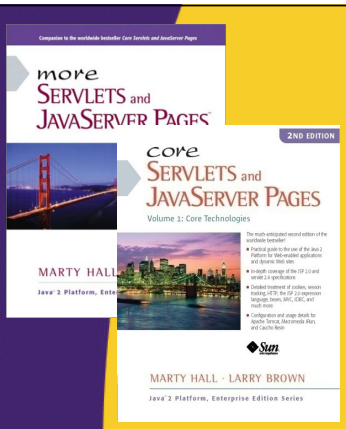
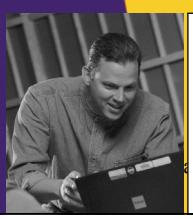
Basic Swing

Better GUI Controls

Originals of Slides and Source Code for Examples:
http://courses.coreservlets.com/Course-Materials/java.html





Topics in This Section

- **New features**
  - Vs. AWT
- **Basic approach**
- **Summary of Swing components**
  - Starting points
    - JApplet, JFrame
  - Swing equivalent of AWT components
    - JLabel, JButton, JPanel, JSlider
  - Swing components that have no AWT equivalent
    - JColorChooser, JInternalFrame, JOptionPane, JToolBar, JEditorPane
  - Other simple components
    - JCheckBox, JRadioButton, JTextField, JTextArea, JFileChooser

Overview

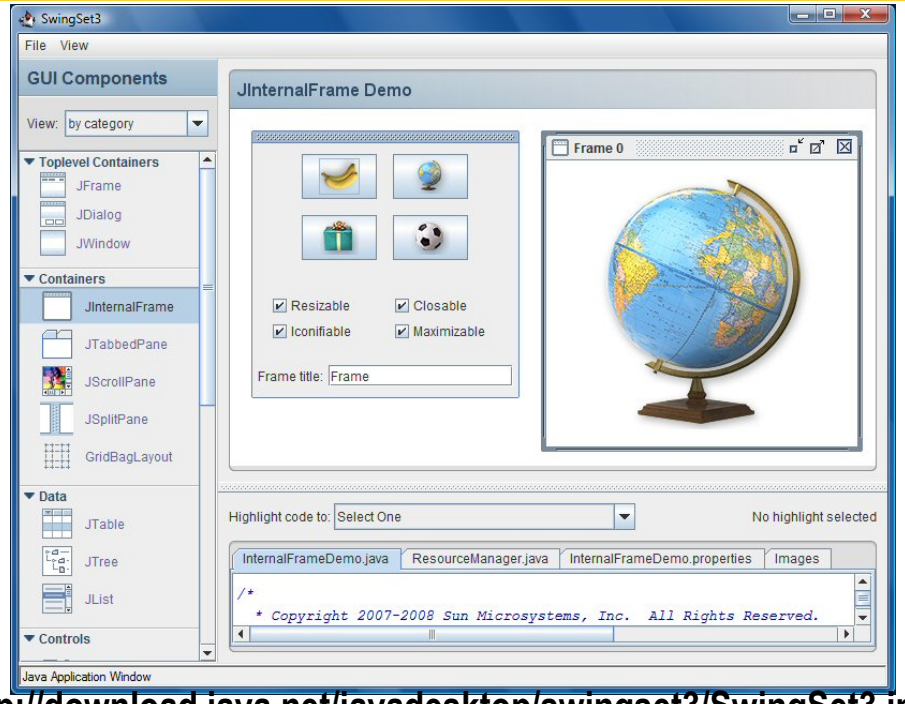
New Features vs AWT

- **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

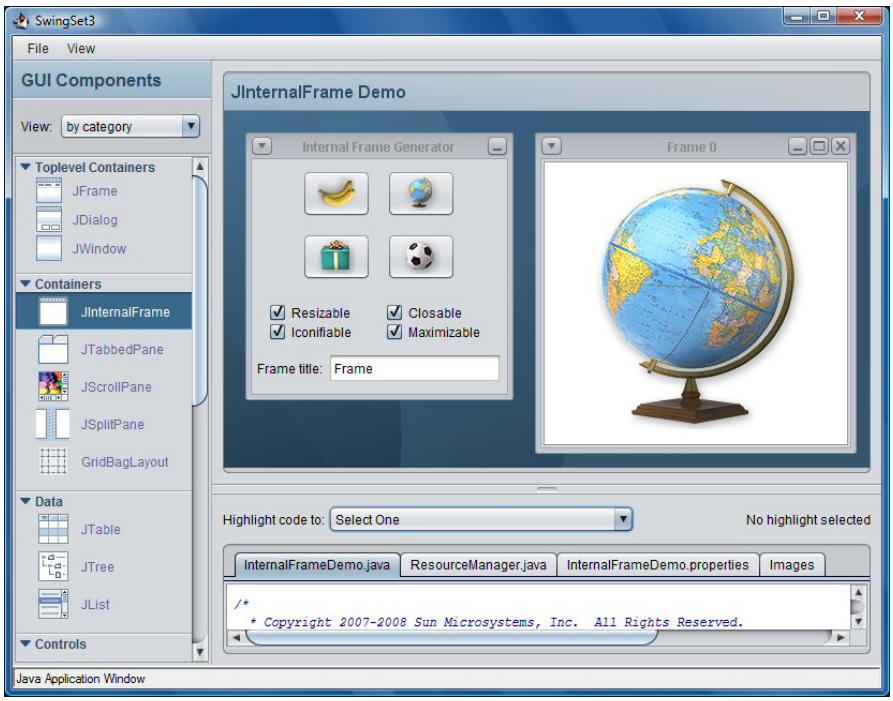
- **Naming convention**
  - All Swing component names begin with a capital J and follow the format J*Xxx*. E.g., JFrame, JPanel, JApplet, JDialog, JButton. Many are just AWT names with a J.
- **Lightweight components**
  - Most Swing components are *lightweight*: formed by drawing in the underlying window.
- **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**

Classic Java Look and Feel (Metal)

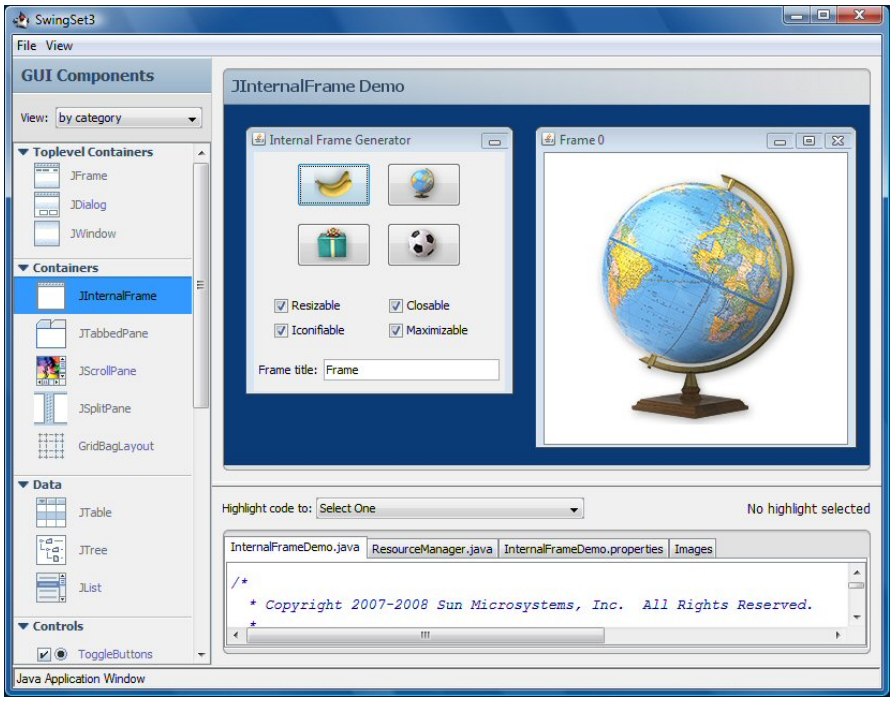


http://download.java.net/javadesktop/swingset3/SwingSet3.jnlp

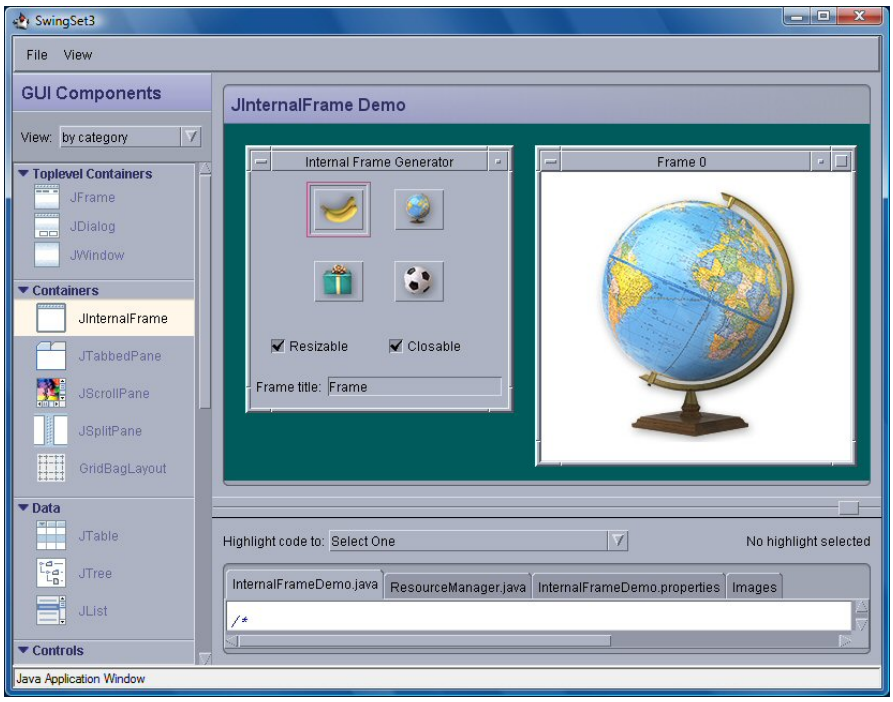
New Java Look and Feel (Nimbus – JDK 1.6.0_10)



Windows Look and Feel



CDE/Motif Look and Feel



Setting Native Look and Feel

- **Idea**
  - Many apps use native look, not default "Java" look
  - Changing is tedious, so use static method

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


Nimbus Look and Feel

- **New**
  - Introduced in JDK 1.6.0_10
- **Motivations**
  - Original Java LAF a bit dull compared to modern interfaces
  - Windows LAF not updated to be consistent with Vista and Aero
  - Other LAFs did not scale well
    - Nimbus based on vector graphics
- **Be portable**
  - Stick with original Java LAF if Nimbus is unavailable
- **More info**
  - http://developers.sun.com/learning/javaoneonline/2008/pdf/TS-6096.pdf

Setting Nimbus Look and Feel

```
public static void setNimbusLookAndFeel() {
  try {
    LookAndFeelInfo[] lafs =
      UIManager.getInstalledLookAndFeels();
    for (LookAndFeelInfo laf: lafs) {
      if ("Nimbus".equals(laf.getName())) {
        UIManager.setLookAndFeel(laf.getClassName());
      }
    }
  } catch(Exception e) {
    System.out.println("Error setting Nimbus 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

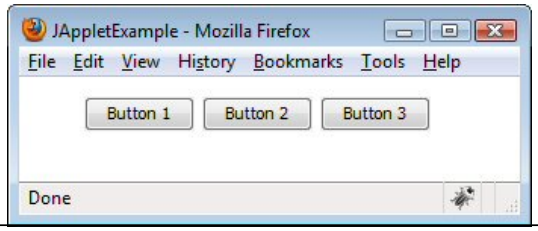
Starting Windows: JApplet and JFrame

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, so you have to explicitly switch if you want the native look and feel.

JApplet: Example Code

```
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"));
  }
}
```



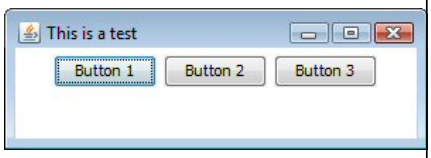
WindowUtilities is a class I wrote: download it from the Web site.
The code for setNativeLookAndFeel was shown on an earlier slide.

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. To get this behavior, 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. So, you can still use an explicit exit listener as we did with Frame.
- **Look and feel**
  - The default look and feel is Java (Metal)

JFrame: Example Code

```
public class JFrameExample extends JFrame {
  public static void main(String[] args) {
    JFrame frame = new JFrameExample("This is a test");
    frame.setVisible(true);
  }

  public JFrameExample(String title) {
    super(title);
    WindowUtilities.setNativeLookAndFeel();
    setSize(300, 100);
    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"));
    setDefaultCloseOperation(EXIT_ON_CLOSE);
  }
}
```



New Features of Swing Components (vs. AWT)

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

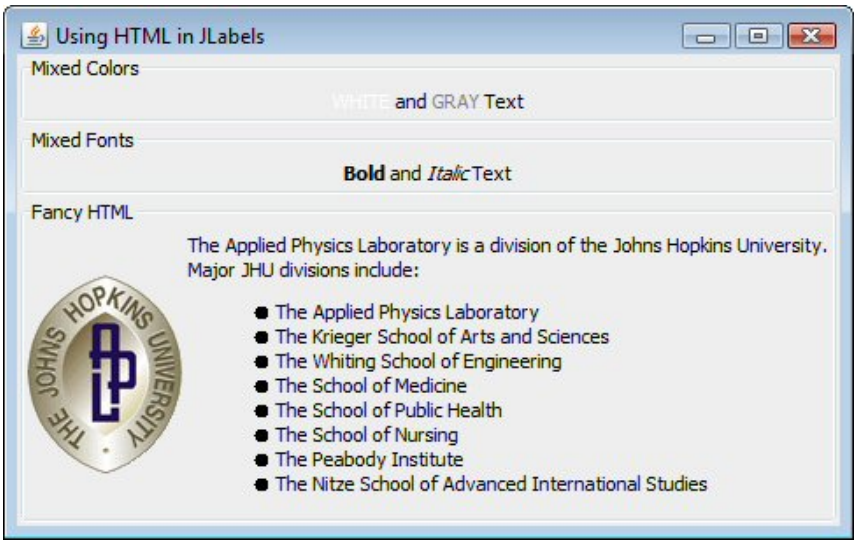
JLabel

- **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
, 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



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

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

public class JButtons extends JFrame {
  public static void main(String[] args) {
    JFrame frame = new JButtons();
    frame.setVisible(true);
  }

  public JButtons() {
    super("Using JButton");
    WindowUtilities.setNativeLookAndFeel();
    setDefaultCloseOperation(EXIT_ON_CLOSE);
    Container content = getContentPane();
    content.setBackground(Color.WHITE);
    content.setLayout(new FlowLayout());
```

JButton: Example Code (Continued)

```
    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();
  }
}
```

JPanel

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

```
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

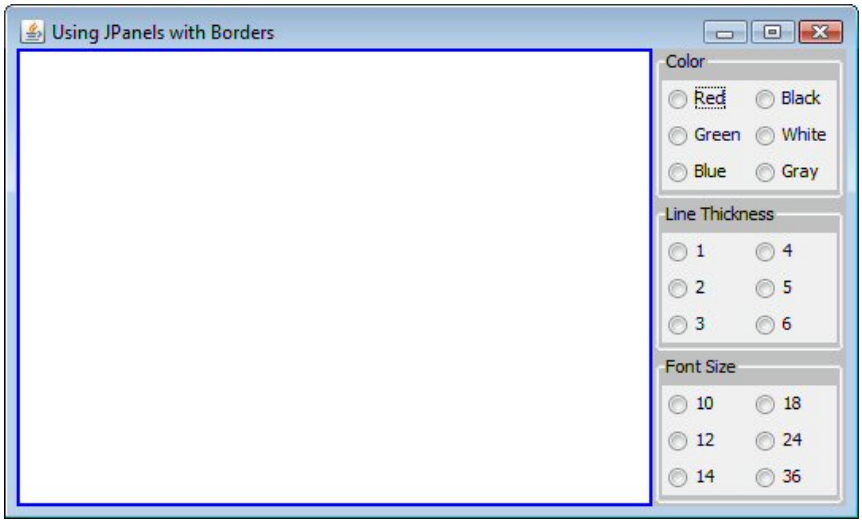
- **Static methods in BorderFactory**
  - createEmptyBorder(int top, int left, int bottom, int right)
    - Creates an EmptyBorder object that simply adds space (margins) around the component.
  - createLineBorder(Color color)
  - createLineBorder(Color color, int thickness)
    - Creates a solid-color 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

```
public class SixChoicePanel extends JPanel {
  public SixChoicePanel(String title, String[] buttonLabels)
   {
     super(new GridLayout(3, 2));
     setBackground(Color.LIGHT_GRAY);
     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**

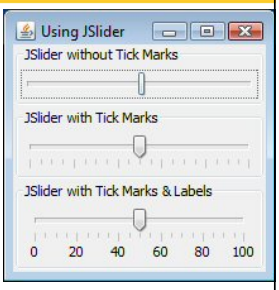


JSlider

- **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);
```



Swing Components that Were Not in AWT

JColorChooser

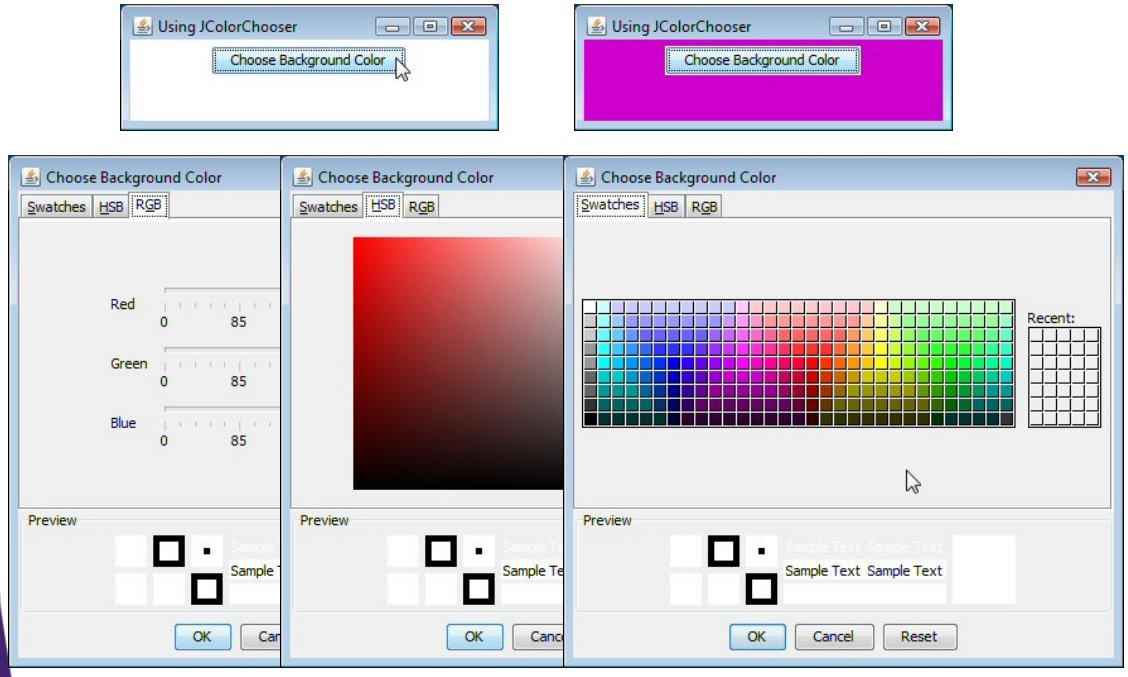
- **Open**
  - Call JColorChooser.showDialog
    - First argument: parent component
    - Second argument: title string
    - Third argument: initially-selected Color
- **Return value**
  - Selected Color if "OK" chosen
  - null if "Cancel" chosen

JColorChooser: Example Code

- **Button that lets you change color of window**

```
public void actionPerformed(ActionEvent e) {
  Color bgColor
    = JColorChooser.showDialog
                (this,
                 "Choose Background Color",
                 getContentPane().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!)

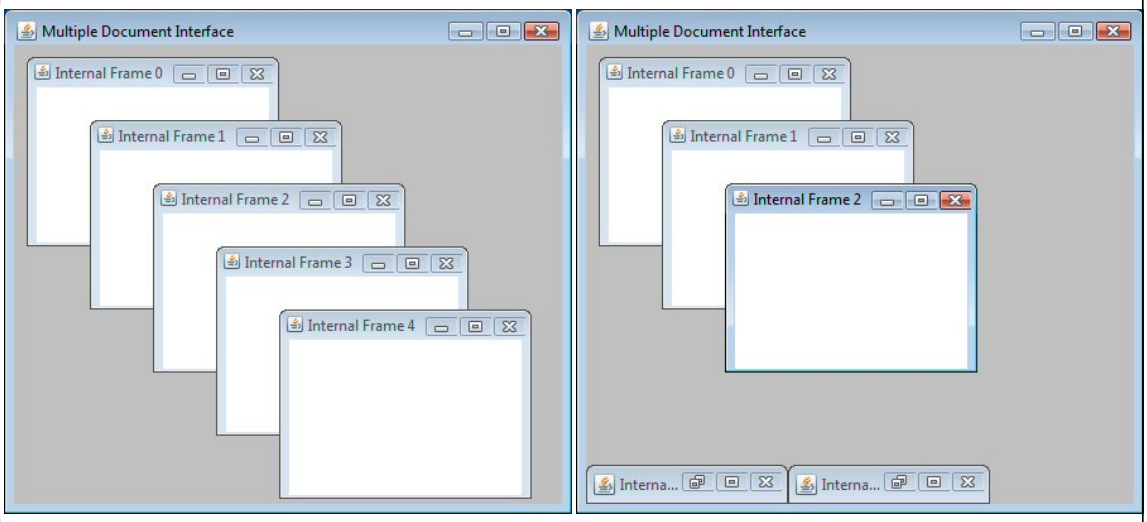
Internal Frames: Example Code

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

public class JInternalFrames extends JFrame {
  public static void main(String[] args) {
    JFrame frame = new JInternalFrames();
    frame.setVisible(true);
  }

  public JInternalFrames() {
    super("Multiple Document Interface");
    WindowUtilities.setNativeLookAndFeel();
    setDefaultCloseOperation(EXIT_ON_CLOSE);
    Container content = getContentPane();
```

Internal Frames: Example Code (Continued)

```
    JDesktopPane desktop = new JDesktopPane();
    desktop.setBackground(Color.LIGHT_GRAY);
    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);
      desktop.add(frame);
      frame.moveToFront();
      frame.setVisible(true);
    }
  }
}
```

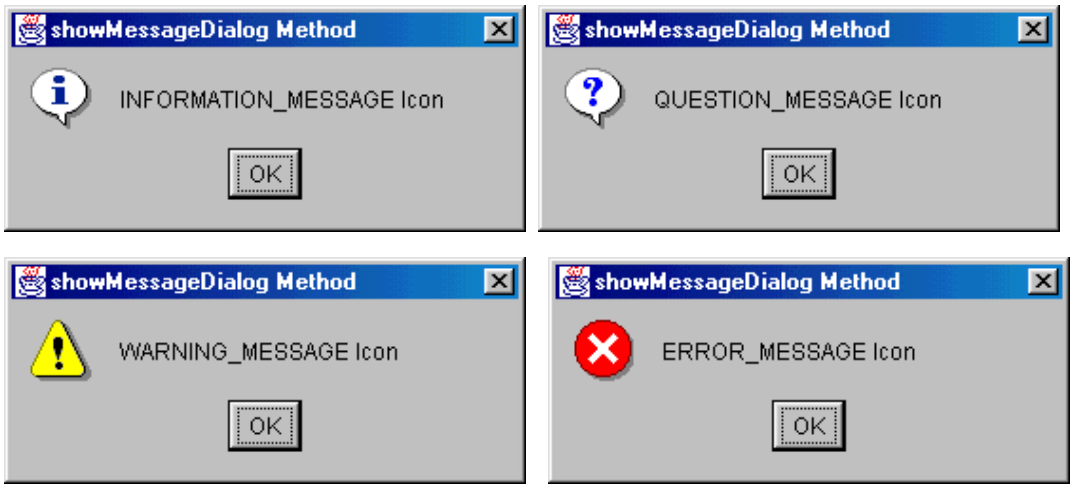

Internal Frames: Example Output



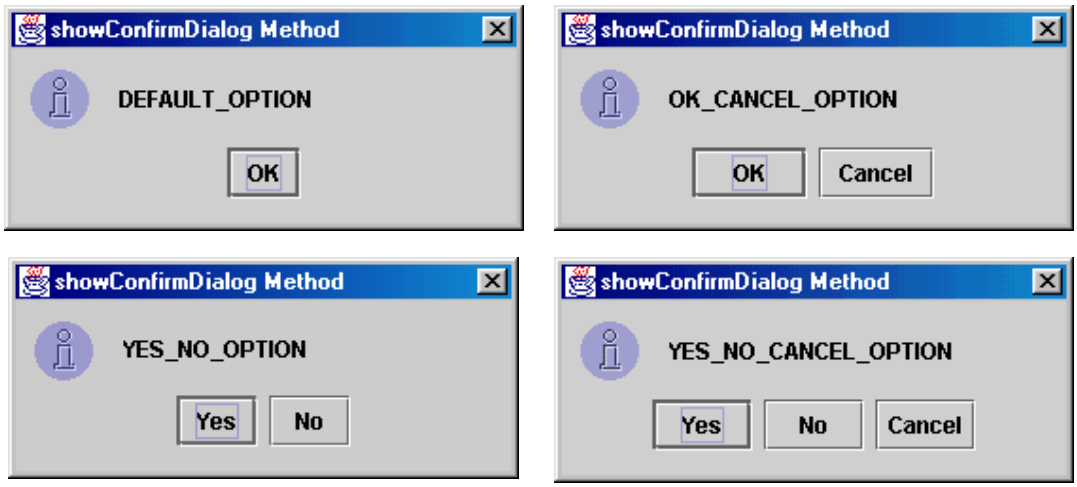
JOptionPane

- **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)

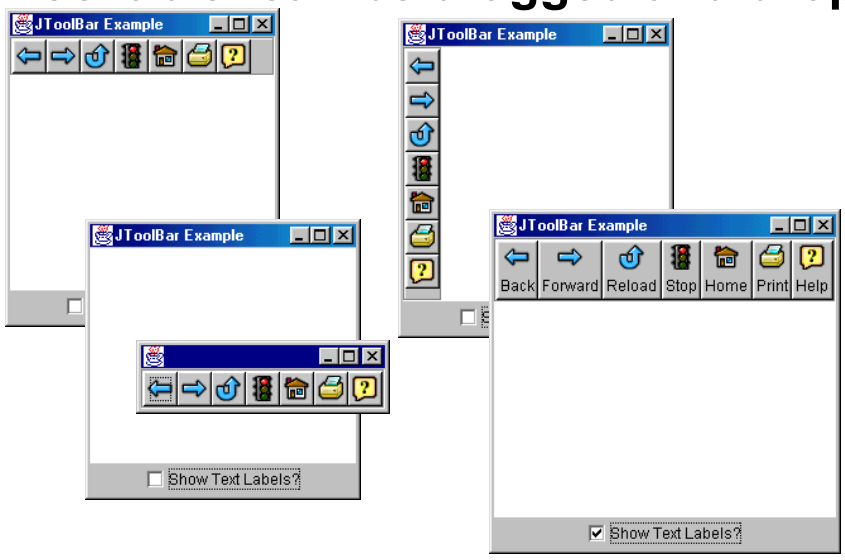


JOptionPane Confirmation Dialogs (Java LAF)



JToolBar

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



JEditorPane

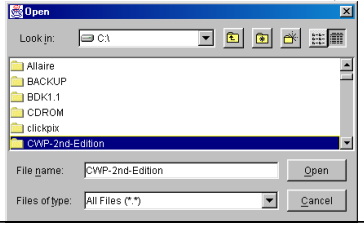
- **Acts somewhat like a text area**
- **Can display HTML and, if HyperLinkListener attached, can follow links**

Other Simple Swing Components

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

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

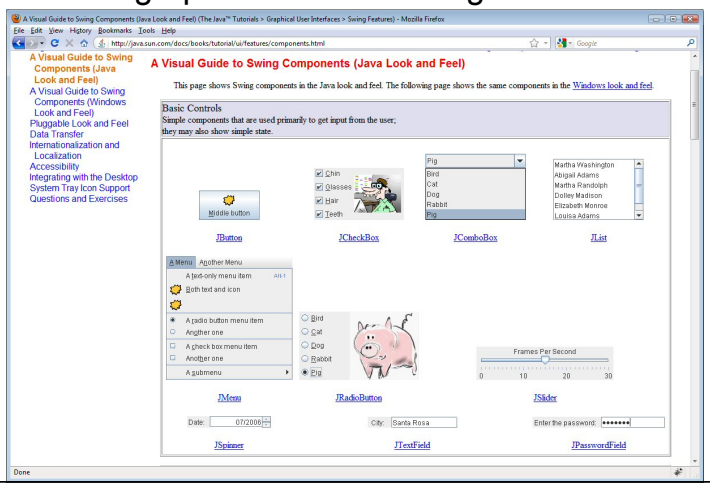
- **JTextField**
  - Just like AWT TextField except that it does not act as a password field (use JPasswordField for that)
- **JTextArea**
  - Place in JScrollPane if you want scrolling
- **JFileChooser**



Wrap-Up

More Info

- **Oracle Java Tutorial: Swing Summary**
  - http://docs.oracle.com/javase/tutorial/ui/features/components.html
  - Very useful summary of most Swing components
    - Gives code examples
    - Includes graphical table showing each



Summary

- **Port simple AWT components to Swing 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 usually want either new (Nimbus) LAF or native LAF
- **Frames and applets use content pane**
  - Don't put anything directly in window
- **Most components support borders & icons**
- **Many new components**

Questions?