Graphical User Interface Components

Outline

13.1 Introduction

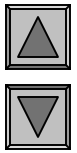
- Graphical User Interface (GUI)
  - Gives program distinctive “look” and “feel”
  - Provides users with basic level of familiarity
  - Built from GUI components (controls, widgets, etc.)
    - User interacts with GUI component via mouse, keyboard, etc.

Fig. 13.1 Netscape window with GUI components

Useful “instant” GUI classes

- JOptionPane:
  - showMessageDialog
  - showInputDialog
- JFileChooser
  - See: jFileChooserTest.java

```java
// Fig. 2.6: Welcome4.java
// Printing multiple lines in a dialog box.

// Java packages
import javax.swing.JOptionPane;  // program uses JOptionPane

public class Welcome4 {

   // main method begins execution of Java application
   public static void main( String args[] )
   {
      JOptionPane.showMessageDialog(
         null, "Welcome\nto\nJava\nProgramming!" );

      System.exit( 0 );  // terminate application with window

   } // end method main

} // end class Welcome4
```



Outline

Welcome4.java

1. import **declaration**

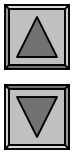
2. Class Welcome4

2.1 main

2.2 showMessageDialog

2.3 System.exit

Program Output



Outline

Addition.java

1. import

2. class Addition

2.1 Declare variables (name and type)

3. showInputDialog

4. parseInt

5. Add numbers, put result in sum

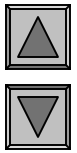
```
1  // Fig. 2.9: Addition.java
2  // Addition program that displays the sum of two numbers.
3
4  // Java packages
5  import javax.swing.JOptionPane;  // program uses JOptionPane
6
7  public class Addition {
8
9     // main method begins executi
10    public static void main( String args[] )
11    {
12       String firstNumber;  // first string entered by user
13       String secondNumber;  // second string entered by user
14
15       int number1;          // fi
16       int number2;          // se
17       int sum;              // su
18
19       // read in first number from user as a String
20       firstNumber = JOptionPane.showInputDialog( "Enter first integer" );
21
22       // read in second number from user as a String
23       secondNumber =
24          JOptionPane.showInputDialog( "Enter second integ
25
26       // convert numbers from type Stri
27       number1 = Integer.parseInt( firstNumber );
28       number2 = Integer.parseInt( secondNumber );
29
30       // add numbers
31       sum = number1 + number2;
32
```

Declare variables: name and type.

Input first integer as a `String`, assign to `firstNumber`.

Convert strings to integers.

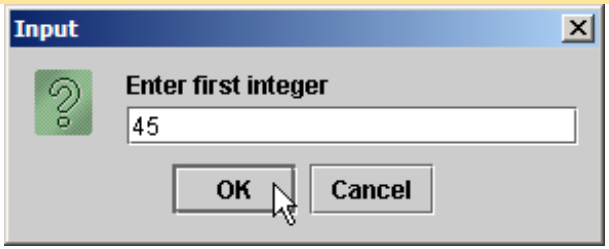
Add, place result in `sum`.

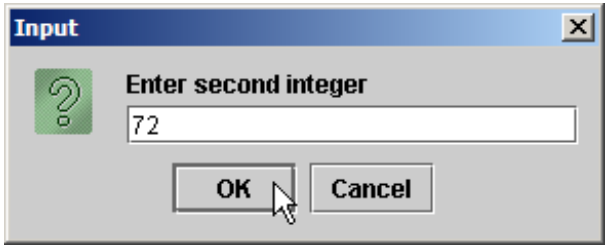


Outline

```
33          // display result
34          JOptionPane.showMessageDialog( null, "The sum is " + sum,
35             "Results", JOptionPane.PLAIN_MESSAGE );
36
37          System.exit( 0 );   // terminate application with window
38
39       } // end method main
40
41    } // end class Addition
```

Program output





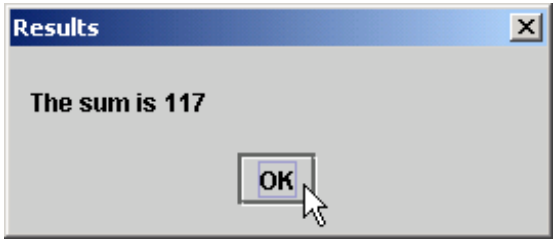


Fig. 13.2 Some basic GUI components

Component	Description
`JLabel`	An area where uneditable text or icons can be displayed.
`JTextField`	An area in which the user inputs data from the keyboard. The area can also display information.
`JButton`	An area that triggers an event when clicked with the mouse.
`JCheckBox`	A GUI component that is either selected or not selected.
`JComboBox`	A drop-down list of items from which the user can make a selection by clicking an item in the list or possibly by typing into the box.
`JList`	An area containing a list of items from which the user can make a selection by clicking on any element in the list. Multiple elements can be selected.
`JPanel`	A container in which components can be placed and organized.

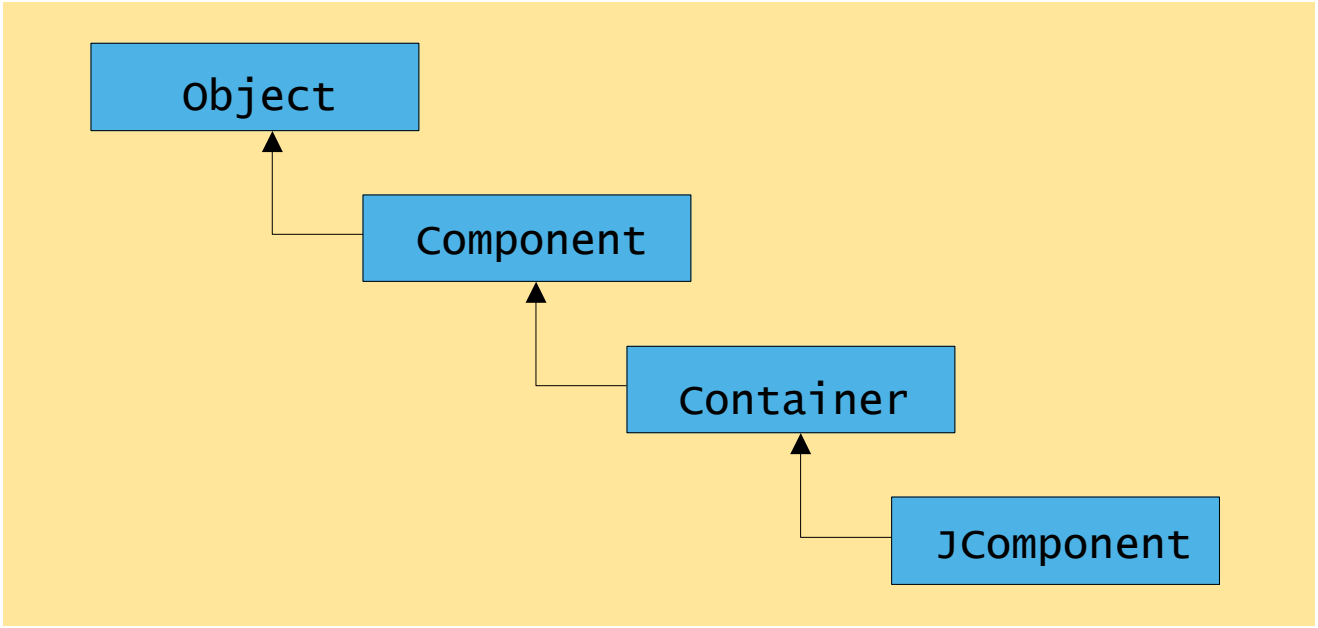
13.2 Overview of Swing Components

- Swing GUI components
  - Package `javax.swing`
  - Components originate from AWT (package `java.awt`)
  - Contain *look and feel*
    - Appearance and how users interact with program
  - *Lightweight components*
    - Written completely in Java

13.2 Overview of Swing Components

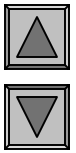
- Class `Component`
  - Contains method `paint` for drawing `Component` onscreen
- Class `Container`
  - Collection of related components
  - Contains method `add` for adding components
- Class `JComponent`
  - *Pluggable look and feel* for customizing look and feel
  - Shortcut keys (*mnemonics*)
  - Common event-handling capabilities

Fig. 13.3 Common superclasses of many of the Swing components



13.3 JLabel

- Label
  - Provide text on GUI
  - Defined with class `JLabel`
  - Can display:
    - Single line of read-only text
    - Image
    - Text and image



Outline

LabelTest.java

Line 8

Line 20

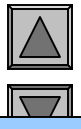
Line 21

```
1  // Fig. 13.4: LabelTest.java
2  // Demonstrating the JLabel class.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class LabelTest extends JFrame {
8     private JLabel label1, label2, label3;
9
10    // set up GUI
11    public LabelTest()
12    {
13       super( "Testing JLabel" );
14
15       // get content pane and set its layout
16       Container container = getContentPane();
17       container.setLayout( new FlowLayout() );
18
19       // JLabel constructor with a string argument
20       label1 = new JLabel( "Label with text" );
21       label1.setToolTipText( "This is label1" );
22       container.add( label1 );
23
```

Declare three `JLabel`s

Create first `JLabel` with text "`Label with text`"

Tool tip is text that appears when user moves cursor over `JLabel`



Outline

```
24        // JLabel constructor with string, Icon and alignment arguments
25        Icon bug = new ImageIcon( "bug1.gif" );
26        label2 = new JLabel( "Label with text and icon", bug,
27           SwingConstants.LEFT );
28        label2.setToolTipText( "This is label2" );
29        container.add( label2 );
30
31        // JLabel constructor no arguments
32        label3 = new JLabel();
33        label3.setText( "Label with icon and text at bottom" );
34        label3.setIcon( bug );
35        label3.setHorizontalTextPosition( SwingConstants.CENTER );
36        label3.setVerticalTextPosition( SwingConstants.BOTTOM );
37        label3.setToolTipText( "This is label3" );
38        container.add( label3 );
39
40        setSize( 275, 170 );
41        setVisible( true );
42
43     } // end constructor
44
45     public static void main( String args[] )
46     {
47        LabelTest application = new LabelTest();
48        application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
49     }
```

Create second `JLabel` with text to left of image

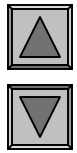
`LabelTest.java`

Lines 16-17

Lines 32-37

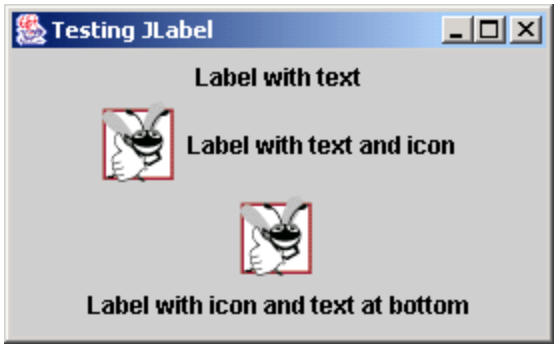
Create third `JLabel` with text below image

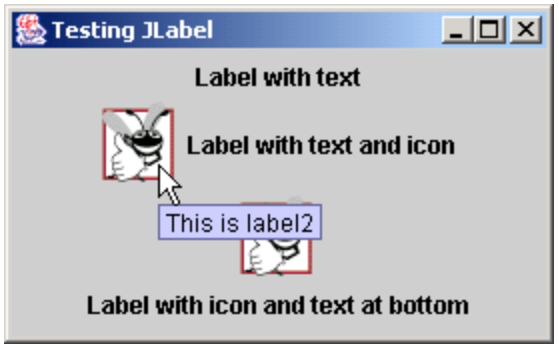
```
50
51 } // end class LabelTest
```



Outline

LabelTest.java

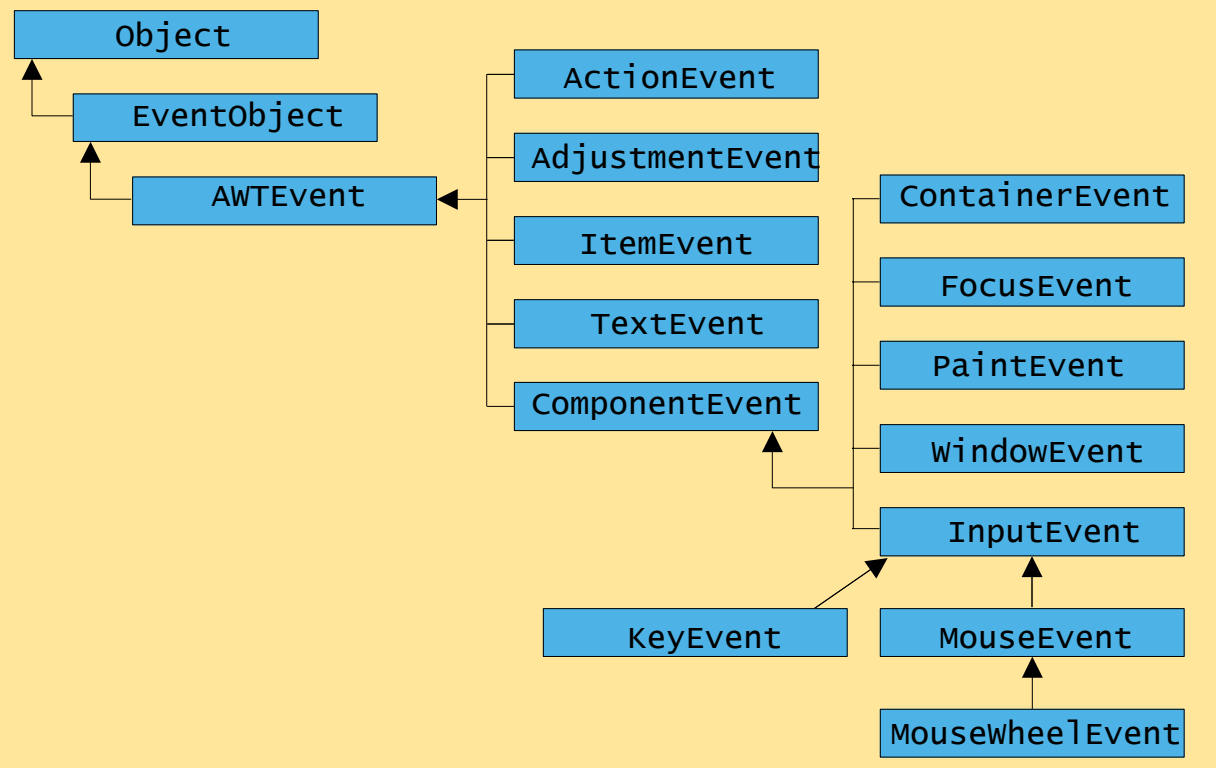




13.4 Event Handling

- GUIs are *event driven*
  - Generate *events* when user interacts with GUI
    - e.g., moving mouse, pressing button, typing in text field, etc.
    - Class `java.awt.AWTEvent`

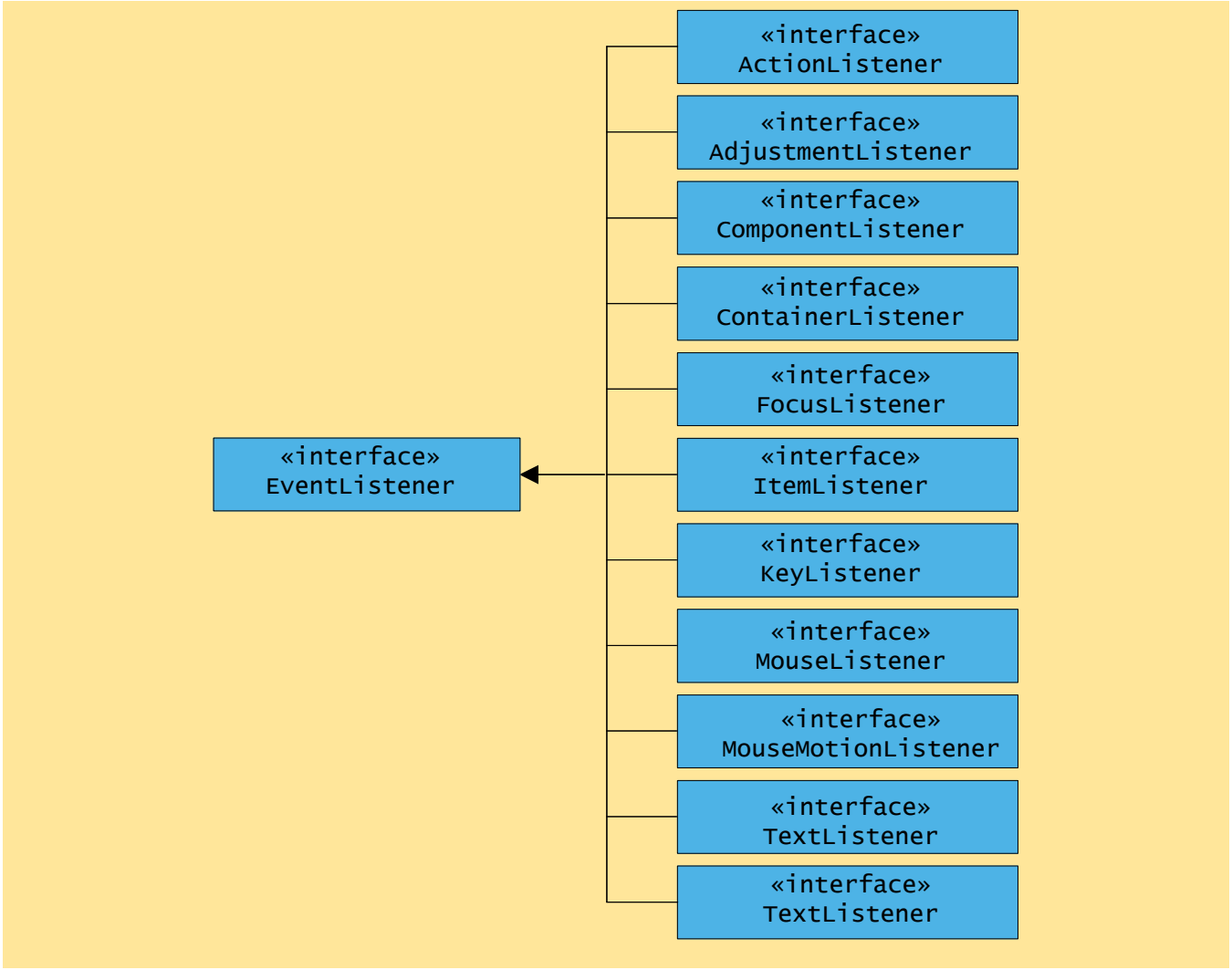
Fig. 13.5 Some event classes of package `java.awt.event`



13.4 Event Handling

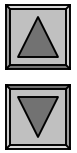
- Event-handling model
  - Three parts
    - Event source
      - GUI component with which user interacts
    - Event object
      - Encapsulates information about event that occurred
    - Event listener
      - Receives event object when notified, then responds
  - Programmer must perform two tasks
    - Register event listener for event source
    - Implement event-handling method (event handler)

Fig. 13.6 Event-listener interfaces of package `java.awt.event`



13.5 TextFields

- `JTextField`
  - Single-line area in which user can enter text
- `JPasswordField`
  - Extends `JTextField`
  - Hides characters that user enters



Outline

TextFieldTest.java

```
1  // Fig. 13.7: TextFieldTest.java
2  // Demonstrating the JTextField class.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class TextFieldTest extends JFrame {
8     private JTextField textField1, textField2, textField3;
9     private JPasswordField passwordField;
10
11    // set up GUI
12    public TextFieldTest()
13    {
14       super( "Testing JTextField and JPasswordField" );
15
16       Container container = getContentPane();
17       container.setLayout( new FlowLayout() );
18
19       // construct textfield with default sizing
20       textField1 = new JTextField( 10 );
21       container.add( textField1 );
22
23       // construct textfield with default text
24       textField2 = new JTextField( "Enter text here" );
25       container.add( textField2 );
26
```

Declare three JTextFields and one JPasswordField

Line 24

First JTextField contains empty string

Second JTextField contains text "Enter text here"

```
27        // construct textfield with default text,
28        // 20 visible elements and no event handler
29        textField3 = new JTextField( "Uneditable text field", 20 );
30        textField3.setEditable( false );
31        container.add( textField3 );
32
33        // construct passwordfield with default text
34        passwordField = new JPasswordField( "Hidden text" );
35        container.add( passwordField );
36
37        // register event handlers
38        TextFieldHandler handler = new TextFieldHandler();
39        textField1.addActionListener( handler );
40        textField2.addActionListener( handler );
41        textField3.addActionListener( handler );
42        passwordField.addActionListener( handler );
43
44        setSize( 325, 100 );
45        setVisible( true );
46
47     } // end constructor TextFieldTest
48
49     public static void main( String args[] )
50     {
51        TextFieldTest application = new TextFieldTest();
52        application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
53     }
```

Third `JTextField` contains uneditable text

`JPasswordField` contains text "`Hidden text`," but text appears as series of asterisks (*)

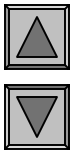
Register GUI components with `TextFieldHandler` (register for `ActionEvents`)

Outline

`ldTest.j`
`ava`

Line 34

Lines 39-42



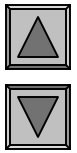
Outline

```
54
55    // private inner class for event handling
56    private class TextFieldHandler implements ActionListener {
57
58       // process textfield events
59       public void actionPerformed( ActionEvent event )
60       {
61          String string = "";
62
63          // user pressed Enter in JTextField textField1
64          if ( event.getSource() == textField1 )
65             string = "textField1: " + event.getActionCommand();
66
67          // user pressed Enter in JTextField textField2
68          else if ( event.getSource() == textField2 )
69             string = "textField2: " + event.getActionCommand();
70
71          // user pressed Enter in JTextField textField3
72          else if ( event.getSource() == textField3 )
73             string = "textField3: " + event.getActionCommand();
74
75          // user pressed Enter in JTextField passwordField
76          else if ( event.getSource() == passwordField ) {
77             string = "passwordField: " +
78                new String( passwordField.getPassword() );
79          }
```

Every `TextFieldHandler` instance is an `ActionListener`

Line 56

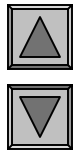
Method `actionPerformed` invoked when user presses Enter in GUI field



Outline

TextFieldTest.java

```
80
81          JOptionPane.showMessageDialog( null, string );
82
83       } // end method actionPerformed
84
85    } // end private inner class TextFieldHandler
86
87 } // end class TextFieldTest
```



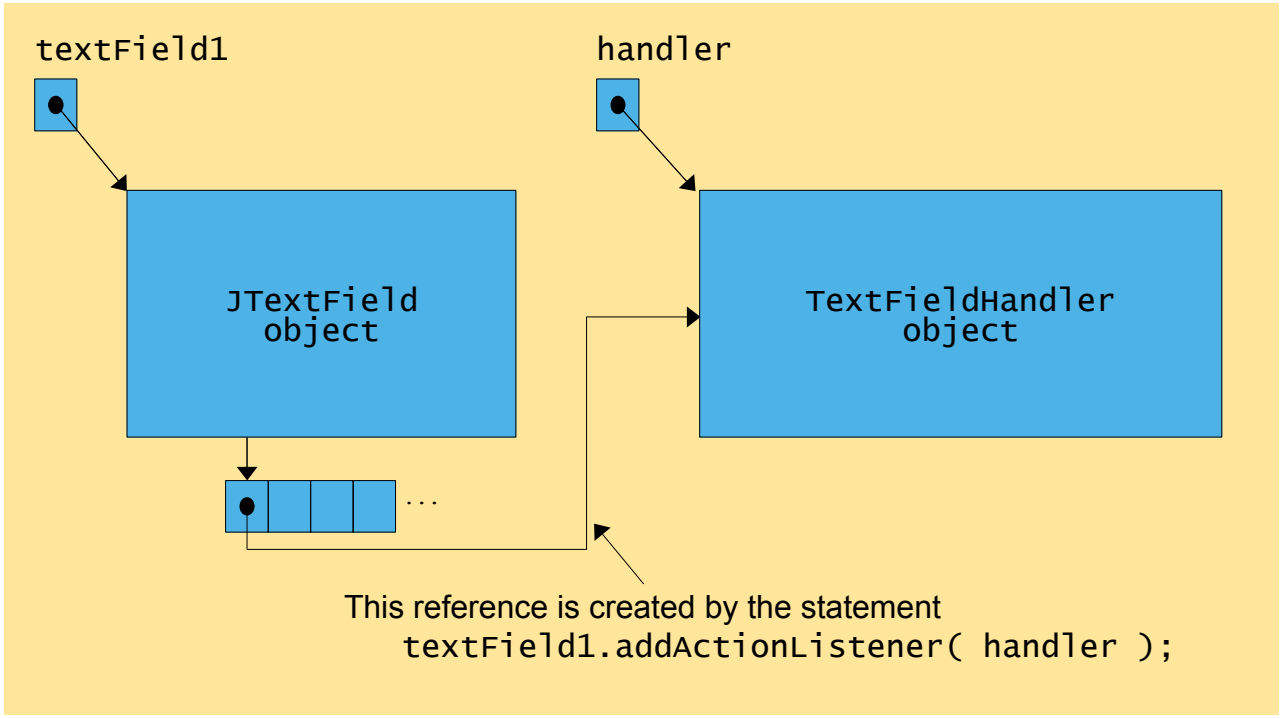
Outline

TextFieldTest.java

13.6 How Event Handling Works

- Two open questions from Section 13.4
  - How did event handler get registered?
    - Answer:
      - Through component's method `addActionListener`
      - Lines 39-42 of `TextFieldTest.java`
  - How does component know to call `actionPerformed`?
    - Answer:
      - Event is dispatched only to listeners of appropriate type
      - Each event type has corresponding event-listener interface
        - Event ID specifies event type that occurred

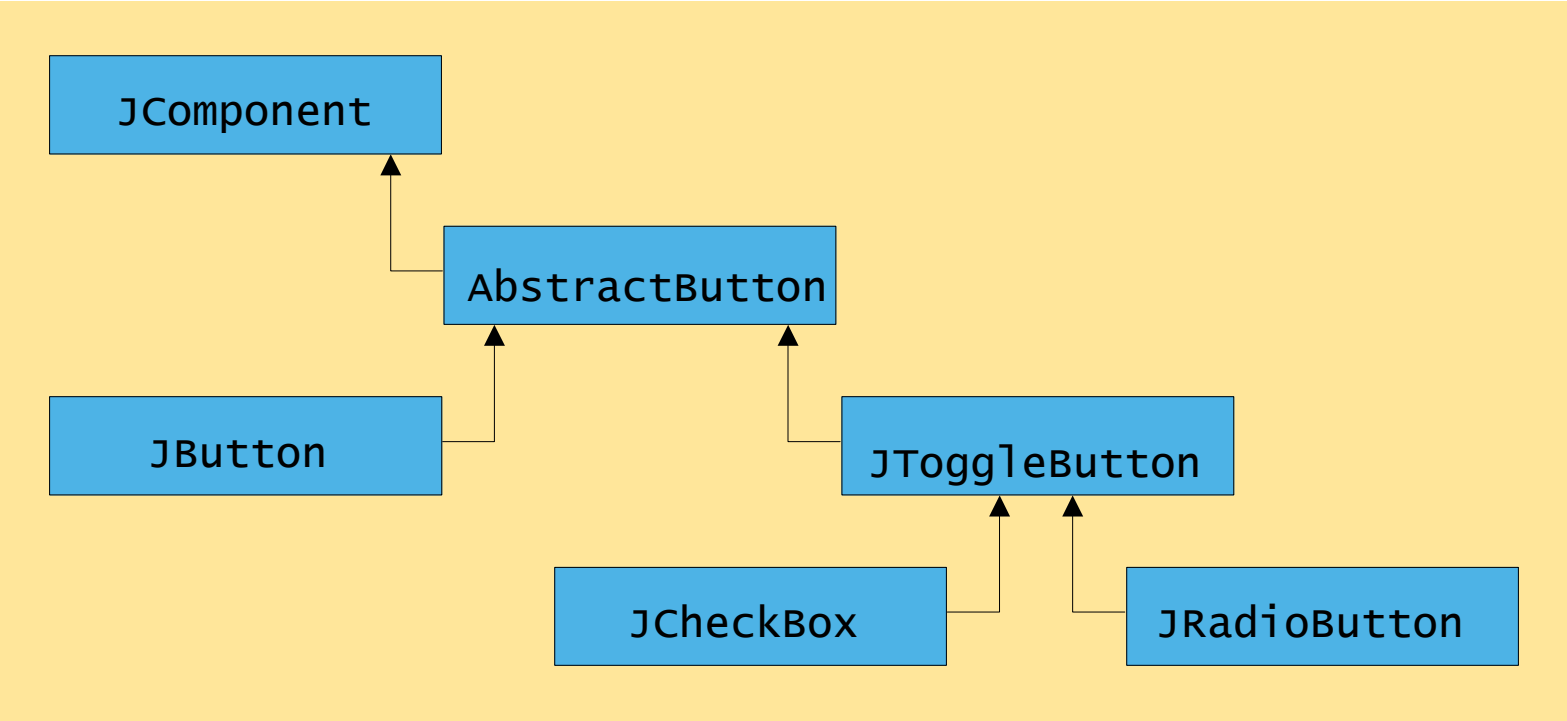
Fig. 13.8 Event registration for `JTextField textField1`

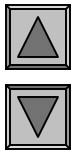


13.7 JButton

- Button
  - Component user clicks to trigger a specific action
  - Several different types
    - Command buttons
    - Check boxes
    - Toggle buttons
    - Radio buttons
  - `javax.swing.AbstractButton` subclasses
    - Command buttons are created with class `JButton`
      - Generate `ActionEvent`s when user clicks button

Fig. 13.9 Swing button hierarchy





Outline

ButtonTest.java

Line 8

Line 20

Lines 24-26

```
1  // Fig. 13.10: ButtonTest.java
2  // Creating JButtons.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class ButtonTest extends JFrame {
8     private JButton plainButton, fancyButton;
9
10    // set up GUI
11    public ButtonTest()
12    {
13       super( "Testing Buttons" );
14
15       // get content pane and set its layout
16       Container container = getContentPane();
17       container.setLayout( new FlowLayout() );
18
19       // create buttons
20       plainButton = new JButton( "Plain Button" );
21       container.add( plainButton );
22
23       Icon bug1 = new ImageIcon( "bug1.gif" );
24       Icon bug2 = new ImageIcon( "bug2.gif" );
25       fancyButton = new JButton( "Fancy Button", bug1 );
26       fancyButton.setRolloverIcon( bug2 );
27       container.add( fancyButton );
```

Create two references to `JButton` instances

Instantiate `JButton` with text

Instantiate `JButton` with image and *rollover* image

Outline

```
28
29       // create an instance of inner class ButtonHandler
30       // to use for button event handling
31       ButtonHandler handler = new ButtonHandler();
32       fancyButton.addActionListener( handler );
33       plainButton.addActionListener( handler );
34
35       setSize( 275, 100 );
36       setVisible( true );
37
38    } // end ButtonTest constructor
39
40    public static void main( String args[] )
41    {
42       ButtonTest application = new ButtonTest();
43       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
44    }
45
46    // inner class for button event handling
47    private class ButtonHandler implements ActionListener {
48
49       // handle button event
50       public void actionPerformed( ActionEvent event )
51       {
52          JOptionPane.showMessageDialog( ButtonTest.this,
53             "You pressed: " + event.getActionCommand() );
54       }
```

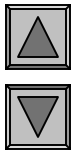
Instantiate `ButtonHandler` for `JButton` event handling

Register `JButton`s to receive events from `ButtonHandler`

Lines 32-33

Line 50

When user clicks `JButton`, `ButtonHandler` invokes method `actionPerformed` of all registered listeners



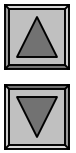
Outline

ButtonTest.java

```
55
56    } // end private inner class ButtonHandler
57
58 } // end class ButtonTest
```

13.8 JCheckBox and JRadioButton

- State buttons
  - On/Off or `true`/`false` values
  - Java provides three types
    - `JToggleButton`
    - `JCheckBox`
    - `JRadioButton`



Outline

CheckBoxTest.java

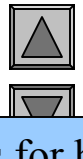
Line 9

Line 22

```
1  // Fig. 13.11: CheckBoxTest.java
2  // Creating JCheckBox buttons.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class CheckBoxTest extends JFrame {
8     private JTextField field;
9     private JCheckBox bold, italic;
10
11    // set up GUI
12    public CheckBoxTest()
13    {
14       super( "JCheckBox Test" );
15
16       // get content pane and set its layout
17       Container container = getContentPane();
18       container.setLayout( new FlowLayout() );
19
20       // set up JTextField and set its font
21       field = new JTextField( "Watch the font style change", 20 );
22       field.setFont( new Font( "Serif", Font.PLAIN, 14 ) );
23       container.add( field );
24
```

Declare two `JCheckBox` instances

Set `JTextField` font to Serif, 14-point plain



Outline

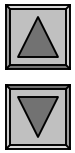
```
25        // create checkbox objects
26        bold = new JCheckBox( "Bold" );
27        container.add( bold );
28
29        italic = new JCheckBox( "Italic" );
30        container.add( italic );
31
32        // register listeners for JCheckBoxes
33        CheckBoxHandler handler = new CheckBoxHandler();
34        bold.addItemListener( handler );
35        italic.addItemListener( handler );
36
37        setSize( 275, 100 );
38        setVisible( true );
39
40     } // end CheckBoxText constructor
41
42     public static void main( String args[] )
43     {
44        CheckBoxTest application = new CheckBoxTest();
45        application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
46     }
47
```

Instantiate `JCheckBox`s for bolding and italicizing `JTextField` text, respectively

Register `JCheckBox`s to receive events from `CheckBoxHandler`

`t.ja`
`va`

Lines 26 and 29



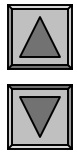
Outline

```
48    // private inner class for ItemListener event handling
49    private class CheckBoxHandler implements ItemListener {
50       private int valBold = Font.PLAIN;
51       private int valItalic = Font.PLAIN;
52
53       // respond to checkbox events
54       public void itemStateChanged( ItemEvent event )
55       {
56          // process bold checkbox events
57          if ( event.getSource() == bold )
58             valBold = bold.isSelected() ? Font.BOLD : Font.PLAIN;
59
60          // process italic checkbox events
61          if ( event.getSource() == italic )
62             valItalic = italic.isSelected() ? Font.ITAL
63
64          // set text field font
65          field.setFont( new Font( "Serif", valBold + valItalic, 14 ) );
66
67       } // end method itemStateChanged
68
69    } // end private inner class CheckBoxHandler
70
71 } // end class CheckBoxTest
```

When user selects `JCheckBox`, `CheckBoxHandler` invokes method `itemStateChanges` of all registered listeners

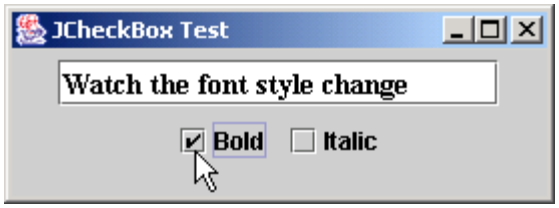
Line 65

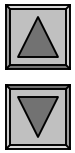
Change `JTextField` font, depending on which `JCheckBox` was selected



Outline

CheckBoxTest.java





Outline

RadioButtonTest.java

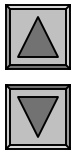
```
1  // Fig. 13.12: RadioButtonTest.java
2  // Creating radio buttons using ButtonGroup and JRadioButton.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class RadioButtonTest extends JFrame {
8     private JTextField field;
9     private Font plainFont, boldFont, italicFont, boldItalicFont;
10    private JRadioButton plainButton, boldButton, italicButton,
11       boldItalicButton;
12    private ButtonGroup radioGroup;
13
14    // create GUI and fonts
15    public RadioButtonTest()
16    {
17       super( "RadioButton Test" );
18
19       // get content pane and set its layout
20       Container container = getContentPane();
21       container.setLayout( new FlowLayout() );
22
23       // set up JTextField
24       field = new JTextField( "Watch the font style change", 25 );
25       container.add( field );
26
```

Declare four `JRadioButton` instances

Lines 10-11

Line 12

`JRadioButton`s normally appear as a `ButtonGroup`



Outline

RadioButtonTest.java

```
27        // create radio buttons
28        plainButton = new JRadioButton( "Plain", true );
29        container.add( plainButton );
30
31        boldButton = new JRadioButton( "Bold", false );
32        container.add( boldButton );
33
34        italicButton = new JRadioButton( "Italic", false );
35        container.add( italicButton );
36
37        boldItalicButton = new JRadioButton( "Bold/Italic", false );
38        container.add( boldItalicButton );
39
40        // create logical relationship between JRadioButtons
41        radioGroup = new ButtonGroup();
42        radioGroup.add( plainButton );
43        radioGroup.add( boldButton );
44        radioGroup.add( italicButton );
45        radioGroup.add( boldItalicButton );
46
47        // create font objects
48        plainFont = new Font( "Serif", Font.PLAIN, 14 );
49        boldFont = new Font( "Serif", Font.BOLD, 14 );
50        italicFont = new Font( "Serif", Font.ITALIC, 14 );
51        boldItalicFont = new Font( "Serif", Font.BOLD + Font.ITALIC, 14 );
52        field.setFont( plainFont );  // set initial font
53
```

Instantiate `JRadioButton`s for manipulating `JTextField` text font

Lines 41-45

`JRadioButton`s belong to `ButtonGroup`

Outline

```
54        // register events for JRadioButtons
55        plainButton.addItemListener( new RadioButtonHandler( plainFont ) );
56        boldButton.addItemListener( new RadioButtonHandler( boldFont ) );
57        italicButton.addItemListener(
58           new RadioButtonHandler( italicFont ) );
59        boldItalicButton.addItemListener(
60           new RadioButtonHandler( boldItalicFont ) );
61
62        setSize( 300, 100 );
63        setVisible( true );
64
65     } // end RadioButtonTest constructor
66
67     public static void main( String args[] )
68     {
69        RadioButtonTest application = new RadioButtonTest();
70        application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
71     }
72
73     // private inner class to handle radio button events
74     private class RadioButtonHandler implements ItemListener {
75        private Font font;
76
77        public RadioButtonHandler( Font f )
78        {
79           font = f;
80        }
```

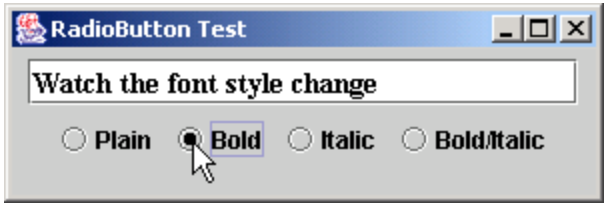
Register `JRadioButtons` to receive events from `RadioButtonHandler`

Lines 55-60

```
81
82       // handle radio button events
83       public void itemStateChanged( ItemEvent event )
84       {
85          field.setFont( font );
86       }
87
88    } // end private inner class RadioButtonHandler
89
90 } // end class RadioButtonTest
```

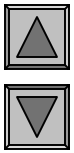
When user selects `JRadioButton`, `RadioButtonHandler` invokes method `itemStateChanged` of all registered listeners

Set font corresponding to `JRadioButton` selected



13.9 JComboBox

- JComboBox
  - List of items from which user can select
  - Also called a *drop-down list*



Outline

ComboBoxTest.java

```
1  // Fig. 13.13: ComboBoxTest.java
2  // Using a JComboBox to select an image to display.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class ComboBoxTest extends JFrame {
8     private JComboBox imagesComboBox;
9     private JLabel label;
10
11    private String names[] =
12       { "bug1.gif", "bug2.gif",  "travelbug.gif", "buganim.gif" };
13    private Icon icons[] = { new ImageIcon( names[ 0 ] ),
14       new ImageIcon( names[ 1 ] ), new ImageIcon( names[ 2 ] ),
15       new ImageIcon( names[ 3 ] ) };
16
17    // set up GUI
18    public ComboBoxTest()
19    {
20       super( "Testing JComboBox" );
21
22       // get content pane and set its layout
23       Container container = getContentPane();
24       container.setLayout( new FlowLayout() );
25
```

Outline

```
26       // set up JComboBox and register its event handler
27       imagesComboBox = new JComboBox( names );
28       imagesComboBox.setMaximumRowCount( 3 );
29       imagesComboBox.addItemListener(
30
31          new ItemListener() {  // anonymous inner class
32
33             // handle JComboBox event
34             public void itemStateChanged( ItemEvent event )
35             {
36                // determine whether check box selected
37                if ( event.getStateChange() == ItemEvent.SELECTED )
38                   label.setIcon( icons[
39                      imagesComboBox.getSelectedIndex() ] );
40             }
41
42          }  // end anonymous inner class
43
44       ); // end call to addItemListener
45
46       container.add( imagesComboBox );
47
48       // set up JLabel to display ImageIcons
49       label = new JLabel( icons[ 0 ] );
50       container.add( label );
51
```

Instantiate `JComboBox` to show three `String`s from `names` array at a time

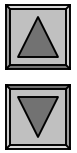
Register `JComboBox` to receive events from anonymous `ItemListener`

Line 29

Line 34

When user selects item in `JComboBox`, `ItemListener` invokes method `itemStateChanged` of all registered listeners

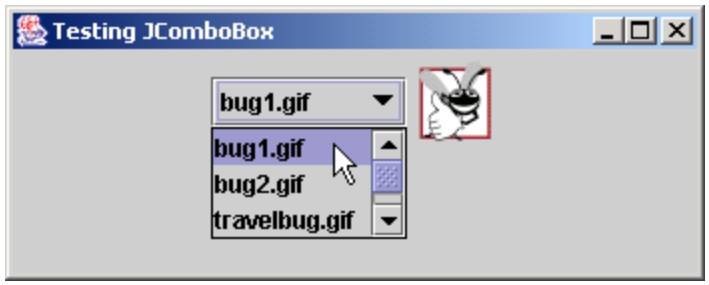
Set appropriate `Icon` depending on user selection

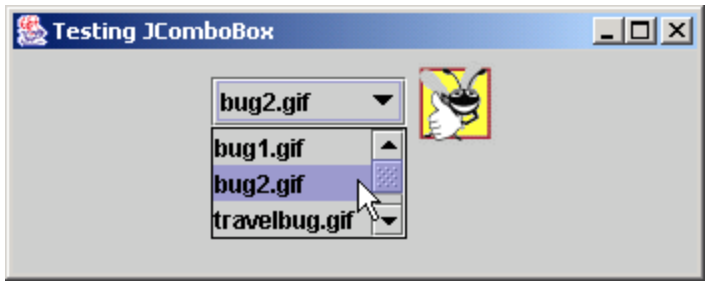


Outline

ComboBoxTest.java

```
52        setSize( 350, 100 );
53        setVisible( true );
54
55     } // end ComboBoxTest constructor
56
57     public static void main( String args[] )
58     {
59        ComboBoxTest application = new ComboBoxTest();
60        application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
61     }
62
63  } // end class ComboBoxTest
```





13.15 Layout Managers

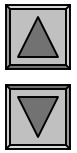
- Layout managers
  - Provided for arranging GUI components
  - Provide basic layout capabilities
  - Processes layout details
  - Programmer can concentrate on basic “look and feel”
  - Interface `LayoutManager`

Fig. 13.23 Layout managers

Layout manager	Description
`FlowLayout`	Default for `java.awt.Applet`, `java.awt.Panel` and `javax.swing.JPanel`. Places components sequentially (left to right) in the order they were added. It is also possible to specify the order of the components by using the `Container` method `add`, which takes a `Component` and an integer index position as arguments.
`BorderLayout`	Default for the content panes of `JFrame`s (and other windows) and `JApplet`s. Arranges the components into five areas: `NORTH`, `SOUTH`, `EAST`, `WEST` and `CENTER`.
`GridLayout`	Arranges the components into rows and columns.

13.15.1 FlowLayout

- FlowLayout
  - Most basic layout manager
  - GUI components placed in container from left to right



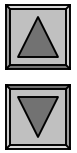
Outline

FlowLayoutDemo.java

Lines 17 and 21

```
1  // Fig. 13.24: FlowLayoutDemo.java
2  // Demonstrating FlowLayout alignments.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class FlowLayoutDemo extends JFrame {
8     private JButton leftButton, centerButton, rightButton;
9     private Container container;
10    private FlowLayout layout;
11
12    // set up GUI and register button listeners
13    public FlowLayoutDemo()
14    {
15       super( "FlowLayout Demo" );
16
17       layout = new FlowLayout();
18
19       // get content pane and set its layout
20       container = getContentPane();
21       container.setLayout( layout );
22
23       // set up leftButton and register listener
24       leftButton = new JButton( "Left" );
25       container.add( leftButton );
```

Set layout as FlowLayout



Outline

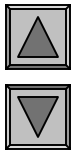
FlowLayoutDemo.java

Line 33

```
26       leftButton.addActionListener(
27
28          new ActionListener() {  // anonymous inner class
29
30             // process leftButton event
31             public void actionPerformed( ActionEvent event )
32             {
33                layout.setAlignment( FlowLayout.LEFT );
34
35                // realign attached components
36                layout.layoutContainer( container );
37             }
38
39          } // end anonymous inner class
40
41       ); // end call to addActionListener
42
43       // set up centerButton and register listener
44       centerButton = new JButton( "Center" );
45       container.add( centerButton );
46       centerButton.addActionListener(
47
48          new ActionListener() {  // anonymous inner class
49
50             // process centerButton event
51             public void actionPerformed( ActionEvent event )
52             {
53                layout.setAlignment( FlowLayout.CENTER );
54
```

When user presses left `JButton`, left align components

When user presses center `JButton`, center components



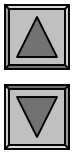
Outline

FlowLayoutDemo.java

Line 71

```
55                // realign attached components
56                layout.layoutContainer( container );
57             }
58          }
59       );
60
61       // set up rightButton and register listener
62       rightButton = new JButton( "Right" );
63       container.add( rightButton );
64       rightButton.addActionListener(
65
66          new ActionListener() {  // anonymous inner class
67
68             // process rightButton event
69             public void actionPerformed( ActionEvent event )
70             {
71                layout.setAlignment( FlowLayout.RIGHT );
72
73                // realign attached components
74                layout.layoutContainer( container );
75             }
76          }
77       );
78
79       setSize( 300, 75 );
80       setVisible( true );
```

When user presses right `JButton`, right components



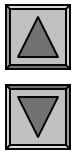
Outline

FlowLayoutDemo.java

```
81
82    } // end constructor FlowLayoutDemo
83
84    public static void main( String args[] )
85    {
86       FlowLayoutDemo application = new FlowLayoutDemo();
87       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
88    }
89
90 } // end class FlowLayoutDemo
```

13.15.2 BorderLayout

- BorderLayout
  - Arranges components into five regions
    - NORTH (top of container)
    - SOUTH (bottom of container)
    - EAST (left of container)
    - WEST (right of container)
    - CENTER (center of container)



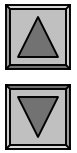
Outline

BorderLayoutDemo.java

Lines 18 and 22

```
1  // Fig. 13.25: BorderLayoutDemo.java
2  // Demonstrating BorderLayout.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class BorderLayoutDemo extends JFrame implements ActionListener {
8     private JButton buttons[];
9     private final String names[] = { "Hide North", "Hide South",
10       "Hide East", "Hide West", "Hide Center" };
11    private BorderLayout layout;
12
13    // set up GUI and event handling
14    public BorderLayoutDemo()
15    {
16       super( "BorderLayout Demo" );
17
18       layout = new BorderLayout( 5, 5 ); // 5 pixel gaps
19
20       // get content pane and set its layout
21       Container container = getContentPane();
22       container.setLayout( layout );
23
24       // instantiate button objects
25       buttons = new JButton[ names.length ];
26
```

Set layout as `BorderLayout` with 5-pixel horizontal and vertical gaps



Outline

BorderLayoutDemo.java

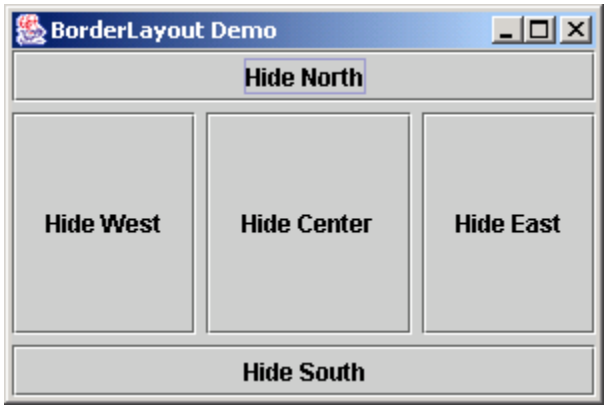
```
27       for ( int count = 0; count < names.length; count++ ) {
28          buttons[ count ] = new JButton( names[ count ] );
29          buttons[ count ].addActionListener( this );
30       }
31
32       // place buttons in BorderLayout; order not important
33       container.add( buttons[ 0 ], BorderLayout.NORTH );
34       container.add( buttons[ 1 ], BorderLayout.SOUTH );
35       container.add( buttons[ 2 ], BorderLayout.EAST );
36       container.add( buttons[ 3 ], BorderLayout.WEST );
37       container.add( buttons[ 4 ], BorderLayout.CENTER );
38
39       setSize( 300, 200 );
40       setVisible( true );
41
42    } // end constructor BorderLayoutDemo
43
44    // handle button events
45    public void actionPerformed( ActionEvent event )
46    {
47       for ( int count = 0; count < buttons.length; count++ )
48
49          if ( event.getSource() == buttons[ count ] )
50             buttons[ count ].setVisible( false );
51          else
52             buttons[ count ].setVisible( true );
```

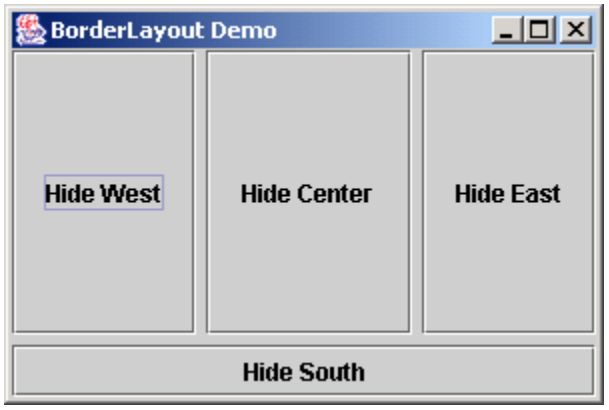
Place `JButton`s in regions specified by `BorderLayout`

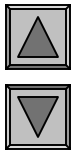
Lines 50 and 52

When `JButton`s are "invisible," they are not displayed on screen, and `BorderLayout` rearranges

```
53
54          // re-layout the content pane
55          layout.layoutContainer( getContentPane() );
56       }
57
58       public static void main( String args[] )
59       {
60          BorderLayoutDemo application = new BorderLayoutDemo();
61          application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
62       }
63
64    } // end class BorderLayoutDemo
```

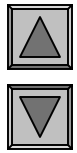






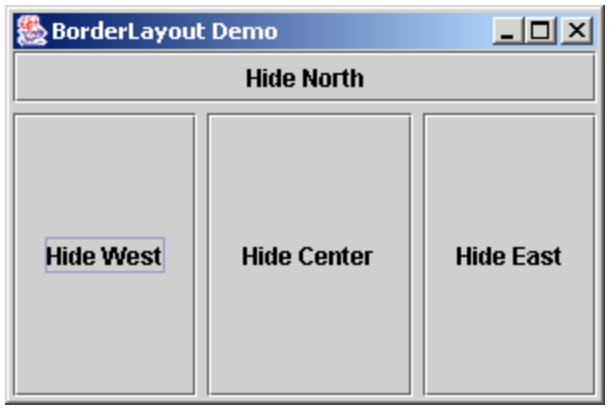
Outline

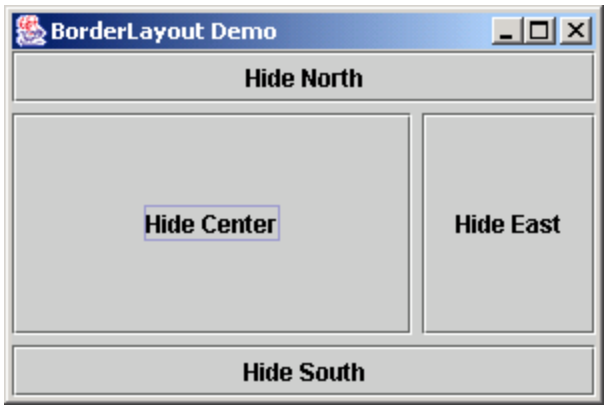
BorderLayoutDemo.java

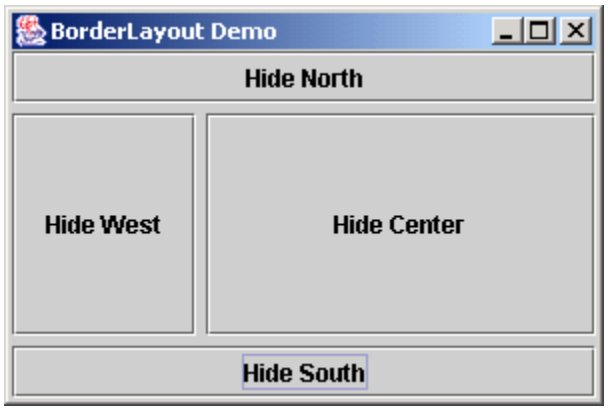


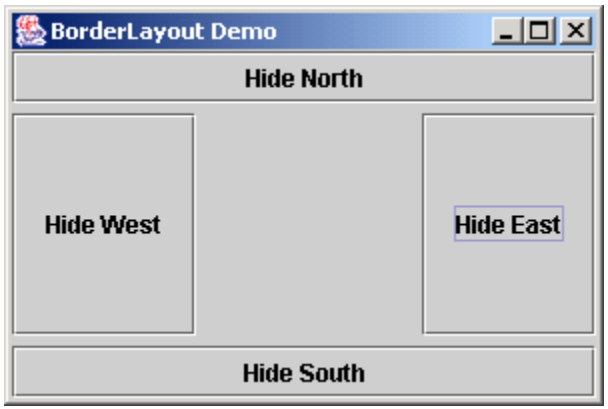
Outline

BorderLayoutDemo.java



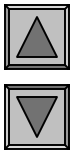






13.15.3 GridLayout

- GridLayout
  - Divides container into grid of specified row an columns
  - Components are added starting at top-left cell
    - Proceed left-to-fight until row is full



Outline

GridLayoutDemo.java

Line 21

Line 22

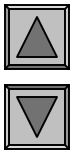
```
1  // Fig. 13.26: GridLayoutDemo.java
2  // Demonstrating GridLayout.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class GridLayoutDemo extends JFrame implements ActionListener {
8     private JButton buttons[];
9     private final String names[] =
10       { "one", "two", "three", "four", "five", "six" };
11    private boolean toggle = true;
12    private Container container;
13    private GridLayout grid1, grid2;
14
15    // set up GUI
16    public GridLayoutDemo()
17    {
18       super( "GridLayout Demo" );
19
20       // set up layouts
21       grid1 = new GridLayout( 2, 3, 5, 5 );
22       grid2 = new GridLayout( 3, 2 );
23
24       // get content pane and set its layout
25       container = getContentPane();
26       container.setLayout( grid1 );
```

Create `GridLayout grid1` with 2 rows and 3 columns

Create `GridLayout grid2` with 3 rows and 2 columns

```
27
28       // create and add buttons
29       buttons = new JButton[ names.length ];
30
31       for ( int count = 0; count < names.length; count++ ) {
32          buttons[ count ] = new JButton( names[ count ] );
33          buttons[ count ].addActionListener( this );
34          container.add( buttons[ count ] );
35       }
36
37       setSize( 300, 150 );
38       setVisible( true );
39
40    } // end constructor GridLayoutDemo
41
42    // handle button events by toggling between layouts
43    public void actionPerformed( ActionEvent event )
44    {
45       if ( toggle )
46          container.setLayout( grid2 );
47       else
48          container.setLayout( grid1 );
49
50       toggle = !toggle;   // set toggle to opposite value
51       container.validate();
52    }
```

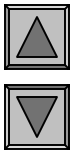
Toggle current `GridLayout` when user presses `JButton`



Outline

`GridLayoutDemo.java`

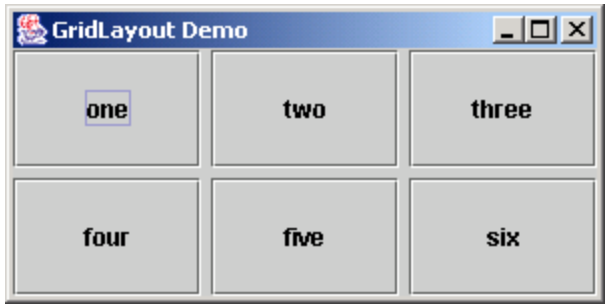
Lines 46 and 48

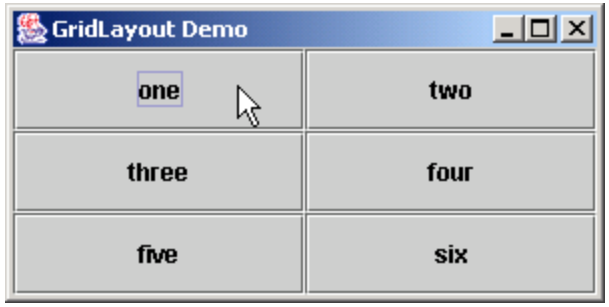


Outline

GridLayoutDemo.java

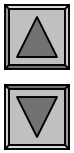
```
53
54    public static void main( String args[] )
55    {
56       GridLayoutDemo application = new GridLayoutDemo();
57       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
58    }
59
60 } // end class GridLayoutDemo
```





13.16 Panels

- Panel
  - Helps organize components
  - Class `JPanel` is `JComponent` subclass
  - May have components (and other panels) added to them



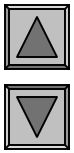
Outline

PanelDemo.java

Line 23

```
1  // Fig. 13.27: PanelDemo.java
2  // Using a JPanel to help lay out components.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class PanelDemo extends JFrame {
8     private JPanel buttonPanel;
9     private JButton buttons[];
10
11    // set up GUI
12    public PanelDemo()
13    {
14       super( "Panel Demo" );
15
16       // get content pane
17       Container container = getContentPane();
18
19       // create buttons array
20       buttons = new JButton[ 5 ];
21
22       // set up panel and set its layout
23       buttonPanel = new JPanel();
24       buttonPanel.setLayout( new GridLayout( 1, buttons.length ) );
25
```

Create `JPanel` to hold `JButtons`



Outline

```
26        // create and add buttons
27        for ( int count = 0; count < buttons.length; count++ ) {
28           buttons[ count ] = new JButton( "Button " + ( count + 1 ) );
29           buttonPanel.add( buttons[ count ] );
30        }
31
32        container.add( buttonPanel, BorderLayout.SOUTH );
33
34        setSize( 425, 150 );
35        setVisible( true );
36
37     } // end constructor PanelDemo
38
39     public static void main( String args[] )
40     {
41        PanelDemo application = new PanelDemo();
42        application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
43     }
44
45  } // end class PanelDemo
```

Add `JButton`s to `JPanel`

Add `JPanel` to `SOUTH` region of `Container`