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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



It's Almost Time for Final Exams!

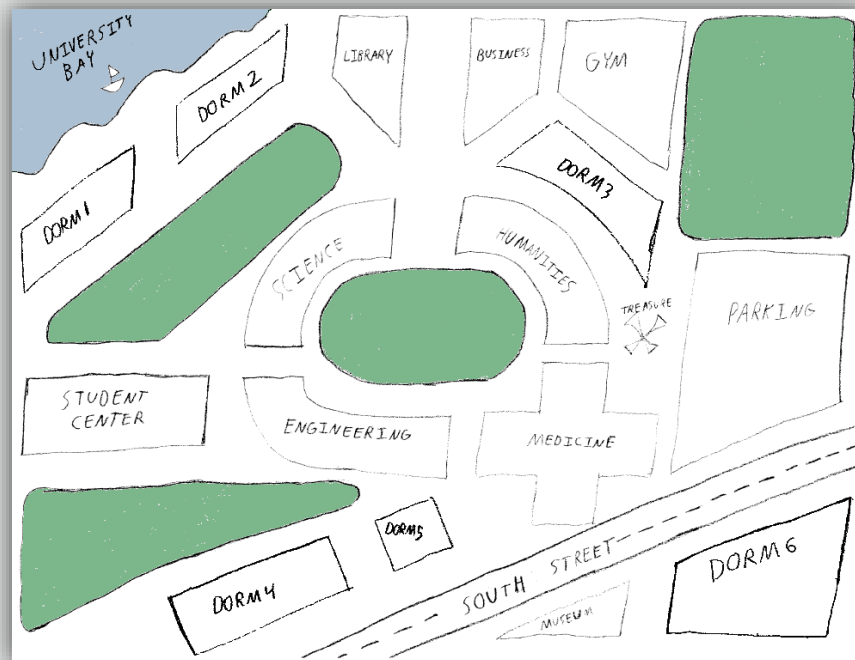
- It's important to study
- Do you like to study with friends?
 - But do your friends live in other dorms?
 - Where is the best place to meet your friends?
 - What is the most centrally located point on campus?

Thanks for
reminding me ...



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



- The reference material for this slide `CampusMap.mp4` demonstrates a completed application written using JavaFX
- Play `CampusMap.mp4`
- Each square is aligned with the correct dorm on the map
- Each dorm's population is adjusted by clicking and dragging 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

Exercise 2

- Create a JavaFX project
 - The reference material for this lesson provided instructions to create a JavaFX project in NetBeans or Eclipse
 - If you are using a different IDE, consult the documentation for the steps to do this
- 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 JavaFXMain 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);  
    }  
}
```

Continued on next slide..

The Default JavaFX Project

... continued

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

primaryStage.setTitle("Hello World!");
primaryStage.setScene(scene);
primaryStage.show();
} //end method start

public static void main(String[] args) {
    launch(args);
} //end method main
} //end class JavaFXMain
```

Two Methods: start() and main()

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

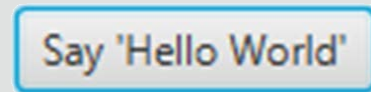
```
public void start(Stage primaryStage) {  
    ...  
} //end method start
```

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

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

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'");  
    ...  
} //end method start
```

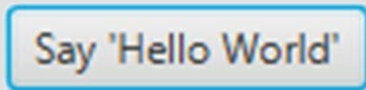
- From this code, we can tell ...
 - Buttons contain a text field
 - Buttons contain a method for changing the text field

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

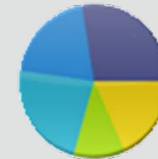
- There are many types of JavaFX Nodes:



Button



Rectangle



PieChart



ScrollBar

Dorm 6:
200

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!");  
        } //end method handle  
    }); //end setOnAction  
    ...  
} //end method start
```

- 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

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");  
    ...  
} //end method start
```

- 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 ...

← At least not yet ...

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);  
    ...  
} //end method start
```

- 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);
```

Adding Nodes to the Root Node

- 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

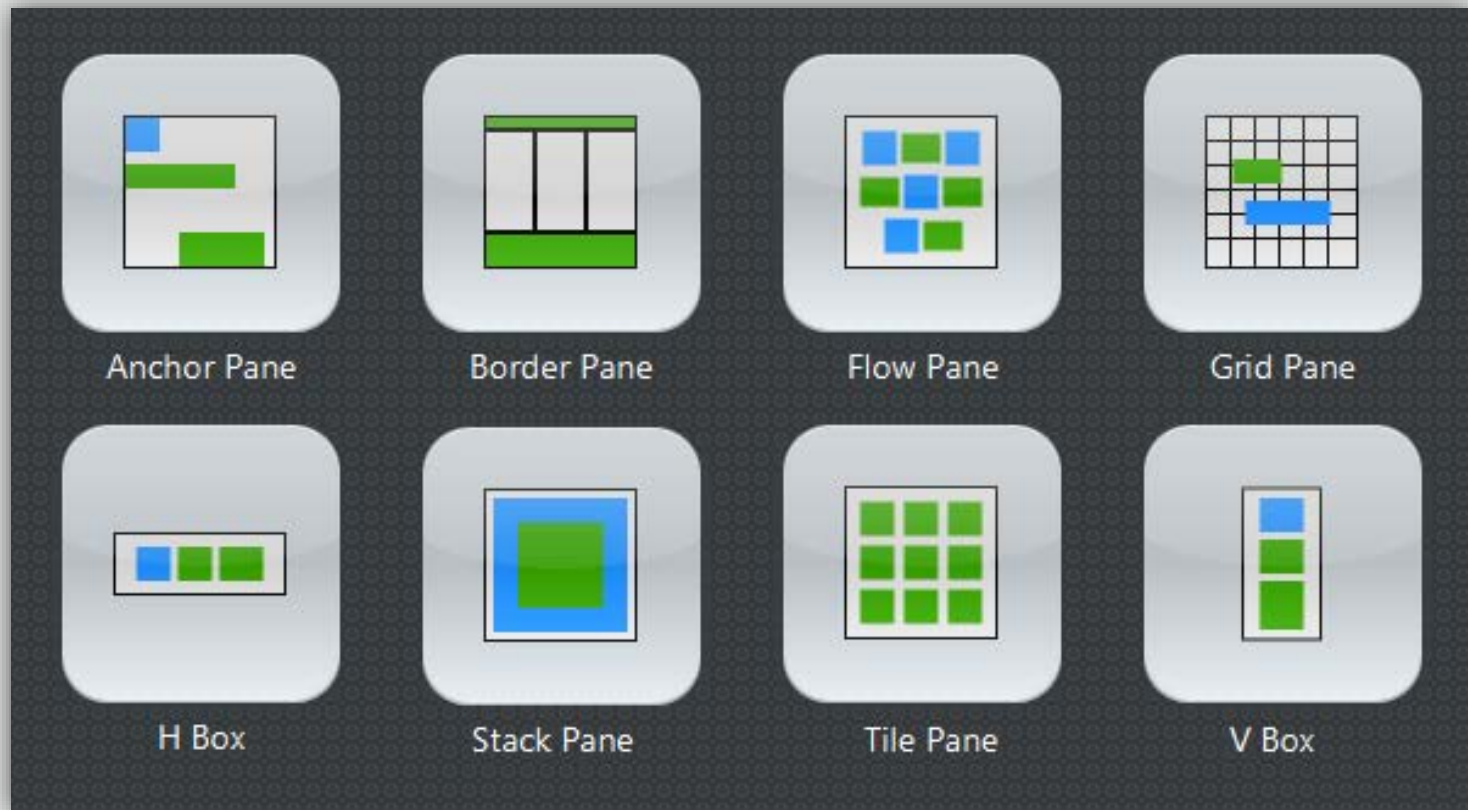
```
StackPane root = new StackPane();  
root.getChildren().addAll(btn1, btn2);
```

- 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

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

And this

```
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

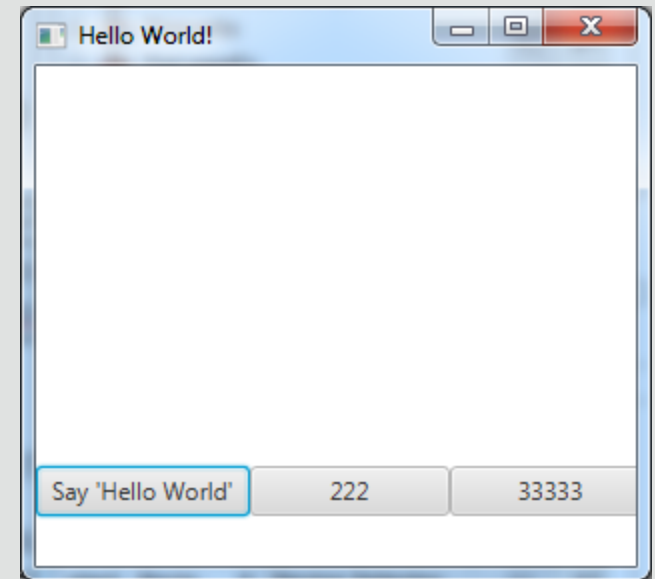
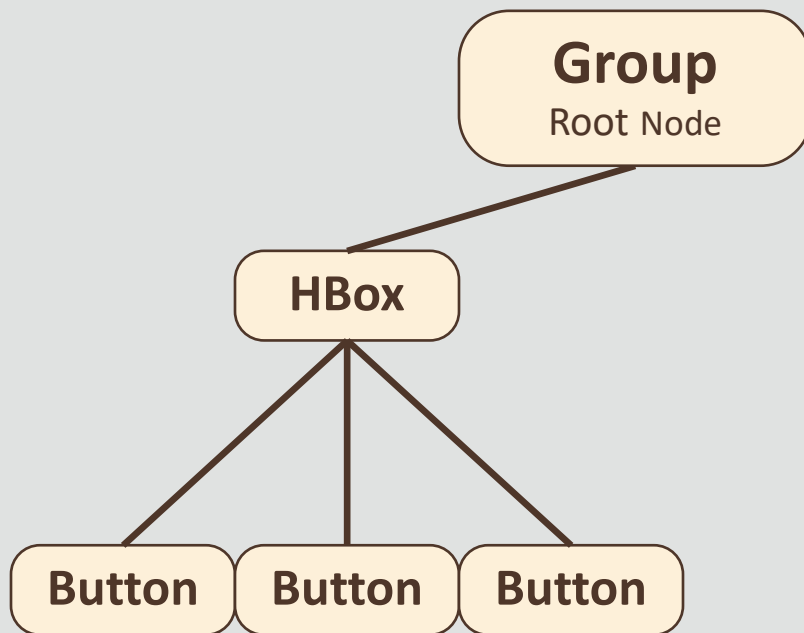
- Panes are also Nodes
 - Any node can be added to the Root Node
- A Pane may be a good option for storing buttons, text input dialog boxes, and other GUI elements
 - You can't quite move individual Nodes in a Pane
 - But you can move the entire Pane in a Group
 - Move the Pane like you would any other 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

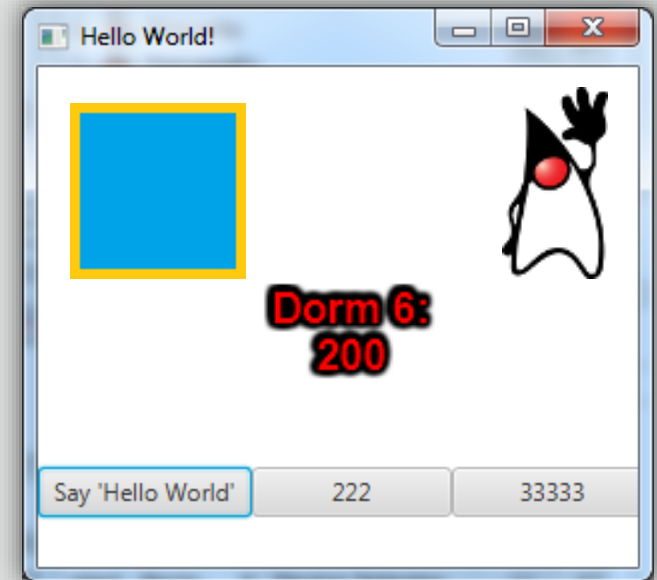
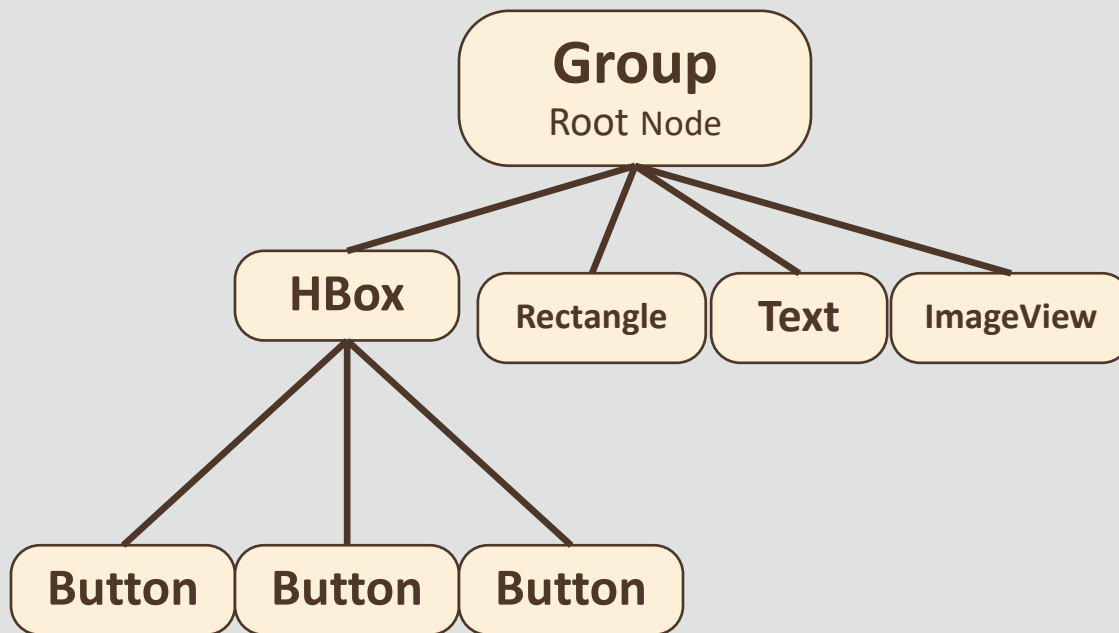
The JavaFX Scene Graph

- 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();  
} //end method start
```


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 properties

Root Node

width

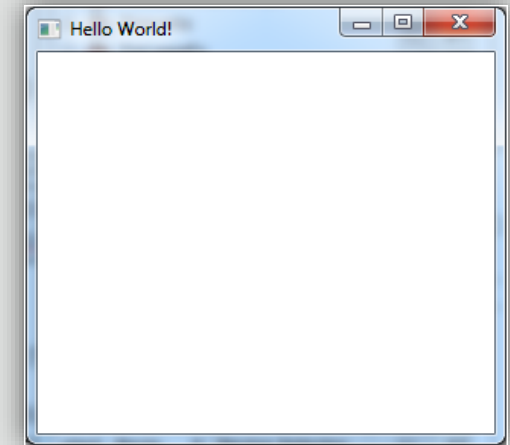
height

background

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

What Is the Stage?

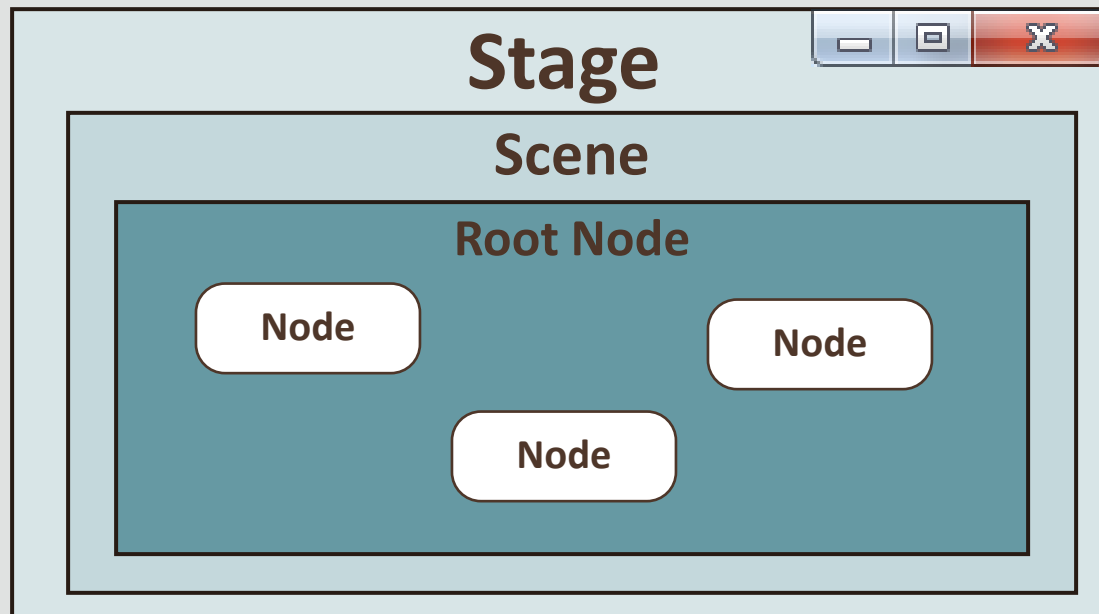
- Think of the Stage as the application window
- Here are two notable Stage properties:
 - Title
 - The title of the Stage can be set
 - Scene
 - The Stage contains a Scene



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

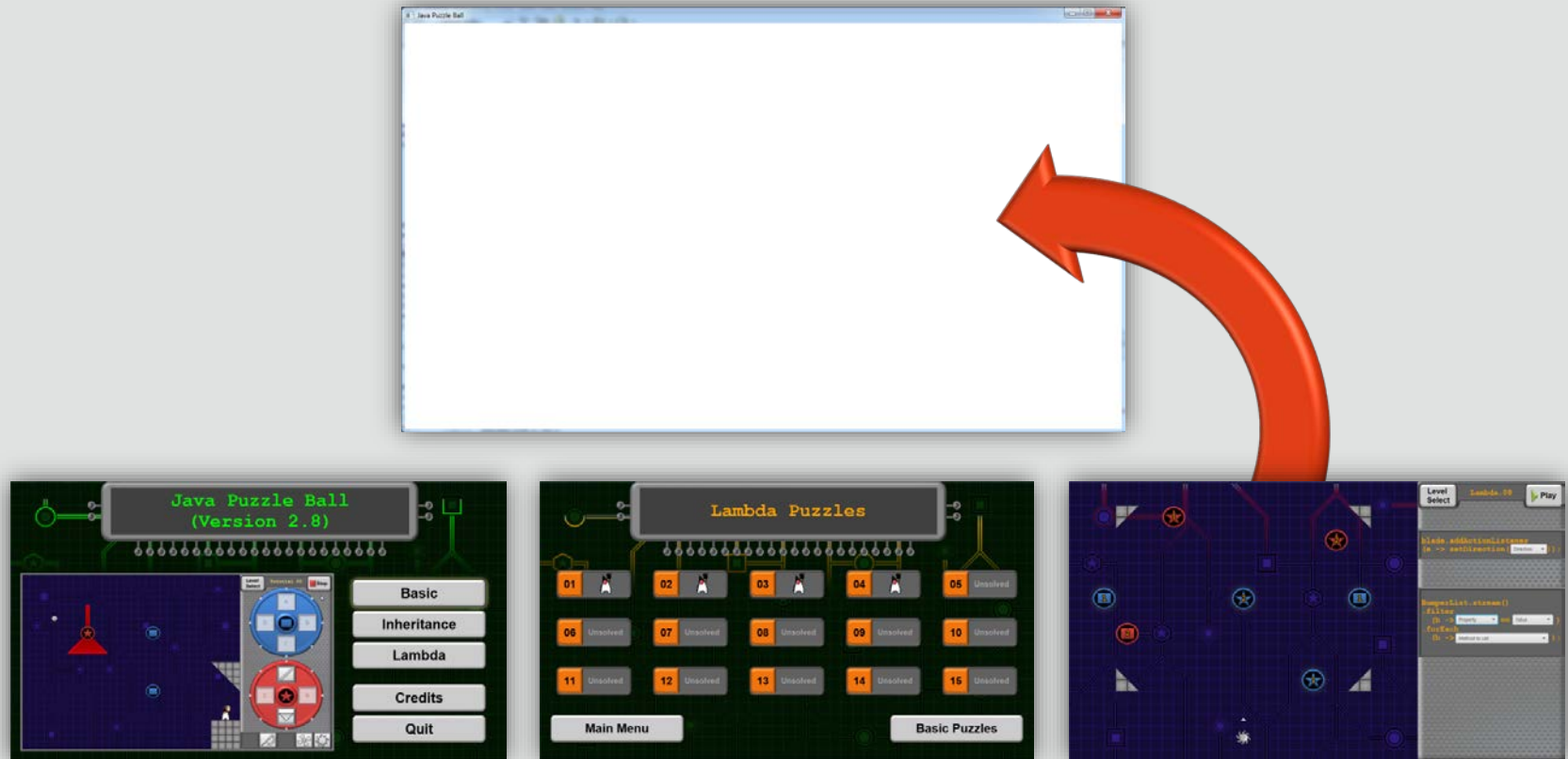
Hierarchy Animation

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



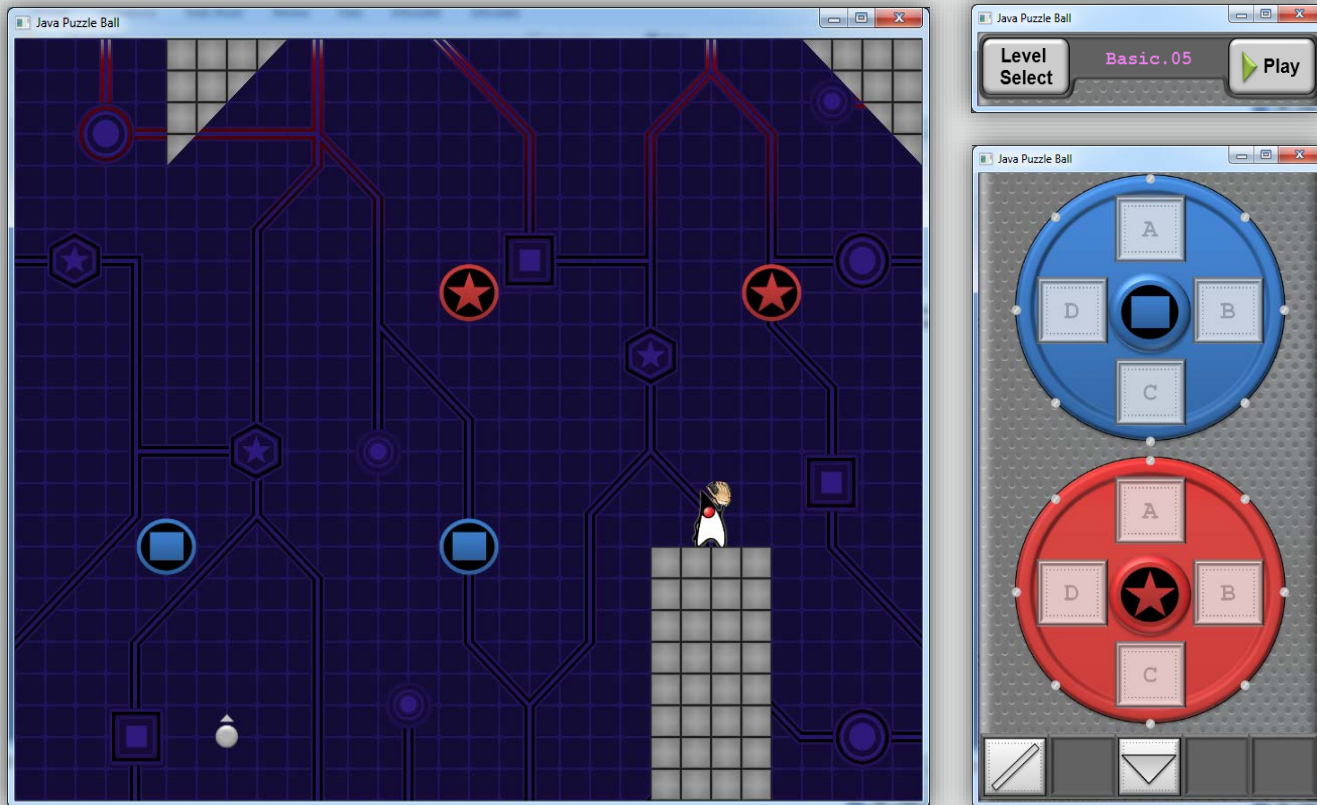
Many Scenes, One Stage

- It's possible to swap any scene into a single Stage



Many Scenes, Many Stages

- It's also possible to create many Stages



Summary

- 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





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