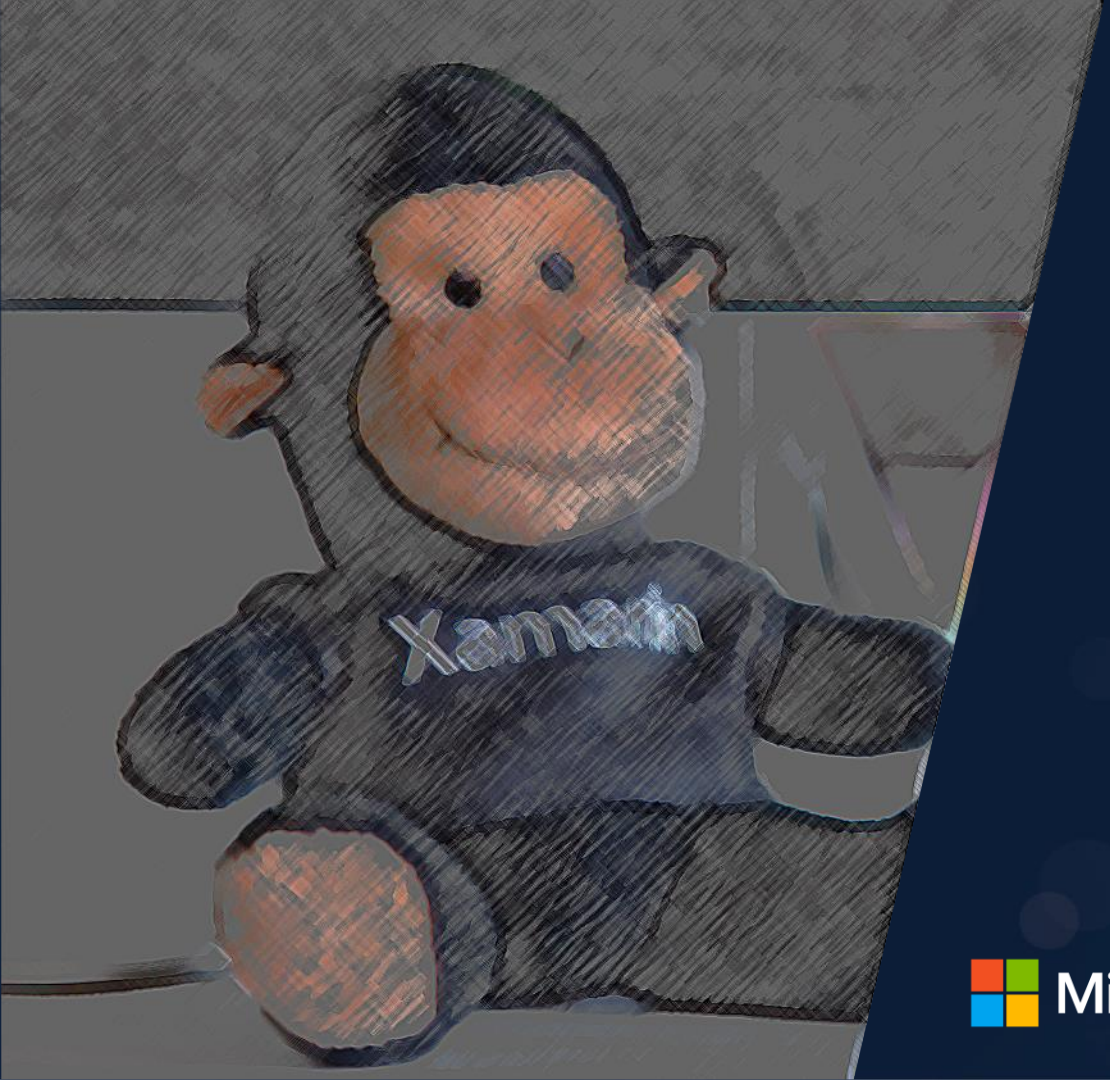


XAM330

Xamarin.Forms Effects

Download class materials from
university.xamarin.com

Microsoft

Xamarin University

Objectives

1. Customize control appearance
2. Apply effects to controls
3. Create an effect
4. Add configurable properties

Customize control appearance

Tasks

1. Change element properties
2. Use platform themes to update native control appearance

Strive for app elegance

- Our goal, as mobile developers, should be to build **useful**, **elegant** and **beautiful** applications

- Our applications should **look and feel natural** on each platform, taking advantage of the platform's unique style and patterns

Recall: Xamarin.Forms elements

- Xamarin.Forms allows you to define your UI using a set of **elements** that are common across all platforms

Button is available everywhere →

```
public class Button : Element
{
    public Color  BorderColor  { get; set; }
    public int    BorderRadius { get; set; }
    public double BorderWidth  { get; set; }
    public string Text         { get; set; }
    public Color  TextColor    { get; set; }
    ...
}
```

Xamarin.Forms elements are models

- Elements provide a *representation* of the UI we want to create and display

Properties let you customize runtime visuals and behavior

```
public class Button : Element
{
    public Color  BorderColor  { get; set; }
    public int    BorderRadius { get; set; }
    public double BorderWidth  { get; set; }
    public string Text         { get; set; }
    public Color  TextColor    { get; set; }
    ...
}
```

Customizing elements

- Changing the properties of Xamarin.Forms elements allows for **limited customization** - which may or may not be sufficient for your needs

Can change most colors

Can adjust position + width/height

Can add background images into views

Can control fonts

From Element to Visual

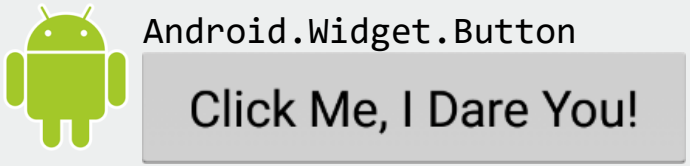
- At runtime, a platform-specific control is created to visualize each Xamarin.Forms Element

```
public class Button : Element
{
    public Color  BorderColor  { get; set; }
    public int    BorderRadius { get; set; }
    public double BorderWidth  { get; set; }
    public string Text         { get; set; }
    public Color  TextColor    { get; set; }
    ...
```

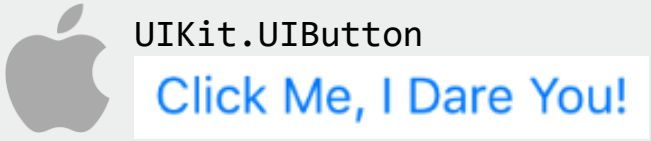
shared

platform

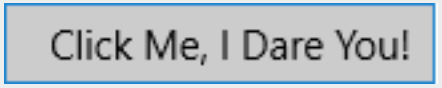
Android.Widget.Button



UIKit.UIButton



Windows.UI.Xaml.Controls.Button



What is a platform renderer?

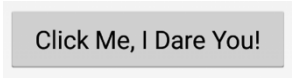
- The *platform renderer* is the code that translates the Xamarin.Forms object to a platform-specific control

`Xamarin.Forms.Button`
Element

shared

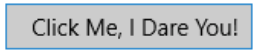
platform

```
Xamarin.Forms
   .Platform.Android
   .ButtonRenderer
```



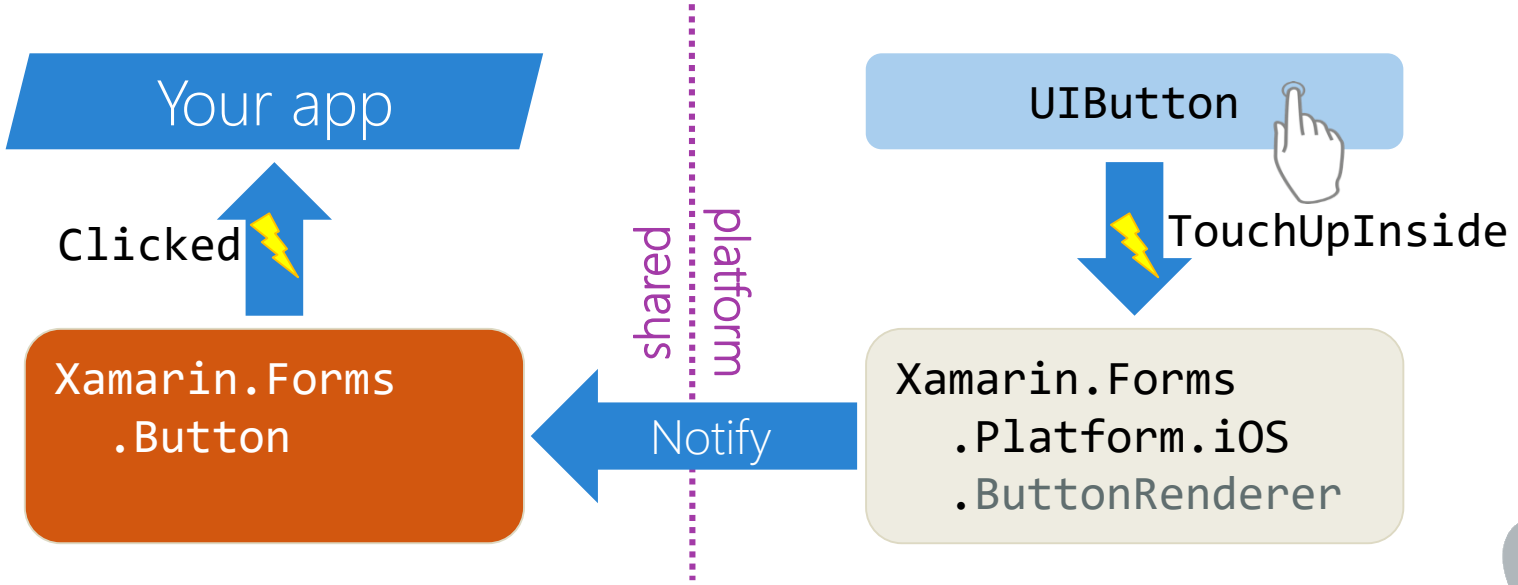
```
Xamarin.Forms
   .Platform.iOS
   .ButtonRenderer
```

```
Xamarin.Forms
   .Platform.WinRT
   .ButtonRenderer
```



From Visual to Element

- The renderer is responsible for **watching** the native control notifications and **forwarding** them to the Xamarin.Forms `Element`



Demonstration

Explore the rendering architecture of Xamarin.Forms

Xamarin University

Going beyond Forms

- There are several ways to influence the native control rendering

Platform Themes

Can use the platform's style/theme/appearance APIs to adjust most visual properties

Going beyond Forms

- There are several ways to influence the native control rendering

Platform

Xamarin.Forms Effects API can be used to adjust native control created by the renderer

Effects

Going beyond Forms

- There are several ways to influence the native control rendering

Platform Themes

Effects

Embedded Native controls

Can embed native controls directly into a Xamarin.Forms UI

Going beyond Forms

- There are several ways to influence the native control rendering

Platform Themes

Effects

Finally, you can *replace* the renderer and generate a completely different visualization!

Custom Renderers

Going beyond Forms

- There are several ways to influence the native control rendering

Platform Themes

Effects

Platform Themes

- Each platform has an API you can use to control the native visual appearance of your app

`Style + ControlTemplate`

`UIAppearance`

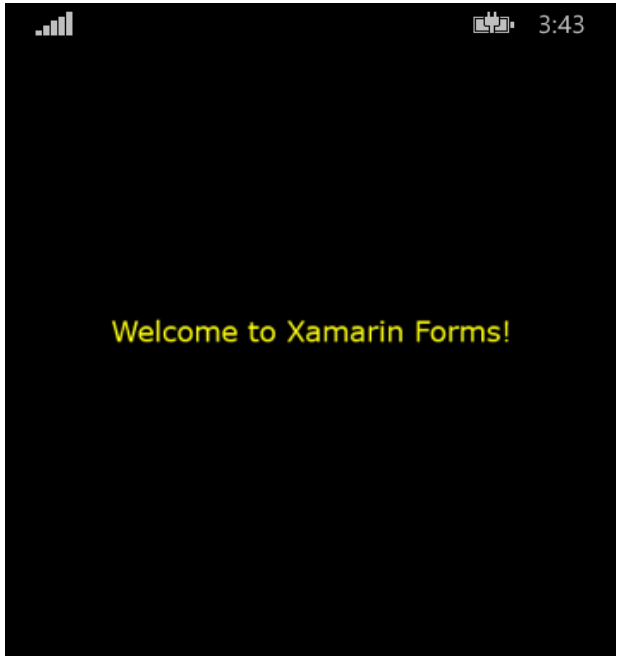
`android:theme`

Styles and control templates [Windows]

- Each Windows XAML control has a default style and control template – these can be modified to customize appearance and behavior

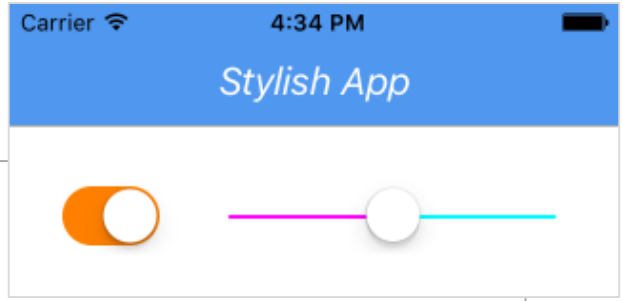
```
<Application.Resources>
   <Style TargetType="TextBlock">
      <Setter Property="Foreground" Value="Yellow" />
      <Setter Property="FontFamily" Value="Verdana" />
      <Setter Property="FontSize"   Value="18" />
   </Style>
<Application.Resources/>
```

Native Windows **Styles** will affect controls created by the Xamarin.Forms renderer



Appearance API [iOS]

- The iOS Appearance API lets you define visual settings at a class level that apply to all instances of that type

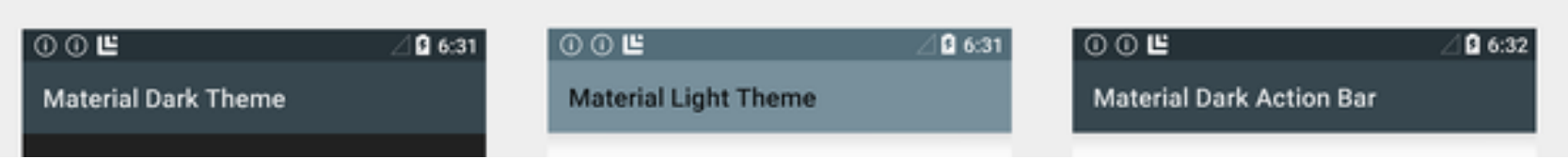



```
public override bool FinishedLaunching(...)
{
   UISwitch.Appearance.OnTintColor = UIColor.Orange;
   UISlider.Appearance.MinimumTrackTintColor = UIColor.Magenta;
   UISlider.Appearance.MaximumTrackTintColor = UIColor.Cyan;

   UINavigationBar.Appearance.BarTintColor = UIColor.FromRGB(51, 134, 238);
   UINavigationBar.Appearance.SetTitleTextAttributes(new UITextAttributes()
   { TextColor = UIColor.White, Font = UIFont.ItalicSystemFontOfSize(20)});
}
```

Themes [Android]

- Android Themes determine the look and feel of views and activities; there are built in themes and you can create custom themes




```
[Activity(Label = "DroidThemes",
          Theme = "@android:style/Theme.Material.Light",
          MainLauncher = true, Icon = "@mipmap/icon")]
public class MainActivity : Activity
{
    ...
}
```

Exercise

Use platform-specific themes

Xamarin University

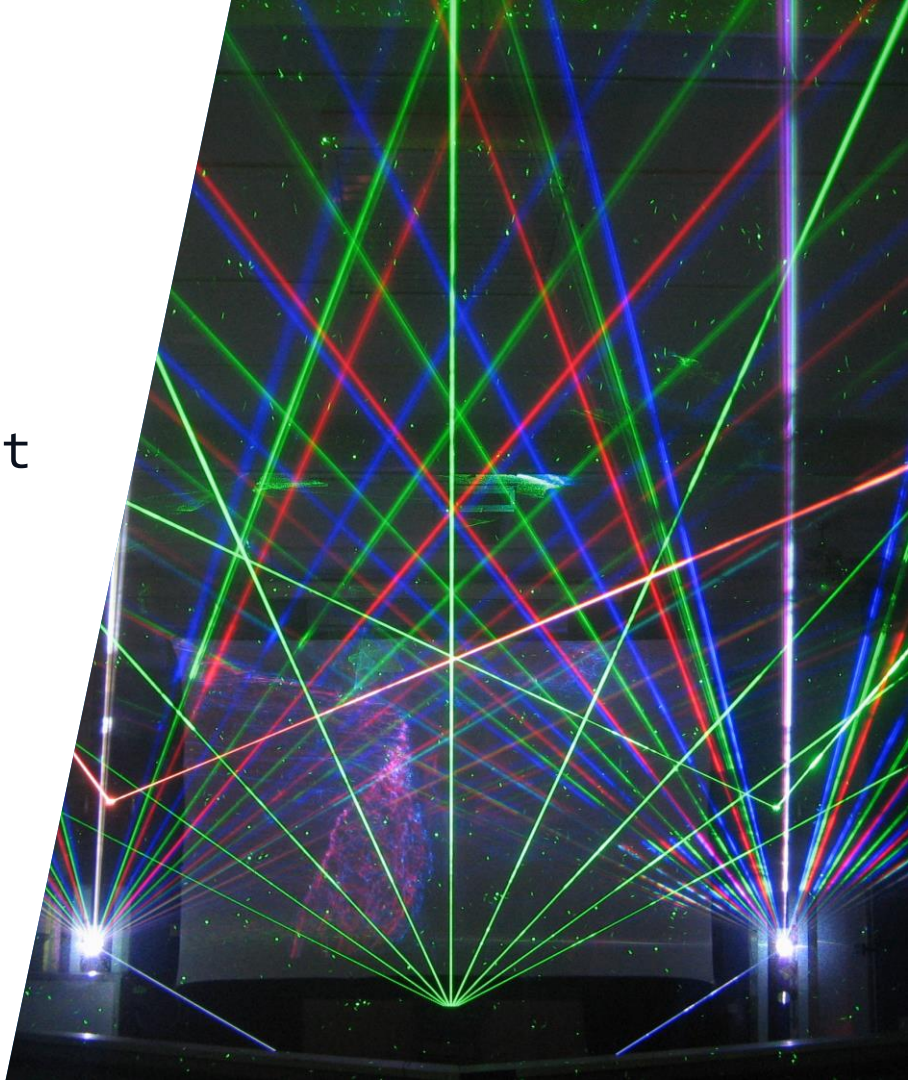
Summary

1. Change element properties
2. Use platform themes to update native control appearance

Apply effects to controls

Tasks

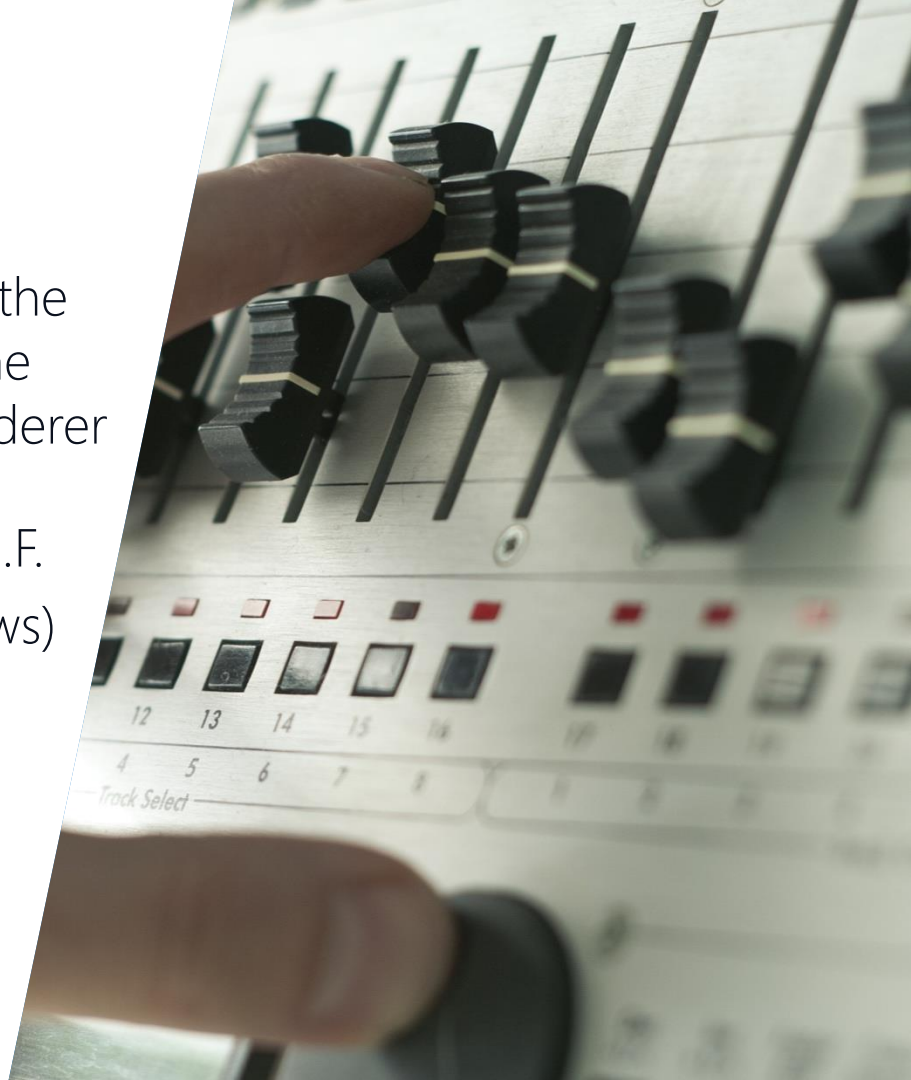
1. Resolve an effect
2. Apply an effect programmatically
3. Wrap an effect with `RoutingEffect`
4. Apply an effect in XAML



Xamarin.Forms Effects

- The **Effects API** lets your code *tweak* the visual appearance and behavior of the native controls generated by the renderer

- Change properties not exposed by X.F.
- Access platform features (e.g. shadows)
- Handle native control notifications
- Add or remove visual children



What is an effect?

- An *effect* is a platform-specific class that uses the native APIs to change the appearance and behavior of the native control that underlies a Xamarin.Forms `Element`

Xamarin.Forms Effects API

- The Effects API allows you to interact with and change properties on the controls created by the native renderers

Element
(Button)

shared

platform

```
Xamarin.Forms
  .Platform.iOS
  .ButtonRenderer
```

Click Me, I Dare You!

```
UIButton
```

```
MyIOSShadowEffect :
   PlatformEffect
```

Click Me, I Dare You!

One effect per platform

- The author of an effect implements one class for each platform they choose to support

shared

platform

The implementation has access to the native APIs

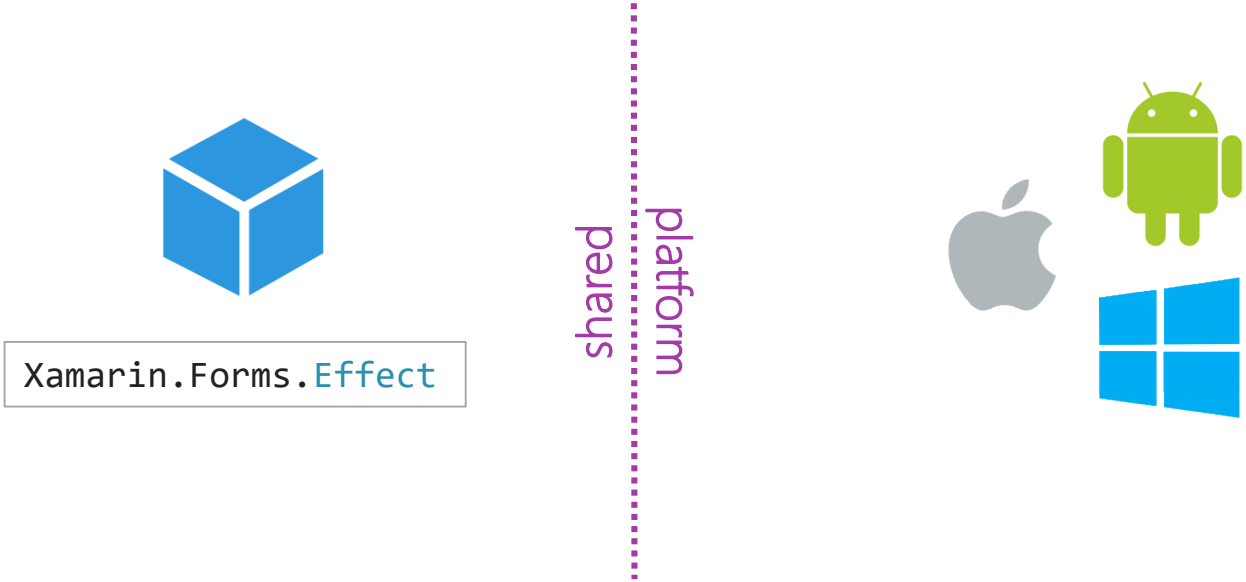
```
class MyAndroidShadowEffect : ...
{ ...
}
```

```
class MyIOSShadowEffect : ...
{ ...
}
```

```
class MyUWPShadowEffect : ...
{ ...
}
```

The Effect class

- In the shared code, effects are represented by the abstract **`Effect`** class which is the shared representation of the native platform-specific effect



Effects collection

- Every Xamarin.Forms **`Element`** has a collection to hold applied effects called **`Effects`**

```
public class Element : ...
{
    public IList<Effect> Effects { get; }
```

Used to add and remove effects to an element

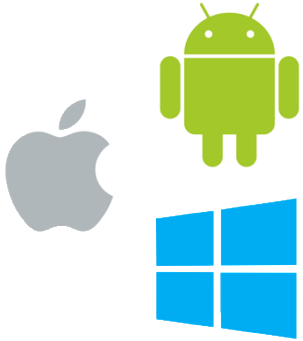
The effect identifier

- The effect author chooses a string to identify the effect

shared

platform

```
"MyCompany.ShadowEffect"
```



The Xamarin Forms code uses the string to resolve the platform-specific effect

The string identifies the effect: all platforms agree on the same string

Resolve an effect

- Effects are resolved at runtime by the identifier using the static **`Effect.Resolve`** method

```
Button dareButton = new Button();
...
Effect eff = Effect.Resolve("MyCompany.ShadowEffect"));

dareButton.Effects.Add(eff); // ok
```

Add the effect to the collection

Resolve by name

shared

platform

Effect instances

- Each element must have a **unique instance** of the effect

```
Effect eff = Effect.Resolve("MyCompany.ShadowEffect"));

dareButton.Effects.Add(eff); // ok

anotherButton.Effects.Add(eff);  ✖ // runtime error
```

shared

platform

Removing Effects

- `Effect`s can be removed dynamically; the comparison is done using reference equality

```
var dareButton = new Button();
...
dareButton.Effects.Remove(eff);

dareButton.Effects.Clear();
```

Remove the effect instance

shared

platform

Individual Exercise

Add and use an existing Effect

Xamarin University

The RoutingEffect class

- **`RoutingEffect`** is a class that wraps a call to the **`Effect.Resolve`** static method – which makes it easier to apply effects in code and XAML

```
public class RoutingEffect : Effect
{
    internal readonly Effect Inner;
    ...
    protected RoutingEffect(string effectId)
    {
        Inner = Resolve(effectId);
    }
```

Implementing a RoutingEffect

- Create a **`RoutingEffect`** derived class for each effect you want to resolve

```
public class ShadowEffect : RoutingEffect
{
    public ShadowEffect()
        : base("MyCompany.ShadowEffect")
    {
    }
}
```

Supply effect identifier to the **`RoutingEffect`** constructor

shared

platform

Using RoutingEffect in code

- Instantiate your **`RoutingEffect`** derived type and add it to an element's **`Effects`** collection – this is a type safe way to add effects

```
public class ShadowEffect : RoutingEffect
{
    public ShadowEffect()
        : base("MyCompany.ShadowEffect")
    {
    }
}
```

```
dareButton.Effects.Add(new ShadowEffect());
```

shared

platform

Using RoutingEffect in XAML

- **`RoutingEffect`** makes it easy to apply an effect in XAML

```
xmlns:ef="clr-namespace:MyEffects"
...
<Button ...>
  <Button.Effects>
     <ef:MyShadowEffect />
  </Button.Effects>
</Button>
```

Create an instance and add it to the **`Effects`** collection

shared

platform

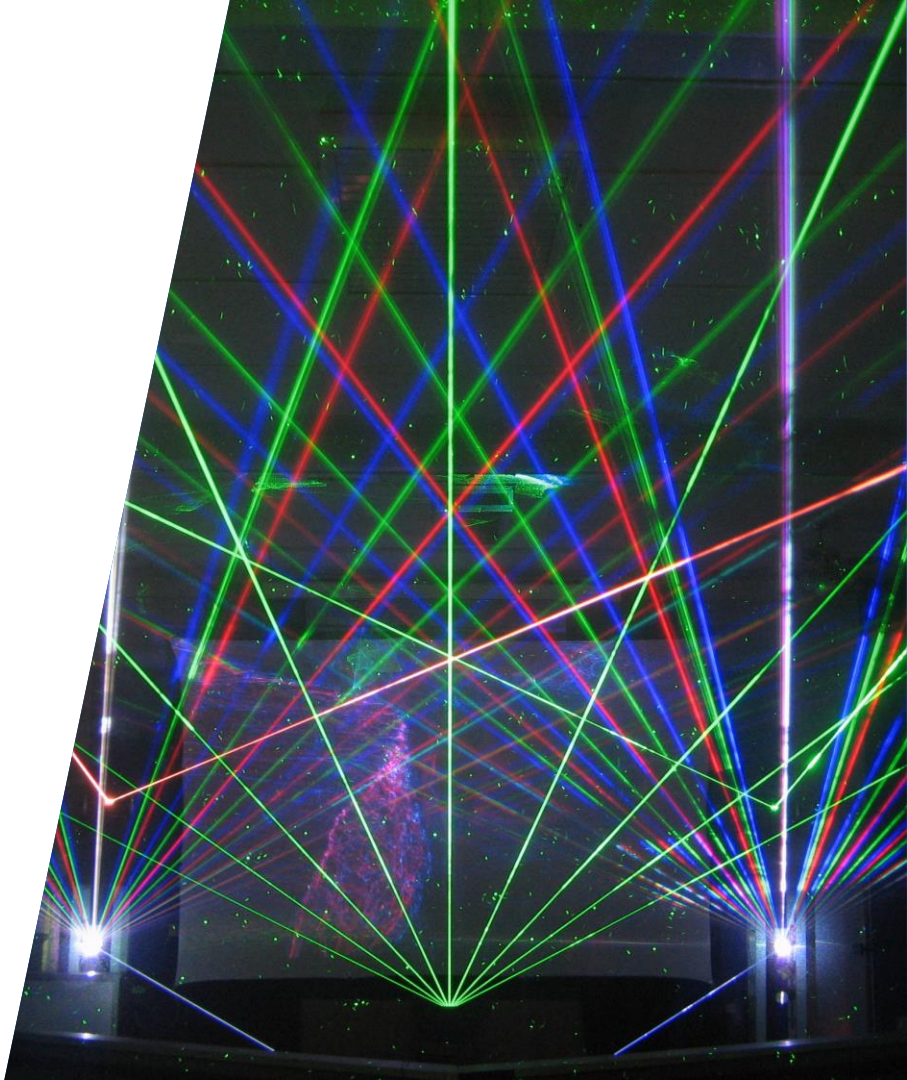
Individual Exercise

Create a RoutingEffect

Xamarin University

Summary

1. Resolve an effect
2. Apply an effect programmatically
3. Wrap an effect with RoutingEffect
4. Apply an effect in XAML



Create an Effect

Xamarin University

Tasks

1. Create an effect
2. Update platform specific UI
3. Respond to UI changes and notifications
4. Export an effect

Creating a new Effect

- Effects are platform-specific classes located in a platform-specific project (iOS, Android, or Windows)

shared

platform

```
internal class MyIOSShadowEffect : PlatformEffect
{
    ...
}
```

Effect can be internal to the platform project

Derive from **`PlatformEffect`** which provides access to the native control

PlatformEffect properties

- **`PlatformEffect`** base class provides properties to interact with and manipulate both sides of the visual: the element and the native control

The native renderer (visual parent of the control)

```
public class PlatformEffect
{
    public UIView  Container { get; }
    public UIView  Control   { get; }
    public Element Element   { get; }
    ...
}
```

The native control

The Xamarin.Forms element

PlatformEffect property types

- Each platform has platform-specific types for the **`Container`** and **`Control`** properties

```
public class PlatformEffect : ...
{   ...
    public UIView Container { get; }
    public UIView Control   { get; }
}
```

```
public class PlatformEffect : ...
{   ...
    public ViewGroup Container { get; }
    public View      Control   { get; }
}
```

```
public class PlatformEffect : ...
{   ...
    public FrameworkElement Container { get; }
    public FrameworkElement Control   { get; }
}
```

PlatformEffect methods

- **`PlatformEffect`** base class has lifecycle methods that you override to do your work

shared

platform

```
public class MyPlatformEffect : PlatformEffect
{
    ...
    protected override void OnAttached() {...}

    protected override void OnDetached() {...}

    protected override void OnElementPropertyChanged(...) {...}
}
```

Adjusting visual properties

- **`OnAttached`** is called when the effect is added to a control; should adjust visual properties, update visual tree, wire up native events, etc.

```
class MyAndroidShadowEffect : PlatformEffect
{
    protected override void OnAttached()
    {
        ...
        Control.SetShadowLayer (5, 2, 2, Color.Black);
    }
}
```

shared

platform

The control is the Android View

Use the native android APIs

Restricting Effects to specific types

- Effects are intended to be used with any element type, but you can restrict to specific elements deliberately when necessary

shared

platform

```
class MyButtonEffect : PlatformEffect
{
    protected override void OnAttached()
    {
        Button button = Element as Button;
        if (button == null)
            return;
        ...
    }
}
```

Detaching from the native control

- **`OnDetached`** indicates the effect is being removed from the control, should reverse any visual changes, remove event handlers, etc.

shared

platform

```
class ShadowEffect : PlatformEffect
{
    ...
    protected override void OnDetached()
    {
        // Remove drop shadow
        ...
        Control.ClearShadowLayer();
    }
}
```

Monitoring runtime changes

- Effects can also monitor changes to the Xamarin.Forms **`Element`** by overriding the **`OnElementPropertyChanged`** method

shared

platform

```
class DisabledOpacityEffect : PlatformEffect
{
  protected override void OnElementPropertyChanged(PropertyChangedEventArgs e)
  {
    base.OnElementPropertyChanged(e);
    if (e.PropertyName == VisualElement.IsEnabledProperty.PropertyName ) {
      if (((VisualElement)Element).IsEnabled)
        Control.Layer.Opacity = 1;
      else
        Control.Layer.Opacity = 0.5f;
    }
  }
}
```

Can cast the **`Element`** to more specific classes to check current properties

Setting an effect identifier

- The effect identifier is a combination of two values (group name and effect name) which are set using two assembly-level attributes applied in the platform assembly

```
[assembly: ResolutionGroupName("MyCompany")]
[assembly: ExportEffect(typeof(MyIOSShadowEffect), "ShadowEffect")]
```

platform

shared

```
Effect.Resolve("MyCompany.ShadowEffect")
```

Export an effect

- The **`ExportEffect`** attribute ties the effect name to the platform-specific class that implements the effect

shared

platform

```
[assembly: ResolutionGroupName("MyCompany")]
[assembly: ExportEffect(typeof(MyIOSShadowEffect), "ShadowEffect")]
```

```
class MyIOSShadowEffect : PlatformEffect
{
    ...
}
```

Individual Exercise

Create a PlatformEffect

Xamarin University

Summary

1. Create an effect
2. Update platform specific UI
3. Respond to UI changes and notifications
4. Export an effect

Add configurable properties

Tasks

1. Add attached properties to an effect
2. Use and update attached properties

Creating flexible effects

- You may want to provide additional properties to customize your visual behavior

Drop Shadow Text

Shadow properties could include:
size, color, angle, transparency, etc.

How to add properties?

- You add properties to your **`RoutingEffect`** derived class to pass data to the platform effects – there are two ways to do this

Regular C# Properties

Easy to code but does not support dynamic update

Attached Properties

More work to code, automatically supports dynamic update

Defining regular properties

- Public properties can be added to **`RoutingEffect`** derived classes and consumed from the platform-specific effect

```
public class ShadowEffect : RoutingEffect
{
    public Color ShadowColor { get; set; }
}
```

```
<Button ...>
  <Button.Effects>
     <ef:ShadowEffect ShadowColor="Blue" />
  </Button.Effects>
</Button>
```

shared

platform

Consuming regular properties

- **PlatformEffect** derived classes can consume properties defined on the **RoutingEffect**

```
protected override void OnAttached ()
{
    var effect = (ShadowEffect)Element.Effects.
        FirstOrDefault (e => e is ShadowEffect);

    if (effect != null)
        Control.Layer.ShadowColor = effect.Color.ToCGColor ();
}
```

Access the **RoutingEffect** from the **Effects** collection on the **Element**

shared

platform

These properties will not respond to runtime property changes

Adding attached properties

- Can use *attached properties* on the **`RoutingEffect`** definition to provide custom updatable data to the platform effect

```
public class ShadowEffect : RoutingEffect
{  ...
   public static readonly BindableProperty ColorProperty
     = BindableProperty.CreateAttached("Color",
          typeof(Color), typeof(ShadowEffect), Color.Black);

   public static Color GetColor(View view) {
      return (Color)view.GetValue(ColorProperty);
   }
   public static void SetColor(View view, Color color) {
      view.SetValue(ColorProperty, color);
   }

   public ShadowEffect() : base ("MyCompany.ShadowEffect") { }
}
```

shared

platform

What are attached properties?

- Attached properties are global properties that are settable on any object – allows external properties to be "added" to an object

Creating attached properties

- Creating attached properties is done in 3 steps:

Creating an attached property

- Attached properties are identified through a static BindableProperty

```
public static readonly BindableProperty ColorProperty
          = BindableProperty.CreateAttached(
                                 propertyName: "Color",
                                 returnType: typeof(Color),
                                 declaringType: typeof(ShadowEffect),
                                 defaultValue: Color.Black);
```

Use the factory **`CreateAttached`** method and specify the name, declaring type and return type

shared

platform

Read and write attached properties

- Define static Get and Set methods to read and write the attached property

```
public static void SetColor(View view, Color color)
{
    view.SetValue(ColorProperty, color);
}

public static Color GetColor(View view)
{
    return (Color)view.GetValue(ColorProperty);
}
```

shared

platform

Setting property values

- Set values onto the element using the static Set method – either in code or XAML

```
BoxView box = new BoxView() { ... }

ShadowEffect.SetColor(box, Color.Blue);
```

```
<BoxView local:ShadowEffect.Color="Blue" ...>
```

shared

platform

Responding to property changes

- Platform effect can watch for attached property changes in the **`OnElementPropertyChanged`** method and update control properties

shared

platform

```
protected override void OnElementPropertyChanged(PropertyChangedEventArgs e)
{
    base.OnElementPropertyChanged(e);

    if (e.PropertyName == MyApp.ShadowEffect.ColorProperty.PropertyName)
    {
        Container.Layer.ShadowColor =
            MyApp.ShadowEffect.GetColor((View)Element).ToCGColor();
    }
}
```

Individual Exercise

Add an attached property to an Effect

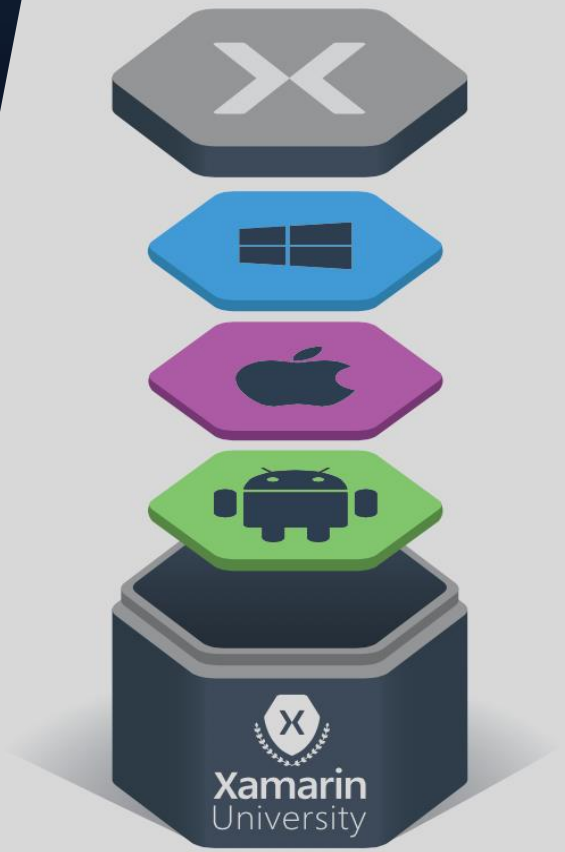
Xamarin University

Summary

1. Add attached properties to an effect
2. Use and update attached properties

Thank You!

Please complete the class survey in your profile:
university.xamarin.com/profile



Microsoft