ES3 Lecture 5

InterfaceBuilder and UI development

Creating views programmatically

- The loadView method of a UIViewController subclass creates the view for the view controller
- Can add in UI components here
  - You have to manually specify properties like color, position, etc.

```
- (void) loadView {
    //Full size
    self.view = [[UIView alloc] initWithFrame:CGRectMake(0, 0, 320, 480)];

    UILabel *label = [[UILabel alloc] initWithFrame:CGRectMake(50, 50, 100, 20)];
    label.text = @"Test";
    [self.view addSubview:label];

    [label release]; // the view will hold onto a reference now
}
```

  - Remember, you must add the control to the **view** of the viewcontroller
- This can be very verbose
  - But some people prefer it because it involves less "*magic*"

Using InterfaceBuilder

- InterfaceBuilder is a visual editor for iPhone applications
  - Allows you to quickly and easily add and arrange views
  - These views are linked to objects in your code
- If you're making an app with conventional GUI components, InterfaceBuilder is the way to go
- Can seem a bit like magic
  - Connections between objects are not visible in source
  - NIB files store archived objects which store this data
- Once you get used to it, it's very powerful

InteFaceBuilder

- IB can create objects and store them in archives (NIB files)
- These objects can be connected to your code in several ways

  - **Outlet**: a reference to an IB object in your code
    - e.g. so you can set the text of a label

  - **Action**: a message that an IB object can send to your code
    - e.g. a message to be sent when a button is pushed

  - And other miscellaneous ways...
    - **Delegate**: an object in your code which is a delegate for an IB object
      - e.g. responding to actions on a table

    - **Data source**: an object that provides data for a view
      - e.g. a table data source can provide row entries when requested

NIB files

- NIB files (actually extension xib) store data from InterfaceBuilder

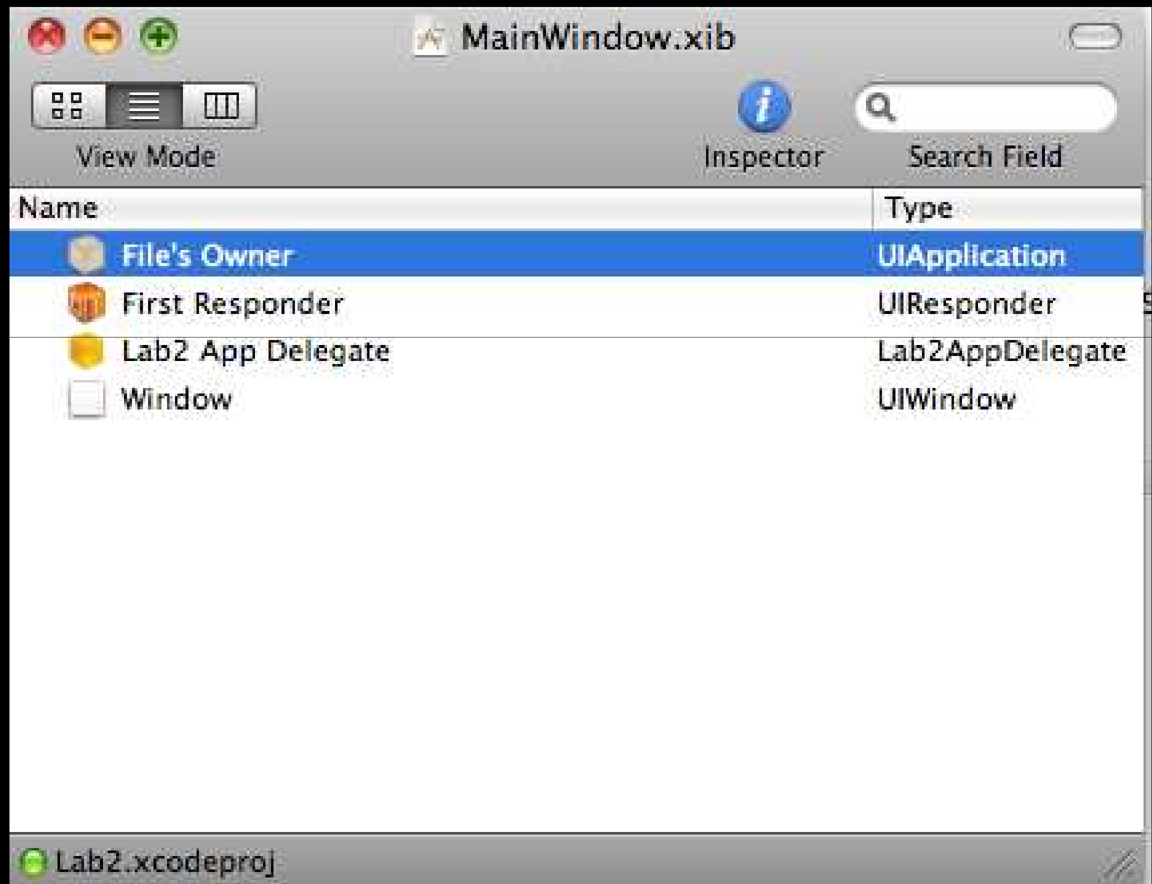
- You can open them in XCode, InterfaceBuilder will be launched
- When creating new UIViewController subclasses, XCode can create a blank NIB file and use it to create the viewController

```
UIViewController *controller = [[UIViewController alloc]
initWithNibName:@"mainview.xib"];
```

- **initWithNibName** initialises a viewcontroller and links it to an NIB file

- **mainwindow.xib** is automatically created as and linked to the main UIApplication

MainWindow.xib
View Mode
Inspector
Search Field
File's Owner
First Responder
Lab2 App Del...
Window
Lab2.xcodeproj


MainWindow.xib
View Mode
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UIApplication
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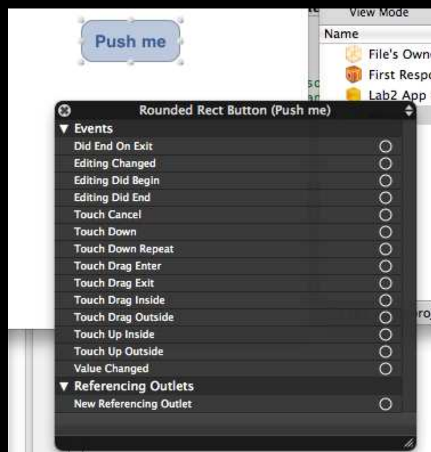
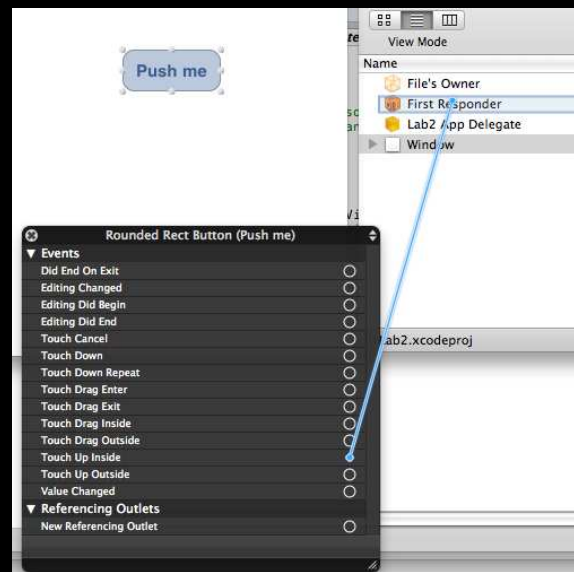
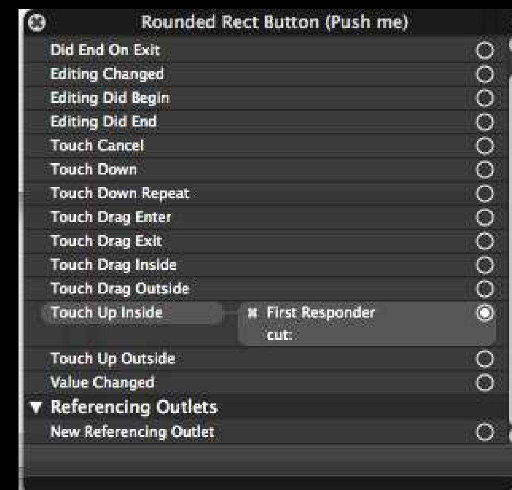
UIResponder
Lab2 App Delegate
Lab2AppDelegate
Window
UIWindow
Lab2.xcodeproj

Using InterfaceBuilder (II)

- Right-click (or control-click) to bring up the list of connections an object or UI component can make
  - drag to another object
  - a list of possible connections appear
  - click on the connection you want to make
    - If a connection doesn't appear the receiving object is not of the right type, or doesn't have methods or variables of the right type

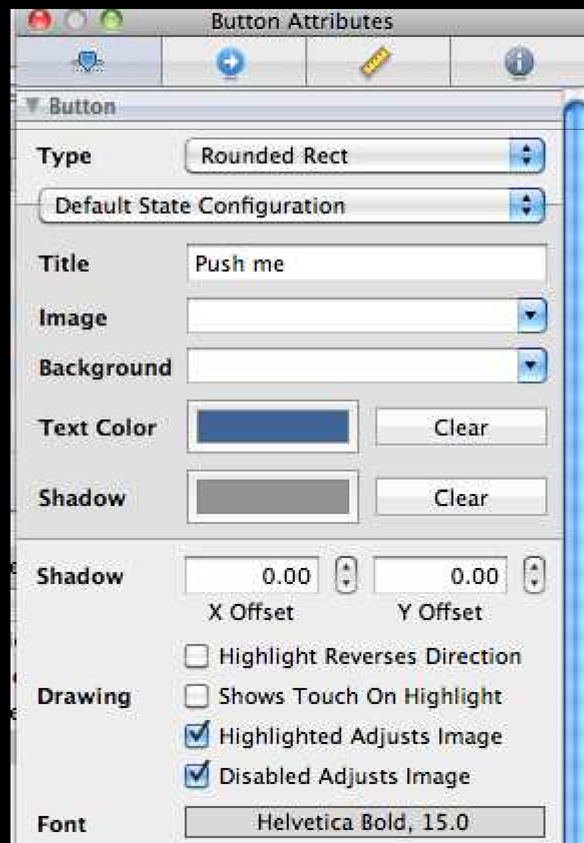


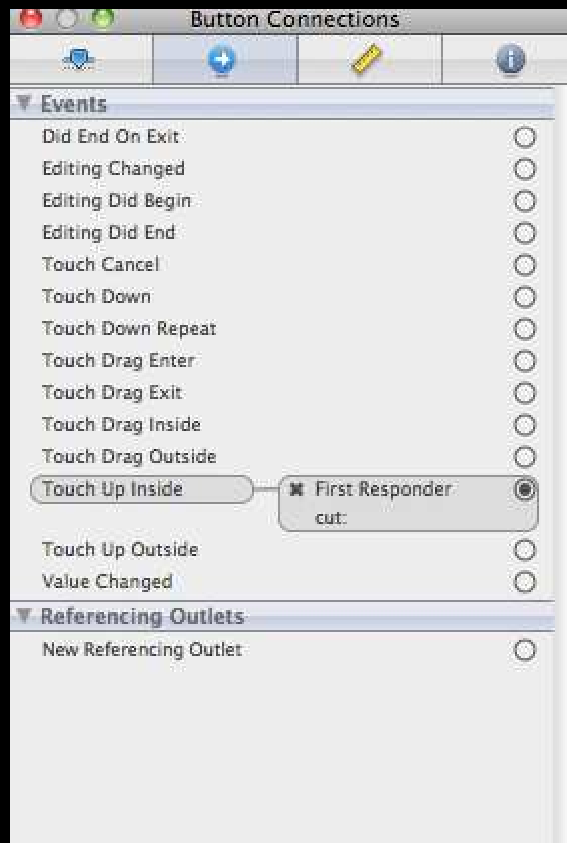


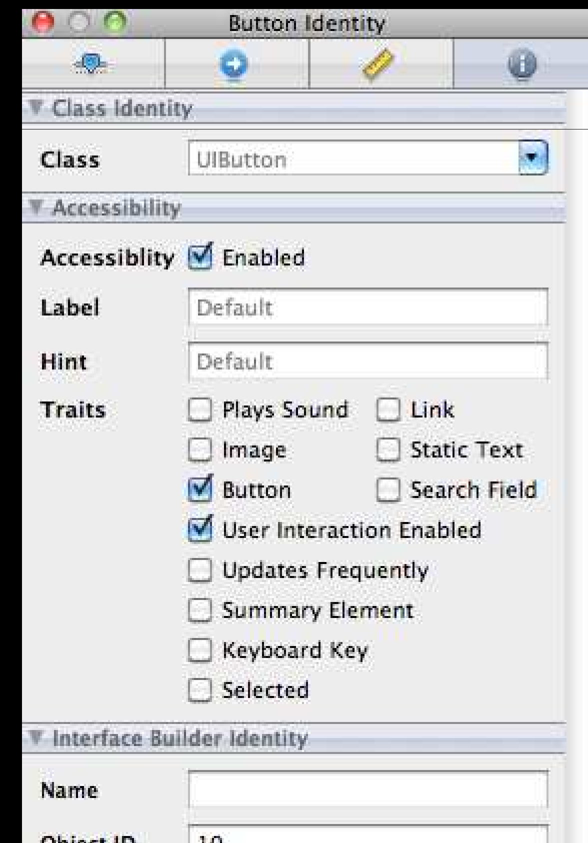


Using InterfaceBuilder (II)

- The inspector lets you set properties of objects and check connections
  - it has four panes -- third pane is just size information







Inspector panes

- The first pane (attributes) allows things like font, color, and other appearance attributes to edited without using any code
- The second (connections) shows a permanently available record of connections to and from this object
- The third has size and alignment options
- The fourth (identity) allows the class of the object to be set and various underlying attributes of the object to be accessed

IBAction and IBOutlet

- You can link instance variables and methods between your code and InterfaceBuilder

- Mark a method as an "action receiver" by making it of return type **IBAction**
  - InterfaceBuilder will then recognize it as a valid receiver of actions
  - you will be able to create connections from actions to an object with methods returning **IBAction**

```
- (IBAction) buttonPushed {
 // do something with a button push
}
```

- To link an object to an object in InterfaceBuilder, mark it's **property** with IBOutlet

```
 UILabel *myLabel;
 }

 @property (nonatomic, retain) IBOutlet UILabel *label;
```

IBOutlet

- You can then link a user interface component *of that type* in InterfaceBuilder

- **Note: Do not instantiate that object!**
  - **InterfaceBuilder creates an instance of the object and stores it in the NIB file**

- All linking the object to the interface component does is give you a reference that you can manipulate
  - e.g. setting the text of a label, reading the value of a slider

```
- (IBAction) buttonPushed
{
  myLabel.text = [NSString stringWithFormat:@"%f", mySlider.value];
}
```

Protocols

- InterfaceBuilder requires strict adherence to protocols

- IB checks whether objects are of the right type or conform to the protocol before it allows you to even create a connection
  - if a method is not marked IBAction, it won't appear as an option when connecting actions

  - if an outlet is not of the right type, a referencing connection cannot be made (it just won't appear)

  - components which have **delegate**s or **dataSource**s (like **UITableView)** must be linked to objects which conform to the appropriate protocol
    - **UITableViewDelegate, UITableViewDataSource, for example**

UIViewController

- Combines a **UIView** and **UIResponder**
  - **UIView** is the **view** property
  - UIViewController Inherits from **UIResponder**
    - **UIResponder** handles events (i.e. touches)

- **touchesBegan** message
  - indicates a finger has gone down

- **touchesEnded** message
  - indicates a finger has been lifted

- It is very common to use a subclass of **UViewController** as a "whole screen"
  - adding controls to the viewcontrollers view

UIViewController

- **loadView**
  - this is where construction of subviews should go
    - e.g. populating a form with buttons

- **viewDidLoad**
  - this message is sent after the view is loaded
  - other initialisation should go here
  - this is where initialisation should go if your are using InterfaceBuilder

- **UIViewControllers** also respond to screen rotation changes
  - portrait <-> landscape
  - see the API docs

Handling events

- Use target action
  - Tell a component which object to send messages to
  - Note that you need to specify what events you want to listen to:
    - UIControlEvent*
    - UIControlEventTouchUpInside / DownInside most common
    - also for drags, event changes, editing start and stopping

- This will send the message **doSomethingInteresting** to **self** (the view controller object in this case) when the user touches down then up on a button:

```
//Inside view controller's loadView
UIButton *pressMe = [[UIButton alloc] initWithFrame:CGRectMake(10,10,50,50)];
[pressMe addTarget:self action:@selector(doSomethingInteresting)
forControlEvents:UIControlEventTouchUpInside];
```

Responding to a button push

```
- (void) loadView
{

...

//Inside view controller's loadView
//pressMe is UIButton instance variable of this class
pressMe = [[UIButton alloc] initWithFrame:CGRectMake(10,10,50,50)];
[pressMe addTarget:self action:@selector(doSomethingInteresting)
forControlEvents:UIControlEventTouchUpInside];
}


- (void) doSomethingInteresting:(id)sender  {
  if(sender==pressMe) {
    doSomethingElse(); // doSomethingElse is called when finger goes up inside the
button
  }

}
```

The tag property

- Every UIView (include UIButton etc.) has a tag property
- This is a NSInteger which you can set so as to identify the control or group

```
- (void) doSomethingInteresting:(id)sender  {

  if([(UIView*)sender.tag intValue] == 60) {
    doSomethingElse(); // doSomethingElse is called when finger goes up inside any
control tagged with 60
  }

}
```

Text Entry

- **UITextField** is the basic text field component

- Text entry widgets need configuration on the iPhone
  - Different types of entry (numbers, words)
  - Different actions on finishing entering text

- You must also specify a delegate for the textfield object
  - This, at a minimum, must specify what to do when the return key is pressed
  - **If you don't set this, the virtual keyboard will never be dismissed!**

- You can set the type of entry in InterfaceBuilder
  - numeric or alphabetic
  - whether or not autocorrect is enabled
  - what capitalization rules to apply (first, never, all)

UITextFieldDelegate

```
//assume there is an instance variable myTextField

//self should conform to the UITextFieldDelegate protocol
myTextField.delegate = self; // you can also do this in InterfaceBuilder

- (BOOL)textFieldShouldReturn:(UITextField *)textField
{
  [textField resignFirstResponder]; // ESSENTIAL -- this dismisses the keyboard!
  // do something with the text...
  return YES;
}


// You can validate text by implementing this method

- (BOOL)textField:(UITextField *)textField
shouldChangeCharactersInRange:(NSRange)range replacementString:(NSString *)string
{
   if([self isValid:replaceString])
     return YES;
   else
     return NO;

  // can also directly correct the string in this method
}
```

Animation effects

- Easy support for animation effects
  - Key part of "flashy iPhone effect"
- Views (any UI component)... can be dynamically altered
  - Alpha
  - Coloring
  - Transform (rotation, position, scale)
- You simply set a target state and specify:
  - how long it will take
  - what curve to use (just linear, or with ease in/ease out)
  - whether it repeats
  - and a target/action to use when the animation finishes
- Then commit the animation and it will play in the background
  - Notified when it is complete

Animation effects

- Animations are done with **class methods** of UIView
  - Begin an animation with **[UIView beginAnimation]**
    - need to give a unique name, and a context -- usually nil for the context will do
  - End it with **[UIView commitAnimation]**
  - Specify all parameters between these two calls!

- Important things you can set
  - duration **[UIVIew setAnimationDuration:(double)d]** in seconds
  - repeats **[UIView setAnimationRepeatCount:(int)repeats]**
  - autoreversing **[UIView setAnimationRepeatAutoreverses:(BOOL)doesReverse]**
  - curve **[UIView setAnimationCurve:curveType]**
    - Interesting -- can have simple linear transitions, or ones which "ease in" or "ease out" or both
    - i.e. gradually accelerate or decelelate

  - when it happens **[UIView setAnimationStartDate:(NSDate) when]** or **[UIView setAnimationDelay:(double)seconds]**
    - default is to start immediately

Animation delgate

- Often need to tell when an animation stops or starts
  - Set a delegate inside the begin/commit block
  - set selectors for **setAnimationWillStartSelector / setAnimationWillStopSelector**

```
[UIView beginAnimations:@"myAnimation context:nil];

[UIView setAnimationDelegate:self];
[UIView setAnimationWillStopSelector:@selector(animationOver)];

[UIView commitAnimations];

// later...

- (void) animationOver
{
  // do something interesting, like reseting the
  // properties of the view

}
```

Example: A table view

- Tables are very common in iPhone applications
  - Often used full screen

- Tables can have text, images and controls
- Each cell is a **view**
  - **i.e. it can have contain other controls**

- Each table needs a delegate and a data source
  - **delegate**: messages relating to actions of tables are sent here
  - **dataSource**: this must provide the cells that populate the table

- NB cells are requested from the **dataSource** *as needed*
- *Must link the table to a delegate and dataSource, either in InterfaceBuilder or in your code*
  - Without a dataSource nothing will be drawn!

UITableViewDataSource

- Essential part of table construction
- Supplies data about the table
  - Number of sections
  - Number of rows in a section
  - The **cells** for each row
    - Note: cells are not strings, but general **views**
  - **A pool of cell objects is maintained and reused**
    - don't need to worry about this if you subclass UITableViewController in XCode

- **need to implement:**
  - **numberOfSectionsInTableView** -- return number of sections
  - **sectionTitleIndexTitlesForTableView --** return array of titles
  - **numberOfRowsInSection --** given a section number, return no. of rows
  - **cellForRowAtIndexPath --** return a cell given an index path (row + section)

UITableViewDelegate

- Responds to user interaction with the table
  - key messages
    - **didSelectRowAtIndexPath**
    - **didEndEditingRowAtIndexPath**
  - Sent when user selects or edits row respectively

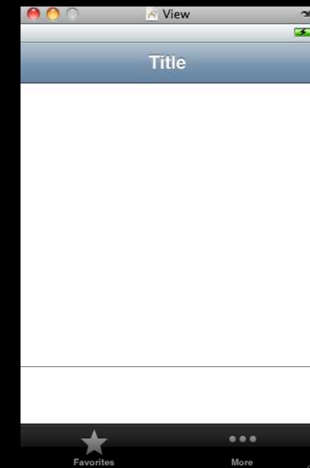
- Uses **NSIndexPath**
  - Represents a **section** and a **row**
  - Can be read from the **section** and **row** properties of the NSIndexPath instance
  - Construct with **[NSIndexPath indexPathForRow:row inSection:section]**

UITableViewController

- Combines a **UITableView** with **delegate** and **dataSource**
- Simple, all-in-one solution for fullscreen table views
    - Not very flexible, unsuitable for tables which are part of a larger interface
- Just override the necessary methods
    - XCode fills them in for you when you create a subclass of **UITableViewController**

UINavigationController

- Makes managing multi-page hierarchical views easy
- You can "push" a view onto a UINavigationController
  - and pop it off again



- Controller automatically creates a back button at top of screen
  - will automatically pop the view when pressed
- Use: create **UINavigationController** instance with a root view controller
  - this is view controller for the "base" page of the controller
- When you want to replace it with a new view, call **pushViewController**

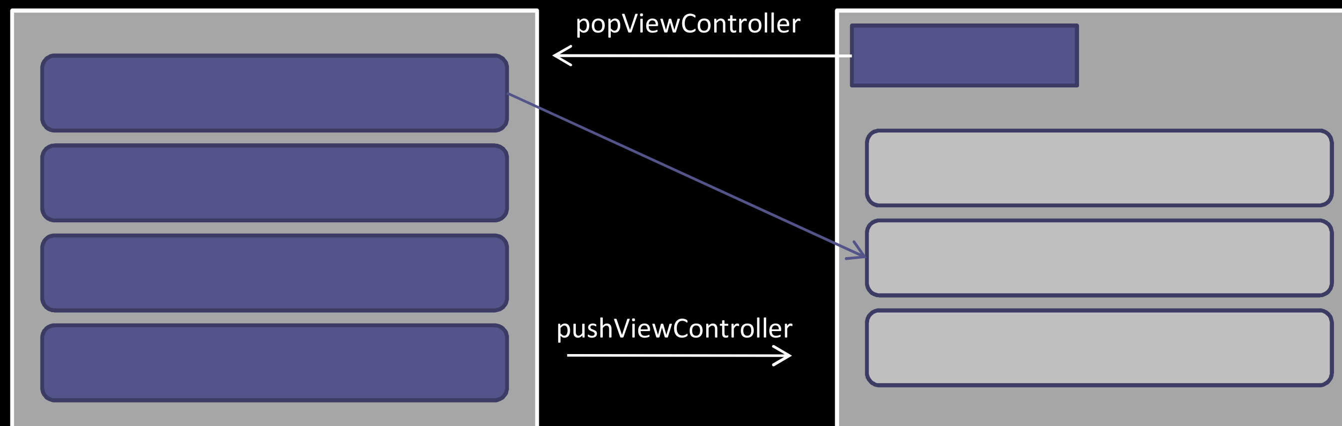
```
UINavigationController *navigationController = [[UINavigationController alloc]
initWithRootViewController:baseViewController];

// later

[navigationController pushViewController:newDisplay animated:YES];
```

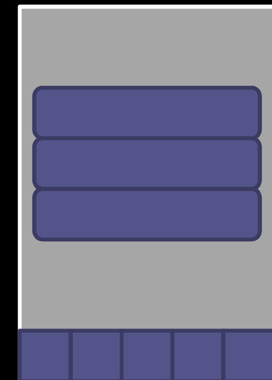
UINavigationController

- Can jump back to the root page by calling **popToRootViewControllerAnimated**
- Navigation bar visibility can be toggled with **setNavigationBarHidden**
- **UINavigationController** is excellent for navigation in conjunction UITableView
  - When the user selects a table element, drill down, and push on a new view with new more detailed table



UITabBarController

- An analogue of **UINavigationContoller**, but for for short linear lists, not hierarchies
  - (optionally) allows user to rearrange tab bar
- Displays a set of page tabs at the bottom
  - Each is linked to a view
- You can link them in code, or directly in InterfaceBuilder (using the Inspector)
  - Just create, and pass an **NSArray** of **UIViewControllers**
  - These will appear as tabs
- Has a **UITabBar** property, which in turn takes an array of **UITabBarItems**
  - Each tab bar item can have a title and an image
  - image should be 30x30 pixels



MapView

- Map view is a ready made widget for display maps
  - Provided by **MKMapView**

- **Many handy features**
  - Can center on current location (or other specified location)
  - Add, remove and select annotations (i.e. pins on the map)
  - Convert screen co-ordinates to and from world co-ordinates

  - Optionally allow user to zoom and pan the map

- Part of the **MapKit** framework -- you need to add it to your project, and import <MapKit/MapKit.h>

Using MapView

- Create an instance of MKMapView with the frame it's to go in
  - add it to your view controller

```
- (void) viewDidLoad { mapView = [[MKMapView alloc]
initWithFrame:self.view.bounds];
[self.view addSubview:mapView];
}
```

  - Show current location by setting **showsUserLocation** to **YES**
  - Drop a pin by using **addAnnotation**with a **MKPinAnnotationView** instance
    - Can make more complex annotations by subclassing **MKAnnotation**
  - Recenter with **setCenterCoordinate** or **setRegion** to set a visible region (sets zoom level too, based on a lat/long span)

```
//drops a pin somewhere near Glasgow...
self.mapView.showsUserLocation = YES;
MKPinAnnotationView *annotation = [[MKPinAnnotation alloc] init];
annotation.coordinate.latitude = 55.0;
annotation.coordinate.longitude = -4.0;
[self.mapView addAnnoation:annotation];
```

Dealing with Multitouch

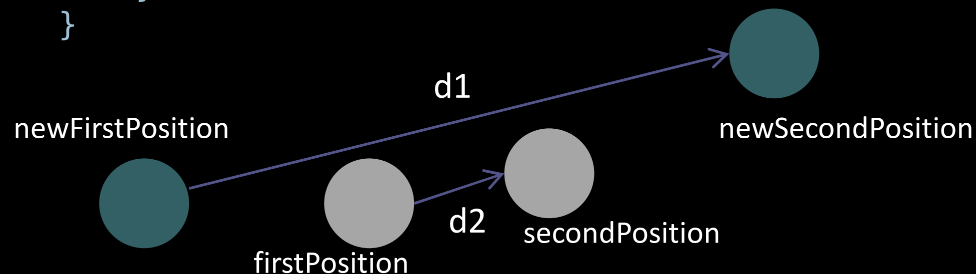
- Lots of iPhone applications make a big deal of multitouch
  - But there aren't any built in methods to deal with multitouch interaction
- You get **touchesBegan**, **touchesMoved** and **touchesEnded** calls
  - with a set of touches
    - assuming you set the view to respond to multitouch!
- Assume we want to make a stretch to scale gesture, *a la* the image viewer
- We need to record initial finger positions **when both fingers are down**
  - when they move, we need to update the scale appropriately
  - *note: UITouch objects persist throughout a multitouch interaction*
    - no longer, but that's enough...

Simple stretch gesture

```
// in the class definition
UITouch *firstTouch, *secondTouch;
CGPoint firstPosition, secondPosition;


- (void)touchesBegan:(NSSet *)touches withEvent:(UIEvent *)event {
    // get the touches on this control
    NSSet *touches = [event touchesForView];

    // only if we now have two touches (we ignore the first touchesBegan, where
the first finger went down)
    if(touches.count==2)   {
          NSEnumerator *touchEnumerator = [touches objectEnumerator];
          firstTouch = [touchEnumerator nextObject];
          secondTouch = [touchEnumerator nextObject];
          firstPosition = [firstTouch  locationInView:self];
          secondPosition = [secondTouch locationInView:self];
    }
}
```



Simple stretch gesture

```
- (void) touchesMoved:(NSSet *)touches withEvent:(UIEvent *)event {
 // get the touches on this control
    NSSet *touches = [event touchesForView];

    // if we have two touches, we must have had two-finger touchesBegan before
    if(touches.count==2)   {
          CGPoint newFirstPosition, newSecondPosition;
          newFirstPosition = [firstTouch locationInView:self];
          newSecondPosition = [secondTouch locationInView:self];

          double dx1,dx2,dy1,dy2,d1,d2;
          // compute distance
          dx1 = newFirstPosition.x - newSecondPosition.x;
          dx2 = firstPosition.x - secondPosition.x;
          dy1 = newFirstPosition.y - newSecondPosition.y;
          dy2 = firstPosition.y - secondPosition.y;
          d1 = sqrt(dx1*dx1+dy1*dy1);
          d2 = sqrt(dx2*dx2+dy2*dy2);

          // new scale is ratio of distances...
          self.scale = d1/d2;

    }

}
```

Summary

- InterfaceBuilder provides a way of visually connecting objects
  - actions send messages, marked **IBAction**
  - outlets make references to objects, marked **IBOutlet**
- Table views provide powerful table support
  - read data as needed from a dataSource
- Navigation controllers make it easy to manipulate a stack of "pages"
  - great for hierarchical viewing
- Tab bars provide simple multi-page interaction
- MapKit provides a ready made map viewer and annotation tool