JavaFx

Dnes:

- základné komponenty knižnice JavaFx
- spracovanie udalostí
- spôsoby návrhu jednoduchej (pravouhlej) hry

Zdroj a literatúra:

Å What Is JavaFX

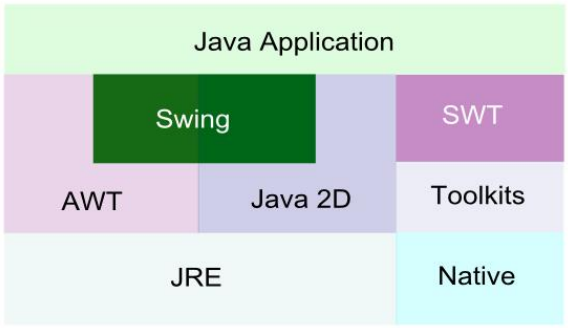
Å **JavaFX 2.0: Introduction by Example**

Å **Introduction to Java Programming, !!!!Tenth Edition**

Cvičenia:
jednoduché aplikácie s interakciou:

- maľovátko, euro-kalkulačka,
- logické hry: pexeso, piškvorky, ...
- dynamické hry: tenis

AWT-SWING
SWT-JavaFx



Java Graphics - The Layer Cake

JAVA vznikla v r. 1995,

- Java 1.1, 1997, integrovaný grafický balík AWT (Abstract Windows Toolkit),
- Java 1.2, 1998, integrovaný grafický balík SWING,
- od cca 2005, SWT (Standard Widget Toolkit), Eclipse Foundation, IBM
- Java 1.7, 2012, integrovaný grafický balík JavaFx, pôvodný vývoj od 2007.

SWING (AWT):

- je aktuálne mŘvy, nevyvíja sa,
- nie je multi-platformový,
- je nepouźiteŎný na mobilných zariadeniach,
- je ļ asto pomerne Šaźkopádny pre programátora (ale zvykli sme sié).

medziļ asom vznikli a odzneli: Adobe Flash, Microsoft Silverlight, ...

preto sme tieź nahradili v prednáźkach Swing a AWT platformou JavaFx

RIA

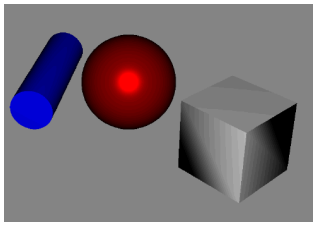
(Rich Internet application)

CieĽ: poskytnúť rovnakú funkcionalitu a vlastnosti web-aplikáciam ako ich poznáme u desktopových aplikácií

Najrozšírenejšie platformy: Adobe Flash, Microsoft Silverlight, JavaFx, HTML5/JS

JavaFx :

- umožňuje spustiť lokálnu desktopovú aplikáciu v browseri, WebView,
- podporuje GUI štylizované pomocou CSS,
- podporuje mutli-touch, multi-platform,
- podporuje SWING, komponent SwingNode 😐,
- 2D a 3D grafiku, animácie,
- multi-média (audio, video),
- nájdete ju inde, ScalaFx, Ruby, ...



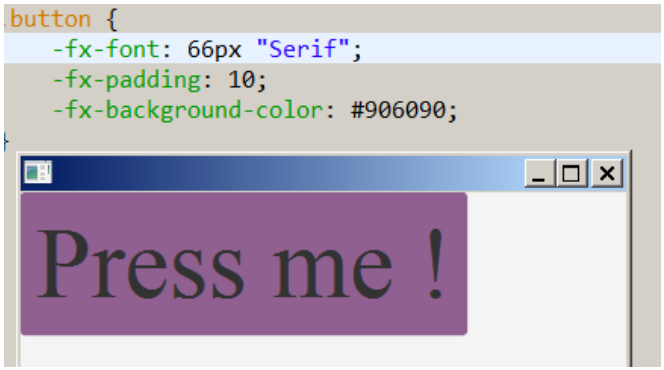
Ako začať

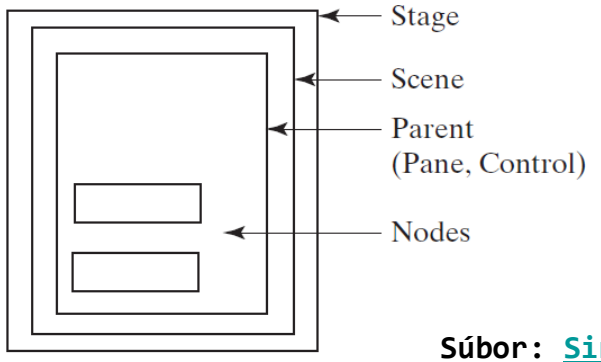
- bezproblémová verzia eclipse (>= 4.4), java 1.8, a **e(fx)clipse** viac info tu: https://www.eclipse.org/efxclipse/install.html
- **NetBeans, https://netbeans.org/features/java-on-client/javafx.html**

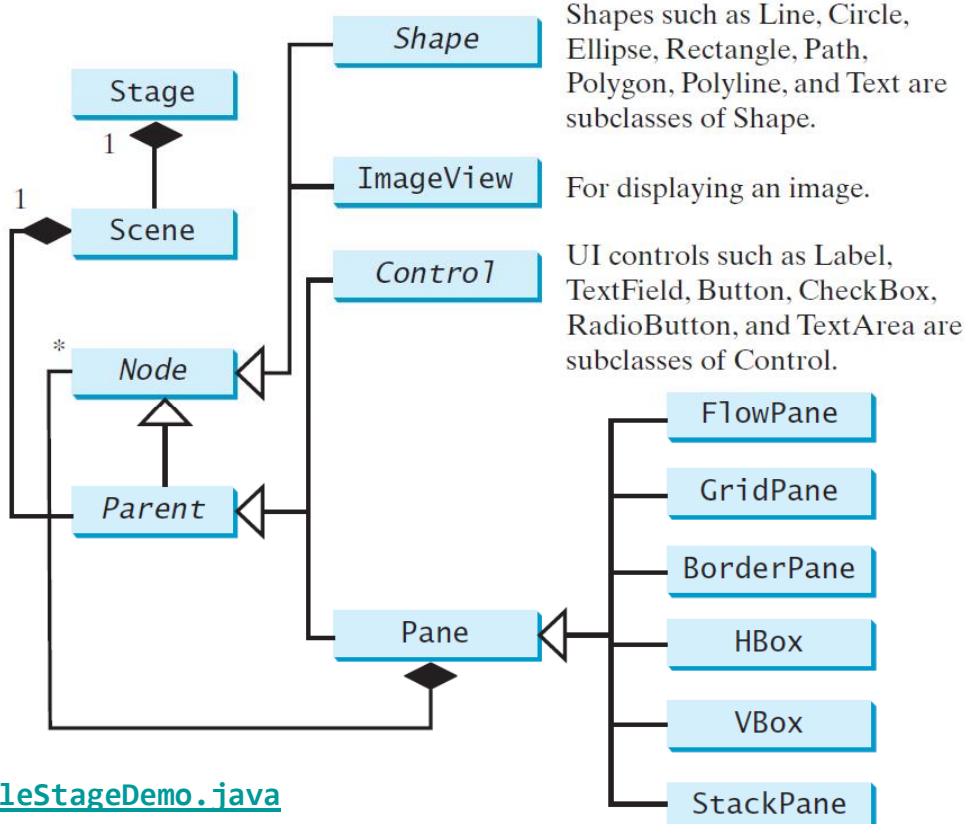
JavaFx aplikácia

```
public class Main extends Application {
  @Override
  public void start(Stage primaryStage) {
    try {
      Button btn = new Button("Press me !");
      Pane root = new Pane(btn);
      Scene scene = new Scene(root,400,400);
      scene.getStylesheets().add(getClass().getResource("application.css").toExternalForm());
      primaryStage.setScene(scene);
      primaryStage.show();
    } catch(Exception e) {
      e.printStackTrace();
    }
}
public static void main(String[] args) {
    launch(args);
} }
```

```
button {
    -fx-font: 66px "Serif";
    -fx-padding: 10;
    -fx-background-color: #906090;
}
```

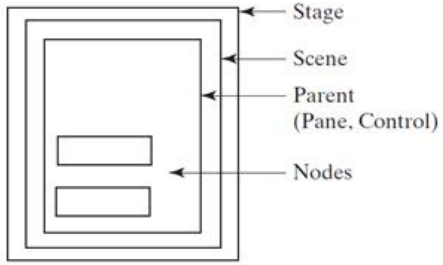






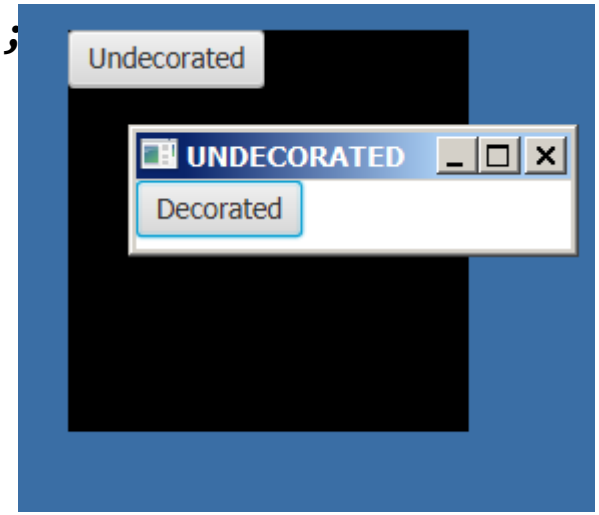
Súbor: SingleStageDemo.java

Stage



Stage je najvrchnejší kontainer, teda okno v rámci OS.

```
Group root = new Group(new Button("Undecorated"));
Scene scene = new Scene(root, 200, 200, Color.BLACK);
Stage newStage = new Stage(StageStyle.UNDECORATED);
newStage.setScene(scene);
newStage.initModality(Modality.WINDOW_MODAL);
newStage.setTitle("UNDECORATED");
newStage.show();
```

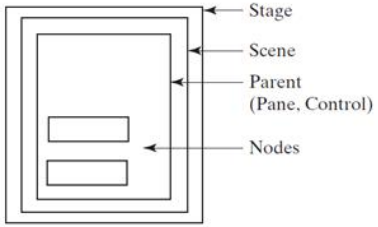



```
Group root = new Group(new Button("Decorated"));
Scene scene = new Scene(root);
Stage newStage = new Stage(StageStyle.DECORATED);
newStage.setScene(scene);
newStage.setTitle("UNDECORATED");
newStage.show();
```

```
.setTitle()
.setScene()
.sizeToScene()
.initStyle()
.initModality()
.show()
```

Súbor: MultiStageDemo.java

Scene



Scéna predstavuje vrchný element stromovej ġtruktúry elementov typu Node, resp. Parent

- **Scene**(Parent root)

```
new Scene(root);
```

- **Scene**(Parent root, double width, double height)

```
new Scene(root,400,400);
```

- **Scene**(Parent root, double w, double h, Paint fill)

```
new Scene(root, 200, 200, Color.BLACK);
```

Parent má deti typu Node, presnejġie poskytuje metódu

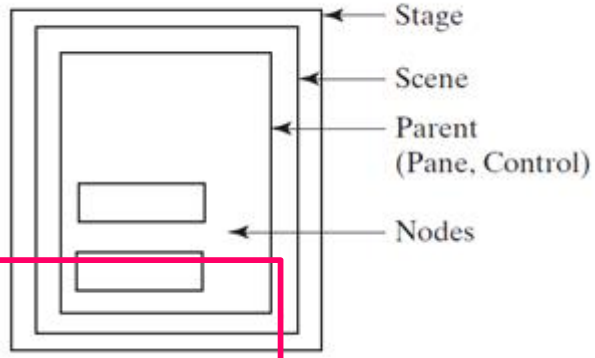
```
ObservableList<Node> getChildren()
```

```
root.getChildren().addAll(node1, node2, …)
```

Parent

- Control,
- Group,
- Region,
  - Axis,
  - Chart,
  - Pane
    - BorderPane,
    - FlowPane,
    - GridPane,
    - HBox,
    - StackPane,
    - Vbox,
    - …

Štruktúra tried



- Node
  - Canvas,
  - ImageView,
  - Parent,
  - MediaView,
  - Shape
    - Circle,
    - Ellipse,
    - Line,
    - Polygon,
    - Polyline,
    - Rectangle,
    - Text
    - ...
- Control
  - ChoiceBox,
  - ComboBoxBase,
    - ComboBox
  - Labeled,
    - ButtonBase,
      - Button,
      - CheckBox,
      - ToggleButton
    - Label,
  - ListView,
  - TextInputControl,
    - TextArea,
    - TextField

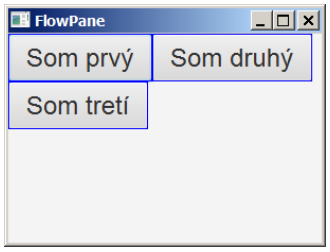
BorderPane

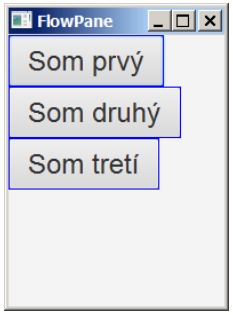
```
class MyButton extends Button {
  public MyButton(String text) {
    super(text);
    setMaxWidth(Double.MAX_VALUE);
    setMaxHeight(Double.MAX_VALUE);
    setStyle("-fx-border-color: blue;
              -fx-font: 24px 'Arial';");
} }

BorderPane root = new BorderPane();
root.setTop(new MyButton("Som na vrchu"));
root.setBottom(new MyButton("I'm in the bottom"));
root.setRight(new MyButton("Ich bin recht"));
root.setLeft(new MyButton("Я в левом"));
root.setCenter(new MyButton("Je suis au milieu"));
Scene scene = new Scene(root, 600, 400);
primaryStage.setScene(scene);
primaryStage.setTitle("BorderPane");
primaryStage.show();
```

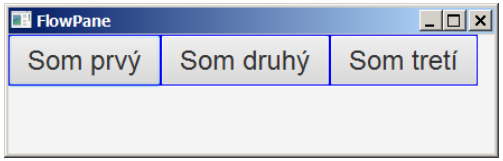
Súbor: Layouts.java

FlowPane, GridPane

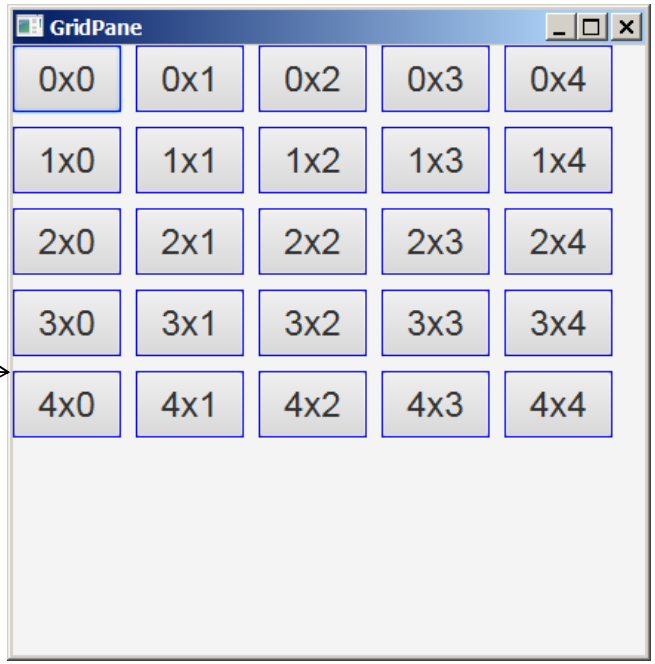
```
FlowPane root = new FlowPane(
    new MyButton("Som prvý"), new MyButton("Som druhý"),new MyButton("Som tretí"));
Scene scene = new Scene(root, 300, 400);
Stage newStage = new Stage();
newStage.setScene(scene);
newStage.setTitle("FlowPane");
newStage.show();
```







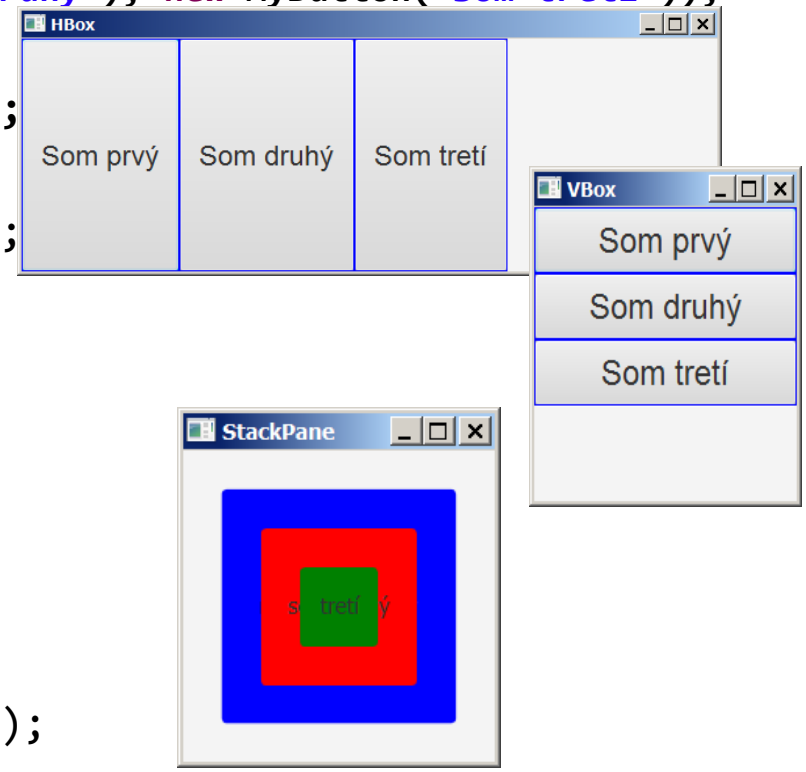

```
GridPane root = new GridPane();
for (int i = 0; i < 5; i++)
  for (int j = 0; j < 5; j++)
    root.add(new MyButton(i + "x" + j), j, i);
root.setHgap(10);
root.setVgap(10);
Scene scene = new Scene(root, 400, 400);
Stage newStage = new Stage();
newStage.setScene(scene);
newStage.setTitle("GridPane");
newStage.show(); }
```



Súbor: Layouts.java

HBox, VBox, StackPane

```
HBox root = new HBox(
    new MyButton("Som prvý"), new MyButton("Som druhý"), new MyButton("Som tretí"));

VBox root = new VBox(
    new MyButton("Som prvý"), new MyButton("Som druhý"), new MyButton("Som tretí"));

Button btn1 = new Button("naozaj som prvý");
btn1.setPrefSize(150,150);
btn1.setStyle("-fx-background-color: blue");

Button btn2 = new Button("som druhý");
btn2.setPrefSize(100,100);
btn2.setStyle("-fx-background-color: red");

Button btn3 = new Button("tretí");
btn3.setPrefSize(50,50);
btn3.setStyle("-fx-background-color: green");

StackPane root = new StackPane(btn1, btn2, btn3);
```



Súbor: Layouts.java

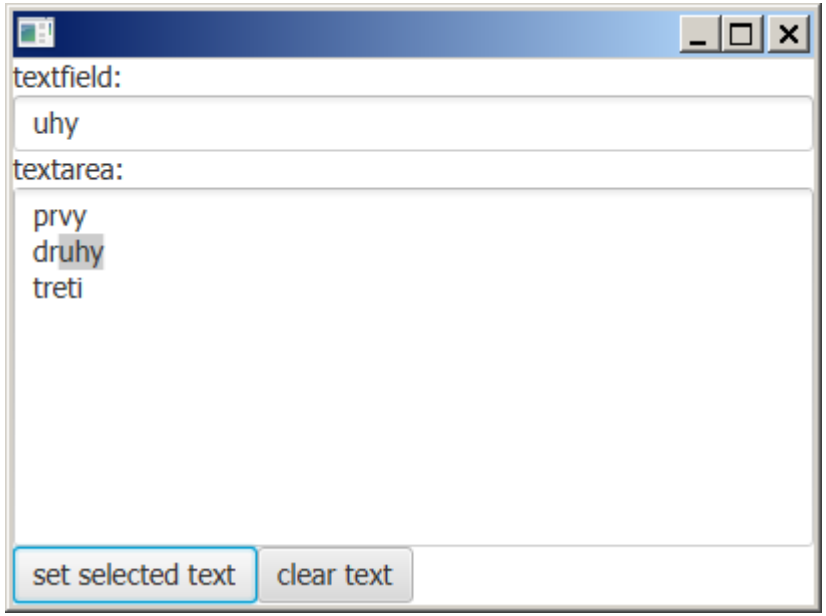
EventHandler

```
class MyButton extends Button {
    setOnAction(new EventHandler<ActionEvent>() {
        @Override
        public void handle(ActionEvent event) {
                System.out.println("stlačil si " + text);
        }
    });
    setOnAction(event -> {
        System.out.println("stlačil si " + text);
    });
    setOnMouseClicked(event -> {
        System.out.println("klikol si " + text + ", " +
        event.getX() + ", " + event.getY());
    });
    setOnKeyPressed(event -> {
        System.out.println("stlačil si " + text + ", " +
        event.getCode());
    });
```

Súbor: Layouts.java

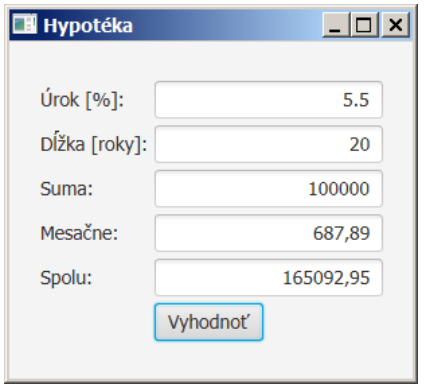
TextField, TextArea

```
Button b1 = new Button("set selected text");
Button b2 = new Button("clear text");
TextField tf = new TextField();  tf.setPrefWidth(100);
TextArea ta = new TextArea();    ta.setPrefWidth(100);
ta.setEditable(false);

b1.setOnAction(event -> {
   tf.setText(ta.getSelectedText());});
b2.setOnAction(event -> {
   ta.clear(); });
tf.setOnAction(event -> {
   ta.appendText(tf.getText() + "\n");});

VBox fp = new VBox(
   new Label("textfield:"), tf,
   new Label("textarea:"), ta,
   new FlowPane(b1, b2));
```



Súbor: TextFieldDemo.java

Malá kalkulaľka



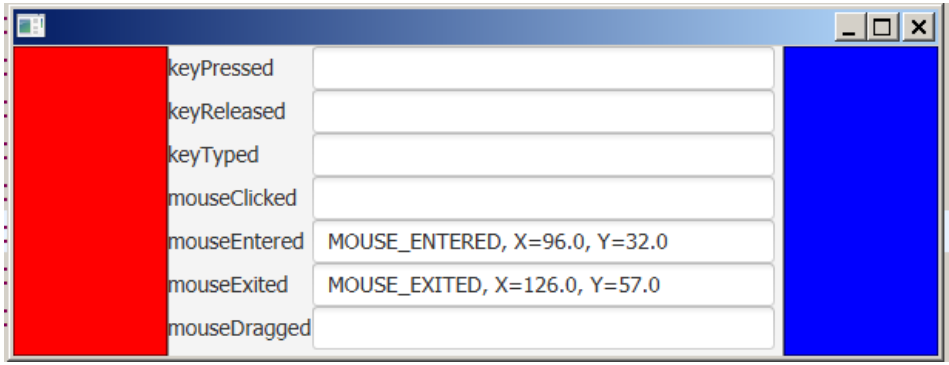

```
public class Hypoteka extends Application {
TextField tfUrokovaMiera = new TextField(),
          tfPocetRokov = new TextField(),
          tfSuma = new TextField(),
          tfMesacneSplatky = new TextField(),
          tfSpolu = new TextField();
Button btVypocet = new Button("Vyhodnoť");
GridPane gridPane = new GridPane();
gridPane.setHgap(5);
gridPane.setVgap(5);
gridPane.add(new Label("Úrok [%]:"),0,0);
gridPane.add(tfUrokovaMiera, 1, 0);
gridPane.add(new Label("Dĺžka [roky]:"),0,1);
gridPane.add(tfPocetRokov, 1, 1);
gridPane.add(new Label("Suma:"),0,2);
gridPane.add(tfSuma, 1, 2);
gridPane.add(new Label("Mesačne:"),0,3);
gridPane.add(tfMesacneSplatky, 1,3);
gridPane.add(new Label("Spolu:"),0,4);
gridPane.add(tfSpolu, 1, 4);
gridPane.add(btVypocet, 1, 5);
```

```
tfUrokovaMiera.setAlignment(Pos.BOTTOM_RIG
tfPocetRokov.setAlignment(Pos.BOTTOM_RIGHT
tfSuma.setAlignment(Pos.BOTTOM_RIGHT);
tfMesacneSplatky.setAlignment(Pos.BOTTOM_R
tfSpolu.setAlignment(Pos.BOTTOM_RIGHT);
tfMesacneSplatky.setEditable(false);
tfSpolu.setEditable(false);

 btVypocet.setOnAction(e -> {
   rocnyUrok =    Double.parseDouble(
           tfUrokovaMiera.getText());
   pocetRokov = Integer.parseInt(
           tfPocetRokov.getText());
   suma = Double.parseDouble(
           tfSuma.getText());
   tfMesacneSplatky.setText(
           String.format("%.2f",
           mesacneSplatky()));
   tfSpolu.setText(
           String.format("%.2f",
           getTotalPayment()));
 });
```

Súbor: Hypoteka.java

MouseEvent, KeyEvent

```
Hashtable<String, Node> h = new Hashtable<String, Node>();
String[] event = { "keyPressed", "keyReleased", "keyTyped",
        "mouseClicked", "mouseEntered", "mouseExited", "mouseDragged"};
SmallPane bluePane = new SmallPane(this, Color.BLUE),
          redPane = new SmallPane(this, Color.RED);
   GridPane gp = new GridPane();
   for (int i = 0; i < event.length; i++) {
        TextField t = new TextField();
        t.setPrefWidth(300); t.setEditable(false);
        gp.add(new Label(event[i]), 0, i);
        gp.add(t, 1, i);
        h.put(event[i], t);
   }
   BorderPane bp = new BorderPane();
   bp.setCenter(gp);
   bp.setRight(bluePane);
   bp.setLeft(redPane);
   Scene scene = new Scene(bp, 600, 200);
```



Súbor: MouseKeyEvent.java

Pokraļovanie

- Event
  - ActionEvent,
  - InputEvent,
    - DragEvent
    - KeyEvent,
    - MouseEvent,
    - TouchEvent
    - ...
  - WindowEvent,
  - ...

```
class SmallPane extends Pane {
   SmallPane(AutoEvent parent, Color color) {
     this.parent = parent;
     this.color = color;
     setPrefWidth(100);
     setFocusTraversable(true);
     setOnKeyPressed(event -> {
        TextField t = (TextField) parent.h.get("keyPressed");
        t.setText(event.getEventType() + ", keyCode="+ event.getCode());
        paint();
        event.consume();
     } );
     setOnMouseClicked(event -> {
        TextField t = (TextField) parent.h.get("mouseClicked");
        t.setText(event.getEventType() + ", X="+ event.getX() + ", Y="+ event.getY());
        paint();
        event.consume();
     } );
```

Súbor: MouseKeyEvent.java

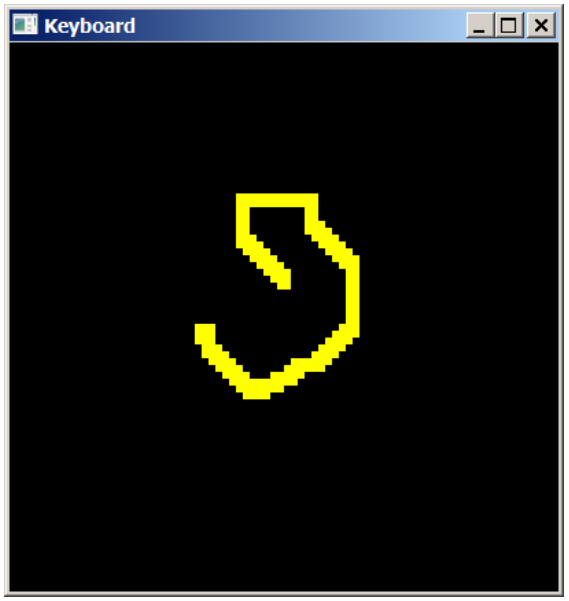
Polyline, Polygon


```
MousePane p = new MousePane();
Scene scene = new Scene(p, 400, 400, Color.BLACK);
scene.setOnMouseMoved(event -> {
  if (listOfPositions.size() >= 200) {
   listOfPositions.removeElementAt(0);
   listOfPositions.removeElementAt(1);
  }
  listOfPositions.addElement(
    event.getX());
  listOfPositions.addElement(
    event.getY());
  p.paint();
  event.consume();
} );
```

```
class MousePane extends Pane {
  public void paint() {
    getChildren().clear();
    Double[] d =
    listOfPositions.toArray(new Double[]{});
    Polyline pl = new Polyline();
    pl.setStroke(Color.YELLOW);
    pl.setStrokeWidth(10);
    pl.getPoints().addAll(d);
    getChildren().add(pl);
  }
}
```

Súbor: MouseDemo.java

Pomocou ģípiek




```
MousePane p = new MousePane();
Scene scene = new Scene(p, 400, 400, Color.BLACK);
scene.setOnKeyPressed(event -> {
  if (listOfPositions.size() >= 200) {
    listOfPositions.removeElementAt(0);
    listOfPositions.removeElementAt(0);
  }
  if (event.getCode() == KeyCode.UP) y -= 5;
  if (event.getCode() == KeyCode.DOWN) y += 5;
  if (event.getCode() == KeyCode.LEFT) x -= 5;
  if (event.getCode() == KeyCode.RIGHT) x += 5;
  listOfPositions.addElement(x);
  listOfPositions.addElement(y);
  p.paint();
  event.consume();
} );
```

Súbor: KeyDemo.java

Canvas

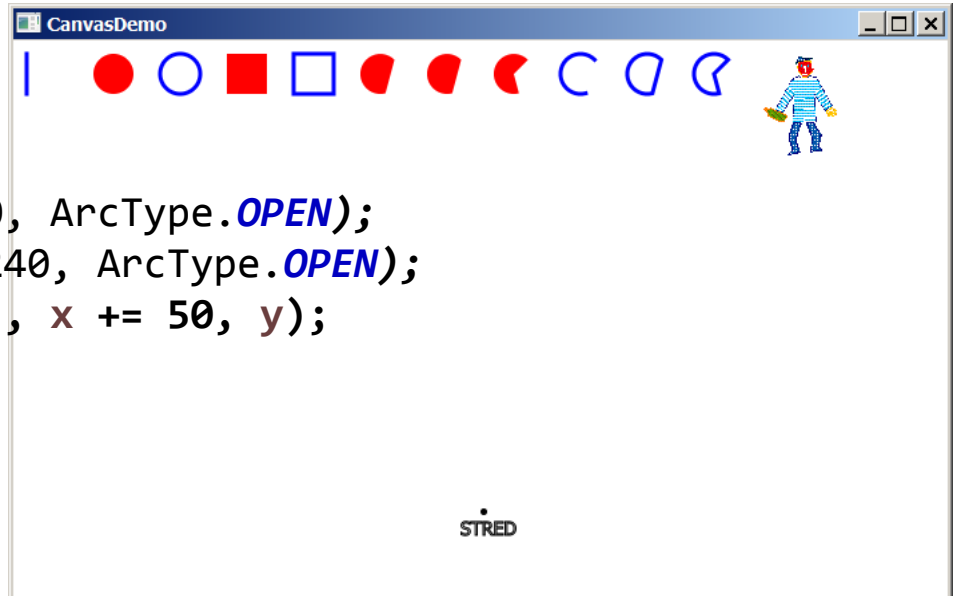
```
public void paintCanvas() {
    GraphicsContext gc = getGraphicsContext2D();// kreslenie do canvasu
    gc.clearRect(0, 0, sizeX, sizeY);
    gc.setFill(Color.gray(0, 0.2));
    gc.fillOval(centerX - scale * moloSize, centerY - scale * moloSize,
                scale * 2 * moloSize, scale * 2 * moloSize);
    if (namornik.alive) { // ak sa este neutopil, nakresli obrazok namornika
      gc.drawImage(new Image("namornik.gif"),  // namornik.img,
      namornik.getXPixel(false),
      namornik.getYPixel(false));
    } else { // ak je utopeny, nakresli vlny zobraz v strede vln pocet krokov
      gc.setStroke(Color.RED);
      gc.strokeText(Integer.toString(namornik.nsteps),
         namornik.getXPixel(true) - 8,
         namornik.getYPixel(true) + 7);
```

Súbor: NamornikAppFx.java

Kreslenie do Canvas

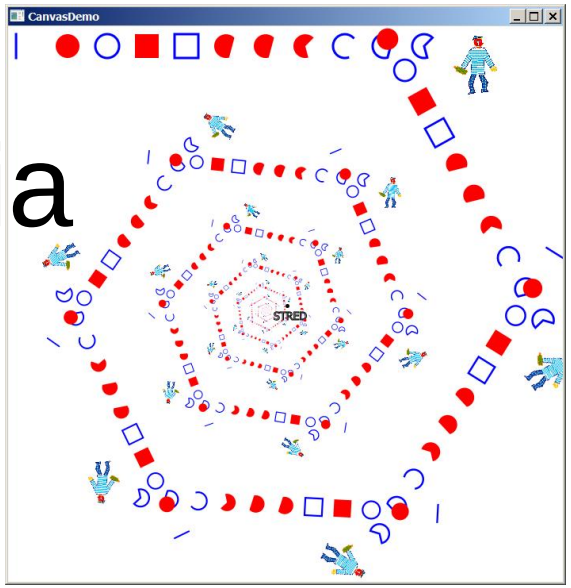
```
Canvas canvas = new Canvas(700, 700);
GraphicsContext gc = canvas.getGraphicsContext2D();
gc.fillOval(350, 350, 5, 5);
gc.strokeText("STRED", 335, 370);
```

```
.setFill(Color.RED);
.setStroke(Color.BLUE);
.setLineWidth(3);
.strokeLine(x, y, x, y + 30);
.fillOval(x += 50, y, 30, 30);
.strokeOval(x += 50, y, 30, 30);
.fillRect(x += 50, y, 30, 30);
.strokeRect(x += 50, y, 30, 30);

.fillArc(x += 50, y, 30, 30, 45, 240, ArcType.OPEN);
.strokeArc(x += 50, y, 30, 30, 45, 240, ArcType.OPEN);
.drawImage(new Image("namornik.gif"), x += 50, y);
```



Súbor: CanvasDemo.java

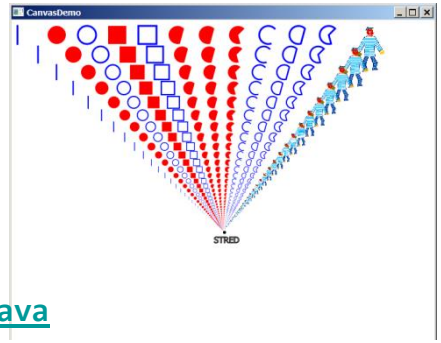
Afinné zobrazenia

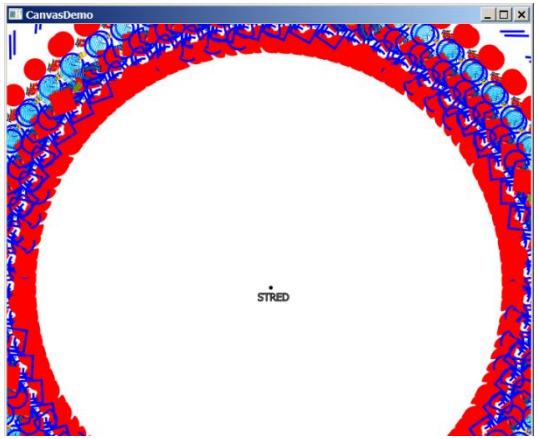


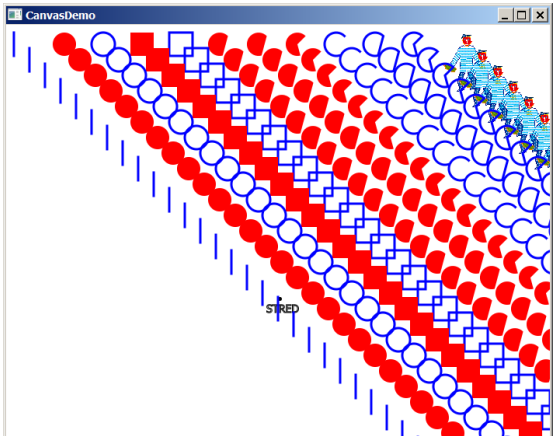
Z lineárnej algebry:

- otoľenie o uhol Ťokolo stredu x,y,
- posunutie dx,dy
- rovnoľahlosťnatiahnutie kx,ky podľa stredu x,y

```
Affine af = new Affine();                    // afinné zobrazenie
for (int i = 0; i < 100; i++) {
   af.append(Affine.scale(0.9, 0.9, 350, 350)); // rovnoľahlosť
   af.append(Affine.rotate(60, 350, 350));      // otočenie
   af.append(Affine.translate(20, 20));         // posunutie
   gc.setTransform(af);
   paintShapes(gc);
}
```





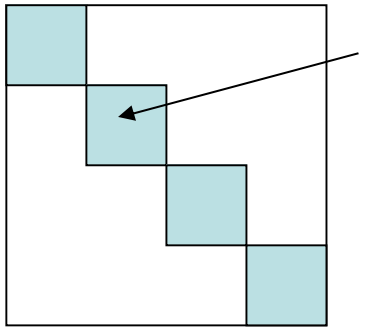


Súbor: CanvasDemo.java

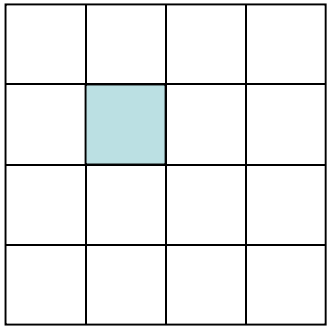
Hracia plocha

hracia plocha je často šachovnica rôznych rozmerov. Ako ju implementujeme:

1. jeden veľký canvas/Pane-l
   - musíme riešiť transformáciu pixelových súradníc do súradníc hracej plochy:

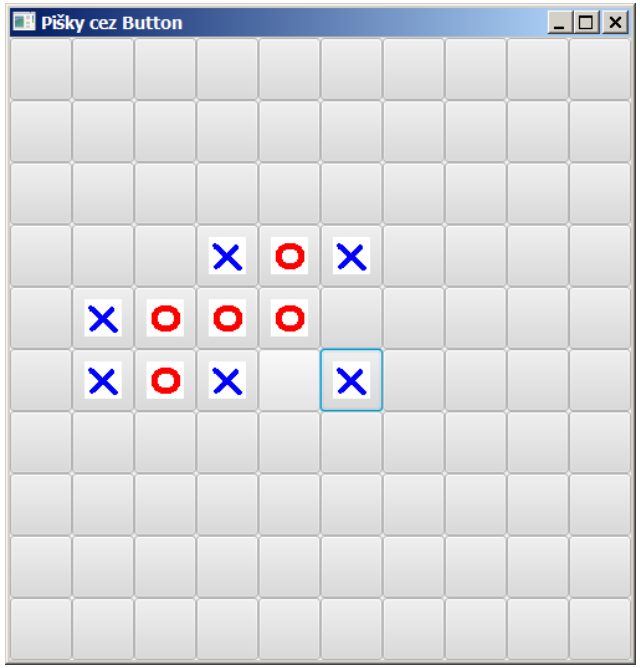


   - a naopak, v metóde paint/paintComponent [i,j] -> [x, y]
2. grid canvasov/Pane-lov:
   - každý canvas/panel má svoje súradnice od [0,0]
   - každý canvas/panel má svoj mouse lhandler
   - každý canvas panel má svoju metódu paint/paintComponent
   - veľkosť gridu upravíme podľa veľkosti obrázkov, resp. veľkosť obrázku upravíme podľa veľkosti panelu



3. grid buttonov/Button-ov:

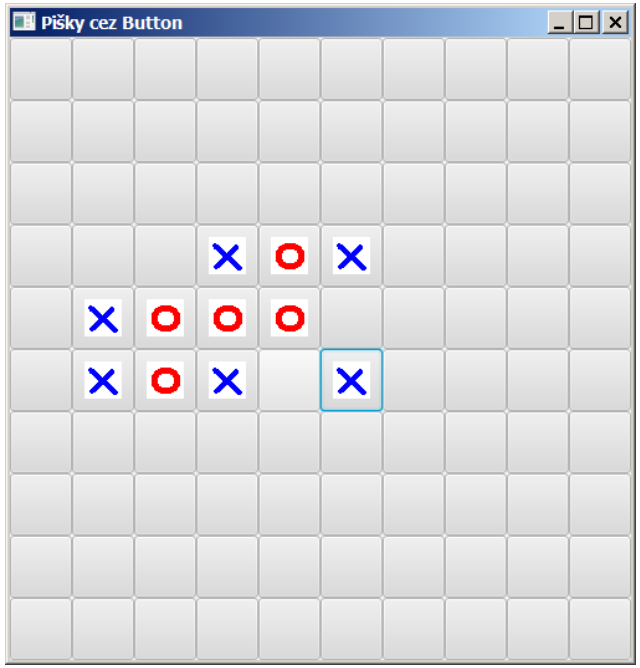
Rieġenie Grid/Button




```
class PiskyState implements Serializable {
  public int[][] playground = new int[SIZE][SIZE];
  public boolean nextPlayerIsX = false;
  public long elapsedTime = 0;
}
class Piskyground extends GridPane {
  public Piskyground() {
    for (int i = 0; i < PiskvorkyGridButton.SIZE; i++)
      for (int j = 0; j < PiskvorkyGridButton.SIZE; j++)
        add(new PiskyCell(i, j), j, i);
} }
```

Súbor: PiskvorkyGridButton.java

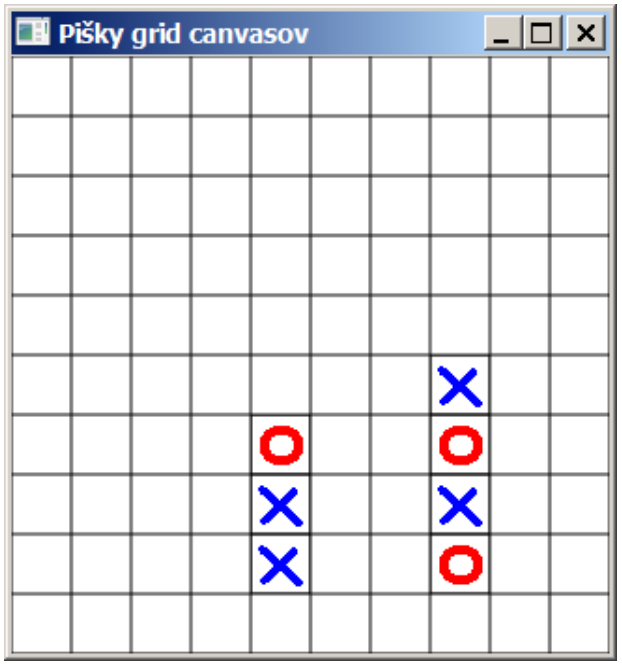
Rieġenie Grid/Button




```
class PiskyCell extends Button {
  int i, j;
  public PiskyCell(int i, int j) {
    this.i = i;
    this.j = j;
    setPrefSize(50, 50);
    setOnAction(event -> {
     if (ps.playground[i][j] != 0) return;
     if (ps.nextPlayerIsX) {
       ps.playground[i][j] = 1;
       setGraphic(new ImageView(new Image("x.gif")));
     } else {
       ps.playground[i][j] = -1;
       setGraphic(new ImageView(new Image("o.gif")));
     }
     ps.nextPlayerIsX = !ps.nextPlayerIsX;
    } );
} }
```

Súbor: PiskvorkyGridButton.java

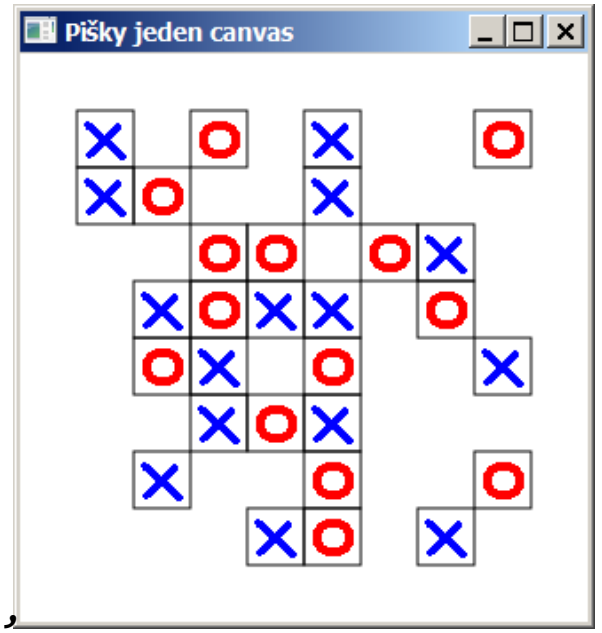
Rieġenie Grid/Canvas




```
class PiskyCell extends Canvas {
int i, j;

 public PiskyCell(int i, int j) {
   this.i = i; this.j = j;
   setWidth(imageX.getWidth()+2);
   setHeight(imageX.getHeight()+2);
   setOnMouseClicked(event -> {
         if (ps.playground[i][j] != 0) return;
         ps.playground[i][j] = (ps.nextPlayerIsX)?1:-1;          paintCell();
         ps.nextPlayerIsX = !ps.nextPlayerIsX;
   });
  }
  public void paintCell() {
   GraphicsContext gc = getGraphicsContext2D();
   gc.strokeRect(0, 0, getWidth(), getHeight());
   if (ps.playground[i][j] == 1) gc.drawImage(new Image("x.gif"), 1, 1);
   else if (ps.playground[i][j] == -1) gc.drawImage(new Image("o.gif"), 1,1);
} }
```

Súbor: PiskvorkyGridCanvas.java

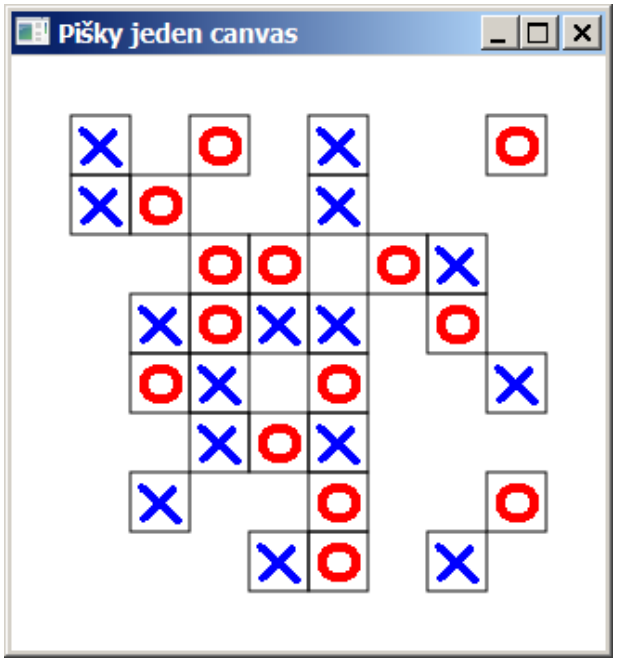
Rieġenie Canvas




```
class Piskyground extends Canvas {
  Image imageX = new Image("o.gif");
  Image imageO = new Image("x.gif");
  double cellSize = 2+Math.max(
      Math.max(imageX.getWidth(), imageO.getWidth()),
      Math.max(imageX.getHeight(), imageO.getHeight()));
  public Piskyground() {
   setWidth(SIZE * (imageX.getWidth() + 2));
   setHeight(SIZE * (imageX.getHeight() + 2));
   setOnMouseClicked(event -> {
     int i = getRow(event.getX());
     int j = getCol(event.getY());
     if (ps.playground[i][j] != 0) return;
     ps.playground[i][j] = (ps.nextPlayerIsX) ? 1 : -1;
     paintCell(i, j);
     ps.nextPlayerIsX = !ps.nextPlayerIsX;
  } );
}
```

Súbor: PiskvorkyCanvas.java

Riegenie Canvas




```
class Piskyground extends Canvas {
  public void paintCell(int i, int j) {
    double px = getPixelX(i);
    double py = getPixelY(j);
    GraphicsContext gc = getGraphicsContext2D();
    gc.strokeRect(px, py, cellSize, cellSize);
    if (ps.playground[i][j] == 1) gc.drawImage(imageX, px+1, py+1);
    else if (ps.playground[i][j] == -1) gc.drawImage(imageO, px+1, py+1);
  }
  private int getRow(double pixel) { ===  private int getCol(double pixel) {
   return (int)(pixel/cellSize);
  }
  private double getPixelX(int i) { === private double getPixelY(int i) {
   return i*cellSize;
  }
```

Súbor: PiskvorkyCanvas.java