Advanced Swing & MVC

Custom Data Models and Cell Renderers

Originals of Slides and Source Code for Examples:
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Taught by the author of *Core Servlets and JSP*, *More Servlets and JSP*, and this tutorial. Available at public venues, or customized versions can be held on-site at your organization.

- Courses developed and taught by Marty Hall
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Agenda

- **Building a simple static JList**
- **Adding and removing entries from a JList at runtime**
- **Making a custom data model**
  - Telling JList how to extract data from existing objects
  - Using toString to *display* a String but *return* a complex object upon selection
- **Making a custom cell renderer**
  - Telling JList what GUI component to use for each of the data cells

MVC Architecture

- **Custom data models**
  - Changing the way the GUI control obtains the data. Instead of copying data from an existing object into a GUI control, simply tell the GUI control how to get at the existing data.
- **Custom cell renderers**
  - Changing the way the GUI control displays data values. Instead of changing the data values, simply tell the GUI control how to build a Swing component that represents each data value.
- **Main applicable components**
  - JList
  - JTable
  - JTree

JList with Fixed Set of Choices

- **Build JList: pass strings to constructor**
  - The simplest way to use a JList is to supply an array of strings to the JList constructor. Cannot add or remove elements once the JList is created.

```
String options = { "Option 1", ... , "Option N"};
JList<String> optionList = new JList<>(options);
```

- **Set visible rows**
  - Call setVisibleRowCount and drop JList into JScrollPane

```
optionList.setVisibleRowCount(4);
JScrollPane optionPane =
  new JScrollPane(optionList);
someContainer.add(optionPane);
```

- **Handle events**
  - Attach ListSelectionListener and use valueChanged

Simple JList: Example Code

```
public class JListSimpleExample extends JFrame {
...
  public JListSimpleExample() {
    super("Creating a Simple JList");
    WindowUtilities.setNimbusLookAndFeel();
    addWindowListener(new ExitListener());
    Container content = getContentPane();
    String[] entries = { "Entry 1", "Entry 2", "Entry 3",
                         "Entry 4", "Entry 5", "Entry 6" };
    sampleJList = new JList<>(entries);
    sampleJList.setVisibleRowCount(4);
    sampleJList.addListSelectionListener
                                  (new ValueReporter());
    JScrollPane listPane = new JScrollPane(sampleJList);
    ...
  }
```

Simple JList: Example Code (Continued)

```
private class ValueReporter implements ListSelectionListener {

  /** You get three events in many cases -- one for the
   *  deselection of the originally selected entry, one
   *  indicating the selection is moving, and one for the
   *  selection of the new entry. In the first two cases,
   *  getValueIsAdjusting returns true; thus, the test
   *  below since only the third case is of interest.
   */

  public void valueChanged(ListSelectionEvent event) {
    if (!event.getValueIsAdjusting()) {
      String value = sampleJList.getSelectedValue();
      if (value != null) {
        valueField.setText(value.toString());
      }
    }
  }
}
}
```


Simple JList: Example Output

JList with Changeable Choices

- **Build JList:**
  - Create a DefaultListModel, add data, pass to constructor

```
String choices = { "Choice 1", ... , "Choice N"};
DefaultListModel<String> sampleModel =
  new DefaultListModel<>();
for(int i=0; i<choices.length; i++) {
  sampleModel.addElement(choices[i]);
}
JList<String> optionList = new JList<>(sampleModel);
```

- **Set visible rows**
  - Same: Use setVisibleRowCount and a JScrollPane
- **Handle events**
  - Same: attach ListSelectionListener and use valueChanged
- **Add/remove elements**
  - Use the model, not the JList directly

Changeable JList: Example Code

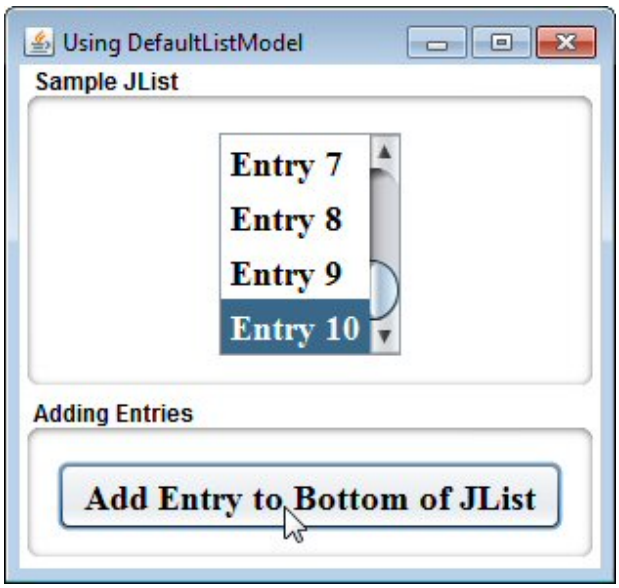
```
String[] entries = { "Entry 1", "Entry 2", "Entry 3",
                     "Entry 4", "Entry 5", "Entry 6" };
sampleModel = new DefaultListModel<>();
for(int i=0; i<entries.length; i++) {
  sampleModel.addElement(entries[i]);
}
sampleJList = new JList<>(sampleModel);
sampleJList.setVisibleRowCount(4);
Font displayFont = new Font("Serif", Font.BOLD, 18);
sampleJList.setFont(displayFont);
JScrollPane listPane = new JScrollPane(sampleJList);
```

Changeable JList: Example Code (Continued)

```
  private class ItemAdder implements ActionListener {
    /** Add an entry to the ListModel whenever the user
     *  presses the button. Note that since the new entries
     *  may be wider than the old ones (e.g., "Entry 10" vs.
     *  "Entry 9"), you need to rerun the layout manager.
     *  You need to do this <I>before</I> trying to scroll
     *  to make the index visible.
     */

    public void actionPerformed(ActionEvent event) {
      int index = sampleModel.getSize();
      sampleModel.addElement("Entry " + (index+1));
      ((JComponent)getContentPane()).revalidate();
      sampleJList.setSelectedIndex(index);
      sampleJList.ensureIndexIsVisible(index);
    }
  }
}
```


Changeable JList: Example Output



JList with Custom Data Model

- **Build JList**
  - Have existing data implement ListModel interface
    - getElementAt
      - Given an index, returns data element
    - getSize
      - Tells JList how many entries are in list
    - addListDataListener
      - Lets user add listeners that should be notified when an item is selected or deselected.
    - removeListDataListener
  - Pass model to JList constructor
- **Set visible rows & handle events: as before**
- **Add/remove items: use the model**

Custom Model: Example Code

```
public class JavaLocationListModel
    implements ListModel<JavaLocation> {
  private JavaLocationCollection collection;

  public JavaLocationListModel(JavaLocationCollection collection) {
    this.collection = collection;
  }

  public JavaLocation getElementAt(int index) {
    return(collection.getLocations()[index]);
  }

  public int getSize() {
    return(collection.getLocations().length);
  }

  public void addListDataListener(ListDataListener l) {}

  public void removeListDataListener(ListDataListener l) {}
}
```

Actual Data

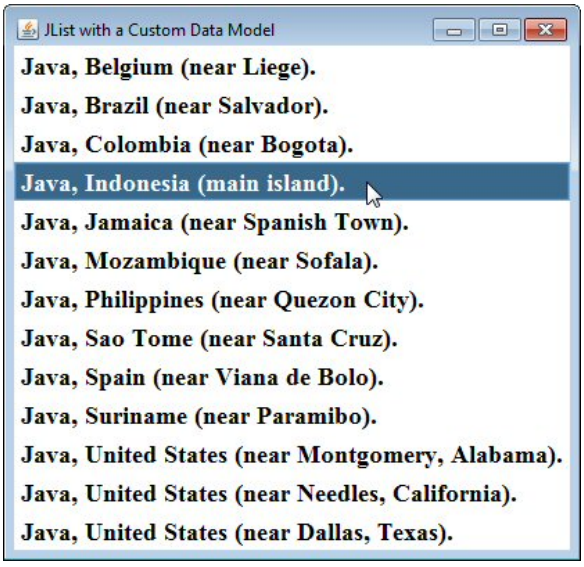
```
public class JavaLocationCollection {
  private static JavaLocation[] defaultLocations =
    { new JavaLocation("Belgium",
                       "near Liege",
                       "flags/belgium.gif"),
      new JavaLocation("Brazil",
                       "near Salvador",
                       "flags/brazil.gif"),
      new JavaLocation("Colombia",
                       "near Bogota",
                       "flags/colombia.gif"),
       ... }; ...
}
```

- **JavaLocation has toString plus 3 fields**
  - Country, comment, flag file

JList with Custom Model: Example Code

```
JavaLocationCollection collection =
  new JavaLocationCollection();
JavaLocationListModel listModel =
  new JavaLocationListModel(collection);
JList<JavaLocation> sampleJList =
  new JList<>(listModel);
Font displayFont =
  new Font("Serif", Font.BOLD, 18);
sampleJList.setFont(displayFont);
content.add(sampleJList);
```

JList with Custom Model: Example Output



JList with Custom Cell Renderer

- **Idea**
  - Instead of predetermining how the JList will draw the list elements, Swing lets you specify what graphical component to use for the various entries. Attach a ListCellRenderer that has a getListCellRendererComponent method that determines the GUI component used for each cell.
- **getListCellRendererComponent arguments**
  - JList: the list itself
  - Object: the value of the current cell
  - int: the index of the current cell
  - boolean: is the current cell selected?
  - boolean: does the current cell have focus?

Custom Renderer: Example Code

```
public class JavaLocationRenderer extends
                                  DefaultListCellRenderer {
  private Map<Object,ImageIcon> iconTable =
    new HashMap<Object,ImageIcon>();
  public Component getListCellRendererComponent
               (JList<?> list, Object value, int index,
                boolean isSelected, boolean hasFocus) {
    JLabel label = (JLabel)super.getListCellRendererComponent
                      (list,value,index,isSelected,hasFocus);
    if (value instanceof JavaLocation) {
      JavaLocation location = (JavaLocation)value;
      ImageIcon icon = iconTable.get(value);
      if (icon == null) {
        icon = new ImageIcon(location.getFlagFile());
        iconTable.put(value, icon);
      }
      label.setIcon(icon);
    ...
    return(label);
  }}
```


Custom Renderer: Example Output

Summary

- **Simple static JList**
  - Pass array of strings to JList constructor
- **Simple changeable JList**
  - Pass DefaultListModel to JList constructor.
  - Add/remove data to/from the model, not the JList.
- **Custom data model**
  - Have real data implement ListModel interface.
  - Pass real data to JList constructor.
- **Custom cell renderer**
  - Assign a ListCellRenderer
  - ListCellRenderer has a method that determines the Component to be used for each cell

Questions?