An Introduction to Xamarin.Forms

Getting Started with Cross Platform User Interfaces

Overview

Xamarin.Forms is a framework that allows developers to rapidly create cross platform user interfaces. It provides it's own abstraction for the user interface that will be rendered using native controls on iOS, Android, or Windows Phone. This means that applications can share a large portion of their user interface code and still retain the native look and feel of the target platform.

Xamarin.Forms are written in C# and allow for rapid prototyping of applications that can evolve over time to complex applications. Because Xamarin.Form applications are native applications, they do not have the limitations of other toolkits such as browser sandboxing, limited APIs, or poor performance. Applications written using Xamarin.Forms are able to utilize any of the API's or features of the underlying platform, such as (but not limited to) CoreMotion, PassKit, and StoreKit on iOS; NFC and Google Play Services on Android; and Tiles on Windows Phone. This also means it is possible to create applications that will have parts of their user interface created with Xamarin.Forms while other parts are created using the native UI toolkit.

Xamarin.Forms applications are architected in the same way as traditional cross-platform applications. The most common approach is to use Portable Libraries or Shared Projects to house the shared code, and then create platform specific applications that will consume the shared code.

There are two techniques to create user interfaces in Xamarin.Forms. The first one is to create UI views entirely with source code using the rich API provided by Xamarin.Forms. The other option available is to use *Extensible Application Markup Language* (XAML), a declarative markup language from Microsoft that is used to describe user interfaces. The user interface itself is defined in an XML file using the XAML syntax, while run time behaviour is defined in a separate code-behind file. To learn more about XAML, please read Microsoft's XAML Overview documentation on What is XAML.

This guide will discuss the fundamentals of the Xamarin.Forms framework. It will cover the following topics:

- Installing Xamarin.Forms.
- Setting up a Xamarin.Forms solution in Visual Studio or Xamarin Studio.
- How Xamarin.Forms pages and controls are used.
- How to navigate between pages.

- How to set up data binding.

Requirements

Xamarin.Forms applications can be written for the following mobile operating systems:

- Android 4.0 or higher
- iOS 6.1 or higher
- Windows Phone 8 (using Visual Studio)

Xamarin.Forms also requires the Windows Phone Toolkit for some of its controls (such as the DatePicker) and animations.

It is assumed that the developer has familiarity with Portable Class Libraries and Shared Projects.

Getting Started with Xamarin Forms

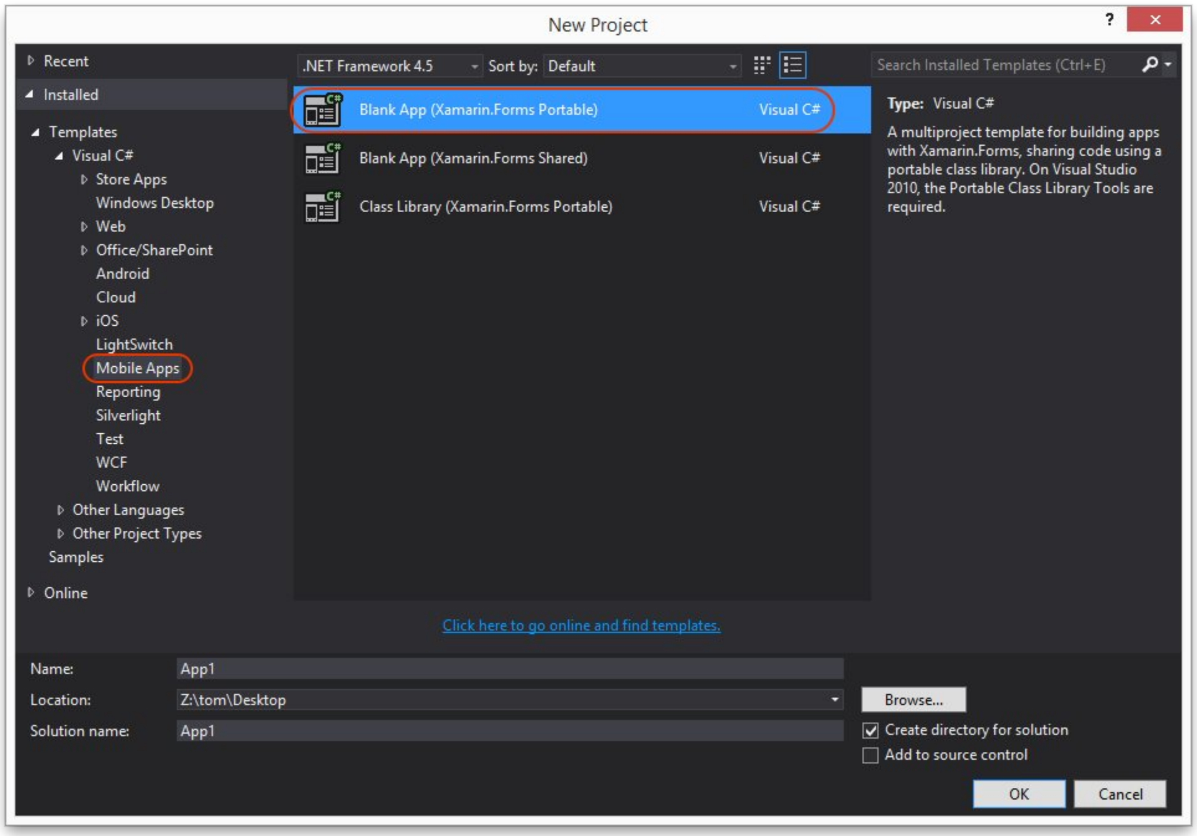
As discussed above, Xamarin.Forms is implemented as a .NET Portable Class Library (*PCL*), which makes it very easy to share the Xamarin.Forms API's across a variety of platforms. The first step to getting started is to create a solution for the various projects that will make up the application.

A Xamarin.Forms solution can be created in Xamarin Studio or Visual Studio and will typically contain the following projects:

- **Portable Library** - This project is the cross platform application library that holds all of the shared code and share UI.
- **Xamarin.Android Application** - This project holds Android specific code and is the entry point for Android applications.
- **Xamarin.iOS Application** - This project holds iOS specific code and is the entry point for iOS applications.
- **Windows Phone Application** - This project holds the Windows Phone specific code and is the entry point for Windows Phone applications.

Xamarin 3.0 provides templates that will create a complete solution with all of the necessary projects for a Xamarin.Forms application.

In Visual Studio, select File > New > Project. In the New Project Dialog that appears, click on Templates > Visual C# > Mobile Apps, and select the Blank App (Xamarin.Forms Portable) project in the centre of the dialog. An example of this can be seen in the following screenshot:



Blank App (Xamarin.Forms Portable)	Visual C#
Blank App (Xamarin.Forms Shared)	Visual C#
Class Library (Xamarin.Forms Portable)	Visual C#

Type: Visual C#

A multiproject template for building apps with Xamarin.Forms, sharing code using a portable class library. On Visual Studio 2010, the Portable Class Library Tools are required.

Name: App1

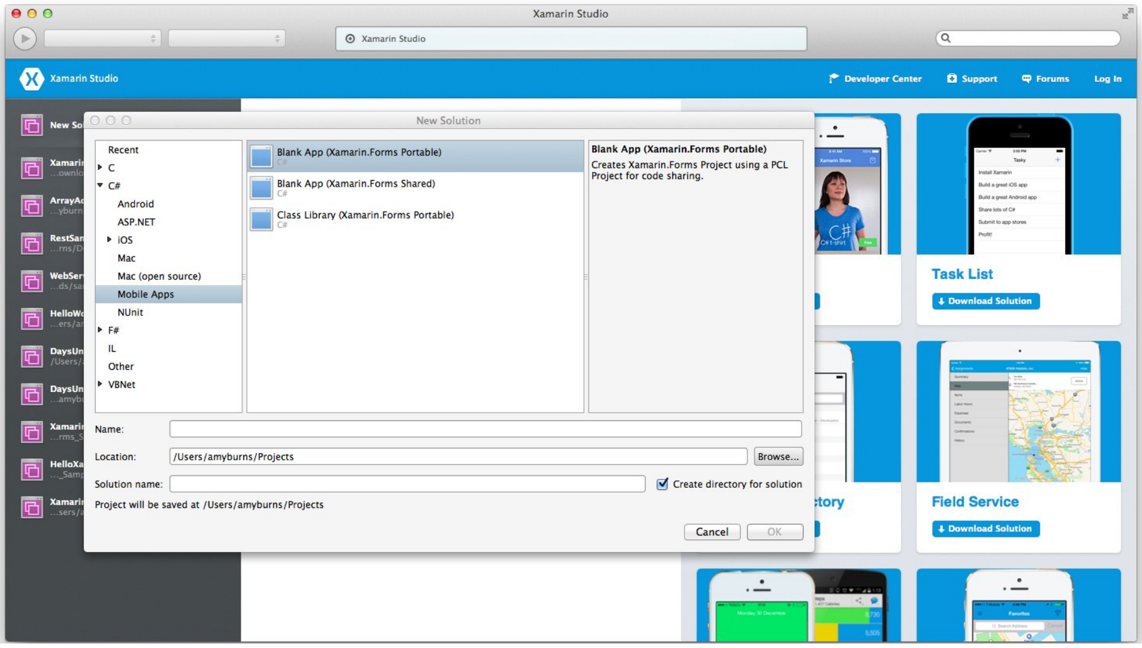
Location: Z:\tom\Desktop

Solution name: App1

[✓] Create directory for solution

[ ] Add to source control

In Xamarin Studio Studio, select File > New > Solution. In the New Solution dialog that appears, click on C# > Mobile Apps, and select the Blank App (Xamarin.Forms Portable) project in the centre of the dialog. An example of this can be seen in the following screenshot:



Blank App (Xamarin.Forms Portable)
C#

Blank App (Xamarin.Forms Shared)
C#

Class Library (Xamarin.Forms Portable)
C#

Blank App (Xamarin.Forms Portable)

Creates Xamarin.Forms Project using a PCL Project for code sharing.

Name:

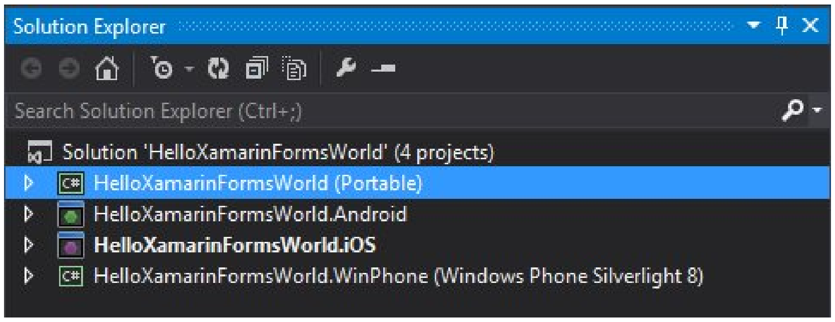
Location: /Users/amyburns/Projects

Solution name:

[✓] Create directory for solution

Project will be saved at /Users/amyburns/Projects

Enter the name of the project and click the OK button. The template will create a new solution with four projects in it. The following screenshots depict the solution:

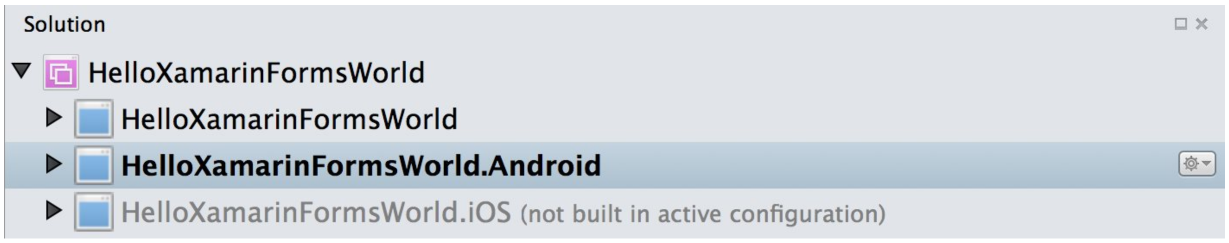


Solution Explorer

Search Solution Explorer (Ctrl+;)

Solution 'HelloXamarinFormsWorld' (4 projects)
HelloXamarinFormsWorld (Portable)
HelloXamarinFormsWorld.Android
HelloXamarinFormsWorld.iOS
HelloXamarinFormsWorld.WinPhone (Windows Phone Silverlight 8)

Enter the name of the project and click the OK button. The template will create a new solution with three projects in it. The following screenshots depict the solution:

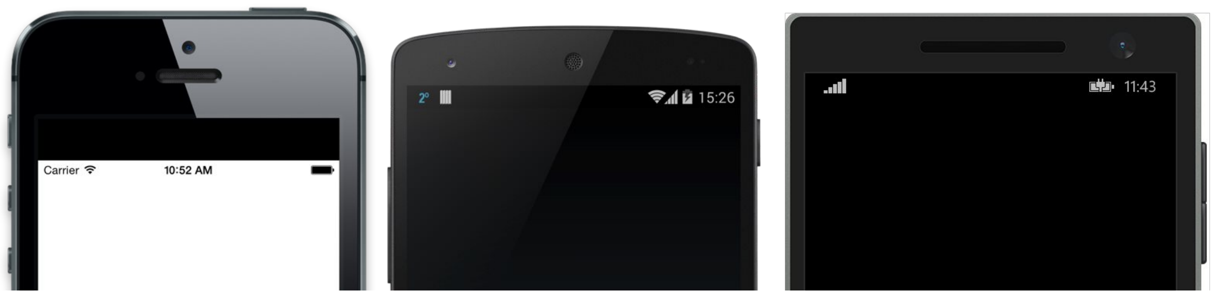


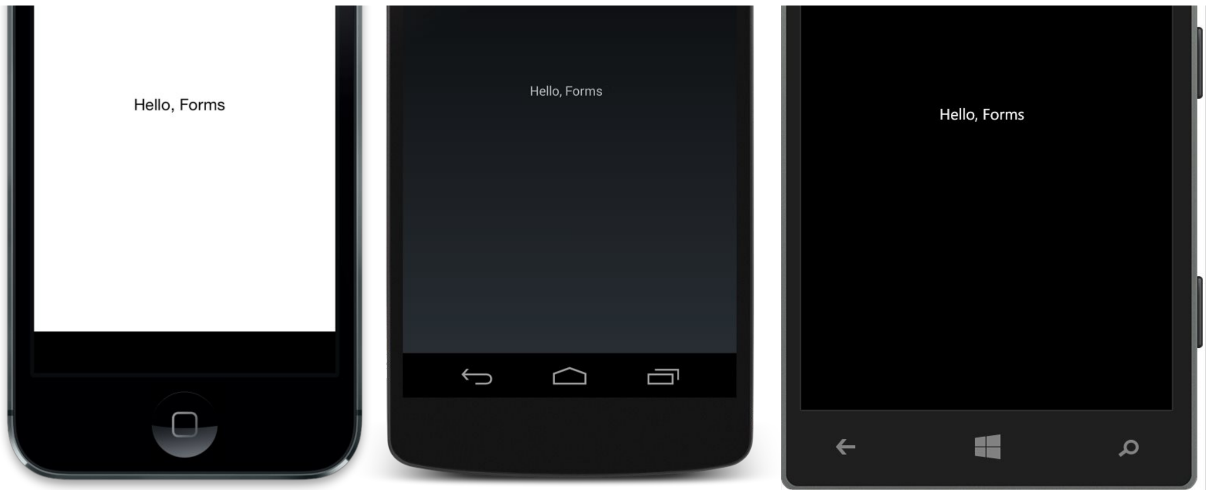
Solution
HelloXamarinFormsWorld
HelloXamarinFormsWorld
HelloXamarinFormsWorld.Android
HelloXamarinFormsWorld.iOS (not built in active configuration)

Solutions created with Xamarin Studio do *not* include a Windows Phone project. Use Visual Studio to create new Xamarin.Forms solutions that support iOS, Android as well as Windows Phone. Note that while Xamarin Studio does not support the creation of Windows Phone applications they can still be loaded as a part of an existing solution (ie. one that was created with Visual Studio). This allows you to browse your Windows Phone code in Xamarin Studio, even though it cannot be built or deployed.

Examining A Xamarin.Forms Application

The default template creates the simplest Xamarin.Forms solution possible. If you run the application, it should appear similar to the following screenshots:





Each screen in the screenshots above corresponds to a *Page* in Xamarin.Forms. A `Xamarin.Forms.Page` represents an *Activity* in Android, a *View Controller* in iOS, or a *Page* in Windows Phone. The HelloXamarinFormsWorld in the screenshots above instantiates a `Xamarin.Forms.ContentPage` object and uses that to display the Label.

To maximize the reuse of the startup code, Xamarin.Forms applications will have a single class named App that is responsible for instantiating the first Page that will be displayed. An example of the `App` class can be seen in the following code:

```
public class App
{
    public static Page GetMainPage()
    {
        return new ContentPage
        {
            Content = new Label
            {
                Text = "Hello, Forms !",
                VerticalOptions = LayoutOptions.CenterAndExpand,
                HorizontalOptions = LayoutOptions.CenterAndExpand,
            },
        };
    }
}
```

This code will instantiate a new `ContentPage` object that will display a single `Label` centered both vertically and horizontally on the page.

Launching the Initial Xamarin.Forms Page on Each Platform

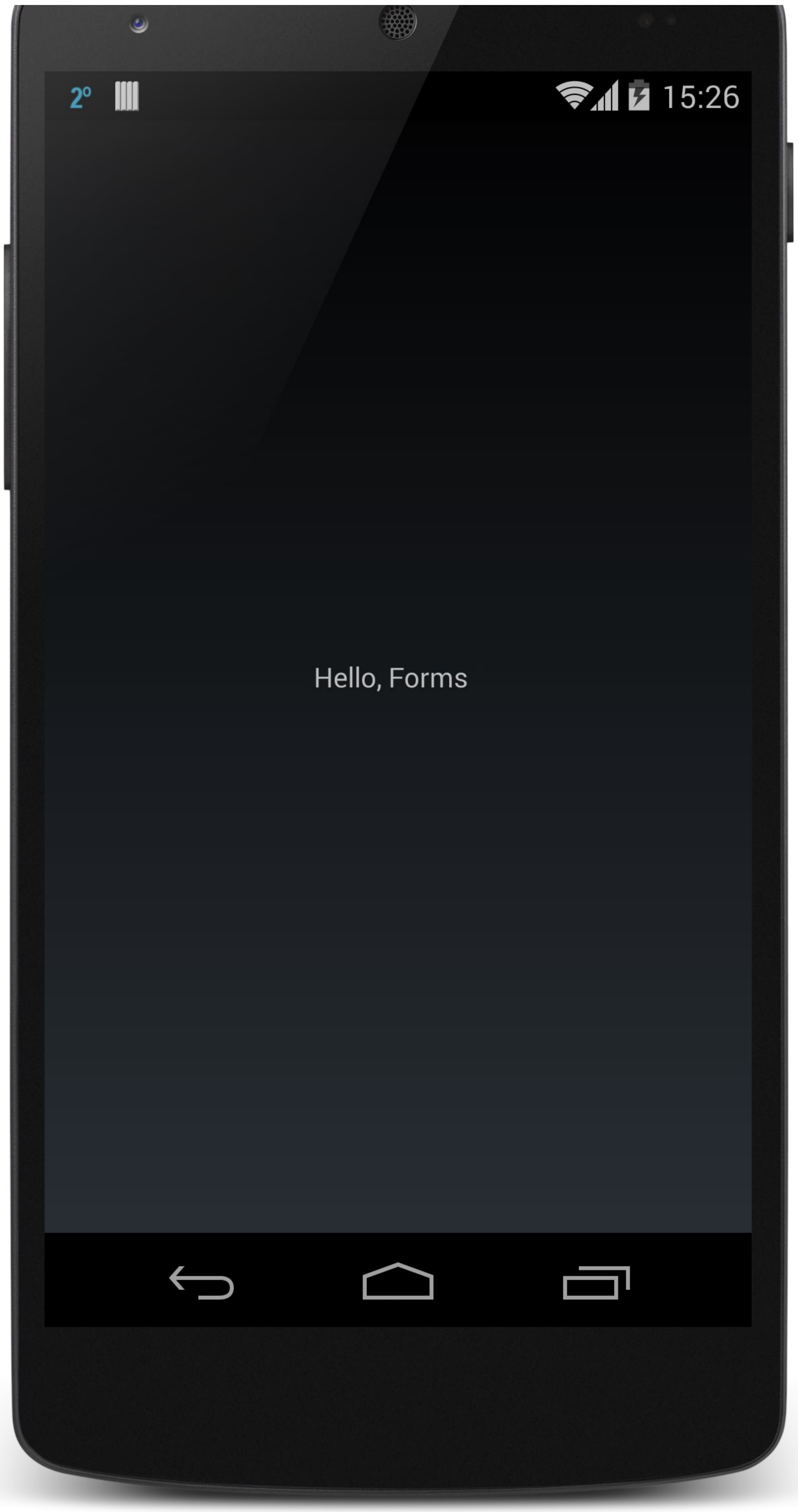
To use this Page inside an application, each platform application must initialize the Xamarin.Forms framework and then provide an instance of the ContentPage as it is starting up. This initialization step varies from platform from platform and will be discussed in the following sections.

Android

To launch the initial Xamarin.Forms page in Android, you create an Activity with the `MainLauncher` attribute just as you would a traditional Android application, except that your activity must inherit from `Xamarin.Forms.Platform.Android.AndroidActivity`, initialize the Xamarin.Forms framework, and then display the initial Page in the `OnCreate` method. The following code example illustrates this pattern in action:

```
namespace HelloXamarinFormsWorld.Android
{
    [Activity(Label = "HelloXamarinFormsWorld", MainLauncher = true)]
    public class MainActivity : AndroidActivity
    {
        protected override void OnCreate(Bundle bundle)
        {
            base.OnCreate(bundle);

            Xamarin.Forms.Forms.Init(this, bundle);

            SetPage(App.GetMainPage());
        }
    }
}
```

The code above will create a Xamarin.Android application that will initialize the Xamarin.Forms framework and then run the shared UI code.



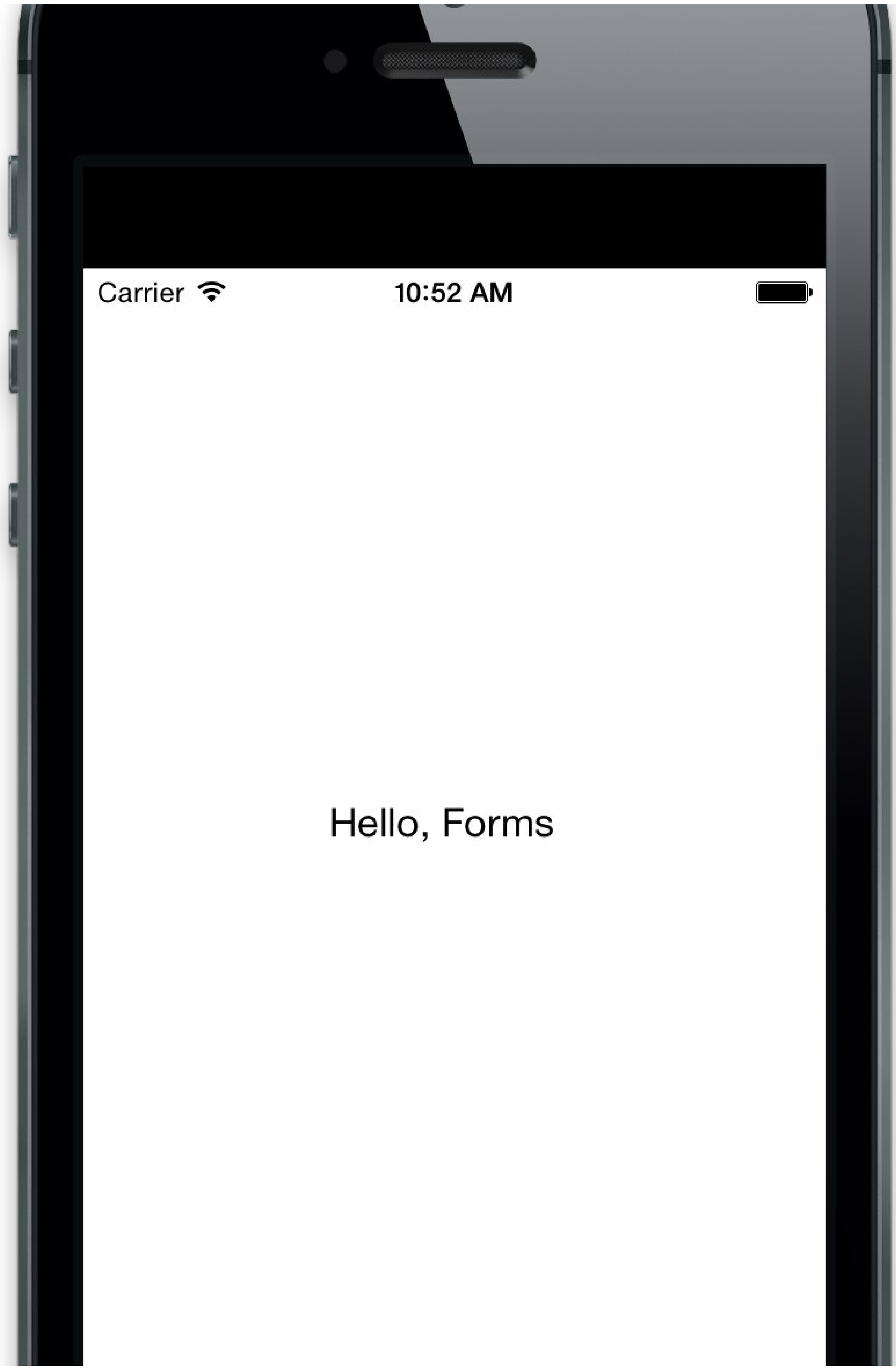
Hello, Forms

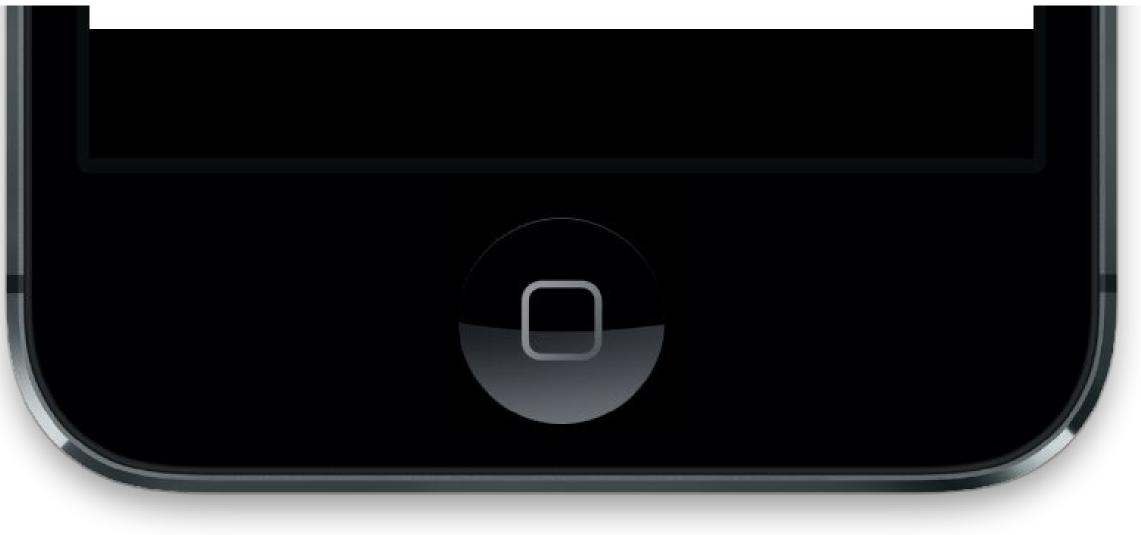
iOS

For a Xamarin.iOS application, the AppDelegate class must initialize the Xamarin.Forms framework and then set the RootViewController to the initial Xamarin.Forms Page. This is done inside the FinishedLaunching method, as demonstrated in the following code:

```
[Register("AppDelegate")]
public partial class AppDelegate : UIApplicationDelegate
{
    UIWindow window;

    public override bool FinishedLaunching(UIApplication app, NSDictionary
options)
    {
        Forms.Init();

        window = new UIWindow(UIScreen.MainScreen.Bounds);

        window.RootViewController =  App.GetMainPage().CreateViewController();

        window.MakeKeyAndVisible();

        return true;
    }
}
```

As with the Android application, the first step in the `FinishedLaunching` event is to initialize the Xamarin.Forms framework with a call to `Xamarin.Forms.Forms.Init()`. This step causes the iOS specific implementation of Xamarin.Forms to be globally loaded in the application. The next step is set the root view controller of the application. This is done by invoking the `CreateViewController()` method on an instance of the `HelloWordPage` class that we created in the cross platform application library.

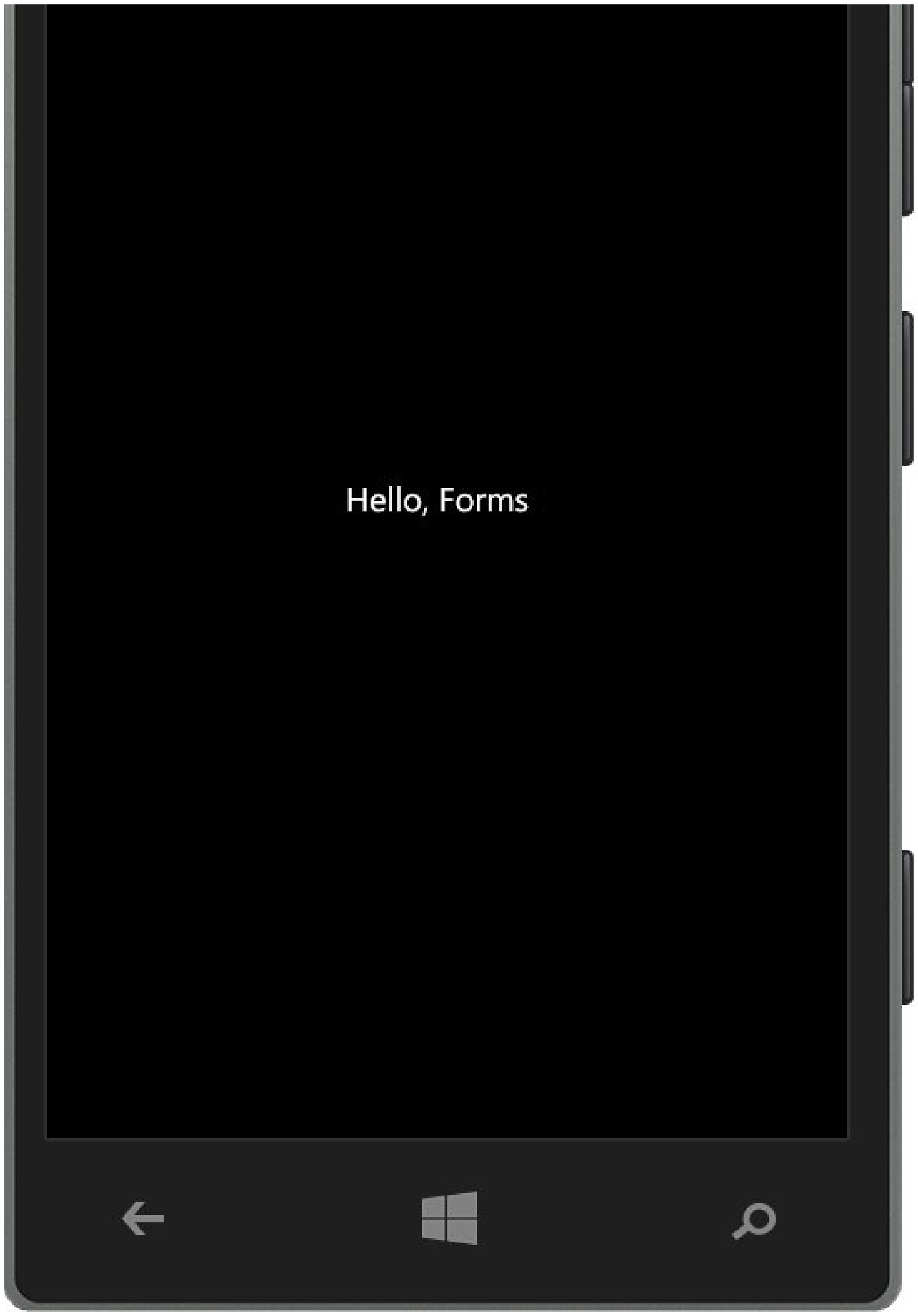

Carrier
10:52 AM
Hello, Forms



Windows Phone

For a Windows Phone project the start up page will initialize the Xamarin.Forms framework and then set the content of the startup page to that of the Xamarin.Forms Page. An example of how to do this can be seen in the code below:

```
public partial class MainPage : PhoneApplicationPage
{
    public MainPage()
    {
        InitializeComponent();

        Forms.Init();
        Content =
HelloXamarinFormsWorld.App.GetMainPage().ConvertPageToUIElement(this);
    }
}
```



Now that we have some familiarity with Xamarin.Forms lets discuss the parts of a Xamarin.Forms application in more detail.

Views and Layouts

Xamarin.Forms provides a single API for creating user interfaces with controls and *layouts*. At runtime, Xamarin.Forms control will be mapped to the appropriate native control and that is what will be rendered.

There are four main classes that are used to compose Xamarin.Forms apps:

- **View** - these are typically referred to as controls or widgets in other platforms. They correspond to UI elements such as labels, buttons, text fields, etc.
- **Page** - a Xamarin.Forms represents a single screen in your application. These are analagous to an Android Activity, a Windows Phone Page, or an iOS View Controller.
- **Layout** - this is a specialized View subtype. It is meant to act as a container for other Layout or Views. Layout subtypes typically contain logic that is specific to organizing the child views in a certain way.
- **Cell** - This class is a specialized element that is used for items in a list or a table. It describes how each item in a list should be drawn.

The following table lists some of the more common controls:

Xamarin.Forms Control	Description
`Label`	The `Label` is a read-only text display control.
`Entry`	An `Entry` is a simple single-line text-input control.
`Button`	Buttons are used to initiate commands.
`Image`	This control is used to display a bitmap.
`ListView`	The `ListView` presents a scrolling list of items. The items inside a list are known as *cells*.

Controls themselves are hosted inside of a layout. Xamarin.Forms has two different categories of layouts that arrange the controls in very different ways:

- **Managed Layouts** - these are layouts that will take care of positioning and sizing child controls on the screen and follow the CSS box model. Applications should not attempt to directly set the size or position of child controls. One common example of a managed Xamarin.Forms layout is the `StackLayout`.
- **Unmanaged Layouts** - as opposed to managed layouts, unmanaged layouts will not arrange or position their children on the screen. Typically, the user will specify the size and location of the child control as it is being added to the layout. The `AbsoluteLayout` is an example of an unmanaged layout control.

Let’s take a look at the `StackLayout` and `AbsoluteLayout` in more detail below.

StackLayout

The `StackLayout` is a very common managed layout. The `StackLayout` greatly simplifies cross-platform application development by automatically arranging controls on the screen regardless of the screen size. Each child element is positioned one after the other, either horizontally or vertically in the order they were added. How much space the `StackLayout` will use depends on how the `HorizontalOptions` and the `LayoutOptions` properties are set, but by default the `StackLayout` will try to use the entire screen.

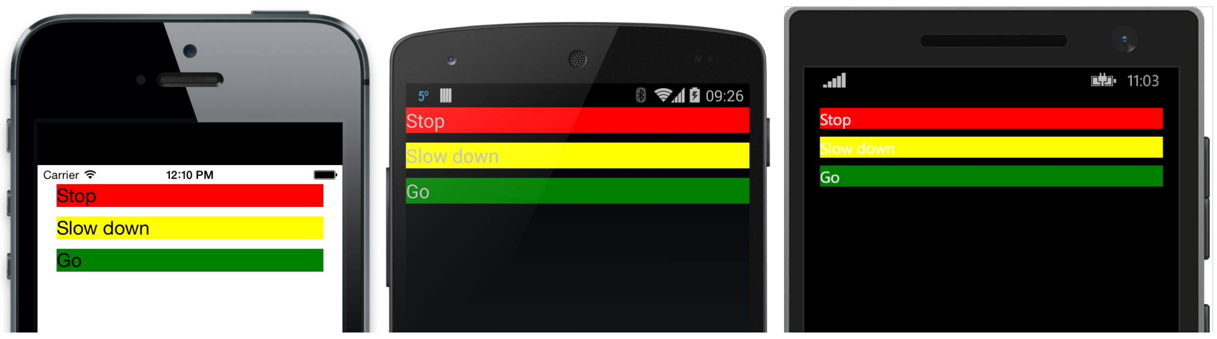
The following code is an example of using a `StackLayout` to arrange three `Label` controls on the screen:

```
public class StackLayoutExample: ContentPage
{
    public StackLayoutExample()
    {
        Padding = new Thickness(20);
        var red = new Label
        {
            Text = "Stop",
            BackgroundColor = Color.Red,
            Font = Font.SystemFontOfSize (20)
        };
        var yellow = new Label
        {
            Text = "Slow down",
            BackgroundColor = Color.Yellow,
            Font = Font.SystemFontOfSize (20)
        };
        var green = new Label
        {
            Text = "Go",
            BackgroundColor = Color.Green,
            Font = Font.SystemFontOfSize (20)
        };

        Content = new StackLayout
        {
            Spacing = 10,
            Children = { red, yellow, green }
        };
    }
}
```

The following snippet is an example of the same layout using XAML:

```
<?xml version="1.0" encoding="utf-8" ?>
<ContentPage xmlns="http://xamarin.com/schemas/2014/forms"

xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"

x:Class="HelloXamarinFormsWorldXaml.StackLayoutExample1"
             Padding="20">

  <StackLayout Spacing="10">

    <Label Text="Stop"
           BackgroundColor="Red"
           Font="20" />

    <Label Text="Slow down"
           BackgroundColor="Yellow"
           Font="20" />

    <Label Text="Go"
           BackgroundColor="Green"
           Font="20" />

  </StackLayout>
</ContentPage>
```

By default the StackLayout assumes a vertical orientation as illustrated by the following screenshots:



It is possible to change the Orientation and Vertical options by using the following code:

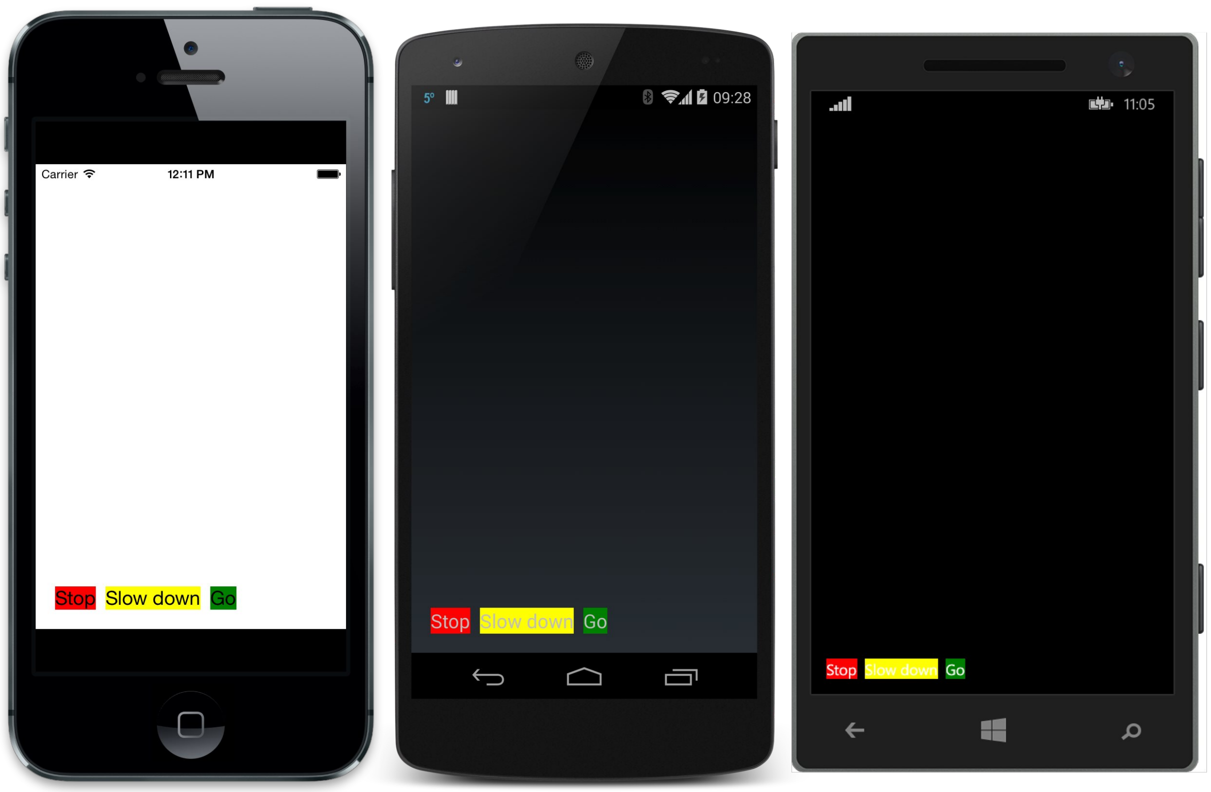
```
public class StackLayoutExample: ContentPage
{
    public StackLayoutExample()
    {
        // Code that creates labels removed for clarity

        Content = new StackLayout
        {
            Spacing = 10,
            VerticalOptions = LayoutOptions.End,
            Orientation = StackOrientation.Horizontal,
            HorizontalOptions = LayoutOptions.Start,
            Children = { red, yellow, green }
        };
    }
}
```

The next snippet shows how to accomplish the same layout using XAML:

```
<?xml version="1.0" encoding="utf-8" ?>
<ContentPage xmlns="http://xamarin.com/schemas/2014/forms"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             x:Class="HelloXamarinFormsWorldXaml.StackLayoutExample2"
             Padding="20">

  <StackLayout Spacing="10"
```

```
                VerticalOptions="End"
                Orientation="Horizontal"
                HorizontalOptions="Start">

      <Label Text="Stop"
             BackgroundColor="Red"
             Font="20" />

      <Label Text="Slow down"
             BackgroundColor="Yellow"
             Font="20" />

      <Label Text="Go"
             BackgroundColor="Green"
             Font="20" />

    </StackLayout>
  </ContentPage>
```

The following image show what the screens would look after this code change:



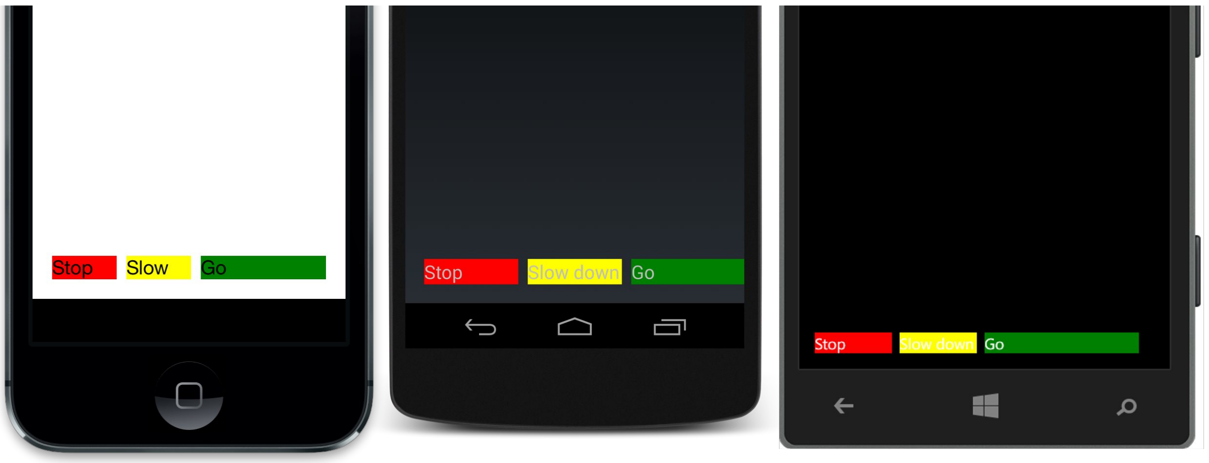
Although it is not possible to explicitly size the child controls in a `StackLayout`, it is possible to provide hints to the layout engine through the `HeightRequest` and `WidthRequest` properties. The following code snippet shows how to request the width for each label:

```
var red = new Label
{
    Text = "Stop",
    BackgroundColor = Color.Red,
    Font = Font.SystemFontOfSize (20),
    WidthRequest = 100
};
var yellow = new Label
{
    Text = "Slow down",
    BackgroundColor = Color.Yellow,
    Font = Font.SystemFontOfSize (20),
    WidthRequest = 100
};
var green = new Label
{
    Text = "Go",
    BackgroundColor = Color.Green,
    Font = Font.SystemFontOfSize (20),
    WidthRequest = 200
};

Content = new StackLayout
{
    Spacing = 10,
    VerticalOptions = LayoutOptions.End,
    Orientation = StackOrientation.Horizontal,
    HorizontalOptions = LayoutOptions.Start,
    Children = { red, yellow, green }
};
```

This next snippet is one example of what this layout looks like in XAML:

```
<?xml version="1.0" encoding="utf-8" ?>
<ContentPage xmlns="http://xamarin.com/schemas/2014/forms"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             x:Class="HelloXamarinFormsWorldXaml.StackLayoutExample3"
             Padding="20">

  <StackLayout Spacing="10"
               VerticalOptions="End"
               Orientation="Horizontal"
               HorizontalOptions="Start">

    <Label Text="Stop"
           BackgroundColor="Red"
           Font="20"
           WidthRequest="100" />

    <Label Text="Slow down"
           BackgroundColor="Yellow"
           Font="20"
           WidthRequest="100" />

    <Label Text="Go"
           BackgroundColor="Green"
           Font="20"
           WidthRequest="200" />

  </StackLayout>
</ContentPage>
```

The following screenshots illustrates the StackLayout attempting to respect these suggestions:



Absolute Layout

In contrast to the `StackLayout`, the `AbsoluteLayout` is an unmanaged layout. Each control must be explicitly positioned within the layout. Conceptually it is very much like how controls are positioned in iOS (without constraints) or the old style Windows Forms. While this allows for very precise positioning of controls, this layout does require extra testing on different screen sizes.

A simple example of an `AbsoluteLayout` can be seen in the following code snippet:

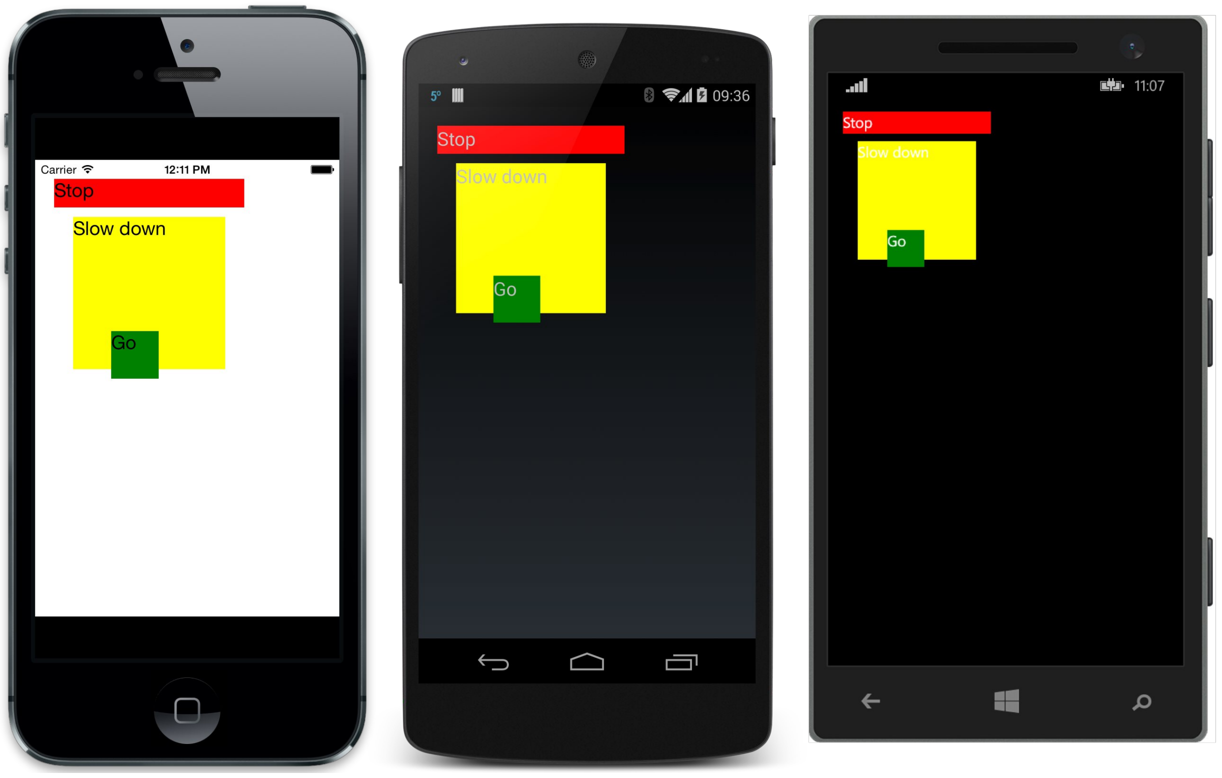
```
public class MyAbsoluteLayoutPage : ContentPage
{
    public MyAbsoluteLayoutPage()
    {
        var red = new Label
        {
            Text = "Stop",
            BackgroundColor = Color.Red,
            Font = Font.SystemFontOfSize (20),
            WidthRequest = 200,
            HeightRequest = 30
        };
        var yellow = new Label
        {
            Text = "Slow down",
            BackgroundColor = Color.Yellow,
            Font = Font.SystemFontOfSize (20),
            WidthRequest = 160,
            HeightRequest = 160
        };
        var green = new Label
        {
            Text = "Go",
            BackgroundColor = Color.Green,
            Font = Font.SystemFontOfSize (20),
            WidthRequest = 50,
            HeightRequest = 50

        };
        var absLayout = new AbsoluteLayout();
        absLayout.Children.Add(red, new Point(20,20));
        absLayout.Children.Add(yellow, new Point(40,60));
        absLayout.Children.Add(red, new Point(80,180));

        Content = absLayout;
    }
}
```

The following XML is the XAML implementation of the previous C# code:

```
<?xml version="1.0" encoding="utf-8" ?>
<ContentPage xmlns="http://xamarin.com/schemas/2014/forms"

xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"

x:Class="HelloXamarinFormsWorldXaml.AbsoluteLayoutExample"
             Padding="20">

  <AbsoluteLayout>

    <Label Text="Stop"
           BackgroundColor="Red"
           Font="20"
           AbsoluteLayout.LayoutBounds="20,20,200,30" />

    <Label Text="Slow down"
```

```
               BackgroundColor="Yellow"
               Font="20"
               AbsoluteLayout.LayoutBounds="40,60,160,160" />

        <Label Text="Go"
               BackgroundColor="Green"
               Font="20"
               AbsoluteLayout.LayoutBounds="80,180,50,50" />

    </AbsoluteLayout>

</ContentPage>
```

When rendered, this page may look something like the following screenshot:



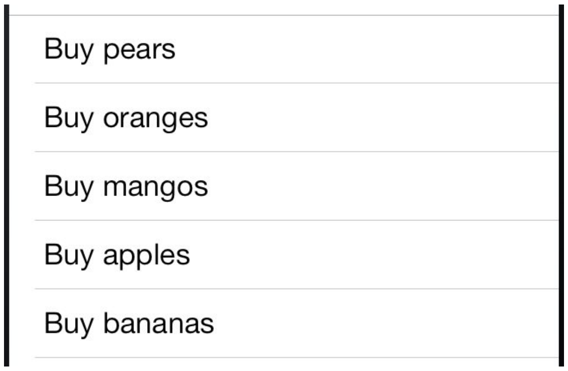
Note that the order the controls are added to the `Children` collection affects the Z-order of elements on screen – the first control appears at the ‘bottom’ of the Z-order and subsequent controls are added higher, meaning they can overlap (as the green label does in this example). Care must be taken when absolute positioning controls not to hide other controls by completely covering them or to accidentally positioning them off the edge of the screen.

Lists in Xamarin.Forms

`ListViews` are a very common control in mobile applications and deserve to be covered in a bit more detail. The `ListView` is responsible for displaying a collection of items on the screen; each item in the `ListView` will be contained in a single cell. By default, a `ListView` will use the built-in `TextCell` template and render a single line of text. The code snippet below is a simple example of using the `ListView`:

```
var listView = new ListView
{
    RowHeight = 40
};
listView.ItemsSource = new string []
    {
        "Buy pears",
        "Buy oranges",
        "Buy mangos",
        "Buy apples",
        "Buy bananas"
    };
Content = new StackLayout
{
    VerticalOptions = LayoutOptions.FillAndExpand,
    Children = { listView }
};
```

This code will resemble the following screenshot at run time:


Buy pears
Buy oranges
Buy mangos
Buy apples
Buy bananas

Binding to a Custom Class

Custom objects can also be displayed by a `ListView` using the default `TextCell` template. Using this `TodoItem` class definition:

```
 public class TodoItem {
    public string Name { get; set; }
    public bool Done { get; set; }
}
```

the `ListView` can be populated like this:

```
listView.ItemSource = new TodoItem [] {
    new TodoItem {Name = "Buy pears"},
    new TodoItem {Name = "Buy oranges", Done=true},
    new TodoItem {Name = "Buy mangos"},
    new TodoItem {Name = "Buy apples", Done=true},
    new TodoItem {Name = "Buy bananas", Done=true}
};
```

To control which property is displayed in the list, create a binding that specifies the path to the property - in this case the `Name` property.

```
Listview.ItemTemplate = new DataTemplate(typeof(TextCell));
listview.ItemTemplate.SetBinding(TextCell.TextProperty, "Name");
```

This code will render the same way as the previous example (above).

Selecting an Item in a ListView

To respond to the user touching a cell in a `ListView` implement the `ItemSelected` event as shown here showing a simple alert:

```
listView.ItemSelected += (sender, e) => {
    DisplayAlert("Tapped!", e.Item + " was tapped.", "OK", null);
};
```

When contained within a `NavigationPage` the `Navigation.PushAsync` method can be used to open a new page with built-in back-navigation. The `ItemSelected` event can then access the object that was associated with the cell via `e.SelectedItem`, bind it to a new page and then display the new page using

`PushAsync`:

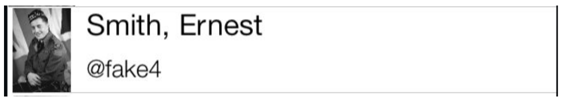
```
listView.ItemSelected += (sender, e) => {
    var todoItem = (TodoItem)e.SelectedItem;
    var todoPage = new TodoItemPage(todoItem); // so the new page shows correct
data
    Navigation.PushAsync(todoPage);
};
```

Each platform implements built-in back-navigation in its own way. Navigation is covered in more detail below.

Customizing the Appearance of a Cell

It is possible to customize the cells by subclassing ViewCell and then setting the type of this class to the ItemTemplate property of the ListView.

Consider the following screenshot of a cell in a ListView:


Smith, Ernest
@fake4

This cell is composed of one `Image` control and two `Label` views. To create this custom layout, we would subclass `ViewCell` as shown in the sample class below:

```
class EmployeeCell : ViewCell
{
    public EmployeeCell()
    {
        var image = new Image
                    {
                        HorizontalOptions = LayoutOptions.Start
                    };
        image.SetBinding(Image.SourceProperty, new Binding("ImageUri"));
        image.WidthRequest = image.HeightRequest = 40;

        var nameLayout = CreateNameLayout();

        var viewLayout = new StackLayout()
                         {
```

```
                                    Orientation = StackOrientation.Horizontal,
                                    Children = { image, nameLayout }
                               };
            View = viewLayout;
        }

        static StackLayout CreateNameLayout()
        {

            var nameLabel = new Label
                              {
                                  HorizontalOptions= LayoutOptions.FillAndExpand
                              };
            nameLabel.SetBinding(Label.TextProperty, "DisplayName");

            var twitterLabel = new Label
                                 {
                                     HorizontalOptions = LayoutOptions.FillAndExpand,
                                     Font = Fonts.Twitter
                                 };
            twitterLabel.SetBinding(Label.TextProperty, "Twitter");

            var nameLayout = new StackLayout()
                               {
                                   HorizontalOptions = LayoutOptions.StartAndExpand,
                                   Orientation = StackOrientation.Vertical,
                                   Children = { nameLabel, twitterLabel }
                               };
            return nameLayout;
        }
    }
```

The code has a lot happening:

- It adds an `Image` and binds it to the `ImageUri` property of the `Employee` object. Data binding will be covered in just a moment.
- It creates a `StackLayout` with a vertical orientation to hold the two `Labels`. The `Labels` are bound to the `DisplayName` property and the `Twitter` property of the `Employee` object.

- It creates another `StackLayout` that will host the `Image` and the `StackLayout` from the previous two steps. It will arrange its children using a horizontal orientation.

Once the custom cell has been created it can be used with a `ListView` control by wrapping in a `DataTemplate`:

```
List<Employee> myListOfEmployeeObjects = GetAListOfAllEmployees();
var listView = new ListView
{
    RowHeight = 40
};
listView.ItemsSource = myListOfEmployeeObjects;
listView.ItemTemplate = new DataTemplate(typeof(EmployeeCell));
```

This code will provide a `List` objects to the `ListView`. Each cell will be rendered using the `EmployeeCell` class. The `ListView` will pass the `Employee` object to the `EmployeeCell` as its `BindingContext`.

Using XAML to Create and Customize A List

The XAML equivalent of the list in the previous section can be seen in the following snippet:

```
<?xml version="1.0" encoding="utf-8" ?>
<ContentPage xmlns="http://xamarin.com/schemas/2014/forms"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:local="clr-
namespace:XamarinFormsXamlSample;assembly=XamarinFormsXamlSample"
             xmlns:constants="clr-
namespace:XamarinFormsSample;assembly=XamarinFormsXamlSample"
             x:Class="XamarinFormsXamlSample.Views.EmployeeListPage"
             Title="Employee List">

  <ListView x:Name="listView"
            IsVisible="false"
            ItemsSource="{x:Static local:App.Employees}"
            ItemSelected="EmployeeListOnItemSelected">
    <ListView.ItemTemplate>
      <DataTemplate>
```

```
        <ViewCell>
          <ViewCell.View>
            <StackLayout Orientation="Horizontal">

              <Image Source="{Binding ImageUri}"
                     WidthRequest="40"
                     HeightRequest="40" />

              <StackLayout Orientation="Vertical"
                           HorizontalOptions="StartAndExpand">

                <Label Text="{Binding DisplayName}"
                       HorizontalOptions="FillAndExpand" />

                <Label Text="{Binding Twitter}"
                       Font="{x:Static constants:Fonts.Twitter}"/>

              </StackLayout>
            </StackLayout>
          </ViewCell.View>
        </ViewCell>
      </DataTemplate>
    </ListView.ItemTemplate>
  </ListView>
</ContentPage>
```

The previous bit of XAML defines a `ContentPage` that contains a `ListView`. The data source of the `ListView` is set via the `ItemsSource` attribute. The layout of each row in the `ItemsSource` is defined within the `ListView.ItemTemplate` element.

Data Binding

Data binding is used to simplify how a Xamarin.Forms application can display and interact with its data. It establishes a connection between the user interface and the underlying application. When the user edits the value in a text box, the data binding automatically updates an associated property on an underlying object. The `BindableObject` class contains much of the infrastructure to support data binding.

Data binding defines the relationship between two objects. The *source* object will provide data. The *target* object is another object that will consume (and often display) the data from the source object. For example, a `Label` may display the name from an `Employee` class. In this case, the `Employee` object is the source, while the `Label` is the target.

Setting up data binding on a Xamarin.Forms object (such as a Page or a Control) follows these two steps:

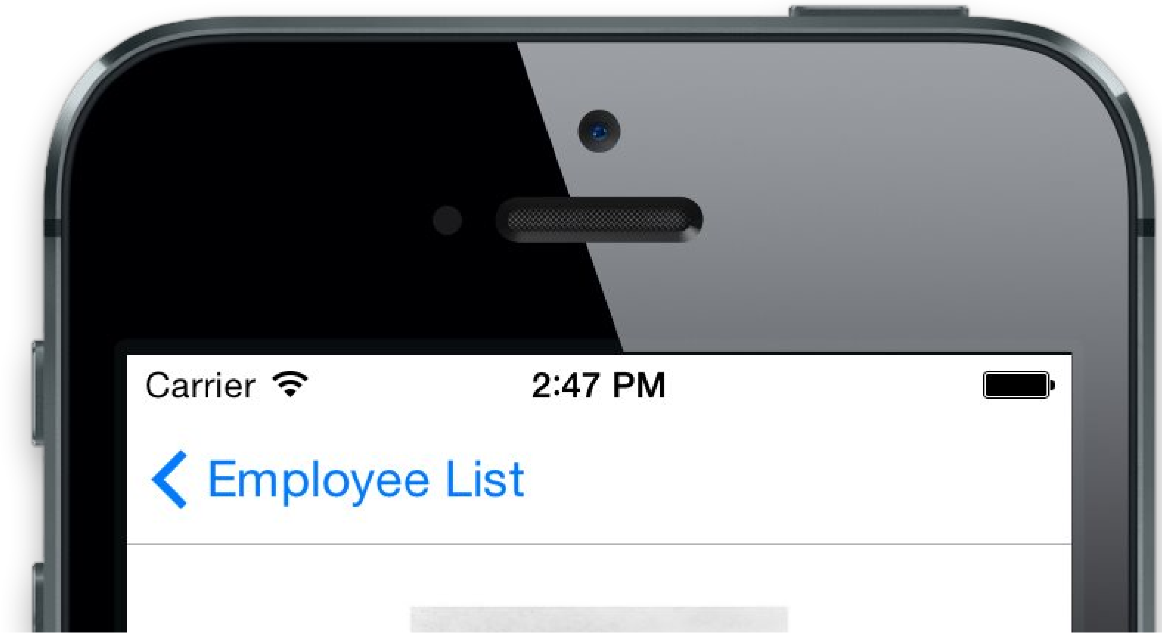
- Set the *BindingContext* property to the object that will be bound to. The bound object may be any .NET object that implements the `INotifyPropertyChanged` interface (discussed below).
- Invoke the *SetBinding* method on the Xamarin.Forms object once for each property or method that should be bound.

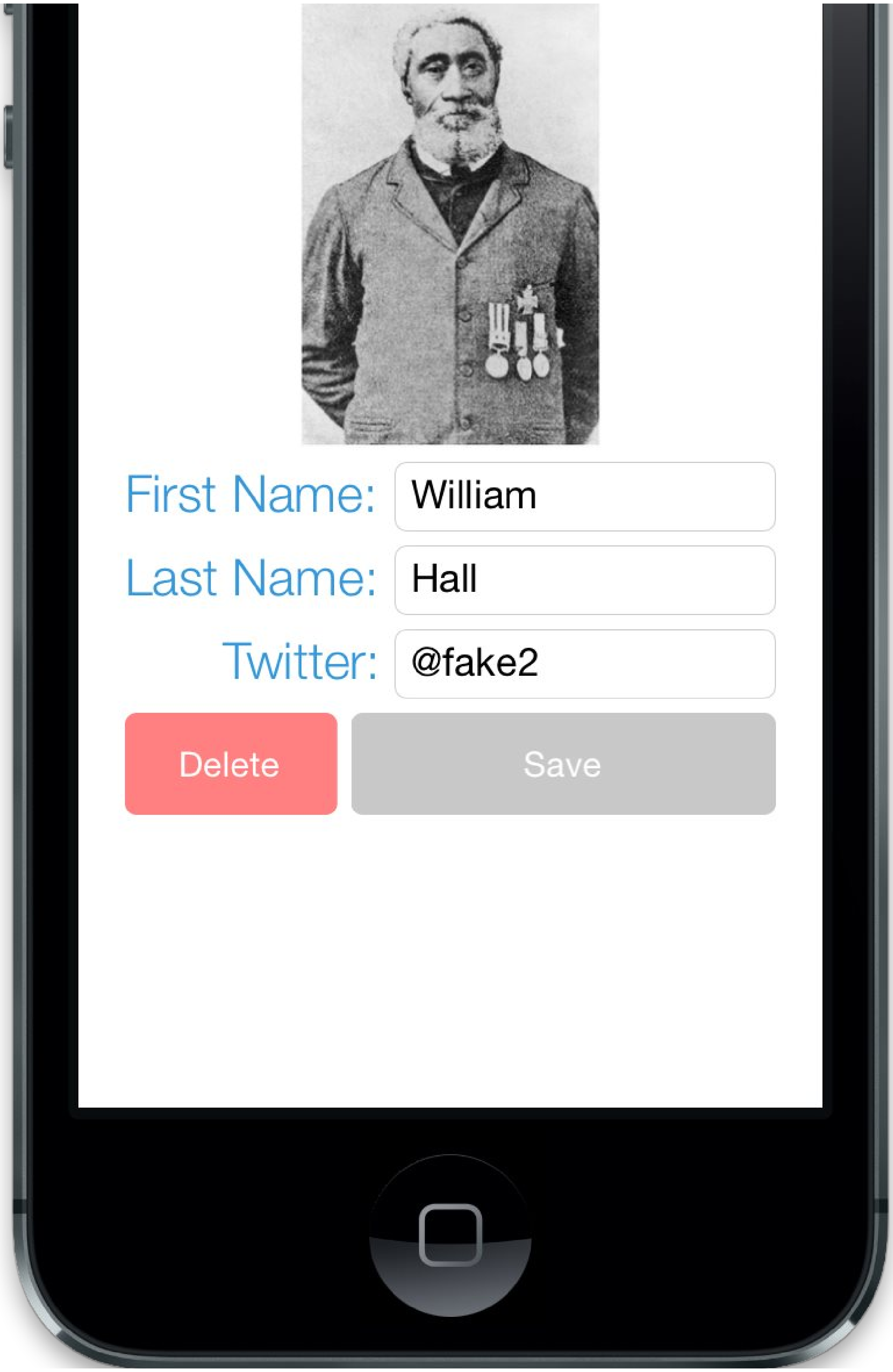
The `SetBinding` method takes two parameters. The first parameter specifies information about the type of binding. The second parameter is used to provide information about what to bind to or how to bind. The second parameter is, in most cases, just a string holding the name of property on the `BindingContext`. If we wanted to bind to the `BindingContext` directly, then we could use the following syntax:

```
someLabel.SetBinding(Label.TextProperty, new Binding("."));
```

The dot syntax tells Xamarin.Forms to use the `BindingContext` as the data source instead of a property on the `BindingContext`. This is handy when the `BindingContext` is a more simple type, such as a string or an integer.

To help understanding how to set up data binding in a Xamarin.Forms page, consider the following the following screenshot:

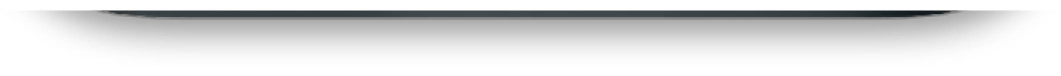




First Name: William

Last Name: Hall

Twitter: @fake2



This Page consists of the following controls:

- `Xamarin.Forms.Image`
- `Xamarin.Forms.Label`
- `Xamarin.Forms.Entry`
- `Xamarin.Forms.Button`

The Page that makes up this screen would be passed an instance of an `Employee` object via the constructor. The following code snippet is an example of what this constructor might look like:

```
public EmployeeDetailPage(Employee employeeToDisplay)
{
    this.BindingContext = employeeToDisplay;

    var firstName = new Entry()
                {
                    HorizontalOptions = LayoutOptions.FillAndExpand
                };
    firstName.SetBinding(Entry.TextProperty, "FirstName");

    // Rest of the code omitted…
}
```

The first line of code sets the `BindingContext` to a .NET object – this tells the underlying data binding API's what object to bind to. The next line of code instantiates a `Xamarin.Forms.Entry` control. The last line defines the binding between the `Xamarin.Forms.Entry` and `employeeToDisplay`; the `Entry.Text` property should be bound to the `FirstName` property of the object set to the `BindingContext`. The changes made in the `Entry` control will automatically be propagated to the `employeeToDisplay` object. Likewise, if changes are made to `employeeToDisplay.FirstName`, then Xamarin.Forms will also update the contents of the `Entry` control. This is known as *two-way binding*.

In order for two-way binding to work, the model class must implement `INotifyPropertyChanged` that we will look at next.

INotifyPropertyChanged

The INotifyPropertyChanged interface is used to notify a client of an object that a value has changed. The interface is very simple:

```
public interface INotifyPropertyChanged
{
    event PropertyChangedEventHandler PropertyChanged;
}
```

Objects that implement INotifyPropertyChanged must raise the PropertyChanged event when one of their properties is updated with a new value. An example of one such class can be seen in the following class:

```
public class MyObject : INotifyPropertyChanged
{
    public event PropertyChangedEventHandler PropertyChanged;

    string _firstName;
    public string FirstName
    {
        get { return _firstName; }
        set
        {
            if (value.Equals(_firstName, StringComparison.Ordinal))
            {
                // Nothing to do - the value hasn't changed;
                return;
            }
            _firstName = value;
            OnPropertyChanged();

        }
    }

    void OnPropertyChanged([CallerMemberName] string propertyName = null)
    {
        var handler = PropertyChanged;
        if (handler != null)
        {
            handler(this, new PropertyChangedEventArgs(propertyName));
        }
    }
}
```

When an instance of `MyObject` has the `FirstName` changed, the method `OnPropertyChanged` is invoked which will raise the `PropertyChanged` event.

Notice the `propertyName` parameter is adorned with the `CallMemberName` attribute. If the method `OnPropertyChanged` is invoked with a `null` value, the `CallMemberName` attribute will provide the name of the method that invoked `OnPropertyChanged`.

Navigation

Now that we understand how to create pages and arrange controls, lets discuss how to navigate from one page to another. Navigation can be thought of as a last-in, first-out stack of Page objects. To move from one page to another an application will push a new page onto this stack. To return back to the previous page the application will pop the current page from the stack. This navigation in Xamarin.Forms is handled by the `INavigation` interface which provides the following methods:

```
public interface INavigation
{
    Task PushAsync(Page page);
    Task<Page> PopAsync();
    Task PopToRootAsync();
    Task PushModalAsync(Page page);
    Task<Page> PopModalAsync();
}
```

These methods return a `Task` which will allow the calling code to check if the `Push` or `Pop` was successful.

Xamarin.Forms has a `NavigationPage` class that implements this interface and will manage the stack of Pages. The `NavigationPage` class will also add a navigation bar to the top of the screen that displays a title and will also have a platform appropriate Back button that will return to the previous page. The following code shows how to wrap a `NavigationPage` around the first page in an application:

```
public static Page GetMainPage()
{
    var mainNav = new NavigationPage(new EmployeeListPage());
    return mainNav;
}
```

To display the `LoginPage` for the current page it is necessary to invoke the `INavigation.PushAsync` as demonstrated in the following code snippet:

```
await Navigation.PushAsync(new LoginPage());
```

This causes the new LoginPage object to be pushed on the Navigation stack. To return back to the original page, the LoginPage must invoke:

```
await Navigation.PopAsync();
```

Modal navigation is similar. The following snippet will display a new page modally:

```
await Navigation.PushModalAsync(new LoginPage());
```

To return to the calling page, LoginPage must invoke:

```
await Navigation.PopModalAsync();
```

Summary

In this guide we discussed what Xamarin.Forms is and how it can be used to create cross platform applications. We covered how to install Xamarin.Forms and setup a solution. We learned how to create a Xamarin.Forms application with a common user interface that will retain the native look and feel of the underlying platform. We also saw how to set up data binding between the user interface and the underlying data and how to navigate between Pages.