JavaFX Tutorial

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Intro

Anatomy of an FX-App

Anatomy of an FX-App

```
import javafx.application.Application;

public class Main extends Application {

  @Override
  public void start(Stage primaryStage) {
```

Dervived from base class

Anatomy of an FX-App

```
import javafx.application.Application;

public class Main extends Application {

  @Override
  public void start(Stage primaryStage) {
      BorderPane root = new BorderPane();
```

Dervived from base class

Root-Container

Anatomy of an FX-App

```
import javafx.application.Application;

public class Main extends Application {

 @Override
 public void start(Stage primaryStage) {
     BorderPane root = new BorderPane();


     Scene scene = new Scene(root,400,400);
```

Dervived from base class

Root-Container

Scene with size

Anatomy of an FX-App

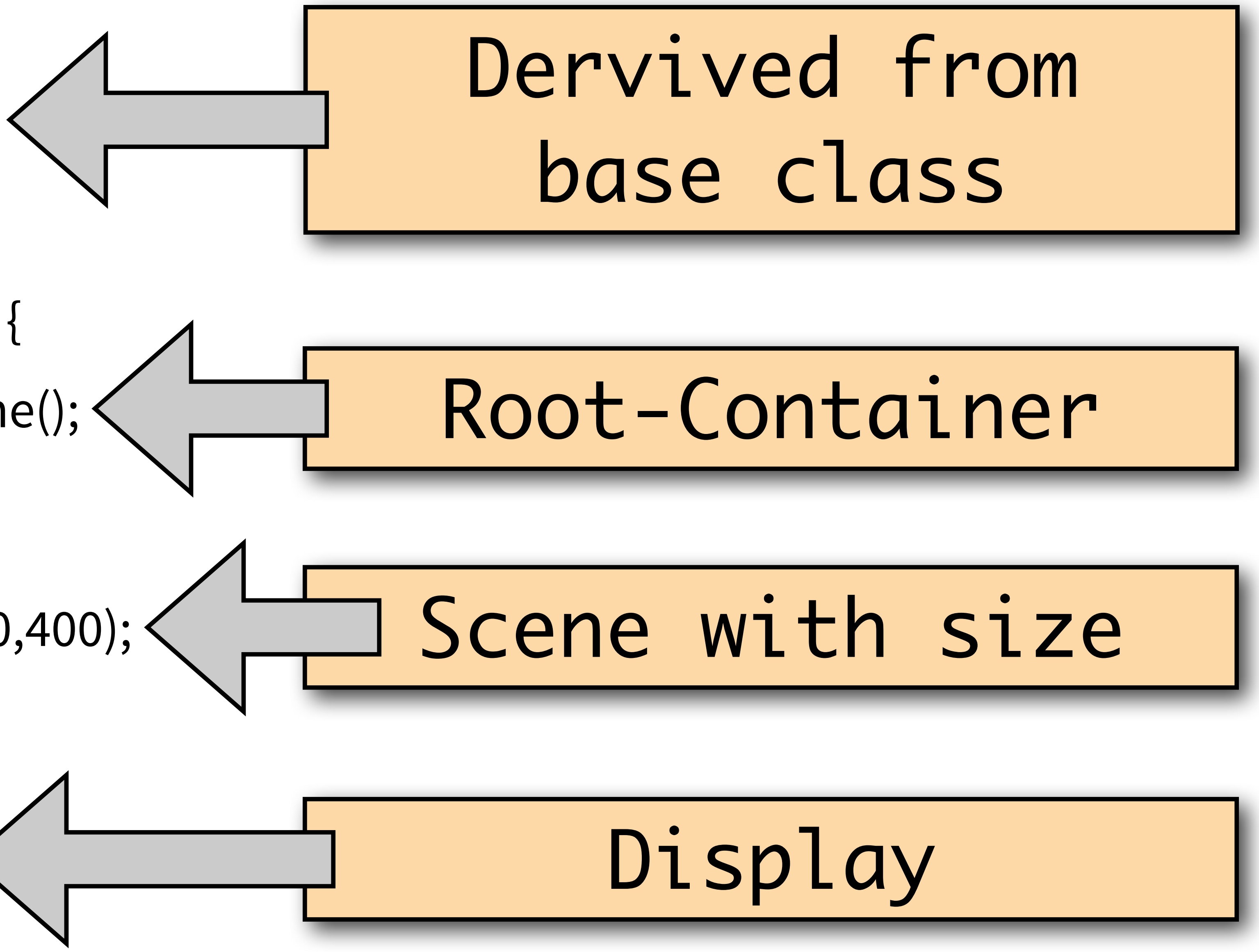
```
import javafx.application.Application;

public class Main extends Application {

  @Override
  public void start(Stage primaryStage) {
        BorderPane root = new BorderPane();


        Scene scene = new Scene(root,400,400);


        primaryStage.setScene(scene);
        primaryStage.show();
```



Anatomy of an FX-App

```
import javafx.application.Application;

public class Main extends Application {

  @Override
  public void start(Stage primaryStage) {
      BorderPane root = new BorderPane();


      Scene scene = new Scene(root,400,400);


      primaryStage.setScene(scene);
      primaryStage.show();

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

Dervived from base class

Root-Container

Scene with size

Display

inherited method

Lab HelloWorld

- Setting up Eclipse
- Creating your first JavaFX project
- Attaching the first Event-Listener

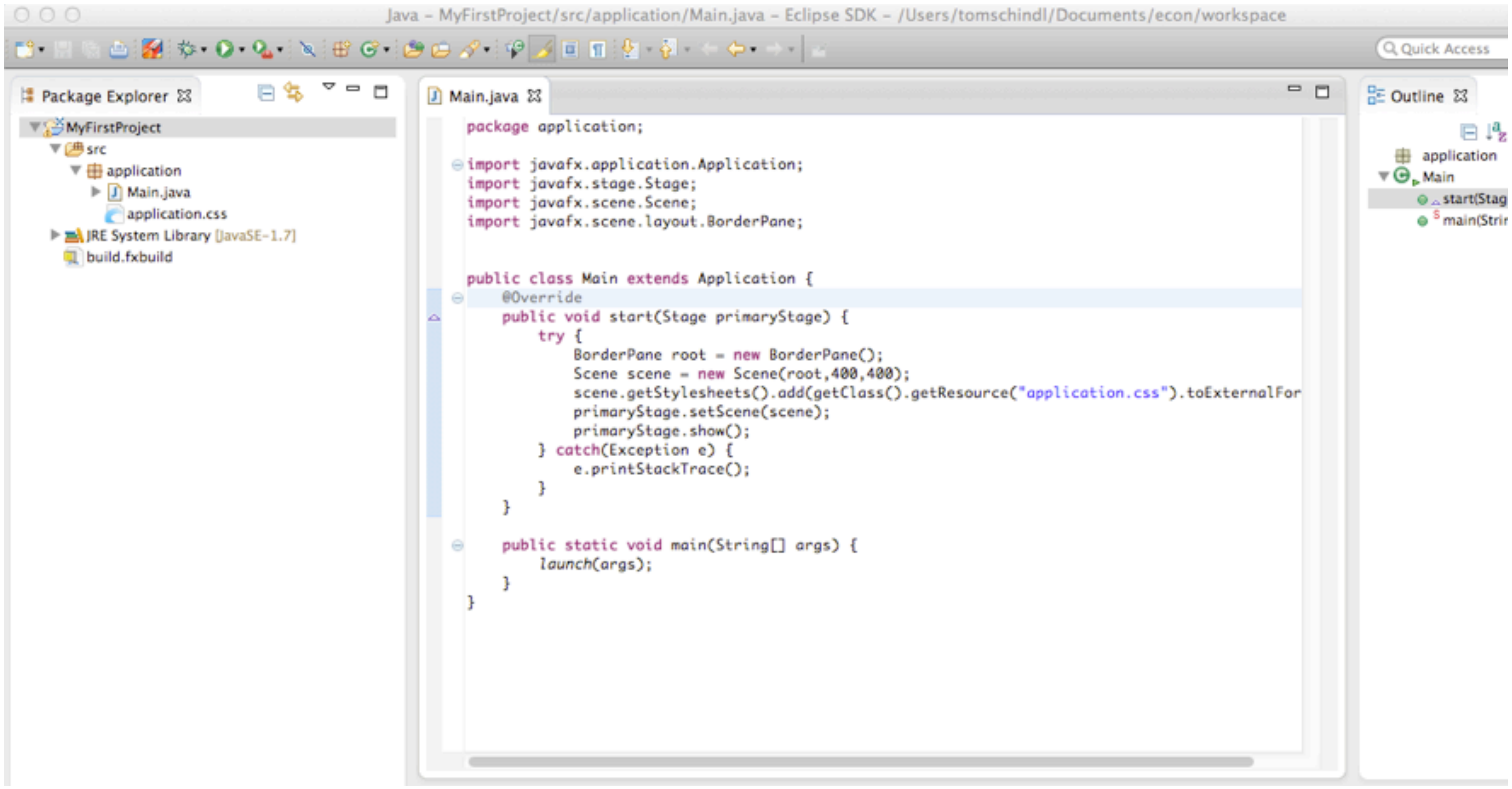
Lab Hello World

- Create a directory named „fx_tutorial“ on your filesystem e.g. C:\fx_tutorial, /Users/tom/fx_tutorial
- Move eclipse-SDK-4.3.0-$arch$.tar.gz/.zip to the directory and uncompress it there
- Install JDK8u111
  - Linux: extract it next to your eclipse-SDK
- Launch Eclipse with JDK8
  - Linux: Launch with ./eclipse -vm ../jdk8..../
  - Check that JDK8 is used via About > Installation Details > Configuration - search for „eclipse.vm“

Lab Hello World

- File > New > Project ...
- Search for the JavaFX category
- Select „JavaFX Project“ > Next
- Enter the following data:
  - Project name: MyFirstProject
  - Use an execution environment JRE: JavaSE-1.7
- Select: Finish

Lab Hello World



```
package application;

import javafx.application.Application;
import javafx.stage.Stage;
import javafx.scene.Scene;
import javafx.scene.layout.BorderPane;


public class Main extends Application {
    @Override
    public void start(Stage primaryStage) {
        try {
            BorderPane root = new BorderPane();
            Scene scene = new Scene(root,400,400);
            scene.getStylesheets().add(getClass().getResource("application.css").toExternalFor
            primaryStage.setScene(scene);
            primaryStage.show();
        } catch(Exception e) {
            e.printStackTrace();
        }
    }

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

Lab Hello World

- Create an instance of javafx.scene.control.Button which displays a text „Hello World!“
- Handle a button click and print „Hello World!“
  - Try to use the setOnAction API
  - Try to use the addEventHandler API
- Display the button in the center of the BorderPane

Lab Hello World

```
BorderPane root = new BorderPane();
Button b = new Button("Hello World");
b.setOnAction(new EventHandler<ActionEvent>() {

 @Override
 public void handle(ActionEvent event) {
  System.out.println("Hello World via setOnAction!");
 }
});
b.addEventHandler(ActionEvent.ACTION, new EventHandler<ActionEvent>() {

 @Override
 public void handle(ActionEvent event) {
  System.out.println("Hello World via addEventHandler!");
 }
});
root.setCenter(b);
```

FX-Properties

FX-Properties

- JavaFX Beans use extend the JavaBean pattern
  - get$Name$/set$Name$ method
  - $name$Property method
- property-method returns
  - read/writable: javafx.beans.property.Property
  - readonly: javafx.beans.property.ReadOnlyProperty
- Property-Objects are observable and can be bound together

FX-Properties

```
public class JavaBean {
    private String name;

    private PropertyChangeSupport support = new PropertyChangeSupport(this);

    public void setName(String name) {
        support.firePropertyChange("name", this.name, this.name = name);
    }

    public String getName() {
        return this.name;

    }
}
```

FX-Properties

```
public class JavaFXBean {
	private StringProperty name = new SimpleStringProperty(this,"name");

	public void setName(String name) {
		this.name.set(name);
	}

	public String getName() {
		return this.name.get();
	}

	public StringProperty nameProperty() {
		return this.name;
	}
}
```

FX-Properties

- Properties can be bound
  - Unidirectional: Property#bind()
  - Bidirectional: Property#bindBidirectional()
- Unlink bindings:
  - Unidirectional: Property#unbind()
  - Bidirectional: Property#unbindBirectional()

Lab FXProperties

- Create JavaFX Bean
- Create UI with and bind properties

Lab FXProperties

- Create a new JavaFX-Project
- Create a JavaFX Bean
  - Name: MyBean
  - Properties: String-Property named „text“
- Add the following UI-Elements to the Main class
  - top: javafx.scene.control.TextField
  - center: javafx.scene.text.Text
  - left: javafx.scene.control.Slider (hint: orientation!)
  - right: javafx.scene.control.Slider

Lab FXProperties

- Make the slider accept values in range min=1 & max=10
- Create an instance of MyBean
- Bind:
  - bidirectional: MyBean#text to TextField#text
  - unidirectional:
    - MyBean#text to Text#text
    - H-Slider#value to Text#scaleX
    - V-Slider#value to Text#scaleY

Lab FXProperties (for the fast one)

- Make sure the sliders are only modifiable when the text field has a value entered

FX-Layouts

FX Layouts

- JavaFX comes with predefined layout panes like
  - javafx.scene.layout.BorderPane
  - javafx.scene.layout.HBox
  - javafx.scene.layout.VBox
  - javafx.scene.layout.GridPane
- Layout constraints are applied through constant setters

```
BorderPane root = new BorderPane();
Button child = new Button("Layout Test");
BorderPane.setAlignment(child, Pos.CENTER_LEFT);
root.setCenter(child);
```

FX Layouts

- Additional layouts
  - SWT-Layouts part of e(fx)clipse
    - org.eclipse.fx.ui.panes.GridLayoutPane
    - org.eclipse.fx.ui.panes.FillLayoutPane
    - org.eclipse.fx.ui.panes.RowLayoutPane
  - MigPane (http://www.miglayout.com/)

FXML

FXML

- FXML is a declarative way to define a JavaFX-Scenegraph
- WYSIWYG Tool called SceneBuilder
- Rules how to map Java to XML-Constructors
  - classes get xml-elements
    Java: `Button b = new Button()`
    FXML: `<Button>`
  - simple attribute types get xml-attributes
    Java: `b.setText("Hello World");`
    FXML: `<Button text="Hello World"`
  - complex attribute types get xml-elements
    Java: `new BorderPane().setCenter(new Button("Hello World"))`
    FXML: `<BorderPane><center><Button text="Hello World" /></center></BorderPane>`

FXML

```xml
<?xml version="1.0" encoding="UTF-8"?>

<?import javafx.scene.layout.HBox?>
<?import javafx.scene.control.Button?>

<HBox xmlns:fx="http://javafx.com/fxml">
    <children>
        <Button
            text="Hello World">
        </Button>
    </children>
</HBox>
```

```java
import javafx.scene.control.Button;
import javafx.scene.layout.HBox;

HBox box = new HBox();

Button button = new Button("Hello World");

box.getChildren().add(button);
```

FXML

- Executing actions

```
<?xml version="1.0" encoding="UTF-8"?>

<?import javafx.scene.layout.BorderPane?>
<?import javafx.scene.layout.HBox?>
<?import javafx.scene.control.Button?>

<HBox xmlns:fx="http://javafx.com/fxml"
    fx:controller="application.SampleController">
    <children>
        <Button
            fx:id="mybutton"
            text="Hello World"
            onAction="#run">
        </Button>
    </children>
</HBox>
```

FXML

- Executing actions

```
<?xml version="1.0" encoding="UTF-8"?>

<?import javafx.scene.layout.BorderPane?>
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        <Button
            fx:id="mybutton"
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        </Button>
    </children>
</HBox>
```

Java-Class

FXML

- Executing actions

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    <children>
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            text="Hello World"
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        </Button>
    </children>
</HBox>
```

Java-Class

Field in class

FXML

- Executing actions

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<?xml version="1.0" encoding="UTF-8"?>

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    fx:controller="application.SampleController">
    <children>
        <Button
            fx:id="mybutton"
            text="Hello World"
            onAction="#run">
        </Button>
    </children>
</HBox>
```

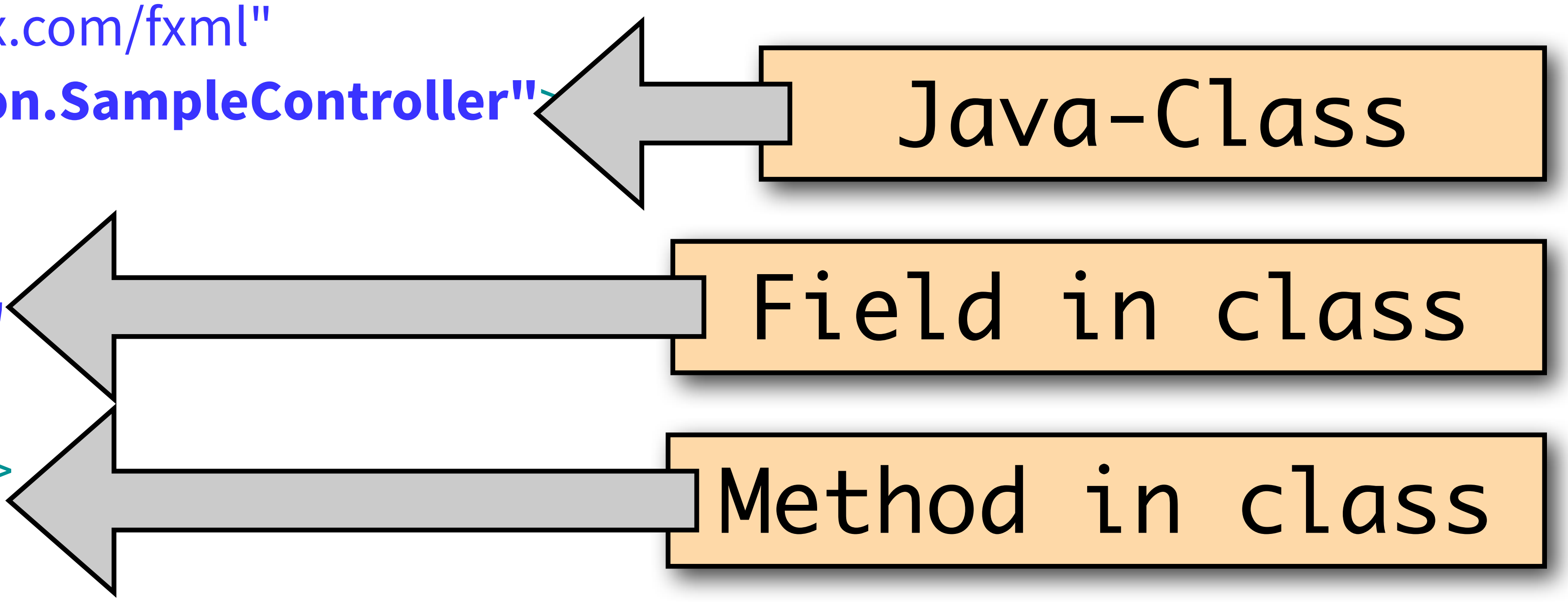

FXML

- Executing actions / accessing stuff in Java

```xml
<?xml version="1.0" encoding="UTF-8"?>

<?import javafx.scene.layout.BorderPane?>
<?import javafx.scene.layout.HBox?>
<?import javafx.scene.control.Button?>

<HBox xmlns:fx="http://javafx.com/fxml"
    fx:controller="application.SampleController">
    <children>
        <Button
            fx:id="mybutton"
            text="Hello World"
            onAction="#run">
        </Button>
    </children>
</HBox>
```

```java
package application;

import javafx.fxml.FXML;
import javafx.scene.control.Button;

public class SampleController {
    @FXML Button mybutton;

    @FXML
    public void run() {

    }
}
```

FXML

- layout-constraint support
  - simple constraints: `<Button BorderPane.alignment="CENTER_LEFT">`
  - complex constraints: `<BorderPane.margin><Insets left="10"></Insets></BorderPane.margin>`
- i18n support
  - prefix value with %: `<Button fx:id="mybutton" text="%hello.world">`
  - preview: `<?scenebuilder-preview-i18n-resource messages.properties?>`
- media resource support
  - prefix value with @: `<Image url="@Money-icon_48.png" />`
- loading FXML-Files using `javafx.fxml.FXMLLoader.load`

Lab FXML

- Create FXML
- Connect to controller
- Use i18n

Lab FXML

- Create a JavaFX-Project named „FXMLProject“
  - Navigate to the last page in the wizard
    - Language: FXML
    - Root-Type: javafx.scene.layout.BorderPane
    - Filename: Sample
    - Controller Name: SampleController
- Open Preview using Window > Show View > JavaFX > JavaFX Preview

Lab FXML

- Create basic UI
  - Create a center-element below the BorderPane
  - Add a button-element with a text „Hello World“
  - Align the button to CENTER_LEFT
- Open the SampleController
- Go back to the Sample.fxml
- Add an onAction-Attribute and set #run as the value
  - Notice the error marker
  - Use auto-correction CTRL/CMD+1
  - Select first proposal and notice SampleController change

Lab FXML

- Add an fx:id to Button-element and use value mybutton
  - Notice warning marker
  - Use auto-correction CTRL/CMD+1
  - Select first proposal and notice SampleController change
- Modify SampleController#run to update the text-Value of the button
- Create a messages.properties-File
  - Add a key „hello.world“
  - Update the FXML to use hello.world
  - Update the Main-Code to use FXMLLoader.load(URL,ResourceBundle)

Lab FXML (for the fast ones)

- Try to add an image to the button
  - Hints: graphic, ImageView, Image
  - Hints 2: FXML-Editor does not know about url-Property of Image

FXGraph

FXGraph

- FXGraph is a declarative language with a similar notation to JSON
  - Remove a lot of noise created by XML
- It „compiles“ to FXML (=no extra runtime libs needed)
- Has some extra features
- Definitions:
  - Object-Def: `Button { }`
  - Simple-Attribute: `Button { text : "Hello World" }`
  - Complex-Attribute: `BorderPane { center : Button { text : "Hello World" } }`

FXGraph

```
package application

import javafx.scene.layout.BorderPane
import application.SampleController
import javafx.scene.control.Button

component Sample resourcefile "messages.properties" controlledby SampleController {
	BorderPane {
		center : Button {
			text : "Hello World"
		}
	}
}
```

FXGraph

```
package application

import javafx.scene.layout.BorderPane
import application.SampleController
import javafx.scene.control.Button

component Sample resourcefile "messages.properties" controlledby SampleController {
	BorderPane {
		center : Button {
			text : "Hello World"
		}
```

Filename

```
}
```

FXGraph

```
package application

import javafx.scene.layout.BorderPane
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    BorderPane {
        center : Button {
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        }
}
```

Translations

Filename

FXGraph

```
package application

import javafx.scene.layout.BorderPane
import application.SampleController
import javafx.scene.control.Button

component Sample resourcefile "messages.properties" controlledby SampleController {
    BorderPane {
        center : Button {
            text : "Hello Wo
        }
}
```

Filename

Translations

Controller

FXGraph

- Layout-constraint support:
  - simple constraints: `Button { static alignment : "CENTER_LEFT" }`
  - complex constraints: `Button { static margin : Insets { left : 10 } }`
- i18n support
  - prefix string with rstring: `Button { text : rstring "hello.world" }`
- media support:
  - prefix string with location: `Image { url : location "Money-icon_48.png" }`
- preview marker:
  - prefix an attribute with preview: `TextField { preview text : "Preview only"}`

FXGraph

- Executing actions / accessing stuff in Java

```
component Sample controlledby application.CurrencyController {
	BorderPane {
		center : Button id mybutton {
			text : "Hello World",
			onAction : controllermethod run
		}
	}
}
```

FXGraph

- Executing actions / accessing stuff in Java

```
component Sample controlledby application.CurrencyController {
    BorderPane {
        center : Button id mybutton {
            text : "Hello World",
            onAction : controllermethod run
        }
    }
}
```

Field in class

FXGraph

- Executing actions / accessing stuff in Java

```
component Sample controlledby application.CurrencyController {
    BorderPane {
        center : Button id mybutton {
            text : "Hello World",
            onAction : controllermethod run
        }
    }
}
```

Field in class

Method in class

Lab FXGraph

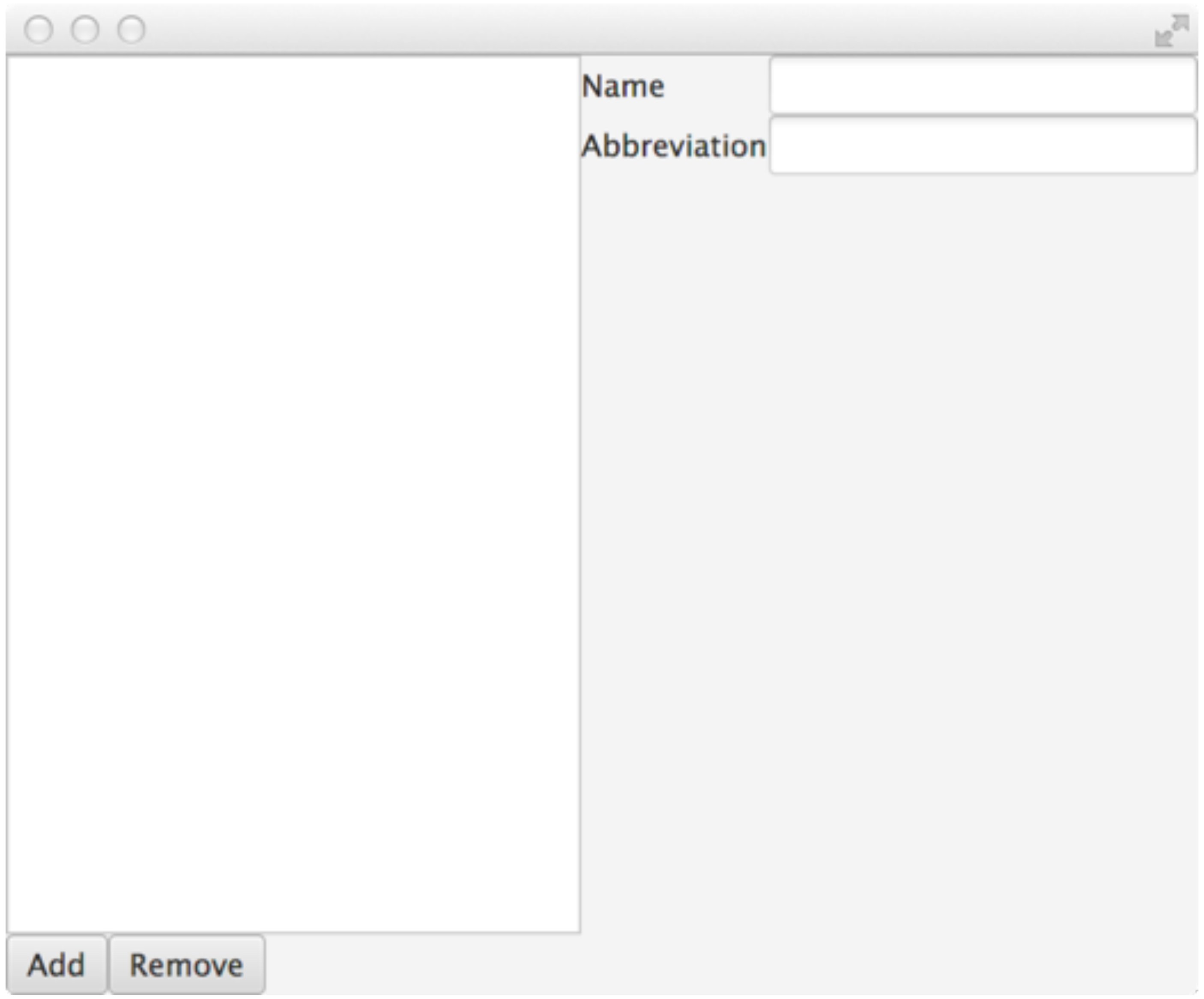
- Create complex UI
- Connect to controller
- Use i18n

Lab FXGraph

- Create a JavaFX-Project named „FXGraphProject“
  - Navigate to the last page in the wizard
    - Language: FXGraph
    - Root-Type: javafx.scene.layout.BorderPane
    - Filename: Currency
    - Controller Name: CurrencyController

Lab FXGraph

- Create the UI



Lab FXGraph

- Put another javafx.scene.layout.BorderPane in the left-Property
  - put a javafx.scene.control.ListView in the center
  - put a javafx.scene.layout.HBox in the bottom
    - add 2 javafx.scene.control.Button as the children
- Put javafx.scene.layout.GridPane in the center Property
  (Hint row, colum-index and hgrow can be set using static)
  - add a javafx.scene.control.Label (text=Name)
  - add a javafx.scene.control.TextField
  - add a javafx.scene.control.Label (text=Abbreviation)
  - add a javafx.scene.control.TextField

Lab FXGraph

- Create a file messages.properties
  - Add the following keys with translations:
    common.add
    common.remove
    currency.name
    currency.abbrev
  - Modify Currency.fxgraph adding resourcefile "messages.properties" in the component definition
  - Use rstring in the Button and Label text-property
- Connect the following to the controller (using id)
  - ListView as currencyList
  - TextField as nameField, abbreviationField

Lab FXGraph

- Connect the buttons onAction-Slot to the controller (using controllermethod)
  - Add Button to addCurrency
  - Remove Button to removeCurrency
- Set the id-attribute(!!!) of the GridPane to „currencyDetail“

CSS

CSS

- JavaFX uses CSS to theme ALL elements
- Selectors supported are mainly CSS2 compatible
  - Element-Selectors: Applies to the classname in the SceneGraph (e.g. BorderPane, HBox, ...)
  - ID-Selectors: Applies to the id-attribute set via Node#id: String
  - Class-Selectors: Applies to the classes assigned through Node#styleClass: ObservableList<String>

CSS

- JavaFX-Controls automatically assign the controls name to the Skin-Class making up the control. e.g. Button styles itself not with Button but .button

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```
SceneGraph
      BorderPane
           TitledPane
```

CSS

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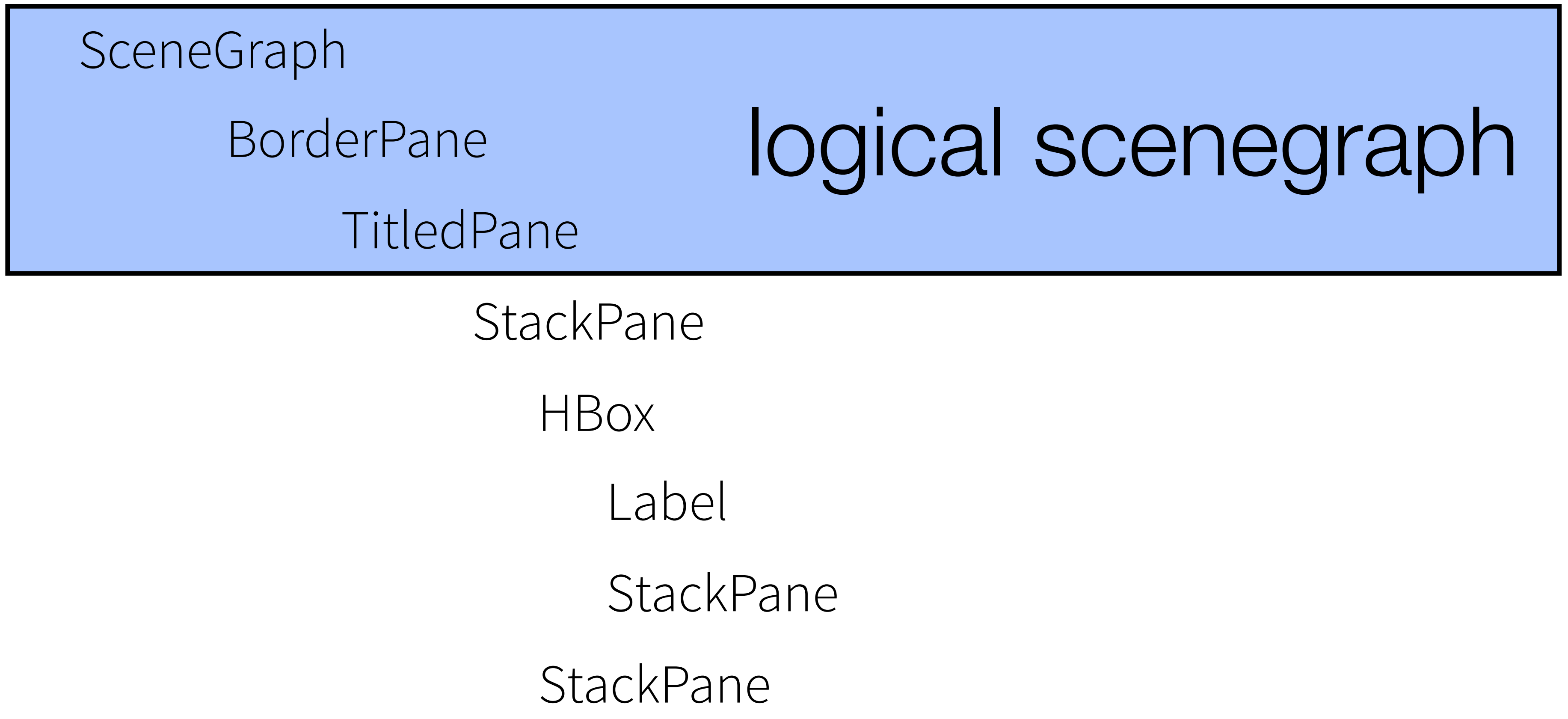
```
SceneGraph
    BorderPane
        TitledPane
            StackPane
                HBox
                    Label
                    StackPane
                StackPane
```

CSS

- JavaFX-Controls automatically assign the controls name to the Skin-Class making up the control. e.g. Button styles itself not with Button but .button



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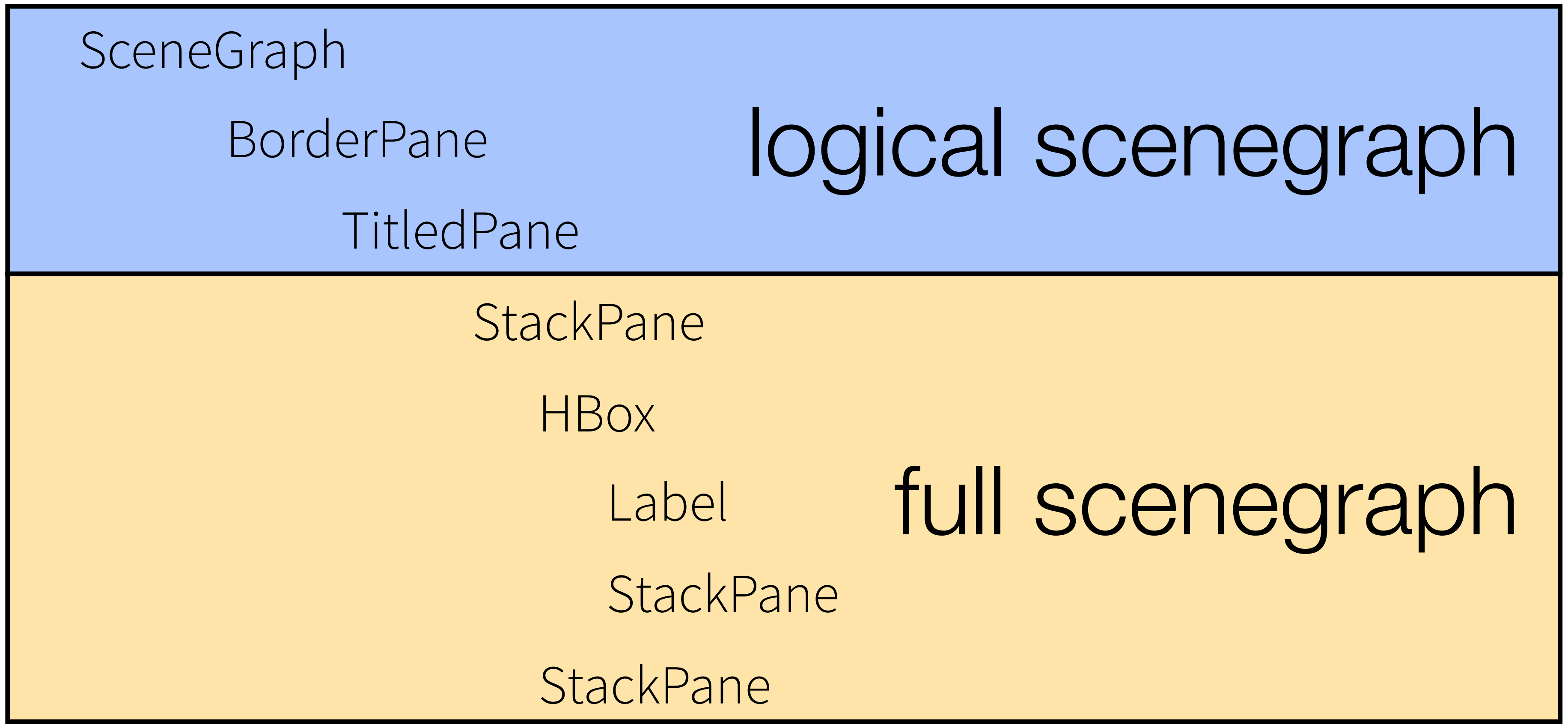

CSS

- JavaFX properties all start with -fx
- Informations which properties apply to which element are available from http://docs.oracle.com/javafx/2/api/javafx/scene/doc-files/cssref.html
- e(fx)clipse CSS-Editor knows which properties apply if you use the predefined class and element selectors

Lab CSS

- Use some simple css

Lab CSS

- Open the application.css in the FXGraphProject
  - Redefine the hgap / vgap for GripPanes
  - Redefine the padding for the GridPane with ID currencyDetail

Working with Views

Working with Views

Working with Views

- `All views are virtual (cells are reused!!)`

Working with Views

- All views are virtual (cells are reused!!)
- All views are made up of Cell-Nodes

Working with Views

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- Cell-Nodes are created through factories

Working with Views

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- All views are made up of Cell-Nodes
- Cell-Nodes are created through factories

```
ListView<Currency> currencyList = new ListView<>();
currencyList.setCellFactory(new Callback<ListView<Currency>, ListCell<Currency>>() {

    @Override
    public ListCell<Currency> call(ListView<Currency> param) {
        return new CurrencyCell();
    }
});
```

Working with Views

- All views are virtual (cells are reused!!)
- All views are made up of Cell-Nodes
- Cell-Nodes are created through factories

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ListView<Currency> currencyList = new ListView<>();
currencyList.setCellFactory(new Callback<ListView<Currency>, ListCell<Currency>>() {

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    public ListCell<Currency> call(ListView<Currency> param) {
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});
```

JDK7-Style

Working with Views

- All views are virtual (cells are reused!!)
- All views are made up of Cell-Nodes
- Cell-Nodes are created through factories

```
ListView<Currency> currencyList = new ListView<>();
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    public ListCell<Currency> call(ListView<Currency> param) {
        return new CurrencyCell();
    }
});
```

JDK7-Style

```
ListView<Currency> currencyList = new ListView<>();
currencyList.setCellFactory((param) -> new CurrencyCell());
```

Working with Views

Working with Views

```
public class CurrencyCell extends ListCell<Currency> {
        @Override
        protected void updateItem(Currency item, boolean empty) {
            if( item != null && ! empty ) {
                setText(item.getName());
            } else {
                setText(null);
            }
            super.updateItem(item, empty);
        }
    }
```

Working with Views

- Input for views is an ObservableList

```
public class CurrencyCell extends ListCell<Currency> {
        @Override
        protected void updateItem(Currency item, boolean empty) {
            if( item != null && ! empty ) {
                setText(item.getName());
            } else {
                setText(null);
            }
            super.updateItem(item, empty);
        }
    }
```

Working with Views

- Input for views is an ObservableList
- ListCell can be subclass and updateItem is called when a new item is associated with the Cell (can happen at ANY time!)

```
public class CurrencyCell extends ListCell<Currency> {
    @Override
    protected void updateItem(Currency item, boolean empty) {
        if( item != null && ! empty ) {
            setText(item.getName());
        } else {
            setText(null);
        }
        super.updateItem(item, empty);
    }
}
```

Lab Views

- Setup the ListView

Lab Views

Lab Views

- Create a lib-Dir and copy there all jars from the fxgraph-libraries

Lab Views

- Create a lib-Dir and copy there all jars from the fxgraph-libraries
- Open the CurrencyController

Lab Views

- Create a lib-Dir and copy there all jars from the fxgraph-libraries
- Open the CurrencyController
  - make the ListView hold items of type Currency

Lab Views

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  - make the ListView hold items of type Currency
  - make the controller implement Initializable

Lab Views

- Create a lib-Dir and copy there all jars from the fxgraph-libraries
- Open the CurrencyController
  - make the ListView hold items of type Currency
  - make the controller implement Initializable
- Add a subclass of ListCell named CurrencyCell as an inner-static-class

Lab Views

- Create a lib-Dir and copy there all jars from the fxgraph-libraries
- Open the CurrencyController
  - make the ListView hold items of type Currency
  - make the controller implement Initializable
- Add a subclass of ListCell named CurrencyCell as an inner-static-class
- In the initialize-method setup the cellFactory

Eclipse Databinding

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Eclipse Databinding

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Eclipse Databinding

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  - Abstract representation of a property

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    - single value: IValueProperty

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  - Abstract representation of a property
    - single value: IValueProperty
    - list value: IListValueProperty

Eclipse Databinding

- Eclipse Databinding is Domain-Model-Type agnostic
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    - single value: IValueProperty
    - list value: IListValueProperty
  - Representation of the property instance

Eclipse Databinding

- Eclipse Databinding is Domain-Model-Type agnostic
  - Abstract representation of a property
    - single value: IValueProperty
    - list value: IListValueProperty
  - Representation of the property instance
    - single value: IObservableValue

Eclipse Databinding

- Eclipse Databinding is Domain-Model-Type agnostic
  - Abstract representation of a property
    - single value: IValueProperty
    - list value: IListValueProperty
  - Representation of the property instance
    - single value: IObservableValue
    - list value: IObservableList

Eclipse Databinding

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  - Representation of the property instance
    - single value: IObservableValue
    - list value: IObservableList
- 2 instance can be synced through the DatabindingContext

Eclipse Databinding

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  - simple: IValueProperty#observe(Object)
  - master-detail: IValueProperty#observeDetail(IObservableValue)

Lab DB

- Bind TextFields
- Update based on selection
- Change ListView to keep up-to-date

Lab Eclipse DB

- In the Main#start call JFXRealm.createDefault()
- In CurrencyController create and initialize a field of type WritableValue
- In the initialize-method
  - Create an instance of EMFDatabindingContext
  - Create an instance IValueProperty for CURRENCY__NAME - through EMFProperties, MyfondPackage.Literals
  - Create an instance IValueProperty for TextField#text property through JFXUIProperties
  - Create an observable of the name IValueProperty#observeDetail
  - Create an observable of the text IValueProperty#observe

Lab Eclipse DB

- Repeat the steps for the CURRENCY__SYMBOL
- add an InvalidationListener to the currencyList‘s selectionModel and when call update master using IObservableValue#setValue
- Notice when running: ListCell is not updated!!!
- Create an IValueProperty for CURRENCY__NAME
- Replace the list-setup through ListUtil.setupList(ListView,IValueProperty)

Deployment

- The optimal way to deploy JavaFX applications is
  - Through the native install format (setup.exe, dmg, rpm, deb)
  - The JRE included so that no prerequisits are needed (e.g. Mac App Store requirement)
- JavaFX provides packageing tasks
  - Can be call on command line
  - Ant integration
- e(fx)clipse has a special file to configure the export named .fxbuild

Lab Deploy

- Generate a native installer

FX + OSGi

FX + OSGi + e4