



XAM130

XAML in Xamarin.Forms

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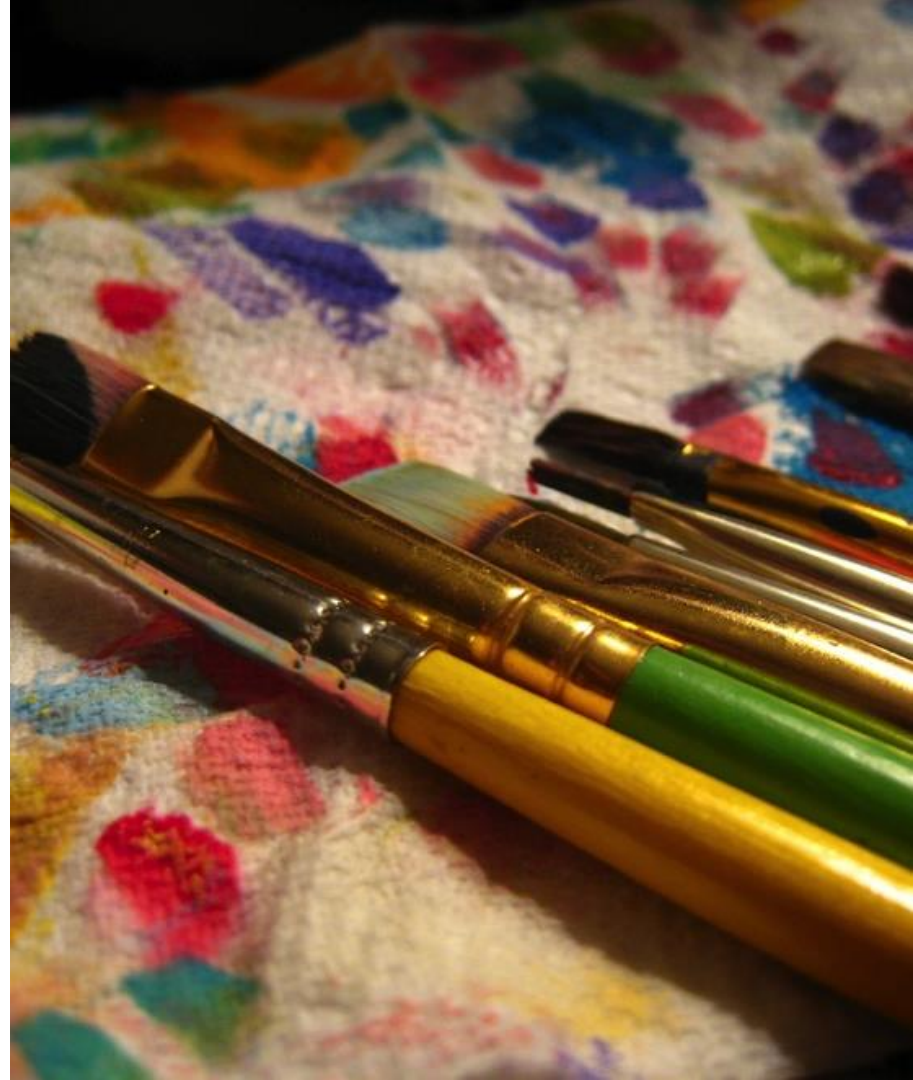
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Objectives

1. Examining XAML syntax
2. Adding Behavior to XAML-based pages
3. Exploring XAML capabilities



Examining XAML syntax

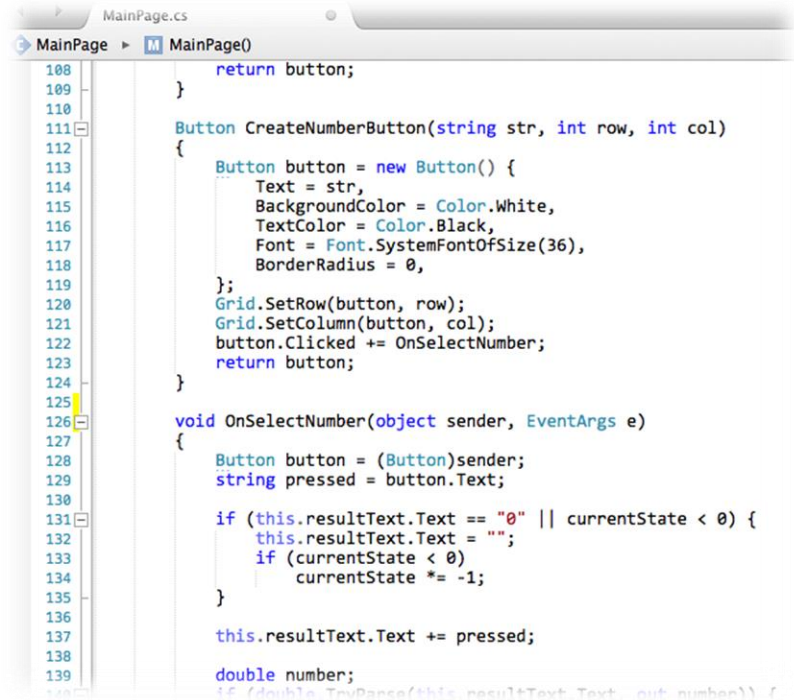
Tasks

- ❖ Why use XAML?
- ❖ Microsoft XAML vs. Xamarin.Forms
- ❖ XAML 101
- ❖ Using XAML with Xamarin.Forms



Creating Pages in Code

- ❖ Significant portion of code behind tends to be in **UI creation**: setup and layout
- ❖ Mixing of UI and behavior in one file can make **both design and behavior** harder to understand / evolve
- ❖ Prohibits designer role involvement
 - **developer is forced to do everything**



```
108         return button;
109     }
110
111     Button CreateNumberButton(string str, int row, int col)
112     {
113         Button button = new Button() {
114             Text = str,
115             BackgroundColor = Color.White,
116             TextColor = Color.Black,
117             Font = Font.SystemFontOfSize(36),
118             BorderRadius = 0,
119         };
120         Grid.SetRow(button, row);
121         Grid.SetColumn(button, col);
122         button.Clicked += OnSelectNumber;
123         return button;
124     }
125
126     void OnSelectNumber(object sender, EventArgs e)
127     {
128         Button button = (Button)sender;
129         string pressed = button.Text;
130
131         if (this.resultText.Text == "0" || currentState < 0) {
132             this.resultText.Text = "";
133             if (currentState < 0)
134                 currentState *= -1;
135         }
136
137         this.resultText.Text += pressed;
138
139         double number;
140         if (double.TryParse(this.resultText.Text, out number)) {
```

Working in Markup

❖ HTML has taught us that markup languages are a great way to define user interfaces because they are:

- Toolable
- Human readable
- Extensible



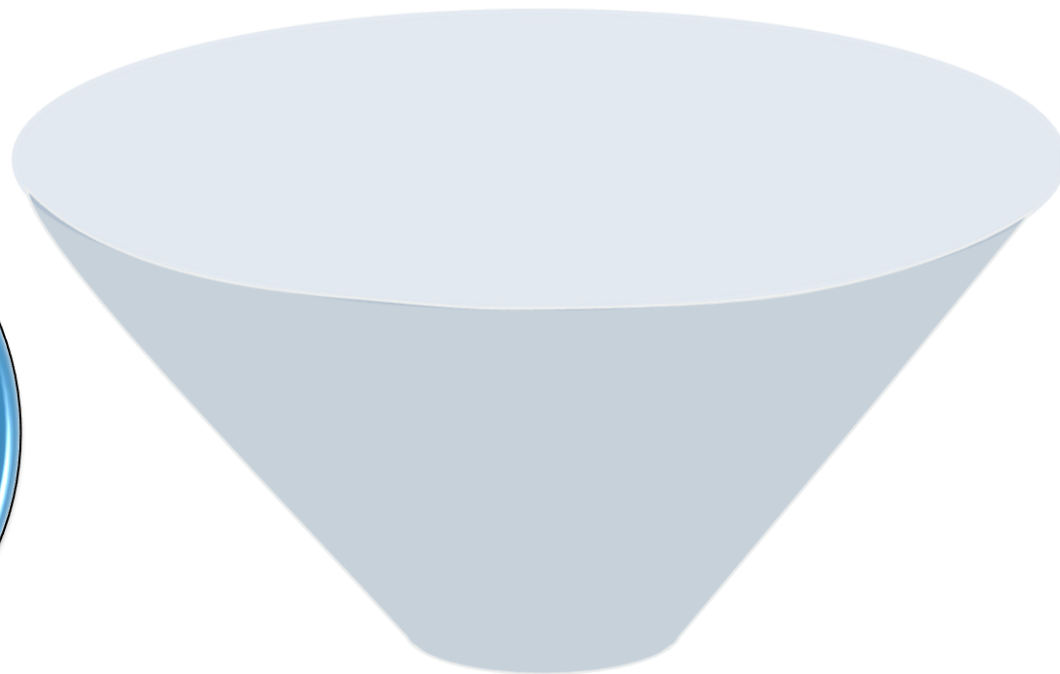
Extensible Application Markup Language

- ❖ XAML was created by Microsoft specifically to describe UI

XAML

Xamarin Forms + XAML
= Sweetness!

Benefits



XAML

Microsoft XAML vs. Xamarin.Forms

- ❖ Xamarin.Forms conforms to the XAML 2009 specification; the differences are really in the controls and layout containers you use

```
<Page x:Class="App2.MainPage"
      xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
      xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml">

    <StackPanel Margin="50" VerticalAlignment="Center">
        <TextBox PlaceholderText="User name" />
        <PasswordBox PlaceholderText="Password" />
        <Button Background="#FF77D065"
                Content="Login"
                Foreground="White" />
    </StackPanel>

</Page>
```

Microsoft XAML (WinRT)

```
<?xml version="1.0" encoding="UTF-8"?>
<ContentPage xmlns="http://xamarin.com/schemas/2014/forms"
             xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
             x:Class="Test.MyPage">

    <StackLayout Spacing="20"
                 Padding="50" VerticalOptions="Center">
        <Entry Placeholder="User Name" />
        <Entry Placeholder="Password"
                IsPassword="True" />
        <Button Text="Login" TextColor="White"
                BackgroundColor="#FF77D065" />
    </StackLayout>

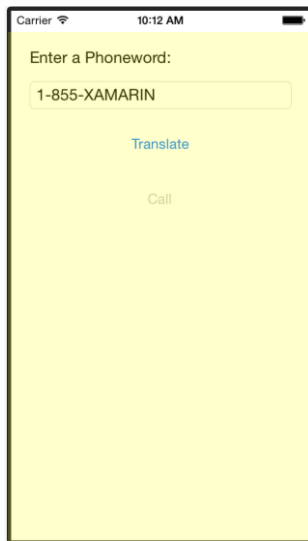
</ContentPage>
```

Xamarin.Forms

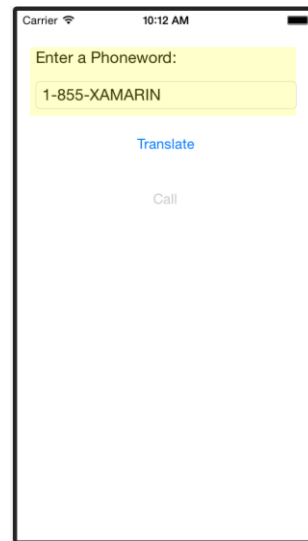
Feature	Supported in Xamarin.Forms
XAML 2009 compliance	✓
Shapes (Rectangle, Ellipse, Path, etc.)	BoxView
Resources, Styles and Triggers	✓
Data binding	✓ *not all features
Data templates	✓
Control templates	Custom renderers
Render Transforms	✓
Animations	Code-only
Custom XAML behaviors	✓
Custom markup extensions	✓
Value converters	✓

Adding a XAML Page

- ❖ There are two Item Templates available to add XAML content



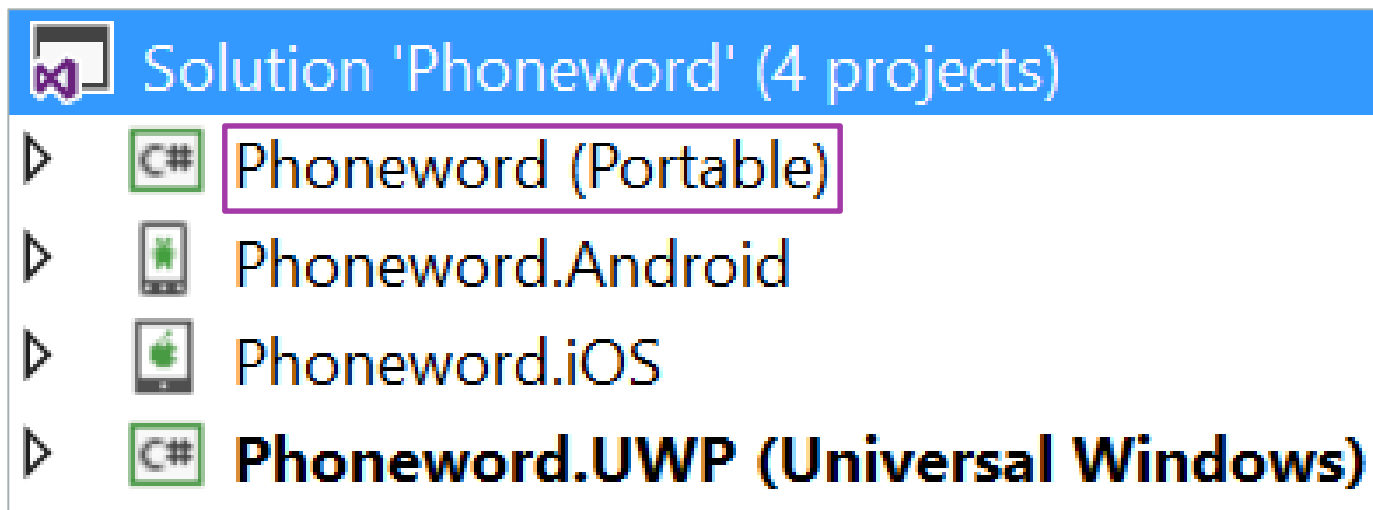
Forms **ContentPage** XAML
Entire screen of content



Forms **ContentView** XAML
Composite control (smaller than a page)

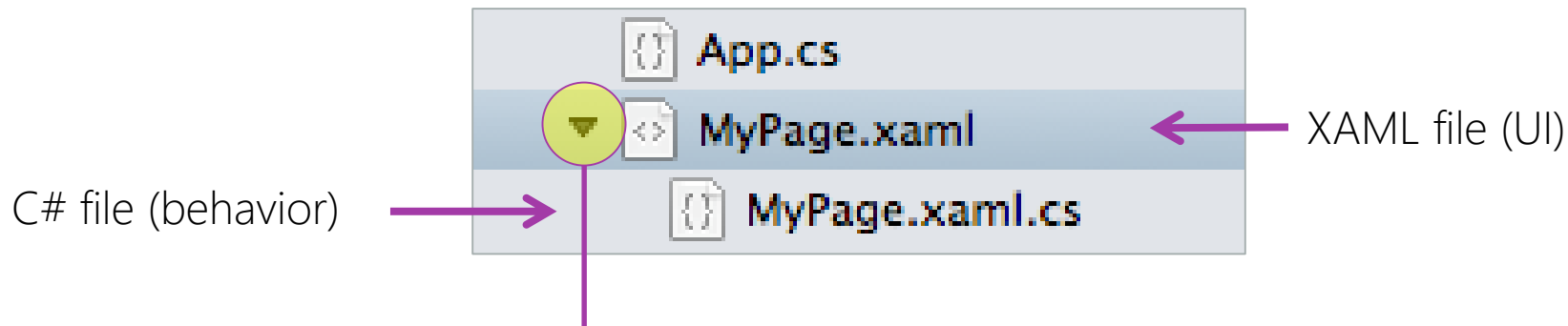
Where do the XAML pages go?

You should always add the XAML content to the *platform-independent* part of your application – this is **shared UI and code** for all your target platforms



What gets created?

- ❖ XAML pages have two related files which work together to define the class

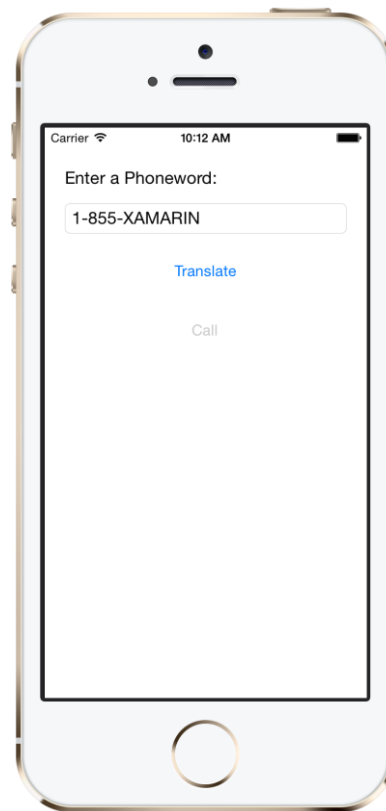


Disclosure arrow *collapses* the C# file and indicates these files go together

Let's create a UI with XAML

❖ Our goal is to build the UI for our old friend **Phoneword**:

- Label (Enter a Phoneword:)
- Entry (1-855-XAMARIN)
- Button (Translate)
- Button (Call)



Describing a screen in XAML

- ❖ XAML is used to construct object graphs, in this case a visual **Page**

```
<?xml version="1.0" encoding="UTF-8" ?>
<ContentPage ...>
    <StackLayout Padding="20" Spacing="10">
        <Label Text="Enter a Phoneword:" />
        <Entry Placeholder="Number" />
        <Button Text="Translate" />
        <Button Text="Call" IsEnabled="False" />
    </StackLayout>
</ContentPage>
```

XML based: case sensitive, open tags must be closed, etc.

Describing a screen in XAML

- ❖ XAML is used to construct object graphs, in this case a visual **Page**

Element tags
create objects

```
<?xml version="1.0" encoding="UTF-8" ?>
<ContentPage ...>
  <StackLayout Padding="20" Spacing="10">
    <Label Text="Enter a Phoneword:" />
    <Entry Placeholder="Number" />
    <Button Text="Translate" />
    <Button Text="Call" IsEnabled="False" />
  </StackLayout>
</ContentPage>
```

Describing a screen in XAML

- ❖ XAML is used to construct object graphs, in this case a visual **Page**

```
<?xml version="1.0" encoding="UTF-8" ?>
<ContentPage ...>
  <StackLayout Padding="20" Spacing="10">
    <Label Text="Enter a Phoneword:" />
    <Entry Placeholder="Number" />
    <Button Text="Translate" />
    <Button Text="Call" IsEnabled="False" />
  </StackLayout>
</ContentPage>
```

Attributes set
properties or
events

Describing a screen in XAML

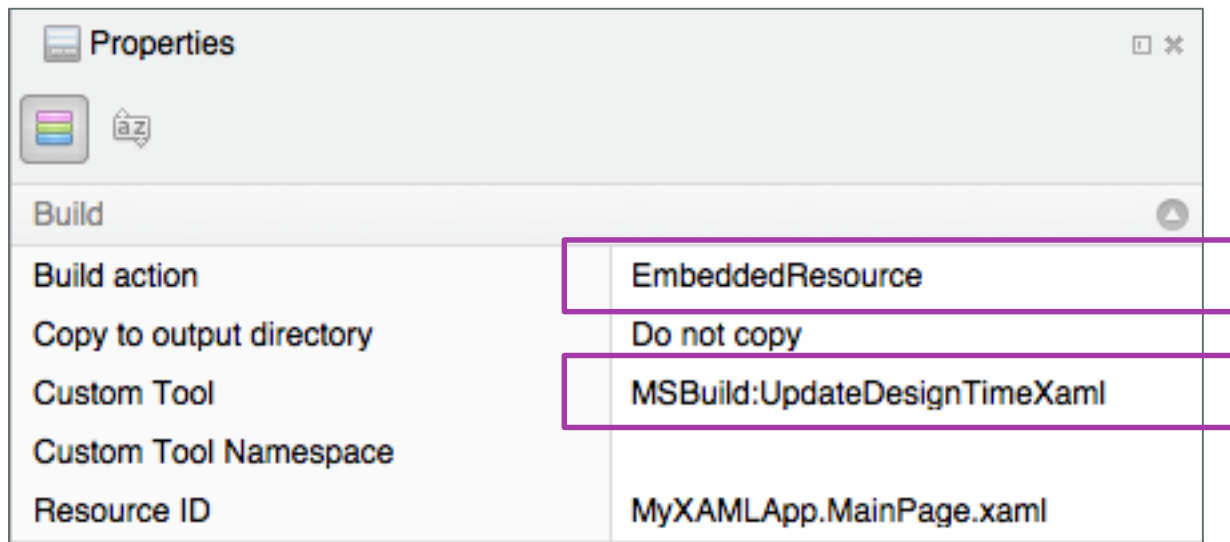
- ❖ XAML is used to construct object graphs, in this case a visual **Page**

Child nodes
used to
establish
relationship

```
<?xml version="1.0" encoding="UTF-8" ?>
<ContentPage ...>
  <StackLayout Padding="20" Spacing="10">
    <Label Text="Enter a Phoneword:" />
    <Entry Placeholder="Number" />
    <Button Text="Translate" />
    <Button Text="Call" IsEnabled="False" />
  </StackLayout>
</ContentPage>
```

XAML build type

- ❖ XAML files are stored as *embedded resources* and have a special build type of **MSBuild:UpdateDesignTimeXaml**



XAML + Code Behind

- ❖ XAML and code behind files are tied together

```
<?xml version="1.0" encoding="UTF-8" ?>
<ContentPage x:Class="Phoneword.MainPage" ...>
```

```
namespace Phoneword
{
    public partial class MainPage : ContentPage
    {
        ...
    }
}
```

x:Class Identifies the full name of the class defined in the code behind file

XAML initialization

- ❖ Code behind constructor has call to **InitializeComponent** which is responsible for loading the XAML and creating the objects

```
public partial class MainPage : ContentPage
{
    public MainPage ()
    {
        InitializeComponent ();
    }
}
```

implementation of method generated by XAML compiler as a result of the **x:Class** tag – added to hidden file (same partial class)

Demonstration

Creating a XAML-based application



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Property Conversions

- ❖ XML attributes only allow for **string values** – works fine for intrinsic types

```
<Label Text="This is a Label" IsVisible="True" Opacity="0.75"  
      FontAttributes="Bold,Italic" FontSize="Large"  
      Margin="5,20,5,0" TextColor="#fffc0d34" />
```

Text is a **string** which is just set directly

Property Conversions

- ❖ XML attributes only allow for **string values** – works fine for intrinsic types

```
<Label Text="This is a Label" IsVisible="True" Opacity="0.75"  
      FontAttributes="Bold,Italic" FontSize="Large"  
      Margin="5,20,5,0" TextColor="#fffc0d34" />
```

IsVisible is a **bool** which is converted from the value using **Boolean.TryParse**

Property Conversions

- ❖ XML attributes only allow for **string values** – works fine for intrinsic types

```
<Label Text="This is a Label" IsVisible="True" Opacity="0.75"  
      FontAttributes="Bold,Italic" FontSize="Large"  
      Margin="5,20,5,0" TextColor="#fffc0d34" />
```

Opacity is a **double** which is converted from the value using **Double.TryParse**

Property Conversions

- ❖ XML attributes only allow for **string values** – works fine for intrinsic types

```
<Label Text="This is a Label" IsVisible="True" Opacity="0.75"  
      FontAttributes="Bold,Italic" FontSize="Large"  
      Margin="5,20,5,0" TextColor="#fffc0d34" />
```



Enumerations are parsed with **Enum.TryParse** and support **[Flags]** with comma-separated values

Property Conversions

- ❖ XML attributes only allow for **string values** – works fine for intrinsic types

```
<Label Text="This is a Label" IsVisible="True" Opacity="0.75"  
      FontAttributes="Bold,Italic" FontSize="Large"  
      Margin="5,20,5,0" TextColor="#fffc0d34" />
```

```
[TypeConverter(typeof(ThicknessTypeConverter))]  
public struct Thickness  
{  
    ...  
}
```

Property Conversions

- ❖ XML attributes only allow for **string values** – works fine for intrinsic types


```
<Label Text="This is a Label" IsVisible="True" Opacity="0.75"  
      FontAttributes="Bold,Italic" FontSize="Large"  
      Margin="5,20,5,0" TextColor="#fffc0d34" />
```

Margin is a **Thickness** object, you can specify as a single number, two numbers, or four numbers (L,T,R,B)

Property Conversions

- ❖ XML attributes only allow for **string values** – works fine for intrinsic types

```
<Label Text="This is a Label" IsVisible="True" Opacity="0.75"  
  FontAttributes="Bold,Italic" FontSize="Large"  
  Margin="5,20,5,0" TextColor="#fffc0d34" />
```



Colors can be specified as a known value (e.g. "Red", "Green", ...) or as a hex value (RGB or aRGB)

Setting Complex Properties

- ❖ When a more complex object needs to be created and assigned, you can use the *Property Element* syntax
- ❖ This changes the style to use an element tag (create-an-object) as part of the assignment

```
<BoxView Color="Transparent">  
  <BoxView.GestureRecognizers>  
    <TapGestureRecognizer  
      NumberOfTapsRequired="2"  
      ... />  
  </BoxView.GestureRecognizers>  
</BoxView>
```



Property value is set as a child tag of the
<Type.PropertyName> element

Setting Attached Properties

- ❖ Attached Properties provide runtime "attached" data for a visual element
- ❖ Used by layout containers to provide container-specific values on each child

```
<Grid>  
  <Label Text="Position" />  
  <Entry Grid.Column="1" />  
</Grid>
```



Set in XAML with **OwnerType.Property="Value"** form, can also use property-element syntax for more complex values

Content Properties

- ❖ Some types have a *default* property which is set when child content is added to the element
- ❖ This is the *Content Property* and is identified through a **[ContentAttribute]** applied to the class

```
<ContentPage ...>  
  <Label>  
    This is the Text  
  </Label>  
</ContentPage>
```

These create
the same UI


```
<ContentPage ...>  
  <ContentPage.Content>  
    <Label>  
      <Label.Text>  
        This is the Text  
      </Label.Text>  
    </Label>  
  </ContentPage.Content>  
</ContentPage>
```

Identifying Types

- ❖ XAML creates objects when it encounters an element tag, XML namespaces are used to correlate .NET types to tags

Default namespace includes most of the Xamarin.Forms types you use

```
<ContentPage ...  
  xmlns="http://xamarin.com/schemas/2014/forms"  
  xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml">  
  
  <StackLayout ... />  
  
</ContentPage>
```


A diagram with two purple arrows. One arrow points from the text 'Default namespace includes most of the Xamarin.Forms types you use' down to the 'xmlns:x' attribute in the XAML code. The other arrow points from the 'xmlns:x' attribute down to the 'x:' prefix in the 'StackLayout' tag.

x: namespace includes XAML types and known CLR types (**Int32**, **String**, etc.)

Custom Types

- ❖ XAML can create any public object, including ones with parameterized constructors – you just need to tell it where the type lives

Must supply the namespace, and *possibly* the assembly, the type is defined in



```
<scg:List x:TypeArguments="x:String"  
  xmlns:scg="clr-namespace:System.Collections.Generic;assembly=mscorlib">  
  <x:String>One</x:String>  
  <x:String>Two</x:String>  
  <x:String>Three</x:String>  
</scg:List>
```

xmlns definition can be placed on a single element, or a parent element to use with any children



Individual Exercise

Create a XAML-based version of Calculator



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Summary

- ❖ Why use XAML?
- ❖ XAML 101
- ❖ Using XAML with Xamarin.Forms



Adding Behavior to XAML-based pages

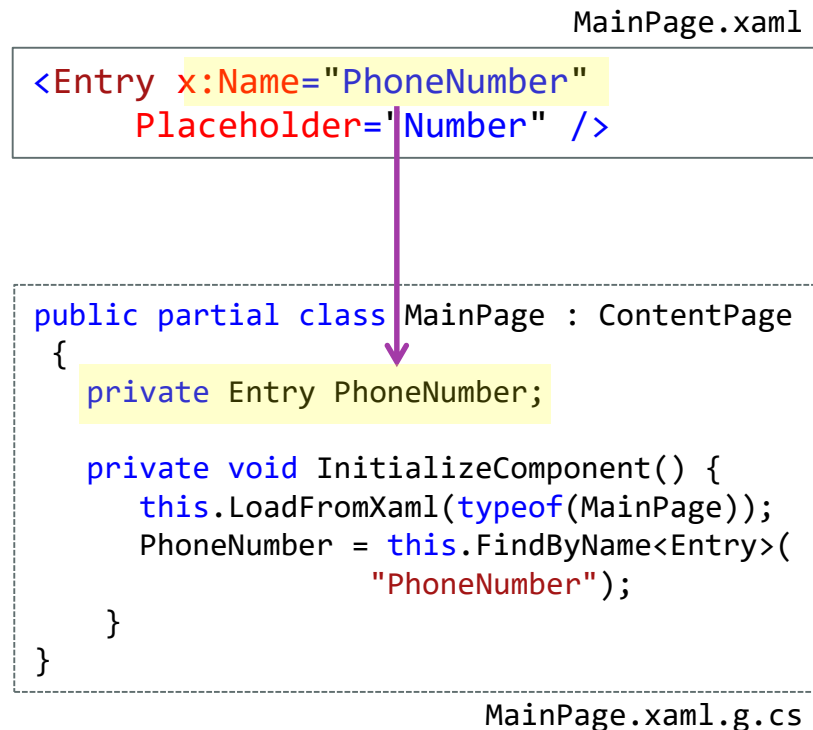
Tasks

- ❖ Accessing elements in Code Behind
- ❖ Handling Events



Naming Elements in XAML

- ❖ Use **x:Name** to assign field name
 - allows you to reference element in XAML and code behind
- ❖ Adds a private field to the XAML-generated partial class (.g.cs)
- ❖ Name must conform to C# naming conventions and be unique in the file




Working with named elements

- ❖ Can work with named elements as if you defined them in code, but keep in mind the field is not set until *after* **InitializeComponent** is called

Can wire up events, set properties, even add new elements to layout

```
public partial class MainPage : ContentPage
{
    public MainPage () {
        InitializeComponent ();
        PhoneNumber.TextChanged += OnTextChanged;
    }

    void OnTextChanged(object sender, TextChangedEventArgs e) {
        ...
    }
}
```



Sharing elements

- ❖ Generated field is always private, but **Page** owner can wrap in a public property to allow external access

```
public partial class MainPage : ContentPage
{
    public Entry PhoneNumberEntry
    {
        get { return this.PhoneNumber; }
    }
    ...
}
```

should *not* provide a setter – replacing the field's value will not change the actual element on the screen

Handling events in XAML

- ❖ Can also wire up events in XAML – event handler *must be defined* in the code behind file and have *proper signature* or it's a runtime failure

```
<Entry Placeholder="Number" TextChanged="OnTextChanged" />
```

```
public partial class MainPage : ContentPage
{
    ...
    void OnTextChanged(object sender, TextChangedEventArgs e) {
        ...
    }
}
```

Handling events in code behind

- ❖ Many developers prefer to wire up all events in code behind by naming the XAML elements and adding event handlers in code
 - Keeps the UI layer "pure" by pushing all behavior + management into the code behind
 - Names are validated at compile time, but event handlers are not
 - Easier to see how logic is wired up

- ❖ Pick the approach that works for your team / preference

Flash Quiz

Flash Quiz

- ① Putting an **x:Name** tag onto an element _____. (Select all that apply)
- a) Creates a private field in the associated code behind file
 - b) Creates a protected field in the associated code behind file
 - c) Makes the element accessible to other things in XAML
 - d) Makes the element accessible in the code behind after **InitializeComponent** returns

Flash Quiz

- ① Putting an **x:Name** tag onto an element _____. (Select all that apply)
- a) Creates a private field in the associated code behind file
 - b) Creates a protected field in the associated code behind file
 - c) Makes the element accessible to other things in XAML
 - d) Makes the element accessible in the code behind after **InitializeComponent** returns

Flash Quiz

- ② Event Handlers in code behind that are wired up in XAML must be public
- a) True
 - b) False

Flash Quiz

- ② Event Handlers in code behind that are wired up in XAML must be public
- a) True
 - b) False



Individual Exercise

Adding Behavior to XAML Calculator



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Summary

- ❖ Accessing elements in Code Behind
- ❖ Handling Events





Exploring XAML capabilities

Tasks

- ❖ Using device-specific values
- ❖ Markup Extensions
- ❖ Using **ContentView** to share XAML
- ❖ Compiling XAML

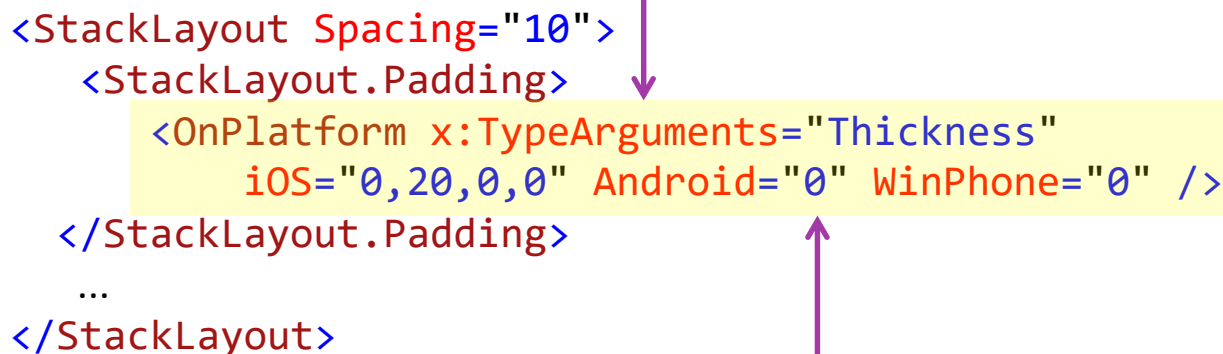


Using device-specific values

- ❖ XAML is a static (compile-time) definition of the UI; can provide different values for each platform just like we do in code with **Device.OnPlatform**

x:TypeArguments used for generic instantiation

```
<StackLayout Spacing="10">
  <StackLayout.Padding>
    <OnPlatform x:TypeArguments="Thickness"
      iOS="0,20,0,0" Android="0" WinPhone="0" />
  </StackLayout.Padding>
  ...
</StackLayout>
```



can then supply different platform-specific value for property

Using runtime values

- ❖ XAML defines a way to set properties to values known at runtime called *markup extensions*, these conform to the **IMarkupExtension** interface

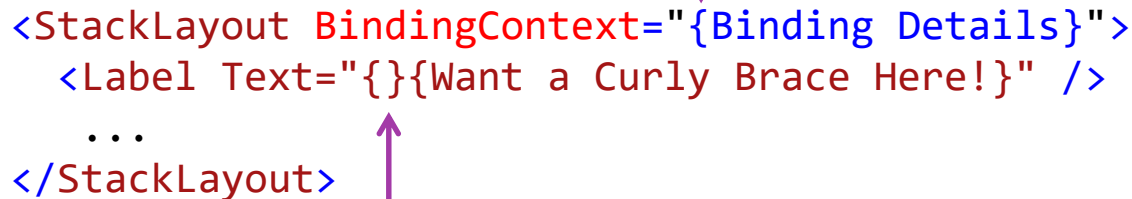
```
public interface IMarkupExtension
{
    object ProvideValue(IServiceProvider serviceProvider);
}
```

method is called during the XAML load process to retrieve a runtime value and apply it to the property

Using Markup Extensions

- ❖ Markup Extensions are identified by "{**extension_here**}" curly braces

parser expects to find a class named **BindingExtension** that implements **IMarkupExtension** when it encounters the curly brace as the first character



```
<StackLayout BindingContext="{Binding Details}">
    <Label Text="{}{Want a Curly Brace Here!}" />
    ...
</StackLayout>
```

literal curly braces need to be escaped properly to avoid a parser error

Reading static properties

- ❖ A very useful markup extension is **x:Static** which lets you get the value of public static fields or properties

```
public static class Constants
{
    public static string Title = "Hello, Forms";
    public static Thickness Padding = new Thickness(5, Device.OnPlatform(20, 0, 0), 5, 0);
    public static Color TextColor = Color.Yellow;
}
```

```
<ContentPage ... Padding="{x:Static me:Constants.Padding}">
    <Label Text="{x:Static me:Constants.Title}"
           TextColor="{x:Static me:Constants.TextColor}" />
</ContentPage>
```

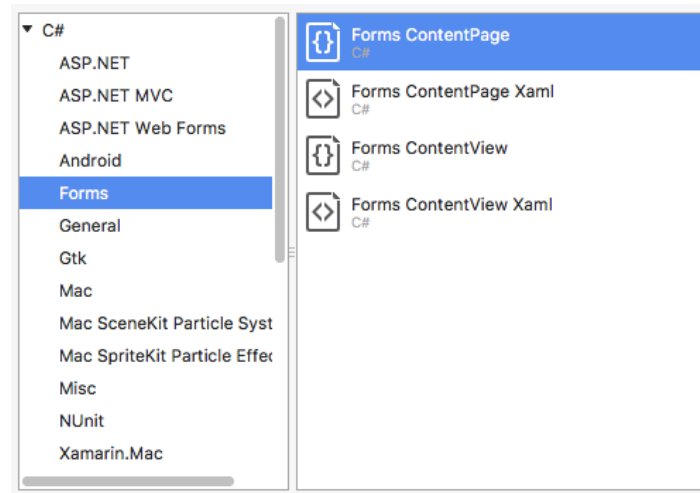
Other built-in Markup Extensions

- ❖ Use resource values with `{StaticResource}` and `{DynamicResource}`
- ❖ Supply a `null` value with `{x:Null}`
- ❖ Lookup a `Type` with `{x:Type}`
- ❖ Create an array with `{x:Array}`
- ❖ Create data bindings with `{Binding}`

```
<ListView SelectedItem="{x:Null}">  
  <ListView.ItemsSource>  
    <x:Array Type="{x:Type x:Int32}">  
      <x:Int32>10</x:Int32>  
      <x:Int32>20</x:Int32>  
      <x:Int32>30</x:Int32>  
    </x:Array>  
  </ListView.ItemsSource>  
</ListView>
```

Sharing XAML fragments

- ❖ Can be useful to split XAML into different files
 - Reuse useful UI pieces
 - Refactor large pages
- ❖ **ContentView** allows for this
 - Similar to Android Fragments
 - ... or User Controls in Windows



ContentView structure

- ❖ ContentView combines a piece of XAML with code behind behavior - just like **ContentPage**, can name elements, wire up events, etc.

```

1  <?xml version="1.0" encoding="UTF-8"?>
2  <ContentView xmlns="http://xamarin.com/schemas/2014/forms"
3      xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
4      x:Class="Phoneword.PhoneView">
5
6      <!-- Content goes here -->
7
8  </ContentView>
    
```

Can be placed into a separate class library if desired

```

1  using Xamarin.Forms;
2
3  namespace Phoneword
4  {
5      public partial class PhoneView : ContentView
6      {
7          public PhoneView()
8          {
9              InitializeComponent();
10         }
11     }
12 }
    
```


Using a ContentView

- ❖ **ContentView** is not displayed on it's own - must be added to a **Page**

```

1  <?xml version="1.0" encoding="UTF-8"?>
2  <ContentPage xmlns="http://xamarin.com/schemas/2014/forms"
3      xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
4      xmlns:local="clr-namespace:Phoneword;assembly=Phoneword"
5      x:Class="TestApp.MainPage">
6
7      <local:PhoneView PhoneNumber="1-800-XAMARIN"
8          PhoneNumberChanged="OnPhoneNumberChanged" />
9
10 </ContentPage>
11

```



ContentView can expose it's own properties and events to provide customization or "hooks" into the logic

Flash Quiz

Flash Quiz

- ① To specify a platform-specific value in XAML you use ____.
- a) Device<T>
 - b) OnPlatform<T>
 - c) Platform<T>
 - d) x:Platform<T>

Flash Quiz

- ① To specify a platform-specific value in XAML you use ____.
- a) Device<T>
 - b) OnPlatform<T>
 - c) Platform<T>
 - d) x:Platform<T>

Flash Quiz

- ② To share a value you can use _____ (select all that apply).
- a) Resource Dictionary with {StaticResource}
 - b) Resource Dictionary with {x:Static}
 - c) Static properties in code and {x:Static}
 - d) Static properties in code and {StaticResource}

Flash Quiz

- ② To share a value you can use _____ (select all that apply).
- a) Resource Dictionary with {StaticResource}
 - b) Resource Dictionary with {x:Static}
 - c) Static properties in code and {x:Static}
 - d) Static properties in code and {StaticResource}

Flash Quiz

- ③ Which one of these is not a system-provided markup extension?
- a) {StaticResource}
 - b) {x:Null}
 - c) {ImageResource}
 - d) {x:Type}

Flash Quiz

- ③ Which one of these is not a system-provided markup extension?
- a) {StaticResource}
 - b) {x:Null}
 - c) {ImageResource}
 - d) {x:Type}

Flash Quiz

- ④ To have a property value be set to "{Text" you would type: _____.
- a) "\\{Text"
 - b) "{{Text"
 - c) "{Text"
 - d) "{}{Text"


Flash Quiz

- ④ To have a property value be set to "{Text" you would type: _____.
- a) "\\{Text"
 - b) "{{Text"
 - c) "{Text"
 - d) "}{Text"

XAML resources

- ❖ By default, your XAML files are included as a plain-text resource in the generated assembly which is **parsed at runtime** to generate the page

```
private void InitializeComponent()  
{  
    this.LoadFromXaml(typeof(MainPage));  
}
```



This **Page** method looks up the embedded resource by name, parses it, and creates each object found; it returns the **root created object**

Compiling XAML

- ❖ XAML can be optionally compiled to intermediate language (IL)
 - Provides compile-time validation of your XAML files
 - Reduces the load time for pages
 - Reduces the assembly size by removing text-based **.xaml** files



Enabling XAMLC

- ❖ XAMLC (the XAML compiler) is disabled by default to ensure backwards compatibility; can be enabled through a **.NET attribute**

```
using Xamarin.Forms.Xaml;  
  
[assembly: XamlCompilationAttribute(  
    XamlCompilationOptions.Compile)]
```



Can enable the compiler for all XAML files in the assembly

Enabling XAMLC

- ❖ XAMLC (the XAML compiler) is disabled by default to ensure backwards compatibility; can be enabled through a **.NET attribute**

```
using Xamarin.Forms.Xaml;  
  
[XamlCompilationAttribute(XamlCompilationOptions.Compile)]  
public partial class MainPage : ContentPage {
```



... or on a specific XAML-based class

What does it do?


- ❖ Attribute presence causes MSBuild command to be run which parses the XAML and generates **InitializeComponent** to create the page in code

```
private void InitializeComponent()
{
    Label label = new Label();
    StackLayout stackLayout = new StackLayout();
    stackLayout.SetValue(VisualElement.BackgroundColorProperty,
        new ColorTypeConverter().ConvertFrom("Red"));
    stackLayout.SetValue(Layout.PaddingProperty,
        new ThicknessTypeConverter().ConvertFrom("10"));
    stackLayout.SetValue(StackLayout.SpacingProperty, 5);
    label.SetValue(Label.TextProperty, "Hello, Forms");
    stackLayout.Children.Add(label);
    ...
    this.Content = stackLayout;
}
```

Disabling XAMLC

- ❖ Attribute also lets you disable XAMLC for a specific class

```
using Xamarin.Forms.Xaml;  
  
[XamlCompilationAttribute(XamlCompilationOptions.Skip)]  
public partial class DetailsPage : ContentPage {
```

A purple arrow pointing upwards from the text below to the 'Skip' property in the code above.

Specify **Skip** to turn off compiler for this specific page; goes back to using **LoadFromXaml**



Individual Exercise

Cleanup the XAML code and tailor the UI to the platform

Summary

- ❖ Using device-specific values
- ❖ Markup Extensions
- ❖ Using **ContentView** to share XAML
- ❖ Compiling XAML



Thank You!

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