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Java Foundations

9-3
Graphics, Audio, and MouseEvents

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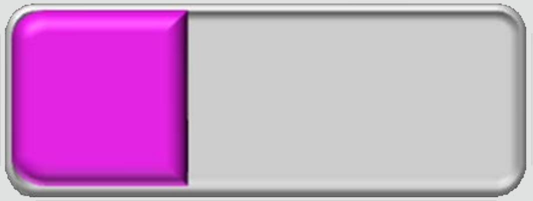
Objectives

- This lesson covers the following objectives:
  - Create and use a JavaFX image and ImageView
  - Create and use JavaFX audio
  - Create and use MouseEvents
  - Understand Lambda expressions in GUI applications

Using Your Own Graphics

- JavaFX can provide UI elements, shapes, and text
  - But if you have a talent for art, you can use your own graphics in place of those that JavaFX provides
- For example:



  - The art for the level-select button wasn’t created by JavaFX
  - But we used JavaFX to procedurally add level numbers, text, and the graphic of Duke

A JavaFX Image and ImageView

- An Image is an object that describes the location of a graphics file (.png, .jpg, .gif …)

```
Image image;
String imagePath = "Images/Fan1.png";
image = new Image(getClass().getResource(imagePath).toString);
```

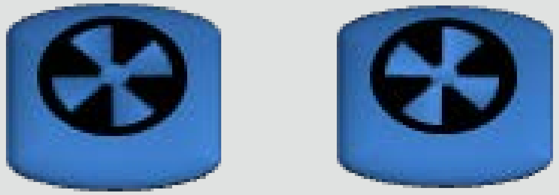
- An ImageView is the actual Node
  - Calling its constructor requires an Image argument

```
ImageView imageView = new ImageView(image);
```

  - An ImageView also contains the same properties as any other node: x-position, y-position, width, height …

Why Have Both an Image and ImageView?

- One big advantage is animation
  - Images can be swapped in and out of the same ImageView
- The Fan in Java Puzzle Ball takes advantage of this
  - The fan cycles through 2 images when it's blowing



- Custom buttons also benefit
  - You could use different images for buttons depending on their state:
    - Is the mouse hovering over the button?
    - Is the user clicking the button?

ImageView Hints

- How to create Images:

```
Image image1 = new
Image(getClass().getResource("Images/fan1.png").toString());
Image image2 = new
Image(getClass().getResource("Images/fan2.png").toString());
```

- How to create an ImageView:

```
ImageView imageView = new ImageView(image1);
```

- How to swap an Image into an ImageView:

```
imageView.setImage(image2);
```

  - imageView retains its properties, such as positioning

Remember to import javafx.scene.image.Image; and javafx.scene.image.ImageView;

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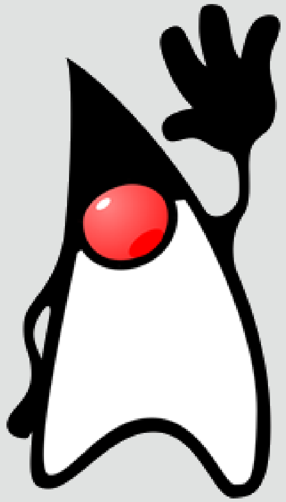
Creating Objects with Node Properties

- So far, we've written all JavaFX code in the start() method
  - This is similar to the beginning of the course, where most code was written in the main() method
- Object-oriented code shouldn't be written this way
  - Instead, objects should have Node fields
- The start() and main() methods are intended to be drivers

Example: The Goal Class

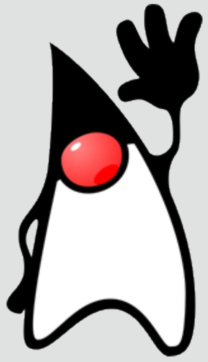
- Fields
  - `private Image dukeImage;`
  - `private ImageView dukeImageView;`



- Constructor
  - Takes arguments for x and y positions
  - Assigns the image to its respective ImageView
  - Positions dukeImageView according to the x and y arguments

Exercise 1

- Create a new Java project and name it `GoalTest`
- Right click on the project and select New-> package - Name the package `goaltest`
- Add the supplied java files `Goal.java` and `GoalTest.java` to the package
- Right click the project again and create another new package, and name it `goaltest.Images`
- Right click the project once more and create another new package, and name it `goaltest.Audio`
- This creates a folder structure that can be used to easily reference image and audio files

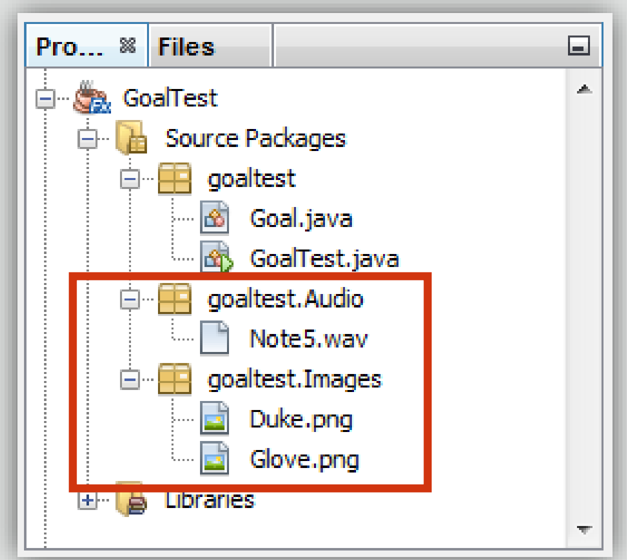


File Locations

- Add the supplied image and audio files to the correct location (drag and drop or copy and paste) to the package folders in your IDE

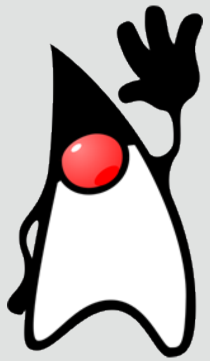
```
Image image = new Image(getClass().getResource("Images/Duke.png").toString());
```

- Images/Duke.png refers to a folder within the GoalTest folder
  - …\\$\underbrace{\text{GoalTest}}_{\text{Project Folder}}\backslash\underbrace{\text{src}}_{\text{Source}}\backslash\underbrace{\text{goaltest}}_{\text{Primary Package}}\backslash\underbrace{\text{Images}}_{\text{Another Package}}$
  - Or a package within a package



Exercise 1 continued

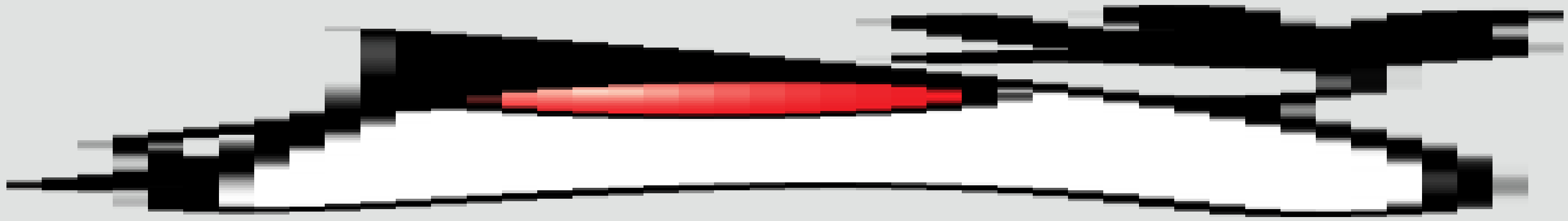
- Notice that …
  - The Root Node is publicly available
  - The Goal class is an ordinary Java class file type
- Write the Goal class according to the specifications on the slide 9
  - You'll also need to add this class's ImageView to the Root Node
- Instantiate a few Goal objects from the start() method



Scaling a Node

- It’s very easy to make a rectangle wider:

- But if you try the same thing with an ImageView …
  - It might look awful!



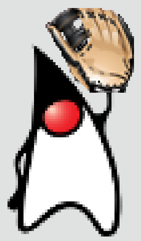
Scaling a Node the Right Way

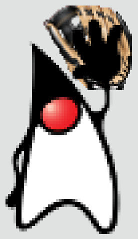
- JavaFX is very good at scaling graphics
  - The quality of the image is less likely to deteriorate
- You have the option to preserve the aspect ratio of an ImageView
  - An ImageView's width and height scale together
  - This avoids distortion

```
imageView.setPreserveRatio(true);
imageView.setFitWidth(25);
```

Ordering Nodes

- Sometimes, testers of Java Puzzle Ball didn't realize that their goal was to get the ball to Duke
- We thought adding a baseball glove would help solve the problem
- Duke and the glove are two separate ImageViews
  - These needed to be ordered properly so that the glove doesn't display behind the hand

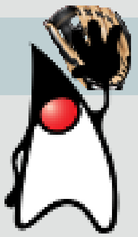

Correct


Incorrect

Ordering Nodes the Right Way

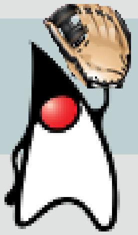
- The order that Nodes are added to the Root Node determines the order that they are displayed
- Nodes added early are buried under nodes added later

```
root.getChildren().addAll(gloveImageView, dukeImageView);
```



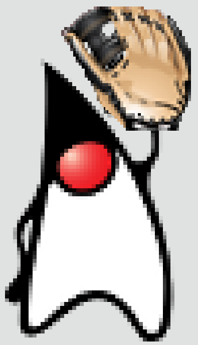
- To fix this you could …
  - Change the order that Nodes are added to the Root Node
  - Bring an ImageView to the front or back

```
gloveImageView.toFront();     //Either one of these
dukeImageView.toBack();       //will solve the problem
```



The Goal Class

- Fields
  - `private Image dukeImage;`
  - `private ImageView dukeImageView;`
  - `private Image gloveImage;`
  - `private ImageView gloveImageView;`



- Constructor
  - Takes arguments for x and y positions
  - Assigns each Image to its respective ImageView
  - Positions dukeImageView according to the x and y arguments
  - Positions and scales gloveImageView relative to dukeImageView

Exercise 2

- Continue editing the `GoalTest` project
- Write the Goal class according to the specifications on the previous slide
  - The constructor should still take only two arguments
  - A glove should appear on top of Duke's hand
- **Hint**: Nodes, including ImageViews, have getter and setter methods for properties like position

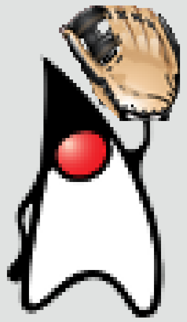


Image and Audio Similarities

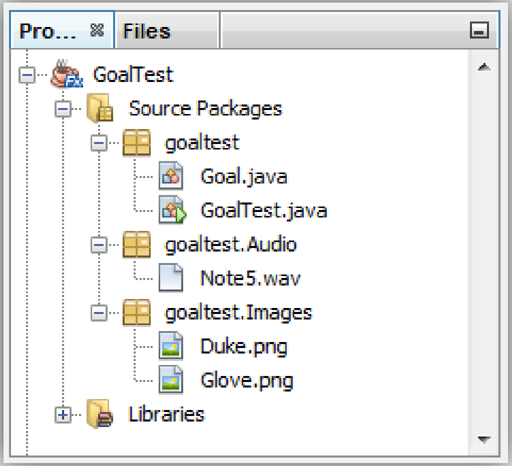
- Creating a JavaFX Image object ...

```
Image image = new
Image(getClass().getResource("Images/fan1.png").toString());
```

- Is very similar to creating a JavaFX AudioClip object

```
AudioClip audio = new
        AudioClip(getClass().getResource("Audio/Note5.wav").toString());
```

- It’s common to store images and audio in their own packages/folders



```
GoalTest
  Source Packages
    goaltest
      Goal.java
      GoalTest.java
    goaltest.Audio
      Note5.wav
    goaltest.Images
      Duke.png
      Glove.png
  Libraries
```

Image and Audio Differences

- An AudioClip object describes the location of an audio file (.wav, .mp3 …)

```
AudioClip audio = new
        AudioClip(getClass().getResource("Audio/Note5.wav").toString());
```

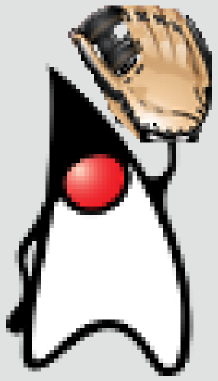
- And unlike an Image …
  - There is no AudioClip equivalent of an ImageView
  - Audio can be played by referencing the AudioClip object directly

```
audio.play();
```

  - There are many other AudioClip methods you can call

The Goal Class

- Fields
  - `private Image dukeImage;`
  - `private ImageView dukeImageView;`
  - `private Image gloveImage;`
  - `private ImageView gloveImageView;`
  - `private AudioClip tone;`

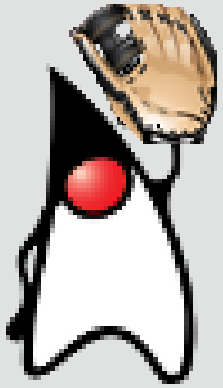


- The Goal class contains an AudioClip object as a field
  - A tone plays when the mouse is pressed on Duke
  - We'll see how to implement this feature in the next part of this lesson

Exercise 3

- Continue editing the `GoalTest` project
- Declare an AudioClip object as a field
- Instantiate the AudioClip object
  - Use the supplied .wav file `Note5.wav`

Remember to import
javafx.scene.media.AudioClip;



Mouse and Keyboard Events

- Nodes can detect mouse and keyboard events
  - This is true about ImageViews, too!
  - You aren't limited to buttons and other GUI components.
- Helpful methods to make this happen include:
  - `setOnMouseClicked()`
  - `setOnMouseDragged()`
  - `setOnMouseEntered()`
  - `setOnMouseExited()`
  - `setOnMouseMoved()`
  - `setOnMousePressed()`
  - `setOnMouseReleased()`

Remember to import javafx.scene.input.MouseEvent

Lambda Expressions

- These methods use a special argument, called a Lambda expression:

```
imageView.setOnMousePressed( /*Lambda Expression*/ );
```

- Lambda expressions use special syntax:

```
(MouseEvent me) -> System.out.println("Pressed")
```

No semicolon

- Curley braces allow Lambda expressions to contain multiple statements:

```
(MouseEvent me) -> {
   System.out.println("Statement 1");
   System.out.println("Statement 2");
}//end MouseEvent
```

semicolons

Lambda Expressions as Arguments

- When these are combined, we get the following:

```
imageView.setOnMousePressed( (MouseEvent me) -> {
       System.out.println("Statement 1");
       System.out.println("Statement 2");
} );
```

- What this code does:
  - Allows imageView to detect a mouse press at any time
  - If that occurs, the two print statements are executed
  - Otherwise, this code is ignored

MouseEvent

- A MouseEvent object exists only within the scope of the Lambda expression
- It contains many useful properties and methods:

```
imageView.setOnMousePressed( (MouseEvent me) -> {
       System.out.println(me.getSceneX());
       System.out.println(me.getSceneY());
} );
```

- In this example:
  - me is the MouseEvent object
  - me is accessed to print the x and y positions of the mouse cursor when imageView is pressed

MouseEvent Methods

- `getSceneX()`
- `getSceneY()`
  - Returns a double
  - Returns the position of the cursor within the JavaFX Scene
  - The top-left corner of the Scene is position (0,0)

- `getScreenX()`
- `getScreenY()`
  - Returns a double
  - Returns the position of the cursor on your computer’s screen
  - The top-left corner of your computer’s screen is (0,0)

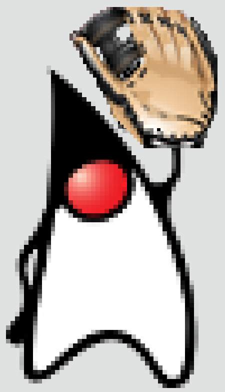
Event Listening

- When you write code for MouseEvents
  - You're telling a Node to listen for a particular event
  - But the events don't actually have to occur
- As long as the Node is listening …
  - It can detect any event, at any time
- A Node can listen for many events

```
imageView.setOnMousePressed( /*Lambda Expression*/ );
imageView.setOnMouseDragged( /*Lambda Expression*/ );
imageView.setOnMouseReleased(/*Lambda Expression*/ );
```

Exercise 4

- Continue editing the `GoalTest` project
- Complete the interactions() method so that …
  - Duke listens for a mouse press and mouse drag
  - Play a sound when the mouse is pressed
  - Print the x and y positions of the mouse dragged event
  - This will be helpful for the problem set
- What if interactions() is never called?
  - Comment out this method call in the constructor



Summary

- In this lesson, you should have learned how to:
  - Create and use a JavaFX image and ImageView
  - Create and use JavaFX audio
  - Create and use MouseEvents
  - Understand Lambda expressions in GUI applications

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