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JavaFX – a Crash Course

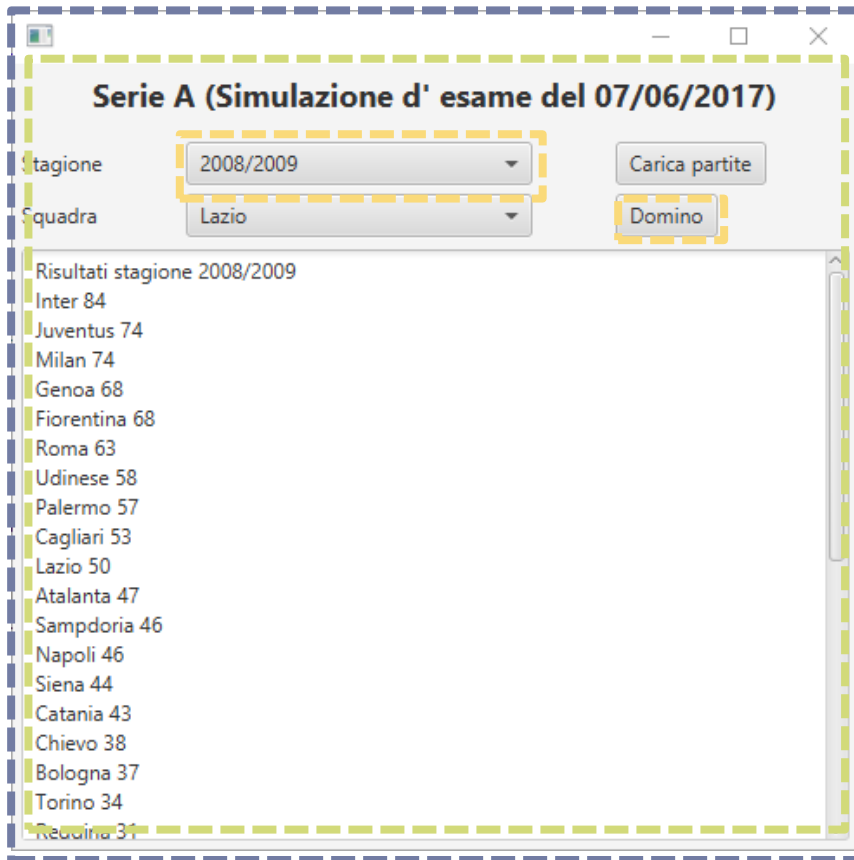
Tecniche di Programmazione – A.A. 2018/2019



JavaFX applications

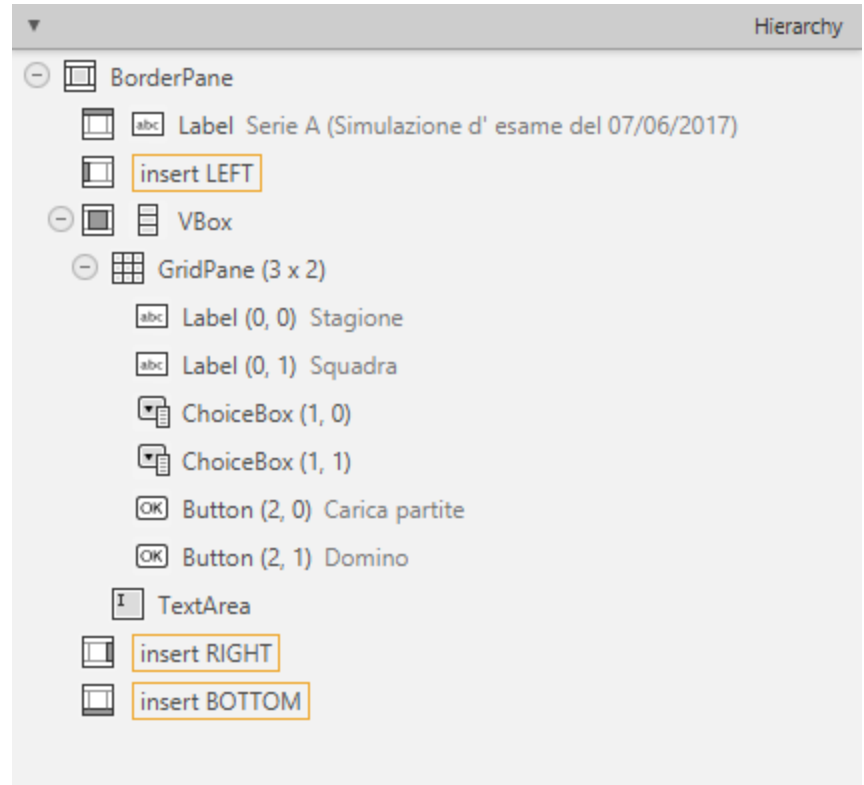


Application structure

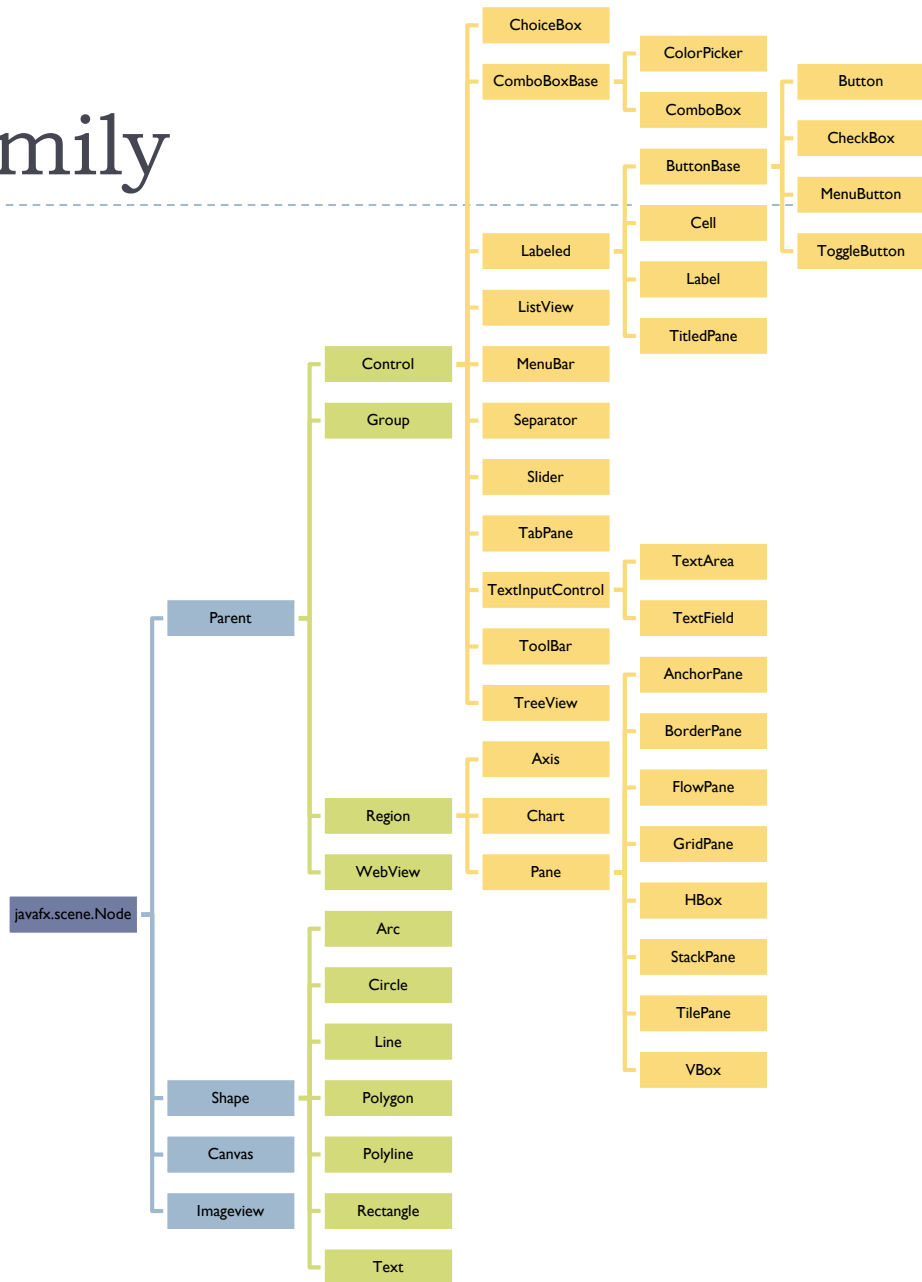


- ▶ **Stage:** where the application will be displayed (e.g., a Windows' window)
- ▶ **Scene:** one container of Nodes that compose one "page" of your application
- ▶ **Node:** an element in the Scene, with a visual appearance and an interactive behavior.
 - ▶ Nodes may be hierarchically nested

Nested nodes



Nodes family



Focus on
Panels
and
Controls

Essential Reference

▶ JavaFX JavaDoc API

▶ <http://docs.oracle.com/javase/8/javafx/api/>

▶ JavaFX Class Diagrams

▶ <http://falkhausen.de/JavaFX-8/index.html>

Package	Description
javafx.animation	Provides the set of classes for ease of use transition based animations.
javafx.application	Provides the application life-cycle classes.
javafx.beans	The package javafx.beans contains the interfaces that define the most generic form of observability.
javafx.beans.binding	Characteristics of Bindings
javafx.beans.property	The package javafx.beans.property defines read-only properties and writable properties, plus a number of implementations.
javafx.beans.property.adapter	
javafx.beans.value	The package javafx.beans.value contains the two fundamental interfaces ObservableValue and WritableValue and all of its sub-interfaces.
javafx.collections	Contains the essential JavaFX collections and collection utilities
javafx.collections.transformation	
javafx.concurrent	Provides the set of classes for javafx task.
javafx.css	Provides API for making properties styleable via CSS and for supporting pseudo-class state.
javafx.embed.swing	Provides the set of classes to use JavaFX inside Swing applications.
javafx.embed.swt	Provides the set of classes to use JavaFX inside SWT applications.
javafx.event	Provides basic framework for FX events, their delivery and handling.
javafx.fxml	Contains classes for loading an object hierarchy from markup.
javafx.geometry	Provides the set of 2D classes for defining and performing operations on objects related to two-dimensional geometry.
javafx.print	Provides the public classes for the JavaFX Printing API
javafx.scene	Provides the core set of base classes for the JavaFX Scene Graph API.
javafx.scene.canvas	Provides the set of classes for canvas, an immediate mode style of rendering API.
javafx.scene.chart	The JavaFX User Interface provides a set of chart components that are a very convenient way for data visualization.
javafx.scene.control	The JavaFX User Interface Controls (UI Controls or just Controls) are specialized Nodes in the JavaFX Scenegraph especially suited for reuse in many different application contexts.
javafx.scene.control.cell	The javafx.scene.control.cell package is where all cell-related classes are located, other than the core

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- cell
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- Choice, Combo
- Container
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- FocusModel
- Labeled
- ListView
- Menu
- Progress, Slider, Separator
- Scrolling
- SelectionModel
- Spinner
- TableView
- TableColumn
- TableView
- TextInputControl
- Tree
- TreeTable

Example application structure

```
1 package it.polito.tdp.seriea;
2
3 import it.polito.tdp.seriea.model.Model;
4 import javafx.application.Application;
5 import javafx.stage.Stage;
6 import javafx.scene.Scene;
7 import javafx.scene.layout.BorderPane;
8 import javafx.fxml.FXMLLoader;
9
10
11 public class Main extends Application {
12     @Override
13     public void start(Stage primaryStage) {
14         try {
15             FXMLLoader loader = new FXMLLoader(getClass().getResource("SerieA.fxml"));
16             BorderPane root = (BorderPane)loader.load();
17             Scene scene = new Scene(root);
18
19             SerieAController controller = loader.getController();
20             Model model = new Model();
21             controller.setModel(model);
22
23             scene.getStylesheets().add(getClass().getResource("application.css").toExternalForm());
24             primaryStage.setScene(scene);
25             primaryStage.show();
26
27         } catch (Exception e) {
28             e.printStackTrace();
29         }
30     }
31
32     public static void main(String[] args) {
33         Launch(args);
34     }
35 }
36
```

Extend
javafx.application.Application

Load scene nodes
from XML file

Define algorithms
and data

Populate and show
window

main()

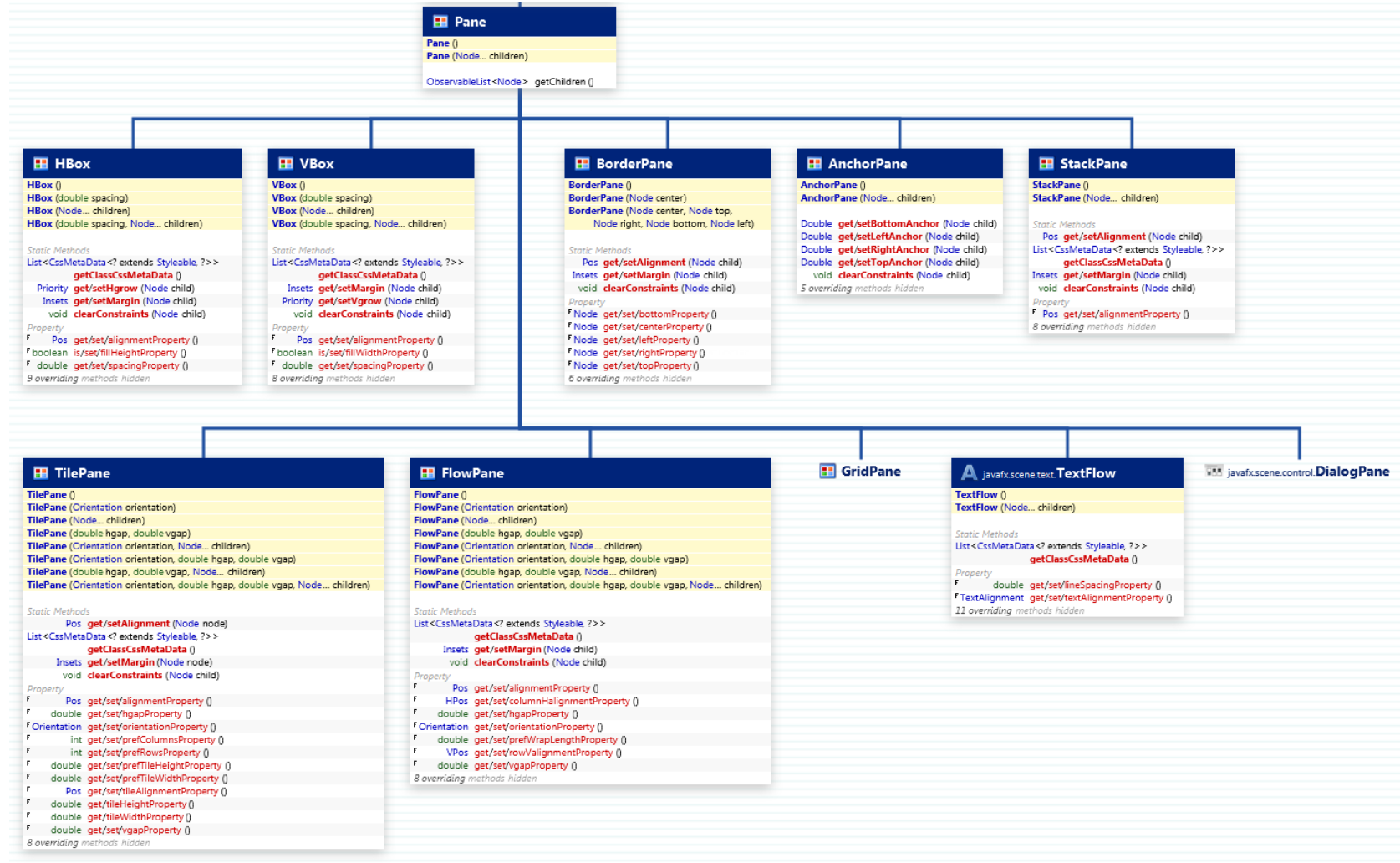
General rules

- ▶ A JavaFX application extends `javafx.application.Application`
- ▶ The `main()` method should call `Application.launch()`
- ▶ The `start()` method is the main entry point for all JavaFX applications
 - ▶ Called with a Stage connected to the Operating System's window
- ▶ The content of the scene is represented as a hierarchical scene graph of Nodes
 - ▶ Stage is the top-level JavaFX container
 - ▶ Scene is the container for all content

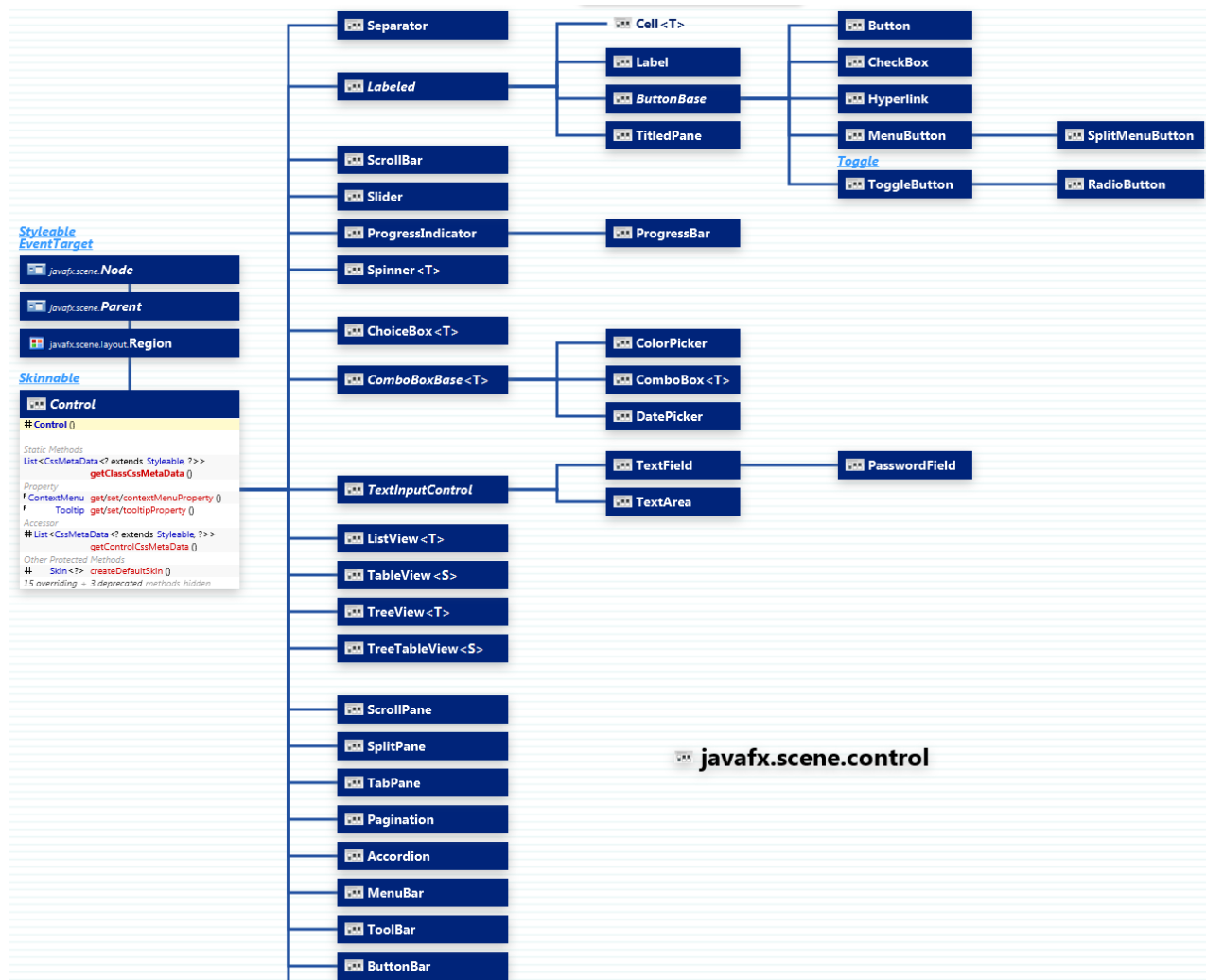
Nodes

- ▶ **The Scene is populated with a tree of Nodes**
 - ▶ Layout components (Panels)
 - ▶ UI Controls
 - ▶ Charts
 - ▶ Shapes
- ▶ **Nodes have Properties**
 - ▶ Visual (size, position, z-order, color, ...)
 - ▶ Contents (text, value, data sets, ...)
 - ▶ Programming (event handlers, controller)
- ▶ **Nodes generate Events**
 - ▶ UI events
- ▶ **Nodes can be styled with CSS**

Panes

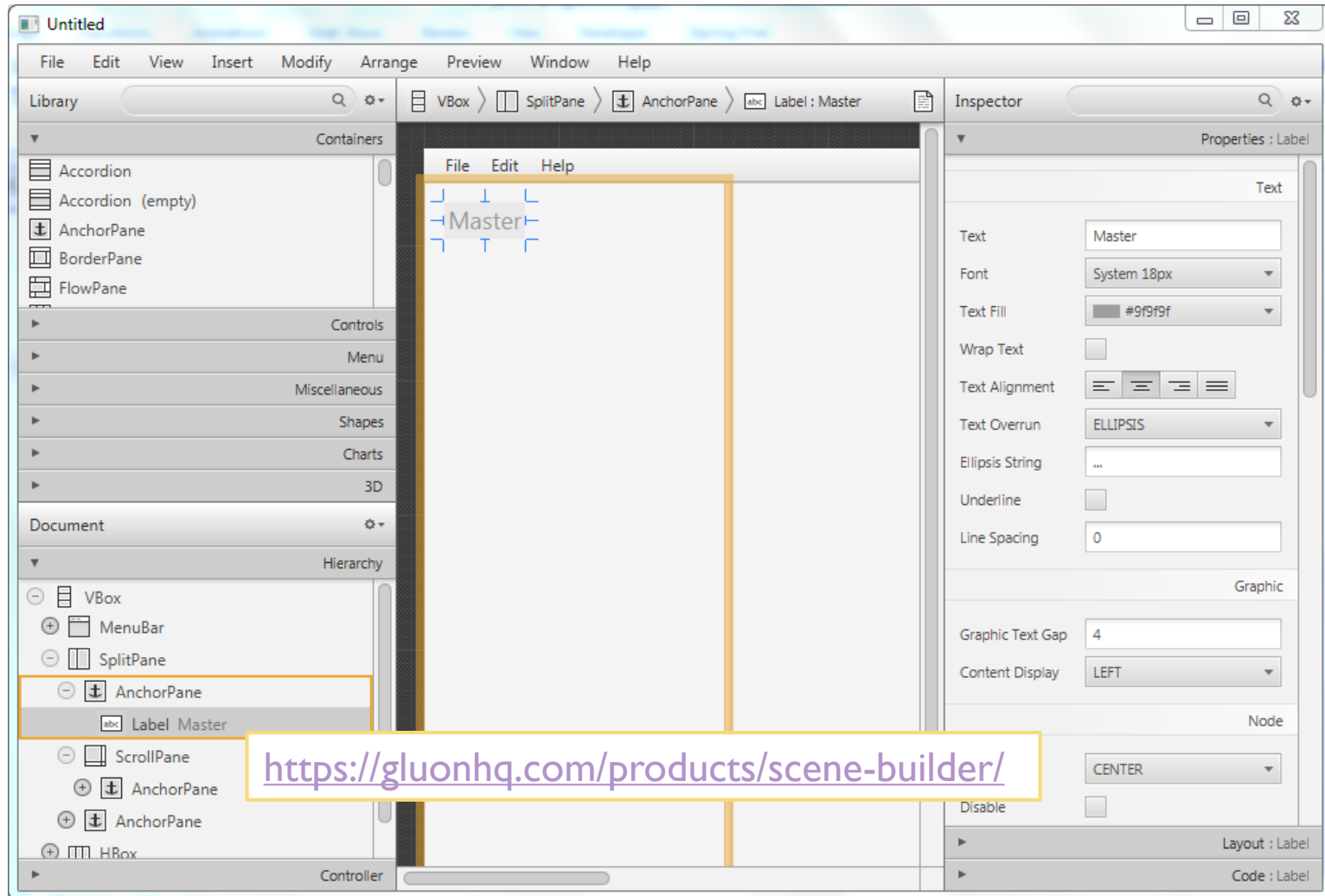


Controls





JavaFX Scene Builder 8.5



Building a scene from FXML

```
public void start(Stage stage) throws Exception {  
    Parent root = FXMLLoader.Load(  
        getClass().getResource("circle.fxml"));  
  
    stage.setTitle("Circle Demo");  
    stage.setScene(new Scene(root));  
    stage.show();  
}
```

Key concepts in JavaFX

- ▶ **Property:** attributes of the Nodes, may specify content, size, color, ... Can be read and written by the application
- ▶ **Event:** every user action on one element of the GUI generates a different *event*. Events can be captured and *handled* by our code
- ▶ **Controller:** the Java class that contains
 - ▶ References to interesting Nodes
 - ▶ Event Handlers

Properties

- ▶ Extension of the Java Beans convention
 - ▶ May be used also outside JavaFX
- ▶ Encapsulate properties of an object
 - ▶ Different types (string, number, object, collection, ...)
 - ▶ Set/Get
 - ▶ Observe changes
 - ▶ Support lazy evaluation
- ▶ Each Node has a large set of Properties
 - ▶ Can be manipulated
 - ▶ The scene updates

Properties	
Type	Property and Description
BooleanProperty	cancelButton A Cancel Button is the button that receives a keyboard VK_ESC press, if no other node in the scene
BooleanProperty	defaultButton A default Button is the button that receives a keyboard VK_ENTER press, if no other node in the scene

Properties inherited from class <code>javafx.scene.control.ButtonBase</code>
armed, onAction

Properties inherited from class <code>javafx.scene.control.Labeled</code>
alignment, contentDisplay, ellipsisString, font, graphic, graphicTextGap, labelPadding, mnemonicParsing, textFill, textOverrun, text, underline, wrapText

Properties inherited from class <code>javafx.scene.control.Control</code>
contextMenu, height, maxHeight, maxWidth, minHeight, minWidth, prefHeight, prefWidth, skinClassName, skin, t

Properties inherited from class <code>javafx.scene.Parent</code>
needsLayout

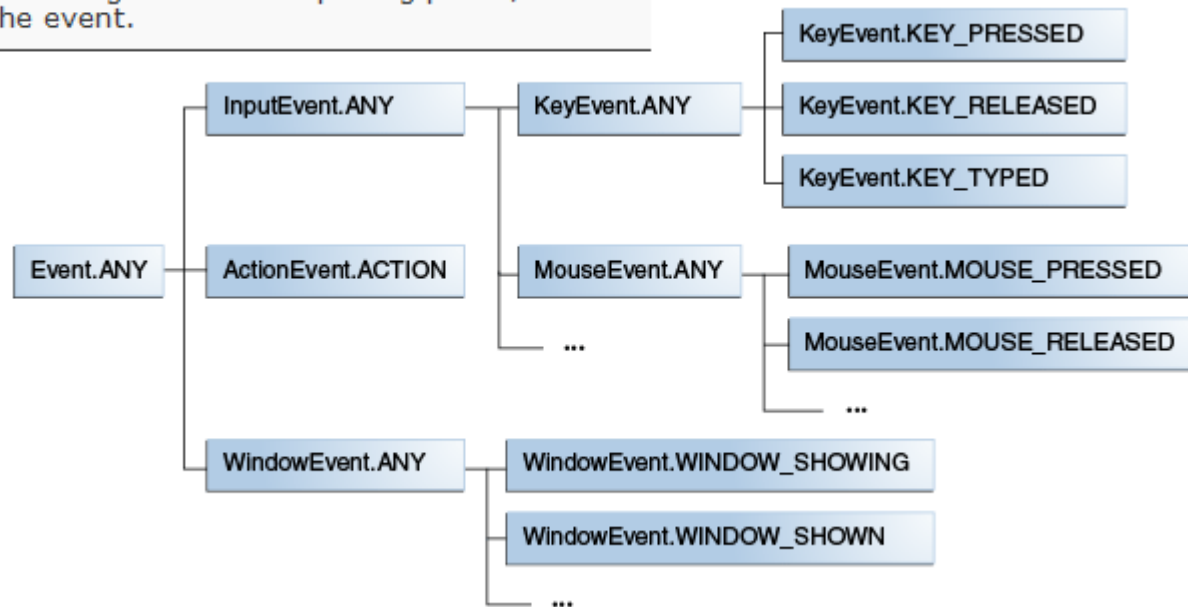
Properties inherited from class <code>javafx.scene.Node</code>
blendMode, boundsInLocal, boundsInParent, cacheHint, cache, clip, cursor, depthTest, disabled, disable, effe eventDispatcher, focused, focusTraversable, hover, id, inputMethodRequests, layoutBounds, layoutX, layoutY, localToParentTransform, localToSceneTransform, managed, mouseTransparent, onContextMenuRequested, onDragDete onDragDone, onDragDropped, onDragEntered, onDragExited, onDragOver, onInputMethodTextChanged, onKeyPressed, onKeyTyped, onMouseClicked, onMouseDragEntered, onMouseDragExited, onMouseDragged, onMouseDragOver, onMouseD onMouseEntered, onMouseExited, onMouseMoved, onMousePressed, onMouseReleased, onRotate, onRotationFinished, onRotationStarted, onScrollFinished, onScroll, onScrollStarted, onSwipeDown, onSwipeLeft, onSwipeRight, onSw onTouchMoved, onTouchPressed, onTouchReleased, onTouchStationary, onZoomFinished, onZoom, onZoomStarted, opa pickOnBounds, pressed, rotate, rotationAxis, scaleX, scaleY, scaleZ, scene, style, translateX, translateY, t visible

Events

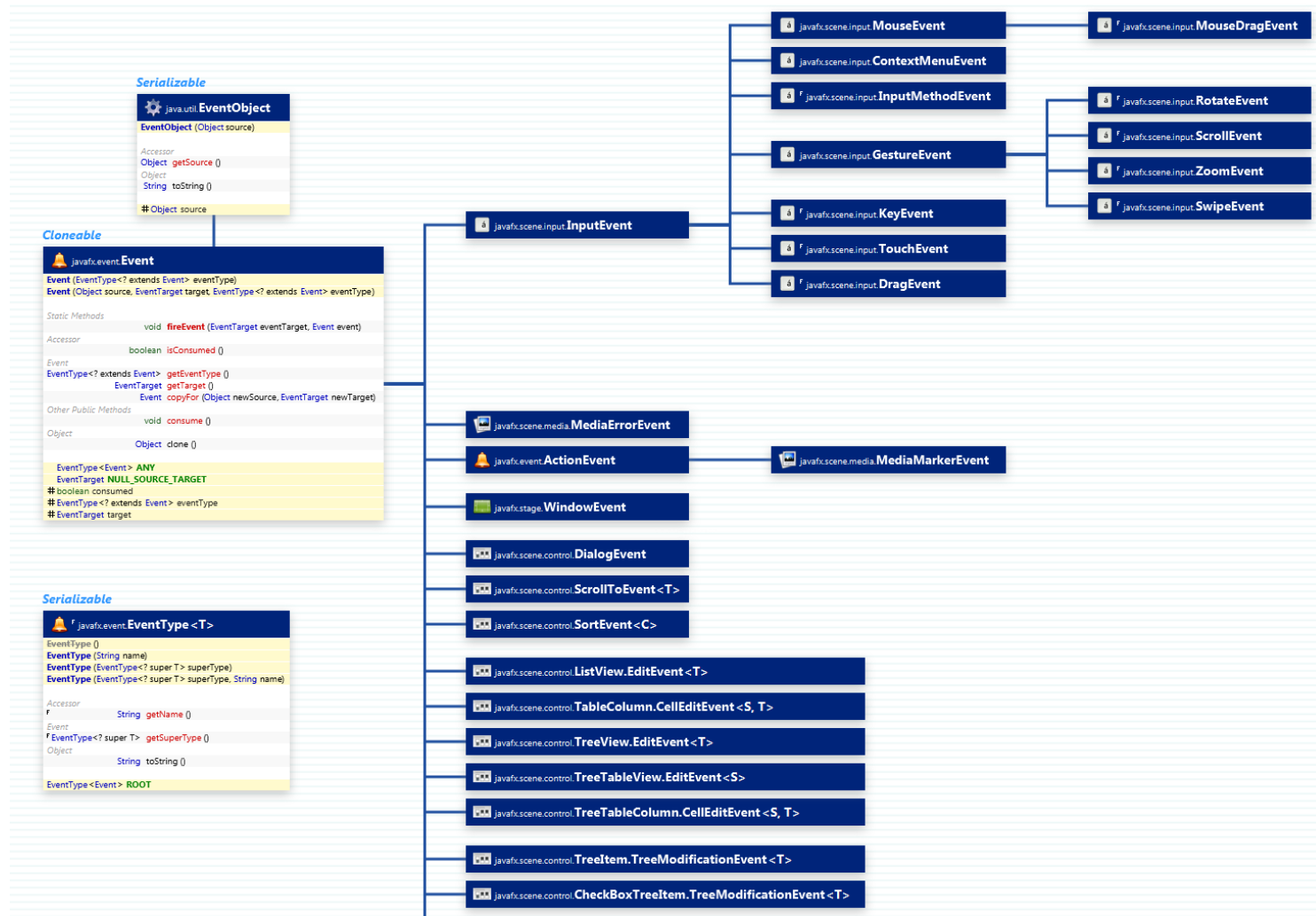
- ▶ **FX Event (javafx.event.Event):**
 - ▶ Event Source => a Node
 - ▶ Event Target
 - ▶ Event Type
- ▶ Usually generated after some user action
- ▶ Event Types
- ▶ You can define **event handlers** in your application

What is an event?

Property	Description
Event type	Type of event that occurred.
Source	Origin of the event, with respect to the location of the event in the event dispatch chain. The source changes as the event is passed along the chain.
Target	Node on which the action occurred and the end node in the event dispatch chain. The target does not change, however if an event filter consumes the event during the event capturing phase, the target will not receive the event.

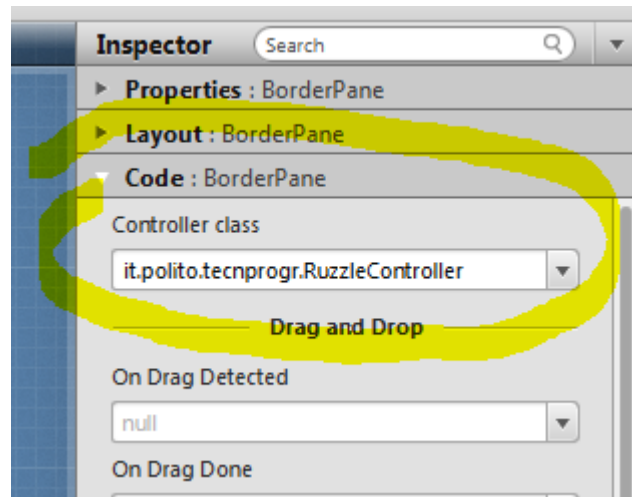


Event types



Defining a Controller class

- ▶ The Root element of the scene graph may specify a **fx:controller** attribute
 - ▶ `<BorderPane`
`id="BorderPane"`
`xmlns:fx="http://javafx.com/fxml"`
`fx:controller="it.polito.tdp.RuzzleController">`



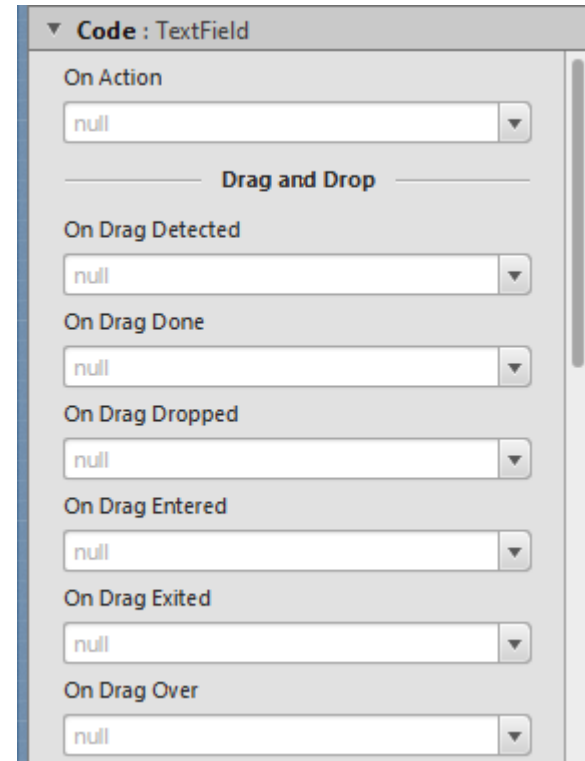
Injection of Node references

- ▶ The controller code may directly access various Nodes in the associated scene graph
- ▶ The attribute `@FXML` associates a Node variable with the corresponding node, with the same `fx:id` value as the variable name
- ▶ Try: View | Show Sample Controller Skeleton on the Scene Builder!

```
@FXML // fx:id="theTitle"  
    private Label theTitle;
```

Registration of Event Handlers

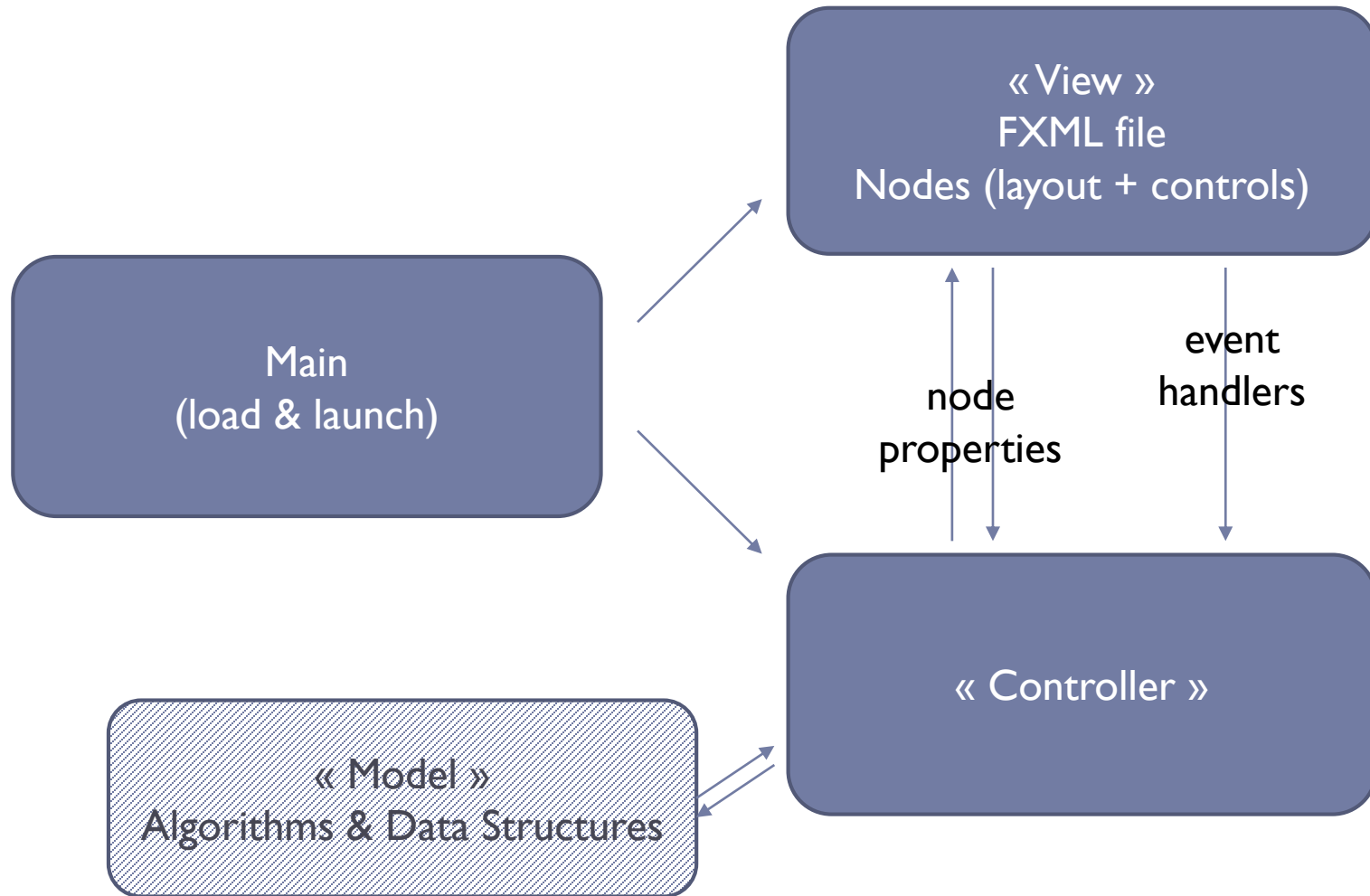
- ▶ In FXML, you may set a event handler through attributes
 - ▶ `onAction`, `onKeyTyped`, `onMouseClicked`, ... hundreds more ...
- ▶ The value should be the `#name` of a method in the controller class
 - ▶ With the right signature for the event type



```
<Button fx:id="cercaBtn"  
onAction="#doCercaParola"  
text="Cerca" />
```






```
@FXML  
void doCercaParola (  
ActionEvent event ) {
```

Minimal program structure



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