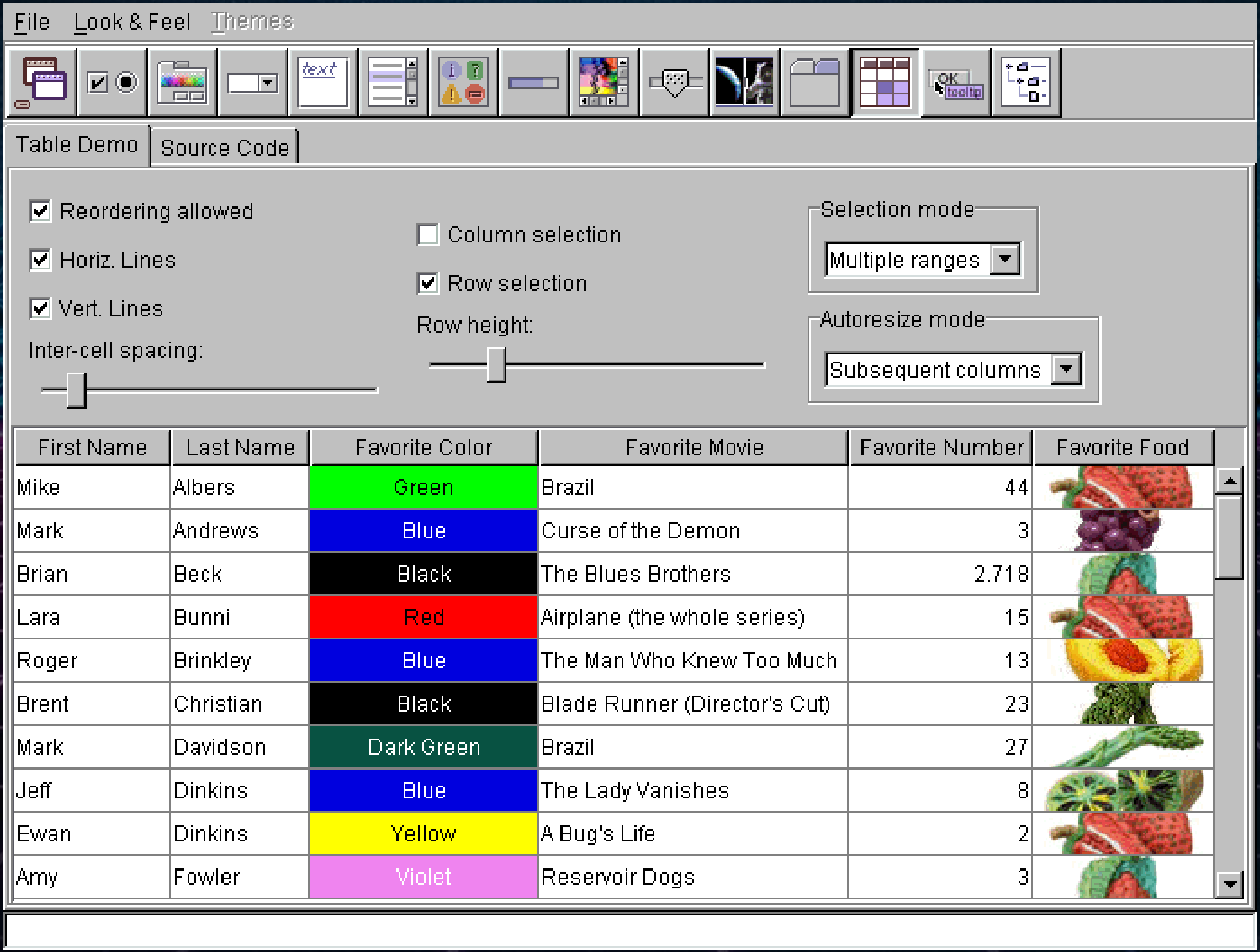
Event Handling

GUI are Event Driven



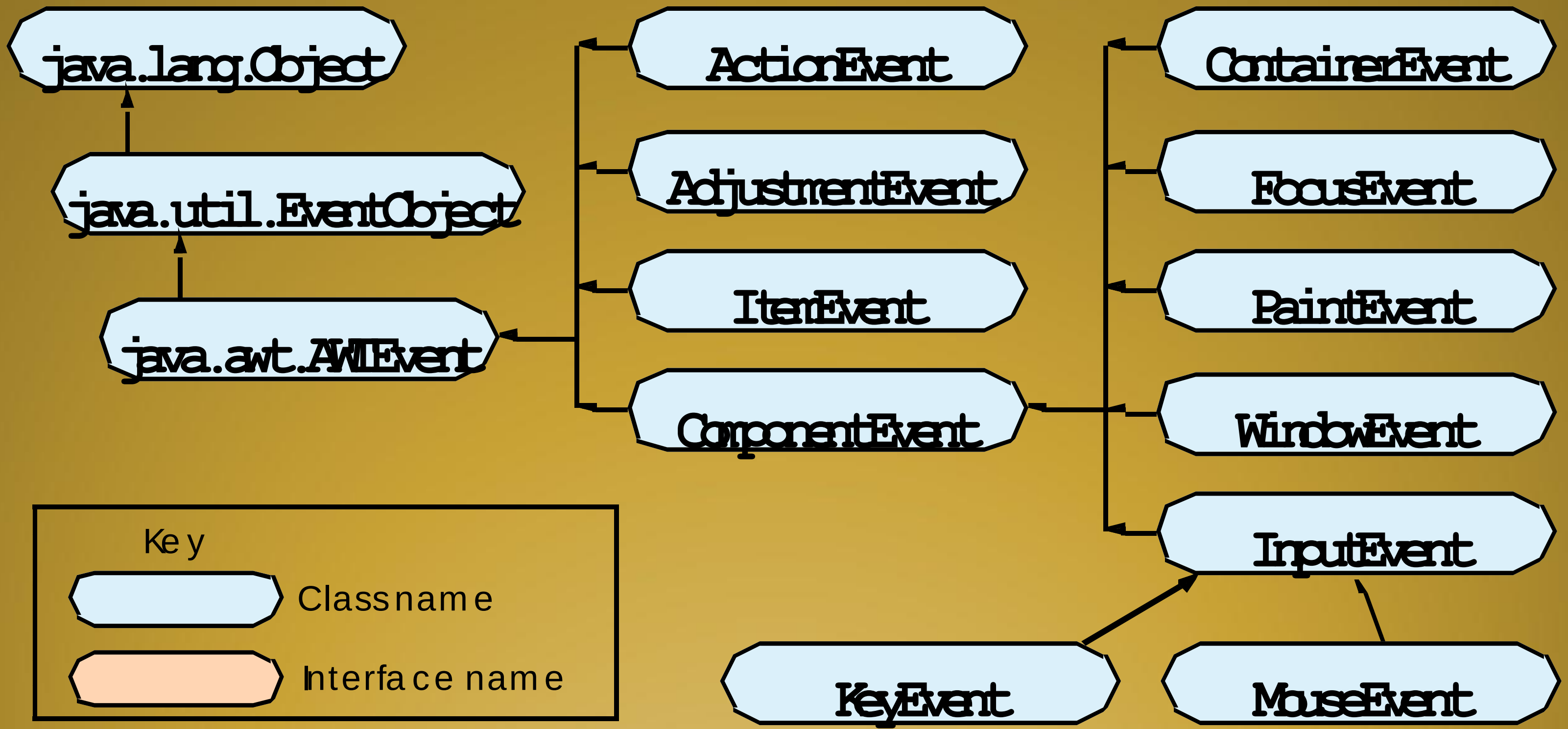
☑ Reordering allowed
☑ Horiz. Lines
☑ Vert. Lines
Inter-cell spacing:
☐ Column selection
☑ Row selection
Row height:
Selection mode: Multiple ranges
Autoresize mode: Subsequent columns

First Name	Last Name	Favorite Color	Favorite Movie	Favorite Number	Favorite Food
Mike	Albers	Green	Brazil	44	
Mark	Andrews	Blue	Curse of the Demon	3	
Brian	Beck	Black	The Blues Brothers	2.718	
Lara	Bunni	Red	Airplane (the whole series)	15	
Roger	Brinkley	Blue	The Man Who Knew Too Much	13	
Brent	Christian	Black	Blade Runner (Director's Cut)	23	
Mark	Davidson	Dark Green	Brazil	27	
Jeff	Dinkins	Blue	The Lady Vanishes	8	
Ewan	Dinkins	Yellow	A Bug's Life	2	
Amy	Fowler	Violet	Reservoir Dogs	3	

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”);

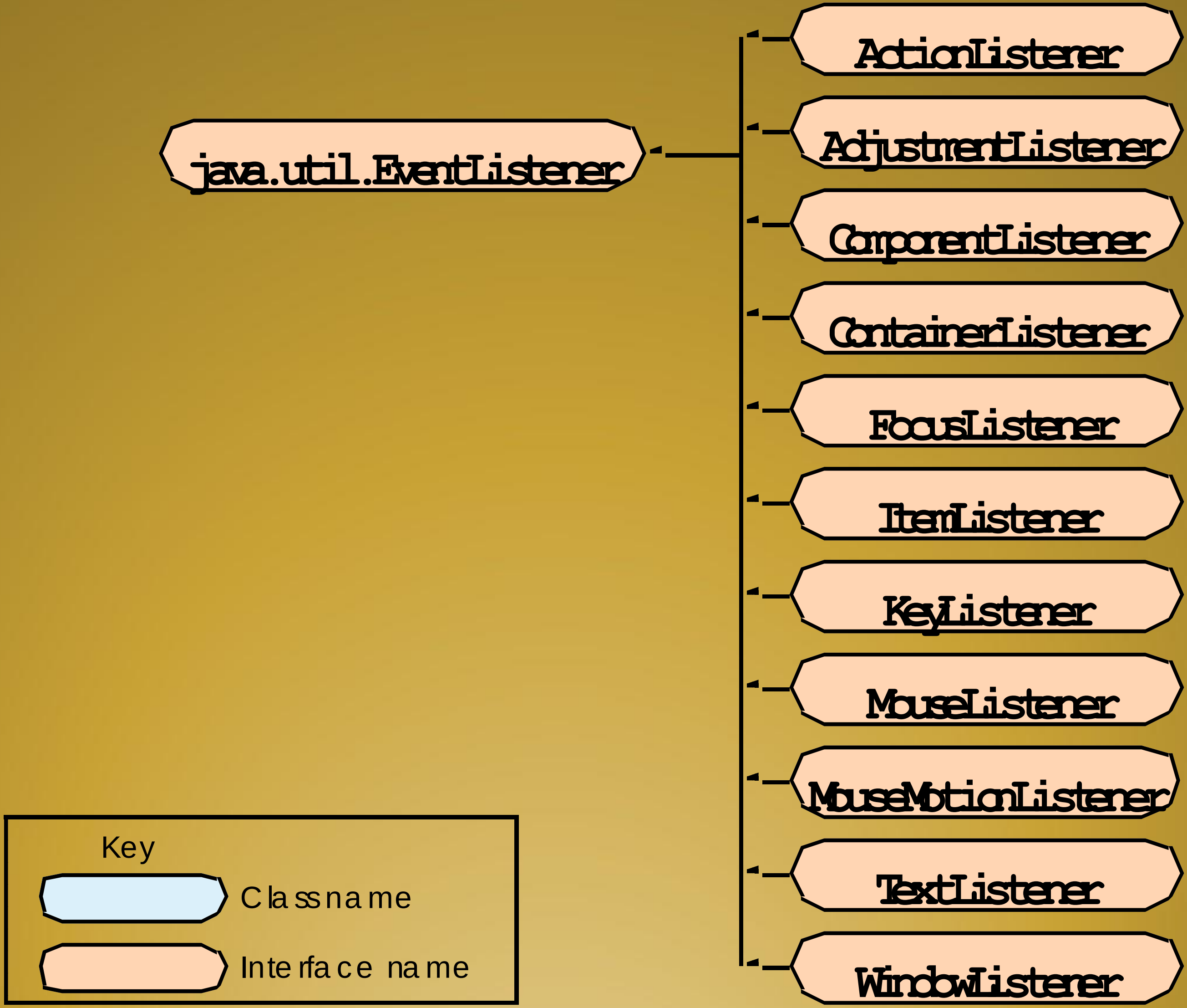
- Now b1 can generate events

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]

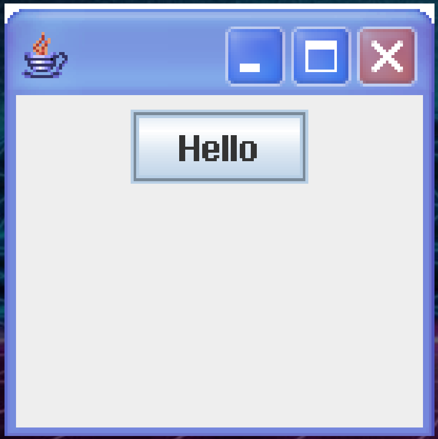
Registering Handler with Generator

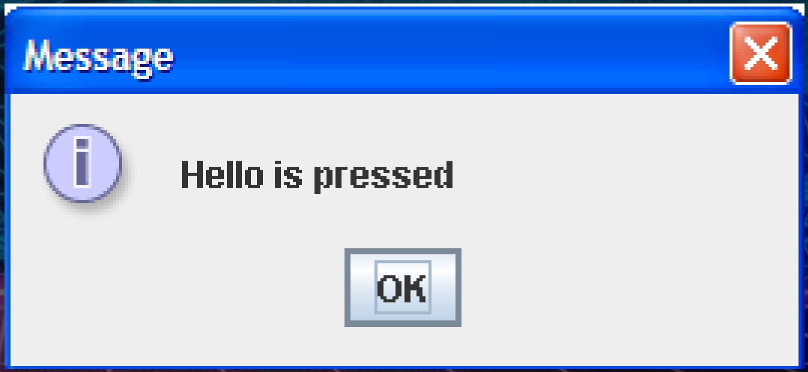
- The event generator is told about the object which can handle its events
- Event Generators have a method
  - add_______Listener(_________)
- b1.addActionListener(objectOfTestClass)

Event Handling

Simple Example

Event Handling: Simple Example Scenario





Hello is pressed

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 class ActionEventTest implements ActionListner{

   JFrame frame;
   JButton bHello;

    public void initGUI () {

         frame =  new JFrame();

         // 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

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

   public ActionEventTest( ) {
         initGUI ();
   }

   public static void main (String args [ ]) {

        ActionEventTest aeTest = new ActionEventTest();
   }

}//end ActionEvent class
```

Behind the Scenes

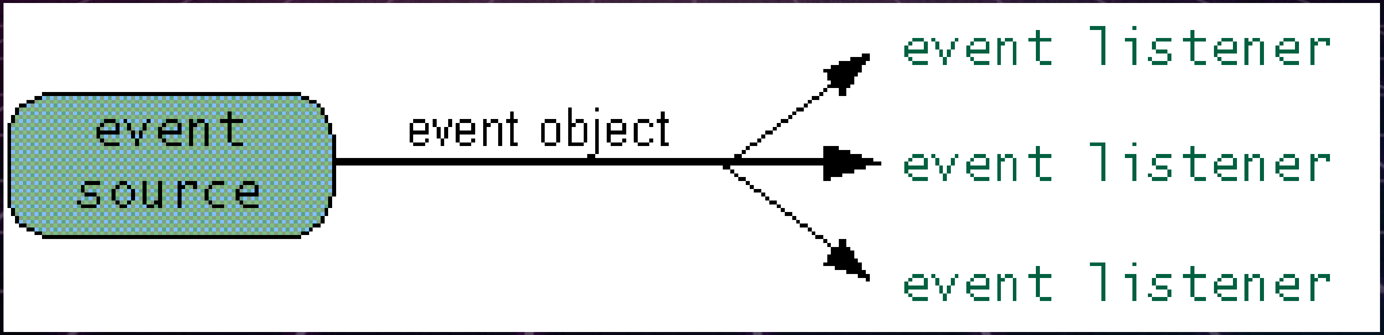
Event Handling Participants

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.)

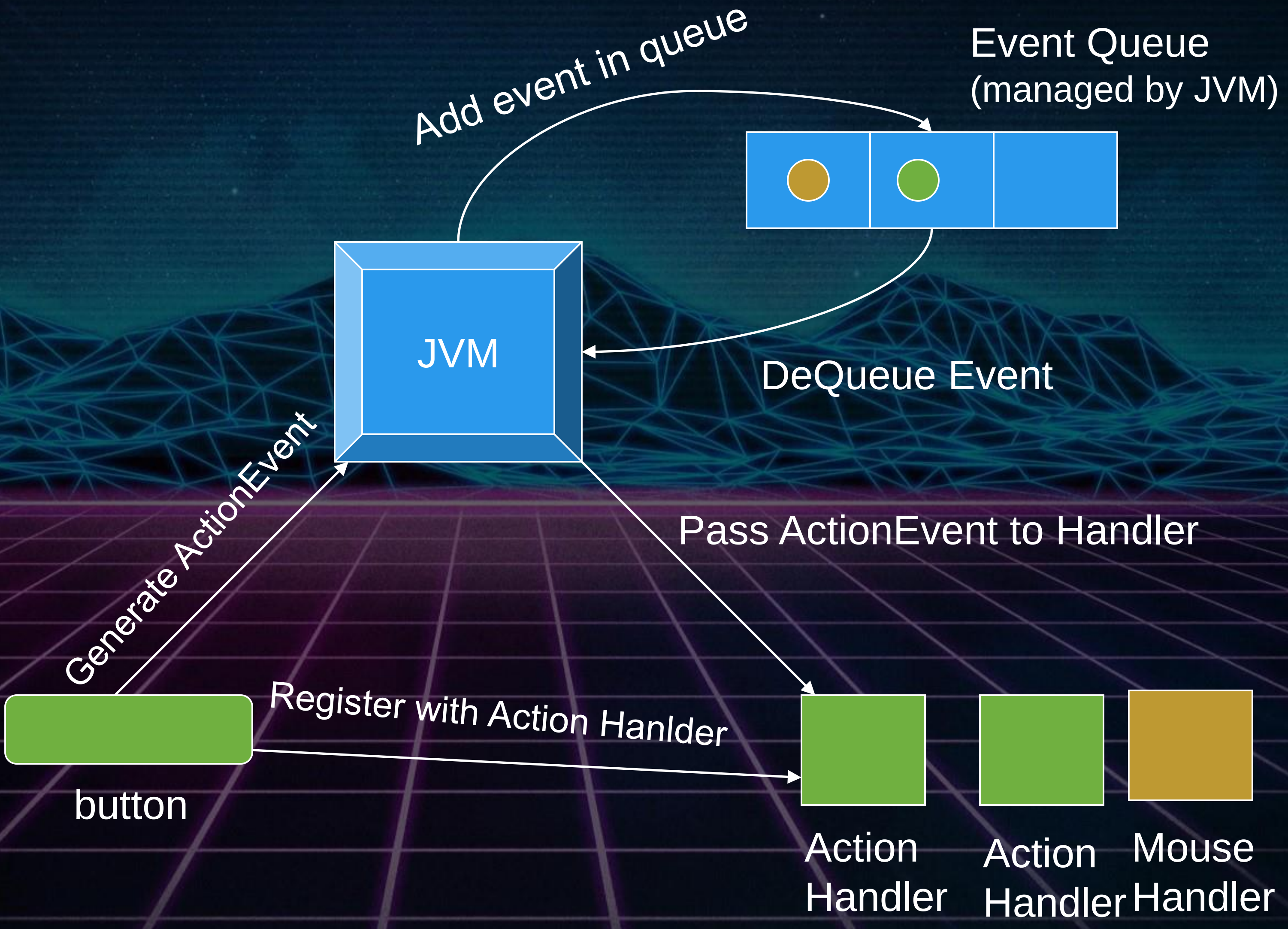
3. Event Listener/handler
   - Receives event objects when notified, then responds
   - Each event source can have multiple listeners registered on it
   - Conversely, a single listener can register with multiple event sources



Event Handling Participants (cont.)

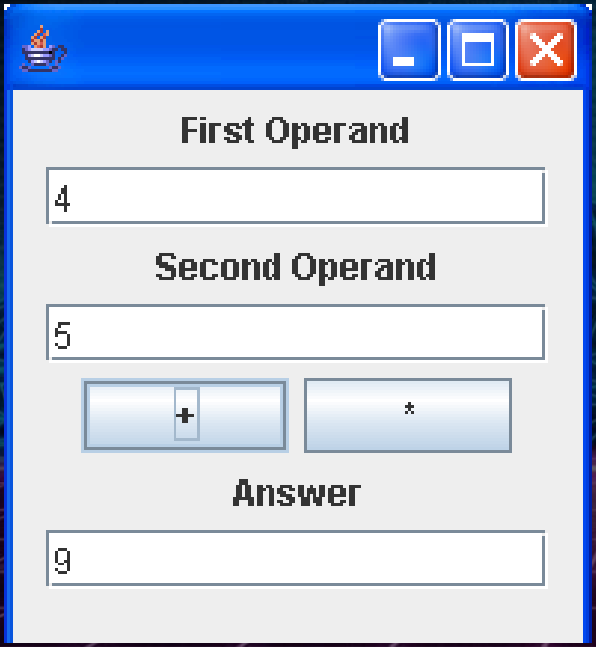
4. JVM
   - Receives an event whenever one is generated
   - Looks for the listener/handler of that event
   - If exist, delegate it for processing
   - If not, discard it (event).

Event Handling Diagram



Making Small Calculator Example Code

Event Handling: Small Calculator Scenario


First Operand

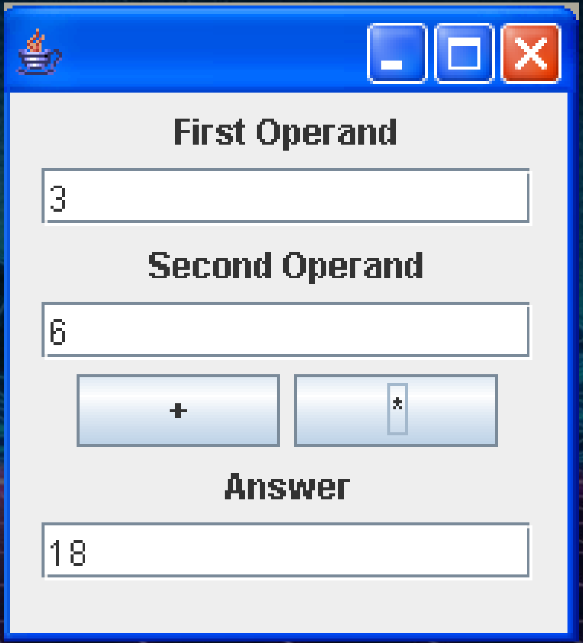
4

Second Operand

5

Answer

9


First Operand

3

Second Operand

6

Answer

18

- 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
```