XAML

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About the Tutorial

Welcome to the XAML tutorial for beginners. This tutorial puts greater emphasis on real-time implementation of the concept rather than discussing just the theory part.

The primary objective of this tutorial is to provide you a better understating of what you can do with XAML development irrespective of the platform you are using.

Audience

This tutorial has been designed for all those readers who want to learn XAML and to apply it instantaneously in different type of applications.

Prerequisites

Before proceeding with this tutorial, you should have a basic understanding of XML, Web Technologies, and HTML.

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1. XAML – OVERVIEW

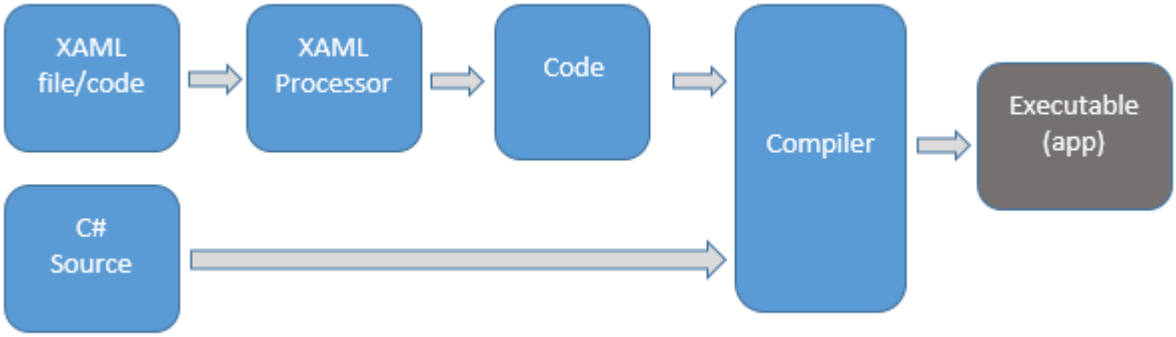
XAML stands for Extensible Application Markup Language. It's a simple and declarative language based on XML.

- In XAML, it very easy to create, initialize, and set properties of an object with hierarchical relations.
- It is mainly used for designing GUIs.
- It can be used for other purposes as well, e.g., to declare workflow in Workflow Foundation.

XAML can be used in different platforms such as WPF (Windows Presentation Foundation), Silverlight, Mobile Development, and Windows Store App. It can be used across different .Net framework and CLR (common language runtime) versions.

How XAML Works

XAML is a **declarative** language in the sense it defines the **WHAT** and **HOW** you want to do. XAML processor is responsible for the **HOW** part to find out. Let's have a look at the following schema. It sums up the XAML side of things:



The figure illustrates the following actions:

- The XAML file is interpreted by a platform-specific XAML processor.
- The XAML processor transforms the XAML to internal code that describes the UI element.
- The internal code and the C# code are linked together through partial classes definitions and then the .NET compiler builds the app.

Advantages of XAML

One of the longstanding problems that all of us face with GUI design can be solved by using XAML. It can be used to design UI elements in Windows Forms applications.

In the earlier GUI frameworks, there was no real separation between how an application looks like and how it behaves. Both the GUI and its behavior were created in the same language, e.g. C# or VB.net, which would require more effort from the developer to implement both the UI and the behavior associated with it.

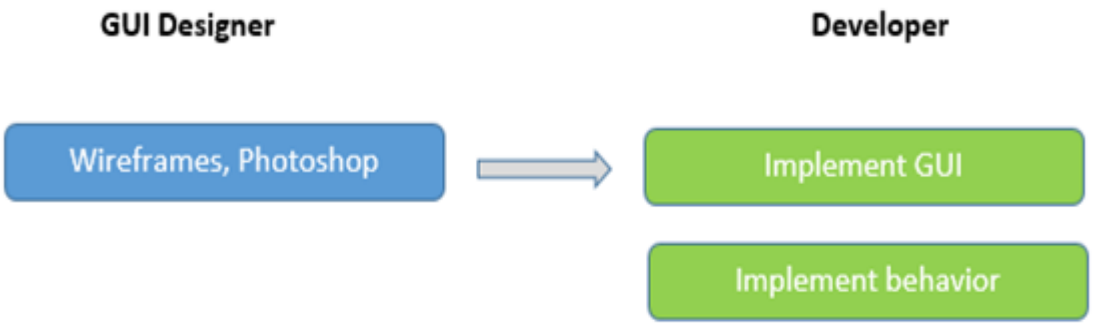


Figure: Earlier GUI Frameworks

With XAML, it is very easy to separate the behavior from the designer code. Hence, the XAML programmer and the designer can work in parallel. XAML codes are very easy to read and understand.

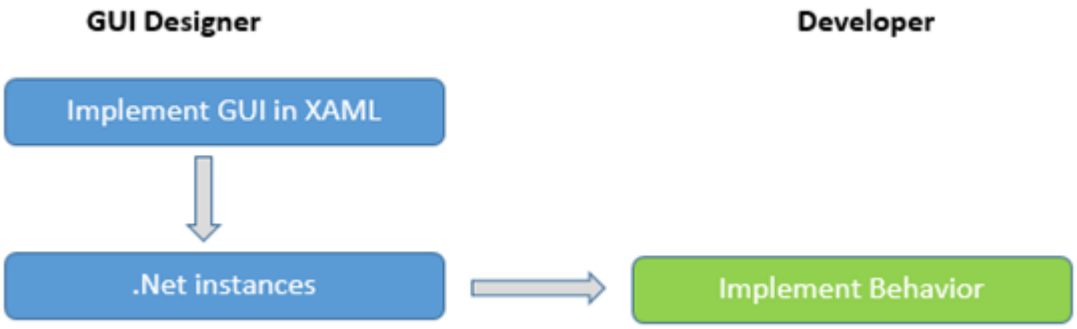


Figure: XAML Framework

2. XAML – ENVIRONMENT SETUP

Microsoft provides two important tools for XAML:

- Visual Studio
- Expression Blend

Currently, both the tools can create XAML, but the fact is that Visual Studio is used more by developers while Expression Blend is still used more often by designers.

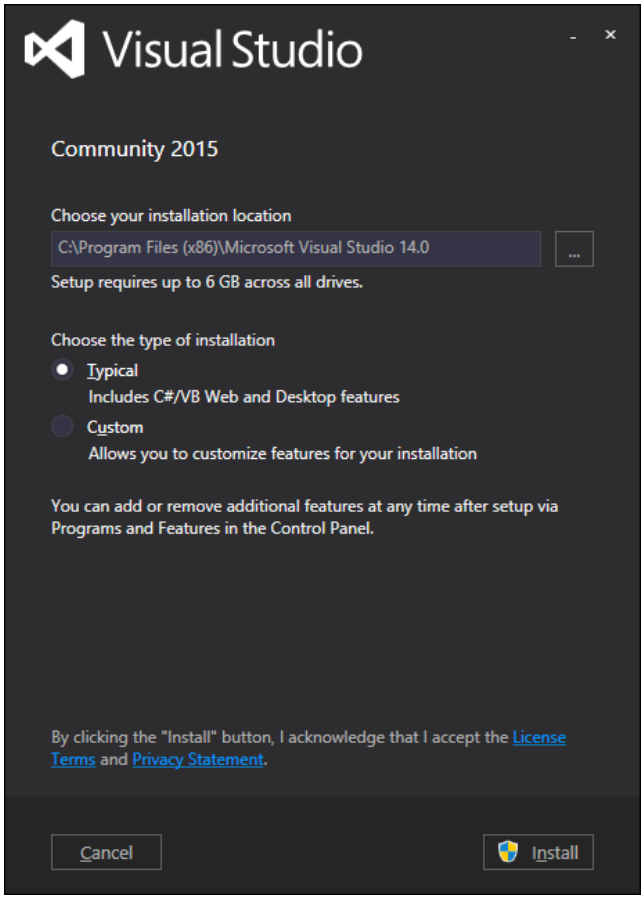
Microsoft provides a free version of Visual Studio which can be downloaded from https://www.visualstudio.com/en-us/downloads/download-visual-studio-vs.aspx

Note: For this tutorial, we will mostly be using WPF projects and Windows Store App. But the free version of Visual Studio doesn't support Windows Store App. So for that purpose, you will need a licensed version of Visual Studio.

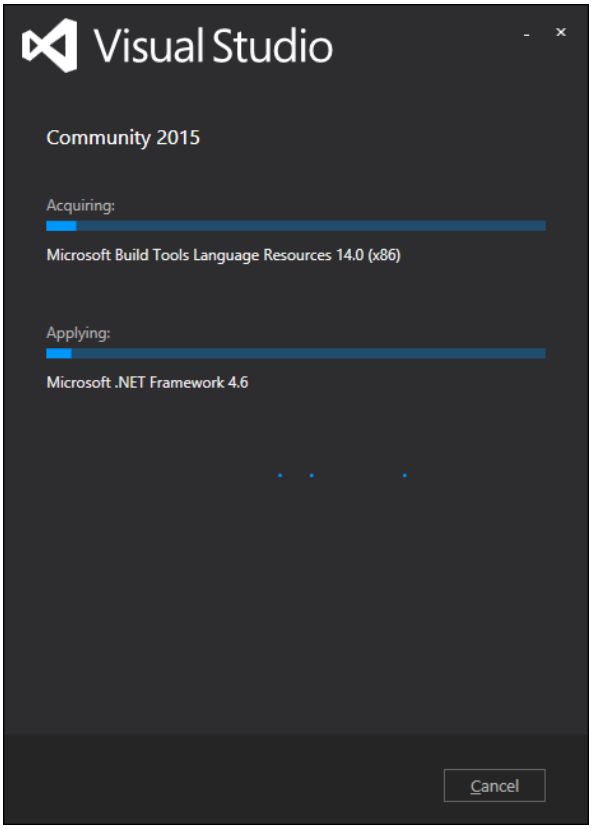
Installation

Follow the steps given below to install Visual Studio on your system:

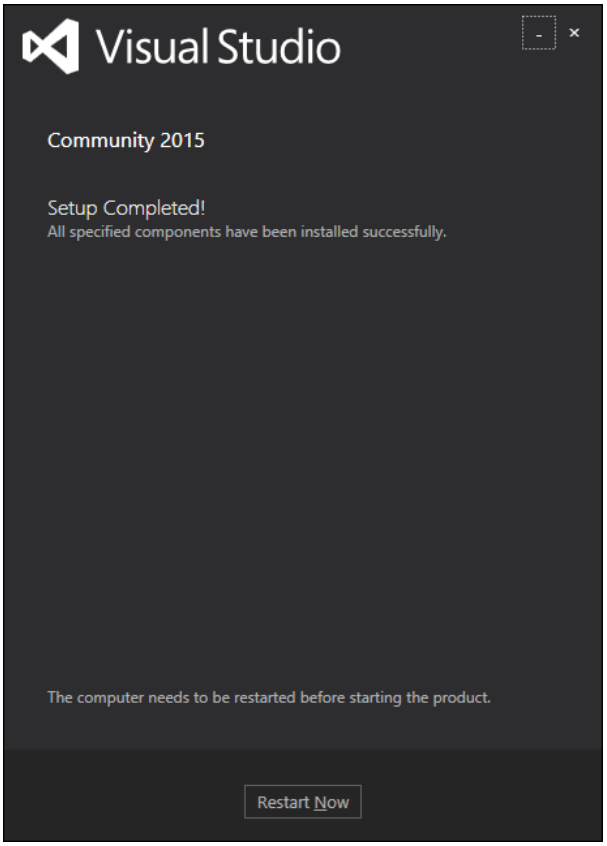
1. After downloading the files, run the installer. The following dialog box will be displayed.



2. Click on the Install button and it will start the installation process.

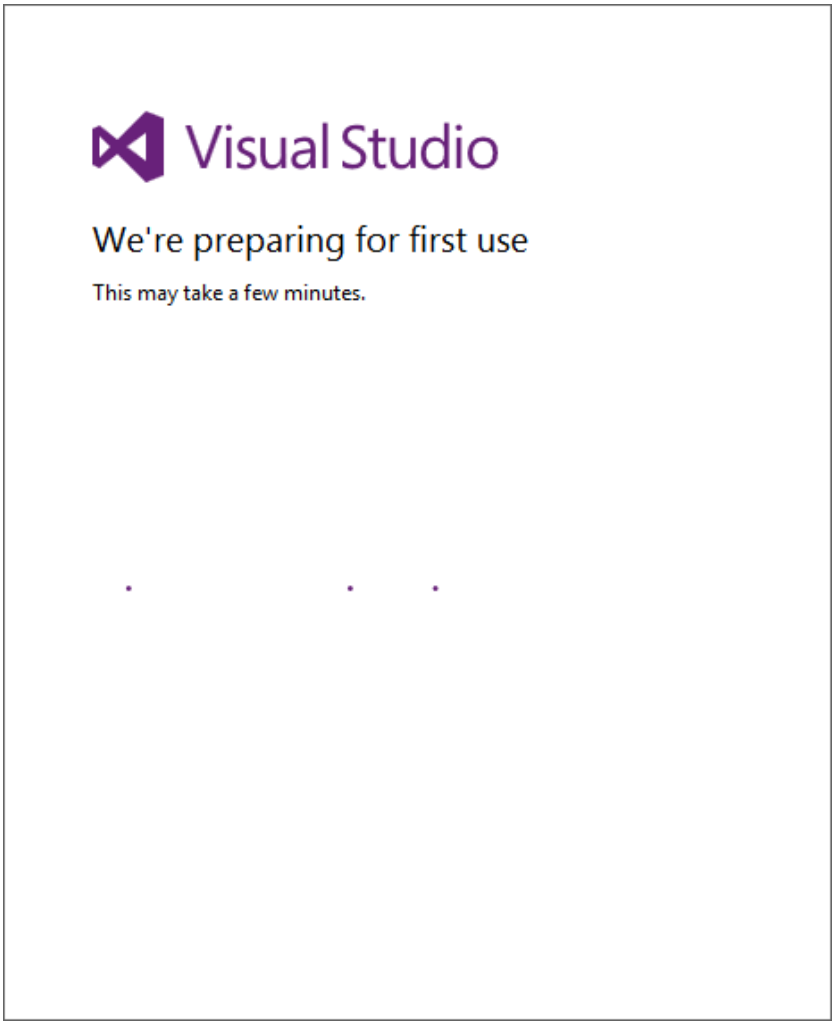


3. Once the installation process completes successfully, you will see the following screen.

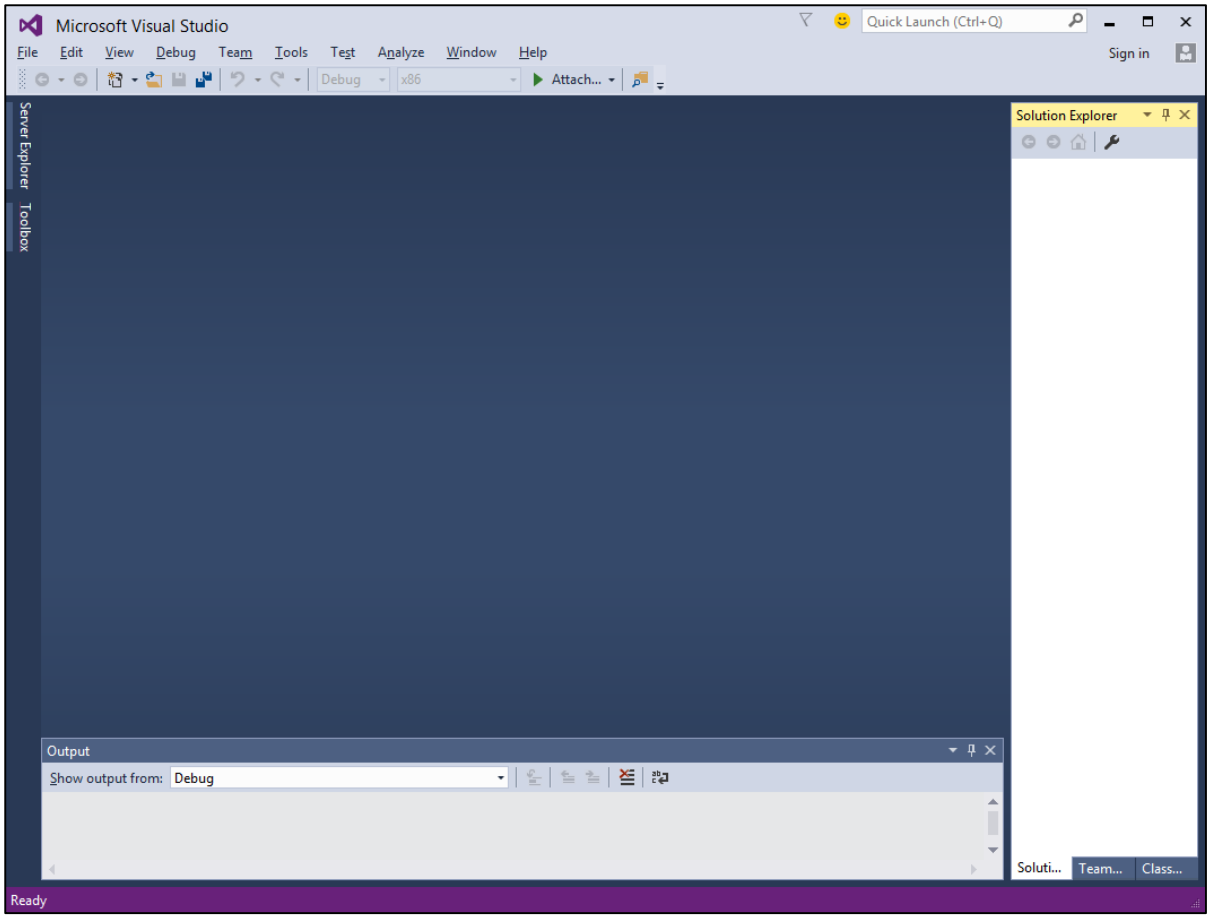


4. Close this dialog box and restart your computer if required.

5. Now open Visual studio from the Start Menu which will show the following dialog box. It will take some time for the first time, only for preparation.



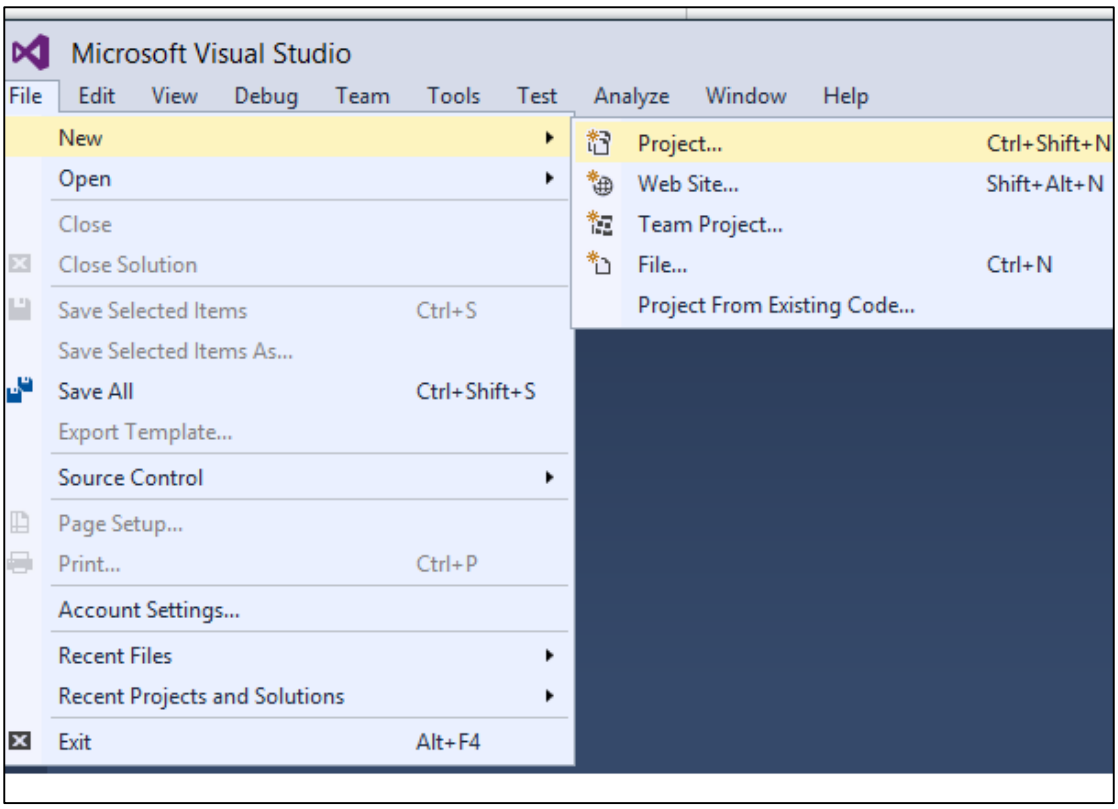
Once all is done, you will see the main window of Visual Studio.



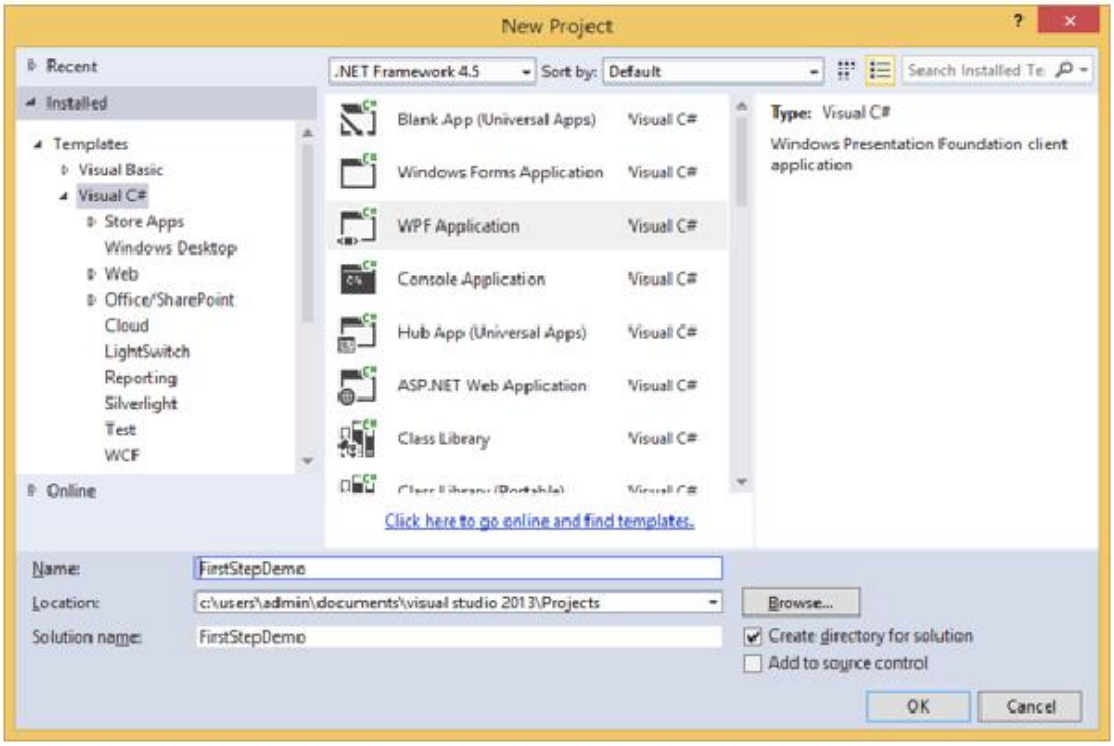
First Step towards Implementation

Let us start with a simple implementation. Follow the steps given below:

1. Click on File > New > Project menu option.



2. The following dialog box will be displayed:



3. Under Templates, select Visual C# and select WPF Application. Give a name to the project and click the OK button.

4. In the mainwindow.xaml file, the following XAML tags are written by default. You will understand all these tags later in this tutorial.

```
<Window x:Class="FirstStepDemo.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:FirstStepDemo"
        mc:Ignorable="d"
        Title="MainWindow" Height="350" Width="604">
    <Grid>


    </Grid>
</Window>
```

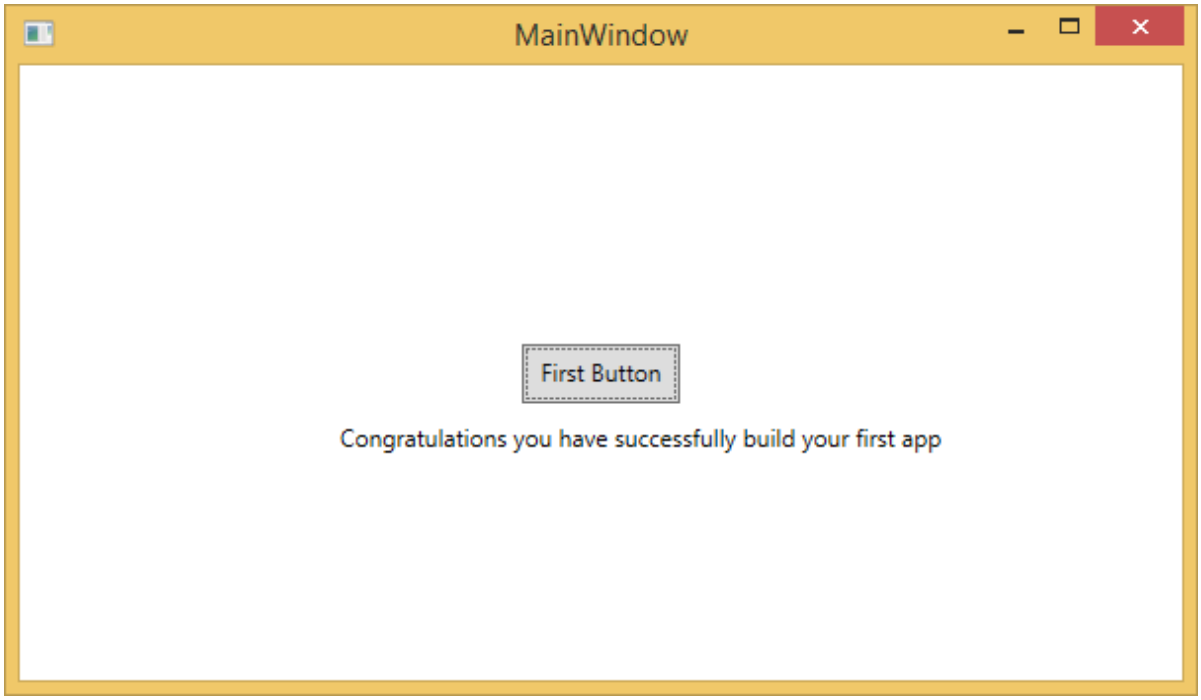
By default, a grid is set as the first element after page.

Let's add a button and a text block under the Grid element. This is called **object element syntax**, a left angle bracket followed by the name of what we want to instantiate, for example a button, then define a content property. The string assigned to the Content will be displayed on the button. Now set the height and width of the button as 30 and 50 respectively. Similarly initialize the properties of the Text block.

Now look at the design window. You will get to see a button. Now press F5 to execute this XAML code.

```
<Window x:Class="FirstStepDemo.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:FirstStepDemo"
        mc:Ignorable="d"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <Button Content="First Button" Height="30" Width="80"/>
        <TextBlock Text="Congratulations you have successfully build your first
app"
                   Height="30" Margin="162,180,122,109" />
    </Grid>
</Window>
```

When you compile and execute the above code, you will see the following window.



Congratulation! You have designed your First Button.

3. WRITING XAML APPLICATION ON MAC OS

XAML applications can be developed on Mac as well. On Mac, XAML can be used as iOS and Android applications. To setup the environment on Mac, go to xamarin.com. Click on Products and select the Xamarin Platform. Download Xamarin Studio and install it. It will allow you to develop applications for the various platforms.

XAML – C# Syntax

In this chapter, you will learn the basic XAML syntax/rules to write XAML applications. Let's have a look at a simple XAML file.

```
<Window x:Class="Resources.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">
    <Grid>


    </Grid>
</Window>
```

As you can see in the above XAML file, there are different kinds of tags and elements. The following table briefly describes all the elements.

`<Window`	It is the opening object element or container of the root.
`x:Class="Resources.MainWindow"`	It is the partial class declaration which connects the markup to the partial class code behind defined in it.
`xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"`	Maps the default XAML namespace for WPF client/framework
`xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"`	XAML namespace for XAML language which maps it to x: prefix
`>`	End of object element of the root.
`<Grid>` `</Grid>`	Starting and closing tags of an empty grid object.
`</Window>`	Closing the object element

Syntax Rules for Object Element

Syntax rules for XAML is almost similar to XML. If you take a look at an XAML document, then you will notice that actually it is a valid XML file. However, an XML file cannot be a valid XAML file. It is because in XML, the value of the attributes must be a string, while in XAML, it can be a different object which is known as Property element syntax.

- The syntax of an Object element starts with a left angle bracket (<) followed by the name of the object, e.g. Button
- Define some Properties and attributes of that object element
- The Object element must be closed by a forward slash (/) followed immediately by a right angle bracket (>).

Example of simple object with no child element:

```
<Button/>
```

Example of object element with some attributes:

```
<Button Content="Click Me"
        Height="30"
        Width="60"/>
```

Example of an alternate syntax to define properties (Property element syntax):

```
<Button
        <Button.Content>Click Me</Button.Content>
        <Button.Height>30</Button.Height>
        <Button.Width>60</Button.Width>
</Button>
```

Example of Object with Child Element: StackPanel contains Textblock as child element

```
<StackPanel Orientation="Horizontal">
            <TextBlock Text="Hello"/>
</StackPanel>
```

4. XAML VS C# CODE

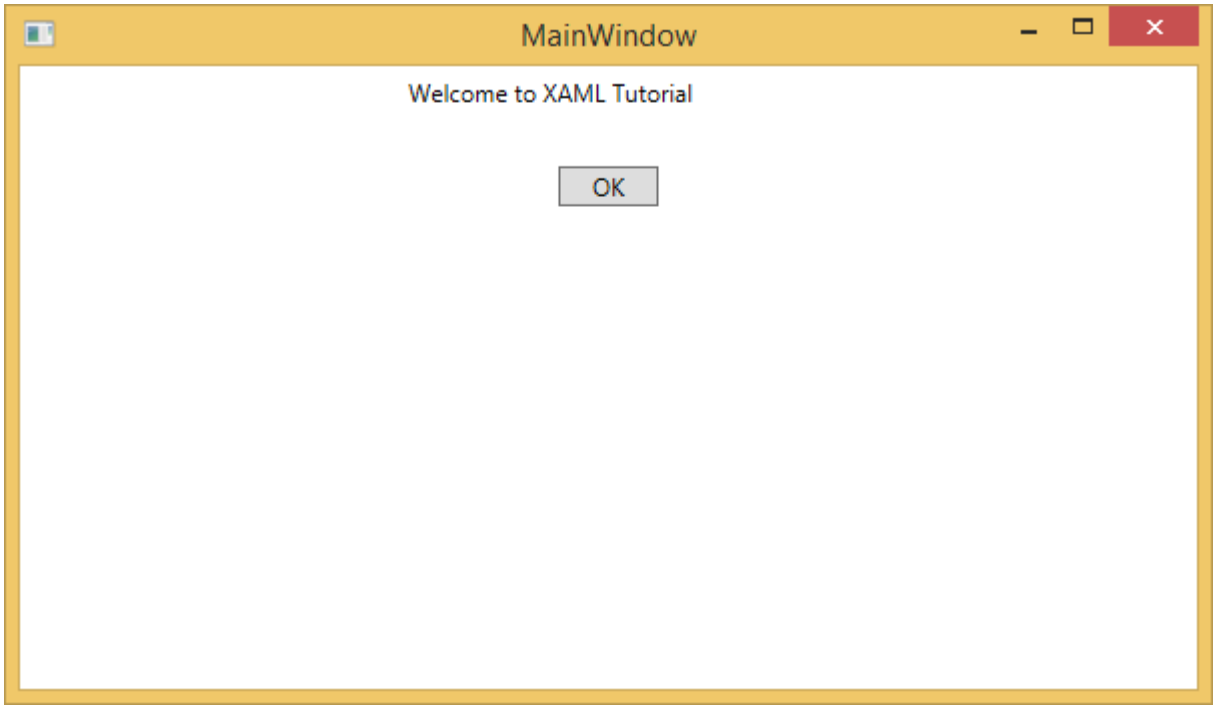
You can use XAML to create, initialize, and set the properties of objects. The same activities can also be performed using programming code.

XAML is just another simple and easy way to design UI elements. With XAML, it is up to you to decide whether you want to declare objects in XAML or declare them using code.

Let's take a simple example to demonstrate how to write in XAML:

```
<Window x:Class="XAMLVsCode.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">

    <StackPanel>
        <TextBlock Text="Welcome to XAML Tutorial" Height="20" Width="200"
                   Margin="5"/>
        <Button Content="Ok" Height="20" Width="60" Margin="5"/>
    </StackPanel>
</Window>
```

In this example, we have created a stack panel with a Button and a Text block and defined some of the properties of button and text block such as Height, Width, and Margin. When the above code is compiled and executed, it will produce the following output:



Now look at the same code which is written in C#.

```
using System;
using System.Text;
using System.Windows;
using System.Windows.Controls;

namespace XAMLVsCode
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();

            // Create the StackPanel
            StackPanel stackPanel = new StackPanel();
            this.Content = stackPanel;
```

```
            // Create the TextBlock
            TextBlock textBlock = new TextBlock();
            textBlock.Text = "Welcome to XAML Tutorial";
            textBlock.Height = 20;
            textBlock.Width = 200;
            textBlock.Margin = new Thickness(5);
            stackPanel.Children.Add(textBlock);

            // Create the Button
            Button button = new Button();
            button.Content = "OK";
            button.Height = 20;
            button.Width = 50;
            button.Margin = new Thickness(20);
            stackPanel.Children.Add(button);
        }
    }
}
```

When the above code is compiled and executed, it will produce the following output. Note that it is exactly the same as the output of XAML code.

Now you can see that how simple it is to use and understand XAML.

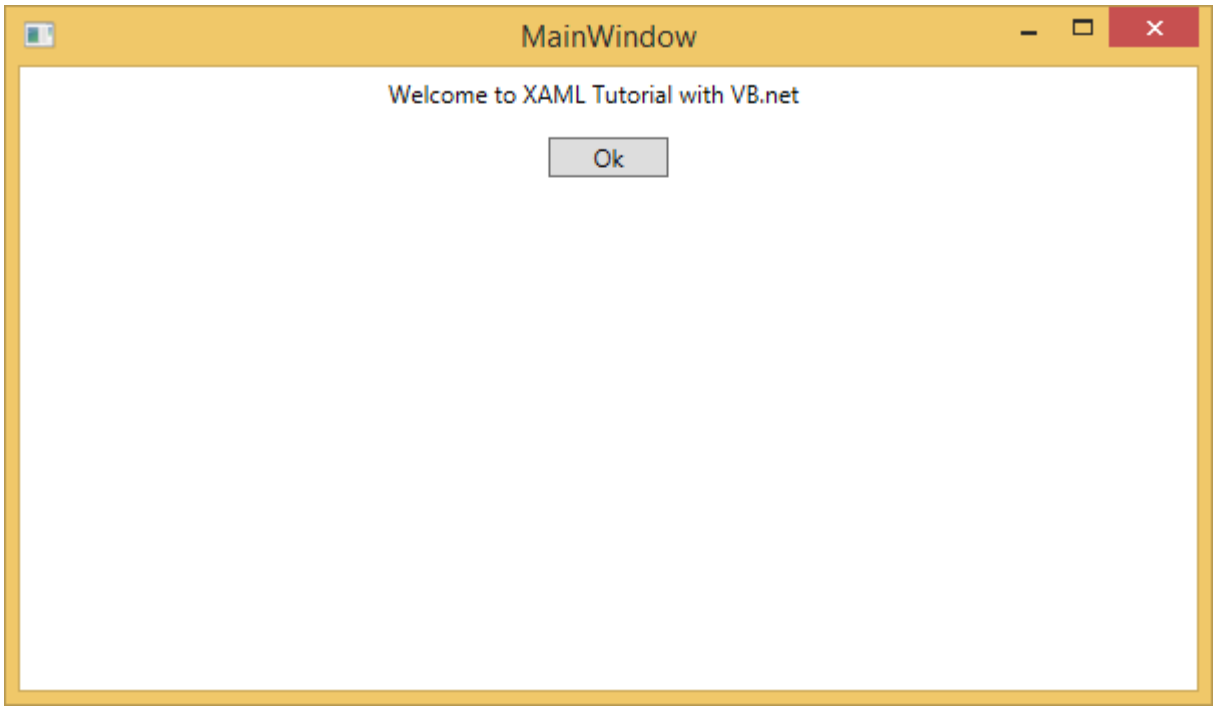
5. XAML VS. VB.NET

In this chapter, we will write the same example in VB.Net so that those who are familiar with VB.Net can also understand the advantages of XAML.

Let's take a look at the the same example again which is written in XAML:

```
<Window x:Class="XAMLVsCode.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">


    <StackPanel>
        <TextBlock Text="Welcome to XAML Tutorial with VB.net" Height="20"
Width="220"
                   Margin="5"/>
        <Button Content="Ok" Height="20" Width="60" Margin="5"/>
    </StackPanel>
</Window>
```

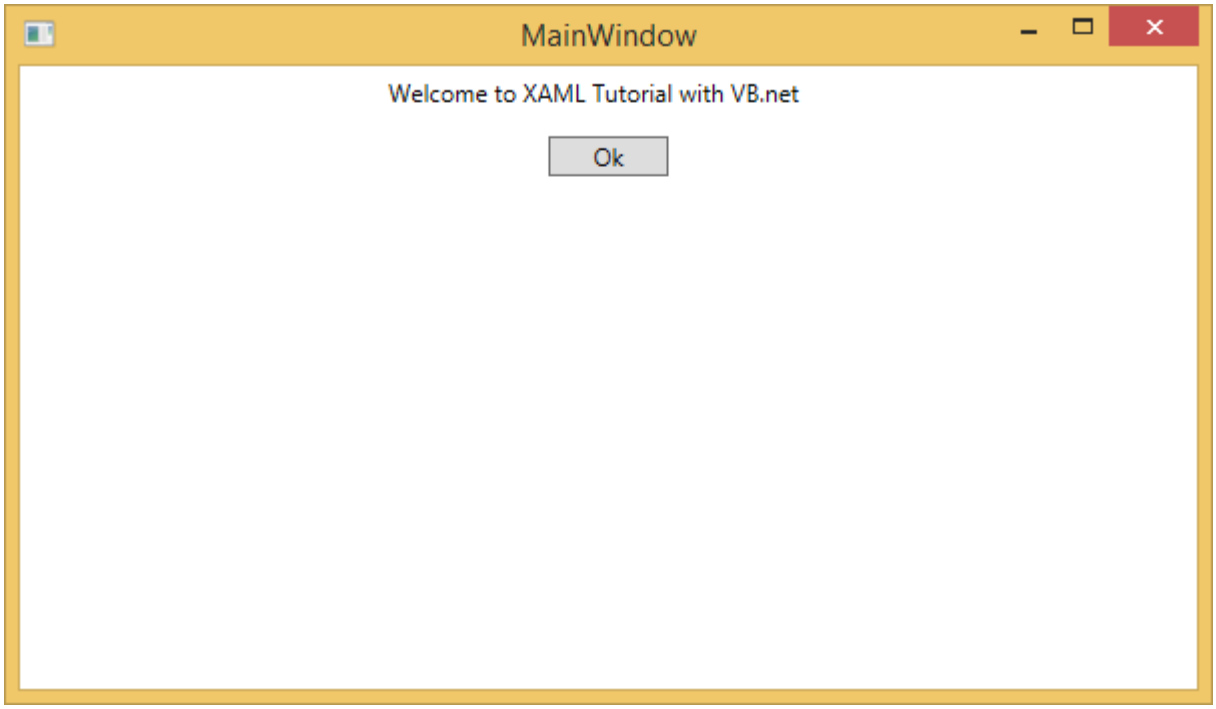
In this example, we have created a stack panel with a button and a Text block and defined some of the properties of the button and the text block such as Height, Width, and Margin. When the above code is compiled and executed, it will produce the following output:



Now look at the same code which is written in VB.Net:

```
Public Class MainWindow

    Private Sub Window_Loaded(sender As Object, e As RoutedEventArgs)
        Dim panel As New StackPanel()
        panel.Orientation = Orientation.Vertical
        Me.Content = panel
        Dim txtInput As New TextBlock
        txtInput.Text = "Welcome to XAML Tutorial with VB.net"
        txtInput.Width = 220
        txtInput.Height = 20
        txtInput.Margin = New Thickness(5)
        panel.Children.Add(txtInput)

        Dim btn As New Button()
        btn.Content = "Ok"
        btn.Width = 60
        btn.Height = 20
        btn.Margin = New Thickness(5)
        panel.Children.Add(btn)

    End Sub
End Class
```

When the above code is compiled and executed the output is exactly the same as the output of XAML code.



You can now visualize how simple it is to work with XAML as compared to VB.Net.

In the above example, we have seen that what we can do in XAML can also be done in other procedural languages such as C# and VB.Net.

Let's have a look at another example in which we will use both XAML and VB.Net. We will design a GUI in XAML and the behavior will be implemented in VB.Net.

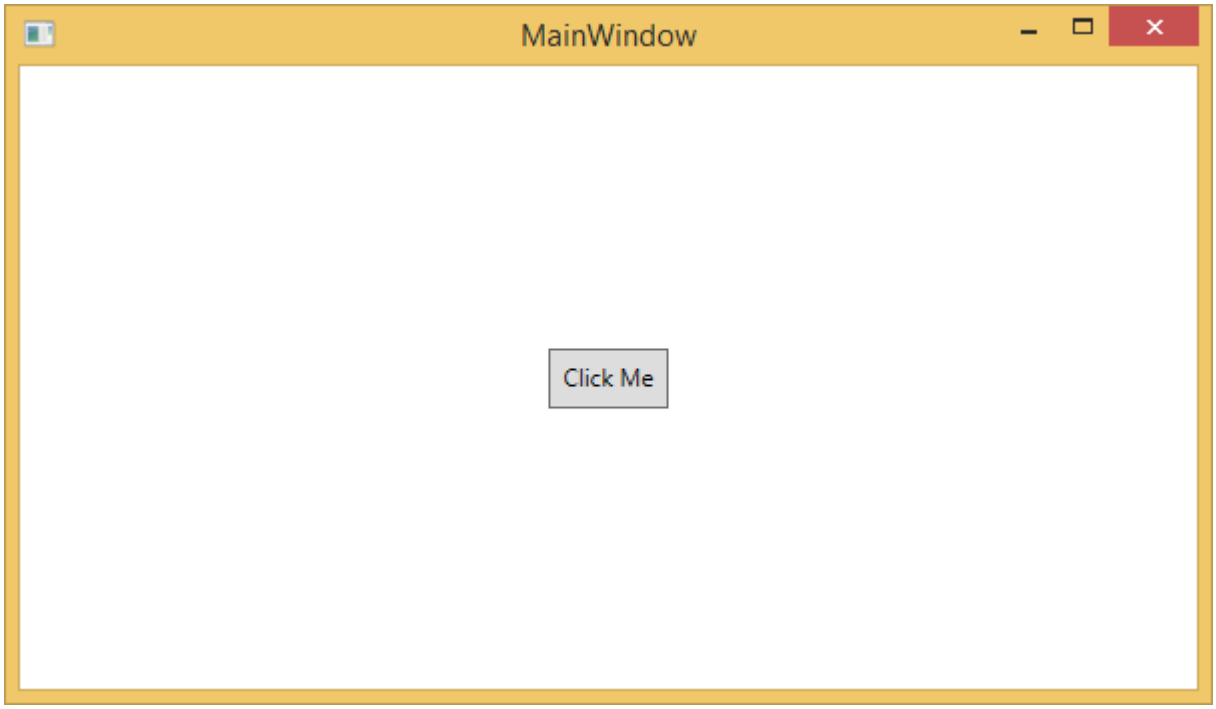
In this example, a button is added to the main window. When the user clicks this button, it displays a message on the message box. Here is the code in XAML in which a Button Object is declared with some properties.

```
<Window x:Class="MainWindow"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    Title="MainWindow" Height="350" Width="604">
    <Grid>
        <Button Name="btn" HorizontalAlignment="Center" Width="60" Height="30"
Content="Click Me" />
    </Grid>
</Window>
```

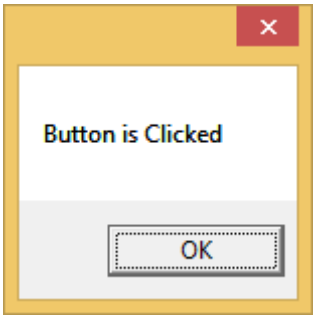
In VB.Net, the button click event (behavior) is implemented. This event displays the message on the messagebox.

```
Public Class MainWindow
    Private Sub btn_Click(sender As Object, e As RoutedEventArgs) Handles btn.Click
        MessageBox.Show("Button is Clicked")
    End Sub
End Class
```

When the above code is compiled and executed, it will display the following screen:



Now click on the above button that says "Click Me". It will display the following message:



6. XAML – BUILDING BLOCKS

This chapter will describe some of the basic and important building blocks of XAML applications. It will explain how

- to create and initialize an object,
- an object can be modified easily by using resources, styles, and templates,
- to make an object interactive by using transformations and animations.

Objects

XAML is a typically declarative language which can create and instantiate objects. It is another way to describe objects based on XML, i.e., which objects need to be created and how they should be initialized before the execution of a program. Objects can be

- Containers (Stack Panel, Dock Panel)
- UI Elements / Controls (Button, TextBox, etc.)
- Resource Dictionaries

Resources

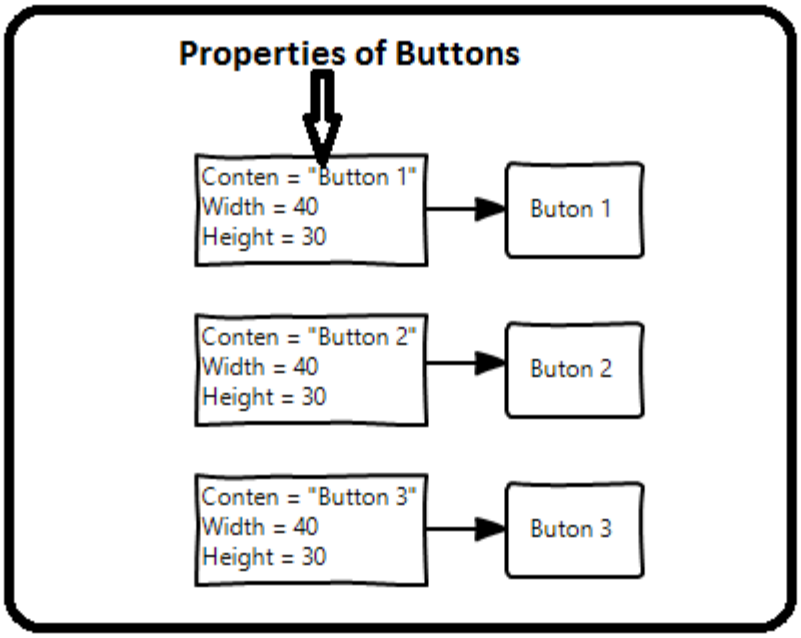
Resources are normally definitions connected with some object that you just anticipate to use more often than once. It is the ability to store data locally for controls or for the current window or globally for the entire applications.

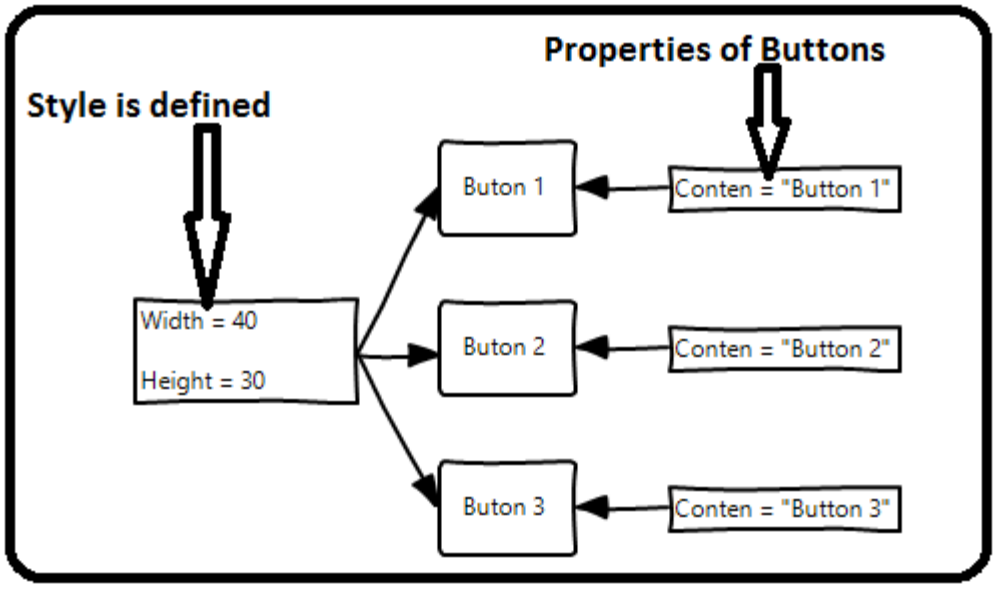
Styles

XAML framework provides several strategies to personalize and customize the appearance of an application. Styles give us the flexibility to set some properties of an object and reuse these specific settings across multiple objects for a consistent look.

- In styles, you can set only the existing properties of an object such as Height, Width, Font size, etc.
- Only the default behavior of a control can be specified.
- Multiple properties can be added into a style.

In the first diagram, you can see the same height and width properties are set for all the three button separately; but in the second diagram, you can see that height and width which are same for all the buttons are added to a style and then this style is associated with all the buttons.

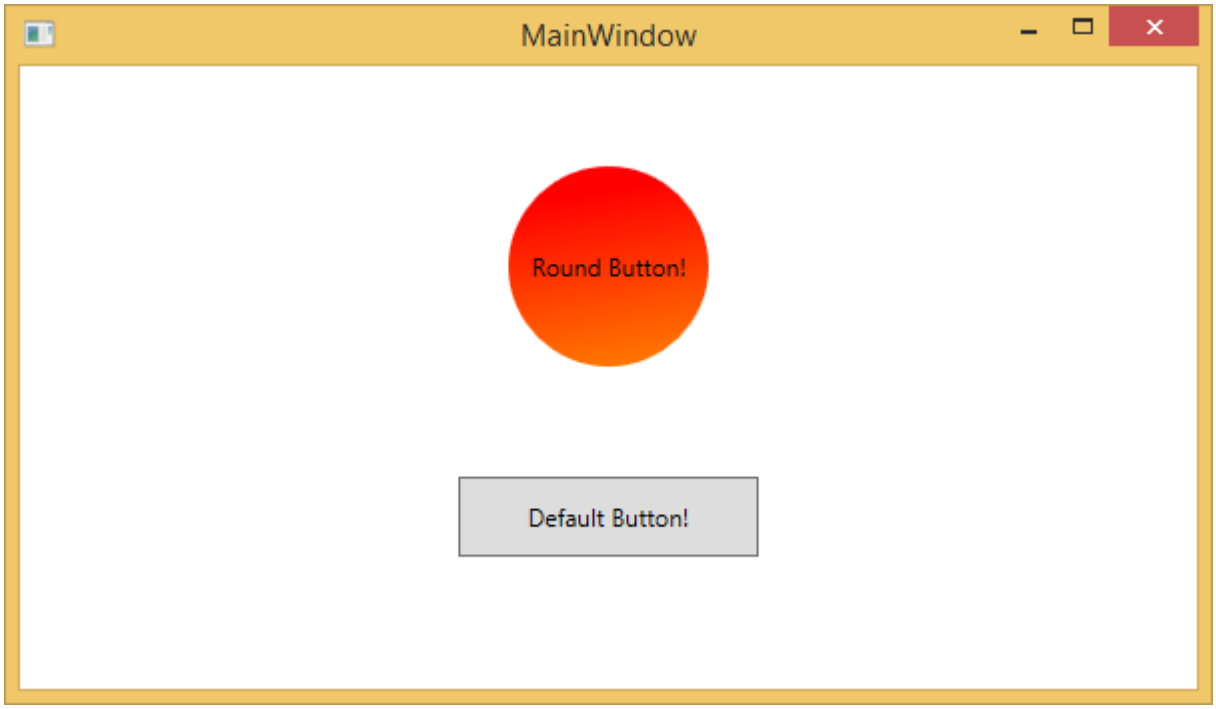




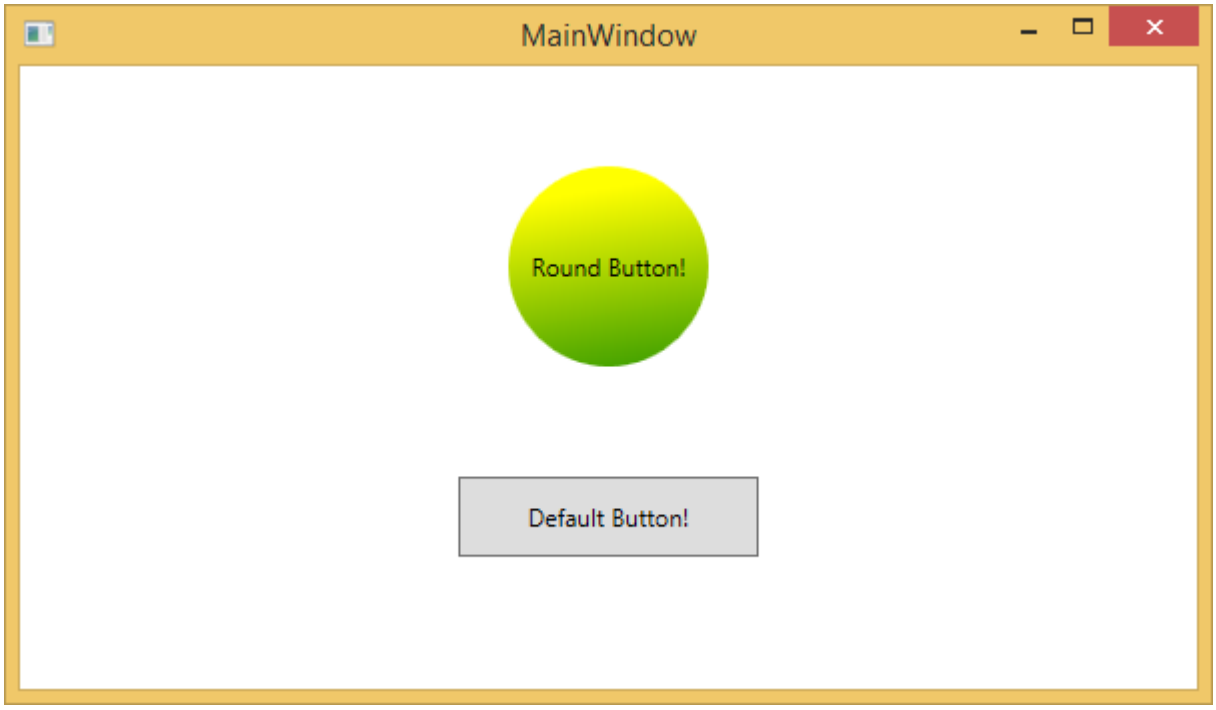
Templates

A template describes the overall look and visual appearance of a control. For each control, there is a default template associated with it which gives the appearance to that control. In XAML, you can easily create your own templates when you want to customize the visual behavior and visual appearance of a control.

In the following screenshot, there are two buttons, one is with template and the other one is the default button.



Now when you hover the mouse over the button, it also changes the color as shown below.



With templates, you can access more parts of a control than in styles. You can specify both existing and new behavior of a control.

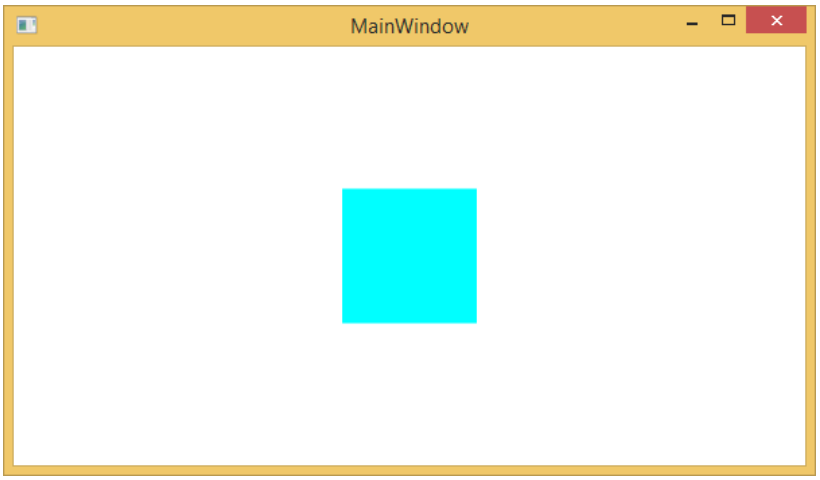
Animations and Transformations

Animations and transformations inside the Windows Runtime can improve your XAML application by building interactivity and movement. You can easily integrate the interactive

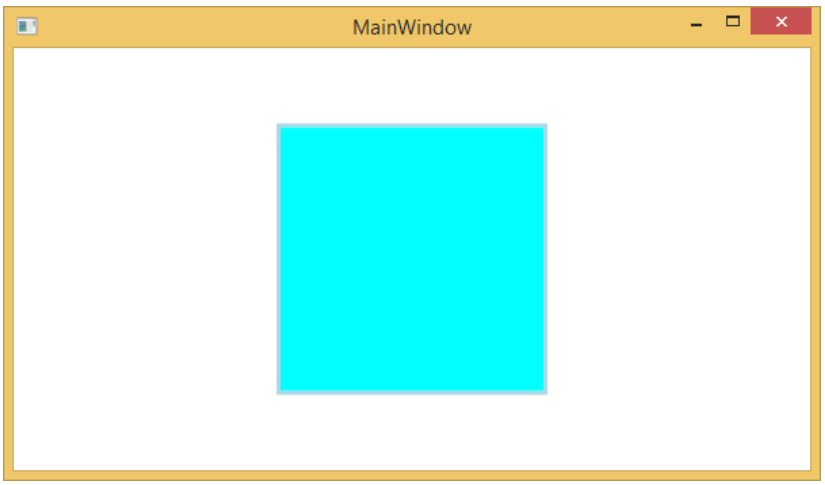
look and feel in your XAML application by using the animations from Windows Runtime animation library. Animations are used

- to enhance the user interface or to make it more attractive.
- to attract the attention of the user to a change.

In the following screenshot, you can see a square:



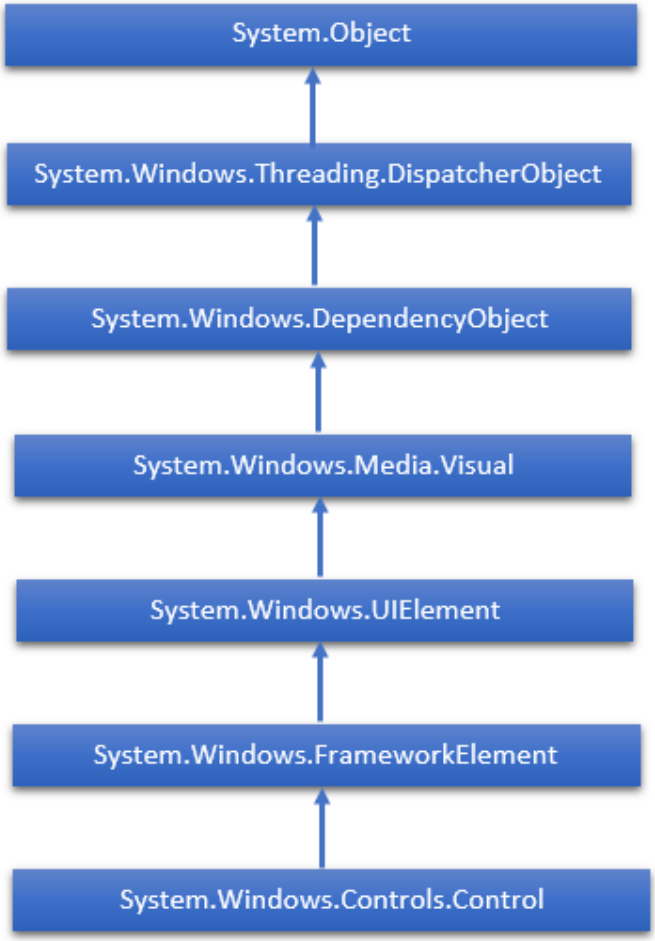
When you hover the mouse over this square, it will expend in all directions as shown below.



7. XAML – CONTROLS

The XAML User Interface framework offers an extensive library of controls that supports UI development for Windows. Some of them have a visual representation such Button, Textbox, TextBlock, etc.; while other controls are used as containers for other controls or content, for example, images. All the XAML controls are inherited from **System.Windows.Controls.Control**.

The complete inheritance hierarchy of controls is as follows:



Here is the list of controls which we will discuss one by one in this chapter.

Sr. No.	Controls & Description
1	**Button** A control that responds to user input.
2	**Calendar** Represents a control that enables a user to select a date by using a visual calendar display.
3	**CheckBox** A control that a user can select or clear.

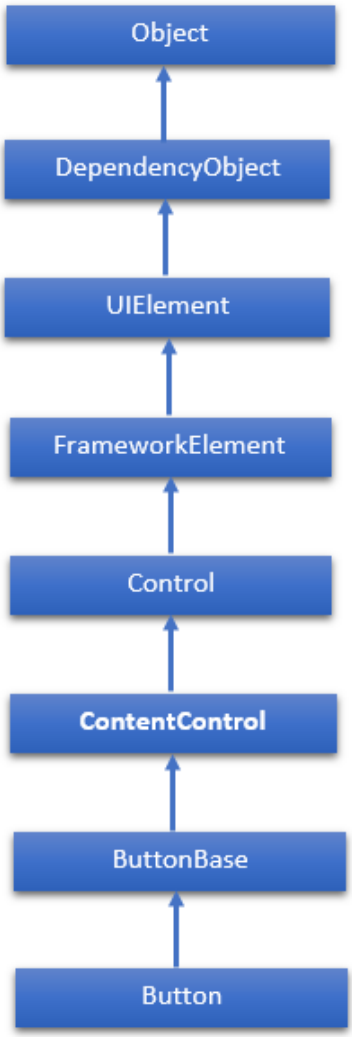
4	**ComboBox** A drop-down list of items a user can select from.
5	**ContextMenu** Gets or sets the context menu element that should appear whenever the context menu is requested through a user interface (UI) from within this element.
6	**DataGrid** Represents a control that displays data in a customizable grid.
7	**DatePicker** A control that lets a user select a date.
8	**Dialogs** An application may also display additional windows to the user to gather or display important information.
9	**GridView** A control that presents a collection of items in rows and columns that can scroll horizontally.
10	**Image** A control that presents an image.
11	**ListBox** A control that presents an inline list of items that the user can select from.
12	**Menus** Represents a Windows menu control that enables you to hierarchically organize elements associated with commands and event handlers.
13	**PasswordBox** A control for entering passwords.
14	**Popup** Displays content on top of existing content, within the bounds of the application window.
15	**ProgressBar** A control that indicates progress by displaying a bar.
16	**ProgressRing** A control that indicates indeterminate progress by displaying a ring.
17	**RadioButton** A control that allows a user to select a single option from a group of options.
18	**RichEditBox** A control that lets a user edit rich text documents with content like formatted text, hyperlinks, and images.
19	**ScrollViewer** A container control that lets the user pan and zoom its content.
20	**SearchBox** A control that lets a user enter search queries.
21	**Slider** A control that lets the user select from a range of values by moving a Thumb control along a track.
22	**TextBlock** A control that displays text.
23	**TimePicker** A control that lets a user set a time value.
24	**ToggleButton** A button that can be toggled between 2 states.
25	**ToolTip** A pop-up window that displays information for an element.
26	**Window**

	The root window which provides minimize/maximize option, Title bar, border and close button.

In this chapter we will discuss all these controls with implementation.

Button

The Button class represents the most basic type of button control. The hierarchical inheritance of Button class is as follows:



Given below are the most commonly used properties of Button.

Sr. No.	Property & Description
1	**Background** Gets or sets a brush that provides the background of the control. (Inherited from Control)
2	**BorderBrush** Gets or sets a brush that describes the border fill of a control. (Inherited from Control)

3	**BorderThickness** Gets or sets the border thickness of a control. (Inherited from Control)
4	**Content** Gets or sets the content of a ContentControl. (Inherited from ContentControl)
5	**ClickMode** Gets or sets a value that indicates when the Click event occurs, in terms of device behavior. (Inherited from ButtonBase)
6	**ContentTemplate** Gets or sets the data template that is used to display the content of the ContentControl. (Inherited from ContentControl)
7	**FontFamily** Gets or sets the font used to display text in the control. (Inherited from Control)
8	**FontSize** Gets or sets the size of the text in this control. (Inherited from Control)
9	**FontStyle** Gets or sets the style in which the text is rendered. (Inherited from Control)
10	**FontWeight** Gets or sets the thickness of the specified font. (Inherited from Control)
11	**Foreground** Gets or sets a brush that describes the foreground color. (Inherited from Control)
12	**Height** Gets or sets the suggested height of a FrameworkElement. (Inherited from FrameworkElement)
13	**HorizontalAlignment** Gets or sets the horizontal alignment characteristics that are applied to a FrameworkElement when it is composed in a layout parent, such as a panel or items control. (Inherited from FrameworkElement)
14	**IsEnabled** Gets or sets a value indicating whether the user can interact with the control. (Inherited from Control)
15	**IsPressed** Gets a value that indicates whether a ButtonBase is currently in a pressed state. (Inherited from ButtonBase)
16	**Margin** Gets or sets the outer margin of a FrameworkElement. (Inherited from FrameworkElement)
17	**Name** Gets or sets the identifying name of the object. When a XAML processor creates the object tree from XAML markup, run-time code can refer to the XAML-declared object by this name. (Inherited from FrameworkElement)
18	**Opacity** Gets or sets the degree of the object's opacity. (Inherited from UIElement)
19	**Resources** Gets the locally defined resource dictionary. In XAML, you can establish resource items as child object elements of a frameworkElement. Resources property element, through XAML implicit collection syntax. (Inherited from FrameworkElement)
20	**Style** Gets or sets an instance Style that is applied for this object during layout and rendering. (Inherited from FrameworkElement)
21	**Template**

	Gets or sets a control template. The control template defines the visual appearance of a control in UI, and is defined in XAML markup. (Inherited from Control)
22	**VerticalAlignment** Gets or sets the vertical alignment characteristics that are applied to a FrameworkElement when it is composed in a parent object such as a panel or items control. (Inherited from FrameworkElement)
23	**Visibility** Gets or sets the visibility of a UIElement. A UIElement that is not visible is not rendered and does not communicate its desired size to layout. (Inherited from UIElement)
24	**Width** Gets or sets the width of a FrameworkElement. (Inherited from FrameworkElement)

Given below are the commonly used methods of Button.

Sr. No.	Method & Description
1	**ClearValue** Clears the local value of a dependency property. (Inherited from DependencyObject)
2	**FindName** Retrieves an object that has the specified identifier name. (Inherited from FrameworkElement)
3	**OnApplyTemplate** Invoked whenever application code or internal processes (such as a rebuilding layout pass) call ApplyTemplate. In simplest terms, this means the method is called just before a UI element displays in your app. Override this method to influence the default post-template logic of a class. (Inherited from FrameworkElement)
4	**OnContentChanged** Invoked when the value of the Content property changes. (Inherited from ContentControl)
5	**OnDragEnter** Called before the DragEnter event occurs. (Inherited from Control)
6	**OnDragLeave** Called before the DragLeave event occurs. (Inherited from Control)
7	**OnDragOver** Called before the DragOver event occurs. (Inherited from Control)
8	**OnDrop** Called before the Drop event occurs. (Inherited from Control)
9	**OnGotFocus** Called before the GotFocus event occurs. (Inherited from Control)
10	**OnKeyDown** Called before the KeyDown event occurs. (Inherited from Control)
11	**OnKeyUp** Called before the KeyUp event occurs. (Inherited from Control)
12	**OnLostFocus** Called before the LostFocus event occurs. (Inherited from Control)
13	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)

Given below are the commonly used events of Button.

Sr. No.	Event & Description
1	**Click** Occurs when a button control is clicked. (Inherited from ButtonBase)
2	**DataContextChanged** Occurs when the value of the FrameworkElement.DataContext property changes. (Inherited from FrameworkElement)
3	**DragEnter** Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
4	**DragLeave** Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
5	**DragOver** Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)
6	**DragStarting** Occurs when a drag operation is initiated. (Inherited from UIElement)
7	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
8	**Holding** Occurs when an otherwise unhandled Hold interaction occurs over the hit test area of this element. (Inherited from UIElement)
9	**IsEnabledChanged** Occurs when the IsEnabled property changes. (Inherited from Control)
10	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
11	**KeyUp** Occurs when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)
12	**LostFocus** Occurs when a UIElement loses focus. (Inherited from UIElement)
13	**SizeChanged** Occurs when either the ActualHeight or the ActualWidth property changes value on a FrameworkElement. (Inherited from FrameworkElement)

Example

The following example contains three buttons that respond differently based on their ClickMode property value.

Here is the XAML code in which three buttons are created with some properties and a click event.

```
<Window x:Class="XAMLButton.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
```

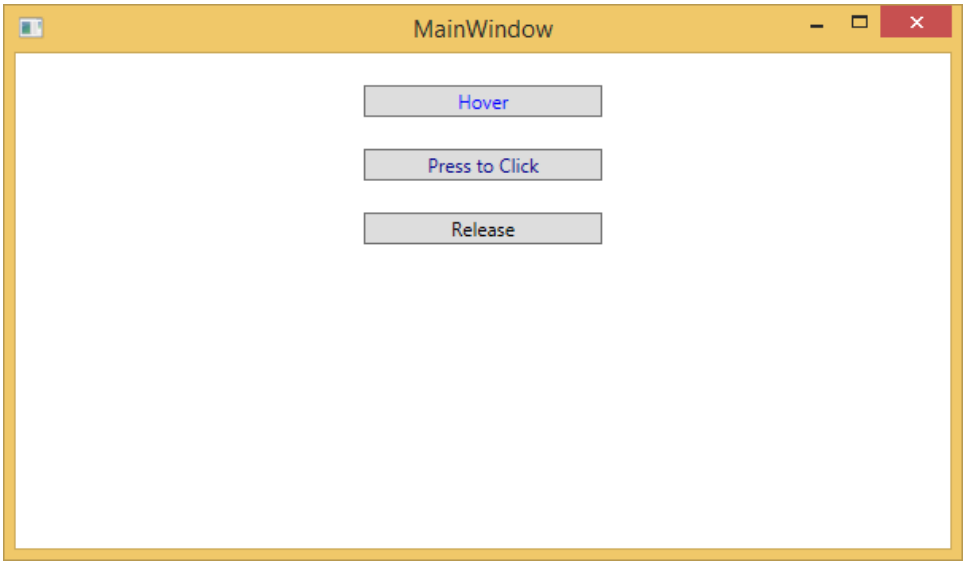
```
        <StackPanel Margin="10">
            <Button x:Name="button1"
                    Content="Hover"
                    Click="OnClick1"
                    ClickMode="Hover"
                    Margin="10"
                    Width="150"
                    HorizontalAlignment="Center"
                    Foreground="Gray"/>
            <Button x:Name="button2"
                    Content="Press to Click"
                    Click="OnClick2"
                    ClickMode="Press"
                    Margin="10"
                    Width="150"
                    HorizontalAlignment="Center"
                    Foreground="DarkBlue"/>
            <Button x:Name="button3"
                    Content="Release"
                    Click="OnClick3"
                    ClickMode="Release"
                    Margin="10"
                    Width="150"
                    HorizontalAlignment="Center"/>
        </StackPanel>
    </Grid>
</Window>
```

Here is the click event implementation in C#.

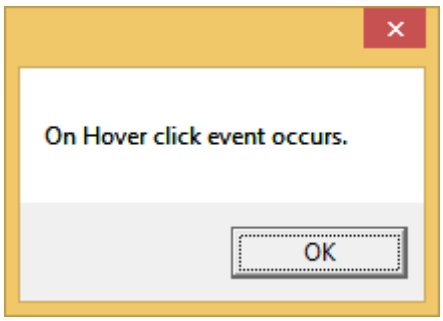
```
using System;
using System.Windows;
using System.Windows.Controls;
using System.Windows.Media;

namespace XAMLButton
{
```

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

        void OnClick1(object sender, RoutedEventArgs e)
        {
            button1.Foreground = new SolidColorBrush(Colors.Blue);
            MessageBox.Show("On Hover click event occurs.");
        }

        void OnClick2(object sender, RoutedEventArgs e)
        {
            button2.Foreground = new SolidColorBrush(Colors.Green);
            MessageBox.Show("On Press click event occurs.");
        }

        void OnClick3(object sender, RoutedEventArgs e)
        {
            button1.Foreground = new SolidColorBrush(Colors.Green);
            button2.Foreground = new SolidColorBrush(Colors.Blue);
            MessageBox.Show("On Release click event occurs.");
        }
    }
}
```

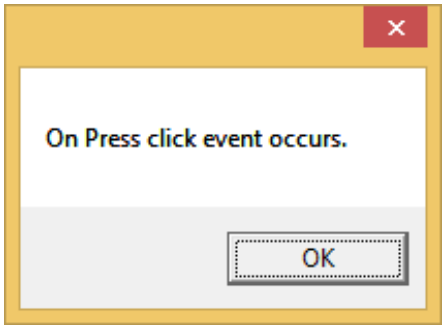
When you compile and execute the above code, it will produce the following screen:



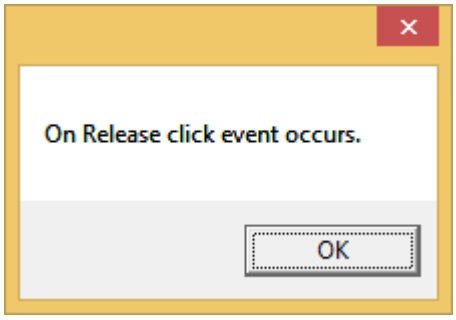
When the mouse enters in the region of the first button, it will display the following message:



When you press the second button, it will display the following message:



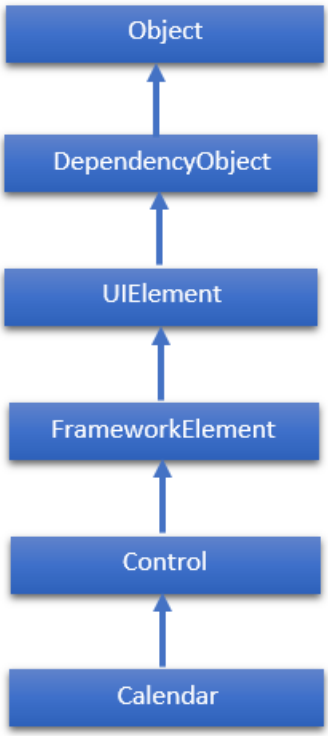
When you release the last button after a click, it will display the following message:



We recommend you to execute the above example code and experiment with some other properties and events.

Calendar

Calendar represents a control that enables a user to select a date by using a visual calendar display. It provides some basic navigation facilities using either the mouse or the keyboard. The hierarchical inheritance of Calendar class is as follows:



Given below are the most commonly used properties of Calendar class.

Sr. No.	Properties & Description
1	**BlackoutDates** Gets a collection of dates that are marked as not selectable.
2	**CalendarButtonStyle** Gets or sets the Style associated with the control's internal CalendarButton object.
3	**CalendarDayButtonStyle** Gets or sets the Style associated with the control's internal CalendarDayButton object.
4	**CalendarItemStyle** Gets or sets the Style associated with the control's internal CalendarItem object.
5	**DisplayDate** Gets or sets the date to display.
6	**DisplayDateEnd** Gets or sets the last date in the date range that is available in the calendar.
7	**DisplayDateStart** Gets or sets the first date that is available in the calendar.
8	**DisplayMode**

	Gets or sets a value that indicates whether the calendar displays a month, year, or decade.
9	**FirstDayOfWeek** Gets or sets the day that is considered the beginning of the week.
10	**IsTodayHighlighted** Gets or sets a value that indicates whether the current date is highlighted.
11	**SelectedDate** Gets or sets the currently selected date.
12	**SelectedDates** Gets a collection of selected dates.
13	**SelectionMode** Gets or sets a value that indicates what kind of selections are allowed.

Given below are the commonly used methods of Calendar class.

Sr. No.	Method & Description
1	**OnApplyTemplate** Builds the visual tree for the Calendar control when a new template is applied. (Overrides FrameworkElement.OnApplyTemplate())
2	**ToString** Provides a text representation of the selected date. (Overrides Control.ToString())

Given below are the commonly used events of Calendar class.

Sr. No.	Events & Description
1	**DisplayDateChanged** Occurs when the DisplayDate property is changed.
2	**DisplayModeChanged** Occurs when the DisplayMode property is changed.
3	**SelectedDatesChanged** Occurs when the collection returned by the SelectedDates property is changed.
4	**SelectionModeChanged** Occurs when the SelectionMode changes.

Example

The following example contains a Calendar control with selections and blackout dates. When you click on any date except the blackout dates, the program will update the title with that date.

Here is the XAML code in which a calendar is created with some properties and a click event.

```
<Window x:Class="XAMLCalendar.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
```

```
    <Grid>
        <StackPanel Orientation="Horizontal">
```

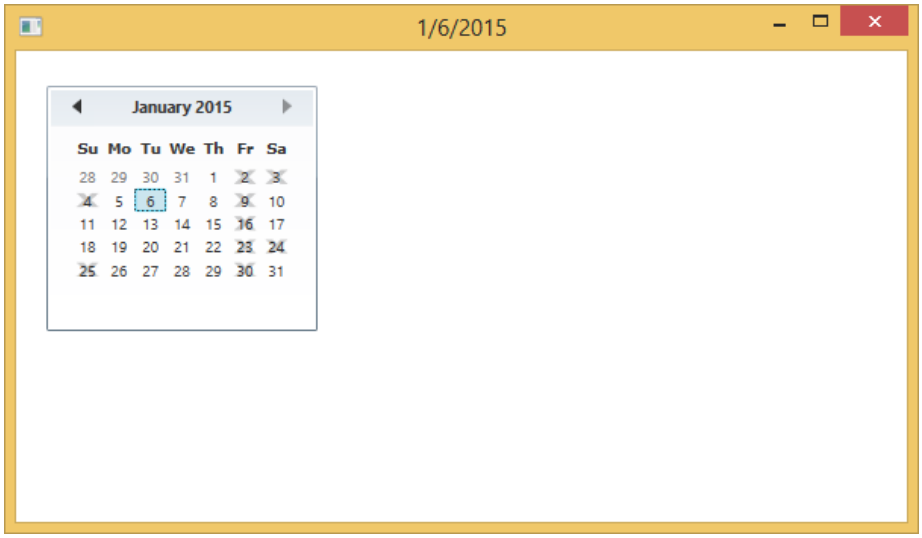
```
            <!-- Create a Calendar that displays dates through
       Januarary 31, 2015 and has dates that are not selectable. -->
            <Calendar Margin="20" SelectionMode="MultipleRange"
                      IsTodayHighlighted="false"
                      DisplayDate="1/1/2015"
                      DisplayDateEnd="1/31/2015"
                      SelectedDatesChanged="Calendar_SelectedDatesChanged"
                      xmlns:sys="clr-namespace:System;assembly=mscorlib">

                <Calendar.BlackoutDates>
                    <CalendarDateRange Start="1/2/2015" End="1/4/2015"/>
                    <CalendarDateRange Start="1/9/2015" End="1/9/2015"/>
                    <CalendarDateRange Start="1/16/2015" End="1/16/2015"/>
                    <CalendarDateRange Start="1/23/2015" End="1/25/2015"/>
                    <CalendarDateRange Start="1/30/2015" End="1/30/2015"/>
                </Calendar.BlackoutDates>

                <Calendar.SelectedDates>
                    <sys:DateTime>1/5/2015</sys:DateTime>
                    <sys:DateTime>1/12/2015</sys:DateTime>
                    <sys:DateTime>1/14/2015</sys:DateTime>
                    <sys:DateTime>1/13/2015</sys:DateTime>
                    <sys:DateTime>1/15/2015</sys:DateTime>
                    <sys:DateTime>1/27/2015</sys:DateTime>
                    <sys:DateTime>4/2/2015</sys:DateTime>
                </Calendar.SelectedDates>
            </Calendar>
        </StackPanel>
    </Grid>
</Window>
```

Here is the select event implementation in C#.

```
using System;
```

```
using System.Windows;
using System.Windows.Controls;
using System.Windows.Media;

namespace XAMLCalendar
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }

        private void Calendar_SelectedDatesChanged(object sender,
SelectionChangedEventArgs e)
        {
            var calendar = sender as Calendar;

             // ... See if a date is selected.
            if (calendar.SelectedDate.HasValue)
            {
                // ... Display SelectedDate in Title.
                DateTime date = calendar.SelectedDate.Value;
                this.Title = date.ToShortDateString();
            }
        }

    }
}
```

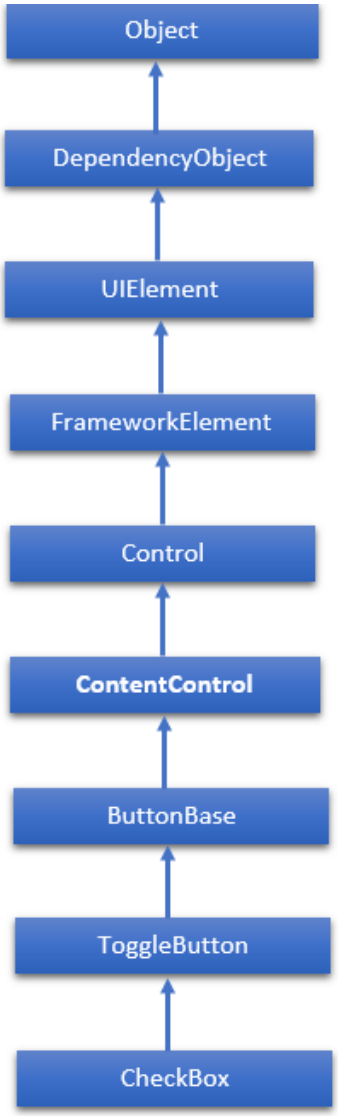
When you compile and execute the above code, it will display the following screen:



We recommend you to execute the above example code and experiment with some other properties and events.

CheckBox

A CheckBox is a control that a user can select (check) or clear (uncheck). It provides a list of options that a user can select, such as a list of settings to apply to an application. The hierarchical inheritance of Checkbox class is as follows:



Given below are the most commonly used properties of CheckBox.

Sr. No.	Property & Description
1	**Background** Gets or sets a brush that provides the background of the control. (Inherited from Control)
2	**BorderBrush** Gets or sets a brush that describes the border fill of a control. (Inherited from Control)
3	**BorderThickness** Gets or sets the border thickness of a control. (Inherited from Control)

4	**Content** Gets or sets the content of a ContentControl. (Inherited from ContentControl)
5	**ClickMode** Gets or sets a value that indicates when the Click event occurs, in terms of device behavior. (Inherited from ButtonBase)
6	**ContentTemplate** Gets or sets the data template that is used to display the content of the ContentControl. (Inherited from ContentControl)
7	**FontFamily** Gets or sets the font used to display text in the control. (Inherited from Control)
8	**FontSize** Gets or sets the size of the text in this control. (Inherited from Control)
9	**FontStyle** Gets or sets the style in which the text is rendered. (Inherited from Control)
10	**FontWeight** Gets or sets the thickness of the specified font. (Inherited from Control)
11	**Foreground** Gets or sets a brush that describes the foreground color. (Inherited from Control)
12	**Height** Gets or sets the suggested height of a FrameworkElement. (Inherited from FrameworkElement)
13	**HorizontalAlignment** Gets or sets the horizontal alignment characteristics that are applied to a FrameworkElement when it is composed in a layout parent, such as a panel or items control. (Inherited from FrameworkElement)
14	**IsChecked** Gets or sets whether the ToggleButton is checked. (Inherited from ToggleButton)
15	**IsEnabled** Gets or sets a value indicating whether the user can interact with the control. (Inherited from Control)
16	**IsPressed** Gets a value that indicates whether a ButtonBase is currently in a pressed state. (Inherited from ButtonBase)
17	**IsThreeState** Gets or sets a value that indicates whether the control supports three states. (Inherited from ToggleButton)
18	**Margin** Gets or sets the outer margin of a FrameworkElement. (Inherited from FrameworkElement)
19	**Name** Gets or sets the identifying name of the object. When a XAML processor creates the object tree from XAML markup, run-time code can refer to the XAML-declared object by this name. (Inherited from FrameworkElement)
20	**Opacity** Gets or sets the degree of the object's opacity. (Inherited from UIElement)
21	**Resources** Gets the locally defined resource dictionary. In XAML, you can establish resource items as child object elements of a frameworkElement.Resources property element, through XAML implicit collection syntax. (Inherited from FrameworkElement)
22	**Style**

	Gets or sets an instance Style that is applied for this object during layout and rendering. (Inherited from FrameworkElement)
23	**Template** Gets or sets a control template. The control template defines the visual appearance of a control in UI, and is defined in XAML markup. (Inherited from Control)
24	**VerticalAlignment** Gets or sets the vertical alignment characteristics that are applied to a FrameworkElement when it is composed in a parent object such as a panel or items control. (Inherited from FrameworkElement)
25	**Visibility** Gets or sets the visibility of a UIElement. A UIElement that is not visible is not rendered and does not communicate its desired size to layout. (Inherited from UIElement)
26	**Width** Gets or sets the width of a FrameworkElement. (Inherited from FrameworkElement)

Given below are the commonly used methods of CheckBox.

Sr. No.	Method & Description
1	**ClearValue** Clears the local value of a dependency property. (Inherited from DependencyObject)
2	**FindName** Retrieves an object that has the specified identifier name. (Inherited from FrameworkElement)
3	**OnApplyTemplate** Invoked whenever application code or internal processes (such as a rebuilding layout pass) call ApplyTemplate. In simplest terms, this means the method is called just before a UI element displays in your app. Override this method to influence the default post-template logic of a class. (Inherited from FrameworkElement)
4	**OnContentChanged** Invoked when the value of the Content property changes. (Inherited from ContentControl)
5	**OnDragEnter** Called before the DragEnter event occurs. (Inherited from Control)
6	**OnDragLeave** Called before the DragLeave event occurs. (Inherited from Control)
7	**OnDragOver** Called before the DragOver event occurs. (Inherited from Control)
8	**OnDrop** Called before the Drop event occurs. (Inherited from Control)
9	**OnGotFocus** Called before the GotFocus event occurs. (Inherited from Control)
10	**OnKeyDown** Called before the KeyDown event occurs. (Inherited from Control)
11	**OnKeyUp** Called before the KeyUp event occurs. (Inherited from Control)
12	**OnLostFocus** Called before the LostFocus event occurs. (Inherited from Control)
	OnToggle

13	Called when the ToggleButton receives toggle stimulus. (Inherited from ToggleButton)
14	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)

Given below are the commonly used events of CheckBox.

Sr. No.	Event & Description
1	**Checked** Fires when a ToggleButton is checked. (Inherited from ToggleButton)
2	**Click** Occurs when a button control is clicked. (Inherited from ButtonBase)
3	**DataContextChanged** Occurs when the value of the FrameworkElement.DataContext property changes. (Inherited from FrameworkElement)
4	**DragEnter** Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
5	**DragLeave** Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
6	**DragOver** Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)
7	**DragStarting** Occurs when a drag operation is initiated. (Inherited from UIElement)
8	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
9	**Holding** Occurs when an otherwise unhandled Hold interaction occurs over the hit test area of this element. (Inherited from UIElement)
10	**Intermediate** Fires when the state of a ToggleButton is switched to the indeterminate state. (Inherited from ToggleButton)
11	**IsEnabledChanged** Occurs when the IsEnabled property changes. (Inherited from Control)
12	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
13	**KeyUp** Occurs when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)
14	**LostFocus** Occurs when a UIElement loses focus. (Inherited from UIElement)
15	**SizeChanged** Occurs when either the ActualHeight or the ActualWidth property changes value on a FrameworkElement. (Inherited from FrameworkElement)
16	**Unchecked** Occurs when a ToggleButton is unchecked. (Inherited from ToggleButton)

Example

The following example contains two checkboxes. The first checkbox has two states checked or unchecked. The second checkbox has 3 states which are checked, unchecked, and intermediate state. Both checkboxes display a message based on Checked, Unchecked, and Intermediate events.

Here is the XAML code in which two checkboxes have been created with some properties and events.

```
<Window x:Class="XAMLCheckBox.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <StackPanel Orientation="Vertical" >
            <CheckBox x:Name="cb1"
                      Content="2 state CheckBox"
                      Checked="HandleCheck"
                      Unchecked="HandleUnchecked"
                      Margin="10" />
            <TextBlock x:Name="text1"
                       Margin="10" />

            <CheckBox x:Name="cb2"
                      Content="3 state CheckBox"
                      IsThreeState="True"
                      Indeterminate="HandleThirdState"
                      Checked="HandleCheck"
                      Unchecked="HandleUnchecked"
                      Margin="10" />
            <TextBlock x:Name="text2"
                       Margin="10" />
        </StackPanel>

    </Grid>
</Window>
```

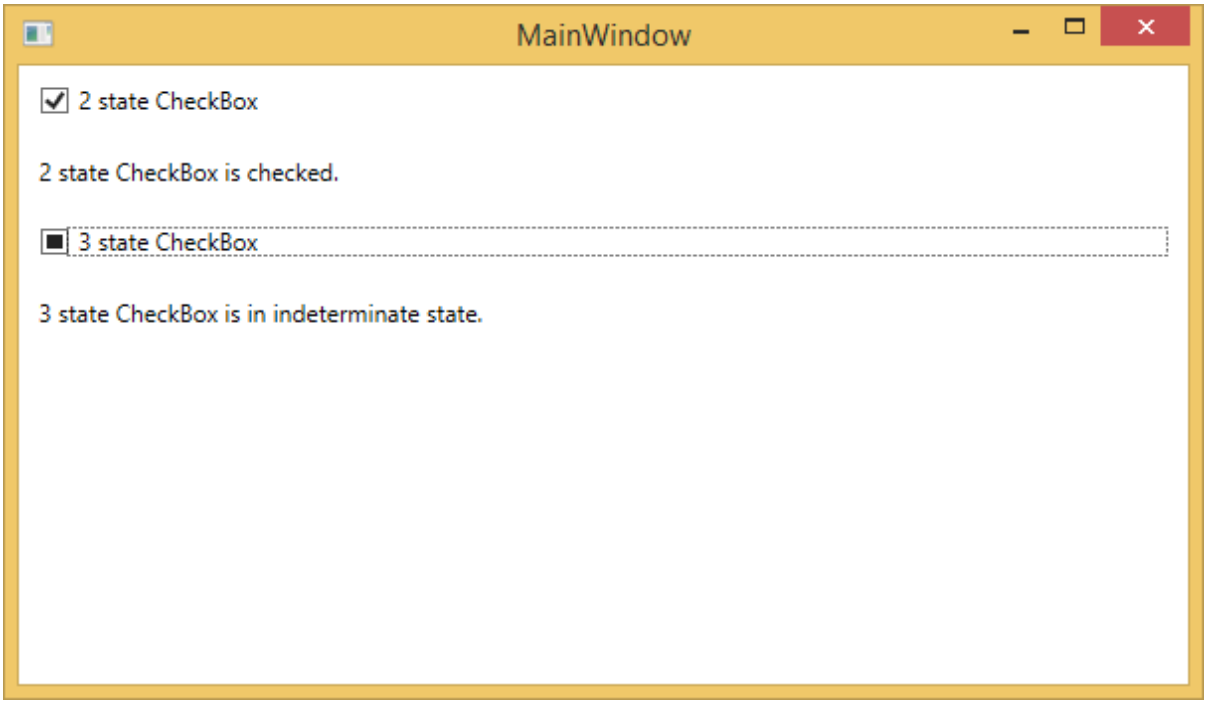
Here is the implementation in C# for different events:

```
using System;
```

```
using System.Windows;
using System.Windows.Controls;
using System.Windows.Media;

namespace XAMLCheckBox
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }

        private void HandleCheck(object sender, RoutedEventArgs e)
        {
            CheckBox cb = sender as CheckBox;
            if (cb.Name == "cb1") text1.Text = "2 state CheckBox is checked.";
            else text2.Text = "3 state CheckBox is checked.";
        }

        private void HandleUnchecked(object sender, RoutedEventArgs e)
        {
            CheckBox cb = sender as CheckBox;
            if (cb.Name == "cb1") text1.Text = "2 state CheckBox is unchecked.";
            else text2.Text = "3 state CheckBox is unchecked.";
        }

        private void HandleThirdState(object sender, RoutedEventArgs e)
        {
            CheckBox cb = sender as CheckBox;
            text2.Text = "3 state CheckBox is in indeterminate state.";
        }
    }
```

```
}
```

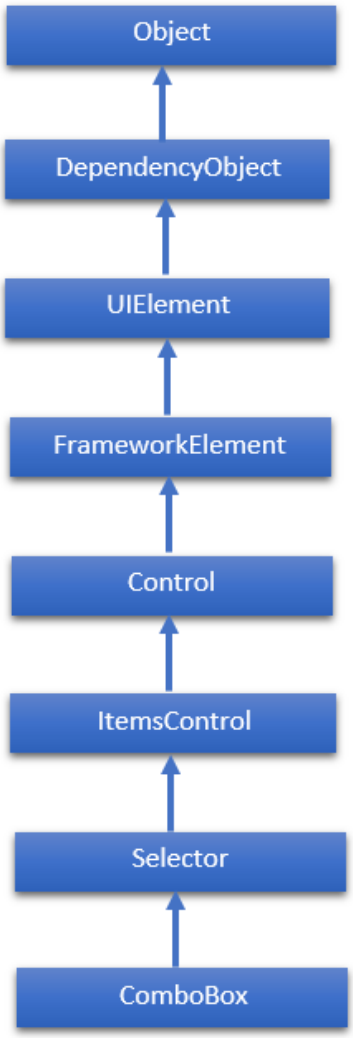
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

ComboBox

A ComboBox represents a selection control that combines a non-editable textbox and a drop-down list box that allows users to select an item from a list. It either displays the current selection or is empty if there is no selected item. The hierarchical inheritance of ComboBox class is as follows:



Given below are the most commonly used properties of ComboBox:

Sr. No.	Property & Description
1	**Background** Gets or sets a brush that provides the background of the control. (Inherited from Control)
2	**BorderThickness** Gets or sets the border thickness of a control. (Inherited from Control)
3	**FontFamily** Gets or sets the font used to display text in the control. (Inherited from Control)
4	**FontSize** Gets or sets the size of the text in this control. (Inherited from Control)
5	**FontStyle** Gets or sets the style in which the text is rendered. (Inherited from Control)
6	**FontWeight** Gets or sets the thickness of the specified font. (Inherited from Control)
7	**Foreground** Gets or sets a brush that describes the foreground color. (Inherited from Control)
8	**GroupStyle**

	Gets a collection of GroupStyle objects that define the appearance of each level of groups. (Inherited from ItemsControl)
9	**Header** Gets or sets the content for the control's header.
10	**Height** Gets or sets the suggested height of a FrameworkElement. (Inherited from FrameworkElement)
11	**HorizontalAlignment** Gets or sets the horizontal alignment characteristics that are applied to a FrameworkElement when it is composed in a layout parent, such as a panel or items control. (Inherited from FrameworkElement)
12	**IsDropDownOpen** Gets or sets a value that indicates whether the drop-down portion of the ComboBox is currently open.
13	**IsEditable** Gets a value that indicates whether the user can edit text in the text box portion of the ComboBox. This property always returns false.
14	**IsEnabled** Gets or sets a value indicating whether the user can interact with the control. (Inherited from Control)
15	**Margin** Gets or sets the outer margin of a FrameworkElement. (Inherited from FrameworkElement)
16	**Name** Gets or sets the identifying name of the object. When a XAML processor creates the object tree from XAML markup, run-time code can refer to the XAML-declared object by this name. (Inherited from FrameworkElement)
17	**Opacity** Gets or sets the degree of the object's opacity. (Inherited from UIElement)
18	**SelectedIndex** Gets or sets the index of the selected item. (Inherited from Selector)
19	**SelectedItem** Gets or sets the selected item. (Inherited from Selector)
20	**SelectedValue** Gets or sets the value of the selected item, obtained by using the SelectedValuePath. (Inherited from Selector)
21	**Style** Gets or sets an instance Style that is applied for this object during layout and rendering. (Inherited from FrameworkElement)
22	**VerticalAlignment** Gets or sets the vertical alignment characteristics that are applied to a FrameworkElement when it is composed in a parent object such as a panel or items control. (Inherited from FrameworkElement)
23	**Width** Gets or sets the width of a FrameworkElement. (Inherited from FrameworkElement)
24	**ItemsSource** Gets or sets an object source used to generate the content of the ItemsControl. (Inherited from ItemsControl)

Given below are the most commonly used methods of ComboBox:

Sr. No.	Method & Description

1	**Arrange** Positions child objects and determines a size for a UIElement. Parent objects that implement custom layout for their child elements should call this method from their layout override implementations to form a recursive layout update. (Inherited from UIElement)
2	**FindName** Retrieves an object that has the specified identifier name. (Inherited from FrameworkElement)
3	**Focus** Attempts to set the focus on the control. (Inherited from Control)
4	**GetValue** Returns the current effective value of a dependency property from a DependencyObject. (Inherited from DependencyObject)
5	**IndexFromContainer** Returns the index to the item that has the specified, generated container. (Inherited from ItemsControl)
6	**OnDragEnter** Called before the DragEnter event occurs. (Inherited from Control)
7	**OnDragLeave** Called before the DragLeave event occurs. (Inherited from Control)
8	**OnDragOver** Called before the DragOver event occurs. (Inherited from Control)
9	**OnDrop** Called before the Drop event occurs. (Inherited from Control)
10	**OnKeyDown** Called before the KeyDown event occurs. (Inherited from Control)
11	**OnKeyUp** Called before the KeyUp event occurs. (Inherited from Control)
12	**OnLostFocus** Called before the LostFocus event occurs. (Inherited from Control)
13	**ReadLocalValue** Returns the local value of a dependency property, if a local value is set. (Inherited from DependencyObject)
14	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)
15	**SetValue** Sets the local value of a dependency property on a DependencyObject. (Inherited from DependencyObject)

Given below are the most commonly used events of ComboBox.

Sr. No.	Event & Description
1	**DragEnter** Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
2	**DragLeave** Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
3	**DragOver** Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)
4	**DragStarting**

	Occurs when a drag operation is initiated. (Inherited from UIElement)
5	**Drop** Occurs when the input system reports an underlying drop event with this element as the drop target. (Inherited from UIElement)
6	**DropCompleted** Occurs when a drag-and-drop operation is ended. (Inherited from UIElement)
7	**DropDownClosed** Occurs when the drop-down portion of the ComboBox closes.
8	**DropDownOpened** Occurs when the drop-down portion of the ComboBox opens.
9	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
10	**IsEnabledChanged** Occurs when the IsEnabled property changes. (Inherited from Control)
11	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
12	**KeyUp** Occurs when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)
13	**LostFocus** Occurs when a UIElement loses focus. (Inherited from UIElement)
14	**SelectionChanged** Occurs when the currently selected item changes. (Inherited from Selector)
15	**SizeChanged** Occurs when either the ActualHeight or the ActualWidth property changes value on a FrameworkElement. (Inherited from FrameworkElement)

Example

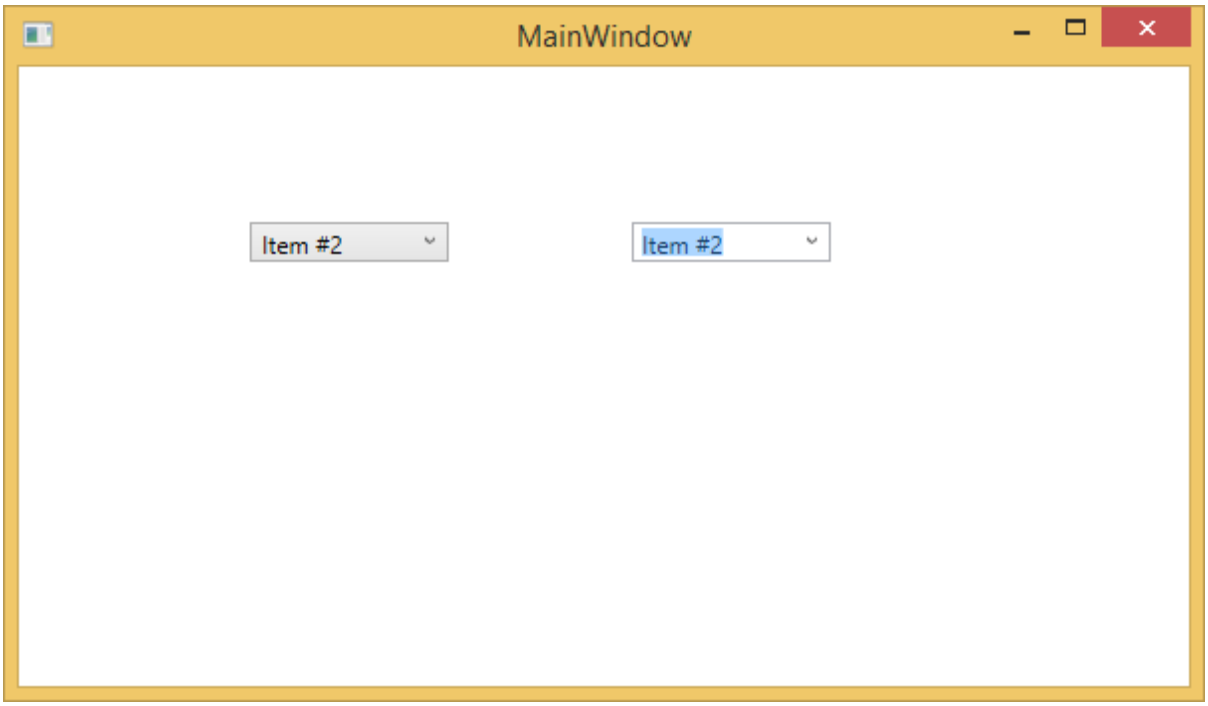
The following example contains two comboboxes. The first combobox is a simple one and the second one is editable.

Here is the XAML code in which two comboboxes have been created with some properties.

```
<Window x:Class="XAMLComboBox.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <ComboBox Height="20"
                  Width="100"
                  HorizontalAlignment="Left" Margin="116,77,0,212">
            <ComboBoxItem Content="Item #1"/>
            <ComboBoxItem Content="Item #2"/>
            <ComboBoxItem Content="Item #3"/>
        </ComboBox>
        <ComboBox IsEditable="True"
```

```
            Height="20"
            Width="100"
            HorizontalAlignment="Right" Margin="0,77,180,212">
            <ComboBoxItem Content="Item #1"/>
            <ComboBoxItem Content="Item #2"/>
            <ComboBoxItem Content="Item #3"/>
        </ComboBox>
    </Grid>
</Window>
```

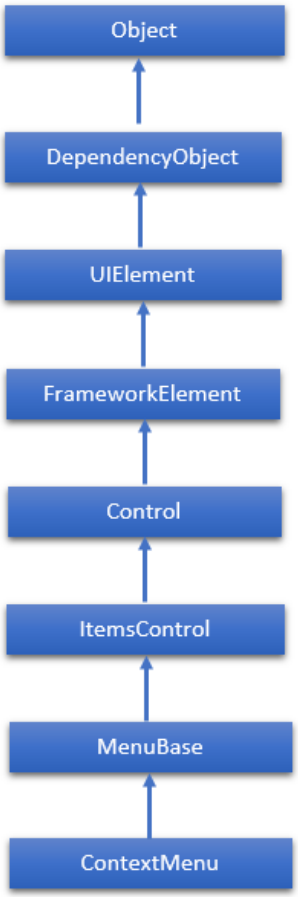
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

ContextMenu

A ContextMenu represents a pop-up menu that enables a control to expose a functionality that is specific to the context of a control. It appears whenever the context menu is requested through a user interface from within this element. The hierarchical inheritance of ContextMenu class is as follows:



Given below are the most commonly used properties of ContextMenu:

Sr. No.	Property & Description
1	**Background** Gets or sets a brush that provides the background of the control. (Inherited from Control)
2	**BorderThickness** Gets or sets the border thickness of a control. (Inherited from Control)
3	**ContextMenu** Gets or sets the context menu element that should appear whenever the context menu is requested through user interface (UI) from within this element. (Inherited from FrameworkElement.)
4	**FontFamily** Gets or sets the font used to display text in the control. (Inherited from Control)
5	**FontSize** Gets or sets the size of the text in this control. (Inherited from Control)
6	**FontStyle** Gets or sets the style in which the text is rendered. (Inherited from Control)
7	**FontWeight** Gets or sets the thickness of the specified font. (Inherited from Control)
8	**Foreground** Gets or sets a brush that describes the foreground color. (Inherited from Control)
9	**GroupStyle**

	Gets a collection of GroupStyle objects that define the appearance of each level of groups. (Inherited from ItemsControl)
10	**HasItems** Gets a value that indicates whether the ItemsControl contains items. (Inherited from ItemsControl.)
11	**Height** Gets or sets the suggested height of a FrameworkElement. (Inherited from FrameworkElement)
12	**HorizontalAlignment** Gets or sets the horizontal alignment characteristics that are applied to a FrameworkElement when it is composed in a layout parent, such as a panel or items control. (Inherited from FrameworkElement)
13	**IsFocused** Gets a value that determines whether this element has logical focus. This is a dependency property. (Inherited from UIElement.)
14	**IsOpen** Gets or sets a value that indicates whether the ContextMenu is visible.
15	**IsEnabled** Gets or sets a value indicating whether the user can interact with the control. (Inherited from Control)
16	**ItemsSource** Gets or sets an object source used to generate the content of the ItemsControl. (Inherited from ItemsControl)
17	**Margin** Gets or sets the outer margin of a FrameworkElement. (Inherited from FrameworkElement)
18	**Name** Gets or sets the identifying name of the object. When a XAML processor creates the object tree from XAML markup, run-time code can refer to the XAML-declared object by this name. (Inherited from FrameworkElement)
19	**Opacity** Gets or sets the degree of the object's opacity. (Inherited from UIElement)
20	**Style** Gets or sets an instance Style that is applied for this object during layout and rendering. (Inherited from FrameworkElement)
21	**VerticalAlignment** Gets or sets the vertical alignment characteristics that are applied to a FrameworkElement when it is composed in a parent object such as a panel or items control. (Inherited from FrameworkElement)
22	**Width** Gets or sets the width of a FrameworkElement. (Inherited from FrameworkElement)

Given below are the most commonly used methods of ContextMenu.

Sr. No.	Method & Description
1	**AddChild** Adds the specified object as the child of the ItemsControl object. (Inherited from ItemsControl.)
2	**Arrange** Positions child objects and determines a size for a UIElement. Parent objects that implement custom layout for their child elements should call this method from their layout override implementations to form a recursive layout update. (Inherited from UIElement)

3	**FindName** Retrieves an object that has the specified identifier name. (Inherited from FrameworkElement)
4	**Focus** Attempts to set the focus on the control. (Inherited from Control)
5	**GetValue** Returns the current effective value of a dependency property from a DependencyObject. (Inherited from DependencyObject)
6	**IsItemItsOwnContainer** Determines if the specified item is (or is eligible to be) its own container. (Inherited from ItemsControl.)
7	**OnDragEnter** Called before the DragEnter event occurs. (Inherited from Control)
8	**OnDragLeave** Called before the DragLeave event occurs. (Inherited from Control)
9	**OnDragOver** Called before the DragOver event occurs. (Inherited from Control)
10	**OnDrop** Called before the Drop event occurs. (Inherited from Control)
11	**OnContextMenuOpening** Invoked whenever an unhandled ContextMenuClosing routed event reaches this class in its route. Implement this method to add class handling for this event. (Inherited from FrameworkElement.)
12	**OnItemsChanged** Invoked when the Items property changes. (Inherited from ItemsControl.)
13	**OnLostFocus** Called before the LostFocus event occurs. (Inherited from Control)
14	**ReadLocalValue** Returns the local value of a dependency property, if a local value is set. (Inherited from DependencyObject)
15	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)
16	**SetValue** Sets the local value of a dependency property on a DependencyObject. (Inherited from DependencyObject)

Given below are the most commonly used events of ContextMenu.

Sr. No.	**Event & Description**
1	**Closed** Occurs when a particular instance of a ContextMenu closes.
2	**ContextMenuClosing** Occurs just before any context menu on the element is closed. (Inherited from FrameworkElement.)
3	**ContextMenuOpening** Occurs when any context menu on the element is opened. (Inherited from FrameworkElement.)
4	**DataContextChanged** Occurs when the data context for this element changes. (Inherited from FrameworkElement.)
5	**DragEnter**

	Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
6	**DragLeave** Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
7	**DragOver** Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)
8	**Drop** Occurs when the input system reports an underlying drop event with this element as the drop target. (Inherited from UIElement)
9	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
10	**IsEnabledChanged** Occurs when the IsEnabled property changes. (Inherited from Control)
11	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
12	**KeyUp** Occurs when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)
13	**LostFocus** Occurs when a UIElement loses focus. (Inherited from UIElement)

Example

The following example contains a textbox with a ContextMenu which manipulates the text inside the textbox.

Here is the XAML code in which a TextBox, a ContextMenu, and MenuItems have been created with some properties and events.

```
<Window x:Class="XAMLContextMenu.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
<TextBox Name="textBox1" TextWrapping="Wrap" Margin="10" Grid.Row="7">
            Hi, this is XAML tutorial.
            <TextBox.ContextMenu>
                <ContextMenu>
                    <MenuItem Header="_Bold" IsCheckable="True"
                           Checked="Bold_Checked" Unchecked="Bold_Unchecked" />
                    <MenuItem Header="_Italic" IsCheckable="True"
                           Checked="Italic_Checked"
                           Unchecked="Italic_Unchecked" />
                    <Separator />
```

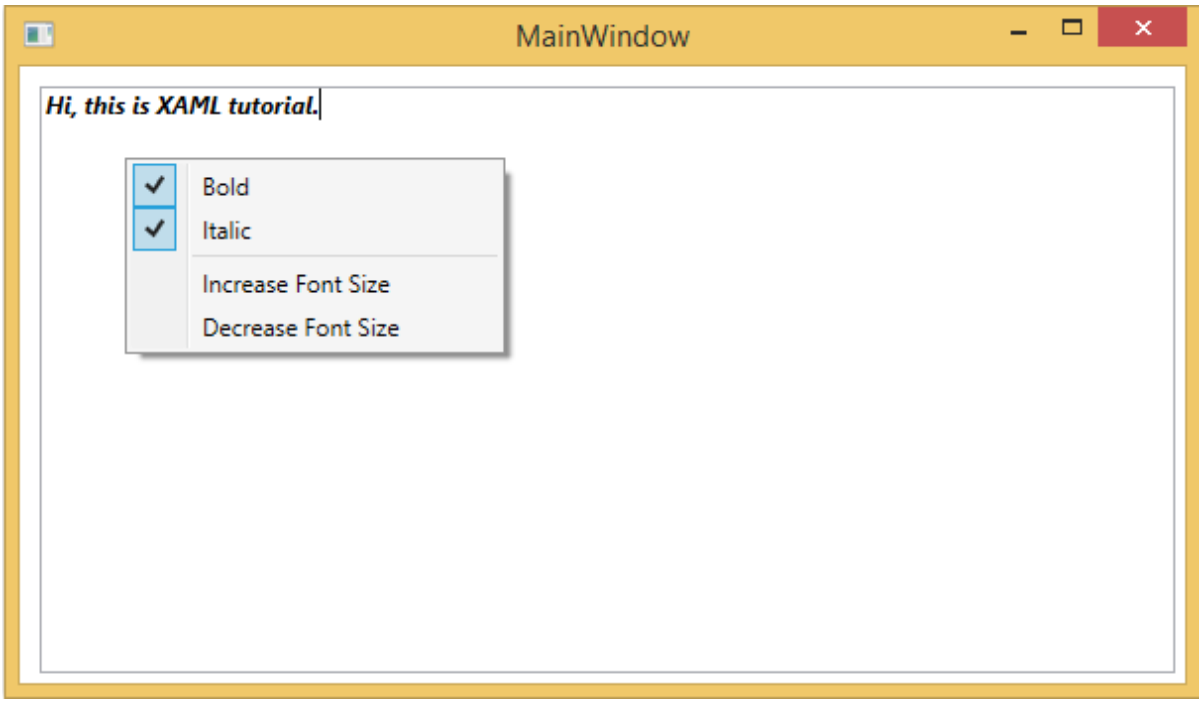
```
                    <MenuItem Header="Increase Font Size"
                              Click="IncreaseFont_Click" />
                    <MenuItem Header="_Decrease Font Size"
                         Click="DecreaseFont_Click" />
                </ContextMenu>
            </TextBox.ContextMenu>
        </TextBox>
    </Grid>
</Window>
```

Here is the implementation in C# for different events.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows;
using System.Windows.Controls;
using System.Windows.Data;

namespace XAMLContextMenu
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }
        private void Bold_Checked(object sender, RoutedEventArgs e)
        {
            textBox1.FontWeight = FontWeights.Bold;
        }
```

```
        private void Bold_Unchecked(object sender, RoutedEventArgs e)
        {
            textBox1.FontWeight = FontWeights.Normal;
        }

        private void Italic_Checked(object sender, RoutedEventArgs e)
        {
            textBox1.FontStyle = FontStyles.Italic;
        }

        private void Italic_Unchecked(object sender, RoutedEventArgs e)
        {
            textBox1.FontStyle = FontStyles.Normal;
        }

        private void IncreaseFont_Click(object sender, RoutedEventArgs e)
        {
            if (textBox1.FontSize < 18)
            {
                textBox1.FontSize += 2;
            }
        }

        private void DecreaseFont_Click(object sender, RoutedEventArgs e)
        {
            if (textBox1.FontSize > 10)
            {
                textBox1.FontSize -= 2;
            }
        }
    }
}
```

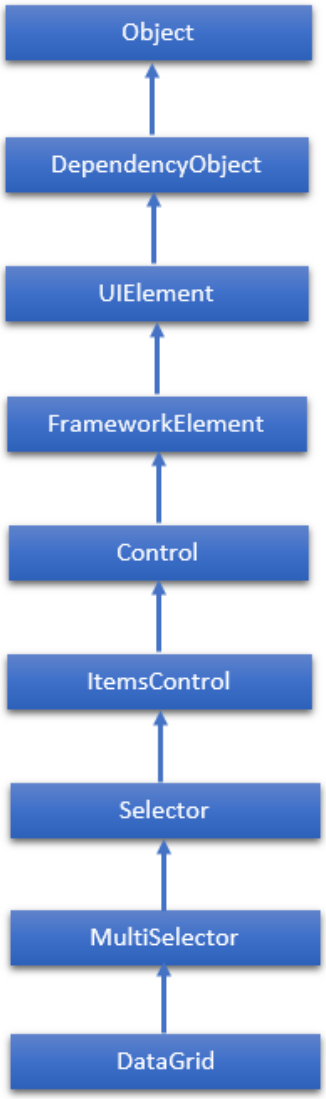
When you compile and execute the above code, it will produce the following screen:



We recommend you to execute the above example code and experiment with some other properties and events.

DataGrid

A DataGrid represents a control that displays data in a customizable grid. It provides a flexible way to display a collection of data in rows and columns. The hierarchical inheritance of DataGrid class is as follows:



Given below are the commonly used properties of DataGrid:

Sr. No.	Properties & Description
1	**AlternatingRowBackground** Gets or sets the background brush for use on alternating rows.
2	**AreRowDetailsFrozen** Gets or sets a value that indicates whether the row details can scroll horizontally.
3	**AutoGenerateColumns** Gets or sets a value that indicates whether the columns are created automatically.
4	**CanUserAddRows** Gets or sets a value that indicates whether the user can add new rows to the DataGrid.
5	**CanUserDeleteRows** Gets or sets a value that indicates whether the user can delete rows from the DataGrid.
6	**CanUserReorderColumns**

	Gets or sets a value that indicates whether the user can change the column display order by dragging column headers with the mouse.
7	**CanUserResizeColumns** Gets or sets a value that indicates whether the user can adjust the width of columns by using the mouse.
8	**CanUserResizeRows** Gets or sets a value that indicates whether the user can adjust the height of rows by using the mouse.
9	**CanUserSortColumns** Gets or sets a value that indicates whether the user can sort columns by clicking the column header.
10	**ColumnHeaderHeight** Gets or sets the height of the column headers row.
11	**ColumnHeaderStyle** Gets or sets the style applied to all column headers in the DataGrid.
12	**Columns** Gets a collection that contains all the columns in the DataGrid.
13	**ColumnWidth** Gets or sets the standard width and sizing mode of columns and headers in the DataGrid.
14	**CurrentCell** Gets or sets the cell that has focus.
15	**CurrentColumn** Gets or sets the column that contains the current cell.
16	**CurrentItem** Gets the data item bound to the row that contains the current cell.
17	**FrozenColumnCount** Gets or sets the number of non-scrolling columns.
18	**HorizontalScrollBarVisibility** Gets or sets a value that indicates how horizontal scroll bars are displayed in the DataGrid.
19	**IsReadOnly** Gets or sets a value that indicates whether the user can edit values in the DataGrid.
20	**RowBackground** Gets or sets the default brush for the row background.
21	**RowHeight** Gets or sets the suggested height for all rows.
22	**SelectedCells** Gets the list of cells that are currently selected.

Given below are the commonly used methods of DataGrid:

Sr. No.	Methods & Description
1	**BeginEdit** Invokes the BeginEdit command, which will place the current cell or row into edit mode.
2	**CancelEdit** Invokes the CancelEditCommand command for the cell or row currently in edit mode.
3	**ClearDetailsVisibilityForItem** Clears the DetailsVisibility property for the DataGridRow that represents the specified data item.

4	**ColumnFromDisplayIndex** Gets the DataGridColumn at the specified index.
5	**CommitEdit** Invokes the CommitEditCommand command for the cell or row currently in edit mode.
6	**GenerateColumns** Generates columns for the specified properties of an object.
7	**GetDetailsVisibilityForItem** Gets the DetailsVisibility property for the DataGridRow that represents the specified data item.
8	**OnApplyTemplate** When overridden in a derived class, is invoked whenever application code or internal processes call ApplyTemplate. (Overrides FrameworkElement.OnApplyTemplate())
9	**ScrollIntoView** Scrolls the DataGrid vertically to display the row for the specified data item.
10	**SelectAllCells** Selects all the cells in the DataGrid.
11	**SetDetailsVisibilityForItem** Sets the value of the DetailsVisibility property for the DataGridRow that contains the specified object.
12	**UnselectAllCells** Unselects all the cells in the DataGrid.

Given below are the most commonly used events of DataGrid.

Sr. No.	Events & Description
1	**AddingNewItem** Occurs before a new item is added to the DataGrid.
2	**AutoGeneratedColumns** Occurs when auto generation of all columns is completed.
3	**AutoGeneratingColumn** Occurs when an individual column is auto-generated.
4	**BeginningEdit** Occurs before a row or cell enters edit mode.
5	**CellEditEnding** Occurs before a cell edit is committed or canceled.
6	**ColumnDisplayIndexChanged** Occurs when the DisplayIndex property on one of the columns changes.
7	**ColumnHeaderDragCompleted** Occurs when the user releases a column header after dragging it by using the mouse.
8	**ColumnHeaderDragDelta** Occurs every time the mouse position changes while the user drags a column header.
9	**ColumnHeaderDragStarted** Occurs when the user begins dragging a column header by using the mouse.
10	**ColumnReordered** Occurs when a column moves to a new position in the display order.
11	**ColumnReordering** Occurs before a column moves to a new position in the display order.
12	**CopyingRowClipboardContent** Occurs after the default row content is prepared.

13	**CurrentCellChanged** Occurs when the value of the CurrentCell property has changed.
14	**InitializingNewItem** Occurs when a new item is created.
15	**LoadingRow** Occurs after a DataGridRow is instantiated, so that you can customize it before it is used.
16	**LoadingRowDetails** Occurs when a new row details template is applied to a row.
17	**PreparingCellForEdit** Occurs when a cell enters edit mode.
18	**RowDetailsVisibilityChanged** Occurs when the visibility of a row details element changes.
19	**RowEditEnding** Occurs before a row edit is committed or canceled.
20	**SelectedCellsChanged** Occurs when the SelectedCells collection changes.
21	**Sorting** Occurs when a column is being sorted.
22	**UnloadingRow** Occurs when a DataGridRow object becomes available for reuse.
23	**UnloadingRowDetails** Occurs when a row details element becomes available for reuse.

Example

The following example shows how to display data in a DataGrid. Here is the XAML code to create two checkboxes with some properties and events.

```
<Window x:Class="DataGrid.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:core="clr-namespace:System;assembly=mscorlib"
        xmlns:local="clr-namespace:DataGrid"
        Title="MainWindow" Height="350" Width="525">
    <Window.Resources>
        <ObjectDataProvider x:Key="myEnum"
                            MethodName="GetValues"
                            ObjectType="{x:Type core:Enum}">
            <ObjectDataProvider.MethodParameters>
                <x:TypeExtension Type="local:Party" />
            </ObjectDataProvider.MethodParameters>
        </ObjectDataProvider>
    </Window.Resources>
    <Grid>
        <DataGrid Name="dataGrid"
```

```
                  AlternatingRowBackground="LightBlue"
                  AlternationCount="2"
                  AutoGenerateColumns="False">
            <DataGrid.Columns>
                <DataGridTextColumn Header="Name"
                                    Binding="{Binding Name}" />
                <DataGridTextColumn Header="Title"
                                    Binding="{Binding Title}" />
                <DataGridCheckBoxColumn Header="ReElected?"
                                        Binding="{Binding WasReElected}"/>
                <DataGridComboBoxColumn Header="Party"
                                        SelectedItemBinding="{Binding Affiliation}"
                                        ItemsSource="{Binding
Source={StaticResource myEnum}}" />
            </DataGrid.Columns>
        </DataGrid>
    </Grid>
</Window>
```

Here is the implementation in C# for two different classes.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows;
using System.Windows.Controls;
using System.Windows.Data;
using System.Windows.Documents;
using System.Windows.Input;
using System.Windows.Media;
using System.Windows.Media.Imaging;
using System.Windows.Navigation;
using System.Windows.Shapes;

namespace DataGrid
```

```
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
            dataGrid.ItemsSource = Employee.GetEmployees();
        }
    }
    public enum Party
    {
        Indepentent,
        Federalist,
        DemocratRepublican,
    }
}
```

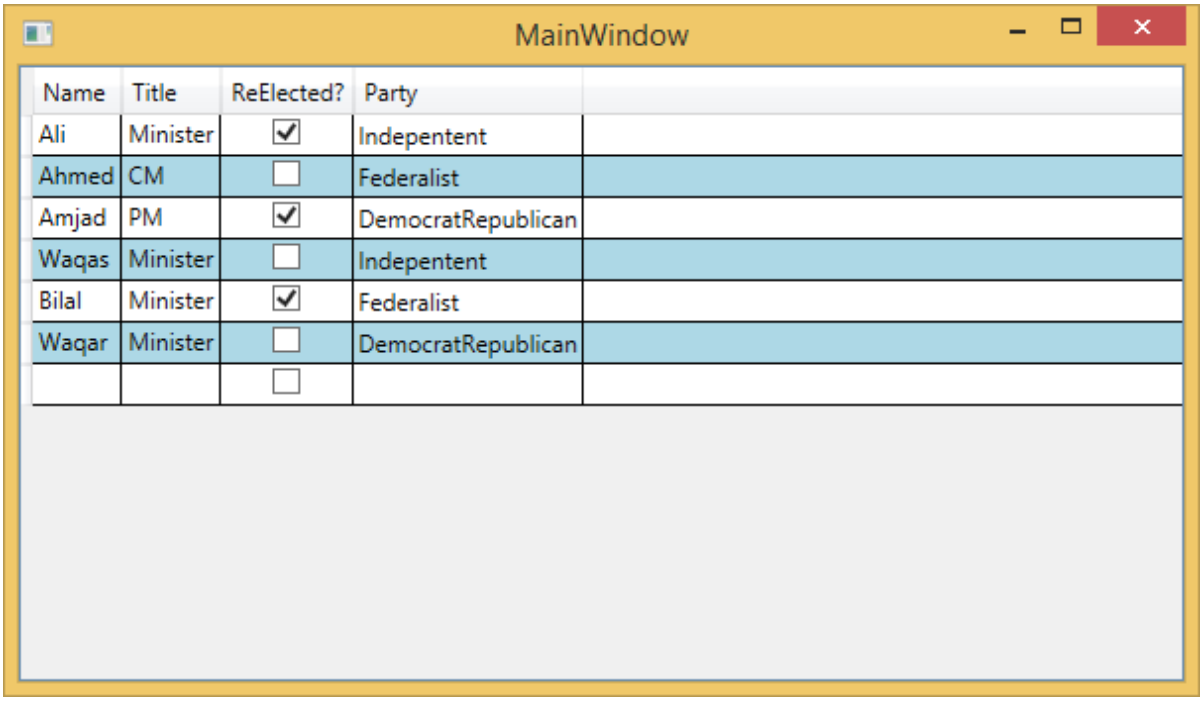
Here is another Employee class implementation in C#.

```
public class Employee : INotifyPropertyChanged
    {
        private string name;
        public string Name
        {
            get { return name; }
            set
            {
                name = value;
                RaiseProperChanged();
            }
        }
        private string title;
        public string Title
        {
```

```
            get { return title; }
            set
            {
                title = value;
                RaiseProperChanged();
            }
        }

        private bool wasReElected;
        public bool WasReElected
        {
            get { return wasReElected; }
            set
            {
                wasReElected = value;
                RaiseProperChanged();
            }
        }

        private Party affiliation;
        public Party Affiliation
        {
            get { return affiliation; }
            set
            {
                affiliation = value;
                RaiseProperChanged();
            }
        }

        public static ObservableCollection<Employee> GetEmployees()
        {
            var employees = new ObservableCollection<Employee>();
            employees.Add(new Employee() { Name = "Ali", Title = "Minister",
WasReElected = true, Affiliation = Party.Indepentent });
            employees.Add(new Employee() { Name = "Ahmed", Title = "CM",
WasReElected = false, Affiliation = Party.Federalist });
```

```
            employees.Add(new Employee() { Name = "Amjad", Title = "PM",
WasReElected = true, Affiliation = Party.DemocratRepublican });

            employees.Add(new Employee() { Name = "Waqas", Title = "Minister",
WasReElected = false, Affiliation = Party.Independent });

            employees.Add(new Employee() { Name = "Bilal", Title = "Minister",
WasReElected = true, Affiliation = Party.Federalist });

            employees.Add(new Employee() { Name = "Waqar", Title = "Minister",
WasReElected = false, Affiliation = Party.DemocratRepublican });

            return employees;

        }


        public event PropertyChangedEventHandler PropertyChanged;

        private void RaiseProperChanged(

            [CallerMemberName] string caller = "")

        {

            if (PropertyChanged != null)

            {

                PropertyChanged(this, new PropertyChangedEventArgs(caller));

            }

        }

    }
```

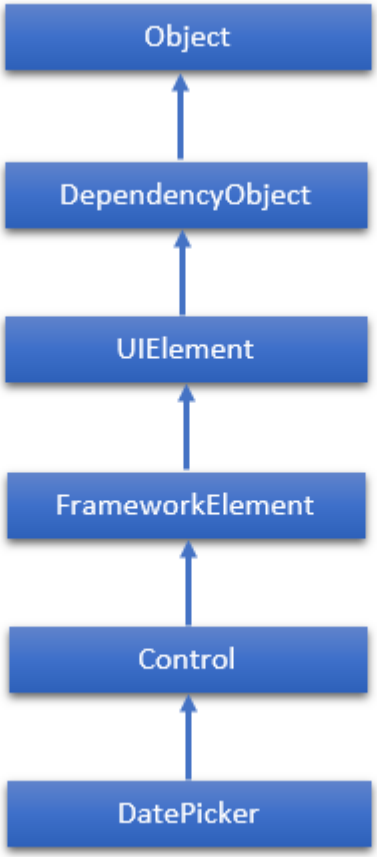
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

DatePicker

A DatePicker represents a control that allows a user to pick a date value. The user picks the date by using ComboBox selection for month, day, and year values. The hierarchical inheritance of DatePicker class is as follows:



Given below are some of the most commonly used properties of DatePicker:

Sr. No.	Property & Description
1	**CalendarIdentifier** Gets or sets the calendar system to use.
2	**CalendarIdentifierProperty** Gets the identifier for the CalendarIdentifier dependency property.
3	**Date** Gets or sets the date currently set in the date picker.
4	**DateProperty** Gets the identifier for the Date dependency property.
5	**DayFormat** Gets or sets the display format for the day value.
6	**DayFormatProperty** Gets the identifier for the DayFormat dependency property.
7	**DayVisible** Gets or sets a value that indicates whether the day selector is shown.

8	**DayVisibleProperty** Gets the identifier for the DayVisible dependency property.
9	**Header** Gets or sets the content for the control's header.
10	**HeaderProperty** Identifies the Header dependency property.
11	**HeaderTemplate** Gets or sets the DataTemplate used to display the content of the control's header.
12	**HeaderTemplateProperty** Identifies the HeaderTemplate dependency property.
13	**MaxYear** Gets or sets the maximum Gregorian year available for picking.
14	**MaxYearProperty** Gets the identifier for the MaxYear dependency property.
15	**MinYear** Gets or sets the minimum Gregorian year available for picking.
16	**MinYearProperty** Gets the identifier for the MinYear dependency property.
17	**MonthFormat** Gets or sets the display format for the month value.
18	**MonthFormatProperty** Gets the identifier for the MonthFormat dependency property.
19	**MonthVisible** Gets or sets a value that indicates whether the month selector is shown.
20	**MonthVisibleProperty** Gets the identifier for the MonthVisible dependency property.
21	**Orientation** Gets or sets a value that indicates whether the day, month, and year selectors are stacked horizontally or vertically.
22	**OrientationProperty** Gets the identifier for the Orientation dependency property.
23	**YearFormat** Gets or sets the display format for the year value.
24	**YearFormatProperty** Gets the identifier for the YearFormat dependency property.
25	**YearVisible** Gets or sets a value that indicates whether the year selector is shown.
26	**YearVisibleProperty** Gets the identifier for the YearVisible dependency property.

Events in DatePicker class:

Sr. No.	Event & Description
1	**DateChanged** Occurs when the date value is changed.
2	**DragEnter** Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
3	**DragLeave** Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
4	**DragOver**

	Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)
5	**DragStarting** Occurs when a drag operation is initiated. (Inherited from UIElement)
6	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
7	**Holding** Occurs when an otherwise unhandled Hold interaction occurs over the hit test area of this element. (Inherited from UIElement)
8	**IsEnabledChanged** Occurs when the IsEnabled property changes. (Inherited from Control)
9	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
10	**KeyUp** Occurs when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)
11	**LostFocus** Occurs when a UIElement loses focus. (Inherited from UIElement)

Given below are the most commonly used methods in DatePicker class.

Sr. No.	Method & Description
1	**ClearValue** Clears the local value of a dependency property. (Inherited from DependencyObject)
2	**FindName** Retrieves an object that has the specified identifier name. (Inherited from FrameworkElement)
3	**OnApplyTemplate** Invoked whenever application code or internal processes (such as a rebuilding layout pass) call ApplyTemplate. In simplest terms, this means the method is called just before a UI element displays in your app. Override this method to influence the default post-template logic of a class. (Inherited from FrameworkElement)
4	**OnDragEnter** Called before the DragEnter event occurs. (Inherited from Control)
5	**OnDragLeave** Called before the DragLeave event occurs. (Inherited from Control)
6	**OnDragOver** Called before the DragOver event occurs. (Inherited from Control)
7	**OnDrop** Called before the Drop event occurs. (Inherited from Control)
8	**OnGotFocus** Called before the GotFocus event occurs. (Inherited from Control)
9	**OnKeyDown** Called before the KeyDown event occurs. (Inherited from Control)
10	**OnKeyUp** Called before the KeyUp event occurs. (Inherited from Control)
11	**OnLostFocus** Called before the LostFocus event occurs. (Inherited from Control)
12	**SetBinding**

	Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)

Example

The following example shows how to create a DatePicker control. When you click on any date from the DatePicker control, the program will update the title with that date.

Here is the XAML code to create a DatePicker with some properties and a click event.

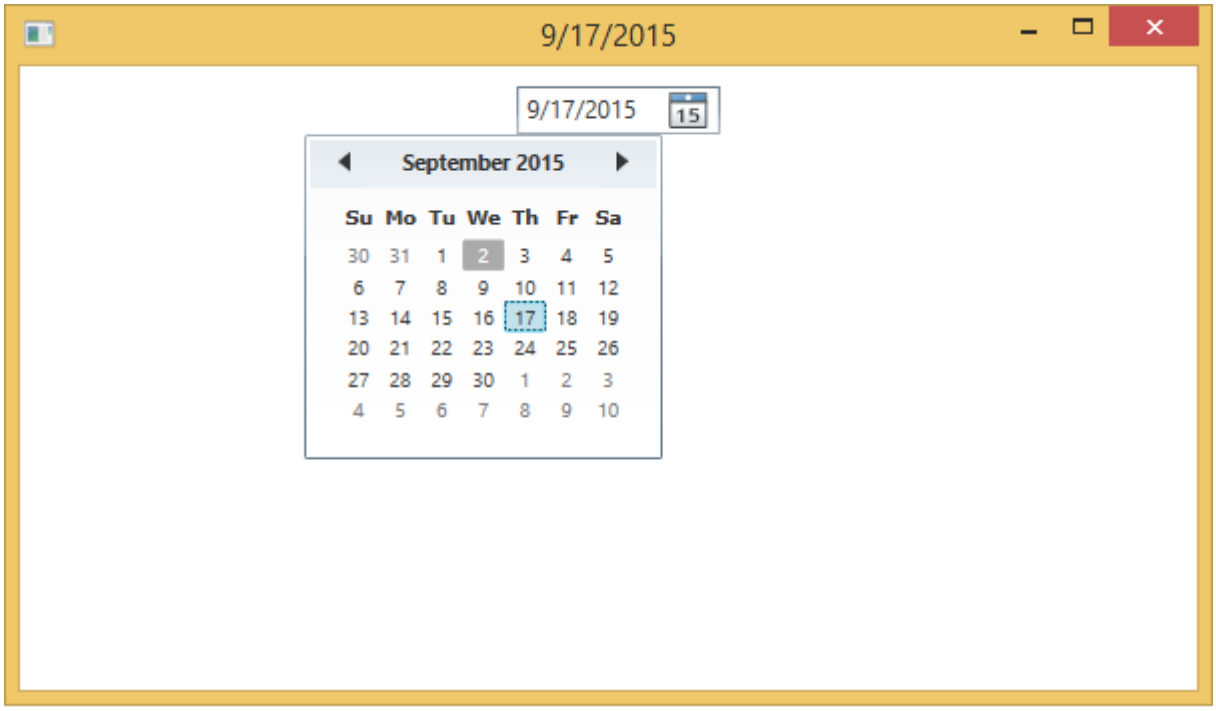
```
<Window x:Class="XAMLDatePicker.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <DatePicker HorizontalAlignment="Center"
                Margin="10,10,0,0"
                VerticalAlignment="Top"
                SelectedDateChanged="DatePicker_SelectedDateChanged"/>
    </Grid>
</Window>
```

Given below is the C# implementation for **DatePicker_SelectedDateChanged** event.

```
using System;
using System.Windows;
using System.Windows.Controls;

namespace XAMLDatePicker
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }
        private void DatePicker_SelectedDateChanged(object sender,
SelectionChangedEventArgs e)
```

```
        {
            var picker = sender as DatePicker;

            DateTime? date = picker.SelectedDate;
            if (date == null)
            {
                this.Title = "No date";
            }
            else
            {
                this.Title = date.Value.ToShortDateString();
            }
        }

    }

}
```

When you compile and execute the above code, it will display the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

Dialog Box

All standalone applications have a main window that exposes some functionality and displays some data over which the application operates through its GUI. An application may also display additional windows to do the following:

- To display some specific information to users.
- To gather useful information from users.
- To both display and gather important information.

Example

Let's have a look at the following example. On the main window, there is a button and a textbox. When the user clicks this button, it opens another dialog box with Yes, No, and Cancel buttons and displays a message on it that prompts the user to click a button.

When the user clicks a button, then the current dialog box gets closed and shows a textbox with the information "which button has been clicked".

Here is the XAML code to create and initialize a button and a textbox with some properties:

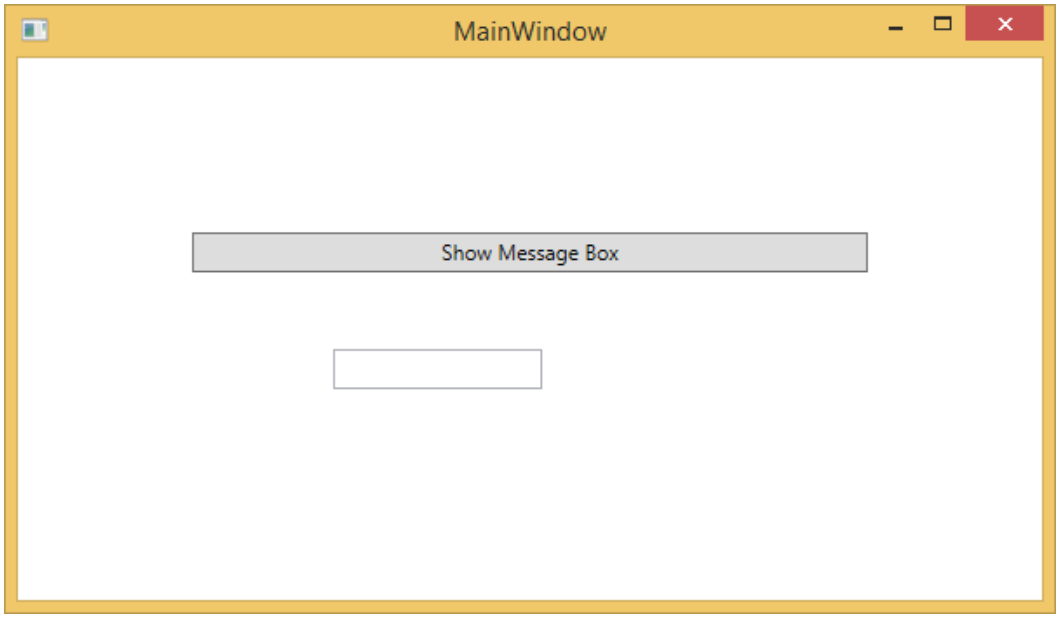
```
<Window x:Class="XAMLDialog.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <Button Height="23"
                Margin="100"
                Name="ShowMessageBox"
                VerticalAlignment="Top"
                Click="ShowMessageBox_Click">Show Message Box</Button>
        <TextBox Height="23"
                 HorizontalAlignment="Left"
                 Margin="181,167,0,0"
                 Name="textBox1"
                 VerticalAlignment="Top"
                 Width="120" />
    </Grid>
</Window>
```

Given below is the C# code to implement a button click event.

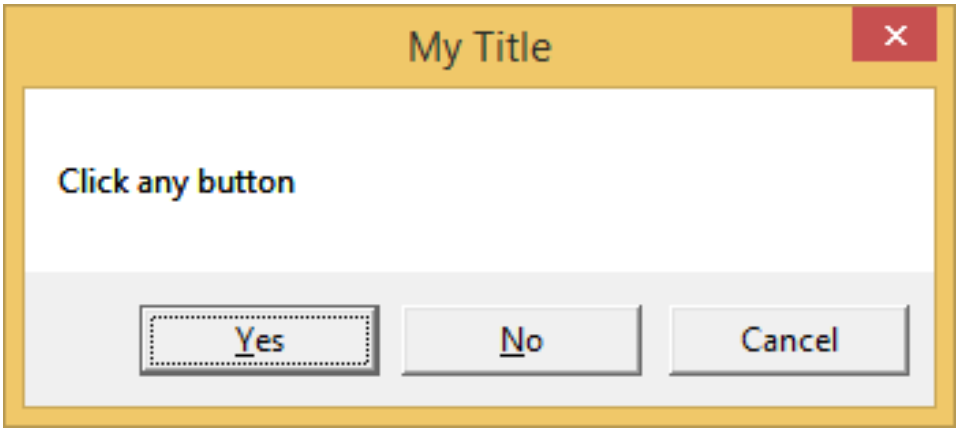
```
using System;
```

```
using System.Windows;
using System.Windows.Controls;

namespace XAMLDialog
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }
        private void ShowMessageBox_Click(object sender, RoutedEventArgs e)
        {
            string msgtext = "Click any button";
            string txt = "My Title";
            MessageBoxButton button = MessageBoxButton.YesNoCancel;
            MessageBoxResult result = MessageBox.Show(msgtext, txt, button);
            switch (result)
            {
                case MessageBoxResult.Yes:
                    textBox1.Text = "Yes";
                    break;
                case MessageBoxResult.No:
                    textBox1.Text = "No";
                    break;
                case MessageBoxResult.Cancel:
                    textBox1.Text = "Cancel";
                    break;
            }

        }
    }
}
```

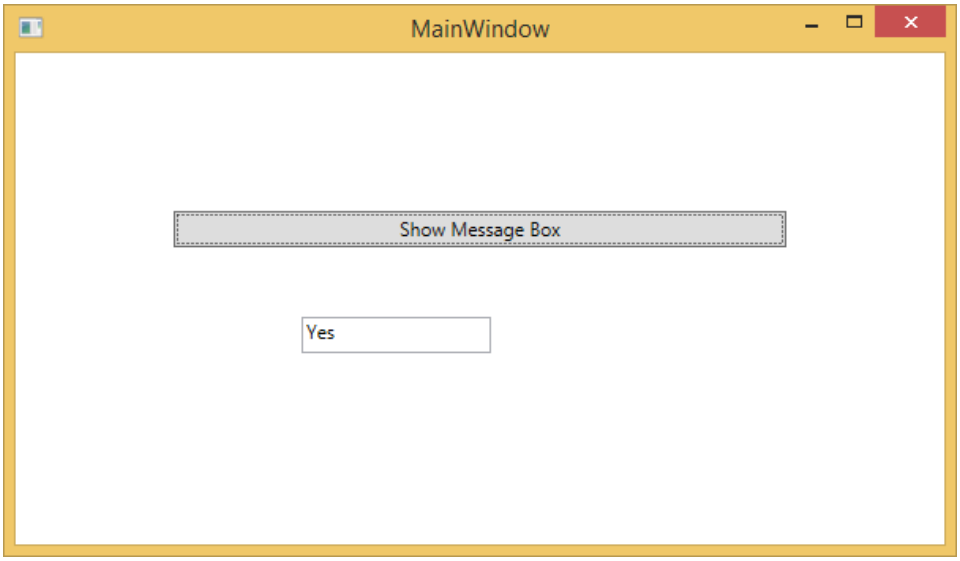
When you compile and execute the above code, it will produce the following output:



When you click on the button, it displays another dialog box as shown below that prompts the user to click a button. Now, click the Yes button.

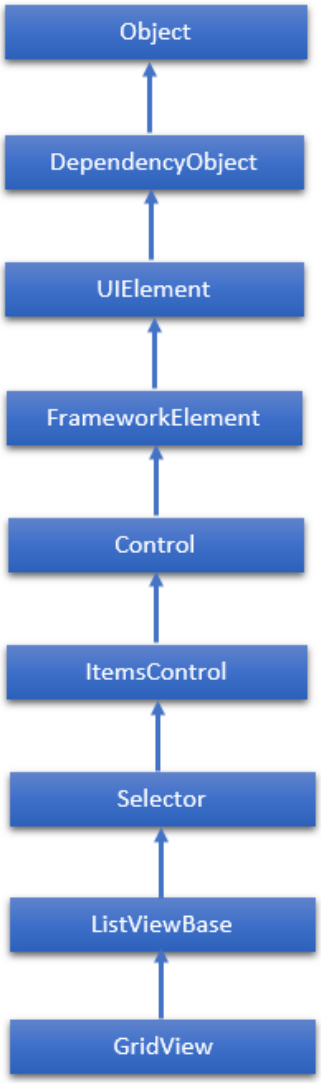


It updates the textbox with the button content.



GridView

A GridView represents a control that displays data items in rows and columns. Actually, a ListView displays data. By default, it contains a GridView. The hierarchical inheritance of GridView class is as follows:



Given below are the commonly used properties of GridView.

Sr. No.	Property & Description
1	**Background** Gets or sets a brush that provides the background of the control. (Inherited from Control)
2	**BorderThickness** Gets or sets the border thickness of a control. (Inherited from Control)
3	**DataContext** Gets or sets the data context for a FrameworkElement when it participates in data binding. (Inherited from FrameworkElement)
4	**FontFamily** Gets or sets the font used to display text in the control. (Inherited from Control)
5	**FontSize** Gets or sets the size of the text in this control. (Inherited from Control)
6	**FontStyle** Gets or sets the style in which the text is rendered. (Inherited from Control)
7	**FontWeight** Gets or sets the thickness of the specified font. (Inherited from Control)

8	**Foreground** Gets or sets a brush that describes the foreground color. (Inherited from Control)
9	**GroupStyle** Gets a collection of GroupStyle objects that define the appearance of each level of groups. (Inherited from ItemsControl)
10	**Header** Gets or sets the content for the list header. (Inherited from ListViewBase)
11	**Height** Gets or sets the suggested height of a FrameworkElement. (Inherited from FrameworkElement)
12	**HorizontalAlignment** Gets or sets the horizontal alignment characteristics that are applied to a FrameworkElement when it is composed in a layout parent, such as a panel or items control. (Inherited from FrameworkElement)
13	**HorizontalContentAlignment** Gets or sets the horizontal alignment of the control's content. (Inherited from Control)
14	**Items** Gets the collection used to generate the content of the control. (Inherited from ItemsControl)
15	**ItemsSource** Gets or sets an object source used to generate the content of the ItemsControl. (Inherited from ItemsControl)
16	**ItemTemplate** Gets or sets the DataTemplate used to display each item. (Inherited from ItemsControl)
17	**Margin** Gets or sets the outer margin of a FrameworkElement. (Inherited from FrameworkElement)
18	**Name** Gets or sets the identifying name of the object. When a XAML processor creates the object tree from XAML markup, run-time code can refer to the XAML-declared object by this name. (Inherited from FrameworkElement)
19	**Opacity** Gets or sets the degree of the object's opacity. (Inherited from UIElement)
20	**Resources** Gets the locally defined resource dictionary. In XAML, you can establish resource items as child object elements of a frameworkElement.Resources property element, through XAML implicit collection syntax. (Inherited from FrameworkElement)
21	**SelectedIndex** Gets or sets the index of the selected item. (Inherited from Selector)
22	**SelectedItem** Gets or sets the selected item. (Inherited from Selector)
23	**SelectedItems** Gets the currently selected items. (Inherited from ListViewBase)
24	**SelectedRanges** Gets a collection of ItemIndexRange objects that describe the currently selected items in the list. (Inherited from ListViewBase)
25	**SelectedValue** Gets or sets the value of the selected item, obtained by using the SelectedValuePath. (Inherited from Selector)
26	**Style**

	Gets or sets an instance Style that is applied for this object during layout and rendering. (Inherited from FrameworkElement)
27	**VerticalAlignment** Gets or sets the vertical alignment characteristics that are applied to a FrameworkElement when it is composed in a parent object such as a panel or items control. (Inherited from FrameworkElement)
28	**VerticalContentAlignment** Gets or sets the vertical alignment of the control's content. (Inherited from Control)
29	**Width** Gets or sets the width of a FrameworkElement. (Inherited from FrameworkElement)

Given below are the commonly used events in GridView:

Sr. No.	Event & Description
1	**DataContextChanged** Occurs when the value of the FrameworkElement.DataContext property changes. (Inherited from FrameworkElement)
2	**DragEnter** Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
3	**DragLeave** Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
4	**DragOver** Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)
5	**DragStarting** Occurs when a drag operation is initiated. (Inherited from UIElement)
6	**Drop** Occurs when the input system reports an underlying drop event with this element as the drop target. (Inherited from UIElement)
7	**ImageFailed** Occurs when there is an error associated with image retrieval or format.
8	**ImageOpened** Occurs when the image source is downloaded and decoded with no failure. You can use this event to determine the natural size of the image source.
9	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
10	**KeyUp** when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)

Below are the commonly used Methods of GridView.

Sr. No.	Method & Description
1	**Arrange** Positions child objects and determines a size for a UIElement. Parent objects that implement custom layout for their child elements should call this method

	from their layout override implementations to form a recursive layout update. (Inherited from UIElement)
2	**ClearValue** Clears the local value of a dependency property. (Inherited from DependencyObject)
3	**FindName** Retrieves an object that has the specified identifier name. (Inherited from FrameworkElement)
4	**GetValue** Returns the current effective value of a dependency property from a DependencyObject. (Inherited from DependencyObject)
5	**ReadLocalValue** Returns the local value of a dependency property, if a local value is set. (Inherited from DependencyObject)
6	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)
7	**SetValue** Sets the local value of a dependency property on a DependencyObject. (Inherited from DependencyObject)

Example

The following example shows the data (Name, ID, and Age) contained in a table. Here is the XAML implementation to create and initialize a GridView.

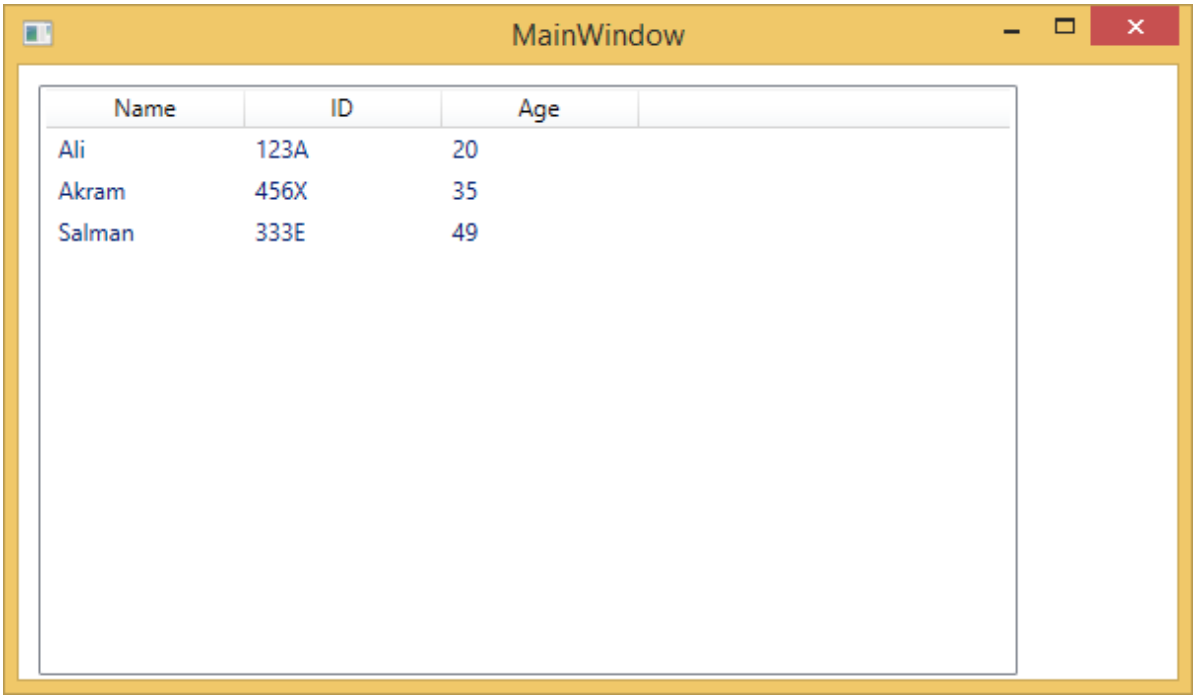
```
<Window x:Class="XAMLGridView.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="525">
    <Grid>
        <ListView HorizontalAlignment="Left"
              Height="299" Margin="10,10,0,0" VerticalAlignment="Top" Width="497"
              Name="MenList">
            <ListView.View>
                <GridView>
                    <GridViewColumn Header="Name"
                             DisplayMemberBinding="{Binding Name}"
                             Width="100"/>
                    <GridViewColumn Header="ID"
                             DisplayMemberBinding="{Binding ID}"
                             Width="100"/>
                    <GridViewColumn Header="Age"
                             DisplayMemberBinding="{Binding Age}"
                             Width="100"/>
```

```
                </GridView>
            </ListView.View>
        </ListView>
    </Grid>
</Window>
```

Here is the C# implementation to implement a person class.

```
using System;
using System.Windows;
using System.Windows.Controls;

namespace XAMLGridView
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
            MenList.Items.Add(new Person() { Name = "Ali", ID = "123A", Age = 20 });
            MenList.Items.Add(new Person() { Name = "Akram", ID = "456X", Age = 35 });
            MenList.Items.Add(new Person() { Name = "Salman", ID = "333E", Age = 49 });
        }
    }

    class Person
    {
        public string Name { get; set; }
        public string ID { get; set; }
        public int Age { get; set; }
    }
}
```

When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

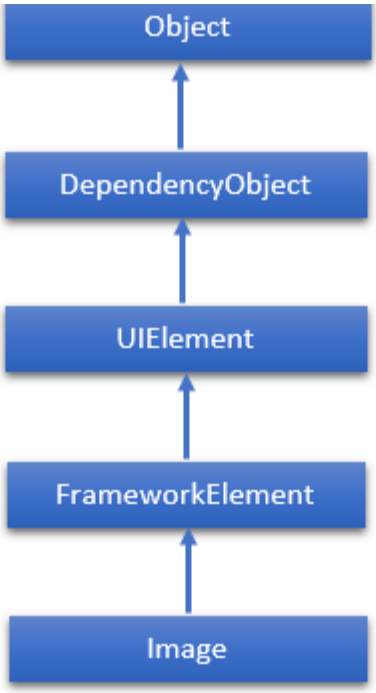
Image

It is a control that displays an imag. You can use either the Image object or the ImageBrush object. An Image object displays an image, while an ImageBrush object paints another object with an image.

The image source is specified by referring to an image file using several supported formats. It can display the following formats:

- Bitmap (BMP)
- Tagged Image File Format (TIFF)
- Icons (ICO)
- Joint Photographic Experts Group (JPEG)
- Graphics Interchange Format (GIF)
- Portable Network Graphics (PNG)
- JPEG XR

The hierarchical inheritance of Image class is as follows:



Given below are some of the commonly used properties of an Image class:

Sr. No.	Property & Description
1	**CanDrag** Gets or sets a value that indicates whether the element can be dragged as data in a drag-and-drop operation. (Inherited from UIElement)
2	**Height** Gets or sets the suggested height of a FrameworkElement. (Inherited from FrameworkElement)
3	**HorizontalAlignment** Gets or sets the horizontal alignment characteristics that are applied to a FrameworkElement when it is composed in a layout parent, such as a panel or items control. (Inherited from FrameworkElement)
4	**Margin** Gets or sets the outer margin of a FrameworkElement. (Inherited from FrameworkElement)
5	**Name** Gets or sets the identifying name of the object. When a XAML processor creates the object tree from XAML markup, run-time code can refer to the XAML-declared object by this name. (Inherited from FrameworkElement)
6	**Opacity** Gets or sets the degree of the object's opacity. (Inherited from UIElement)

7	**PlayToSource** Gets the information that is transmitted if the Image is used for a Play To scenario.
8	**Resources** Gets the locally defined resource dictionary. In XAML, you can establish resource items as child object elements of a frameworkElement.Resources property element, through XAML implicit collection syntax. (Inherited from FrameworkElement)
9	**SourceProperty** Identifies the Source dependency property.
10	**Stretch** Gets or sets a value that describes how an Image should be stretched to fill the destination rectangle.
11	**StretchProperty** Identifies the Stretch dependency property.
12	**Style** Gets or sets an instance Style that is applied for this object during layout and rendering. (Inherited from FrameworkElement)
13	**VerticalAlignment** Gets or sets the vertical alignment characteristics that are applied to a FrameworkElement when it is composed in a parent object such as a panel or items control. (Inherited from FrameworkElement)
14	**Width** Gets or sets the width of a FrameworkElement. (Inherited from FrameworkElement)
15	**wSource** Gets or sets the source for the image.

Given below are the commonly used events of an Image class:

Sr. No.	Event & Description
1	**DataContextChanged** Occurs when the value of the FrameworkElement.DataContext property changes. (Inherited from FrameworkElement)
2	**DragEnter** Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
3	**DragLeave** Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
4	**DragOver** Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)
5	**DragStarting** Occurs when a drag operation is initiated. (Inherited from UIElement)
6	**Drop** Occurs when the input system reports an underlying drop event with this element as the drop target. (Inherited from UIElement)
7	**DropCompleted** Occurs when a drag-and-drop operation is ended. (Inherited from UIElement)
8	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
9	**ImageFailed**

	Occurs when there is an error associated with image retrieval or format.
10	**ImageOpened** Occurs when the image source is downloaded and decoded with no failure. You can use this event to determine the natural size of the image source.
11	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
12	**KeyUp** Occurs when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)
13	**SizeChanged** Occurs when either the ActualHeight or the ActualWidth property changes value on a FrameworkElement. (Inherited from FrameworkElement)

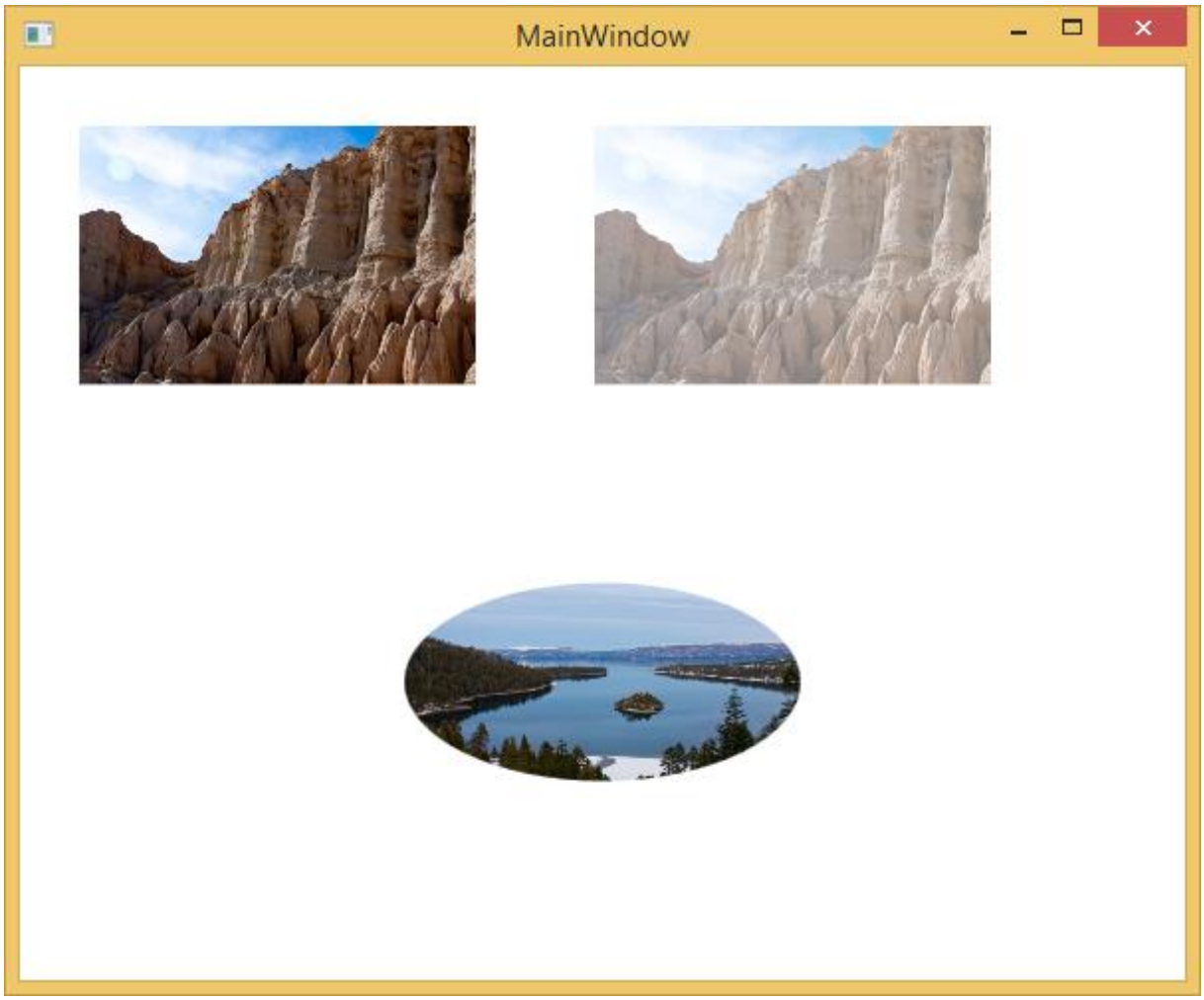
Example

The following example shows three images. The first one is a simple image; in the second image, the Opacity property is set; and in the third image, the eclipse is painted with an ImageBrush. Here is the XAML code:

```
<Window x:Class="XAMLImage.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="500" Width="604">
    <Grid>
        <Grid.RowDefinitions>
            <RowDefinition Height="1*"/>
            <RowDefinition Height="1*"/>
        </Grid.RowDefinitions>
        <StackPanel Orientation="Horizontal">
            <Image Width="200"
                   Source="Images\red_rock_01.jpg"
                   VerticalAlignment="Top"
                   Margin="30"/>
            <Image Width="200"
                   Source="Images\red_rock_01.jpg"
                   VerticalAlignment="Top"
                   Margin="30"
                   Opacity="0.5"/>
        </StackPanel>
        <StackPanel Grid.Row="1">
            <Ellipse Height="100"
                     Width="200"
```

```
                    HorizontalAlignment="Center"
                    Margin="30">
                <Ellipse.Fill>
                    <ImageBrush ImageSource="Images\tahoe_01.jpg" />
                </Ellipse.Fill>
            </Ellipse>
        </StackPanel>
    </Grid>
</Window>
```

When you compile and execute the above code, it will produce the following output:

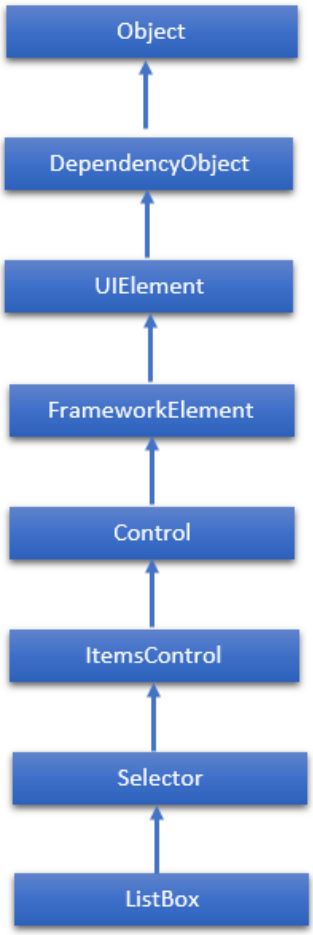


We recommend you to execute the above example code and experiment with some other properties and events.

ListBox

A ListBox is a control that provides a list of items to the user item selection. The user can select one or more items from a predefined list of items at a time. In a ListBox, multiple

options are always visible to the user without any user interaction. The hierarchical inheritance of ListBox class is as follows:



Given below are the commonly used Properties of ListBox class.

Sr. No.	Property & Description
1	**Background** Gets or sets a brush that provides the background of the control. (Inherited from Control)
2	**BorderThickness** Gets or sets the border thickness of a control. (Inherited from Control)
3	**FontFamily** Gets or sets the font used to display text in the control. (Inherited from Control)
4	**FontSize** Gets or sets the size of the text in this control. (Inherited from Control)
5	**FontStyle** Gets or sets the style in which the text is rendered. (Inherited from Control)
6	**FontWeight** Gets or sets the thickness of the specified font. (Inherited from Control)
7	**Foreground** Gets or sets a brush that describes the foreground color. (Inherited from Control)
8	**GroupStyle** Gets a collection of GroupStyle objects that define the appearance of each level of groups. (Inherited from ItemsControl)

9	**Height** Gets or sets the suggested height of a FrameworkElement. (Inherited from FrameworkElement)
10	**HorizontalAlignment** Gets or sets the horizontal alignment characteristics that are applied to a FrameworkElement when it is composed in a layout parent, such as a panel or items control. (Inherited from FrameworkElement)
11	**IsEnabled** Gets or sets a value indicating whether the user can interact with the control. (Inherited from Control)
12	**Item** Gets the collection used to generate the content of the control. (Inherited from ItemsControl)
13	**ItemsSource** Gets or sets an object source used to generate the content of the ItemsControl. (Inherited from ItemsControl)
14	**Margin** Gets or sets the outer margin of a FrameworkElement. (Inherited from FrameworkElement)
15	**Name** Gets or sets the identifying name of the object. When a XAML processor creates the object tree from XAML markup, run-time code can refer to the XAML-declared object by this name. (Inherited from FrameworkElement)
16	**Opacity** Gets or sets the degree of the object's opacity. (Inherited from UIElement)
17	**SelectedIndex** Gets or sets the index of the selected item. (Inherited from Selector)
18	**SelectedItem** Gets or sets the selected item. (Inherited from Selector)
19	**SelectedValue** Gets or sets the value of the selected item, obtained by using the SelectedValuePath. (Inherited from Selector)
20	**Style** Gets or sets an instance Style that is applied for this object during layout and rendering. (Inherited from FrameworkElement)
21	**VerticalAlignment** Gets or sets the vertical alignment characteristics that are applied to a FrameworkElement when it is composed in a parent object such as a panel or items control. (Inherited from FrameworkElement)
22	**Width** Gets or sets the width of a FrameworkElement. (Inherited from FrameworkElement)

Given below are the most commonly used Events of ListBox:

Sr. No.	Event & Description
1	**DragEnter** Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
2	**DragLeave** Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
3	**DragOver**

	Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)
4	**DragStarting** Occurs when a drag operation is initiated. (Inherited from UIElement)
5	**Drop** Occurs when the input system reports an underlying drop event with this element as the drop target. (Inherited from UIElement)
6	**DropCompleted** Occurs when a drag-and-drop operation is ended. (Inherited from UIElement)
7	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
8	**IsEnabledChanged** Occurs when the IsEnabled property changes. (Inherited from Control)
9	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
10	**KeyUp** Occurs when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)
11	**LostFocus** Occurs when a UIElement loses focus. (Inherited from UIElement)
12	**SelectionChanged** Occurs when the currently selected item changes. (Inherited from Selector)
13	**SizeChanged** Occurs when either the ActualHeight or the ActualWidth property changes value on a FrameworkElement. (Inherited from FrameworkElement)

Given below are the most commonly used methods of ListBox:

Sr. No.	Method & Description
1	**Arrange** Positions child objects and determines a size for a UIElement. Parent objects that implement custom layout for their child elements should call this method from their layout override implementations to form a recursive layout update. (Inherited from UIElement)
2	**FindName** Retrieves an object that has the specified identifier name. (Inherited from FrameworkElement)
3	**Focus** Attempts to set the focus on the control. (Inherited from Control)
4	**GetValue** Returns the current effective value of a dependency property from a DependencyObject. (Inherited from DependencyObject)
5	**IndexFromContainer** Returns the index to the item that has the specified, generated container. (Inherited from ItemsControl)
6	**OnDragEnter** Called before the DragEnter event occurs. (Inherited from Control)
7	**OnDragLeave** Called before the DragLeave event occurs. (Inherited from Control)
8	**OnDragOver** Called before the DragOver event occurs. (Inherited from Control)
9	**OnDrop**

	Called before the Drop event occurs. (Inherited from Control)
10	**OnKeyDown** Called before the KeyDown event occurs. (Inherited from Control)
11	**OnKeyUp** Called before the KeyUp event occurs. (Inherited from Control)
12	**OnLostFocus** Called before the LostFocus event occurs. (Inherited from Control)
13	**ReadLocalValue** Returns the local value of a dependency property, if a local value is set. (Inherited from DependencyObject)
14	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)
15	**SetValue** Sets the local value of a dependency property on a DependencyObject. (Inherited from DependencyObject)

Example

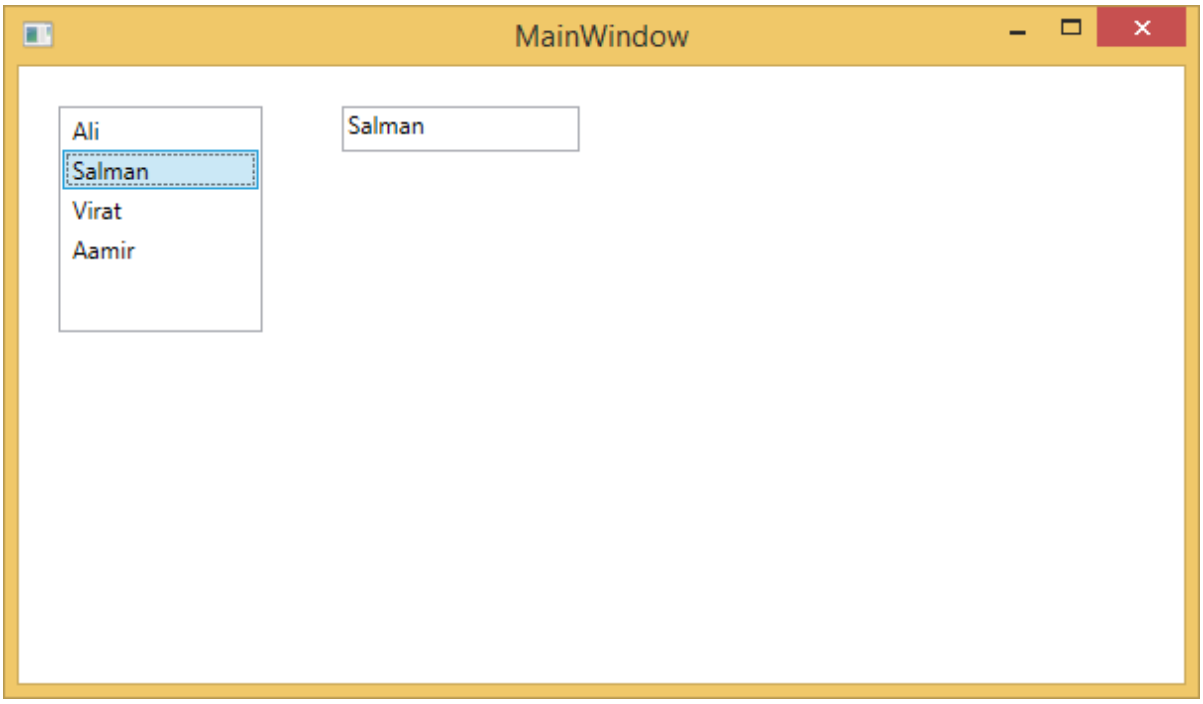
The following example shows the ListBox control and a TextBox. When a user selects any item from the ListBox, then it gets displayed on the TextBox as well.

Here is the XAML code to create and initialize a ListBox and a TextBox with some properties.

```
<Window x:Class="XAMLListBox.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <StackPanel Orientation="Horizontal">
            <ListBox Name="listbox" Margin="20,20,20,177" Width="103">
                <ListBoxItem Content="Ali"/>
                <ListBoxItem Content="Salman"/>
                <ListBoxItem Content="Virat"/>
                <ListBoxItem Content="Aamir"/>
            </ListBox>
            <TextBox Height="23"
                     Name="textBox1"
                     Width="120"
                     Margin="20"
                     HorizontalAlignment="Left"
                     VerticalAlignment="Top" >
                <TextBox.Text>
```

```
                    <Binding ElementName="listbox"
Path="SelectedItem.Content"/>
                </TextBox.Text>


            </TextBox>


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

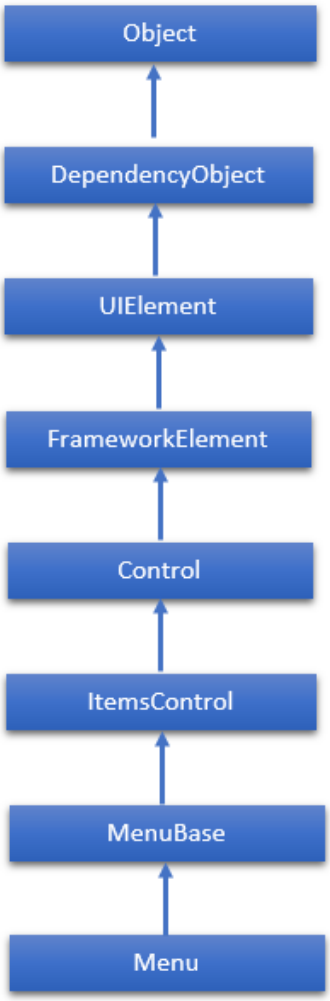
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

Menu

A Menu is a control that enables you to hierarchically organize the elements associated with the commands and event handlers. Menu is an ItemsControl, so it can contain a collection of any object type such as string, image, or panel. The hierarchical inheritance of Menu class is as follows:



Given below are the commonly used properties of Menu class:

Sr. No.	Name & Description
1	**Background** Gets or sets a brush that describes the background of a control. (Inherited from Control.)
2	**BindingGroup** Gets or sets the BindingGroup that is used for the element. (Inherited from FrameworkElement.)
3	**BitmapEffect** Obsolete. Gets or sets a bitmap effect that applies directly to the rendered content for this element. This is a dependency property. (Inherited from UIElement.)
4	**BorderThickness** Gets or sets the border thickness of a control. (Inherited from Control.)
5	**ContextMenu** Gets or sets the context menu element that should appear whenever the context menu is requested through user interface (UI) from within this element. (Inherited from FrameworkElement.)
6	**Effect** Gets or sets the bitmap effect to apply to the UIElement. This is a dependency property. (Inherited from UIElement.)

7	**Height** Gets or sets the suggested height of the element. (Inherited from FrameworkElement.)
8	**IsMainMenu** Gets or sets a value that indicates whether this Menu receives a main menu activation notification.
9	**Items** Gets the collection used to generate the content of the ItemsControl. (Inherited from ItemsControl.)
10	**ItemsPanel** Gets or sets the template that defines the panel that controls the layout of items. (Inherited from ItemsControl.)
11	**ItemsSource** Gets or sets a collection used to generate the content of the ItemsControl. (Inherited from ItemsControl.)
12	**ItemStringFormat** Gets or sets a composite string that specifies how to format the items in the ItemsControl if they are displayed as strings. (Inherited from ItemsControl.)
13	**ItemTemplate** Gets or sets the DataTemplate used to display each item. (Inherited from ItemsControl.)
14	**ToolTip** Gets or sets the tool-tip object that is displayed for this element in the user interface (UI). (Inherited from FrameworkElement.)
15	**VerticalContentAlignment** Gets or sets the vertical alignment of the control's content. (Inherited from Control.)
16	**Width** Gets or sets the width of the element. (Inherited from FrameworkElement.)

Given below are the commonly used events in Menu class:

Sr. No.	Event & Description
1	**ContextMenuClosing** Occurs just before any context menu on the element is closed. (Inherited from FrameworkElement.)
2	**ContextMenuOpening** Occurs when any context menu on the element is opened. (Inherited from FrameworkElement.)
3	**KeyDown** Occurs when a key is pressed while focus is on this element. (Inherited from UIElement.)
4	**KeyUp** Occurs when a key is released while focus is on this element. (Inherited from UIElement.)
5	**ToolTipClosing** Occurs just before any tooltip on the element is closed. (Inherited from FrameworkElement.)
6	**ToolTipOpening** Occurs when any tooltip on the element is opened. (Inherited from FrameworkElement.)
7	**TouchDown** Occurs when a finger touches the screen while the finger is over this element. (Inherited from UIElement.)

8	**TouchEnter** Occurs when a touch moves from outside to inside the bounds of this element. (Inherited from UIElement.)
9	**TouchLeave** Occurs when a touch moves from inside to outside the bounds of this element. (Inherited from UIElement.)
10	**TouchMove** Occurs when a finger moves on the screen while the finger is over this element. (Inherited from UIElement.)
11	**TouchUp** Occurs when a finger is raised off of the screen while the finger is over this element. (Inherited from UIElement.)

Example

The following example contains two menu options with some menu item. When a user clicks an item from the menu, the program updates the title. Here is the XAML code.

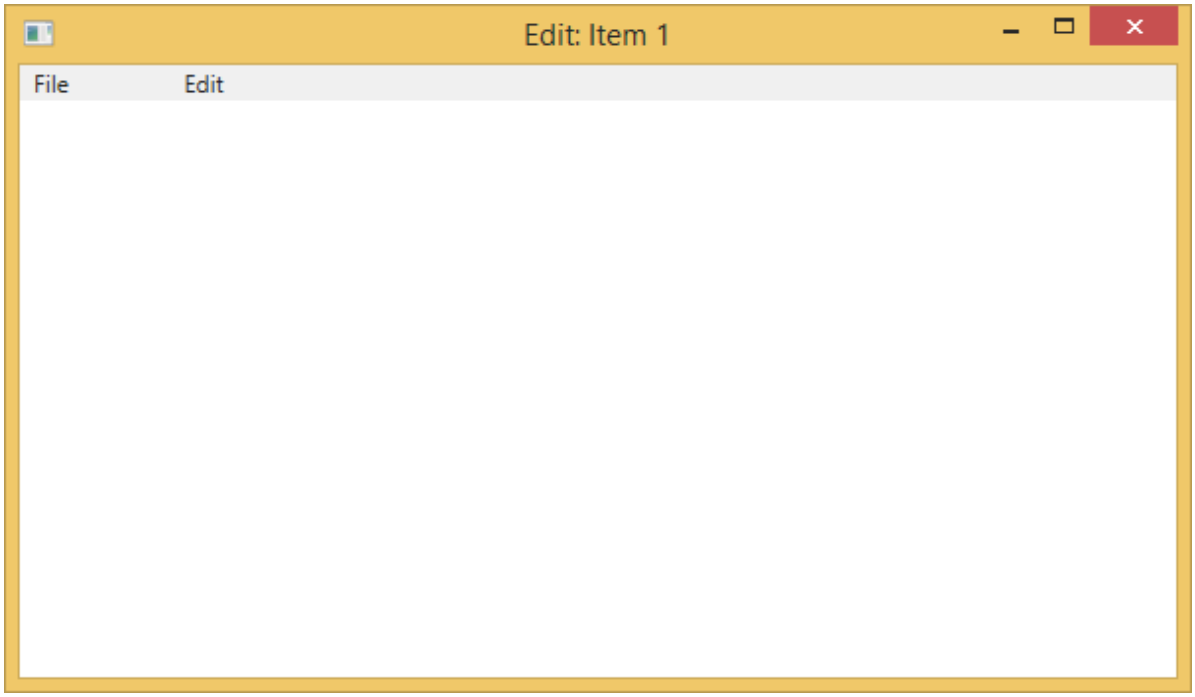
```
<Window x:Class="XAMLMenu.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="525">
    <Grid>
        <Menu HorizontalAlignment="Left" VerticalAlignment="Top" Width="517">
            <MenuItem Header="File">
                <MenuItem Header="Item 1" HorizontalAlignment="Left" Width="140"
                    Click="MenuItem_Click"/>
                <MenuItem Header="Item 2" HorizontalAlignment="Left" Width="140"
                    Click="MenuItem_Click"/>
                <Separator HorizontalAlignment="Left" Width="140"/>
                <MenuItem Header="Item 3" HorizontalAlignment="Left" Width="140"
                    Click="MenuItem_Click"/>
            </MenuItem>
        </Menu>
        <Menu  VerticalAlignment="Top" Width="517" Margin="41,0,-41,0">
            <MenuItem Header="Edit">
                <MenuItem Header="Item 1" HorizontalAlignment="Left" Width="140"
                    Click="MenuItem_Click1"/>
                <MenuItem Header="Item 2" HorizontalAlignment="Left" Width="140"
                    Click="MenuItem_Click1"/>
                <Separator HorizontalAlignment="Left" Width="140"/>
              <MenuItem Header="Item 3" HorizontalAlignment="Left" Width="140"
                    Click="MenuItem_Click1"/>
```

```
            </MenuItem>
        </Menu>
    </Grid>
</Window>
```

Here is the events implementation in C#:

```
using System.Linq;
using System.Windows;
using System.Windows.Controls;

namespace XAMLMenu
{
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }
        private void MenuItem_Click(object sender, RoutedEventArgs e)
        {
            MenuItem item = sender as MenuItem;
            this.Title = "File: " + item.Header;
        }
        private void MenuItem_Click1(object sender, RoutedEventArgs e)
        {
            MenuItem item = sender as MenuItem;
            this.Title = "Edit: " + item.Header;
        }
    }
}
```

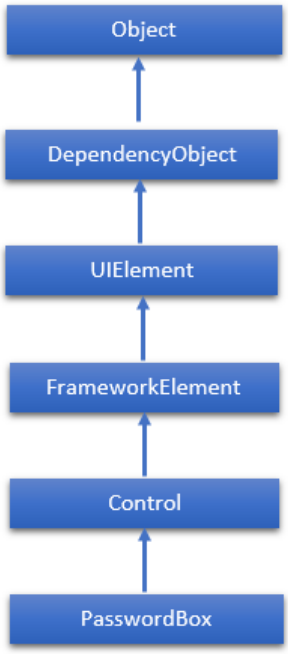
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

PasswordBox

A PasswordBox is a control in which the user can enter a masked password. When the user enters a password, the text is not displayed, only the password characters are shown. The password character (usually shown as *) can be easily changed by the **PasswordChar** property. The hierarchical inheritance of PasswordBox class is as follows:



Given below are the commonly used properties of PasswordBox class:

Sr. No.	Property & Description
1	**InputScope** Gets or sets the context for input used by this PasswordBox.
2	**InputScopeProperty** Identifies the InputScope dependency property.
3	**IsPasswordRevealButtonEnabled** Gets or sets a value that specifies whether the visual UI of the PasswordBox includes a button element that toggles showing or hiding the typed characters. In Windows 10 and later, use PasswordRevealMode instead.
4	**IsPasswordRevealButtonEnabledProperty** Identifies the IsPasswordRevealButtonEnabled dependency property.
5	**MaxLength** Gets or sets the maximum length for passwords to be handled by this PasswordBox.
6	**MaxLengthProperty** Identifies the MaxLength dependency property.
7	**Password** Gets or sets the password currently held by the PasswordBox.
8	**PasswordChar** Gets or sets the masking character for the PasswordBox.
9	**PasswordCharProperty** Identifies the PasswordChar dependency property.
10	**PasswordProperty** Identifies the Password dependency property.
11	**PasswordRevealMode** Gets or sets a value that specifies whether the password is always, never, or optionally obscured.
12	**PasswordRevealModeProperty** Identifies the PasswordRevealMode dependency property.
	Resources

13	Gets the locally defined resource dictionary. In XAML, you can establish resource items as child object elements of a frameworkElement.Resources property element, through XAML implicit collection syntax. (Inherited from FrameworkElement)

Given below are the commonly used events of PasswordBox class.

Sr. No.	Event & Description
1	**ContextMenuOpening** Occurs when the system processes an interaction that displays a context menu.
2	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
3	**PasswordChanged** Occurs when the value of the Password property changes.
4	**Paste** Occurs when text is pasted into the control.

Given below are the commonly used methods of PasswordBox class.

Sr. No.	Method & Description
1	**OnLostFocus** Called before the LostFocus event occurs. (Inherited from Control)
2	**SelectAll** Selects all the characters in the PasswordBox.
3	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)
4	**SetValue** Sets the local value of a dependency property on a DependencyObject. (Inherited from DependencyObject)

Example

The following example shows the PasswordBox, labels, and a button. Here is the XAML code to create and initialize all these controls.

```
<Window x:Class="PasswordBox.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid >
        <PasswordBox x:Name="pwBox"
                     Height="35"
                     Width="200"
                     MaxLength="8"
                     Margin="159,55,158,229" />
        <Label Content="Password"
```

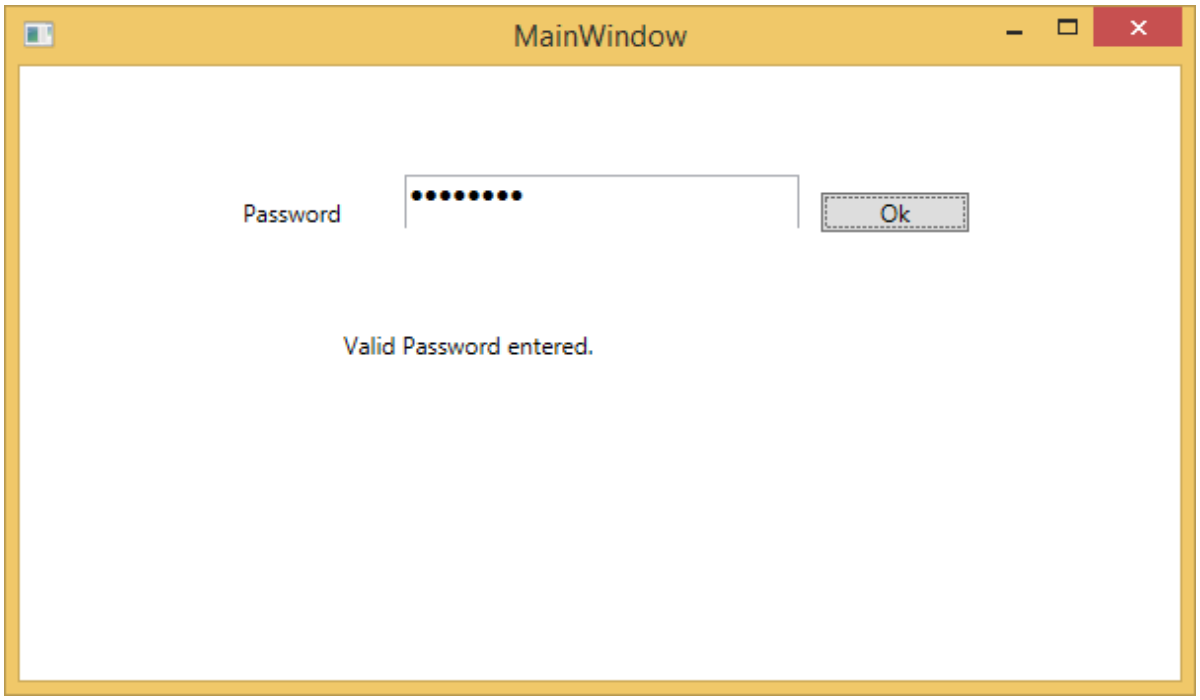
```
                HorizontalAlignment="Left"
                Margin="108,61,0,0"
                VerticalAlignment="Top"
                Width="70" />
        <Button Content="Ok"
                HorizontalAlignment="Left"
                Margin="406,64,0,0"
                VerticalAlignment="Top"
                Width="75" Click="Button_Click"/>
        <Label Name="statusText"
                HorizontalAlignment="Left"
                Margin="159,128,0,0"
                VerticalAlignment="Top"
                Width="200"
                Height="38"/>
    </Grid>
</Window>
```

Here is the button click event implementation in C# in which the program compares the password. If the entered password is “xaml1234”, then it will display the message "correct password" on the label.

```
using System.Linq;
using System.Windows;
using System.Windows.Controls;

namespace XAMLMenu
{
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }
        private void MenuItem_Click(object sender, RoutedEventArgs e)
        {
            MenuItem item = sender as MenuItem;
```

```
            this.Title = "File: " + item.Header;
        }
        private void MenuItem_Click1(object sender, RoutedEventArgs e)
        {
            MenuItem item = sender as MenuItem;
            this.Title = "Edit: " + item.Header;
        }
    }
}
```

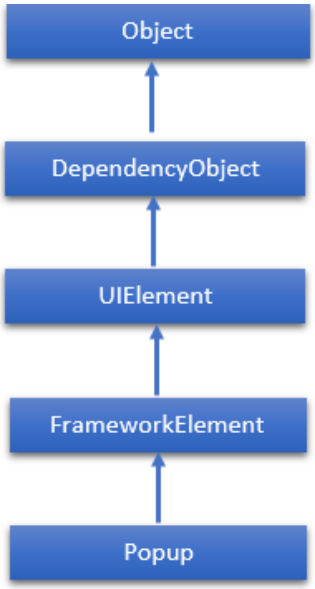
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

Popup

A Popup displays content on top of existing content, within the bounds of the application window. It is a temporarily display on other content. The hierarchical inheritance of Popup class is as follows:



Given below are the commonly used properties of Popup class:

Sr. No.	Property & Description
1	**Child** Gets or sets the content to be hosted in the popup.
2	**ChildProperty** Gets the identifier for the Child dependency property.
3	**ChildTransitions** Gets or sets the collection of Transition style elements that apply to child content of a Popup.
4	**ChildTransitionsProperty** Identifies the ChildTransitions dependency property.
5	**HorizontalOffset** Gets or sets the distance between the left side of the application window and the left side of the popup.
6	**HorizontalOffsetProperty** Gets the identifier for the HorizontalOffset dependency property.
7	**IsLightDismissEnabled** Gets or sets a value that determines how the Popup can be dismissed.
8	**IsLightDismissEnabledProperty** Identifies the IsLightDismissEnabled dependency property.
9	**IsOpen** Gets or sets whether the popup is currently displayed on the screen.
10	**IsOpenProperty** Gets the identifier for the IsOpen dependency property.
11	**VerticalOffset** Gets or sets the distance between the top of the application window and the top of the popup.
12	**VerticalOffsetProperty** Gets the identifier for the VerticalOffset dependency property.

Popup class has the following events:

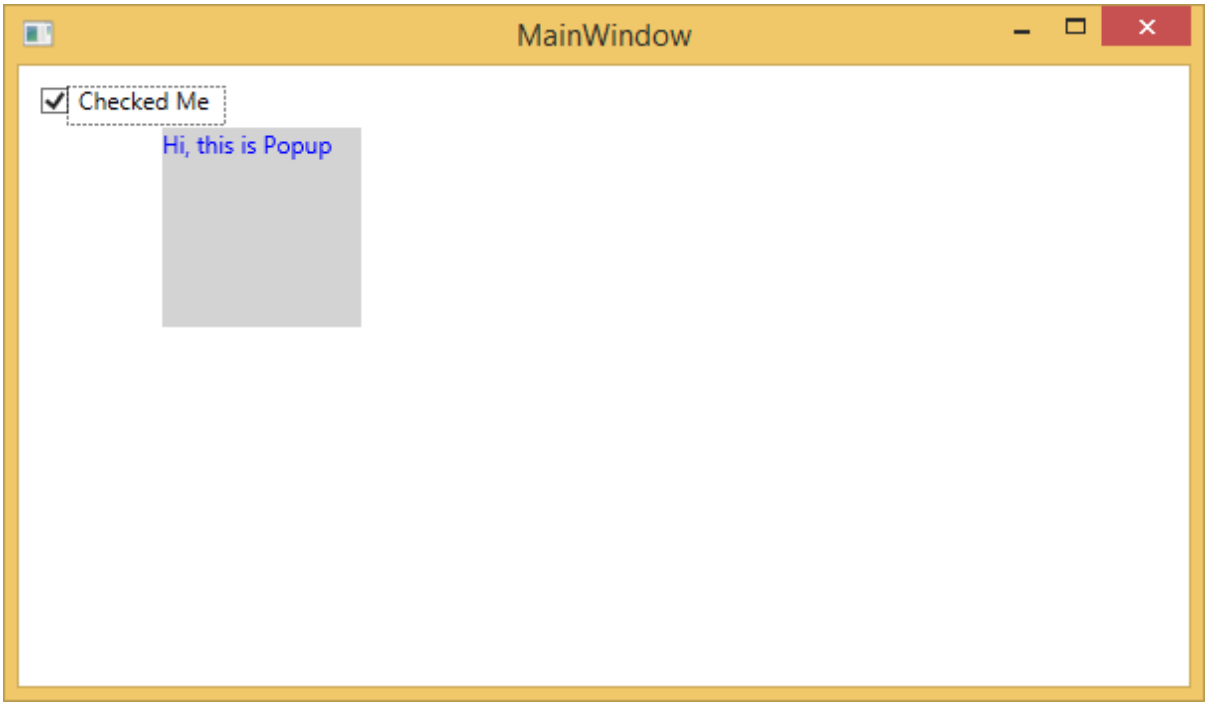
Sr. No.	Event & Description
1	**Closed** Fires when the IsOpen property is set to false.
2	**Opened** Fires when the IsOpen property is set to true.

Example

The following example shows how to use Popup control. Given below is the XAML code to create and iniliaze a Popup control and a CheckBox. When the user checks the CheckBox, it displays a Popup.

```
<Window x:Class="XAMLPopup.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <StackPanel>
            <CheckBox Name="PCheckBox" Margin="10,10,484,500"
              Content="Checked Me" Height="18"/>
            <Popup IsOpen="{Binding ElementName=PCheckBox,Path=IsChecked}"
                    PlacementTarget="{Binding ElementName=PCheckBox}"
                    AllowsTransparency="True"
                    PopupAnimation="Slide"
                    HorizontalOffset="150"
                    VerticalOffset="100">
                <Canvas Width="100" Height="100" Background="LightGray" Margin="5">
                    <Canvas.RenderTransform>
                        <RotateTransform x:Name="theTransform" />
                    </Canvas.RenderTransform>
                    <TextBlock TextWrapping="Wrap"
                               Foreground="Blue"
                               Text="Hi, this is Popup"/>
                </Canvas>
            </Popup>
        </StackPanel>
    </Grid>
</Window>
```

When you compile and execute the above code, it will produce the following output:



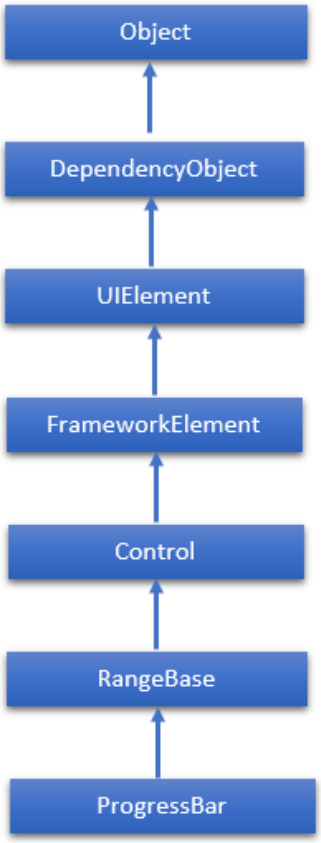
We recommend you to execute the above example code and experiment with some other properties and events.

ProgressBar

A ProgressBar represents a control that indicates the progress of an operation, where the typical visual appearance is a bar that animates a filled area as the progress continues. It can show the progress in either of the two following styles:

- A bar that displays a repeating pattern, or
- A bar that fills based on a value.

The hierarchical inheritance of ProgressBar class is as follows:



Given below are the commonly used properties of ProgressBar:

Sr. No.	Property & Description
1	**IsIndeterminate** Gets or sets a value that indicates whether the progress bar reports generic progress with a repeating pattern or reports progress based on the Value property.
2	**IsIndeterminateProperty** Identifies the IsIndeterminate dependency property.
3	**ShowError** Gets or sets a value that indicates whether the progress bar should use visual states that communicate an Error state to the user.
4	**ShowErrorProperty** Identifies the ShowError dependency property.
5	**ShowPaused** Gets or sets a value that indicates whether the progress bar should use visual states that communicate a Paused state to the user.
6	**ShowPausedProperty** Identifies the ShowPaused dependency property.
7	**TemplateSettings** Gets an object that provides calculated values that can be referenced as TemplateBinding sources when defining templates for a ProgressBar control.

Given below are the commonly used events in ProgressBar class:

Sr. No.	Event & Description
1	**ManipulationCompleted** Occurs when a manipulation on the UIElement is complete. (Inherited from UIElement)
2	**ManipulationDelta** Occurs when the input device changes position during a manipulation. (Inherited from UIElement)
3	**ManipulationInertiaStarting** Occurs when the input device loses contact with the UIElement object during a manipulation and inertia begins. (Inherited from UIElement)
4	**ManipulationStarted** Occurs when an input device begins a manipulation on the UIElement. (Inherited from UIElement)
5	**ManipulationStarting** Occurs when the manipulation processor is first created. (Inherited from UIElement)
6	**ValueChanged** Occurs when the range value changes. (Inherited from RangeBase)

Given below are the commonly used methods in ProgressBar class:

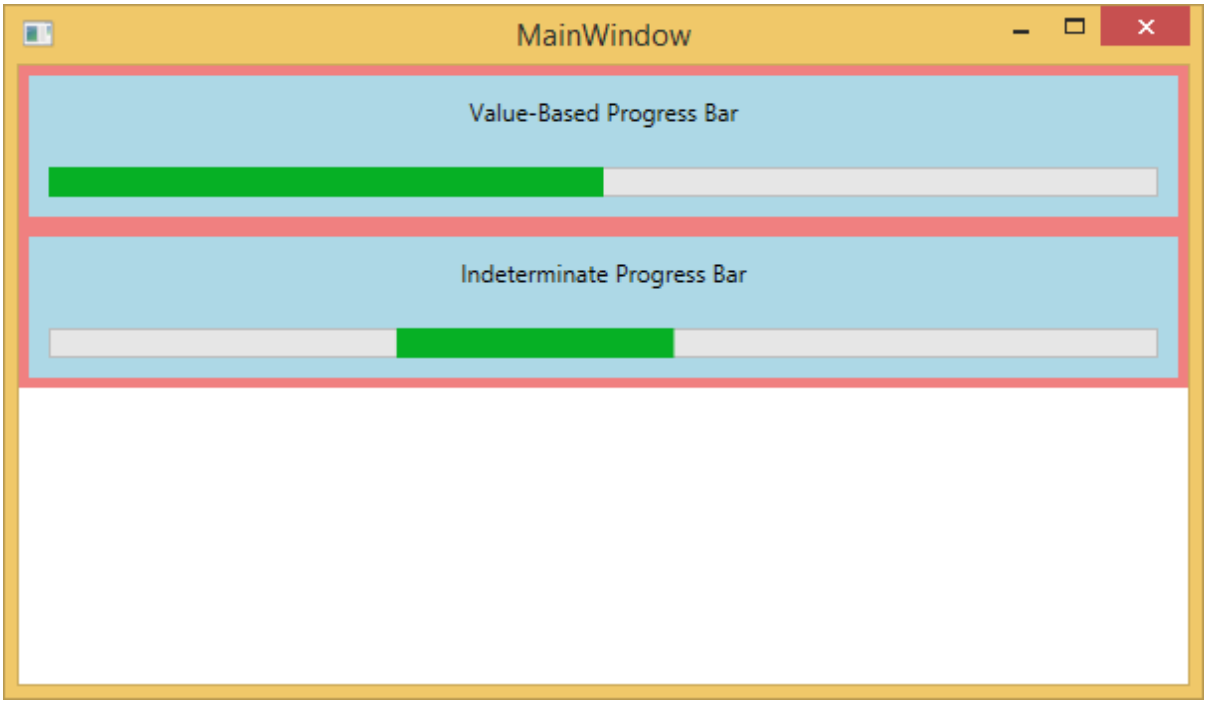
Sr. No.	Method & Description
1	**OnManipulationCompleted** Called before the ManipulationCompleted event occurs. (Inherited from Control)
2	**OnManipulationDelta** Called before the ManipulationDelta event occurs. (Inherited from Control)
3	**OnManipulationInertiaStarting** Called before the ManipulationInertiaStarting event occurs. (Inherited from Control)
4	**OnManipulationStarted** Called before the ManipulationStarted event occurs. (Inherited from Control)
5	**OnManipulationStarting** Called before the ManipulationStarting event occurs. (Inherited from Control)
6	**OnMaximumChanged** Called when the Maximum property changes. (Inherited from RangeBase)
7	**OnMinimumChanged** Called when the Minimum property changes. (Inherited from RangeBase)
8	**OnValueChanged** Fires the ValueChanged routed event. (Inherited from RangeBase)
9	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)
10	**SetValue** Sets the local value of a dependency property on a DependencyObject. (Inherited from DependencyObject)

Example

The following example shows how to use the ProgressBar control. Here is the XAML code to create and initialize two ProgressBar controls with **IsIndeterminate** property.

```
<Window x:Class="ProgressBar.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">
    <Grid>
        <StackPanel x:Name="LayoutRoot" >
            <Border BorderThickness="5" BorderBrush="LightCoral">
                <StackPanel Background="LightBlue">
                    <TextBlock HorizontalAlignment="Center" Margin="10"
        Text="Value-Based Progress Bar" />
                    <ProgressBar x:Name="pg1" Value="100"  Margin="10" Maximum="200"
        Height="15" IsIndeterminate="False" />
                </StackPanel>
            </Border>
            <Border BorderThickness="5" BorderBrush="LightCoral">
                <StackPanel Background="LightBlue">
                    <TextBlock HorizontalAlignment="Center"
        Margin="10" Text="Indeterminate Progress Bar" />
                    <ProgressBar x:Name="pg2" Margin="10" Height="15"
        IsIndeterminate="True"   />
                </StackPanel>
            </Border>
        </StackPanel>

    </Grid>
</Window>
```

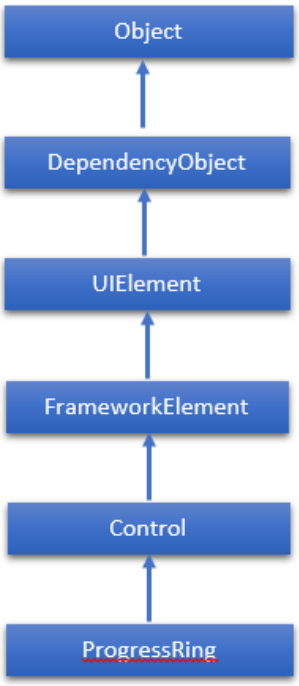
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

ProgressRing

A ProgressRing is a control that indicates an ongoing operation. The typical visual appearance is a ring-shaped "spinner" that cycles an animation as the progress continues. An important point here is that WPF projects do not support ProgressRing. So for this control, we will work on Windows Store App. The hierarchical inheritance of ProgressRing class is as follows:



Given below are the commonly used properties of ProgressRing:

Sr. No.	Description
1	**IsActive** Gets or sets a value that indicates whether the ProgressRing is showing progress.
2	**IsActiveProperty** Identifies the IsActive dependency property.
3	**TemplateSettings** Gets an object that provides calculated values that can be referenced as TemplateBinding sources when defining templates for a ProgressRing control.

Given below are the commonly used events in ProgressRing class:

Sr. No.	Event & Description
1	**ManipulationCompleted** Occurs when a manipulation on the UIElement is complete. (Inherited from UIElement)
2	**ManipulationDelta** Occurs when the input device changes position during a manipulation. (Inherited from UIElement)
3	**ManipulationInertiaStarting** Occurs when the input device loses contact with the UIElement object during a manipulation and inertia begins. (Inherited from UIElement)
4	**ManipulationStarted** Occurs when an input device begins a manipulation on the UIElement. (Inherited from UIElement)
5	**ManipulationStarting** Occurs when the manipulation processor is first created. (Inherited from UIElement)

6	**ValueChanged** Occurs when the range value changes. (Inherited from RangeBase)

Given below are the commonly used methods in ProgressRing class:

Sr. No.	Method & Description
1	**OnManipulationCompleted** Called before the ManipulationCompleted event occurs. (Inherited from Control)
2	**OnManipulationDelta** Called before the ManipulationDelta event occurs. (Inherited from Control)
3	**OnManipulationInertiaStarting** Called before the ManipulationInertiaStarting event occurs. (Inherited from Control)
4	**OnManipulationStarted** Called before the ManipulationStarted event occurs. (Inherited from Control)
5	**OnManipulationStarting** Called before the ManipulationStarting event occurs. (Inherited from Control)
6	**OnMaximumChanged** Called when the Maximum property changes. (Inherited from RangeBase)
7	**OnMinimumChanged** Called when the Minimum property changes. (Inherited from RangeBase)

Example

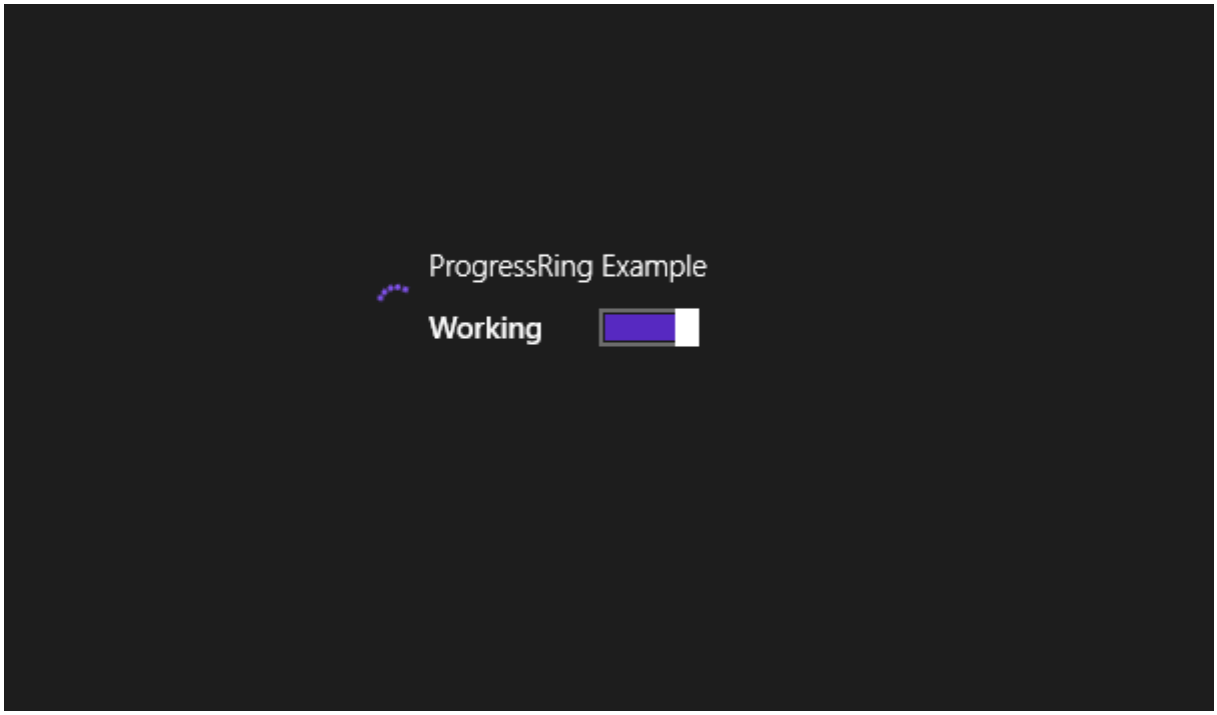
The following example shows how to use ProgressRing with ToggleSwitch. Here is the code in XAML to create and initialize a ProgressRing and a ToggleSwitch:

```
<Page
    x:Class="ProgressRing.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:local="using:ProgressRing"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d">

    <Grid Background="{ThemeResource ApplicationPageBackgroundThemeBrush}">
        <StackPanel Orientation="Horizontal" Margin="342,0,-342,0">
            <ProgressRing x:Name="progress1"/>
            <ToggleSwitch Header="ProgressRing Example" OffContent="Do work"
                                OnContent="Working"
Toggled="ToggleSwitch_Toggled" Margin="0,348,0,347"/>
        </StackPanel>
    </Grid>
</Page>
```

Given below is the implementation in C# for Toggled event:

```
using System;
using System.Runtime.InteropServices.WindowsRuntime;
using Windows.Foundation;
using Windows.Foundation.Collections;
using Windows.UI.Xaml;
using Windows.UI.Xaml.Controls;
using Windows.UI.Xaml.Controls.Primitives;
namespace ProgressRing
{
    public sealed partial class MainPage : Page
    {
        public MainPage()
        {
            this.InitializeComponent();
        }
        private void ToggleSwitch_Toggled(object sender, RoutedEventArgs e)
        {
            ToggleSwitch toggleSwitch = sender as ToggleSwitch;
            if (toggleSwitch != null)
            {
                if (toggleSwitch.IsOn == true)
                {
                    progress1.IsActive = true;
                    progress1.Visibility = Visibility.Visible;
                }
                else
                {
                    progress1.IsActive = false;
                    progress1.Visibility = Visibility.Collapsed;
                }
            }
        }
    }
}
```

When you compile and execute the above code, it produces the following output:



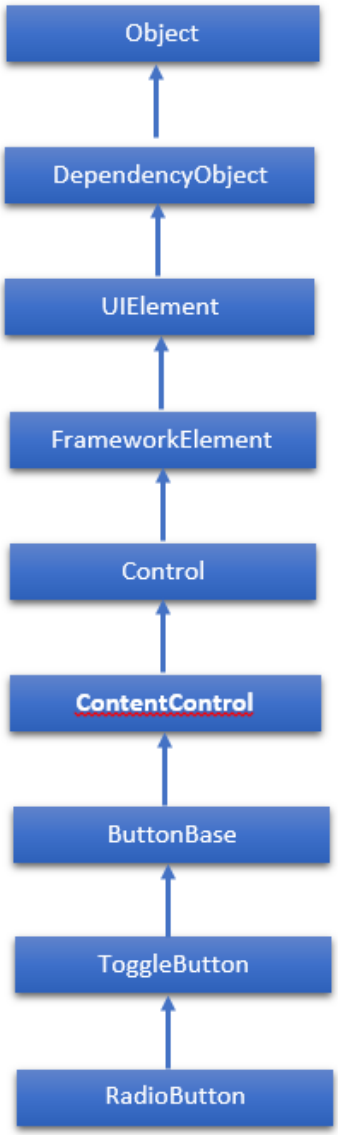
We recommend you to execute the above example code and experiment with some other properties and events in Windows App.

RadioButton

A RadioButton is a control that allows a user to select a single option from a group of options. The user is limited to select a single option from a related list of options which are mutually exclusive. It has only two options:

- Selected
- Cleared

The hierarchical inheritance of RadioButton class is as follows:



Given below are the most commonly used properties of RadioButton:

Sr. No.	Property & Description
1	**Background** Gets or sets a brush that provides the background of the control. (Inherited from Control)
2	**BorderBrush** Gets or sets a brush that describes the border fill of a control. (Inherited from Control)
3	**BorderThickness** Gets or sets the border thickness of a control. (Inherited from Control)
4	**Content** Gets or sets the content of a ContentControl. (Inherited from ContentControl)
5	**ClickMode** Gets or sets a value that indicates when the Click event occurs, in terms of device behavior. (Inherited from ButtonBase)
6	**ContentTemplate**

	Gets or sets the data template that is used to display the content of the ContentControl. (Inherited from ContentControl)
7	**FontFamily** Gets or sets the font used to display text in the control. (Inherited from Control)
8	**FontSize** Gets or sets the size of the text in this control. (Inherited from Control)
9	**FontStyle** Gets or sets the style in which the text is rendered. (Inherited from Control)
10	**FontWeight** Gets or sets the thickness of the specified font. (Inherited from Control)
11	**Foreground** Gets or sets a brush that describes the foreground color. (Inherited from Control)
12	**Height** Gets or sets the suggested height of a FrameworkElement. (Inherited from FrameworkElement)
13	**HorizontalAlignment** Gets or sets the horizontal alignment characteristics that are applied to a FrameworkElement when it is composed in a layout parent, such as a panel or items control. (Inherited from FrameworkElement)
14	**IsChecked** Gets or sets whether the ToggleButton is checked. (Inherited from ToggleButton)
15	**IsEnabled** Gets or sets a value indicating whether the user can interact with the control. (Inherited from Control)
16	**IsPressed** Gets a value that indicates whether a ButtonBase is currently in a pressed state. (Inherited from ButtonBase)
17	**IsThreeState** Gets or sets a value that indicates whether the control supports three states. (Inherited from ToggleButton)
18	**Margin** Gets or sets the outer margin of a FrameworkElement. (Inherited from FrameworkElement)
19	**Name** Gets or sets the identifying name of the object. When a XAML processor creates the object tree from XAML markup, run-time code can refer to the XAML-declared object by this name. (Inherited from FrameworkElement)
20	**Opacity** Gets or sets the degree of the object's opacity. (Inherited from UIElement)
21	**Resources** Gets the locally defined resource dictionary. In XAML, you can establish resource items as child object elements of a frameworkElement.Resources property element, through XAML implicit collection syntax. (Inherited from FrameworkElement)
22	**Style** Gets or sets an instance Style that is applied for this object during layout and rendering. (Inherited from FrameworkElement)
23	**Template** Gets or sets a control template. The control template defines the visual appearance of a control in UI, and is defined in XAML markup. (Inherited from Control)
	VerticalAlignment

24	Gets or sets the vertical alignment characteristics that are applied to a FrameworkElement when it is composed in a parent object such as a panel or items control. (Inherited from FrameworkElement)
25	**Visibility** Gets or sets the visibility of a UIElement. A UIElement that is not visible is not rendered and does not communicate its desired size to layout. (Inherited from UIElement)
26	**Width** Gets or sets the width of a FrameworkElement. (Inherited from FrameworkElement)

Given below are the commonly used methods of RadioButton:

Sr. No.	Method & Description
1	**ClearValue** Clears the local value of a dependency property. (Inherited from DependencyObject)
2	**FindName** Retrieves an object that has the specified identifier name. (Inherited from FrameworkElement)
3	**OnApplyTemplate** Invoked whenever application code or internal processes (such as a rebuilding layout pass) call ApplyTemplate. In simplest terms, this means the method is called just before a UI element displays in your app. Override this method to influence the default post-template logic of a class. (Inherited from FrameworkElement)
4	**OnContentChanged** Invoked when the value of the Content property changes. (Inherited from ContentControl)
5	**OnDragEnter** Called before the DragEnter event occurs. (Inherited from Control)
6	**OnDragLeave** Called before the DragLeave event occurs. (Inherited from Control)
7	**OnDragOver** Called before the DragOver event occurs. (Inherited from Control)
8	**OnDrop** Called before the Drop event occurs. (Inherited from Control)
9	**OnGotFocus** Called before the GotFocus event occurs. (Inherited from Control)
10	**OnKeyDown** Called before the KeyDown event occurs. (Inherited from Control)
11	**OnKeyUp** Called before the KeyUp event occurs. (Inherited from Control)
12	**OnLostFocus** Called before the LostFocus event occurs. (Inherited from Control)
13	**OnToggle** Called when the ToggleButton receives toggle stimulus. (Inherited from ToggleButton)
14	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)

Given below are the commonly used events of RadioButton:

Sr. No.	Event & Description
1	**Checked** Fires when a ToggleButton is checked. (Inherited from ToggleButton)
2	**Click** Occurs when a button control is clicked. (Inherited from ButtonBase)
3	**DataContextChanged** Occurs when the value of the FrameworkElement.DataContext property changes. (Inherited from FrameworkElement)
4	**DragEnter** Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
5	**DragLeave** Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
6	**DragOver** Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)
7	**DragStarting** Occurs when a drag operation is initiated. (Inherited from UIElement)
8	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
9	**Holding** Occurs when an otherwise unhandled Hold interaction occurs over the hit test area of this element. (Inherited from UIElement)
10	**Intermediate** Fires when the state of a ToggleButton is switched to the indeterminate state. (Inherited from ToggleButton)
11	**IsEnabledChanged** Occurs when the IsEnabled property changes. (Inherited from Control)
12	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
13	**KeyUp** Occurs when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)
14	**LostFocus** Occurs when a UIElement loses focus. (Inherited from UIElement)
15	**SizeChanged** Occurs when either the ActualHeight or the ActualWidth property changes value on a FrameworkElement. (Inherited from FrameworkElement)
16	**Unchecked** Occurs when a ToggleButton is unchecked. (Inherited from ToggleButton)

Example

The following example shows the usage of RadioButton in which two groups of RadioButton is shown. When the user selects an option, the program displays the message on the TextBlock.

Here is the XAML code to create two RadioButtons with some properties and events.

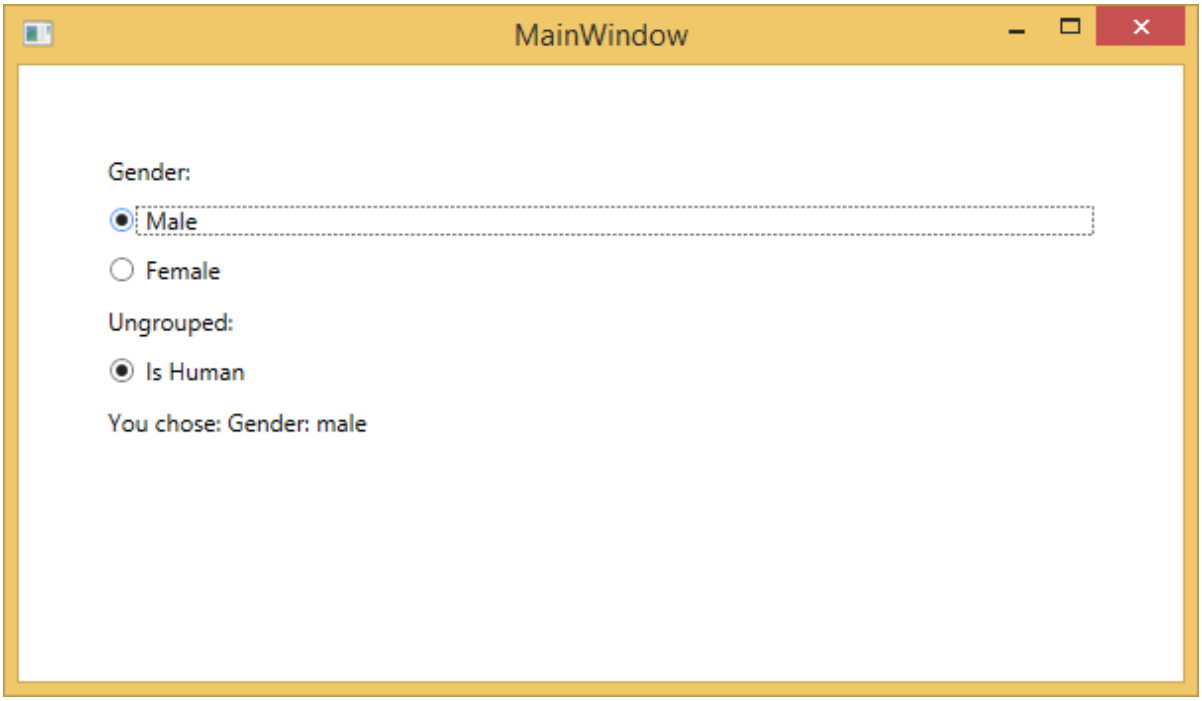
```
<Window x:Class="XAMLRadioButton.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <StackPanel Margin="40">
            <TextBlock Text="Gender:"  Margin="5" />
            <RadioButton x:Name="male" Margin="5" Checked="HandleCheck"
                         GroupName="Gender" Content="Male" />
            <RadioButton x:Name="female" Margin="5" Checked="HandleCheck"
                         GroupName="Gender" Content="Female" />
            <TextBlock Text="Ungrouped:" Margin="5" />
            <RadioButton x:Name="isHuman" Margin="5" Checked="HandleCheck"
                         Content="Is Human" />
            <TextBlock x:Name="choiceTextBlock" Margin="5" />
        </StackPanel>
    </Grid>
</Window>
```

Here is the implementation in C# for different events:

```
using System;
using System.Windows;
using System.Windows.Controls;
using System.Windows.Media;

namespace XAMLRadioButton
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
```

```
            InitializeComponent();
        }
        private void HandleCheck(object sender, RoutedEventArgs e)
        {
            RadioButton rb = sender as RadioButton;
            choiceTextBlock.Text = "You chose: " + rb.GroupName + ": " + rb.Name;
        }
    }
}
```

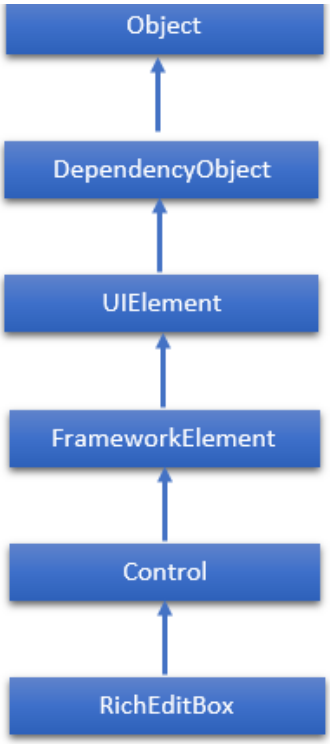
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

RichEditBox

A RichEditBox is a rich text editing control that supports formatted text, hyperlinks, and other rich content. WPF projects do not support this control. So it will be implemented in Windows App. The hierarchical inheritance of RichEditBox class is as follows:



Given below are the most commonly used properties of RichEditBox.

Sr. No.	Property & Description
1	**AcceptsReturn** Gets or sets a value that indicates whether the RichEditBox allows and displays the newline or return characters when the ENTER or RETURN keys are pressed.
2	**AcceptsReturnProperty** Identifies the AcceptsReturn dependency property.
3	**DesiredCandidateWindowAlignment** Gets or sets a value that indicates the preferred alignment of the Input Method Editor (IME).
4	**DesiredCandidateWindowAlignmentProperty** Identifies the DesiredCandidateWindowAlignment dependency property.
5	**Document** Gets an object that enables access to the text object model for the text contained in a RichEditBox.
6	**Header** Gets or sets the content for the control's header.
7	**HeaderProperty** Identifies the Header dependency property.
8	**HeaderTemplate** Gets or sets the DataTemplate used to display the content of the control's header.
9	**HeaderTemplateProperty** Identifies the HeaderTemplate dependency property.
10	**InputScope** Gets or sets the context for input used by this RichEditBox.
11	**InputScopeProperty** Identifies the InputScope dependency property.
12	**IsColorFontEnabled**

	Gets or sets a value that determines whether font glyphs that contain color layers, such as Segoe UI Emoji, are rendered in color.
13	**IsColorFontEnabledProperty** Identifies the IsColorFontEnabled dependency property.
14	**IsReadOnly** Gets or sets a value that indicates whether the user can change the text in the RichEditBox.
15	**IsReadOnlyProperty** Identifies the IsReadOnly dependency property.
16	**IsSpellCheckEnabled** Gets or sets a value that indicates whether the text input should interact with a spell check engine.
17	**IsSpellCheckEnabledProperty** Identifies the IsSpellCheckEnabled dependency property.
18	**IsTextPredictionEnabled** Gets or sets a value that indicates whether text prediction features ("autocomplete") are enabled for this RichEditBox.
19	**IsTextPredictionEnabledProperty** Identifies the IsTextPredictionEnabled dependency property.
20	**PlaceholderText** Gets or sets the text that is displayed in the control until the value is changed by a user action or some other operation.
21	**PlaceholderTextProperty** Identifies the PlaceholderText dependency property.
22	**PreventKeyboardDisplayOnProgrammaticFocus** Gets or sets a value that indicates whether the on-screen keyboard is shown when the control receives focus programmatically.
23	**PreventKeyboardDisplayOnProgrammaticFocusProperty** Identifies the PreventKeyboardDisplayOnProgrammaticFocus dependency property.
24	**SelectionHighlightColor** Gets or sets the brush used to highlight the selected text.
25	**SelectionHighlightColorProperty** Identifies the SelectionHighlightColor dependency property.
26	**TextAlignment** Gets or sets a value that indicates how text is aligned in the RichEditBox.
27	**TextAlignmentProperty** Identifies the TextAlignment dependency property.
28	**TextReadingOrder** Gets or sets a value that indicates how the reading order is determined for the RichEditBox.
29	**TextReadingOrderProperty** Identifies the TextReadingOrder dependency property.
30	**TextWrapping** Gets or sets a value that indicates how text wrapping occurs if a line of text extends beyond the available width of the RichEditBox.
31	**TextWrappingProperty** Identifies the TextWrapping dependency property.

Given below are the most commonly used and important events of RichEditBox:

Sr. No.	Event & Description
1	**CandidateWindowBoundsChanged** Occurs when the Input Method Editor (IME) window open, updates, or closes.
2	**ContextMenuOpening** Occurs when the system processes an interaction that displays a context menu.
3	**Paste** Occurs when text is pasted into the control.
4	**SelectionChanged** Occurs when the text selection has changed.
5	**TextChanged** Occurs when content changes in the RichEditBox.
6	**TextChanging** Occurs when the text in the RichEditBox starts to change.
7	**TextCompositionChanged** Occurs when text being composed through an Input Method Editor (IME) changes.
8	**TextCompositionEnded** Occurs when a user stops composing text through an Input Method Editor (IME).
9	**TextCompositionStarted** Occurs when a user starts composing text through an Input Method Editor (IME).

Given below are the commonly used methods in RichEditBox class:

Sr. No.	Method & Description
1	**OnManipulationCompleted** Called before the ManipulationCompleted event occurs. (Inherited from Control)
2	**OnManipulationDelta** Called before the ManipulationDelta event occurs. (Inherited from Control)
3	**OnManipulationInertiaStarting** Called before the ManipulationInertiaStarting event occurs. (Inherited from Control)
4	**OnManipulationStarted** Called before the ManipulationStarted event occurs. (Inherited from Control)
5	**OnManipulationStarting** Called before the ManipulationStarting event occurs. (Inherited from Control)
6	**OnMaximumChanged** Called when the Maximum property changes. (Inherited from RangeBase)
7	**OnMinimumChanged** Called when the Minimum property changes. (Inherited from RangeBase)
8	**OnValueChanged** Fires the ValueChanged routed event. (Inherited from RangeBase)
9	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)
10	**SetValue** Sets the local value of a dependency property on a DependencyObject. (Inherited from DependencyObject)
11	**StartDragAsync**

	Initiates a drag-and-drop operation. (Inherited from UIElement)
12	**UnregisterPropertyChangedCallback** Cancels a change notification that was previously registered by calling RegisterPropertyChangedCallback. (Inherited from DependencyObject)

Example

The following example shows how to open and save an RTF file in RichEditBox. Here is the XAML code to create and initialize two buttons and a RichEditBox with some properties and events.

```
<Page
    x:Class="XAMLRichEditBox.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:local="using:XAMLRichEditBox"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d">

    <Grid Background="{ThemeResource ApplicationPageBackgroundThemeBrush}">
        <Grid Margin="120">
            <Grid.RowDefinitions>
                <RowDefinition Height="50"/>
                <RowDefinition/>
            </Grid.RowDefinitions>
            <StackPanel Orientation="Horizontal">
                <Button Content="Open file" Click="OpenButton_Click"/>
                <Button Content="Save file" Click="SaveButton_Click"/>
            </StackPanel>

            <RichEditBox x:Name="editor" Grid.Row="1"/>
        </Grid>
    </Grid>
</Page>
```

Here is the implementation in C# for different events and file handling:

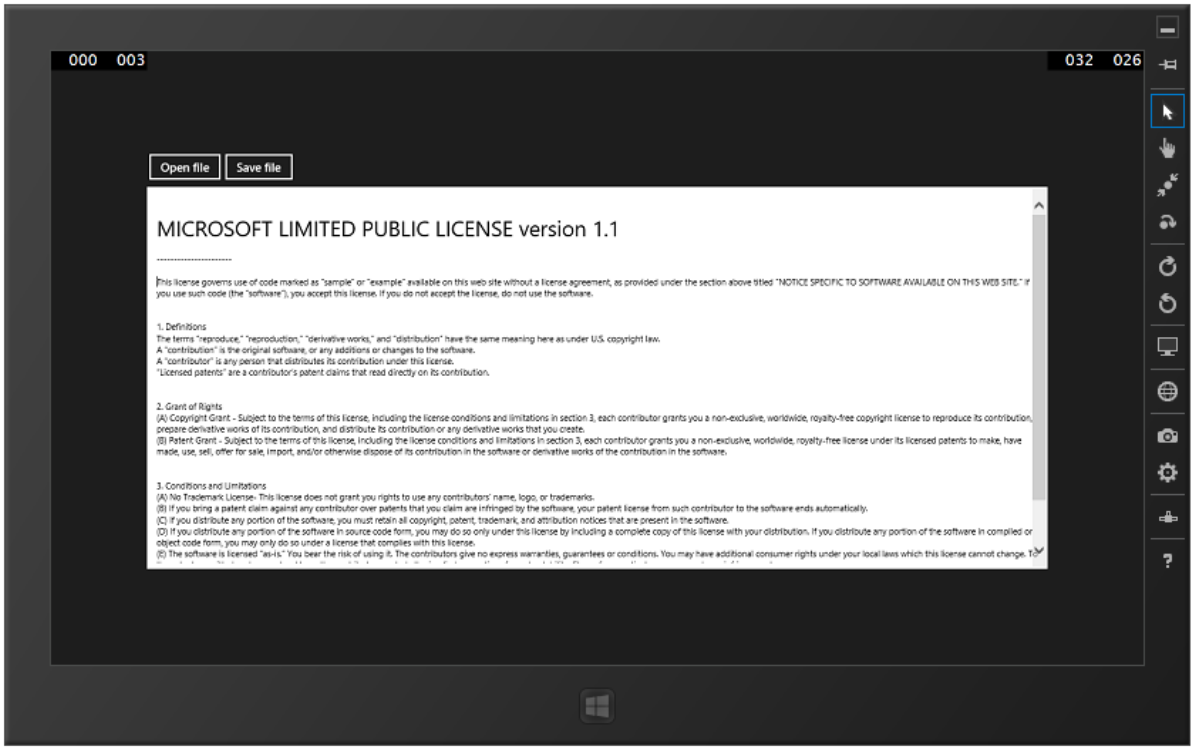
```
using System;
using System.Collections.Generic;
using System.IO;
```

```
using System.Linq;
using System.Runtime.InteropServices.WindowsRuntime;
using Windows.Foundation;
using Windows.Foundation.Collections;
using Windows.Storage;
using Windows.Storage.Pickers;
using Windows.Storage.Provider;
using Windows.UI.ViewManagement;
using Windows.UI.Xaml;
using Windows.UI.Xaml.Controls;
using Windows.UI.Xaml.Controls.Primitives;
using Windows.UI.Xaml.Data;
using Windows.UI.Xaml.Input;
using Windows.UI.Xaml.Media;
using Windows.UI.Xaml.Navigation;

// The Blank Page item template is documented at
http://go.microsoft.com/fwlink/?LinkId=234238

namespace XAMLRichEditBox
{
    /// <summary>
    /// An empty page that can be used on its own or navigated to within a Frame.
    /// </summary>
    public sealed partial class MainPage : Page
    {
        public MainPage()
        {
            this.InitializeComponent();
        }
        private async void OpenButton_Click(object sender, RoutedEventArgs e)
        {
            // Open a text file.
            Windows.Storage.Pickers.FileOpenPicker open =
                new Windows.Storage.Pickers.FileOpenPicker();
            open.SuggestedStartLocation =
                Windows.Storage.Pickers.PickerLocationId.DocumentsLibrary;
```

```
            open.FileTypeFilter.Add(".rtf");

            Windows.Storage.StorageFile file = await open.PickSingleFileAsync();

            if (file != null)
            {
                Windows.Storage.Streams.IRandomAccessStream randAccStream =
                    await file.OpenAsync(Windows.Storage.FileAccessMode.Read);

                // Load the file into the Document property of the RichEditBox.

editor.Document.LoadFromStream(Windows.UI.Text.TextSetOptions.FormatRtf,
randAccStream);
            }
        }

        private async void SaveButton_Click(object sender, RoutedEventArgs e)
        {
            if (((ApplicationView.Value != ApplicationViewState.Snapped) ||
                  ApplicationView.TryUnsnap()))
            {
                FileSavePicker savePicker = new FileSavePicker();
                savePicker.SuggestedStartLocation =
PickerLocationId.DocumentsLibrary;

                // Dropdown of file types the user can save the file as
                savePicker.FileTypeChoices.Add("Rich Text", new List<string>()
{ ".rtf" });

                // Default file name if the user does not type one in or select
a file to replace
                savePicker.SuggestedFileName = "New Document";

                StorageFile file = await savePicker.PickSaveFileAsync();
                if (file != null)
                {
                    // Prevent updates to the remote version of the file until we
                    // finish making changes and call CompleteUpdatesAsync.
```

```
                    CachedFileManager.DeferUpdates(file);
                    // write to file
                    Windows.Storage.Streams.IRandomAccessStream randAccStream =
                        await file.OpenAsync(Windows.Storage.FileAccessMode.ReadWrite);



editor.Document.SaveToStream(Windows.UI.Text.TextGetOptions.FormatRtf,
randAccStream);


                    // Let Windows know that we're finished changing the file so the
                    // other app can update the remote version of the file.
                    FileUpdateStatus status = await
CachedFileManager.CompleteUpdatesAsync(file);
                    if (status != FileUpdateStatus.Complete)
                    {
                        Windows.UI.Popups.MessageDialog errorBox =
                            new Windows.UI.Popups.MessageDialog("File " +
file.Name + " couldn't be saved.");
                        await errorBox.ShowAsync();
                    }
                }
            }
        }
    }
}
```

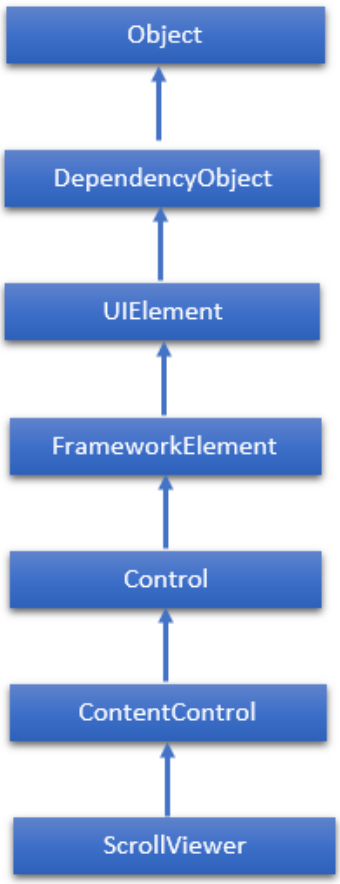
When you compile and execute the above code, it will produce the following output. You can open, edit, and save any RTF file in this application.



We recommend you to execute the above example code and experiment with some other properties and events.

ScrollViewer

This control provides a scrollable area that can contain other visible elements. The hierarchical inheritance of ScrollViewer class is as follows:



Given below are the commonly used properties of ScrollViewer class:

Sr. No.	Property & Description
1	**ComputedHorizontalScrollBarVisibility** Gets a value that indicates whether the horizontal ScrollBar is visible.
2	**ComputedHorizontalScrollBarVisibilityProperty** Identifies the ComputedHorizontalScrollBarVisibility dependency property.
3	**HorizontalScrollBarVisibility** Gets or sets a value that indicates whether a horizontal ScrollBar should be displayed.
4	**HorizontalScrollBarVisibilityProperty** Identifies the HorizontalScrollBarVisibility dependency property.
5	**HorizontalScrollMode** Gets or sets a value that determines how manipulation input influences scrolling behavior on the horizontal axis.
6	**HorizontalScrollModeProperty** Identifies the HorizontalScrollMode dependency property.
7	**HorizontalSnapPointsAlignment** Gets or sets a value that indicates how the existing snap points are horizontally aligned versus the initial viewport.
8	**HorizontalSnapPointsAlignmentProperty** Identifies the HorizontalSnapPointsAlignment dependency property.
9	**IsHorizontalScrollChainingEnabled** Gets or sets a value that indicates whether scroll chaining is enabled from this child to its parent, for the horizontal axis.

10	**IsHorizontalScrollChainingEnabledProperty** Identifies the IsHorizontalScrollChainingEnabled dependency property.
11	**IsScrollInertiaEnabled** Gets or sets a value that indicates whether scroll actions should include inertia in their behavior and value.
12	**IsScrollInertiaEnabledProperty** Identifies the IsScrollInertiaEnabled dependency property.
13	**IsVerticalScrollChainingEnabled** Gets or sets a value that indicates whether scroll chaining is enabled from this child to its parent, for the vertical axis.
14	**IsVerticalScrollChainingEnabledProperty** Identifies the IsVerticalScrollChainingEnabled dependency property.
15	**ScrollableHeight** Gets a value that represents the vertical size of the area that can be scrolled; the difference between the width of the extent and the width of the viewport.
16	**ScrollableHeightProperty** Identifies the ScrollableHeight dependency property.
17	**ScrollableWidth** Gets a value that represents the horizontal size of the area that can be scrolled; the difference between the width of the extent and the width of the viewport.
18	**ScrollableWidthProperty** Identifies the ScrollableWidth dependency property.
19	**VerticalScrollBarVisibility** Gets or sets a value that indicates whether a vertical ScrollBar should be displayed.
20	**VerticalScrollBarVisibilityProperty** Identifies the VerticalScrollBarVisibility dependency property.
21	**VerticalScrollMode** Gets or sets a value that determines how manipulation input influences scrolling behavior on the vertical axis.
22	**VerticalScrollModeProperty** Identifies the VerticalScrollMode dependency property.

Given below are the commonly used events of ScrollViewer class:

Sr. No.	Event & Description
1	**DirectManipulationCompleted** Occurs when any direct manipulation of the ScrollViewer finishes.
2	**DirectManipulationStarted** Occurs when any direct manipulation of the ScrollViewer begins.
3	**ViewChanged** Occurs when manipulations such as scrolling and zooming have caused the view to change.
4	**ViewChanging** Occurs when manipulations such as scrolling and zooming cause the view to change.

Given below are the commonly used methods of ScrollViewer class:

Sr. No.	Method & Description
1	**GetHorizontalScrollBarVisibility**

	Gets the value of the HorizontalScrollBarVisibility dependency property / ScrollViewer.HorizontalScrollBarVisibility XAML attached property from a specified element.
2	**GetHorizontalScrollMode** Gets the value of the HorizontalScrollMode dependency property / ScrollViewer.HorizontalScrollMode XAML attached property from a specified element.
3	**GetIsDeferredScrollingEnabled** Gets the value of the IsDeferredScrollingEnabled dependency property / ScrollViewer.IsDeferredScrollingInertiaEnabled XAML attached property from a specified element.
4	**GetIsHorizontalScrollChainingEnabled** Gets the value of the IsHorizontalScrollChainingEnabled dependency property / ScrollViewer.IsHorizontalScrollChainingEnabled XAML attached property from a specified element.
5	**GetIsScrollInertiaEnabled** Gets the value of the IsScrollInertiaEnabled dependency property / ScrollViewer.IsScrollInertiaEnabled XAML attached property from a specified element.
6	**GetIsVerticalScrollChainingEnabled** Gets the value of the IsVerticalScrollChainingEnabled dependency property / ScrollViewer.IsVerticalScrollChainingEnabled XAML attached property from a specified element.
7	**GetVerticalScrollBarVisibility** Gets the value of the VerticalScrollBarVisibility dependency property / ScrollViewer.VerticalScrollBarVisibility XAML attached property from a specified element.
8	**GetVerticalScrollMode** Gets the value of the VerticalScrollMode dependency property / ScrollViewer.VerticalScrollMode XAML attached property from a specified element.
9	**InvalidateScrollInfo** Called when the value of properties that describe the size and location of the scroll area change.
10	**ScrollToHorizontalOffset** Scrolls the content that is within the ScrollViewer to the specified horizontal offset position.
11	**ScrollToVerticalOffset** Scrolls the content that is within the ScrollViewer to the specified vertical offset position.
12	**SetHorizontalScrollBarVisibility** Sets the value of the HorizontalScrollBarVisibility dependency property / ScrollViewer.HorizontalScrollBarVisibility XAML attached property on a specified element.
13	**SetHorizontalScrollMode** Sets the value of the HorizontalScrollMode dependency property / ScrollViewer.HorizontalScrollMode XAML attached property on a specified element.
14	**SetIsDeferredScrollingEnabled** Sets the value of the IsDeferredScrollingEnabled dependency property / ScrollViewer.IsDeferredScrollingEnabled XAML attached property on a specified element.
15	**SetIsHorizontalScrollChainingEnabled**

	Sets the value of the IsHorizontalScrollChainingEnabled dependency property / ScrollViewer.IsHorizontalScrollChainingEnabled XAML attached property on a specified element.
16	**SetIsScrollInertiaEnabled** Sets the value of the IsScrollInertiaEnabled dependency property / ScrollViewer.IsScrollInertiaEnabled XAML attached property on a specified element.
17	**SetIsVerticalScrollChainingEnabled** Sets the value of the IsVerticalScrollChainingEnabled dependency property / ScrollViewer.IsVerticalScrollChainingEnabled XAML attached property on a specified element.
18	**SetVerticalScrollBarVisibility** Sets the value of the VerticalScrollBarVisibility dependency property / ScrollViewer.VerticalScrollBarVisibility XAML attached property on a specified element.
19	**SetVerticalScrollMode** Sets the value of the VerticalScrollMode dependency property / ScrollViewer.VerticalScrollMode XAML attached property on a specified element.

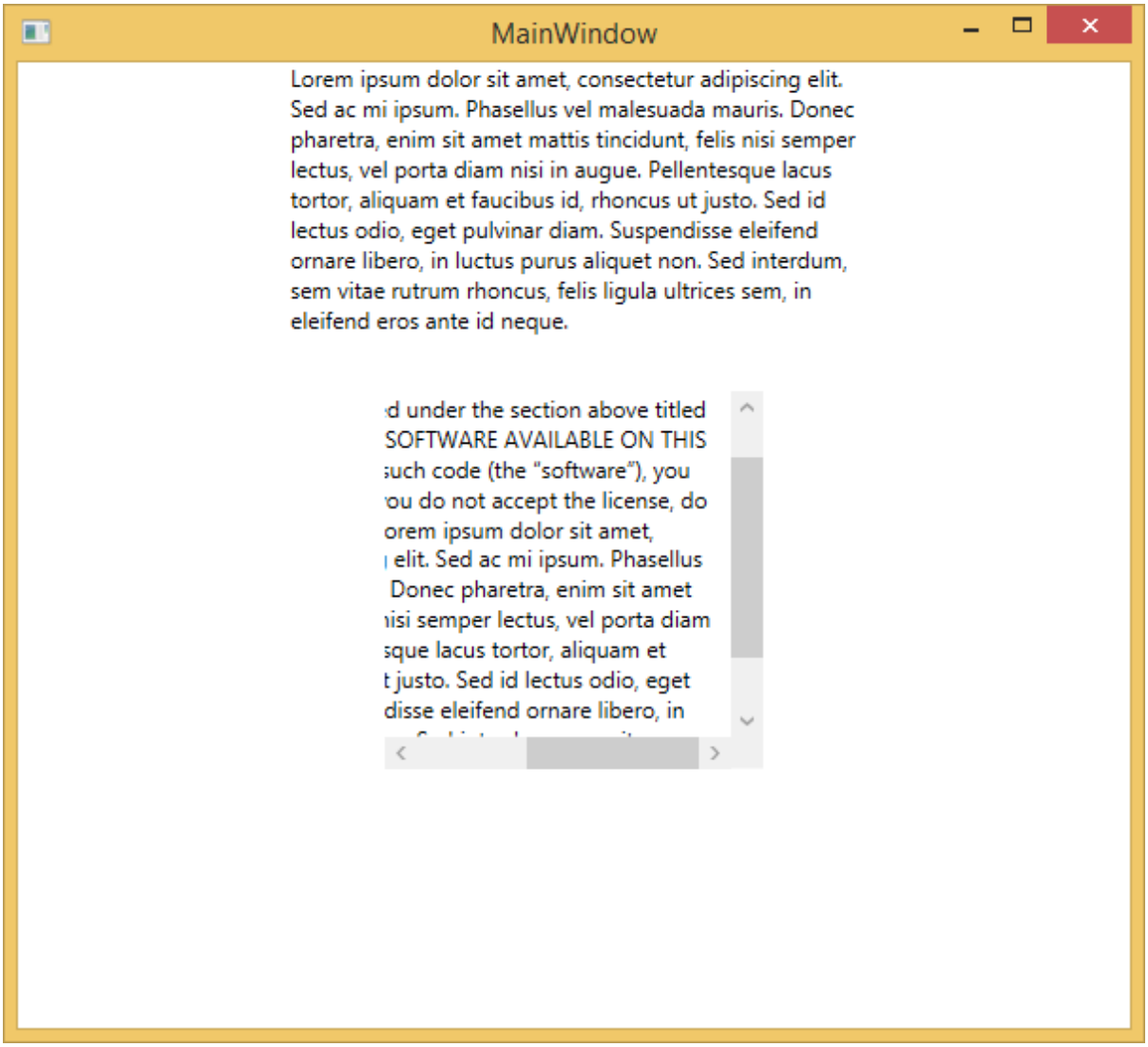
Example

The following example shows how to add a ScrollViewer in your XAML application. Here is the XAML code in which two TextBlocks are added and one with a ScrollViewer and initialized with some properties and events.

```
<Window x:Class="XAMLScrollViewer.MainWindow"

        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"

        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"

        Title="MainWindow" Height="550" Width="604">

    <Grid>

        <StackPanel>

            <!-- A large TextBlock. -->

            <TextBlock Width="300" TextWrapping="Wrap" Margin="0,0,0,30"

        Text="Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed ac
mi ipsum. Phasellus vel malesuada mauris. Donec pharetra, enim sit amet mattis
tincidunt, felis nisi semper lectus, vel porta diam nisi in augue. Pellentesque
lacus tortor, aliquam et faucibus id, rhoncus ut justo. Sed id lectus odio,
eget pulvinar diam. Suspendisse eleifend ornare libero, in luctus purus aliquet
non. Sed interdum, sem vitae rutrum rhoncus, felis ligula ultrices sem, in
eleifend eros ante id neque." />


            <!-- The same large TextBlock, wrapped in a ScrollViewer. -->

            <ScrollViewer Height="200" Width="200"

                    HorizontalScrollBarVisibility="Auto"

                    VerticalScrollBarVisibility="Auto">

                <TextBlock Width="300" TextWrapping="Wrap"
```

```
                Text=" This license governs use of code marked as “sample” or
“example” available on this web site without a license agreement, as provided
under the section above titled “NOTICE SPECIFIC TO SOFTWARE AVAILABLE ON THIS
WEB SITE.” If you use such code (the “software”), you accept this license. If
you do not accept the license, do not use the software.Lorem ipsum dolor sit
amet, consectetur adipiscing elit. Sed ac mi ipsum. Phasellus vel malesuada
mauris. Donec pharetra, enim sit amet mattis tincidunt, felis nisi semper
lectus, vel porta diam nisi in augue. Pellentesque lacus tortor, aliquam et
faucibus id, rhoncus ut justo. Sed id lectus odio, eget pulvinar diam.
Suspendisse eleifend ornare libero, in luctus purus aliquet non. Sed interdum,
sem vitae rutrum rhoncus, felis ligula ultrices sem, in eleifend eros ante id
neque." />

            </ScrollViewer>

        </StackPanel>

    </Grid>

</Window>
```

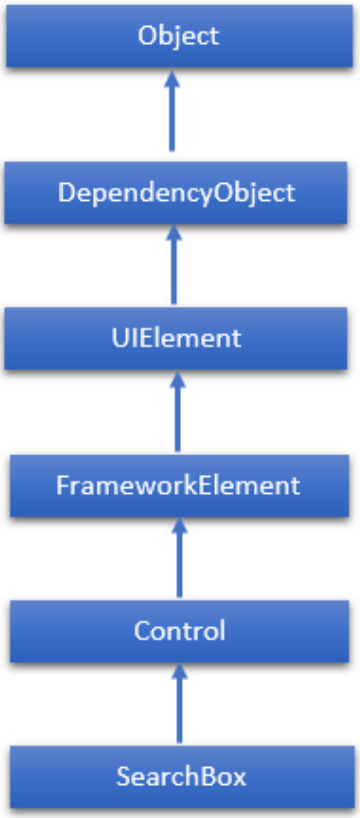
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

SearchBox

A SearchBox represents a control that can be used to enter search query text. WPF projects do not support SearchBox, so it will be implemented in Windows App. The hierarchical inheritance of SearchBox class is as follows:



Given below are the commonly used properties of SearchBox class:

Sr. No.	Property & Description
1	**PlaceholderText** Gets or sets the text that is displayed in the control until the value is changed by a user action or some other operation.
2	**ChooseSuggestionOnEnter** Gets or sets a value that determines whether the suggested search query is activated when the user presses Enter.
3	**ChooseSuggestionOnEnterProperty** Identifies the ChooseSuggestionOnEnter dependency property.
4	**FocusOnKeyboardInput** Gets or sets a value that determines whether a user can search by typing anywhere in the app.
5	**FocusOnKeyboardInputProperty** Identifies the FocusOnKeyboardInput dependency property.
6	**PlaceholderTextProperty** Identifies the PlaceholderText dependency property.

7	**QueryText** Gets or sets the text contents of the search box.
8	**QueryTextProperty** Identifies the QueryText dependency property.
9	**SearchHistoryContext** Gets or sets a string that identifies the context of the search and is used to store the user's search history with the app.
10	**SearchHistoryContextProperty** Identifies the SearchHistoryContext dependency property.
11	**SearchHistoryEnabled** Gets or sets a value that determines whether search suggestions are made from the search history.
12	**SearchHistoryEnabledProperty** Identifies the SearchHistoryEnabled dependency property.

Given below are the commonly used events of SearchBox:

Sr. No.	Event & Description
1	**PrepareForFocusOnKeyboardInput** Occurs when the FocusOnKeyboardInput property is true and the app receives textual keyboard input.
2	**QueryChanged** Occurs when the query text changes.
3	**QuerySubmitted** Occurs when the user submits a search query.
4	**ResultSuggestionChosen** Occurs when the user picks a suggested search result.
5	**SuggestionsRequested** Occurs when the user's query text changes and the app needs to provide new suggestions to display in the search pane.

Given below are the commonly used methods of SearchBox:

Sr. No.	Method & Description
1	**OnManipulationCompleted** Called before the ManipulationCompleted event occurs. (Inherited from Control)
2	**OnManipulationDelta** Called before the ManipulationDelta event occurs. (Inherited from Control)
3	**OnManipulationInertiaStarting** Called before the ManipulationInertiaStarting event occurs. (Inherited from Control)
4	**OnManipulationStarted** Called before the ManipulationStarted event occurs. (Inherited from Control)
5	**OnManipulationStarting** Called before the ManipulationStarting event occurs. (Inherited from Control)
6	**OnMaximumChanged** Called when the Maximum property changes. (Inherited from RangeBase)
7	**OnMinimumChanged** Called when the Minimum property changes. (Inherited from RangeBase)
8	**OnValueChanged** Fires the ValueChanged routed event. (Inherited from RangeBase)
9	**SetBinding**

	Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)
10	**SetLocalContentSuggestionSettings** Specifies whether suggestions based on local files are automatically displayed in the search box suggestions, and defines the criteria that Windows uses to locate and filter these suggestions.
11	**SetValue** Sets the local value of a dependency property on a DependencyObject. (Inherited from DependencyObject)
12	**StartDragAsync** Initiates a drag-and-drop operation. (Inherited from UIElement)
13	**UnregisterPropertyChangedCallback** Cancels a change notification that was previously registered by calling RegisterPropertyChangedCallback. (Inherited from DependencyObject)

Example

The following example shows the usage of SearchBox in an XAML application. Here is the XAML code to create and initialize a SearchBox with some properties and events.

```
<Page
    x:Class="XAML_SearchBox.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:local="using:XAML_SearchBox"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d">

    <Grid Background="{ThemeResource ApplicationPageBackgroundThemeBrush}">
        <SearchBox x:Name="mySearchBox"
                    FocusOnKeyboardInput="False"
                    QuerySubmitted="mySearchBox_QuerySubmitted"
                    Height="35"
                   Width="400" Margin="234,132,732,601"/>
    </Grid>
</Page>
```

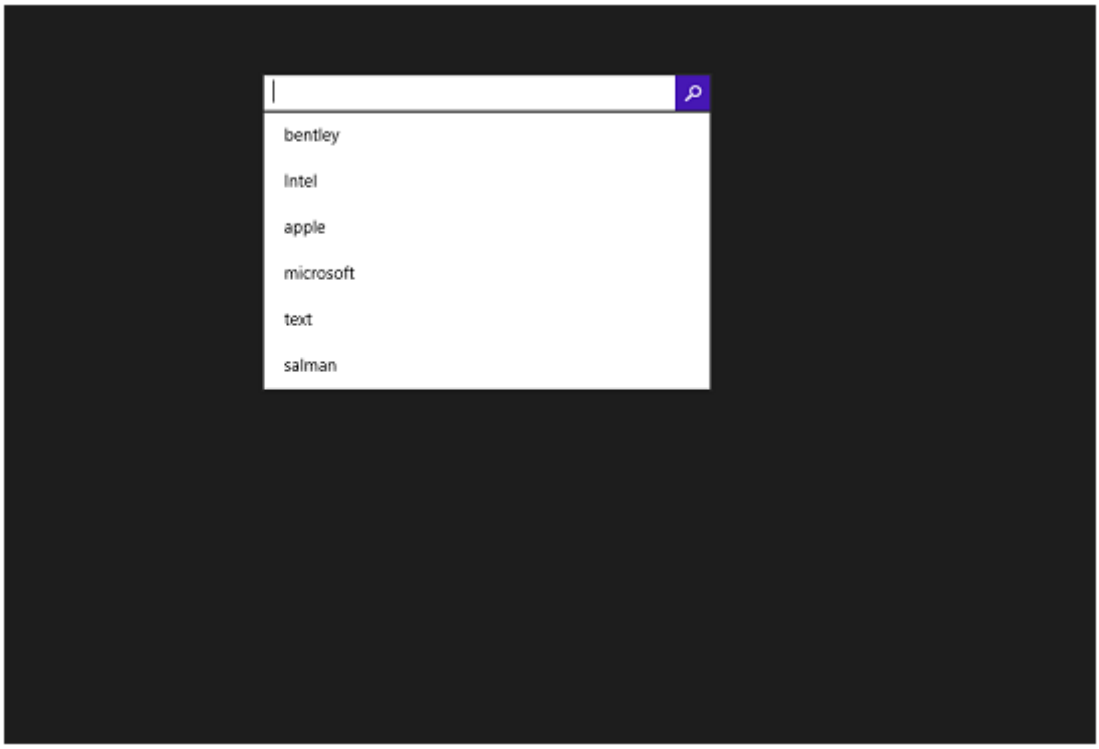
Here is the implementation in C# for search query:

```
using System;
using System.Collections.Generic;
using System.IO;
using System.Linq;
```

```
using System.Runtime.InteropServices.WindowsRuntime;
using Windows.Foundation;
using Windows.Foundation.Collections;
using Windows.UI.Xaml;
using Windows.UI.Xaml.Controls;
using Windows.UI.Xaml.Controls.Primitives;
using Windows.UI.Xaml.Data;
using Windows.UI.Xaml.Input;
using Windows.UI.Xaml.Media;
using Windows.UI.Xaml.Navigation;

// The Blank Page item template is documented at
http://go.microsoft.com/fwlink/?LinkId=234238

namespace XAML_SearchBox
{
    /// <summary>
    /// An empty page that can be used on its own or navigated to within a
Frame.
    /// </summary>
    public sealed partial class MainPage : Page
    {
        public MainPage()
        {
            this.InitializeComponent();
        }
        private void mySearchBox_QuerySubmitted(SearchBox sender,
SearchBoxQuerySubmittedEventArgs args)
        {
            this.Frame.Navigate(typeof(SearchResultsPage1), args.QueryText);
        }
    }
}
```

In Windows App project for this example, add a **Search Results Page** with the name **SearchResultsPage1.xaml**. The default implementation is sufficient to run this App.

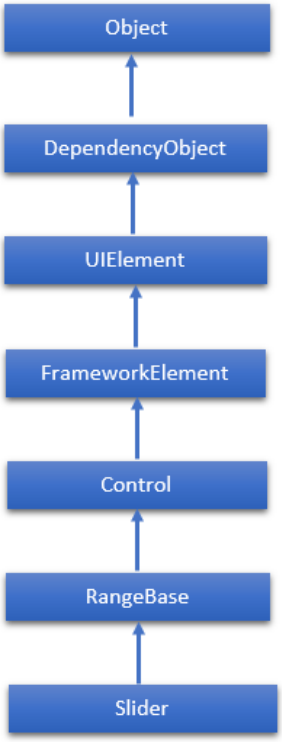
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

Slider

A Slider is a control with the help of which a user can select from a range of values by moving a Thumb control along a track. The hierarchical inheritance of the Slider class is as follows:



Given below are the commonly used properties of Slider:

Sr. No.	Property & Description
1	**Header** Gets or sets the content for the control's header.
2	**HeaderProperty** Identifies the Header dependency property.
3	**HeaderTemplate** Gets or sets the DataTemplate used to display the content of the control's header.
4	**HeaderTemplateProperty** Identifies the HeaderTemplate dependency property.
5	**IntermediateValue** Gets or sets the value of the Slider while the user is interacting with it, before the value is snapped to either the tick or step value. The value the Slider snaps to is specified by the SnapsTo property.
6	**IntermediateValueProperty** Identifies the IntermediateValue dependency property.
7	**IsDirectionReversed** Gets or sets a value that indicates the direction of increasing value.
8	**IsDirectionReversedProperty** Identifies the IsDirectionReversed dependency property.
9	**IsThumbToolTipEnabled** Gets or sets a value that determines whether the slider value is shown in a tool tip for the Thumb component of the Slider.
10	**IsThumbToolTipEnabledProperty** Identifies the IsThumbToolTipEnabled dependency property.
11	**Orientation** Gets or sets the orientation of a Slider.
12	**OrientationProperty**

	Identifies the Orientation dependency property.
13	**StepFrequency** Gets or sets the value part of a value range that steps should be created for.
14	**StepFrequencyProperty** Identifies the StepFrequency dependency property.
15	**ThumbToolTipValueConverter** Gets or sets the converter logic that converts the range value of the Slider into tool tip content.
16	**ThumbToolTipValueConverterProperty** Identifies the ThumbToolTipValueConverter dependency property.
17	**TickFrequency** Gets or sets the increment of the value range that ticks should be created for.
18	**TickFrequencyProperty** Identifies the TickFrequency dependency property.
19	**TickPlacement** Gets or sets a value that indicates where to draw tick marks in relation to the track.
20	**TickPlacementProperty** Identifies the TickPlacement dependency property.

Given below are the commonly used events in Slider class:

Sr. No.	Event & Description
1	**ManipulationCompleted** Occurs when a manipulation on the UIElement is complete. (Inherited from UIElement)
2	**ManipulationDelta** Occurs when the input device changes position during a manipulation. (Inherited from UIElement)
3	**ManipulationInertiaStarting** Occurs when the input device loses contact with the UIElement object during a manipulation and inertia begins. (Inherited from UIElement)
4	**ManipulationStarted** Occurs when an input device begins a manipulation on the UIElement. (Inherited from UIElement)
5	**ManipulationStarting** Occurs when the manipulation processor is first created. (Inherited from UIElement)
6	**ValueChanged** Occurs when the range value changes. (Inherited from RangeBase)

Given below are the commonly used methods in Slider class:

Sr. No.	Method & Description
1	**OnManipulationCompleted** Called before the ManipulationCompleted event occurs. (Inherited from Control)

2	**OnManipulationDelta** Called before the ManipulationDelta event occurs. (Inherited from Control)
3	**OnManipulationInertiaStarting** Called before the ManipulationInertiaStarting event occurs. (Inherited from Control)
4	**OnManipulationStarted** Called before the ManipulationStarted event occurs. (Inherited from Control)
5	**OnManipulationStarting** Called before the ManipulationStarting event occurs. (Inherited from Control)
6	**OnMaximumChanged** Called when the Maximum property changes. (Inherited from RangeBase)
7	**OnMinimumChanged** Called when the Minimum property changes. (Inherited from RangeBase)
8	**OnValueChanged** Fires the ValueChanged routed event. (Inherited from RangeBase)
9	**SetBinding** Attaches a binding to a FrameworkElement, using the provided binding object. (Inherited from FrameworkElement)
10	**SetValue** Sets the local value of a dependency property on a DependencyObject. (Inherited from DependencyObject)

Example

The following example shows the usage of Slider in an XAML application. Here is the XAML code to create a Slider and text blocks with some properties and events.

```
<Window x:Class="XAMLSlider.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">
    <Grid>
        <StackPanel >
            <TextBlock Text="Slider with ValueChanged event handler:" Margin="10"/>
            <Slider x:Name="slider2"
                      Minimum="0"
                      Maximum="100"
                      TickFrequency="2"
                      TickPlacement="BottomRight"
                      ValueChanged="slider2_ValueChanged"
                    Margin="10"/>
```

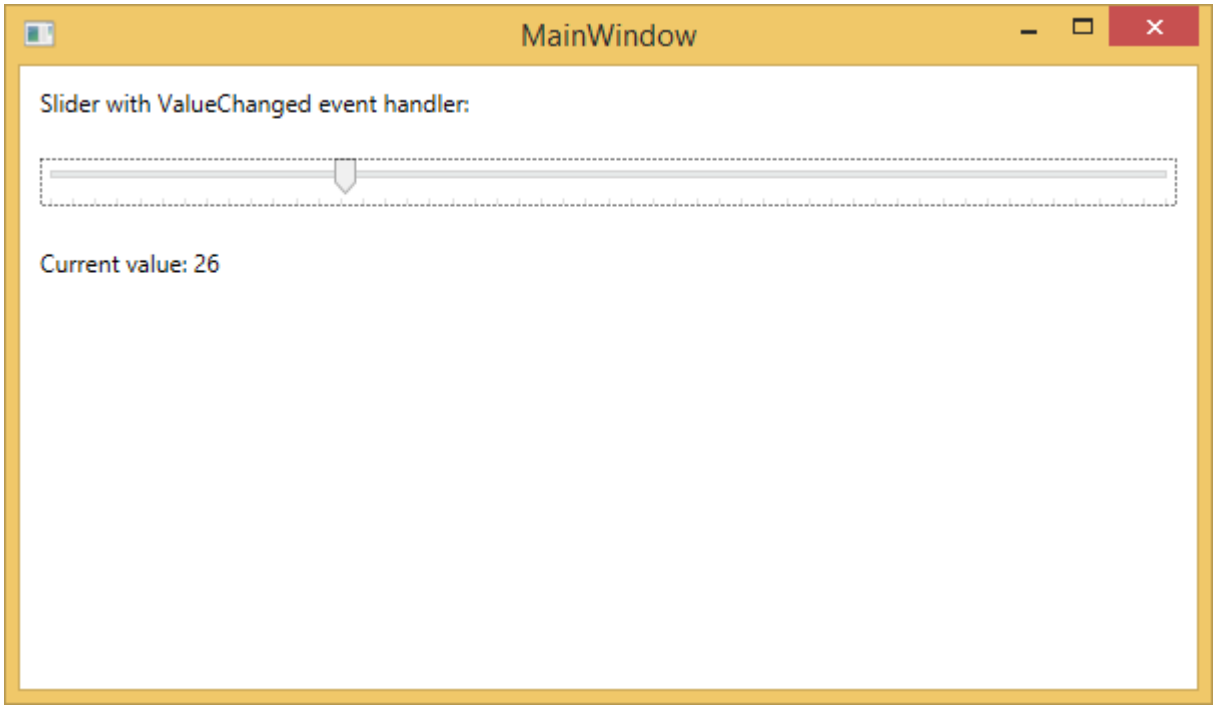
```
            <TextBlock x:Name="textBlock1"
                  Margin="10"
                  Text="Current value: 0" />
        </StackPanel>
    </Grid>
</Window>
```

Here is the implementation in C# for ValueChanged event:

```
using System;
using System.Windows;
using System.Windows.Controls;

namespace XAMLSlider
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }
        //private void slider2_ValueChanged(object sender,
RangeBaseValueChangedEventArgs e)
        //{
        //    string msg = String.Format("Current value: {0}", e.NewValue);
        //    this.textBlock1.Text = msg;
        //}

        private void slider2_ValueChanged(object sender,
RoutedPropertyChangedEventArgs<double> e)
        {
            int val = Convert.ToInt32(e.NewValue);
            string msg = String.Format("Current value: {0}", val);
            this.textBlock1.Text = msg;
```

```
        }
    }
}
```

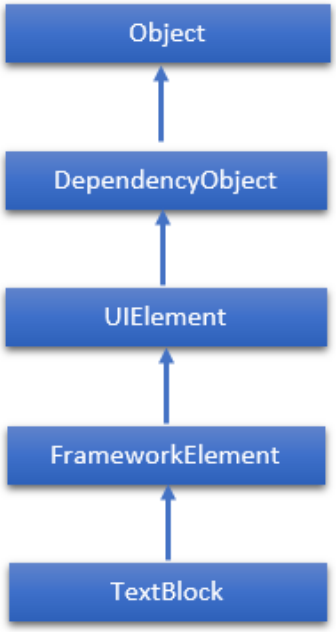
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

TextBlock

A TextBlock provides a lightweight control for displaying small amounts of read-only text. The hierarchical inheritance of TextBlock class is as follows:



Given below are the commonly used properties of TextBlock class:

Sr. No.	Property & Description
1	**ContentEnd** Gets a TextPointer object for the end of text content in the TextBlock.
2	**ContentStart** Gets a TextPointer object for the start of text content in the TextBlock.
3	**IsTextSelectionEnabled** Gets or sets a value that indicates whether text selection is enabled in the TextBlock, either through user action or calling selection-related API.
4	**IsTextSelectionEnabledProperty** Identifies the IsTextSelectionEnabled dependency property.
5	**LineHeight** Gets or sets the height of each line of content.
6	**MaxLines** Gets or sets the maximum lines of text shown in the TextBlock.
7	**SelectedText** Gets a text range of selected text.
8	**SelectionEnd** Gets the end position of the text selected in the TextBlock.
9	**SelectionHighlightColor** Gets or sets the brush used to highlight the selected text.
10	**SelectionStart** Gets the starting position of the text selected in the TextBlock.
11	**Text** Gets or sets the text contents of a TextBlock.
12	**TextAlignment** Gets or sets a value that indicates the horizontal alignment of text content.
13	**TextTrimming** Gets or sets the text trimming behavior to employ when content overflows the content area.
14	**TextWrapping** Gets or sets how the TextBlock wraps text.

Given below are commonly used events of TextBlock class:

Sr. No.	Event & Description
1	**ContextMenuOpening** Occurs when the system processes an interaction that displays a context menu.
2	**SelectionChanged** Occurs when the text selection has changed.

Given below are the commonly used methods in TextBlock class:

Sr. No.	Method & Description
1	**Focus** Focuses the TextBlock, as if it were a conventionally focusable control.
2	**Select** Selects a range of text in the TextBlock.
3	**SelectAll** Selects the entire contents in the TextBlock.

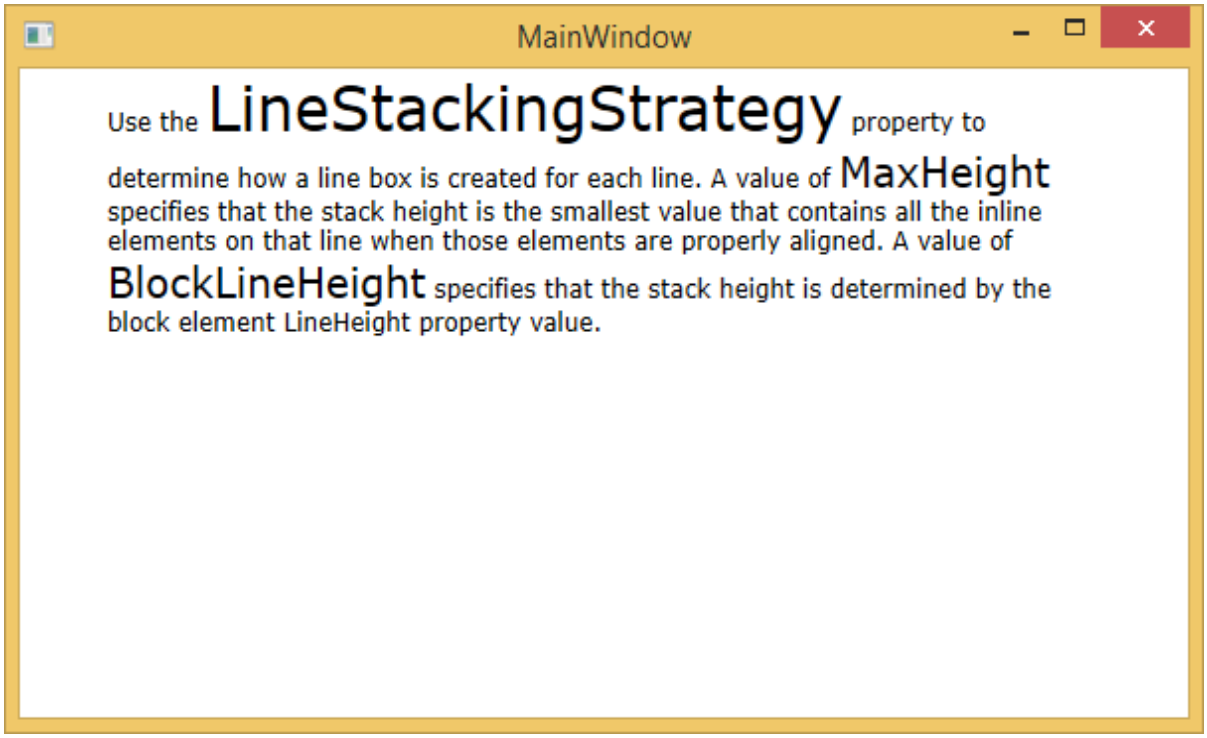
Example

The following example shows the usage of TextBlock in an XAML application. Here is the XAML code to create and initialize a TextBlock with some properties.

```
<Window x:Class="XAMLTextBlock.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <StackPanel>
            <TextBlock FontFamily="Verdana"
                       LineStackingStrategy="MaxHeight"
                       LineHeight="10"
                       Width="500"
                       TextWrapping="Wrap" >
                Use the <Run FontSize="30">LineStackingStrategy</Run> property
to determine how a line box is
                created for each line. A value of <Run
FontSize="20">MaxHeight</Run> specifies that the stack
                height is the smallest value that contains all the inline
elements on that line when those
                elements are properly aligned. A value of <Run
FontSize="20">BlockLineHeight</Run> specifies
```

```
                that the stack height is determined by the block element
LineHeight property value.
            </TextBlock>


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

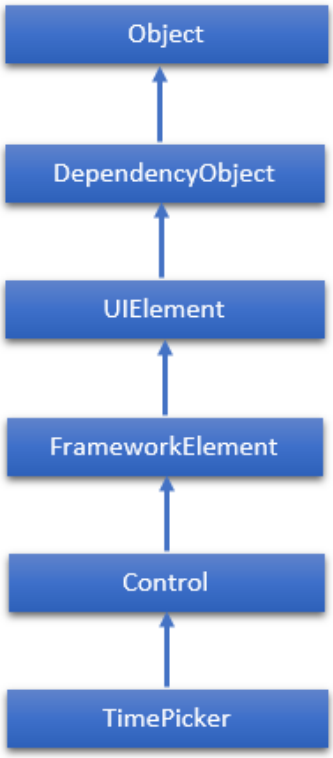
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

TimePicker

A TimePicker is a control that allows a user to pick a time value. The hierarchical inheritance of TimePicker class is as follows:



Given below are the commonly used properties of TimePicker:

Sr. No.	Property & Description
1	**ClockIdentifier** Gets or sets the clock system to use.
2	**ClockIdentifierProperty** Gets the identifier for the ClockIdentifier dependency property.
3	**Header** Gets or sets the content for the control's header.
4	**HeaderProperty** Identifies the Header dependency property.
5	**HeaderTemplate** Gets or sets the DataTemplate used to display the content of the control's header.
6	**HeaderTemplateProperty** Identifies the HeaderTemplate dependency property.
7	**MinuteIncrement** Gets or sets a value that indicates the time increments shown in the minute picker. For example, 15 specifies that the TimePicker minute control displays only the choices 00, 15, 30, 45.
8	**MinuteIncrementProperty** Gets the identifier for the MinuteIncrement dependency property.
9	**Time** Gets or sets the time currently set in the time picker.
10	**TimeProperty** Gets the identifier for the Time dependency property.

Given below are the commonly used events in TimePicker class:

Sr. No.	Event & Description
1	**ManipulationCompleted** Occurs when a manipulation on the UIElement is complete. (Inherited from UIElement)
2	**ManipulationDelta** Occurs when the input device changes position during a manipulation. (Inherited from UIElement)
3	**ManipulationInertiaStarting** Occurs when the input device loses contact with the UIElement object during a manipulation and inertia begins. (Inherited from UIElement)
4	**ManipulationStarted** Occurs when an input device begins a manipulation on the UIElement. (Inherited from UIElement)
5	**ManipulationStarting** Occurs when the manipulation processor is first created. (Inherited from UIElement)
6	**TimeChanged** Occurs when the time value is changed.

Given below are the commonly used methods in TimePicker class:

Sr. No.	Method & Description
1	**OnManipulationCompleted** Called before the ManipulationCompleted event occurs. (Inherited from Control)
2	**OnManipulationDelta** Called before the ManipulationDelta event occurs. (Inherited from Control)
3	**OnManipulationInertiaStarting** Called before the ManipulationInertiaStarting event occurs. (Inherited from Control)
4	**OnManipulationStarted** Called before the ManipulationStarted event occurs. (Inherited from Control)
5	**OnManipulationStarting** Called before the ManipulationStarting event occurs. (Inherited from Control)

Example

The following example shows the usage of TimePicker in an XAML application. Here is the XAML code to create and initialize a TimePicker with some properties.

```
<Page
    x:Class="XAMLTimePicker.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:local="using:XAMLTimePicker"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
```

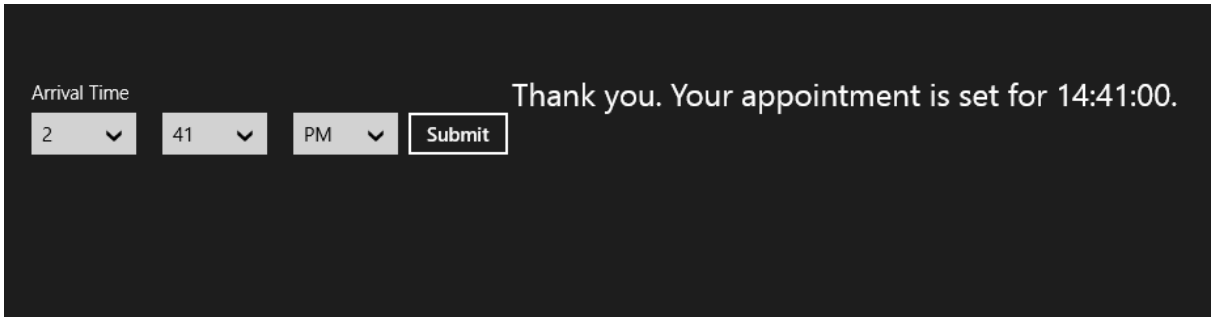
```
    mc:Ignorable="d">

    <Grid Background="{ThemeResource ApplicationPageBackgroundThemeBrush}">
        <StackPanel Orientation="Horizontal" Height="60" Margin="46,67,-46,641">
            <TimePicker x:Name="arrivalTimePicker" Header="Arrival Time"
Margin="0,1"/>
            <Button Content="Submit" Click="SubmitButton_Click"
            Margin="5,0,0,-2" VerticalAlignment="Bottom"/>
            <TextBlock x:Name="Control1Output" FontSize="24"/>
        </StackPanel>
    </Grid>
</Page>
```

Here is the click event implementation in C#:

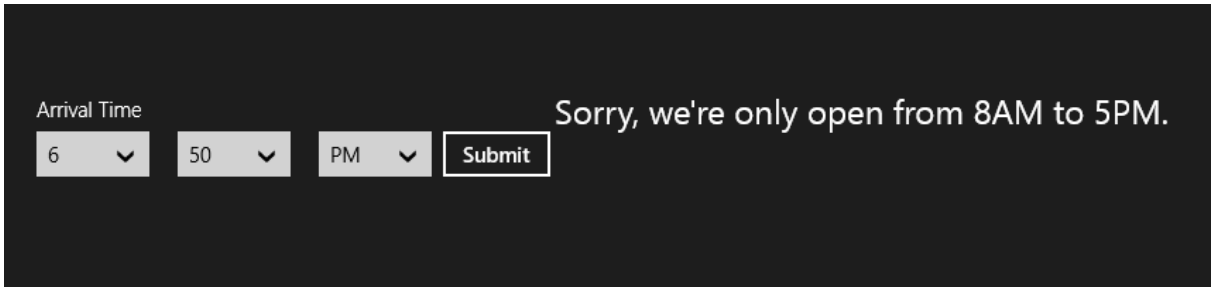
```
using System;
using Windows.UI.Xaml;
using Windows.UI.Xaml.Controls;

namespace XAMLTimePicker
{
    public sealed partial class MainPage : Page
    {
        public MainPage()
        {
            this.InitializeComponent();
        }
        private void SubmitButton_Click(object sender, RoutedEventArgs e)
        {
            if (VerifyTimeIsAvailable(arrivalTimePicker.Time) == true)
            {
                Control1Output.Text = string.Format("Thank you. Your
appointment is set for {0}.",

arrivalTimePicker.Time.ToString());


            }
            else
```

```
            {
                Control1Output.Text = "Sorry, we're only open from 8AM to 5PM.";
            }
        }
        private bool VerifyTimeIsAvailable(TimeSpan time)
        {
            // Set open (8AM) and close (5PM) times.
            TimeSpan openTime = new TimeSpan(8, 0, 0);
            TimeSpan closeTime = new TimeSpan(17, 0, 0);

            if (time >= openTime && time < closeTime)
            {
                return true; // Open
            }

            return false; // Closed
        }
    }
}
```

When you compile and execute the above code, it will display the following output. When time is selected between 8 am to 5 pm, it will display the following message:



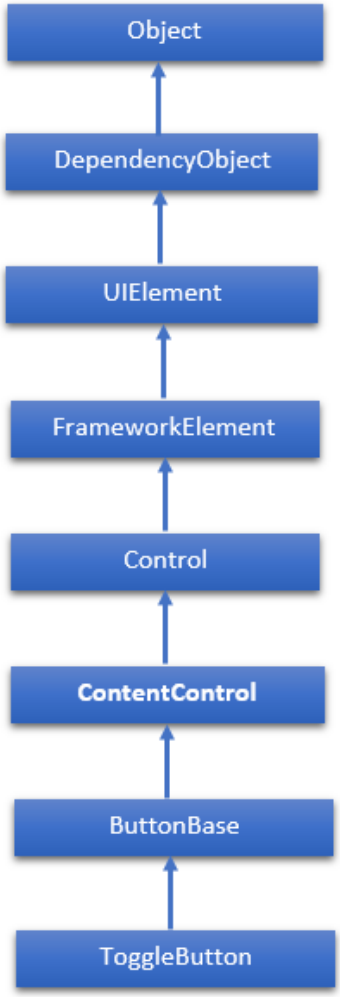
Otherwise, the following message will be displayed:



We recommend you to execute the above example code and experiment with some other properties and events.

ToggleButton

A toggle button is a control that can switch states, such as CheckBox and RadioButton. The hierarchical inheritance of ToggleButton class is as follows:



Given below are the commonly used properties in ToggleButton class:

Sr. No.	Property & Description
1	**IsChecked** Gets or sets whether the ToggleButton is checked.
2	**IsCheckedProperty** Identifies the IsChecked dependency property.
3	**IsThreeState** Gets or sets a value that indicates whether the control supports three states.
4	**IsThreeStateProperty** Identifies the IsThreeState dependency property.

Given below are the commonly used Events in ToggleButton class:

Sr. No.	Event & Description
1	**Checked** Fires when a ToggleButton is checked.
2	**Indeterminate** Fires when the state of a ToggleButton is switched to the indeterminate state.
3	**Unchecked** Occurs when a ToggleButton is unchecked.

Example

The following example shows the usage of ToggleButton in an XAML application. Here is the XAML code to create and initialize a ToggleButton with some properties.

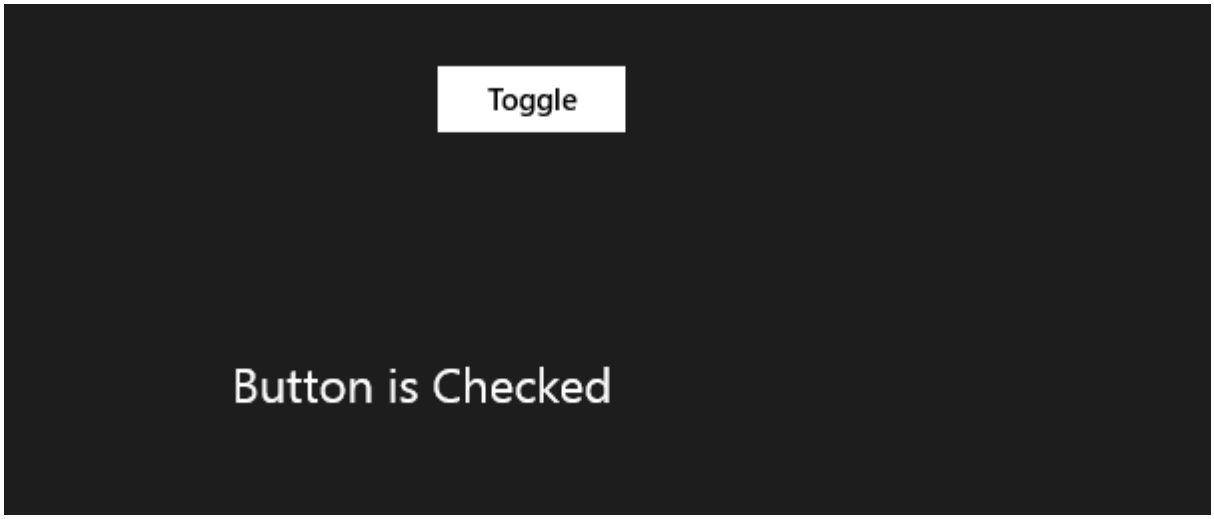
```
<Page
    x:Class="XAMLToggleButton.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:local="using:XAMLToggleButton"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d">

    <Grid Background="{ThemeResource ApplicationPageBackgroundThemeBrush}">
        <StackPanel Orientation="Vertical">
            <ToggleButton x:Name="cb2"
                            Content="Toggle"
                            Checked="HandleCheck"
                            Unchecked="HandleUnchecked"
                            Margin="100"
                            Width="100"
                         HorizontalAlignment="Center"/>
            <TextBlock x:Name="text2"
                         Margin="10"
                         Width="300"
                       HorizontalAlignment="Center"
                       Height="50"
                       FontSize="24"/>
        </StackPanel>

    </Grid>
```

```
</Page>
```

Here is the C# implementation of Checked and Unchecked events:

```
using System;
using Windows.UI.Xaml;
using Windows.UI.Xaml.Controls;

// The Blank Page item template is documented at
http://go.microsoft.com/fwlink/?LinkId=234238

namespace XAMLToggleButton
{
    /// <summary>
    /// An empty page that can be used on its own or navigated to within a Frame.
    /// </summary>
    public sealed partial class MainPage : Page
    {
        public MainPage()
        {
            this.InitializeComponent();
        }
        private void HandleCheck(object sender, RoutedEventArgs e)
        {
            text2.Text = "Button is Checked";
        }

        private void HandleUnchecked(object sender, RoutedEventArgs e)
        {
            text2.Text = "Button is unchecked.";
        }
    }
}
```

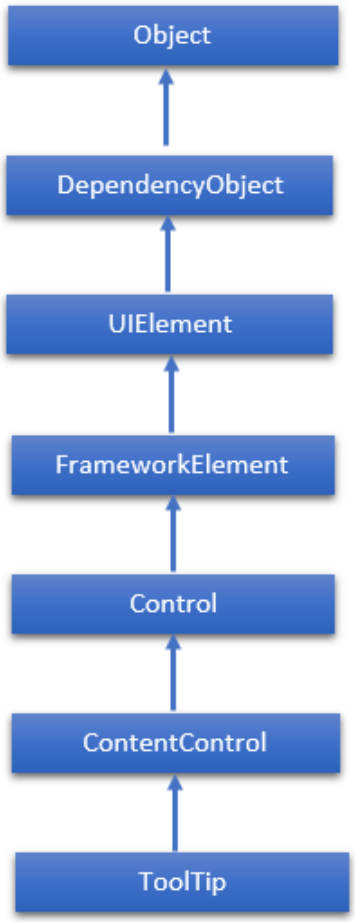
When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

ToolTip

A ToolTip is a control that creates a pop-up window that displays information for an element in the GUI. The hierarchical inheritance of ToolTip class is as follows:



Given below are the commonly used properties of ToolTip class:

Sr. No.	Property & Description
1	**IsOpen** Gets or sets a value that indicates whether the ToolTip is visible.
2	**IsOpenProperty** Identifies the IsOpen dependency property.
3	**Placement** Gets or sets how a ToolTip is positioned in relation to the placement target element.
4	**PlacementProperty** Identifies the Placement dependency property.
5	**PlacementTarget** Gets or sets the visual element or control that the tool tip should be positioned in relation to when opened by the ToolTipService.
6	**PlacementTargetProperty** Identifies the PlacementTarget dependency property.
7	**TemplateSettings** Gets an object that provides calculated values that can be referenced as TemplateBinding sources when defining templates for a ToolTip.

Given below are the commonly used Events of ToolTip class:

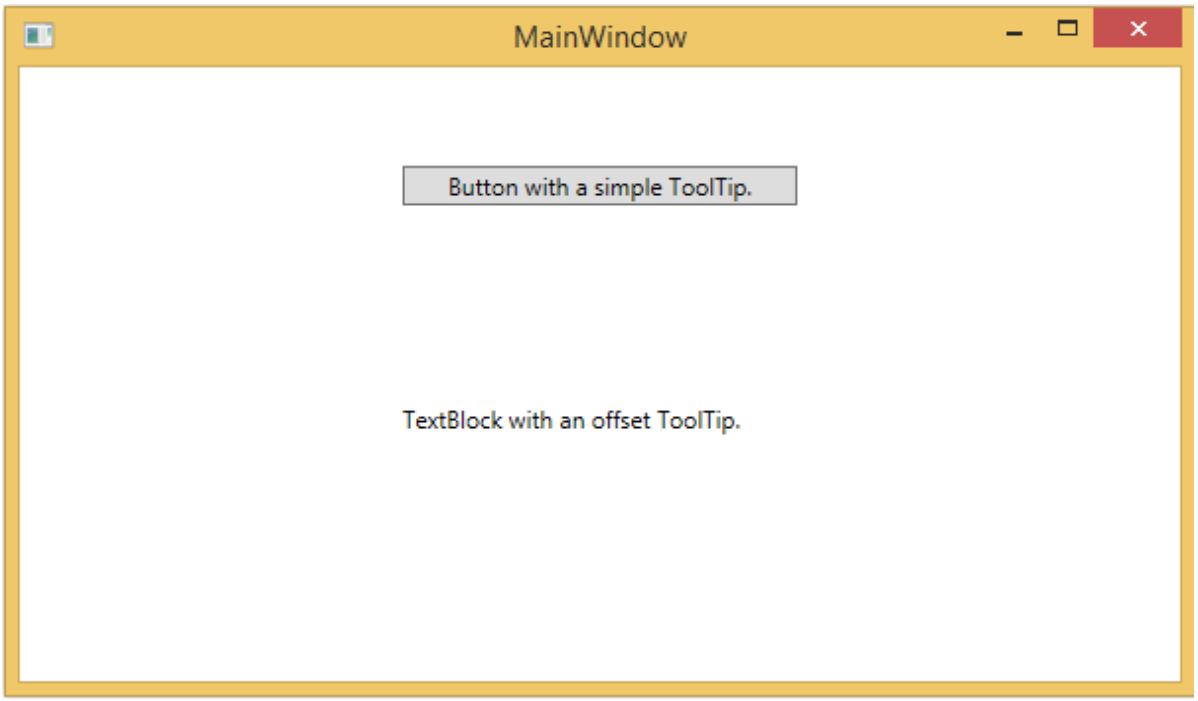
Sr. No.	Event & Description
1	**Closed** Occurs when a ToolTip is closed and is no longer visible.
2	**Opened** Occurs when a ToolTip becomes visible.

Example

The following example shows the usage of ToolTip in an XAML application. Here is the XAML code in which a ToolTip is created with some properties to display ToolTip on Button and TextBlock.

```
<Window x:Class="XAMLToolTip.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <StackPanel Orientation="Vertical">
            <Button Content="Button with a simple ToolTip."
             ToolTipService.ToolTip="Simple ToolTip" Width="200" Margin="50" />

            <!-- A TextBlock with an offset ToolTip. -->
            <TextBlock Text="TextBlock with an offset ToolTip." Width="200"
Margin="50">
                <ToolTipService.ToolTip>
                    <ToolTip Content="Offset ToolTip."
                             HorizontalOffset="20" VerticalOffset="30"/>
                </ToolTipService.ToolTip>
            </TextBlock>
        </StackPanel>
    </Grid>
</Window>
```

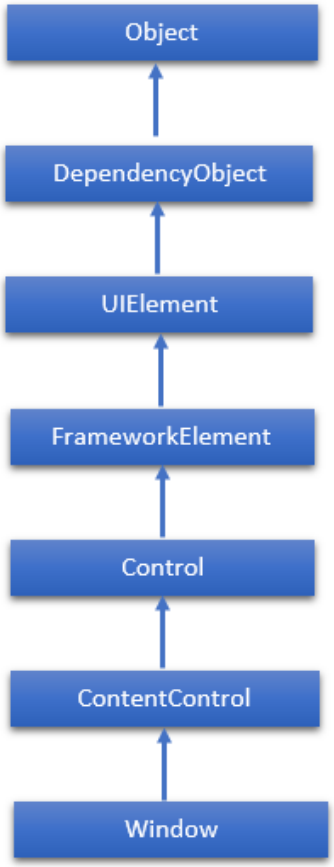
When the above code is compiled and executed with the ToolTip on Button and TextBlock, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

Window

It is the root window of an XAML application which provides minimize/maximize option, Title bar, border, and close button. It also provides the ability to create, configure, show, and manage the lifetime of windows and dialog boxes. The hierarchical inheritance of Window class is as follows:



Given below are the commonly used properties of Window class:

Sr. No.	Property & Description
1	**AllowsTransparency** Gets or sets a value that indicates whether a window's client area supports transparency.
2	**DialogResult** Gets or sets the dialog result value, which is the value that is returned from the ShowDialog method.
3	**Icon** Gets or sets a window's icon.
4	**IsActive** Gets a value that indicates whether the window is active.
5	**Left** Gets or sets the position of the window's left edge, in relation to the desktop.
6	**OwnedWindows** Gets a collection of windows for which this window is the owner.
7	**Owner** Gets or sets the Window that owns this Window.
8	**ResizeMode** Gets or sets the resize mode.
9	**RestoreBounds** Gets the size and location of a window before being either minimized or maximized.
10	**ShowActivated**

	Gets or sets a value that indicates whether a window is activated when first shown.
11	**ShowInTaskbar** Gets or sets a value that indicates whether the window has a task bar button.
12	**SizeToContent** Gets or sets a value that indicates whether a window will automatically size itself to fit the size of its content.
13	**TaskbarItemInfo** Gets or sets the Windows 7 taskbar thumbnail for the Window.
14	**Title** Gets or sets a window's title.
15	**Top** Gets or sets the position of the window's top edge, in relation to the desktop.
16	**Topmost** Gets or sets a value that indicates whether a window appears in the topmost z-order.
17	**WindowStartupLocation** Gets or sets the position of the window when first shown.
18	**WindowState** Gets or sets a value that indicates whether a window is restored, minimized, or maximized.
19	**WindowStyle** Gets or sets a window's border style.

Given below are the commonly used events of Window class:

Sr. No.	Event & Description
1	**Activated** Occurs when a window becomes the foreground window.
2	**Closed** Occurs when the window is about to close.
3	**Closing** Occurs directly after Close is called, and can be handled to cancel window closure.
4	**ContentRendered** Occurs after a window's content has been rendered.
5	**Deactivated** Occurs when a window becomes a background window.
6	**LocationChanged** Occurs when the window's location changes.
7	**SourceInitialized** This event is raised to support interoperation with Win32. See HwndSource.
8	**StateChanged** Occurs when the window's WindowState property changes.

Given below are the commonly used methods of Window class:

Sr. No.	Method & Description
1	**Activate** Attempts to bring the window to the foreground and activates it.
2	**Close** Manually closes a Window.

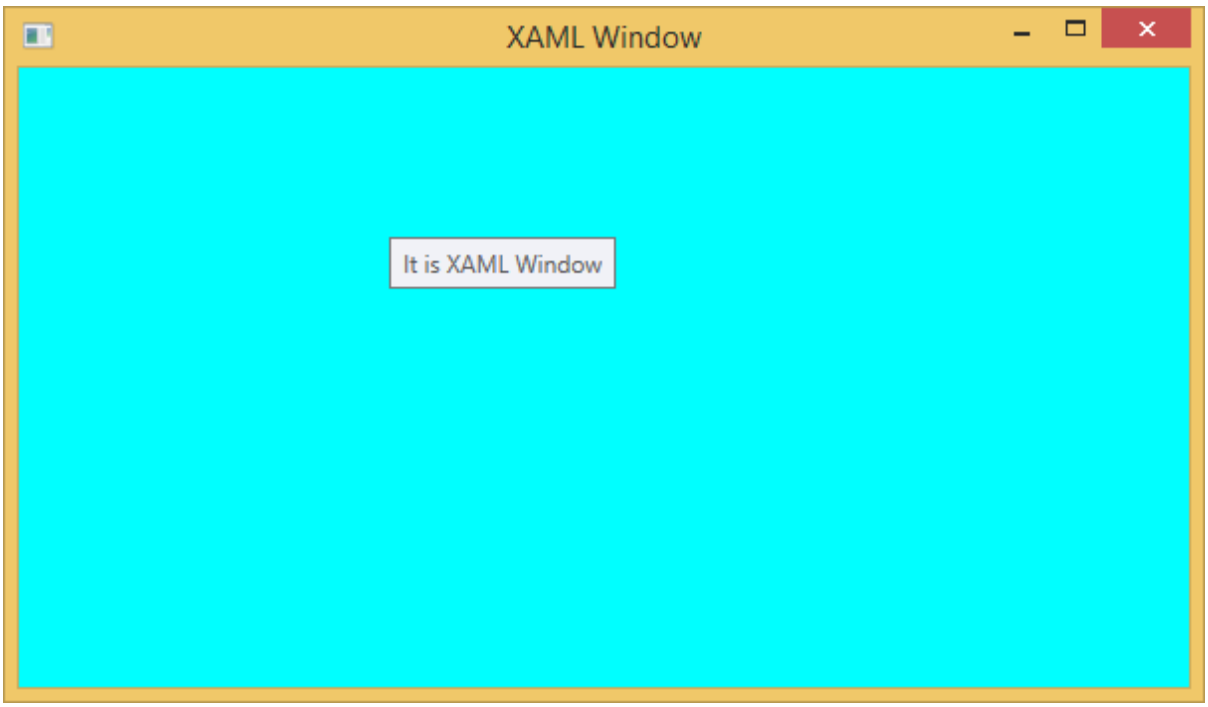
3	**DragMove** Allows a window to be dragged by a mouse with its left button down over an exposed area of the window's client area.
4	**GetWindow** Returns a reference to the Window object that hosts the content tree within which the dependency object is located.
5	**Hide** Makes a window invisible.
6	**Show** Opens a window and returns without waiting for the newly opened window to close.
7	**ShowDialog** Opens a window and returns only when the newly opened window is closed.

Example

When you create a new WPF project, then by default, the Window control is present. Let's have a look at the following XAML code which starts from <Window Tag and ends with </Window> tag. We have also defined some properties as well for the window.

```
<Window x:Class="XAMLToolTip.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <StackPanel Orientation="Vertical">
            <Button Content="Button with a simple ToolTip."
             ToolTipService.ToolTip="Simple ToolTip" Width="200" Margin="50" />

            <!-- A TextBlock with an offset ToolTip. -->
            <TextBlock Text="TextBlock with an offset ToolTip." Width="200"
Margin="50">
                <ToolTipService.ToolTip>
                    <ToolTip Content="Offset ToolTip."
                             HorizontalOffset="20" VerticalOffset="30"/>
                </ToolTipService.ToolTip>
            </TextBlock>
        </StackPanel>
    </Grid>
</Window>
```

When you compile and execute the above code with the mouse entering the Window, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties and events.

8. XAML – LAYOUTS

The layout of controls is very important and critical for application usability. It is required to arrange a group of GUI elements in your application. There are certain important points to consider while selecting layout panels;

- Positions of the child elements.
- Sizes of the child elements.
- Layering of overlapping child elements on top of each other.

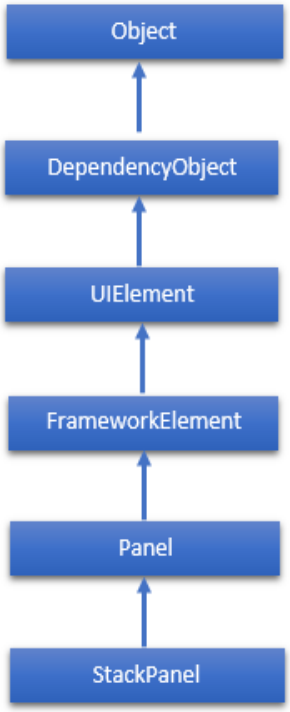
Fixed pixel arrangement of controls doesn't work when an application has been used on different screen resolutions. XAML provides a rich set of built-in layout panels to arrange GUI elements in an appropriate way. Some of the most commonly used and popular layout panels are as follows:

- Stack Panel
- Wrap Panel
- Dock Panel
- Canvas Panel
- Grid Panel

Stack Panel

Stack panel is a simple and useful layout panel in XAML. In a stack panel, child elements can be arranged in a single line, either horizontally or vertically, based on the orientation property.

It is often used whenever any kind of list needs to be created. Stack panels are used by ItemsControls like Menu, ListBox, and ComboBox. The hierarchical inheritance of StackPanel class is as follows:



Given below are the commonly used properties of StackPanel:

Sr. No.	Property & Description
1	**Background** Gets or sets a Brush that fills the panel content area. (Inherited from Panel)
2	**Children** Gets a UIElementCollection of child elements of this Panel. (Inherited from Panel.)
3	**Height** Gets or sets the suggested height of the element. (Inherited from FrameworkElement.)
4	**ItemHeight** Gets or sets a value that specifies the height of all items that are contained within a WrapPanel.
5	**ItemWidth** Gets or sets a value that specifies the width of all items that are contained within a WrapPanel.
6	**LogicalChildren** Gets an enumerator that can iterate the logical child elements of this Panel element. (Inherited from Panel.)
7	**LogicalOrientation** The Orientation of the panel, if the panel supports layout in only a single dimension. (Inherited from Panel.)
8	**Margin** Gets or sets the outer margin of an element. (Inherited from FrameworkElement.)
9	**Name** Gets or sets the identifying name of the element. The name provides a reference so that code-behind, such as event handler code, can refer to a

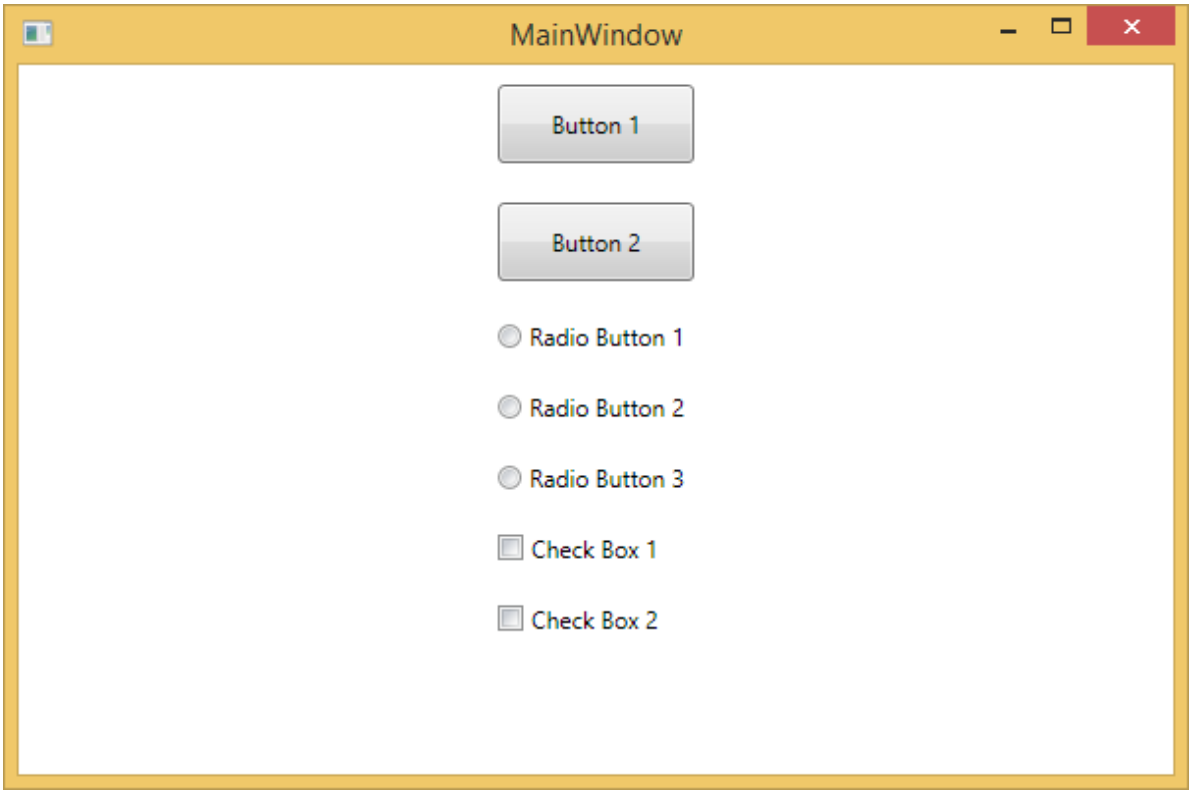
	markup element after it is constructed during processing by a XAML processor. (Inherited from FrameworkElement.)
10	**Orientation** Gets or sets a value that specifies the dimension in which child content is arranged.
11	**Parent** Gets the logical parent element of this element. (Inherited from FrameworkElement.)
12	**Resources** Gets or sets the locally-defined resource dictionary. (Inherited from FrameworkElement.)
13	**Style** Gets or sets the style used by this element when it is rendered. (Inherited from FrameworkElement.)
14	**Width** Gets or sets the width of the element. (Inherited from FrameworkElement.)

Example

The following example shows how to add child elements into a StackPanel. Here is the XAML implementation in which Ellipses are created inside a StackPanel which some properties.

```
<Window x:Class="XAMLStackPanel.Window1"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    Title="MainWindow" Height="400" Width="604">
    <Grid>
        <StackPanel x:Name="myPanel">
            <Button Content="Button 1" Width="100" Height="40" Margin="10"/>
            <Button Content="Button 2" Width="100" Height="40" Margin="10"/>
            <RadioButton Content="Radio Button 1" Width="100"  Margin="10" />
            <RadioButton Content="Radio Button 2" Width="100"  Margin="10" />
            <RadioButton Content="Radio Button 3" Width="100"  Margin="10" />
            <CheckBox Content="Check Box 1" Width="100" Margin="10"/>
            <CheckBox Content="Check Box 2" Width="100" Margin="10"/>
        </StackPanel>
    </Grid>
</Window>
```

When you compile and execute the above code, it will produce the following output. You can see that, by default, the child elements are arranged in a Vertical order. You can change the arrangement by setting the orientation property to Horizontal.

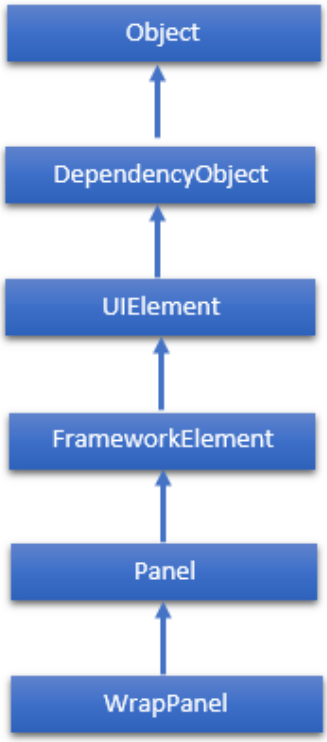


We recommend you to execute the above example code and experiment with some other properties as well.

Wrap Panel

In WrapPanel, child elements are positioned in a sequential order from left to right or from top to bottom based on the orientation property. The only difference between StackPanel and WrapPanel is that it doesn't stack all the child elements into a single line, but it wraps the remaining elements to another line if there is no space left.

WrapPanel is mostly used for tabs or menu items. The hierarchical inheritance of WrapPanel class is as follows:



Given below are the commonly used properties of WrapPanel:

Sr. No.	Property & Description
1	**Background** Gets or sets a Brush that fills the panel content area. (Inherited from Panel)
2	**Children** Gets a UIElementCollection of child elements of this Panel. (Inherited from Panel.)
3	**Height** Gets or sets the suggested height of the element. (Inherited from FrameworkElement.)
4	**ItemHeight** Gets or sets a value that specifies the height of all items that are contained within a WrapPanel.
5	**ItemWidth** Gets or sets a value that specifies the width of all items that are contained within a WrapPanel.
6	**LogicalChildren** Gets an enumerator that can iterate the logical child elements of this Panel element. (Inherited from Panel.)
7	**LogicalOrientation** The Orientation of the panel, if the panel supports layout in only a single dimension. (Inherited from Panel.)
8	**Margin** Gets or sets the outer margin of an element. (Inherited from FrameworkElement.)
9	**Name** Gets or sets the identifying name of the element. The name provides a reference so that code-behind, such as event handler code, can refer to a markup element

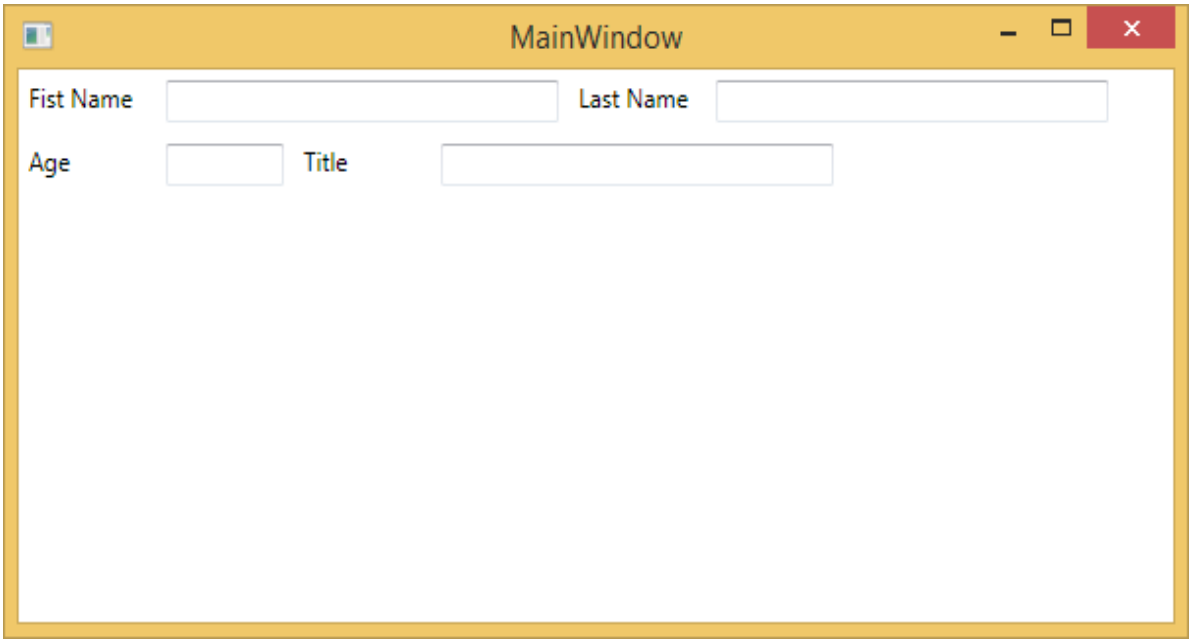
	after it is constructed during processing by a XAML processor. (Inherited from FrameworkElement.)
10	**Orientation** Gets or sets a value that specifies the dimension in which child content is arranged.
11	**Parent** Gets the logical parent element of this element. (Inherited from FrameworkElement.)
12	**Resources** Gets or sets the locally-defined resource dictionary. (Inherited from FrameworkElement.)
13	**Style** Gets or sets the style used by this element when it is rendered. (Inherited from FrameworkElement.)
14	**Width** Gets or sets the width of the element. (Inherited from FrameworkElement.)

Example

The following example shows how to add child elements into a WrapPanel. Here is the XAML implementation to create Text Blocks and Text Boxes inside a WrapPanel in horizontal direction.

```
<Window x:Class="XAMLWrapPanel.Window1"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    Title="MainWindow" Height="300" Width="604">
    <Grid>
        <WrapPanel Orientation="Horizontal">
            <TextBlock Text="Fist Name" Width="60" Height="20" Margin="5"/>
            <TextBox  Width="200" Height="20" Margin="5"/>
            <TextBlock Text="Last Name" Width="60" Height="20" Margin="5"/>
            <TextBox  Width="200" Height="20" Margin="5"/>
            <TextBlock Text="Age" Width="60" Height="20" Margin="5"/>
            <TextBox  Width="60" Height="20" Margin="5"/>
            <TextBlock Text="Title" Width="60" Height="20" Margin="5"/>
            <TextBox  Width="200" Height="20" Margin="5"/>
        </WrapPanel>
    </Grid>
</Window>
```

When the above code is compiled and executed, it will produce the following output. You can change the arrangement from top to bottom by changing the orientation property to Vertical.

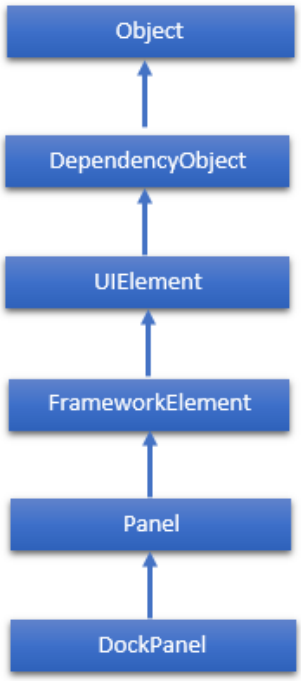


We recommend you to execute the above example code and experiment with some other properties as well.

Dock Panel

DockPanel defines an area to arrange child elements relative to each other, either horizontally or vertically. With DockPanel, you can easily dock child elements to top, bottom, right, left, and center with Dock property.

With LastChildFill property, the last child element fills the remaining space regardless of any other dock value when set for that element. The hierarchical inheritance of DockPanel class is as follows:



Given below are the commonly used properties of DockPanel:

Sr. No.	Property & Description
1	**Background** Gets or sets a Brush that fills the panel content area. (Inherited from Panel)
2	**Children** Gets a UIElementCollection of child elements of this Panel. (Inherited from Panel.)
3	**Dock** Gets or sets a value that indicates the position of a child element within a parent DockPanel.
4	**Height** Gets or sets the suggested height of the element. (Inherited from FrameworkElement.)
5	**ItemHeight** Gets or sets a value that specifies the height of all items that are contained within a WrapPanel.
6	**ItemWidth** Gets or sets a value that specifies the width of all items that are contained within a WrapPanel.
7	**LastChildFill** Gets or sets a value that indicates whether the last child element within a DockPanel stretches to fill the remaining available space.
8	**LogicalChildren** Gets an enumerator that can iterate the logical child elements of this Panel element. (Inherited from Panel.)
9	**LogicalOrientation** The Orientation of the panel, if the panel supports layout in only a single dimension. (Inherited from Panel.)
10	**Margin** Gets or sets the outer margin of an element. (Inherited from FrameworkElement.)
11	**Name** Gets or sets the identifying name of the element. The name provides a reference so that code-behind, such as event handler code, can refer to a markup element after it is constructed during processing by a XAML processor. (Inherited from FrameworkElement.)
12	**Orientation** Gets or sets a value that specifies the dimension in which child content is arranged.
13	**Parent** Gets the logical parent element of this element. (Inherited from FrameworkElement.)
14	**Resources** Gets or sets the locally-defined resource dictionary. (Inherited from FrameworkElement.)
15	**Style** Gets or sets the style used by this element when it is rendered. (Inherited from FrameworkElement.)
16	**Width** Gets or sets the width of the element. (Inherited from FrameworkElement.)

Given below are the commonly used methods of DockPanel:

Sr. No.	Method & Description
1	**GetDock** Gets the value of the Dock attached property for a specified UIElement.
2	**SetDock** Sets the value of the Dock attached property to a specified element.

Example

The following example shows how to add child elements into a DockPanel. Here is the XAML implementation to create buttons inside a DockPanel.

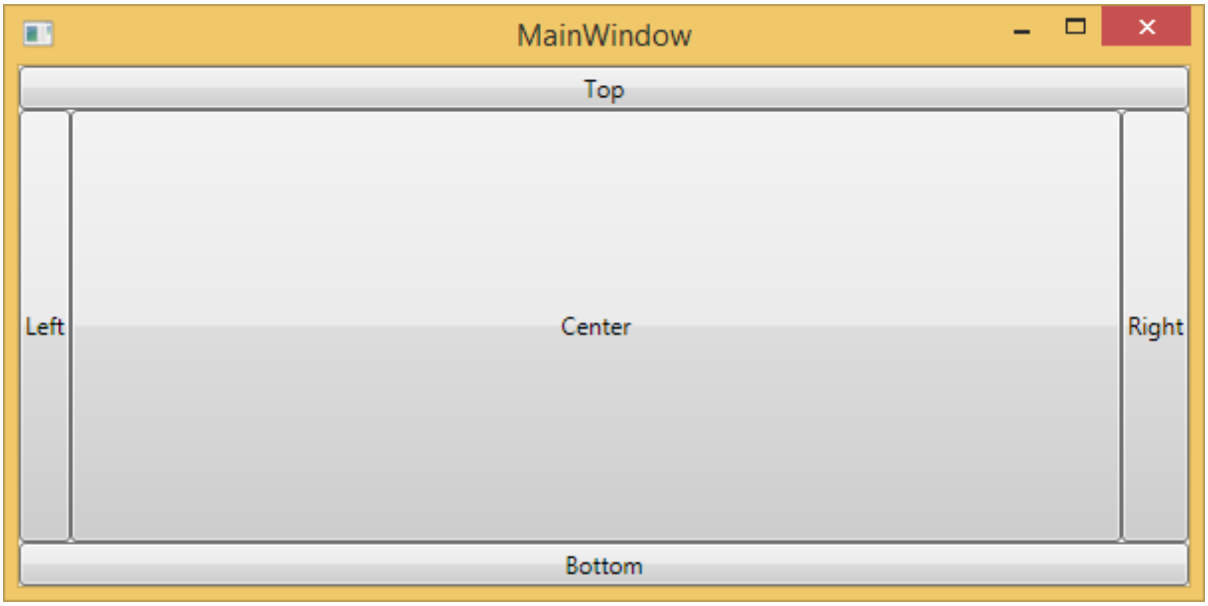
```
<Window x:Class="XAMLDockPanel.Window1"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    Title="MainWindow" Height="300" Width="604">
    <Grid>
        <DockPanel LastChildFill="True">
            <Button Content="Top" DockPanel.Dock="Top" Click="Click_Me"/>
            <Button Content="Bottom" DockPanel.Dock="Bottom" Click="Click_Me"/>
            <Button Content="Left" Click="Click_Me"/>
            <Button Content="Right" DockPanel.Dock="Right" Click="Click_Me"/>
            <Button Content="Center" Click="Click_Me"/>
        </DockPanel>
    </Grid>
</Window>
```

Given below is the implementation in C# for event:

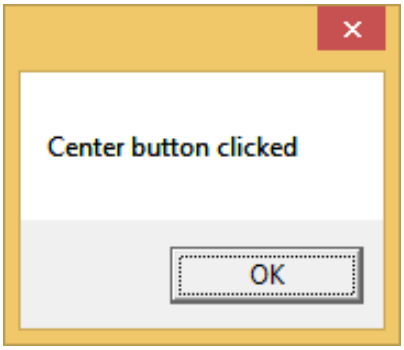
```
using System;
using System.Windows;
using System.Windows.Controls;

namespace XAMLDockPanel
{
    /// <summary>
    /// Interaction logic for Window1.xaml
    /// </summary>
    public partial class Window1 : Window
```

```
    {
        public Window1()
        {
            InitializeComponent();
        }

        private void Click_Me(object sender, RoutedEventArgs e)
        {
            Button btn = sender as Button;
            string str = btn.Content.ToString() + " button clicked" ;
            MessageBox.Show(str);
        }
    }
}
```

When you compile and execute the above code, it will produce the following output:



On clicking any button, it will also display a message. For example, when you click the button that is at Center, it will display the following message:



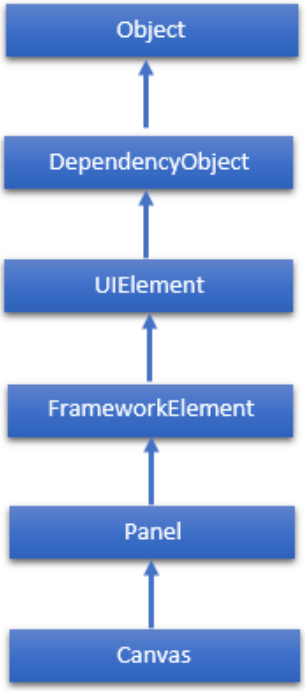
We recommend you to execute the above example code and experiment with some other properties as well.

Canvas Panel

Canvas panel is the basic layout panel in which child elements can be positioned explicitly using coordinates that are relative to the **Canvas** any side such as left, right, top, and bottom.

A Canvas is typically used for 2D graphic elements (such as Ellipse, Rectangle, etc.), but not for UI elements because specifying absolute coordinates creates trouble while resizing, localizing, or scaling the XAML application.

The hierarchical inheritance of Canvas class is as follows:



Given below are the commonly used properties of Canvas class:

Sr. No.	Property & Description
1	**Background** Gets or sets a Brush that fills the panel content area. (Inherited from Panel)

2	**Children** Gets a UIElementCollection of child elements of this Panel. (Inherited from Panel.)
3	**Height** Gets or sets the suggested height of the element. (Inherited from FrameworkElement.)
4	**ItemHeight** Gets or sets a value that specifies the height of all items that are contained within a WrapPanel.
5	**ItemWidth** Gets or sets a value that specifies the width of all items that are contained within a WrapPanel.
6	**LogicalChildren** Gets an enumerator that can iterate the logical child elements of this Panel element. (Inherited from Panel.)
7	**LogicalOrientation** The Orientation of the panel, if the panel supports layout in only a single dimension. (Inherited from Panel.)
8	**LeftProperty** Identifies the Canvas.Left XAML attached property.
9	**Margin** Gets or sets the outer margin of an element. (Inherited from FrameworkElement.)
10	**Name** Gets or sets the identifying name of the element. The name provides a reference so that code-behind, such as event handler code, can refer to a markup element after it is constructed during processing by a XAML processor. (Inherited from FrameworkElement.)
11	**Orientation** Gets or sets a value that specifies the dimension in which child content is arranged.
12	**Parent** Gets the logical parent element of this element. (Inherited from FrameworkElement.)
13	**Resources** Gets or sets the locally-defined resource dictionary. (Inherited from FrameworkElement.)
14	**Style** Gets or sets the style used by this element when it is rendered. (Inherited from FrameworkElement.)
15	**TopProperty** Identifies the Canvas.Top XAML attached property.
16	**Width** Gets or sets the width of the element. (Inherited from FrameworkElement.)
17	**ZIndexProperty** Identifies the Canvas.ZIndex XAML attached property.

Given below are the commonly used methods of Canvas:

Sr. No.	Method & Description
1	**GetLeft** Gets the value of the Canvas.Left XAML attached property for the target element.

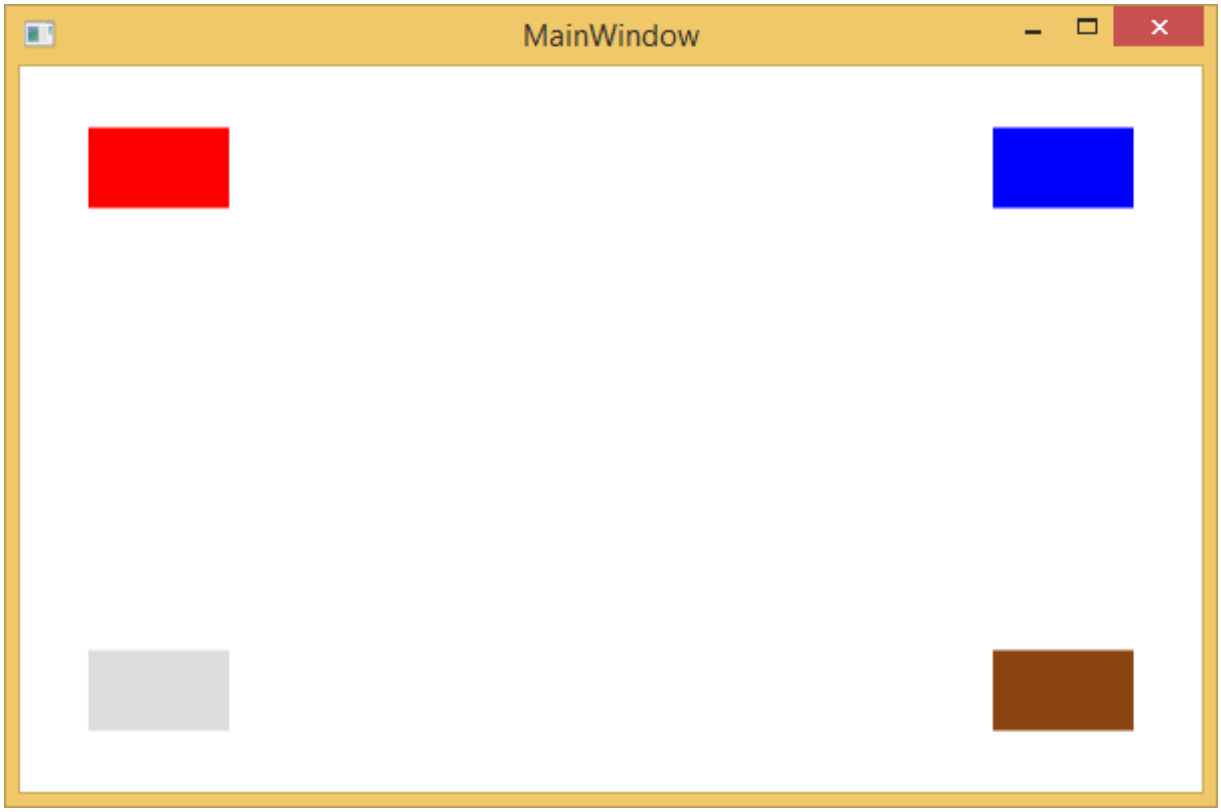
2	**GetTop** Gets the value of the Canvas.Top XAML attached property for the target element.
3	**GetZIndex** Gets the value of the Canvas.ZIndex XAML attached property for the target element.
4	**SetLeft** Sets the value of the Canvas.Left XAML attached property for a target element.
5	**SetTop** Sets the value of the Canvas.Top XAML attached property for a target element.
6	**SetZIndex** Sets the value of the Canvas.ZIndex XAML attached property for a target element.

Example

The following example shows how to add child elements into a Canvas. Here is the XAML implementation in which Rectangles are created inside a Canvas with different offset properties.

```
<Window x:Class="XAMLCanvas.Window1"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    Title="MainWindow" Height="400" Width="604">
    <Grid>
        <Canvas Width="580" Height="360" >
            <Rectangle Canvas.Left="30" Canvas.Top="30"
                       Fill="Red" Width="70" Height="40" />
            <Rectangle Canvas.Right="30" Canvas.Top="30"
                       Fill="Blue" Width="70" Height="40" />
            <Rectangle Canvas.Left="30" Canvas.Bottom="30"
                       Fill="Gainsboro" Width="70" Height="40" />
            <Rectangle Canvas.Right="30" Canvas.Bottom="30"
                       Fill="SaddleBrown" Width="70" Height="40" />
        </Canvas>
    </Grid>
</Window>
```

When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties as well.

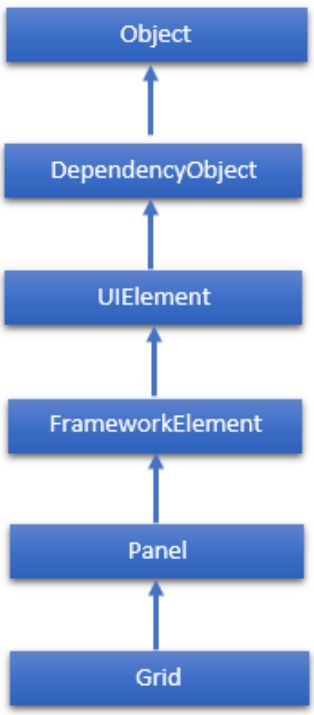
Grid

A Grid panel provides a flexible area which consists of rows and columns. In a Grid, child elements can be arranged in a tabular form. Elements can be added to any specific row and column by using the **Grid.Row** and **Grid.Column** properties.

By default, a Grid panel is created with one row and one column. Multiple rows and columns can be created by using the **RowDefinitions** and **ColumnDefinitions** properties. The height of rows and the width of columns can be defined in the following three ways:

- **Fixed value:** To assign a fixed size of logical units (1/96 inch)
- **Auto:** It will take only as much space as is required for the controls in that specific row/column.
- **Star (*):** It will take the remaining space when Auto and fixed sized are filled.

The hierarchical inheritance of Canvas class is as follows:



Given below are the commonly used properties of Grid class:

Sr. No.	Property & Description
1	**Background** Gets or sets a Brush that fills the panel content area. (Inherited from Panel)
2	**Children** Gets a UIElementCollection of child elements of this Panel. (Inherited from Panel.)
3	**ColumnDefinitions** Gets a list of ColumnDefinition objects defined on this instance of Grid.
4	**Height** Gets or sets the suggested height of the element. (Inherited from FrameworkElement.)
5	**ItemHeight** Gets or sets a value that specifies the height of all items that are contained within a WrapPanel.
6	**ItemWidth** Gets or sets a value that specifies the width of all items that are contained within a WrapPanel.
7	**Margin** Gets or sets the outer margin of an element. (Inherited from FrameworkElement.)
8	**Name** Gets or sets the identifying name of the element. The name provides a reference so that code-behind, such as event handler code, can refer to a markup element after it is constructed during processing by a XAML processor. (Inherited from FrameworkElement.)
9	**Orientation**

	Gets or sets a value that specifies the dimension in which child content is arranged.
10	**Parent** Gets the logical parent element of this element. (Inherited from FrameworkElement.)
11	**Resources** Gets or sets the locally-defined resource dictionary. (Inherited from FrameworkElement.)
12	**RowDefinitions** Gets a list of RowDefinition objects defined on this instance of Grid.
13	**Style** Gets or sets the style used by this element when it is rendered. (Inherited from FrameworkElement.)
14	**Width** Gets or sets the width of the element. (Inherited from FrameworkElement.)

Given below are the commonly used properties of Grid class:

Sr. No.	Method & Description
1	**GetColumn** Gets the value of the Grid.Column XAML attached property from the specified FrameworkElement.
2	**GetColumnSpan** Gets the value of the Grid.ColumnSpan XAML attached property from the specified FrameworkElement.
3	**GetRow** Gets the value of the Grid.Row XAML attached property from the specified FrameworkElement.
4	**SetColumn** Sets the value of the Grid.Column XAML attached property on the specified FrameworkElement.
5	**SetRow** Sets the value of the Grid.Row XAML attached property on the specified FrameworkElement.
6	**SetRowSpan** Sets the value of the Grid.RowSpan XAML attached property on the specified FrameworkElement.

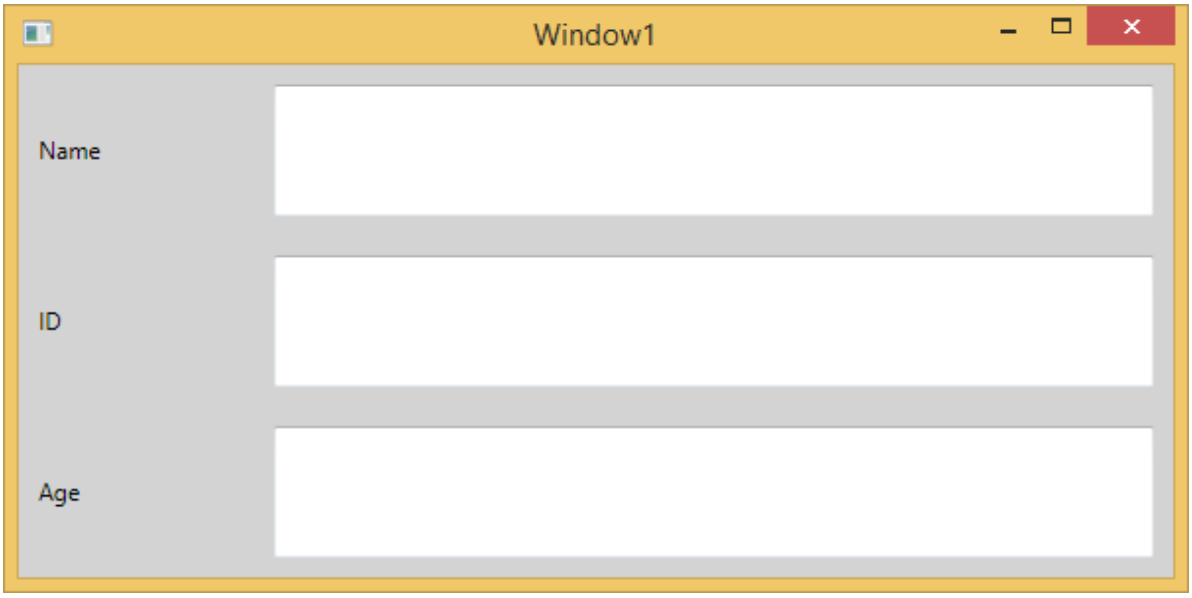
Example

The following example shows how to add child elements into a Grid to specify it in a tabular form. Here is the XAML implementation in which Text Blocks are added in the first column and Text Boxes are added in the second column of a Grid.

```
<Window x:Class="XAMLGrid.Window1"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    Title="Window1" Height="300" Width="604">
    <Grid x:Name="FormLayoutGrid" Background="LightGray">
        <Grid.ColumnDefinitions>
```

```
            <ColumnDefinition Width="Auto" />
            <ColumnDefinition />
        </Grid.ColumnDefinitions>
        <Grid.RowDefinitions>
            <RowDefinition Height="*" />
            <RowDefinition Height="*" />
            <RowDefinition Height="*" />
        </Grid.RowDefinitions>
        <TextBlock Grid.Row="0" Grid.Column="0" Text="Name" Margin="10"
               HorizontalAlignment="Left" VerticalAlignment="Center" Width="100"/>
        <TextBox Grid.Row="0" Grid.Column="1" Margin="10" />
        <TextBlock Grid.Row="1" Grid.Column="0" Text="ID" Margin="10"
               HorizontalAlignment="Left" VerticalAlignment="Center" Width="100"/>
        <TextBox Grid.Row="1" Grid.Column="1" Margin="10" />
        <TextBlock Grid.Row="2" Grid.Column="0" Text="Age" Margin="10"
               HorizontalAlignment="Left" VerticalAlignment="Center" Width="100"/>
        <TextBox Grid.Row="2" Grid.Column="1" Margin="10" />

    </Grid>
</Window>
```

When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other properties as well.

Nesting of Layout

Nesting of layout means using a layout panel inside another layout, e.g., defining stack panels inside a grid. This concept is widely used to take advantage of multiple layouts in an application.

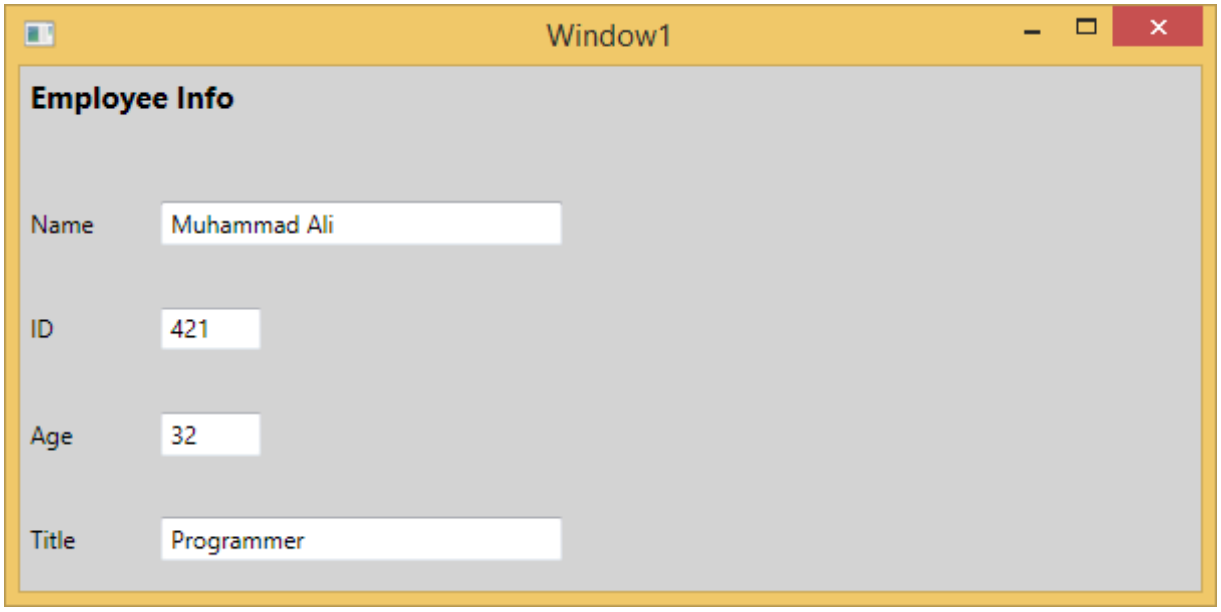
Example

In the following example, we will be using stack panels inside a grid. Let's have a look at the following XAML code:

```
<Window x:Class="XAMLNestingLayouts.Window1"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    Title="Window1" Height="300" Width="604">

    <Grid Background="LightGray">
        <Grid.RowDefinitions>
            <RowDefinition Height="*"/>
            <RowDefinition Height="*"/>
            <RowDefinition Height="*"/>
            <RowDefinition Height="*"/>
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>

        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="*"/>
        </Grid.ColumnDefinitions>

        <Label Content="Employee Info"
                FontSize="15" FontWeight="Bold"
                Grid.Column="0" Grid.Row="0"/>

        <StackPanel Grid.Column="0" Grid.Row="1" Orientation="Horizontal">
            <Label Content="Name"  VerticalAlignment="Center" Width="70"/>
            <TextBox Name="txtName" Text="Muhammad Ali"
VerticalAlignment="Center" Width="200"></TextBox>
        </StackPanel>

        <StackPanel Grid.Column="0" Grid.Row="2" Orientation="Horizontal">
```

```
            <Label Content="ID" VerticalAlignment="Center" Width="70"/>
            <TextBox Name="txtCity" Text="421" VerticalAlignment="Center"
Width="50"></TextBox>
        </StackPanel>

        <StackPanel Grid.Column="0" Grid.Row="3" Orientation="Horizontal">
            <Label Content="Age" VerticalAlignment="Center" Width="70"/>
            <TextBox Name="txtState" Text="32" VerticalAlignment="Center"
Width="50"></TextBox>
        </StackPanel>

        <StackPanel Grid.Column="0" Grid.Row="4" Orientation="Horizontal">
            <Label Content="Title" VerticalAlignment="Center" Width="70"/>
            <TextBox Name="txtCountry" Text="Programmer"
VerticalAlignment="Center" Width="200"></TextBox>
        </StackPanel>
    </Grid>
</Window>
```

When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other nesting layouts.

9. XAML – EVENT HANDLING

The general concept of events in XAML is similar to events in other popular programming languages such as .NET and C++. In XAML, all of the controls expose some events so that they can be subscribed for specific purposes.

Whenever an event takes place, the application will be notified and the program can react to them, e.g., close buttons are used to close a dialog.

There are many types of events that can be subscribed for different behaviors of an application based on the requirement of that application, but the most commonly used events are those which are related to mouse and keyboard such as,

- Click
- MouseDown
- MouseEnter
- MouseLeave
- MouseUp
- KeyDown
- KeyUp

In this chapter, we will use some of the basic and most commonly used events to understand how an event of a specific control can be linked to the code behind where the behavior will be implemented depending on what the user wants to do when a specific event occurs.

Let's have a look at a simple example of a button click event. Given below is the XAML implementation for Button control which is created and initialized with some properties and a Click event (`Click="OnClick"`).

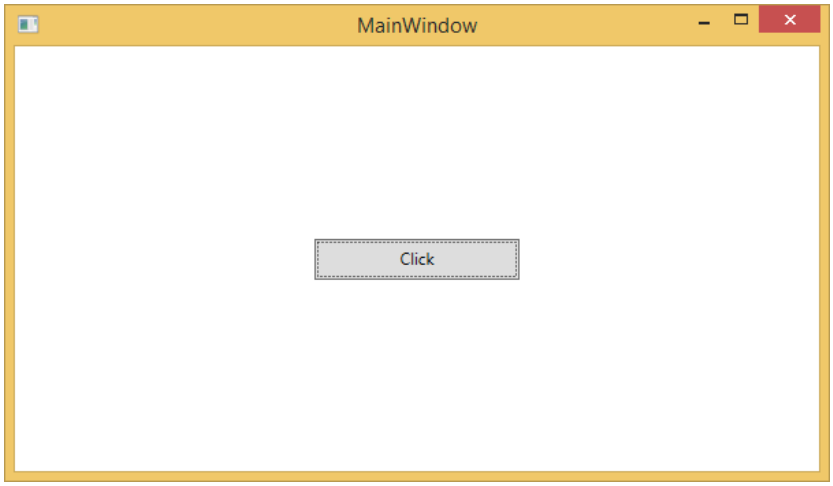
```
<Window x:Class="XAMLEventHandling.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <Button x:Name="button1"
                Content="Click"
                Click="OnClick"
                Width="150"
                Height="30"
                HorizontalAlignment="Center"/>
    </Grid>
```

```
</Window>
```

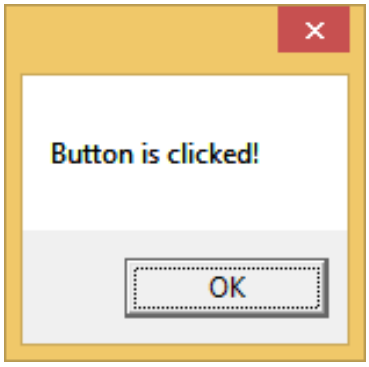
Whenever this button is clicked, it will fire an **OnClick** event and you can add any type of behavior as a response to the Click. Let's have a look at the OnClick event implementation which will show a message when this button is clicked.

```
using System;
using System.Windows;
using System.Windows.Controls;

namespace XAMLEventHandling
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }

        private void OnClick(object sender, RoutedEventArgs e)
        {
            MessageBox.Show("Button is clicked!");
        }
    }
}
```

When you compile and execute the above code, it will produce the following output:



When you click on the button, the click (OnClick) event will be fired and the following message will be displayed.



Now let's have a look at a little bit complex example where multiple events are handled.

Example

The following example contains a textbox with ContextMenu which manipulates the text within the textbox.

The following XAML code creates a TextBox, a ContextMenu, and MenuItems with some properties and events such as Checked, Unchecked, and Click.

```
<Window x:Class="XAMLContextMenu.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
<TextBox Name="textBox1" TextWrapping="Wrap" Margin="10" Grid.Row="7">
            Hi, this is XAML tutorial.
            <TextBox.ContextMenu>
                <ContextMenu>
```

```
                    <MenuItem Header="_Bold" IsCheckable="True"
                           Checked="Bold_Checked" Unchecked="Bold_Unchecked" />
                    <MenuItem Header="_Italic" IsCheckable="True"
                           Checked="Italic_Checked"
                           Unchecked="Italic_Unchecked" />
                    <Separator />
                    <MenuItem Header="Increase Font Size"
                                Click="IncreaseFont_Click" />
                    <MenuItem Header="_Decrease Font Size"
                         Click="DecreaseFont_Click" />
                </ContextMenu>
            </TextBox.ContextMenu>
        </TextBox>
    </Grid>
</Window>
```

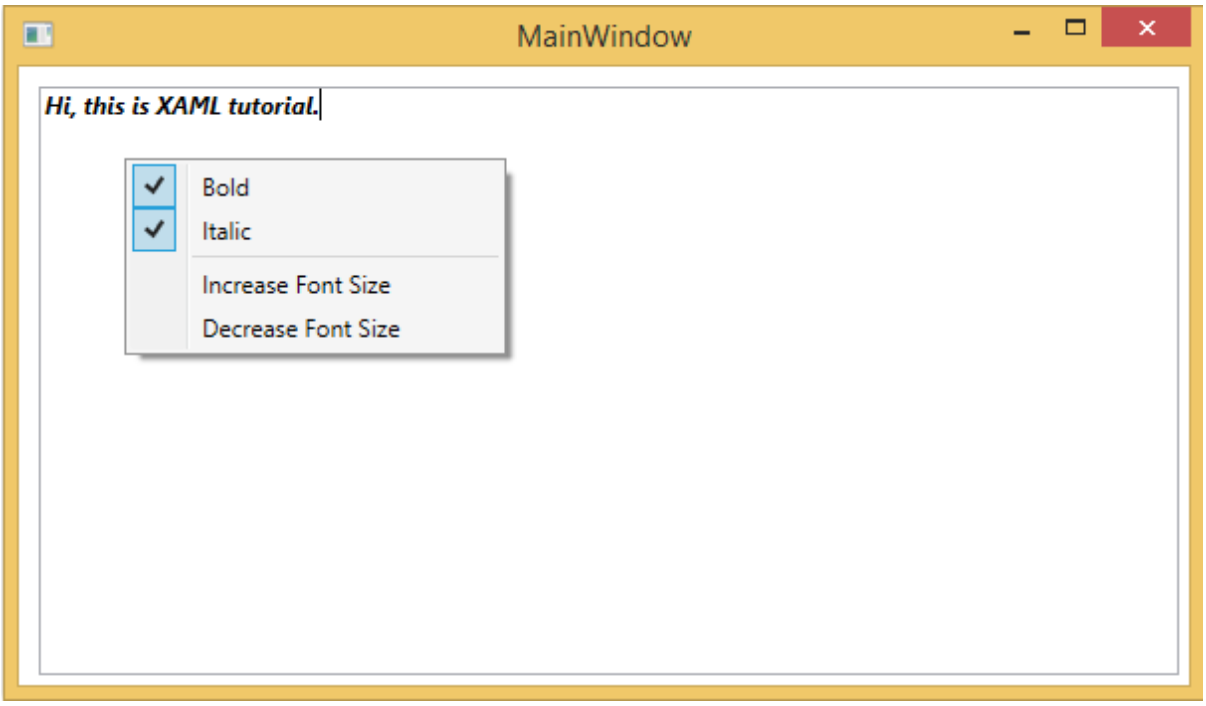
Here is the implementation in C# for the different events which will be fired whenever a menu item is checked, unchecked, or clicked.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows;
using System.Windows.Controls;
using System.Windows.Data;

namespace XAMLContextMenu
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
```

```
        }
        private void Bold_Checked(object sender, RoutedEventArgs e)
        {
            textBox1.FontWeight = FontWeights.Bold;
        }

        private void Bold_Unchecked(object sender, RoutedEventArgs e)
        {
            textBox1.FontWeight = FontWeights.Normal;
        }

        private void Italic_Checked(object sender, RoutedEventArgs e)
        {
            textBox1.FontStyle = FontStyles.Italic;
        }

        private void Italic_Unchecked(object sender, RoutedEventArgs e)
        {
            textBox1.FontStyle = FontStyles.Normal;
        }

        private void IncreaseFont_Click(object sender, RoutedEventArgs e)
        {
            if (textBox1.FontSize < 18)
            {
                textBox1.FontSize += 2;
            }
        }

        private void DecreaseFont_Click(object sender, RoutedEventArgs e)
        {
            if (textBox1.FontSize > 10)
            {
                textBox1.FontSize -= 2;
            }
        }
```

```
    }
}
```

When you compile and execute the above code, it will produce the following output:



We recommend you to execute the above example code and experiment with some other events.

Here are the commonly used events for different controls:

Sr. No.	Event & Description
1	**Checked** Fires when a ToggleButton is checked. (Inherited from ToggleButton)
2	**Click** Occurs when a button control is clicked. (Inherited from ButtonBase)
3	**ContextMenuClosing** Occurs just before any context menu on the element is closed. (Inherited from FrameworkElement.)
4	**ContextMenuOpening** Occurs when any context menu on the element is opened. (Inherited from FrameworkElement.)
5	**DataContextChanged** Occurs when the value of the FrameworkElement.DataContext property changes. (Inherited from FrameworkElement)
6	**DragEnter** Occurs when the input system reports an underlying drag event with this element as the target. (Inherited from UIElement)
7	**DragLeave**Occurs when the input system reports an underlying drag event with this element as the origin. (Inherited from UIElement)
8	**DragOver** Occurs when the input system reports an underlying drag event with this element as the potential drop target. (Inherited from UIElement)

9	**DragStarting** Occurs when a drag operation is initiated. (Inherited from UIElement)
10	**DropCompleted** Occurs when a drag-and-drop operation is ended. (Inherited from UIElement)
11	**DropDownClosed** Occurs when the drop-down portion of the ComboBox closes.
12	**DropDownOpened** Occurs when the drop-down portion of the ComboBox opens.
13	**GotFocus** Occurs when a UIElement receives focus. (Inherited from UIElement)
14	**Holding** Occurs when an otherwise unhandled Hold interaction occurs over the hit test area of this element. (Inherited from UIElement)
15	**Intermediate** Fires when the state of a ToggleButton is switched to the indeterminate state. (Inherited from ToggleButton)
16	**IsEnabledChanged** Occurs when the IsEnabled property changes. (Inherited from Control)
17	**KeyDown** Occurs when a keyboard key is pressed while the UIElement has focus. (Inherited from UIElement)
18	**KeyUp** Occurs when a keyboard key is released while the UIElement has focus. (Inherited from UIElement)
19	**LostFocus** Occurs when a UIElement loses focus. (Inherited from UIElement)
20	**ManipulationCompleted** Occurs when a manipulation on the UIElement is complete. (Inherited from UIElement)
21	**ManipulationDelta** Occurs when the input device changes position during a manipulation. (Inherited from UIElement)
22	**ManipulationInertiaStarting** Occurs when the input device loses contact with the UIElement object during a manipulation and inertia begins. (Inherited from UIElement)
23	**ManipulationStarted** Occurs when an input device begins a manipulation on the UIElement. (Inherited from UIElement)
24	**ManipulationStarting** Occurs when the manipulation processor is first created. (Inherited from UIElement)
25	**SelectionChanged** Occurs when the text selection has changed.
26	**SizeChanged** Occurs when either the ActualHeight or the ActualWidth property changes value on a FrameworkElement. (Inherited from FrameworkElement)
27	**Unchecked** Occurs when a ToggleButton is unchecked. (Inherited from ToggleButton)
28	**ValueChanged** Occurs when the range value changes. (Inherited from RangeBase)

10. XAML – DATA BINDING

Data binding is a mechanism in XAML applications that provides a simple and easy way for Windows Runtime Apps using partial classes to display and interact with data. The management of data is entirely separated from the way the data is displayed in this mechanism.

Data binding allows the flow of data between UI elements and data object on user interface. When a binding is established and the data or your business model changes, then it will reflect the updates automatically to the UI elements and vice versa. It is also possible to bind, not to a standard data source, but rather to another element on the page. Data binding can be of two types:

- One-way data binding
- Two-way data binding

One-Way Data Binding

In one-way binding, data is bound from its source (that is the object that holds the data) to its target (that is the object that displays the data).

Let's have a look at a simple example of one-way data binding. The following XAML code creates four text blocks with some properties.

```
<Window x:Class="DataBindingOneWay.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
      <StackPanel Name="Display">
         <StackPanel Orientation="Horizontal" Margin="50, 50, 0, 0">
                    <TextBlock Text="Name: " Margin="10" Width="100"/>
                    <TextBlock Margin="10" Width="100"
                               Text="{Binding Name}"/>
         </StackPanel>
          <StackPanel Orientation="Horizontal" Margin="50,0,50,0">
                    <TextBlock Text="Title: " Margin="10" Width="100"/>
                    <TextBlock Margin="10" Width="100"
                           Text="{Binding Title}" />
         </StackPanel>
      </StackPanel>
```

```
   </Grid>
</Window>
```

Text properties of two text blocks are set to “Name” and “Title” statically, while the other two text blocks Text properties are bound to “Name” and “Title” which are class variables of Employee class which is shown below.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace DataBindingOneWay
{
   public class Employee
   {
      public string Name { get; set; }
      public string Title { get; set; }

      public static Employee GetEmployee()
      {
         var emp = new Employee()
         {
            Name = "Ali Ahmed",
            Title = "Developer"
         };
         return emp;
      }

   }
}
```

In this class, we have just two variables, **Name** and **Title**, and one static method in which the Employee object is initialized which will return that employee object. So we are binding to a property, Name and Title, but we have not selected what object that property belongs to. The easiest way is to assign an object to DataContext whose properties we are binding in the following C# code:

```
using System;
```

```
using System.Windows;
using System.Windows.Controls;

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

Let's run this application and you can see immediately in our MainWindow that we have successfully bound to the Name and Title of that Employee object.

Two-Way Data Binding

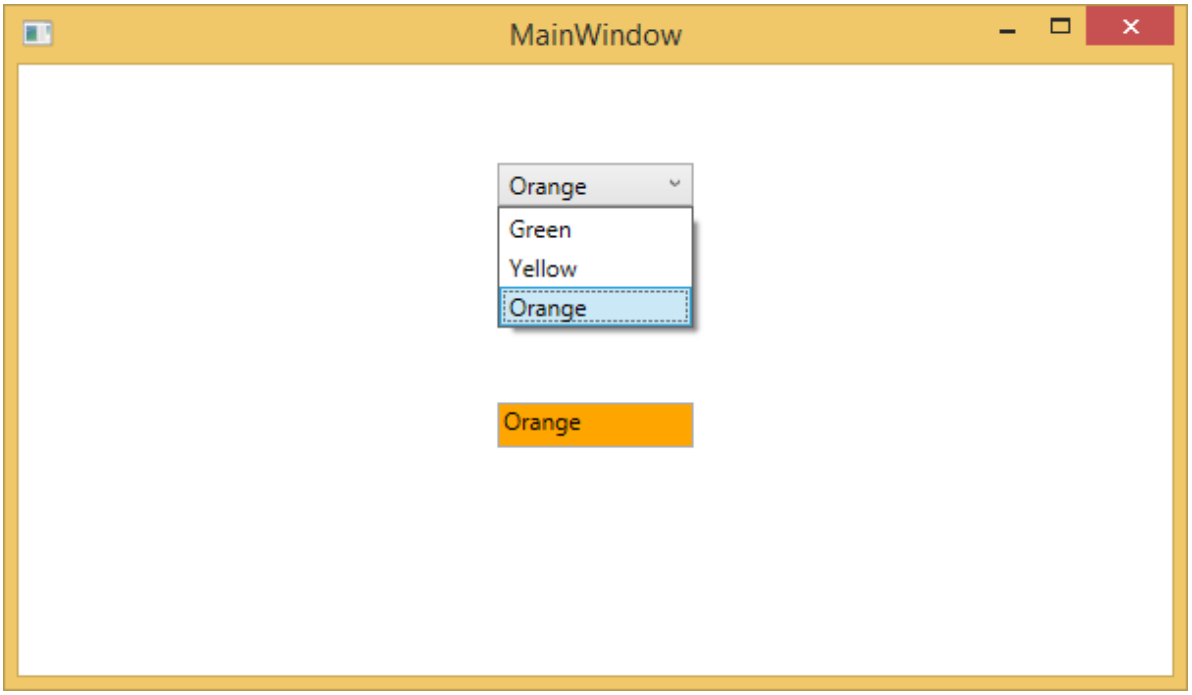
In two-way binding, the user can modify the data through the user interface and have that data updated in the source. If the source changes while the user is looking at the view, you would want to update the view.

Example

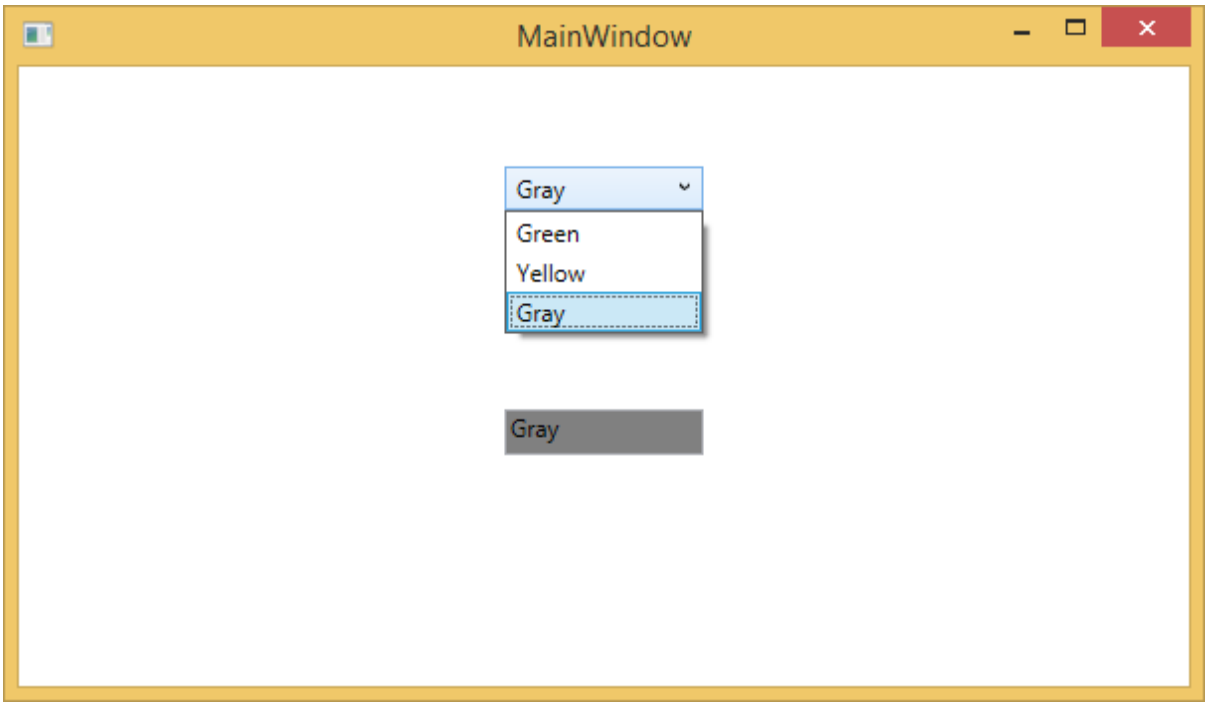
Let's have a look at the following example in which one combobox with three combobox items and one textbox are created with some properties. In this example, we don't have any standard data source, but the UI elements are bound to other UI elements.

```
<Window x:Class="XAMLTestBinding.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <StackPanel>
        <ComboBox Name="comboBox"  Margin="50" Width="100">
            <ComboBoxItem Content="Green"/>
            <ComboBoxItem  Content="Yellow" IsSelected="True"/>
            <ComboBoxItem Content="Orange" />
        </ComboBox>
        <TextBox  Name="textBox" Margin="50" Width="100" Height="23"
VerticalAlignment="Top"
                Text ="{Binding ElementName=comboBox,
                        Path=SelectedItem.Content,
                        Mode=TwoWay,
                        UpdateSourceTrigger=PropertyChanged}"
                Background="{Binding ElementName=comboBox,
Path=SelectedItem.Content}">
        </TextBox>
    </StackPanel>
</Window>
```

When you compile and execute the above code, it will produce the following output. When the user selects an item from the combobox, the textbox text and the background color will be updated accordingly.



Similarly, when the user types a valid color name in the textbox, then the combobox and the textbox background color will also be updated.



11. XAML – MARKUP EXTENSIONS

In XAML applications, markup extensions are a method/technique to gain a value that is neither a specific XAML object nor a primitive type. Markup extensions can be defined by opening and closing curly braces and inside that curly braces, the scope of the markup extension is defined.

Data binding and static resources are markup extensions. There are some predefined XAML markup extensions in **System.xaml** which can be used.

Let's have a look at a simple example where **StaticResources** markup extension is used which is a predefined XAML markup extension.

The following XAML code creates two text blocks with some properties and their foreground is defined in **Window.Resources**.

```
<Window x:Class="XAMLStaticResourcesMarkupExtension.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>
        <SolidColorBrush Color="Blue" x:Key="myBrush"></SolidColorBrush>
    </Window.Resources>
    <Grid>
        <StackPanel Orientation="Vertical">
            <TextBlock Foreground="{StaticResource myBrush}"
                       Text="First Name"
                       Width="100"
                       Margin="10"/>
            <TextBlock Foreground="{StaticResource myBrush}"
                       Text="Last Name"
                       Width="100"
                       Margin="10"/>
        </StackPanel>
    </Grid>
</Window>
```

In **Window.Resources**, you can see **x:Key** is used which uniquely identifies the elements that are created and referenced in an XAML defined dictionary to identify a resource in a resource dictionary.

When you compile and execute the above code, it will produce the following MainWindow. You can see the two text blocks with blue foreground color.

In XAML, custom markup extensions can also be defined by inheriting MarkupExtension class and overriding the ProvideValue method which is an abstract method in the MarkupExtension class.

Let's have a look at a simple example of custom markup extension.

```
<Window x:Class="XAMLMarkupExtension.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:my="clr-namespace:XAMLMarkupExtension"
        Title="MainWindow" Height="350" Width="525">
    <Grid>
        <Button Content="{my:MyMarkupExtension FirstStr=Markup,
SecondStr=Extension}"
                Width="200"
                Height="20"/>
    </Grid>
</Window>
```

In the above XAML code, a button is created with some properties and for the content value, a custom markup extension (`my:MyMarkupExtension`) has been used with two values "Markup" and "Extension" which are assigned to FirstStr and SecondStr respectively.

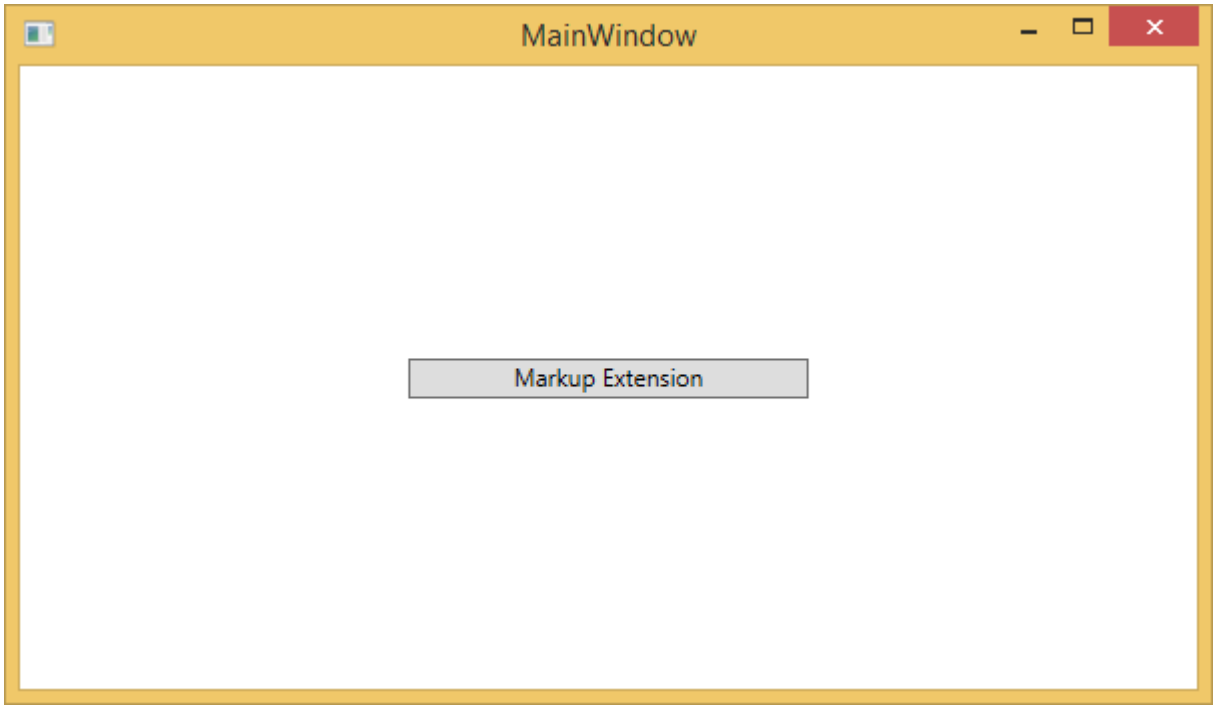
Actually, `MyMarkupExtension` is a class which is derived from `MarkupExtension` as shown below in the C# implementation. This class contains two string variables, FirstStr and SecondStr,

which are concatenated and return that string from the ProvideValue method to the Content of a button.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows;
using System.Windows.Controls;
using System.Windows.Data;
using System.Windows.Documents;
using System.Windows.Input;
using System.Windows.Markup;
using System.Windows.Media;
using System.Windows.Media.Imaging;
using System.Windows.Navigation;
using System.Windows.Shapes;

namespace XAMLMarkupExtension
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }
    }
    public class MyMarkupExtension : MarkupExtension
    {
        public MyMarkupExtension() { }
        public String FirstStr { get; set; }
        public String SecondStr { get; set; }
```

```
        public override object ProvideValue(
                        IServiceProvider serviceProvider)
        {
            return FirstStr + " " + SecondStr;
        }
    }
}
```

Let's run this application and you can see immediately in our MainWindow that "markup extension" has been successfully used as the content of the button.



12. XAML – DEPENDENCY PROPERTIES

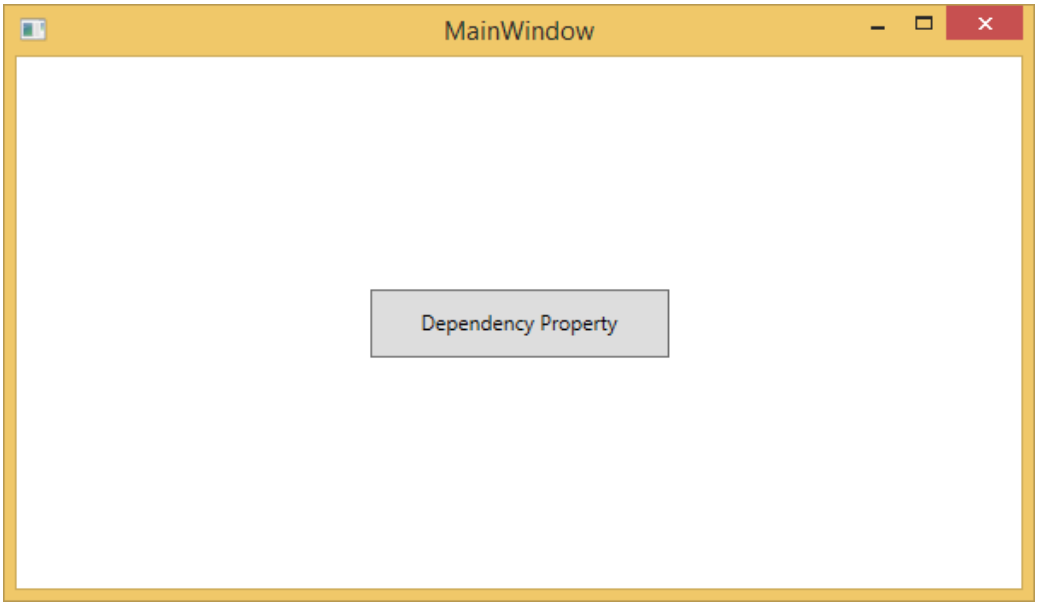
A dependency property is a specific type of property where the value is followed by a keen property system which is also a part of the Windows Runtime App. A class which defines a dependency property must be inherited from the DependencyObject class.

Many of the UI control classes which are used in XAML are derived from the DependencyObject class and support dependency properties. The following XAML code creates a button with some properties.

```
<Window x:Class="XAMLDependencyProperty.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:local="clr-namespace:XAMLDependencyProperty"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <Button  Height="40"
                 Width="175"
                 Margin="10"
                 Content="Dependency Property">
            <Button.Style>
                <Style TargetType="{x:Type Button}">
                    <Style.Triggers>
                        <Trigger Property="IsMouseOver" Value="True">
                            <Setter Property="Foreground" Value="Red"/>
                        </Trigger>
                    </Style.Triggers>
                </Style>
            </Button.Style>
        </Button>
    </Grid>
</Window>
```

The x:Type markup extension in XAML has a similar functionality like typeof() in C#. It is used when attributes are specified that take the type of the object such as `<Style TargetType="{x:Type Button}">`

When you compile and execute the above code, it will produce the following MainWindow. When the mouse is over the button, it will change the foreground color of the button. When the mouse leaves the button, it will change back to its original color.



The main difference between dependency properties and other CLR properties are:

- CLR properties can directly read/write from the private member of a class by using **getter** and **setter**. In case of dependency properties, it is not stored in a local object.
- Dependency properties are stored in a dictionary of key/value pairs which is provided by the DependencyObject class.
- It also saves a lot of memory because it stores the property when changed.
- It can be bound in XAML as well.

In .NET framework, custom dependency properties can also be defined. Here are the steps to define custom dependency property in C#.

- Declare and register your dependency property with system call register.
- Provide the setter and getter for the property.
- Define a static handler to handle any changes that occur globally.
- Define an instance handler to handle any changes that occur to that particular instance.

Given below is the code in C# for dependency property which defined to set the SetText property of the user control.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
```

```
using System.Windows;
using System.Windows.Controls;
using System.Windows.Data;
using System.Windows.Documents;
using System.Windows.Input;
using System.Windows.Media;
using System.Windows.Media.Imaging;
using System.Windows.Navigation;
using System.Windows.Shapes;

namespace WpfApplication3
{
    /// <summary>
    /// Interaction logic for UserControl1.xaml
    /// </summary>
    public partial class UserControl1 : UserControl
    {
        public UserControl1()
        {
            InitializeComponent();
        }

        public static readonly DependencyProperty SetTextProperty =
DependencyProperty.Register("SetText", typeof(string), typeof(UserControl1),
new PropertyMetadata("", new PropertyChangedCallback(OnSetTextChanged)));
        public string SetText
        {
            get { return (string)GetValue(SetTextProperty); }
            set { SetValue(SetTextProperty, value); }
        }
        private static void OnSetTextChanged(DependencyObject d,
DependencyPropertyChangedEventArgs e)
        {
            UserControl1 UserControl1Control = d as UserControl1;
            UserControl1Control.OnSetTextChanged(e);
        }
        private void OnSetTextChanged(DependencyPropertyChangedEventArgs e)
```

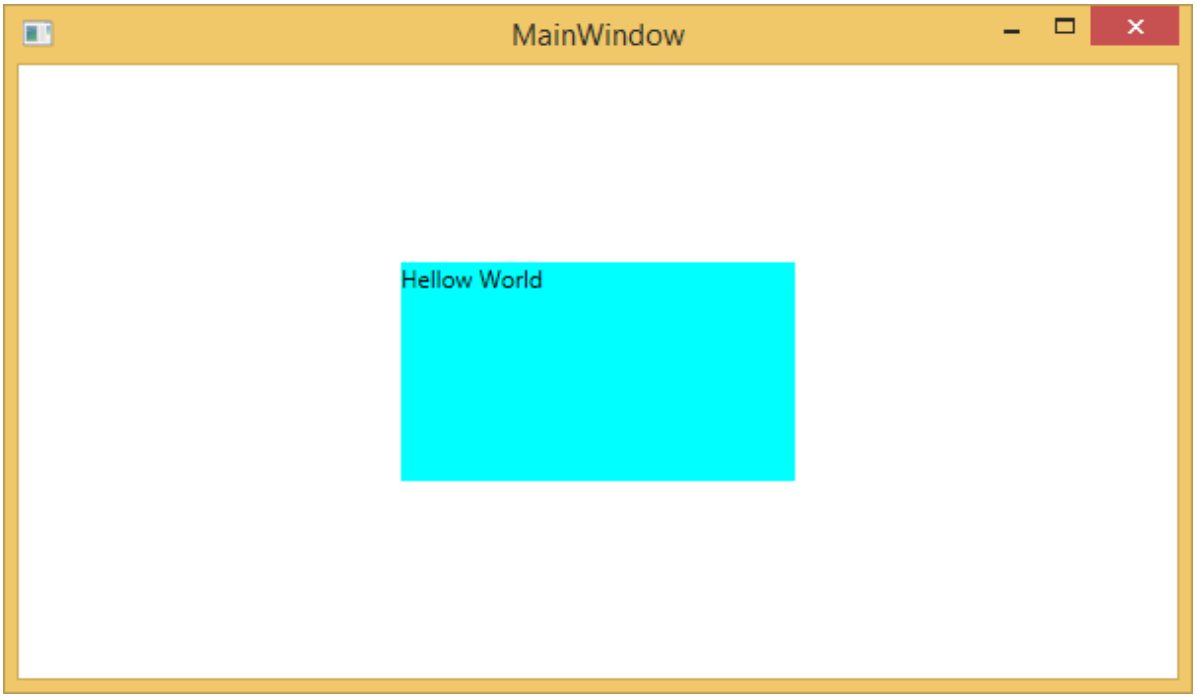
```
        {
            tbTest.Text = e.NewValue.ToString();
        }

    }
}
```

Here is the XAML file in which the TextBlock is defined as a user control and the Text property will be assigned to it by the SetText dependency property.

The following XAML code creates a user control with initializing its SetText dependency property and some other properties.

```
<Window x:Class="WpfApplication3.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:views="clr-namespace:WpfApplication3"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <views:UserControl1 SetText="Hellow World"/>
    </Grid>
</Window>
```

Let's run this application and you can see immediately in our MainWindow that dependency property for user control has been successfully used as a Text.



13. XAML – RESOURCES

Resources are normally definitions connected with some object that you just anticipate to use more often than once. It has the ability to store data locally for controls or for the current window or globally for the entire applications.

Defining an object as a resource allows us to access it from another place. Hence, it allows reusability. Resources are defined in resource dictionaries and any object can be defined as a resource effectively making it a shareable asset. A unique key is specified to XAML resource and with that key, it can be referenced by using a StaticResource markup extension.

Let's have a look at a simple example again in which two text blocks are created with some properties and their foreground color is defined in **Window.Resources**.

```
<Window x:Class="XAMLResources.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Window.Resources>
        <SolidColorBrush Color="Blue" x:Key="myBrush"></SolidColorBrush>
    </Window.Resources>

    <StackPanel Orientation="Vertical">
        <TextBlock Foreground="{StaticResource myBrush}"
                       Text="First Name"
                       Width="100"
                       Margin="10"/>
        <TextBlock Foreground="{StaticResource myBrush}"
                       Text="Last Name"
                       Width="100"
                       Margin="10"/>
    </StackPanel>
</Window>
```

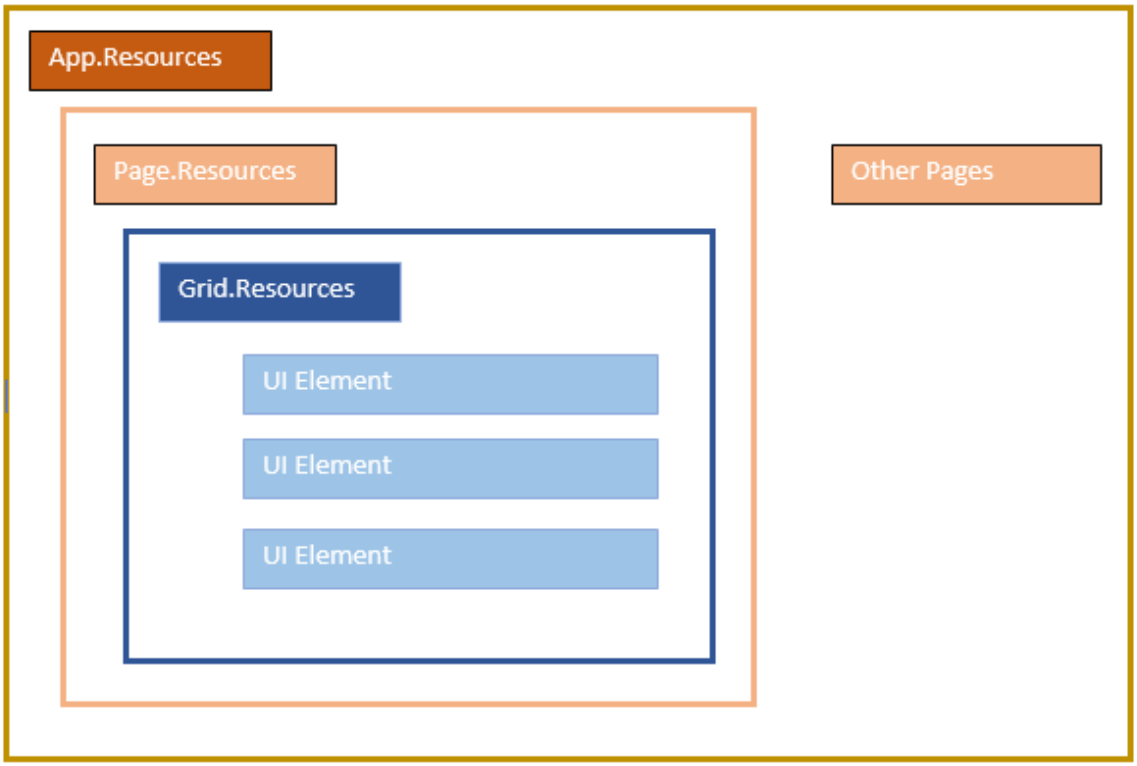
When the above code is compiled and executed, it will produce the following MainWindow. You can see two text blocks with blue foreground color. The advantage of the resource is that if there are multiple text blocks and you want to change their background color, then you will need just to change it in the resource dictionary.

Resource Scope

Resources are defined in resource dictionaries, but there are numerous places where a resource dictionary can be defined. In the above example, a resource dictionary is defined on Window/page level. In what dictionary a resource is defined immediately limits the scope of that resource. So the scope, i.e. where you can use the resource, depends on where you've defined it.

- Define the resource in the resource dictionary of a grid and it's accessible by that grid and by its child elements only.
- Define it on a window/page and it's accessible by all elements on that window/page.
- The App root can be found in App.xaml resources dictionary. It's the root of our application, so the resources defined here are scoped to the complete application.

As far as the scope of the resource is concerned, the most often are application level, page level, and a specific element level like a Grid, StackPanel, etc.



Resource Dictionaries

Resource dictionaries in XAML apps imply resource dictionaries in separate files. It is followed in almost all XAML apps. Defining resources in separate files can have the following advantages:

- Separation between defining resources in the resource dictionary and UI related code.
- Defining all the resources in a separate file such as App.xaml would make them available across the App.

So, how we can define our resources in a resource dictionary in a separate file? Well, it is very easy, just add a new resource dictionary through Visual Studio by the following steps:

- In your solution, add a new folder and name it **ResourceDictionaries**.
- Right-click on this folder and select Resource Dictionary from Add submenu item and name it **DictionaryWithBrush.xaml**

Let's have a look at the same application; just the resource dictionary is now defined in App level.

Here is the XAML code for MainWindow.xaml.

```
<Window x:Class="XAMLResources.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
```

```
    <StackPanel Orientation="Vertical">
        <TextBlock Foreground="{StaticResource myBrush}"
                       Text="First Name"
                       Width="100"
                       Margin="10"/>
        <TextBlock Foreground="{StaticResource myBrush}"
                       Text="Last Name"
                       Width="100"
                       Margin="10"/>
    </StackPanel>
</Window>
```

Here is the implementation in DictionaryWithBrush.xaml:

```
<ResourceDictionary
xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
                     xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml">
    <SolidColorBrush Color="Blue" x:Key="myBrush"></SolidColorBrush>
</ResourceDictionary>
```

Here is the implementation in app.xaml:

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

When the above code is compiled and executed, it will produce the following output:

We recommend you to execute the above code and experiment with some more resources such as background color, etc.

14. XAML – TEMPLATES

A template describes the overall look and visual appearance of a control. For each control, there is a default template associated with it which gives the appearance to that control.

In XAML, you can easily create your own templates when you want to customize the visual behavior and visual appearance of a control. Connectivity between the logic and template can be achieved by data binding.

The main difference between styles and templates are:

- Styles can only change the appearance of your control with default properties of that control.
- With templates, you can access more parts of a control than in styles. You can also specify both existing and new behavior of a control.

There are two types of templates which are most commonly used.

- Control Template
- Data Template

Control Template

The Control Template defines or specifies the visual appearance and structure of a control. All of the UI elements have some kind of appearance as well as behavior, e.g., Button has an appearance and behavior. Click event or mouse hover events are the behaviors which are fired in response to a click and hover, and there is also a default appearance of button which can be changed by the Control template.

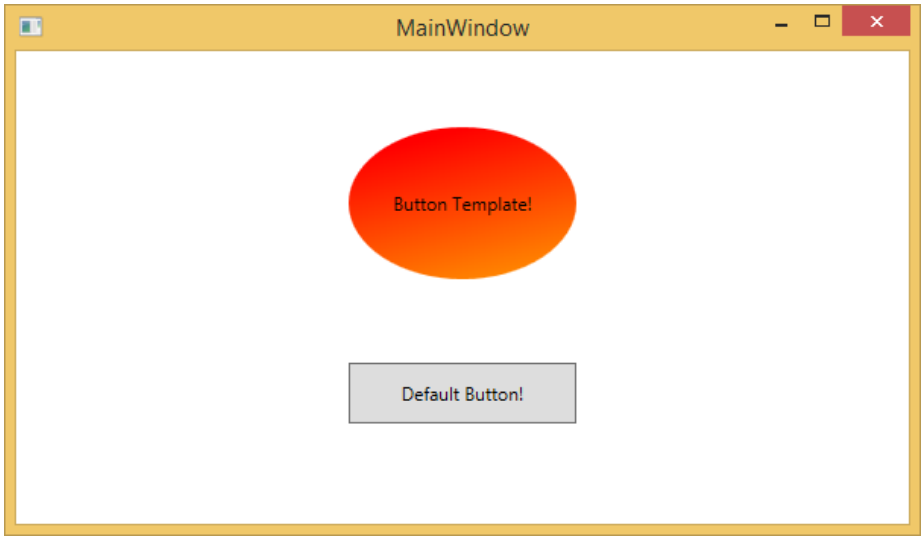
Let's have a look at a simple example again in which two buttons are created with some properties. One is with **template** and the other one is with the **default** button.

```
<Window x:Class="TemplateDemo.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Window.Resources>
            <ControlTemplate x:Key="ButtonTemplate" TargetType="Button">
                <Grid>
                    <Ellipse x:Name="ButtonEllipse" Height="100" Width="150" >
                        <Ellipse.Fill>
                            <LinearGradientBrush StartPoint="0,0.2"
                                     EndPoint="0.2,1.4">
                                <GradientStop Offset="0" Color="Red"/>
```

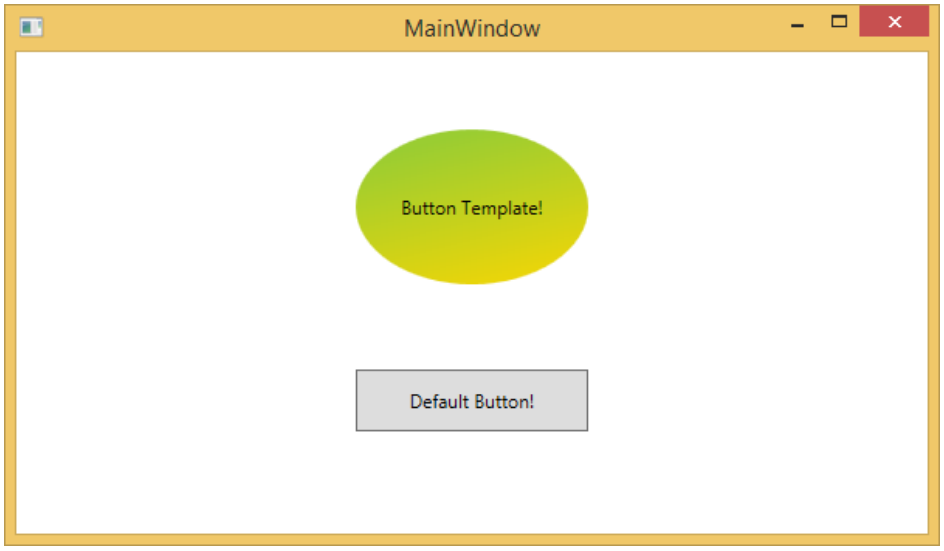
```
                            <GradientStop Offset="1" Color="Orange"/>
                        </LinearGradientBrush>
                    </Ellipse.Fill>
                </Ellipse>
                <ContentPresenter Content="{TemplateBinding Content}"
                        HorizontalAlignment="Center"
                        VerticalAlignment="Center" />
            </Grid>
            <ControlTemplate.Triggers>
                <Trigger Property="IsMouseOver" Value="True">
                    <Setter TargetName="ButtonEllipse" Property="Fill" >
                        <Setter.Value>
                            <LinearGradientBrush StartPoint="0,0.2"
                                     EndPoint="0.2,1.4">
                                <GradientStop Offset="0" Color="YellowGreen"/>
                                <GradientStop Offset="1" Color="Gold"/>
                            </LinearGradientBrush>
                        </Setter.Value>
                    </Setter>
                </Trigger>
                <Trigger Property="IsPressed" Value="True">
                    <Setter Property="RenderTransform">
                        <Setter.Value>
                            <ScaleTransform ScaleX="0.8" ScaleY="0.8"
                                CenterX="0" CenterY="0"  />
                        </Setter.Value>
                    </Setter>
                    <Setter Property="RenderTransformOrigin"
                Value="0.5,0.5" />
                </Trigger>
            </ControlTemplate.Triggers>
        </ControlTemplate>
    </Window.Resources>
<StackPanel>
    <Button Content="Round Button!"
    Template="{StaticResource ButtonTemplate}"
```

```
        Width="150" Margin="50" />
        <Button Content="Default Button!" Height="40"
        Width="150" Margin="5" />
    </StackPanel>
</Window>
```

When the above code is compiled and executed, it will produce the following MainWindow:



When you hover the mouse over the button with custom template, then it also changes the color as shown below:



Data Template

A Data Template defines and specifies the appearance and structure of the collection of data. It provides the flexibility to format and define the presentation of the data on any UI element. It is mostly used on data related Item controls such as ComboBox, ListBox, etc.

Let's have a look at a simple example of data template. The following XAML code creates a combobox with Data Template and text blocks.

```
<Window x:Class="XAMLDataTemplate.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid VerticalAlignment="Top">
        <ComboBox Name="Presidents"
                  ItemsSource="{Binding}"
                  Height="30"
                  Width="400">
            <ComboBox.ItemTemplate>
                <DataTemplate>
                    <StackPanel Orientation="Horizontal"
                                Margin="2">
                        <TextBlock Text="Name: "
                                   Width="95"
                                   Background="Aqua"
                                   Margin="2" />
                        <TextBlock Text="{Binding Name}"
                                   Width="95"
                                   Background="AliceBlue"
                                   Margin="2" />
                        <TextBlock Text="Title: "
                                   Width="95"
                                   Background="Aqua"
                                   Margin="10,2,0,2" />
                        <TextBlock Text="{Binding Title}"
                                   Width="95"
                                   Background="AliceBlue"
                                   Margin="2" />
                    </StackPanel>
                </DataTemplate>
            </ComboBox.ItemTemplate>
        </ComboBox>
    </Grid>
```

```
</Window>
```

Here is the implementation in C# in which the employee object is assigned to DataContext:

```
using System;
using System.Windows;
using System.Windows.Controls;

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

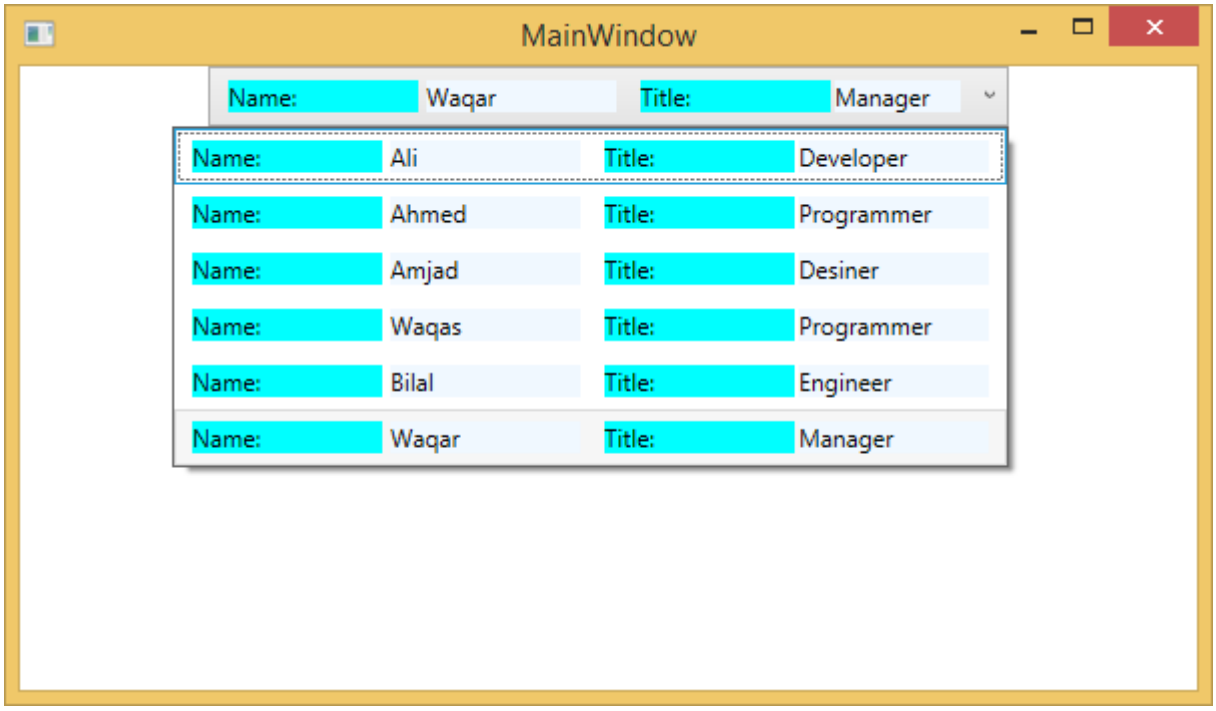
Here is the implementation in C# for Employee class:

```
using System;
using System.Collections.Generic;
using System.Collections.ObjectModel;
using System.ComponentModel;
using System.Linq;
using System.Runtime.CompilerServices;
using System.Text;
using System.Threading.Tasks;

namespace XAMLDataTemplate
{
    public class Employee : INotifyPropertyChanged
```

```
    {
        private string name;
        public string Name
        {
            get { return name; }
            set
            {
                name = value;
                RaiseProperChanged();
            }
        }
        private string title;
        public string Title
        {
            get { return title; }
            set
            {
                title = value;
                RaiseProperChanged();
            }
        }

        public static Employee GetEmployee()
        {
            var emp = new Employee()
            {
                Name = "Waqas",
                Title = "Software Engineer"
            };

            return emp;
        }
        public event PropertyChangedEventHandler PropertyChanged;
        private void RaiseProperChanged(
            [CallerMemberName] string caller = "")
        {
```

```
            if (PropertyChanged != null)
            {
                PropertyChanged(this, new PropertyChangedEventArgs(caller));
            }
        }
        public static ObservableCollection<Employee> GetEmployees()
        {
            var employees = new ObservableCollection<Employee>();
            employees.Add(new Employee() { Name = "Ali", Title = "Developer" });
            employees.Add(new Employee() { Name = "Ahmed", Title = "Programmer" });
            employees.Add(new Employee() { Name = "Amjad", Title = "Desiner" });
            employees.Add(new Employee() { Name = "Waqas", Title = "Programmer" });
            employees.Add(new Employee() { Name = "Bilal", Title = "Engineer" });
            employees.Add(new Employee() { Name = "Waqar", Title = "Manager" });
            return employees;
        }
    }
}
```

When the above code is compiled and executed, it will produce the following output. It contains a combobox and when you click on the combobox, you see that the collection of data which are created in the Employee class is listed as the combobox items.



We recommend you to execute the above code and experiment with it.

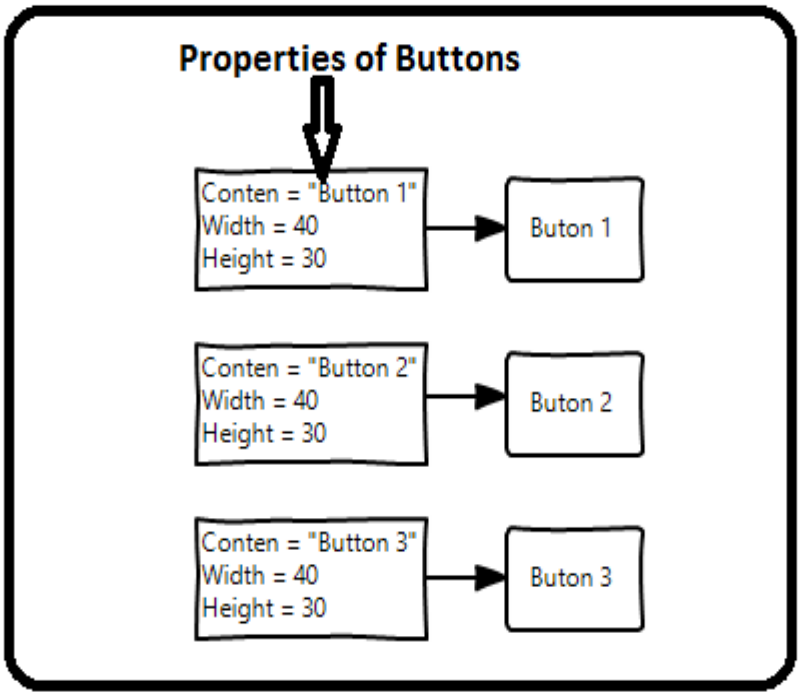
15. XAML – STYLES

XAML framework provides several strategies to personalize and customize the appearance of an application. Styles give us the flexibility to set some properties of an object and reuse these specific settings across multiple objects for a consistent look.

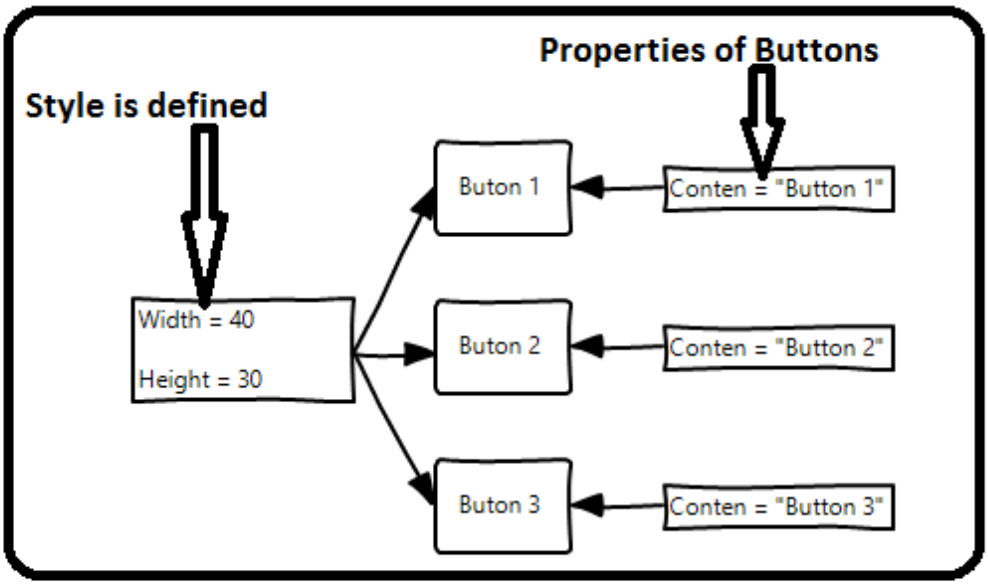
- In styles, you can set only the existing properties of an object such as Height, Width, and Font size.
- Only default behavior of a control can be specified.
- Multiple properties can be added into a single style.

Styles are used to give a uniform look to a set of controls. Implicit Styles are used to apply an appearance to all controls of a given type and simplify the application.

Imagine we have three buttons and all of them have to look the same – same width and height, same font size, and same foreground color. We can set all those properties on the button elements themselves and that's still quite okay for all of the buttons as shown in the following diagram.



But in a real-life App, you'll typically have a lot more of these that need to look exactly the same. And not only buttons of course, you'll typically want your text blocks, text boxes, and combo boxes, etc., to look the same across your App. Surely there must be a better way to achieve this – it is known as **styling**. You can think of a style as a convenient way to apply a set of property values to more than one element as shown in the following diagram.

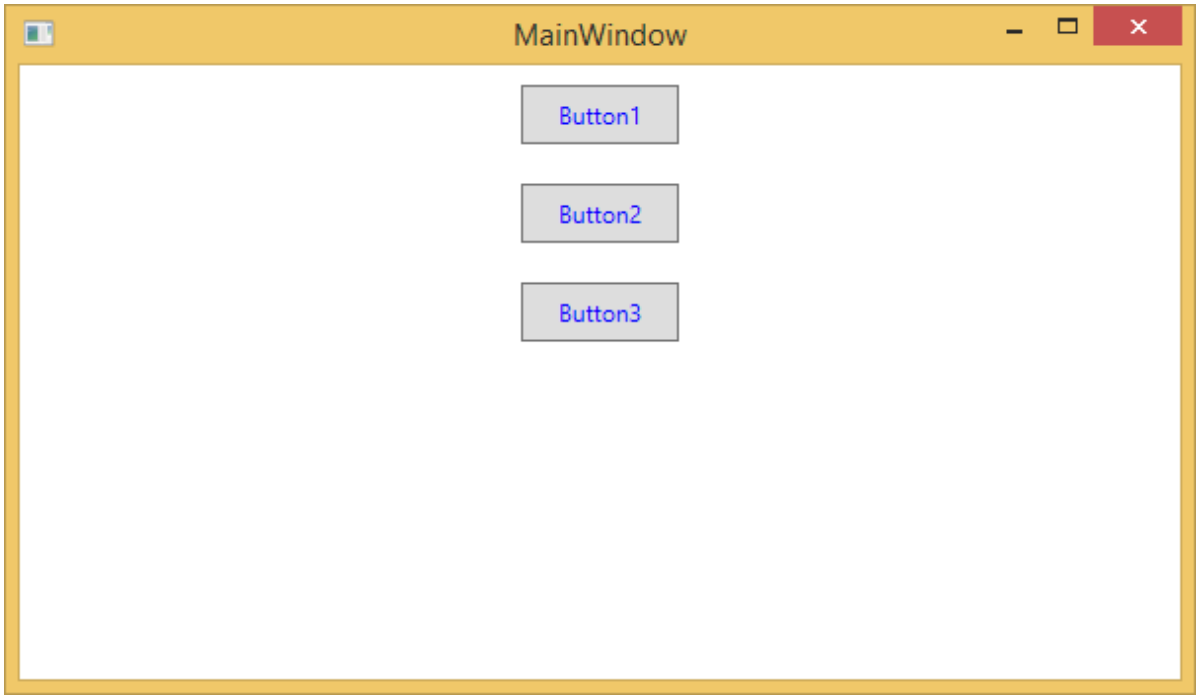


Let's have look at the example which contains three buttons which are created in XAML with some properties.

```
<Window x:Class="XAMLStyle.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:XAMLStyle"
        mc:Ignorable="d"
        Title="MainWindow" Height="350" Width="604">
    <StackPanel>
        <Button Content="Button1"
                Height="30"
                Width="80"
                Foreground="Blue"
                FontSize="12"
                Margin="10"/>
        <Button Content="Button2"
                Height="30"
                Width="80"
                Foreground="Blue"
                FontSize="12"
```

```
                Margin="10"/>
        <Button Content="Button3"
                Height="30"
                Width="80"
                Foreground="Blue"
                FontSize="12"
                Margin="10"/>
    </StackPanel>
</Window>
```

When you look at the above code, you will see that for all the buttons, height, width, foreground color, font size, and margin properties remain same. When the above code is compiled and executed, it will display the following output:



Now let's have a look at the same example, but this time, we will be using **style**.

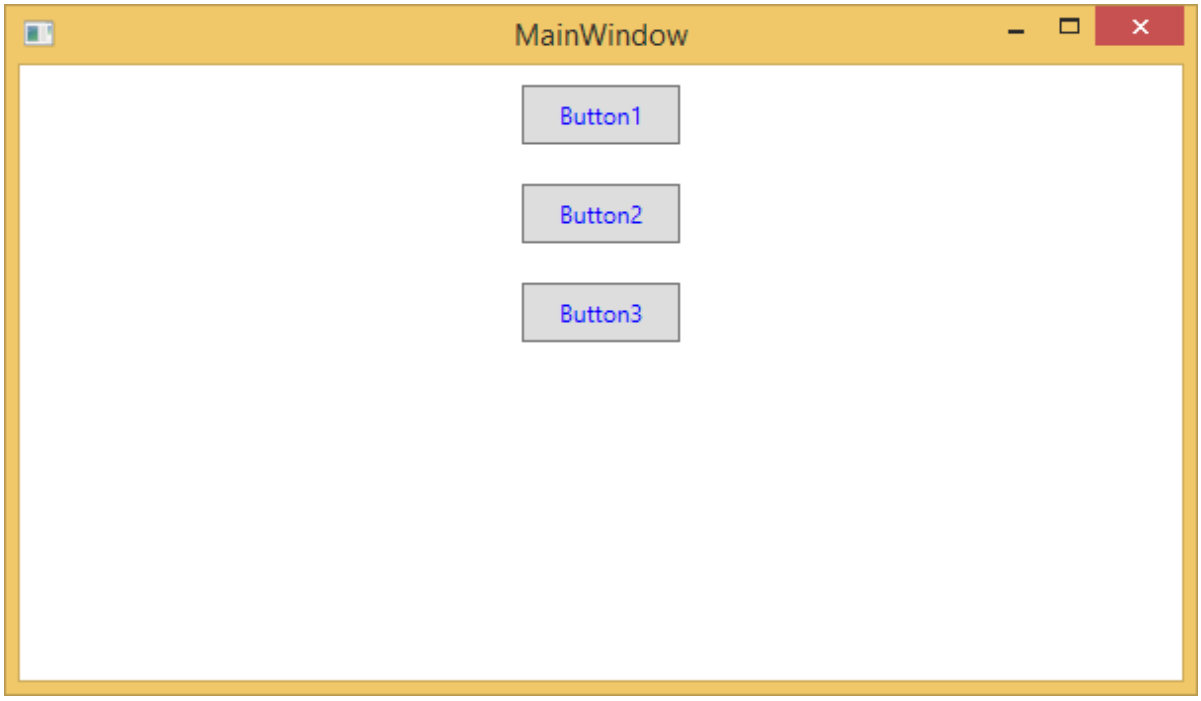
```
<Window x:Class="XAMLStyle.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
        xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
        xmlns:local="clr-namespace:XAMLStyle"
        mc:Ignorable="d"
        Title="MainWindow" Height="350" Width="604">
    <Window.Resources>
```

```
        <Style x:Key="myButtonStyle" TargetType="Button">
            <Setter Property="Height" Value="30"/>
            <Setter Property="Width" Value="80"/>
            <Setter Property="Foreground" Value="Blue"/>
            <Setter Property="FontSize" Value="12"/>
            <Setter Property="Margin" Value="10"/>
        </Style>
    </Window.Resources>
    <StackPanel>
        <Button Content="Button1" Style="{StaticResource myButtonStyle}"/>
        <Button Content="Button2" Style="{StaticResource myButtonStyle}"/>
        <Button Content="Button3" Style="{StaticResource myButtonStyle}"/>
    </StackPanel>
</Window>
```

Styles are defined in the resource dictionary and each style has a unique key identifier and a target type. Inside <style>, you can see that multiple setter tags are defined for each property which will be included in the style.

In the above example, all of the common properties of each button are now defined in style and then the style are assigned to each button with a unique key by setting the style property through the StaticResource markup extension.

When the above code is compiled and executed, it will produce the following window which is the same output.



The advantage of doing it like this is immediately obvious. We can reuse that style anywhere in its scope, and if we need to change it, we simply change it once in the style definition instead of on each element.

In what level a style is defined instantaneously limits the scope of that style. So the scope, i.e. where you can use the style, depends on where you've defined it. Style can be defined on the following levels:

- Control level
- Layout level
- Window level
- Application level

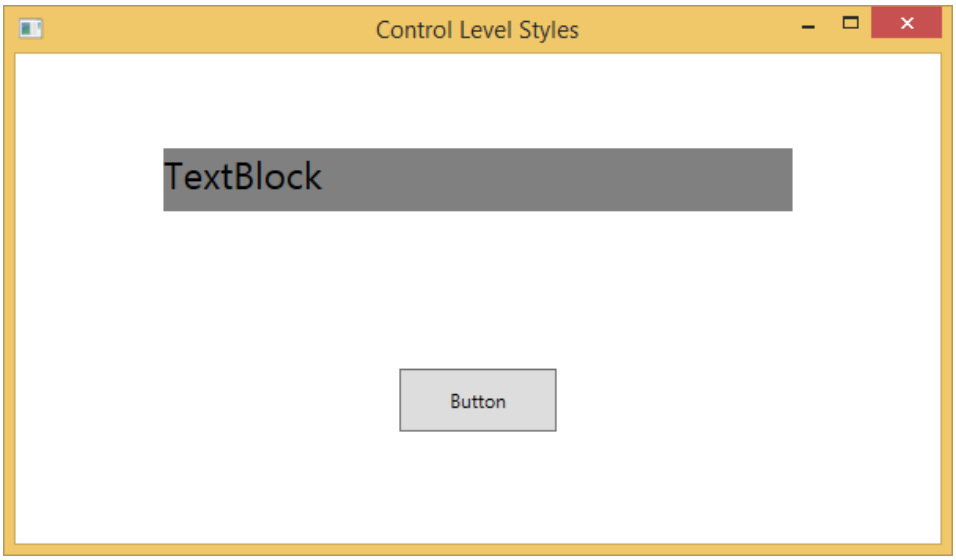
Control Level

Defining a style on control level can only be applied to that particular control. Given below is the example of a control level where the button and TextBlock have their own styles.

```
<Window x:Class="XAMLControlLevelStyle.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="Control Level Styles" Height="350" Width="604">
    <StackPanel Margin="10" VerticalAlignment="Top">
        <TextBlock Text="TextBlock">
            <TextBlock.Style>
                <Style>
                    <Setter Property="TextBlock.FontSize" Value="24" />
                    <Setter Property="TextBlock.Width" Value="400" />
                    <Setter Property="TextBlock.Height" Value="40" />
                    <Setter Property="TextBlock.Background" Value="Gray" />
                    <Setter Property="TextBlock.Margin" Value="50" />
                </Style>
            </TextBlock.Style>
        </TextBlock>
        <Button Content="Button">
            <Button.Style>
                <Style>
                    <Setter Property="TextBlock.Width" Value="100" />
                    <Setter Property="TextBlock.Height" Value="40" />
                    <Setter Property="TextBlock.Margin" Value="50" />
                </Style>
```

```
            </Button.Style>
        </Button>
    </StackPanel>
</Window>
```

When the above code is compiled and executed, it will produce the following output:



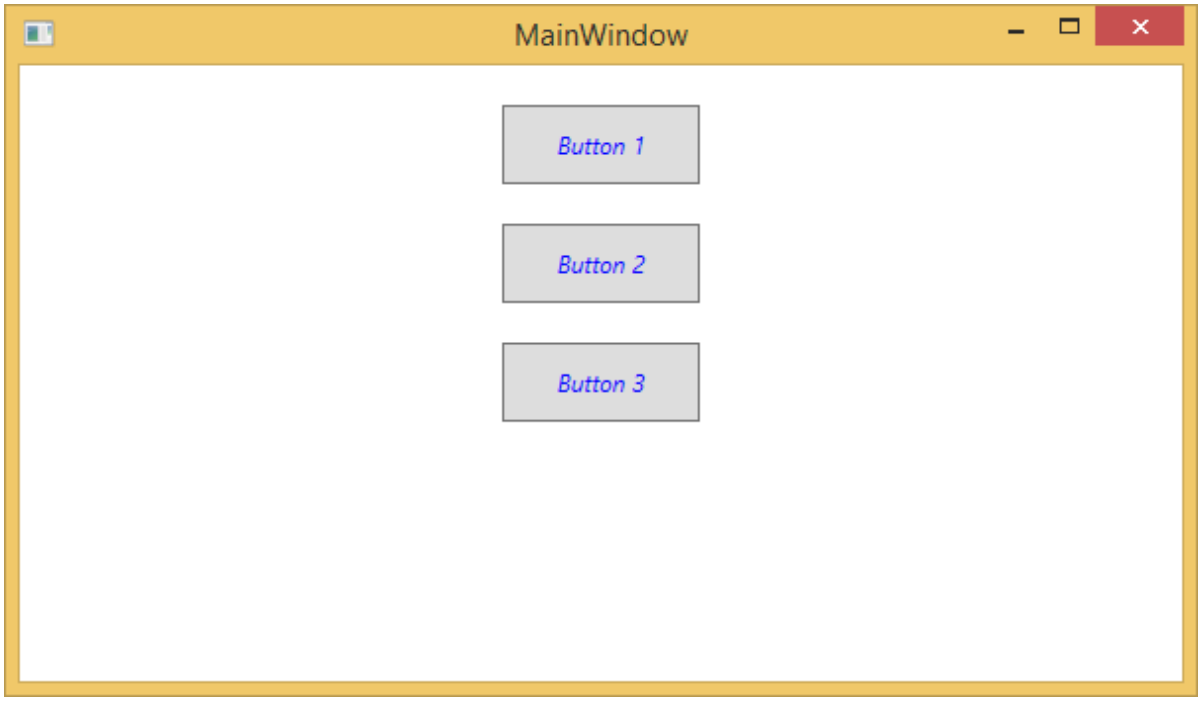
Layout Level

Defining a style on any layout level can only be accessible by that layout and by its child elements only. Given below is the example of a layout level where all the three buttons have a common style.

```
<Window x:Class="XAMLLayoutLevelStyle.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <StackPanel Margin="10">
        <StackPanel.Resources>
            <Style TargetType="Button">
                <Setter Property="Foreground" Value="Blue" />
                <Setter Property="FontStyle" Value="Italic" />
                <Setter Property="Width" Value="100" />
                <Setter Property="Height" Value="40" />
                <Setter Property="Margin" Value="10" />
            </Style>
        </StackPanel.Resources>
```

```
        <Button>Button 1</Button>
        <Button>Button 2</Button>
        <Button Foreground="Blue">Button 3</Button>
    </StackPanel>
</Window>
```

When the above code is compiled and executed, it will produce the following output:



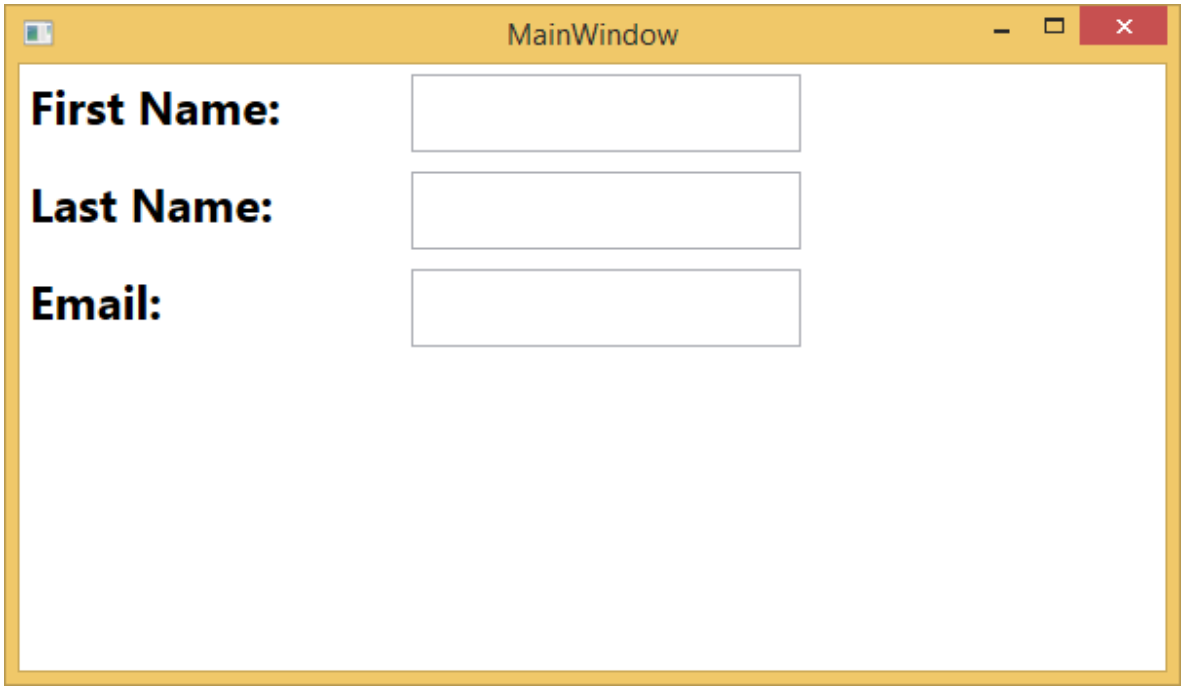
Window Level

Defining a style on a window level can be accessible by all the elements on that window. Given below is the example of a window level where all the three text blocks and the textbox have a common style.

```
<Window x:Class="Styles.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
   <Window.Resources>
      <Style TargetType="TextBlock">
            <Setter Property="FontSize" Value="24" />
            <Setter Property="Margin" Value="5" />
            <Setter Property="FontWeight" Value="Bold" />
      </Style>
      <Style TargetType="TextBox">
```

```
            <Setter Property="HorizontalAlignment" Value="Left" />
            <Setter Property="FontSize" Value="24" />
            <Setter Property="Margin" Value="5" />
            <Setter Property="Width" Value="200" />
            <Setter Property="Height" Value="40" />
      </Style>
   </Window.Resources>
    <Grid>
      <Grid.RowDefinitions>
         <RowDefinition Height="Auto" />
         <RowDefinition Height="Auto" />
         <RowDefinition Height="Auto" />
         <RowDefinition Height="*" />
      </Grid.RowDefinitions>
      <Grid.ColumnDefinitions>
         <ColumnDefinition Width="*" />
         <ColumnDefinition Width="2*" />
      </Grid.ColumnDefinitions>
      <TextBlock Text="First Name: "/>
      <TextBox Name="FirstName" Grid.Column="1" />
      <TextBlock Text="Last Name: " Grid.Row="1" />
      <TextBox Name="LastName" Grid.Column="1" Grid.Row="1" />
      <TextBlock Text="Email: " Grid.Row="2" />
        <TextBox Name="Email" Grid.Column="1" Grid.Row="2"/>
    </Grid>
</Window>
```

When the above code is compiled and executed, it will produce the following output:



Application Level

Defining a style on App level makes it accessible in entire application. Let's have a look at the same example; just put the styles in app.xaml file to make it accessible throughout the application. Given below is the XAML code in app.xaml.

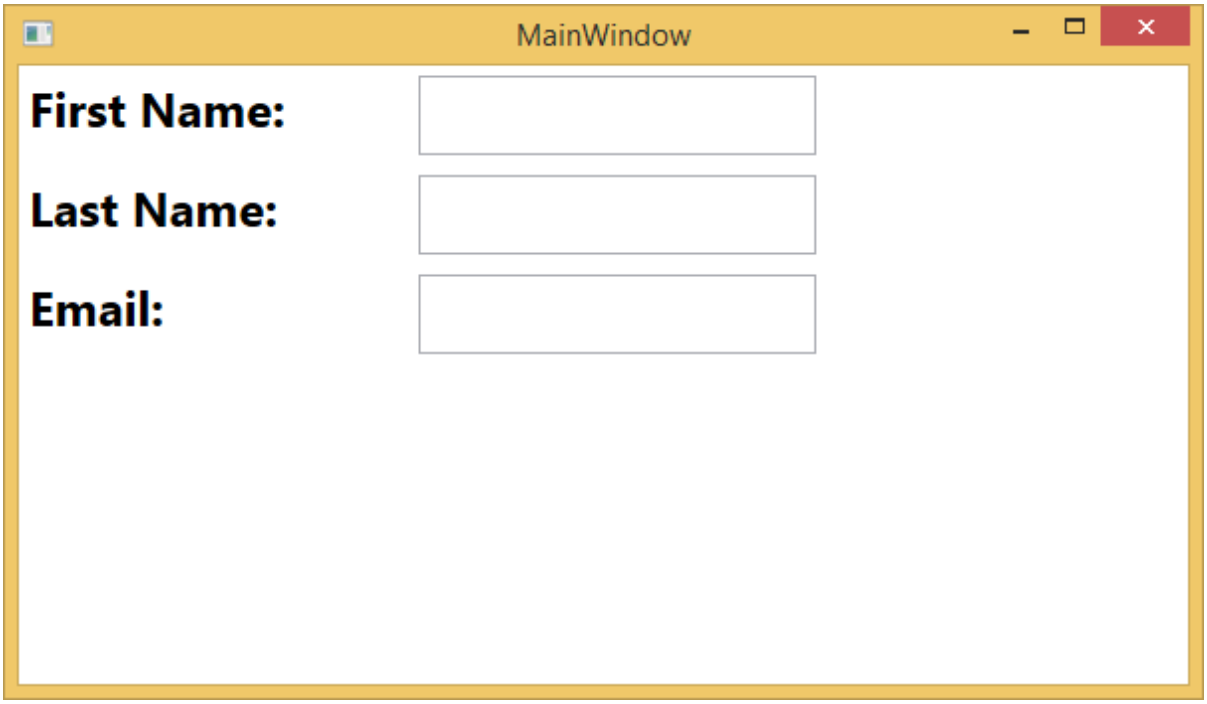
```
<Application x:Class="Styles.App"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             StartupUri="MainWindow.xaml">
    <Application.Resources>
        <Style TargetType="TextBlock">
            <Setter Property="FontSize" Value="24" />
            <Setter Property="Margin" Value="5" />
            <Setter Property="FontWeight" Value="Bold" />
        </Style>
        <Style TargetType="TextBox">
            <Setter Property="HorizontalAlignment" Value="Left" />
            <Setter Property="FontSize" Value="24" />
            <Setter Property="Margin" Value="5" />
            <Setter Property="Width" Value="200" />
            <Setter Property="Height" Value="40" />
        </Style>
    </Application.Resources>
```

```
</Application>
```

Here is the XAML code in which the text blocks and text boxes are created.

```
<Window x:Class="Styles.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
      <Grid.RowDefinitions>
         <RowDefinition Height="Auto" />
         <RowDefinition Height="Auto" />
         <RowDefinition Height="Auto" />
         <RowDefinition Height="*" />
      </Grid.RowDefinitions>
      <Grid.ColumnDefinitions>
         <ColumnDefinition Width="*" />
         <ColumnDefinition Width="2*" />
      </Grid.ColumnDefinitions>
      <TextBlock Text="First Name: "/>
      <TextBox Name="FirstName" Grid.Column="1" />
      <TextBlock Text="Last Name: " Grid.Row="1" />
      <TextBox Name="LastName" Grid.Column="1" Grid.Row="1" />
      <TextBlock Text="Email: " Grid.Row="2" />
        <TextBox Name="Email" Grid.Column="1" Grid.Row="2"/>
    </Grid>
</Window>
```

When the above code is compiled and executed, it will produce the following output. Observe that the output remains identical.


MainWindow
First Name:
Last Name:
Email:

16. XAML – TRIGGERS

Basically, a trigger enables you to change property values or take actions based on the value of a property. So, it basically allows you to dynamically change the appearance and/or behavior of your control without having to create a new one.

Triggers are used to change the value of any given property, when certain conditions are satisfied. Triggers are usually defined in a style or in the root of a document which are applied to that specific control. There are three types of triggers:

- Property Triggers
- Data Triggers
- Event Triggers

Property Triggers

In property triggers, when a change occurs in one property, it will bring either an immediate or an animated change in another property. For example, you can use a property trigger if you want to change the button appearance when the mouse is over the button.

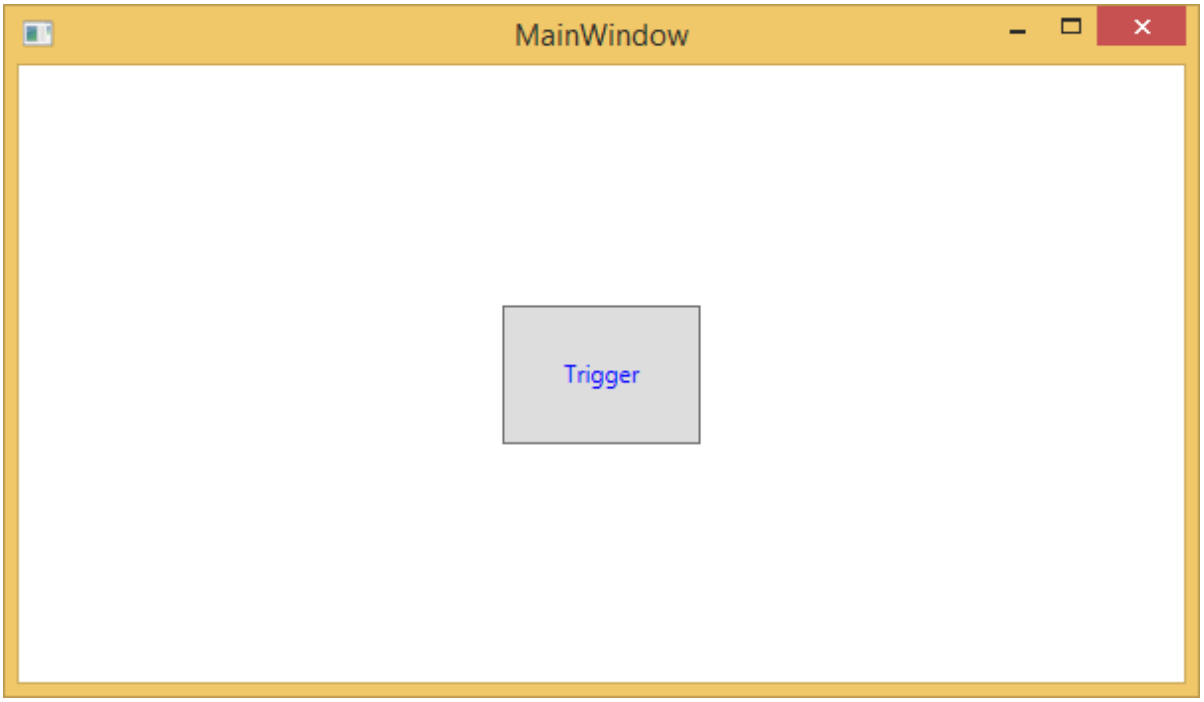
Example

The following example demonstrates how to change the foreground color of a button when the mouse enters its region.

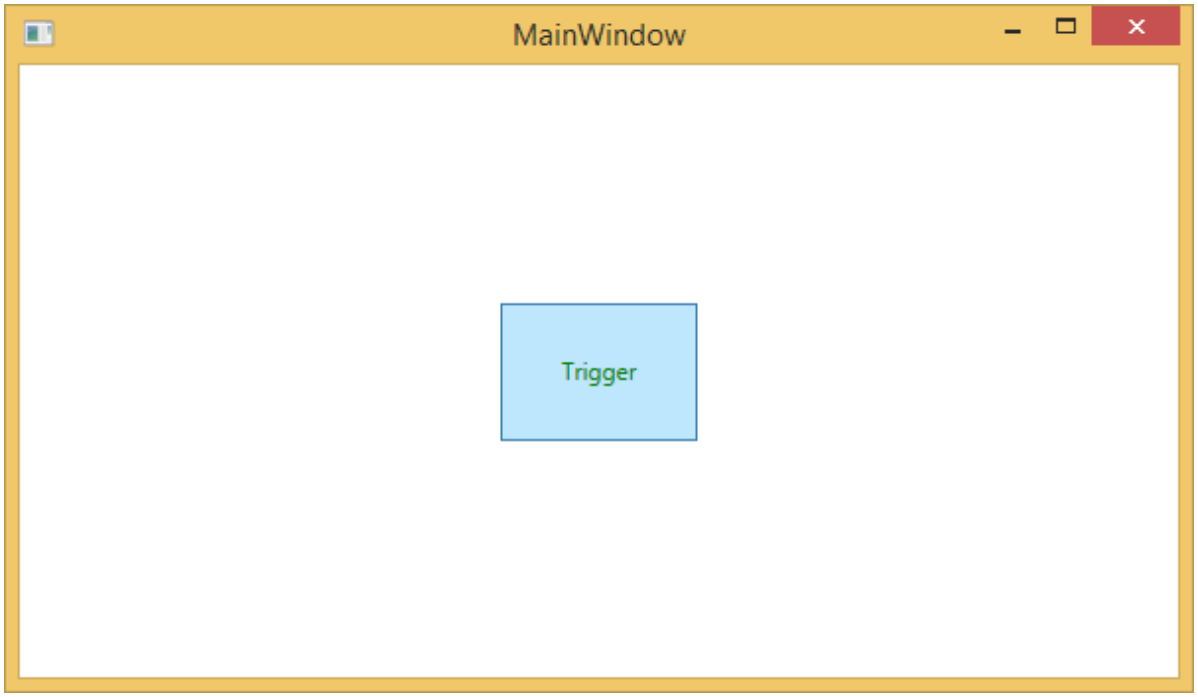
```
<Window x:Class="XAMLPropertyTriggers.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Window.Resources>
        <Style x:Key="TriggerStyle" TargetType="Button">
            <Setter Property="Foreground" Value="Blue" />
            <Style.Triggers>
                <Trigger Property="IsMouseOver" Value="True">
                    <Setter Property="Foreground" Value="Green" />
                </Trigger>
            </Style.Triggers>
        </Style>
    </Window.Resources>
    <Grid>
```

```
        <Button Width="100"
                 Height="70"
                 Style="{StaticResource TriggerStyle}"
                Content="Trigger"/>
    </Grid>
</Window>
```

When you compile and execute the above code, it will produce the following output:



When the mouse enters the region of button, the foreground color will change to green.



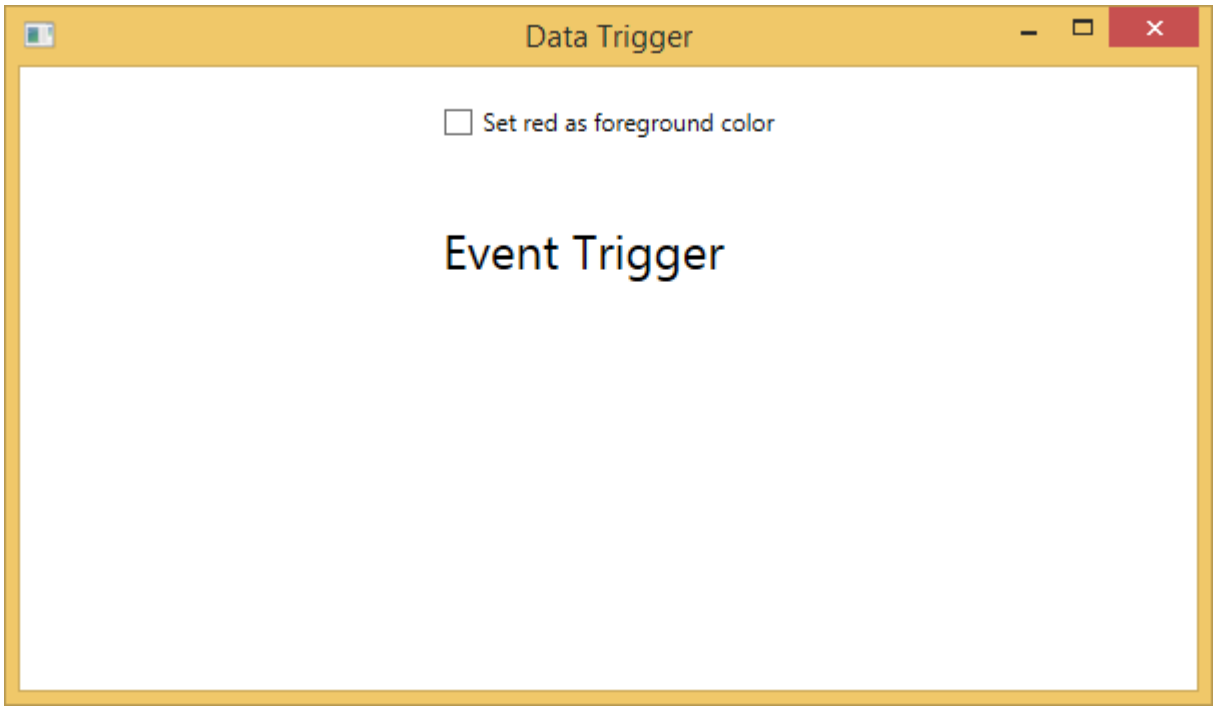
Data Triggers

A data trigger performs some action when the bound data satisfies some condition. Let's have a look at the following XAML code in which a checkbox and a text block are created with some properties. When the checkbox is checked, it will change the foreground color to red.

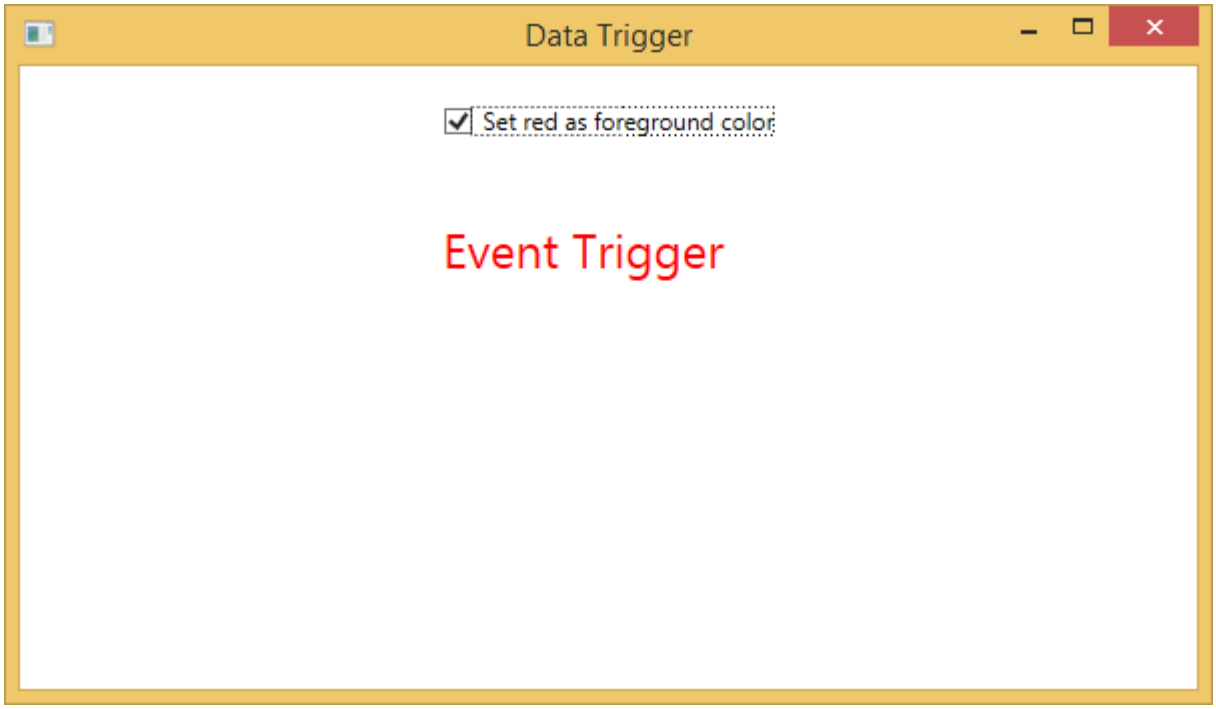
```
<Window x:Class="XAMLDataTrigger.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="Data Trigger" Height="350" Width="604">
    <StackPanel HorizontalAlignment="Center">
        <CheckBox x:Name="redColorCheckBox"
                  Content="Set red as foreground color"
                  Margin="20"/>
        <TextBlock Name="txtblock"
                   VerticalAlignment="Center"
                   Text="Event Trigger"
                   FontSize="24"
                   Margin="20">
            <TextBlock.Style>
                <Style>
                    <Style.Triggers>
```

```
                        <DataTrigger Binding="{Binding
ElementName=redColorCheckBox, Path=IsChecked}"
                                Value="true">
                            <Setter Property="TextBlock.Foreground" Value="Red"/>
                            <Setter Property="TextBlock.Cursor" Value="Hand" />
                        </DataTrigger>
                    </Style.Triggers>
                </Style>
            </TextBlock.Style>
        </TextBlock>
    </StackPanel>
</Window>
```

When you compile and execute the above code, it will produce the following output:



When the checkbox is checked, the foreground color of the text block will change to red.



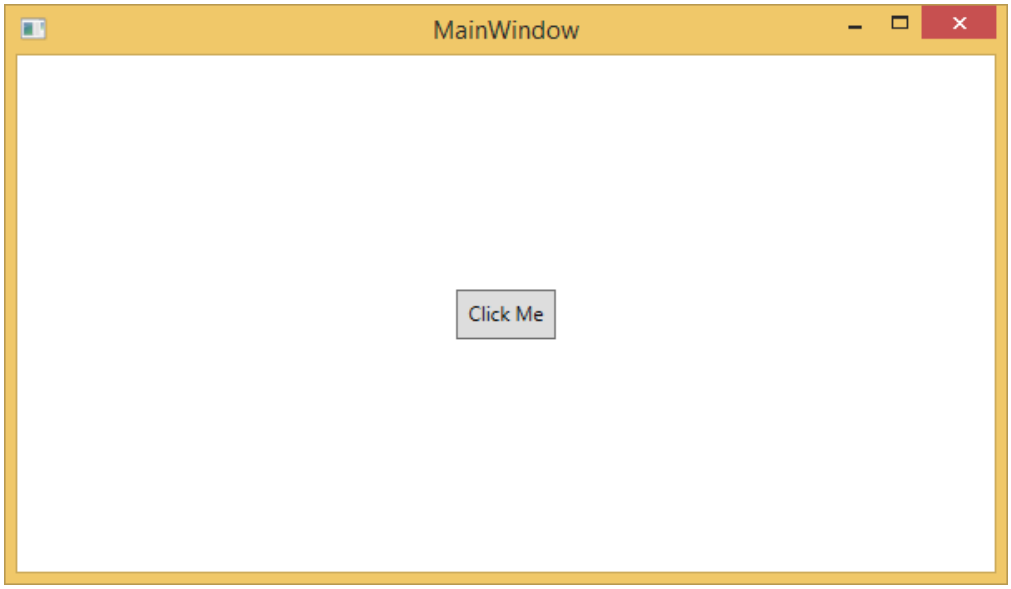
Event Triggers

An event trigger performs some action when a specific event is fired. It is usually used to accomplish some animation such DoubleAnimation, ColorAnimation, etc. The following code block creates a simple button. When the click event is fired, it will expand the width and height of the button.

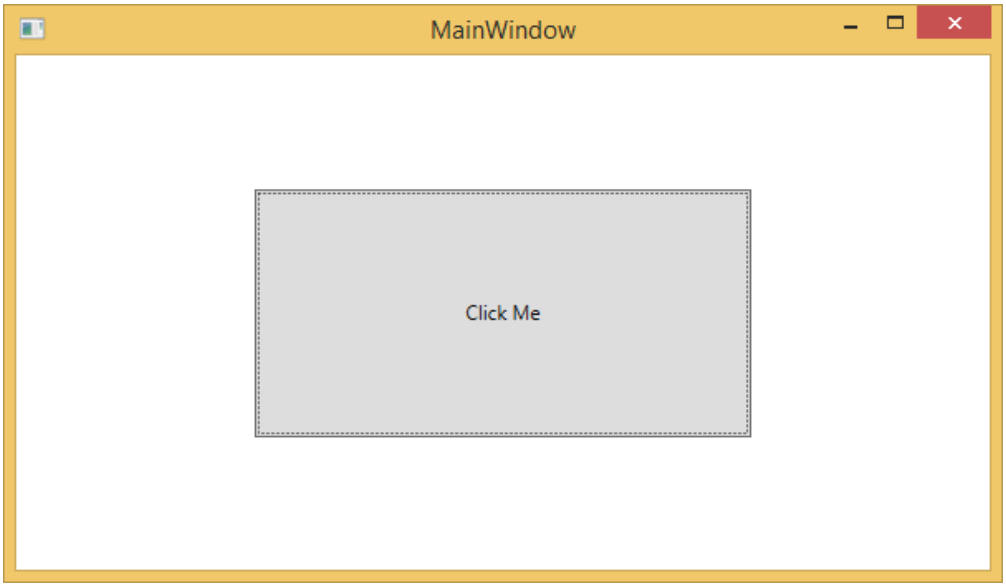
```
<Window x:Class="XAMLEventTrigger.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
        <Button Content="Click Me"
                Width="60"
                Height="30">
            <Button.Triggers>
                <EventTrigger RoutedEvent="Button.Click">
                    <EventTrigger.Actions>
                        <BeginStoryboard>
                            <Storyboard>
                                <DoubleAnimationUsingKeyFrames
Storyboard.TargetProperty="Width"

Duration="0:0:4">
```

```
                                    <LinearDoubleKeyFrame Value="60"
                                                          KeyTime="0:0:0"/>
                                    <LinearDoubleKeyFrame Value="120"
                                                          KeyTime="0:0:1"/>
                                    <LinearDoubleKeyFrame Value="200"
                                                          KeyTime="0:0:2"/>
                                    <LinearDoubleKeyFrame Value="300"
                                                          KeyTime="0:0:3"/>
                                </DoubleAnimationUsingKeyFrames>
                                <DoubleAnimationUsingKeyFrames
Storyboard.TargetProperty="Height"

Duration="0:0:4">
                                    <LinearDoubleKeyFrame Value="30"
                                                          KeyTime="0:0:0"/>
                                    <LinearDoubleKeyFrame Value="40"
                                                          KeyTime="0:0:1"/>
                                    <LinearDoubleKeyFrame Value="80"
                                                          KeyTime="0:0:2"/>
                                    <LinearDoubleKeyFrame Value="150"
                                                          KeyTime="0:0:3"/>
                                </DoubleAnimationUsingKeyFrames>
                            </Storyboard>
                        </BeginStoryboard>
                    </EventTrigger.Actions>
                </EventTrigger>
            </Button.Triggers>
        </Button>
    </Grid>
</Window>
```

When you compile and execute the above code, it will produce the following output:



Now, click on the button and you will observe that it will start expanding in both dimensions.



17. XAML – DEBUGGING

If you are familiar with debugging in any procedural language (such as C#, C/C++ etc.) and you know the usage of **break** and are expecting the same kind of debugging in XAML, then you will be surprised to know that it is not possible yet to debug an XAML code like the way you used to debug any other procedural language code. Debugging an XAML app means trying to find an error;

- In data binding, your data doesn't show up on screen and you don't know why
- Or an issue is related to complex layouts.
- Or an alignment issue or issues in margin color, overlays, etc. with some extensive templates like ListBox and combo box.

Debugging in XAML is something you typically do to check if your bindings work, and if it is not working, then to check what's wrong. Unfortunately, setting breakpoints in XAML bindings isn't possible except in Silverlight, but we can use the Output window to check for data binding errors. Let's have a look at the following XAML code to find the error in data binding.

```
<Window x:Class="DataBindingOneWay.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        Title="MainWindow" Height="350" Width="604">
    <Grid>
      <StackPanel Name="Display">
         <StackPanel Orientation="Horizontal" Margin="50, 50, 0, 0">
                    <TextBlock Text="Name: " Margin="10" Width="100"/>
                    <TextBlock Margin="10" Width="100"
                               Text="{Binding FirstName}"/>
         </StackPanel>
          <StackPanel Orientation="Horizontal" Margin="50,0,50,0">
                    <TextBlock Text="Title: " Margin="10" Width="100"/>
                    <TextBlock Margin="10" Width="100"
                           Text="{Binding Title}" />
         </StackPanel>
      </StackPanel>
   </Grid>
</Window>
```

Text properties of the two text blocks are set to "Name" and "Title" statically, while the other two text block's Text properties are bound to "FirstName" and "Title". But the class variables are intentionally taken as Name and Title in the Employee class which are incorrect variable names. Let us now try to understand where we can find this type of mistake when the desired output is not shown.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace DataBindingOneWay
{
   public class Employee
   {
      public string Name { get; set; }
      public string Title { get; set; }

      public static Employee GetEmployee()
      {
         var emp = new Employee()
         {
            Name = "Ali Ahmed",
            Title = "Developer"
         };
         return emp;
      }

   }
}
```

Here is the implementation of MainWindow class in C# code:

```
using System;
using System.Windows;
using System.Windows.Controls;

namespace DataBindingOneWay
```

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

Let's run this application and you can see immediately in our MainWindow that we have successfully bound to the Title of that Employee object but the name is not bound.

To check what happened with the name, let's look at the output window where a lot of log is generated.

The easiest way to find an error is to just search for error and you will find the below mentioned error which says "*BindingExpression path error: 'FirstName' property not found on 'object' ''Employe*"

```
System.Windows.Data Error: 40 : BindingExpression path error: 'FirstName'
property not found on 'object' ''Employee' (HashCode=11611730)'.
```

```
BindingExpression:Path=FirstName; DataItem='Employee' (HashCode=11611730);
target element is 'TextBlock' (Name=''); target property is 'Text' (type
'String')
```

Which clearly indicate that FirstName is not a member of Employee class, so it helps to fix this type of issues in your application.

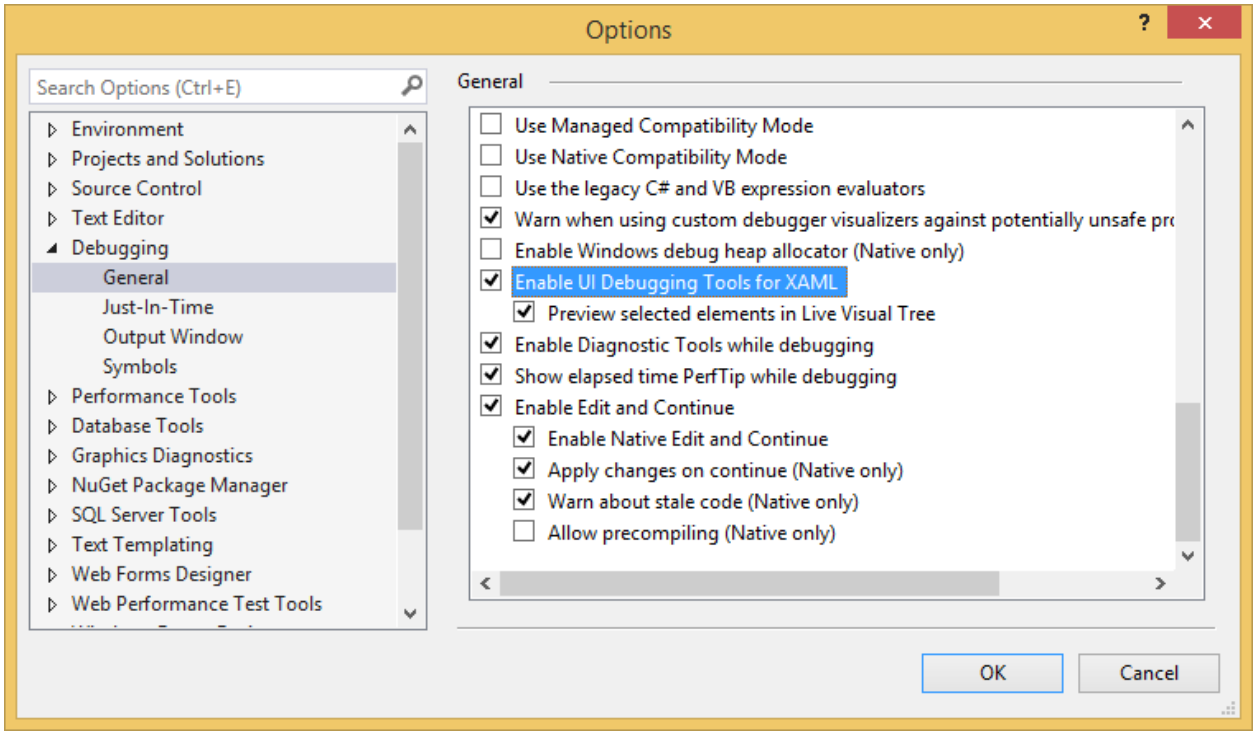
When you change the **FirstName** to **Name** again, you will see the desired output.

UI Debugging Tools for XAML

UI debugging tools for XAML are introduced with Visual Studio 2015 to inspect the XAML code at runtime. With the help of these tools, XAML code is presented in the form of visual tree of your running WPF application and also the different UI element properties in the tree. To enable this tool, follow the steps given below.

1. Go to the Tools menu and select Options from the Tools menu.

2. You will get to see the following dialog box.



3. Go to the General Options under Debugging item on the left side.

4. Check the highlighted option, i.e, "Enable UI Debugging Tools for XAML"

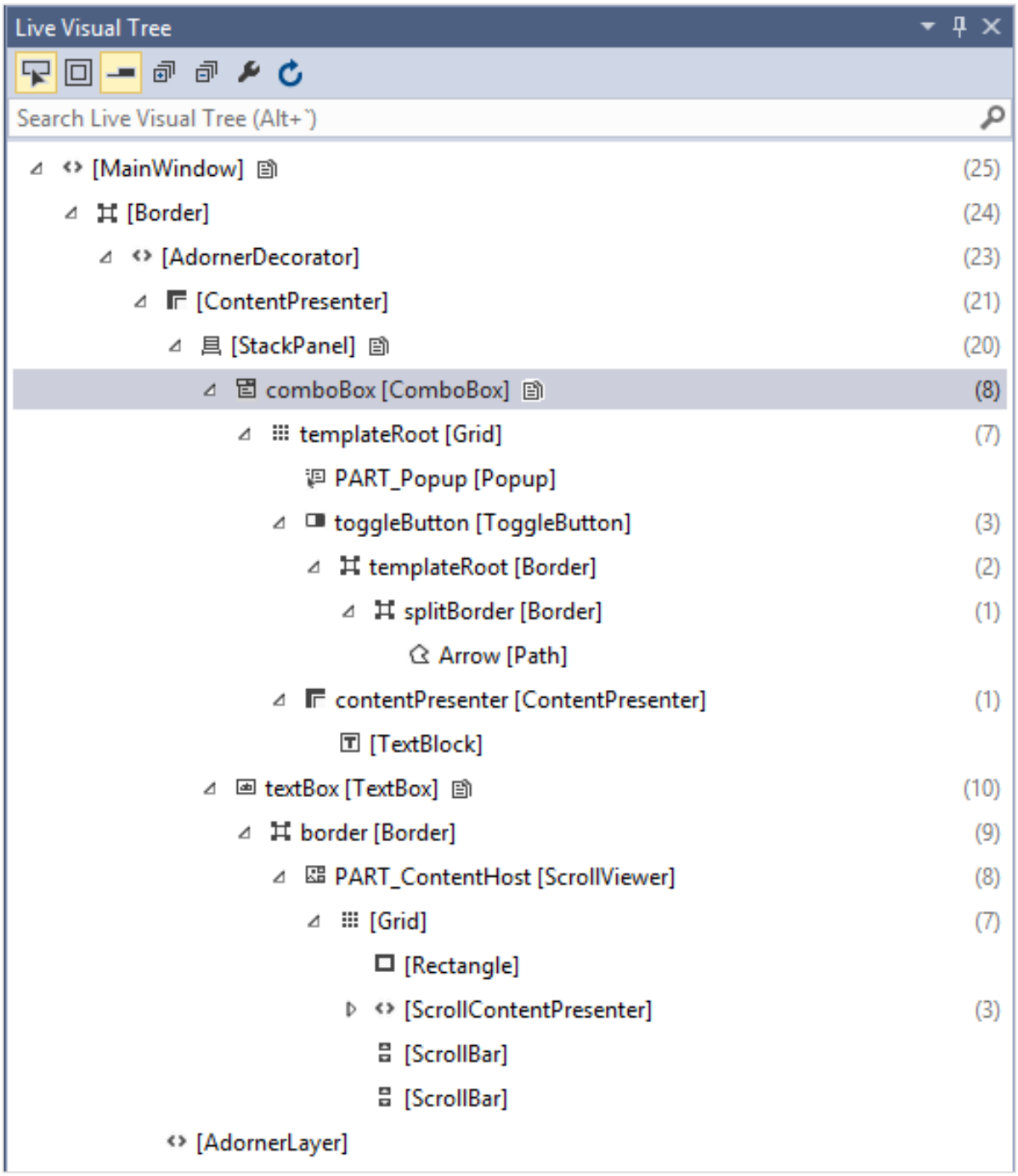
5. Press the OK button.

Now run any XAML application or use the following XAML code:

```
<Window x:Class="XAMLTestBinding.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
```

```
        Title="MainWindow" Height="350" Width="604">
    <StackPanel>
        <ComboBox Name="comboBox"  Margin="50" Width="100">
            <ComboBoxItem Content="Green"/>
            <ComboBoxItem  Content="Yellow" IsSelected="True"/>
            <ComboBoxItem Content="Orange" />
        </ComboBox>
        <TextBox  Name="textBox" Margin="50" Width="100" Height="23"
VerticalAlignment="Top"
                Text ="{Binding ElementName=comboBox,
                        Path=SelectedItem.Content,
                        Mode=TwoWay,
                        UpdateSourceTrigger=PropertyChanged}"
                Background="{Binding ElementName=comboBox,
Path=SelectedItem.Content}">
        </TextBox>
    </StackPanel>
</Window>
```

When the application executes, it will show the Live Visual Tree where all the elements are shown in a tree.



This Live Visual Tree shows the complete layout structure to understand where the UI elements are placed. But this option is only available in Visual Studio 2015. If you are using an older version of Visual studio, then you can't use this tool; however there is another tool which can be integrated with Visual Studio such as XAML Spy for Visual Studio. You can download it from http://xamlspy.com/download. We recommend you to download this tool if you are using an older version of Visual Studio.

18. XAML – CUSTOM CONTROLS

XAML has one of the most powerful features provided to create custom controls which make it very easy to create feature-rich and customizable controls. Custom controls are used when all the built-in controls provided by Microsoft are not fulfilling your criteria or you don't want to pay for 3rd party controls.

In this chapter, you will learn how to create custom controls. Before we start taking a look at Custom Controls, let's take a quick look at a User Control first.

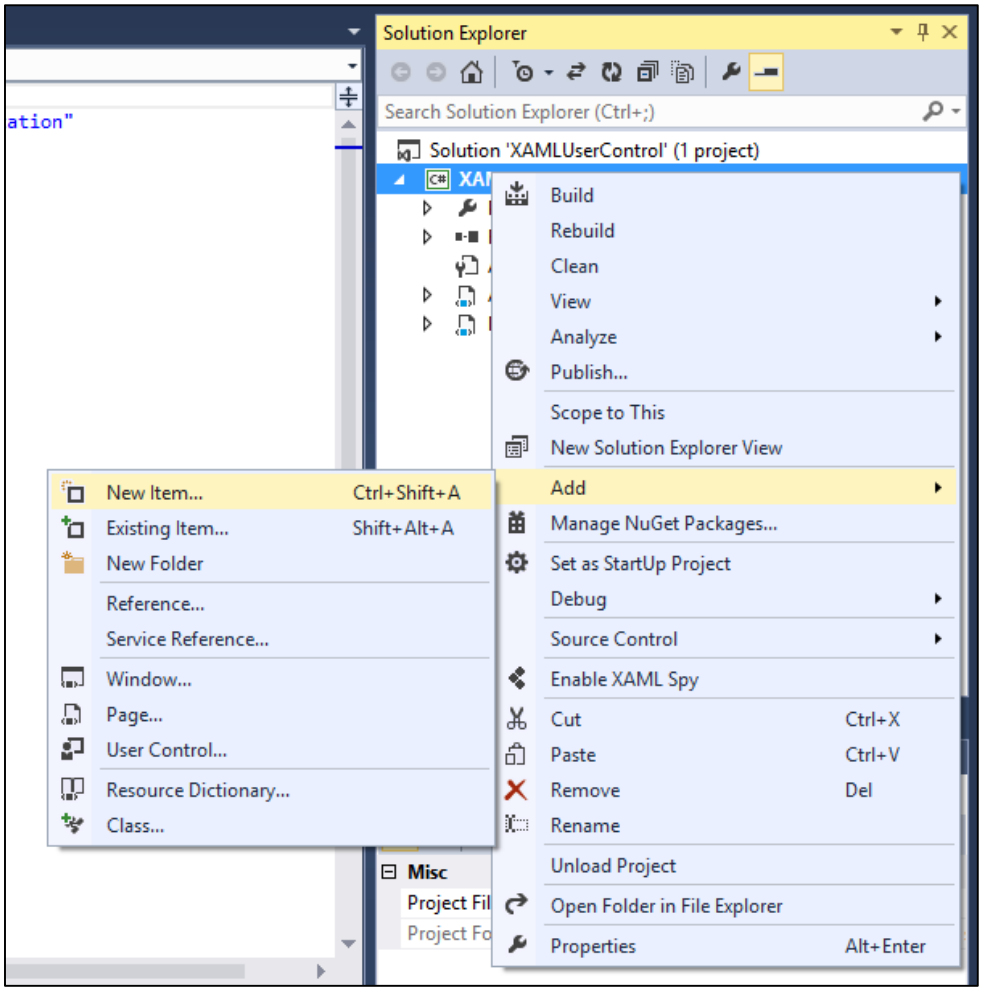
User Control

User Controls provide a technique to collect and combine different built-in controls together and package them into re-usable XAML. User controls are used in the following scenarios:

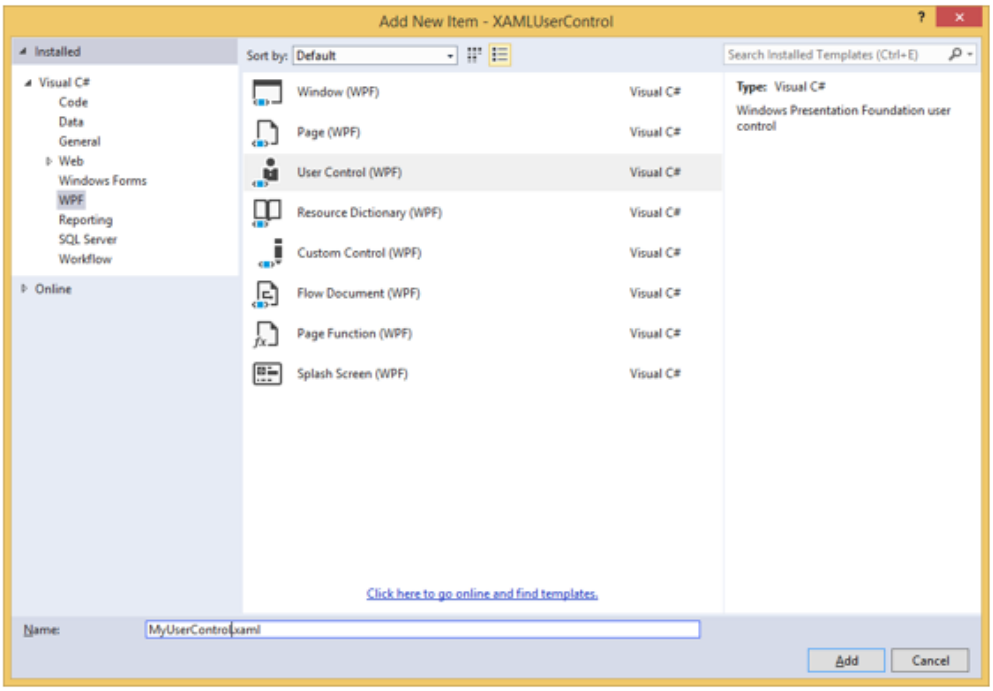
- If the control consists of existing controls, i.e., you can create a single control of multiple, already existing controls.
- If the control don't need support for theming. User Controls do not support complex customization, control templates, and also difficult to style.
- If a developer prefers to write controls using the code-behind model where a view and then a direct code is written behind for event handlers.
- You won't be sharing your control across applications.

Let's take an example of User control and follow the steps given below:

1. Create a new WPF project and then right-click on your solution and select Add > New Item...



2. The following dialog will open, now select **User Control (WPF)** and name it **MyUserControl**.



3. Click on the Add button and you will see that two new files (MyUserControl.xaml and MyUserControl.cs) will be added in your solution.

Given below is the XAML code in which a button and a textbox is created with some properties in MyUserControl.xaml file.

```
<UserControl x:Class="XAMLUserControl.MyUserControl"
             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>
        <TextBox Height="23"
                 HorizontalAlignment="Left"
                 Margin="80,49,0,0" Name="txtBox"
                 VerticalAlignment="Top"
                 Width="200" />
        <Button Content="Click Me"
                Height="23"
                HorizontalAlignment="Left"
                Margin="96,88,0,0"
                Name="button"
                VerticalAlignment="Top"
                Width="75"
                Click="button_Click" />
    </Grid>
</UserControl>
```

Given below is the C# code for button click event in MyUserControl.cs file which updates the textbox.

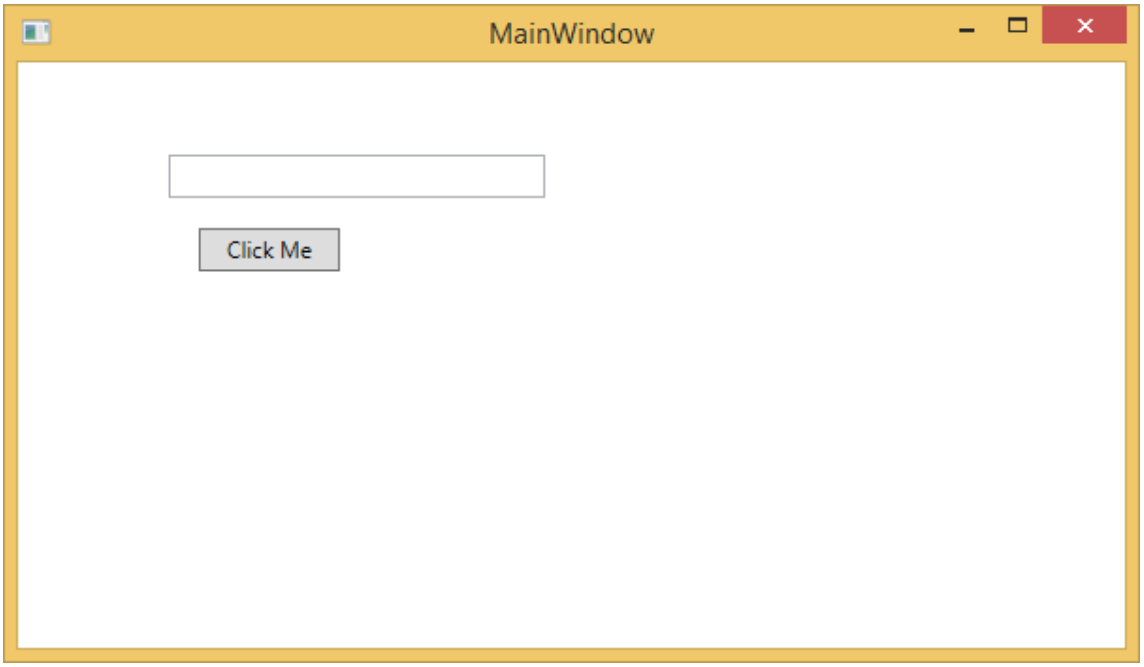
```
using System;
using System.Windows;
using System.Windows.Controls;

namespace XAMLUserControl
{
    /// <summary>
```

```
    /// Interaction logic for MyUserControl.xaml
    /// </summary>
    public partial class MyUserControl : UserControl
    {
        public MyUserControl()
        {
            InitializeComponent();
        }

        private void button_Click(object sender, RoutedEventArgs e)
        {
            txtBox.Text = "You have just clicked the button";
        }
    }
}
```

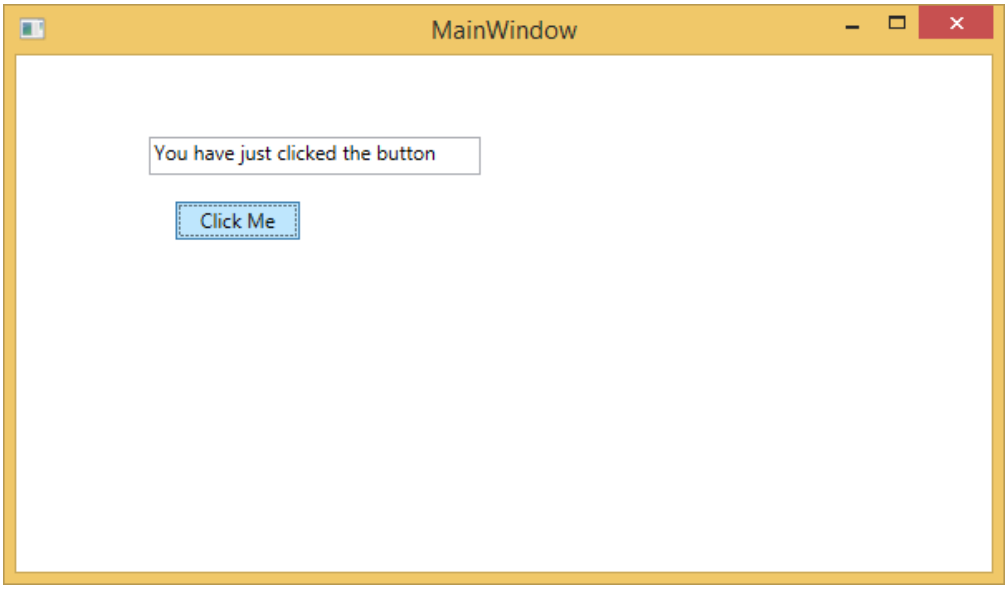
Here is implementation in MainWindow.xaml to add the user control.

```
<Window x:Class="XAMLUserControl.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:control="clr-namespace:XAMLUserControl"
        Title="MainWindow" Height="350" Width="525">
    <Grid>
        <control:MyUserControl/>
    </Grid>
</Window>
```

When you compile and execute the above code, it will produce the following output:



Now click on the "Click Me" button and you will see that the textbox text is updated.



Custom Controls

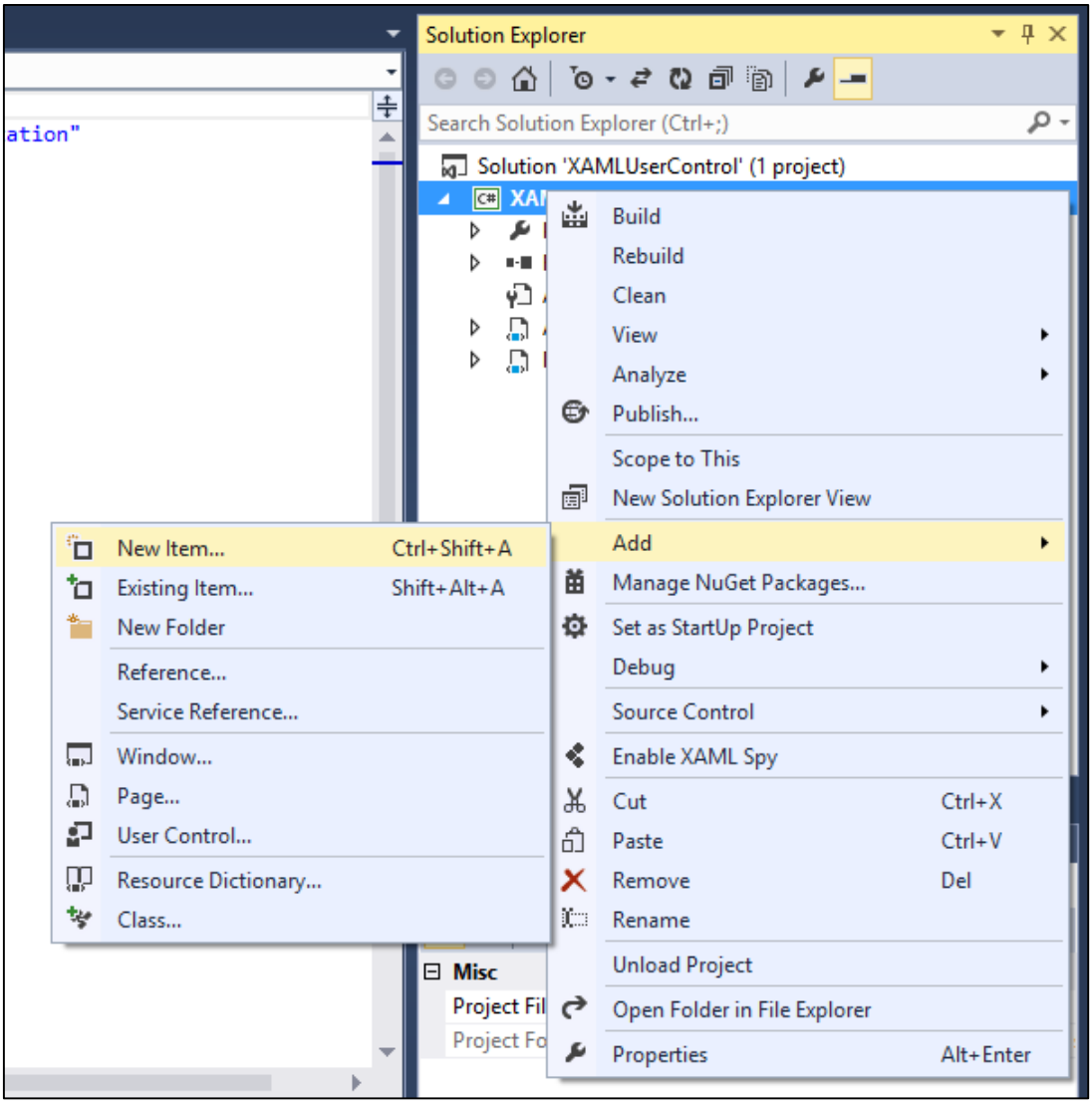
A custom control is a class which offers its own style and template which are normally defined in **generic.xaml**. Custom controls are used in following scenarios,

- If the control doesn't exist and you have to create it from scratch.
- If you want to extend or add functionality to a preexisting control by adding an extra property or an extra functionality to fit your specific scenario.

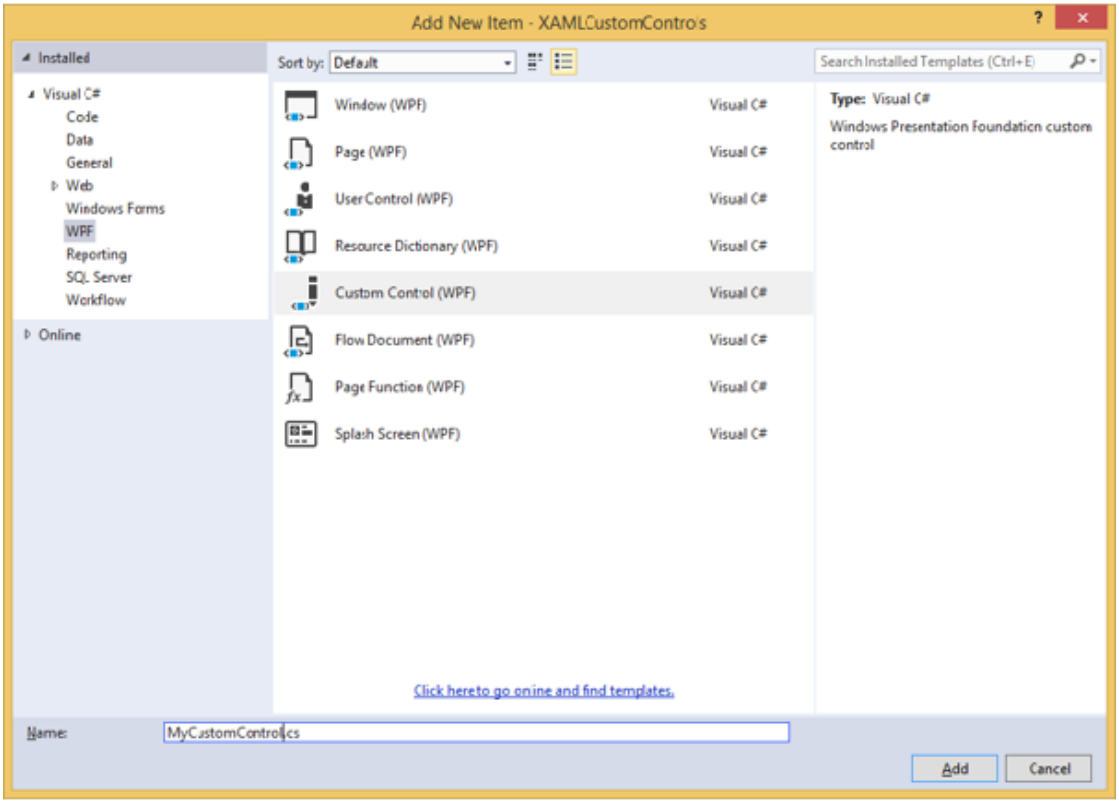
- If your controls need to support theming and styling.
- If you want to share you control across applications.

Let's take an example of custom control and follow the steps given below.

1. Create a new WPF project and then right-click on your solution and select Add > New Item...



2. The following dialog box will open. Now select **Custom Control (WPF)** and name it **MyCustomControl**.



3. Click on the Add button and you will see that two new files (Themes/Generic.xaml and MyCustomControl.cs) will be added in your solution.

Given below is the XAML code in which style is set for the custom control in Generic.xaml file.

```
<ResourceDictionary
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:local="clr-namespace:XAMLCustomControls">

    <Style TargetType="{x:Type local:MyCustomControl}" BasedOn="{StaticResource
{x:Type Button}}">
        <Setter Property="Background" Value="LightSalmon" />
        <Setter Property="Foreground" Value="Blue"/>
    </Style>
</ResourceDictionary>
```

Given below is the C# code for MyCustomControl class which is inherited from the button class and in the constructor, it overrides the metadata.

```
using System;
using System.Windows;
using System.Windows.Controls;

namespace XAMLCustomControls
{
    public class MyCustomControl : Button
    {
        static MyCustomControl()
        {
            DefaultStyleKeyProperty.OverrideMetadata(typeof(MyCustomControl),
new FrameworkPropertyMetadata(typeof(MyCustomControl)));
        }
    }
}
```

Given below is the custom control click event implementation in C# which updates the text of the text block.

```
using System;
using System.Windows;
using System.Windows.Controls;

namespace XAMLCustomControls
{
    /// <summary>
    /// Interaction logic for MainWindow.xaml
    /// </summary>
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();
        }
```

```
        private void customControl_Click(object sender, RoutedEventArgs e)
        {
            txtBlock.Text = "You have just click your custom control";
        }
    }
}
```

Here is the implementation in MainWindow.xaml to add the custom control and a TextBlock.

```
<Window x:Class="XAMLCustomControls.MainWindow"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:control="clr-namespace:XAMLCustomControls"
        Title="MainWindow" Height="350" Width="604">
    <StackPanel>
        <control:MyCustomControl x:Name="customControl"
                                 Content="Click Me"
                                 Width="70"
                                 Margin="10"
                                 Click="customControl_Click"/>
        <TextBlock Name="txtBlock"
                   Width="250"
                   Height="30"/>
    </StackPanel>
</Window>
```

When you compile and execute the above code, it will produce the following output. Observe the output contains a custom control which is a customized button.

Now click on the customized button. You will see that the text block text is updated.