Objective-C for Java Developers

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Objective-C Overview

Objective-C

The old new hotness

- Strict superset of ANSI C
  - Object-oriented extensions
  - Additional syntax and types
- Native Mac & iOS development language
- Flexible typing
- Simple, expressive syntax
- Dynamic runtime

Why Use Objective-C?

No Java love from Apple?

- Key to developing for Mac & iOS platforms
- Performance
  - Continually optimized runtime environment
    - Can optimize down to C as needed
  - Memory Management
- Dynamic languages provide greater flexibility
  - Cocoa APIs rely heavily on these features

Java Developer’s Concerns

Ugh, didn’t Java solve all of this stuff

- Pointers
- Memory Management
- Preprocessing & Linking
- No Namespaces
    - Prefixes used to avoid collisions
    - Common Prefixes: NS, UI, CA, MK, etc.

Creating Classes

Classes

- Classes define the blueprint for objects.
- Objective-C class definitions are separated into an *interface* and an *implementation.*
  - Usually defined in separate .h and .m files

.h

- Defines the programming interface
- Defines the object's instance variable

.m

- Defines the actual implementation code
- Defines one or more initializers to properly initialize and object instance

Defining the class *interface*

```
@interface BankAccount : NSObject {
  float accountBalance;
  NSString *accountNumber;
}

- (float)withDraw:(float)amount;
- (void)deposit:(float)amount;

@end
```

Defining the class *interface*

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Defining the class *implementation*

```
#import "BankAccount.h"

@implementation BankAccount

- (id)init {
  self = [super init];
  return self;
}

- (float)withdraw:(float)amount {
  // calculate valid withdrawal
  return amount;
}

- (void)deposit:(float)amount {
    // record transaction
}
@end
```

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Working with Objects

Creating Objects

From blueprint to reality

- No concept of constructors in Objective-C
- Regular methods create new instances
  - Allocation and initialization are performed separately
    - Provides flexibility in *where* an object is allocated
    - Provides flexibility in how an object is initialized

Java

```
BankAccount account = new BankAccount();
```

Objective C

```
BankAccount *account = [[BankAccount alloc] init];
```

Creating Objects

- NSObject defines class method called `alloc`
  - Dynamically allocates memory for object
  - Returns new instance of receiving class

  ```
  BankAccount *account = [BankAccount alloc];
  ```
- NSObject defines instance method `init`
  - Implemented by subclasses to initialize instance after memory for it has been allocated
  - Subclasses commonly define several initializers

  ```
  account = [account init];
  ```
- `alloc` and `init` calls are almost always nested into single line

  ```
  BankAccount *account = [[BankAccount alloc] init];
  ```

Methods

- Classes can define both class and instance methods
- Methods are always public.
  - “Private” methods defined in implementation
- Class methods (prefixed with +):
  - Define behaviors associated with class, not particular instance
  - No access to instance variables
- Instance methods (prefixed with -)
  - Define behaviors specific to particular instance
  - Manage object state
- Methods invoked by passing *messages*...

Messages

Speaking to objects

- Methods are invoked by passing *messages*
  - Done indirectly. We never directly invoke methods
  - Messages dynamically bound to method implementations at runtime
  - Dispatching handled by runtime environment
- Simple messages take the form:

  ```
  [object message];
  ```

- Can pass one or more arguments:

  ```
  [object messageWithArg1:arg1 arg2:arg2];
  ```

self and super

- Methods have implicit reference to owning object called `self` (similar to Java's `this`)
- Additionally have access to superclass methods using `super`

```
-(id)init {
    if (self = [super init]) {
        // do initialization
    }
    return self;
}
```

Invoking methods in Java

```java
Map person = new HashMap();

person.put("name", "Joe Smith");

String address = "123 Street";
String house = address.substring(0, 3);
person.put("houseNumber", house);

List children = Arrays.asList("Sue", "Tom");
person.put("children", children);
```

Invoking methods in Objective-C

```
NSMutableDictionary *person =
     [NSMutableDictionary dictionary];

[person setObject:@"Joe Smith" forKey:@"name"];

NSString *address = @"123 Street";
NSString *house =
    [address substringWithRange:NSMakeRange(0, 3)];
[person setObject:house forKey:@"houseNumber"];

NSArray *children =
   [NSArray arrayWithObjects:@"Sue", @"Tom", nil];

[person setObject:children forKey:@"children"];
```

Memory Management

Memory Management

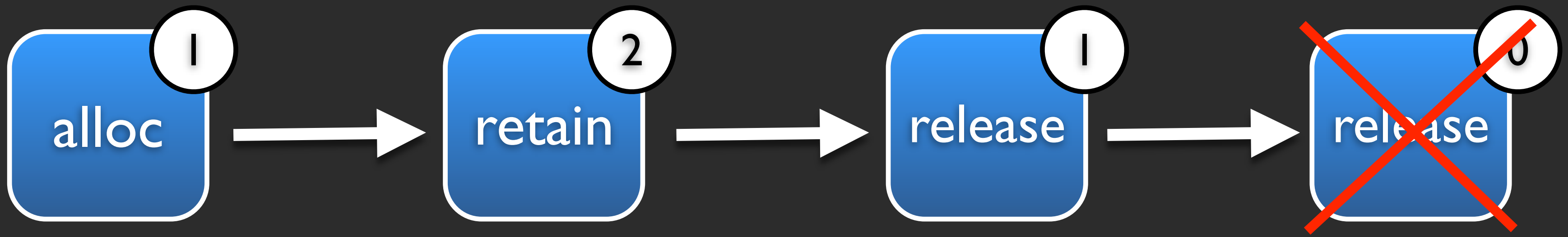
Dude, where's my Garbage Collection?

- Garbage collection available for Mac apps (10.5+)
  - Use it if targeting 10.5+!
  - Use explicit memory management if targeting <= 10.4
- No garbage collection on iOS due to performance concerns.
- Memory managed using simple *reference counting* mechanism:
  - Higher level abstraction than `malloc` / `free`
  - Straightforward approach, but must adhere to conventions and rules

Memory Management

Reference Counting

- Objective-C objects are reference counted
  - Objects start with reference count of 1
  - Increased with retain
  - Decreased with release, autorelease
  - When count equals 0, runtime invokes dealloc



Memory Management

Understanding the rules

- Implicitly `retain` any object you create using:

  Methods starting with "`alloc`", "`new`", or contains "`copy`"

  e.g `alloc`, `allocWithZone`, `newObject`, `mutableCopy`, etc.

- If you've retained it, you must `release` it
- Many objects provide convenience methods that return an *autoreleased* reference.
- Holding object reference from these methods does not make you the retainer
  - However, if you `retain` it you need an offsetting `release` or `autorelease` to free it

retain / release / autorelease

```
@implementation BankAccount

- (NSString *)accountNumber {
    return [[accountNumber retain] autorelease];
}

- (void)setAccountNumber:(NSString *)newNumber {
    if (accountNumber != newNumber) {
        [accountNumber release];
        accountNumber = [newNumber retain];
    }
}

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

@end
```

Properties

Properties

Simplifying Accessors

- Object-C 2.0 introduced new syntax for defining accessor code
    - Much less verbose, less error prone
    - Highly configurable
    - Automatically generates accessor code
- Compliments existing conventions and technologies
    - Key-Value Coding (KVC)
    - Key-Value Observing (KVO)
    - Cocoa Bindings
    - Core Data

Properties: Interface

```
@property(attributes) type variable;
```

Attribute	Impacts
readonly/readwrite	Mutability
assign/retain/copy	Storage
nonatomic	Concurrency
setter/getter	API

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```
@property(readonly) NSString *acctNumber;
```

Properties: Interface

```
@property(attributes) type variable;
```

Attribute	Impacts
readonly/readwrite	Mutability
assign/retain/copy	Storage
nonatomic	Concurrency
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```
@property(readwrite, copy) NSString *acctNumber;
```

Properties: Interface

```
@property(attributes) type variable;
```

Attribute	Impacts
readonly/readwrite	Mutability
assign/retain/copy	Storage
nonatomic	Concurrency
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```
@property(nonatomic, retain) NSDate *activeOn;
```

Properties: Interface

```
@property(attributes) type variable;
```

Attribute	Impacts
readonly/readwrite	Mutability
assign/retain/copy	Storage
nonatomic	Concurrency
setter/getter	API

```
@property(readonly, getter=username) NSString *name;
```

Properties: Interface

```
@interface BankAccount : NSObject {
    NSString *accountNumber;
    NSDecimalNumber *balance;
    NSDecimalNumber *fees;
    BOOL accountCurrent;
}

@property(readwrite, copy) NSString *accountNumber;
@property(readwrite, retain) NSDecimalNumber *balance;
@property(readonly) NSDecimalNumber *fees;
@property(getter=isCurrent) BOOL accountCurrent;

@end
```

Properties: Interface

New in 10.6
and iOS 4

```
@interface BankAccount : NSObject {
  // Look ma, no more ivars
}

@property(readwrite, copy) NSString *accountNumber;
@property(readwrite, retain) NSDecimalNumber *balance;
@property(readonly) NSDecimalNumber *fees;
@property(getter=isCurrent) BOOL accountCurrent;

@end
```

Properties: Implementation

```
@implementation BankAccount

@synthesize accountNumber;
@synthesize balance;
@synthesize fees;
@synthesize accountCurrent;

...

@end
```

Properties: Implementation

New in 10.6 and iOS 4

```
@implementation BankAccount

// no more @synthesize statements

...

@end
```

Accessing Properties

- Generated properties are standard methods
- Accessed through normal messaging syntax

```
[object property];
[object setProperty:(id)newValue];
```

- Objective-C 2.0 property access via dot syntax

```
object.property;
object.property = newValue;
```

Dot notation is just syntactic sugar. Still uses accessor methods. Doesn't get/set values directly.

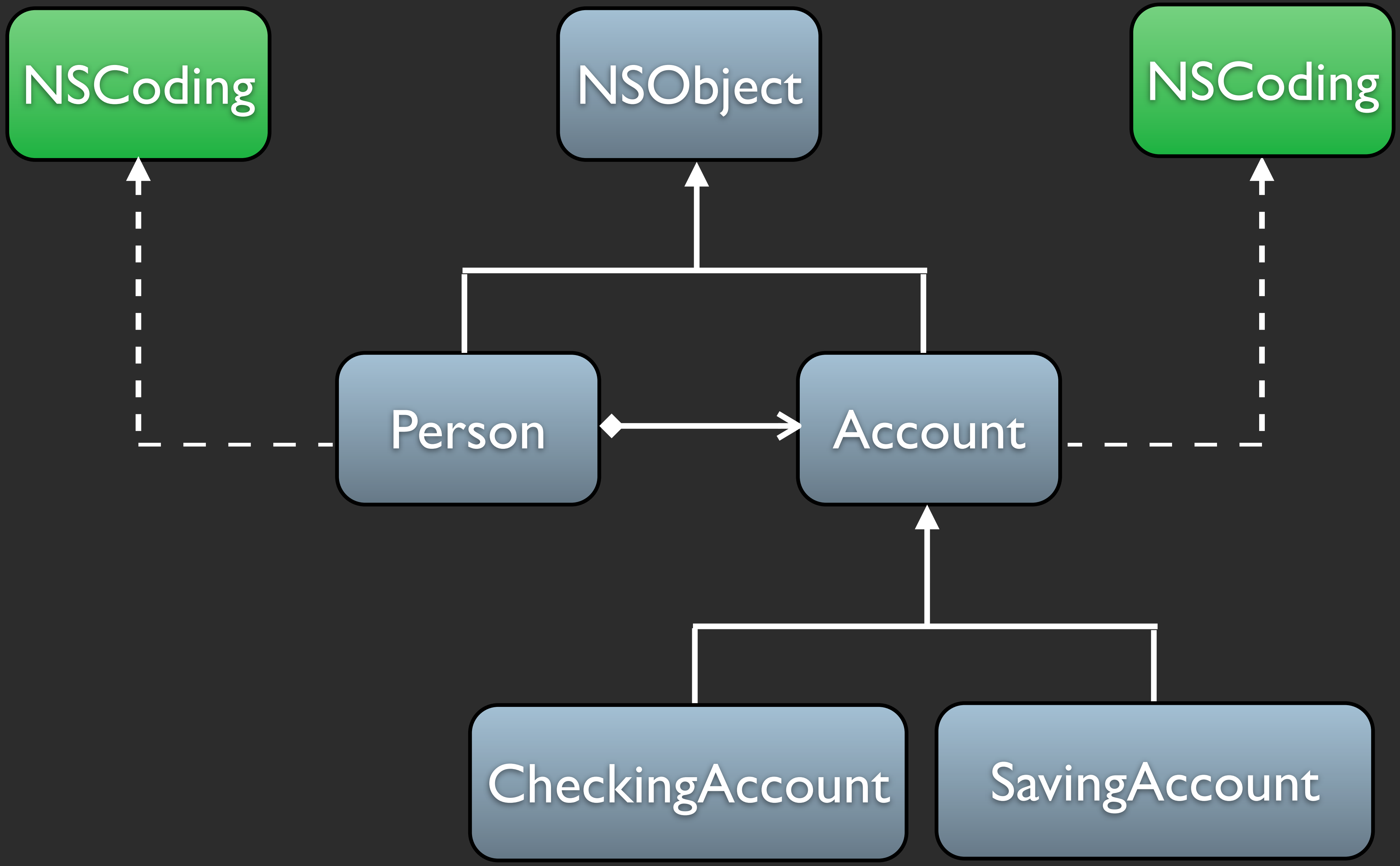
Protocols

Protocols

Java’s Interface done Objective-C style

- List of method declarations
  - Not associated with a particular class
  - Conformance, not class, is important
- Useful in defining:
  - Methods that others are expected to implement
  - Declaring an interface while hiding its particular class
  - Capturing similarities among classes that aren't hierarchically related

Protocols


NSCoding
NSObject
NSCoding
Person
Account
CheckingAccount
SavingAccount

Defining a Protocol

NSCoding from Foundation Framework
Objective-C equivalent to java.io.Externalizable

```
@protocol NSCoding

- (void)encodeWithCoder:(NSCoder *)aCoder;
- (id)initWithCoder:(NSCoder *)aDecoder;

@end
```

Adopting a Protocol

```
@interface Person : NSObject <NSCoding> {
  NSString *name;
  NSString *street;
  NSString *city, *state, *zip;
}

// method declarations

@end
```

Conforming to a Protocol

Partial implementation of conforming Person class

```
@implementation Person

-(id)initWithCoder:(NSCoder *)coder {
    if (self = [super init]) {
        name = [coder decodeObjectForKey:@"name"];
        [name retain];
    }
    return self;
}

-(void)encodeWithCoder:(NSCoder *)coder {
    [coder encodeObject:name forKey:@"name"];
}

@end
```

@required and @optional

- Protocols methods are required by default
- Can be relaxed with @optional directive

```
@protocol SomeProtocol

- (void)requiredMethod;

@optional
- (void)anOptionalMethod;
- (void)anotherOptionalMethod;

@required
- (void)anotherRequiredMethod;

@end
```

Categories & Extensions

Categories

Extending Object Features

- Add new methods to existing classes
  - Alternative to subclassing
  - Defines new methods and can override existing
  - Does not define new instance variables
  - Becomes part of the class definition
    - Inherited by subclasses
- Can be used as organizational tool
- Often used in defining "private" methods

Using Categories

Interface

```
@interface NSString (Extensions)
-(NSString *)trim;
@end
```

Implementation

```
@implementation NSString (Extensions)
-(NSString *)trim {
   NSCharacterSet *charSet =
      [NSCharacterSet whitespaceAndNewlineCharacterSet];
  return [self stringByTrimmingCharactersInSet:charSet];
}
@end
```

Usage

```
NSString *string = @"   A string to be trimmed    ";
NSLog(@"Trimmed string: '%@'", [string trim]);
```

Class Extensions

Unnamed Categories

- Objective-C 2.0 adds ability to define "anonymous" categories
  - Category is unnamed
  - Treated as class interface continuations
- Useful for implementing required "private" API
- Compiler enforces methods are implemented

Class Extensions

Example

```
@interface Person : NSObject {
  NSString *name;
}
-(NSString *)name;

@end
```

Class Extensions

Example

```
@interface Person ()
-(void)setName:(NSString *)newName;
@end

@implementation Person
- (NSString *)name {
  return name;
}

- (void)setName:(NSString *)newName {
  name = newName;
}
@end
```

Summary

Objective-C

Summary

- Fully C, Fully Object-Oriented
- Powerful dynamic runtime
- Objective-C 2.0 added many useful new features
  - Garbage Collection for Mac OS X apps
  - Properties, Improved Categories & Protocols
- Objective-C 2.1 continues its evolution:
  - Blocks (Closures)
  - Synthesize by default for properties

Questions?