XAM 130 //

XAML in Xamarin.Forms

- Lecture will begin shortly
- Download class materials from university.xamarin.com

Trainer Name | Trainer Email

Objectives

1. XAML Syntax
2. Adding Behavior to XAML-based pages
3. Advanced XAML

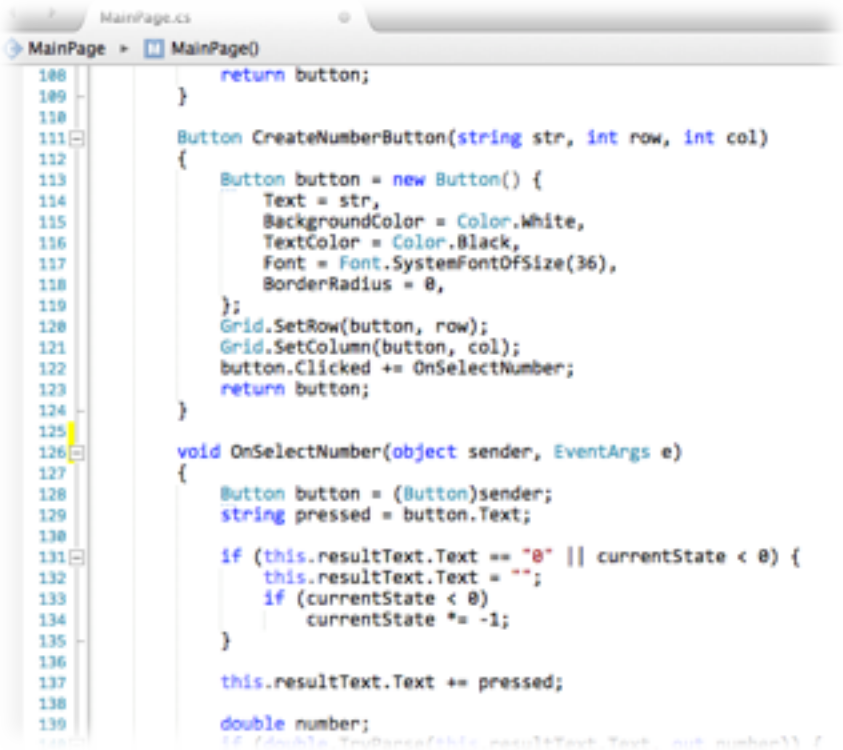
XAML Syntax

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



Working in Markup

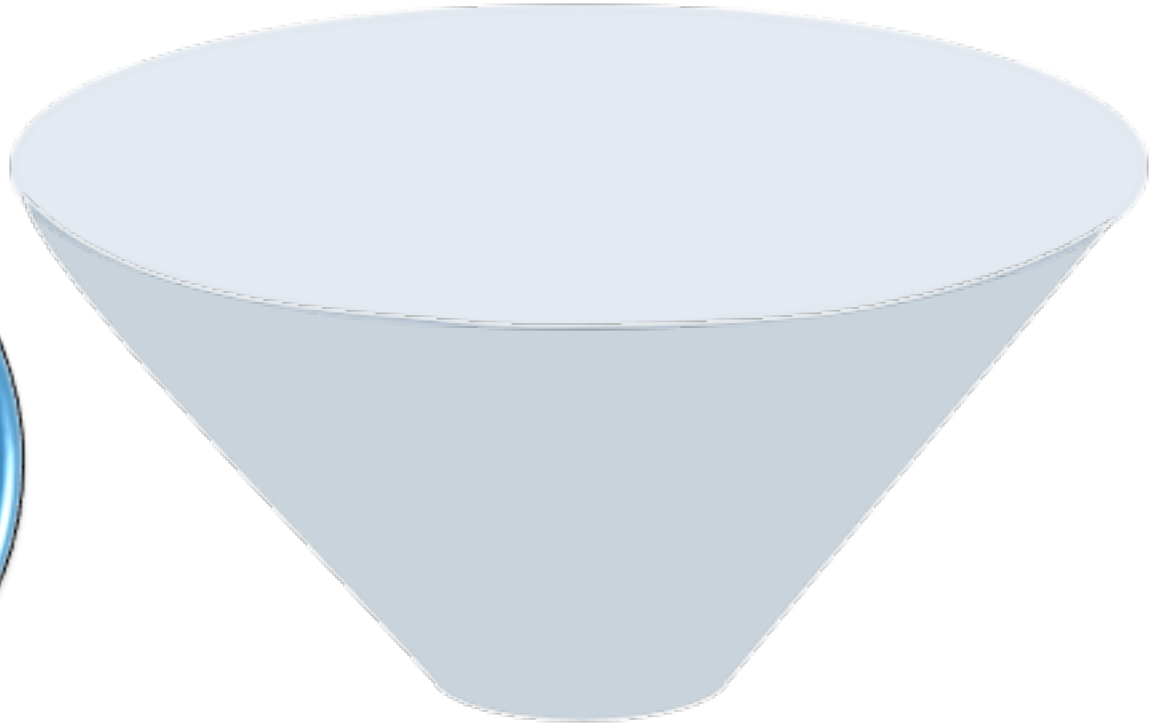
- HTML has taught us that markup languages are a great way to define user interfaces because they are:
  - Toolable
  - Human readable
  - Extensible

Extensible Application Markup Language

- XAML was created by Microsoft specifically to describe UI

Benefits

Separation of UI from Behavior



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)

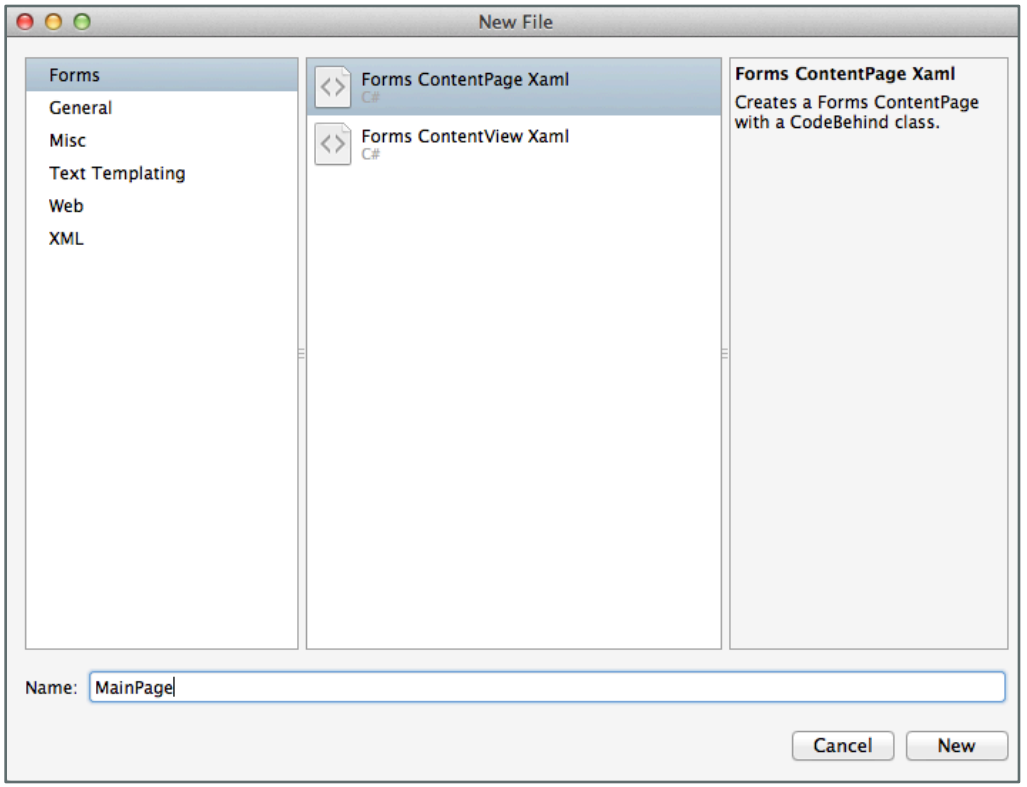
```
<?xml version="1.0" encoding="UTF-8"?>
<ContentPage xmlns="http://xamarin.com/schemas/2014/forms"
             xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
             x:Class="Test.MyPage">

    <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	✓

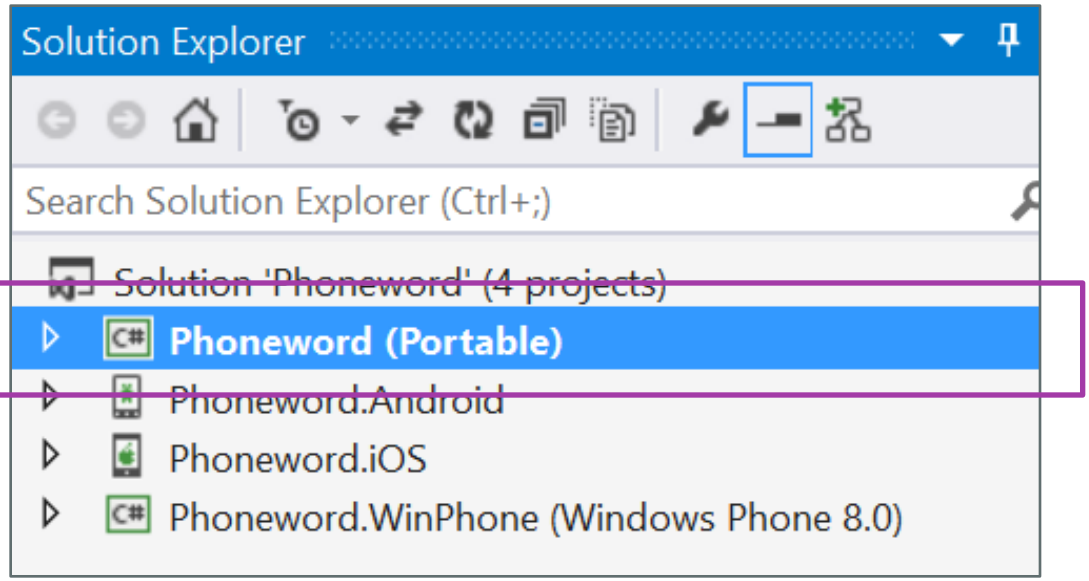
Adding a XAML Page

- Item Templates used to add XAML content
  - `ContentPage`
  - `ContentView`
- Recommended to use PCL approach for XAML pages



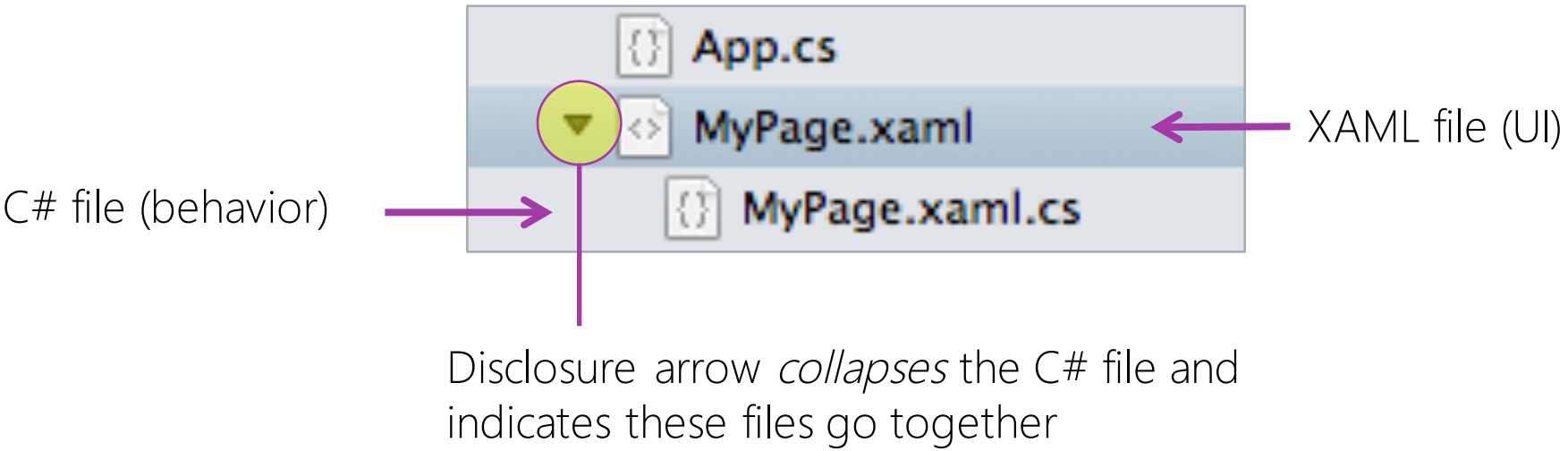
Where do the XAML pages go?

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



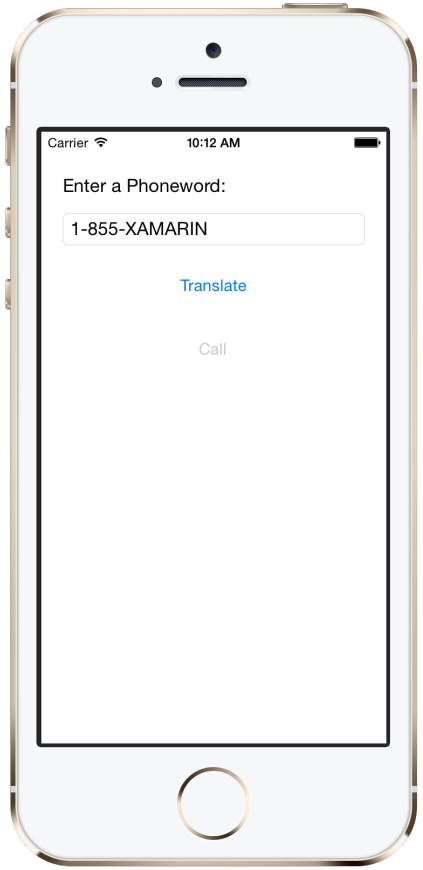
What gets created?

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



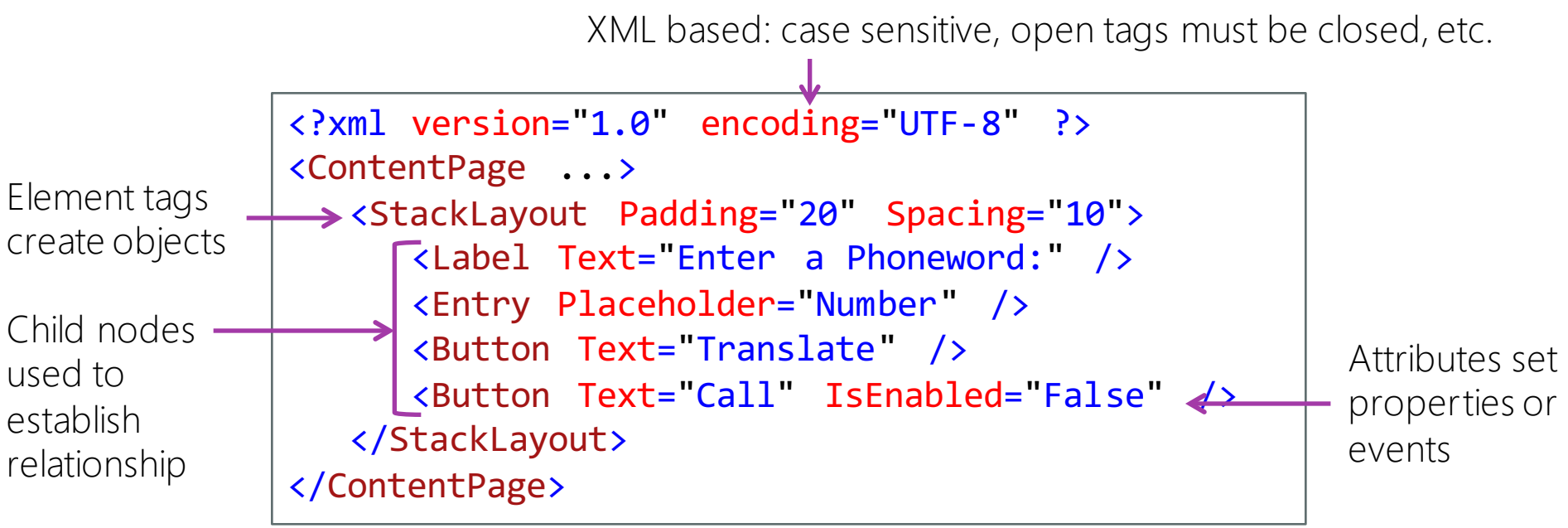
Let's create a UI with XAML

- Our goal is to build the UI for our old friend **Phoneword**:
  - Label (Enter a Phoneword:)
  - Entry (1-8555-XAMARIN)
  - Button (Translate)
  - Button (Call)



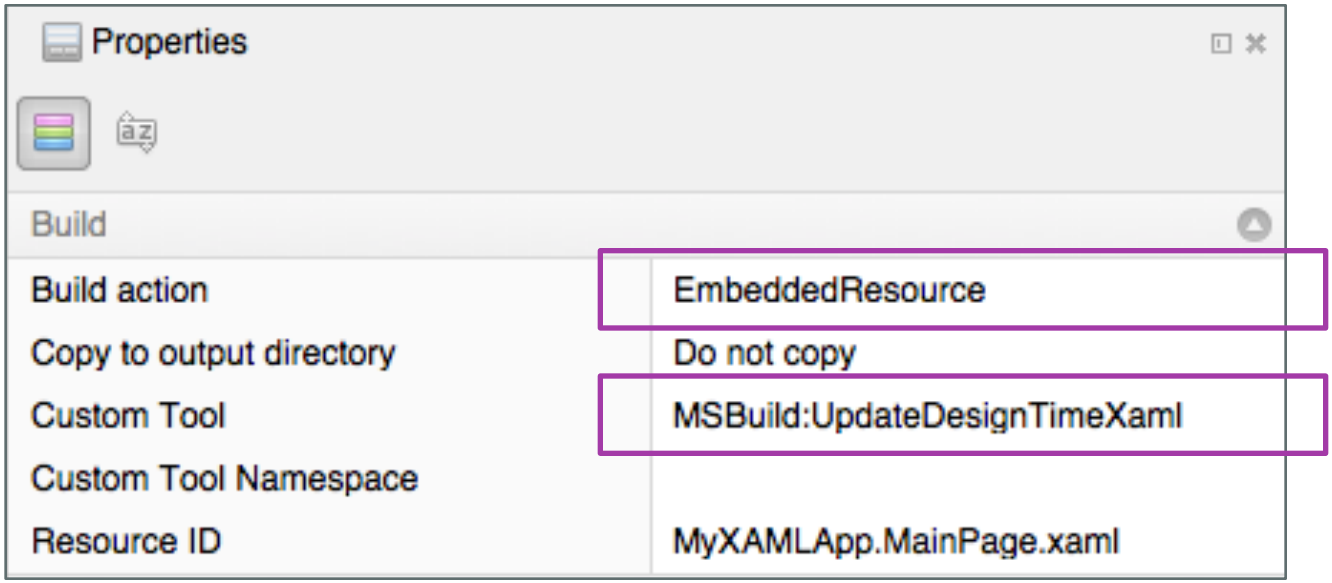
Describing a screen in XAML

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



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

```
<Label
    Text="Hello  Forms!"
    Rotation="45.75"
    VerticalOptions="Center"
    FontAttributes="Bold"
    FontSize="36"
    TextColor="Red"  />
```

- XML attributes only allow for string values – works fine for intrinsic types
- **Enum**s are matched by name, use comma separators to combine flags
- XAML invokes *type converters* to convert string to proper type

Built-in Type Converters

- **`FontAttributes`**, **`ImageSource`**, **`Color`** and **`Thickness`** all have built-in type converters to make them easy to set in XAML

```
<Label …
    FontAttributes="Bold,Italic"
    FontSize="Large"
    TextColor="#fffc0d34" />
```

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

```
<StackLayout …
      Thickness="5,20,5,0" />
```

`Thickness` is specified as a single number, two numbers, or four numbers (L,T,R,B)

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>
```

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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Flash Quiz

Flash Quiz

① XAML can be associated to a code-behind file with the _____ tag.

a) x:Code
b) x:Type
c) x:Class
d) x:Name

Flash Quiz

① XAML can be associated to a code-behind file with the _____ tag.

a) x:Code
b) x:Type
c) x:Class
d) x:Name

Flash Quiz

② A mapping for a custom namespace "Test" in a Data.dll assembly to an XML namespace named "local" would be:

a) xmlns:local="using Test"

b) xmlns:Test="clr-namespace:Test,assembly=Data.dll"

c) xmlns:local="clr-namespace=Test;assembly=Test"

d) xmlns:local="clr-namespace:Test;assembly=Data"

Flash Quiz

② A mapping for a custom namespace "Test" in a Data.dll assembly to an XML namespace named "local" would be:

a) xmlns:local="using Test"

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c) xmlns:local="clr-namespace=Test;assembly=Test"

d) xmlns:local="clr-namespace:Test;assembly=Data"

Flash Quiz

③ XAML uses _____ to translate strings to object values for properties

a) Value Converters
b) Type Converters
c) Property Converters
d) String Converters

Flash Quiz

③ XAML uses _____ to translate strings to object values for properties

a) Value Converters

b) Type Converters

c) Property Converters

d) String Converters

Flash Quiz

④ Which is not a valid way to set the Padding property:

a)
```
<ContentPage Padding="5">
```

b)
```
<ContentPage Padding="5,20,5">
```

c)
```
<ContentPage.Padding>
  <Thickness Left="5" Top="20" Right="5" />
</ContentPage.Padding>
```

Flash Quiz

④ Which is not a valid way to set the Padding property:

a) `<ContentPage Padding="5">`

b) **`<ContentPage Padding="5,20,5">`**

c)
```
<ContentPage.Padding>
  <Thickness Left="5" Top="20" Right="5" />
</ContentPage.Padding>
```

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

MainPage.xaml

```
<Entry x:Name="PhoneNumber"
       Placeholder="Number" />
```

```
public partial class MainPage : ContentPage
 {
   private Entry PhoneNumber;

   private void InitializeComponent() {
      this.LoadFromXaml(typeof(MainPage));
      PhoneNumber = this.FindByName<Entry>(
                    "PhoneNumber");
    }
}
```

MainPage.xaml.g.cs

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

Individual Exercise

Adding Behavior to XAML Calculator

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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

Summary

- Accessing elements in Code Behind
- Handling Events

Advanced XAML

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Tasks

- Using device-specific values
- Markup Extensions
- Using `ContentView` to share 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 Font Font = Font.SystemOfSize(24);
    public static Color TextColor = Color.Yellow;
}
```

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

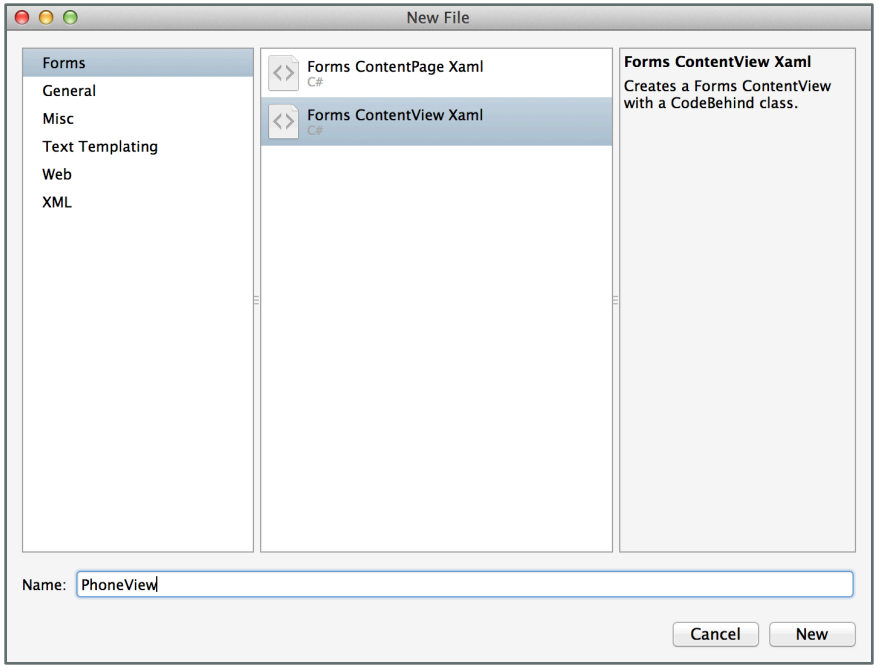
Other built-in Markup Extensions

- 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}"
     SelectedIndex="{Binding  Index}">
  <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.**

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

    <!-- Content goes here -->

</ContentView>
```

```xml
using Xamarin.Forms;

namespace Phoneword
{
    public partial class PhoneView : ContentView
    {
        public PhoneView()
        {
            InitializeComponent();
        }
    }
}
```

Can be placed into a separate class library if desired

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

Individual Exercise

Cleanup the XAML code and tailor the UI to the platform

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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"

Summary

- Device-Specific values
- Sharing Resource Values
- Setting Properties to Runtime Values
- Using `ContentView` to share XAML

// XAM130, XAML in Xamarin.Forms

Questions?

Thank You!

Please complete the class survey in your profile:
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