Resources and Styles

Microsoft

Objectives

1. Avoid duplicate XAML with Resources
2. Create consistent UI with Styles
3. Make your Resources and Styles available across your entire app
4. Apply the user's Accessibility choices with built-in Styles

Avoid duplicate XAML with Resources

Tasks

1. Use page-level Resources
2. Dynamically update Resources

Motivation

- Duplicate XAML values are error prone and difficult to maintain

```
<StackLayout BackgroundColor="#FFFFFF">
  <Label           TextColor="#00FF00" FontSize="16.5" ... />
  <Entry     BackgroundColor="#FFFFFF"                 ... />
  <BoxView   BackgroundColor="#00FF00"                 ... />
  <Button    BackgroundColor="#00FF00" FontSize="16.5" ... />
</StackLayout>
```

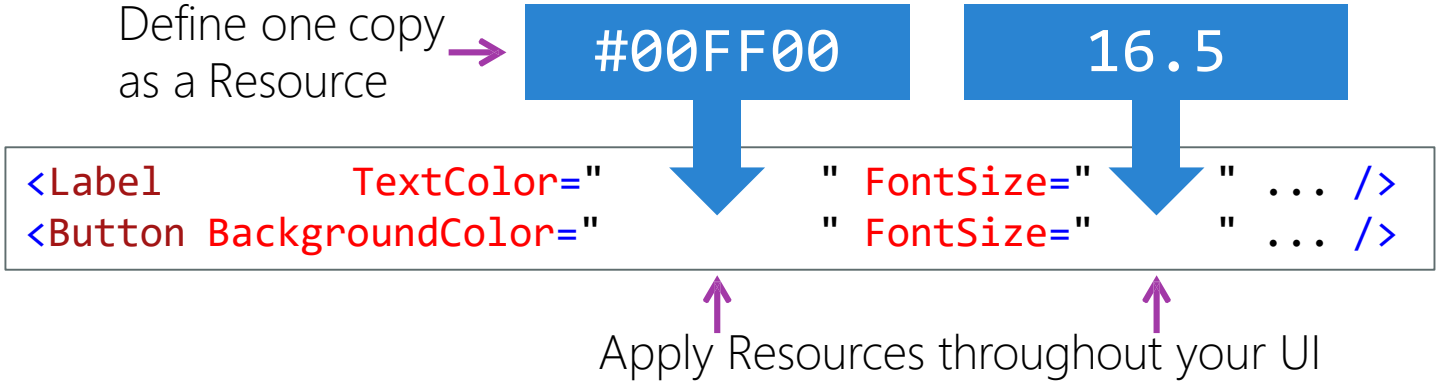
Common to use the same colors and sizes across the UI

Group Exercise

Examine an app containing repeated code

What is a Resource?

- A *Resource* is an object that can be used in multiple places in your UI



What is a ResourceDictionary?

- **`ResourceDictionary`** is a key/value dictionary that is customized for use with UI Resources

Mostly has standard dictionary operations

```
public sealed class ResourceDictionary : ...
{ ...
  public object this[string index] { get; set; }

  public void Add(string key, object value);
  public void Add(Style implicitStyle);
}
```

Some added UI-specific functionality

Page-level Resources

- Every page can have a resource dictionary, must be set in code or XAML

You must create the dictionary

```
<ContentPage ...>

  <ContentPage.Resources>
    <ResourceDictionary>
      ...
    </ResourceDictionary>
  </ContentPage.Resources>

</ContentPage>
```

Assign the dictionary you create to the page's **Resources** property

Creating Resources

- Resources created in XAML must use the XAML-language keyword **`x:Key`** to set the key

Create inside the page's dictionary

```
<ContentPage ...>

  <ContentPage.Resources>
    <ResourceDictionary>
      <Thickness x:Key="myKey">10,20,40,80</Thickness>
    </ResourceDictionary>
  </ContentPage.Resources>

</ContentPage>
```

Value

Key

Choose Resource names based on use, not value; e.g. use **`bgColor`**, not **`redColor`**.

Using static Resources

- The **`StaticResource`** markup extension retrieves a resource, the value is applied once when the target object is created

Define

Use

```
<ContentPage ...>

  <ContentPage.Resources>
    <ResourceDictionary>
      <Thickness x:Key="myKey">10,20,40,80</Thickness>
    </ResourceDictionary>
  </ContentPage.Resources>

  <StackLayout Padding="{StaticResource
  myKey}">
  </StackLayout>

</ContentPage>
```

XAML intrinsic types

- The XAML spec defines many types you can use for XAML Resources

String and **Double** are useful since many UI properties use those types

```
<ResourceDictionary>
  <x:String   x:Key="...">Hello</x:String>
  <x:Char     x:Key="...">X</x:Char>
  <x:Single   x:Key="...">31.4</x:Single>
  <x:Double   x:Key="...">27.1</x:Double>
  <x:Byte     x:Key="...">8</x:Byte>
  <x:Int16    x:Key="...">16</x:Int16>
  <x:Int32    x:Key="...">32</x:Int32>
  <x:Int64    x:Key="...">64</x:Int64>
  <x:Decimal  x:Key="...">12345</x:Decimal>
  <x:TimeSpan x:Key="...">1.23:5959</x:TimeSpan>
  <x:Boolean  x:Key="...">True</x:Boolean>
</ResourceDictionary>
```

Platform dependencies

- Can use **`OnPlatform`** objects in your resource dictionaries to handle platform-specific values

```
<ResourceDictionary>
  <OnPlatform x:Key="textColor"
    x:TypeArguments="Color"
    iOS="Silver"
    Android="Green"
    WinPhone="Blue" />
</ResourceDictionary>
```

```
<Label TextColor="{StaticResource textColor}" ... />
```

Platform dependencies

- Can use **`OnPlatform`** objects in your resource dictionaries to handle platform-specific values

```
<ResourceDictionary>
  <OnPlatform x:Key="textColor"
    x:TypeArguments="Color">
    <OnPlatform="iOS" Value="Silver"/>
    <OnPlatform="Android" Value="Green"/>
    <OnPlatform="Windows" Value="Blue"/>
   <OnPlatform />
</ResourceDictionary>
```

```
<Label TextColor="{StaticResource textColor}" ... />
```

Group Exercise

Use page-level Resources

Motivation [delayed availability]

- You might download resource values after startup; however, resources applied with **`StaticResource`** will fail if the key is not in the dictionary

Will throw an exception if key not found

```
<ContentPage ...>

  <ContentPage.Resources>
    <ResourceDictionary>
    </ResourceDictionary>
  </ContentPage.Resources>

  <StackLayout BackgroundColor="{StaticResource
  bg}">
    ...
  </StackLayout>
</ContentPage>
```

Motivation [change]

- Resource values might change over time; however, resources applied with **`StaticResource`** will not update in response to the change

```
<ContentPage ...>

  <ContentPage.Resources>
    <ResourceDictionary>
      <Color x:Key="bg">Blue</Color>
    </ResourceDictionary>
  </ContentPage.Resources>

  <StackLayout BackgroundColor="{StaticResource
  bg}">
    ...
  </StackLayout>
</ContentPage>
```

Value applied once when the object is created

How to update Resources

- Can update resource values from code, useful when you download new values or let the user select preferred colors, font sizes, etc.

Define a default in XAML

```
<ResourceDictionary>
  <Color x:Key="bg">Blue</Color>
</ResourceDictionary>
```

Update to new value

```
void OnChangeColor()
{
  this.Resources["bg"] = Color.Green;
}
```

Using dynamic Resources

- The **`DynamicResource`** markup extension retrieves a resource when the target object is created and updates it as the value changes

`BackgroundColor` set to **`Blue`** initially →

```
<ResourceDictionary>
  <Color x:Key="bg">Blue</Color>
</ResourceDictionary>

<StackLayout BackgroundColor="{DynamicResource bg}">
  ...
</StackLayout>
```

`BackgroundColor` changes to **`Green`** →

```
void OnChangeColor()
{
  this.Resources["bg"] = Color.Green;
}
```

Key not found is OK

- **`DynamicResource`** leaves the property unset if the key is not found, it is not an error and no exception is generated

Key not defined

No value assigned to **`BackgroundColor`**

```
<ContentPage ...>

  <ContentPage.Resources>
    <ResourceDictionary>
    </ResourceDictionary>
  </ContentPage.Resources>

  <StackLayout BackgroundColor="{DynamicResource
  bg}">
    ...
  </StackLayout>
</ContentPage>
```

Applying Resources in code

- Resources can be set in code using **`SetDynamicResource`**, allows logic to apply different resources based on runtime knowledge

```
var name = new Label { Text = "Name" };

if (Device.OS == TargetPlatform.iOS)
{
   name.SetDynamicResource(Label.TextColorProperty, "hlColor");
}
```

The **`BindableProperty`** to assign

The Resource key to apply

Individual Exercise

Dynamically update Resources

Summary

1. Use page-level Resources
2. Dynamically update Resources

Create consistent UI with Styles

Tasks

1. Create and apply a Style
2. Use Style inheritance to avoid repeated Setters

Motivation [repeated code]

- Resources let you avoid duplicate values, but you still have to set each property individually which creates clutter and yields repeated code

The property settings must be repeated on each view

```
<Button
  BackgroundColor="{StaticResource highlightColor}"
  BorderColor     ="{StaticResource edgeColor}"
  BorderRadius    ="{StaticResource edgeRadius}"
  BorderWidth     ="{StaticResource edgeSize}"
  TextColor       ="{StaticResource textColor}"
  Text            ="OK" />
```

OK

```
<Button
  BackgroundColor="{StaticResource highlightColor}"
  BorderColor     ="{StaticResource edgeColor}"
  BorderRadius    ="{StaticResource edgeRadius}"
  BorderWidth     ="{StaticResource edgeSize}"
  TextColor       ="{StaticResource textColor}"
  Text            ="Cancel" />
```

Cancel

Motivation [efficiency]

- Resource lookup can increase the startup time of your app since the lookup takes longer than assigning a literal value

```
<Button
  TextColor="{StaticResource textColor}"
  ... />
```

Slower

```
<Button
  TextColor="White"
  ... />
```

Faster

What is a Setter?

- A **`Setter`** is a container for a property・value pair

```
<Setter Property="TextColor" Value="White" />
```

A bindable property

A value appropriate for the property

What is a Style?

- A **`Style`** is a collection of setters for a particular type of view

`TargetType` must be set (or runtime exception)

```
<Style TargetType="Button">
  <Setter Property="BackgroundColor" Value="#2A84D3" />
  <Setter Property="BorderColor"     Value="#1C5F9B" />
  <Setter Property="BorderRadius"    Value="10"      />
  <Setter Property="BorderWidth"     Value="3"       />
  <Setter Property="TextColor"       Value="White"   />
</Style>
```

The properties must be members of the **`TargetType`** class (or runtime exception)

Styles as Resources

- Styles are shareable, so they are generally defined as Resources

Define in a dictionary

```
<ContentPage.Resources>
  <ResourceDictionary>

    <Style x:Key="MyButtonStyle" TargetType="Button">
      ...
    </Style>

  </ResourceDictionary>
</ContentPage.Resources>
```

Using a Style

- Styles are set on a control through the **`Style`** property, this applies all the setters in the style to that control

```
<Button Text="OK"     Style="{StaticResource MyButtonStyle}" />
<Button Text="Cancel" Style="{StaticResource MyButtonStyle}" />
```

The **`Style`** property is defined in the **`VisualElement`** base class so it is available in all views

Combining Styles and Resources

- Can use a resource as the **`Value`** for a setter, this lets it share a value with other styles

```
<Color x:Key="bgColor">White</Color>
<Color x:Key="fgColor">Black</Color>

<Style TargetType="Button" x:Key="AllButtons">
  <Setter Property="BackgroundColor" Value="{StaticResource  bgColor}" />
  <Setter Property="TextColor"       Value="{DynamicResource fgColor}" />
  ...
</Style>
```

Can use either static or dynamic lookup

Implicit Styles

- Styles can be automatically applied to all controls of a target type by omitting **`x:Key`** and placing the style into an accessible dictionary

```
<ContentPage.Resources>
   <ResourceDictionary>
      <Style TargetType="Button">
         <Setter Property="BackgroundColor" Value="Blue" />
         <Setter Property="BorderColor"     Value="Navy" />
            ...
      </Style>
   </ResourceDictionary>
</ContentPage.Resources>
```

The target type is still specified and is matched exactly, this style will be applied to all buttons in this page

Overriding a setter

- Styles provide the *default* values, explicit property values on the control are applied *after* the style and take precedence

```
<Style x:Key="MyButtonStyle" TargetType="Button">
  <Setter Property="BackgroundColor" Value="Red" />
</Style>
```

```
<Button
  Style="{StaticResource MyButtonStyle}"
  BackgroundColor="Blue"
  Text="Cancel"
  ... />
```

Cancel

Value set directly overrules the style value

Background is blue, not red

Ancestor targeting

- A **`Style`** can target a base type of the object to which it is applied

This style targets **`VisualElement`**

```
<Style x:Key="MyVisualElementStyle" TargetType="VisualElement">
  <Setter Property="BackgroundColor" Value="#2A84D3" />
</Style>
```

```
<Button Style="{StaticResource MyVisualElementStyle}" ... />
```

Can apply to a button since the **`Button`** class is derived from **`VisualElement`**

Creating a Style in code

- Styles can be created in code to allow runtime customizations

```
var s = new Style(typeof(Button));

s.Setters.Add(new Setter {Property = Button.BackgroundColorProperty, Value = Color.Red});
s.Setters.Add(new Setter {Property = Button.BorderRadiusProperty,    Value = 4        });
```

Can then apply **`Style`** to a **`Button`** directly, or add it to the resources to apply in XAML

Individual Exercise

Create and apply a Style

Motivation [repeated code]

- Styles often have duplicate Setters which are then hard to maintain

Repeated

```
<Style x:Key="MyButtonStyle" TargetType="Button">
  <Setter Property="BackgroundColor" Value="Blue"  />
  <Setter Property="BorderColor"     Value="Navy"  />
  <Setter Property="BorderWidth"     Value="5"     />
</Style>

<Style x:Key="MyEntryStyle" TargetType="Entry">
  <Setter Property="BackgroundColor" Value="Blue"  />
  <Setter Property="TextColor"       Value="White" />
</Style>
```

Motivation [customization]

- A provided Style might need some adjustment to meet your needs

```
<Style x:Key="MyButtonStyle" TargetType="Button">
  <Setter Property="BackgroundColor" Value="Blue" />
  ...
</Style>
```

Color might not be right for current use

```
<Button Style="{StaticResource MyButtonStyle}" Text="OK"     BackgroundColor="Purple" />
<Button Style="{StaticResource MyButtonStyle}" Text="Cancel" BackgroundColor="Purple" />
```

It is tedious to manually set properties that don't fit the current situation

Style inheritance

- A style can inherit from a base style

Base's **`TargetType`** must be the same or a base class

```
<Style x:Key="MyButtonStyle"     TargetType="Button">
  ...
</Style>

<Style x:Key="DiscoButtonStyle" TargetType="Button" BasedOn="{StaticResource MyButtonStyle}">
  ...
</Style>
```

Indicates which style this will inherit from

Only **`StaticResource`** is allowed to set the base style

Inherited properties

- The new style can modify existing property values and/or add new ones

```
<Style x:Key="MyButtonStyle" TargetType="Button">
  <Setter Property="BackgroundColor" Value="Blue" />
  <Setter Property="BorderColor"     Value="Navy" />
</Style>

<Style x:Key="DiscoButtonStyle" TargetType="Button" BasedOn="{StaticResource MyButtonStyle}">
   <Setter Property="BackgroundColor" Value="Purple" />
   <Setter Property="Rotation"        Value="30"     />
</Style>
```

Add new setter

Replace inherited setter

Individual Exercise

Use Style inheritance to refactor repeated code

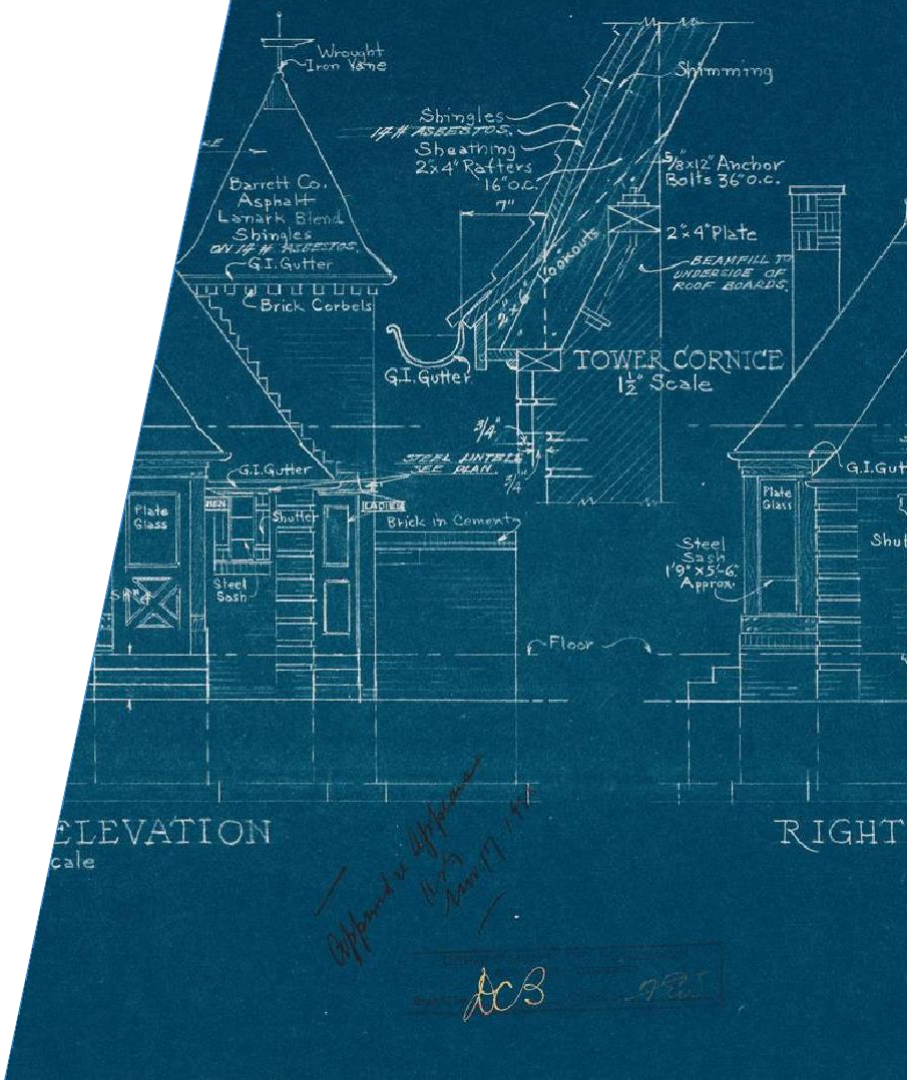
Summary

1. Create and apply a Style
2. Use Style inheritance to avoid repeated Setters

Make your Resources and Styles available across your entire app

Tasks

1. Create App.xaml
2. Use application-wide resources



Motivation

- You will often need to share resources across multiple pages of your app; however, page-level resources are only available on one page

```
<ContentPage ...>

  <ContentPage.Resources>
    <ResourceDictionary>
      <x:Double x:Key="size">32</x:Double>
    </ResourceDictionary>
  </ContentPage.Resources>
  ...
  <Label FontSize="{StaticResource size}" />
  ...
</ContentPage>
```

✓ OK, definition and use are in the same page

```
<ContentPage ...>
  ...
  ...
  ...
  ...
  ...
  ...
  ...
  <Button FontSize="{StaticResource size}" />
  ...
</ContentPage>
```

🚫 Resources defined in one page are not available in a different page

Available dictionaries

- **`VisualElement`** and **`Application`** have built-in resource dictionaries – these are initialized to **`null`** by default

```
public class VisualElement : ...
{ ...
  public ResourceDictionary Resources
  {
    get;
    set;
  }
}
```

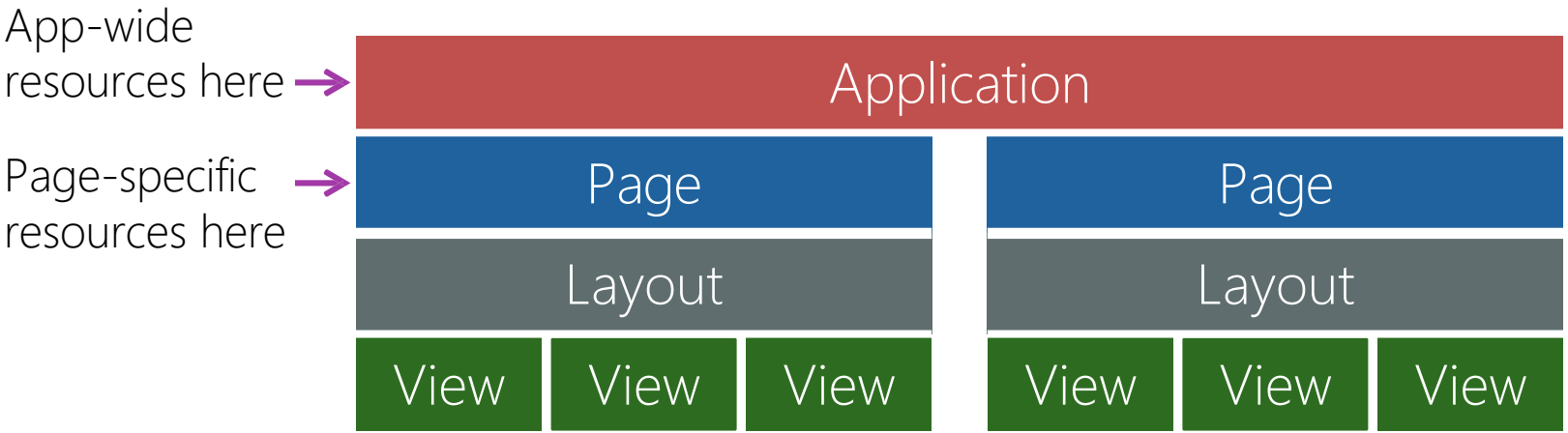
Pages, layouts, and views inherit from **`VisualElement`**

```
public class Application : ...
{ ...
  public ResourceDictionary Resources
  {
    get;
    set;
  }
}
```

Your app class inherits from **`Application`**

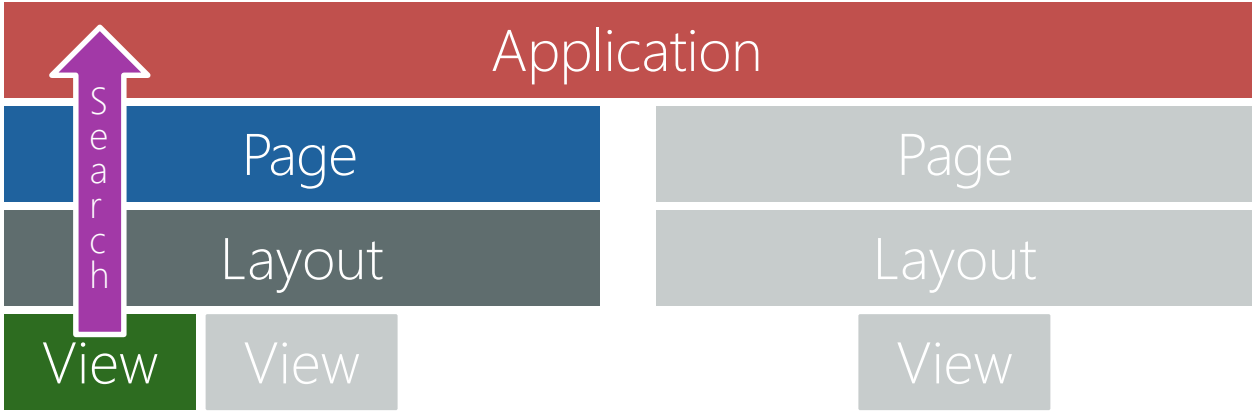
Resource scope

- Resources can be defined at different levels so they are scoped to a specific usage area in the application



Lookup rules

- Dictionaries are searched starting at the point a resource is applied, then up the visual tree to the Page, and finally to the App



Apply a resource to a view, lookup will proceed up the hierarchy

Place resources close to where they are used to minimize lookup cost

Defining application-level resources

- **`App.xaml`** and **`App.xaml.cs`** files are needed in order to use an application-wide resource dictionary in xaml

App.xaml

```xml
<Application
  xmlns ="http://xamarin.com/schemas/2014/forms"
  xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
  x:Class="MyApp.App">

  <Application.Resources>
    <ResourceDictionary>
      <x:Double x:Key="size">32</x:Double>
    </ResourceDictionary>
  </Application.Resources>

</Application>
```

App.xaml.cs

```csharp
namespace MyApp
{
  public partial class App : Application
  {
    public App()
    {
      InitializeComponent();
      MainPage = new MyPage();
    }
  }
}
```

Using application-level resources

- Can use either **`StaticResource`** or **`DynamicResource`** to apply an application-level resource

```
<ContentPage ...>
  ...
  <Label FontSize="{StaticResource size}" />
  ...
</ContentPage>
```

```
<ContentPage ...>
  ...
  <Button FontSize="{StaticResource size}" />
  ...
</ContentPage>
```

The resource will be available in all pages of the app

Duplicate keys

- Keys can be repeated in different dictionaries, the first matching key on the search path is used

```
<Application.Resources>
  <ResourceDictionary>
    <x:String x:Key="msg">Two</x:String>
  </ResourceDictionary>
</Application.Resources>
```

App.xaml

```
<ContentPage.Resources>
  <ResourceDictionary>
    <x:String x:Key="msg">One</x:String>
  </ResourceDictionary>
</ContentPage.Resources>

<Label Text="{StaticResource msg}">
```

MainPage.xaml

Text set to **One**

Group Exercise

Use application-wide Resources

Merged Dictionaries

- Xamarin.Forms allows you to import a dictionary into another dictionary by assigning the **MergedWith** property of a **ResourceDictionary**

AboutPage owns a ResourceDictionary

AboutPage

```
<ContentPage ...>
   <ContentPage.Resources>
      <ResourceDictionary>
         <x:Double x:Key="size">32</x:Double>
      </ResourceDictionary>
   </ContentPage.Resources>
   ...
</ContentPage>
```

dictionary is referenced by owning class name

SettingsPage

```
<ContentPage ...>
   <ContentPage.Resources>
     <ResourceDictionary
        MergedWith="theme:AboutPage" />
   </ContentPage.Resources>
   ...
</ContentPage>
```

SettingsPage now has access to resources defined in **AboutPage**

Guideline for global styles

- Use explicit styles at the application level and then put an implicit style in each page that uses **`BasedOn`**

Explicit Style at the app level

Application

```
<Style TargetType="Button" x:Key="gsk">...</Style>
```

Page

```
<Style TargetType="Button" BasedOn="{StaticResource gsk}" />
```

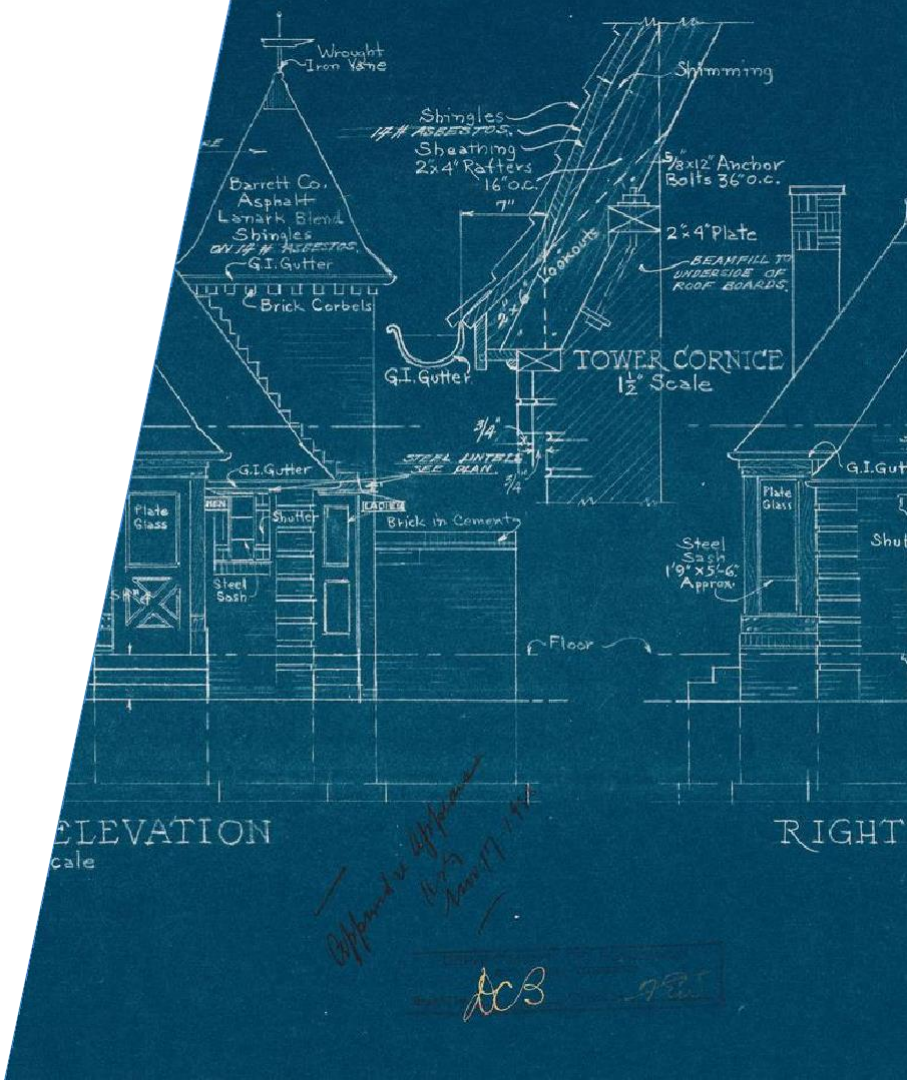
Implicit Style on each Page, based on the app Style

No added Setters

This approach makes it clear which implicit Styles will be applied on each page

Summary

1. Create App.xaml
2. Use application-wide resources



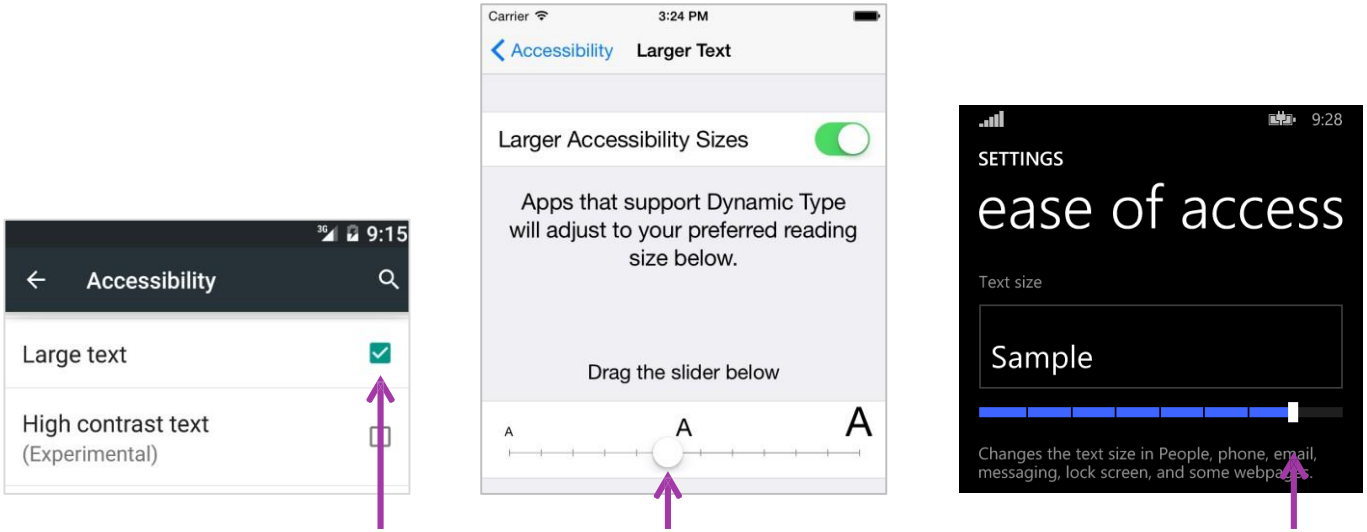
Apply the user's Accessibility choices with built-in Styles

Tasks

1. Apply a built-in Style
2. Customize a built-in Style

Motivation

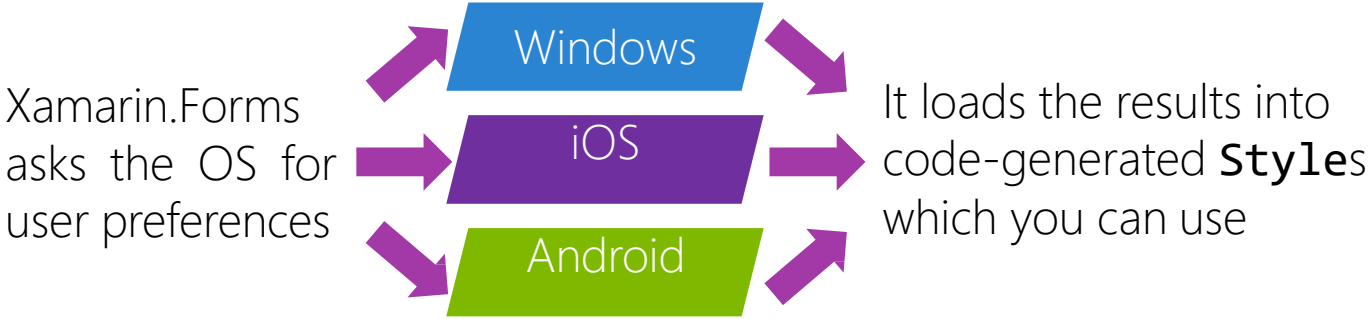
- Apps should respect the user's device-wide preferences for appearance and accessibility; ideally, apps update their UI when settings change



Apps should try to use the text size the user requested

What is a built-in Style?

- Xamarin.Forms maps the user's device-wide preferences to Styles, it keeps those Styles updated as the user changes their settings



Built-in Styles are under development, please expect changes and additions.

Implementation

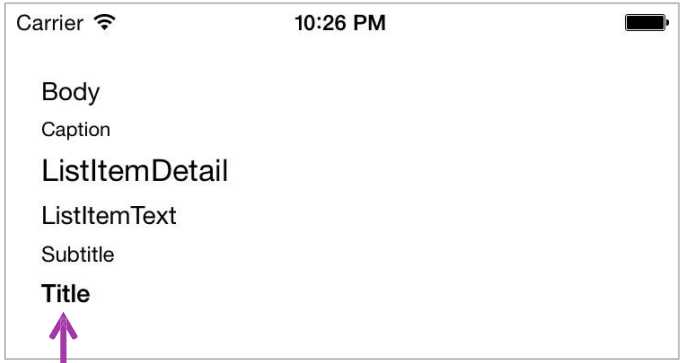
- The built-in styles are provided as **`Style`** objects in **`Device.Styles`**

```
public static class Styles
{ ...
  public static readonly Style BodyStyle;
  public static readonly Style
  CaptionStyle;
  public static readonly Style ListItemDetailTextStyle;
  public static readonly Style ListItemTextStyle;
  public static readonly Style SubtitleStyle;
  public static readonly Style TitleStyle;
}
```

Styles are for common UI
like titles, body text, and lists

Targets

- The built-in Styles use a `TargetType` of `Label`



The Styles have setters for common properties such as fonts and colors

Resource keys

- Symbolic constants from **`Device.Styles`** identify the built-in Styles in XAML

```
public static class Styles
{ ...
  public static readonly string BodyStyleKey                = "BodyStyle";
  public static readonly string                             = "CaptionStyle";
  CaptionStyleKey
  public static readonly string ListItemDetailTextStyleKey =
  "ListItemDetailTextStyle";
  public static readonly string ListItemTextStyleKey        = "ListItemTextStyle";
  public static readonly string SubtitleStyleKey            = "SubtitleStyle";
  public static readonly string TitleStyleKey               = "TitleStyle";
}
```

You use these in your XAML

Using a built-in Style

- Must use **`DynamicResource`** to access a built-in Style

```
public static class Styles
{ ...
  public static readonly string TitleStyleKey = "TitleStyle";
}
```

Use the predefined string resource key

```
<Label Text="Welcome" Style="{DynamicResource TitleStyle}" />
```

`DynamicResource` is required because these styles are generated via code and can change at runtime if the user changes their preferences

Customizing built-in Styles

- **`BaseResourceKey`** lets you use a built-in Style as a base, it performs a dynamic lookup which keeps the property values synchronized to the user preferences

```
<Style BaseResourceKey="TitleStyle" TargetType="Label" x:Key="MyTitleStyle">
  ...
</Style>
```

Property identifies the Resource to use as the **`BasedOn`** style
(i.e. you are supplying a key that will be used for Resource lookup)

Summary

1. Apply a built-in style
2. Customize a built-in style

Thank You!

Microsoft