무료 전자 책

배우기

javafx

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#javafx

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1: javafx

JavaFX RIA (Rich Internet Application) . JavaFX Java SE GUI Swing .

IT , , , .

CSS (Cascading Style Sheets) JavaFX (JavaFX : CSS). (F) XML (FXML) . Scene Builder UI fxml .

JavaFX 2	2011-10-10
JavaFX 8	2014-03-18

Examples

> JavaFX API Java SE Runtime Environment (JRE) Java Development Kit (JDK) . JDK (Windows, Mac OS X Linux) JDK 7 JavaFX . ARM JavaFX 8 . ARM JDK JavaFX , .

JavaFX Java Runtime Java Development Kit .

JavaFX .

1. Java API.
2. FXML .
3. WebView.
4. .
5. UI CSS.
6. .
7. 3D .
8. Canvas API.
9. API.
10. .
11. .
12. Hi-DPI .
13.
14. .
15. .

Hello World

`String` `Button` .

```
import javafx.application.Application;
import javafx.scene.Scene;
```

```
import javafx.scene.control.Alert;
import javafx.scene.control.Alert.AlertType;
import javafx.scene.control.Button;
import javafx.scene.layout.StackPane;
import javafx.stage.Stage;

public class HelloWorld extends Application {

    @Override
    public void start(Stage primaryStage) {
        // create a button with specified text
        Button button = new Button("Say 'Hello World'");

        // set a handler that is executed when the user activates the button
        // e.g. by clicking it or pressing enter while it's focused
        button.setOnAction(e -> {
           //Open information dialog that says hello
           Alert alert = new Alert(AlertType.INFORMATION, "Hello World!?");
           alert.showAndWait();
        });

        // the root of the scene shown in the main window
        StackPane root = new StackPane();

        // add button as child of the root
        root.getChildren().add(button);

        // create a scene specifying the root and the size
        Scene scene = new Scene(root, 500, 300);

        // add scene to the stage
        primaryStage.setScene(scene);

        // make the stage visible
        primaryStage.show();
    }

    public static void main(String[] args) {
        // launch the HelloWorld application.

        // Since this method is a member of the HelloWorld class the first
        // parameter is not required
        Application.launch(HelloWorld.class, args);
    }

}
```

`Application` JavaFX . `Application` .

```
Application.launch(HelloWorld.class, args);
```

`Application` JavaFX .

.

1. `launch` `Application` (`HelloWorld`). `Application` .
2. `Application` `init()` . `Application` .
3. `start` `Appication` primary `Stage` (= window) . JavaFX ( ) .
4.

. .

5. `stop` `Application` . `Application` . JavaFX ( ) .

`start` . `Button` `StackPane` `Node` .

`Button` UI `Button` `StackPane` `Button` .

`Node` `Scene` . `Scene` UI `Stage` .

javafx : https://riptutorial.com/ko/javafx/topic/887/javafx-

2: CSS

- NodeClass / * * /
- .someclass / * * /
- #someId / * id * /
- [selector1]> [selector2] / * selector2 selector1 selector * /
- [selector1] [selector2] / * selector2 selector1 selector * /

Examples

CSS

CSS .

- (`Node.setStyle`)
-
  - `Scene`
    - ( )
    - `Scene` ""
  - `Node`

`Nodes` . .

```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.layout.HBox;
import javafx.scene.layout.Region;
import javafx.scene.layout.VBox;
import javafx.scene.paint.Color;
import javafx.stage.Stage;

public class StyledApplication extends Application {

    @Override
    public void start(Stage primaryStage) {

        Region region1 = new Region();
        Region region2 = new Region();
        Region region3 = new Region();
        Region region4 = new Region();
        Region region5 = new Region();
        Region region6 = new Region();

        // inline style
        region1.setStyle("-fx-background-color: yellow;");

        // set id for styling
        region2.setId("region2");

        // add class for styling
        region2.getStyleClass().add("round");
        region3.getStyleClass().add("round");

        HBox hBox = new HBox(region3, region4, region5);
```

```
        VBox vBox = new VBox(region1, hBox, region2, region6);

        Scene scene = new Scene(vBox, 500, 500);

        // add stylesheet for root
        scene.getStylesheets().add(getClass().getResource("style.css").toExternalForm());

        // add stylesheet for hBox
        hBox.getStylesheets().add(getClass().getResource("inlinestyle.css").toExternalForm());

        scene.setFill(Color.BLACK);

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

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

}
```

inlinestyle.css

```
* {
    -fx-opacity: 0.5;
}

HBox {
    -fx-spacing: 10;
}

Region {
    -fx-background-color: white;
}
```

style.css

```
Region {
    width: 50;
    height: 70;

    -fx-min-width: width;
    -fx-max-width: width;

    -fx-min-height: height;
    -fx-max-height: height;

    -fx-background-color: red;
}

VBox {
    -fx-spacing: 30;
    -fx-padding: 20;
}

#region2 {
    -fx-background-color: blue;
```

```
}
```

JavaFX 8

css `Node` .

2 `DoubleProperty` `Rectangle` CSS `width` `height` .

CSS .

```
 StyleableRectangle {
    -fx-fill: brown;
    -fx-width: 20;
    -fx-height: 25;
    -fx-cursor: hand;
}
```

```
import java.util.ArrayList;
import java.util.Arrays;
import java.util.Collections;
import java.util.List;
import javafx.beans.property.DoubleProperty;
import javafx.css.CssMetaData;
import javafx.css.SimpleStyleableDoubleProperty;
import javafx.css.StyleConverter;
import javafx.css.Styleable;
import javafx.css.StyleableDoubleProperty;
import javafx.css.StyleableProperty;
import javafx.scene.paint.Paint;
import javafx.scene.shape.Rectangle;

public class StyleableRectangle extends Rectangle {

    // declaration of the new properties
    private final StyleableDoubleProperty styleableWidth = new
SimpleStyleableDoubleProperty(WIDTH_META_DATA, this, "styleableWidth");
    private final StyleableDoubleProperty styleableHeight = new
SimpleStyleableDoubleProperty(HEIGHT_META_DATA, this, "styleableHeight");

    public StyleableRectangle() {
        bind();
    }

    public StyleableRectangle(double width, double height) {
        super(width, height);
        initStyleableSize();
        bind();
    }

    public StyleableRectangle(double width, double height, Paint fill) {
        super(width, height, fill);
        initStyleableSize();
        bind();
    }

    public StyleableRectangle(double x, double y, double width, double height) {
        super(x, y, width, height);
        initStyleableSize();
```

```
        bind();
    }

    private void initStyleableSize() {
        styleableWidth.set(getWidth());
        styleableHeight.set(getHeight());
    }

    private final static List<CssMetaData<? extends Styleable, ?>> CLASS_CSS_META_DATA;

    // css metadata for the width property
    // specify property name as -fx-width and
    // use converter for numbers
    private final static CssMetaData<StyleableRectangle, Number> WIDTH_META_DATA = new
CssMetaData<StyleableRectangle, Number>("-fx-width", StyleConverter.getSizeConverter()) {

        @Override
        public boolean isSettable(StyleableRectangle styleable) {
            // property can be set iff the property is not bound
            return !styleable.styleableWidth.isBound();
        }

        @Override
        public StyleableProperty<Number> getStyleableProperty(StyleableRectangle styleable) {
            // extract the property from the styleable
            return styleable.styleableWidth;
        }
    };

    // css metadata for the height property
    // specify property name as -fx-height and
    // use converter for numbers
    private final static CssMetaData<StyleableRectangle, Number> HEIGHT_META_DATA = new
CssMetaData<StyleableRectangle, Number>("-fx-height", StyleConverter.getSizeConverter()) {

        @Override
        public boolean isSettable(StyleableRectangle styleable) {
            return !styleable.styleableHeight.isBound();
        }

        @Override
        public StyleableProperty<Number> getStyleableProperty(StyleableRectangle styleable) {
            return styleable.styleableHeight;
        }
    };

    static {
        // combine already available properties in Rectangle with new properties
        List<CssMetaData<? extends Styleable, ?>> parent = Rectangle.getClassCssMetaData();
        List<CssMetaData<? extends Styleable, ?>> additional = Arrays.asList(HEIGHT_META_DATA,
WIDTH_META_DATA);

        // create arraylist with suitable capacity
        List<CssMetaData<? extends Styleable, ?>> own = new ArrayList(parent.size()+
additional.size());

        // fill list with old and new metadata
        own.addAll(parent);
        own.addAll(additional);

        // make sure the metadata list is not modifiable
```

```
        CLASS_CSS_META_DATA = Collections.unmodifiableList(own);
    }

    // make metadata available for extending the class
    public static List<CssMetaData<? extends Styleable, ?>> getClassCssMetaData() {
        return CLASS_CSS_META_DATA;
    }

    // returns a list of the css metadata for the stylable properties of the Node
    @Override
    public List<CssMetaData<? extends Styleable, ?>> getCssMetaData() {
        return CLASS_CSS_META_DATA;
    }

    private void bind() {
        this.widthProperty().bind(this.styleableWidth);
        this.heightProperty().bind(this.styleableHeight);
    }


    // -------------------------------------------------------------------------
    // ---------------------- PROPERTY METHODS ---------------------------------
    // -------------------------------------------------------------------------

    public final double getStyleableHeight() {
        return this.styleableHeight.get();
    }

    public final void setStyleableHeight(double value) {
        this.styleableHeight.set(value);
    }

    public final DoubleProperty styleableHeightProperty() {
        return this.styleableHeight;
    }

    public final double getStyleableWidth() {
        return this.styleableWidth.get();
    }

    public final void setStyleableWidth(double value) {
        this.styleableWidth.set(value);
    }

    public final DoubleProperty styleableWidthProperty() {
        return this.styleableWidth;
    }

}
```

CSS : https://riptutorial.com/ko/javafx/topic/1581/css

3: FXML

- xmlns : fx = " http://javafx.com/fxml"//

Examples

FXML

`AnchorPane` FXML :

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

<?import java.lang.*?>
<?import java.util.*?>
<?import javafx.scene.*?>
<?import javafx.scene.control.*?>
<?import javafx.scene.layout.*?>

<AnchorPane id="AnchorPane" prefHeight="200" prefWidth="320"
xmlns:fx="http://javafx.com/fxml/1"
        fx:controller="com.example.FXMLDocumentController">
    <children>
        <Button layoutX="126" layoutY="90" text="Click Me!" onAction="#handleButtonAction"
fx:id="button" />
        <Label layoutX="126" layoutY="120" minHeight="16" minWidth="69" fx:id="label" />
    </children>
</AnchorPane>
```

FXML . FXML FXML : `fx:controller="com.example.FXMLDocumentController"` `fx:controller` . FXML UI Java .

```
package com.example ;

import java.net.URL;
import java.util.ResourceBundle;
import javafx.event.ActionEvent;
import javafx.fxml.FXML;
import javafx.fxml.Initializable;
import javafx.scene.control.Label;

public class FXMLDocumentController {

    @FXML
    private Label label;

    @FXML
    private void handleButtonAction(ActionEvent event) {
        System.out.println("You clicked me!");
        label.setText("Hello World!");
    }

    @Override
    public void initialize(URL url, ResourceBundle resources) {
        // Initialization code can go here.
```

```
        // The parameters url and resources can be omitted if they are not needed
    }

}
```

`FXMLLoader` FXML .

```
public class MyApp extends Application {

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

        FXMLLoader loader = new FXMLLoader();
        loader.setLocation(getClass().getResource("FXMLDocument.fxml"));
        Parent root = loader.load();

        Scene scene = new Scene(root);

        stage.setScene(scene);
        stage.show();
    }

}
```

`load` , . :

1. `FXMLLoader` FXML . `fx:id` .
2. FXML `fx:controller` `FXMLLoader` . .
3. `public` ( ) `@FXML` () "" `fx:id` . , `Label` FXML `fx:id="label"`

   ```
   @FXML
   private Label label ;
   ```

   `label` `FXMLLoader` `Label` .
4. onXXX `onXXX="#..."` FXML . . `Button` `onAction="#handleButtonAction"`

   ```
   @FXML
   private void handleButtonAction(ActionEvent event) { ... }
   ```

   (:) . `void` (`ActionEvent` .
5. `initialize` . `@FXML` `@FXML` FXML . `initialize()` `URL` `ResourceBundle` . , `URL` FXML , `ResourceBundle` `FXMLLoader` `loader.setResources(...)` . `null` .

FXML UI .

`<fx:include>` fxml . fxml `FXMLLoader` .

`<fx:include>` `fx:id` . fxml `<fx:id value>Controller` .

:

fx : id	
	fooController
42	42
xYz	xYzController

---

fxmls

`Text StackPane` fxml. fxml .

counter.fxml

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

<?import javafx.scene.text.*?>
<?import javafx.scene.layout.*?>

<StackPane prefHeight="200" prefWidth="200" xmlns:fx="http://javafx.com/fxml/1"
fx:controller="counter.CounterController">
    <children>
        <Text fx:id="counter" />
    </children>
</StackPane>
```

CounterController

```
package counter;

import javafx.fxml.FXML;
import javafx.scene.text.Text;

public class CounterController {
    @FXML
    private Text counter;

    private int value = 0;

    public void initialize() {
        counter.setText(Integer.toString(value));
    }

    public void increment() {
        value++;
        counter.setText(Integer.toString(value));
    }

    public int getValue() {
        return value;
    }

}
```

---

fxml

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

<?import javafx.scene.control.*?>
<?import javafx.scene.layout.*?>

<BorderPane prefHeight="500" prefWidth="500" xmlns="http://javafx.com/javafx/8"
xmlns:fx="http://javafx.com/fxml/1" fx:controller="counter.OuterController">
    <left>
        <Button BorderPane.alignment="CENTER" text="increment" onAction="#increment" />
    </left>
    <center>
        <!-- content from counter.fxml included here -->
        <fx:include fx:id="count" source="counter.fxml" />
    </center>
</BorderPane>
```

OuterController

fxml . `Button onAction` .

```
package counter;

import javafx.fxml.FXML;

public class OuterController {

    // controller of counter.fxml injected here
    @FXML
    private CounterController countController;

    public void initialize() {
        // controller available in initialize method
        System.out.println("Current value: " + countController.getValue());
    }

    @FXML
    private void increment() {
        countController.increment();
    }

}
```

`outer.fxml` fxmls .

```
Parent parent = FXMLLoader.load(getClass().getResource("outer.fxml"));
```

fxml .

.

`<fx:define>` .

`<fx:define>` `fx:id` .

<fx:reference> .

<fx:reference> <fx:reference> <fx:reference> fx:id fx:id <fx:reference> <fx:reference> source .

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

<?import javafx.scene.text.*?>
<?import java.lang.*?>
<?import javafx.scene.*?>
<?import javafx.scene.control.*?>
<?import javafx.scene.layout.*?>


<VBox xmlns:fx="http://javafx.com/fxml/1" prefHeight="300.0" prefWidth="300.0"
xmlns="http://javafx.com/javafx/8">
    <children>
        <fx:define>
            <String fx:value="My radio group" fx:id="text" />
        </fx:define>
        <Text>
            <text>
                <!-- reference text defined above using fx:reference -->
                <fx:reference source="text"/>
            </text>
        </Text>
        <RadioButton text="Radio 1">
            <toggleGroup>
                <ToggleGroup fx:id="group" />
            </toggleGroup>
        </RadioButton>
        <RadioButton text="Radio 2">
            <toggleGroup>
                <!-- reference ToggleGroup created for last RadioButton -->
                <fx:reference source="group"/>
            </toggleGroup>
        </RadioButton>
        <RadioButton text="Radio 3" toggleGroup="$group" />

        <!-- reference text defined above using expression binding -->
        <Text text="$text" />
    </children>
</VBox>
```

FXML -

: fxml .

fx:controller FXMLLoader FXMLLoader .

.

FXML

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

<?import javafx.scene.text.*?>
```

```
<?import javafx.scene.layout.*?>

<VBox xmlns:fx="http://javafx.com/fxml/1" fx:controller="valuepassing.TestController">
    <children>
        <Text fx:id="target" />
    </children>
</VBox>
```

```
package valuepassing;

import javafx.fxml.FXML;
import javafx.scene.text.Text;

public class TestController {

    @FXML
    private Text target;

    public void setData(String data) {
        target.setText(data);
    }

}
```

fxml

```
String data = "Hello World!";

FXMLLoader loader = new FXMLLoader(getClass().getResource("test.fxml"));
Parent root = loader.load();
TestController controller = loader.<TestController>getController();
controller.setData(data);
```

FXML -

: fxml .

`FXMLLoader` `FXMLLoader` .

fxml .

: fxml `fx:controller` .

FXML

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

<?import javafx.scene.text.*?>
<?import javafx.scene.layout.*?>

<VBox xmlns:fx="http://javafx.com/fxml/1">
    <children>
        <Text fx:id="target" />
    </children>
</VBox>
```

```
import javafx.fxml.FXML;
import javafx.scene.text.Text;

public class TestController {

    private final String data;

    public TestController(String data) {
        this.data = data;
    }

    @FXML
    private Text target;

    public void initialize() {
        // handle data once the fields are injected
        target.setText(data);
    }

}
```

fxml

```
String data = "Hello World!";

FXMLLoader loader = new FXMLLoader(getClass().getResource("test.fxml"));

TestController controller = new TestController(data);
loader.setController(controller);

Parent root = loader.load();
```

controllerFactory FXML

: fxml .

. .

FXML

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

<?import javafx.scene.text.*?>
<?import javafx.scene.layout.*?>

<VBox xmlns:fx="http://javafx.com/fxml/1" fx:controller="valuepassing.TestController">
    <children>
        <Text fx:id="target" />
    </children>
</VBox>
```

```
package valuepassing;

import javafx.fxml.FXML;
import javafx.scene.text.Text;
```

```
public class TestController {

    private final String data;

    public TestController(String data) {
        this.data = data;
    }

    @FXML
    private Text target;

    public void initialize() {
        // handle data once the fields are injected
        target.setText(data);
    }

}
```

fxml

= "Hello World!";

```
Map<Class, Callable<?>> creators = new HashMap<>();
creators.put(TestController.class, new Callable<TestController>() {

    @Override
    public TestController call() throws Exception {
        return new TestController(data);
    }

});

FXMLLoader loader = new FXMLLoader(getClass().getResource("test.fxml"));

loader.setControllerFactory(new Callback<Class<?>, Object>() {

    @Override
    public Object call(Class<?> param) {
        Callable<?> callable = creators.get(param);
        if (callable == null) {
            try {
                // default handling: use no-arg constructor
                return param.newInstance();
            } catch (InstantiationException | IllegalAccessException ex) {
                throw new IllegalStateException(ex);
            }
        } else {
            try {
                return callable.call();
            } catch (Exception ex) {
                throw new IllegalStateException(ex);
            }
        }
    }
});

Parent root = loader.load();
```

---

fxml .

FXML

.

JavaFX 8

`Person(@NamedArg("name") String name) @NamedArg  @NamedArg .`

```
package fxml.sample;

import javafx.beans.NamedArg;
import javafx.beans.property.SimpleStringProperty;
import javafx.beans.property.StringProperty;

public class Person {

    public static final Person JOHN = new Person("John");

    public Person() {
        System.out.println("Person()");
    }

    public Person(@NamedArg("name") String name) {
        System.out.println("Person(String)");
        this.name.set(name);
    }

    public Person(Person person) {
        System.out.println("Person(Person)");
        this.name.set(person.getName());
    }

    private final StringProperty name = new SimpleStringProperty();

    public final String getName() {
        System.out.println("getter");
        return this.name.get();
    }

    public final void setName(String value) {
        System.out.println("setter");
        this.name.set(value);
    }

    public final StringProperty nameProperty() {
        System.out.println("property getter");
        return this.name;
    }

    public static Person valueOf(String value) {
        System.out.println("valueOf");
        return new Person(value);
    }

    public static Person createPerson() {
        System.out.println("createPerson");
        return new Person();
```

```
    }

}
```

fxml `Person` .

fxml imports . fxml .

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

fxml imports . **.java.lang .**

.

```
<?import java.lang.*?>
<?import fxml.sample.Person?>
```

JavaFX 8

@NamedArg

`@NamedArg` `@NamedArg` fxml .

```
<Person name="John"/>
```

```
<Person xmlns:fx="http://javafx.com/fxml">
    <name>
        <String fx:value="John"/>
    </name>
</Person>
```

.

```
Person(String)
```

args

`@NamedArg` .

`@NamedArg` .

```
<Person name="John"/>
```

.

:

```
Person()
```

```
setter
```

fx:value

fx:value String static valueOf .

```
<Person xmlns:fx="http://javafx.com/fxml" fx:value="John"/>
```

:

```
valueOf
Person(String)
```

fx:factory

fx:factory static .

```
<Person xmlns:fx="http://javafx.com/fxml" fx:factory="createPerson">
    <name>
        <String fx:value="John"/>
    </name>
</Person>
```

:

```
createPerson
Person()
setter
```

<fx:copy>

fx:copy . fx:id source .

:

```
<ArrayList xmlns:fx="http://javafx.com/fxml">
    <Person fx:id="p1" fx:constant="JOHN"/>
    <fx:copy source="p1"/>
</ArrayList>
```

```
Person(Person)
getter
```

fx:constant

fx:constant static final fx:constant .

```
<Person xmlns:fx="http://javafx.com/fxml" fx:constant="JOHN"/>
```

JOHN .

fxml .

<property>

. setter (/).

@DefaultProperty . .

---

property="value"

. .

```
<property>
    <String fx:value="value" />
</property>
```

---

static . , setProperty static . ContainingClass.property .

: String getter (, getProperty) .

---

setter .

.

.

	(s)
Boolean , boolean	Boolean.valueOf(s)
char , Character	s.toString.charAt(0)
	. s Number valueOf(s.toString())
BigInteger	BigInteger.valueOf(s.longValue()) s Number , new BigInteger(s.toString()) ,
BigDecimal	BigDecimal.valueOf(s.doubleValue()) s Number , new BigDecimal(s.toString()) ,
	Double.valueOf(s.toString()) s.toString() . , Long.valueOf(s.toString())

	(s)
Class	ClassLoader Class.forName(s.toString())
	valueOf s String _ String .
	a static valueOf TARGETTYPE, s

: .

```
public enum Location {
    WASHINGTON_DC,
    LONDON;
}
```

```
package fxml.sample;

import java.math.BigInteger;
import java.util.ArrayList;
import java.util.HashMap;
import java.util.List;
import java.util.Map;
import javafx.beans.DefaultProperty;

@DefaultProperty("items")
public class Sample {

    private Location loaction;

    public Location getLoaction() {
        return loaction;
    }

    public void setLoaction(Location loaction) {
        this.loaction = loaction;
    }

    public int getNumber() {
        return number;
    }

    public void setNumber(int number) {
        this.number = number;
    }

    int number;

    private final List<Object> items = new ArrayList<>();

    public List<Object> getItems() {
        return items;
    }

    private final Map<String, Object> map = new HashMap<>();

    public Map<String, Object> getMap() {
        return map;
```

```
    }

    private BigInteger serialNumber;

    public BigInteger getSerialNumber() {
        return serialNumber;
    }

    public void setSerialNumber(BigInteger serialNumber) {
        this.serialNumber = serialNumber;
    }

    @Override
    public String toString() {
        return "Sample{" + "loaction=" + loaction + ", number=" + number + ", items=" + items
+ ", map=" + map + ", serialNumber=" + serialNumber + '}';
    }

}
```

```
package fxml.sample;

public class Container {

    public static int getNumber(Sample sample) {
        return sample.number;
    }

    public static void setNumber(Sample sample, int number) {
        sample.number = number;
    }

    private final String value;

    private Container(String value) {
        this.value = value;
    }

    public static Container valueOf(String s) {
        return new Container(s);
    }

    @Override
    public String toString() {
        return "42" + value;
    }

}
```

fxml .

```
Sample{loaction=WASHINGTON_DC, number=5, items=[42a, 42b, 42c, 42d, 42e, 42f], map={answer=42,
g=9.81, hello=42A, sample=Sample{loaction=null, number=33, items=[], map={},
serialNumber=null}}, serialNumber=4299}
```

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

<?import java.lang.*?>
```

```
<?import fxml.sample.*?>

<Sample xmlns:fx="http://javafx.com/fxml/1" Container.number="5" loaction="washingtonDc">

    <!-- set serialNumber property (type coercion) -->
    <serialNumber>
        <Container fx:value="99"/>
    </serialNumber>

    <!-- Add elements to default property-->
    <Container fx:value="a"/>
    <Container fx:value="b"/>
    <Container fx:value="c"/>
    <Container fx:value="d"/>
    <Container fx:value="e"/>
    <Container fx:value="f"/>

    <!-- fill readonly map property -->
    <map g="9.81">
        <hello>
            <Container fx:value="A"/>
        </hello>
        <answer>
            <Container fx:value=""/>
        </answer>
        <sample>
            <Sample>
                <!-- static setter-->
                <Container.number>
                    <Integer fx:value="33" />
                </Container.number>
            </Sample>
        </sample>
    </map>
</Sample>
```

FXML : https://riptutorial.com/ko/javafx/topic/1580/fxml--

4: JavaFX

Examples

JavaFX API . , . :

```
SimpleIntegerProperty first =new SimpleIntegerProperty(5); //create a property with value=5
SimpleIntegerProperty second=new SimpleIntegerProperty();

public void test()
{
    System.out.println(second.get()); // '0'
    second.bind(first);               //bind second property to first
    System.out.println(second.get()); // '5'
    first.set(16);                    //set first property's value
    System.out.println(second.get()); // '16' - the value was automatically updated
}
```

, , .

```
public void test2()
{
        second.bind(first.add(100));
        System.out.println(second.get()); //'105'
        second.bind(first.subtract(50));
        System.out.println(second.get()); //'-45'
}
```

SimpleObjectProperty .

```
SimpleObjectProperty<Color> color=new SimpleObjectProperty<>(Color.web("45f3d1"));
```

f . .

```
public void test3()
{
        second.bindBidirectional(first);
        System.out.println(second.get()+" "+first.get());
        second.set(1000);
        System.out.println(second.get()+" "+first.get()); //both are '1000'
}
```

JavaFX : https://riptutorial.com/ko/javafx/topic/7014/javafx-

5: JavaFX

Examples

JavaFX . FXML `FXMLLoader` .

```
Locale locale = new Locale("en", "UK");
ResourceBundle bundle = ResourceBundle.getBundle("strings", locale);

Parent root = FXMLLoader.load(getClass().getClassLoader()
                                  .getResource("ui/main.fxml"), bundle);
```

`%` FXML . `strings_en_UK.properties` `strings_en_UK.properties` .

```
ui.button.text=I'm a Button
```

FXML .

```
<Button text="%ui.button.text"/>
```

`ui.button.text` .

. `FXMLLoader` . `Initializable` `initialize(URL location, ResourceBundle resources)` . `ResourceBundle` FXMLLoader .

```
public class MyController implements Initializable {

    @Override
    public void initialize(URL location, ResourceBundle resources) {
        label.setText(resources.getString("country"));
    }
}
```

JavaFX .

.

messages_en.properties :

```
window.title=Dynamic language change
button.english=English
button.german=German
label.numSwitches=Number of language switches: {0}
```

messages_de.properties :

```
window.title=Dynamischer Sprachwechsel
button.english=Englisch
button.german=Deutsch
```

```
label.numSwitches=Anzahl Sprachwechsel: {0}
```

I18N ( ).

```
import javafx.beans.binding.Bindings;
import javafx.beans.binding.StringBinding;
import javafx.beans.property.ObjectProperty;
import javafx.beans.property.SimpleObjectProperty;
import javafx.scene.control.Button;
import javafx.scene.control.Label;

import java.text.MessageFormat;
import java.util.ArrayList;
import java.util.Arrays;
import java.util.List;
import java.util.Locale;
import java.util.ResourceBundle;
import java.util.concurrent.Callable;

/**
 * I18N utility class..
 */
public final class I18N {

    /** the current selected Locale. */
    private static final ObjectProperty<Locale> locale;

    static {
        locale = new SimpleObjectProperty<>(getDefaultLocale());
        locale.addListener((observable, oldValue, newValue) -> Locale.setDefault(newValue));
    }

    /**
     * get the supported Locales.
     *
     * @return List of Locale objects.
     */
    public static List<Locale> getSupportedLocales() {
        return new ArrayList<>(Arrays.asList(Locale.ENGLISH, Locale.GERMAN));
    }

    /**
     * get the default locale. This is the systems default if contained in the supported
locales, english otherwise.
     *
     * @return
     */
    public static Locale getDefaultLocale() {
        Locale sysDefault = Locale.getDefault();
        return getSupportedLocales().contains(sysDefault) ? sysDefault : Locale.ENGLISH;
    }

    public static Locale getLocale() {
        return locale.get();
    }

    public static void setLocale(Locale locale) {
        localeProperty().set(locale);
        Locale.setDefault(locale);
    }
```

```
    public static ObjectProperty<Locale> localeProperty() {
        return locale;
    }

    /**
     * gets the string with the given key from the resource bundle for the current locale and
uses it as first argument
     * to MessageFormat.format, passing in the optional args and returning the result.
     *
     * @param key
     *         message key
     * @param args
     *         optional arguments for the message
     * @return localized formatted string
     */
    public static String get(final String key, final Object... args) {
        ResourceBundle bundle = ResourceBundle.getBundle("messages", getLocale());
        return MessageFormat.format(bundle.getString(key), args);
    }

    /**
     * creates a String binding to a localized String for the given message bundle key
     *
     * @param key
     *         key
     * @return String binding
     */
    public static StringBinding createStringBinding(final String key, Object... args) {
        return Bindings.createStringBinding(() -> get(key, args), locale);
    }

    /**
     * creates a String Binding to a localized String that is computed by calling the given
func
     *
     * @param func
     *         function called on every change
     * @return StringBinding
     */
    public static StringBinding createStringBinding(Callable<String> func) {
        return Bindings.createStringBinding(func, locale);
    }

    /**
     * creates a bound Label whose value is computed on language change.
     *
     * @param func
     *         the function to compute the value
     * @return Label
     */
    public static Label labelForValue(Callable<String> func) {
        Label label = new Label();
        label.textProperty().bind(createStringBinding(func));
        return label;
    }

    /**
     * creates a bound Button for the given resourcebundle key
     *
     * @param key
```

```
     *         ResourceBundle key
     * @param args
     *         optional arguments for the message
     * @return Button
     */
    public static Button buttonForKey(final String key, final Object... args) {
        Button button = new Button();
        button.textProperty().bind(createStringBinding(key, args));
        return button;
    }
}
```

JavaFX `ObjectProperty` Java `Locale` `locale` `ObjectProperty` . JavaFX .

`get(final String key, final Object... args)` `ResourceBundle` .

`createStringBinding` `locale` `StringBinding` `locale` . `get` , `Callable` .

JavaFX . `Label` `Callable` . `Button` String .

`MenuItem` `ToolTip` .

.

```
import javafx.application.Application;
import javafx.geometry.Insets;
import javafx.scene.Scene;
import javafx.scene.control.Button;
import javafx.scene.control.Label;
import javafx.scene.layout.BorderPane;
import javafx.scene.layout.HBox;
import javafx.stage.Stage;

import java.util.Locale;

/**
 * Sample application showing dynamic language switching,
 */
public class I18nApplication extends Application {

    /** number of language switches. */
    private Integer numSwitches = 0;

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

        primaryStage.titleProperty().bind(I18N.createStringBinding("window.title"));

        // create content
        BorderPane content = new BorderPane();

        // at the top two buttons
        HBox hbox = new HBox();
        hbox.setPadding(new Insets(5, 5, 5, 5));
        hbox.setSpacing(5);

        Button buttonEnglish = I18N.buttonForKey("button.english");
        buttonEnglish.setOnAction((evt) -> switchLanguage(Locale.ENGLISH));
```

```
        hbox.getChildren().add(buttonEnglish);

        Button buttonGerman = I18N.buttonForKey("button.german");
        buttonGerman.setOnAction((evt) -> switchLanguage(Locale.GERMAN));
        hbox.getChildren().add(buttonGerman);

        content.setTop(hbox);

        // a label to display the number of changes, recalculating the text on every change
        final Label label = I18N.labelForValue(() -> I18N.get("label.numSwitches",
numSwitches));
        content.setBottom(label);

        primaryStage.setScene(new Scene(content, 400, 200));
        primaryStage.show();
    }

    /**
     * sets the given Locale in the I18N class and keeps count of the number of switches.
     *
     * @param locale
     *         the new local to set
     */
    private void switchLanguage(Locale locale) {
        numSwitches++;
        I18N.setLocale(locale);
    }
}
```

`I18N` `StringBinding` .

1. `StringBinding` .
2. .
3. `Callable` . `Callable` `I18N.get()` `I18N.get()` .

`I18N` UI .

JavaFX : https://riptutorial.com/ko/javafx/topic/5434/javafx-

6: ScrollPane

ScrollPane . . (/ /) .

Examples

A) :

ScrollPane .

```
import javafx.scene.control.ScrollPane;   //Import the ScrollPane
import javafx.scene.control.ScrollPane.ScrollBarPolicy; //Import the ScrollBarPolicy
import javafx.scene.layout.Pane;

ScrollPane scrollpane;
Pane content = new Pane();  //We will use this Pane as a content

scrollpane = new ScrollPane(content);  //Initialize and add content as a parameter
scrollpane.setPrefSize(300, 300);   //Initialize the size of the ScrollPane

scrollpane.setFitToWidth(true);  //Adapt the content to the width of ScrollPane
scrollpane.setFitToHeight(true); //Adapt the content to the height of ScrollPane


scrollpane.setHbarPolicy(ScrollBarPolicy.ALWAYS);  //Control the visibility of the Horizontal
ScrollBar
scrollpane.setVbarPolicy(ScrollBarPolicy.NEVER);  //Control the visibility of the Vertical
ScrollBar
//There are three types of visibility (ALWAYS/AS_NEEDED/NEVER)
```

B) :

( ) .

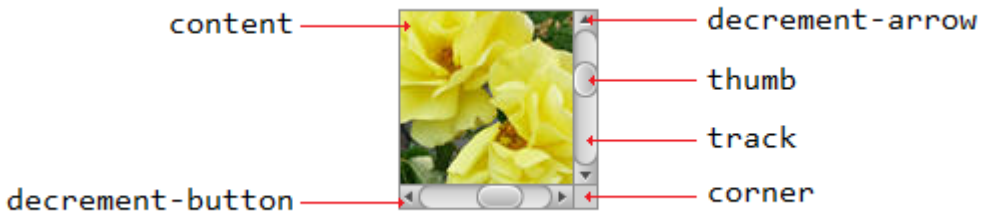
```
import javafx.scene.control.ScrollPane;   //Import the ScrollPane
import javafx.scene.control.ScrollPane.ScrollBarPolicy; //Import the ScrollBarPolicy
import javafx.scene.layout.Pane;

ScrollPane scrollpane;
Pane content = new Pane();  //We will use this Pane as a content

scrollpane = new ScrollPane();
scrollpane.setPrefSize(300, 300);   //Initialize the size of the ScrollPane
content.setMinSize(300,300); //Here a minimum size is set so that the container can be
extended.
scrollpane.setContent(content); // we add the content to the ScrollPane
```

: (setFitToWidth / setFitToHeight) .

ScrollPane :

ScrollPane " *CSS* " " " " " .

A) ScrollPane :



B) CSS :

```
.scroll-bar:vertical .track{}

.scroll-bar:horizontal .track{}

.scroll-bar:horizontal .thumb{}

.scroll-bar:vertical .thumb{}


.scroll-bar:vertical *.increment-button,
.scroll-bar:vertical *.decrement-button{}

.scroll-bar:vertical *.increment-arrow .content,
.scroll-bar:vertical *.decrement-arrow .content{}

.scroll-bar:vertical *.increment-arrow,
.scroll-bar:vertical *.decrement-arrow{}


.scroll-bar:horizontal *.increment-button,
.scroll-bar:horizontal *.decrement-button{}

.scroll-bar:horizontal *.increment-arrow .content,
.scroll-bar:horizontal *.decrement-arrow .content{}

.scroll-bar:horizontal *.increment-arrow,
.scroll-bar:horizontal *.decrement-arrow{}

.scroll-pane .corner{}

.scroll-pane{}
```

ScrollPane : https://riptutorial.com/ko/javafx/topic/8259/scrollpane

7: TableView

Examples

2 TableView

name (`String`) size (`double`) 2 property . `TableView` JavaFX .

```
import javafx.beans.property.DoubleProperty;
import javafx.beans.property.SimpleDoubleProperty;
import javafx.beans.property.SimpleStringProperty;
import javafx.beans.property.StringProperty;

public class Person {

    public Person(String name, double size) {
        this.size = new SimpleDoubleProperty(this, "size", size);
        this.name = new SimpleStringProperty(this, "name", name);
    }

    private final StringProperty name;
    private final DoubleProperty size;

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

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

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

    public final double getSize() {
        return this.size.get();
    }

    public final void setSize(double value) {
        this.size.set(value);
    }

    public final DoubleProperty sizeProperty() {
        return this.size;
    }

}
```

2 `TableView` . `Person` . `Person` `TableView` `TextField` . `TableView` .

`TableView` `TableColumn` `cellValueFactory` . `TableView` `ObservableValue` (`Person`) .

```
import javafx.application.Application;
import javafx.beans.value.ChangeListener;
```

```
import javafx.beans.value.ObservableValue;
import javafx.collections.FXCollections;
import javafx.collections.ObservableList;
import javafx.event.ActionEvent;
import javafx.event.EventHandler;
import javafx.scene.Scene;
import javafx.scene.control.Button;
import javafx.scene.control.Label;
import javafx.scene.control.TableColumn;
import javafx.scene.control.TableView;
import javafx.scene.control.TextField;
import javafx.scene.control.TextFormatter;
import javafx.scene.layout.HBox;
import javafx.scene.layout.VBox;
import javafx.stage.Stage;
import javafx.util.Callback;
import javafx.util.StringConverter;

public class TableSample extends Application {

    @Override
    public void start(Stage primaryStage) {
        // data for the tableview. modifying this list automatically updates the tableview
        ObservableList<Person> data = FXCollections.observableArrayList(
                new Person("John Doe", 1.75),
                new Person("Mary Miller", 1.70),
                new Person("Frank Smith", 1.80),
                new Person("Charlotte Hoffman", 1.80)
        );

        TableView<Person> tableView = new TableView<>(data);

        // table column for the name of the person
        TableColumn<Person, String> nameColumn = new TableColumn<>("Name");
        nameColumn.setCellValueFactory(new Callback<TableColumn.CellDataFeatures<Person,
String>, ObservableValue<String>>() {

            @Override
            public ObservableValue<String> call(TableColumn.CellDataFeatures<Person, String>
param) {
                return param.getValue().nameProperty();
            }
        });

        // column for the size of the person
        TableColumn<Person, Number> sizeColumn = new TableColumn<>("Size");
        sizeColumn.setCellValueFactory(new Callback<TableColumn.CellDataFeatures<Person,
Number>, ObservableValue<Number>>() {

            @Override
            public ObservableValue<Number> call(TableColumn.CellDataFeatures<Person, Number>
param) {
                return param.getValue().sizeProperty();
            }
        });

        // add columns to tableview
        tableView.getColumns().addAll(nameColumn, sizeColumn);

        TextField name = new TextField();
```

```
        TextField size = new TextField();

        // convert input from textfield to double
        TextFormatter<Double> sizeFormatter = new TextFormatter<Double>(new
StringConverter<Double>() {

            @Override
            public String toString(Double object) {
                return object == null ? "" : object.toString();
            }

            @Override
            public Double fromString(String string) {
                if (string == null || string.isEmpty()) {
                    return null;
                } else {
                    try {
                        double val = Double.parseDouble(string);
                        return val < 0 ? null : val;
                    } catch (NumberFormatException ex) {
                        return null;
                    }
                }
            }

        });
        size.setTextFormatter(sizeFormatter);

        Button commit = new Button("Change Item");
        commit.setOnAction(new EventHandler<ActionEvent>() {

            @Override
            public void handle(ActionEvent event) {
                Person p = tableView.getSelectionModel().getSelectedItem();
                p.setName(name.getText());
                Double value = sizeFormatter.getValue();
                p.setSize(value == null ? -1d : value);
            }

        });

        // listen for changes in the selection to update the data in the textfields
        tableView.getSelectionModel().selectedItemProperty().addListener(new
ChangeListener<Person>() {

            @Override
            public void changed(ObservableValue<? extends Person> observable, Person oldValue,
Person newValue) {
                commit.setDisable(newValue == null);
                if (newValue != null) {
                    sizeFormatter.setValue(newValue.getSize());
                    name.setText(newValue.getName());
                }
            }

        });

        HBox editors = new HBox(5, new Label("Name:"), name, new Label("Size: "), size,
commit);

        VBox root = new VBox(10, tableView, editors);
```

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

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

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

}
```

PropertyValueFactory

PropertyValueFactory TableColumn cellValueFactory . TableView .

```
TableColumn<Person, String> nameColumn = ...
PropertyValueFactory<Person, String> valueFactory = new PropertyValueFactory<>("name");
nameColumn.setCellValueFactory(valueFactory);
```

PropertyValueFactory .

- : ObservableValue . . <constructor parameter>Property <constructor parameter>Property .
- **Getter :** (String). get<Constructor parameter> . <Constructor parameter> . .

( )		getter
	fooProperty	getFoo
fooBar	fooBarProperty	getFooBar
XYZ	XYZ	getXYZ
listIndex	listIndexProperty	getListIndex
	aValueProperty	getAValue

TableCell

toString . TableColumn cellFactory TableCell .

: TableView UI TableCell . . TableCell . " " .

ImageView .

```
image.setImage(item.getEmoji());
setText(item.getValue());
```

null null .

```
setText(null);
image.setImage(null);
```

`TableCell` `TableCell` .

`updateItem` `Cell` . . Listener `itemProperty()` `TableCell` .

```
import javafx.scene.image.Image;

// enum providing image and text for certain feelings
public enum Feeling {
    HAPPY("happy",
"https://upload.wikimedia.org/wikipedia/commons/thumb/8/80/Emojione_1F600.svg/64px-
Emojione_1F600.svg.png"),
    SAD("sad",
"https://upload.wikimedia.org/wikipedia/commons/thumb/4/42/Emojione_1F62D.svg/64px-
Emojione_1F62D.svg.png")
    ;
    private final Image emoji;
    private final String value;

    Feeling(String value, String url) {
        // load image in background
        emoji = new Image(url, true);
        this.value = value;
    }

    public Image getEmoji() {
        return emoji;
    }

    public String getValue() {
        return value;
    }

}
```

```
import javafx.application.Application;
import javafx.beans.property.ObjectProperty;
import javafx.beans.property.SimpleObjectProperty;
import javafx.collections.FXCollections;
import javafx.event.ActionEvent;
import javafx.event.EventHandler;
import javafx.scene.Node;
import javafx.scene.Scene;
import javafx.scene.control.Button;
import javafx.scene.control.TableCell;
import javafx.scene.control.TableColumn;
import javafx.scene.control.TableView;
import javafx.scene.control.cell.PropertyValueFactory;
import javafx.scene.image.ImageView;
import javafx.scene.layout.HBox;
import javafx.scene.layout.VBox;
import javafx.stage.Stage;
import javafx.util.Callback;

public class EmotionTable extends Application {
```

```
    public static class Item {

        private final ObjectProperty<Feeling> feeling;

        public Item(Feeling feeling) {
            this.feeling = new SimpleObjectProperty<>(feeling);
        }

        public final Feeling getFeeling() {
            return this.feeling.get();
        }

        public final void setFeeling(Feeling value) {
            this.feeling.set(value);
        }

        public final ObjectProperty<Feeling> feelingProperty() {
            return this.feeling;
        }

    }

    @Override
    public void start(Stage primaryStage) {
        TableView<Item> table = new TableView<>(FXCollections.observableArrayList(
                new Item(Feeling.HAPPY),
                new Item(Feeling.HAPPY),
                new Item(Feeling.HAPPY),
                new Item(Feeling.SAD),
                null,
                new Item(Feeling.HAPPY),
                new Item(Feeling.HAPPY),
                new Item(Feeling.SAD)
        ));

        EventHandler<ActionEvent> eventHandler = new EventHandler<ActionEvent>() {

            @Override
            public void handle(ActionEvent event) {
                // change table items depending on userdata of source
                Node source = (Node) event.getSource();
                Feeling targetFeeling = (Feeling) source.getUserData();
                for (Item item : table.getItems()) {
                    if (item != null) {
                        item.setFeeling(targetFeeling);
                    }
                }
            }

        };

        TableColumn<Item, Feeling> feelingColumn = new TableColumn<>("Feeling");

        feelingColumn.setCellValueFactory(new PropertyValueFactory<>("feeling"));

        // use custom tablecell to display emoji image
        feelingColumn.setCellFactory(new Callback<TableColumn<Item, Feeling>, TableCell<Item,
Feeling>>() {

            @Override
            public TableCell<Item, Feeling> call(TableColumn<Item, Feeling> param) {
```

```
                return new EmojiCell<>();
            }
        });

        table.getColumns().add(feelingColumn);

        Button sunshine = new Button("sunshine");
        Button rain = new Button("rain");

        sunshine.setOnAction(eventHandler);
        rain.setOnAction(eventHandler);

        sunshine.setUserData(Feeling.HAPPY);
        rain.setUserData(Feeling.SAD);

        Scene scene = new Scene(new VBox(10, table, new HBox(10, sunshine, rain)));

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

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

}
```

```
import javafx.scene.control.TableCell;
import javafx.scene.image.ImageView;

public class EmojiCell<T> extends TableCell<T, Feeling> {

    private final ImageView image;

    public EmojiCell() {
        // add ImageView as graphic to display it in addition
        // to the text in the cell
        image = new ImageView();
        image.setFitWidth(64);
        image.setFitHeight(64);
        image.setPreserveRatio(true);

        setGraphic(image);
        setMinHeight(70);
    }

    @Override
    protected void updateItem(Feeling item, boolean empty) {
        super.updateItem(item, empty);

        if (empty || item == null) {
            // set back to look of empty cell
            setText(null);
            image.setImage(null);
        } else {
            // set image and text for non-empty cell
            image.setImage(item.getEmoji());
            setText(item.getValue());
        }
    }
```

```
}
```

Tableview

`setCellFactory(Callback value)` Tableview javafx .

TableView . .

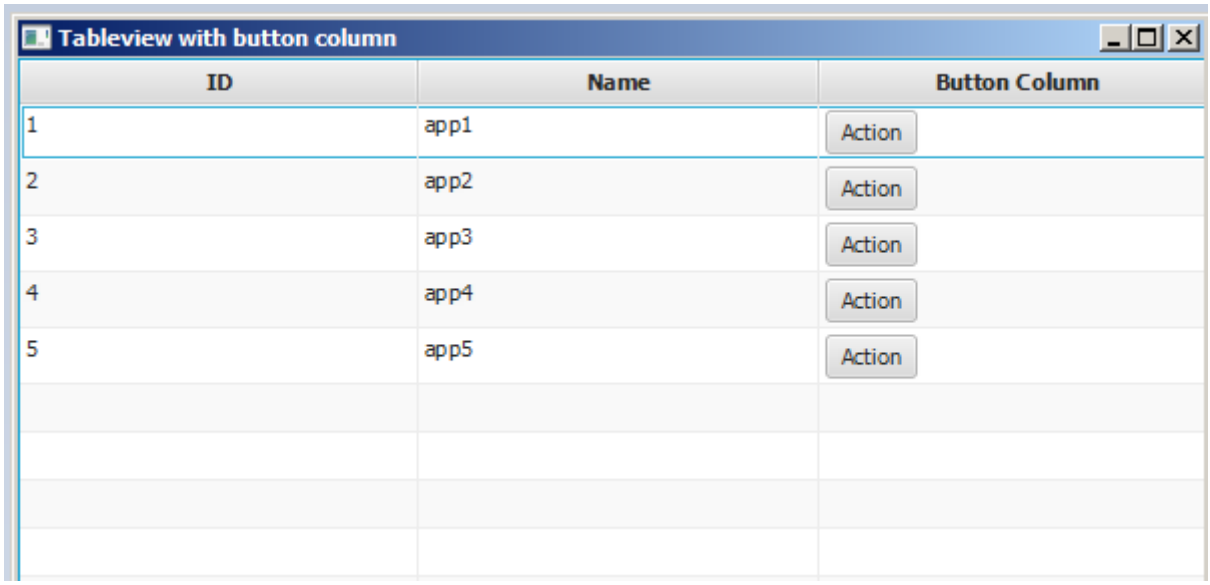
`addButtonToTable()` `cellFactory` . cellFactory `call(...)` `TableCell` `cellFactory` `cellFactory` `setCellFactory(..)` . `colBtn.setCellFactory(cellFactory)` . SSCCE .

```
import javafx.application.Application;
import javafx.beans.property.SimpleIntegerProperty;
import javafx.beans.property.SimpleStringProperty;
import javafx.collections.FXCollections;
import javafx.collections.ObservableList;
import javafx.event.ActionEvent;
import javafx.scene.Group;
import javafx.scene.Scene;
import javafx.scene.control.Button;
import javafx.scene.control.TableCell;
import javafx.scene.control.TableColumn;
import javafx.scene.control.TableView;
import javafx.scene.control.cell.PropertyValueFactory;
import javafx.stage.Stage;
import javafx.util.Callback;

public class TableViewSample extends Application {

    private final TableView<Data> table = new TableView<>();
    private final ObservableList<Data> tvObservableList = FXCollections.observableArrayList();

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

    @Override
    public void start(Stage stage) {

        stage.setTitle("Tableview with button column");
        stage.setWidth(600);
        stage.setHeight(600);

        setTableappearance();

        fillTableObservableListWithSampleData();
        table.setItems(tvObservableList);

        TableColumn<Data, Integer> colId = new TableColumn<>("ID");
        colId.setCellValueFactory(new PropertyValueFactory<>("id"));

        TableColumn<Data, String> colName = new TableColumn<>("Name");
        colName.setCellValueFactory(new PropertyValueFactory<>("name"));

        table.getColumns().addAll(colId, colName);

        addButtonToTable();
```

```
        Scene scene = new Scene(new Group(table));

        stage.setScene(scene);
        stage.show();
    }

    private void setTableappearance() {
        table.setColumnResizePolicy(TableView.CONSTRAINED_RESIZE_POLICY);
        table.setPrefWidth(600);
        table.setPrefHeight(600);
    }

    private void fillTableObservableListWithSampleData() {

        tvObservableList.addAll(new Data(1, "app1"),
                                new Data(2, "app2"),
                                new Data(3, "app3"),
                                new Data(4, "app4"),
                                new Data(5, "app5"));
    }

    private void addButtonToTable() {
        TableColumn<Data, Void> colBtn = new TableColumn("Button Column");

        Callback<TableColumn<Data, Void>, TableCell<Data, Void>> cellFactory = new
Callback<TableColumn<Data, Void>, TableCell<Data, Void>>() {
            @Override
            public TableCell<Data, Void> call(final TableColumn<Data, Void> param) {
                final TableCell<Data, Void> cell = new TableCell<Data, Void>() {

                    private final Button btn = new Button("Action");

                    {
                        btn.setOnAction((ActionEvent event) -> {
                            Data data = getTableView().getItems().get(getIndex());
                            System.out.println("selectedData: " + data);
                        });
                    }

                    @Override
                    public void updateItem(Void item, boolean empty) {
                        super.updateItem(item, empty);
                        if (empty) {
                            setGraphic(null);
                        } else {
                            setGraphic(btn);
                        }
                    }
                };
                return cell;
            }
        };

        colBtn.setCellFactory(cellFactory);

        table.getColumns().add(colBtn);

    }

    public class Data {
```

```
        private int id;
        private String name;

        private Data(int id, String name) {
            this.id = id;
            this.name = name;
        }

        public int getId() {
            return id;
        }

        public void setId(int ID) {
            this.id = ID;
        }

        public String getName() {
            return name;
        }

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

        @Override
        public String toString() {
            return "id: " + id + " - " + "name: " + name;
        }

    }
}
```

:



TableView : https://riptutorial.com/ko/javafx/topic/2229/tableview

8: WebView WebEngine

`WebView` JavaFX JavaFX . `WebEngine` .

`WebEngine` .

Examples

```
WebView wv = new WebView();
WebEngine we = wv.getEngine();
we.load("https://stackoverflow.com");
```

`WebView` `WebEngine` UI . UI `WebEngine` .

WebView

```
WebHistory history = webView.getEngine().getHistory();
```

. URL, .

`getEntries()` . `WebEngine` . . ObservableList API .

`currentIndexProperty()` . `go(int)` . `maxSizeProperty()` .

.

`ComboBox` (comboBox) . `WebHistory` `ListChangeListener` `ComboBox` `WebHistory` . `ComboBox` `EventHandler` .

```
final WebHistory history = webEngine.getHistory();

comboBox.setItems(history.getEntries());
comboBox.setPrefWidth(60);
comboBox.setOnAction(new EventHandler<ActionEvent>() {
    @Override
    public void handle(ActionEvent ev) {
        int offset =
                comboBox.getSelectionModel().getSelectedIndex()
                - history.getCurrentIndex();
        history.go(offset);
    }
});

history.currentIndexProperty().addListener(new ChangeListener<Number>() {

    @Override
    public void changed(ObservableValue<? extends Number> observable, Number oldValue, Number
newValue) {
        // update currently selected combobox item
        comboBox.getSelectionModel().select(newValue.intValue());
    }
```

```
});

// set converter for value shown in the combobox:
//   display the urls
comboBox.setConverter(new StringConverter<WebHistory.Entry>() {

    @Override
    public String toString(WebHistory.Entry object) {
        return object == null ? null : object.getUrl();
    }

    @Override
    public WebHistory.Entry fromString(String string) {
        throw new UnsupportedOperationException();
    }
});
```

Javascript Java .

```
private final Logger logger = Logger.getLogger(getClass().getCanonicalName());

WebView webView = new WebView();
webEngine = webView.getEngine();

webEngine.setOnAlert(event -> logger.warning(() -> "JS alert: " + event.getData()));
```

WebView Javascript Java Javascript .

.

. Java . Javascript .

Javascript Java Java . , .

Java .

```
package com.sothawo.test;

import javafx.application.Application;
import javafx.concurrent.Worker;
import javafx.scene.Scene;
import javafx.scene.web.WebEngine;
import javafx.scene.web.WebView;
import javafx.stage.Stage;
import netscape.javascript.JSObject;

import java.io.File;
import java.net.URL;

/**
 * @author P.J. Meisch (pj.meisch@sothawo.com).
 */
public class WebViewApplication extends Application {

    /** for communication to the Javascript engine. */
    private JSObject javascriptConnector;
```

```
    /** for communication from the Javascript engine. */
    private JavaConnector javaConnector = new JavaConnector();;

    @Override
    public void start(Stage primaryStage) throws Exception {
        URL url = new File("./js-sample.html").toURI().toURL();

        WebView webView = new WebView();
        final WebEngine webEngine = webView.getEngine();

        // set up the listener
        webEngine.getLoadWorker().stateProperty().addListener((observable, oldValue, newValue)
-> {
            if (Worker.State.SUCCEEDED == newValue) {
                // set an interface object named 'javaConnector' in the web engine's page
                JSObject window = (JSObject) webEngine.executeScript("window");
                window.setMember("javaConnector", javaConnector);

                // get the Javascript connector object.
                javascriptConnector = (JSObject) webEngine.executeScript("getJsConnector()");
            }
        });

        Scene scene = new Scene(webView, 300, 150);
        primaryStage.setScene(scene);
        primaryStage.show();

        // now load the page
        webEngine.load(url.toString());
    }

    public class JavaConnector {
        /**
         * called when the JS side wants a String to be converted.
         *
         * @param value
         *         the String to convert
         */
        public void toLowerCase(String value) {
            if (null != value) {
                javascriptConnector.call("showResult", value.toLowerCase());
            }
        }
    }
}
```

`JavaConnector` ( ) .

```
JSObject window = (JSObject) webEngine.executeScript("window");
window.setMember("javaConnector", javaConnector);
```

`javascriptConnector` .

```
javascriptConnector = (JSObject) webEngine.executeScript("getJsConnector()");
```

`JavaConnector toLowerCase(String)` `javascriptConnector` .

html javascript :

```
<!DOCTYPE html>
<html lang="en">
    <head>
        <meta charset="UTF-8">
        <title>Sample</title>
    </head>
    <body>
        <main>

            <div><input id="input" type="text"></div>
            <button onclick="sendToJava();">to lower case</button>
            <div id="result"></div>

        </main>

        <script type="text/javascript">
            function sendToJava () {
                var s = document.getElementById('input').value;
                javaConnector.toLowerCase(s);
            };

            var jsConnector = {
                showResult: function (result) {
                    document.getElementById('result').innerHTML = result;
                }
            };

            function getJsConnector() {
                return jsConnector;
            };
        </script>
    </body>
</html>
```

`sendToJava` Java `JavaConnector` .

```
function sendToJava () {
    var s = document.getElementById('input').value;
    javaConnector.toLowerCase(s);
};
```

`javascriptConnector` Java `jsConnector` .

```
var jsConnector = {
    showResult: function (result) {
        document.getElementById('result').innerHTML = result;
    }
};

function getJsConnector() {
    return jsConnector;
};
```

Java Javascript . JSObject API .

WebView WebEngine : https://riptutorial.com/ko/javafx/topic/5156/webview--webengine

9: Windows

Examples

Stage . show showAndWait Stage .

```
// create sample content
Rectangle rect = new Rectangle(100, 100, 200, 300);
Pane root = new Pane(rect);
root.setPrefSize(500, 500);

Parent content = root;

// create scene containing the content
Scene scene = new Scene(content);

Stage window = new Stage();
window.setScene(scene);

// make window visible
window.show();
```

: JavaFX .

. .
tableview (AddingPersonDialog) . SceneBuilder GUI .

:

AppMain.java

```
package customdialog;

import javafx.application.Application;
import javafx.fxml.FXMLLoader;
import javafx.scene.Parent;
import javafx.scene.Scene;
import javafx.stage.Stage;

public class AppMain extends Application {

    @Override
    public void start(Stage primaryStage) throws Exception {
        Parent root = FXMLLoader.load(getClass().getResource("AppMain.fxml"));
        Scene scene = new Scene(root, 500, 500);
        primaryStage.setScene(scene);
        primaryStage.show();
    }

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

}
```

AppMainController.java

```
package customdialog;

import javafx.collections.FXCollections;
import javafx.collections.ObservableList;
import javafx.event.ActionEvent;
import javafx.fxml.FXML;
import javafx.fxml.FXMLLoader;
import javafx.fxml.Initializable;
import javafx.scene.Parent;
import javafx.scene.Scene;
import javafx.scene.control.TableColumn;
import javafx.scene.control.TableView;
import javafx.scene.control.cell.PropertyValueFactory;
import javafx.stage.Modality;
import javafx.stage.Stage;

public class AppMainController implements Initializable {

    @FXML
    private TableView<Person> tvData;
    @FXML
    private TableColumn colId;
    @FXML
    private TableColumn colName;
    @FXML
    private TableColumn colAge;

    private ObservableList<Person> tvObservableList = FXCollections.observableArrayList();

    @FXML
    void onOpenDialog(ActionEvent event) throws IOException {
        FXMLLoader fxmlLoader = new
FXMLLoader(getClass().getResource("AddPersonDialog.fxml"));
        Parent parent = fxmlLoader.load();
        AddPersonDialogController dialogController =
fxmlLoader.<AddPersonDialogController>getController();
        dialogController.setAppMainObservableList(tvObservableList);

        Scene scene = new Scene(parent, 300, 200);
        Stage stage = new Stage();
        stage.initModality(Modality.APPLICATION_MODAL);
        stage.setScene(scene);
        stage.showAndWait();
    }

    @Override
    public void initialize(URL location, ResourceBundle resources) {
        colId.setCellValueFactory(new PropertyValueFactory<>("id"));
        colName.setCellValueFactory(new PropertyValueFactory<>("name"));
        colAge.setCellValueFactory(new PropertyValueFactory<>("age"));
        tvData.setItems(tvObservableList);
    }

}
```

AppMain.fxml

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

<?import javafx.scene.control.Button?>
<?import javafx.scene.control.TableColumn?>
<?import javafx.scene.control.TableView?>
<?import javafx.scene.layout.AnchorPane?>
<?import javafx.scene.layout.VBox?>

<AnchorPane maxHeight="400.0" minHeight="400.0" minWidth="500.0"
xmlns="http://javafx.com/javafx/8.0.111" xmlns:fx="http://javafx.com/fxml/1"
fx:controller="customdialog.AppMainController">
   <children>
      <VBox alignment="CENTER" layoutX="91.0" layoutY="85.0" spacing="10.0"
AnchorPane.bottomAnchor="30.0" AnchorPane.leftAnchor="30.0" AnchorPane.rightAnchor="30.0"
AnchorPane.topAnchor="30.0">
         <children>
            <Button mnemonicParsing="false" onAction="#onOpenDialog" text="Add Person" />
            <TableView fx:id="tvData" prefHeight="300.0" prefWidth="400.0">
              <columns>
                <TableColumn fx:id="colId" prefWidth="75.0" text="ID" />
                <TableColumn fx:id="colName" prefWidth="75.0" text="Name" />
                  <TableColumn fx:id="colAge" prefWidth="75.0" text="Age" />
              </columns>
               <columnResizePolicy>
                  <TableView fx:constant="CONSTRAINED_RESIZE_POLICY" />
               </columnResizePolicy>
            </TableView>
         </children>
      </VBox>
   </children>
</AnchorPane>
```

AddPersonDialogController.java

```
package customdialog;

import javafx.collections.ObservableList;
import javafx.event.ActionEvent;
import javafx.fxml.FXML;
import javafx.scene.Node;
import javafx.scene.control.TextField;
import javafx.stage.Stage;

public class AddPersonDialogController  {

    @FXML
    private TextField tfId;

    @FXML
    private TextField tfName;

    @FXML
    private TextField tfAge;

    private ObservableList<Person> appMainObservableList;

    @FXML
    void btnAddPersonClicked(ActionEvent event) {
        System.out.println("btnAddPersonClicked");
        int id = Integer.valueOf(tfId.getText().trim());
```

```
        String name = tfName.getText().trim();
        int iAge = Integer.valueOf(tfAge.getText().trim());

        Person data = new Person(id, name, iAge);
        appMainObservableList.add(data);

        closeStage(event);
    }

    public void setAppMainObservableList(ObservableList<Person> tvObservableList) {
        this.appMainObservableList = tvObservableList;

    }

    private void closeStage(ActionEvent event) {
        Node  source = (Node)  event.getSource();
        Stage stage  = (Stage) source.getScene().getWindow();
        stage.close();
    }

}
```

AddPersonDialog.fxml

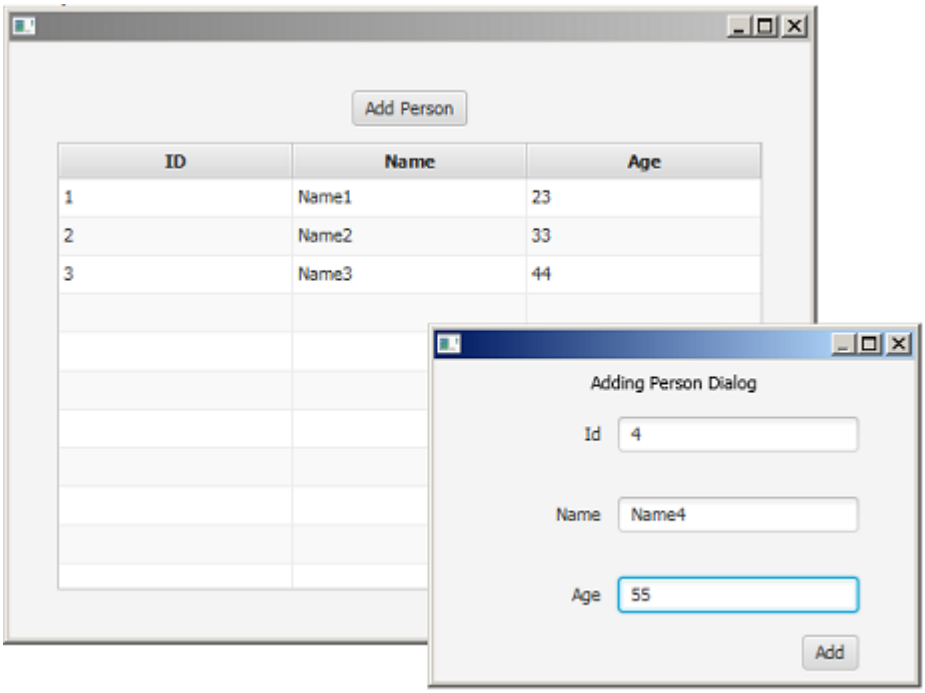
```
<?xml version="1.0" encoding="UTF-8"?>

<?import javafx.geometry.Insets?>
<?import javafx.scene.control.Button?>
<?import javafx.scene.control.Label?>
<?import javafx.scene.control.TextField?>
<?import javafx.scene.layout.AnchorPane?>
<?import javafx.scene.layout.HBox?>
<?import javafx.scene.layout.VBox?>
<?import javafx.scene.text.Text?>

<AnchorPane minHeight="300.0" minWidth="400.0" xmlns="http://javafx.com/javafx/8.0.111"
xmlns:fx="http://javafx.com/fxml/1" fx:controller="customdialog.AddPersonDialogController">
   <children>
      <VBox alignment="CENTER" layoutX="131.0" layoutY="50.0" prefHeight="200.0"
prefWidth="100.0" AnchorPane.bottomAnchor="5.0" AnchorPane.leftAnchor="5.0"
AnchorPane.rightAnchor="5.0" AnchorPane.topAnchor="5.0">
         <children>
            <Text strokeType="OUTSIDE" strokeWidth="0.0" text="Adding Person Dialog" />
            <HBox alignment="CENTER" prefHeight="50.0" prefWidth="200.0" spacing="10.0">
               <children>
                  <Label alignment="CENTER_RIGHT" minWidth="100.0" text="Id" />
                  <TextField fx:id="tfId" HBox.hgrow="ALWAYS" />
               </children>
               <padding>
                  <Insets right="30.0" />
               </padding>
            </HBox>
            <HBox alignment="CENTER" prefHeight="50.0" prefWidth="200.0" spacing="10.0">
               <children>
                  <Label alignment="CENTER_RIGHT" minWidth="100.0" text="Name" />
                  <TextField fx:id="tfName" HBox.hgrow="ALWAYS" />
               </children>
               <padding>
                  <Insets right="30.0" />
               </padding>
```

```
            </HBox>
            <HBox alignment="CENTER" prefHeight="50.0" prefWidth="200.0" spacing="10.0">
               <children>
                  <Label alignment="CENTER_RIGHT" minWidth="100.0" text="Age" />
                  <TextField fx:id="tfAge" HBox.hgrow="ALWAYS" />
               </children>
               <padding>
                  <Insets right="30.0" />
               </padding>
            </HBox>
            <HBox alignment="CENTER_RIGHT">
               <children>
                  <Button mnemonicParsing="false" onAction="#btnAddPersonClicked" text="Add"
/>
               </children>
               <opaqueInsets>
                  <Insets />
               </opaqueInsets>
               <padding>
                  <Insets right="30.0" />
               </padding>
            </HBox>
         </children>
      </VBox>
   </children>
</AnchorPane>
```

Person.java

```
package customdialog;

import javafx.beans.property.SimpleIntegerProperty;
import javafx.beans.property.SimpleStringProperty;

public class Person {

    private SimpleIntegerProperty id;
    private SimpleStringProperty name;
    private SimpleIntegerProperty age;

    public Person(int id, String name, int age)  {
        this.id = new SimpleIntegerProperty(id);
        this.name = new SimpleStringProperty(name);
        this.age = new SimpleIntegerProperty(age);
    }

    public int getId() {
        return id.get();
    }

    public void setId(int ID) {
        this.id.set(ID);
    }

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

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

```
    }

    public int getAge() {
        return age.get();
    }

    public void setAge(int age) {
        this.age.set(age);
    }

    @Override
    public String toString() {
        return "id: " + id.get() + " - " + "name: " + name.get()+ "age: "+ age.get();
    }

}
```



. .
tableview (AddingPersonDialog) . SceneBuilder GUI .

:

AppMain.java

```
package customdialog;

import javafx.application.Application;
import javafx.fxml.FXMLLoader;
import javafx.scene.Parent;
import javafx.scene.Scene;
import javafx.stage.Stage;

public class AppMain extends Application {

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

```
        Parent root = FXMLLoader.load(getClass().getResource("AppMain.fxml"));
        Scene scene = new Scene(root, 500, 500);
        primaryStage.setScene(scene);
        primaryStage.show();
    }

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

}
```

AppMainController.java

```
package customdialog;

import javafx.collections.FXCollections;
import javafx.collections.ObservableList;
import javafx.event.ActionEvent;
import javafx.fxml.FXML;
import javafx.fxml.FXMLLoader;
import javafx.fxml.Initializable;
import javafx.scene.Parent;
import javafx.scene.Scene;
import javafx.scene.control.TableColumn;
import javafx.scene.control.TableView;
import javafx.scene.control.cell.PropertyValueFactory;
import javafx.stage.Modality;
import javafx.stage.Stage;

public class AppMainController implements Initializable {

    @FXML
    private TableView<Person> tvData;
    @FXML
    private TableColumn colId;
    @FXML
    private TableColumn colName;
    @FXML
    private TableColumn colAge;

    private ObservableList<Person> tvObservableList = FXCollections.observableArrayList();

    @FXML
    void onOpenDialog(ActionEvent event) throws IOException {
        FXMLLoader fxmlLoader = new
FXMLLoader(getClass().getResource("AddPersonDialog.fxml"));
        Parent parent = fxmlLoader.load();
        AddPersonDialogController dialogController =
fxmlLoader.<AddPersonDialogController>getController();
        dialogController.setAppMainObservableList(tvObservableList);

        Scene scene = new Scene(parent, 300, 200);
        Stage stage = new Stage();
        stage.initModality(Modality.APPLICATION_MODAL);
        stage.setScene(scene);
        stage.showAndWait();
    }

    @Override
```

```
    public void initialize(URL location, ResourceBundle resources) {
        colId.setCellValueFactory(new PropertyValueFactory<>("id"));
        colName.setCellValueFactory(new PropertyValueFactory<>("name"));
        colAge.setCellValueFactory(new PropertyValueFactory<>("age"));
        tvData.setItems(tvObservableList);
    }

}
```

AppMain.fxml

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

<?import javafx.scene.control.Button?>
<?import javafx.scene.control.TableColumn?>
<?import javafx.scene.control.TableView?>
<?import javafx.scene.layout.AnchorPane?>
<?import javafx.scene.layout.VBox?>

<AnchorPane maxHeight="400.0" minHeight="400.0" minWidth="500.0"
xmlns="http://javafx.com/javafx/8.0.111" xmlns:fx="http://javafx.com/fxml/1"
fx:controller="customdialog.AppMainController">
   <children>
      <VBox alignment="CENTER" layoutX="91.0" layoutY="85.0" spacing="10.0"
AnchorPane.bottomAnchor="30.0" AnchorPane.leftAnchor="30.0" AnchorPane.rightAnchor="30.0"
AnchorPane.topAnchor="30.0">
         <children>
            <Button mnemonicParsing="false" onAction="#onOpenDialog" text="Add Person" />
            <TableView fx:id="tvData" prefHeight="300.0" prefWidth="400.0">
              <columns>
                <TableColumn fx:id="colId" prefWidth="75.0" text="ID" />
                <TableColumn fx:id="colName" prefWidth="75.0" text="Name" />
                  <TableColumn fx:id="colAge" prefWidth="75.0" text="Age" />
              </columns>
               <columnResizePolicy>
                  <TableView fx:constant="CONSTRAINED_RESIZE_POLICY" />
               </columnResizePolicy>
            </TableView>
         </children>
      </VBox>
   </children>
</AnchorPane>
```

AddPersonDialogController.java

```
package customdialog;

import javafx.collections.ObservableList;
import javafx.event.ActionEvent;
import javafx.fxml.FXML;
import javafx.scene.Node;
import javafx.scene.control.TextField;
import javafx.stage.Stage;

public class AddPersonDialogController  {

    @FXML
    private TextField tfId;
```

```
    @FXML
    private TextField tfName;

    @FXML
    private TextField tfAge;

    private ObservableList<Person> appMainObservableList;

    @FXML
    void btnAddPersonClicked(ActionEvent event) {
        System.out.println("btnAddPersonClicked");
        int id = Integer.valueOf(tfId.getText().trim());
        String name = tfName.getText().trim();
        int iAge = Integer.valueOf(tfAge.getText().trim());

        Person data = new Person(id, name, iAge);
        appMainObservableList.add(data);

        closeStage(event);
    }

    public void setAppMainObservableList(ObservableList<Person> tvObservableList) {
        this.appMainObservableList = tvObservableList;

    }

    private void closeStage(ActionEvent event) {
        Node  source = (Node)  event.getSource();
        Stage stage  = (Stage) source.getScene().getWindow();
        stage.close();
    }

}
```

AddPersonDialog.fxml

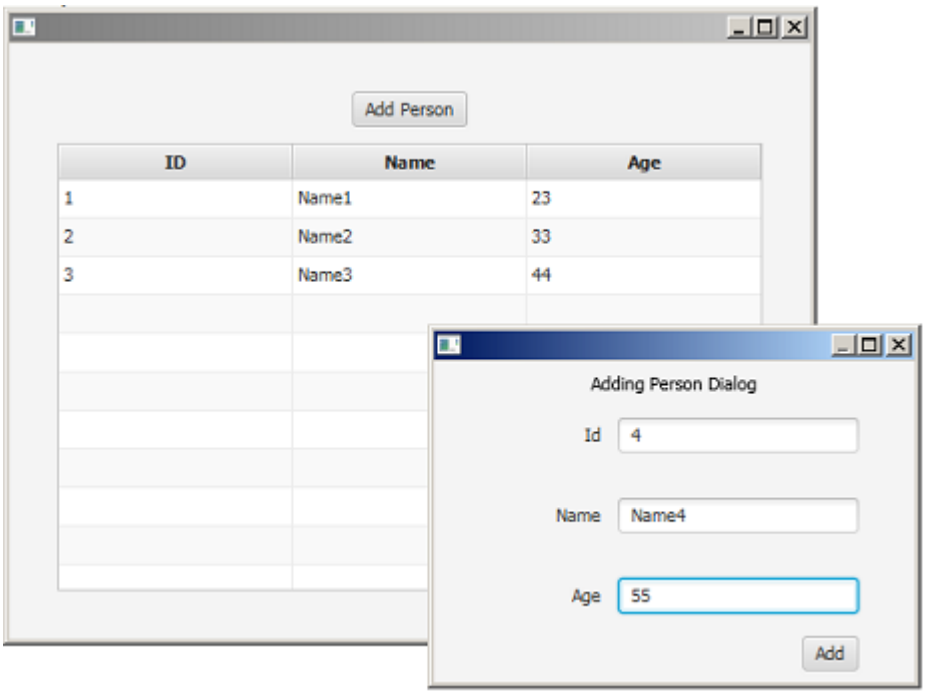
```
<?xml version="1.0" encoding="UTF-8"?>

<?import javafx.geometry.Insets?>
<?import javafx.scene.control.Button?>
<?import javafx.scene.control.Label?>
<?import javafx.scene.control.TextField?>
<?import javafx.scene.layout.AnchorPane?>
<?import javafx.scene.layout.HBox?>
<?import javafx.scene.layout.VBox?>
<?import javafx.scene.text.Text?>

<AnchorPane minHeight="300.0" minWidth="400.0" xmlns="http://javafx.com/javafx/8.0.111"
xmlns:fx="http://javafx.com/fxml/1" fx:controller="customdialog.AddPersonDialogController">
   <children>
      <VBox alignment="CENTER" layoutX="131.0" layoutY="50.0" prefHeight="200.0"
prefWidth="100.0" AnchorPane.bottomAnchor="5.0" AnchorPane.leftAnchor="5.0"
AnchorPane.rightAnchor="5.0" AnchorPane.topAnchor="5.0">
         <children>
            <Text strokeType="OUTSIDE" strokeWidth="0.0" text="Adding Person Dialog" />
            <HBox alignment="CENTER" prefHeight="50.0" prefWidth="200.0" spacing="10.0">
               <children>
                  <Label alignment="CENTER_RIGHT" minWidth="100.0" text="Id" />
                  <TextField fx:id="tfId" HBox.hgrow="ALWAYS" />
               </children>
```

```
               <padding>
                  <Insets right="30.0" />
               </padding>
            </HBox>
            <HBox alignment="CENTER" prefHeight="50.0" prefWidth="200.0" spacing="10.0">
               <children>
                  <Label alignment="CENTER_RIGHT" minWidth="100.0" text="Name" />
                  <TextField fx:id="tfName" HBox.hgrow="ALWAYS" />
               </children>
               <padding>
                  <Insets right="30.0" />
               </padding>
            </HBox>
            <HBox alignment="CENTER" prefHeight="50.0" prefWidth="200.0" spacing="10.0">
               <children>
                  <Label alignment="CENTER_RIGHT" minWidth="100.0" text="Age" />
                  <TextField fx:id="tfAge" HBox.hgrow="ALWAYS" />
               </children>
               <padding>
                  <Insets right="30.0" />
               </padding>
            </HBox>
            <HBox alignment="CENTER_RIGHT">
               <children>
                  <Button mnemonicParsing="false" onAction="#btnAddPersonClicked" text="Add"
/>
               </children>
               <opaqueInsets>
                  <Insets />
               </opaqueInsets>
               <padding>
                  <Insets right="30.0" />
               </padding>
            </HBox>
         </children>
      </VBox>
   </children>
</AnchorPane>
```

Person.java

```
package customdialog;

import javafx.beans.property.SimpleIntegerProperty;
import javafx.beans.property.SimpleStringProperty;

public class Person {

    private SimpleIntegerProperty id;
    private SimpleStringProperty name;
    private SimpleIntegerProperty age;

    public Person(int id, String name, int age)  {
        this.id = new SimpleIntegerProperty(id);
        this.name = new SimpleStringProperty(name);
        this.age = new SimpleIntegerProperty(age);
    }

    public int getId() {
        return id.get();
```

```
    }

    public void setId(int ID) {
        this.id.set(ID);
    }

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

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

    public int getAge() {
        return age.get();
    }

    public void setAge(int age) {
        this.age.set(age);
    }

    @Override
    public String toString() {
        return "id: " + id.get() + " - " + "name: " + name.get()+ "age: "+ age.get();
    }

}
```



Windows : https://riptutorial.com/ko/javafx/topic/1496/windows

10:

Examples

(: , ...).

```
button.setOnAction(new EventHandler<ActionEvent>() {
    @Override
    public void handle(ActionEvent event) {
        System.out.println("Hello World!");
    }
});
```

Java 8 .

```
button.setOnAction((ActionEvent a) -> System.out.println("Hello, World!"));
// or
button.setOnAction(a -> System.out.println("Hello, World!"));
```

. graphic ProgressBar JavaFX .

```
button.setGraphic(new ProgressBar(-1));
```

ImageView

```
button.setGraphic(new ImageView("images/icon.png"));
```

```
button.setGraphic(new Button("Nested button"));
```

Button .

```
Button sampleButton = new Button();
```

Button .

Button String (Button textProperty).

```
Button sampleButton = new Button("Click Me!");
```

Node Button .

```
Button sampleButton = new Button("I have an icon", new ImageView(new Image("icon.png")));
```

Button API Scene . , : setDefaultButton setCancelButton :

- setDefaultButton true KeyCode.ENTER Button .

- setCancelButton true KeyCode.ESCAPE Button .

Scene .

```
FlowPane root = new FlowPane();

Button okButton = new Button("OK");
okButton.setDefaultButton(true);
okButton.setOnAction(e -> {
    System.out.println("OK clicked.");
});

Button cancelButton = new Button("Cancel");
cancelButton.setCancelButton(true);
cancelButton.setOnAction(e -> {
    System.out.println("Cancel clicked.");
});

root.getChildren().addAll(okButton, cancelButton);
Scene scene = new Scene(root);
```

KeyEvents Node .

```
scene.setOnKeyPressed(e -> {
    e.consume();
});
```

: https://riptutorial.com/ko/javafx/topic/5162/

11:

JavaFX 8 40 .

Examples

TextInputDialog

`TextInputDialog` (), `String` .

```
TextInputDialog dialog = new TextInputDialog("42");
dialog.setHeaderText("Input your favourite int.");
dialog.setTitle("Favourite number?");
dialog.setContentText("Your favourite int: ");

Optional<String> result = dialog.showAndWait();

String s = result.map(r -> {
    try {
        Integer n = Integer.valueOf(r);
        return MessageFormat.format("Nice! I like {0} too!", n);
    } catch (NumberFormatException ex) {
        return MessageFormat.format("Unfortunately \"{0}\" is not a int!", r);
    }
}).orElse("You really don't want to tell me, huh?");

System.out.println(s);
```

ChoiceDialog

`ChoiceDialog` .

```
List<String> options = new ArrayList<>();
options.add("42");
options.add("9");
options.add("467829");
options.add("Other");

ChoiceDialog<String> dialog = new ChoiceDialog<>(options.get(0), options);
dialog.setHeaderText("Choose your favourite number.");
dialog.setTitle("Favourite number?");
dialog.setContentText("Your favourite number:");

Optional<String> choice = dialog.showAndWait();

String s = choice.map(c -> "Other".equals(c) ?
              "Unfortunately your favourite number is not available!"
              : "Nice! I like " + c + " too!")
           .orElse("You really don't want to tell me, huh?");

System.out.println(s);
```

`Alert` .

1 .

```
@Override
public void start(Stage primaryStage) {
    Scene scene = new Scene(new Group(), 100, 100);

    primaryStage.setOnCloseRequest(evt -> {
        // allow user to decide between yes and no
        Alert alert = new Alert(Alert.AlertType.CONFIRMATION, "Do you really want to close
this application?", ButtonType.YES, ButtonType.NO);

        // clicking X also means no
        ButtonType result = alert.showAndWait().orElse(ButtonType.NO);

        if (ButtonType.NO.equals(result)) {
            // consume event i.e. ignore close request
            evt.consume();
        }
    });
    primaryStage.setScene(scene);
    primaryStage.show();
}
```

Locale .

ButtonType .

```
ButtonType answer = new ButtonType("42");
ButtonType somethingElse = new ButtonType("54");

Alert alert = new Alert(Alert.AlertType.NONE, "What do you get when you multiply six by
nine?", answer, somethingElse);
ButtonType result = alert.showAndWait().orElse(somethingElse);

Alert resultDialog = new Alert(Alert.AlertType.INFORMATION,
                               answer.equals(result) ? "Correct" : "wrong",
                               ButtonType.OK);

resultDialog.show();
```

: https://riptutorial.com/ko/javafx/topic/3681/-

12:

Examples

. RadioButton RadioButton . RadioButton() setText(String) RadioButton(String) .

```
RadioButton radioButton1 = new RadioButton();
radioButton1.setText("Select me!");
RadioButton radioButton2= new RadioButton("Or me!");
```

RadioButton Labeled RadioButton Image . RadioButton setGraphic(ImageView) Image .

```
Image image = new Image("ok.jpg");
RadioButton radioButton = new RadioButton("Agree");
radioButton.setGraphic(new ImageView(image));
```

ToggleGroup RadioButton .

ToggleGroup .

```
ToggleGroup group = new ToggleGroup();
```

Togglegroup setToggleGroup(ToggleGroup) RadioButton .setSelected(Boolean) RadioButton .

```
RadioButton radioButton1 = new RadioButton("stackoverlow is awesome! :)");
radioButton1.setToggleGroup(group);
radioButton1.setSelected(true);

RadioButton radioButton2 = new RadioButton("stackoverflow is ok :|");
radioButton2.setToggleGroup(group);

RadioButton radioButton3 = new RadioButton("stackoverflow is useless :(");
radioButton3.setToggleGroup(group);
```

ToggleGroup RadioButton . setUserData(Object) RadioButton .

```
radioButton1.setUserData("awesome")
radioButton2.setUserData("ok");
radioButton3.setUserData("useless");

ToggleGroup group = new ToggleGroup();
group.selectedToggleProperty().addListener((obserableValue, old_toggle, new_toggle) -> {
    if (group.getSelectedToggle() != null) {
        System.out.println("You think that stackoverflow is " +
group.getSelectedToggle().getUserData().toString());
    }
});
```

RadioButton setSelected(Boolean) . RadioButton . requestFocus() .

```
radioButton2.setSelected(true);
radioButton2.requestFocus();
```

: https://riptutorial.com/ko/javafx/topic/5906/-

13:

Examples

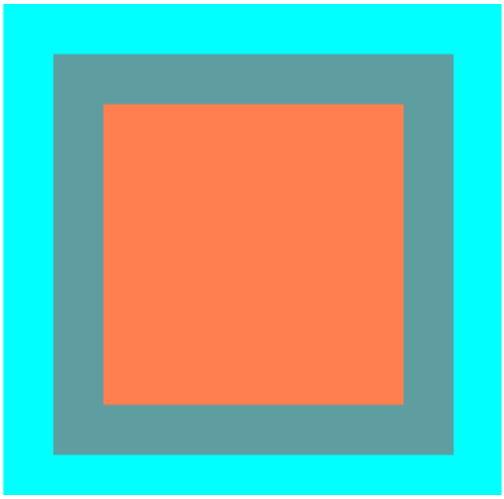
StackPane

`StackPane` back-to-front .

Z , (`getChildren`) . 0 , .

. ( ) `StackPane` area , `StackPane alignmentProperty Pos.CENTER.` `Pos.CENTER.`

```
// Create a StackPane
StackPane pane = new StackPane();

// Create three squares
Rectangle rectBottom = new Rectangle(250, 250);
rectBottom.setFill(Color.AQUA);
Rectangle rectMiddle = new Rectangle(200, 200);
rectMiddle.setFill(Color.CADETBLUE);
Rectangle rectUpper = new Rectangle(150, 150);
rectUpper.setFill(Color.CORAL);

// Place them on top of each other
pane.getChildren().addAll(rectBottom, rectMiddle, rectUpper);
```



HBox VBox

`HBox VBox` .

`HBox VBox` / `HBox` .

. .

alignment , **`Pos.TOP_LEFT`** .

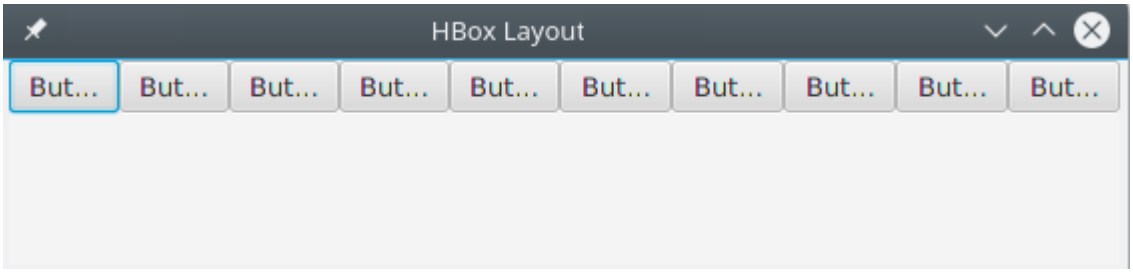
HBox

`HBox` .

`HBox` ( ) s fillHeight (fillHeight true).

HBox

```
// HBox example
HBox row = new HBox();
Label first = new Label("First");
Label second = new Label("Second");
row.getChildren().addAll(first, second);
```



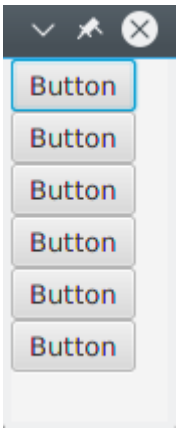
VBox

`VBox` .

`VBox` fillWidth (fillWidth true).

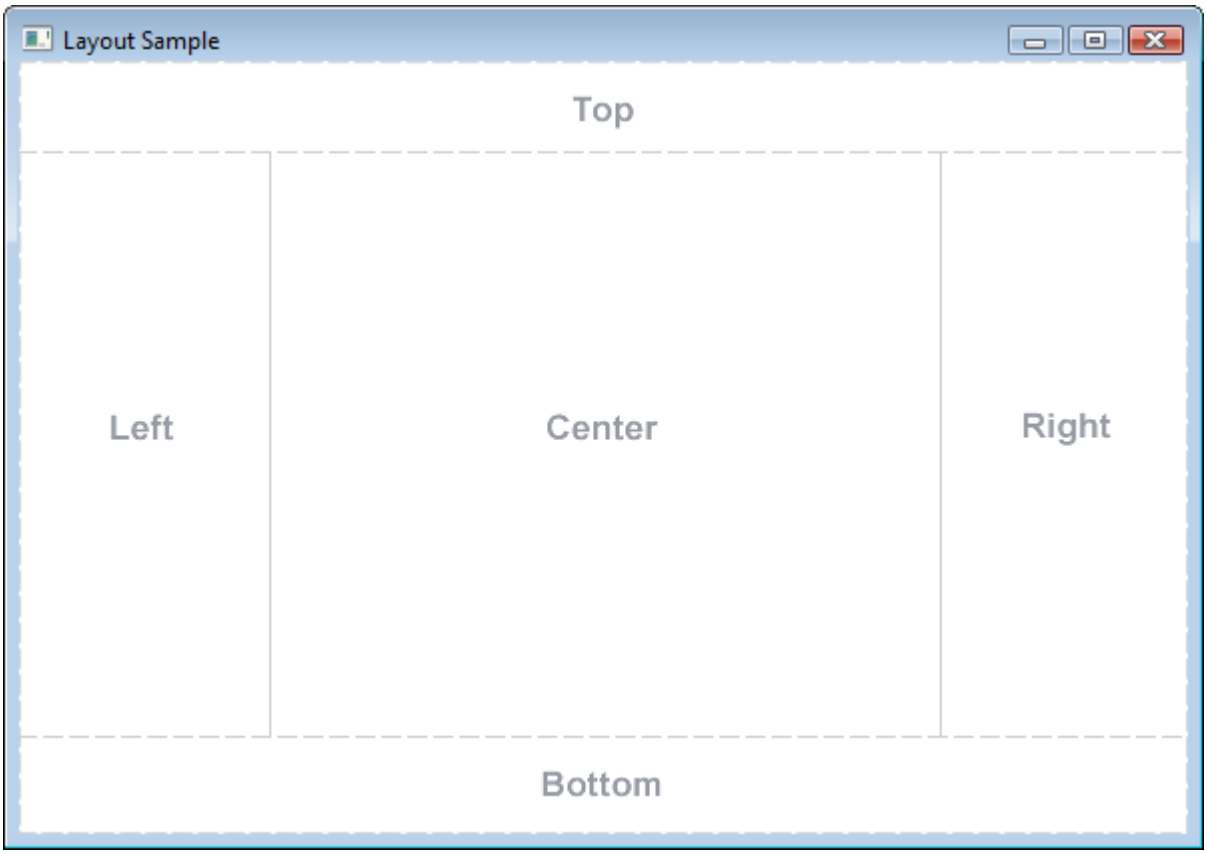
VBox

```
// VBox example
VBox column = new VBox();
Label upper = new Label("Upper");
Label lower = new Label("Lower");
column.getChildren().addAll(upper, lower);
```



BorderPane

`BorderPane` 5 .



(Top , Right , Bottom , Left) . , Center . .

. setTop(Node) , setRight(Node) , setBottom(Node) , setLeft(Node) , setCenter(Node) . .

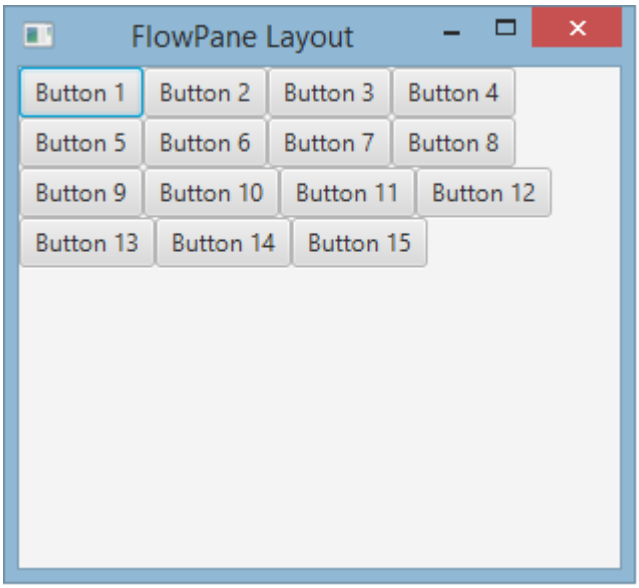
```
//BorderPane example
BorderPane pane = new BorderPane();

Label top = new Label("Top");

Label right = new Label("Right");

HBox bottom = new HBox();
bottom.getChildren().addAll(new Label("First"), new Label("Second"));

VBox left = new VBox();
left.getChildren().addAll(new Label("Upper"), new Label("Lower"));

StackPane center = new StackPane();
center.getChildren().addAll(new Label("Lorem"), new Label("ipsum"));

pane.setTop(top);         //The text "Top"
pane.setRight(right);     //The text "Right"
pane.setBottom(bottom);   //Row of two texts
pane.setLeft(left);       //Column of two texts
pane.setCenter(center);   //Two texts on each other
```

FlowPane

FlowPane . . . .

```
import javafx.application.Application;
```

```
import javafx.fxml.FXMLLoader;
import javafx.scene.Parent;
import javafx.scene.Scene;
import javafx.scene.control.Button;
import javafx.scene.layout.FlowPane;
import javafx.stage.Stage;

public class Main extends Application {
    @Override
    public void start(Stage primaryStage) throws Exception{
        FlowPane root = new FlowPane();
        for (int i=1; i<=15; i++) {
            Button b1=new Button("Button "+String.valueOf(i));
            root.getChildren().add(b1); //for adding button to root
        }
        Scene scene = new Scene(root, 300, 250);
        primaryStage.setTitle("FlowPane Layout");
        primaryStage.setScene(scene);
        primaryStage.show();
    }
    public static void main(String[] args) {
        launch(args);
    }
}
```



`FlowPane` :

```
FlowPane root = new FlowPane();
```

`FlowPane` :

```
FlowPane() //Creates a horizontal FlowPane layout with hgap/vgap = 0 by default.
FlowPane(double hgap, double gap) //Creates a horizontal FlowPane layout with the specified
hgap/vgap.
FlowPane(double hgap, double vgap, Node... children) //Creates a horizontal FlowPane layout
with the specified hgap/vgap.
FlowPane(Node... children) //Creates a horizontal FlowPane layout with hgap/vgap = 0.
FlowPane(Orientation orientation) //Creates a FlowPane layout with the specified orientation
and hgap/vgap = 0.
```

```
FlowPane(Orientation orientation, double hgap, double gap) //Creates a FlowPane layout with
the specified orientation and hgap/vgap.
FlowPane(Orientation orientation, double hgap, double vgap, Node... children) //Creates a
FlowPane layout with the specified orientation and hgap/vgap.
FlowPane(Orientation orientation, Node... children) //Creates a FlowPane layout with the
specified orientation and hgap/vgap = 0.
```

Pane add() addAll() .

```
Button btn = new Button("Demo Button");
root.getChildren().add(btn);
root.getChildren().addAll(…);
```

FlowPane . Pos setAlignment() .

:

```
root.setAlignment(Pos.TOP_RIGHT);     //for top right
root.setAlignment(Pos.TOP_CENTER);    //for top Center
root.setAlignment(Pos.CENTER);        //for Center
root.setAlignment(Pos.BOTTOM_RIGHT);  //for bottom right
```

GridPane

GridPane , .

GridPane

GridPane GridPane (1) .

columnIndex	.
rowIndex	.
columnSpan	.
rowSpan	.

/ / .

GridPane

Node A GridPane GridPane GridPane .

```
GridPane gridPane = new GridPane();

// Set the constraints: first row and first column
```

```
Label label = new Label("Example");
GridPane.setRowIndex(label, 0);
GridPane.setColumnIndex(label, 0);
// Add the child to the grid
gridpane.getChildren().add(label);
```

`GridPane` :

```
gridPane.add(new Button("Press me!"), 1, 0); // column=1 row=0
```

`GridPane` setter .

```
Label labelLong = new Label("Its a long text that should span several rows");
GridPane.setColumnSpan(labelLong, 2);
gridPane.add(labelLong, 0, 1);  // column=0 row=1
```

. `RowConstraints` `ColumnConstraints` `GridPane` . 100 200 .

```
gridPane.getColumnConstraints().add(new ColumnConstraints(100));
gridPane.getColumnConstraints().add(new ColumnConstraints(200));
```

, `GridPane` , `GridPane` / . *I* contstaints min size, max size preferred size .

`ColumnConstraints` `setHGrow` `RowConstraints` `setVGrow` . .

- . : .
- . : . .
- **Priority.NEVER** : .

```
ColumnConstraints column1 = new ColumnConstraints(100, 100, 300);
column1.setHgrow(Priority.ALWAYS);
```

100 300 .

. , 40 % , 60 % `GridPane` .

```
GridPane gridpane = new GridPane();
ColumnConstraints column1 = new ColumnConstraints();
column1.setPercentWidth(40);
ColumnConstraints column2 = new ColumnConstraints();
column2.setPercentWidth(60);
gridpane.getColumnConstraints().addAll(column1, column2);
```

`Node` (S) `setHalignment` () `ColumnConstraints` `setValignment` () `RowConstraints` .

```
ColumnConstraints column1 = new ColumnConstraints();
column1.setHalignment(HPos.RIGHT);

RowConstraints row1 = new RowConstraints();
row1.setValignment(VPos.CENTER);
```

TilePane

FlowPane . TilePane . .

```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.control.Button;
import javafx.scene.layout.TilePane;
import javafx.stage.Stage;

public class Main extends Application {

    @Override
    public void start(Stage primaryStage) {
        primaryStage.setTitle("TilePane Demo");
        double width = 400;
        double height = 300;
        TilePane root = new TilePane();
        root.setStyle("-fx-background-color:blue");
        // to set horizontal and vertical gap
        root.setHgap(20);
        root.setVgap(50);
        Button bl = new Button("Buttons");
        root.getChildren().add(bl);
        Button btn = new Button("Button");
        root.getChildren().add(btn);
        Button btn1 = new Button("Button 1");
        root.getChildren().add(btn1);
        Button btn2 = new Button("Button 2");
        root.getChildren().add(btn2);
        Button btn3 = new Button("Button 3");
        root.getChildren().add(btn3);
        Button btn4 = new Button("Button 4");
        root.getChildren().add(btn4);

        Scene scene = new Scene(root, width, height);
        primaryStage.setScene(scene);
        primaryStage.show();
    }


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


```
TilePane root = new TilePane();
```

setHgap () setVgap () .

```
int columnCount = 2;
root.setPrefColumns(columnCount);
```

`AnchorPane` a .

`AnchorPane` 4 4 . `Node` . setter `Double` . `null` .

setBottomAnchor	getBottomAnchor
setLeftAnchor	getLeftAnchor
setRightAnchor	getRightAnchor
setTopAnchor	getTopAnchor

.

`center` . .

```
public static void setBackgroundColor(Region region, Color color) {
    // change to 50% opacity
    color = color.deriveColor(0, 1, 1, 0.5);
    region.setBackground(new Background(new BackgroundFill(color, CornerRadii.EMPTY,
Insets.EMPTY)));
}
```

```
@Override
public void start(Stage primaryStage) {
    Region right = new Region();
    Region top = new Region();
    Region left = new Region();
    Region bottom = new Region();
    Region center = new Region();

    right.setPrefSize(50, 150);
    top.setPrefSize(150, 50);
    left.setPrefSize(50, 150);
    bottom.setPrefSize(150, 50);

    // fill with different half-transparent colors
    setBackgroundColor(right, Color.RED);
    setBackgroundColor(left, Color.LIME);
    setBackgroundColor(top, Color.BLUE);
    setBackgroundColor(bottom, Color.YELLOW);
    setBackgroundColor(center, Color.BLACK);

    // set distances to sides
    AnchorPane.setBottomAnchor(bottom, 50d);
    AnchorPane.setTopAnchor(top, 50d);
    AnchorPane.setLeftAnchor(left, 50d);
    AnchorPane.setRightAnchor(right, 50d);

    AnchorPane.setBottomAnchor(center, 50d);
    AnchorPane.setTopAnchor(center, 50d);
    AnchorPane.setLeftAnchor(center, 50d);
    AnchorPane.setRightAnchor(center, 50d);

    // create AnchorPane with specified children
    AnchorPane anchorPane = new AnchorPane(left, top, right, bottom, center);

    Scene scene = new Scene(anchorPane, 200, 200);

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

: https://riptutorial.com/ko/javafx/topic/2121/

14:

Examples

```
Button button = new Button("I'm here...");

Timeline t = new Timeline(
        new KeyFrame(Duration.seconds(0), new KeyValue(button.translateXProperty(), 0)),
        new KeyFrame(Duration.seconds(2), new KeyValue(button.translateXProperty(), 80))
);
t.setAutoReverse(true);
t.setCycleCount(Timeline.INDEFINITE);
t.play();
```

JavaFX `Timeline` . `KeyFrame` . (`0 seconds`) `translateXProperty` 0 (`2 seconds`) `80` .
.

.

```
Timeline t = new Timeline(
        new KeyFrame(Duration.seconds(0), new KeyValue(button.translateXProperty(), 0)),
        new KeyFrame(Duration.seconds(1), new KeyValue(button.translateYProperty(), 10)),
        new KeyFrame(Duration.seconds(2), new KeyValue(button.translateXProperty(), 80)),
        new KeyFrame(Duration.seconds(3), new KeyValue(button.translateYProperty(), 90))
);                                                                  //   ^ notice X vs Y
```

`Y` `0` ( ) `10` `90` 3 `90` . `Y` 0 .

: https://riptutorial.com/ko/javafx/topic/5166/

15:

. Node .

Examples

3 . <property> <property> <Property> . T . . String StringProperty double ReadOnlyDoubleProperty .

<property>Property	()	, . DoubleProperty , ReadOnlyStringProperty , ObjectProperty<VPos>	/ .
get<Property>	()	T	.
set<Property>	(T)	void	.

setter .

getter . ObservableList , . . ObservableList .

getter . getter ObservableMap .

StringProperty

(StringProperty ChangeListener .

```
import java.text.MessageFormat;
import javafx.beans.property.SimpleStringProperty;
import javafx.beans.property.StringProperty;
import javafx.beans.value.ChangeListener;
import javafx.beans.value.ObservableValue;

public class Person {

    private final StringProperty name = new SimpleStringProperty();

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

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

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

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

```
        Person person = new Person();
        person.nameProperty().addListener(new ChangeListener<String>() {

            @Override
            public void changed(ObservableValue<? extends String> observable, String oldValue,
String newValue) {
                System.out.println(MessageFormat.format("The name changed from \"{0}\" to
\"{1}\"", oldValue, newValue));
            }

        });

        person.setName("Anakin Skywalker");
        person.setName("Darth Vader");
    }

}
```

ReadOnlyIntegerProperty

f} . `cost` `price` `profit` `price - cost` .

```
import java.text.MessageFormat;
import javafx.beans.property.IntegerProperty;
import javafx.beans.property.ReadOnlyIntegerProperty;
import javafx.beans.property.ReadOnlyIntegerWrapper;
import javafx.beans.property.SimpleIntegerProperty;
import javafx.beans.value.ChangeListener;
import javafx.beans.value.ObservableValue;

public class Product {

    private final IntegerProperty price = new SimpleIntegerProperty();
    private final IntegerProperty cost = new SimpleIntegerProperty();
    private final ReadOnlyIntegerWrapper profit = new ReadOnlyIntegerWrapper();

    public Product() {
        // the property itself can be written to
        profit.bind(price.subtract(cost));
    }

    public final int getCost() {
        return this.cost.get();
    }

    public final void setCost(int value) {
        this.cost.set(value);
    }

    public final IntegerProperty costProperty() {
        return this.cost;
    }

    public final int getPrice() {
        return this.price.get();
    }

    public final void setPrice(int value) {
        this.price.set(value);
```

```
    }

    public final IntegerProperty priceProperty() {
        return this.price;
    }

    public final int getProfit() {
        return this.profit.get();
    }

    public final ReadOnlyIntegerProperty profitProperty() {
        // return a readonly view of the property
        return this.profit.getReadOnlyProperty();
    }

    public static void main(String[] args) {
        Product product = new Product();
        product.profitProperty().addListener(new ChangeListener<Number>() {

            @Override
            public void changed(ObservableValue<? extends Number> observable, Number oldValue,
Number newValue) {
                System.out.println(MessageFormat.format("The profit changed from {0}$ to
{1}$", oldValue, newValue));
            }

        });
        product.setCost(40);
        product.setPrice(50);
        product.setCost(20);
        product.setPrice(30);
    }

}
```

: https://riptutorial.com/ko/javafx/topic/4436/---

16:

Examples

Platform.runLater UI

JavaFX . JavaFX UI UI .

"" `Node` JavaFX . `Platform.runLater` JavaFX .

`Text Node` .

```
import javafx.application.Application;
import javafx.application.Platform;
import javafx.scene.Scene;
import javafx.scene.layout.StackPane;
import javafx.scene.text.Text;
import javafx.stage.Stage;

public class CounterApp extends Application {

    private int count = 0;
    private final Text text = new Text(Integer.toString(count));

    private void incrementCount() {
        count++;
        text.setText(Integer.toString(count));
    }

    @Override
    public void start(Stage primaryStage) {
        StackPane root = new StackPane();
        root.getChildren().add(text);

        Scene scene = new Scene(root, 200, 200);

        // longrunning operation runs on different thread
        Thread thread = new Thread(new Runnable() {

            @Override
            public void run() {
                Runnable updater = new Runnable() {

                    @Override
                    public void run() {
                        incrementCount();
                    }
                };

                while (true) {
                    try {
                        Thread.sleep(1000);
                    } catch (InterruptedException ex) {
                    }

                    // UI update is run on the Application thread
```

```
                    Platform.runLater(updater);
                }
            }

        });
        // don't let thread prevent JVM shutdown
        thread.setDaemon(true);
        thread.start();

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

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

}
```

UI

`Platform.runLater` UI . (`ListView` .)

```
@Override
public void start(Stage primaryStage) {
    ObservableList<Integer> data = FXCollections.observableArrayList();
    ListView<Integer> listView = new ListView<>(data);

    Button btn = new Button("Say 'Hello World'");
    btn.setOnAction((ActionEvent event) -> {
        new Thread(() -> {
            for (int i = 0; i < 100000; i++) {
                final int index = i;
                Platform.runLater(() -> data.add(index));
            }
        }).start();
    });

    Scene scene = new Scene(new VBox(listView, btn));

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

`AnimationTimer` .

```
import java.util.ArrayList;
import java.util.Arrays;
import java.util.List;
import java.util.logging.Level;
import java.util.logging.Logger;
import javafx.animation.AnimationTimer;

public class Updater {

    @FunctionalInterface
    public static interface UpdateTask {
```

```
        public void update() throws Exception;
    }

    private final List<UpdateTask> updates = new ArrayList<>();

    private final AnimationTimer timer = new AnimationTimer() {

        @Override
        public void handle(long now) {
            synchronized (updates) {
                for (UpdateTask r : updates) {
                    try {
                        r.update();
                    } catch (Exception ex) {
                        Logger.getLogger(Updater.class.getName()).log(Level.SEVERE, null, ex);
                    }
                }
                updates.clear();
                stop();
            }
        }
    };

    public void addTask(UpdateTask... tasks) {
        synchronized (updates) {
            updates.addAll(Arrays.asList(tasks));
            timer.start();
        }
    }

}
```

`Updater` .

```
private final Updater updater = new Updater();

...

        // Platform.runLater(() -> data.add(index));
        updater.addTask(() -> data.add(index));
```

JavaFX

`JavaFX Thread` `Service` . ?

`Thread` . .

JavaFX Service . `Map<String,String>()` .

```
public class WorkerService extends Service<Map<String, String>> {

    /**
     * Constructor
     */
    public WorkerService () {

        // if succeeded
```

```
        setOnSucceeded(s -> {
            //code if Service succeeds
        });

        // if failed
        setOnFailed(fail -> {
            //code it Service fails
        });

        //if cancelled
        setOnCancelled(cancelled->{
            //code if Service get's cancelled
        });
    }

    /**
    * This method starts the Service
    */
    public void startTheService(){
        if(!isRunning()){
           //...
           reset();
           start();
        }

    }

    @Override
    protected Task<Map<String, String>> createTask() {
        return new Task<Map<String, String>>() {
            @Override
            protected Void call() throws Exception {

                    //create a Map<String, String>
                    Map<String,String> map  = new HashMap<>();

                   //create other variables here

                   try{
                        //some code here
                        //.....do your manipulation here

                        updateProgress(++currentProgress, totalProgress);
                    }

                } catch (Exception ex) {
                    return null; //something bad happened so you have to do something instead
of returning null
                }

                return map;
            }
        };
    }

}
```

: https://riptutorial.com/ko/javafx/topic/2230/

17:

JavaFX Scene Builder JavaFX . FXML .

JavaFX Scene Builder JavaFX . UI FXML . UI Java FXML .

(MVC) :

- FXML .
- Java FXML Initializable .
- Java .

1. Gluon Scene Builder Jar .

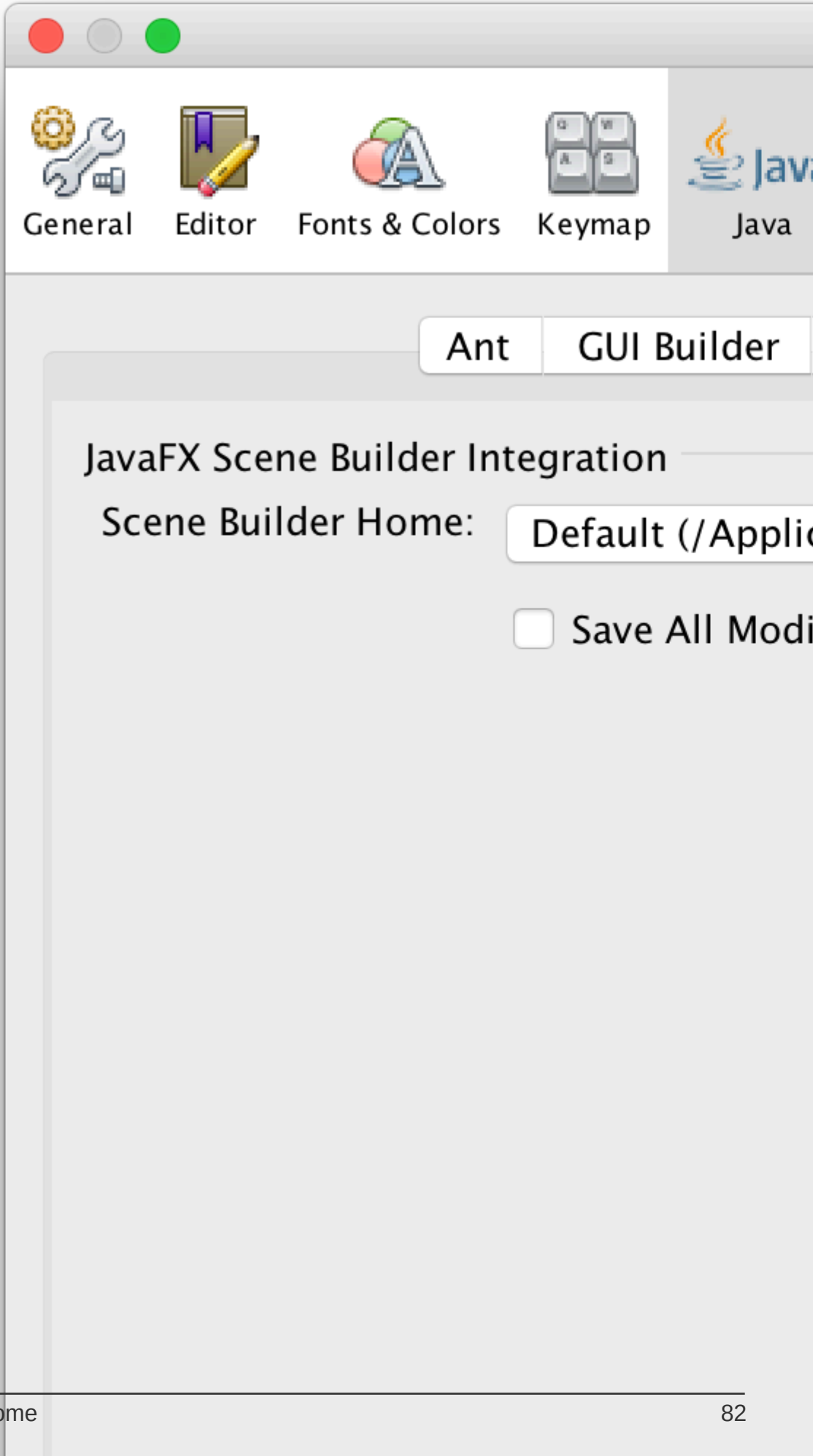
2. Scene Builder . JRE .

3. Scene Builder .

4. IDE

   Scene Builder Java SE FXML . IDE FXML Scene Builder .

   - NetBeans : Windows NetBeans -> -> -> Java -> JavaFX . Mac OS X NetBeans -> -> Java -> JavaFX . .


General
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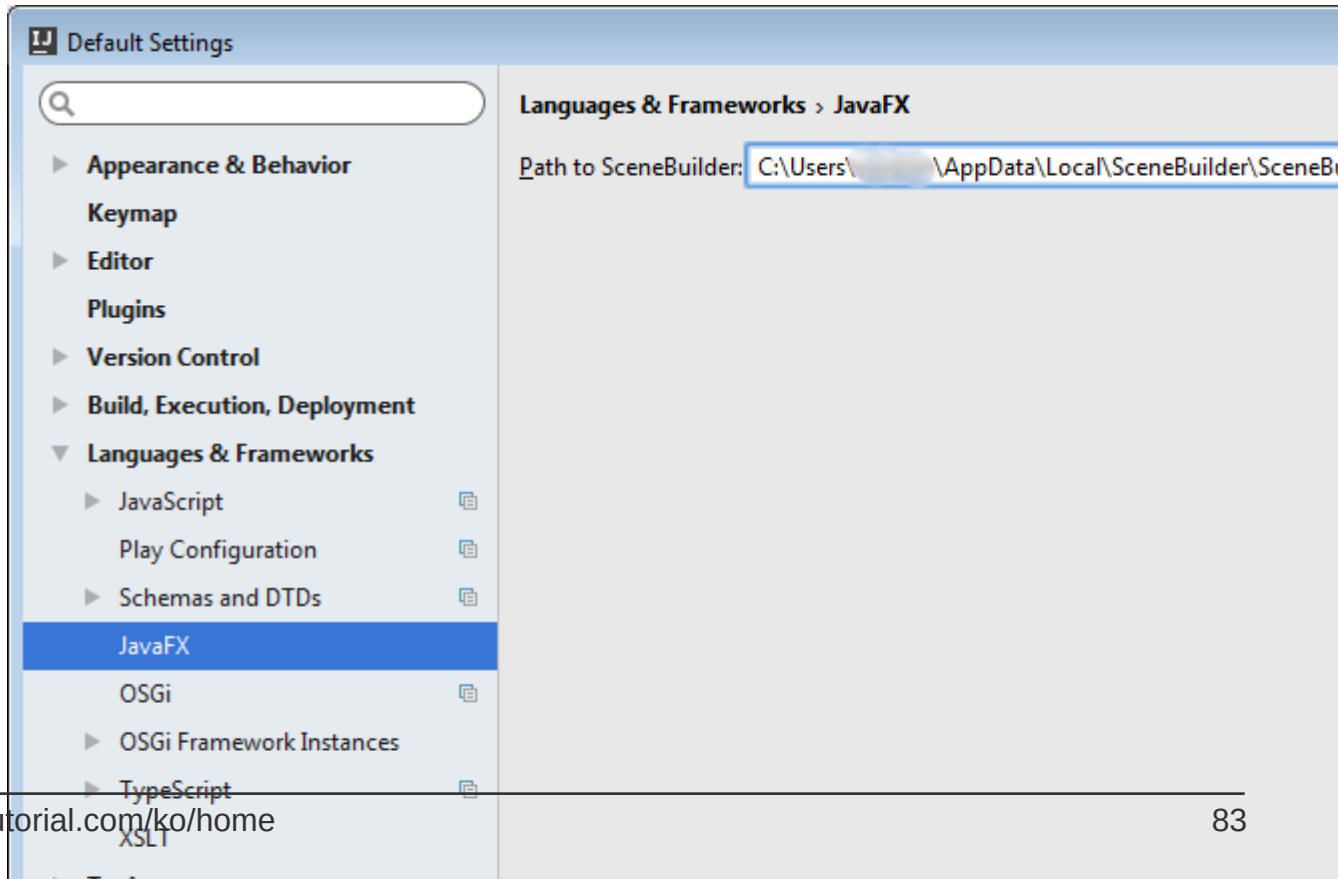
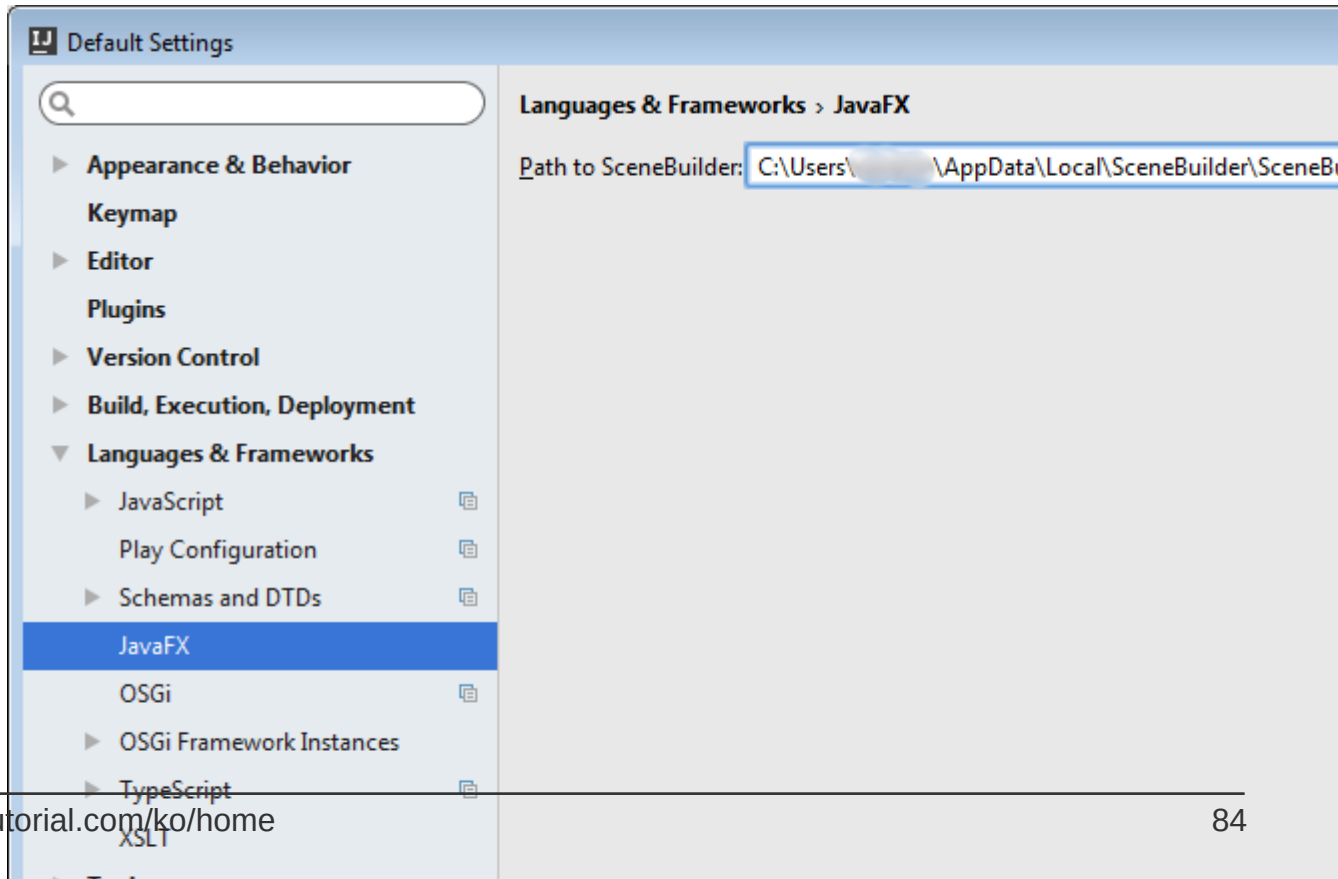
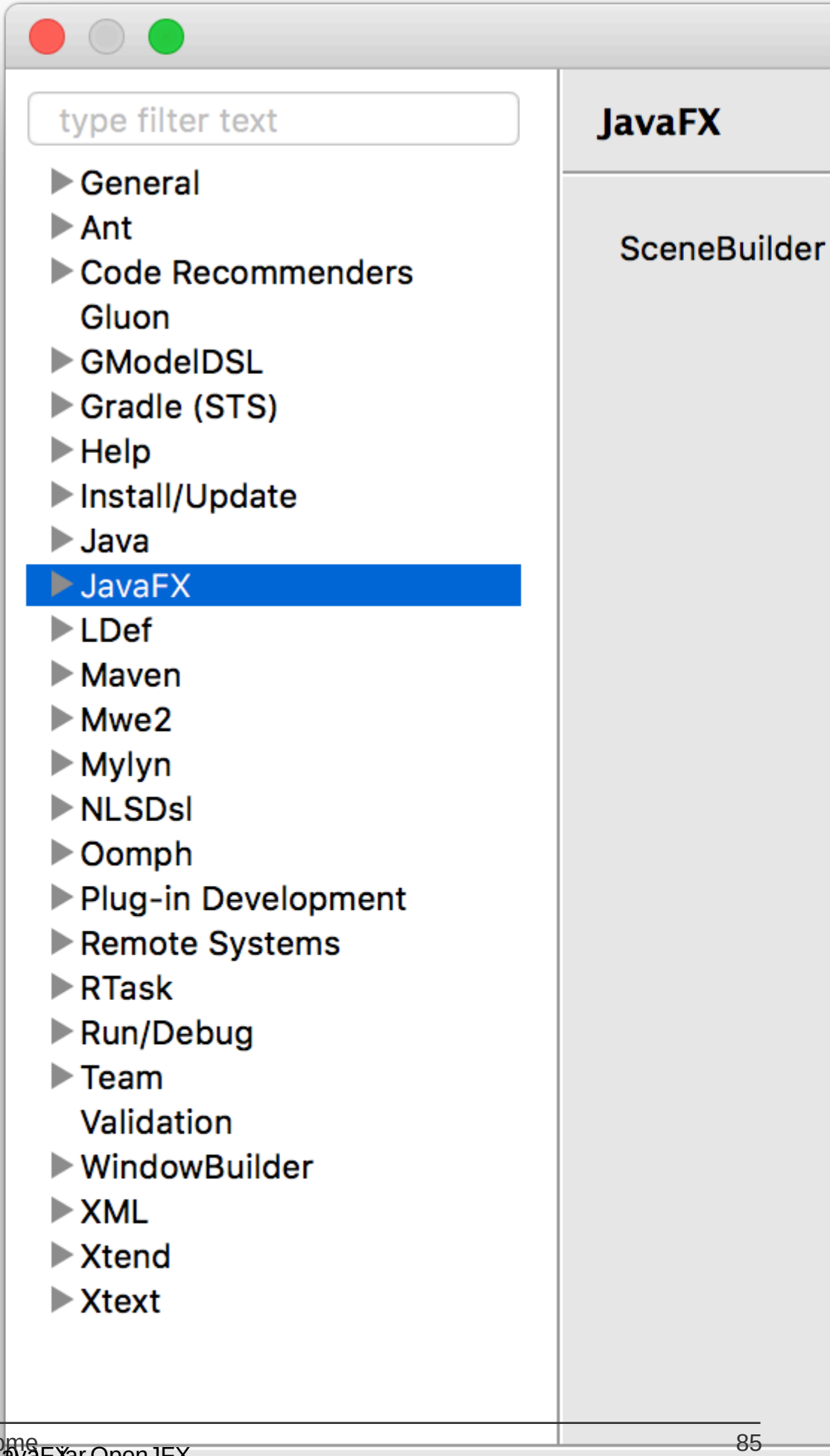
- IntelliJ : Windows IntelliJ-> Settings-> Languages & Frameworks-> JavaFX . Mac OS X IntelliJ -> -> -> JavaFX . .

IntelliJ -> -> -> JavaFX . .



- Eclipse : Windows Eclipse-> Window-> Preferences-> JavaFX . Mac OS X Eclipse-> Preferences-> JavaFX . .





Scene Builder Gradle JavaFX jar OpenJFX .

.

FXML FXMLLoader `initialize` .

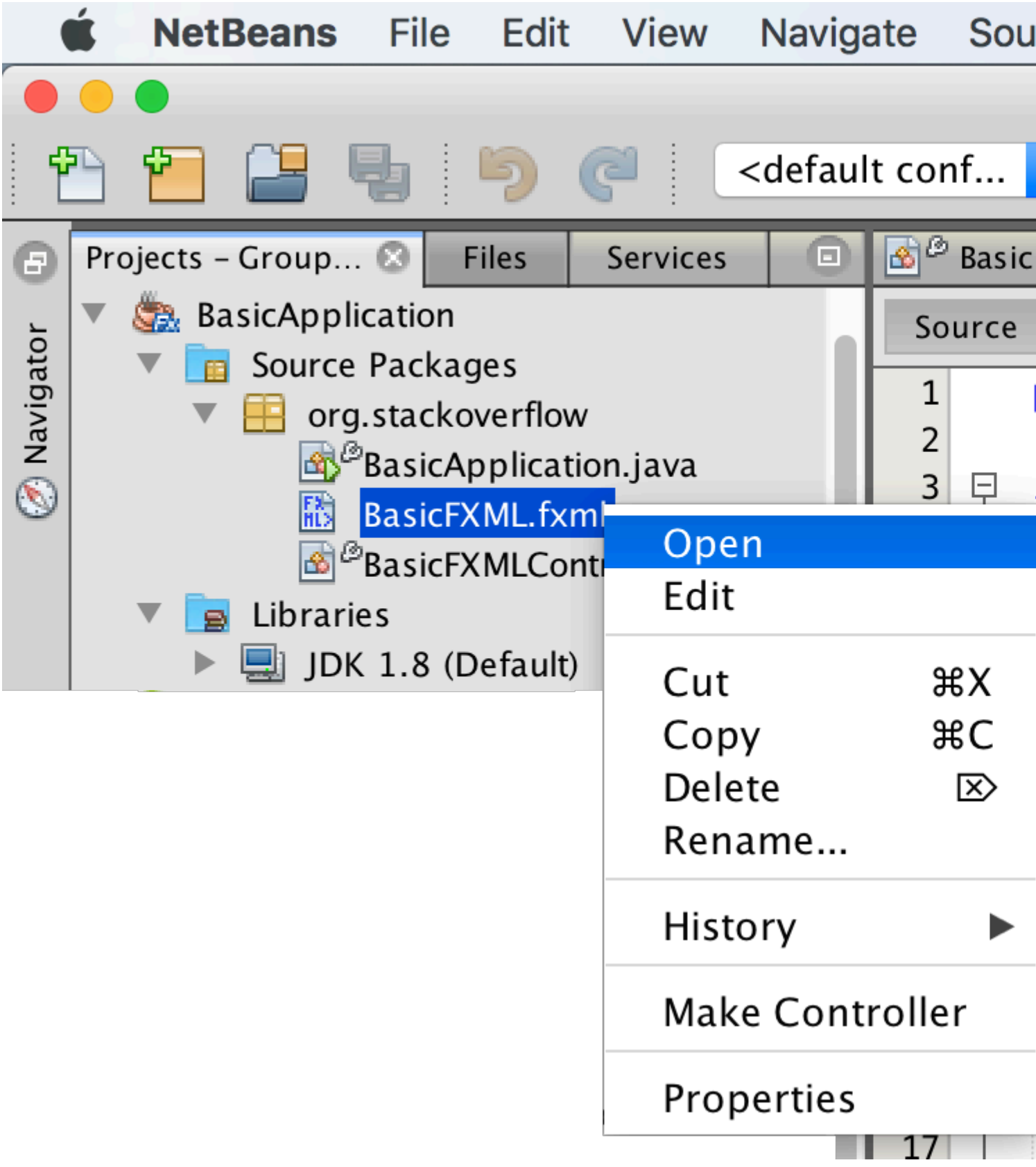
FXML IDE IDE .

FXML .

:

IDE Scene Builder .

- NetBeans `Open` .
- IntelliJ `Open In Scene Builder` `Open In Scene Builder` .
- Eclipse `Open with Scene Builder` .


NetBeans
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Files
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Basic
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BasicApplication
Source Packages
org.stackoverflow
BasicApplication.java
BasicFXML.fxml
BasicFXMLCont
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JDK 1.8 (Default)
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Open
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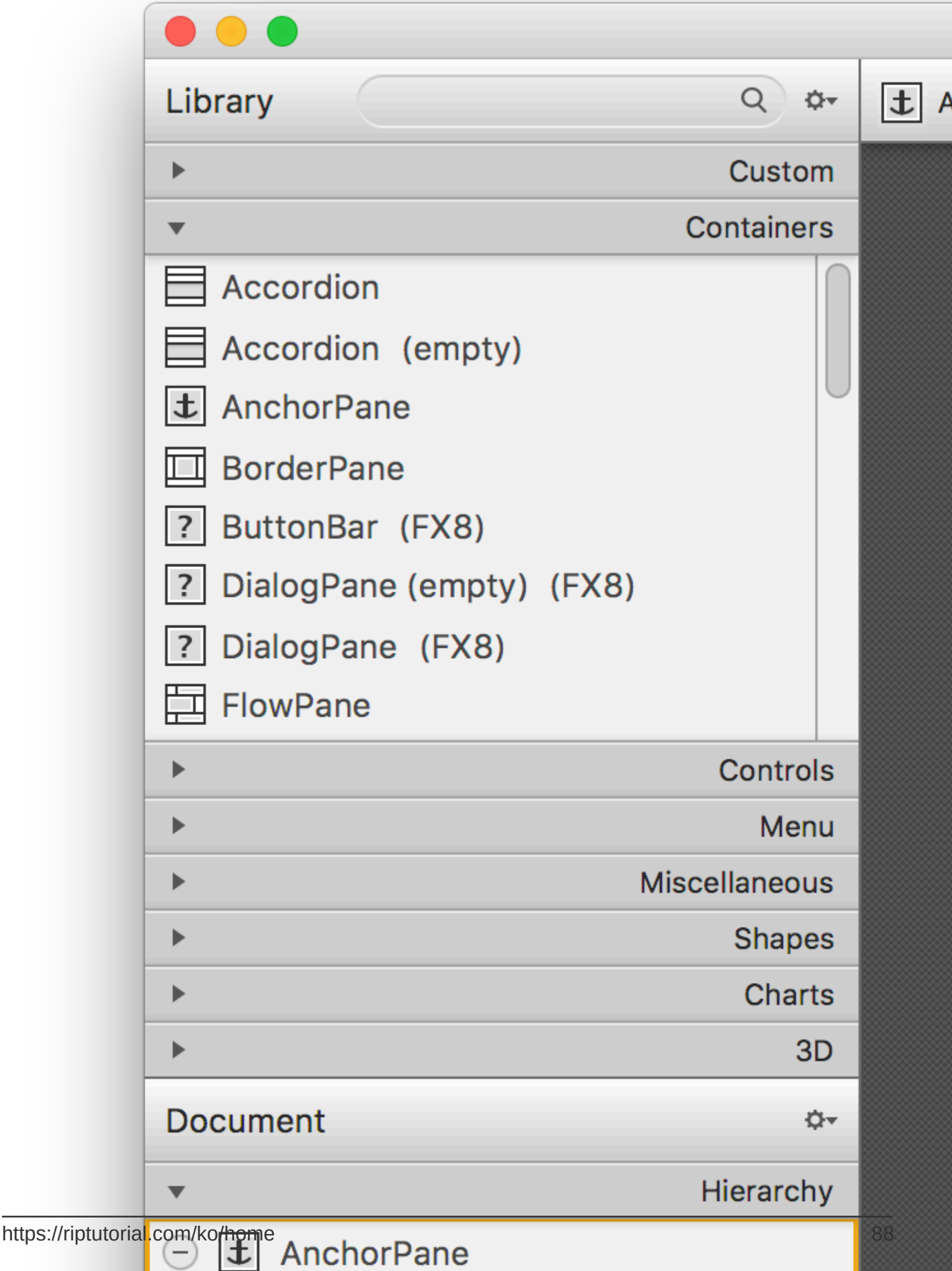
Cut ⌘X
Copy ⌘C
Delete
Rename...
History
Make Controller
Properties

IDE ( ), :


Library
Custom
Containers
Accordion
Accordion (empty)
AnchorPane
BorderPane
ButtonBar (FX8)
DialogPane (empty) (FX8)
DialogPane (FX8)
FlowPane
Controls
Menu
Miscellaneous
Shapes
Charts
3D
Document
Hierarchy
AnchorPane

18:

Examples

```
PrinterJob pJ = PrinterJob.createPrinterJob();

if (pJ != null) {
    boolean success = pJ.printPage(some-node);
    if (success) {
        pJ.endJob();
    }
}
```

. PrinterJob#createPrinterJob(Printer) . .

```
System.out.println(Printer.getAllPrinters());
```

```
PrinterJob pJ = PrinterJob.createPrinterJob();

if (pJ != null) {
    boolean success = pJ.showPrintDialog(primaryStage);// this is the important line
    if (success) {
        pJ.endJob();
    }
}
```

: https://riptutorial.com/ko/javafx/topic/5157/

19:

Examples

JavaFX .

```
Pagination p = new Pagination();
p.setPageFactory(param -> new Button(param.toString()));
```

0 arg `0..` . `setPageFactory` int .

```
Pagination p = new Pagination(10);

Timeline fiveSecondsWonder = new Timeline(new KeyFrame(Duration.seconds(5), event -> {
    int pos = (p.getCurrentPageIndex()+1) % p.getPageCount();
    p.setCurrentPageIndex(pos);
}));
fiveSecondsWonder.setCycleCount(Timeline.INDEFINITE);
fiveSecondsWonder.play();

stage.setScene(new Scene(p));
stage.show();
```

5 .

```
Pagination p = new Pagination(10);

Timeline fiveSecondsWonder = new Timeline(new KeyFrame(Duration.seconds(5), event -> {
```

`fiveSecondsWonder` . 5 .

```
    int pos = (p.getCurrentPageIndex()+1) % p.getPageCount();
    p.setCurrentPageIndex(pos);
```

.

```
}));
fiveSecondsWonder.setCycleCount(Timeline.INDEFINITE);
```

.

```
fiveSecondsWonder.play();
```

```
ArrayList<String> images = new ArrayList<>();
images.add("some\\cool\\image");
images.add("some\\other\\cool\\image");
images.add("some\\cooler\\image");

Pagination p = new Pagination(3);
```

```
p.setPageFactory(n -> new ImageView(images.get(n)));
```

URL.


```
p.setPageFactory(n -> new ImageView(images.get(n)));
```


. . `setPageFactory` int . , .

: https://riptutorial.com/ko/javafx/topic/5165/-

20:

Examples

PieChart . () . PieChart.Data . PieChart.Data .

PieChart . . setData .

```
PieChart pieChart = new PieChart(); // Creates an empty pie chart
```

PieChart.Data ObservableList .

```
ObservableList<PieChart.Data> valueList = FXCollections.observableArrayList(
            new PieChart.Data("Cats", 50),
            new PieChart.Data("Dogs", 50));
PieChart pieChart(valueList); // Creates a chart with the given data
```

100 .

. .

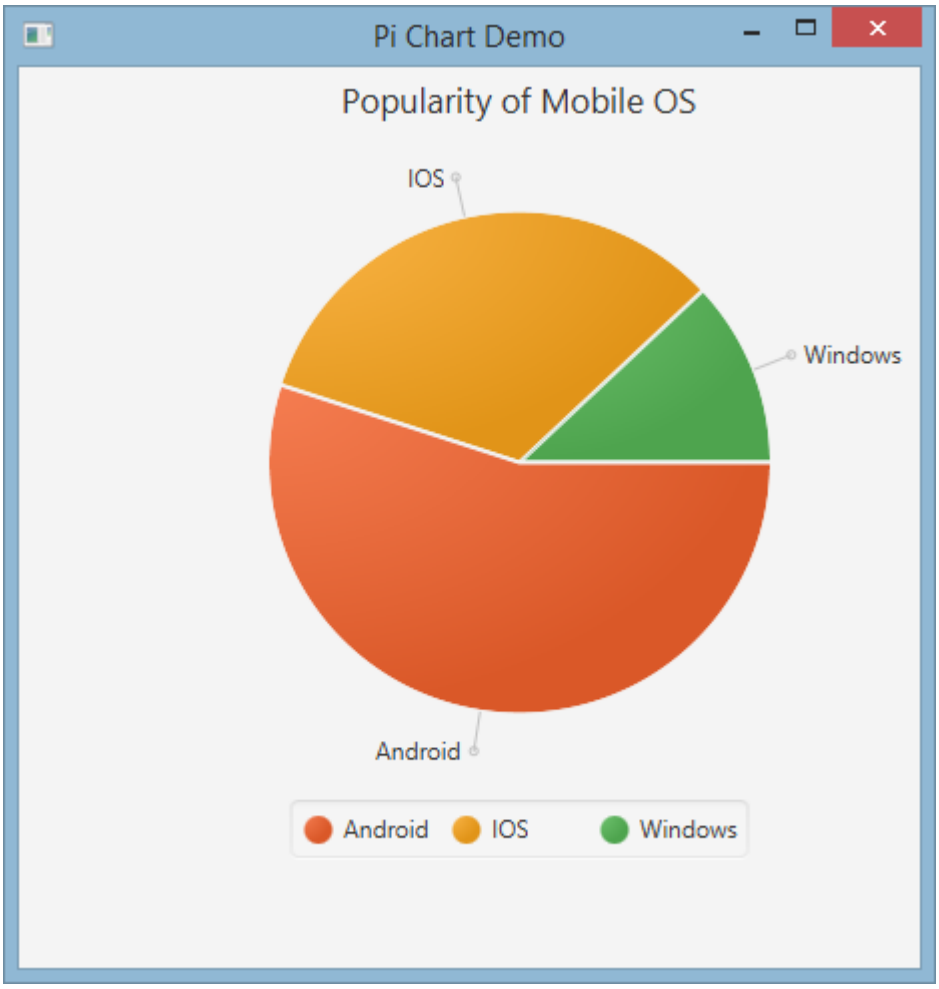
```
pieChart.setClockwise(false);
```

.

```
import javafx.application.Application;
import javafx.collections.FXCollections;
import javafx.collections.ObservableList;
import javafx.scene.Scene;
import javafx.scene.chart.PieChart;
import javafx.scene.layout.Pane;
import javafx.stage.Stage;

public class Main extends Application {

@Override
public void start(Stage primaryStage) {
    Pane root = new Pane();
    ObservableList<PieChart.Data> valueList = FXCollections.observableArrayList(
            new PieChart.Data("Android", 55),
            new PieChart.Data("IOS", 33),
            new PieChart.Data("Windows", 12));
    // create a pieChart with valueList data.
    PieChart pieChart = new PieChart(valueList);
    pieChart.setTitle("Popularity of Mobile OS");
    //adding pieChart to the root.
    root.getChildren().addAll(pieChart);
```

```
    Scene scene = new Scene(root, 450, 450);

    primaryStage.setTitle("Pie Chart Demo");
    primaryStage.setScene(scene);
    primaryStage.show();
}

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

:



`PieChart` JavaFX `Node` .

.

```
ObservableList<PieChart.Data> valueList = FXCollections.observableArrayList(
            new PieChart.Data("Nitrogen", 7809),
            new PieChart.Data("Oxygen", 2195),
            new PieChart.Data("Other", 93));

PieChart pieChart = new PieChart(valueList);
```

```
pieChart.setTitle("Air composition");

pieChart.getData().forEach(data -> {
    String percentage = String.format("%.2f%%", (data.getPieValue() / 100));
    Tooltip toolTip = new Tooltip(percentage);
    Tooltip.install(data.getNode(), toolTip);
});
```

LineChart . XYChart.Data XYChart.Series .

XYChart.Data getXValue getYValue x y .

```
XYChart.Data data = new XYChart.Data(1,3);
System.out.println(data.getXValue()); // Will print 1
System.out.println(data.getYValue()); // Will print 3
```

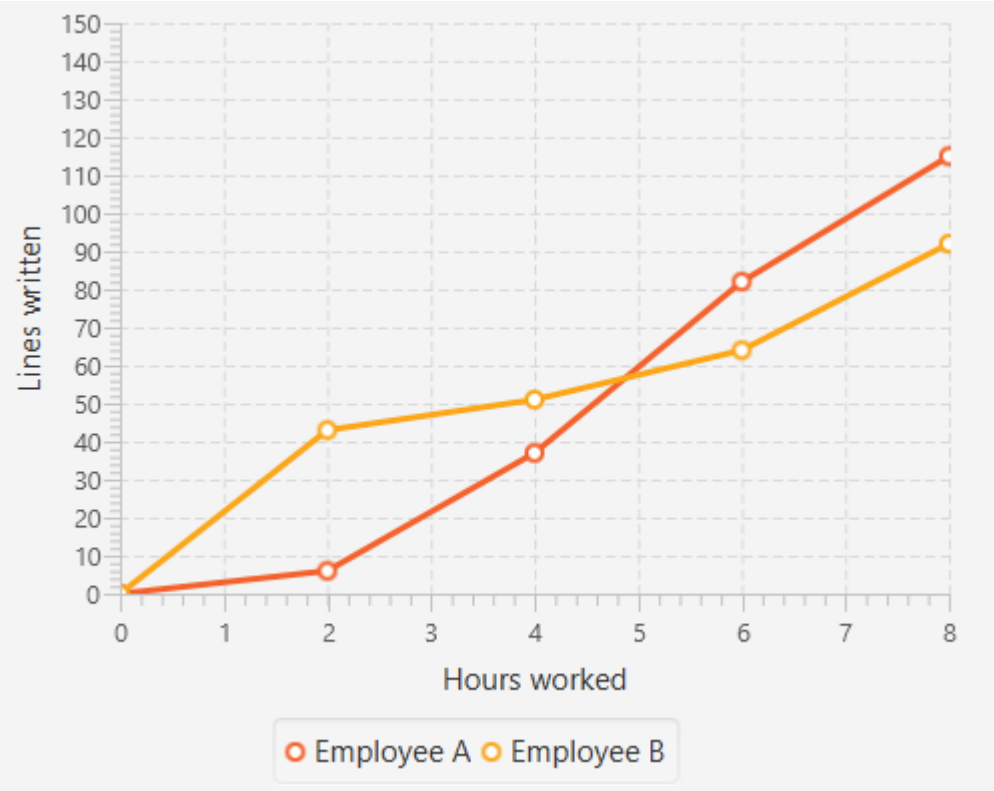
LineChart . NumberAxis .

```
Axis xAxis = new NumberAxis();
```

. , .

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

    // Create empty series
    ObservableList<XYChart.Series> seriesList = FXCollections.observableArrayList();

    // Create data set for the first employee and add it to the series
    ObservableList<XYChart.Data> aList = FXCollections.observableArrayList(
            new XYChart.Data(0, 0),
            new XYChart.Data(2, 6),
            new XYChart.Data(4, 37),
            new XYChart.Data(6, 82),
            new XYChart.Data(8, 115)
    );
    seriesList.add(new XYChart.Series("Employee A", aList));

    // Create data set for the second employee and add it to the series
    ObservableList<XYChart.Data> bList = FXCollections.observableArrayList(
            new XYChart.Data(0, 0),
            new XYChart.Data(2, 43),
            new XYChart.Data(4, 51),
            new XYChart.Data(6, 64),
            new XYChart.Data(8, 92)
    );
    seriesList.add(new XYChart.Series("Employee B", bList));

    // Create axes
    Axis xAxis = new NumberAxis("Hours worked", 0, 8, 1);
    Axis yAxis = new NumberAxis("Lines written", 0, 150, 10);
```

```
    LineChart chart = new LineChart(xAxis, yAxis, seriesList);

    root.getChildren().add(chart);

    Scene scene = new Scene(root);
    primaryStage.setScene(scene);
    primaryStage.show();
}

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



: https://riptutorial.com/ko/javafx/topic/2631/

21:

`Canvas` , JavaFX `Node` . `Canvas` `GraphicsContext` . `Canvas` draw .

Examples

`GraphicsContext` . `double` . `Canvas` .

: `GraphicsContext` `Canvas` ., `Canvas` .

3 .

```
Canvas canvas = new Canvas(185, 70);
GraphicsContext gc = canvas.getGraphicsContext2D();

// Set stroke color, width, and global transparency
gc.setStroke(Color.BLACK);
gc.setLineWidth(2d);
gc.setGlobalAlpha(0.5d);

// Draw a square
gc.setFill(Color.RED);
gc.fillRect(10, 10, 50, 50);
gc.strokeRect(10, 10, 50, 50);

// Draw a triangle
gc.setFill(Color.GREEN);
gc.fillPolygon(new double[]{70, 95, 120}, new double[]{60, 10, 60}, 3);
gc.strokePolygon(new double[]{70, 95, 120}, new double[]{60, 10, 60}, 3);

// Draw a circle
gc.setFill(Color.BLUE);
gc.fillOval(130, 10, 50, 50);
gc.strokeOval(130, 10, 50, 50);
```

: https://riptutorial.com/ko/javafx/topic/8935/

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3	FXML	D3181, fabian, James_D
4	JavaFX	Alexiy
5	JavaFX	ItachiUchiha, Joffrey, Nico T, P.J.Meisch
6	ScrollPane	Bo Halim
7	TableView	Bo Halim, fabian, GltknBtn
8	WebView WebEngine	fabian, J Atkin, James_D, P.J.Meisch, Squidward
9	Windows	fabian, GltknBtn
10		Dth, DVarga, J Atkin, Maverick283, Nico T, Squidward
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18		J Atkin, Squidward
19		fabian, J Atkin
20		Dth, James_D, Jinu P C
21		Dth