Announcements

- **Lab 1 is due tonight by midnight**
- **Lab 2 is now posted**
  - Due Monday Feb 9th
- **On Monday we will meet in the Mac Lab**
  - Two sessions 8:30 AM and 10 AM

Lab 2

Today's Topics

- Autorelease
- Automatic Reference Counting (ARC)
- Objective-C Properties
- Quick Intro to Debugging
- Application Lifecycle
- Model, View, Controller design
- Controls and Target-Action

Autorelease

Returning a newly created object

```
-(NSString *)fullName {
  NSString *result;

  result = [[NSString alloc] initWithFormat:@"%@ %@",
    firstName, lastName];

  return result;
}
```

- Wrong: result is leaked!

Returning a newly created object

```
-(NSString *)fullName {
  NSString *result;

  result = [[NSString alloc] initWithFormat:@"%@ %@",
    firstName, lastName];

  [result release];
  return result;
}
```

- Wrong: result is released too early!
- Uncertain what method returns

Returning a newly created object

```
-(NSString *)fullName {
  NSString *result;

  result = [[NSString alloc] initWithFormat:@"%@ %@",
    firstName, lastName];

  [result autorelease];
  return result;
}
```

- Just right: result is released, but not right away!
- Caller gets valid object and could retain if needed

Autoreleasing Objects

- Calling -autorelease flags an object to be sent release at some point in the future
- Let's you fulfill your retain/release obligations while allowing an object some additional time to live
- Makes it much more convenient to manage memory
- Very useful in methods which return a newly created object

Method Names & Autorelease

- Methods whose names includes **alloc** or **copy** return a retained object that the caller needs to release

```
NSMutableString *string = [[NSMutableString alloc] init];

// We are responsible for calling -release or –autorelease
[string autorelease];
```

- All other methods return autoreleased objects

```
NSMutableString *string = [NSMutableString string];

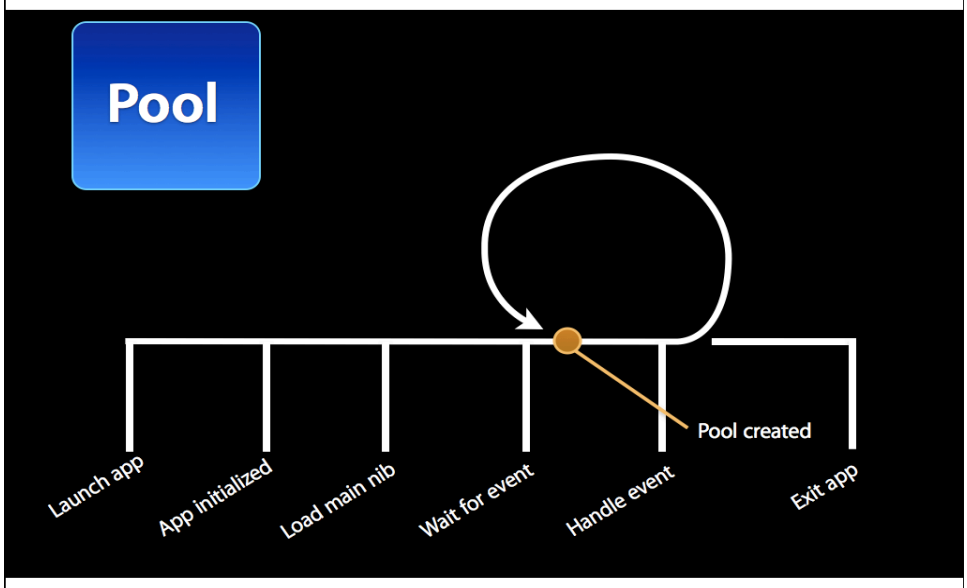
// The method name doesn't indicate that we need to release it
// So don't- we're cool!
```

- This is a convention
  - follow it in methods you define

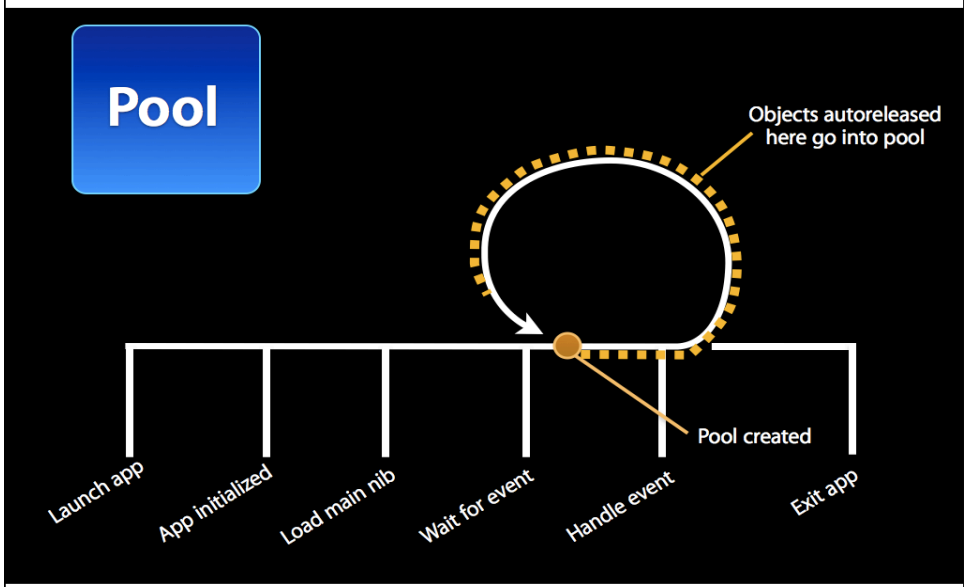
How does -autorelease work?

- Object is added to current autorelease pool
- Autorelease pools track objects scheduled to be released
  - When the pool itself is released, it sends -release to all its objects
- UIKit automatically wraps a pool around every event dispatch

Autorelease Pools (from cs193p slides)



Autorelease Pools (from cs193p slides)



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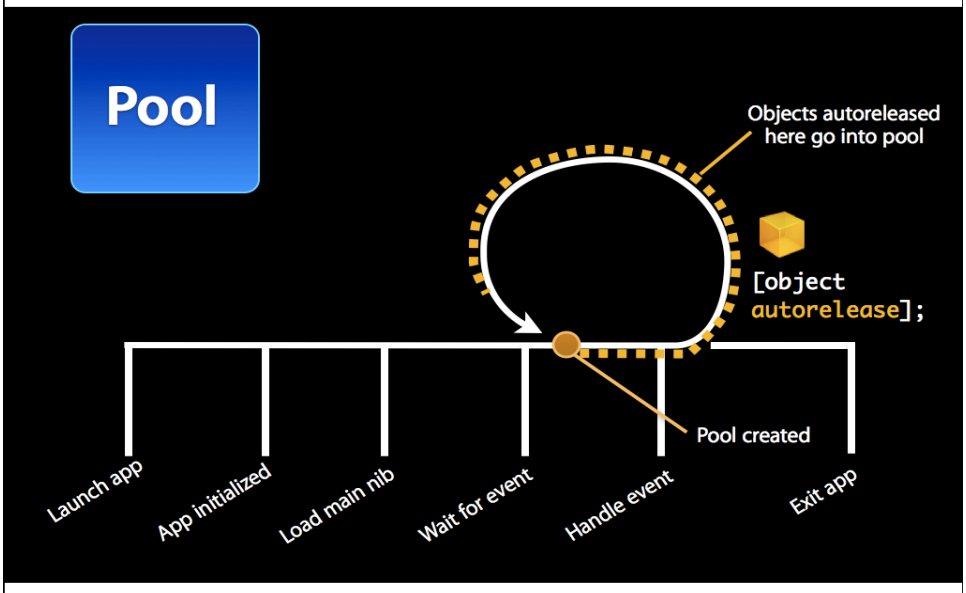

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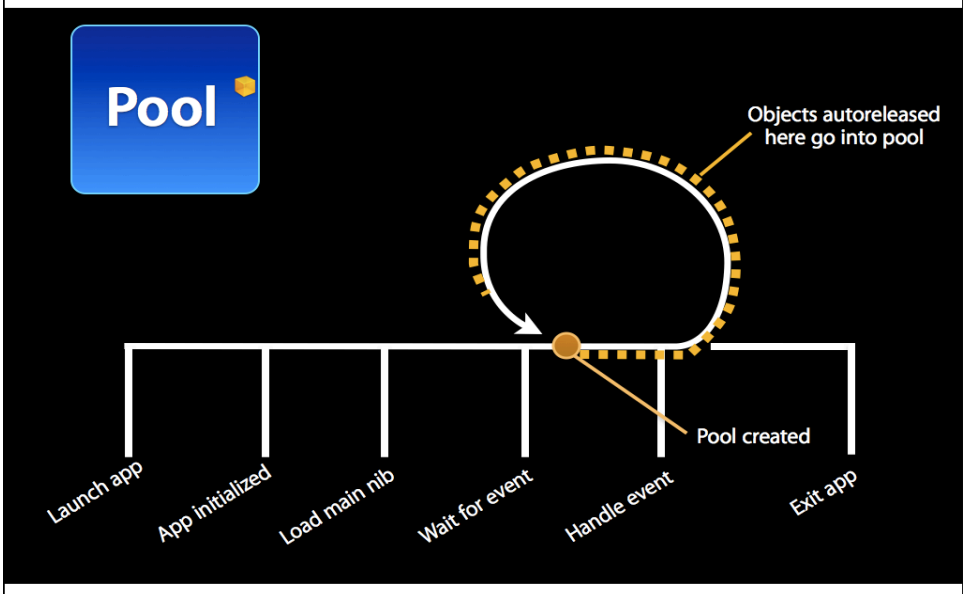

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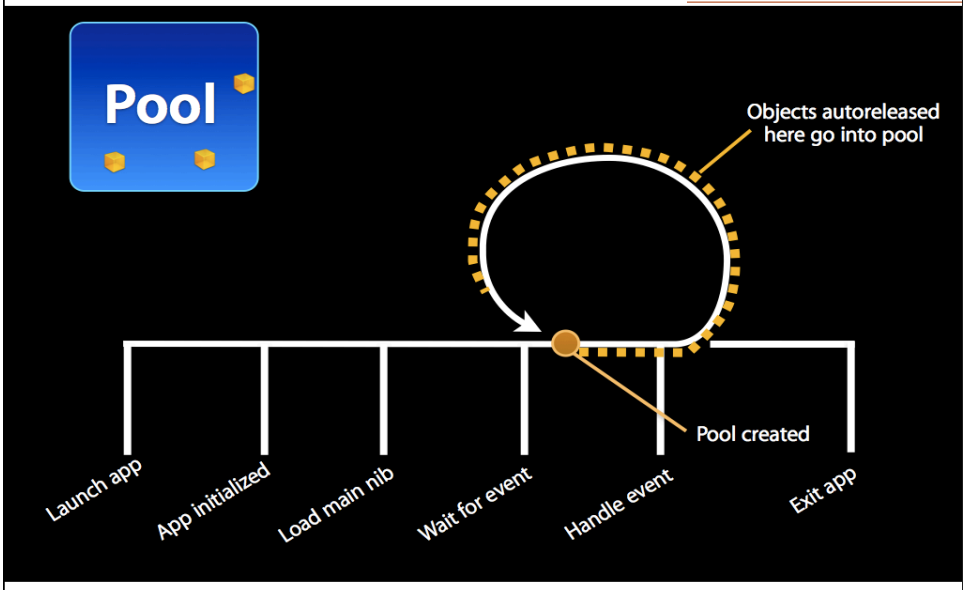

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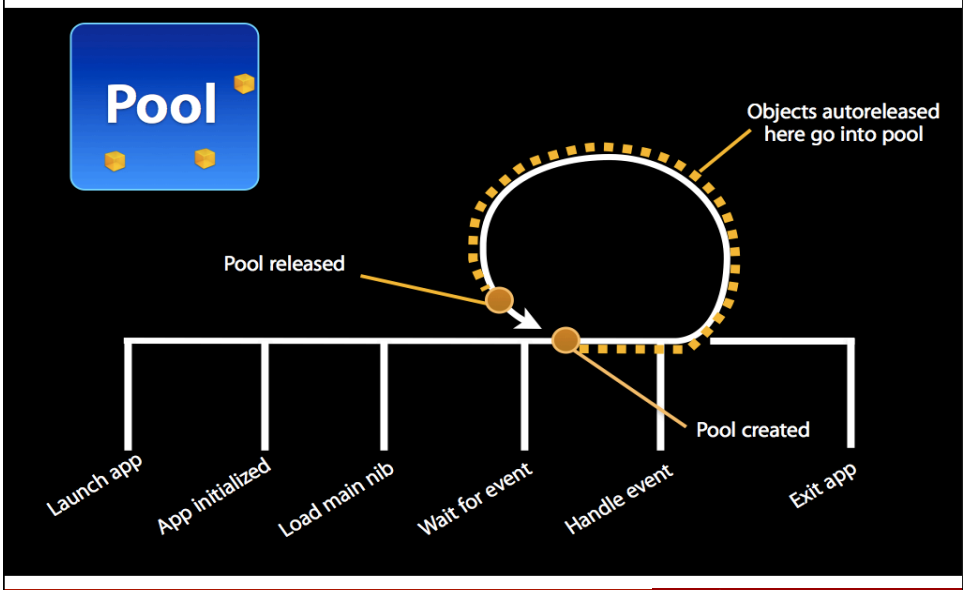

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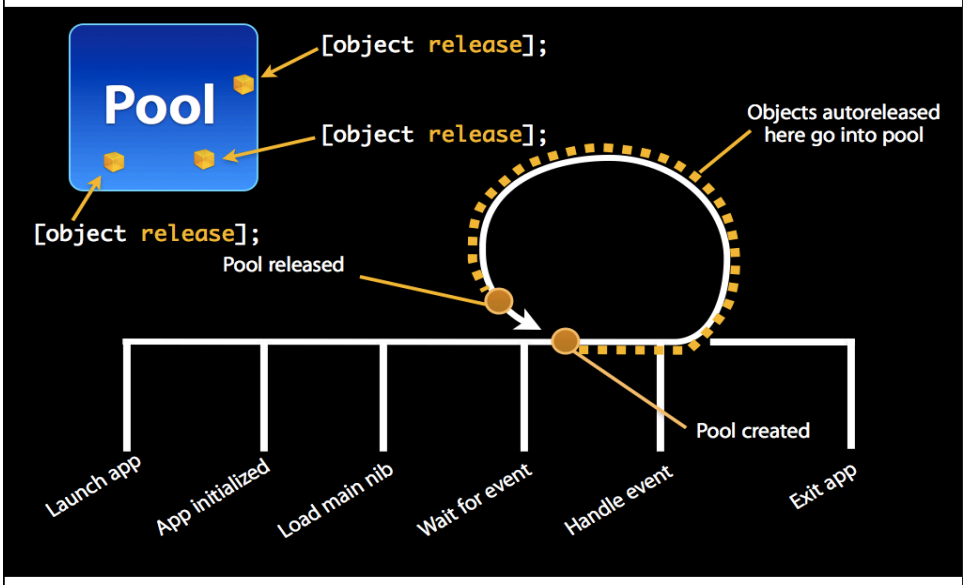

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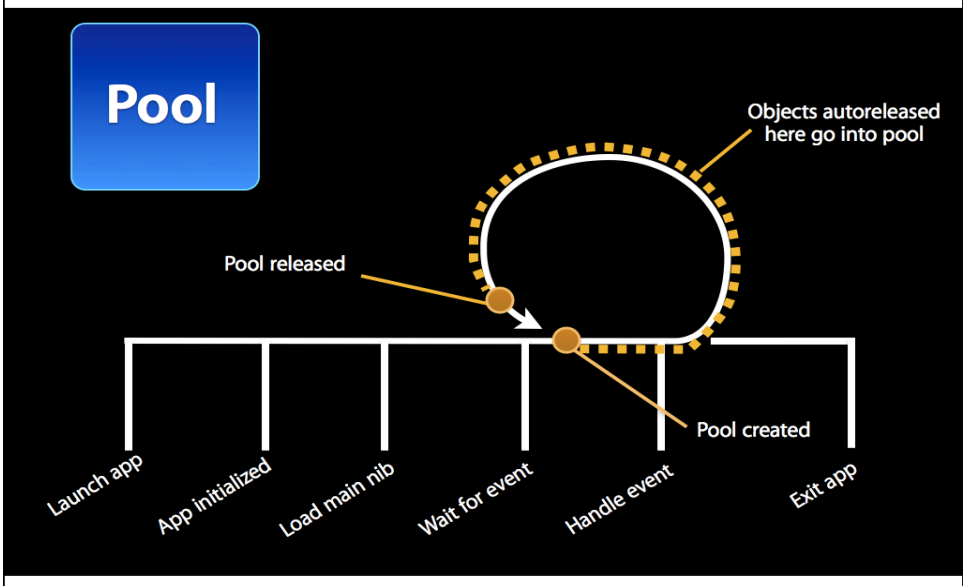


Hanging Onto an Autoreleased Object

- **Many methods return autoreleased objects**
  - Remember the naming conventions...
  - They're hanging out in the pool and will get released later
- **If you need to hold onto those objects you need to retain them**
  - Bumps up the retain count before the release happens

```
name = [NSMutableString string];

// We want to name to remain valid!
[name retain];
// ...
// Eventually, we'll release it (maybe in our -dealloc?)
[name release];
```


Side Note: Garbage Collection

- **Autorelease is not garbage collection**
- **Objective-C on iPhone OS (iOS) does not have garbage collection**

Automatic Reference Counting (ARC)

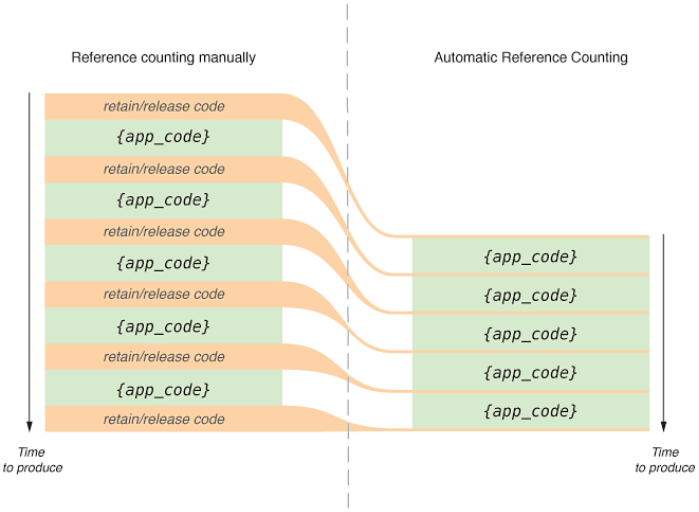
Automatic Reference Counting (ARC)

- **The new and "improved" way to manage memory**
  - All objects are either strong or weak
- **Strong**
  - Keep me around until I no longer need this memory
- **Weak**
  - Keep me around as long as some other object needs this memory

Automatic Reference Counting

- **By default all objects allocated when using ARC are strong**
  - NSNumber *myNumber = [NSNumber alloc] init];
- **Weak references are often used when pointing to objects on a storyboard**
  - UIButton, UILabel, UIImage
    - These objects are already instantiated when the storyboard loads
    - We just want a pointer to them while they are alive

Automatic Retain/Release



Properties

- Provide access to object attributes
- Shortcut to implementing getter/setter methods
- Also allow you to specify:
  - read-only versus read-write access
  - memory management policy

Defining Properties

```
#import<Foundation/Foundation.h>
@interface Person : NSObject
{
// instance variables
   NSString *name;
   int age;
}

// method declarations
-(NSString *)name;
-(void)setName:(NSString *)value;
-(int)age;
-(void)setAge:(int)age;
-(BOOL)canLegallyVote;

-(void)castBallot;
@end
```

Defining Properties

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-(NSString *)name;
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-(int)age;
-(void)setAge:(int)age;
-(BOOL)canLegallyVote;

-(void)castBallot;
@end
```

Defining Properties

```
#import<Foundation/Foundation.h>
@interface Person : NSObject
{
// instance variables
   NSString *name;
   int age;
}

// property declarations
@property int age;
@property (copy) NSString  *name;
@property (readonly) BOOL canLegallyVote;

-(void)castBallot;
@end
```


Synthesizing Properties

```
@implementation Person

-(int)age {
 return age;
 }

-(void)setAge:(int)value {
  age = value;
 }

-(NSString *)name {
  return name;
 }

-(void)setName:(NSString *)value {
   if (value != name) {
      [value release];
      name = [value copy];
   }

- (BOOL)canLegallyVote { …
```

Synthesizing Properties

```
@implementation Person

-(int)age {
  return age;
 }

-(void)setAge:(int)value {
   age = value;
 }

-(NSString *)name {
   return name;
 }

-(void)setName:(NSString *)value {
    if (value != name) {
        [value release];
        name = [value copy];
    }

- (BOOL)canLegallyVote { …
```


Synthesizing Properties

```
@implementation Person

-(int)age {
  return age;
 }

-(void)setAge:(int)value {
   age = value;
 }

-(NSString *)name {
   return name;
 }

-(void)setName:(NSString *)value {
    if (value != name) {
        [value release];
        name = [value copy];
    }

- (BOOL)canLegallyVote { …
```

Synthesizing Properties

```
@implementation Person

@synthesize age;
@synthesize name;
-    (BOOL)canLegallyVote {
   return (age > 17);
}

@end
```


iOS Property Attributes

- **Use strong and weak instead of retain and assign**

```
@property (retain) NSString *name; // retain called
@property (strong) NSString *name;// new way


@property (assign) NSString *name; // pointer assignment
@property (weak) NSString *name; //new way
```

Property Names vs. Instance Variables

- Property name can be different than instance variable

```
@interface Person : NSObject {
  int numberOfYearsOld;
}

@property int age;

@end


@implementation Person

@synthesize age = numberOfYearsOld;

@end
```


Properties

- Mix and match synthesized and implemented properties

```
@implementation Person

@synthesize age;
@synthesize name;

(void)setAge:(int)value {
    age = value;
}
@end
```

- Setter method explicitly implemented
- Getter method still synthesized

Properties In Practice

- **Newer APIs use @property**
- **Older APIs use getter/setter methods**
- **Properties used heavily throughout UIKit APIs**
  - Not so much with Foundation APIs
- **You can use either approach**
  - Properties mean writing less code, but "magic" can sometimes be non-obvious

Further Reading

- **Objective-C 2.0 Programming Language**
  - "Defining a Class"
  - "Declared Properties"
- **Memory Management Programming Guide for Cocoa**

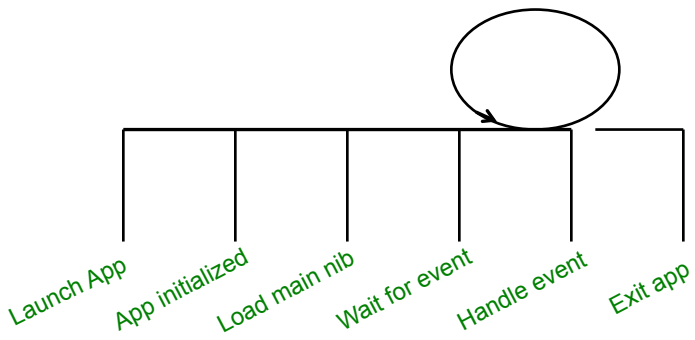
ARC and Properties Demo

Building an Application

Anatomy of an Application

- **Compiled code**
  - Your code
  - Frameworks
- **Nib files**
  - UI elements and other objects
  - Details about object relationships
- **Resources (images, sounds, strings, etc)**
- **Info.plist file (application configuration)**

App Lifecycle



UIKit Framework

- **Provides standard interface elements**
- **UIKit and you**
  - Don't fight the frameworks
  - Understand the designs and how you fit into them

UIKit Framework

- **Starts your application**
- **Every application has a single instance of UIApplication**
  - Singleton design pattern

```
@interface UIApplication
 + (UIApplication *)sharedApplication
@end
```

- **Orchestrates the lifecycle of an application**
- **Dispatches events**
- **Manages status bar, application icon badge**
- **Rarely subclassed**
  - Uses delegation instead

Delegation

- Control passed to delegate objects to perform application-specific behavior
- Avoids need to subclass complex objects
- Many UIKit classes use delegates
  - UIApplication
  - UITableView
  - UITextField

UIApplicationDelegate

- Xcode project templates have one set up by default
- Object you provide that participates in application lifecycle
- Can implement various methods which UIApplication will call
- Examples:

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

-(void)applicationWillResignActive:(UIApplication *)application;
-(BOOL)application:(UIApplication *)application handleOpenURL:(NSURL *)url;

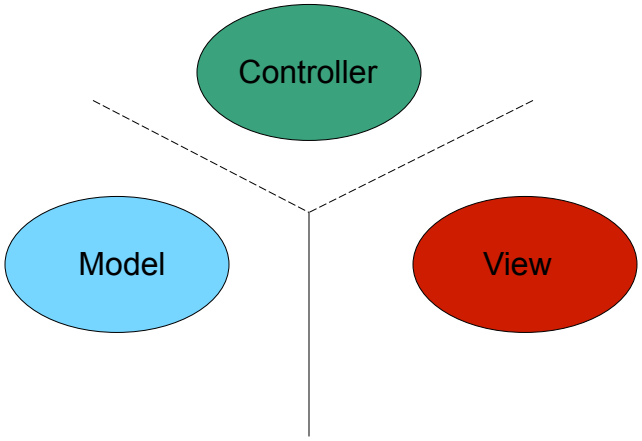
-(void)applicationDidReceiveMemoryWarning:(UIApplication *)application;
```

Info.plist file

- **Property List (often XML), describing your application**
  - Icon appearance
  - Status bar style (default, black, hidden)
  - Orientation
  - Uses Wifi networking
  - System Requirements
- **Can edit most properties in Xcode**
  - Project > Edit Active Target "Foo" menu item
  - On the properties tab

Model, View, Controller

Model, View, Controller



Model

- Manages the app data and state
- Not concerned with UI or presentation
- Often persists somewhere
- Same model should be reusable, unchanged in different interfaces

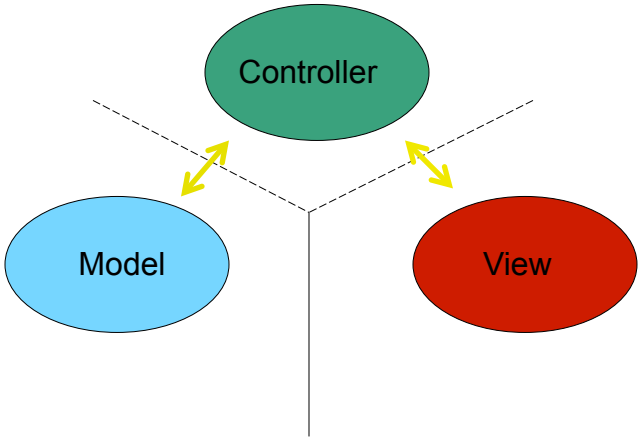
View

- Present the Model to the user in an appropriate interface
- Allows user to manipulate data
- Does not store any data
  - (except to cache state)
- Easily reusable & configurable to display different data

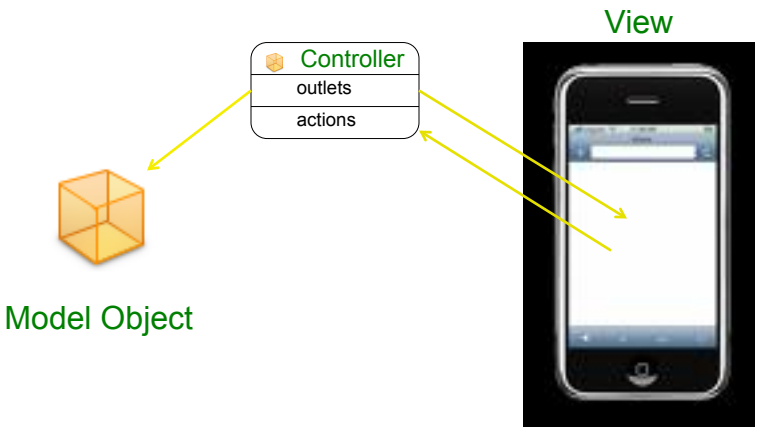
Controller

- Intermediary between Model & View
- Updates the view when the model changes
- Updates the model when the user manipulates the view
- Typically where the app logic lives

Model, View, Controller



Model, View, Controller

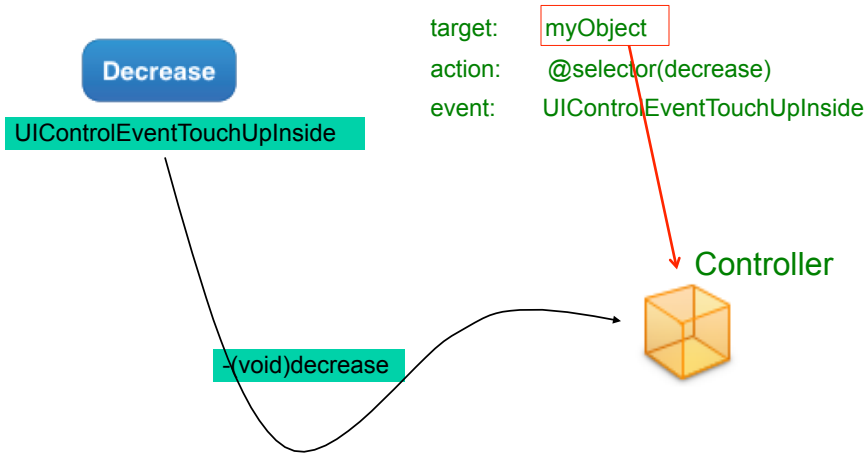


Controls and Target-Action

Controls - Events

- View objects that allows users to initiate some type of action
- Respond to variety of events
  - Touch events
    - touchDown
    - touchDragged (entered, exited, drag inside, drag outside)
    - touchUp (inside, outside)
  - Value changed
  - Editing events
    - editing began
    - editing changed
    - editing ended

Controls - Target/Action



Action Methods

- **3 different flavors of action method selector types**

```
-(void)actionMethod;
-(void)actionMethod:(id)sender;
-(void)actionMethod:(id)sender withEvent:(UIEvent *)event;
```

- **UIEvent contains details about the event that took place**

Action Method Variations

- **Simple no-argument method**

```
-(void)increase {
  // bump the number of sides of the polygon up
     polygon.numberOfSides += 1;
  }
```

- **Single argument method - control is 'sender'**

```
// for example, if control is a slider...
-(void)adjustNumberOfSides:(id)sender {
   polygon.numberOfSides = [sender value];
 }
```


Action Method Variations

- **Two-arguments in method (sender & event)**

```
-(void)adjustNumberOfSides:(id)sender
  withEvent:(UIEvent *)event{
  // could inspect event object if you  needed to
}
```

Manual Target-Action

- Same information IB would use
- API and UIControlEvents found in UIControl.h
- UIControlEvents is a bitmask

```
@interface UIControl
-(void)addTarget:(id)target action:(SEL)action forControlEvents:
    (UIControlEvents)controlEvents;

-(void)removeTarget:(id)target action:(SEL)action forControlEvents:
    (UIControlEvents)controlEvents;@end
```


Multiple target-actions

- Controls can trigger multiple actions on different targets in response to the same event
- Different than Cocoa on the desktop where only one target-action is supported
- Different events can be setup in IB

Questions?

Debugging Intro

iPhone University Program

How do I run my apps on my phone?

Outline of Steps Required

- **Create an Apple ID**
  - Most of you have done this already
  - Necessary to download SDK
- **Enroll in the iPhone University Program**
- **Generate a Certificate Signing Request (CSR)**
- **Send me your iPhone or iPod Touch UDID**
- **Download a provisioning profile**

iPhone University Program

- **Three levels of membership**
  - Team Agent
  - Team Admin
  - Team Members
- **All members have the ability to run apps on iPhones**
- **Team Agent and Team Admin have very similar roles**
  - Add new members and admins
  - Add devices to the group
  - Approve CSRs
  - Create provisioning profiles
- **Team Members**
  - Download provisioning profiles
  - Submit CSR
- **I am one of twoTeam Admins for WashU**
- **Rick Tyler is the WashU Team Agent**

Digital Certificate

- **All iPhone applications must be signed by a valid certificate before they can run on an Apple device**
- **In order to sign applications for testing, Team Members need an iPhone Development Certificate**
- **This is accomplished through a digital identity**
  - Consists of a secret "private key" and a shared "public key"
  - The private key allows Xcode to sign your iPhone OS application binary
- **The digital certificate associates your digital identity with other information**
  - name, email address, business..
- **The iPhone development certificate is restricted to application development only and valid for a limited time**

Requesting a Development Certificate

- **Generate a Certificate Signing Request (CSR)**
  - Use Keychain Access in Max OS X Leopard
  - http://developer.apple.com/iphone/download.action?path=/iphone/iphone_developer_program_at_a_glance/at_a_glance_v1.pdf
- **Upload the CSR to the iPhone University Website Portal**
- **I will then approve the certificate request and your will receive a confirmation email**

iPhone UDID

- **I also need your iPhone or iPod Touch devices Unique Device Identifier (UDID)**
  - 40 character string tied to a single device.
- **Locate the UDID in Xcode**
  - Windows -> Organizer
  - email me this ID and I will add your device