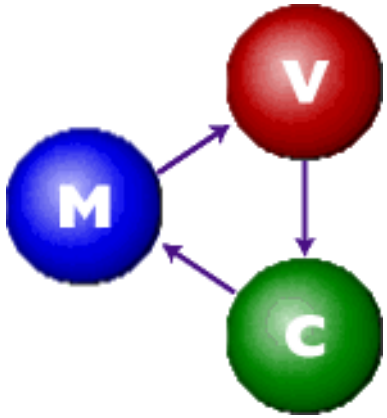
Programowanie i projektowanie obiektowe
GUI

Paweł Daniluk

Wydział Fizyki

Jesień 2012

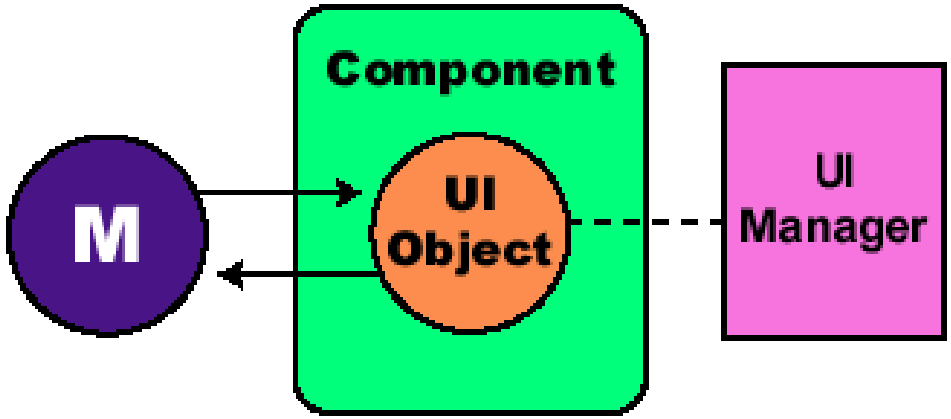
MVC



Model-View-Controller

- Model – Dane
- Widok – Graficzna reprezentacja
- Kontroler – Aktualizuje model na podstawie działań użytkownika

Swing



Swing

Jedna z bibliotek interfejsu graficznego w Javie. Uproszczona wersja modelu MVC.

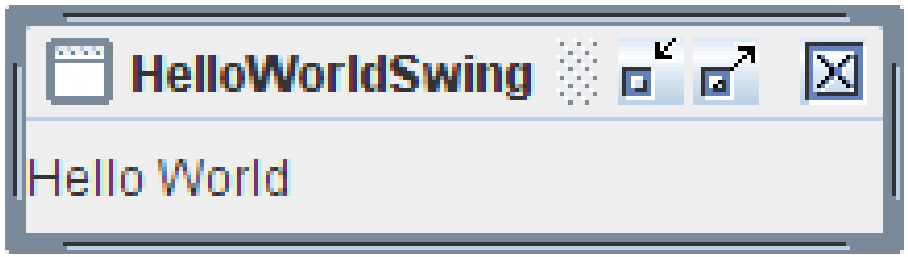
Hello World

```
import javax.swing.*;

public class HelloWorldSwing {
    /**
     * Create the GUI and show it.  For thread safety,
     * this method should be invoked from the
     * event-dispatching thread.
     */
    private static void createAndShowGUI() {
        //Create and set up the window.
        JFrame frame = new JFrame("HelloWorldSwing");
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

        //Add the ubiquitous "Hello World" label.
        JLabel label = new JLabel("Hello World");
        frame.getContentPane().add(label);

        //Display the window.
        frame.pack();
        frame.setVisible(true);
    }
```

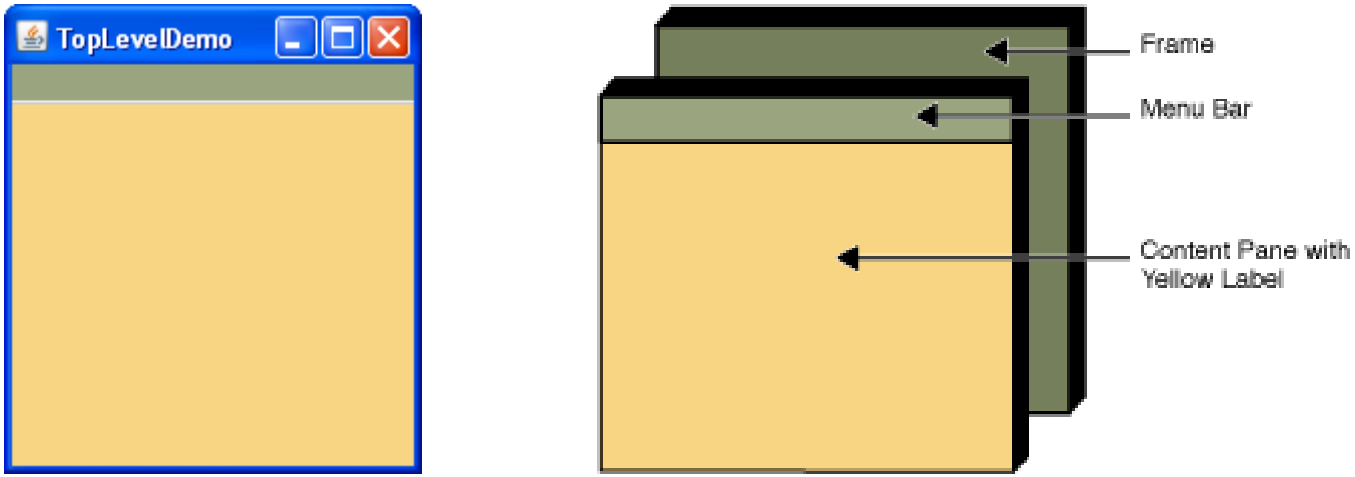
Hello World c.d.

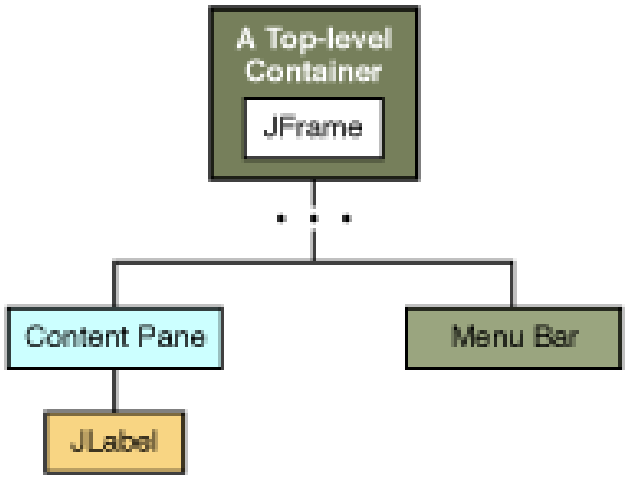
```
    public static void main(String[] args) {
        //Schedule a job for the event-dispatching thread:
        //creating and showing this application's GUI.
        javax.swing.SwingUtilities.invokeLater(new Runnable() {

            public void run() {
                createAndShowGUI();
            }
        });
    }
}
```

Hello World c.d.



Kontenery

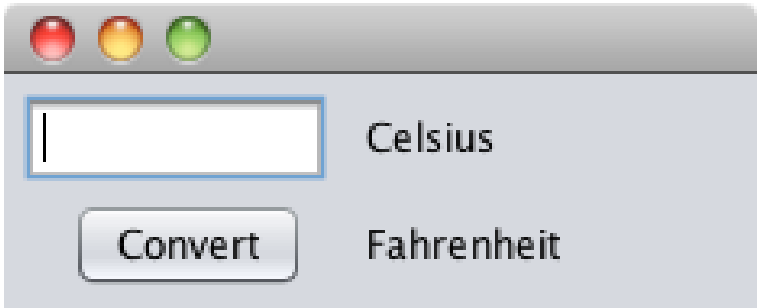

TopLevelDemo
Frame
Menu Bar
Content Pane with
Yellow Label

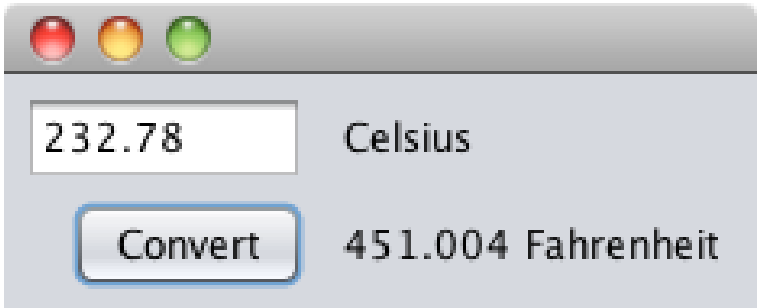

A Top-level
Container
JFrame
Content Pane
Menu Bar
JLabel

Kontenery c.d.

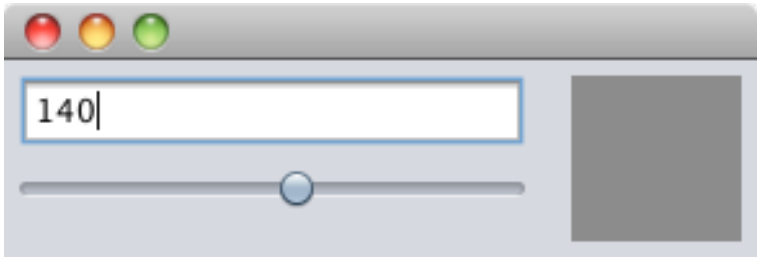
```
private static void createAndShowGUI() {
    //Create and set up the window.
    JFrame frame = new JFrame("TopLevelDemo");
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

    //Create the menu bar.  Make it have a green background.
    JMenuBar greenMenuBar = new JMenuBar();
    greenMenuBar.setOpaque(true);
    greenMenuBar.setBackground(new Color(154, 165, 127));
    greenMenuBar.setPreferredSize(new Dimension(200, 20));

    //Create a yellow label to put in the content pane.
    JLabel yellowLabel = new JLabel();
    yellowLabel.setOpaque(true);
    yellowLabel.setBackground(new Color(248, 213, 131));
    yellowLabel.setPreferredSize(new Dimension(200, 180));

    //Set the menu bar and add the label to the content pane.
    frame.setJMenuBar(greenMenuBar);
    frame.getContentPane().add(yellowLabel, BorderLayout.CENTER);

    //Display the window.
    frame.pack();
    frame.setVisible(true);
}
```

Celsius to Fahrenheit





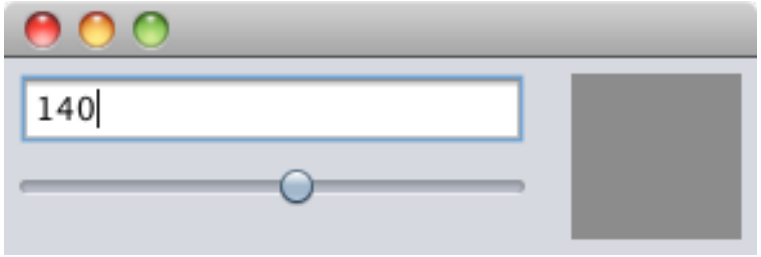
Modele i zdarzenia



Widok i kontroler

1. `javax.swing.JTextField numberTextField` – zmiana pola powoduje przesunięcie suwaka i zmianę koloru etykiety
2. `javax.swing.JSlider slider` – przesunięcie suwaka powoduje aktualizację pola i zmianę koloru etykiety
3. `javax.swing.JLabel colorLabel` – etykieta tylko zmienia kolor

Modele i zdarzenia



Widok i kontroler

1. `javax.swing.JTextField numberTextField` – zmiana pola powoduje przesunięcie suwaka i zmianę koloru etykiety
2. `javax.swing.JSlider slider` – przesunięcie suwaka powoduje aktualizację pola i zmianę koloru etykiety
3. `javax.swing.JLabel colorLabel` – etykieta tylko zmienia kolor

Model

`DefaultBoundedRangeModel model` – zmiana modelu powoduje aktualizację wszystkich komponentów, zmiana wartości w edytowalnym komponencie powoduje zmianę modelu.

Modele i zdarzenia c.d.

Model

```
DefaultBoundedRangeModel model = new DefaultBoundedRangeModel(0, 0, 0, 255);
```

Konstruktor okna (podklasy JFrame)

```
public EventExamples() {
    initComponents();

    slider.setModel(model);

    model.addChangeListener(new ModelChangeListener());

    numberTextField.getDocument().addDocumentListener(new TextFieldChangeListener()
}
```

Modele i zdarzenia c.d.

Po aktualizacji modelu

```
private class ModelChangeListener implements ChangeListener {
    @Override
    public void stateChanged(ChangeEvent ce) {
        int val = model.getValue();

        if (!String.valueOf(val).equals(numberTextField.getText())) {
            numberTextField.setText(String.valueOf(model.getValue()));
        }

        colorLabel.setBackground(new Color(val, val, val));
        colorLabel.repaint();
    }
}
```

Modele i zdarzenia c.d.

Po aktualizacji pola tekstowego

```
private class TextFieldChangeListener implements DocumentListener {
    @Override
    public void insertUpdate(DocumentEvent de) {
        textFieldUpdated();
    }

    @Override
    public void removeUpdate(DocumentEvent de) {
        textFieldUpdated();
    }

    @Override
    public void changedUpdate(DocumentEvent de) {
        textFieldUpdated();
    }
}
```

Modele i zdarzenia c.d.

```
private void textFieldUpdated() {
    int val;

    try {
        val = new Integer(numberTextField.getText());
    } catch (NumberFormatException ex) {
        return;
    }

    if (val >= model.getMinimum() && val <= model.getMaximum()) {
        model.setValue(val);
    }
}
```

Skąd się biorą zdarzenia?

```
protected EventListenerList listenerList = new EventListenerList();

public void addChangeListener(ChangeListener l) {
    listenerList.add(ChangeListener.class, l);
}

public void removeChangeListener(ChangeListener l) {
    listenerList.remove(ChangeListener.class, l);
}

protected void fireStateChanged() {
    Object[] listeners = listenerList.getListenerList();
    for (int i = listeners.length - 2; i >= 0; i -=2 ) {
        if (listeners[i] == ChangeListener.class) {
            if (changeEvent == null) {
                changeEvent = new ChangeEvent(this);
            }
            ((ChangeListener)listeners[i+1]).stateChanged(changeEvent);
        }
    }
}
```

Grafika – metoda paintComponent()

Klasa `JComponent` ma metodę `paintComponent(Graphics g)`.

```
public void paintComponent(Graphics g) {
    Graphics2D g2 = (Graphics2D) g;

    g2.draw(new Rectangle2D.Double(10, 10, 200, 50));

    g2.draw(new RoundRectangle2D.Double(220, 10, 200, 50, 40, 20));

    g2.draw(new Ellipse2D.Double(10, 120, 200, 50));
}
```

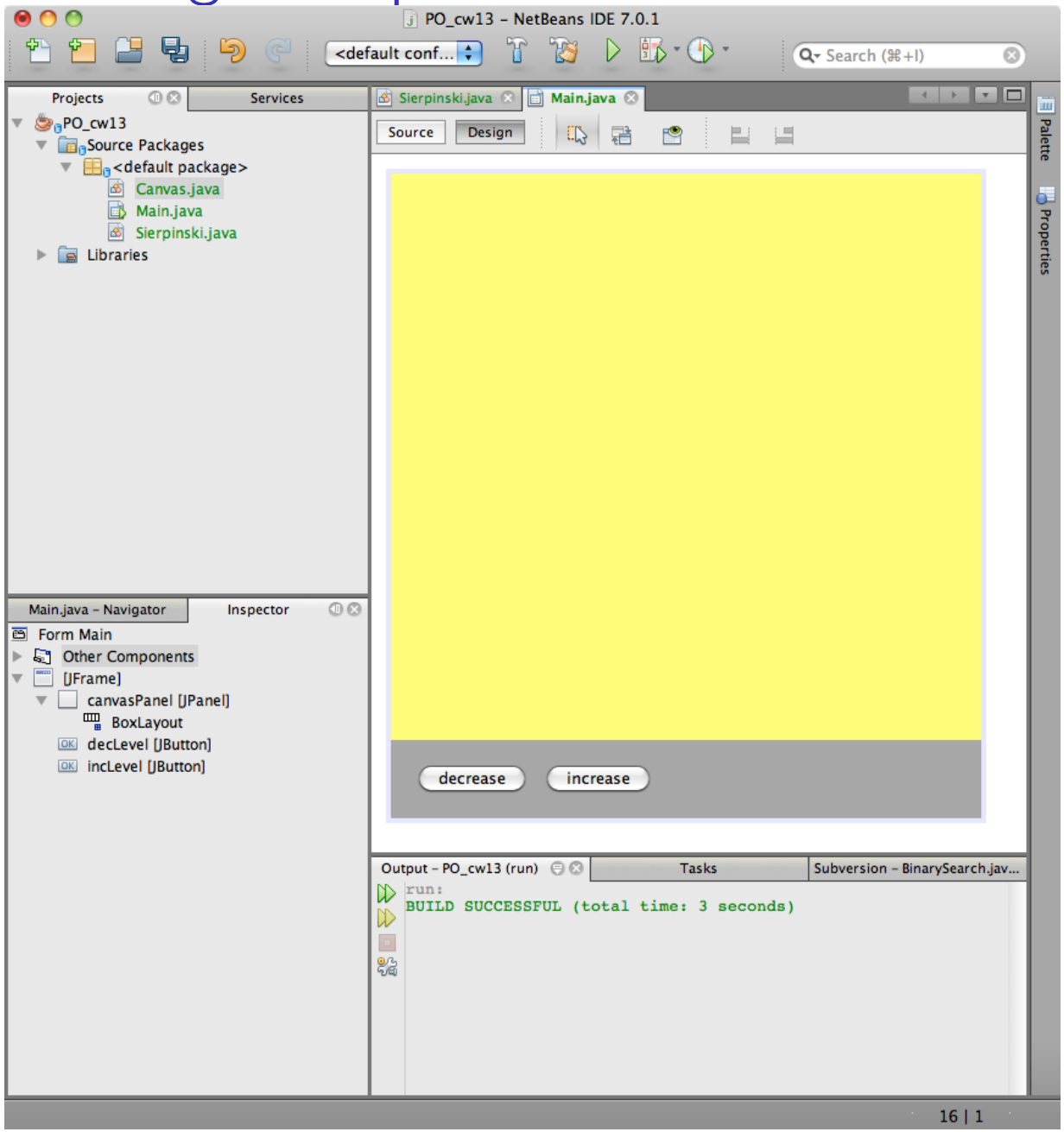
Dziedziczenie z JPanel

```
public class Sierpinski extends JPanel {
    private int level=0;

    Sierpinski(int level) {
        super();
        this.level=level;
        setBounds(0, 0, 1200, 1200);
        setBackground(Color.white);
        setOpaque(true);
    }

@Override
    public void paintComponent(Graphics g) {
        Graphics2D g2 = (Graphics2D) g;

        g2.setBackground(Color.white);
        g2.clearRect(0, 0,1200,1200);
        g2.setPaint(Color.red);

        draw_sierpinski(g2, getLevel(),100, 1000, 1100, 1000,600,1000*(1-Math.sqrt(3)/2));
    }

    public int getLevel() {
        return level;
    }

    public void setLevel(int level) {
        this.level = level;
        repaint();
    }
}
```

Trójkąt Sierpińskiego

```
GeneralPath make_triangle(double x1, double y1, double x2, double y2, double x3, double y3) {
    GeneralPath polygon = new GeneralPath(GeneralPath.WIND_EVEN_ODD, 3);
    polygon.moveTo(x1, y1);
    polygon.lineTo(x2, y2);
    polygon.lineTo(x3, y3);
    polygon.closePath();

    return polygon;
}

void draw_sierpinski(Graphics2D g2, int l,double x1, double y1, double x2, double y2, double x3, double y3)
    if(l==0) {
        g2.fill(make_triangle(x1,y1,x2,y2,x3,y3));
    } else {
        double mx1=(x1+x3)/2;
        double my1=(y1+y3)/2;

        double mx2=(x2+x3)/2;
        double my2=(y2+y3)/2;

        double mx3=(x1+x2)/2;
        double my3=(y1+y2)/2;

        draw_sierpinski(g2,l-1,mx1,my1,mx2,my2,x3,y3);
        draw_sierpinski(g2,l-1,x1,y1,mx3,my3,mx1,my1);
        draw_sierpinski(g2,l-1,mx3,my3,x2,y2,mx2,my2);
    }
}
```

Osadzanie własnego komponentu w JFrame



Osadzanie własnego komponentu w JFrame c.d.

```
public class Main extends javax.swing.JFrame {
    Sierpinski sierp;

    public Main() {
        initComponents();
        sierp = new Sierpinski(0);
        canvasPanel.add(sierp);
    }

    private void decLevelActionPerformed(java.awt.event.ActionEvent evt) {
        int l = sierp.getLevel();

        if (l > 0) {
            sierp.setLevel(l - 1);
        }
    }

    private void incLevelActionPerformed(java.awt.event.ActionEvent evt) {
        int l = sierp.getLevel();

        if (l < 15) {
            sierp.setLevel(l + 1);
        }
    }

    ...

}
```

Zadanie 1 – Kolory

Zadanie

Rozszerzyć przykład do trzech liczb określających kolor RGB.

Zadanie 2 – Kwadrat Sierpińskiego

Zadanie

Zaimplementować rysowanie kwadratu Sierpińskiego.