit** to save your work to this point.

Once your conditions are set, your **Conditions** panel should look like the following image.



Now we can move on to specifying the actions that will take place for shopping carts that match our conditions.

Defining the rule's actions

There are two parts to a rule's actions:

- The amount discounted
- For which products the discount is to be applied

This is important to understand, as many are confused by the fact that action conditions appear very similar to the rule conditions that we created before. The conditions in this panel dictate which products qualify for the discounts.

In other words — as in our case — we're using one set of conditions to qualify the shopping cart and another set, within the **Actions** panel, to identify to which products the discount will be applied. These conditions are different. If they were the same — for example, you're discounting a shopping cart containing $100 or more in products — then you do not have to add any conditions to the **Actions** panel.

Let's now configure our **Actions** panel for our needs:

1. For **Apply**, select the default: **Percent of product price discount**.

   Let's go over the various choices here, so you have an idea as to which discount will work best with your purposes. Any value that is required will be entered into the **Discount Amount** field.

   - **Percent of product price discount**: Subtracts a percentage discount from the price of the applicable products.
   - **Fixed amount discount**: Subtracts a fixed amount from the price of the products.
   - **Fixed amount discount for whole cart**: The fixed amount entered here will be discounted from the entire cart total (you can specify whether the discount applies to shipping elsewhere on this panel).
   - **Buy X Get Y Free (discount amount is Y)**: You can specify that if a customer buys X quantity of a product (entered into the **Discount Qty Step (Buy X) field**), they will receive Y quantity of the same product for free.

2. Enter **20** into the **Discount Amount field**. You do not need to enter % for percentage discounts.
3. Since we are not limiting the number of the same item to which the discount may be applied, we will set **Maximum Qty Discount is Applied To** as **0**.
4. The **Discount Qty Step (Buy X)** does not apply for our case (see above regarding the Buy X Get Y Free discount choice).
5. Set **Leave Apply to Shipping Amount** as **No**.
6. Set **Discard subsequent rules** to **Yes**. We do not want other offers to apply if this discount is used.



If the priority of your rule is lower than another rule, the higher priority rule will still be applied. This setting only applies to lower priority rules.

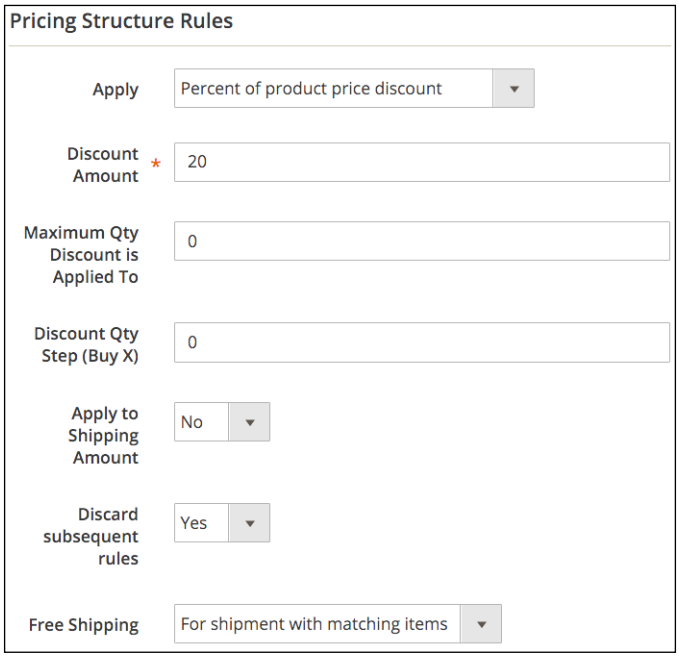
7. Set **Free Shipping** to **For shipment with matching items**, as our example discount also gives the customer free shipping for the entire qualifying order.



For free shipping to work, you have to have at least one free shipping method configured. See *Chapter 4*, *Configuring to Sell*, for more information on shipping.

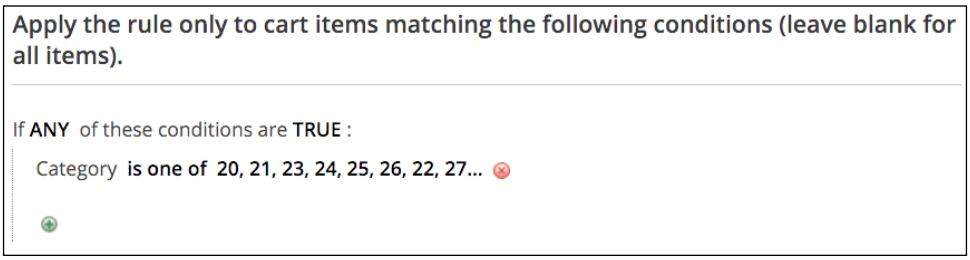
8. Click on **Save and Continue Edit** to save your settings so far.

The fields mentioned above can be visualized in the following screenshot:



The next part of our actions configuration is to designate to which products the discount will be applied. In our case, any women's apparel (up to the three we set in the top part of the panel).

Using the same methodology we use in the **Conditions** panel, our **Actions** panel rules, when completed, will look like the following:



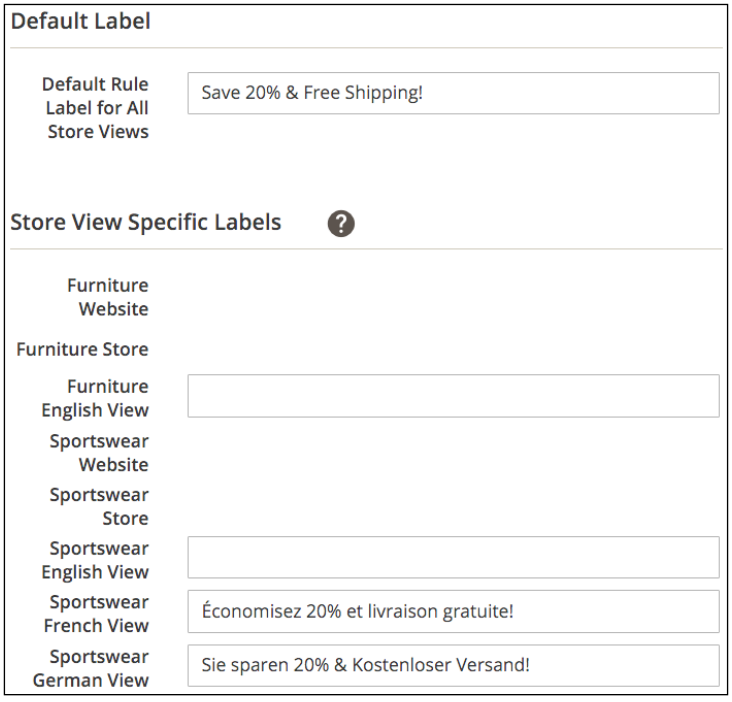
Modifying the rule's labels

While you could use the name of the rule as what displays to customers, it's probably more prudent to compose a discount label that more succinctly describes the discount. Furthermore, as in our example, we need different labels for each of the foreign language sites on which we sell sportswear.

For our example, we're going to label our discount for our customers as **Save 20% & Free Shipping!**

1. In the **Labels** panel, enter **Save 20% & Free Shipping!** in **Default Rule Label for All Store Views**.
2. Since we can use this same label for our English store view, we can leave **Sportswear English View** blank.
3. For **Sportswear French View**, we might enter (and, again, our French and German are not polished at all!) **Économisez 20% et livraison gratuite!**
4. In the **Sportswear German View**, we might use **Sie sparen 20% & Kostenloser Versand!**

And, of course, we click on **Save and Continue Edit**. Our **Labels** panel now looks like the following screenshot:



Generating coupon codes

In our example, we want to create 100 unique coupon codes that we can send to our selected customers. Magento does an amazing job of helping you generate codes and also keeps track of how many times specific codes have been used.

To begin, go to the **Manage Coupon Codes** panel. Let's assume we want to create codes that are alphanumeric (both letters and numbers), 12 characters long, and have a prefix of ASW and a suffix of F20. Our coupon pattern would be ASW-XXX-XXX-F20, where "XXX" is a unique alphanumeric code. To configure this, we set up the parameters for the codes and then click on **Generate** to allow Magento to create the 100 unique codes we need:

1. In **Coupon Qty**, enter **100**.



For testing purposes — and particularly if these are single-use coupon codes —you should generate a few more than you need. In this case, we might want to generate 110 or 120 codes, just so we can thoroughly test. See the next section about testing for more information.

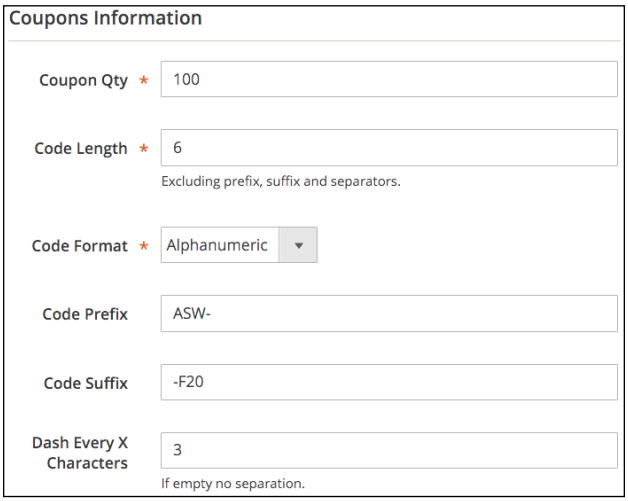
2. Our **Code Length** is **6** (we do not count the hyphens or the prefix and suffix, as we specify those a bit later).
3. For **Code Format**, select **Alphanumeric**.
4. In **Code Prefix**, enter **ASW-** (we're using this for Acme Sportswear).
5. In **Code Suffix**, enter **-F20** (for Free and 20% off).



The use of a prefix and/or suffix is purely optional. If you're using unique coupon codes, you may want to use some designators that will help you identify that the code is a valid code for the order. When an order is viewed in your backend, it will show what codes, if any, were applied to the order. If you only use randomly generated codes without other designators, you might not be able to easily determine what actual discount rule was applied. If you want hyphens before or after a prefix/suffix, you need to include it in the appropriate fields.

6. Since we want a hyphen inserted into our codes, we can enter **3** in **Dash Every X Characters**.

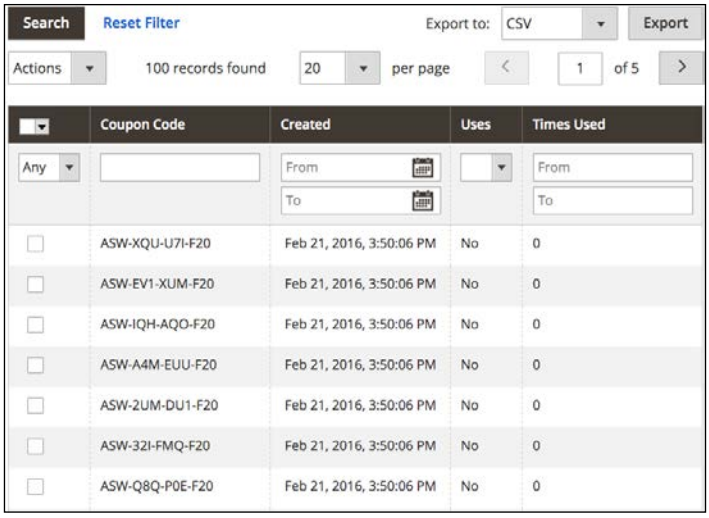
The fields mentioned above can be visualized in the following screenshot:



Now, we can click on **Generate** to create our 100 unique codes. Once generated, you should see 100 records created in the lower portion of the panel. Although your codes will be different (they are randomly generated, after all), your list should look similar to ours.



Customers may enter codes using either lower or upper case. asw-xqu-u7i-f20 will work just as well as ASW-XQU-U7I-F20 or AsW-xQu-U7I-f20.



Using the export tool at the top of your list, you can now export your codes and use them with your email program to send these codes to your customers.



Unfortunately, Magento 2 does not have a native means of sending your unique codes to your customers. You will have to use a third-party email solution or extension if you wish to send these codes to your customers.

Testing the rule

As with any configuration you make in Magento, you should test and re-test to make sure your settings are correct. Try various tests, too. In developer-ese, these are called use cases.



If your coupon code is only valid at a future date, you should change the start date to TODAY, then change to the future date once you have completed testing.

The more you test, the more confident you'll feel that your rule is valid.

Newsletters

When you acquire a new customer, it makes great sense to keep them interested in your offerings so that they will return again to make a purchase from your online store. The *Cost of Acquisition* for a sale is far less with a repeat transaction.

Magento 2 is able to help you keep your brand in front of your customers with basic email newsletter tools. With these tools you can:

- Allow customers to subscribe
- Create newsletter templates
- Schedule the sending of your newsletter
- Manage your subscribers



Magento will be the first to admit that their newsletter tools are pretty basic. If you want to be more sophisticated in how you construct your newsletters, segment your customers, and more, you should consider a more robust third-party tool. We use **MailChimp** (`http://www.mailchimp.com`), a leading email system that makes it easy to manage campaigns. It's fun to use, as well.

For connecting your Magento 2 store to MailChimp, we recommend the *MageMonkey for Magento 2* extension (`http://store.ebizmarts.com/magemonkey-magento2.html`). Ebizmarts, the creator of this extension, worked closely with MailChimp. The extension also adds emails for abandoned carts, supports multiple MailChimp lists, and creates autoresponders — emails for customer birthdays, related products, and product reviews. And, best of all, at the time of this writing, the extension was offered for free!

Subscribing customers

The newsletter function is enabled by default in Magento 2. As long as you have a newsletter subscription form on your site, your customers can subscribe and be added to your newsletter list.

Settings for newsletters are configured under **Stores** | **Configuration** | **Customers** in the Magento 2 backend.

By default, a subscription form is placed in the footer of the base theme. If you use a third-party theme, the subscription form may be placed in another location.



Creating newsletter templates

Before you can send a newsletter, you have to create a newsletter template. The template contains your marketing message but can also contain dynamic content.

To begin, go to **Marketing | Newsletter** templates in your Magento backend. Click on **Add New Template**. On the **Template Information** panel, you will see the following fields:

- **Template Name**: Enter a name for the newsletter that is meaningful to you, as shown in your list of templates. You might use something like Marketing Newsletter, Feb 2016 or Spring Sale Announcement, 2016.
- **Template Subject**: This is the subject that will appear in the email subject received by your customers. Use something that is both enticing without sounding spammy.
- **Sender Name**: The From email shown in the email header will contain a name and an email address, something like: Acme Support `<support@acmefurniture.com>`. This field is the name part (for example, Acme Support).
- **Sender Email**: This is the email address part of the From address. It is also the email address to which replies to your newsletter will be sent.



Some people use `noreply@` as a sending email address. Some spam filters will object to this, and if you're intent on customer service, this is considered poor form.

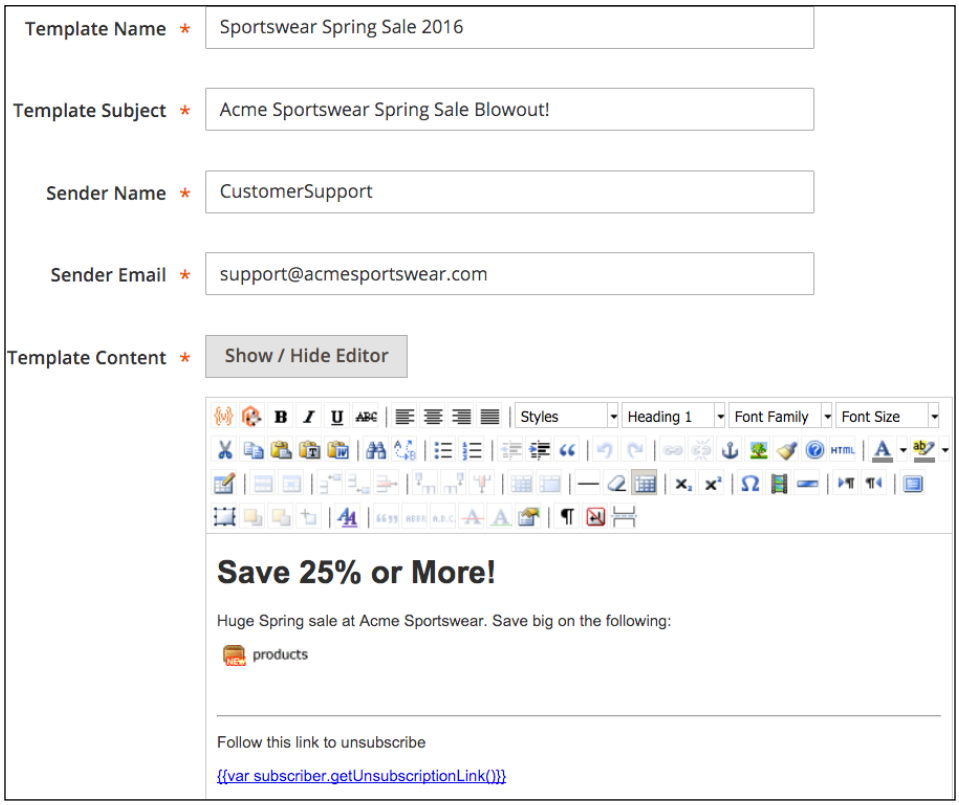
- **Template Content**: As with other complex text fields in Magento, this one has a WYSIWYG editor to give you several tools for building an attractive and meaningful email newsletter. As with the blocks and CMS pages we discussed in *Chapter 5*, *Managing Non-Product Content*, you can insert variables and widgets, as well. This gives you the ability to insert products, category links, and more!



When creating a new template, you'll see default content for inserting a variable for an unsubscribe link. This is key if you want to avoid violating anti-spam standards. However, there are more guidelines you should follow if you want your newsletters to be considered valid emails to subscribed customers. A good resource for compliance guidance can be found at `http://kb.mailchimp.com/accounts#Compliance_Tips`.

- **Template Styles**: If you wish to add CSS styles to your newsletter content, you can add the CSS styling in this field.

The fields mentioned above can be visualized in the following screenshot:

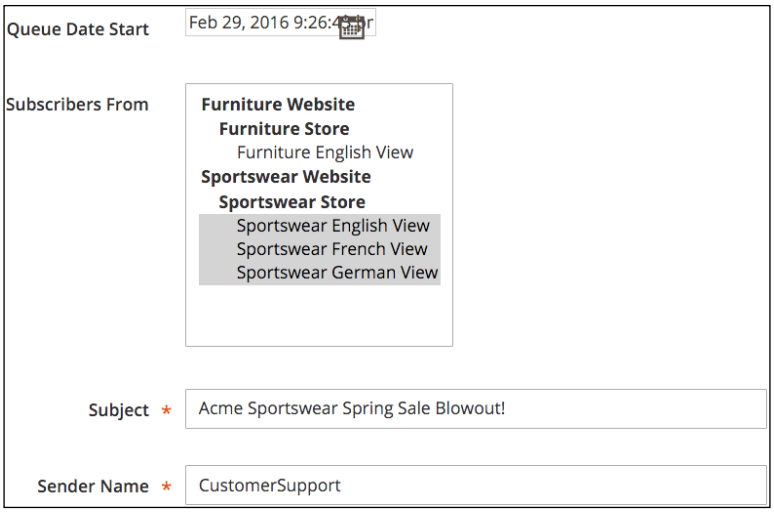


Once you've completed your template, you can click on **Preview Template** to view your newsletter as it will appear to your customers.

Scheduling your newsletter

When you're ready to schedule your newsletter to be sent, go to **Marketing | Newsletter Templates**. In the **Action** column to the right of the newsletter you wish to send, select **Queue Newsletter** in the dropdown menu. The screen will redirect to the **Queue Information** panel.

Here, you can select the date on which you wish to send your newsletter, select the store views for whose subscribers you wish to receive your newsletter, and review the contents of your newsletter.



Once you have made your selection, click on **Save Newsletter** to add it to the internal queue. Magento will send your newsletters to your chosen subscribers on the date you have selected.

To view your newsletter queue and the status of your queued newsletters, go to **Marketing** | **Newsletter Queue**.



As of writing this, there is no means of cancelling a queued newsletter. You can, however, set the **Queue Date Start** to **blank**, which will prevent it from being sent.

Checking for problems

Once your newsletter is sent, you can see how well it is sent — and check for any problems — by going to **Reports** | **Newsletter Problems Report**. If any problems are found, a report identifying each error will appear in this list.

Managing your subscribers

Under **Marketing** | **Newsletter Subscribers**, you can view all or a filtered sub-set of your newsletter subscribers. This can be helpful if you wish to see how many have come from various stores in your installation. You can also unsubscribe customers from this screen.

As with most other grid listings in Magento, you can export your subscriber list to use for other purposes.

Using sitemaps

Many websites have pages that show sitemaps — a hierarchal list of pages within a site. For our purposes, a sitemap is an XML file that resides on your server and is read by Google and other search engines to learn about your site.

If you've ever worked with Google Webmaster Tools (`https://www.google.com/webmasters/`), you're familiar with the concept of providing a sitemap URL to Google. By doing so, Google can become fully aware of the pages and products within your Magento store without having to figure it out themselves. Sitemaps are an important component of your **Search Engine Optimization** (**SEO**) efforts.

Magento 2 has a built-in sitemap functionality that you can configure to generate sitemaps for each store view within your installation.

Adding a sitemap

To create a sitemap for a store view, go to **Marketing** | **Site Map** in the Magento 2 backend. Click on **Add Sitemap**.



Magento spells it "Site Map" as two words in many places. We use the one word, sitemap as it is used by Google and others. We're not sure why Magento prefers the two-word version. Given that Magento uses the single word version in some places, it appears they're not entirely consistent.

For our first sitemap, we'll create one for our furniture store view. We only have the one English language view for that website.

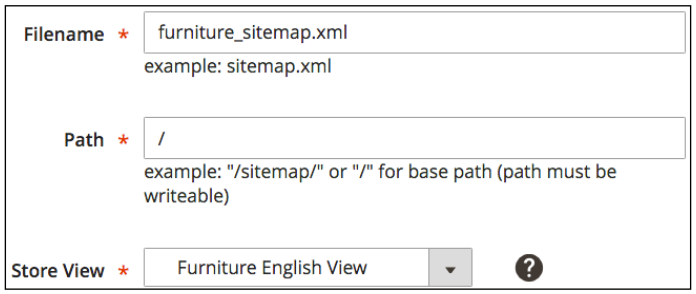
1. Enter **furniture_sitemap.xml** for **Filename**. If you only have one store view, you can simply use `sitemap.xml`. However, if you use the same file name for each store, you would not have unique sitemaps for each store view.
2. We'll enter **/** for **Path**. This places the sitemap file at the root folder of our installation. You could create a subdirectory on your installation for storing your sitemap files as well, but any directory must be writeable.



You could also create sub-folders for each of your store views and use `sitemap.xml` as the file name, such as `/furniture/sitemap.xml`, `/sportswear_en/sitemap.xml`, `/sportswear_de/sitemap.xml`.

3. Choose the applicable **Store View**.
4. Click on **Save & Generate**.

The fields mentioned above can be visualized in the following screenshot:



When Magento returns you to your list of sitemaps, you can click on the listed URL to view the actual XML file. The first part of your sitemap file may look like this:

```
<urlset xmlns="http://www.sitemaps.org/schemas/sitemap/0.9"
xmlns:content="http://www.google.com/schemas/sitemap-
content/1.0"xmlns:image="http://www.google.com/schemas/sitemap-
image/1.1">
<url>
<loc>http://acmefurniture.novusweb.com/sofas.html</loc>
<lastmod>2015-12-06T17:24:17+00:00</lastmod>
<changefreq>daily</changefreq>
<priority>0.5</priority>
</url>
<url>
<loc>http://acmefurniture.novusweb.com/sofas/couch.html</loc>
<lastmod>2015-12-30T23:09:56+00:00</lastmod>
<changefreq>daily</changefreq>
<priority>1.0</priority>
<image:image>
<image:loc>
http://acmefurniture.novusweb.com/pub/media/catalog/product/s/a/
sample-couch-red_2.jpg
</image:loc>
<image:title>Couch</image:title>
</image:image>
<PageMap xmlns="http://www.google.com/schemas/sitemap-pagemap/1.0">
<DataObject type="thumbnail">
<Attribute name="name" value="Couch"/>
<Attribute name="src" value="http://acmefurniture.novusweb.com/pub/
media/catalog/product/s/a/sample-couch-red_2.jpg"/>
</DataObject>
</PageMap>
</url>
```

This XML code is parsed by search engines to determine all the products and content of your site. You can control the frequency and importance of various sitemap elements under **Stores** | **Configuration** | **Catalog** | **XML Sitemap**.



The discussion of these elements is beyond the scope of this book. For a good explanation of indexing sitemaps, go to `https://support.google.com/webmasters/answer/156184`.

Optimizing for search engines

Search Engine Optimization, or SEO, is both important and often misunderstood. There's probably as much misinformation on the Internet about SEO as there is good, solid advice.

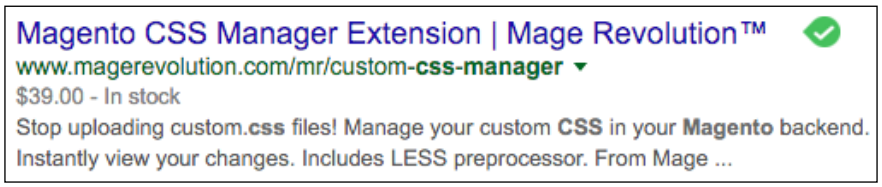
While we don't have the opportunity or space to go into great detail about SEO in this book, we can help you establish good practices that can reap great rewards in terms of increasing your search engine visibility and helping online shoppers know what you're offering.

Meta fields are data that are stored in the HTML code of a web page. Customers can't see this code, as it's not displayed by the browser, but search engines can see this data (in fact, they can see everything under the hood). Google, Bing, and others use this meta data in conjunction with many other analyzed items on your page to determine how to present your site to search users, including rank and content.

Using meta fields for search engine visibility

It begins with a basic understanding of how search engines use meta fields, particularly Google, since Google will provide you with most of your search engine referred traffic.

Take a look at this Google search result:



The title, **Magento CSS Manager Extension | Mage Revolution™** is taken from the **Title** field of the product page, unless a value is used in the **Meta Title** field of the product in Magento. If so, Google would use the **Meta Title** value instead.

The URL of the page is, of course, the actual link to the product page. As we The use of canonical URLs is important, as it gives Google one link to the product, even though, as in this case, the product is also accessible by going to `http://www.magerevolution.com/mr/magento-content-management-extensions/custom-css-manager`. Without the use of canonical URLs, Google would see this as two different pages, each with the exact same content. Google is known to penalize sites that contain duplicate content by decreasing their rank position.

Finally, the description part of the listing comes first from any existing **Meta Description** field. If none exists, Google attempts to construct a meaningful description from the content of the page. By using a **Meta Description** field, you can control how the product is described in search engines.

Meta fields in Magento

We talked about the use of **Product Fields Auto-Generation**: the use of variables to automatically construct meta values for your products. While that is certainly a fast way of populating meta fields in products, it's also important to attend to meta fields for CMS pages and categories. There may also be certain products for which you want to insert special titles and descriptions to enhance their search engine presentation.



Do not under-value the efforts you take to improve your site SEO. So much of your traffic will come from search engines. But also be aware of SEO scams and bogus offers from so-called SEO experts. If anyone says they can guarantee you first page position, they are scammers. No one can guarantee first page search results. That position comes from careful attention to your meta information, product and page content, and really knowing your customers and your products. There are no shortcuts, but there are best practices. If you do need help in managing your SEO, shop around for reputable firms. Visit SEO-related forums and groups and ask others who are successful with SEO for recommendations. Never pay anyone who simply contacts you by unsolicited email. You'll just end up wasting your money with no credible result. And finally, use someone familiar with Magento's SEO features. We've seen several sites compromised by so-called SEO "experts" who tried hard-coding SEO features.

SEO checklist

As you prepare your site for launch — and beyond launch — take time to address each important SEO feature in Magento:

- **Meta title fields**: Enter a title no longer than 50-60 characters. Any more will be truncated when displayed in search results. Including your company name is nice but not critical; the customer is looking for a specific product. Use your company name on the home page meta title and they'll find you if searching for your brand. If customers shop by SKU, include the SKU or part number in the title.
- **Meta description fields**: Describe your product in 150 characters or less. Use action verbs and strong adjectives: "Save 20% on Yoga gear today! Top quality, 100% guarantee and free shipping" or "Premium 48 inch Yoga ball. Great durability, hypoallergenic material. Guaranteed. Free shipping."



Note that descriptions may not show up in Google for some time. Therefore, avoid using time-sensitive descriptions — such as for temporary discounts and the like — or you may have upset customers expecting a discount well after it has expired!

- **Meta keywords**: Meta keywords are no longer given any ranking weight by search engines. However, it doesn't hurt to include at least the name of the product as a clue to search engines.
- **Canonical URLs**: Make sure to activate **Canonical Link Meta Tags** under **Stores** | **Configuration** | **Catalog** | **Catalog** | **Search Engine Optimization**. This will reduce any potential duplicate content penalties.
- **XML Sitemap**: Configure and activate your XML sitemap in **Stores** | **Configuration** | **Catalog** | **XML Sitemap**. Search engines use this to learn the hierarchy of your site and to make sure they visit all pages in your store. Don't forget to change **Enable Submission to Robots.txt** to **Yes**.
- **Category and product descriptions**: Don't be shy about describing your products. Use 300 words or more to really sell your product. Category descriptions can also help by informing the search engines about your categories, noting brands offered, and generally inspiring customers to carefully consider your product offerings.



Magento 2 also includes a number of SEO features, such as rich snippets. These are hidden data that provides Google et al with specific information about your products in a format that they understand. Price, availability, SKU, and more are easily read by search engines regardless of how this information is or is not presented to your customers.

Summary

As you prepare your Magento store for launch — or even if you're up and running — there's always more you can do to increase the sales productivity of your operation. It's important to continue working on your store.

In this chapter, we dove into customer groups, pricing rule promotions, newsletters, sitemaps, and Search Engine Optimization.

By mastering these features, you'll find new customers and new opportunities to sell more.

In the next chapter, we begin exploring the more technical aspects of Magento 2, by learning how to leverage its new architecture and features to customize functionality to meet your e-commerce objectives.

7
Extending Magento

One of Magento's strengths is the fact that the platform can be extended to provide additional features and functions. These **extensions**—or **add-ons**—number in the thousands. They include themes, payment gateway integrations, site management enhancements, utilities and many, many more features.

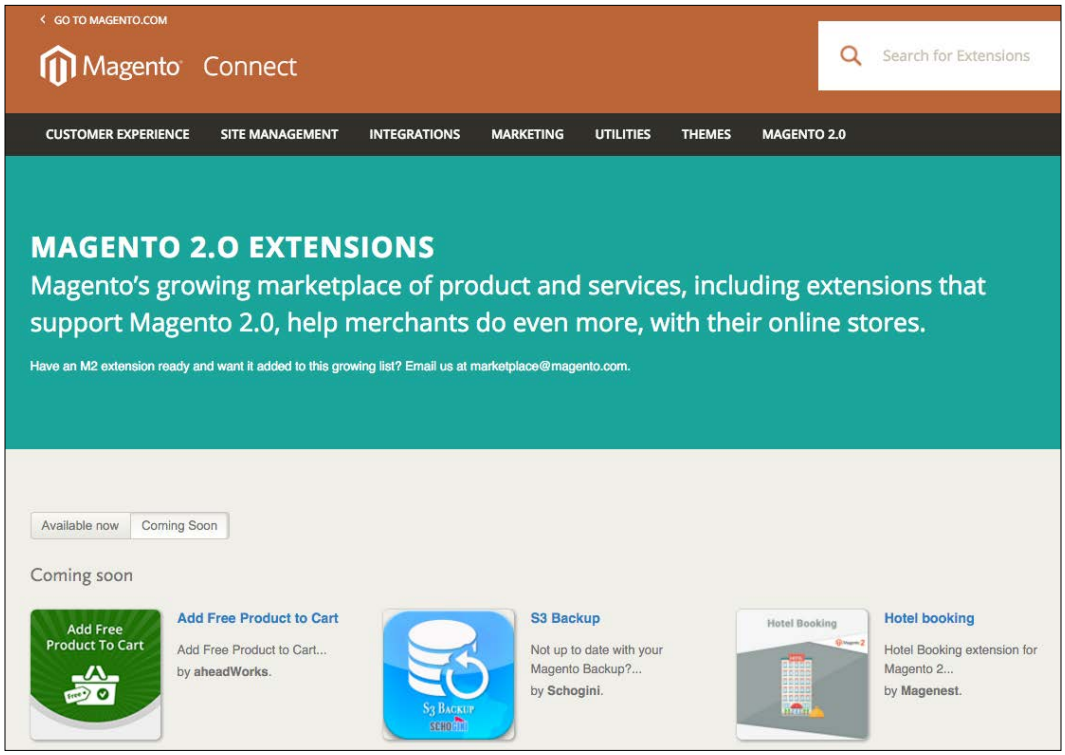
In this chapter, we will discuss the two primary ways of extending Magento:

- Extending existing Magento functionality to meet your own needs
- A quick overview of the current iteration of Magento Connect
- Creating your own Magento extensions

By learning how Magento can be enhanced, you will find that the power of Magento can be broadened to meet almost any specific e-commerce need you might imagine.

Magento Connect

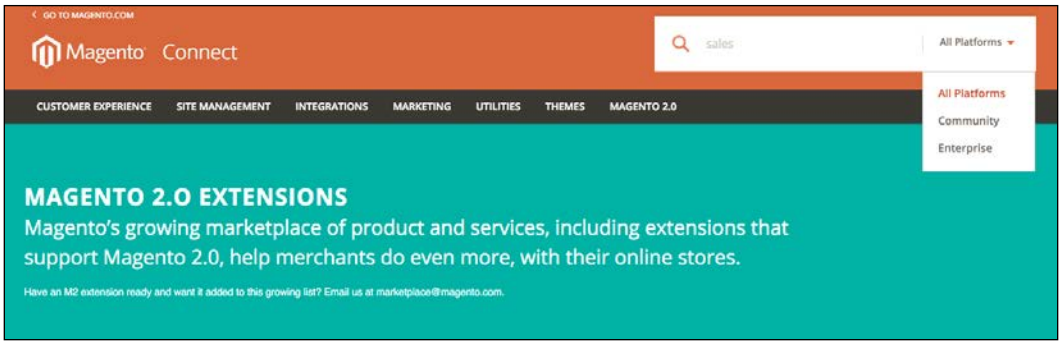
Third-party extensions that are offered to the Magento community are, for the most part, listed in a special section of the Magento website called Magento Connect (`http://www.Magentocommerce.com/Magento-connect/`):



Let's now review some of the features of Magento Connect, as they relate to researching possible add-ons for your Magento installation.

Searching Magento Connect

At the center-right of the Magento Connect home page is a search field. As with any intuitive search, simply enter in one or more keywords. You can also select the specific version – which Magento calls a platform—in the drop-down menu to the right of the keyword entry field. As shown in the following screenshot, we are searching for any extensions relating to sales:



Search field in Magento Connect

Furthermore, we can narrow our search to the specific Magento platform, such as the one on which this book is focused: Community.

The results of our search can be further refined by identifying extensions that are free versus paid, or, if paid, fall within a certain price range.

You can also browse the extensions using the categories in the top navigation bar, or the groupings listed below the search form on the main **Magento Connect** page.

Why developers create free extensions

Magento extensions take time to create, test, package and distribute. Additionally, responsible developers provide support to those who install their extensions. Considering this investment of time and effort, why would any developer offer a free extension?

- In some case, the free extension is a light, or less-featured, version of a paid extension. If you like how the light version works in your Magento installation, you might pay to get additional functionality.
- Some extension developers provide other paid extensions as well. Again, if you like how the free extension works, you might be more trusting of the developer's paid extensions. This is particularly popular among theme developers who create one or more free themes with modest features, but sell much more feature-laden themes.
- I downloaded an extension once that did exactly what it promised, but I needed it to do something slightly different. Rather than change the code myself, I hired the extension developer to create a modified version to meet my needs. I ended up paying a lot less than if I had hired a developer to create the entire extension from scratch.

- Finally, there are developers who simply like to share. Amazing as it may seem, some people actually like to contribute to the overall success of Magento. Of course, I'm being cheeky here, but in many cases a developer has created a solution for their own needs that they realize could benefit others in the world of Magento. By providing a free extension, or theme, the developer is also validating their expertise. If I need to hire a developer for a specific Magento need, I would first look to developers who have solved similar issues. For example, if I need a payment gateway extension that doesn't already exist, I would first look to those developers who have demonstrated their ability to successfully create payment gateway integrations for Magento. A free extension, therefore, becomes a portfolio piece for a developer.

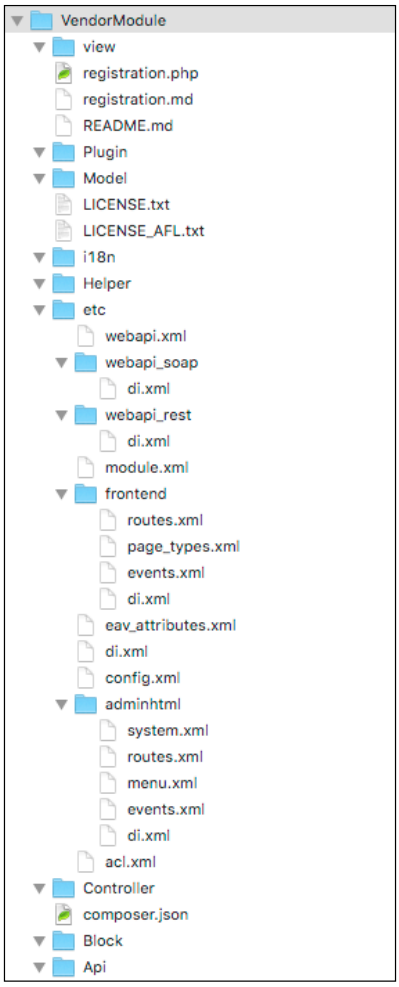


At the time of writing this, the Magento Connect site for 2.0 was still evolving, and there were no protocols available for uploading extensions to the Connect marketplace. In its current iteration, the Connect site is a module catalog that directs the user to different developer websites. For the latest information on submitting extensions, go to `http://www.magentocommerce.com/magento-connect/create_your_extension`. The packaging process here is still specific to 1.0 extensions, but will be updated with information when Magento Connect for 2.0 comes online.

The new Magento module architecture

Much like Magento 1.0, Magento 2 is divided into modules. These modules are meant to encapsulate functionality related to a certain business feature. The framework provides organization for these modules, which can be found in the `app/code` directory with the following convention: `app/code/(vendor)/(modulename)`.

Under the `(modulename)` directory, there are a series of nested directories that contain the blocks, helpers, controllers, and models that make up a module. The hierarchy looks like this:



Module architecture with nested directories

The following is a brief description of these directories and the programmatic roles of the files they contain:

- `Block/`: This directory has PHP classes that contain logic to manage the view template. Blocks, therefore, are fundamentally related to display logic and are key to managing this logic.
- `Controller/`: This directory contains controllers for the module. A controller is responsible for routing requests in Magento, and handles requests by defining actions in controller class methods. These methods collect relevant data, and prepare and render the view.

- `etc/`: The `etc/` directory contains files related to Magento configuration. For example, the `module.xml` file, a required file, contains information about the module version number and name.
- `Model/`: This directory has files that provide logic related to the model. The model provides abstraction for managing data from the relational database underlying Magento. Class methods here will allow you to perform **CRUD** (create read update, and delete) operations without the use of SQL (Structured Query Language), by providing an interstitial layer that generates SQL as a result of method invocation.
- `Setup/`: This directory contains classes for the setup of a new database structure and the data it needs to contain. This code is invoked when the module is installed.
- `Api/`: The `Api/` directory contains module classes that are exposed to the Magento API, making them available to API calls.
- `I18n/`: This directory contains module language files used for localization.
- `Plugin/`: This directory contains plugins that can be used to extend the functionality of any public method in a `Magento` class. We'll discuss this directory in greater detail in the section immediately following this one.
- `view/`: This directory contains view files, including static templates, design templates, and layout files. We have discussed the contents of this directory and theming in general in greater detail in *Chapter 3*, *Designs and Themes*.

Extending Magento functionality with Magento plugins

We'll review a simple example of extending Magento functionality to give you an idea of what's involved and get you on your way. Magento 2.0 has introduced the concept of plugins that rely on dependency injection. While it's tempting to think of a plugin as interchangeable with extension or module, a plugin actually plays a significantly different role. It listens to any public method call on another object. As long as the class or method doesn't use the `final` keyword, any class and any public method is fair game, including methods in your classes, third-party classes and Magento classes. That's pretty impressive!

Start by declaring the plugin in the `di.xml` file, in the `app/code/(vendor)/(modulename)/Plugins/` path, with the following XML code:

```
<config>
    <type name="ObservedType">
        <plugin name="pluginName" type="PluginClassName" sortOrder="1"
```

```
disabled="false"/>
    </type>
</config>
```

In this example, the `type name` is the class being observed. This is the class with methods we're trying to extend. The `plugin name` is an arbitrary name you provide to the plugin, and the type is the name of the plugin's class in the `\Vendor\Module\Model\class\Plugin` format.

This is the class where we'll be defining the custom functionality that extends the method established in the type node.

The sort order attribute in the preceding XML allows for even greater flexibility. Multiple plugins can call the same method, and this field determines the order in which they are run.

The disabled attribute is pretty straightforward. It simply determines whether or not the plugin is active.

Once we've got the `di.xml` file in place, our next step is to create the class that's going to extend the original method in the `\Vendor\Module\Model\class\Plugin.php` file. Once it's there, we can choose to extend functionality before, after, and around the original method. So, say you wanted to execute some code, such as logging some data or firing off a call to a third-party API before the result of another public method; the following code would do this before the method was called:

```
<?php

namespace My\Module\{class};

class classPlugin
{
    public function beforeGetName(\Magento\Catalog\Model\Product
$subject, $variable)
    {
        //execute code here
    }
}
?>
```

Now, say you wanted to insert some arbitrary code after the original public method. It would simply look like the following code snippet. Note that `before` has been replaced with `after`. So the naming convention involves the original method name with `before`, `after`, or `around` as a prefix:

```
<?php

namespace My\Module\class;

class classPlugin
{
    public function afterGetName(\Magento\Catalog\Model\Product
$subject,$variable)
    {
        //execute code here
    }
}
?>
```

In the final example, code can be executed before and after the target method, as follows:

```
namespace My\Module\class;

class classPlugin
{
    public function afterGetName(\Magento\Catalog\Model\Product
$subject,$proceed)
    {
       //execute code before original method here.
     $result = $proceed();
     //execute code after original method here.
    return true;
    }
}
?>
```

The special sauce here is in the `$proceed` parameter passed in, which allows delineation between code to be executed before and after a target method.

Building your own extensions

If you're a strong PHP developer, you may find it beneficial to create your own Magento enhancements. In fact, if you've been working with Magento for any length of time, you've no doubt had cause to tweak the code, even perhaps adding new functionality. For those with experience in MVC object-oriented programming, building new functionality for Magento can be quite rewarding.

If you do plan to create an extension you would like to share with other Magento developers, whether for free or profit, you should know about certain guidelines and resources that can help you create an extension which will be well-received by the Magento community.

Whether others have gone before

If you can't find an extension for Magento to meet your needs, and you think you want to do your own enhancements, take a moment to do some online searching first. One of the first places I look is the Magento documentation (`https://magento.com/help/documentation`). At the time of writing this, the Magento documentation has been rewritten for Magento 2.0 and is a fantastic source for understanding how extensions work in Magento. Additionally, for a deep dive into Magento functionality, the writings of Alan Storm are without parallel. You can find his articles on Magento 2 here: `http://alanstorm.com/category/magento-2`. The articles there are quite technical, but remarkably readable and laced with humorous nuggets.

You can also search on Google for possible solutions for your issue. There are numerous blogs where developers freely share some significant solutions. One of my favorites is the Inchoo blog (`http://inchoo.net/blog/`). These Magento experts have tackled some very interesting challenges with some quite elegant solutions. I also post solutions and tweaks on our website (`http://www.novusweb.com`).

Therefore, before you dive into your own modifications, check around. Why start from scratch if others have already done most of the work for you?

Your extension files

For your new extension to work, it must be placed correctly within the Magento file hierarchy. We've reviewed the entire hierarchy at the top of the chapter, but for the purposes of this example, we'll only be touching on the subset of those files and directories necessary to stub out a basic module. We've broken this into a series of steps, grouped functionally, to make it a bit more digestible.

Step one

The first thing we'll need to do is create a `module.xml` and register the module. This is actually pretty straightforward in comparison to a lot of what we've been reviewing. You'll place the `module.xml` file in the `app\code\{vendor}\{module_name}\etc\` folder and edit it, adding the following content:

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNa
mespaceSchemaLocation="../../../../../lib/internal/Magento/Framework/
Module/etc/module.xsd">
    <module name="{module_name}" setup_version="1.0.0">
    </module>
</config>
```

Next, in the root directory of the module `{vendor}\{module_name}\`, create a file named `register.php` with the following content:

```
<?php
\Magento\Framework\Component\ComponentRegistrar::register(
    \Magento\Framework\Component\ComponentRegistrar::MODULE,
    '{vendor}_{module}',
    __DIR__
);
```



The inclusion of `register.php` is a new step in Magento 2.0, and it's required. I was surprised when reviewing a series of themes and modules to find it frequently left out. If you're having problems with a theme or module, this is a good first place to check. If you leave it out, you won't be able to activate the module.

Step two

The second thing we'll need to do is create a frontend router. Add the following text to `etc/frontend/routes.xml` in your module:

```
<?xml version="1.0"?>
<config xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:
noNamespaceSchemaLocation="../../../../../../lib/internal/Magento/
Framework/App/etc/routes.xsd">
    <router id="standard">
        <route id="{module}" frontName="{module_name}">
            <module name="{vendor}_{module_name}" />
        </route>
    </router>
</config>
```

It's beyond the scope of this book to pick apart and discuss the constituent parts of this XML, but if you're curious about the details, the resources alluded to earlier in this chapter (especially Alan Storm's series of articles) are an excellent place to go for detail.

Step three

The third thing we'll need to do is create a controller action. Start by creating an `index.php` file in `app\code\{vendor}\{module_name}\Controller\Index\` with the following content:

```
<?php
namespace {vendor}\{module}\Controller\Index;

class Index extends \Magento\Framework\App\Action\Action {
protected $resultPageFactory;
public function __construct(\Magento\Framework\App\Action\Context
$context,
        \Magento\Framework\View\Result\PageFactory $resultPageFactory)
{
        $this->resultPageFactory = $resultPageFactory;
        parent::__construct($context);
    }

public function execute()
    {
      $resultPage = $this->resultPageFactory->create();
      $resultPage->getConfig()->getTitle()->prepend(__('vendor
examplemodule'));
      return $resultPage;
    }
}
```

Every action extends the core Magento action class, and always has an `execute()` method, which is executed when the action is invoked. It's also important to note how this impacts the URL. The `frontname` specified in the router is the first part of the URL, the `controller` folder the second part, and the name of the file containing the controller code, the third part.

Again, there's more fun detail here, but for the purposes of this rudimentary example, we don't want to get bogged down breaking this down into too much detail.

Step four

The fourth thing we'll need to do is create a layout file. You'll add this file in the `app\code\{vendor}\{module}\View\frontend\layout\` directory using the name `default.xml`.

The contents should look like this:

```
<?xml version="1.0"?>
<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
layout="1column" xsi:noNamespaceSchemaLocation="urn:magento:framework:
View/Layout/etc/page_configuration.xsd">
  <body>
    <referenceContainer name="content">
      <block class="{vendor}\{module}\Block\{module}.php"
name="{vendor}_{module}" template="arbitrary_template_name.phtml">
      </block>
    </referenceContainer>
  </body>
</page>
```

Step five

The fifth thing we'll need to do is create a block for our module. Once this is done, we can create a template file and activate the module. The block will be intuitively added to `app\code\{vendor}\{module}\Block\{module}.php` and contain the following content:

```
<?php
namespace {vendor}\{module_name}\Block;
class {module_name} extends \Magento\Framework\View\Element\Template
{
  public function _prepareLayout()
  {
    return parent::_prepareLayout();
  }
}
```

For the template, we'll just add valid HTML content to the `app\code\{vendor}\{module}\View\frontend\layout\ arbitrary_template_name.phtml` file, as follows:

```
<h1> This is text from the arbitrary_template_name.phtml template
file. Maybe add some CSS? </h1>
```

Step six

Activate the module. This is most easily done by editing the `app\etc\config.php` file and adding an entry for your module here:

```
143     'Magento_Sitemap' => 1,
144     'Magento_Solr' => 1,
145     'Magento_WishlistSampleData' => 1,
146     'Magento_Support' => 1,
147     'Magento_Swagger' => 1,
148     'Magento_Swatches' => 1,
149     'Magento_SwatchesSampleData' => 1,
150     'Magento_GoogleTagManager' => 1,
151     'Magento_TargetRuleSampleData' => 1,
152     'Magento_ProductLinksSampleData' => 1,
153     'Magento_TaxImportExport' => 1,
154     'Magento_TaxSampleData' => 1,
155     'Magento_ReviewSampleData' => 1,
156     'Magento_CmsSampleData' => 1,
157     'Magento_Translation' => 1,
158     'Magento_Shipping' => 1,
159     'Magento_Ups' => 1,
160     'Magento_UrlRewrite' => 1,
161     'Magento_SalesRuleSampleData' => 1,
162     'Magento_Usps' => 1,
163     'Magento_Variable' => 1,
164     'Magento_Version' => 1,
165     'Magento_BannerCustomerSegment' => 1,
166     'Magento_VisualMerchandiser' => 1,
167     'Magento_Webapi' => 1,
168     'Magento_CatalogPermissions' => 1,
169     'Magento_SalesSampleData' => 1,
170     'Magento_CatalogWidget' => 1,
171     'Magento_WidgetSampleData' => 1,
172     'Magento_GiftRegistrySampleData' => 1,
173     'Magento_MultipleWishlistSampleData' => 1,
174     'Magento_Worldpay' => 1,
175     'Vendor_ExampleModule' => 1,
176   ),
177 );
```

There's another way to activate the module as well. If you have access to the command line, and are comfortable with its use, you can simply invoke the Magento binary to activate the module, by running the following command from the document root of your website:

```
bin/magento setup:upgrade
```

You should see output similar, but not identical, to the following screenshot:

```
[ec2-user@ip-172-30-0-146 m2ee.praxisis.com]$ bin/magento setup:upgrade
Cache cleared successfully
File system cleanup:
/var/www/html/m2ee.praxisis.com/var/generation/Composer
/var/www/html/m2ee.praxisis.com/var/generation/Jonathanbownds
/var/www/html/m2ee.praxisis.com/var/generation/Magento
/var/www/html/m2ee.praxisis.com/var/generation/Pulsestorm
/var/www/html/m2ee.praxisis.com/var/generation/Symfony
/var/www/html/m2ee.praxisis.com/var/generation/Vendor
The directory '/var/www/html/m2ee.praxisis.com/var/di/' doesn't exist - skipping cleanup
Updating modules:
```

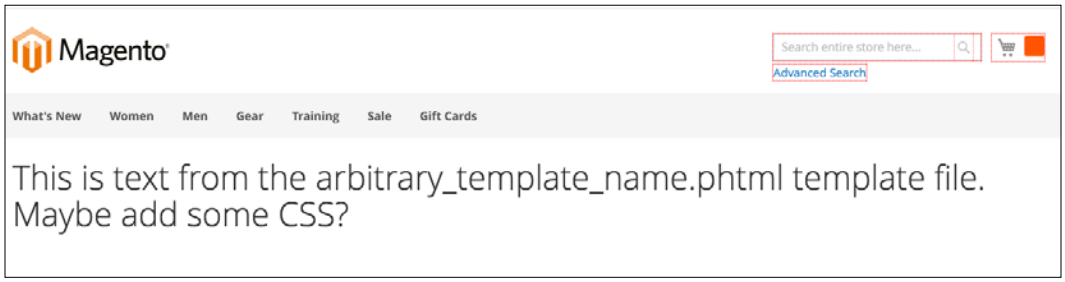
Once the module is active, clear the system cache using the following command:

```
bin/magento cache:clean
```

The cleared cache types will be displayed:

```
[ec2-user@ip-172-30-0-146 m2ee.praxisis.com]$ bin/magento cache:clean
Cleaned cache types:
config
layout
block_html
collections
reflection
db_ddl
eav
full_page
config_integration
config_integration_api
target_rule
translate
config_webservice
```

After the cache has been cleared, you can view the result of your labor. Remember, the `frontname` defined in the `route.xml` defines the first part of the URL, and the second and third are defined by the `controller` folder and the PHP file. In the example reviewed above, this URL would be `http://magentostore/{module_name}/index/index/`. Depending on what HTML you've put in your sample template, you should see a result that looks something like the following screenshot:



Summary

Almost every week, I search Magento Connect just to see what new features and themes are being added. The creativity of the Magento developer community can be quite impressive.

One of the great joys of working with Magento is knowing that it is fully extendable in many ways, from simple theme enhancements, to full-fledged functionality changes. Depending on your own skills and talents, you may want to take solutions you've created and let others benefit, either as free contributions or money-making add-ons.

In this chapter, we have covered searching, evaluating, and installing Magento Connect extensions, the process of extending existing Magento functionality using plugins, and creating and registering your own extension from scratch.

Of course, we have a couple more interesting areas to cover in *Chapters 8*, *Optimizing Magento*, and *Chapter 9*, *Advanced Techniques*, which will further help you extend the power of Magento.

8
Optimizing Magento

As you've no doubt realized by now, Magento 2 is a very powerful e-commerce platform. From its robust product management suite to its virtually unlimited extendability, Magento packs a lot into one open source platform.

From our work within its files, we have learned that Magento combines a great number of separate files and data tables to present any page to online visitors. By its very nature, the MVC architecture of Magento puts a good deal of overhead on any web server. In the beginning, the complexity of Magento discouraged some developers because of the demands the platform placed on hosting servers.

However, over time Magento's developers have worked hard to improve overall performance, and Magento 2 represents a milestone in that regard. Magento 2 is indeed faster than before, even when taking faster servers into account.

That said, for Magento to perform at the highest levels of performance, there are areas with which you should become familiar. Specifically:

- The Magento EAV methodology
- Indexing and caching
- Server tuning configurations

After all, a faster website improves the customer's experience and helps improve your rankings with search engines.

Exploring the EAV

Most databases for open source platforms are quite simple in comparison to Magento's. For instance, in the past, when one designed e-commerce systems from scratch, it was likely that a simple relational model would suffice: one table for products that would contain all the key information relating to that product, such as price, available quantity, description, weight, and so on. The challenge with this traditional approach was that if we needed to add a new product attribute, such as height, that field would have to be added to the product table, thereby making previous versions incompatible and complicating any upgrade path.

In order for Magento to be a truly scalable platform, its developers utilize an **Entity**, **Attribute and Value** (**EAV**), or **Sparse Matrix,** architecture. This database structure adds a great deal of complexity to the Magento data model to be sure, but its advantage is its ability to allow an unlimited number of attributes to be added to any core item, such as products, categories, customers, addresses, and more. Today's Magento installs an initial 296 data tables, many of which are related to EAV.

EAV allows developers (and you) the ability to extend any entity's attributes without changing any of the data tables. Let's break down EAV to understand how this works.



As you go through this chapter, you may want to take an actual look at the tables of your Magento installation. With most hosting providers, you are provided **phpAdmin** as a tool for exploring and manipulating your database. If not, you can use any number of available tools, including the free *MySQL Workbench* (`http://www.mysql.com/products/workbench/`). See your hosting provider for information on how to directly access your database.

Entity

Products, categories, customers, customer addresses, ratings, and reviews are all entities in the Magento data scheme. Each entity has its own entity record in one of the following tables:

- `catalog_product_entity`
- `catalog_category_entity`
- `customer_entity`

- `customer_address_entity`
- `rating_entity`
- `review_entity`
- `eav_entity` (stores product attribute entities)

Each of these entity tables stores very basic information about the entity. For instance, let's take a look at the columns of the `catalog_product_entity` table:

- `entity_id`
- `entity_type_id`
- `attribute_set_id`
- `type_id`
- `sku`
- `has_options`
- `required_options`
- `created_at`
- `updated_at`

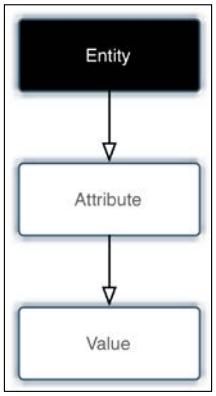
These are the only columns required to define any product in the database. Notice that the name, description, and price of the product are not included in this table.

Attribute

Attributes are the names of various items that belong to an entity. For instance, a product has attributes of price, description, and quantity. Attribute tables don't store the actual value of the item, only its name and its relationship to the entity. That's where value comes in.

Value

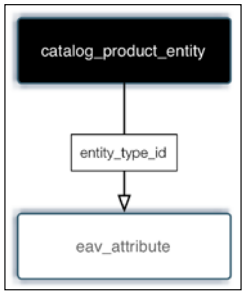
If you're following the bouncing ball so far, you now can surmise that value is the actual data of the attribute. So, if we use a simple graphic such as shown in the following figure, we can visualize the entire EAV relationship.



Putting it all together

Let's look at how this works in practice for a product. The product entity is stored in the `catalog_product_entity` table, as described before. To bring together all the information related to a product, we have to pull in all the various attributes (and their values) connected to the product.

To do that, we look into the `eav_attribute` table. This table connects all attributes to their respective entities. One column in this table is called `entity_type_id`. This column relates to the `entity_type_id` column in the `catalog_product_entity` table, as shown in the following figure:

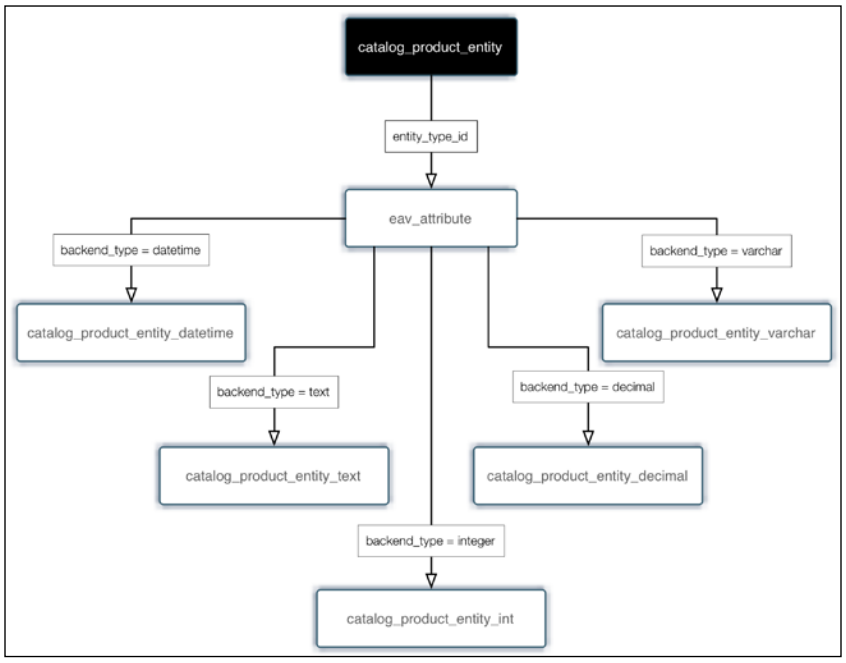


Once the associated attribute for an entity (in this example, a product) is determined, Magento next works to associate the actual value for the attribute. Here's where it gets a bit complicated, but fun!

For each attribute, Magento stores a type for the associated value. In other words, is the value a decimal value (such as price), a text value (for example, description), and so on. These are stored in the `eav_attribute` table in a column named `backend_type`. For each type, Magento has a corresponding table whose name ends in the particular type. The following are the value tables for product entities:

- `catalog_product_entity_datetime`
- `catalog_product_entity_decimal`
- `catalog_product_entity_int`
- `catalog_product_entity_text`
- `catalog_product_entity_varchar`

If a lookup of a product's attribute shows a type of decimal, then the associated value would be found in the `catalog_product_entity_decimal` table. The following figure illustrates this basic relationship:



If you take a look at the Magento data tables, you'll now begin to understand the relationship between various entities, attributes, and values.

The good and bad of EAV

EAV is a key feature of Magento that allows developers to extend the platform without changing its core data structure. Imagine that you want to add new functionality that depends on a new product attribute - you could simply add that attribute into the system without adding a single new column to any table!

Unfortunately, there is a trade-off: performance. As you can see, in order to pull in all the information for a product — such as for a product detail page — Magento has to do a lot of calls to a lot of tables within the database. These lookups take time and server resources.

Fortunately, Magento's developers are still a step ahead of us.

Making it flat

Long ago, developers realized that while EAV was a cool way to build extendability into Magento, it added a major hit in performance. All the lookups, particularly for busy sites, can really slow down response times. MySQL, the database used for Magento, is a single-threaded database, meaning it can only handle one operation at a time.

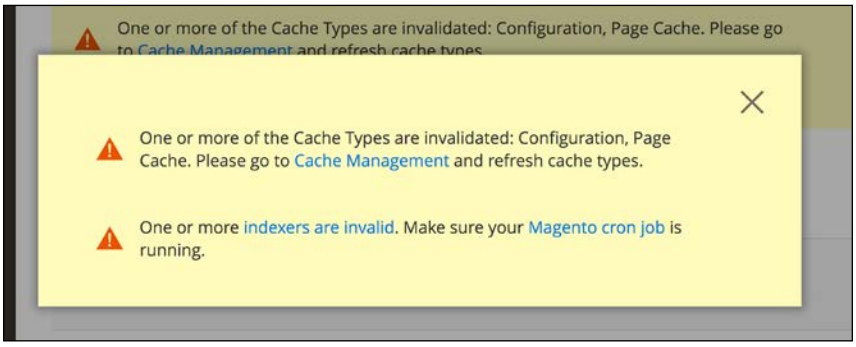
The solution was to take all the various relationships and pre-compile them into other tables. In essence, Magento could do its lookups using fewer tables (and therefore fewer SQL statements) in order to get the same data.

If you look again at the data tables, you'll see a number of tables with index or flat in the name. These tables combine the EAV relationships into one table.

In order to take advantage of this feature for categories and products (sales orders are automatically flattened):

1. Log into your Magento backend.
2. Go to **Stores** | **Configuration** | **Catalog**.
3. Click to expand **Storefront**.
4. Select **Yes** for both **Use Flat Catalog Category** and **Use Flat Catalog Product**.
5. Click on **Save Config**.

After saving, you should get a notice at the top of your Admin page, like the following screenshot:



One of the things you will have to do as you add or update products and categories is to reindex your site. We'll discuss indexing in more depth in the next section.

Indexing and caching

Today's search engines have started measuring rendering times — the time it takes for a web page to download, including graphics and other files — as part of their ranking algorithms. In the past, we used to concentrate on download speed because so many users were connected to the Internet with slow, dial-up connections. With the proliferation of broadband speeds, most developers eased up on this goal, opting to include more flash animations, larger graphics, and complex JavaScripts. Now, we're moving back to the beginning in order to satisfy Google, Yahoo!, and Bing.

With Magento's complex MVC architecture and database structure, you can have the most efficient front-end design possible, yet still experience very slow download speeds as Magento works to build the pages and query the database. Therefore, to create a site with the lowest download speed, we need to take advantage of two important tools: indexing and caching. Each contributes its own benefit to your goal of speeding up the page generation process.

Indexing

As your Magento installation grows with products, customers, and orders, database lookups can become slower as the MySQL database has to look among a greater number of records to find the ones it needs. Magento uses a number of indexing tables which provide faster lookups by pre-organizing the data records. However, as your site grows, so do these index tables.

In our discussion on EAV, we talked about flattening the categories and products. In essence, when Magento is asked to index categories and products, it pulls in all the various related EAV data for each and creates records in special tables that contain all the related data in one record. In other words, instead of doing lookups among as many as 50 tables to display all the information on a product, Magento looks to only a handful of tables, thereby gathering the necessary information more quickly.

Flat or no flat

The speed difference when using a flat catalog versus a non-flat catalog is unnoticeable for low-traffic sites, as MySQL can adequately handle requests very, very well. However, as your site grows in traffic, you will notice a wider speed differential. Additionally, if your store hosts thousands of products, you'll certainly appreciate the added speed a flat catalog will give your site.

The trade-off is that reindexing a site with lots of products and/or categories can take a long time if you choose to use a flat catalog. For that reason, we generally keep the flattening feature turned off when we populate a new site with products. However, once we go live, we almost always turn on the flat feature to give our sites the fastest possible rendering possible, even if the initial site traffic is low.

Reindexing

As we saw in the previous figure, if you make changes to your site, Magento will notify you that you need to reindex your site. To do this, you need to perform the following steps:

1. Go to **System** | **Index Management** in your Magento backend.
2. Select the indexes that say **REINDEX REQUIRED**.
3. Select **Reindex Data** in the dropdown menu at the top right of the screen.
4. Click on **Submit**.

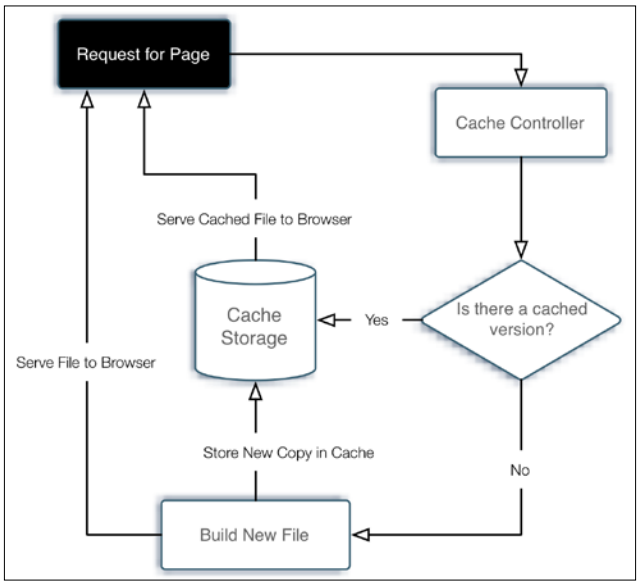
Once completed, you will see these indexes with a status of **READY**.

Caching

While indexing can help speed up database lookups by pre-organizing the data for faster lookups, caching does virtually the same thing for the HTML page components that make up the front-end experience. Caching stores completed pages or parts of pages so that website visitors will be provided with faster downloads.

In a nutshell, caching works like this (see the following chart, also):

1. Site visitor requests a page from your site.
2. Magento first checks to see if the request can already be fulfilled from a cached file.
3. If no cached file exists, or if the cached data is deemed to be old, Magento rebuilds the actual file.
4. Magento stores a new copy of the file in the cache.
5. Then, the file is sent to the visitor's browser.



Caching in Magento is accomplished in a couple of ways: with core components, such as modules and layouts, and through whole page caching, which stores entire page outputs.

Core caching

Every time a page is accessed by a visitor, various modules, layouts, product images, and more are cached or stored for easy retrieval within the `/var/cache` directory of your Magento installation. If you explore this directory on your server, you'll see thousands of files with strange names. These are the actual pieces of cached data that are delivered to visitors to your site.

Full page cache

Whole page caching is just as the name implies: the caching of an entire web page. Imagine the speed boost if Magento did not have to build a new page by assembling dozens of layout and module components, cached or otherwise!

The impact of caching

I've run some tests of sites with and without caching turned on. In almost all of our tests, caching improved download speeds by approximately 25%-40%, depending on the overall load on the server. The heavier the load, the more the benefit since the server is naturally slower in building new pages versus serving cached pages.

This increase in speed, while perhaps not as noticeable to your site visitors, can have a huge impact on how search engines rank your site.

Managing caching

While caching does help speed up page delivery, it does take a bit of management on your part. Caching is controllable in two areas of your backend:

1. Go to **Store** | **Configuration** | **System**.
2. Expand the **External Full Page Cache Settings**.
3. Select **Yes** for **Enable External Cache**.
4. Click on **Save Config**.

Then, you need to set your core cache settings:

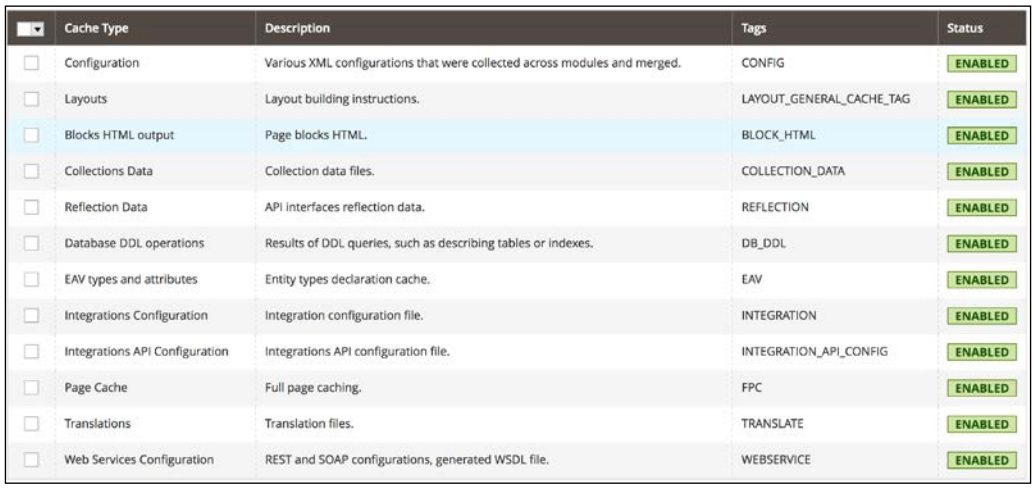
1. Go to **System** | **Cache Management**.
2. Click **Select All** over the first column.
3. Select **Enable** in the upper right menu.
4. Click on **Submit**.



Unfortunately, some extensions are not properly designed to participate in Magento's caching system. If you experience problems in how certain content blocks are rendered, you may want to leave the **Blocks HTML output** cache disabled. While this prevents content blocks from being cached, it may be your best remedy if you have a third-party extension which you're really fond of.

Caching in Magento 2 – not just FPC

Magento 2 has included a variety of new areas to the caching engine, as can be seen from the following screenshot:



Cache Type	Description	Tags	Status
Configuration	Various XML configurations that were collected across modules and merged.	CONFIG	ENABLED
Layouts	Layout building instructions.	LAYOUT_GENERAL_CACHE_TAG	ENABLED
Blocks HTML output	Page blocks HTML.	BLOCK_HTML	ENABLED
Collections Data	Collection data files.	COLLECTION_DATA	ENABLED
Reflection Data	API interfaces reflection data.	REFLECTION	ENABLED
Database DDL operations	Results of DDL queries, such as describing tables or indexes.	DB_DDL	ENABLED
EAV types and attributes	Entity types declaration cache.	EAV	ENABLED
Integrations Configuration	Integration configuration file.	INTEGRATION	ENABLED
Integrations API Configuration	Integrations API configuration file.	INTEGRATION_API_CONFIG	ENABLED
Page Cache	Full page caching.	FPC	ENABLED
Translations	Translation files.	TRANSLATE	ENABLED
Web Services Configuration	REST and SOAP configurations, generated WSDL file.	WEBSERVICE	ENABLED

This is great for performance but also good to keep in mind when making changes to the site. Translation changes not showing up? You probably need to clear the cached translation files to fix this. As a rule of thumb, clearing the cache is a good first step when troubleshooting Magento.

Tuning your server for speed

Everyone we talk to who works with Magento is concerned about speed. As we've noted earlier, Magento's complex architecture is simultaneously good and bad. The level of functionality and extendability is practically unparalleled in the world of open source platforms, yet even with proper use of indexing and caching, substantial site traffic can make your Magento site feel like a tortoise on sedatives.

The problem lies, in part, in the fact that developers assume that open source is analogous to quick and easy. The fault is not Magento's: it is what is it — a powerful, yet complex, e-commerce platform.

Therefore, if you want to use Magento to its fullest, it's your responsibility to make sure you have the resources and tools to capitalize on its power. In *Chapter 1*, *Planning for Magento*, we discussed technical requirements for running a Magento installation. Now, let's discuss some ways of increasing its speed and performance.



Travel with Caution

You'll find an almost endless supply of online blogs, wikis, and postings relating to the optimization of Magento. Some offer quick tweaks; others go into elaborate schemas. The challenge when looking for any type of fix is knowing what is sound practice and what may be out-dated, or simply wrong. The following suggestions are based on what I have found are both within the reach of most developers and that work for the sites we develop and manage. That said, any time you find something you want to try, try it on a test server or your local computer first. Never apply these modifications to a live, production Magento installation.

Deflation

Apache web servers have a module called `mod_deflate`. This module, when called by a website, serves to compress files sent by the server. To engage this module, insert the following code into the `.htaccess` file located in the root directory of your Magento installation, replacing what is currently there for the `mod_deflate` directive:

```
<IfModule mod_deflate.c>
##############################################
## enable apache served files compression
## http://developer.yahoo.com/performance/rules.html#gzip

# Insert filter
SetOutputFilter DEFLATE
# Netscape 4.x has some problems...
BrowserMatch ^Mozilla/4 gzip-only-text/html
# Netscape 4.06-4.08 have some more problems
BrowserMatch ^Mozilla/4\.0[678] no-gzip
# MSIE masquerades as Netscape, but it is fine
BrowserMatch \bMSIE !no-gzip !gzip-only-text/html
# Don't compress images
SetEnvIfNoCase Request_URI \.(?:gif|jpe?g|png)$ no-gzip dont-vary
# Make sure proxies don't deliver the wrong content
Header append Vary User-Agent env=!dont-vary

</IfModule >
```

Using BrowserMob (`http://www.browsermob.com`) as our testing source, a configurable product page on our test site (the one we built to use for writing this book) was reduced in size from 452 KB to 124KB, a 73% reduction in the amount of data delivered!

Enabling expires

Another Apache module, `mod_expires`, controls how browser caches should treat files they store on users' computers. When you visit a website, your browser caches the results. For files that have not changed since a previous visit, the browser will use the file in the cache on the local computer rather than pull it again from the web server.

The expiration of these cached files can be controlled by your web server. If your server provides no expiration instructions, then your site visitor's browser may assume that the cached information is not good (or is still good long after it is) and fail to pull the best information from your site.

Insert the following within the `<IfModule mod_expires.c>` directive in your root `.htaccess` file:

```
ExpiresActive On
ExpiresDefault "access plus 1 month"
```

You can also use a shorter period of time, but generally, you want to allow browsers to use unchanged, cached files for quite a while, thereby lessening the load on your server.

Increasing PHP memory

This is one of the more difficult items to change if you're hosting on a shared account, as many hosting providers will not allow you to increase the amount of memory allocated to PHP. The normal default of 64 MB may be sufficient, but if you're expecting a high volume of users, increasing this to 256 MB has produced noticeable improvements for us.

To increase this in your `.htaccess` file, simply place a hash mark (#) before `php_value memory_limit 64M` and remove the hash mark before `php_value memory_limit 256M`.

Increasing the MySQL cache

This is one configuration you may have trouble implementing as it involves changing a couple of core variables for MySQL. When we started looking more closely at ways of speeding up database lookups, we found that with our hosting provider, MySQL was configured to do lookups without a cache: the `query cache` and `query cache limit` were both set to zero.

By doing some research, we found that MySQL queries could be made faster by increasing the total size of the `query cache` and the `query cache limit` allowed for any one query. Other developers who had experimented with this suggested at least a limit of 1 MB for the individual query and a total limit of 64 MB would handle most initial, growing Magento stores. As your store grows, you may want to increase these limits to allow MySQL to take advantage of its own internal caching mechanism.

If you do have the ability to modify your MySQL database — or if you can request a modification with your hosting provider — you should set the `query_cache_limit` and the `query_cache_size` to amounts such as the ones given above.



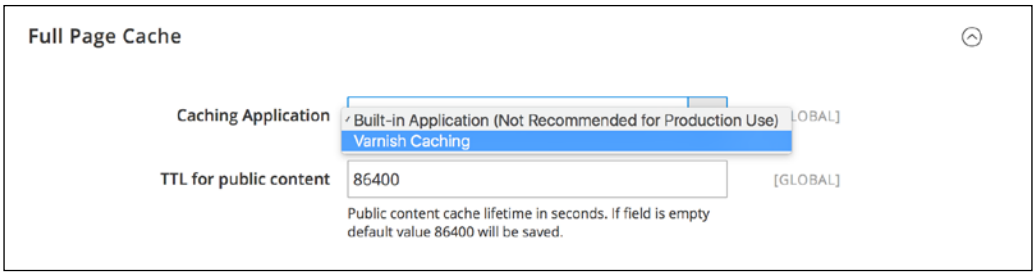
For specific information on how to set these in MySQL, see `http://dev.mysql.com/doc/refman/5.0/en/query-cache-configuration.html`.

Using the Nginx server

Nginx is an alternative to Apache when running Magento. Significant performance improvement out of the box is driving quite a bit of this adoption, and a large number of vendors have made the switch from Apache to Nginx. In recognition of this, Magento 2 has been built with full support for Nginx. It's beyond the scope of this chapter to discuss Nginx configuration, but a vast majority of hosting providers will install Nginx for you to use. Magento 2 also has a suggested Nginx configuration file in the root folder, which can be seen via GitHub as well, here: `https://github.com/magento/magento2/blob/develop/nginx.conf.sample`.

Using Varnish cache

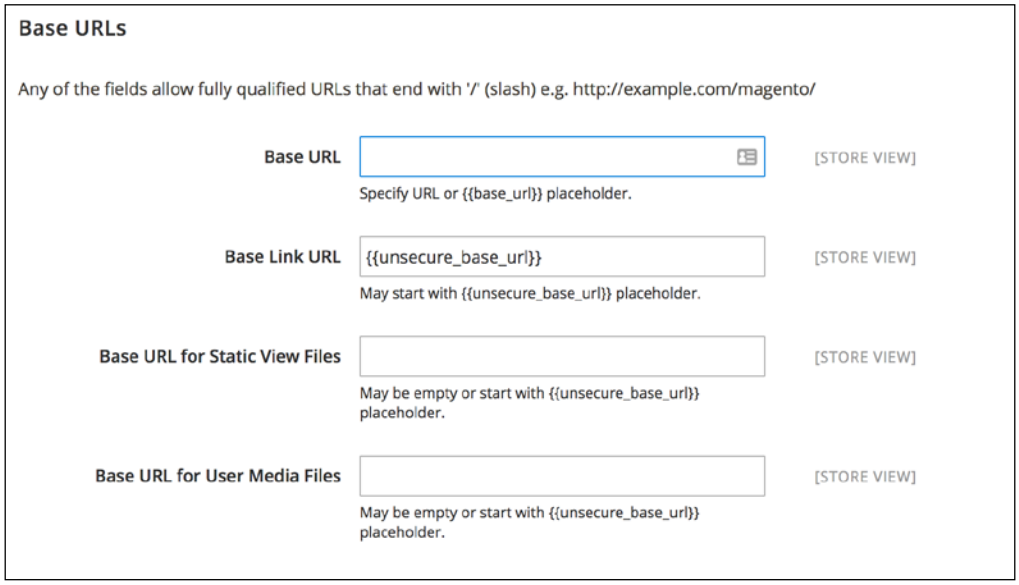
Magento 2 supports Varnish and allows for general parameter and **VCL** (**Varnish Configuration Language**) management. It's beyond the scope of this book to dive into configuring a Varnish proxy on your server, but again, this is something that many Magento specific hosting providers will support and configure on your behalf. Once this is in place, you can manage Varnish through Magento 2 in the **Store** | **Configuration** | **Advanced** | **System** | **Full page cache**, as shown in the following screenshot:



Using a CDN

CDNs (**Content Delivery Networks**), are servers which host your static or non-dynamic content on very fast servers and networks. For instance, if your images and JavaScript files are hosted on CDN servers, such as the ones provided by Amazon or Rackspace, your Magento server doesn't have to spend time processing and delivering those files to your visitors. Since web servers have limits in terms of the number of active connections they can support for delivering files, allowing other servers to carry part of the load means your server can accommodate more visitor requests.

Magento 2 has native CDN support, and if you navigate to **Store** | **Configuration** | **Web** you'll see an area called **Base URLs**. You can provide the CDN URL's here and Magento will automatically pull the resources from it.



Summary

Magento continues to amaze me each day I spend building and managing e-commerce sites. There's little debate over the fact that it is both powerful and complicated; both configurably pleasant and frustratingly massive.

The marketing side of me enjoys the flexibility in design, presentation, and user interaction. The developer side finds satisfaction in learning new ways to squeeze additional performance and functionality from the world's most prolific open source platform.

Hopefully, this chapter has helped you gain a better understanding and appreciation of Magento's EAV data model; learn how to use the inherent indexing and caching capabilities of Magento, and dive into methods of fine-tuning your Magento installation for increased performance and shorter download times for store customers.

As we near the end of our journey toward Magento mastery, we have one final area to explore in the next chapter.

9
Advanced Techniques

By now, even if you're new to Magento, you should have a newfound appreciation for the power and extensibility of the industry's most active open source e-commerce platform. We've covered just about everything from installation to extending the platform. Your Magento store, if not already online, is most likely ready from a preparation viewpoint.

However, we're not quite finished yet. You may want to undertake a few more options that can make your installation act more like that of a Fortune 500 company — and less like a hobbyist's experiment in e-commerce.

In this chapter, I will take you through four advanced techniques that I feel any bona fide Magento *master* should have in their own personal knowledge base:

- Setting up a staging environment
- Versioning your site
- The Magento cron
- Backing up your database

You may not wish to undertake all of these now, or later, but at some point you will find these concepts helpful in turning Magento Community into an enterprise-level contender.

Setting up a staging environment

I know it is so very tempting to install Magento onto a production server account, do the initial configurations, and launch your new store. I also know that if you're only working with one Magento installation, there will undoubtedly come a time when — no matter how careful you are — a buggy extension, an errant piece of code, or a mistyped tag will cause your site to "go dark." You may even experience the dreaded Magento error screen (well known for offering little advice or remedy).

Therefore, if you take no other advice in this book to heart, take this one seriously: create a staging environment.

A simple approach

Some developers, particularly those working for large enterprise operations, may want to create an elaborate remote development, staging, and production setup with matching hardware for each environment, to decrease the number of variables present when deploying and testing code. If you're working with a large team and you have the funds available for the time and effort needed to create this type of setup, by all means do so. It's more likely, though, that if you do fall into this category, you're better suited for Magento's Enterprise solution, rather than the do-it-yourself Community edition discussed in this book.

For those of us on smaller budgets — who appreciate what Magento Community offers as a robust yet open source platform — I would suggest that you use a simpler, more rapidly deployable solution. Keep it simple and manageable.

The basic staging setup

There are actually two staging setups I maintain: one for testing and one for client development. The former is used to test new extensions, programming ideas, and design concepts, with no particular client use in mind. The latter is created for each client site and, except for the data, is an exact duplicate of the client site in terms of code, extensions, and design.

For client sites, this is my suggestion for a basic operation procedure:

1. Before installing the client Magento instance, install Magento into another server account (you can actually use one account with multiple sub-directories, one for each client staging site).
2. Install another copy of Magento onto the actual server account that will become the live (or production) store.
3. Complete your install design and configuration onto this first installation. As you complete each major task of your set-up, duplicate that task on the production server installation. By keeping the tasks in sync, it will be easier to make sure that every step taken is duplicated for the production installation.

At some point, you will feel you're ready to "go live." Guess what? You probably are. If your staging and production installations are in sync, going live is merely repointing the live domain name to your production account and setting payment gateways to "live" mode.

Don't be tempted to skip

One of the dubious benefits of writing a book like this one is that I get the pleasure of reliving some of my less brilliant moments as a student of Magento as I impart the wisdoms gained to you. This is one of those cases.

If you've followed the simple approach previously outlined, you should have a staging and a production environment that both work successfully. After all, you're not going to do anything to the production installation that you haven't already tried and tested on the staging installation. At least, that's the plan.

But once you launch the production store, there will come a time when you want to take a shortcut. Your client might be pressing to install a new extension they found at the Magento Connect website, or you might need to import some new product types the current store has not been using. Regardless, if you skip applying your changes to your staging installation and go directly to the production installation, you'll find that you will experience the moment when your heart drops out of your chest as your production store ceases to work as intended. It's another of Murphy's laws.

I only had to do that once — and suffer the client's anguished pleas to "get my store back online!" — to learn my lesson: staging first, then production. Never waiver from this dictum and you'll continue to successfully please your client, yourself, or whoever is the owner of the Magento store.

Version control

Version control is one of the most helpful and time-saving tools that can be used in support of software development. Even if you're only making small changes to the templates you're using, or adding modules without modifying the code inside of them, version control allows you to track changes that have been made and to evaluate code at any given point in time after the implementation. Even more importantly, it allows you to roll back the code to an earlier state, in cases where you're not quite sure what changes might have caused problems with the site.

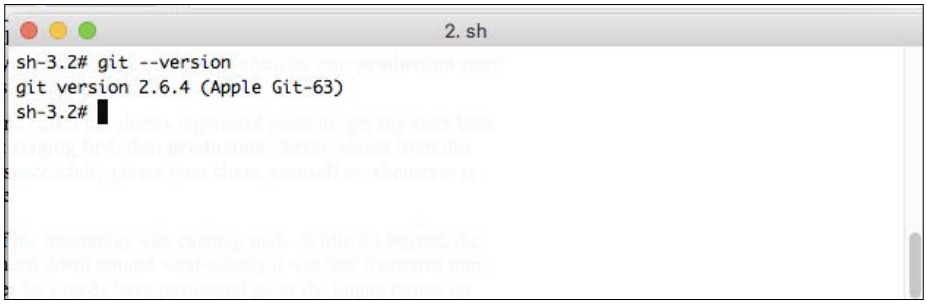
At this point, the tool most widely used for version control by the development community is Git**.** Git is a system that was developed by Linus Torvalds (the originator of LINUX himself!) as a result of his frustration with existing tools. While it's beyond the scope of this book to go into much detail around what exactly it was that frustrated him, suffice to say that the changes he's made have positioned Git as the lingua franca for version control, and understanding its basics is a necessary endeavor if you want to do any development, or even just track changes to your system caused by upgrades.

Magento is a complicated system and even small changes can have a significant impact, causing errors that are obvious (site down) and some that are pernicious and creeping, such as the creation of bad data over time. Using a system to track all the changes that you and others have made to the system is a strongly recommended practice and will invariably, at some point, save you time, money, or both.

Let's start with a very basic prescription: installing the Git binary on your system and checking your current Magento site into a local repository. For the purposes of this example, we'll assume the use of OSX, although Git can be used for pretty much any modern operating system.

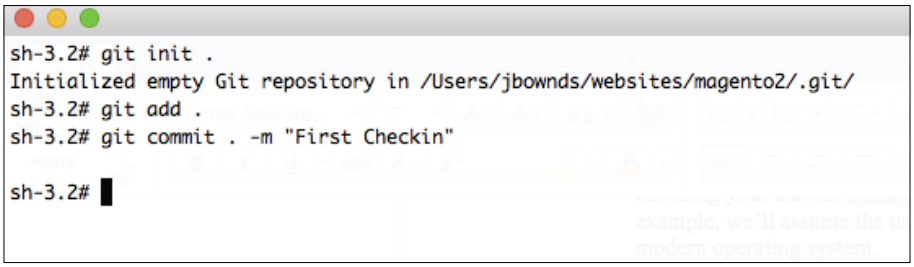
If you've installed the developer tools that come with OSX on your system, the Git binary will already be there. If you haven't and don't want to, you can download the Git binary from this link: `https://git-scm.com/download/mac`.

To make sure that Git has been installed on your system, open a terminal and type `git -version`. You should see the following output:

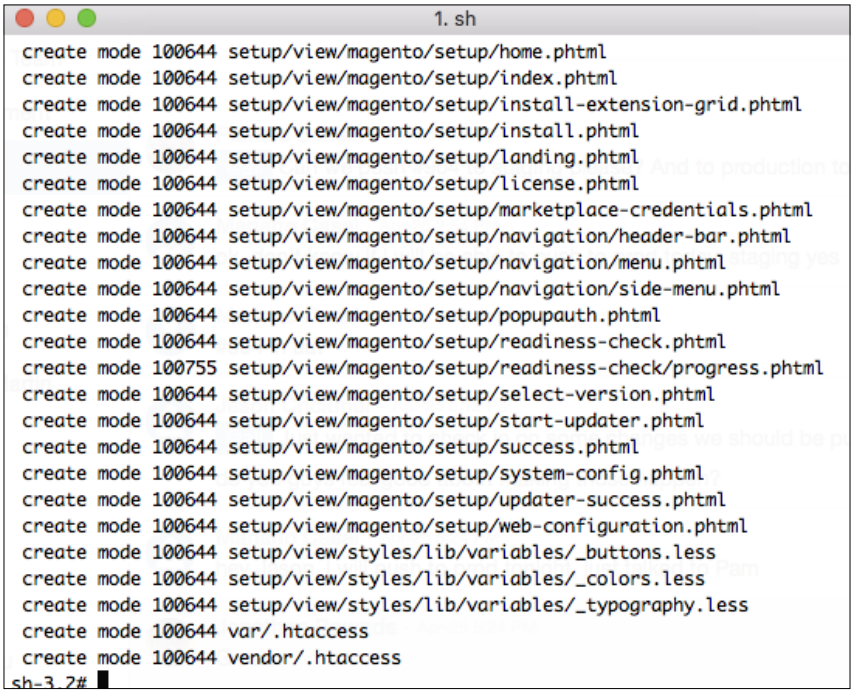


The next step you'll take will be to change to the document root of your Magento install. In this example, that's `/Users/jbownds/websites/magento2`. Once here, you can issue three simple commands to initialize the repository and check in the first version of your files. You'll start with `git init .`, followed by `git add .`, and finally `git commit . -m "first checkin of files"` (you can substitute another message here, if you like).

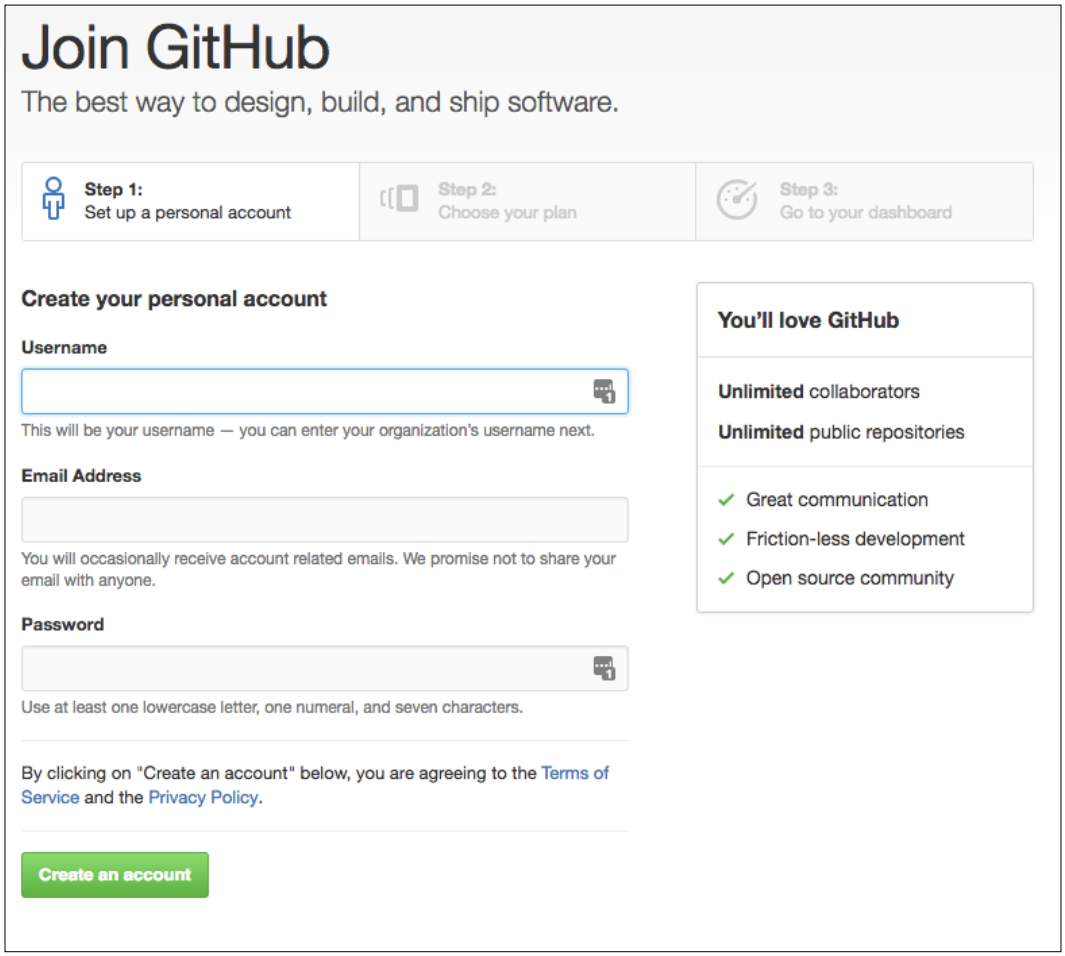
See the following screenshot for an example of what this will look like:



Once you've checked in the files, you'll see a flurry of messages indicating which files have been added, which looks something like this:



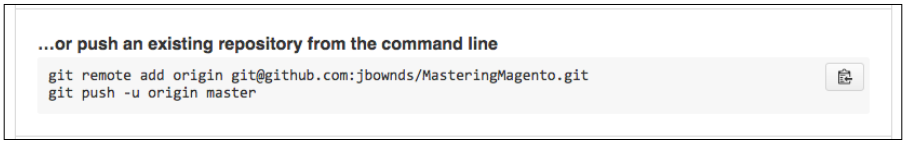
This indicates that the Git repository has been initialized locally and you're ready for the next step. As mentioned before, Git is a distributed version control system. That means it's easy (and a good idea) to store copies of it in different locations. There are many services that allow for this, but the most popular is probably GitHub. For this reason, we'll walk through the steps necessary to take the repository you've created and push it out to GitHub. Start by creating an account here: `https://github.com/join`:



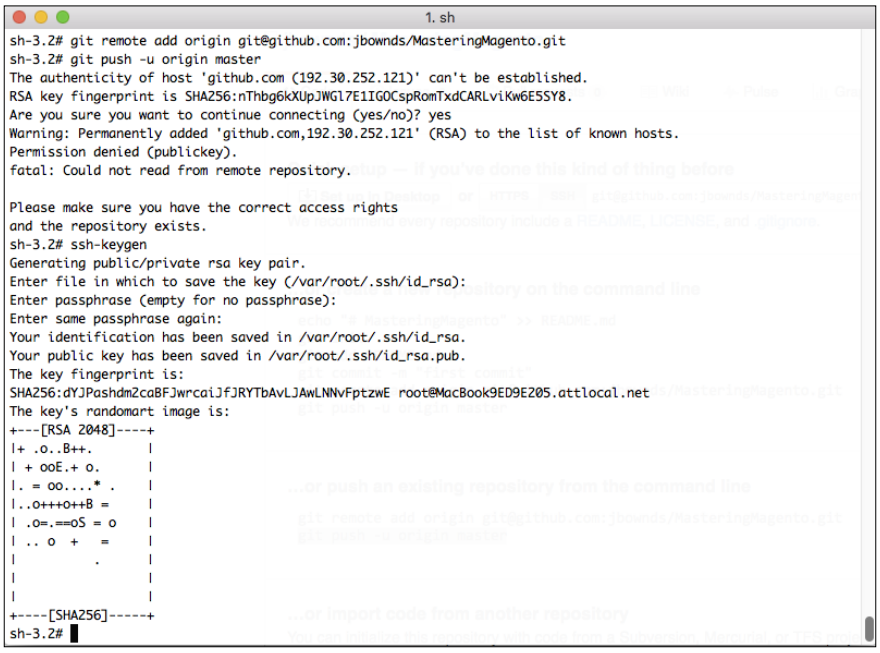
Once you've created an account (there are both free and paid options here), you can create a new repository by clicking the appropriate button on the right gutter:



Click on the repository and there will be step-by-step instructions for pushing an existing repository from the command line:



Go back to the document root for the repository you created and paste these commands into the terminal. The first one should run without a problem, but the second one will probably run into some authentication issues, as in the following example:

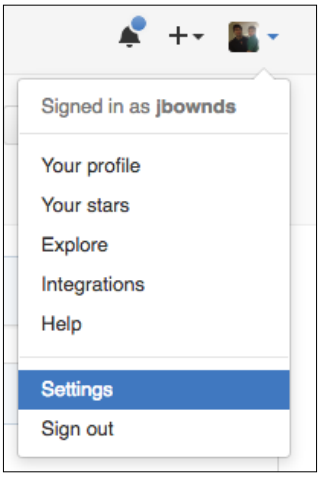


As you can see in this example, the second command had issues. The specific error message is **Fatal: could not read remote repository. Please make sure you have the correct access rights**.

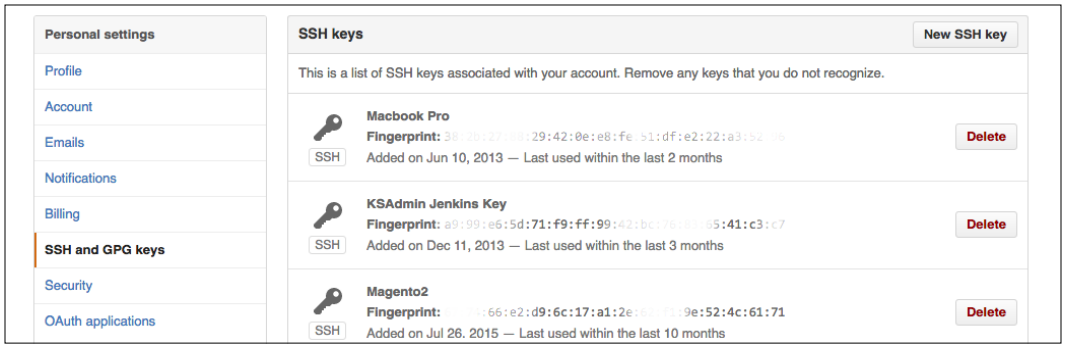
To address this, you'll need to add a public key for the user to GitHub, so GitHub recognizes the user trying to push this information into the remote repository. Don't worry - this sounds trickier than it is. All you need to do is type in `ssh-keygen`. You'll be prompted with several questions, all of which you can leave blank. At this point, you should have a generated public key for your user. You can view it by typing `vi ~/.ssh/id_rsa.pub`, and it'll look something like this (ignore the black arrow, this is just to blot out information in the private key).



Copy this key and head back to GitHub. Once there, you can add this key in the **Settings** area of your account:



Click **New SSH key**, provide a title, and paste the value you copied into the text area. Save this value:



Now, when you go back to the command line and try `git push -u origin master` command again, you'll see results like this:

```
sh-3.2# git push -u origin master
Warning: Permanently added the RSA host key for IP address '192.30.252.129' to the list of known hosts.
Counting objects: 36044, done.
Delta compression using up to 4 threads.
Compressing objects: 100% (30064/30064), done.
Writing objects: 100% (36044/36044), 24.11 MiB | 2.71 MiB/s, done.
Total 36044 (delta 8312), reused 0 (delta 0)
To git@github.com:jbownds/MasteringMagento.git
 * [new branch]      master -> master
Branch master set up to track remote branch master from origin.
sh-3.2#
```

Congratulations! You've created your first Git repository and pushed it out to GitHub.

Now, it's worth noting that there are a slew of very well-conceived visual tools that manage this process for you as well. It's beyond the scope of this text to evaluate these tools but it's worth mentioning a couple.

GitHub itself has a free desktop tool you can download and use, and it's quite handy for a visual representation of what's going on. The other tool we've seen used predominately is **Tower**. Tower can be obtained by visiting their website at `https://www.git-tower.com/`.While there is cost associated with the use of this tool (after a free trial), if you prefer a visual representation of what's happening with version control, this option may be more attractive to you.



Magento cron

If you're not up on Unix lingo, a **cron job** is a scheduled action that occurs at preset intervals on your server. For instance, Magento can create a new **sitemap** for your store according to the time interval you configure in the backend.

What is confounding to many new to Magento is that configuring cron intervals for various Magento functions doesn't actually cause anything to happen. The reason is that your server must still be told to run the configured tasks.

Cron jobs are configured by using what are called **crontabs**. These are expressions that dictate how often the server is to run the particular task.

Magento cron jobs

There are a few inherent functions included with Magento that can be run periodically, including:

- Catalog pricing rules
- Sending out scheduled newsletters
- Customer alerts for product price changes and availability

- Retrieval of currency exchange rates
- Creating sitemaps
- Log cleanup

Some third-party modules also include scheduled tasks, such as **Google Product feeds**. The frequency of most of these can be configured in your Magento backend. For those that aren't, you can find the crontab-style setting for each in the `config.xml` file of each module.

For example, the following is the cron schedule for the function that sends out scheduled newsletters, from `app/code/Mage/Newsletter/etc/config.xml`:

```
    <crontab>
        <jobs>
            <newsletter_send_all>
                <schedule><cron_expr>*/5 * * * *</cron_expr></
schedule>
                <run><model>newsletter/observer::scheduledSend</
model></run>
            </newsletter_send_all>
        </jobs>
    </crontab>
```

According to this crontab, Magento looks every 5 minutes to see if any newsletters need to be sent out.

Module	Cron job	Default frequency	Active?
Catalog	Reindex pricing	Every day at 2am	Yes
CatalogIndex	Reindex the entire catalog	Every day at 2am	No
CatalogIndex	Run queued indexing	Every minute	No
CatalogRule	Daily catalog update	Every day at 1am	Yes
Directory	Update currency rates	Controlled by **Currency Setup | Scheduled Import Settings**	Yes
Log	Clean logs	Every 10 minutes	No
Newsletter	Send scheduled newsletters	Every 5 minutes	Yes
PayPal	Fetch settlement reports	Controlled by **PayPal | Settlement Report Settings**	Yes
ProductAlert	Send product alerts to subscribing customers	Controlled by Catalog | **Product Alerts Run Settings**	Yes
Sales	Clean expired quotes	Every day at midnight	Yes

Module	Cron job	Default frequency	Active?
Sales	Generate aggregate reports (there are actually five configured)	Every day at midnight	Yes
SalesRule	Generate aggregate coupon data report	Every day at midnight	Yes
Sitemap	Generate sitemaps	Controlled by **Google Sitemap | Generation Settings**	Yes
Tax	Generate aggregate tax report	Every day at midnight	Yes

Many of Magentos core modules contain crontab scripts, although some are commented out. The following is a list of Magento Community 1.5 crontabs I have found within Magento, indicating for each whether the script is active or not. To make a script active, simply remove the comment tags surrounding the `<crontab>` code in the appropriate `config.xml` file.



Note that some crontabs run according to values stored in your Magento database. The paths to these settings within **System | Configuration** in your backend are included in this table. Even if these crontabs are active, your backend configuration may need to be enabled in order for these to run.

Triggering cron jobs

For your staging environment, you may want to keep cron jobs from running automatically. Rather, you may wish to have Magento run through its list of scheduled tasks at your command so you can watch for any problems or errors.

A wrinkle in Magento 2.0 is that there's no longer a `cron.php`, so Magento's cron can no longer be triggered from the command line (manually).

To manually run any scheduled jobs, access the `magento` file found in your site's root folder from the terminal and use the following command:

```
php <path to magento root>/bin/magento cron:run
```

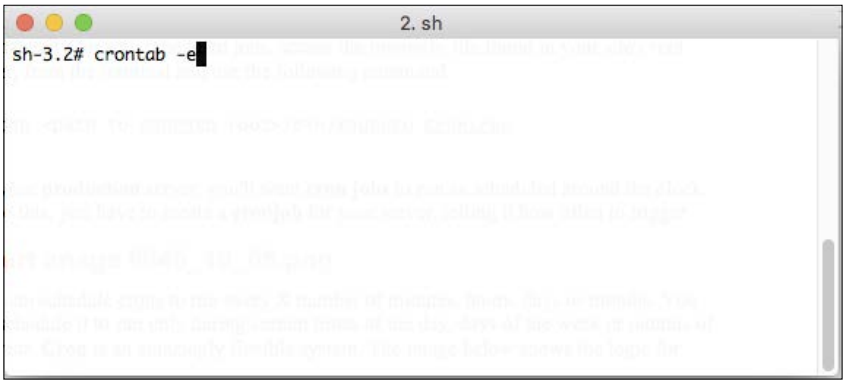
For your production server, you'll want cron jobs to run as scheduled around the clock. To do this, you have to create a cronjob for your server, telling it how often to trigger Magento's cron tasks. For most servers — Unix and Linux — the cron program operates as a continuous daemon, waiting to take some action according to any programmed crontabs. In this case, we want to have the **magento** binary (also in our Magento root folder) run by the server every few minutes or so.



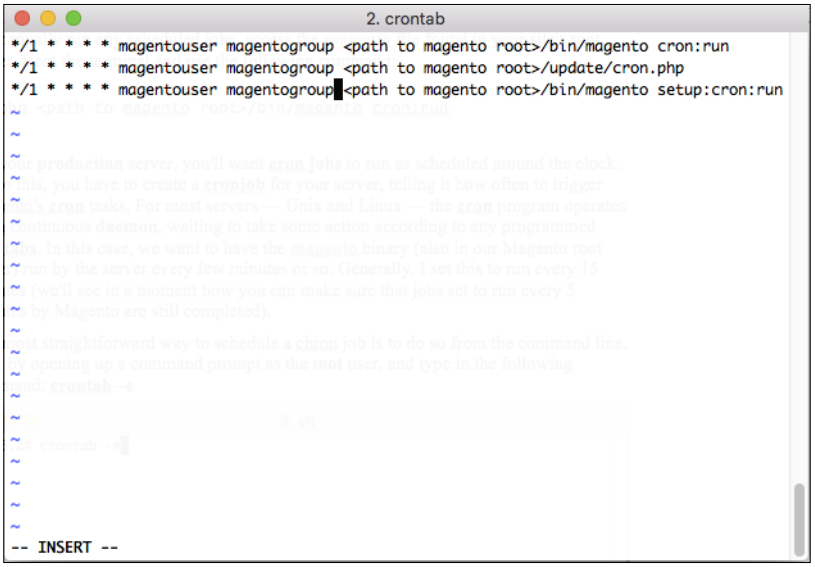
Generally, I set this to run every 15 minutes (we'll see in a moment how you can make sure that jobs set to run every 5 minutes by Magento are still completed).

The most straightforward way to schedule a cron job is to do so from the command line. Start by opening up a command prompt as the root user and typing in the following command:

```
crontab -e
```



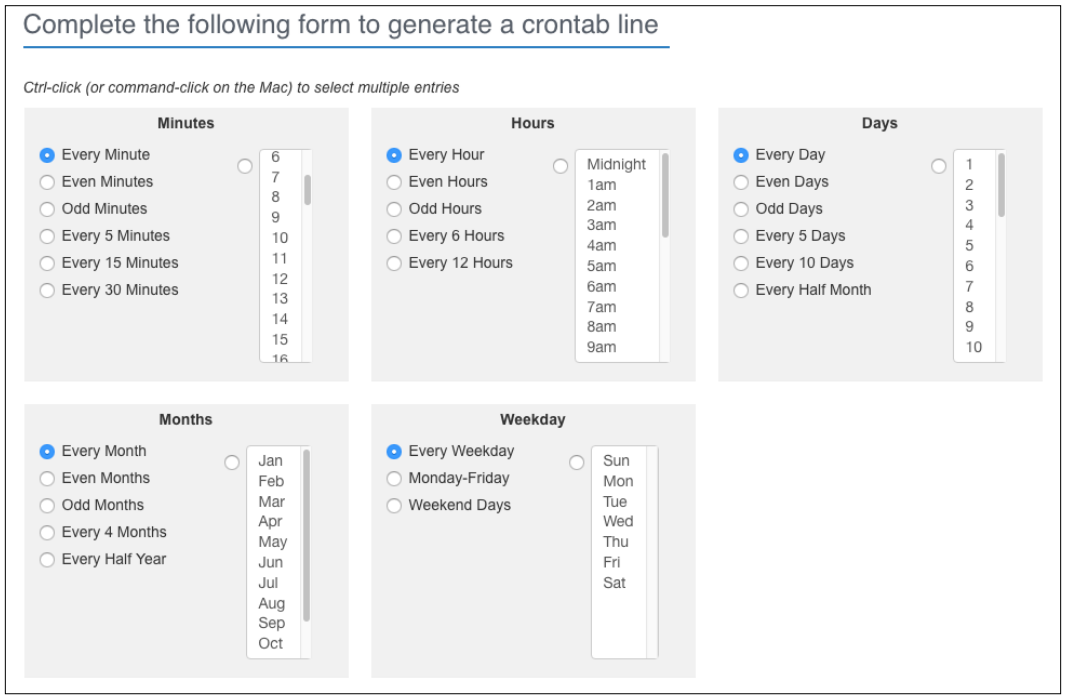
This command will take you to a screen where you can add entries to schedule the cron. To automate the Magento cron, you'll want to add entries that look like this:



You can schedule crons to run every X number of minutes, hours, days, or months. You can schedule them to run only during certain times of the day, days of the week, or months of the year. Cron is an amazingly flexible system. The following screenshot shows the logic for scheduling crons:

```
minute      hour      day      month       day-of-week        command-line-to-execute

*    *    *    *    *       command or shell script to be executed

┬    ┬    ┬    ┬    ┬
│    │    │    │    │
│    │    │    │    │
│    │    │    │    └─────── day-of-week (0 - 6) (0 is Sunday)
│    │    │    └──────────── month  (1 - 12)(1=JAN, 12=DEC)
│    │    └───────────────── day    ( day of month (1 - 31))
│    └────────────────────── hour   (0 - 23)( 0=12AM, 23=11PM)
└─────────────────────────── minute  (0 - 59)
```

This can be a bit obtuse to understand, though; if you want a quick way to sort out timing for a cron job, you can visit one of the many crontab generating websites. One example is `http://crontab-generator.org/`. As you can see, this site provides assistance and makes it a bit easier to generate the desired schedule:



Tuning Magento's schedules

The Magento binary does a number of things when your server cron job runs:

- It executes any scheduled tasks
- The script generates schedules for any future tasks
- Finally, the script cleans up any history of scheduled tasks

The parameters that control this behavior are configured in your Magento backend:

1. Go to **Stores** | **Configuration** | **Advanced** | **System**.
2. Expand the **Cron (Scheduled Tasks)** panel.
3. For each item, fill in the number of minutes.
4. Click on **Save Config**.

Each field in this panel controls the timing actions of the `cron` script, as follows:

- **Generate Schedules Every** means that new schedules will not be created more frequently than the number of minutes configured.
- **Schedule Ahead for** is the number of minutes that will be generated in future schedules.
- **Missed if Not Run Within** tells the script to run any tasks that were scheduled within the indicated number of minutes before the script ran, but which haven't run already.
- **History Cleanup Every** deletes old history entries in the `cron_schedule` database table. This will help keep the table from growing too large.
- **Success History Lifetime** similarly purges successful entries from the `cron_schedule` table.
- **Failure History Lifetime** does just what you imagine: purges failure entries.

There remains considerable debate among bloggers on what values are ideal for this configuration. However, from my observations, there are some principles I follow when configuring Magento cron jobs.

Setting your frequency

Decide the frequency of your server cron job. If you configure your server cron to run every 15 minutes, then you do not need any Magento crontab or cron configuration to be set at anything less than 15 minutes. For example, the **Send Newsletter crontab**, as shown in the earlier table, is configured by default to run every 5 minutes.

If your system cron task runs every 15 minutes, then when `cron.php` is executed, the send newsletter task is actually run three times, since Magento schedules ahead and looks back to run any scheduled tasks. In order words, if your system cron runs at 10:00 am, it will run any tasks that were scheduled to run between 9:45 am (the last time it ran) and 10:00 am. Since the send newsletter task was scheduled to run every 5 minutes, at 9:45 am, Magento scheduled it to run at 9:50, 9:55, and 10:00. The task did not run at those times, but instead were all run at once at 10:00 when your system cron ran.

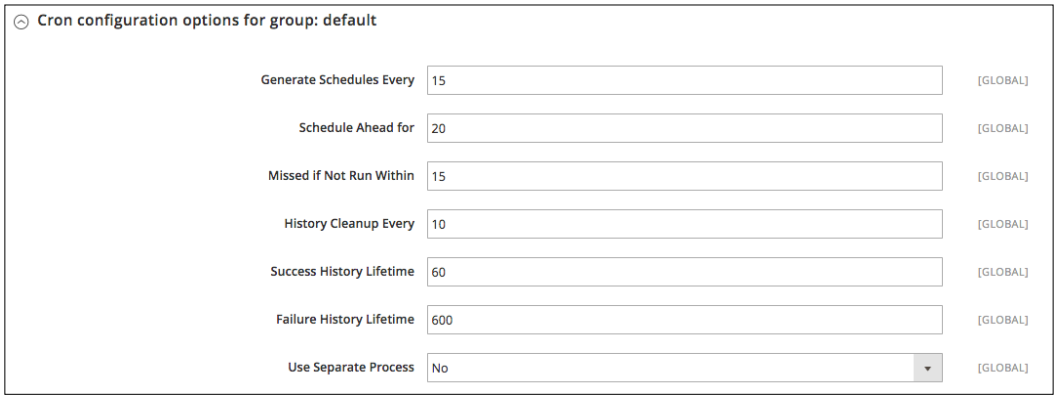
Therefore, you may want to go back through the various module `config.xml` files (such as the ones in the earlier table) and set the frequency of the jobs to match or be less frequent than your system cron.

Creating compatible settings

Once you have modified any crontabs to match your system cron job frequency, you should now configure the **Store | Configuration | Advanced | Cron (Scheduled Tasks)** panel:

- Use the same number of minutes as your system cron job frequency for **Generate Schedules Every**.
- Use the same value for **Schedule Ahead For**. In this way, you are capturing all the upcoming cron jobs Magento intends before your next system cron runs.
- Use the same value for **Missed If Not Run Within** to run any scheduled tasks that did not run during the last system cron.
- Use the same value for **History Cleanup Every**. You can use a larger interval if you wish, as this is not a critical function to running the necessary cron jobs for your store.
- For **Success History Lifetime** and **Failure History Lifetime**, you can use whatever settings you feel are most important. Generally, when launching a new Magento store, I set the **Failure History Lifetime** for a long time (as much as 3 days, or 4320 minutes) so that if something seems amiss, I can go into the `cron_schedule` database table and see if there are any failure messages that can help me diagnose the problem. In fact, even if your store is running smoothly, keeping this number large should not grow your database, as there will be no failure messages to record.

So, for example, if I set my system cron job to run every 15 minutes, my **Cron (Scheduled Tasks)** panel might look like this:



Backing up your database

While we're on the topic of cron jobs, one system cron job you should consider is backing up your Magento database. As usual, this advice is based on hard-earned experience. In the course of working with Magento, and especially if you have clients who have permissions to add extensions and change configuration, you may need to restore the Magento database to a previous working state.

While most server hosting providers provide backup services, restoring just the Magento database can take a long time as server backups restore all the files on the server, not just your database. Some providers do provide specific database back-ups, but to be safe, it doesn't hurt to schedule your server to do your own back-ups. Additionally, learning how to quickly and easily back-up and restore your database will come in handy, since you should always do a back-up of your database before installing new extensions or significantly changing configurations.

The built-in back-up

Magento does have a back-up function in the backend, under **Store | Tools | Backups**. While this is one way of backing up your Magento database, there is no built-in restore function. Furthermore, I have had problems in the past using the back-up file to restore, due to foreign-key conflicts. For extra, extra safety, it wouldn't hurt to use this function to create a back-up — especially if you do not have SSH access to your server account — but it is not as easy or quick as the following method.

Using MySQLDump

If you have SSH access to your server, using MySQL's built-in backup and restore functions are both quick and easy. You do need a username and password for your database (which you should have if you installed Magento):

1. To back up your database, access your server via SSH using a terminal program.
2. At the prompt, enter `mysqldump –u [username] –p[password] –h [hostname] [databasename] > [filename].sql`.
3. In very short order, MySQL will create a file containing a complete restoration script, including all of your database records.

To provide an example for the previous command, let's assume the following:

- **MySQL username**: `mageuser1`
- **MySQL password**: `magepassword1`
- **Host name**: `localhost`
- **Name of Magento database**: `magento_db`
- **File name for the dump**: `magento_db`

Using these example values, your command would look like this:

```
> mysqldump –u mageuser1 –pmagepassword1 –h localhost magento_db > magento_db.sql
```

To restore your database, a slightly different format is used: `mysql –u [username] –p[password] –h [hostname] [databasename] < [filename].sql`, or the following to use our above examples:

```
> mysql –u mageuser1 –pmagepassword1 –h localhost magento_db < magento_db.sql
```

It's as easy as that!

Setting a cron for back-up

Now that you know how MySQL can dump a back-up of your database, you can use your server cron to do a dump every night, every week, and/or every month, depending on how fervent you want to be about preserving backups.

Every developer will have their own back-up strategies; so, naturally, do I. While our hosting provider does a complete server back-up every night and preserves back-ups for 7 days, I like to augment that with my own database rolling back-up strategy:

- Daily backups for each day of the week. Monday's next backup will replace the current Monday backup. Therefore, we will have one backup for each day of the week, but not more than seven at any one time.
- Alternating weekly backups. In essence, we save a backup every other week, so that we have two weekly backups.
- One monthly backup. So far, after 15+ years of doing this, we've never had to revert to a monthly backup, but I certainly like having it there nonetheless.



One note here: if you can, you may want to consider dumping these to a computer other than your Magento server. Since our hosting provider does off-site backups, I feel quite comfortable backing up our Magento databases onto a local machine at our office. The chances of all three locations, our hosting provider's facility, the off-site back-up facility, and our office, all burning down at the same time (I'm sure)' is pretty darn remote, especially since all three facilities are spread across a continent.

To schedule your dumps as crontabs, invoke the crontab, as you did earlier in this chapter, and create as many jobs as you feel you need (if you're dumping to another server, you need to, of course, schedule these jobs on the machine to which the backup is to be dumped).

Create a new schedule according to your desired frequency (every day, week, month, and so on) and enter your MySQL dump command, as used previously. For the file name, though, use a name unique to the purpose of the dump. For example, for a dump on Monday, you might use `magento_db_Mon.sql`; for week 1, `magento_db_week_1.sql`. In this manner, the next dump for a given script will overwrite the previous dump without filling up your hard drive with dump files.

Upgrading Magento

From time to time, as Magento improves its platform features, or to address bugs and security issues, you will receive a notice that your system needs to be upgraded. With Magento 2, this upgrade process is made infinitely easier and better than in Magento 1.x.



If you are versioning your Magento installation, you should not upgrade your production installation using our instructions here. Rather, upgrade your development environment, test, and then promote your code to your production server.

In order to keep your Magento installation upgraded, you must take certain steps:

- Obtain Magento Marketplace keys
- Run the System Upgrade routine in your Magento 2 backend

Obtaining Magento Marketplace keys

In order for your store to communicate to Magento for upgrade verifications, you or a developer has to obtain developer keys. While this suggests that keys are only for developers, anyone can create an account at Magento and obtain keys.

If you don't already have an account at Magento, go to `https://www.magentocommerce.com/magento-connect/customer/account/create/` and create your free account. Once you are registered, log in to your account at `https://www.magentocommerce.com/magento-connect/customer/account/login/`.

After you log in:

1. Click on the **Connect** tab.
2. Click on the **Developers** side menu tab.
3. Click on **Secure Keys** in the sidebar menu.
4. Enter a **Name** for your keys. This is only a reference name (such as "Production Server"), so you can easily determine which keys are for which Magento installation.
5. Click on **Generate new**.
6. On the results screen, you will see two keys: **Public Key** and **Private Key**. You will use these for the next part of this process:



7. In your Magento 2 backend, go to **System** | **Web Setup Wizard**.
8. Click the large button labeled **System Configuration**.
9. On this page, paste the keys obtained previously into the appropriate spaces and click on **Save Config**.

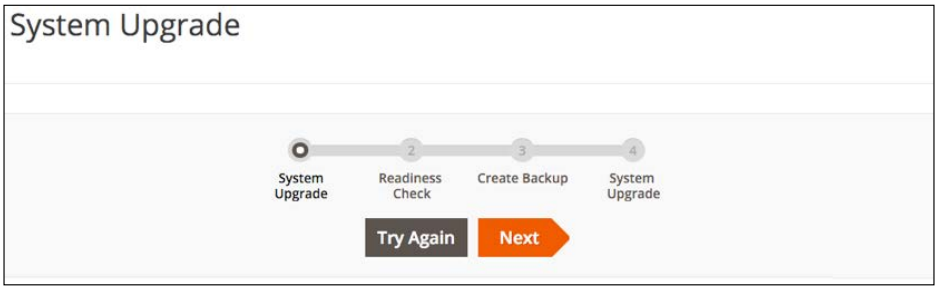


Upgrading your Magento installation

Now that you're able to communicate with Magento Connect, you can begin the process of upgrading your installation.

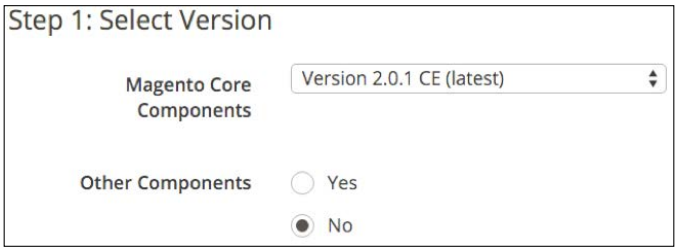
After entering your keys, you should still be within the Wizard. Find the **System Upgrade** button or sidebar menu and click it to begin the upgrade process.

The **System Upgrade** screen shows the steps the process will undertake to complete:



When this screen first loads, it goes through a series of checks to find out what needs to be upgraded. You can choose the version of Magento Core Components you wish to upgrade, as well as any other components that may have been added to your installation.

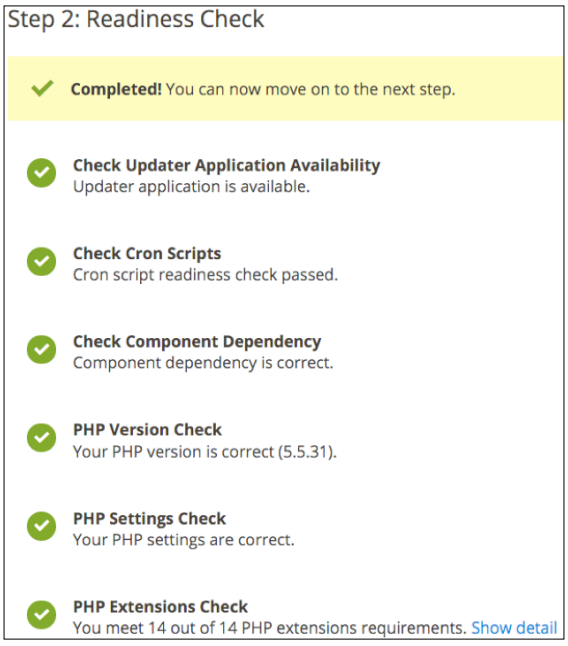
Once you make your choices, click on **Next**:





There are many reasons why an upgrade might fail. We have certainly had our share of issues, although far less with Magento 2 than with earlier versions. If you are a developer, you can find that most upgrade errors can be fixed by going to `http://devdocs.magento.com/guides/v2.0/comp-mgr/trouble/cman/were-sorry.html` and reviewing the advice shown there.

On the next screen, you can determine whether your installation is truly ready for a system upgrade. Click on **Start Readiness Check** and wait for it to complete its analysis:



Click **Next** to create a backup of your installation.



If you're not using a hosting company that provides backups or you do not have a backup protocol, well, you're flirting with trouble. No matter how well a server is configured or you maintain your Magento installation, you should never fail to make regular backups. As in this process, you should also make a backup whenever you make any changes to your Magento code.

In most cases, you will want to include all items in your backup. However, if your server is regularly backed up and you have lots of product images (for example, thousands of product SKUs), you might consider not backing up site "media." Media can take a long time to back-up and consume considerable space. However, if you update your media often, don't hesitate to include it in your backup.

Click on **Create Backup** to trigger the backup process.



Backups of even the most modest-sized Magento installations can take some time. Do not interrupt this process. If something goes awry, Magento will alert you with an error message. In other words, be patient!

When the backup is complete, click on **Next**. If all has gone well, the system will tell you it's ready for you to click on **Upgrade**.

Summary

After working your way through this book, you've now reached a level of familiarity and understanding that enables you to call yourself a Magento master. Of course, given the complexity and features of Magento, there's always more that you can learn. You should now have enough comfort with Magento that you can freely experiment. After all, one of the great features of open source software is that you have the access and freedom to augment the original system to meet your needs.

In this chapter on advanced techniques, we have learned a nifty way of integrating WordPress into a Magento installation, discussed a simple method of building and using a staging installation, provided a complete tutorial on scheduling Magento cron tasks, and covered strategies and techniques for backing up your Magento database.

With this book in hand, you most likely are close to completing a new Magento store. Launch date is just around the corner. If you've never launched a Magento store before, you're in for a treat now!

Just one task remaining now: go through the pre-launch checklist one final time before we are all set to go live. This is what we shall go through in the next chapter.

10
Pre-Launch Checklist

As you've no doubt realized — and one great reason for this book — Magento 2 delivers its power as an e-commerce platform by giving you a lot of versatility. This versatility comes at a price, though, most notably in terms of the vast number of configuration tasks and choices available.

Over the years, we have created our own Magento Pre-Launch Checklist to make sure we touch all the important configuration and design points within Magento 2 that are necessary for a live store to operate. If you've read through this entire book, you may have already addressed a number of these items, but having an itemized list to follow will save you a lot of time and give your store owner a great deal of immediate satisfaction.

We've broken down this checklist into the following areas:

- System
- Design and interface
- SEO
- Sales
- Products
- Maintenance

In this chapter, we will go over the configurations to review in order to have a successful Magento store launch.



Since so many of the processes noted in this checklist have been discussed in previous chapters, many of the sections in this chapter will refer to previous chapters. Another very good reason to keep your *Mastering Magento 2* book close at hand!

A word about scope

In *Chapter 1*, *Planning for Magento*, we discussed the **Global-Website-Store** methodology. When planning your Magento installation, you set up whether your installation would have one or more websites, each with one or more store views. As you go through this checklist, you need to pay close attention to the scope in which you are updating configurations and designs. For instance, as we discuss base URLs, take care that your store view is set at the proper level for the configuration. In other words, if you're updating the base URL for the entire installation, your store view is **Default Config**. On the other hand, if the base URL applies only to your English language furniture store view, then set to that store view.

System configurations

The area of the Magento back-end that has the most configuration choices is within the **Stores** | **Configuration** menus and panels. So, let's begin there first.

SSL

Unless your store is using PayPal Express, PayPal Standard, PayPal Advanced, or another off-site payment processing method (for example, Authorize.Net Direct), your store may be taking credit card information on your server. Even though you're not storing the credit card information, you will need to get a **Secure Socket Layer** (**SSL**) **Encryption Certificate** installed on your server. Depending on the type of certificate you purchase, this process can take from 2 days to 2 weeks. It pays to plan ahead on this one: don't wait until the day before launch to try to get an **SSL Certificate**. Unless you're a master at web server configuration, consult with your hosting provider who can provide you with the necessary encryption keys and installation assistance. For most hosting providers, the installation of an SSL Certificate is outside the permissions of the client (you).

Base URLs

You should also review the following panels:

- **General** | **Web** | **Url Options**: If you're using a shared shopping cart and/or a shared SSL, set **Add Store Code to Urls** to **Yes**. To avoid duplication of content (which may hurt your search engine rankings), set **Auto-redirect to Base URL** to **Yes (301 Moved Permanently)**.

- **General | Web | Base URLs (Secure)**: If you have your SSL Certificate installed, and you have entered the secure URL as the base URL in this panel, set both **Use Secure URLs on Storefront** and **Use Secure URLs in Admin** to **Yes**.

Administrative base URL

Since anyone who has used Magento 2 knows that, by default, the administrative backend of your store is accessible by going to `http://www.storedomain.com/backend`, changing this URL may help keep out the bad guys. To set up a new admin domain:

1. Set up your new domain on your server to point to your Magento installation (see your hosting provider, if needed, for assistance).
2. Go to **Advanced | Admin | Admin Base URL**, set **Use Custom Admin URL** to **Yes** and enter the new domain into **Custom Admin URL**. Include any path that is necessary for your store front end, such as `http://www.newdomain.com/magento`.
3. Set **Use Custom Admin Path** to **Yes** and enter the new path for accessing the Magento backend into **Custom Admin Path**. For example, if you enter **mybackend**, you would then access the Magento 2 backend using `http://www.domain.com/mybackend`.

Now you should be able to access your Magento backend using the new domain name. If you have set a **Secure Base URL** and set **Use Secure URLs in Admin** to **Yes**, then the new domain should automatically change to the secure URL. However, this does provide a convenient and more secure means of isolating access to your Magento backend.

Reducing file download time

Today's search engines are monitoring the speed with which web pages download. The faster the download speed, the better your site is liked by Google et al. More importantly, it makes for a better user experience. Magento helps you by giving the backend administrator the means to combine CSS and JavaScript files, creating fewer files to download to render a page.

Merging JavaScript files

To combine your design's JavaScript files into one downloadable file:

1. Go to the **Advanced** | **Developer** | **JavaScript Settings** panel.
2. Select **Yes** for **Enable JavaScript Bundling** and **Merge JavaScript Files**.
3. Click on **Save Config**.



You may find, when looking at your frontend source code, that not all JavaScript files have been combined. Some add-on modules add JavaScript links outside of Magento's JavaScript combine functionality. That said, combining most of them using this tool can help reduce overall download time.

Merging CSS files

The same process can be applied to your theme's CSS files:

1. Go to the **Advanced** | **Developer** | **CSS Settings** panel.
2. Select **Yes** for **Merge CSS Files**.
3. To further reduce the size of this combined file, you can set **Minify CSS Files** to **Yes**.
4. Click on **Save Config**.

Caching

We went into quite a bit of detail about caching in *Chapter 8*, *Optimizing Magento*. We mention it here because during development you may have turned off caching to help speed up design and code changes. Take the time now to set your optimum caching settings.

Cron jobs

If you haven't already, configure and turn on cron jobs on your installation. Refer to *Chapter 9*, *Advanced Techniques*, for information on how to configure cron jobs.

Users and roles

Before you launch, you may want to set up specific users for whoever will have access to your Magento backend. Certain users may only need access to orders and customers. Others may be responsible for product information and pricing.

Before setting up users, you need to set up various roles or groups of permissions to which you can assign users:

1. Go to **System** | **User Roles** in your Magento backend.
2. Click on **Add New Role**.
3. Give the new role an appropriate name in **Role Name**.
4. Click on **Role Resources** in the left sidebar.
5. Check the specific permissions you wish to give this role.
6. Click on **Save Role**.

Once you have your roles set up, you can set up your users:

1. Go to **System** | **All Users**.
2. Click on **Add New User**.
3. Enter the required fields for **User Info**.
4. Click on **User Role** in the sidebar menu.
5. Choose one of the roles you set up previously.
6. Click on **Save User**.

Once you save the user, an email will be sent to them with the login credentials.

Design configurations

Undoubtedly, you've invested a considerable amount of time creating a frontend design to meet your e-commerce needs. Before you launch, however, there are a few design-related tasks that need to be performed.

Transactional emails

Using the techniques described in *Chapter 4*, *Configuring to Sell*, build and assign the emails that will be sent to customers who purchase, register, and subscribe to newsletters.

Invoices and packing slips

The primary thing you need to do for invoice and packing slips is to upload an appropriate logo as a substitute for the default Magento logo. Upload the logo you wish to use for PDF print-outs and on-screen views in the **Sales** | **Sales** | **Invoice and Packing Slip Design** panel.

Favicon

Don't overlook this little item! You'd be surprised how many Magento-powered websites we visit that still show the Magento logo. To upload your own favicon, go to the **General** | **Design** | **HTML Head** panel under **Stores** | **Configuration**.

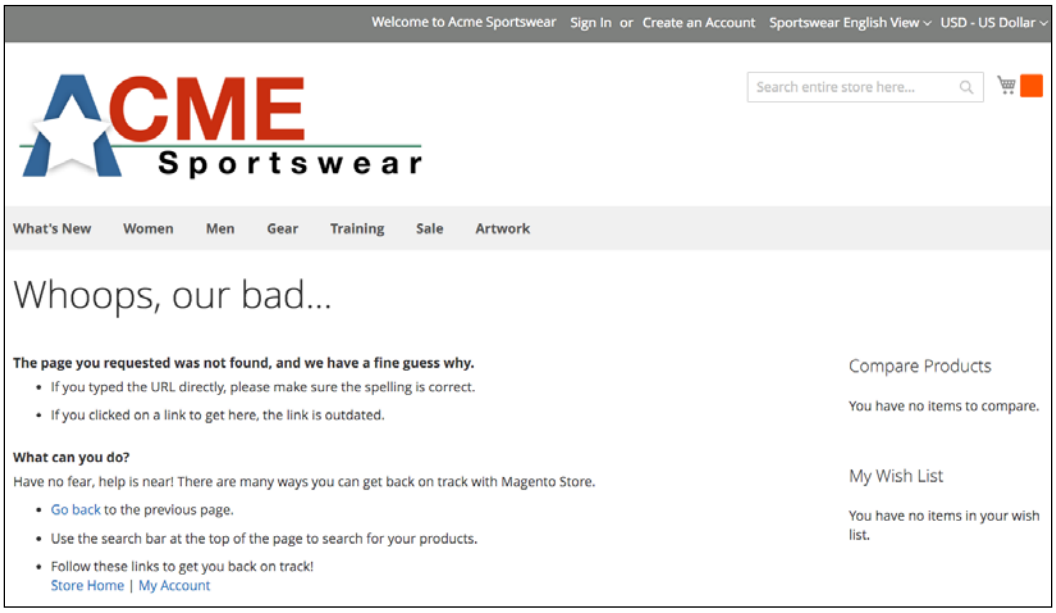
Placeholder images

For products that have no image, Magento inserts default placeholder images. You can create your own — perhaps with your own company's logo — to use instead of the default images with the Magento logo.

To upload your own versions, go to the **Stores** | **Configuration** | **Catalog** | **Catalog** | **Product Image Placeholders** panel. Use images similar in size to those that your theme design uses for regular product images.

404 and error pages

When you first install Magento, a CMS page is automatically created for use when a visitor tries to access a non-existent page. This default page, as shown in the following screenshot, is not bad, but you may want to update the banner images and, perhaps, provide even better information to visitors as to what they can do to find the correct page.



You may want to modify the layout to include a sidebar of categories. It might also be helpful to show your telephone number in large numbers if you want customers to call you for help.

Search engine optimization

Without exception, for an online store to prosper it has to have customers. Attracting customers comes from a variety of efforts, including search engine rankings. There are a number of SEO-related activities for increasing traffic, from blog postings and backlinks, to product descriptions and reviews. For pre-launch purposes, you want to make sure to do the initial tasks that will add to the SEO arsenal.

Meta tags

If you intend to use meta tags as part of your Search Engine Optimization, see *Chapter 6*, *Marketing Tools*, for specific procedural information.

Analytics

In your Magento backend, under **Stores** | **Configuration** | **Sales** | **Google API**, is a panel titled **Google Analytics**. To have Magento automatically include a Google tracking code on each page of your site, set **Enable** to **Yes** and enter your **Google Analytics ID** in the **Account Number** field.

Sitemap

If you did not already do it after reading *Chapter 6*, *Marketing Tools*, configure and activate your Magento store sitemap.

Sales configurations

Before you can begin taking orders on your new Magento website, you need to confirm that you have all the necessary configurations in place.

Company information

In your Magento backend, go to **Stores** | **Configuration** | **General** | **General**. Review your settings for the following panels:

- **Countries Options**: This panel allows you to restrict the countries to which you will sell products. Your store owner may have limitations where they can ship and/or receive payments. The **Default Country** sets the default for any country selection drop-down menu.
- **Locale Options**: Use these settings to accommodate the backend users of your Magento store.
- **Store Information**: The values entered here will be used throughout the Magento stores as defaults for name, telephone number, and address.

Store e-mail addresses

Even small online vendors may use different email addresses for different purposes. We often set up multiple email addresses for our client's stores, even if the same person may be receiving emails for sales and support. Having separate email addresses helps to segregate emails by purpose. Additionally, if the business grows and assigns different people to different purposes, you will have already established different email addresses with the store's customers.



A little known feature for those of you who use Google Apps — more specifically, Google Mail — you can create multiple email addresses for the same email account without having to add forwarding or alias configurations to Google Mail. For example, if you have an email address of `info@domain.com`, you could create the following emails and each one will go to the same email account: `info+sales@domain.com`, `info+support@domain.com`, and `info+contact@domain.com`. Google Mail will ignore the portion of the email address after and including the "+" in the address. We use this often to provide different email addresses without creating multiple email accounts.

Contacts

The panels on the **General** | **Contacts** screen allow you to enable the standard **Contact Us** form and set to whom these emails should be sent. You can also assign a customized transactional email.

Currency

To confirm that any necessary currency conversion settings are ready to go.

General sales settings

Under **Stores** | **Configuration** | **Sales** | **Sales** are various panels that control a rather eclectic group of sales-related functions.

- **Checkout Totals Sort Order**: Using numbers of any value, you can control the order in which various order line items are displayed.
- **Reorder**: Select whether registered customers may use previous orders to generate new purchases.
- **Invoice and Packing Slip Design**: Earlier in this checklist, you uploaded any custom logo designs. You can also enter a company address that you wish to use as an alternative to the company address you entered before.
- **Minimum Order Amount**: In this panel, you can set any minimum order amount (if one is to be enforced), as well as set whether to validate multiple addresses submitted in a multi-address checkout.
- **Dashboard**: If you find that server processing power is low, you may want to set **Use Aggregated Data** to **No**.
- **Gift Options**: For sellers of gift items, such as flowers or jewelry, you may want to allow Magento to include a field for purchasers to use to include a gift message to the recipient. These messages will appear in your order detail page for processing.

Customers

If you plan on having more than one customer group (for example, wholesale, preferred, and so on), set up multiple customer groups according to the process described in *Chapter 6*, *Marketing Tools*.

In addition, there are a few settings you should review under **Stores** | **Configuration** | **Customers** | **Customer Configuration**:

- **Account Sharing Options**: Set whether you want customer accounts shared among all websites or not.

- **Online Customers Options**: The vaguely named **Online Minutes Interval** is used to calculate the number of current customers visiting your store, as displayed under **Customers** | **Online Customers**. For example, if you set this to 30 minutes, then any customer accessing a page of your site within the past 30 minutes will be considered a current online customer.
- **Create New Account Options**: Use these settings to control how new customer accounts are handled. Reference the transactional emails you created earlier for the email-related settings.
- **Password Options**: If you created a new transactional email for sending customers their forgotten password, select it for **Forgot Email Template**.
- **Name and Address Options**: In this panel, you can customize how you capture customer information.
- **Login Options**: Select if you want the customer to land on their **Dashboard** page or your site home page after logging in.
- **Address Templates**: This is an interesting panel and one often forgotten when customer address layout issues arise. If you find that any layout in your site is not displaying customer information properly, refer to this page.

Sales emails

The **Stores** | **Configuration** | **Sales** | **Sales Emails** screen provides panels to allow you to choose customized transactional emails and sender email addresses for orders, invoices, shipment notices, and credit memos.

Tax rates and rules

In *Chapter 4*, *Configuring to Sell*, we discussed at length how to configure sales tax rates and rules. Afterwards, you should go to **Stores** | **Configuration** | **Sales** | **Tax** in your Magento backend for additional sales tax configurations:

- **Tax Classes**: Select whether sales tax is to be calculated for shipping charges.
- **Calculation Settings**: Based on the expectations of your customers and your marketplace, you can configure how sales tax calculations are made and presented in online shopping carts and invoices.
- **Default Tax Destination Calculation**: Since sales tax is generally calculated for sales made to customers living in the taxing jurisdiction of the business, you can set the default sales tax rule for individual store views. Your actual taxing rules will override these default settings.

- **Price Display Settings**: These configurations affect whether products and shipping prices should be displayed with or without including any applicable sales tax calculation.
- **Shopping Cart Display Settings**: Generally, the default settings are appropriate, but this is especially useful if you should review how prices, totals, and taxes are to be displayed in shopping carts.
- **Orders, Invoices, Credit memos Display Settings**: This panel is the same as for the previous panel.
- **Fixed Product Taxes**: Where products are assigned fixed taxes, such as excise taxes, you can configure how those taxes are to be displayed on the site.

Shipping

Using *Chapter 4*, *Configuring to Sell*, for guidance, confirm that the shipping methods you want for your new store are configured and ready.

Payment methods

Likewise, you should confirm your desired payment methods. Most can be set in test mode during configuration.

Newsletters

Configure and test your newsletter configurations. Refer to *Chapter 6*, *Marketing Tools*, for detailed information on creating and sending customer newsletters.

Terms and conditions

Later in this checklist, you will set whether or not you want customers to confirm that they have read your site's terms and conditions before completing their purchase. To compose your terms, go to **Stores** | **Terms and conditions** in your Magento backend. Here, you can add the actual text that will be displayed during checkout.

Checkout

Now, let's turn our attention to the checkout process. Go to **Stores** | **Configuration** | **Sales** | **Checkout**, where you will find the following panels:

- **Checkout Options**: On this panel, you can decide whether or not to use the onepage checkout feature, allow guests (non-registered customers) to checkout, and require the customer to confirm they have read and will abide by your terms and conditions.
- **Shopping Cart**: This panel dictates settings for how long quotes should survive, to where shoppers are redirected after adding a product to their shopping cart, and what images should be displayed in the shopping cart for grouped or configurable products.
- **My Cart Link**: Set whether the **My Cart Link** shown on each page should display the total number of items in the cart (number of unique products) or the total item quantities (products X quantity of each). For example, if you choose **Display number of items in cart**, a shopping cart with two baseball bats will show 1 item in the **My Cart** link. **Display item quantities** would show 2 items.

Product configurations

Aside from the process of adding new products to your store, there are a number of configurations you should review that affect how products are managed and presented. The goal of any Magento store is to sell, and the ease with which customers can shop, as well as the presentation of the categories and products, greatly affects the success of any e-commerce venture.

Therefore, this section of the checklist may be a lengthy, yet necessary, process. There are no set recommendations, either, for most of these settings, as we find different intentions for each site we build. As with all Magento configurations, don't assume each setting's purpose is clear.

Some product categories lend themselves to long listings of products, each on its own line. Other products may be better suited to a grid layout of no more than six products to a page. Magento's immense flexibility means you not only have a variety of presentation options; it also means you have to be willing to experiment and test. And that, my friend, is one of the exciting aspects of configuring a Magento store.

Catalog

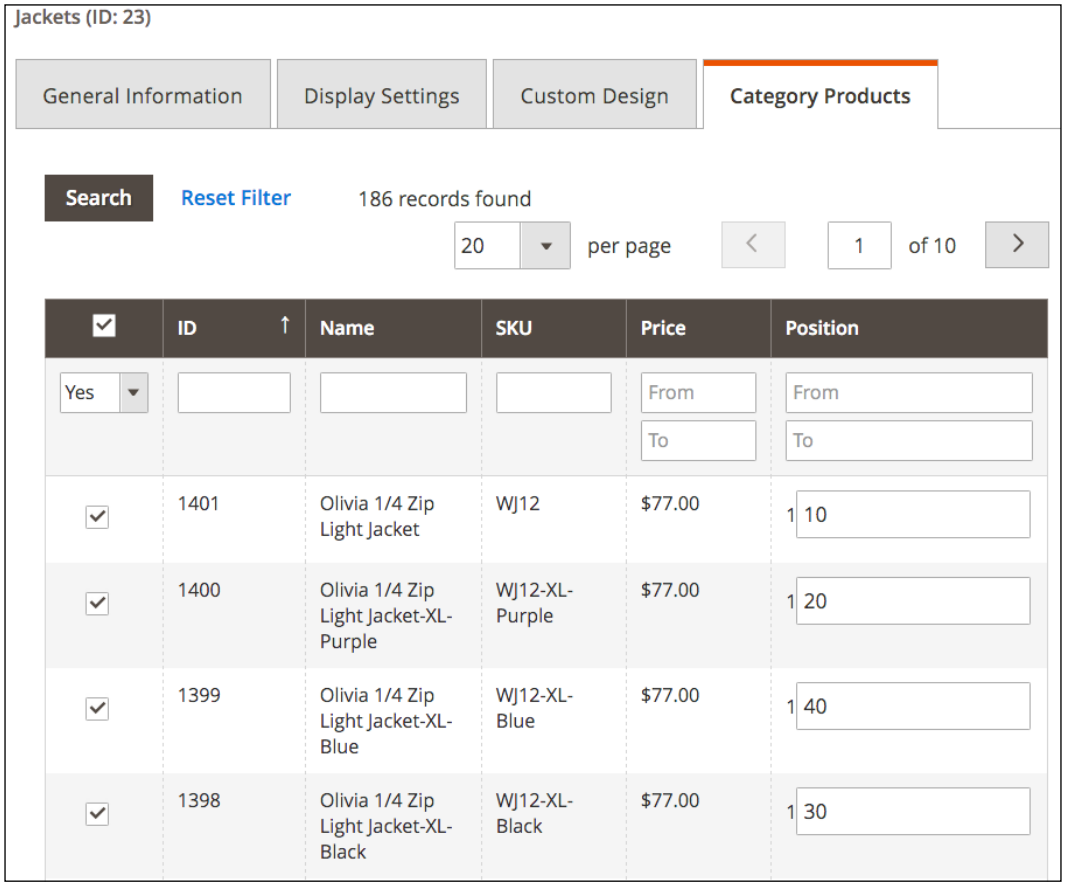
The **Stores** | **Configuration** | **Catalog** | **Catalog** configuration section has, perhaps, the most panels of any section in Magento. I'm going to break each panel down into its own subsection in order to address the many configuration choices.

Storefront panel

This is one panel with which we encourage you to experiment, as it dictates how products are to be displayed when a customer views a category in your store.

- **List Mode**: Set the default category view to **Grid Only**, **List Only**, **Grid by default**, or **List by default**.
- **Products per Page on Grid Allowed Values**: On grid view pages, there will be a drop-down menu to allow customers to select how many products should appear. The values you use here should be a multiple of how many products appear on each row. For the default of three products in each row, use values that are evenly divisible by three to avoid having an incomplete last row.
- **Products per Page on Grid Default Value**: Set the default number of products to display on a grid layout category page.
- **Products per Page on List Allowed Values**: This uses the same methodology as for the **Grid Allowed Values**, except that you're not concerned with multiples of products per row, since each row only contains one product.
- **Products per Page on List Default Value**: As you can imagine, this is the default number of products that appear in a list view. As with any view default value, this can be a number larger than the smallest number in your list of allowed values.
- **Allow All Products per Page**: If your categories don't contain a very large number of products, you may want to allow customers to select All as one of the allowed values. Setting this value to **Yes** will automatically add All to the drop-down menu of allowed values.

- **Product Listing Sort by**: Customers can sort views by **Best Value**, **Name**, or **Price**. This selection determines the default sorting of views. **Position** is one of the more misunderstood concepts of Magento configurations, so allow me to explain. If you go to a category detail screen under **Products | Categories**, you'll find under the **Category Products** tab a list of products assigned to that category. The last column is labeled **Position**. By entering values into these fields, you dictate a manual sorting order for those products, in ascending order of the position value. For instance, if you want to feature products in a special order, you might enter position values of 10, 20, 30, and so on. The following screenshot shows how we can dictate the sorting order for the Jackets category so that the items are in ascending order according to the values entered into the last column.





If you do not enter position values, **Position** sorts by the products' ID values. In this example, if I leave the position values at their default value of zero, these products would appear in this order: **Ottoman**, **Chair**, **Couch**, **Magento Red Furniture Set**.

- **Use Flat Catalog Category** and **Use Flat Catalog Product**: As discussed in *Chapter 8*, *Optimizing Magento*, flattening category and product records can speed up database lookups, thus decreasing page generation times.
- **Allow Dynamic Media URLs in Products and Categories**: If you want to insert images into product and category descriptions, you may want Magento to use dynamic URLs to preserve the image link regardless of changes you make to design themes. If you're set on your theme and where you want to store images, set this to **No**, as it can help reduce the amount of server processing time needed to render description content.

Product reviews

By default, Magento allows viewers to submit reviews for products. This panel determines whether non-registered customers — or guests — are allowed to submit reviews for products.

Product alerts

The alerts configured in this panel pertain to emails that can be sent to customers when product prices or stock availability changes. If you set **Allow Alert When Product Price Changes** to **Yes**, then customers will see a link labeled **Sign up for price alert** on each product page.

Product alerts run settings

If you have activated your cron jobs, Magento will process any customer-subscribed pricing and stock availability alerts according to the schedule you specify in this panel. You can also receive email alerts if an error in the processing occurs.

Product image placeholders

See the section *Placeholder Images* earlier in this checklist for information on uploading placeholder images.

Recently viewed/compared products

In this panel, you can set how customer-selected recently viewed and compared product lists are handled, especially if you are operating a multi-store installation.

Price

How you choose product price sharing — globally or by website — affects how currency conversions are applied to prices.

Layered navigation

In most cases, automatic calculation of price steps in the layered navigation sidebar will work fine. However, in some cases, you may want to set your own steps for each store.

Category top navigation

If you want to limit the depth of your top menu category navigation, enter the maximum level you wish. Zero (0) means all levels will be displayed.

Search engine optimizations

This panel contains several settings that can affect how well your site is indexed by search engines, such as Google, Yahoo! and Bing.

- **Popular Search Terms**: Enabling this feature adds a link to a page of search terms used in searches on your site. This helps search sites identify links generated by popular searches and can help in your rankings when those terms are used in the search engines.
- **Product URL Suffix** and **Category URL Suffix**: By default, product and catalog page URLs end in `.html`. You can specify any suffix you wish, but you may also want to have no suffix, as is the common practice for many websites.
- **Use Categories Path for Products URLs**: If you want URLs for products to contain the category name in the path, such as `http://www.storedomain.com/furniture/living-room/ottoman`, set this to **Yes**.
- **Create Permanent Redirect for old URLs if URL key changed**: During development and setup, I generally set this to **No**, as there is no reason to have Magento create a lot of redirects as you edit product URL keys. However, before launch, you should set this to **Yes** so that future updates will create redirects. These redirects mean that older links still showing in search engines will lead visitors to the correct pages.

- **Page Title Separator**: Enter the character you wish to use in URLs as a substitute for blank spaces. It is generally accepted that a hyphen (-) is better for SEO than an underscore (_).
- **Use Canonical Link Meta Tag for Categories** and **Use Canonical Link Meta Tag for Products**: Search engines — especially Google — can penalize you for duplicate content. In an e-commerce store, categories and products can be accessed through a variety of URLs. For instance, `http://www.storedomain.com/ottoman` and `http://www.storedomain.com/furniture/living-room/ottoman` take the user to the very same page (Magento knows how to interpret both URLs). To Google, these are two different pages, both with the same content. Therefore, Google might penalize your site for having duplicate content, when, in fact, it's not. Canonical link meta tags are, as the name implies, meta tags in your page header that contain, for lack of a better term, the *definitive link* to the page. That is, if Google analyzes multiple URLs, but each one has the same value for the canonical link meta tag, then Google understands that these pages are really one in the same and treats them not as duplicate pages, but simply alternative link paths. An example of a canonical link meta tag, for our example ottoman, would be `<link rel="canonical" href="http://www.storedomain.com/ottoman" />`, and it would be the same regardless of the URL used to arrive at the ottoman page.

Catalog search

Your site will most likely have a site-wide search feature, with a search field somewhere on the page. Allowing your visitors to be able to search your site to find products is one more way you can increase the usability of your Magento site.

- **Minimal Query Length**: This represents the minimum number of characters that are required in order to do a search of your site. While the default value is 1, we usually set this to at least 3. Searching for one letter among all the possible categories and products of your site doesn't really make sense. Three may even be too small. Experiment and find the ideal minimum. In most Magento themes, the search field is auto complete, meaning that once the user starts typing into the field, Magento is immediately searching the database for possible matches, displaying them just below the field. This minimum value dictates how many letters are typed before Magento starts this searching process.

- **Maximum Query Length**: Enter the maximum number of characters you wish to allow for a query.
- **Maximum Query Words Count**: To keep searches fast and efficient, you should have some limit to the number of words that are used in a Like search.

RSS feeds

Go to **Stores** | **Configuration** | **Catalog** | **RSS Feeds** and enable any **RSS feeds** you want Magento to create.

Maintenance configurations

After setting up a new site, we know it's tempting to consider maintenance issues at a later time. However, before you know it, later becomes yesterday and you may find that not attending to basic maintenance tasks become tomorrow's "oh, shucks!"

Backups

Use the information in *Chapter 9*, *Advanced Techniques*, to re-confirm that you have set your backup systems in place. This is perhaps the most important pre-launch activity!

Summary

At this point, you should be ready to launch. Of course, the store owner or administrator may still need to add more products and content, but from a developer's point of view, if you have completed the steps in this checklist, your initial work is done.

Congratulations!

We would like to add one more item to the list, though: test. Test, test, test, and test again. Before you go live, have the store administrator, any backend users, and your colleagues go through all possible scenarios. Store owners are always eager to launch — usually yesterday — but you cannot overdo thorough testing. It's always better to catch problems before launch than after.

As you've no doubt realized — and one great reason you bought this book — Magento is powerful and complex. Many assume that since the community edition is free to use and PHP-based, that anyone with the knowledge of PHP can easily master Magento. We all know that's not really the case. Knowledge of how to apply Magento and the depth of Magento's features and interactions is what will truly turn a Magento novice into a Magento master.

Bibliography

This course is packaged keeping your journey in mind. It includes content from the following Packt products:

- *Magento 2 Development Essentials, Fernando Miguel*
- *Magento 2 Cookbook, Ray Bogman & Vladimir Kerkoff*
- *Mastering Magento 2, Bret Williams & Jonathan Bownds*

Index

Symbols

.htaccess configuration
reference link 134, 135
.json format
reference link 66

A

access control list (ACL) resource 317
advanced pricing
managing 286-289
aheadWorks
URL 10
Alternative PHP Cache (APC) 190
Apache
about 4
URL 4
Apache Friends 4
Apache Friends Support Forum
URL 6
Apache Varnish 18
Apache Web server deflation
about 133, 134
reference link 133
Application Programming Interface (API) 18
Atom.io 53, 54
attributes
about 426
advanced properties 433
changing 429
labels, managing 434
options, managing 431
properties 430
storefront properties 434, 435
swatch, managing 431, 432
attribute sets
creating 435-438
managing 247-251
attribute types
about 428, 429
selecting 429
Authorize.net direct post 506

B

backend cache
Redis, configuring 190-198
backend data grid
creating 320-326
uiComponent configuration 327
backend form
adding 336, 337
creating 336
creating, to add/edit data 330-336
data, loading 338
data, saving 338
URL 330
backend orders
managing 494-497
orders, converting to invoices 497, 498
shipments, creating 498, 499
basic Magento 2.0 theme
creating 52
BitBucket
URL 295
Bitnami
URL 6

blank theme features 47
blocks
about 92, 93
using 543, 544
Braintree 505
branding 463
BrowserMob
URL 617
bundled products
creating 448-450
bundle product type 423, 424
bundler
URL 62
Business to Business (B2B) 237, 278
Business to Consumer (B2C) 278

C

cache configuration
reference link 131
cache management
about 52
reference link 26
caching
about 127, 612
core caching 613
enabling 130, 131
full page cache 614
impact 614
in Magento 2 615
managing 614
cart price rules
coupon codes, generating 575-577
creating 564, 565
new rule, adding 565, 567
rule actions, defining 571-573
rule labels, modifying 574
rules conditions, defining 568-570
testing 577
catalog grid
products, managing 260-264
catalog price rule
creating 559-563
catalogs 409
categories
about 409
creating 410, 411
re-ordering 416
special 416-418
categories, creating
category products tab 415
custom design tab 415
general information tab 411-413
settings tab, displaying 413, 414
CDN for Magento 139
CDNs (Content Delivery Networks)
about 139
using 619
Chrome Web Store
URL 110
CLI command option
creating 382-390
CloudFlare
about 190
Magento 2, configuring with 209-217
URL 210
CMS blocks 49
CMS page
about 49
creating 540-543
customizing 536
CMS page, customizing
about 536
content screen 538, 540
Home Page layout, modifying 536-538
command line
used, for installing Magento 2 sample data 163-166
used, for managing Magento 2 backup 175-177
used, for managing Magento 2 cache 169-174
used, for managing Magento 2 indexes 166-169
command-line configuration, Magento 2.0 24
command-line utility 24-26
Community Edition (CE) 9, 181
complex product types
about 420
bundle product type 423, 424
configurable product type 420-422
downloadable product type 425

grouped product type 423
virtual product type 425
Composer
about 62, 63, 153
installing, on Unix-like operating systems 63
Magento extension, installing via 143
URL 62
composer.json file, parameters
autoload 66
description 66
license 66
name 66
require 66
type 66
version 66
Composer packages
reference link 88
Composer-Setup.exe
reference link 64
CompStore content
creating 71-75
CompStore Electronics theme
activating 70
CompStore logo
creating 69, 70
CompStore theme
about 61
adjusting, for mobile devices 112
building 64-66
new CSS, applying to 67-69
configurable product
creating 443-447
configurable product type 420-422
connect portal
URL 164
Content Management System (CMS) 36, 533, 534
controller
about 89-91
creating, to display data 309-315
crashlytics 83
Creative Commons by 3.0
URL 70
Criteo
URL 103
cron
setting up, for back-up 638, 639
cron jobs
about 27
reference link 130
cron, Magento
about 630
compatible settings, creating 636
frequency, setting 635
jobs 630-632
jobs, triggering 632-634
schedules, tuning 635
URL 634
crontabs 630
cross-sell products 458
CSS 99
CSS 3 media queries 112
CSS preprocessing, with LESS 66
CURL 181
currency rates
configuring 284, 285
customer groups
about 557, 558
creating 558
managing 278-280
customers 396
customers segments 558
custom variables
about 49
creating 50
working 51

D

data
displaying, web route and controller creation for 309-315
indexing 127, 128
re-indexing 127, 128
database, backing up
about 637
built-in back-up 637
cron, setting up 638, 639
MySQLDump, using 638
database models
working with 296-298

data interface 362
Data Migration Tool 181
DemoInterface 381
DemoRepositoryInterface 381
dependency injection
about 91
reference link 91
used, for passing classes to own class 342-345
dependency injection (DI) 324
design configurations
404 and error pages 650
about 649
favicon 650
packing slips 649
placeholder images 650
transactional e-mails 649
design packages and themes
default installation 471, 472
Development Test Acceptance Production (DTAP) 178
DevTools extension, options
about 107
CSS, viewing 108
custom devices, creating 109
device preset, modifying 107
media queries, inspecting 108
network connectivity 107
DigitalOcean
URL 238
Document Object Model (DOM) 94
downloadable product
creating 450
downloadable product type 425
dynamic view files 45

E

e-commerce project
scope, defining 394
technical resources, assessing 397
users, planning 395
Enterprise Edition (EE)
about 9, 251
version 181
Entity, Attribute Value (EAV)
about 126, 67, 606
advantages 610
attribute 126, 607
disadvantages 610
entity 126, 606, 607
making flat 610, 611
merging 608, 609
value 126, 608
Entity Attribute Value (EAV) 167
environmental variables
URL 166
Exchangeable Image File (EXIF) data 217
expires header
enabling 134
extensions
authenticating, TwitterOAuth used 85
basics, initailizing 292-294
building 597
creation, ways 291, 292
files 597
packages, installing from 295, 296
step five 600
step four 600
step one 598
step six 601, 602
step three 599
step two 598, 599
URL 592
extension structure, Magento 2.0 80-82

F

Facebook 82
fallback model 468
filtered navigation 414
Firebug plugin
URL 480
FlatIcon
URL 70
Full Page Cache
Varnish, configuring as 203-209
Full Page Cache (FPC) 190
functions
modifying, plugins used 345-348

G

GitHub
URL 88
GitHub Data Migration Tool
URL 187
GitHub Gist
URL 202
GitHub token
URL 164
Global 402, 403
Global-Website-Store methodology 401
Google 82
Google Analytics
tracking code 36
URL 36
Google Checkout 24
Google Chrome
URL, for downloading 104
Google Chrome DevTools
about 104
accessing 104-106
Google Chrome DevTools Device Mode 104
Google DevTools
URL, for official page 106
Google PageSpeed ranking 189
Google Product feeds 631
graphical user interface (GUI)
used, for installing Magento 2
sample data 157-162
grouped product
creating 447, 448
grouped product type 423
Grunt.js
about 144
URL 144
Grunt task runner
styles, debugging with 143-146

H

hashtag parameter 97
hosted libraries
reference link 139
HTML
using 547
HTTP/2
Magento 2, configuring with 221-228
URL 227

I

ImageMagick library
URL 221
Inchoo blog
URL 597
indexers 128
indexing
about 127, 611
flat catalog, using 612
non-flat catalog, using 612
reindexing 612
indexing sitemaps
URL 584
in-house hosting
about 399
servers 399, 400
inline translations 475, 476
installation files, XAMPP for Windows
7zip 5
Installer 5
Zip 5
installing
Composer, on Unix-like operating systems 63
Composer, on Windows 64
Magento 11-15
Magento extension 142
Magento extension, manually 143
Magento extension, via composer 143
XAMPP 5
XAMPP, for Linux 8
XAMPP, for OS X 9
XAMPP, for Windows 5-7
interception 345, 346
inventory
configuring 280-284
low stock notifications 452
managing 451, 452
product reports 452, 453

L

layered navigation 236, 426
layouts
controlling, expertly 484-486
customizing 481-483
default layout file, customizing 487, 488
reference tag, using to relocate blocks 486, 487
LESS
about 66
reference link 66
Linux
XAMPP, installing for 8
local test installation
setting up 400
Logomakr
URL 69
Luma 161
Luma theme 44-47

M

Magento
about 3-10
functionality extending, Magento plugins used 594, 596
installing 11-15
MVC architecture 15, 16
module architecture 592, 593
project, requisites 394
reference link, for installation 15
reference link, for official project website 132
SEO management 30
sales process 492, 493
URL 3, 11
URL, for documentation 147
URL, for official training program 148
Magento 1 database
about 183
transferring, to Magento 2 181-187
Magento 2
about 236
caching 615
configuring, HTTP/2 used 221-227
configuring, with CloudFlare 209-217
indexes 166
optimized images, configuring 217-221
performance testing, configuring 228-233
URL 159
Magento 2.0
command-line configuration 24
enhancements, in security layer 18
extension structure 80-82
responsive design 112
theme structure 44, 45
URL, for official documentation 66
Magento 2.0 templates
customizing 76
Magento 2 backup
managing, via command line 174-177
Magento 2 cache
managing, via command line 169-174
Magento 2 Composer repository
reference link 143
Magento 2 indexes
managing, via command line 166-169
Magento 2 sample data
installing, graphical user interface (GUI) used 157-162
installing, via command line 163-166
Magento 2 set mode (MAGE_MODE)
managing 178-181
Magento certification
about 148
reference link 148
Magento Commerce 18
Magento Community users 400
Magento Connect
about 590, 102
extensions 141
free extensions 591, 592
searching 590, 591
URL 17, 102, 141
Magento Core extensions 143
Magento cron
reference link 130
Magento cron job 128-130
Magento developers
URL 102, 397
Magento development
overview 80
Magento documentation
URL 597

Magento EAV 126
Magento extension
creating 82
installing 142
installing, manually 143
installing, via composer 143
Magento Framework 20
Magento hosting server
fine tuning 132
Magento hosting service
selecting 132
Magento indexing
managing 27
reference link 128
Magento installation
checklist, requisites 395
Magento knowledge center 147, 148
Magento order management system
about 21
sales operations 22, 23
simplified checkout process 23
Magento pages
category pages 39, 40
CMS pages 36, 37
optimizing 36
product pages 38, 39
Magento plugins
used, for extending Magento functionality 594-596
Magento skills
improving 148
Magento study guide
reference link 148
Magento theme
about 44
URL, for official documentation 44
Magento theme structure
about 464-467
parent theme, configuring in theme.xml 469
theme files and directories 467, 468
URL, for official documentation 46
Magento UI
about 113, 114
URL 115
Magento UI library 112
Magento, upgrading
about 639
installation, upgrading 641-643
Marketplace keys, obtaining 640
Magento user interface (UI) library 46
Mail transfer agent (MTA) 400
maintenance configurations
about 662
backups 662
management interface 362
Manufacturer's Suggested Retail Price (MSRP) 286
MariaDB
about 4
URL 4
Marketplace keys
obtaining 640
Memcache 19
Memcached
configuring, for session caching 199-203
Memcached session storage
reference link 132
Memcached viewer 203
meta fields
in Magento 585
using, for search engine visibility 584, 585
minimum advertised price (MAP) 286
mobile devices
CompStore theme, adjusting for 112
mod_deflate configuration
reference link 134
Models 20
Model View Controller (MVC) 3
module
deploying 99-101
developing 86-88
packaging 102
publishing 102
mopub 83
multiple businesses
used, for keeping finances separate 406
multiple domains
using, for effective market segmentation 404

multiple languages
used, for selling globally 406
multiple stores, planning
about 404
multiple businesses, used for keeping finances separate 405
multiple domains, used for effective market segmentation 404
multiple languages, used for selling globally 406
MySQL
about 4
URL 618
MySQL cache size configuration
reference link 137
MySQLDump
using 638
MySQL server
optimizing 135-137
MySQL Workbench
URL 606

N

namespaces 91
new CSS
applying, to CompStore theme 67-69
new CSS mixin media query
implementing 115-118
newsletters
about 577
customers, subscribing 578
issues, checking for 581
scheduling 580, 581
subscribers, managing 581
templates, creating 578, 580
Nexcess
about 139
URL 203
Nginx server
using 618
Node.js
URL 144
non-product content 533
npm
URL 62

O

Observer
about 93, 94
event handler 87
reference link 87
off-site payment systems
about 501
cons 502
pros 502
on-site payment systems
about 502
cons 503
pros 502
operating systems (OS) 5
optimized images
in Magento 2, configuring 217-221
OS X
XAMPP, installing for 9

P

Packagist
URL 143
page_cache 195
page link
adding 544, 545
HTML, using 547
widget, using 547
WYSIWYG, using 545, 546
pages
about 534-536
CMS page, customizing 536
PageSpeed
URL 220
parent theme 47
payment methods
about 499
authorize.net direct post 506
bank transfer payment 505
Braintree 505
cash on delivery payment 505
check/money order 505
Payment Card Industry Data Security Standard (PCI DSS) 500
PCI compliance 500, 501
purchase order 506
zero subtotal checkout 505

payment systems
classes 501
PayPal
about 24, 503
all-in-one payment solutions 503
payment gateways 504
PayPal Express 504
PayPal Express 646
PDO 19
performance testing
configuring 228-233
Perl
about 4
URL 4
PHP
about 4, 397
memory configuration 135
URL 4
phpAdmin 606
PHP extensions 19
phpMyAdmin 12
PHP object-oriented programming
reference link 91
PHP Redis
URL 192
PHPRedMin
URL 196
PHP Standards Recommendations (PSR)
about 19
reference link 20
pipe delimited list 460
plugins
used, for modifying functions 345-348
practices, PHP Standards Recommendations (PSR)
PHP extensions 19
PSR-0-Autoloading Standard 19
PSR-1-Basic Coding Standard 19
PSR-2-Coding Style Guide 19
PSR-3-Logger Interface 20
PSR-4-Autoloading Standard 20
pre-launch checklist, Magento
system configurations 646
pricing tools
about 453
autosettings 455, 456
pricing, by customer group 453, 454
quantity-based pricing 454, 455
processes/modules, Magento 2.0
improvements 18
product inventory management (PIM) system 280
products
bundle 252
bundled products, creating 448-450
complex product types 420
configurable 252
configurable product, creating 443-447
creating 251-260
downloadable 252
downloadable product, creating 450
gift card 252
grouped 252
grouped product, creating 447, 448
importing 459
importing, shortcut 459-461
managing, customer focused way 419
managing, in catalog grid 260-264
new product screen 439
simple 252
simple product, creating 440-442
simple product type 419, 420
virtual 252
virtual product, creating 451
products configurations
about 656
catalog 657
catalog search 661
category top navigation 660
layered navigation 660
price 660
product alerts 659
product alerts run settings 659
product image placeholders 659
product reviews 659
recently viewed/compared products 660
RSS feeds 662
search engine optimizations 660, 661
storefront panel 657-659
product-type
creating 356-362

promotions
about 559
cart price rules, creating 564, 565
catalog price rule, creating 559-563
PSR-0-Autoloading Standard 19
PSR-1-Basic Coding Standard 19
PSR-2-Coding Style Guide 19
PSR-3-Logger Interface 20
PSR-4-Autoloading Standard 20
PSR-4 pattern
URL 91

Q

quantity-based pricing 454, 455
query cache feature 135

R

Rapido image
URL 218
Redis
configuring, for backend cache 190
reference link 132
related products 457
repository interface 362
Representational State Transfer (REST) 82
responsive design, Magento 2.0 112
Responsive Web Designer Tester extension 104, 110-112
Responsive Web Design (RWD) 46, 112
root catalog 237-243

S

sales configurations
about 651
checkout 656
company information 652
contacts 652
currency 653
customers 653, 654
general sales settings 653
newsletters 655
payment methods 655
sales emails 654
shipping 655
store email addresses 652
tax rates and rules 654
terms and conditions 655
Sales layer 21
sales process
about 492
Magento sales process 492, 493
sample data
URL 159
scope 646
scripts
minifying 138
Search Engine Optimization (SEO)
about 29, 236, 281, 582, 651
analytics 651
meta tags 651
sales configurations 651
sitemap 651
search engines
meta fields, in Magento 585
optimizing 584
visibility, meta fields used 584
search ranking optimization 218
Secure Socket Layer (SSL) Encryption Certificate 646
segmentation fault 176
Send Newsletter crontab 635
SEO catalog configuration
about 34
options 34, 35
XML sitemap manager 35
SEO checklist
about 586
canonical URLs 586
category and product descriptions 586
meta description fields 586
meta keywords 586
meta title fields 586
XML Sitemap 586
SEO configuration 31-33
server
CDNs (Content Delivery Networks), using 619
deflation 616, 617
expires, enabling 617
MySQL cache, increasing 618
Nginx server, using 618

PHP memory, increasing 617
turning, for speed 615, 616
Varnish cache, using 618
Service Consumers 20
Service Layer 20
service layers/contracts
data interface 362
DemoInterface 381
DemoRepositoryInterface 381
management interface 362
repository interface 362
working with 362-381
session caching
Memcached, configuring 199-203
setup scripts
used, for creating tables 298-307
shipping and tax rules
creating 266-277
shipping methods
about 506, 507
allowed countries 509
carrier methods 513
flat rate 510
free shipping 509
handling fee 508
method not available 509
origin 508
table rates 510, 511
simple product image configuration 54, 55
simplified checkout process, Magento order management system
about 23
orders 23
payments 24
promotions 24
sitemaps
adding 582, 584
using 582
software binaries 218
Sparse Matrix 606
SSL Certificate 646
staff 396
staging environment
about 621
basic staging set-up 622, 623
simple approach 622
static blocks 413
static files
overriding 469
static files' directories
creating 55
static view files 45
stock keeping unit (SKU) 419
Store 403
store configuration 30, 31
store management screen 401
styles
debugging, with Grunt task runner 143-146
subcategories
creating 244-246
Sublime Text2 53, 54
Swiss army knife tool 153
Symfony Console component 382
system configuration fields
creating 315
new field, creating 318-320
new group, creating 318
new section, creating 317
new tab, creating 316
system configurations
about 646
administrative base URL 647
base URLs 646, 647
caching 648
cron jobs 648
CSS files, merging 648
file download time, reducing 647
JavaScript files, merging 648
SSL 646
users and roles 648, 649

T

table rates, shipping methods
about 510, 511
quantity and price based rates 511
saving 512
settings 512, 513
uploading 513
tables
creating, setup scripts used 298-307
data installation 307, 308

taxes, managing
about 514
Magento manages taxes 514, 515
tax rates, importing 520
tax rules, creating 515-520
value added tax configurations 520, 521
VAT taxes, setting up 521-525
technical considerations
about 398
hosting provider 398
in-house hosting 399
technical resources
assessing 397
TextMate 53, 54
theme
applying 57, 58
creating 53, 54
declaring 53, 54
theme files
overriding 470, 471
theme inheritance
about 47, 48, 468
static files, overriding 469
theme files, overriding 470, 471
theme logo
creating 55, 56
theme marketplace
reference link 61
themes
customizing 480
theme structure, Magento 2.0 44-46
theme variants
applying 479
selecting 479
themes, assigning 478, 479
working with 476, 477
third-party themes
installing 473, 474
transactional e-mails
about 526, 527
e-mail header and footer, assigning 529, 530
new e-mail template, creating 530, 531
new header template, creating 528, 529
tweets
adjusting, about extensions for mobile devices 120-123
TweetsAbout extension
TwitterOAuth, installing on 85
TweetsAbout module
about 79
structure 84
Twitter
about 82
URL 83
Twitter application
URL 83
Twitter Developer page
URL 83
Twitter Developers Documentation
reference link 82
TwitterOAuth
installing, on TweetsAbout extension 85
URL 85
used, for authenticating extension 85
Twitter REST API 82, 84

U

UberTheme
URL 187
uiComponent configuration
data source 327
mass actions, for grid 327, 329
URL 324, 330
Uniform Resource Names (URN) 86
Unix-like operating systems
Composer, installing on 63
upsell products 458
URL rewrites 411
User-Agent Header
URL 466

V

variables
own variables, using 551, 552
using 549, 550
variant 420
Varnish
configuring, as Full Page Cache 203-209
Varnish cache
reference link 132

Varnish Configuration Language (VCL) file 203, 618
version control 623- 629
views 95-99
virtual product
creating 451
virtual product type 425

W

Webalys
URL 70
Web Application Firewall (WAF) 210
Webcomm Magento Boilerplate 103
Web developer add-on
URL 480
web route
creating, to display data 309-315
website
testing, on different devices 104
Website 403
Web Users 20
Web Users layer, processes
Content 20
Customer 20
Marketing 20
Products 20
Report 20
Sales 20
widget
using 547-549
widget management system 72
widgets
used, for inserting content onto site pages 553-555
using 543, 544
Windows
XAMPP, installing for 5-7
WYSIWYG
using 545, 546

X

XAMPP
about 4
installing 5
installing, for Linux 8
installing, for OS X 9
installing, for Windows 5-7
URL 5
XAMPP PHP development environment 4
XML module configuration file
creating 349-355
XML Schema Definition (XSD) schema 292

Z

Zend framework Case Study
reference link 80
Zend Framework (ZF)
about 20
URL 15, 80
using 80



Thank you for buying

Magento 2 - Build World-Class online stores

About Packt Publishing

Packt, pronounced 'packed', published its first book, *Mastering phpMyAdmin for Effective MySQL Management*, in April 2004, and subsequently continued to specialize in publishing highly focused books on specific technologies and solutions.

Our books and publications share the experiences of your fellow IT professionals in adapting and customizing today's systems, applications, and frameworks. Our solution-based books give you the knowledge and power to customize the software and technologies you're using to get the job done. Packt books are more specific and less general than the IT books you have seen in the past. Our unique business model allows us to bring you more focused information, giving you more of what you need to know, and less of what you don't.

Packt is a modern yet unique publishing company that focuses on producing quality, cutting-edge books for communities of developers, administrators, and newbies alike. For more information, please visit our website at `www.packtpub.com`.

Writing for Packt

We welcome all inquiries from people who are interested in authoring. Book proposals should be sent to `author@packtpub.com`. If your book idea is still at an early stage and you would like to discuss it first before writing a formal book proposal, then please contact us; one of our commissioning editors will get in touch with you.

We're not just looking for published authors; if you have strong technical skills but no writing experience, our experienced editors can help you develop a writing career, or simply get some additional reward for your expertise.