Fast-NU-ISB SPRING 2022

Lab 03–GUI with JavaFX Scene Builder and Event Handling

1. Introduction

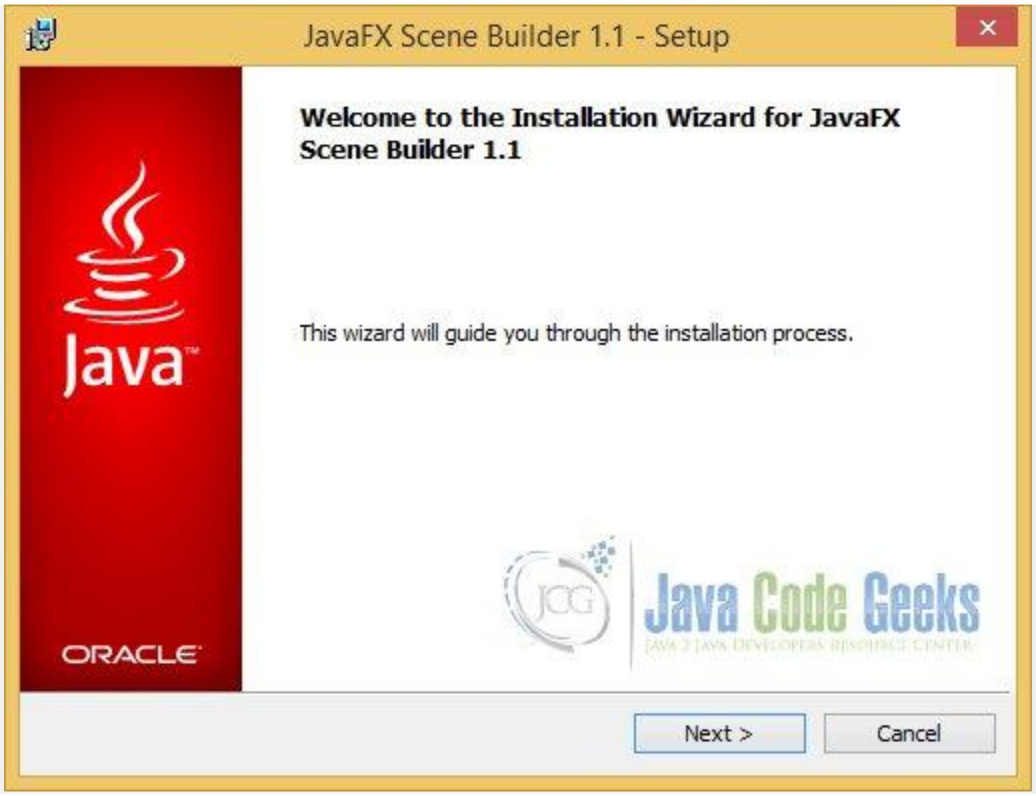
The JavaFX Scene Builder is a tool that lets you design JavaFX application user interfaces without coding. Users can drag and drop UI components to a work area, modify their properties, apply style sheets, and the FXML code for the layout that they are creating is automatically generated in the background. The result is an FXML file that can then be combined with a Java project by binding the UI to the application.
JavaFX Scene Builder includes the following key features:

- A drag-and-drop interface allows you to quickly create a UI layout without the need to write source code.
- You can add, combine, and edit JavaFX UI controls to your layout by using the library of UI controls and the content panel.
- Integration with any Java IDE is easy since it is a standalone development tool.
- Automatic FXML code generation occurs as you build and modify your UI layout.
- The generated FXML code is stored in a separate file from the application logic source and style sheet files.
- Live editing and preview features let you quickly visualize the UI layout changes that you make without the need to compile.
- Access to the complete JavaFX 2.2 UI controls library is provided.
- CSS support enables flexible management of the look and feel of your application's UI.

2. Installation

The installation of the Scene Builder 1.1 consists of the following Steps:

Go to the JavaFX Scene Builder Archive and download your package, which depends on the used Operating System.
If you are using windows, double click the setup file. Thereafter the following Dialog appears:

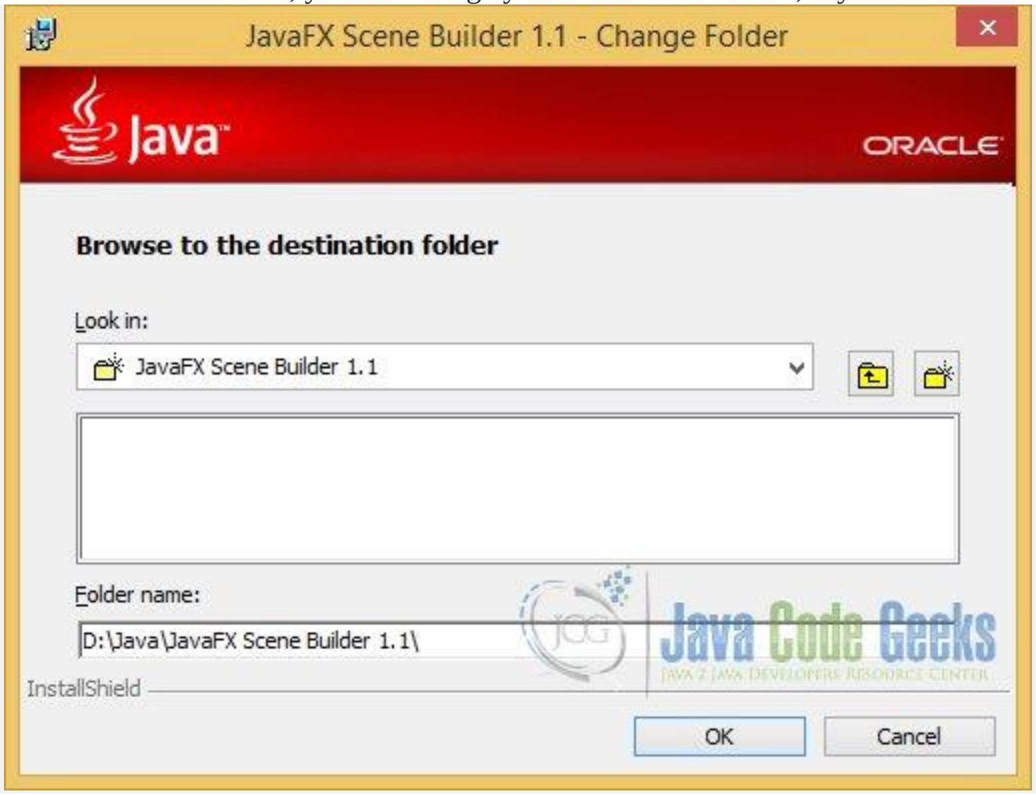

JavaFX Scene Builder 1.1 - Setup

Welcome to the Installation Wizard for JavaFX Scene Builder 1.1

This wizard will guide you through the installation process.

Start the Setup of the JavaFX Scene Builder

After a click on the Next Button, you can change your Destination Folder, if you want:


JavaFX Scene Builder 1.1 - Change Folder

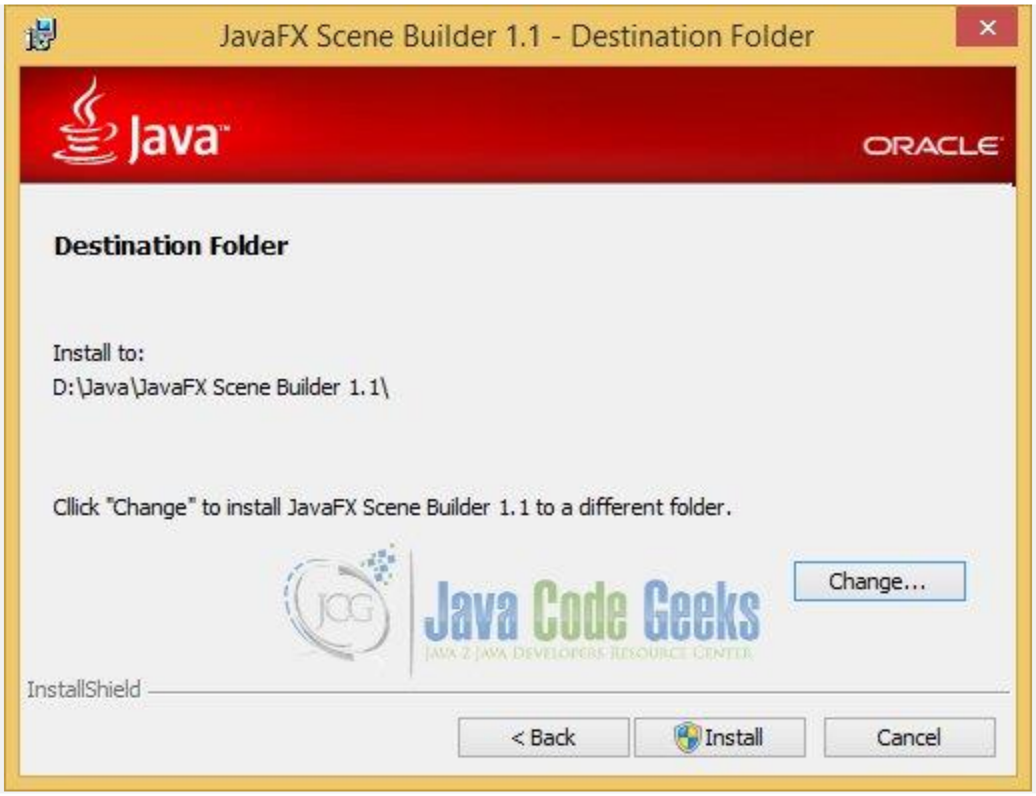
Browse to the destination folder

Look in: JavaFX Scene Builder 1.1

Folder name: D:\Java\JavaFX Scene Builder 1.1\

Choose the Destination Folder of the JavaFX Scene Builder

Thereafter, the selected Destination Folder will be shown:



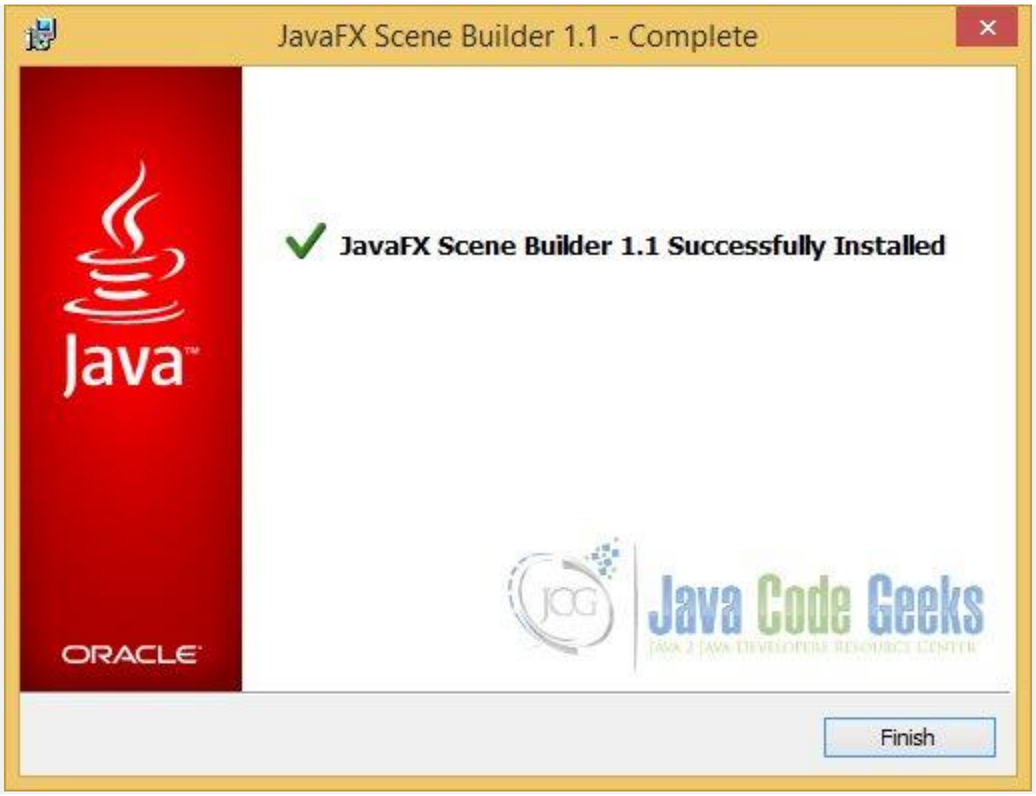
Destination Folder

Install to:
D:\Java\JavaFX Scene Builder 1.1\

Cllick "Change" to install JavaFX Scene Builder 1.1 to a different folder.

Verify the Destination Folder of the JavaFX Scene Builder

After a click on the Finish Button, your Setup is complete.


JavaFX Scene Builder 1.1 - Complete
Java
ORACLE
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Finish

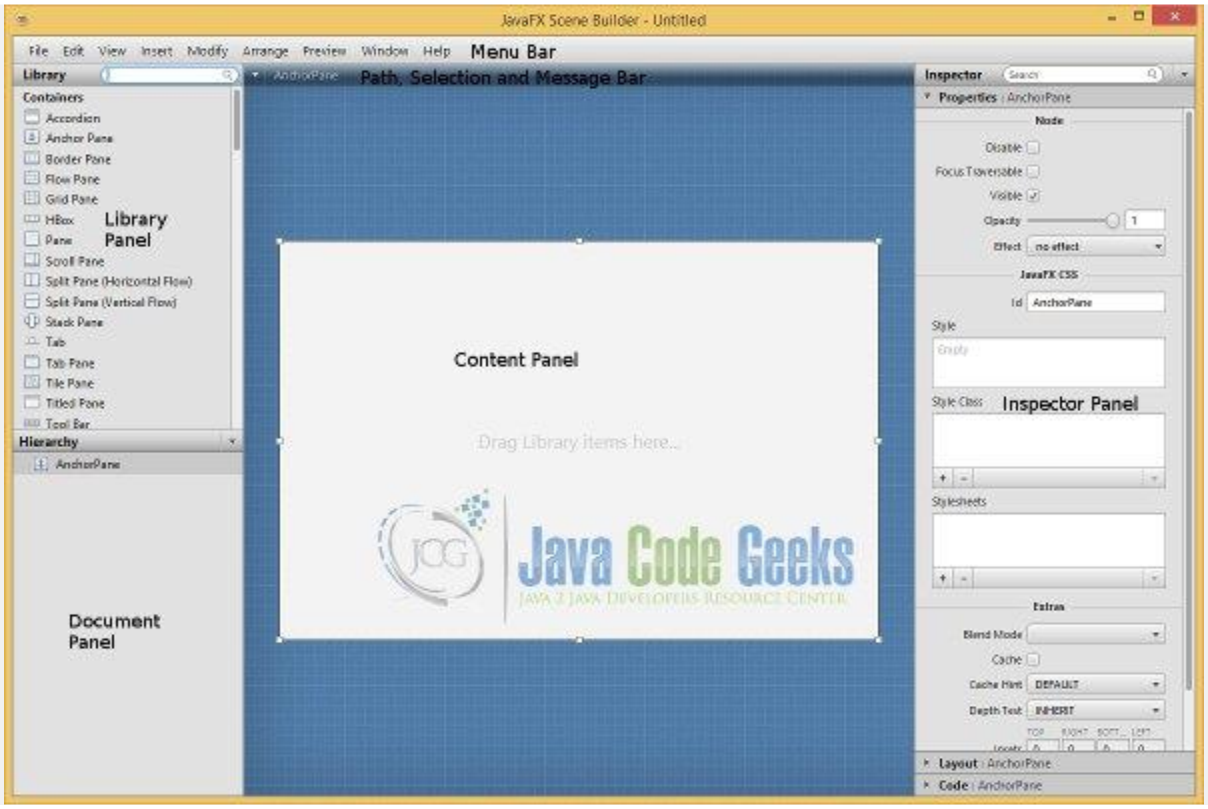
JavaFX Scene Builder 1.1 Successfully Installed

Finish the Setup of the JavaFX Scene Builder

Now you can use the Scene Builder.

3. The GUI of the Scene Builder

After starting the Application (Double-Click to the Icon on the Desktop), you get the following GUI:



The GUI of the JavaFX Scene Builder

By default, the main window of JavaFX Scene Builder includes the following sections:

- Menu Bar
- Path, Selection and Message Bar
- Content Panel
- Library Panel
- Document Panel
- Inspector Panel

4. FXML

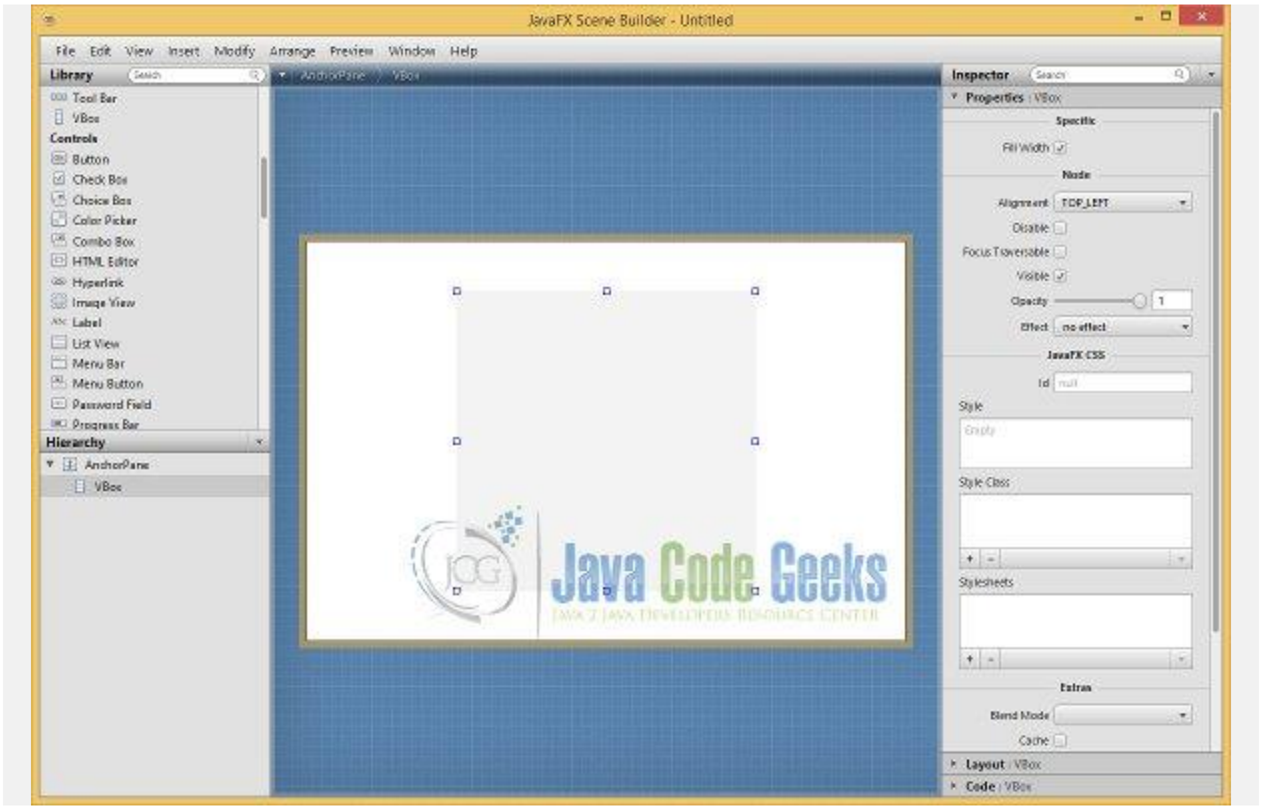
FXML is an XML-based language designed to build the user interface for JavaFX applications. You can use FXML to build an entire scene or part of a scene. FXML allows application developers to separate the logic for building the UI from the business logic. You still use JavaFX to write business logic using the Java language. An FXML document is an XML document.
A JavaFX scene graph is a hierarchical structure of Java objects. XML format is well suited for storing information representing some kind of hierarchy. It is common to use FXML to build a scene graph in a JavaFX application. However, the use of FXML is not limited to building only scene graphs. It can build a hierarchical object-graph of Java objects.
An FXML document is simply a text file. Typically, the file name has a .fxml extension (e.g., TextAreaExample.fxml).
In the following chapters you will generate a scene using the Scene Builder. Additionally, the corresponding parts of FXML will be discussed.

5. Example Application

Now, let´s create a simple example using the JavaFX Scene Builder. We will create a VBox which contains a Label for the In- and Output, a Button, a TextField and a TextArea.

5.1 Adding UI Elements

The root element of the FXML document is the top-level object in the object-graph. Our top-level object is an AnchorPane.
At first we add the `VBox` to the `AnchorPane`. This can be done via Drag and Drop of the Object from the Containers.



Adding a VBox to the AnchorPane

5.2 Setting Properties to an Object

You can set properties for Java objects in FXML. There are two ways to set properties:

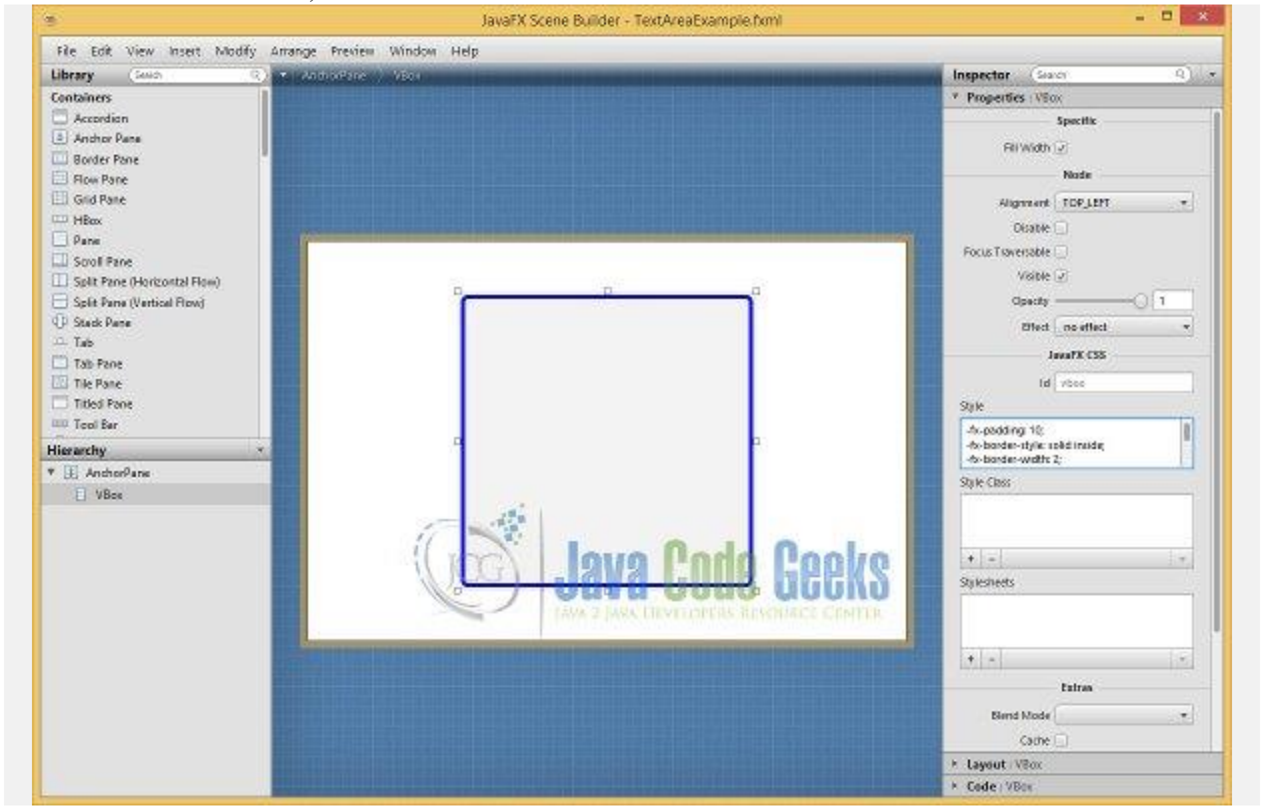
- Using attributes of an FXML element
- Using property elements

5.2.1 Setting the Style Properties to an Object

In the Hierarchy panel, select the `VBox` element and click the Properties section of the Inspector panel.
In our example. the following properties were inserted into the Style Text Field.

```
-fx-padding: 10;
-fx-border-style: solid inside;
```

```
-fx-border-width: 2;
-fx-border-insets: 5;
-fx-border-radius: 5;
-fx-border-color: blue;
```

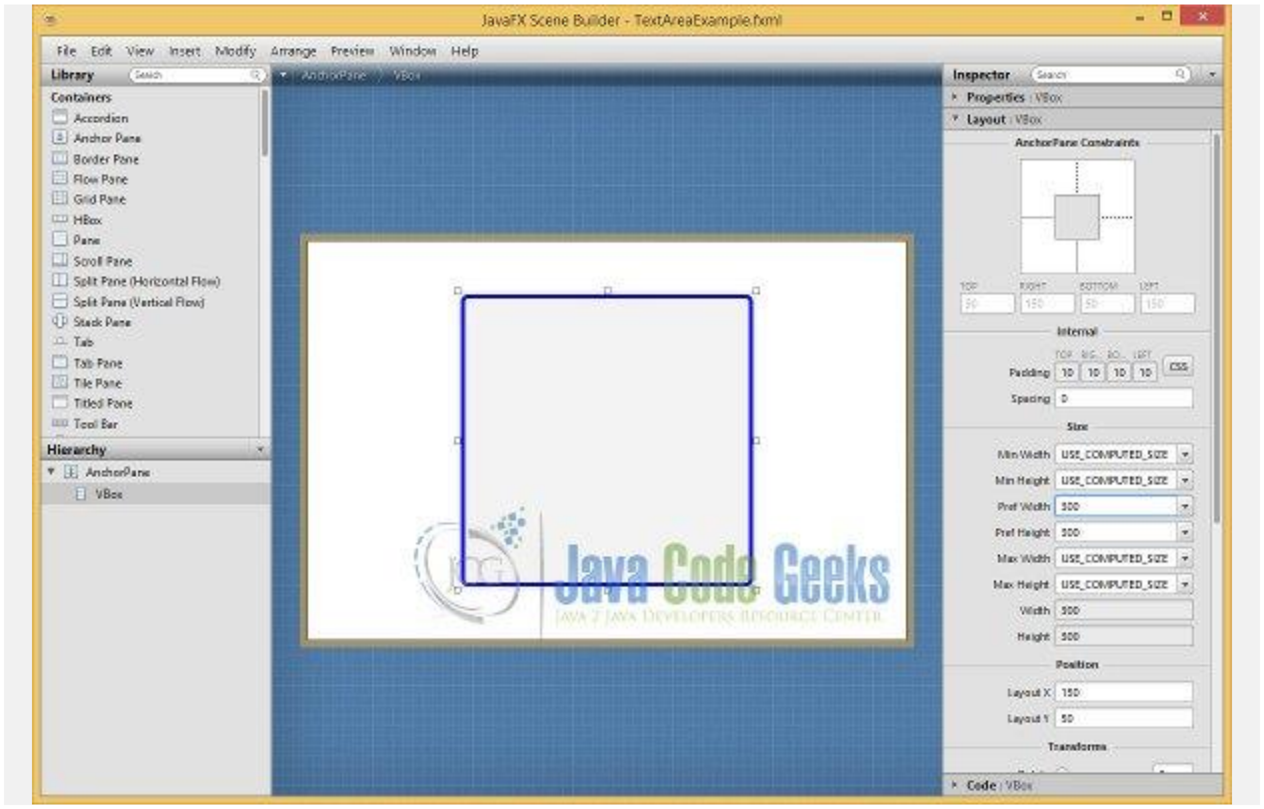


Fill Width ✓
Alignment TOP_LEFT
Disable
Focus Traversable
Visible ✓
Opacity 1
Effect no effect
Id vbox
Style
-fx-padding: 10;
-fx-border-style: solid inside;
-fx-border-width: 2;
Blend Mode
Cache

Setting Style Properties to the VBox

5.2.2 Setting the Width and Height Properties to an Object

In the Hierarchy panel, select the `VBox` element and click the Layout section of the Inspector panel. In this example, the Preferred Width and the Preferred Height was set to 300px.

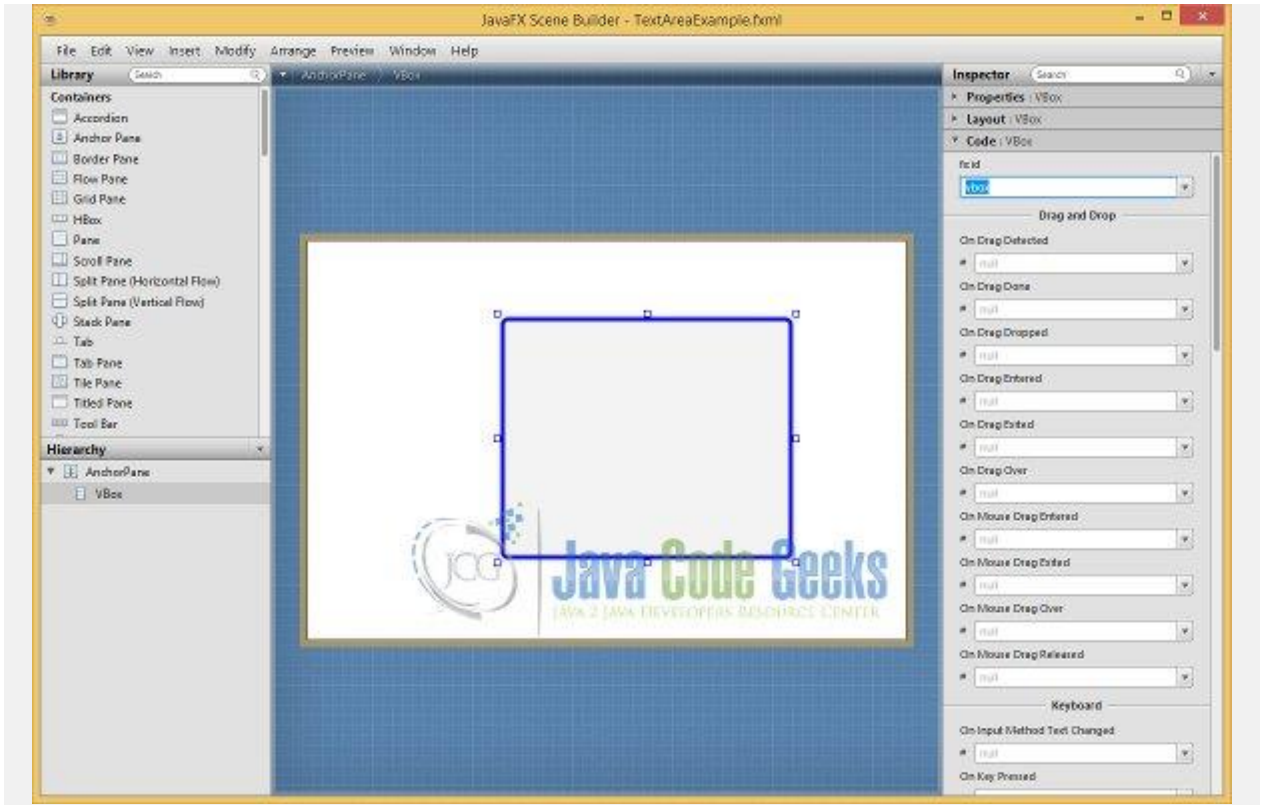


Padding 10 10 10 10
Spacing 0
Min Width USE_COMPUTED_SIZE
Min Height USE_COMPUTED_SIZE
Pref Width 300
Pref Height 300
Max Width USE_COMPUTED_SIZE
Max Height USE_COMPUTED_SIZE
Width 300
Height 300
Layout X 150
Layout Y 50

Setting the Width and Height Properties for the VBox

5.2.3 Assigning an Identifier to an Object

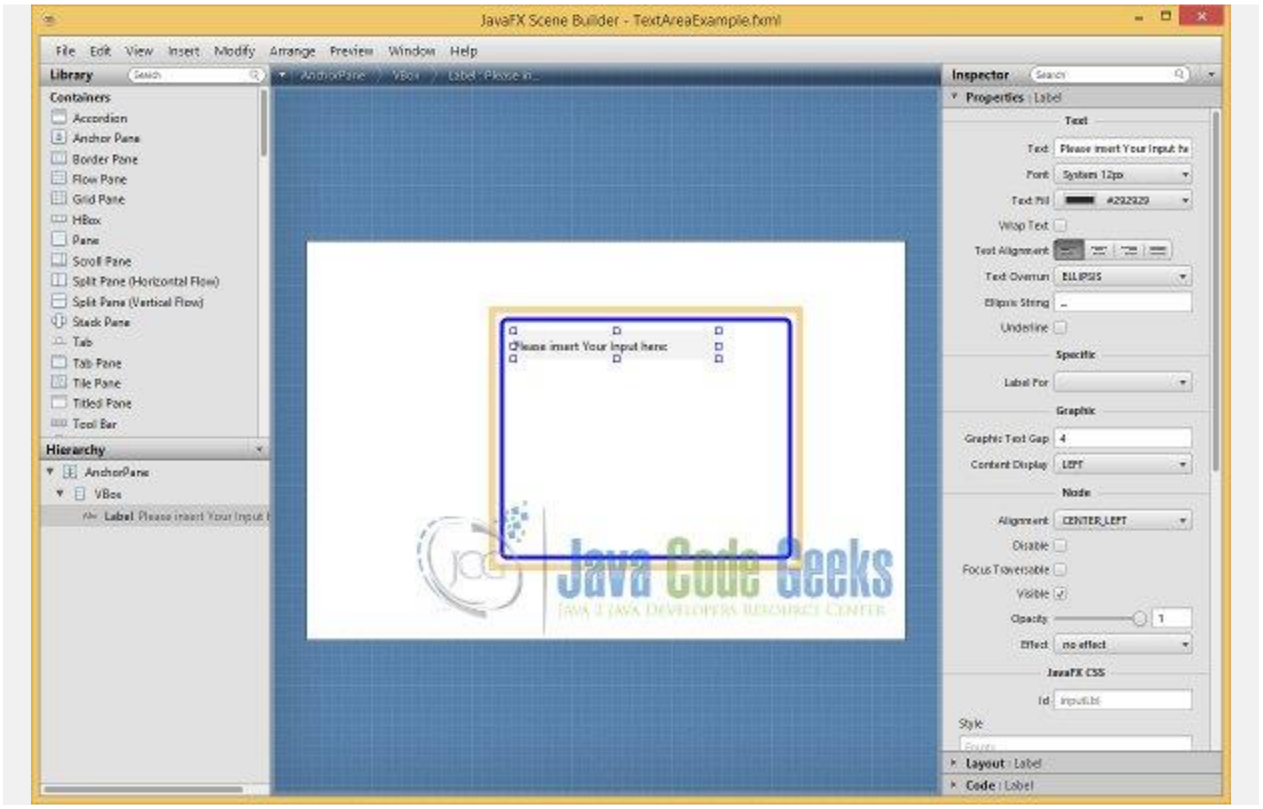
An object created in FXML can be referred to somewhere else in the same document. It is common to get the reference of UI objects created in FXML inside the JavaFX code. You can achieve this by first identifying the objects in FXML with an `fx:id` attribute. The value of the `fx:id` attribute is the identifier for the object. If the object type has an `id` property, the value will be also set for the property. Note that each Node in JavaFX has an id property that can be used to refer to them in CSS. In the Hierarchy panel, select the `VBox` element and click the Code section of the Inspector panel. In this example, the Identifier was set to vbox.



Assigning an Identifier to the VBox

5.3 Adding the other UI Elements

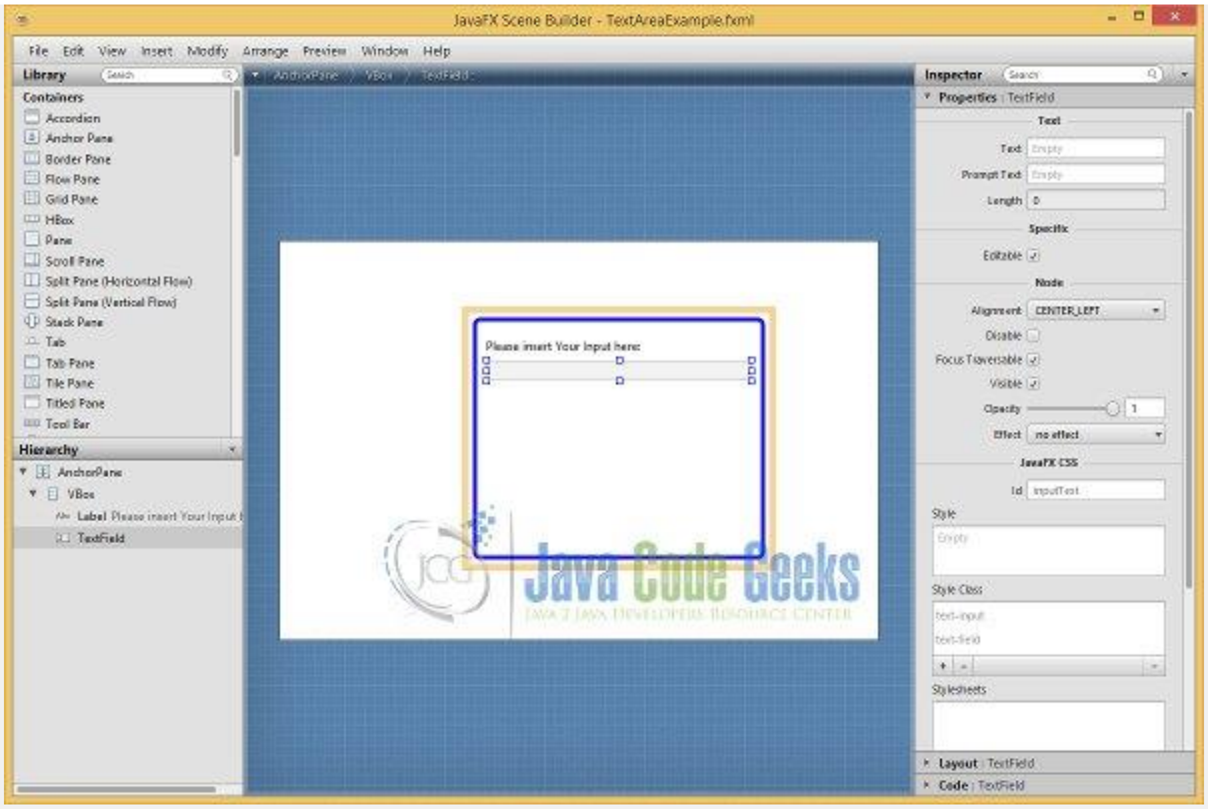
Now we have to add the other necessary elements to the `VBox` to finish our example. This step includes also the setting of the Properties, which were already discussed. At first we add a `Label`.


JavaFX Scene Builder - TextAreaExample.fxml
File Edit View Insert Modify Arrange Preview Window Help
Library
Containers
Accordion
Anchor Pane
Border Pane
Flow Pane
Grid Pane
HBox
Pane
Scroll Pane
Split Pane (Horizontal Flow)
Split Pane (Vertical Flow)
Stack Pane
Tab
Tab Pane
Tile Pane
Titled Pane
Tool Bar
Hierarchy
AnchorPane
VBox
Label Please insert Your Input
Please insert Your Input here:
Inspector
Properties : Label
Layout : Label
Code : Label

Text: Please insert Your Input he
Font: System 12px
Text Fill: #292929
Wrap Text: ☐
Text Overrun: ELLIPSIS
Ellipsis String: ...
Underline: ☐
Graphic Text Gap: 4
Content Display: LEFT
Alignment: CENTER_LEFT
Disable: ☐
Focus Traversable: ☐
Visible: ✓
Opacity: 1
Effect: no effect
Id: inputLbl

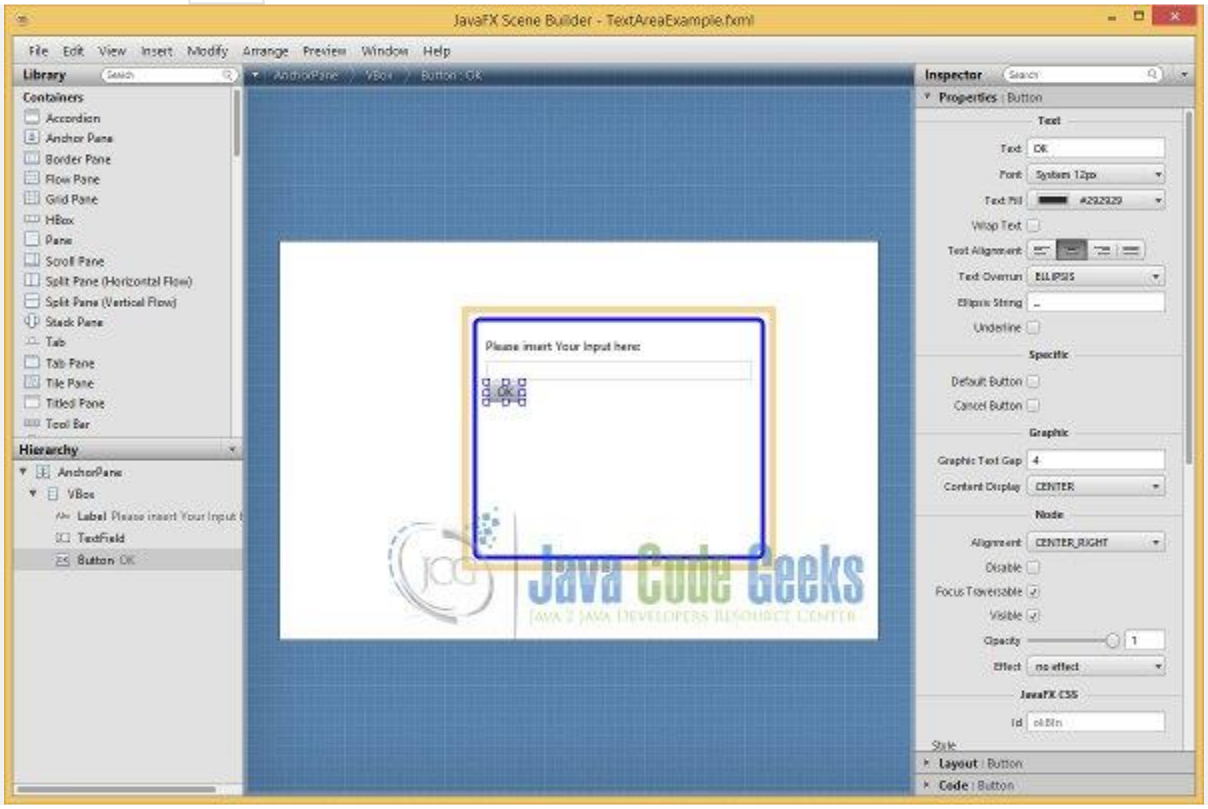
Insert a Label to the VBox

Thereafter we add a `TextField` for the Input:


JavaFX Scene Builder - TextAreaExample.fxml
File Edit View Insert Modify Arrange Preview Window Help
Library
Inspector
Properties : TextField
Please insert Your Input here:
Layout : TextField
Code : TextField

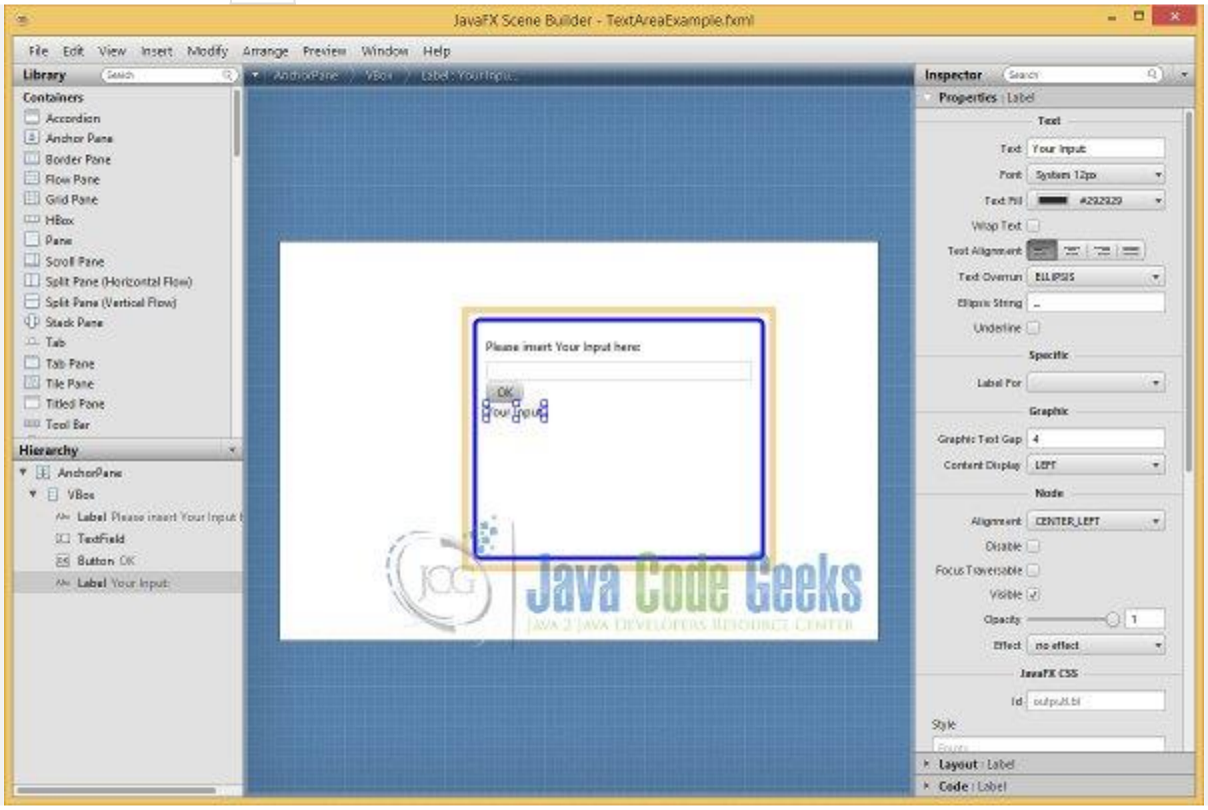
Insert a TextField to the VBox

Now, let´s add a `Button` which handles the necessary [ActionEvent](https://docs.oracle.com/javase/8/javafx/api/javafx/event/ActionEvent.html).


JavaFX Scene Builder - TextAreaExample.fxml
File Edit View Insert Modify Arrange Preview Window Help
Library
Inspector
Properties : Button
Please insert Your Input here:
OK
Layout : Button
Code : Button

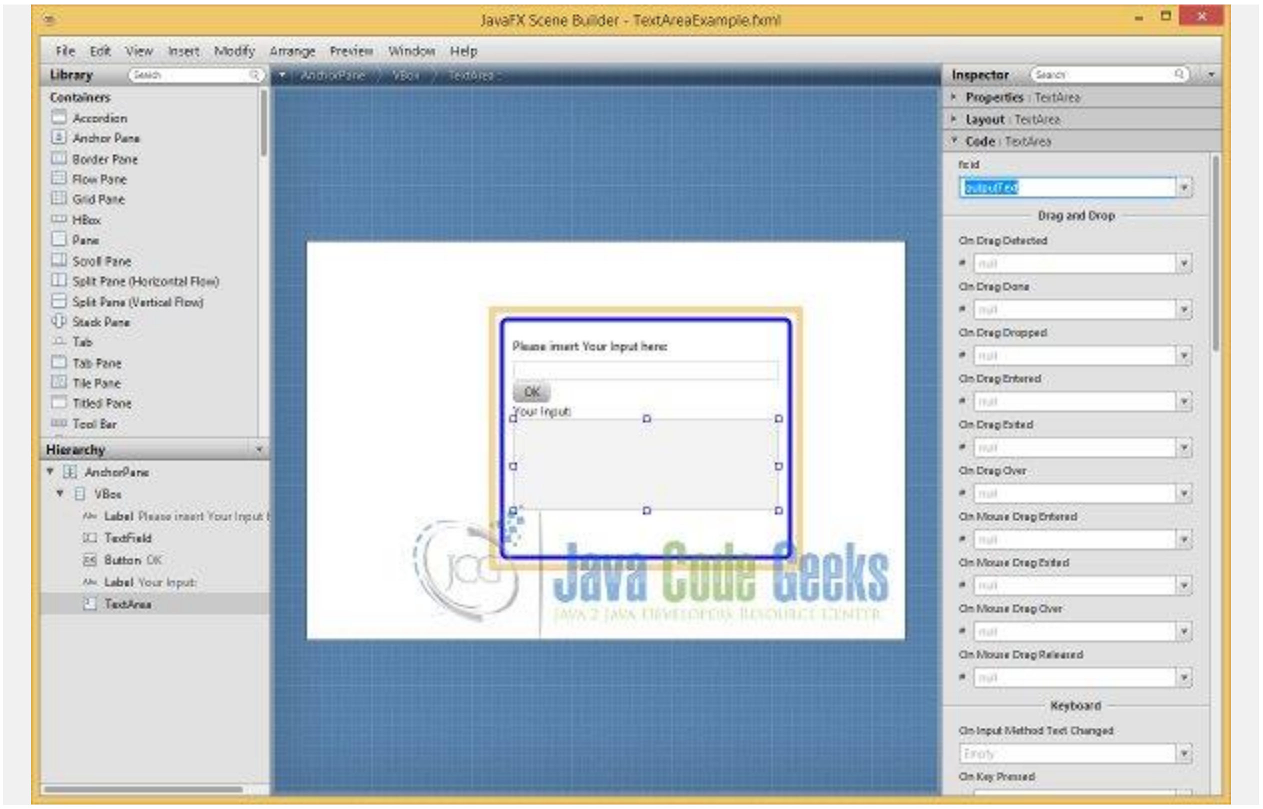
Insert a Button to the VBox

So we add a second Label as Head for the Output:



Insert a second Label to the VBox

And finally, we have to add a TextArea, which contains and display our input.



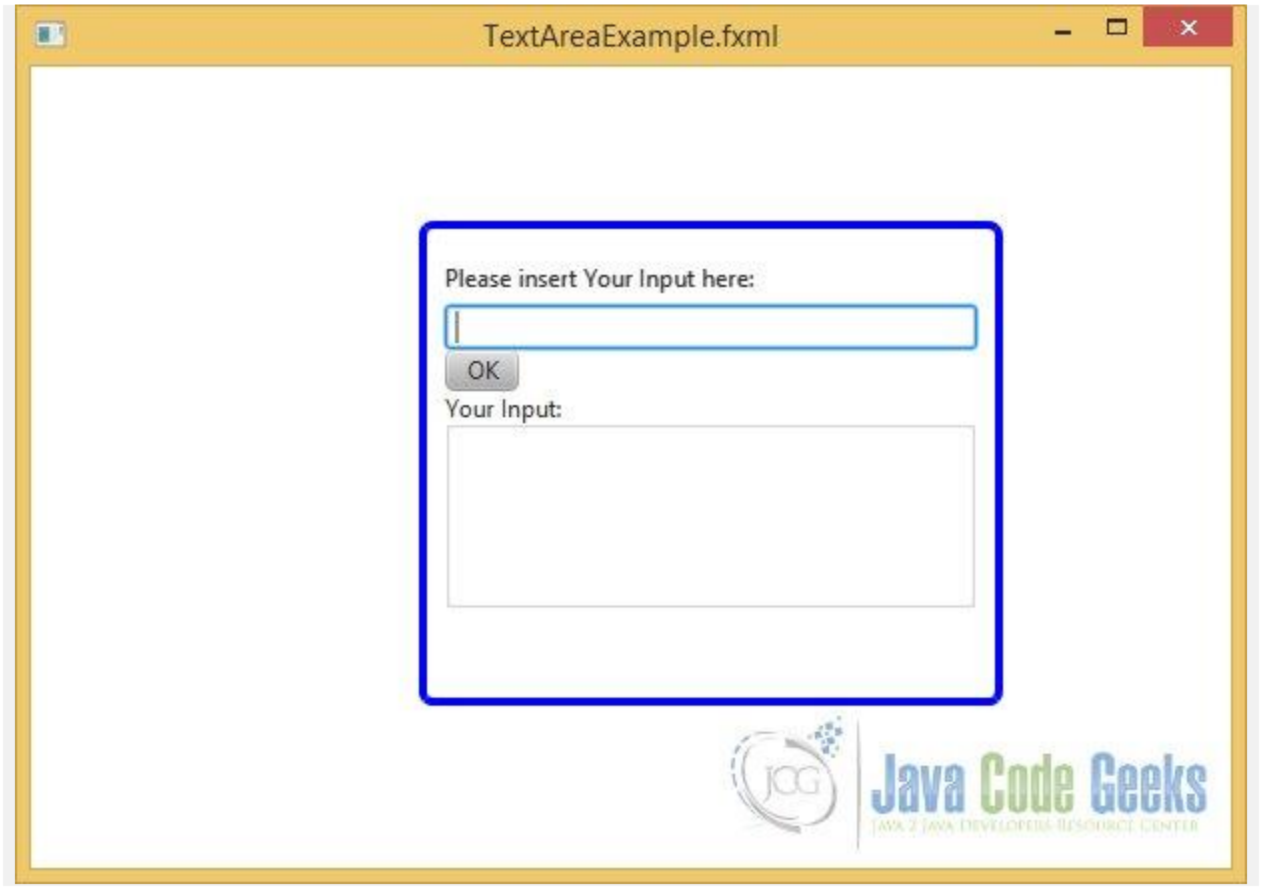
fx:id: outputText

Insert a TextArea to the VBox

Let´s save the example by using the "Save As" Menu Entry in the File Menu. Choose a directory and save the scene as TextAreaExample.fxml.

5.4 Preview of your Design

You can always make a Preview in the Scene Builder about your current design under usage of the "Show Preview in Window" Menu Entry in the "Preview" Menu.


TextAreaExample.fxml
Please insert Your Input here:
OK
Your Input:
Java Code Geeks
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A Scene Builder Preview Example

5.5 The Generated FXML Source Code

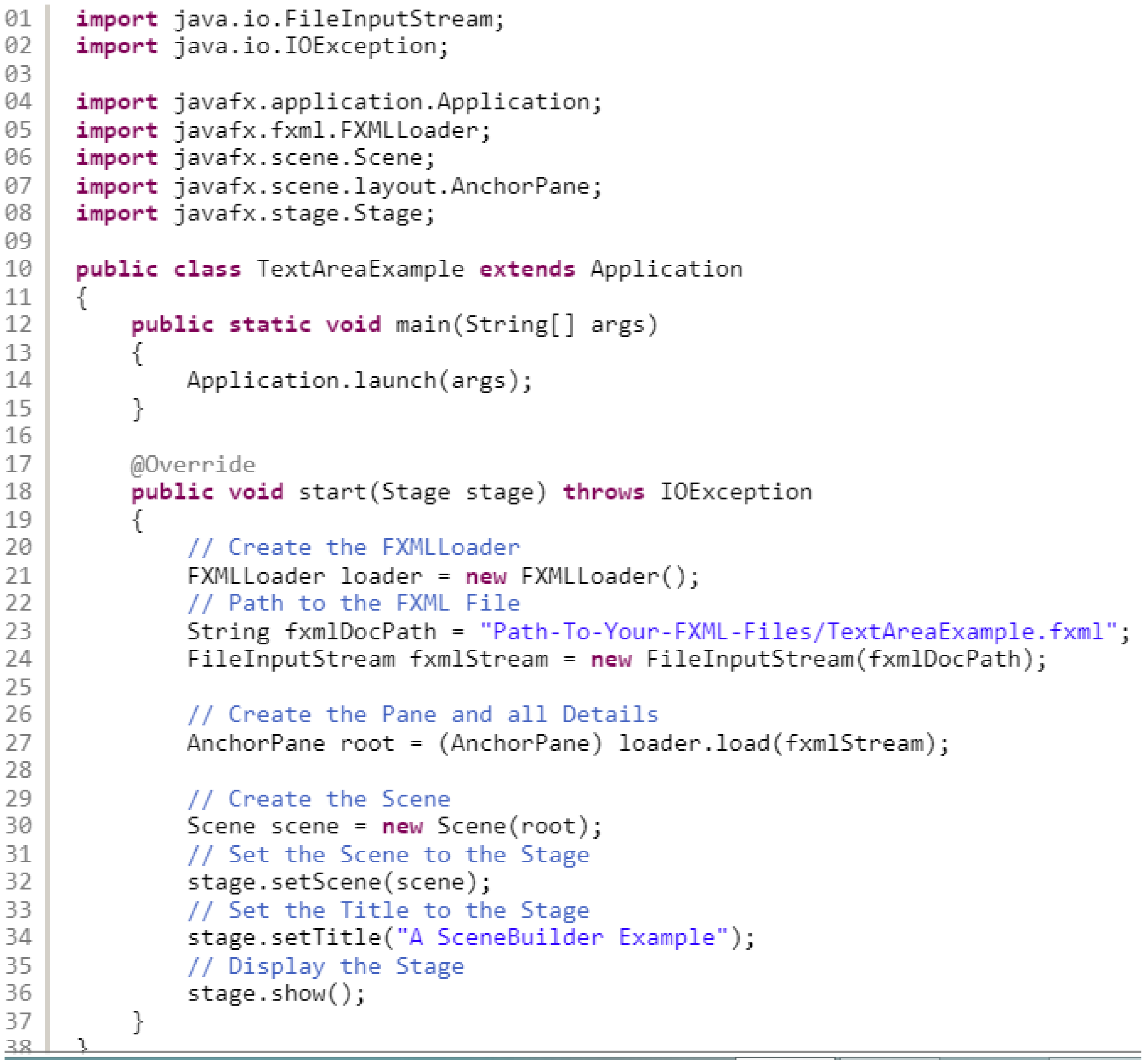
If you open the created FXML File with an editor, you will see the following FXML Code:
TextAreaExample.fxml

6. Loading FXML Documents

An FXML document defines the view (the GUI) part of a JavaFX application. You need to load the FXML document to get the object-graph it represents. Loading an FXML is performed by an instance of the FXMLLoader class, which is in the javafx.fxml package. The FXMLLoader class provides several constructors that let you specify the location, charset, resource bundle, and other elements to be used for loading the document. You need to specify at least the location of the FXML document, which is a URL. The class contains `load()` methods to perform the actual loading of the document.

6.1 The Code

The following snippet of code loads an FXML document from a local file system in Windows:
TextAreaExample.java



```java
import java.io.FileInputStream;
import java.io.IOException;

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

public class TextAreaExample extends Application
{
    public static void main(String[] args)
    {
        Application.launch(args);
    }

    @Override
    public void start(Stage stage) throws IOException
    {
        // Create the FXMLLoader
        FXMLLoader loader = new FXMLLoader();
        // Path to the FXML File
        String fxmlDocPath = "Path-To-Your-FXML-Files/TextAreaExample.fxml";
        FileInputStream fxmlStream = new FileInputStream(fxmlDocPath);

        // Create the Pane and all Details
        AnchorPane root = (AnchorPane) loader.load(fxmlStream);

        // Create the Scene
        Scene scene = new Scene(root);
        // Set the Scene to the Stage
        stage.setScene(scene);
        // Set the Title to the Stage
        stage.setTitle("A SceneBuilder Example");
        // Display the Stage
        stage.show();
    }
}
```

XMLLoader supports loading a FXML document using an InputStream. The following snippet of code loads the same FXML document using an `InputStream`.

```
// Create the FXMLLoader
FXMLLoader loader = new FXMLLoader();
// Path to the FXML File
String fxmlDocPath = "Path-To-Your-FXML-Files/TextAreaExampleController.fxml";
FileInputStream fxmlStream = new FileInputStream(fxmlDocPath);

// Create the Pane and all Details
AnchorPane root = (AnchorPane) loader.load(fxmlStream);
```

6.2 The GUI

After starting the Application, you can insert Text in the Input Field and press the OK Button. But at this time, it does not have any effect. The reason is the fact, that we don´t have added an Event Handler to the Button. This will be discussed in the next part of this article.

7. Adding Event Handlers

You can set event handlers for nodes in FXML. Setting an event handler is similar to setting any other properties. For example, the Button class contains an onAction property to set an `ActionEvent` handler. In FXML, you can specify two types of event handlers:

- Script Event Handlers
- Controller Event Handlers

7.2 Controller Event Handlers

A controller is simply a class name whose object is created by FXML and used to initialize the UI elements. FXML lets you specify a controller on the root element using the `fx:controller` attribute. Note that only one controller is allowed per FXML document, and if specified, it must be specified on the root element.

7.2.1 The Controller Class

At first, you have to write a Controller for your root element. In our case the root element is the `AnchorPane`

TextAreaController.java

```
import java.net.URL;
import java.util.ResourceBundle;

import javafx.fxml.FXML;
import javafx.scene.control.TextArea;
import javafx.scene.control.TextField;

public class TextAreaController
{
    @FXML
    // The reference of inputText will be injected by the FXML loader
    private TextField inputText;

    // The reference of outputText will be injected by the FXML loader
    @FXML
    private TextArea outputText;

    // location and resources will be automatically injected by the FXML loader
    @FXML
    private URL location;

    @FXML
    private ResourceBundle resources;

    // Add a public no-args constructor
    public TextAreaController()
    {
    }

    @FXML
```

```
        private void initialize()
        {
        }

        @FXML
        private void printOutput()
        {
            outputText.setText(inputText.getText());
        }
    }
```

The controller class uses a `@FXML` annotation on some members. The `@FXML` annotation can be used on fields and methods. It cannot be used on classes and constructors. By using a `@FXML` annotation on a member, you are declaring that the FXML loader can access the member even if it is private. A public member used by the FXML loader does not need to be annotated with `@FXML`. However, annotating a public member with `@FXML` is not an error. It is better to annotate all members, public and private, used by the FXML loader with `@FXML` annotation. This tells the reader of your code how the members are being used.
A controller needs to conform to some rules:
The controller must have a public no-args constructor. If it does not exist, the FXML loader will not be able to instantiate it, which will throw an exception at the load time.

```
// Add a public no-args constructor
public TextAreaController()
{
}
```

The controller can have accessible methods, which can be specified as event handlers in FXML.

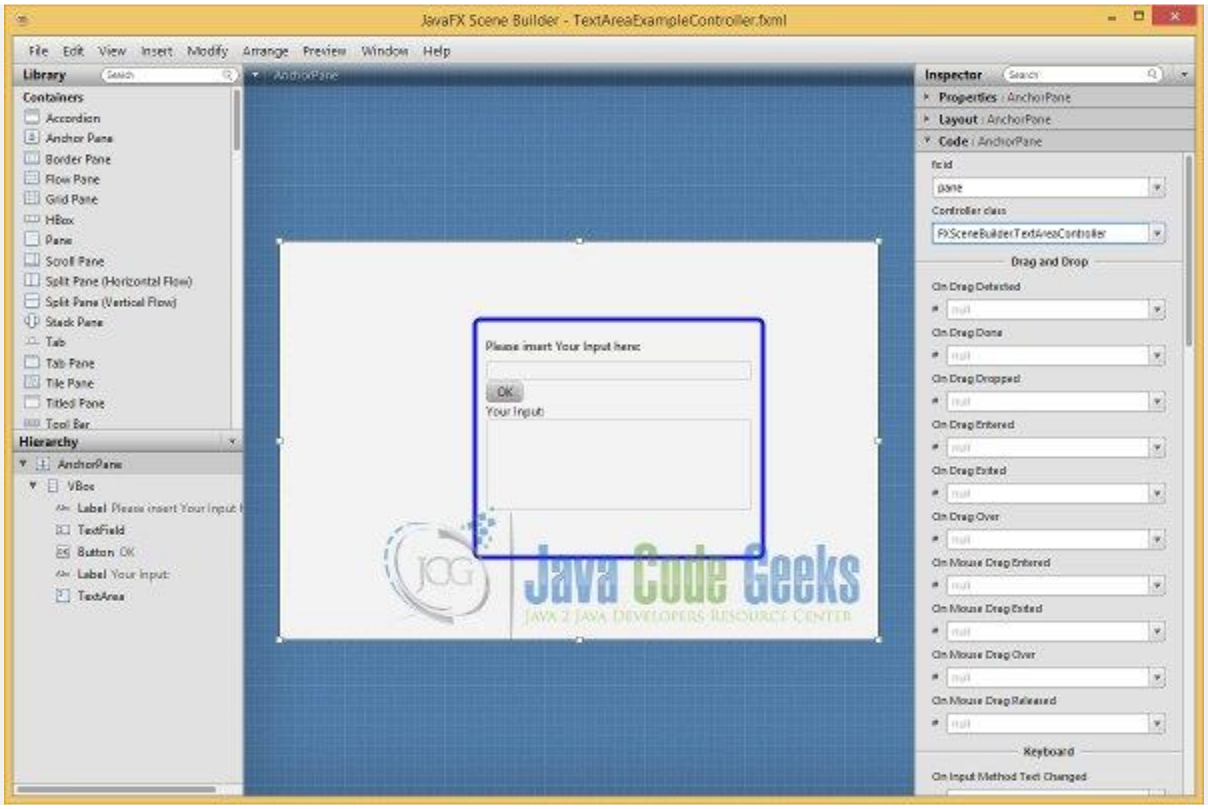
```
@FXML
private void printOutput()
{
    outputText.setText(inputText.getText());
}
```

The FXML loader will automatically look for accessible instance variables of the controller. If the name of an accessible instance variable matches the `fx:id` attribute of an element, the object reference from FXML is automatically copied into the controller instance variable. This feature makes the references of UI elements in FXML available to the controller. The controller can use them later, such as binding them to model.

The controller can have an accessible `initialize()` method, which should take no arguments and have a return type of void. The FXML loader will call the `initialize()` method after the loading of the FXML document is complete.

```
@FXML
private void initialize()
{
}
```

The following image shows an example of the definition of an Controller for the `AnchorPane`.

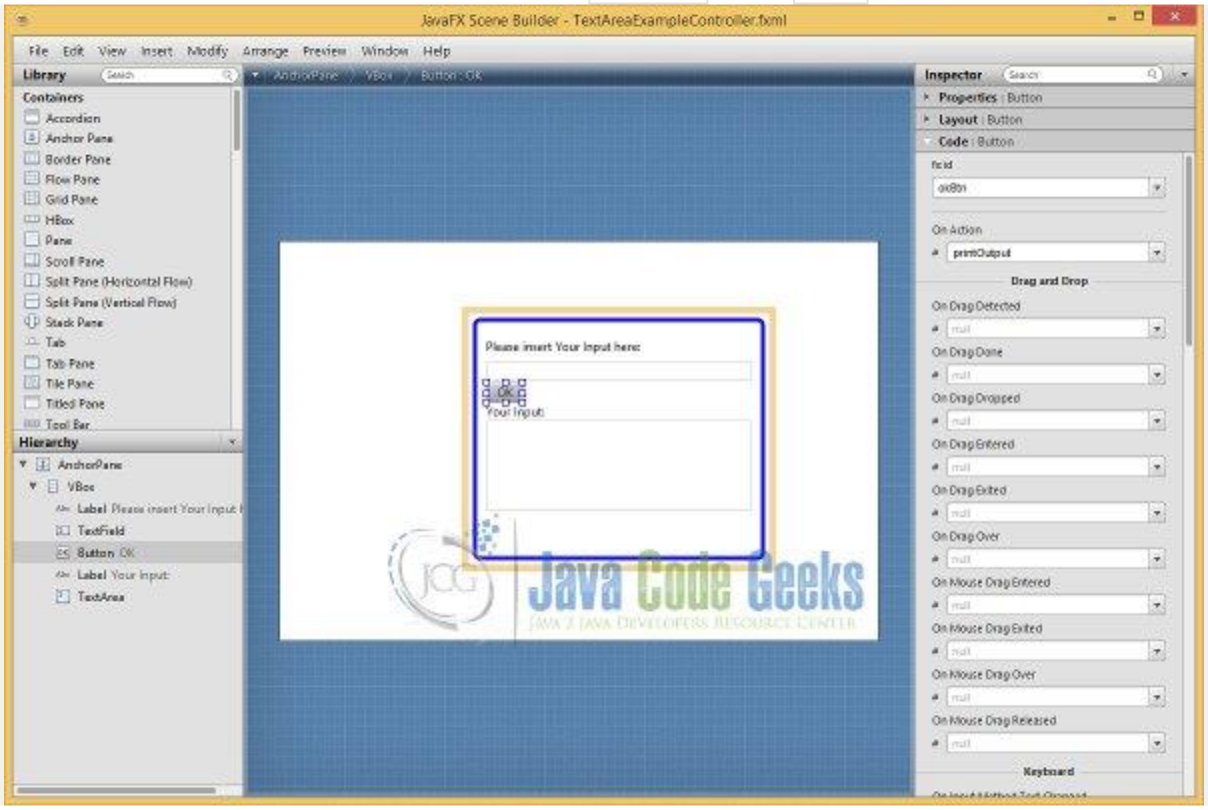


fx:id: pane

Controller class: FXSceneBuilder.TextAreaController

Adding a Controller to the Pane

Additionally you have to define the Java Method printOutput to the Button.


JavaFX Scene Builder - TextAreaExampleController.fxml
File Edit View Insert Modify Arrange Preview Window Help
AnchorPane > VBox > Button : OK
Library
Containers
Hierarchy
AnchorPane
VBox
Label Please insert Your Input here:
TextField
Button OK
Label Your Input:
TextArea
Please insert Your Input here:
OK
Your Input:
Inspector
Properties : Button
Layout : Button
Code : Button
Drag and Drop
Keyboard

fx:id: okBtn

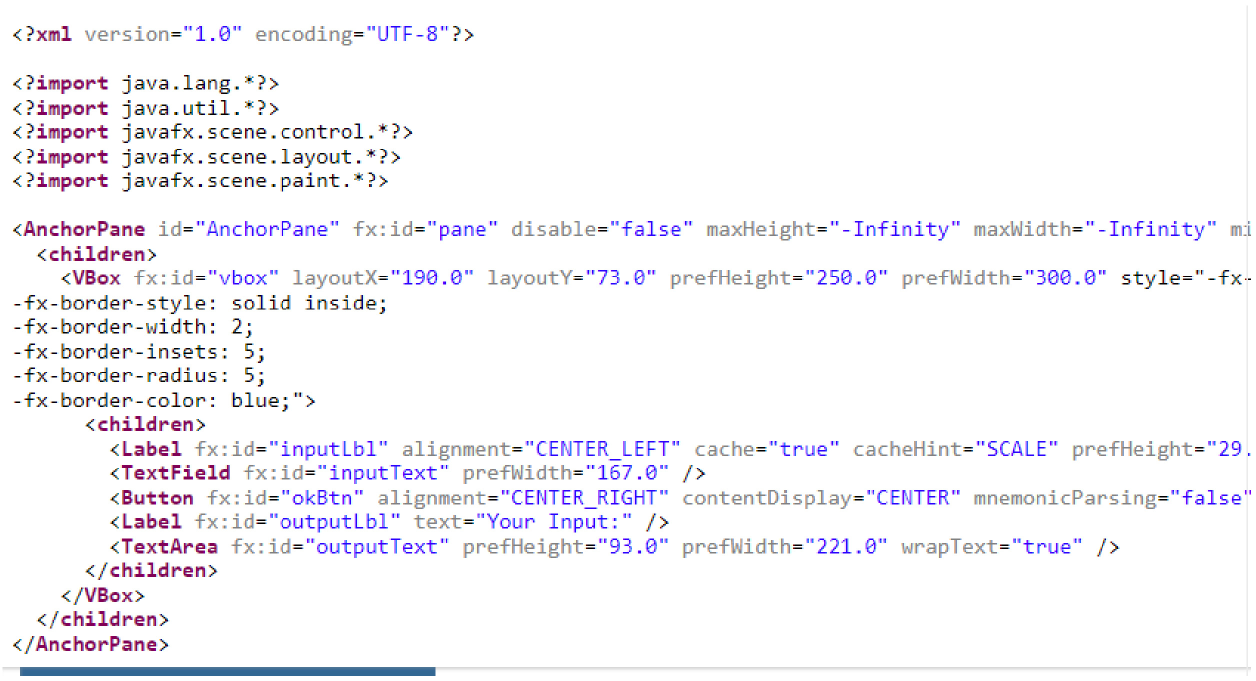
On Action: printOutput

Adding a Java Method to the Button

7.2.2 The FXML Code

Thereafter you get the following FXML Code:

TextAreaExampleController.fxml



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

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

<AnchorPane id="AnchorPane" fx:id="pane" disable="false" maxHeight="-Infinity" maxWidth="-Infinity" mi
  <children>
    <VBox fx:id="vbox" layoutX="190.0" layoutY="73.0" prefHeight="250.0" prefWidth="300.0" style="-fx-
-fx-border-style: solid inside;
-fx-border-width: 2;
-fx-border-insets: 5;
-fx-border-radius: 5;
-fx-border-color: blue;">
      <children>
        <Label fx:id="inputLbl" alignment="CENTER_LEFT" cache="true" cacheHint="SCALE" prefHeight="29.
        <TextField fx:id="inputText" prefWidth="167.0" />
        <Button fx:id="okBtn" alignment="CENTER_RIGHT" contentDisplay="CENTER" mnemonicParsing="false"
        <Label fx:id="outputLbl" text="Your Input:" />
        <TextArea fx:id="outputText" prefHeight="93.0" prefWidth="221.0" wrapText="true" />
      </children>
    </VBox>
  </children>
</AnchorPane>
```

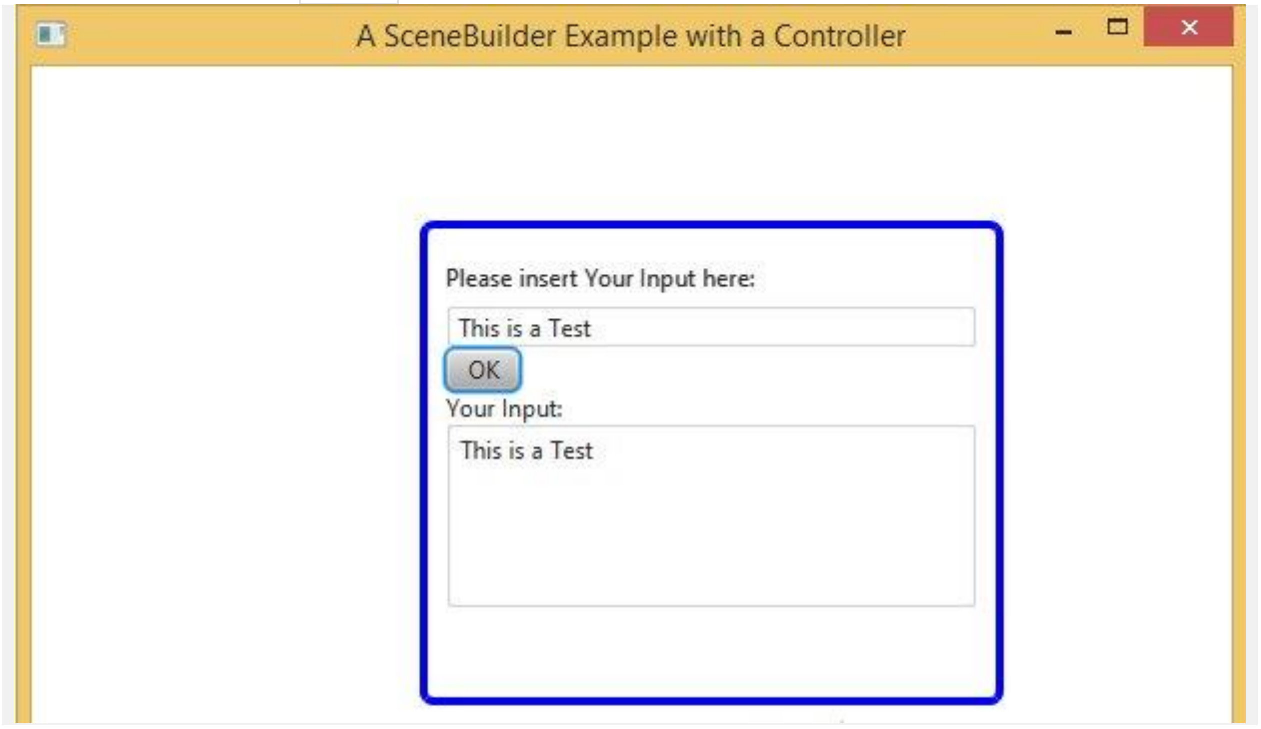
7.2.3 The Java Code

TextAreaExampleController.java

```
import java.io.FileInputStream;
import java.io.IOException;

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

public class TextAreaExampleController extends Application
{
    public static void main(String[] args)
    {
        Application.launch(args);
    }

    @Override
    public void start(Stage stage) throws IOException
    {
        // Create the FXMLLoader
        FXMLLoader loader = new FXMLLoader();
        // Path to the FXML File
        String fxmlDocPath = "Path-To-Your-FXML-Files/
                TextAreaExampleController.fxml";
        FileInputStream fxmlStream = new FileInputStream(fxmlDocPath);

        // Create the Pane and all Details
        AnchorPane root = (AnchorPane) loader.load(fxmlStream);

        // Create the Scene
        Scene scene = new Scene(root);
        // Set the Scene to the Stage
        stage.setScene(scene);
        // Set the Title to the Stage
        stage.setTitle("A SceneBuilder Example with a Controller");
        // Display the Stage
        stage.show();
    }

}
```

7.2.4 The GUI

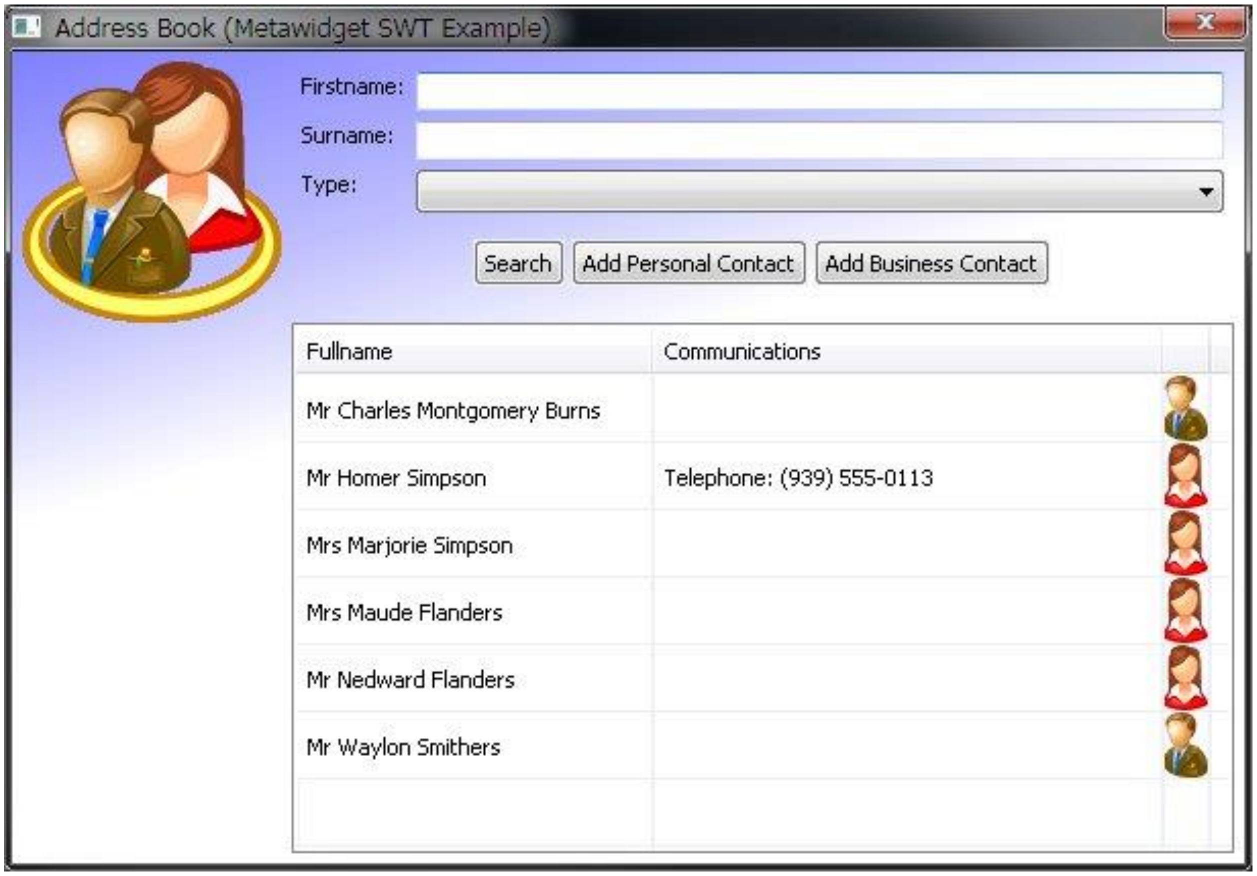
After starting the Application, we can insert a Text in the `TextField`, press the OK `Button`, and the Message appears in the `TextArea`. The Controller has the same effect, like the JavaScript Method.


A SceneBuilder Example with a Controller
Please insert Your Input here:
This is a Test
OK
Your Input:
This is a Test

A Scene Builder Example with a Controller Class

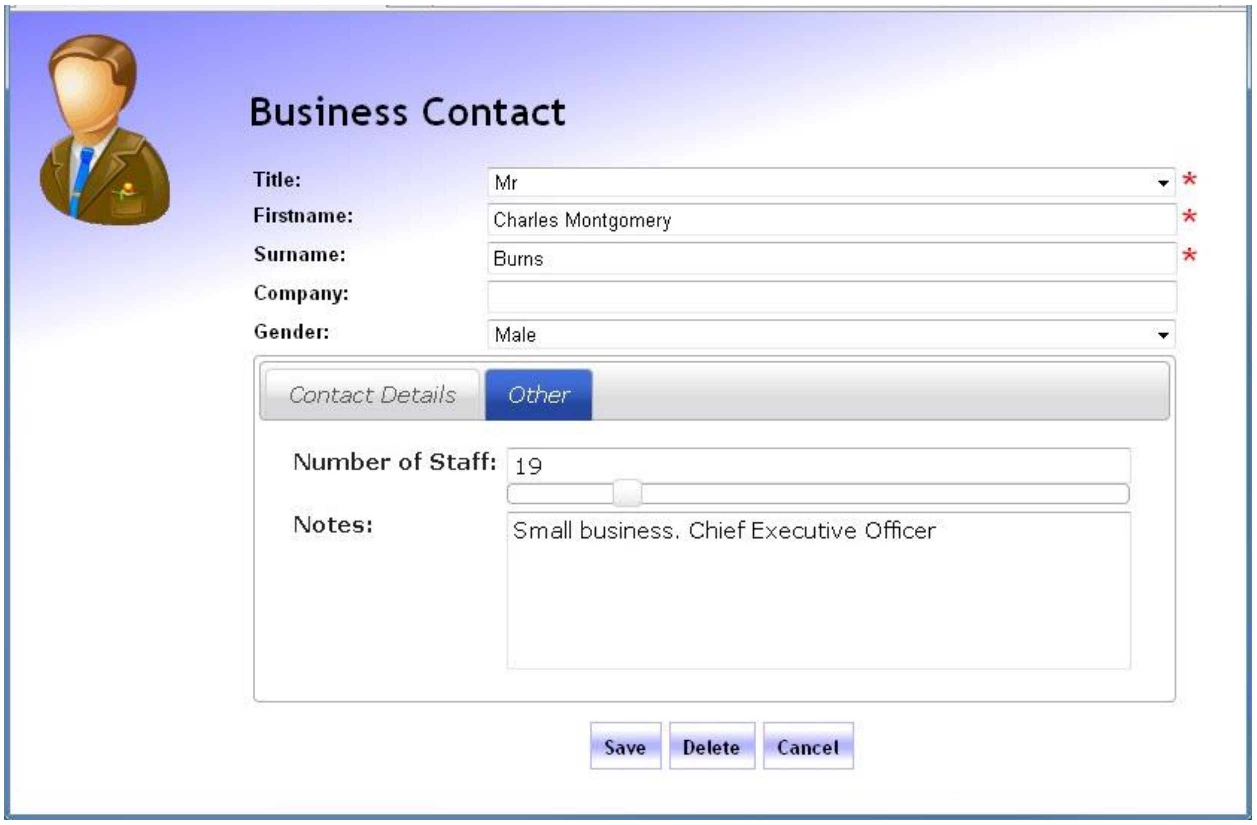
Tasks

1. Design bellow given UI for contact directory application using SceneBuilder.



Fullname	Communications
Mr Charles Montgomery Burns	
Mr Homer Simpson	Telephone: (939) 555-0113
Mrs Marjorie Simpson	
Mrs Maude Flanders	
Mr Nedward Flanders	
Mr Waylon Smithers	

Figure 1-Address Book Home

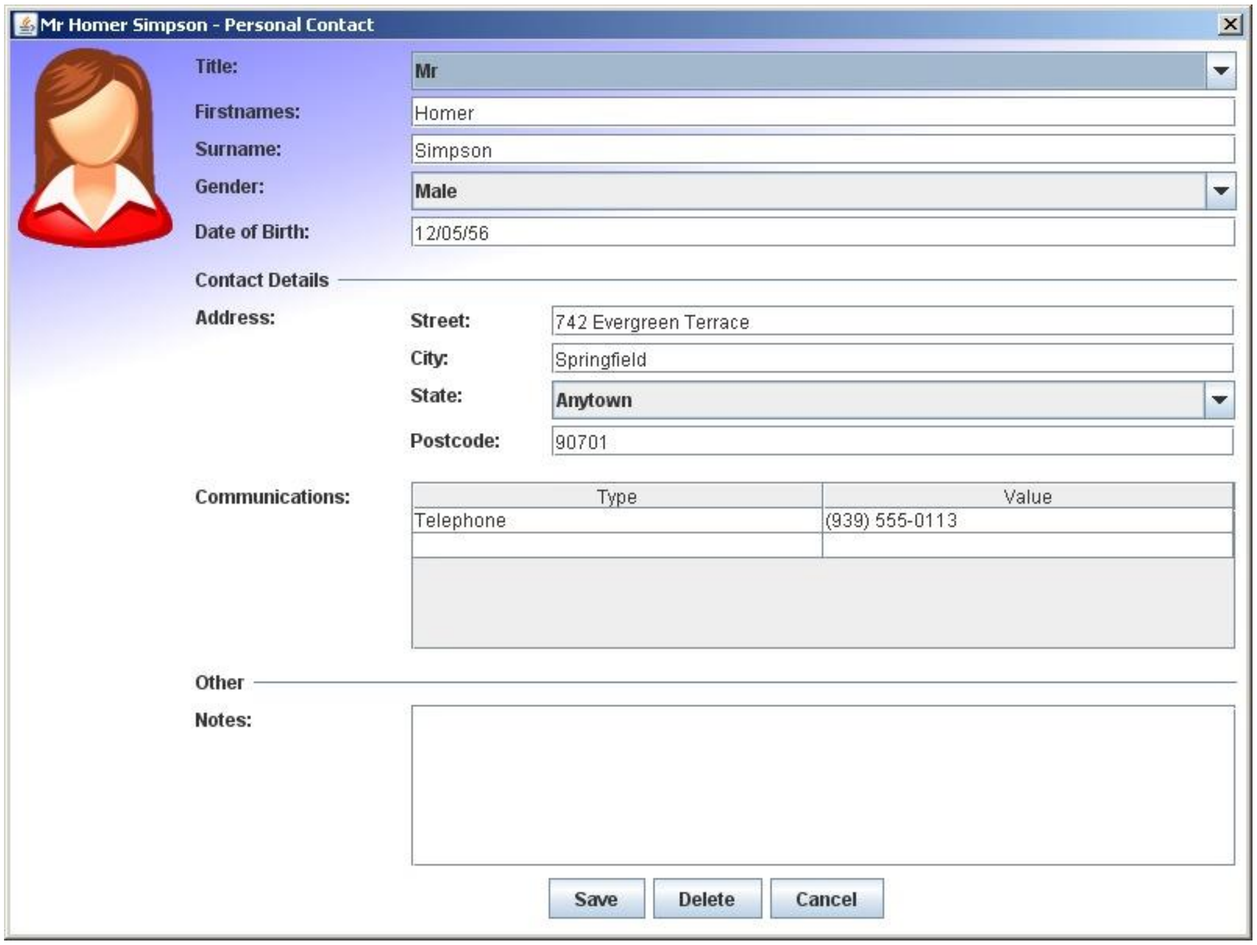


Business Contact

Title:	Mr *
Firstname:	Charles Montgomery *
Surname:	Burns *
Company:	
Gender:	Male

Number of Staff:	19
Notes:	Small business. Chief Executive Officer

Figure 2-Add Business Contact



Title:	Mr
Firstnames:	Homer
Surname:	Simpson
Gender:	Male
Date of Birth:	12/05/56

Contact Details

Address:

Street:	742 Evergreen Terrace
City:	Springfield
State:	Anytown
Postcode:	90701

Communications:

Type	Value
Telephone	(939) 555-0113

Other

Notes:

Figure 3-Add Personal Contact

2. Create connections between all three screens using controller event handler. For Example clicking Add Personal Contact on Home screen should open the screen as given in Figure 3 and clicking Add Business Contact on Home screen should open the screen as given in Figure 2.