# GUI Programming with Java

## Event Handling

- We will look at…
  - Event Handling
  - Listeners

## Event Handing

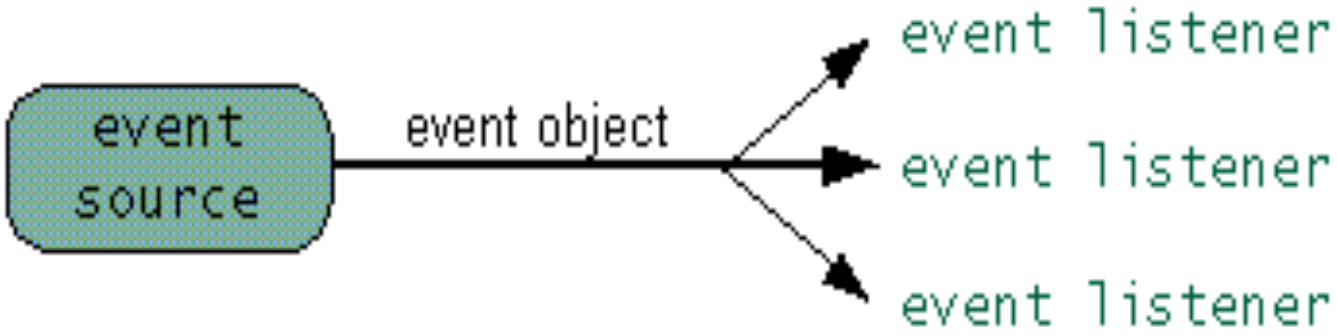
- Every time the user types a character or pushes a mouse button, an event occurs. Any object can be notified of the event.
- All it has to do is implement the appropriate interface and be registered as an *event listener* on the appropriate *event source*.
- Swing components can generate many kinds of events. Lets look at a few examples.

# Examples of Event handling

| Act that results in the event | Listener type |
|---|---|
| User clicks a button, presses Return while typing in a text field, or chooses a menu item | ActionListener |
| User closes a frame (main window) | WindowListener |
| User presses a mouse button while the cursor is over a component | MouseListener |
| User moves the mouse over a component | MouseMotionListener |
| Component becomes visible | ComponentListener |
| Component gets the keyboard focus | FocusListener |
| Table or list selection changes | ListSelectionListener |

# Event Handing

- Each event is represented by an object that gives information about the event and identifies the event source.
- Event sources are typically components, but other kinds of objects can also be event sources.
- As the following figure shows, each event source can have multiple listeners registered on it. Conversely, a single listener can register with multiple event sources.



## How to Implement an Event Handler

- Every event handler requires three bits of code:

1. In the declaration for the event handler class, code that specifies that the class either implements a listener interface or extends a class that implements a listener interface. For example:

```
public class MyClass implements ActionListener {
```

2. Code that registers an instance of the event handler class as a listener upon one or more components. For example:

```
someComponent.addActionListener(instanceOfMyClass);
```

3. Code that implements the methods in the listener interface. For example:

```
public void actionPerformed(ActionEvent e) { .../*code that reacts to the action...*/ }
```

## How to Implement an Event Handler (2)

- Let's investigate a typical event-handling scenario by looking at how buttons (JButton) handle mouse clicks.
- To detect when the user clicks an on-screen button (or does the keyboard equivalent), a program must have an object that implements the ActionListener interface.
- The program must register this object as an action listener on the button (the event source), using the addActionListener method.
- When the user clicks the on-screen button, the button fires an action event.
- This results in the invocation of the action listener's actionPerformed method (the only method in the ActionListener interface).
- The single argument to the method is an ActionEvent object that gives information about the event and its source.

Some simple event handling examples

- Here's the code that implements the event handling for the button.

```
public class Beeper ... implements ActionListener {
        ...
        //where initialization occurs:
        button.addActionListener(this);
        ...
        public void actionPerformed(ActionEvent e) {
        ...//Do Something
        } //end of actionlistener

//end of class
```

## Some simple event handing examples (2)

- Lets look at the sample program (myAction.java) in the sample 1 folder for this lecture.
- The myAction class implements the ActionListener interface, which contains one method: actionPerformed
- Since myAction implements ActionListener, a myAction object can register as a listener for the action events that buttons fire.
- Once the myAction has been registered using the Button addActionListener method, the myAction actionPerformed method is called every time the button is clicked.

## A More Complex Example

- The event model, which you saw at its simplest in the previous example, is quite powerful and flexible.
- Any number of event listener objects can listen for all kinds of events from any number of event source objects.
- For example, a program might create one listener per event source. Or a program might have a single listener for all events from all sources.
- A program can even have more than one listener for a single kind of event from a single event source.

## A More Complex Example (2)

- For a more complex sample of event handling please refer to the sample 2 folder - complexAction.java
- Any number of event listener objects can listen for all kinds of events from any number of event source objects.
- For example, a program might create one listener per event source. Or a program might have a single listener for all events from all sources.
- A program can even have more than one listener for a single kind of event from a single event source.

| User Action | Source Object | Event Type Generated |
|---|---|---|
| Click a button | JButton | ActionEvent |
| Change Text | JTextComponent | TextEvent |
| Press return on a text field | JTextField | ActionEvent |
| Select a new item | JComboBox | ItemEvent, ActionEvent |
| Select Item(s) | JList | ListSelectionEvent |
| Click a check box | JCheckBox | ItemEvent, ActionEvent |
| Click a radio button | JRadioButton | ItemEvent, ActionEvent |
| Select a menu item | JMenuItem | ActionEvent |
| Move the scroll bar | JScrollBar | AdjustMent Event |
| Window opened, closed, iconified, deiconified, or closing | Window | WindowEvent |
| Component Added or removed from the container | Container | ContainerEvent |
| Component moved, resized, hidden or shown | Component | ComponentEvent |
| Component gained or lost focus | Component | Focus Event |
| Mouse Movement | Component | Mouse Event |
| Key released or pressed | Component | Key Event |

## Listeners Supported by Swing Components

- You can tell what kinds of events a component can fire by looking at the kinds of event listeners you can register on it. For example, the Component class defines these listener registration methods:
  - addComponentListener
  - addFocusListener
  - addKeyListener
  - addMouseListener
  - addMouseMotionListener
- Thus, every component supports component, focus, key, mouse, and mouse-motion listeners. See the following link for more: http://download.oracle.com/javase/tutorial/uiswing/events/eventsandcomponents.html#many
- However, a component fires only those events for which listeners have registered on it. For example, if a mouse listener is registered on a particular component, but the component has no other listeners, then the component will fire only mouse events--no component, focus, key, or mouse-motion events.

## Common Listeners

- As well as the listeners that are common to all components, there are several listeners that are used by only certain components. These include
  - Action listener (e.g. called when we click on button)
  - Item Listener (e.g. called when we click on a radio button)
  - List Selection Listener (e.g. select an item in a list)
  - Window (e.g. called when we close a window)
- There are other listeners available such as pop up menu listeners, hyperlink listeners and internal frame listeners

## How to Write an Action Listener

- Action listeners are probably the easiest -- and most common -- event handlers to implement.
- When the user clicks a button , chooses a menu item or presses Return in a text field , an action event occurs. The result is that an actionPerformed message is sent to all action listeners that are registered on the relevant component.
- We've already covered the action listener in sample 1. Lets have a quick review.

## How to Write an Item Listener

- Item events are fired by components that implement the ItemSelectable interface.
- Generally, ItemSelectable components maintain on/off state for one or more items.
- The Swing components that fire item events include check boxes , check box menu items and combo boxes .
- For an example of item listening please refer to sample 3 java file itemAction.java

## How to Write a List Selection Listener

- List selection events occur when the selection in a list or table is either changing or has just changed.
- As with our other event handlers we must implement a listener to handle events generated by the list. The listener we implement is ListSelectionListener

  e.g public class listSelection implements ListSelectionListener
- To register the listener we use the addListSelectionListener method. This is used to detect when selections on the lists are altered.
- For an example of item listening please refer to sample 4 java file listSelection.java

## How to Write a Window Listener

- Window events are fired by a window (such as a frame or dialog ).
- just after the window is opened, closed, iconified, deiconified, activated, or deactivated.
  - *Opening* a window means showing it for the first time
  - *closing* it means removing the window from the screen
  - *Iconifying* it means substituting a small icon on the desktop for the window
  - *deiconifying* means the opposite
  - A window is *activated* if it or a component it contains has the keyboard focus
  - *deactivation* occurs when the window and all of its contents lose the keyboard focus
- If you want to be notified when a window is made visible or hidden, then you should register a component listener on the window.

## How to Write a Window Listener(2)

- The most common use of window listeners is implementing custom window-closing behavior. For example, you might use a window listener to save data before closing the window, or to exit the program when the last window closes.

- You don't necessarily need to implement a window listener to specify what a window should do when the user closes it. By default, when the user closes a window the window becomes invisible.

- Another common use of window listeners is to stop threads and release resources when a window is iconified, and to start up again when the window is deiconified.

- For an example of window listening please refer to sample 5 java file WindowEventDemo.java

## Summary

- Every time the user types a character or pushes a mouse button, an event occurs. Any object can be notified of the event.
- All it has to do is implement the appropriate interface and be registered as an *event listener* on the appropriate *event source*.
- Swing components can generate many kinds of events.
- Each event is represented by an object that gives information about the event and identifies the event source.
- Event sources are typically components, but other kinds of objects can also be event sources.

## Summary (2)

- Every event handler requires three bits of code:

1. In the declaration for the event handler class, code that specifies that the class either implements a listener interface or extends a class that implements a listener interface. For example:

   public class MyClass implements ActionListener {

2. Code that registers an instance of the event handler class as a listener upon one or more components. For example:

   someComponent.addActionListener(instanceOfMyClass);

3. Code that implements the methods in the listener interface. For example:

   public void actionPerformed(ActionEvent e) { *...//code that reacts to the action...* }

## Summary (3)

- All components support the following listeners
  - addComponentListener
  - addFocusListener
  - addKeyListener
  - addMouseListener
  - addMouseMotionListener
- As well as the listeners that are common to all components, there are several listeners that are used by only certain components. These include
  - Action listener (e.g. called when we click on button)
  - Item Listener (e.g. called when we click on a radio button)
  - Window (e.g. called when we close a window)

# END OF SESSION