

Essentials of Information Technology

PC-CS-305

Event handlers

Objectives



- Define events and event handling
- Write code to handle events that occur in a GUI
- Event Categories
- Java GUI Behavior
- Describe the concept of adapter classes, including how and when to use them

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Overview



- Our buttons from the previous lecture seem to do nothing
 - The buttons are visible, but nothing appears to happen when the user clicks one
- This lecture will explain why and give the solution
 - We need an event handler

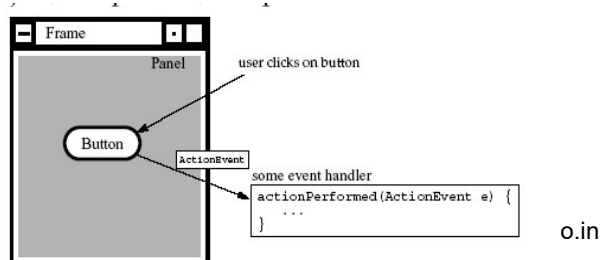
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Event



- Events – Objects that describe what happened
- Event sources – The generator of an event
- Event handlers – A method that receives an event object, deciphers it, and processes the user's interaction



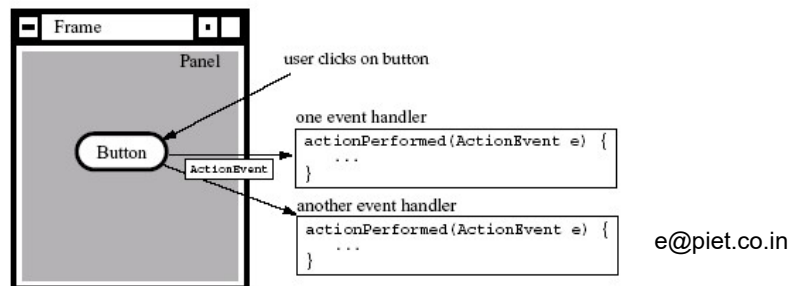
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Delegation Model



An event can be sent to many event handlers

Event handlers register with components when they are interested in events generated by that component

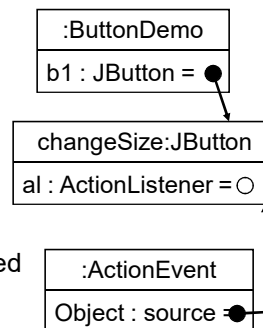


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Why Our Buttons Do Nothing



- The buttons have no action listener registered
- When user clicks button
 - JRE generates an `ActionEvent` object
 - JRE asks source for registered action listener
 - No registered action listener, so JRE discards `ActionEvent`
 - Nothing appears to have happened



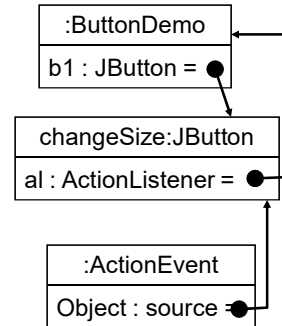
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Register an Action Listener



- For each button
`addActionListener(listener)`
- When user clicks button
 - JRE generates an `ActionEvent` object
 - JRE asks source for registered action listener
 - JRE sends `ActionEvent` object to registered action listener
 - Action listener performs task



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Listener Interfaces



- To become an action listener, a class must implement the interface, `java.awt.event.ActionListener`
- There are many interfaces in the package, `java.awt.event`
 - `MouseListener`, `MouseMotionListener`, `WindowListener`, `KeyListener` (to name a few)

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Event-Handling Application



- The basic model for a GUI program requires the following:
 1. Declaring application as *event listener* (*action listener*)
(e.g. ***implements ActionListener***)
 2. Register the reactive components
(e.g. ***tFahr.addActionListener(this)***)
 3. Define the action to be performed (methods)
(e.g. ***actionPerformed(ActionEvent e)***)
- 2 key tasks to process a GUI event:
 - Register an ***event listener*** for the GUI component that is expected to generate the event
 - Implement an ***event-handling method*** (event handlers)

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In the Button Demonstration



- When declaring the class:

```
import java.awt.event.*;
public class ButtonDemo6 extends JFrame
    implements ActionListener
```
- In the constructor, for each button:

```
changeSize = new JButton("Change size");
changeSize.addActionListener(this);
```
- Implement the interface:

```
public void actionPerformed(ActionEvent e)
{
    // code to change size and colour
}
```

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Handling Mouse Events



There are two types of Mouse Events:
– MouseEvent and MouseMotionEvent

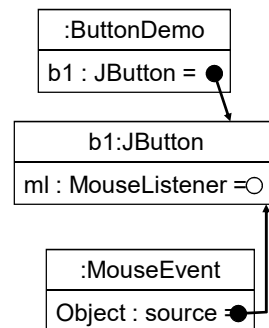
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Mouse Listener



- The buttons have no mouse listener registered
- When mouse moves over a button
 - JRE generates a MouseEvent object
 - JRE asks source for registered mouse listener
 - No registered mouse listener, so JRE discards MouseEvent object
 - Nothing appears to have happened



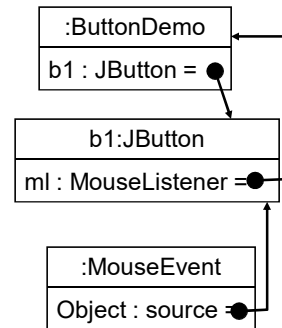
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Register a Mouse Listener



- For each button
`addMouseListener(listener)`
- When user clicks button
 - JRE generates a `MouseEvent` object
 - JRE asks source for registered mouse listener
 - JRE sends `MouseEvent` object to registered mouse listener
 - Mouse listener performs task



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In the Button Demonstration



- The `MouseListener` interface has five methods
 - `mouseEntered(MouseEvent e)`
 - `mouseExited(MouseEvent e)`
 - `mouseClicked(MouseEvent e)`
 - `mousePressed(MouseEvent e)`
 - `mouseReleased(MouseEvent e)`

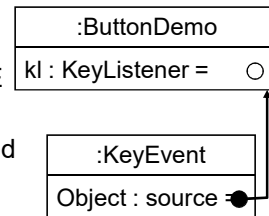
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Key Listener



- The frame has no key listener registered
- When the user hits a keyboard key
 - JRE generates a KeyEvent object
 - JRE asks source for registered key listener
 - No registered key listener, so JRE discards KeyEvent object
 - Nothing appears to have happened



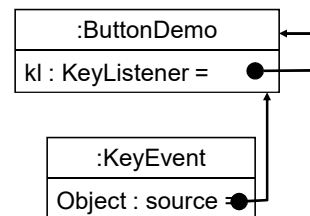
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Register a Key Listener



- For the frame
 - `addKeyListener(listener)`
- When user clicks button
 - JRE generates a KeyEvent object
 - JRE asks source for registered key listener
 - JRE sends KeyEvent object to registered key listener
 - Key listener performs task



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In the Button Demonstration

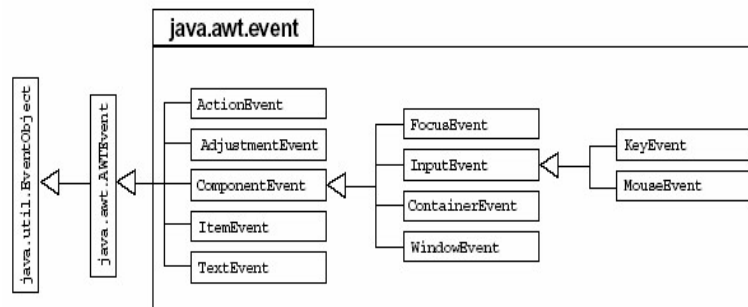


- The `KeyListener` interface has three methods
 - `keyTyped(KeyEvent e)`
 - `keyPressed(KeyEvent e)`
 - `keyReleased(KeyEvent e)`

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Event Categories



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Event Handling Examples



- **ActionEvent & ActionListener**
 - ButtonDemo.java
- **ItemEvent & ItemListener**
 - CheckboxDemo.java
- **AdjustmentEvent & AdjustmentListener**
 - SBDemo.java

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Java GUI Behaviour



Category	Interface Name	Methods
Action	ActionListener	actionPerformed (ActionEvent)
Item	ItemListener	itemStateChanged (ItemEvent)
Mouse	MouseListener	mousePressed (MouseEvent) mouseReleased (MouseEvent) mouseEntered (MouseEvent) mouseExited (MouseEvent) mouseClicked (MouseEvent)
Mouse Motion	MouseMotionListener	mouseDragged (MouseEvent) mouseMoved (MouseEvent)
Key	KeyListener	keyPressed (KeyEvent) keyReleased (KeyEvent) keyTyped (KeyEvent)
Focus	FocusListener	focusGained (FocusEvent) focusLost (FocusEvent)
Adjustment	AdjustmentListener	adjustmentValueChanged (AdjustmentEvent)
Component	ComponentListener	componentMoved (ComponentEvent) componentHidden (ComponentEvent) componentResized (ComponentEvent) componentShown (ComponentEvent)

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Java GUI Behaviour



Category	Interface Name	Methods
Window	WindowListener	windowClosing(WindowEvent) windowOpened(WindowEvent) windowIconified(WindowEvent) windowDeiconified(WindowEvent) windowClosed(WindowEvent) windowActivated(WindowEvent) windowDeactivated(WindowEvent)
Container	ContainerListener	componentAdded(ContainerEvent) componentRemoved(ContainerEvent)
Text	TextListener	textValueChanged(TextEvent)

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Event Adapters



- The listener classes that you define can extend adapter classes and override only the methods that you need

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Example



```
import java.awt.*;
import java.awt.event.*;
public class MouseClickHandler extends MouseAdapter {
    // We just need the mouseClicked handler, so we use the an
    // adapter to avoid having to write all the event handler
    // methods
    public void mouseClicked(MouseEvent e)
        // Do stuff with the mouse click...
    }
}
```

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Summary of Main Teaching Points



- Defined what are events and how events handled
- Wrote code to handle events that occur in a GUI
- Understood Event Categories and Java GUI Behavior
- Described the concept of adapter classes, including how and when to use them

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Question and Answer Session



Q & A

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