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Academy

Java Foundations

9-1
Introduction to JavaFX

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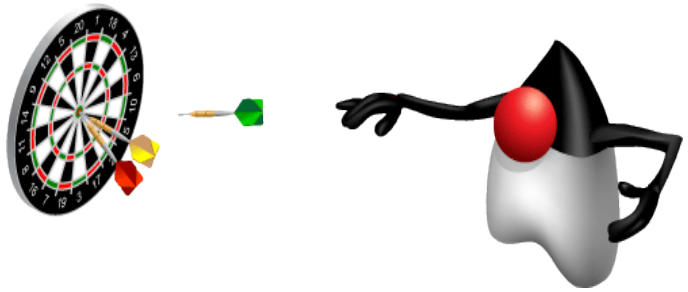
Objectives

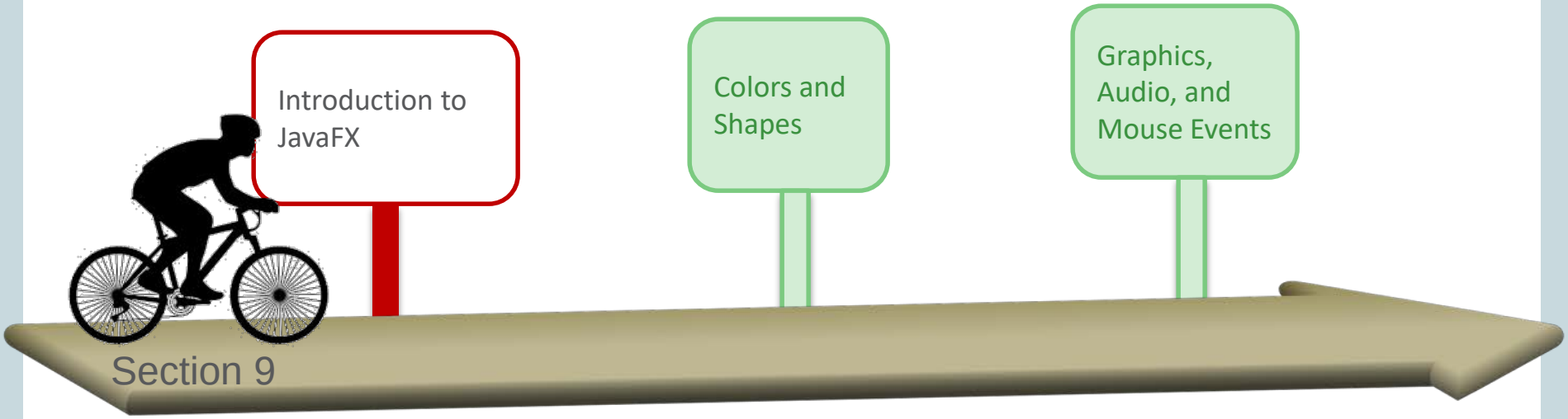
This lesson covers the following objectives:

- Create a JavaFX project
- Explain the components of the default JavaFX project
- Describe different types of Nodes and Panes
- Explain the Scene Graph, Root Node, Scenes, and Stages



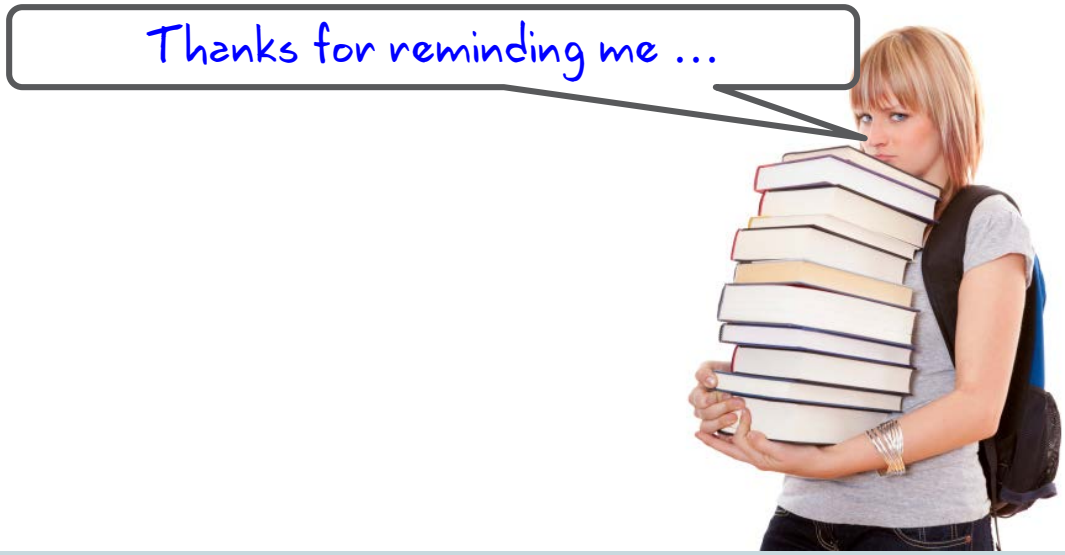
Topics

- Preview
- Creating a JavaFX Program
- The Root Node
- The Scene Graph, Scene, and Stage



It’s Almost Time for Final Exams!

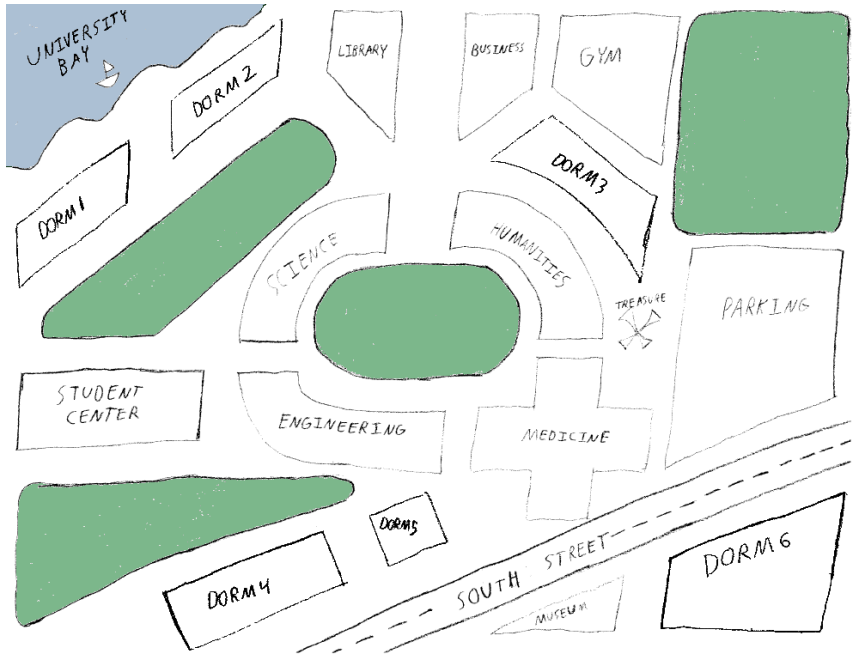
- It’s important to study.
- Do you like to study with friend?
  - But do your friends live in other dorms?
  - Where is the best place to meet your friends?
  - What is the most centrally located point on campus?



JavaFX Can Help

JavaFX is used to create GUI applications.

- GUI: Graphical user interface
- A GUI application allows us to see the answer on a map.



Exercise 1

- Run `CampusMap.jar`.
- Align each square with the correct dorm on the map.
- Estimate and adjust each dorm's population
  - Click and drag the text below each square.
- Observe changes in the following center points:
  - All students in all dorms
  - A study group of three friends living in Dorms 1, 2, and 4

But That's Not my Campus!

- You're right.
- It would be better if the program used your school's …
  - Map of campus
  - Dorm names
  - Dorm populations
  - And your group of friends
- That's this section's problem set. Section 9 discusses everything you'll need to re-create the program.

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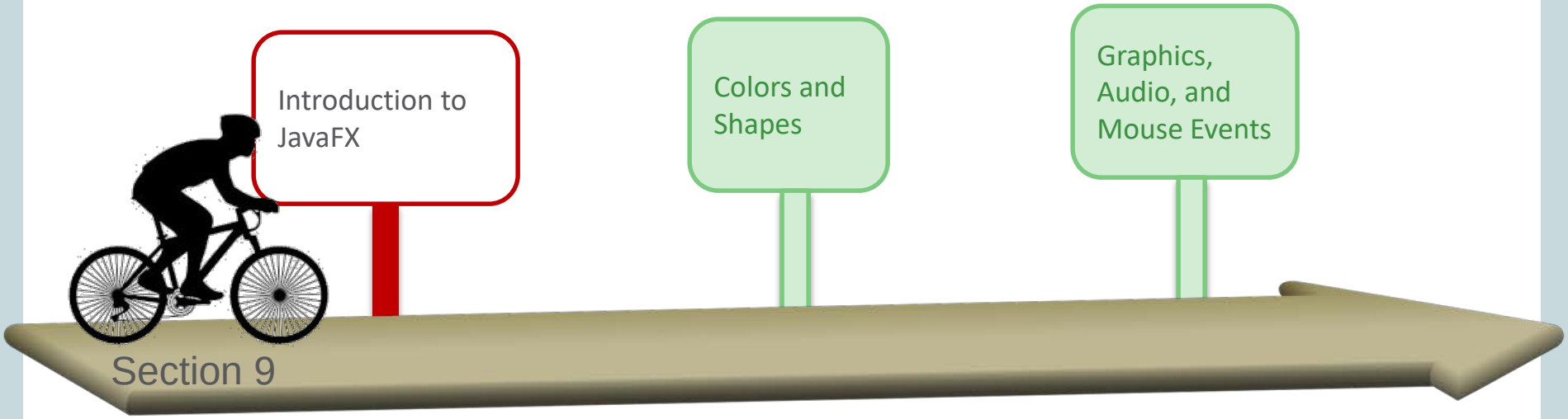

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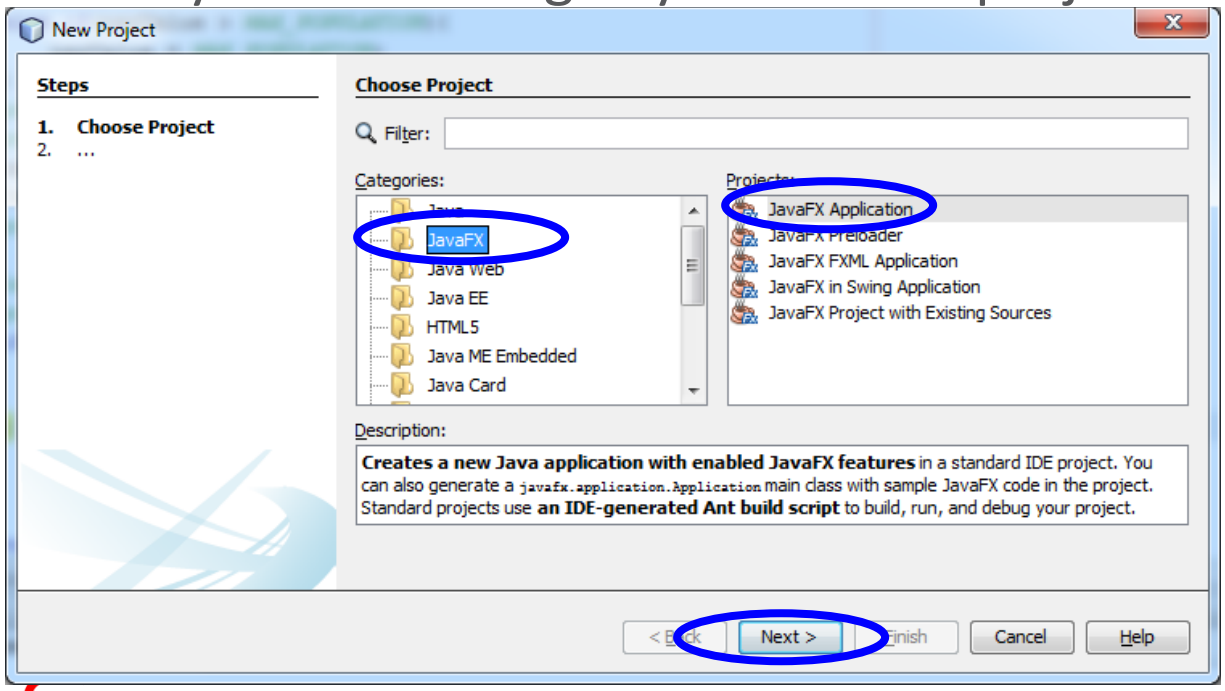
How to Create a JavaFX Program

1. In NetBeans, click the **New Project** button ( ).
2. Select **JavaFX** for Category and **JavaFX Application** for Project, and then click **Next**.
3. Continue like you're creating any other Java project.



Exercise 2

- Create a JavaFX project.
  - Java should provide you with a default program.

- Experiment with the program. Can you make these changes?
  - Change the button's label.
  - Change what's printed when the button is clicked.
  - Create another button and display both buttons.
  - Change the default size of the application's window.

The Default JavaFX Project

```
public class JavaFXTest extends Application {

    @Override
    public void start(Stage primaryStage) {
        Button btn = new Button();
        btn.setText("Say 'Hello World'");
        btn.setOnAction(new EventHandler<ActionEvent>() {

            @Override
            public void handle(ActionEvent event) {
                System.out.println("Hello World!");
            }
        });

        StackPane root = new StackPane();
        root.getChildren().add(btn);

        Scene scene = new Scene(root, 300, 250);

        primaryStage.setTitle("Hello World!");
        primaryStage.setScene(scene);
        primaryStage.show();
    }


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

Two Methods: `start()` and `main()`

- **`start()`** is the entry point for all JavaFX applications.
  - Think of it as the main method for JavaFX.

```
public void start(Stage primaryStage) {
    …
}
```

- **`main()`** is still required in your programs.
  - It launches the JavaFX application.

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

Buttons Are Objects

- `Buttons` are like any other object.
  - They can be instantiated.
  - They contain fields.
  - They contain methods.


```
public void start(Stage primaryStage) {
    Button btn = new Button();
    btn.setText("Say 'Hello World'");
    …
}
```

- From this code, we can tell …
  - `Buttons` contain a text field.
  - `Buttons` contain a method for changing the text field.

Buttons Are Nodes

- Some of these fields and methods are designed to store and manipulate **visual properties**:
  - `btn.getText()`
  - `btn.setMinHeight()`
  - `btn.setLayoutX()` `//set x position`
  - `btn.setLayoutY()` `//set y position`
  - `btn.isPressed()` `//is it pressed?`

- Objects like this are called JavaFX **Nodes**.

Nodes

- There are many types of JavaFX Nodes:

Button

Rectangle

PieChart

ScrollBar

Text

ImageView

- Visual objects you'll create will most likely …
  - Be a Node, or
  - Include a Node as a field

Node Interaction

- The following helps handle Button interaction:

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

- This is called an “anonymous inner class.”
  - Doesn’t the syntax look messy?
  - Java SE 8 **Lambda expressions** are an elegant alternative.
  - We’ll discuss Lambda expressions later in this section.

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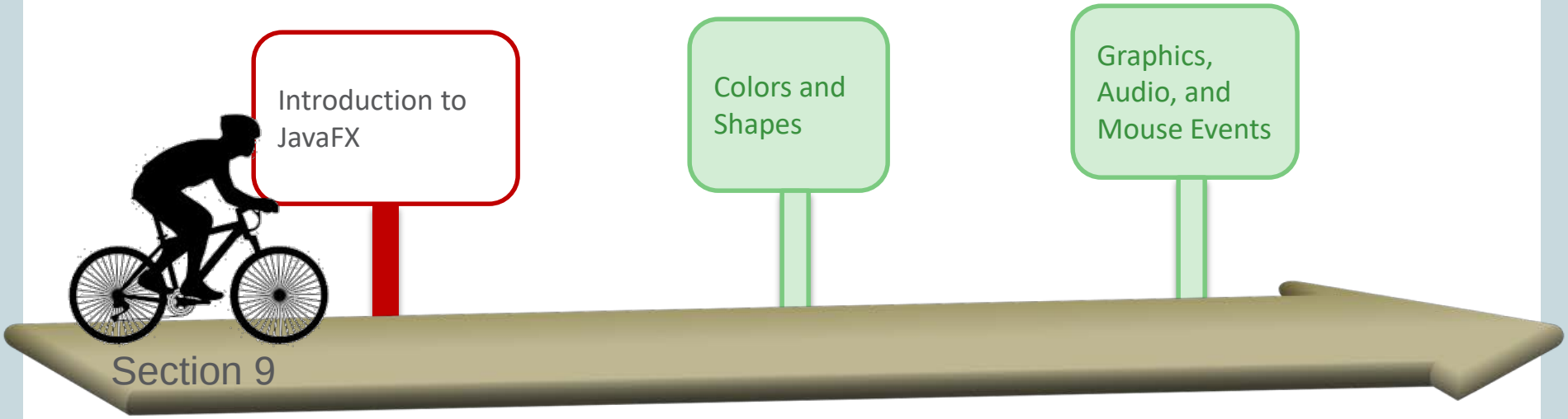


Creating Nodes

- Nodes are instantiated like any other Java object:

```
public void start(Stage primaryStage) {
    Button btn1 = new Button();
    Button btn2 = new Button();
    btn1.setText("Say 'Hello World'");
    btn2.setText("222");
    …
}
```

- After you instantiate a Node:
  - It exists and memory is allocated to store the object.
  - Its fields can be manipulated, and methods can be called.
  - But it might not be displayed …

Displaying Nodes

- There are a few steps to displaying a node.

```
public void start(Stage primaryStage) {
    Button btn1 = new Button();
    Button btn2 = new Button();
    btn.setText("Say 'Hello World'");
    btn.setText("222");

    StackPane root = new StackPane();
    root.getChildren().add(btn1);
    root.getChildren().add(btn2);
    …
}
```

- First, add each Node to the **Root Node**.
  - It's usually named root.
  - It's very much like an ArrayList of all Nodes.

Adding Nodes to the Root Node

- You could add each Node separately:

```
root.getChildren().add(btn1);
root.getChildren().add(btn2);
root.getChildren().add(btn3);
```

- Or you could add many Nodes at once:

```
root.getChildren().addAll(btn1, btn2, btn3);
```

- But don't add the same Node more than once.
  - This causes a compiler error:

```
root.getChildren().add(btn1);
root.getChildren().add(btn1);
```

StackPane Root Node

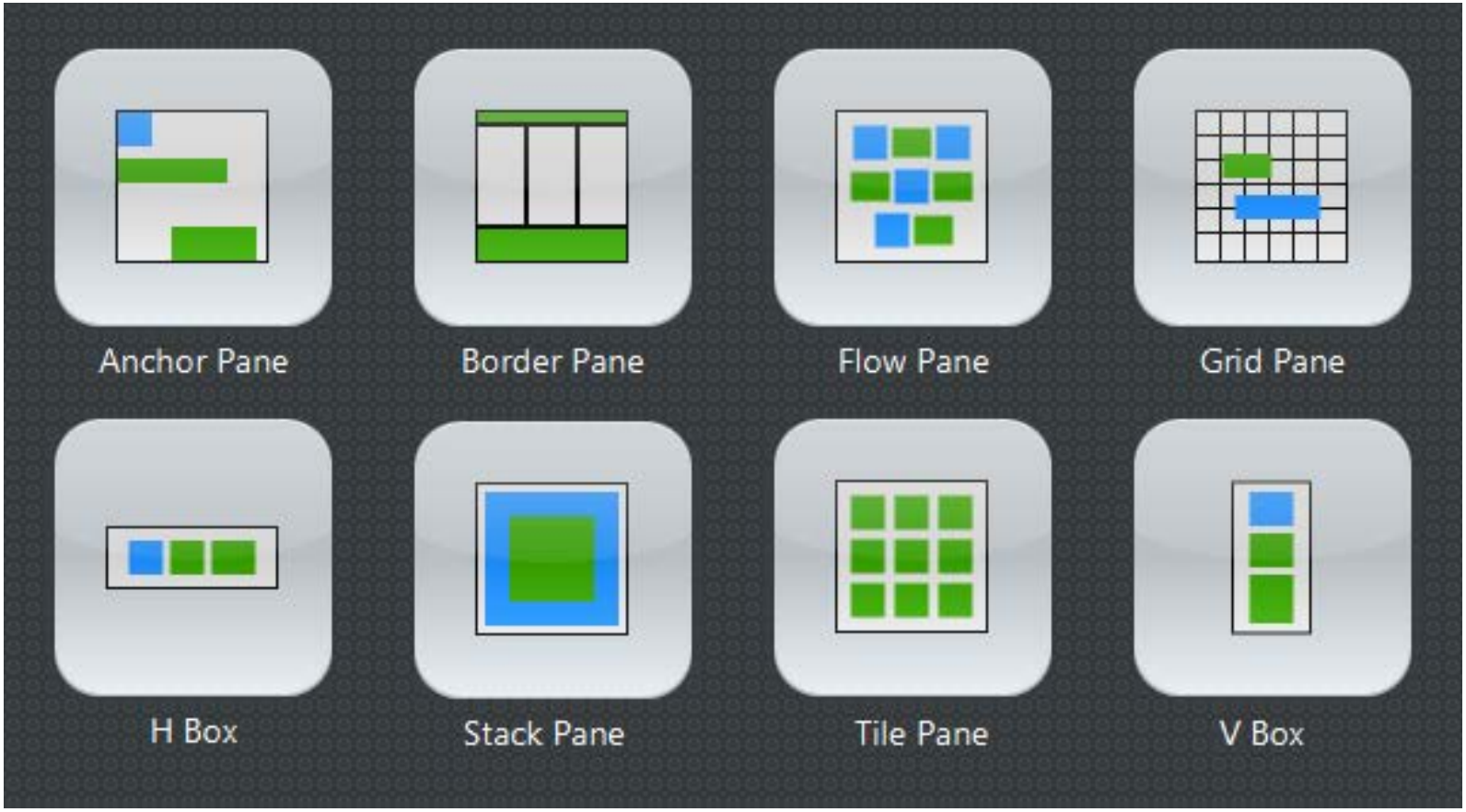
- The Root Node in this example is a `StackPane`.

```
StackPane root = new StackPane();
root.getChildren().addAll(btn1, btn2);
```

  - The `StackPane` stacks Nodes on top of each other.
  - But small buttons could become buried and unreachable.

Panes as Root Nodes

- Each **Pane** determines the layout of Nodes.



Programming Different Panes as Root Nodes

- It's easy to design the root node as a different pane.
- Just specify a different reference type and object type.

Change this

And this

```
StackPane root = new StackPane();
root.getChildren().addAll(btn1, btn2);
```

```
TilePane root = new TilePane();
root.getChildren().addAll(btn1, btn2);
```

```
VBox root = new VBox();
root.getChildren().addAll(btn1, btn2);
```

Exercise 3

- Edit your current JavaFX project.
  - We're going to do a little experimenting.
- After adding a button to the Root Node, try to change its position.
  - `btn1.setLayoutY(100);`
- Will a button's position change if the Root Node wasn't a StackPane? Try these alternatives:
  - `TilePane`
  - `VBox`
  - `Group`

Group Root Node

- A Group allows you to place Nodes anywhere.

```
Group root = new Group();
root.getChildren().addAll(btn1, btn2);
btn1.setLayoutY(100);
```

- A pane may restrict where Nodes are placed.
  - You couldn't move them even if you wanted to.
  - You couldn't click and drag a node that's locked in a pane.

```
StackPane root = new StackPane();
root.getChildren().addAll(btn1, btn2);
btn1.setLayoutY(100);                    //Has no effect
```

A Group Can Contain a Pane

- Panes are also Nodes.
  - Any node can be added to the Root Node.

- A Pane may be a good option for storing buttons, text input dialog boxes, and other GUI elements.
  - You can't quite move individual Nodes in a Pane.
  - But you can move the entire Pane in a `Group`. Move the Pane like you would any other Node.

Exercise 4

- Edit your current JavaFX project.
  - It's time for more experimenting.

- Can you figure out how to do the following?
  - Create an `HBox` pane and add several buttons to it.
  - Add the `HBox` pane to a `Group` Root Node.
  - Position the `HBox` near the bottom of the window.

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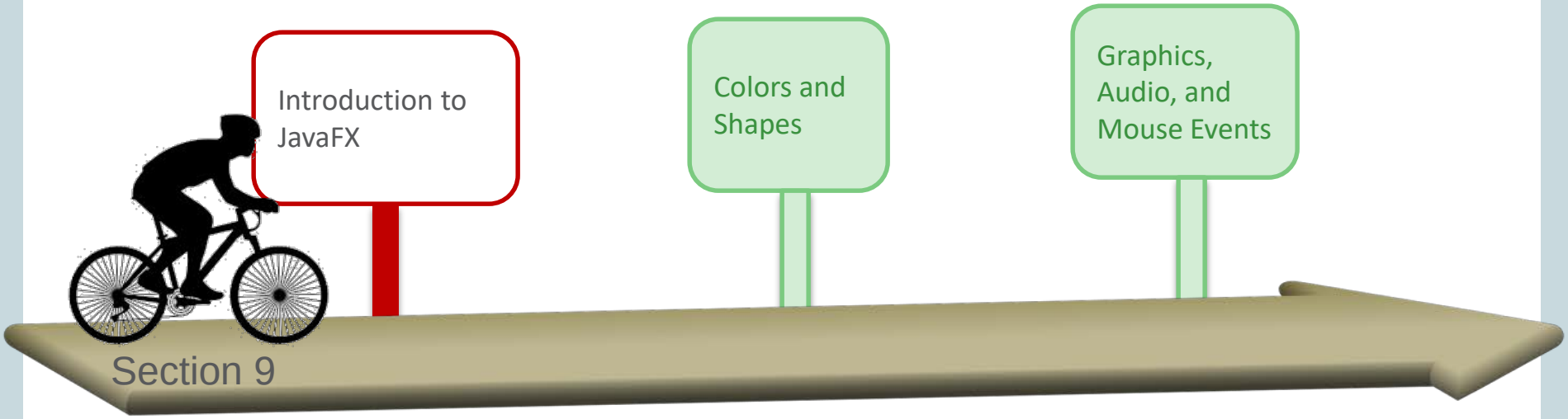
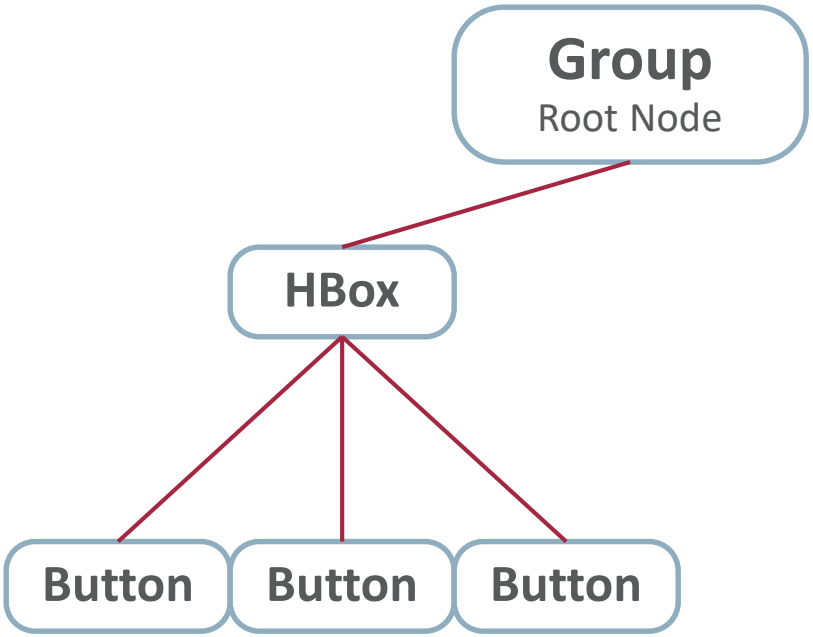
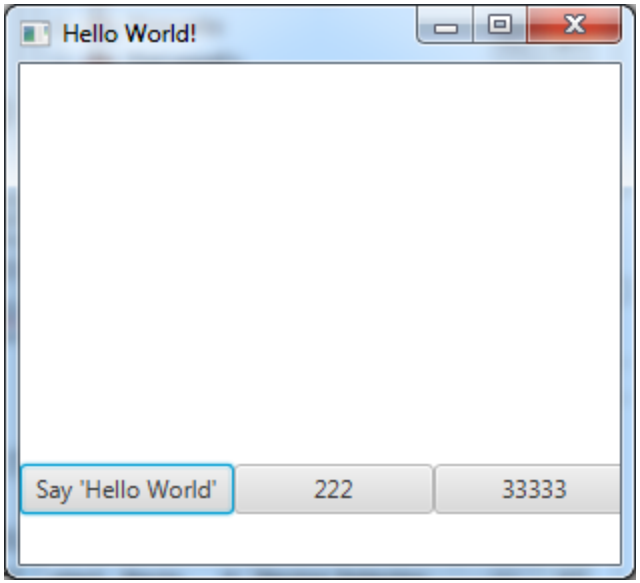


The JavaFX Scene Graph

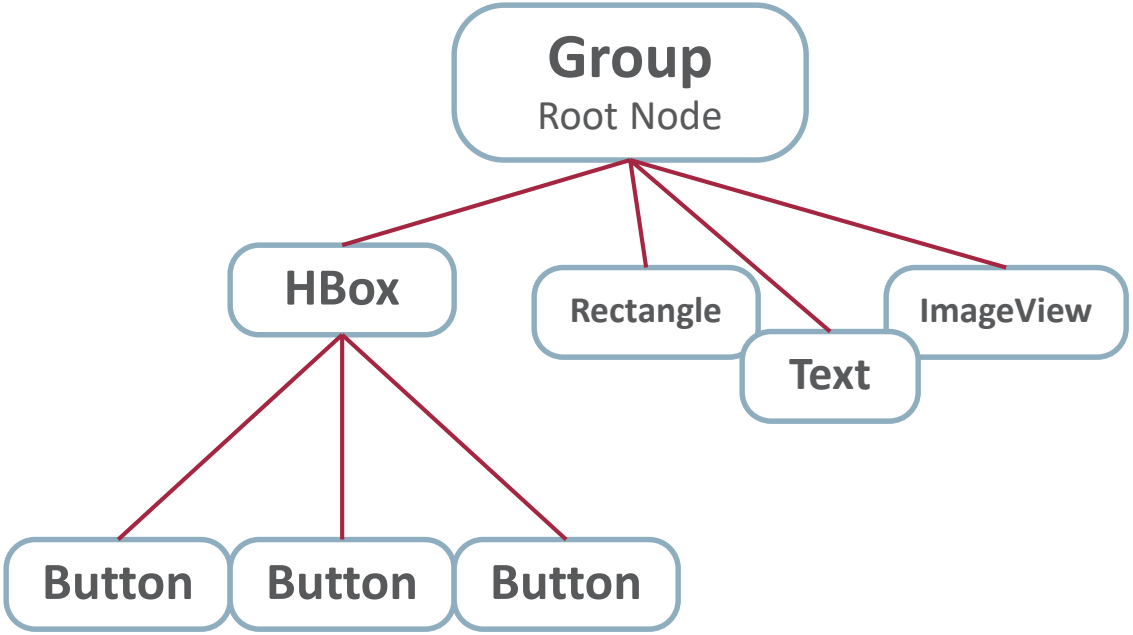
- How you decide to add nodes can be drawn as a Scene Graph.
- The Root Node contains an Hbox.
- The HBox acts as a container for buttons.

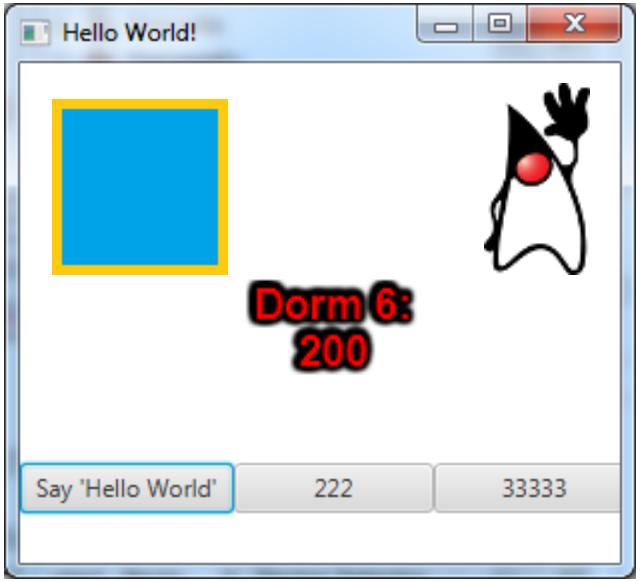




The Scene Graph

- The HBox keeps the GUI organized and conveniently located.
- The rest of the window could be used for other Nodes.





The Scene and Stage

- If we look at the rest of the default JavaFX program, we notice two more things:
- A Scene (which contains the Root Node)
- A Stage (which contains the Scene)

```
    public void start(Stage primaryStage) {
        …
        Scene scene = new Scene(root, 300, 250);

        primaryStage.setTitle("Hello World!");
        primaryStage.setScene(scene);
        primaryStage.show();
}
```

What Is the Scene?

- There are a few notable properties that describe a Scene:
- Scene Graph
  - The Scene is the container for all content in the JavaFX Scene Graph.
- Size
  - The width and height of the Scene can be set.
- Background
  - The background can be set as a Color or BackgroundImage.
- Cursor Information
  - The Scene can detect mouse events and handles cursor

```
Scene scene = new Scene(root, 300, 250, Color.BLACK);
```

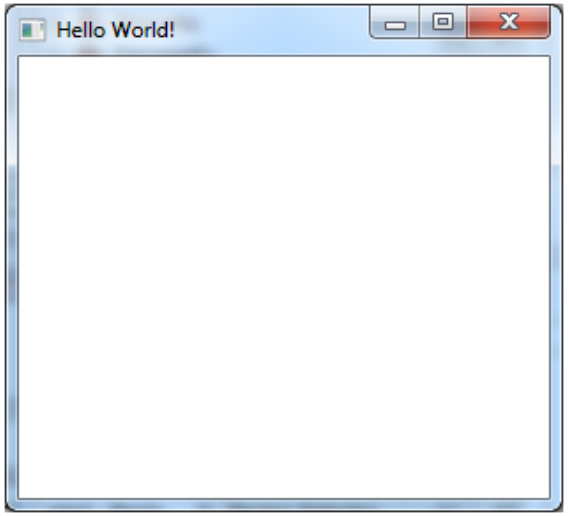
Root Node width height background

What Is the Stage?

- Think of the Stage as the application window.

Here are two notable Stage properties:

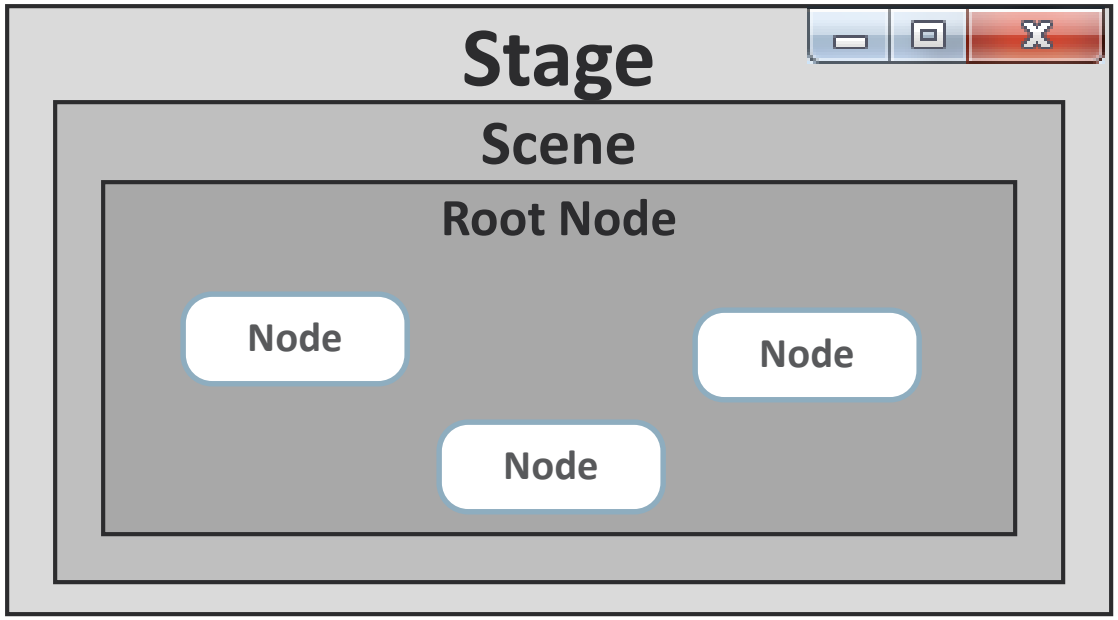
- Title
  - The title of the Stage can be set.
- Scene
  - The Stage contains a Scene.




```
        primaryStage.setTitle("Hello World!");
        primaryStage.setScene(scene);
        primaryStage.show();
```

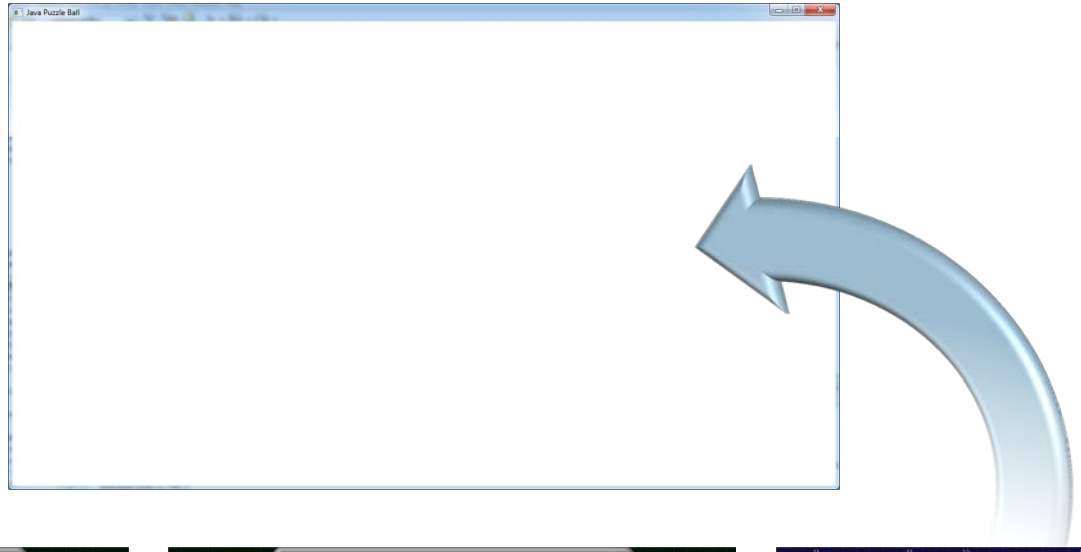
Hierarchy Animation

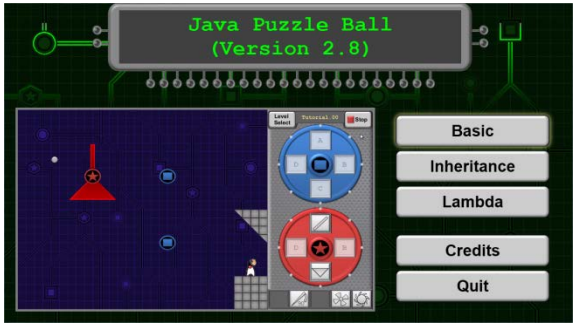
- A Stage is the top-level container.
- A Stage contains a Scene.
- A Scene contains a Root Node.
- The Root Node contains other Nodes.

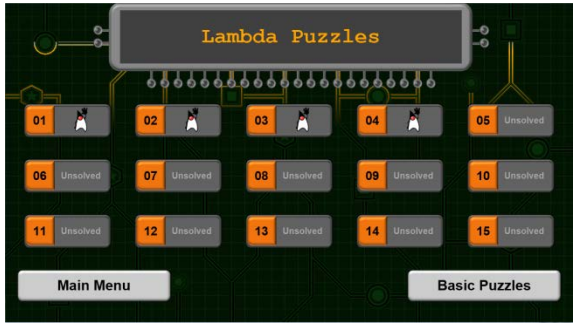


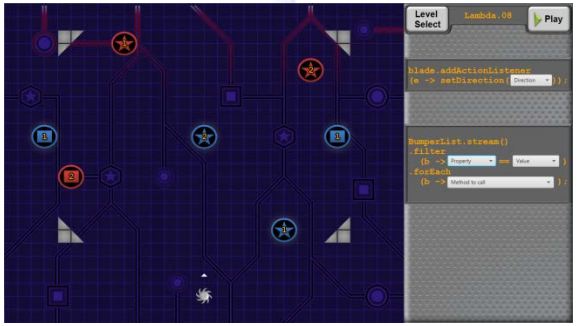
Many Scenes, One Stage

It’s possible to swap any scene into a single Stage.



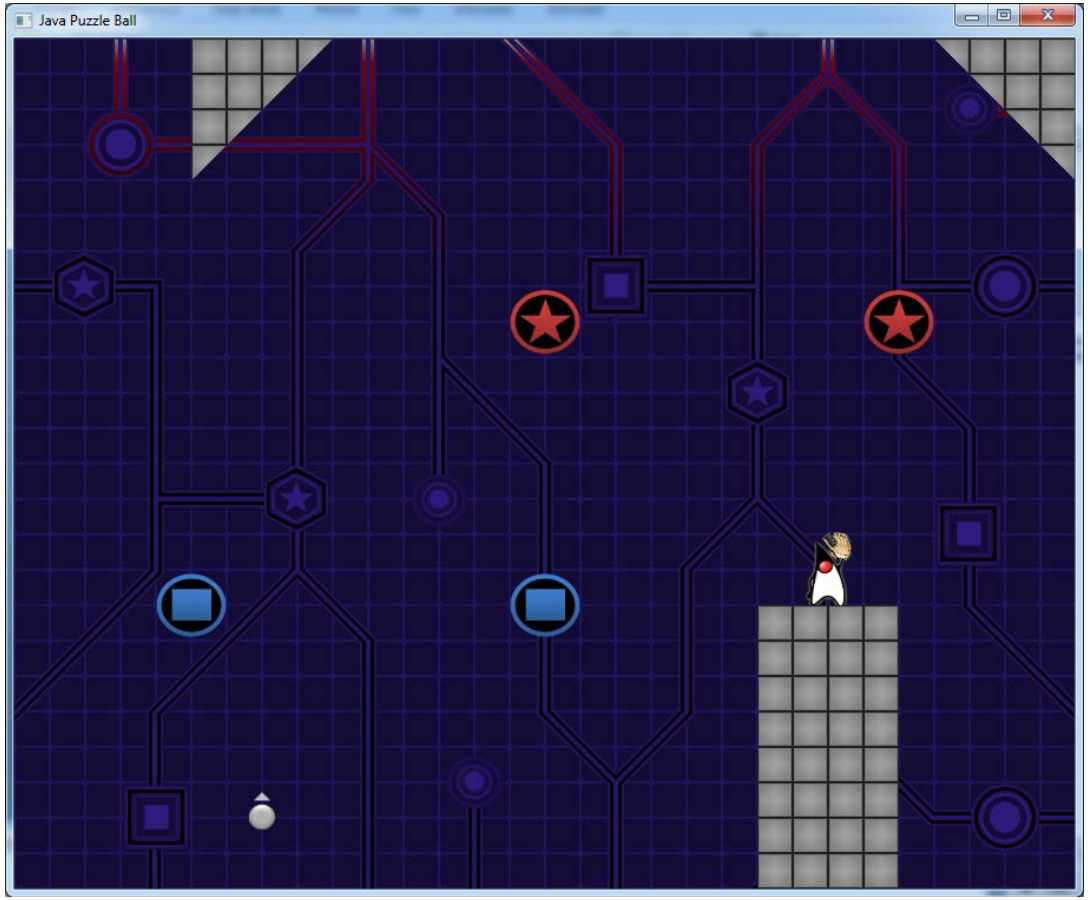


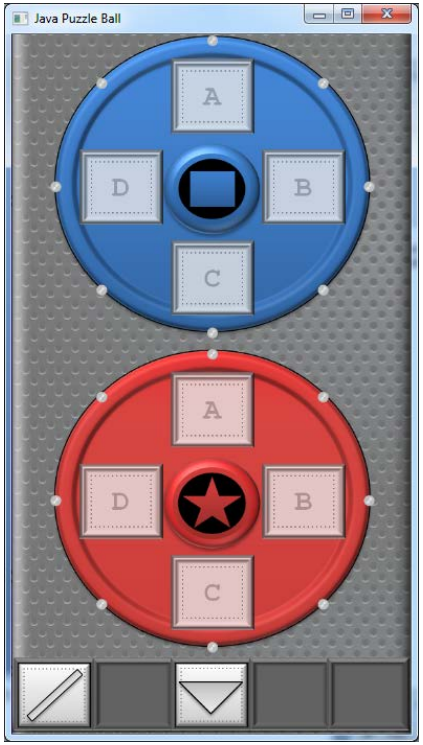




Many Scenes, Many Stages

It’s also possible to create many Stages.





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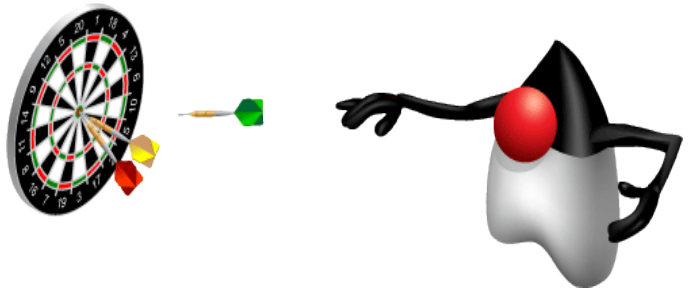


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