CS 329E
Elements of Mobile Computing

Spring 2018
University of Texas at Austin

Lecture 6

Agenda

- Protocols
- Delegates
- Table View Controllers
- Navigation Controllers
- In-Class Exercise
- Homework 3

Protocols

Protocols

Why do we care about protocols and delegates?

They are used extensively in iOS development.

They are used in a new programming paradigm:

Protocol-Oriented Programming
(as opposed to Object-Oriented Programming)

Protocols

What is a protocol?

- A *blueprint* of methods, properties and other requirements that suit a particular task or piece of functionality.
- Similar to interfaces in Java, but more powerful and flexible.
- Can be adopted by a class, structure or enumeration to provide an actual implementation of the defined functionality.
- Any type (class, struct, enum) that satisfies the requirements of a protocol is said to *conform* to that protocol.

Protocols

What is a protocol? (continued)

- Frequently, the protocol has no implementation.
- But you can provide a default implementation by *extending* a protocol.
- A way to have *fake* single or multiple inheritance.

Protocols

What is a protocol? (continued)

- A group of related properties and methods that can be implemented in *any* class. As such, they are independent of any class.

- When you define a protocol you identify what is *required* and what is *optional.*
  - Anything *required* must be implemented.

- Just like classes, protocols can inherit from other protocols.

Protocols

- It's also a way to define a set of methods that are implemented in unrelated classes
  - Unlike inheritance, where there is a clear relationship
  - All that is required is that you indicate you conform to the protocol and implement all the required methods
  - Example: both an Employee and an (unrelated) Automobile class could implement the same protocol.

Protocols

Protocols are declared using the **protocol** keyword.

When defining a protocol, we provide:

- The signatures for any **methods** that the protocol should implement.
- The types of any **properties** that should be implemented along with whether they should implement both get and set methods or only get.
- Unless specified otherwise, everything is required.

Protocols

Example:

```
protocol Bird {
    var name: String { get }
    var canFly: Bool { get }
    func printBird()
}

class SillyBird : Bird {

}
```

Protocols

Example (continued):

```
// This class conforms to the Bird protocol.
class SillyBird : Bird {
    // class-specific property.
    var prop1: Int = 0

    // class-specific method.
    func printMe() {
        print("SillyBird: \(prop1)")
    }

    // Protocol implementations.
    var name: String {
        get { return "Silly Bird" }
    }
    var canFly: Bool {
        get { return true }
    }
    func printBird() {
        print("SillyBird: printBird: name: \(name), canFly: \(canFly)")
    }
}
```

Protocols

Real-world iOS protocol example:

- *UITableViewDataSource*
    - Defines the set of methods that are called by the framework to get something to display in a table view.

Protocols

```
protocol UITableViewDataSource : NSObjectProtocol {
. . . . .

    func tableView(tableView: UITableView, numberOfRowsInSection section: Int) -> Int

    // Row display. Implementers should *always* try to reuse cells by setting each cell's
reuseIdentifier and querying for available reusable cells with dequeueReusableCellWithIdentifier:
    // Cell gets various attributes set automatically based on table (separators) and data source
(accessory views, editing controls)

    func tableView(tableView: UITableView, cellForRowAtIndexPath indexPath: NSIndexPath) ->
UITableViewCell

    // Editing

    // Individual rows can opt out of having the -editing property set for them. If not implemented, all
rows are assumed to be editable.
    optional func tableView(tableView: UITableView, canEditRowAtIndexPath indexPath: NSIndexPath) -> Bool

    // Moving/reordering

    // Allows the reorder accessory view to optionally be shown for a particular row. By default, the
reorder control will be shown only if the datasource implements -
tableView:moveRowAtIndexPath:toIndexPath:
    optional func tableView(tableView: UITableView, canMoveRowAtIndexPath indexPath: NSIndexPath) -> Bool

. . . . .

}
```

Protocols

Benefits of protocols:

- It enables loose coupling of components.
- Using protocols instead of subclassing gives developers much more leeway when it comes to organizing their application's code.
- Allows you to very easily add a protocol to a type (class, struct, enum) thus giving it that capability without concern for something like a class hierarchy.

Delegates

Delegates

Protocols and delegates are closely associated, in that, in order for protocols to be useful in a lot of cases you need at least one delegate to conform to the protocol.

What is a delegate?

- A pointer to *some object* that has implemented the protocol's methods (conformed to the protocol).
- The *some object* means we don't really know, or care, specifically what kind of object the delegate is referring to, only that the *required* methods/properties defined in the protocol are implemented in that object.

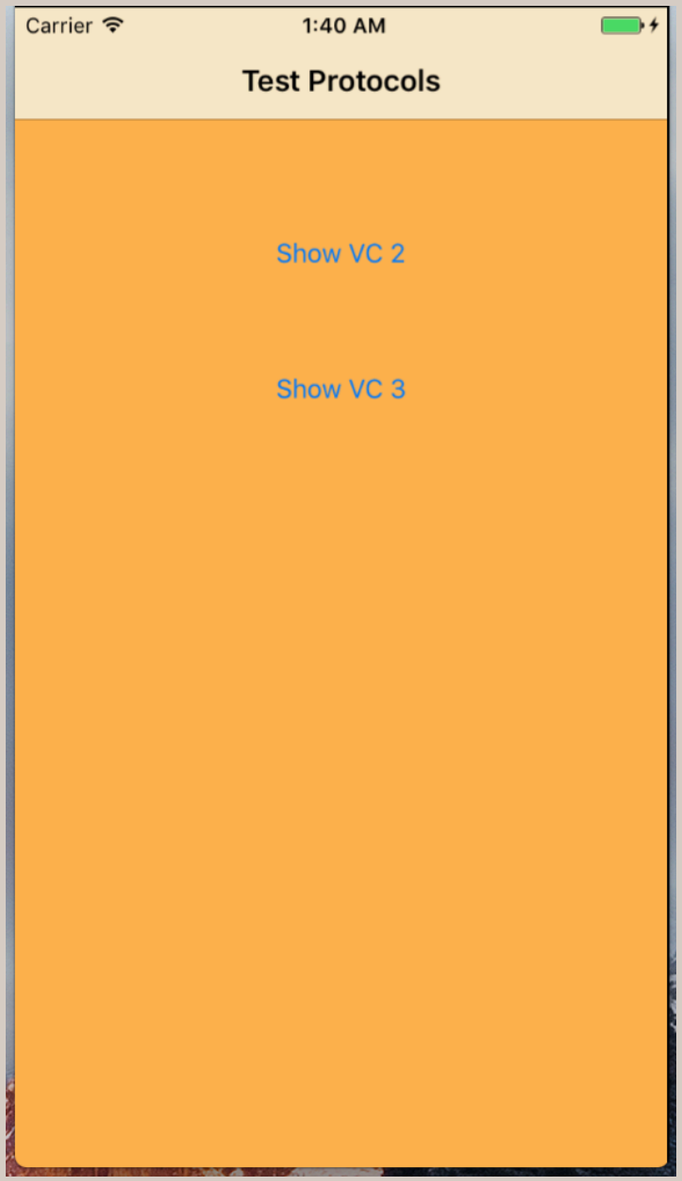
Delegates

What is delegation? What are delegates?

- Delegation is a simple and powerful pattern in which one object in a program acts on behalf of, or in coordination with, another object.
- The *delegating* object keeps a reference to another object - the *delegate* - and at the appropriate time makes use of the delegates implementation.
- The main value of delegation is that it allows you to easily customize the behavior of several objects (delegates) in one central object (delegator).
- Used extensively in normal iOS programming.

Delegates

Demo: TestProtocols



Delegates

Demo: TestProtocolsAndDelegates

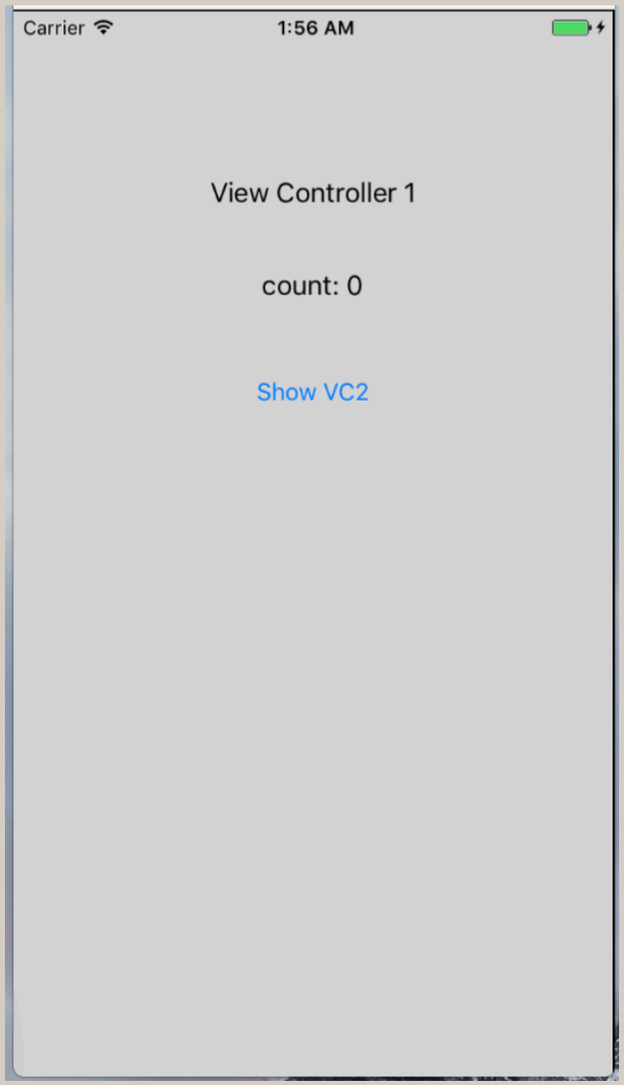


Table View Controllers

Table View Controllers

- A UITableViewController contains a UITableView.
- A UITableView contains *at least one* UITableViewCell.
- A UITableViewCell contains UI elements - Labels, Buttons, etc.

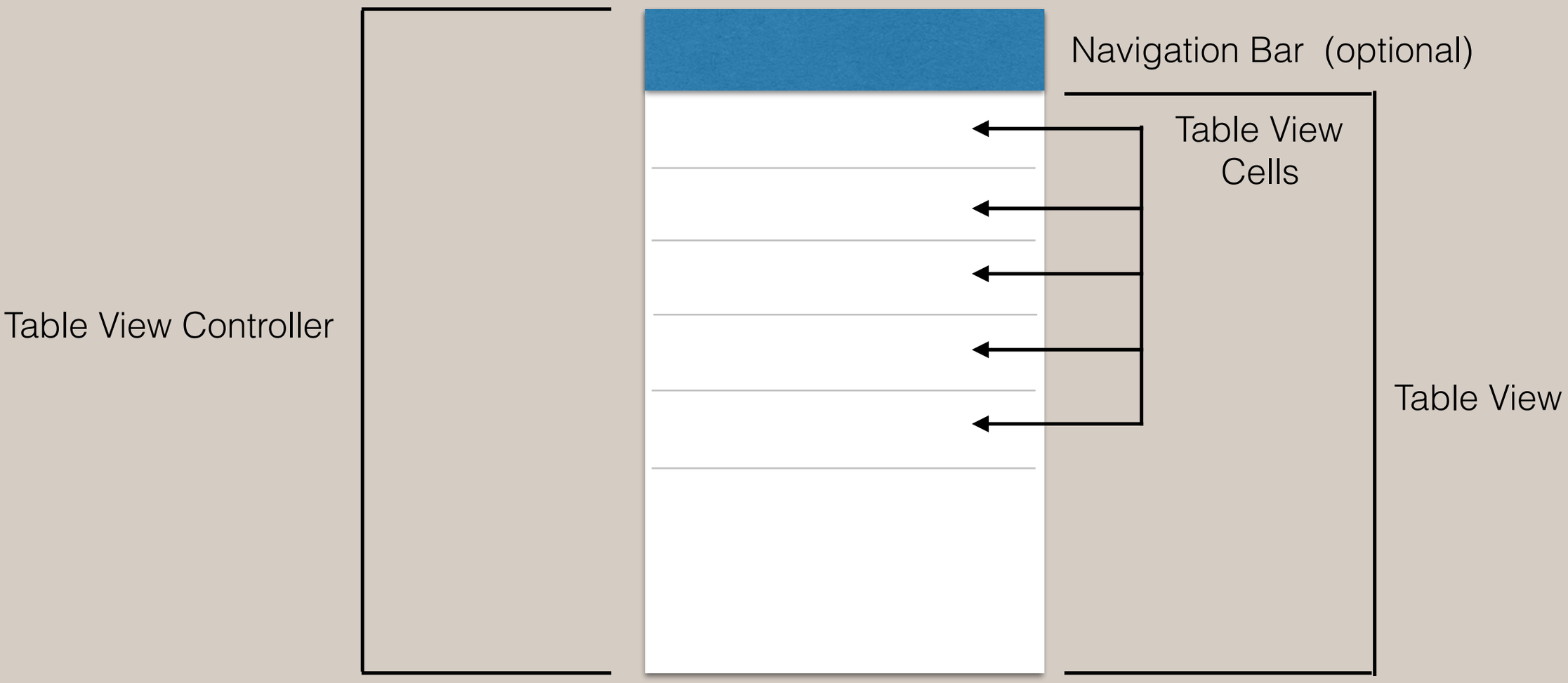


Table View Controllers

A UITableViewCell has a *style* property.

The pre-defined table view cell styles are:

Basic

Right Detail

Left Detail

Subtitle

There is also the *custom* table view cell style.

Table View Controllers

- A UITableViewCell contains UI elements - Labels, Buttons, etc.

- The outlet names for the text in the standard cell styles:
  - “Title” -> textLabel
  - “Detail” -> detailTextLabel

- The UILabel outlet names for the 4 standard cell styles:
  - Basic - textLabel
  - Right Detail - textLabel, detailTextLabel
  - Left Detail - textLabel, detailTextLabel
  - Subtitle - textLabel, detailTextLabel

Table View Controllers

So, how does data appear in a Table View?

By creating a custom UITableViewController or UITableView derived class and implementing the necessary protocol methods as defined in the *UITableViewDataSource* protocol.

Most importantly:

- numberOfSections
- numberOfRowsInSection
- cellForRowAtIndexPath

Table View Controllers

UITableViewController *conforms* to a number of protocols:

- The two most important in our case:
  - UiTableViewDataSource - methods used to get data into the table view
  - UITableViewDelegate - methods used to handle actions of the table view

```
class UITableViewController : UIViewController, UITableViewDelegate,
                              NSObjectProtocol, UIScrollViewDelegate,
                              UITableViewDataSource {

    init(style: UITableViewStyle)
    init!(nibName nibNameOrNil: String!, bundle nibBundleOrNil: NSBundle!)
    init!(coder aDecoder: NSCoder!)

    var tableView: UITableView!
    @availability(iOS, introduced=3.2)
    var clearsSelectionOnViewWillAppear: Bool // defaults to YES. If YES, any
                                              // selection is cleared in
                                              // viewWillAppear:


    @availability(iOS, introduced=6.0)
    var refreshControl: UIRefreshControl?
}
```

Table View Controllers

```
protocol UITableViewDataSource : NSObjectProtocol {
. . . . .

    func tableView(tableView: UITableView, numberOfRowsInSection section: Int) -> Int

    // Row display. Implementers should *always* try to reuse cells by setting each cell's
reuseIdentifier and querying for available reusable cells with dequeueReusableCellWithIdentifier:
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Table View Controllers

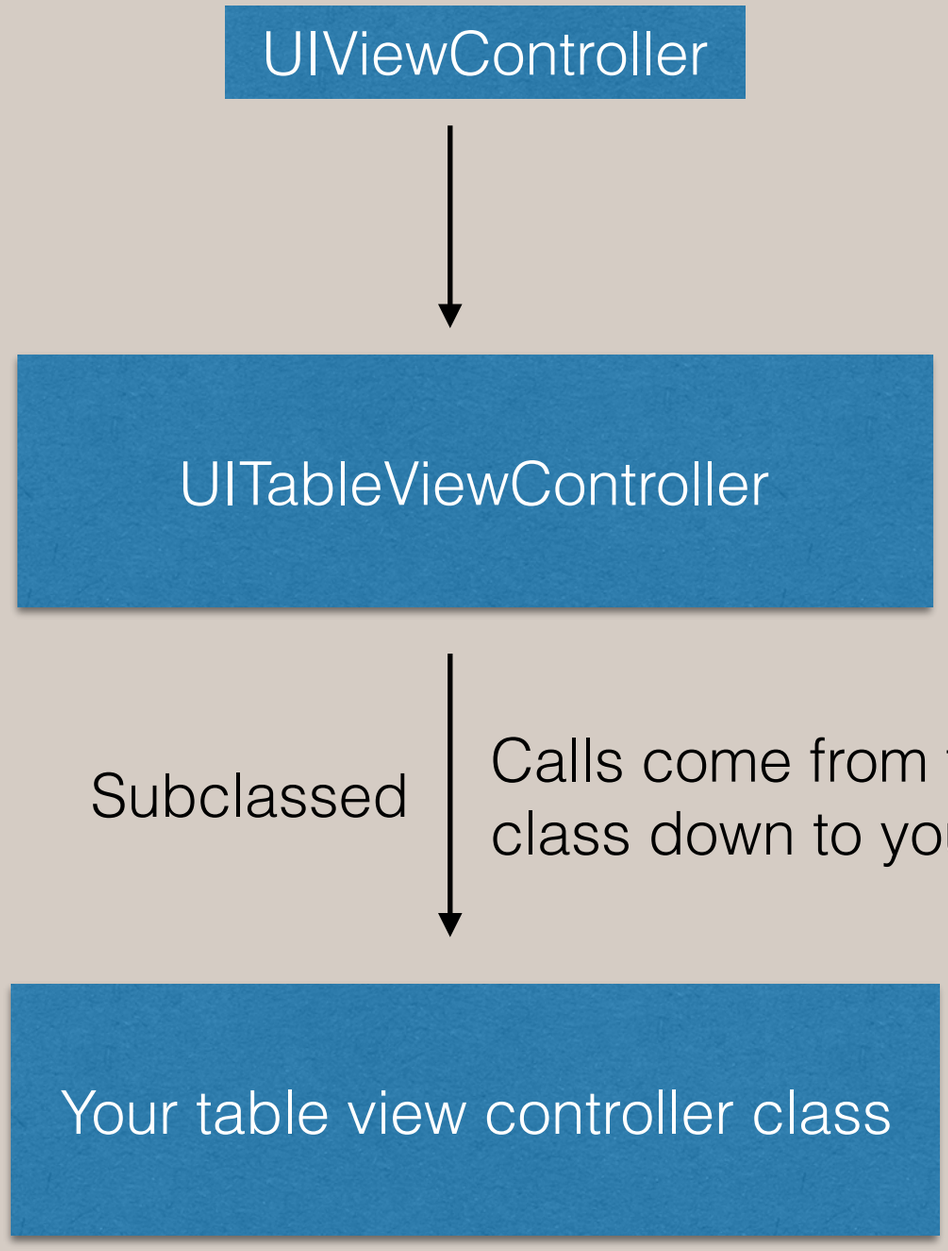


Table View Controllers

An app with a Table View Controller using the *Basic* predefined table view cell style:

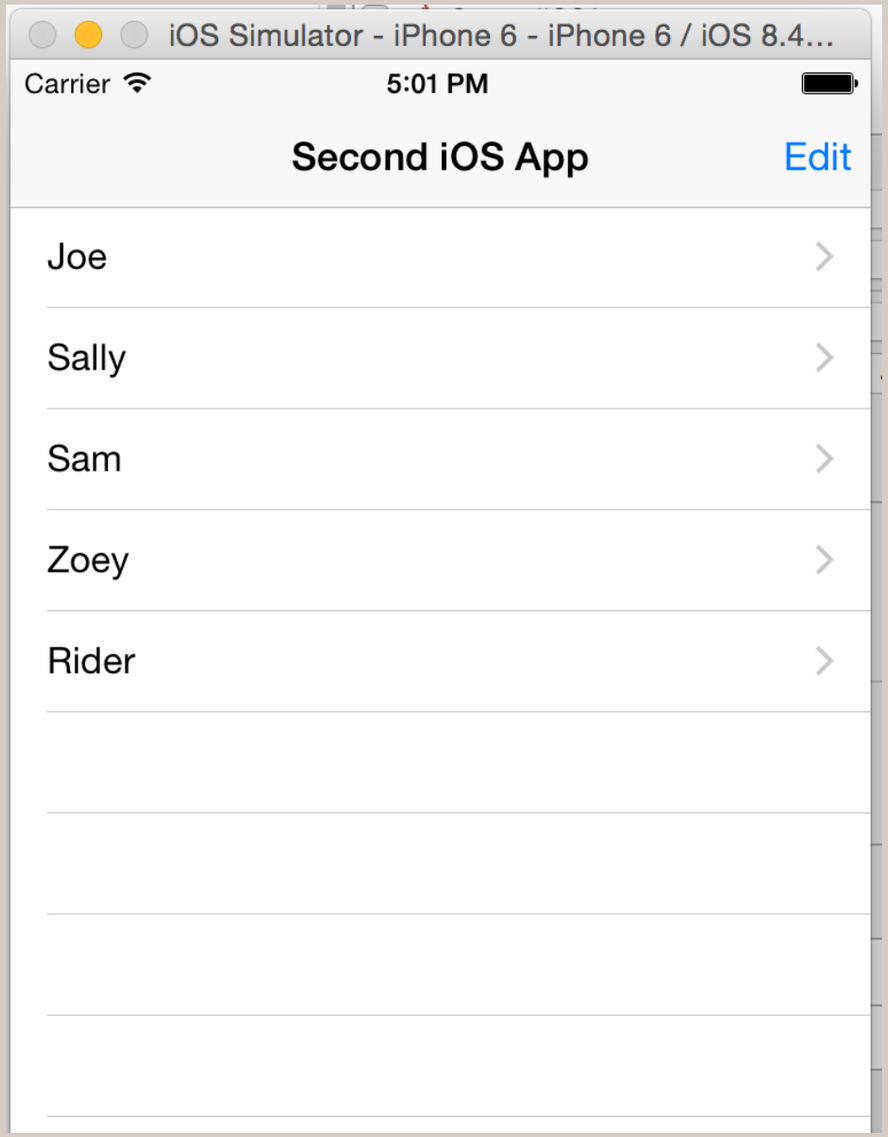


Table View Controllers

Basic use:

- Derive a new class from UITableViewController.
- Code generated will include method signatures for all required methods, and some commented out optional methods.
- Minimally, you fill in the necessary code in the required methods and data appears in the table.
- Two of the more important early decisions are:
  - Whether to make use of one of the base table view cell styles or create a custom cell layout.
  - The structure of the app's data model.

Navigation Controllers

Navigation Controllers

What are Navigation Controllers?

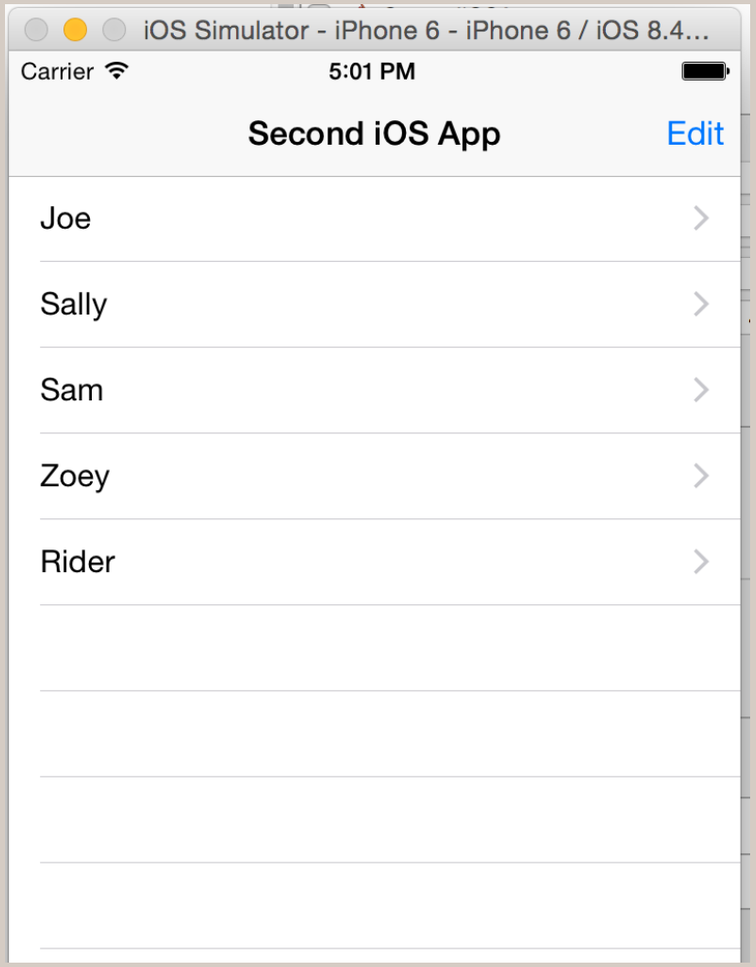
- Container controllers that contain some number of view controllers.
- The child view controllers are referenced in an internal array that is a list of view controllers that have been *pushed* onto the view controller stack - for display to the user; and *popped* from the view controller stack - for removal and display of the prior view controller.

Navigation Controllers

A typical app with a Navigation Controller:

- In this case, the detail view controller was *pushed* onto the view controller stack for display when the user touches one of the table rows

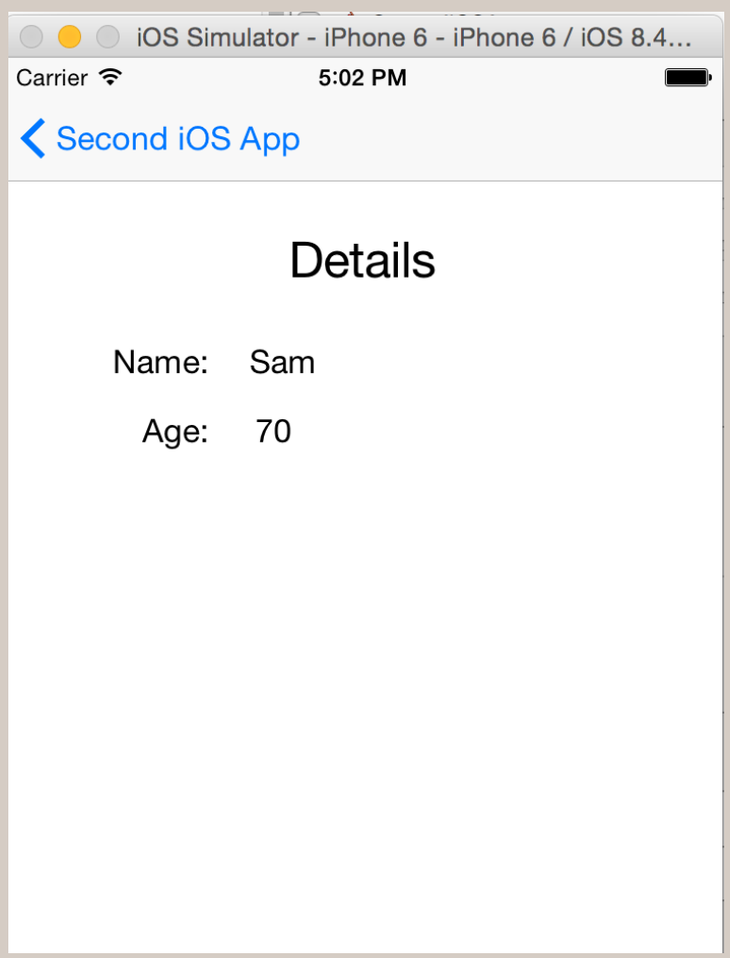
Table view controller



Pushed

Popped

Detail view controller



Navigation Controllers

How to set the navigation bar title:

In viewDidLoad: (either one works)

```
self.title = “Add Person”
self.navigationItem.title = “Add Person”
```

One way to set the back button text:

In viewDidLoad:

```
let barButton = UIBarButtonItem()
barButton.title = "Back"
navigationController!.navigationBar.topItem!.backBarButtonItem = barButton
```

Note: Be careful about the combined width of the title and back button text.

In-Class Exercise

In-Class Exercise

Create an iOS app that:

- Includes a Table view controller embedded in a Navigation controller
- Segues to a simple view controller when a table view cell is touched
- Each table view cell will be populated with data from an element of a data model

Homework 3

Homework 3

- Define an interface with:
  - A Table View controller.
  - A Navigation controller.
  - A View controller.
- Define constraints for each user interface element.
- Define a segue between the Table View controller and the View controller.
- Pass information from the Table View controller to the View controller, via prepare(for segue).