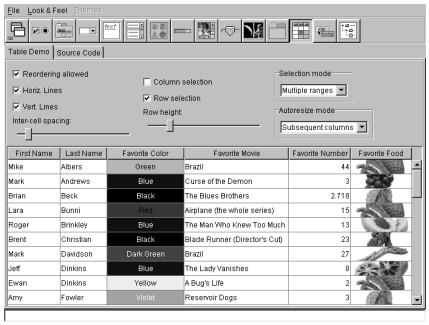
Event Handling

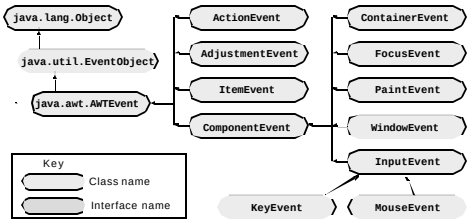
GUI are Event Driven



Events

- GUIs generate events when the user interacts with GUI
- For example,
  - Clicking a button
  - Moving the mouse
  - Closing Window etc
- In java, events are represented by Objects
  - These objects tells us about event and its source. Examples are
    - ActionEvent (Clicking a button)
    - WindowEvent (Doing something with window e.g. closing , minimizing)
- Both AWT and swing components (not all) generate events
  - java.awt.event.*;
  - javax.swing.event.*;

Some event classes of java.awt.event



Event Handling Model

- Common for both AWT and Swing components
- Event Delegation Model
  - Processing of an event is delegated to a particular object (handlers) in the program
  - Publish-Subscribe
  - Separate UI code from program logic

Event Handling Steps

- For a programmer the event Handling is a three step process in terms of code
- Step 1
  - Create components which can generate events
- Step 2
  - Build component (objects) that can handle events (Event Handlers)
- Step 3
  - Register handlers with generators

Event Handling Process [1]

Event Generators

- You have already seen alot of event generators
  - Buttons
  - Mouse
  - Key
  - Window

  Etc
- JButton b1 = new JButton("Hello");
- Now b1 can generate events

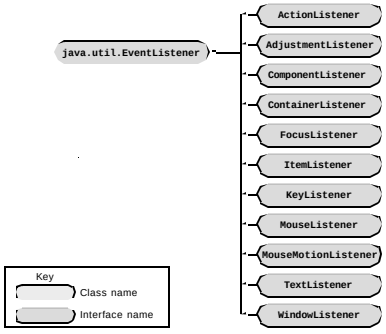
Event Handling Process [2]

Event Handlers/ Event Listener

- First Technique - By Implementing Listener Interfaces
  - Java defines interfaces for every event type
  - If a class needs to handle an event. It needs to implement the corresponding listener interface
  - To handle "ActionEvent" a class needs to implement "ActionListener"
  - To handle "KeyEvent" a class needs to implement "KeyListener"
  - To handle "MouseEvent" a class needs to implement "MouseListener"

  And so on

Event Listener interfaces of package java.awt.event



Example Listeners

```
public interface ActionListener {
      public void actionPerformed(ActionEvent e);
}

public interface ItemListener {
      public void itemStateChanged(ItemEvent e);
}

public interface ComponentListener {
      public void componentHidden(ComponentEvent e);
      public void componentMoved(ComponentEvent e);
      public void componentResized(ComponentEvent e);
      public void componentShown(ComponentEvent e);
}
```

Event Handling Process [3]

Event Handlers

- By implementing an interface the class agrees to implement all the methods that are present in that interface.
- Implementing an interface is like signing a contract
- Inside the method the class can do what ever it wants to do with that event
- Event Generator and Event Handler can be the same or different classes

Event Handling Process [4]

Event Handlers

- To handle events generated by Button. A class needs to implement ActionListener interface.
- public class Test implements ActionListener{

```
    public void actionPerformed(ActionEvent ae){
          // do something
    }
}
```

Event Handling Process [4]
Registering Handler with Generator

- The event generator is told about the object which can handle its events
- Event Generators have a method
  – add_____Listener(_____)
- b1.addActionListener(objectOfTestClass)

Event Handling
Simple Example

Event Handling: Simple Example Scenario

When Hello button is pressed, the Dialog box would be displayed

Event Handling: Simple Example Step 1(cont.)

```
/* This program demonstrates the handling of Action Event.
   Whenever "Hello" button is presses, a dialog box would
   be displayed in response containing some informative
   message
 */

import java.awt*;
import javax.swing.*;
impor java.awt.event.*;

public class ActionEventTest {
   JFrame frame;
   JButton bHello;
```

Event Handling: Simple Example Step 1 (cont.)

```
public void initGUI () {
    frame = new JFrame();
    // Event Generator
    bHello = new JButton("Hello");

    Container con = frame.getContenetPane();
    con.add(bHello);
    frame.setSize(200,200);
    frame.setVisible(true);

}//end initGUI
```

Event Handling: Simple Example (cont.) Step 2

```
// import your packages

public class ActionEventTest implements ActionListener {
   .....
   public void initGUI() ....

   public void actionPerformed (ActionEvent ae ){
      JOptionPane.showMessageDialog("Hello is pressed");
    }

   }
```

Event Handling: Simple Example Step 3 (cont.)

```
public void initGUI () {
    // Event Generator
    bHello = new JButton("Hello");

    Container con = frame.getContenetPane();
    con.add(bHello);

    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setSize(200,200);
    frame.setVisible(true);

   // Event Registration
    bHello.addActionListner(this);

}//end initGUI
```

Event Handling: Simple Example (cont.)

```
public ActionEventTest( ) {
      initGUI ();
  }

  public static void main (String  args [ ]) {

     ActionEventTest aeTest = new ActionEventTest();
  }

}//end ActionEvent class
```

Event Handling: Simple Example Complete Code

```
import java.awt.*;
import javax.swing.*;
impor java.awt.event.*;

public classActionEventTestimplements ActionListner{

  JFrame frame;
  JButton bHello;

    public void initGUI () {
        frame = newJFrame ();
        // Event Generator
        bHello= newJButton("Hello");

        Container con = frame.getContenetPane();
       con.add(bHello);

        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setSize(200,200);
        frame.setVisible(true );

        // Event Registration
     bHello.addActionListner(this );

  }//endinitGUI

  public void actionPerformed (ActionEvent ae ){
      JOptionPane.showMessageDialog("Hello  spressed");
  }

  publicActionEventTest( ) {
      initGUI ();
  }

  public static void main (String args [ ]) {

      ActionEventTest aeTest = new ActionEventTest();
  }

}//end ActionEventclass
```

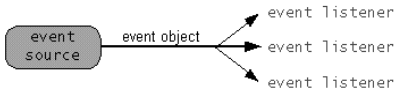
Behind the Scenes

Event Handling Participants

1. Event Generator / Source
   - Swing and awt components
   - For example, JButton, JTextField, JFrame etc
   - Generates an event object
   - Registers listeners with itself
2. Event Object
   - Encapsulate information about event that occurred and the source of that event
   - For example, if you click a button, ActionEvent object is created

Event Handling Participants (cont.)

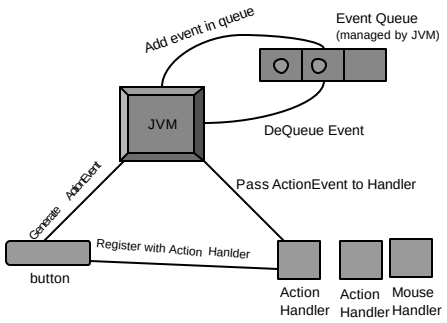
3. Event Listener/handler
   - Receives event objects when notified, then responds
   - Each event source can have multiple listeners registered on it
   - Conversely, a single listener can register with multiple event sources



Event Handling Participants (cont.)

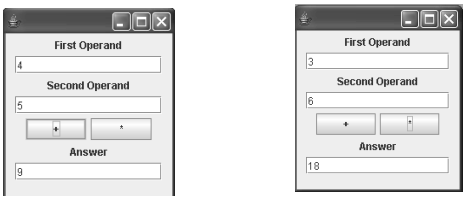
4. JVM
   - Receives an event whenever one is generated
   - Looks for the listener/handler of that event
   - If exist, delegate it for processing
   - If not, discard it (event).

Event Handling Diagram



Making Small Calculator Example Code

Event Handling: Small Calculator Scenario



- User enters numbers in the provided fields
- On pressing "+" button, sum would be displayed in the answer field
- On pressing "*" button, product would be displayed in the answer field

Code: Small Calculator

```
import java.awt.*;
import javax.swing.*;
impor java.awt.event.*;

public class SmallCalcApp implements ActionListener {
    JFrame frame;
    JLabel firstOperand, secondOperand, answer;
    JTextField op1, op2, ans;
    JButton plus, mul;

    public void initGUI () {
        …….
        plus = new JButton("+");
        mul  = new JButton("*");
        …….
        plus.addActionListner(this);
        mul.addActionListner(this);
        ……..
  }//end initGUI
```

Code: Small Calculator (cont.)

```
 // providing definition of interface  ActionListner's methos
public void actionPerformed (ActionEvent event ) {

   String oper, result;
   int num1, num2, res;

    if (event.getSource () == plus) {

       oper  = op1.getText();
       num1 = Integer.parseInt(oper);

       oper  = op2.getText();
       num2 = Integer.parseInt (oper);

       res = num1+num2;
       result = res+"";

       ans.setText(result);

    } // end if

    //continue
```

Code: Small Calculator (cont.)

```
else if (event.getSource() == mul) {

    oper  = op1.getText();
    num1 = Integer.parseInt(oper);

    oper  = op2.getText();
    num2 = Integer.parseInt (oper);

    res = num1*num2;
    result = res+"";

    ans.setText(result);

}
} // end actionPerformed method

.....
```

Code: Small Calculator (cont.)

```
……..      //write default constructor and call initGUI

  public static void main (String args[ ]) {
      SmallCalcApp scApp = new SmallCalcApp();
  }

} // end SmallCalcApp
```