

Introduction

Kernel development can be a daunting task and is very different from programming traditional user applications. The kernel environment is more volatile and complex. Extraordinary care must be taken to ensure that kernel code is free of bugs because any issue may have serious consequences to the stability, security, and performance of the system. This book covers the fundamentals necessary to begin programming in the kernel. We cover kernel development from a theoretical and practical point of view. We cover concepts fundamental to kernel development such as virtual memory and synchronization, as well as more practical knowledge. The book primarily focuses on Mac OS X, however the XNU kernel is also used by iOS, and hence the theoretical material in this book will also apply to it. By far the most common reason for doing development within the kernel's execution environment is to implement a device driver for controlling internal or external hardware devices. Because of this, much of the focus of this book is centred on the development of device drivers. The primary framework for device driver development in the XNU kernel is I/O Kit, which we cover extensively. As theory becomes boring quickly we have provided working code samples which you can play with to learn more or use as a starting point for your own drivers.

We hope you have as much fun reading this book as we have enjoyed writing it.

Who Is This Book For?

The book was written for anyone interested in Apple's iOS and Mac OS X operating systems, with a focus on practical kernel development, especially driver devel. Regardless of whether you are a hobbyist, student, or professional engineer, we hope to provide you with material of interest. While the focus is on kernel programming and development, we will cover many theoretical aspects of OS technology and provide a detailed overview of the OS X and iOS kernel environments. The aim of the book is to provide the knowledge necessary to start developing your own kernel extensions and drivers. We will focus in particular on the I/O Kit framework for writing device drivers and extensions, but we will also cover general knowledge that will give you a deeper understanding of how I/O Kit interacts with the OS. If you are mainly interested in developing OS X or iOS user applications, this book may not be for you. We will not cover Cocoa or any other framework used for developing end-user applications. This book covers kernel-programming topics such as driver and kernel extension development on Apple's OS X and iOS platform.

Some knowledge of operating system internals will be useful in understanding the concepts discussed in this book. Having completed an introductory computer science or engineering course will be a helpful starting point. Additionally, knowledge of at least one programming language will be required in order to understand examples throughout the book. Since we focus on I/O Kit, which is written in a subset of C++ called Embedded C++, it would be highly beneficial to have some experience with C++ (or at least C) to make the most of this book. The book does not cover general programming topics or theory. We will briefly cover some fundamentals of OS theory to provide a context for further discussions.