CS 47

Beginning iPhone Application Development

Week 2: App Fundamentals

Office Hours Update

10-11am

Class Schedule

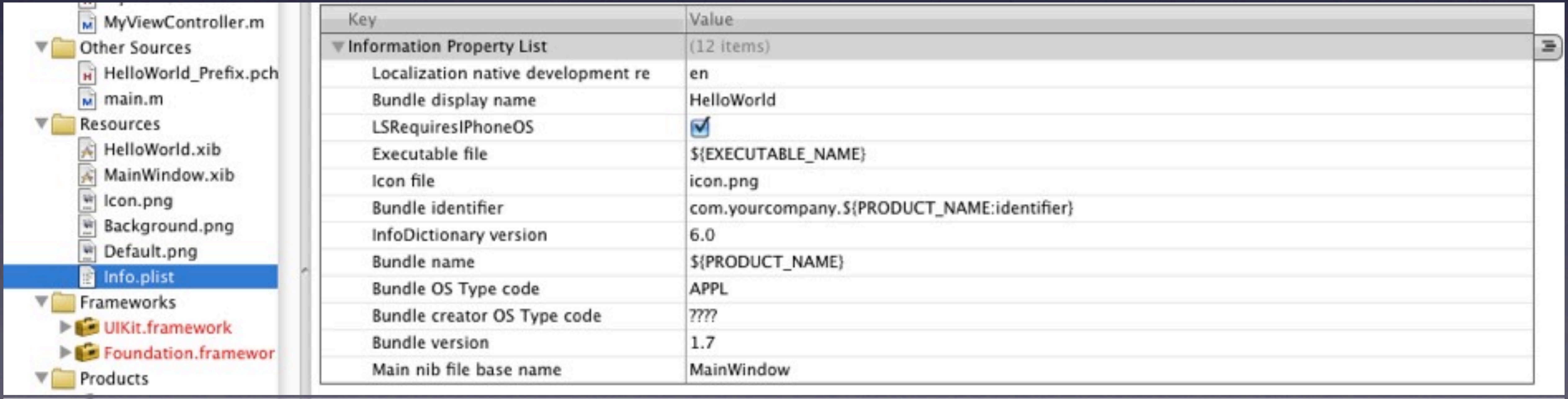
- Reminder: No class on March 4
- Class is extended to March 25, but the last class may not be in this room due to finals. I will keep you updated.

Agenda

- Basic app fundamentals
  - Structure, initialization
- MVC Framework
- UIView and UIViewController basics

App Fundamentals

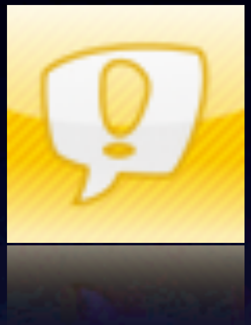
- Every app has an info.plist (property list) file
- Contains many basic global settings of an application (e.g. version, name, etc)



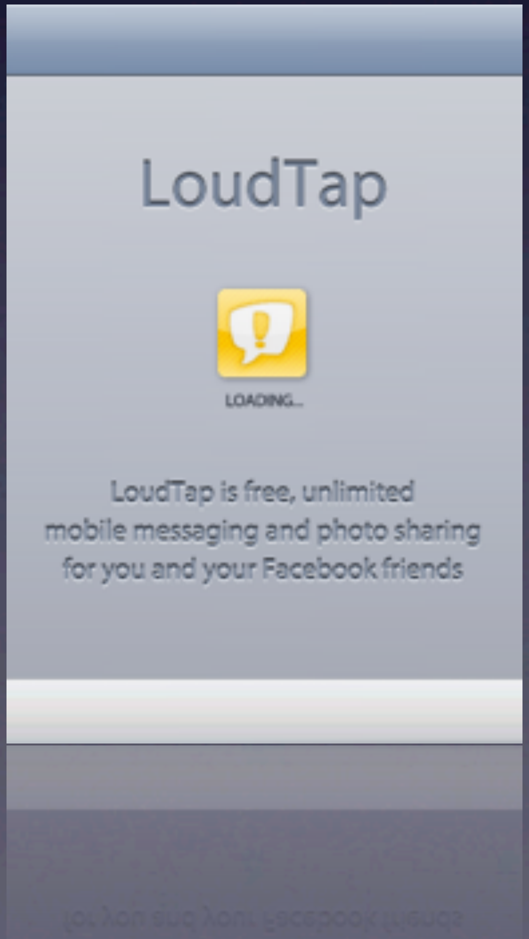
Key	Value
Information Property List	(12 items)
Localization native development re	en
Bundle display name	HelloWorld
LSRequiresIPhoneOS	☑
Executable file	${EXECUTABLE_NAME}
Icon file	icon.png
Bundle identifier	com.yourcompany.${PRODUCT_NAME:identifier}
InfoDictionary version	6.0
Bundle name	${PRODUCT_NAME}
Bundle OS Type code	APPL
Bundle creator OS Type code	????
Bundle version	1.7
Main nib file base name	MainWindow

App Fundamentals

- The bundle icon filename is definied in the info.plist file (normally icon.png). It must be a 57x57 PNG file



- The splash screen (when is shown before your application is finished loading) is stored in Default.png (case sensitive), and should be a 320x480 PNG file



LoudTap

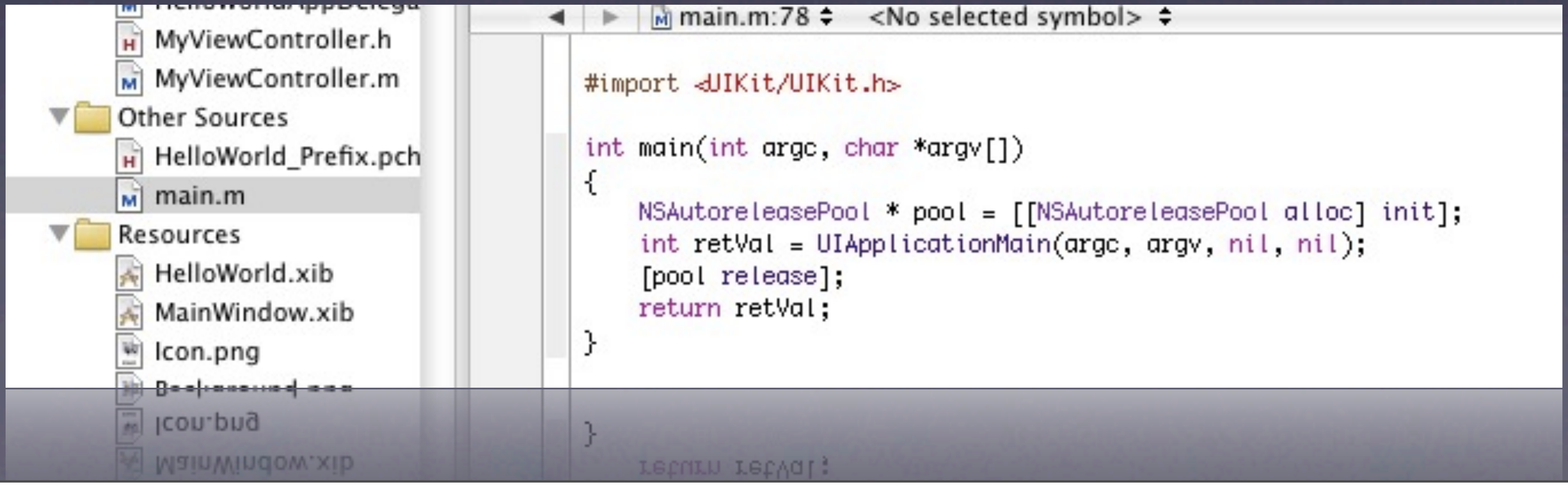
LOADING...

LoudTap is free, unlimited mobile messaging and photo sharing for you and your Facebook friends

- Both icon.png and Default.png should be in the resources group of your project

App Fundamentals

- Where does the app start?
- At a basic level, main! (Just like C)
  - main.m, you will never need to change this file.
- Calls UIApplicationMain



```
#import <UIKit/UIKit.h>

int main(int argc, char *argv[])
{
    NSAutoreleasePool * pool = [[NSAutoreleasePool alloc] init];
    int retVal = UIApplicationMain(argc, argv, nil, nil);
    [pool release];
    return retVal;
}
```

App Fundamentals

- UIApplicationMain
  - Sets up UIApplication and UIApplicationDelegate objects
    - nil params mean: use defaults (default delegate is determined by the info.plist default nib file).
  - Sets up main event loop

App Delegate

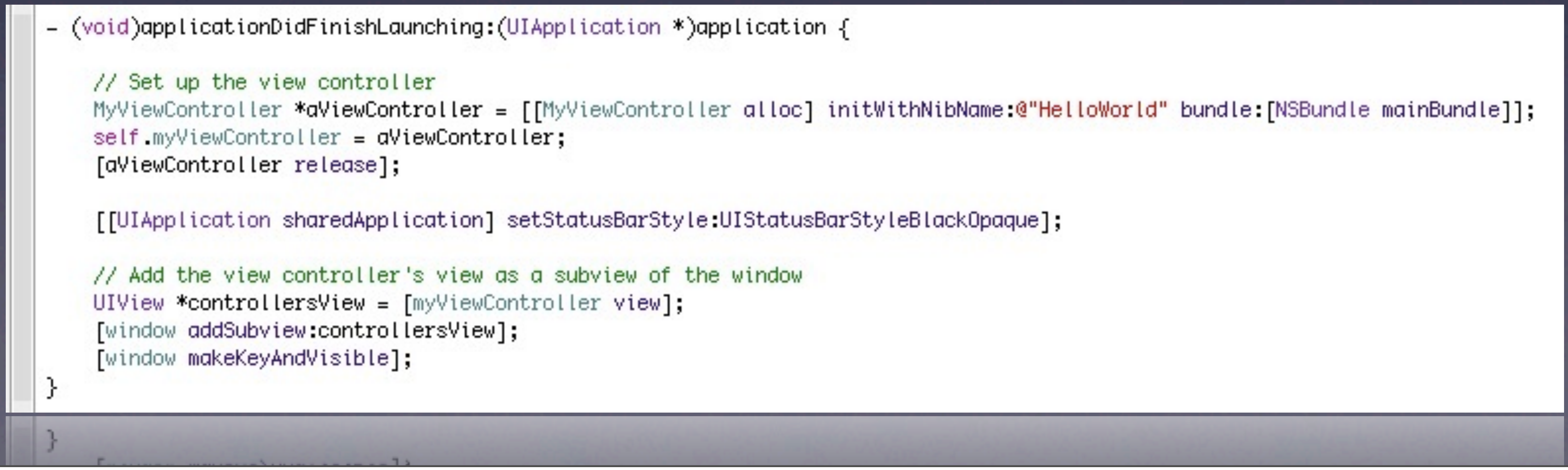
- The app delegate will be the first class you dive into
- It handles all application lifecycle-related callbacks
    - App starting, app ending, pausing due to the idle timer, receiving push notifications, etc.
- Remember: this is a delegate. It does not subclass UIApplication. It's an arbitrary NSObject-based class that conforms to the UIApplicationDelegate protocol

App Delegate

The entrance point that we care about:

```
- (void) applicationDidFinishLaunching:(UIApplication*)application
```

This is our only opportunity to initialize the application! After this function we turn over control to the event loop



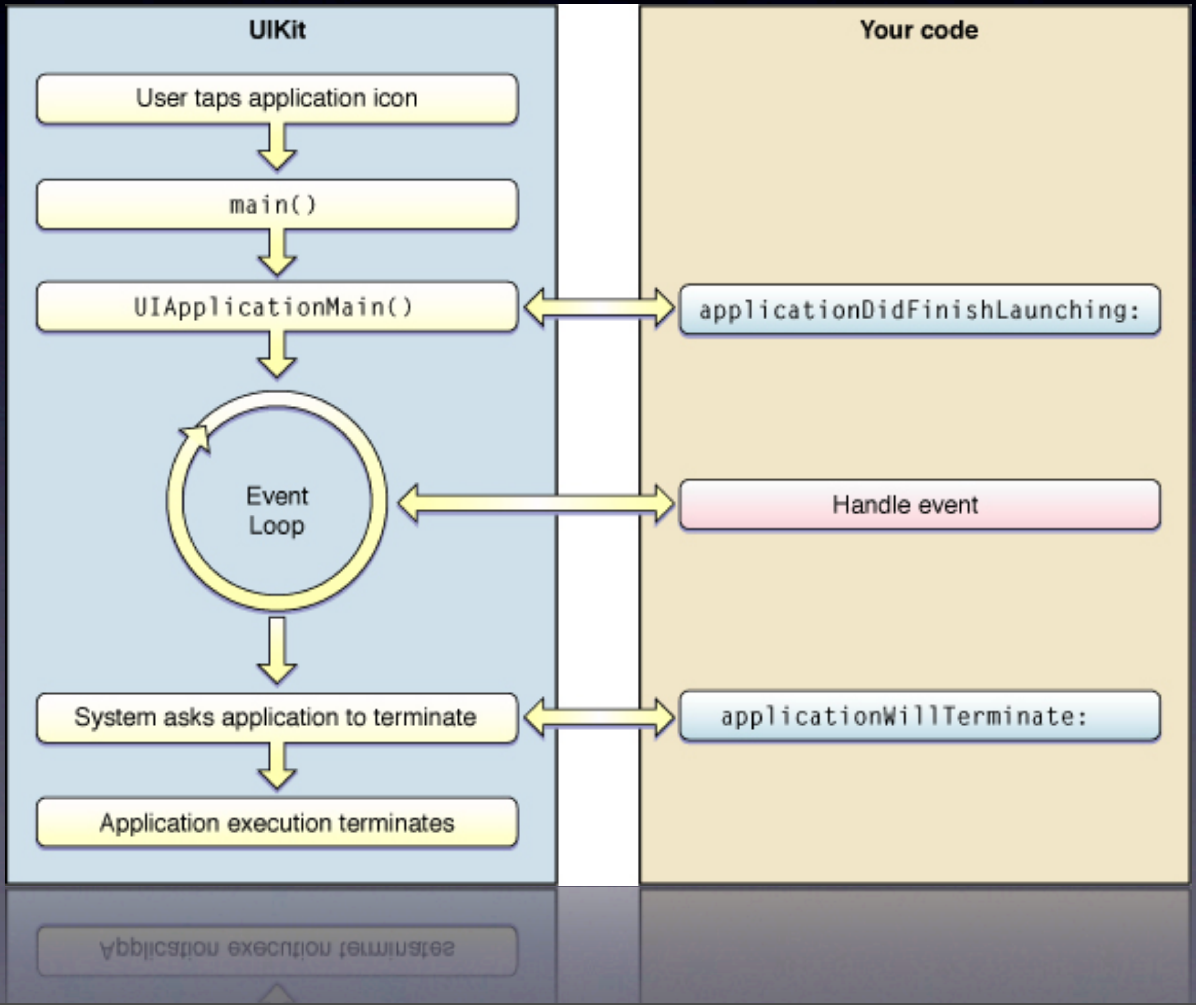
```
- (void)applicationDidFinishLaunching:(UIApplication *)application {

    // Set up the view controller
    MyViewController *aViewController = [[MyViewController alloc] initWithNibName:@"HelloWorld" bundle:[NSBundle mainBundle]];
    self.myViewController = aViewController;
    [aViewController release];

    [[UIApplication sharedApplication] setStatusBarStyle:UIStatusBarStyleBlackOpaque];

    // Add the view controller's view as a subview of the window
    UIView *controllersView = [myViewController view];
    [window addSubview:controllersView];
    [window makeKeyAndVisible];
}
```

App Delegate

- Our responsibilities in applicationDidFinishLaunching:
  - Initialize our data models
  - Setup the main UIWindow
  - Setup initial views and view controllers under the window (initial interaction hierarchy)
  - If our data model indicates that we are resuming a session, we need to rebuild the app state to where it was when interrupted.
- Do this as fast as possible or users will hate you

I Thought This Was Cool

Application Lifecycle Diagram


UIKit
Your code
User taps application icon
main()
UIApplicationMain()
applicationDidFinishLaunching:
Event Loop
Handle event
System asks application to terminate
applicationWillTerminate:
Application execution terminates

Event Loop

- The event loop looks something like this (behind the scenes):

```
while(wait for event) {

   NSAutoreleasePool *pool = [[NSAutoreleasePool alloc] init];
   handle_event(event);
   [pool drain];

}
```

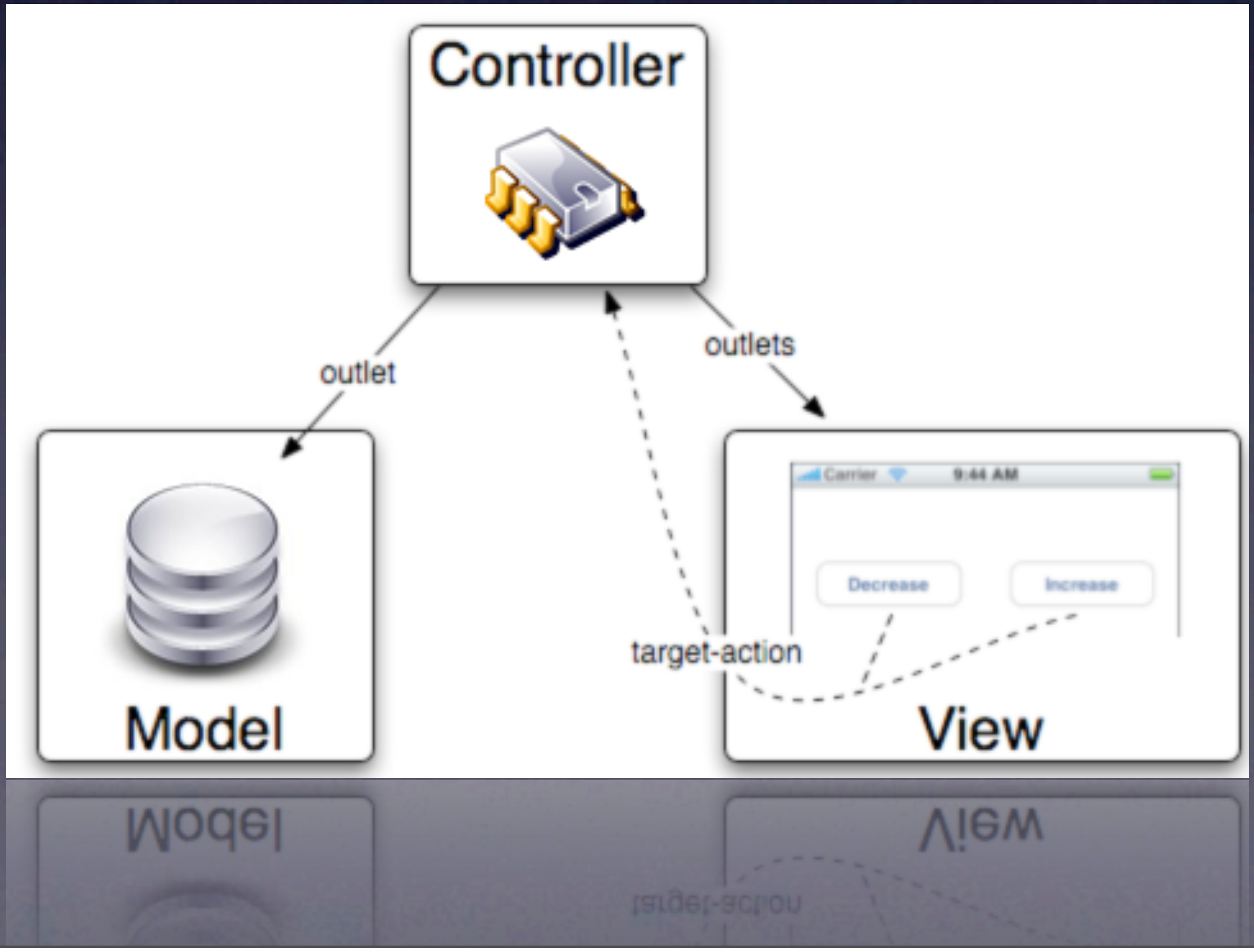
- This is why autorelease works - a new pool is created for each event, and drained when the event is handled

Event Loop

- Notice: events are handled one at a time
- You need to handle events quickly or your application will appear unresponsive
- Querying things that may not be available immediately needs to be done asynchronously or in another thread

MVC

- The iPhone SDK is based on the model-view-controller paradigm



MVC

- Why?
  - Reduces spaghetti code
  - Abstraction! Easier to compartmentalize areas of code in your mind
  - Separate reusable code (model, view) from specific-purpose code (controller)

Model

- Responsible for handling the organization of you application’s data:
  - Storage (database or flat file)
  - Retrieval (from disk or remote system)
  - Analysis (basic data analytic functions)

Model

- Models can have very complex implementations (e.g. caching policies, complex databases, remote queries)
- But they should always have as simple an interface as possible for your application controllers

Abstraction and reusable code!

Views

- Represented by the UIView class
- Responsible for handling all I/O with the user
    - Displaying information to the user
    - Recognizing user input
- Views are controlled by (you guessed it) controllers! Controllers tell them what to display, and the views send input events back to the controllers

Views

- You should also strive for reusable code when implementing views
- Your views should display specific things in a specific manner, and have a good API to affect that display - don’t pack too much functionality into a single view class!
- Implement callbacks for general events (e.g. touched, modified, etc)

Views

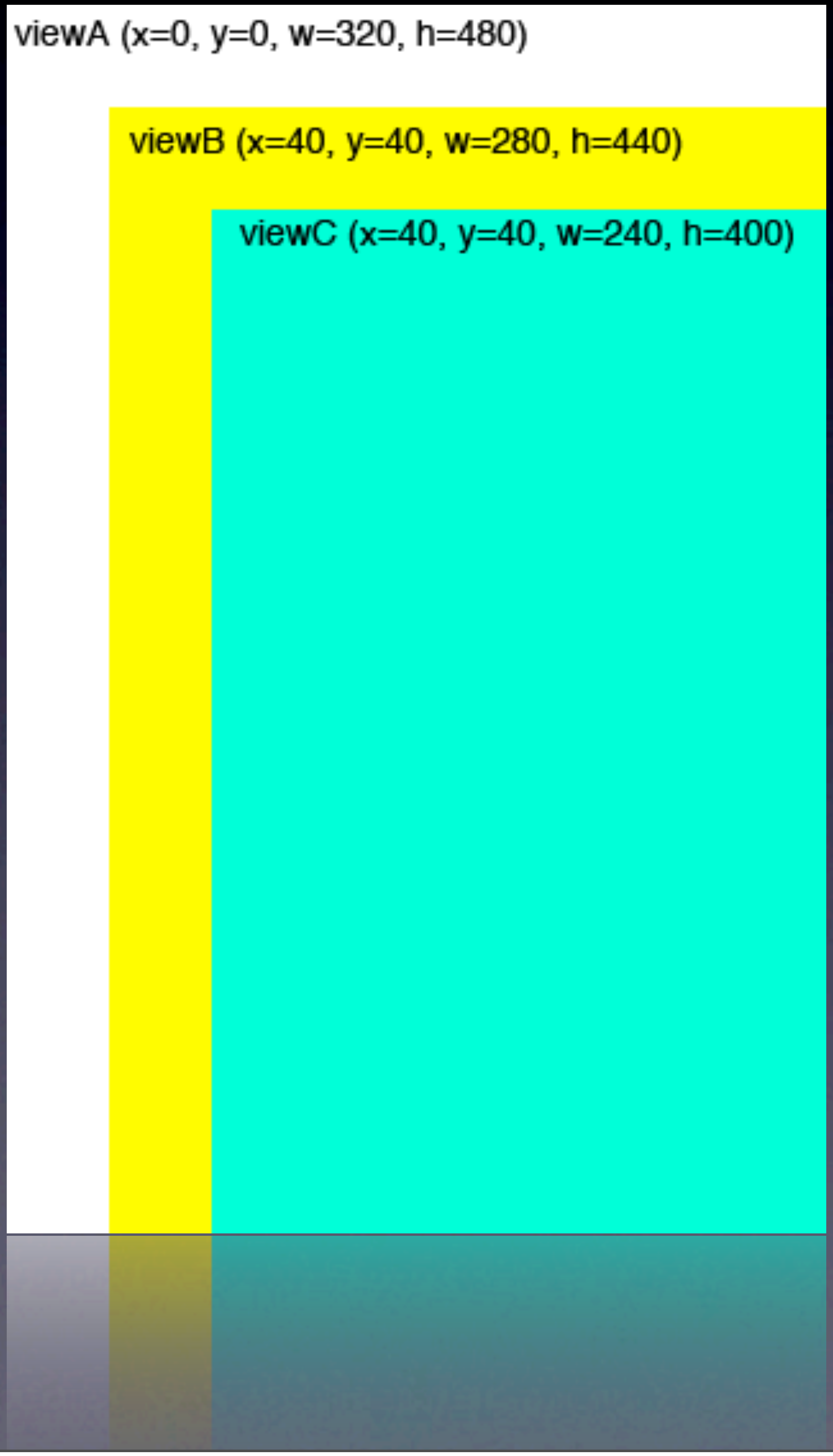
- In the iPhone SDK, UIViews create a view hierarchy
- There is a key window (ref: `makeKeyAndVisible`) that is the top-level UIVIew in the application
- UIViews are attached to a parent UIView with the `addSubView:` message
- UIViews can be removed with `removeFromSuperview:`

Views

- UIViews are displayed relative to their parent UIView
- Position, transparency, touch-enabled state, etc - all are relative to the parent UIView
  - e.g. if the parent UIView is set to alpha=0.5 (half blend), then all child UIViews have their alphas halved

Views

- Positioning example:
- C is a subview of B
- B is a subview of A
- Notice B and C both have defined origins at 40,40
- But C is at absolute screen origin 80,80 since its origin is relative to B's
- Note that width/height are always absolute


viewA (x=0, y=0, w=320, h=480)
viewB (x=40, y=40, w=280, h=440)
viewC (x=40, y=40, w=240, h=400)

Views

- The view hierarchy is dynamic!
- The top-level UIWindow is always present, but its children are continuously swapped out as the user navigates around the application
- These hierarchy transitions are handled by UIViewControllers

Controllers

- The controller is the glue logic that ties the model and views together
  - Takes model info and displays it through views
  - Takes input from views and affects the model
  - This is where app-specific code goes! Controllers are generally not reusable
- Deals with other event-driven callbacks like timers or asynchronous data requests
- Controls the dynamic view hierarchy
- Controllers can have their own hierarchy (UINavigationControl, UITabBarController, etc)

Controllers

- Think of a typical iPhone application that navigates through a sequence of distinct screens.
- Generally, every screen in an application is represented by its own subclassed UIViewController

Controllers

- One UIViewController per screen:
  - Try to focus on one UI interaction behavior per screen
  - Presenting data to the user in an expected and easy-to-use way
  - Link to other screens to get to other types of data/interactions

Controllers

- There is no standard mechanism for a UIViewController to interact with the model.
- Completely up to your discretion and heavily influenced by your model's implementation

Controllers

- Controller -> View interaction is also flexible, but there are some rules
- Every UIViewController has a `view` instance variable

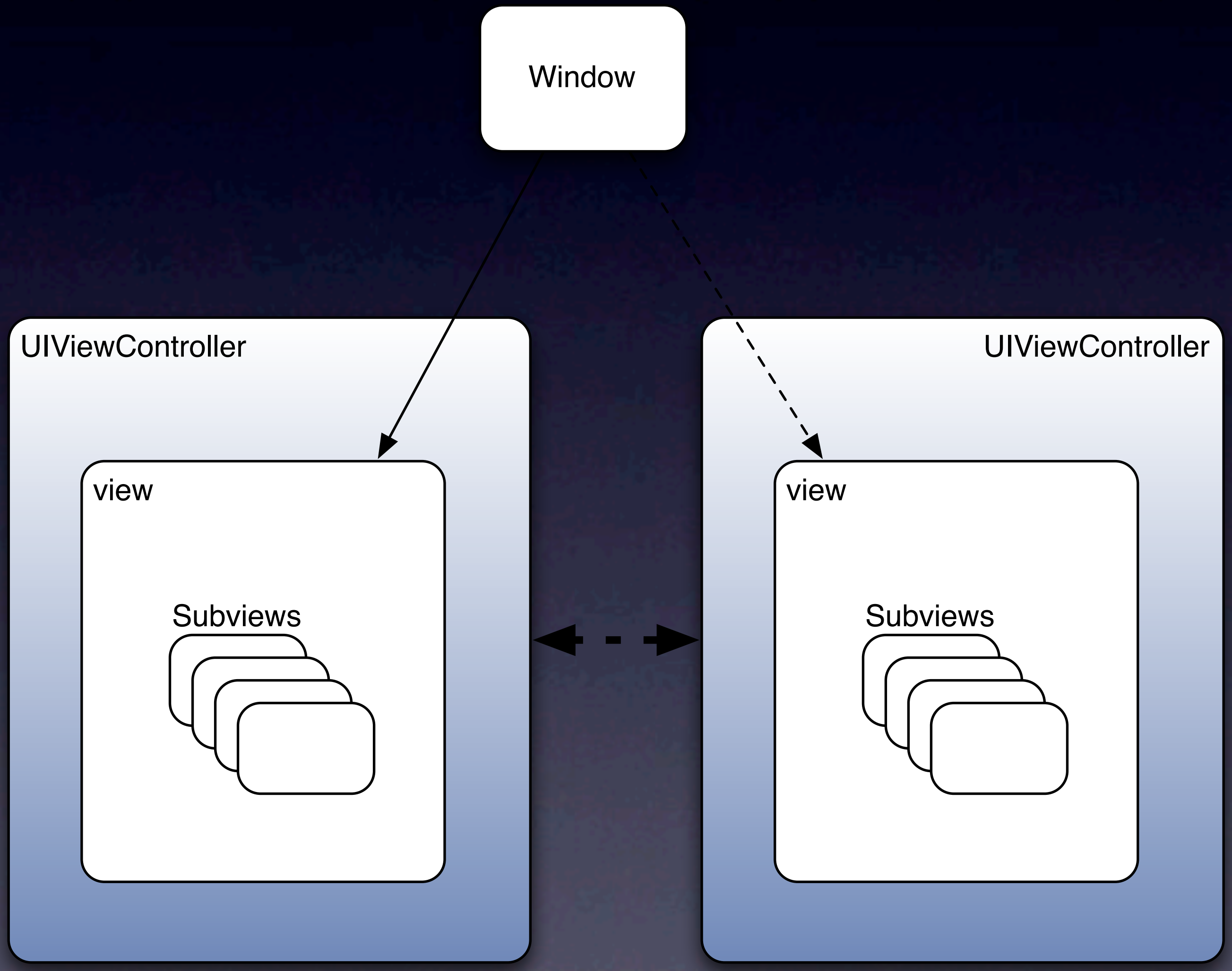
```
@property (retain) UIView view;
```

- If you are subclassing from UIViewController, it is your responsibility to initialize this instance variable

Controllers

- The `loadView:` message is called if `view` is nil when accessed (`UIView *v = myViewController.view`)
- Usually, in the same place that you initialize the `view` instance member you also take the time initialize and add the entire UIView hierarchy of this controller to the `view`
- e.g. adding tables, buttons, labels, pickers, etc

Controllers



UIViewControllers themselves are NOT part of the view hierarchy!

Remember: `[window addSubview:myViewController.view];`

Controllers

- What if you want to animate between screens? Use special controllers designed to manage UIViewControllers
- You could use a UINavigationController, which animates left-right transitions and handles the navbar at the top of the screen
- Or a UITabBarController, which provides a selection of UIViewControllers in its tab at the bottom of the screen

Controllers

- Or you can implement your own transition style! Your only responsibility is removing the active UIViewController's `view` from the hierarchy and bringing another one in.

Controllers

- Why else is it important to manage UIViewControllers?
- Remember that our view hierarchy only retains the UIViewController's `view` member (during `addSubview:`)
- It does not implicitly retain the entire UIViewController object!

Controllers

- Use UIViewController manager classes to help you manage UIViewController lifecycle
- UINavigationController and UITabBarController will retain your UIViewControllers until no longer needed
- Think about what this means: UIViewControllers are created and destroyed just like any other class

Controllers

- Since they can be instantiated and destroyed so often, you want to make sure your UIViewController subclasses can initialize and destruct quickly, without memory leaks
- Yes, you can have global view controllers, but it’s not ideal.

Controllers

Global UIViewController (sharedInstance)

```
@interface MyViewController : UIViewController {
}
- (MyViewController*) sharedInstance;
@end


@implementation MyViewController

- (MyViewController*) sharedInstance {
  static MyViewController *singleton_instance = nil;
  if (!singleton_instance) {
    singleton_instance = [[MyViewController alloc] init];
  }
  return singleton_instance;
}
```

Controllers

- Another note on UIViewController managers: they call various lifecycle messages as your controllers come in and out of view:

```
- viewWillAppear:
- viewDidAppear:
- viewWillDisappear:
- viewDidDisappear:
```

MVC Interaction

- Let’s recap how components of an MVC system interact

MVC Interaction

Controller-Model

- As discussed before: This is easy... it's up to you!
- Generally the controller queries for information from the model (pull)
- The model may use a protocol to inform the controller that asynchronous info is ready (push)

MVC Interaction

Model-View

- This is tricky. There is a trade-off between reusable and succinct code.
- It may be very easy/fast to assign entire model objects to view instance variables in order to pass in much information at once, but this ties the view to the model
- Must be considered on a case-by-case basis, no general rules

MVC Interaction

Controller-View

- Controllers setup views and tell them what data to display
- Views tell controllers when user interaction occurs
  - Either through delegate methods, or target-action

MVC Interaction

Controller-View

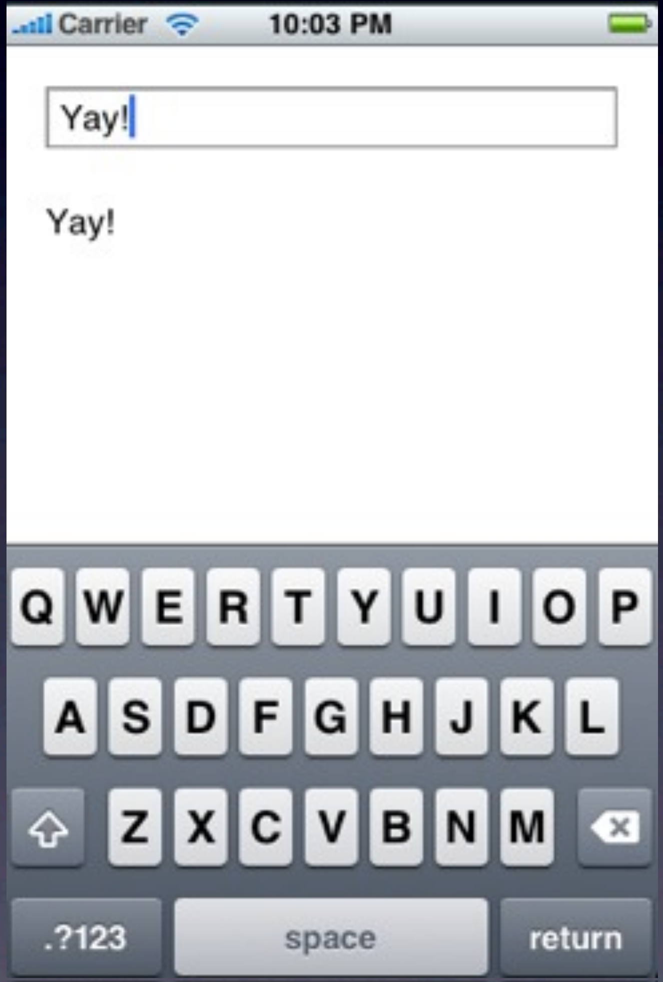
- We know what delegates are. But what is target-action?
- Every UIView has a list of events that it can handle (UIControlEventXXX)
- When an event is detected by the view, it looks up an internal target-action table to see if anyone needs to be notified of that event

MVC Interaction

Controller-View

```
@implementation MyViewController

- (id) init {
  if (self = [super init]) {
    ...
    myButton = [UIButton buttonWithType:UIButtonTypeCustom];
    [myButton addTarget:self
                 action:@selector(buttonPressed:)
       forControlEvents:UIControlEventTouchUpInside];
    [self.view addSubview:myButton];
    ...
  }
  return self;
}

- (void) buttonPressed:(id)sender {
  NSLog(@”Button pressed!!”);
}

@end
```

Demo Time



Yay!

Yay!