
JavaOne™

Custom Controls

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Program Agenda

- JavaFX UI Controls
  - Definition of a UI Control
  - Options for developing Controls
- Worked examples
- Looking ahead

JavaFX UI Control

- A Control might be loosely defined as
  - A JavaFX Node that allows for user interaction,
  - It does not necessarily extend from Control,
  - It is not necessarily reusable
  - It is commonly styled using CSS

Options for developing Custom UI controls

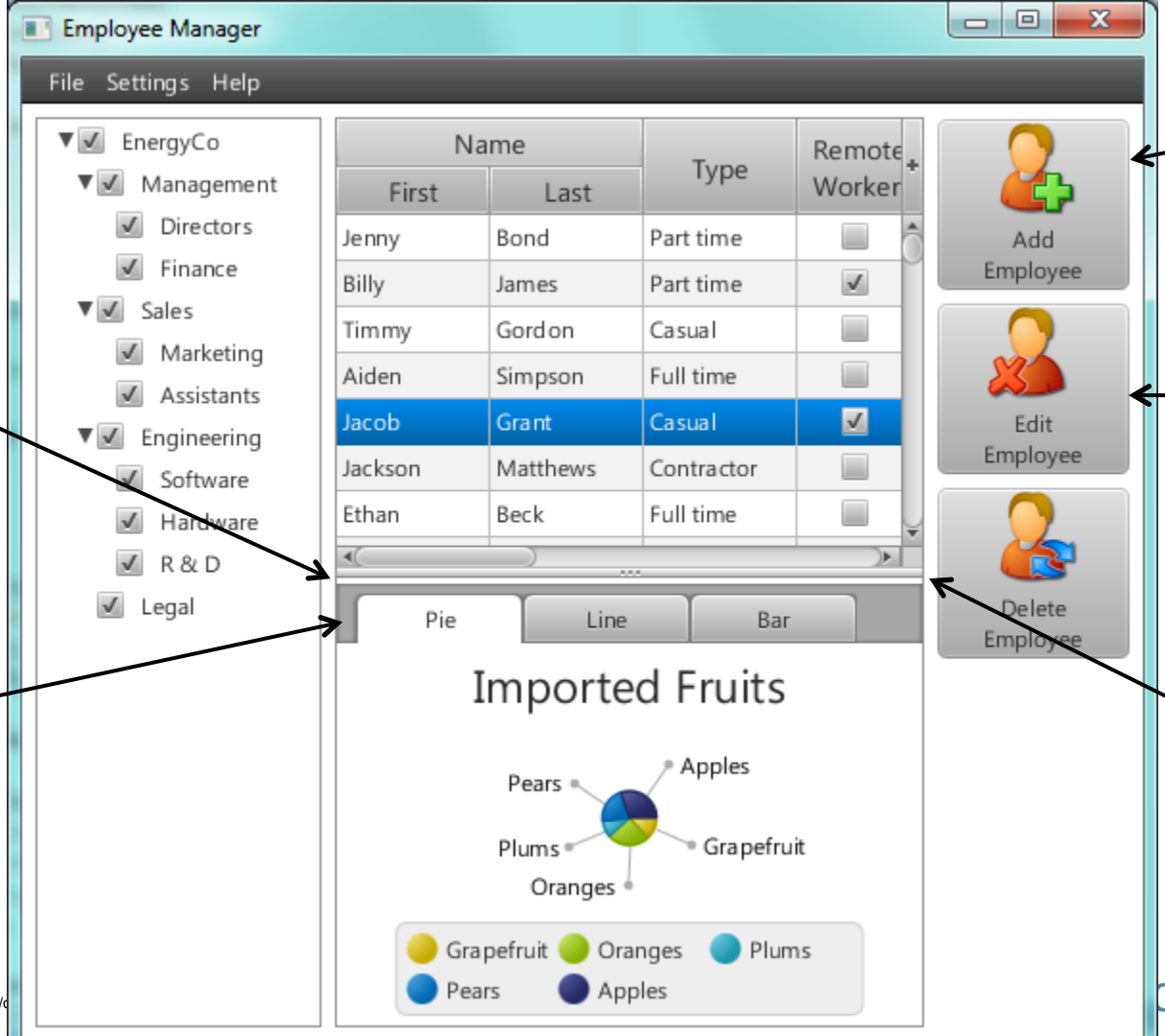
- Simplest
  - Use custom CSS to style an existing control
- For Custom / Unique functionality
  - Extend layout container and use custom CSS
- For redistribution as a library
  - Extend Control and / or create a new Skin, use custom CSS

Option 1: CSS styling

- All JavaFX 2.x controls are styled via CSS
- All styling is contained within caspian.css file
- You can overwrite any of this styling for your own purposes
  - Specify shapes
  - Fill and Stroke
  - Specify effects etc

SplitPane shows a border around all content.

Colour behind tabs differs from other gradients.



UI styled to look sharp / square: default round buttons look out of place.

Border colour of buttons is a lighter grey than the other borders.

SplitPane divider looks out of place.

Custom CSS: TabPane

```
// make border around TabPane be darker (by default the border is hidden)
.tab-content-area {
    -fx-border-color: gray;
    -fx-border-width: 0 1 1 1;
}

// Change background colour behind tabs to have a nicer gradient fill
.tab-pane *.tab-header-background {
    -fx-background-color: -fx-shadow-highlight-color, -fx-outer-border, -fx-inner-border, -fx-body-color;
    -fx-background-insets: 0 0 -1 0, 0, 1, 2;
}
```

Custom CSS: SplitPane

```
// Hide the border around the SplitPane
.split-pane {
    -fx-background-insets: 0;
}

// Hide the SplitPane divider (although retain the ability to drag with mouse)
.split-pane *.split-pane-divider {
    -fx-opacity: 0;
}

// Adding padding around TableView, for special case when embedded within SplitPane
.split-pane > * > * > .table-view { -fx-padding: 1px; }
```

Custom CSS: Button

```
// Make the outer border a darker gray, and remove rounded corners
.button {
    -fx-background-color: -fx-shadow-highlight-color, gray, -fx-inner-border, -fx-body-color;
    -fx-background-radius: 0;
}
```

Using custom stylesheets

- Define custom stylesheet and override default
- Stylesheets are applied to nodes in a scene

Using custom stylesheets

```
@Override public void start(Stage primaryStage) throws Exception {
      primaryStage.setTitle("Employee Manager");

       BorderPane root = new BorderPane();
       …
       Scene scene = new Scene(root);

       String javaoneCSS = getClass().getResource("javaone.css").toExternalForm();
       scene.getStylesheets().add(javaoneCSS);

       primaryStage.setScene(scene);
       primaryStage.show();
 }
```

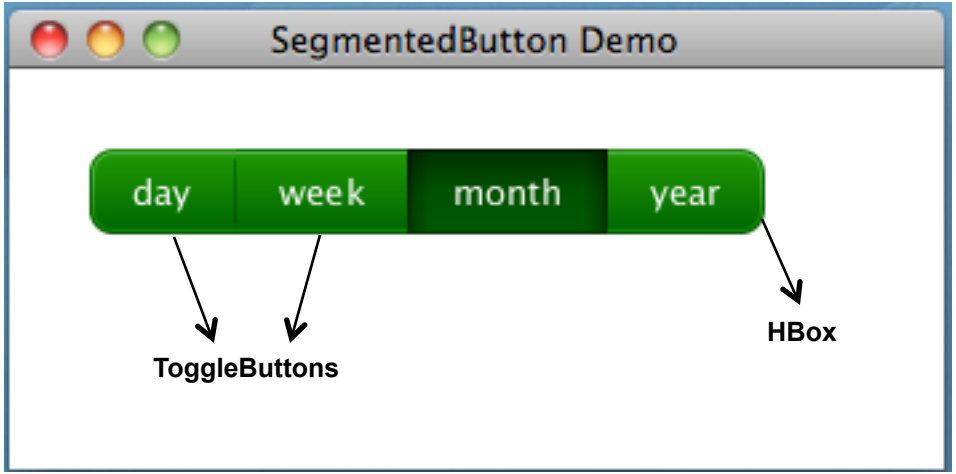
Option 2: Unique functionality

- No need to extend from Control
  - need more functionality than provided by a existing control.
  - not necessary to provide as a library control
- Extend Layout container and CSS styles
- Upsides to this approach:
  - Far less overhead (no need for separate Skin class, lower Node count, etc)
- Downsides:
  - Slightly more difficult to reuse control (must manually install CSS styling into scene)

```
scene.getStyleSheets().add("pathtostylesheet");
```

Option 2: Segmented Button example

- Horizontal Button made of multiple segments.
- Extends HBox
- Adds ToggleButtons to the container.
- Applies additional styles and custom CSS to these buttons



Option 2: Segmented Button Code

```
public SegmentedButton extends HBox  {
   private ObjectProperty<ObservableList<ToggleButton>> buttons;

   public SegmentedButton(ObservableList<ToggleButton> buttons) {
    getStyleClass().add("segmented-button");
    setButtons(buttons);
    buttons.addListener(new InvalidationListener() {
        @Override public void invalidated(Observable o) {
            updateButtons();
        }
    });
 }
```

Option 2: Segmented Button Code

```
private void updateButtons()  {
      for (int i = 0; i < getButtons().size(); i++) {
         ToggleButton t = getButtons().get(i);
         t.setToggleGroup(group);
         getChildren().add(t);
         if (i == buttons.get().size() - 1) {
             t.getStyleClass().add((i == 0) ? "only-button" : "last-button");
         } else if (i == 0) {
             t.getStyleClass().add("first-button");
         } else {
             t.getStyleClass().add("middle-button");
         }
    }
}
```

Option 2: Segmented Button CSS

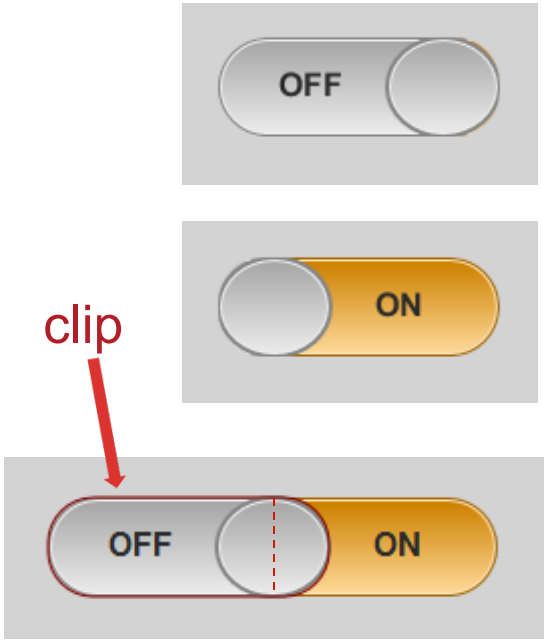
```
.segmented-button .first-button {
        -fx-background-radius: 12 0 0 12;
        -fx-background-insets: 0 0 -1 0, 0, 1 0 1 1, 2 0 2 2;
        -fx-border-insets: 4 0 4 0;
}
.segmented-button .last-button {
        -fx-background-radius: 0 12 12 0;
        -fx-background-insets: 0 0 -1 0, 0, 1 1 1 0, 2 2 2 0;
        -fx-border-insets: 4 0 4 0;
}
.segmented-button .middle-button {
        -fx-background-radius: 0;
        -fx-background-insets: 0 0 -1 0, 0, 1 0 1 0, 2 0 2 0;
        -fx-border-insets: 4 0 4 0;
}
```

Option 2: Segmented Button CSS

```
.segmented-button .toggle-button:selected  {
    -fx-background-color:  -fx-shadow-highlight-color,
            linear-gradient( to bottom, derive(-fx-color,-90%) 0%, derive(-fx-color,-60%) 100% ),
            linear-gradient( to bottom, derive(-fx-color,-60%) 0%, derive(-fx-color,-35%) 50%, derive(-fx-color,-30%) 98%, derive(-fx-color,-50%) 100% ),
            linear-gradient( to right, rgba(0,0,0,0.3) 0%, rgba(0,0,0,0) 10%, rgba(0,0,0,0) 90%, rgba(0,0,0,0.3) 100% );
    -fx-background-insets: 0 0 -1 0, 0, 1, 1;
    -fx-text-fill: -fx-light-text-color;
}
```

Option 2: (Example 2) ToggleSwitch

- Extends Region.
- Can be either On or Off.
- Has two labels (on/off) and a StackPane in the center for the slider.
- Animates the state change.
- Sets a clip to show only one of the state at any given time.



Option 2: ToggleSwitch Code

```
public class ToggleSwitch extends Region {
   final Label offLabel = new Label("Off");
   final Label onLabel = new Label("On");
   final StackPane slider = new StackPane();
   Timeline timeline = new Timeline();

   public ToggleSwitch() {
        getChildren().addAll(offLabel, onLabel, slider);
        // clipRect is a rectangle whose width is set the size of half of the Region's Width.
        setClip(clipRect);
        // add event handlers for interaction
   }
```

Option 2: ToggleSwitch Code

```
/** animates when either the slider or ON/OFF label is clicked
  clip rectangle moves in the opposite direction of the Region itself.
*/
private void animate() {
     timeline.getKeyFrames().addAll (
          new KeyFrame(Duration.ZERO, new KeyValue(clipRect.xProperty(), 0)),
          new KeyFrame(Duration.ZERO, new KeyValue(layoutXProperty(), 0)),
          new KeyFrame(new Duration(400), new KeyValue(clipRect.xProperty(), movingWidth),
                                new KeyValue(layoutXProperty(), -movingWidth)));
     timeline.setRate((!toggle.get()) ? 1 : -1);
     timeline.play();
     toggle.set(!toggle.get()); // used to reverse animation direction.
 }
```

Specifies the direction of animation

Option 2: ToggleSwitch CSS

```
.toggle-switch {
      -fx-background-color: derive(-fx-color,-36%), derive(-fx-color,73%),
        linear-gradient(to bottom, derive(-fx-color,-19%),derive(-fx-color,61%));
      -fx-background-radius: 30;
}
.on-label {
       -fx-background-color: derive(orange,-36%), derive(orange,73%),
             linear-gradient(to bottom, derive(orange,-19%),derive(orange,61%));
      -fx-background-radius: 0 30 30 0;
}
.off-label {
       -fx-background-radius: 30 0 0 30;
}
.on-off-slider {
        -fx-background-radius: 30;
}
```

ToggleSwitch as CheckBoxSkin

- ToggleSwitch has the same functionality as that of a CheckBox.
- Implement ToggleSwitchSkin that implements the Skin Interface.
- Add “toggle-switch” styleclass to CheckBox.

```
checkbox.getStyleClass().setAll(“toggle-switch);
```

- Swap in ToggleSwitchSkin for CheckBox by specifying (in CSS):

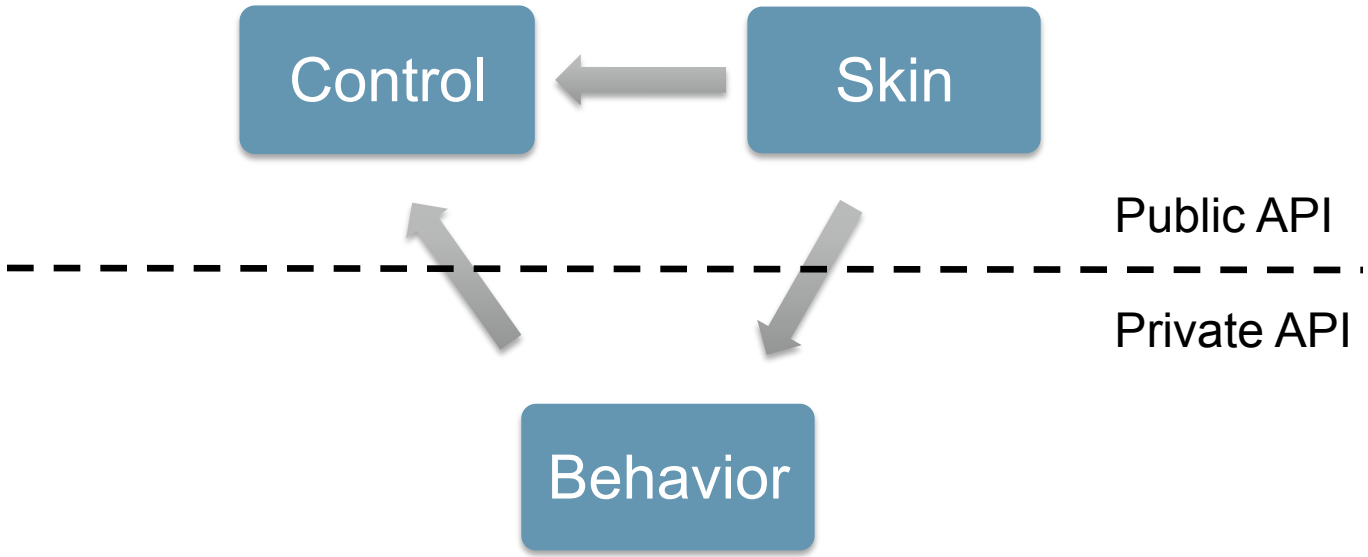
```
.toggle-switch {
    -fx-skin: <path to ToggleSwitchSkin>;

}
```

Option 3: For redistribution of controls

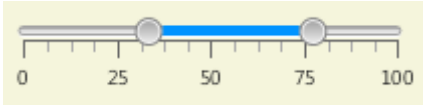
- Extend the Control class and or provide custom skin
- All controls that ship with JavaFX 2.x extend Control
- Control is-a Node
  - Has state values and all scenegraph transformations are valid
- Controls has-a Skin
  - Visual appearance of Control (has nodes)
- Behavior
  - Interaction like event handling.

Option 3: The Control API



First steps to creating a Custom Control

- Create a class that implements Skin (RangeSliderSkin)
- Create a CSS file to contain your CSS styling (range-slider.css)
  - Create a .range-slider{ … } section, and specify –fx-skin: “com.widgets.RangeSliderSkin”;
- Create a class that extends Control (RangeSlider)
  - Set a style class by calling getStyleClasses().add(“range-slider”)
  - Override getUserAgentStyleSheet and return the path to range-slider.css



- Next steps:
  - Add relevant API into RangeSlider
  - Implement RangeSliderSkin to return visual representation of control, and observe changes in RangeSlider

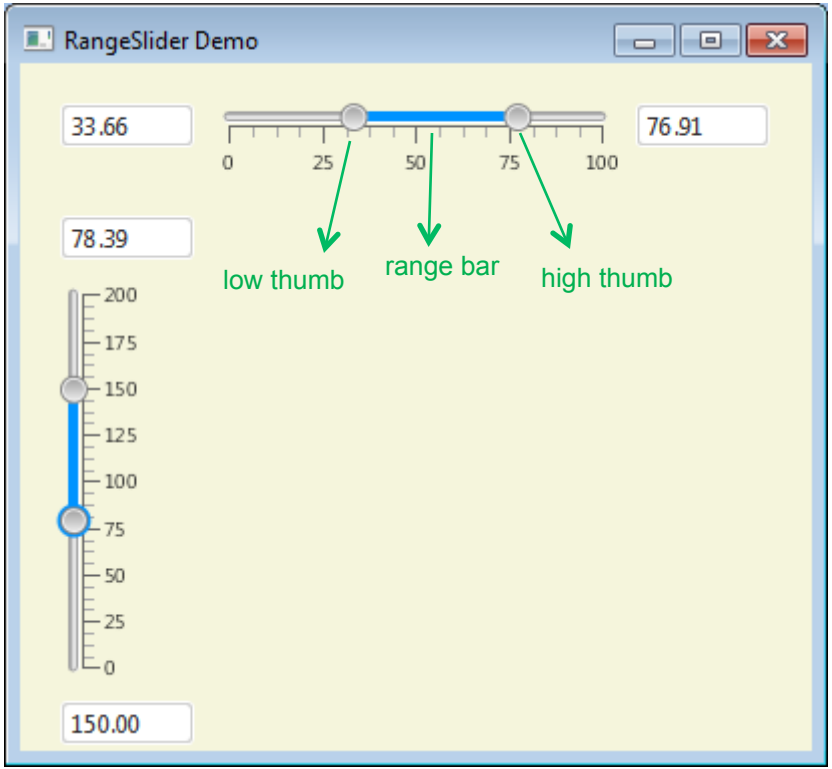
Option 3: RangeSlider Example

Options

- Reuse some of the code from Slider control, skin and behavior
  - Not a good idea to subclass Slider (API would not make sense)
  - Start by **copying the source** into a RangeSlider class.
- RangeSlider extends **Control** class
- RangeSliderSkin implements **Skin** Interface
- RangeSliderBehavior to handle slider interaction.
- rangeslider.css contains **CSS** styling

Option 3: RangeSlider Properties

```
public class RangeSlider extends Control {
  private DoubleProperty lowValue;
  private BooleanProperty lowValueChanging;
  private DoubleProperty highValue;
  private BooleanProperty highValueChanging;
  ...and other properties of Slider.
  public RangeSlider() {
     getStyleClass().add("range-slider");
  }
  @Override
  protected String getUserAgentStylesheet() {
        // "rangeslider.css";
  }
}
```



Option 3: RangeSliderSkin and behavior

```
public class RangeSliderSkin extends SkinBase<RangeSlider, RangeSliderBehavior> {
     // StackPanes used for track, lowThumb, highThumb and rangeBar
     public RangeSliderSkin() {
        lowThumb.getStyleClass().add("low-thumb");
        highThumb.getStyleClass().add("high-thumb");
        rangeBar.getStyleClass().add("range-bar");
        track.getStyleClass().add("track");
     }
}
public class RangeSliderBehavior extends BehaviorBase<RangeSlider> {
  // handles RangeSlider interaction.
}
```

Option 3: rangeslider.css

```
.range-slider > .low-thumb, .range-slider > .high-thumb {
      -fx-background-color: derive(-fx-color,-36%), derive(-fx-color,73%),
       linear-gradient(to bottom, derive(-fx-color,-19%),derive(-fx-color,61%));
       -fx-background-insets: 0, 1, 2;
       -fx-background-radius: 1.0em; /* makes sure this remains circular */
       -fx-padding: 0.583333em; /* 7 */
}
.range-slider > .range-bar {
       -fx-background-color: -fx-focus-color;
}
.range-slider:vertical > .track {
       -fx-background-color: -fx-shadow-highlight-color, derive(-fx-color,-22%),
        linear-gradient(to right, derive(-fx-color,-15.5%), derive(-fx-color,34%) 30%, derive(-fx-color,68%));
       -fx-background-insets: 0 -1 0 1, 0, 1;
}
```

Option 3: (Example 2) Rating control

```
public class Rating extends Control {
     // public properties
     IntegerProperty rating;
     IntegerProperty max;
     ObjectProperty<Orientation> orientation;

     @Override protected String getUserAgentStylesheet() {
         return getClass().getResource("rating.css").
              toExternalForm();
     }
}
```

Option 3: (Example 2) Rating control

```
public class RatingSkin extends SkinBase<Rating, RatingBehavior> {
     private static final String STRONG = "strong";
     public RatingSkin(Rating control) {
        Pane btnContainer = isVertical() ? new VBox() : new HBox();
        // Add ToggleButtons to the pane based on max value.
     }
         private void updateRating(int newRating) {
        // for all toggle in buttons
        toggle.getStyleClass().remove(STRONG);
              if (toggleIndex <= newRating) {
                   toggle.getStyleClass().add(STRONG);
              }
     }
}
```

Option 3: (Example 2) Rating control CSS

```
.rating > .container > .toggle-button {
    -fx-background-color: transparent;
    -fx-background-image: url("unselected-star.png");
    -fx-padding: 8 16;
    -fx-background-image-repeat: no-repeat;
}
.rating > .container > .toggle-button.strong {
    -fx-background-image: url("selected-star.png");
}
.rating > .container > .toggle-button:hover {
    -fx-effect: dropshadow( three-pass-box , rgba(0,0,0,0.6) , 8, 0.0 , 0 , 0 );
}
```

default style

Worked Examples

Looking Ahead

Looking Ahead

- There is a lot that is planned for JavaFX 8.0 (for UI controls):
  - Public API for custom UI controls
  - Public (Java-based) API for CSS
  - RTL / bidi text support
  - A11y support
  - TreeTableView (maybe)
  - Charts improvements
  - Miscellaneous features / tweaks
  - Performance improvements
  - Bug fixes

Looking Ahead

Public API for custom UI controls

- In JavaFX 2.2, Control/Skin is public API
  - However, the base Skin implementation, SkinBase, has always been private API
  - This makes building 3rd party controls more difficult / risky than it needs to be
  - However, almost all 3rd party controls use SkinBase rather than Skin
- The controls API will be made public and finally committed to for JavaFX 8.0
- Already there are two changes and ideas that we can talk about…

Looking Ahead

Public API for custom UI controls

http://javafx-jira.kenai.com/browse/RT-21596

Looking Ahead

Public API for custom UI controls

- Change #1: SkinBase no longer extends from Region
  - Pros:
    - Controls are lighter-weight: Control extends from Region, SkinBase extends from Object
    - Controls are now conceptually simpler: a Control contains children which the Skin lays out (previously the controls children were separate from the skins children, which was confusing)
  - Cons:
    - All skins extending from SkinBase (naughty people!) are now broken

- SkinBase, in JavaFX 8.0, has moved to be public API (although the API isn't finished changing quite yet)

Looking Ahead

Public API for custom UI controls

- (Proposed) Change #2: Behavior does not move into public API, introduce alternative public API for recording key / mouse actions

- Current in-research approach uses annotations to annotate methods, and input/action maps on the control to store these.

Looking Ahead

Public API for custom UI controls

- You would annotate a method as shown below, and most probably group together all methods relevant to a single control in a single class.
  - In other words, the Behavior classes for our controls are perfect for this approach – they will just become implementation details rather than public API.

```
@ActionMethod(actionCommands={
    @KeyEventMethod(keyCode="space", keyEventType=KEY_PRESSED),

    // Mac OS doesn't support enter press, so we add Enter support for
    // everyone apart from Mac OS
    @KeyEventMethod(keyCode="enter", keyEventType=KEY_PRESSED, mac=false),
})
public void keyPressed() {
    …
}
```

Looking Ahead

Public API for custom UI controls

- Then, rather than have the Skin defer all key interactions to the behavior, the constructor call the ActionManager to parse the annotations from a given object.

```
// initialise behavior by populating the button input and action maps
ActionManager.populateControlMaps(button, new ButtonBehavior<Button>(button));
```

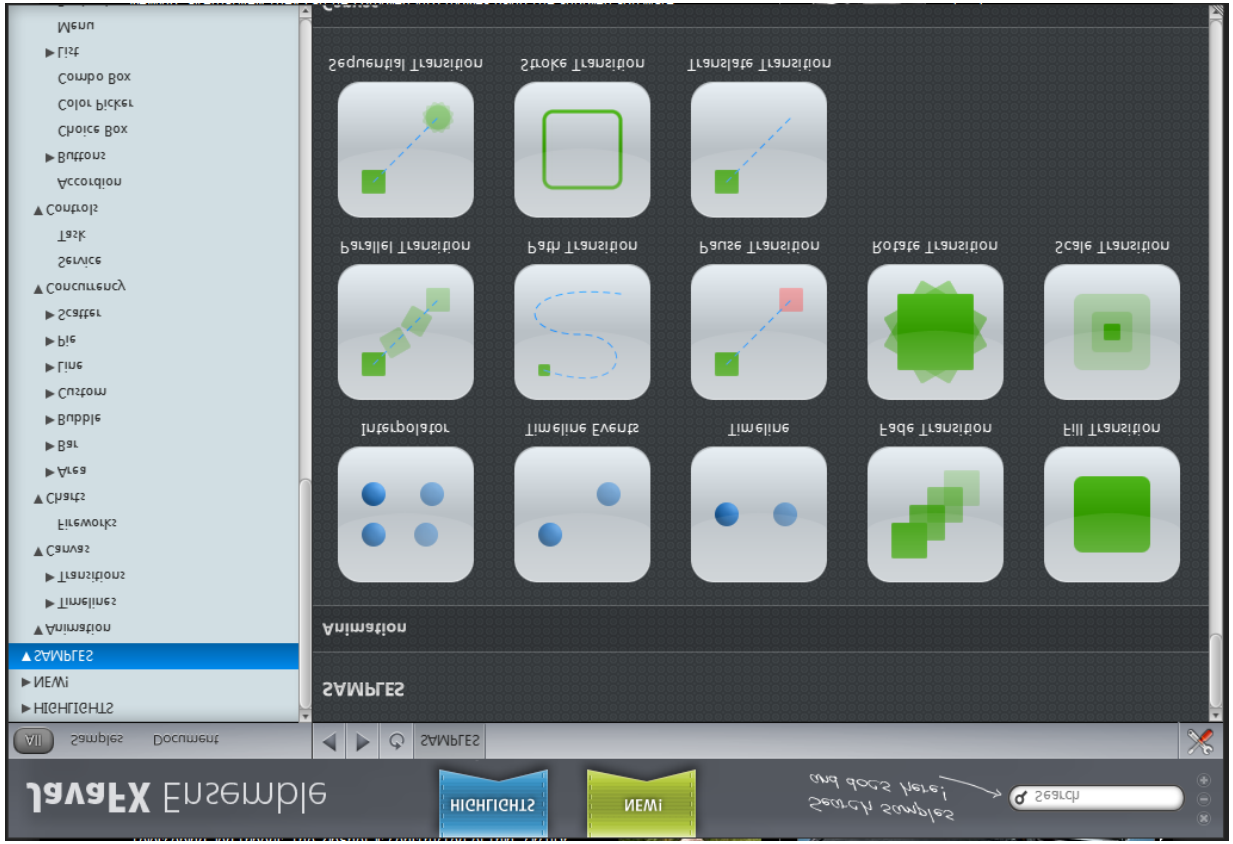
- What this does is populate two new maps in the control (in this case Button):

```
ObservableMap<KeyCombination, Object> inputMap;
ObservableMap<Object, Action> actionMap;
```

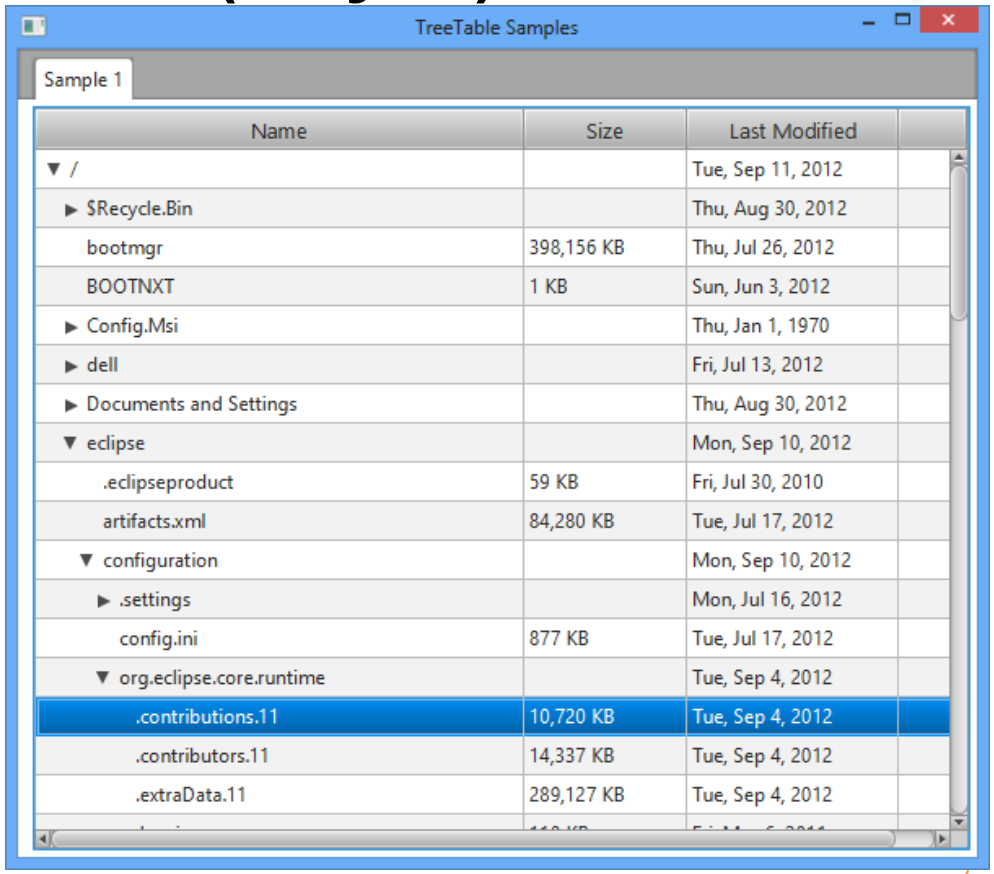
- These will be called (via SkinBase) when a key event occurs
- These two maps can then be manually manipulated by people wanting to modify behaviors

RTL Support

RTL Support



TreeTableView (maybe)



Accessibility Support

- Accessibility support on Windows and Mac platform.
  - Using standard accessibility interfaces
    - UIAutomation on Windows
    - NSAccessibility on Mac
- Full keyboard support for navigation
- Better support for high contrast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Thanks for attending!
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