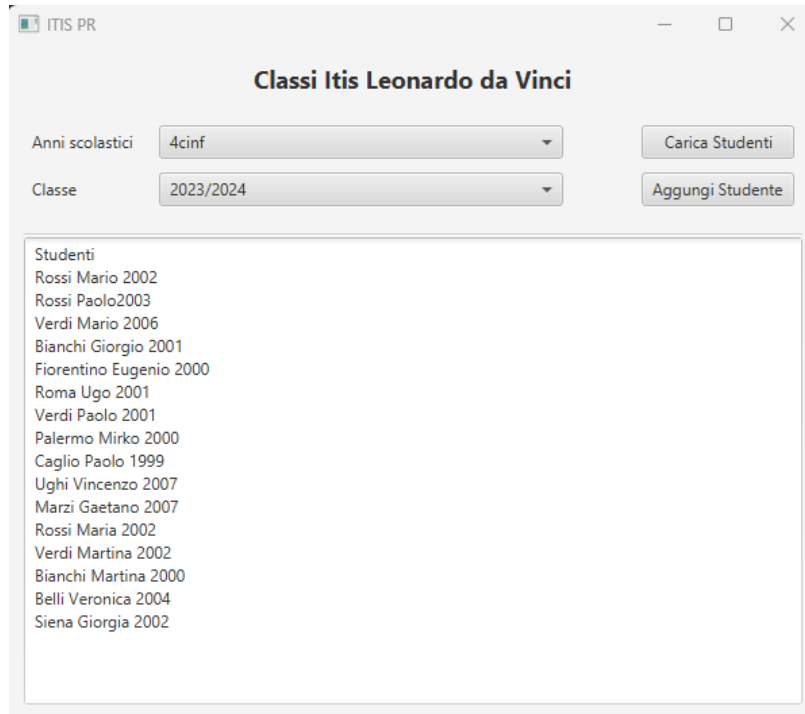


JavaFX applications

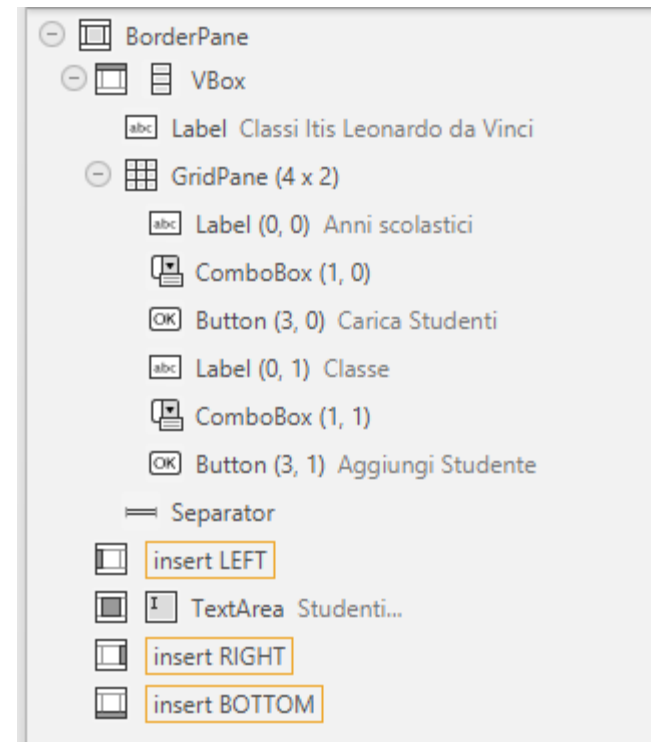


Application structure

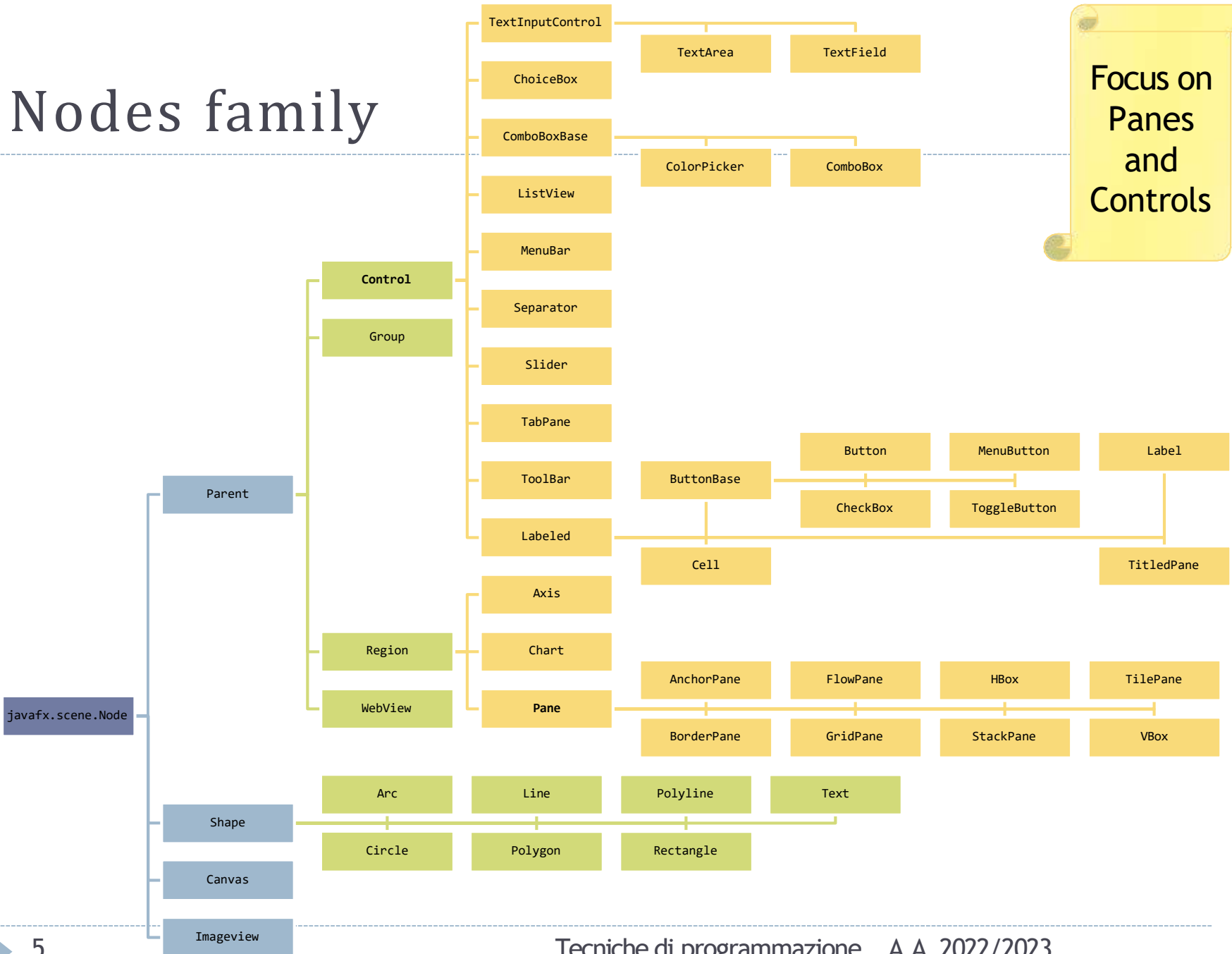


- ▶ **Stage**: where the application will be displayed (e.g., a Windows' window)
- ▶ **Scene**: one container of Nodes that compose one “page” of your application
- ▶ **Node**: an element in the Scene, with a visual appearance and an interactive behavior.
 - ▶ Nodes may be hierarchically nested

Nested nodes



Nodes family



Essential Reference

► JavaFX JavaDoc API

► <https://openjfx.io/javado/c/11/>

► JavaFX Class Diagrams

► <http://falkhausen.de/JavaFX-10/index.html>



The screenshot shows the JavaFX JavaDoc API website. The top navigation bar includes links for Overview, Modules, Package, Class, Use, Tree, Deprecated, Index, and Help. The main content area is titled "Modules" and contains a table with the following information:

| Module | Description |
|-----------------|--|
| javafx.base | Defines the base APIs for the JavaFX UI toolkit, including APIs for bindings, properties, collections, and events. |
| javafx.controls | Defines the UI controls, charts, and skins that are available for the JavaFX UI toolkit. |
| javafx.fxml | Defines the FXML APIs for the JavaFX UI toolkit. |
| javafx.graphics | Defines the core scenegraph APIs for the JavaFX UI toolkit (such as layout containers, application lifecycle, shapes, transformations, canvas, input, painting, image handling, and effects), as well as APIs for animation, concurrency, geometry, printing, and windowing. |
| javafx.media | Defines APIs for playback of media and audio content, as part of the JavaFX UI toolkit, including MediaPlayer and MediaView. |
| javafx.swing | Defines APIs for the JavaFX / Swing interoperability support included with the JavaFX UI toolkit, including SwingNode (for embedding Swing inside a JavaFX application) and JFXNode (for embedding JavaFX inside a Swing application). |
| javafx.web | Defines APIs for the WebView functionality contained within the JavaFX UI toolkit. |

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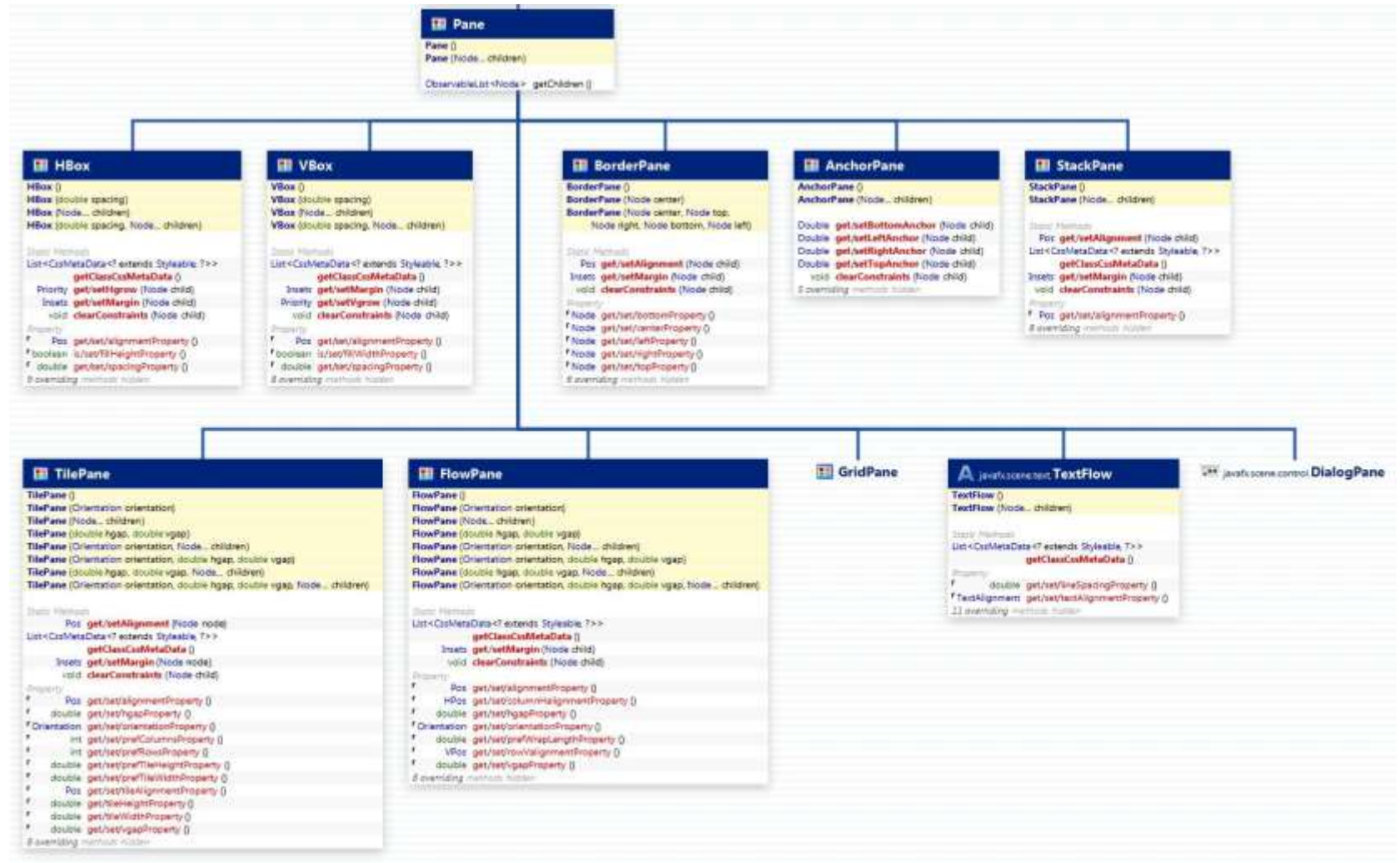
General rules

- ▶ 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

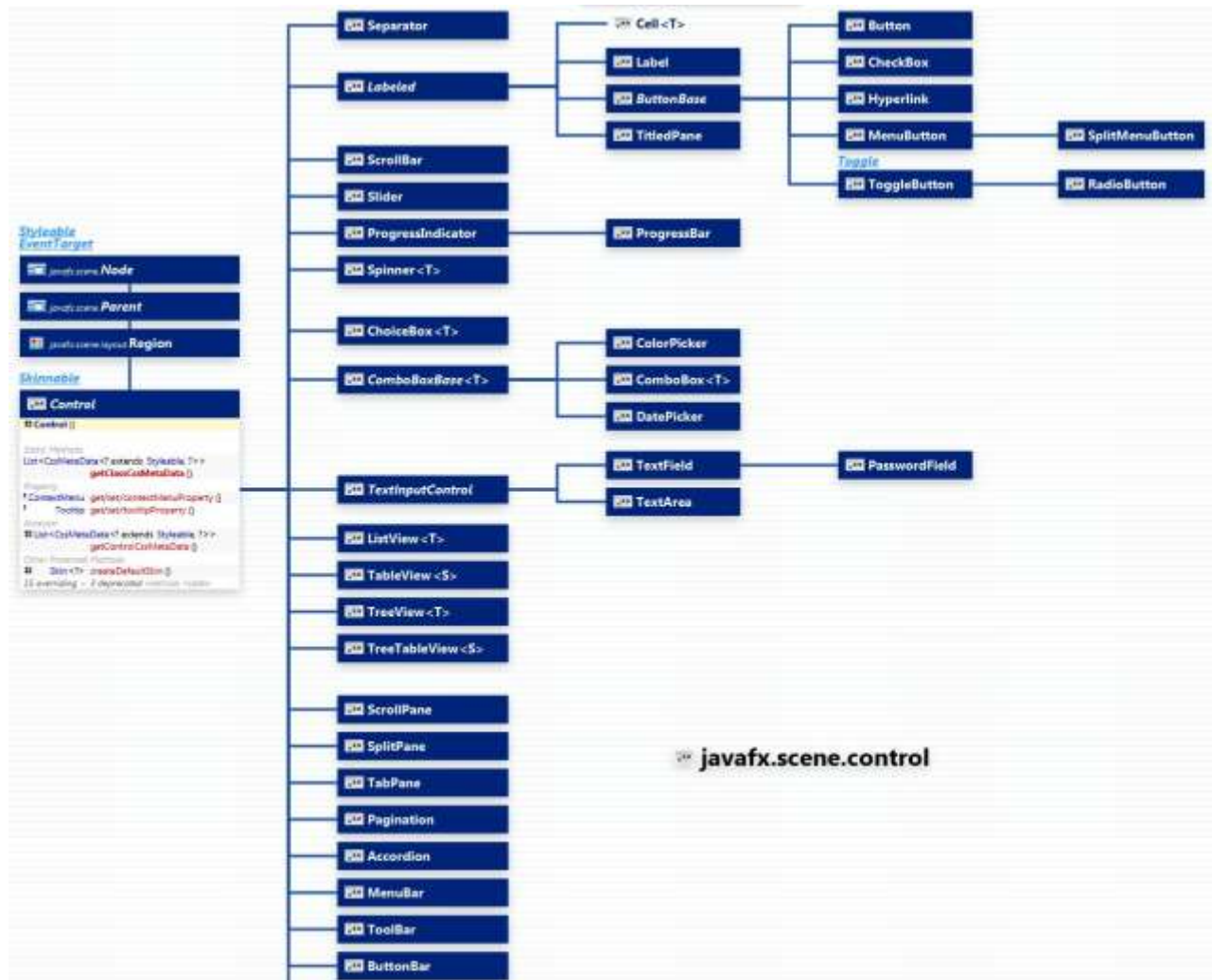
Nodes

- ▶ 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

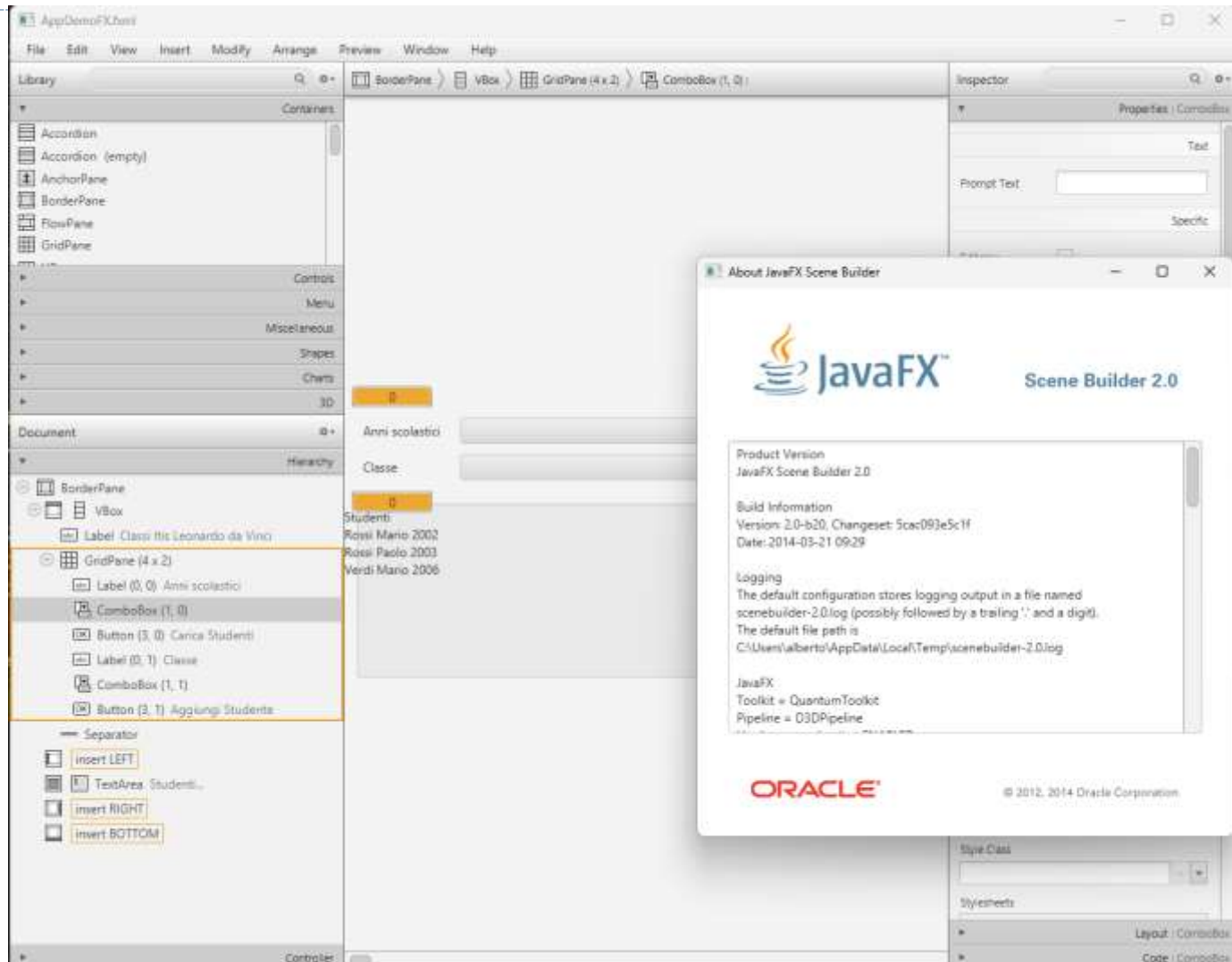
Panes



Controls



JavaFX Scene Builder 2.0 Oracle




Building a scene from FXML

```
public void start(Stage stage) throws Exception {  
    Parent root = FXMLLoader.load(  
        getClass().getResource("/fxml/Scene.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

| Property | |
|-----------------|--|
| Type | Property and Description |
| BooleanProperty | cancelButton |
| | A Cancel Button is the button that receives a keyboard VK_ESCAPE key. |
| BooleanProperty | defaultButton |
| | A default Button is the button that receives a keyboard VK_RETURN key. |

Properties inherited from class `javafx.scene.control.ButtonBase`

`armed`, `onAction`

Properties inherited from class `javafx.scene.control.Labeled`

`alignment`, `contentDisplay`, `ellipsisString`, `font`, `graphic`, `graphicTextGap`, `labelTextFill`, `textOverrun`, `text`, `underline`, `wrapText`

Properties inherited from class `javafx.scene.control.Control`

`contextMenu`, `height`, `maxHeight`, `maxWidth`, `minHeight`, `minWidth`, `prefHeight`, `prefWidth`

Properties inherited from class `javafx.scene.Parent`

`needsLayout`

Properties inherited from class `javafx.scene.Node`

`blendMode`, `boundsInLocal`, `boundsInParent`, `cacheHint`, `cache`, `clip`, `cursor`, `depthOrder`, `eventDispatcher`, `focused`, `focusTraversable`, `hover`, `id`, `inputMethodRequests`, `isLocalToParentTransform`, `localToSceneTransform`, `managed`, `mouseTransparent`, `onClickedDragDown`, `onDragDropped`, `onDragEntered`, `onDragExited`, `onDragOver`, `onInputMethodTextChanged`, `onMouseClicked`, `onMouseDragEntered`, `onMouseDragExited`, `onMouseEntered`, `onMouseExited`, `onMouseMoved`, `onMousePressed`, `onMouseReleased`, `onMouseClicked`, `onScrollFinished`, `onScroll`, `onScrollStarted`, `onSwipeDown`, `onSwipeUp`, `onTouchMoved`, `onTouchPressed`, `onTouchReleased`, `onTouchStationary`, `onTouchFinished`, `pickBounds`, `preferred`, `rotate`, `rotationAxis`, `scaleX`, `scaleY`, `scaleZ`, `scene`, `strokeWidth`
- ▶ Can be manipulated
- ▶ The scene updates

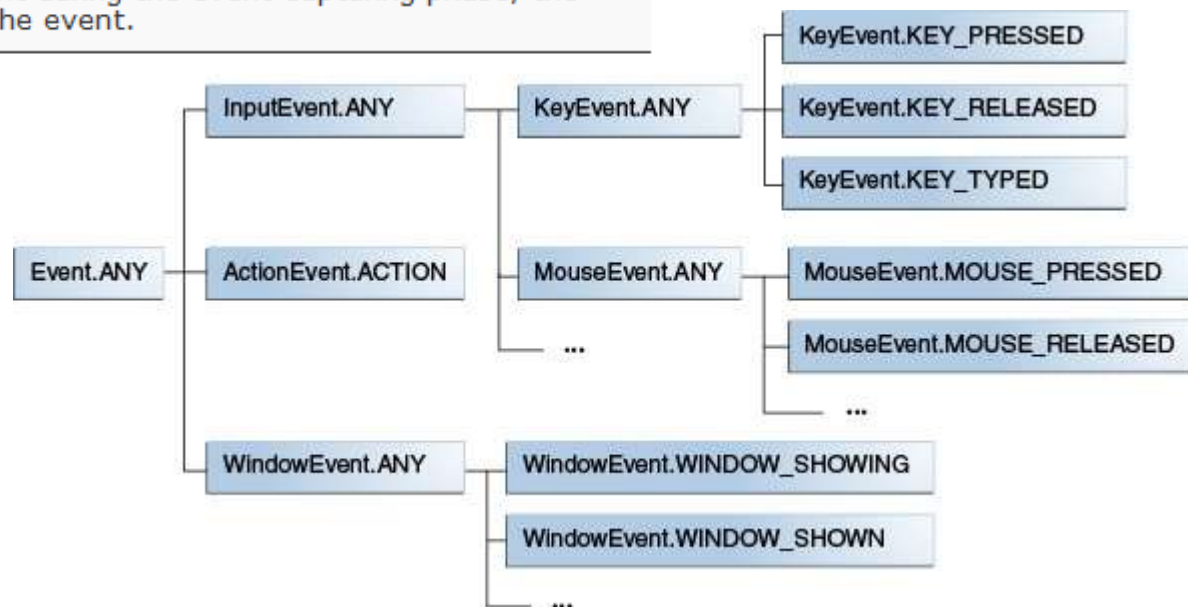
[illegible]

Events

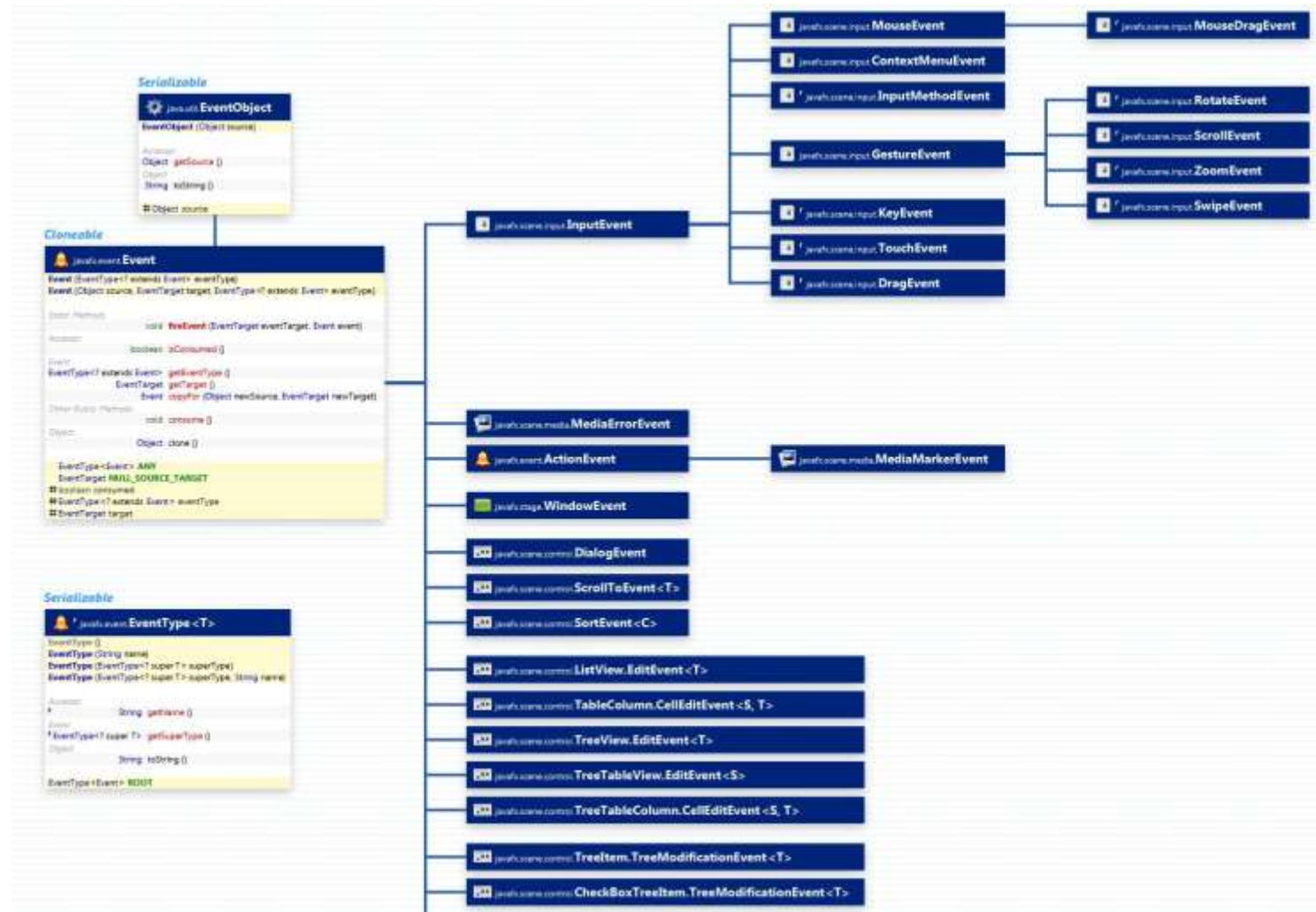
- ▶ FX Event (`javafx.event.Event`):
 - ▶ Event Source => a Node
 - ▶ Event Target
 - ▶ Event Type
- ▶ Usually generated after some user action
- ▶ Event Types
- ▶ You can define **event handlers** in your application

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.pr.itis.informatica.MioController">`

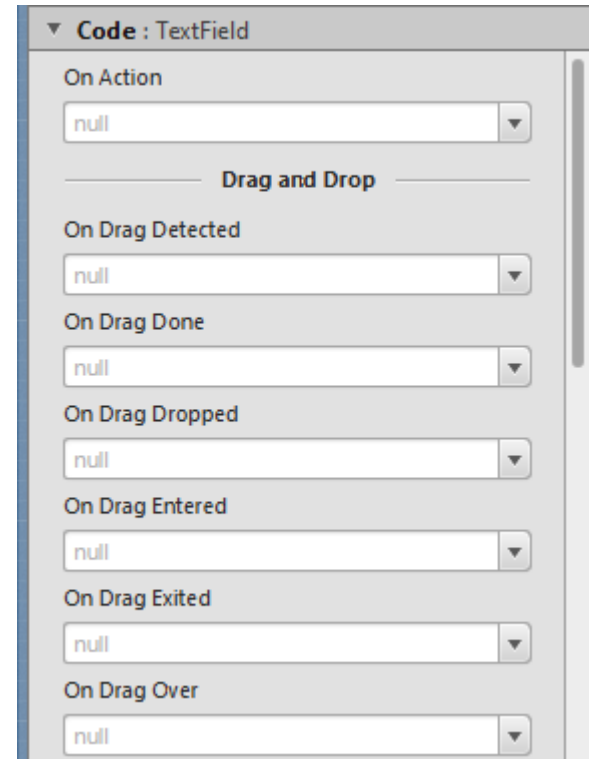
Injection of Node references

- ▶ 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 an 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

