CS 213 – Software Methodology

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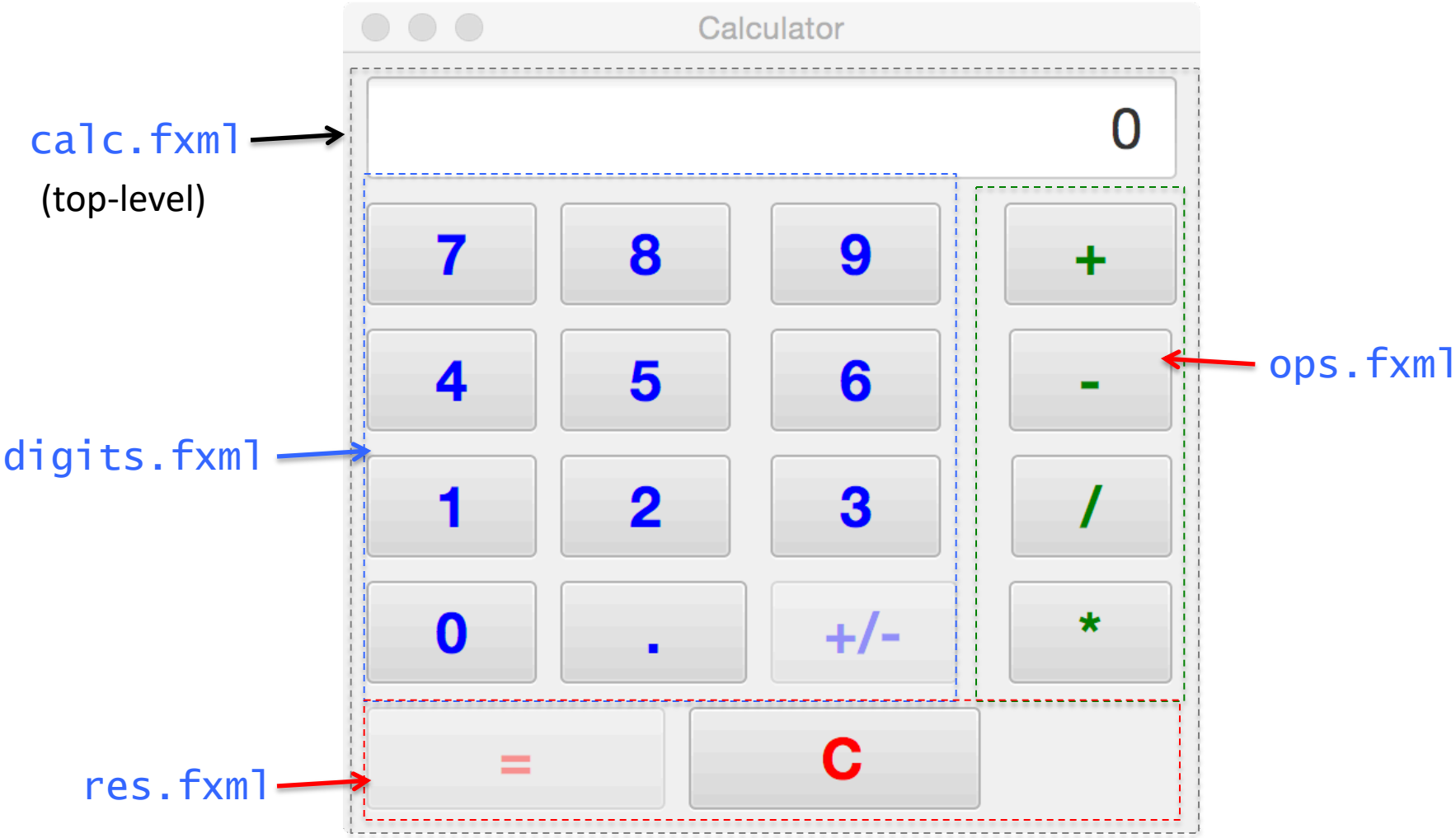
Design Patterns – 2

Singleton Pattern

Calculator Design/Implementation

Building a Calculator - UI

Calculator UI – Nested UI Entities



Nested UI Entities - FXMLs

calc.fxml

```
...
<?import java.net.*?>

<GridPane
    ...
    fx:controller="view.CalcController">
    ...
    <TextField fx:id="display" editable="false" alignment="CENTER_RIGHT"
               GridPane.columnSpan="2" />

    <fx:include fx:id="digits" source="digits.fxml" GridPane.rowIndex="1" />
    <fx:include fx:id="ops" source="ops.fxml" GridPane.columnIndex="1"
                GridPane.rowIndex="1" />
    <fx:include fx:id="res" source="res.fxml" GridPane.rowIndex="2"/>

    <stylesheets>
        <URL value="@calc.css" />
    </stylesheets>

</GridPane>
```

Need this for URL tag used with CSS styling (see bottom)

You can nest UI entities with their own FXML layouts, with `fx:include`

```
.button {
  -fx-font-size: 18pt;
  -fx-font-weight: bold;
}
.text-field {
  -fx-font-size: 18pt;_
}
```

Matching Nested Entities with Controllers

calc.fxml

```
...
fx:controller="view.CalcController">
...
<fx:include fx:id="digits" source="digits.fxml" ... />
<fx:include fx:id="ops" source="ops.fxml" ... />
<fx:include fx:id="res" source="res.fxml"... />
```

CalcController.java

```
public class CalcController {
    ...
    @FXML
    protected DigitController digitsController;

    @FXML
    protected OperatorController opsController;

    @FXML
    protected ResultController resController;
    ...
}
```

IMPORTANT!!

The names of the controllers for the contained UI FXMLs must match the ids that go with fx:include in the container's FXML

fx:define and fx:reference

digits.fxml

```
<GridPane
  ...
  fx:controller="view.DigitController">
   ...
   <Button fx:id="d7" onAction="#digitPressed" text="  7  "  />
   <Button fx:id="d8" onAction="#digitPressed" text="  8  " ... />
   <Button fx:id="d9" onAction="#digitPressed" text="  9  " ... />
   <Button fx:id="d4" onAction="#digitPressed" text="  4  " ... />
   <Button fx:id="d5" onAction="#digitPressed" text="  5  " ... />
   <Button fx:id="d6" onAction="#digitPressed" text="  6  " ... />
   <Button fx:id="d1" onAction="#digitPressed" text="  1  " ... />
   <Button fx:id="d2" onAction="#digitPressed" text="  2  " ... />
   <Button fx:id="d3" onAction="#digitPressed" text="  3  " ... />
   <Button fx:id="d0" onAction="#digitPressed" text="  0  " ... />
   ...
   <fx:define>
     <ArrayList fx:id="digitButtons">
      <fx:reference source="d0"/>
      <fx:reference source="d1"/>
      ...
      <fx:reference source="d8"/>
      <fx:reference source="d9"/>
     </ArrayList>
   </fx:define>
   ...
</GridPane>
```

needs `<?import java.util.*?>`

source values are the ids declared elsewhere in the FXML

This set up does away with the tedium of defining one @FXML field per button in the controller class

Matching ArrayList of fx:define to Java Code

digits.fxml

```
...
<fx:define>
   <ArrayList fx:id="digitButtons">
      ...
   </ArrayList>
</fx:define>
...
<stylesheets>
    <URL value="@digits.css" />
</stylesheets>
```

```
public class DigitController {

   ...
   @FXML
   protected List<Button> digitButtons;
   ...
}
```

Container's styling is inherited by contained UIs

calc.css

```
.button {
   -fx-font-size: 18pt;
   -fx-font-weight: bold;
}
.text-field {
   -fx-font-size: 18pt;
}
```

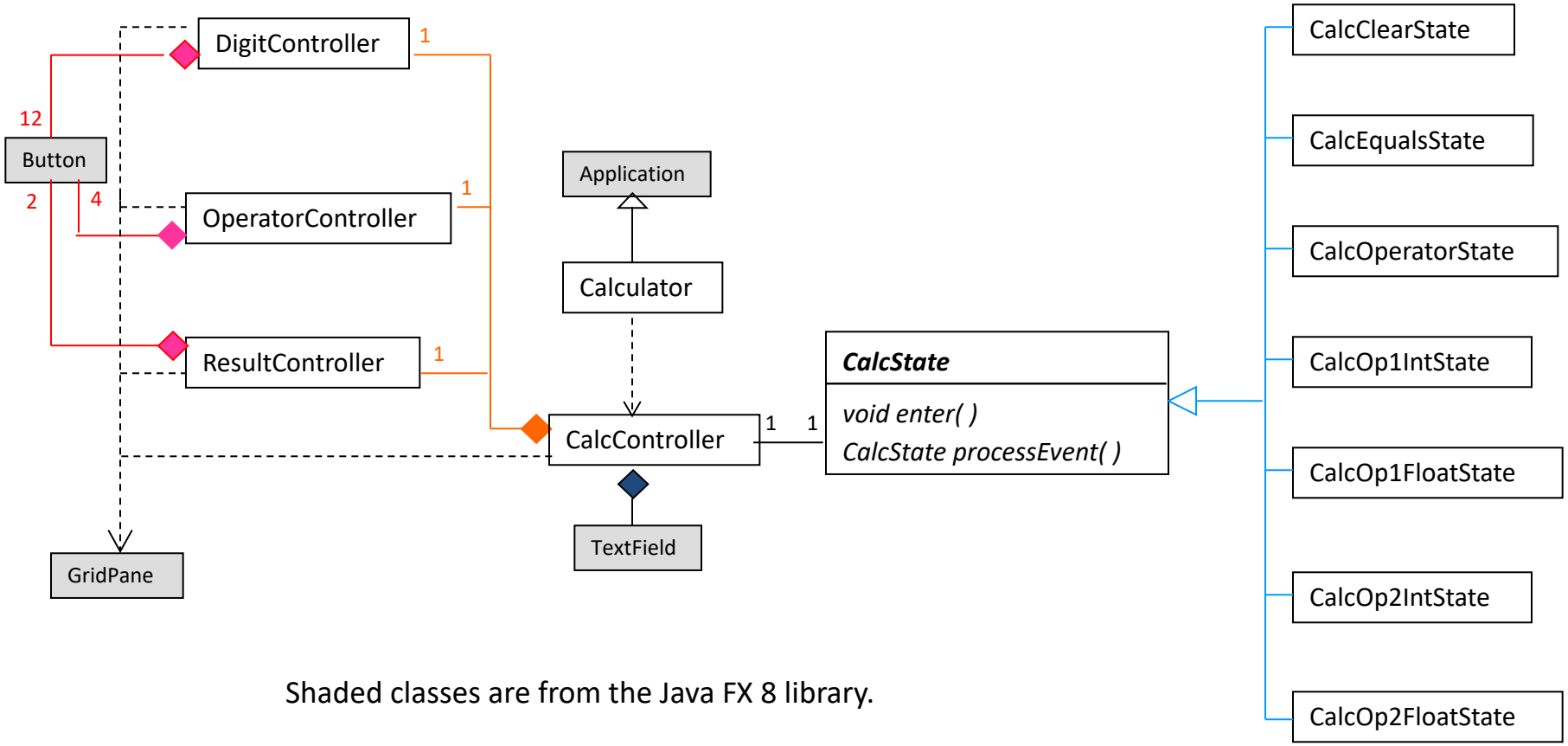
digits.css

```
.button {
   -fx-text-fill: blue;
}
```

digits will be boldfaced and
have font size of 18 pt, as
defined in calc.css, plus
color blue as defined in digits.css

Building a Calculator – Integrating UI with Patterns

State-based Calculator – UML Class Diagram

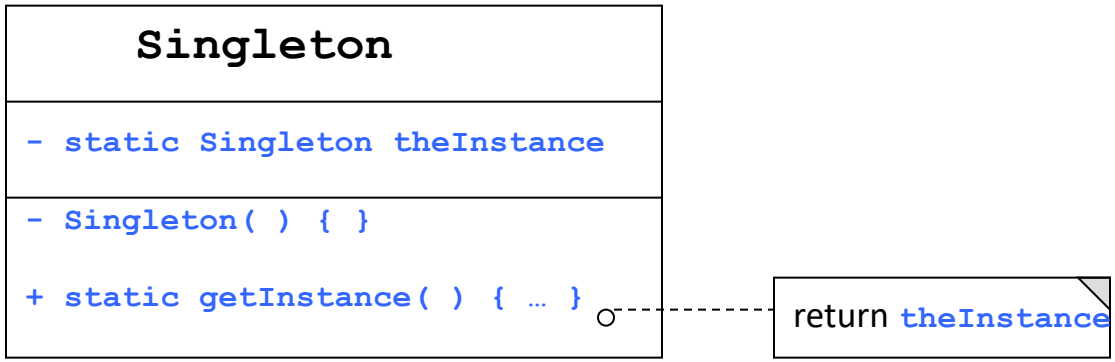


Shaded classes are from the Java FX 8 library.

All application classes are in the `view` package, except `Calculator` which is in the `calc` package.

Singleton Design Pattern: Creational

- Ensure that a class has only one object (instance) and provide a global point of access to this single instance



- The single private constructor ensures that an instance of Singleton cannot be created using `new`

Singleton Design Pattern: Applied to Calculator

- Each of the concrete state classes implements the Singleton pattern. For instance, the `CalcClearState` class:

```
class CalcClearState {

   . . .
   private static CalcClearState instance = null;
   . . .
   private CalcClearState() {

   }
   . . .
   public static CalcClearState getInstance() {
      if (instance == null) {
         instance = new CalcClearState();
      }
      return instance;
   }
   ...
}
```

Code walkthrough of Calculator application key highlights, in video