Basic Swing
GUI Controls in Java 2

Agenda

• New features
• Basic approach
• Summary of Swing components
  – Starting points
    • JApplet, JFrame
  – Swing equivalent of AWT components
    • JLabel, JButton, JPanel, JSlider
  – New Swing components
    • JColorChooser, JInternalFrame, JOptionPane, JToolBar, JEditorPane
  – Other simple components
    • JCheckBox, JRadioButton, JTextField, JTextArea, JFileChooser
New Features

• Many more built-in controls
  – Image buttons, tabbed panes, sliders, toolbars, color
    choosers, HTML text areas, lists, trees, and tables.

• Increased customization of components
  – Border styles, text alignments, and basic drawing
    features. Images can be added to almost any control.

• A pluggable “look and feel”
  – Not limited to “native” look.

• Many miscellaneous small features
  – Built-in double buffering, tool-tips, dockable toolbars,
    keyboard accelerators, custom cursors, etc.

• Model-view-controller architecture
  – Can change internal representation of trees, lists, tables.

Swing vs. AWT Programming

• Naming convention
  – All Swing component names begin with a capital J and
    follow the format JXxx. E.g., JFrame, JPanel, JApplet,
    JDialog, JButton. Many are just AWT names with a J.

• Lightweight components
  – Most Swing components are lightweight: formed by
    drawing in the underlying window.

• Use of paintComponent for drawing
  – Custom drawing code is in paintComponent, not paint.
    Double buffering turned on by default.

• New Look and Feel as default
  – With Swing, you have to explicitly set the native look.

• Don’t mix Swing and AWT in same window
## Windows Look and Feel

### Table Demo

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Favorite Color</th>
<th>Favorite Movie</th>
<th>Favorite Number</th>
<th>Favorite Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike</td>
<td>Albers</td>
<td>Green</td>
<td>Brazil</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Mark</td>
<td>Andrews</td>
<td>Blue</td>
<td>Curse of the Demon</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Brian</td>
<td>Beck</td>
<td>Black</td>
<td>The Blues Brothers</td>
<td>2,718</td>
<td></td>
</tr>
<tr>
<td>Lara</td>
<td>Buni</td>
<td>Red</td>
<td>Airplane (the whole series)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Roger</td>
<td>Brinkley</td>
<td>Blue</td>
<td>The Man Who Knew Too Much</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Brent</td>
<td>Christian</td>
<td>Black</td>
<td>Blade Runner (Director's Cut)</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Mark</td>
<td>Davidson</td>
<td>Dark Green</td>
<td>Brazil</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Jeff</td>
<td>Drinkin</td>
<td>Blue</td>
<td>The Lady Vanishes</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Ewan</td>
<td>Drinkin</td>
<td>Yellow</td>
<td>A Bug's Life</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Ewan</td>
<td>Fowler</td>
<td>Green</td>
<td>Reservoir Dogs</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

## Motif Look and Feel

### Table Demo

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Favorite Color</th>
<th>Favorite Movie</th>
<th>Favorite Number</th>
<th>Favorite Food</th>
</tr>
</thead>
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<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Java Look and Feel

Setting Native Look and Feel

- Most applications should use native look, not default “Java” look
- Changing is tedious, so use static method

```java
public class WindowUtilities {
    public static void setNativeLookAndFeel() {
        try {
            UIManager.setLookAndFeel(
                UIManager.getSystemLookAndFeelClassName());
        } catch (Exception e) {
            System.out.println("Error setting native LAF: " + e);
        }
    }
}
```
Whirlwind Tour of Basic Components

- **Starting points**
  - JApplet, JFrame

- **Swing equivalent of AWT components**
  - JLabel, JButton, JPanel, JSlider

- **New Swing components**
  - JColorChooser, JInternalFrame, JOptionPane, JToolBar, JEditorPane

- **Other simple components**
  - JCheckBox, JRadioButton, JTextField, JTextArea, JFileChooser

Starting Point 1: JApplet

- **Content pane**
  - A JApplet contains a content pane in which to add components. Changing other properties like the layout manager, background color, etc., also applies to the content pane. Access the content pane through getContentPane.

- **Layout manager**
  - The default layout manager is BorderLayout (as with Frame and JFrame), not FlowLayout (as with Applet). BorderLayout is really layout manager of content pane.

- **Look and feel**
  - The default look and feel is Java (Metal), so you have to explicitly switch the look and feel if you want the native look.
import java.awt.*;
import javax.swing.*;

public class JAppletExample extends JApplet {
    public void init() {
        WindowUtilities.setNativeLookAndFeel();
        Container content = getContentPane();
        content.setBackground(Color.white);
        content.setLayout(new FlowLayout());
        content.add(new JButton("Button 1"));
        content.add(new JButton("Button 2"));
        content.add(new JButton("Button 3"));
    }
}

JApplet: Example Output

![JApplet Example Output](image-url)
Starting Point 2: JFrame

• **Content pane**
  – JFrame uses content pane in same way as does JApplet.

• **Auto-close behavior**
  – JFrames close automatically when you click on the Close button (unlike AWT Frames). However, closing the last JFrame does not result in your program exiting the Java application. So, your “main” JFrame still needs a WindowListener to call System.exit. Or, alternatively, if using JDK 1.3 or later, you can call setDefaultCloseOperation(EXIT_ON_CLOSE). This permits the JFrame to close; however, you won’t be able to complete any house cleaning as you might in the WindowListener.

• **Look and feel**
  – The default look and feel is Java (Metal)

### JFrame: Example Code

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

public class JFrameExample {
    public static void main(String[] args) {
        WindowUtilities.setNativeLookAndFeel();
        JFrame f = new JFrame("This is a test");
        f.setSize(400, 150);
        Container content = f.getContentPane();
        content.setBackground(Color.white);
        content.setLayout(new FlowLayout());
        content.add(new JButton("Button 1"));
        content.add(new JButton("Button 2"));
        content.add(new JButton("Button 3"));
        f.addWindowListener(new ExitListener());
        f.setVisible(true);
    }
}
```
import java.awt.*;
import java.awt.event.*;

public class ExitListener extends WindowAdapter {
    public void windowClosing(WindowEvent event) {
        System.exit(0);
    }
}

JFrame: Example Output

This is a test

Button 1

Button 2

Button 3
Swing Equivalents of AWT Components

- **JLabel**
  - New features: HTML content images, borders
- **JButton**
  - New features: icons, alignment, mnemonics
- **JPanel**
  - New feature: borders
- **JSlider**
  - New features: tick marks and labels

**JLabel**

- **Main new feature: HTML content**
  - If text is "<html>...</html>", it gets rendered as HTML
  - HTML labels only work in JDK 1.2.2 or later, or in Swing 1.1.1 or later.
  - In JDK 1.2 the label string must begin with <html>, not <HTML>. It is case-insensitive in JDK 1.3 and 1.4.
  - JLabel fonts are ignored if HTML is used. If you use HTML, all font control must be performed by HTML.
  - You must use <P>, not <BR>, to force a line break.
  - Other HTML support is spotty.
    - Be sure to test each HTML construct you use. Permitting the user to enter HTML text at runtime is asking for trouble.
- **Other new features: images, borders**
JLabel: Example Code

String labelText =
  "<html><FONT COLOR=WHITE>WHITE</FONT> and " +
  "<FONT COLOR=GRAY>GRAY</FONT> Text</html>";
JLabel coloredLabel =
    new JLabel(labelText, JLabel.CENTER);
...
labelText =
  "<html><B>Bold</B> and <I>Italic</I> Text</html>";
JLabel boldLabel =
    new JLabel(labelText, JLabel.CENTER);
labelText =
  "<html>The Applied Physics Laboratory is..." +
  "of the Johns Hopkins University." +
  "<P>" + ... "...</html>";

JLabel: Example Output

The Applied Physics Laboratory is a division of the Johns Hopkins University. Major JHU divisions include:

- The Applied Physics Laboratory
- The Krieger School of Arts and Sciences
- The Whiting School of Engineering
- The School of Medicine
- The School of Public Health
- The School of Nursing
- The Peabody Institute
- The Nina School of Advanced International Studies
**JButton**

- **Main new feature: icons**
  1. Create an ImageIcon by passing the ImageIcon constructor a String representing a GIF or JPG file (animated GIFs are supported!).
     - From an applet, call `getImage(getCodeBase()...)` normally, then pass resultant image to ImageIcon.
  2. Pass the ImageIcon to the JButton constructor.
     - Alternatively, call `setIcon`. In fact, there are 7 possible images (rollover images, images for when button is depressed, etc.)

- **Other features**
  - HTML content as with JLabel
  - Alignment: location of image with respect to text
  - Mnemonics: keyboard accelerators that let you use Alt-someChar to trigger the button.

---

### JButton: Example Code

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

public class JButtons extends JFrame {
    public static void main(String[] args) {
        new JButtons();
    }

    public JButtons() {
        super("Using JButton");
        WindowUtilities.setNativeLookAndFeel();
        addWindowListener(new ExitListener());
        Container content = getContentPane();
        content.setBackground(Color.white);
        content.setLayout(new FlowLayout());
    }
}
```
### JButton: Example Code (Continued)

```java
JButton button1 = new JButton("Java");
content.add(button1);
ImageIcon cup = new ImageIcon("images/cup.gif");
JButton button2 = new JButton(cup);
content.add(button2);
JButton button3 = new JButton("Java", cup);
content.add(button3);
JButton button4 = new JButton("Java", cup);
button4.setHorizontalTextPosition(SwingConstants.LEFT);
content.add(button4);
pack();
setVisible(true);
```

### JButton: Example Output

![Example Output](image)
### JPanel

- **Main new feature: borders**
  - Create a Border object by calling `BorderFactory.createXxxBorder`.
  - Supply the Border object to the JPanel by means of `setBorder`.

```java
JPanel p = new JPanel();
p.setBorder(BorderFactory.createTitledBorder("Java"));
```

- **Other features:**
  - Layout manager settings
    - Can pass the layout manager to the JPanel constructor
  - Setting preferred size
    - There is no JCanvas. If you want JPanel to act like Canvas, call `setPreferredSize`.

### Standard Borders

- **Static methods in BorderFactory**
  - `createEmptyBorder(int top, int left, int bottom, int right)`
    - Creates an EmptyBorder object that simply adds space (margins) around the component.
  - `createLineBorder(Color color)`
  - `createLineBorder(Color color, int thickness)`
    - Creates a solid-color border
  - `createTitledBorder(String title)`
  - `createTitledBorder(Border border, String title)`
    - The border is an etched line unless you explicitly provide a border style in second constructor.
  - `createEtchedBorder()`
  - `createEtchedBorder(Color highlight, Color shadow)`
    - Creates a etched line without the label.
**JPanel: Example Code**

```java
public class SixChoicePanel extends JPanel {
    public SixChoicePanel(String title, String[] buttonLabels) {
        super(new GridLayout(3, 2));
        setBackground(Color.lightGray);
        setBorder(BorderFactory.createTitledBorder(title));
        ButtonGroup group = new ButtonGroup();
        JRadioButton option;
        int halfLength = buttonLabels.length/2;
        for(int i=0; i<halfLength; i++) {
            option = new JRadioButton(buttonLabels[i]);
            group.add(option);
            add(option);
            option = new JRadioButton(buttonLabels[i+halfLength]);
            group.add(option);
            add(option);
        }
    }
}
```

**JPanel: Example Output**

- Left window uses createLineBorder
- Right window has three SixChoicePanels
JSlider

• Basic use
  – public JSlider()
  – public JSlider(int orientation)
  – public JSlider(int min, int max)
  – public JSlider(int min, int max, int initialValue)
  – public JSlider(int orientation, int min, int max, int initialValue)

• New features: tick marks and labels
  – setMajorTickSpacing
  – setMinorTickSpacing
  – setPaintTicks
  – setPaintLabels (icons allowed as labels)

JSlider: Example Code

JSlider slider1 = new JSlider();
slider1.setBorder(...);
content.add(slider1, BorderLayout.NORTH);
JSlider slider2 = new JSlider();
slider2.setBorder(...);
slider2.setMajorTickSpacing(20);
slider2.setMinorTickSpacing(5);
slider2.setPaintTicks(true);
content.add(slider2, BorderLayout.CENTER);
JSlider slider3 = new JSlider();
slider3.setBorder(...);
slider3.setMajorTickSpacing(20);
slider3.setMinorTickSpacing(5);
slider3.setPaintTicks(true);
slider3.setPaintLabels(true);
content.add(slider3, BorderLayout.SOUTH);
JSlider: Example Output (Windows, Motif, Java LAF)

JColorChooser

- **Open**
  - Call JColorChooser.showDialog
    - First argument: parent component
    - Second argument: title string
    - Third argument: initially-selected Color

- **Return value**
  - Selected Color if "OK" chosen
  - null if "Cancel" chosen
JColorChooser: Example Code

- Button that lets you change color of window

```java
public void actionPerformed(ActionEvent e) {
    Color bgColor = JColorChooser.showDialog
        (this,
         "Choose Background Color",
         getBackground());
    if (bgColor != null)
        getContentPane().setBackground(bgColor);
}
```

JColorChooser: Example Output
Internal Frames

• **MDI: Multiple Document Interface**
  – Program has one large “desktop” pane that holds all other windows. The other windows can be iconified (minimized) and moved around within this desktop pane, but not moved outside the pane. Furthermore, minimizing the desktop pane hides all the contained windows as well.
  – Examples: Microsoft PowerPoint, Corel Draw, Borland JBuilder, and Allaire HomeSite

• **Swing Support for MDI**
  – JDesktopPane
    • Serves as a holder for the other windows.
  – JInternalFrame
    • Acts mostly like a JFrame, except that it is constrained to stay inside the JDesktopPane.

Using JInternalFrame

• **Main constructor**
  – public JInternalFrame(String title, boolean resizable, boolean closeable, boolean maximizable, boolean iconifiable)

• **Other useful methods**
  – moveToFront
  – moveToBack
  – setSize (required!)
  – setLocation (required!)
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;

public class JInternalFrames extends JFrame {
    public static void main(String[] args) {
        new JInternalFrames();
    }

    public JInternalFrames() {
        super("Multiple Document Interface");
        WindowUtilities.setNativeLookAndFeel();
        addWindowListener(new ExitListener());
        Container content = getContentPane();
        content.setBackground(Color.white);
        JDesktopPane desktop = new JDesktopPane();
        desktop.setBackground(Color.white);
        content.add(desktop, BorderLayout.CENTER);
        setSize(450, 400);
        for(int i=0; i<5; i++) {
            JInternalFrame frame = new JInternalFrame("Internal Frame " + i),
                            true, true, true, true);
            frame.setLocation(i*50+10, i*50+10);
            frame.setSize(200, 150);
            frame.setBackground(Color.white);
            frame.setVisible(true);
            desktop.add(frame);
            frame.moveToFront();
        }
        setVisible(true);
    }
}
Internal Frames: Example Output

![Diagram of Internal Frames]

JOptionPane

- Very rich class with many options for different types of dialog boxes.
- Five main static methods
  - `JOptionPane.showMessageDialog`
    - Icon, message, OK button
  - `JOptionPane.showConfirmDialog`
    - Icon, message, and buttons: OK, OK/Cancel, Yes/No, or Yes/No/Cancel
  - `JOptionPane.showInputDialog` (2 versions)
    - Icon, message, textfield or combo box, buttons
  - `JOptionPane.showOptionDialog`
    - Icon, message, array of buttons or other components
JOptionPane Message Dialogs (Windows LAF)

- INFORMATION_MESSAGE Icon: OK
- QUESTION_MESSAGE Icon: OK
- WARNING_MESSAGE Icon: OK
- ERROR_MESSAGE Icon: OK

JOptionPane Confirmation Dialogs (Java LAF)

- DEFAULT_OPTION: OK
- OK_CANCEL_OPTION: OK, Cancel
- YES_NO_OPTION: Yes, No
- YES_NO_CANCEL_OPTION: Yes, No, Cancel
JToolBar

- Acts mostly like a JPanel for buttons
- Dockable: can be dragged and dropped

JEditorPane

- Acts somewhat like a text area
- Can display HTML and, if HyperLinkListener attached, can follow links
Other Simple Swing Components

- **JCheckBox**
  - Note uppercase B (vs. Checkbox in AWT)

- **JRadioButton**
  - Use a ButtonGroup to link radio buttons

- **JTextField**
  - Just like AWT TextField except that it does not act as a password field (use JPasswordField for that)

- **JTextArea**
  - Place in JScrollPane if you want scrolling

- **JFileChooser**

Summary

- **Port simple AWT components by adding J to front of class name**
- **Put custom drawing in paintComponent**
  - Call super.paintComponent at beginning unless you turn off double buffering
- **Java look and feel is default**
  - But you almost always want native look and feel
- **Frames and applets use content pane**
  - Don't put anything directly in window
- **Most components support borders & icons**
- **Many new components**
Questions?