Objects in Programming

Lecture 5

Advanced User Interfaces

Extra material in Canvas

Overview

1. Layout Management
2. Choices
3. Menus
4. Using Time Events for Animations
5. Mouse Events
6. JavaFX

Learning goals

- Be able to implement GUIs making use of a *layout manager*
- Understand and be able to utilize commonly use *graphical components*
- Identify differences between *frames* and *panels*
- Understand and be able to utilize *menus*
- Understand and be able to utilize *time and mouse events*

LAYOUT MANAGEMENT

JFrame and JPanel

- JFrame: framed window
  - Generally used as a window for hosting stand-alone applications, like an alert window or notification window
  - Contains the title bar
- JPanel: it works as a container to host components
  - Can be considered as general container, which is used in case of complex or bigger functions which require grouping of different components together

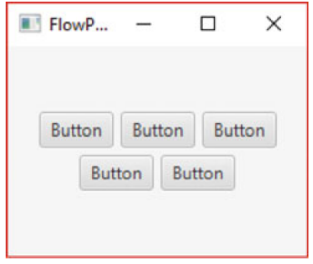
https://www.educba.com/jpanel-vs-jframe/

Layout Management

- In Java, you build up user interfaces by adding components into containers such as panels
- Each container has its own layout manager, which determines how components are laid out
- Three useful layout managers are the **flow layout**, **border layout**, and **grid layout**

https://www.oreilly.com/library/view/java-awt-reference/9781565922402/10_chapter-07.html

Before resizing



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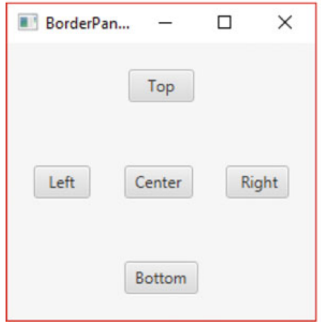

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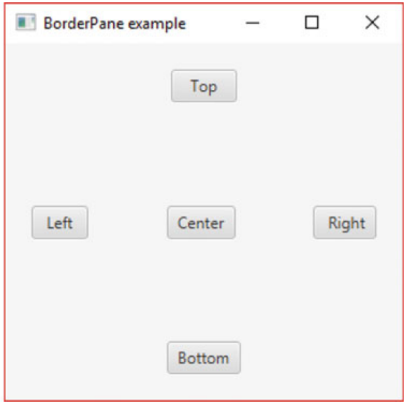

After resizing

Charatan, Q., & Kans, A. (2019). *Java in Two Semesters: Featuring JavaFX*. Springer.

Flow Layout

- By default, a JPanel uses a flow layout

- A flow layout simply arranges its components from left to right and starts a new row when there is no room in the current row

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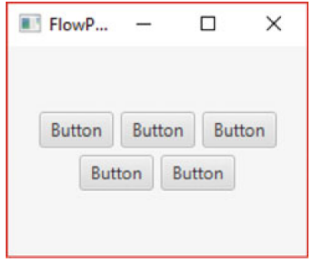

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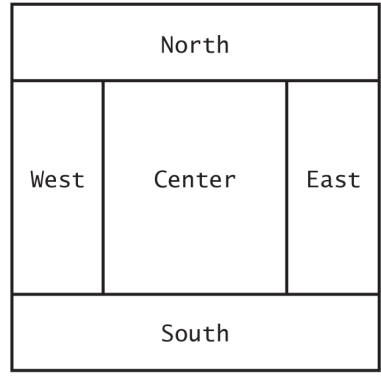
Border Layout

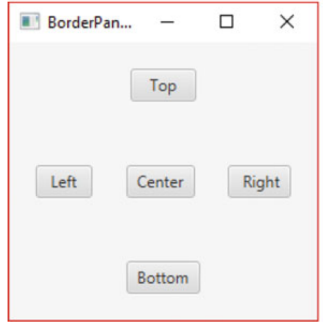


- Another commonly used layout manager is the border layout
- The border layout groups components into 5 areas (CENTER, NORTH, SOUTH, WEST, EAST)
- It is the default layout manager for a frame, but you can also use it in a panel:

```
panel.setLayout(new BorderLayout());
```

- Now the panel is controlled by a border layout, not the flow layout. When adding a component, you specify the position like this:

```
panel.add(component, BorderLayout.NORTH);
```



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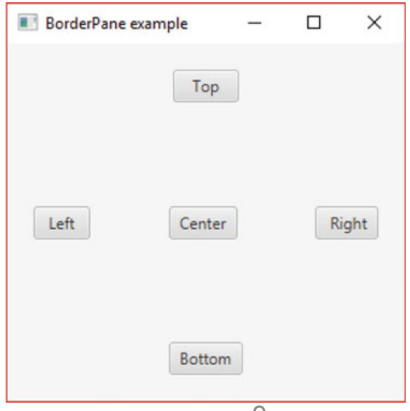
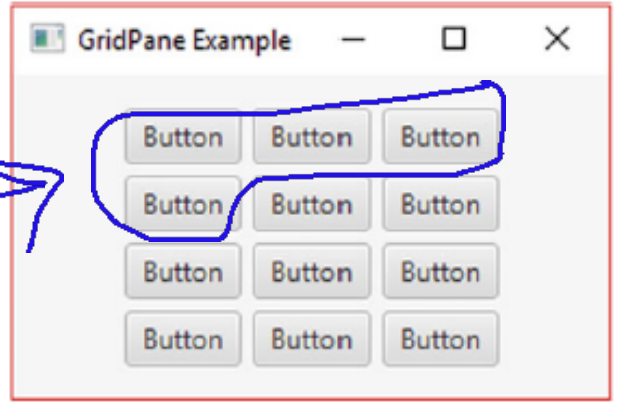


After resizing

Grid Layout

- The grid layout arranges components in a grid with a fixed number of rows and columns
- All components are resized so that they all have the same width and height
- Like the border layout, it expands each component to fill the entire allotted area
- If not desirable, you need to place each component inside a panel
- To create a grid layout, you supply the number of rows and columns in the constructor, then add the components row by row, left to right

```
JPanel buttonPanel = new JPanel();
buttonPanel.setLayout(new GridLayout(4, 3));
buttonPanel.add(button1);
buttonPanel.add(button2);
buttonPanel.add(button3);
buttonPanel.add(button4);
...
```



https://docs.oracle.com/javase/7/docs/api/java/awt/Container.html

Charatan, Q., & Kans, A. (2019). *Java in Two Semesters: Featuring JavaFX*. Springer.

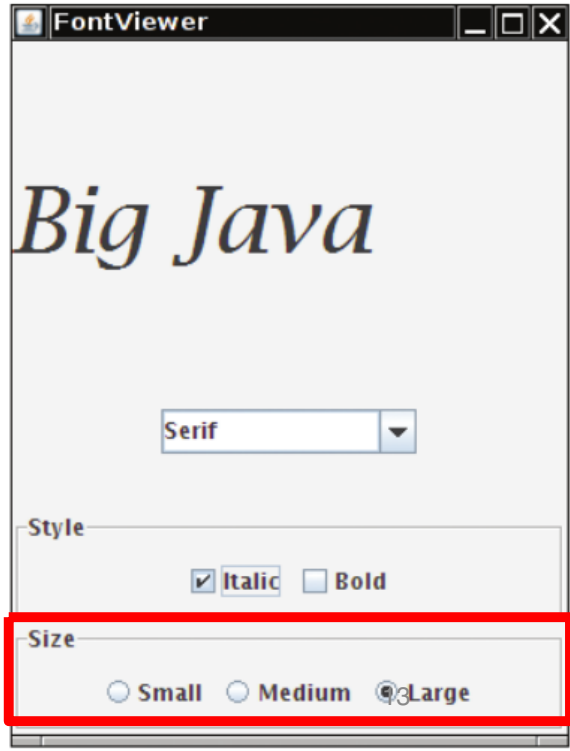
CHOICES

Choices

- How to present a finite set of choices to the user?
- Which Swing component you use if the choices are mutually exclusive or not?
- What about the amount of space you have for displaying the choices?

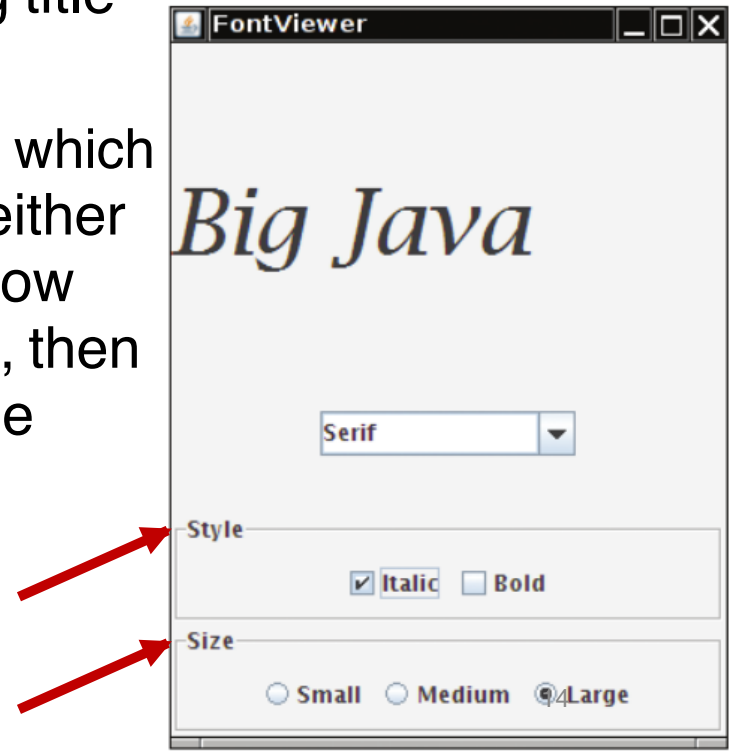
Radio Buttons

- If the choices are mutually exclusive, use a set of radio buttons
- Only one button can be selected at a time



Presenting button groups

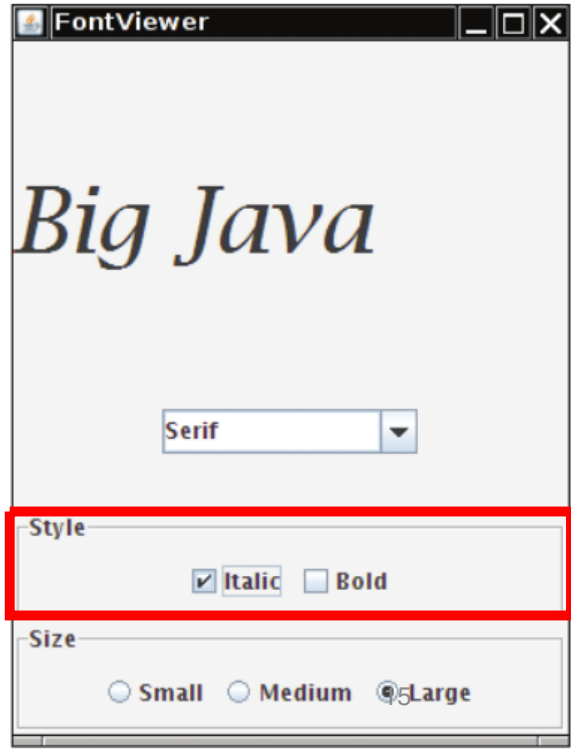
- **javax.swing.border.TitledBorder**: A class which implements an arbitrary border with the addition of a String title in a specified position and justification
- **javax.swing.border.EtchedBorder**: A class which implements a simple etched border which can either be etched-in or etched-out. If no highlight/shadow colors are initialized when the border is created, then these colors will be dynamically derived from the background color of the component argument passed into the paintBorder() method.



Check Boxes

- A check box is a UI component with 2 states: **checked** and **unchecked**
- They are not exclusive
- Check boxes are square and have a check mark when selected
- Because check box settings do not exclude each other, you do not place a set of check boxes inside a button group
- You can use ***isSelected*** method to find out whether a check box is currently checked or not

```
JCheckBox italicBox = new JCheckBox("Italic");
JCheckBox boldBox = new JCheckBox("Bold");
```

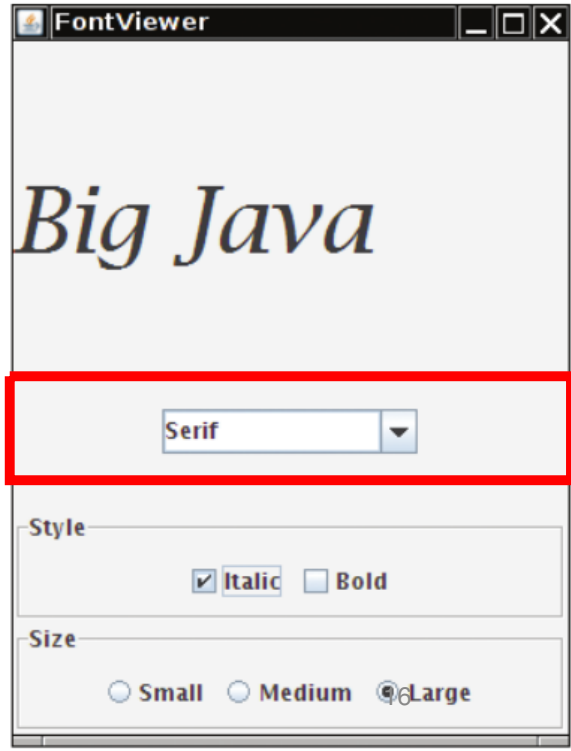


Combo Boxes

- If you have a lot of choices and little space you can use a combo box
- A combination of a list and a text field
- If the combo box is editable you can also type in your own selection
- To make a combo box editable, call the ***setEditable*** method

```
JComboBox combo = new JComboBox();
combo.addItem("Serif");
combo.addItem("SansSerif");
...
String select = (String) combo.getSelectedItem();
```

Exercise to practise: replace the Radio buttons with a combo box



Homework

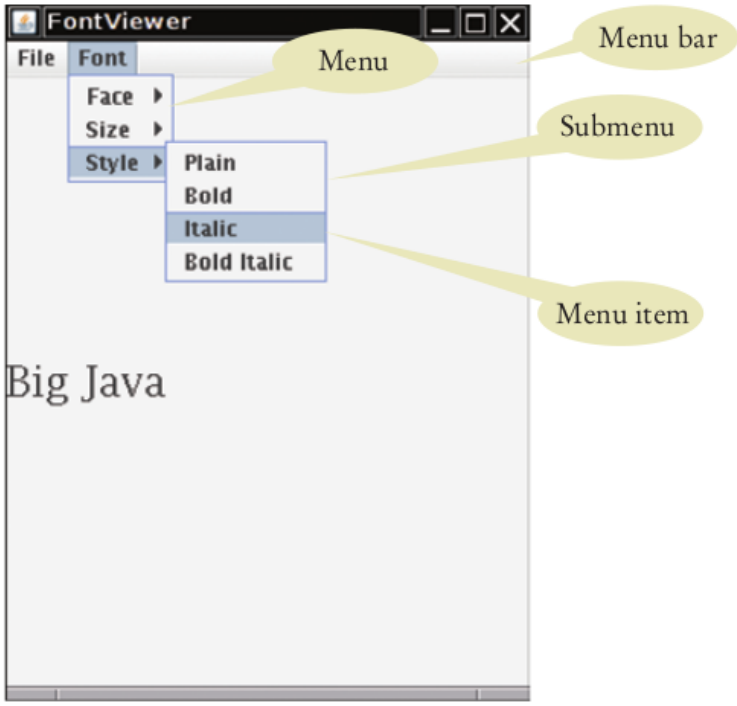
- Implement the GUI including:
  - Label
  - Combo box
  - Check boxes
  - Radio buttons
  - **Events to modify the label accordingly**

MENUS

Menus

- Anyone who has ever used GUI is familiar with pull-down menus
- At the top of the frame is a **menu bar** that contains the top-level menus
- Each menu is a collection of **menu items** and **submenus**

Menu's example



Menus

- When the user selects a menu item, the menu item sends an action event. Therefore, you must add a listener to each menu item

```
ActionListener listener = new ExitItemListener();
exitItem.addActionListener(listener);
```

- You add action listeners only to menu items, not to menus or the menu bar
- When the user clicks on a menu name and a submenu opens, no action event is sent

Using variables from an inner class method

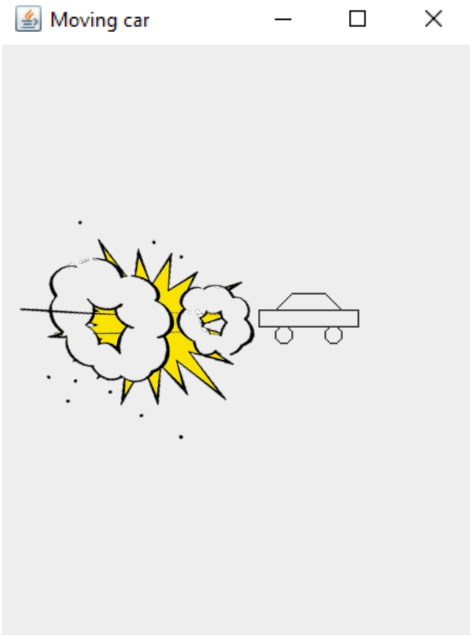
USING TIMER EVENTS FOR ANIMATIONS

Using Timer Events for Animations

- The **Timer** class in the **javax.swing** package generates a sequence of action events, spaced at even time intervals
- This is useful whenever you want to send continuous updates to a component
  - E.g., in an animation you may want to update a scene 10 times per second and redisplay the image to give the illusion of movement

1. When you use a timer you specify the frequency of the events and an object of a class that implements the **ActionListener** interface
2. Place whatever action you want to occur inside the **actionPerformed** method
3. Start the timer

Let’s start our car!



Example – refreshing components

https://docs.oracle.com/javase/7/docs/api/javax/swing/Timer.html

Homework

MOUSE EVENTS

Mouse Events

- If you write programs that show drawings, and you want the users to manipulate the drawings with a mouse, then you need to listen to mouse events

- Mouse listeners are more complex than action listeners

Mouse Listener

- A mouse listener must implement the MouseListener interface, which contains the following 5 methods

```
public interface MouseListener {
    void mousePressed(MouseEvent event);
    void mouseReleased(MouseEvent event);
    void mouseClicked(MouseEvent event);
    void mouseEntered(MouseEvent event);
    void mouseExited(MouseEvent event);
}
```

- It often happens that a particular listener specifies actions only for one or two of the listener methods. Nevertheless, all 5 methods of the interface must be implemented
  - You can also use adapters (see Lecture 4)

JAVAFX

JavaFX

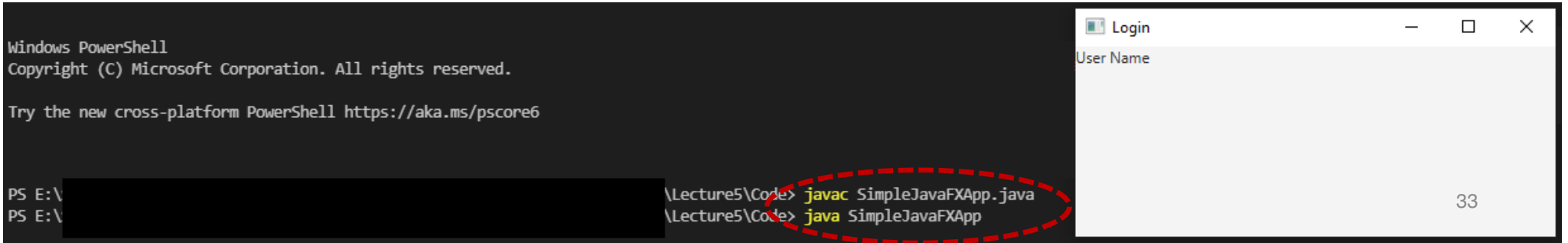
- JavaFX is a library that enables you to create and deploy a rich client application

- The main purpose of this library is to enable a developer to create a consistent look and feel across a variety of platforms such as cell phone, browser, car dashboard, and so forth

JavaFX

- The library is shipped along with the Java SDK by default (no separate installation required) in versions before Java 11
  - For newer versions (JavaFX JDK and SDK!!!): https://docs.oracle.com/javafx/2/installation/jfxpub-installation.htm
  - For its access from Visual Studio Code: https://marketplace.visualstudio.com/items?itemName=shrey150.javafx-support
  - Setting up VS Code: https://www.youtube.com/watch?v=H67COH9F718 https://linuxtut.com/en/66fbd4a6b3db8e7c2851/

- If you face issue to set up VS Code, just compile and run the files directly from the command line:



JavaFX and Swing

- Swing has been around for quite some time with the same purpose of providing UI needs of Java
- Swing offers excellent flexibility and capability in creating a GUI
- Swing classes are not built to leverage graphical hardware components. This reduces performance and lacks efficiency when dealing with complex graphics
- JavaFX brought a fresh new UI framework as a complete UI library

https://www.educba.com/java-swing-vs-java-fx/

Layouts and UI Controls

- Layouts should have consistent arrangements of a UI control such as Buttons, Texts, Shapes, within the viewable area
- JavaFX layouts are simpler and more intuitive to implement than Swing layouts
- Some common layouts are:

  javax.scene.layout.Hbox: Lays out UI controls within a horizontal box

  javax.scene.layout.Vbox: Lays out UI controls within a vertical box

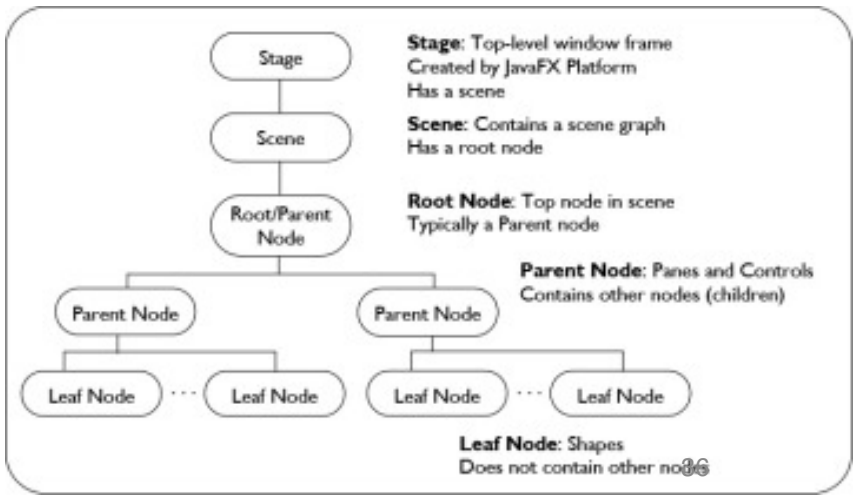
  javax.scene.layout.FlowPane: UI controls are arranged in a flow that wraps at the flow pane interior

  javax.scene.layout.BorderPane: UI controls are laid out in the left, top, right, bottom, and centre position of the scene

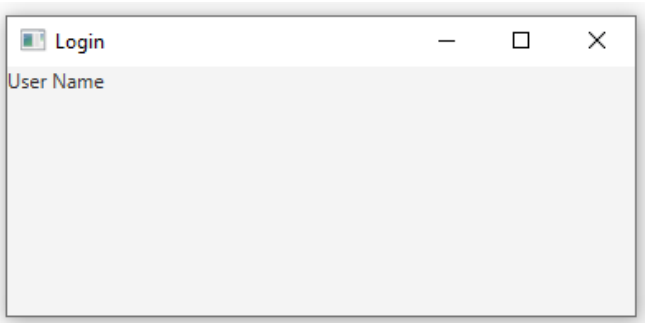
  javax.scene.layout.GridPane: Lays out UI controls in a tabular fashion, in grids of rows and columns

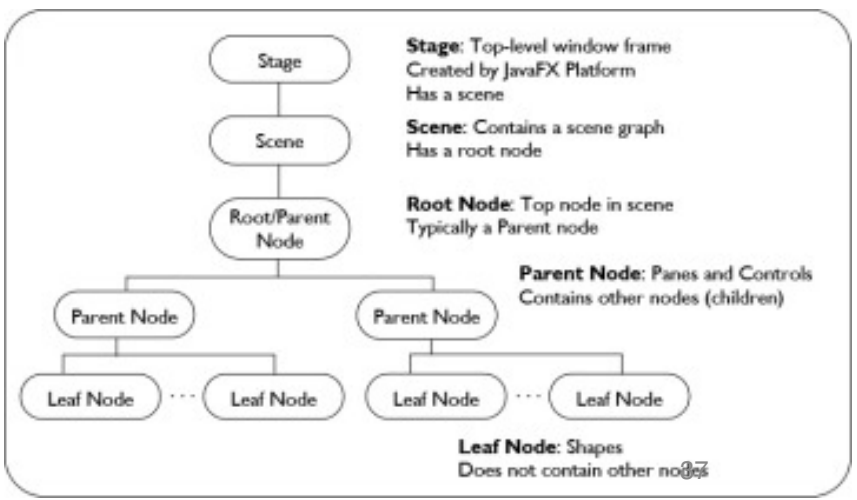
JavaFX example

- JavaFX *Stage* (javafx.stage.Stage): represents a window in a JavaFX desktop application
- JavaFX *Scene*: inside a JavaFX Stage you can insert a JavaFX Scene which represents the content displayed inside a window (inside a *Stage*).
- Launching a JavaFX application: it creates a root Stage object which is passed to the start(*Stage* primaryStage) method of the root class of your JavaFX application. This *Stage* object represents the primary window of your JavaFX application. You can create new *Stage* objects (in life time), if your application needs to open more windows.



JavaFX example





JavaFX Media

- The JavaFX media API enables a developer to incorporate audio and video capabilities into a Java application
- The Media API is designed to be cross platform; that means multimedia content can be implemented in an equivalent manner while coding across multiple devices (tablet, media player, TV, etc.)
- The **MediaPlayer** class provides the controls for media playing but does not provide any view
- A view can be realized with the help of **MediaView**

JavaFX Media example

JavaFX Web

- JavaFX provides capabilities to interoperate HTML5 contents with the help of **WebKit** rendering engine
- Similar to MediaView, WebView is used to manage WebEngine and display its content
- JavaFX can harness HTML5's rich Web content to create a Web user interface resembling the native desktop

JavaFX Web example

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