Multimedia-Programmierung
Übung 4

Ludwig-Maximilians-Universität München

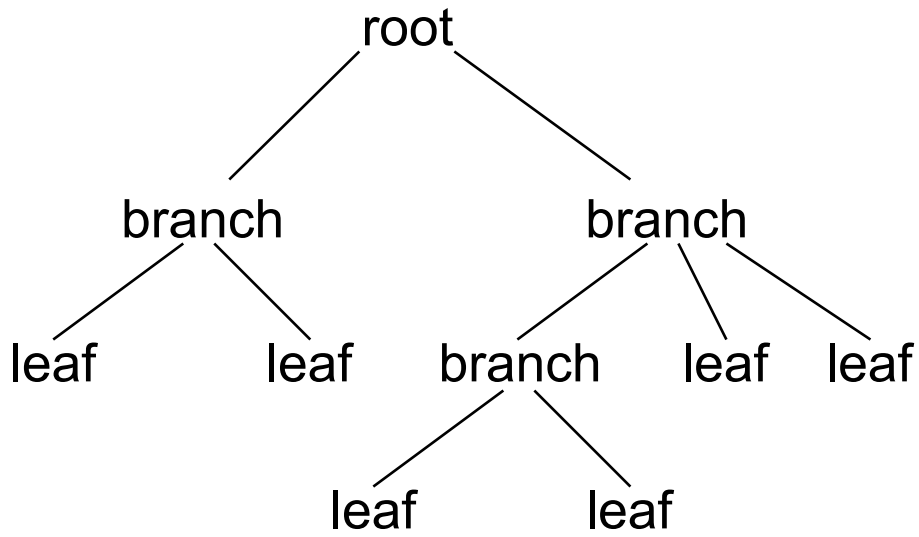
Sommersemester 2013

Today

- Scene Graph and Layouts
- Interaction
- CustomNodes
- Effects
- Animation
- Stylesheets
- MediaPlayer

JavaFX Scene Graph 1

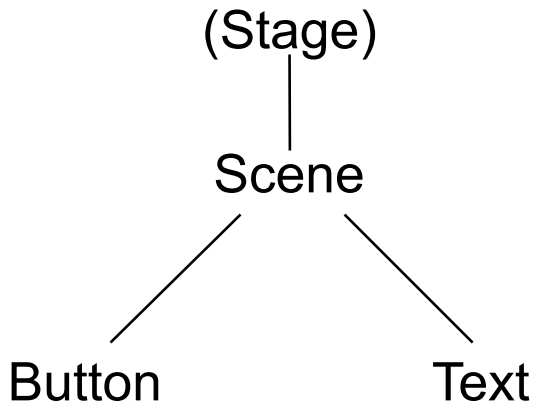
- Scene graph is a tree data structure consisting of **nodes**
- Nodes can be the root, branches or leafs
- Branches have one or more children, while leafs have no children



JavaFX Scene Graph 2

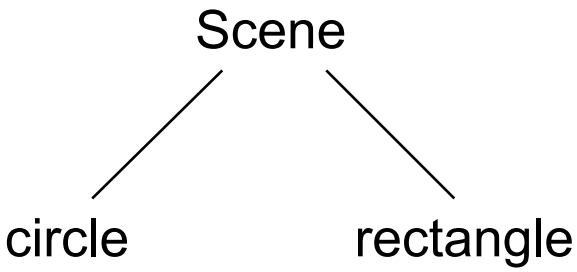
- Nodes can be UI components, text, images …
- Nodes can be transformed, animated or applied with effects

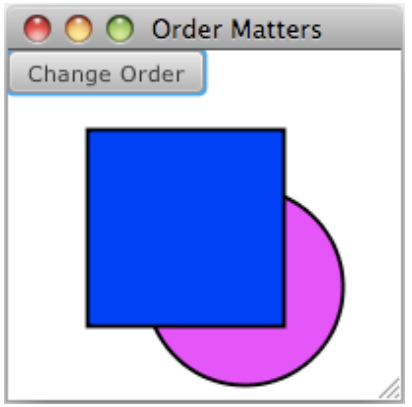
```
var counter = 0;
Stage {
    title: "My first App"
    width: 250
    height: 200

    scene: Scene {
        content: [
            Button {
                text: "press me"
                layoutX: 80, layoutY: 100
                action: function() { counter++; }
            }
            Text {
                font : Font { size: 24 }
                x: 100, y: 80
                content: bind "{counter}"
            }
        ]
    }
}
```

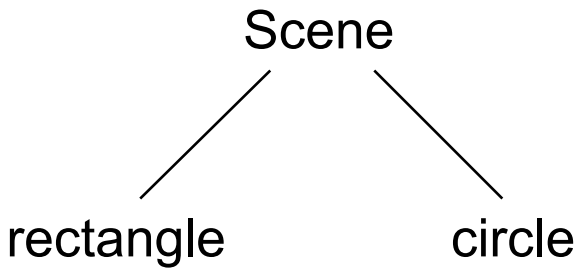


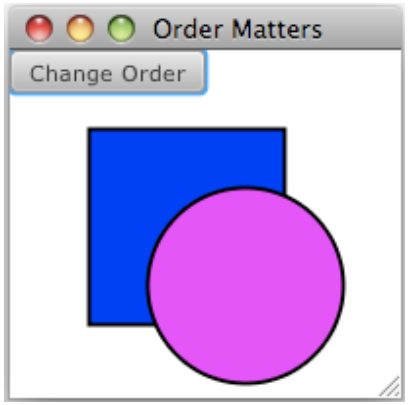
Order Matters

- Nodes are painted in their order
- Later nodes are painted on top of previous nodes



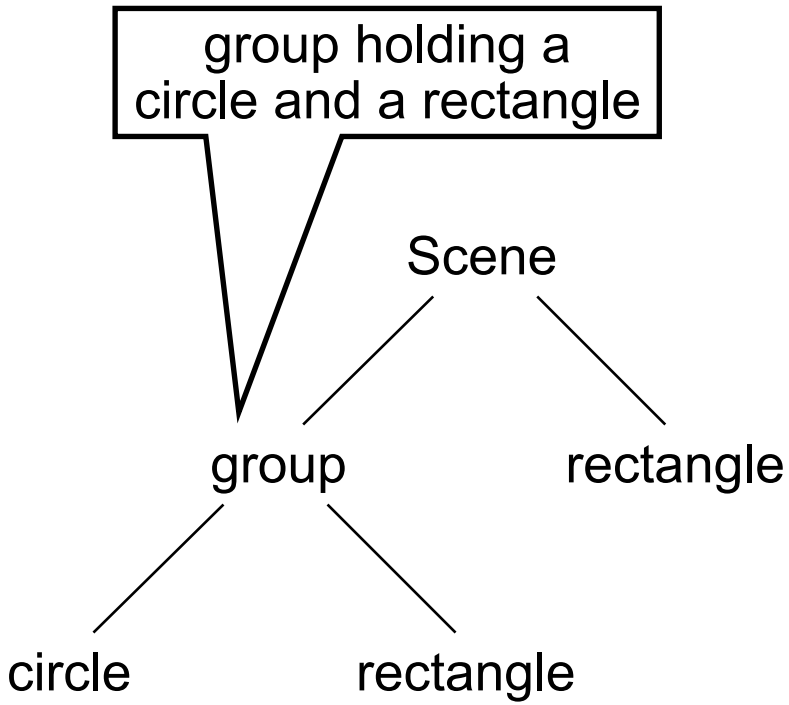






Grouping Nodes

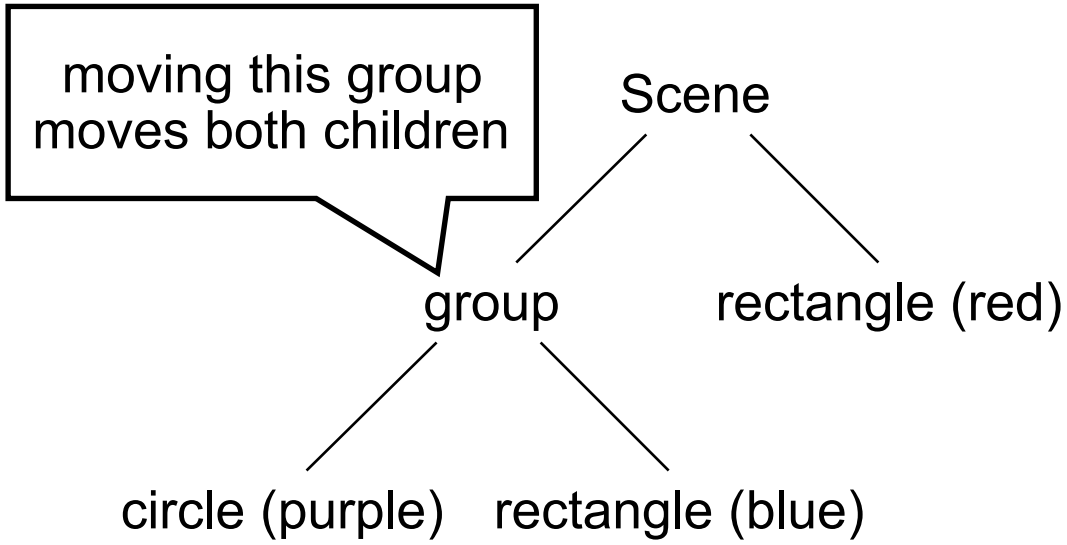
- Nodes can be grouped together (javafx.scene.Group)
- Groups enable the manipulation of several nodes at the same time

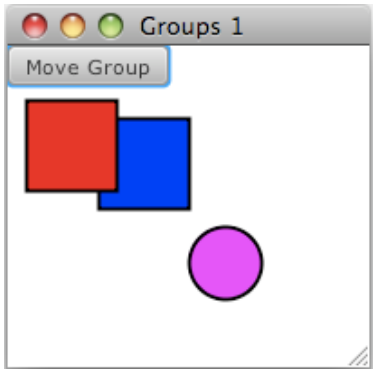


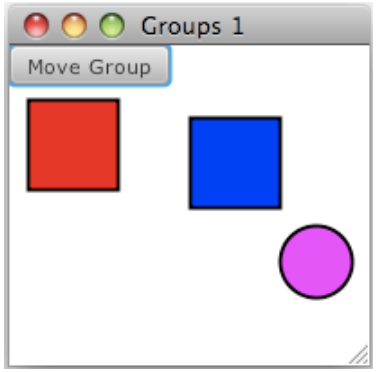

```
Stage {
    title: "My first Group", width: 200, height: 200
    scene: Scene {
        content: [
            Group {
                content: [
                    Circle {
                        centerX: 120, centerY: 120, radius: 20
                        fill: Color.MAGENTA, stroke: Color.BLACK
                        strokeWidth: 2
                    }
                    Rectangle {
                        x: 50, y: 40, width: 50, height: 50, fill: Color.BLUE
                        stroke: Color.BLACK, strokeWidth: 2
                    }
                ]
            }
            Rectangle {
                x: 10, y: 30, width: 50, height: 50, fill: Color.RED
                stroke: Color.BLACK, strokeWidth: 2
            } ]}}
```

Changing Nodes

- Changes on a node (e.g. transformations) affect the node's children in the same way

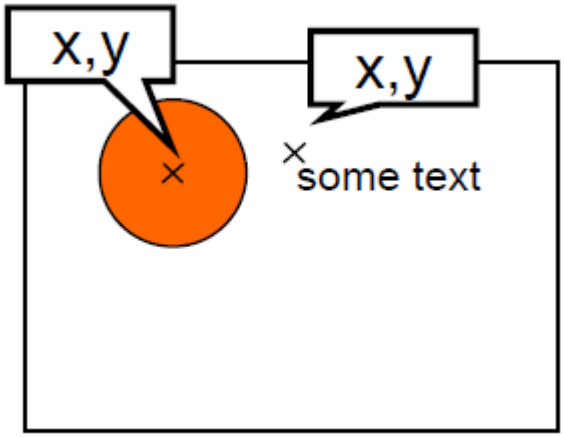




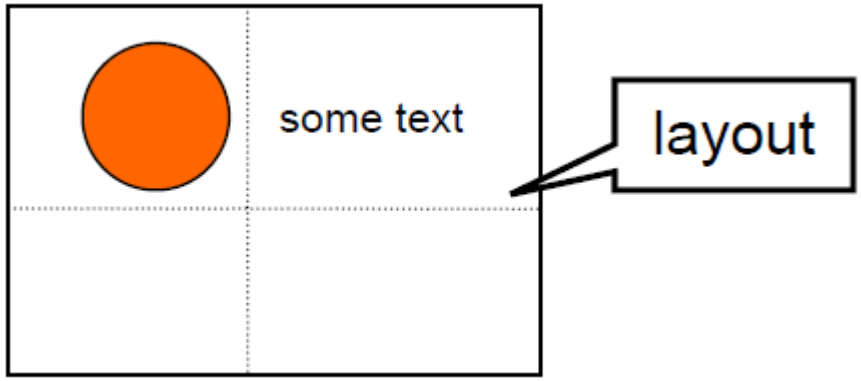


Layout Nodes

- Until now: layouts defined by absolute coordinates

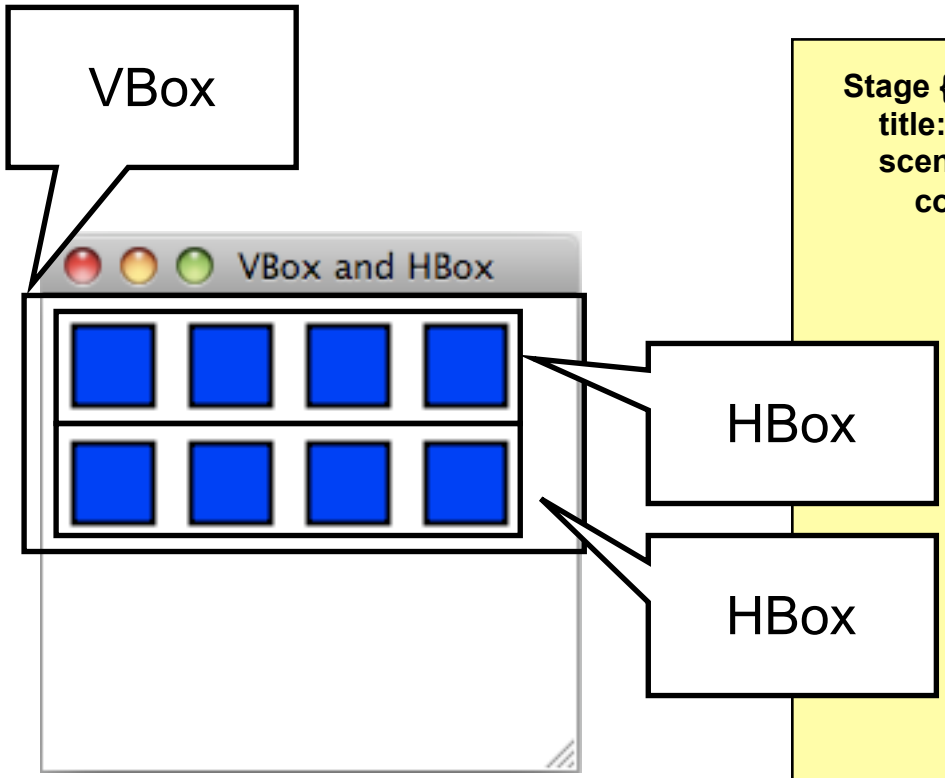


- Now: layout nodes support relative layouts (javafx.scene.layout)



VBox and HBox Layouts

- Nodes are laid out horizontally (HBox) or vertically (VBox)




```
Stage {
    title: "VBox and HBox“, width: 200, height: 200
    scene: Scene {
        content: [
            VBox {
                layoutX: 10, layoutY: 10, spacing: 10
                content: [
                    for(i in [0..1])
                        HBox {
                            spacing: 10
                            content:
                                for(j in [0..3])
                                    Rectangle {
                                        width: 30, height: 30, fill: Color.BLUE
                                        stroke: Color.BLACK, strokeWidth: 2
                                    }
                        }
                ]
            }
        ]
    }
}
```

HBox and VBox variables

- HBox

access	name	type	Can Read	Can Init	Can Write	Default Value	description
public	**hpos**	HPos	•	•	•	HPos.LEFT	The horizontal position of the row of nodes within this container's width.
public	**nodeVPos**	VPos	•	•	•	VPos.TOP	The vertical position of each node within the hbox's row.
public	**spacing**	Number	•	•	•	0	The amount of horizontal space between each child node in the `HBox`.
public	**vpos**	VPos	•	•	•	VPos.TOP	Defines the vertical position of the row of nodes within this container's height.

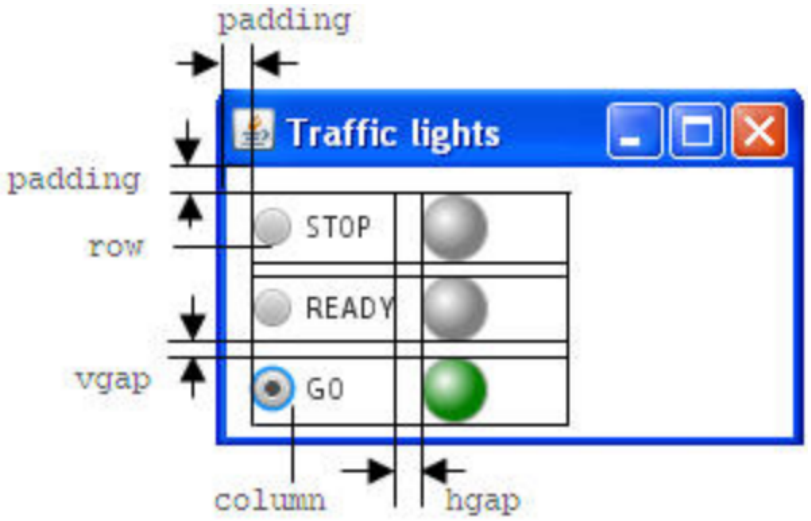
http://docs.oracle.com/cd/E17802_01/javafx/javafx/1.3/docs/api/javafx.scene.layout/javafx.scene.layout.HBox.html

- VBox:
  - same variables
  - nodeHPos instead of nodeVPos

Tile Layout

- Nodes are laid out in tiles
- Tiles are of equal size (by default the size of the largest node)
- Nodes can be ordered horizontally or vertically
- The layout will automatically wrap its content when the width or height of the Tile layout is reached (has to be specified manually)

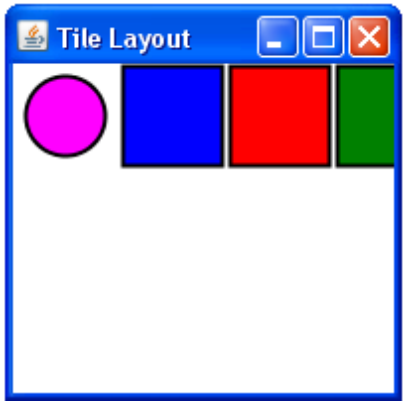
```
Tile {
        columns: 2
        rows: 3
        tileWidth: 40
        nodeHPos: HPos.LEFT
        padding: Insets{top: 10 left: 10}
        vgap: 5
        hgap: 10
        content: for (i in [0..2])
                [choices[i], lights[i]] }//Tile
```



http://java.sun.com/javafx/1/tutorials/ui/layout/

Tile Layout
Examples 1

- Horizontal tile layout, no width, no column count



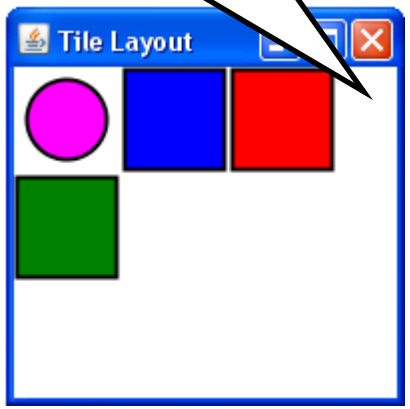

```
Stage {
   title: "Tile Layout", width: 200, height: 200
   scene: Scene {
      content: [
         Tile {
            content: [
               Circle {
                  …
               }
               Rectangle {
                  …
               }
               Rectangle {
                  …
               }
               Rectangle {
                  …
               }
            ]
         }
]}}
```

tile without
any parameters

Tile Layout
Examples 2

- Horizontal tile layout, with width, no column count

nodes are wrapped at 200



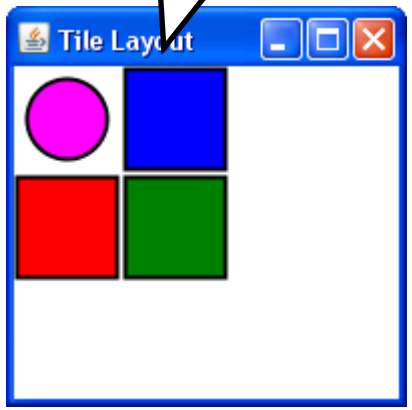

```
Stage {
   title: "Tile Layout", width: 200, height: 200
   scene: Scene {
      content: [
         Tile {
            width: 200
            content: [
                Circle {
                    …
                }
                Rectangle {
                    …
                }
                Rectangle {
                    …
                }
                Rectangle {
                    …
                }
            ]
         }
]}}
```

tile with a fixed width

Tile Layout
Examples 3

- Horizontal tile layout, no width, two columns

nodes are arranged in two columns horizontally

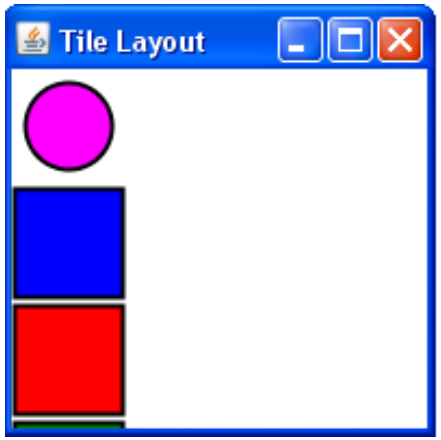



```
Stage {
   title: "Tile Layout", width: 200, height: 200
   scene: Scene {
      content: [
         Tile {
            columns: 2
            content: [
               Circle {
                  …
               }
               Rectangle {
                  …
               }
               Rectangle {
                  …
               }
               Rectangle {
                  …
               }
            ]
         }
]}}
```

layout with two columns

Tile Layout
Examples 4

- Vertical tile layout, no height, no column count



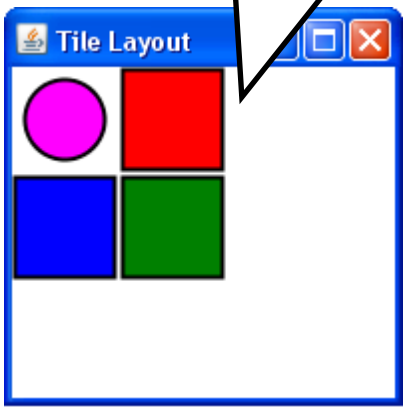

```
Stage {
   title: "Tile Layout", width: 200, height: 200
   scene: Scene {
      content: [
         Tile {
            vertical: true
            content: [
                Circle {
                    …
                }
                Rectangle {
                    …
                }
                Rectangle {
                    …
                }
                Rectangle {
                    …
                }
            ]
         }
]}}
```

vertical layout

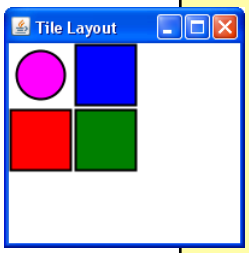
Tile Layout
Examples 5

- Vertical tile layout, no width, two rows

nodes are arranged in two row vertically



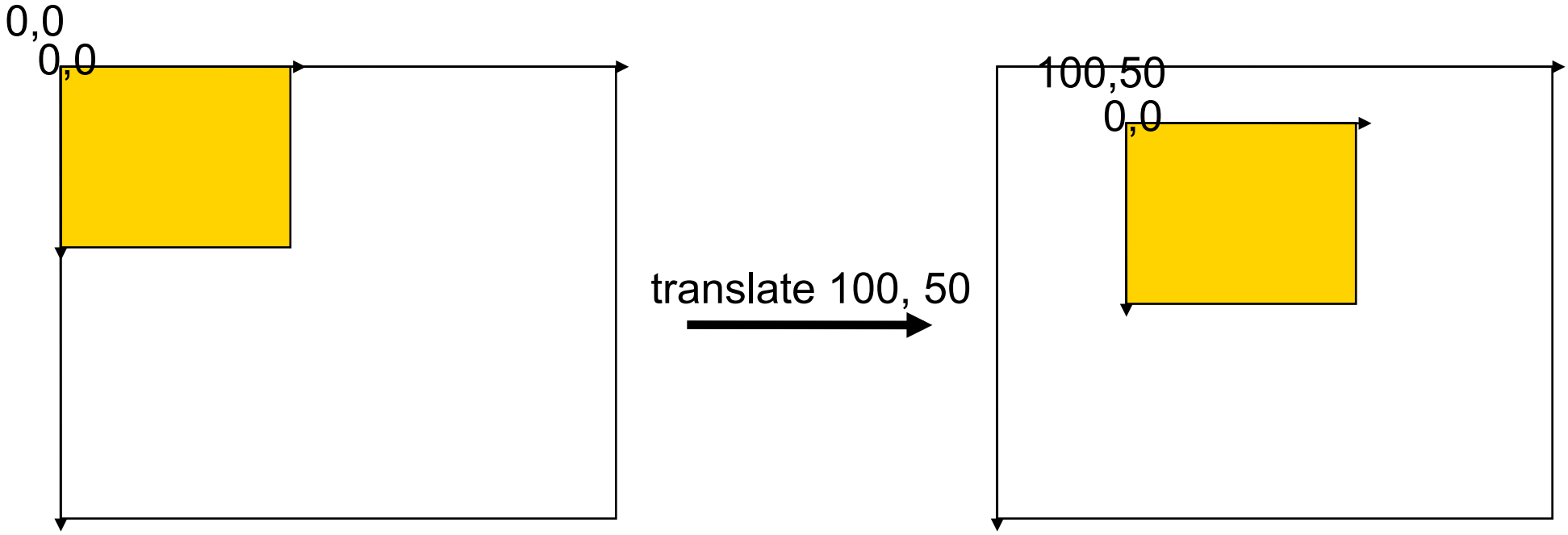
compare to two columns horizontally




```
Stage {
   title: "Tile Layout", width: 200, height: 200
   scene: Scene {
      content: [
         Tile {
            vertical: true
            rows: 2
            content: [
                Circle {
                   …
                }
                Rectangle {
                   …
                }
                Rectangle {
                   …
                }
                Rectangle {
                   …
                }
            ]
         }
]}}
```

vertical layout with two rows

Transformations

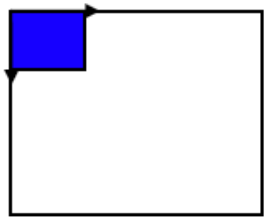


- Nodes can be transformed (rotation, translation, scaling, skew)
- Transforming a node does not change its size, height, width, x, y, etc. but its coordinate system

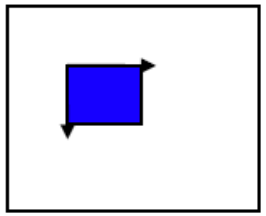
Transformations

the transform variable

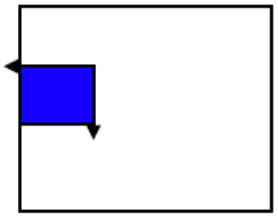
- Transformations are applied in order of their appearance within the transform sequence



1. translate(100,100)



2. rotate(90,0,0)

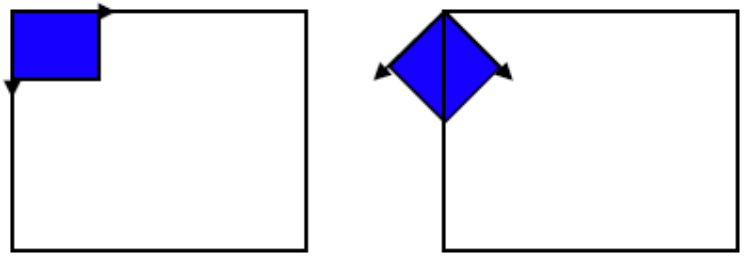


```
Stage {
    title : "Transformations"
    scene: Scene {
        width: 400
        height: 400
        content: [
            Rectangle {
                x: 0, y: 0
                width: 100, height: 100
                fill: Color.BLUE
                stroke: Color.BLACK
                transforms: [
                    Transform.translate(100,100),
                    Transform.rotate(90, 0, 0)
                ]
            }
        ]
    }
}
```

Transformations

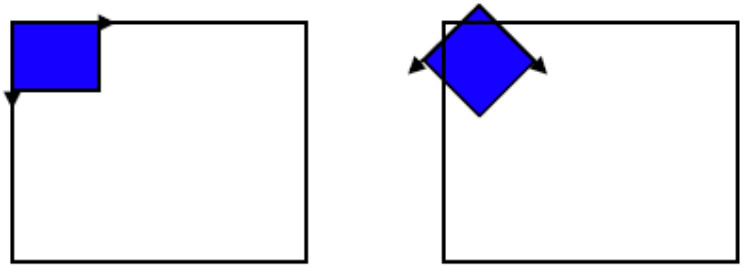
some examples

- Transform.rotate(angle,x,y) rotates clockwise around a pivot point



```
...
transforms: [
    Transform.rotate(45, 0, 0)
]
...
```

rotate 45° clockwise around 0,0



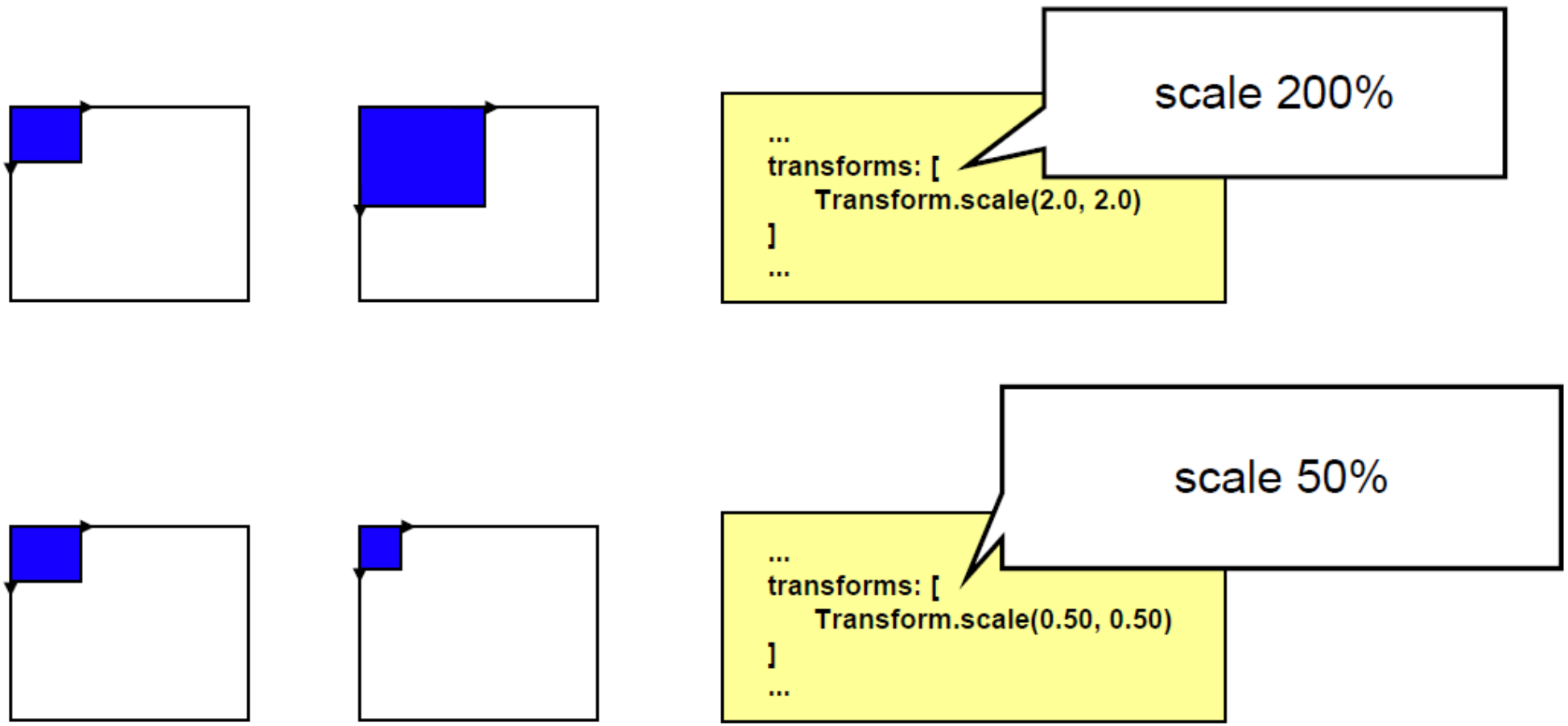
```
...
transforms: [
    Transform.rotate(45, 50, 50)
]
...
```

around the center (if rectangle is 100x100px)

Transformations

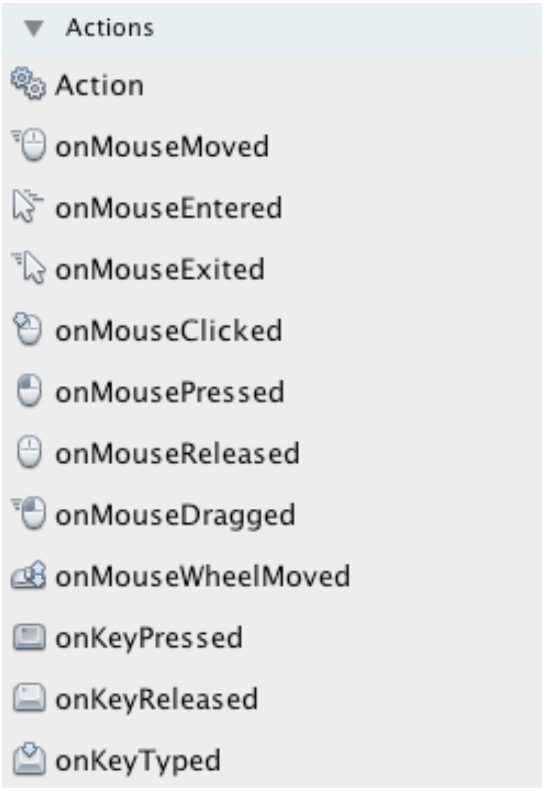
some examples (2)

- Transform.scale(xfactor, yfactor) scales the node‘s axes



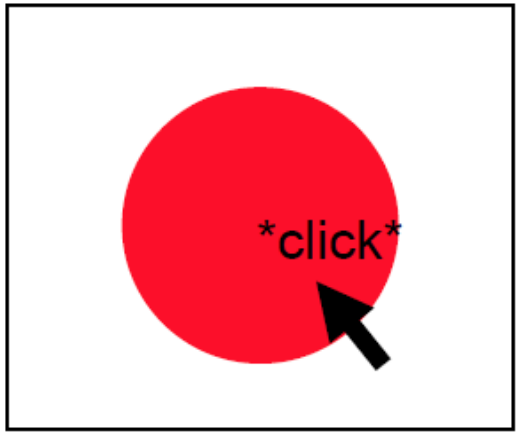
Interaction with Nodes

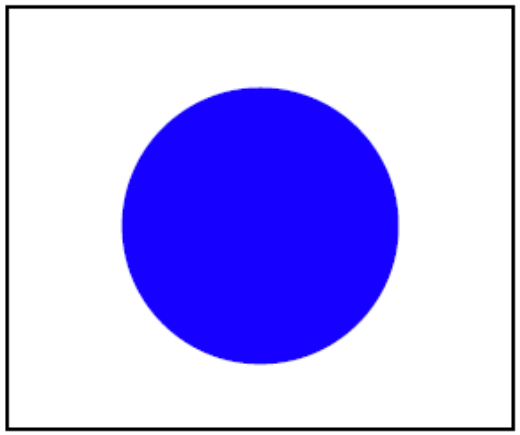
- Nodes can receive mouse and keyboard events
- Depending on the node, different events might be available
- Instance variables map to event related functions
- Events include (but are not limited to):
  - onKeyPressed
  - onKeyReleased
  - onMouseClicked
  - onMouseDragged
  - onMouseMoved
  - onMouseReleased
  - onMouseWheelMoved
  - etc.



Interaction with Nodes

example 1: clicking a node





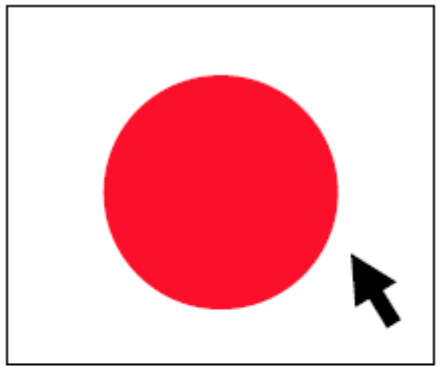
```
Stage {
    title : "Clicking a Node"
    scene: Scene {
        width: 400
        height: 400
        content: [
            Circle {
                centerX: 100, centerY: 100
                radius: 40
                fill: Color.RED
                onMouseClicked: function( e: MouseEvent ):Void {
                    (e.node as Circle).fill = Color.BLUE; // type casting
                }
            }
        ]
    }
}
```

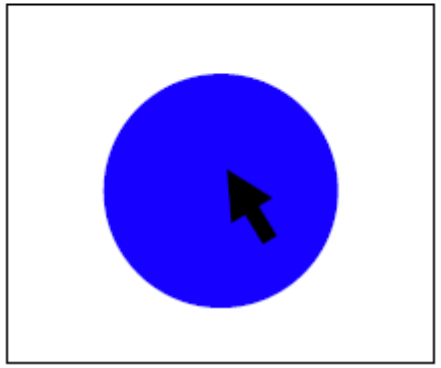
function assigned to instance variable onMouseClicked

JavaFX type casting: (object as object)

Interaction with Nodes

example 2: entering an element





```
Stage {
        title : ''Hovering a Node"
        scene: Scene {
              width: 200
              height: 200
              content: [
                 Circle {
                       centerX: 100, centerY: 100
                       radius: 40
                       fill: Color.RED
                       onMouseEntered: function( e: MouseEvent ):Void {
                          (e.node as Circle).fill = Color.BLUE;
                       }
                       onMouseExited: function( e: MouseEvent ):Void {
                          (e.node as Circle).fill = Color.RED;
                       }
                 }
              ]
        }
}
```

Interaction with Nodes

example3: simple node dragging


```
var xOffset:Number = 0;
var yOffset:Number = 0;
Stage {
    title : "Dragging a Node"
    scene: Scene {
        width: 200
        height: 200
        content: [
            Circle {
                centerX: 100, centerY: 100
                radius: 40
                fill: Color.RED
                onMousePressed: function( e: MouseEvent ):Void {
                    def cur_circle = (e.node as Circle);
                    xOffset = e.sceneX - cur_circle.centerX;
                    yOffset = e.sceneY - cur_circle.centerY;
                }

                onMouseDragged: function( e: MouseEvent ):Void {
                    def cur_circle = (e.node as Circle);
                    cur_circle.centerX = e.sceneX - xOffset;
                    cur_circle.centerY = e.sceneY - yOffset;
                }
            }
        ]
    }
}
```

when the circle is pressed, calculate the offset

while dragging the circle, recalculate its center

CustomNodes

- Build own custom nodes that can be used within a scene
- Build subclass of `CustomNode`
- Implement `create()` function, that returns a node

MyCustomNode.fx

```
public class MyCustomNode extends CustomNode{
    public var text:String;

  override protected function create () : Node {
     HBox {
      content: [
       TextBox {
          text: bind text
       }
       Button {
          text: "OK"
          action: function() {}
       }
     ]
  }  } }
```

Main.fx

```
Stage {
   title: "Stylesheets"
   scene: Scene {
      width: 280
      height: 100
      content: [
            MyCustomNode{
                  text: "My Custom Node"
                  }
      ]
   }
}
```

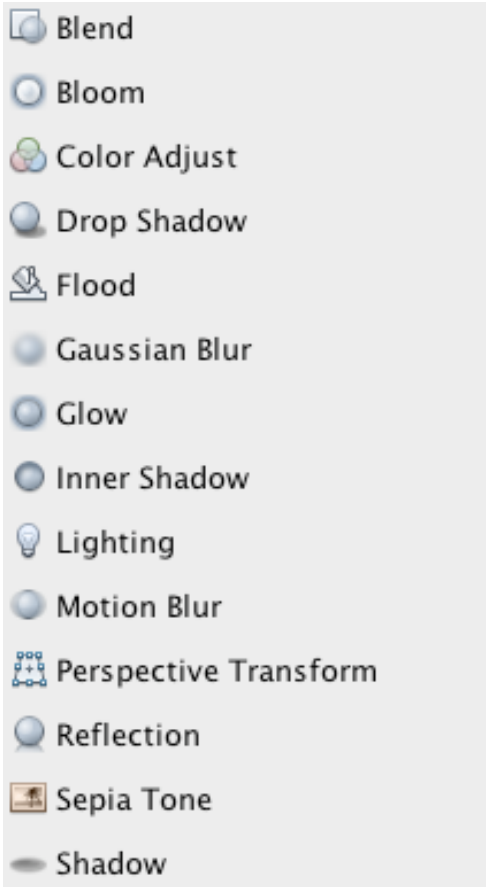
Effects

Attention: desktop profile only

Effects are applied to nodes using the effect variable

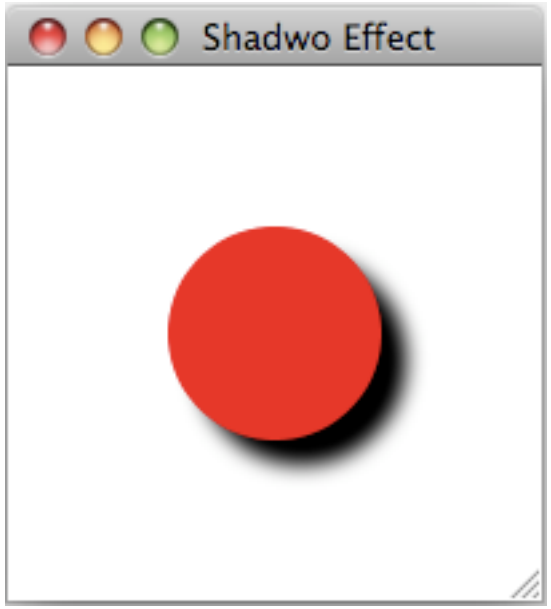
Effects include:

- Blend
- Bloom
- Shadow
- Glow
- Gaussian Blur
- Reflection
- Etc.



Effects

example1: shadow

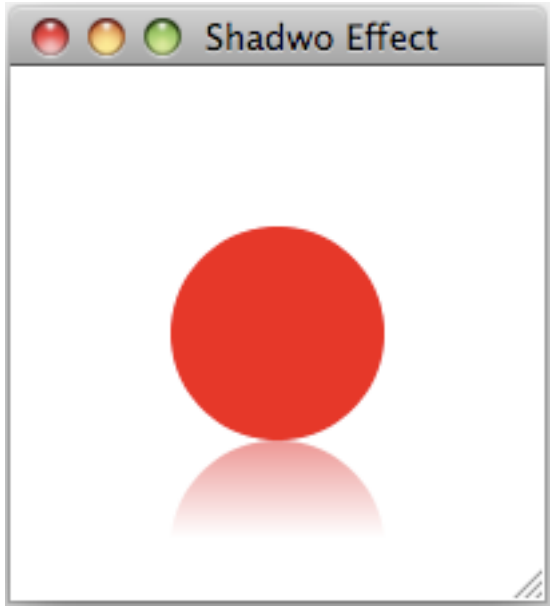



```
Stage {
    title : "Shadow Effect"
    scene: Scene {
        width: 400
        height: 400
        content: [
            Circle {
                centerX: 100, centerY: 100
                radius: 40
                fill: Color.RED
                effect: DropShadow {
                        offsetX: 10
                        offsetY: 10
                        color: Color.BLACK
                        radius: 10
                    }

            }
        ]
    }
}
```

adding the DrowpShadow effect to the Circle node.

Effects

example2: Reflection




```
Stage {
    title : "Shadow Effect"
    scene: Scene {
        width: 400
        height: 400
        content: [
            Circle {
                centerX: 100, centerY: 100
                radius: 40
                fill: Color.RED
                effect: Reflection {
                        fraction: 0.45
                        topOffset: 0.0
                        topOpacity: 0.5
                        bottomOpacity: 0.0
                    }
            }
        ]
    }
}
```

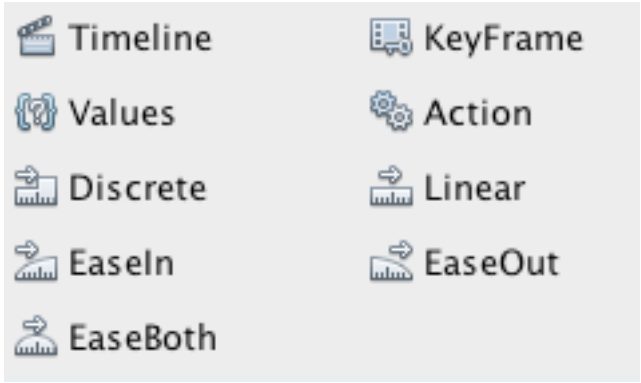
adding the Reflection effect to the Circle node.

Animation

JavaFX support the keyframe concept

That is, animations are defined by so called keyframes

Other values are interpolated

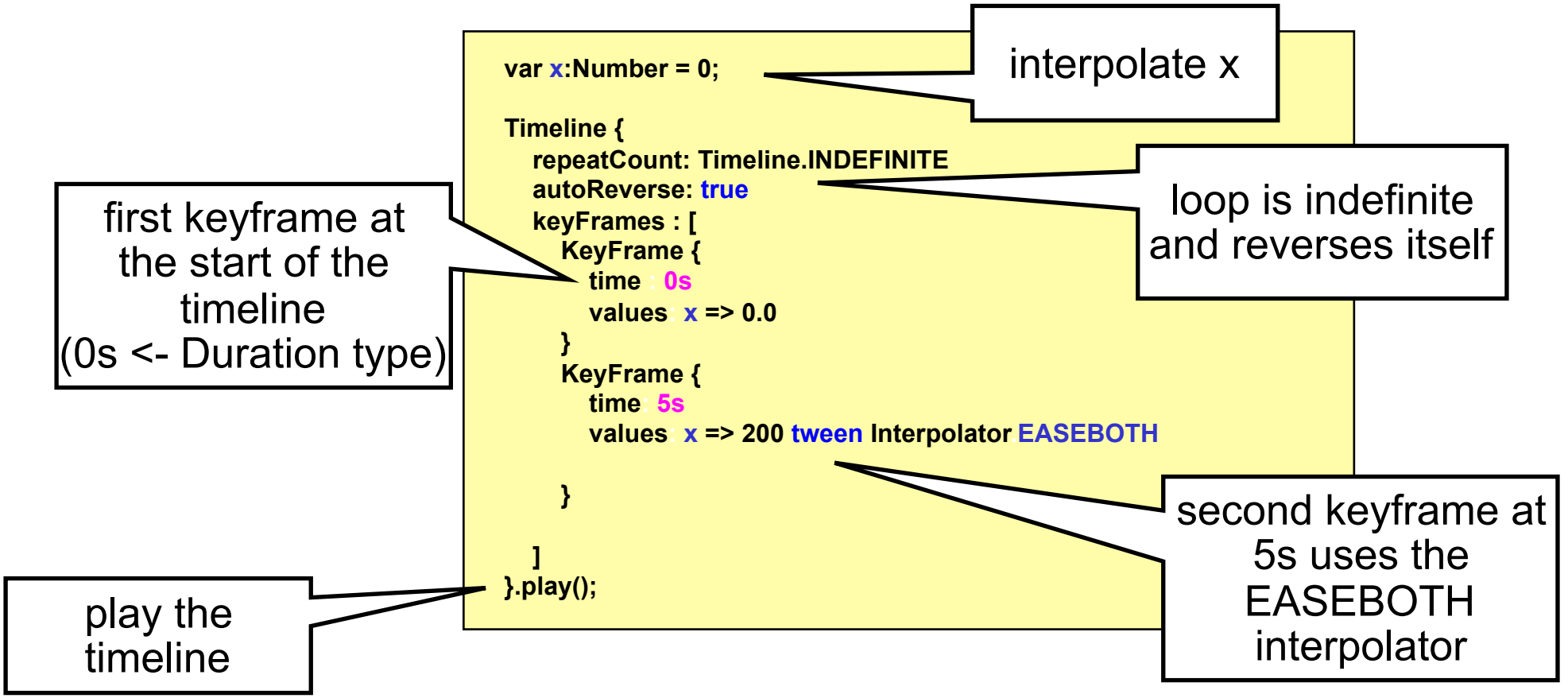


Animation

creating a timeline

To animate an object, a Timeline is needed

Within the Timeline, Keyframes are defined



Animation

binding to the animated value

The interpolated variable can be used like any other variable

```
Stage {
   title : "First Animation"
   scene: Scene {
      width: 200
      height: 200
      content: [
         Circle {
            centerX: bind x
            centerY: 100
            radius: 40
            fill: Color.RED
         }
      ]
   }
}
```

bind to the interpolated variable

Animation

Interpolators

Discrete: no interpolation, value “jumps” directly to the keyframe value

Linear: linear interpolation

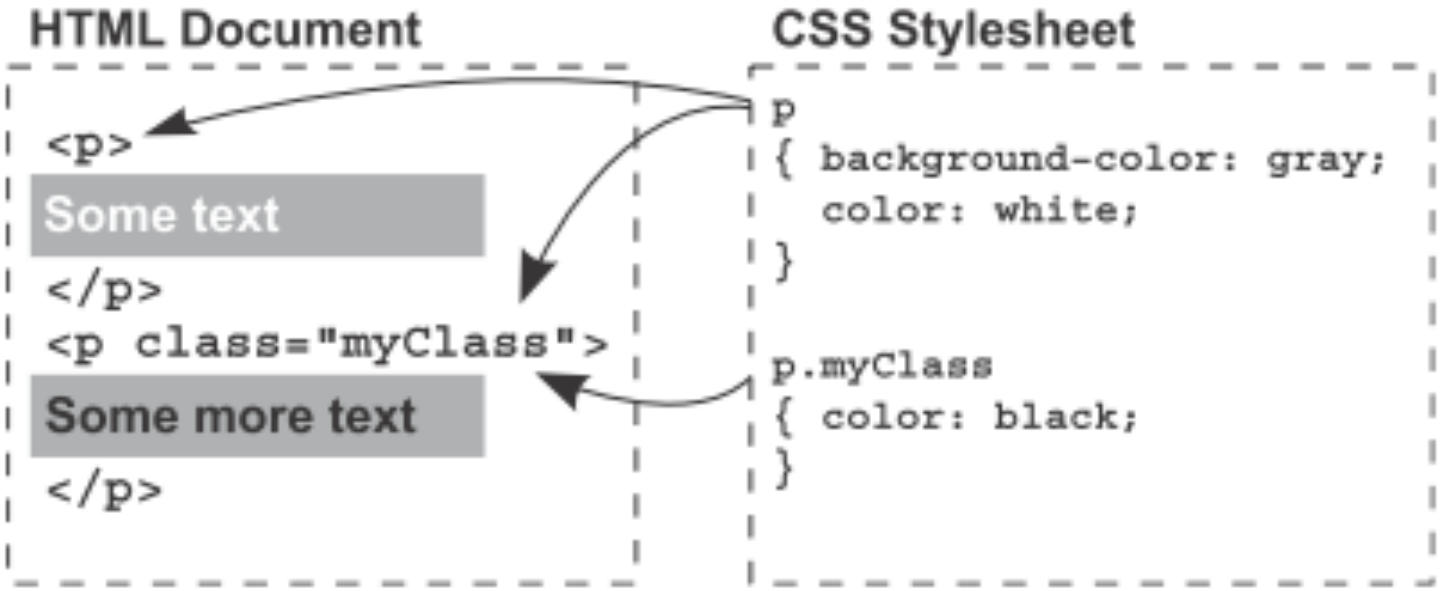
EaseIn: interpolated values smaller at the beginning then linear

EaseOut: smaller in the end

EaseBoth: EaseIn + EaseOut

Stylesheets

- Stylesheets determine the appearance of UI elements
- Separate file *.css
- Mostly known from HTML



from JavaFX in Action (Simon Morris)

Stylesheets

style.css

```
Text {
    fill: navy;
    font:bold italic 35pt "sans-serif";
}
```

or:

style.css

```
“javafx.scene.text.Text” {
    fill: navy;
    font:bold italic 35pt "sans-serif";
}
```

Main.fx

```
Stage {
    title: "Stylesheets"
    scene: Scene {
        stylesheets: ["{__DIR__}style.css"]
        width: 250
        height: 80
        content: [
            Text {
                x: 10
                y: 30
                content: "My styled text"
            }
        ]
    }
}
```

Stylesheets

style.css

```
Text#Caption {
    fill: navy;
    font:bold italic 35pt "sans-serif";
}
```

Main.fx

```
Stage {
    title: "Stylesheets"
    scene: Scene {
        stylesheets: ["{__DIR__}style.css"]
        width: 280
        height: 100
        content: [
            Text {
                id:"Caption"
                x: 10
                y: 30
                content: "Text with Style"
            }
            Text {
                x: 10
                y: 60
                content: "Text without Style"
            }
        ]
    }
}
```

Stylesheets

style.css

```
Text.Caption {
    fill: navy;
    font:bold italic 35pt "sans-serif";
}
```

Main.fx

```
Stage {
    title: "Stylesheets"
    scene: Scene {
        stylesheets: ["{__DIR__}style.css"]
        width: 280
        height: 100
        content: [
            Text {
                styleClass: "Caption"
                x: 10
                y: 30
                content: "Text with Style"
            }
            Text {
                x: 10
                y: 60
                content: "Text without Style"
            }
        ]
    }
}
```

Stylesheets

Style Sheets in JavaFX Version 1.3:

```
.scene {

   -fx-font: 16pt "Amble Cn";

   -fx-base: #AEBBD2;
   -fx-accent: #385589;
   -fx-mark-color: #3E857C;
}

.text-box {
   -fx-effect: innershadow( two-pass-box, rgba(0,0,0,0.2), 10, 0.0, 0, 2 );
   -fx-text-fill: #385589
}
```

MediaPlayer

- `javafx.scene.media.Media` is used for storing audio or video
- `javafx.scene.media.MediaPlayer` controls the play of the media
- Common media formats (e.g. .mp3, .flv, .avi, .mov, .mp4, .wav, etc.) and audio/video codecs supported (e.g. MP3, MPEG-4, MPEG-1, MIDI, H264, H.261 etc.)

```
var song1 = Media {
    onError: function(e:MediaError) {
        println("got a media error {e}");
    }
    source: „someURLorFile"
};
```

```
var mediaPlayer:MediaPlayer = MediaPlayer {
    media: song1
    volume: 0.5
    autoPlay: false
    onError: function(e:MediaError) {
        println("got a MediaPlayer error : {e.cause} {e}");
        mediaPlayer.stop();
        mediaPlayer.media = null;
    }
    onEndOfMedia: function() {
        println("reached end of media");
        mediaPlayer.play();
        mediaPlayer.stop();
        mediaPlayer.media = null;
    }
};
```