Music 120: Introduction to Audio/Multimedia App. Programming

Week #5 - 10/23/2006, Part I
CCRMA, Department of Music
Stanford University

Last Week...
• IDE (briefly)
• VST Plug-in (also briefly)

Today...
• HW1 review
• VST SDK: Xcode projects
• GUI programming with Cocoa
• Objective-C
• Demo: GUI-based Stk app.
  ‣ Xcode / Interface Builder / StkX
• Assignment #2

Cocoa

Cocoa Is Many Things
• It’s a runtime environment
  ‣ Dynamic dispatch is fundamental
• It’s a user interface framework
  ‣ Events, views, buttons, sliders and so on
• It’s a development framework
  ‣ A collection of reusable and extendable objects

Using Cocoa
• GUI (Graphical User Interface) applications
• Command-line tools
• Plug-ins
• Even device drivers!
Cocoa Applications

- Mail
- Safari
- iChat
- Photo Booth
- Automator
- iPhoto
- Keynote
- Aperture
- IB

Mac OS X Architecture

- Frameworks
- Application Services
- Core Services
- Kernel - Darwin
- Developer Tools
- Interface Builder
- Xcode

Cocoa Architecture

- Frameworks
  - Application Kit
    - Aqua Elements
    - Application Runtime
    - UI Widgets
  - Foundation Kit
    - Utility Classes
    - Collection Classes
    - Object Wrappers
    - for OS Services

GUI Programming with Cocoa

Basic Tools

- Xcode
  - coding
  - building
  - debugging
- Interface Builder
  - user-interface design
  - basic connections between objects

Xcode

- "Wizard" helps you create new projects
  - no Harry Potter this
- Best to stick with Xcode-defaults in new projects for now
  - except StkX
- Don’t let the complexity overwhelm you
Xcode (cont’d)

- Programming in 4 easy(?) steps!
  - Edit your code
  - Specify how your code is compiled and linked
  - Build and run your code
  - Debug your code

Interface Builder

- Lays out and connects user-interface elements
  - Target/action
  - Outlets
  - Bindings
- Edits nib files
  - A nib file a collection of archived objects (your user interface) stored on disk

Objective-C

- A very simple language, but some new syntax
- Strict superset of C
- Single inheritance
  - classes inherit from one and only one superclass
- Dynamic runtime

Why ObjC?

- Exposure to other languages is always good
- A language focused on simplicity and the elegance of OO design
- Concepts in Objective C are applicable to any other OOP language

Class Interfaces (C)

typedef struct
{
    char *name;
    int age;
    float weight;
} Person;

void printName(Person *person);
Class Interfaces (ObjC)

```
@interface Person : NSObject
{
    char *name;
    int age;
    float weight;
}
@end
```

Instance Variables

- (void)printName;

Methods

Implementations (ObjC)

```
@implementation Person
{- (void)printName
    
    @end
}
@end
```

Implementations (C)

```
void printName(Person *person)
{
    printf ("Name: %s\n", person->name);
}
```

详细介绍类的接口和实现细节。通过说明不同语言（C、C++、Java、Objective-C）的交互方式，展示如何使用这些语言来定义和操作类。具体实现代码被标记为Objective-C和C语言。

**Messaging Syntax**

- Calling a method called “doSomething”

  - C Function: `doSomething(anObject);`
  - C++ or Java: `anObject.doSomething();`
  - ObjC: `[anObject doSomething];`

- Calling a method “divide” with arguments

  - C Function: `divide(arg1, arg2);`
  - C++ or Java: `obj.divide(arg1, arg2);`
  - ObjC: `[obj divide:arg1 by:arg2];`
  - Selector: `divide:by:`
String Constants

- In C constant strings are
  - "simple"
- In ObjC, constant strings are
  - @"just as simple"
- Constant strings are NSString instances

More ObjC Info?

- Cocoa Programming for Mac OS X (Ch. 3)
  - by Aaron Hillegass
- ADC document

More Cocoa...?

- CS193E
  - taught by Apple engineers
- Cocoa Programming for Mac OS X (Ch. 3)
  - by Aaron Hillegass
- ADC document

Demo!

Assignment #2
Due 11/17/06

Truth of A2

- VST plug-ins:
  - start from templates
  - add more features step by step
- GUI-based applications:
  - extend your A1 by add some GUI
  - communication between UI and functions
- For both:
  - experience with IDE