Object Oriented Programming and Design in Java

Session 8

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Announcements

- Example code and slides on homepage in Schedule section
- Homework 1 example posted
- Homework 2 due Mar. 3rd, 11 AM
- Midterm exam Mar. 10th

Review

- Introduction to **programming patterns**
- Patterns in GUI programming and examples
  - Model/View/Controller - GUIs
  - Observer - ActionListener
  - Composite - JPanel
  - Decorator - JScrollPane
  - Strategy - Layout Managers

Today's Plan

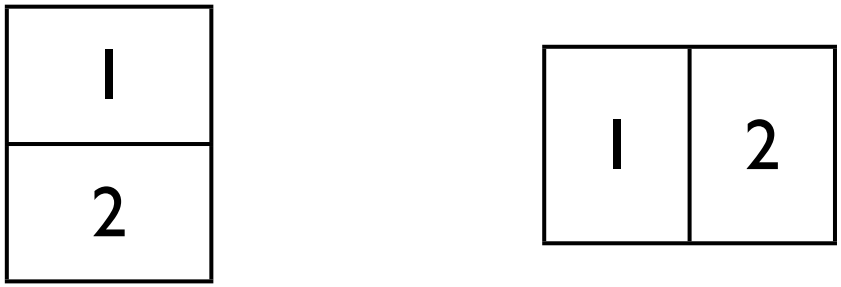
- More Swing components
  - JTextArea, JSplitPane
- Listeners in Swing
  - Change listener
  - Focus listener
  - Mouse listeners

JTextArea

- Arbitrarily large, editable text field
- `void setEditable(boolean)`
  `// sets whether the user can edit text`
- `void setText(String)`
  `// sets the text`
- `void append(String)`
- `void insert(String, int)`

JSplitPane

- Not a Composite nor a Decorator
- JSplitPane contains two JPanels, placed horizontally or vertically



- Provides a draggable divider

JSplitPane Methods

- `JSplitPane(int Orientation, Component, Component)`
  `// JSplitPane.VERTICAL_SPLIT, HORIZONTAL_SPLIT`
- `void setOneTouchExpandable(boolean)`
  `// Adds one-click expand arrows`
- `setTopComponent(Component)`
  `// also Bottom, Right, Left`
- `setDividerLocation(double)`
  `// moves divider`

JSplitPane Example

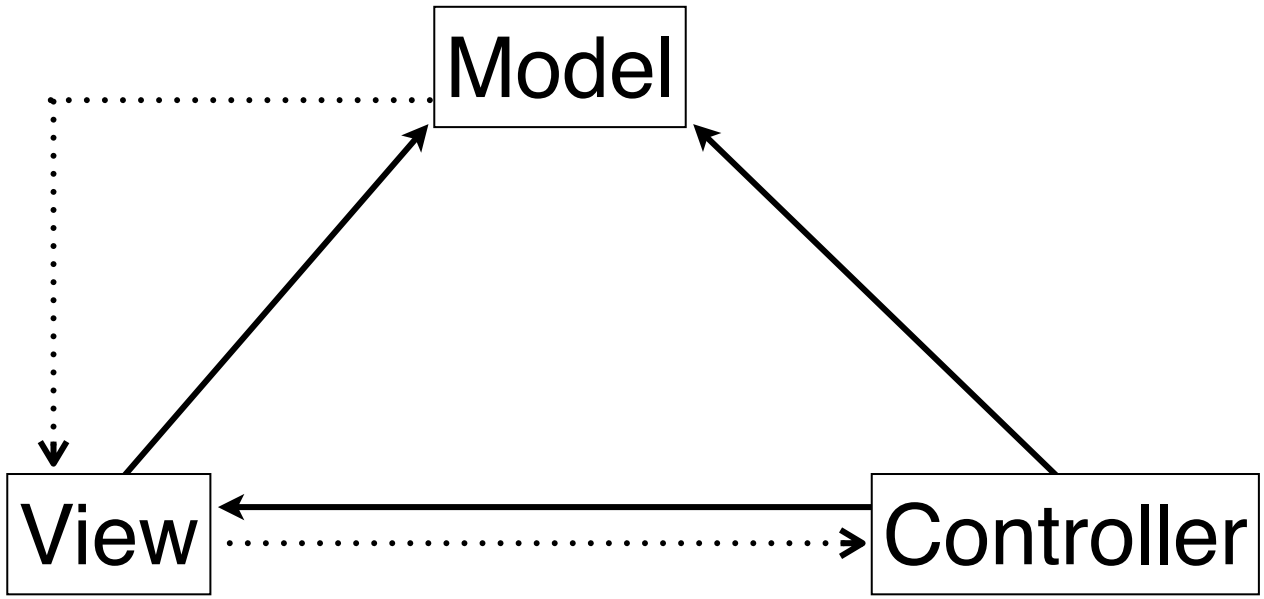
```
JTextArea left = new JTextArea();
for (int i=0; i<20; i++)
   left.append("Hello, World!\n");

JPanel right = new JPanel();
right.setLayout(new GridLayout(0,4));
for (int i=0; i<20; i++)
   right.add(new JButton("Button "+i));

JSplitPane splitPane =
   new JSplitPane(JSplitPane.HORIZONTAL_SPLIT,
         new JScrollPane(left),
         new JScrollPane(right));
```

Observers in MVC

- Swing provides many Listeners for standard JComponents
- so the View can notify the Controller



Listener Interfaces for Simple Controllers

- Trick if your program is very simple
- You can have your Controller class implement Listener interfaces
- Then you add the Controller directly to your components
- But this doesn't work if your Controller has more than one action

ActionListener

- A single method,
- void actionPerformed(ActionEvent a)
- Makes sense for components with clear actions
  - Clicking buttons
  - hitting "enter" in text fields

EventObject

- All Listener methods get a single argument, which must inherit from EventObject
- Object getSource()
  - e.g., getSource() and then getText()
  - Need to cast to (JTextField)

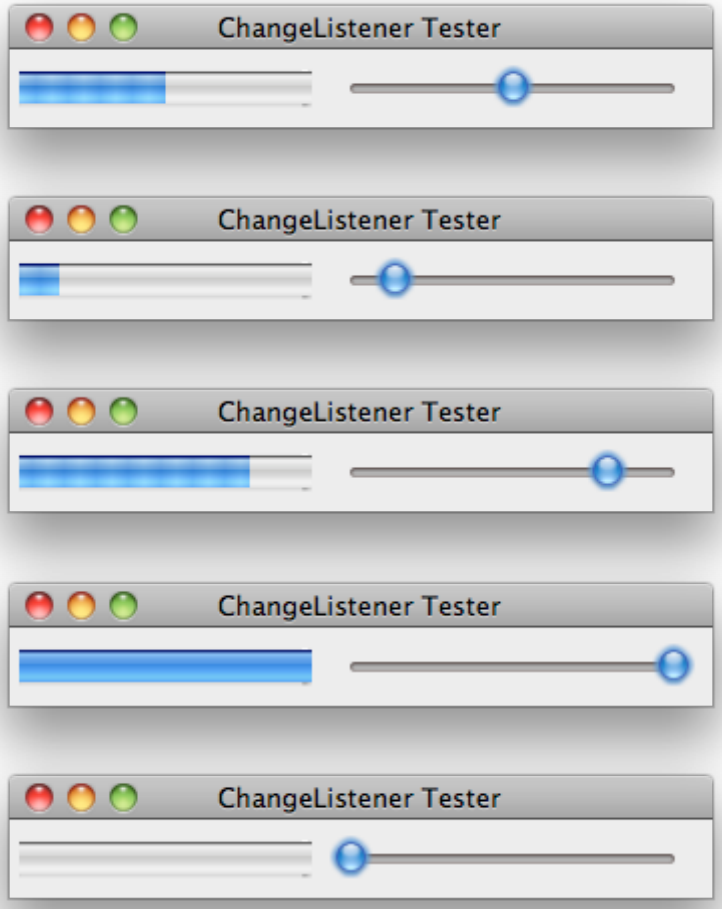
Types of Events

- Events are either *low-level* events or *semantic* events
- Low-level: window-system, raw input
  e.g., click, key presses
- Semantic: item events, actions
  e.g., button, timer tick, text field entry
- Try to listen for semantic events when possible. Let Swing take care of low-level

ChangeListener

- Provides method
  - stateChanged(ChangeEvent event)
- ChangeEvent just an EventObject
  - Object getSource()
- ```
  JSlider source = (JSlider)event.getSource();
  Double x = source.getValue();
  ```
  ```

ChangeListener Example



ChangeListener Example

```
public static void main(String [] args)
{
   JProgressBar myBar = new JProgressBar();
   myBar.setValue(50);

   JSlider mySlider = new JSlider();
   mySlider.addChangeListener(new MyListener(myBar));

   JFrame frame = new JFrame("ChangeListener Tester");
   frame.setLayout(new FlowLayout());
   frame.add(myBar);
   frame.add(mySlider);
   frame.pack();
   frame.setVisible(true);
}
```

ChangeListener Example

```
public static class MyListener implements ChangeListener
{
   public MyListener(JProgressBar bar)
   {
      myProgressBar = bar;
   }

   public void stateChanged(ChangeEvent event)
   {
      JSlider mySlider = (JSlider)event.getSource();

      myProgressBar.setValue(mySlider.getValue());
   }

   private JProgressBar myProgressBar;
}
```

FocusListener

- Triggers events when component gains or loses keyboard focus
  - focusGained(FocusEvent event)
  - focusLost(FocusEvent event)
- FocusEvent provides getComponent() and
  - boolean isTemporary()
  - Component getOppositeComponent()

MouseListener

- Listens for any low-level mouse activity
- Provides five methods:
  - MouseClicked(MouseEvent event)
  - MouseEntered(MouseEvent event)
  - MouseExited(MouseEvent event)
  - MousePressed(MouseEvent event)
  - MouseReleased(MouseEvent event)

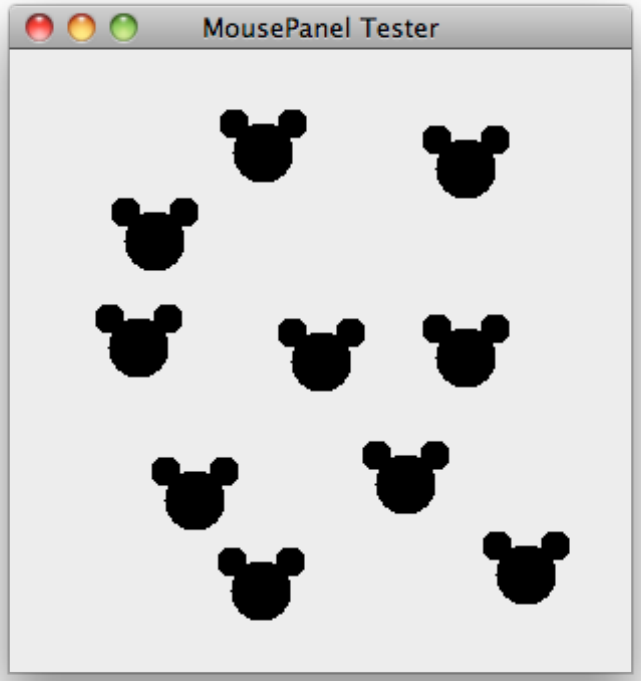
MouseEvent

- int getX(); int getY(); Point getPoint()
- int getButton()
- int getClickCount()
- String getMouseModifiersText(int)
- boolean isPopupTrigger()
- int getWhen() // inherited

Event Adapters

- Usually, you don't need all five methods in MouseListener
- But to implement interface, you must implement all five (some empty)
- Instead, Swing provides adapter classes that implement all with empty
- Extend adapter class and only implement methods you need

MouseAdapter Example



MousePanelTester

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

public class MousePanelTester {
   public static void main(String [] args)
   {
      MousePanel panel = new MousePanel();
      panel.addMouseListener(new MyMouseListener(panel));

      JFrame frame = new JFrame("MousePanel Tester");
      frame.setLayout(new FlowLayout());
      frame.add(panel);
      frame.pack();
      frame.setVisible(true);
   }
```

```
      frame.setLayout(new FlowLayout());
      frame.add(panel);
      frame.pack();
      frame.setVisible(true);
   }

   private static class MyMouseListener extends MouseAdapter
   {
      public MyMouseListener(MousePanel panel)
      {
         super();
         myPanel = panel;
      }

      public void mouseClicked(MouseEvent event)
      {
         myPanel.setLoc(event.getX(), event.getY());
      }

      private MousePanel myPanel;
   }
}
```

MousePanel

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

/**
 * MousePanel draws a mouse
 * @author 1007
 */
public class MousePanel extends JPanel {

   public MousePanel()
   {
      super();
      this.setPreferredSize(
            new Dimension(DEFAULT_SIZE, DEFAULT_SIZE));
      location = new Point(DEFAULT_SIZE / 2, DEFAULT_SIZE / 2);
   }
```

```
        location = new Point(DEFAULT_SIZE / 2, DEFAULT_SIZE / 2);
    }

    /**
     * Sets the location of the mouse drawing
     * @param x location of mouse drawing
     * @param y location of mouse drawing
     */
    public void setLoc(int x, int y)
    {
        location.setLocation(x, y);
        this.repaint();
    }

    public void paint(Graphics g)
    {
        Graphics2D g2 = (Graphics2D) g;

        double x = location.getX();
        double y = location.getY();

        Ellipse2D.Double head =
            new Ellipse2D.Double(x - RADIUS, y - RADIUS,
                2 * RADIUS, 2 * RADIUS);
```

```
      double y = location.getY();

      Ellipse2D.Double head =
         new Ellipse2D.Double(x - RADIUS, y - RADIUS,
               2 * RADIUS, 2 * RADIUS);
      Ellipse2D.Double rightEar =
         new Ellipse2D.Double(x - OFFSET, y - OFFSET,
               RADIUS, RADIUS);
      Ellipse2D.Double leftEar =
         new Ellipse2D.Double(x + OFFSET - RADIUS,
               y - OFFSET, RADIUS, RADIUS);

      g2.fill(head);
      g2.fill(leftEar);
      g2.fill(rightEar);
   }

   private int DEFAULT_SIZE = 300;
   private double RADIUS = 15;
   private double OFFSET = 22;
   private Point location;
}
```

Reading

- Today's material is loosely based on official Java tutorials
  - http://java.sun.com/docs/books/tutorial/uiswing/events/index.html
  - http://java.sun.com/docs/books/tutorial/uiswing/components/index.html
- Use these and the API for hw reference