

Module 4

"Events and Commands"



TEKNOLOGISK
INSTITUT



Agenda

- ▶ **Events**
- ▶ Commands

WPF Trees

► Logical Tree

- View in Visual Studio with
 - **View → Other Windows → Document Outline**
 - Bottom-left corner icon ☺
- Essential for eventing

► Visual Tree

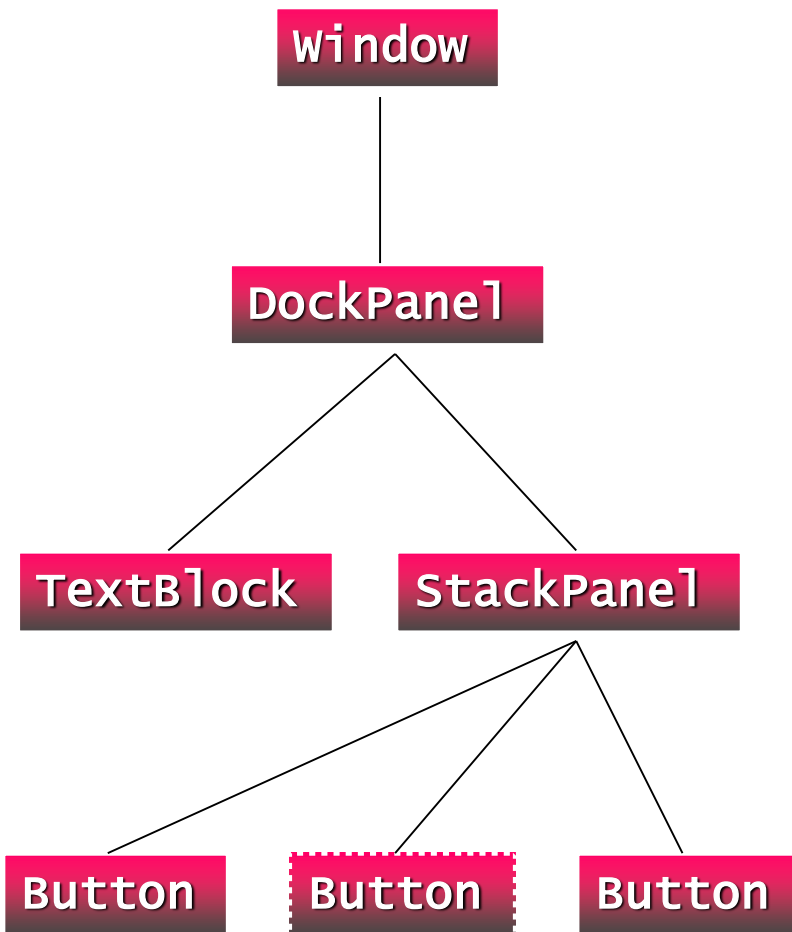
- Elements deriving from **Visual** and **Visual3D**
- View in Visual Studio with “WPF Tree Visualizer”
 - Access from Locals, Autos, or Watch window
- Essential for styling and templating



Introducing Routed Events

- ▶ **RoutedEventArgs** and **RoutedEventHandler**
- ▶ Attached events
- ▶ Three types of routed events
 - Direct
 - Bubbling
 - Tunneling

Direct Events



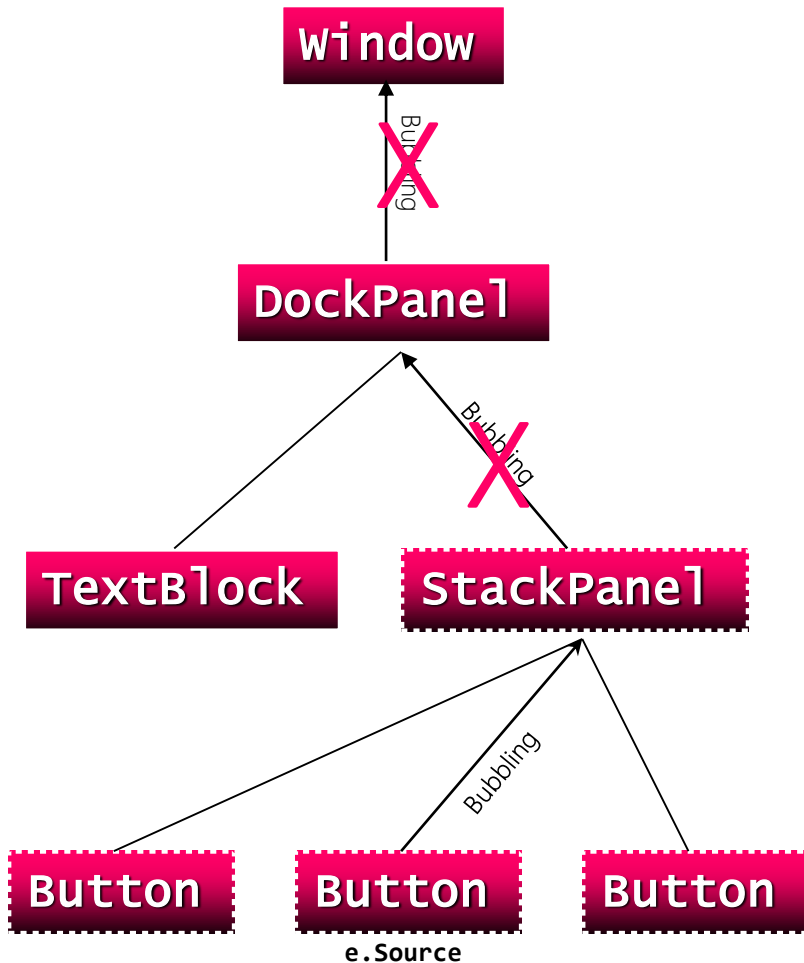
```
<Window Title="Routed Events">
  <DockPanel>
    <TextBlock>Event Routing</TextBlock>

    <StackPanel>
      <Button>One</Button>
      <Button MouseLeave="OnButtonLeave">
        Two
      </Button>
      <Button>Three</Button>
    </StackPanel>
  </DockPanel>
</Window>
```

```
private void OnButtonLeave(
    object sender, MouseEventArgs e )
{
    // Handle event...
}
```



Bubbling Events



```
<Window Title="Routed Events">
  <DockPanel>
    <TextBlock>Bubbling Events</TextBlock>

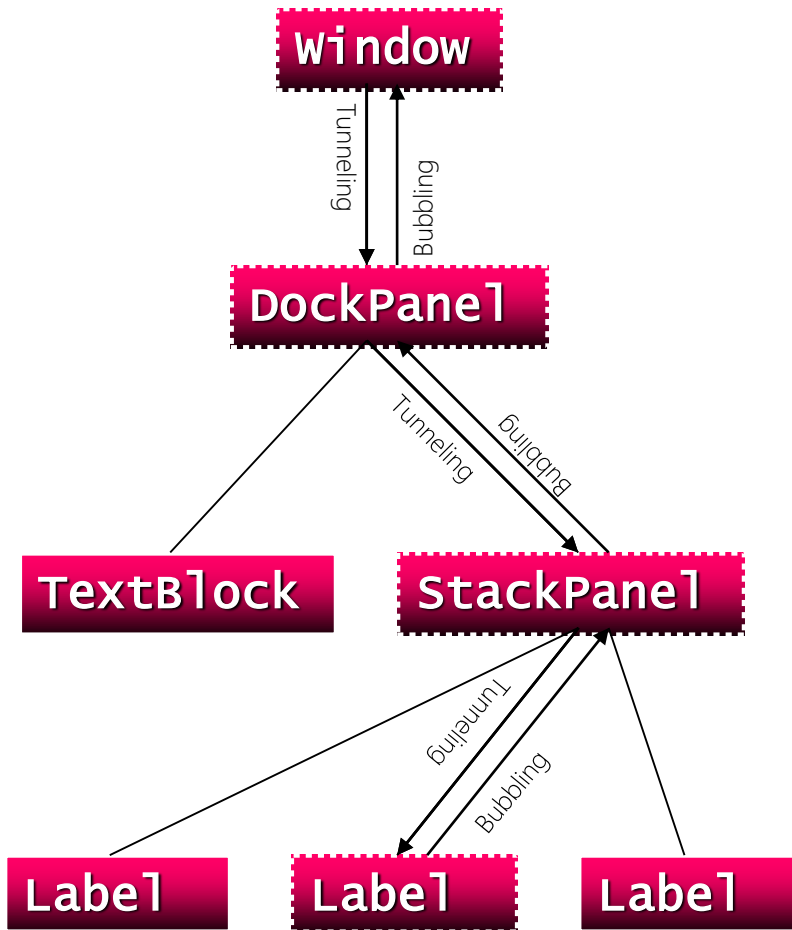
    <StackPanel
      Button.Click="OnButtonClicked">
      <Button>One</Button>
      <Button>Two</Button>
      <Button>Three</Button>
    </StackPanel>
  </DockPanel>
</Window>
```

```
private void OnButtonClicked(
    object sender, RoutedEventArgs e )
{
    // Handle event
    ... e.Source ...

    e.Handled = true;
}
```



Tunneling Events



- ▶ Events are paired
 - Tunneling ("**PreviewEvent**")
 - Bubbling ("**Event**")
- ▶ Example:
 - **PreviewMouseDown**
 - **MouseDown**

PreviewMouseDown @ Window
 PreviewMouseDown @ DockPanel
 PreviewMouseDown @ StackPanel
 PreviewMouseDown @ Label
 MouseDown @ Label
 MouseDown @ StackPanel
 MouseDown @ DockPanel
 MouseDown @ Window



A Few Words of Caution

- ▶ **RoutedEventArgs** properties
 - **Handled**
 - **Source** Control object raising event
 - **OriginalSource** Visual Tree object entailing event
- ▶ Some events interfere with each other
 - Click event interferes with **(Preview)MouseDown**
- ▶ Argh! Already handled events can still be handled...! 😊
 - But only programmatically
 - Bubbling and tunnelling continue
 - **UIElement.AddHandler()**
 - `handledEventsToo == true` in code!



EventManager Class

- ▶ **EventManager** class
 - **RegisterRoutedEvent()**
 - Creates new routed events
 - **RegisterClassHandler()**
 - Adds class-level event handlers
- ▶ **UIElement.RaiseEvent()**
 - Raises routed events
- ▶ Class-level event handling occurs before instance-level event handling



Application-Level Events

► Application events

- Startup
- Exit
- SessionEnding
- Activated
- Deactivated
- `DispatcherUnhandledException`
 - Not WPF-specific, but important in practice:
`AppDomain.CurrentDomain.UnhandledException` event

► Added in `App.xaml`





Agenda

- ▶ Events
- ▶ **Commands**

Introducing Commands

- ▶ Commands are abstract, high-level event-style classes implementing **ICommand**
 - **Execute()** method
 - **CanExecute()** boolean method
 - **CanExecuteChanged** event
- ▶ Some controls implement **ICommandSource** to interact with commands
 - **Button, CheckBox, MenuItem, ...**
- ▶ Built-in commands in five classes
 - **ApplicationCommands, ComponentCommands, MediaCommands, NavigationCommands, EditingCommands**
- ▶ Commanding is an essential ingredient in the MVVM pattern

Commands and Command Bindings

▶ **Command**

- Can be invoked declaratively
- Can be invoked programmatically
- Can be invoked through input gestures
 - **MouseGesture**
 - **KeyGesture**
- But nothing happens until command is bound

▶ **CommandBinding**

- Binds commands to command handler
 - **Command**
 - **CanExecute**
 - **Executed**

▶ Commands bubble up the logical tree!

▶ Note: Parameters can be supplied to commands, if needed



Built-in Command Bindings

- ▶ Some controls have built-in command bindings
 - **TextBox**, ...
- ▶ Bind via
 - **Command**
 - **ICommandSource.CommandTarget**
 - E.g. **Button**
- ▶ Note that command targets must be set with binding-syntax, i.e.

```
CommandTarget = "{Binding ElementName = textbox1}"
```



Custom Commands

- ▶ **ICommand**
 - **RoutedCommand**
 - **RoutedUICommand** (adds localized **Text** property)

- ▶ Do custom commands in a **static** class by either
 - Implementing **ICommand** by hand, or
 - Using a **Routed(UI)Command**





Summary

- ▶ Events
- ▶ Commands



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