Chapter 13: Custom Renderers

Section 13.1: Accessing renderer from a native project

```
var renderer = Platform.GetRenderer(visualElement);

if (renderer == null)
{
    renderer = Platform.CreateRenderer(visualElement);
    Platform.SetRenderer(visualElement, renderer);
}

DoSomeThingWithRender(render); // now you can do whatever you want with render
```

Section 13.2: Rounded label with a custom renderer for Frame (PCL & iOS parts)

First step : PCL part

```
using Xamarin.Forms;

namespace ProjectNamespace
{
    public class ExtendedFrame : Frame
    {
        /// <summary>
        /// The corner radius property.
        /// </summary>
        public static readonly BindableProperty CornerRadiusProperty =
            BindableProperty.Create("CornerRadius", typeof(double), typeof(ExtendedFrame), 0.0);

        /// <summary>
        /// Gets or sets the corner radius.
        /// </summary>
        public double CornerRadius
        {
            get { return (double)GetValue(CornerRadiusProperty); }
            set { SetValue(CornerRadiusProperty, value); }
        }
    }
}
```

Second step : iOS part

```
using ProjectNamespace;
using ProjectNamespace.iOS;
using Xamarin.Forms;
using Xamarin.Forms.Platform.iOS;

[assembly: ExportRenderer(typeof(ExtendedFrame), typeof(ExtendedFrameRenderer))]
namespace ProjectNamespace.iOS
{
    public class ExtendedFrameRenderer : FrameRenderer
    {
        protected override void OnElementChanged(ElementChangedEventArgs<Frame> e)
        {
            base.OnElementChanged(e);
```

```
            if (Element != null)
            {
                Layer.MasksToBounds = true;
                Layer.CornerRadius = (float)(Element as ExtendedFrame).CornerRadius;
            }
        }

        protected override void OnElementPropertyChanged(object sender,
System.ComponentModel.PropertyChangedEventArgs e)
        {
            base.OnElementPropertyChanged(sender, e);

            if (e.PropertyName == ExtendedFrame.CornerRadiusProperty.PropertyName)
            {
                Layer.CornerRadius = (float)(Element as ExtendedFrame).CornerRadius;
            }
        }
    }
}
```

Third step : XAML code to call an ExtendedFrame

If you want to use it in a XAML part, don't forget to write this :

```
xmlns:controls="clr-namespace:ProjectNamespace;assembly:ProjectNamespace"
```

after

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

Now, you can use the ExtendedFrame like this :

```
<controls:ExtendedFrame
   VerticalOptions="FillAndExpand"
   HorizontalOptions="FillAndExpand"
   BackgroundColor="Gray"
   CornerRadius="35.0">
    <Frame.Content>
        <Label
           Text="MyText"
           TextColor="Blue"/>
    </Frame.Content>
</controls:ExtendedFrame>
```

Section 13.3: Custom renderer for ListView

Custom Renderers let developers customize the appearance and behavior of Xamarin.Forms controls on each platform. Developers could use features of native controls.

For example, we need to disable scroll in `ListView`. On iOS `ListView` is scrollable even if all items are placed on the screen and user shouldn't be able to scroll the list. `Xamarin.Forms.ListView` doesn't manage such setting. In this case, a renderer is coming to help.

Firstly, we should create custom control in PCL project, which will declare some required bindable property:

```
public class SuperListView : ListView
{
```

```
    public static readonly BindableProperty IsScrollingEnableProperty =
        BindableProperty.Create(nameof(IsScrollingEnable),
                                typeof(bool),
                                typeof(SuperListView),
                                true);

    public bool IsScrollingEnable
    {
        get { return (bool)GetValue(IsScrollingEnableProperty); }
        set { SetValue(IsScrollingEnableProperty, value); }
    }
}
```

Next step will be creating a renderer for each platform.

iOS:

```
[assembly: ExportRenderer(typeof(SuperListView), typeof(SuperListViewRenderer))]
namespace SuperForms.iOS.Renderers
{
    public class SuperListViewRenderer : ListViewRenderer
    {
        protected override void OnElementChanged(ElementChangedEventArgs<ListView> e)
        {
            base.OnElementChanged(e);

            var superListView = Element as SuperListView;
            if (superListView == null)
                return;


            Control.ScrollEnabled = superListView.IsScrollingEnable;
        }
    }
}
```

And Android(Android's list doesn't have scroll if all items are placed on the screen, so we will not disable scrolling, but still we are able to use native properties):

```
[assembly: ExportRenderer(typeof(SuperListView), typeof(SuperListViewRenderer))]
namespace SuperForms.Droid.Renderers
{
    public class SuperListViewRenderer : ListViewRenderer
    {
        protected override void OnElementChanged(ElementChangedEventArgs<Xamarin.Forms.ListView> e)
        {
            base.OnElementChanged(e);

            var superListView = Element as SuperListView;
            if (superListView == null)
                return;
        }
    }
}
```

`Element` property of renderer is my `SuperListView` control from PCL project.

`Control` property of renderer is native control. `Android.Widget.ListView` for Android and `UIKit.UITableView` for iOS.

And how we will use it in XAML:

```
<ContentPage x:Name="Page"
        xmlns="http://xamarin.com/schemas/2014/forms"
        xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
        xmlns:controls="clr-namespace:SuperForms.Controls;assembly=SuperForms.Controls"
        x:Class="SuperForms.Samples.SuperListViewPage">


  <controls:SuperListView ItemsSource="{Binding Items, Source={x:Reference Page}}"
                          IsScrollingEnable="false"
                          Margin="20">
    <controls:SuperListView.ItemTemplate>
      <DataTemplate>
        <ViewCell>
          <Label Text="{Binding .}"/>
        </ViewCell>
      </DataTemplate>
    </controls:SuperListView.ItemTemplate>
  </controls:SuperListView>
</ContentPage>
```

.cs file of page:

```
public partial class SuperListViewPage : ContentPage
{
    private ObservableCollection<string> _items;

    public ObservableCollection<string> Items
    {
        get { return _items; }
        set
        {
            _items = value;
            OnPropertyChanged();
        }
    }

    public SuperListViewPage()
    {
        var list = new SuperListView();

        InitializeComponent();

        var items = new List<string>(10);
        for (int i = 1; i <= 10; i++)
        {
            items.Add($"Item {i}");
        }

        Items = new ObservableCollection<string>(items);
    }
}
```

Section 13.4: Custom Renderer for BoxView

Custom Renderer help to allows to add new properties and render them differently in native platform that can not be otherwise does through shared code. In this example we will add radius and shadow to a boxview.

Firstly, we should create custom control in PCL project, which will declare some required bindable property:

```
namespace Mobile.Controls
{
    public class ExtendedBoxView : BoxView
    {
        /// <summary>
        /// Respresents the background color of the button.
        /// </summary>
        public static readonly BindableProperty BorderRadiusProperty =
BindableProperty.Create<ExtendedBoxView, double>(p => p.BorderRadius, 0);

        public double BorderRadius
        {
            get { return (double)GetValue(BorderRadiusProperty); }
            set { SetValue(BorderRadiusProperty, value); }
        }

        public static readonly BindableProperty StrokeProperty =
            BindableProperty.Create<ExtendedBoxView, Color>(p => p.Stroke, Color.Transparent);

        public Color Stroke
        {
            get { return (Color)GetValue(StrokeProperty); }
            set { SetValue(StrokeProperty, value); }
        }

        public static readonly BindableProperty StrokeThicknessProperty =
            BindableProperty.Create<ExtendedBoxView, double>(p => p.StrokeThickness, 0);

        public double StrokeThickness
        {
            get { return (double)GetValue(StrokeThicknessProperty); }
            set { SetValue(StrokeThicknessProperty, value); }
        }
    }
}
```

Next step will be creating a renderer for each platform.

iOS:

```
[assembly: ExportRenderer(typeof(ExtendedBoxView), typeof(ExtendedBoxViewRenderer))]
namespace Mobile.iOS.Renderers
{
 public class ExtendedBoxViewRenderer : VisualElementRenderer<BoxView>
 {
    public ExtendedBoxViewRenderer()
    {
    }

    protected override void OnElementChanged(ElementChangedEventArgs<BoxView> e)
    {
        base.OnElementChanged(e);
        if (Element == null)
            return;

        Layer.MasksToBounds = true;
        Layer.CornerRadius = (float)((ExtendedBoxView)this.Element).BorderRadius / 2.0f;
    }


    protected override void OnElementPropertyChanged(object sender,
```

```
System.ComponentModel.PropertyChangedEventArgs e)
    {
        base.OnElementPropertyChanged(sender, e);
        if (e.PropertyName == ExtendedBoxView.BorderRadiusProperty.PropertyName)
        {
            SetNeedsDisplay();
        }
    }

    public override void Draw(CGRect rect)
    {
        ExtendedBoxView roundedBoxView = (ExtendedBoxView)this.Element;
        using (var context = UIGraphics.GetCurrentContext())
        {
            context.SetFillColor(roundedBoxView.Color.ToCGColor());
            context.SetStrokeColor(roundedBoxView.Stroke.ToCGColor());
            context.SetLineWidth((float)roundedBoxView.StrokeThickness);

            var rCorner = this.Bounds.Inset((int)roundedBoxView.StrokeThickness / 2,
(int)roundedBoxView.StrokeThickness / 2);

            nfloat radius = (nfloat)roundedBoxView.BorderRadius;
            radius = (nfloat)Math.Max(0, Math.Min(radius, Math.Max(rCorner.Height / 2,
rCorner.Width / 2)));

            var path = CGPath.FromRoundedRect(rCorner, radius, radius);
            context.AddPath(path);
            context.DrawPath(CGPathDrawingMode.FillStroke);
        }
    }

 }
}
```

Again you can customize however you want inside the draw method.

And same for Android:

```
[assembly: ExportRenderer(typeof(ExtendedBoxView), typeof(ExtendedBoxViewRenderer))]
namespace Mobile.Droid
{
    /// <summary>
    ///
    /// </summary>
    public class ExtendedBoxViewRenderer : VisualElementRenderer<BoxView>
    {
        /// <summary>
        ///
        /// </summary>
        public ExtendedBoxViewRenderer()
        {
        }

        /// <summary>
        ///
        /// </summary>
        /// <param name="e"></param>
        protected override void OnElementChanged(ElementChangedEventArgs<BoxView> e)
        {
            base.OnElementChanged(e);
```

```
            SetWillNotDraw(false);

            Invalidate();
        }

        /// <summary>
        ///
        /// </summary>
        /// <param name="sender"></param>
        /// <param name="e"></param>
        protected override void OnElementPropertyChanged(object sender,
System.ComponentModel.PropertyChangedEventArgs e)
        {
            base.OnElementPropertyChanged(sender, e);

            if (e.PropertyName == ExtendedBoxView.BorderRadiusProperty.PropertyName)
            {
                Invalidate();
            }
        }

        /// <summary>
        ///
        /// </summary>
        /// <param name="canvas"></param>
        public override void Draw(Canvas canvas)
        {
            var box = Element as ExtendedBoxView;
            base.Draw(canvas);
            Paint myPaint = new Paint();

            myPaint.SetStyle(Paint.Style.Stroke);
            myPaint.StrokeWidth = (float)box.StrokeThickness;
            myPaint.SetARGB(convertTo255ScaleColor(box.Color.A),
convertTo255ScaleColor(box.Color.R), convertTo255ScaleColor(box.Color.G),
convertTo255ScaleColor(box.Color.B));
            myPaint.SetShadowLayer(20, 0, 5, Android.Graphics.Color.Argb(100, 0, 0, 0));

            SetLayerType(Android.Views.LayerType.Software, myPaint);

            var number = (float)box.StrokeThickness / 2;
            RectF rectF = new RectF(
                        number, // left
                        number, // top
                        canvas.Width - number, // right
                        canvas.Height - number // bottom
                );


            var radius = (float)box.BorderRadius;
            canvas.DrawRoundRect(rectF, radius, radius, myPaint);
        }

        /// <summary>
        ///
        /// </summary>
        /// <param name="color"></param>
        /// <returns></returns>
        private int convertTo255ScaleColor(double color)
        {
            return (int) Math.Ceiling(color * 255);
        }
```

```
}
```

}

The XAML:

We first reference to our control with the namespace we defined earlier.

```
xmlns:Controls="clr-namespace:Mobile.Controls"
```

We then use the Control as follows and use properties defined at the beginning:

```
<Controls:ExtendedBoxView
   x:Name="search_boxview"
   Color="#444"
   BorderRadius="5"
   HorizontalOptions="CenterAndExpand"
   />
```

Section 13.5: Rounded BoxView with selectable background color

First step : PCL part

```
public class RoundedBoxView : BoxView
{
    public static readonly BindableProperty CornerRadiusProperty =
        BindableProperty.Create("CornerRadius", typeof(double), typeof(RoundedEntry),
default(double));

    public double CornerRadius
    {
        get
        {
            return (double)GetValue(CornerRadiusProperty);
        }
        set
        {
            SetValue(CornerRadiusProperty, value);
        }
    }

    public static readonly BindableProperty FillColorProperty =
        BindableProperty.Create("FillColor", typeof(string), typeof(RoundedEntry),
default(string));

    public string FillColor
    {
        get
        {
            return (string) GetValue(FillColorProperty);
        }
        set
        {
            SetValue(FillColorProperty, value);
        }
    }
}
```

Second step : Droid part

```
[assembly: ExportRenderer(typeof(RoundedBoxView), typeof(RoundedBoxViewRenderer))]
namespace MyNamespace.Droid
{
    public class RoundedBoxViewRenderer : VisualElementRenderer<BoxView>
    {
        protected override void OnElementChanged(ElementChangedEventArgs<BoxView> e)
        {
            base.OnElementChanged(e);
            SetWillNotDraw(false);
            Invalidate();
        }

        protected override void OnElementPropertyChanged(object sender,
System.ComponentModel.PropertyChangedEventArgs e)
        {
            base.OnElementPropertyChanged(sender, e);
            SetWillNotDraw(false);
            Invalidate();
        }

        public override void Draw(Canvas canvas)
        {
            var box = Element as RoundedBoxView;
            var rect = new Rect();
            var paint = new Paint
            {
                Color = Xamarin.Forms.Color.FromHex(box.FillColor).ToAndroid(),
                AntiAlias = true,
            };

            GetDrawingRect(rect);

            var radius = (float)(rect.Width() / box.Width * box.CornerRadius);

            canvas.DrawRoundRect(new RectF(rect), radius, radius, paint);
        }
    }
}
```

Third step : iOS part

```
[assembly: ExportRenderer(typeof(RoundedBoxView), typeof(RoundedBoxViewRenderer))]
namespace MyNamespace.iOS
{
    public class RoundedBoxViewRenderer : BoxRenderer
    {
        protected override void OnElementChanged(ElementChangedEventArgs<BoxView> e)
        {
            base.OnElementChanged(e);

            if (Element != null)
            {
                Layer.CornerRadius = (float)(Element as RoundedBoxView).CornerRadius;
                Layer.BackgroundColor = Color.FromHex((Element as
RoundedBoxView).FillColor).ToCGColor();
            }
        }

        protected override void OnElementPropertyChanged(object sender,
```

```
System.ComponentModel.PropertyChangedEventArgs e)
        {
            base.OnElementPropertyChanged(sender, e);

            if (Element != null)
            {
                Layer.CornerRadius = (float)(Element as RoundedBoxView).CornerRadius;
                Layer.BackgroundColor = (Element as RoundedBoxView).FillColor.ToCGColor();
            }
        }
    }
}
```