

# Events and Their Handling

Object Oriented Programming  
2024 First Semester  
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- 1 Event driven
- 2 Example: `guiWithAction`
- 3 Example: `ColorChoice`
- 4 Class design for `ColorPanel` class

# Today's program

`https://github.com/oop-mc-saga/ColorChoice`

# Event Driven

- Events in GUI applications are generated by
  - User's action through mouse, keyboard
  - Changes in widgets, etc.
- Mechanisms driven by events are called *Event Driven*.
- Event driven mechanisms are common in GUI applications

# Event Driven in Java

- Event classes are defined as extensions of `java.util.EventObject`.
- `EventListener` (receivers of events) classes are defined as extensions of `java.util.EventListener`.
- `EventListener` instances have methods for handling events.

# Actions in `guiWithAction`

## Examples of events and event handling

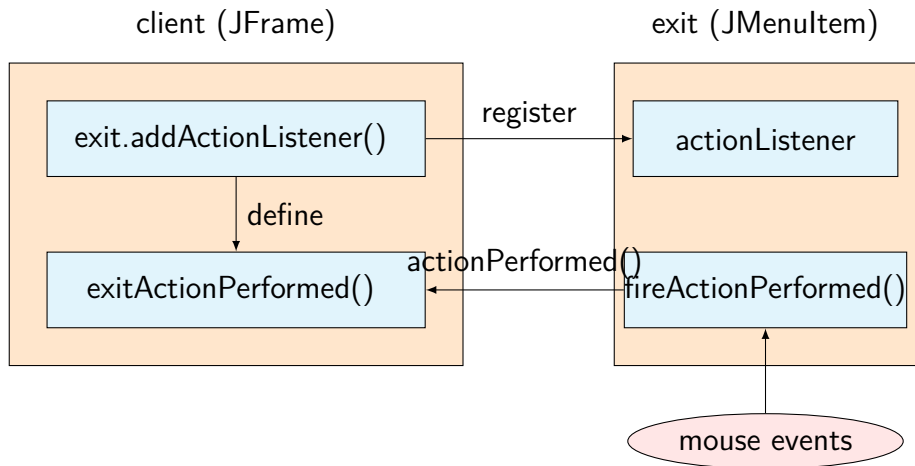
- `guiWithAction` responds to button events.
- Registering `actionListener`
  - `JFrame`: `exit.addActionListener()`
  - `JMenuItem`: Register as an instance of `ActionListener`
- Event handling
  - `JFrame`: call `exitActionPerformed()`
  - `JMenuItem`: call `actionPerformed()` in `fireActionListener()`

# Code in guiWithAction

```
1  exit.addActionListener(new java.awt.event.ActionListener() {  
2      public void actionPerformed(java.awt.event.ActionEvent evt) {  
3          exitActionPerformed(evt);  
4      }  
5  });
```

- The JMenuItem instance exit has a method `addActionListener()`.
- The method registers an instance of the event listener interface `ActionListener`.
- The method `actionPerformed()` is implemented to call `exitActionPerformed()`.

# Relations between widgets and actions in guiWithAction





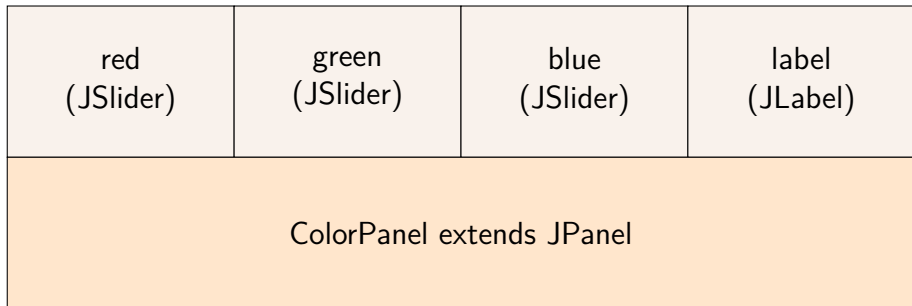
# Actions in event generators

- An instance or a list of instances of action listeners
- `addActionListener()` method registers listeners
- At an occurrence of events
  - Notify event to listeners through `fireActionListener()`
  - In the `fireActionListener()` method, call `actionPerformed()` of each listener.

# Example: ColorChoice

- The application specifies color by rgb components using sliders.
- Sliders
  - JSlider class
  - Generate ChangeEvent
- Place three color sliders for rgb components in a panel
  - Place JSlider instances in JPanel
  - JPanel usually does not generate ChangeEvent
  - Need to define event handling mechanisms

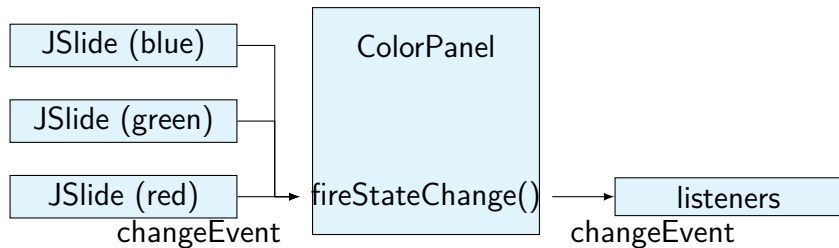
# Widget composition



# Class design for ColorPanel class

- List of `ChangeListener` instances
- `fireStateChange()` method
  - notify changes to listeners
- Three `JSlider` instances for `rgb`
  - Each `stateChange()` calls `fireStateChange()` method

# Event propagation in ColorPanel



# ColorPanel

```
1 public ColorPanel() {  
2     initComponents();  
3     listeners = new ArrayList<>();  
4     setColor();  
5     redSlider.addChangeListener(e->fireStateChanged(e));  
6     greeSlider.addChangeListener(e->fireStateChanged(e));  
7     blueSlider.addChangeListener(e->fireStateChanged(e));  
8 }
```

- Define actions as calling `fireStateChanged()` at state change events of sliders.
- Instances of `ChangeListener` are registered using lambda expressions.
  - The interface `ChangeListener` has a single method `stateChanged()`.

# ColorPanel

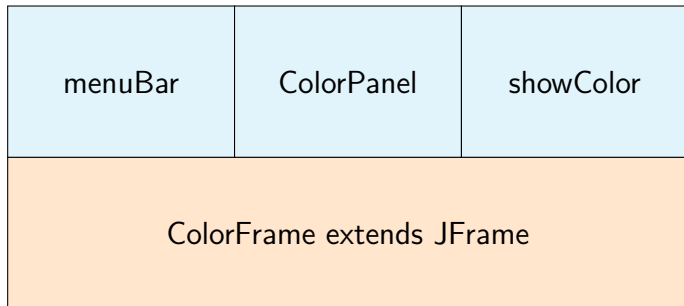
```
1  /**
2   * Add change listener
3   *
4   * @param listener
5   */
6  public void addChangeListener(ChangeListener listener) {
7      listeners.add(listener);
8  }
9
10 /**
11  * Notify listeners of event
12  *
13  * @param e
14  */
15 protected void fireStateChanged(ChangeEvent e) {
16     setColor();
17     listeners.forEach(li -> li.stateChanged(e));
18 }
```

Notify an event to listeners at state change events.

```
1  /**
2   * Get color values from three sliders and set color
3   */
4  private void setColor() {
5      int r = redSlider.getValue();
6      int g = greeSlider.getValue();
7      int b = blueSlider.getValue();
8      color = new Color(r, g, b);
9      setLabel(r, g, b);
10 }
```



# Widgets in ColorFrame



# Exercise

Get color from Colors and set the color to colorPanel (see quiz).