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This tutorial provides an overview of JavaFX benefits available to GUI developers, illustrates the JavaFX–Swing interoperability, shows how to enrich an existing Swing application by taking advantage of JavaFX functionality, and how to implement a typical Swing application in JavaFX.

This tutorial contains the following chapters:

- The JavaFX Advantage for Swing Developers
- Integrating JavaFX into Swing Applications
- Enriching Swing Applications with JavaFX Functionality
- Leveraging Applications with Media Features
- Implementing a Swing Application in JavaFX
JavaFX is designed to provide applications with such sophisticated GUI features as smooth animation, web views, audio and video playback, and styles based on Cascading Style Sheets (CSS).

For more than 10 years, application developers have found Swing to be a highly effective toolkit for building graphical user interfaces (GUIs) and adding interactivity to Java applications. However, some of today’s most popular GUI features cannot be easily implemented by using Swing. These features and others described in the following sections can help application developers to meet the full range of modern requirements. Later chapters in this document explain how to use Swing and JavaFX together.

**Using FXML**

FXML is an XML-based markup language that enables developers to create a user interface (UI) in a JavaFX application separately from implementing the application logic. Swing has never offered a declarative approach to building a user interface. The declarative method for creating a UI is particularly suitable for the scene graph, because the scene graph is more transparent in FXML. Using FXML enables developers to more easily maintain complex user interfaces.

To learn more about the benefits of using FXML, see the Getting Started with FXML document.

**JavaFX Scene Builder**

To help developers build the layout of their applications, JavaFX provides a design tool called the JavaFX Scene Builder. You drag and drop UI components to a JavaFX Content pane, and the tool generates the FXML code that can be used in an IDE such as NetBeans or Eclipse.

For more information, see Getting Started with JavaFX Scene Builder and the Scene Builder User Guide.

**CSS Support**

Cascading style sheets contain style definitions that control the look of UI elements. The usage of CSS in JavaFX applications is similar to the usage of CSS in HTML. With CSS, you can easily customize and develop themes for JavaFX controls and scene graph objects.
Using CSS as opposed to setting inline styles enables you to separate the logic of the application from setting its visual appearance. Using CSS also simplifies further maintenance of how your application looks and provides some performance benefits.

For more information about CSS, see Skinning JavaFX Applications with CSS and JavaFX CSS Reference Guide.

**JavaFX Media Support**

With the media support provided by the JavaFX platform, you can leverage your desktop application by adding media functionality such as playback of audio and video files. Media functionality is available on all platforms where JavaFX is supported. For the list of supported media codecs, see Introduction to JavaFX Media.

For more details, see Leveraging Applications with Media Features chapter.

**Animation**

Animation brings dynamics and a modern look to the interface of your applications. Animating objects in a Swing application is possible but is not straightforward. In the Swing rendering model, painting happens on a double buffer. All alterations of object properties and positions with time are rendered on a double buffer. Only when the painting is completed, is the final result actually painted onto the screen. To show time-based alterations of objects requires significant efforts from a developer using Swing. In contrast, JavaFX enables developers to animate graphical objects in their applications more easily because of the scene graph underlying the platform and the particular APIs that are specifically created for that purpose.

For more details about animation in JavaFX, see Creating Transitions and Timeline Animation in JavaFX. Be sure to check the Tree animation example.

**HTML Content**

For a long time, Swing developers have wanted the ability to render HTML content in Java applications. JavaFX brought this feature to life by providing a user interface component that has web view and full browsing functionality.

For more details, see Adding HTML Content to JavaFX Applications.
This chapter describes how to add JavaFX content into a Swing application and how to use threads correctly when both Swing and JavaFX content operate within a single application.

JavaFX SDK provides the JFXPanel class, which is located in the javafx.embed.swing package and enables you to embed JavaFX content into Swing applications.

Adding JavaFX Content to a Swing Component

For the purpose of this chapter, you create a JFrame component, add a JFXPanel object to it, and set the graphical scene of the JFXPanel component that contains JavaFX content.

As in any Swing application, you create the graphical user interface (GUI) on an event dispatch thread (EDT). Example 2–1 shows the initAndShowGUI method, which creates a JFrame component and adds a JFXPanel object to it. Creating an instance of the JFXPanel class implicitly starts the JavaFX runtime. After the GUI is created, call the initFX method to create the JavaFX scene on the JavaFX application thread.

Example 2–1

```java
import javafx.application.Platform;
import javafx.embed.swing.JFXPanel;
import javafx.scene.Group;
import javafx.scene.Scene;
import javafx.scene.paint.Color;
import javafx.scene.text.Font;
import javafx.scene.text.Text;
import javax.swing.JFrame;
import javax.swing.SwingUtilities;
public class Test {
    private static void initAndShowGUI() {
        // This method is invoked on the EDT thread
        JFrame frame = new JFrame("Swing and JavaFX");
        final JFXPanel fxPanel = new JFXPanel();
        frame.add(fxPanel);
        frame.setSize(300, 200);
        frame.setVisible(true);
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

        Platform.runLater(new Runnable() {
            @Override
            public void run() {
```
private static void initFX(JFXPanel fxPanel) {
    // This method is invoked on the JavaFX thread
    Scene scene = createScene();
    fxPanel.setScene(scene);
}

private static Scene createScene() {
    Group root = new Group();
    Scene scene = new Scene(root, Color.ALICEBLUE);
    Text text = new Text();
    text.setX(40);
    text.setY(100);
    text.setFont(new Font(25));
    text.setText("Welcome JavaFX!");
    root.getChildren().add(text);
    return scene;
}

public static void main(String[] args) {
    SwingUtilities.invokeLater(new Runnable() {
        @Override
        public void run() {
            initAndShowGUI();
        }
    });
}

### Swing–JavaFX Interoperability and Threads

With JavaFX and Swing data coexisting in a single application, you may encounter the following interoperability situations:

- A JavaFX data change is triggered by a change in Swing data.
- A Swing data change is triggered by a change in JavaFX data.

### Changing JavaFX Data in Response to a Change in Swing Data

JavaFX data should be accessed only on the JavaFX User thread. Whenever you must change JavaFX data, wrap your code into a Runnable object and call the `Platform.runLater` method as shown in Example 2–2.

**Example 2–2**

```java
jbutton.addActionListener(new ActionListener() {
    public void actionPerformed(ActionEvent e) {
        Platform.runLater(new Runnable() {
            @Override
            public void run() {
                fxlabel.setText("Swing button clicked!");
            }
        });
    }
});
```
Introducing the SimpleSwingBrowser Application

Integrating JavaFX into Swing Applications

Changing Swing Data in Response to a Change in JavaFX Data

Swing data should be changed only on the EDT. To ensure that your code is implemented on the EDT, wrap it into a Runnable object and call the SwingUtilities.invokeLater method as shown in Example 2–3.

Example 2–3

```java
SwingUtilities.invokeLater(new Runnable() {
    @Override
    public void run() {
        //Code to change Swing data.
    }
});
```

Introducing the SimpleSwingBrowser Application

To see how Swing–JavaFX interoperability works, consider the SimpleSwingBrowser application. This is a Swing application with an integrated JavaFX component intended to view Web pages. You can type a URL in an address bar and view the page loaded in the application window. The SimpleSwingBrowser application window is shown in Figure 2–1.

Figure 2–1 The SimpleSwingBrowser Application Window

Initializing Swing Data

You can view the SimpleSwingBrowser.java file or download the SimpleSwingBrowser.zip file with a NetBeans project. Extract files from the zip file to a directory on your local file system and run the project in your Netbeans IDE.
As of version 7.2, the NetBeans IDE provides support for Swing applications with the embedded JavaFX content. When creating a new project, in the **JavaFX** category choose **JavaFX in Swing Application**.

---

**Note:** To run this application from behind a firewall, you must specify proxy settings in order for the application to access a remote resource.

In the NetBeans IDE, right-click the **SimpleSwingBrowser** project in the Projects window, select **Properties**, and in the Projects Properties dialog, select **Run**.

In the VM Options field, set the proxy in the following format:

-Dhttp.proxyHost=webcache.mydomain.com -Dhttp.proxyPort=8080

---

The GUI of the **SimpleSwingBrowser** application is created on the EDT when the application starts. The main method is implemented as shown in **Example 2–4**.

**Example 2–4**

```java
public static void main(String[] args) {
    SwingUtilities.invokeLater(new Runnable() {
        @Override
        public void run() {
            SimpleSwingBrowser browser = new SimpleSwingBrowser();
            browser.setVisible(true);
            browser.loadURL("http://oracle.com");
        }
    });
}
```

The **SimpleSwingBrowser** class initializes Swing objects and calls the **initComponents** method to create the GUI as shown in **Example 2–5**.

**Example 2–5**

```java
public class SimpleSwingBrowser extends JFrame {
    private final JFXPanel jfxPanel = new JFXPanel();
    private WebEngine engine;

    private final JPanel panel = new JPanel(new BorderLayout());
    private final JLabel lblStatus = new JLabel();
    private final JButton btnGo = new JButton("Go");
    private final JTextField txtURL = new JTextField();
    private final JProgressBar progressBar = new JProgressBar();

    public SimpleSwingBrowser() {
        super();
        initComponents();
    }

    private void initComponents() {
        createScene();
        ActionListener al = new ActionListener() {
        
```
Introducing the SimpleSwingBrowser Application

Integrating JavaFX into Swing Applications

```java
@Override
public void actionPerformed(ActionEvent e) {
    loadURL(txtURL.getText());
}
```

btnGo.addActionListener(al);
txtURL.addActionListener(al);

progressBar.setPreferredSize(new Dimension(150, 18));
progressBar.setStringPainted(true);

JPanel topBar = new JPanel(new BorderLayout(5, 0));
topBar.setBorder(BorderFactory.createEmptyBorder(3, 5, 3, 5));
topBar.add(txtURL, BorderLayout.CENTER);
topBar.add(btnGo, BorderLayout.EAST);

JPanel statusBar = new JPanel(new BorderLayout(5, 0));
statusBar.setBorder(BorderFactory.createEmptyBorder(3, 5, 3, 5));
statusBar.add(lblStatus, BorderLayout.CENTER);
statusBar.add(progressBar, BorderLayout.EAST);

panel.add(topBar, BorderLayout.NORTH);
panel.add(jfxPanel, BorderLayout.CENTER);
panel.add(statusBar, BorderLayout.SOUTH);

getContentPane().add(panel);

setPreferredSize(new Dimension(1024, 600));
setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
pack();
```

The topmost window of this application is a JFrame object, which contains various Swing components such as a text field, a button, a progress bar, and a JFX panel intended to display JavaFX content.

Loading JavaFX Content

On the first run, the web page at http://oracle.com is loaded into a WebView object. As a new URL is entered in the address bar, the action listener, which is attached to the txtURL text field in the initComponents method, initiates the loading of a page as shown in Example 2–6.

Example 2–6

```java
ActionListener al = new ActionListener() {
    @Override public void actionPerformed(ActionEvent e) {
        loadURL(txtURL.getText());
    }
};
```

JavaFX data should only be accessed on the JavaFX application thread. The loadURL method wraps the code into a Runnable object and calls the Platform.runLater method as shown in Example 2–7.
Example 2–7

```java
public void loadURL(final String url) {
    Platform.runLater(new Runnable() {
        @Override public void run() {
            String tmp = toURL(url);

            if (url == null) {
                tmp = toURL("http://" + url);
            }

            engine.load(tmp);
        }
    });
}

private static String toURL(String str) {
    try {
        return new URL(str).toExternalForm();
    } catch (MalformedURLException exception) {
        return null;
    }
}
```

Updating Swing Data

As a new page is loaded into the WebView component, the title of the page is retrieved from the JavaFX data and passed to the Swing GUI to be placed on the application window as a title. This behavior is implemented in the `createScene` method as shown in Example 2–8.

Example 2–8

```java
private void createScene() {
    Platform.runLater(new Runnable() {
        @Override
        public void run() {
            WebView view = new WebView();
            engine = view.getEngine();

            engine.titleProperty().addListener(new ChangeListener<String>() {
                @Override
                public void changed(ObservableValue<? extends String> observable,
                                     String oldValue, final String newValue) {
                    SwingUtilities.invokeLater(new Runnable() {
                        @Override
                        public void run() {
                            SimpleSwingBrowser.this.setTitle(newValue);
                        }
                    });
                }
            });
        }
    });
}
```
Deploying Swing-JavaFX Applications

As of JavaFX 2.2, you can use the same deployment approach to package Swing-JavaFX applications that you would for pure JavaFX applications. Using JavaFX Ant tasks, you only need to set an attribute that the application’s primary UI toolkit is Swing. The resulting package provides support for the same set of execution modes as a package for a JavaFX application; in other words, the application can be run standalone, using Web Start, embedded into a web page, or distributed as a self-contained application bundle. For more information, see the Deploying JavaFX Applications guide.

View and Download Application Files

**View Source Code**
http://docs.oracle.com/javafx/2/swing/SimpleSwingBrowser.java.htm

**Download Source Code**
http://docs.oracle.com/javafx/2/swing/SimpleSwingBrowser.zip
In this chapter you learn how to intermix a Swing table and JavaFX bar chart in a single application.

This chapter starts with a Swing application and provides an example of how to enrich the Swing application by adding JavaFX functionality.

Sample Swing Application

Many real-world projects employ Swing applications that deal with tables. You can continue using the existing code and still take an advantage of JavaFX APIs. For example, you can add a JavaFX bar chart to provide a colorful illustration of the tabular data. This chapter provides the SwingInterop example that handles a Swing table and a JavaFX bar chart. As you change the data in a table cell, the bar chart immediately updates.

Start with the sample application that has only the Swing table shown in Figure 3–1.

*Figure 3–1  Swing JTable Application Window*

This application consists of two classes:

- SampleTableModel.java
- SwingInterop.java

The SampleTableModel class inherits from the AbstractTableModel class and defines the table.

The SwingInterop class inherits from the JApplet class and is the basic class of the application. Its main method calls the run method on the Event Dispatch Thread (EDT) to create the graphical user interface (GUI). The run method creates a JFrame object and a JApplet object, and initializes the JApplet object with an instance of the SwingInterop class. Then it calls the init method, which creates the table and adds the table to the content pane of the applet.
You can see the implementation of both classes by using the links in the sidebar.

## Integrating JavaFX Bar Chart

To provide data for a bar chart, modify the `SampleTableModel` class by adding a new class variable (`bcData`) and a method that retrieves data from the table and returns the data in the format appropriate for the bar chart. The implementation of the `getBarChartData` method is shown in Example 3–1.

### Example 3–1

```java
import javafx.collections.FXCollections;
import javafx.collections.ObservableList;
import javafx.scene.chart.BarChart;

public class SampleTableModel extends AbstractTableModel {
    private static ObservableList<BarChart.Series> bcData;

    public ObservableList<BarChart.Series> getBarChartData() {
        if (bcData == null) {
            bcData = FXCollections.observableArrayList();
            for (int row = 0; row < getRowCount(); row++) {
                ObservableList<BarChart.Data> series =
                    FXCollections.observableArrayList();
                for (int column = 0; column < getColumnCount(); column++) {
                    series.add(new BarChart.Data(getColumnName(column),
                        getValueAt(row, column)));
                }
            bcData.add(new BarChart.Series(series));
        }
    return bcData;
    }
    //rest of the SampleTableModel class code
}
```

The `SwingInterop` class overrides the `JApplet.init` method to create the content pane of the application. Modify the `init` method to create a `JFXPanel` object to hold the JavaFX bar chart and a `JSplitPane` object to hold both the JavaFX chart and the table. The required changes to the `init` method are shown in bold in Example 3–2.

### Example 3–2

```java
@override
public void init() {
    tableModel = new SampleTableModel();
    // create javafx panel for charts
    chartFxPanel = new JFXPanel();
    chartFxPanel.setPreferredSize(new Dimension(PANEL_WIDTH_INT, PANEL_HEIGHT_INT));
    //create JTable
    JTable table = new JTable(tableModel);
    table.setAutoCreateRowSorter(true);
    table.setGridColor(Color.DARK_GRAY);
    SwingInterop.DecimalFormatRenderer renderer =
        new SwingInterop.DecimalFormatRenderer();
    renderer.setHorizontalAlignment(JLabel.RIGHT);
    for (int i = 0; i < table.getColumnCount(); i++) {
        table.getColumnModel().getColumn(i).setCellRenderer(renderer);
```
To get rid of a syntax error, add import statements and the definition of the chartFxPanel class variable to the SwingInterop class as shown in Example 3–3.

Example 3–3

```java
import javafx.embed.swing.JFXPanel;
import javax.swing.*;

public class SwingInterop extends JApplet {
    private static JFXPanel chartFxPanel;
    // rest of the SwingInterop class code here
}
```

You prepared the UI of your Swing application to render JavaFX data. The next step is creating the JavaFX scene. Because the JavaFX scene must be created on the JavaFX Application thread, wrap your code into a Runnable object as shown in Example 3–4. Add this code at the end of the `init` method.

Example 3–4

```java
Platform.runLater(new Runnable() {
    @Override
    public void run() {
        createScene();
    }
});
```

Add the import statement shown in Example 3–5 to the SwingInterop class.

Example 3–5

```java
import javafx.application.Platform;
```

Implement the `createScene` method of the SwingInterop class as shown in Example 3–6. Add the import statements and define the instance variable `chart`.

Example 3–6

```java
import javafx.scene.Scene;
import javafx.scene.chart.Chart;

private void createScene() {
}
```
chart = createBarChart();
chartFxPanel.setScene(new Scene(chart));
}

The createBarChart method creates the chart diagram and adds a change listener to the table. Note that any change of JavaFX data must happen on the JavaFX thread. For this reason, wrap the code in the event handler, which updates the JavaFX chart, into a Runnable object and pass it to the Platform.runLater method. The implementation of the createBarChart method is shown in Example 3–7.

**Example 3–7**

```java
private BarChart createBarChart() {
    CategoryAxis xAxis = new CategoryAxis();
xAxis.setCategories(FXCollections.observableArrayList(tableModel.getColumnNames()));
xAxis.setLabel("Year");
double tickUnit = tableModel.getTickUnit();

    NumberAxis yAxis = new NumberAxis();
yAxis.setTickUnit(tickUnit);
yAxis.setLabel("Units Sold");

    final BarChart chart = new BarChart(xAxis, yAxis, tableModel.getBarChartData());
    tableModel.addTableModelListener(new TableModelListener() {
        public void tableChanged(TableModelEvent e) {
            if (e.getType() == TableModelEvent.UPDATE) {
                final int row = e.getFirstRow();
                final int column = e.getColumn();
                final Object value = ((SampleTableModel) e.getSource()).getValueAt(row, column);

                Platform.runLater(new Runnable() {
                    public void run() {
                        XYChart.Series<String, Number> s = (XYChart.Series<String, Number>) chart.getData().get(row);
                        BarChart.Data data = s.getData().get(column);
                        data.setYValue(value);
                    }
                });
            }
        }
    });
    return chart;
}
```

Add the import statements shown in Example 3–8.

**Example 3–8**

```java
import javafx.collections.FXCollections;
import javafx.scene.chart.BarChart;
import javafx.scene.chart.CategoryAxis;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.XYChart;
import javax.swing.event.TableModelEvent;
import javax.swing.event.TableModelListener;
```
Rename the title of the frame to "Swing JTable and Bar Chart" and run the SwingInterop application.

The application window is shown in Figure 3–2.

**Figure 3–2  SwingInterop Application Window**

```
<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>567.0</td>
<td>956.0</td>
<td>1154.0</td>
</tr>
<tr>
<td></td>
<td>1292.0</td>
<td>1685.0</td>
<td>1927.0</td>
</tr>
<tr>
<td></td>
<td>1292.0</td>
<td>2559.0</td>
<td>2774.0</td>
</tr>
</tbody>
</table>
```

View and Download Application Files

**View Source Code**
http://docs.oracle.com/javafx/2/swing/SwingInterop.java.htm
http://docs.oracle.com/javafx/2/swing/SampleTableModel.java.htm

**Download Source Code**
http://docs.oracle.com/javafx/2/swing/SwingInterop.zip
Leveraging Applications with Media Features

In this chapter you review a Media Player application that plays a video file and has controls typical for a video player such as a start/pause button, sliders to show playback progress and adjust volume, and a check box that turns repeat on.

For the purpose of this chapter, get familiar with the javaxfx.scene.media package that enables developers to create media applications.

About Media Integration

Any JavaFX media application can be built using the following key classes:

- Media class: Represents a media resource
- MediaPlayer class: Provides the controls for playing the specified resource
- MediaView class: Provides a view of the media resource played by a MediaPlayer object

Because the MediaView class is a subclass of the Node class, the MediaView object can be added to a JavaFX scene. This is the principal factor that provides a foundation for integration of the JavaFX media functionality into desktop and web applications. Now that you know how to embed the JavaFX scene into Swing applications, you can further leverage your applications by integrating the Media Player component. You can animate the MediaView object, transform it, and apply effects to it, just as you can with any other node. In this way, you can support numerous creative tasks.

Building the Media Player Application

The Incorporating Media Assets Into JavaFX Applications document provides step-by-step instructions on how to create the EmbeddedMediaPlayer application. It also provides the Netbeans project source. Follow the detailed instructions to build the application or download the source project using the link on the sidebar.

The MediaPlayer application discussed in this chapter is based on the EmbeddedMediaPlayer application but is slightly improved as follows:

- As a best programming practice, the application uses an external CSS file.
- The control bar contains the Loop check box to turn repeat on.

The application window is shown in Figure 4–1.
You can modify the EmbeddeMediaPlayer project or save its copy with a different name and modify the new project.

Skinning the Application with CSS

To skin the application with CSS, first create the mediaplayer.css file and save it in the folder with the source files of your application. Add the style rules shown in Example 4–1.

Example 4–1

```java
#mediaControl {
    -fx-background-color: #bfc2c7;
}
#mediaViewPane {
    -fx-background-color: black;
}
```

Next, open the MediaControl.java file and remove from the MediaControl constructor the lines shown in Example 4–2.

Example 4–2

```java
setLabel("-fx-background-color: #bfc2c7;";)
mvPane.setStyle("-fx-background-color: black;";)
```

Then modify the MediaControl constructor by adding the lines shown in bold in Example 4–3.

Example 4–3

```java
public MediaControl(final MediaPlayer mp) {
    this.mp = mp;
    setId("mediaControl");
    mediaView = new MediaView(mp);
    Pane mvPane = new Pane();
    mvPane.getChildren().add(mediaView);
```
mvPane.setId("mediaViewPane");
setCenter(mvPane);

Adding a New Control to the Control Bar

Adding a new control to the control bar requires only a few steps. In the section where you define the MediaControl class instance variables, remove the definition of the repeat variable shown in Example 4–4.

**Example 4–4**

```java
private final boolean repeat = false;
```

In the MediaControl class, remove the code that used the repeat instance variable shown in Example 4–5.

**Example 4–5**

```java
mp.setCycleCount(repeat ? MediaPlayer.INDEFINITE : 1);
```

Now add the class variable `repeatBox` as shown in Example 4–6.

**Example 4–6**

```java
private CheckBox repeatBox;
```

Add a label and the check box to the control bar of your Media Player. Place the following code in the MediaControl constructor after the lines that added the volumeSlider to the bar, as shown in Example 4–7.

**Example 4–7**

```java
mediaBar.getChildren().add(volumeSlider);
Label repeatLabel = new Label(" Loop: ");
repeatLabel.setPrefWidth(50);
repeatLabel.setMinWidth(25);
mediaBar.getChildren().add(repeatLabel);

repeatBox = new CheckBox();
repeatBox.setSelected(true);
mediaBar.getChildren().add(repeatBox);

setBottom(mediaBar);
```

Implement the logic of using the check box in the setOnEndOfMedia method, as shown in Example 4–8.

**Example 4–8**

```java
mp.setOnEndOfMedia(new Runnable() {
    public void run() {
        if (repeatBox.isSelected()) {
            mp.seek(mp.getStartTime());
        } else {
            playButton.setText(">");
            stopRequested = true;
            atEndOfMedia = true;
        }
    }
});
```
You can view the source files and download the MediaPlayer.zip file with the NetBeans project.

To enable the Media Player access a remote media resource when running from behind a firewall, provide the proxy settings in the following format:
-Dhttp.proxyHost=yourproxyhost.com -Dhttp.proxyPort=portNumber. In this example, yourproxyhost.com is your proxy and portNumber is a port number to use.

View and Download Application Files

View Source Code
http://docs.oracle.com/javafx/2/swing/MediaPlayer.java.htm
http://docs.oracle.com/javafx/2/swing/MediaControl.java.htm

Download Source Code
http://docs.oracle.com/javafx/2/swing/MediaPlayer.zip
In this chapter, you consider a Swing application and learn how to implement it in JavaFX.

For the purpose of this chapter, get familiar with the Converter application shown in Figure 5–1. This application converts distance measurements between metric and U.S. units.

**Figure 5–1 Converter Application in Java**

Analyzing the Converter Application Developed in Swing

For more information about the implementation of this example in the Java programming language, see How to Use Panels and Using Models trails in the Swing tutorial. In particular, the graphical user interface (GUI) is discussed in the trail about the panels.

To learn the code of the Converter application, download its NetBeans project or the source files available at the example index.

Swing components use models. If you look at the contents of the project, you notice the `ConverterRangeModel` and `FollowerRangeModel` classes that define models for the Converter application.

The Converter application consists of the following files:

- `ConversionPanel.java` — contains a custom `JPanel` subclass to hold components
- `Converter.java` — contains the main application class
- `ConverterRangeModel.java` — defines the top slider’s model
■ FollowerRangeModel.java — defines the bottom slider’s model
■ Units.java — creates Unit objects

Note that the synchronization between each text field and its slider is implemented by event handlers that listen for changes in values.

### Planning the Converter Application in JavaFX

The Converter application contains two similar panels that hold components such as a text field, slider, and combo box. The panels have titles. The TitlePane class from the javax.scene.control package ideally suits the GUI of the Converter application.

In what follows, you will implement the ConversionPanel class and add two instances of this class to the graphical scene of the Converter application.

First, note that the components within a single ConversionPanel object should be synchronized as follows. Whenever you move the knob on the slider, you must update the value in the text field and vice versa: Whenever you change the value in the text field, you must adjust the position of the knob on the slider.

As soon as you choose another value from the combo box, you must update the value of the text field and, hence, the position of the knob on the slider.

Second, note that both ConversionPanel objects should be synchronized. As soon as changes happen on one panel, the corresponding components on another panel must be updated.

It is suggested that you implement synchronization between the panels using the DoubleProperty object, called meters, and listen to changes in the properties of the text fields and combo boxes by creating and registering two InvalidationListener objects: fromMeters and toMeters. Whenever the property of the text field on one panel changes, the invalidated method of the attached InvalidationListener object is called, which updates the meters property. Because the meters property changes, the invalidated method of the InvalidationListener object, attached to the meters property, is called, which updates the corresponding text field on another panel.

Similarly, whenever the property of the combo box on one panel changes, the invalidated method of the attached InvalidationListener object is called, which updates the text field on this panel.

To provide synchronization between the value of the slider and the value of the meters object, use bidirectional binding.

For more information about JavaFX properties and binding, see Using JavaFX Properties and Binding.

### Creating the Converter Application in JavaFX

Create a new JavaFX project in NetBeans IDE and name it Converter. Copy the Unit.java file from the Swing application to the Converter project. Add a new java class to this project and name it ConversionPanel.java.

### Standard JavaFX Pattern to Create the GUI

Before you start creating the GUI of the Converter application in JavaFX, see the standard pattern of GUI creation in Swing applications, as shown in Example 5–1.
Creating the Converter Application in JavaFX

Example 5–1

```java
public class Converter {
    private void initAndShowGUI() {
        // ...
    }

    public static void main(String[] args) {
        SwingUtilities.invokeLater(new Runnable() {
            @Override
            public void run() {
                initAndShowGUI();
            }
        });
    }
}
```

To map this pattern to JavaFX, you extend the `javafx.application.Application` class, override the `start` method, and call the `main` method, as shown in Example 5–2.

Example 5–2

```java
import javafx.application.Application;
import javafx.stage.Stage;

public class Converter extends Application {
    @Override
    public void start(Stage t) {
        // ...
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

When you create a new JavaFX project in the NetBeans IDE, this pattern is automatically generated for you. However, it is important that you understand the basic approach to GUI creation in JavaFX, especially if you use a text editor.

Containers and Layouts

In Swing, containers and layout managers are different entities. You create a container, such as a `JPanel` or `JComponent` object, and set a layout manager for this container. You can assign a specific layout manager and write `.add()` in your code or assign none of the layout managers.

In JavaFX, the container itself takes care of laying out its child nodes. You create a specific layout pane, such as a `Vbox`, `FlowPane`, or `TitledPane` object, and then add content to the list of its child nodes using the `.getChildren().add()` methods.

There are several layout container classes in JavaFX, called panes, some of which have their counterparts in Swing, such as the `FlowPane` class in JavaFX and `FlowLayout` class in Swing.

For more information, see Working With Layouts in JavaFX.

UI Controls

JavaFX SDK provides a set of standard UI controls. Some of the UI controls have their counterparts in Swing such as the `Button` class in JavaFX and `JButton` in Swing;
Creating the Converter Application in JavaFX

Slider in JavaFX and JSlider in Swing; and TextField in JavaFX and JTextField in Swing.

To implement the Converter application in JavaFX, you can use the standard UI controls provided by the TextField, Slider, and ComboBox classes.

For more information, see Using JavaFX UI Controls.

Usage of the Builder Classes

The JavaFX SDK provides a set of builder classes that can be used to create objects. For example, the SliderBuilder class is used to create objects of the Slider class. The builder classes and the classes whose objects they build reside within the same packages. To create an object using the corresponding builder class, see the code pattern shown in Example 5–3.

Example 5–3
slider=SliderBuilder.create().max(MAX).build();

Note that the usage of builders is not compulsory. You might use builders for your convenience, or you might not. An alternative way of creating the same object without using the builder class is shown in Example 5–4.

Example 5–4
slider = new Slider();
slider.setMax(MAX);

Mechanism of Getting Notifications on User Actions and Binding

In Swing, you can register a listener on any component and listen for changes in the component properties, such as size, position, or visibility; or listen for events, such as whether the component gained or lost the keyboard focus; or whether the mouse was clicked, pressed, or released over the component.

In JavaFX, each object has a set of properties for which you can register a listener. The listener is called whenever a value of the property changes.

Note that an object can be registered as a listener for changes in another object’s properties. Thus, you can use the binding mechanism to synchronize some properties of two objects.

Creating the ConversionPanel Class

The ConversionPanel class is used to hold components: a text field, a slider, and a combo box. When creating the graphical scene of the Converter application, you add two instances of the ConversionPanel class to the graphical scene. Add the import statement for the TitledPane class and extend the ConversionPanel class as shown in Example 5–5.

Example 5–5
import javafx.scene.control.TitledPane;

public class ConversionPanel extends TitledPane {
Creating Instance Variables for UI Controls
Add import statements for the TextField, Slider, ComboBox controls and define instance variables for the components as shown in Example 5–6.

Example 5–6
import java.text.NumberFormat;
import javafx.scene.control.ComboBox;
import javafx.scene.control.Slider;
import javafx.scene.control.TextField;

private ComboBox<Unit> comboBox;
private Slider slider;
private TextField textField;

Creating DoubleProperty and NumberFormat Objects
Add the import statement for the DoubleProperty class and create a DoubleProperty object named meters as shown in Example 5–7. The meters object is used to ensure the synchronization between two ConversionPanel objects.

Example 5–7
import javafx.beans.property.DoubleProperty;

private DoubleProperty meters;

Add the import statement for the NumberFormat class and add the block of code after this import statement to define the text field format as shown in Example 5–8.

Example 5–8
private NumberFormat numberFormat;
{
    numberFormat = NumberFormat.getNumberInstance();
    numberFormat.setMaximumFractionDigits(2);
}

Laying Out the Components
To lay out the text field and the slider, use the VBox class. To lay out both of these components and a combo box, use the HBox class. Add the import statements for the ObservableList, TextFieldBuilder, SliderBuilder, ComboBoxBuilder, VBoxBuilder, HBoxBuilder classes and implement the constructor of the ConversionPanel class as shown in Example 5–9.

Example 5–9
import javafx.collections.ObservableList;
import javafx.scene.control.ComboBoxBuilder;
import javafx.scene.control.SliderBuilder;
import javafx.scene.control.TextFieldBuilder;
import javafx.scene.layout.HBoxBuilder;
import javafx.scene.layout.VBoxBuilder;
public ConversionPanel(String title, ObservableList<Unit> units,
DoubleProperty meters) {
    setText(title);
    setCollapsible(false);
    setContent(HBoxBuilder.create()
        .children(
            VBoxBuilder.create()
                .children(
                    textField = TextFieldBuilder.create()
                        .build(),
                    slider = SliderBuilder.create()
                        .max(MAX)
                        .build()
                )
            .build(),
            comboBox = ComboBoxBuilder.<Unit>create()
                .items(units)
                .converter(new StringConverter<Unit>() {
                    @Override
                    public String toString(Unit t) {
                        return t.description;
                    }

                    @Override
                    public Unit fromString(String string) {
                        throw new UnsupportedOperationException("Not supported yet.");
                    }
                })
            .build()
        )
    .build());

    this.meters = meters;
    comboBox.getSelectionModel().select(0);
}

The last line of code selects a value in the ComboBox object.

Creating InvalidationListener Objects

To listen to changes in the properties of the text fields and combo boxes, create the
InvalidationListener objects fromMeters and toMeters as shown in Example 5–10.

Example 5–10

import javafx.beans.InvalidationListener;

private InvalidationListener fromMeters = new InvalidationListener() {

    @Override
    public void invalidated(Observable arg0) {
        if (!textField.isFocused()) {
            textField.setText(numberFormat.format(meters.get() /
                getMultiplier()));
        }
    }
};

private InvalidationListener toMeters = new InvalidationListener() {


@Override
public void invalidated(Observable arg0) {
    if (!textField.isFocused()) {
        return;
    }
    try {
        meters.set(numberFormat.parse(textField.getText()).doubleValue() * 
            getMultiplier());
    } catch (Exception ignored) {
    }
}

Adding Change Listeners to Controls and Ensuring Synchronization
To provide the synchronization between the text fields and combo boxes, add change
listeners as shown in Example 5–11.

**Example 5–11**
meters.addListener(fromMeters);
comboBox.valueProperty().addListener(fromMeters);
textField.textProperty().addListener(toMeters);
fromMeters.invalidated(null);

Create a bidirectional binding between the value of the slider and the value of the
meters object as shown in Example 5–12.

**Example 5–12**
slider.valueProperty().bindBidirectional(meters);

When a new value is typed in the text field, the invalidated method of the toMeters
listener is called, which updates the value of the meters object.

Creating the Converter Class
Open the Converter.java file that was automatically generated by the NetBeans IDE
and remove all of the code except for the main method. Then, press Ctrl (or
Cmd)+Shift+I to correct the import statements.

Defining Instance Variables
Add import statements for the ObservableList, DoubleProperty, and
SimpleDoubleProperty classes and create metricDistances, usaDistances, and
meters variables of the appropriate types as shown in Example 5–13.

**Example 5–13**
import javafx.beans.property.DoubleProperty;
import javafx.collections.ObservableList;
import javafx.beans.property.SimpleDoubleProperty;

private ObservableList<Unit> metricDistances;
private ObservableList<Unit> usaDistances;
private DoubleProperty meters = new SimpleDoubleProperty(1);
Creating the Constructor for the Converter Class

In the constructor for the Converter class, create Unit objects for the metric and the U.S. distances as shown in Example 5–14. Add the import statement for the FXCollections class. Later, you will instantiate two ConversionPanel objects with these units.

Example 5–14

```java
import javafx.collections.FXCollections;

public Converter() {
    metricDistances = FXCollections.observableArrayList(
        new Unit("Centimeters", 0.01),
        new Unit("Meters", 1.0),
        new Unit("Kilometers", 1000.0));

    usaDistances = FXCollections.observableArrayList(
        new Unit("Inches", 0.0254),
        new Unit("Feet", 0.305),
        new Unit("Yards", 0.914),
        new Unit("Miles", 1613.0));
}
```

Creating the Graphical Scene

Override the start method to create the graphical scene for your Converter application. Add two ConversionPanel objects to the graphical scene and lay out them vertically. Note that two ConversionPanel objects are instantiated with the same meters object. Use the VBoxBuilder class as a root container for the graphical scene. Add import statements for the SceneBuilder, VBoxBuilder, and StageBuilder classes and instantiate two ConversionPanel objects as shown in Example 5–15.

Example 5–15

```java
import javafx.scene.SceneBuilder;
import javafx.scene.layout.VBoxBuilder;
import javafx.stage.StageBuilder;

@Override
public void start(Stage stage) {
    StageBuilder.create()
        .scene(SceneBuilder.create()
            .root(VBoxBuilder.create()
                .children(
                    new ConversionPanel("Metric System", metricDistances, meters),
                    new ConversionPanel("U.S. System", usaDistances, meters))
                .build())
            .applyTo(stage);

    stage.show();
}
```

You can download the source code of the Converter application in JavaFX.
The Converter application in JavaFX is shown in Figure 5–2.

Figure 5–2  Converter Application in JavaFX

Compare the two applications with the same functionality implemented using the Swing library and JavaFX.

Not only does the application in JavaFX contain three files as compared with five files of the Swing application, but the code in JavaFX is cleaner. The applications also differ in look and feel.

View and Download Application Files

View Source Code
http://docs.oracle.com/javafx/2/swing/Converter.java.htm
http://docs.oracle.com/javafx/2/swing/ConversionPanel.java.htm

Download Source Code
http://docs.oracle.com/javafx/2/swing/Converter.zip