

CS193P - Lecture 18

iPhone Application Development

Unit Testing

Fun with Objective-C

Localization

Mailbag

Unit Testing

What Are Unit Tests?

- Test specific areas of functionality
- Minimal external dependencies
- Run frequently during development

Who Writes Unit Tests?

- **You do!**
- Ideally written along with new code
- Test-driven development
 - Write tests first
 - Fill in the implementation until tests pass
 - Rinse & repeat

Running Unit Tests

- Automate so you don't have to explicitly run tests
- Many testing frameworks can run tests **every time you build**
- Just as compiler checks **syntax**, unit tests check **semantics**

Why Unit Test?

- **Fewer bugs**
 - More confidence that you're shipping a high quality product
- Find bugs **early**
 - Bugs are easier (and cheaper) to fix early in development
- Avoid **regressions**
 - Ensure that changing one piece of code doesn't break another
- **Document** your code
 - How is a method intended to be used? Check out the tests...
- Encourage **good design**
 - Spaghetti code is hard to test! Design with **testability** in mind

Unit Testing Frameworks

- Family of similar frameworks for testing various languages
 - JUnit, NUnit, PyUnit...
- **OCUnit** for Objective-C
 - Ships with Mac OS X developer tools, integrates with Xcode
 - **Included with iPhone SDK as of 2.2**

Basics of OCUUnit

- SenTestCase is abstract test case superclass
- Automatically runs methods that begin with "test"
- Macros for asserting conditions during tests
 - STAssertNotNil(someObject, @"Some object was nil");
 - See SenTestCase.h for more
- -setUp and -tearDown methods run before and after each test

Defining A New Test Case Class

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

```
@class Foo;
```

```
@interface FooTests : SenTestCase {  
    Foo *foo;  
}  
@end
```

Preparing Tests

```
@implementation FooTests
```

```
- (void)setUp {  
    // Every test will have its own Foo instance  
    foo = [[Foo alloc] init];  
}
```

```
- (void)tearDown {  
    [foo release];  
}
```

```
...
```

```
@end
```

Adding Tests

```
@implementation FooTests
```

```
...
```

```
- (void)testCreateFoo {  
    STAssertNotNil(foo, @"Couldn't create Foo");  
}
```

```
- (void)testSetBar {  
    Bar *bar = ...;  
    foo.bar = bar;  
    STAssertEqualObjects(foo.bar, bar, @"Couldn't set foo.bar");  
}
```

```
...
```

```
@end
```

Testing Error Conditions

```
@implementation FooTests
```

```
...
```

```
- (void)testOutOfBoundsAccess {  
    STAssertNil([foo barAtIndex:99], @"Index 99 should be nil");  
}
```

```
...
```

```
@end
```

Demo: Unit Testing an iPhone App

When Does Unit Testing Make Sense?

- Always be conscious of the return on investment
 - Benefit of the test versus time to create and maintain?
- Some types of code are notoriously difficult to test
 - Networking
 - Databases
 - Often possible to **test a subset of behavior** and still benefit

Unit Testing Philosophy

- Keep tests short, lightweight, fast
- Test individual methods, not end-to-end behavior
- Find a new bug? Write a new test before you fix it
- Complement (rather than replace) other types of tests
 - <http://www.friday.com/bbum/2005/09/24/unit-testing/>

Fun with Objective-C

The Objective-C Runtime

- How does OCUnt find all the methods that begin with “test”?
- Any other cool tricks?

/usr/include/objc

- **<objc/objc.h>**
 - id, Nil, nil, BOOL, YES, NO
- **<objc/message.h>**
 - objc_msgSend() and friends
- **<objc/runtime.h>**
 - Inspect and manipulate classes, protocols, methods
 - **Add and replace methods at runtime**

Inspecting Methods

- Copy all methods for a class

```
Method *class_copyMethodList(Class cls,  
                             unsigned int *outCount);
```

- Get attributes for a method

```
SEL method_getName(Method m);  
IMP method_getImplementation(Method m);  
char *method_copyReturnType(Method m);  
...
```

Demo: Inspecting Methods

Playing With Fire

- Adding a method to a class

```
BOOL class_addMethod(Class cls, SEL name, IMP imp,  
                    const char *types);
```

- Replacing the implementation for a method

```
IMP method_setImplementation(Method method, IMP imp);
```

- Method swizzling

```
void method_exchangeImplementations(Method m1, Method m2);
```

Method Swizzling

- What if you want to **override a method in a category** while still making use of the original method?
 - Can't call super, a category isn't a subclass
- Define a new method, swizzle it into place

```
Method existingMethod = ...;  
Method fancyNewMethod = ...;  
method_exchangeImplementations(existingMethod, fancyNewMethod);
```

```
- (void)fancyNewMethod  
{  
    // This looks like it will cause an infinite loop...  
    // Once swizzled, it will actually invoke -existingMethod!  
    [self fancyNewMethod];  
  
    // Perform additional work here  
}
```

Demo: Method Swizzling

Why is this dangerous?

- Other code may be dependent on the original implementation
 - Perhaps code you didn't even write?
- Can cause unexpected behavior, bizarre bugs, crashes
 - This has caused some popular apps to break on iPhone OS 3.0
- Writing “clever” code is **fun until you have to debug it**
- **Never ship an app that swizzles methods on system classes**

Objective-C 2.0 Runtime Reference

- <http://developer.apple.com/DOCUMENTATION/Cocoa/Reference/ObjCRuntimeRef/Reference/reference.html>

class-dump

- Inspect the classes and methods of an Objective-C binary
- Fascinating to see how a complex application is architected
 - Especially one that you didn't write!
- As usual, this can be used for evil purposes as well
 - Discover and use private methods in a framework

**“Calling unpublished APIs
is like jaywalking...”**

**“Calling unpublished APIs
is like jaywalking across 280”**

The Problem with Using Private APIs

- Framework APIs are kept private for one of a few reasons:
 - They're not done yet (and **will probably change**)
 - They're never going to be public (and **may disappear**)
- Not just because Apple wants to hide cool stuff from you
- If your app depends on a private API that goes away...
 - At best, your app won't work correctly anymore
 - More often, your app will just crash

Localization

Your International Application

- Multiple languages and locales in a **single built application**
- Keep localized resources separate from everything else
 - Strings
 - Images
 - User interfaces (in NIBs)

Where Do Localized Resources Go?

- **MyApp.app/**
 - MyApp
 - **English.lproj/**
 - Localizable.strings
 - MyView.nib
 - **Japanese.lproj/**
 - Localizable.strings
 - MyView.nib

Two Steps

- Internationalization (i18n)
 - Prepare your app to be used in different languages and locales
- Localization (l10n)
 - Add localized data for specific languages and locales

NSString to the Rescue

- Interconverts with dozens of encodings
- Saves you from having to deal with complexities of text
- Remember encoding when reading data from disk or web
 - (id) initWithData:(NSData *)data
encoding:(NSStringEncoding)encoding;

Localized Strings

- For user-visible strings in your application code
- Map from an unlocalized key to a localized string
- Stored in .strings files
 - Key-value pairs
 - Use UTF-16 for encoding

Strings File Example

- **en.lproj/Greetings.strings**

```
"Hello" = "Hello";
```

```
"Welcome to %@" = "Welcome to %@";
```

```
"Blah %@ blah %@!" = "Blah %@ blah %@";
```

- **fr.lproj/Greetings.strings**

```
"Hello" = "Bonjour";
```

```
"Welcome to %@" = "Bienvenue a %@";
```

```
"Blah %@ blah %@" = "Blah %2$@ %1$@ blah";
```

Accessing Localized Strings

```
// By default, uses Localizable.strings
```

```
NSString(@"Hello", @"Greeting for welcome screen");
```

```
// Specify a table, uses Greetings.strings
```

```
NSStringFromTable(@"Hello", @"Greetings",  
                  @"Greeting for welcome screen");
```

genstrings

- Tool to scan your code and produce a .strings file
- Inserts comments found in code as clues to localizer
- Run the tool over your *.m files

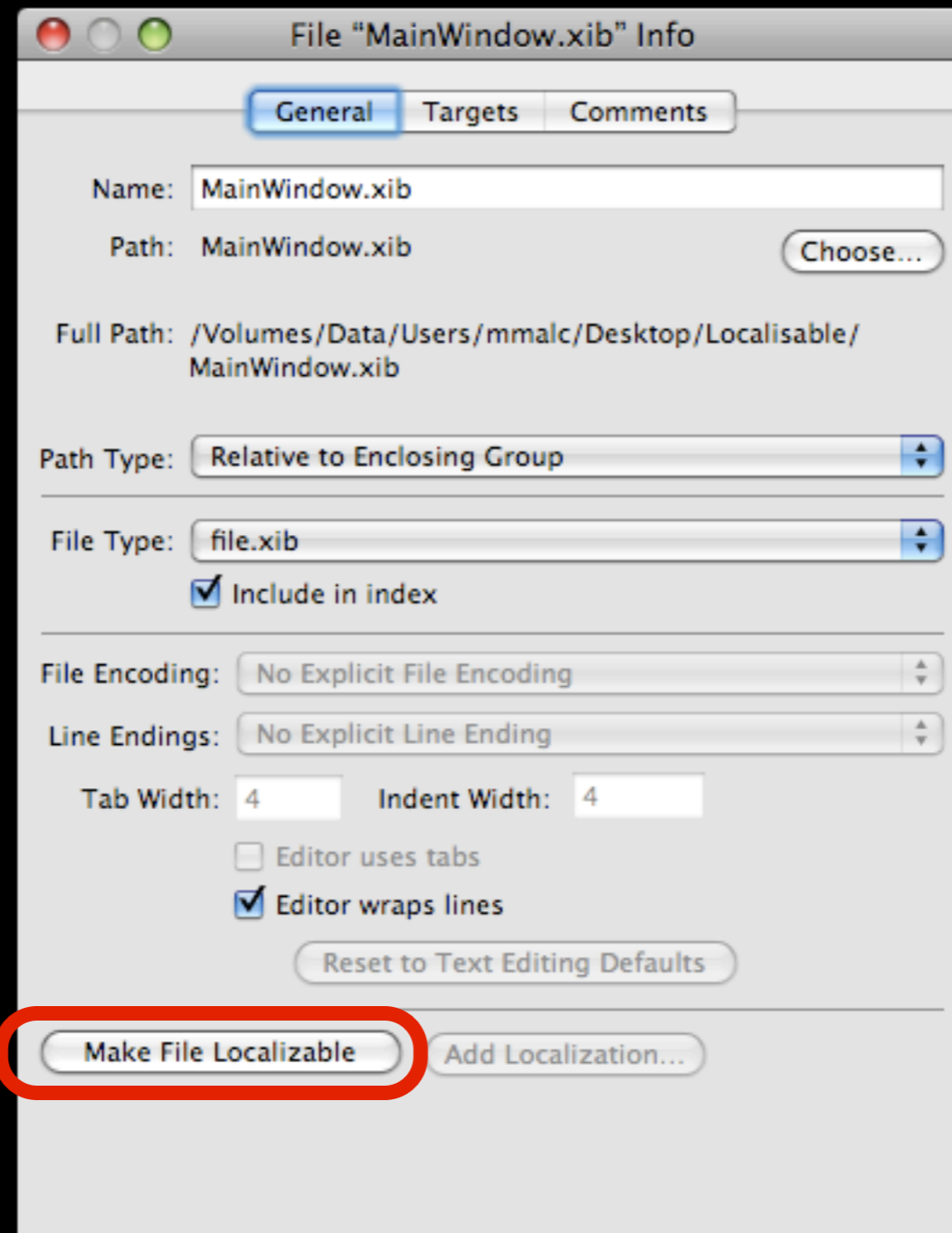
Other Resources

- NSBundle resource methods automatically use the best available localization
- Nib loading does the same

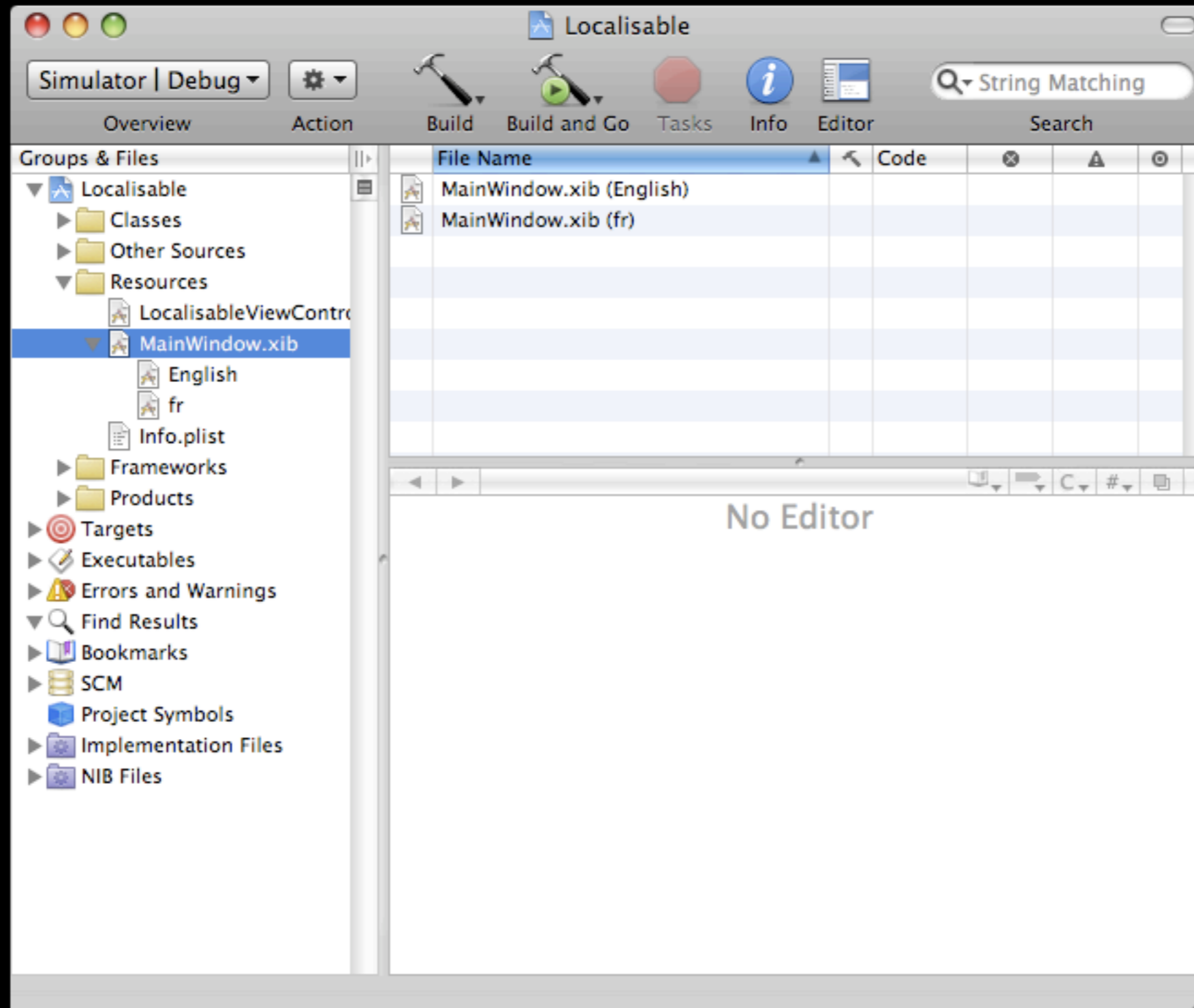
Internationalizing NIBs

- Plan for different string lengths in different languages
 - Good idea to start with German...

Localizing a Resource



Localizing a Resource



NSLocale

- Measurements
- Currency
- Number formatting
- Calendar and date format
- Country information

Opening the Mailbag...



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Pellentesque scelerisque nisi in dol. Etiam tincidunt, lorem et convallis sodales, urna arcu sagittis leo, et
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**“How do I launch my app in
landscape orientation?”**

Launching Your App in Landscape

- Two steps
 - Specify **initial interface orientation** in your Info.plist

Key	Value
▼ Information Property List	(13 items)
Initial interface orientation	Landscape (right home button)
Main nib file base name	MainWindow
Localization native development re	English

- **Support the specified orientation** in your view controller
 - Override `-shouldAutorotateToInterfaceOrientation:`
 - Return YES to indicate interface orientations that you support
- Works on iPhone OS 2.1 or later



AT&T 12:03 PM



ON

My Landscape iPhone App



First Second

Demo: Launching in Landscape

“How can I customize UIKit views and controls?”

Customizing UIKit Views

- Some classes are designed to be **totally customizable**
 - UIButton
 - UITableView
- Many classes have **limited customizability**
 - UINavigationController
 - UISlider
- Other classes are **not customizable**
 - UISwitch
 - UITabBar

What's Safe to Customize?

- Look for methods for customizing appearance
 - UIButton: background image
 - UINavigationController: style, tint, translucency
 - UITableView: delegate methods for appearance
- You can always create your own UIView or UIControl subclass
 - Handle touches
 - Custom drawing

Respecting the View Hierarchy

- Internal view hierarchies are always subject to change
 - Navigation bar
 - Navigation and tab bar controllers
 - Image picker controller
- Making assumptions is unsafe and **will likely break your app**
 - Don't manipulate undocumented subviews of system views
 - Don't add your own custom subviews
- You want your application to be **future-ready**

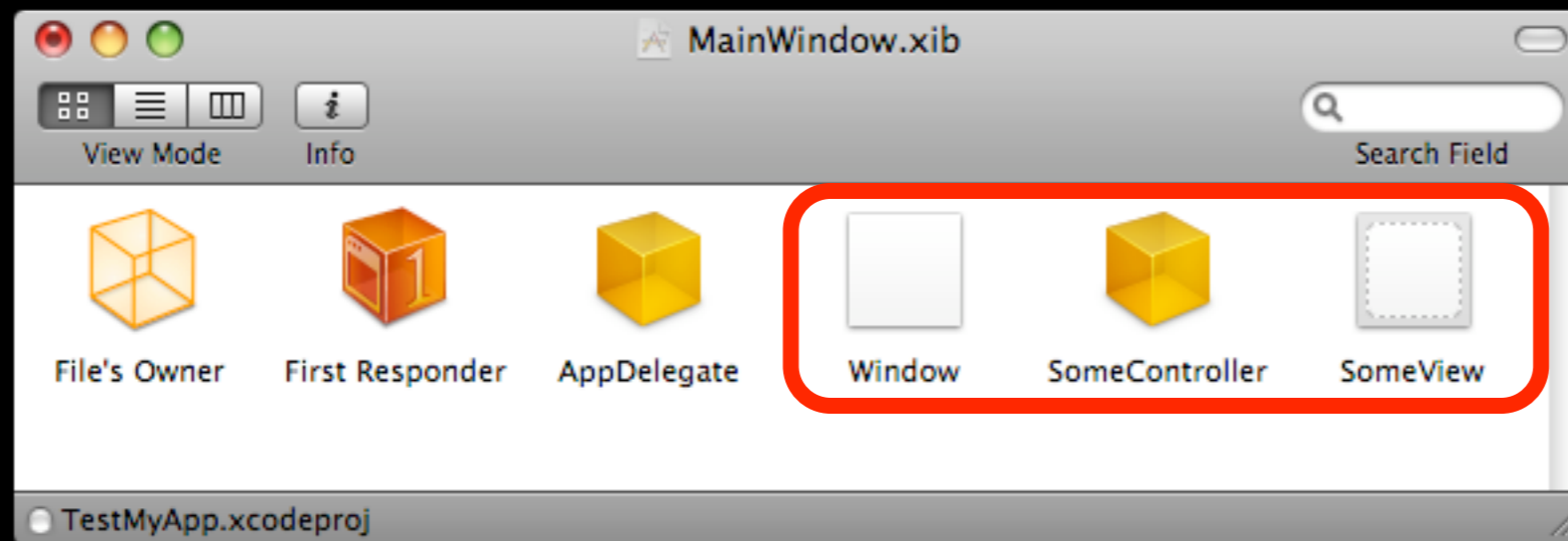
**“Should I create my views using
Interface Builder or in code?”**

When to Use Interface Builder

- Almost always recommended
- Especially useful when creating a view with many subviews
- Not as useful when dealing with just a single view
 - Table views
- Remember: **one view controller subclass, one NIB**
 - Make connections to view controller via File's Owner

Nibs and Memory Management

- Top-level nib objects are autoreleased
 - Retain them if they should stick around after loading



- IBOutlets are **retained by default**
 - Release them in `-dealloc` even if you don't have a setter!
 - Implement or synthesize a non-retained setter if desired

“Where can I get cool icons for my toolbar or tab bar items?”

Toolbar and Tab Bar Images

- Images should be about 30 x 30 pixels
- PNG with alpha channel
- Used as a mask by UIKit for drawing with system colors

Some Great Free* Icons

- Glyphish, by Joseph Wain: <http://www.glyphish.com>
- Creative Commons License
 - *Free to use, share, or remix with attribution



“Can I build Mac apps now that I know iPhone development?”

Building iPhone & Mac OS X Apps

- At this point, you're familiar with
 - Objective-C language
 - Cocoa Touch frameworks
 - Object-oriented design patterns
 - Interface Builder and NIBs
- Developing for the Mac desktop is within your reach!
 - First few lectures of CS193P and CS193E are identical
- Big difference is Cocoa vs. Cocoa Touch
 - Many UIKit and AppKit classes are similar
- Check out <http://cs193e.stanford.edu>

Wrapping up the Quarter

- Course evaluations
 - We want your feedback!
 - <http://registrar.stanford.edu/students/courses/evals.htm>
- **Submit final projects by Sunday at midnight**
 - Don't forget to include your slides!
- Final project demos on Monday, 12:15-3:15PM
 - Rehearse your 2-minute presentation
- WWDC next week...
 - Come to "iPhone View Controller Techniques" if you're there!

It's been a fun quarter...

Thank you!