Introduction to JavaFX
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JavaFX is the Evolution of Java as a Rich Client Platform.

It is designed to provide a modern Java environment featuring a lightweight, hardware accelerated UI platform that meets tomorrow’s needs.
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.
## Java APIs and FXML

### Java APIs for JavaFX
- 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)

### FXML
- 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
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 today; Full 3D objects in future
Open Source and Standardization

• JavaFX source code being contributed as part of OpenJFX
  http://openjdk.java.net/projects/openjfx/
  – Source code being contributed in phases
  – Initial phase: UI Controls

• Oracle is committed to standardize JavaFX through JCP
  – One or more JSRs will be submitted
  – Expected to be become part of the Java SE specification
Let's Compare: JavaFX 1.x

```java
import javafx.application.*;
import javafx.scene.shape.*;
import javafx.scene.paint.*;

Stage {
    scene:Scene{
        Content:[
            Circle {
                centerX: 50
                centerY: 50
                radius: 50
                fill: Color.RED
            }
        ]
    }
}
```
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.setVisible(true);
    }

    public static void main(String args[]) {
        launch(args);
    }
}
Let’s Compare: FXML

```xml
<BorderPane>
  <center>
    <Circle radius="50" centerX="50"
      centerY="50" color="red"/>
  </center>
</BorderPane>
```

```java
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();
    }
}
```
Fluent API

• Controls have associated Builder class
  – e.g. `CircleBuilder<B extends CircleBuilder<B>>`

```
Circle c = CircleBuilder.<B extends CircleBuilder<B>>
  .create()
  .centreX(50).
  .centreY(50).
  .radius(50).
  .fill(Color.RED).
  .build();
```
Scene Graph

• Directed Acyclic Graph
• Parents and children
• Representation of the GUI components
Media

- Stable media framework based on GStreamer
- VP6, MP3 playback of Web multimedia content
  - Platform specific formats supported via native players/codecs
- Low latency audio
- Alpha channel support
- Performance improvements
- Full screen video
Media

- JavaFX supports both visual and audio media
  - Including low latency audio/alpha channel support
- 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)
Table

- Full featured table component
  - Resizeable columns
  - Columns can be moved
  - Groups of columns can be moved
- Uses standard MVC pattern
  - Create model for data
  - Attach to Table ‘view’ for display
- Efficient
  - Lazy loading of data – only displayed data is loaded

<table>
<thead>
<tr>
<th>First</th>
<th>Last</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacob</td>
<td>Smith</td>
<td><a href="mailto:jacob.smith@example.com">jacob.smith@example.com</a></td>
</tr>
<tr>
<td>Isabella</td>
<td>Johnson</td>
<td><a href="mailto:isabella.johnson@example.com">isabella.johnson@example.com</a></td>
</tr>
<tr>
<td>Ethan</td>
<td>Williams</td>
<td><a href="mailto:ethan.williams@example.com">ethan.williams@example.com</a></td>
</tr>
<tr>
<td>Emma</td>
<td>Jones</td>
<td><a href="mailto:emma.jones@example.com">emma.jones@example.com</a></td>
</tr>
<tr>
<td>Michael</td>
<td>Brown</td>
<td><a href="mailto:michael.brown@example.com">michael.brown@example.com</a></td>
</tr>
</tbody>
</table>
Adding HTML Content
The Embedded Browser (WebKit based)

• WebEngine
  – Provides basic web page browsing functionality
  – Supports user interaction: navigating links, submitting forms
  – DOM/JavaScript access/injection

• WebView
  – Web page as a Node in scenegraph
    • Effects can be applied
  – Encapsulates WebEngine object
  – No plugin support
Charts

- Area Chart
- Bar Chart
- Line Chart
- Pie Chart
- Scatter Chart
CSS Support

• All controls can be styled through CSS
  – Default, ‘Caspian’ stylesheet

• Change before starting application, or during runtime

```
.my-rect {
  -fx-fill: yellow;
  -fx-stroke: green;
  -fx-stroke-width: 5;
  -fx-stroke-dash-array: 12 2 4 2;
  -fx-stroke-dash-offset: 6;
  -fx-stroke-line-cap: butt;
}
```
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

```java
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 arbitrarily

• Transitions and Timelines share ancestry
  – A Timeline can be added to a Parallel / Sequential transition
Swing and SWT Interoperability

• 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
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 Scene Builder for Rapid UI Design

- WYSIWYG GUI design tool for the JavaFX platform
- Enables designing user interface screens by simply dragging and positioning GUI components from a palette onto a scene
- Generates files in FXML format that can be used within a project in any IDE such as NetBeans or Eclipse
- Can be used to create GUI for desktop and Web applications
- Currently in Early Access (by invitation)
Deployment

• Standard Java methods
  – Standalone application
  – Applet
  – Webstart

• From Java SE 7u6, JavaFX packager 2.2
  – Executable bundles: msi, exe, dmg, rpm
  – No admin permission (currently Windows only)
  – Auto-update facility being developed
Distribution and Support

• JavaFX Distribution
  – JavaFX Runtime can now be distributed with third party applications
  – Applies to JavaFX 2.0.2 and higher

• JavaFX Platform Commercial Support
  – JavaFX is now part of the Java SE technologies covered through Oracle Premier Support
  – Applies to JavaFX 2.0.2 and higher
JavaFX Future Directions

Oracle’s Next Generation Java Client Solution

• Tighter Integration with Java SE
• Migration Path for Java Client UI Technologies
• Optimized Web Services Support
• Advanced Tooling
• Support for Modern Device Interactions
• Delivering on the Cross Platform Promise
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
Resources

• JavaFX website: http://javafx.com

• Open source project
  http://openjdk.java.net/projects/openjfx/

• Oracle Premier Support for Software
  http://www.oracle.com/us/support/software/premier/

• Blogs
  – http://fxexperience.com
  – http://blogs.oracle.com/javafx

• Twitter: @javafx4you
Demos