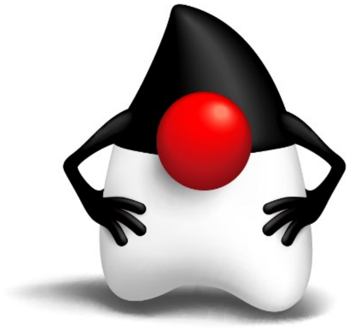
Java™

MOVING JAVA FORWARD

ORACLE®

JavaFX: Java's new Rich Client Platform



Java Pioneered Rich Client Applications

But developers had to learn multiple technologies

Tutorial and API Docs

http://docs.oracle.com/javase/8/javafx/get-started-tutorial/

http://docs.oracle.com/javase/8/javase-clienttechnologies.htm

Ensemble – Collection of Examples

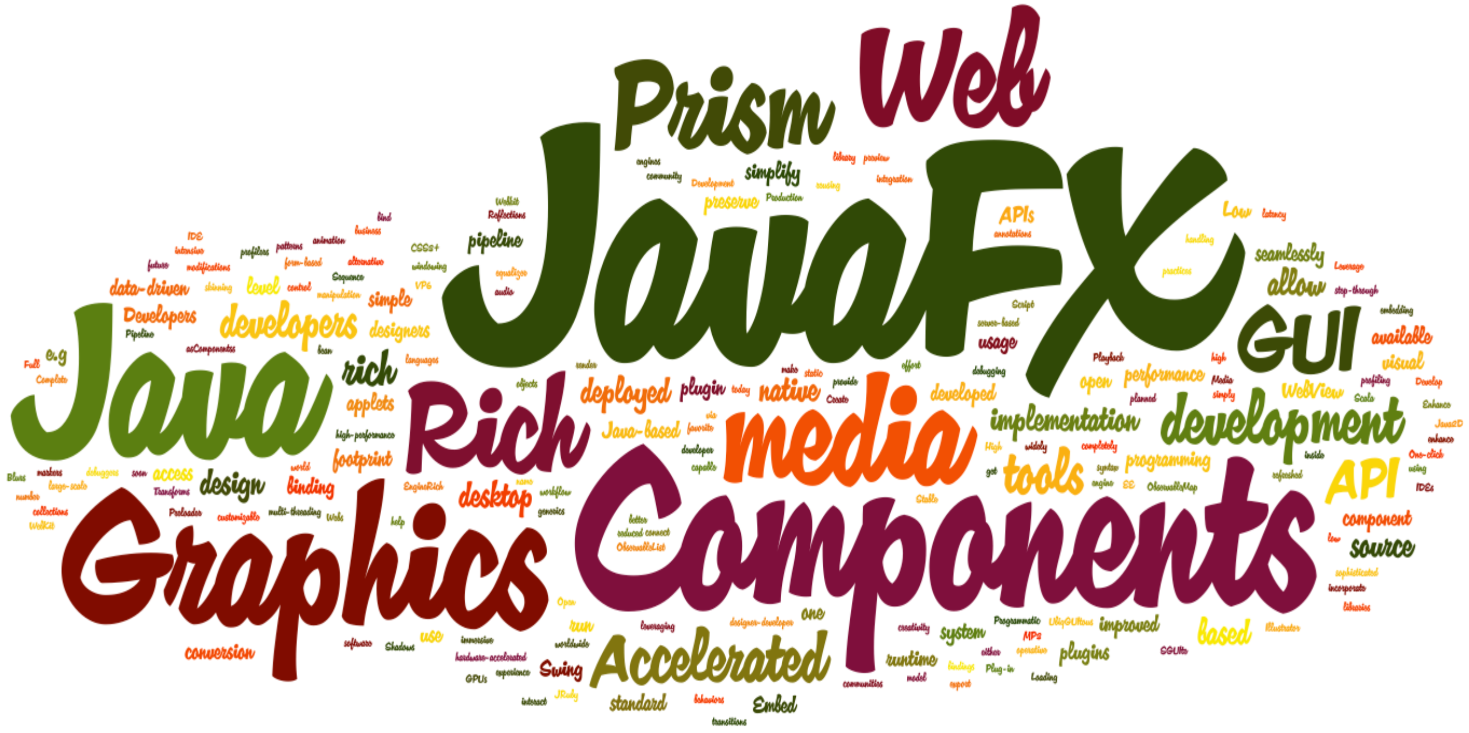
http://download.oracle.com/otndocs/products/javafx/2/samples/Ensemble/index.html

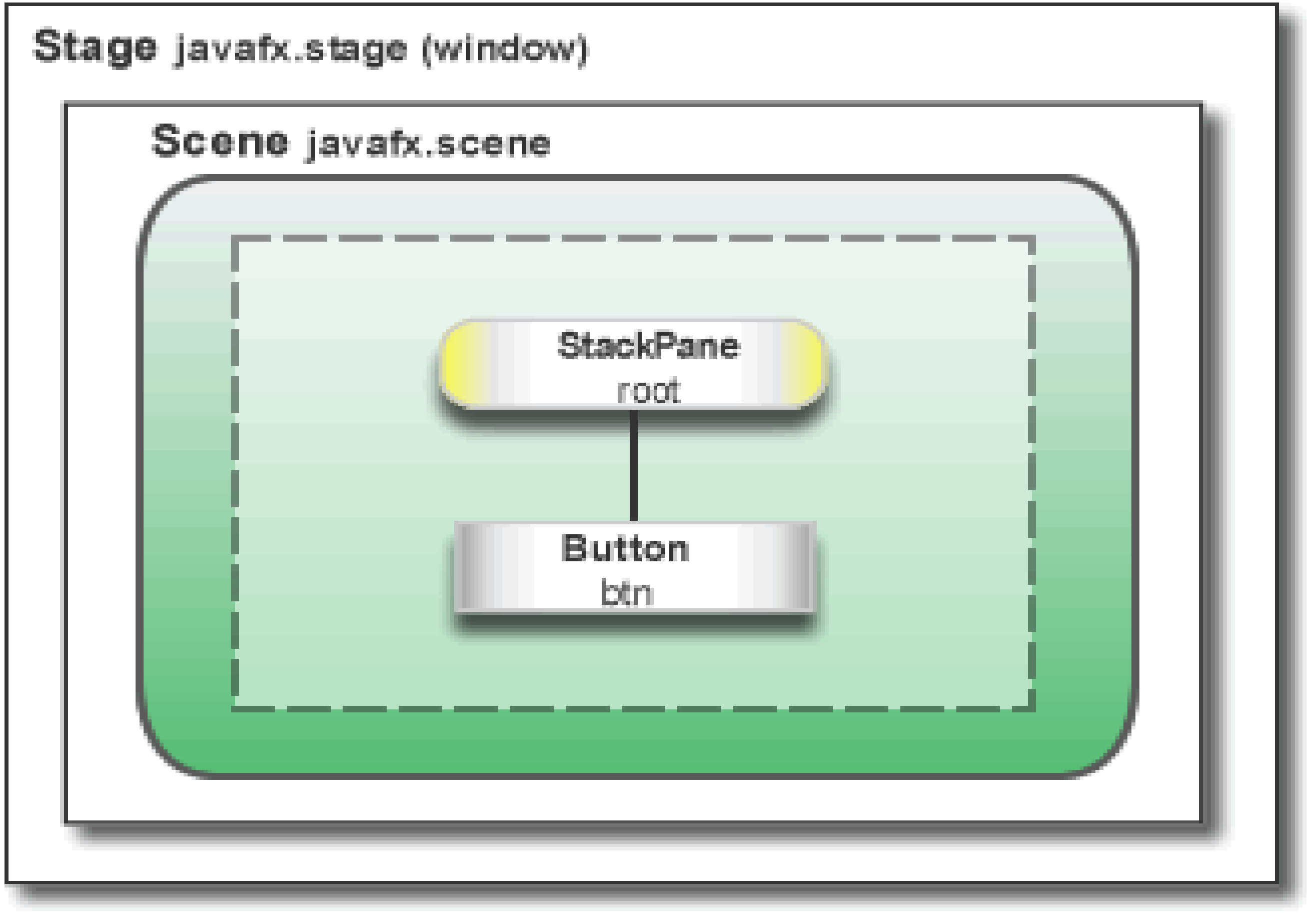
Videos on JavaFX

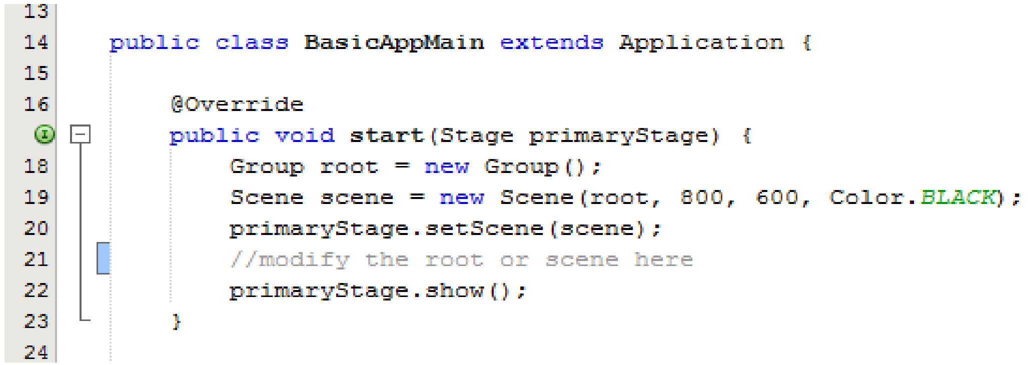
https://www.youtube.com/user/OracleLearning/search?query=javafx

JavaFX Simplifies Application Development

Developers Focus on Capabilities Instead of Technologies

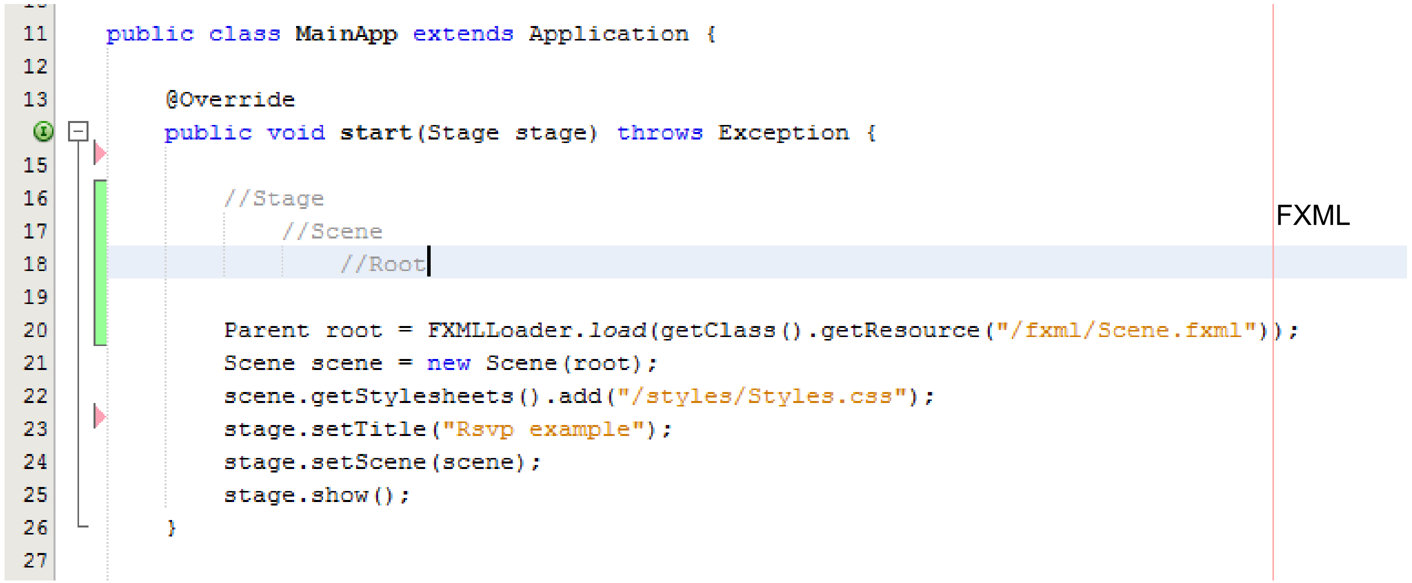



Stage javafx.stage (window)
Scene javafx.scene
StackPane
root
Button
btn



```
public class BasicAppMain extends Application {

    @Override
    public void start(Stage primaryStage) {
        Group root = new Group();
        Scene scene = new Scene(root, 800, 600, Color.BLACK);
        primaryStage.setScene(scene);
        //modify the root or scene here
        primaryStage.show();
    }

```

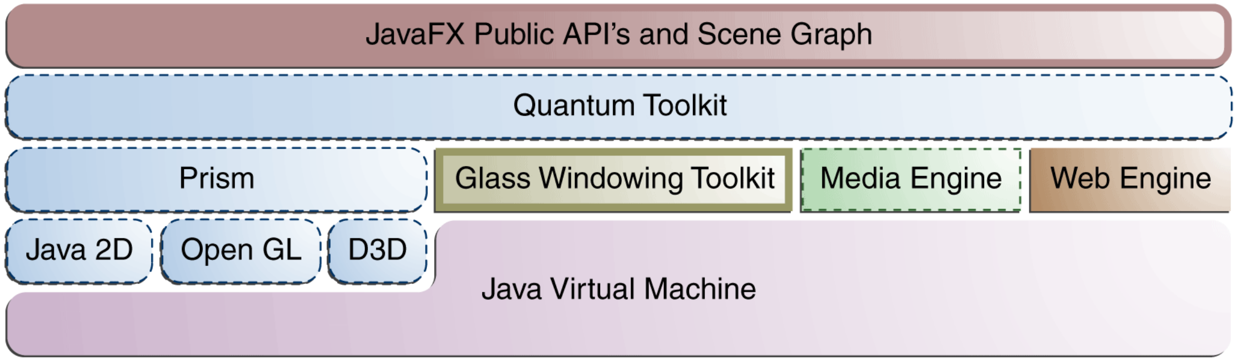
Manual



```
public class MainApp extends Application {

    @Override
    public void start(Stage stage) throws Exception {

        //Stage
            //Scene
                //Root

        Parent root = FXMLLoader.load(getClass().getResource("/fxml/Scene.fxml"));
        Scene scene = new Scene(root);
        scene.getStylesheets().add("/styles/Styles.css");
        stage.setTitle("Rsvp example");
        stage.setScene(scene);
        stage.show();
    }

```

FXML

JavaFX Runtime High Level Architecture



JavaFX Glossary

- **Glass Windowing Toolkit**: Provides native operating services, such as managing the windows, timers, and surfaces
- **Prism**: Graphics pipeline that can run on hardware and software renderers
- **Quantum Toolkit**: Ties Prism and Glass together and makes them available to the JavaFX APIs
- This is completely seemless in Java8

Threads in JavaFX

- **JavaFX application thread**: This is the primary thread used by JavaFX application developers. Any "live" scene, which is a scene that is part of a window, **must be accessed from this thread**. A scene graph can be created and manipulated in a background thread, but when its root node is attached to any live object in the scene, that scene graph must be accessed from the JavaFX application thread. This enables developers to create complex scene graphs on a background thread while keeping animations on 'live' scenes smooth and fast. The JavaFX application thread is a different thread from the Swing and AWT Event Dispatch Thread (EDT), so care must be taken when embedding JavaFX code into Swing applications.
- **Prism render thread**: This thread handles the rendering separately from the event dispatcher. It allows frame N to be rendered while frame N +1 is being processed. This ability to perform concurrent processing is a big advantage, especially on modern systems that have multiple processors. The Prism render thread may also have multiple rasterization threads that help off-load work that needs to be done in rendering.
- **Media thread**: This thread runs in the background and synchronizes the latest frames through the scene graph by using the JavaFX application thread.

JavaFX Pulse

- A pulse is an event that indicates to the JavaFX scene graph that it is time to synchronize the state of the elements on the scene graph with Prism.
- A pulse is throttled at 60 frames per second (fps) maximum and is fired whenever animations are running on the scene graph.
- Even when animation is not running, a pulse is scheduled when something in the scene graph is changed.
- When a pulse is fired, the state of the elements on the scene graph is synchronized down to the rendering layer.
- Numerous changes in the scene graph could lead to multiple layout or CSS updates, which could seriously degrade performance. The system automatically performs a CSS and layout pass once per pulse to avoid performance degradation.
- The Glass Windowing Toolkit is responsible for executing the pulse events.

Java APIs and FXML

Java APIs for JavaFX	FXML
• End-to-end Java development • Java language features - generics, annotations, multi-threading • Fluent API for UI construction • Alternative JVM supported languages (e.g. Groovy, Scala) with JavaFX • Leverage sophisticated Java IDEs, debuggers and profilers • Java APIs preserve convenient JavaFX Script features (e.g., bind)	• Scriptable, XML-based markup language for defining UI • Convenient alternative to developing UI programmatically in Java • Easy to learn and intuitive for developers familiar with web technologies or other markup based UI technologies • Powerful scripting feature allows embedding scripts within FXML. Any JVM scripting language can be used, including JavaScript, Groovy, and Scala

Graphics and Media

New Graphics Pipeline

- New hardware accelerated graphics pipeline (Prism)
- New windowing toolkit (Glass) for Prism
- Java2D software pipeline under Prism
- High-level support for making rich graphics simple
  - Shadows, Blurs, Reflections, Effects, 2D transforms
  - 3D Transforms; Full 3D objects

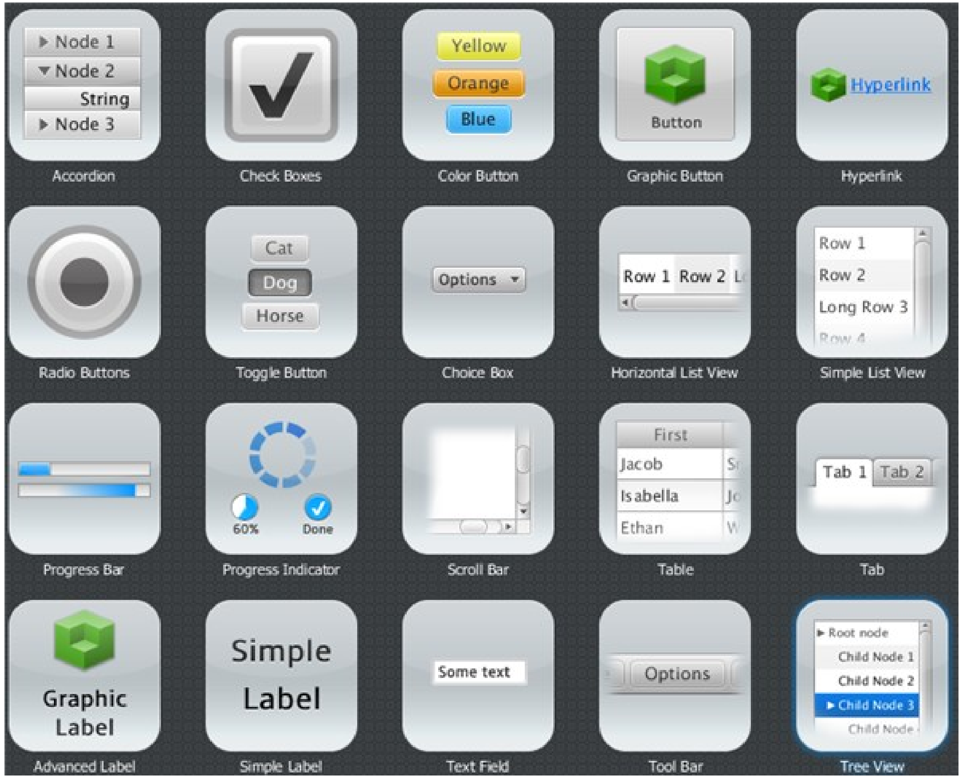
Media

- Stable media framework based on GStreamer
- VP6, MP3 playback of Web multimedia content
- Low latency audio
- Alpha channel support
- Performance improvements
- Full screen video

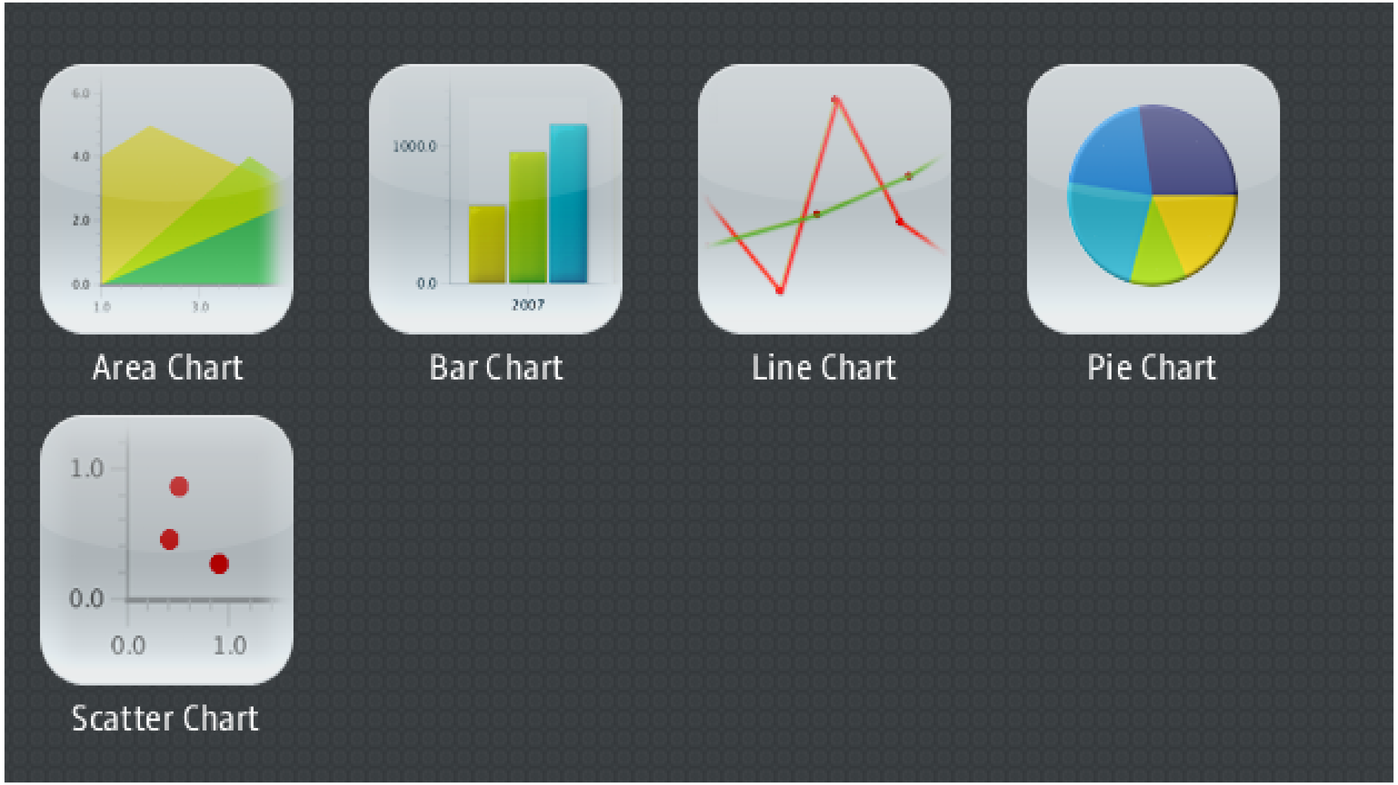
WebView and Swing Interoperability

WebView Component	Swing and SWT Interop	Browser Plugin
• Embed Web content in JavaFX applications • HTML rendering based on Webkit • Hardware accelerated rendering using PRISM • DOM access and manipulation	• Embed JavaFX content into existing Swing applications • Extend existing Swing applications with new JavaFX features such as WebView and high-performance graphics • Applies to SWT applications as well	• Faster loading of JavaFX Web applications based on Prism • Pre-loader for improved user experience with JavaFX Web applications

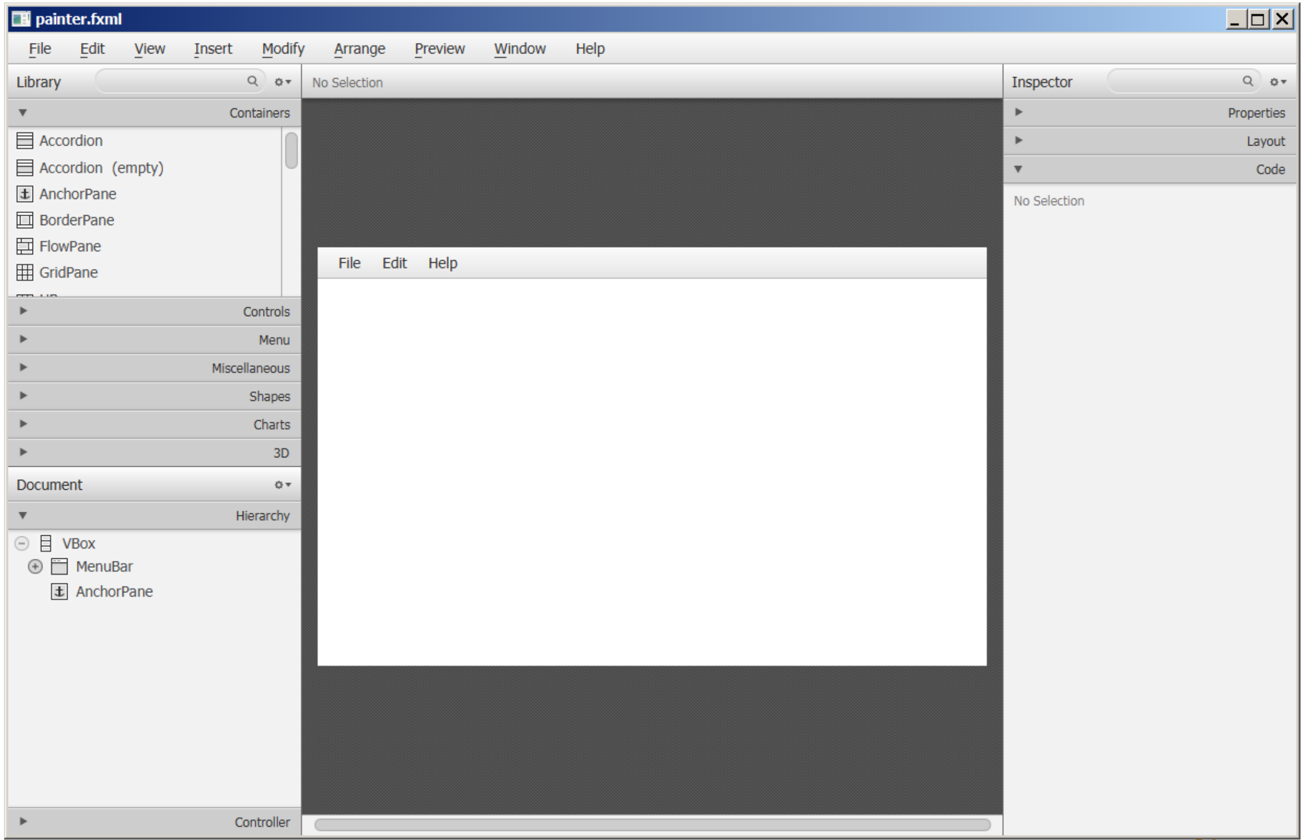
UI Controls


Node 1
Node 2
String
Node 3
Accordion
Check Boxes
Yellow
Orange
Blue
Color Button
Button
Graphic Button
Hyperlink
Hyperlink
Radio Buttons
Cat
Dog
Horse
Toggle Button
Options
Choice Box
Row 1
Row 2
Horizontal List View
Row 1
Row 2
Long Row 3
Row 4
Simple List View
Progress Bar
60%
Done
Progress Indicator
Scroll Bar
First
Jacob
Isabella
Ethan
Table
Tab 1
Tab 2
Tab
Graphic Label
Advanced Label
Simple Label
Simple Label
Some text
Text Field
Options
Tool Bar
Root node
Child Node 1
Child Node 2
Child Node 3
Child Node
Tree View

Charts

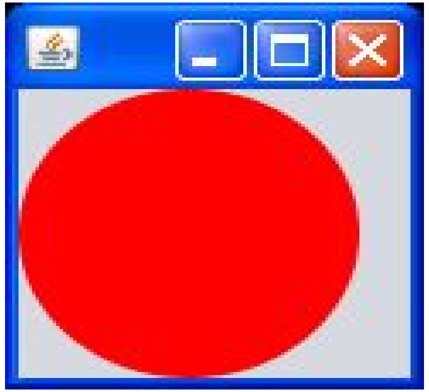

6.0
4.0
2.0
0.0
1.0
3.0
Area Chart
1000.0
0.0
2007
Bar Chart
Line Chart
Pie Chart
1.0
0.0
0.0
1.0
Scatter Chart

SceneBuilder



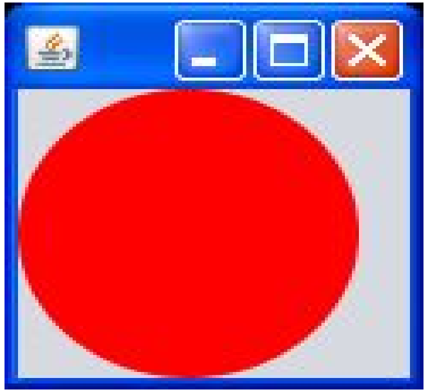
Let’s Compare: JavaFX 2.0

```
public class JavaFXTest extends Application {
  @Override public void start(Stage stage) {
    Group root = new Group();
    Scene scene = new Scene(root,100,100);
    stage.setScene(scene);

    Circle c1 =
      new Circle(50.0f, 50.0f, 50.0f, Color.RED);

    root.getChildren().add(c1);
    stage.show();
  }

  public static void main(String a[]) {
    launch(JavaFXTest.class, null);
  }
}
```



Let’s Compare: FXML

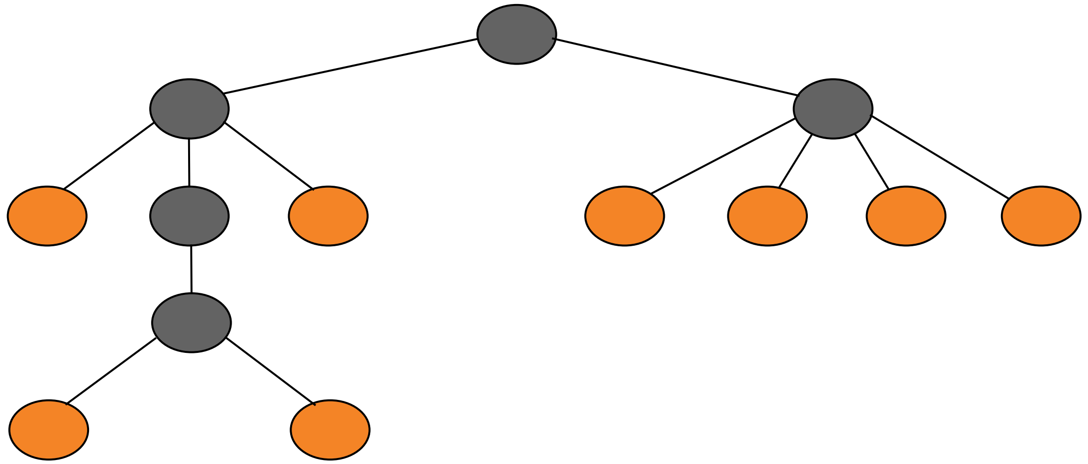
```
<BorderPane>
  <center>
    <Circle radius=“50” centerX=“50” centerY=“50”/>
  </center>
</BorderPane>
```

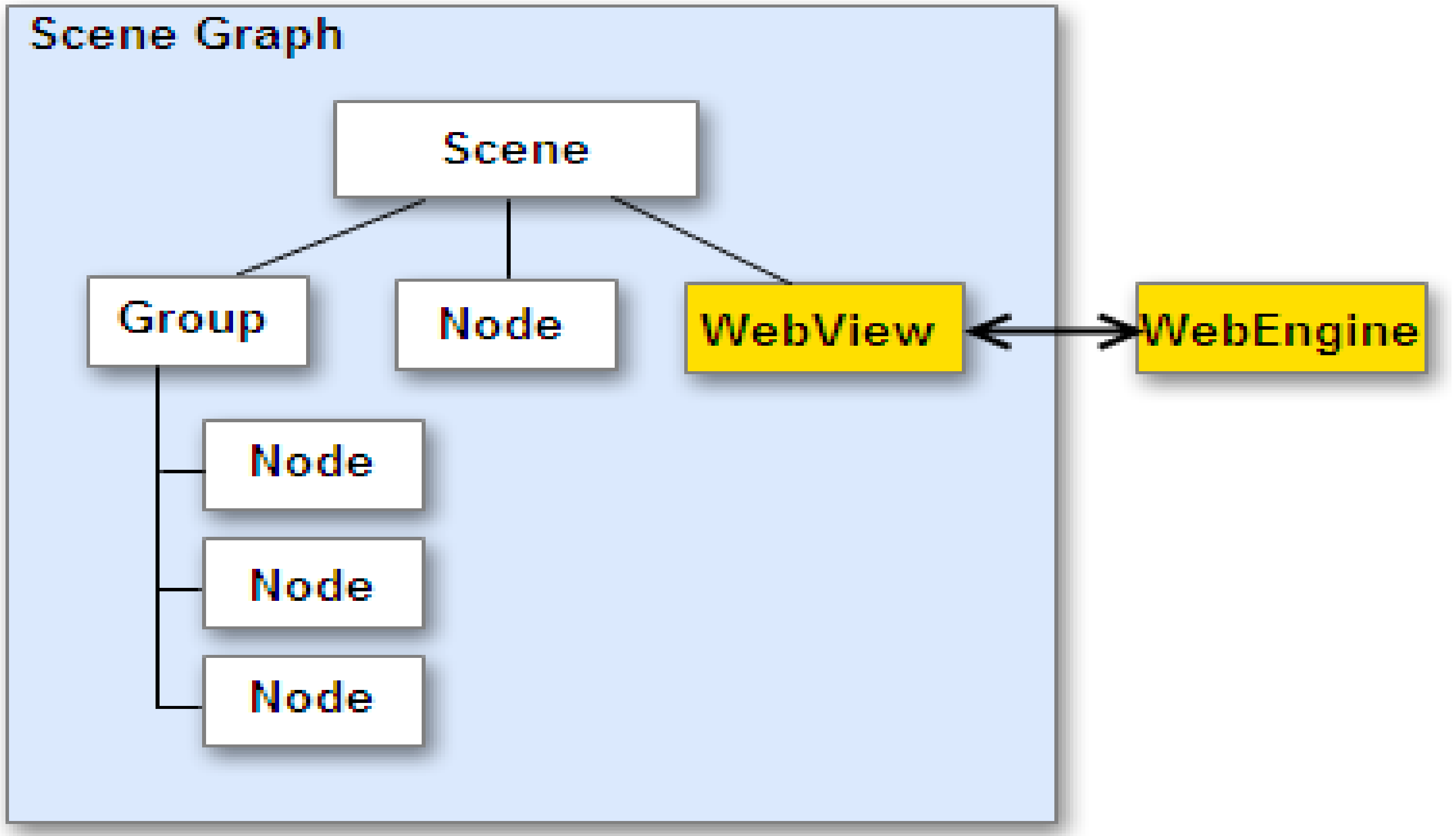


```
public class JavaFXTest extends Application {
  @Override public void start(Stage stage) {
    stage.setTitle(“FXML Example”);
    Parent root = FXMLLoader.load(getClass().getResource(“example.fxml"),
        ResourceBundle.getBundle(“r.fxml_example"));
    stage.setScene(new Scene(root));
    stage.show();

  }
}
```

Scene Graph

- Directed Acyclic Graph
- Parents and children
- Representation of the GUI components




Scene Graph
Scene
Group
Node
WebView
WebEngine
Node
Node
Node

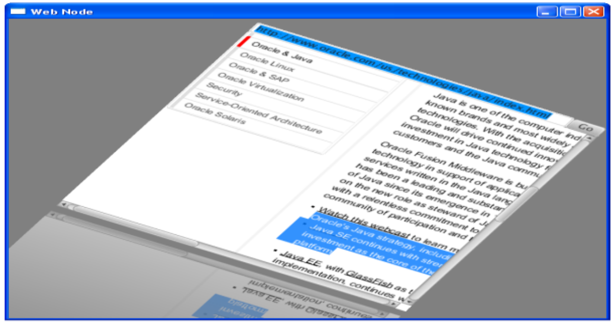
Media

- JavaFX supports both visual and audio media
- Cross-platform JavaFX media file format (fxm, mp3)
  - Platform specific formats supported via native players
- Media class represents a media file
- MediaPlayer provides control of the media rendering
- MediaView uses MediaPlayer to render media as Node
  - Many MediaViews can use the same MediaPlayer (cheaply)

Adding HTML Content

The Embedded Browser

- WebEngine
  - Provides basic web page browsing functionality
  - Supports user interaction: navigating links, submitting forms
- WebView
  - Web page as a Node in scenegraph
    - Effects can be applied
  - Encapsulates WebEngine object
  - No plugin support



Effects...

GaussianBlur

InnerShadow

Reflection

SepiaTone

Transforms

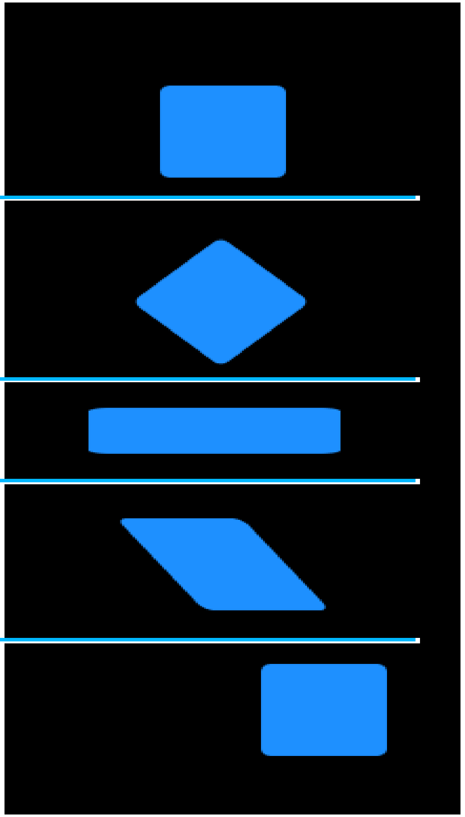
```
Rectangle rect=new Rectangle(0,0,60,60);
rect.setFill(Color.DODGERBLUE);
rect.setArcWidth(10);
rect.setArcHeight(10);
```

```
rect.setRotate(45);
```

```
rect.setScaleX(2);
rect.setScaleY(0.5);
```

```
Shear shear = new Shear(0.7, 0);
rect.getTransforms().add(shear);
```

```
rect.setTranslateX(40);
rect.setTranslateY(10);
```



Binding

- Creates a dependency between a property and a changeable value
- High level API
  - Easy to use
  - Covers most common situations
- Low level API
  - Allows for more complex interactions
  - Optimised for fast execution and small footprint

Properties

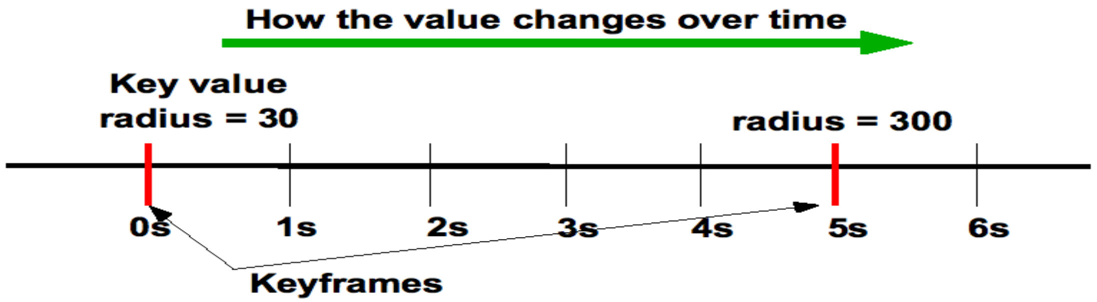
- Basis for high level binding API
- Concrete types for all primitives, String and Object
  - **`DoubleProperty`**, **`StringProperty`**, etc
- Simple API
  - **`bind`** / **`unbind`**
  - **`bindBidirectional`** / **`unbindBidirectional`**
  - **`isBound`**

Simple Binding Example

```
private SimpleDoubleProperty topXProperty =
  new SimpleDoubleProperty();
private SimpleDoubleProperty topYProperty =
  new SimpleDoubleProperty();

Line foldLine = new Line();
foldLine.setEndX(200);
foldLine.setEndY(200);
foldLine.startXProperty().bind(topXProperty);
foldLine.startYProperty().bind(topYProperty);

...

topXProperty.set(tx);
topYProperty.set(ty);
```

Timeline Based Animations

- `Timeline`
  - Modifies values of variables specified in KeyFrames
- `KeyFrame`: specifies that a variable should have
  - A particular value at a particular time
- `KeyValue`: Value to be interpolated for an interval



Animated Transitions

- Pre-defined, single-purpose animations
  - Fade, Path, Pause, Rotate, Scale, Translate
  - Can specify to, from and by values
- Container transitions
  - Parallel, sequential
  - Can be nested arbitarily
- Transitions and Timelines share ancestary
  - A Timeline can be added to a Parallel / Sequential transition

Standard Java Tools for Easy Development

- Source editor with improved syntactic highlighting, code completion, refactoring etc.
- Full debugger and profiler support
- Project wizard for easy creation of JavaFX applications

Other Java IDEs

- Source editor with syntactic highlighting, code completion, refactoring etc.
- Full debugger and Profiler support

JavaFX is …

- Cross platform: Windows GA, Mac & Linux Dev. Preview
- Familiar: 100% Java APIs
- Powerful: leverages underlying Java platform
- Modern: CSS skinning, HW acceleration, Webkit
- Backwards ‘compatible’: Swing & SWT interoperability
- Flexible: applicable to embedded, tablets and mobile
- Open Source: http://openjdk.java.net/projects/openjfx