Migrating to Modern Objective-C

Session 413

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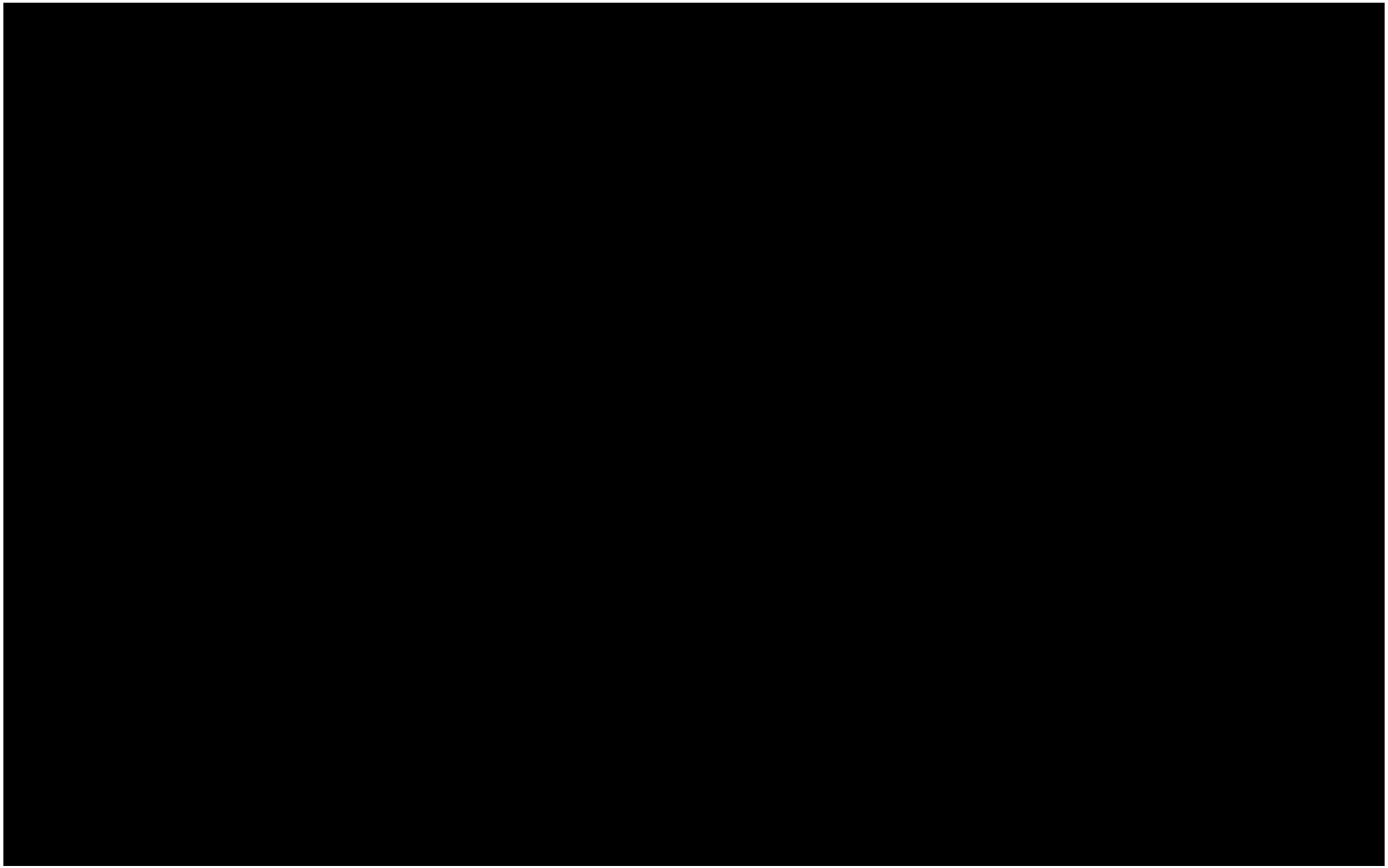
Developer Publications

Rip van NSWinkle

Asleep since 2005



Where did all the money go?

Perhaps I should have used
that maid service.

What are all those little black
things everyone's tapping on?

Where can I get a haircut?

Where did all the money go?

Perhaps I should have used
Interface Builder.

What happened to Objective-C?

What are all those little black
things everyone's tapping on?

Where can I get a haircut?

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Where can I get a haircut?

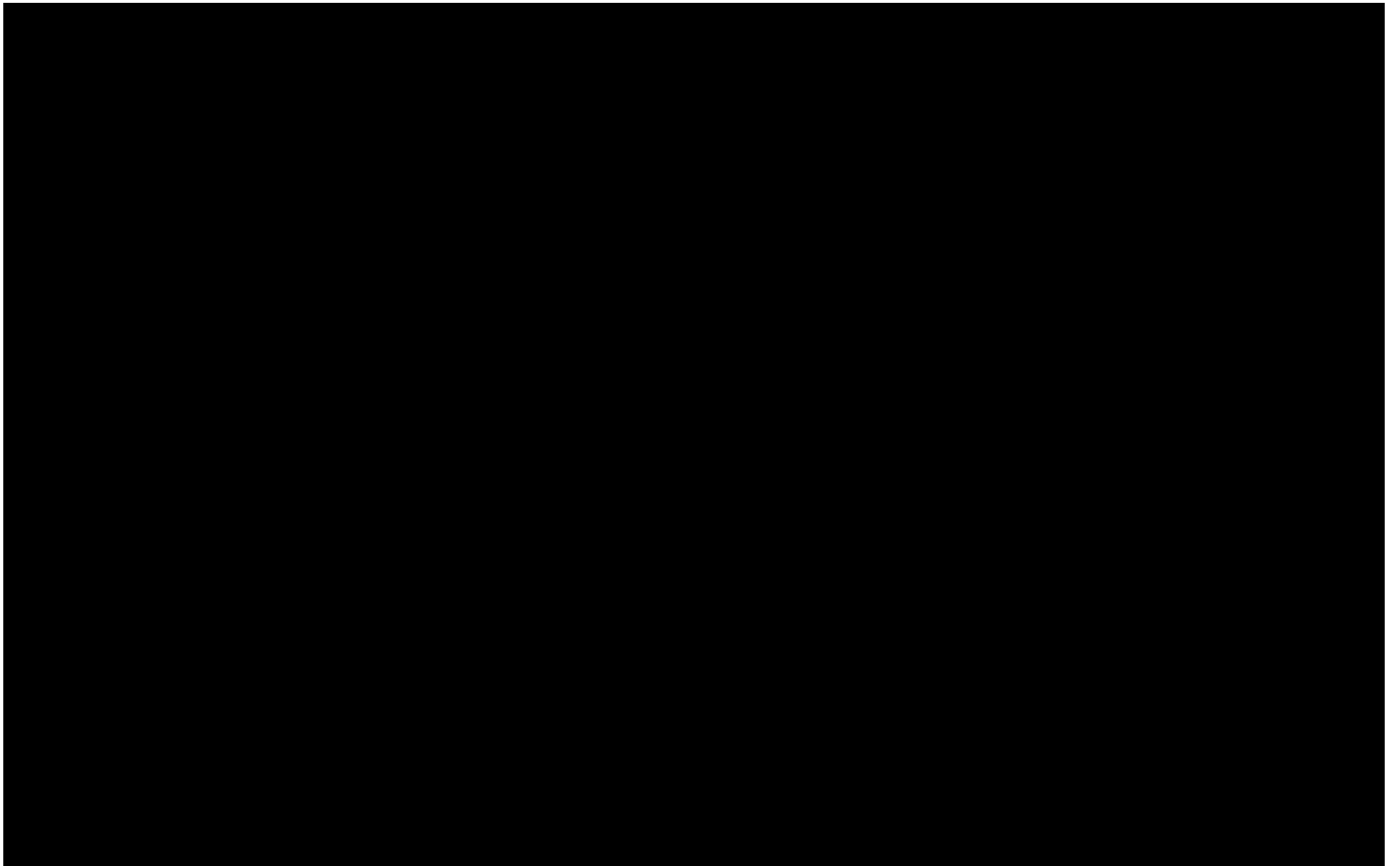
How do I use it?

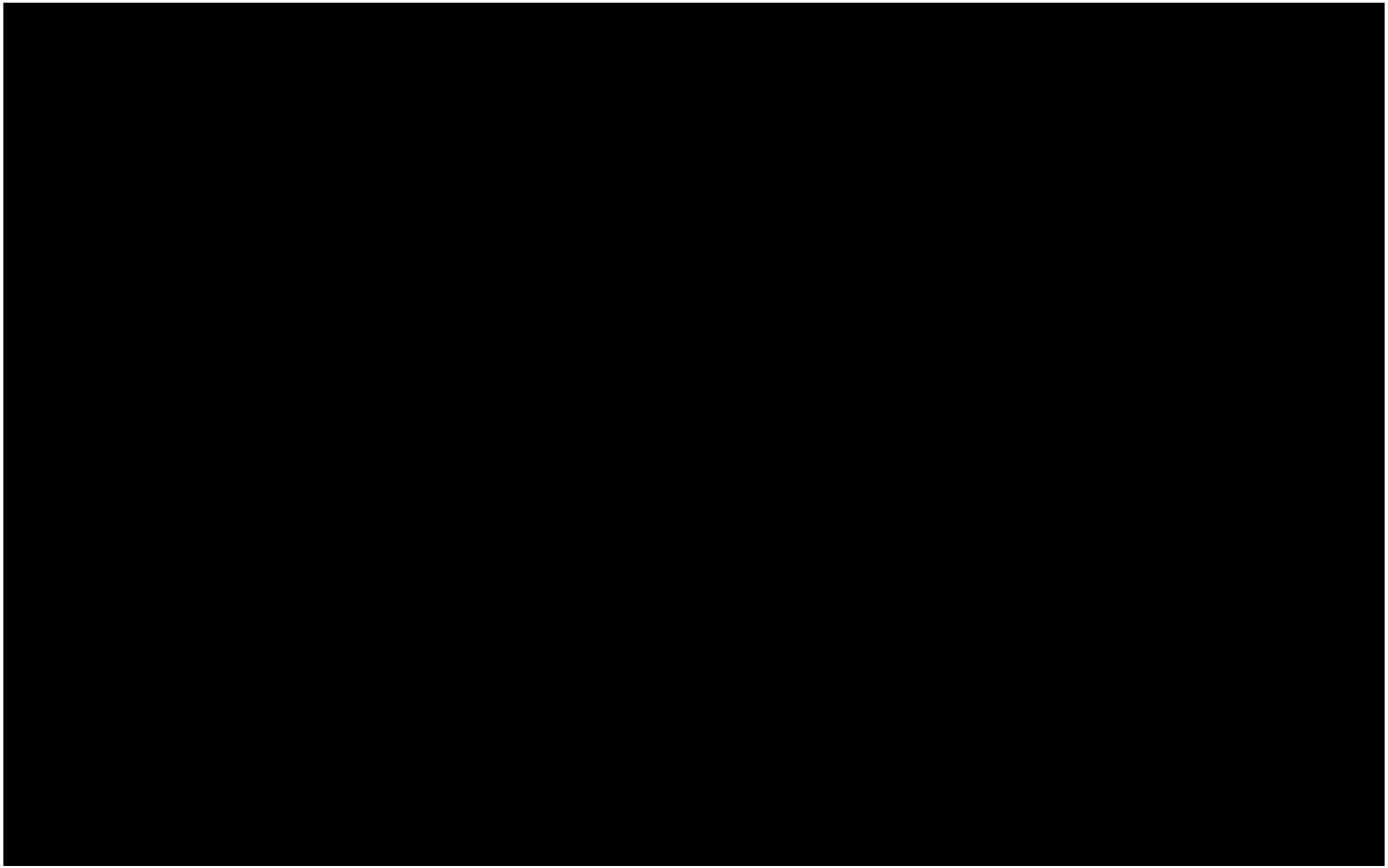
Agenda

- Philosophy
- Headers
- Enums
- Accessor methods
- Memory management
- Properties
- Initializers and dealloc
- Protocols
- Collections and literals
- Blocks

Objective-C Has Evolved

- Historically: Objective-C was a thin layer atop C
- Today: Objective-C is still atop C
  - But it's not such a thin layer

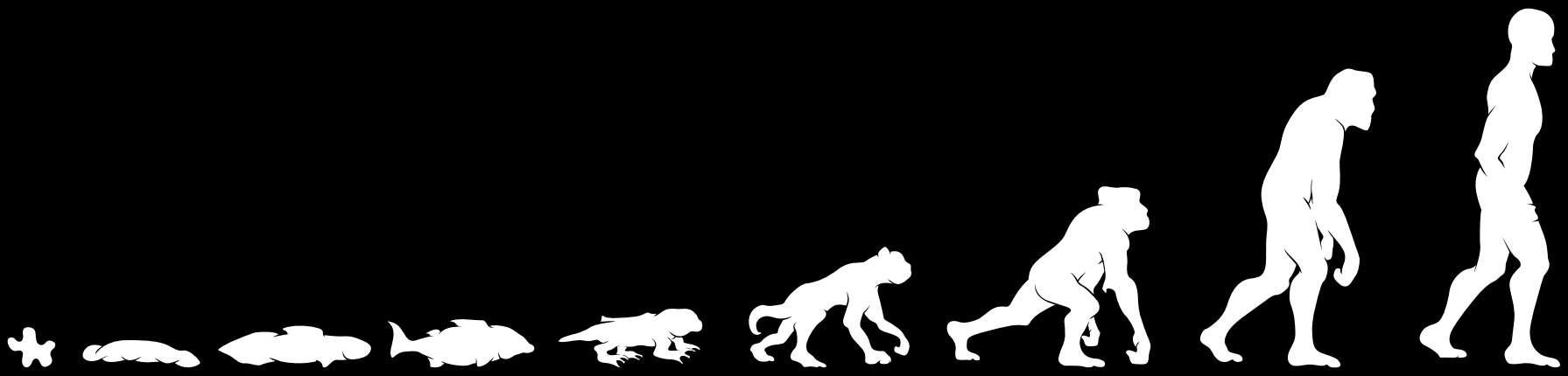




Evolution of Objective-C

Simpler, safer through automation

- Object Oriented C
- Retain counting
- Properties
- Blocks
- ARC



New (and Better) Practices

- With new language features have come new patterns
  - Conventions have evolved
  - Important—Cocoa has strong conventions
- New features make code more compact, expressive, correct, efficient
  - Remove unnecessary boilerplate
  - Clarify API contracts
  - Separate private from public
  - Build conventions into the language
    - So you don't have to think about them

“Civilization advances by extending the number of important operations which we can perform without thinking about them.”

Alfred North Whitehead, 1861-1947

Importing Headers

```
#import <Foundation/NSObject.h>
#import <Foundation/NSString.h>
//or @class NSString;
```

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

Enums with Fixed Underlying Type

```
enum {
  NSOperationQueuePriorityVeryLow = -8,
  NSOperationQueuePriorityLow = -4,
  NSOperationQueuePriorityNormal = 0,
  NSOperationQueuePriorityHigh = 4,
  NSOperationQueuePriorityVeryHigh = 8
};
```

```
enum {
   NSOperationQueuePriorityVeryLow = -8,
   NSOperationQueuePriorityLow = -4,
   NSOperationQueuePriorityNormal = 0,
   NSOperationQueuePriorityHigh = 4,
   NSOperationQueuePriorityVeryHigh = 8
};

typedef NSInteger NSOperationQueuePriority;
```

```
typedef enum : NSInteger {
  NSOperationQueuePriorityVeryLow = -8,
  NSOperationQueuePriorityLow = -4,
  NSOperationQueuePriorityNormal = 0,
  NSOperationQueuePriorityHigh = 4,
  NSOperationQueuePriorityVeryHigh = 8
} NSOperationQueuePriority;
```

Accessor Methods

```
- (void)myMethod {
    // ...
    [title release];
    title = [NSString stringWithFormat:@"Area: %1.2f", [self area]];
    [title retain];
    // ...
}
```

```
- (void)myMethod {
    // ...

    [self setTitle:[NSString stringWithFormat:@"Area: %1.2f", [self area]]];

    // ...
}
```

```
- (void)myMethod {
    // ...

    self.title = [NSString stringWithFormat:@"Area: %1.2f", self.area];

    // ...
}
```

Always use accessor methods

Always use accessor methods

Except in initializer methods and dealloc

Memory Management

```objc
NSMutableArray *array = [[NSMutableArray alloc] init];

// Use the array

[array release];
```

```objc
NSMutableArray *array = [[[NSMutableArray alloc] init] autoelease];

// Use the array
```

```objc
NSMutableArray *array = [NSMutableArray array];

// Use the array
```

```
id heisenObject = [array objectAtIndex:n];
[array removeObjectAtIndex:n];
// ...
[heisenObject doSomething];
// ...
```

```
id heisenObject = [[array objectAtIndex:n] retain];
[array removeObjectAtIndex:n];
// ...
[heisenObject doSomething];
[heisenObject release];
// ...
```

```objc
// Person.m

- (void)takeLastNameFrom:(Person *)person
{
    NSString *oldLastname = [self lastName];
    [self setLastName:[person lastName]];
    NSLog(@"Lastname changed from %@ to %@", oldLastname, [self lastName]);
}
```

```
// Person.m

- (void)takeLastNameFrom:(Person *)person
{
    NSString *oldLastname = [[self lastName] retain];
    [self setLastName:[person lastName]];
    NSLog(@"Lastname changed from %@ to %@", oldLastname, [self lastName]);
    [oldLastName release];
}
```

Use ARC

Adopting Automatic Reference Counting	Marina Wednesday 11:30AM
Adopting Automatic Reference Counting (Repeat)	Nob Hill Friday 11:30AM

```
NSMutableArray *array = [[NSMutableArray alloc] init];

// Use the array
```

```
id heisenObject = [array objectAtIndex:n];
[array removeObjectAtIndex:n];
// ...
[heisenObject doSomething];
// ...
```

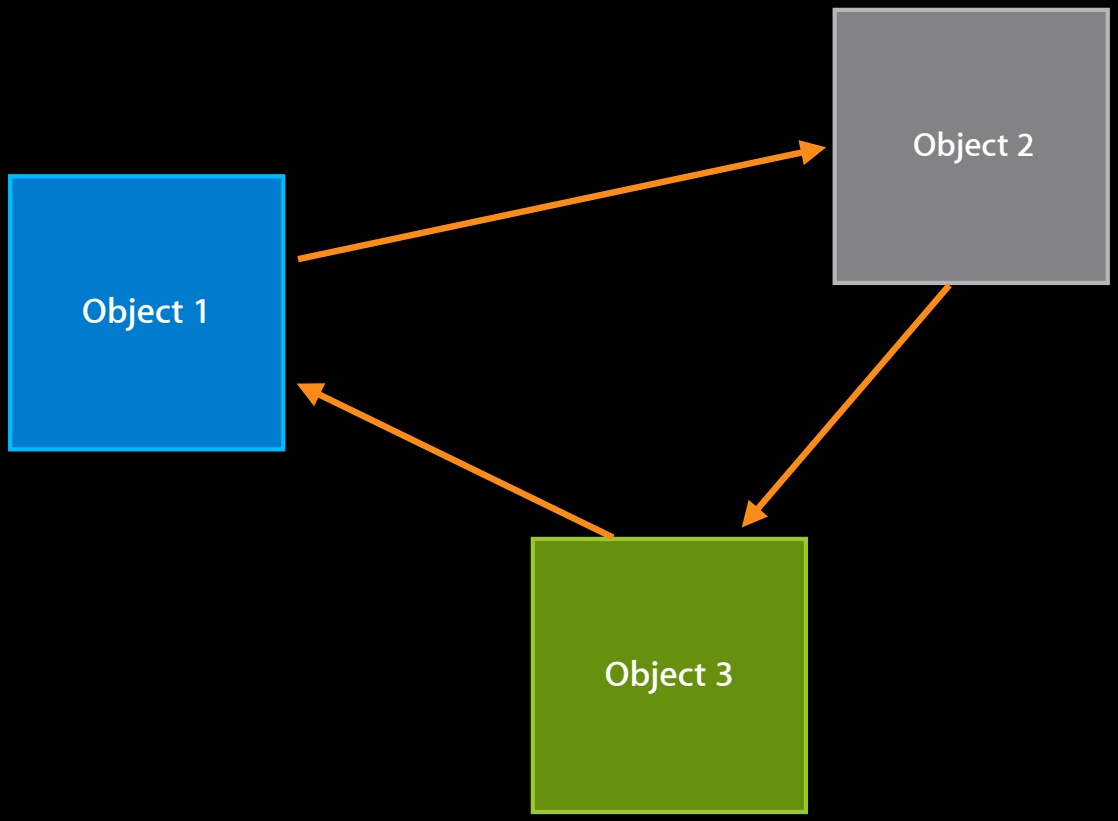
```
// Person.m

- (void)takeLastNameFrom:(Person *)person
{
    NSString *oldLastname = [self lastName];
    [self setLastName:[person lastName]];
    NSLog(@"Lastname changed from %@ to %@", oldLastname, [self lastName]);
}
```

```
CFUUIDRef cfUUID = CFUUIDCreate(NULL);
NSString *noteUUID = (NSString *)
                      CFUUIDCreateString(NULL, cfUUID);
CFRelease(cfUUID);
```

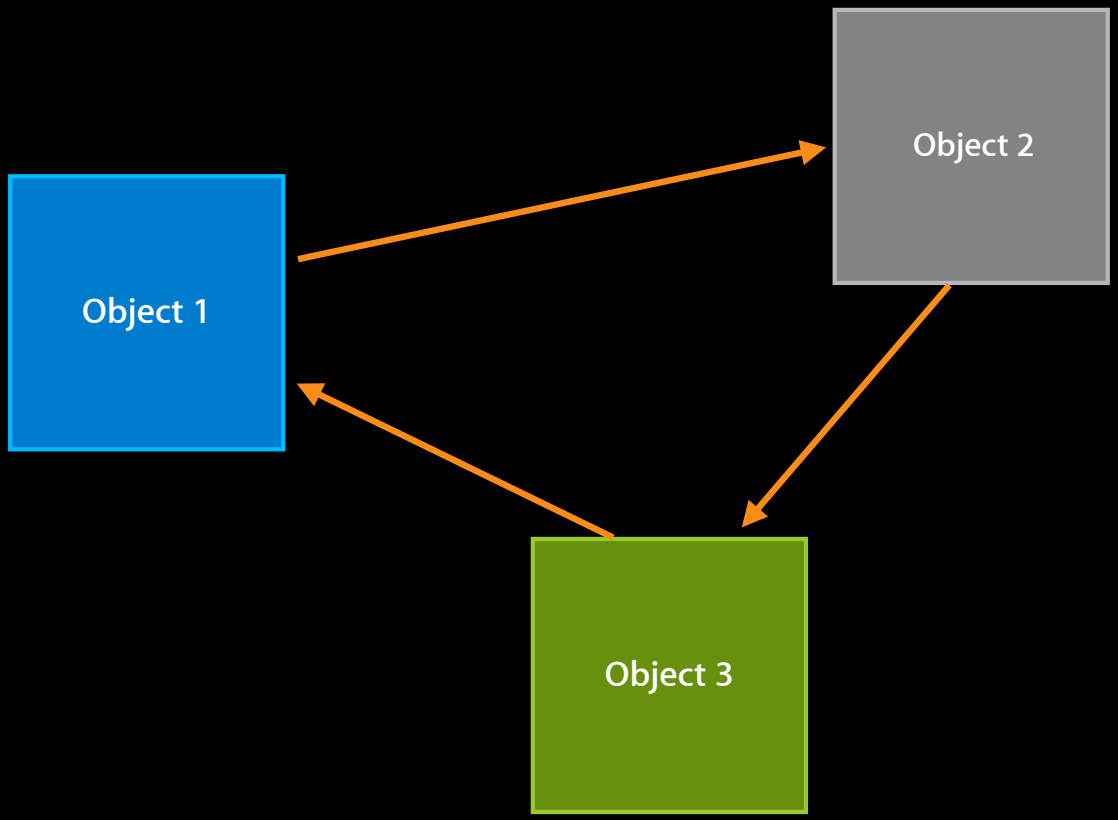
```
CFUUIDRef cfUUID = CFUUIDCreate(NULL);
NSString *noteUUID = (__bridge_transfer NSString *)
                      CFUUIDCreateString(NULL, cfUUID);
CFRelease(cfUUID);
```

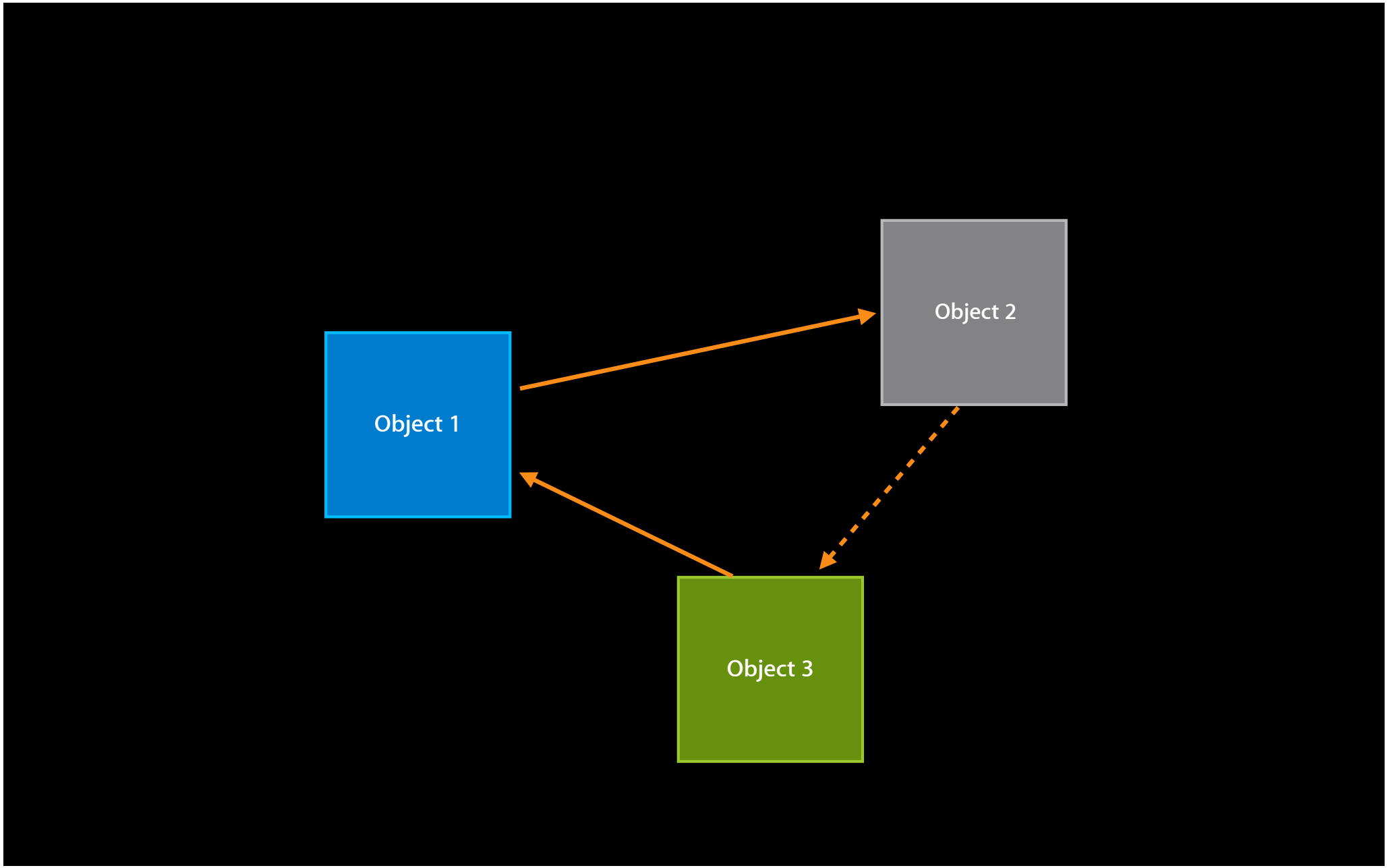
```
NSString *noteUUID = [[[NSUUID alloc] init] UUIDString];
```

Retain Cycle



Strong Reference Cycle




Object 1
Object 2
Object 3

Properties

The Old

```
@interface Thing : NSObject {
    NSString *title;
    float radius;
    id delegate;
}
- (float)area;
- (NSString *)title;
- (void)setTitle:(NSString *)newTitle;
- (float)radius;
- (void)setRadius:(float)newValue;
- (id)delegate;
- (void)setDelegate:(id)newDelegate;
@end
```

```
@implementation Thing
- (float)area {
    return M_PI * pow(radius, 2.0);
}
- (NSString *)title {
    return title;
}
- (void)setTitle:(NSString *)newTitle {
    if (title != newTitle) {
        [title release];
        title = [newTitle copy];
    }
}
// ....
```

The New

```
@interface Thing : NSObject
@property (copy) NSString *title;
@property float radius;
@property (weak) id delegate;
@property(readonly, nonatomic) float area;
@end
```

```
@implementation Thing
- (float)area {
    return M_PI * pow(self.radius, 2.0);
}
@end
```

```
@interface Thing : NSObject
{
   NSString *title;
   float radius;
   id delegate;
}
```

```
@interface Thing : NSObject
{
    NSString *title;
    float radius;
    id delegate;
}
```

```
@implementation Thing
{
    NSString *title;
    float radius;
    id delegate;
}
```

```
@interface Thing : NSObject
```

```
- (NSString *)title;
- (void)setTitle:(NSString *)newTitle;

- (float)radius;
- (void)setRadius:(float)newValue;
- (float)area;

- (id)delegate;
- (void)setDelegate:(id)newDelegate;
```

```
- (NSString *)title;
- (void)setTitle:(NSString *)newTitle;

- (float)radius;
- (void)setRadius:(float)newValue;
- (float)area;

- (id)delegate;
- (void)setDelegate:(id)newDelegate;
```

```
- (NSString *)title;
- (void)setTitle:(NSString *)newTitle;
```

```
@property NSString *title;
```

```
@property (copy) NSString *title;
```

```
@property NSString *title;


- (float)radius;
- (void)setRadius:(float)newValue;
- (float)area;

- (id)delegate;
- (void)setDelegate:(id)newDelegate;
```

```
@property NSString *title;


- (float)radius;
- (void)setRadius:(float)newValue;
- (float)area;

- (id)delegate;
- (void)setDelegate:(id)newDelegate;
```

```
- (float)radius;
- (void)setRadius:(float)newValue;
- (float)area;
```

```
@property float radius;

- (float)area;
```

```
@property float radius;

@property (readonly) float area;
```

```
@property float radius;

@property (readonly, nonatomic) float area;
```

```
@property NSString *title;
@property float radius;
@property (readonly, nonatomic) float area;



- (id)delegate;
- (void)setDelegate:(id)newDelegate;
```

```
@property NSString *title;
@property float radius;
@property (readonly, nonatomic) float area;
```

```
- (id)delegate;
- (void)setDelegate:(id)newDelegate;
```

```
- (id)delegate;
- (void)setDelegate:(id)newDelegate;
```

```
@property (weak) id delegate;
```

```
@interface Thing : NSObject {
    NSString *title;
    float radius;
    id delegate;
}
- (float)area;
- (NSString *)title;
- (void)setTitle:(NSString *)newTitle;
- (float)radius;
- (void)setRadius:(float)newValue;
- (id)delegate;
- (void)setDelegate:(id)newDelegate;
@end
```

```
@implementation Thing
- (float)area {
    return M_PI * pow(self.radius, 2.0);
}
- (NSString *)title {
    return title;
}
- (void)setTitle:(NSString *)newTitle {
    if (title != newTitle) {
        [title release];
        title = [newTitle copy];
    }
}
// ....
```

```objc
@interface Thing : NSObject {
    NSString *title;
    float radius;
    id delegate;
}
- (float)area;
- (NSString *)title;
- (void)setTitle:(NSString *)newTitle;
- (float)radius;
- (void)setRadius:(float)newValue;
- (id)delegate;
- (void)setDelegate:(id)newDelegate;
@end
```

```objc
@implementation Thing
- (float)area {
    return M_PI * pow(self.radius, 2.0);
}
- (NSString *)title {
    return title;
}
- (void)setTitle:(NSString *)newTitle {
    if (title != newTitle) {
        [title release];
        title = [newTitle copy];
    }
}
// ....
```

```
- (NSString *)title {
    return title;
}
- (void)setTitle:(NSString *)newTitle
{
    if (title != newTitle) {
        [title release];
        title = [newTitle copy];
    }
}
// ....
```

```
@synthesize title;
```

```
@synthesize title = _title;
```

```
@synthesize title = _title;
```

Autosynthesis

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Private State

```
@interface Thing
{
   BOOL privateTest;
}

// ...
```

```
@interface Thing

@property BOOL privateTest;


// ...
```

```
@implementation Thing
{
   BOOL _privateTest;
}
// ...
```

```
@interface Thing ()

@property BOOL privateTest;

@end
// ...
```

```
@interface Thing (PrivateMethods)
- (void)doSomethingPrivate;
- (void)doSomethingElsePrivate;
@end
```

```
@interface Thing ()
- (void)doSomethingPrivate;
- (void)doSomethingElsePrivate;
@end
```

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Outlets

```
@interface MyViewController : MySuperclass {

    IBOutlet ElementClass *uiElement;
}

@end
```

```
@interface MyViewController : MySuperclass

@property (weak) IBOutlet ElementClass *uiElement;

@end
```

```
@interface MyViewController ()

@property (weak) IBOutlet ElementClass *uiElement;

@end
```

Initializer Methods and dealloc

```
- (id)init
{
    if (self = [super init]) {
        [self setTitle:@"default"];
    }
    return self;
}
```

```
- (id)init
{
    if ((self = [super init])) {
        [self setTitle:@"default"];
    }
    return self;
}
```

```objc
- (id)init
{
    self = [super init];
    if (self) {
        _title = @"default";
    }
    return self;
}
```

```
- (void)dealloc
{
    [self setTitle:nil];
    [super dealloc];
}
```

```
- (void)dealloc
{
    [_title release];
    [super dealloc];
}
```

[This slide intentionally left blank]

Protocols

Formalize communication channels

```
@ButlerProtocol

- (void)makeTea;
- (void)serveSandwiches;
- (void)mowTheLawn;

@end
```

```
@ButlerProtocol

- (void)makeTea;
- (void)serveSandwiches;
- (void)mowTheLawn;

@end




- (id <ButlerProtocol>)butler;
```

```
@interface NSObject (ButlerProtocol)

- (void)makeTea;
- (void)serveSandwiches;
- (void)mowTheLawn;

@end




- (id)butler;
```

```
@protocol ButlerProtocol <NSObject>

- (void)makeTea;
- (void)serveSandwiches;
@optional
- (void)mowTheLawn;

@end



@property id <ButlerProtocol> butler;
```

Collections and Literals

```
NSNumber *aNumber = [NSNumber numberWithFloat:2.3];

NSNumber *anotherNumber = [NSNumber numberWithFloat:x];

NSArray *anArray = [NSArray arrayWithObjects:aThing, @"A String",
                    [NSNumber numberWithFloat:3.14], nil];

NSDictionary *aDictionary = [NSDictionary dictionaryWithObjectsAndKeys:
                                value, @"Key",
                                [NSNumber numberWithBOOL:YES], @"OtherKey",
                                nil];
```

```
NSNumber *aNumber = @2.3f;

NSNumber *anotherNumber = @(x);

NSArray *anArray = @[ aThing, @"A String", @3.14 ];


NSDictionary *aDictionary = @{ @"Key" : value, @"OtherKey" : @YES };
```

```
NSDictionary *distanceDict = [NSDictionary dictionaryWithObjectsAndKeys:
            [NSNumber numberWithDouble:  0.0], kCIAttributeMin,
            [NSNumber numberWithDouble:  1.0], kCIAttributeMax,
            [NSNumber numberWithDouble:  0.0], kCIAttributeSliderMin,
            [NSNumber numberWithDouble:  0.7], kCIAttributeSliderMax,
            [NSNumber numberWithDouble:  0.2], kCIAttributeDefault,
            [NSNumber numberWithDouble:  0.0], kCIAttributeIdentity,
            kCIAttributeTypeScalar,            kCIAttributeType,
            nil];

NSDictionary *slopeDict = [NSDictionary dictionaryWithObjectsAndKeys:
            [NSNumber numberWithDouble: -0.01], kCIAttributeSliderMin,
            [NSNumber numberWithDouble:  0.01], kCIAttributeSliderMax,
            [NSNumber numberWithDouble:  0.00], kCIAttributeDefault,
            [NSNumber numberWithDouble:  0.00], kCIAttributeIdentity,
            kCIAttributeTypeScalar,            kCIAttributeType,
            nil];
```

```
NSDictionary *distanceDict = @{
        kCIAttributeMin       : @0.0,
        kCIAttributeMax       : @1.0,
        kCIAttributeSliderMin : @0.0,
        kCIAttributeSliderMax : @0.7,
        kCIAttributeDefault   : @0.2,
        kCIAttributeIdentity  : @0.0,
        kCIAttributeType      : kCIAttributeTypeScalar };


NSDictionary *slopeDict = @{
        kCIAttributeSliderMin : @-0.01,
        kCIAttributeSliderMax : @0.01,
        kCIAttributeDefault   : @0.00,
        kCIAttributeIdentity  : @0.00,
        kCIAttributeType      : kCIAttributeTypeScalar };
```

```
id firstElement = [anArray objectAtIndex:0];

[anArray replaceObjectAtIndex:0 withObject:newValue];
```

```
id firstElement = anArray[0];

anArray[0] = newValue;
```

```
id value = [aDictionary objectForKey:@"key"];

[aDictionary setObject:newValue forKey:@"key"];
```

```
id value = aDictionary[@"key"];

aDictionary[@"key"] = newValue;
```

```
NSArray *array = …;
int i;

for (i = 0; i < [array count]; i++) {

    id element = [array objectAtIndex:i];
    // …

}
```

```
NSArray *array = …;
int i;

for (i = 0; i < [array count]; i++) {

    id element = [array objectAtIndex:i];
    // …

}
```

```
NSArray *array = …;
int i;

for (i = 0; i < [array count]; i++) {

    id element = [array objectAtIndex:i];
    // …

}
```

```
NSArray *array = …;

for (id element in array) {

     // …

}
```

Blocks

```
NSArray *array = ...;
NSArray *sortedArray;
sortedArray = [array sortedArrayUsingFunction:MySort context:NULL];
```

```
NSInteger MySort(id num1, id num2, void *context)
{
    NSComparisonResult result;
    // Do comparison
    return result;
}
```

```
NSArray *array = ...;
BOOL reverse = ...;
NSArray *sortedArray;
sortedArray = [array sortedArrayUsingComparator:^(id num1, id num2) {
    NSComparisonResult result;
    // Do comparison
    return result;
}];
```

```
NSArray *array = …;

for (id element in array) {

     // …

}
```

```
NSArray *array = …;

[array enumerateObjectsUsingBlock:
      ^(id obj, NSUInteger idx, BOOL *stop) {
       // ...
       NSLog(@"Processing %@ at index %d”, obj, idx);
       // ...
}];
```

```objc
NSDictionary *dictionary = …;

for (NSString *key in dictionary) {

    id object = [dictionary objectForKey:key];

    // Do things with key and object.

}
```

```objc
NSDictionary *dictionary = …;

[dictionary enumerateKeysAndObjectsUsingBlock:^(id key, id object, BOOL *stop) {

    // Do things with key and object.

}];
```

```
- (void)registerForNotifications
{
    NSNotificationCenter *center = ...

    [center addObserver:self
        selector:@selector(windowBecameKey:)
        name:NSWindowDidBecomeKeyNotification
        object:self.window];
}

// Different context
// No queue information
- (void)windowBecameKey:(NSNotification *)notification
{
    // Get contextual information.
}
```

```
- (void)registerForNotifications
{
    NSNotificationCenter *center = ...

    [center addObserverForName:NSWindowDidBecomeKeyNotification
        object:self.window
        queue:[NSOperationQueue mainQueue]
        usingBlock:^(NSNotification *){
            // ...
            // Contextual information is already here
            // ...
    }];
}
```

```
- (void)registerForNotifications
{
    NSNotificationCenter *center = ...

    [center addObserverForName:NSWindowDidBecomeKeyNotification
        object:self.window
        queue:[NSOperationQueue mainQueue]
        usingBlock:^(NSNotification *) {
            // ...
            // Contextual information is already here
            // ...
    }];
}
```

```
- (void)registerForNotifications
{
    NSNotificationCenter *center = ...

    MyClass *__weak weakSelf = self;
    [center addObserverForName:NSWindowDidBecomeKeyNotification
        object:self.window
        queue:[NSOperationQueue mainQueue]
        usingBlock:^(NSNotification *) {
            // ...
            [weakSelf doSomething];
            // ...
    }];
}
```

Wrap Up

More Information

Michael Jurewitz
Developer Tools and Performance Evangelist
jury@apple.com

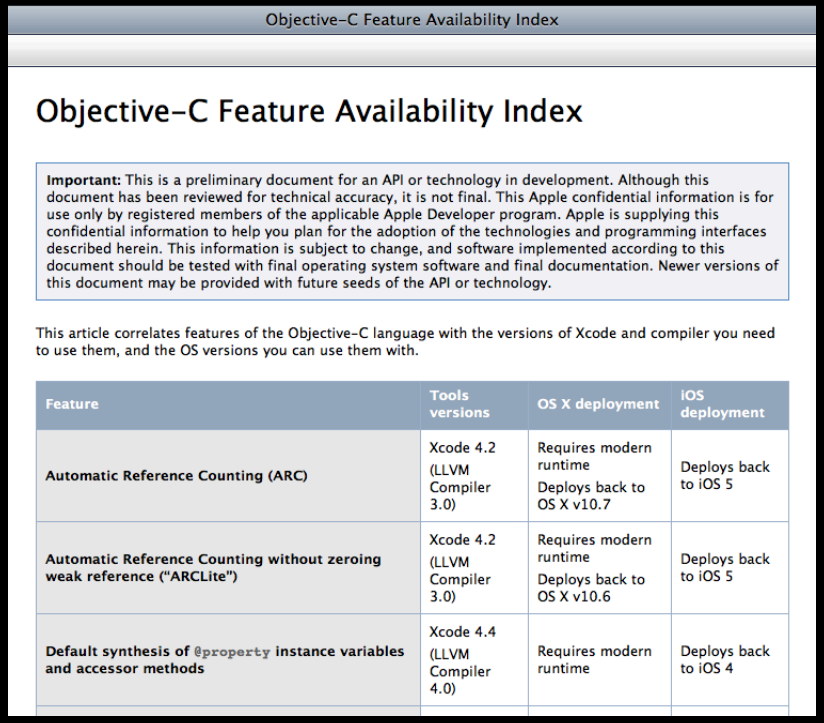
Apple Developer Forums
http://devforums.apple.com

Related Sessions

Modern Objective-C	Presidio Wednesday 10:15AM
Adopting Automatic Reference Counting	Marina Wednesday 11:30AM
Adopting Automatic Reference Counting (Repeat)	Nob Hill Friday 11:30AM

Documentation

- New document describes what features became available with which tools



Objective-C Feature Availability Index

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This article correlates features of the Objective-C language with the versions of Xcode and compiler you need to use them, and the OS versions you can use them with.

Feature	Tools versions	OS X deployment	iOS deployment
Automatic Reference Counting (ARC)	Xcode 4.2 (LLVM Compiler 3.0)	Requires modern runtime Deploys back to OS X v10.7	Deploys back to iOS 5
Automatic Reference Counting without zeroing weak reference ("ARCLite")	Xcode 4.2 (LLVM Compiler 3.0)	Requires modern runtime Deploys back to OS X v10.6	Deploys back to iOS 5
Default synthesis of `@property` instance variables and accessor methods	Xcode 4.4 (LLVM Compiler 4.0)	Requires modern runtime	Deploys back to iOS 4

Summary

- New features make code more compact, expressive, correct, efficient
- Adopt them


WWDC2012