Quadterm 2

(streda 20.5. !9:20! – 11:30)

Bude:

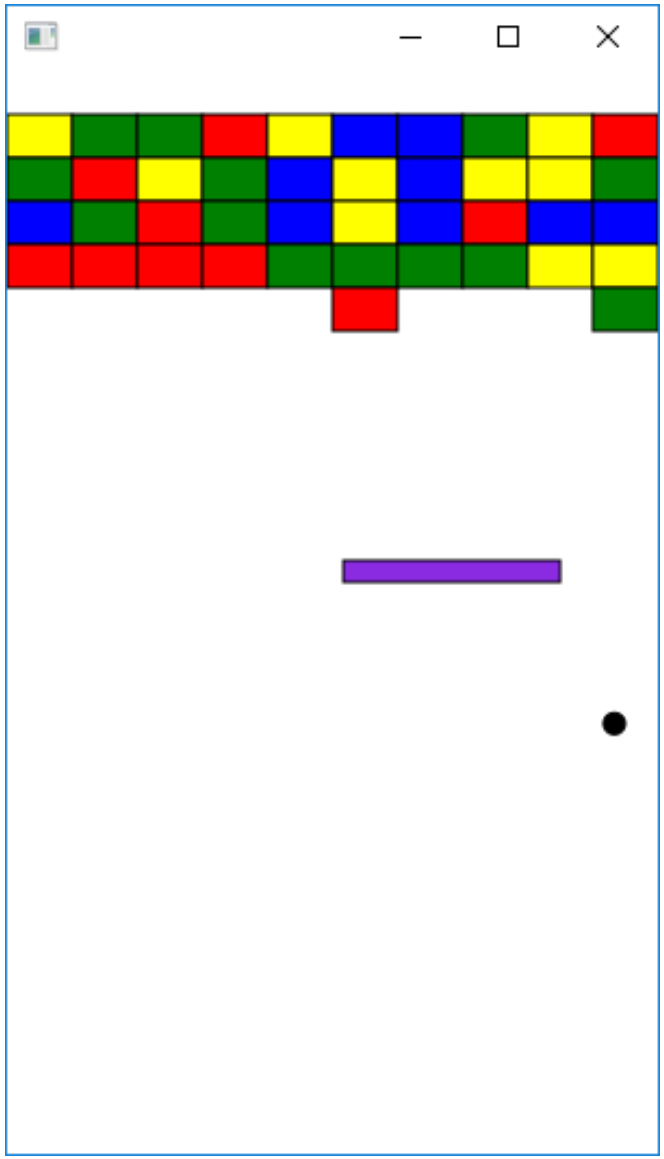
- simulácia niečoho, čo sa hýbe
  - Thread/Timeline/AnimationTimer
- odchytávanie udalostí myš/klávesnica
- kreslenie do
  - Pane
    - getChildren().clear()
    - new Rect(…)
    - new Circle(…)
    - new ImageView()
    - getChildren().add(…)
  - Canvas
    - gc = getGraphicContext
    - gc.strokeLine
    - gc.fillRect()
    - gc.drawImage()

Nebude:

- serializácia
- zložitejší layout
- import project –
  asi nebude template ☹
- unit testy ☺

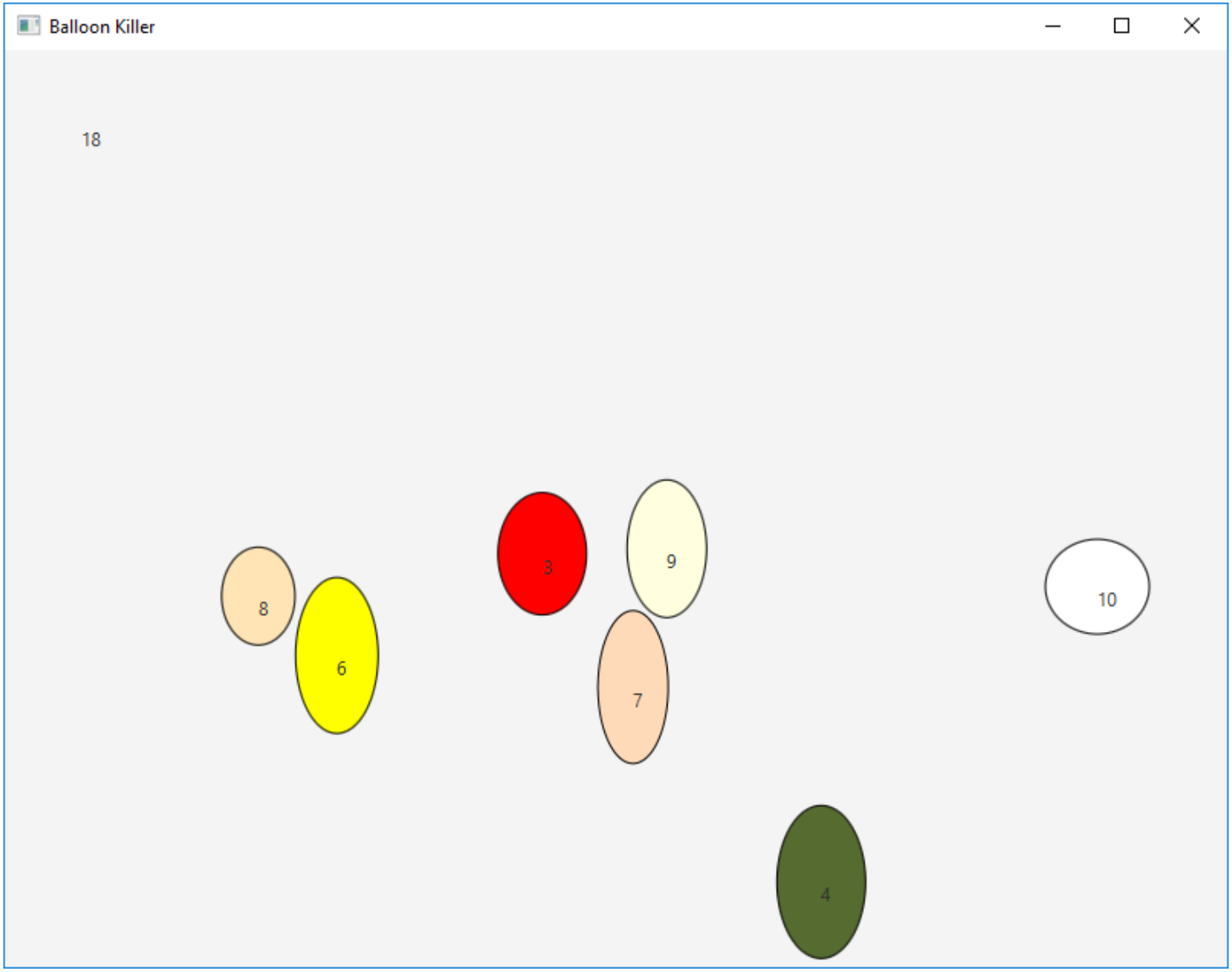
Arkanoid

Quad2 2015



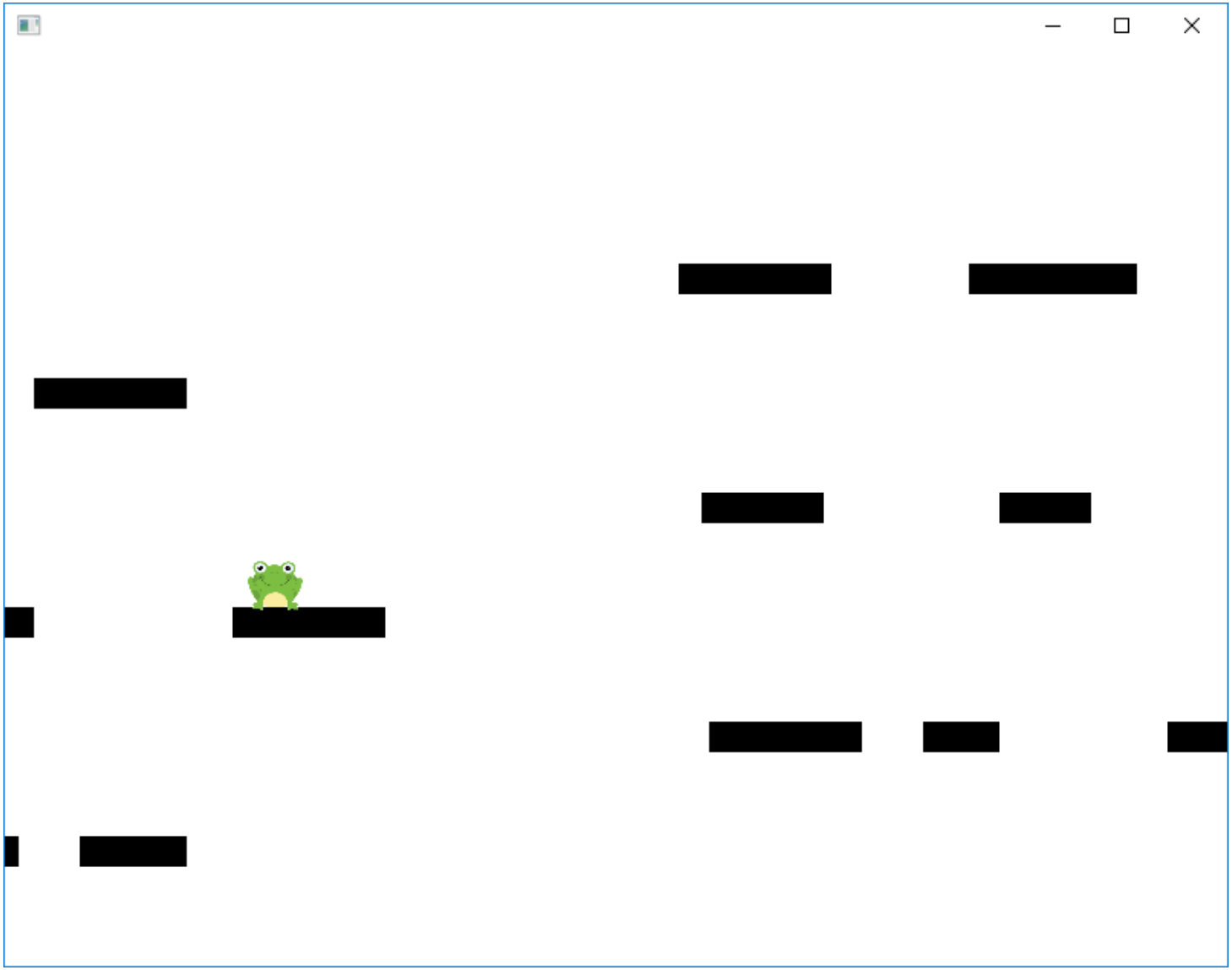
Balloon Killer

Quad2 2016



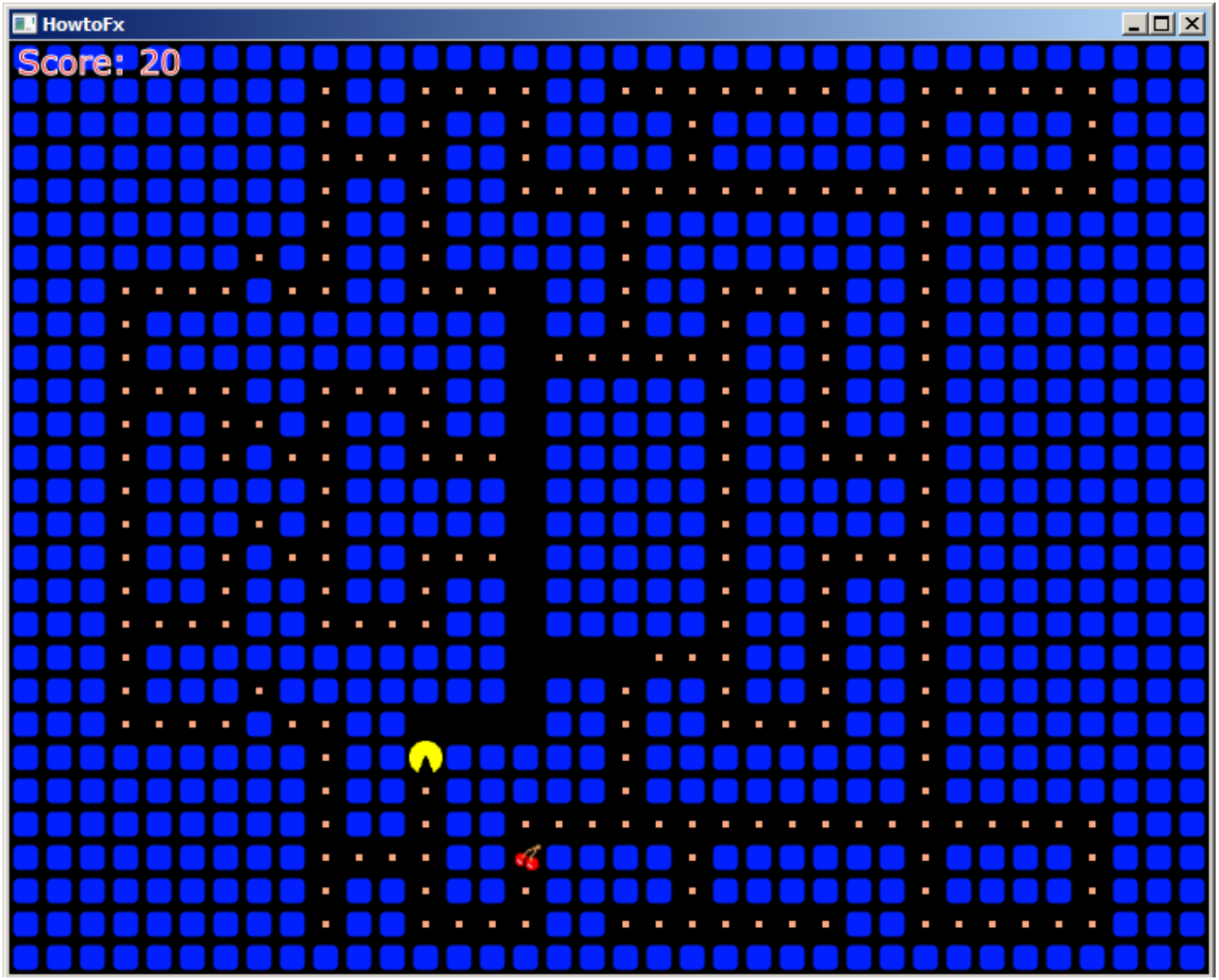
Žabky

Quad2 2017



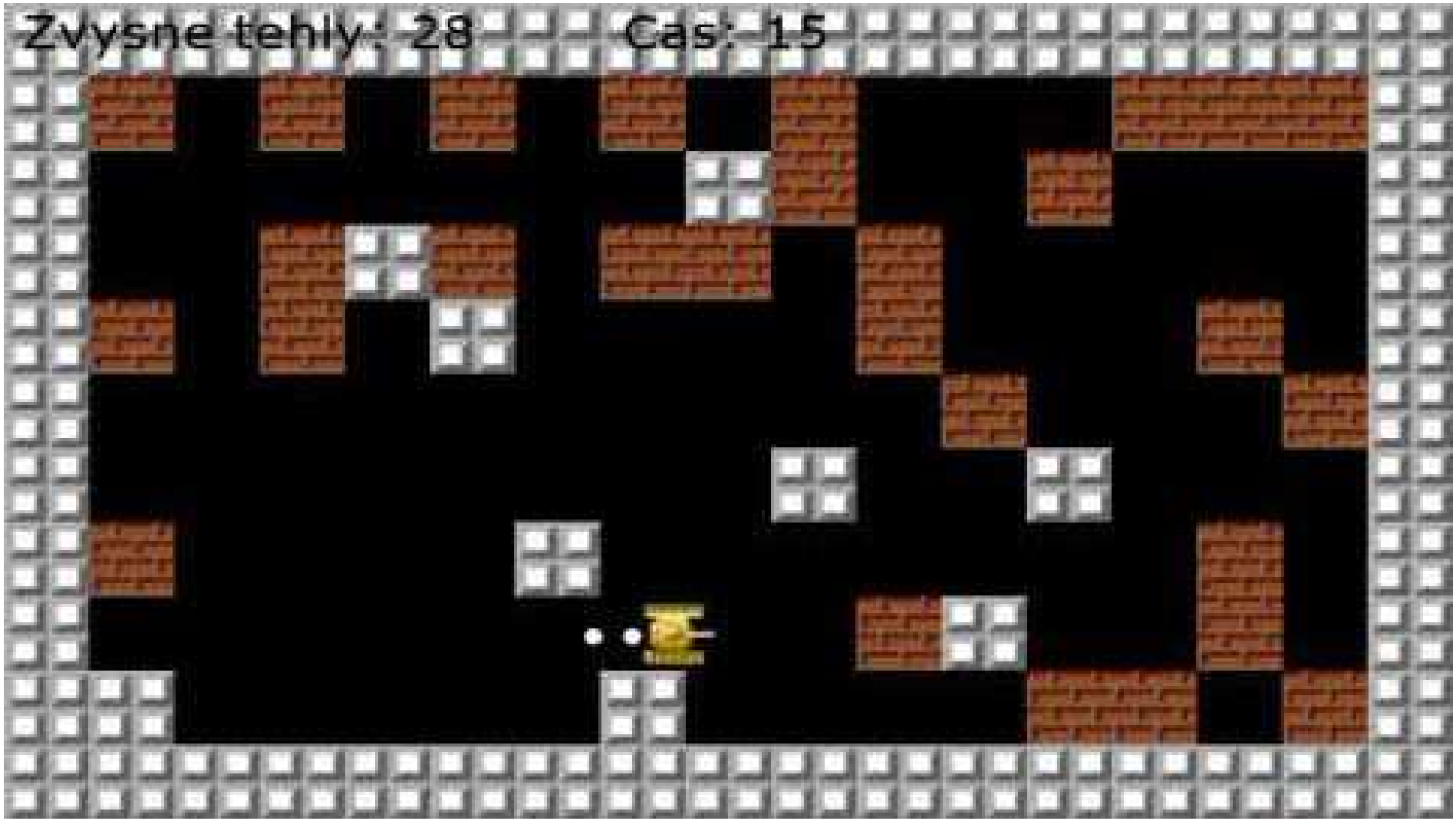
Pacman

Quad2 2018



Tanky

Quad2 2019



Cenzorovaná verzia

JavaFx

pokračovanie

Už vieme (treba pre quadterm2):

- kresliť do Canvas, vložiť Canvas->Pane->Scene->Stage, HowToWithFx
- simulovať dej pomocou Thread/Timeline/AnimationTimer,
- prekreslovať GUI komponenty pomocou Platform.runlater
- odchytiť udalosti od ActionEvent/KeyEvent/MouseEvent,
- aj to že uhol dopadu sa rovná uhlu odrazu ☺
- rôzne spôsoby návrhu jednoduchej (pravouhlej) hry (Grid/Canvas/Button)

Dnes bude:

- aspekt škálovateľnosti (re-zoom hracej plochy),
- perzistencia (ukladanie dát),
- 3D JavaFX od Lukáša G.,

Zdroj a literatúra:

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

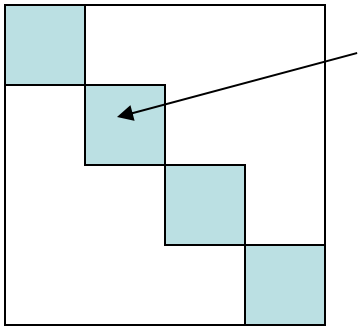
Cvičenia: jednoduché aplikácie s GUI:

- škálovateľná logická hra
- 3D Labyrint

Hracia plocha

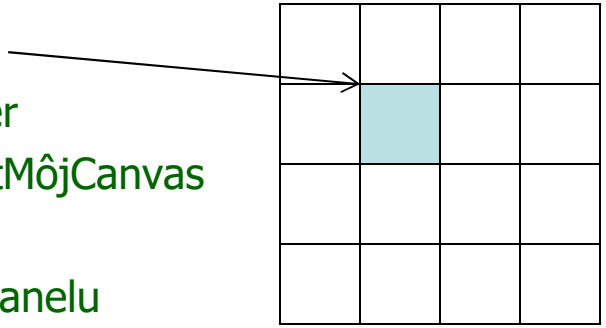
hracia plocha je často šachovnica rôznych rozmerov. Ako ju implementujeme:

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



[event.getX(),event.getY()]->[1,1]

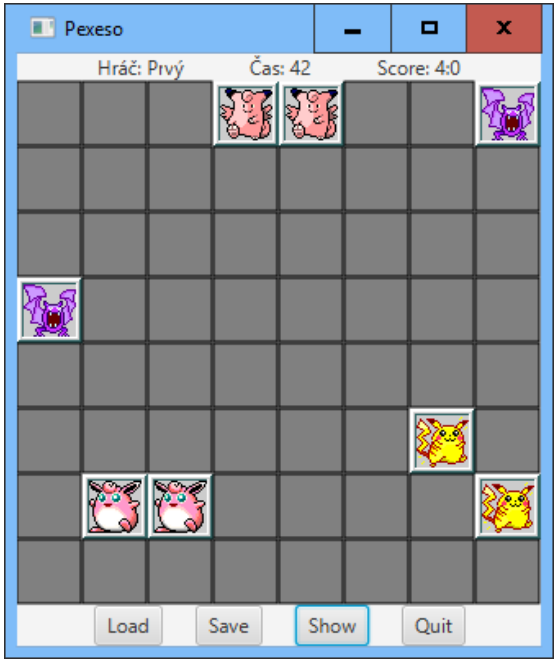
   - a naopak, v metóde paintMôjCanvas/paintMôjComponent [i,j] -> [pixelX, pixelY]
2. grid canvasov/Pane-lov:
   - každý canvas/panel má svoje súradnice od [0,0]
   - každý canvas/panel má svoj mouse event handler
   - každý canvas panel má svoju metódu paint/paintMôjCanvas
   - veľkosť gridu upravíme podľa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



3. grid buttonov/Button-ov, Button môže mať obrázok ako ikonu

Pexeso

bolo na cvičení



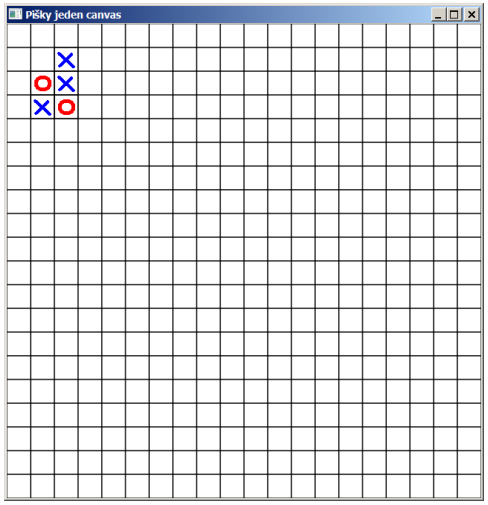

```
public class Pexeso extends Application {
State state = new State();
Playground playground;
    public class Playground extends GridPane {
       public class Cart extends Pane { ...  }
    }
}
// POZOR, TOTO NEMOŽE BYŤ VNORENÁ TRIEDA, lebo  ... ani public
class State implements Serializable {
   private static final long serialVersionUID = 918972645L;
     public class CartObject implements Serializable {
        private static final long serialVersionUID = 911775039L;
            int id;
            boolean visible = false;
            transient ImageView pikaImage;        // neserializovať
```

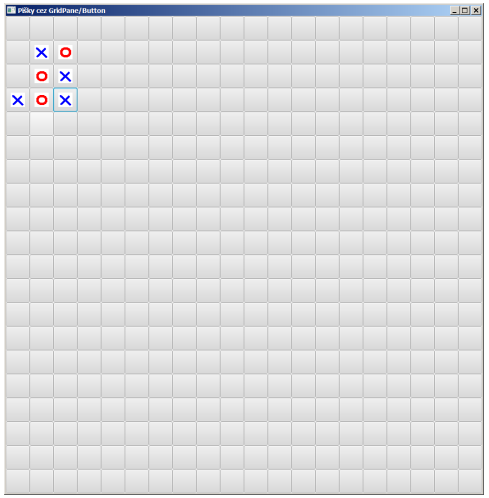
- **transient** znamená, že nechceme serializovať,
- väčšina JavaFX objektov nie je serializovatelná !!! a dostanete NotSerializableException…
- **transient static** a **transient final** nerobí nič

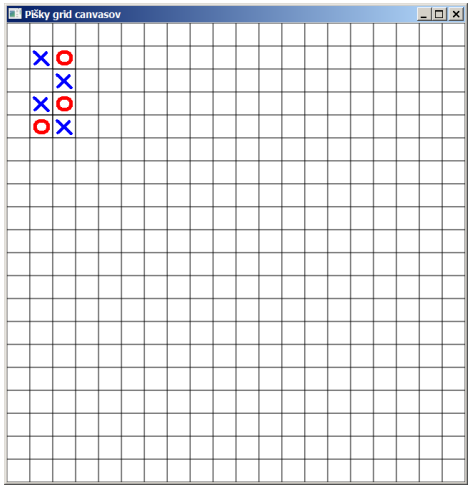
Súbor: Pexeso.java

Škálovateľnosť

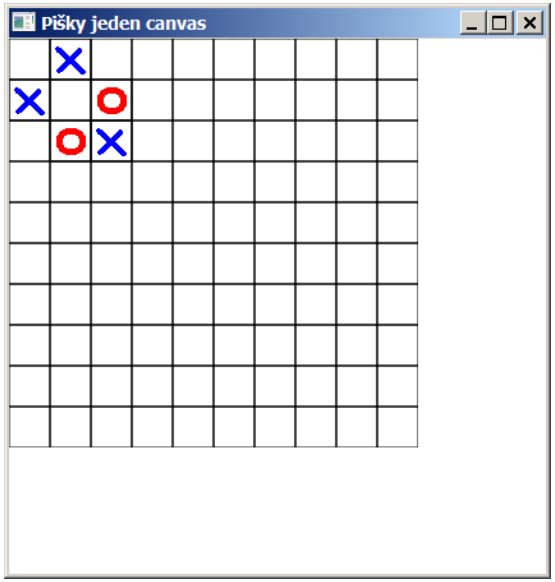
- Škálovateľnosť hry (miesto 10x10 chceme hrať 20x20):

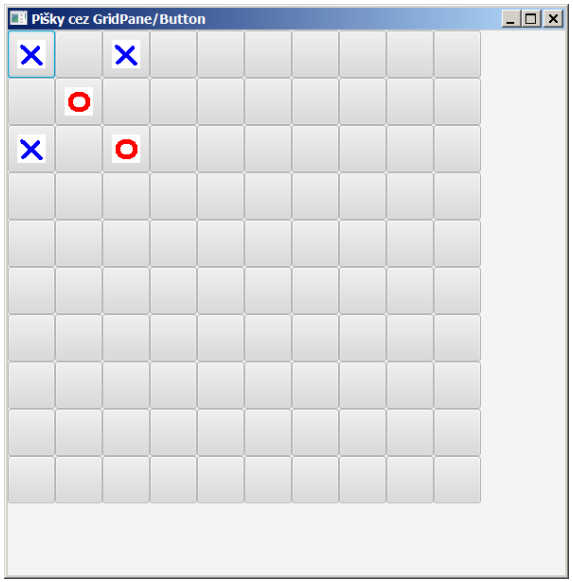


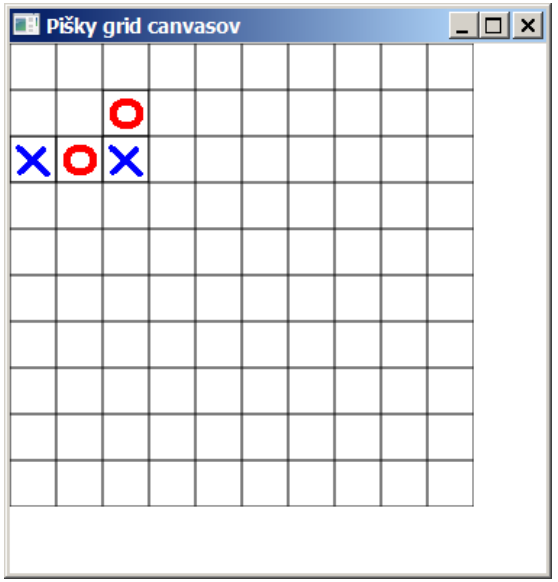




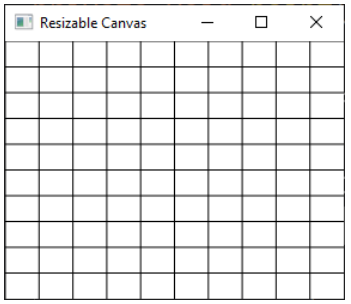
- Škálovateľnosť GUI (zmeníme rozmer okna):







Škálovateľný Canvas




```
final int SIZE = 10;
    class Playground extends Canvas {
        public Playground() {  // ak sa zmení veľkosť, prekresli celý canvas
            widthProperty().addListener(event -> paint());
            heightProperty().addListener(event -> paint());
        }
        private void paint() {
            double width = getWidth();    // zisti aktuálnu veľkosť, šírku
            double height = getHeight(); // a výšku
            GraphicsContext gc = getGraphicsContext2D();          // kresli pravoúhlu mriežku
            gc.clearRect(0, 0, width, height);                    // ale najprv si to vygumuj
            gc.setStroke(Color.BLACK);
            for(int i = 0; i<SIZE; i++) gc.strokeLine(0, i*height/SIZE, width, i*height/SIZE);
            for(int i = 0; i<SIZE; i++) gc.strokeLine(i*width/SIZE, 0, i*width/SIZE, height);
    }    }
public void start(Stage stage) throws Exception {
    Playground pg= new Playground();
    Pane p = new Pane(pg);
    pg.widthProperty().bind(p.widthProperty()); // pg.width = p.width
    pg.heightProperty().bind(p.heightProperty());//pg.height=p.height
    stage.setScene(new Scene(p, 400, 400));
```

Súbor: ResizableCanvas.java

Properties & Bindings

```
DoubleProperty polomer = new SimpleDoubleProperty();
DoubleProperty priemer = new SimpleDoubleProperty();
priemer.bind(polomer.multiply(2));                    // priemer = 2*polomer

DoubleProperty obvod = new SimpleDoubleProperty();
obvod.bind(polomer.multiply(2).multiply(Math.PI));  // obvod = 2*PI*polomer

NumberBinding stvorec = Bindings.multiply(polomer, polomer);
DoubleProperty obsah = new SimpleDoubleProperty();// stvorec=polomer*polomer
obsah.bind(stvorec.multiply(Math.PI));                // obsah = PI*stvorec

// polomer.bind(priemer.divide(2));      // cyklická referencia, to nedá ☹
for (double r = 0; r < 2; r += 0.5) {
    polomer.set(r);
    // obvod.set(r); // génius nie je!
    System.out.printf(
          "polomer=%6.2f, priemer=%6.2f, obvod=%6.2f, obsah=%6.2f\n",
    polomer.getValue(),
    priemer.getValue(), obvod.getValue(), obsah.getValue());
}
```

```
polomer=  0,00, priemer=  0,00, obvod=  0,00, obsah=  0,00
polomer=  0,50, priemer=  1,00, obvod=  3,14, obsah=  0,79
polomer=  1,00, priemer=  2,00, obvod=  6,28, obsah=  3,14
polomer=  1,50, priemer=  3,00, obvod=  9,42, obsah=  7,07
```

Súbor: RealBindings.java

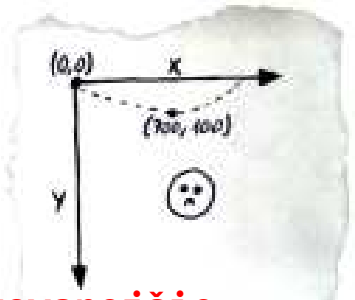
1.Riešenie škálovateľné

jeden Canvas

```
Piskyground pg = new Piskyground();                    // one big Canvas
Scene scene = new Scene(new Group(pg), 500, 500); // najaká iniciálna veľkosť
pg.widthProperty().bind(scene.widthProperty());    // pg.width = scene.width
pg.heightProperty().bind(scene.heightProperty()); // pg.height = scene.height
pg.paintAll();                                     // inak by sa nič nevykreslilo

scene.widthProperty().addListener(event -> pg.paintAll()); // changeListener
scene.heightProperty().addListener(new ChangeListener<Number>() {//full verzia
  @Override
  public void changed(ObservableValue<? extends Number> observableValue,
                      Number oldSceneHeight, Number newSceneHeight) {
    System.out.println("Height: " + newSceneHeight);
    pg.paintAll();
  }
});
primaryStage.setTitle("Resizable Pišky jeden canvas");
…
```

Súbor: PiskvorkyCanvasResizable.java

Transformácie



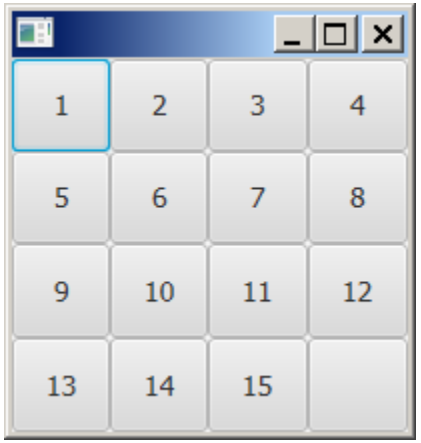

```
class Piskyground extends Canvas {                    // sú komplikovanejšie
                          // a už záleží na x,y lebo plocha môže byť obĺžnik
  private double cellWidth()        { return getWidth()/SIZE; }
  private double cellHeight()       { return getHeight()/SIZE; }
  private int getRow(double pixelY) { return (int) (pixelY / cellHeight()); }
  private int getCol(double pixelX) { return (int) (pixelX / cellWidth());  }
  private double getPixelX(int row)  { return row * cellHeight();  }
  private double getPixelY(int col)  { return col * cellWidth(); }
} ! Napriek tomu, že ide o lineárne transformácie, abstrahujte ich do metód !

public void paintCell(int i, int j) {
  Image imageO =          // keď potrebujem obrázok danej šírky a výšky
           new Image("o.gif", cellWidth()-2, cellHeight()-2, false, false);
  Image imageX =
           new Image("x.gif", cellWidth()-2, cellHeight()-2, false, false);
  . . . .
```

Súbor: PiskvorkyCanvasResizable.java

Hra 15

BoundsProperty listener

```
public class Hra15 extends Application {
  final int SIZE = 4;    final int COLS = SIZE;  final int ROWS = SIZE;
  @Override
  public void start(final Stage primaryStage) throws Exception {
   GridPane gp = new GridPane();
   for (int i = 0; i < 16; i++) {          // vytvorí hraciu plochu
     Button button = (i == 15) ? new Button("") : new Button("" + (i + 1));
     gp.add(button, i % COLS, i / COLS);  // mod, div=súradnice políčka i
   }
   gp.layoutBoundsProperty().addListener( // ak sa zmenia rozmery gp
         (observable, oldBounds, newBounds) -> {
         double cellHeight = newBounds.getHeight() / ROWS;
         double cellWidth = newBounds.getWidth() / COLS;
         for (final Node child : gp.getChildren()) {
                 final Control tile = (Control) child;
                 tile.setPrefSize(cellWidth, cellHeight);
         }        // prekresli všetky Node v gp
   });
```



Súbor: Hra15.java

2.Riešenie škálovateľné

fitWidth/HeightProperty

Súbor:PiskvorkyGridButtonResizable.java

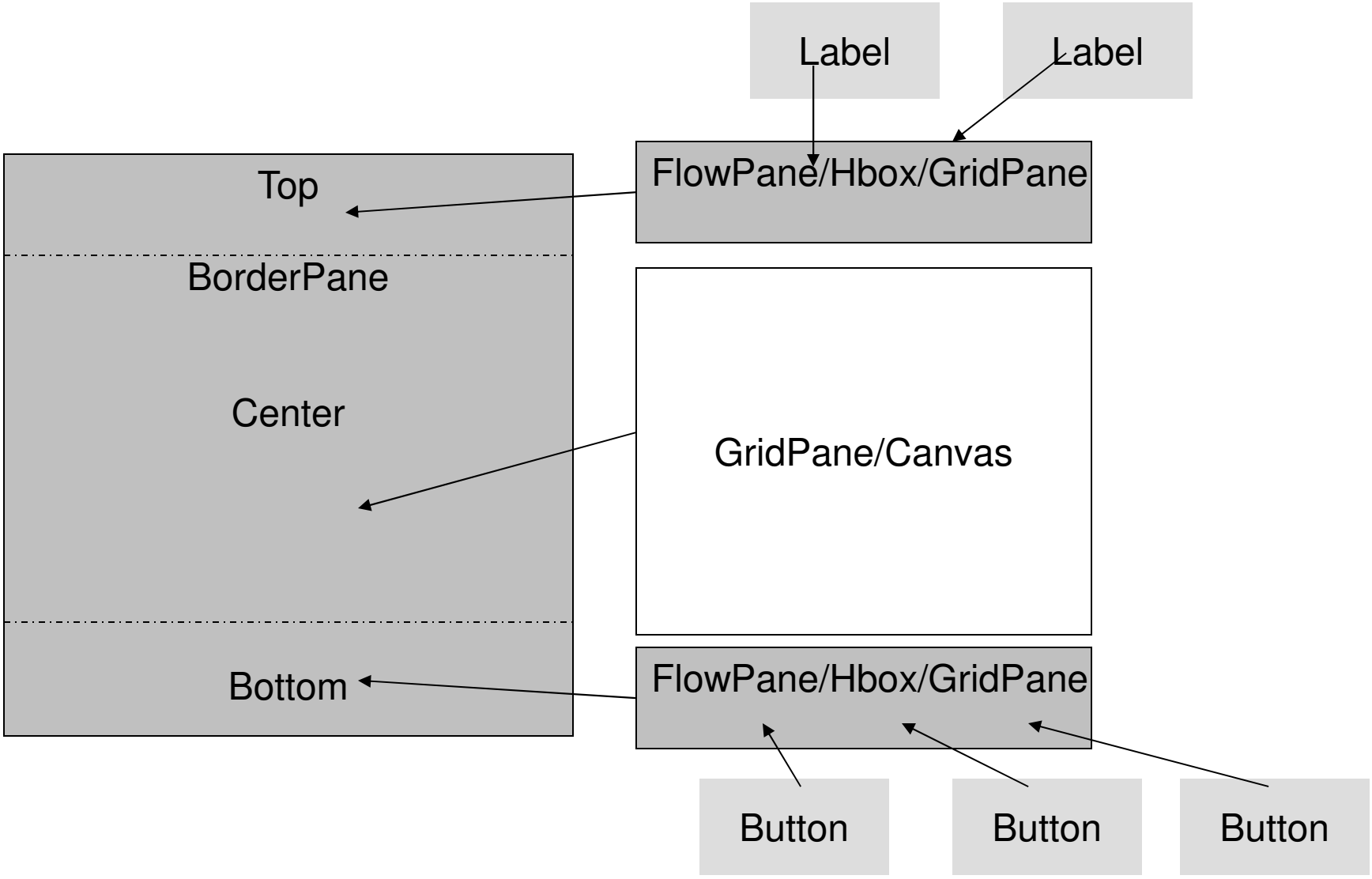
```
@Override
public void start(Stage primaryStage) {
    Piskyground pg = new Piskyground();
    pg.layoutBoundsProperty().addListener((observable, old, newBounds) -> {
        for (final Node child : pg.getChildren()) { // ak sa zmení rozmer pg
            final Control tile = (Control) child; // zmeň veľkosti buniek
            tile.setPrefSize(newBounds.getWidth() / SIZE,
                             newBounds.getHeight() / SIZE);
    }});
class PiskyCell extends Button {
    ImageView imageO = new ImageView(new Image("o.gif"));
    ImageView imageX = new ImageView(new Image("x.gif"));
    public PiskyCell(int i, int j) {
        setMinSize(50, 50);                          // menej nedovolí
        imageX.fitWidthProperty().bind(widthProperty());   // X.width = this.width
        imageX.fitHeightProperty().bind(heightProperty()); // X.height = this.height
        imageO.fitWidthProperty().bind(widthProperty().substract(4)); // 2px okraj
        imageO.fitHeightProperty().bind(heightProperty().substract(4)); // 2px lem
```

3.Riešenie škálovateľné

Súbor:PiskvorkyCanvasResizable.java

```
public class PiskvorkyGridCanvasResizable extends Application {
  pg = new Piskyground();
  scene.widthProperty().addListener((observableValue, old, newSceneWidth)->{
   pg.prefWidth((double) newSceneWidth);
   pg.paint();
  });            // to isté pre height
class Piskyground extends GridPane {
  public Piskyground() {
   for (int i = 0; i < SIZE; i++) for (int j = 0; j < SIZE; j++) {
        PiskyCell pc = canvasGrid[i][j] = new PiskyCell(i, j);
        add(pc, j, i);
        pc.widthProperty().bind(widthProperty().divide(SIZE)); // tiež height
} }
class PiskyCell extends Canvas {
  public void paintCell() {
    GraphicsContext gc = getGraphicsContext2D();
     Image imageX=new Image("x.gif",getWidth()-2,getHeight()-2,false,false);
     Image imageO=new Image("o.gif",getWidth()-2,getHeight()-2,false,false);
```

Scéna hry


Label
Label
Top
FlowPane/Hbox/GridPane
BorderPane
Center
GridPane/Canvas
Bottom
FlowPane/Hbox/GridPane
Button
Button
Button

Layout

```
Piskyground pg = new Piskyground();       // pôvodná hracia plocha
BorderPane bp = new BorderPane();         // vonkajší rámec
bp.setCenter(pg);

HBox labelPane = new HBox(                // vrchný panel, FlowPane, GridPane, ...
   new Label("Score:"),                   lbScore = new Label("0"),
   new Label("Elapsed time:"),            lbTime = new Label("0"),
   new Label("Next:"),                    lbOnMove = new Label("o"));
labelPane.setSpacing(20);                 // hrubý layout, s tým sa dá vyhrať...
lbScore.setFont(Font.font(18)); ...
bp.setTop(labelPane);                     // umiestnime na vrch

HBox buttonPane = new HBox(               // spodný panel plný tlačidiel, gombíkov
   btnLoad = new Button("Load"), btnSave = new Button("Save"),
   btnQuit = new Button("Quit"));
buttonPane.setSpacing(50);
bp.setBottom(buttonPane);                  // umiestnime na spodok
```

PiskvorkyCanvasResizableControls.java

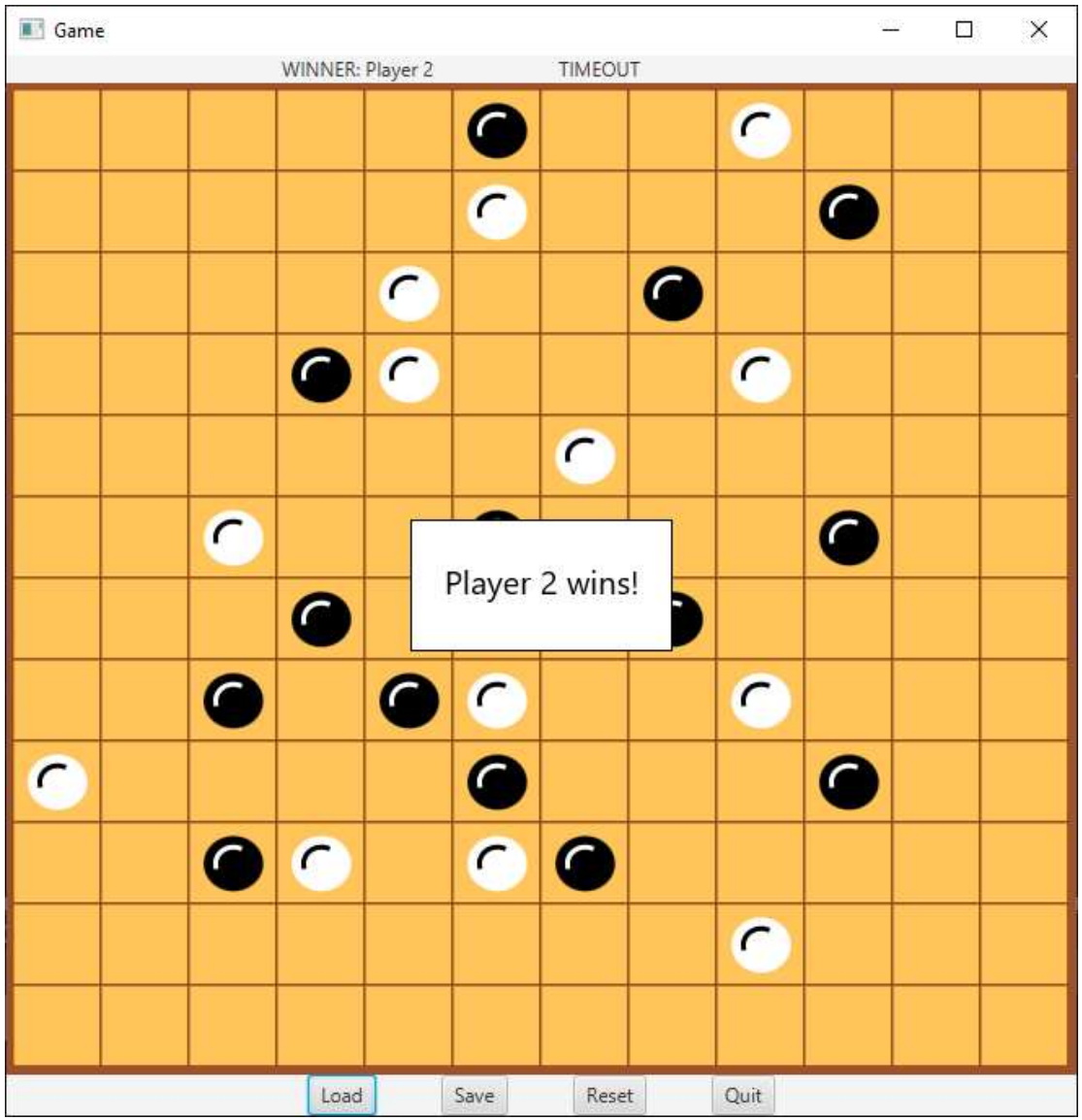
Control

```
btnQuit.setOnAction(event -> Platform.exit());

btnLoad.setOnAction(event -> {            // načítanie konfigurácie
  try {
   ObjectInputStream is=new ObjectInputStream(new FileInputStream("p.cfg"));
   ps = (PiskyState) is.readObject();
   is.close();
   pg.paintAll();                  // prekresli scénu, inak sa zmení len stav
  } catch (Exception e) { e.printStackTrace();}
} );

btnSave.setOnAction(event -> {            // uloženie konfigurácie
  try {
    ObjectOutputStream fs=new ObjectOutputStream(new FileOutputStream("p.cfg"));
    fs.writeObject(ps);
    fs.close();
  } catch (Exception e) { e.printStackTrace(); }
} );  // pozor ! Väčšina javafx objektov nie je serializovateľná, ani Image...
```

Timer

```
Timeline tl = new Timeline(1000);          // počítame spotrebovaný čas
tl.setCycleCount(Timeline.INDEFINITE);
tl.getKeyFrames().add(new KeyFrame(Duration.seconds(1), event -> {
    ps.elapsedTime++;
    Platform.runLater(new Runnable() {
          @Override
          public void run() {
            lbTime.setText(""+ps.elapsedTime); // a prekreslujeme do info políčka

          }
    });
}));
tl.play();
```

Scéna hry



BasicGame.java

Pokračovanie

- Lukáš Gajdošech: JavaFX3D
- https://www.youtube.com/playlist?list=PLUtV5iyaCT5GKtStZiVfGb6JbN0cmQ0gJ

Zdrojáky:

- https://drive.google.com/file/d/1KNwE47_6qIugosRKQ-0priXy-t0-32Yc/view

Zajtra cvičenie:

- JavaFX3D (labyrint) alternatíva FX2D (škálovateľná pravouhla hra)

Posledná DÚ-C

- JavaFX3D (labyrint) alternatíva FX2D (škálovateľná pravouhla hra)