App Development Using iOS iCloud

Incorporating CloudKit with Swift in Xcode

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Printed on acid-free paper

For my parents and my son's grandparents,
Meenu Baruah and Late Sailendar Nath Baruah

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About the Authors

Shantanu Baruah is an Executive Vice President leading new business acquisition in the Life Sciences and Healthcare business at HCL Technologies. With over 21+ years of experience across multiple disciplines, Shantanu has been a pioneer in the fields of healthcare, life sciences, and digital and information technology at HCL Technologies. His leadership has guided delivery, practice building, and development of market-leading solutions to reach new heights. A leader with global exposure, Shantanu has successfully led teams across India, Singapore, France, and the United States. His technological expertise and innovative leadership qualities have placed him at the forefront of important business acquisitions. Shantanu is active in the App development community and has an approved App on Apple App Store. He has been recognized as one of the top 25 Healthcare IT Executives of 2020 by the IT Services Report. He is also recognized as one of the Top 50 Healthcare Leaders in Consulting by *The Consulting Report* Magazine in August 2022. Shantanu lives in New Jersey. His philanthropic outreach includes education for children in developing nations.

Shaurya Baruah is a high school student of the class of 2024, who attends The Peddie School, an elite boarding school located in New Jersey. He has a strong interest in Math, Physics, & Computer Science. Some of his relevant coursework include AP (college-level) Computer Science A, Calculus BC, Physics C, English Literature, and Statistics. Shaurya is dedicated to giving back to his community, as he founded a 501(c)(3) nonprofit, Academic Advancements, with the mission to support the education of underprivileged students globally through means of financial aid and tutoring. Shaurya also participates in a variety of extracurricular activities, including Varsity Wrestling and Public Forum Debate.

About the Technical Reviewer

Vishwesh Ravi Shrimali completed his bachelor's in mechanical engineering and master's in machine learning and artificial intelligence. Currently, he is working at Mercedes Benz Research and Development as an ADAS Engineer. He has also coauthored *Machine Learning for OpenCV 4 (Second Edition)*, *Computer Vision Workshop*, and *Data Science for Marketing Analytics (Second Edition)* by Packt. When he is not writing blogs or working on projects, he likes to go on long walks or play his acoustic guitar.

Acknowledgments

Writing a book on technology is quite a time-consuming task, for it is not about writing your thoughts on paper but also writing code and validating its completeness. I would like to thank my wife Kapila Sood and my daughter Nitara Baruah for their undeterred support and patience as I put together endless hours to bring this book to life. Their feedback on the aesthetics of the App, which is an integral part of the book, and the outline of the book content is invaluable.

I would also like to thank my mother Meenu Baruah who discovered the writing itch in me quite early in my life and has always encouraged me to pursue writing. While at times I remained uncertain, she never doubted that one day I will be a published author. She is also the first published author in our family, and I am certain I got my writing genes from her. I would also like to thank my father, Late Sailender Nath Baruah, who introduced me to the world of software back in the day when computers were not ubiquitously available.

I cannot thank enough my Apress team for all their help in making this book a reality. Aaron Black, who I pitched the book to, loved the idea instantly and introduced me to the world of publishing. Susan McDermott, for all the coaching and help in navigating through the publishing process; Shonmirin, in helping with all coordination; Vishwesh Ravi Shrimali and James Markham, for reviewing my code and making sure it works as expected and for providing valuable comments in reorganizing the chapters and content.

—Shantanu Baruah

I am extremely thankful to my father, Shantanu Baruah, for introducing me to the world of programming. He was always enthusiastic about teaching me programming, ever since my early days. At first, I questioned why he would push me to work hard when I was only an early middle schooler, but now, as I look back, I realize how much his help supported me in excelling in not only learning this subject but also having the great fortune to author a book along with him.

I would also like to thank my mother, Kapila Sood, for all her help in assisting me on this project.

I am also thankful to Ms. Joy Wolfe, who taught me computer science in high school for the last two years. She has helped me expand my knowledge to a variety of computer science languages, which has helped me immensely in writing this book.

Finally, I want to thank the Apress team for their help and support in making this book a reality.

—Shaurya Baruah

Introduction

Over the last decade, the usage of iPhones has skyrocketed. Apple released their first iPhone back in the summer of 2007. What started off as a small idea, a handheld computer used to call and message people, has become the new normal. Practically everyone carries a phone in their back-pocket. The first smartphone, released in 1994, had just ten inbuilt Apps, including Address Book, Calculator, Calendar, Mail, Notepad, and Sketch Pad, among a few others. If you have an iPhone, you will probably realize that you still have all these Apps. They have been around for over two decades! The only difference today is that we have an App store, where we can download about 2.2 million other Apps, if we so desire. This is a big jump from the original ten.

Here is a scenario. You wake up one morning, pull out your iPhone, and suddenly have an idea for a brilliant App, something humanity has never seen before. However, you don't know how to code, or where to even start. If you have navigated your way to this book, you are probably in a similar predicament. This book shouldn't scare you. It is not a dictionary filled with every single line of code that has ever existed. Rather, it is a step-by-step guide, which will help you with everything you need to know for creating a professionally appealing App, even if you are just a beginner who has never written a line of code in your life.

The first part of the book will teach you the basics of coding as you will build the initial version of your sample App (read the next section to learn more about the App we will build). The second part of the book delves deeper into exploring all additional features that the Apple ecosystem offers, and we will create the professional version of the sample App.

If that sounds intimidating, there is no reason to worry because this book is designed to take you on a journey of learning; it is not a reference book for all syntax and concepts. Some concepts may take multiple sittings – even a few days. The answer sometimes could be right in front of you the entire time. Demonstrate patience. Read at your own pace, build along as you move from chapter to chapter, use the book as a reference, and if code doesn't compile or the concept becomes overwhelming, then take a break and revisit the topic. You will be surprised how easy the same concept will appear when you look at it the next time around with a fresh mind.

This book breaks everything down in a simple way and will guide you toward the right path in deciphering the complexities of building your App. In the end, if you still need help, send us an email (`shantanu.baruah@gmail.com`), and we will try to get back to you as soon as possible.

Thank you for reading. Enjoy your journey through the world of programming.

About the Book Tracker App

The book is designed to teach you a new concept as you progress through building the Book Tracker application. You will first learn the new idea, and then implement it into your very own App. As you read through this book, you will slowly make your very own iPhone application. Let us first understand what App we will build.

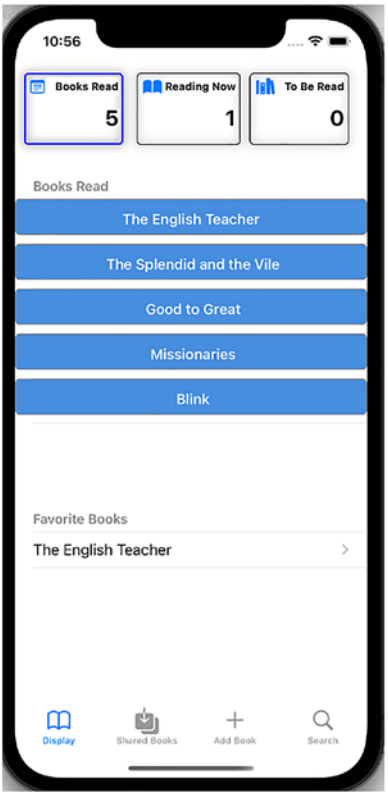
Have you ever forgotten the book you just read last week? Do you want a reliable way to make sure you're reading consistently? Do you feel like taking electronic notes, scanning portions of text for reference purposes? How about creating a good reading list and sharing with your friends? The Book Tracker App will allow you to perform all such functions and many more. The App allows you to create a new book and give it additional details (such as author name, genre, etc.). You can search for a book,

take book notes, and share your reading list with friends. If you want to change some of the details in your book, you can do that very easily with the Update Feature. You can also delete a book whenever you like. In summary, the book tracker App will have the following functions:

- Ability to add, update, and delete books
- Functionality to view book details
- Define book genre
- Classify book views by criteria such as a book currently read, already read, or to be read
- Search books by book and author names
- Share books with other readers
- Set reminders
- Take exhaustive notes on any book in the library
- Mark a book as Favorite and view all favorite books in one place

We will also learn about design concepts to create professional-looking Apps. We will exhaustively leverage iCloud CloudKit APIs to persist data in private secure databases. To create this App, we will use the language Swift and the Xcode IDE.

A screenshot of the Book Tracker App is shown here:



Parts of the Book

The book is divided into two parts.

Part I – Basic App Building

In this part, users will get familiarized with Xcode and CloudKit (the cloud-based database). This part will help users to create a basic Book Tracker App. The primary intent is to get you accustomed to the basics of building an iPhone Application. The part also focuses on designing Application

UI using code (instead of Apple providing drag and drop interface) and applying constraints for multiform display. For complex iPhone App development, we recommend code-based UI creation and constraint management, and though this is an advanced concept, we are introducing this in Part I. At the end of Part I, we will have a basic functioning App.

This part also provides details on some core Swift language concepts. This is a separate section for reference purposes only in case details around a core concept need a revisit.

Part II – Advance App

This part teaches all the advanced concepts required to build any professional looking App in the App Store. The following concepts will be covered in this part:

- Enhancing the Book Tracker App – Robust functionality, enhanced UI, and better usability
- Multiuser Mode – iCloud Database concepts for sharing data across users with the right security setup
- Integration to iPhone native features – Siri, Notification Center
- Introduction to Test Flight – How to make a beta release before posting the App for review to the App Store, and subsequently, how to submit the App to the App Store

Our Goal and Final Words

The goal of this book is to spread new ideas and to share our knowledge with the world. Before writing this book, we worked together on creating an iPhone App called Tracking Genie (it is available in the Apple Store). While working on this project, we faced multiple issues with CloudKit, as

there is lack of documentation available on this topic. This book will share everything we learned along the way while making this App from scratch. It will teach you everything you need to know in building iPhone App CloudKit. If you are planning to create a native iOS application, this book should help make that journey enriching and enjoyable.

The code is compatible with the latest iOS 15.0 version and is built using Swift language in Xcode 13.3.1.

PART I

Basic App Development Using Swift Core Concepts

CHAPTER 1

Xcode Introduction

In this chapter, you will learn about the platform we will use to write our code. If you already have downloaded Xcode, and have a good understanding of the system, feel free to skip this chapter and head to Chapter 3 to learn about CloudKit.

About Xcode

For beginners, you will probably have no idea what Xcode is. No need to worry, read through this short chapter, and you will be well versed with the necessary Xcode concepts.

Apple has developed Xcode as its IDE platform for macOS users to create native applications for all Apple devices. It was first released in 2003, and since then, it has received many updates. The latest edition is version 13.3.1 (as of September 2021). It is a free download from the Mac App Store; however, for a developer license, you need to pay around 100 dollars a year.

Although it may seem daunting at first, when you get used to programming and the interface, Xcode is a brilliant platform for coding. There are a few reasons why I fell in love with this IDE.

First, the auto-completion feature of Xcode is a great little tool which will come in quite handy in writing your code. When you type any character or phrase, a list of all the suggested functions pops up, so it's easy to find functions, their definition, and related elements, particularly

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helpful if you are new to the syntax. Because of this feature, you don't have to spend a ton of time looking for help content. You can simply type something like the name of the function and try finding it using the auto-complete feature.

I would also like to mention Playground, which is a great feature often overlooked. Use Playground to test out different codes and for learning the basics of programming. Playground also will give you instant results; the program is always running, so you can see the results of your code in the console. There's no need to click any button or refresh the project. This way, you don't waste a lot of your time worrying about code structure at an early stage of learning. It is a great way to train, learn new concepts, and get better at programming.

Apps which span across devices (iPhone, iPad, and iOS) and use multiple form factors often will demand their screen to be designed using code. However, Xcode also has a Storyboard, where you can easily drag and drop to create your own screen. This feature works fine for a simple-looking screen. We will start by making the screen with this feature, and later, we will completely revamp the App by designing the screens using code.

Storyboard allows you to add any items to your screen, such as labels, buttons, text fields, and so on. You can also change the color, text, font sizes, and many more in the property's screen. The reason most programmers don't use the storyboard in the final version of their App is because when you create the screen using code, you can create complex screen without worrying about overlapping objects and anchors, and it is easier to draw the App the way you want it on different form factors of iOS devices.

Apple released the language Swift in October 2014. Ever since then, it has continued to grow, and it has become the most preferred language for iOS coding. Prior to Swift, Apple had Objective-C as the primary language. There are over 1.5 million jobs created around App design and development since the launch of the App Store in 2008. The best part about Swift is that it is not difficult for beginners to learn.

Before you get started with coding, consider reading the next section to learn how you can install Xcode.

Installation and System Requirements

Apple has only created Xcode for its own Mac products. Xcode requires running macOS 10.13.6 or later. You will need 11.2 GB of storage on your Mac to install this application.

To install Xcode, search for it in the App Store. Look for the App that looks like the image shown as follows.

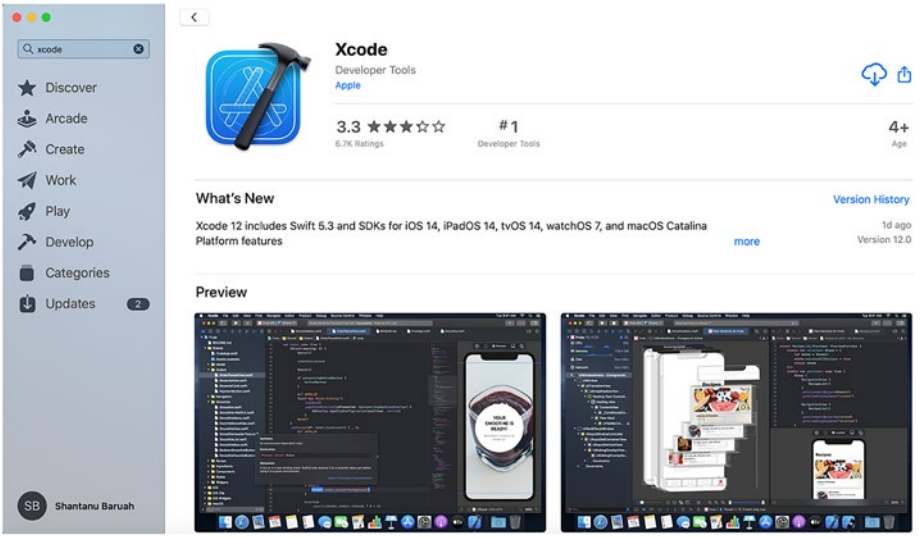

Figure 1-1. *App Store Xcode Download Screen*

It will probably take some time to download, as it is a big file. After the initial download is complete, it will ask you to agree to the terms and conditions document. After you select *agree,* it will begin installing the components.

Interface Introduction

When you first launch Xcode, your screen should look something like this.

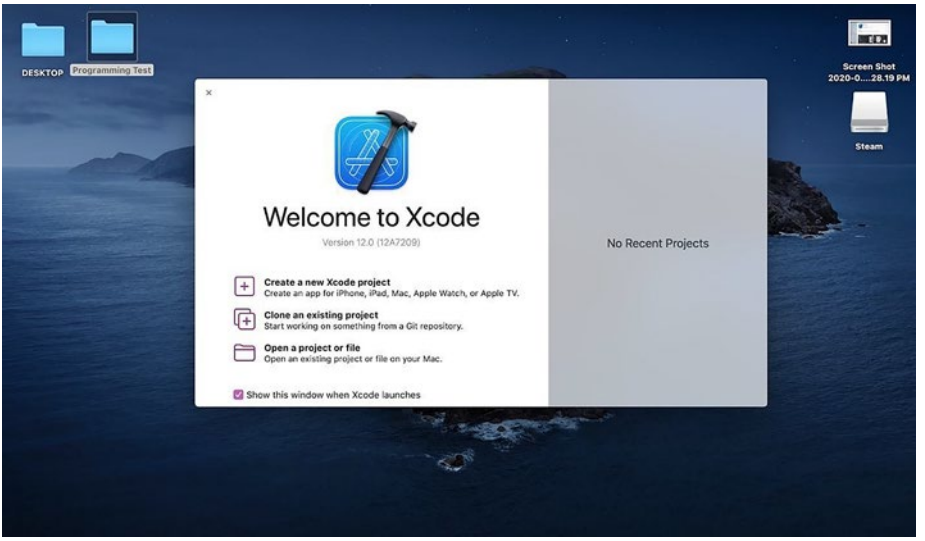

Figure 1-2. *Xcode Launch Screen*

Your initial Xcode screen will have two columns. On the left side, you will see three options that you can select right underneath the Xcode logo. The first option will allow you to create an Xcode project. This is what we will be using when we start creating our App. Underneath that, you will see the button which allows you to clone an existing project. This is useful when the project you are going to work on is quite like an existing project, or when you need to do major changes to an already existing project.

If you select the third option, you will be able to search through files on your computer. Most of the time, you will not need to use this feature, because the right side of the screen will show the recent projects that you have been working on. If you want to create a new playground, you will go to File ➤ New ➤ Playground.

If you select *Create a new Xcode Project*, or go to File ➤ New ➤ Project, it will ask you to select a template for your project. On the top of the screen,