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THIRD EDITION

7 Fully Coded
iOS® Apps

iOS® 8 for Programmers

An App-Driven Approach

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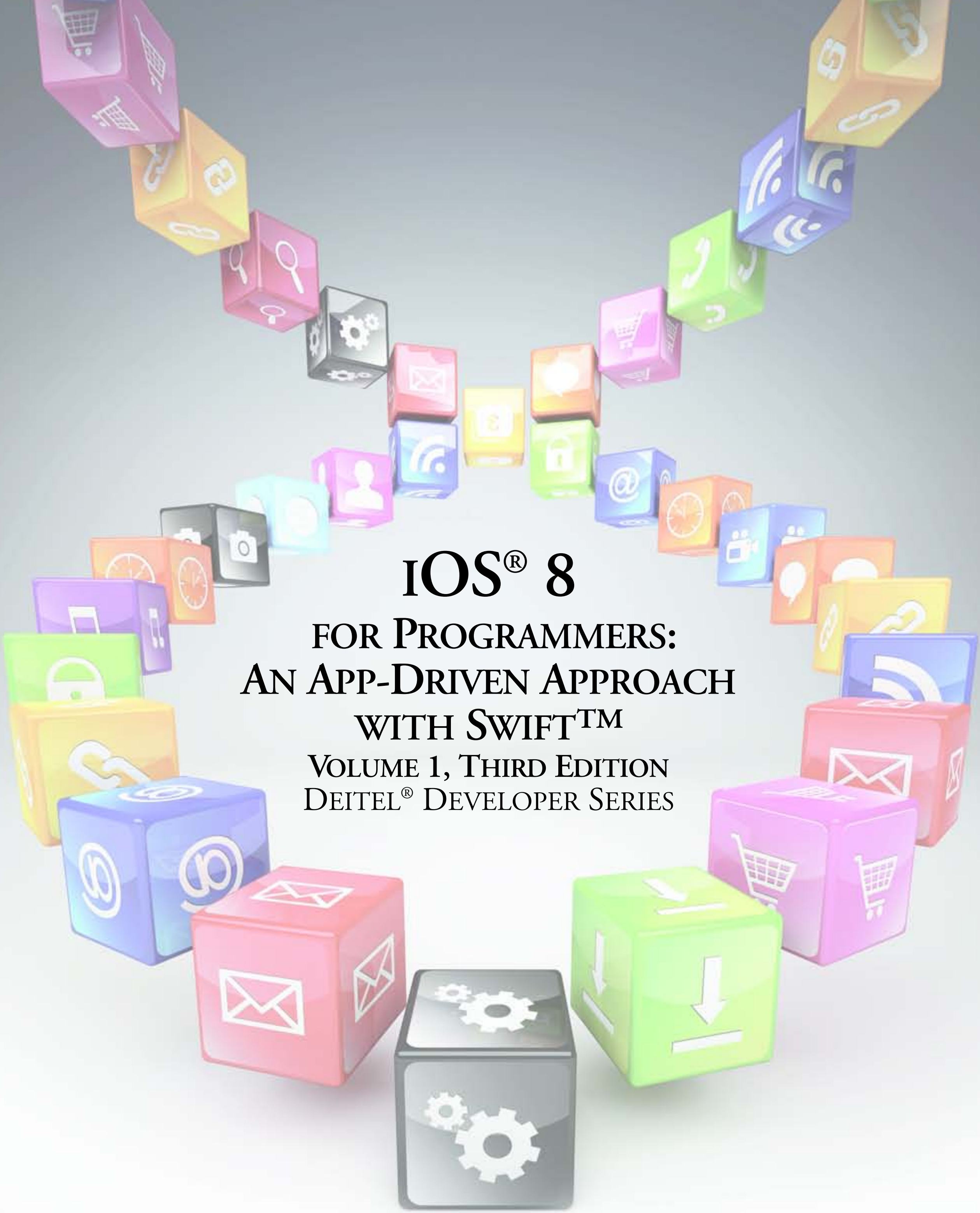

iOS® 8

for Programmers: An App-Driven Approach with Swift™

Volume 1, Third Edition

Deitel® Developer Series

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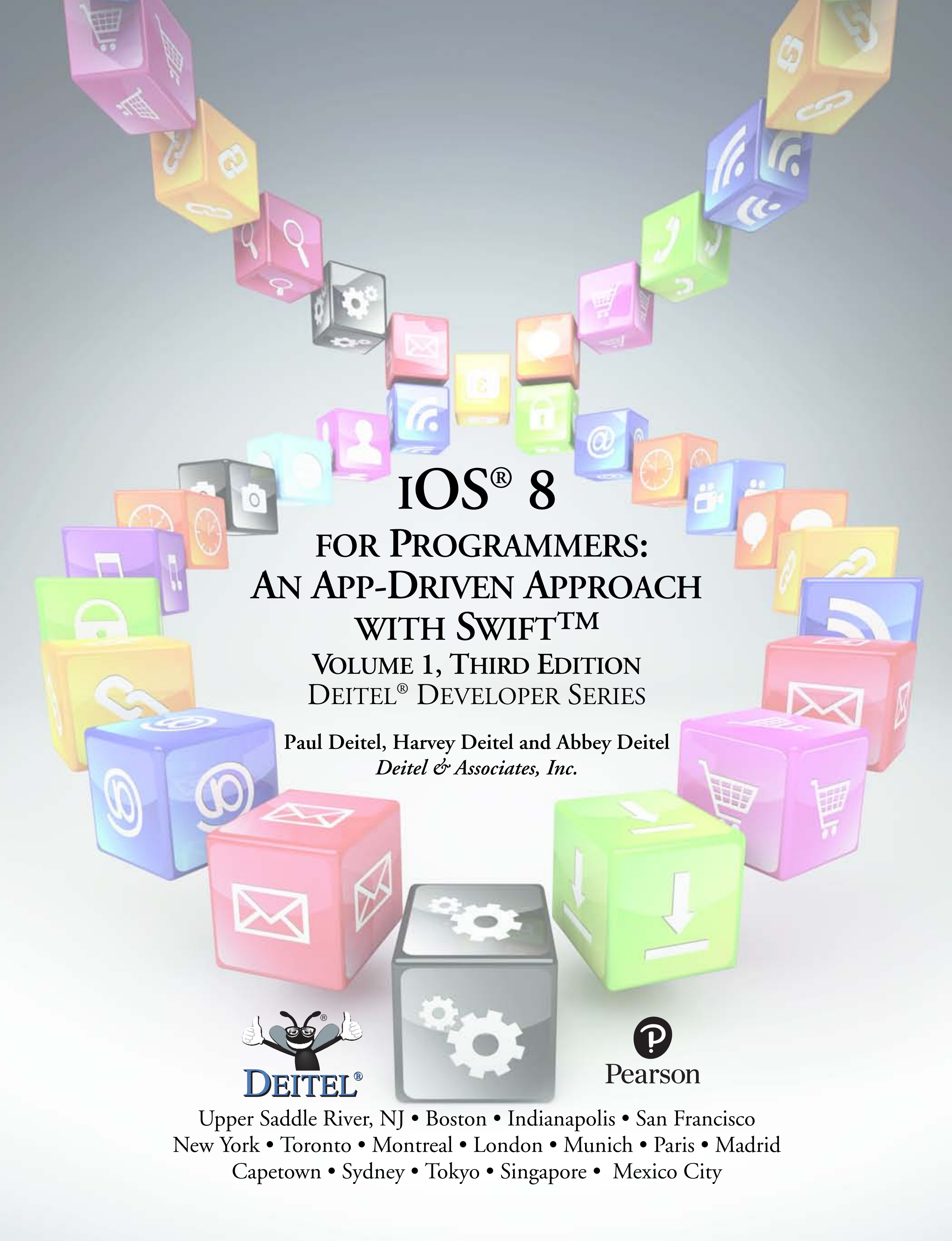

iOS® 8

for Programmers: An App-Driven Approach with Swift™

Volume 1, Third Edition

Deitel® Developer Series

Paul Deitel, Harvey Deitel and Abbey Deitel
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In Memory of Amar G. Bose, MIT Professor and Founder and Chairman of the Bose Corporation:

It was a privilege being your student—and members of the next generation of Deitels, who heard our dad say how your classes inspired him to do his best work.

You taught us that if we go after the really hard problems, then great things can happen.

Harvey Deitel
Paul and Abbey Deitel

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Introducing the iOS Developer Program and iTunes® Connect

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Preface

Welcome to the world of iOS® 8 app development with Apple's new and rapidly evolving Swift™ programming language, the Cocoa Touch® frameworks and the Xcode® 6 development tools.

iOS® 8 for Programmers: An App-Driven Approach with Swift™, Volume 1, 3/e presents leading-edge mobile computing technologies for professional software developers. At the heart of the book is our *app-driven approach*—we present concepts in the context of *seven completely coded and fully tested iOS 8 apps* rather than using code snippets. We've always favored teaching by example—in an app-development world, the best examples are real, working apps.

Chapters 2–8 each present one app. We begin each of these chapters with an introduction to the app, an app test-drive showing one or more sample executions and a technologies overview. Then we proceed with a detailed source code walkthrough. We don't try to be exhaustive—our goal is to get you developing apps quickly with the Xcode 6 integrated development environment, the Swift programming language and the Cocoa Touch frameworks. All of the source code is available at

```
http://www.deitel.com/books/iOS8FP1
```

We recommend that you keep the code open in the IDE as you read the book. You should study the apps sequentially because each introduces technologies that are used in subsequent apps.

This book is Volume 1 of what will become a multi-volume set. Volume 1 presents seven fully coded apps of increasingly rich functionality. The apps cover a range of topics from simple visual programming (without code), to simple programming with Swift, to more involved programming.

Explosive Growth of the iPhone and iPad Is Creating Opportunity for Developers

iPhone and iPad device sales have been growing exponentially, creating significant opportunities for iOS app developers. The first-generation iPhone, released in June 2007, sold 6.1 million units in its initial five quarters of availability.[1] The iPhone 5s and the iPhone 5c, released simultaneously in September 2013, sold over nine million combined in the first three days of availability.[2] The most recent iPhone 6 and iPhone 6 Plus, announced in September 2014, pre-sold four million combined in just one day—double the number of

[1] `http://www.apple.com/pr/library/2009/07/21results.html`.

[2] `https://www.apple.com/pr/library/2013/09/23First-Weekend-iPhone-Sales-Top-Nine-Million-Sets-New-Record.html`.

iPhone 5 pre-sales in its first day of pre-order availability.[3] Apple sold 10 million iPhone 6 and iPhone 6 Plus units combined in their first weekend of availability.[4]

Sales of the iPad are equally impressive. The first generation iPad, launched in April 2010, sold 3 million units in its first 80 days of availability[5] and over 40 million worldwide by September 2011.[6] The iPad mini with Retina display (the second-generation iPad mini) and the iPad Air (the fifth-generation iPad) were released in November 2013. In just the first quarter of 2014, Apple sold a record 26 million iPads.[7]

There are over 1.3 million apps in the App Store[8] and over 75 billion iOS apps have been downloaded.[9] The potential for iOS app developers is enormous.

SafariBooksOnline e-Book and LiveLessons Videos

If you have a subscription to Safari Books Online (`www.safaribooksonline.com`), check out the e-book and LiveLessons video versions of *iOS® 8 for Programmers: An App-Driven Approach with Swift*. Safari is a subscription service popular with large companies, colleges, libraries and individuals who would like access to video training and electronic versions of print publications.

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Intended Audience

This book is part of the *Deitel Developer Series* intended for experienced programmers who know object-oriented programming in a C-based programming language such as Objective-C, Java, C# or C++. Objective-C experience is helpful, but not specifically required. If you have not worked in any of these languages, you should still be able to learn a good amount of iOS 8 app development and object-oriented programming in Swift and Cocoa

[3] `http://techcrunch.com/2014/09/15/apple-sells-4m-iphone-6-and-6-plus-pre-orders-in-opening-24-hours/`.

[4] `http://www.apple.com/pr/library/2014/09/22First-Weekend-iPhone-Sales-Top-10-Million-Set-New-Record.html`.

[5] `http://www.ipadinsider.com/tag/ipad-sales-figures/`.

[6] `http://www.statista.com/statistics/180656/sales-of-tablets-and-ipads-in-the-us-until-2012/`.

[7] `http://www.theverge.com/2014/1/27/5350106/apple-q1-2014-earnings`.

[8] `http://mashable.com/2014/09/09/apple-1-3-million-apps-app-store/`.

[9] `http://techcrunch.com/2014/06/02/itunes-app-store-now-has-1-2-million-apps-has-seen-75-billion-downloads-to-date/`.

Touch by reading the code and our code walkthroughs, running the apps and observing the results. We review the basics of object-oriented programming in Chapter 1. We also assume that you're comfortable with OS X, as you'll need to work on a Mac to develop iOS apps. The book does not include exercises.

This book is *not* a Swift tutorial, but it presents a significant amount of Swift in the context of iOS 8 app development. If you're interested in learning Swift, check out our publications:

- *Swift for Programmers* print book (`www.deitel.com/books/swiftfp`). This book is also available as an e-book on `SafariBooksOnline.com`, `Informit.com`, Amazon® Kindle® and a growing number of other electronic platforms.
- *Swift Fundamentals: Parts I, II and III* LiveLessons videos (`www.deitel.com/books/LiveLessons`), available on `SafariBooksOnline.com`, `Informit.com`, `Udemy.com` and soon on other popular e-learning platforms.

Academic Bundle iOS® 8 for Programmers and Swift™ for Programmers

The *Academic Bundle iOS® 8 for Programmers and Swift™ for Programmers* is designed for professionals, students and instructors interested in learning or teaching iOS 8® app development with a broader and deeper treatment of Swift. You can conveniently order the Academic Bundle with one ISBN: 0-13-408775-5. The Academic Bundle includes:

- *Swift™ for Programmers* (print book)
- *iOS® 8 for Programmers: An App-Driven Approach with Swift™, Volume 1, 3/e* (print book)
- Access Code Card for Academic Package to accompany *Swift™ for Programmers*
- Access Code Card for Academic Package to accompany *iOS® 8 for Programmers: An App-Driven Approach with Swift™, Volume 1, 3/e*

The two Access Code Cards for the Academic Packages (when used together) give you access to the companion websites, which include self-review questions (with answers), short-answer questions, programming exercises, programming projects and selected videos chosen to get you up to speed quickly with Xcode 6, visual programming and basic Swift-based, iOS 8 programming.

Ordering the Books and Supplements Separately

The print books and Access Code Cards may be purchased separately using the following ISBNs:

- *Swift™ for Programmers* (print book): ISBN 0-13-402136-3
- Standalone access code card for Academic Package to accompany *Swift™ for Programmers*: ISBN 0-13-405818-6
- *iOS® 8 for Programmers: An App-Driven Approach with Swift™* (print book): ISBN 0-13-396526-0
- Standalone access code card for Academic Package to accompany *iOS® 8 for Programmers: An App Driven Approach with Swift™, Volume 1, 3/e*: ISBN 0-13-405825-9

Instructor Supplements

Instructor supplements are available online at Pearson's Instructor Resource Center IRC). The supplements include:

- Solutions Manual with selected solutions to the short-answer exercises.
- Test Item File of multiple-choice examination questions (with answers).
- PowerPoint® slides with the book's source code and tables.

Please do not write to us requesting access to the Pearson Instructor's Resource Center. Certified instructors who adopt the book for their courses can obtain password access from their regular Pearson sales representatives (`www.pearson.com/replocator`). Solutions are *not* provided for "project" exercises.

Key Features of *iOS® 8 for Programmers: An App-Driven Approach with Swift™, Volume 1, 3/e*

Here are some of this book's key features:

App-Driven Approach. Chapters 2–8 each present one completely coded app—we discuss what the app does, show screen shots of the app in action, test-drive it and overview the technologies and architecture we'll use to build it. Then we build the app's GUI and resource files, present the complete code and do a detailed code walkthrough. We discuss the Swift programming concepts and demonstrate the functionality of the Cocoa Touch APIs used in the app.

Swift Programming Language. Swift was arguably the most significant announcement at Apple's Worldwide Developers Conference in 2014. Although apps can still be programmed in Objective-C, Swift is Apple's language of the future for app development and systems programming.

We've programmed all the book's apps in Swift—previous editions were programmed in Objective-C. Swift is a contemporary language with simpler syntax than Objective-C. It enables a clean, concise coding style and has a strong focus on error prevention. Our own experience with Swift has been that we can develop apps faster and with significantly less code than when we program in Objective-C.

At the time of this writing, Apple had not as yet published coding guidelines for Swift—we'll conform to them when they appear. We use a mix of Apple's Objective-C coding guidelines and Deitel coding guidelines for this edition.

Cocoa Touch Frameworks. Cocoa Touch is the groups of reusable components (known as frameworks) for building iOS apps. Throughout this edition, we use many of the Cocoa Touch features and frameworks, even though they're programmed mostly in Objective-C. Apple has made this easy with a technique called "bridging." We simply call Cocoa Touch methods and receive the returns *transparently*—it feels as if Cocoa Touch is written in Swift.

iOS SDK 8. Between Volumes 1 and 2 of *iOS® 8 for Programmers: An App-Driven Approach with Swift™, Volume 1, 3/e*, we cover a broad range of the features included in iOS Software Development Kit (SDK) 8.

Xcode 6. Apple's Xcode integrated development environment (IDE) and its associated tools for Mac OS X, combined with the iOS 8 Software Development Kit (SDK), provide all the software you need to develop and test iOS 8 apps.

Instruments. The Instruments tool, which is packaged with the SDK, is used to inspect apps while they're running to check for memory leaks, monitor processor (CPU) usage and network activity, and review the objects allocated in memory.

iOS Human Interface Guidelines. We encourage you to read Apple's *iOS Human Interface Guidelines* (HIG) and follow them as you design and develop your apps. The HIG discusses human interface principles, app design strategies, user experience guidelines, iOS technology usage guidelines and more. We gradually introduce HIG issues as we encounter them in the apps we develop. Section 9.3 overviews the HIG, discusses features and functionality required to get your app accepted on the App Store and lists reasons why Apple rejects apps.

Multimedia. The apps use iOS 8 multimedia capabilities, including graphics, images, animation and audio. We'll present video capabilities in Volume 2.

iOS App Design Patterns. This book adheres to Apple's app coding standards, including design patterns, such as Model-View-Controller (MVC), Delegation, Target-Action and Observer.

Features

Syntax Coloring. For readability, we syntax color the code, similar to Xcode's use of syntax coloring. Our syntax-coloring conventions are as follows:

```
comments appear in green
keywords appear in blue
constants and literal values appear in light blue
all other code appears in black
```

Code Highlighting. We highlight the key code segments in each app that exercise the new technologies the app features.

Using Fonts for Emphasis. We place key terms and the index's page reference for each term's defining occurrence in **bold maroon** text for easier reference. We emphasize on-screen components in the **bold Helvetica** font (e.g., the **File** menu) and emphasize Swift program text in the `Lucida` font (for example, `var x = 5`).

Source Code. All of the source-code examples are available for download from:

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http://www.deitel.com/books/iOS8FP1/
```

Documentation. All of the manuals that you'll need to develop iOS 8 apps are available free at `http://developer.apple.com/ios`.

Chapter Objectives. Each chapter begins with a list of objectives.

Figures. Abundant tables, source-code listings and iOS screen shots are included.

Index. We include an extensive index, which is especially useful when you use the book as a reference. Defining occurrences of key terms are highlighted with a **bold** page number.

iOS® 8 for Programmers: An App-Driven Approach with Swift™, Volume 2

Volume 2 of this series will contain additional app-development chapters. **For the status of Volume 2 and for continuing book updates, visit**

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http://www.deitel.com/books/iOS8fp2
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Our *iOS 8 Fundamentals* LiveLessons videos show you what you need to know to start building robust, powerful iOS apps with the iOS Software Development Kit (SDK) 8, the Swift programming language, Xcode and Cocoa Touch. It will include approximately 10+ hours of expert training synchronized with *iOS® 8 for Programmers: An App-Driven Approach with Swift™, Volume 1, 3/e*. For additional information about Deitel LiveLessons video products, visit

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http://www.safaribooksonline.com/register
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Acknowledgments

We'd like to thank Barbara Deitel for long hours spent researching iOS 8 and its many related technologies.

Pearson Education Team

We're fortunate to have worked on this project with the dedicated publishing professionals at Prentice Hall/Pearson. We appreciate the extraordinary efforts and 19-year mentorship of our friend and professional colleague Mark L. Taub, Editor-in-Chief of Pearson Technology Group. Kim Boedigheimer recruited distinguished members of the iOS community to review the manuscript and she managed the review process. We selected the cover art and Chuti Prasertsith designed the cover. John Fuller managed the book's publication.

Reviewers

We wish to acknowledge the efforts of our current and recent editions reviewers. They scrutinized the text and the programs and provided countless suggestions for improving the presentation.

iOS 8 edition reviewers: Scott Bossak (Lead iOS Developer, Thrillist Media Group), Charles E. Brown (Independent Contractor affiliated with Apple and Adobe), Matt Galloway (iOS Developer and author of *Effective Objective-C 2.0*), Michael Haberman (Software Engineer, Instructor at University of Illinois), Rob McGovern (Indie Developer) and Rik Watson (Technical Team Lead, HP Enterprise Services).

Earlier iOS editions reviewers: Cory Bohon (Indie Developer at `CocoaApp.com` and Writer at Mac|Life), Scott Gustafson (Owner/Developer, Garlic Software LLC), Firoze Lafeer (Master Developer, Capital One Labs), Dan Lingman (Partner, `www.nogotog-`

ames.com), Marcantonio Magnarapa (Chief Mobile Officer, www.bemyeye.com), Nik Saers (iOS Developer, SAERS), Zach Saul (Founder, Retronyms) and Rik Watson (then a Senior Software Engineer, Lockheed Martin).

Keeping in Touch with the Authors

As you read the book, we'd appreciate your comments, criticisms, corrections and suggestions for improvement. Please address all correspondence to:

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deitel@deitel.com
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We'll respond promptly. For updates on this book, visit

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- LinkedIn® (`http://linkedin.com/company/deitel-&-associates`)
- Google+™ (`http://google.com/+DeitelFan`)
- YouTube® (`http://youtube.com/DeitelTV`)

Well, there you have it! We hope you enjoy working with *iOS*® *8 for Programmers: An App-Driven Approach with Swift, Volume 1* as much as we enjoyed writing it!

Paul, Harvey and Abbey Deitel

About the Authors

Paul Deitel, CEO and Chief Technical Officer of Deitel & Associates, Inc., is a graduate of MIT, where he studied Information Technology. He holds the Java Certified Programmer and Java Certified Developer designations, and is an Oracle Java Champion. Paul was also named as a Microsoft® Most Valuable Professional (MVP) for C# in 2012–2014. Through Deitel & Associates, Inc., he has delivered hundreds of programming courses worldwide to clients, including Cisco, IBM, Siemens, Sun Microsystems, Dell, Fidelity, NASA at the Kennedy Space Center, the National Severe Storm Laboratory, White Sands Missile Range, Rogue Wave Software, Boeing, SunGard, Nortel Networks, Puma, iRobot, Invensys and many more. He and his co-author, Dr. Harvey Deitel, are the world's best-selling programming-language textbook/professional book/video authors.

Dr. Harvey Deitel, Chairman and Chief Strategy Officer of Deitel & Associates, Inc., has over 50 years of experience in the computer field. Dr. Deitel earned B.S. and M.S. degrees in Electrical Engineering from MIT and a Ph.D. in Mathematics from Boston University. He has extensive college teaching experience, including earning tenure and serving as the Chairman of the Computer Science Department at Boston College before founding Deitel & Associates, Inc., in 1991 with his son, Paul. The Deitels' publications have earned international recognition, with translations published in Japanese, German, Russian, Spanish, French, Polish, Italian, Simplified Chinese, Traditional Chinese, Korean, Portuguese, Greek, Urdu and Turkish. Dr. Deitel has delivered hundreds of programming courses to corporate, academic, government and military clients.

Abbey Deitel, President of Deitel & Associates, Inc., is a graduate of Carnegie Mellon University's Tepper School of Management where she received a B.S. in Industrial Management. Abbey has been managing the business operations of Deitel & Associates, Inc. for 17 years. She has contributed to numerous Deitel & Associates publications including *Swift™ for Programmers* and, together with Paul and Harvey, is the co-author of *iOS® 8 for Programmers: An App-Driven Approach with Swift™, Volume 1, 3/e, Android for Programmers: An App-Driven Approach, 2/e, Internet & World Wide Web How to Program, 5/e, Visual Basic 2012 How to Program, 6/e* and *Simply Visual Basic 2010, 5/e*.

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deitel@deitel.com
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http://www.informit.com/store/sales.aspx
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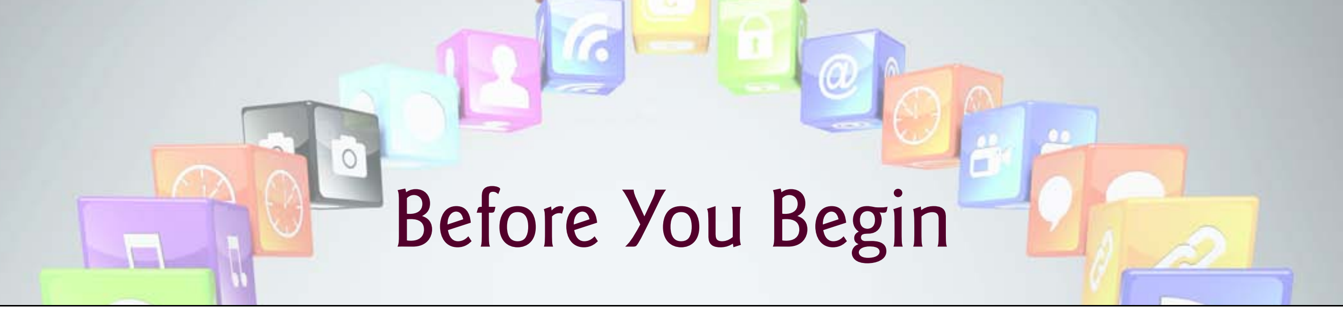

Before You Begin

This section contains information you should review before using this book. Updates will be posted at:

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http://www.deitel.com/books/iOS8FP1
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Font and Naming Conventions

We use fonts to distinguish between on-screen components (such as menu names and menu items) and Swift code. Our convention is to emphasize on-screen components in a sans-serif bold **Helvetica** font (for example, **File** menu) and to emphasize Swift code and commands in a sans-serif `Lucida` font (for example, `import UIKit`). When building user interfaces (UIs) using Xcode's Interface Builder, we also use the bold **Helvetica** font to refer to property names for UI components (such as a **Label**'s **Text** property).

Conventions for Referencing Menu Items in a Menu

We use the **>** character to indicate selecting a menu item from a menu. The notation **File > Open…** indicates that you should select the **Open…** menu item from the **File** menu.

Software Used in this Book

To execute our apps and write your own iOS 8 apps, you must install Xcode 6. You can install the currently released Xcode version for free from the Mac App Store. When you open Xcode for the first time, it will download and install additional features required for development. For the latest information about Xcode, visit

```
https://developer.apple.com/xcode
```

A Note Regarding the Xcode 6 Toolbar Icons

We developed this book's examples with Xcode 6 on OS X Yosemite. If you're running OS X Mavericks, some Xcode toolbar icons we show in the text may differ on your screen.

Becoming a Registered Apple Developer

Registered developers have access to the online iOS documentation and other resources. Apple also now makes Xcode pre-release versions (such as the next point release or major version) available to all registered Apple developers. To register, visit:

```
https://developer.apple.com/register
```

To download the next pre-release Xcode version, visit:

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https://developer.apple.com/xcode/downloads
```

Once you download the DMG (disk image) file, double click it to launch the installer, then follow the on-screen instructions.

Fee-Based Developer Programs

iOS Developer Program

The fee-based **iOS Developer Program** allows you to load your iOS apps onto iOS devices for testing and to submit your apps to the App Store. If you intend to distribute iOS apps, you'll need to join the fee-based program. You can sign up at

```
    https://developer.apple.com/programs
```

iOS Developer Enterprise Program

Organizations may register for the iOS Developer Enterprise Program at

```
    https://developer.apple.com/programs/ios/enterprise
```

which enables developers to deploy proprietary iOS apps to employees within their organization.

iOS Developer University Program

Colleges and universities interested in offering iOS app-development courses can apply to the iOS Developer University Program at

```
    https://developer.apple.com/programs/ios/university
```

Qualifying schools receive free access to all the developer tools and resources. Students can share their apps with each other and test them on iOS devices.

Adding Your Paid iOS Developer Program Account to Xcode

Xcode can interact with your paid iOS Developer Program account on your behalf so that you can install apps onto your iOS devices for testing. If you have a paid iOS Developer Program account, you can add it to Xcode. To do so:

1. Select **Xcode > Preferences…**.
2. In the **Accounts** tab, click the **+** button in the lower left corner and select **Add Apple ID…**.
3. Enter your Apple ID and password, then click **Add**.

Obtaining the Code Examples

The final versions of the apps you'll build in this book are available for download as a ZIP file from

```
    http://www.deitel.com/books/iOS8FP1
```

under the heading **Download Code Examples and Other Premium Content**. When you click the link to the ZIP file, it will be placed by default in your user account's `Downloads` folder. We assume that the examples are located in the `iOS8Examples` folder in your user account's `Documents` folder. You can use Finder to move the ZIP file there, then double click the file to extract its contents.

Xcode Projects

For each app, we provide a project that you can open in Xcode by double clicking its project file, which has the `.xcodeproj` extension. You'll use these projects to test-drive the apps before building them.

Configuring Xcode to Display Line Numbers

Many programmers find it helpful to display line numbers in the code editor. To do so:

1. Open Xcode and select **Preferences…** from the **Xcode** menu.
2. Select the **Text Editing** tab, then ensure that the **Editing** subtab is selected.
3. Check the **Line Numbers** checkbox.

Configuring Xcode's Code Indentation Options

Xcode uses four space indents by default. To configure your own indentation preferences:

1. Open Xcode and select **Preferences…** from the **Xcode** menu.
2. Select the **Text Editing** tab, then ensure that the **Indentation** subtab is selected.
3. Specify your indentation preferences.

You're now ready to begin working with *iOS® 8 for Programmers: An App-Driven Approach with Swift™, Volume 1, 3/e*. We hope you enjoy the book! If you have any questions, please email us at `deitel@deitel.com`.

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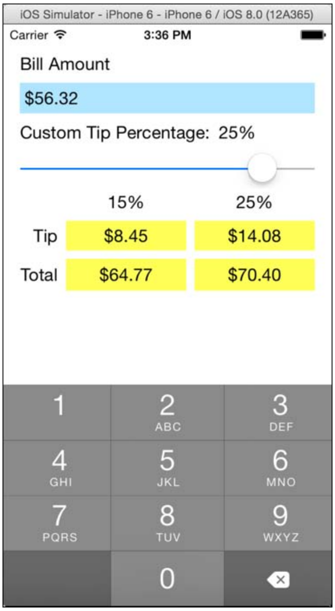
1

Introduction to iOS 8 App Development and Swift



iOS Simulator - iPhone 6 - iPhone 6 / iOS 8.0 (12A365)

Carrier 3:36 PM

Bill Amount

$56.32

Custom Tip Percentage: 25%

	15%	25%
Tip	$8.45	$14.08
Total	$64.77	$70.40

Objectives

In this chapter we discuss:

- iPhone and iPad gestures, sensors and accessibility features.
- History and features of the iOS operating system.
- iPhone 6, iPhone 6 Plus and Apple Watch.
- Key software for iOS app development, including the Xcode® 6 integrated development environment, the iOS simulator, the Swift programming language and the Cocoa Touch® frameworks.
- Review of object-oriented programming concepts.
- Test-driving an app in the iOS simulator.
- Characteristics of great iOS apps.
- iOS security.
- Key Apple publications for iOS developers.

Outline

1.1 Introduction

Welcome to iOS 8 app development! We hope that using *iOS 8 for Programmers: An App-Driven Approach with Swift, Volume 1* will be an informative, challenging, entertaining and rewarding experience for you.

This book is geared toward experienced programmers who have worked in a C-based object-oriented language such as Objective-C®, C++, Java™ or C#. If you don't specifically know Apple's Swift programming language and the Cocoa Touch® frameworks, you should be able to absorb a good amount of them by running the book's iPhone and iPad apps and studying the feature presentations and detailed code walkthroughs.

App-Driven Approach

We use an **app-driven approach**—new features are discussed in the context of complete working iPhone or iPad apps, with one app each in Chapters 2–8. Some of our apps are built as **universal apps** so they can run on iPhone, iPad and iPod touch devices. For each app, we start by describing it, then have you test-drive it. Next, we briefly overview the key **Xcode**® integrated development environment, Swift and Cocoa Touch technologies we use to implement the app. We walk through designing each app's user interface (UI) *visually*. Then we provide the complete source-code listing with *line numbers*, *syntax coloring* and *code highlighting* to emphasize the key portions of the code. We also show one or more screen shots of the running app. Then we do a detailed code walkthrough, emphasizing the new programming concepts introduced in the app. You can download the source code for all of the book's apps from `http://www.deitel.com/books/iOS8FP1`. See the Preface for the code license details.

1.2 iPhone and iPad Sales Data

iPhone and iPad device sales have been growing exponentially, creating enormous opportunities for iOS app developers.

- *First-generation iPhone*: The first-generation iPhone was released in June 2007 and was an instant blockbuster success. Sales have grown significantly with each new version. According to Apple, 6.1 million first-generation iPhones were sold in the initial five quarters of availability.[1]
- *iPhone 3G*: The second-generation iPhone 3G included GPS and was released in July 2008; it sold 6.9 million units in the first quarter alone.
- *iPhone 3GS*: The third-generation iPhone 3GS included a compass; it was launched in June 2009 and sold 5.2 million in its first month of availability.
- *iPhone 4*: The iPhone 4, launched in June 2010, sold over three million units in its first three weeks.
- *iPhone 4S*: The iPhone 4S, released in October 2011, sold over four million in its first three days.[2] Apple sold 35.1 million iPhones during the first three months of 2012, helping the company to nearly double its profits from the previous quarter.[3]
- *iPhone* 5: The iPhone 5, released in September 2012, sold over five million in its first three days.[4]
- *iPhone 5s* and *iPhone 5c*: The iPhone 5s and the iPhone 5c, released simultaneously in September 2013, sold over nine million combined in the first three days of availability.[5] In mid-January 2014, China Mobile—the world's largest mobile carrier —began selling the iPhone for the first time in mainland China. Analysts predict sales of over 20 million iPhones by China Mobile in 2014.[6]

[1] `http://www.apple.com/pr/library/2009/07/21results.html`.

[2] `http://www.apple.com/pr/library/2011/10/17iPhone-4S-First-Weekend-Sales-Top-Four-Million.html`.

[3] `http://money.cnn.com/2012/04/25/technology/apple-supplier-stocks/index.htm`.

[4] `http://www.apple.com/pr/library/2012/09/24iPhone-5-First-Weekend-Sales-Top-Five-Million.html`.

[5] `https://www.apple.com/pr/library/2013/09/23First-Weekend-iPhone-Sales-Top-Nine-Million-Sets-New-Record.html`.

[6] `http://www.forbes.com/sites/connieguglielmo/2013/12/23/apple-inks-important-china-mobile-deal-could-sell-17-million-iphones-in-first-year/`.

- *iPhone 6*: The iPhone 6 and iPhone 6 Plus, released in September 2014, pre-sold four million combined in just one day—double the number of iPhone 5 pre-sales in its first day of pre-order availability.[7] Apple sold 10 million units in the first weekend that the iPhone 6 was available.[8]

Sales of the iPad are equally impressive. Gartner predicts that global tablet sales will rise from 207 million in 2013 to 321 million in 2015.[9] Here are some sales statistics by iPad model:

- *First-generation iPad*: The iPad, launched in April 2010, sold three million units in its first 80 days of availability[10] and a total of over 40 million worldwide by September 2011.[11]
- *iPad 2*: The thinner, lighter and faster iPad 2 was launched in March 2011 and sold one million units in just the first weekend of availability. By the end of 2011, the iPad accounted for 58% of worldwide tablet market share.[12]
- *The New iPad*: The third-generation iPad went on sale in March 2012; three million of these devices were sold in just three days.[13] Overall iPad sales in the first quarter of 2012 reached 11.8 million units—a 151% increase over same quarter the previous year.
- *First-generation iPad Mini* and the *fourth-generation iPad*: The WiFi-only versions of the first-generation iPad Mini—which featured a 7.9-inch display—and the fourth-generation iPad were released in November 2012. They sold a combined three million units in the first weekend of availability.[14]
- *Second-generation iPad Mini* (also referred to as the *iPad mini with Retina® display*) and the *iPad Air* (the fifth-generation iPad) were released in November 2013. In just the first quarter of 2014, Apple sold a record 26 million iPads.[15]

1.3 Gestures

Apple's Multi-Touch screen allows you to control the device with **gestures** involving one touch or multiple simultaneous touches (Fig. 1.1). You'll learn how to recognize and respond to gestures in your code.

[7] `http://techcrunch.com/2014/09/15/apple-sells-4m-iphone-6-and-6-plus-pre-orders-in-opening-24-hours/`.

[8] `http://www.apple.com/pr/library/2014/09/22First-Weekend-iPhone-Sales-Top-10-Million-Set-New-Record.html`.

[9] `http://www.gartner.com/newsroom/id/2791017`.

[10] `http://www.apple.com/pr/library/2010/06/22Apple-Sells-Three-Million-iPads-in-80-Days.html`.

[11] `http://www.statista.com/statistics/180656/sales-of-tablets-and-ipads-in-the-us-until-2012/`.

[12] `http://finance.yahoo.com/news/why-google-android-tablet-market-185500797.html`.

[13] `http://www.apple.com/pr/library/2012/03/19New-iPad-Tops-Three-Million.html`.

[14] `https://www.apple.com/pr/library/2012/11/05Apple-Sells-Three-Million-iPads-in-Three-Days.html`.

[15] `http://www.theverge.com/2014/1/27/5350106/apple-q1-2014-earnings`.

Gesture	Action	Used to
Tap	Tap the screen once.	Open an app, click a button.
Double Tap	Tap the screen twice.	Select text to cut, copy and paste.
Touch and Hold (also called a Long Press)	Touch the screen and hold your finger in position.	Move the cursor in e-mail and SMS messages, move app icons, and so on. This can also be used to select text to cut, copy and paste.
Drag	Touch and drag your finger across the screen.	Move a slider left and right or up and down, move around to different areas on a map or web page.
Swipe	Touch the screen, then move your finger in the swipe direction and release.	Flip item-by-item through a series, such as photos or music album covers. A swipe automatically stops at the next item.
Flick	Touch and quickly flick your finger across the screen in the direction you'd like to move.	Scroll through a **Table View** (e.g., Contacts) or a **Picker View** (e.g., dates and times in the Calendar). Unlike a swipe, a flick does not have a specific stop point. If you overshoot or undershoot your target, you can then drag to get to the desired stop point.
Pinch	Using two fingers, touch and pinch your fingers together, or spread them apart.	Zoom out and in on the screen (for example, enlarging text and pictures).
Shake	Shake the device.	Undo or redo an action (e.g., undo or redo typing).

Fig. 1.1 | iPhone and iPad gestures.

1.4 Sensors

The iPhone and iPad include several sensors.

- The **accelerometer** allows the device to respond to up/down, left/right and forward/backward acceleration. For example, you can rotate the device from *portrait* to *landscape* (vertical to horizontal) to change the orientation of pictures, e-mails, web pages and more. You can also use the accelerometer to control games by shaking or tilting the device. You can shake the device to "shuffle" randomly to a different song in your music library, or turn the device sideways to display a **landscape keyboard** for easier typing (Fig. 1.2). We use the accelerometer in Chapter 7's **Doodlz** app, where we allow the user to shake the device to erase the current drawing.
- The **three-axis gyro** (a gyroscope; introduced with the iPhone 4) works with the accelerometer, making the device more responsive and sensitive to motion by allowing apps to detect the device's rotation around the *x*-, *y*- and *z*-axes (left/right, up/down and forward/backward, respectively). The gyroscope helps the **Camera** app stabilize images for better pictures and video, helps improve game controllers and more.[16] We use the gyroscope in Chapter 7.

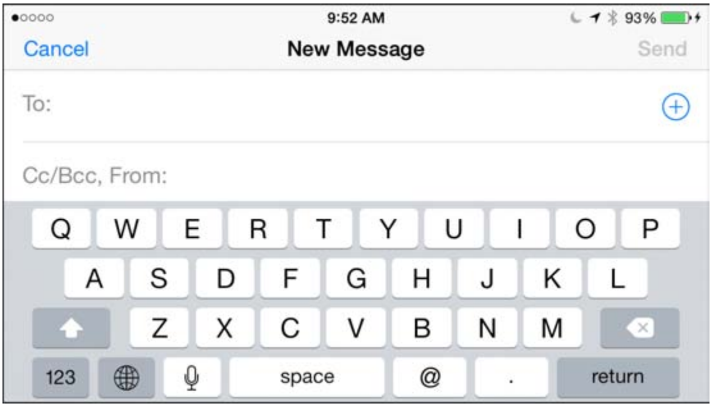


Fig. 1.2 | Landscape keyboard.

- The digital **compass** (included on iPhone 3GS and higher and on the iPad) allows you to orient maps to point in the direction the device is facing.
- The **ambient light sensor** determines the amount of light around the device and adjusts the screen's brightness to preserve the battery.
- The iPhone **proximity sensor** determines whether the device is near your face (e.g., when you're on a phone call). The screen turns off when the iPhone is held close to your face and turns back on when the device is moved away from your face. This sensor is not included on the iPad or iPod touch.
- The iPad **magnetic sensor** determines whether an iPad smart cover—which is attached to the device magnetically and covers the screen—is open or closed, and turns the screen on or off, respectively.
- The **GPS sensor** supplies global-positioning satellite data for location-based and mapping apps.
- The **Touch ID sensor**, which was introduced with the iPhone 5s, is a fingerprint authentication feature built into the *Home* button. You can use your fingerprint to unlock the device and to make purchases from the App Store. As of iOS 8, app developers can use Touch ID for in-app security.
- The **NFC sensor**, new in the iPhone 6 and iPhone 6 Plus, currently is used only for the Apple Pay service—Apple's new payment technology for mobile and online payments. Apple Pay and NFC are introduced in Fig. 1.3.

1.5 Accessibility

iOS includes several **accessibility** features to help vision-, hearing- and physically impaired users. **VoiceOver** is a gesture-based screen-reader program available in numerous languages. It lets vision-impaired users interact with objects on the screen and understand their context. For example, users can touch the screen to hear a description of the item they

[16] `www.zdnet.com/blog/apple/inside-the-iphone-4s-vibrational-gyroscope/7410`.

touch, then drag their finger to hear descriptions of the surrounding content. VoiceOver is also used with the keyboard to speak each character touched, or each complete word. Starting with iOS 7, VoiceOver is integrated with **Maps**. The voice-recognition capabilities allow you to use voice commands to access features on the phone, such as making phone calls and playing music. Vision-impaired users can also pair their device with a Bluetooth-enabled refreshable braille display.

Users with low vision can change their device display to **Large Text** for readability, **White on Black** for higher contrast, or use **Zoom** to magnify the screen 100–500% (including the home screen, all apps, etc.). To magnify the screen, double tap with three fingers and drag your fingers up to zoom in or down to zoom out. To set **Zoom**, **White on Black** and other accessibility features on the device, go to **Settings > General > Accessibility**.

For hearing-impaired users, iOS has closed-captioning capabilities, MMS texting, visible and vibrating alerts, **FaceTime** video calling and more. For physically impaired users, **AssistiveTouch** enables entry of multi-touch gestures with one finger or a stylus (sold separately). Also, Siri®—the iOS personal digital assistant—enables voice entry of numerous commands.

To help users with autism, attention deficit and sensory disorders, **Guided Access** allows you to restrict the device to one app, disable touch input on specific areas or all of the screen, control the user's access to the **Settings** app, turn off motion sensors and more. To set up restrictions, go to **Settings > General > Accessibility > Guided Access**.

Check out the overview of accessibility features at

```
    http://www.apple.com/accessibility/
```

To view the *Accessibility Programming Guide for iOS*, visit

```
    https://developer.apple.com/library/ios/documentation/
      UserExperience/Conceptual/iPhoneAccessibility/Introduction/
      Introduction.html
```

1.6 iPhone 6 and iPhone 6 Plus

The iPhone 6 and the larger iPhone 6 Plus were announced by Apple in September, 2014. Figure 1.3 discusses a few of the key new iPhone 6 features.

Feature	Description
A8 64-bit chip	This new chip provides 25% faster processing power and 50% faster graphics performance than its predecessor.
Retina HD display	The new Retina HD display is brighter and more color-accurate than in previous models. The ion-strengthened glass is harder to scratch or break. The iPhone 6 has a 4.7", 1334 x 750-pixel display. The iPhone 6 Plus has a 5.5", 1920 x 1080-pixel high definition (HD) display—it plays games in higher resolution than many game consoles.
Memory	Both iPhones are available in three memory sizes—16GB, 64GB and the new 128GB.

Fig. 1.3 | Key new iPhone 6 and iPhone 6 Plus features. (Part 1 of 2.)

Feature	Description
Barometer	The barometer sensor determines your elevation based on air pressure. You can use it for health and fitness apps to more accurately track how far a user has run, the number of stairs the user has climbed and more.
Camera	iPhones are now used to take more pictures than any other camera (`http://www.apple.com/iphone-6/`). The iPhone 6 and iPhone 6 Plus feature a new 8-megapixel iSight camera. The camera's sensor includes focus pixels—previously available in only professional cameras—that enable faster and improved autofocus. You can record 1080p high-definition video at 60 frames per second and 720p slow-motion videos at 240 frames per second. The improved auto-image stabilization helps eliminate motion blur. For additional information about the new cameras, see `http://www.apple.com/iphone-6/cameras/`.
Near-Field Communications	**Near-field communication (NFC)**—new in the iPhone 6 and iPhone 6 Plus—is a short-range wireless connectivity standard that enables communication between two devices within a few centimeters. Currently, NFC can be used only with Apple Pay for mobile payments and is not available for developers to use in their apps.
Apple Pay	Apple's new wireless payment technology, **Apple Pay**, uses NFC and TouchID authentication to make secure one-touch payments at participating retailers. You can link the credit card that's associated with your iTunes account or submit other credit cards for authentication. The cards are added to your **Passbook** app. The actual card numbers are not stored and other Apple Pay data is encrypted on a dedicated secure storage chip so it's not vulnerable if your phone is lost or stolen. When you pay at an approved retailer, simply select the card you want to use from the **Passbook** app, touch the *Home* button to authenticate and simultaneously hold the iPhone up to an NFC device at the retailer's point-of-sale terminal. A one-time-use credit card number is used for the transaction, so the retailer never sees your sensitive information including name, credit-card number and security code. This is particularly important given recent security breaches at large retailers. Apple Pay can also be used for online payments, eliminating the need to share your credit card numbers, etc. through websites. For more information, visit `https://www.apple.com/iphone-6/apple-pay/`.

Fig. 1.3 | Key new iPhone 6 and iPhone 6 Plus features. (Part 2 of 2.)

1.7 iOS Operating System History and Features

In this section we provide a brief history and feature summary of the various versions of the iOS mobile operating system. Though originally designed for the iPhone, iOS also runs on the iPod touch, iPad and Apple TV, and Apple Watch. It's a proprietary operating system tightly controlled by Apple and available only on Apple's devices. Google's Android operating system is open source and available for use on third-party devices. iOS does use various open-source libraries—for information on this, visit:

```
http://opensource.apple.com
```