iPhone Application Programming
Lecture 4: User Interface Design

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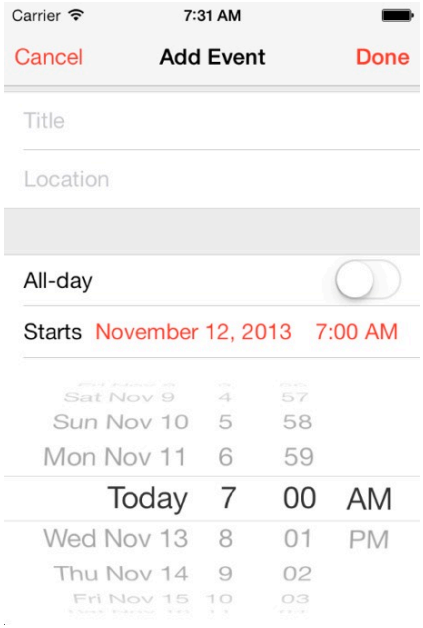
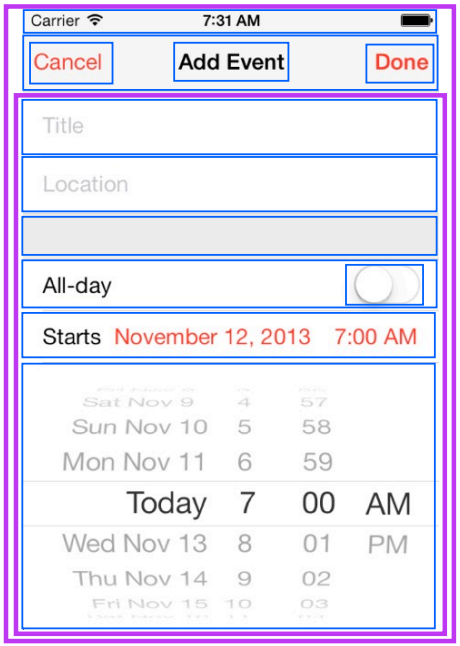
Winter Semester 2013/2014

http://hci.rwth-aachen.de/iphone

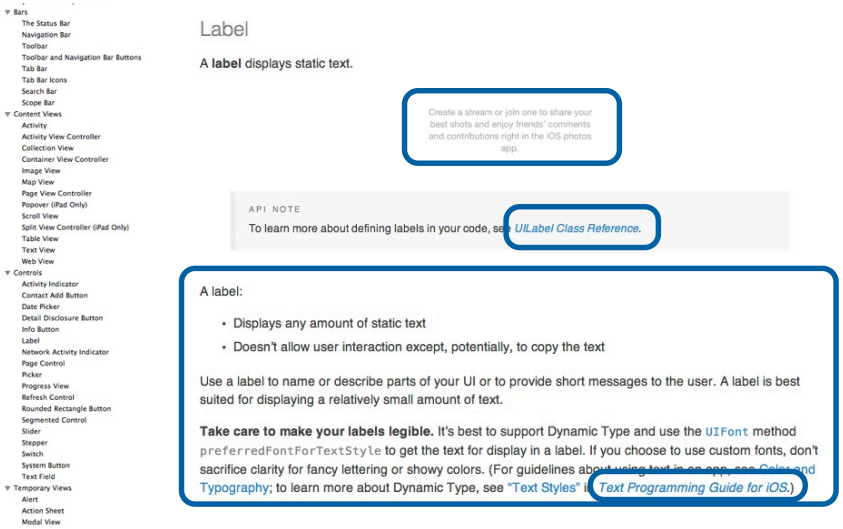
View Concepts

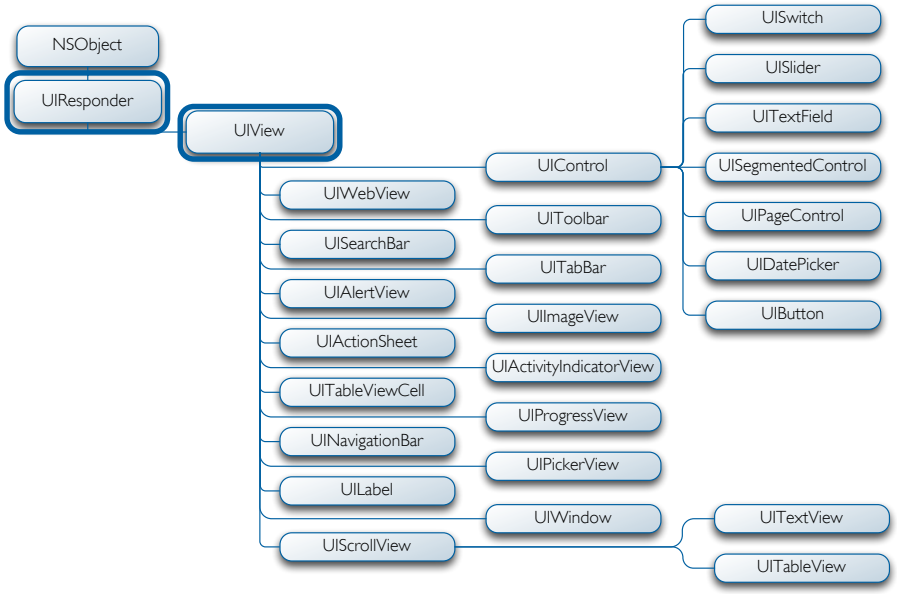
- SDK provide many types of Views to show your content
- At run-time Views are organized as a tree
- Use Interface Builder to design your UI and connect it to code
- Geometry of Views are determined by constraints





Finding the Right View





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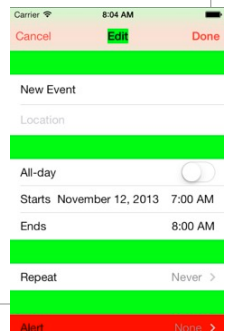
Demo: Hacking Calendar

```
(lldb) po [[UIWindow keyWindow] recursiveDescription]
<UIWindow
   | <UILayoutContainerView
   |    | <UINavigationTransitionView
   |    |    | <UIViewControllerWrapperView
   |    |    |    | <EKCalendarItemEditorTableView: 0xf870200; baseClass = UITableView;
   |    |    |    |    | <UITableViewWrapperView
   |    |    |    |    |    | <UITableViewCell: 0xb19ad90
   |    |    |    |
   |    |    |    ...
   |    |    |
   |    | <UINavigationBar
   |    |    |
   |    |    |    ...
   |    |    |
   |    |    | <UINavigationItemView
   |    |    |    | <UILabel
   |    |    | <UINavigationButton
   |    |    |    ...

(lldb) expr ((UIView *)0xb19ad90).backgroundColor = [UIColor redColor]
(lldb) expr ((UIView *)0xf870200).backgroundColor = [UIColor greenColor]
```



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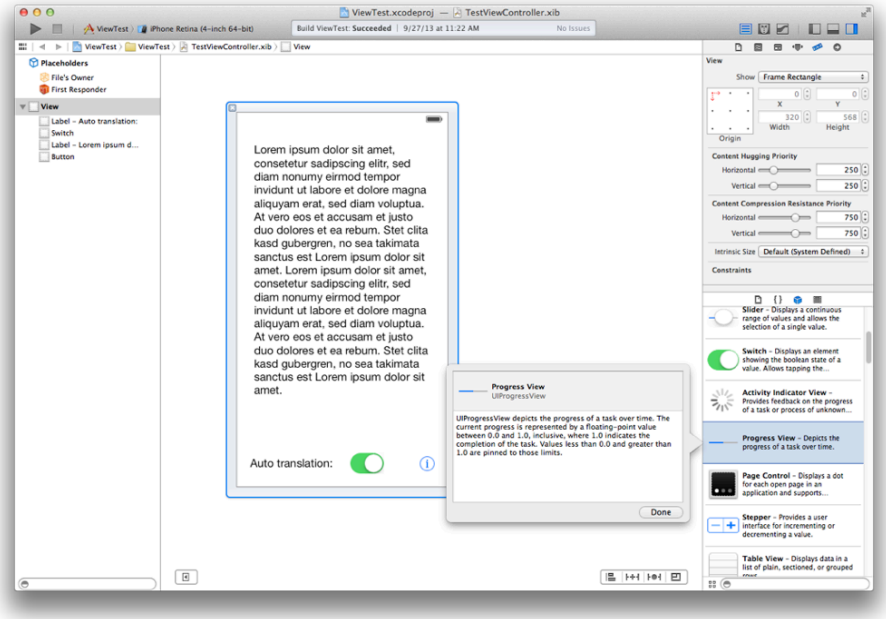
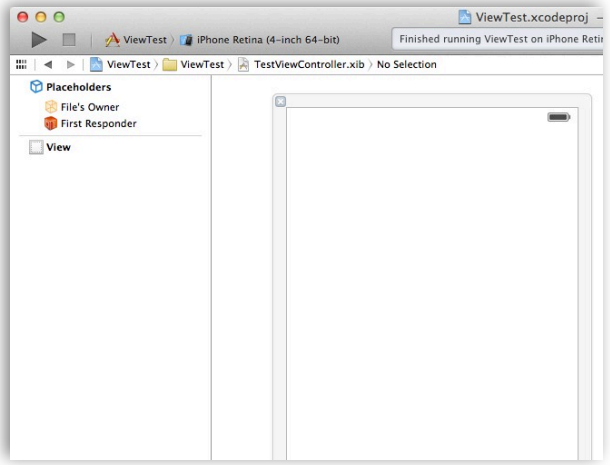


Interface Builder

- Graphical tool to layout user interfaces
- Create the widget hierarchy
- Set attributes of widgets
- Set up connections between the widgets
- Store these informations in nib files

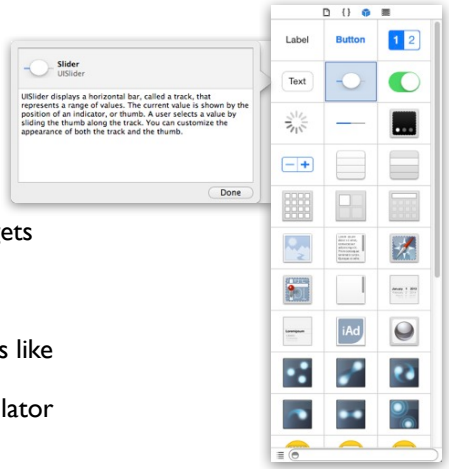
The Anatomy of a xib File



The Source of a xib

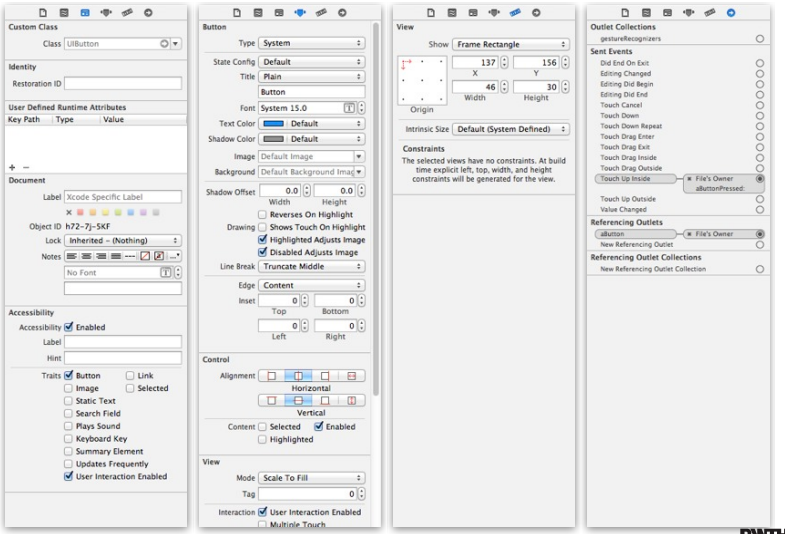
```
<?xml version="1.0" encoding="UTF-8"?>
<archive type="com.apple.InterfaceBuilder3.CocoaTouch.XIB" version="8.00">
    <data>
        <int key="IBDocument.SystemTarget">1280</int>
        <string key="IBDocument.SystemVersion">11C74</string>
        <string key="IBDocument.InterfaceBuilderVersion">1938</string>
        <string key="IBDocument.AppKitVersion">1138.23</string>
        <string key="IBDocument.HIToolboxVersion">567.00</string>
        <object class="NSMutableDictionary" key="IBDocument.PluginVersions">
            <string key="NS.key.0">com.apple.InterfaceBuilder.IBCocoaTouchPlugin</string>
            <string key="NS.object.0">933</string>
        </object>
        <array key="IBDocument.IntegratedClassDependencies">
            <string>IBUITextView</string>
            <string>IBUISwitch</string>
            <string>IBUIButton</string>
            <string>IBUIView</string>
            <string>IBUILabel</string>
            <string>IBProxyObject</string>
        </array>
        <array key="IBDocument.PluginDependencies">
            <string>com.apple.InterfaceBuilder.IBCocoaTouchPlugin</string>
        </array>
        <object class="NSMutableDictionary" key="IBDocument.Metadata">
            <string key="NS.key.0">PluginDependencyRecalculationVersion</string>
            <integer value="1" key="NS.object.0"/>
        </object>
        <array class="NSMutableArray" key="IBDocument.RootObjects" id="1000">
            <object class="IBProxyObject" id="841351856">
                <string key="IBProxiedObjectIdentifier">IBFilesOwner</string>
                <string key="targetRuntimeIdentifier">IBCocoaTouchFramework</string>
            </object>
            <object class="IBProxyObject" id="371349661">
                <string key="IBProxiedObjectIdentifier">IBFirstResponder</string>
                <string key="targetRuntimeIdentifier">IBCocoaTouchFramework</string>
            </object>
            <object class="IBUIView" id="474857037">
                <reference key="NSNextResponder"/>
                <int key="NSvFlags">292</int>
                <array class="NSMutableArray" key="NSSubviews">
                    <object class="IBUITextView" id="694905917">
                        <reference key="NSNextResponder" ref="474857037"/>
                        <int key="NSvFlags">274</int>
                        <string key="NSFrame">{{20, 20}, {280, 385}}</string>
                        <reference key="NSSuperview" ref="474857037"/>
```


Laying out the User Interface



- The library contains all UI Widgets
- Drag them to your view
- See instantly what your UI looks like
- Test your UI in the iPhone Simulator

Set Widget Attributes



Connecting Widgets and Code

- IBActions
  - Tags a method as a target for an interface action
- IBOutlets
- IBOutletCollection
  - Variables to populate with objects from a nib file

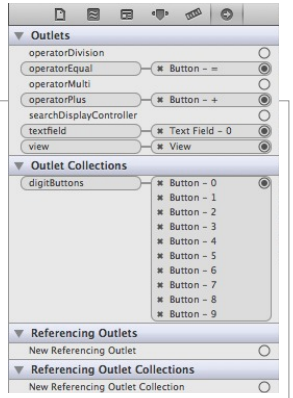
Connecting Widgets and Code

```
@interface iCalcView: UIView {

}

- (IBAction)addDigit:(id)sender;
- (IBAction)calculateResult:(id)sender;


//declared properties
//textfield
@property (nonatomic,weak) IBOutlet UITextField *textfield;
//operators: + =
@property (nonatomic,weak) IBOutlet UIButton *operatorPlus
@property (nonatomic,weak) IBOutlet UIButton *operatorEqual;
//digits
@property (nonatomic,weak) IBOutletCollection (UIButton) NSArray* digitButtons;
```



Interface Builder Demo

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Auto Layout

- Preferred layout management
- Allows you to create views that work both in portrait and landscape mode
- Available in iOS 6 and higher
- Spatial relationships expressed by constraints

Auto Layout Constraints

- Constraints are mathematical expressions
  - <=, ==, =>
- Constraints have a priority level
- The runtime tries to solve the system of equations

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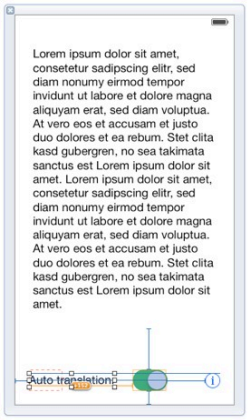
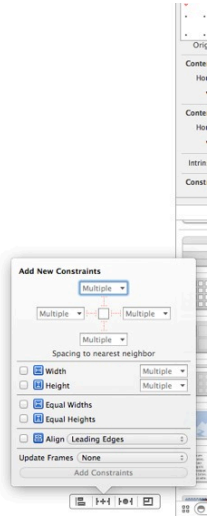
Adding Constraints





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Review

- A calendar app reminds user of a scheduled event
- A news reader app loads updates in background and updates the UI upon completion
- An app determines a path for an image that is shipped with the app itself
- Base class for objects that respond to UI events
- Base class for managing screen content

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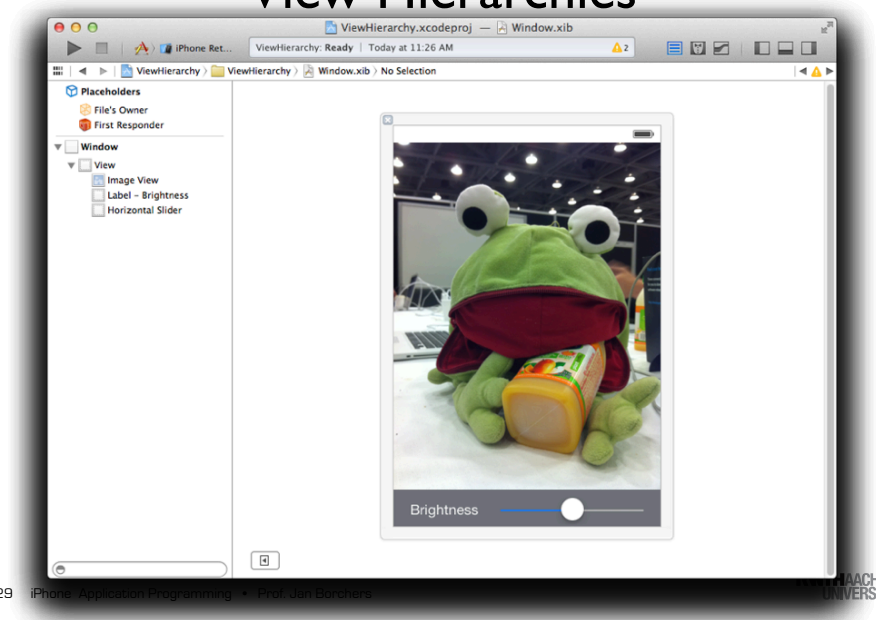
View Programming

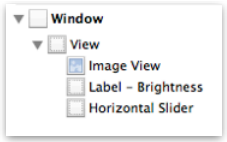
UIView

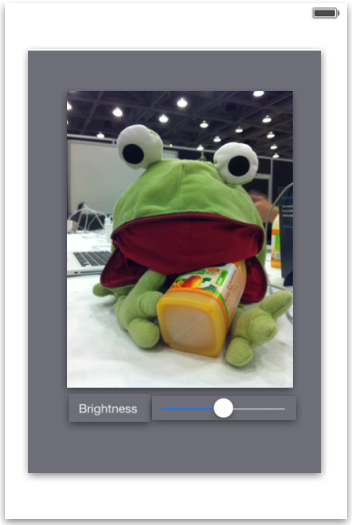
- Defines a rectangular area on the screen
- Two responsibilities
  - Render content
  - React to user input
  - Manage subviews
- Layout as view hierarchy

View Hierarchies

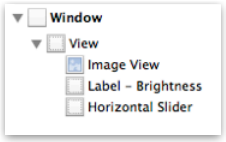


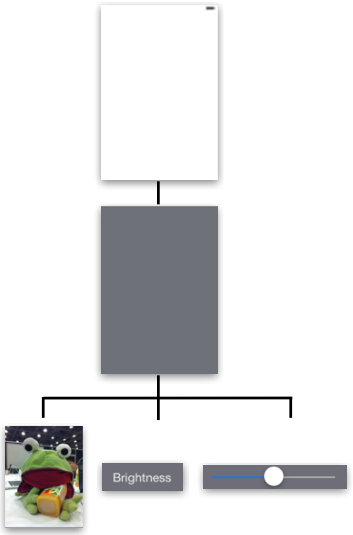
View Hierarchies





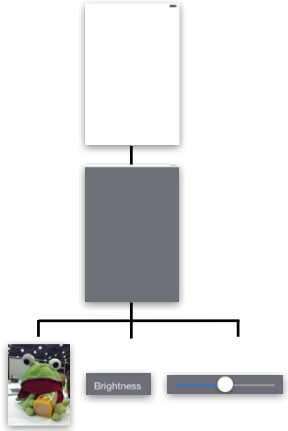
View Hierarchies





Managing Views

- addSubview
- insertSubview:atIndex:
- insertSubview:aboveSubview:
- removeFromSuperview
- bringSubviewToFront:
- sendSubviewToBack:
- exchangeSubviewAtIndex:withSubviewAtIndex:



View Coordinate System

- Origin at top-left corner
- Coordinates use points as unit
  - iPhone: 320x480
  - iPhone 5: 320x568
  - iPad: 768x1024

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View Geometry

- Frame
  - A rectangle with origin and size relative to the superview
- Bounds
  - A rectangle with origin (0,0) and the size of the view
- Center
  - The center point of the frame rectangle

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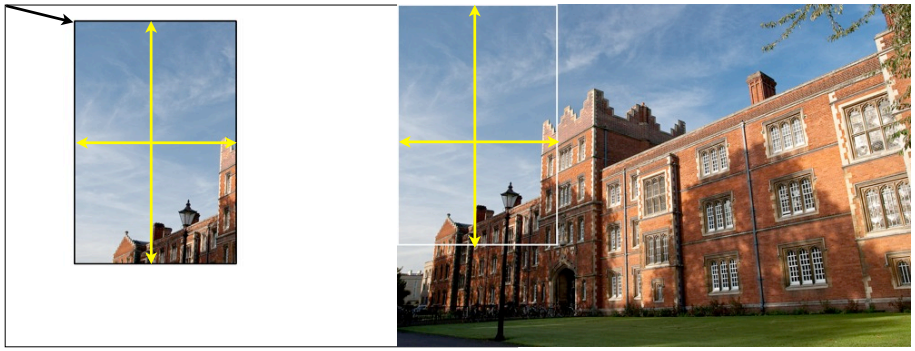
Frame vs. Bounds



Frame (looking from outside)
Origin: (140.0,35.0)
Size: (320.0,480.0)

Bound (looking from the view itself)
Origin: (0.0,0.0)
Size: (320.0,480.0)

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Setting Values

- Setting `frame`:
  - `bounds` matches the size
  - `center` is adjusted
- Setting `center`:
  - The origin of `frame` is set accordingly
- Setting the size of `bounds`
  - The size of `frame` is set accordingly

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Content Modes & Scaling

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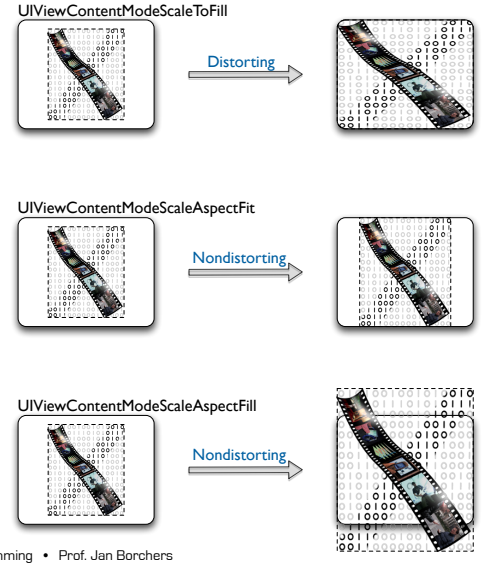
Content Mode



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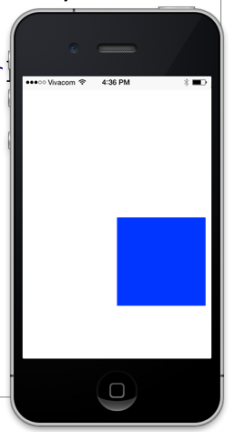
Creating Views

```
// Create a view with blue background
CGRect viewFrame = CGRectMake(160, 240, 150, 150);
UIView *blueView = [[UIView alloc]
initWithFrame:viewFrame];
blueView.backgroundColor = [UIColor blueColor];

// add it to the main window
[window addSubview:blueView];
```



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Subclassing UIView

```
// Only override drawRect: if you perform custom drawing.
// An empty implementation adversely affects performance during animation.
- (void)drawRect:(CGRect)rect {}

   [view setNeedsDisplay];

// Overridden by subclasses to layout subviews when layoutIfNeeded is
invoked.
// The default implementation of this method does nothing
- (void)layoutSubviews{}


   [view setNeedsLayout];
```

Lecture 6

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Reaction to Events

- Adjust properties of the view and its subviews
- Mark the view as needing a change in its layout
- Mark the view as needing to be redrawn
- Notify a controller that data has changed

Scroll Views

- Container view
- Displays content larger than the app window
- Support for scrolling
- Support for zooming

UIScrollView

```
UIScrollView *scrollView = [[UIScrollView alloc]
initWithFrame:window.bounds];
[window addSubview:scrollView];
// window retains its subview, thus we can release the view here
[scrollView release];

CGRect contentFrame = CGRectMake(0.,
                                 0.,
                                 window.bounds.size.width*2.,
                                 window.bounds.size.height*2.);

scrollView.contentSize = contentFrame.size;
scrollView.contentOffset = window.center;


// add the content view
[scrollView addSubview:aView];
```


UIScrollView: Zooming

```
// Enable zooming
scrollView.minimumZoomScale = 0.5;
scrollView.maximumZoomScale = 2.5;
scrollView.delegate = self;


#pragma mark ScrollView delegate methods

- (UIView*)viewForZoomingInScrollView:(UIScrollView *)scrollView;
{
  return [window viewWithTag:1];

}
```

Summary

- Interface Builder
- UIView
- View hierarchies

- Reading Assignment:
  - View Programming Guide
  - Interface Builder User Guide
  - UIView Class Reference
    - Taking control of Auto Layout in Xcode 5 WWDC2013

UIViewController

- Manages typically one screen
- Flushes the view on low-memory situations
- Resizes the view on orientation change
- Creates modal views on top of the current view