무료 전자 책

배우기

wpf

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#wpf

1: wpf

WPF (Windows Presentation Foundation) Windows Microsoft . WPF UWP (Universal Windows Platform) .

WPF , . XML XAML (eXtensible Application Markup Language) . XAML WPF .

Windows Forms WPF . , .

WPF Windows Presentation Foundation (Codename Avalon) . Microsoft .NET Framework . WPF Windows Vista, 7, 8 10 Windows XP Server 2003 .

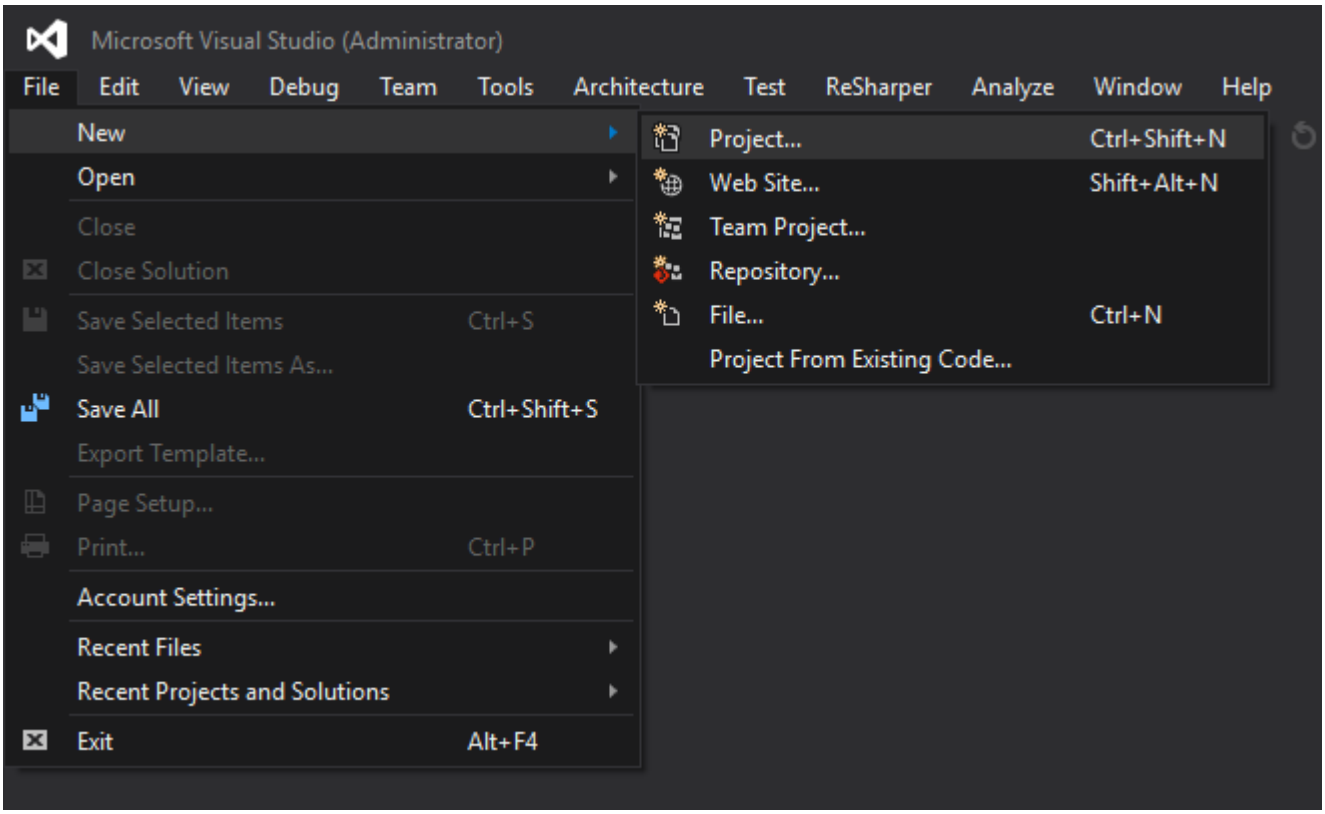
4.6.1 - 2015 12

Examples

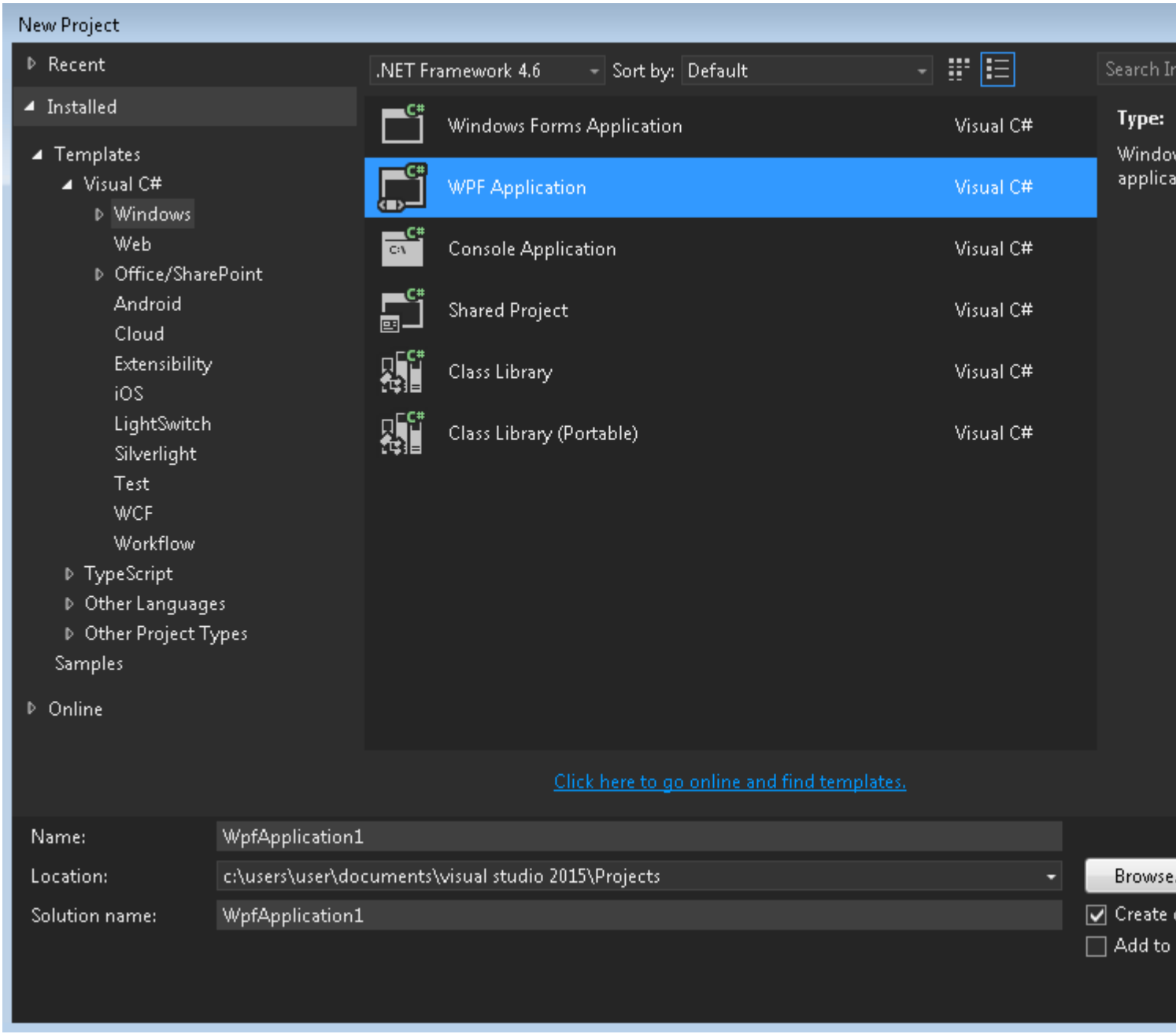
Hello World

Visual Studio WPF

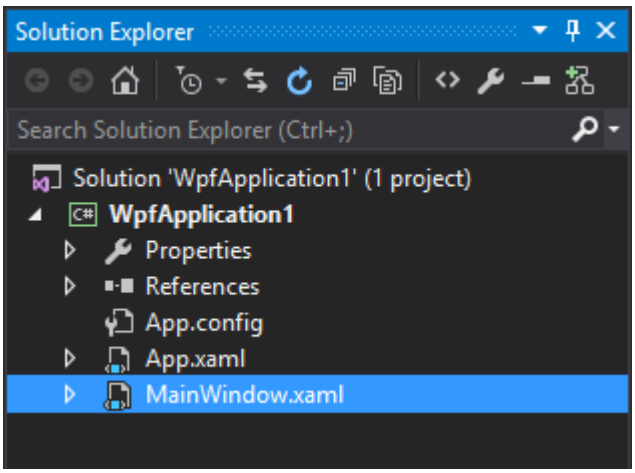
1. → → .



2. → **Visual C # → Windows → WPF** .



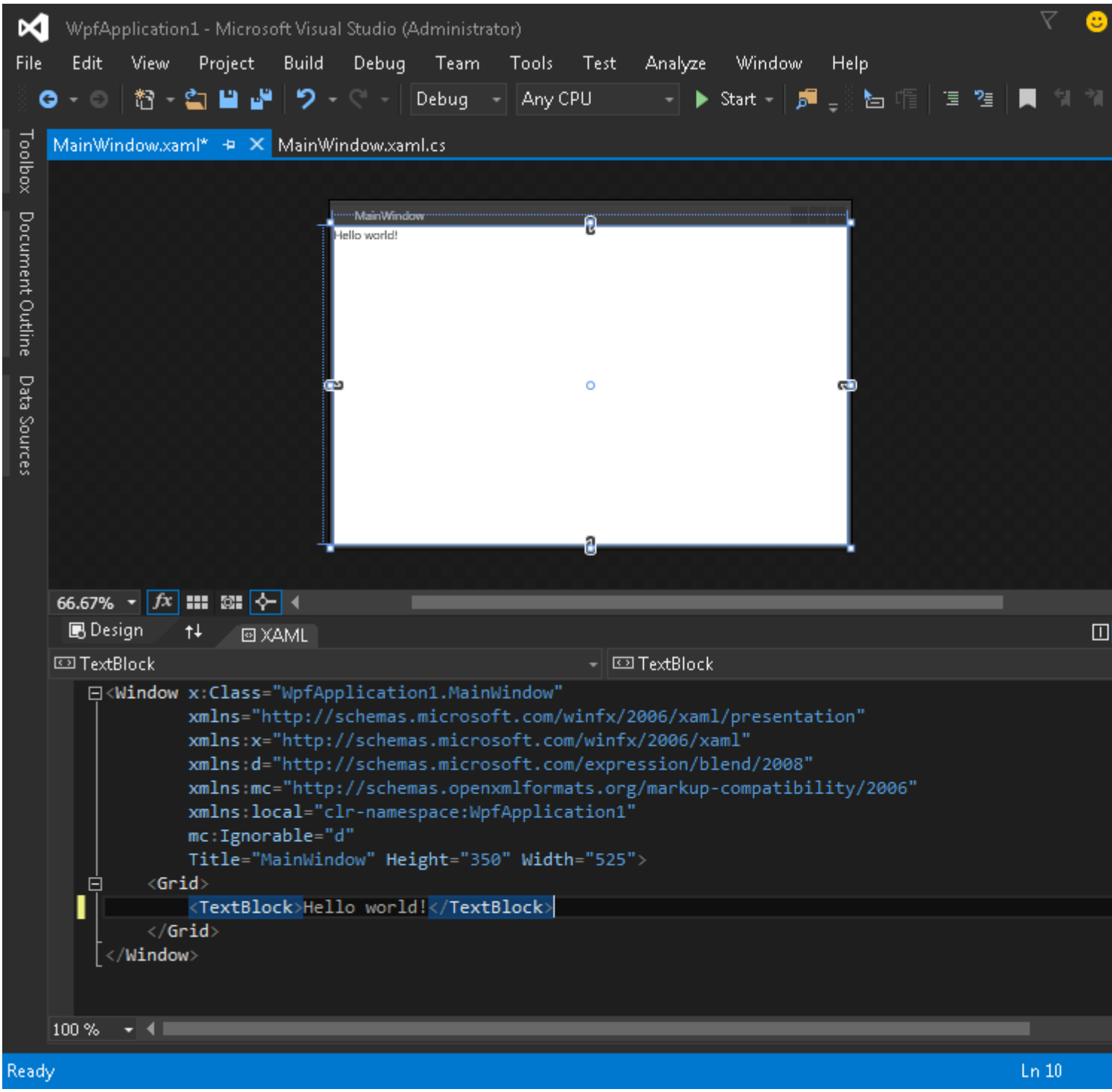
3. **MainWindow.xaml** (→).



4. *XAML* ( ) .

```
<TextBlock>Hello world!</TextBlock>
```

`Grid` :

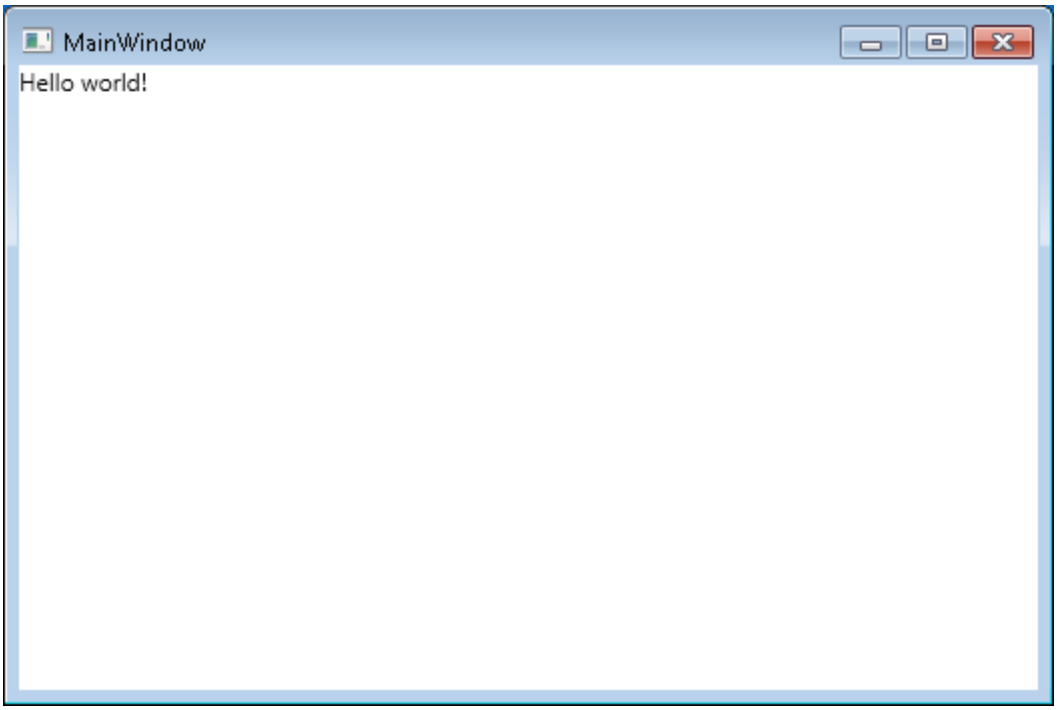


.

```
<Window x:Class="WpfApplication1.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
        xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
        xmlns:local="clr-namespace:WpfApplication1"
        mc:Ignorable="d"
```

```
        Title="MainWindow" Height="350" Width="525">
    <Grid>
        <TextBlock>Hello world!</TextBlock>
    </Grid>
</Window>
```

5. F5 □ → . .



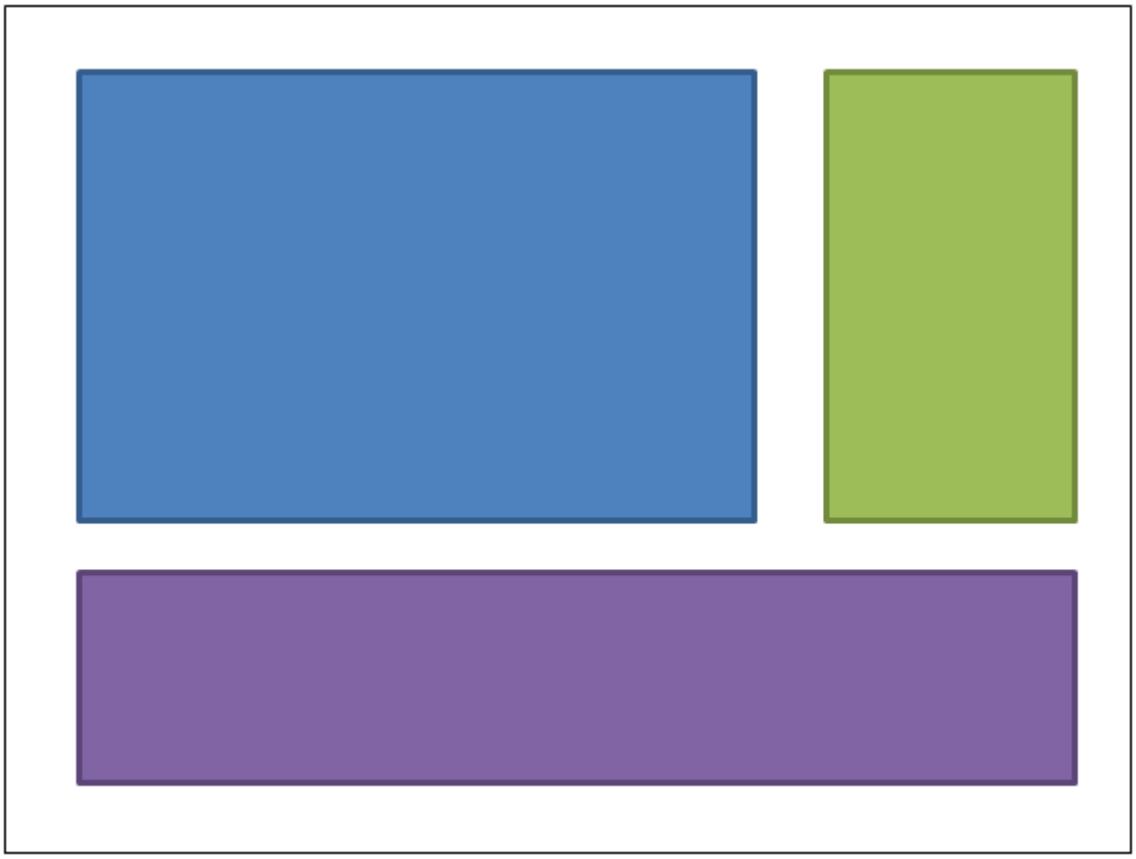
wpf : https://riptutorial.com/ko/wpf/topic/820/wpf-

2: " "

. . .

.

Examples



, 3 .

4,4,0,0 . 4,4,4,0 . 4,4,4,4. XAML ( ).

```
<UserControl x:Class="WpfApplication5.UserControl1HardCoded"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
             xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
             mc:Ignorable="d"
             d:DesignHeight="300" d:DesignWidth="300">
<Grid>
    <Grid.ColumnDefinitions>
        <ColumnDefinition Width="3*"/>
        <ColumnDefinition Width="*"/>
    </Grid.ColumnDefinitions>
    <Grid.RowDefinitions>
        <RowDefinition Height="2*"/>
        <RowDefinition Height="*"/>
    </Grid.RowDefinitions>
```

```
    <Border Grid.Column="0" Grid.Row="0" Margin="4,4,0,0" Background="DodgerBlue"
BorderBrush="DarkBlue" BorderThickness="5"/>
    <Border Grid.Column="1" Grid.Row="0" Margin="4,4,4,0" Background="Green"
BorderBrush="DarkGreen" BorderThickness="5"/>
    <Border Grid.Column="0" Grid.ColumnSpan="2" Grid.Row="1" Margin="4,4,4,4"
Background="MediumPurple" BorderBrush="Purple" BorderThickness="5"/>
</Grid>
</UserControl>
```

. , ? . 0,4,4,0 . 4,4,4,0, 4,4,0,0 . XAML .

```
<UserControl x:Class="WpfApplication5.UserControl2HardCoded"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
             xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
             mc:Ignorable="d"
             d:DesignHeight="300" d:DesignWidth="300">
    <Grid>
        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="*"/>
            <ColumnDefinition Width="3*"/>
        </Grid.ColumnDefinitions>
        <Grid.RowDefinitions>
            <RowDefinition Height="2*"/>
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>

        <Border Grid.Column="1" Grid.Row="0" Margin="4,4,4,0" Background="DodgerBlue"
BorderBrush="DarkBlue" BorderThickness="5"/>
        <Border Grid.Column="0" Grid.Row="0" Margin="4,4,0,0" Background="Green"
BorderBrush="DarkGreen" BorderThickness="5"/>
        <Border Grid.Column="0" Grid.ColumnSpan="2" Grid.Row="1" Margin="4,4,4,4"
Background="MediumPurple" BorderBrush="Purple" BorderThickness="5"/>
    </Grid>
</UserControl>
```

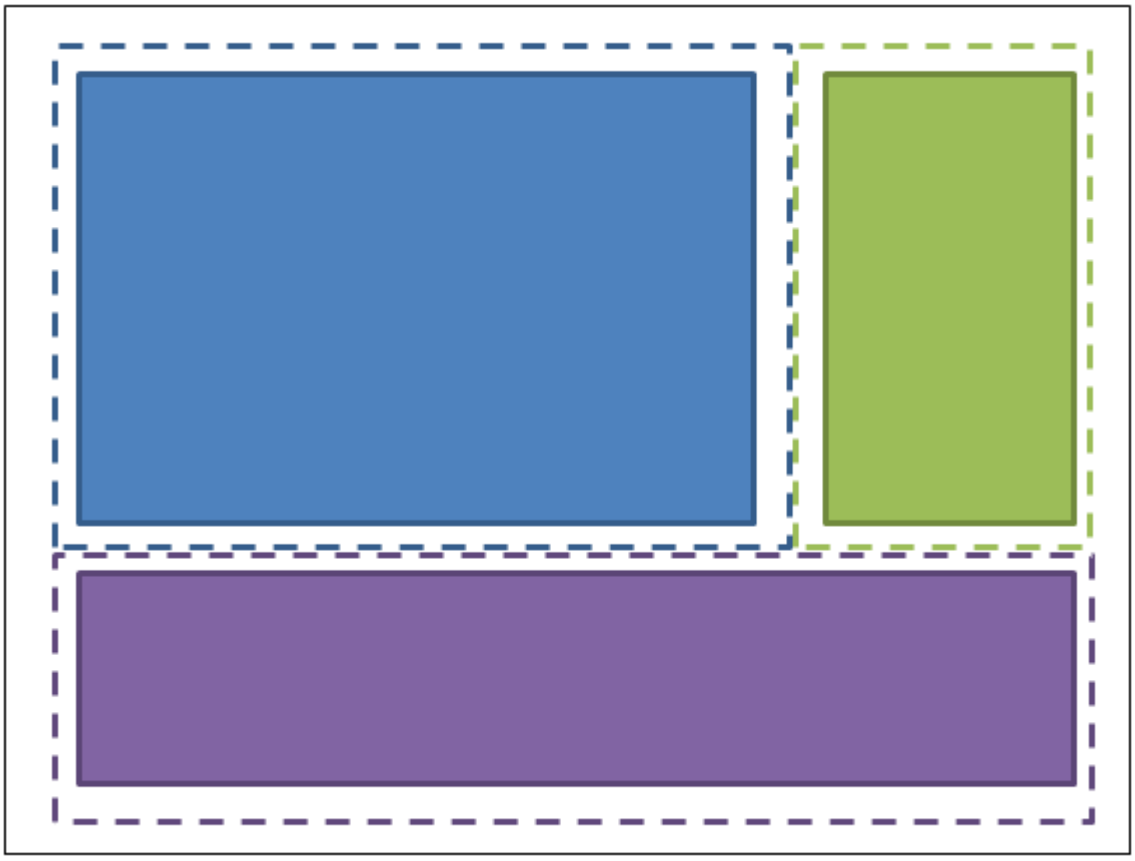
. 4,0,4,4. 4,0,0,4.

```
<UserControl x:Class="WpfApplication5.UserControl3HardCoded"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
             xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
             mc:Ignorable="d"
             d:DesignHeight="300" d:DesignWidth="300">
    <Grid>
        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="*"/>
            <ColumnDefinition Width="3*"/>
        </Grid.ColumnDefinitions>
        <Grid.RowDefinitions>
            <RowDefinition Height="*"/>
            <RowDefinition Height="2*"/>
        </Grid.RowDefinitions>

        <Border Grid.Column="1" Grid.Row="1" Margin="4,0,4,4" Background="DodgerBlue"
BorderBrush="DarkBlue" BorderThickness="5"/>
```

```
        <Border Grid.Column="0" Grid.Row="1" Margin="4,0,0,4" Background="Green"
BorderBrush="DarkGreen" BorderThickness="5"/>
        <Border Grid.Column="0" Grid.ColumnSpan="2" Grid.Row="0" Margin="4,4,4,4"
Background="MediumPurple" BorderBrush="Purple" BorderThickness="5"/>
    </Grid>
</UserControl>
```

? . (-) .



2,2,2,2. 2,2,2,2. 2,2,2,2. 2,2,2,2 ( ) . XAML .

```
<UserControl x:Class="WpfApplication5.UserControl1HalfTheWhitespace"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
             xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
             mc:Ignorable="d"
             d:DesignHeight="300" d:DesignWidth="300"
             Padding="2,2,2,2">
    <Grid>
        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="3*"/>
            <ColumnDefinition Width="*"/>
        </Grid.ColumnDefinitions>
        <Grid.RowDefinitions>
            <RowDefinition Height="2*"/>
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>

        <Border Grid.Column="0" Grid.Row="0" Margin="2,2,2,2" Background="DodgerBlue"
BorderBrush="DarkBlue" BorderThickness="5"/>
```

```
        <Border Grid.Column="1" Grid.Row="0" Margin="2,2,2,2" Background="Green"
BorderBrush="DarkGreen" BorderThickness="5"/>
        <Border Grid.Column="0" Grid.ColumnSpan="2" Grid.Row="1" Margin="2,2,2,2"
Background="MediumPurple" BorderBrush="Purple" BorderThickness="5"/>
    </Grid>
</UserControl>
```

... . . . XAML .

```
<UserControl x:Class="WpfApplication5.UserControl2HalfTheWhitespace"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
             xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
             mc:Ignorable="d"
             d:DesignHeight="300" d:DesignWidth="300"
             Padding="2,2,2,2">
    <Grid>
        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="*"/>
            <ColumnDefinition Width="3*"/>
        </Grid.ColumnDefinitions>
        <Grid.RowDefinitions>
            <RowDefinition Height="2*"/>
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>

        <Border Grid.Column="1" Grid.Row="0" Margin="2,2,2,2" Background="DodgerBlue"
BorderBrush="DarkBlue" BorderThickness="5"/>
        <Border Grid.Column="0" Grid.Row="0" Margin="2,2,2,2" Background="Green"
BorderBrush="DarkGreen" BorderThickness="5"/>
        <Border Grid.Column="0" Grid.ColumnSpan="2" Grid.Row="1" Margin="2,2,2,2"
Background="MediumPurple" BorderBrush="Purple" BorderThickness="5"/>
    </Grid>
</UserControl>
```

. . . XAML .

```
<UserControl x:Class="WpfApplication5.UserControl3HalfTheWhitespace"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
             xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
             mc:Ignorable="d"
             d:DesignHeight="300" d:DesignWidth="300"
             Padding="2,2,2,2">
    <Grid>
        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="*"/>
            <ColumnDefinition Width="3*"/>
        </Grid.ColumnDefinitions>
        <Grid.RowDefinitions>
            <RowDefinition Height="*"/>
            <RowDefinition Height="2*"/>
        </Grid.RowDefinitions>

        <Border Grid.Column="1" Grid.Row="1" Margin="2,2,2,2" Background="DodgerBlue"
BorderBrush="DarkBlue" BorderThickness="5"/>
        <Border Grid.Column="0" Grid.Row="1" Margin="2,2,2,2" Background="Green"
```

```
BorderBrush="DarkGreen" BorderThickness="5"/>
        <Border Grid.Column="0" Grid.ColumnSpan="2" Grid.Row="0" Margin="2,2,2,2"
Background="MediumPurple" BorderBrush="Purple" BorderThickness="5"/>
    </Grid>
</UserControl>
```

: " " , " " . . "HalfTheWhiteSpace" .

```
<system:Double x:Key="DefaultMarginSize">2</system:Double>
<Thickness x:Key="HalfTheWhiteSpace" Left="{StaticResource DefaultMarginSize}"
Top="{StaticResource DefaultMarginSize}" Right="{StaticResource DefaultMarginSize}"
Bottom="{StaticResource DefaultMarginSize}"/>
```

(FontFamily, FontSize)

```
<Style x:Key="BaseStyle" TargetType="{x:Type Control}">
    <Setter Property="Margin" Value="{StaticResource HalfTheWhiteSpace}"/>
</Style>
```

TextBox .

```
<Style TargetType="TextBox" BasedOn="{StaticResource BaseStyle}"/>
```

DatePickers, Labels ( ) . TextBlock . . TextBlock . TextBlock ; XAML TextBlock TextBlock .

(: ScrollViewer, Border) .

.

" " : https://riptutorial.com/ko/wpf/topic/9407/----

3: System.Windows.Controls.WebBrowser

WPF .

(https : //) InternetExplorer7 . west-wind.com/posts/2011/may/21/web-browser-control-specifying-the-ie-version).

. HTML (!) . (.)

" "/ " " . .

Examples

BusyIndicator WebBrowser

WebBrowser XAML . , Busy BusyIndicator . WebBrowser BusyIndicator . :

```
    <telerik:RadBusyIndicator IsBusy="{Binding IsBusy}">
        <WebBrowser Visibility="{Binding IsBusy, Converter={StaticResource
InvertBooleanToVisibilityConverter}}"/>
    </telerik:RadBusyIndicator>
```

System.Windows.Controls.WebBrowser : https://riptutorial.com/ko/wpf/topic/9115/system-windows-controls-webbrowser

4: WPF

- {Binding PropertyName} {Binding Path = PropertyName} .
- { = SomeProperty.SomeOtherProperty.YetAnotherProperty}
- { = SomeListProperty [1]}

	. DataContext .
UpdateSourceTrigger	. `LostFocus` . `PropertyChanged` .
	`OneWay` `TwoWay` . , `TwoWay` `OneWay` . `TwoWay` . `TextBox.Text` `OneWay` .
	`StaticResource` DataContext .
	XAML DataContext .
	XAML DataContext .
FallbackValue	.
TargetNullValue	Y `null` , Y .
	`StaticResource` . : `Visibility` .
ConverterParameter	. .
StringFormat	.
	(WPF 4.5) `ViewModel` `BindingSource` `milliseconds`) `ViewModel` . `Mode=TwoWay` `UpdateSourceTrigger=PropertyChanged` .

UpdateSourceTrigger

WPF . ( ) `UpdateSourceTrigger=PropertyChanged` .

`PropertyChanged` .

`LostFocus` . Enter `IsDefault` . .

UWP WPF (4.5) `Delay` . `TextBox` .

Examples

`IValueConverter` () .

: `BooleanToVisibilityConverter` System.Windows.Controls .

XAML :

```
<Window x:Class="StackOverflowDataBindingExample.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="525">
    <Window.Resources>
        <BooleanToVisibilityConverter x:Key="VisibleIfTrueConverter" />
    </Window.Resources>
    <StackPanel>
        <CheckBox x:Name="MyCheckBox"
                  IsChecked="True" />
        <Border Background="Red" Width="20" Height="20"
                Visibility="{Binding Path=IsChecked,ElementName=MyCheckBox,
Converter={StaticResource VisibleIfTrueConverter}}" />
    </StackPanel>
</Window>
```

DataContext

WPF **DataContext** . DataContext .

```
<Window x:Class="StackOverflowDataBindingExample.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
        xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
        xmlns:local="clr-namespace:StackOverflowDataBindingExample"
        xmlns:vm="clr-namespace:StackOverflowDataBindingExample.ViewModels"
        mc:Ignorable="d"
        Title="MainWindow" Height="350" Width="525">
    <Window.DataContext>
        <vm:HelloWorldViewModel />
    </Window.DataContext>
    ...
</Window>
```

DataContext XAML IntelliSense . DataContext XAML IntelliSense .

```
/// <summary>
/// Interaction logic for MainWindow.xaml
/// </summary>
public partial class MainWindow : Window
{
    public MainWindow()
    {
        InitializeComponent();
        DataContext = new HelloWorldViewModel();
    }
}
```

DataContext (: MVVM Light) .

WPF DataContext . DataContext (: ContentPresenter) .

INotifyPropertyChanged

`INotifyPropertyChanged` (, DataContext) . WPF `PropertyChanged` UI . .

C # 6 .

```
public abstract class ViewModelBase : INotifyPropertyChanged
{
    public event PropertyChangedEventHandler PropertyChanged;

    protected void NotifyPropertyChanged([CallerMemberName] string name = null)
    {
        PropertyChanged?.Invoke(this, new PropertyChangedEventArgs(name));
    }
}
```

`NotifyPropertyChanged` .

1. `NotifyPropertyChanged()` . CallerMemberName setter .
2. `NotifyPropertyChanged(nameof(SomeOtherProperty))` , SomeOtherProperty .

C # 5.0 .NET 4.5 .

```
public abstract class ViewModelBase : INotifyPropertyChanged
{
    public event PropertyChangedEventHandler PropertyChanged;

    protected void NotifyPropertyChanged([CallerMemberName] string name = null)
    {
        var handler = PropertyChanged;
        if (handler != null)
        {
            handler(this, new PropertyChangedEventArgs(name));
        }
    }
}
```

4.5 .NET .

: `INotifyPropertyChanged` " C # "(POCO) . .NET . `Mode OneTime` ( ).

INotifyPropertyChanged ?

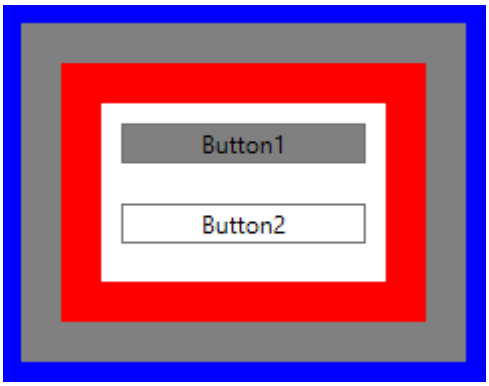
.

```
<StackPanel>
    <CheckBox x:Name="MyCheckBox" IsChecked="True" />
    <TextBlock Text="{Binding IsChecked, ElementName=MyCheckBox}" />
</StackPanel>
```

`RelativeSource` . .

```
<Grid Background="Blue">
    <Grid Background="Gray" Margin="10">
        <Border Background="Red" Margin="20">
            <StackPanel Background="White" Margin="20">
                <Button Margin="10" Content="Button1" Background="{Binding Background,
RelativeSource={RelativeSource Mode=FindAncestor, AncestorType={x:Type Grid}}}" />
                <Button Margin="10" Content="Button2" Background="{Binding Background,
RelativeSource={RelativeSource Mode=FindAncestor, AncestorType={x:Type FrameworkElement}}}" />
            </StackPanel>
        </Border>
    </Grid>
</Grid>
```

`Grid` *Button1* . *Button2* `FrameworkElement` `StackPanel` `StackPanel` .



MultiBinding . Text StringFormat .

```
<TextBlock>
    <TextBlock.Text>
        <MultiBinding StringFormat="{}{0} {1}">
            <Binding Path="User.Forename"/>
            <Binding Path="User.Surname"/>
        </MultiBinding>
    </TextBlock.Text>
</TextBlock>
```

`StringFormat` `IMultiValueConverter` Bindings MultiBinding .

MultiBinding .

WPF : https://riptutorial.com/ko/wpf/topic/2236/wpf---

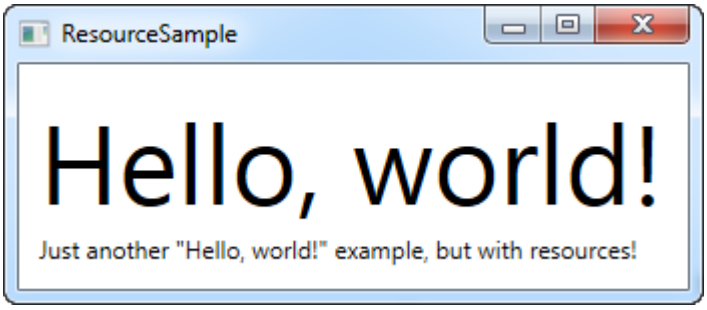
5: WPF

Examples

.

WPF . . , . WPF . . .

```
<Window x:Class="WPFApplication.ResourceSample"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:sys="clr-namespace:System;assembly=mscorlib"
        Title="ResourceSample" Height="150" Width="350">
    <Window.Resources>
        <sys:String x:Key="strHelloWorld">Hello, world!</sys:String>
    </Window.Resources>
    <StackPanel Margin="10">
        <TextBlock Text="{StaticResource strHelloWorld}" FontSize="56" />
        <TextBlock>Just another "<TextBlock Text="{StaticResource strHelloWorld}" />" example,
but with resources!</TextBlock>
    </StackPanel>
</Window>
```



StaticResource x : Key . TextBlock .

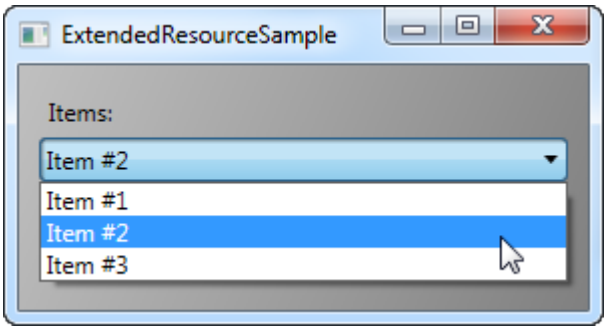
. . .

```
<Window x:Class="WPFApplication.ExtendedResourceSample"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:sys="clr-namespace:System;assembly=mscorlib"
        Title="ExtendedResourceSample" Height="160" Width="300"
        Background="{DynamicResource WindowBackgroundBrush}">
    <Window.Resources>
        <sys:String x:Key="ComboBoxTitle">Items:</sys:String>

        <x:Array x:Key="ComboBoxItems" Type="sys:String">
            <sys:String>Item #1</sys:String>
            <sys:String>Item #2</sys:String>
            <sys:String>Item #3</sys:String>
        </x:Array>

        <LinearGradientBrush x:Key="WindowBackgroundBrush">
            <GradientStop Offset="0" Color="Silver"/>
```

```
            <GradientStop Offset="1" Color="Gray"/>
        </LinearGradientBrush>
    </Window.Resources>
    <StackPanel Margin="10">
        <Label Content="{StaticResource ComboBoxTitle}" />
        <ComboBox ItemsSource="{StaticResource ComboBoxItems}" />
    </StackPanel>
</Window>
```



Window , LinearGradientBrush . ComboBox . .

. . .

```
<StackPanel Margin="10">
    <StackPanel.Resources>
        <sys:String x:Key="ComboBoxTitle">Items:</sys:String>
    </StackPanel.Resources>
    <Label Content="{StaticResource ComboBoxTitle}" />
</StackPanel>
```

StackPanel Label . StackPanel . StackPanel .

. App.xaml WPF App.xaml . .

```
<Application x:Class="WpfSamples.App"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:sys="clr-namespace:System;assembly=mscorlib"
             StartupUri="WPFApplication/ExtendedResourceSample.xaml">
    <Application.Resources>
        <sys:String x:Key="ComboBoxTitle">Items:</sys:String>
    </Application.Resources>
</Application>
```

WPF App.xaml .

```
<Label Content="{StaticResource ComboBoxTitle}" />
```

Code-behind .

App.xaml :

```
<Application x:Class="WpfSamples.App"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
```

```
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:sys="clr-namespace:System;assembly=mscorlib"
             StartupUri="WPFApplication/ResourcesFromCodeBehindSample.xaml">
    <Application.Resources>
        <sys:String x:Key="strApp">Hello, Application world!</sys:String>
    </Application.Resources>
</Application>
```

:

```
<Window x:Class="WpfSamples.WPFApplication.ResourcesFromCodeBehindSample"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:sys="clr-namespace:System;assembly=mscorlib"
        Title="ResourcesFromCodeBehindSample" Height="175" Width="250">
    <Window.Resources>
        <sys:String x:Key="strWindow">Hello, Window world!</sys:String>
    </Window.Resources>
    <DockPanel Margin="10" Name="pnlMain">
        <DockPanel.Resources>
            <sys:String x:Key="strPanel">Hello, Panel world!</sys:String>
        </DockPanel.Resources>

        <WrapPanel DockPanel.Dock="Top" HorizontalAlignment="Center" Margin="10">
            <Button Name="btnClickMe" Click="btnClickMe_Click">Click me!</Button>
        </WrapPanel>

        <ListBox Name="lbResult" />
    </DockPanel>
</Window>
```

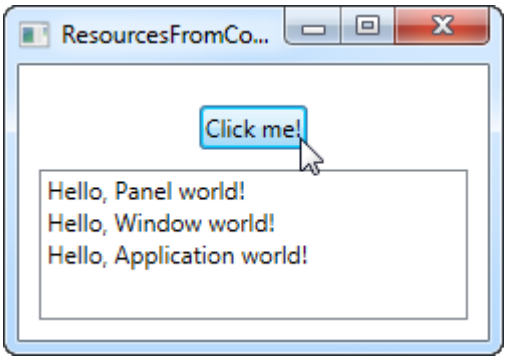
:

```
using System;
using System.Windows;

namespace WpfSamples.WPFApplication
{
        public partial class ResourcesFromCodeBehindSample : Window
        {
                public ResourcesFromCodeBehindSample()
                {
                        InitializeComponent();
                }

                private void btnClickMe_Click(object sender, RoutedEventArgs e)
                {
                        lbResult.Items.Add(pnlMain.FindResource("strPanel").ToString());
                        lbResult.Items.Add(this.FindResource("strWindow").ToString());

lbResult.Items.Add(Application.Current.FindResource("strApp").ToString());
                }
        }
}
```



, "Hello, world!" . : App.xaml , , . ListBox .

. ListBox . FindResource () . ( ) ToString () .

FindResource () . , Application . , FindResource () . .

.

WPF : https://riptutorial.com/ko/wpf/topic/4371/wpf-

6: WPF

WPF WPF . `System.Windows.Interactity Behavior` . Expression Blend SDK [nuget] [1] . [1] : https://www.nuget.org/packages/System.Windows.Interactivity.WPF/

Examples

`ScrollViewer ScrollViewer . ScrollViewer .`

```
public class BubbleMouseWheelEvents : Behavior<UIElement>
{
    protected override void OnAttached()
    {
        base.OnAttached();
        this.AssociatedObject.PreviewMouseWheel += PreviewMouseWheel;
    }

    protected override void OnDetaching()
    {
        this.AssociatedObject.PreviewMouseWheel -= PreviewMouseWheel;
        base.OnDetaching();
    }

    private void PreviewMouseWheel(object sender, MouseWheelEventArgs e)
    {
        var scrollViewer = AssociatedObject.GetChildOf<ScrollViewer>(includeSelf: true);
        var scrollPos = scrollViewer.ContentVerticalOffset;
        if ((scrollPos == scrollViewer.ScrollableHeight && e.Delta < 0) || (scrollPos == 0 &&
e.Delta > 0))
        {
            UIElement rerouteTo = AssociatedObject;
            if (ReferenceEquals(scrollViewer, AssociatedObject))
            {
                rerouteTo = (UIElement) VisualTreeHelper.GetParent(AssociatedObject);
            }

            e.Handled = true;
            var e2 = new MouseWheelEventArgs(e.MouseDevice, e.Timestamp, e.Delta);
            e2.RoutedEvent = UIElement.MouseWheelEvent;
            rerouteTo.RaiseEvent(e2);
        }
    }
}
```

Behaviors `Behavior<T> Behavior<T> . T` (`UIElement` . XAML `Behavior OnAttached . AssociatedControl . OnDetached . .`

`PreviewMouseWheel ScrollViewer . ScrollViewer ScrollViewer . e.Handled true . AssociatedObject MouseWheelEvent . .`

XAML

XAML `interactivity` xml-namespace . XAML .

xmlns : interactivity = " http://schemas.microsoft.com/expression/2010/interactivity "

.

```
<ScrollViewer>
    <!--...Content...-->
    <ScrollViewer>
        <interactivity:Interaction.Behaviors>
            <behaviors:BubbleMouseWheelEvents />
        </interactivity:Interaction.Behaviors>
        <!--...Content...-->
    </ScrollViewer>
    <!--...Content...-->.
</ScrollViewer>
```

BubbleMouseWheelEvents ScrollViewer Behaviors .

GridView ScrollViewer .

WPF : https://riptutorial.com/ko/wpf/topic/8365/wpf-

7: WPF

WPF . .

Examples

.

.

```
<Window x:Class="WPF_Style_Example.MainWindow"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d" ResizeMode="NoResize"
    Title="MainWindow"
    Height="150" Width="200">
<Grid>
    <Grid.RowDefinitions>
        <RowDefinition/>
        <RowDefinition/>
    </Grid.RowDefinitions>
    <Button Margin="5" Content="Button 1"/>
    <Button Margin="5" Grid.Row="1" Content="Button 2"/>
</Grid>
```

Visual Studio " " " ..." .

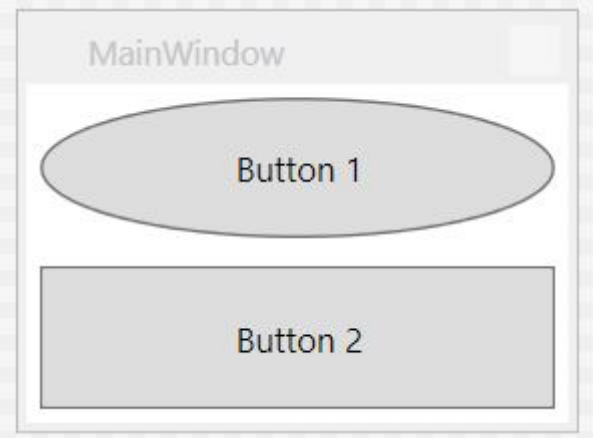
" " .

.

```
<Style x:Key="ButtonStyle1" TargetType="{x:Type Button}">
        <Setter Property="FocusVisualStyle" Value="{StaticResource FocusVisual}"/>
        <Setter Property="Background" Value="{StaticResource Button.Static.Background}"/>
        <Setter Property="BorderBrush" Value="{StaticResource Button.Static.Border}"/>
        <Setter Property="Foreground" Value="{DynamicResource {x:Static
SystemColors.ControlTextBrushKey}}"/>
        <Setter Property="BorderThickness" Value="1"/>
        <Setter Property="HorizontalContentAlignment" Value="Center"/>
        <Setter Property="VerticalContentAlignment" Value="Center"/>
        <Setter Property="Padding" Value="1"/>
        <Setter Property="Template">
            <Setter.Value>
                <ControlTemplate TargetType="{x:Type Button}">
                    <Grid>
                        <Ellipse x:Name="ellipse" StrokeThickness="{TemplateBinding
BorderThickness}" Stroke="{TemplateBinding BorderBrush}" Fill="{TemplateBinding Background}"
SnapsToDevicePixels="true"/>
                        <ContentPresenter x:Name="contentPresenter" Focusable="False"
HorizontalAlignment="{TemplateBinding HorizontalContentAlignment}" Margin="{TemplateBinding
Padding}" RecognizesAccessKey="True" SnapsToDevicePixels="{TemplateBinding
SnapsToDevicePixels}" VerticalAlignment="{TemplateBinding VerticalContentAlignment}"/>
```

```
                    </Grid>
                    <ControlTemplate.Triggers>
                        <Trigger Property="IsDefaulted" Value="true">
                            <Setter Property="Stroke" TargetName="ellipse"
Value="{DynamicResource {x:Static SystemColors.HighlightBrushKey}}"/>
                        </Trigger>
                        <Trigger Property="IsMouseOver" Value="true">
                            <Setter Property="Fill" TargetName="ellipse"
Value="{StaticResource Button.MouseOver.Background}"/>
                            <Setter Property="Stroke" TargetName="ellipse"
Value="{StaticResource Button.MouseOver.Border}"/>
                        </Trigger>
                        <Trigger Property="IsPressed" Value="true">
                            <Setter Property="Fill" TargetName="ellipse"
Value="{StaticResource Button.Pressed.Background}"/>
                            <Setter Property="Stroke" TargetName="ellipse"
Value="{StaticResource Button.Pressed.Border}"/>
                        </Trigger>
                        <Trigger Property="IsEnabled" Value="false">
                            <Setter Property="Fill" TargetName="ellipse"
Value="{StaticResource Button.Disabled.Background}"/>
                            <Setter Property="Stroke" TargetName="ellipse"
Value="{StaticResource Button.Disabled.Border}"/>
                            <Setter Property="TextElement.Foreground"
TargetName="contentPresenter" Value="{StaticResource Button.Disabled.Foreground}"/>
                        </Trigger>
                    </ControlTemplate.Triggers>
                </ControlTemplate>
            </Setter.Value>
        </Setter>
    </Style>
```

:



x : Key .

```
<Style TargetType="{x:Type Button}">
        <Setter Property="FocusVisualStyle" Value="{StaticResource FocusVisual}"/>
        <Setter Property="Background" Value="{StaticResource Button.Static.Background}"/>
        <Setter Property="BorderBrush" Value="{StaticResource Button.Static.Border}"/>
        <Setter Property="Foreground" Value="{DynamicResource {x:Static
SystemColors.ControlTextBrushKey}}"/>
        <Setter Property="BorderThickness" Value="1"/>
        <Setter Property="HorizontalContentAlignment" Value="Center"/>
        <Setter Property="VerticalContentAlignment" Value="Center"/>
```

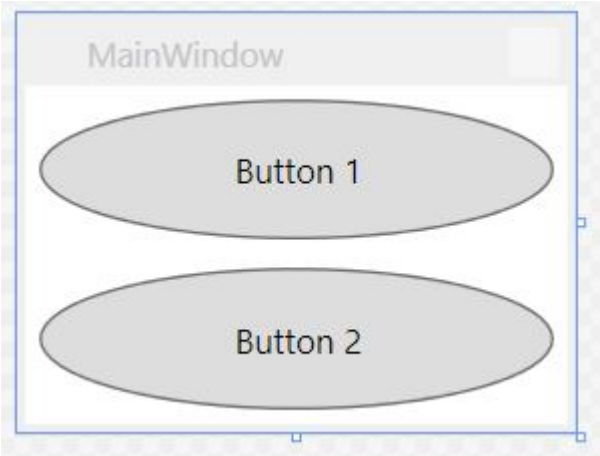
```
        <Setter Property="Padding" Value="1"/>
        <Setter Property="Template">
            <Setter.Value>
                <ControlTemplate TargetType="{x:Type Button}">
                    <Grid>
                        <Ellipse x:Name="ellipse" StrokeThickness="{TemplateBinding
BorderThickness}" Stroke="{TemplateBinding BorderBrush}" Fill="{TemplateBinding Background}"
SnapsToDevicePixels="true"/>
                        <ContentPresenter x:Name="contentPresenter" Focusable="False"
HorizontalAlignment="{TemplateBinding HorizontalContentAlignment}" Margin="{TemplateBinding
Padding}" RecognizesAccessKey="True" SnapsToDevicePixels="{TemplateBinding
SnapsToDevicePixels}" VerticalAlignment="{TemplateBinding VerticalContentAlignment}"/>
                    </Grid>
                    <ControlTemplate.Triggers>
                        <Trigger Property="IsDefaulted" Value="true">
                            <Setter Property="Stroke" TargetName="ellipse"
Value="{DynamicResource {x:Static SystemColors.HighlightBrushKey}}"/>
                        </Trigger>
                        <Trigger Property="IsMouseOver" Value="true">
                            <Setter Property="Fill" TargetName="ellipse"
Value="{StaticResource Button.MouseOver.Background}"/>
                            <Setter Property="Stroke" TargetName="ellipse"
Value="{StaticResource Button.MouseOver.Border}"/>
                        </Trigger>
                        <Trigger Property="IsPressed" Value="true">
                            <Setter Property="Fill" TargetName="ellipse"
Value="{StaticResource Button.Pressed.Background}"/>
                            <Setter Property="Stroke" TargetName="ellipse"
Value="{StaticResource Button.Pressed.Border}"/>
                        </Trigger>
                        <Trigger Property="IsEnabled" Value="false">
                            <Setter Property="Fill" TargetName="ellipse"
Value="{StaticResource Button.Disabled.Background}"/>
                            <Setter Property="Stroke" TargetName="ellipse"
Value="{StaticResource Button.Disabled.Border}"/>
                            <Setter Property="TextElement.Foreground"
TargetName="contentPresenter" Value="{StaticResource Button.Disabled.Foreground}"/>
                        </Trigger>
                    </ControlTemplate.Triggers>
                </ControlTemplate>
            </Setter.Value>
        </Setter>
    </Style>
```

.

```
<Window x:Class="WPF_Style_Example.MainWindow"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d" ResizeMode="NoResize"
    Title="MainWindow"
    Height="150" Width="200">
<Grid>
    <Grid.RowDefinitions>
        <RowDefinition/>
        <RowDefinition/>
    </Grid.RowDefinitions>
    <Button Margin="5" Content="Button 1"/>
```

```
    <Button Margin="5" Grid.Row="1" Content="Button 2"/>
</Grid>
```

.



ComboBox

`ComboBox` es :

```
<Window x:Class="WPF_Style_Example.ComboBoxWindow"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d" ResizeMode="NoResize"
    Title="ComboBoxWindow"
    Height="100" Width="150">
<StackPanel>
    <ComboBox Margin="5" SelectedIndex="0">
        <ComboBoxItem Content="Item A"/>
        <ComboBoxItem Content="Item B"/>
        <ComboBoxItem Content="Item C"/>
    </ComboBox>
    <ComboBox IsEditable="True" Margin="5" SelectedIndex="0">
        <ComboBoxItem Content="Item 1"/>
        <ComboBoxItem Content="Item 2"/>
        <ComboBoxItem Content="Item 3"/>
    </ComboBox>
</StackPanel>
```

`ComboBox` " -> ". .

3 .

```
ComboBoxToggleButton
ComboBoxEditableTextBox
ComboBoxStyle1
```

2 :

```
ComboBoxTemplate
```

```
ComboBoxEditableTemplate
```

ComboBoxToggleButton .

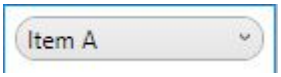
```
<SolidColorBrush x:Key="ComboBox.Static.Border" Color="#FFACACAC"/>
    <SolidColorBrush x:Key="ComboBox.Static.Editable.Background" Color="#FFFFFFFF"/>
    <SolidColorBrush x:Key="ComboBox.Static.Editable.Border" Color="#FFABADB3"/>
    <SolidColorBrush x:Key="ComboBox.Static.Editable.Button.Background" Color="Transparent"/>
    <SolidColorBrush x:Key="ComboBox.Static.Editable.Button.Border" Color="Transparent"/>
    <SolidColorBrush x:Key="ComboBox.MouseOver.Glyph" Color="#FF000000"/>
    <LinearGradientBrush x:Key="ComboBox.MouseOver.Background" EndPoint="0,1"
StartPoint="0,0">
        <GradientStop Color="Orange" Offset="0.0"/>
        <GradientStop Color="OrangeRed" Offset="1.0"/>
    </LinearGradientBrush>
    <SolidColorBrush x:Key="ComboBox.MouseOver.Border" Color="Red"/>
    <SolidColorBrush x:Key="ComboBox.MouseOver.Editable.Background" Color="#FFFFFFFF"/>
    <SolidColorBrush x:Key="ComboBox.MouseOver.Editable.Border" Color="#FF7EB4EA"/>
    <LinearGradientBrush x:Key="ComboBox.MouseOver.Editable.Button.Background" EndPoint="0,1"
StartPoint="0,0">
        <GradientStop Color="#FFEBF4FC" Offset="0.0"/>
        <GradientStop Color="#FFDCECFC" Offset="1.0"/>
    </LinearGradientBrush>
    <SolidColorBrush x:Key="ComboBox.MouseOver.Editable.Button.Border" Color="#FF7EB4EA"/>
    <SolidColorBrush x:Key="ComboBox.Pressed.Glyph" Color="#FF000000"/>
    <LinearGradientBrush x:Key="ComboBox.Pressed.Background" EndPoint="0,1" StartPoint="0,0">
        <GradientStop Color="OrangeRed" Offset="0.0"/>
        <GradientStop Color="Red" Offset="1.0"/>
    </LinearGradientBrush>
    <SolidColorBrush x:Key="ComboBox.Pressed.Border" Color="DarkRed"/>
    <SolidColorBrush x:Key="ComboBox.Pressed.Editable.Background" Color="#FFFFFFFF"/>
    <SolidColorBrush x:Key="ComboBox.Pressed.Editable.Border" Color="#FF569DE5"/>
    <LinearGradientBrush x:Key="ComboBox.Pressed.Editable.Button.Background" EndPoint="0,1"
StartPoint="0,0">
        <GradientStop Color="#FFDAEBFC" Offset="0.0"/>
        <GradientStop Color="#FFC4E0FC" Offset="1.0"/>
    </LinearGradientBrush>
    <SolidColorBrush x:Key="ComboBox.Pressed.Editable.Button.Border" Color="#FF569DE5"/>
    <SolidColorBrush x:Key="ComboBox.Disabled.Glyph" Color="#FFBFBFBF"/>
    <SolidColorBrush x:Key="ComboBox.Disabled.Background" Color="#FFF0F0F0"/>
    <SolidColorBrush x:Key="ComboBox.Disabled.Border" Color="#FFD9D9D9"/>
    <SolidColorBrush x:Key="ComboBox.Disabled.Editable.Background" Color="#FFFFFFFF"/>
    <SolidColorBrush x:Key="ComboBox.Disabled.Editable.Border" Color="#FFBFBFBF"/>
    <SolidColorBrush x:Key="ComboBox.Disabled.Editable.Button.Background"
Color="Transparent"/>
    <SolidColorBrush x:Key="ComboBox.Disabled.Editable.Button.Border" Color="Transparent"/>
    <SolidColorBrush x:Key="ComboBox.Static.Glyph" Color="#FF606060"/>
    <Style x:Key="ComboBoxToggleButton" TargetType="{x:Type ToggleButton}">
        <Setter Property="OverridesDefaultStyle" Value="true"/>
        <Setter Property="IsTabStop" Value="false"/>
        <Setter Property="Focusable" Value="false"/>
        <Setter Property="ClickMode" Value="Press"/>
        <Setter Property="Template">
            <Setter.Value>
                <ControlTemplate TargetType="{x:Type ToggleButton}">
                    <Border x:Name="templateRoot" CornerRadius="10"
BorderBrush="{StaticResource ComboBox.Static.Border}" BorderThickness="{TemplateBinding
BorderThickness}" Background="{StaticResource ComboBox.Static.Background}"
SnapsToDevicePixels="true">
                        <Border x:Name="splitBorder" BorderBrush="Transparent"
```

```
BorderThickness="1" HorizontalAlignment="Right" Margin="0" SnapsToDevicePixels="true"
Width="{DynamicResource {x:Static SystemParameters.VerticalScrollBarWidthKey}}">
                            <Path x:Name="arrow" Data="F1 M 0,0 L 2.667,2.66665 L 5.3334,0 L
5.3334,-1.78168 L 2.6667,0.88501 L0,-1.78168 L0,0 Z" Fill="{StaticResource
ComboBox.Static.Glyph}" HorizontalAlignment="Center" Margin="0" VerticalAlignment="Center"/>
                        </Border>
                    </Border>
                    <ControlTemplate.Triggers>
                        <MultiDataTrigger>
                            <MultiDataTrigger.Conditions>
                                <Condition Binding="{Binding IsEditable,
RelativeSource={RelativeSource AncestorType={x:Type ComboBox}}}" Value="true"/>
                                <Condition Binding="{Binding IsMouseOver,
RelativeSource={RelativeSource Self}}" Value="false"/>
                                <Condition Binding="{Binding IsPressed,
RelativeSource={RelativeSource Self}}" Value="false"/>
                                <Condition Binding="{Binding IsEnabled,
RelativeSource={RelativeSource Self}}" Value="true"/>
                            </MultiDataTrigger.Conditions>
                            <Setter Property="Background" TargetName="templateRoot"
Value="{StaticResource ComboBox.Static.Editable.Background}"/>
                            <Setter Property="BorderBrush" TargetName="templateRoot"
Value="{StaticResource ComboBox.Static.Editable.Border}"/>
                            <Setter Property="Background" TargetName="splitBorder"
Value="{StaticResource ComboBox.Static.Editable.Button.Background}"/>
                            <Setter Property="BorderBrush" TargetName="splitBorder"
Value="{StaticResource ComboBox.Static.Editable.Button.Border}"/>
                        </MultiDataTrigger>
                        <Trigger Property="IsMouseOver" Value="true">
                            <Setter Property="BorderThickness" TargetName="templateRoot"
Value="2"/>
                        </Trigger>
                        <MultiDataTrigger>
                            <MultiDataTrigger.Conditions>
                                <Condition Binding="{Binding IsMouseOver,
RelativeSource={RelativeSource Self}}" Value="true"/>
                                <Condition Binding="{Binding IsEditable,
RelativeSource={RelativeSource AncestorType={x:Type ComboBox}}}" Value="false"/>
                            </MultiDataTrigger.Conditions>
                            <Setter Property="Background" TargetName="templateRoot"
Value="{StaticResource ComboBox.MouseOver.Background}"/>
                            <Setter Property="BorderBrush" TargetName="templateRoot"
Value="{StaticResource ComboBox.MouseOver.Border}"/>
                        </MultiDataTrigger>
                        <MultiDataTrigger>
                            <MultiDataTrigger.Conditions>
                                <Condition Binding="{Binding IsMouseOver,
RelativeSource={RelativeSource Self}}" Value="true"/>
                                <Condition Binding="{Binding IsEditable,
RelativeSource={RelativeSource AncestorType={x:Type ComboBox}}}" Value="true"/>
                            </MultiDataTrigger.Conditions>
                            <Setter Property="Background" TargetName="templateRoot"
Value="{StaticResource ComboBox.MouseOver.Editable.Background}"/>
                            <Setter Property="BorderBrush" TargetName="templateRoot"
Value="{StaticResource ComboBox.MouseOver.Editable.Border}"/>
                            <Setter Property="Background" TargetName="splitBorder"
Value="{StaticResource ComboBox.MouseOver.Editable.Button.Background}"/>
                            <Setter Property="BorderBrush" TargetName="splitBorder"
Value="{StaticResource ComboBox.MouseOver.Editable.Button.Border}"/>
                        </MultiDataTrigger>
                        <Trigger Property="IsPressed" Value="true">
```

```
                            <Setter Property="Fill" TargetName="arrow" Value="{StaticResource
ComboBox.Pressed.Glyph}"/>
                        </Trigger>
                        <MultiDataTrigger>
                            <MultiDataTrigger.Conditions>
                                <Condition Binding="{Binding IsPressed,
RelativeSource={RelativeSource Self}}" Value="true"/>
                                <Condition Binding="{Binding IsEditable,
RelativeSource={RelativeSource AncestorType={x:Type ComboBox}}}" Value="false"/>
                            </MultiDataTrigger.Conditions>
                            <Setter Property="Background" TargetName="templateRoot"
Value="{StaticResource ComboBox.Pressed.Background}"/>
                            <Setter Property="BorderBrush" TargetName="templateRoot"
Value="{StaticResource ComboBox.Pressed.Border}"/>
                        </MultiDataTrigger>
                        <MultiDataTrigger>
                            <MultiDataTrigger.Conditions>
                                <Condition Binding="{Binding IsPressed,
RelativeSource={RelativeSource Self}}" Value="true"/>
                                <Condition Binding="{Binding IsEditable,
RelativeSource={RelativeSource AncestorType={x:Type ComboBox}}}" Value="true"/>
                            </MultiDataTrigger.Conditions>
                            <Setter Property="Background" TargetName="templateRoot"
Value="{StaticResource ComboBox.Pressed.Editable.Background}"/>
                            <Setter Property="BorderBrush" TargetName="templateRoot"
Value="{StaticResource ComboBox.Pressed.Editable.Border}"/>
                            <Setter Property="Background" TargetName="splitBorder"
Value="{StaticResource ComboBox.Pressed.Editable.Button.Background}"/>
                            <Setter Property="BorderBrush" TargetName="splitBorder"
Value="{StaticResource ComboBox.Pressed.Editable.Button.Border}"/>
                        </MultiDataTrigger>
                        <Trigger Property="IsEnabled" Value="false">
                            <Setter Property="Fill" TargetName="arrow" Value="{StaticResource
ComboBox.Disabled.Glyph}"/>
                        </Trigger>
                        <MultiDataTrigger>
                            <MultiDataTrigger.Conditions>
                                <Condition Binding="{Binding IsEnabled,
RelativeSource={RelativeSource Self}}" Value="false"/>
                                <Condition Binding="{Binding IsEditable,
RelativeSource={RelativeSource AncestorType={x:Type ComboBox}}}" Value="false"/>
                            </MultiDataTrigger.Conditions>
                            <Setter Property="Background" TargetName="templateRoot"
Value="{StaticResource ComboBox.Disabled.Background}"/>
                            <Setter Property="BorderBrush" TargetName="templateRoot"
Value="{StaticResource ComboBox.Disabled.Border}"/>
                        </MultiDataTrigger>
                        <MultiDataTrigger>
                            <MultiDataTrigger.Conditions>
                                <Condition Binding="{Binding IsEnabled,
RelativeSource={RelativeSource Self}}" Value="false"/>
                                <Condition Binding="{Binding IsEditable,
RelativeSource={RelativeSource AncestorType={x:Type ComboBox}}}" Value="true"/>
                            </MultiDataTrigger.Conditions>
                            <Setter Property="Background" TargetName="templateRoot"
Value="{StaticResource ComboBox.Disabled.Editable.Background}"/>
                            <Setter Property="BorderBrush" TargetName="templateRoot"
Value="{StaticResource ComboBox.Disabled.Editable.Border}"/>
                            <Setter Property="Background" TargetName="splitBorder"
Value="{StaticResource ComboBox.Disabled.Editable.Button.Background}"/>
                            <Setter Property="BorderBrush" TargetName="splitBorder"
```

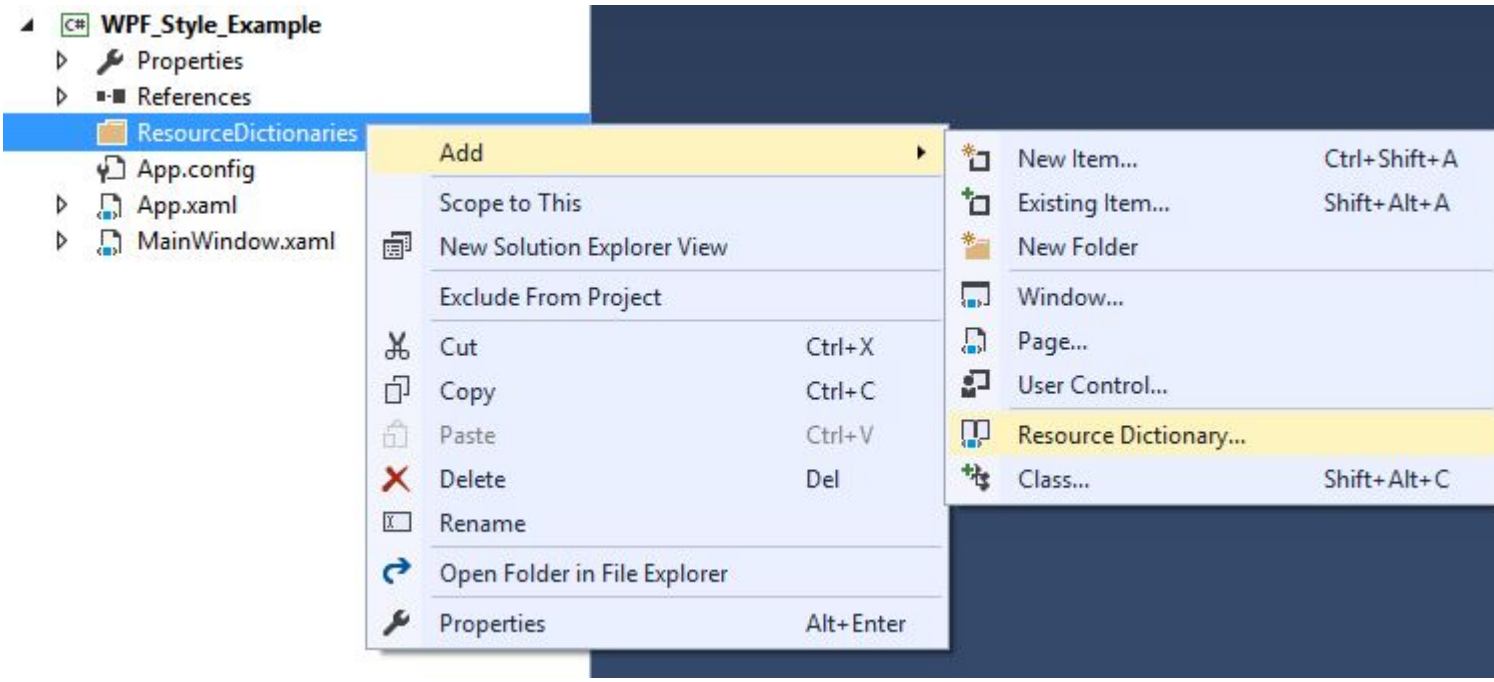
```
Value="{StaticResource ComboBox.Disabled.Editable.Button.Border}"/>
                        </MultiDataTrigger>
                    </ControlTemplate.Triggers>
                </ControlTemplate>
            </Setter.Value>
        </Setter>
    </Style>
```

ComboBox .



. ComboBoxEditableTextBox ComboBoxEditableTemplate .

App.xaml .



App.xaml . App.xaml .

```
<Application
         xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
         xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
         x:Class="WPF_Style_Example.App"
         StartupUri="MainWindow.xaml">
    <Application.Resources>
        <ResourceDictionary>
            <ResourceDictionary.MergedDictionaries>
                <ResourceDictionary Source="ResourceDictionaries/Dictionary1.xaml"/>
            </ResourceDictionary.MergedDictionaries>
        </ResourceDictionary>
    </Application.Resources>
</Application>
```

Dictionary1.xaml App.xaml . Visual Studio .

DoubleAnimation

Window .

```
<Window x:Class="WPF_Style_Example.MainWindow"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d" ResizeMode="NoResize"
    Title="MainWindow"
    Height="150" Width="250">
<Grid>
    <Grid.RowDefinitions>
        <RowDefinition/>
        <RowDefinition/>
    </Grid.RowDefinitions>
    <Button Margin="5" Content="Button 1" Width="200"/>
    <Button Margin="5" Grid.Row="1" Content="Button 2" Width="200"/>
</Grid>
```

App.xaml 200 100, 100 200 .

```
<Style TargetType="{x:Type Button}">
    <Setter Property="FocusVisualStyle" Value="{StaticResource FocusVisual}"/>
    <Setter Property="Background" Value="{StaticResource Button.Static.Background}"/>
    <Setter Property="BorderBrush" Value="{StaticResource Button.Static.Border}"/>
    <Setter Property="Foreground" Value="{DynamicResource {x:Static
SystemColors.ControlTextBrushKey}}"/>
    <Setter Property="BorderThickness" Value="1"/>
    <Setter Property="HorizontalContentAlignment" Value="Center"/>
    <Setter Property="VerticalContentAlignment" Value="Center"/>
    <Setter Property="Padding" Value="1"/>
    <Setter Property="Template">
        <Setter.Value>
            <ControlTemplate TargetType="{x:Type Button}">
                <Grid Background="White">
                    <Border x:Name="border" BorderBrush="{TemplateBinding BorderBrush}"
BorderThickness="{TemplateBinding BorderThickness}" Background="{TemplateBinding Background}"
SnapsToDevicePixels="true">
                        <ContentPresenter x:Name="contentPresenter" Focusable="False"
HorizontalAlignment="{TemplateBinding HorizontalContentAlignment}" Margin="{TemplateBinding
Padding}" RecognizesAccessKey="True" SnapsToDevicePixels="{TemplateBinding
SnapsToDevicePixels}" VerticalAlignment="{TemplateBinding VerticalContentAlignment}"/>
                    </Border>
                </Grid>
                <ControlTemplate.Triggers>
                    <EventTrigger RoutedEvent="MouseEnter">
                        <BeginStoryboard>
                            <Storyboard>
                                <DoubleAnimation To="100" From="200"
Storyboard.TargetProperty="Width" Storyboard.TargetName="border" Duration="0:0:0.25"/>
                            </Storyboard>
                        </BeginStoryboard>
                    </EventTrigger>
                    <EventTrigger RoutedEvent="MouseLeave">
                        <BeginStoryboard>
                            <Storyboard>
```

```
                                <DoubleAnimation To="200" From="100"
Storyboard.TargetProperty="Width" Storyboard.TargetName="border" Duration="0:0:0.25"/>
                            </Storyboard>
                        </BeginStoryboard>
                    </EventTrigger>
                    <Trigger Property="IsDefaulted" Value="true">
                        <Setter Property="BorderBrush" TargetName="border"
Value="{DynamicResource {x:Static SystemColors.HighlightBrushKey}}"/>
                    </Trigger>
                    <Trigger Property="IsMouseOver" Value="true">
                        <Setter Property="Background" TargetName="border"
Value="{StaticResource Button.MouseOver.Background}"/>
                        <Setter Property="BorderBrush" TargetName="border"
Value="{StaticResource Button.MouseOver.Border}"/>
                    </Trigger>
                    <Trigger Property="IsPressed" Value="true">
                        <Setter Property="Background" TargetName="border"
Value="{StaticResource Button.Pressed.Background}"/>
                        <Setter Property="BorderBrush" TargetName="border"
Value="{StaticResource Button.Pressed.Border}"/>
                    </Trigger>
                    <Trigger Property="IsEnabled" Value="false">
                        <Setter Property="Background" TargetName="border"
Value="{StaticResource Button.Disabled.Background}"/>
                        <Setter Property="BorderBrush" TargetName="border"
Value="{StaticResource Button.Disabled.Border}"/>
                        <Setter Property="TextElement.Foreground"
TargetName="contentPresenter" Value="{StaticResource Button.Disabled.Foreground}"/>
                    </Trigger>
                </ControlTemplate.Triggers>
            </ControlTemplate>
        </Setter.Value>
    </Setter>
</Style>
```

WPF : https://riptutorial.com/ko/wpf/topic/9670/wpf--

8: WPF

Examples

DispatcherObject

`Object`

```
public Dispatcher Dispatcher { get; }
```

WPF `DispatcherObject` . Dispatcher .

Dispatcher DispatcherObject . DispatcherObject DispatcherObject Dispatcher `Invoke` `BeginInvoke` `Invoke` .

DependencyObject

`DispatcherObject`

```
public object GetValue(DependencyProperty dp);
public void   SetValue(DependencyProperty dp, object value);
```

`DependencyObject` . WPF WPF `DependencyObject` .

WPF : https://riptutorial.com/ko/wpf/topic/3571/wpf-

9: WPF

. XAML C # VB .

.

- WPF : public internal.
- C # WPF XAML .
- VB WPF XAML Custom Tool `PublicVbMyResourcesResXFileCodeGenerator` .
- VB WPF Resources.resx
  - .
  - ' ' .
  -

Examples

VB XAML

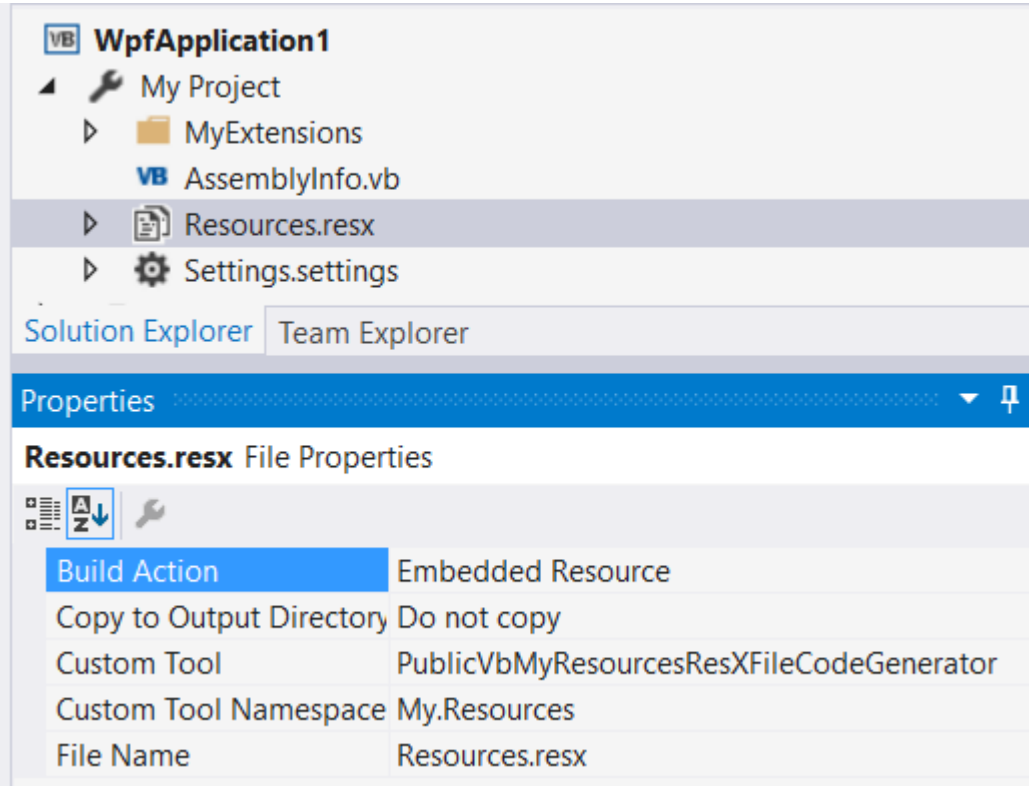
```
<Window x:Class="MainWindow"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    xmlns:local="clr-namespace:WpfApplication1"
    xmlns:my="clr-namespace:WpfApplication1.My.Resources"
    mc:Ignorable="d"
    Title="MainWindow" Height="350" Width="525">
<Grid>
    <StackPanel>
        <Label Content="{Binding Source={x:Static my:Resources.MainWindow_Label_Country}}" />
    </StackPanel>
</Grid>
```

VB

VB `VbMyResourcesResXFileCodeGenerator` . (XAML) . Custom Tool `Public` .

VB WPF Resources.resx

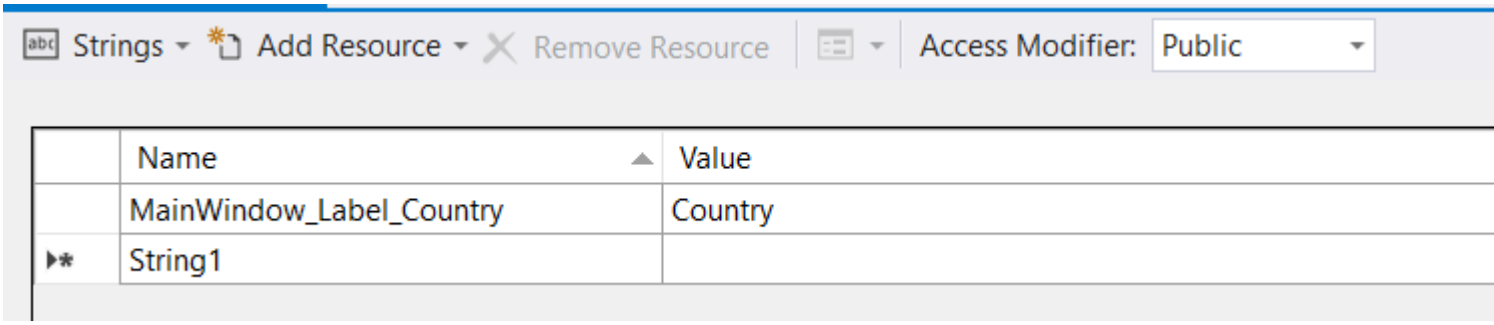
- .
- ' ' .
- " "



C # XAML

```
<Window x:Class="WpfApplication2.MainWindow"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    xmlns:local="clr-namespace:WpfApplication2"
    xmlns:resx="clr-namespace:WpfApplication2.Properties"
    mc:Ignorable="d"
    Title="MainWindow" Height="350" Width="525">
<Grid>
    <StackPanel>
        <Label Content="{Binding Source={x:Static resx:Resources.MainWindow_Label_Country}}"/>
    </StackPanel>
</Grid>
```

. "" .



WPF : https://riptutorial.com/ko/wpf/topic/3905/wpf-

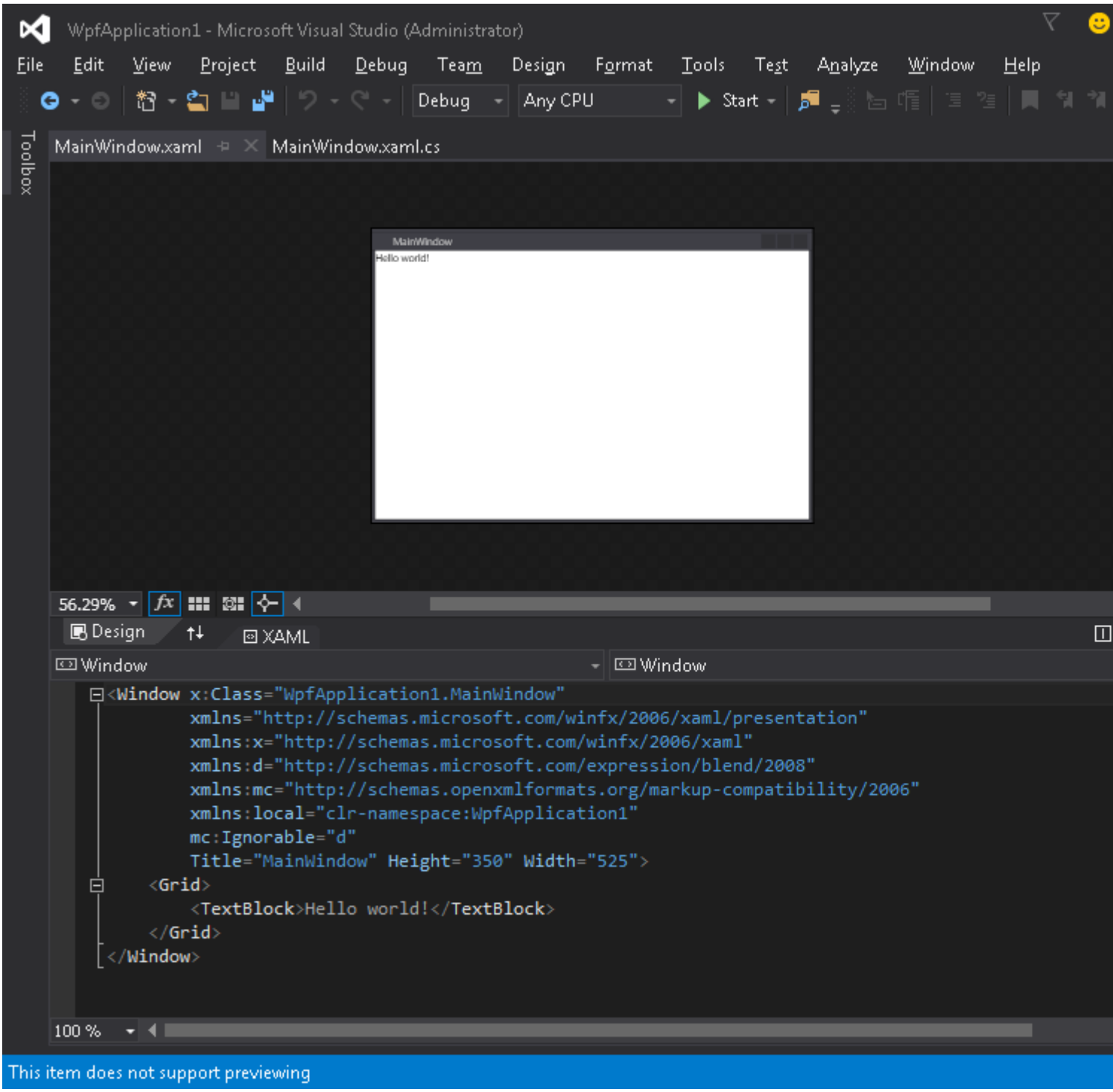
10: WPF

WPF (CLR) .NET Framework . . WPF .

Examples

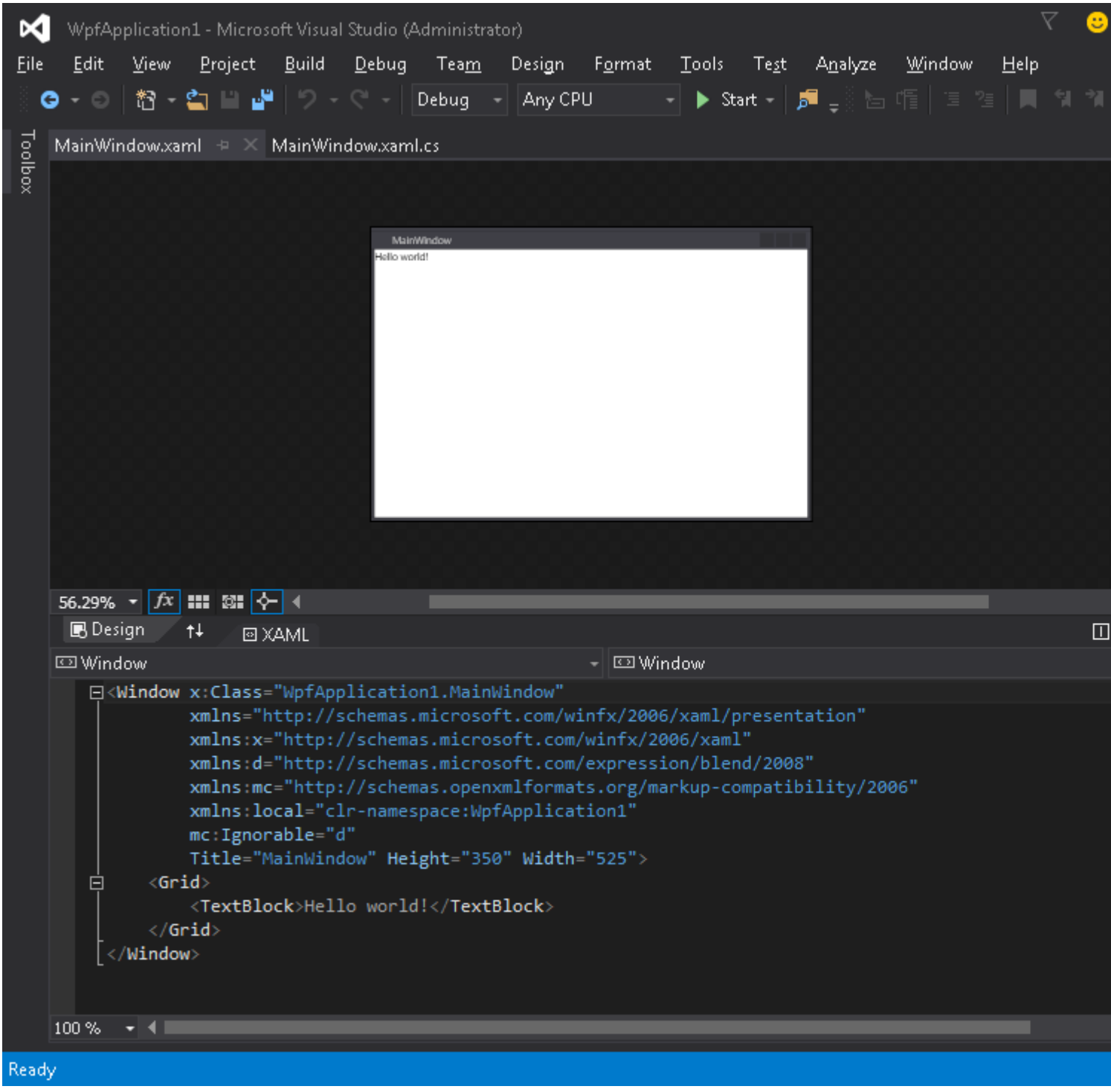
Visual Studio WPF .

1. (: *Images*).



2.

(→) **SplashScreen** :

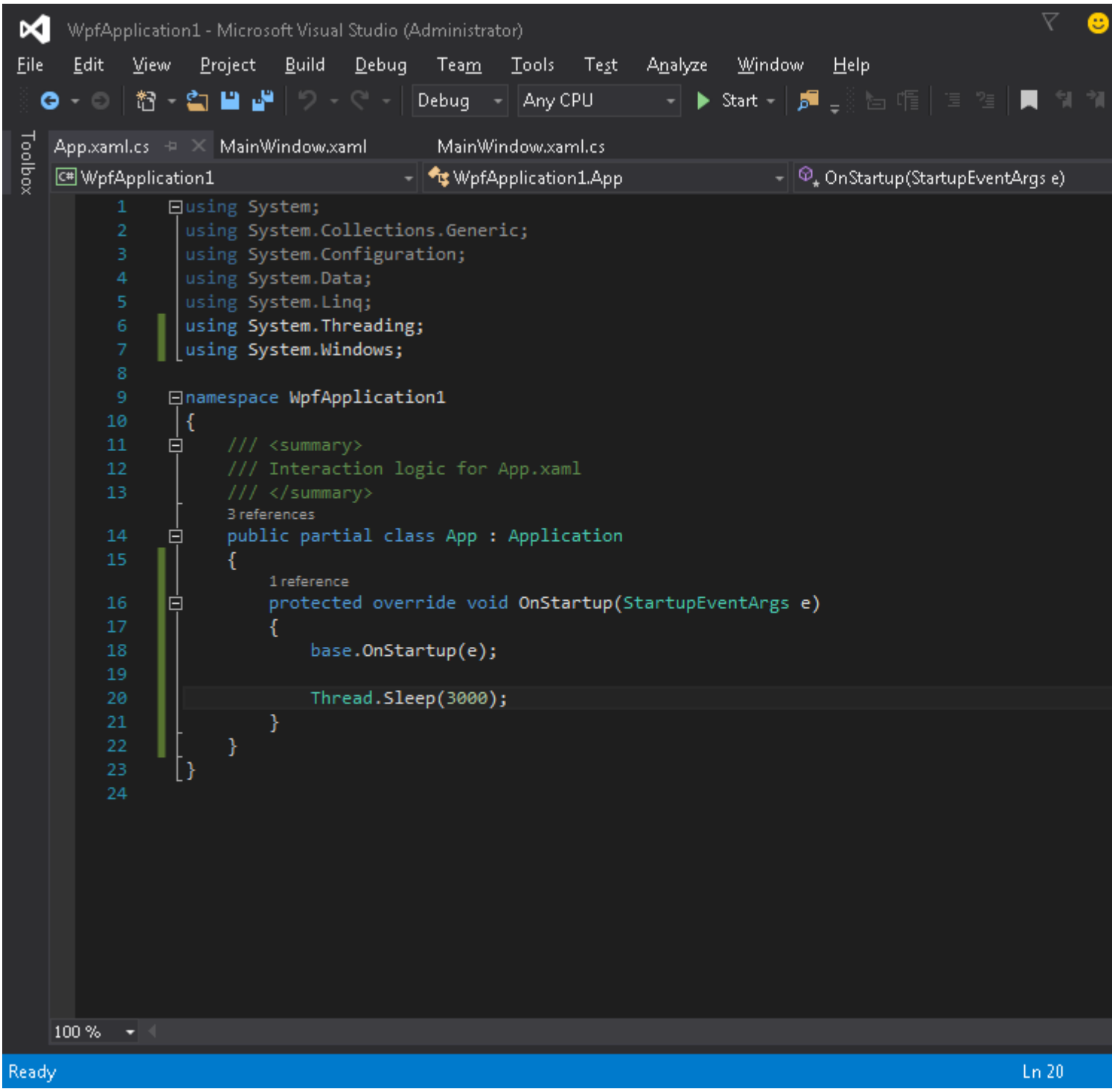


3. . (300).

.

`Application.Startup` .

1. **App.xaml.cs**
2. `using System.Threading;` `using System.Threading;` `using System.Threading;`
3. `OnStartup` `OnStartup` `Thread.Sleep(3000);` `Thread.Sleep(3000);` :



.

```
using System;
using System.Collections.Generic;
using System.Configuration;
using System.Data;
using System.Linq;
using System.Threading;
using System.Windows;

namespace WpfApplication1
{
    /// <summary>
    /// Interaction logic for App.xaml
```

```
    /// </summary>
    public partial class App : Application
    {
        protected override void OnStartup(StartupEventArgs e)
        {
            base.OnStartup(e);

            Thread.Sleep(3000);
        }
    }
}
```

4. . 3 .

WPF Window . MainWindow . .

SplashScreenWindow .

```
<Window x:Class="SplashScreenExample.SplashScreenWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        WindowStartupLocation="CenterScreen"
        WindowStyle="None"
        AllowsTransparency="True"
        Height="30"
        Width="200">
    <Grid>
        <ProgressBar IsIndeterminate="True" />
        <TextBlock HorizontalAlignment="Center"
                   VerticalAlignment="Center">Loading...</TextBlock>
    </Grid>
</Window>
```

Application.OnStartup (***App.xaml.cs***) .

```
public partial class App
{
    protected override void OnStartup(StartupEventArgs e)
    {
        base.OnStartup(e);

        //initialize the splash screen and set it as the application main window
        var splashScreen = new SplashScreenWindow();
        this.MainWindow = splashScreen;
        splashScreen.Show();

        //in order to ensure the UI stays responsive, we need to
        //do the work on a different thread
        Task.Factory.StartNew(() =>
        {
            //simulate some work being done
            System.Threading.Thread.Sleep(3000);

            //since we're not on the UI thread
            //once we're done we need to use the Dispatcher
            //to create and show the main window
            this.Dispatcher.Invoke(() =>
            {
```

```
                //initialize the main window, set it as the application main window
                //and close the splash screen
                var mainWindow = new MainWindow();
                this.MainWindow = mainWindow;
                mainWindow.Show();
                splashScreen.Close();
            });
        });
    }
}
```

`MainWindow` . ***App.xaml*** `Application StartupUri="MainWindow.xaml"` `StartupUri="MainWindow.xaml"` .

WPF `Window . MainWindow` . .

`SplashScreenWindow` .

```
<Window x:Class="SplashScreenExample.SplashScreenWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        WindowStartupLocation="CenterScreen"
        WindowStyle="None"
        AllowsTransparency="True"
        Height="30"
        Width="200">
    <Grid>
        <ProgressBar x:Name="progressBar" />
        <TextBlock HorizontalAlignment="Center"
                   VerticalAlignment="Center">Loading...</TextBlock>
    </Grid>
</Window>
```

`SplashScreenWindow` (***SplashScreenWindow.xaml.cs***) .

```
public partial class SplashScreenWindow : Window
{
    public SplashScreenWindow()
    {
        InitializeComponent();
    }

    public double Progress
    {
        get { return progressBar.Value; }
        set { progressBar.Value = value; }
    }
}
```

`Application.OnStartup` , (***App.xaml.cs***) .

```
public partial class App : Application
{
    protected override void OnStartup(StartupEventArgs e)
    {
        base.OnStartup(e);
```

```
        //initialize the splash screen and set it as the application main window
        var splashScreen = new SplashScreenWindow();
        this.MainWindow = splashScreen;
        splashScreen.Show();

        //in order to ensure the UI stays responsive, we need to
        //do the work on a different thread
        Task.Factory.StartNew(() =>
        {
            //we need to do the work in batches so that we can report progress
            for (int i = 1; i <= 100; i++)
            {
                //simulate a part of work being done
                System.Threading.Thread.Sleep(30);

                //because we're not on the UI thread, we need to use the Dispatcher
                //associated with the splash screen to update the progress bar
                splashScreen.Dispatcher.Invoke(() => splashScreen.Progress = i);
            }

            //once we're done we need to use the Dispatcher
            //to create and show the main window
            this.Dispatcher.Invoke(() =>
            {
                //initialize the main window, set it as the application main window
                //and close the splash screen
                var mainWindow = new MainWindow();
                this.MainWindow = mainWindow;
                mainWindow.Show();
                splashScreen.Close();
            });
        });
    }
}
```

`MainWindow` . ***App.xaml*** `Application StartupUri="MainWindow.xaml"` `StartupUri="MainWindow.xaml"` .

WPF : https://riptutorial.com/ko/wpf/topic/3948/wpf---

11: WPF MVVM

. "" `INotifyPropertyChanged` , . , . .

MVVM , . (VM) () MVVM VM . VM . VM `TextBox` , `Button` UI .

UI . " " . UI . VM . UI .

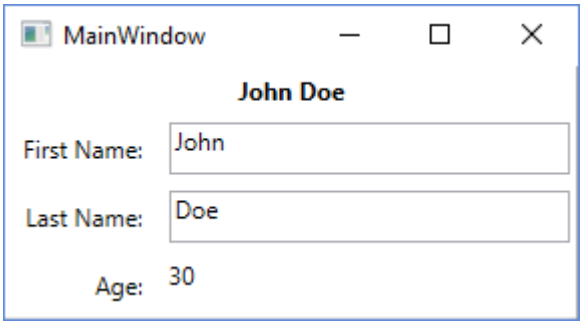
`RelayCommand` `RelayCommand` WPF WPF . .

`RelayCommand` `Microsoft.Expression.Interactivity.Core` `ActionCommand` .

Examples

WPF C # MVVM

WPF C # Windows MVVM . " " .



XAML

```
<Grid>
    <Grid.ColumnDefinitions>
        <ColumnDefinition Width="Auto"/>
        <ColumnDefinition Width="*"/>
    </Grid.ColumnDefinitions>
    <Grid.RowDefinitions>
        <RowDefinition Height="Auto"/>
        <RowDefinition Height="Auto"/>
         <RowDefinition Height="Auto"/>
         <RowDefinition Height="Auto"/>
     </Grid.RowDefinitions>

    <TextBlock Grid.Column="0" Grid.Row="0" Grid.ColumnSpan="2" Margin="4" Text="{Binding
FullName}" HorizontalAlignment="Center" FontWeight="Bold"/>

    <Label Grid.Column="0" Grid.Row="1" Margin="4" Content="First Name:"
HorizontalAlignment="Right"/>
    <!-- UpdateSourceTrigger=PropertyChanged makes sure that changes in the TextBoxes are
immediately applied to the model. -->
    <TextBox Grid.Column="1" Grid.Row="1" Margin="4" Text="{Binding FirstName,
UpdateSourceTrigger=PropertyChanged}" HorizontalAlignment="Left" Width="200"/>

    <Label Grid.Column="0" Grid.Row="2" Margin="4" Content="Last Name:"
HorizontalAlignment="Right"/>
```

```
    <TextBox Grid.Column="1" Grid.Row="2" Margin="4" Text="{Binding LastName,
UpdateSourceTrigger=PropertyChanged}" HorizontalAlignment="Left"  Width="200"/>

    <Label Grid.Column="0" Grid.Row="3" Margin="4" Content="Age:"
HorizontalAlignment="Right"/>
    <TextBlock Grid.Column="1" Grid.Row="3" Margin="4" Text="{Binding Age}"
HorizontalAlignment="Left"/>

</Grid>
```

```
public partial class MainWindow : Window
{
    private readonly MyViewModel _viewModel;

    public MainWindow() {
        InitializeComponent();
        _viewModel = new MyViewModel();
        // The DataContext serves as the starting point of Binding Paths
        DataContext = _viewModel;
    }
}
```

```
// INotifyPropertyChanged notifies the View of property changes, so that Bindings are updated.
sealed class MyViewModel : INotifyPropertyChanged
{
    private User user;

    public string FirstName {
        get {return user.FirstName;}
        set {
            if(user.FirstName != value) {
                user.FirstName = value;
                OnPropertyChange("FirstName");
                // If the first name has changed, the FullName property needs to be udpated as
well.
                OnPropertyChange("FullName");
            }
        }
    }

    public string LastName {
        get { return user.LastName; }
        set {
            if (user.LastName != value) {
                user.LastName = value;
                OnPropertyChange("LastName");
                // If the first name has changed, the FullName property needs to be udpated as
well.
                OnPropertyChange("FullName");
            }
        }
    }

    // This property is an example of how model properties can be presented differently to the
View.
    // In this case, we transform the birth date to the user's age, which is read only.
    public int Age {
        get {
            DateTime today = DateTime.Today;
```

```
            int age = today.Year - user.BirthDate.Year;
            if (user.BirthDate > today.AddYears(-age)) age--;
            return age;
        }
    }

    // This property is just for display purposes and is a composition of existing data.
    public string FullName {
        get { return FirstName + " " + LastName; }
    }

    public MyViewModel() {
        user = new User {
            FirstName = "John",
            LastName = "Doe",
            BirthDate = DateTime.Now.AddYears(-30)
        };
    }

    public event PropertyChangedEventHandler PropertyChanged;

    protected void OnPropertyChange(string propertyName) {
        if(PropertyChanged != null) {
            PropertyChanged(this, new PropertyChangedEventArgs(propertyName));
        }
    }
}
```

```
sealed class User
{
    public string FirstName { get; set; }

    public string LastName { get; set; }

    public DateTime BirthDate { get; set; }
}
```

MV **VM** "VM". () . .

```
public class CustomerEditViewModel
{
    /// <summary>
    /// The customer to edit.
    /// </summary>
    public Customer CustomerToEdit { get; set; }

    /// <summary>
    /// The "apply changes" command
    /// </summary>
    public ICommand ApplyChangesCommand { get; private set; }

    /// <summary>
    /// Constructor
    /// </summary>
    public CustomerEditViewModel()
    {
        CustomerToEdit = new Customer
                         {
                             Forename = "John",
```

```
                            Surname = "Smith"
                        };

        ApplyChangesCommand = new RelayCommand(
            o => ExecuteApplyChangesCommand(),
            o => CustomerToEdit.IsValid);
    }

    /// <summary>
    /// Executes the "apply changes" command.
    /// </summary>
    private void ExecuteApplyChangesCommand()
    {
        // E.g. save your customer to database
    }
}
```

`Customer` `CustomerToEdit` .

`RelayCommand` `ApplyChangesCommand` . WPF .

`RelayCommand` . (:). . `IsValid` . false . . .

`TextBox` (`Customer`). `TextBox` Tab "" .

`INotifyPropertyChanged` (INPC) . , `Customer` `CustomerToEdit` . `TextBox` forename .

`Customer` , `DataContext` ( ). . VM INPC `CustomerToEdit` " "getter setter setter `PropertyChanged` .

`ApplyChangesCommand` INPC . , `Initialize()` .

INPC . INPC . .

M VVM "M". .

.

```
public class Customer : INotifyPropertyChanged
{
    private string _forename;
    private string _surname;
    private bool _isValid;

    public event PropertyChangedEventHandler PropertyChanged;

    /// <summary>
    /// Customer forename.
    /// </summary>
    public string Forename
    {
        get
        {
            return _forename;
        }
        set
```

```
        {
            if (_forename != value)
            {
                _forename = value;
                OnPropertyChanged();
                SetIsValid();
            }
        }
    }

    /// <summary>
    /// Customer surname.
    /// </summary>
    public string Surname
    {
        get
        {
            return _surname;
        }
        set
        {
            if (_surname != value)
            {
                _surname = value;
                OnPropertyChanged();
                SetIsValid();
            }
        }
    }

    /// <summary>
    /// Indicates whether the model is in a valid state or not.
    /// </summary>
    public bool IsValid
    {
        get
        {
            return _isValid;
        }
        set
        {
            if (_isValid != value)
            {
                _isValid = value;
                OnPropertyChanged();
            }
        }
    }

    /// <summary>
    /// Sets the value of the IsValid property.
    /// </summary>
    private void SetIsValid()
    {
        IsValid = !string.IsNullOrEmpty(Forename) && !string.IsNullOrEmpty(Surname);
    }

    /// <summary>
    /// Raises the PropertyChanged event.
    /// </summary>
    /// <param name="propertyName">Name of the property.</param>
```

```
    private void OnPropertyChanged([CallerMemberName] string propertyName = "")
    {
        PropertyChanged?.Invoke(this, new PropertyChangedEventArgs(propertyName));
    }
}
```

`PropertyChanged` `INotifyPropertyChanged` . . . `PropertyChanged` WPF . WPF .

. public . WPF "" . *WPF* .

M **V** VM "V". . Visual Studio HTML XAML .

`Customer` XAML. WPF `MainWindow.xaml` `<Window ...> </Window>` .

```
<StackPanel Orientation="Vertical"
            VerticalAlignment="Top"
            Margin="20">
    <Label Content="Forename"/>
    <TextBox Text="{Binding CustomerToEdit.Forename}"/>

    <Label Content="Surname"/>
    <TextBox Text="{Binding CustomerToEdit.Surname}"/>

    <Button Content="Apply Changes"
            Command="{Binding ApplyChangesCommand}" />
</StackPanel>
```

`TextBox` es . forename . `TextBox` `Label` "Apply" `Button` .

`TextBox` `Text` .

```
Text="{Binding CustomerToEdit.Forename}"
```

`TextBox` "path" `CustomerToEdit.Forename` . ? " "- . `CustomerToEdit` . `Customer` `Forename` " " .

`Button` XAML View-Model `ApplyChangesCommand` `Command` . VM .

DataContext

? " " . F7 `DataContext` . :

```
    public MainWindow()
    {
        InitializeComponent();

        // Our new line:-
        DataContext = new CustomerEditViewModel();
    }
```

MVVM .

MVVM

MVVM WPF `Events` .

`EventHandler` (`Code-Behind`).

```
public MainWindow()
{
    _dataGrid.CollectionChanged += DataGrid_CollectionChanged;
}

private void DataGrid_CollectionChanged(object sender,
System.Collections.Specialized.NotifyCollectionChangedEventArgs e)
{
        //Do what ever
}
```

MVVM `Commands` :

```
 <Button Command="{Binding Path=CmdStartExecution}" Content="Start" />
```

(`Cmd`) . xaml - .

MVVM `ViewModel` Command (`Button` "eq" `Button_Click`) `ViewModel` .

.

1. System.Windows.Input.Command
2. RelayCommand (: .

.

```
private RelayCommand _commandStart;
public ICommand CmdStartExecution
{
   get
   {
      if(_commandStart == null)
      {
          _commandStart = new RelayCommand(param => Start(), param => CanStart());
      }
      return _commandStart;
   }
}

public void Start()
{
   //Do what ever
}

public bool CanStart()
{
    return (DateTime.Now.DayOfWeek == DayOfWeek.Monday); //Can only click that button on
mondays.
}
```

:

ICommand xaml Control . RelayCommand Action (, Method) . Null-Check Command . RelayCommand RelayCommand . (Action<object> execute) (Action<object> execute, Predicate<object> canExecute) .

, () bool Method "" Control Control .

Method false Button Enabled="false" .

CommandParameters

```
<DataGrid x:Name="TicketsDataGrid">
    <DataGrid.InputBindings>
        <MouseBinding Gesture="LeftDoubleClick"
                      Command="{Binding CmdTicketClick}"
                      CommandParameter="{Binding ElementName=TicketsDataGrid,
                                                 Path=SelectedItem}" />
    </DataGrid.InputBindings>
<DataGrid />
```

DataGrid.SelectedItem ViewModel Click_Command .

ICommand .

```
private RelayCommand _commandTicketClick;

public ICommand CmdTicketClick
{
   get
   {
       if(_commandTicketClick == null)
       {
           _commandTicketClick = new RelayCommand(param => HandleUserClick(param));
       }
       return _commandTicketClick;
   }
}

private void HandleUserClick(object item)
{
    MyModelClass selectedItem = item as MyModelClass;
    if (selectedItem != null)
    {
        //Do sth. with that item
    }
}
```

WPF MVVM : https://riptutorial.com/ko/wpf/topic/2134/wpf-mvvm

12: WPF

WPF . (:) (:).

(: *App.xaml*) `ResourceDictionary` . `StackPanel` `TextBlock` .

```
<StackPanel>
    <StackPanel.Resources>
        <Style TargetType="TextBlock">
            <Setter Property="Margin" Value="5,5,5,0"/>
            <Setter Property="Background" Value="#FFF0F0F0"/>
            <Setter Property="Padding" Value="5"/>
        </Style>
    </StackPanel.Resources>

    <TextBlock Text="First Child"/>
    <TextBlock Text="Second Child"/>
    <TextBlock Text="Third Child"/>
</StackPanel>
```

- .
- `StaticResource` . , , / .
- `DynamicResource` `StaticResource` .

MSDN .

-
-
-

Examples

`x:Key` .

```
<StackPanel>
    <StackPanel.Resources>
        <Style x:Key="MyTextBlockStyle" TargetType="TextBlock">
            <Setter Property="Background" Value="Yellow"/>
            <Setter Property="FontWeight" Value="Bold"/>
        </Style>
    </StackPanel.Resources>

    <TextBlock Text="Yellow and bold!" Style="{StaticResource MyTextBlockStyle}" />
    <TextBlock Text="Also yellow and bold!" Style="{DynamicResource MyTextBlockStyle}" />
    <TextBlock Text="Plain text." />
</StackPanel>
```

. `TargetType` `x:Key` .

```
<StackPanel>
    <StackPanel.Resources>
        <Style TargetType="TextBlock">
            <Setter Property="Background" Value="Yellow"/>
            <Setter Property="FontWeight" Value="Bold"/>
        </Style>
    </StackPanel.Resources>

    <TextBlock Text="Yellow and bold!"  />
    <TextBlock Text="Also yellow and bold!" />
    <TextBlock Style="{x:Null}" Text="I'm not yellow or bold; I'm the control's default
style!" />
</StackPanel>
```

`TextBlock` / . `BasedOn` . .

```
<Style x:Key="BaseTextBlockStyle" TargetType="TextBlock">
    <Setter Property="FontSize" Value="12"/>
    <Setter Property="Foreground" Value="#FFBBBBBB" />
    <Setter Property="FontFamily" Value="Arial" />
</Style>

<Style x:Key="WarningTextBlockStyle"
       TargetType="TextBlock"
       BasedOn="{StaticResource BaseTextBlockStyle">
    <Setter Property="Foreground" Value="Red"/>
    <Setter Property="FontWeight" Value="Bold" />
</Style>
```

`WarningTextBlockStyle` `TextBlock` 12px Arial .

`TargetType` `x:Key` .

```
<!-- Implicit -->
<Style TargetType="TextBlock">
    <Setter Property="FontSize" Value="12"/>
    <Setter Property="Foreground" Value="#FFBBBBBB" />
    <Setter Property="FontFamily" Value="Arial" />
</Style>

<Style x:Key="WarningTextBlockStyle"
       TargetType="TextBlock"
       BasedOn="{StaticResource {x:Type TextBlock}}">
    <Setter Property="Foreground" Value="Red"/>
    <Setter Property="FontWeight" Value="Bold" />
</Style>
```

WPF : https://riptutorial.com/ko/wpf/topic/4090/wpf-

13:

	.
	values .
targetType	.
	.
	.

IValueConverter IMultiValueConverter ?

IValueConverter IMultiValueConverter - .

()

1. 0 .
2. .
3. .
4. .

.

. IValueConverter IMultiValueConverter . .

Examples

- BooleanToVisibilityConverter [IValueConverter]

. bool Visibility .

: **System.Windows.Controls .**

```
public sealed class BooleanToVisibilityConverter : IValueConverter
{
    /// <summary>
    /// Convert bool or Nullable bool to Visibility
    /// </summary>
    /// <param name="value">bool or Nullable bool</param>
    /// <param name="targetType">Visibility</param>
    /// <param name="parameter">null</param>
    /// <param name="culture">null</param>
    /// <returns>Visible or Collapsed</returns>
    public object Convert(object value, Type targetType, object parameter, CultureInfo
```

```
culture)
    {
        bool bValue = false;
        if (value is bool)
        {
            bValue = (bool)value;
        }
        else if (value is Nullable<bool>)
        {
            Nullable<bool> tmp = (Nullable<bool>)value;
            bValue = tmp.HasValue ? tmp.Value : false;
        }
        return (bValue) ? Visibility.Visible : Visibility.Collapsed;
    }

    /// <summary>
    /// Convert Visibility to boolean
    /// </summary>
    /// <param name="value"></param>
    /// <param name="targetType"></param>
    /// <param name="parameter"></param>
    /// <param name="culture"></param>
    /// <returns></returns>
    public object ConvertBack(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        if (value is Visibility)
        {
            return (Visibility)value == Visibility.Visible;
        }
        else
        {
            return false;
        }
    }
}
```

1.

```
<BooleanToVisibilityConverter x:Key="BooleanToVisibilityConverter"/>
```

3. .

```
<Button Visibility="{Binding AllowEditing,
                             Converter={StaticResource BooleanToVisibilityConverter}}"/>
```

[IValueConverter]

. bool Visibility . Inverted True .

```
public class BooleanToVisibilityConverter : IValueConverter
{
    public bool Inverted { get; set; }

    /// <summary>
    /// Convert bool or Nullable bool to Visibility
```

```
    /// </summary>
    /// <param name="value">bool or Nullable bool</param>
    /// <param name="targetType">Visibility</param>
    /// <param name="parameter">null</param>
    /// <param name="culture">null</param>
    /// <returns>Visible or Collapsed</returns>
    public object Convert(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        bool bValue = false;
        if (value is bool)
        {
            bValue = (bool)value;
        }
        else if (value is Nullable<bool>)
        {
            Nullable<bool> tmp = (Nullable<bool>)value;
            bValue = tmp ?? false;
        }

        if (Inverted)
            bValue = !bValue;
        return (bValue) ? Visibility.Visible : Visibility.Collapsed;
    }

    /// <summary>
    /// Convert Visibility to boolean
    /// </summary>
    /// <param name="value"></param>
    /// <param name="targetType"></param>
    /// <param name="parameter"></param>
    /// <param name="culture"></param>
    /// <returns>True or False</returns>
    public object ConvertBack(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        if (value is Visibility)
        {
            return ((Visibility) value == Visibility.Visible) && !Inverted;
        }

        return false;
    }
}
```

1.

```
xmlns:converters="clr-namespace:MyProject.Converters;assembly=MyProject"
```

2.

```
<converters:BooleanToVisibilityConverter x:Key="BoolToVisibilityInvertedConverter"
                                         Inverted="False"/>
```

3. .

```
<Button Visibility="{Binding AllowEditing, Converter={StaticResource
BoolToVisibilityConverter}}"/>
```

[IMultiValueConverter]

`IMultiValueConverter` xaml `MultiBinding` `.values` .

```
public class AddConverter : IMultiValueConverter
{
    public object Convert(object[] values, Type targetType, object parameter, CultureInfo
culture)
    {
        decimal sum = 0M;

        foreach (string value in values)
        {
            decimal parseResult;
            if (decimal.TryParse(value, out parseResult))
            {
                sum += parseResult;
            }
        }

        return sum.ToString(culture);
    }

    public object[] ConvertBack(object value, Type[] targetTypes, object parameter,
CultureInfo culture)
    {
        throw new NotSupportedException();
    }
}
```

1.

```
xmlns:converters="clr-namespace:MyProject.Converters;assembly=MyProject"
```

2.

```
<converters:AddConverter x:Key="AddConverter"/>
```

3. .

```
<StackPanel Orientation="Vertical">
    <TextBox x:Name="TextBox" />
    <TextBox x:Name="TextBox1" />
    <TextBlock >
        <TextBlock.Text>
            <MultiBinding Converter="{StaticResource AddConverter}">
                <Binding Path="Text" ElementName="TextBox"/>
                <Binding Path="Text" ElementName="TextBox1"/>
            </MultiBinding>
         </TextBlock.Text>
    </TextBlock>
</StackPanel>
```

ConverterParameter

`ConverterParameter` `ConverterParameter` . ConverterParameter .

```
public class MultiplyConverter : IValueConverter
{
    public object Convert(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        if (value == null)
            return 0;

        if (parameter == null)
            parameter = 1;

        double number;
        double coefficient;

        if (double.TryParse(value.ToString(), out number) &&
double.TryParse(parameter.ToString(), out coefficient))
        {
            return number * coefficient;
        }

        return 0;
    }

    public object ConvertBack(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        throw new NotSupportedException();
    }
}
```

1.

```
xmlns:converters="clr-namespace:MyProject.Converters;assembly=MyProject"
```

2.

```
<converters:MultiplyConverter x:Key="MultiplyConverter"/>
```

3. .

```
<StackPanel Orientation="Vertical">
    <TextBox x:Name="TextBox" />
    <TextBlock Text="{Binding Path=Text,
                             ElementName=TextBox,
                             Converter={StaticResource MultiplyConverter},
                             ConverterParameter=10}"/>
</StackPanel>
```

[IValueConverter]

.

```
public class ValueConverterGroup : List<IValueConverter>, IValueConverter
```

```
{
    public object Convert(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        return this.Aggregate(value, (current, converter) => converter.Convert(current,
targetType, parameter, culture));
    }

    public object ConvertBack(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        throw new NotSupportedException();
    }
}
```

EnumToBooleanConverter BooleanToVisibilityConverter .

```
<local:ValueConverterGroup x:Key="EnumToVisibilityConverter">
    <local:EnumToBooleanConverter/>
    <local:BooleanToVisibilityConverter/>
</local:ValueConverterGroup>
```

CurrentMode Ready .

```
<Button Content="Ok" Visibility="{Binding Path=CurrentMode, Converter={StaticResource
EnumToVisibilityConverter}, ConverterParameter={x:Static local:Mode.Ready}"/>
```

MarkupExtension .

.

```
<converters:SomeConverter x:Key="SomeConverter"/>
```

MarkupExtension ProvideValue . .

```
namespace MyProject.Converters
{
public class Converter_Negative : MarkupExtension, IValueConverter
{
    public object Convert(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        return this.ReturnNegative(value);
    }

    public object ConvertBack(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        return this.ReturnNegative(value);
    }

    private object ReturnNegative(object value)
    {
        object result = null;
        var @switch = new Dictionary<Type, Action> {
```

```
            { typeof(bool), () => result=!(bool)value },
            { typeof(byte), () => result=-1*(byte)value },
            { typeof(short), () => result=-1*(short)value },
            { typeof(int), () => result=-1*(int)value },
            { typeof(long), () => result=-1*(long)value },
            { typeof(float), () => result=-1f*(float)value },
            { typeof(double), () => result=-1d*(double)value },
            { typeof(decimal), () => result=-1m*(decimal)value }
        };

        @switch[value.GetType()]();
        if (result == null) throw new NotImplementedException();
        return result;
    }

    public Converter_Negative()
        : base()
    {
    }

    private static Converter_Negative _converter = null;

    public override object ProvideValue(IServiceProvider serviceProvider)
    {
        if (_converter == null) _converter = new Converter_Negative();
        return _converter;
    }
}
}
```

:

1. xmlns : converters = "clr-namespace : MyProject.Converters; assembly = MyProject"

2. ```
   <RichTextBox IsReadOnly="{Binding Path=IsChecked, ElementName=toggleIsEnabled,
   Converter={converters:Converter_Negative}}"/>
   ```

IMultiValueConverter

`IMultiValueConverter MultiBinding  CommandParameter     .`

```
namespace MyProject.Converters
{
    public class Converter_MultipleCommandParameters : MarkupExtension, IMultiValueConverter
    {
        public object Convert(object[] values, Type targetType, object parameter, CultureInfo
culture)
        {
            return values.ToArray();
        }
        public object[] ConvertBack(object value, Type[] targetTypes, object parameter,
CultureInfo culture)
        {
            throw new NotSupportedException();
        }
```
```

```
        private static Converter_MultipleCommandParameters _converter = null;

        public override object ProvideValue(IServiceProvider serviceProvider)
        {
            if (_converter == null) _converter = new Converter_MultipleCommandParameters();
            return _converter;
        }

        public Converter_MultipleCommandParameters()
            : base()
        {
        }
    }
}
```

:

1. - SomeCommand SomeCommand (: *DelegateCommand* *ICommand*).

```
 private ICommand _SomeCommand;
 public ICommand SomeCommand
 {
     get { return _SomeCommand ?? (_SomeCommand = new DelegateCommand(a =>
OnSomeCommand(a))); }
 }

 private void OnSomeCommand(object item)
 {
     object[] parameters = item as object[];

     MessageBox.Show(
         string.Format("Execute command: {0}\nParameter 1: {1}\nParamter 2: {2}\nParamter
3: {3}",
         "SomeCommand", parameters[0], parameters[1], parameters[2]));
 }
```

2. xmlns : converters = "clr-namespace : MyProject.Converters; assembly = MyProject"

3.
```
<Button Width="150" Height="23" Content="Execute some command" Name="btnTestSomeCommand"
     Command="{Binding Path=SomeCommand}" >
     <Button.CommandParameter>
         <MultiBinding Converter="{converters:Converter_MultipleCommandParameters}">
             <Binding RelativeSource="{RelativeSource Self}" Path="IsFocused"/>
             <Binding RelativeSource="{RelativeSource Self}" Path="Name"/>
             <Binding RelativeSource="{RelativeSource Self}" Path="ActualWidth"/>
         </MultiBinding>
     </Button.CommandParameter>
 </Button>
```

: https://riptutorial.com/ko/wpf/topic/3950/----

14:

Examples

```
<Grid>
    <Grid.RowDefinitions>
        <RowDefinition/>
        <RowDefinition/>
    </Grid.RowDefinitions>
    <Grid.ColumnDefinitions>
        <ColumnDefinition/>
        <ColumnDefinition/>
    </Grid.ColumnDefinitions>
    <TextBlock Grid.Column="1" Text="abc"/>
    <TextBlock Grid.Row="1" Grid.Column="1" Text="def"/>
</Grid>
```

RowDefinition ColumnDefinition .

Grid . Grid.Row Grid.Column 0. 0.

. .

/

Grid.RowSpan Grid.ColumnSpan Grid . TextBlock Grid .

```
<Grid>
    <Grid.ColumnDefinitions>
        <ColumnDefinition/>
        <ColumnDefinition/>
        <ColumnDefinition/>
    </Grid.ColumnDefinitions>
    <TextBlock Grid.Column="2" Text="abc"/>
    <TextBlock Grid.Column="1" Grid.ColumnSpan="2" Text="def"/>
</Grid>
```

Grid SharedSizeGroup . Grid Grid.IsSharedSizeScope True .

```
<StackPanel Grid.IsSharedSizeScope="True">
    <Grid>
        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="Auto" SharedSizeGroup="MyGroup"/>
            <ColumnDefinition Width="*" />
        </Grid.ColumnDefinitions>
        [...]
    </Grid>
    <Grid>
        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="Auto" SharedSizeGroup="MyGroup"/>
            <ColumnDefinition Width="*" />
        </Grid.ColumnDefinitions>
        [...]
```

```
    </Grid>
</StackPanel>
```

Grid .

: https://riptutorial.com/ko/wpf/topic/6483/-

15: UserControls

UserControl Control . UserControl XAML . . . UserControl .

Examples

ComboBox

UserControl ComboBox .

UserControl . ComboBox Label .

CustomComboBox.xaml

```
<UserControl x:Class="UserControlDemo.CustomComboBox"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:cnvrt="clr-namespace:UserControlDemo"
             x:Name="customComboBox">
    <UserControl.Resources>
        <cnvrt:InverseNullVisibilityConverter x:Key="invNullVisibleConverter" />
    </UserControl.Resources>
    <Grid>
        <ComboBox x:Name="comboBox"
                  ItemsSource="{Binding ElementName=customComboBox, Path=MyItemsSource}"
                  SelectedItem="{Binding ElementName=customComboBox, Path=MySelectedItem}"
                  HorizontalContentAlignment="Left" VerticalContentAlignment="Center"/>

        <Label HorizontalAlignment="Left" VerticalAlignment="Center"
               Margin="0,2,20,2" IsHitTestVisible="False"
               Content="{Binding ElementName=customComboBox, Path=DefaultText}"
               Visibility="{Binding ElementName=comboBox, Path=SelectedItem,
Converter={StaticResource invNullVisibleConverter}}"/>
    </Grid>
</UserControl>
```

UserControl . ComboBox .

.

- UserControl `x:Name` . . , .
- ComboBox `ElementName` UserControl . UserControl .
- . Label ComboBox . `IsHitTestVisible=false` `IsHitTestVisible=false` . ComboBox .
- Label `InverseNullVisibility` . .

CustomComboBox.xaml.cs

```
public partial class CustomComboBox : UserControl
{
    public CustomComboBox()
    {
```

```
        InitializeComponent();
    }

    public static DependencyProperty DefaultTextProperty =
        DependencyProperty.Register("DefaultText", typeof(string), typeof(CustomComboBox));

    public static DependencyProperty MyItemsSourceProperty =
        DependencyProperty.Register("MyItemsSource", typeof(IEnumerable),
typeof(CustomComboBox));

    public static DependencyProperty SelectedItemProperty =
        DependencyProperty.Register("SelectedItem", typeof(object), typeof(CustomComboBox));

    public string DefaultText
    {
        get { return (string)GetValue(DefaultTextProperty); }
        set { SetValue(DefaultTextProperty, value); }
    }

    public IEnumerable MyItemsSource
    {
        get { return (IEnumerable)GetValue(MyItemsSourceProperty); }
        set { SetValue(MyItemsSourceProperty, value); }
    }

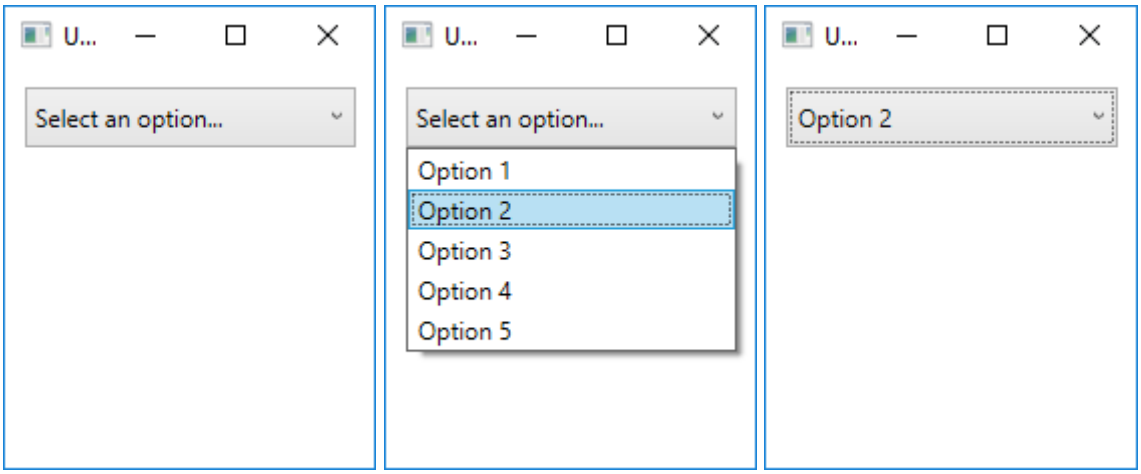
    public object MySelectedItem
    {
        get { return GetValue(MySelectedItemProperty); }
        set { SetValue(MySelectedItemProperty, value); }
    }
}
```

UserControl . ComboBox (: ComboBox `ItemsSource` `MyItemsSource` . .

`CustomComboBox` UserControl .

```
<Window x:Class="UserControlDemo.UserControlDemo"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:cntrls="clr-namespace:UserControlDemo"
        Title="UserControlDemo" Height="240" Width=200>
    <Grid>
        <cntrls:CustomComboBox HorizontalAlignment="Left" Margin="10,10,0,0"
VerticalAlignment="Top" Width="165"
                               MyItemsSource="{Binding Options}"
                               MySelectedItem="{Binding SelectedOption, Mode=TwoWay}"
                               DefaultText="Select an option..."/>
    <Grid>
</Window>
```

:



InverNullVisibilityConverter UserControl Label . III .

```
public class InverseNullVisibilityConverter : IValueConverter
{
    public object Convert(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        return value == null ? Visibility.Visible : Visibility.Hidden;
    }

    public object ConvertBack(object value, Type targetType, object parameter, CultureInfo
culture)
    {
        throw new NotImplementedException();
    }
}
```

UserControls : https://riptutorial.com/ko/wpf/topic/6508/-----usercontrols-

16:

ProvideValue	MarkupExtension XAML .

, .

XAML ({}) . .

. (<>) XAML .

https://msdn.microsoft.com/en-us/library/ms747254(v=vs.110).aspx .

Examples

IValueConverter

IValueConverter . BoolToVisibilityConverter . XAML .

```
Visibility="{Binding [BoolProperty], Converter={[xmlns]:BoolToVisibilityConverter}}"
```

bool .

```
public class BoolToVisibilityConverter : MarkupExtension, IValueConverter
    {
        public object Convert(object value, Type targetType, object parameter, CultureInfo
culture)
        {
            if (value is bool)
                return (bool)value ? Visibility.Visible : Visibility.Collapsed;
            else
                return Visibility.Collapsed;
        }

        public object ConvertBack(object value, Type targetType, object parameter, CultureInfo
culture)
        {
            if (value is Visibility)
            {
                if ((Visibility)value == Visibility.Visible)
                    return true;
                else
                    return false;
            }
            else
                return false;
        }

        public override object ProvideValue(IServiceProvider serviceProvider)
        {
            return this;
        }
```

```
    }
```

XAML

XAML .

`x:Type` Type . .

```
<object property="{x:Type prefix:typeNameValue}" .../>
```

`x:Static` . .

```
<object property="{x:Static prefix:typeName.staticMemberName}" .../>
```

`x:Null` null .

```
<object property="{x:Null}" .../>
```

`x:Array` WPF XAML .

```
<x:Array Type="typeName">
  arrayContents
</x:Array>
```

: https://riptutorial.com/ko/wpf/topic/6619/--

17:

Trigger , DataTrigger , MultiTrigger , MultiDataTrigger EventTrigger WPF .

FrameworkElement FrameworkContentElement . .

- EventTrigger <Style> . EventTrigger <Style> Triggers .
- <Trigger> <Setter> . <Trigger> .
- <Setter> . <TextBlock Text="Sample"> . Text .
- .

Examples

Trigger .

```
<TextBlock>
    <TextBlock.Style>
        <Style TargetType="{x:Type TextBlock}">
            <Style.Triggers>
                <Trigger Property="Text" Value="Pass">
                    <Setter Property="Foreground" Value="Green"/>
                </Trigger>
            </Style.Triggers>
        </Style>
    </TextBlock.Style>
</TextBlock>
```

Text "Pass" TextBlock .

MultiTrigger

MultiTrigger Trigger . MultiTrigger . <Condition> .

```
<TextBlock x:Name="_txtBlock" IsEnabled="False">
    <TextBlock.Style>
        <Style TargetType="{x:Type TextBlock}">
            <Style.Triggers>
                <MultiTrigger>
                    <MultiTrigger.Conditions>
                        <Condition Property="Text" Value="Pass"/>
                        <Condition Property="IsEnabled" Value="True"/>
                    </MultiTrigger.Conditions>
                    <Setter Property="Foreground" Value="Green"/>
                </MultiTrigger>
            </Style.Triggers>
        </Style>
    </TextBlock.Style>
</TextBlock>
```

MultiTrigger .

DataTrigger

`DataTrigger` , UI . .

```
public class Cheese
{
    public string Name { get; set; }
    public double Age { get; set; }
    public int StinkLevel { get; set; }
}
```

`TextBlock` `DataContext` .

```
<TextBlock Text="{Binding Name}">
    <TextBlock.DataContext>
        <local:Cheese Age="12" StinkLevel="100" Name="Limburger"/>
    </TextBlock.DataContext>
    <TextBlock.Style>
        <Style TargetType="{x:Type TextBlock}">
            <Style.Triggers>
                <DataTrigger Binding="{Binding StinkLevel}" Value="100">
                    <Setter Property="Foreground" Value="Green"/>
                </DataTrigger>
            </Style.Triggers>
        </Style>
    </TextBlock.Style>
</TextBlock>
```

`TextBlock.Foreground` . `StinkLevel` 100 XAML `Text.Foreground` .

: https://riptutorial.com/ko/wpf/topic/9624/

18: UI

Examples

UI

UI . .net . UI . .

.

. . . :

```
//Prepare the action
Action taskAction = new Action( () => {
    int progress = 0;
    Action invokeAction = new Action( () => { progressBar.Value = progress; });
    while (progress <= 100) {
        progress = CalculateSomething();
        progressBar.Dispatcher.Invoke( invokeAction );
    }
} );

//After .net 4.5
Task.Run( taskAction );

//Before .net 4.5
Task.Factory.StartNew( taskAction ,
    CancellationToken.None,
    TaskCreationOptions.DenyChildAttach,
    TaskScheduler.Default);
```

UI `DispatcherObject` (`System.Windows.Threading`) Dispatcher . Dispatcher Dispatcher . . dispatcher delegate `int progress` .

UI `invokeAction` .

```
//Prepare the action
Action taskAction = new Action( () => {
    int progress = 0;
    Action<int> invokeAction = new Action<int>( (i) => { progressBar.Value = i; } )
    while (progress <= 100) {
        progress = CalculateSomething();
        progressBar.Dispatcher.BeginInvoke(
            invokeAction,
            progress );
    }
} );

//After .net 4.5
Task.Run( taskAction );

//Before .net 4.5
Task.Factory.StartNew( taskAction ,
    CancellationToken.None,
```

```
    TaskCreationOptions.DenyChildAttach,
    TaskScheduler.Default);
```

int progress   .

UI   : https://riptutorial.com/ko/wpf/topic/6128/--ui--

19: :

(float)	Dependency .

- XAML *xmlns : i* *System.Windows.Interactivity* .
- *xmlns : b* .
- XAML .

Examples

```
using System.Windows;
using System.Windows.Controls;
using System.Windows.Controls.Primitives;
using System.Windows.Interactivity;

namespace MyBehaviorAssembly
{

public class SliderDragEndValueBehavior : Behavior<Slider>
{

    public static readonly DependencyProperty ValueProperty = DependencyProperty.Register(
        "Value", typeof (float), typeof (SliderDragEndValueBehavior), new
PropertyMetadata(default(float)));

    public float Value
    {
        get { return (float) GetValue(ValueProperty); }
        set { SetValue(ValueProperty, value); }
    }

    protected override void OnAttached()
    {
        RoutedEventHandler handler = AssociatedObject_DragCompleted;
        AssociatedObject.AddHandler(Thumb.DragCompletedEvent, handler);
    }

    private void AssociatedObject_DragCompleted(object sender, RoutedEventArgs e)
    {
        Value = (float) AssociatedObject.Value;
    }

    protected override void OnDetaching()
    {
        RoutedEventHandler handler = AssociatedObject_DragCompleted;
        AssociatedObject.RemoveHandler(Thumb.DragCompletedEvent, handler);
    }
}
}
```

XAML

```
<UserControl x:Class="Example.View"
         xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
         xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
         xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
         xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
         xmlns:i="http://schemas.microsoft.com/expression/2010/interactivity"

         xmlns:b="MyBehaviorAssembly;assembly=MyBehaviorAssembly"

         mc:Ignorable="d"
         d:DesignHeight="200" d:DesignWidth="200"

         >
           <Slider>
            <i:Interaction.Behaviors>
                <b:SliderDragEndValueBehavior

                        Value="{Binding Value, Mode=OneWayToSource,
UpdateSourceTrigger=PropertyChanged}"

                        />
            </i:Interaction.Behaviors>
          </Slider>

</UserControl>
```

: : https://riptutorial.com/ko/wpf/topic/6339/------

20:

`System.Speech` Microsoft .

1. SpeechSynthesizer speechSynthesizerObject = SpeechSynthesizer ();

   speechSynthesizerObject.Speak ("Text to Speak");

Examples

- Hello World

```
using System;
using System.Speech.Synthesis;
using System.Windows;

namespace Stackoverflow.SpeechSynthesisExample
{
        public partial class SpeechSynthesisSample : Window
        {
                public SpeechSynthesisSample()
                {
                        InitializeComponent();
                        SpeechSynthesizer speechSynthesizer = new SpeechSynthesizer();
                        speechSynthesizer.Speak("Hello, world!");
                }
        }
}
```

: https://riptutorial.com/ko/wpf/topic/8368/-

21:

PixelHeight (System.Int32)	
PixelWidth (System.Int32)	
PixelFormat (System.Windows.Media.PixelFormat)	
	IList <T> - C #
DpiX	Dpi - .
DpiY	Dpi - .

- XAML *xmlns : i* *System.Windows.Interactivity* .
- *xmlns : b* .
- XAML .
- *IList* . C # *IList* .
  .
- .
- -
- Pixel, PixelWidth, PixelHeight PixelFormat .
- .

Examples

```
using System;
using System.Collections.Generic;
using System.Runtime.InteropServices;
using System.Threading.Tasks;
using System.Windows;
using System.Windows.Controls;
using System.Windows.Interactivity;
using System.Windows.Media;
using System.Windows.Media.Imaging;

namespace MyBehaviorAssembly
{
    public class PixelSupportBehavior : Behavior<Image>
    {

    public static readonly DependencyProperty PixelsProperty = DependencyProperty.Register(
        "Pixels", typeof (IList<byte>), typeof (PixelSupportBehavior), new
PropertyMetadata(default(IList<byte>),OnPixelsChanged));

    private static void OnPixelsChanged(DependencyObject d, DependencyPropertyChangedEventArgs
e)
    {
        var b = (PixelSupportBehavior) d;
        var pixels = (IList<byte>) e.NewValue;
```

```
        b.RenderPixels(pixels);
    }

    public IList<byte> Pixels
    {
        get { return (IList<byte>) GetValue(PixelsProperty); }
        set { SetValue(PixelsProperty, value); }
    }

    public static readonly DependencyProperty PixelFormatProperty =
DependencyProperty.Register(
        "PixelFormat", typeof (PixelFormat), typeof (PixelSupportBehavior), new
PropertyMetadata(PixelFormats.Default,OnPixelFormatChanged));


    private static void OnPixelFormatChanged(DependencyObject d,
DependencyPropertyChangedEventArgs e)
    {
        var b = (PixelSupportBehavior) d;
        var pixelFormat = (PixelFormat) e.NewValue;

        if(pixelFormat==PixelFormats.Default)
            return;

        b._pixelFormat = pixelFormat;

        b.InitializeBufferIfAttached();
    }

    public PixelFormat PixelFormat
    {
        get { return (PixelFormat) GetValue(PixelFormatProperty); }
        set { SetValue(PixelFormatProperty, value); }
    }

    public static readonly DependencyProperty PixelWidthProperty =
DependencyProperty.Register(
        "PixelWidth", typeof (int), typeof (PixelSupportBehavior), new
PropertyMetadata(default(int),OnPixelWidthChanged));

    private static void OnPixelWidthChanged(DependencyObject d,
DependencyPropertyChangedEventArgs e)
    {
        var b = (PixelSupportBehavior)d;
        var value = (int)e.NewValue;

        if(value<=0)
            return;

        b._pixelWidth = value;

        b.InitializeBufferIfAttached();
    }

    public int PixelWidth
    {
        get { return (int) GetValue(PixelWidthProperty); }
        set { SetValue(PixelWidthProperty, value); }
    }
```

```
    public static readonly DependencyProperty PixelHeightProperty =
DependencyProperty.Register(
        "PixelHeight", typeof (int), typeof (PixelSupportBehavior), new
PropertyMetadata(default(int),OnPixelHeightChanged));

    private static void OnPixelHeightChanged(DependencyObject d,
DependencyPropertyChangedEventArgs e)
    {
        var b = (PixelSupportBehavior)d;
        var value = (int)e.NewValue;

        if (value <= 0)
            return;

        b._pixelHeight = value;

        b.InitializeBufferIfAttached();
    }

    public int PixelHeight
    {
        get { return (int) GetValue(PixelHeightProperty); }
        set { SetValue(PixelHeightProperty, value); }
    }

    public static readonly DependencyProperty DpiXProperty = DependencyProperty.Register(
        "DpiX", typeof (int), typeof (PixelSupportBehavior), new
PropertyMetadata(96,OnDpiXChanged));

    private static void OnDpiXChanged(DependencyObject d, DependencyPropertyChangedEventArgs
e)
    {
        var b = (PixelSupportBehavior)d;
        var value = (int)e.NewValue;

        if (value <= 0)
            return;

        b._dpiX = value;

        b.InitializeBufferIfAttached();
    }

    public int DpiX
    {
        get { return (int) GetValue(DpiXProperty); }
        set { SetValue(DpiXProperty, value); }
    }

    public static readonly DependencyProperty DpiYProperty = DependencyProperty.Register(
        "DpiY", typeof (int), typeof (PixelSupportBehavior), new
PropertyMetadata(96,OnDpiYChanged));

    private static void OnDpiYChanged(DependencyObject d, DependencyPropertyChangedEventArgs
e)
    {
        var b = (PixelSupportBehavior)d;
        var value = (int)e.NewValue;

        if (value <= 0)
```

```
            return;

        b._dpiY = value;

        b.InitializeBufferIfAttached();
    }

    public int DpiY
    {
        get { return (int) GetValue(DpiYProperty); }
        set { SetValue(DpiYProperty, value); }
    }

    private IntPtr _backBuffer = IntPtr.Zero;
    private int _bytesPerPixel;
    private const int BitsPerByte = 8;
    private int _pixelWidth;
    private int _pixelHeight;
    private int _dpiX;
    private int _dpiY;
    private Int32Rect _imageRectangle;
    private readonly GCHandle _defaultGcHandle = new GCHandle();
    private PixelFormat _pixelFormat;

    private int _byteArraySize;
    private WriteableBitmap _bitMap;

    private bool _attached;

    protected override void OnAttached()
    {
        _attached = true;
        InitializeBufferIfAttached();
    }

    private void InitializeBufferIfAttached()
    {
        if(_attached==false)
            return;

        ReevaluateBitsPerPixel();

        RecomputeByteArraySize();

        ReinitializeImageSource();
    }

    private void ReevaluateBitsPerPixel()
    {
        var f = _pixelFormat;

        if (f == PixelFormats.Default)
        {
            _bytesPerPixel = 0;
            return;
        };

        _bytesPerPixel = f.BitsPerPixel/BitsPerByte;
    }

    private void ReinitializeImageSource()
```

```
    {
        var f = _pixelFormat;
        var h = _pixelHeight;
        var w = _pixelWidth;

        if (w<=0|| h<=0 || f== PixelFormats.Default)
            return;

        _imageRectangle = new Int32Rect(0, 0, w, h);
        _bitMap = new WriteableBitmap(w, h, _dpiX, _dpiY, f, null);
        _backBuffer = _bitMap.BackBuffer;
        AssociatedObject.Source = _bitMap;
    }

    private void RenderPixels(IList<byte> pixels)
    {
        if (pixels == null)
        {
            return;
        }

        var buffer = _backBuffer;
        if (buffer == IntPtr.Zero)
            return;

        var size = _byteArraySize;

        var gcHandle = _defaultGcHandle;
        var allocated = false;
        var bitMap = _bitMap;
        var rect = _imageRectangle;
        var w = _pixelWidth;
        var locked = false;
        try
        {
            gcHandle = GCHandle.Alloc(pixels, GCHandleType.Pinned);
            allocated = true;

            bitMap.Lock();
            locked = true;
            var ptr = gcHandle.AddrOfPinnedObject();
            _bitMap.WritePixels(rect, ptr, size,w);
        }
        finally
        {
            if(locked)
                bitMap.Unlock();

            if (allocated)
                gcHandle.Free();
        }
    }

    private void RecomputeByteArraySize()
    {
        var h = _pixelHeight;
        var w = _pixelWidth;
        var bpp = _bytesPerPixel;

        if (w<=0|| h<=0 || bpp<=0)
            return;
```

```
        _byteArraySize = (w * h * bpp);
    }

    public PixelSupportBehavior()
    {
        _pixelFormat = PixelFormats.Default;
    }
}
}
```

XAML

```
<UserControl x:Class="Example.View"
         xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
         xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
         xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
         xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
         xmlns:b="clr-namespace:MyBehaviorAssembly;assembly=MyBehaviorAssembly"
         xmlns:i="http://schemas.microsoft.com/expression/2010/interactivity"
         mc:Ignorable="d"
         d:DesignHeight="200" d:DesignWidth="200"
         >

                <Image Stretch="Uniform">

                <i:Interaction.Behaviors>

                    <b:PixelSupportBehavior
                            PixelHeight="{Binding PixelHeight}"
                            PixelWidth="{Binding PixelWidth}"
                            PixelFormat="{Binding PixelFormat}"
                            Pixels="{Binding Pixels}"
                            />

                </i:Interaction.Behaviors>

            </Image>

</UserControl>
```

: https://riptutorial.com/ko/wpf/topic/6435/--------

22:

CLR . CLR DependencyObject GetValue () .

.

- DependencyProperty.Register (, Type , ownerType)
- DependencyProperty.Register (, Type , ownerType, PropertyMetadata typeMetadata)
- DependencyProperty.Register (, propertyType, ownerType, PropertyMetadata typeMetadata, ValidateValueCallback validateValueCallback)
- DependencyProperty.RegisterAttached (, Type , ownerType)
- DependencyProperty.RegisterAttached (, Type , ownerType, PropertyMetadata typeMetadata)
- DependencyProperty.RegisterAttached (, propertyType, ownerType, PropertyMetadata typeMetadata, ValidateValueCallback validateValueCallback)
- DependencyProperty.RegisterReadOnly (, Type , ownerType, PropertyMetadata typeMetadata)
- DependencyProperty.RegisterReadOnly (, propertyType, ownerType, PropertyMetadata typeMetadata, ValidateValueCallback validateValueCallback)
- DependencyProperty.RegisterAttachedReadOnly (, Type , ownerType, PropertyMetadata typeMetadata)
- DependencyProperty.RegisterAttachedReadOnly (, propertyType, ownerType, PropertyMetadata typeMetadata, ValidateValueCallback validateValueCallback)

	`String`
propertyType	`Type typeof(int)`
	`Type typeof(MyControl)` : `typeof(MyControl)` `typeof(MyAttachedProperties)` .
typeMetadata	, `System.Windows.PropertyMetadata` ( ) `FrameworkPropertyMetadata` `System.Windows.Data.BindingMode.TwoWay` .
validateValueCallback	true , false.

Examples

?

WPF . , , , CLR WPF .

`TextBox.Text` . `Text` CLR .

```
<TextBox Text="{Binding FirstName}" />
```

FrameworkElement , Control DependencyObject .

"propdp" propdp . .

```
public class MyControl : Control
{
    public int MyProperty
    {
        get { return (int)GetValue(MyPropertyProperty); }
        set { SetValue(MyPropertyProperty, value); }
    }

    // Using a DependencyProperty as the backing store for MyProperty.
    // This enables animation, styling, binding, etc...
    public static readonly DependencyProperty MyPropertyProperty =
        DependencyProperty.Register("MyProperty", typeof(int), typeof(MyControl),
            new PropertyMetadata(0));
}
```

, , .

/ .

1. **CLR .** . GetValue SetValue .
2. . DependencyProperty public static readonly . CLR "Property" (: Text TextProperty .
3. **CLR .** (XAML) CLR . PropertyMetadata .

```
public static readonly DependencyProperty MyPropertyProperty =
    DependencyProperty.Register("MyProperty", typeof(int), typeof(MyControl),
        new PropertyMetadata(0, MyPropertyChangedHandler));

private static void MyPropertyChangedHandler(DependencyObject sender,
DependencyPropertyChangedEventArgs args)
{
    // Use args.OldValue and args.NewValue here as needed.
    // sender is the object whose property changed.
    // Some unboxing required.
}
```

Mode=TwoWay (TextBox.Text) PropertyMetadata FrameworkPropertyMetadata .

```
public static readonly DependencyProperty MyPropertyProperty =
    DependencyProperty.Register("MyProperty", typeof(int), typeof(MyControl),
        new FrameworkPropertyMetadata(0,
FrameworkPropertyMetadataOptions.BindsTwoWayByDefault));
```

?

DependencyObject .

.

1. . , Grid Grid.Row , Grid.Column , Grid.RowSpan Grid.ColumnSpan .
2. . TextBox .
3. (ToolTipService FocusManager .
4. , DataContext .

Grid .

```
<Grid>
    <Grid.ColumnDefinitions>
        <ColumnDefinition />
        <ColumnDefinition />
    </Grid.ColumnDefinitions>

    <Label Grid.Column="0" Content="Your Name:" />
    <TextBox Grid.Column="1" Text="{Binding FirstName}" />
</Grid>
```

Grid.Column Label TextBox . Grid .

Grid . Grid.Column DependencyPropertyChangedEventHandler .

```
public static readonly DependencyProperty RowProperty =
    DependencyProperty.RegisterAttached("Row", typeof(int), typeof(Grid),
        new FrameworkPropertyMetadata(0, ...));

public static void SetRow(UIElement element, int value)
{
    if (element == null)
        throw new ArgumentNullException("element");

    element.SetValue(RowProperty, value);
}

public static int GetRow(UIElement element)
{
    if (element == null)
        throw new ArgumentNullException("element");

    return ((int)element.GetValue(RowProperty));
}
```

CLR . .

DependencyObject .

RowProperty GetRow SetRow .

MSDN :

. RegisterAttached .

?

. IsMouseOver IsKeyboardFocusWithin .

DependencyObject .

```
public class MyControl : Control
{
    private static readonly DependencyPropertyKey MyPropertyPropertyKey =
        DependencyProperty.RegisterReadOnly("MyProperty", typeof(int), typeof(MyControl),
            new FrameworkPropertyMetadata(0));

    public static readonly DependencyProperty MyPropertyProperty =
MyPropertyPropertyKey.DependencyProperty;

    public int MyProperty
    {
        get { return (int)GetValue(MyPropertyProperty); }
        private set { SetValue(MyPropertyPropertyKey, value); }
    }
}
```

.

1. DependencyProperty private DependencyPropertyKey .
2. CLR public protected private .

Setter MyPropertyPropertyKey MyPropertyProperty SetValue . SetValue DependencyPropertyKey . , InvalidOperationException Throw.

: https://riptutorial.com/ko/wpf/topic/2914/--

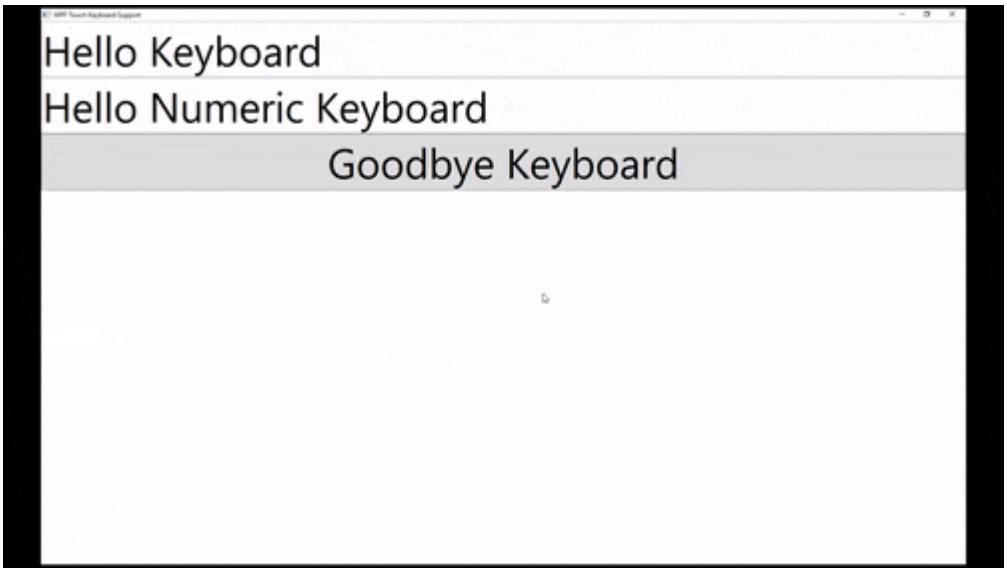
23:

Examples

Windows 8 Windows 10

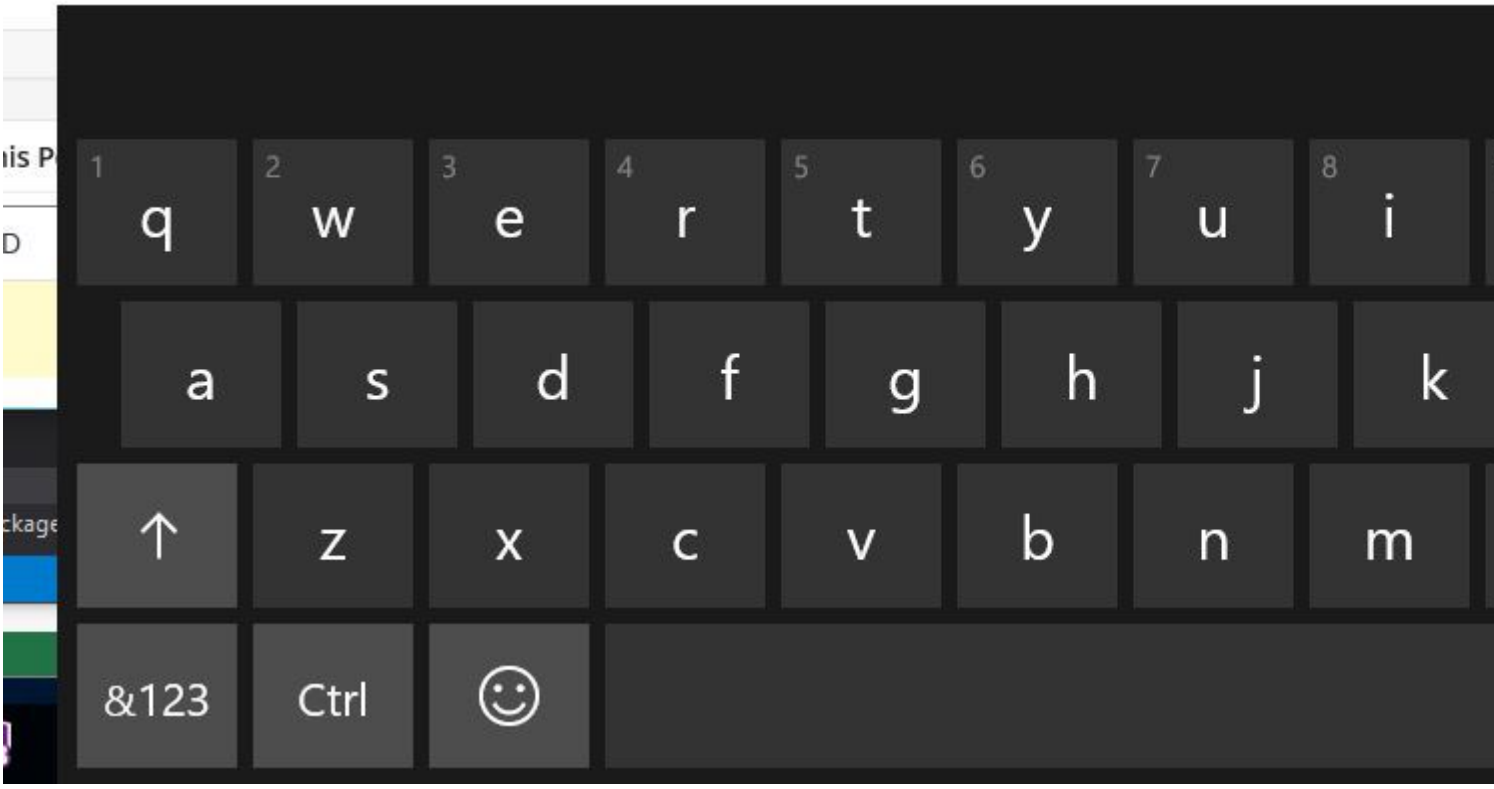
.NET Framework 4.6.2 WPF

.NET Framework 4.6.2 () WPF .



.NET Framework 4.6.1 WPF

WPF . , WPF `TextBox` . .



Windows 8 Windows 10 PC `C:\Program Files\Common Files\Microsoft Shared\Ink\TabTip.exe` exe `C:\Program Files\Common Files\Microsoft Shared\Ink\TabTip.exe` .

`GotTouchCapture` `TextBox` ( ). .

```
public class TouchEnabledTextBox : TextBox
{
    public TouchEnabledTextBox()
    {
        this.GotTouchCapture += TouchEnabledTextBox_GotTouchCapture;
    }

    private void TouchEnabledTextBox_GotTouchCapture(
       object sender,
       System.Windows.Input.TouchEventArgs e )
    {
        string touchKeyboardPath =
           @"C:\Program Files\Common Files\Microsoft Shared\Ink\TabTip.exe";
        Process.Start( touchKeyboardPath );
    }
}
```

.

```
//added field
private Process _touchKeyboardProcess = null;

//replace Process.Start line from the previous listing with
_touchKeyboardProcess = Process.Start( touchKeyboardPath );
```

`LostFocus` .

```
//add this at the end of TouchEnabledTextBox's constructor
this.LostFocus += TouchEnabledTextBox_LostFocus;

//add this method as a member method of the class
private void TouchEnabledTextBox_LostFocus( object sender, RoutedEventArgs eventArgs ){
   if ( _touchKeyboardProcess != null )
   {
      _touchKeyboardProcess.Kill();
      //nullify the instance pointing to the now-invalid process
      _touchKeyboardProcess = null;
   }
}
```

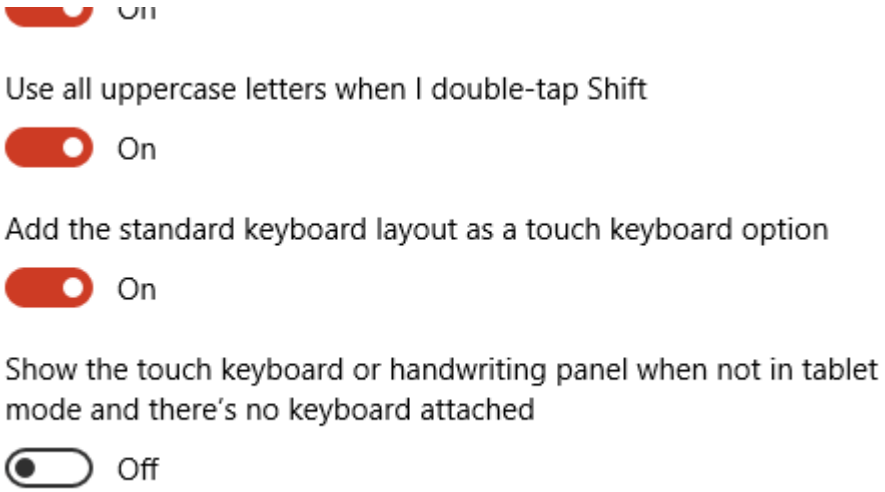
Windows 10

Windows 10 PC . WPF .

Windows 10

Windows 10 . .

. " " .



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: https://riptutorial.com/ko/wpf/topic/6799/---

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