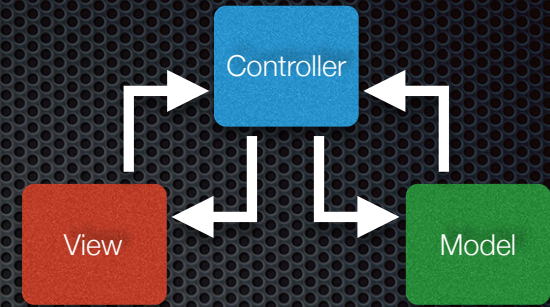


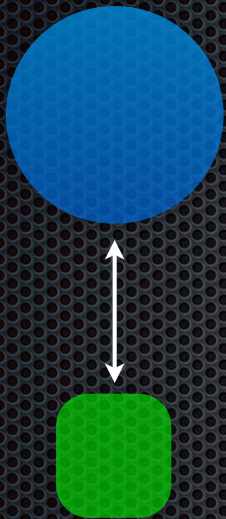
Mobile Application Programming

Data and Persistence

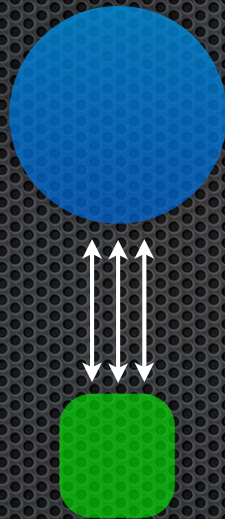
Messaging Options



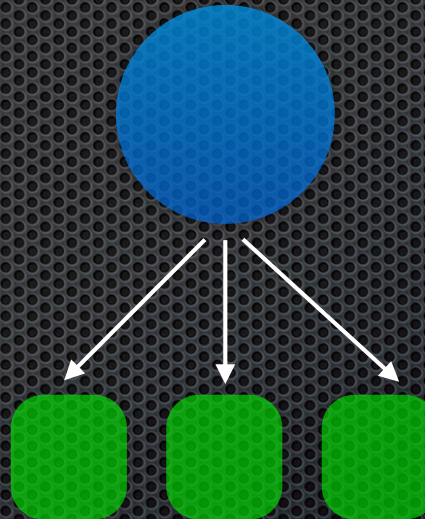
Handler



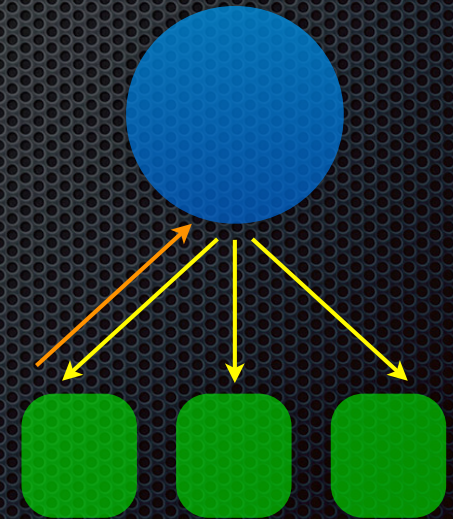
Delegate



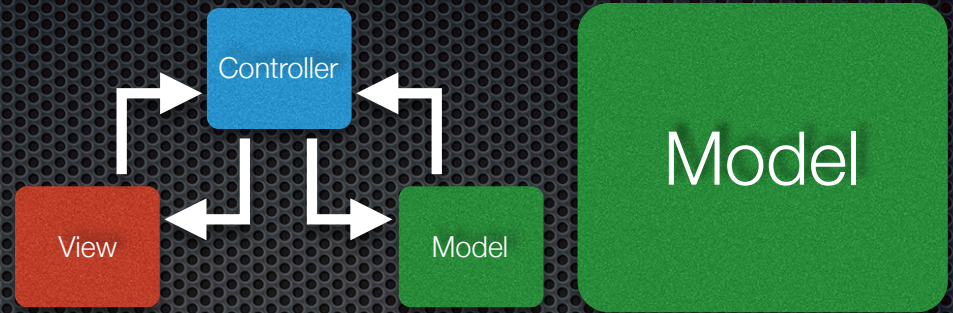
Handler Collection



Notification Center



The Model



- ✦ Source of data for the application
- ✦ Contains all or nearly all of the program's state
- ✦ Should be thought of as persistent, that is, it stays the same over separate runs of the program
- ✦ Could be specifics of a running simulation, network and caching code for interfacing with a server, interface into a database running on the phone itself, or a simple object that saves the state of the app to file

Data Files

IMG_0274.PNG - Data																	
Len: \$00011939				Type/Creator: /				Sel: \$00000000:00000000 / \$00000000									
00000000:	89	50	4E	47	0D	0A	1A	0A	00	00	00	0D	49	48	44	52	.PNG.....IHDR
00000010:	00	00	01	40	00	00	01	E0	08	06	00	00	00	D4	8C	B4	...@.....
00000020:	44	00	00	20	00	49	44	41	54	78	01	EC	7D	05	7C	1D	D...IDATx..}. .
00000030:	55	FA	F6	93	E4	C6	DD	DD	9A	B4	A9	2B	35	DA	42	A1	U.....+5.B.
00000040:	B4	40	A1	B8	B3	8B	2C	0B	7F	58	64	B1	0F	5F	16	59	.@.....Xd...Y
00000050:	6C	F1	C5	DD	A1	C5	4B	A1	D4	A8	50	4A	DD	3D	A9	C5	l.....K...PJ.=..
00000060:	DD	5D	EF	F7	3E	E7	66	6E	26	C9	8D	B5	97	36	29	F3	.]..>.fn&...6).
00000070:	E6	77	33	76	F4	9D	99	E7	BC	36	E7	38	FC	E3	96	5B	.w3v.....6.8...[
00000080:	CD	37	DD	72	1B	22	A3	A3	E1	E0	E0	00	83	0C	0E	18	.7.r.".....
00000090:	1C	30	38	70	BC	73	20	23	2D	0D	6F	BC	FA	3F	38	EC	.08p.s #-..o..?8.
000000A0:	DC	8B	DF	1C	16	15	01	B3	D9	6C	00	E0	F1	7E	D7	8D	l.....^..
000000B0:	FE	19	1C	30	38	60	E5	40	4E	46	16	1C	F2	CB	AB	CC	...08`.0NF.....
000000C0:	3C	63	00	A0	95	2F	C6	8E	C1	01	83	03	7F	10	07	E6	<c.../.....
000000D0:	CF	FD	1E	33	66	9E	05	93	B3	F3	1F	54	43	CF	8A	35	...3f.....TC..5
000000E0:	35	35	36	A9	1C	06	00	F6	8C	71	46	EA	3F	9E	03	25	556.....qF.?..%
000000F0:	25	25	30	37	59	9E	4F	D6	E6	E2	EA	0A	4F	4F	CF	56	%%07V.O.....00.V
00000100:	15	57	56	56	A2	AE	B6	56	9D	F3	F0	F0	80	AB	9B	9B	.WVV...V.....
00000110:	F5	7A	49	71	B1	1A	D8	79	C2	D7	CF	0F	8E	8E	8E	D6	.z!q...y.....
00000120:	6B	C6	CE	B1	E1	C0	DE	DD	3B	51	90	97	8B	F3	2F	B9	k.....;0..../.
00000130:	1C	9E	5E	5E	C7	A6	11	BA	5A	4D	4D	4D	8D	EA	D0	5E	..^^....ZMMM...^
00000140:	00	18	73	FD	5E	A0	51	84	4A	79	70	D3	3E	1C	AC	AB	..s.^..Q.Jyp.>...
00000150:	AA	6F	EC	EE	4C	2F	C2	8A	6D	05	D8	B3	BF	06	59	F9	.o..L/..m.....Y.
00000160:	0E	48	CF	B3	B4	3B	3A	04	88	94	5F	52	3F	57	9C	3C	.H...;....R?W.<
00000170:	3C	08	43	A2	03	50	DF	D8	08	67	27	A7	BE	D1	B1	C3	<.C..P...g'.....
00000180:	6C	E5	07	EF	BE	83	17	9E	7D	06	AF	BE	F5	0E	4E	9E	l.....}.....N.
00000190:	7A	4A	87	A5	D4	D7	D5	E1	F1	47	1E	C6	8A	65	CB	50	zJ.....6...e.P
000001A0:	56	5A	8A	11	A3	46	E1	FE	7F	3D	8C	A4	81	83	54	9E	VZ...F...=....T.
000001B0:	03	F8	F7	E1	D1	7F	3D	84	6D	5B	B6	C0	43	40	EC	F4	=.m[...C0..
000001C0:	33	67	E2	AE	7B	EF	6B	07	68	FA	0A	4E	99	34	1E	59	3g...{.k.h...N.4.Y
000001D0:	99	99	D6	53	04	B0	71	13	26	E2	AC	59	E7	E0	DA	BF	...S..q.&...Y....
000001E0:	5F	0F	27	E1	FD	3D	77	DC	86	AF	BF	9C	A3	D2	DC	70	..'.=w.....p
000001F0:	D3	3F	F0	E8	13	4F	A9	7D	B6	61	50	42	9C	3C	86	16	.?...0..}..aPB.<..
00000200:	00	DD	B4	63	37	C2	23	22	AC	65	19	3B	C7	86	03	8E	...c7.#"..e.;....
00000210:	E2	67	C8	CA	CC	C0	C7	EF	BE	85	73	2E	BA	58	EE	49	.g.....s..X.l
00000220:	64	A7	0D	79	F4	B1	97	B0	7D	87	60	CA	11	D2	B0	A1	d..y....}.^.....
00000230:	49	F8	F7	C3	B7	B7	2B	C5	D4	28	2F	31	C9	5E	00	18	l.....+..{/1.^..

Data Files

FILE

fopen()

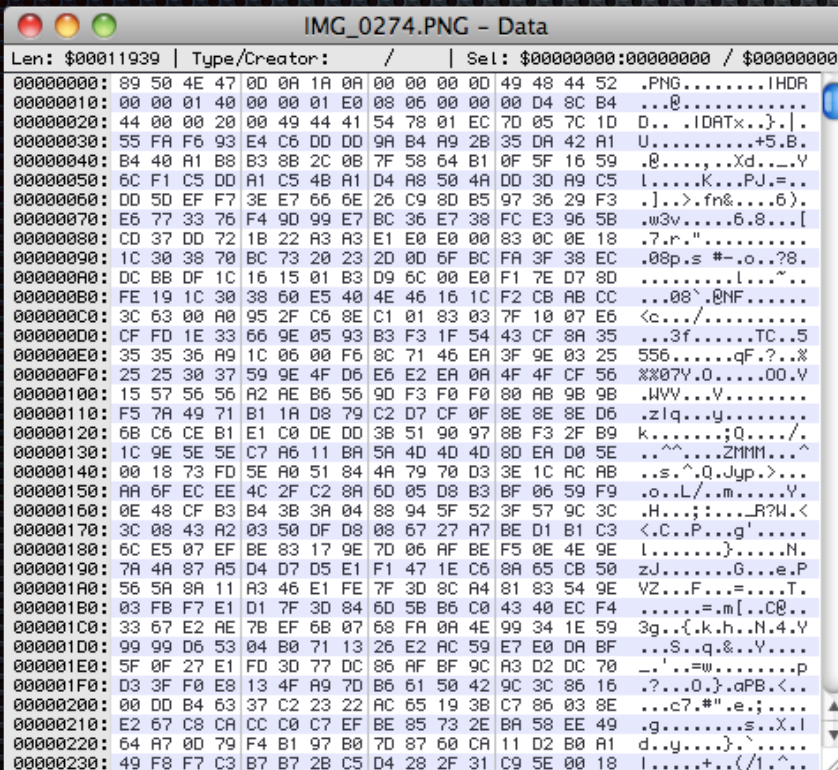
fread()

vfscanf()

fwrite()

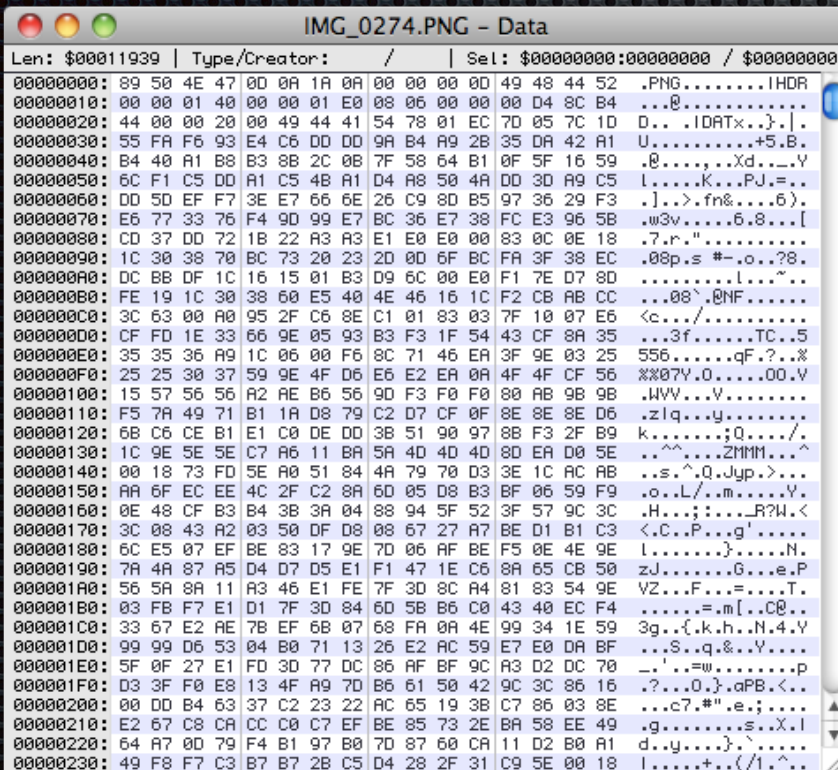
vfprintf()

fclose()



C compatibility
knowledge required!

Data Files



Len: \$00011939	Type/Creator: /	Sel: \$00000000:00000000 / \$00000000
00000000: 89 50 4E 47 0D 0A 1A 0A 00 00 00 0D 49 48 44 52	.PNG.....IHDR	
00000010: 00 00 01 40 00 00 01 E0 08 06 00 00 00 04 8C B4	...0.....	
00000020: 44 00 00 20 00 49 44 41 54 78 01 EC 7D 05 7C 1D	D...IDATx... .	
00000030: 55 FA F6 93 E4 C6 DD DD 9A B4 A9 2B 35 DA 42 A1	U.....+5.B.	
00000040: B4 40 A1 B8 B3 8B 2C 0B 7F 58 64 B1 0F 5F 16 59	0.....Xd...Y	
00000050: 6C F1 C5 DD A1 C5 4B A1 D4 A8 50 4A DD 3D A9 C5	l.....K...PJ.=.	
00000060: DD 5D EF F7 3E E7 66 6E 26 C9 8D B5 97 36 29 F3	].>.fn&...6).	
00000070: E6 77 33 76 F4 9D 99 E7 BC 36 E7 38 FC E3 96 5B	.w3v....6.8...[	
00000080: CD 37 DD 72 1B 22 A3 A3 E1 E0 E0 00 83 0C 0E 18	.7.r.".....	
00000090: 1C 30 38 70 BC 73 20 23 2D 00 6F BC FA 3F 38 EC	.08p.s #-..o..?8.	
000000A0: DC 8B DF 1C 16 15 01 B3 D9 6C 00 E0 F1 7E D7 8D	l.....~	
000000B0: FE 19 1C 30 38 60 E5 40 4E 46 16 1C F2 CB AB CC	...08\..0NF.....	
000000C0: 3C 63 00 A0 95 2F C6 8E C1 01 83 03 7F 10 07 E6	<c.....	
000000D0: CF FD 1E 33 66 9E 05 93 B3 F3 1F 54 43 CF 8A 35	...3f.....TC..5	
000000E0: 35 35 36 A9 1C 06 00 F6 8C 71 46 EA 3F 9E 03 25	556.....qf.?..%	
000000F0: 25 25 30 37 59 9E 4F D6 E6 E2 EA 0A 4F 4F CF 56	%%07V..00.V	
00000100: 15 57 56 56 A2 AE B6 56 9D F3 F0 F0 80 AB 98 98	.UVV...V.....	
00000110: F5 7A 49 71 B1 1A D8 79 C2 D7 CF 0F 8E 8E 8E D6	.z1q...y.....	
00000120: 68 C6 CE B1 E1 C0 DE D0 3B 51 90 97 8B F3 2F B9	k.....;Q.../.	
00000130: 1C 9E 5E 5E C7 A6 11 BA 5A 40 40 40 8D EA D0 5E	..^^.....ZMMM...^	
00000140: 00 18 73 FD 5E A0 51 84 4A 79 70 D3 3E 1C AC AB	..s.^..Q..Jyp.>...	
00000150: AA 6F EC EE 4C 2F C2 8A 6D 05 D8 B3 BF 06 59 F9	.o..L/.m.....Y.	
00000160: 0E 48 CF B3 B4 3B 3A 04 88 94 5F 52 3F 57 9C 3C	.H...;....R?W.<	
00000170: 3C 08 43 A2 03 50 DF D8 08 67 27 A7 BE D1 B1 C3	<.C..P...g'.....	
00000180: 6C E5 07 EF BE 83 17 9E 7D 06 AF BE F5 0E 4E 9E	l.....}.....N.	
00000190: 7A 4A 87 A5 D4 D7 D5 E1 F1 47 1E C6 8A 65 C8 50	zJ.....G...e.P	
000001A0: 56 5A 8A 11 A3 46 E1 FE 7F 3D 8C A4 81 83 54 9E	VZ...F...=....T.	
000001B0: 03 FB F7 E1 D1 7F 3D 84 6D 5B B6 C0 43 40 EC F4	=m[...C0..	
000001C0: 33 67 E2 AE 7B EF 68 07 68 FA 0A 4E 99 34 1E 59	3g...{.k.h..N.4.V	
000001D0: 99 99 D6 53 04 B0 71 13 26 E2 AC 59 E7 E0 DA BF	...S...q.&...Y....	
000001E0: 5F 0F 27 E1 FD 3D 77 DC 86 AF BF 9C A3 D2 DC 70	..'....=w.....p	
000001F0: D3 3F F0 E8 13 4F A9 7D B6 61 50 42 9C 3C 86 16	.?...0..}.aPB.<..	
00000200: 00 DD B4 63 37 C2 23 22 AC 65 19 3B C7 86 03 8E	...c7.#".e.;....	
00000210: E2 67 C8 CA CC C0 C7 EF BE 85 73 2E BA 58 EE 49	.g.....s..X.l	
00000220: 64 A7 0D 79 F4 B1 97 B0 7D 87 60 CA 11 D2 B0 A1	d..y.....}.~....	
00000230: 49 F8 F7 C3 B7 B7 2B C5 D4 28 2F 31 C9 5E 00 18	l.....+..{/1.^..	

`NSData(contentsOfFile:)`

`data.writeToFile(path: atomically:)`

`NSString(data:, encoding:)`

Easy to initiate,
Difficult to use

XML

<?xml?>

- ✦ iOS offers NSXMLParser, an **event-driven** XML parser
- ✦ Parses an XML document, reporting what items it encounters **as it reads** the document (streaming parser)
- ✦ Consumes **very little memory** parsing even the largest of XML documents and is very efficient
- ✦ Offers **no schema validation**

XML

<?xml?>

```
// Somewhere in a class declared as an NSXMLParserDelegate
let parser = NSXMLParser(contentsOfURL: NSURL(string: "http://www.google.com"))
parser?.delegate = self
parser?.parse()

// Include these methods, which are called as parsing progresses
func parserDidStartDocument(parser: NSXMLParser!) { /* ... */ }
func parserDidEndDocument(parser: NSXMLParser!) { /* ... */ }
func parser(parser: NSXMLParser!, didStartElement elementName: String!,
            namespaceURI: String!, qualifiedName qName: String!,
            attributes attributeDict: [NSObject : AnyObject]!) { /* ... */ }
func parser(parser: NSXMLParser!, foundCharacters string: String!) { /* ... */ }
func parser(parser: NSXMLParser!, didEndElement elementName: String!,
            namespaceURI: String!, qualifiedName qName: String!) { /* ... */ }
```


.plist Files



.plist Files

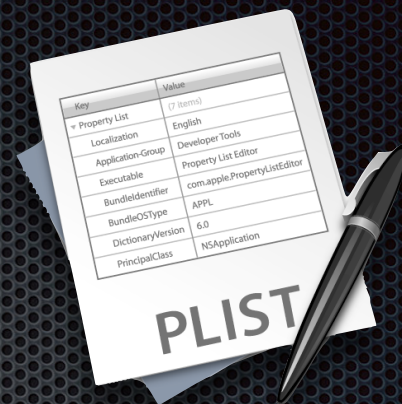


Key	Value
▼ Information Property List	(13 items)
CFBundleDevelopmentRegion	English
CFBundleDisplayName	\${PRODUCT_NAME}
CFBundleExecutable	\${EXECUTABLE_NAME}
CFBundleIconFile	Icon.png
CFBundleIdentifier	com.pixiotech.MobileFinder
CFBundleInfoDictionaryVersion	6.0
CFBundleName	\${PRODUCT_NAME}
CFBundlePackageType	APPL
CFBundleSignature	????
CFBundleVersion	1.6.0
UIFileSharingEnabled	☒
▼ UISupportedInterfaceOrientations	(4 items)
Item 0	UIInterfaceOrientationPortrait
Item 1	UIInterfaceOrientationPortraitUpsideDown
Item 2	UIInterfaceOrientationLandscapeLeft
Item 3	UIInterfaceOrientationLandscapeRight
▼ CFBundleURLTypes	(1 item)
▶ Item 0	(2 items)

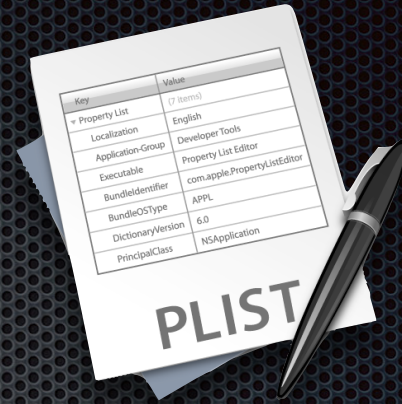

```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/DTDs/PropertyList-1.0.dtd">
3 <plist version="1.0">
4 <dict>
5     <key>CFBundleDevelopmentRegion</key>
6     <string>English</string>
7     <key>CFBundleDisplayName</key>
8     <string>${PRODUCT_NAME}</string>
9     <key>CFBundleExecutable</key>
10    <string>${EXECUTABLE_NAME}</string>
11    <key>CFBundleIconFile</key>
12    <string>Icon.png</string>
13    <key>CFBundleIdentifier</key>
14    <string>com.pixiotech.MobileFinder</string>
15    <key>CFBundleInfoDictionaryVersion</key>
16    <string>6.0</string>
17    <key>CFBundleName</key>
18    <string>${PRODUCT_NAME}</string>
19    <key>CFBundlePackageType</key>
20    <string>APPL</string>
21    <key>CFBundleSignature</key>
22    <string>????</string>
23    <key>CFBundleVersion</key>
24    <string>1.6.0</string>
25    <key>UIFileSharingEnabled</key>
26    <true/>
27    <key>UISupportedInterfaceOrientations</key>
28    <array>
29        <string>UIInterfaceOrientationPortrait</string>
30        <string>UIInterfaceOrientationPortraitUpsideDown</string>
31        <string>UIInterfaceOrientationLandscapeLeft</string>
32        <string>UIInterfaceOrientationLandscapeRight</string>
33    </array>
34    <key>CFBundleURLTypes</key>
35    <array>
36        <dict>
37            <key>CFBundleURLName</key>
38            <string>com.pixiotech.MobileFinder</string>
39            <key>CFBundleURLSchemes</key>
40            <array>
41                <string>mobilestudio</string>
42            </array>
43        </dict>
44    </array>
45 </dict>
46 </plist>

```



.plist Files



```
NSArray(contentsOfFile: "file.plist")  
array.writeToFile("file.plist", atomically: true)
```

Foundation class	CoreFoundation type	XML Tag	Storage format
NSString	CFString	<string>	UTF-8 encoded string
NSNumber	CFNumber	<real>, <integer>	Decimal string
NSNumber	CFBoolean	<true />, or <false />	No data (tag only)
NSDate	CFDate	<date>	ISO 8601 formatted string
NSData	CFData	<data>	Base64 encoded data
NSArray	CFArray	<array>	Can contain any number of child elements
NSDictionary	CFDictionary	<dict>	Alternating <key> tags and plist element tags

NSUserDefaults

`NSUserDefaults.standardUserDefaults()`

`NSUserDefaults.standardUserDefaults().boolForKey("key")`

`NSUserDefaults.standardUserDefaults().integerForKey("key")`

`NSUserDefaults.standardUserDefaults().floatForKey("key")`

`NSUserDefaults.standardUserDefaults().objectForKey("key")`

`NSUserDefaults.standardUserDefaults().setBool(value, forKey:"key")`

`NSUserDefaults.standardUserDefaults().setInteger(value, forKey:"key")`

`NSUserDefaults.standardUserDefaults().setFloat(value, forKey:"key")`

`NSUserDefaults.standardUserDefaults().setObject(value, forKey:"key")`

`NSUserDefaults.standardUserDefaults().removeObjectForKey("key")`

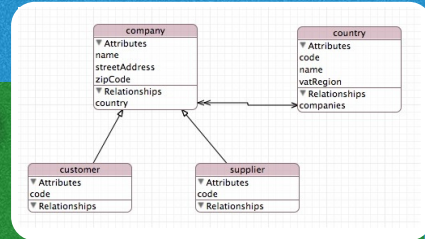
CoreData



- ✦ Core Data is an **in-memory object graph** that can be persisted to non-volatile storage
- ✦ Core Data keeps track of “**managed**” objects that contain the data for an application
- ✦ Core Data only loads data from storage **when needed** by a managed object, and keeps track of changes so they can all be **saved at one time**.
- ✦ Can use **SQLite** or other file types as the data store
- ✦ Visual schema editor available in Xcode

NSManagedObjectContext

- entities ↴



NSEntityDescription

- name (NSString)
- properties ↴

NSArray

NSAttributeDescription

- name (NSString)
- optional (BOOL)
- attributeType (eg. NSFloatAttributeType)

NSAttributeDescription

- name (NSString)
- optional (BOOL)
- attributeType (eg. NSFloatAttributeType)

NSManagedObject

object.valueForKey("key")
object.setValue(value forKey:"key")

NSManagedObjectContext

- persistentStoreCoordinator ↴

NSPersistentStoreCoordinator

- store initWithManagedObjectModel:model]
- store.addPersistentStoreWithType(
configuration: nil
URL: fileUrl
options: nil
error: nil)

context.save(nil)

let results =

context.executeFetchRequest(request,
error: nil)

NSFetchRequest

- entity (NSEntityDescription)
- predicate (NSPredicate)
- sortDescriptors (NSArray)



Creating Managed Objects

NSManagedObject

```
let object: NSManagedObject = NSEntityDescription.  
insertNewObjectForEntityForName("EntityName"  
inManagedObjectContext: context)
```



OR

```
let results: NSArray = context(  
executeFetchRequest:request  
error: nil)
```

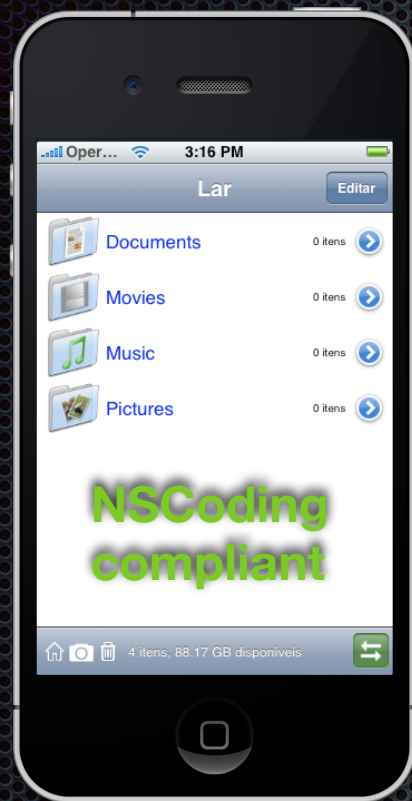


Persistence and Serialization

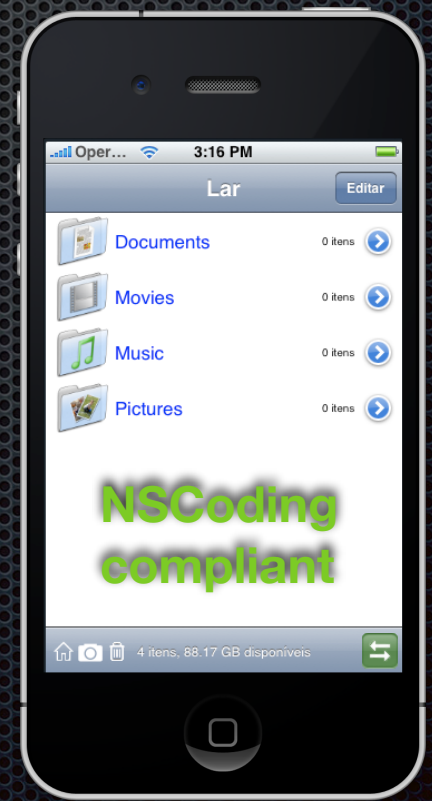
- ✦ Objects can be very easily saved to file or sent over a network socket if they are serializable
- ✦ Any object that implements the **NSCoding** protocol can be serialized using an **NSKeyedArchiver** and de-serialized with an **NSKeyedUnarchiver**



Persistence and Serialization



NSData



NSKeyedArchiver

NSKeyedUnarchiver

Model View Controller

