XAM 120

Introduction to Xamarin.Forms

Download class materials from
university.xamarin.com

Microsoft

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Objectives

1. What is Xamarin.Forms?
2. Pages, Controls, and Layout
3. Using Platform-Specific Features

What is Xamarin.Forms?

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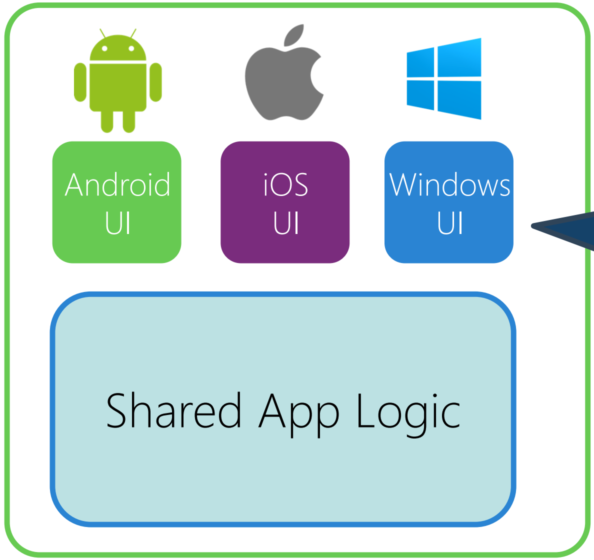
Tasks

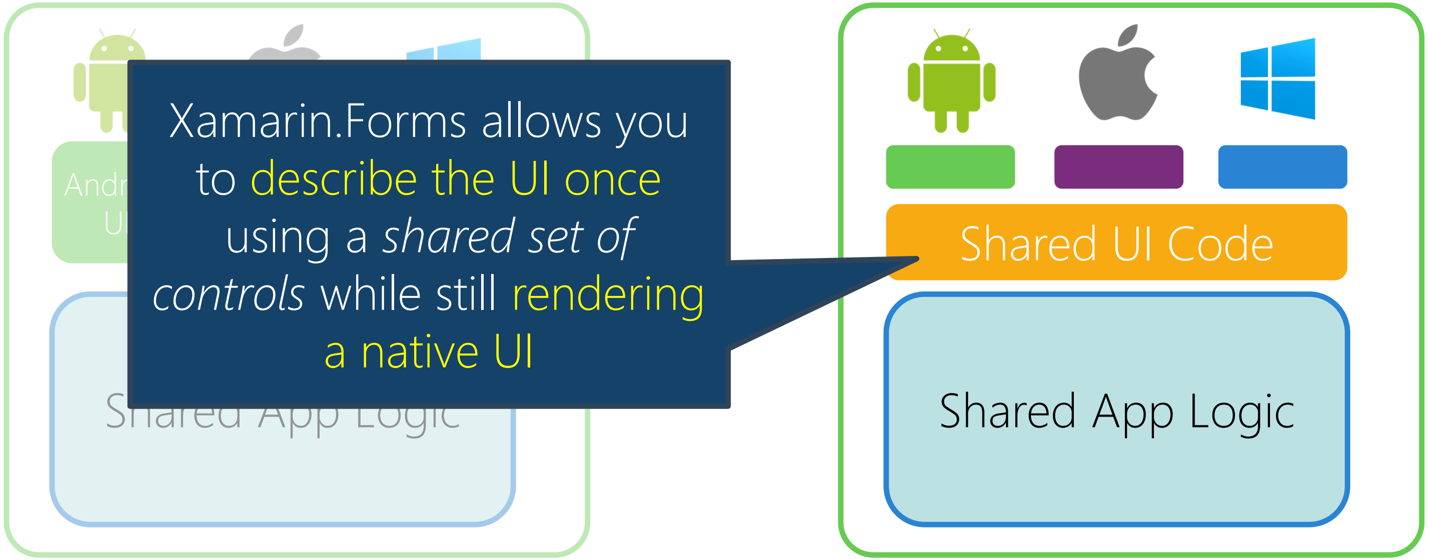
- Traditional vs. Xamarin.Forms
- Xamarin.Forms project structure
- Application Components
- "Hello, Forms!"

Reminder: Traditional Xamarin approach



Traditional Xamarin approach creates non-sharable platform-specific code for the UI layer

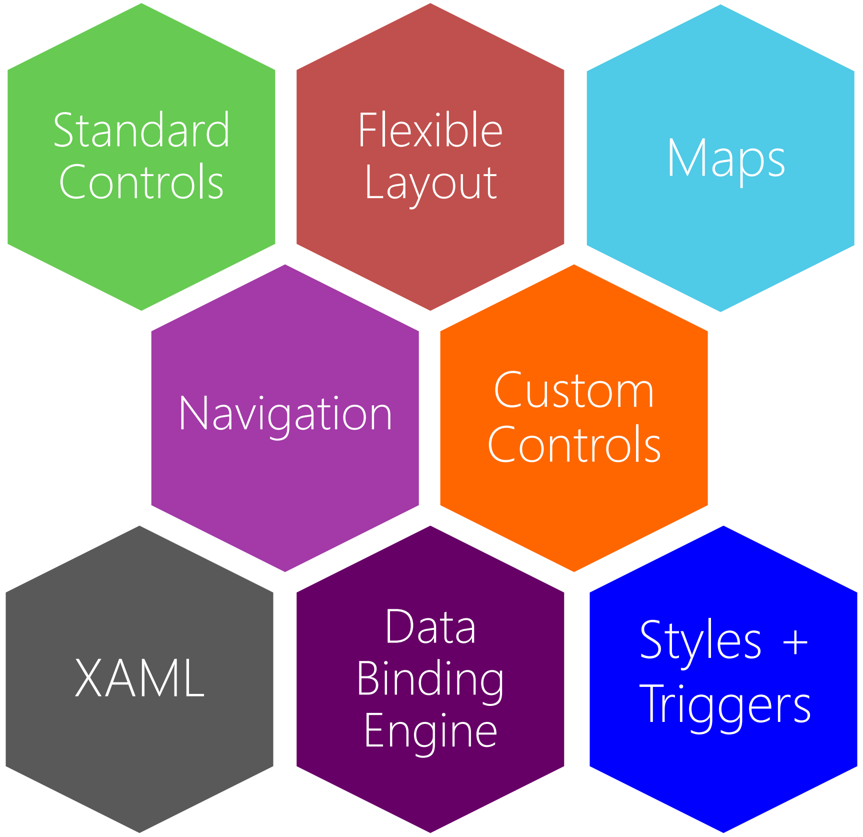
Traditional vs. Xamarin.Forms



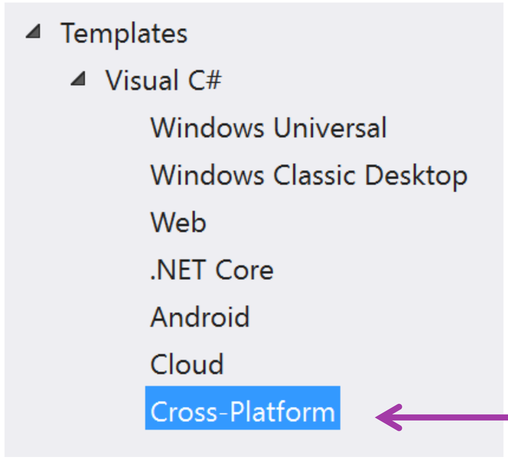
Xamarin.Forms allows you to describe the UI once using a *shared set of controls* while still rendering a native UI

What is Xamarin.Forms?

- Xamarin.Forms is a cross-platform UI framework to create mobile apps for:
  - Android 4.0+
  - iOS 6.1+
  - Windows Phone 8.x (SL)
  - Windows Phone 8.1 (RT)
  - Windows 10 (UWP)



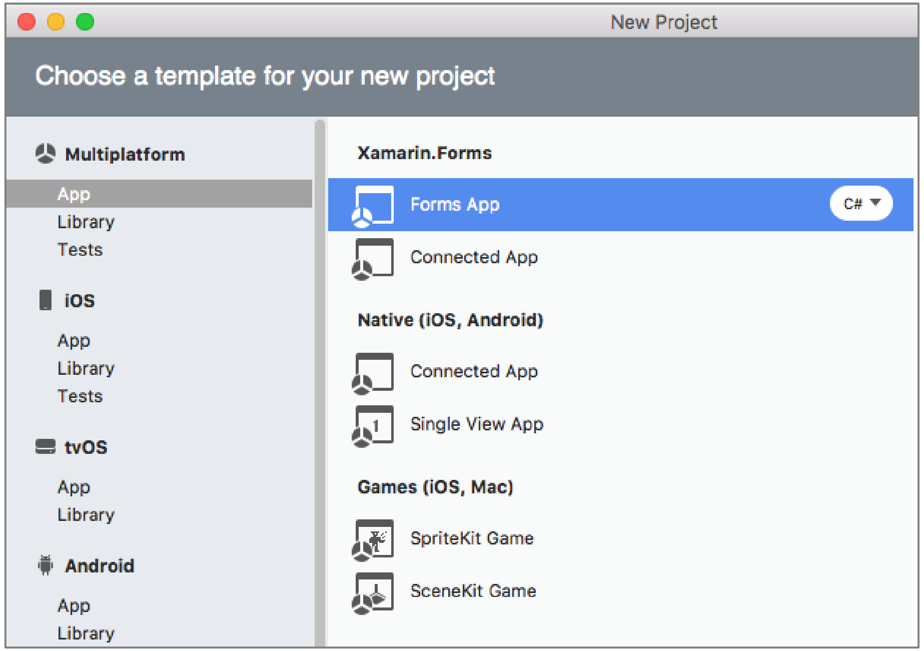
Creating a Xamarin.Forms App [Windows]



Built-in project templates for Xamarin.Forms applications available under **Cross-Platform**

Creating a Xamarin.Forms App [Mac]

- ❖ Project wizard walks through the available options
- ✓ Supports Android & iOS


New Project

Choose a template for your new project

Multiplatform
- App
- Library
- Tests

iOS
- App
- Library
- Tests

tvOS
- App
- Library

Android
- App
- Library

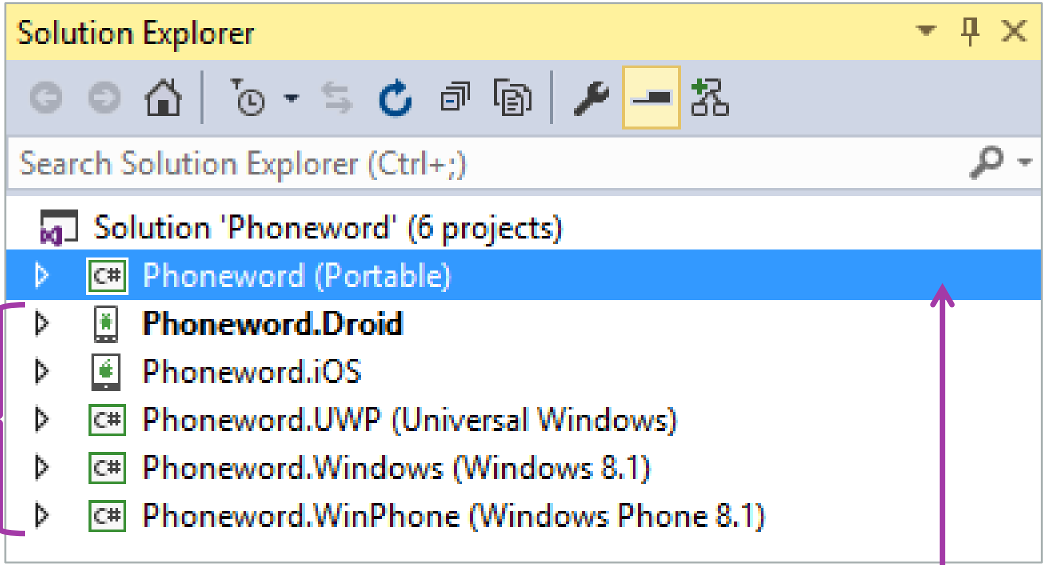
Xamarin.Forms
- Forms App — C#
- Connected App

Native (iOS, Android)
- Connected App
- Single View App

Games (iOS, Mac)
- SpriteKit Game
- SceneKit Game

Project Structure

❖ Blank App project template creates several related projects



Solution Explorer

Search Solution Explorer (Ctrl+;)

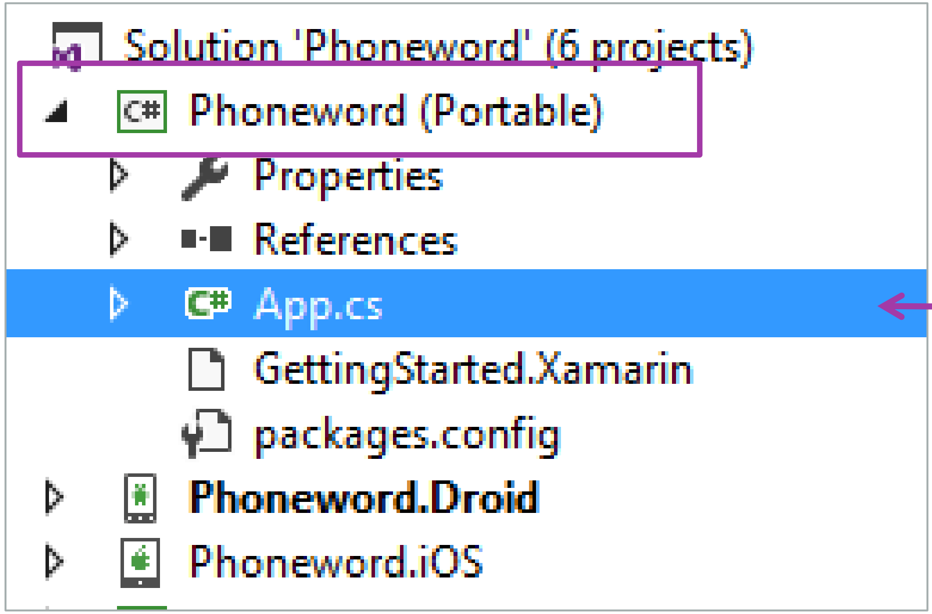
Solution 'Phoneword' (6 projects)
- Phoneword (Portable)
- **Phoneword.Droid**
- Phoneword.iOS
- Phoneword.UWP (Universal Windows)
- Phoneword.Windows (Windows 8.1)
- Phoneword.WinPhone (Windows Phone 8.1)

Platform-specific projects act as "host" to create native application

PCL or SAP used to hold shared code that defines UI and logic

Project Structure - PCL

- Most of your code will go into the PCL used for shared logic + UI

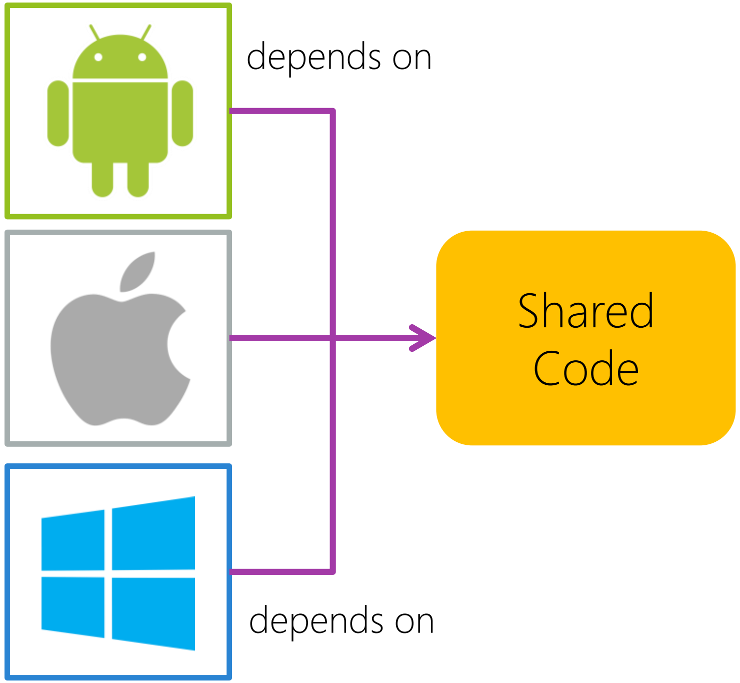


Default template creates a single **`App.cs`** file which decides the initial screen for the application

Project Structure - Dependencies

- Platform-specific projects depend on the shared code (PCL or SAP), but *not* the other way around

- Xamarin.Forms defines the UI and behavior in the PCL or SAP (shared) and then calls it from each platform-specific project



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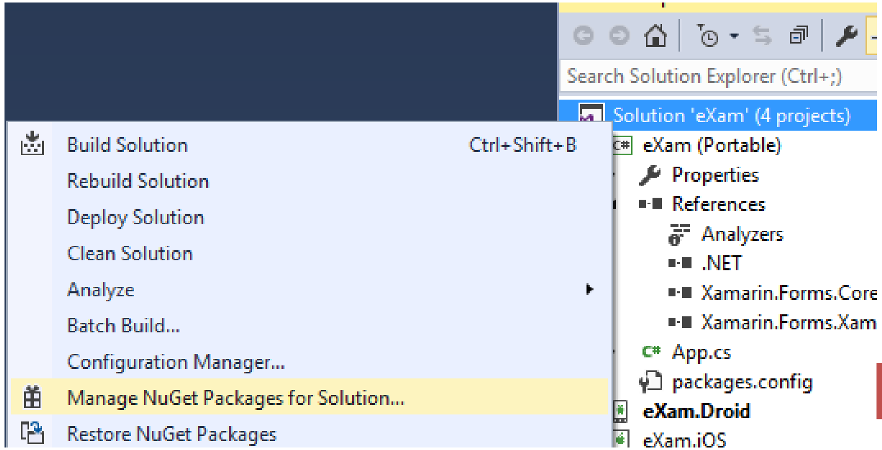
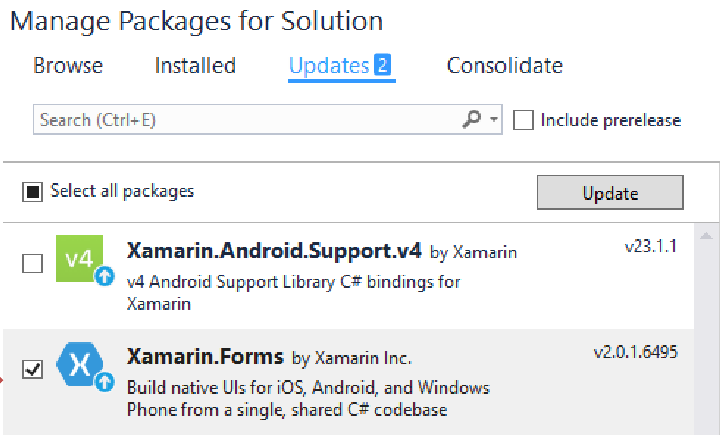
Xamarin.Forms updates [Windows]

- Should update Xamarin.Forms **Nuget package** when starting a new project




Manage Packages for Solution

Xamarin.Android.Support.v4 by Xamarin v23.1.1
v4 Android Support Library C# bindings for Xamarin

Xamarin.Forms by Xamarin Inc. v2.0.1.6495
Build native UIs for iOS, Android, and Windows Phone from a single, shared C# codebase

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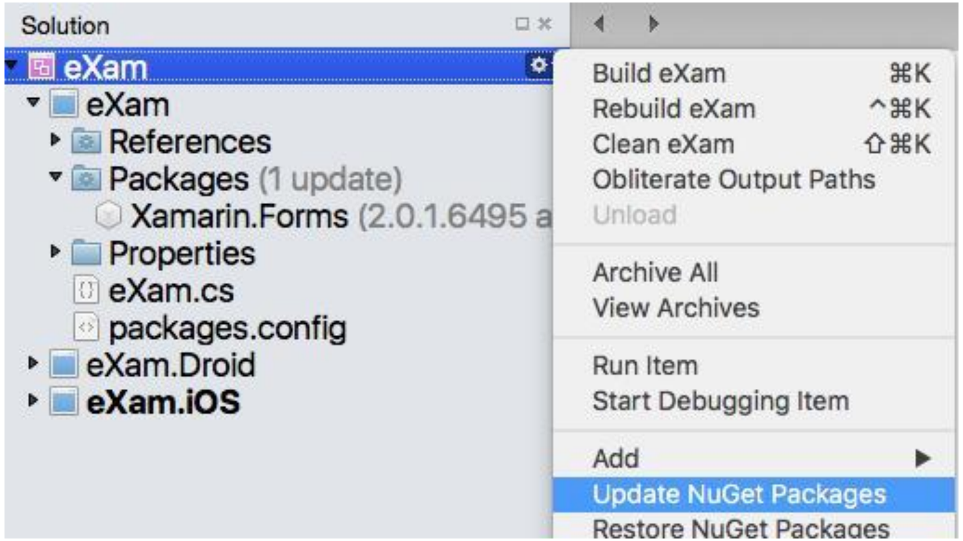
Xamarin.Forms updates [Mac]

- Should update Xamarin.Forms **Nuget package** when starting a new project

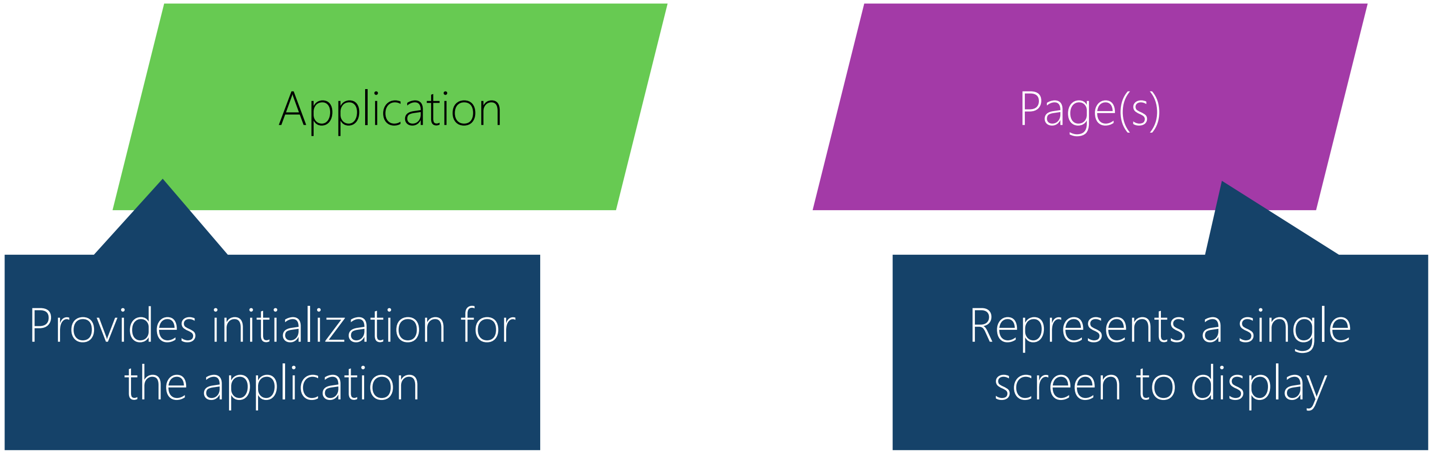


Demonstration

Creating a Xamarin.Forms application

Xamarin.Forms app anatomy

❖ Xamarin.Forms applications have two required components which are provided by the template



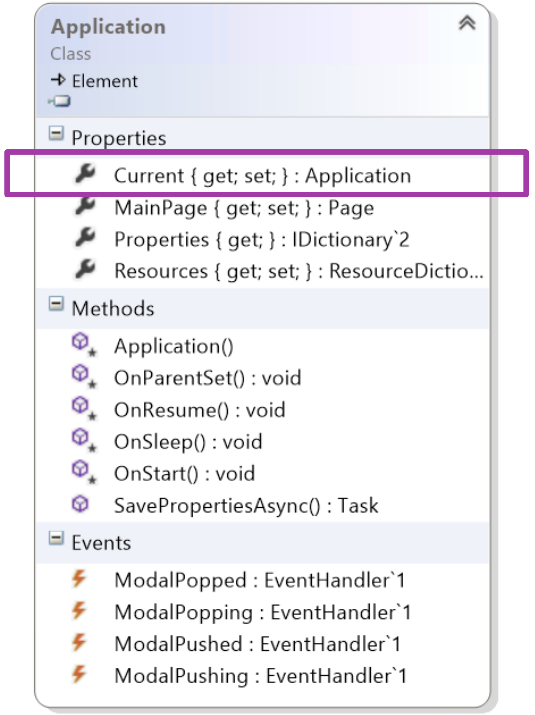
Provides initialization for the application

Represents a single screen to display

Xamarin.Forms Application

- **`Application`** class provides a *singleton* which manages:
  - Lifecycle methods
  - Modal navigation notifications
  - Currently displayed page
  - Application state persistence

- New projects will have a derived implementation named **`App`**



Application
Class
Element

Properties
- Current { get; set; } : Application
- MainPage { get; set; } : Page
- Properties { get; } : IDictionary`2
- Resources { get; set; } : ResourceDictio...

Methods
- Application()
- OnParentSet() : void
- OnResume() : void
- OnSleep() : void
- OnStart() : void
- SavePropertiesAsync() : Task

Events
- ModalPopped : EventHandler`1
- ModalPopping : EventHandler`1
- ModalPushed : EventHandler`1
- ModalPushing : EventHandler`1

Note: Windows apps *also* have an **`Application`** class, make sure not to confuse them!

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Xamarin.Forms Application

❖ **`Application`** class provides lifecycle methods which can be used to manage persistence and refresh your data

```
public class App : Application
{
   // Handle when your app starts
   protected override void OnStart() {}
   // Handle when your app sleeps
   protected override void OnSleep() {}
   // Handle when your app resumes
   protected override void OnResume() {}
}
```

Use **`OnStart`** to initialize and/or reload your app's data

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Xamarin.Forms Application

- **`Application`** class provides lifecycle methods which can be used to manage persistence and refresh your data

```
public class App : Application
{
   // Handle when your app starts
   protected override void OnStart() {}
   // Handle when your app sleeps
   protected override void OnSleep() {}
   // Handle when your app resumes
   protected override void OnResume() {}
}
```

Use **`OnSleep`** to save changes or persist information the user is working on

Xamarin.Forms Application

- **`Application`** class provides lifecycle methods which can be used to manage persistence and refresh your data

```
public class App : Application
{
   // Handle when your app starts
   protected override void OnStart() {}
   // Handle when your app sleeps
   protected override void OnSleep() {}
   // Handle when your app resumes
   protected override void OnResume() {}
}
```

Use **`OnResume`** to refresh your displayed data

Persisting information

- `Application` class also includes a `string` >> `object` property bag which is persisted between app launches

```
// Save off username in global property bag
Application.Current.Properties["username"] = username.Text;
```

```
// Restore the username before it is displayed
if (Application.Current.Properties.ContainsKey("username")) {
   var uname = Application.Current.Properties["username"] as string
                 ?? "";
   username.Text = uname;
}
```

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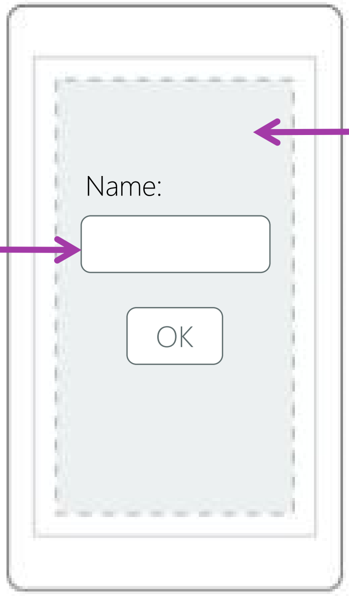
Creating the application UI

❖ Application UI is defined in terms of *pages* and *views*

Views are the UI controls the user interacts with



Page represents a single screen displayed in the app

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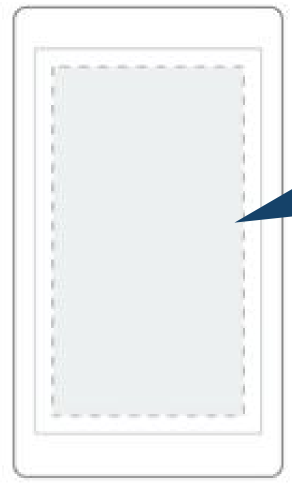
Pages

- **Page** is an abstract class used to define a single screen of content
  - derived types provide specific visualization / behavior



Content

Displays a single piece of *content* (visual thing)

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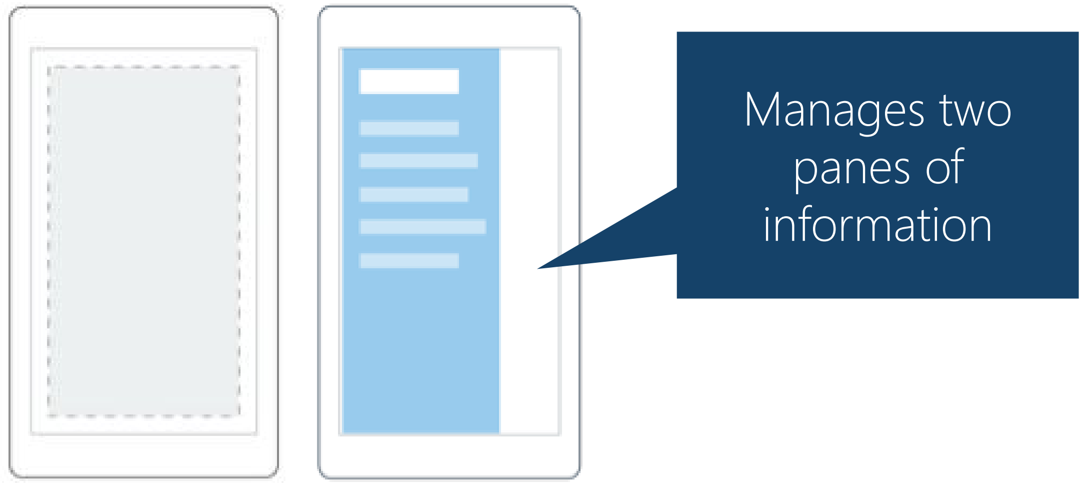
Pages

- **Page** is an abstract class used to define a single screen of content
  - derived types provide specific visualization / behavior



Content

Master Detail

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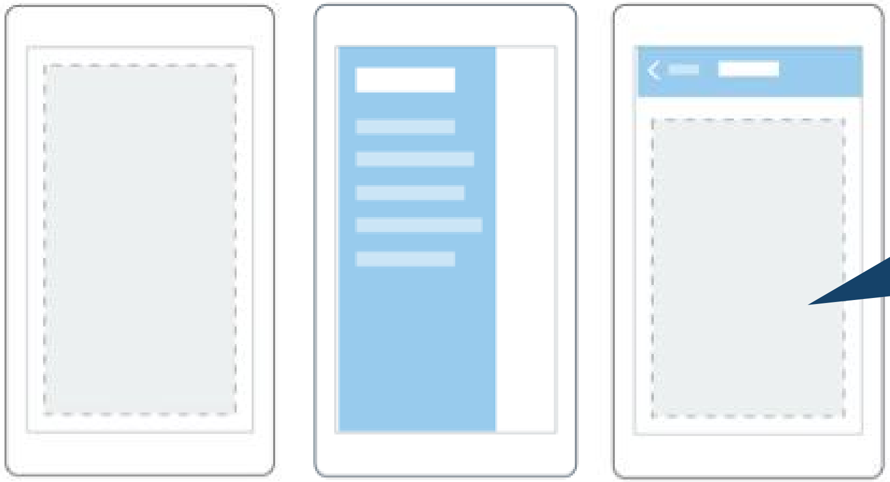
Pages

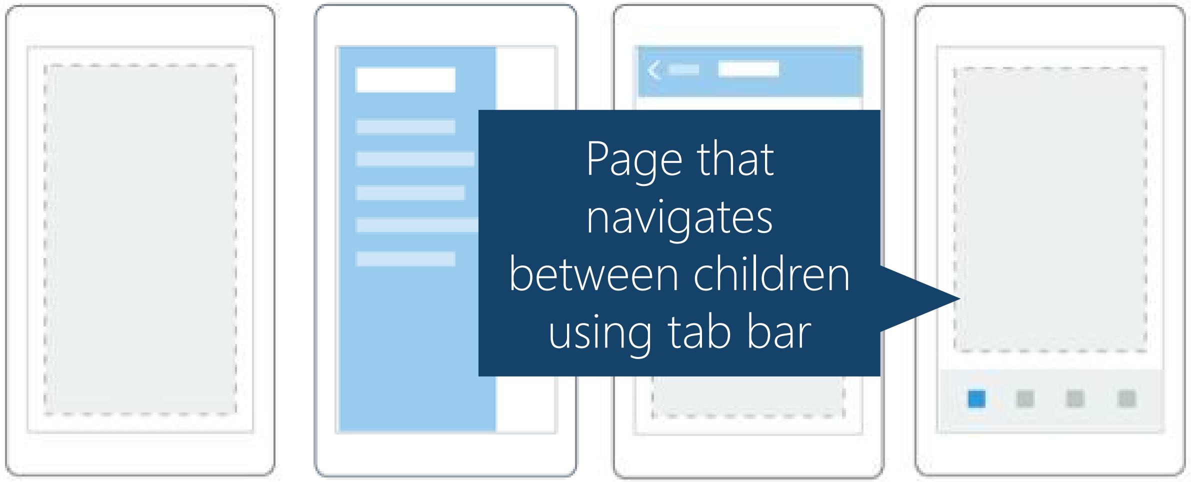
- **Page** is an abstract class used to define a single screen of content
  - derived types provide specific visualization / behavior


Content Master Detail Navigation

Manages a *stack* of pages with navigation bar

Pages

- **Page** is an abstract class used to define a single screen of content
  - derived types provide specific visualization / behavior



Content

Master Detail

Navigation

Tabbed

Demonstration

Adding a new ContentPage to a Xamarin.Forms application

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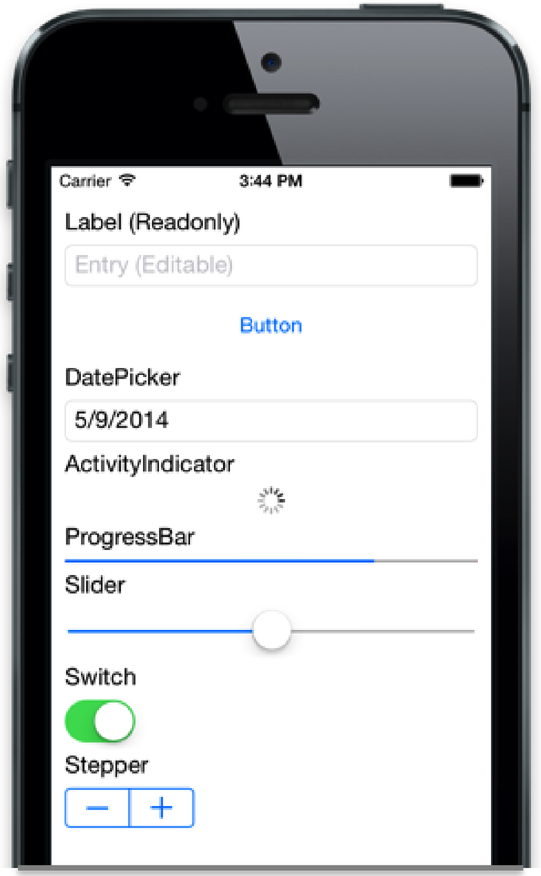
Views

- View is the base class for all visual controls, most standard controls are present

`Label`	`Image`	`SearchBar`
`Entry`	`ProgressBar`	`ActivityIndicator`
`Button`	`Slider`	`OpenGLView`
`Editor`	`Stepper`	`WebView`
`DatePicker`	`Switch`	`ListView`
`BoxView`	`TimePicker`	
`Frame`	`Picker`	



Views - Button

- Button provides a clickable surface with text

```
Button okButton = new Button() {
    Text = "Button"
};
okButton.Clicked += OnClick;
```

```
void OnClick(object sender, EventArgs e) {
  ...
}
```

Views - Label

- Use a **`Label`** to display read-only text blocks

Hello, Forms!

```
Label hello = new Label() {
   Text = "Hello, Forms!",
   HorizontalTextAlignment = TextAlignment.Center,
   TextColor = Color.Blue,
   FontFamily = "Arial"
};
```

Views - Entry

- Use an **`Entry`** control if you want the user to provide input with an on-screen or hardware keyboard

```
Entry edit = new Entry() {
   Text = "Hello",
   Keyboard = Keyboard.Text,
   PlaceholderText = "Enter Text"
};
```

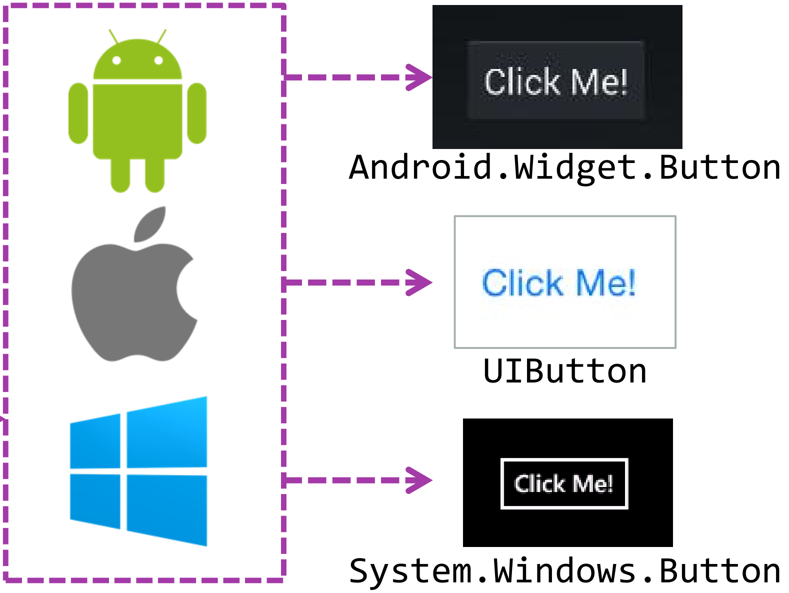
Rendering views

- Platform defines a *renderer* for each view that creates a native representation of the UI

UI uses a Xamarin.Forms Button

```
Button button = new Button {
   Text = "Click Me!"
};
```

Platform Renderer takes view and turns it into **platform-specific control**



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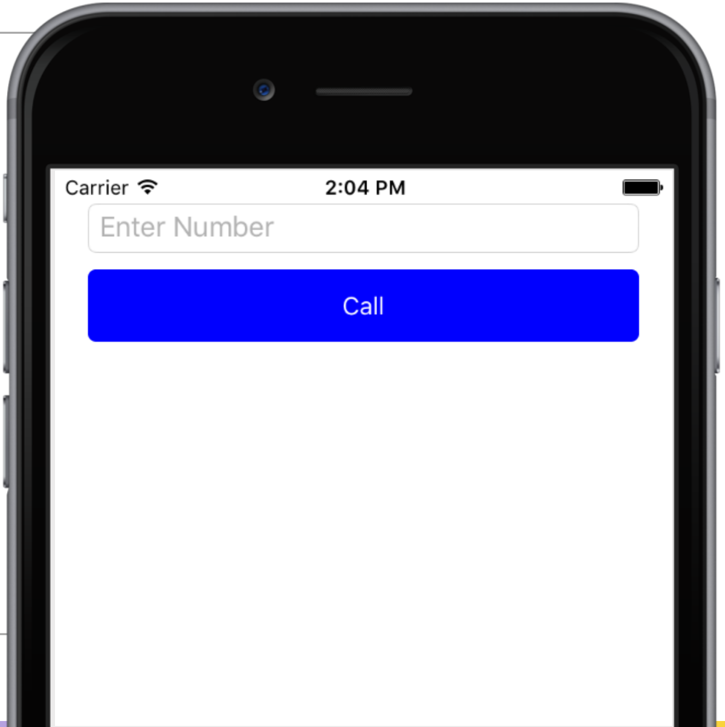
Visual adjustments

- Views utilize **properties** to adjust visual appearance and behavior

```
Entry numEntry = new Entry {
    Placeholder = "Enter Number",
    Keyboard = Keyboard.Numeric
};

Button callButton = new Button {
    Text = "Call",
    BackgroundColor = Color.Blue,
    TextColor =  Color.White
};
```



Providing Behavior

❖ Controls use events to provide interaction behavior, should be very familiar model for most .NET developers

```
Entry numEntry = new Entry { ... };
numEntry.TextChanged += OnTextChanged;
...

void OnTextChanged (object sender, string newValue)
{
    ...
}
```

You can use traditional delegates, anonymous methods, or lambdas to handle events

Group Exercise

Creating our first Xamarin.Forms application

Flash Quiz

Flash Quiz

① Xamarin.Forms creates a single binary that can be deployed to Android, iOS or Windows Phone

a) True

b) False

Flash Quiz

① Xamarin.Forms creates a single binary that can be deployed to Android, iOS or Windows Phone

a) True

b) <u>False</u>

Flash Quiz

② You must call _________ before using Xamarin.Forms

a) Forms.Initialize

b) Forms.Init

c) Forms.Setup

d) No setup call necessary.

Flash Quiz

② You must call ________ before using Xamarin.Forms

a) Forms.Initialize

b) [✓ Forms.Init]

c) Forms.Setup

d) No setup call necessary.

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Flash Quiz

③ To supply the initial page for the application, you must set the _______ property.

a) Application.FirstPage
b) Application.PrimaryPage
c) Application.MainPage
d) Application.MainView

Flash Quiz

③ To supply the initial page for the application, you must set the _______ property.

a) Application.FirstPage

b) Application.PrimaryPage

c) [✓ Application.MainPage]

d) Application.MainView

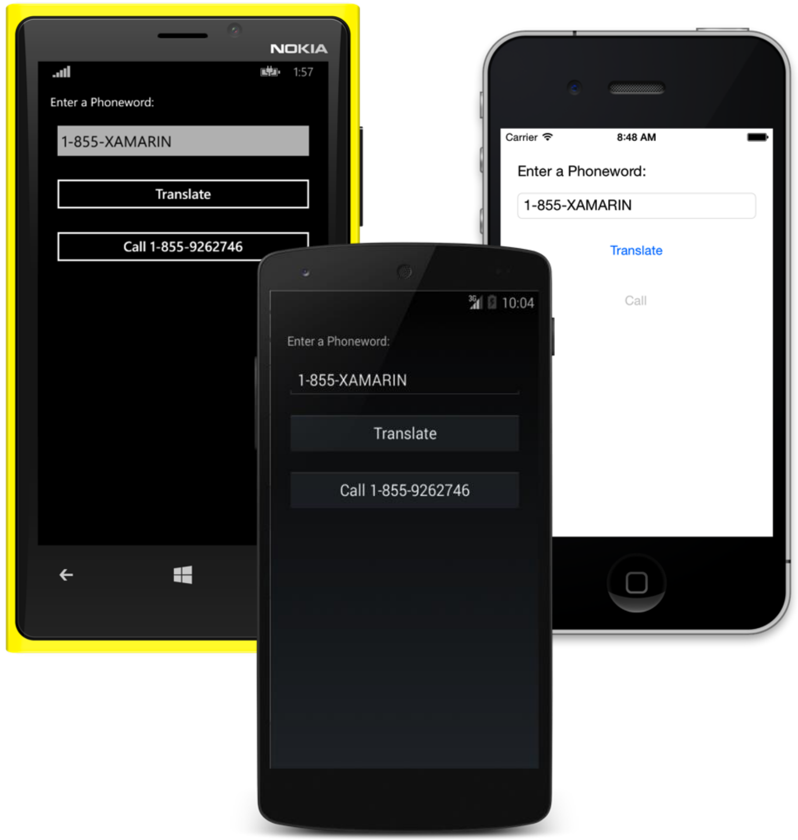
Summary

- Xamarin.Forms project structure
- Application Components
- "Hello, Forms!"

Pages, Controls, and Layout

Tasks

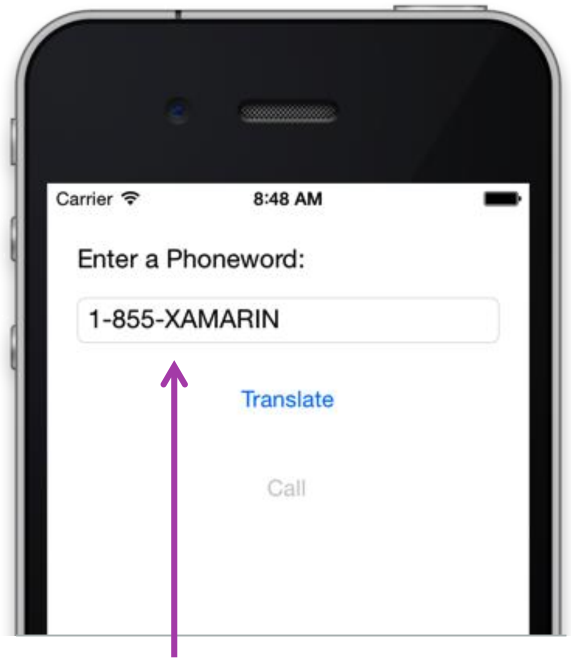
- Layout containers
- Adding views
- Fine-tuning layout



Organizing content

- Rather than specifying positions with coordinates (pixels, dips, etc.), you use layout containers to control how views are positioned relative to each other

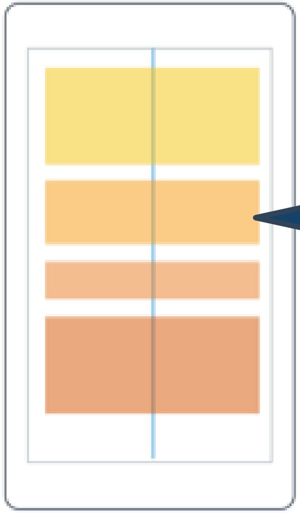
- This provides for a more *adaptive* layout which is not as sensitive to dimensions and resolutions



For example, "stacking" views on top of each other with some spacing between them

Layout containers

- *Layout Containers* organize child elements based on specific rules

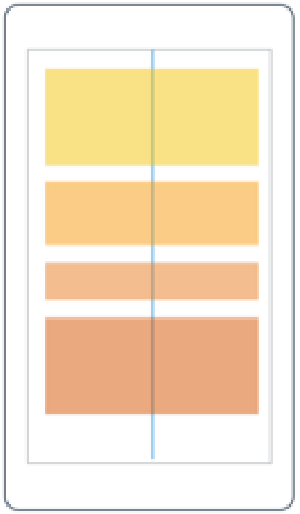


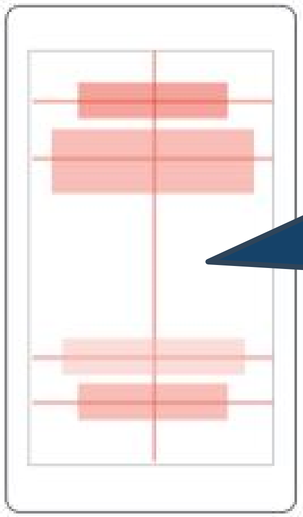
StackLayout

`StackLayout` places children top-to-bottom (default) or left-to-right based on **`Orientation`** property setting

Layout containers

- *Layout Containers* organize child elements based on specific rules

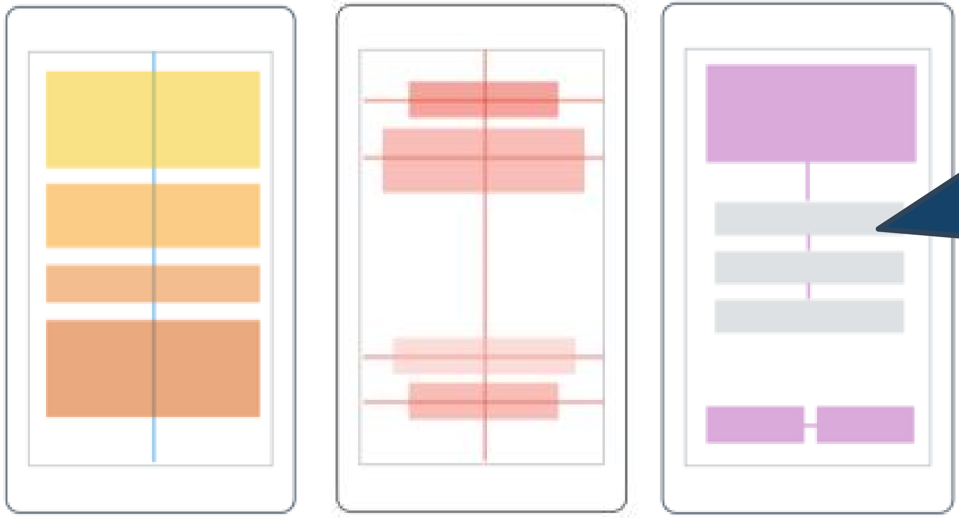

StackLayout


AbsoluteLayout

`AbsoluteLayout` places children in absolute requested positions based on anchors and bounds

Layout containers

❖ *Layout Containers* organize child elements based on specific rules


StackLayout

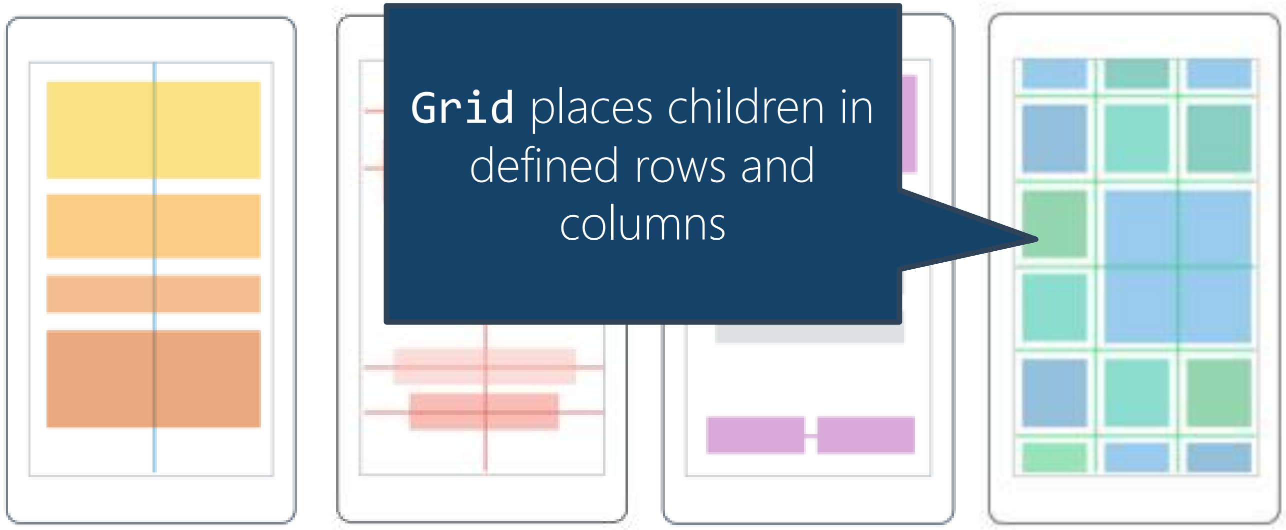
Absolute Layout

Relative Layout

`RelativeLayout` uses constraints to position the children

Layout containers

- *Layout Containers* organize child elements based on specific rules



StackLayout

Absolute Layout

Relative Layout

Grid

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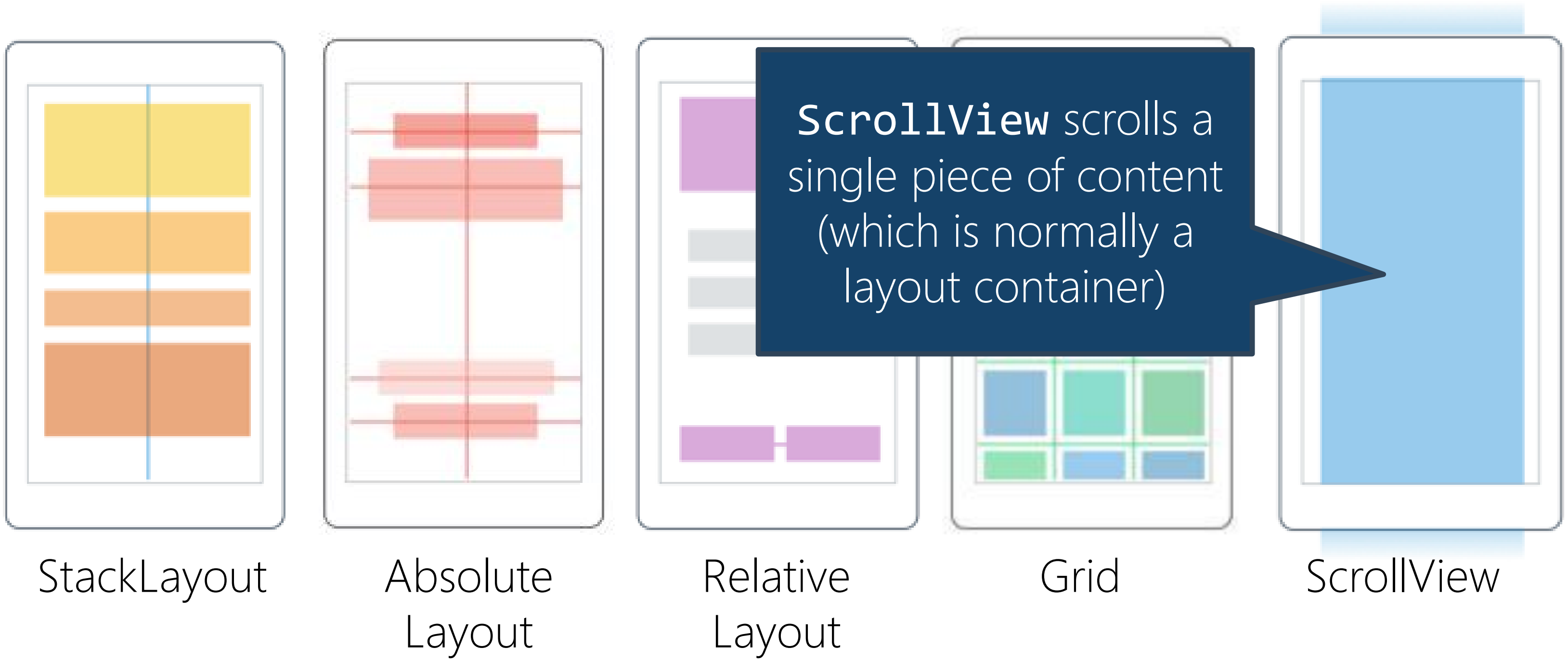
Layout containers

❖ *Layout Containers* organize child elements based on specific rules



`ScrollView` scrolls a single piece of content (which is normally a layout container)

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Adding views to layout containers

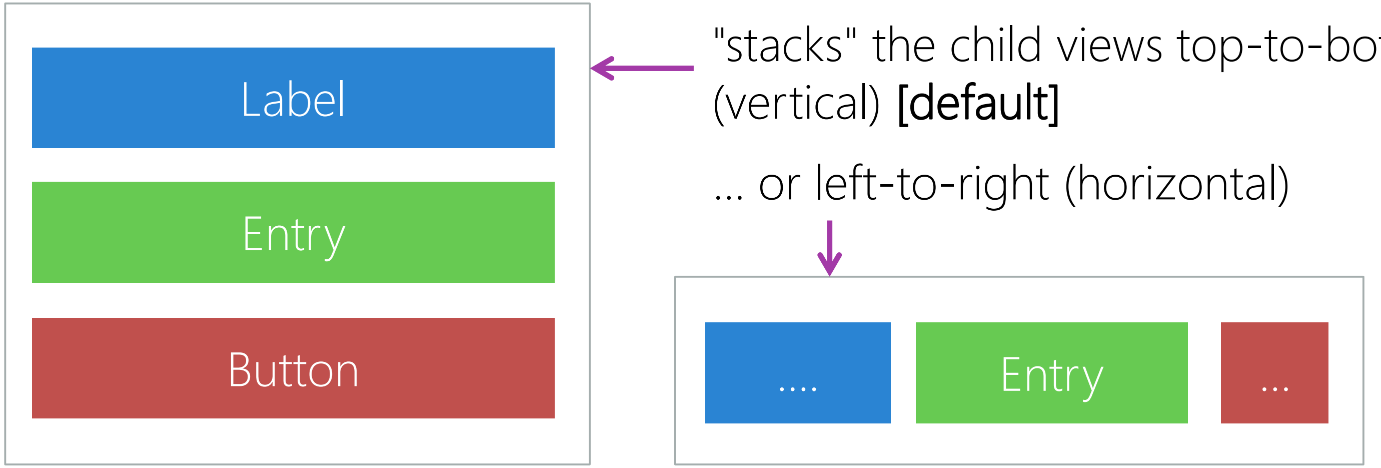
❖ Layout containers have a **`Children`** collection property which is used to hold the views that will be organized by the container

```
Label label = new Label { Text = "Enter Your Name" };
Entry nameEntry = new Entry();

StackLayout layout = new StackLayout();
layout.Children.Add(label);
layout.Children.Add(nameEntry);

this.Content = layout;
```

Views are laid out and rendered in the order they appear in the collection

Working with StackLayout

❖ `StackLayout` is used to create typical form style layout

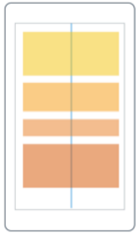

Label
Entry
Button
"stacks" the child views top-to-bottom (vertical) [default]
... or left-to-right (horizontal)
....
Entry
...

The `Orientation` property can be set to either `Horizontal` or `Vertical` to control which direction the child views are stacked in

Working with StackLayout

- **`StackLayout`** is used to create typical form style layout, **`Orientation`** property decides the direction that children are stacked

```
var layout = new StackLayout {
   Orientation = StackOrientation.Vertical
};

layout.Children.Add(new Label { Text = "Enter your name:" });
layout.Children.Add(new Entry());
layout.Children.Add(new Button { Text = "OK" });
```



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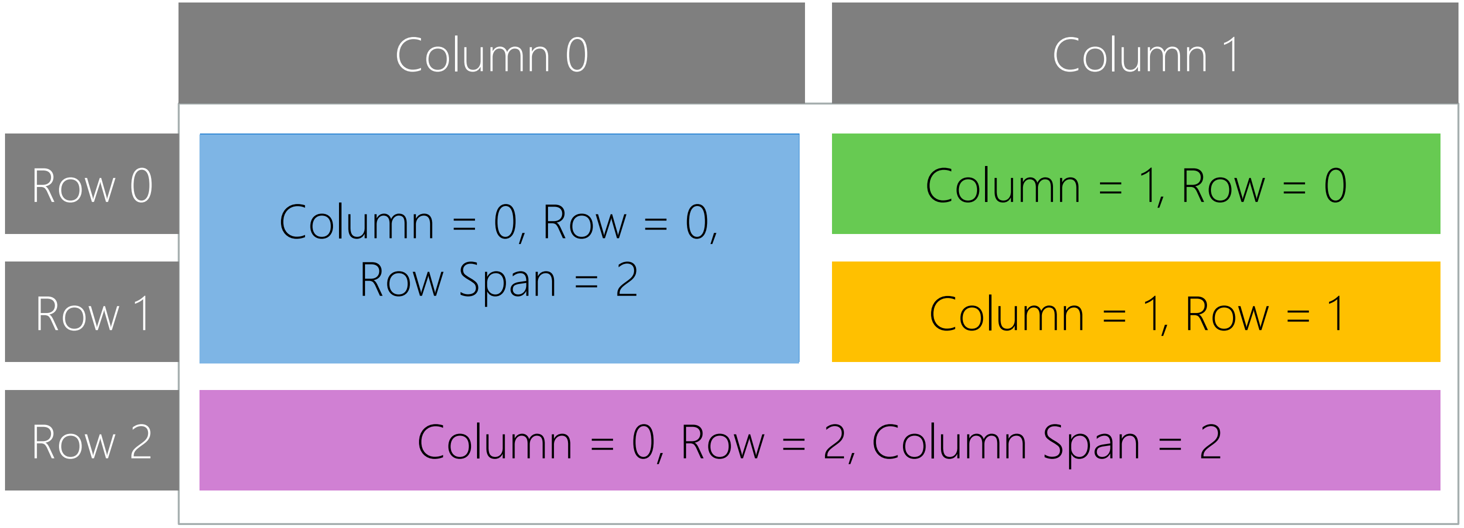
Working with Grid

- `Grid` is used to create rows and columns of information, children identify specific column, row and span


Column 0
Column 1
Row 0
Row 1
Row 2
Column = 0, Row = 0, Row Span = 2
Column = 1, Row = 0
Column = 1, Row = 1
Column = 0, Row = 2, Column Span = 2

Adding items to a Grid

- Children in **Grid** must specify the layout properties, or they will default to the first column/row

```
Label label = new Label { Text = "Enter Your Name" };

Grid layout = new Grid();
layout.Children.Add(label);

Grid.SetColumn(label, 1);
Grid.SetRow(label, 1);
Grid.SetColumnSpan(label, 2);
Grid.SetRowSpan(label, 1);
```

Use static methods defined on **Grid** to set layout properties

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Adding items to a Grid

- Children in **Grid** must specify the layout properties, or they will default to the first column/row

```
Grid layout = new Grid();

...

layout.Children.Add(label, 0, 1);             // Left=0 and Top=1
layout.Children.Add(button, 0, 2, 2, 3);   // L=0, R=2, T=2, B=3
```

Can also specify row/column as Left/Right/Top/Bottom values to **Add** method

Controlling the shape of the grid

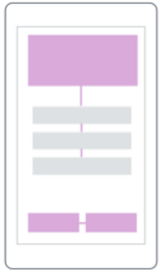
❖ Can influence the determined shape and size of the columns and rows

```
Grid layout = new Grid();
layout.RowDefinitions.Add(new RowDefinition {
    Height = new GridLength(100, GridUnitType.Absolute) // 100px
});
layout.RowDefinitions.Add(new RowDefinition {
    Height = new GridLength(1, GridUnitType.Auto) // "Auto" size
});
layout.ColumnDefinitions.Add(new ColumnDefinition {
    Width = new GridLength(1, GridUnitType.Star)  // "Star" size
});
```

Working with RelativeLayout

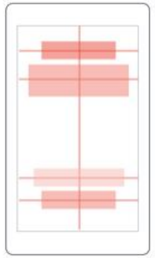
- **`RelativeLayout`** allows you to position child views relative to two other views, or to the **`RelativeLayout`** itself using **constraint-based** rules

```
var layout = new RelativeLayout();
...
layout.Children.Add(label,
      Constraint.RelativeToParent(
           parent => (0.5 * parent.Width) - 25),   // X
     Constraint.RelativeToView(button,
           (parent, sibling) => sibling.Y + 5),    // Y
     Constraint.Constant(50),                      // Width
     Constraint.Constant(50));                     // Height
```



Working with AbsoluteLayout

- `AbsoluteLayout` positions and sizes children by **absolute values** through either a coordinate (where the view determines it's own size), or a bounding box

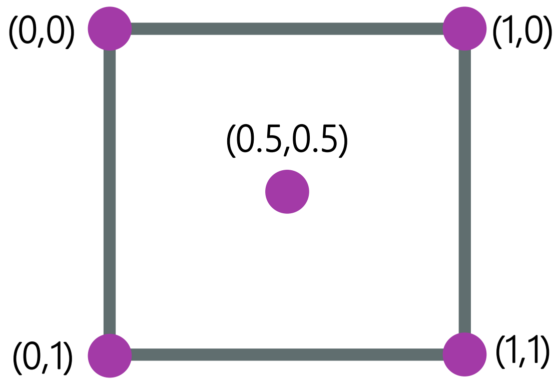


```
var layout = new AbsoluteLayout();
...
// Can do absolute positions by coordinate point
layout.Children.Add(label1, new Point(100, 100));

// Or use a specific bounding box
layout.Children.Add(label2, new Rectangle(20, 20, 100, 25));
```

Working with AbsoluteLayout

- `AbsoluteLayout` can also position and size children **proportional to its own size** using coordinates based on a 1x1 unit square which represents a percentage of the container's size



Working with AbsoluteLayout

- `AbsoluteLayout` can also position and size children **proportional to its own size** using coordinates based on a 1x1 unit square which represents a percentage of the container's size

```
var layout = new AbsoluteLayout();
...
// Center at the bottom of the container, take up ½ the space
layout.Children.Add(bottomLabel, new Rectangle (.5, 1, .5, .1),
                            AbsoluteLayoutFlags.All );
```

Here we center the label (.5) at the bottom of the container (1) and take up ½ the space (.5) width and 1/10 the space height (.1)

Working with AbsoluteLayout

- `AbsoluteLayout` can also position and size children proportional to its own size using coordinates based on a 1x1 unit square which represents a percentage of the container's size

```
var layout = new AbsoluteLayout();
...
// Stretch image across entire container
layout.Children.Add(fillImage, new Rectangle (0, 0, 1, 1),
                               AbsoluteLayoutFlags.All );
```

Here we "fill" the container with an image
[0,0] – [1,1]

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Fine-tuning AbsoluteLayout

- Can use either **Add** method, or specific static methods to control the bounding box and layout flags for children in **AbsoluteLayout** – this allows for "runtime" adjustments

```
Label bottomLabel;

void MoveLabelToTopRight(object sender, EventArgs e)
{
   AbsoluteLayout.SetLayoutBounds(bottomLabel,
                  new Rectangle (1, 0, .5, .1));
   AbsoluteLayout.SetLayoutFlags (bottomLabel,
                  AbsoluteLayoutFlags.All);
}
```

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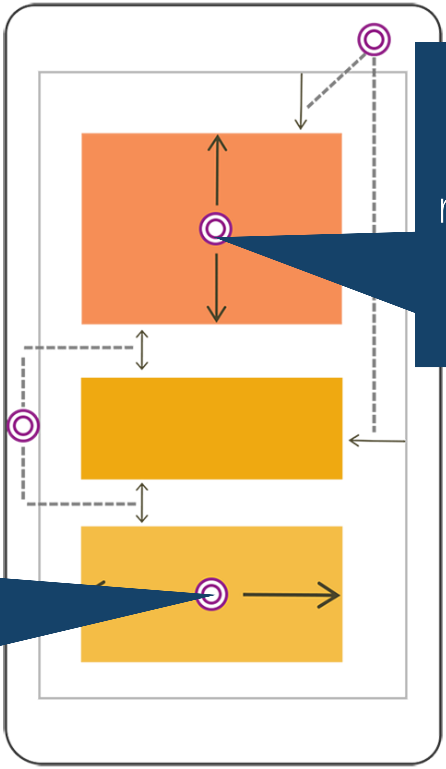
Adding spacing and padding

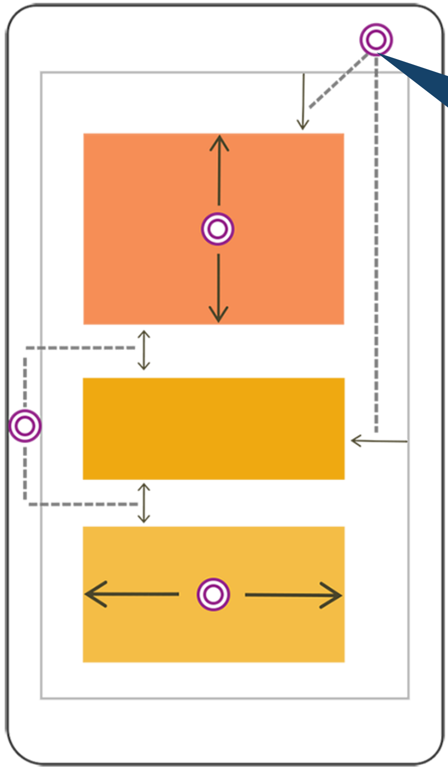


`HeightRequest` property used to request a specific height on a view in the parent container

`WidthRequest` property used to request a specific width on a view in the parent container

```
Button okButton = ...;
okButton.WidthRequest = 100;
okButton.HeightRequest = 75;
```

Adding spacing and padding

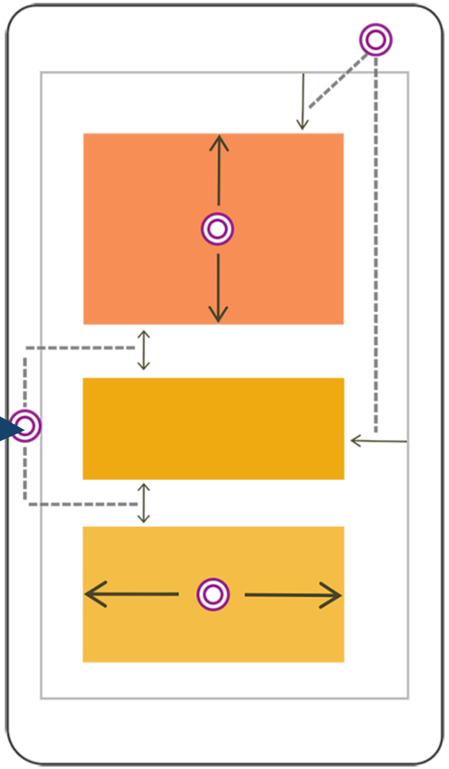


`Padding` property on parent containers is used to add padding *around* the children

```
ContentPage mainPage = ...;
mainPage.Padding =
   new Thickness(5,20,5,5);
```

Adding spacing and padding

`Spacing` property on `StackLayout` and `Grid` allows you to control spacing *in-between* children



```
StackLayout layout = ...;
layout.Spacing = 20;
```

```
Grid layout = ...;
layout.RowSpacing = 10;
layout.ColumnSpacing = 20;
```

Individual Exercise

Creating Xamarin.Forms Phoneword

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Flash Quiz

Flash Quiz

① The direction (left-to-right or top-to-bottom) a `StackLayout` organizes content is controlled by which property?

a) Style

b) Direction

c) Orientation

d) LayoutDirection

Flash Quiz

① The direction (left-to-right or top-to-bottom) a **`StackLayout`** organizes content is controlled by which property?

a) Style

b) Direction

c) Orientation

d) LayoutDirection

Flash Quiz

② Which of these controls is <u>not</u> available in Xamarin.Forms?

a) Button
b) DatePicker
c) ListBox
d) ListView

Flash Quiz

② Which of these controls is not available in Xamarin.Forms?

a) Button

b) DatePicker

c) ListBox

d) ListView

Flash Quiz

③ To adjust spacing between children when using the `StackLayout` container we can change the ______ property.

a) Margin
b) Padding
c) Spacing

Flash Quiz

③ To adjust spacing between children when using the `StackLayout` container we can change the ______ property.

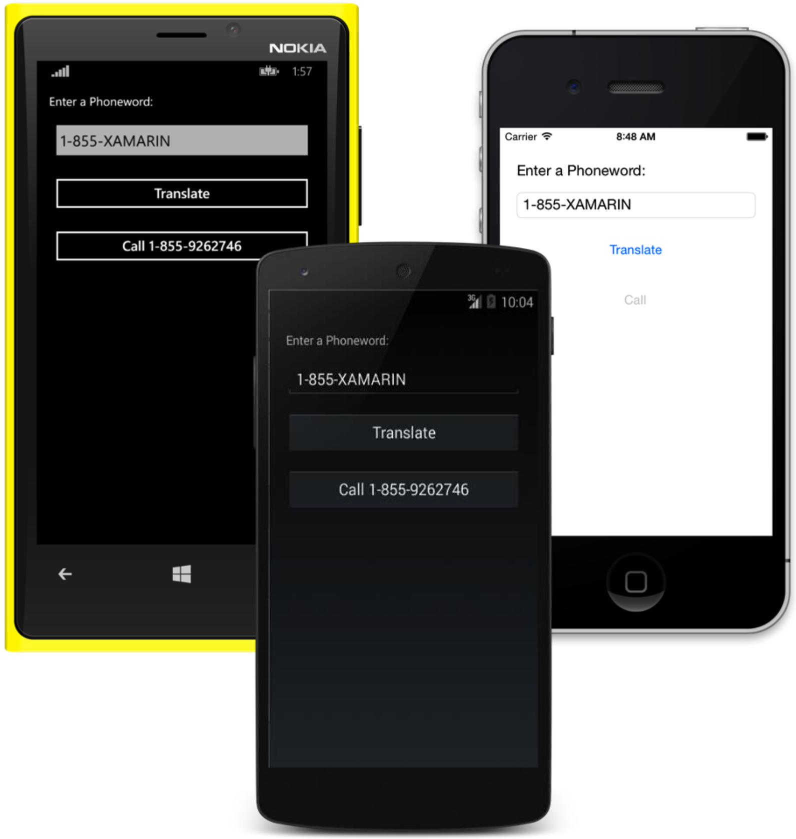
a) Margin

b) Padding

c) [✓ Spacing]

Summary

- ❖ Layout containers
- ❖ Adding views
- ❖ Fine-tuning layout



Using Platform-Specific Features

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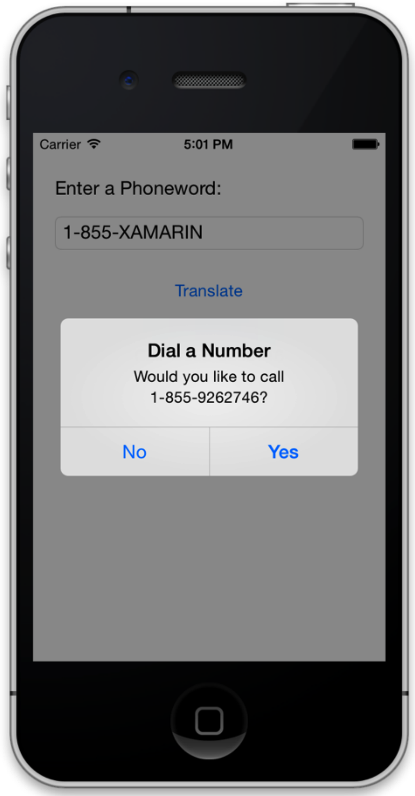
Tasks

- ❖ Changing the UI per-platform
- ❖ Using Platform features
- ❖ Working with `DependencyService`

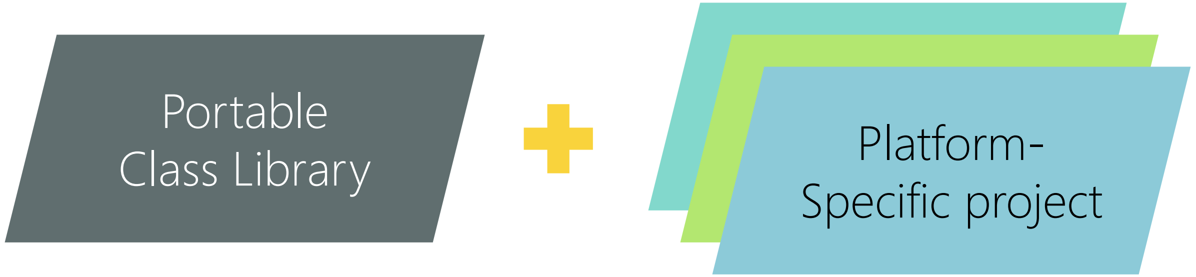


Dial a Number

Would you like to call 1-855-9262746?

Recall: Xamarin.Forms architecture

- Xamarin.Forms applications have two projects that work together to provide the logic + UI for each executable



- *shared* across all platforms
- limited access to .NET APIs
- want most of our code here

- 1-per platform
- code is *not* shared
- full access to .NET APIs
- any platform-specific code must be located in these projects

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Changing the UI per-platform

❖ `Device.OnPlatform` allows you to fine-tune the UI for each platform

```
Device.OnPlatform(
   iOS: () => { ... },
   Android: () => { ... },
   WinPhone: () => { ... },
   Default: () => { ... });
```

Can execute specific logic per-platform using delegates for each platform

```
new Thickness(5,
    Device.OnPlatform(20, 0, 0),
    5, 5);
```

Can return a different value per-platform (iOS, Android, WinPhone) using `Device.OnPlatform<T>`

This code is used in the shared code but only uses one of the supplied values or delegates when the code is executed on a specific platform

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Detecting the platform

- Can use the static **Device** class to identify the platform and device style

```
if (Device.Idiom == TargetIdiom.Tablet) {
    // Code for tablets only
    if (Device.OS == TargetPlatform.iOS) {
        // Code for iPad only
    }
}
```

Note that this does not allow for *platform-specific code* to be executed, it allows runtime detection of the platform to execute a unique branch of code in your shared PCL

Using Platform Features

- Xamarin.Forms has support for dealing with a few, very common platform-specific features

`Device.OpenUri` to launch external apps based on a URL scheme

`Page.DisplayAlert` to show simple alert messages

Timer management using `Device.StartTimer`

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Using Platform Features

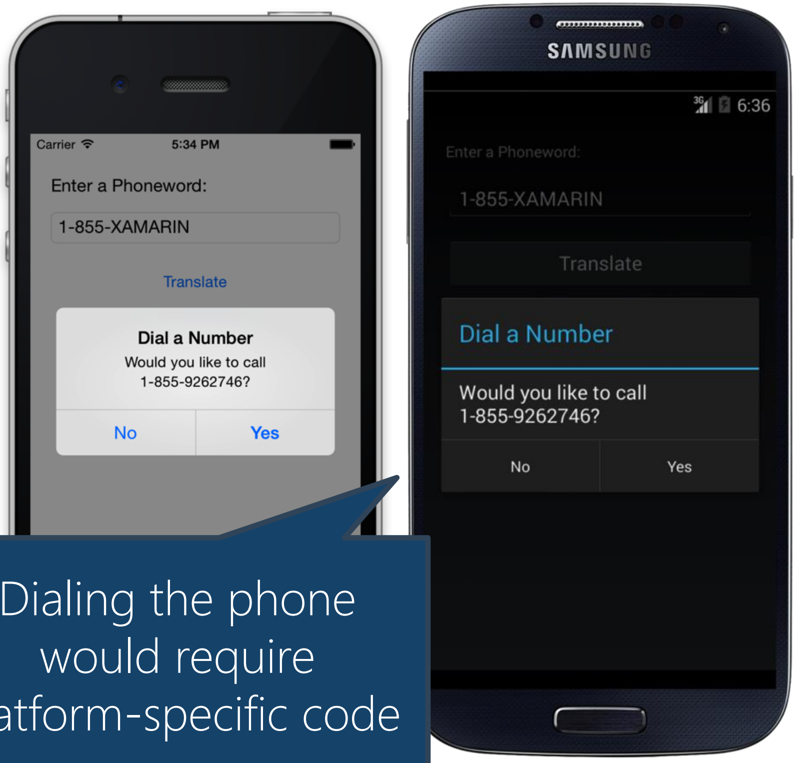
- Xamarin.Forms has support for dealing with a few, very common platform-specific features

UI Thread marshaling with Device.BeginInvokeOnMainThread

Mapping and Location through `Xamarin.Forms.Maps`

Other platform-specific features

- Platform features *not* exposed by Xamarin.Forms can be used, but will require some architectural design
  - code goes into platform-specific projects
  - often must (somehow) use code from your shared logic project
- Attend **XAM110** and **XAM300** for more details



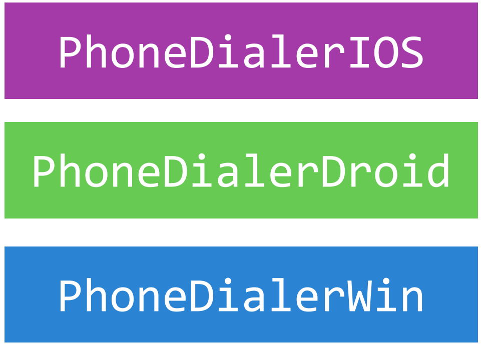
Dialing the phone would require platform-specific code

Creating abstractions

- Best practice to build an *abstraction* implemented by the target platform which defines the platform-specific functionality

```
public interface IDialer
{
    bool MakeCall(string number);
}
```

Shared code defines **`IDialer`** interface to represent required functionality



Platform projects implement the shared dialer interface using the platform-specific APIs

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Locating dependencies

- Xamarin.Forms includes a *service locator* called **`DependencyService`** which can be used to register platform-specific implementations and then locate them through the abstraction in your shared code

1 Define an interface or abstract class in the shared code project (PCL)

```
public interface IDialer
{
    bool MakeCall(string number);
}
```

Locating dependencies

- Xamarin.Forms includes a *service locator* called **`DependencyService`** which can be used to register platform-specific implementations and then locate them through the abstraction in your shared code

2 Provide implementation of abstraction in each platform-specific project

```
class PhoneDialerIOS : IDialer
{
    public bool MakeCall(string number) {
      // Implementation goes here
    }
}
```

Locating dependencies

- Xamarin.Forms includes a *service locator* called **`DependencyService`** which can be used to register platform-specific implementations and then locate them through the abstraction in your shared code

3 Expose platform-specific implementation using assembly-level attribute in platform-specific project

```
[assembly: Dependency(typeof(PhoneDialerIOS))]
```

Implementation type is supplied to attribute as part of registration

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Locating dependencies

- Xamarin.Forms includes a *service locator* called **`DependencyService`** which can be used to register platform-specific implementations and then locate them through the abstraction in your shared code

4 Retrieve and use the dependency anywhere using **`DependencyService.Get<T>`** (both shared and platform specific projects can use this API)

```
IDialer dialer = DependencyService.Get<IDialer>();
if (dialer != null) {
    ...
}
```

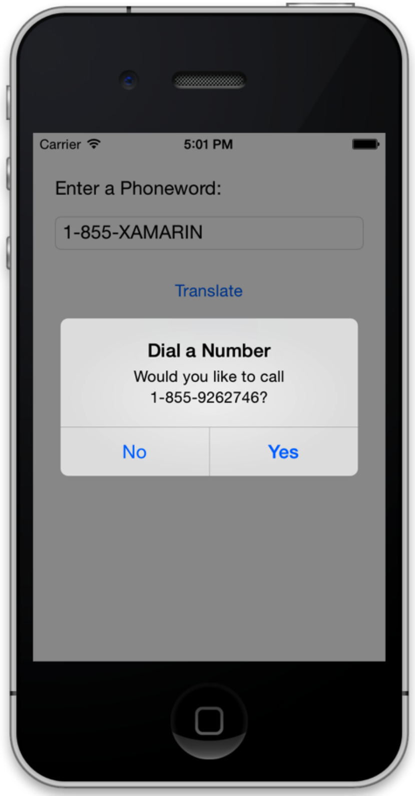
Request the *abstraction* and the implementation will be returned

Individual Exercise

Adding support for dialing the phone

Summary

- Changing the UI per-platform
- Using Platform features
- Working with `DependencyService`



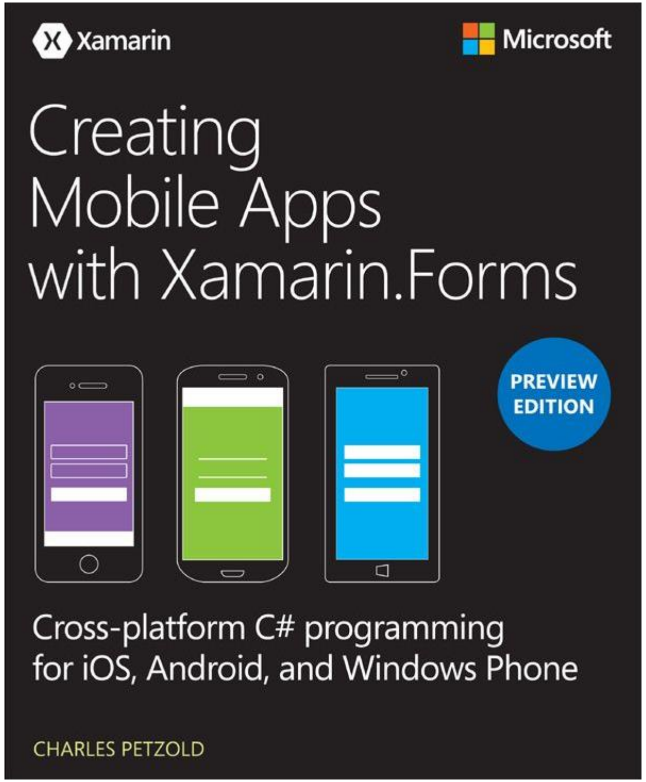
Dial a Number

Would you like to call 1-855-9262746?

What's Next?

- ✓ XAM130 continues your exploration of Xamarin.Forms by diving into XAML
- ✓ XAM140 looks at Styles and Triggers
- ✓ XAM310 covers Data Binding
- ✓ XAM311/312 explores the `ListView`
- ✓ XAM320 caps it off with MVVM coverage

Also, make sure to download Charles Petzold's book online: bit.ly/xforms-book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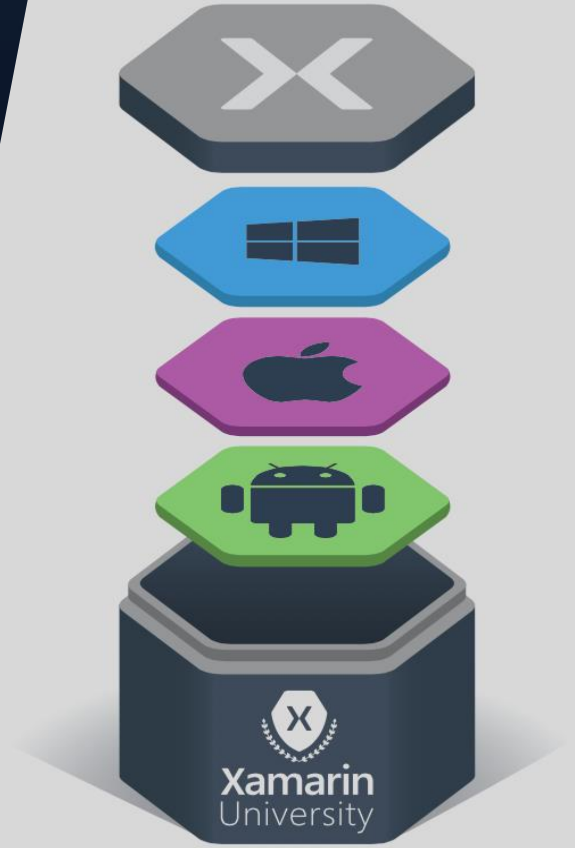

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