App Structure and UIKit

March 17, ‘16

Working with iOS SDK

Most iOS SDK are still written in Objective-C and C.

Also for SDKs of OS X, tvOS and watchOS.

Both Swift and Objective-C are able to work with iOS SDK.

This relationship is like the one between JavaScript and jQuery or the one between Python and Django.

Objective-C classes are bridged as Swift classes. And C structs are bridged as Swift structs.

Most types in iOS SDK are actually classes. `@objc` may be used necessary.

Working with iOS SDK

```
@objc protocol SomeProtocol: NSObjectProtocol {
    func someRequired()
    optional func someOptional()
}
```

Types conforming to a Swift protocol must implement all methods declared in the protocol. *(Like Java's Interface)*

Objective-C protocols include optional methods, which are not required to be implemented by conforming types.

Working with iOS SDK

Numbers *(Integers, Floats, and Boolean)*, String, Array, Set, and Dictionary are bridged between 2 languages.
As NSNumber, NSString, NSArray, NSSet, and NSDictionary.

Objective-C doesn’t use *namespace*. Instead, it uses prefixes before class names.
“NS” means for the “NeXTSTEP” where the OS X is derived from. “UI” means UIKit (the iOS SDK).

Check `ObjC-Bridge.playground` in the *Swift-Introduction* git repo.

Launch iOS app

Launch iOS app

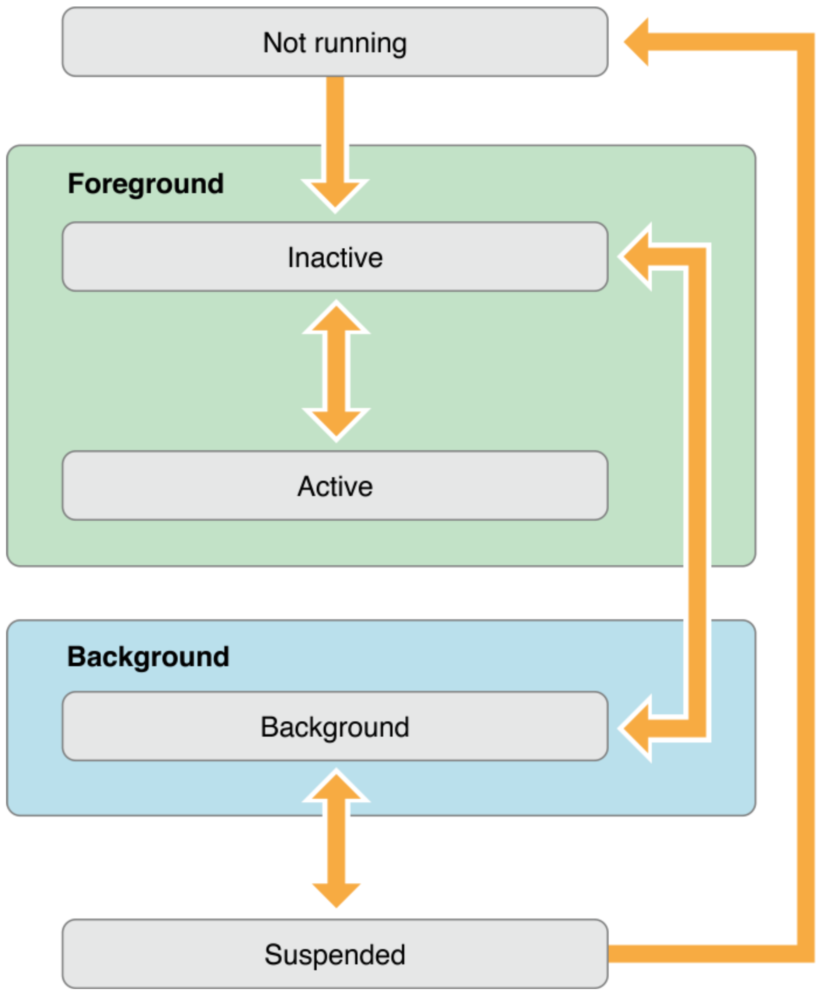
The runtime would find for the class which annotated with the `@UIApplicationMain` attribute. This class would be the main entry point of your app.
It's usually annotated on `AppDelegate` class in `AppDelegate.swift`

The annotated class <u>must</u> implement `UIApplicationDelegate` protocol. And it *usually* inherits from `UIResponder` class.
UIApplicationDelegate handles events related to app's lifecycle. UIResponder responds to global events of the app.

App Lifecycle

Implement methods of `UIApplicationDelegate` to handle app lifecycle events.

Observe `NSNotification` emitted by `UIApplication` to handle app lifecycle events.
Notification pattern would be mentioned in future classes.



App Lifecycle - Event Handling

Implementing method in `UIApplicationDelegate` is like a ground control center of your app elements, which is suited for app-level resources.

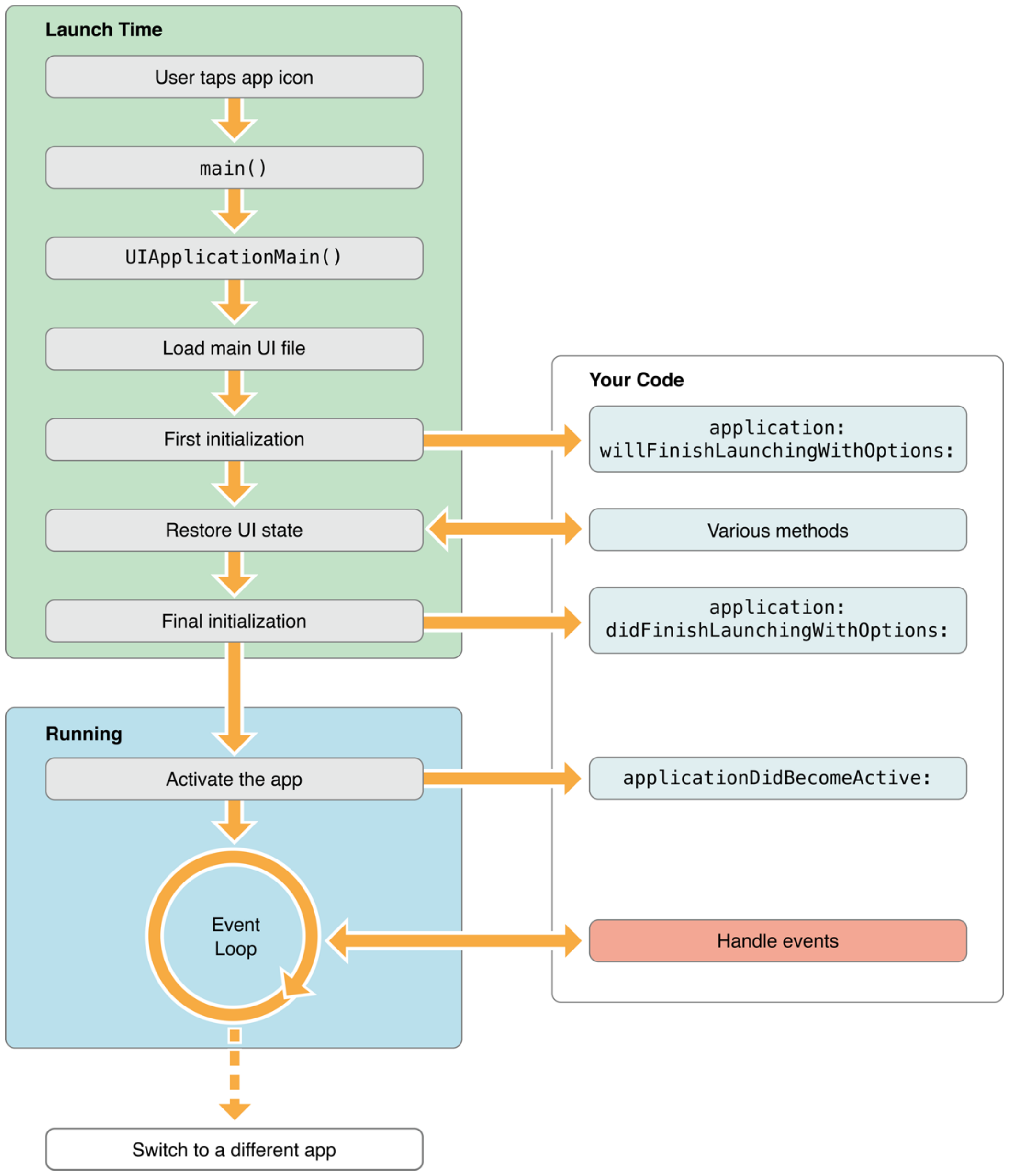
Observing `NSNotification` emitted by `UIApplication` is distributed in each elements and better for local resources.

App Lifecycle

We usually prepare app level resources when “finish initialization” state.

The event loop dispatches events to the responder chain.

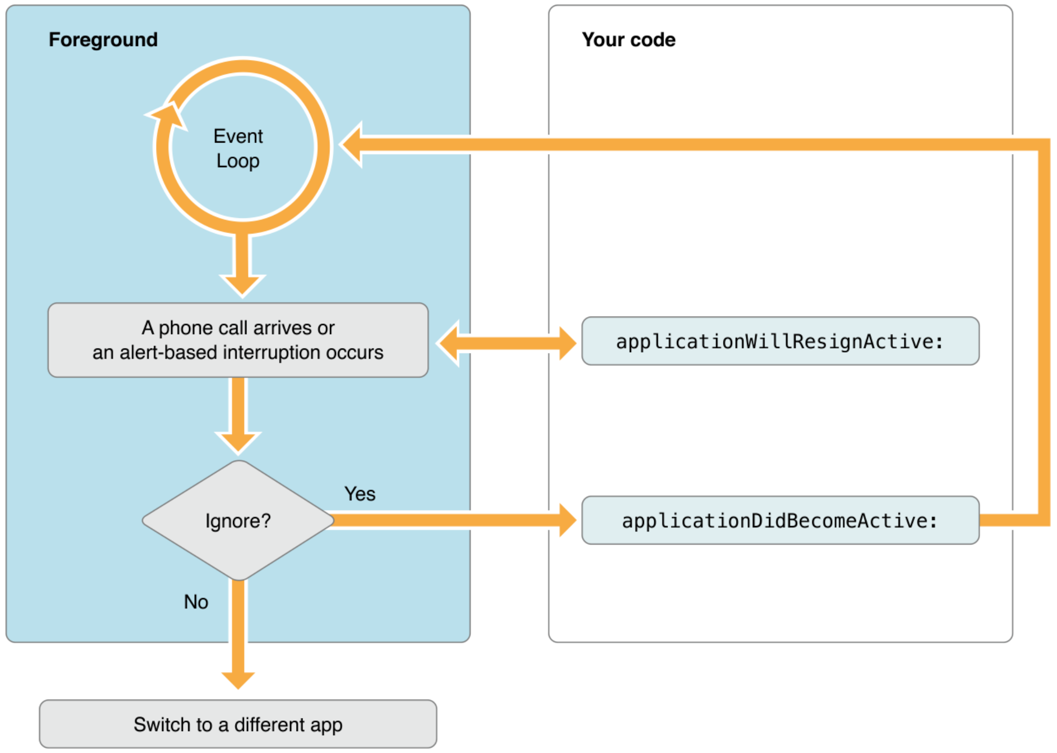
Your UI elements are part of the responder chain.



App Lifecycle

Interruptions result in a temporary loss of control by your app.

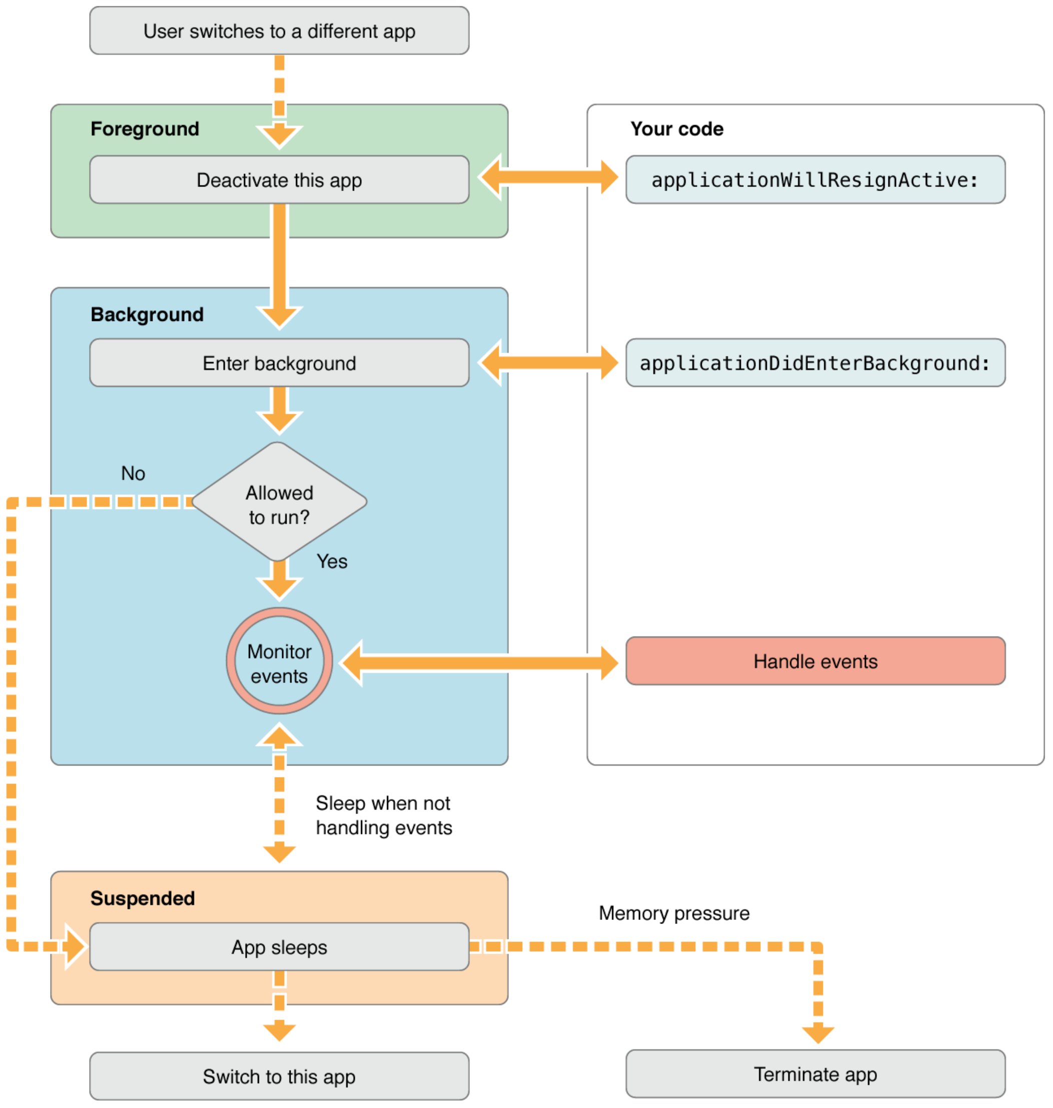
Including user double-clicks the home button


Foreground
Event Loop
A phone call arrives or an alert-based interruption occurs
Ignore?
Yes
No
Switch to a different app
Your code
applicationWillResignActive:
applicationDidBecomeActive:

App Lifecycle

Background modes are advanced topics.
Check Apple's references

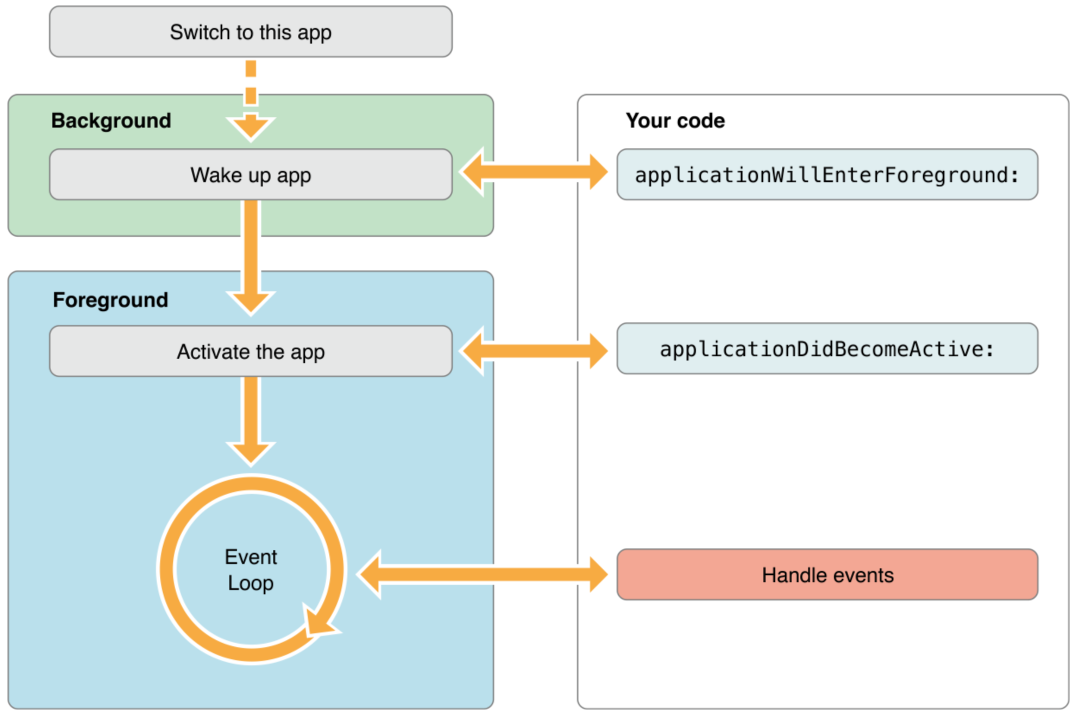
Save data and app states when the app is being deactivated.



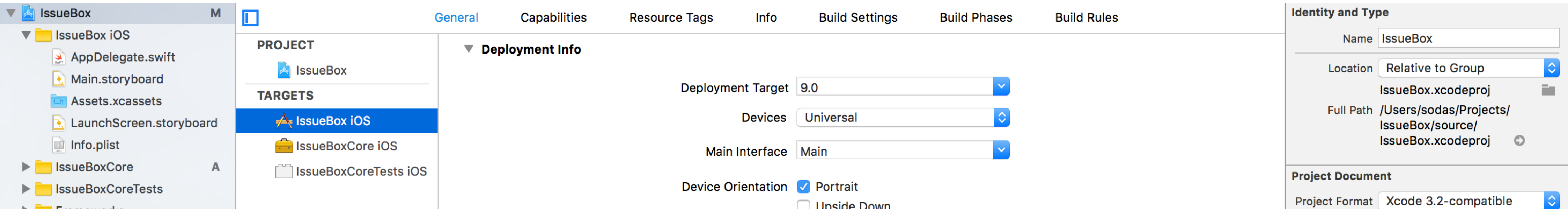
App Lifecycle

When coming back to the foreground, remember to check system changes.

Like locale change, file system change, and etc.



Launch iOS app - Load Storyboard



Deployment Info

Deployment Target: 9.0
Devices: Universal
Main Interface: Main
Device Orientation: ✓ Portrait, Upside Down

Identity and Type

Name: IssueBox
Location: Relative to Group
IssueBox.xcodeproj
Full Path: /Users/sodas/Projects/IssueBox/source/IssueBox.xcodeproj

Project Document

Project Format: Xcode 3.2-compatible

By default, the runtime would find the Main Interface settings of your project to load the Storyboard and instantiate *the initial view controller* as app's root view controller.

This setting is actually stored in "Info.plist" of your app

App Structure and File System

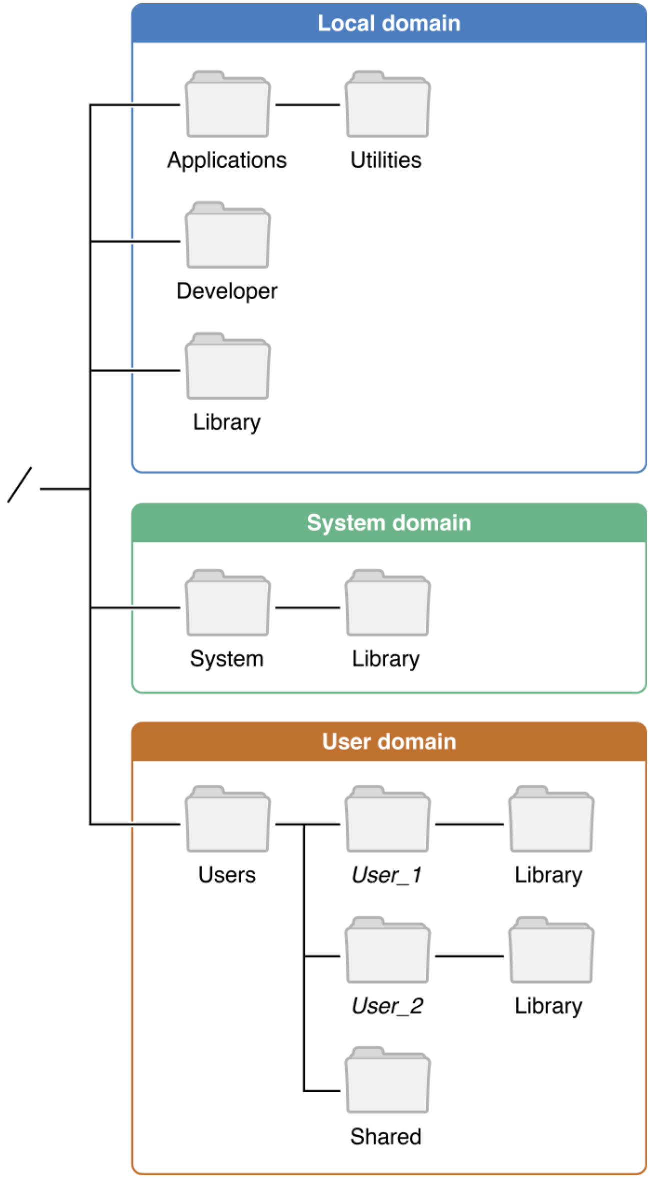
File System in OS X

the OS X is a Unix-based system.

Derived from BSD and NeXTSTEP. The root of FS is "/". But Apple changed FS naming convention of UNIX-like system.

Applications may be able to walk through the whole file system.

Applications may be also sandboxed which are only able to access its own directory.



Sandboxed iOS app

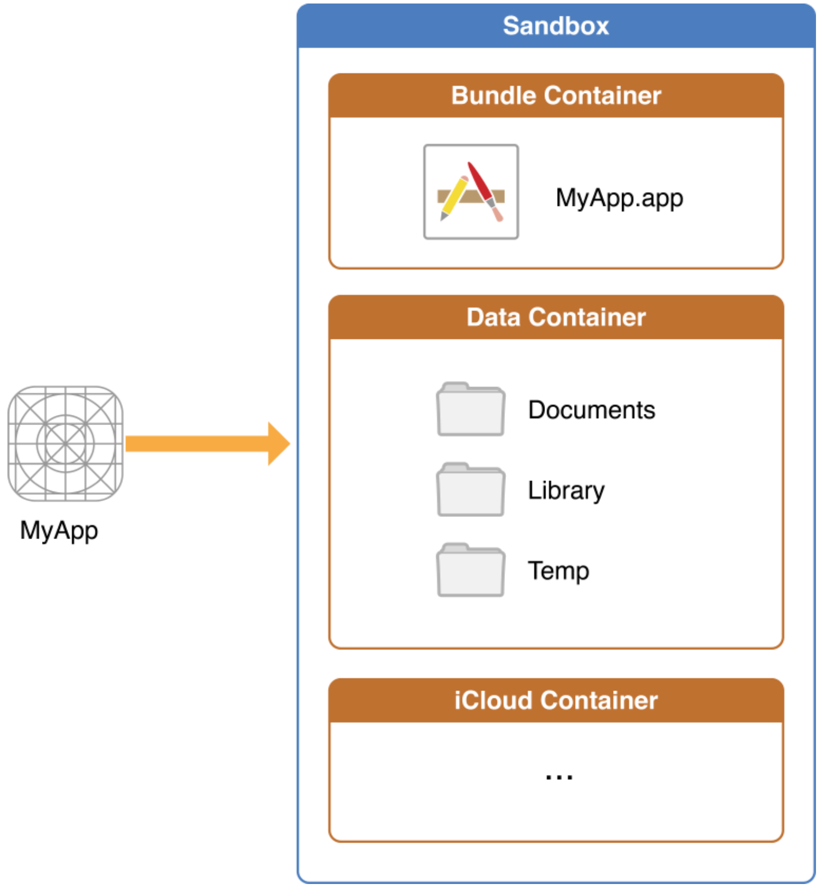
Each app has its own sandbox, like an isolated island.

Each apps are only able to access its own files and directories in its sandbox.

Use API call to get paths.

In the sandbox, there are only User Domain folders.

No folders in local domain and system domain are available to iOS apps.



`<Application_Home>/AppName.app`

This is the bundle directory containing the app itself. Readonly.

`<Application_Home>/Documents/`

Store user documents and data files, which are not re-generable.
It will be backed up.

`<Application_Home>/tmp/`

Temporary files that do not need to persist between launches of your app.
It won't be backed up.

`<Application_Home>/Library/`

Top-level directory for files that are not user data files (regenerable by app).
Content are usually grouped by your bundle identifier.
It will be backed up, except the "Caches" folder.

`<Application_Home>/Library/Caches`

Used to store cached files. It won't be backed up.

`<Application_Home>/Library/Application Support`

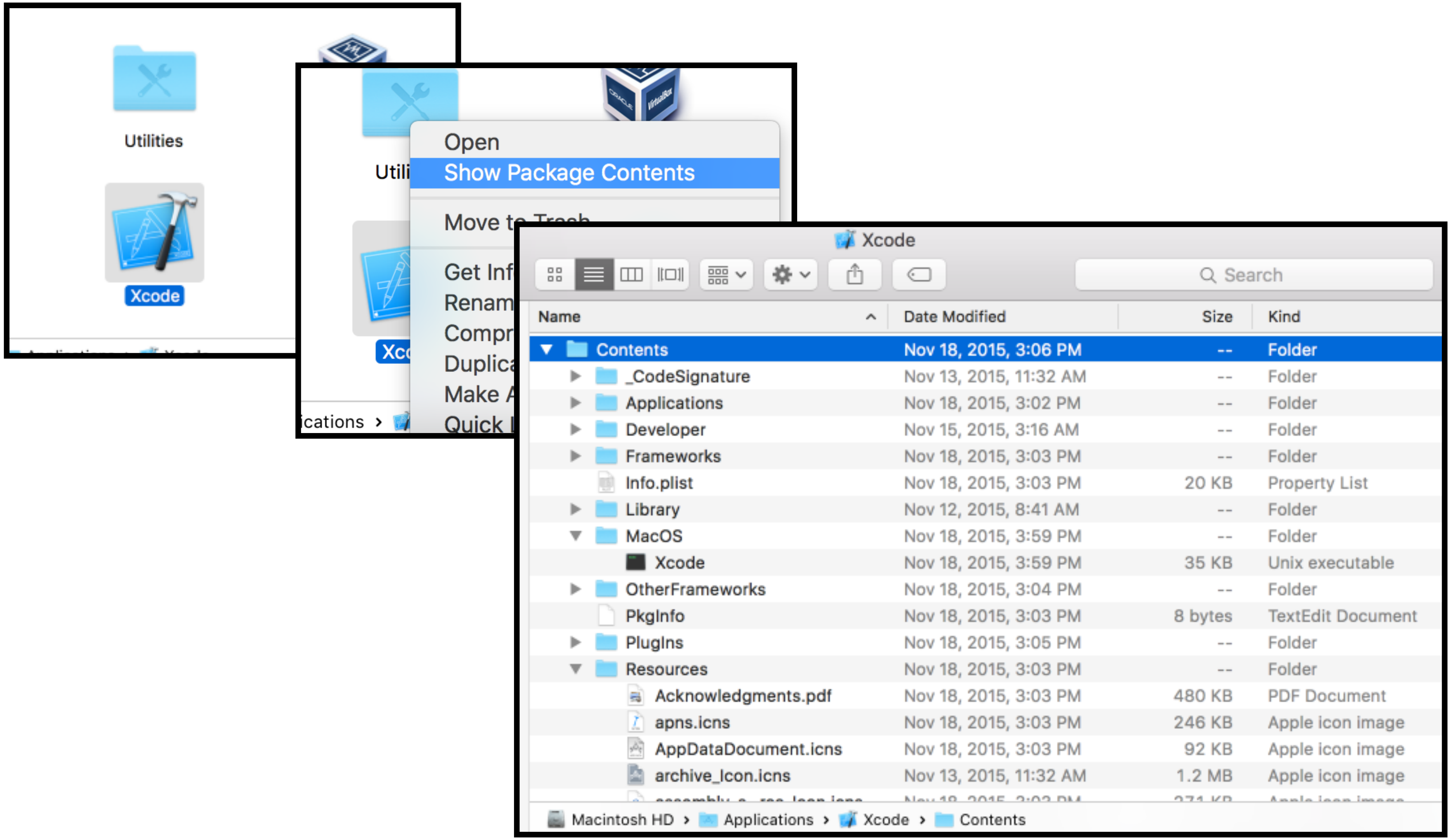
In general, this directory includes files that the app uses to run but that should remain hidden from the user.

Application Bundle

In OS X and its derived platforms, applications are bundles.
Bundles are a fundamental technology in OS X that are used to encapsulate code and resources.

A package is any directory that the Finder presents to the user as if it were a single file.

A bundle is a package with a standardized hierarchical structure that holds executable code and the resources used by that code.



Name	Date Modified	Size	Kind
▼ Contents	Nov 18, 2015, 3:06 PM	--	Folder
▶ _CodeSignature	Nov 13, 2015, 11:32 AM	--	Folder
▶ Applications	Nov 18, 2015, 3:02 PM	--	Folder
▶ Developer	Nov 15, 2015, 3:16 AM	--	Folder
▶ Frameworks	Nov 18, 2015, 3:03 PM	--	Folder
Info.plist	Nov 18, 2015, 3:03 PM	20 KB	Property List
▶ Library	Nov 12, 2015, 8:41 AM	--	Folder
▼ MacOS	Nov 18, 2015, 3:59 PM	--	Folder
Xcode	Nov 18, 2015, 3:59 PM	35 KB	Unix executable
▶ OtherFrameworks	Nov 18, 2015, 3:04 PM	--	Folder
PkgInfo	Nov 18, 2015, 3:03 PM	8 bytes	TextEdit Document
▶ PlugIns	Nov 18, 2015, 3:05 PM	--	Folder
▼ Resources	Nov 18, 2015, 3:03 PM	--	Folder
Acknowledgments.pdf	Nov 18, 2015, 3:03 PM	480 KB	PDF Document
apns.icns	Nov 18, 2015, 3:03 PM	246 KB	Apple icon image
AppDataDocument.icns	Nov 18, 2015, 3:03 PM	92 KB	Apple icon image
archive_Icon.icns	Nov 13, 2015, 11:32 AM	1.2 MB	Apple icon image
[illegible]	[illegible]	[illegible]	[illegible]

Macintosh HD › Applications › Xcode › Contents

Content of iOS App Bundle

`<AppBundle>/<AppName>`
The main Unix executable file

`<AppBundle>/Info.plist`
Configuration information for the application, including app display name, identifier, and main storyboard file. The system relies on the presence of this file to identify relevant information about your app and any related files.

Content of iOS App Bundle

`<AppBundle>/*.lproj`
Localized resources

`<AppBundle>/Frameworks`
Embedded frameworks (dynamically linked components)

`<AppBundle>/*.*`
General resources and assets

NSBundle

```
let mainBundle = NSBundle.mainBundle()
let pathOfContentTxt: String? = mainBundle.
    pathForResource("content", ofType: "txt")
let infoDict = mainBundle.infoDictionary
```

Use `NSBundle.mainBundle()` to access the app’s bundle.

Use `pathForResource(_:ofType:)` method to find assets and resources in a given bundle.

Use `infoDictionary` to access the Info.plist content of a bundle.

NSFileManager

```
let fileManager = NSFileManager.defaultManager()
let documentsURLs = fileManager.URLsForDirectory(.DocumentDirectory,
    inDomains: .UserDomainMask)
let libraryURLs = fileManager.URLsForDirectory(.LibraryDirectory,
    inDomains: .UserDomainMask)
```

Use `NSFileManager` to find paths of sandbox directories. It also provides methods for manipulating file systems.

Path manipulation APIs are provided by `NSString`.

Common Resources in an App

Storyboard

Asset catalogs

Used to simplify management of images that are used by your app as part of its user interface.

Launch files

Provides a simple placeholder image that iOS displays when your app starts up.

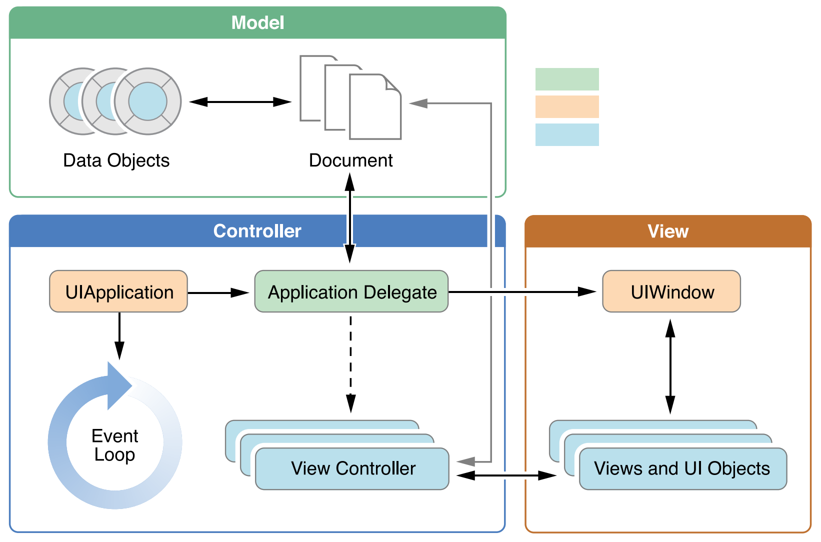
Demo for Asset catalog and Launch Screen

View Controller and MVC Pattern

MVC Pattern

Usually used in GUI application development

Becomes popular for web applications too

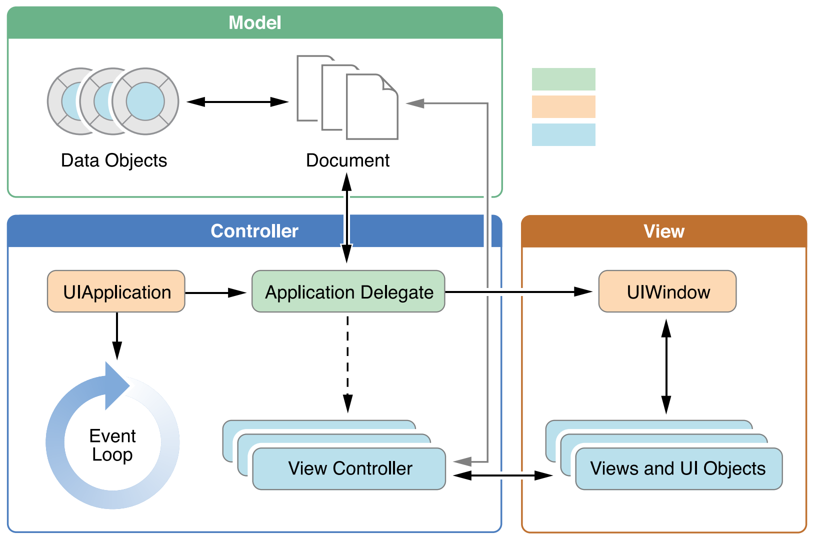


MVC Pattern

The model directly manages the data, logic and rules of the application

A view can be any output representation of information

The controller accepts input and converts it to commands for the model or view



View Controller

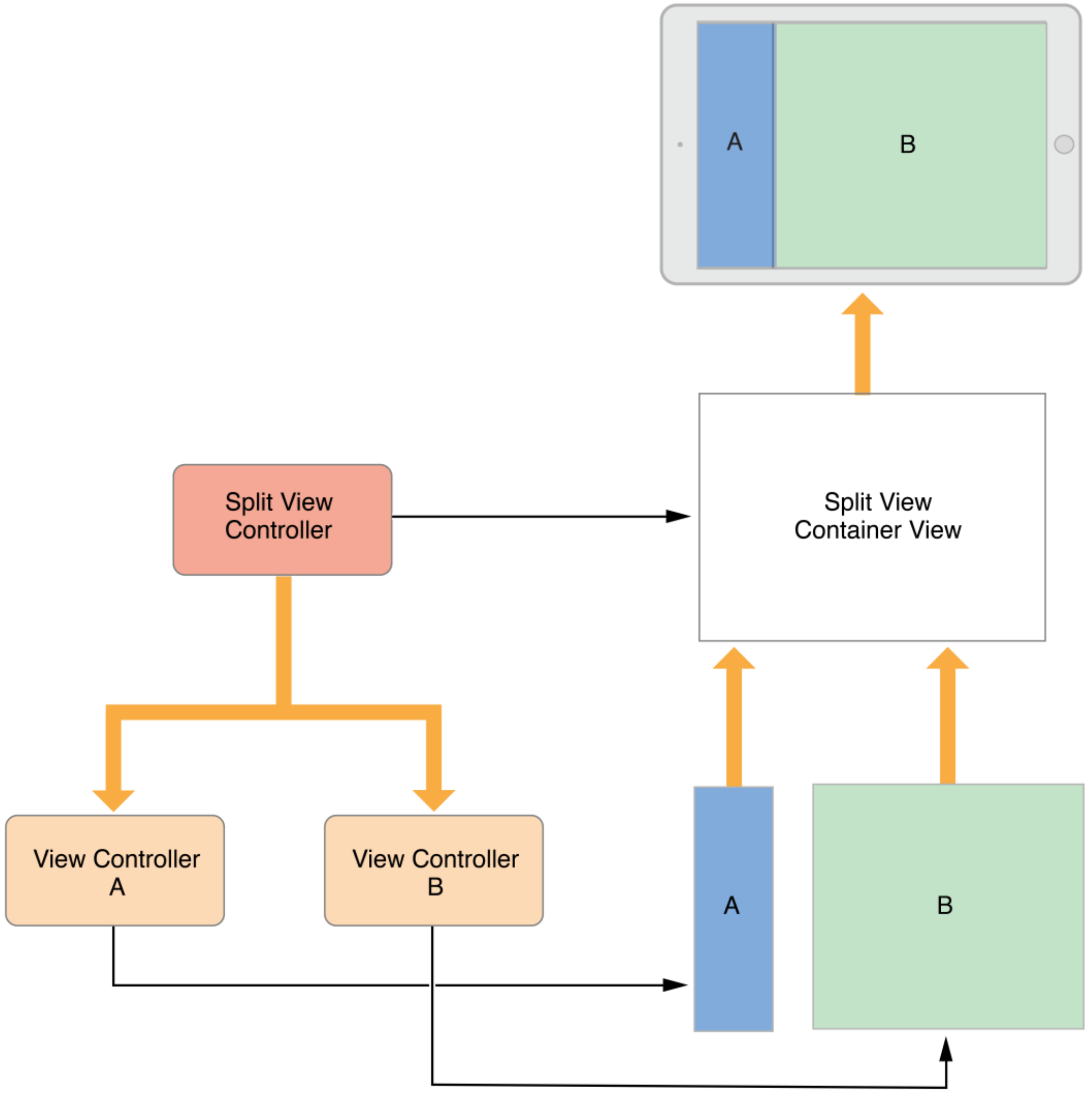
View Management

Including Layout and Adaptivity of a tree of views.

User Interactions

Data Marshaling

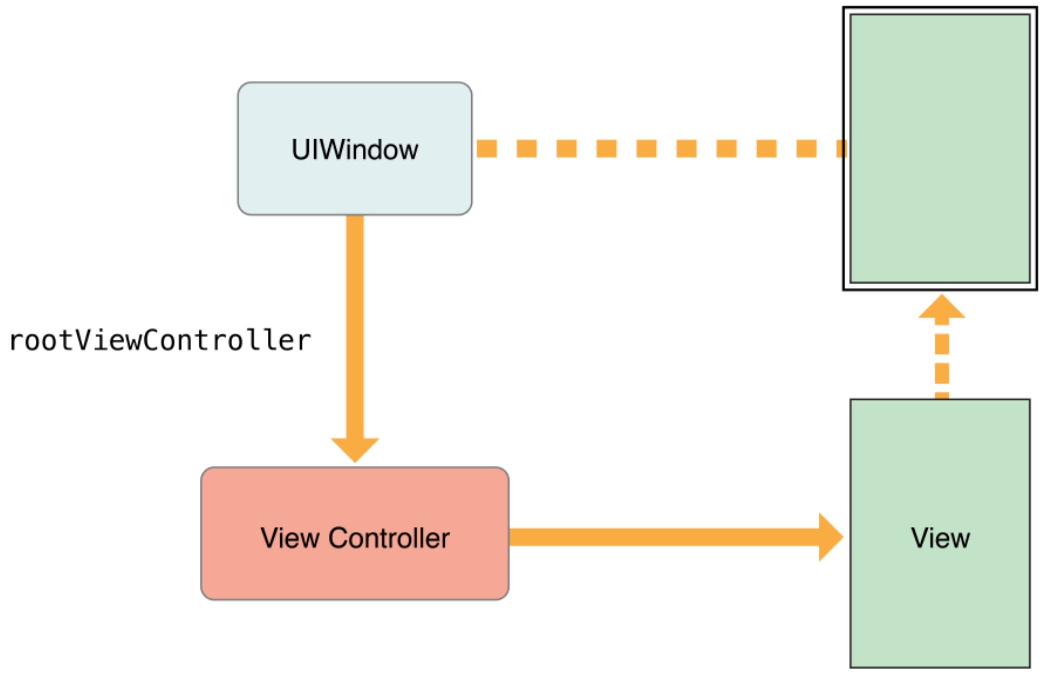
Resource Management

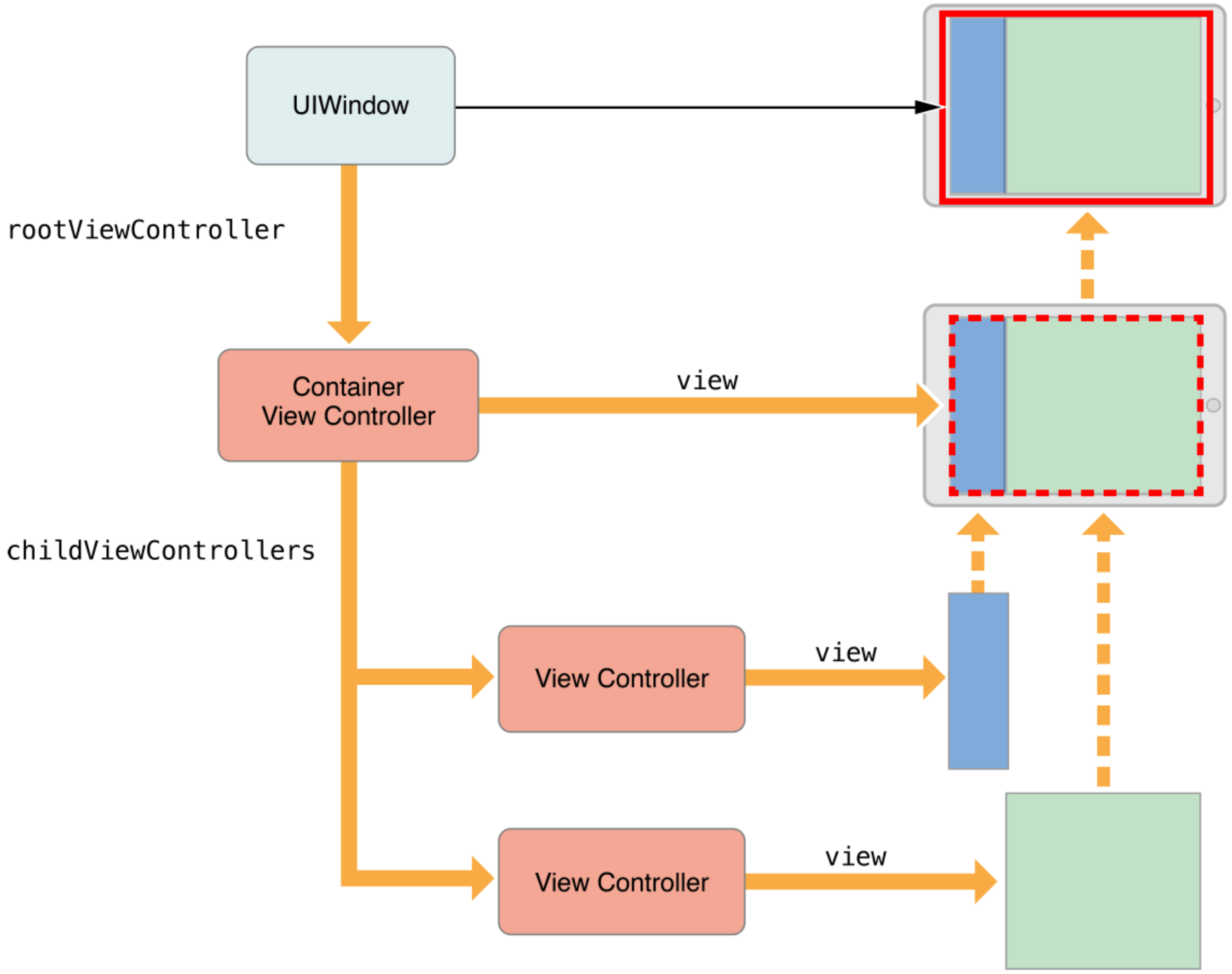


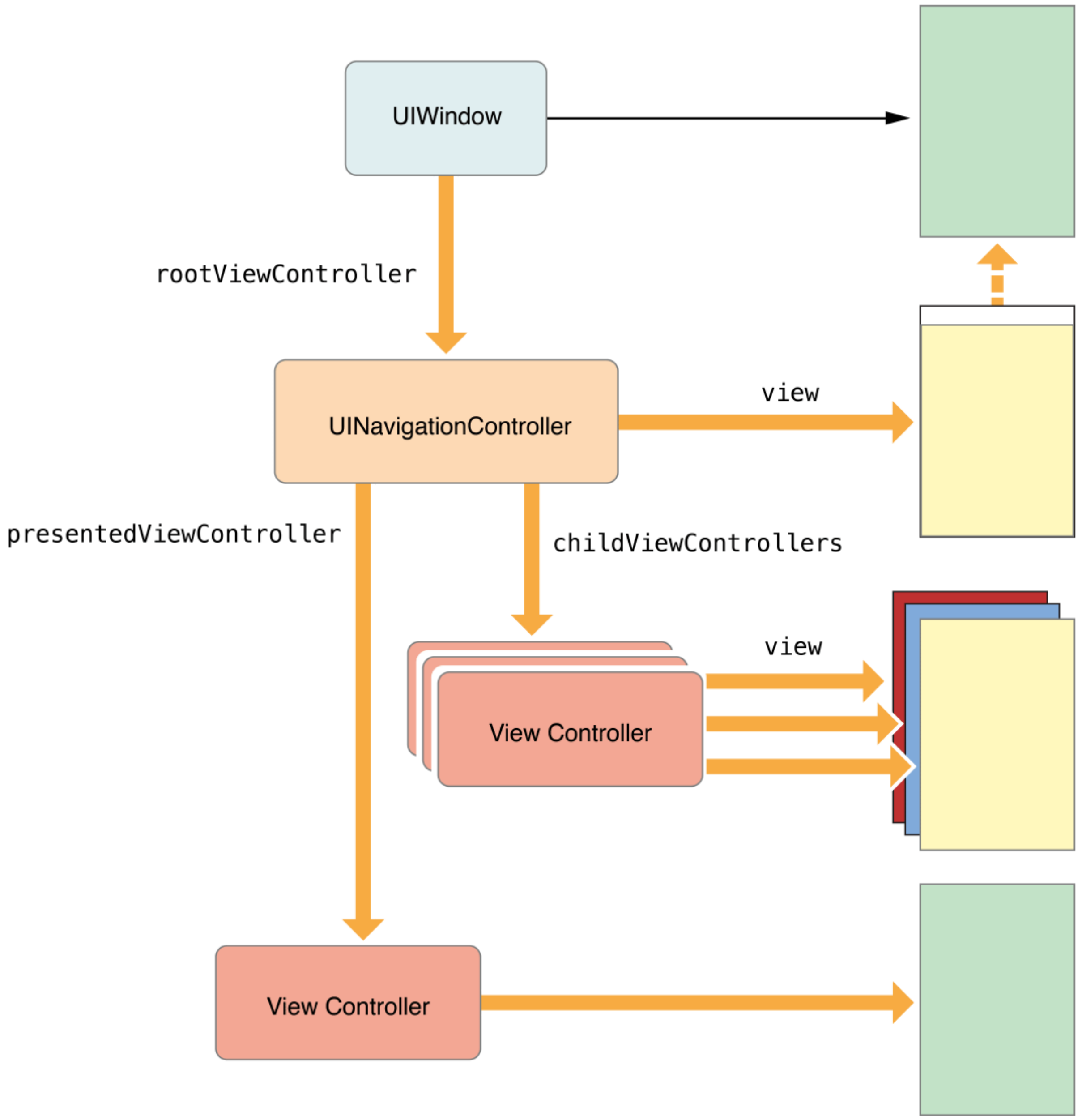
View Controller

Each app has a root view controller which attached to its window.

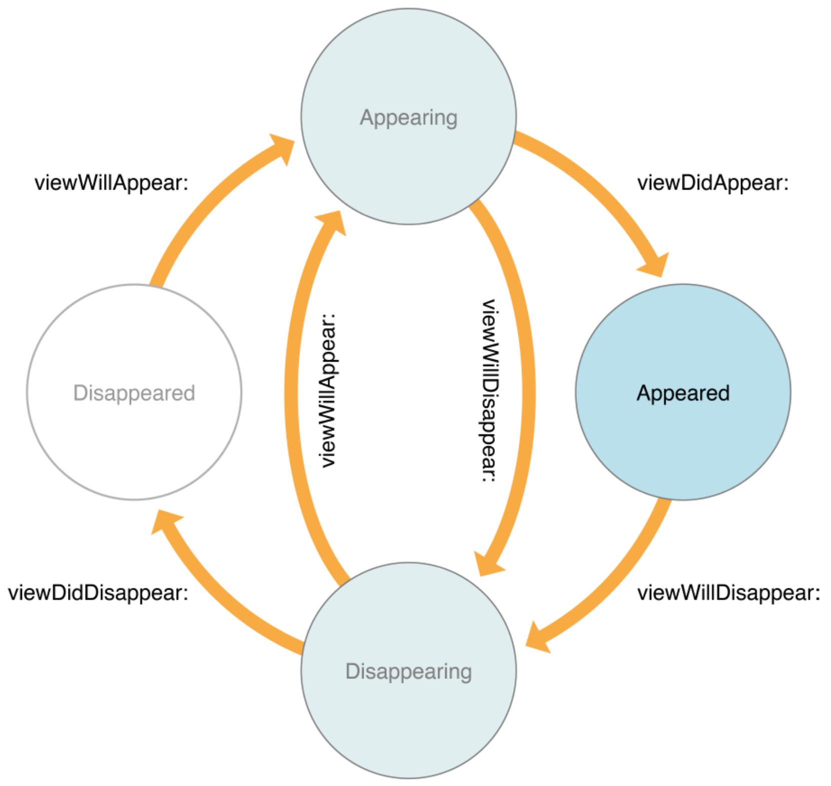
It's usually the first view controller in your storyboard.




UIWindow
rootViewController
Container View Controller
view
childViewControllers
View Controller
view
View Controller
view


UIWindow
rootViewController
UINavigationController
view
presentedViewController
childViewControllers
view
View Controller
View Controller

View Controller States



View Controller Memory Management

Methods	Usage / Task
`init` *(initializers)*	Allocate critical data structures required by your view controller.
`viewDidLoad`	Allocate or load data to be displayed in your views. Custom setup of your views.
`didReceiveMemoryWarning`	Respond to low-memory notifications.
`deinit`	Release resources if necessary.

Communication Patterns - I

Communication Patterns - I

Notifications

Key-Value Observation KVO

Callback blocks/closures

Delegation

Target-Action

Target-Action Pattern

Target-Action is the typical pattern used to send messages in response to UI events.

Target-Action establishes is loose coupling and easy to setup between the event sender and the receiver.
Storyboard connections and UIControl uses this pattern.

Compilers could not check and validate for developers, like duck-typing.

Delegate Pattern

Delegation is a widespread pattern throughout Apple's frameworks.
It allows us to customize an object's behavior and to be notified about certain events.

Delegation uses protocols to make sure the receiver understands curtain methods.
It's still loose-coupled, but compilers know how to check the relationship between event sender and receiver.

Delegate Pattern

Should I start loading this URL? *(configuration)*

I did start loading the URL. *(callback)*

I have finished loading the URL. *(callback)*

I failed to load the URL. *(error handling)*

UIWebView

Delegate Pattern

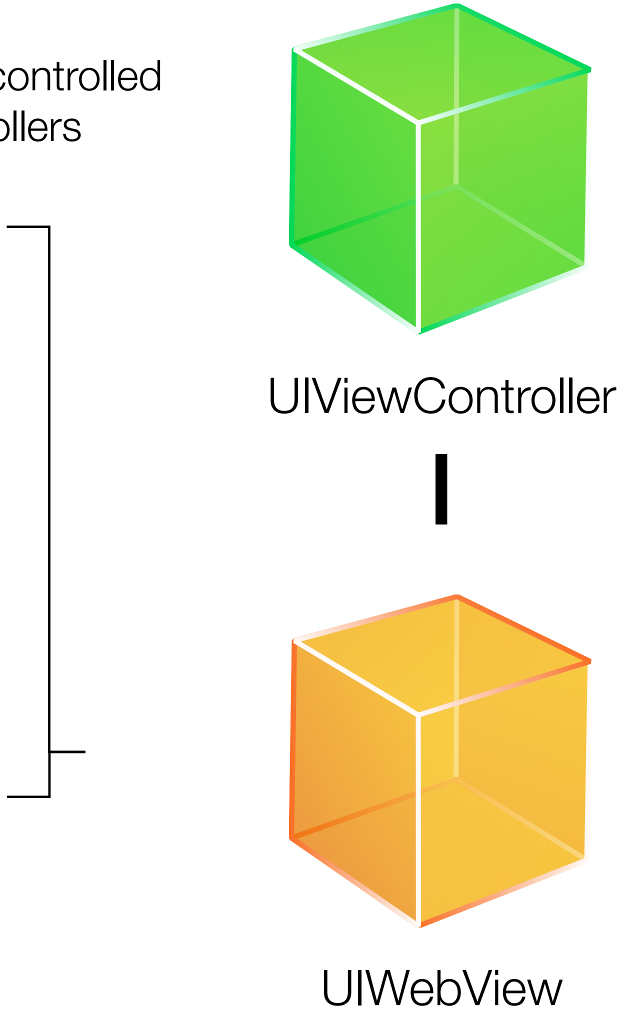
Views are usually controlled
by view controllers

Should I start loading this URL? *(configuration)*

I did start loading the URL. *(callback)*

I have finished loading the URL. *(callback)*

I failed to load the URL. *(error handling)*



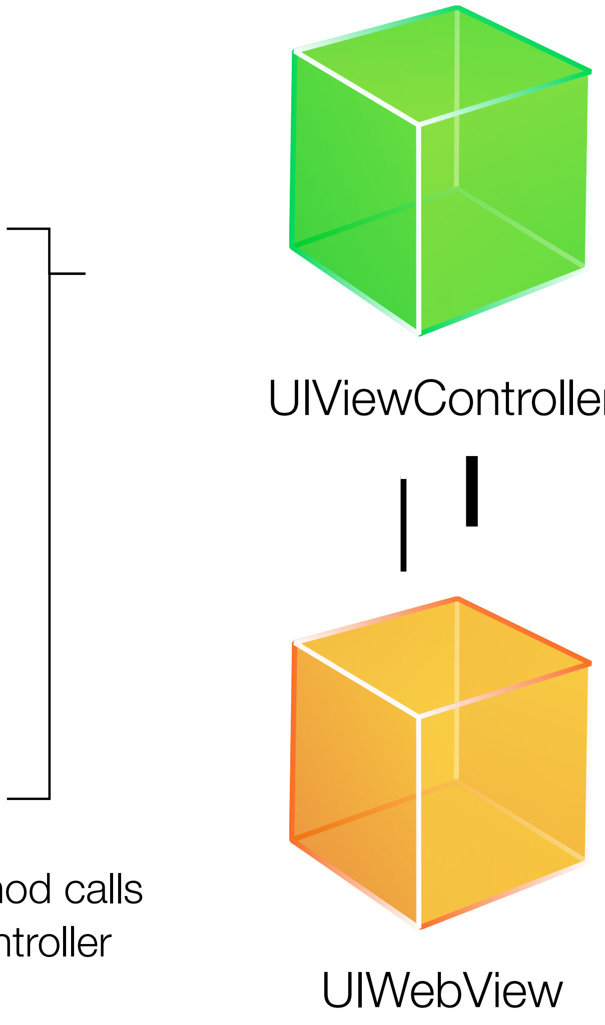
Delegate Pattern

Should I start loading this URL? *(configuration)*

I did start loading the URL. *(callback)*

I have finished loading the URL. *(callback)*

I failed to load the URL. *(error handling)*



Delegates method calls
to its view controller

Delegate Pattern

Protocols could make compilers check conformity

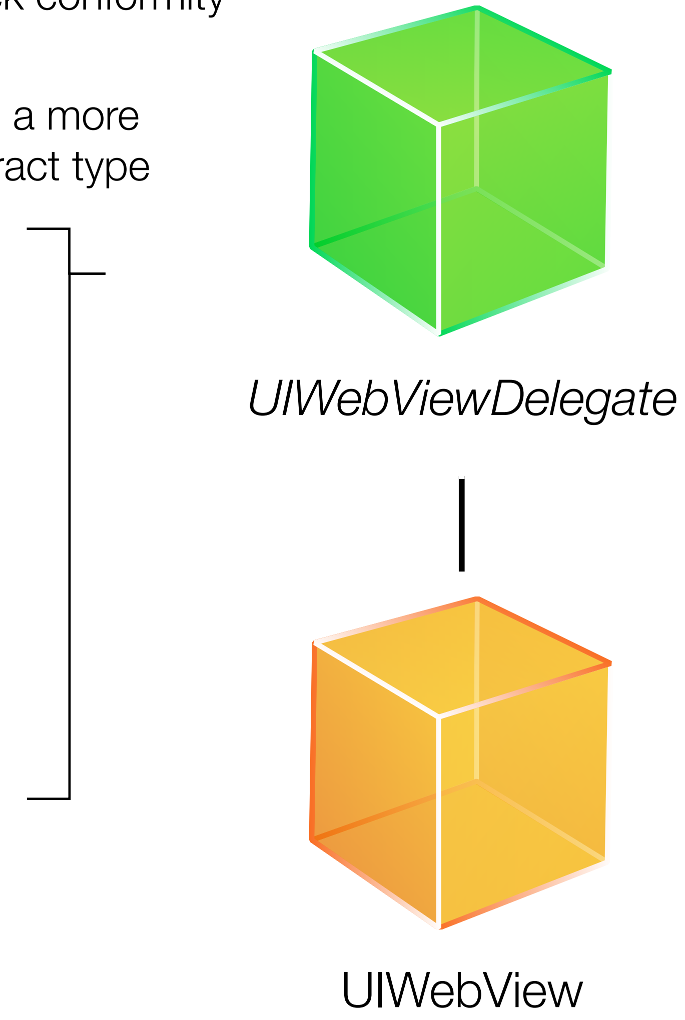
Use protocols as a more general and abstract type

Should I start loading this URL? *(configuration)*

I did start loading the URL. *(callback)*

I have finished loading the URL. *(callback)*

I failed to load the URL. *(error handling)*



Delegate Pattern - Declaration

```
@objc protocol MYWebViewDelegate: NSObjectProtocol {
    optional func webView(webView: MYWebView, shouldLoadURL url: NSURL) -> Bool
    optional func webView(webView: MYWebView, didStartLoadingURL url: NSURL)
    optional func webView(webView: MYWebView, finishedLoadingURL url: NSURL)
    optional func webView(webView: MYWebView, failedToLoadURL url: NSURL,
        withError error: NSError?)
}
```

We usually pass the instance into delegate methods for identification since the delegatee may be shared by multiple delegators.

Delegate Pattern - Implementation

```
class MYWebView: UIView {
    weak var delegate: MYWebViewDelegate?

    func loadURL(url: NSURL) {
        if let shouldLoad = self.delegate?.webView?(self, shouldLoadURL: url) {
            if !shouldLoad { return }
        }
        self.delegate?.webView?(self, didStartLoadingURL: url)
        // Load ...
        let success = true
        // Done
        if success {
            self.delegate?.webView?(self, finishedLoadingURL: url)
        } else {
            self.delegate?.webView?(self, failedToLoadURL: url, withError: nil)
        }
    }
}
```

Delegate Pattern - Adoption

```
class MYViewController: UIViewController, MYWebViewDelegate {

    var webView: MYWebView!

    override func viewDidLoad() {
        super.viewDidLoad()
        self.webView = MYWebView()
        self.webView.delegate = self
    }

    func webView(webView: MYWebView, didStartLoadingURL url: NSURL) {
        print("Start loading url: \(url)")
    }
}
```

Demo: TextFieldDelegate *(uikit-intro repo)*

References

Using Swift with Cocoa and Objective-C

Strategies for Handling App State Transitions
App Programming Guide for iOS

File System Programming Guide

About Asset Catalogs

View Controller Programming Guide for iOS

Communication Patterns @ objc.io

Target-Action
Concepts in Objective-C Programming

Delegates and Data Sources
Concepts in Objective-C Programming